Introduction

- Many software organizations are addressing process maturity as part of improving their software development capabilities
  - Seek repeatable, predictable project performance
  - Build software better, cheaper, faster
  - Meet customer requirements for maturity
- Customers want to know whether a potential software developer has the capability to develop large, complex, software systems
  - Recent Request for Proposals (RFPs) require the bidder to meet a specified level of maturity
- The process maturity initiative presents special challenges for cost and schedule estimation
The Software Capability Maturity Model (SW-CMM) is the most widely used indicator of process maturity. Developed by the Software Engineering Institute (SEI), it is based on practices used in successful software companies. A software organization's maturity is ranked on a 1-5 scale.

Organizations are seeking improvements in Key Process Areas at each level. The diagram illustrates the process maturity levels and key practices:

- Initial (Level 1): Unfocused, unstructured processes
- Repeated (Level 2): Established, basic processes
- Defined (Level 3): Standardized, controlled processes
- Managed (Level 4): Quantitatively measured, predictable processes
- Optimizing (Level 5): Continuous improvement, self-adjusting processes

Key processes include:

- Defect prevention
- Technology change management
- Process change management
- Quantitative process management
- Software quality management
- Organization process focus
- Training program
- Integrated software management
- Requirements management
- Software project planning
- Software project tracking & oversight
- Software subcontract management
- Software quality assurance
- Software configuration management

References:
- Rick Hefner, "Process Maturity: Implications for Cost and Schedule Estimation"
Software Project Planning

Goals
1. Software estimates are documented for use in planning and tracking the software project.
2. Software project activities and commitments are planned and documented.
3. Affected groups and individuals agree to their commitments related to the software project.

Activities Performed
- Software group participates on proposal team
- Software group participates in planning through program life
- Project's software life-cycle is identified or defined
- Project's SDP is developed according to a procedure
- Project's software plan is documented
- Software work products are identified
- A documented procedure is used to estimate:
  - Size of the software work products
  - Project effort and cost
  - Critical computer resources
  - Software schedule
  - Software risks
- Plans for software facilities and support are prepared
- Software planning data is recorded

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Software Project Planning

Estimation Issues

Activity 9
Estimates for the size of the software work products (or changes to the size of software work products) are derived according to a documented procedure.

This procedure typically specifies that:

1. Size estimates are made for all major software work products and activities:
   - Operational software and support software;
   - Deliverable and non-deliverable work products;
   - Software and non-software work products (e.g., documents);
   - Activities for developing, verifying, and validating work products.

2. Software work products are decomposed to the granularity needed to meet the estimating objectives.

3. Historical data are used where available.

4. Size estimating assumptions are documented.

5. Size estimates are documented, reviewed, and agreed to.

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This procedure typically specifies that:

1. Estimates for the software project's effort and costs are related to the size estimates of the software work products (or the size of the changes).
2. Productivity data (historical and/or current) are used for the estimates when available; sources and rationale for these data are documented.
   - direct labor expenses, overhead expenses, travel expenses, and computer use costs
3. Effort, staffing, and cost estimates are based on past experience.
   - Similar projects should be used when possible.
   - Time phasing of activities is derived.
   - Distributions of the effort, staffing, and cost estimates over the software life cycle are prepared.
4. Estimates and the assumptions made in deriving the estimates are documented, reviewed, and agreed to.

CMM Level 2 - Implementation

- The Level 2 KPIs provide for consistent project management
  - Requirements are the basis for estimates and plans
  - Estimates and plans are the basis for tracking, which provides feedback for re-planning
Institutionalizing the Practice of Estimation

- At CMM Level 2, the organization must ensure estimation is performed consistently on all projects
  - Policies and procedures
  - Organizational structures
  - Training (estimators, planners, managers), resources, tools
  - Measurements
  - Quality audits, management reviews

- At higher maturity levels, the organization must provide additional centralized support for estimation
  - Standard organizational software process, including processes for estimation
  - Corporate training programs, to distribute estimation skills and knowledge throughout the organization
  - Corporate database, including past experience data and guidance on how to use it in estimation

Requisites for Reliable Estimating Processes

1. A corporate memory (historical database)
2. Structured processes for estimating product size and reuse
3. Mechanisms for extrapolating from demonstrated accomplishments on past projects
4. Audit trails (Values for the cost model parameters used to produce each estimate are recorded and explained.)
5. Integrity in dealing with dictated costs and schedules (Imposed answers are acceptable only when legitimate design-to-cost or plan-to-cost processes are followed.)
6. Data collection and feedback processes that foster capturing and correctly interpreting data from work performed.

Indicators of Estimating Capability

1. Management acknowledges its responsibilities for developing and sustaining an estimating capability.
2. The estimating function is supported by a budget and funds.
3. Estimators have been equipped with the tools and training needed for reliable estimating.
4. The people assigned as estimators are experienced and capable.
5. Recognition and career paths exist such that qualified people want to serve as estimators.
6. Estimators work with process improvement teams to quantify and track progress in software process improvement.
7. The estimating capability of the organization is quantified, tracked, and evaluated.


Summary

- Many software organizations are addressing process maturity as part of improving their software development capabilities
- These improvements:
  - Require implementation of strong estimation practices;
  - Require institutionalization of estimation support through organizational infrastructure;
  - Build on accurate cost, effort, and schedule estimation for continued improvement in other process areas.
- Our challenge is to keep pace with the increased demand
  - Communication
  - Consistency
  - Confidence

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