

 POLITECNICO DI MILANO

Dipartimento di
Elettronica e Informazione

Planning and Managing Software Projects 2012-13
Class 5

Planning Phase – Part 1

Project Phases and Lifecycle Planning

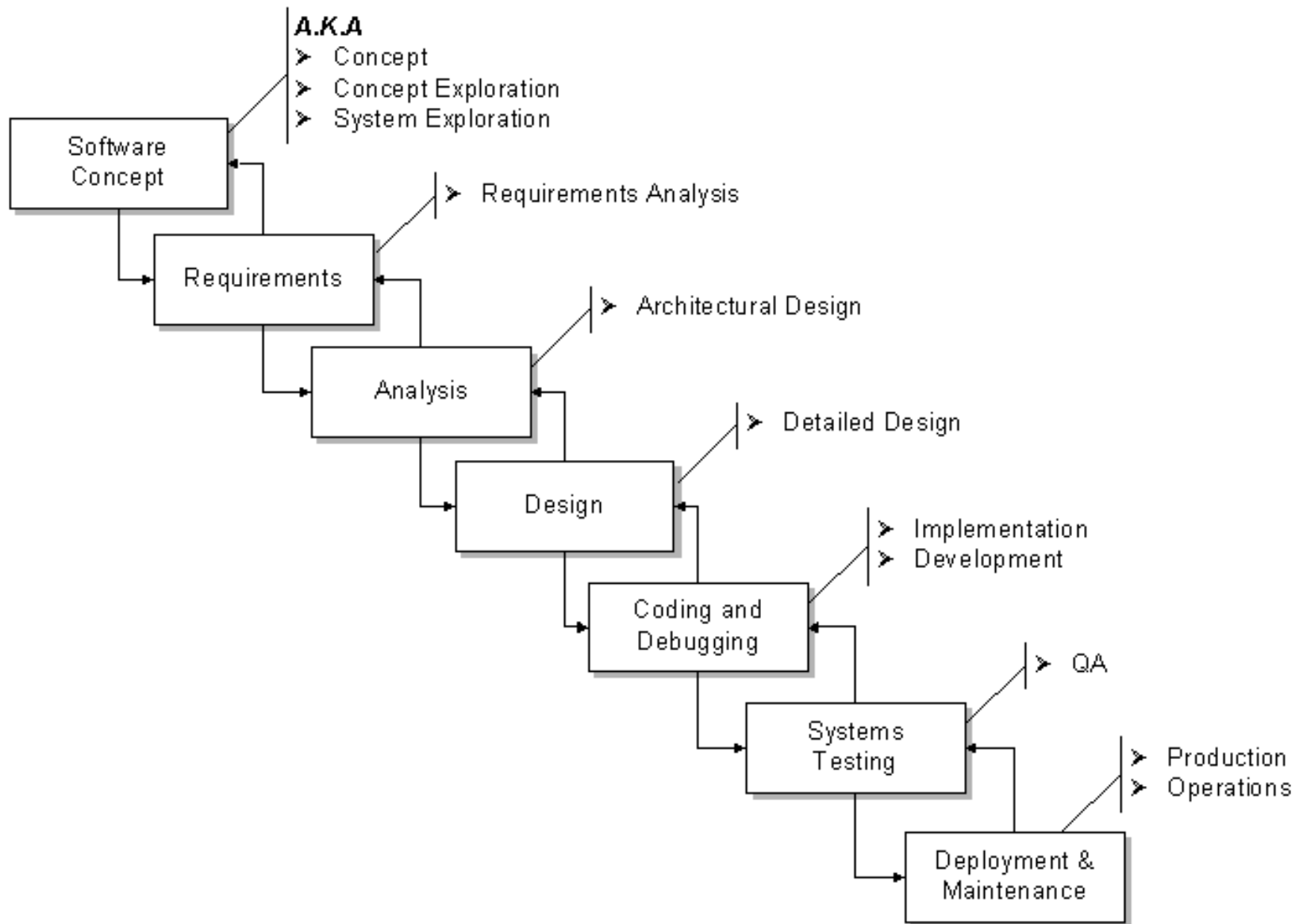
Emanuele Della Valle
<http://emanueledellavalle.org>

- This slides are largely based on Prof. John Musser class notes on “Principles of Software Project Management”
- Original slides are available at <http://www.projectreference.com/>
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- Today
 - Phases in Detail
 - Step-by-step of typical software project
 - Lifecycles
- Next Class
 - Matching Lifecycles to Project
 - Project plans
- Next Weeks:
 - Lots of Project-ish Details: WBS, PERT, CPM, Scheduling & Estimation

- PMI Fundamentals
- PMI Processes
- Project and Organizations
 - Functional, Project, Matrix organizations
 - Role of PM in this type of organizations
- Project Selection
- Project Portfolio Management
- Procurement Management
- Initial documents
 - Statement of Work (SOW)
 - Project Charter

Project Phases



Time Allocation by Phase

- Remember the 40-20-40 Rule
 - Specification-Implementation-Test

	Planning	Code & Unit Test	Integration & Test
Commercial DP	25%	40%	35%
Internet Systems	55%	15%	30%
Real-time Systems	35%	25%	40%
Defense Systems	40%	20%	40%

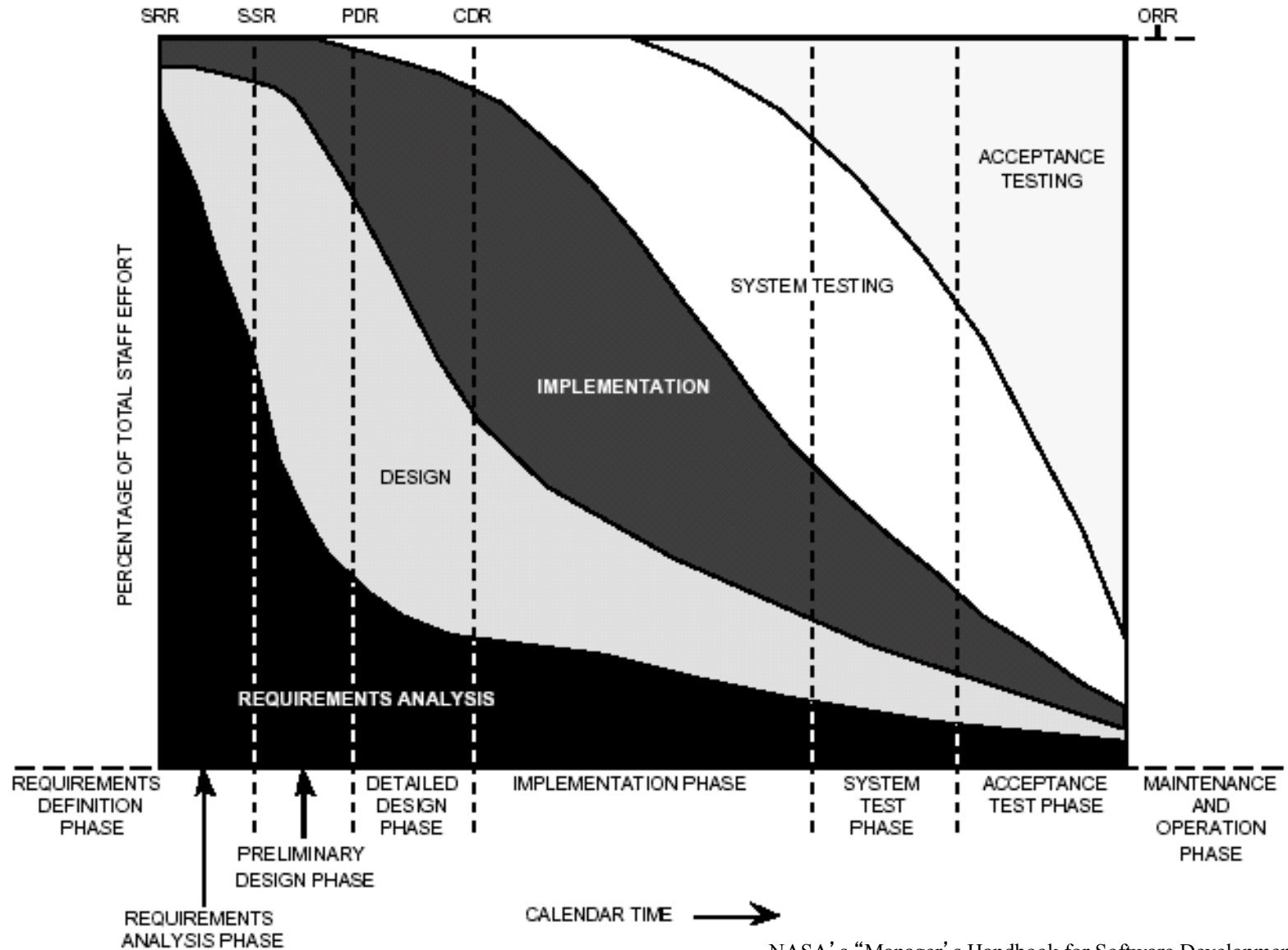
Bennatan, E.M, "On Time Within Budget"

Time Allocation by Phase

Activity	Small Project (2.5K LOC)	Large Project (500K LOC)
Analysis	10%	30%
Design	20%	20%
Code	25%	10%
Unit Test	20%	5%
Integration	15%	20%
System test	10%	15%

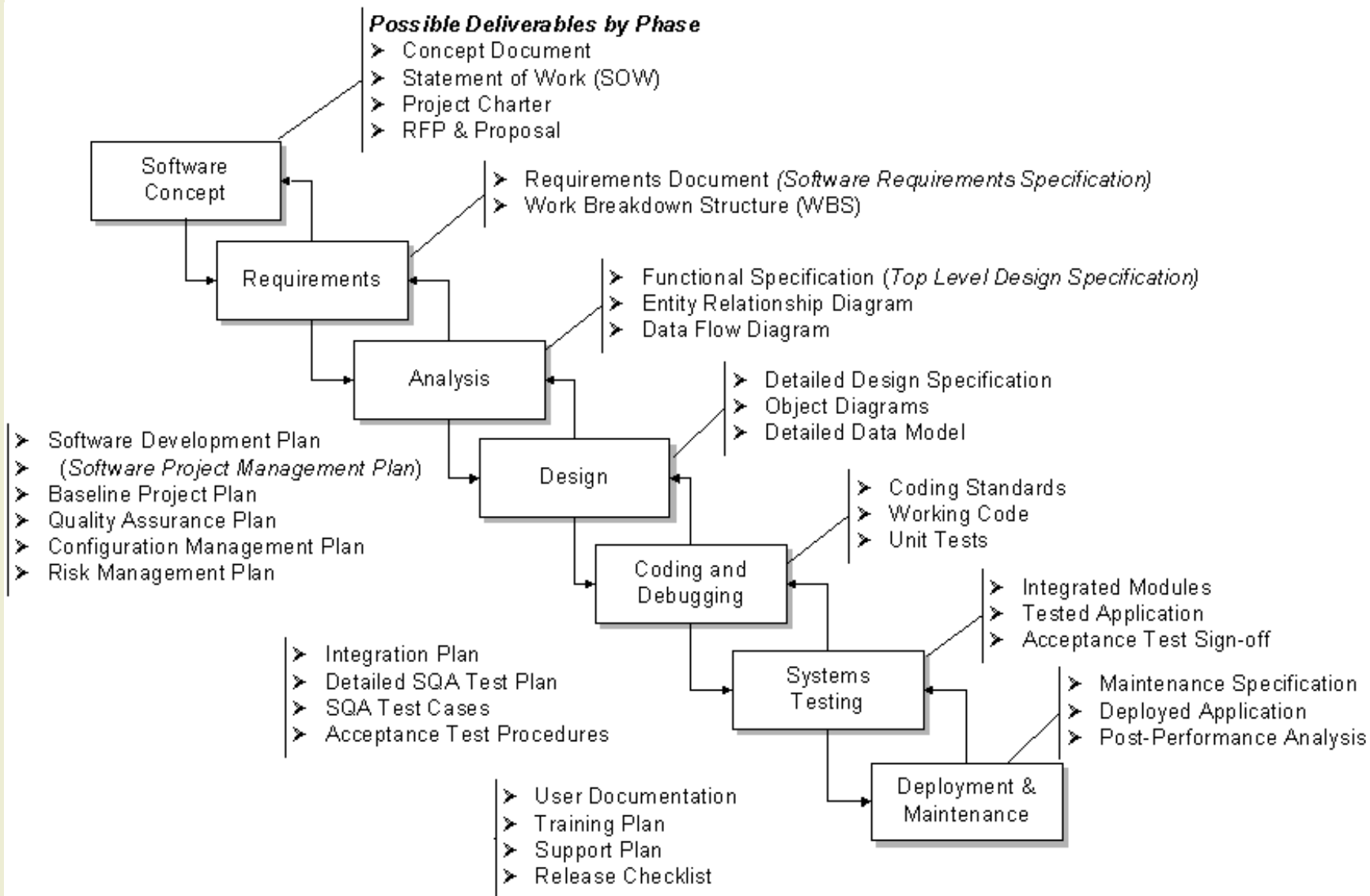
McConnell, Steve, "Rapid Development"

Activities by % of Total Effort



NASA's "Manager's Handbook for Software Development"

Potential Deliverables by Phase



Concept Exploration Phase 1/3

- The “Why” phase
- Not a “mandatory formal” phase
 - Sometimes called the “pre-project” phase
- Collecting project ideas
 - Then the “funneling” process
- Project Justification
 - Cost-benefit analysis
 - Project Portfolio Matrix
 - ROI
- Initial planning and estimates

Concept Exploration Phase 2/3

- Possibly includes Procurement Management:
 - RFP Process
 - Vendor selection
 - Contract management
- Gathering the initial team
 - Including PM if not already on-board
- Identify the project sponsor
 - Primary contact for approval and decision making
- Potential Phase Outputs:
 - Concept Document, Product Description, Proposal, SOW, Project Charter

Concept Exploration Phase 3/3

- Characteristics & Issues
 - Lack of full commitment and leadership
 - Some frustrations:
 - Management only getting rough estimates from development
 - Development not getting enough specifics from customer
 - Finding a balanced team
 - Budget sign-off may be your 1st major task as PM

- Achieved via:
 - Good concept document or equivalent
 - Demonstration of clear need (justification)
 - Initial estimates

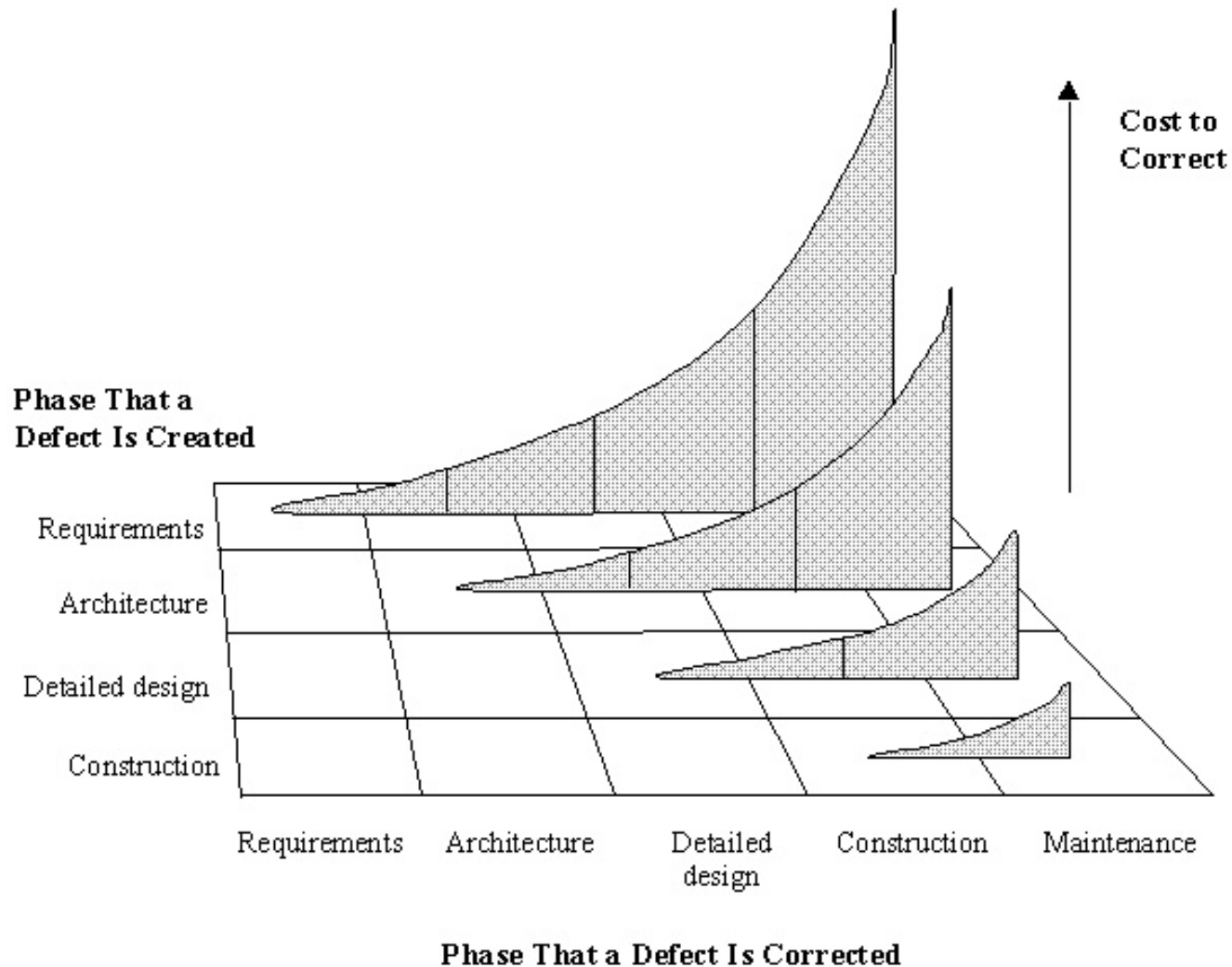
Requirements Phase

- The “What” phase
- Inputs: SOW, Proposal
- Outputs:
 - Requirements Document (RD)
 - a.k.a. Requirements Specification Document (RSD)
 - Software Requirements Specification (SRS)
 - 1st Project Baseline
 - Software Project Management Plan (SPMP)
 - Requirements Approval & Sign-Off
 - Your most difficult task in this phase

More on Requirements Phase

- Perhaps most important & difficult phase
- Shortchanging it is a ‘classic mistake’
- Can begin with a Project Kickoff Meeting
- Can end with a Software Requirements Review (SRR)
 - For Sponsor and/or customer(s) approval

Why are Requirements so Important?



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- Conflict of interest: developer vs. customer
- Potential tug-of-war:
 - Disagreement on Features & Estimates
 - Especially in fixed-price contracts
- Frequent requirements changes
- Achieving sign-off
- Project planning occurs in parallel

- **Requirements are capabilities and condition to which the system** – more broadly, the project – **must conform**

2 Types of Requirements

- Functional (behavioral)
 - Features and capabilities
- Non-functional (a.k.a. “technical”) (everything else)
 - Usability
 - Human factors, help, documentation
 - Reliability
 - Failure rates, recoverability, availability
 - Performance
 - Response times, throughput, resource usage
 - Supportability
 - Maintainability, internationalization
 - Operations: systems management, installation
 - Interface: integration with other systems
 - Other: legal, packaging, hardware

- Other ways of categorizing
 - Go-Ahead vs. Catch-up
 - Relative to competition
 - Backward-looking vs. Forward-looking
 - Backward: address issues with previous version
 - Forward: Anticipating future needs of customers
- Must be prioritized
 - Must-have
 - Should-have
 - Could-have (Nice-to-have: NTH)
- Must be approved
- An example I'm proud of
 - <http://www.service-finder.eu/attachments/D1.1.pdf>
 - You may find it a bit gold-plated, you may be right

Early Phases Meetings

- Project Kickoff Meeting
- Project Brainstorming Meeting
 - Clarify goals, scope, assumptions
 - Refine estimates
- WBS Meeting

Analysis & Design Phase

- The “How” Phases
- Inputs: Requirements Document
- Outputs:
 - Functional Specification
 - Detailed Design Document
 - User Interface Specification
 - Data Model
 - Prototype (can also be done with requirements)
 - Updated Plan (improved estimates; new baseline)

More on Analysis & Design Phase

- a.k.a. Top-level design & detailed design
- Continues process from requirement definition
- Ends with Critical Design Review (CDR)
 - Formal sign-off
 - Can also include earlier Preliminary Design Review (PDR) for high level design

- Enthusiasm via momentum
- Team structure and assignments finalized
- Delays due to requirements changes, new information or late ideas
- Issues around personnel responsibilities
- Unfeasible requirements (technical complexity)
- Resource Issues
 - Including inter-project contention

Development Phase

- The “Do It” phase
- Coding & Unit testing
- Often overlaps Design & Integration phases
 - To shorten the overall schedule
 - PM needs to coordinate this
- Other concurrent activities
 - Design completion
 - Integration begins
 - Unit testing of individual components
 - Test bed setup (environment and tools)
 - Project plans updated
 - Scope and Risk Management conducted

- Characteristics
 - Pressure increases
 - Staffing at highest levels
 - Often a “heads-down” operation

- Issues
 - Last-minute changes
 - Team coordination (esp. in large projects)
 - Communication overhead
 - Management of sub-contractors

Integration & Test Phase

- Evolves from Development Phase
- Often done as 2 parallel phases
 - Partial integration & initial test
- Starts with integration of modules
- An initial, incomplete version constructed
- Progressively add more components

- Integration primarily a programmer task
- Test primarily a QA team task
- Integration:
 - Top-down: Core functionality first, empty shells for incomplete routines (stubs)
 - Bottom up: gradually bind low-level modules
 - Prefer top-down generally
- Tests
 - Integration testing
 - Black & White-box testing
 - Load & Stress testing
 - Alpha & Beta testing
 - Acceptance testing

- final budgeting
- risk management
- training
- installation preparation
- team reduced

- Increased pressure
- Overtime
- Customer conflicts over features
- Frustration over last-minute failures
- Budget overruns
- Motivation problems (such as burnout)
- Difficulty in customer acceptance
 - Especially true for fixed-price contracts

Deployment & Maintenance Phase

- Installation depends on system type
 - Web-based, CD-ROM, in-house, etc.
- Migration strategy
- How to get customers up on the system
 - Parallel operation
- Deployment typically in your project plan,
maintenance not

- Maintenance
 - Fix defects
 - Add new features
 - Improve performance
- Configuration control is very important here
- Documents need to be maintained also
- Sometimes a single team maintains multiple products

- Lack of enthusiasm
- Pressure for quick fixes
- Insufficient budget
- Too many patches
- Personnel turnover
- Regression testing is critical
 - Preferably through automated tools

- a.k.a. Lifecycle Management or Systems Development Life Cycle (SDLC)
- Greatly influences your chance of success
- Not choosing a lifecycle is a bad option
- Three primary lifecycle model components
 - Phases and their order
 - Intermediate products of each phase
 - Reviews used in each phase

- Different projects require different approaches
- You do not need to know all models by name
- You should know how that if given a certain scenario what sort of SDLC would be appropriate
- There are more than covered here
- A lifecycle is not a design, modeling or diagramming technique
 - The same technique (UML, DFD, etc) can be used with multiple lifecycles

- The “granddaddy” of models
- Linear sequence of phases
 - “Pure” model: no phases overlap
- Document driven
- All planning done up-front

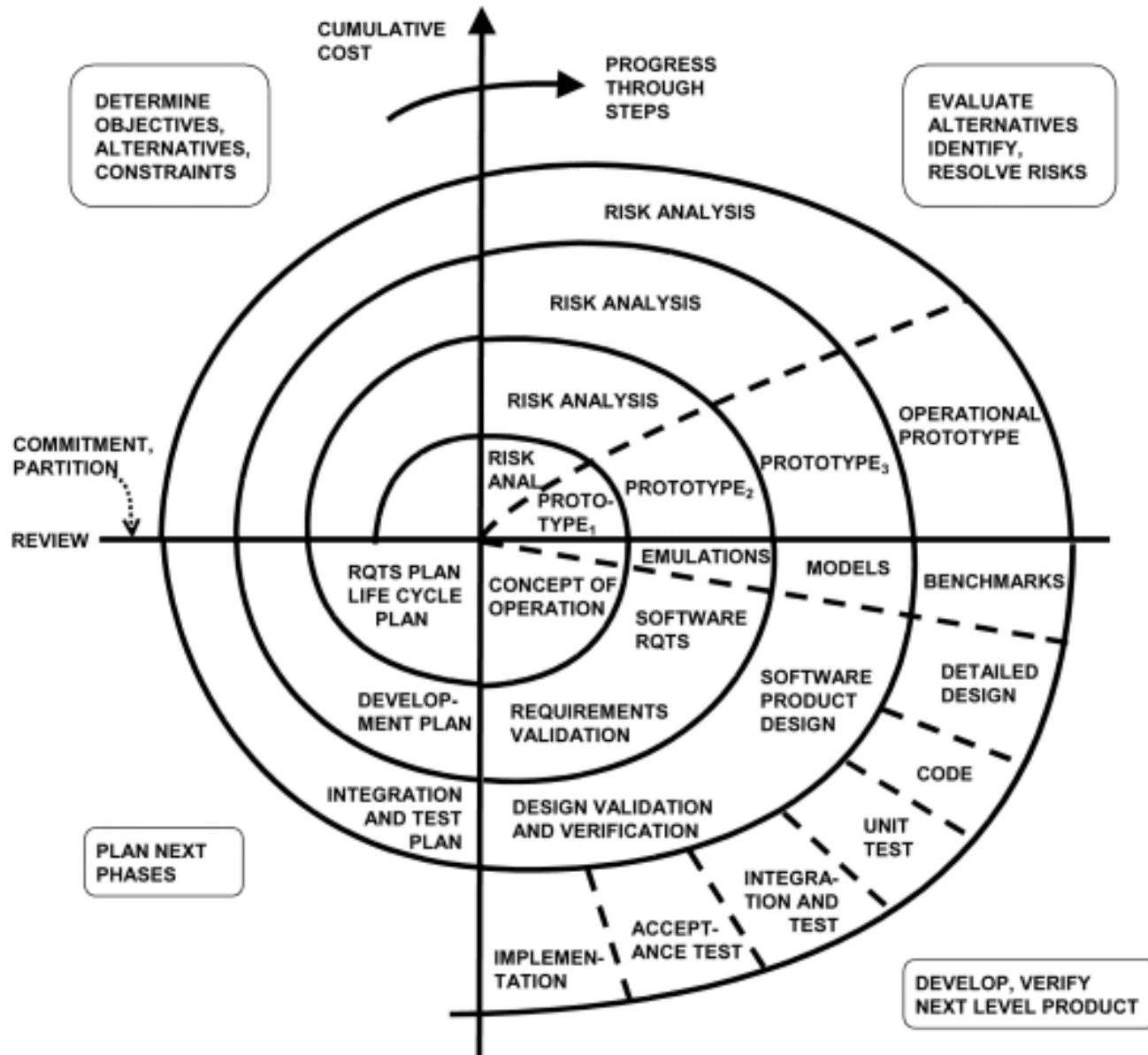
- Why does the waterfall model “invite risk”?
- Integration and testing occur at the end
 - Often anyone’s 1st chance to “see” the program

- Works well for projects with
 - Stable product definition
 - Well-understood technologies
 - Quality constraints stronger than cost & schedule
 - Technically weak staff
 - Provides structure
 - Good for overseas projects

- Disadvantages
 - Not flexible
 - Rigid march from start->finish
 - Difficult to fully define requirements up front
 - Can produce excessive documentation
 - Few visible signs of progress until the end

- “Code-like-Hell”
- Specification (maybe), Code (yes), Release (maybe)
- Advantages
 - No overhead
 - Requires little expertise
- Disadvantages
 - No process, quality control, etc.
 - Highly risky
- Suitable for prototypes or throwaways

Lifecycle Planning Spiral



- Emphasizes risk analysis & mgmt. in each phase
- A Series of Mini-projects
- Each addresses a set of “risks”
 - Start small, explore risks, prototype, plan, repeat
- Early iterations are “cheapest”
- Number of spirals is variable
 - Last set of steps are waterfall-like

- Advantages
 - Can be combined with other models
 - As costs increase, risks decrease
 - Risk orientation provides early warning

- Disadvantages
 - More complex
 - Requires more management

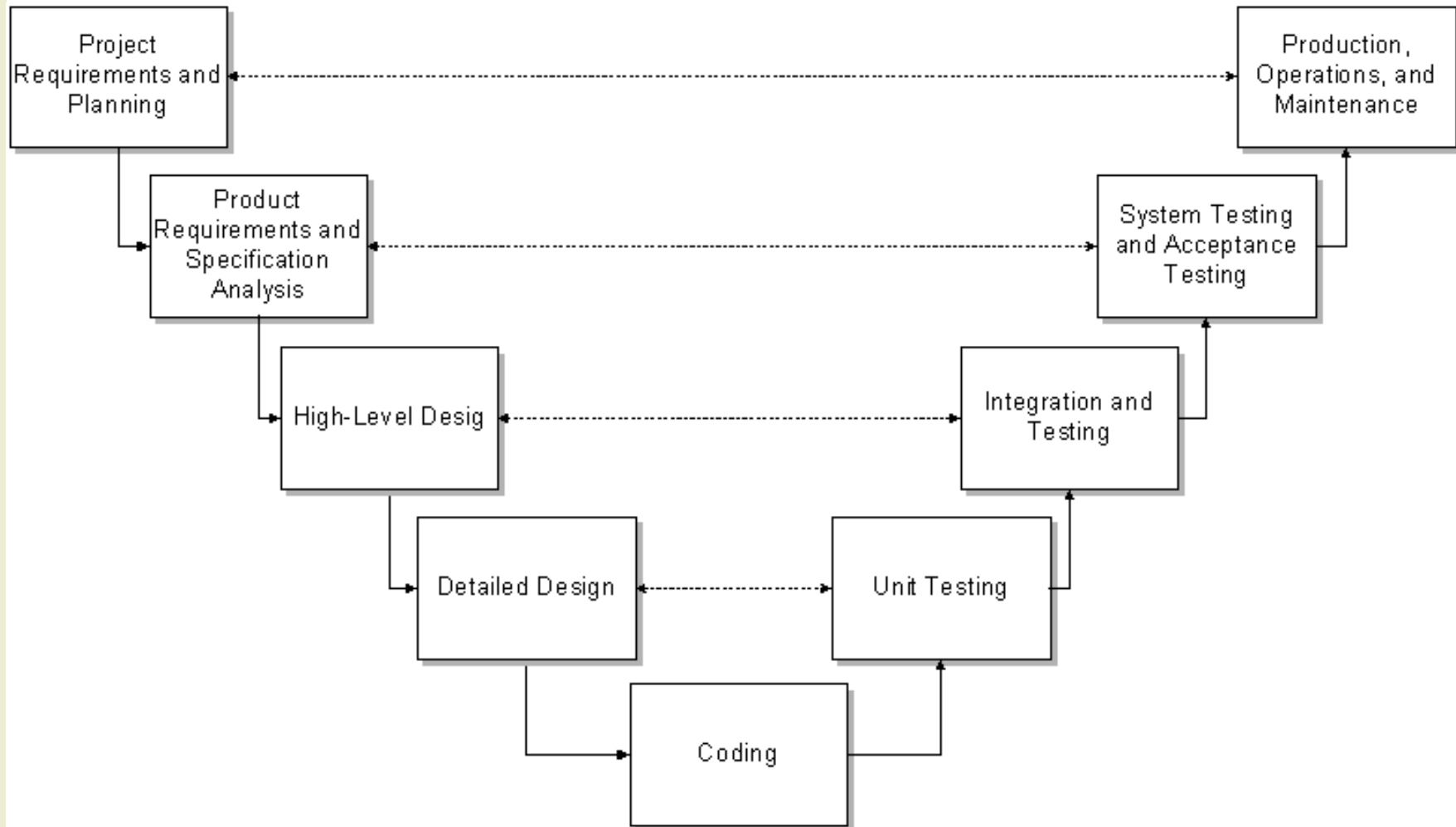
- Overlapping phases
- Advantages
 - Reduces overall schedule
 - Reduces documentation
 - Works well if personnel continuity
- Disadvantages
 - Milestones more ambiguous
 - Progress tracking more difficult
 - Communication can be more difficult

- Design most prominent parts first
 - Usually via a visual prototype
- Good for situations with:
 - Rapidly changing requirements
 - Non-committal customer
 - Vague problem domain
- Provides steady, visible progress
- Disadvantages
 - Time estimation is difficult
 - Project completion date may be unknown
 - An excuse to do “code-and-fix”

- Waterfall steps through architectural design
- Then detailed design, code, test, deliver in stages
- Advantages
 - Customers get product much sooner
 - Tangible signs of progress sooner
 - Problems discovered earlier
 - Increases flexibility
 - Reduces: status reporting overhead & estimation error
- Disadvantages
 - Requires more planning (for you the PM)
 - More releases increase effort (and possible feature creep)
- Similar to Evolutionary Prototyping, but guided by a strong architectural design

Lifecycle Planning

V Process Model

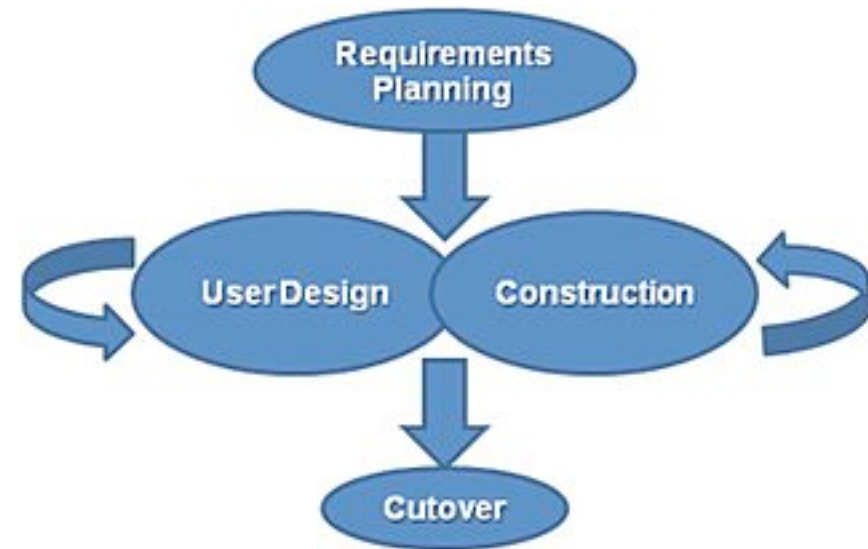


- Designed for testability
 - Emphasizes Verification & Validation (V&V)
- Variation of waterfall
- Strengths
 - Encourages V&V at all phases
- Weaknesses
 - Does not handle iterations
 - Changes can be more difficult to handle
- Good choice for systems that require high reliability such as patient control systems

- Build-vs.-buy decision
- Advantages
 - Available immediately
 - Potentially lower cost
- Disadvantages
 - Not as tailored to your requirements
- Remember: custom software rarely meets its ideal (so compare that reality to COTS option)

- Phases

1. Joint Requirements Planning (JRP)
2. Joint Application Design (JAD)
3. Construction
 - Heavy use of tools, code generators
 - Time-boxed, many prototypes
4. Cutover



- Good for systems with extensive user input available

- Part of movement called “Agile Development”
- A “Lightweight” methodology
- A bit counter-culture
- Currently in vogue
- Motto: “Embrace Change”
- Highly Incremental / Iterative

Extreme Programming Planning/Feedback Loops



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- Suitable for small groups
- Attempts to minimize unnecessary work
- Uses an “on-site” customer
- Small releases
- Pair programming
- Refactoring
- Stories as requirements
- You want good developers if you use this

- Agile here means “lite”, reduced docs, highly iterative
- Agile Software Development
 - Alliance , <http://www.agilealliance.org/home>
 - their “manifesto”, <http://agilemanifesto.org/>
 - their book
<http://www.amazon.com/exec/obidos/ASIN/0201699699/104-2402656-5403151>
- SCRUM
 - Features 30-day “Sprint” cycles
 - See <http://jeffsutherland.org/scrum/>
- Feature Driven Development (FDD)
 - XP with more emphasis on docs and process

- Pros
 - can reduce process overhead
 - Responsive to user feedback
 - Amenable to change

- Cons
 - Requires close monitoring by PM
 - May not “scale” to large projects
 - Often requires better quality developers

- “Iterative software development process” methods has to be “metabolise”
- If the team, the PM and all the stakeholders do not metabolize them, the project risks failing.
- Reading: **“How to Fail with the Rational Unified Process: Seven Steps to Pain and Suffering”**
 - <http://www.ceng.metu.edu.tr/~gtumuklu/web/SE548/Reading%20Material/HowToFailWRational.pdf>