What this Talk is About

Agile modeling
  • A story
  • The activity diagram model
  • Use cases and Patterns

Use cases → Services
  • Tasks to use cases (with variation points) to Services
  • Activity patterns to use cases to decision services (with variation points)

Product line goals
  • Achieving systematic reuse
  • Evolutionary approach
A Medical Story – Chapter 1

Walking down the street one morning, a Schlemazel trips over his own feet.
The sidewalk immediately comes up and strikes the Schlemazel in the face.
Unfortunately for the Schlemazel, his chin and nose take the brunt of the impact.

Symptoms
- some swelling
- minor bleeding
- sore hand (must have tried to stop the sidewalk)

Call to doctor’s office
- “If you are otherwise all right, we can see you today or tomorrow. Even if it’s broken, nothing can be done until swelling relieves.”
Build an Activity Diagram

Schlemazel

- Falls on Sidewalk
- Phones PCP
- Schedules Appointment

PCP

«requirement»
Phone call

- Schedules Appointment
- Retrieves medical record
A Medical Story – Chapter 2

The patient checks in
• presents insurance card (at least the Schlemazel has decent insurance)
• makes co-payment (not that good)
• taken to exam room with medical chart

Assistant performs preliminaries and records in paper chart
• weight, vitals, etc.
• reason for visit

Doctor examines patient
• nose appears undamaged but may still be broken
• prescribes x-ray
• if broken, prescribes follow-up with ENT
• records incident report in chart

Patient takes prescriptions and proceeds to hospital radiology department
Activity - Office Visit

Schlemazel
- Registers
- Prepare Info. Makes co-pay
- Need for follow-up?
- Take Prescriptions

PCP
- Record Insurance
- Record Vital's
- Conduct exam
- Prepare Prescriptions
- Record Progno.
- Office visit

Insurance
- Review Insurance Claim
- Process EBA
- Process Insurance Claim

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The patient checks in to radiology

- presents insurance card (at least the Schlemazel has decent insurance)
- makes co-payment (not that good)
- taken to exam X-ray room with medical chart requisition

Assistant Technician performs preliminaries and records in paper chart
X-ray system

- weight, vitals, etc.
- name, id, etc.
- reason for visit
- Takes required X-rays

Doctor Radiology examines patient x-ray

- nose has break

Patient takes prescriptions and proceeds to hospital radiology department ENT
Activity - Radiology

Schlemazel
- Registers
- Presents les.
- Pay co-pay.
- Take prescriptions
- Get report

PCP
- Contact PCP
- Conduct exam
- Prepare prescriptions
- Need for follow-up

Radiology
- Creates/Retrieves Medical Record
- Record insurance
- Examine
- Prognosis
- Process Insurance Claim

Insurance
- «requirement» Office visit
- Radiology visit
- «requirement» Insurance Claim

SEI Presentation (Basic)
Author, Date
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A Medical Story – Chapter 4a

Walking down the street one morning, a Schlemazel Trips Over His Own Feet
The sidewalk immediately comes up and strikes the Schlemazel in the face.
Unfortunately for the Schlemazel, his chin and nose take the brunt of the impact.

Symptoms
- some swelling
- minor bleeding
- sore hand (must have tried to stop the sidewalk)

Call to doctor’s ENT office
- “If you are otherwise all right, we can see you today or tomorrow between four and seven days. Even if it’s broken, nothing can be done until swelling relieves.”

Patient retrieves radiology report from radiology
A Medical Story – Chapter 4b

The patient checks in

- presents insurance card (at least the Schlemazel has decent insurance)
- makes co-payment (not that good)
- taken to exam room with medical chart

Presents radiology report

Assistant performs preliminaries and records in paper chart

- weight, vitals, etc.
- reason for visit

Doctor examines patient

- nose appears undamaged but may still be broken
- reviews x-ray
- if broken, prescribes follow-up with ENT
- records incident report in chart

Patient takes prescriptions and proceeds to hospital radiology department.

Nose broken but not displaced. No further treatment required.
### Activity – ENT (with common tasks and patterns)

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduling (PCP &amp; ENT)</td>
<td>Processing Insurance (all)</td>
</tr>
<tr>
<td>Registering</td>
<td>Examination (all)</td>
</tr>
<tr>
<td>Maintaining Medical Record (all)</td>
<td>Managing Medical Record?</td>
</tr>
<tr>
<td>Report referral (radiology and ENT)</td>
<td></td>
</tr>
</tbody>
</table>

**Tasks**
- Scheduling (PCP & ENT)
- Registering
- Maintaining Medical Record (all)

**Patterns**
- Processing Insurance (all)
- Examination (all)
- Managing Medical Record?
Chapter 5 – Medical Records

PCP - no electronic medical records other than
- patient profile
- insurance records

Radiology - extensive electronic medical record
- Patient profile – next visit of patient to hospital brought up referring physician as PCP
- Diagnostic results – delivered via CD for ENT
  - X-rays
  - facsimile of referral orders
  - Radiology report

ENT - no electronic medical records other than
- patient profile
- insurance records
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  • Use cases and Patterns

Use cases → Services → Decision Support
  • Goals
  • Use cases (with variation points) to Services
  • Activity patterns to common use cases (with variation points)

Product line goals
  • Achieving systematic reuse
  • Evolutionary approach
Goals

Generalize tasks based on variations across practices (swim lanes)
Use tasks to identify potential services
Understand variations within each service
Link services via patterns
Use patterns to identify potential decision services

For SOA

• create services for use across applications and practices
• support reuse through reusability that is built in
• Lay ground for development of multiple, related systems (i.e., product line)
  from core asset base of services
Use Cases with Variations

Actors – PCP, ENT, Radiology, Medical Record system, Patient

Tasks

- Scheduling
  - (PCP & ENT) schedule appointment
  - (radiology) schedule patient
  - vary by activities each generates
- Registering
  - (PCP, ENT, radiology) new/returning patient
  - vary by information required and produced
- Maintaining Medical Record
  - (PCP, ENT, radiology) new/returning patient
  - vary by information required and produced

Tasks may be modeled as use cases with extensions for variations depending on actors
Schedule Event Use Case

Scenario for Radiology Schedule Patient

<table>
<thead>
<tr>
<th>Actor</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient requests exam</td>
<td>System places patient in queue for that exam category (variations for pediatric, neo-natal, etc.). Schedules technician work flow.</td>
</tr>
<tr>
<td>Option: Radiology performs pre-exam activity</td>
<td>Updates record with pre-exam results</td>
</tr>
<tr>
<td>Technician performs exam</td>
<td>Updates record with exam results</td>
</tr>
<tr>
<td>Optional: Patient provides time</td>
<td>Optional: Schedule clinical consultation</td>
</tr>
<tr>
<td>Optional: Radiology accepts reminder. Submits analysis</td>
<td>Send reminder to clinician to follow up with PCP. Optional: consultation.</td>
</tr>
<tr>
<td>Optional: Schedule next reminder to patient</td>
<td>Forwards report</td>
</tr>
</tbody>
</table>
Features of Scheduling Service

Capabilities
- Workflow management by exam types and options
- Resource management and availability
- Balancing needs/priorities against resources
- Publish tasks
- Set up follow up
- Etc.

Variations

<table>
<thead>
<tr>
<th>Within Radiology</th>
<th>Across Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-exam (e.g., IV, injection, ingestion)</td>
<td>Pharmacy</td>
</tr>
<tr>
<td>Need for clinical consultation</td>
<td>Cardiology</td>
</tr>
<tr>
<td>Patient reminders</td>
<td>Laboratory</td>
</tr>
<tr>
<td>Follow up</td>
<td>Therapy</td>
</tr>
</tbody>
</table>
Pattern: Managing Medical Record

Actors – PCP, ENT, Radiology, 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 Workflow Sequence

1. Use sequence to elaborate services, objects, workflow
2. Develop UIs
3. Refine data schema (XML)
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Product line goals
  • Achieving systematic reuse
  • Product line concepts
  • Evolutionary approach
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.

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

Interview with Dr. James Levin, CIO of Children’s Hospital of Pittsburgh (HIMSS Stage 6): As a CIO of a major medical center, what keeps you awake at night?

• scheduling
• alerts
• escalation
• follow through and follow up

Dr. Lawrence Weed – Managing Medicine, 1984:

• lack of coordination among health care providers - “chain of service” “alerts”
• excessive reliance on memory - “daily schedule”
• lack of recorded logic - “managed work flow” “notes and consistency”
• lack of effective feedback following interventions - “decision and follow up”

Our goal – apply SOA technology to address these issues
Contact Information Slide Format

Presenter / Point of Contact
Sholom Cohen
Research Technology and System Solutions
Telephone: +1 412-268-5872
Email: sgc@sei.cmu.edu

World Wide Web:
www.sei.cmu.edu
http://www.sei.cmu.edu/staff/sgc/index.html

U.S. mail:
Software Engineering Institute
Customer Relations
4500 Fifth Avenue
Pittsburgh, PA 15213-2612
USA

Customer Relations
Email: customer-relations@sei.cmu.edu
Telephone: +1 412-268-5800
SEI Phone: +1 412-268-5800
SEI Fax: +1 412-268-6257