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Using Data to Define Current Security Knowledge Gaps

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Software is Everywhere and it is All Data

You think you're building (or buying, or using) a product such as:

car or truck	satellite	mobile phone	development tools
home security system	aircraft	pacemaker	security tools
home appliance	financial system	bullets for a gun	

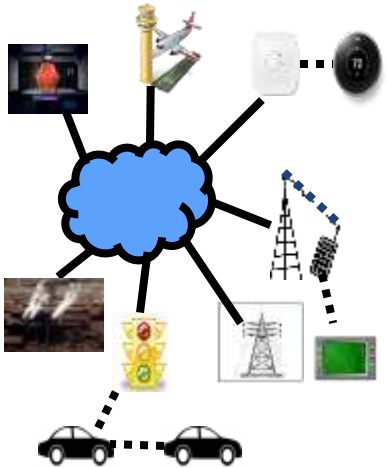
Actually you're getting ***a software platform:***

- Software is a part of almost everything we use.
- Software defines and delivers component and system communication.
- Software is used to build, analyze and secure software.

All software has defects:

- Best-in-class code has <600 defects per million lines of code (MLOC).
- Good code has around 1000 defects per MLOC.
- Average code has around 6000 defects per MLOC.

(based on Capers Jones research http://www.namcook.com/Working-srm-Examples.html)



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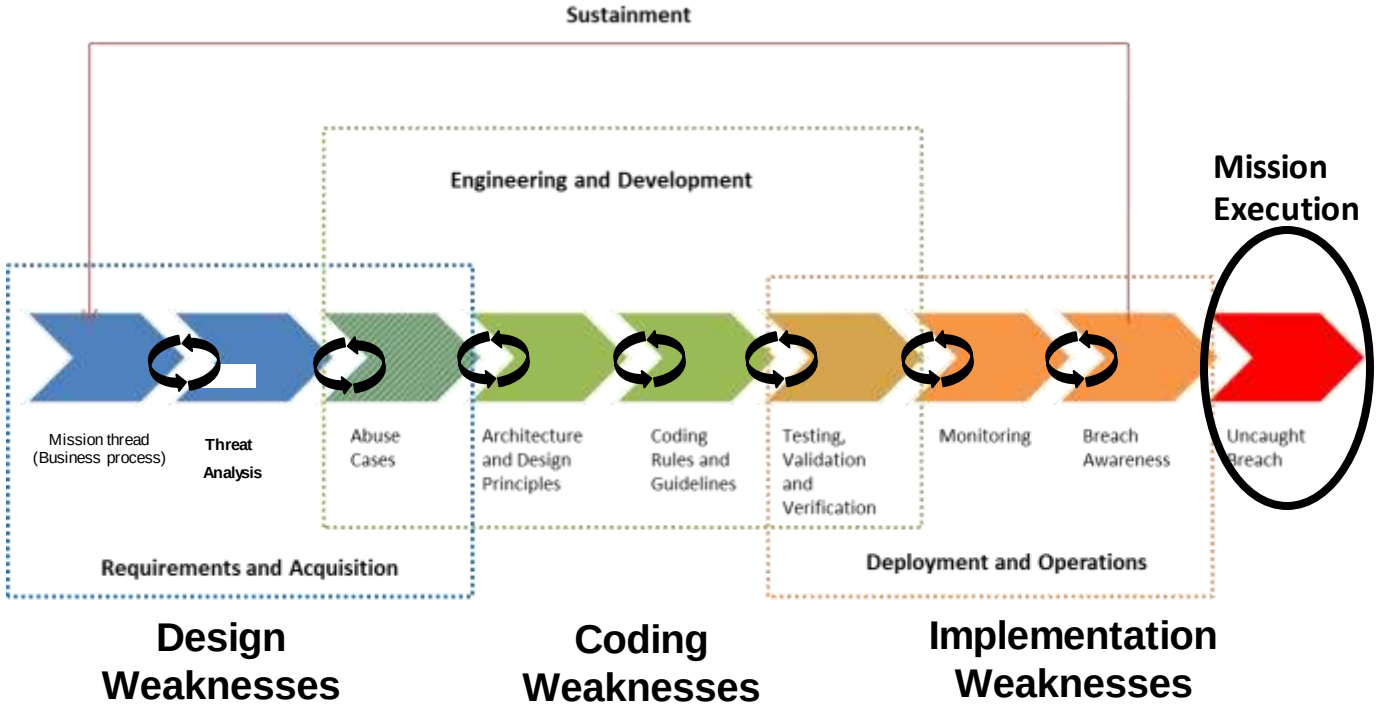
Many Hands Contribute the Security of the Product



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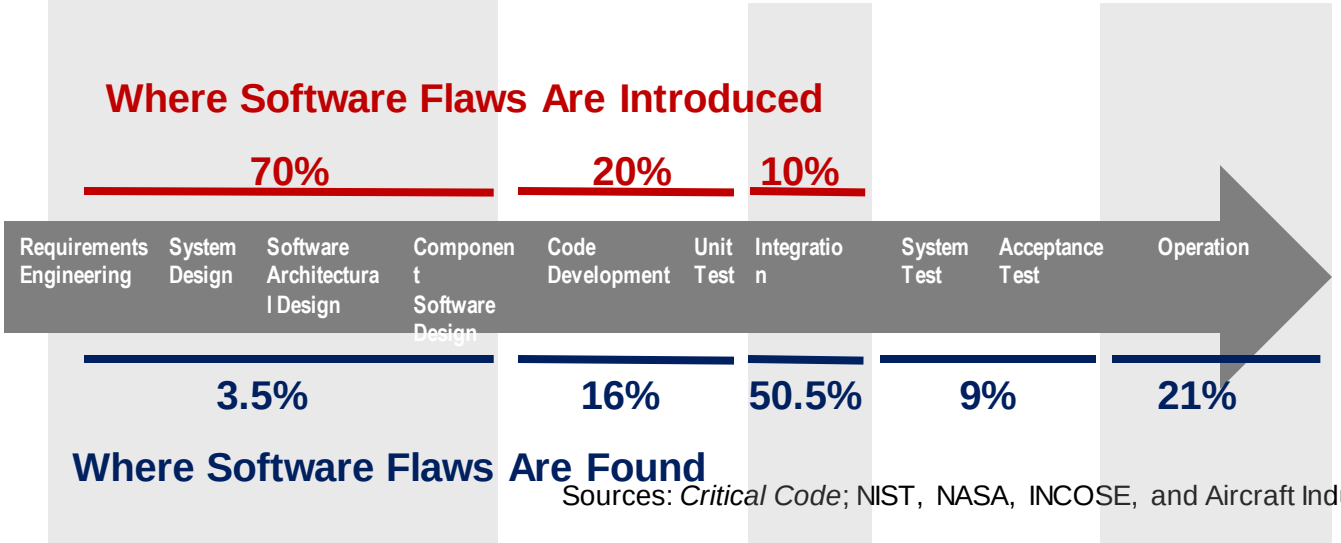
What Does the Data Tell Us About Defects in Software?



Sources: *Critical Code*; NIST, NASA, INCOSE, and Aircraft Industry Studies

All software code contain defects; up to 5% are vulnerabilities

ref: Woody, Carol et al. *Predicting Software Assurance Using Quality and Reliability Measures* http://resources.sei.cmu.edu/library/asset-view.cfm?AssetID=428589)

Hundreds of thousands of known software vulnerabilities exist in operations

ref: NIST National Vulnerability Database, https://nvd.nist.gov/general/nvd-dashboard

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Today, Operations Plays Whack-a-mole Chasing Attacks

Rapid delivery of features is prioritized over defensibility, reliability, and stability.

Operational missions are jeopardized by weak designs that allow attackers to leverage the many vulnerabilities.

Once software's in an operational system, vulnerabilities can be difficult (or impossible) to mitigate.

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Major Shifts In Processes and Design Add Cybersecurity Risk

From…	To…
Hardware-based solution	Software-intensive system
Waterfall methodology	Agile at scale approach
Organization owned infrastructure	Shared infrastructure (e.g. Cloud)
Compliance verification upon completion before fielding (e.g. ATO)	Continuous integrated monitoring (e.g. cATO)
Systems developed from requirements and architectural designs	Systems assembled primarily from reused (often 3rd party) components that map to requirements
Development life cycle tailored to the system under development	DevSecOps Development Factory using 3rd party tools and automation

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Key Knowledge Gaps

- System Engineers are not required to understand software
- Systems Engineers are not learning from current operational experience
- Acquisitions can be defined using standards, guidelines, and controls as a substitute for effective system security requirements
- Program Managers are not required to define and manage the risk of software failure

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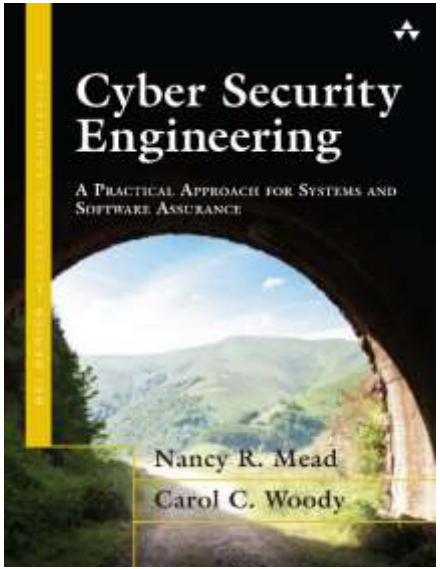
My Contributions to the Knowledge Gaps

Textbook

Cybersecurity Engineering



SEI Book Series

Professional Certificate

CERT Cybersecurity Engineering and Software Assurance

https://sei.cmu.edu/education-outreach/credentials/credential.cfm?customel_datapageid_14047=33881

Online training in five components

- Software Assurance Methods in Support of Cybersecurity Engineering
- Security Quality Requirements (SQUARE)
- Security Risk Analysis (SERA)
- Supply Chain Risk Management
- Advanced Threat Modeling

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Web Resources

Building security into application lifecycles

https://sei.cmu.edu/research-capabilities/all-work/display.cfm?customel_datapageid_4050=48574

CMU SEI Home Page

https://sei.cmu.edu/

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