Coping with Change and Process Improvement

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ROAR

Topics Covered

- Coping with change
- Process improvement

Coping with change

- Change is inevitable in all large software projects.
  - Business changes lead to new and changed system requirements
  - New technologies open up new possibilities for improving implementations
  - Changing platforms require application changes
- Change leads to rework so that costs of change include both rework (e.g., re-analyzing requirements) as well as the costs of implementing new functionality

Reducing the costs of rework

- Change anticipation, where the software process includes activities that can anticipate possible changes before significant rework is required.
  - For example, a prototype system may be developed to show some key features of the system to customers.
- Change tolerance, where the process is designed so that changes can be accommodated at relatively low cost.
  - This normally involves some form of incremental development. Proposed changes may be implemented in increments that have not yet been developed. If this is impossible, then only a single increment (a small part of the system) may have to be altered to incorporate the change.

Changing requirements

- System prototyping, where a version of the system or part of the system is developed quickly to check the customer’s requirements and the feasibility of design decisions. This approach supports change anticipation.
- Incremental delivery, where system increments are delivered to the customer for comment and experimentation. This supports both change avoidance and change tolerance.

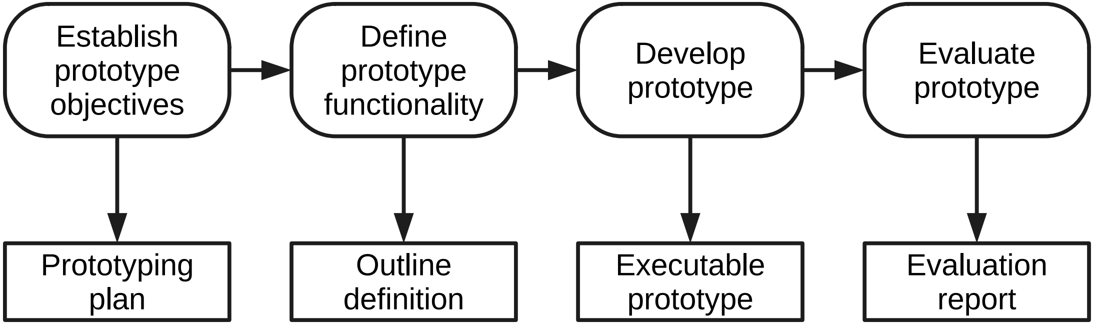
Software prototyping

- A prototype is an initial version of a system used to demonstrate concepts and try out design options.
- A prototype can be used in:
  - The requirements engineering process to help with requirements elicitation and validation
  - In design processes to explore options and develop a UI design
  - In the testing process to run back-to-back tests.

Benefits of prototyping

- Improved system usability
- A closer match to users’ real needs
- Improved design quality
- Improved maintainability
- Reduced development effort.

Prototyping process



Prototype development

- May be based on rapid prototyping languages or tools
- May involve leaving out functionality
  - Prototype should focus on areas of the product that are not well understood
  - Error checking and recovery may not be included in the prototype
  - Focus on functional rather than non-functional requirements such as reliability and security

Throw-away prototypes

- Prototypes should be discarded after development as they are not a good basis for a production system:
  - It may be impossible to tune the system to meet non-functional requirements
  - Prototypes are normally undocumented
  - The prototype structure is usually degraded through rapid change
  - The prototype probably will not meet normal organizational quality standards

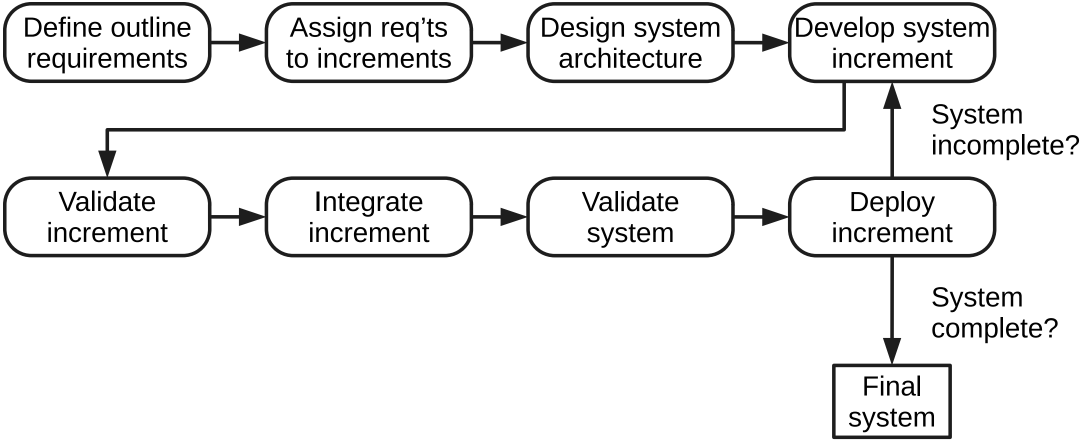
Incremental delivery

- Rather than deliver the system as a single delivery, the development and delivery is broken down into increments with each increment delivering part of the required functionality
- User requirements are prioritized and the highest priority requirements are included in early increments.
- Once the development of an increment is started, the requirements are frozen through requirements for later increments can continue to evolve.

Incremental development and delivery

- Incremental development
  - Develop the system in increments and evaluate each increment before proceeding to the development of the next increment
  - Normal approach used in agile methods
  - Evaluation done by user/customer proxy
- Incremental delivery
  - Deploy an increment for use by end-users
  - More realistic evaluation about practical use of software
  - Difficult to implement for replacement systems as increments have less functionality than the system being replaced

Incremental delivery



Incremental delivery advantages

- Customer value can be delivered with each increment so system functionality is available earlier.
- Early increments act as a prototype to help elicit requirements for later increments.
- Lower risk of overall project failure.
- The highest priority system services tend to receive the most testing.

Incremental delivery problems

- Most systems require a set of basic facilities that are used by different parts of the system.
  - As requirements are not defined in detail until an increment is to be implemented, it can be hard to identify common facilities that are needed by all increments.
- The essence of iterative processes is that the specification is developed in conjunction with the software.
  - However, this conflicts with the procurement model of many organizations, where the complete system specification is part of the system development contract.

Process improvement

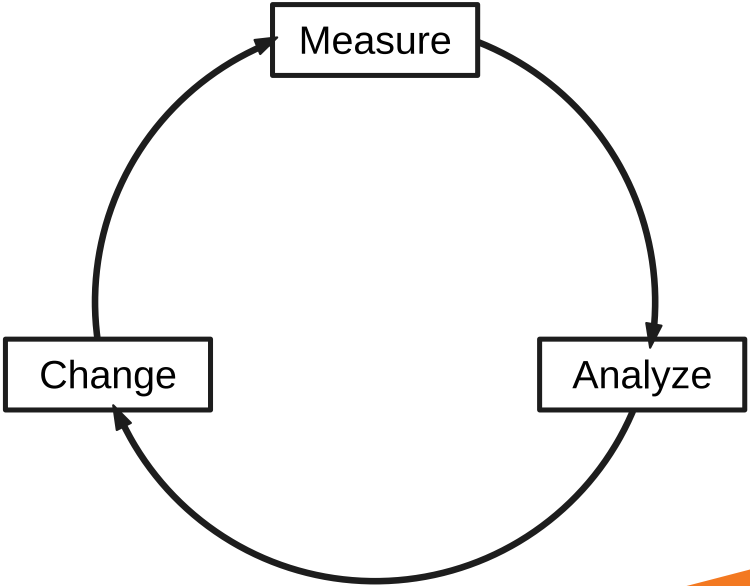
Process improvement

- Many software companies have turned to software process improvement as a way of enhancing the quality of their software, reducing costs of accelerating their development processes.
- Process improvement means understanding existing processes and changing these processes to increase product quality and/or reduce costs and development time.

Approaches to improvement

- The process maturity approach, which focuses on improving process and project management and introducing good software engineering practice.
  - The level of process maturity reflects the extend to which good technical and management practice has been adopted in organizational software development processes.
- The agile approach, which focuses on iterative development and the reduction of overheads in the software process.
  - The primary characteristics of agile methods are rapid delivery of functionality and responsiveness to changing customer requirements.

The process improvement cycle



Process improvement activities

- Process measurement
  - You measure one or more attributes of the software process or product. These measurements form a baseline that helps you decide if process improvements have been effective.
- Process analysis
  - The current process is assessed, and process weaknesses and bottlenecks are identified. Process models (sometimes called process maps) that describe the process may be developed.
- Process change
  - Process changes are proposed to address some of the identified process weaknesses. These are introduced and the cycle resumes to collect data about the effectiveness of the changes.

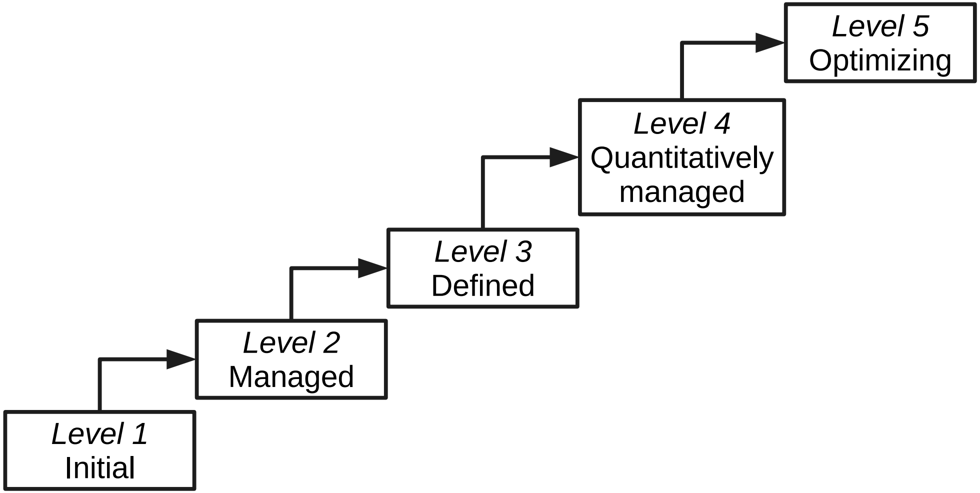
Process measurement

- Whenever possible, quantitative process data should be collected
  - However, where organizations do not have clearly defined process standards this is very difficult as you don't know what to measure. A process may have to be defined before any measurement is possible.
- Process measurements should be used to assess process improvements
  - But this does not mean that measurements should drive the improvements. The improvement driver should be the organizational objectives.

Process metrics

- Time taken for process activities to be completed
  - E.g., Calendar time or effort to complete an activity or process
- Resources required for processes or activities
  - E.g., Total effort in person-days.
- Number of occurrences of a particular event
  - E.g., Number of defects discovered.

Capability maturity levels



The SEI CMM

- Initial
  - Essentially uncontrolled
- Repeatable
  - Product management procedures defined and used
- Defined
  - Process management procedures and strategies defined and used
- Managed
  - Quality management strategies defined and used
- Optimizing
  - Process improvement strategies defined and used

Key Points

- Processes should include activities such as prototyping and incremental delivery to cope with change.
- Processes may be structured for iterative development and delivery so that changes may be made without disrupting the system as a whole.

Key Points

- The principal approaches to process improvement are agile approaches, geared to reducing process overheads, and maturity-based approaches based on better process management and the use of good software engineering practice.
- The SEI process maturity framework identifies maturity levels that essentially correspond to the use of good software engineering practice.

Are there any questions?