What Every Systems Engineer Should Know About Project Management

Presentation to INCOSE Heartland Chapter

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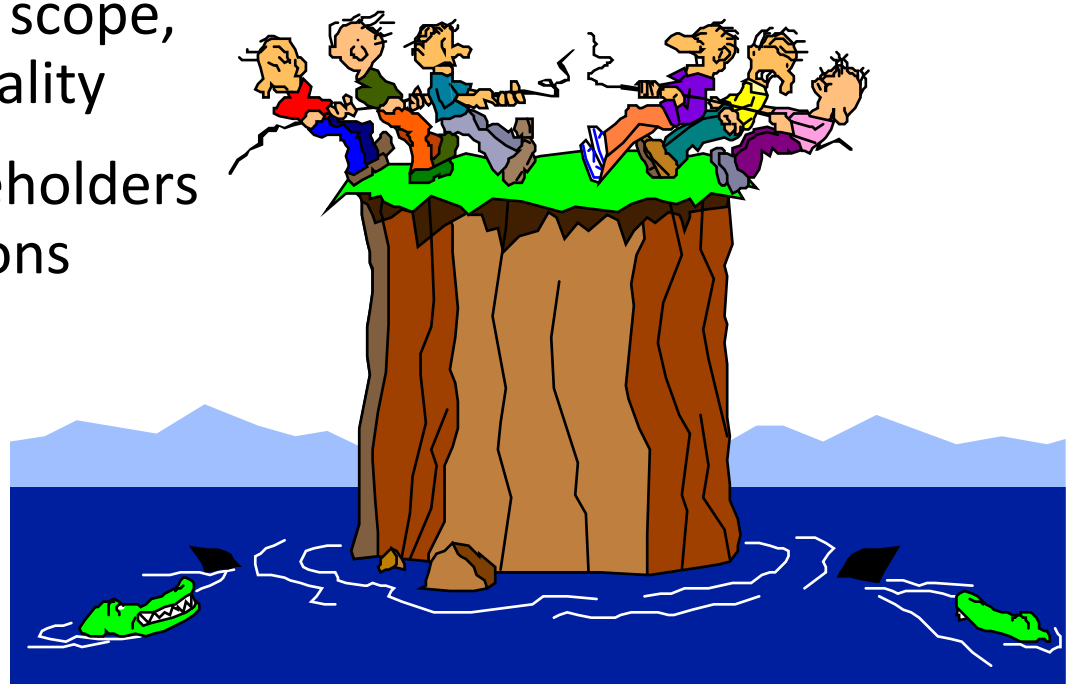
What Is Project Management?

The application of knowledge, skills, tools and techniques to project activities to meet project requirements

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide)

Typically involves:

- Conflicting demands for scope, time, resources, risk, quality
- Satisfying multiple stakeholders with differing expectations
- Living within defined resource constraints

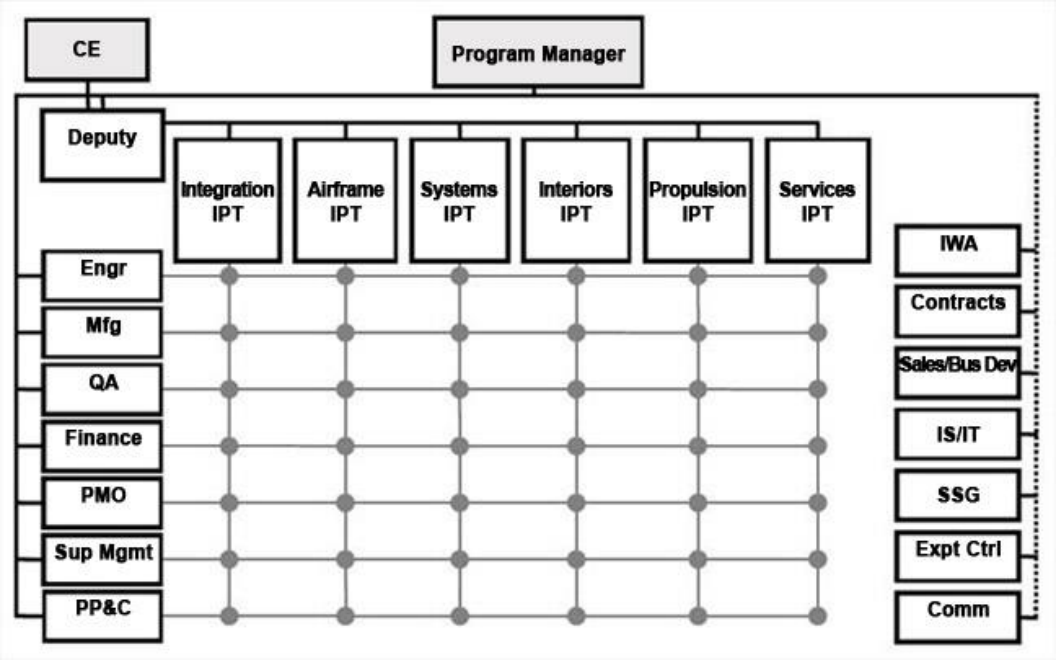


Why Is It Important for Systems Engineers to Understand Project Management?

If you understand project management activities, you can contribute more effectively and accurately

The first promotion for a systems engineer is often to lead a small team on a project

Integrated Product/Process Team (IPT) Approach

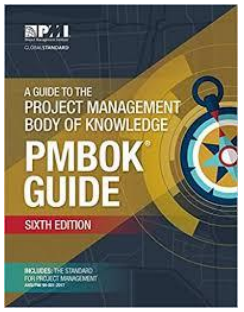


Helpful Aspects	Adverse Aspects
• Product-focused organization • Units are multi-functional • Decision making at the lowest level • Program/product integration occurs as the product is developed • People have a “home”	• Restricts use of critical resources • Demands excellent interpersonal skills • Sub-optimization often • Team members work with people of different discipline • Goals and procedures vary • Power differences • Group decision making takes time

Integrated Product Team (IPT) – Multiple disciplines, focused on a product

Integrated Process Team (or discipline) – Focus on processes spanning multiple IPTs

Sources of Project Management Information

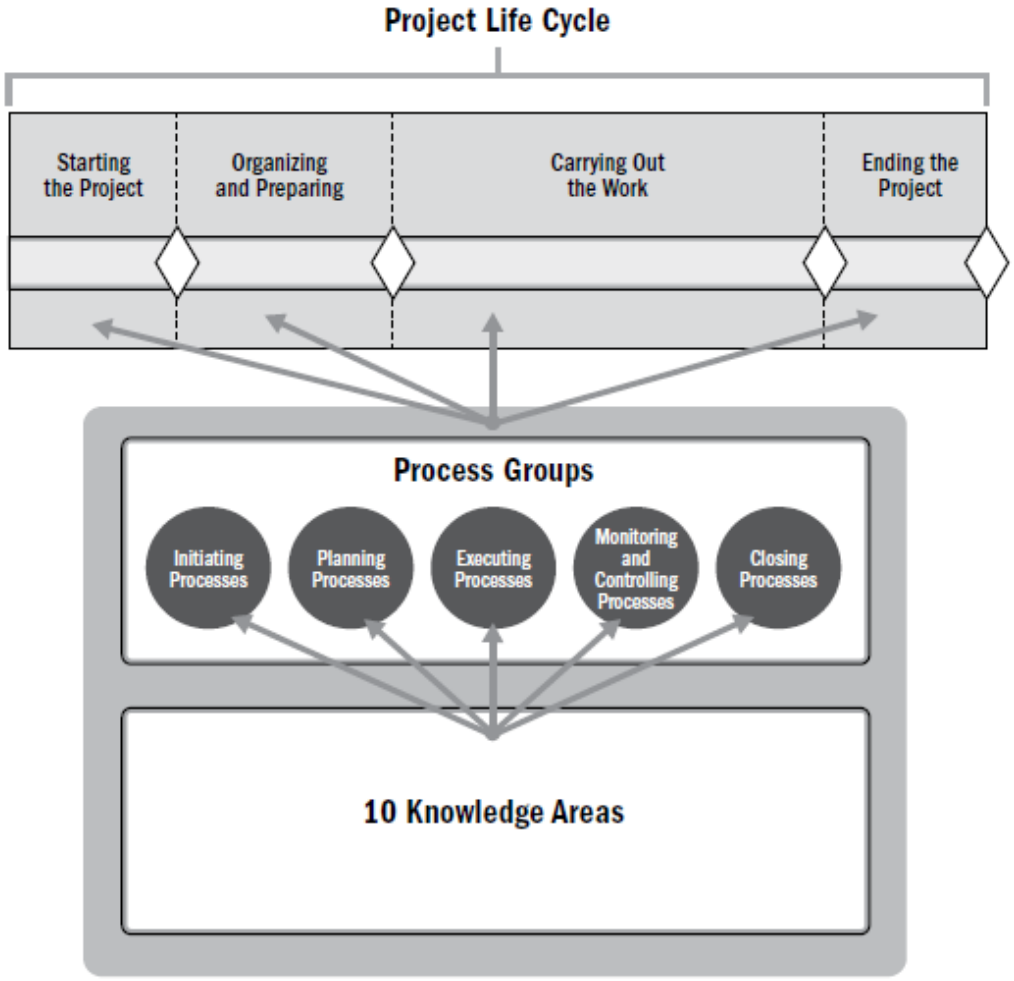


A Guide to the Project Management Body of Knowledge (PMBOK® Guide) provides an overview of project management for those seeking PMI certification (PMP®)

[sebokwiki.org] *Systems Engineering and Project Management* section addresses:

- The Nature of Project Management
- Relationships between Systems Engineering and Project Management
- The Influence of Project Structure and Governance on Systems Engineering and Project Management Relationships
- Procurement and Acquisition
- Portfolio Management

Project Management Framework (PMBOK® Guide)



Knowledge Areas

- Project Integration Management
- Project Scope Management
- Project Schedule Management
- Project Cost Management
- Project Quality Management
- Project Resource Management
- Project Communications Management
- Project Risk Management
- Project Procurement Management
- Project Stakeholder Management

Project Management Knowledge Areas

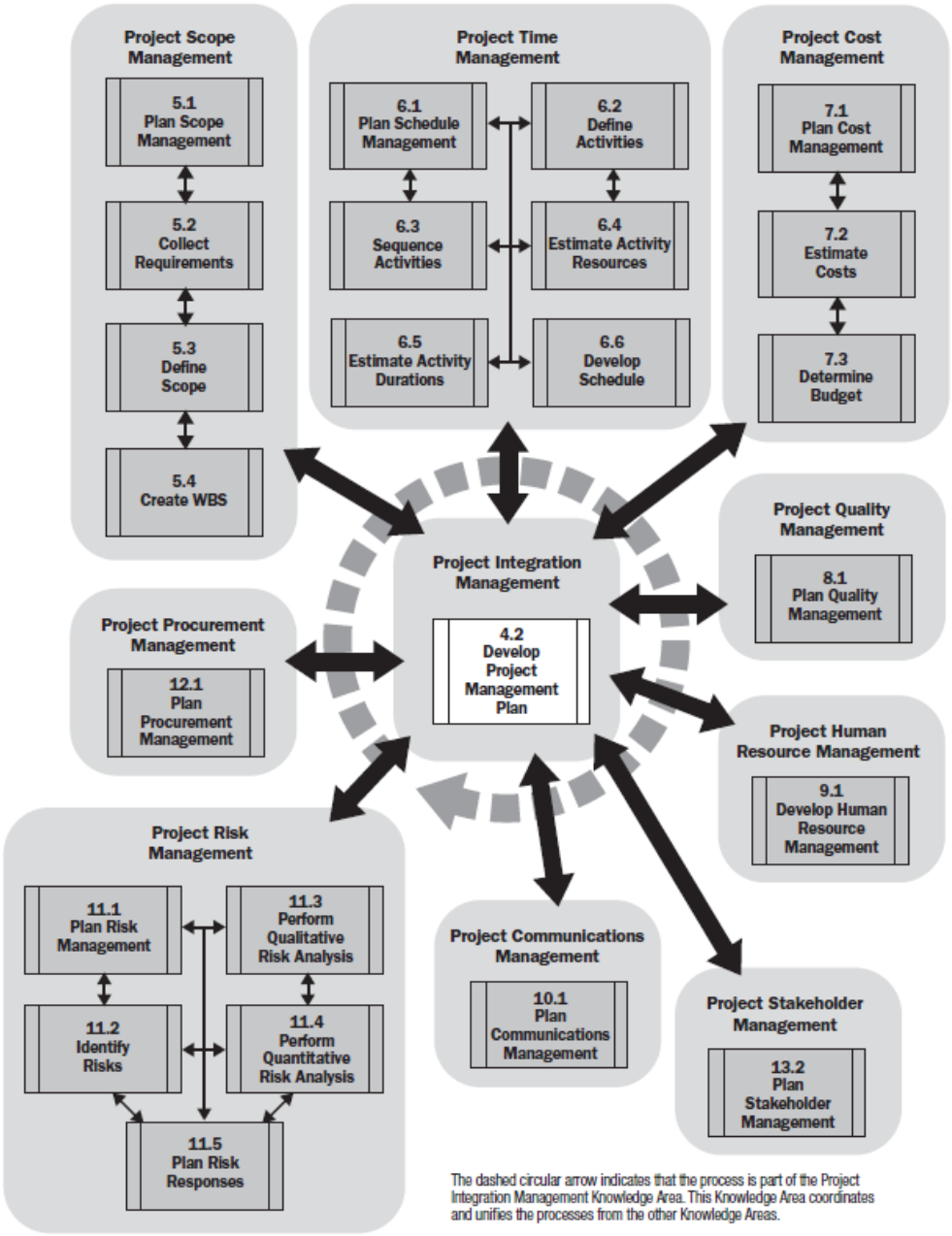
Project Integration Management	Project Scope Management	Project Time Management
• Develop Project Charter • Develop Preliminary Project Scope Statement • Develop Project Management Plan • Direct and Manage Project Execution • Monitor and Control Project Work • Integrated Change Control • Close Project	• Scope Planning • Scope Definition • Create WBS • Scope Verification • Scope Control	• Activity Definition • Activity Sequencing • Activity Resource Estimating • Activity Duration Estimating • Schedule Development • Schedule Control

Project Cost Management	Project Quality Management	Project Human Resource Mgmt.
• Cost Estimating • Cost Budgeting • Cost Control	• Quality Planning • Perform Quality Assurance • Perform Quality Control	• Human Resource Planning • Acquire Project Team • Develop Project Team • Manage Project Team

Project Communication Mgmt.	Project Risk Management	Project Procurement Mgmt.
• Communication Planning • Information Distribution • Performance Reporting • Manage Stakeholders	• Risk Management Planning • Risk Identification • Qualitative Risk Analysis • Quantitative Risk Analysis • Risk Response Planning • Risk Monitoring and Control	• Plan Purchases and Acquisitions • Plan Contracting • Request Seller Response • Select Sellers • Contract Administration • Contract Closing

Project Planning

Processes performed to establish the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives

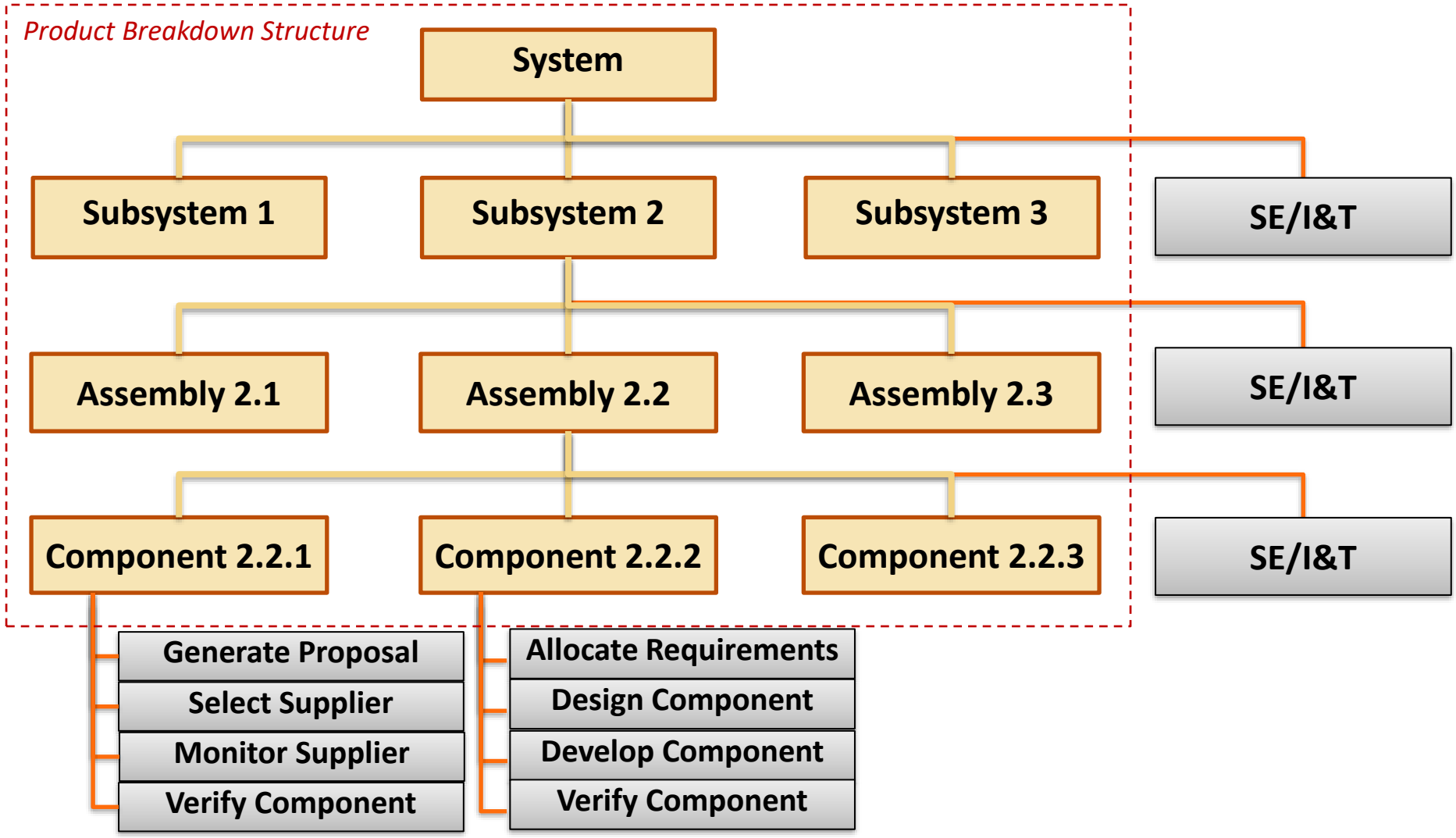


A Guide to the Project Management Body of Knowledge

SE's Contribution to Project Planning

Planning Tasks	SE Contribution
Develop a Work Breakdown Structure	WBS driven by Product Breakdown Structure
Estimate the effort required and time duration of tasks	Ensures that: • Overall system life cycle is understood; • Dependencies on other systems and organizations are identified • Logical dependencies during development are identified • Resources and key skills are identified and planned
Identify/optimize critical path	Provides strategies to "crash" the schedule, impacts to project risk
Allocate/level resources, including time/cost tradeoffs	Provides strategies
Evaluate/select suppliers	Make-buy decisions, technical evaluation

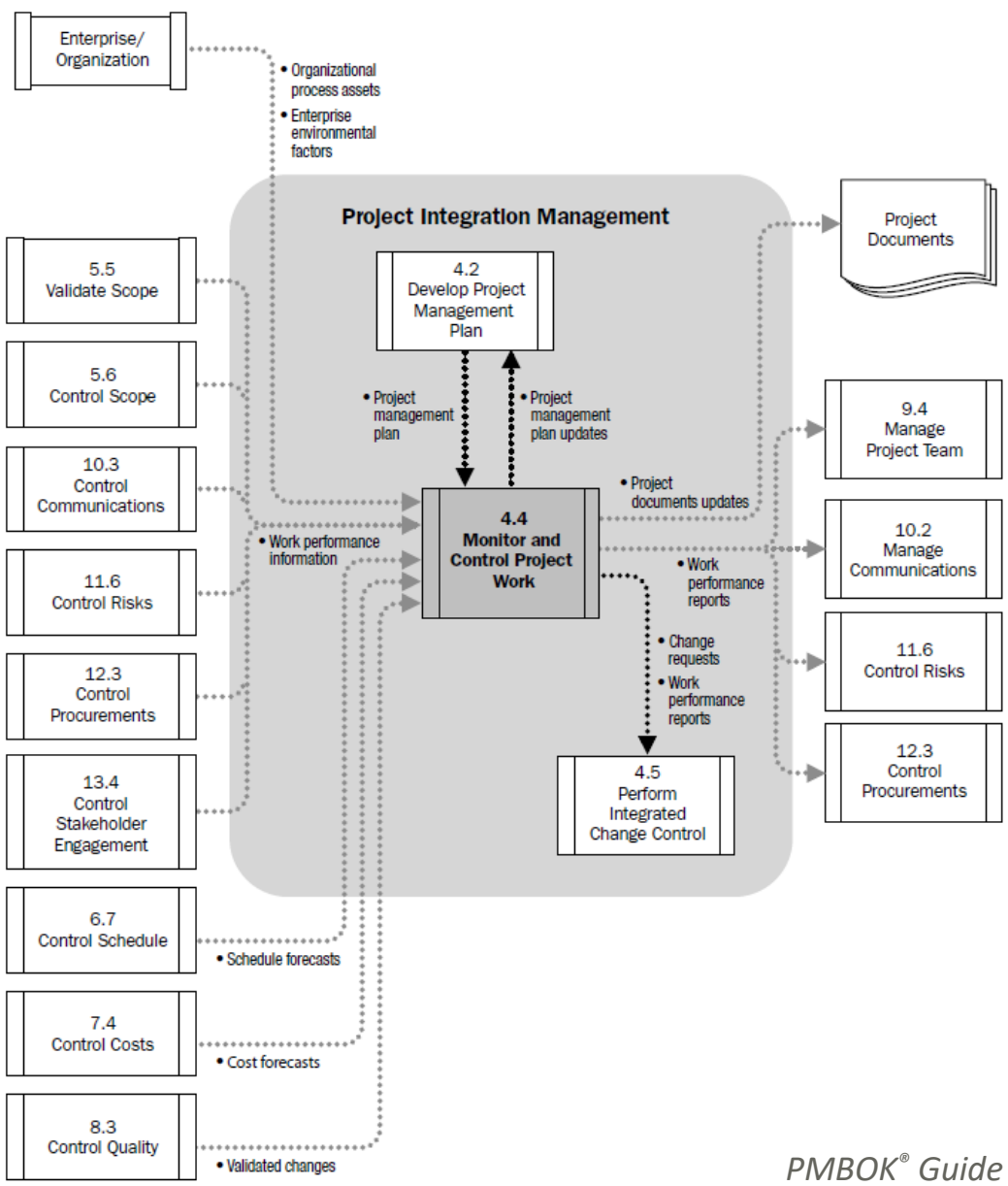
The Work Breakdown Structure (WBS) is Often Derived from the Product Breakdown Structure (PBS)



Project Monitoring and Control

Processes required to:

- Track, review, and report the progress to meet the performance objectives defined in the project management plan
- Identify and initiate any required changes to the plan



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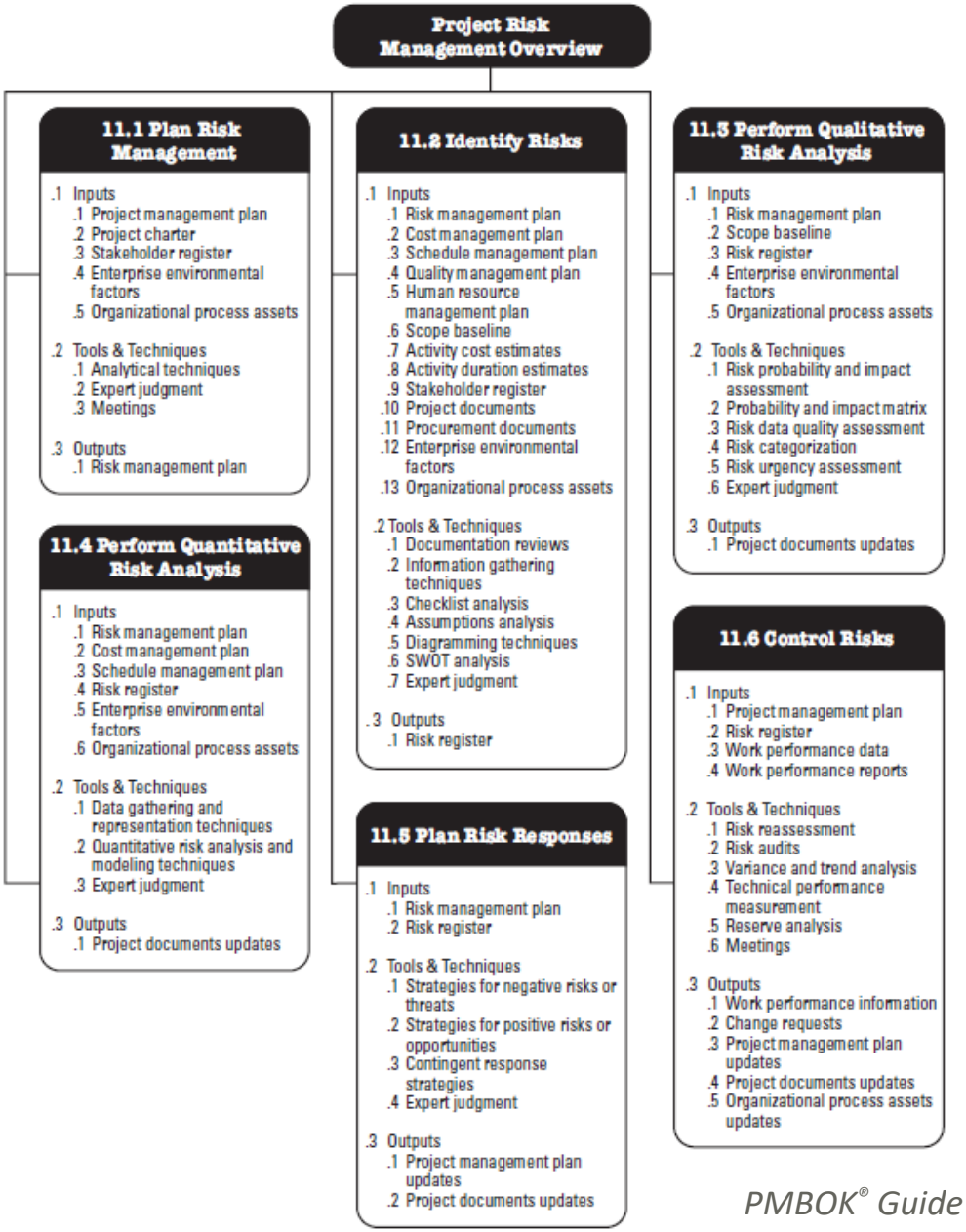
SE's Contribution to Project Monitoring and Control

Monitoring and Control Tasks
Compare actual project performance against the project management plan
Maintain accurate, timely information on the project's product(s) and process performance
Forecast cost, schedule, scope, and quality based on performance to date
Monitor risks and risk response plans, and identify new risks
Determine whether any corrective or preventive actions are indicated, and identify needed actions
Monitor suppliers

Project Risk Management

- A formal, systematic method of managing projects which concentrates on identifying and controlling areas or events that have a potential of causing change
- Risk Management skills include the processes concerned with identifying, analyzing, and responding to project risk
- Risk Management seeks to maximize the results of positive events (opportunities) and minimize the consequences of adverse events (risks)



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SE's Role in Risk Management

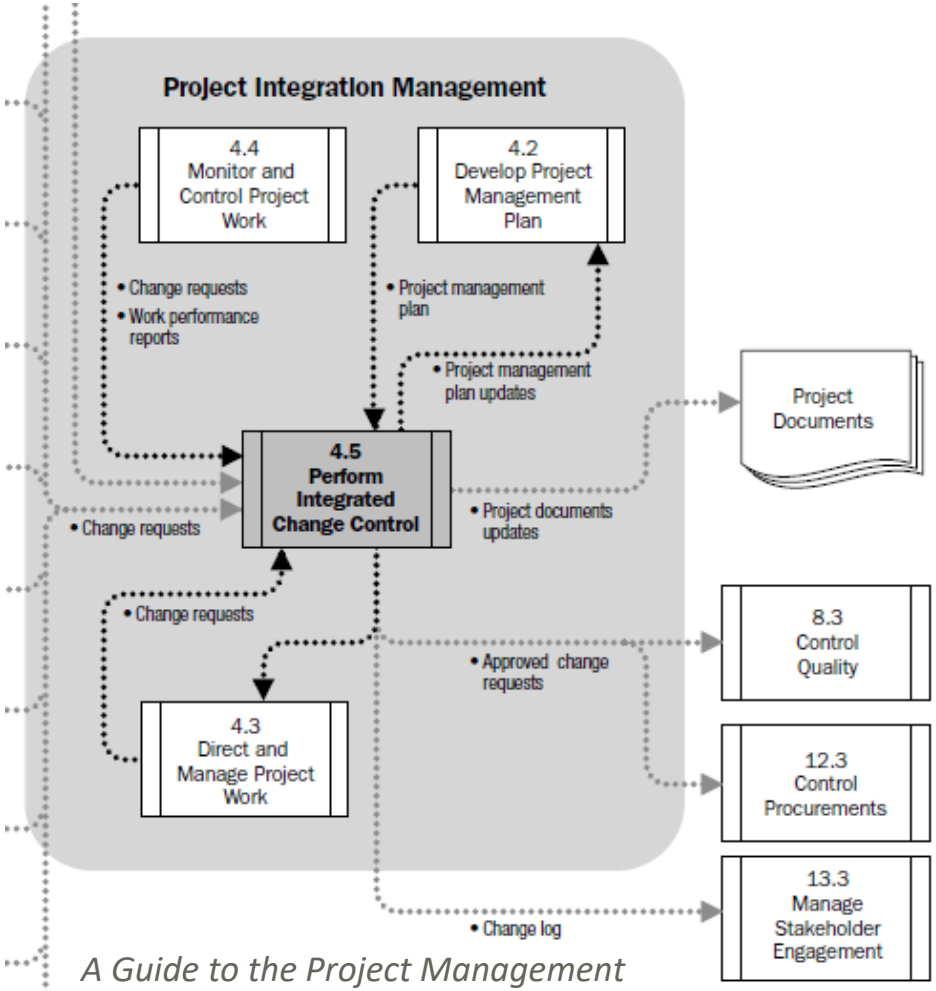
- The system engineer is typically the person most familiar with the technical challenges and implementation
- For many projects, technical risks are the most likely and have the greatest impact
- Often the SE is the Risk Manager (which requires them to be especially aware of programmatic risks)
- Technical personnel may resist identifying and discussing risks
  - "Shoot the messenger"
  - Micro-management
  - Perceived technical inability
  - Selection of lower risk, less technically exciting solutions

Promote a Risk-Embracing Culture

- Express management commitment
- Create awareness of the need
- Define and communicate the expected behaviors
- Reinforce the behaviors
- Encourage a frank and open discussion of risks
- Bring in external interviewers or reviewers to help identify risks
- Recognize the risk environment changes over the project life cycle

Integrated Change Control

- Process change requests (Change Control Board, Engineering Change Board)
- Maintain a valid budget baseline (time-phased budget plus management reserve plus fee)
- Maintain a valid performance baseline
- Provide a disciplined, documented control of changes to the baseline design
- Control revisions to work scope, schedules, and budgets



A Guide to the Project Management Bodo of Knowledge

Other Resources

INCOSE PM-SE Integration Working Group initiatives:

- Project Breakdown Structures
- Strategic Technical Planning
- Systems Engineering Handbook V5 Update
- Comparison of PMBoK and SEBoK - updates
- PM/SE Integration Best Practices Guidelines