COM4506/6506: Testing and Verification in Safety Critical Systems

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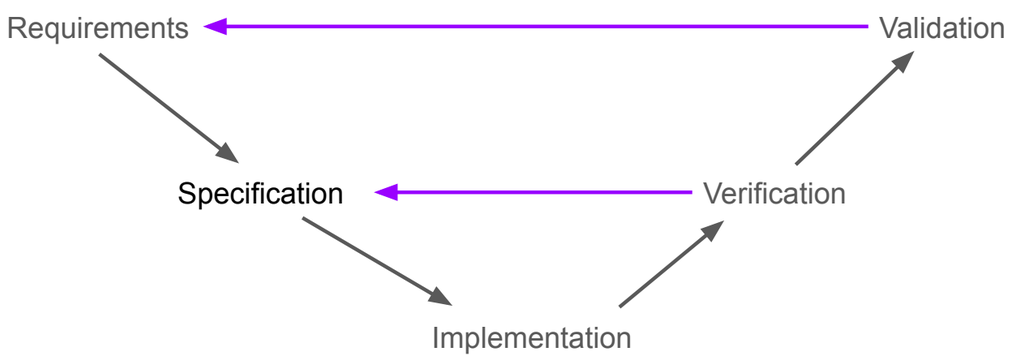
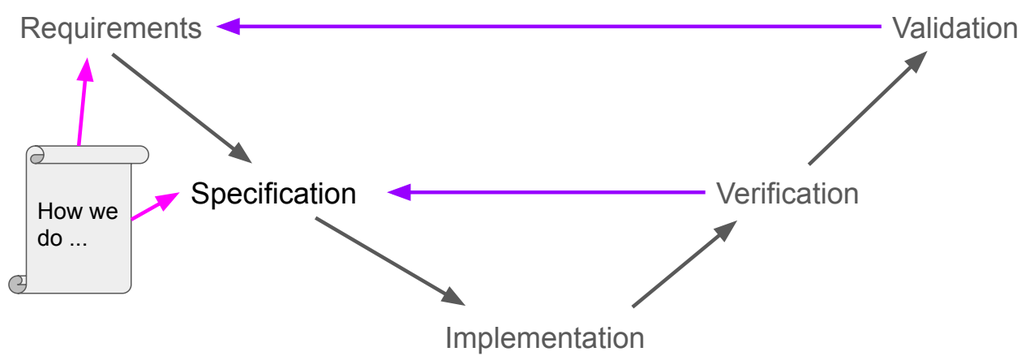
The V model



Processes...

The V model



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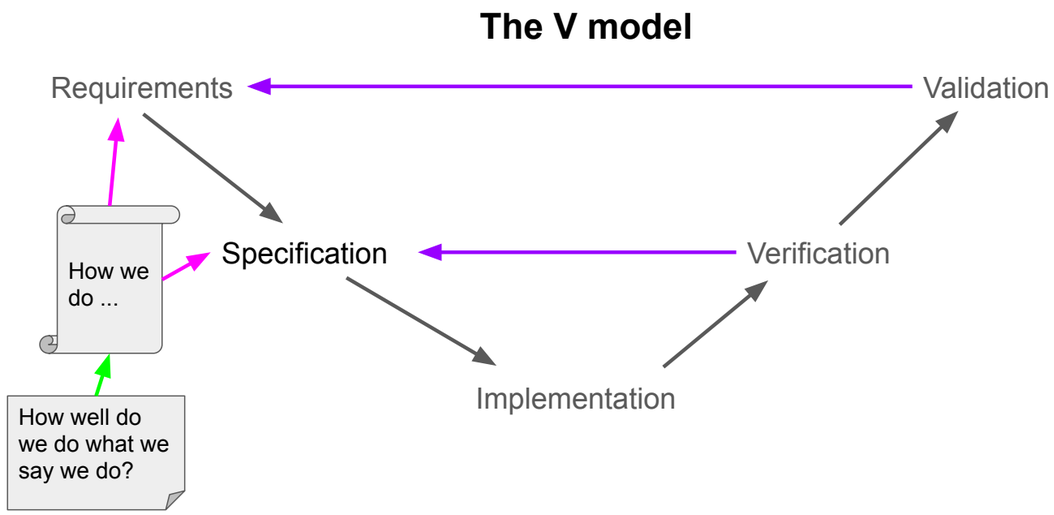

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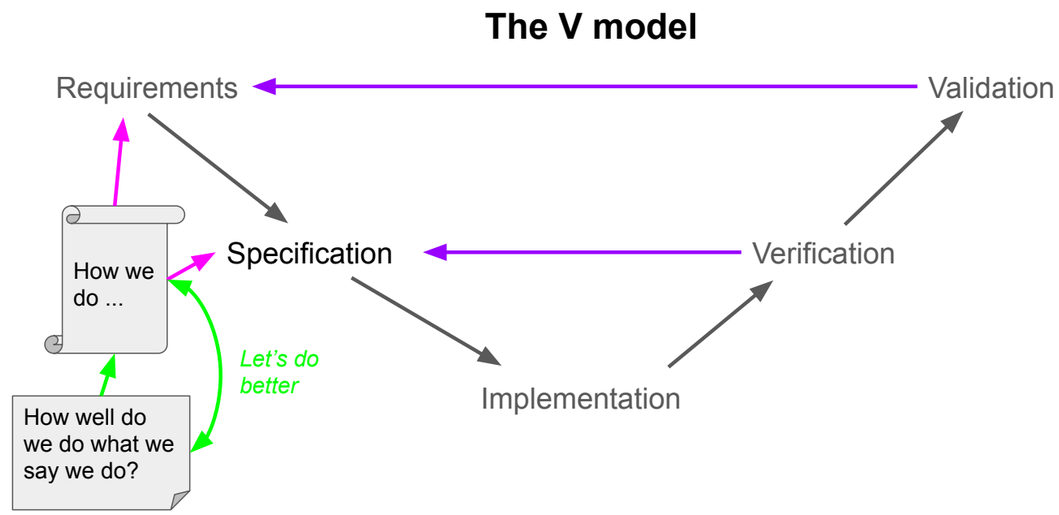

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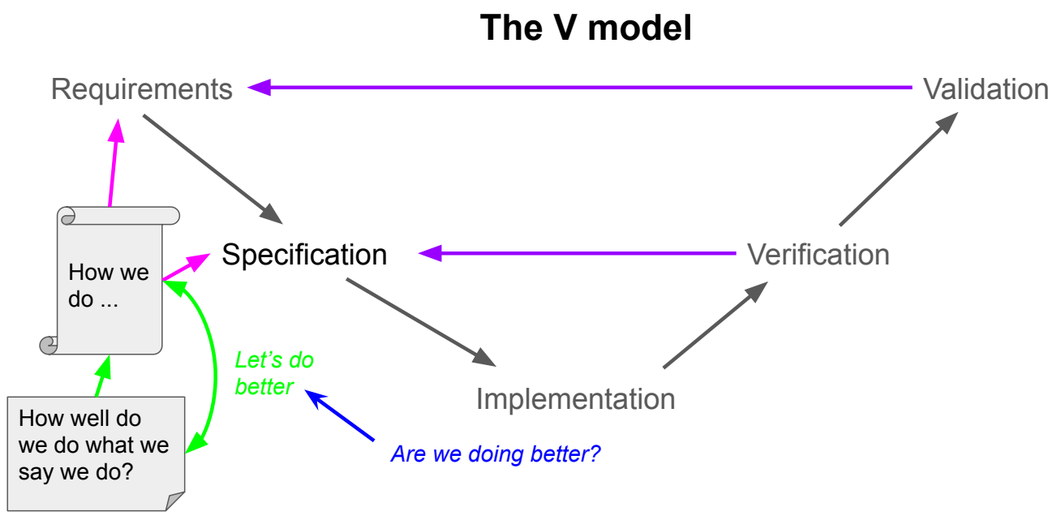

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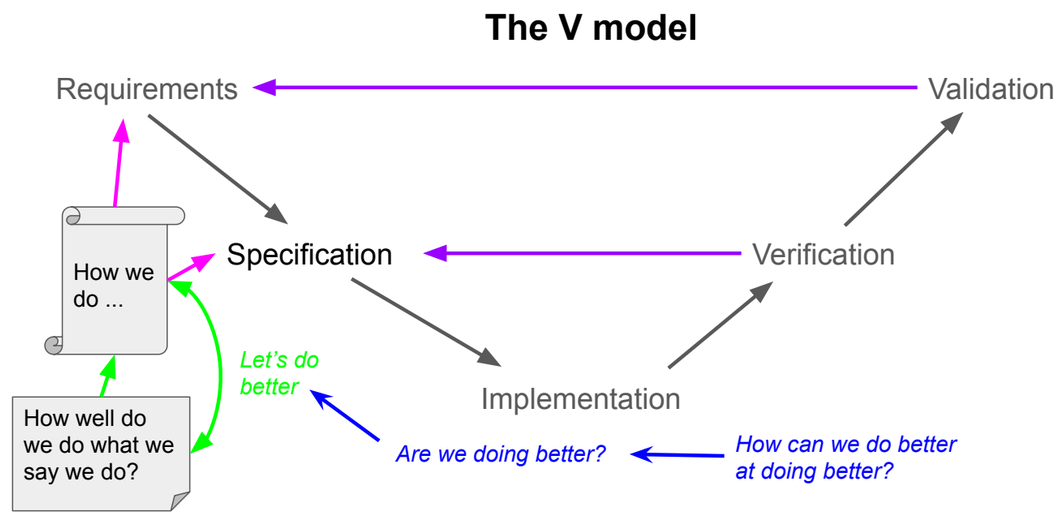

Assessing process processes(!)

Some “early” approaches:

- Six-Sigma
  - Motorola in the 1980’s, General Electric in the 1990s
  - Focussed on manufacturing and general business processes
- Lean Engineering
  - Technically, originates with Toyota in the 1930s
  - Codified in the 1980s and 1990s
  - Focussed on reducing “waste” - particularly wasted effort and time in production
- “Stages of Growth” model
  - Focussed on IT - but in the 1970s when that was rather different!
- ISO9001
  - Based on 1970s British Standards for Quality Control

CMM

After a number of cost and time overruns, the US Air Force commissioned the Carnegie Mellon University Software Engineering Institute (SEI) to develop a framework to assess the processes of development companies.

The produced the **Capability Maturity Model.**

This assessed the *maturity* of a company’s processes in terms of how well they **self-analysed** and **self-improved**.

CMMI

“...there are many maturity models available such as the Software Engineering Institute’s Capability Maturity Model for Software (SW-CMM), which focuses of improving software, and Electronic Industries Alliance’s System Engineering Capability Model (SECM), which focuses on systems engineering. By focussing on improving one area of a business, these models have unfortunately perpetuated the stovepipes and barriers that exist in organisations”

CMMI - Guidelines for Process Integration and Product Improvement
M. B. Chrissis, M. Konrad, and S. Shrum

Capability Maturity Model *Integrated*

CMMI aims to assess not just individual business processes, but also the joined-up effects of these processes, and **whether the organisation is improving them**.

Organisations’ processes are measured and rated into one of **5 levels of maturity**.

Level 0: Incomplete

(Technically, there are six levels!)

Processes either don’t actually exist, or don’t actually get followed!

Level 1: Performed

There is some kind of process.

The process does actually happen.

The process does actually produce a result.

Level 2: Managed

There is some kind of process that actually happens *and someone supports this*.

Staff get training and have skills.

Things get planned and people are held to the plan.

Stakeholders are included in the decisions.

Level 3: Defined

A process is planned, happens, and is managed, *and is based on some organisational standard*.

The organisation has a set of standard processes that are clearly documented.

The standard documentation tells you how to apply the process to specific projects.

Central training can be provided, and trained staff can move between projects and work in the same process.

Level 4: Quantitatively Managed

A process is planned, based on an organisational standard, happens, and is managed *with well defined metrics and measures.*

Management of the process includes **quantitative** techniques - metrics and measures that have well defined meaning.

Quality and performance is understood in statistical terms - “98% successful” means something!

The metrics are used as feedback for the management.

Level 5: Optimising

Processes happen as instances of the central, documented, quantitatively measured and managed system, *and the recorded metrics are used to improve the central process*.

Once several projects are running or have run a particular process and recorded metrics, this information is used to **improve** the centrally defined process.

Obviously, we are still doing all the things from levels 1-4!

Advancing through the levels

Whilst Level 5 should be the aim, organisations and processes can’t just jump straight there.

“Organisations can achieve progressive improvements in their organisational maturity by achieving control first at the project level and continuing to the most advanced level, organisation-wide continuous process improvement, using both quantitative and qualitative data to make decisions”

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Summary

- Processes are good, so processes for processes are better!
- There are various approaches that different organisations might use
- CMMI is designed to be cross domain
- There are 5 (or 6) levels of maturity
  - First, actually control your process
  - Then measure your process
  - Then use the measures to improve the process