Electrical & Computer ENGINEERING

18-642:
Key Development Metrics

2/26/2018

Without requirements and design, programming is the art of adding bugs to an empty text file.

— Louis Srygley

Carnegie Mellon University

It would be a pure function if not for the side effects on your sanity

Turning Coffee Into Code

The Definitive Guide

O RLY?

@ThePracticalDev

Key Embedded Software Metrics

- **Anti-Patterns:**
  - **Development effort > validation effort**
  - **Too many lines of code per hour**
  - **Peer review finds <50% of all bugs**

- **Healthy project metrics:**
  - About 2 hours of validation effort per hour development
    - Tester:Developer head count ratio is about 1 to 1
  - Productivity of 1-2 lines of code per hour for solid software
    - This includes entire process (requirements through acceptance test)
  - Peer review should be finding >50% of all defects

Software = Design + Testing

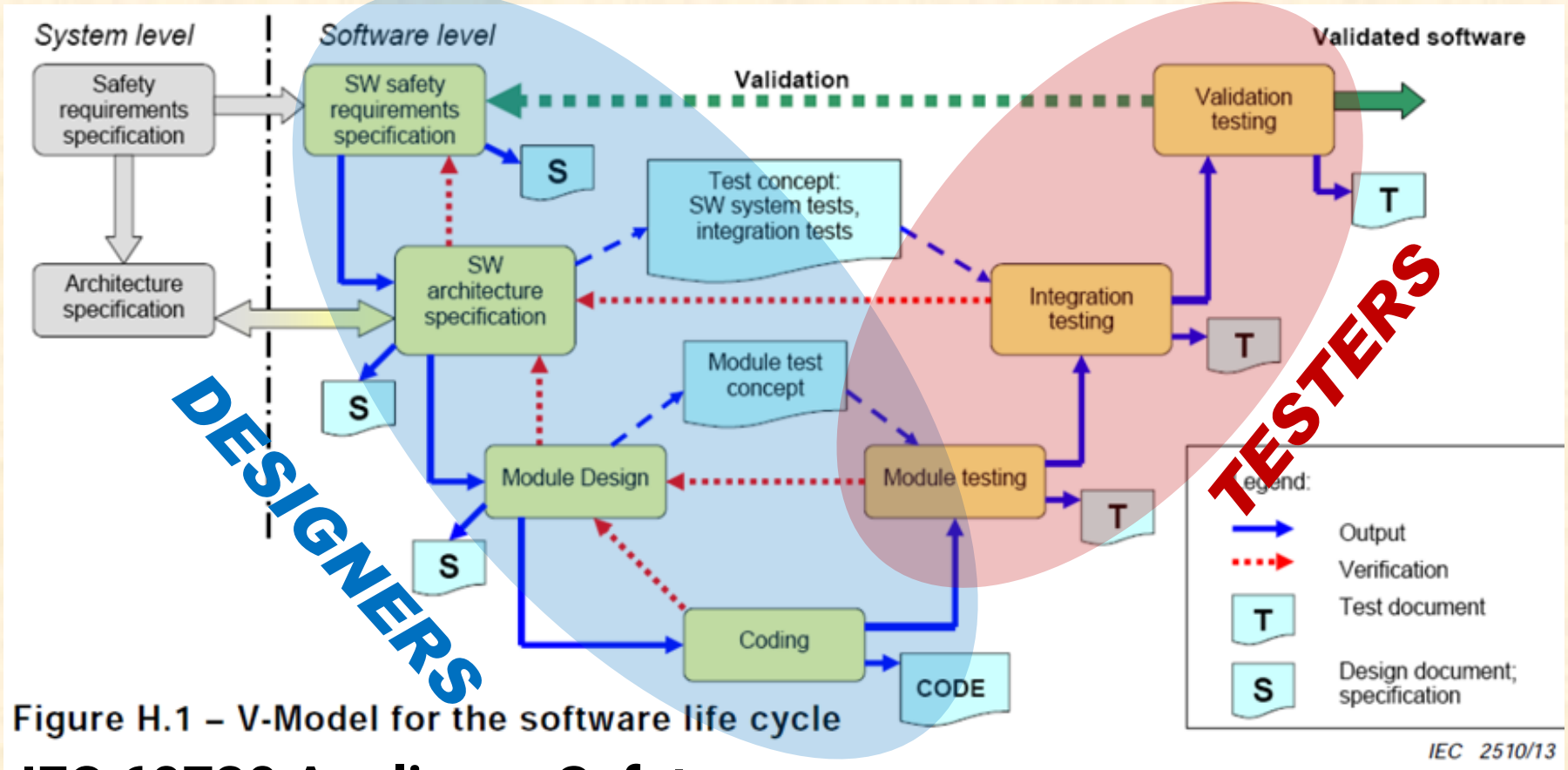


Figure H.1 – V-Model for the software life cycle

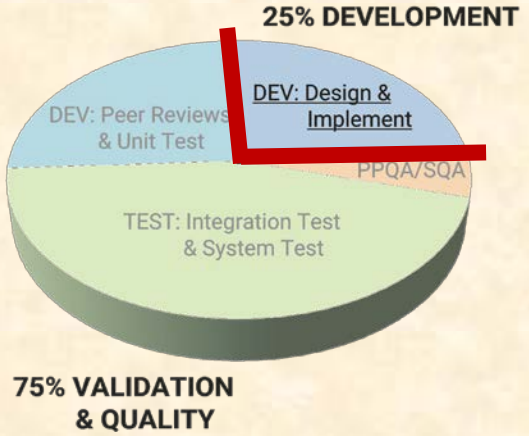
IEC 60730 Appliance Safety

[IEC 60730]

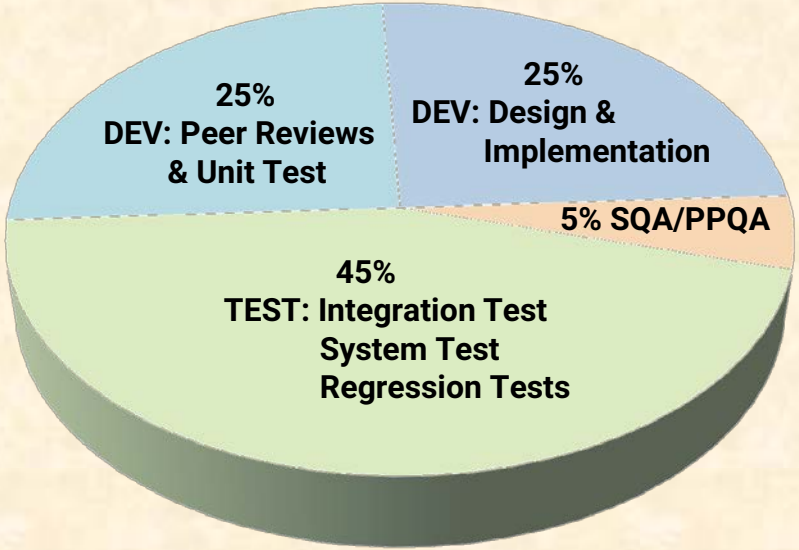
Typical Effort Distribution

- **Tester to Developer ratio varies depending on situation**
  - Web development: 1 tester per 5-10 developers
  - Microsoft: 1 tester per 1 developer
  - Aircraft controls: ~5 testers per 1 developer

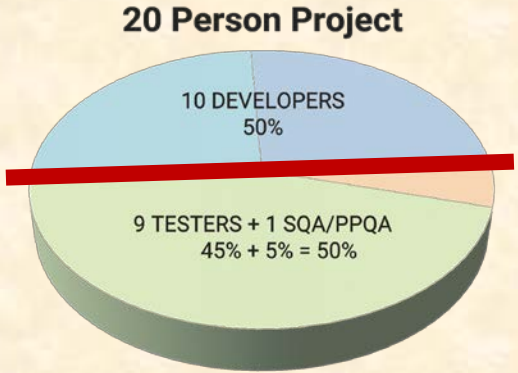
25%/75% Effort



EMBEDDED SW PROJECT EFFORT

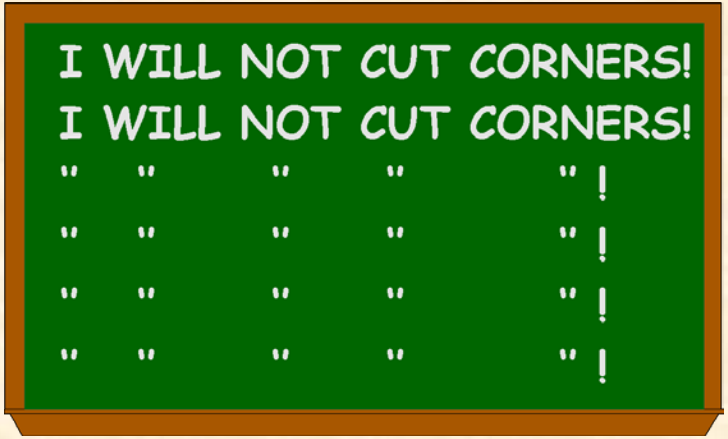


50%/50% Head Count



Code Productivity

- **Productivity 1-2 lines of code/hr (including testers)**
  - Perhaps 3 lines/hr with Agile, but that speed increases quality risk
- **High lines of code/hr ➔ cutting corners**
  - Partial requirements, no design?
  - No peer reviews?
  - Only system level testing?



[Simpsons 7F11]

- **$25-$75 / line of source code**
  - All-in cost, including entire V process, until field testing
  - “Maintenance” can cost more, but might count as new project

Peer Review Effectiveness

- **Good peer reviews find 50%-70% of the defects**
  - Fewer than 40%-50% of defects found in peer reviews mean they are **BROKEN**
- **Peer Reviews cost perhaps 5%-10% of total project cost**
  - Let's do the math:
    - Peer reviews process about 100 lines of code per hour total
    - Three reviewers ➔ 33 lines of code per person-hr
      = 0.033 hours per line of code reviewed (2 minutes)
    - 0.033 hours review / .5 hours per LOC total = **6.7% for code review**
    - Plus review requirements & design … but still a great ROI

- **Are peer reviews finding half your bugs?**
  - Are you spreading them out or bunching them together?
  - If they're not finding bugs, consider improving review culture

Best Practices For Key Software Metrics

- **2 hours of validation for each 1 hour of development**
  - Head count ratio generally 1 Tester to 1 Developer
  - About 5% of effort for SQA
- **Code productivity of about 1 to 3 lines per hour**
  - At or above 3 lines/hr, you probably are cutting corners
- **Peer reviews should find 50% (or more) of defects**
  - At about 5%-10% of total project cost
- **Metric Pitfalls**
  - Use only metrics that provide value – don't go crazy with metrics!
  - Gaming the metric doesn't improve software quality
  - Reward/punish based on metric values will render metric useless
  - Fast, good, cheap: pick any two.