EEC 521/421: Software Engineering

The Software Process

The Top Thrill Dragster

- 420 ft tall
- Max speed over 120 mph
- World’s second fastest roller coaster
Roller Coaster Process

- The park conceptualizes what it wants
- Hires a company to build it; communicates its concept to the builder
- Builder plans the coaster, and communicates its plans and the budget to park for approval
- Builder then makes models of the coaster and makes sure that all the requirements are met
- The models also help understand the physics a little better than plain calculations
- The actual coaster is built, and tested
- The coaster is delivered to the park and is opened to public

What is a Software Process?

- A series of **predictable** steps that helps produce a timely, high-quality result
- What are the actual steps?
  - Differs from one process model to another
- Important because it provides stability, control and organization

"A **process** defines who is doing what, when, and how to reach a certain goal" – Ivar Jacobson, Grady Booch, and James Rumbaugh
Software Engineering:
A Layered Technology

Software requirements are embodied knowledge that is initially dispersed, tacit, latent, and incomplete.

Software engineering encompasses a process, management and technical methods, and tools.

Generic Software Engineering Phases

- The definition phase
  - What product is going to be built?
- The development phase
  - How will the product be built, and how will it be tested?
- The support phase
  - Incorporate changes from the four sources of change.
    - Correction
    - Adaptation
    - Enhancement
    - Prevention
Process Framework

- Provides the foundation for a complete software process
  - Identifies framework activities
    - Applicable to all software projects
    - Defines a set of software engineering actions
    - Each action has a set of work tasks
  - Defines umbrella activities
    - Applicable to the process across all process stages
    - Focus is on project management, tracking, and control

Generic Framework Activities

- Communication
  - Communication/collaboration with customer
- Planning
  - Technical tasks, risks, resource requirements, schedule, etc.
- Modeling
  - Design, models, prototypes, customer feedback
- Construction
  - Coding, testing
- Deployment
  - Delivery
Umbrella Activities

- Software project tracking and control
- Risk management
- Software quality assurance
- Formal technical reviews
- Measurement
- Software configuration management
- Reusability management
- Work product preparation and production

Process Variety

- Prescriptive models
  - CMMI
  - Waterfall model
  - Spiral model
  - The Unified Process
  - Formal methods
  - In general, more disciplined, and more rules

- Agile models
  - Extreme programming
  - Adaptive software development
  - Scrum
  - Feature-driven Development
  - Fewer rules, focus on end product
SEI CMMI

- Level 0: Incomplete
  - No process
- Level 1: Performed
  - Specific goals of process area are performed
- Level 2: Managed
  - Work in process area conforms to a defined policy
- Level 3: Defined
  - The process is tailored to the specific organization
- Level 4: Quantitatively Managed
  - Quantitative objectives are established and reviewed
- Level 5: Optimized
  - Process is adapted and optimized based on statistical evidence

Process Improvement Benefits

- The quality of a system is highly influenced by the quality of the process used to acquire, develop, and maintain it.
- Process improvement increases product and service quality as organizations apply it to achieve their business objectives.
- Process improvement objectives are aligned with business objectives.

Source: SEI CMMI website
CMMI Benefits

- Explicitly link management and engineering activities to business objectives
- Expand the scope of and visibility into the product lifecycle and engineering activities to ensure that the product or service meets customer expectations
- Incorporate lessons learned from additional areas of best practice (e.g., measurement, risk management, and supplier management)
- Implement more robust high-maturity practices
- Address additional organizational functions critical to their products and services
- More fully comply with relevant ISO standards

Source: SEI CMMI website

Process Patterns

- A consistent template for describing important characteristics for the software process
- Provides suggested solutions to recurring problems in the software process e.g., customer-communication, project-team assembly
- Can be reused in several different contexts
Software Process Assessment

- Standard CMMI Assessment Method for Process Improvement (SCAMPI)
- CMM-Based Appraisal for Internal Process Improvement (CBA IPI)
- SPICE (ISO/IEC 15504)
  - Software Process Improvement and Capability Determination
- ISO 9001:2000 for software

Final thought

- Roller coasters have a one in a billion-and-half chance of a fatal accident
- The prime reason for this stat is the maturity of the process
Reading Assignment