Software Risk Evaluation (SRE) Method Description (Version 2.0)

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Process Improvement Team

Software Engineering Process Management

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The ideas and findings in this report should not be construed as an official DoD position. It is published in the interest of scientific and technical information exchange.

FOR THE COMMANDER

Norton L. Compton, Lt Col., USAF
SEI Joint Program Office

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Acknowledgements

everything the SEI did and made sure that the steps were justified and documented either in the SRE Team Member's Notebook or in his own detailed notes. It was through LT Hofferber's notes that I was reminded of the breakthrough application of the "picture of success" in the USCG SRE—it provided a focus for clarifying the purpose of risk identification, analysis, and mitigation strategy planning steps. As a result, this step has been added to both the SRE Method Description and the Team Member's Notebook. Both have also been improved by his commentary and examples.

Team Member's Notebook

The SRE Team Member's Notebook that is the appendix to this technical report was put together—in virtually the form you see it here—in 1996 and 1997 as a training aid for the SRE course that George Pandelios, Dr. Sandra Behrens, Richard Murphy, William Wilson, and I designed and presented (once). However, the majority of it was lifted from the earlier Risk Identification and Analysis (RI&A) course that several of the same people designed and delivered (twice) along with Julie Walker. It was Julie who originally identified the need for a Team Member's Notebook and put the original one together from both available and new material. The Notebook grew from there.

SEI Technical Communications

Many people in the Technical Communications group at the SEI contributed to the production of the final text of this technical report. Overall editing was handled by Pennie Walters; detailed editing and revision of the text and graphics were by Laura Bentrem, and additional graphics support was provided Bob Fantazier. Barbara White, Jeannine Caracciolo, Bill Thomas, David Gregg, and Bob Lang all provided editing help or technical counsel at one time or another during the document's long gestation period.

Development of CD-ROM

The lecture on the CD-ROM of this technical report grew out of original concepts that were shaped in conversations with John Waclo of the SEI Process Improvement Team (PIT) from the Software Engineering Process Management (SEPM) initiative[1]. These ideas were developed further and

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1. The PIT and SEPM are also my home at the SEI. This group inherited the products of the former Acquisition Risk Management initiative (a.k.a. "the Risk Program") that flourished at the SEI from 1990 to about 1998).

taken in a new direction by John Antonucci of the SEI Distance Learning Center. John did the taping and general production of my lecture, and then Roger Van Scoy of TTFN Software Inc. in Gibsonia, Pennsylvania put the lecture, video clips, and slides together using his Just-In-Time Learning™ product.

Video Clips

The video clips themselves were produced in the 1995-96 time-frame to support the RI&A course and later reused for the SRE course. They were shot and produced by Kurt Haverstock and John Antonucci in the SEI video studios, which have since become the SEI Distance Learning Center.

The SRE Interview Players

The players include the following people who were SEI technical staff members at the time:

> George Phelps (Interviewer) .... George J. Pandelios
> Dick Lakeland (Risk Recorder) .... Richard L. Murphy
> Judy Walner (Session Recorder) .... Julie A. Walker
> Emma Whitney (Interviewee) .... Carol Ulrich
> Joe Cleveland (Interviewee) .... Kurt Wallnau

Of these, only Kurt Wallnau is currently a full-time SEI staff member. Dick Murphy still works with members of the PIT on a part-time basis; he periodically teaches the SEI's CRM course and continues to serve as an SRE team member when asked.

Historical Foundations

From here, I'll go back in time to acknowledge the vast body of earlier SEI work on which the current SRE method was built, in reverse chronological order.

Interrelationship Digraph Approach

F. Michael Dedolph and I introduced the interrelationship digraph technique to the SRE. This reshaped the Interim Report phase and greatly sharpened the focus of the ensuing Mitigation Strategy Planning (MSP) phase.

Mitigation Strategy Planning

Audrey Dorofee and Julie Walker built the MSP phase of the SRE process in its current form. Audrey had already done an enormous amount of work to put together the Planning section of the *Continuous Risk Management Guidebook* by the SEI, and she and

Julie reshaped the MSP approach of the SRE to be more consistent with CRM Planning.

"Harmonized" SRE Process Flow

Dick Murphy, Sujoe Joseph, Julie Walker, and George Pandelios worked to bring together a number of available and often competing techniques to begin the general process flow design of this Version 2.0 of the SRE. Before this "harmonizing," we had three different processes in use at the SEI for risk identification and analysis: risk assessments, field tests, and SREs. The SRE process described in this technical report was greatly enriched by this harmonization effort and is distinctly different from any of its predecessors.

SRE Version 1.0

Frank Sisti and Sujoe Joseph authored Version 1.0 of the SRE Method Description. Frank Sisti, Sujoe Joseph, William Wood, F. Michael Dedolph, and Carol Ulrich did the field work (the very first SREs) on which that Method Description was based.

Condition-Consequence Risk Statement Form

David Gluch focused us all on the condition-consequence form that is inherent in a truly useful risk statement, and he provided a theoretical basis for it in his 1994 technical report, *A Construct for Describing Software Development Risks* (CMU/SEI-94-TR-14). This was a key insight that rationalized the analysis process for risk statements.

Risk Taxonomy, TBQ, and Interviewing Technique

Marvin Carr, Suresh Konda, Ira Monarch, Carol Ulrich, and Clay Walker developed and refined the SEI risk identification technique first described in 1993 in *Taxonomy Based Risk Identification* (CMU/SEI-93-TR-6). They conducted numerous field tests of both the taxonomy they developed and interviewing approaches, pioneering the roles and protocols used in the interview. Their interviewing techniques, the SEI Risk Taxonomy, and the Taxonomy-Based Questionnaire remain the foundation of the RI&A phase of the SRE as practiced today by the SEI.

—Ray Williams, December, 1999

Abstract

The Software Risk Evaluation (SRE) is a process for identifying, analyzing, and developing mitigation strategies for risks in a software-intensive system while it is in development. The SRE process has been in evolutionary development at the SEI since 1992 and has been used on over 50 Department of Defense (DoD) and civil (federal and state) contractors and program offices. Version 1.0 of the SRE Method Description was published in December, 1994.

The SRE Method Description provides

- a description of the SRE method's principles, including helpful concepts and applications
- additional insight into the SRE process so that an organization can responsibly customize the process for its own needs
- specific "key results" listings for each process step that can be used to assess quality of execution

The description should allow members of an organization's process improvement staff to perform an initial SRE competently without outside help, and then continuously improve their process over time.

Preface

Proven but Unpublished Material

This document has waited a long time to be published, and it has only been made possible today because of the support and encouragement of the National Reconnaissance Office (NRO). The materials in this technical report, its appendix, and the CD-ROM that accompanies them have been in use at the Software Engineering Institute (SEI) in various forms since at least 1995, but have been continually reworked and refined through internal SEI practice and never before published.

Getting You to Use the Process

The intent of this technical report is to make the practice of Software Risk Evaluation (SRE) available for use throughout the software system development community, without requiring that the SEI (or even authorized representatives of the SEI) come to your location to do the process for you. You should be able to follow and customize this process for yourself, ultimately using a self-prepared team of four or five people with facilitation skills to produce a sound risk baseline for a project or program.

"Flawless" Conduct of an SRE

The Method Description has been written to clarify what is important to achieve during each of the five steps of the SRE, and what the products of those steps need to be in order to carry the process forward reliably. In this, we have taken our inspiration from Peter Block's *Flawless Consulting* (Pfeiffer & Co., 1981), a text that has been used for years in the Consulting Skills Workshop developed by the SEI, and one which I recommend to anyone who is engaged in helping an organization to change the way it approaches its work. Certainly initiating an effective risk management program for a project is an endeavor which will call for the greatest consulting skills that the people involved can muster, whether they are outside consultants or have been drawn from staff positions within the organization.

Providing a Basis for Customizing Your Own SRE Process

The inspiration of Peter Block's book lies in this approach to the SRE Method Description: follow these steps and assure these high-quality products as you proceed, and you will have executed a "flawless" SRE, regardless of the ultimate response of the organization. By emphasizing the principles and "important bits" of the SRE process (in this document they are called the "key results" of a step or phase), the Method Description will allow you to customize the process to suit your target project, whether it is the hundred-person, ten-year projects the SEI has often encountered, or a three-person, six-month project.

The Appendix—The SEI's Own SRE Team Member's Notebook

The appendix, the SRE Team Member's Notebook, is quite different in its approach. It is a *prescriptive* text, designed for use on those hundred-person, ten-year projects. We have been using this Team Member's Notebook for years in our own SREs, but in practice the SRE team leaders have been customizing its directions to suit local conditions. The guidance for this customization has been provided orally, from the experience of others within the SEI who have previously led SREs. The reader should look to the Method Description for the customization guidance that the SEI would provide to its own SRE team leaders.

Creating the Risk Statement

At the heart of the entire process is the construction of the *risk statement*: a short, fact-based, and actionable statement of concern elicited from the members of a project. This statement needs to be accompanied by *context* that will preserve the specific original intent of the risk statement throughout the subsequent risk management process (which can stretch out over years). Together, the risk statement and its context form one of the "data bricks" on which a solid risk management program can be built. The SRE process creates these "data bricks" in a modified interviewing process that draws on the collaborative efforts of the interviewer and the interviewees. Because this creation process is so central to the SRE (and so hard to describe in text), we have created an accompanying CD-ROM that supplements the description of these activities in the Method Description and the Team Member's Notebook. The interview clips were filmed in 1995 to support a course on the Risk Identification and Analysis phase of the SRE, a course which was given publicly only once and then supplanted by a course on the entire SRE process (also given only once, to internal SEI staff).

How to Reach the Projects that Would Benefit from the SRE

The conclusion we reached after offering these courses was that it was prohibitively expensive for organizations to train their proposed SRE team (four or five people with good facilitation skills, travelling to Pittsburgh for three days). Most organizations sent only one employee who was interested in learning about the process, but powerless to implement the newly-learned skills. This sending of "pioneers" is a natural, cautious approach to organizational learning, but in this case it just wasted everyone's time. How could we reach the teams of people needed to carry out the SRE process? There appeared to be only two feasible solutions:

1. have those organizations that want to institute SREs as a risk baselining technique in their projects enter into a technology transition agreement with the SEI that (for example) will have the SEI perform an SRE on one project, then have the SEI and the home-organization together perform an SRE on a second project, then have the home-organization perform an SRE on a third project with SEI coaching and mentoring; or

2. put the material in the public domain and allow organizations that want to try SREs to put together their own groups and stumble through the process, learning by doing, the way we did when we developed it (but more efficiently, since they shouldn't have to repeat our mistakes).

Designing and Funding the Method Description

The two approaches are not incompatible, and they both require that the contents of this Method Description, SEI Team Member's Notebook, and CD-ROM be published. Because risk work at the SEI is now funded exclusively by client contracts, the cost of producing the CD-ROM and editing the document text had to be underwritten by a client who shared our vision of making this information available to the public. The NRO generously provided that funding.

How to Start Learning about the SRE

I suggest you begin your understanding of the SRE process developed by the SEI by reading the "Overview of the Software Risk Evaluation Method" that begins on page 15, and then go to the heart of the process by reading the "Conduct Interviews" section on page 39. After you've done that, load up the CD-ROM and watch at least the beginning of my lecture, focusing particularly

on the first video clip that shows one risk statement being constructed. From there, you can learn about the rest of the pieces of the process in any order that suits you; we've designed this document to support a "random access" approach to learning and using the material. Decide for yourself whether this process can help you generate the "critical mass of risks" you need to kick-start a risk program for a project in your organization. Whether you then are interested in having the SEI assist you in making the SRE process work for your organization or believe that you can go it alone, the materials here will get you well along your way.

—Ray Williams, December, 1999

Introduction to the Technical Report

Components of This Technical Report

This technical report is made up of three major parts:

3. the Software Risk Evaluation (SRE) Method Description, Version 2.0

4. the SRE Team Member's Notebook, Version 2.0

5. a CD-ROM about the SRE interviewing process

Method Description   The Method Description provides:

- a description of the SRE method's principles, including helpful concepts and applications

- insight into the SRE process so that project managers, risk management champions, and responsible staff members can customize the process for their own purposes without compromising the underlying principles

- specific "key results" listings for each process substep that can be used to determine the quality of an SRE provider's implementation

SRE Team Member's Notebook

The SRE Team Member's Notebook (Version 2.0) is a specific implementation of the SRE principles for the Risk Identification and Analysis (RI&A), Interim Report, and Mitigation Strategy Planning (MSP) phases. It should be used as a baseline when creating a custom version that will work for your particular circumstances, keeping in mind the principles of the Method Description.

CD-ROM

The CD-ROM portion of this technical report gives specific guidance on the process that is at the very heart of the SRE: the risk identification interview. It does this in a way that is impossible to convey in text: by providing video clips ("vignettes") from various phases of the interview process, with an explanation of what is important about what happens in the clips.

Context of the SRE within Risk Management

The SRE is both a stand-alone diagnostic that can help an organization determine how best to assure the success of one of its projects and a solid foundation for risk management programs. The SRE discovers, analyzes, and sets mitigation strategies for the elemental "data bricks" of risk management: risk statements coupled with their descriptive context. Furthermore, the SRE sets out to discover all of these "data bricks" for a project at a given time in its life cycle. These "data bricks" can be used to provide the initial data for a risk management database and to generate the energy and focus that a project needs to effectively confront potential future problems that might otherwise overwhelm it.

The SRE is thus a useful tool for *project* management. There is, in fact, little that restricts it to being a tool applicable only to software projects or even to projects that are developing software-intensive systems. The basic principles you will find in the Method Description can probably be customized for any long-term project with a definable end product, widely-held vision of "success," and specific time in the future when that "success" is desired.

Overview of Risk Management

Why Manage Risk?   All projects have some level of risk associated with them. Even if the product under development is simply another version of an existing system or product, risks may appear in areas such as:

- changes in development personnel (and resulting experience levels with the product)
- changing market conditions and customer expectations
- changing business conditions for the development organization

The more you understand the risks, the better equipped you are to manage them.

SEI Definition of Risk   The Software Engineering Institute (SEI) defines risk as the possibility of suffering loss.

In a development project, the loss describes the impact to the project which could be in the form of diminished quality of the end product, increased costs, delayed completion, loss of market-share, or failure.

Risk Vs. Opportunity   Risk and opportunity go hand in hand. Success cannot be achieved without some degree of risk. "Risk in itself is not bad; risk is essential to progress, and failure is often a key part of learning. But we must learn to balance the possible negative consequences of risk against the potential benefits of its associated opportunity" [1].

To be successful, the project manager must face risks head on. Common risks include

- a new development process

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1. Roger L. Van Scoy. *Software Development Risk: Opportunity, Not Problem (CMU*/SEI-92-TR-030). Pittsburgh, Pa.: Software Engineering Institute, Carnegie Mellon University, 1992. Available www: http://www.sei.cmu.edu/publications/documents/92.reports/92.tr.030.html.

- the technical requirements of the product or system itself
- constraints placed upon the project or product by the customer(s) or market
- aggressive budget and schedule

For the project manager, the challenge is to know the risks facing the project and to manage them. The SRE is a tool that answers that challenge. It is the central and first implementation of the SEI risk management paradigm, explained below.

SEI Risk Management Paradigm

Risk Management Paradigm

Risk management is a process that is systematic and continuous and it can best be described by the SEI risk management paradigm.
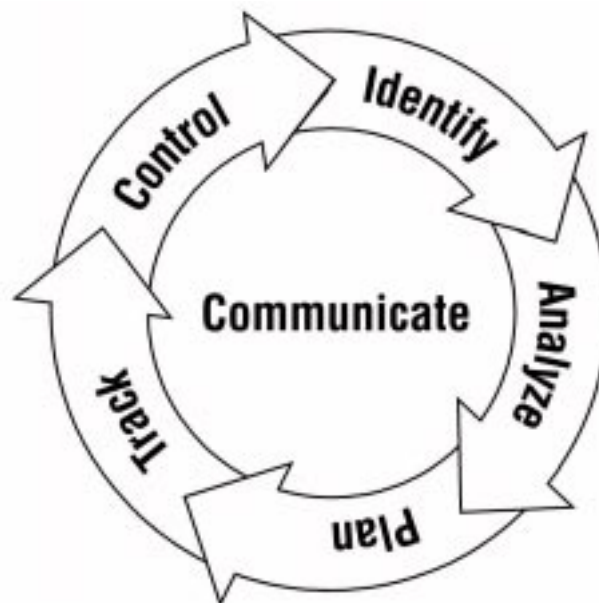
Elements of the Risk Management Paradigm

The elements of the risk management paradigm are introduced below. These steps take place sequentially but the activity occurs continuously, concurrently (e.g., risks are tracked in parallel while new risks are identified and analyzed), and iteratively (e.g., the mitigation plan for one risk may yield another risk) throughout the project life cycle.

Element	Purpose
Identify	makes all known project risks explicit before they become problems
Analyze	transforms risk data into decision-making information
Plan	translates risk information into decisions and mitigating actions (both present and future) and implements those actions
Track	monitors risk indicators and mitigation actions
Control	corrects for deviations from the risk mitigation plans
Communicate	enables the sharing of all information throughout the project and is the cornerstone of effective risk management

The SRE and the Paradigm

The SRE addresses the identification, analysis, planning, and communication elements of the SEI Risk Paradigm. The SRE, while not the only identification method available, is typically the initial and most prominent one used on a project. The analysis element is also covered fully by SRE activities. Planning elements are partially addressed through the construction of high-level mitigation strategy plans. The SRE also contributes significantly to the communication element. The remaining elements of the paradigm, tracking and control, are not addressed during an SRE.
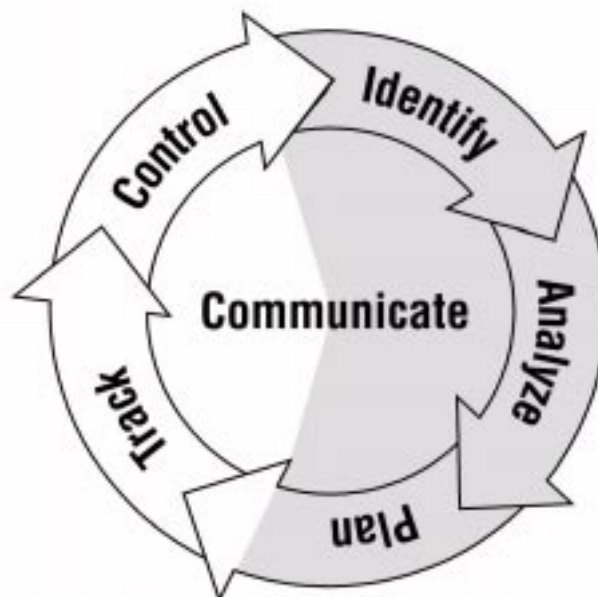
What is an SRE?

Description

An SRE is a diagnostic and decision-making tool for a project. An SRE is used to identify and categorize specific project risk statements emanating from product, process, and constraint sources. The project's own personnel participate in the identification and analysis of risk statements, and in the mitigation of risk areas (collections of risk statements that are likely to have common mitigation strategies) facing their own development effort. The SRE has the following attributes:

- trains teams to conduct systematic risk identification, analysis, and mitigation planning
- focuses upon risks that can affect the delivery and quality of software and system products
- provides project manager and personnel with multiple perspectives on identified risks
- creates foundation for continuous and team (customer/supplier) risk management

An SRE provides a project manager with a structured early warning mechanism for anticipating and addressing project risks. It also introduces a set of activities that begins the process of managing risks. These activities can be integrated with existing methods and tools to enhance project management practices.

Purposes of the SRE

The primary purpose of the SRE is to provide a clear and understandable picture of the risks which may affect the project. That picture may be used

- as a diagnostic—Are the risks acceptable for starting a project?
- to create a risk baseline—The SRE identifies critical risks before they become problems so that they can be managed on a continuous basis.
- to prepare for a critical milestone in the project life cycle
- to "recover from crisis"—The SRE provides a way to reset a baseline for a project

Features of the SRE   The SRE has the following features:

- is principle based—the principles of the SRE described in this Method Description are derived from the seven principles of risk management[1], primarily *Open Communication*, *Forward-Looking View*, *Global Perspective*, and *Shared Product Vision*

- uses proven group techniques such as the SEI Risk Taxonomy[2], Xerox Problem-Solving Technique, and the Interrelationship Digraph

- uses structured brainstorming and interviewing techniques to elicit risks from the project staff

- protects confidentiality of SRE participants and enforces non-attribution in the reporting of risks

- involves project staff in the elicitation, analysis, and mitigation of risks

- minimizes interruption to project work schedules

- produces diverse views of project risk

Benefits of the SRE   Benefits of the SRE include

- creates a shared view of risks facing a project among the staff

- creates a common framework for talking about and mitigating risks

- provides a snapshot of risks
  - enables the tracking of risks systematically (changes in probability and impact)
  - enables the tracking of risk mitigation efforts systematically

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1. Dorofee et al. *Continuous Risk Management Guidebook*. Pittsburgh, Pa: Carnegie Mellon University, 1996.

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2. Carr et al. *Taxonomy-Based Risk Identification (CMU/SEI-93-TR-060)*. Pittsburgh, Pa: Software Engineering Institute, Carnegie Mellon University, 1993. Available www: http://www.sei.cmu.edu/publications/documents/93.reports/93.tr.060.html.

- provides an impetus to focused project-level process improvement
- provides decision-making information to the project manager
- accelerates the creation of a shared product vision among project staff

Maximizing SRE Benefits

To maximize the impact of a successful SRE, team members must be trained properly, and the SRE must have an experienced, authorized leader. To conduct an effective SRE, a team of qualified individuals from the organization should receive adequate training in the method.

Developing SRE Capability

What if you can't have all those conditions that will "maximize" the impact of the SRE? What if you can't get the SEI to help you do the first few SREs? There are *no* "SEI-authorized SRE providers" out in the marketplace today, so that's not an alternative.

You're going to have do it the way the SEI did: develop the capability for yourself. Here is an approach that will work:

1. Select four or five qualified individuals for the SRE team-in-training. These would be people in your organization who have facilitation skills and who probably already are involved in general process-improvement activities for the organization. A typical example would be members of the organization's software engineering process group (SEPG), if there is one.

2. Have the team study the materials in this technical report: the Method Description, the SRE Team Member's Notebook, and the CD-ROM.

3. Have the team create its own Team Member's Notebook based on the SEI example.

4. Make a series of projects available on which the team can use the process. These should be available in fairly rapid succession (say, one every three months) so that the team can complete its work on one and analyze the lessons learned before confronting the next one. It should not be critical for the first two SREs to identify important risks, so choose healthy projects that are likely to be reasonably successful regardless of the outcome of the process.

5. Convene a postmortem meeting of the SRE team after each phase of the process and record which key results of the Method Description were and were not achieved and document lessons learned for the next time.

6. When the SRE for next project is being planned, get the team to dust off the lessons learned from last time, read them, and refine the process for this time.

The SRE team-in-training will soon be comfortable with the process and able to identify and analyze a sizeable quantity of risk statements after a few opportunities.

The SRE Within Risk Management

Role of the SRE   When discussing the role of the SRE within risk management, there are two views that must be considered. First, the SRE is useful as a stand-alone diagnostic. However, the SRE is most effective as the initiator of continuous risk management (CRM) [1] within the project or parent organization and team risk management (TRM) [2] among customers and suppliers. The SRE provides a foundation for CRM and TRM by providing a "baseline" of risks. A baseline is a "critical mass" of risks that serves as a focus for later mitigation and management activities.

Continuous Risk Management (CRM)   Continuous risk management (CRM) is a software engineering practice with processes, methods, and tools for managing risks in a project. It provides a disciplined environment for proactive decision making to:

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1. Dorofee et al. *Continuous Risk Management Guidebook*. Pittsburgh, Pa: Carnegie Mellon University, 1996.

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2. *Team Risk Management: A New Model for Customer-Supplier Relationships* (CMU/SR-94-SR-005). Pittsburgh, Pa: Software Engineering Institute, Carnegie Mellon University, 1994. Available www: http://www.sei.cmu.edu/publications/documents/94.reports/94.sr.005.html

- assess continuously what could go wrong (risks)
- determine which risks are important to deal with
- implement strategies to deal with those risks

When using CRM, risks are assessed continuously and used for decision making in all phases of a project. Risks are carried forward and dealt with until they are resolved or turn into problems and are handled as such.

Team Risk Management (TRM)

Team risk management (TRM) is a new paradigm for managing projects by developing a shared product vision, focusing on results, and using the principles and tools of risk management to cooperatively manage risk and opportunities.

TRM establishes an environment built on a set of processes, methods, and tools that enables the customer and supplier to work together cooperatively, continuously managing risk through the life cycle of a software-dependent development project.

TRM Roadmap

The TRM roadmap, shown below, illustrates the progression towards the joint management of risk and the establishment of a trusted customer/supplier network.
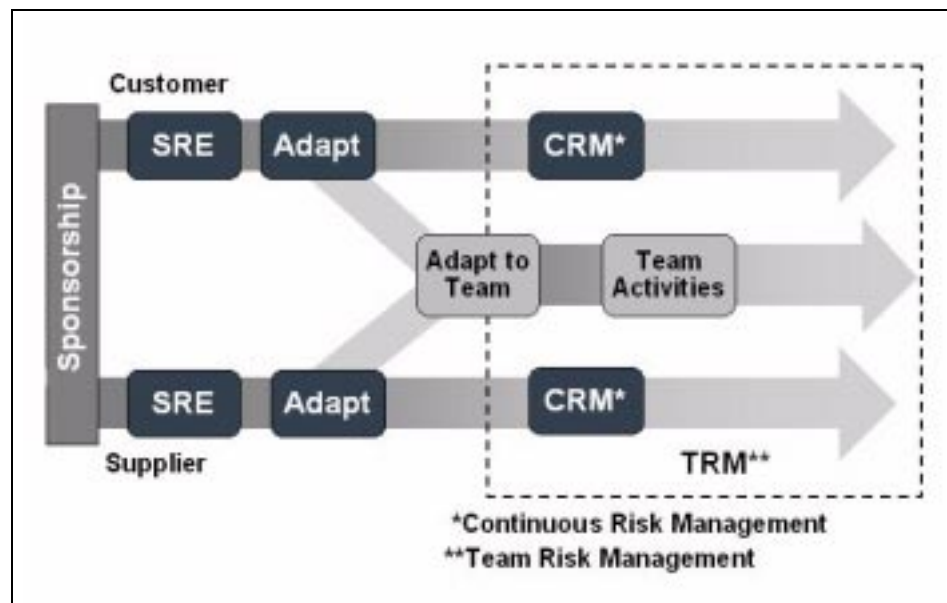
Definitions   Items listed on the diagram are defined as follows:

- The SRE is a service that helps projects establish an initial baseline set of risks and mitigation plans—one of the key first steps for putting risk management in place.

- The Risk Clinic is the workshop that initiates the installation of CRM within an organization. This clinic can be used to tailor CRM to suit a client's specific needs and implement it in one or more projects.

- CRM builds upon the results of the SRE and uses various methods to advance projects to managing risk on a continuing basis and to install a CRM process at the organizational level.

- The Team Risk Clinic is the workshop that initiates the installation of TRM. This clinic can be used to tailor TRM to suit the clients' specific needs and implement it in all the partners in a program (e.g., customer, supplier, subcontractors).

- TRM extends CRM to include all partners in a program. TRM brings about joint management of risks in a collaborative fashion.

Getting Help from the SEI on SREs

Most organizations interested in the SRE and risk management fall into one of these categories:

- those wanting to conduct an SRE on a specific project, but with no long-term needs for this capability, and

- those wanting to acquire self-sufficiency in conducting SREs

Conducting an SRE   To simply have an SRE conducted on one of your projects, please contact SEI Customer Relations at (412) 268-5800.

Becoming Self-Sufficient at Conducting SREs   If your organization wants to conduct multiple SREs or acquire this capability for repeated use at a later time, we recommend that

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you engage the SEI to transition the SRE into your organization. A typical transition might proceed as follows:

1. The SEI would lead the first SRE.

2. Either the team-members-in-training or the SEI would lead the second SRE (depending on the comfort level that was achieved with the first one), but the involvement of the organization's team-members-in-training in process planning and interview roles would be greatly increased in any case.

3. The team-in-training would lead the third SRE, with the SEI taking a mentoring/coaching role in the process.

4. The organization would then be considered self-sufficient in the SRE.

Overview of the Software Risk Evaluation Method

Description

This chapter provides an overview of the Software Risk Evaluation (SRE) method, defines terms and definitions used throughout the document, discusses the applicability of the method, and in general terms, introduces the overall concepts of risk management, briefly describes the SRE method, and discusses its place within the framework of risk management.

Terms and Definitions

Terms Used in this Method Description

The following terms are used in this document.

Term	Definition
project manager	person who is responsible for managing the project. The project manager has control over the visibility and distribution of findings and reports. The project manager is the ultimate customer of the SRE and commits funds, personnel, and other resources to the activity.
project	the group of people, plans, and resources involved in the development of a product or system

Table 1: Terms and Definitions Used in This Document

Term	Definition
organization	the larger group that is home to the project. Typically, organizations have more than one project.
customer	the organization acquiring systems (typically designated as programs or projects) and responsible for • defining the requirements • obtaining funding • selecting the supplier/contractor • negotiating the contract • accepting the product Customers are often prime candidates for SREs because of their responsibility for specifying the system.
end user	the organization or set of individuals that will ultimately use the product or system under development. The "end user" is often synonymous with the "customer" (see above).
interviewee	a project staff member interviewed during the Risk Identification & Analysis phase (see page 33)
participants	a project staff member taking part in any process of the Risk Identification & Analysis phase (see page 33) or the Mitigation Strategy Planning phase (see page 73). Participants may be referred to as "interviewees."
SRE provider	the group providing the SRE service (may be the SEI, another outside organization, or a staff group that is outside the project having the SRE but within the organization)
SRE team leader	the individual leading the SRE (usually supplied by the SRE provider). This person is ultimately responsible for the quality of the output (SRE closure) and the fidelity to the process.

Table 1: Terms and Definitions Used in This Document

Term	Definition
SRE team	group of four to eight individuals who will conduct the SRE process on the selected project. This team typically consists of one leader and three to seven team members. Usually, the SRE provider supplies the team leader and one to two team members. The organization supplies the remaining SRE team members.
site coordinator	This individual is responsible for managing the logistical issues—arranging for conference rooms, scheduling participants for meetings, and supplying the SRE team with the items necessary to conduct the activity.
supplier	the organization developing and producing the system. The supplier is responsible for implementing the requirements under the terms of the contract, which include cost and schedule.

Table 1: Terms and Definitions Used in This Document

Overview of the SRE Method
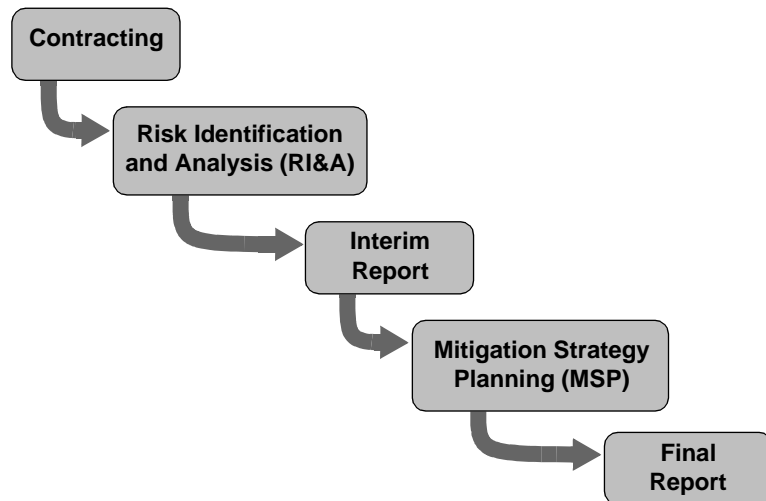
Description The SRE is implemented in five phases—Contracting, Risk Identification and Analysis (RI&A), Interim Report, Mitigation Strategy Planning (MSP), and Final Report.

Contracting Phase

The Contracting phase consists of the activities needed to identify project goals, obtain agreements for the SRE, and coordinate resources for its conduct.

Risk Identification & Analysis (RI&A) Phase

During the Risk Identification & Analysis (RI&A) phase, the SRE team visits the project's development site and conducts structured interviews with staff members to elicit risk statements. The risk statements are analyzed, prioritized with regard to impact on the project, and grouped into risk areas. The SRE team then presents these findings to the involved project staff and manager.

Interim Report Phase

During the Interim Report phase, the SRE team reanalyzes the risk areas and prepares a recommendation of those to be addressed in Mitigation Strategy Planning (MSP) for the project manager. This recommendation is agreed to by the project manager before proceeding with the MSP phase.

Mitigation Strategy Planning (MSP) Phase

The Mitigation Strategy Planning (MSP) phase is focused on the construction of high-level mitigation plans for the selected subset of risk areas. Project staff, management, and the SRE team work together to create goals, strategies, and activities which will mitigate the concerns identified within the risk areas. Project staff, now equipped with the necessary information, plans, and sponsorship, can begin mitigating their most critical risks.

Final Report Phase

The mitigation strategy plans are added to the information already compiled and the final report is assembled. The final report and the associated risk data are presented to the project manager.

Contracting Phase

Description   In many ways, the Contracting phase is the most important part of the Software Risk Evaluation (SRE). By properly setting the expectations of all players, explicitly agreeing upon the deliverable items produced by the event, and securing sponsorship from project management, a high degree of success is assured. It is important that everyone involved in the SRE understands what will be accomplished.

Process Diagram

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┌──────────────┐
│ Contracting  │
└──────────────┘
       │
       ▼
   ┌──────────────────────┐
   │ Risk Identification  │
   │ and Analysis (RI&A)  │
   └──────────────────────┘
              │
              ▼
          ┌──────────────┐
          │ Interim      │
          │ Report       │
          └──────────────┘
                 │
                 ▼
             ┌──────────────────────┐
             │ Mitigation Strategy  │
             │ Planning (MSP)       │
             └──────────────────────┘
                        │
                        ▼
                    ┌──────────────┐
                    │ Final        │
                    │ Report       │
                    └──────────────┘
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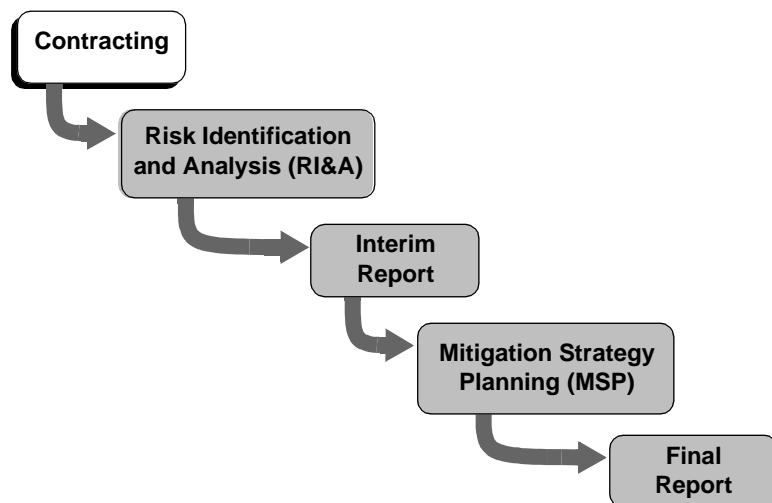
Section	Page
Expectations	18
Sponsor Support	19
Working Agreement	22
Risk Exposure	29

Expectations

**Project
Manager
Challenges**

To accomplish anything of value, the project itself (and therefore the project manager) must take on risk, and typically faces several major challenges, such as

- a new development process
- the technical requirements of the product or system itself
- constraints placed upon the project or product by the customer(s) or market
- aggressive budget and schedule

**Project Manager's
Expectations**

The project manager may have some unrealistic expectations or be unaware of what the SRE can actually accomplish. (See "What is an SRE?" on page 6 for a discussion of the purpose, features, and benefits of the SRE in general.) The project manager's expectations should be revealed, understood, and responded to as early in the Contracting phase as possible. The SRE process is flexible and can usually accommodate some of the more common project manager issues shown below:

- "I need to identify areas where my staff needs technical assistance or expertise."
- "What is the effect of having taken on a particular technical risk? Is it being handled? Is it affecting other portions of the project?"
- "Are we going to make our schedule?"
- "What are we not paying attention to that can hurt us?"

Once alerted to project manager's important issues, the SRE team can discuss them with the project manager and determine the appropriate amount of attention to spend on them during the process. While the SRE cannot provide answers with 100% certainty, it does afford some insight into these types of questions by providing two perspectives on the risks:

1. participant's view – expressed as risk statements and collective top risks

2. team's view – expressed as evaluated, analyzed, and prioritized risk statements and risk areas proposed for prioritized mitigation

Stakeholder Expectations

Other stakeholders may have expectations regarding the activities and impact of the SRE. Some of the other potential stakeholders are

- the project manager's superior – This individual may view the SRE as a "report card" on the performance of the project manager. This expectation must be set aside before an SRE can be conducted. This constitutes misuse of the SRE (see "What is an SRE?" on page 6).

- sponsor – Sometimes the project manager is not the sponsor or did not request an SRE. Nonetheless, the results of the SRE belong to the project manager and may not be shown to the sponsor without the project manager's permission. For the remainder of this document, we will use the term project manager to represent both the project manager and sponsor.

- project staff members – Often these individuals are uncertain or unclear about the use of the SRE results, so their expectations must be set properly early in the process. Usually the opening briefing is the first opportunity to do so.

- members of the organization's software engineering process group (SEPG) – These staff members are committed to process improvement within the entire organization. Performing an SRE often starts project-level, process-improvement activities. The SEPG may be able to provide assistance in such matters. Frequently, SEPG members may be recruited as SRE team members.

Sponsor Support

Who Can Sponsor an SRE?

The following discussion assumes that the project manager sponsors the SRE. This arrangement that has proven to be the most natural, as it allows the risk information generated in the SRE process to be controlled within the project itself, generally assuring the greatest cooperation from the interviewees because there is usually less concern that the information will be used later to punish the project staff.

We have seen two major exceptions to this in our years of conducting SREs:

- In one case, there was an antagonistic relationship between the project manager and the project staff; the information was used internally to punish the project staff.

- In another case, the SRE was used by an outside examination team to evaluate a project that had come under a cloud and was being threatened with cancellation.

The first case should have been normal and satisfactory, and the SEI assumed all was normal until the Risk Identification and Analysis (RI&A) phase had been completed. The second case should have normally have been avoided, but careful work in the Contracting phase assured that the SRE team leader, the leader of examination team, and the project manager had consistent expectations of the SRE and that confidentiality and non-attribution would be scrupulously maintained. As a result, the SRE was most successful and helped the project demonstrate its ability to confront the risks facing it.

Receiving sponsorship only from the project manager is generally the safest approach. If you become aware of conditions like the first case, it is best to avoid doing the SRE at all. Leave tricky conditions like the second case until you have built up a solid experience base in performing successful SREs.

Sponsor Responsibilities

A successful SRE depends as much upon the contributions of the project manager and staff as the efforts of the SRE team. Active support and involvement are required from the project manager. Sponsorship is more than mere endorsement; it means that the organization or individual sponsoring the activity is willing to provide visible and active support and the resources necessary to get the job done. The support needed from the project manager includes

- sponsorship—not just endorsement
- a site-visit coordinator
- a "risk-management champion"
- team participation
- SRE participation

Sponsorship　Sponsorship is the project manager's active participation and visible support for the risk management activities. Simply telling project staff to "do risk management" is not sufficient. If the manager does not lead by example, or fails to adopt the principles of managing risk, the project staff will not change their work habits or activities to support it either. Sponsorship is the involvement with, rewarding of, recognition of, and consistent behavior in support of risk management which is visible to all members of the project.

Site-Visit Coordinator　The project manager will assign a site-visit coordinator to make the necessary arrangements for SRE activities. Ideally, this person is an administrative assistant or skilled at coordinating and arranging facilities and the schedules of personnel.

"Risk-Management Champion"　The sponsor should appoint a person in the organization who will be the "conscience" or "cheerleader" for risk-management activities. This person should have the respect of the project staff, so that the importance of risk-management activities is clear to the project. The "champion" will be the person to see that risk is on meeting agendas, risk activities are maintained and kept visible, and that risk information is passed both up the line to the sponsor and down the line to the project.

SRE Team Members　The project manager and SRE team leader should discuss and agree on recruiting well-qualified, experienced, and capable people from within the organization to be team members. "Working Agreement" on page 22 discusses the selection of SRE team members from within the organization.

SRE Participants　The project manager is also responsible for assigning knowledgeable, well-respected project staff members as SRE participants. The quality of SRE results depend on it. (This is also covered in "Selection of Participants" on page 25.)

Key Considerations
- To be successful, the client organization must provide support and resources.
- Engineering staff typically make poor site coordinators.

Working Agreement

Description
The SRE working agreement is important to both the SRE team leader and the sponsor, because it helps assure that their relationship will mutually beneficial and that the responsibilities for success are shared as equally as possible. The working agreement operates as a "contract" between the two parties, whether it is formally written and signed or not. Such contracts have two main attributes, which also apply to consulting relationships generally: *mutual consent* and *valid consideration*[1].

- mutual consent – when both sides enter the agreement freely and by their own choosing. The concept of mutual consent directly addresses the issue of how motivated the parties are in conducting an SRE.

- consideration – the exchange of something of value between the parties. Project managers will receive information that they typically could not obtain in any other fashion. SRE providers (the SRE team leader and the members of the outside SRE team) will receive, in addition to monetary consideration (if any), access to people and information in the project, the time of people in the project, and the ability to impact the future course of action for the project. Most importantly, the team will get to handle real project risk information and learn how to preform SREs successfully in the future.

Inputs for the Working Agreement
The following topics should be considered as part of a working agreement between the SRE supplier and the project conducting the SRE:

- boundaries of the activity
- objectives of the SRE
- kinds of information sought
- SRE team role
- products the team will deliver

If the scope changes, it may become necessary to renegotiate the working agreement. For example, at the Mitigation Strategy Planning (MSP) meeting, it may become clear that other types of interventions are appropriate.

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1. Block, Peter. *Flawless Consulting—A Guide to Getting Your Expertise Used*. San Diego, Ca.: Pfeiffer & Company, 1981.

It may become necessary to bring other skills, such as organizational capability, process improvement, domain-specific knowledge, and problem-solving techniques to bear on the project's issues.

Boundaries of the SRE Activity

The boundary describes the limit or margin within which the SRE activity will be conducted. Risks or issues which are identified as beyond the boundary of the SRE are not dismissed, but rather captured and recorded for the client sponsor's awareness. Some of the questions for determining the boundary are

- Which part(s) of the client project/program will be the subject of the SRE?
- Which parts will not be considered?
- Which parts of the organization should/will participate?

An example of this boundary is "The SRE will address and include Release 1.3 of the operating system."

Objectives of the SRE

The project manager and SRE supplier should be clear about the purposes of the SRE which are to

- Identify and analyze risks to the project.
- Prepare high-level, strategic mitigation plans for major risks and risk areas, creating a way to further define and incorporate tasks into the overall project development plan.
- Address project manager expectations (see "Expectations" on page 18).

Kinds of Information Sought

The primary objective is to identify the risks which may affect the project. The data being sought will include

- a clear "picture of success" for the project in the eyes of the project members
- issues, worries, and concerns about achieving that picture of success
- specific conditions existing in the project that are generating those issues, worries, and concerns

SRE Team Role   The primary role of the SRE team is to provide a clear and understandable picture of the risks which may affect the project. Doing this involves

1. identifying risks

2. analyzing risk data

3. consolidating risks into areas for management action

4. facilitating the creation of mitigation strategy plans for selected risk areas

In addition, the SRE team

- enhances the risk management capabilities of the target project
- develops project staff awareness of risk management
- helps project staff prepare for future risk management activities in their organization, such as continuous risk identification and analysis, creation and support of a risk database, and development of a risk management plan

Products the SRE Team Will Deliver   The SRE process results in an identifiable number of products which are designed to collect the relevant data and provide the sponsor with a rich source of information about project risks, high priority risks, and risk areas that can be selected for MSP. These products include

- data confirmation briefing
- interim SRE report
- mitigation strategy plans and briefing
- final SRE report and briefing/closure meeting

Project managers are the primary customers of SREs. ***The results of the SREs belong to them.***   They determine who receives copies of the outputs, and ultimately, what is done with the results.

Selection of SRE Team   The composition of the SRE team is an important success factor. In most cases, the team members will be selected for their judgment and experience in the application domain.

A typical team consists of an SRE team leader and three to five team members. Team leaders are usually supplied by the SRE provider and should meet the following qualifications:

- at least five years of software system development experience

- not part of the project under consideration

- experienced facilitator or leader of small groups

- well respected within the organization (if coming from within the organization conducting the SRE)

Although not required, knowledge of interviewing skills is also desirable.

One or two team members are supplied by the SRE provider, while one to seven of them come from the client organization. Best results are achieved if all team members meet the following requirements:

- at least 2 years software system development experience

- not part of the project being evaluated

- knowledgeable about the project's work

- have an understanding of the organizational climate, politics, and environment

Selection of Participants   Project personnel are needed for the following situations:

- as participants in the risk interviews held during the RI&A phase of the SRE. These participants are the first "voice" in the process. The objective is to schedule an effective cross-section of the project staff. This will achieve a breadth and depth of expertise to identify the risks and uncertainties. The following is a list of typical group sessions and their participants from the project staff:

Group Session	Participants
Technical Leads	two to five team or subsystem leaders in the project
Design	two to five designers/implementors of the system (software developers)

Group Session	Participants
Functional	three to five members from such staff support groups as Testing and Evaluation (T&E), Quality Assurance (QA), Integrated Logistics Support (ILS), Configuration Management (CM), Validation and Verification (V&V), and so on.
Management	project manager

• Just prior to the MSP phase, project staff members will be assigned ownership of risk areas for mitigation. As such, they take part in the construction of mitigation plans during the MSP phase of the SRE, and then are responsible for completing the mitigation activities for their respective areas.

Schedule and Time   The project manager and SRE team leader need to work out a reasonable schedule for accomplishing the activities of the SRE. These are the guidelines the SEI has used for scheduling the RI&A phase:

1. Allow a half-day (four hours) for preparatory meetings such as the following:

   a. a briefing by a project representative explaining to the SRE team the technical challenges facing the project, project organization, schedule, and cost constraints

   b. a briefing by the SRE team leader explaining to the people who are to be interviewed (and any other people in the project who are interested in what is happening) the process that will be followed and what will happen to the information gathered

   c. a meeting of the SRE team to provide just-in-time training to the people who are local and may be new to the SRE process

   Briefing (a) and meeting (c) could be completed a week or more in advance of the interviews, but briefing (b) should be within one day of the first interview.

2. Allow a half-day (four hours) for each interview and the team analysis session that will follow it.

3. Allow at least 10 hours (and one good night's sleep) to complete the team's analysis steps and prepare the briefing.

4. Allow one hour for the data confirmation briefing that presents the rolled-up analysis of the risk information gathered in the interviews.

5. If at all possible, keep the entire process to a week. If that isn't possible, schedule some interviews the week before the data confirmation briefing (but keep the majority of the interviews during the week of the data confirmation briefing).

A notional schedule for a four-interview RI&A schedule is portrayed in the Team Member's Notebook (Appendix A, page 3 and 15-19).

Allow two weeks to prepare the interim report, and a week or more to get the project manager's decision about the risk areas to be addressed in the MSP phase.

The SEI developed guidelines for scheduling the MSP phase:

1. Allow a full work day for the first risk area to be addressed.

2. Allow a half-day (four hours) for each subsequent risk area to be addressed (NOTE: We have often been unable to complete the process in four hours. Schedule more time if you can!)

3. If it will be necessary to use different project decision-makers in the various risk area sessions, schedule an MSP cross-area strategy session to last a half-day (four hours).

4. Allow a half-day (four hours) to consolidate the strategy information from the various MSP sessions and prepare a briefing.

5. Allow an hour for the briefing itself.

Allow two weeks to prepare the final report.

Use of Data Confidentiality and non-attribution are non-negotiable issues. The successful SRE depends on open, unconstrained communication between the participants and the SRE team. The participants must be confident that what they say will not be revealed. Make this clear to the project manager—explain that you will not reveal who identified any specific risk statement, or even the session that it came from.

It's a good idea to write a confidentiality agreement that will be signed by every member of the SRE team, and to review the

agreement with the project manager, so that they all understand the extent of the team members' obligation to maintain confidentiality and non-attribution.

The Project's "Picture of Success"

Before discussing the topic of Risk Exposure with the project manager, it is important to lay the groundwork by asking for the project manager's "picture of success." Have the project manager imagine a time in the future when the project is completely successful. What will have been accomplished? How will this part of the world have been improved? Focus on three key questions:

- **When will it be?** Determine how far in the future the project manager is focused. Are they talking about delivery of a product? Long-term use by satisfied customers? Leaving a legacy to mankind?

- **What will it be?** Get a high level description of the product(s) the project will have produced at that time, with some information about the important attributes of the product(s)

- **What makes it a "success"?** What is the reward the project manager foresees at the end of the project? Is it enhanced national defense? Becoming legends of the industry? Becoming rich?

At the end of the discussion, write the "Picture of Success" in a way that the project manager can edit it and amend it (e.g., on a flip chart or on a computer screen) until it is satisfactory.

Example

The following is an example of a picture of success:

By March 1, 1986, The Toivolia Telephone Company will have the new Computerized Directory Assistance System in full operation, with operators clearing three times as many directory assistance calls per person-hour as was ever possible before. The interconnected hardware of ten computer with 500 operator stations will have started up flawlessly and will have had negligible downtime to date. This will make a significant contribution to Toivolia's bottom line and will provide S3I with a demonstration site for potential customers that will assure strong sales to other telephone companies well into the 1990's.

Purpose

Risks need to be identified in terms of some desired end-state. If I am focused on arriving safely at my destination tomorrow, my list of risks will be completely different from the list I would define if I were focused

on successfully raising a family, or getting my children through college. By getting the project manager's "Picture of Success" you have an expectation that you can present the same vision to the interviewees during the RI&A phase, and they can identify the conditions in the project that put that vision at risk. The three "key questions" called out above relate directly to the SEI risk management principles *Forward-Looking View*, *Shared Product Vision*, and *Global Perspective*.[1]

Risk Exposure

Description Risk exposure is a measure used during the analysis portion of the RI&A phase and is created by combining the impact and probability of the risk, should it materialize. The table below defines these terms at the level of detail that the SEI found useful in its SREs (four levels of impact and three of probability, translating to six levels of risk exposure).

impact	the effect of the particular risk on the project which is determined on the basis of the risk's effect on the software's performance, supportability, cost, and schedule. The levels of impact are • 4—catastrophic • 3—critical • 2—marginal • 1—negligible
probability	the chance that particular impact will occur. The levels of probability are • 3—very likely • 2—probable • 3—improbable
risk exposure	the function of probability and impact rated on a 6-point scale are computed by the simple look-up table shown in Figure 1 on page 30

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1. The SEI's *Continuous Risk Management Guidebook*, Pittsburgh, PA: Carnegie Mellon University, 1996, pp. 7-9

With just three levels of probability, the SEI has found it is relatively easy to achieve common understanding of what the probability means. We explain it as follows.

First, choose the level of impact you think is appropriate for this risk to the project. Next consider the probability that the risk will have *this impact*.

- If you think it's about a "coin toss" that this will be the impact of the risk, assign it the probability "2—probable."
- If you think it's significantly more probable than a "coin toss," assign it the probability "3—very likely."
- Conversely, if you think it's significantly less probable than a "coin toss," assigning it the probability "1—improbable."

The actual titles used for the levels of probability are not important—"probable-likely-not likely" would be a reasonable alternative set of probability titles, for example.

Also, in Figure 1 the words "High" (associated with risk exposures 5 and 6), "Medium" (3 and 4), and "Low" (1 and 2) are simply characterizations of these levels of risk exposure. In discussions with the project manager, the team leader will probably set the goal that the SRE and any resulting risk program should set mitigation strategies in place to deal with all risks that are evaluated as "High" (i.e., 5 or 6).

Figure 1:   Lookup Table for Risk Exposure

Project Manager's Input on Definitions

The project manager can provide excellent guidance to SRE team and group session participants by refining the definitions of impacts to make them more meaningful to the project. The figure below gives generic definitions of the terms "Negligible," "Marginal," Critical," and "Catastrophic," but the SRE team leader should get the project manager to adjust these definitions for local conditions. For example, if just a 20% cost overrun would be "catastrophic" for this project, the definitions of "catastrophic," "critical," and "marginal" should all be adjusted to reflect this local reality. Likewise, the vague performance definitions should be sharpened to reflect the real performance goals of the project.

In these discussions, it may be necessary to explain to the project manager that "negligible" does not mean "no impact"—it means that this risk *by itself* will not cause the project to miss its performance, support, cost, or schedule goals, but it could combine with another risk to have that result.

Figure 1 can also be customized for local conditions. For example, if the project manager considers *any* "catastrophic" impact to be a "High" risk exposure, regardless of the associated probability, the table can be changed to reflect this (i.e., change the intersection of "Catastrophic" and "Improbable" from "4—Medium" to "5—High").

Component➜ Category ⬇	Performance	Support	Cost	Schedule
Catastrophic	nonachievement of technical performance	unsupportable software	major budget overrun (>50%)	unachievable IOC
Critical	significant degradation of technical performance	major delays in software modifications	serious budget overrun (~30%)	serious delay in IOC (>30% late)
Marginal	some reduction in technical performance	minor delays in software modifications	budget overrun (~10%)	delay in IOC (>10% late)
Negligible	minimal to small reduction in technical performance, at detail level	irritating and awkward maintenance	consumption of some budget cushion	consumption of some slack—not on critical path

Figure 2:   Risk Exposure Matrix

Key Results from the Contracting Phase

❒ The SRE team leader and project manager understand one another's expectations for the SRE.

❒ The project manager is engaged as an active sponsor of the SRE process, assuring that project personnel have been told through the project's "informal communications channels" that the success of the SRE is important.

❒ Support for the confidentiality and non-attribution of the interviews in the RI&A phase has been assured.

❒ The SRE team leader has a written statement of the project's "picture of success," defined from the project manager's viewpoint.

❒ The project manager has taken ownership of the definitions of risk impact and risk exposure by customizing them for the project. (This helps assure consistent expectations for the SRE.)

Risk Identification and Analysis Phase

Description The Risk Identification and Analysis (RI&A) phase of the SRE is designed to help project members identify and analyze risks facing their development effort. The SRE team elicits and captures the risk statements from the project members who are interviewed; analyzes the statements for probability, impact, and risk exposure; collects them into groups (risk areas) for mitigation in the Mitigation Strategy Planning (MSP) phase; and makes a first assessment of the relative importance of both the risk statements and risk areas. These results are presented to the people who were interviewed to confirm the general picture that emerges.

Process Diagram

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Contracting
    │
    ▼
Risk Identification
and Analysis (RI&A)
    │
    ▼
Interim
Report
    │
    ▼
Mitigation Strategy
Planning (MSP)
    │
    ▼
Final
Report
```

Sessions Discussed

In the discussion that follows, we refer to the group session, and describe the interview and participants' evaluation sessions in some detail. The term "group session" includes both the interview session and the participants' evaluation session, because the process is structured around performing those two activities back-to-back in a single three-hour time slot.

Using the CD-ROM to Understand the Interview Process

The heart of the entire SRE process is the construction of the risk statement in the condition-consequence form, and this construction is accomplished in the interview session. The CD-ROM will provide you with a far more vivid understanding of how risk statements are created, because it contains video clips of the interview session and the participants' evaluation session that immediately follows it. I recommend that when you are ready to tackle this subject, you skim the material in the sections titled "Conduct Interviews" and "Participants' Evaluation," and then watch the lecture on the CD-ROM. The five video clips of the group session in progress are embedded in the lecture, and the lecture and clips cover the the same material as the text beginning on page 51.

Conduct Project Briefing

Description

The project briefing is the opportunity for the SRE team to obtain project context and background before the interviews begin. Typically, the project manager presents the briefing to the SRE team. This briefing should

- provide the team with a project overview
- help the team to understand the organization, goals, and purpose of the project
- afford an opportunity for the team to clarify knowledge and issues about the project

It is important that the SRE team understands the above items before starting the RI&A activities. The more the team knows

about the context, basic assumptions, and current status of the project, the better it will assimilate the risk data it receives.

Who's Involved   The participants for this step are

- project manager (or designated substitute) who gives the project briefing

- any other project members the project manager chooses to invite

- SRE team members

Example Project Briefing Topics   A typical project briefing might contain the following topics:

- What is the project's current "picture of success"?

- a description of the product or system being built by the project staff
  - What does it do?
  - What makes it a challenge?
  - What need or market does it serve?
  - Who is the customer?

- the project personnel
  - Who are the people the team will be seeing in the interviews?
  - Where do these people fit into the project organization and operations?

- Where is the work being done? Where will the product be delivered?

- the project schedule
  - When must the product be delivered to the customer?
  - What are the milestones and contractual dates of the project?
  - Where is the project on the schedule right now?

- How is the product being developed? What processes are being followed?

- How does the project budget compare with the current estimate of cost at completion?

Key Results from the Project Briefing   All SRE team members understand the following:

❒ the desired future state—the date, products to be delivered, and performance criteria

❒ the organizational structure of the project and the general project roles and responsibilities

❒ the technical challenges (and associated opportunities) of the project

❒ the project schedule and progress to date (Has the project been missing milestones? Has there been re-planning of the schedule?)

❒ cost constraints and current estimate of cost at completion

Conduct Opening Briefing

Description   The opening briefing is usually the first SRE activity that is visible to the project staff and officially begins the SRE. During the opening briefing, the project manager typically introduces the SRE members to the project staff, explains their purpose in visiting, asks for complete cooperation and candor, and turns the meeting over to the SRE team leader. Then the team leader discusses the SRE process, sets the participants' expectations, reviews the scheduled activities, and answers questions.

Who's Involved   The following people take part in this step:

• project manager (extremely important)

• all project members who will be interviewed during the RI&A phase (strongly recommended)

• other project personnel for information purposes (recommended, but optional)

• SRE team leader (typically presents the majority of the opening briefing)

• all other SRE team members (should be a requirement)

Example Briefing Agenda   The typical opening briefing discusses

• who the SRE team is and why they are here (presented by the project manager)

- the purpose, desires, and objectives of the project manager in conducting an SRE (presented by the project manager)

- overview of risk and risk management (presented by the SRE team leader)
    - attributes of risk
    - construction of risk statements

- overview of the SRE process
    - what to expect during the interviews
    - confidentiality and non-attribution
    - what the other steps are

- confirmation of the RI&A phase schedule

- confirmation of participants' schedule (who will be where and when)

Key Results from the Opening Briefing

When this step is completed, all project members who are to be interviewed should understand

❒ why this process is being used

❒ the condition —> consequence structure of the risk statements they will be helping to write during the interviews

❒ that the organization's management and the project manager are committed to making the SRE activity a success

❒ what will happen to the information that is gathered, and the rules of confidentiality and non-attribution that will be applied during the process

❒ the interview session schedule (where they are expected to be, and *when*)

Prepare SRE Team

Description   This is a short period of training conducted for the benefit of organization members who have joined the SRE team. It provides operational guidance for team roles in the execution of the RI&A phase of the SRE. Typically this training is conducted by the SRE team leader and provides

- an overview of the SRE process
- activities and schedule for the upcoming RI&A phase
- guidance for SRE team behaviors during the RI&A phase
- an opportunity for SRE team members to ask questions regarding the process

Inputs   The inputs for this step are

- the SRE orientation materials
- SRE Team Member's Notebook

Outputs   When this step is completed, participants should understand their roles and activities during the RI&A phase of the SRE.

Who's Involved   The participants for this step are

- SRE team leader—in the role of instructor
- SRE team members from the project or organization—in the role of students

Example   Below is a typical set of topics for the team preparation:

1. risk management basics
    - definition and attributes of risk
    - risk statement definitions
    - SEI Risk Taxonomy (or other guide to be used in interviewing to assure full coverage of risk sources)

2. SRE process overview

3. RI&A topics

- interview technique
- note-taking techniques
- interview roles for SRE team members
- participant evaluation of risk and use of risk exposure matrix
- team evaluation of risk
- classification

4. consolidation activities
   - risk areas
   - briefing preparation

5. review of logistical arrangements and support tools

Key Results from SRE Team Preparation

❒ New SRE team members understand what is expected of them and what opportunities may be available for them to take one of the major roles (interviewer, risk recorder, session recorder) in the interviews.

❒ If more is expected of the new SRE team members during the interviews than to watch, listen, and keep notes, this is made explicit by the SRE team leader.

❒ The roles of interviewer, risk recorder, and session recorder are assigned for at least the first two interviews.

❒ The strategy for each interview is set (e.g., beginning in Taxonomy Class A—risks that arise from the product being developed—for "worker bees" on the project, but beginning in Taxonomy Class B—sources of risks that arise from the people and processes the project has chosen to use—when interviewing the first line managers of the project).

Conduct Interviews

Description An RI&A phase can contain any number of group sessions. Each group session is three hours long and includes the following:

- risk interview segment (2.5 hours) – in which the project members are asked questions designed to elicit risks within the project. The SRE team conducts the interviews, collects context, and captures risk statements put forth by project members.

- participant evaluation segment (0.5 hours) – in which project members are asked to individually score the collectively generated risk statements for probability and impact (risk exposure) and then to choose the top five risks to the project

The risk interview is the basic information-gathering activity of the SRE. Risk interviews are structured interviews of selected key project people which focus on their individual knowledge of the project risks. The activity brings the participants' knowledge out into the open in a non-threatening way by adhering to the principlesof non-attribution and confidentiality. The risk interview generally supports the principle of individual knowledge (i.e., for the most part, risks in the project are known by the individuals working on the project). In general, the risk interview is an engine that creates the fundamental output of the SRE: the risk statement.

Interview Diagram   A diagram of the inputs, constraints, supporting information, and outputs (intermediate products) of the SRE interview process is shown below.
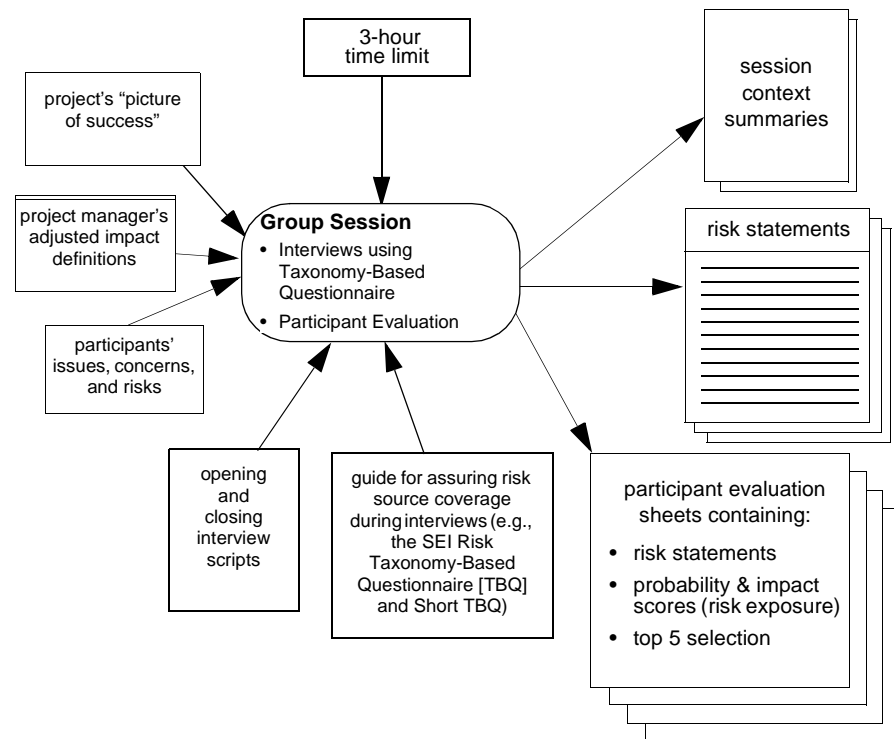
SRE Interview Diagram

Inputs　　The inputs for the risk interview include

- the project's "picture of success" from the Contracting phase and/or the Project Briefing

- participants' issues, concerns, and risks—which they bring to the interview in their heads (no special preparation is required)

- the project manager's adjusted values for the risk exposure matrix (from the Contracting phase)

Outputs　　The outputs of this step include

- a set of 15-40 risk statements for each session

- context summaries for the interview – session recorder(s) are responsible for capturing the spoken context for each risk statement. After the session, that session's recorder(s) polls other team members for context notes, aggregates the notes, and duplicates and distributes the aggregated set to all team members.

- completed participant evaluation forms – one per participant with each risk statement scored for probability and impact definitions from the Contracting phase. Each participant then selects the most important risk statements that could affect the project's success.

Who's Involved　　SRE team members participate in the roles of

- interviewer – asks questions from the Taxonomy-Based Questionnaire, asks probing questions, follows up discussion points, and leads the session

- risk recorder – assists the participants in wording the risk statements. Captures risk statements on flipchart for all to see.

- session recorder – captures the discussion and non-verbal communications (context) surrounding the raising of a risk

- data compiler – captures risk statements in a spreadsheet and produces the risk evaluation forms for use by participants in the next step

Participants (project staff) gather in peer groups of one to five. Participants must be peers—no perceived or explicit reporting relationships can exist within the group. The following are typical of the groups interviewed:

- project manager – (Note: If the project manager has a deputy and the functions in a relationship that makes them almost peers, interviewing the project manager and deputy together will greatly enhance the process of creating risk statements. Interviewing just one person at a time is generally undesirable, but is often necessary in the case of the project manager.)

- team leaders – technical staff leading teams of developers. (Teams may be aligned along subsystem or functional lines.)

- designers – staff involved in the development of the project software (software engineers)

- support engineers – staff involved in supporting the project in the areas of configuration management, testing, software quality assurance, or project-assigned members of the organization's software engineering process group (SEPG)

The Risk Statement

The risk statement is the product of the risk interview step and consists of

- a condition: something that is true or accepted as true
- a separator: either a semicolon, arrow, or linking phrase
- a consequence: something that may occur as a result of the condition

Risk Statement Diagram

A diagram depicting the form of the risk statement, including an example, is shown below.
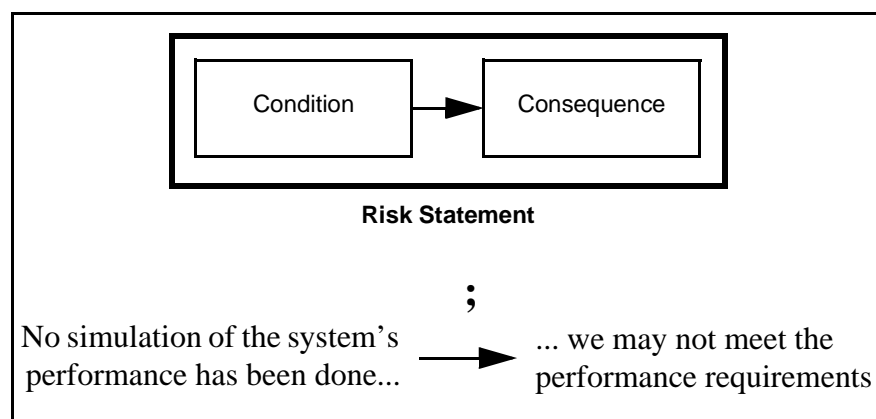
Typical Number of Risk Statements
SEI experience has shown that a 2.5 hour interview will generate 15-40 risk statements.

SEI Risk Taxonomy
The diagram in Figure 3 shows the general structure of the SEI Risk Taxonomy (see page 44). The SRE uses the Taxonomy-Based Questionnaire (TBQ) to elicit risks from the interview participants. In the Session Analysis step, the Taxonomy is used as a classification framework for risk statements created in the interview.

Alternative Frameworks to Assure Completeness and Closure
The SEI Risk Taxonomy, Taxonomy-Based Questionnaire (TBQ), and Short TBQ (on page 53 of the Appendix) are not *required* for a "flawless" SRE process; however, some near-analogues for each of them will have to be created if you do not use the SEI products. The essential issues/principles you need to apply are these:

1. *Taxonomy* – You need a conceptual framework of all the potential sources of risk to your project. This framework needs to consider all the risk sources that are
   - inherent in or driven by the product the project is creating. (In the SEI Risk Taxonomy, these sources are grouped into the class called *Product Engineering*),
   - associated with the way the project has chosen to go about its development (*Development Environment* in the SEI Risk Taxonomy)
   - outside the project's control (*Program Constraints* in the SEI Risk Taxonomy)

2. *TBQ* – You need a specific set of questions for probing into each area of the conceptual framework. These need to be written out fully so that different interviewers always ask the same question the same way, and so that the questions can be improved over time.

3. *Short TBQ* – You need an alternative set of questions or an approach that will let you jump to a more inclusive way of asking about sources of risk as time begins to run out in the interview. This is needed to assure *coverage* (or completeness) of the interview.

Software Development Risk

Class	Product Engineering	Product Engineering	Product Engineering
Element	Requirements ... Engineering Specialties	Development Processes ... Work Environment	Resources ... Externals
Attribute	Stability ... Scale	Formality ... Product Control	Schedule ... Facilities
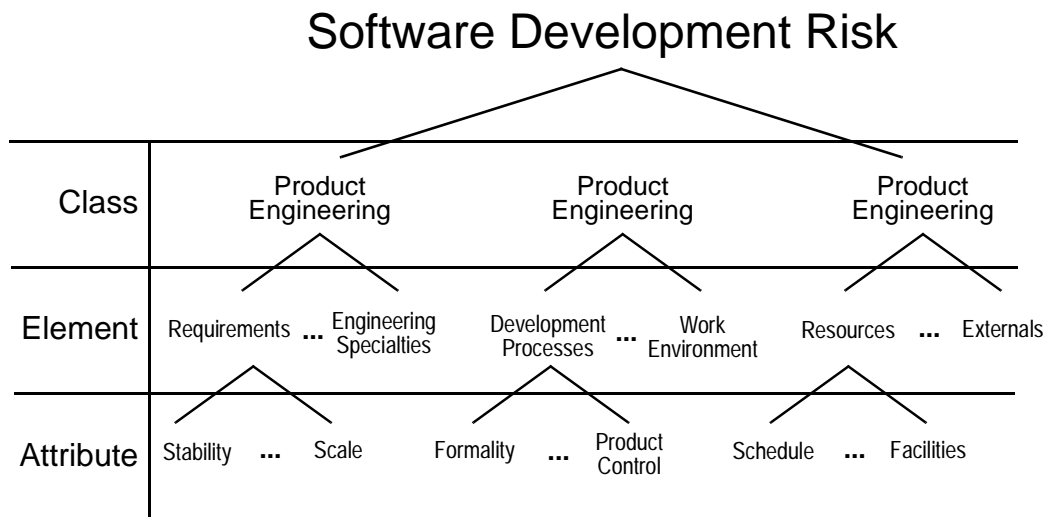
Figure 3:   SEI Risk Taxonomy

Interview Protocol   Risks are elicited and captured during an interview. An interview protocol is used which combines the use of a structured question *list* (e.g., the SEI TBQ) and follow-up questioning or "probing" for a potential risk. The overall process is depicted graphically below.

Interview Cycle
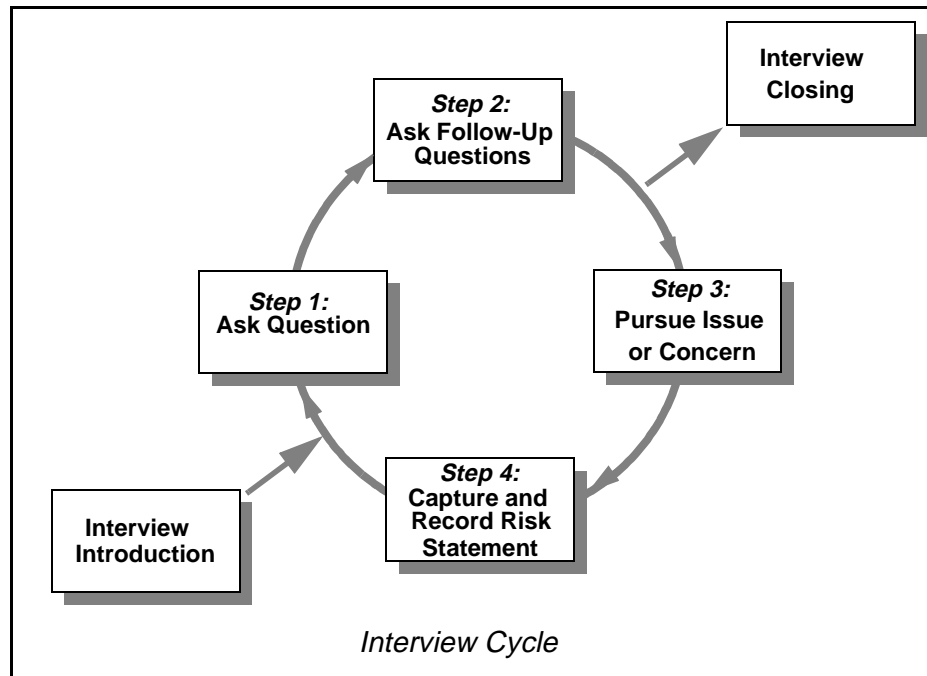
After the introductory phase (best handled by reading a standard script, to assure consistency from interview to interview), follow these steps for each question:

Step 1: The interviewer should maintain a strict discipline of reading the question *exactly* as written (again to assure consistency and maintain the intended "suspense" of the question). ***If the response to the question indicates there is reason for concern in that area, proceed directly to Step 3.***

Step 2: If the question in Step 1 elicits no issue or concern, and if there is a follow-up question available for further probing of the area, ask the follow-up question(s), *exactly* as written and ask the next question. ***If there is still no issue or concern in this area, return to Step 1.***

Step 3: The interviewer is now in free-form pursuit of a risk statement. This can be a further clarification and discussion of the concerns, or it can be as specific as, "That sounds like an issue we ought to capture; can you phrase that for us in Condition-Consequence form?"

Step 4: The risk recorder steps to the flipchart and writes out the statement in Condition-Consequence form, in full view of the interviewees, following the guidance of the particular interviewee who is articulating the issue. The risk recorder asks for confirmation that what is written is exactly what the interviewee means. Then the interviewer asks for confirmation that the other interviewees understand the issue that has been captured. ***It is not necessary for the other interviewees to agree that the statement is a "risk," and this should be pointed out as often as necessary until they all understand that point.*** Upon confirmation, the interviewer can proceed to the next question (i.e., Step 1).

This process is continued cyclically until time is running out (10 to 20 minutes before the end of the 2-1/2 hour interview period, depending on whether all the sources of risk are being covered efficiently or not—twenty if the interviewer has not gotten very far into the questions, ten if half to two-thirds of the questions have been covered). Then the interviewer switches to a higher-level question format (the SEI Short Taxonomy-Based Question-

naire, for example), but still maintains the Step 1 – Step 4 process until the 2-1/2 hours are up. The "Interview Closing" step occurs in the following half hour.

Interviewer

The SRE RI&A interviewing process is based on the principle that the interviewer is always in charge of the pacing and direction of the interview. *The interviewer is always in charge*, except when the responsibility for closure on the exact wording of a risk statement has shifted to the risk recorder. As a general rule, other team members should not address follow-up questions to the interviewees, but should rather ask the interviewer to inquire more deeply in to a subject, or point out that some other interviewee appeared to have something to say on that last subject, and so on.

Risk Recorder

The risk recorder has the responsibility of writing the risk statements clearly, putting them into proper condition-consequence form, and confirming with the interviewee whose concern is being captured that the words written are accurate. The important point is that the risk recorder forces the interviewee to take *ownership* of the statement as it is written on the flipchart; it must never be perceived by the interviewees as the *risk recorder's* risk statement. In addition, the risk recorder needs to do whatever is necessary to make sure that *all* the risk statements captured during the interview session remain visible to the interviewees at all times. (The interviewees have historically done an excellent job of policing themselves during the interview, making sure that the discussion doesn't "double back" and start capturing issues that are already covered by the risk statements on the flipcharts.)

Session Recorder

The responsibility for capturing the context that is associated with the risk statements falls primarily on the session recorder. Context for the risk statements is critical, because of the transient nature of people's memories. A risk statement that seemed perfectly clear when it was written can become unclear within a matter of hours or—worse yet—change in interpreted meaning within hours, and many will become unclear over the course of several interviews over two or three days.

The technique that the SEI has used most successfully for capturing context has been to have one person (the session recorder) responsible for creating a "stream of discussion" set of notes during the interview. The technique has been that of a good note-taker in a college course, and peo-

ple who have good skills at that have made the best session recorders. To aid in subsequent discussion and analysis, the session recorder needs to maintain two special sets of "pointers" in the notes:

1. the number of the question from the interviewer's questionnaire, at the chronological point where it is asked (so that the discussion and any risk statements that are created can be traced back to the triggering question)

2. the number of the risk statement at the chronological point where the risk recorder begins to write it on the flipchart

The session recorder should not write down the question or the risk statement in the notes (since they already are captured), but should concentrate on the interviewee's discussion.

Other team members who are not in one of the other interview roles should also be capturing notes the same way as the session recorder is. After the interview is over, the session recorder should gather all the other notes that were made and reconcile them with the official record.

Data Compiler   This is a role that the SEI never wanted to create and has constantly tried to figure out how to eliminate. The data compiler is responsible for getting the risk statements from the flipcharts into a printable spreadsheet, and for doing this efficiently enough that the spreadsheet can be formatted, printed, duplicated, and in the interviewees' hands within ten minutes of the end of the interview session. This has typically required most of the attention of someone who is adept at manipulating computer spreadsheets and prevented the data compiler from participating fully in the interview dialogue.

Commentary on Interviewing

The following insightful commentary was provided by the US Coast Guard's Lieutenant Brian Hofferber, based on his observations of the process used during four SEI interview sessions:

> *Identifying Risks: Other than posing the taxonomy-based questions, the Interviewer's primary job is to continually scan the content of the interview dialog for identifiable risks and stop the conversation to capture the risks within a formulated Risk Statement on the flip chart. However, during some conversations, interviewees will occasionally make comments which implicitly point to potential risks which are not directly related to the main flow of the dialog. In such instances, the Interviewer should not interrupt the main flow of the conversation but rather make a written note of the potential risk and return to it at the end of the conversation before the next question is posed. Recognizing both explicit and implicit risks within the content of an interview and knowing when the conversation should be stopped to capture a risk on the flip chart and when a potential risk should merely captured within the Interviewer's notes to be addressed at a later moment is a skill that only comes with experience in the Interviewer role.*

Changing Priorities During the Interview

During the 2-1/2 hour interview process, the interviewer needs to change his priorities through three distinct phases, depicted in the graphic below:

Interview Priorities
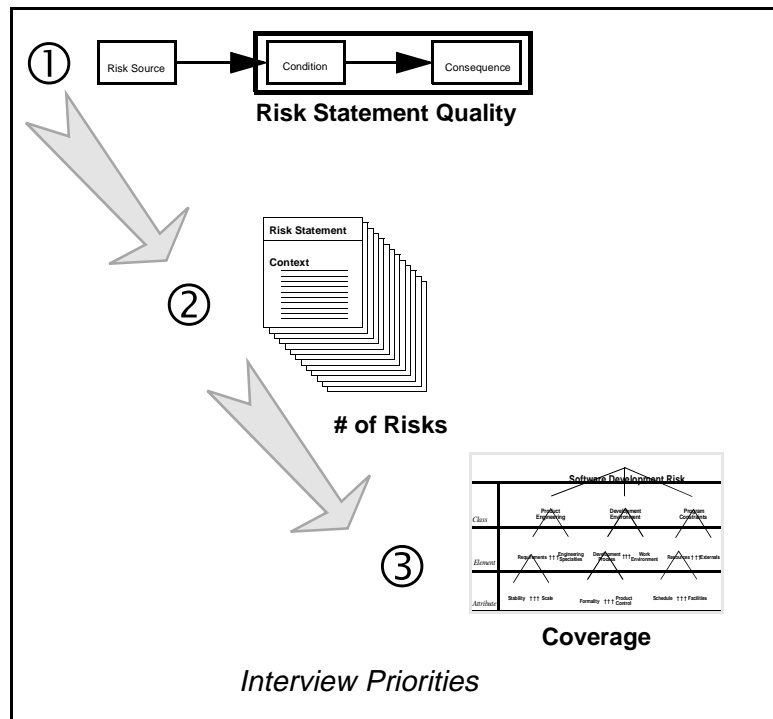
1. For the first one or two risk statements, it is critical that the interviewees understand exactly how the Condition-Consequence form is created from their own words. Once they have seen it happen correctly and have positive feedback from the interviewer and risk recorder that what they have created are indeed satisfactory statements in form, the interviewees will be able to police themselves and construct properly formed statements quickly, with little further help.

2. In the middle of the interview, the interviewer focuses on getting as many risk statements as possible written. This mostly means avoiding the pitfalls of allowing "problem solving" or digressions into examples or "war stories."

3. Toward the end of the interview, it is necessary for the interviewer to "shift gears" and turn to an alternate set of questions written at a higher level (i.e., more inclusive in the scope of risk sources being pursued) to assure that all sources of risks are covered in the remaining time. The SEI Short

Taxonomy-Based Questionnaire (on page 53 in the Appendix) is an example of such a higher level set of questions, 13 of which were derived from the 194-question SEI Taxonomy-Based Questionnaire; however, a similar set of questions can be derived from any set of detailed interview questions. An alternative approach is to show them the "roadmap" of the coverage items (e.g., the SEI often shows the interviewees a one-page table of the titles of the Risk Taxonomy Classes, Elements, and Attributes) as a prompt to consider areas that were not brought up in the interview questions.

Tools
- a Team Member's Notebook (use the appendix as a baseline for constructing one that is more suitable for your purposes)
- a conference room for the interviews that is private (floor-to-ceiling walls and door)
- flipcharts, markers, and tape for capturing risk statements
- portable computer (laptop) with spreadsheet software for capturing risk statements and a printer (either connected, or available within a short distance to "sneaker-net" a floppy disk copy of the risk evaluation form)
- portable computer (laptop) for capturing the session recorder's notes (strongly recommended)

Sample Risk Statements

Typical risk statements are shown below.

Requirements seem to be changing; can't be sure that the test cases cover all requirements.
There is no formal change control process that coordinates all affected groups; test plans are not keeping up with changes.
There have been instances where programmers have been relaxing argument typing to facilitate compilation (C++ allows this); this may cause unpredictable system behavior and extensive system debugging time.

Key Results from the Interview
- ❐ flipcharts listing all the risk statements created during the interview and remaining visible during the entire interview (e.g., taped on the walls in front of the interviewees as they are filled up)
- ❐ a risk evaluation form with all the risk statements generated during the interview, one copy for each interviewee and SRE team member

☐ at least one "stream-of-discussion" set of notes with pointers embedded in it that show when the interviewer asked which question, and when each risk statement was captured

☐ a lot of good risk statements. The SEI expects no fewer than 15 risk statements from a 2-1/2 hour interview; fewer than that, and we would want to analyze what went wrong and consider arranging another interview (with an alternative group of the same type) to be sure that the risk coverage is complete

Participants' Evaluation

Description   Immediately following the risk interview, participants are asked to evaluate the risks they just created. Participants are given copies of the risks statements on an evaluation form and asked to individually

- score the risk statements for probability and impact using the impact definitions from the Contracting phase

- select the most important risks to the project

Diagram   The following diagram shows the relationship of the participant evaluation activity to the group session.
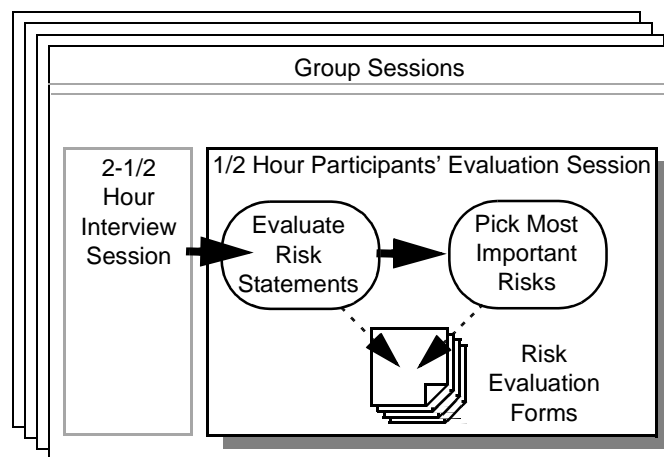
Who's Involved   The participants in the risk interview individually evaluate the risk statements for probability and impact and choose the top five project risks.

Guidance to the Participants

1. Each participant should fill out an evaluation form without consulting other participants.

2. Show the participants the definitions of levels of impact that were defined with the project manager's help in the Contracting phase (see page 17). These will help to "calibrate" their perception of the meaning of terms like "catastrophic" and "critical."

3. Have participants pick the impact first, then decide what probability should be associated with that level of impact. Give them practical examples of the various levels of probability you are using to help them do this.

4. *After they have filled in their estimates of impact and probability*, have them pick what they think are the most important 3, 4, or 5 risks threatening the success of the project. If the total number of interviewees in all the sessions is small (fewer than 10), have them pick 5; if it is large (15 to 20 total participants), have them pick 3. The SEI has typically instructed the participants to put "1" next to the risk statement they think is most important, "2" next to the one they think is the next most important, and so on.

Use of the Information Gathered

The SEI has used only the participants' choices of the most important risks to the project in subsequent analysis steps and in the data confirmation briefing; their judgement of impact and probability is not used at all. So why have them go through that step?

Recall that the risk statement is made up of a condition and a consequence. Often, the condition part is a *problem* that exists today and may already have high visibility in the project, with a great deal of effort already underway to solve it. Our concern is that by simply asking the participants to pick the most important risks, they would pick the most important *conditions* (i.e., the most important problems). By first getting the participants to focus on the *consequences* of the conditions rather than the conditions themselves, we believe that they are more accurate in picking the most important future risks to the project. This is, however, an unproven working hypothesis.

Tools
- definitions of impact and probability that were confirmed with the project manager during the Contracting phase
- a printed evaluation form for each participant and SRE team member
- portable computer (laptop) with spreadsheet software for data entry of completed risk evaluation sheets

Example The following is an example of a completed participant evaluation sheet:

	Participant's Name->		R. B. Everette	
Risk ID	**Risk Statement**	**Impact**	**Probability**	**Top 5**
G2.1	There are two competing developmental models in use—waterfall and incremental build; this may be causing confusion among the system developers.	1	2	
G2.2	Software Quality Assurance and Configuration Management seem not to have formal, controlled plans at this time; could increase our costs and development time, we may lose or overwrite modules.	3	2	
G2.3	Concern that waterfall methodology that is in use is not the proper approach; may cause major problems at "big bang" integration and test time.	1	1	
G2.4	There is concern that the software development group is not reviewing integration and test plans carefully and not giving feedback; at integration and test time there may be a major confrontation between the groups.	1	3	
G2.5	Requirements seem to be changing; can't be sure that the test cases cover all requirements.	4	2	3
G2.6	There is no formal change control process that coordinates all affected groups; test plans are not keeping up with changes.	1	2	
G2.7	There have been instances where programmers have been relaxing argument typing to facilitate compilation (C++ allows this); this may cause unpredictable system behavior and extensive system debugging time.	3	2	4
G2.8	There is a lack of training in C++; system developers don't know which features are "safe" to use and which should be left alone.	3	2	5

**Closing the Group
Session**

After all the completed forms have been collected, the interviewer closes the group session by

1. reviewing all that has been accomplished during the group session

2. thanking them for their participation in this effort

3. reminding the participants of the rules of confidentiality and non-attribution under which the session was conducted

4. asking them all to be present for the data confirmation briefing

**Key Results from
the Evaluation
Session**

❐ Participants have been shown how problems ("conditions") can create risks that are different from the problems themselves.

❐ Participants have had the experience of determining impact and probability based on a set of project standards.

❐ Each participant has picked the top three to five risks to the project identified during the interview.

Session Analysis

Description

Following each risk interview (or while the participants were doing theirs during the evaluation session), the SRE team members individually evaluate the risk statements (using the same definitions of impact and probability that the participants use). The team collectively classifies the risk statements (to the element level) using the SEI Risk Taxonomy. Classification is a consensus activity.

While classification is taking place or during a break, the team's data compiler collects each individual team member's scoring evaluation of the risk statements. The risk exposure lookup table that was confirmed (or modified) by the project manager during the Contracting phase is used to convert the impacts and probabilities into risk exposures (can be done automatically by the spread-

sheet, if it is set up for this) on a combined team members' risk evaluation sheet.

Diagram   The diagram below shows the general process followed during session analysis.
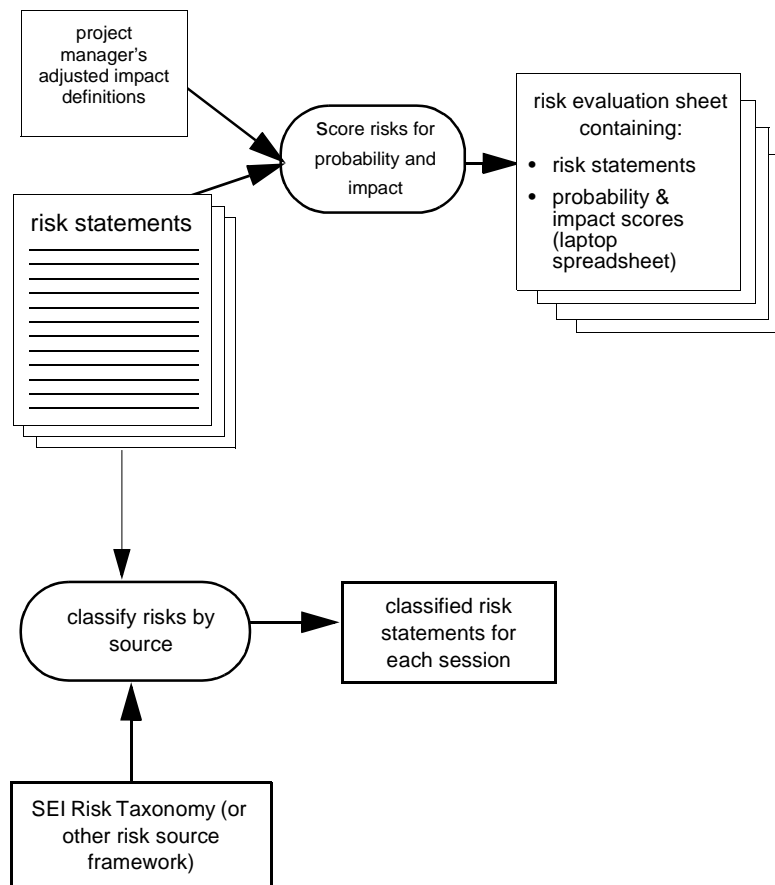
Who's Involved   This is an SRE team-only activity. Every effort is made to complete these two activities before the next group session. However, if time runs out, the team completes these activities for the day's group sessions before adjourning for the day.

Key Results of Session Analysis

❐ a completed evaluation worksheet (containing probability, impact, and computed risk exposure values for each risk statement) for each team member

❐ a classification for each risk statement according to the general risk source framework being used for the SRE. This can be done conveniently using a wall chart to which the risk statements are taped in the appropriate "pigeonholes," *provided* that the wall chart is in another room or is covered when interviewees are in the room during subsequent group sessions. (It could affect the new interviewees' identification of risks.)

Consolidation

Description Consolidation is an SRE team-only step that consists of the following substeps:

- context review – Team members individually review the aggregated context notes for each session and select quotes and observations for use in the data confirmation briefing.

- reconcile scoring – These risk exposures were then arranged in descending order from those the team had the most disagreement on to the least. During this substep, the team revisits the risks, discussing each and attempting to come to a consensus or to understand why team members scored them as they did. Values that change as a result of these discussions are revised and re-entered into the team's reconciled scoring worksheet.

- rearrangement into risk areas – The classification of all risk statements is revisited in order to create risk areas, which are logical collections of risks that the team feels can be mitigated as a group.

- preparation of the data confirmation briefing – The SRE team prepares slides for each risk area and a histogram showing (on a per risk area basis) the total number of risk statements, the number of participants' critical risk statements, and the number of team's critical risk statements.

Inputs The inputs for this step include

- team members' scoring summary worksheet

- context summaries for each group session

- taxonomic classification of each risk statement

Outputs The outputs for this step include

- reconciled team members' scoring summary worksheet

- risk areas

- slides for each risk area

- column chart

Who's Involved SRE team members execute this step.

Tools • classification wall chart

- portable computer (laptop) with spreadsheet software and printer

Examples   The following is a sample column chart that would be created in the con-
solidation step and used in the data confirmation briefing, the next step in
the RI&A phase.
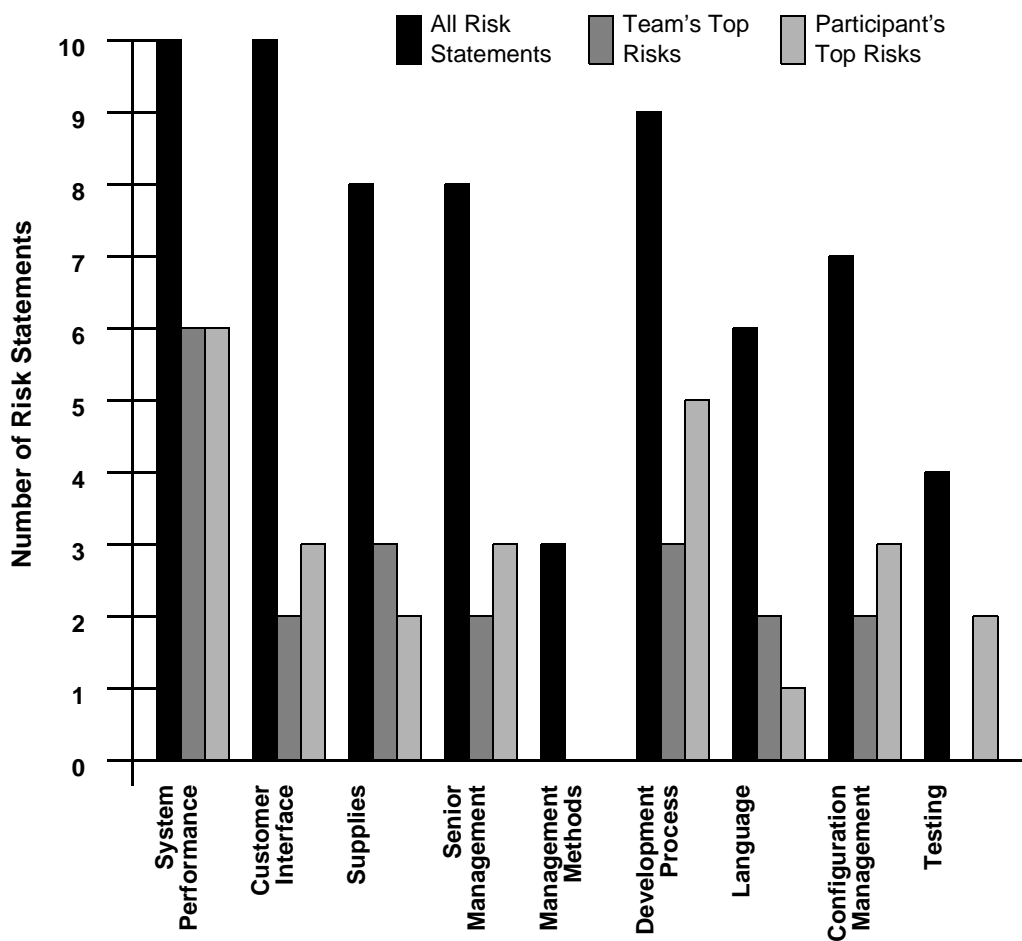
**Key Results of
Consolidation**

❐ a completed and reconciled team scoring spreadsheet that supports a
conclusion by the team as to which risk statements are most important

❐ all risk statements categorized into 7 to 11 risk areas that are affinity
grouped on the basis of risks that are likely to allow mitigation by the
same general strategies

❐ a set of persuasive briefing slides that include

-   a description of the process that was followed and the results
    obtained (e.g., how many interviews, resulting in how many risk
    statements, resulting in how many risk areas)

- a graphic showing the relative number of risk statements in each risk area and the relative importance that the SRE team members and interview participants attached to the risk statements in each risk area
- a characterization of each risk area and the attributes that support the affinity of the risk statements in that area
- a listing of the exact risk statements included in each area

❒ a relaxed and confident SRE team leader who knows exactly how to present these results persuasively to the people who were interviewed

Data Confirmation Briefing

Description   Following consolidation, the SRE team conducts the data confirmation briefing. This 30-45 minute presentation (but allow a full hour, to handle any questions that may come up) is usually carried out by the SRE team leader and includes

- recapping the SRE process, participants, and progress to date
- presenting a graphical overview of the risk statements (and their relative importance, as seen by both the SRE team and the interviewees) categorized by risk area
- discussing each risk area slide
- discussing the next steps in the SRE

The purpose of the data confirmation briefing is to present the findings of the SRE team and confirm their accuracy with the participants.

Who's Involved   The following people take part in this step:

- project manager
- all participants
- SRE team members in the following roles:
  - The team leader presents the data confirmation briefing.

- Other team members watch the project staff (participants) for verbal and non-verbal communications regarding its acceptance and accuracy.

Example Outline of Data Confirmation Briefing

The following is a sample outline of a data confirmation briefing:

Section	Description
Cover Page	• sets the stage • time for team leader's introductory comments
SRE Objectives	• overall objectives of this SRE
SRE Process Overview	• shows the larger context into which this RI&A effort fits
RI&A Process	• schedule of work sessions for the participants and team members ("where we've been") • RI&A process flowchart ("what we've been through")
Summary of Activities	• numbers: how many sessions, how many participants, how many risk statements, and so on.
Summary of Findings	• risk area names • risk statements by risk area (risk area column chart) • summary analysis of team and participant scores
Findings by Risk Area	• observations for each area • direct quotes and risk statements, as appropriate
Next Steps	• interim report: why and when • mitigation strategy planning: when and how

Ownership of the Information

RI&A findings and the data confirmation briefing are still "raw data." They should be considered the property of the project manager and the team. The SRE team should not release the results (or even talk about them) to anyone outside of the project without the project manager's *explicit* permission.

Key Results of Data Confirmation Briefing

❐ The interviewees as a group confirm that

   - The overall analysis makes sense. The SRE team captured risk statements and key context accurately.

   - No important risk issue was missed.

❐ The SRE team has noted any corrections that need to be made to the conclusions before carrying them forward.

❐ The participants in the RI&A phase of the SRE understand what is going to happen next and *when*.

Interim Report Phase

Description   During the Interim Report phase, the results of the Risk Identification and Analysis (RI&A) phase are reanalyzed from the perspective of the interrelationship of the risk areas. The results of the RI&A phase are formally documented, and a recommendation of the risk areas to be addressed in the Mitigation Strategy Planning (MSP) phase is made to the project manager. An agreement is reached on those risk areas, and the MSP phase is scheduled.

Process Diagram
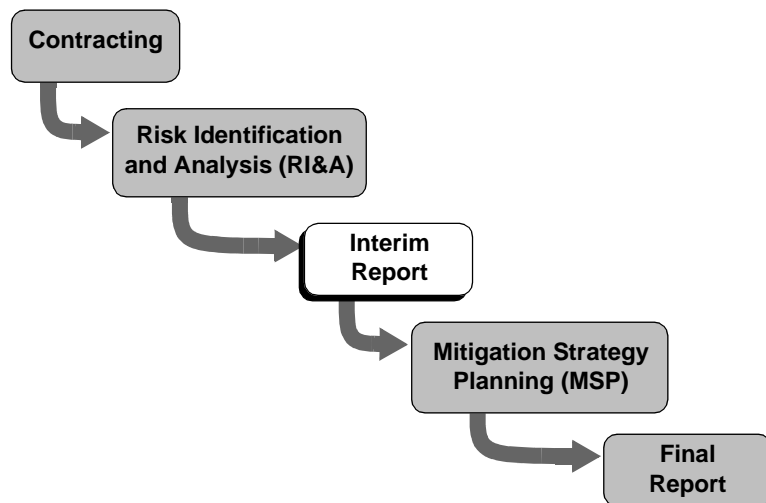
Section	Page
Interrelationship Digraph	64
Report Preparation	68
MSP Preparation Meeting	70

Interrelationship Digraph[1]

Description   The interrelationship digraph is used to discern dependency relationships among the risk areas captured during the RI&A phase of the SRE.

Inputs   Inputs for this include

- risk areas, which consist of the area title and the risk statements under it
- group session context summaries

Outputs   The output of this activity is the interrelationship digraph which is useful for illustrating the cause and effect relationship (if any) of risk areas. It also helps the SRE team to prioritize risk areas for mitigation.

Process Flow   To create an interrelationship digraph you first examine the risk statements in each risk area for their impacts on other risk areas. These impacts are assigned a weighting and noted on the diagram as outgoing arrows. Next, you determine the most important effects and the relative direction of the arrows. The result is a cause and effect diagram of risk areas, such as the one shown on page 65.
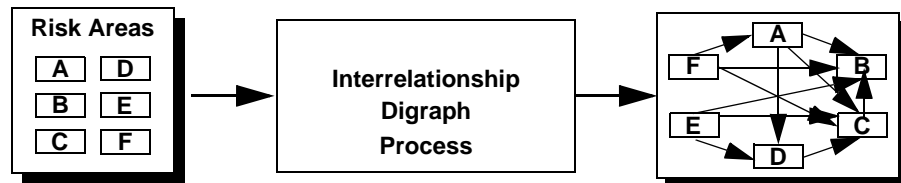
Creating the Interrelationship Digraph

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1. The material in this section is based on The *Continuous Risk Management Guidebook*, developed by the SEI, which was, in turn was based largely on *The Memory Jogger™ II: A Pocket Guide of Tools for Continuous Improvement & Effective Planning*. Please refer to those sources for a better understanding of the process of constructing an interrelationship digraph and of such terms as "Cause/Driver" and "Result/Rider."

A large number of outgoing arrows from one risk area indicates that the area has a causal or influential effect on a number of other risk areas, and it may be a root cause or an item that must be dealt with first. This risk area can be thought as a "Cause/Driver."

A large number of incoming arrows indicates that the risk area is affected or influenced by a number of other risk areas. This risk area can be thought of as a "Result/Rider."

Who's Involved   SRE team members create the interrelationship digraph.

Examples   The following diagram is an interrelationship digraph.
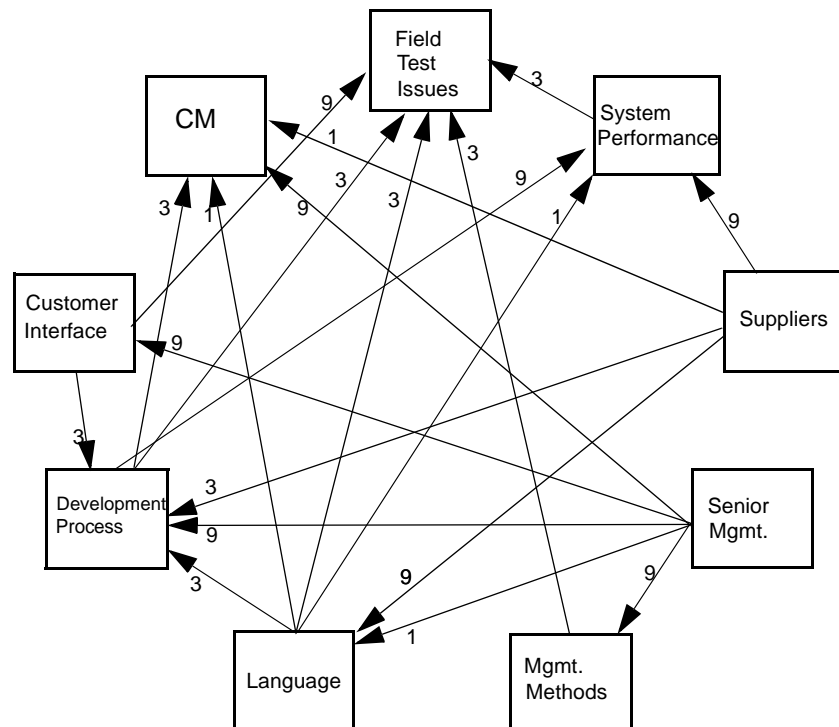
The *hierarchical* interrelationship digraph is simply a rearrangement of the interrelationship digraph described above to make it tell a more persuasive story. The figure below shows virtually the same information as the example in the previous section, but with the risk areas that are the most significant *drivers* of the other risk areas moved to the top half of the figure, and the risk areas that are the mostly just the *result* of risks in other areas moved to the bottom half of the figure:
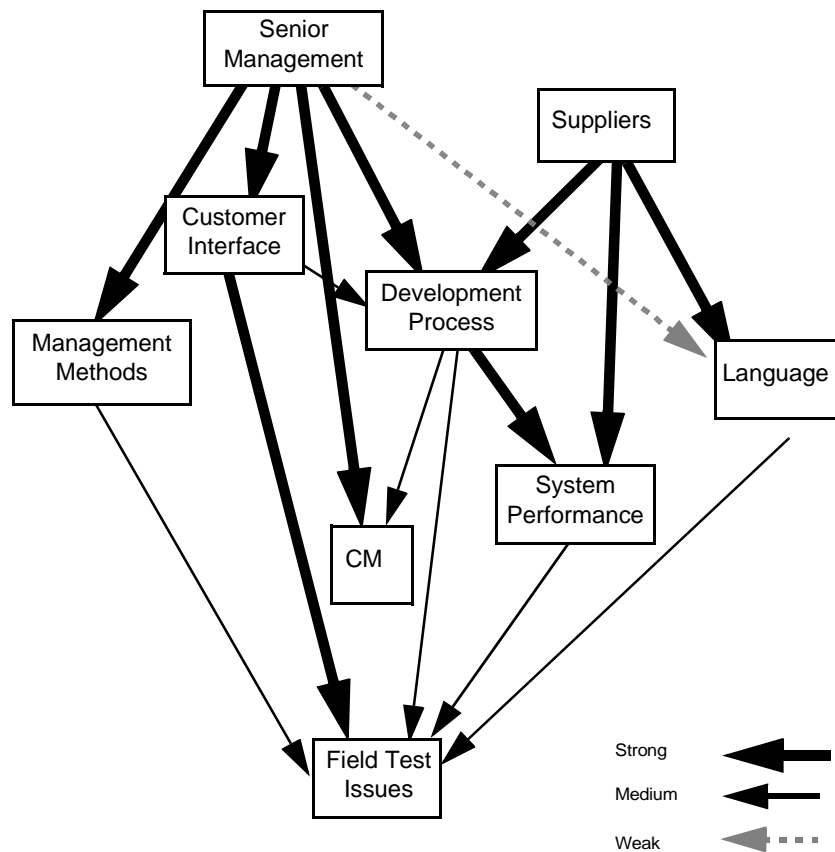
Interpretation of the Hierarchical Interrelationship Digraph

The hierarchical interrelationship digraph can be used to make this argument to the project manager:

1. The risk statements that have been grouped in the *Senior Management r*isk area are strongly driving the risk areas *Methods Manage-*

---

1. The hierarchical interrelationship digraph is *not* based the previously mentioned references. It was invented to support the SRE process, and is—so far as we know—original.

ment, *Customer Interface*, *Configuration Management* (CM) and *Development Process*, and are also weakly driving the risk area *Language*.

2. The risk statements that have been grouped in the *Suppliers* risk area are strongly driving the risk areas *Development Process*, *System Performance*, and *Language*.

3. Although the RI&A phase found numerous and significant risk statements in the *Customer Interface* and *Development Process* risk areas (these were the most significant risk areas described at the data confirmation briefing), the risk statements in those risk areas appear to be more symptomatic than causal. The same can be said about the *System Performance* risk area, which was the fourth most significant area in terms of number of risk statements and the number judged by the SRE team to be most significant to the project.

4. The team should recommend that the MSP process address the *Senior Management* and *Suppliers* risk areas, continuing on to the *Customer Interface* risk area if time permits, and if the mitigation strategies developed for the first two do not fully mitigate the significant risk statements in the *Customer Interface* risk area.

Key Results of the Interrelationship Digraph Process

❒ Team members have explored the ways in which the conditions of the risk statements in each risk area impact on the risk statements in other risk areas.

❒ Risk statements have been moved from one risk statement to another if the group analysis indicated that the groupings constructed during RI&A contained inconsistencies (NOTE: if more than two or three risk statements move between risk areas, the results classification process may need to be reconsidered as a whole.)

❒ A hierarchical interrelationship digraph has been constructed for inclusion in the interim report.

❒ A recommendation of the first, second, and third most important risk areas to address is agreed upon by the SRE team.

Report Preparation

Description   The interim report forms the basis of the MSP work in the remainder of
the SRE. It is an important document that provides

- a snapshot of the risks facing the project

- background and discussion surrounding the risk areas and
  information presented at the data confirmation briefing

- all the risk statements and their risk exposure scores

- decision-making information to the project manager regarding which
  risk areas to mitigate first

Inputs   The inputs for constructing the interim report include

- data confirmation briefing slides

- context summaries for all group sessions

- interrelationship digraph for risk areas (described in the previous
  section)

- opening briefing slides

- project profile

Outputs   The output for this activity is the interim report itself.

Who's Involved   While the entire SRE team may participate and such participation is
encouraged, the ultimate responsibility for the production of the interim
report remains with the SRE team leader.

**Sample
Interim Report
Outline**

Below is a sample outline for an interim report:

Section	Description
Executive Summary	• summary of risk findings and risk areas • near-term recommendations ("bleeders to be stopped") • observed strengths (optional—always good for public relations, though)
Introduction	• "caveats" (e.g., "This deals only with risk statements that came out in the interview—it is not an independent identification of risks to the project"; "We may not have the technical expertise on the team to evaluate the area in detail"; "This is only a snapshot in time—conditions can change quickly.") • layout of this report (how to read it)
SRE Process Overview	shows the larger context into which this RI&A effort fits
Background	• SRE objectives • SRE team makeup • review of the RI&A method used
Findings	• risks by area • Interrelationship Digraph results • high-level mitigation recommendations by area (the "low-hanging fruit")
Conclusions	• next steps • timing of MSP preparation meeting
Appendices	• RI&A schedule • risk statement listing • (optional) data confirmation briefing slides • (optional) opening briefing slides

Guidelines

• It may not be practical to have the entire SRE team participate in the writing of the entire report. All members should contribute portions (particularly the description of the findings), but a single person (typically the team leader) should edit the entire document to assure a consistent "voice."

- The timeliness of this report is critical. The SEI *strongly* recommends that this report be completed no later than two weeks after the end of the RI&A phase.

- The team leader should assure that there is a strictly controlled distribution of the document. Depending on the sensitivity of the material to the project manager, it may be necessary to produce only one physical copy of the report, which is given to the project manager alone. The project manager may reproduce and distribute the report, but the SRE team leader may not.

Key Results of the Interim Report Preparation Process

❐ The findings of the RI&A phase are documented in a clear and readable report.

❐ The recommendation of the risk areas to be addressed during MSP is presented in a clear, logical, and persuasive manner.

❐ The project manager has the report in hand while the issues addressed in it are still fresh.

MSP Preparation Meeting

Description

The MSP preparation meeting is a "re-contracting" process between to SRE team leader and the project manager. Its ostensible purpose is to line up the dates, people, and risk areas that will combine to make a successful MSP phase. However, it is also an important opportunity for the SRE team leader and the project manager to discuss what has happened to this point in the SRE, and the extent to which their expectations about the process have been met.

Mitigation Goals and Priorities

An important point of discussion in the MSP preparation meeting should be the elicitation of the project manager's goals and priorities to guide the MSP process. These will probably hinge on the tension among the com-

peting demands of performance, cost, and schedule as depicted in the "iron triangle" of project management:
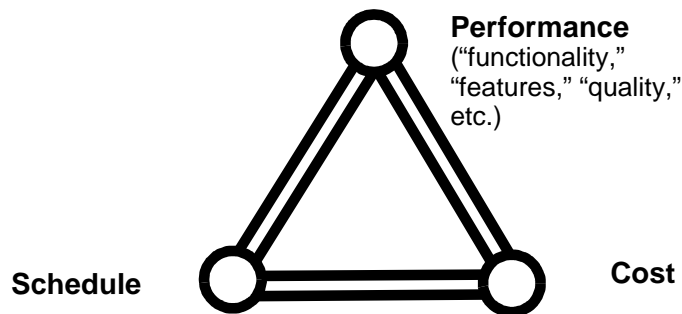
The "Iron Triangle" of Project Management

Every project sets out to satisfy the constraints at all three corners of the "iron triangle" simultaneously. However, responsible risk management requires a widely-held understanding of which constraints are the most important when all *cannot* be achieved simultaneously. A project that is developing a software/hardware system that will be part of a space satellite might have this lineup of priorities:

1. *Schedule*—because the launch date must be met, no matter what

2. *Performance*—because there will not be another opportunity for the instruments in this system to be carried into space, and they must function as designed

3. *Cost*—This *has* to be the dependent variable, simply by the process of elimination.

The project manager would express the mitigation goals for the MSP sessions as, "Do whatever it takes to meet the schedule, and make sure that all the most important experiments are built into the delivered system. I'll worry about the budget and resources it will take to carry out the strategies that come out of the MSP sessions."

Face-to-Face or By Telephone?

It is always preferable for the meeting to be face-to-face. However, if a having a face-to-face meeting would necessitate signifi-

cant travel by one of the participants, and if no major planning or re-contracting issues are anticipated, it is reasonable to have the meeting by telephone or teleconference.

Who's Involved   The following people are involved in the MSP preparation meeting:

- SRE team leader
- project manager
- SRE team members (optional/as needed)

Key Results of the MSP Preparation Meeting
❐ The schedule for the MSP sessions is set.

❐ The project personnel to be available for the MSP sessions are identified.

❐ The risk areas to be addressed during the MSP process are spelled out and clearly agreed to by the project manager and the SRE team leader.

❐ The SRE team leader has the project manager's mitigation goals and strategies.

Mitigation Strategy Planning Phase

Description The Mitigation Strategy Planning (MSP) phase begins the strategy to develop a concrete plan for managing and mitigating some of the most important risks identified during the Risk Identification and Analysis (RI&A) phase. During the MSP phase, project teams learn an effective process and a set of methods that can be used to manage identified risks. Metrics that can be used to track risk and mitigation plan progress are identified, and plans are made for evaluating the success of the mitigation strategies.

Process Diagram

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┌──────────────┐
│ Contracting  │
└──────────────┘
        ↓
   ┌────────────────────┐
   │ Risk Identification │
   │ and Analysis (RI&A) │
   └────────────────────┘
           ↓
      ┌──────────┐
      │ Interim  │
      │ Report   │
      └──────────┘
             ↓
        ┌────────────────────┐
        │ Mitigation Strategy │
        │ Planning (MSP)      │
        └────────────────────┘
               ↓
          ┌──────────┐
          │ Final    │
          │ Report   │
          └──────────┘
```

Team Preparation

Description   The MSP phase is important for the successful outcome of the SRE. It is therefore essential that the SRE team has the information and skills needed to conduct the MSP sessions. In addition to the information obtained during the prior phases, team members need to use their problem-solving and decision-making skills.

Inputs   The following must occur before beginning the first MSP session:

- The team needs to understand the outcome of the MSP preparation meeting, including any issues or concerns that the project manager identified, the areas to be mitigated, and the schedule for MSP sessions.
- Team roles need to be assigned for session facilitator, session recorder, and the team member responsible for the context.
- The media for capturing plan components needs to be selected (e.g. flipchart and marker).

Outputs   The result of the Team Preparation step is that the team is ready to begin the MSP sessions.

Who's Involved   The participants for this activity include the SRE team members, session facilitator, context recorder, and session recorder (optional).

Context Keeper   It may be necessary for one member of the SRE team to serve as "context keeper" if the session notes from the RI&A phase have not yet been sanitized. This person would have a copy of the unsanitized notes at hand and be prepared to paraphrase the context of a given risk statement if any member of the project team expresses concern about the exact meaning of that statement.

"Hip-Pocket" Mitigation Approaches   Possible mitigation strategies often occur to members of the SRE team prior to the MSP phase. A suggestion may have been made during the RI&A phase, or an area may seem similar to one addressed during a prior SRE. Such approaches can be shared during the MSP sessions to get the ball rolling or contribute a good idea that should be considered. Such "hip-pocket" approaches should never be used to shortcut this phase,

because the value of the session relies on the ideas generated by project members themselves.

Guidance   The experience of the SEI with MSP sessions has been that they are far more "relaxed" and less structured than the RI&A phase group sessions are. For example, it has not proved difficult for the facilitator to also be the stand-up scribe for the process. Also, we have not found it necessary to record session notes for the MSP sessions.

Key Results of Team Preparation

❒ Each SRE team member knows what to do during the MSP sessions.

❒ Session notes from the RI&A phase are on hand.

❒ "Hip-pocket" mitigation strategies have been outlined.

❒ The room(s) for the sessions are prepared with flip charts and suitable markers.

MSP Sessions

Description   During MSP sessions, in-depth, structured discussions of each mitigation area are conducted. The goal of these sessions is to begin to identify and document how the risk areas might be mitigated. The depth of planning in an MSP session is dependent on the group problem-solving skills of the project members who have been assembled. If this is a completely unfamiliar process for them, or if the junior members of the group are unable to participate fully in the company of their superiors, it can take a long time to achieve full participation.

The first MSP session usually lasts a full day. Subsequent sessions can last from half a day to a full day.

Typical Session Activities A typical session should include:

- opening the session: this involves setting the stage and discussing the rules of engagement and other issues about how the session will be conducted. It is important to emphasize that these are problem solving sessions, in which all ideas are captured and considered.

- reviewing the "Picture of Success" defined (and possibly refined) during the Contracting and RI&A phases and refining it further (if necessary)

- discussing and identifying possible causes of the risks

- discussing and identifying mitigation goals for the risks

- discussing and determining possible mitigation strategies

- discussing and determining mitigation activities that would support suggested strategies

- beginning to identify key measures that will be used to track and control mitigation activities

- discussing possible resources and constraints for suggested strategies

- estimating the scope of effort needed

- reviewing and closing out the MSP session

Logistical Considerations Logistical considerations are important to a successful MSP session and include the following:

- Participants must be able to see what the session facilitator is writing.

- All plan components should be visible to all participants.

- Each strategy and action developed for a given risk area should have a unique numerical designator.

- There should be ready access to copy machines, computers, printers, and other services that keep the activity running smoothly.

Inputs The inputs to the MSP sessions include

- the mitigation areas that have been determined and agreed upon

- the roles and assignments that have been determined for conducting the sessions

- the schedule for MSP sessions

- the project manager's mitigation goals and priorities (from the Interim Report phase)

Additional support would include risk statements and context captured during the RI&A phase, domain expertise, project schedules, plans, and budgets.

Outputs   For each risk area addressed, outputs of the MSP sessions should include

- a mitigation goal specific to the risk area
- sources of the conditions of the risk statements for the risk area
- strategies
- actions
- metrics
- a budget estimate
- a schedule estimate
- actions, metrics, and goals that are linked to schedule and project milestones
- briefing slides suitable for presentation to the project manager

Who's Involved   Those involved include

- SRE team members
- session facilitator
- individual responsible for locating and contributing the context captured during the RI&A phase
- risk area owner(s)
- session recorder (optional)

The MSP sessions are conducted by the session facilitator, who ensures that a true problem-solving approach is used. As ideas are generated (usually using a brainstorming approach), the session facilitator captures the components of the mitigation plan. The person designated to capture context does so carefully for each plan.

Methods   Throughout each step of the MSP sessions, beginning with the identification of causes, the risk area being addressed should be displayed so that everyone in the room can easily see it. Each participant in the session should be given a chance to discuss the area and possible causes of the risks in it. The goal is for everyone involved to understand the risk area and the alternatives being considered. Ideas should be shared and discussed openly.

Guidance
- These sessions rely on an effective, proactive session facilitator, who is skilled in leading a team through effective brainstorming techniques, such as structured, unstructured, anonymous, and public. Because prioritization facilitation is also needed, facilitators need to be comfortable with prioritization, techniques such as nominal group. They must be flexible in the use of a mix of these techniques, depending on how the sessions progress.

- While it is important to establish a session schedule, it may need to be amended. The team should not cut an area or topic short simply to adhere to the proposed schedule. If the schedule does need to be amended, the session facilitator should be careful that all activities are given sufficient time to be addressed.

- The metrics for risk management are difficult to articulate; a great deal of work remains to be done in this area. Therefore, do not let the session bog down in the pursuit of metrics. If suitable metrics to show progress in mitigating the risk area do not present themselves readily, move on to other MSP session tasks.

- The budget estimate work can be deferred to a later time, after the MSP phase, and it can be left to the project to complete.

- The preparation of briefing slides can be deferred to an SRE team-only session after the MSP and cross-area strategy sessions have been completed, using the material on the flipcharts from the sessions

- To estimate the true effort required to mitigate a risk area, determine the resource allocations needed, and establish a schedule, the project should break down the activities into tasks. Realistic estimates can be determined only after the tasks to be performed and the actual resources that are available to implement them are delineated. The individuals responsible for implementing the plans can use these estimates as a guide. However, final documentation of plans should not be conducted until the conclusion of all on-site activities. The outcome of the cross-area strategy session, described in the next section, may result in changes to individual mitigation plans.

Key Results from the MSP Session

While you should strive for all the results listed under "Outputs," above, you should consider the session successful if you collect these results:

❒ a mitigation goal for the risk area

❒ a comprehensive listing of the sources of the risk statement conditions

❒ a set of mitigation strategies to pursue (typically three to five strategies)

❒ a listing of activities that will be taken in pursuit of these strategies, each of which includes
  - a specific description of the activity
  - a date by which that activity will be completed
  - the name of a person who is responsible for assuring that the activity is completed, and who has agreed to that commitment

Cross-Area Strategy Session

Description

The cross-area strategy session identifies conflicts and synergies among the strategies and actions developed for each mitigation area. Conflicts and synergies among strategies often occur when MSP sessions are conducted by parallel teams or when different people are involved with each session. Conducting a cross-area strategy session minimizes the potential for conflicting plans or duplicated effort, and maximizes the impact of strategies, resources, and actions.

Typical Session Organization

The cross-area strategy session is conducted by the session facilitator who captures the identified conflict and synergies in clear view of all participants. The suggested schedule for this session is as follows:

• opening the session

• reviewing mitigation area results

- identifying conflicts, commonalities, dependencies, and possible sequencing

- resolving conflicts

- prioritizing strategies and actions

- reviewing and closing out the cross-area strategy session

- documenting the overall mitigation plan which can be completed off-line or in parallel with the MSP results preparation activities

- reconciling individual risk area plans

Inputs The cross-area strategy session requires all of the outputs from the individual MSP sessions:

- a mitigation goal

- strategies

- actions

- metrics

- a budget estimate

- a schedule estimate

Additional inputs include the interim report and any relevant information concerning program constraints, policies, or regulations.

Outputs The cross-area strategy session has these results:

- Mitigation strategies and action conflicts are resolved.

- Mitigation strategies and actions from each risk area are improved by adding applicable strategies and actions that came out of other sessions.

Who's Involved
- SRE team members

- session facilitator

- individual responsible for locating and contributing the context captured during the RI&A phase

- risk area owner(s)

- session recorder (optional)

Methods   This session is conducted as a problem-solving and decision-making activity, in which methods such as brainstorming and structured facilitation should be used.

Guidance   • The cross-area strategy session is optional and may not be necessary if either the same people participated in all MSP sessions or the mitigation areas are clearly unrelated with no overlap in strategies and actions.

• Before determining whether a cross-area strategy session is needed, the team should review all mitigation plans to check for potential conflicts and synergies. Mitigation area prioritizing that results from the MSP planning meeting should be revisited at the conclusion of all MSP sessions. If the team puts a process in place that reviews the individual MSP sessions in this way, the cross-area strategy session may not be needed.

Key Results of the Cross-Area Strategy Session   The session will have the following key results for each risk area addressed:

❐ a mitigation goal for the risk area which does not conflict with the goals of any other risk area

❐ a set of mitigation strategies to pursue that does not conflict with that of any other risk area. (If it does, specific rules for when that strategy will be invoked should be included, e.g., strategy 1 will be pursued for three months, and if the risk does not appear to be decreasing, we will switch to strategy 2.)

❐ a fully reconciled listing of activities that will be taken in pursuit of these strategies

MSP Results Briefing

Description   The MSP results briefing is a formal presentation in which all of the MSP participants see the results of the overall mitigation plan, and learn how their own planning efforts contributed to these results. Project members are shown how the risk areas addressed in the MSP phase will be mitigated.

This briefing includes an introduction, summary, individual session results, and a discussion of the appropriate next steps such as determining the process to complete and implement mitigation plans.

Inputs   Prior to delivering the MSP results briefing, presentation transparencies must have been prepared, along with a "leave behind" copy of the presentation for the project manager.

Additionally, the following inputs, which are the results of the MSP sessions, are needed:

- list of key or root causes
- list of mitigation goals
- list of mitigation strategies
- list of mitigation activities for each strategy
- list of key measures (if developed in the MSP session)
- an estimate for all activities associated with a given strategy (number of people, number of person-days, number of days/week—if developed in the MSP session)

Who's Involved   Everyone involved in the MSP phase should be at the meeting, including

- the project manager
- all MSP participants
- any other project members the project manager chooses to invite
- the SRE team

Guidance   The MSP results briefing enables the identification of the appropriate next steps, such as

- getting required authorizations, contract modifications, or approvals
- defining needs for more detailed plans
- clarifying cost, personnel, and facility estimates
- determining the frequency of data collection, evaluation, and reporting
- establishing the means by which to report status

Key Results of MSP Results Briefing

❐ Everyone understands the mitigation goals, mitigation strategies, and activities to carry out those strategies that were developed in each MSP session.

❐ All project members involved in the MSP phase have had an opportunity to get their questions and concerns addressed.

❐ Everyone understands the timing and content of the next step of the SRE (delivery of the final report and risk data).

Final Report Phase

Description   The Final Report phase provides the final report, the raw material
                      with which the project can create a risk database, and recommen-
                      dations to the project manager or sponsor of the SRE. This phase
                      also brings the SRE process to an end. The SRE team assists the
                      team leader in writing the report; then the leader meets with the
                      project manager to present the results and close out the SRE.

Process Diagram
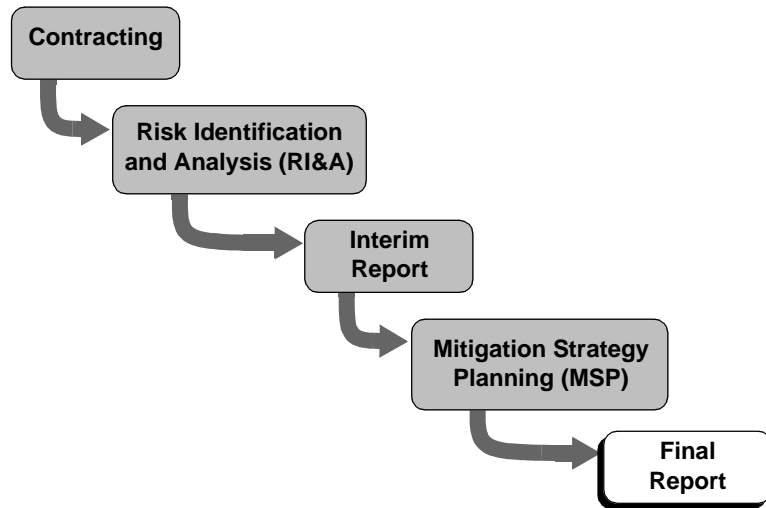
```
┌─────────────┐
│ Contracting │
└─────────────┘
      │
      ▼
   ┌────────────────────┐
   │ Risk Identification │
   │ and Analysis (RI&A) │
   └────────────────────┘
           │
           ▼
       ┌──────────┐
       │ Interim  │
       │ Report   │
       └──────────┘
              │
              ▼
          ┌────────────────────┐
          │ Mitigation Strategy │
          │ Planning (MSP)      │
          └────────────────────┘
                   │
                   ▼
               ┌──────────┐
               │ Final    │
               │ Report   │
               └──────────┘
```

Write Final Report

Description   The final report is the consolidation of the Risk Identification and Analysis (RI&A) phase results (as documented in the interim report) and the results of the Mitigation Strategy Planning (MSP) sessions. The final report summarizes and integrates all of the results into a report format and makes any final recommendations for follow-on activities. Generation of the final report is largely a matter of integrating, editing, polishing, and refining the contents of the interim report and MSP briefing.
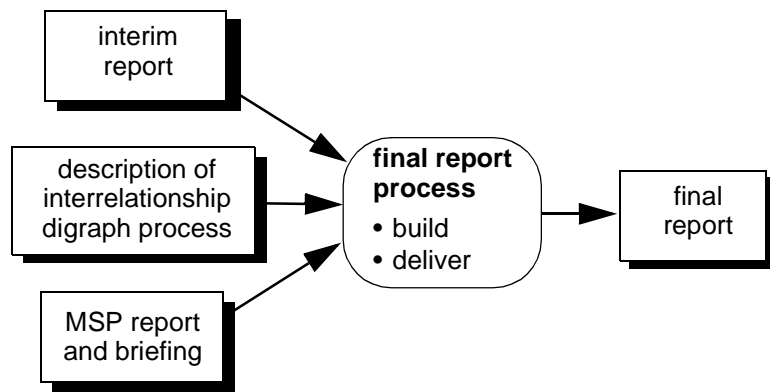
Final Report Process

Inputs   The inputs for this step include

- interim report
- description of interrelationship digraph process
- MSP report and briefing

Outputs   The output of this step is the final report. Its contents should include

- results of the RI&A activities, namely the list of prioritized risks, risk areas, evaluation results, and any identified issues
- recommendations from the interim report
- results from the MSP Sessions, including the intermediate results of planning steps, recommended strategies and actions, task and action assignments, identified issues, follow-on activities, schedules, and so on

- final recommendations resulting from the SRE and any
  recommendations for follow-on risk management activities

Who's involved The participants for this step include

- SRE team leader who coordinates all inputs and additional
  writing

- SRE team members who may write or edit specific sections

Tools No specific tools are used for this step other than standard word
processing tools. Accessing the results of other SRE activities
may require using tools from those activities.

Data for Project Risk Database

Description One of the most important "legacies" that the SRE can leave with
a project is leaving input data for a risk database around which
project members can build a continuous risk management pro-
gram. The project itself must build the database to suit its own
needs; it is not the team's responsibility to provide a database.
However, expediency and common sense virtually dictate that the
information be collected in an electronic spreadsheet or simple
database. The information should be given to the project in an
electronic form that the project can handle, rather than on paper.

All the pieces were developed in the course of the SRE: risk state-
ments; context; evaluations of the individual risks for impact and
probability; classification of risk statements into risk areas; prior-
itization of the individual risk statements; mitigation strategies;
responsible individuals; and mitigation plans in the form of action
items. If the program is ever to "kick start" a risk program, this is
the opportunity.

Unfortunately, all the raw risk data in the SRE team's hands is not
suitable to be turned over to the project—doing so would break
the team's commitment to the interviewees of maintaining confi-
dentiality and non-attribution. The team still needs to break the

session recorder notes into fragments that are associated with the individual risk statements (thereby providing the statements with *context*) and then "sanitize" the context fragments.

Diagram A depiction of the process to prepare the SRE data for a project risk database is shown in the diagram below:
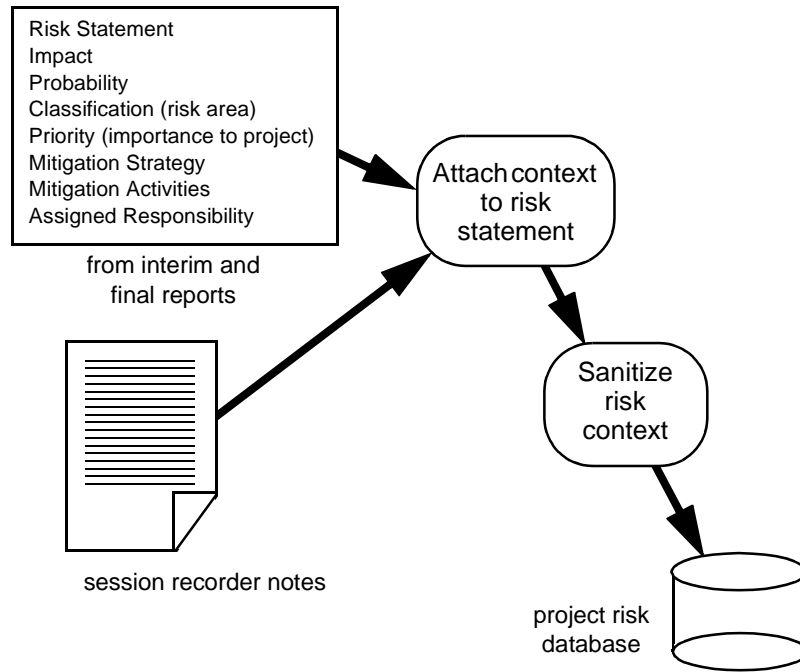
Preparing Data for Project Database

Who's Involved
- the SRE team leader
- the interview session recorder(s)
- other team members as required

Attaching Risk Context to Risk Statements

To do this, use the following general procedure for any risk statement:

1. Scan through the session recorder notes to find the pointer to the risk statement number for which you are isolating context.

2. Back up in the notes until you find the pointer to the last-asked interview question. Place this reference in the context. (NOTE: If you used the SEI Taxonomy-Based Questionnaire or Short Taxonomy-Based Questionnaire in the Appendix, this "reference" would be the question number.)

3. Scan forward until you find the first sentence that could possibly be leading to the articulation of the risk statement. Begin context capture at that point.

4. Continue scanning forward past the pointer to the risk statement until you reach the last sentence that could possibly still be about the issues surrounding the risk statement.

5. Place all text from the sentence isolated in step (3) through that isolated in step (4) in the context for the risk statement.

Guidance for Attaching Context

- Always err on the side of including more context than necessary.

- To make sense of the raw session recorder notes, you must have preserved the original risk numbering scheme and the mapping from those numbers to the identifiers that were used for the RI&A data confirmation briefing and the interim report (and final report, if it includes all the risk information of the Interim Report).

- It is best to do this during or immediately after the RI&A phase, while the memory of the interview session still has some freshness. It can be very easy to put this off until "later," simply because it is not needed in this form during RI&A or MSP.

- It is up to the project to add to the context for the risk statement as more is learned about it in the future. The risk statement is not edited or changed over time, but its context should be. Remind the project of this maintenance responsibility.

Sanitizing Context

"Sanitizing" context is the process of changing any words in the text that could possibly link the risk statement to an individual interviewee or group. It must be done by a team member who was present at the interview. It demands great care and sensitivity, and should probably be done by the SRE team leader unless either the leader *absolutely* trusts someone else's judgement for this, or the

leader happened not to be in the room during that particular interview session.

At the simplest level, sanitizing is the elimination of all names and references to the group session from which the context is taken. At the more subtle level, it requires sensitivity to and the elimination of "catch phrases" or characteristic expressions that may identify the speaker.

Guidance for Sanitizing Context

- First, get rid of all names and references to the group, levels of responsibility, technical expertise, and so on.

- Either blank out names or rewrite sentences in passive voice.

- Look for wording that reflects a particular perspective in the project: "The programmers only worry about meeting their milestones and productivity bogeys, then they throw the programs over the transom to us." This is probably coming from a tester or a member of Quality Assurance. Also, an expression like "over the transom" may be unique to an individual or department in that organization. The context might have to be completely flattened: "The project incentives that drive the program developers are milestones and productivity, rather than the performance of the product."

- Still, you want to preserve colorful images and powerful metaphors: "It's like having a Ferrari on a desert island"; "The various departments here just play Liar's Poker with the project schedule"; "We're just re-arranging the deck chairs on the Titanic"—all these can enrich the context, but at the same time can point to one individual or group. If you're not sure, rewrite the context to flatten it out (i.e., take the color and power out of it).

Destroy SRE Process Artifacts

The final obligation of the SRE team is to ensure that all artifacts of the SRE process have been destroyed. Examples include

- flipcharts from the interview sessions

- session recorder notes

- notes kept by individual team members during the interviews

- interviewee and team member risk evaluation forms

- risk statement numbering "maps" that show the correlation between interview risk statement numbers and the numbers used for those statements in the Interim Report

At the end of the SRE process, each risk statement and its context should be complete and freestanding, with no history except in the context itself, and no association with other risk statements except in the risk area.

Once this destruction of SRE artifacts is complete, the SRE team leader has completed the process obligations relating to confidentiality and non-attribution. The team and leader are still bound by the terms of the confidentiality agreement (if this was effected) or professional ethics not to attribute any particular risk statement to any individual interviewee or interview group.

Key Results of Data Preparation

❒ Each risk statement is complete with its context— it has become a freestanding data object.

❒ No risk statement's context contains information making it traceable to the originator.

❒ All process artifacts of the RI&A phase have been destroyed.

Present Report to Customer

Description The final report and the data from the SRE are given to the project manager.

Who's Involved the SRE team leader and the project manager

Process There is no special process. The report may be mailed to the project manager or delivered in person. The data for the risk database may be delivered on a portable medium such as a floppy disk, or it may be emailed.

Guidance on Sending the Report Electronically Common sense requires that the report not be delivered to the project in an editable "soft-copy" form; it would be too easy for it to get into the wrong hands and be changed from the as-delivered wording. Sending or hand-carrying a single paper copy to the project manager is always the best course of action.

If the report *must* be delivered electronically (e.g, dictated by distance and some critical need for speed), send it in a form like *portable data format* (PDF) that can be read and printed out in a static, non-editable form by a PDF viewer such as Adobe Acrobat™.

Key Results of Report Presentation

❐ The project manager has the final report in hand on or before the date promised by the SRE team leader.

❐ The project manager has the risk statement, context, and associated data from the RI&A and MSP phases in an electronic form that can be readily reshaped electronically to populate a risk database.

Closure Meeting

Description The closure meeting is optional, but strongly recommended. It is intended to get feedback on the SRE process itself from the customer and a verbal commitment to support a follow-up meeting. The closure meeting can be used as an opportunity to present the final report to the customer. It is also an opportunity to answer any final questions, discuss any remaining issues, and set the stage for establishing a continuous process of managing risks. Any additional recommendations or findings that arose after the completion of the MSP sessions should be highlighted during this presentation.

Inputs The inputs to this step include

- final report
- original contract for this SRE
- recommendations from the final report
- additional information relative to getting a continuous process of managing risks put in place

Guidance Possible goals for this meeting include:

- agreement from the project manager that all deliverables have been met

- acceptance of the final report. If the project manager's demands change, they should be negotiated and the final agreement documented (the corrected final report should be sent to the project manager later, but as soon as possible.)

- consideration by the project manager continuous process for managing risks, and understanding/acceptance that some kind of risk management process needs to be built on the SRE foundation

- feedback and recommendations from the project manager for improvement to the SRE

- verbal commitment to support a return visit from the SRE provider at a later time (any appropriate time from a month to a year) to evaluate additional progress with risk management

Who's Involved   The participants for this step include

- SRE team leader
- an additional member of the contracting team, if needed
- additional customer representatives if desired by the project manager

Possible Follow-On Work   The following approaches are recommended after an SRE has been completed:

- To continue the momentum in managing risks provided by the SRE, a continuous practice of managing risks needs to be implemented. Without this, the SRE risks most likely will not be tracked to closure, and new risks will be ignored.

- It may be useful to expand risk management to other partners in the program; that is, team or joint management of risks, through the addition of team-based activities to highlight and discuss the top risks to the program as identified by all partners.

Key Results from Closure Meeting   ❒ Constructive feedback on the SRE process has been solicited and captured.

❒ Possible next steps that the SRE provider can undertake for the project have been outlined.

❐ The project manager has been presented with the arguments for quickly constructing a risk database and building a continuous risk management process.

Summary

Purpose   The purpose of this section is to give a final, high-level listing of all the things that define the SEI Software Risk Evaluation process. Regardless of the customization required by your local conditions (e.g, size of project, length of development cycle), if you achieve the following characteristics, you may credit yourself with having conducted a "flawless" SRE process.

Characteristics of a "Flawless" SRE

❐ A large number (50 or more) risk statements in condition-consequence form have been captured, along with clarifying context information for each statement.

❐ These risk statements have been generated by the interview techniques described in this document and the CD-ROM, using a disciplined interviewing team that performs the interview roles as described, and under the assurance of confidentiality and non-attribution to the people interviewed.

❐ At least three interviews of representative peer groups have been conducted, of the appropriate length (2-1/2 hours or more), and no more than one of those interviews was with an individual (groups of 3-5 interviewees are the goal).

❐ The risk statements have been evaluated for potential impact and probability by both the interviewees and the SRE team, classified into "risk areas" by the SRE team, and prioritized on the basis of "importance to the project" by both the interviewees and the SRE team.

❐ The resulting "risk picture" has been presented by the SRE team to the assembled interviewees from all interview sessions and has had its credibility confirmed.

❐ The risk areas have been analyzed for their interrelationships, based on the "condition" portions of their member risk statements.

❒ The data assembled to this point has been summarized in a document that also presents a recommendation of the two or three risk areas to address in Mitigation Strategy Planning (MSP).

❒ Two or more risk areas have been addressed in MSP, resulting in (1) the definition of an overall mitigation goal for each risk area, (2) a listing of the key causes of all the "conditions" of the risk statements each risk area (3) a listing of the mitigation strategies chosen to deal with each risk area as a whole, and (4) a listing of the initial activities for carrying out the strategies, with an assigned (and accepted) responsibility and due date for each.

❒ Final results have been summarized and presented to the project manager in a formal document.

❒ Data from the SRE has been sanitized and turned over to the project for its use.

❒ The establishment of a risk management process for the project that is defined, methodical, and continuous has been encouraged at every opportunity.

What If It Wasn't "Flawless"?
All SRE process deliveries, even "flawless" ones, should be followed by a SRE team postmortem that documents

1. any items in the above listing (or in the more detailed listings of "Key Results" elsewhere in this Method Description) that were not achieved

2. aspects of the process that went particularly well (seemed "right on target," were clear to all team members, and functioned smoothly)

3. aspects of the process that seemed awkward and should be listed for follow-up study in subsequent SREs (but not changed at this time)

4. items that need to be fixed *now*, before the next SRE is undertaken

A "flawless" SRE can be achieved only by the honest assessment of lessons learned and continuous improvement of delivery based on feedback.

The first truly "flawless" SRE has yet to be completed.

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The Software Risk Evaluation (SRE) is a process for identifying, analyzing, and developing mitigation strategies for risks in a software-intensive system while it is in development. The SRE process has been in evolutionary development at the SEI since 1992 and has been used on over 50 DoD and civil (federal and state) contractors and program offices. Version 1.0 of the SRE Method Description was published in December, 1994.

The SRE Method Description provides

- a description of the SRE method's principles, including helpful concepts and applications

- additional insight into the SRE process so that an organization can responsibly customize the process for its own needs

- specific "key results" listings for each process step that can be used to assess quality of execution

The description should allow members of an organization's process improvement staff to perform an initial SRE competently without outside help, and then continuously improve their process over time.

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Version 2.0 Revisions

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December 1999

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Process Improvement Team

Software Engineering Process Management

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FOR THE COMMANDER

[signature]

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Table of Contents

Abstract

The Software Risk Evaluation (SRE) is a process for identifying, analyzing, and developing mitigation strategies for risks in a software-intensive system while it is in development. The SRE process has been in evolutionary development at the SEI since 1992 and has been used on over 50 Department of Defense (DoD) and civil (federal and state) contractors and program offices.

The SRE Team Member's Notebook was written for the SEI's own use in administering SREs. It is a "prescriptive" document—long on direction and short on explanation. It is being published as an appendix to SRE Method Description Version 2.0 to provide an example of a specific procedure that complies with the SRE Method Description. Because the size and life-cycle duration of individual projects may vary widely, the SRE Team Member's Notebook may not be ideal for all organizations. It is intended as a starting point for organizations to create a similar document that meets their unique needs.

Appendix
SRE Team Member's Notebook (Version 2.0)

To The Reader

Document Purpose

This Software Risk Evaluation (SRE) Team Member's Notebook (TMNB) is a dual-purpose document. The two purposes are

1. as an appendix to the Method Description, Version 2.0, to provide an example of a straightforward process flow description

2. as a stand-alone document, to be carried by each SEI SRE team member and *used* (marked on, flagged, highlighted, torn apart) in the course of the SRE

The first purpose can be met with a static, unchanging document as you see here. The second requires that there will be revisions as the SEI performs SREs over time—there could be a revision per SRE, depending on how strictly future SEI team leaders feel bound to follow (and revise) the processes as written.

Intended Audience

This TMNB is written for use by SEI SRE team leaders and team members, and by SRE team members drawn from the local organization as part of an SEI-led SRE.

Relationship to the Method Description

This document only provides detail information on three phases outlined in the SRE Method Description:

- the *Risk Identification and Analysis* (RI&A) phase,

- the *Interim Report* phase

- the *Mitigation Strategy Planning* (MSP) phase

The *Contracting* and *Final Report* phases are considered to be primarily the SRE team leader's responsibility (with little or no involvement from

the rest of the team) and are described adequately in the SRE Method Description.

This TMNB does not attempt to explain why the particular tools and methods were selected to implement the SRE process. In many cases, this was an arbitrary choice of the SEI person responsible for that step; if it seemed to work, it stayed in. In other cases, the tool or method was chosen after another was tried and abandoned. The TMNB does not provide historical insight—just tools and methods that have been tried successfully by the SEI.

High-Level Content Description

This TMNB contains the following:

- summaries of all SRE activities during the RI&A, Interim Report, and MSP phases, much of which is carried out on-site in the offices of the project receiving the SRE
- checklists and sample forms used throughout the process

Document Organization

The TMNB is organized according to the schedule of activities during a "typical" SRE conducted by the SEI. Note that the MSP phase is often delayed by weeks or months after the completion of the Interim Report.

The TMNB is structured first in the order of the three phases depicted below, and within the phases in the order that a *unique* block occurs temporally.

Risk Identification and Analysis (RI&A) Phase

Project Briefing*	0800-1100 Group Session #2	0800-1100 Group Session #4	0800-1200 Consolidation
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	1300-1700 Consolidation	1300-1530 Briefing Preparation
1600-1700 Session Analysis	1600-1700 Session Analysis		1530-1630 Data Confirmation Briefing
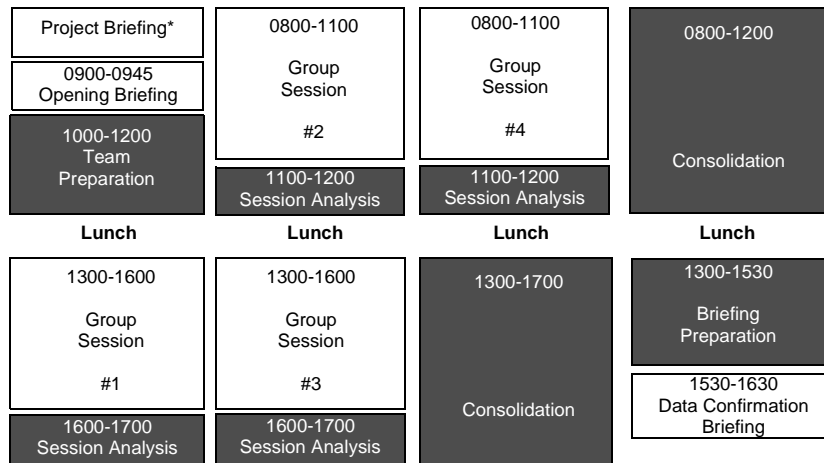
* The 1-hour project briefing can occur prior to the RI&A on-site visit. ▇ Team only

Interim Report Phase*

*   The Interim Report Phase should begin immediately after the RI&A phase and be completed within two weeks.

Mitigation Strategy Planning Phase
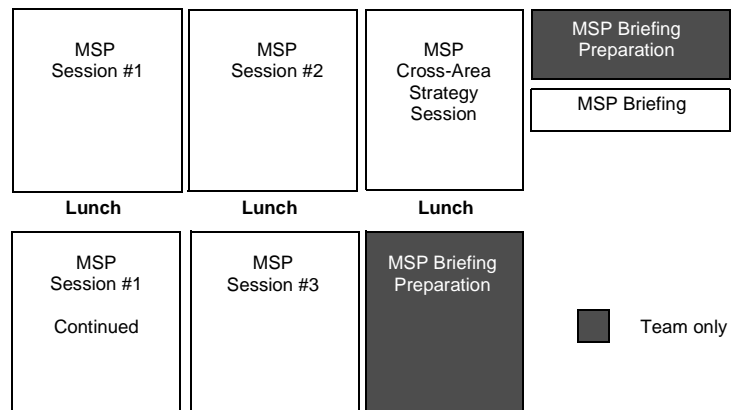
MSP Session #1	MSP Session #2	MSP Cross-Area Strategy Session	MSP Briefing Preparation
			MSP Briefing
Lunch	**Lunch**	**Lunch**	
MSP Session #1 Continued	MSP Session #3	MSP Briefing Preparation	

▇ Team only

MSP Sessions may range from 1/2 to 1 day in length, depending on the size of the risk area and the order of sessions. The first session will take the longest.

Project Briefing
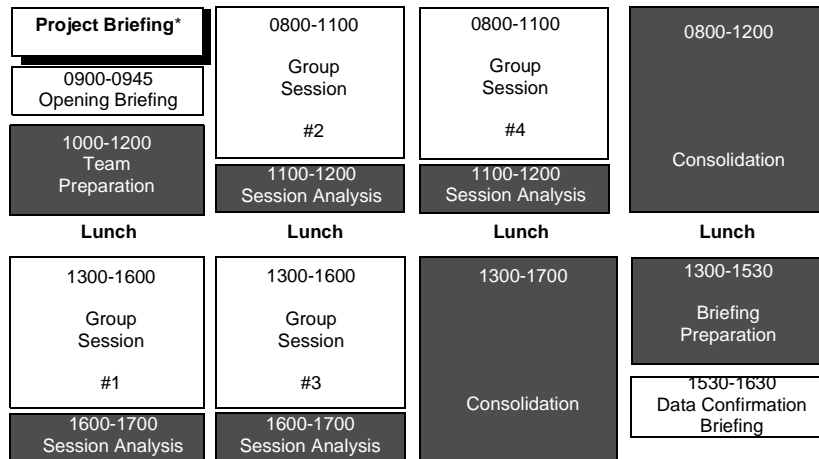
Project Briefing*	0800-1100 Group Session #2	0800-1100 Group Session #4	0800-1200
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	Consolidation
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	1300-1700	1300-1530 Briefing Preparation
1600-1700 Session Analysis	1600-1700 Session Analysis	Consolidation	1530-1630 Data Confirmation Briefing

* The 1-hour project briefing can occur prior to the RI&A on-site visit   ▇ Team only

Objectives	to provide context and background to the SRE team on the project
Who's in the Room?	• the project manager (or designated substitute) who is giving the briefing
	• any other project members the project manager chooses to invite
	• SRE team
Duration	1 hour (includes a 15-minute Q&A session)
Preparation	Prior to the project briefing, the following must be completed: By site coordinator • The completed project profile is given to the SRE team. • The project briefing content is given to the project manager.

By project manager

- The briefing presenter is chosen and briefing materials are complete.
- The briefing attendees are selected.
- The SRE participants are selected.

Logistics The site coordinator is responsible for arranging the project briefing with the project manager.

Approach This briefing will be run by the project manager or a chosen delegate. If, after the presentation, you still do not know the answers to the following questions, ask the presenter:

- *Who?* Who are the people the team will be interviewing and where do they fit into the project organization and operations? Who is the customer?
- *What?* What is the product this project is making? What are its special features? What makes it a challenge?
- *Where?* Where is the work being done? Where will the product be delivered?
- *When?* When must the product be delivered to the customer? What are the milestones and contractual dates of the project? Where is the project in its schedule right now?
- *How?* How is the project team developing the product? What processes is it following?
- *What is the project's "picture of success?"* This should be stated succinctly in two or three written sentences.

Results The SRE team has answers to the questions listed above.

Key Considerations It is likely that the project manager has a "set piece" briefing on hand that is used in various forms to inform outsiders about the project. This usually makes a good starting point for the project briefing. However, if the SRE team needs specific information that will serve as a context for group sessions, make sure that the project manager is asked to give the needed information.

Opening Briefing

Project Briefing*	0800-1100 Group Session #2	0800-1100 Group Session #4	0800-1200 Consolidation
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	1300-1700 Consolidation	1300-1530 Briefing Preparation
			1530-1630 Data Confirmation Briefing
1600-1700 Session Analysis	1600-1700 Session Analysis		
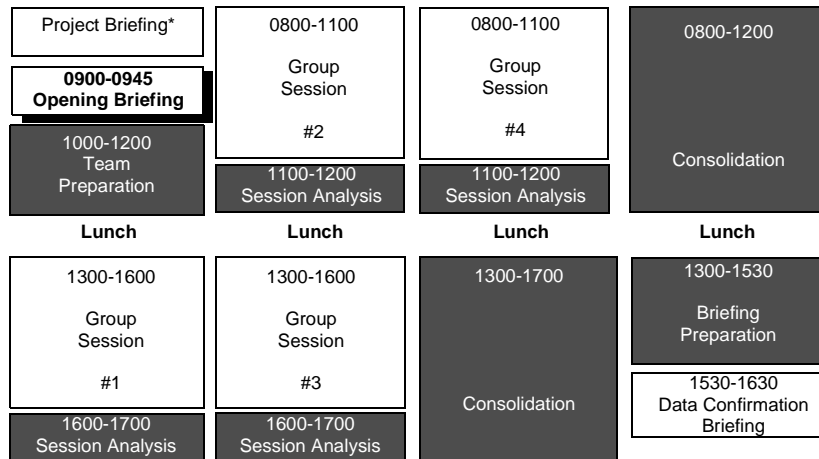
* The 1-hour project briefing can occur prior to the RI&A on-site visit   ▮ Team only

Objectives	• to demonstrate management's commitment to the SRE activity
	• to set the participants at ease by familiarizing them with the SRE process and its outputs
	• to review schedules - where to be, and when
	• to answer questions
Who's in the Room?	• project manager (required)
	• all individuals who will participate (strongly recommended)
	• other project personnel (recommended, but optional)
	• SRE team.
Duration	45 minutes
Preparation	Prior to the opening briefing, the following must be completed:

- All on-site logistics arrangements have been made by the site coordinator.
- Briefing materials have been completed.

Approach The project manager will introduce SRE team members and demonstrate his or her management commitment to the activity. The SRE team leader will then take over and deliver the briefing, which should take 30 minutes. This allows 15 minutes for questions.

The opening briefing should cover the following:

- the benefits of conducting an SRE
- the products of an SRE
- the SRE process
- what to expect from an SRE
- why an SRE is used
- the schedule

After the briefing, take any questions from the audience.

Results Participants understand the following

- that management is committed
- what to expect during the SRE process
- where to be and when

Key Considerations
- It is key that the project manager visibly commits to the process and introduces the SRE team. Showing commitment encourages project personnel to participate fully in the process. If the management isn't committed, why should the project personnel participate?
- Allow ample time for questions from the audience. The purpose is to set participants in the process at ease about what to expect and what is expected of them.

Team Preparation

Project Briefing*	0800-1100 Group Session #2	0800-1100 Group Session #4	0800-1200 Consolidation
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	1300-1700 Consolidation	1300-1530 Briefing Preparation
			1530-1630 Data Confirmation Briefing
1600-1700 Session Analysis	1600-1700 Session Analysis		
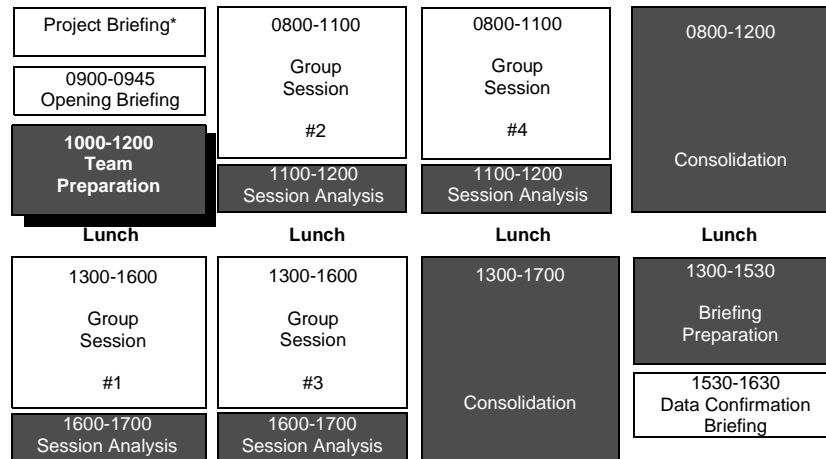
* The 1-hour project briefing can occur prior to the RI&A on-site visit   ▇ Team only

Objectives   to finalize any last minute preparations for the RI&A phase

Who's in the Room?   SRE team

Duration   3 hours maximum

Preparation   All on-site logistical arrangements must be completed by the site coordinator before the team preparation begins.

Results   All team members know exactly what will happen in each activity and what their roles and responsibilities are.

Points to Remember   This is the only time the team will have an extended period of time to "sit back" and take a look at what is going to happen. The following three

days of on-site activity are fit into a tight schedule. Use the time to make sure that team members are in synch with each other. A prepared team is a more effective team.

Logistics   If possible, take a look at the rooms assigned for each activity. Knowing the layout of the rooms ahead of time will minimize the set-up time later.

Forms to Be Used   The project profile shown on page 11 is used.

Project Profile

1. What are the normal work hours of the project (e.g., 8:00-5:00)? _____

2. What is your project's contractual role?

    ❐ Prime   ❐ Subcontractor

    ❐ Integrator   Other: _____

3   What are the start and delivery dates for your project?

    Start: _____   Delivery: _____

4   What phases does the contract life cycle cover?

    Demonstration and validation   ❐yes❐no

    Full-scale development   ❐yes❐no

    Maintenance   ❐yes❐no

    Other: _____

5   What is the current phase of your project?

    _____

6   Specifically, are you *in* or *past* the implementation phase of your project?

    ❐in   ❐past

7   Has your company implemented other systems of this application type?
    ❐yes ❐no

8   Has your company built other systems of this size?

    ❐yes ❐no

8   How big is the software portion of your project?

    Number of   LOC   Number of CSCs
    CSCIs

    _____   _____   _____

10 Are there any requirements that require unprecedented or state-of-the-art technology to implement?

Technologies   ❏yes ❏no

Methods   ❏yes ❏no

Languages   ❏yes ❏no

11 Are you using any reused or reengineered software?

❏yes ❏no

12 Are you using any COTS software?

❏yes ❏no

13 Is any developmental hardware being used?

❏yes ❏no

14 Are you doing any prototyping?

❏yes ❏no

15 Are there distributed development sites?

❏yes ❏no

16 Do you have any associate contractors?

❏yes ❏no

17 Do you have any subcontractors?

❏yes ❏no

17 Are any security requirements allocated to the software?

❏yes ❏no

18 Are any safety requirements allocated to the software?

❏yes ❏no

18 Are there multiple installation sites?

❏yes ❏no

Using the Project Profile to Delete Questions from the Taxonomy-Based Questionnaire

Description   When the SRE team receives the filled-out project profile from the project, the information in the profile can be used to eliminate some questions that would otherwise be asked in the group session interview.

Procedure   The following table defines which answers to the profile's questions can permit questions in the Taxonomy-Based Questionnaire (TBQ) to be skipped. No other answers in the profile have any effect on the TBQ—they only provide general data that may be useful to the SRE team to know before the RI&A phase.

Caution: **Make sure that crossed-out questions on the inter-viewers' copies remain legible.** In the course of the interview, the team may learn that one or more of the questions was incorrectly elimi-nated, and legibility will permit their immediate reintroduction.

For this profile question...	if the answer is…	cross out these TBQ questions.
2. What is your project's contractual role?	NOT subcontractor	184 - 187
6. Specifically, are you *in* or *past* the implementation phase of your project?	No	76
11. Are you using any reused or reengineered software?	No	28
12. Are you using any COTS software?	No	29 - 30 55
13. Is any developmental hardware being used?	No	43 - 44
14. Are you doing any prototyping?	No	71.a.1 - 71.a.1a.3
15. Are there distributed development sites?	No	83
16. Do you have any associate contractors?	No	175 - 177
17. Do you have any subcontractors?	No	178 - 183
18. Are any security requirements allocated to the software?	No	68-70
19. Are any safety requirements allocated to the software?	No	66-67
20. Are there multiple installation sites?	No	132

Group Sessions

Project Briefing*	**0800-1100** **Group Session** **#2**	**0800-1100** **Group Session** **#4**	0800-1200 Consolidation
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 **Group Session** **#1**	**1300-1600** **Group Session** **#3**	1300-1700 Consolidation	1300-1530 Briefing Preparation
			1530-1630 Data Confirmation Briefing
1600-1700 Session Analysis	1600-1700 Session Analysis		
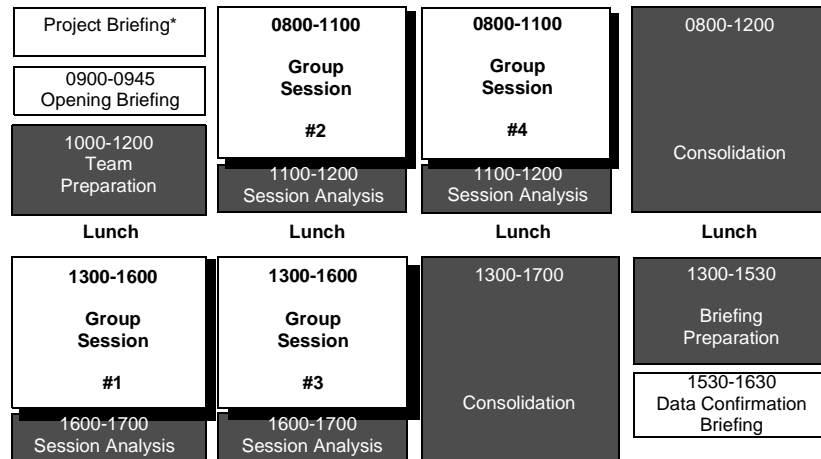
* The 1-hour project briefing can occur prior to the RI&A on-site visit   ▇ Team only

Objectives
- to elicit risks from project members in an efficient, repeatable, and non-judgemental way
- to facilitate the individual analysis of risks from participants

Who's in the Room?
- peer group of one to five participants
- SRE team

Duration   3 hours

Preparation   The following things must be completed prior to conducting a group session:

- Team roles must be assigned for the interviewer, risk recorder, and session recorder (may rotate for each group session).
- The group session script must be filled out by the interviewer.

- The medium for capturing risk statements must be selected (e.g., flip chart and marker).

- The blank evaluation form must be ready to be filled in.

Approach   The interviewer conducts the interview; the risk recorder captures the risk statements; and the session recorder captures the context of each risk. The three-hour group session should break down as follows:

Opening the Group Session: 5 minutes (see the Group Session Introduction Script on page 20)

- Welcome participants.

- Introduce the members of the team.

- Explain confidentiality and non-attribution.

- Describe the group session.

- Explain the interview process.

- Describe how to construct risk statements.

- Explain the focus during identification.

- Explain how the interview will end.

- Announce the starting point in the TBQ.

Identifying Risks in the Interview: 2 hours and 25 minutes

- Read questions verbatim from the TBQ.

- Use the interview protocol to probe for risks (cues and follow-up questions).

- Determine whether participants want to identify a risk. If they do, capture their risk statements.

- Ask the next question in the TBQ.

- Repeat until you finish the TBQ, or there are 10 minutes remaining in the allotted interview time.

- If you do not finish the TBQ, hand out a copy of the TBQ structure and ask the question: "Are there any concerns or issues you would like to raise beyond those already listed?"

- Capture any new risk statements.

Participant Break: 5 minutes

- Declare a 5 minute break for participants.

- Add the new risk statements to the evaluation form.

- Reproduce copies of the evaluation form.

Analyzing the Risks: 20 minutes (see Group Session Analysis Script on page 55)

- Distribute an evaluation form, scoring matrix, and impact definitions handout to each participant.

- Explain how to evaluate the probability and impact for each risk.

- Explain how to select the "top 5" risks to the project.

- Ask participants to hand in the forms when finished.

Closing the Group Session: 5 minutes (see Closing Script on page 56)

- Thank participants.

- Remind participants about confidentiality and non-attribution.

- Remind participants about the data confirmation briefing day, time, and location.

The session recorder(s) are responsible for reproducing and distributing copies of the context notes to SRE team members. If there were two or more session recorders, these notes should be merged to create a single version. Every attempt should be made to produce notes for the day's sessions before the end of that day. It is strongly recommended that context note capture (by both the session recorder and other team members) be done with a laptop computer. This will allow the notes from all sources to be reconciled and combined quickly, and make it possible for each SRE team member to have a *legible* copy of the context when consolidation begins.

Team members are responsible for reading the context notes of all sessions before the start of the reconcile scoring activity.

Results
- a list of project risk statements

- context notes for each risk statement

- a completed risk evaluation form for each participant

Key Considerations
- Keep in mind the interview principle: the interviewer must try to balance the following
  - good risk statement quality (condition; consequence)
  - the number of risks identified
  - covering the TBQ
- Keep in mind the individual voice principle and consensus: Any participant in a group may identify a risk. Consensus of the other participants is needed only in the wording of the risk, not in whether it is a risk.
- Capturing the first risk statement sets the tone for the interview. It is important that the participants and not the team identify risks. Use the words of the participants in capturing the risk statements. Ask them how they would phrase the risk and encourage them to modify a statement if it does not reflect what they said.
- Remember, the SRE team works together to identify risks. The rapport between the interviewer and risk recorder is especially important since they interact directly with the participants.
- There should not be any discussion among participants during the analysis. Each participant should evaluate the attributes and top five risks to the project individually and independently.

Logistics
- It is important that the participants be able to see what the risk recorder is writing.
- Identify the number of each question asked in the TBQ. It helps the session recorder to keep track of where the risk context fits.
- If possible, keep all risk statements visible to the participants. This allows them to review what they have already identified.
- If possible, add the risk statements to the evaluation form as they are identified. It will save you time at the end of the interview. This can be accomplished easily if there is an extra team member. If not, the risk recorder may be able to transcribe the risk onto the evaluation form during the interview.
- Access to copy machines, computers, and printers will keep the activity running smoothly.

Scripts and Forms   The following pages provide

- a script for introducing the group session

- the complete TBQ

- instructions for using several questioning techniques as aids to closing the interview and assuring that all the software risk taxonomy elements are covered during the interview

- a copy of the taxonomy outline

- a blank evaluation form

- an example of a filled-in session recorder's notes page

- the generic risk scoring matrix

- the generic levels of risk impact table

- a script for closing the group session

NOTE: The last two items are "generic" because they may have been superseded by project-specific versions during SRE contracting. If they *have* been superseded, the SRE team leader will provide you with the correct versions.

Blank session recorder notes pages appear at the back of this TMNB beginning on page 145.

Group Session Introduction Script

Welcome
- Thank you for being here.
- My name is _____. I'm the interviewer for this session.
- Do you all have name cards?

Introduction
- I'd like to introduce the Software Risk Evaluation team.

  _____ is the risk recorder.

  _____ is the session recorder.

  _____ is the process observer .

  Other team members include

  _____

  _____

  _____.

- Now I'd like each of you to introduce yourself and briefly describe your function on the project.

Confidentiality
- Remember that this SRE team and your project have agreed that these sessions will remain confidential.
- We will not attribute any remark to any individual or to this group— even among ourselves after the SRE process is completed. We ask that you follow the same guidelines among yourselves.

Session Description
- This group session consists of a two-and-a-half hour structured interview for risk identification. During this time you will help us write risk statements that relate to your project.
- This will be followed by an analysis phase, in which you will individually analyze attributes of the risk statements you have helped to write.
- Finally, you will individually select and rank five of those risk statements as the "most important to the project."
- The whole group session will take three hours.

Interview Process

- The purpose of this interview is to ask you to identify project issues that reflect your perspective on concerns, uncertainties, or risks that you feel the project is facing.

- We do this using a questionnaire that is structured according to the risk taxonomy.

- I will be asking the taxonomy questions during this session; however, my colleagues may ask follow-up questions at any time.

Constructing Risk Statements

- When you identify an issue and our discussion leads to the construction of a **risk statement**, it will be recorded on a flipchart for you to edit and confirm. It is important that the words accurately reflect what you intended.

- The general format of a risk statement is a phrase describing a **condition** that exists today in the project, followed by a phrase describing at least one possible future **consequence** of that condition. A simple (and non-technical) example might be, "There is water on the hall floor; someone could slip on it and fall."

- Remember that the identification of risks does not require consensus; any one of you may bring up an issue and help us refine it into a risk statement.

- However, it is important that you all agree on the meaning of the risk statement, as reflected in the wording, whether or not you individually agree that it is valid.

Identification Focus

- I want to remind you of your project's "Picture of Success," which is _____. The focus of our discussion should be on things that may jeopardize your reaching that goal.

- We encourage the free flow of responses during the interview, so don't restrict yourself by addressing only the question that was asked. Think of the questions as prompts to stimulate your ideas in the spirit of brainstorming.

- Not every question is expected to lead to the creation of a risk statement. If you don't think there is a concern in an area, just tell me and I'll move on. If you think there *is* a concern, bring it up and we'll explore it further.

- It's my job to keep the interview focused on identifying issues. To keep to our deadline, I may interrupt to redirect lengthy discussions or conjecture about solutions.

- And if I get caught up in your discussion, one of my colleagues will suggest that I move on.

Closing the Interview

- We may not complete the questionnaire in the time allotted.

- If we are 10 minutes away from the end of the interview session, and still have not completed the questionnaire, we will interrupt the taxonomy-based interview process and ask if there are any concerns or issues that you would like to raise beyond those already listed.

- Then we will move on to the analysis phase of the session that I mentioned earlier.

Taxonomy Questionnaire

- Do you have any questions before we start?

- We will start with questions from the _____ class of the taxonomy. The first question is from the _____ element and deals with _____ (attribute).

Taxonomy-Based Questionnaire

This is a reprint of Appendix B, Taxonomy-Based Questionnaire, taken from the following technical report: *Taxonomy Based Risk Identification* (CMU/SEI-93-TR-6).

A Product Engineering

A.1 **Requirements**

A.1-a. **Stability**

Are requirements changing even as the product is being produced?

[1] Are the requirements stable?

    (No)   (1.a)   What is the effect on the system?

- *Quality*
- *Functionality*
- *Schedule*
- *Integration*
- *Design*
- *Testing*

[2] Are the external interfaces changing?

A.1-b. **Completeness**
Are requirements missing or incompletely specified?

[3] Are there any TBDs in the specifications?

[4] Are there requirements you know should be in the specification but aren't?

    (Yes)   (4.a)   Will you be able to get these requirements into the system?

[5] Does the customer have unwritten requirements/expectations?

    (Yes)   (5.a)   Is there a way to capture these requirements?

[6] Are the external interfaces completely defined?

A.1-c. **Clarity**
Are requirements unclear or in need of interpretation?

[7] Are you able to understand the requirements as written?

    (No)   (7.a)   Are the ambiguities being resolved satisfactorily?

(Yes) (7.b)   There are no ambiguities or problems of interpretation?

A.1-d. **Validity**
Will the requirements lead to the product the customer has in mind?

[8] Are there any requirements that may not specify what the customer really wants?

(Yes) (8.a)   How are you resolving this?

[9] Do you and the customer understand the same thing by the requirements?

(Yes) (9.a)   Is there a process by which to determine this?

[10] How do you validate the requirements?
- Prototyping
- Analysis
- Simulations

A.1-e. **Feasibility**
Are requirements infeasible from an analytical point of view?

[11] Are there any requirements that are technically difficult to implement?

(Yes) (11.a)   What are they?

(Yes) (11.b)   Why are they difficult to implement?

(No)   (11.c)   Were feasibility studies done for these requirements?

(Yes) (11.c.1) How confident are you of the assumptions made in the studies?

A.1-f. **Precedent**
Do requirements specify something never done before, or that your company has not done before?

[12] Are there any state-of-the-art requirements?
- Technologies
- Methods
- Languages
- Hardware

(No)   (12.a)   Are any of these new to you?

(Yes) (12.b) Does the program have sufficient knowledge in these areas?

            (No) (12.b.1) Is there a plan for acquiring knowledge in these areas?

A.1-g. **Scale**

Do requirements specify a product larger, more complex, or requiring a larger organization than in the experience of the company?

[13] Is the system size and complexity a concern?

    (No) (13.a) Have you done something of this size and complexity before?

[14] Does the size require a larger organization than usual for your company?

A.2 **Design**

A.2-a. **Functionality**

Are there any potential problems in meeting functionality requirements?

[15] Are there any specified algorithms that may not satisfy the requirements?

    (No) (15.a) Are any of the algorithms or designs marginal with respect to meeting requirements?

[16] How do you determine the feasibility of algorithms and designs?

- Prototyping
- Modeling
- Analysis
- Simulation

A.2-b. **Difficulty**
Will the design and/or implementation be difficult to achieve?

[17] Does any of the design depend on unrealistic or optimistic assumptions?

[18] Are there any requirements or functions that are difficult to design?

(No) (18.a) Do you have solutions for all the requirements?

(Yes) (18.b) What are the requirements?

- Why are they difficult?

A.2-c. **Interfaces**
Are the internal interfaces (hardware and software) well defined and controlled?

[19] Are the internal interfaces well defined?
- Software-to-software
- Software-to-hardware

[20] Is there a process for defining internal interfaces?

(Yes) (20.a) Is there a change control process for internal interfaces?

[21] Is hardware being developed in parallel with software?

(Yes) (21.a) Are the hardware specifications changing?

(Yes) (21.b) Have all the interfaces to software been defined?

(Yes) (21.c) Will there be engineering design models that can be used to test the software?

A.2-d. **Performance**
Are there stringent response time or throughput requirements?

[22] Are there any problems with performance?
- Throughput
- Scheduling asynchronous real-time events
- Real-time response
- Recovery timelines
- Response time
- Database response, contention, or access

[23] Has a performance analysis been done?

    (Yes)   (23.a)   What is your level of confidence in the performance analysis?

    (Yes)   (23.b)   Do you have a model to track performance through design and implementation?

A.2-e. **Testability**
Is the product difficult or impossible to test?

[24] Is the software going to be easy to test?

[25] Does the design include features to aid testing?

[26] Do the testers get involved in analyzing requirements?

A.2-f. **Hardware Constraints**
Are there tight constraints on the target hardware?

[27] Does the hardware limit your ability to meet any requirements?
- Architecture
- Memory capacity
- Throughput
- Real-time response
- Response time
- Recovery timelines
- Database performance
- Functionality
- Reliability
- Availability

A.2-g. **Non-Developmental Software**
Are there problems with software used in the program but not developed by the program?

If reused or reengineered software exists

[28] Are you reusing or re-engineering software not developed on the program?

    (Yes)   (28.a)   Do you foresee any problems?

                 - Documentation

- Performance
- Functionality
- Timely delivery
- Customization

If COTS software is being used

[29] Are there any problems with using COTS (commercial off-the-shelf) software?
- Insufficient documentation to determine interfaces, size, or performance
- Poor performance
- Requires a large share of memory or database storage
- Difficult to interface with application software
- Not thoroughly tested
- Not bug free
- Not maintained adequately
- Slow vendor response

[30] Do you foresee any problem with integrating COTS software updates or revisions?

A.3 **Code and Unit Test**

A.3-a. **Feasibility**

Is the implementation of the design difficult or impossible?

[31] Are any parts of the product implementation not completely defined by the design specification?

[32] Are the selected algorithms and designs easy to implement?

A.3-b. **Testing**
Are the specified level and time for unit testing adequate?

[33] Do you begin unit testing before you verify code with respect to the design?

[34] Has sufficient unit testing been specified?

[35] Is there sufficient time to perform all the unit testing you think should be done?

[36] Will compromises be made regarding unit testing if there are schedule problems?

A.3-c. **Coding/Implementation**
Are there any problems with coding and implementation?

[37] Are the design specifications in sufficient detail to write the code?

[38] Is the design changing while coding is being done?

[39] Are there system constraints that make the code difficult to write?
- Timing
- Memory
- External storage

[40] Is the language suitable for producing the software on this program?

[41] Are there multiple languages used on the program?

    (Yes)   (41.a)   Is there interface compatibility between the code produced by the different compilers?

[42] Is the development computer the same as the target computer?

    (No)   (42.a)   Are there compiler differences between the two?

If developmental hardware is being used

[43] Are the hardware specifications adequate to code the software?

[44] Are the hardware specifications changing while the code is being written?

A.4 **Integration and Test**

A.4-a. **Environment**

Is the integration and test environment adequate?

[45] Will there be sufficient hardware to do adequate integration and testing?

[46] Is there any problem with developing realistic scenarios and test data to demonstrate any requirements?
- Specified data traffic
- Real-time response
- Asynchronous event handling
- Multi-user interaction

[47] Are you able to verify performance in your facility?

[48] Does hardware and software instrumentation facilitate testing?

(Yes) (48.a) Is it sufficient for all testing?

A.4-b. **Product**

Is the interface definition inadequate, facilities inadequate, time insufficient?

[49] Will the target hardware be available when needed?

[50] Have acceptance criteria been agreed to for all requirements?

(Yes) (50.a) Is there a formal agreement?

[51] Are the external interfaces defined, documented, and baselined?

[52] Are there any requirements that will be difficult to test?

[53] Has sufficient product integration been specified?

[54] Has adequate time been allocated for product integration and test?

If COTS

[55] Will vendor data be accepted in verification of requirements allocated to COTS products?

(Yes)   (55.a)   Is the contract clear on that?

A.4-c. **System**
System integration uncoordinated, poor interface definition, or inadequate facilities?

[56]   Has sufficient system integration been specified?

[57]   Has adequate time been allocated for system integration and test?

[58]   Are all contractors part of the integration team?

[59]   Will the product be integrated into an existing system?

    (Yes)   (59.a)   Is there a parallel cutover period with the existing system?

        (No)   (59.a.1)   How will you guarantee the product will work correctly when integrated?

[60]   Will system integration occur on customer site?

A.5 **Engineering Specialties**
A.5-a. **Maintainability**
Will the implementation be difficult to understand or maintain?

[61]   Does the architecture, design, or code create any maintenance difficulties?

[62]   Are the maintenance people involved early in the design?

[63]   Is the product documentation adequate for maintenance by an outside organization?

A.5-b. **Reliability**
Are the reliability or availability requirements difficult to meet?

[64]   Are reliability requirements allocated to the software?

[65]   Are availability requirements allocated to the software?

    (Yes)   (65.a)   Are recovery timelines any problem?

A.5-c. **Safety**

Are the safety requirements infeasible and not demonstrable?

[66] Are safety requirements allocated to the software?

(Yes) (66.a) Do you see any difficulty in meeting the safety requirements?

[67] Will it be difficult to verify satisfaction of safety requirements?

A.5-d. **Security**

Are the security requirements more stringent than the current state of the practice or program experience?

[68] Are there unprecedented or state-of-the-art security requirements?

[69] Is it an Orange Book system?

[70] Have you implemented this level of security before?

A.5-e. **Human Factors**

Will the system will be difficult to use because of poor human interface definition?

[71] Do you see any difficulty in meeting the Human Factors requirements?

(No) (71.a.0) How are you ensuring that you will meet the human interface requirements?

If prototyping

(No) (71.a.1) Is it a throw-away prototype?

(No) (71.a.1a) Are you doing evolutionary development?

(Yes) (71.a.1a.1) Are you experienced in this type of development?

(Yes) (71.a.1a.2) Are interim versions deliverable?

(Yes) (71.a.1a.3) Does this complicate change control?

A.5-f. **Specifications**
Is the documentation adequate to design, implement, and test the system?

[72] Is the software requirements specification adequate to design the system?

[73] Are the hardware specifications adequate to design and implement the software?

[74] Are the external interface requirements well specified?

[75] Are the test specifications adequate to fully test the system?

If in or past implementation phase

[76] Are the design specifications adequate to implement the system?
- Internal interfaces

B. Development Environment

B.1 **Development Process**

B.1-a. **Formality**

Will the implementation be difficult to understand or maintain?

[77] Is there more than one development model being used?
- Spiral
- Waterfall
- Incremental

(Yes) (77.a) Is coordination between them a problem?

[78] Are there formal, controlled plans for all development activities?
- Requirements analysis
- Design
- Code
- Integration and test
- Installation
- Quality assurance
- Configuration management

(Yes) (78.a) Do the plans specify the process well?

(Yes) (78.b) Are developers familiar with the plans?

B.1-b. **Suitability**

Is the process suited to the development model, e.g., spiral, prototyping?

[79] Is the development process adequate for this product?

[80] Is the development process supported by a compatible set of procedures, methods, and tools?

B.1-c. **Process Control**
Is the software development process enforced, monitored, and controlled using metrics? Are distributed development sites coordinated?

[81] Does everyone follow the development process?

(Yes) (81.a) How is this insured?

[82] Can you measure whether the development process is meeting your productivity and quality goals?

If there are distributed development sites

[83] Is there adequate coordination among distributed development sites?

B.1-d. **Familiarity**
Are the project members experienced in use of the process? Is the process understood by all staff members?

[84] Are people comfortable with the development process?

B.1-e. **Product Control**
Are there mechanisms for controlling changes in the product?

[85] Is there a requirements traceability mechanism that tracks requirements from the source specification through test cases?

[86] Is the traceability mechanism used in evaluating requirement change impact analyses?

[87] Is there a formal change control process?

(Yes) (87.a) Does it cover all changes to baselined requirements, design, code, and documentation?

[88] Are changes at any level mapped up to the system level and down through the test level?

[89] Is there adequate analysis when new requirements are added to the system?

[90] Do you have a way to track interfaces?

[91] Are the test plans and procedures updated as part of the change process?

B.2 **Development System**

B.2-a. **Capacity**

Is there sufficient work station processing power, memory, or storage capacity?

[92] Are there enough workstations and processing capacity for all staff?

[93] Is there sufficient capacity for overlapping phases, such as coding, integration and test?

B.2-b. **Suitability**

Does the development system support all phases, activities, and functions?

[94] Does the development system support all aspects of the program?
- Requirements analysis
- Performance analysis
- Design
- Coding
- Test
- Documentation
- Configuration management
- Management tracking
- Requirements traceability

B.2-c. **Usability**

How easy is the development system to use?

[95] Do people find the development system easy to use?

[96] Is there good documentation of the development system?

B.2-d. **Familiarity**
Is there little prior company or project member
experience with the development system?

[97] Have people used these tools and methods before?

B.2-e. **Reliability**
Does the system suffer from software bugs, down-time,
insufficient built-in back-up?

[98] Is the system considered reliable?
- Compiler
- Development tools
- Hardware

B.2-f. **System Support**
Is there timely expert or vendor support for the system?

[99] Are the people trained in use of the development tools?

[100] Do you have access to experts in use of the system?

[101] Do the vendors respond to problems rapidly?

B.2-g. **Deliverability**
Are the definition and acceptance requirements defined
for delivering the development system to the customer
not budgeted? HINT: If the participants are confused
about this, it is probably not an issue from a risk
perspective.

[102] Are you delivering the development system to the customer?

(Yes) (102.a) Have adequate budget, schedule, and resources been
allocated for this deliverable?

B.3 **Management Process**

B.3-a. **Planning**

Is the planning timely, technical leads included, contingency planning done?

[103] Is the program managed according to the plan?

(Yes) (103.a) Do people routinely get pulled away to fight fires?

[104] Is re-planning done when disruptions occur?

[105] Are people at all levels included in planning their own work?

[106] Are there contingency plans for known risks?

(Yes) (106.a) How do you determine when to activate the contingencies?

[107] Are long-term issues being adequately addressed?

B.3-b. **Project Organization**
Are the roles and reporting relationships clear?

[108] Is the program organization effective?

[109] Do people understand their own and others' roles in the program?

[110] Do people know who has authority for what?

B.3-c. **Management Experience**
Are the managers experienced in software development, software management, the application domain, the development process, or on large programs?

[111] Does the program have experienced managers?
- Software management
- Hands-on software development
- With this development process
- In the application domain
- Program size or complexity

B.3-d. **Program Interfaces**

Is there poor interface with customer, other contractors, senior and/or peer managers?

[112] Does management communicate problems up and down the line?

[113] Are conflicts with the customer documented and resolved in a timely manner?

[114] Does management involve appropriate program members in meetings with the customer?
- Technical leaders
- Developers
- Analysts

[115] Does management work to ensure that all customer factions are represented in decisions regarding functionality and operation?

[116] Is it good politics to present an optimistic picture to the customer or senior management?

B.4 **Management Methods**

B.4-a. **Monitoring**

Are management metrics defined and development progress tracked?

[117] Are there periodic structured status reports?

(Yes)   (117.a) Do people get a response to their status reports?

[118] Does appropriate information get reported to the right organizational levels?

[119] Do you track progress versus plan?

(Yes)   (119.a) Does management have a clear picture of what is going on?

B.4-b. **Personnel Management**
Are project personnel trained and used appropriately?

[120]   Do people get trained in skills required for this program?

   (Yes)   (120.a) Is this part of the program plan?

[121]   Do people get assigned to the program who do not match the experience profile for your work area?

[122]   Is it easy for program members to get management action?

[123]   Are program members at all levels aware of their status versus plan?

[124]   Do people feel it's important to keep to the plan?

[125]   Does management consult with people before making decisions that affect their work?

[126]   Does program management involve appropriate program members in meetings with the customer?
   • Technical leaders
   • Developers
   • Analysts

B.4-c. **Quality Assurance**
Are there adequate procedures and resources to assure product quality?

[127]   Is the software quality assurance function adequately staffed on this program?

[128]   Do you have defined mechanisms for assuring quality?

   (Yes)   (128.a) Do all areas and phases have quality procedures?

   (Yes)   (128.b) Are people used to working with these procedures?

B.4-d. **Configuration Management**
Are the change procedures or version control, including installation site(s), adequate?

[129]   Do you have an adequate configuration management system?

[130]   Is the configuration management function adequately staffed?

[131]   Is coordination required with an installed system?

(Yes)   (131.a) Is there adequate configuration management of the installed system?

(Yes)   (131.b) Does the configuration management system synchronize your work with site changes?

[132] Are you installing in multiple sites?

(Yes)   (132.a) Does the configuration management system provide for multiple sites?

B.5 **Work Environment**

B.5-a. **Quality Attitude**

Is there a lack of orientation toward quality work?

[133] Are all staff levels oriented toward quality procedures?

[134] Does schedule get in the way of quality?

B.5-b. **Cooperation**

Is there a lack of team spirit? Does conflict resolution require management intervention?

[135] Do people work cooperatively across functional boundaries?

[136] Do people work effectively toward common goals?

[137] Is management intervention sometimes required to get people working together?

B.5-c. **Communication**

Is there poor awareness of mission or goals, poor communication of technical information among peers and managers?

[138] Is there good communication among the members of the program?
- Managers
- Technical leaders
- Developers
- Testers
- Configuration management

- Quality assurance

[139] Are the managers receptive to communication from program staff?

(Yes) (139.a) Do you feel free to ask your managers for help?

(Yes) (139.b) Are members of the program able to raise risks without having a solution in hand?

[140] Do the program members get timely notification of events that may affect their work?

(Yes) (140.a) Is this formal or informal?

B.5-d. **Morale**
Is there a non-productive, non-creative atmosphere? Do people feel that there is no recognition or reward for superior work?

[141] How is morale on the program?

(No) (141.a) What is the main contributing factor to low morale?

[142] Is there any problem keeping the people you need?

C. Program Constraints

C.1 **Resources**

C.1-a. **Schedule**

Is the schedule inadequate or unstable?

[143] Has the schedule been stable?

[144] Is the schedule realistic?

(Yes)   (144.a) Is the estimation method based on historical data?

(Yes)   (144.b) Has the method worked well in the past?

[145] Is there anything for which adequate schedule was not planned?
- Analysis and studies
- QA
- Training
- Maintenance courses and training
- Capital equipment
- Deliverable development system

[146] Are there external dependencies which are likely to impact the schedule?

C.1-b. **Staff**

Is the staff inexperienced, lacking domain knowledge, lacking skills, or understaffed?

[147] Are there any areas in which the required technical skills are lacking?
- Software engineering and requirements analysis method
- Algorithm expertise
- Design and design methods
- Programming languages
- Integration and test methods
- Reliability
- Maintainability
- Availability
- Human factors
- Configuration management
- Quality assurance

- Target environment
- Level of security
- COTS
- Reuse software
- Operating system
- Database
- Application domain
- Performance analysis
- Time-critical applications

[148] Do you have adequate personnel to staff the program?

[149] Is the staffing stable?

[150] Do you have access to the right people when you need them?

[151] Have the program members implemented systems of this type?

[152] Is the program reliant on a few key people?

[153] Is there any problem with getting cleared people?

C.1-c. **Budget**
Is the funding insufficient or unstable?

[154] Is the budget stable?

[155] Is the budget based on a realistic estimate?

    (Yes)   (155.a) Is the estimation method based on historical data?

    (Yes)   (155.b) Has the method worked well in the past?

[156] Have features or functions been deleted as part of a design-to-cost effort?

[157] Is there anything for which adequate budget was not allocated?
- Analysis and studies
- QA
- Training
- Maintenance courses
- Capital equipment
- Deliverable development system

[158] Do budget changes accompany requirement changes?

    (Yes)   (158.a) Is this a standard part of the change control process?

C.1-d. **Facilities**
Are the facilities adequate for building and delivering the product?

[159] Are the development facilities adequate?

[160] Is the integration environment adequate?

C.2 **Contract**

C.2-a. **Type of Contract**

Is the contract type a source of risk to the program?

[161] What type of contract do you have? (Cost plus award fee, fixed price,....)
(161a) Does this present any problems?

[162] Is the contract burdensome in any aspect of the program?
- SOW (Statement of Work)
- Specifications
- DIDs (Data Item Descriptions)
- Contract parts
- Excessive customer involvement

[163] Is the required documentation burdensome?
- Excessive amount
- Picky customer
- Long approval cycle

C.2-b. **Restrictions**
Does the contract cause any restrictions?

[164] Are there problems with data rights?
- COTS software
- Developmental software
- Non-developmental items

C.2-c. **Dependencies**

Does the program have any dependencies on outside products or services?

[165] Are there dependencies on external products or services that may affect the product, budget, or schedule?
- Associate contractors
- Prime contractor
- Subcontractors
- Vendors or suppliers
- Customer furnished equipment or software

C.3 **Program Interfaces**

C.3-a. **Customer**

Are there any customer problems such as: lengthy document-approval cycle, poor communication, and inadequate domain expertise?

[166] Is the customer approval cycle timely?
- Documentation
- Program reviews
- Formal reviews

[167] Do you ever proceed before receiving customer approval?

[168] Does the customer understand the technical aspects of the system?

[169] Does the customer understand software?

[170] Does the customer interfere with process or people?

[171] Does management work with the customer to reach mutually agreeable decisions in a timely manner?
- Requirements understanding
- Test criteria
- Schedule adjustments
- Interfaces

[172] How effective are your mechanisms for reaching agreements with the customer?
- Working groups (contractual?)
- Technical interchange meetings (contractual?)

[173] Are all customer factions involved in reaching agreements?

(Yes) (173.a) Is it a formally defined process?

[174] Does management present a realistic or optimistic picture to the customer?

If there are associate contractors

C.3-b. **Associate Contractors**
Are there any problems with associate contractors such as inadequately defined or unstable interfaces, poor communication, or lack of cooperation?

[175] Are the external interfaces changing without adequate notification, coordination, or formal change procedures?

[176] Is there an adequate transition plan?

(Yes) (176.a) Is it supported by all contractors and site personnel?

[177] Is there any problem with getting schedules or interface data from associate contractors?

(No) (177.a) Are they accurate?

If there are subcontractors

C.3-c. **Subcontractors**
Is the program dependent on subcontractors for any critical areas?

[178] Are there any ambiguities in subcontractor task definitions?

[179] Is the subcontractor reporting and monitoring procedure different from the program's reporting requirements?

[180] Is subcontractor administration and technical management done by a separate organization?

[181] Are you highly dependent on subcontractor expertise in any areas?

[182] Is subcontractor knowledge being transferred to the company?

[183] Is there any problem with getting schedules or interface data from subcontractors?

If program is a subcontract

C.3-d. **Prime Contractor**
Is the program facing difficulties with its Prime contractor?

[184] Are your task definitions from the Prime ambiguous?

[185] Do you interface with two separate prime organizations for administration and technical management?

[186] Are you highly dependent on the Prime for expertise in any areas?

[187] Is there any problem with getting schedules or interface data from the Prime?

C.3-e. **Corporate Management**
Is there a lack of support or micro management from upper management?

[188] Does program management communicate problems to senior management?

(Yes)   (188.a) Does this seem to be effective?

[189] Does corporate management give you timely support in solving your problems?

[190] Does corporate management tend to micro-manage?

[191] Does management present a realistic or optimistic picture to senior management?

C.3-f. **Vendors**
Are vendors responsive to programs needs?

[192] Are you relying on vendors for deliveries of critical components?
- Compilers
- Hardware
- COTS

C.3-g. **Politics**
Are politics causing a problem for the program?

[193] Are politics affecting the program?
- Company
- Customer
- Associate contractors
- Subcontractors

[194] Are politics affecting technical decisions?

Ending the Interview—Directions and Script

Objective   The interviewer has to decide on the fly whether the interview is covering the taxonomy well. If only a few classes and elements have been covered when there are only 15 or so minutes left in the interview, it is appropriate to shift the level of inquiry from the *attribute* level of the taxonomy (the level at which the TBQ questions are written) to the *element* level. Several techniques are available to help ensure coverage of the taxonomy.

Procedure   1. With about 15 minutes remaining (about 2-1/4 hours into the interview), the interviewer will shift to a more unstructured form of questioning. To do this, the interviewer may do one of the following:

-   Use the Short Taxonomy-Based Questionnaire (the "Short TBQ") reproduced on page 53 to shift the level of questioning from the attribute to the element level of the TBQ. Follow the same overall strategy for the order of questioning, and do not ask questions for elements that were already covered completely using the full TBQ.

OR

-   Place a copy of the taxonomy outline (shown on page 54) in front of the participants and ask them to examine it. Then, go around the table and ask each participant to suggest risk statements for areas that have not yet been covered.

2. After the participants have exhausted their risk issues or the allotted time has been used up, declare a five-minute break. Remind the participants that they *must* be back in the room in five minutes and strongly suggest that they not go back to their offices or read email. While they are gone, the computer operator will print the risk evaluation form and make enough copies for everyone in the room.

Script   We are just about out of time, so I will stop asking questions from the Taxonomy-Based Questionnaire.

- **Method 1:** I'm now going to switch to a questionnaire that covers the SEI Risk Taxonomy at a higher level, so that we can cover the remaining areas more quickly. I'm going to be asking questions in the _____ Class, beginning with the Element _____. The question is: _____.

<div align="center">**OR**</div>

- **Method 2:** Here is a copy of the taxonomy outline. Please examine it and then think about any risks that might exist in the areas we have not yet covered. Can you think of any other risks we should capture?.

We are now out of time. Let's take a five-minute break. Please come back after five minutes so that we can keep on schedule. Let me strongly suggest that you do not go back to your desks, go near a telephone, or read email. We'll see you right back here in five minutes. Thank you.

A *Short* Taxonomy-Based Questionnaire

Product (Product Engineering)

Think about risks to the project that may arise from the nature of the product that you are trying to develop...

A.1 Requirements—Are there risks that may arise from requirements being placed on the product? Examples: Stability; Completeness; Clarity; Validity; Feasibility; Precedent; Scale.
A.2 Design—Are there risks that may arise from the design the project has chosen to meet its requirements? Examples: Functionality; Difficulty; Interfaces; Performance; Testability; Hardware Constraints; Non-Developmental Software.
A.3 Code & Unit Test (Manufacturability)—Are there risks that may arise from the way the project is choosing to subdivide the design and construct the pieces? Examples: Feasibility; Testing; Coding/Implementation.
A.4 Integration & Test—Are there risks that may arise from the way the project is choosing to bring the pieces together and prove that they work as a whole? Examples: The HW and SW Support Facilities; integration of the parts of the product; integration with the larger system
A.5 Engineering Specialities—Are there risks that may arise from special attributes of the product, such as Maintainability, Reliability, Safety, Security, Human Factors, etc.?
A.99 (Other)—Are there other risks that may arise from the product itself, but are not covered by the above categories?

Process (Development Environment)

*Think about risks to the project that may arise from the **way** you are going about developing the product...*

B.1 Development Process—Are there risks that may arise from the process the project has chosen to develop the product? Examples: Formality; Suitability; Process Control; Familiarity; Product Control.
B.2 Development System—Are there risks that may arise from the hardware and software tools the project has chosen for controlling and facilitating its development process? Examples: Capacity; Suitability; Usability; Familiarity; Reliability; System Support; Deliverability.
B.3 Management System—Are there risks that may arise from the way project budget or schedule is planned, monitored or controlled, or the project's structure, or its handling of internal and external organization interfaces?
B.4 Management Methods—Are there risks that may arise from the way the development or program personnel are managed, in areas such as Status Monitoring, Personnel Management, Quality Assurance, or Configuration Management?
B.5 Work Environment—Are there risks that may arise from the general environment or the larger organization to which the project belongs, such as Quality Attitude, Cooperation, Communication, or Morale?
B.99 (Other)—Are there other risks that may arise from the way the project is going about its development, but not covered by the above categories?

Constraints (Program Constraints)

Think about risks to the project that may arise from sources outside the project's control...

C.1 Resources—Are there risks that may arise from resources the project needs but that are outside its control to obtain or maintain? Examples: Schedule; Staff; Budget; Facilities.
C.2 Contract—Are there risks that may arise from the [already legally binding] contract? Example areas include the contract's Type, Restrictions, or Dependencies.
C.3 Program Interfaces—Are there risks that may arise from outside interfaces which the project cannot reasonably expect to control? Examples: Customer; Associate Contractors; Subcontractors; Prime Contractor; Corporate Management; Vendors; Politics.
C.99 (Other)—Are there other risks that may arise from factors outside project control, but not covered by the above categories?

Taxonomy of Software Development Risks

A. Product Engineering

1. Requirement
a. Stability
b. Completeness
c. Clarity
d. Validity
e. Feasibility
f. Precedent
g. Scale

1. Design
a. Functionality
b. Difficulty
c. Interfaces
d. Performance
e. Testability
f. Hardware
  Constraints
g. Non-Developmental Software

1. Code and Unit Test
a. Feasibility
b. Testing
c. Coding/Implementation

**1. Integration
  and Test**
a. Environment
b. Product
c. System

1. Engineering Specialties
a. Maintainability
b. Reliability
c. Safety
d. Security
e. Human Factors
f. Specifications

B. Development Environment

1. Development Process
a. Formality
b. Suitability
c. Process Control
d. Familiarity
e. Product Control

1. Development System
a. Capacity
b. Suitability
c. Usability
d. Familiarity
e. Reliability
f. System Support
g. Deliverability

1. Management Process
a. Planning
b. Project Organization
c. Management Experience
d. Program Interfaces

1. Management Methods
a. Monitoring
b. Personnel Management
c. Quality Assurance
d. Configuration Management

1. Work Environment
e. Quality Attitude
f. Cooperation
g. Communication
h. Morale

C. Program Constraints

1. Resources
a. Schedule
b. Staff
c. Budget
d. Facilities

1. Contract
a. Type of Contract
b. Restrictions
c. Dependencies

1. Program Interfaces
a. Customer
b. Associate Contractors
c. Subcontractors
d. Prime Contractor
e. Corporate Management
f. Vendors
g. Politics

Group Session Analysis Directions and Closing Script

Evaluation Forms

- Here is an evaluation form listing all the risk statements you listed during this session.

- The purpose of this analysis is to ask each of you to evaluate the risk statements with respect to two attributes; impact and probability, and then to select the top five most important risks to the program.

- The SRE team is also going to be evaluating the risk statements for impact and probability, and will come up with their own top five risks based on this scoring.

Evaluating the Attributes

- I'm giving you one additional handout to help you in this process. The top half of it is the risk scoring matrix which shows how the scores for impact and probability translate into risk exposure. The bottom half of the handout is the levels of risk impact table, to help us all calibrate what we mean by our impact scores.

- To use the levels of risk impact table, think about the condition that is given in the risk statement and all the consequences that may flow from it; don't limit yourself to just the consequences given in the statement.

- Considering all that could happen as a result of the condition, decide whether you think it is predominantly a risk to *performance*, *support* (supportability or long-term maintainability of the product), *cost*, or *schedule*. Once you decide on the impact areas, review the column from that area in the levels of risk impact table. Then, determine whether you think the risk is catastrophic, critical, marginal, or negligible, based on the criteria given. Notice that negligible doesn't mean "zero impact to the program"—it means that it can be handled by built-in margins in the project plan. Too many negligible risks that all come true together can have serious consequences for the program.

- When you have decided on the level of impact, enter its corresponding value (1 to 4) in the Impact column of your risk evaluation form.

- For probability, think in terms of the impact you just decided on.

  - If you think the probability is "somewhere around 50/50," it should be considered "probable," and you should mark a value of "2" in the probability column of your risk evaluation form.

- If you think it's a lot more probable than that, it would be "very likely," and the value to enter is "3."

- If you think it's a lot less probable than 50/50, enter "1" for "improbable."

- Repeat the process for each risk statement.

Choosing the Top Five Risks to the Program

- After evaluating the attributes for each risk statement, select the risk statements which you think point to the greatest threat to the success of the program. Label your top risk statement 1, your next top risk statement 2, and so on.

- It is important to think about how **the risk will affect the program**, rather than just how it will affect you.

- Please hand in the evaluation form when you are finished.

- Are there any questions about how to evaluate the risks?

Closing the Group Session

- Thank you for participating.

- Again, remember that this SRE team and your project have agreed that these sessions will remain confidential. We will keep the conversation inside this room and not attribute any remark to any individual or to this group. We ask that you do the same.

- Finally, don't forget to attend the data confirmation briefing on _____ (day) at _____ (time) in _____ (room).

Risk Evaluation Form

		Team Member's Name ➜			
Risk ID	**Risk Statement**		**Impact**	**Probability**	**Top 5**

Sample Session Recorder Notes

Notes

Q23—Performance analysis: Some "back of the

envelope" calculations on problem areas. We

may not have targeted all areas. Consequences:

We don't know what they'll be; hard to

predict where there will be problems (e.g.,

bottlenecks). There could be a number of

consequences. I don't want to put just one—

people might think that's all there is. It's a bit

premature to nail down one consequence.

(Note: Risk Condition only.) (R13)

Note: This is an example of context captured by the session recorder—an interview participant's comments after being asked question 23 in the TBQ. At the end of—or in the midst of—the discussion, the risk recorder wrote R13 on the flipchart, indicating risk statement 13. The participant who identified the issue agreed that risk statement 13 was an accurate portrayal of his concern.

Blank session recorder notes pages are provided at the end of this TMNB beginning on page 145.

Risk Scoring Matrix

Impact ↓ / Probability →	3 — Very Likely	2 — Probable	1 — Improbable
4—Catastrophic	**6** High	**5** High	**4** Medium
3—Critical	**5** High	**4** Medium	**3** Medium
2—Marginal	**4** Medium	**3** Medium	**2** Low
1—Negligible	**3** Medium	**2** Low	**1** Low

Levels of Risk Impact

Component → / Category ↓	*Performance*	*Support*	*Cost*	*Schedule*
Catastrophic	nonachievement of technical performance	unsupportable software	major budget overrun (>50%)	unachievable IOC
Critical	significant degradation of technical performance	major delays in software modifications	serious budget overrun (~30%)	serious delay in IOC (>30% late)
Marginal	some reduction in technical performance	minor delays in software modifications	budget overrun (~10%)	delay in IOC (>10% late)
Negligible	minimal to small reduction in technical performance, at detail level	irritating and awkward maintenance	consumption of some budget cushion	consumption of some slack—not on critical path

Session Analysis

Project Briefing*	0800-1100	0800-1100	0800-1200
0900-0945 Opening Briefing	Group Session	Group Session	
1000-1200 Team Preparation	#2	#4	Consolidation
	1100-1200 Session Analysis	**1100-1200 Session Analysis**	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600	1300-1600	1300-1700	1300-1530 Briefing Preparation
Group Session	Group Session		
#1	#3	Consolidation	1530-1630 Data Confirmation Briefing
1600-1700 Session Analysis	**1600-1700 Session Analysis**		

* The 1-hour project briefing can occur prior to the RI&A on-site visit   Team only

Description Team scoring and classification are two activities which begin before the end of the group session and may continue as needed during the hour after it.

These activities are described in the following two sections.

Team Scoring

Objectives   to begin the team's evaluation of the individual risk statements by assigning probability and significance attributes

Who's in the Room?   SRE team

Duration   during the participants' scoring portion of the group session and for no more than 10 minutes after the participants have left the room

Preparation   The following must be completed prior to doing any scoring:

- An interview section of the group session is completed.
- Risk statements and context are captured.
- SRE team members revisit the project-specific definitions of impact and probability. (This is done during the participant's scoring at the end of the group session.)

Approach   Team scoring is nearly identical to the process used for participants scoring, except that the team members *do not* select their top five risk statements. Team scoring is led by the team leader.

Process

- Distribute scoring (evaluation) sheets for the group session.
- Review the project-specific definitions of the four levels of risk impact (negligible, marginal, critical, and catastrophic) that were determined with the project manager's help during contracting.
- Review the definitions of the three levels of risk probability: improbable, probable, and very likely.
- Each team member fills out the evaluation form for the session, ignoring the column for the top five risks.
- After team members (including the team leader) have written their assessment of risk impact and probability for each risk statement, collect the scoring sheets for the team's data compiler (typically, the

person on the team most adept at building and manipulating spreadsheets). At a more convenient time, ***but by the end of the day***, the tool operator enters each team member's values into the team members' scoring summary. If this is postponed, the amount of data will prohibit catching up later. This can best be done by two people: one to read the values and one to enter them.

The data compiler converts the scores that team members assign to each risk statement into risk exposure levels (from 1 to 6) using the risk scoring matrix agreed upon by the project manager during contracting. Within the spreadsheet, these risk exposures are evaluated across the team for mean (X-bar) and standard deviation of the sample (S), and the risk statements are then arranged in descending order by S.

Results   The final output of team scoring is a completed team members' scoring summary worksheet.

Key Considerations   Scoring should be done with the idea that the values assigned will change. As each group session is completed, the team learns more about the risks facing the program. Some risks that seemed very important in the early sessions will shrink in significance. Others will become more pertinent as time progresses. Remember that you will revisit these scores and that almost certainly, they will change when more data becomes available.

Tools
- electronic spreadsheet application
- notebook computer (full-size keyboard and mouse recommended)

Forms to Be Used   risk evaluation forms

Classification

Objectives

to assign risk statements to elements of the SEI taxonomy

Who's in the Room?

SRE team

Duration

30-40 minutes following the team scoring activity for each group session

Preparation

Classification may be performed by using either the risk evaluation forms (around the conference table) or a wall chart and moving risk statement slips around. Such slips can usually be printed out in a suitable font size by the data compiler directly from the spreadsheet application being used to capture the risk statements

"Useful" Proximate Source

The condition of a risk statement has many sources. In principle, there is only one *most proximate* source. All other nearby sources are simply "proximate sources."
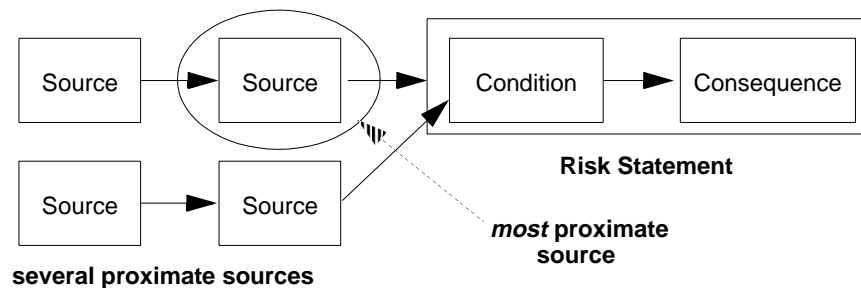
Figure 1:   The Most Proximate Source

The *most* proximate source that the person being interviewed perceives may not be useful for classification purposes.

A "useful" proximate source is one that

•   remains close enough to the original risk statement condition to be reasonably sure that if it had not happened, the condition would not exist

- is at a high enough level to suggest links to other risk statements
- can be acted on by the project manager

Project Manager's Control

Often, the useful proximate source of a condition in a risk statement is not in the project manager's control. This determination—whether the source *is* or *is not* within the project manager's sphere of control—starts the process of locating the risk statement in the taxonomy.

```
          ┌──────────────────────────┐
          │  Useful proximate source │
          │  of condition is determined. │
          └──────────────────────────┘
                       │
                       ▼
                  ╱──────────╲
                 ╱  Does the  ╲
                ╱ project manager ╲        Yes
                ╲  control this   ╱──────────────┐
                 ╲   source?    ╱                │
                  ╲──────────╱                   │
                       │                         │
                       │ No                      │
                       ▼                         ▼
            This is a Class C            This is a Class A
           ("Program Constraints")      ("Product Engineering")
              risk statement.         or Class B ("Development
                                      Process") risk statement.
```
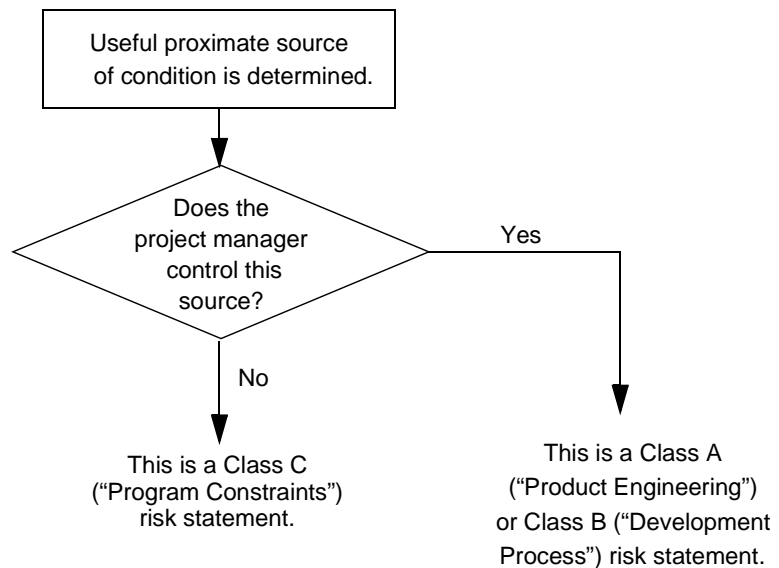
Figure 2:   Locating the Risk Statement in the Taxonomy

Once it has been determined that the source of the condition is in the project manager's control, we must determine whether the source arises from one of the following:

- the nature of the product itself (Class A)
- the way the project is going about its development (Class B)

Approach

Classification is led by the team leader. The process is as follows:

1. Prepare slips with each risk statement from the group session (an unscored risk evaluation form works fine). Each slip should contain

the risk statement and the risk ID (e.g., "G2.6" is the sixth statement captured in the second group session).

2. Put up the taxonomy element wall chart and review "judgement call" criteria:

   - "useful" proximate sources

   - project manager's control

3. Divide up risk statements among the team and have them place the statements under the elements on the wall chart that seem most appropriate, given the proximate source of the risk condition.

4. Ask the team to discuss the resulting classification and to then move risk statements around as seems appropriate (including risk statements from earlier sessions).

5. When all movement is completed, mark on each slip the letter/number of the taxonomy element that it ended up under (e.g., "A.5").

At a more convenient time, **but by the end of the day**, the tool operator enters the taxonomic classification of each risk statement into the team members' scoring summary. If this is postponed, the amount of data will prohibit catching up later. This can best be done by two people: one to read the values and one to enter them.

Results	The final output of classification is an agreed upon set of taxonomically classified risks statements for those risks captured in a group session.
Key Considerations	• Classification should be done with the idea that the values assigned may change. Remember that you will revisit these classifications and that they may change when more data becomes available.
	• It may be convenient to hang the taxonomy wall chart or slips of paper with the class and element labels up on a wall in the meeting room. However, that chart should be *covered* while group session participants are in the room.
	• It is very important that all risk statements generated during the day be classified and scored before the end of that same day. The extra effort to do so will pay dividends during the consolidation step.
Tools	• electronic spreadsheet application

- notebook computer (full-size keyboard and mouse recommended)
- slips of paper for each risk statement (cut up an unscored risk evaluation form from the session)

Forms to Be Used   taxonomy element wall chart described on page 64

Taxonomic Group Definitions

This section provides the definitions of the taxonomic groups in the class, element, and attribute categories of the software development risk taxonomy. An overview of the taxonomy groups and their hierarchical organization is provided in Figure 1.

The taxonomy might be used to classify many different factors associated with the development of software-dependent systems such as development tasks, quality procedures, or sources or consequences of risk. However, the definitions as presented here are designed to facilitate the classification of the risks themselves, as associated with the development process.

> NOTE: The material presented here is a reprint of Appendix B, Taxonomic Group Definitions, taken from the following technical report:
>
> Carr, Marvin; Konda, Suresh; Monarch, Ira; Ulrich, Carol; & Walker, Clay. *Taxonomy Based Risk Identification* (CMU/SEI-93-TR-006, ADA266992). Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 1993.

Taxonomy of Software Development Risks

A. Product Engineering

1. Requirement
a. Stability
b. Completeness
c. Clarity
d. Validity
e. Feasibility
f. Precedent
g. Scale

1. Design
a. Functionality
b. Difficulty
c. Interfaces
d. Performance
e. Testability
f. Hardware Constraints
g. Non-Developmental Software

1. Code and Unit Test
a. Feasibility
b. Testing
c. Coding/Implementation

1. Integration and Test
a. Environment
b. Product
c. System

1. Engineering Specialties
a. Maintainability
b. Reliability
c. Safety
d. Security
e. Human Factors
f. Specifications

B. Development Environment

1. Development Process
a. Formality
b. Suitability
c. Process Control
d. Familiarity
e. Product Control

1. Development System
a. Capacity
b. Suitability
c. Usability
d. Familiarity
e. Reliability
f. System Support
g. Deliverability

1. Management Process
a. Planning
b. Project Organization
c. Management Experience
d. Program Interfaces

1. Management Methods
a. Monitoring
b. Personnel Management
c. Quality Assurance
d. Configuration Management

1. Work Environment
e. Quality Attitude
f. Cooperation
g. Communication
h. Morale

C. Program Constraints

1. Resources
a. Schedule
b. Staff
c. Budget
d. Facilities

1. Contract
a. Type of Contract
b. Restrictions
c. Dependencies

1. Program Interfaces
a. Customer
b. Associate Contractors
c. Subcontractors
d. Prime Contractor
e. Corporate Management
f. Vendors
g. Politics

A Product Engineering

Product engineering refers to the system engineering and software engineering activities involved in creating a system that satisfies specified requirements and customer expectations. These activities include system and software requirements analysis and specification, software design and implementation, integration of hardware and software components, and software and system test.

The elements of this class cover traditional software engineering activities. They comprise those technical factors associated with the deliverable product itself, independent of the processes or tools used to produce it or the constraints imposed by finite resources or external factors beyond program control.

Product engineering risks generally result from requirements that are technically difficult or impossible to implement, often in combination with inability to negotiate relaxed requirements or revised budgets and schedules; from inadequate analysis of requirements or design specification; or from poor quality design or coding specifications.

A.1 Requirements

Attributes of the requirements element cover both the quality of the requirements specification and also the difficulty of implementing a system that satisfies the requirements.

The following attributes characterize the requirements element.

A.1-a. Stability

The stability attribute refers to the degree to which the requirements are changing and the possible effect changing requirements and external interfaces will have on the quality, functionality, schedule, design, integration, and testing of the product being built.

The attribute also includes issues that arise from the inability to control rapidly changing requirements. For example, impact analyses may be inaccurate because it is impossible to define the baseline against which the changes will be implemented.

A.1-b. **Completeness**

Missing or incompletely specified requirements may appear in many forms, such as a requirements document with many functions or parameters "to be defined"; requirements that are not specified adequately to develop acceptance criteria, or inadvertently omitted requirements. When missing information is not supplied in a timely manner, implementation may be based on contractor assumptions that differ from customer expectations.

When customer expectations are not documented in the specification, they are not budgeted into the cost and schedule.

A.1-c. **Clarity**

This attribute refers to ambiguously or imprecisely written individual requirements that are not resolved until late in the development phase. This lack of a mutual contractor and customer understanding may require re-work to meet the customer intent for a requirement.

A.1-d. **Validity**

This attribute refers to whether the aggregate requirements reflect customer intentions for the product. This may be affected by misunderstandings of the written requirements by the contractor or customer, unwritten customer expectations or requirements, or a specification in which the end user did not have inputs.

This attribute is affected by the completeness and clarity attributes of the requirements specifications, but refers to the larger question of the system as a whole meeting customer intent.

A.1-e. **Feasibility**

The feasibility attribute refers to the difficulty of implementing a single technical or operational requirement, or of simultaneously meeting conflicting requirements. Sometimes two requirements by themselves are feasible, but together are not; they cannot both exist in the same product at the same time.

Also included is the ability to determine an adequate qualification method for demonstration that the system satisfies the requirement.

A.1-f. **Precedent**

The precedent attribute concerns capabilities that have not been successfully implemented in any existing systems or are beyond the experience of program personnel or of the company. The degree of risk depends on allocation of additional schedule and budget to determine the feasibility of their implementation; contingency plans in case the requirements are not feasible as stated; and flexibility in the contract to allocate implementation budget and schedule based on the outcome of the feasibility study.

Even when unprecedented requirements are feasible, there may still be a risk of underestimating the difficulty of implementation and committing to an inadequate budget and schedule.

A.1-g. **Scale**

This attribute covers both technical and management challenges presented by large complex systems development.

Technical challenges include satisfaction of timing, scheduling and response requirements, communication among processors, complexity of system integration, analysis of inter-component dependencies, and impact due to changes in requirements.

Management of a large number of tasks and people introduces a complexity in such areas as project organization, delegation of responsibilities, communication among management and peers, and configuration management.

A.2 **Design**

The attributes of the design element cover the design and feasibility of algorithms, functions or performance requirements, and internal and external product interfaces. Difficulty in testing may begin here with failure to work to testable requirements or to include test features in the design. The following attributes characterize the design element.

A.2-a. **Functionality**

This attribute covers functional requirements that may not submit to a feasible design, or use of specified algorithms or designs without a high degree of certainty that they will satisfy their source requirements. Algorithm and design studies may not have used appropriate investigation techniques or may show marginal feasibility.

A.2-b. **Difficulty**

The difficulty attribute refers to functional or design requirements that may be extremely difficult to realize. Systems engineering may design a system architecture difficult to implement, or requirements analysis may have been based on optimistic design assumptions.

The difficulty attribute differs from design feasibility in that it does not proceed from pre-ordained algorithms or designs.

A.2-c. **Interfaces**

This attribute covers all hardware and software interfaces that are within the scope of the development program, including interfaces between configuration items, and the techniques for defining and managing the interfaces. Special note is taken of non-developmental software and developmental hardware interfaces.

A.2-d. **Performance**

The performance attribute refers to time-critical performance: user and real-time response requirements, throughput requirements, performance analyses, and performance modeling throughout the development cycle.

A.2-e. **Testability**

The testability attribute covers the amenability of the design to testing, design of features to facilitate testing, and the inclusion in the design process of people who will design and conduct product tests.

A.2-f. **Hardware Constraints**

This attribute covers target hardware with respect to system and processor architecture, and the dependence on hardware to meet system and software performance requirements. These constraints may include throughput or memory speeds, real-time response capability, database access or capacity limitations, insufficient reliability, unsuitability to system function, or insufficiency in the amount of specified hardware.

A.2-g. **Non-Developmental Software**

Since non-developmental software (NDS) is not designed to system requirements, but selected as a "best fit," it may not conform precisely to performance, operability, or supportability requirements.

The customer may not accept vendor or developer test and reliability data to demonstrate satisfaction of the requirements allocated to NDS. It may then be difficult to produce this data to satisfy acceptance criteria and within the estimated NDS test budget.

Requirements change may necessitate re-engineering or reliance on vendors for special purpose upgrades.

A.3 **Code and Unit Test**

Attributes of this element are associated with the quality and stability of software or interface specifications, and constraints that may present implementation or test difficulties.

A.3-a. **Feasibility**

The feasibility attribute of the code and unit test element addresses possible difficulties that may arise from poor design or design specification or from inherently difficult implementation needs.

For example, the design may not have quality attributes such as module cohesiveness or interface minimization; the size of the modules may contribute complexity; the design may not be specified in sufficient detail, requiring the programmer to make assumptions or design decisions during coding; or the design and interface specifications may be changing, perhaps without an approved detailed design baseline; and the use of developmental hardware may make an additional contribution to inadequate or unstable interface specification. Or, the nature of the system itself may aggravate the difficulty and complexity of the coding task.

A.3-b. **Unit Test**

Factors affecting unit test include planning and preparation and also the resources and time allocated for test.

Constituents of these factors are: entering unit test with quality code obtained from formal or informal code inspection or verification procedures; pre-planned test cases that have been verified to test unit requirements; a test bed consisting of the necessary hardware or emulators, and software or simulators; test data to satisfy the planned test; and sufficient schedule to plan and carry out the test plan.

A.3-c. **Coding/Implementation**

This attribute addresses the implications of implementation constraints. Some of these are: target hardware that is marginal or inadequate with regard to speed, architecture, memory size or external storage capacity; required implementation languages or methods; or differences between the development and target hardware.

A.4 **Integration and Test**

This element covers integration and test planning, execution, and facilities for both the contractual product and for the integration of the product into the system or site environment.

A.4-a. **Environment**

The integration and test environment includes the hardware and software support facilities and adequate test cases reflecting realistic operational scenarios and realistic test data and conditions.

This attribute addresses the adequacy of this environment to enable integration in a realistic environment or to fully test all functional and performance requirements.

A.4-b. **Product**

The product integration attribute refers to integration of the software components to each other and to the target hardware, and testing of the contractually deliverable product. Factors that may affect this are internal interface specifications for either hardware or software, testability of requirements, negotiation of customer agreement on test criteria, adequacy of test specifications, and sufficiency of time for integration and test.

A.4-c. **System**

The system integration attribute refers to integration of the contractual product to interfacing systems or sites. Factors associated with this attribute are external interface specifications, ability to faithfully produce system interface conditions prior to site or system integration, access to the system or site being interfaced to, adequacy of time for testing, and associate contractor relationships.

A.5 **Engineering Specialities**

The engineering specialty requirements are treated separately from the general requirements element primarily because they are often addressed

by specialists who may not be full time on the program. This taxonomic separation is a device to ensure that these specialists are called in to analyze the risks associated with their areas of expertise.

A.5-a. **Maintainability**

Maintainability may be impaired by poor software architecture, design, code, or documentation resulting from undefined or un-enforced standards, or from neglecting to analyze the system from a maintenance point of view.

A.5-b. **Reliability**

System reliability or availability requirements may be affected by hardware not meeting its reliability specifications or system complexity that aggravates difficulties in meeting recovery timelines. Reliability or availability requirements allocated to software may be stated in absolute terms, rather than as separable from hardware and independently testable.

A.5-c. **Safety**

This attribute addresses the difficulty of implementing allocated safety requirements and also the potential difficulty of demonstrating satisfaction of requirements by faithful simulation of the unsafe conditions and corrective actions. Full demonstration may not be possible until the system is installed and operational.

A.5-d. **Security**

This attribute addresses lack of experience in implementing the required level of system security that may result in underestimation of the effort required for rigorous verification methods, certification and accreditation, and secure or trusted development process logistics; developing to unprecedented requirements; and dependencies on delivery of certified hardware or software.

A.5-e. **Human Factors**

Meeting human factors requirements is dependent on understanding the operational environment of the installed system and agreement with vari-

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ous customer and user factions on a mutual understanding of the expectations embodied in the human factors requirements. It is difficult to convey this understanding in a written specification. Mutual agreement on the human interface may require continuous prototyping and demonstration to various customer factions.

A.5-f. **Specifications**

This attribute addresses specifications for the system, hardware, software, interface, or test requirements or design at any level with respect to feasibility of implementation and the quality attributes of stability, completeness, clarity, and verifiability.

B. Development Environment

The development environment class addresses the project environment and the process used to engineer a software product. This environment includes the development process and system, management methods, and work environment. These environmental elements are characterized below by their component attributes.

B.1 Development Process

The development process element refers to the process by which the contractor proposes to satisfy the customer's requirements. The process is the sequence of steps—the inputs, outputs, actions, validation criteria, and monitoring activities—leading from the initial requirement specification to the final delivered product. The development process includes such phases as requirements analysis, product definition, product creation, testing, and delivery. It includes both general management processes such as costing, schedule tracking, and personnel assignment, and also project-specific processes such as feasibility studies, design reviews, and regression testing.

This element groups risks that result from a development process that is inadequately planned, defined and documented; that is not suited to the activities necessary to accomplish the project goals; and that is poorly communicated to the staff and lacks enforced usage.

B.1-a. Formality

Formality of the development process is a function of the degree to which a consistent process is defined, documented, and communicated for all aspects and phases of the development.

B.1-b. Suitability

Suitability refers to the adequacy with which the selected development model, process, methods, and tools support the scope and type of activities required for the specific program.

B.1-c. **Process Control**

Process control refers not only to ensuring usage of the defined process by program personnel, but also to the measurement and improvement of the process based on observation with respect to quality and productivity goals. Control may be complicated due to distributed development sites.

B.1-d. **Familiarity**

Familiarity with the development process covers knowledge of, experience in, and comfort with the prescribed process.

B.1-e. **Product Control**

Product control is dependent on traceability of requirements from the source specification through implementation such that the product test will demonstrate the source requirements. The change control process makes use of the traceability mechanism in impact analyses and reflects all resultant document modifications including interface and test documentation.

B.2 **Development System**

The development system element addresses the hardware and software tools and supporting equipment used in product development. This includes computer aided software engineering tools, simulators, compilers, test equipment, and host computer systems.

B.2-a. **Capacity**

Risks associated with the capacity of the development system may result from too few workstations, insufficient processing power or database storage, or other inadequacies in equipment to support parallel activities for development, test, and support activities.

B.2-b. **Suitability**

Suitability of the development system is associated with the degree to which it is supportive of the specific development models, processes,

methods, procedures, and activities required and selected for the program. This includes the development, management, documentation, and configuration management processes.

B.2-c. **Usability**

Usability refers to development system documentation, accessibility and workspace, as well as ease of use.

B.2-d. **Familiarity**

Development system familiarity depends on prior use of the system by the company and by project personnel as well as adequate training for new users.

B.2-e. **Reliability**

Development system reliability is a measure of whether the needed components of the development system are available and working properly whenever required by any program personnel.

B.2-f. **System Support**

Development system support involves training in use of the system, access to expert users or consultants, and repair or resolution of problems by vendors.

B.2-g. **Deliverability**

Some contracts require delivery of the development system. Risks may result from neglecting to bid and allocate resources to ensure that the development system meets all deliverable requirements.

B.3 **Management Process**

The management process element pertains to risks associated with planning, monitoring, and controlling budget and schedule; with controlling factors involved in defining, implementing, and testing the product; with

managing project personnel; and with handling external organizations including the customer, senior management, matrix management, and other contractors.

B.3-a. **Planning**

The planning attribute addresses risks associated with developing a well-defined plan that is responsive to contingencies as well as long-range goals and that was formulated with the input and acquiescence of those affected by it. Also addressed are managing according to the plan and formally modifying the plan when changes are necessary.

B.3-b. **Project Organization**

This attribute addresses the effectiveness of the program organization, the effective definition of roles and responsibilities, and the assurance that these roles and lines of authority are understood by program personnel.

B.3-c. **Management Experience**

This attribute refers to the experience of all levels of managers with respect to management, software development management, the application domain, the scale and complexity of the system and program, the selected development process, and hands-on development of software.

B.3-d. **Program Interfaces**

This attribute refers to the interactions of managers at all levels with program personnel at all levels, and with external personnel such as the customer, senior management, and peer managers.

B.4 **Management Methods**

This element refers to methods for managing both the development of the product and program personnel. These include quality assurance, configuration management, staff development with respect to program needs, and maintaining communication about program status and needs.

B.4-a. **Monitoring**

The monitoring includes the activities of obtaining and acting upon status reports, allocating status information to the appropriate program organizations, and maintaining and using progress metrics.

B.4-b. **Personnel Management**

Personnel management refers to selection and training of program members and ensuring that they: take part in planning and customer interaction for their areas of responsibility; work according to plan; and receive the help they need or ask for to carry out their responsibilities.

B.4-c. **Quality Assurance**

The quality assurance attribute refers to the procedures instituted for ensuring both that contractual processes and standards are implemented properly for all program activities, and that the quality assurance function is adequately staffed to perform its duties.

B.4-d. **Configuration Management**

The configuration management (CM) attribute addresses both staffing and tools for the CM function as well as the complexity of the required CM process with respect to such factors as multiple development and installation sites and product coordination with existing, possibly changing, systems.

B.5 **Work Environment**

The work environment element refers to subjective aspects of the environment such as the amount of care given to ensuring that people are kept informed of program goals and information, the way people work together, responsiveness to staff inputs, and the attitude and morale of the program personnel.

B.5-a. **Quality Attitude**

This attribute refers to the tendency of program personnel to do quality work in general and to conform to specific quality standards for the program and product.

B.5-b. **Cooperation**

The cooperation attribute addresses lack of team spirit among development staff both within and across work groups and the failure of all management levels to demonstrate that best efforts are being made to remove barriers to efficient accomplishment of work.

B.5-c. **Communication**

Risks that result from poor communication are due to lack of knowledge of the system mission, requirements, and design goals and methods, or to lack of information about the importance of program goals to the company or the project.

B.5-d. **Morale**

Risks that result from low morale range across low levels of enthusiasm and thus low performance, productivity or creativity; anger that may result in intentional damage to the project or the product; mass exodus of staff from the project; and a reputation within the company that makes it difficult to recruit.

C. Program Constraints

Program constraints refer to the "externals" of the project. These are factors that may be outside the control of the project but can still have major effects on its success or constitute sources of substantial risk.

C.1 Resources

This element addresses resources for which the program is dependent on factors outside program control to obtain and maintain. These include schedule, staff, budget, and facilities.

C.1-a. Schedule

This attribute refers to the stability of the schedule with respect to internal and external events or dependencies and the viability of estimates and planning for all phases and aspects of the program.

C.1-b. Staff

This attribute refers to the stability and adequacy of the staff in terms of numbers and skill levels, their experience and skills in the required technical areas and application domain, and their availability when needed.

C.1-c. Budget

This attribute refers to the stability of the budget with respect to internal and external events or dependencies and the viability of estimates and planning for all phases and aspects of the program.

C.1-d. Facilities

This attribute refers to the adequacy of the program facilities for development, integration, and testing of the product.

C.2 **Contract**

Risks associated with the program contract are classified according to contract type, restrictions, and dependencies.

C.2-a. **Type of Contract**

This attribute covers the payment terms (cost plus award fee, cost plus fixed fee, etc.) and the contractual requirements associated with such items as the Statement of Work, Contract Data Requirements List, and the amount and conditions of customer involvement.

C.2-b. **Restrictions**

Contract restrictions and restraints refer to contractual directives to, for example, use specific development methods or equipment and the result-ant complications such as acquisition of data rights for use of non-devel-opmental software.

C.2-c. **Dependencies**

This attribute refers to the possible contractual dependencies on outside contractors or vendors, customer-furnished equipment or software, or other outside products and services.

C.3 **Program Interfaces**

This element consists of the various interfaces with entities and organiza-tions outside the development program itself.

C.3-a. **Customer**

The customer attribute refers to the customer's level of skill and experi-ence in the technical or application domain of the program as well as dif-ficult working relationships or poor mechanisms for attaining customer agreement and approvals, not having access to certain customer factions, or not being able to communicate with the customer in a forthright man-ner.

C.3-b. **Associate Contractors**

The presence of associate contractors may introduce risks due to conflicting political agendas, problems of interfaces to systems being developed by outside organizations, or lack of cooperation in coordinating schedules and configuration changes.

C.3-c. **Subcontractors**

The presence of subcontractors may introduce risks due to inadequate task definitions and subcontractor management mechanisms, or to not transferring subcontractor technology and knowledge to the program or corporation.

C.3-d. **Prime Contractor**

When the program is a subcontract, risks may arise from poorly defined task definitions, complex reporting arrangements, or dependencies on technical or programmatic information.

C.3-e. **Corporate Management**

Risks in the corporate management area include poor communication and direction from senior management as well as non-optimum levels of support.

C.3-f. **Vendors**

Vendor risks may present themselves in the forms of dependencies on deliveries and support for critical system components.

C.3-g. **Politics**

Political risks may accrue from relationships with the company, customer, associate contractors or subcontractors, and may affect technical decisions.

Consolidation

Project Briefing*	0800-1100 Group Session #2	0800-1100 Group Session #4	**0800-1200** **Consolidation**
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	**1300-1700** **Consolidation**	1300-1530 Briefing Preparation
1600-1700 Session Analysis	1600-1700 Session Analysis		1530-1630 Data Confirmation Briefing
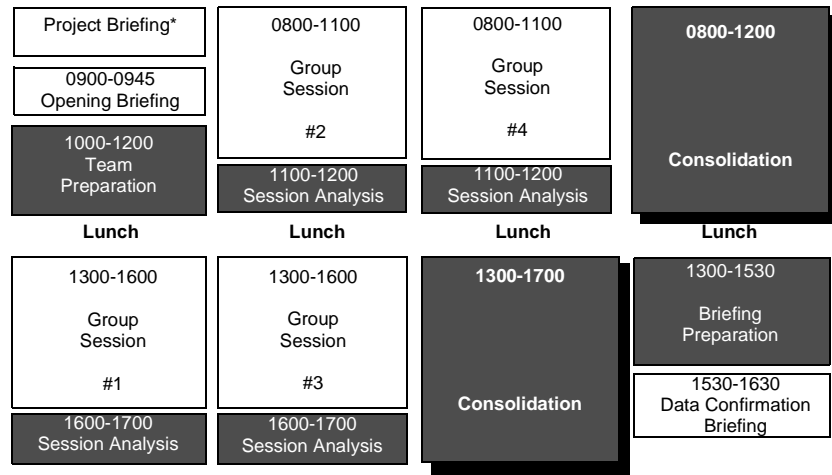
* The 1-hour project briefing can occur prior to the RI&A on-site visit   ▇ Team only

Objectives

- to bring together and interpret the information generated during the group sessions and the team scoring and classification sessions

- to prepare the SRE team to produce the data confirmation briefing slides

Who's in the Room?

The entire SRE team is involved in consolidation. Some tasks may be assigned to subgroups within the team; every SRE team member does not need to be part of every step.

Tasks During Consolidation

The diagram on the next page shows the tasks to be completed during consolidation. These tasks include:

- reconcile scoring
- rearrange risk statements into risk areas
- determine participants' top risks
- select key risk context
- aggregate data

Each task is described in the sections that follow.

The Overall Consolidation Process

All Risk Statements

All Risk Contexts

Participants' Top 5 Risk Results

Classify by Risk Taxonomy

Rearrange in Risk Areas

Select top 25-35% by Strata

Select Key Risk Context (quotes)

G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb
G1.1	Condition; consequence	2	3	1	3	2	3	kdnb

Team Members' Reconciled Scoring

Number of Risk Statements

Customer Intfce
Dev'm't Process
Senior Mgt
Sys Performance
Suppliers
CM
Mgt Methods
Field Test Issues

Risk Areas Column Chart

Reconcile Scoring

Objective
- to generate the team's consensus on the most important risks to the project
- to create a complete ranking of all risks

Who's in the Room?
The entire SRE team must be involved in the reconciliation of scores.

Duration
one hour following the completion of the last group session and team scoring and classification steps

Preparation
The following must be completed prior to doing reconciliation:

- All risks have been scored by team members.
- Within the spreadsheet, these risk exposures have been evaluated across the team for **mean** (X-bar) and **standard** deviation of the sample (S), and the risk statements have been arranged in descending order by S. This produces the team members' scoring summary form.
- Context notes from each of the group sessions have been photocopied (or printed), distributed to each team member, and read.

Approach
Scoring reconciliation is conducted by the team leader using the following process:

1. The data compiler prints and distributes the team members' scoring summary to all team members.

2. Beginning from the top of the list—with the risk statement for which the risk exposure values given by team members were in the greatest disagreement—count down the list and draw a line which demarcates the top 25-35% of the risks. This will be the goal end point for the process.

3. Begin the discussion with the risk statement at the top of the list. Have the person giving the highest risk exposure value and the one giving the lowest value explain their rationales to the others.

4. Allow the discussion to proceed as other team members become involved. When the discussion appears to be approaching either consensus or intractable differences, end the discussion and poll each member to either provide a revised risk exposure value or state that they are "standing pat." Note: these new risk exposure values can be determined directly, without revising the original impact and probability values.

5. Allow no more than one hour for this process, terminating when either the time period has expired or the 25-35% line has been reached.

The data compiler can use the process below to determine the final scores and the list of the team's "most important risks" without input from the rest of the SRE team.

1. After entering all the revised risk exposure values, the data compiler re-sorts the list of risk statements in descending order by the mean of the team's risk exposure values.

2. The data compiler scans the list again from the top to find a point in the range of the top 25-35% risk statements at which a clear breaking point in the means occurs. The risk statements above this breaking point are declared the SRE team's most important risk statements.

3. Each score on the list is then rounded to the nearest whole number from 1 to 6. This is the final risk exposure value to be given to the project manager. Note: This is to preserve the sense that the risk exposure values are ordinal numbers, not points on a continuous, linear scale.

Results   The output of scoring analysis and reconciliation is the team's reconciled scoring - the ranked list of risks faced by the project.

Key Considerations
- This process must be done as quickly as possible; keep arguments concise and impersonal.
- Maintain focus on the risk statements.

- Use context to stimulate discussions.

- Keep in mind the project-specific definitions for risk impact and the definitions of probability.

Tools   laptop computer with electronic spreadsheet application

Forms to Be Used   The team members' scoring worksheet and the team's reconciled scoring form are used. Samples of these forms are provided on the following pages.

Team Members' Scoring Worksheet

Risk No		Risk Statement	sgb				gjp				wrw				rew				Risk Exp			
			1	P	RE	Rev RE	I	P	RE	Rev RE	1	P	RE	Rev RE	1	P	RE	Rev RE	Mx	Mn	S	Mean
G3.11	6	There are rumors that the telephone company is unhappy with the Screen Display design and see it as representative of S31 work. They may cancel the project.	1	1	1		1	1	1		4	2	5		4	1	4		5	1	2.06	2.75
G2.11	20	Concerned about configuration management between development and field test sites; lack of CM may cause version mismatches, lost time, and rework.	3	2	4		4	3	6		3	2	4		1	1	1		6	1	2.06	3.75
G3.06	18	VP introducing new system requirements without budget or schedule relief; this is muddying the protect's lines of authority.	2	1	2		4	3	6		1	3	3		1	2	2		6	2	1.89	3.25
G4.11	46	Toivolia accounting department wanted to do this job, and they are still trying to prove they could do it better; delay in approval cycles, have to constantly prove S31's solution is "best."	1	1	1		4	2	5		2	3	4		2	3	4		5	1	1.73	3.5
G3.17	16	There is a perception that upper management arbitrarily revised the project cost estimate downward to win the contract; people may give up trying to meet deadlines and performance bogeys.	1	1	1		3	2	4		3	1	3		3	3	5		5	1	1.71	3.25
G3.04	64	There are no procedures or processes in place to enforce CM; delays, time spent testing the wrong system.	4	2	5		2	2	3		3	3	5		2	1	2		5	2	1.5	3.75
G1.16	58	the past history of this company is that code and design are poorly documented; there may be difficulty in maintaining what is supposed to be a "flagship" product.	2	1	2		2	3	4		3	3	5		1	2	2		5	2	1.5	3.25
G3.14	36	The three-letter algorithm may result in so many pages of possibles (e.g., for "SMI") that operators may get frustrated and refuse to use the system.	2	1	2		1	2	2		3	2	4		3	3	5		5	2	1.5	3.25
G1.08	41	Acceptance configuration of the system does not replicate the actual operational system configuration; unpredictable consequences and rework in the field.	3	3	5		2	2	3		4	3	6		4	3	6		6	3	1.41	5
G3.05	14	The VP is undercutting the project manager and introducing new requirements; these may remain hidden, and no test cases will be developed for them.	4	2	5		4	3	6		2	3	4		2	2	3		6	3	1.29	4.5
G1.01	57	Requirements are changing because of outside influences (vice president); this will affect quality of the code, integration, morale, and schedule.	3	3	5		4	3	6		2	2	3		2	3	4		6	3	1.29	4.5
G4.09	52	The C++ compiler may not perform adequately; might have to be replaced, for which there is no budget, and schedule impact due to new learning curve.	3	2	4		2	1	2		3	3	5		3	1	3		5	2	1.29	3.5
G2.10	62	Conditions during field startup (testing at night) may mean that our best integrators & testers will not be willing to go; troubleshooting may require excessive time.	3	2	4		3	3	5		2	2	3		2	1	2		5	2	1.29	3.5
G3.10	13	There are rumors that low performers in the project may get fired to serve as a lesson to the rest, so many people are job hunting; we may not have everyone we need to meet our deadlines.	3	2	4		1	1	1		2	2	3		2	1	2		4	1	1.29	2.5
G4.04	40	Upper management has not approved C++ training for project staff—the needed training may have to come from project budget; profit will be in jeopardy.	1	2	2		3	3	5		2	3	4		1	3	3		5	2	1.29	3.5

Team's Reconciled Scoring

Risk No		Risk Statement	sgb				gjp				wrw				rew				Revised Risk Exp.				Final RE	Team Top Risk?
			1	P	RE	Rev RE	I	P	RE	Rev RE	1	P	RE	Rev RE	1	P	RE	Rev RE	Mx	Mn	S	Mean		
G1.08	41	Acceptance configuration of the system does not replicate the actual operational system configuration; unpredictable consequences and rework in the field.	3	3	5	5	2	2	3	5	4	3	6	6	4	3	6	6	6	5	0.577	5.5	6	Yes
G2.09	45	The C++ compiler has bugs; added time to develop workarounds, aggravates lack of C++ experience of developers, may have to replace compiler, for which there is no budget.	4	3	6	6	3	3	5	5	4	2	5	6	3	3	5	5	6	5	0.5	5.25	5	Yes
G1.09	33	We've never tried to make 10 computers work together like this; we don't know what we don't know; could delay final system acceptance.	4	3	6	6	4	2	5	5	3	2	4	4	4	3	6	6	6	4	0.957	5.25	5	Yes
G1.06	43	Have to support 50 terminals on each computer with 3-second response time, but have only tested with 25; might have to buy more computers, network overhead, electronic switch might be affected.	2	2	3	5	3	3	5	5	3	3	5	5	4	3	6	6	6	5	0.5	5.25	5	Yes
G1.13	44	No performance analysis has been done for the system; we don't know what we don't know.	4	2	5	5	4	3	6	6	4	2	5	5	3	3	5	5	6	5	0.5	5.25	5	Yes
G1.07	27	Our programmers are FORTRAN programmers; it's going to be a tough learning curve to move to C++, may cause delays, rework, hard-to-find bugs.	3	3	5	5	3	3	5	5	3	3	5	5	3	3	5	5	5	5	0	5	5	Yes
G3.02	39	Developers are working from their own interpretation of requirements documents, not using the developed test scenarios; the system may not be properly tested and may fail final acceptance—alternatively, lots of rework.	3	3	5	5	3	3	5	5	4	2	5	5	3	2	4	4	5	4	0.5	4.75	5	Yes
G3.05	14	The VP is undercutting the project manager and introducing new requirements; these may remain hidden, and no test cases will be developed for them.	4	2	5	5	4	3	6	6	2	3	4	4	2	2	3	4	6	4	0.957	4.75	5	Yes
G1.01	56	Requirements are changing because of outside influences (vice president); this will affect quality of the code, integration, morale, and schedule	3	3	5	5	4	3	6	6	2	2	3	4	2	3	4	4	6	4	0.957	4.75	5	Yes
G2.13	19	Conflicts with the customer are not being resolved in a timely manner; a lot of unplanned time spent educating the customer, drag on the schedule.	3	2	4	4	4	3	6	6	2	3	4	4	3	2	4	4	6	4	1	4.5	5	Yes
G1.03	28	No impact analysis of changed requirements is being done; may wind up with conflicting features, goals, and requirements.	2	3	4	4	4	3	6	6	3	2	4	4	2	3	4	4	6	4	1	4.5	5	Yes
G3.15	57	The effect of loading on the network was considered to be "negligible" — no tests were done. One computer may handle 50 operators OK, but 10 computers may not be able to handle 500 operators.	3	2	4	4	3	2	4	4	4	2	5	5	3	3	5	5	5	4	0.577	4.5	5	Yes
G2.06	50	There is no formal change control process that coordinates all affected groups; test plans are not keeping up with changes.	2	3	4	4	3	2	4	4	3	3	5	5	2	3	4	4	5	4	0.5	4.25	4	Yes
G2.05	42	Requirements seem to be changing; can't be sure that the test cases cover all requirements.	2	2	3	3	3	3	5	5	2	3	4	4	3	3	5	5	5	3	0.957	4.25	4	Yes

Rearrange Risk Statements into Risk Areas

Objectives to arrange the risk statements into risk areas - groups of risks that can be mitigated together

Who's in the Room? SRE team

Duration one hour following the completion of the classification step

Preparation The classification step must be completed prior to rearranging risk statements.

Approach The team leader leads the following process.

1. Beginning with the risk statement slips in their taxonomic arrangement from the previous step, remove the labels and consider the risk statements for groups that could be mitigated with the same general approach.

2. Ask each team member to begin silently moving risk statements around into new clusters.

3. When movement has slowed, ask team members to provide labels of one to three words for each cluster and then discuss each label. The labels should be written on slips of paper and placed above the clusters.

4. Continue moving, clustering, and labeling until the clusters have been reduced to a reasonable number (seven to eleven). These are the risk areas.

5. In the rare instance where a risk statement falls under two different risk areas and the group cannot decide where to put it, the risk statement can be duplicated and a copy placed under each label. ***Avoid this wherever possible***—having duplicate risk statements will complicate consolidation and the construction of the Data Confirmation Briefing. If more than two risk statements are duplicated, reassess the risk area structure to make the duplication unnecessary.

6. Gather the risk statements up in their clusters, with the labels on top of each cluster, and give them to the team's data compiler to record both the taxonomy element and the risk area name beside each risk statement.

7. The data compiler reports the final count of risk statements in each risk area and prepares to generate the risk areas column chart as shown on page 102.

Results   The outputs are risk areas (clusters of risk statements that can be mitigated as a group).

Key Considerations
- Keep asking yourself, "What makes all of these risk statements that can be mitigated together?"

- It's okay to have a risk area with only one statement in it, but be prepared with solid logic about why this was necessary.

- Creating more than eleven risk areas should be avoided above all else, and having 5 to 9 risk areas is highly desirable. (This is because larger numbers of risk areas become difficult for anyone to comprehend—to remember, focus on, or prioritize. Also, the number of relationship analyses that need to be made between risk areas during the Interrelationship Digraph process increases dramatically as you go up in risk areas (e.g., 36 analyses for 9 risk areas, 45 analyses for 10 risk areas, 55 analyses for 11 risk areas 66 analyses for 12 risk areas), so more risk areas create more unnecessary work for the team.)

Logistics
- You'll need a large work space that the whole team can see at the same time. A big, open wall or whiteboard that the risk statements can be taped to has worked best in the past.

- Printing the risk statements in a large font will help everyone to read them at a distance.

Forms to Be Used   None.

Determine Participants' Top Risks

Objectives   to generate the participants' view of the most important risks to the project

Who's in the Room?   SRE Team. This step may be done by a subgroup of the team—it is a purely mechanical process that does not require decision making or consensus.

Duration   30 minutes after the rearrangement of risk statements into risk areas

Preparation   No preparation is required for this step; it may be done any time after the group sessions are completed.

Approach   This process is shown graphically below:

Group Session
Individual "Top 5" Lists

Top 5	Top 5
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Top 5	Top 5
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Stratify Top 5 Risk Statements

"Top 5" Summary
1.
2.
3.
4.
5.
•
•
N.
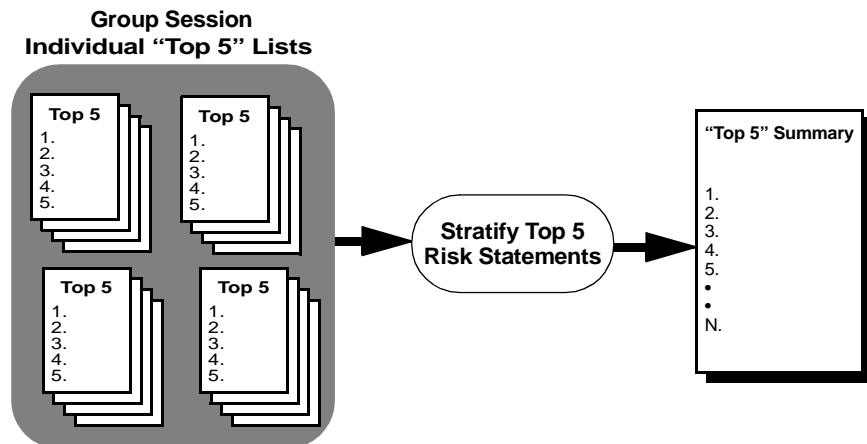
1.   Determine how many risk statements constitute 25% of the total number of risk statements identified.

2. Select the risk statements from the individual "Top Five" lists in rounds, beginning with each participant's top risk, and proceeding to each participant's second risk, and so on, *in full rounds*, until either the 25% figure has been passed, or all the participants' selections have be exhausted

If an individual's choice is already on the list (selected earlier by another), nothing changes. Move on to the next individual.

Note: The absolute number of risks selected using this method cannot be determined in advance. It depends on the number of participants in the interviews and the extent to which they agree with one another as to which risk statements represent the "most important risks to the program."

3. Give the results to the team's data compiler, who then maps the risk statements into the risk areas and summarizes how many are in each area.

Results   The output of this activity is a list of the most important risks to the project as viewed by the participants.

Points to Remember
- This is a mechanical process and can be done at any time prior to consolidation.
- It only provides insight into the risk statements the interviewees perceived as "most important" within the group session. It includes no perspective on risk statements from other group sessions.

Logistics   There are no special requirements. The process can be done on a laptop, flipchart, or a piece of paper.

Forms to Be Used   The completed group session evaluation forms are used as input; no special form is used for output.

Select Key Risk Context

Objectives

to preserve the immediacy and personal perspective of the interview when reporting on risk issues

Who's in the Room?

SRE team

Duration

30 minutes following the rearrangement of risk statements into risk areas.

Preparation

The following must be completed prior to selecting risk context:

- classification
- rearrangement of risk statements into risk areas.

Approach

For each identified risk area, one or two team members review the risk statements and their associated context for particularly vibrant metaphors and descriptions of the concern or issue said by participants during the interview. Examples include

- "project death spiral"
- "We're playing liar's poker here."
- "I'm afraid we may break through the ice out at Toivolia in the middle of acceptance testing."
- "The computer's thrashing itself to death."
- "They keep talking as if the system should work like Lotus 1-2-3, or like a video game."

When the key pieces of context that support a risk area have been highlighted, they are given to the team for use during the preparation of slides for the data confirmation briefing.

Caution: Avoid expressions that seem to be unique to an individual (to avoid implicit attribution). Look for phrases heard often during the interviews, or particularly picturesque language that is widely used in the industry.

Results The outputs are key context phrases that can be used in the preparation of the data confirmation briefing slides.

Key Considerations Be careful to preserve confidentiality. Make sure that the colorful context you pick is not a "stock phrase" already well associated with that individual.

Logistics This process only requires a private work area, a table to work around, and copies of the session records from all group sessions.

Forms to Be Used No special forms are required.

Aggregate Data

Objectives to complete the final consolidation activity - aggregate the relevant data in the form of a column chart

Who's in the Room? SRE team

Duration 30 minutes following the rearrangement of risk statements into risk areas.

Preparation All prior consolidation steps must be completed prior to doing any aggregation of data.

Approach A straight-forward column chart is constructed to compare the total number of risk statements in each risk area with the following:

- the number of those statements judged by the team to be among the top 25-35% in terms of risk exposure
- the number of those risks viewed by the participants themselves as among the most important risks to the program

An example of such a chart is shown below:

Risk Areas Column Chart
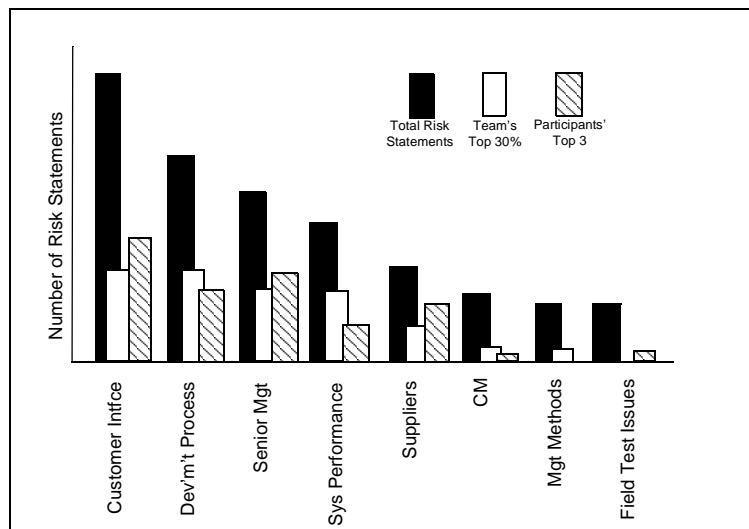
Results　　The output is a column chart that can be used in the preparation of the data confirmation briefing slides.

Key Considerations

- This column chart has long been the centerpiece of the SRE Data Confirmation Briefing. Make sure that each SRE team member understands what the chart says and what it *does not* say.

- The most important message of the chart is the number of risk areas that the SRE team found.

- The second most important message is how many risk statements were grouped into each risk area.

- The third most important message is how many of those risk statements in each risk area were considered to represent potentially serious risks to the project. For this there are two perspectives: the SRE team's and the interview participants'.

- Although this graphic can be set up in an electronic spreadsheet template in advance, it is good risk management to have a team member on hand who knows how to create such a graphic in an electronic spreadsheet program from scratch.

Logistics　　This task can be done by one person using an electronic spreadsheet with graphical output. It requires only simple data manipulation. The most difficult task may be the mechanics of importing the graphic from the spreadsheet into the presentation slide.

Forms to Be Used　　No special form is required. An electronic spreadsheet template for this graphic can easily be created in advance, using dummy information.

Data Confirmation Briefing Preparation

Project Briefing*	0800-1100	0800-1100	0800-1200
0900-0945 Opening Briefing	Group Session	Group Session	
1000-1200 Team Preparation	#2	#4	Consolidation
	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	1300-1700 Consolidation	**1300-1530 Briefing Preparation**
1600-1700 Session Analysis	1600-1700 Session Analysis		1530-1630 Data Confirmation Briefing
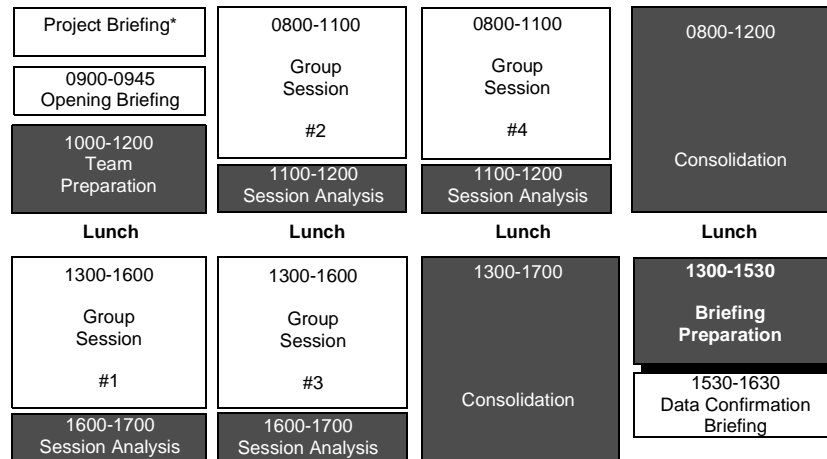
* The 1-hour project briefing can occur prior to the RI&A on-site visit   ▉ Team only

Objectives   to create the data confirmation briefing presentation materials

Who's in the Room?   SRE team

Duration   2 hours

Preparation   The following must be completed prior to creating the data confirmation briefing:

- all group sessions
- all context review
- all team analysis, scoring, and reconciliation
- classification of risks
- consolidation

Approach   Presenting the data confirmation briefing should take a half-hour or less.

At its simplest level, this briefing is a presentation of the data that was collected in an organized fashion. The organizing structure is the risk area listing. The team leader leads development of the results briefing presentation which should include the following:

- "boilerplate" cover page
- review of the SRE process
- list of risks and their attributes
- risk classification results
- "top n" list of risks
- description of "next steps" the organization should take
- placeholder for project manager's closing comments

After the presentation has been created do the following:

- Make transparencies of the slides.
- Make a hard copy of the slides for the project manager.
- Make a dry run of the presentation.

Sample Data Confirmation Briefing Outline   The following outline presents an example of the data confirmation briefing.

Item	Description
Boilerplate cover page	• sets the stage • a place for program manager to introduce the team leader • time for team leader's introductory comments
SRE objectives	overall objectives of an SRE
SRE process overview	shows the larger context into which this RI&A effort fits
RI&A process	• schedule of work sessions for the participants and team members ("where we've been") • RI&A process flowchart ("what we've been through")

Item	Description
summary of activities	numbers: how many sessions, how many participants, how many risk statements, and so on
summary of findings	• risk area names • risk statements by risk area (risk areas column chart) • summary analysis of team and participant scores
findings by risk area	• observations for each area • direct quotes and risk statements, as appropriate
next steps	• interim report: why and when • MSP: when and how

Results The results are the following data confirmation briefing presentation materials:

- transparencies of slides
- hard copy of slides for the project manager

Key Considerations Remind participants of the non-attribution and confidentiality principles.

Logistics It is best to have a direct display device to make this presentation directly from the slide presentation software. If this is not possible, quick access to a photocopier for creating transparencies and making a hard copy for the project manager becomes essential.

Data Confirmation Briefing
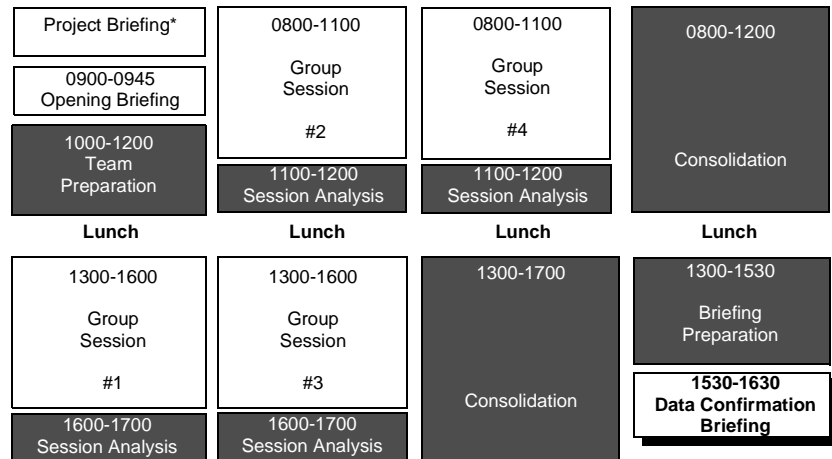
Project Briefing*	0800-1100 Group Session #2	0800-1100 Group Session #4	0800-1200 Consolidation
0900-0945 Opening Briefing			
1000-1200 Team Preparation	1100-1200 Session Analysis	1100-1200 Session Analysis	
Lunch	**Lunch**	**Lunch**	**Lunch**
1300-1600 Group Session #1	1300-1600 Group Session #3	1300-1700 Consolidation	1300-1530 Briefing Preparation
1600-1700 Session Analysis	1600-1700 Session Analysis		**1530-1630** **Data Confirmation** **Briefing**

* The 1-hour project briefing can occur prior to the RI&A on-site visit   Team only

Objectives   to present the project with the results of the Risk Identification and Analysis (RI&A) phase of the SRE

Who's in the Room?

- project manager
- all participants
- any other project members the project manager chooses to invite
- SRE team

Duration   30 minutes

Preparation   Prior to giving the data confirmation briefing, the following must be accomplished:

- Presentation transparencies and a hard copy for the project manager have been prepared.

- the project manager and all participants are in attendance.

Approach   The presentation is a formal briefing during which the following occurs:

- The project manager introduces the team leader.
- The team leader presents the data confirmation briefing.
- After the presentation, the team leader invites the project manager to comment.
- The project manager shares comments with the audience.
- The team leader gives a hard copy of the presentation to the project manager.

Results   The result is the official ending to the RI&A phase of the SRE.

Points to Remember   Participants need to see their manager introduce the team leader before the briefing, and summarize the importance of risk management to the project at the end of the briefing.

Interrelationship Digraph
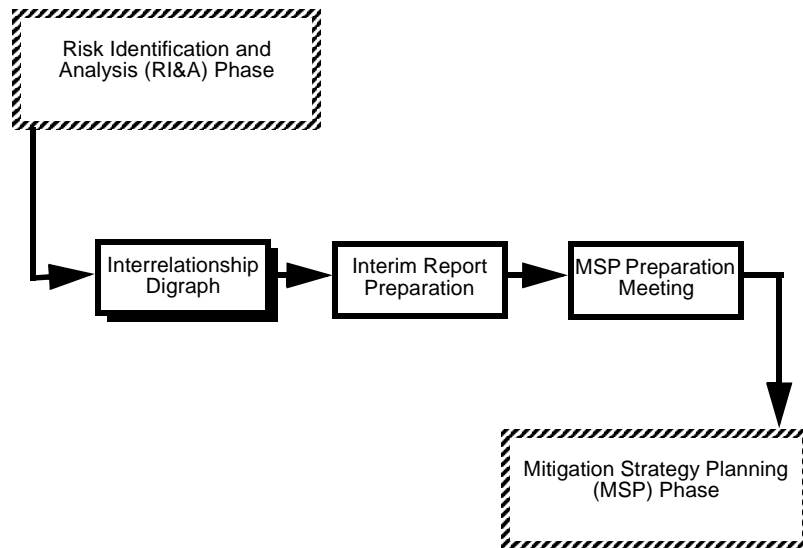
Objectives
- to explore the relationships among risk areas identified during the Risk Identification and Analysis phase of the SRE

- to identify risk areas that include conditions which are creating similar conditions in other risk areas—irrespective of the rated "importance" of those risks—so that the SRE team and project manager can consider whether those "root-cause" risk areas should be mitigated first during the Mitigation Strategy Planning (MSP) phase

Who's in the Room? the SRE team or a subteam taken from it

Duration The digraph should take one hour (but only after being away from the data for a day or two)

Documentation of the results and an interpretive analysis of them may take several hours to days, depending on the complexity and sensitivity of the conclusions reached. For example, if the results point to a lack of commitment from management above the project having the SRE (not an uncommon occurrence), it is advisable to re-examine the interrelation-

ships and carefully explain (in writing) why the data support this conclusion. This should also be reviewed with as many other members of the SRE team as is practicable, to make sure that it is a conclusion that everyone can support. Do not shortcut this part of the process.

Source of Process This description of an interrelationship digraph building process is taken from the *Continuous Risk Management Guidebook*, Chapter A-14 (beginning at page 345), and that chapter should be used as the reference for the general process. The following description is consistent with the reference, though not as detailed, and has been modified slightly to address the particular issues of the SRE team at this point in the SRE process.

Preparation Follow the steps below to prepare for the construction of the interrelationship digraph:

1. Arrange all the risk statements in their risk areas, ideally using a single sheet of paper for each risk area, with the risk area label in large letters at the top of the page. Include with each risk statement the final risk exposure values determined by the team (see Reconcile Scoring on page 91) and identify the participants' top risks. Make a copy of these risk area sheets for each team member who will be participating in the interrelationship digraph building session.

2. Reproduce the session recorder notes (context) from each of the sessions and have a full copy of this context available for each of those participating in the interrelationship digraph building session.

3. Make reduced-size copies of the risk area sheets (complete with all the risk statements belonging to that area) that are small enough to be taped on a large whiteboard in a roughly circular layout, using all the whiteboard space that is available to do so.

Approach   The following table describes how to construct an interrelationship digraph for an SRE after having taped the listings of risk statements by risk area on a whiteboard:

Step	Action
1	**Draw a relationship arrow between any two risk areas.** Look at one pair of risk areas and determine, by consensus, if there is an interrelationship between the risk statements. Do the conditions embodied in the statements of risk area X cause or influence conditions embodied in the statements of risk area Y? If yes, draw an arrow from risk area X to risk area Y. *Be very careful to make the evaluation on the basis of the relationship between the risk statements in the two risk areas, not on the basis of the name of the risk areas.* It is a common temptation to load more meaning into the name of the risk area (e.g., "Requirements" or "Senior Management") than can be supported by the risk statements that were captured in the interviews and collected under that label.
2	**Apply a weighting factor to the arrow.** Determine whether the relationship is "significant" (weighting factor of 9), "medium" (3), or "weak" (1).
3	**Repeat steps 1 and 2 for every pair of risk areas.** Proceeding around the circle of risk areas systematically, be sure that every pair of areas has been evaluated for an interrelationship, and that all interrelationships have been assigned a weighting factor of 1, 3, or 9.
6	**Review and revise, as necessary.** After comparing every pair of risk areas, review the relationships and make any necessary changes.
7	**Tally arrow information.** Count and record the number of incoming and outgoing arrows for each risk area. Calculate and record the total weight for each risk area (the sum of weights of all the arrows going into or out of the area).
8	**Select key items.** Use the tallied arrow information, experience, and judgement to reach consensus on the key risk areas to be worked on. Generally these should be the areas with the largest number of outgoing arrows (risk areas that predominantly include "Cause/Driver" risk statements) and the highest total weight.

**Results**   A typical interrelationship digraph for an SRE and its results matrix are shown below.
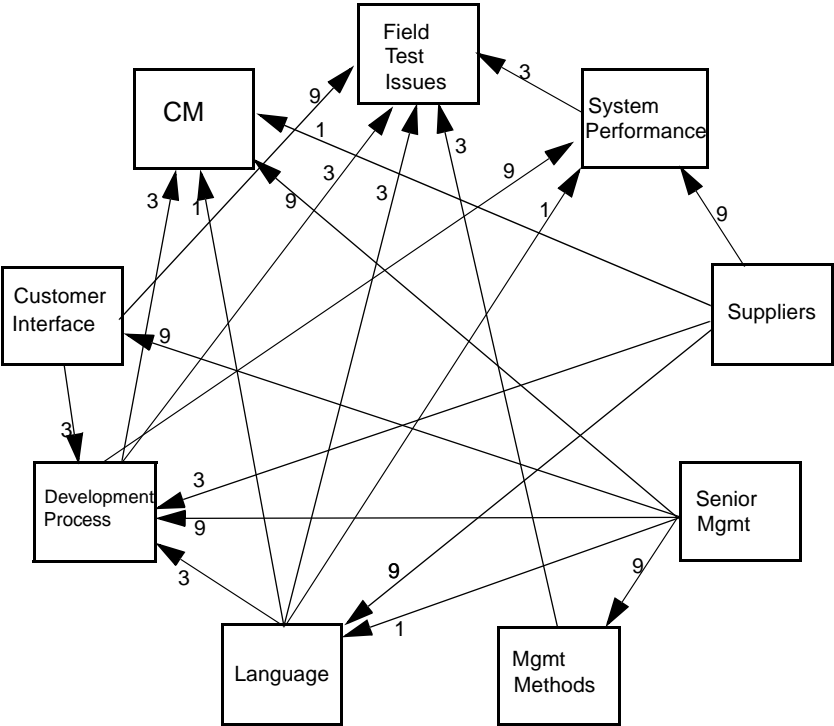
	Field Test Issues	System Performance	Suppliers	Senior Management	Management Methods	Language	Development Process	Customer Interface	CM	Cause/ Driver ⇑	Result/ Rider ⇐	Total Weight
Field Test Issues	•	3⇐			3⇐	3⇐	3⇐	9⇐		0	5	21
System Performance	3⇑	•	9⇐			1⇐	9⇐			1	3	22
Suppliers		9⇑	•			9⇑	3⇑		1⇑	4	0	22
Sr. Mgmt				•	9⇑	1⇑	9⇑	9⇑	9⇑	5	0	37
Mgt Methods	3⇑			9⇐	•					1	1	12
Language	3⇑	1⇑	9⇐	1⇐		•	3⇑		1⇑	4	2	18
Development Process	3⇑	9⇑	3⇐	9⇐		3⇐	•	3⇐	3⇑	3	4	33
Customer Interface	9⇑			9⇐			3⇑	•		2	1	21
CM			1⇐	9⇐		1⇐	3⇐		•	0	4	14

Interpreting the Results   The interrelationship digraph results can be redrawn in a way that more clearly identifies the important interrelationships and the risk areas that deserve first consideration as candidates for mitigation strategy planning. This is called an "interrelationship hierarchy" because the risk areas higher on the chart have risk statement conditions which are closer to

"root causes" than those lower on the chart. The example shown below corresponds to the interrelationship digraph in the previous section..
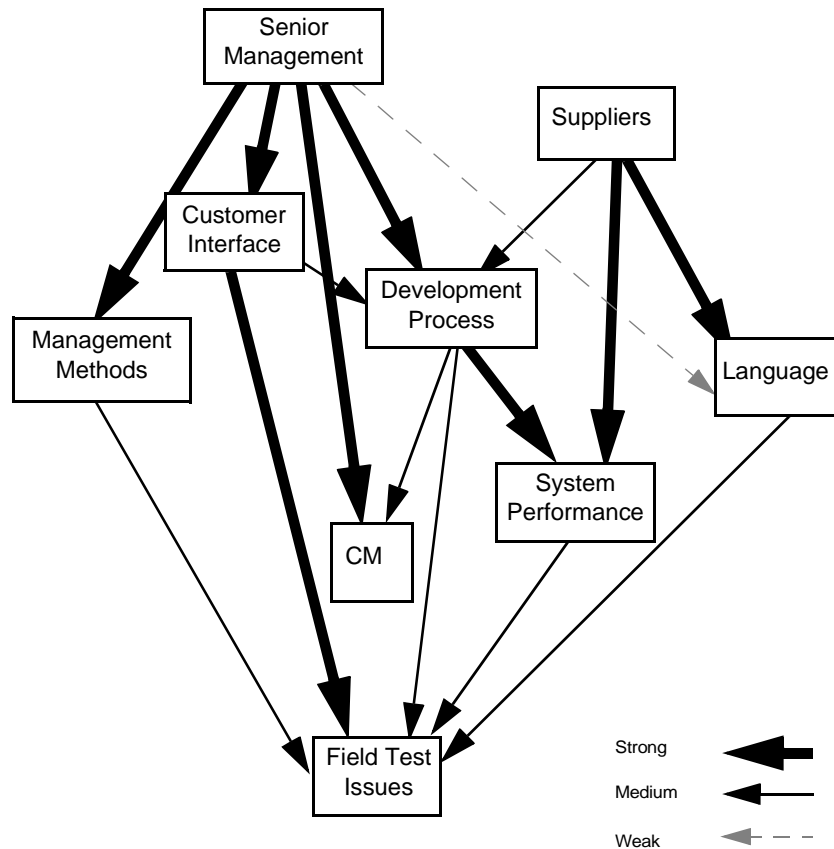
Interrelationship Hierarchy

Notice that some of the "weak" interrelationships of the interrelationship digraph have been removed from the depiction above, particularly when the effect is covered by a two-step relationship. For example, if A strongly affects B, which has a medium effect on C, but A also weakly affects C directly, it is reasonable to eliminate the weak effect of A on C from the hierarchical depiction, since it probably adds no new insight.

The interrelationship hierarchy can be a powerful and easily-grasped tool for explaining why one risk area should be attacked before another. In the example digraph above, the team would argue that the risk areas "Senior Management" and "Suppliers" appear to be largely independent of one another, and both are having major effects on other risk areas. The risk statements in the "Senior Management" risk area have primary or secondary effects on *every* other risk area except "Suppliers." Even though "Sys-

tem Performance" had the largest number of risk statements and the largest number of risk statements identified by the SRE team as "high" in program risk exposure and by the participants as their #1, #2, or #3 top risks, this hierarchy would suggest that these are possibly symptomatic risks, rather than root risks.

The recommendation in this case would be to mitigate the risk areas in the following order:

1   Senior Management
2   Suppliers
3   Customer Interface

Key Considerations

- Risk areas are only collections of risk statements. The interrelationships must be based on the "condition" element of the underlying risk statements, *not* on the risk area labels.

- Make sure that all team members have the context for the risk statements available during the interrelationship digraph construction phase, and that they refer to it for backup information in cases of disagreement.

- The interrelationship hierarchy will typically be constructed by just one person, most likely the team leader (since the team leader is most personally responsible for the recommendation to the client project manager). The person who constructs it should check back with team members to secure their agreement with the depiction, however.

Interim Report Preparation
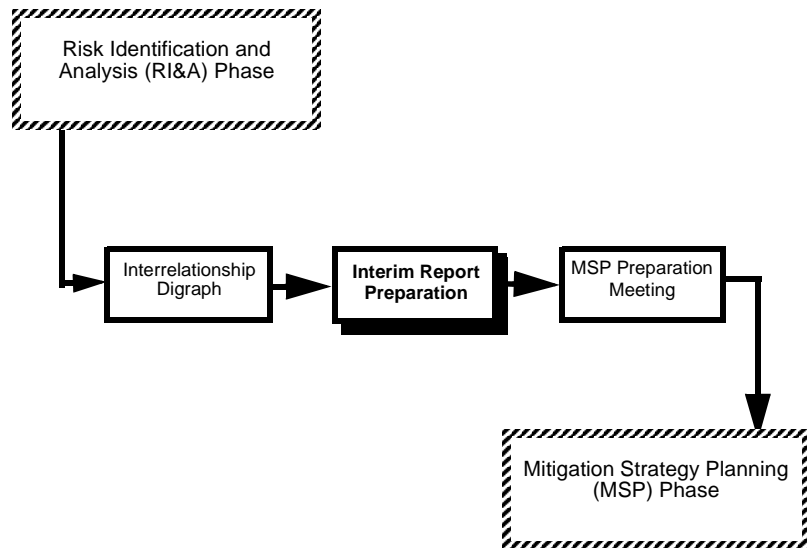
Objectives
- to present the results of the Risk Identification and Analysis (RI&A) phase to the project manager in report form
- to recommend which risk areas should be addressed in mitigation strategy planning (MSP) sessions

Who prepares the report?
The SRE team leader is the overall editor of the interim report. This person assigns the preparation of specific subsections of the report to team members, edits the pieces to give the complete report a coherent perspective and a single "voice," and prepares and signs the cover letter for the report.

Timing of Publication
It is important that the interim report be completed quickly, while the enthusiasm for risk management generated by the RI&A phase remains high. Generally, this means that the interim report should be in the client project manager's hands within two calendar weeks of the data confirmation briefing.

Interim Report Outline
An example outline for the interim report follows.

Item	Description
Executive Summary	• summary of risk findings and risk areas • near-term recommendations ("bleeders to be stopped") • observed strengths (optional—always good for public relations, though)
Introduction	• "caveats" (e.g., "This deals only with risk statements that came out in the interview—it is not an *independent* identification of risks to the project;" "We may not have the technical expertise on the team to evaluate the area in detail;" "This is only a snapshot in time— conditions can change quickly.") • layout of this report (how to read it)
SRE Process Overview	• shows the larger context into which this RI&A effort fits
Background	• SRE objectives • SRE team makeup • review of the RI&A method used
Findings	• risks by area (include listings of the risk statements in each area) • high-level mitigation recommendations by area (the "low-hanging fruit") • interrelationship of risk areas, presenting the interrelationship hierarchy and recommending the specific two or three risk areas to be addressed in mitigation strategy planning (MSP)
Conclusion	• next steps • timing of MSP planning meeting
Appendices	• RI&A schedule • (optional) data confirmation briefing slides • (optional) slides from the RI&A phase opening briefing

MSP Preparation Meeting

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┆   Risk Identification and    ┆
┆   Analysis (RI&A) Phase      ┆
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│Interrelationship│─▶│ Interim Report │─▶│ MSP Preparation│
│   Digraph      │   │  Preparation   │   │    Meeting     │
└──────────────┘   └──────────────┘   └──────────────┘
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                               ┆  Mitigation Strategy Planning  ┆
                               ┆         (MSP) Phase            ┆
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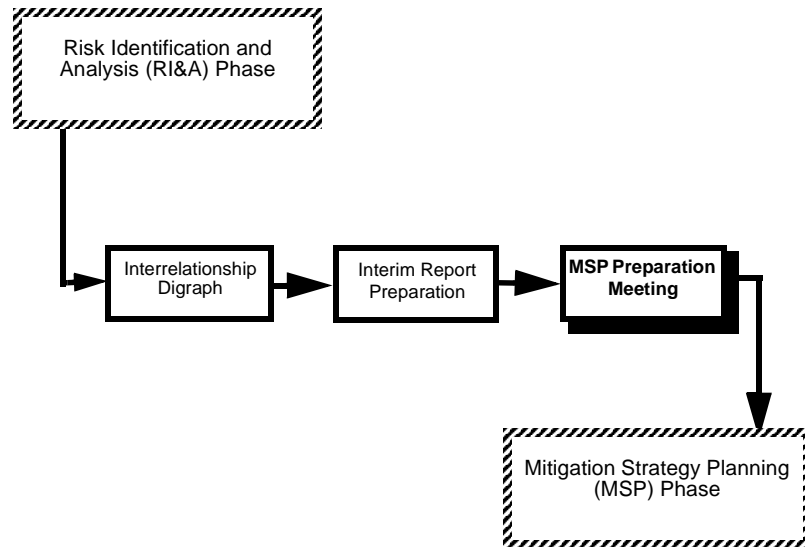
Objectives
- to meet with the project manager to prepare for the mitigation strategy planning (MSP) activities
- to determine which risk areas will be addressed during the MSP Sessions

Who's in the Room?
- project manager (PM)
- any other project members the project manager chooses to invite (for more technical and managerial knowledge)
- SRE team leader
- SRE team members who will participate in MSP activities

Duration one hour

Preparation The following must be completed prior to the MSP meeting.

- Prioritize the list of risk areas generated during the RI&A phase.
- Determine those risk areas that the project is responsible for and can mitigate.

- Determine if a MSP Session is required and beneficial for a particular risk area.

- Propose the number of MSP Sessions to be conducted.

Some or all of these may have been completed as part of the Interim Report.

Approach   The SRE team leader conducts the MSP meeting. The agenda for the meeting should break down as follows:

Review the Interim Report:

- Validate the findings.

- Answer any questions.

Review the SRE team's prioritized list of risk areas for mitigation:

- Review the results of the analysis and prioritization activities from the interim report.

Agree on mitigation areas

- Select mitigation areas to deal with in MSP Sessions.

- Assign the responsible project individual for each mitigation area. (This project member will be responsible for executing the resulting mitigation plan.)

- Assign other project personnel to each selected mitigation area.

- Agree on a schedule for the MSP Sessions (who, when, times, preparation, etc.).

Determine the mitigation goals for the project manager:

- The team leader/facilitator asks the project manager to specify the goals/constraints/interests for mitigating the selected areas.

Set up the distribution of read-ahead material:

- Identify any material or other information that would be beneficial for the session participants.

- Review the logistics for the MSP Session with the on-site coordinator.

Results
- Mitigation areas are agreed upon.
- The project manager's mitigation goals are defined.
- Project personnel is assigned to "lead" mitigation areas.
- The schedule for MSP Sessions is finalized.

Key Considerations
- The planning meeting is considered informal. However, an optional briefing addressing the results of the SRE team's analysis and prioritization activities may be prepared.
- The construction of the on-site MSP Session schedule may require the SRE team leader to redefine the SRE task:
  - number of sessions
  - additional resources for MSP
  - other SEI (or non-SEI) skills required

Logistics The MSP meeting is scheduled after the delivery of the interim report. Adequate time should be allowed for the client's review of the report and for the SRE team to prepare for the meeting. The MSP meeting is typically held one to two weeks prior to the start of on-site MSP activities.

Mitigation Strategy Planning Session
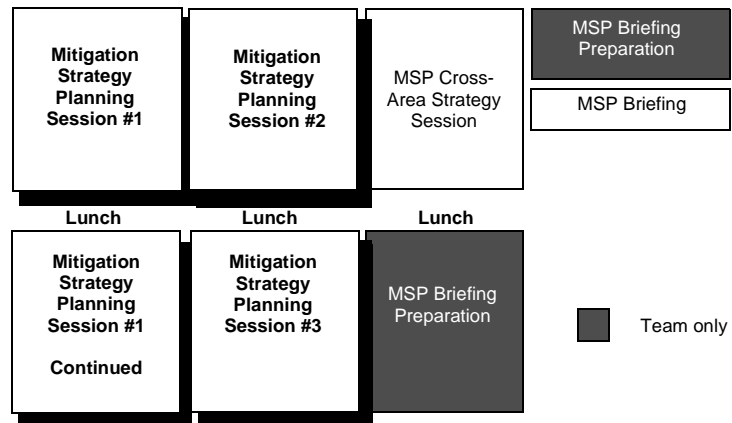
MSP Sessions may range from 1/2 to 1 day in length, depending on the size of the risk area and the order of sessions. The first session will take the longest.

Objectives
- to develop a mitigation plan for the risk area, especially those risk statements ranked among the most important to the project by the SRE team or the participants during the RI&A phase
- to identify metrics to track risk and mitigation plan progress
- to teach clients a process and methods for mitigating the rest of their risks

Who's in the Room?
- leader of the client project who is responsible for completing the mitigation area ("owns the risk")
- facilitator of the SRE team
- keeper of context for the SRE team
- domain expert of the SRE team (optional)

NOTE: The SRE team leader is often the facilitator, but not necessarily. The team leader *per se* does not have a role in this session.

Duration   MSP Sessions may range from four to eight hours in length depending upon material.

Preparation   The following things must be completed prior to conducting an MSP Session:

- The program manager's mitigation goals are defined.
- "Hip pocket" approaches are developed by the SRE team.
- Roles are assigned for facilitator and the team member responsible for context. A domain expert may be requested by the project, and would be a member of the SRE team.
- The medium for capturing plan components is selected (e.g., flipchart and marker).

Approach   The facilitator conducts the MSP Session and captures the components of the mitigation plan in front of the participants. A four-hour MSP Session should break down as follows:

Opening the Session: 15 minutes
- Welcome participants.
- Make introductions.
- The client project leader sets expectations about the session results.
- Provide an overview of the MSP Session activities.
- Review the handout material. This should include the "Picture of Success" used for the RI&A phase and all the original risk statements grouped into the risk area.
- Revise or refine the "Picture of Success," if it no longer is persuasive to the participants.
- Resolve any questions/issues.

Identifying Causes: 30 minutes
- The participants review major risks and suspected causes and jot down key or root causes.
- Participants identify their most important key causes until the key causes are exhausted.

- Record the key causes on flipcharts.
- Capture the key causes in a word processing program.
- Reach consensus on a subset of the key causes which the mitigation plan should address.

Identifying Mitigation Goals: 15 minutes

- Review the tentative goals.
- Review the program manager's mitigation goals.
- Modify, delete, or add new goals as necessary.
- Record the goals on flipcharts.
- Capture the goals in a word processing program. One helpful approach for this is to begin each goal statement with "To <verb> ...". {Example: "To increase employee incentives for staying with the company."]
- Reach consensus on the mitigation goals.

Identifying Mitigation Strategies

- Brainstorm and discuss possible strategies. These will define the general approaches to be taken to reach the stated goal. They will typically start with a broad action verb like "Establish," "Research," or "Investigate." [Example that goes with the goal above: "Establish a team to review standard industry benefits for employees in the IT field and make recommendations to the CEO on potential company improvements."]
- Evaluate proposed strategies and reduce them to the desired set.
- Record the strategies on flipcharts.
- Capture the strategies in a word processing program.
- Reach consensus on the mitigation strategies.

Participant Break: 10 minutes

Identifying Mitigation Activities: 65 minutes

- Brainstorm and discuss possible activities for each strategy. Mitigation activities identify *how* the strategies are carried out, and *by whom*. They should also include a *deadline for completion*. They will typically begin with a succinct and specific action verb such as "Complete," "Publish," "Collect," or "Present." [Examples to go with the mitigation activity above: "Complete a charter for the CEO's signature that will establish an employee benefits improvement team—J. Brown—6/5/1999" and "Publish a request for volunteers to serve on the employee benefits improvement team—F. Jones—7/1/1999"]

- Record the activities on flipcharts.

- Capture the activities in a word processing program.

- Reach consensus on the mitigation activities.

Participant Break: 10 minutes

- Print out the goals, strategies, and actions and distribute them to participants.

Identifying Key Measures

- Brainstorm and discuss key measures.

Note: a key measure may be an ongoing measure such as tracking planned vs. actual numbers or it may be a milestone such as the sign-off of an integrated test plan.

- Record the key measures on flipcharts.

- Capture the key measures in a word processing program.

- Reach consensus on the key measures.

Estimating the Scope of Effort

- Divide the participants and team members into as many subteams as there are mitigation strategies.

- Assign each subteam to a mitigation strategy.

- Develop the following estimates for each activity:
    - the number of people involved
    - the number of person-days effort per person
    - the number of calendar days or weeks to complete
- Review the estimates with the entire group and modify as necessary.

Note: If there are a small number of strategies, the entire team can develop estimates for all of the strategies.

- Record the estimates on flipcharts.
- Capture the estimates in a word processing program.
- Reach consensus on the estimates.

Review and Close-out of the MSP Session

- Ensure that all critical or top N risks and mitigation goals are addressed by the selected strategies and activities.
- Mark any corrections.
- Review the strategies and activities for any new risks that may be generated by them. Capture these as standard condition-consequence risk statements on a flip chart for possible later inclusion in the project's risk database.
- Remind participants of the MSP Results Briefing.
- Remind selected participants of the Cross-Area Strategy Session.
- Answer any questions.
- Thank participants for their involvement.

Results
- bulleted list of key or root causes
- bulleted list of mitigation goals (~two to four)
- numbered list of mitigation strategies (~three to five)
- numbered list of mitigation activities (~two to five) for each strategy
- bulleted list of key measures (~three to five)
- an estimate (of people, person-days, and days/weeks) for each activity associated with a given strategy

An electronic version of the flipcharts generated during the MSP Session is sufficient for use in the Cross-Area Strategy Session. However, the

SRE team must complete the documentation of results (for incorporation into the final report and as an artifact to be used by the client project member responsible for the mitigation area). The SRE team should conduct the following activities offline:

- Review and edit the documentation for correctness and completeness (make any necessary adjustments to schedule, resources, actions, etc.).

- Identify any steps that are required to make this an implementable plan.

- Assign appropriate personnel.

- Assign tasks to personnel.

- Obtain approval of the plan.

- Document the results.

Points to Remember
- The depth of planning in an MSP Session varies based on the following:
    - mitigation area scope and criticality
    - client maturity
    - need for mitigation vs. "problem solving"
- Be prepared to renegotiate or extend the session schedule. The team should not cut an area or topic short simply to adhere to the proposed schedule.
- The project will need to further break down the activities into tasks in order to estimate the true effort required, resource allocations needed, and schedule. Realistic estimates can be determined only after sizing the tasks to be performed and the resources that are available to implement them. Estimates developed during the sessions should be used as a guide and starting point by the individuals responsible for implementing the plan.

It is recommended that the final documentation of plans not be conducted until the conclusion of on-site activities. The outcome of the Cross-Area Strategy Session may result in changes to individual mitigation plans.

Logistics
- It is important that the participants be able to see what the facilitator is writing.
- If possible, keep all plan components visible to the participants.
- Each strategy and action developed for a given risk area should have a unique numerical designator.
- If possible, the tool operator should also enter plan components into a briefing slide template. This will assist in the preparation of the MSP Results Briefing.
- Access to copy machines, computers, and printers will keep the activity running smoothly.

SRE Team Member's Notebook—Appendix to CMU/SEI-99-TR-029

Cross-Area Strategy Session

| Mitigation Strategy Planning Session #1 | Mitigation Strategy Planning Session #2 | **MSP Cross-Area Strategy Session** | MSP Briefing Preparation |
| | | | MSP Briefing |

| **Lunch** | **Lunch** | **Lunch** | |

| Mitigation Strategy Planning Session #1 Continued | Mitigation Strategy Planning Session #3 | MSP Briefing Preparation | ▓ Team only |
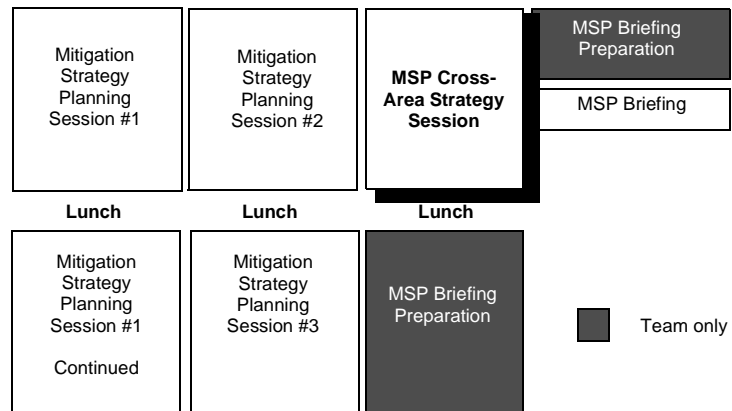
MSP Sessions may range from 1/2 to 1 day in length, depending on the size of the risk area and the order of sessions. The first session will take the longest.

Objectives

- to identify conflicts and synergy among the strategies and actions developed for each mitigation area

- to prioritize mitigation plans and actions

- to teach clients a process and methods for mitigating the rest of their risks

Who's in the Room?

- Client project personnel who are representatives from each mitigation session - ideally all of the mitigation area leaders

- facilitator of the SRE team

- keeper of context for the SRE team

- domain expert of the SRE team (optional)

NOTE: The SRE team leader is often the facilitator, but not necessarily. The team leader *per se* does not have a role in this session.

Duration   Typically, a four-hour session is sufficient to review all mitigation plans. However, if a large number of mitigation areas were addressed through the use of parallel sessions, additional time may be required.

Preparation   The following things must be completed prior to conducting a Cross-Area Strategy Session:

- All MSP Sessions are complete.
- Mitigation area plans are updated and available for review.
- Team roles are assigned for facilitator, mitigation area representatives, and the team member responsible for context.
- The medium for capturing plan components is selected (e.g., flipchart and marker).

Approach   The SRE team facilitator conducts the Cross-Area Session and captures the identified conflicts and synergy in front of the participants. A four-hour Cross-Area Session should break down as follows:

Opening the Session: 10 minutes
- Welcome participants.
- Make introductions.
- The facilitator sets expectations about the session results.
- Provide an overview of the Cross-Area Session activities.
- Review the handout material.
- Resolve any questions/issues.

Review Mitigation Area Results: 60 minutes
- Each plan is reviewed by the mitigation area representatives.
- Make each plan visible to all participants (hang flipcharts on wall).

Participant Break: 10 minutes

Identify Conflicts, Commonalities, Dependencies, and Possible
Sequencing: 75 minutes

- Identify any conflicts (strategies or actions that are in disagreement
  with each other).

- Identify any commonalities (similarities in strategies and actions that
  suggest a combination or deletion for the sake of efficiency).

- Identify any dependencies (when a particular activity can not begin
  until another has completed).

- Record conflicts, commonalities, and dependencies on flipcharts.

- Capture conflicts, commonalities, and dependencies in a word
  processing program.

- Update individual mitigation plans as required.

Participant Break: 10 minutes

Resolve Conflicts: 45 minutes

- If applicable (and possible), resolve any identified conflicts.

- Revise, add, or eliminate actions as needed.

- Review the impact to a mitigation area whenever changes are made
  to the area's action.

- Record any resolutions on flipcharts.

- Capture any resolutions in a word processing program.

- Update individual plans to reflect conflict resolution (or need for
  future consideration).

Prioritizing Strategies and Actions: 30 minutes

- Determine the order of execution for strategies and actions
  considering the following

  - the contribution of strategies and actions to mitigation goals

  - costs

  - dependencies

- Record the prioritized list on flipcharts.

- Capture the prioritized list in a word processing program.

Review and Close Out Cross-Area Session: 10 minutes

- Remind participants of the MSP Results Briefing

- Answer any questions.

- Thank participants for their involvement.

Document Overall Mitigation Plan: offline

- Document the results of the MSP and Cross-Area Sessions.

If the updating of individual plans and documenting of overall plan can not be accomplished during the Cross-Area Session, team members can be assigned to complete these tasks offline or in parallel with the MSP results preparation activities.

Results
- Mitigation strategy and action conflicts are resolved.

- Individual mitigation plans corrected and updated.

- Mitigation strategies and actions are prioritized

- The overall mitigation plan is documented and includes the following:
  - prioritized list of strategies and actions
  - unresolved conflicts
  - dependency or relationship graph/matrix
  - electronic plan charts updated for use in MSP Results Briefing

Points to Remember
- The Cross-Area Strategy Session is considered to be an optional activity and the session may be unnecessary if the same personnel participated in all MSP Sessions or if the mitigation areas are so disjointed they don't overlap in strategies and actions.

- Even if it appears that a Cross-Area Strategy Session is not required, the team should consider the following:
  - All mitigation plans should be reviewed quickly for potential conflicts and synergy.
  - Mitigation area prioritization (resulting from MSP meeting) should be revisited at the conclusion of the MSP Sessions.

Logistics • It is important that the participants be able to see what the facilitator is writing.

• If possible, keep all plan components visible to the participants.

• Access to copy machines, computers, and printers will keep the activity running smoothly.

MSP Briefing Preparation
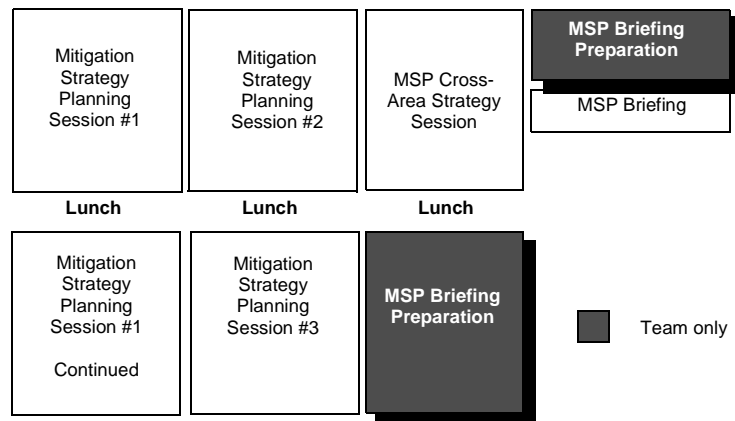
MSP Sessions may range from 1/2 to 1 day in length, depending on the size of the risk area and the order of sessions. The first session will take the longest.

Objectives
- to update and finalize the mitigation plans developed in the Mitigation Strategy Planning sessions
- to create the MSP Results Briefing presentation materials

Who's in the Room?
SRE team

Duration
4 - 5 hours

Preparation
The following must be accomplished prior to creating the MSP Results Briefing:

- All MSP Sessions are complete.
- Cross-area strategy session is complete.
- Mitigation area plans are updated and complete.
- Consideration of project's next steps have been made.

Approach   The team leader leads the team in developing the MSP Results Briefing presentation. The presentation should include the following:

- "boilerplate" cover page
- SRE objectives
- review of the RI&A phase
- review of off-site analysis conducted prior to MSP
- MSP process review
- mitigation plans
- description of "next steps" for the project and the SEI
- summary
- placeholder for project manager's closing comments

After the presentation has been created, do the following:

- Make transparencies of slides.
- Make a hard copy of the slides for the project manager.
- Make a dry run of the presentation.
- Make hard and soft copies of the mitigation plans for the responsible project personnel.

Results   The results are the following Results Briefing presentation materials:

- transparencies of slides
- hard copy of slides for the project manager
- hard and soft copies of the mitigation plans

Key Considerations
- The MSP Results Briefing is the presentation during which all MSP participants see how their own planning efforts contributed to the overall mitigation plan. More importantly, all project personnel will have an opportunity to see how the top risks from the risk identification and analysis activity will be addressed and in what order. They again "buy in" to the process, by seeing that their risks were captured and are being addressed in a proactive manner.
- Encourage all participants to attend the MSP Results briefing.

Logistics   It is best to have a direct display device to make this presentation directly from the slide presentation software. If this is not possible, quick access to a photocopier for creating transparencies and making a hard copy for the project manager becomes essential.

MSP Results Briefing
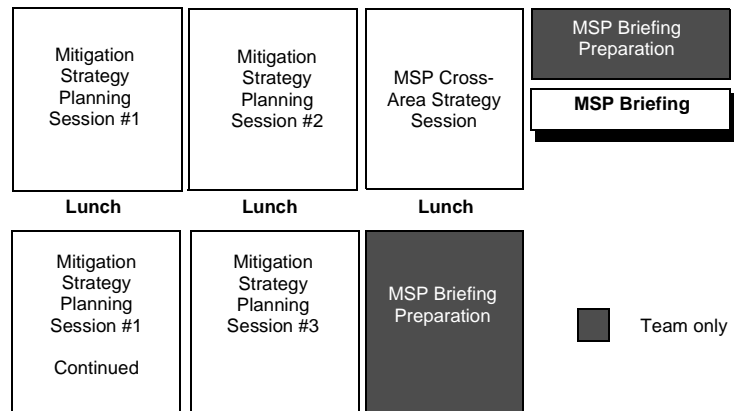
Mitigation Strategy Planning Session #1 | Mitigation Strategy Planning Session #2 | MSP Cross-Area Strategy Session | MSP Briefing Preparation / **MSP Briefing**

Lunch | **Lunch** | **Lunch**

Mitigation Strategy Planning Session #1 Continued | Mitigation Strategy Planning Session #3 | MSP Briefing Preparation | ▮ Team only

MSP Sessions may range from 1/2 to 1 day in length, depending on the size of the risk area and the order of sessions. The first session will take the longest.

Objective   to present the project with the results of the mitigation strategy planning (MSP) activity

Who's in the Room?
- project manager
- All MSP participants
- Any other project members the project manager chooses to invite
- SRE team

Duration   one hour

Preparation   Prior to giving the MSP Results Briefing, the following must be accomplished:

- Both hard and soft copies of developed mitigation plans have been prepared.

- Presentation transparencies and a hard copy of them have been prepared for the project manager.

- The project manager and all participants are in attendance.

Approach   The presentation is a formal briefing. The following will occur:

- The project manager will introduce the SRE team leader.

- The team leader will present the MSP Results Briefing.

- After the presentation, the team leader invites the project manager to comment.

- The project manager shares comments with the audience.

- The team leader gives a hard copy of the presentation to the project manager.

- The team leader gives copies of mitigation plans to the participants who are responsible for the mitigation area.

Results   official ending to the on-site MSP activity

Key Considerations
- The project manager and participants need to see a coherent and focused picture of the results. The briefing includes a section on the next steps - where the program needs to go from here with the developed mitigation strategies and actions. This area needs to be discussed with the project manager and the project manager's representatives when the results of the MSP Sessions are presented. The project manager needs to understand that action on the MSP Session results can begin immediately.

- Participants need to see their manager introduce the team leader at the beginning of and summarize the importance of the risk management activity to the project at the end of the briefing.

- The MSP Results Briefing is a tangible result of the on-site MSP activities. Take time to prepare the words as well as the briefing slides.

SRE Notes

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