

Process Improvement

- Understanding existing processes and changing these processes to increase product quality and/or reduce costs and development time
- Involve a very large number of activities
- Not possible to make process improvements that optimize all process attributes simultaneously
- Adopting methods, tools and models that is used elsewhere
- Take into consideration local organizational factors, procedures and standards specific to the organization
- Long term and continuous activity that constantly evolves as circumstances change
- Critical when quality of process determines product quality
- **Cyclic Activity** (3 phases)
 - o Process Measurement
 - Assess whether the efficiency of a process has been improved resulting in reduced effort and testing time
 - 3 classes of process metric
 - Time taken for process completion
 - Resources required for particular process
 - Number of occurrences of a particular event(defects, requirement changes, lines of code)
 - Fundamental difficulty of knowing what to measure
 - Use of GQM (Goal Question Metric) to identify
 - Goals
 - o Main Objectives
 - Questions (is it big enough)
 - o Sub goals and refinement of goals into specific areas
 - o Based on attributes of the main objectives of the goal and the solution
 - Metrics (does it have 4 bedrooms)
 - o Needed to confirm whether process improvements have achieved the desired goal
 - o Some metrics can assess more than 1 principles
 - o Metric is a measurement(a number) that should yield the same result regardless of the person
 - Advantages
 - Separates organizational concerns from specific process concerns
 - Focuses on data collection and suggests the data to be analyzed in different ways depending on question intended to answer
 - o Process Analysis
 - Study existing processes and develop an abstract model of processes that capture the key characteristics
 - The models enable understanding of processes to others
 - Study existing processes in order to understand the relationships between the parts of the process
 - Initial stages are qualitative and later stages are quantitative
 - Formal model is good as a starting point, defines the critical activities and life cycle deliverables that must be produced
 - Techniques
 - Questionnaires and interviews
 - Ethnographic studies (used to understand the nature of software development as a human activity, reveals subtleties and complexities not revealed with other techniques)
 - Process model elements
 - Role
 - Process
 - Pre/Post Conditions
 - Inputs and Outputs
 - Exception
 - Activity
 - Communication
 - Process models should show when it consumes/produces data
 - In process it shows the sequence of steps at achieving a sub goal
 - Process exceptions
 - Several key people falling ill
 - A serious breach of computer security
 - Organizational reorganization
 - Unanticipated request to write proposals
 - o Process Change
 - Modifications to existing processes for process improvements
 - 5 key stages
 - Improvement identification (what to improve)
 - Improvement prioritization (when to improve)
 - Process change introduction (Putting new tools/procedures in place)
 - Process change training (In order to gain full benefits)
 - Change tuning (Have a tuning phase to try new methods)
- Process Characteristics
 - o Understandability (how easy to understand process definition)
 - o Visibility (Culminate clear results)
 - o Supportability (To what extent do CASE tools support)
 - o Acceptability (Acceptable and usable by engineers)
 - o Reliability (Errors can be avoided/trapped early)
 - o Robustness (Exception handling and die gracefully)
 - o Maintainability (Evolve to changing organizational standards/circumstances)
 - o Rapidity (How fast can it be completed)

Process and Product Quality

- Statistical Quality Control
 - o Measure defects with process
 - o Reduction of defects by improving processes until repeatable
 - o Results are then predictable with less defects
 - o It is then standardize and further improved
- Software Processes
 - o intellectual processes cannot be automated
 - o Involve design processes where human capabilities are significant
 - o 4 main factors for product quality
 - Development technology
 - When teams are small so that they do not spend too much time on administration
 - No as important in large projects as members need to spend more time understanding the bigger picture of the project via communications
 - People quality
 - High experienced small teams usually tend to produce high quality products
 - Inexperienced teams follow good process for damage control but not necessarily high quality products
 - Cost time and schedule
 - Any project planned unrealistically or under budget will affect quality
 - Process Quality
 - Organizations must compete with others leading to sacrifice in quality to meet plan and budgets
 - o The factors are influenced by size and type of project
 - o Problems of large projects are integration, management, communications and volatile team(keep changing)

Process Classification

- Software process depends on formality, type of product and size of organization
- Classifications can overlap in some degree
- Classifications are useful because they serve as a basis for multidimensional process improvement, they help organizations choose the appropriate process for their unique development requirements
- Provides a basis for improving many types of processes
- Tool support that can effective in supporting processes depend on process classification
- 4 classes of software processes
 - o Informal Processes
 - No strictly defined process model
 - Relationships between procedures are defined as required
 - Used to develop prototypes, small systems
 - o Managed Processes
 - Defined process model
 - Schedule, procedures and relationships are defined
 - Used to develop large and long/life-time systems
 - o Methodical Processes
 - Defined development method(s) are used
 - CASE tool supports design and analysis processes
 - Well understood application domains and Re-engineered systems
 - o Improving Processes
 - Specific budget and procedures for processes that have inherent improvement objectives
 - Quantitative process measurement is used

Capability Maturity Model

- Assess QMS maturity in software organization
- Evaluate risk when using sub-contractors
- Focused on process improvement
- As the level of maturity increases, the performances of these key processes must improve
- Benefits
 - o Reduced Cost given less re-work
 - o Improved software reliability
 - o Greater likelihood of meeting cost and schedule targets
- Self evaluation (can be fake for promotion purposes)
- 5 levels

	Initial (1)	Repeatable (2)	Defined (3)	Managed (4)	Optimized (5)
Attributes	- Recognize need for quality management - Outcomes not repeatable due to no defined audited processes - De facto processes (chaotic)	- Quality management - Can produce repeatable outcomes - Motivating managers - Informal de facto processes	- Processes defined, documented and audited - Qualitative process improvement possible	- Process metrics collected - Product metrics collected - Process improvements based on quantitative measures	- Process improvement planned, budgeted and demonstrable - Process improvement part of corporate culture
Key Process Areas	- None - Ad hoc and unmanaged	- SW config management - SW quality assurance - SW sub contract management - SW object tracking & oversight - SW project planning - Requirements managed but not documented	- Peer reviews - Inter group coordination - SW product engineering - Integrated software management Training program Organization process definition Organization process focus	- SW quality management - Quantitative process management	- Process change management - Technology change management - defect prevention
Process Visibility	- No visibility into SW processes - No quantitative process data gathered	- Quantitative data available at process outputs - No process data at intermediate points	- Quantitative data available at process outputs - No process data at intermediate points	- Processes are well defined and managed - Quantitative data available throughout processes	- Quantitative data available throughout processes - Processes improved using the data and improvement processes

Project Planning

- Level 2 KPA
- Tools in project planning can track progress and determine problem areas

Software Configuration Management

- Level 2 KPA
- Managing version to version (patching)
- Concurrent software development (no accidental overwriting)
- Traceability and backtracking
- Branch integrity
 - o Different features from previous version and have concurrent development of 2 versions
- Satisfy SCM
 - o Policy and procedures must be documented, followed and analyzed
 - o Commitment and ability to perform activities in KPA
 - o Based on industry recognized best practices and the necessary infrastructure
- KPA resources
 - o Sufficient resources, funding and infrastructure
 - o RCS (revision control system)
 - o CVS (Concurrent Versions System)
- Goals
 - o SCM activities planned
 - o SW work products identified, controlled and available
 - o Control of Changes
 - o Affected groups are updated
- KPA ability to perform
 - o Organisation have the ability
 - o Have well defined responsibilities
 - o Adequate Resources
 - o A plan for using and managing SCM is documented and used
- KPA Measurement and Analysis
 - o SCM attributes are measured and analyzed
- KPA Verifying Implementation
 - o Periodic process review by the big shots
 - o Audits

CMMI Capability Maturity Model Integration

- Framework for process improvement that has broad applicability across a range of companies
- 3 areas
 - o Process Areas
 - Relevant for process capability and improvement
 - 4 groups
 - Process management
 - Project Management
 - Engineering
 - Support
 - o Goals
 - Specific goals associated with each process area and have defined desirable state for that area
 - Generic goals associated with the institutionalization of good practices
 - o Practices
 - Descriptions of ways to achieving a goal
 - Up to 7 specific and generic practices may be associated with each goal within each process area
- CMMI assessment has a 6 point scale
 - o Not performed
 - Specific goal not satisfied
 - o Performed
 - Goals satisfied
 - Scope of work is set out explicitly and communicated to all members
 - o Managed
 - Goals with each process area are met
 - Organizational policies in place
 - Documented plans, resource management and process monitoring
 - o Defined
 - Focus on organizational standardization and deployment
 - Managed processes tailored from a defined set of organizational processes
 - Process assets and process measurements must be collected for further improvement
 - o Quantitatively managed
 - Responsibility to use statistical and other quantitative methods to control sub-processes
 - o Optimizing
 - Process and product measurements drive process improvements
 - Trends are analyzed and processes are adapted to changes

Staged CMMI model

- Roughly same as CMM model
- 5 stages
 - o Initial
 - o Managed
 - o Defined
 - o Quantitatively managed
 - o Optimizing
- Advantage
 - o Compatible with software CMM
 - o Defines a clear improvement pathway
- Disadvantage
 - o May be more appropriate to introduce foals and practices at higher levels before lower-level practices
 - o Leads to have a maturity assessment giving a misleading picture of its capability

Continuous CMMI model

- Do not classify an organization according to discrete levels
- Use finer grained models that consider individual or groups of practices and assess the use of each
- A set of values show the organizations maturity for each process or process group
- Results is a capability profile showing each process area and its associated capability assessment
- Advantage is the organizations can pick and choose processes to improve according to their own needs and requirements