04: Standards and Frameworks

Software Project Management
Philippe Kruchten

Module outline

- Project management: models, framework, processes
- Software development process
- Examples of processes
  - RUP, DSDM, MSF, agile approaches
- Project management 1-2-3
- Software development plan

Jargon…

- Model
- Framework
- Process
- Process model
- Process framework

Project Management Theory

- Management theory & Production theory
- Transformation view
  - 1900-1950, Taylor and Ford

  - Time in motion
  - Decomposition
  - Local optimization
- Value view
  - 1950-1975, Drucker & Porter

  - Holistic view
  - Value creation
  - Value chains
- Constraints view
  - 1975 – now, Senge & Goldratt

  - Holistic view
  - Constraints focus
  - Downward serving

Source: L. Koskela & Mike Griffiths

Stages in Software Project Control

1. Chaos
   - Controls: minimal
   - Mantra: Just do it!
   - Lifecycle: undefined
2. Prescriptive Control
   - Controls: conformance to plan
   - Mantra: Plan the work and work the plan
   - Lifecycle: Waterfall & Task-based (or WBS)
3. Adaptive control
   - Controls: conformance to acceptable results
   - Mantra: Embrace change
   - Lifecycle: iterative, feature-driven

 Source: Jim Highsmith

Process

- Process: set of activities intended to achieve a goal
- Process to run a project
  = software development process
  = software engineering process
  = software process
- Software project management is a subset of that software development process

Importance of Process

- Processes represent the collective knowledge on how to run a project
- A Project process has 2 main aspects:
  - Engineering : design test, code, technology
  - Project management
- Good project managers must understand the process
  - Both the engineering process
  - and the management process

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Management & Engineering

- Planning, coordinating, leading, controlling
- Focused on people, teams, products & work

- Analyzing, designing, building, testing
- Focused on the quality of the technical solution

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Examples of Processes

- Rational Unified Process (RUP)
- Microsoft Solution Framework (MSF)
- Dynamic System Development Method (DSDM)
- eXtreme programming (XP)
- …

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Examples of Process Frameworks

- Capability Maturity Model (CMM)
  - A process assessment framework
- IEEE 1074: Standard for Developing Software Lifecycle Processes
- ISO/IEC 12207: Software Lifecycle Processes
- Project Management Body of Knowledge (PMBOK)
- ISO 9000 (?)

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Process basics

- Lifecycle
  - Phases, milestone
- Workproducts, artifacts
  - concrete "things" delivered or internal
- Activities, task
  - things to do, recipes on how to do it
- Workflows
  - meaningful sequences of activities
- Roles
  - skills, competencies, responsibilities

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Capability Maturity Model

- Developed in the early 1980's by the Software Engineering Institute (SEI)
- Framework for the assessment of software engineering process
- A reference
- A ladder

Source: Jalote

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CMM – Key Process Areas for SPM

CMM Level 3
- Integrated Software Management
- Intergroup Communication
- Peer Reviews

CMM Level 4
- Quantitative Process Management
- Software Quality Management

CMM Level 5
- Process Change Management

Source: Jalote

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Project Management Body of Knowledge

- PMBOK: Developed by the Project Management Institute (PMI) (USA)
- Initial publication in 1987; republished in 1996
- Adopted by IEEE as IEEE 1490-1998

- Main PMBOK NOT software specific
- 2013: Software Extension
- A certification: Project Management Professional (PMP)

Source: PMI & IEEE

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PMBOK: Knowledge Areas

4. Project Integration management
5. Project Scope management
6. Project Time management
7. Project Cost management
8. Project Quality management
9. Project Human resources management
10. Project Communication management
11. Project Risk management
12. Project Procurement management

Looks like MSF, no?

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Project Management Body of Knowledge

Project Integration Management	Project Scope Management	Project Time Management
Project Plan Development Project Plan Execution Integrated Change Control	Initiation Scope Planning Scope Definition Scope Verification Scope Change Control	Activity Definition Activity Sequencing Activity Duration Estimation Schedule Development Schedule Control
Project Cost Management	**Project Quality Management**	**Project Human Resource Management**
Resource Planning Cost Estimating Cost Budgeting	Quality Planning Quality Assurance Quality Control	Organizational Planning Staff Acquisition Team Development
Project Communications Management	**Project Risk Management**	**Project Procurement Management**
Communications Panning Information Distribution Performance Reporting Administrative Closure	Risk Management Planning Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning Risk Monitoring & Control	Procurement Planning Solicitation Planning Solicitation Source Selection Contract Administration Contract Closeout

Source: E. Lopes Cardozo, Empulsys

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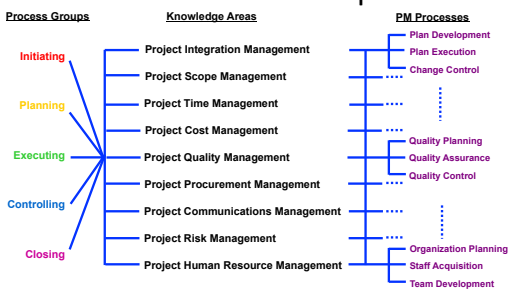
PMI's PMBOK Concepts



Source: Bill Cottrell, IBM

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PMI PMBOK: Focus over Time

Source: Bill Cottrell, IBM

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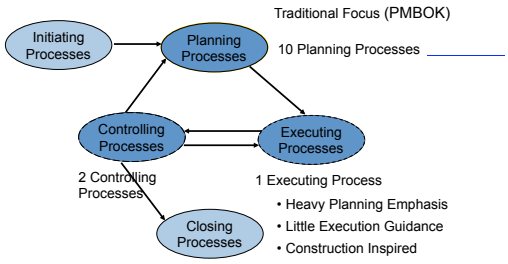
Looking into the PMBOK Philosophy



Sources: L. Koskela & Mike Griffiths

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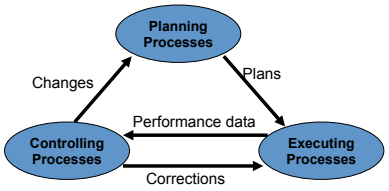
Basic Loops in the PMBOK



Sources: L. Koskela & Mike Griffiths

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Basic Elements & Theories & Practices

- Planning processes
  - Well-understood and pushed to the extreme in some industries; WBS; Activities/tasks; Risks
  - Estimation (when? how much?)
- Executing processes
  - Task assignment
- Controlling processes
  - Thermostat model, cybernetic model
  - What to measure; assessing progress?
  - Earned value

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Microsoft Solution Framework

- Derived form an internal process (MS Office group)
- Version 3
  - Six whitepapers and some 40+ templates
  - Training material
  - Available on www.microsoft.com/msf
- Now V4 on Visual Team System (2006)
  - Cf. MSDN
  - MSF for Agile Software Development…

Source: Microsoft

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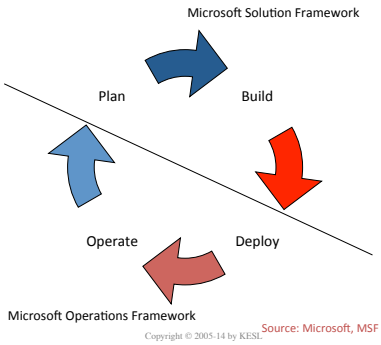
MSF-MOF



Source: Microsoft, MSF v3

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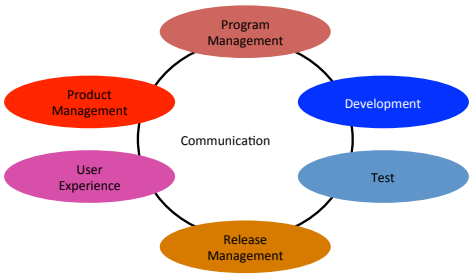
MSF Team Model



Source: Microsoft, MSF v3

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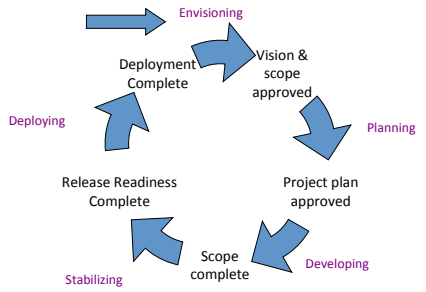
MSF - Lifecycle



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Source: Microsoft, MSF v3

MSF - Project Management Disciplines

- Integration management
- Scope management
- Time management
- Cost management
- Communication management
- Human resources management
- Procurement management
- Risk management
- Quality management

Source: Microsoft, MSF v3

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Rational Unified Process

- Developed by Rational Software in 1995-2003
- A product
- HTML-based
- Configurable to a wide range of situations
- Extensible process framework
- Supported by tools

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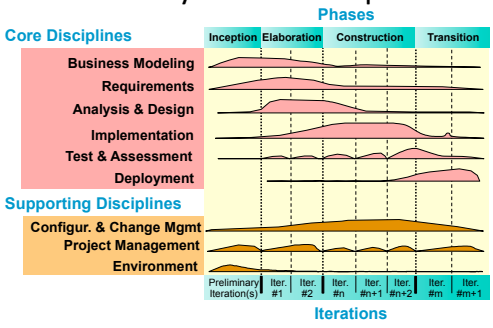
RUP Lifecycle and Disciplines



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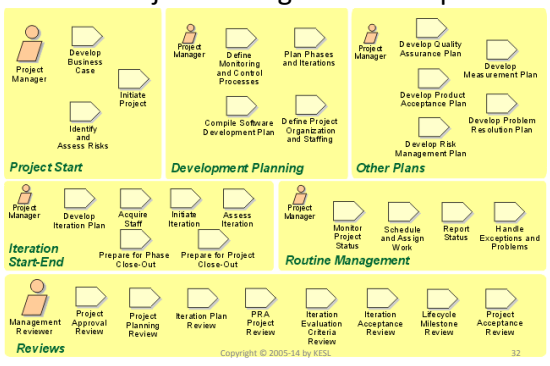
RUP Project Management Discipline



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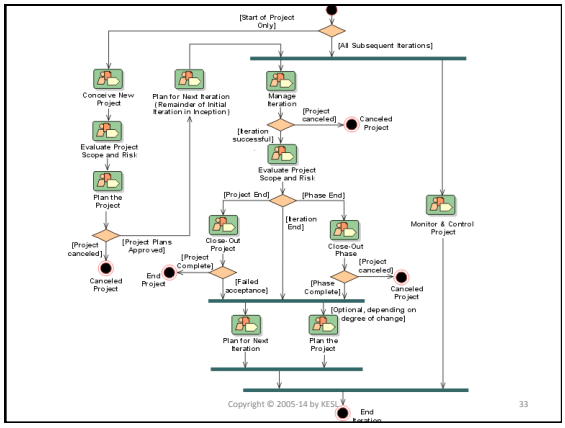

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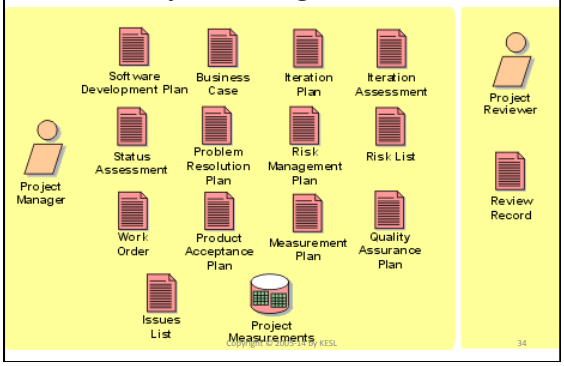
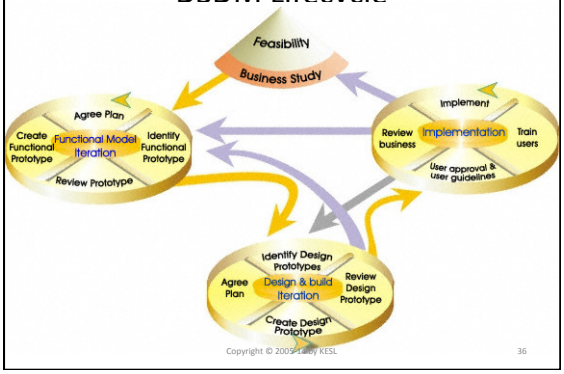
RUP: Project Management Artifacts



Dynamic System Development Method

- DSDM Consortium
- Product, licensed by DSDM Consortium
- Born in the UK beginning of the 90's
- www.dsdm.org

DSDM Lifecycle



Counterpoint to planning: Emergence

- Agile processes:
  The requirements, the design, the process and therefore the product will gradually emerge as the project proceed.
- Very little planning, only rough sketches and envelopes at first.
- Immediate feedback allows driving the project (very short Deming cycles; few artifacts).
- Practices to support this paradigm: Test first, customer on site, Pair Programming, Scrums, Planning game, etc…

Agile Methods

- Agile Alliance
- Late 1990's
- Agile Manifesto
- Kent Beck, Martin Fowler, Jim Highsmith, Alistair Cockburn, Ron Jeffries…
- XP, Scrum, Lean Development (LD), Crystal, Adaptive Software Development, etc… RUP? DSDM?
- See http://www.agilealliance.org

Agility

- A definition
  - Agility is the ability to both create and respond to change in order to profit in a turbulent business environment.

Jim Highsmith (2002)

- Characteristics
  - Iterative and incremental
  - Small release
  - Collocation
  - Release plan/ feature backlog
  - Iteration plan/task backlog

Sanjiv Augustine (2004)

Agile Values: the Agile Manifesto

We have come to value:

- Individuals and interactions *over* process and tools,
- Working software *over* comprehensive documents,
- Customer collaboration *over* contract negotiation,
- Responding to change *over* following a plan.

That is, while there is value in the items on the right, we value the items on the left more

Source: http://www.agilemanifesto.org/

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Agile Principles

- Customer satisfaction
- Change is OK
- Deliver working software frequently
- Business people and developers must work together daily
- Motivated individuals; right environment; trust
- Face-to-face communication is preferred
- Sustainable development

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Agile Principles (cont.)

- Continuous attention to technical excellence
- Simplicity
- Emergence of architecture, requirements and design
- Self-organizing teams
- Self-reflection to become more effective

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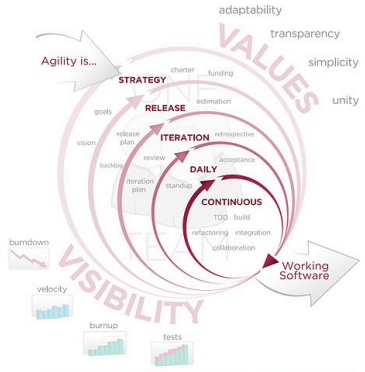

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Named Agile Methods

- XP = eXtreme Programming (K. Beck)
- SCRUM (K. Schwaber, J. Sutherland)
- Adaptive development process (J. Highsmith)
- Lean Software Development (M.&T. Poppendieck)
- Crystal (A. Cockburn)
- Feature Driven Development (S. Palmer)
- Agile Unified Process (S. Ambler)
- etc., etc…

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eXtreme Programming (XP)

- Kent Beck, Ward Cunningham, Ron Jeffries
- Values:
  - Communication
  - Simplicity – simplest product that satisfy needs
  - Feedback – obtain and value feedback from all stakeholders
  - Courage – prepared to make hard decisions
- Some thirteen core practices

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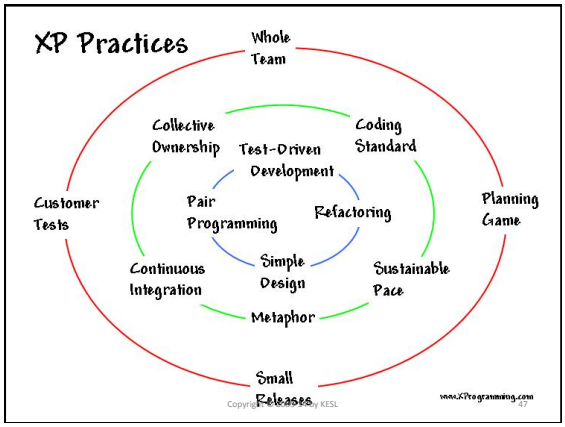

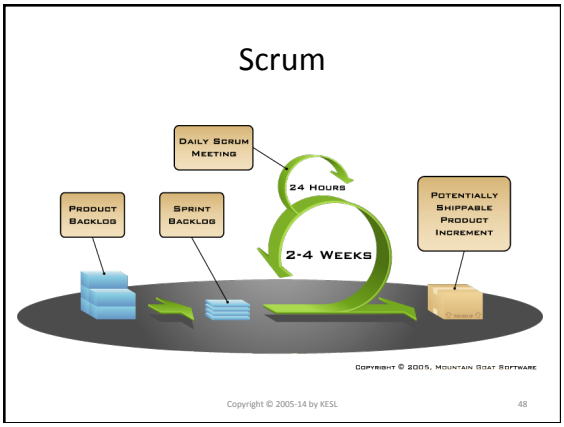

Lean Principles (for Software Development)

- Eliminate waste
- Amplify learning
- Decide as late as possible
- Deliver as fast as possible
- Empower the team
- Build integrity in
- See the whole

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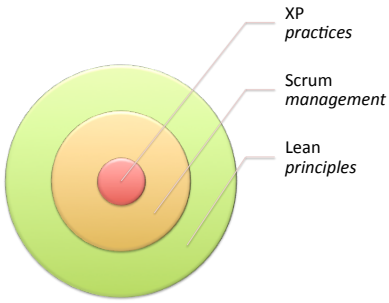
Different methods for different issues



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Getting at the Essence of Agility

- Software development is a knowledge activity
  - Not production, manufacturing, administration…
- The "machines" are humans
- Dealing with uncertainty, unknowns, fear, distrust…
- Feedback loop ->
  - reflect on business, requirements, risks, process, people, technology
- Communication and collaboration ->
  - Building trust

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Key principles

- Feedback loop ->
  - reflect on business, requirements, risks, process, people, technology
- Communication and collaboration ->
  - Building trust

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Agile sweet spot

System Size	• 0 ..**12** … 300
Criticality	• **Simple, $ losses**, … deaths
System Age	• Exploratory, **greenfield**, legacy maintenance
Rate of change	• Low, **medium, high**
Business model	• **In house**, Open Source, ….
Stable architecture	• **Stable**, changed, new
Team distribution	• **Collocated**, …, …, offshore outsource
Governance	• **Simple rules**, …, SOX, …

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Of process, maps, and plans

"If you do not know where you are going, you will probably end up somewhere else."

(Laurence J. Peter)

"Would you tell me please which way I ought to go from here?"
"That depends a good deal on where you want to get to," said the cat.
"I don't much care where—," said Alice.
"Then it does not matter which way you go," said the cat.

(Lewis Carroll)

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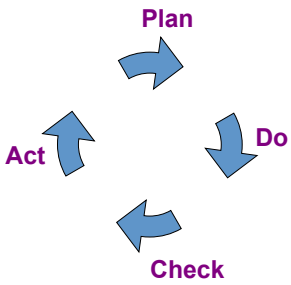
Project Management 101: PDCA

- Deming Cycle

After W. Edwards Deming



- Deming called it Shewhart Cycle

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Deming Cycle

- Plan the short-term objective
  - Determine the time-frame
  - Decide what will be needed
  - Decide who is doing what
- Do what the plan said
  - Collect data
  - Design studies or other stuff
  - Train people …

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Deming Cycle (cont.)

- Check to see how the plan was carried out
  - Compare data collected to plan
  - If plan not carried out, then do it
  - Look for lessons for the future
  - Discuss adjustments
  - Determine course of action and changes
- Act on the recommendation of the team
  - Implement fixes, adjustments
  - Inform others of needed changes
  - Improve communication

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Kaoru Ishikawa's improvements (1985)

- Plan
  1. Determine goals and targets
  2. Determine methods for reaching these goals
- Do
  3. Education and training
  4. Implement the work
- Check
  5. Check the effect of implementation
- Act
  6. Take any appropriate action

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Multiple time horizons

- PDCA at the hour level / individual level
- PDCA at the day or week level for an individual or a small team
- PDCA at the phase level
- PDCA at the project level
- etc…

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Multiple entities to apply PDCA to

- Time
- Product
- People
- Other resources

Also
- PDSA = Plan Do Study Act

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The road ahead

- For each of the important elements:
  - Time, resource, requirements, etc…
- …we will look at:
  - how to represent them
  - how to PLAN for them
  - what tools and techniques are useful
  - what practices exists in various methods and processes

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The Software Development Plan (simple)

- At minimal:
  - Organization and responsibilities
  - Schedule
  - Resources: staff and budget
  - Product overview

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Software Development Plan – Full (1)

- Project Overview
  - Purpose, scope, objectives
  - Assumptions, constraints
  - Key deliverables
- Project organization
  - Organizational structure
  - External interfaces
  - Roles and responsibilities

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Software Development Plan – Full (2)

- Management process
  - Estimates
  - Project plan
    - Phases
    - Iterations (if any)
    - Schedule
    - Resources
    - Budget

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Software Development Plan – Full (3)

- Project monitoring and control
  - Requirement management plan
  - Schedule, control, budget control
  - Quality control plan
  - Reporting plan
  - Measurement plan
- Risk management plan
- Close-out plan
- Technical process plans
  - Process, methods tools techniques
  - Infrastructure plan
  - Product acceptance plan

Software Development Plan – Full (4)

- Supporting Process plans
  - Configuration management plan
  - Evaluation plan
  - Documentation plan
  - Quality assurance plan
  - Problem resolution plan
  - Subcontractor management plan
  - Process improvement plan
  - Communication plan

Tailoring is the key

- Use only the plans that make sense in your context
- First step is to tailor the outline
- Be very clear about what is know and even more about is NOT known
- Be very clear about assumptions, and label them as such

Assessment, monitoring, control, …

- Reports
- Status assessment
- Minutes of reviews and other meetings
- Databases of:
  - requirements
  - issues
  - risks
  - defects

To cover the CA of PDCA (Deming cycle)

Summary

- Software ● Project ● Management
- Process:
  - activities, artifacts=workproducts, workflow, roles
  - techniques, tools, templates, guidelines
- Project:
  - bounded in time
  - unique set of goals & constraints
- Software project management = a (sub) process of software development process

Summary (2)

- Standards and Assessment frameworks:
  - PMBOK
  - SW-CMM (and ISO15504)
  - ISO/IEC 12207
  - IEEE 1074
- Examples of Software Development Processes
  - RUP
  - DSDM
  - MSF
  - Agile: XP, SCRUM, Lean, etc.

Summary (3)

- Deming cycle: PDCA
- Software Development Plan
  - a composite of several plans
  - need tailoring to suit project
  - IEEE std 1058:1998 + others
- Report and Status assessments
- SPM? It's not just about "being the boss"

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