



## Context Setting for this Afternoon

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# Goals

## Use case study approach

- Identify commonality and variation within case study context
- Analyze C&V and consider variation mechanisms

## Use case study as a starting point on an example product line

- define meaning of variation in scope, service features, others
- identify variation mechanisms, requirements for business process variation
- provide example product ontologies
- other topics covered in the various position papers.

Highlight means to construct a product line solution within case study context using SOA and PL approaches

Other goals:



# How

Hear example application based on SOA and Product Line approaches

- “Towards an Approach for Service-Oriented Product Line Architectures”  
Flavio Mota Medeiros, Eduardo Santana de Almeida, Silvio Romero de Lemos Meira
- Listen for ways to use this example to
  - Highlight variations at several levels (scope, architecture, component)
  - Apply variation mechanisms to deal with these variations (feature, service or component)
  - Explore ontologies, business process variation, and other themes

Product: Create enhanced version of example application to illustrate bringing SOA and SPL approaches together.



# Use SOA design as a pattern for multiple product lines

Case study is directed at the conference paper review process

- provides a pattern for scoping other potential product lines that involve
  - Submitting a data item for review
  - Comment on data item
  - Reporting result and suggesting follow up
- examples
  - medical record review and reporting
  - trouble report submission and tracking
  - item order tracking system

Think of other product lines as we further develop the pattern

- Consider infrastructure and other services they might share.
- What specific services would they require?

Product

- a sketch of common and specific services used within each product line
- unique services to support the specific target market



# Example – Medical Related Services

## Create scenarios

- Examples: a patient registers, a patient submits an insurance card, a clinician selects an report for review, a clinician submits a diagnosis, ...
- Expand scenarios using activity diagrams

## Identify and highlight commonality and variations

- in activity diagrams
- as tasks and patterns
- in feature model

## Create use cases with extensions

- Identify actors
- Create use cases and show variations in use case dialogs
- Recognize patterns and model (e.g., context diagram)

## Identify services and select service mechanisms



# A Medical Story – Chapter 1

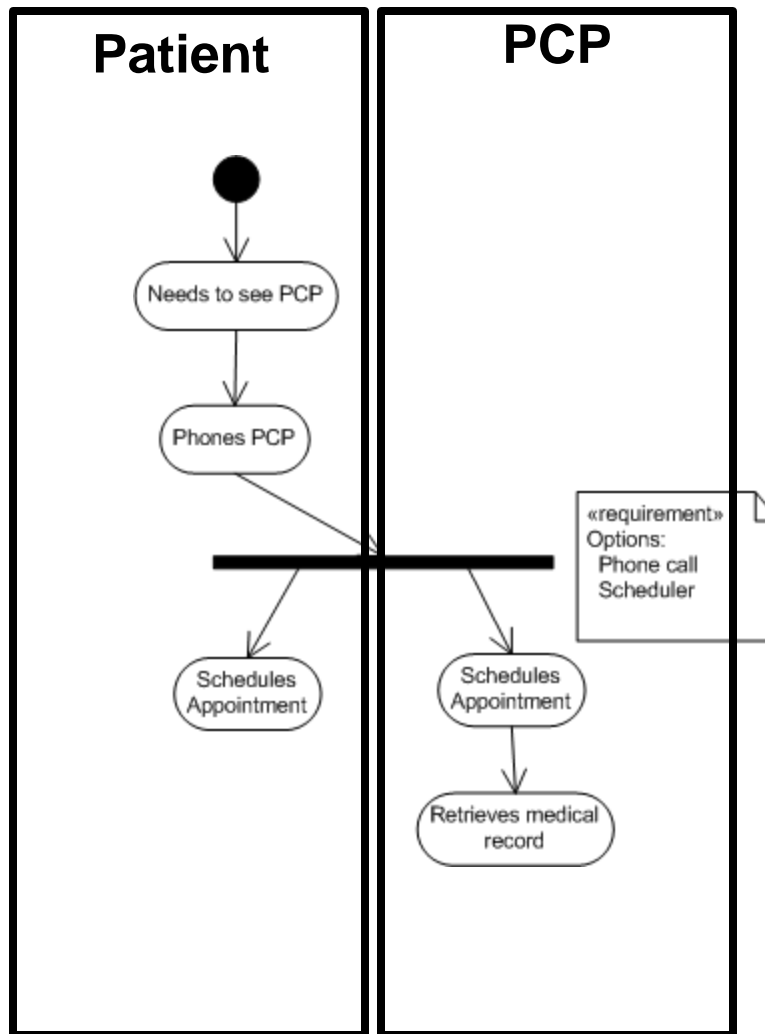
A patient with some history of cardiac problems decides to see his primary care physician

Call to doctor's office

- “If you are otherwise all right, we can see you next week.”



# Build an Activity Diagram



# A Medical Story – Chapter 2

The patient checks in

- presents insurance card
- makes co-payment (relevant outside United States?)
- taken to exam room with medical chart

Assistant performs preliminaries and records in (paper/electronic) chart

- weight, vitals, etc.
- reason for visit

Doctor examines patient (ontology support to build this?)

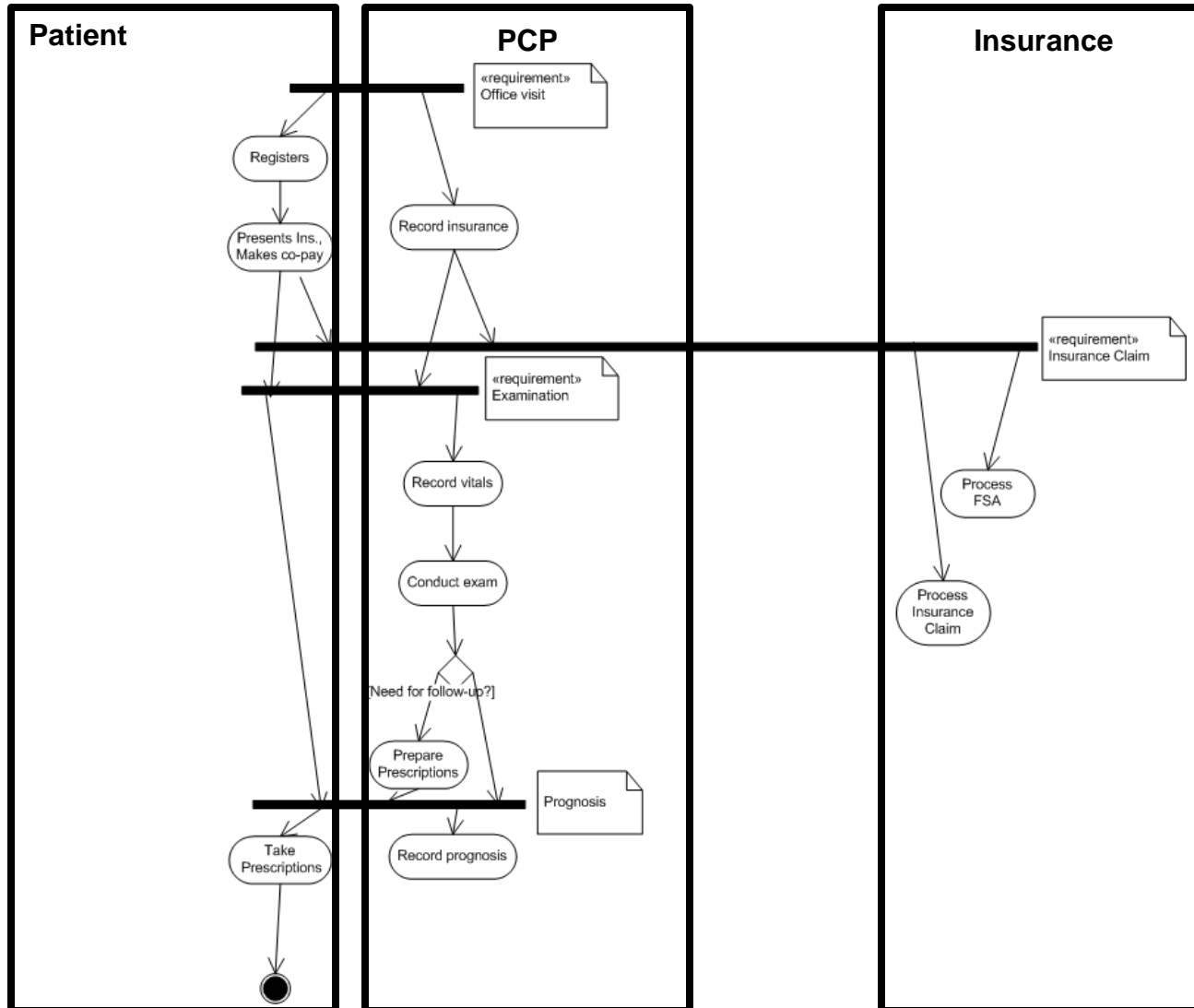
- patient overweight
- blood pressure marginal risk
- family history risk
- records report
- prescribes EKG, blood work, stress echocardiogram

Patient takes prescriptions and proceeds to hospital lab





# Activity - Office Visit



# A Medical Story – Chapter 3

The patient checks into lab

- presents insurance card
- ~~makes co-payment (not that good)~~
- taken to ~~exam~~ phlebotomy room with ~~medical chart~~ requisition

~~Assistant~~ Technician performs preliminaries and records in ~~paper chart~~ system

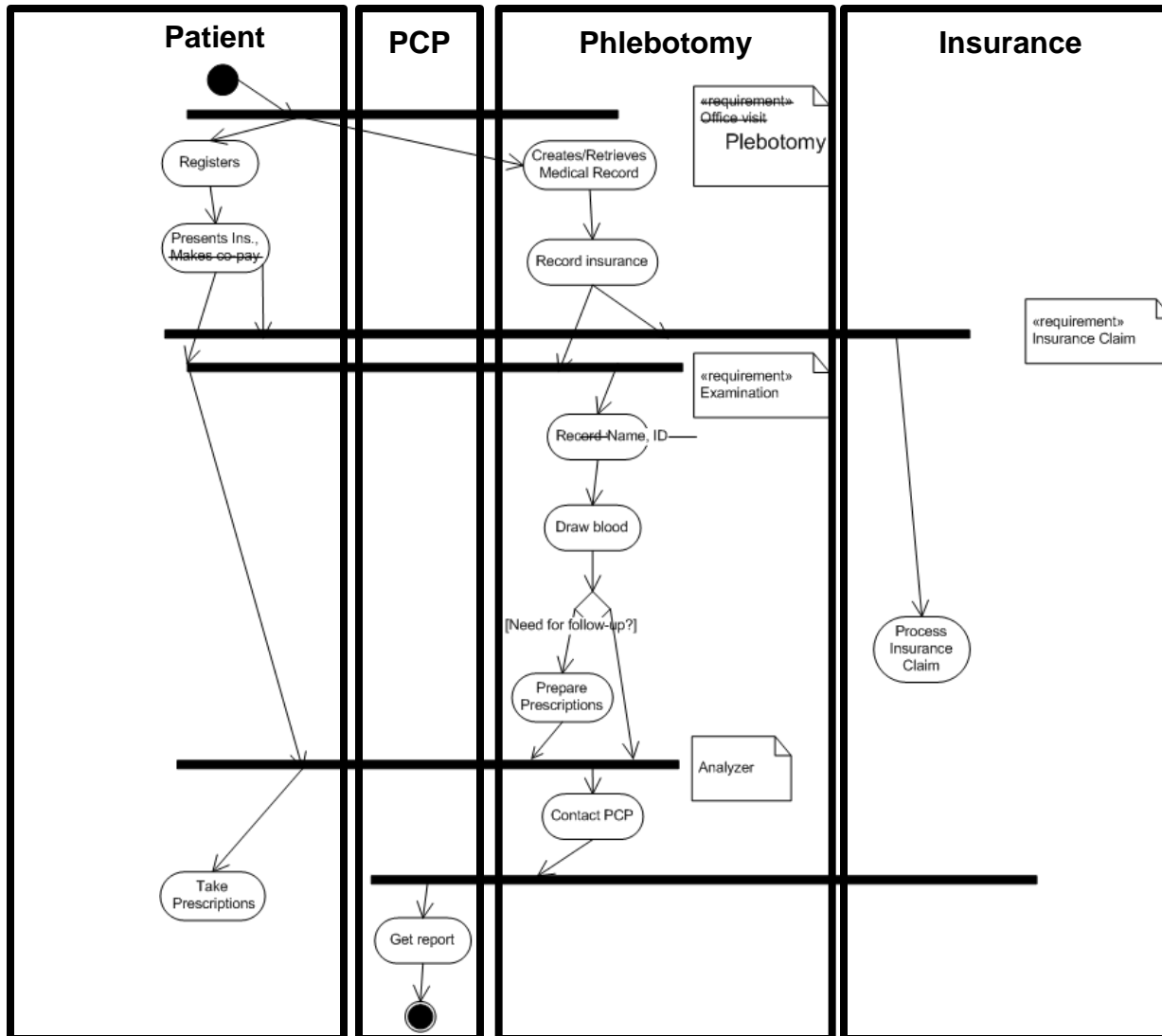
- ~~weight, vitals, etc.~~ name, id, etc.
- reason for visit
- Takes required blood samples

Lab sends samples to analyzer

Patient takes prescriptions and proceeds to ~~hospital radiology~~ department ENT



# Activity - Labs



# A Medical Story – Chapter 4 (Cardiologist)

The patient checks in

- presents insurance card
- makes co-payment
- ~~taken to exam room with medical chart~~ Presents labs report

Assistant performs preliminaries and records in paper/electronic chart

- weight, vitals, etc.
- reason for visit

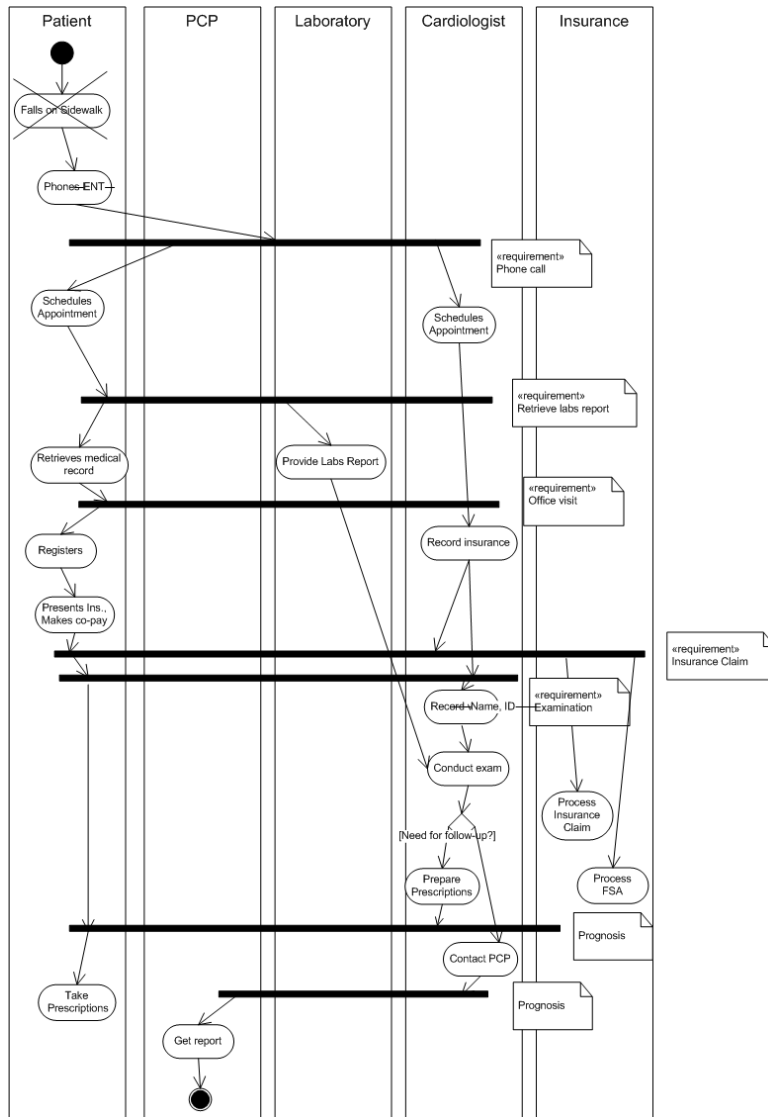
Doctor examines patient

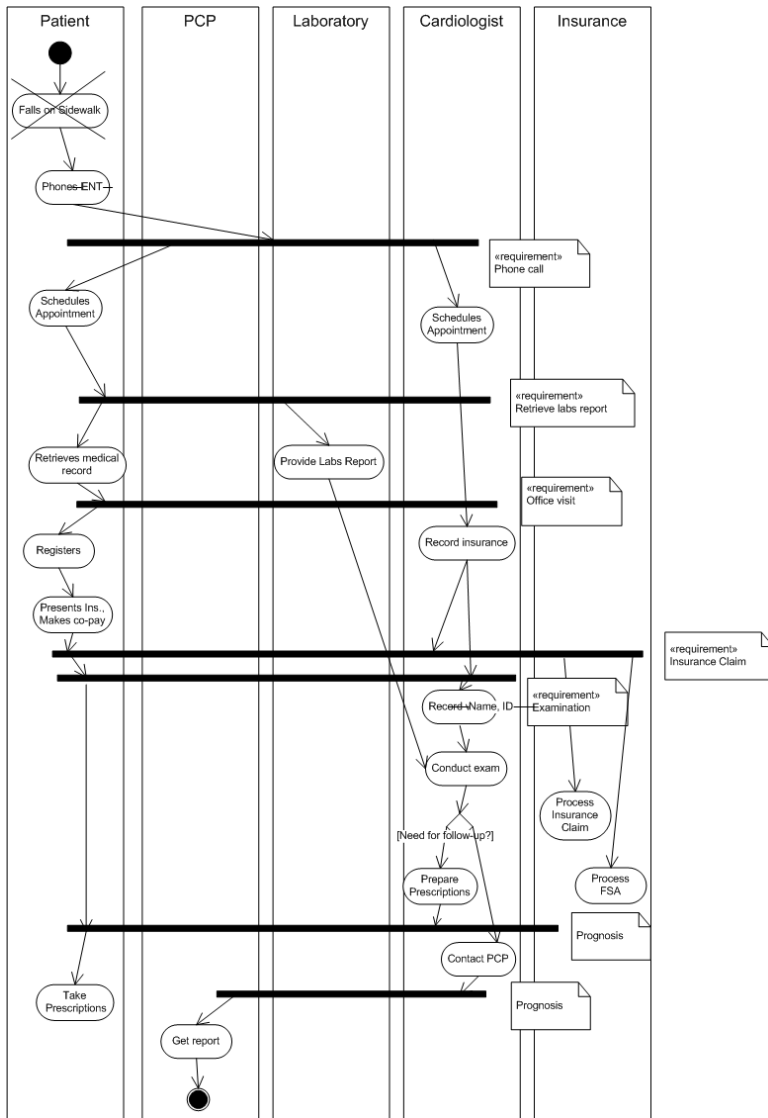
- Conducts general examination
- ~~prescribes~~ reviews labs
- sends patient for echo cardiogram
- Records report in chart

Moderate cardiovascular risk. Further treatment required



# Activity - ENT



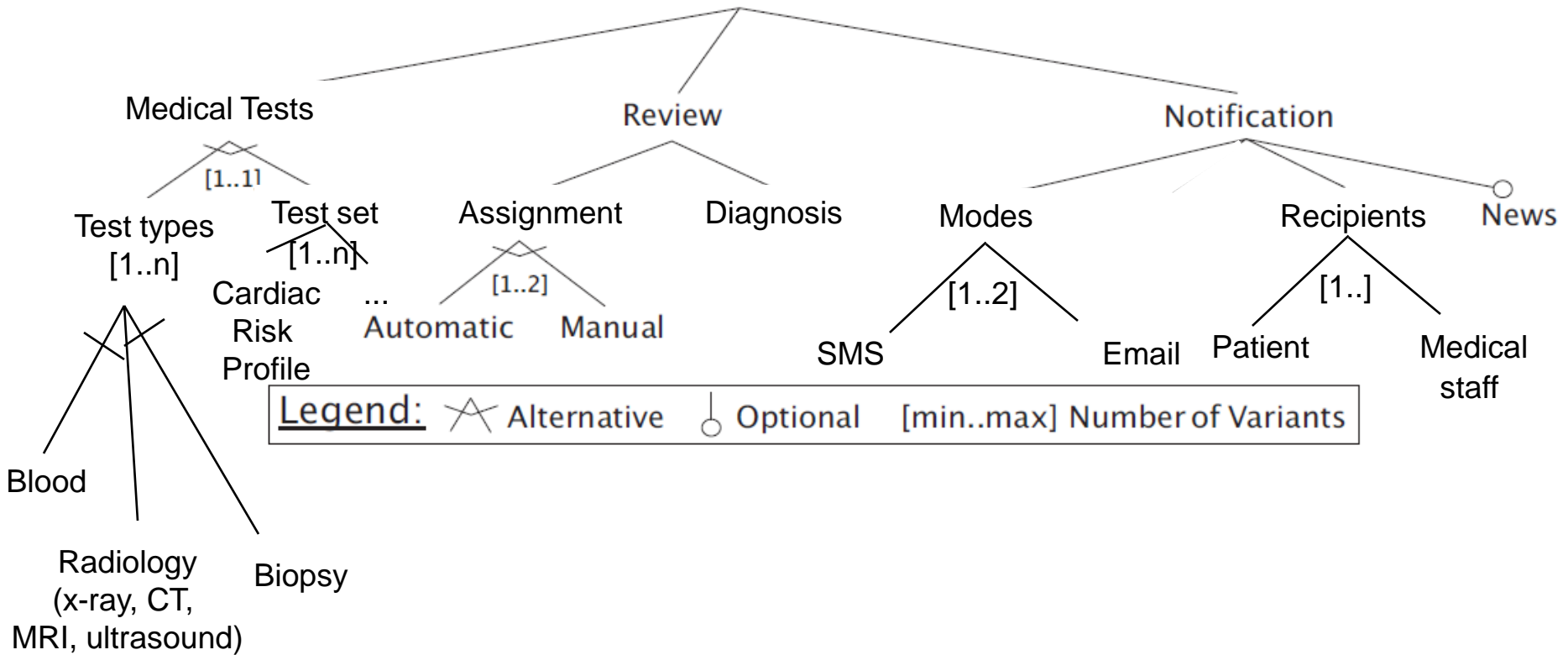


Tasks	Patterns
Scheduling (PCP & Cardio)	Processing Insurance (all)
Registering	Examination (all)
Maintaining Medical Record (all)	Managing Medical Record?
Report referral (labs and Cardio)	Report referral (labs and Cardio)

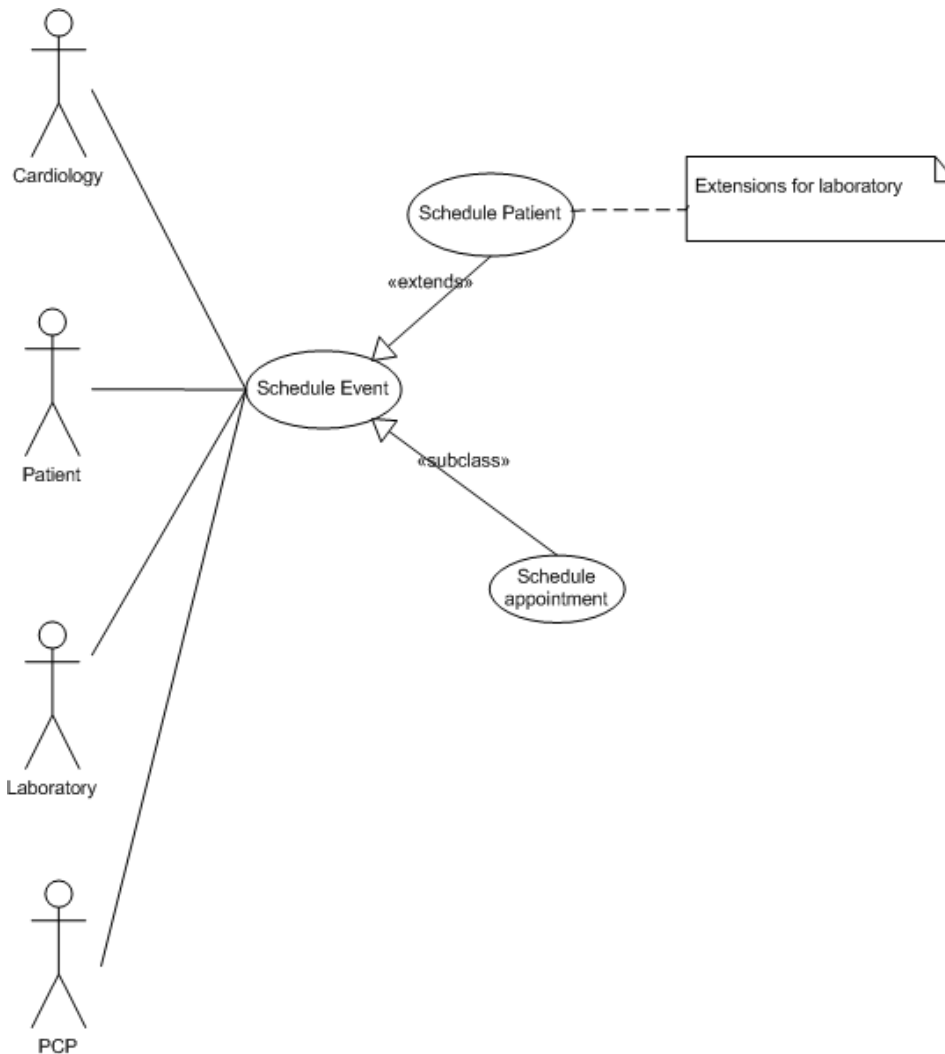


# Example Feature Model

## Healthcare



# Schedule Event Use Case



## Scenario for Laboratory Schedule Patient

Actor	System
Patient requests exam	System places patient in queue for that exam category (variations for pediatric, neo-natal, etc.). Schedules technician work flow.
Option: Lab performs pre-exam activity	Updates record with pre-exam results
Technician performs exam	Updates record with exam results
Optional: Patient provides time	Optional: Schedule clinical consultation
Analysis accepts reminder. Submits analysis	Send reminder to clinician to follow up with PCP. Optional: consultation.
	Forwards report
	Optional: Schedule next reminder to patient





# Pattern: Managing Medical Record

Actors – PCP, Cardiology, Labs, Medical Record system, medical information exchange

Integration across use cases:

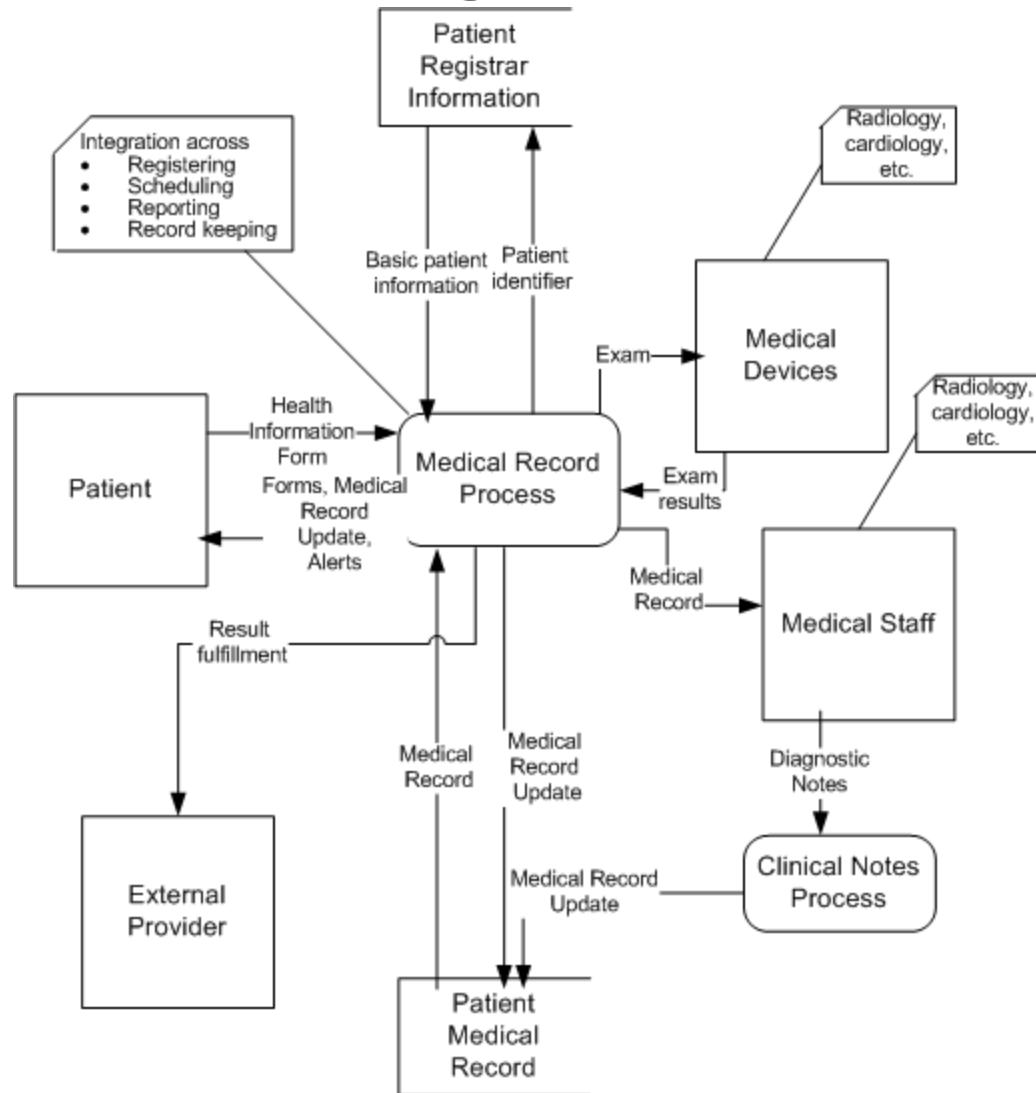
- Registering
- Scheduling
- Reporting
- Record keeping

Integration may be modeled as linking use cases with extensions for variations depending on organizational constraints

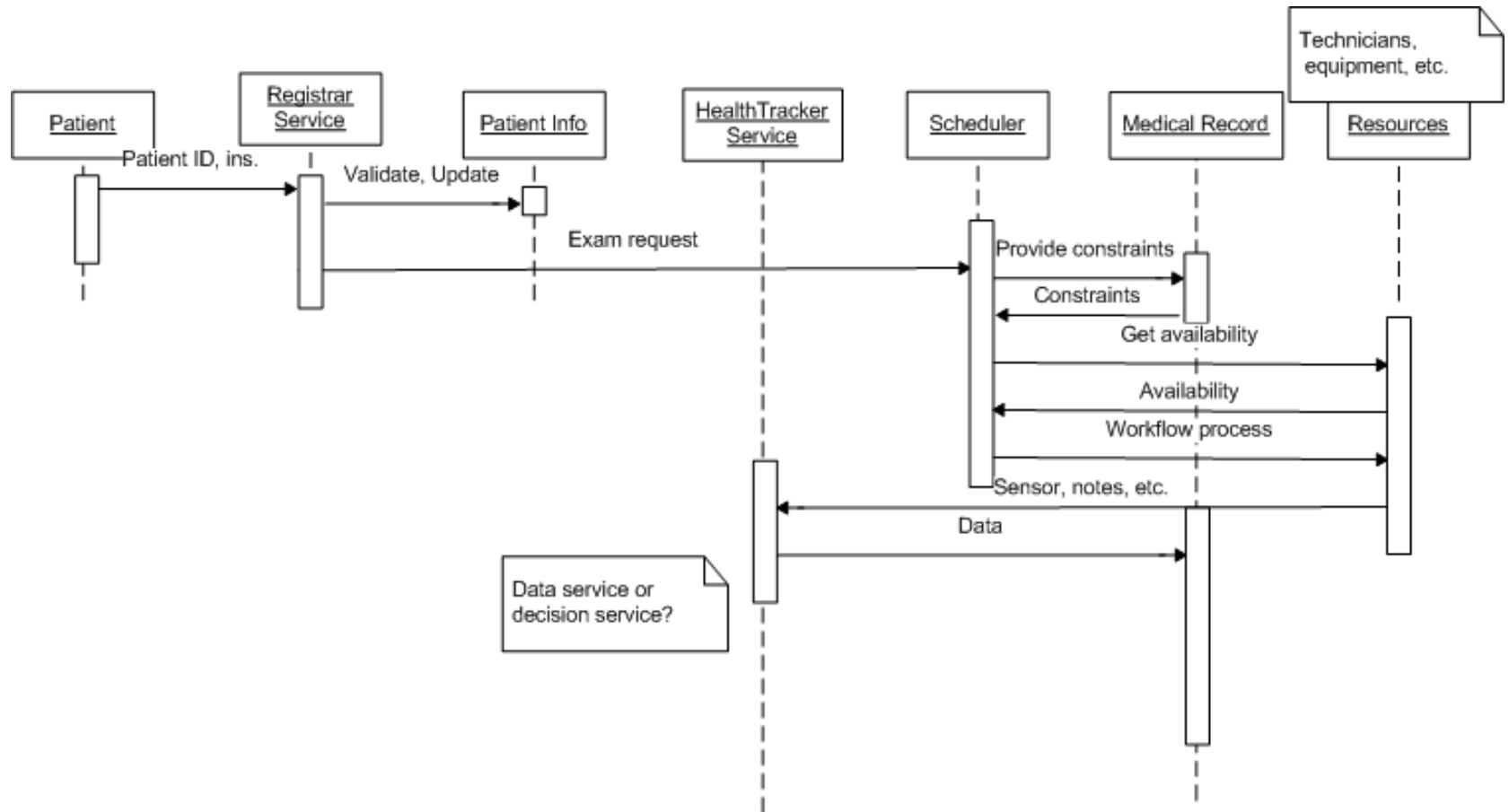
Variations for medical practice area: Radiology, cardiology, etc.



# Medical Record Management Context



# Medical Record Workflow Sequence



# Characteristics of Systematic Reuse

Not about extracting a legacy component and wrapping as a service for use in a single, new system

Systematic reuse is about:

- Creating a family of products, or software product line, whose members vary while sharing many common features
- Identifying and differentiating those features that remain constant across those products versus those that vary
- Defining service functionality and implementation characteristics within context of targeted systems
- Building variations into services and select among the variants to create a unique product
- Examples
  - Medical record management systems
  - Scheduling systems



# What is a Product Line

A set of software-intensive systems that share a common, managed set of features satisfying the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way.

Aspects	SPL definition element	Definition of a service-oriented product line
Scope	A set of software-intensive systems	Medical information management systems
Source of variation	that share a common, managed set of features	Authentication services, medical treatment record services, physician directed services, patient management services, billing record services
Application	satisfying the specific needs of a particular market segment or mission	Electronic medical record services for the healthcare industry including hospitals, clinics, medical offices, patient home (self-directed)
Compositional elements	and that are developed from a common set of core assets	Services, scope definition, feature model, SOA-based product line architecture, etc.
Technical approach	in a prescribed way	Architecture and production plan to guide building of applications using SOA infrastructure.



# Evolutionary Approach

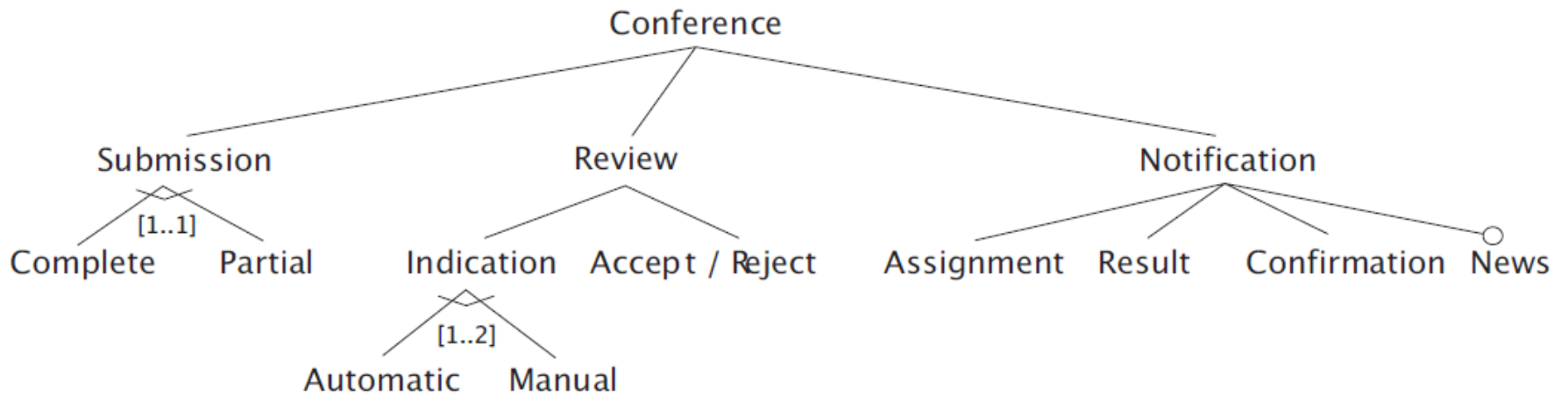
Understand potential scope of applicability of the core asset base of services

Develop the core asset base in stages while planning from the beginning to develop a product line.

- Develop part of the core asset base, including the architecture and some of the services for multiple applications
- Develop one or more applications or products.
- Develop part of the rest of the core asset base.
- Develop more products.
- Evolve more of the core asset base.



# Feature Model



**Legend:** ☆ Alternative ○ Optional [min..max] Number of Variants

