Software Project Management

Lifecycles and Processes - Mapping

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Today's Lecture

- 1. Phases in Detail
  - Step-by-step of typical software project
- 2. Choosing Software Project Lifecycle

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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"

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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"

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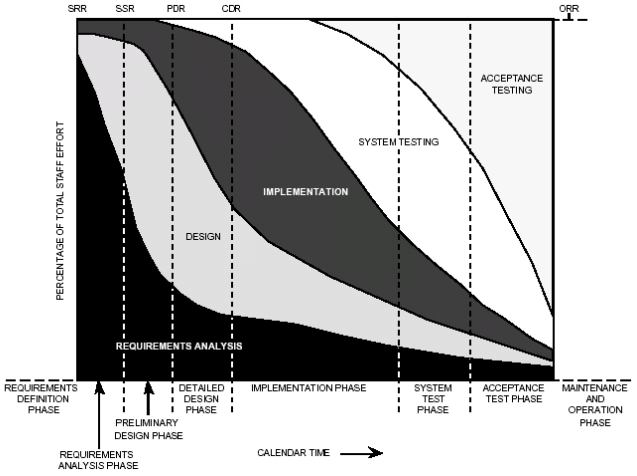
Activities by % of Total Effort



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

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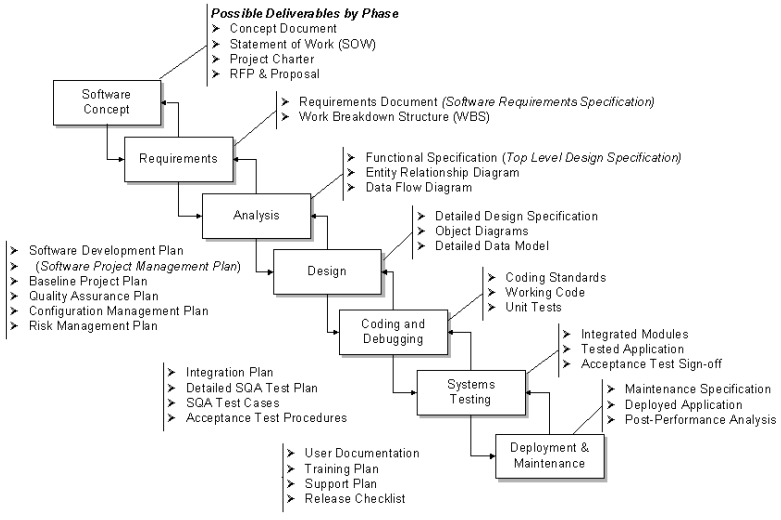
Potential Deliverables by Phase



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Concept Exploration

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

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Software Projects – In general

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Concept Exploration

- 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

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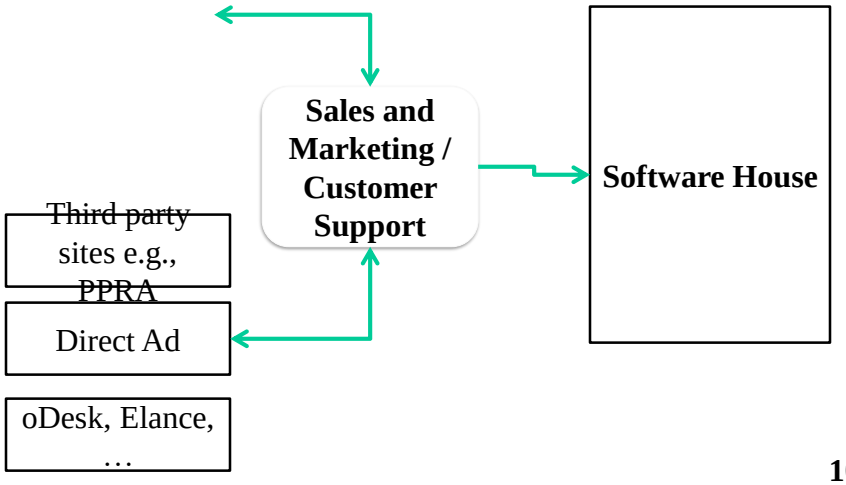
Software house at a glance



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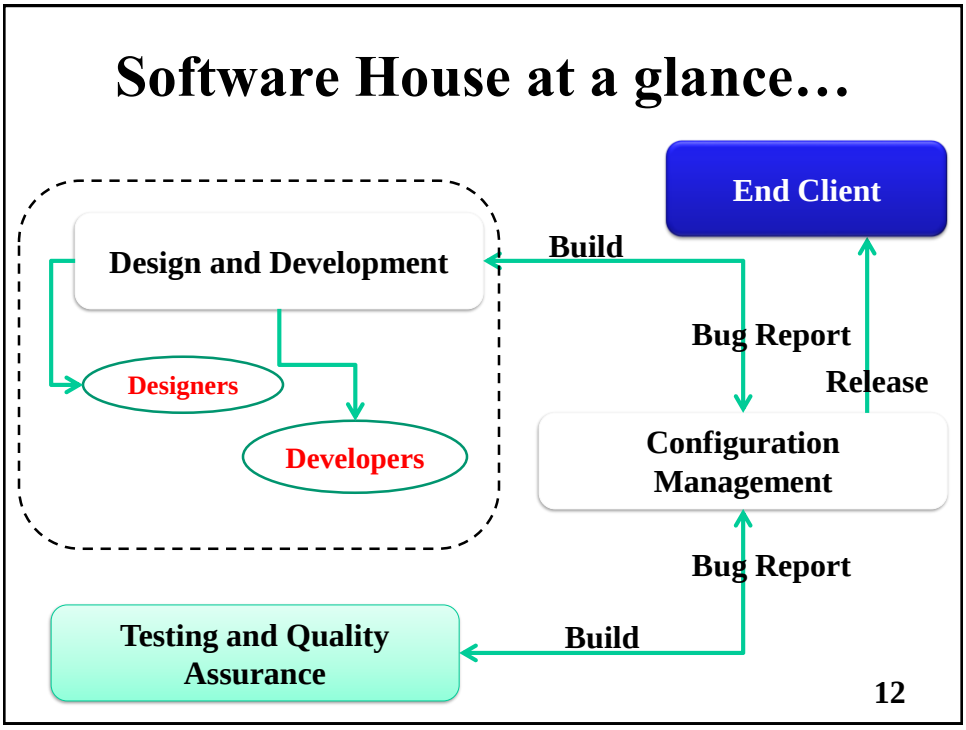
Software House at a glance…
End Client
Design and Development
Build
Bug Report
Release
Designers
Developers
Configuration Management
Bug Report
Testing and Quality Assurance
Build
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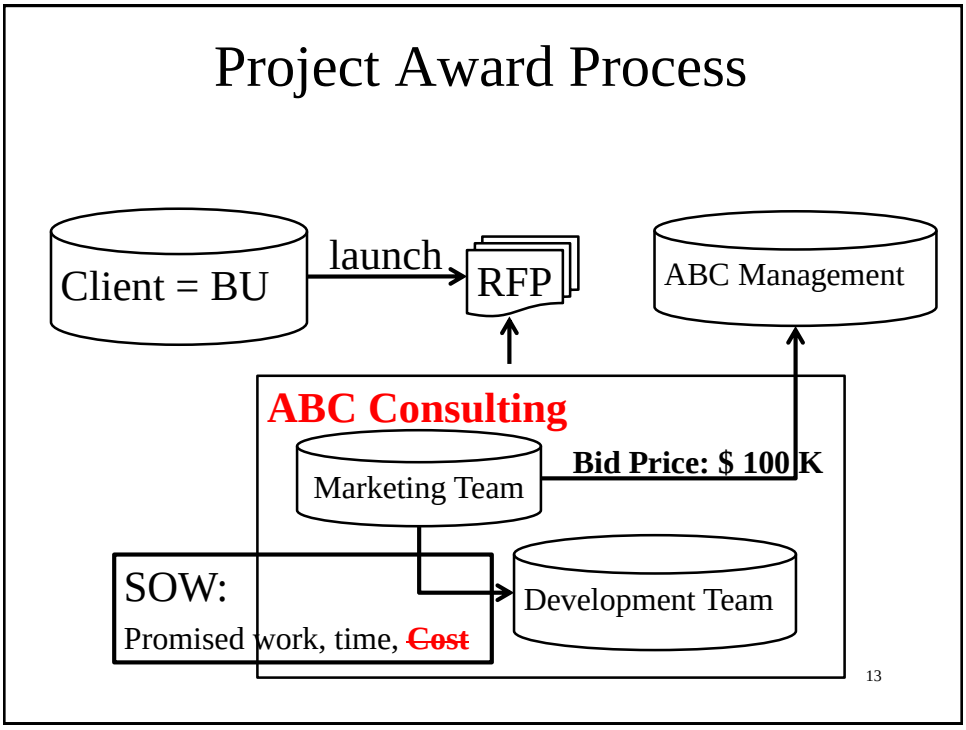
Project Award Process
Client = BU
launch
RFP
ABC Management
ABC Consulting
Marketing Team
Bid Price: $ 100 K
SOW:
Promised work, time, Cost
Development Team
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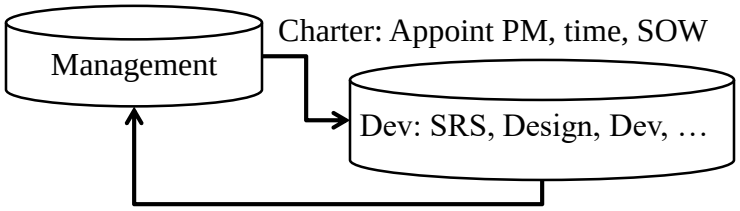
Project Award Process

ABC Consulting

SOW: Promised work, time, ~~**Cost**~~



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Project Award Process

- Initial
  - **Marketing team**, on behalf of Management, received information about a project opening from
    - Newspaper
    - Third party company
    - Contacts
    - Websites such as PPRA

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Project Award Process

- Management / Marketing will request:
  - marketing to prepare required bidding documents
  - A senior business department official to develop:
    - Effort estimates
    - Size estimation
    - HR, H/W, S/W, … (Resource estimates)
    - Timeline

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Requirements

- 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
- Assigned Project Manager can ask further resources, different timeline, different HR …

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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
- Here your knowledge of SRS development comes into play

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Analysis & Design

- 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)

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Development

- The “Do It” phase
- Coding & Unit testing
- Often overlaps Design & Integration phases
  - To shorten the overall schedule
  - PM needs to coordinate this

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Integration & Test

- Evolves from Dev. 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

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Integration & Test

- Tests
  - Integration testing
  - Black & White-box testing
  - Load & Stress testing
  - Alpha & Beta testing
  - Acceptance testing
- Other activities
  - Final budgeting; risk mgmt.; training; installation preparation; team reduced

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Deployment & Maintenance

- 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

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Deployment & Maintenance

- 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

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Lifecycle Planning

- Lifecycle Management or SDLC
- Greatly influences your chance of success
- Three primary lifecycle model components
  - Phases and their order
  - Intermediate products of each phase
  - Reviews used in each phase

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Lifecycle Planning

- 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

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Pure Waterfall

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

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Code-and-Fix

- "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

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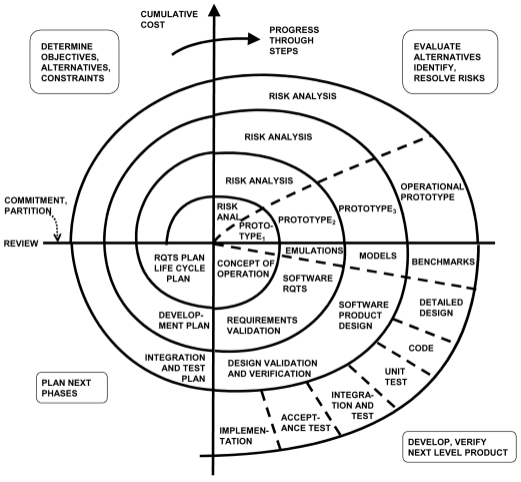
Spiral



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Evolutionary Prototyping

- 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”

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Staged Delivery

- 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)
- How’s this differ from Evolutionary Prototyping?

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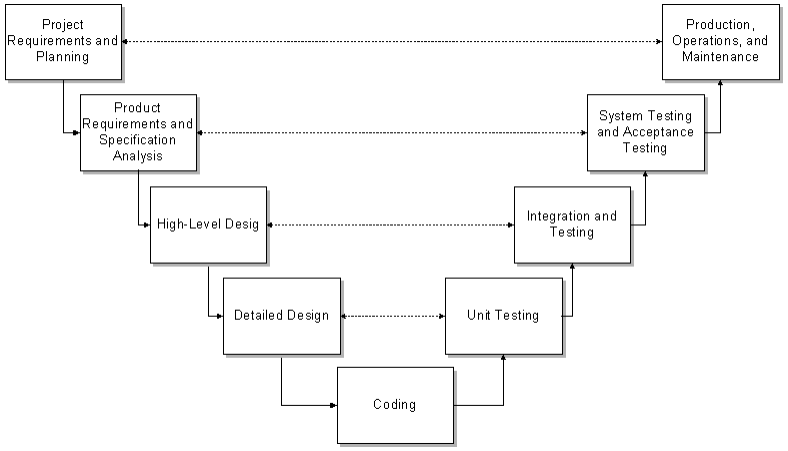
V Process Model



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RAD

- Rapid Application Development
- Popular in the 80's
  - 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

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COTS

- Commercial Off-The-Shelf software
- 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)

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XP: eXtreme Programming

- Not a Microsoft product
- Part of movement called “Agile Development”
- A “Lightweight” methodology
- A bit counter-culture
- Currently in vogue
- Motto: “Embrace Change”
- Highly Incremental / Iterative

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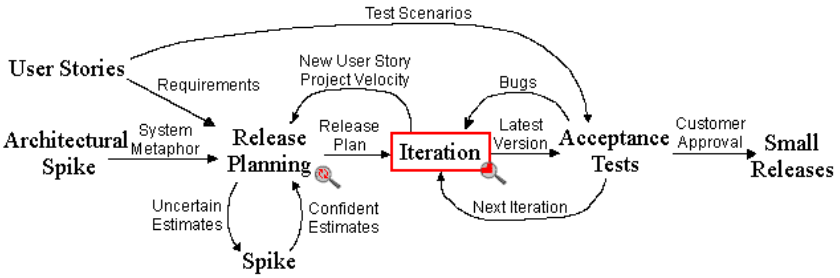
eXtreme Programming



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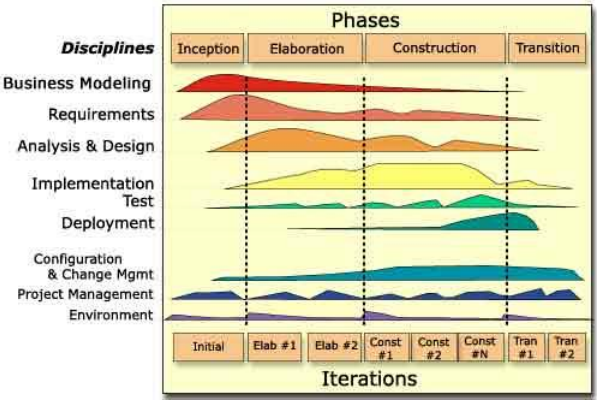
Rational Unified Process



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Choosing Your Lifecycle

- Varies by project
- Opt for “iterative” or “incremental”
- How well are requirements understood?
- What are the risks?
- Is there a fixed deadline?
- How experienced is the team or customer?

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PROCESS GROUPS AND KNOWLEDGE AREAS

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PM Knowledge Areas & Process Groups

PM Process Groups / Knowledge Area Processes	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
Project Management Integration	Develop Project Charter Develop Prelim Project Scope Statement	Develop Project Management Plan	Direct and Manage Project Execution	Monitor and Control Project Work Integrated Change Control	Close Project
Project Scope Management		Scope Planning Scope Definition Create WBS		Scope Verification Scope Control	
Project Time Management		Activity Definition & Sequencing Resource Estimating Duration Estimating Schedule Development		Schedule Control	
Project Cost Management		Cost Estimating Cost Budgeting		Cost Control	
Project Quality Management		Quality Planning	Perform Quality Assurance	Perform Quality Control	
Project HR Management		Human Resources Planning	Acquire Project Team Develop Project Team	Manage Project Team	
Project Communications Management		Communications Planning	Information Distribution	Performance Reporting Manage Stakeholders	
Project Risk Management		Risk Management Planning Risk Identification Qualitative / Quantitative Risk Analysis Risk Response Planning		Risk Monitoring and Control	
Project Procurement Management		Plan Purchases and Acquisitions Plan Contracting	Request Seller Responses Select Sellers	Contract Administration	Contract Closure

Knowledge Areas

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Project Management Knowledge Areas

- An area of project management defined by its knowledge requirements and described in terms of its associated process, practices, inputs, outputs, tools and techniques
- Identified knowledge areas (the 'things')
  1. Project Integration Management
  2. Project Scope Management
  3. Project Time Management
  4. Project Cost Management
  5. Project Quality Management
  6. Project Human Resource Management
  7. Project Communications Management
  8. Project Risk Management
  9. Project Procurement Management

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1. Project Integration Management

- effective integration of the processes required to accomplish project objectives
- processes include
  1. project charter development
  2. preliminary project scope statement development
  3. project management plan development
  4. project execution
  5. monitoring and control of project work

2. Project Scope Management

- defines and controls what is and is not included in the project
- processes include
  1. scope planning
  2. scope definition
  3. creation of a Work Breakdown Schedule
  4. scope verification
  5. scope control

3. Project Time Management

- includes processes required for the timely completion of a project
- processes include
  1. defining activities
  2. sequencing activities
  3. estimating resource activities
  4. estimating duration of activities
  5. developing the project schedule
  6. controlling the project schedule

4. Project Cost Management

- planning, estimating, budgeting and controlling costs to ensure the project can be completed within the approved budget
- processes include
  1. cost estimating
  2. cost budgeting
  3. cost control

5. Project Quality Management

- all activities that determine quality policies, objectives and responsibilities for the project to satisfy the needs for which it was undertaken
- processes include
  1. quality planning
  2. performing quality assurance
  3. performing quality control

6. Project Human Resource Management

- processes that organize and manage the project team
- processes include:
  1. human resource planning
  2. acquiring the project team
  3. developing the project team
  4. managing the project team

7. Project Communications Management

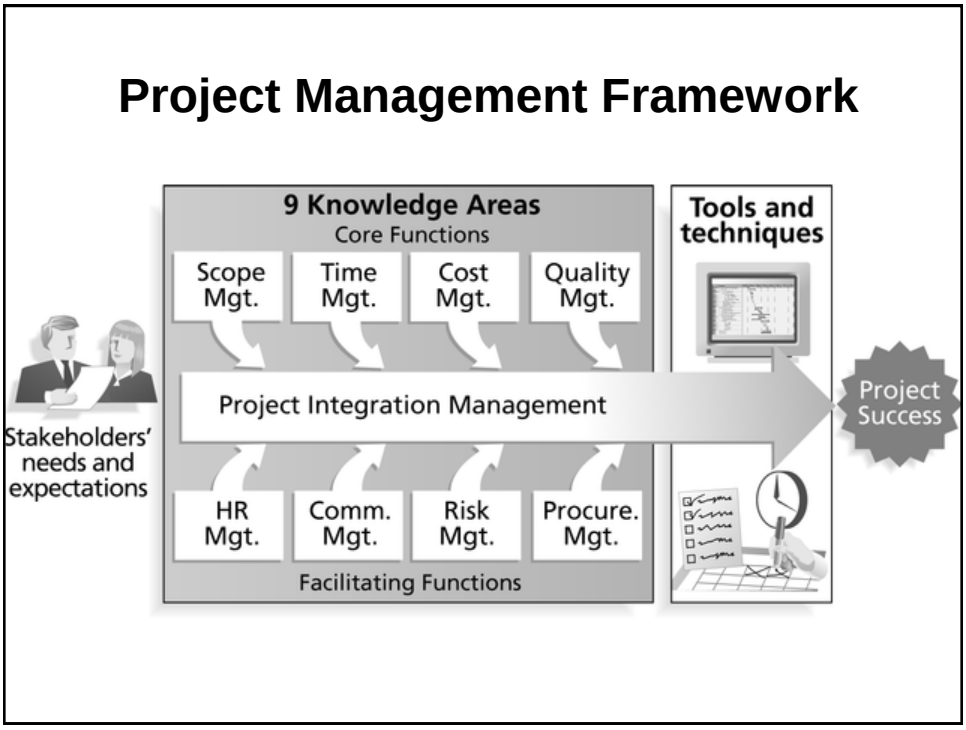
- activities to ensure project information is timely and appropriately generated, collected, distributed, stored, retrieved and disposed of
- processes include
  1. communications planning
  2. information distribution
  3. performance reporting
  4. managing stakeholders

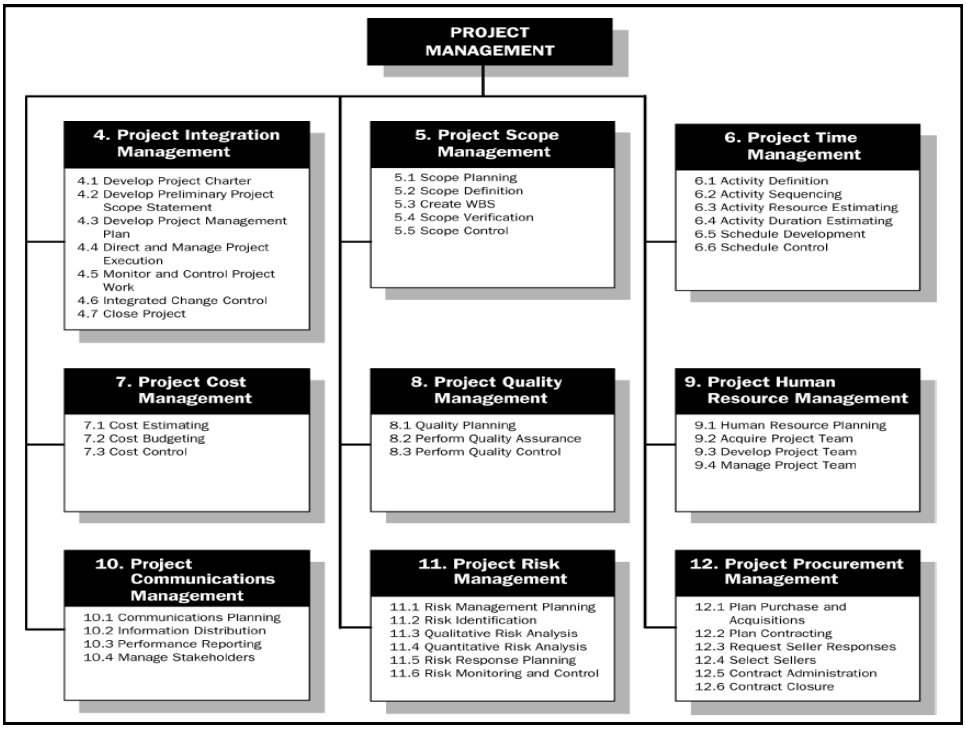
8. Project Risk Management

- processes to increase the probability and impact of positive events and decrease the probability and impact of negative events
- updated throughout the project
- processes include
  1. risk management planning
  2. risk identification
  3. qualitative risk analysis
  4. quantitative risk analysis
  5. risk response planning
  6. risk monitoring and control

9. Project Procurement Management

- processes to purchase/acquire the products, services or results needed to perform the project work
- includes contract management and change control processes to administer contracts or purchase orders
- processes include:
  1. planning purchases and acquisitions
  2. contract planning
  3. requesting seller responses
  4. selecting sellers
  5. contract administration
  6. contract closure


Project Management Framework
9 Knowledge Areas
Core Functions
Scope Mgt.
Time Mgt.
Cost Mgt.
Quality Mgt.
Project Integration Management
HR Mgt.
Comm. Mgt.
Risk Mgt.
Procure. Mgt.
Facilitating Functions
Tools and techniques
Stakeholders' needs and expectations
Project Success


PROJECT MANAGEMENT
4. Project Integration Management
4.1 Develop Project Charter
4.2 Develop Preliminary Project Scope Statement
4.3 Develop Project Management Plan
4.4 Direct and Manage Project Execution
4.5 Monitor and Control Project Work
4.6 Integrated Change Control
4.7 Close Project
5. Project Scope Management
5.1 Scope Planning
5.2 Scope Definition
5.3 Create WBS
5.4 Scope Verification
5.5 Scope Control
6. Project Time Management
6.1 Activity Definition
6.2 Activity Sequencing
6.3 Activity Resource Estimating
6.4 Activity Duration Estimating
6.5 Schedule Development
6.6 Schedule Control
7. Project Cost Management
7.1 Cost Estimating
7.2 Cost Budgeting
7.3 Cost Control
8. Project Quality Management
8.1 Quality Planning
8.2 Perform Quality Assurance
8.3 Perform Quality Control
9. Project Human Resource Management
9.1 Human Resource Planning
9.2 Acquire Project Team
9.3 Develop Project Team
9.4 Manage Project Team
10. Project Communications Management
10.1 Communications Planning
10.2 Information Distribution
10.3 Performance Reporting
10.4 Manage Stakeholders
11. Project Risk Management
11.1 Risk Management Planning
11.2 Risk Identification
11.3 Qualitative Risk Analysis
11.4 Quantitative Risk Analysis
11.5 Risk Response Planning
11.6 Risk Monitoring and Control
12. Project Procurement Management
12.1 Plan Purchase and Acquisitions
12.2 Plan Contracting
12.3 Request Seller Responses
12.4 Select Sellers
12.5 Contract Administration
12.6 Contract Closure

Process Groups

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Project Management Process Groups

- A **process** is a series of actions directed toward a particular result.
- Project management can be viewed as a number of interlinked processes.
- The project management process groups include:
  - Initiating processes
  - Planning processes
  - Executing processes
  - Monitoring and controlling processes
  - Closing processes

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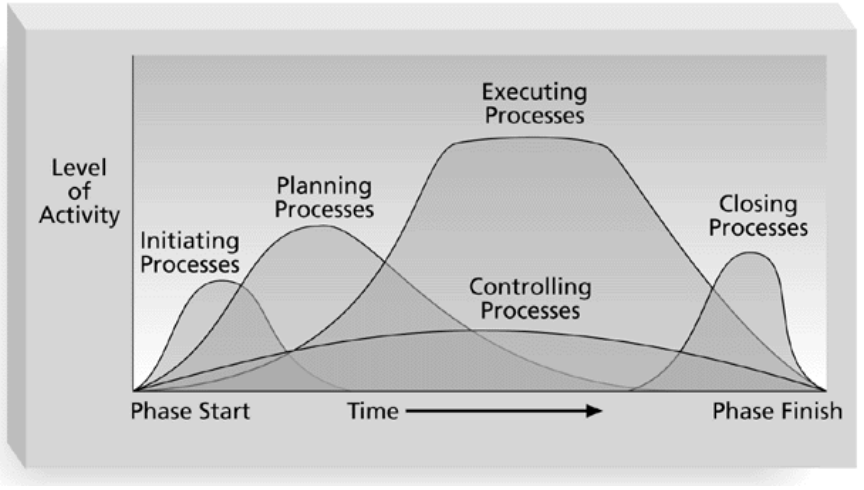
PMI Process Groups



Taken from PMI handbook

Project Initiation

- Initiating a project includes recognizing and starting a new project or project phase.
- Some organizations use a pre-initiation phase, while others include items such as developing a business case as part of the initiation.
- The main goal is to formally select and start off projects.
- Key outputs include:
  - Assigning the project manager.
  - Identifying key stakeholders.
  - Completing a business case.
  - Completing a project charter and getting signatures on it.

Project Planning

- The main purpose of project planning is to **guide execution**.
- Every knowledge area includes planning information
- Key outputs included:
  - A team contract.
  - A scope statement.
  - A work breakdown structure (WBS).
  - A project schedule, in the form of a Gantt chart with all dependencies and resources entered.
  - A list of prioritized risks (part of a risk register).

Project Executing

- Project execution usually takes the most time and resources.
- Project managers must use their leadership skills to handle the many challenges that occur during project execution.
- Many project sponsors and customers focus on deliverables related to providing the products, services, or results desired from the project.
- A milestone report can keep the focus on completing major milestones.

Project Monitoring and Controlling

- Involves measuring progress toward project objectives, monitoring deviation from the plan, and taking corrective action to match progress with the plan.
- Affects all other process groups and occurs during all phases of the project life cycle.
- Outputs include performance reports, requested changes, and updates to various plans.

Project Closing

- Involves gaining stakeholder and customer acceptance of the final products and services.
- Even if projects are not completed, they should be formally closed in order to reflect on what can be learned to improve future projects.
- Outputs include project archives and lessons learned, which are part of organizational process assets.
- Most projects also include a final report and presentation to the sponsor or senior management.

Mapping the Process Groups to the Knowledge Areas

- We can map the main activities of each PM process group into the nine knowledge areas identified by Project management body of knowledge
- Note that there are activities from each knowledge area under the planning process group.
- All initiating activities are part of the project integration management knowledge area.

Relationships Among Process Groups and Knowledge Areas

KNOWLEDGE AREA	PROJECT MANAGEMENT PROCESS GROUPS				
	INITIATING	PLANNING	EXECUTING	MONITORING & CONTROLLING	CLOSING
Project Integration Management	Develop project charter, Develop preliminary project scope statement	Develop project management plan	Direct and manage project execution	Monitor and control project work, Integrated change control	Close project
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•*PMBOK® Guide 2004, p. 69*

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PMBOK® Guide 2004, p. 69

Difference between knowledge areas &Process Groups

- The process groups divide up the processes by function.
- Knowledge areas divide the same processes up by subject matter.
- Process groups concerned with actions you take on your project,
- Knowledge areas with the things you need to understand.
- Knowledge areas are more about helping you understand the PMBOK® Guide material than about running your project.
- But that doesn't mean that every knowledge area has a process in every process group, e.g., the Initiating process group only has two processes, and they both show up in the Integration Management knowledge area.
- The Risk Management knowledge area only has Planning and Monitoring & Controlling processes.
- So process groups and knowledge areas are two different ways to think about all of the processes, but they don't really overlap

Project Management Knowledge Areas and Process Groups

with respect to

Software Projects

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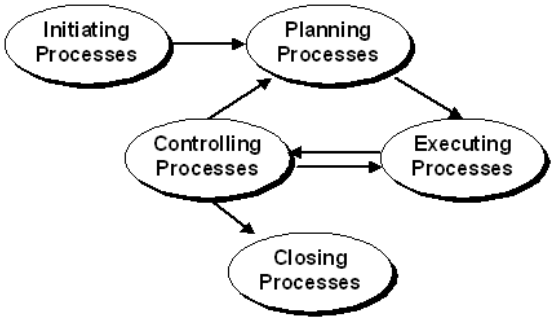
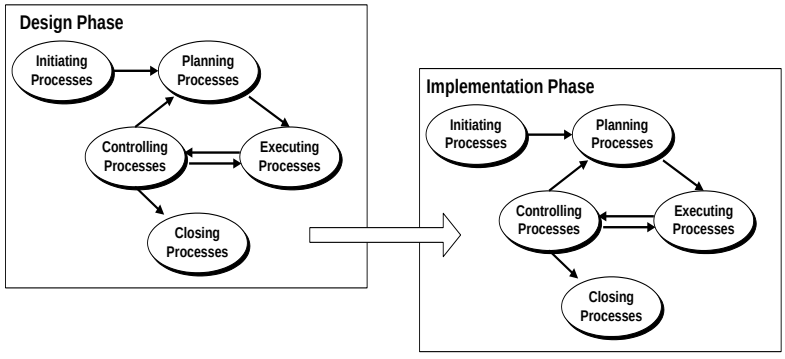
PMI: Process Links



Taken from PMI handbook

PMI Phase Interactions



Conclusion

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