Software Quality Assurance

Software engineering processes

- Systems vs. Software
  - Terms often used interchangeably
- Engineering Processes
- Quality
- Quality Systems
- Capability/Maturity Models

System: definitions

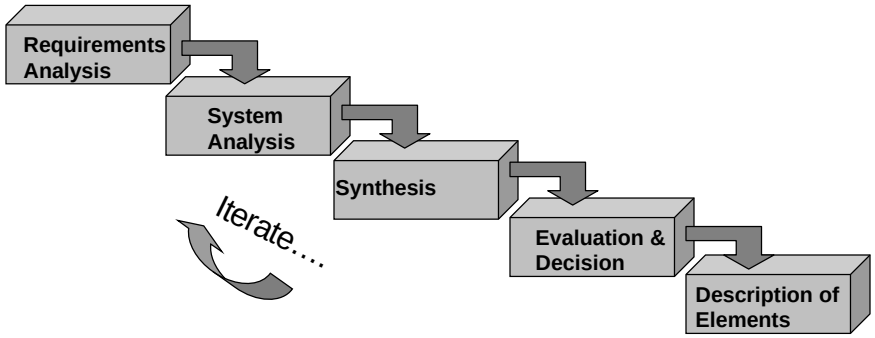
- System:
  - a combination of related elements organized into a complex whole
  - set of principles
  - way of proceeding
  - assembly of components
- It is possible to see how software fits these definitions

Systems engineering

- Design of complex systems
- Not just a bit of hardware, software, or some bricks
- The whole solution:
  - hardware, software, packaging, warranties, instruction manuals, emergency evacuation procedures…

Systems engineering

- A way of proceeding…

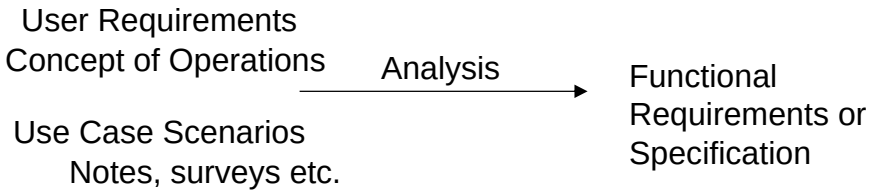


Engineering processes

- Process:
  - A series of actions to bring about an aim
- In any technical or scientific discipline, the intent of processes is to generate output from given inputs

Engineering processes

- E.g. a Requirements Analysis process is aimed at formalising and assessing the completeness and consistency of a set of user requirements



Quality: definition

- Quality
  - distinguishing characteristic
  - essential property
  - standard
  - excellence

Quality: origins

- Early 20th Century notion
- Origins in manufacturing:
  - Repeatable result
  - Little or no deviation between instances
  - Aimed at reducing costs…
  - … because variations require additional activity

Quality

- Today's use of "Quality" focuses on repeatability of results
  - a quality product may not just be of a high standard, but consistently so
- Consistency is the key…

Quality Systems

- Quality + System
  - Set of principles, or a way of proceeding, in order to achieve consistency
- E.g. ISO 9001:2000

- Companies get the “5 ticks”
  - But what does it actually mean?

ISO 9001:2000

- ISO 9001 is a Quality Standard
- It contains a number of requirements that must be met by a company’s procedures
- Highly tailorable
- The fundamental philosophy is:

  “Plan what you do &
  Do what you plan”

ISO 9001:2000

- A business is then audited regularly to ensure that:
  (a) Their procedures continue to meet the requirements of ISO 9001
  (b) Activities are actually carried out in accordance with the set procedures

ISO 9001:2000

- What does this mean for a builder?
- What does this mean for a company?
- What does this mean for customers?

Builders

- Planning
- Customer Focus
- Responsibility and Authority
- Reviews
- Documentation
- Purchase Handling
- Subcontractor Management

Contractor

- Planning
- Customer Focus
- Responsibility and Authority
- Reviews
- Documentation
- Purchase Handling
- Subcontractor Management

Customers

- There is a general feeling that you “pay for quality” as a customer
- The impact is not intended to be simply a higher bottom line, but less risk in that bottom line…
- … and a better chance of success if a repeat performance of a previous result is required

Other Quality Standards

- NATA (ISO 17025)
- ISO 9000 Series
  - Definitions
  - Guidelines for Improvement
  - Etc.
- ISO 16949
- ISO 10013

Quality Systems and Processes

- Process Standards exist for many Disciplines
  - Systems/Software Engineering
  - Civil Engineering
  - Accounting
- Systems and Software:
  - IEEE 2167A
  - MIL-STD-498
  - EIA-632

MIL-STD-498

- For example, MIL-STD-498 describes Software Development
  - Planning
  - Establishing a development environment
  - Requirements analysis
  - Implementation
  - Testing
  - Integration etc.

MIL-STD-498

- MIL-STD-498 is:
  - Prescriptive
    - I.e. it dictates the process, gives specific templates and DIDs (Data Item Descriptions)
  - Rigid
    - There are guidelines for interpretation and “tailoring” but the result looks very similar to the original

MIL-STD-498

- What is the intent?
  - The intent is to have a process that establishes good practices that minimise risks and errors whilst maximising control and visibility
- What does it have to do with Quality and ISO 9001?
  - ISO 9001’s intent is to describe the characteristics of a good set of processes…

ISO 9001 ⇔ MIL-STD-498

- In practice, the relationship is measured through compliance
  - E.g. A software business may establish its internal processes using MIL-STD-498 as a basis
  - A quality manual indicates the objectives of the processes with respect to ISO 9001
  - The business may be accredited as ISO 9001 compliant

Trends…

- Started out as prescriptive
- Have tended to become intent based

IEEE2167A

MIL-STD-498 ISO 12207

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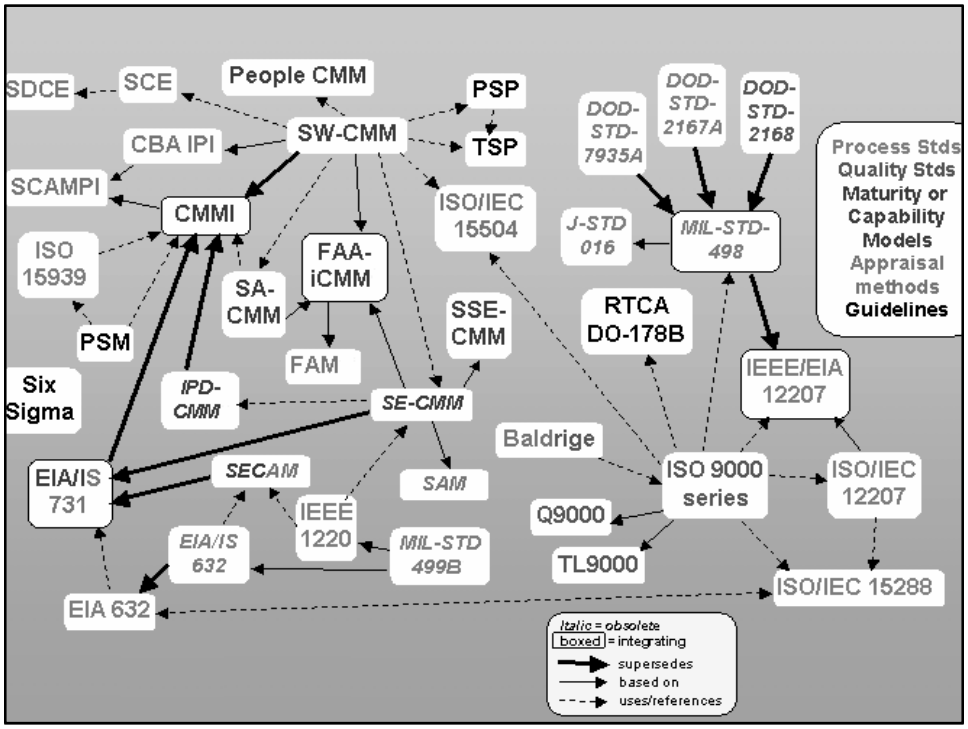
ISO 9001 ISO 15504



Where does this lead?

- Good Practice is the intent
- We have learned a lot since 1900
- We have learned a lot since 1990!
- Modern businesses need to be organic (dynamic and flexible)
- It is desirable to understand capability and maturity rather than strict adherence to dogma.

Capability maturity models

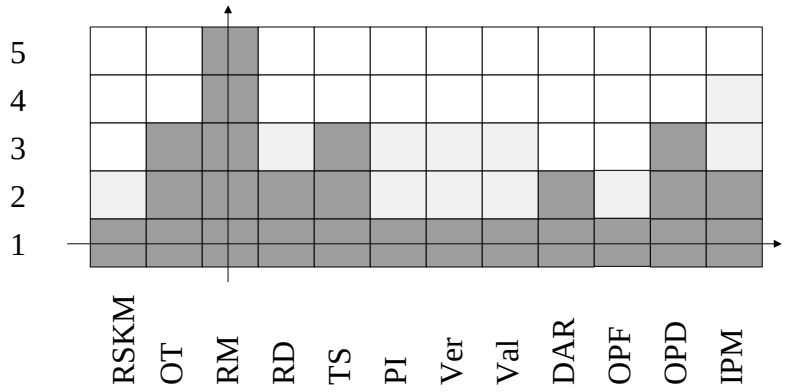
- CMM (c. 1990)
  - Predominantly software-centric
- CMMI (c. 2000)
  - From common “best” engineering practices
  - Two models:
    - Staged (focus on Maturity)
    - Continuous (focus on Capability)

Capability/maturity approach

- Structured as:
  - Process Areas (PA)
  - Specific Goals (SG) of each PA
  - Generic Goals (GG) common to all PAs
- Goals comprise Practices
  - “the kinds of things you should do”
- Intent-based
- Rate a company’s practices on the extent to which SGs and GGs met

Example

Respective capability or maturity level



Met Almost (!)

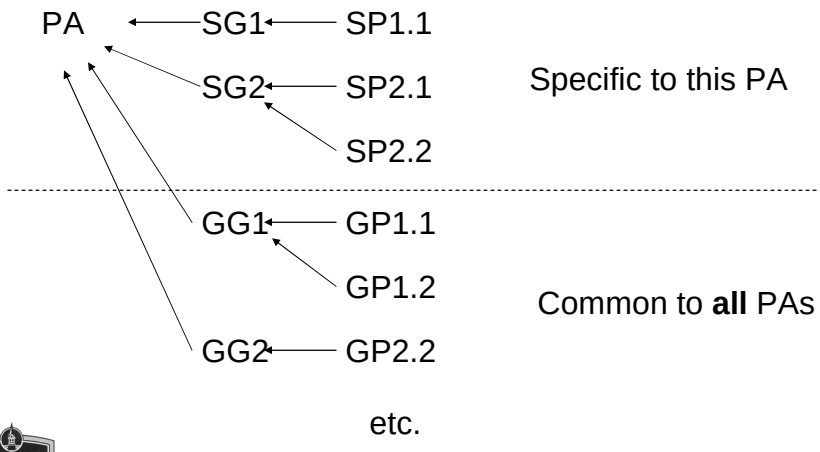
Capability/maturity

Level 5	Optimise
Level 4	Quantitatively Manage
Level 3	Institutionalise
Level 2	Manage
Level 1	Perform
Level 0	Do not perform

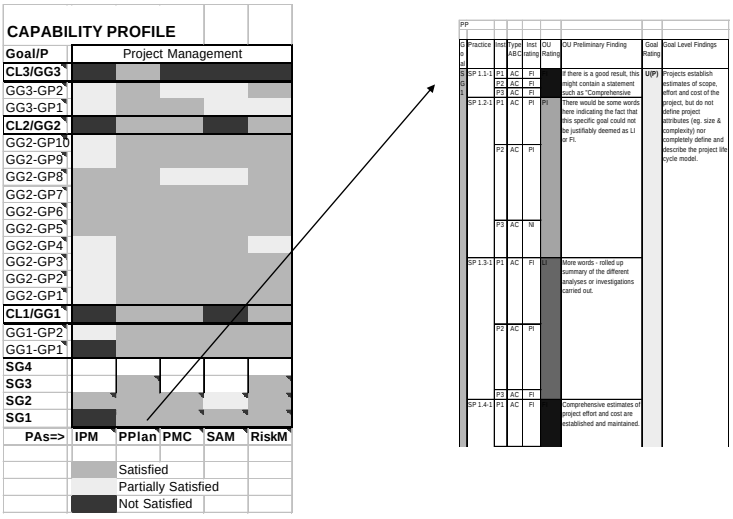
Rating Method

- All practices need to be performed to satisfy a goal
  - All SGs need to be met before a capability measure can be established
- The GGs identify the different capability levels in each PA
  - e.g. if all SGs are satisfied for PM, and GG1 is satisfied, then the organisation is said to have a capability level 1 in PM

Rating Method



Rating Process



Summary

- Provides an analysis of practices
  - Helps identify specific areas of improvement (if desired!)
  - Strengths/weaknesses
- Flexibility is maintained
  - Business behaviour is still organic
- Not intended to be a process policing activity!