1.264 Lecture 1

Course introduction
Engineering process management

Next class: Read Rapid Devt chapters 1-3. Hand in case study 1, 2 by noon before class

Course outline

- **Staff:**
  - **George Kocur**
  - **Yin Wang**
- **No prerequisite; familiarity with Windows assumed**
- **Grading:**
  - **10 homework sets (40%). Submit online, <u>one per group</u>.**
  - **Active learning (10%). Submit online, <u>individually</u>.**
    - **Upload before (case studies) or after class (in-class software)**
  - **Midterm (25%)**
  - **Final exam (25%)**
- **Bring your laptop to class starting with lecture 6**
  - **Work with a partner or by yourself**

Course goals

- **Design, implementation and management of engineering and business systems. Audiences:**
  - **Engineers and developers: 'big picture' systems skills**
  - **Managers: understand technology to manage effectively**
- **This is an engineering course**
  - **You will build a system over the course of the term**
  - **Managers may not build systems in future careers, but there is value in knowing how, and having an appreciation of what it takes**
    - **E.g., Mobile apps: very common, often done without IT**
  - **No software coding, but we explore system models, databases, Web services, security in some detail**

Course goals, p. 2

- **Scope of material covered is large**
  - **Engineers will find the beginning slow and 'soft'**
  - **Managers will find the end fast and detailed**
  - **We try to bridge the gap for each group**
- **Supply chain management (SCM):**
  - **SCM is a subset of business process management (BPM)**
  - **BPM is information- and systems-intensive**
- **Transportation and other engineering:**
  - **Systems have multiple aspects: hardware, software, telecom, data, people, …**
  - **We cover models for doing this well for complex systems**
- **We cover processes and technologies to prepare you for these roles**
  - **My background: telecom, transportation, software, RFID; industry, academic, consulting**

Topics

- **Engineering process change: rapid development methods**
  - **Develop, configure or manage software, business, and engineering projects**
  - **Unified modeling language (UML) for requirements, process modeling, communication among stakeholders**
- **Data modeling and databases**
  - **Business/system rules, normalization: database correctness**
  - **Query language (SQL) to build and query databases**
- **Web-oriented software process for development and configuration**
  - **Web technology: pages, documents, business rules, XML**
  - **Web services, service oriented architectures (SOA)**

Topics, p.2

- **System architecture (software)**
  - **Servers, benchmarks, cloud computing**
  - **Mapping business needs to systems, databases**
- **Security process and software**
  - **Framework, protocols, attacks, secrecy/privacy, crime**
  - **Internet security**
- **Communications networks and services**
  - **Core technologies: fiber, wireless, CATV, satellite…**
  - **Networks: local, metro, wide area, enterprise networks**
  - **Protocols: Ethernet, TCP, IP, 3G/4G, …**

Homework (project)

- **Work in teams of two (1 and 3 allowed by exception)**
  - **Choose your partner this week. Ask TA to match you if you don't find a partner.**
  - **You must get permission from the instructor to have a 1 or 3 person team**
- **Build a system for an aircraft parts distributor**
  - **First cycle of 'spiral model' of system development**
  - **Take 3 months to specify, design, prototype and assess**
    - **And learn about the process and technologies**
  - **After first cycle, you could build an operational system**
    - **Your prototype would almost be ok for a small operation**
    - **If implementing a large supply chain (SCM) or transportation or other system, you follow the same steps**

Homework

1. System development process case studies
2. System requirements narrative
3. UML models (Visual Paradigm)
4. Data modeling (Visual Paradigm)
5. Database development, queries (MS SQL Server)
6. Web: static pages, styles (MS Web Developer)
7. Web: data-driven pages (MS Web Developer, SQL Server)
8. Web: services, XML (MS Web Developer)
9. Security: protocols (processes), risks
10. Enterprise/global communications; process retrospective

Readings, computer systems

- **Books:**
  - McConnell *Rapid Development*
  - Fowler *UML Distilled 3rd ed*
  - *Murach SQL Server 2008 or 2012*
  - Spaanjaars*, Beginning ASP.NET 4.5*
  - Anderson *Security Engineering, 2nd ed*
  - Green *Handbook of Telecom, 5th ed*
- **Software: download and install. Office hours will help.**
  - Visual Paradigm
  - Microsoft SQL Server
  - Microsoft Visual Web Developer
- **Web site**
  - Lecture notes
    - Posted before lecture without solutions
    - Posted after lecture with solutions
  - Download cases, data, etc. before many classes
  - Upload solutions before (12 noon) or after (5pm) each class
 - Homework, online readings, all other materials

A quick quiz

- **What percentage of large projects have excess schedule pressure?**
  - 25%   50%   75%   100%
- **What percentage of small projects have excess schedule pressure?**
  - 25%   50%   75%   100%
- **What percentage of large projects deliver on time and on budget?**
  - 25%   50%   75%   100%
- **What percentage of large projects are cancelled or fail to deliver at all?**
  - 25%   50%   75%   100%
- **What staff increase is necessary to speed up a schedule by 25%?**
  - 25%   50%   75%   100%
- **How much are resource needs reduced by cutting project scope in half?**
  - 25%   50%   75%   100%
- **How much have companies reduced time to market through better software practices in the last 10 years?**
  - 25%   50%   75%   100%

Answers to a quick quiz

- **What percentage of large projects have excess schedule pressure?**
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Project outcomes
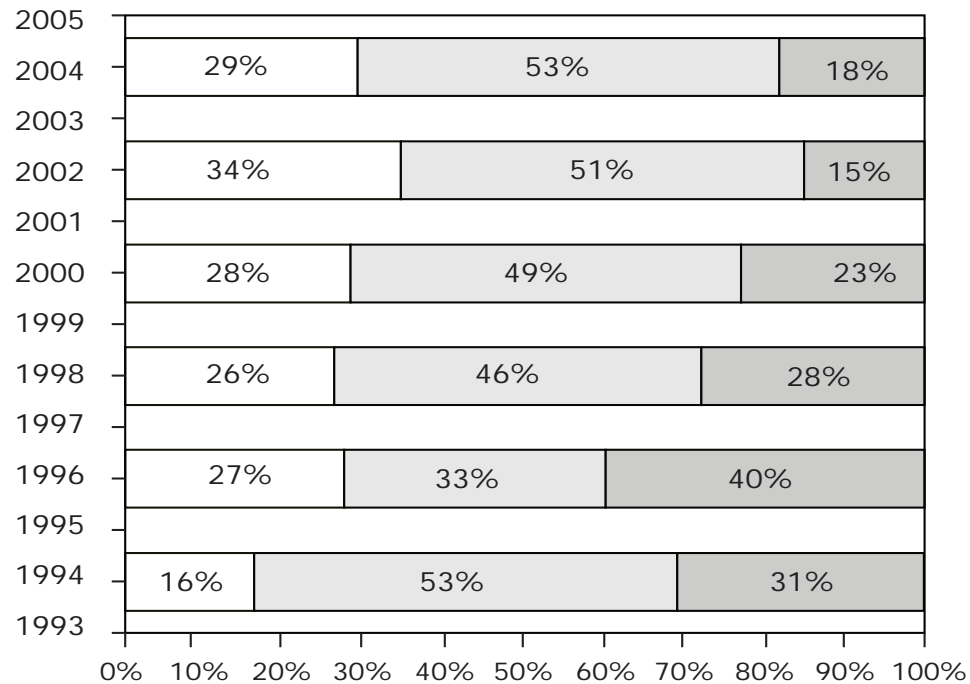
Results of the Standish Group CHAOS Report from 1994 to 2004.

- ○ Completed on time and within budget
- ◔ Late, over budget, or with features missing
- ◕ Canceled before completion

Image by MIT OpenCourseWare.

Steadily increasing use of spiral and other iterative models.

System development process

- **System development is often more demanding than consulting or analysis**
  - System development process has applications and lessons for project management more generally
  - Systems can't be built the night before, like (bad) reports
  - Systems can't be down-scoped at the last minute, with chapters or analyses simply left out, or done very simply
- **Tolstoy (Anna Karenina)**
  - "Happy families are all alike; every unhappy family is unhappy in its own way."
- **Successful projects involving system development or management rely on making no major mistakes**
  - You don't have to do anything perfectly or optimally but you can't make any major mistakes.
  - We cover many topics so you've seen each major topic at least once. Our books are standard references.

What are the four dimensions of development/implementation speed?

- **Key factors that determine how well and how quickly you will develop, configure, implement or manage a project, in order of importance:**

  1. _____
  2. _____
  3. _____
  4. _____

Dimensions of development speed

- **People**
  - **Matter the most: ability, motivation, management**
- **Process**
  - **Fundamentals, risk management, lifecycle planning**
  - **"Implement/code like hell" and chaos are still the most common approaches**
- **Product**
  - **Size and characteristics, phasing**
- **Technology**
  - **Product development/implementation environment**
  - **Tools**

C L A S S I C M I S T A K E S			
People-Related	Process-Related	Product-Related	Technology-Related
Heroics	Contractor failure	Feature creep	Silver-bullet syndrome
Weak personnel	Inadequate design	Developer gold-plating	Lack of automated source-code
Wishful thinking	Insufficient planning	Requirements gold-plating	Switching tools in the middle of a project
Lack of user input	Planning to catch up later	Push-me, pull-me negotiation	Overestimated savings from new tools or methods
Undermined motivation	Overly optimistic schedules	Research-oriented development	
Noisy, crowded offices	Code-like-hell programming		
Unrealistic expectations	Insufficient risk management		
Lack of stakeholder buy-in	Abandonment of planning under pressure		
Politics placed over substance	Shortchanged upstream activities		
Adding people to a late project	Insufficient management controls		
Lack of effective project sponsorship	Wasted time during the fuzzy front end		
Friction between developers and customers	Premature or overly frequent convergence		
Uncontrolled problem employees	Omitting necessary tasks from estimates		
	Shortchanged quality assurance		

Technical fundamentals

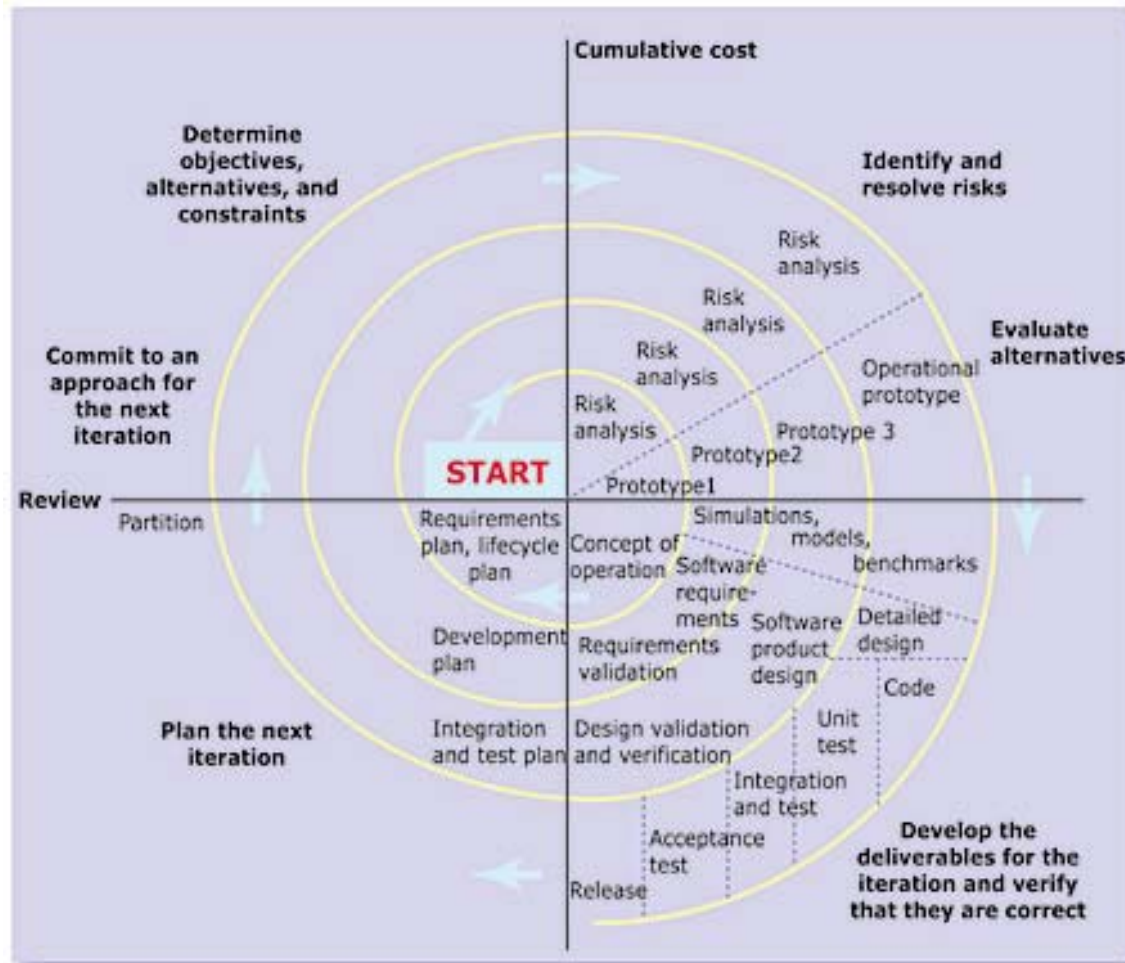Spiral model as basis for development

Image by MIT OpenCourseWare.

For next class

- **Read McConnell chapters 1-3**
  - **Used in mechanical design, entrepreneurship, …**
- **Read case study posted on course Web site**
- **Be prepared to discuss it in class**
- **Upload your case study answers to the course Web site Friday by 12 noon**
  - **See the syllabus for which lectures require uploads before class (12 noon) versus after class (5pm)**
  - **We give you an hour grace period**

Glossary

- **SCM: Supply Chain Management**
- **BPM: Business Process Management**
- **UML: Unified Modeling Language**
- **SQL: Structured Query Language (database)**
- **XML: Extensible Markup Language (Web)**
- **SOA: Service Oriented Architecture (Web)**
- **CATV: Cable TV**
- **TCP: Transmission control protocol (Internet)**
- **IP: Internet protocol**
- **3G/4G: 3rd/4th generation wireless data service**

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