1.264 Lecture 4

Software Process: CMMI, ISO
Case study: Chemical inventory system

- Do you have questions on what happened?
- What are your overall reactions to this?
  - Does it seem familiar? Has this happened to you? Others?
  - What related experiences have you had?
- Discussion items
  - List as many errors that were made by this team as you can.
  - What should the team have done to avoid these errors?
  - What software development process should the team have used? Sketch a rough timeline.
- Summary
Case study: Warehouse management system

- Do you have questions on what happened?
- What are your overall reactions to this?
  - Does it seem familiar? Has this happened to you? Others?
  - What related experiences have you had?
- Discussion items
  - What lifecycle models should you use? Not use?
  - How do estimate the time this system will take?
  - List the major risks
- Summary
Capability Maturity Model for Software

• Developed at Software Engineering Institute (SEI), Carnegie-Mellon University (www.sei.cmu.edu)
• De facto standard for software process assessment
• Five level model
  1: Initial
  2: Repeatable
  3: Defined
  4: Managed
  5: Optimized
• Predictability, effectiveness and control of software processes improve as organization moves up these levels
• Two readings on CMM/CMMI are on the MIT Server.
CMM Motivation

- 20 years of unfulfilled promises about productivity and quality gains from new software technology
- Organizations realized fundamental problem is the inability to manage the software process
- CMM provides guidance on how to evolve toward a culture of software engineering and rational management
CMM Level 1: Initial

- Ad hoc, occasionally chaotic
- Few processes defined
- Success depends on individual effort and heroics
CMM Level 2: Repeatable

- Basic project management processes established to track cost, schedule, functionality
- Discipline in place to repeat earlier successes on projects with similar applications
- Key processes focus on basic project management controls
  - Requirements management: initial spec, change control
  - Software project planning: resource estimation based on past performance
  - Software project tracking and oversight
  - Software subcontract management
  - Software quality assurance: code reviews, test plans, tracking
  - Software configuration management
- At level 2, you can measure what’s going on, and that helps understand future projects
CMM Level 3: Defined

- Software process for management and development is documented, standardized and integrated into an overall process for the organization
- All projects use approved, tailored version of standard process
- Key process areas focus on institutionalizing effective process
  - Organization process: spiral model, tracking, control
  - Training program: managers, analysts, developers
  - Integrated software management: lines of code, defects, time,…
  - Software product engineering: alternative designs, scopes…
  - Intergroup coordination: Web, database, analyst, coder, customer
  - Peer reviews: initiate at requirements, design, QA. Continue code reviews
- At level 3, you begin to have some control; you can actually predict times/costs for new projects and make some choices on how to approach them (fastest, most efficient, nominal…)
CMM Level 4: Managed

- Detailed measures of software process and product quality are collected
- Process and products are quantitatively understood and controlled
- Key processes focus on quantitative understanding of process
  - Quantitative process management: measure and manage time at all stages: requirements, design, code, QA
  - Software quality management: reviews at all stages, tests and traceability at all stages
- At level 4 you have real control: you can measure and manage all aspects of the project
CMM Level 5: Optimizing

- Continuous process improvement through quantitative feedback
- Piloting innovative technology and ideas
- Key process areas focus on continual process improvement
  - Defect prevention (‘extreme programming’, refactoring, reviews)
  - Technology change management (new tools, training, pilots, tests, knowledge sharing)
  - Process change management
- At level 5, you not only have control but are efficient
With well-defined processes, performance improves in Level 3 organizations.

Based on quantitative understanding of process and product, performance continues to improve in Level 4 organizations.

Performance continuously improves in Level 5 organizations.

Schedule and cost targets are typically overrun by Level 1 organizations.

Plans based on past performance are more realistic in Level 2 organizations.

Figure by MIT OCW.
Maturity Profile by All Reporting Organizations

Figure by MIT OCW, adapted from Carnegie Mellon University, Software Engineering Institute.
Trends in the Community Maturity Profile

Figure by MIT OCW, adapted from Carnegie Mellon University, Software Engineering Institute.
Time to Move Up

Number of months to move to next maturity level

Recommended time between appraisals

Time Period of Initial Appraisal

Level Orgs

1 to 2 2 to 3 1 to 2 2 to 3 2 to 3 2 to 3 2 to 3 2 to 3
1 to 2 3 to 4 3 to 4 3 to 4 3 to 4 3 to 4 3 to 4 3 to 4
25 12 170 255 60 62 195 267 62 62

Largest observed value that is not an outlier

75th Percentile

Median 26th Percentile smallest observed value that is not an outlier

Figure by MIT OCW, adapted from Carnegie Mellon University, Software Engineering Institute.
ISO 9001:2000

• International Standards Organization (ISO)
  National standards bodies from 100+ countries
• ISO 9001:2000
  First major modification in 20 years occurred in 2000
  No longer primarily a manufacturing standard, with military origins, implemented as books of procedures
  New standard addresses all products and services in all industry segments
  The old standards have been dropped (9002, 9003, etc.)
• The new standard requires:
  Process approach
  Customer focus
  Continual improvement
  (The old standard didn’t really require anything!)
ISO 9000 cont

• ISO 9000 certification mandatory to do business in Europe, and becoming so in Pacific Rim and eventually Americas

• General approach
  
  Create a quality steering team in management
  Create project plan for ISO 9000 certification
  Perform gap analysis (good process vs current process)
  Write needed quality manuals and system procedures
    Often takes 6-12 months
  Train employees in new procedures
  Use new materials, retain records for at least 3 months
  Sweep facility for uncontrolled documents, uncalibrated equipment, etc. before registrar visit

Registrar visit certifies compliance