# DevSecOps: Essential Tooling to Enable Continuous Security

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# Who is this guy?

- Me: Mad-Software-Developer turned Mad-Software-Engineer turned DevOps-Solution-Architect. Pragmatist. Particular focus on tools and automation. CI, CD, DevOps … what's next?
  - PS: Thanks for inventing the term "DevOps" to describe what I like to do.
  - DevSecOps, on the other hand...
  - Definitely a **DevSecQaEntFinBizOps** specialist
- Pays my bills: Coveros helps organizations accelerate the delivery of secure, reliable software using agile methods.
  - Agile transformations, development, and testing
  - Dev(Sec)Ops implementations
  - Training courses in Agile, DevOps, Application Security
- Keeps me intrigued: SecureCI
  - Open-source DevOps product
  - Integrated CI/CD stack with security flavor

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# Why is he here?

- Impart some experiences (and wisdom?) on people struggling to integrate application security assessment into their Agile development process.
  - Share some of my **experiences** (successes and failures)
  - How can DevSecOps enable **continuous security** in Agile development
  - Visualize examples of CI/CD **pipelines that include security**
  - Identify essential **categories of tools** you need in your DevOps pipeline
  - Anticipate **challenges** with integrating security tools
  - Recognize the importance of **integrating security team members** with development teams

**Give you a reference to walk away with**

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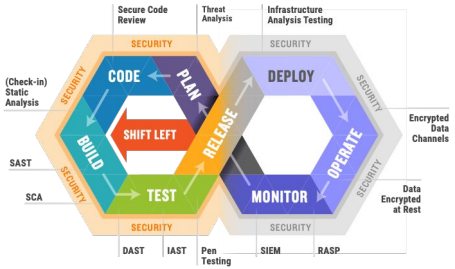
# Problem

- DevOps/Agile processes push code continuously
- Disjoint/mysterious security teams cannot keep up
- No time for slow, manual, late-lifecycle security
- Want to be “secure enough” every day
- Need: confidence that software can defend itself
- Need: continuous security

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# Solution: Dev (Sec) Ops

- Shift security left
- Integrate into daily and sprint-ly cycles
- Touchpoints in CI/CD pipeline
- Security tools run continuously
  - Static code analysis
  - Dynamic security testing
  - Software composition analysis
  - Platform vulnerability scanning
- Break builds, reject changes


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# DevOps and Modern Pipeline

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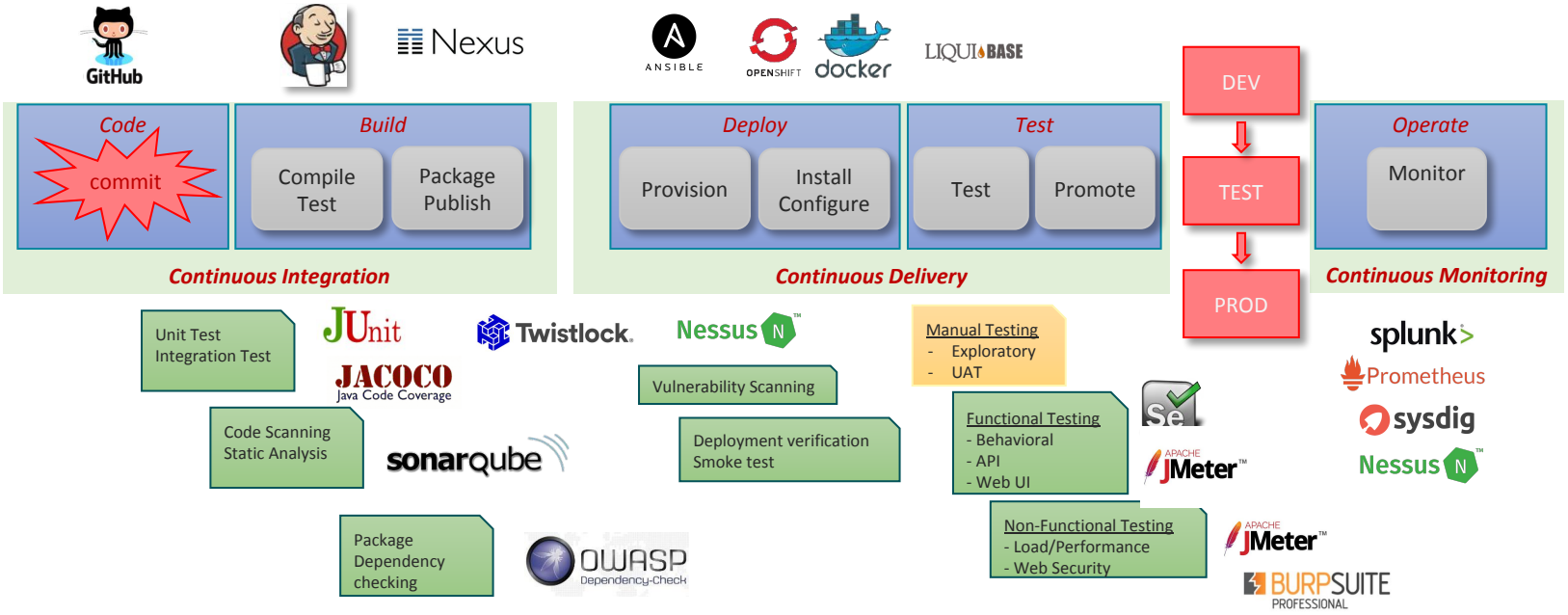
# Pipeline defines delivery process

The software delivery process is automated through a CI/CD pipeline to deliver application microservices into various test (and eventually production) environments

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# Poll

How many people are App Sec professionals?

How many people have a DevOps CI/CD pipeline of some variety?

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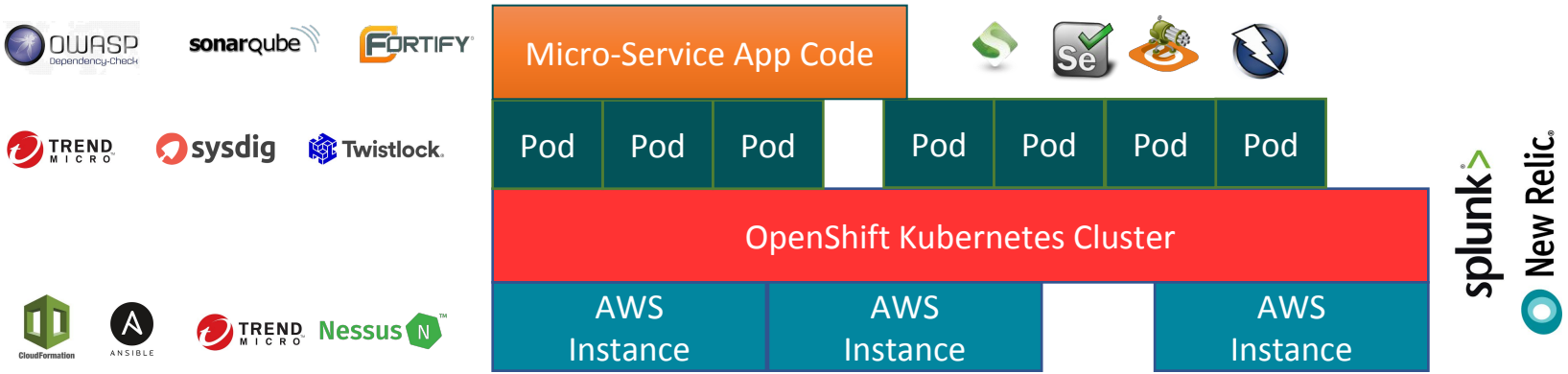
# Levels of Platform Assurance

Application code must be assessed at multiple levels as it makes its way through the delivery process

- Application code scanned and tested for functionality, quality, and security
- Deployable docker container images scanned for security
- OpenShift cluster configured, hardened for security
- AWS instances and infrastructure configured, hardened for security to meet standards
- Entire stack monitored for behavior

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# Security Touch Points

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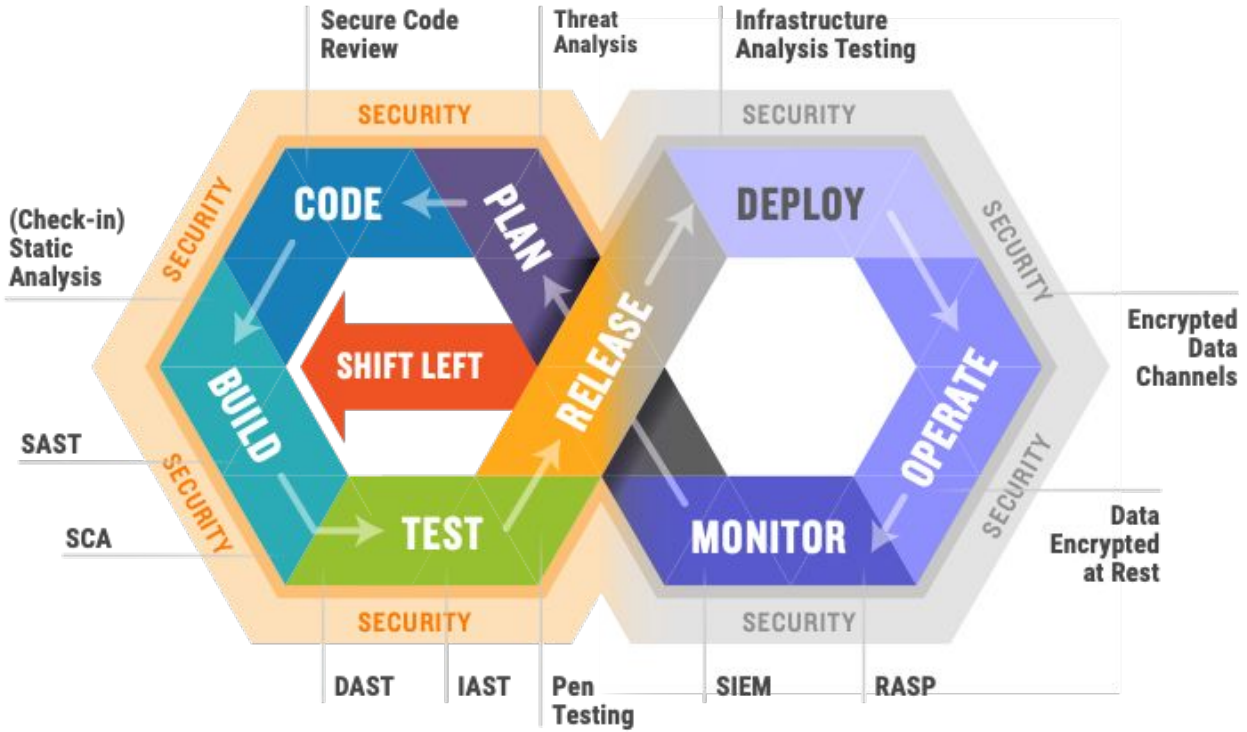
# Touchpoints in lifecycle

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# Pipeline quality and security gates


- From a pipeline and tooling standpoint, we want “Quality Gates”

  *NOTE: “Quality” means “Quality, Security, Maintainability, and every other -ility”*

Goals of Quality Gates:

- Provide overall picture of health
- Stop bad code from making it through the pipeline
- Enforce standards
- Ensure code is production ready at all times

**Ideally: automated with tools (always some manual)**

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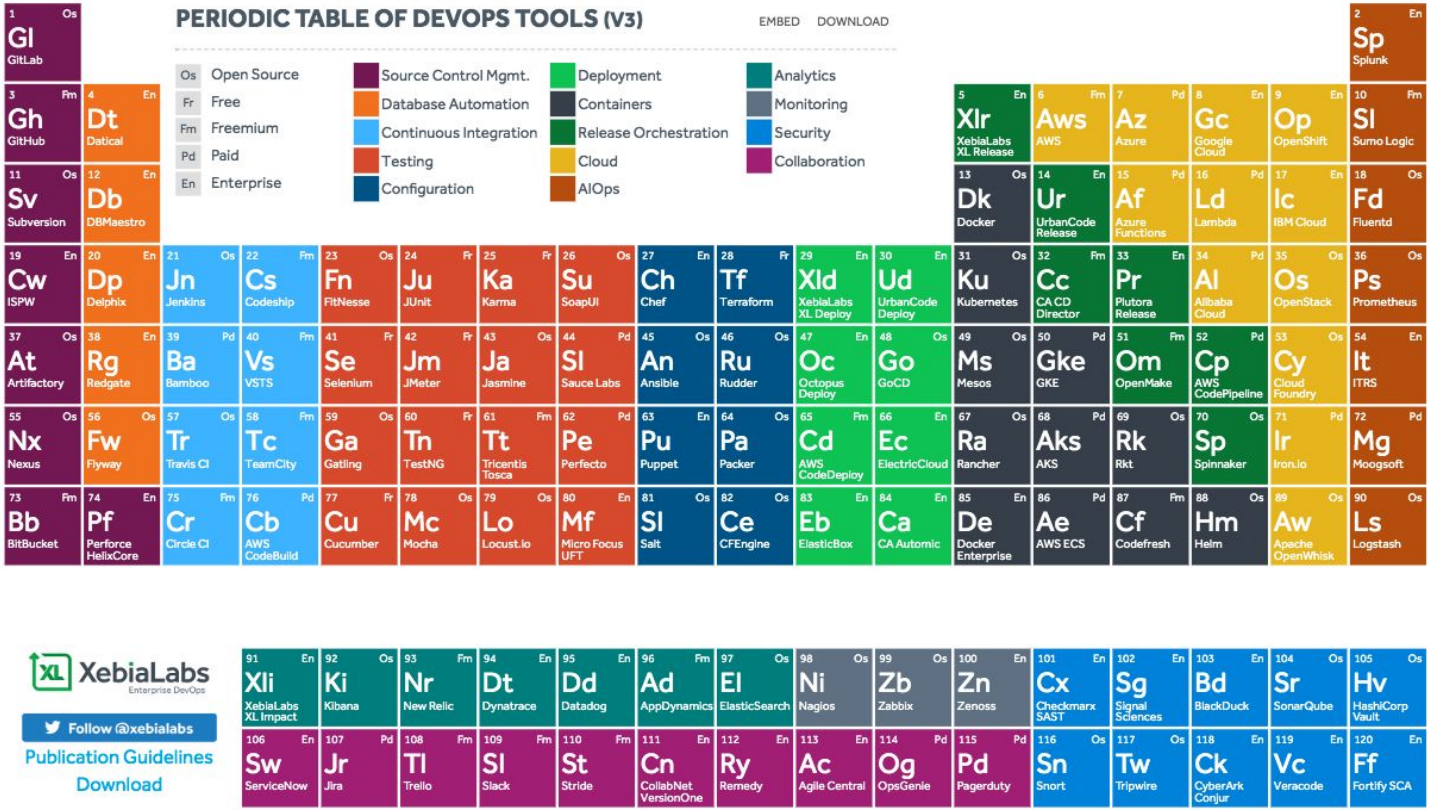
# Tools, tools, and more tools




https://xebialabs.com/periodic-table-of-devops-tools/

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# Essential Security Tooling Categories

- Static application scanning
  - analyze the source code, application structure, or platform as it is built to detect defects or vulnerabilities
  - In security space: SAST, software composition analysis, vulnerability scanning
- *Dynamic functional testing*
  - *variety of sub-categories of functional testing to verify that the software behaves according to its functional requirements.*
- Non-functional testing
  - verify software against sub-categories of cross-cutting, non-functional requirements (security, performance, accessibility, …)
  - In security space: DAST
- Real time monitoring
  - once the software is operating, monitor its operation and look for issues. (not necessarily a "quality gate" but it does ensure that software remains healthy)
  - In security space: may include IAST and RASP

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# Static Application Scanning

- Static application scanning - run before we launch/run software
  - Static **code analysis** - quality, maintainability, **security** (frequently referred to as Static Application Security Testing, SAST).
  - Software **Composition Analysis** - performs 3rd party dependency checks
  - Platform **vulnerability scanning** - scan OS, middleware, configuration for known weaknesses
  - Docker **container scanning** - scan container images as they are built to detect whether vulnerable container layers are being used or misconfigured
- Tools:
  - SonarQube, FindBugs, PMD, Fortify, Veracode, …
  - OWASP Dependency Check, RetireJS, …
  - Nessus, OpenVAS, …
  - Twistlock, Falco, Cilium, Aqua, ...

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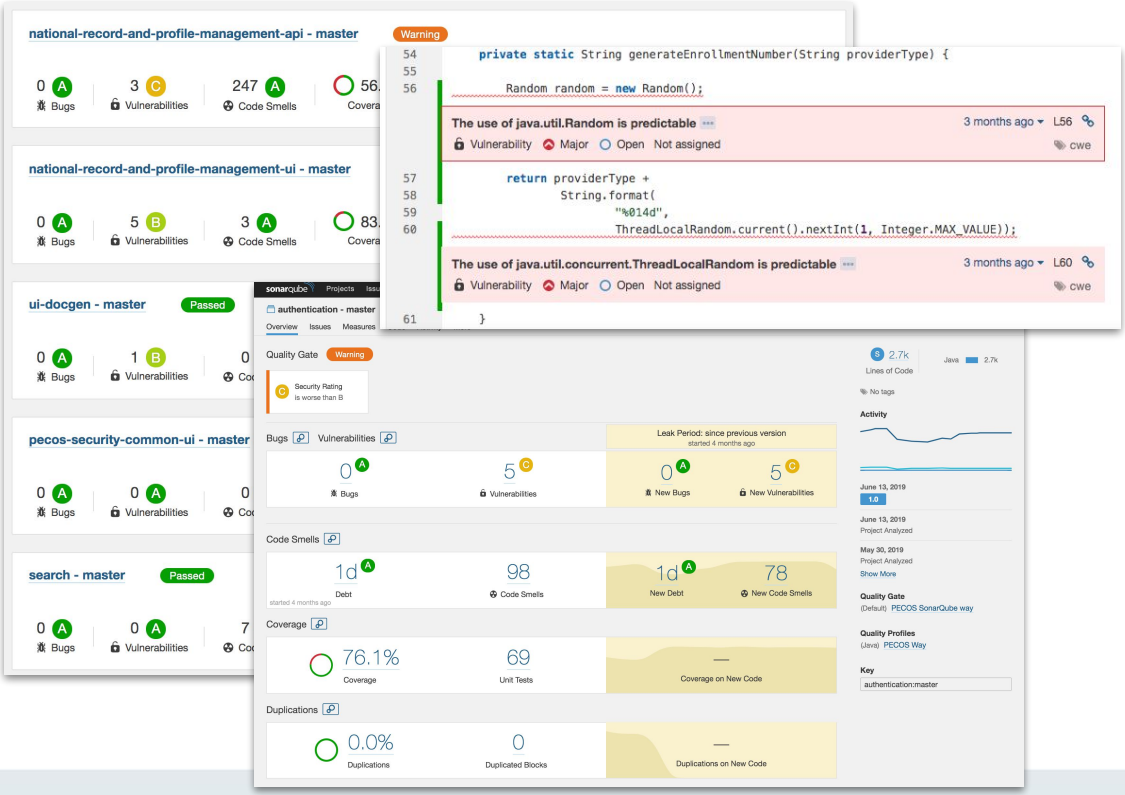
# SonarQube: good place to start…

- Code scanning and quality dashboards
- Includes quality, security, and maintainability scans for many languages
- Continuous view of static code health, unit tests, coverage, …
- Inexpensive alternative to commercial tools such as Fortify, Veracode, etc.

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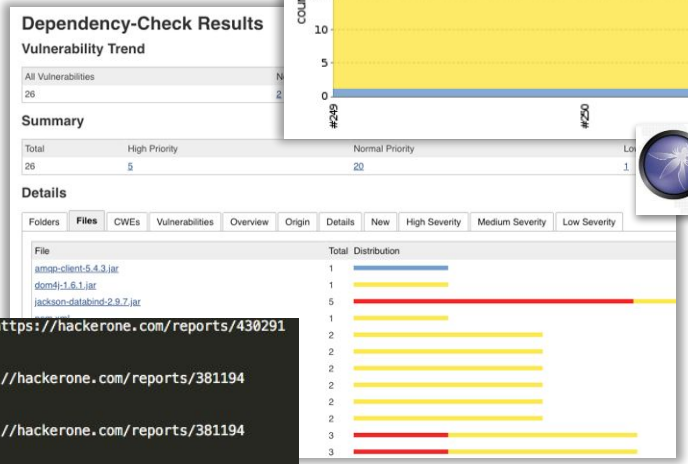
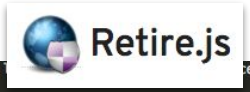
# Dependency Checks

- Ensure that you aren't using someone else's vulnerable code
- Software Composition Analysis against NVD with CVE
  - OWASP (Java), RetireJS (JavaScript), ...
  - Sonatype Nexus IQ Server, JFrog Xray, ...






```
just-extend 3.0.0 has known vulnerabilities: severity: ; https://hackerone.com/reports/430291
@pecos/application 1.0.0
└ just-extend 3.0.0
merge 1.2.0 has known vulnerabilities: severity: high; summary: Denial of Service; https://hackerone.com/reports/381194
@pecos/application 1.0.0
└ merge 1.2.0
merge 1.2.0 has known vulnerabilities: severity: high; summary: Denial of Service; https://hackerone.com/reports/381194
@pecos/application 1.0.0
└ sane 2.5.2
  └ watch 0.18.0
    └ exec-sh 0.2.2
      └ merge 1.2.0
```

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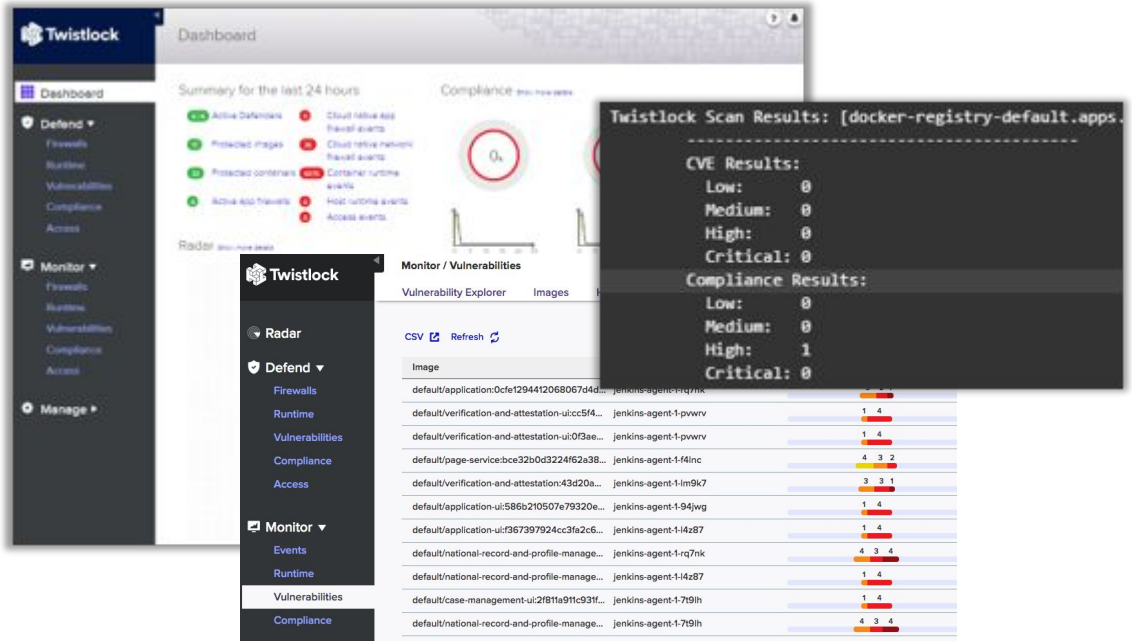
# Container scanning: Twistlock

- Examine container structure and behavior before and during execution
- Similar to vulnerability scanning of hosts

- Two roles:
  - Scan newly build app container images for vulnerabilities
  - Monitor running containers for compliance
- Others: Falco, Cilium, Aqua, ...

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# Dynamic Functional Testing

- Unit testing - verify that code functions properly in isolation during a build (pre-deployment)
- Health Tests - quick API health check endpoint pings to ensure services are running
- API testing - REST tests divided into smoke tests, functional tests, regression tests, etc.
- UI testing - Selenium/selenified tests for UI organized as smoke, functional, etc.

With Security: test your security functions (roles, auditing, encryption, …)


Tools:

- Junit, Jest, TestNG, ...
- Selenium, Selenified, jBehave, Cucumber, ...
- REST Assured, Postman, JMeter, Taurus, …

**Point: these are good places to integrate dynamic security testing**

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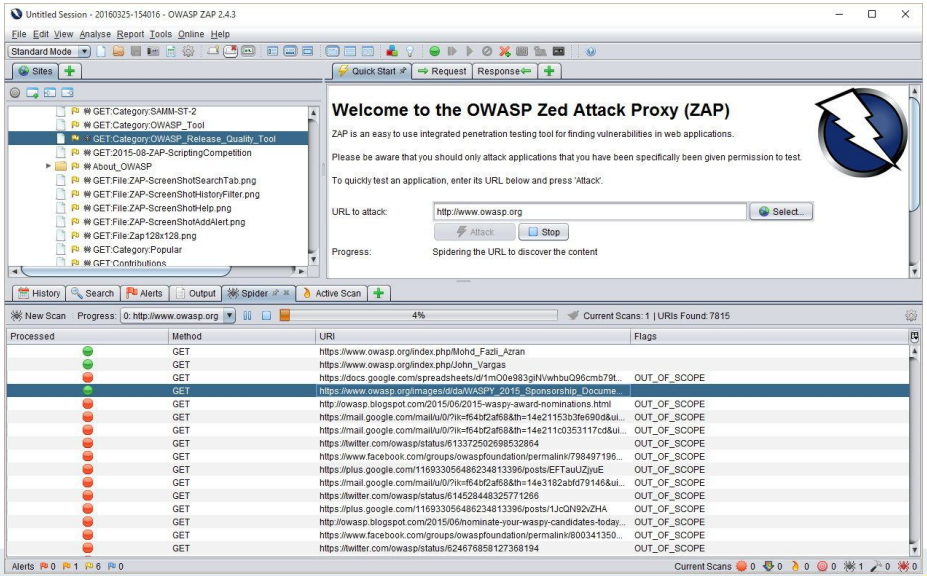
# Non-functional testing

- **Dynamic Application Security Testing (DAST) - automated web scanning, penetration testing, database testing,**
- Performance testing - automated performance tests run manually with JMeter by QA Team
- 508 Accessibility testing - executed periodically to validate that the application is usable for all people
- Other compliance testing…

Security Tools:

- ZAP, Burp, IBM App Scan, Metasploit, Nmap, SQLmap, ...

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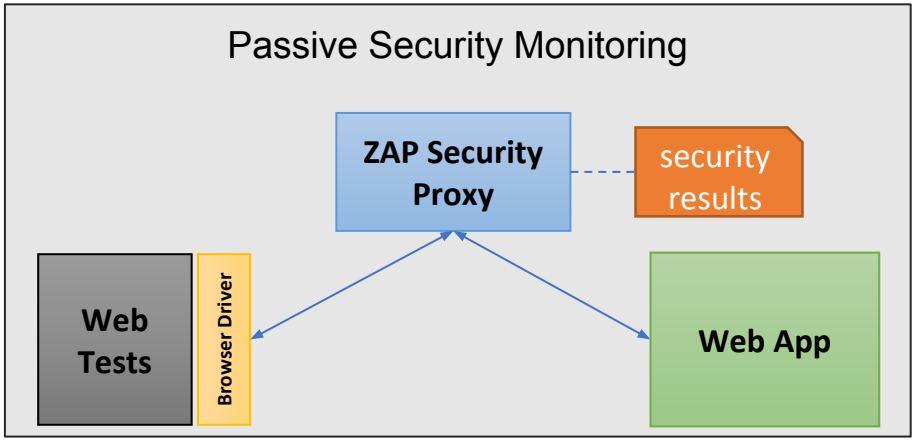
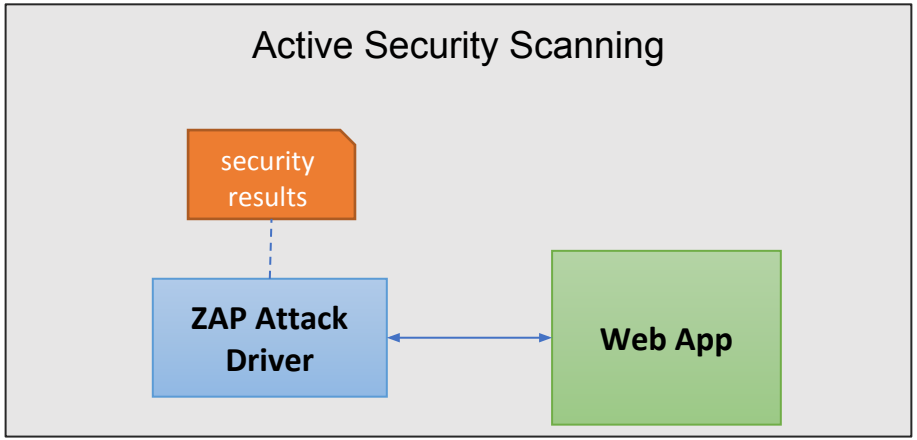
# Security pipeline with ZAP

OWASP Zed Attack Proxy (ZAP) is an easy to use, open-source web scanning and penetration tool

Two primary modes: Passive and Active

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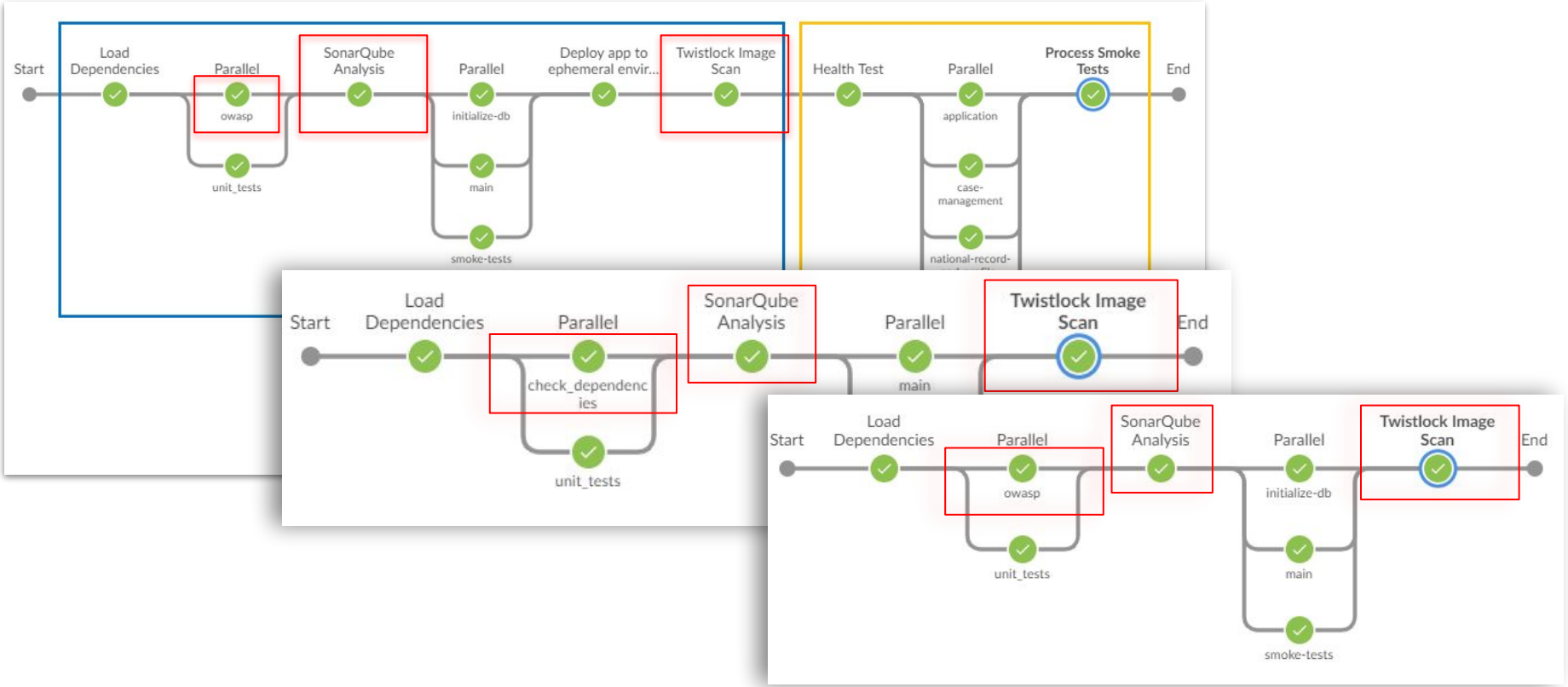
# Tying it together: pipeline flow

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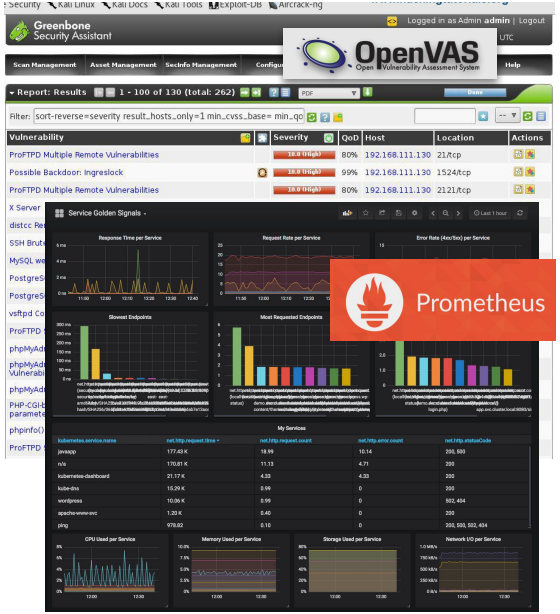
# Real time monitoring

- Various aspects
  - **Log aggregation and scanning** - use processing rules to detect anomalous behavior (information leakage, high error rates, attack detection)
  - **Real-time container and host monitoring** - security monitoring of running docker containers running in test environments for behavior, configuration
  - **Container and host scanning** - scan hosts against configuration benchmarks
  - **Performance monitoring** - monitor system resources, response times, etc.
- Wraps into *Security Information & Event Management (SIEM)*
- Tools
  - Splunk, Kibana/Logstash (ELK), Tripwire, …
  - Nessus, OpenVAS, Twistlock, …
  - Prometheus, Graphana, Hawkular, New Relic, ...




kibana
logstash
splunk>
tripwire

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# Bonus Round: Integrating Teams

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# Integrating Dev, Sec, QA, Ops

Integrate your development, security, quality, and ops teams to streamline your delivery process and enable success

- Use team structures that encourage collaboration of security engineers with developers
  - Need engineers who understand code, build, deployment, testing, automation
  - Can't succeed with only compliance box checkers (yes, you need them too)
- Half the battle: getting teams to work together, not against each other
  - Security consultants, not security police
  - Contributors, not naysayers


**Build a culture of security. Expect every build to be secure.**

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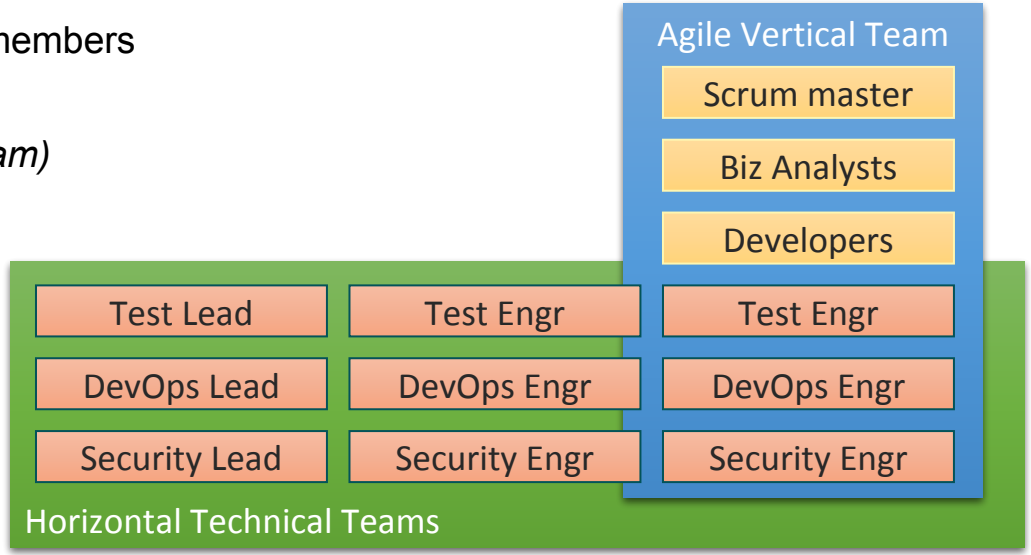
# Horizontal Technical Guilds

- Group of specialized professionals working together to solve cross-team problems
- Guild members in-team are focused on team-specific problems
- Dedicated guild members support cross-team needs
- Guild establishes cross-team standards and shared success
- Important: share knowledge across team members

*Cross-team function (vs. cross-functional team)*

**Challenge: You will never have enough security engineers for every team**

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# Key Takeaways

- Develop a *product* with security built in
- Find tools that fit each major category
  - Static analysis
  - Software Composition Analysis
  - Vulnerability scanning (platform, containers)
  - Dynamic testing
  - Monitoring
- Start with simple (free!) tools until you understand their value and cost
- Strive for continuous assessment
- Develop a *culture* of security

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# Thank You!

## Questions?

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