Software Dev. Improvement Program
Enabling software excellence at a hardware company
A Hardware Company
A global leader in power and automation technologies
Leading market positions in main businesses

- 145,000 employees in about 100 countries
- $39 billion in revenue (2012)
- Formed in 1988 merger of Swiss and Swedish engineering companies
- Predecessors founded in 1883 and 1891
- Publicly owned company with head office in Switzerland
How ABB is organized
Five global divisions

- ABB’s portfolio covers:
  - Electricals, automation, controls and instrumentation for power generation and industrial processes
  - Power transmission
  - Distribution solutions
  - Low-voltage products
  - Motors and drives
  - Intelligent building systems
  - Robots and robot systems
  - Services to improve customers productivity and reliability

(2012 revenues)

Power Products: $10.7 billion, 36,000 employees
Power Systems: $7.9 billion, 20,000 employees
Discrete Automation and Motion: $9.4 billion, 29,000 employees
Low Voltage Products: $6.6 billion, 31,000 employees
Process Automation: $8.2 billion, 28,000 employees
Shaping the world we know today through innovation
Pioneering technology since 1883

- Founding fathers
- Steam turbine 1900
- Turbochargers 1920
- Gas turbine 1930
- Electrical drive system for locomotives 1940
- Gas-insulated switchgear 1970
- Gearless motor drives 1960
- HVDC 1950
- Variable-speed motor drives 1980
- Electric propulsion systems 1990
- Extended control systems 2000
- Ultrahigh voltage
ABB technology
Software ascendance

- 1891: BBC starts selling boxes
- 1980s: first DCS
- 2000s
  - Industrial IT, 800xA, SKYVA (till 2003)
  - Network Manager
  - CPM
- 2010s
  - Ventyx, Mincom
  - 2500 software developers
- 2013: software community of 10’000 people

Computer science expertise is essential for ABB
(service, security, integrating acquisitions, …)
Complexity: Excel vs. ABB controller

30–50 MLOC
SDIP was launched in 2008 as an ABB Group initiative and chartered to **transform the way ABB develops software**

For the benefit of ABB’s overall business objectives, SDIP aims to bring our software R&D above and beyond industry average to achieve speed, quality and predictability in ABB's software product development.

- 3 people at ABB Group
- Some more in divisions, Corporate Research and IS
Communication and Sharing
Communications and Sharing

- New SDIP Blog created & Productive Bits Newsletter published bi-weekly
- More than two dozen locations have people printing it out and hanging it up in prominent locations in break rooms, common areas, etc.

Productive Bits Newsletter - Episode 1 - Drop It Cause It's Hot!

20 May 2012 20:21 - Brian R. Robinson

Introducing the new SDIP Productive Bits Newsletter, where software professionals inside ABB can share tips and tricks they use when developing software. These tips may involve productivity, quality, or any other topic of interest to the larger ABB development community. A new episode will be published every other week on this blog.

The first episode of the Productive Bits Newsletter is written by David Broker, a Principal Scientist in the ISS Program at USRC.

Introduction:
When a software project begins developers usually have one goal: make software that works. As the project moves forward their code begins working... and working and working and working. This brings them to their next goal: make software that works fast. However, at this point it's often difficult to determine which code segments are causing delays. Fortunately, developers can use Visual Studio's built-in profiling tools to discover hot paths in their program. Once identified it's often possible for developers to alter, avoid, or even drop the offending hot paths.

Here is the newsletter:

Drop It Cause It's Hot - final.pdf
Communications and Sharing
Knowledge Bits

250–400 unique users per months
3–4 visits per month and user
65 questions
100 answers
150 comments
3 unanswered questions
SDIP Portal
One stop shop for all things SDIP

- Information consolidated in single site
- Cross-referenced information (practices, training, tools, people)
- Tailored views (eg, courses for managers)
Practices

A practice describes the recommended way of executing an activity by joining people with a process description and tools. A typical practice is comprised of a description, available training, tools, SMEs, references and a link to a support community. It comes with an implementation plan and metrics to meet to demonstrate successful implementation. Depending on your organization's starting point, some practices can take a significant effort to be implemented. Others are as simple as picking a coding standard with no follow up actions.

Different practices affect different areas of the software development lifecycle and are not restricted to software developers. They touch on engineering, business decisions, project management and support. Likewise they are relevant for software engineers, product and line managers, architects and many more roles.

There are two sets of practices: mandatory practices that all teams must follow and a backlog of recommended, but optional practices. Occasionally practices are selected to become mandatory in accordance with the roadmap and the state of practice implementation throughout the company.

Learn more about individual practices, including the actions to take, by selecting an entry from the list.
Coding Standards

Contents
1 Description
2 Tools
3 Training
4 Actions
5 References

Description

Each team must define and follow a common coding standard.

A coding standard makes code reviews more efficient.
## Coding Standards

<table>
<thead>
<tr>
<th>What is Expected?</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate Coding Standards for applicable technologies are defined and used*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Coding Standards are preferably also supported and enforced by the Static Code Analysis tools used

- 3 Ongoing
- 2 Ongoing
- 1 Ongoing
- 0 Not Started

↑ Completed since last Baseline
# Static Code Analysis

<table>
<thead>
<tr>
<th>What is Expected?</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Static Code Analysis on all new and changed code</td>
<td>![Green Arrow]</td>
<td></td>
</tr>
<tr>
<td>For new and changed code, all warnings shall be analyzed and resolved</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Coding standards shall be enforced with the tool used</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What should be Measured?</th>
<th>Data Collected</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The warning levels shall be monitored and controlled</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

3 Ongoing, 2 Ongoing, 1 Ongoing, 0 Not Started

Completed since last Baseline
<table>
<thead>
<tr>
<th>Hot Topic</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization and Resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training Deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool Chain Deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013 Planning and Budget</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key Practice**

<table>
<thead>
<tr>
<th>Key Practice</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Review</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coding Standards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Testing with Automation</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Project and Product Metrics</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Software Estimation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D Self Assessments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nightly Builds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Define and Control Interfaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ongoing Activities**

- ...
- ...
- ...

**Concerns/Issues**

- ...
- ...
- ...

3 Ongoing 2 Ongoing 1 Ongoing 0 Not Started

Completed since last Baseline
# Introduction to Configuration Management

## What is Expected?

<table>
<thead>
<tr>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Green Up Arrow" /></td>
<td><img src="image" alt="Green Arrow" /></td>
</tr>
</tbody>
</table>

- All relevant work products are identified and controlled in an approved Configuration Management Tool.
- A set of baselines is identified and work products are baselined at given points in the product development lifecycle.
- CM Audits are performed to ensure integrity of important baselines.

## What should be Measured?

<table>
<thead>
<tr>
<th>Data Collected</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Green" /></td>
<td><img src="image" alt="Green" /></td>
</tr>
</tbody>
</table>

- Incremental Code Churn*:
  - Also an SDIP Metric

### Progress Tracking

<table>
<thead>
<tr>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ongoing</td>
<td>2 Ongoing</td>
</tr>
</tbody>
</table>

* Also an SDIP Metric

![Green Up Arrow](image) Completed since last Baseline
Tailored views by function

People

On a high level, SDIP differentiates the functions of

- Development (includes architecture, design and implementation)
- People Management
- Product Management
- Project Management
- Quality Assurance (includes test)

The practices and courses cross-reference these functions.

Other functions such as Research, Applications, Information Systems, Support, Marketing, HR, Legal, Sales and various other group functions are not the direct target audience for SDIP. However, anyone from these functions is welcome to participate in the software community, by taking training and getting involved in any sharing initiatives.

Software roles are reflected in the software development career path, which was co-developed by SDIP and GF-HR. It is an extension of...
SDIP Tools

- Convergence on single tool better than many better tools
  - Training
  - Cost

- SDIP selects and recommends tools
- Centrally administered tools
  - Installation, backups
  - Training and support
  - SME
  - Onboarding of teams
- Local power users
Training
50+ courses (e-learning, webinars, video, workshops)
10,000 email recipients
40% opening rate
SDIP Training Program
Training Windows 2013

- Initial Promo (all self paced courses): Jan+, *sent Jan 25th*
  - New: HP ALM 11.5 e-learnings, Klocwork instructional videos
  - Black Duck e-learnings, HP Service Manager

- 1st Window: Feb/March – *promo Feb 4, classes Feb 18-Mar 28*
  - New: SCRUM Software Development
  - Existing: Requirements, Architecture

- 2nd Window: April/May – *promo April 2, classes April 16-May 23*
  - New: Leading Product Development Improvement, Business Scenarios & User Stories
  - Existing: Unit Testing, Quality Assurance, Static Analysis

- 3rd Window: …
## SDIP Training Program
### Global Participation Statistics – 2013 Year to Date

<table>
<thead>
<tr>
<th>Key Training Metrics</th>
<th>2012</th>
<th>1Q13</th>
<th>2Q13</th>
<th>3Q13</th>
<th>4Q13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Enrollment</td>
<td>4,615</td>
<td>1,487</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Enrollment TD</td>
<td>5,142</td>
<td>6,629</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Students</td>
<td>1,654</td>
<td>355</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique Students TD</td>
<td>1,654</td>
<td>2,009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Webinars delivered</td>
<td>98</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Students per Webinar</td>
<td>17</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Webinars cancelled</td>
<td>27</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Webinar No Show Rate</td>
<td>19%</td>
<td>28%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Countries Participating</td>
<td>45</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TD = to date
SDIP Training Program
Global Participation Statistics – 2013 Year to Date

# Students by Month

- January: 419
- February: 598
- March: 471

# New Students / Month

- January: 61
- February: 178
- March: 116

Histogram of Courses / Student

- Frequency: 343
- Number of courses enrolled:
  - 1: 120
  - 2: 99
  - 5: 40
  - 10: 14
  - 20: 1

Average Courses / Student

- January: 2.26
- February: 1.91
- March: 1.61
<table>
<thead>
<tr>
<th>Country</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>394</td>
</tr>
<tr>
<td>India</td>
<td>278</td>
</tr>
<tr>
<td>Sweden</td>
<td>134</td>
</tr>
<tr>
<td>Switzerland</td>
<td>110</td>
</tr>
<tr>
<td>Germany</td>
<td>104</td>
</tr>
<tr>
<td>Poland</td>
<td>85</td>
</tr>
<tr>
<td>China</td>
<td>63</td>
</tr>
<tr>
<td>Finland</td>
<td>62</td>
</tr>
<tr>
<td>Unknown</td>
<td>40</td>
</tr>
<tr>
<td>Norway</td>
<td>39</td>
</tr>
<tr>
<td>Italy</td>
<td>35</td>
</tr>
<tr>
<td>Canada</td>
<td>33</td>
</tr>
<tr>
<td>France</td>
<td>18</td>
</tr>
<tr>
<td>Australia</td>
<td>18</td>
</tr>
<tr>
<td>Ireland</td>
<td>9</td>
</tr>
<tr>
<td>Estonia</td>
<td>9</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>7</td>
</tr>
<tr>
<td>Singapore</td>
<td>7</td>
</tr>
<tr>
<td>Croatia</td>
<td>7</td>
</tr>
<tr>
<td>Brazil</td>
<td>6</td>
</tr>
<tr>
<td>Spain</td>
<td>6</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4</td>
</tr>
<tr>
<td>Mexico</td>
<td>3</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>2</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>1</td>
</tr>
<tr>
<td>Colombia</td>
<td>1</td>
</tr>
<tr>
<td>Denmark</td>
<td>1</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>1</td>
</tr>
<tr>
<td>Oman</td>
<td>1</td>
</tr>
<tr>
<td>Vietnam</td>
<td>1</td>
</tr>
<tr>
<td>Chile</td>
<td>1</td>
</tr>
<tr>
<td>Qatar</td>
<td>1</td>
</tr>
<tr>
<td>Japan</td>
<td>1</td>
</tr>
</tbody>
</table>
SDIP Training Program
Student Evaluation Results – 2012 Yearly Totals

<table>
<thead>
<tr>
<th>Evaluation Question</th>
<th>Very Good</th>
<th>Good</th>
<th>Neutral</th>
<th>Poor</th>
<th>Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall how would you rate the content of this course?</td>
<td>19%</td>
<td>55%</td>
<td>22%</td>
<td>4%</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructors of this course were knowledgeable?</td>
<td>36%</td>
<td>54%</td>
<td>7%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>The instructors’ had a positive impact on my understanding of the material?</td>
<td>26%</td>
<td>55%</td>
<td>16%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>The Webinar content was well organized?</td>
<td>28%</td>
<td>59%</td>
<td>11%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>Provided the knowledge necessary to achieve the objectives of the course?</td>
<td>20%</td>
<td>58%</td>
<td>18%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>The Webinar content was relevant to my position at ABB?</td>
<td>40%</td>
<td>45%</td>
<td>13%</td>
<td>2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: based on 419 student responses

Overall student satisfaction: 95%
### SDIP Training Program
Student Evaluation Results – 2012 Yearly Totals (con’t)

#### Evaluation Question

<table>
<thead>
<tr>
<th>Overall; how would you rate the pace of this course?</th>
<th>Way Too Fast</th>
<th>A Bit Too Fast</th>
<th>Just Right</th>
<th>A Bit Too Slow</th>
<th>Way Too Slow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2%</td>
<td>8%</td>
<td>73%</td>
<td>14%</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall; how would you rate the level of interaction in this course</th>
<th>Not Enough</th>
<th>Just Right</th>
<th>Too Much</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
<td>87%</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall; how would you rate the number of examples in this course</th>
<th>Too Few</th>
<th>Just Right</th>
<th>Too Many</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7%</td>
<td>85%</td>
<td>8%</td>
</tr>
</tbody>
</table>

#### Evaluation Question

<table>
<thead>
<tr>
<th>Overall; how would you rate the level of interaction in this course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Enough: 10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall; how would you rate the number of examples in this course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too Few: 7%</td>
</tr>
</tbody>
</table>

#### Which topic or element in the Webinar do you feel will be most useful to your work at ABB?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>General course content</td>
<td>182</td>
<td>45%</td>
</tr>
<tr>
<td>Instructor led examples</td>
<td>139</td>
<td>34%</td>
</tr>
<tr>
<td>Participant exercises</td>
<td>86</td>
<td>21%</td>
</tr>
</tbody>
</table>
Summary

- Achievements
  - Traction and recognition in company

- Challenges
  - Building a community
  - Making ABB a known and desired workplace place for software engineers

- Lessons learned
  - Small core team can have an impact in a large organization
  - Carrot wins over stick (but peer pressure helps)

- Open question
  - Potential improvements through disruptive organizational changes
Power and productivity for a better world™