Build Secure Applications and Systems with **DevSecOps**

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This material is based upon work funded and supported by the Department of Defense under Contract No. FA8702-15-D-0002 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center.

DM22-0843

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DevOps

DevOps and How it started

DevOps is a set of principles and practices emphasizing collaboration and communication between software development teams and IT operations staff along with acquirers, suppliers and other stakeholders in the life cycle of a software system [1]

- Patrick Debois “Agile infrastructure and operations: how infra-gile are you?”, Agile 2008 Conference
- John Allspaw “ 10+Deploys per Day: Dev and Ops Cooperation”, Velocity 2009
- DevOpsDays, October 30th 2009, #DevOps term born

[1] IEEE P2675 DevOps Standard for Building Reliable and Secure Systems Including Application Build, Package and Deployment

Who are Dev?

- Follow Agile methodologies
  - Using Scrum, Kanban and modern development approaches
  - Self directing, self managed, self organized
- Using any new technology
  - Each Dev has own development strategy
  - OpenSource,
- Allowed to have
  - Close relationships with the business
  - Software driven economy

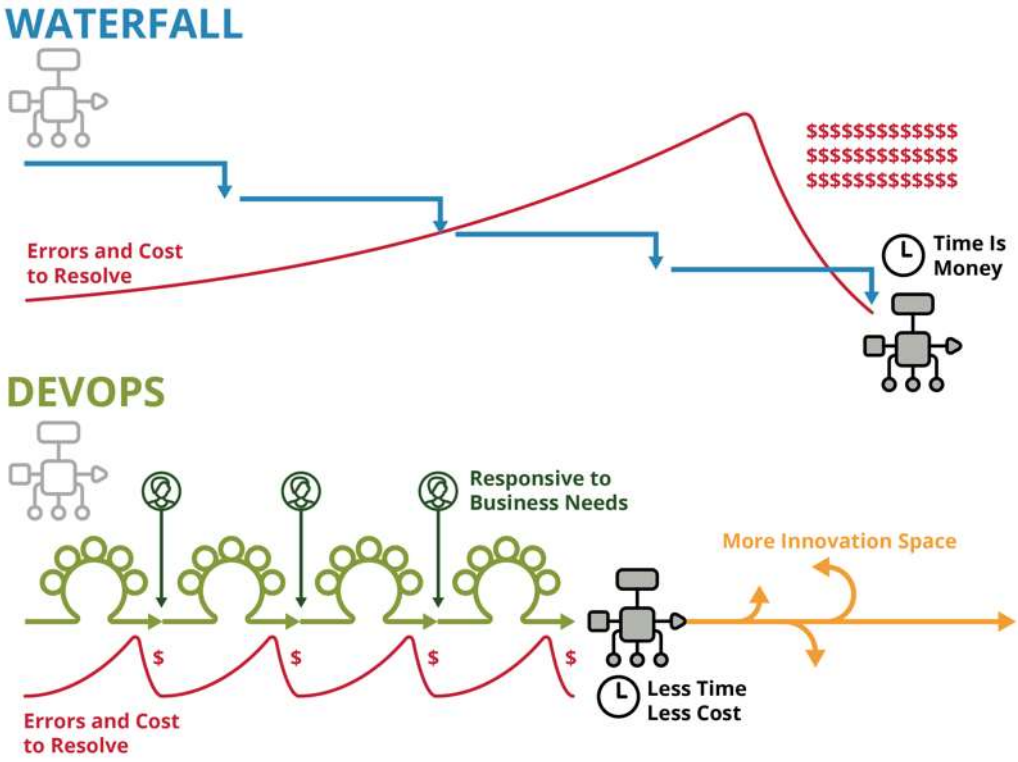
Want to deliver software faster with new requirements…

Who are Ops?

- Operations
  - Runs the application
  - Manages the infrastructure
  - Support the applications
- Operations provides
  - Service Strategy
  - Service Design
  - Service Transition
  - Service Operations
  - Secure systems

Want to maintain stability, reliability and security…

Key Benefits of DevOps



- Reduced errors during deployment
- Reduced time to deploy and resolve discovered errors
- **Repeatable** steps
- **Continuous availability** of pipeline and application
- Increased innovation time
- **Responsiveness** to business needs
- **Traceability** throughout the application lifecycle
- Increased stability and quality
- **Continuous feedback**

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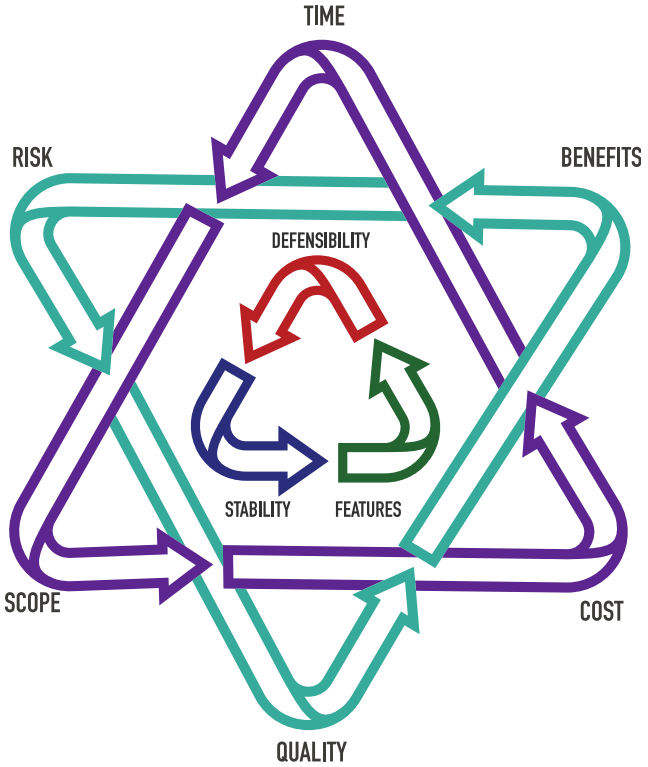
DevSecOps

DevSecOps: Simply a term for modern software engineering practices and tools that encompasses the full software lifecycle.



DevSecOps is a cultural and **engineering practice** that breaks down barriers and opens **collaboration between development, security, and operations** organizations **using automation** to focus on rapid, frequent delivery of secure infrastructure and software to production. It encompasses intake to release of software and manages those flows predictably, transparently, and with minimal human intervention/effort [1].

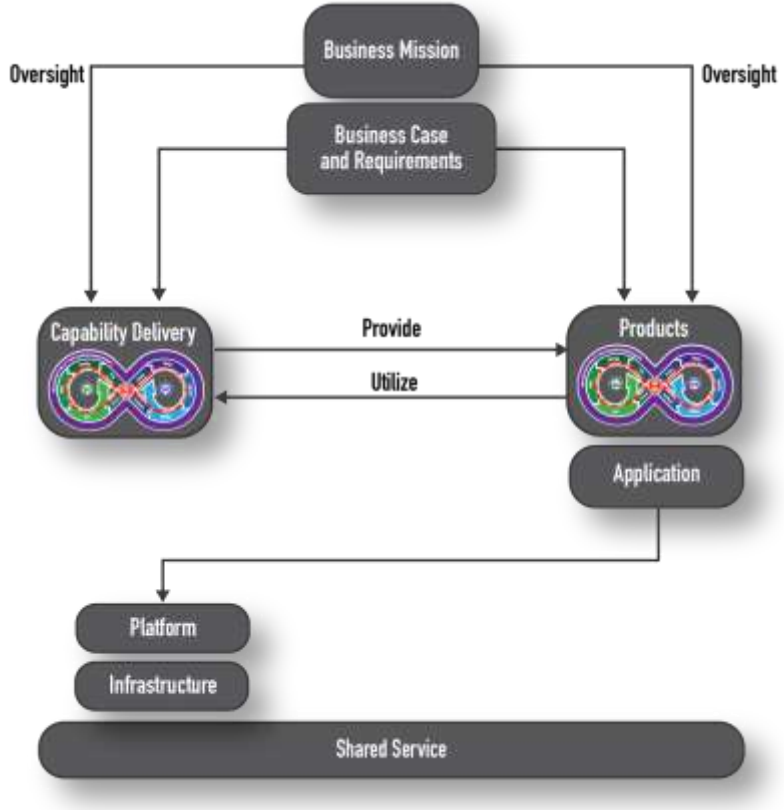
A **DevSecOps Pipeline** attempts to seamlessly integrate "three traditional factions that sometimes have opposing interests:

- **development**; which values features;
- **security**, which values defensibility; and
- **operations**, which values stability [2]."

Not only does one need to balance the factions. They must do so in a way that balances **risk**, **quality** and **benefits** within their **time**, **scope**, and **cost** constraints.

[1] DevSecOps Guide: Standard DevSecOps Platform Framework. U.S. General Services Administration. https://tech.gsa.gov/guides/dev_sec_ops_guide. Accessed 17 May 2021
[2] DevSecOps Platform Independent Model, https://cmu-sei.github.io/DevSecOps-Model/

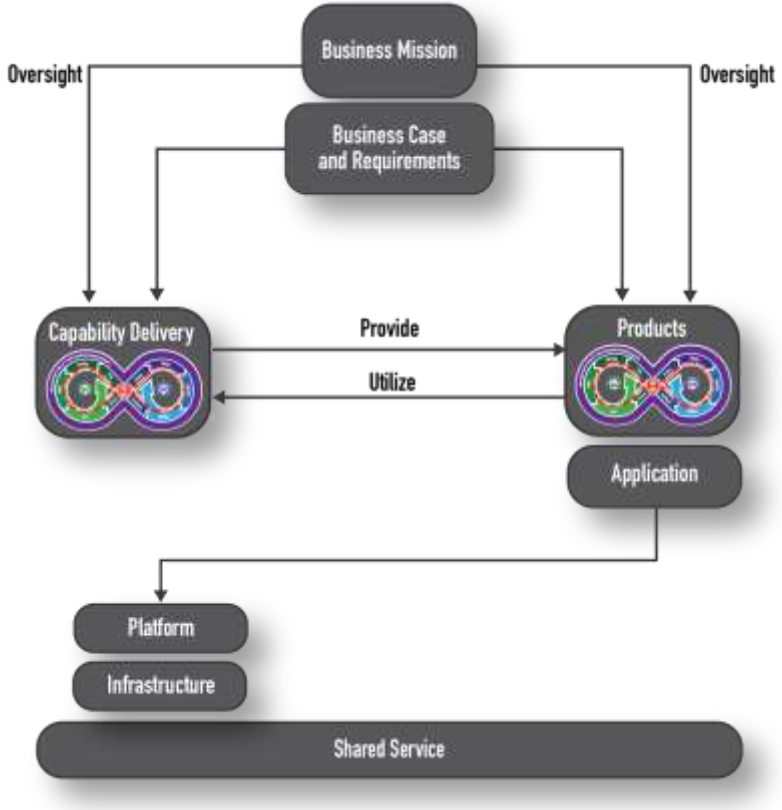
An Enterprise View



All DevSecOps-oriented enterprises are driven by three concerns:

- *Business Mission* - captures stakeholder needs and channels the whole enterprise in meeting those needs. It answer the questions Why and For Whom the enterprise exists
- *Capability to Deliver Value* - covers the people, processes, and technology necessary to build, deploy, and operate the enterprise's products
- *Products* - are the units of value delivered by the organization. Products utilize the capabilities delivered by the software factory and operational environments.

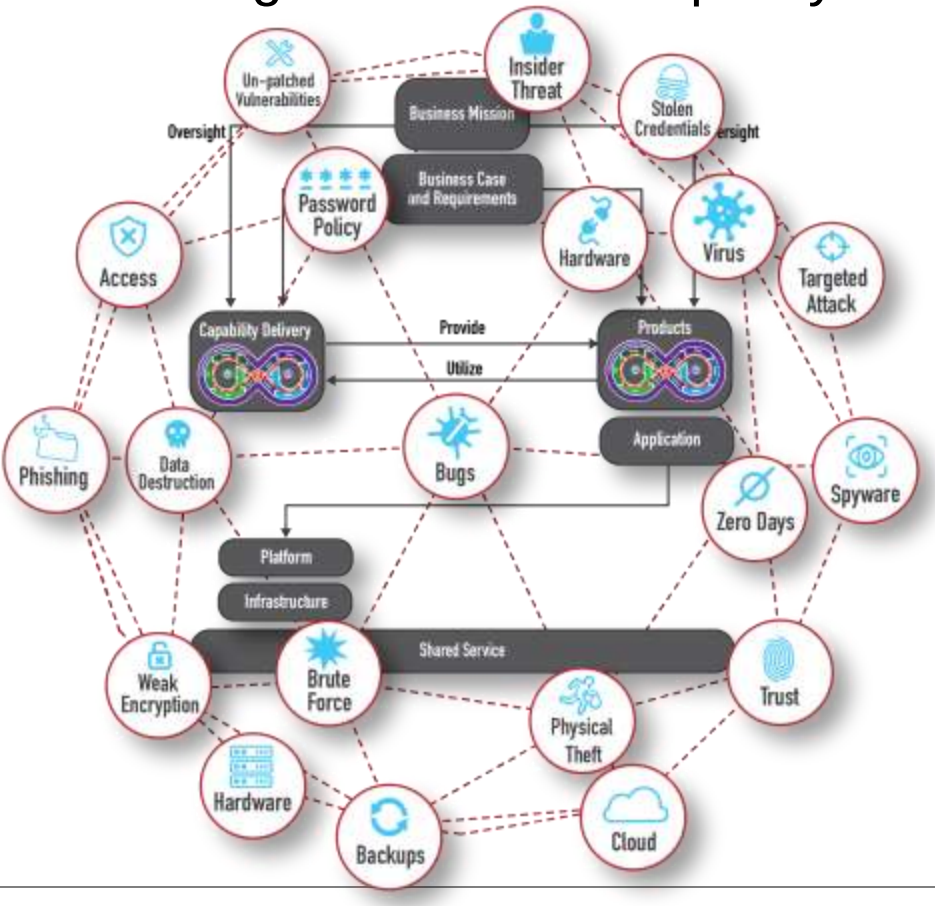
Challenge 1 for DevSecOps: connecting process, practice, & tools



Creation of the DevSecOps (DSO) pipeline for building the product is not static.

- Tools for process automation must work together and connect to the planned infrastructure
- Everything is software and all pieces must be maintained but responsibility will be shared across multiple organizations (Cloud for infrastructure, 3rd parties for tools and services, etc.)

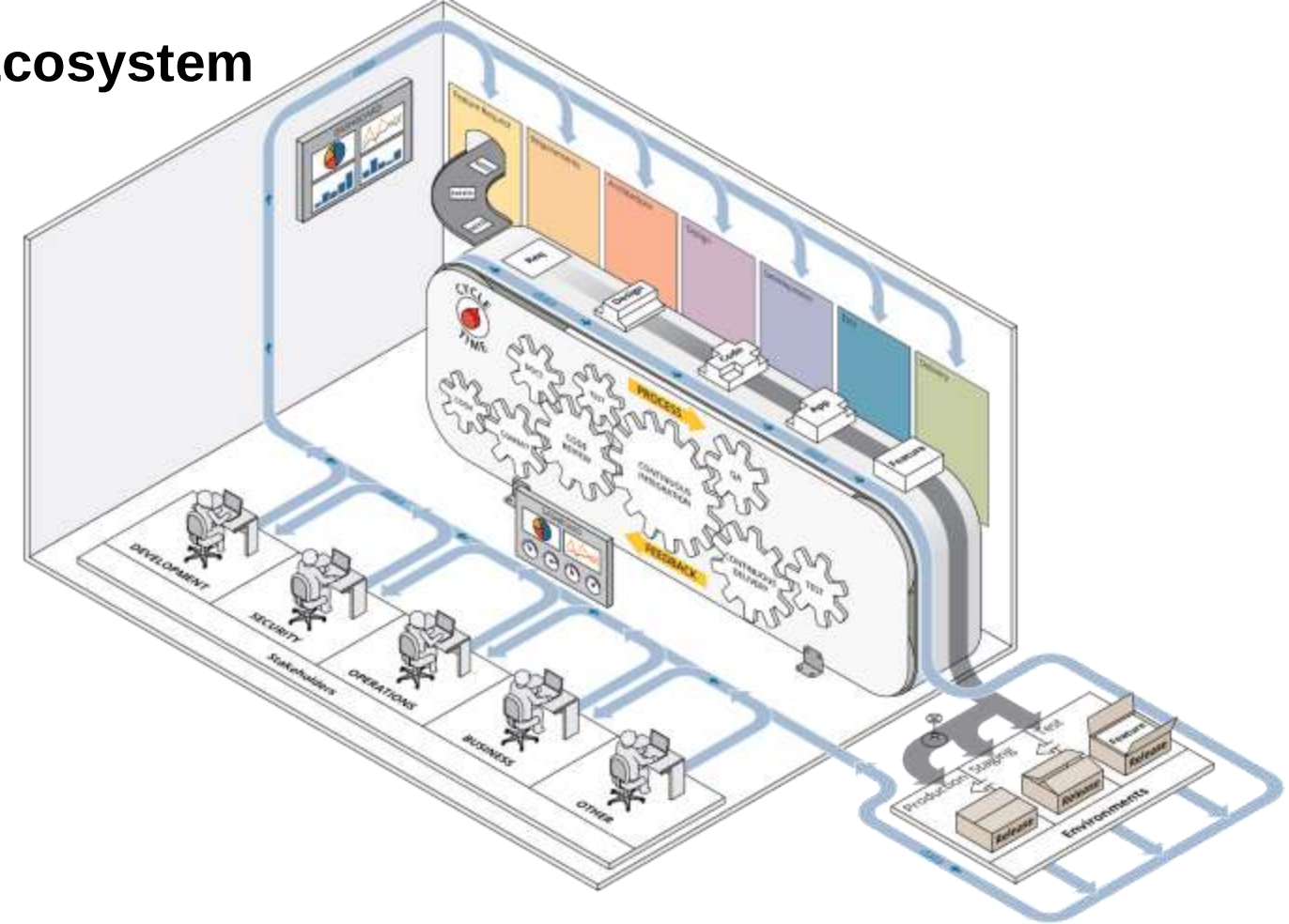
Challenge 2 for DevSecOps: cybersecurity of pipeline and product



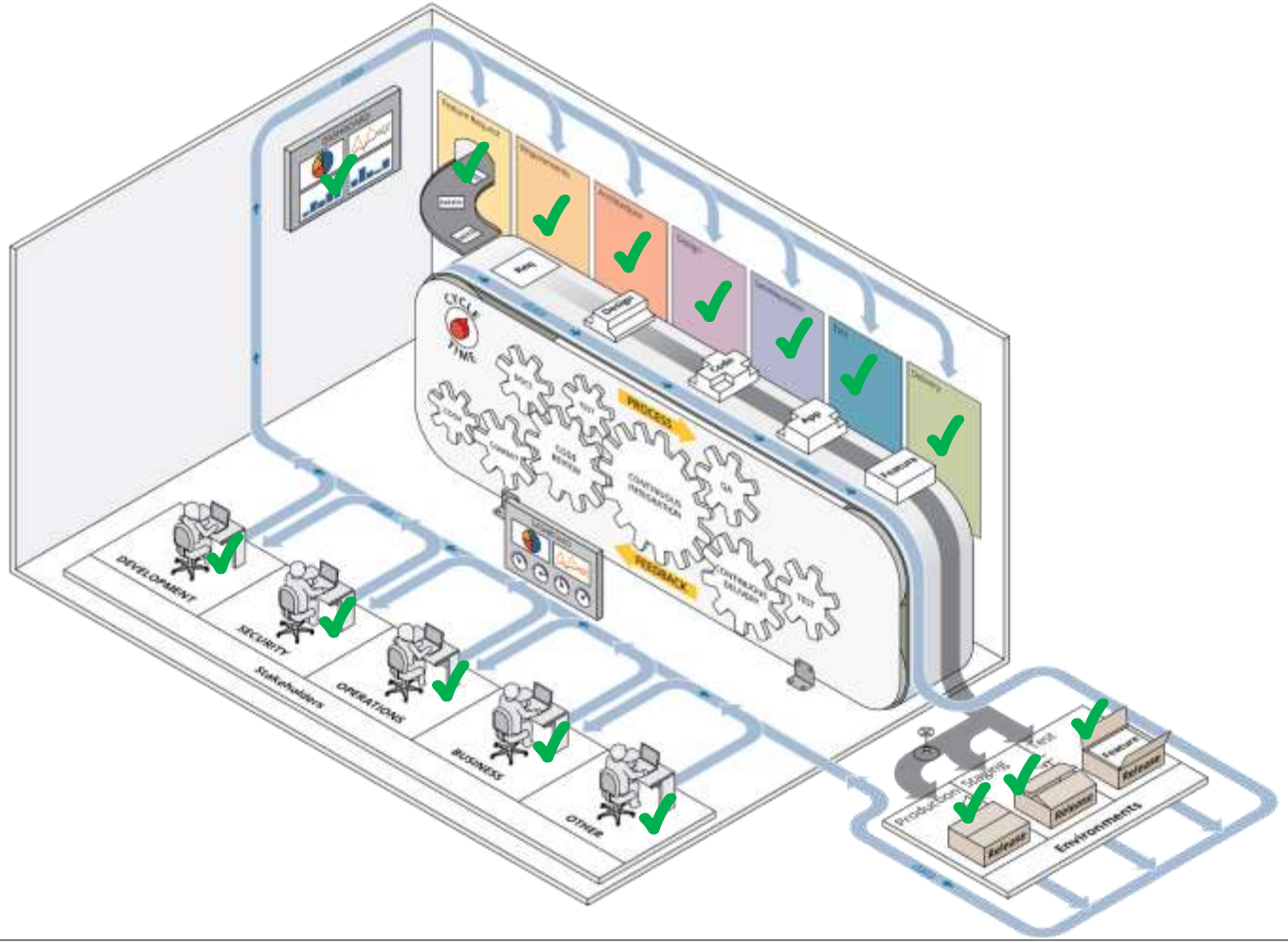
- The tight integration of Business Mission, Capability Deliver, and Products, using integrated processes, tools, and people, increases the attack surface of the product under development.
- Managing and monitoring all of the various parts to ensure the product is built with sufficient cybersecurity and the pipeline is maintained to operate with sufficient cybersecurity is complex.
- How do you focus attention to areas of greatest concern for security risks and identify the attack opportunities that could require additional mitigations?

The DevSecOps Ecosystem

- Feature to deployment
- Iterative and incremental development
- Automation in every phase of the SDLC
- Continuous feedback
- Metrics and measurement
- Complete engagement with all stakeholders
- Transparency and traceability across the lifecycle



Think Security from Inception to Deploy and improve every delivery



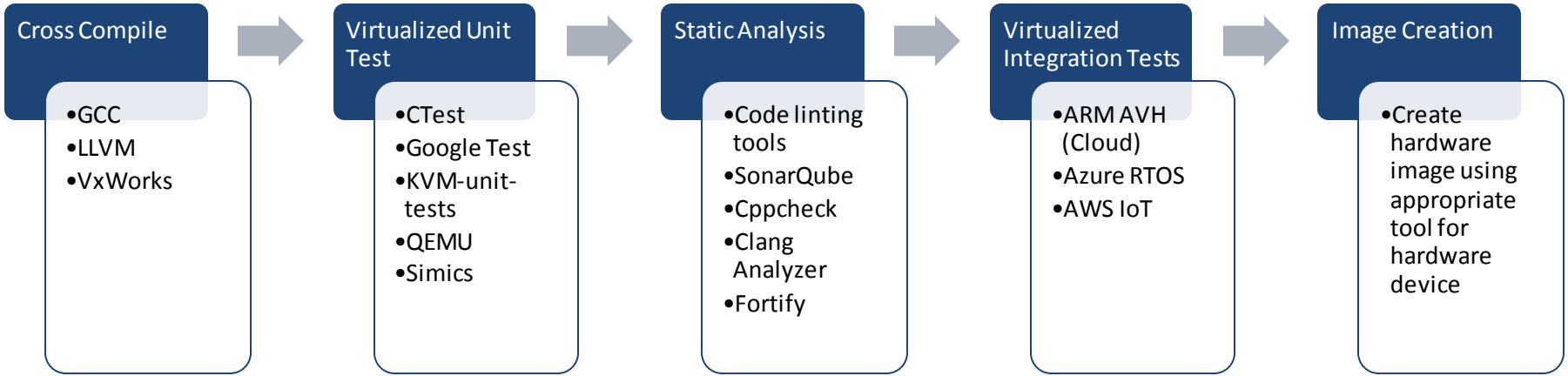
DevSecOps with Hardware in the Loop

DevSecOps Hardware: Identify target hardware and toolchain

- Embedded real-time operating system
  - PowerPC
  - ARM
  - RISC-V
- Field-programmable gate array (FPGA)
  - VHDL
  - Verilog
  - System Verilog
- System on a Chip (SoC)
  - Hybrid embedded operating system running along with an FPGA design

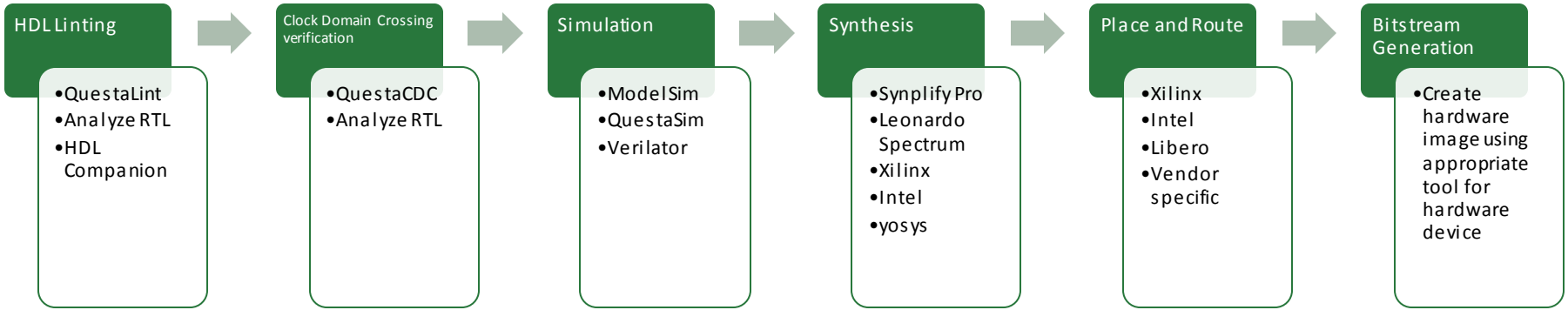
DevSecOps Hardware: Embedded toolchain for target hardware

Embedded software DevSecOps follows a similar path as standard software

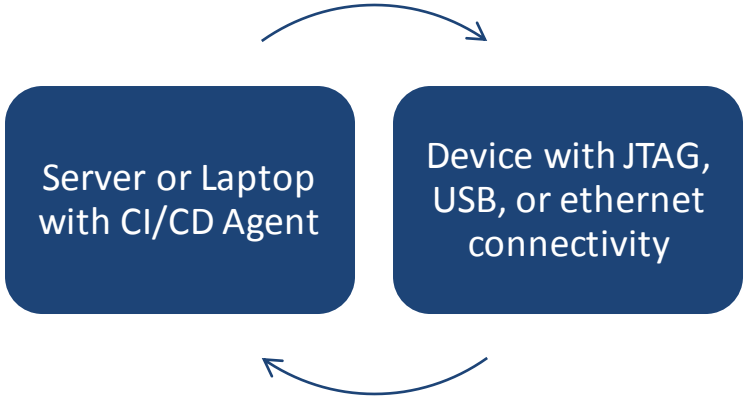


DevSecOps Hardware: FPGA toolchain for target hardware

FPGA DevSecOps requires specialized tools for RTL designs



DevSecOps Hardware: Device Connectivity



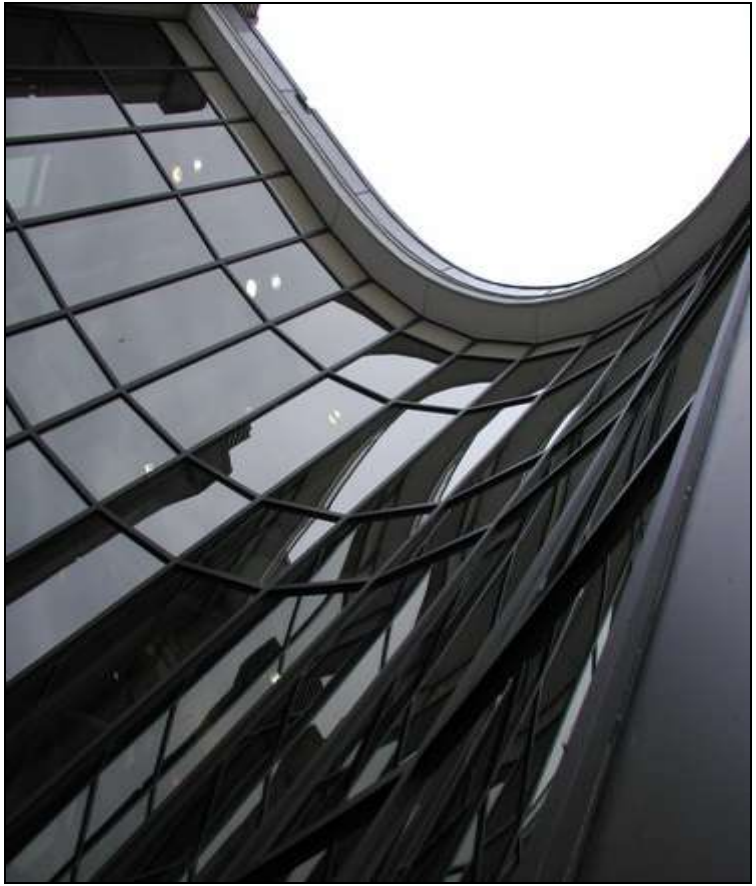
- Programming is triggered via CI/CD pipeline and device is programmed via its JTAG connection
- Various integration or smoke tests can be performed, utilizing a serial or network connection and common test frameworks, such as Pytest, JUnit, or RSpec, depending on the function of the device

DevSecOps Hardware: Device Connectivity Challenges

Device connectivity varies depending on the device and the environment in which it operates:

- Can block continuous delivery in a “production” environment since the device has to be pulled out of service for an update
- Can block device feedback outside of an integration laboratory and requires onboard diagnostics logging or monitoring
- Hardware device may had limited bandwidth for programming which will slow down the design and test cycle
- User feedback and acceptance testing is likely a manual process

Any Questions?



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