The Software Process - Part One

Charles Carter

October 2, 2017

Table of Contents

What is Engineering?

Engineering is the application of mathematics, science, economics, and social and practical knowledge to invent, innovate, design, build, maintain, research, and improve structures, machines, tools, systems, components, materials, processes, solutions, and organizations.

What is Engineering?

Engineering is the application of scientific knowledge to solving problems in the real world.

Frit Bauer

[Software Engineering] is the establishing and use of sound engineering principles in order to obtain economically software that is reliable and works efficiently on real machines.

IEEE

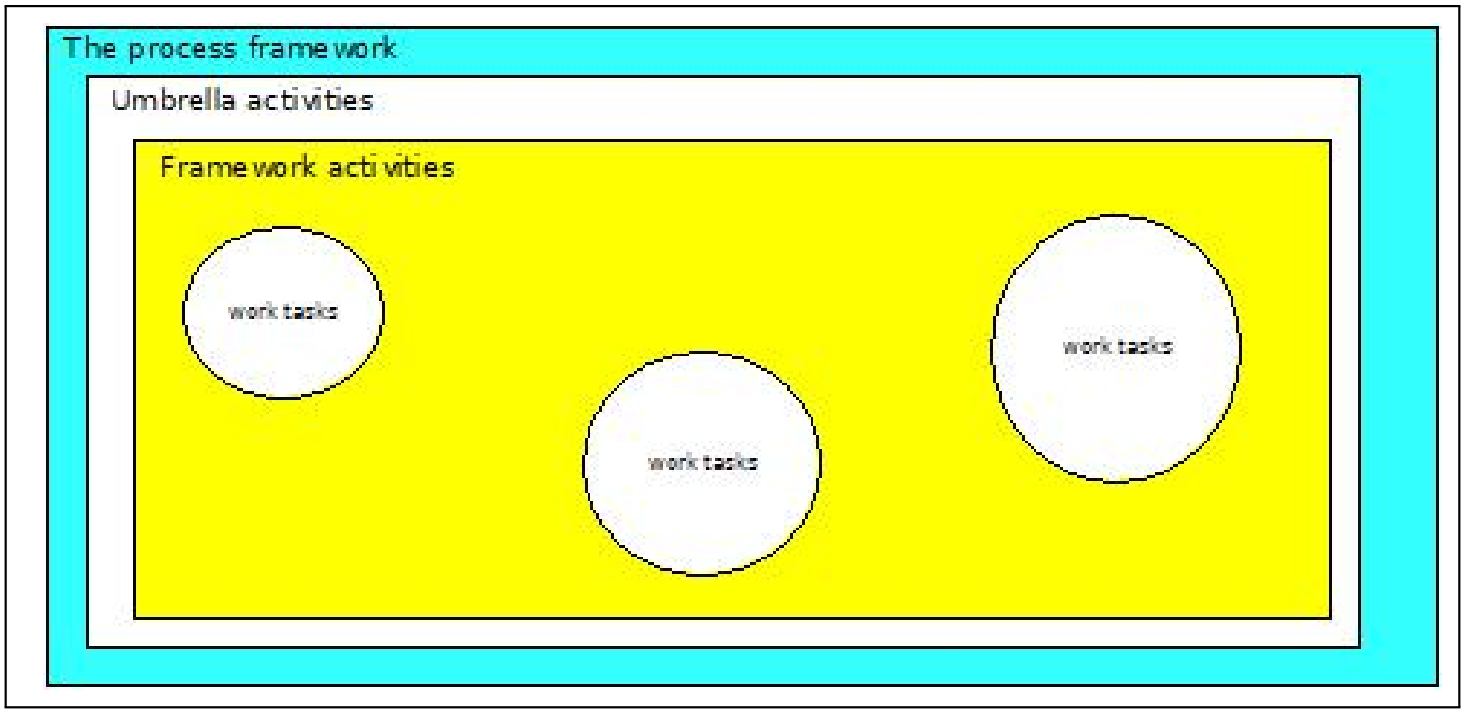
Software Engineering: (1) The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software: that is, the application of engineering to software. (2) The study of approaches as in (1).

The foundation for software engineering is the *process* layer. The software process forms the basis for management control of software projects and established the context in whih technical methods are applied, work products (models, documents, data, reports, forms, etc.) are produced, milestones are established, quality is insured, and change is properly managed.

Jacobson, Booch, and Rambaugh

A process defines *who* is doing *what*, *when*, *and how* to reach a certain goal.

Process


The process framework
Umbrella activities
Framework activities
work tasks
work tasks
work tasks

Process Framework

- Communication
- Planning
- Modeling
- Construction
- Deployment

Communication

Heavy communication with the customer, users, other stakeholders, and includes requirements engineering and other activities.

Planning

Established a plan for the software engineering work that follows. It describes the technical tasks to be performed, the risks that are likely, the resources that will be required, the work products that will be produced, and the work schedule.

Modeling

Encompasses the creations of models that allow the developer and the customer to better understand the requirements and the design that will achieve those requirements.

Construction

Combines code generation and the testing that verifies and validates the implementation artifacts. This especially includes the detection and rectification of errors.

Deployment

The software product is delivered to the customer, who evaluates it ad provides feedback based on that evaluation.

Umbrella activities

- Project tracking and control
- Risk management
- Software quality assurance
- Formal technical reviews
- Measurement
- Configuration management
- Reusability management
- Work product preparation and production

Project tracking and control

This allows the software team to assess progress against the project plan and take necessary action to maintain the schedule.

Risk management

This assesses the risks that may affect the outcome of the projecty or the quality of the project.

Formal technical reviews

This assesses the software engineering work products in order to uncover and remove errors and defects before they are propogated to the next activity.

Measurement

This defines and collects data concerning the process, process, and production metrics that assist in the performance of the other umbrella activities.

Configuration management

This manages the the effects of change throughout the process.

Reusability management

This defies criteria for work reuse and established mechanisms for building anbd maintaining reusable components.

Work product preparation and production

This encompasses all the activities necessary to required to prepare and product the engineering work products.

Capability Maturity Model Integrated

- Level 0: Incomplete
- Level 1: Performed
- Level 2: Managed
- Level 3: Defined
- Level 4: Quantitatively managed
- Level 5: Optimized

CMMI — Incomplete

The process area either does not perform or does not achieve all goals and objectives required.

CMMI — Performed

Meets Level 0, and in addition can perform all the work tasks required.

CMMI — Managed

Meeets Level 1, and in addition all process areas conform to an organizationally defined policy, all people doing the work have access to all the resources they need, and all procedures and processes are monitored, reviewed, and evaluated as to adherence with organizational policy.

CMMI — Defined

Meets Level 2, and in addition, all processes are tailored according to the organization's guidelines, metrics, and other process improvement standards.

CMMI — Quantitatively managed

Meets Level 3, and in addition, processes and procedures are controlled using measurements and quantitatively assessment.

CMMI — Optimized

Meets Level 4, and in addition, process areas are adapted and optimized using statistical metrics in order to institutionalize process improvement.

None

No standards The organization has no processes, procedures, or standards, and all work is not repeatable.

Performed

Basic Project Management

- requirements management
- project planning
- monitoring and control
- supplier management
- measurement and analysis
- quality assurance
- configuration management

Defined

Process Standrdization

- requirements development
- technical solution product integration
- verification and validation
- process focus, definition, and training
- integrated project management
- risk and supplier management
- decision analysis and resolution
- integration envorinment
- integrated teaming

Quantitatively Managed

quantitative management

- organizational process performance
- quantitative process managment

Optimized

continuous process improvement

- organizational innovation and deployment
- causal analysis and resolution

ISO 9001:2015

The ISO 9000 family of quality management systems standards is designed to help organizations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements related to a product or program.[1] ISO 9000 deals with the fundamentalsof quality management systems, including the seven quality management principles upon which the family of standards is based. ISO 9001 deals with the requirements that organizations wishing to meet the standard must fulfill.

Parts

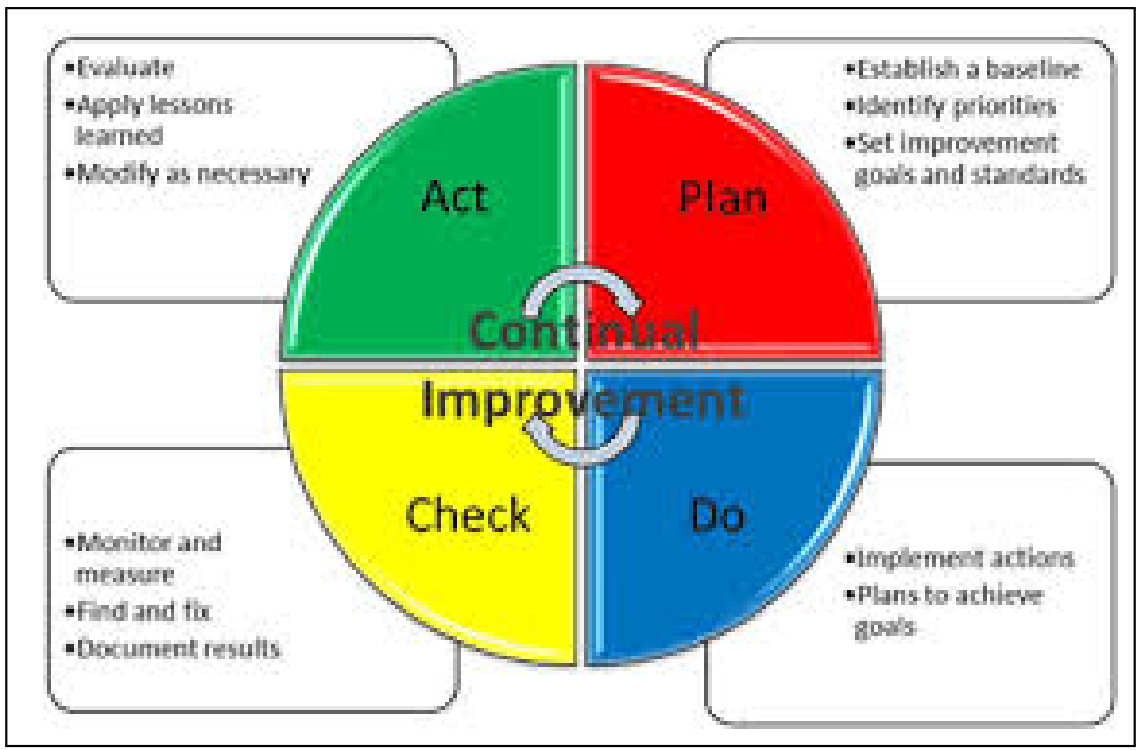
1. Scope
2. Normative references
3. Terms and definitions
4. Context of the organization
5. Leadership
6. Planning
7. Support
8. Operation
9. Performance evaluation
10. Improvement

Process Approach

The process approach is the key to an effective Quality Management System. It basically means that every operation of the company must be observed as a process, meaning you should identify all inputs, necessary resources, documents, activities, and outputs from each operation. In simple terms, the process approach represents the concept of observing all operations in the company as processes.

Plan-Do-Check-Act cycle

The core of this standard, and many other management system standards, is the so-called Plan-Do-Check-Act (PDCA) cycle



Context

- Understand the organization and its context
- Understand the needs and expectations of interested parties
- Determine the scope of the Quality Management System (QMS)
- Understand the QMS and its processes

Leadership

- Leadership and commitment
- Policy
- Organizational roles, responsibilities, and policies

Planning

- Actions to address risks and opportunities
- Quality objectives and planning to achieve them
- Planning changes

Support

- Resources
- Competencies
- Awareness
- Communication
- Documented information

Operation

- Operation planning and control
- Requirements for products and services
- Design and development of products and services
- Control of external processes, products, and services
- Production and service provision
- Release of products and services
- Control of nonconforming outputs

Performance Evaluation

- Monitoring, measurement, analysis and evaluation
- Internal audit
- Management review

Improvements

- General
- Nonconformity and corrective action
- Continual improvement

Personal Software Process

PSP defines five framework activities

- Planning
- High level design
- High level design review
- Development
- Postmortem

Introduces process discipline and measurement

PSP0 has 3 phases: planning, development (design, code, compile, test) and a post mortem. A baseline is established of current process measuring: time spent on programming, faults injected/removed, size of a program. In a post mortem, the engineer ensures all data for the projects has been properly recorded and analysed. PSP0.1 advances the process by adding a coding standard, a size measurement and the development of a personal process improvement plan (PIP). In the PIP, the engineer records ideas for improving his own process.

Introduces estimating and planning

Based upon the baseline data collected in PSP0 and PSP0.1, the engineer estimates how large a new program will be and prepares a test report (PSP1). Accumulated data from previous projects is used to estimate the total time. Each new project will record the actual time spent. This information is used for task and schedule planning and estimation (PSP1.1).

Introduces quality management and design

PSP2 adds two new phases: design review and code review. Defect prevention and removal of them are the focus at the PSP2. Engineers learn to evaluate and improve their process by measuring how long tasks take and the number of defects they inject and remove in each phase of development. Engineers construct and use checklists for design and code reviews. PSP2.1 introduces design specification and analysis techniques