Managing Application Security

Insights & observations from a study of AppSec program management

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About Chris Horn

Product management at Code Dx

Researcher at Secure Decisions

- An R&D division of Applied Visions
- Birthplace of Code Dx

Experience

- 17 years in research, software systems, and new product development
- Focused on the developing technologies to improve application security

Outline of today's talk

PART I — About our study

- Who we interviewed
  - Types of organizations
  - Roles of people

PART II — Application security programs

- Purpose
- Boundaries
- Organizational structure

PART III — What directors are paying attention to

- Goals, questions, metrics, and tools

PART I

About our study

Studied literature and spoke with AppSec practitioners

Literature review

- Read over 75 research papers, technical reports, books, magazine articles, blog posts, and presentations

Interviews

- Interviewed 13 people in application security roles
  - Commercial healthcare insurers, software producers, and military/defense contractors
  - Federal government independent verification & validation groups
  - Plus, one state agency IT group
- Spoke over voice & screen share Web conference, typically for 1 hour

Spoke with two types of AppSec organizations

Internal department

- An application security group operating as a functional department in its parent organization

External reviewer

- An independent verification group, most commonly a legally separate third-party

Interviewed people in one of two roles

	Director	Analyst
Internal department	Responsible for the AppSec program ▪ Champions secure development practices with software development group ▪ Establishes the structure, roles, and responsibilities of their team ▪ Defines testing policies and processes ▪ Selects testing tools ▪ Hires analysts ▪ Manages departmental budget	▪ Work directly with application security testing tools ▪ Screen findings for review with development teams ▪ Serve as security subject matter experts who answer questions that arise during design and development
External reviewer	Similar responsibilities as internal ▪ But typically no software development organization with which to champion secure development practices	

PART II

Application Security Programs

Purpose of AppSec is risk management

Achieve the right balance of risk to remediation cost

- AppSec focuses on risks caused by undesirable behaviors of software applications

Risks are uncertain events

A risk is a chance of gaining or losing something of value

Expected value of a risk:

cost of the event's outcome * probability of the event

Three ways to decrease risk:

- Decrease the probability of the event (aka threat)
- Decrease the probability of the event's success
- Decrease the cost/severity of the outcome

Examples of AppSec risks

Unauthorized disclosure of user credentials through man-in-the-middle attack on load balancer using captured TLS session data

Disclosure of sensitive data due to insecure configuration of cloud object store

Disclosure of database credentials due to remotely exploitable vulnerability in source code library

Loss of database contents due to inadequate sanitization of user input in application source code

Where is the boundary for application security?

Where does AppSec jurisdiction stop?

- First-party source code
- Third-party library
- Third-party application (database, application server, OS)
- Infrastructure (hypervisor, load balancer, router, SAN)

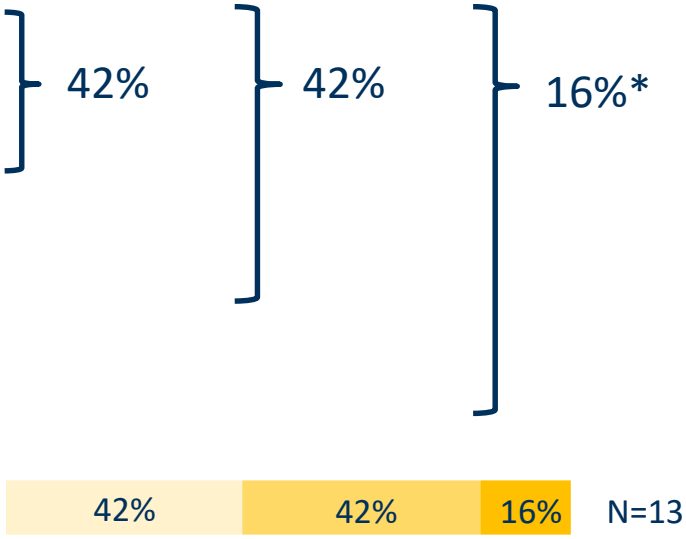
Most organizations leave infrastructure security to IT

First-party source code

Third-party library

Third-party application

Infrastructure



TREND
AppSec growing responsibility for ensuring security of *whole systems*

* Safety-critical systems are certified as a whole system

Service bureaus & champions all around

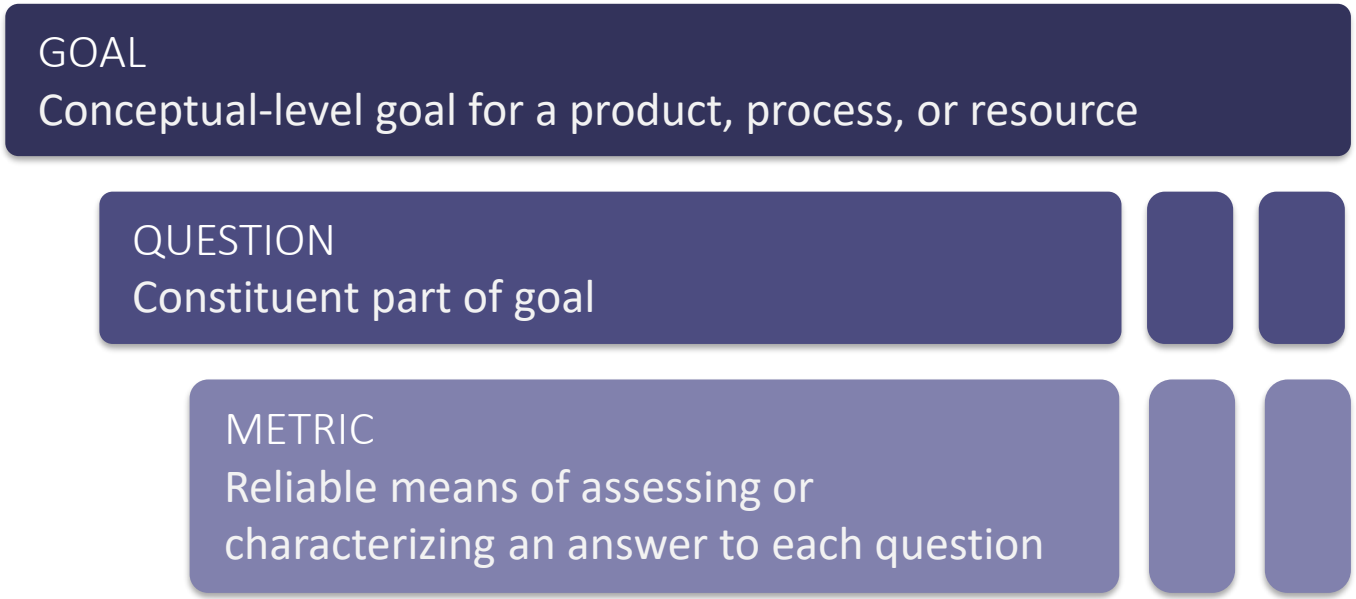
Internal departments almost exclusively organize AppSec analysts into a central “service bureau”

- Conduct testing & answer questions as a service to development teams
- Working to increase the security literacy of developers
- Aims to develop at least one strong security champion on each development team
- Growing practice of providing security input during the early, architecture-design phases of a project

PART III

What directors are paying attention to

Goal, question, metric (GQM) method



Sample GQM tree

GOAL
Reduce expected losses attributable to undesirable behaviors of software applications to an acceptable level

QUESTION
Where are the application vulnerabilities in my software?

METRIC
Number of defects detected by static analysis testing

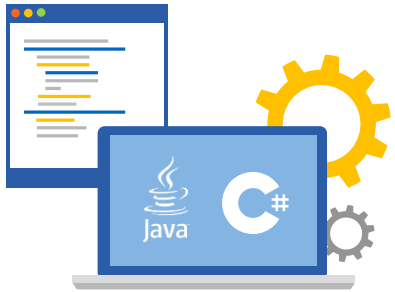
Defect density (number of defects per SLOC)

Percent of systems under secure development lifecycle (SDL)

Seven top-level questions

1. Where are the application vulnerabilities in my software?
2. Where are my blind spots?
3. How do I communicate & demonstrate AppSec's value to my management?
4. Are we getting better at building in security over time?
5. Demonstrate compliance with requirements (e.g., internal commitments, external standards such as NIST 800-53, OWASP Top 10 or Application Security Verification Standard (ASVS), and DISA STIGs)
6. How do I make attacks/breaches more difficult for adversary?
7. What is the AppSec team's input to the broader organization's acquisition decisions?

Measure the application itself (or a portfolio of apps.)



Application software

EXAMPLES

Number of defects/vulnerabilities [by severity, type, ?]

Number of findings

Percent of findings deemed true

Percent of findings remediated

Percent of security requirements satisfied

Defect density (i.e., defects / source lines of code)

Difficulty to exploit

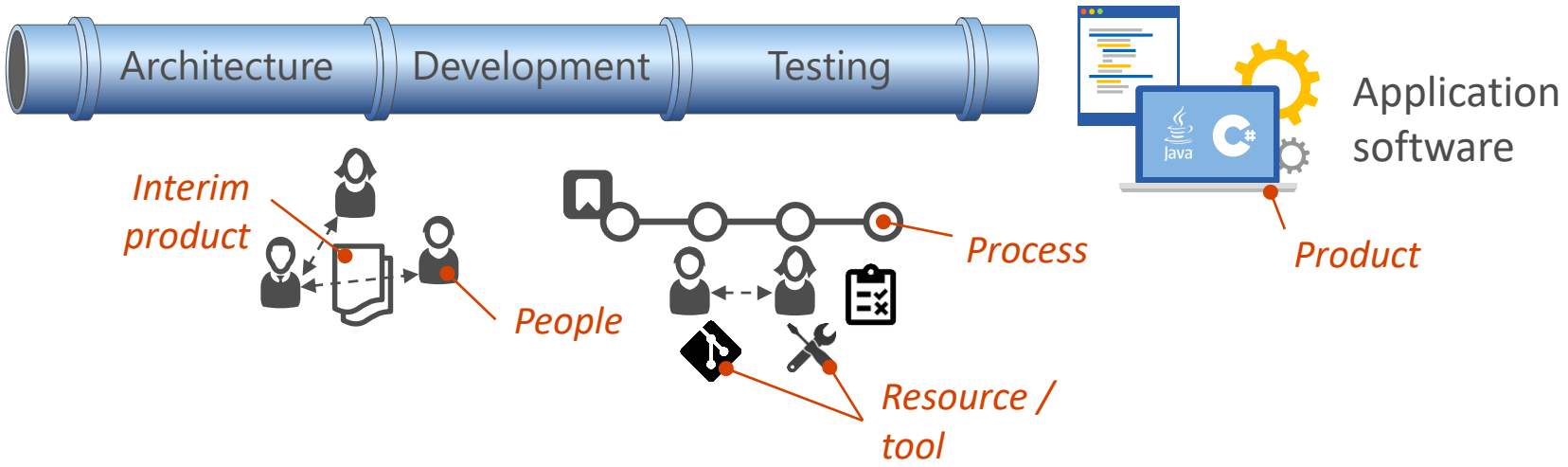
Estimated bug bounty value (dollars would pay)

Total defect age / lifetime

Number of compromise incidents

Code change / churn

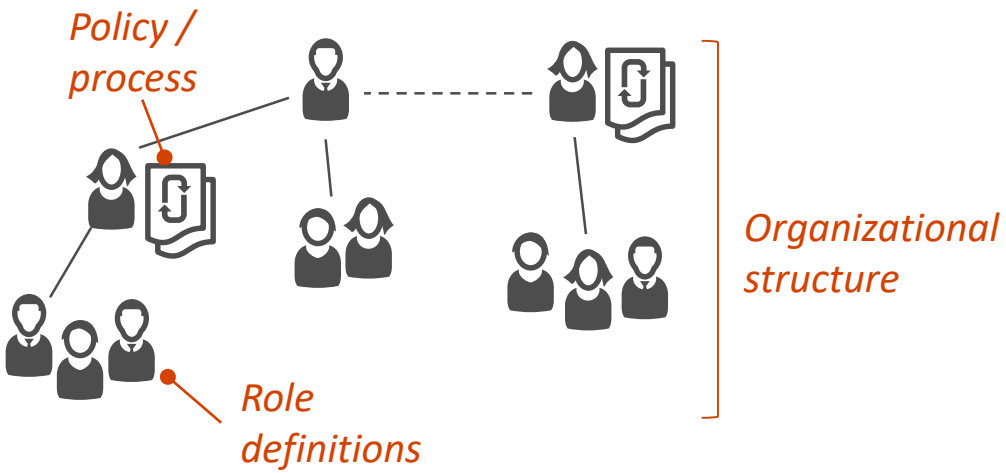
Measure the things that create an application



EXAMPLES

Num./pct. of system in SDL	Code coverage of sec. testing	Presence of threat model
Time to detect	Percent of staff w/ sec. training	Person hours spent remediating
Time to remediate (calendar)	Scan frequency & duration	

Measure the organization or policy level



EXAMPLES

Time since last contact with dev. team

Headcount

AppSec budget percent of dev. budget

Security testing tool budget

Presence of best practice checklist

Full range of services provided?

Measuring risk is hard

Optimal information security investment strategy research discusses many practically infeasible ways to estimate the expected loss of risk

Acknowledged difficulties include:

- Insufficient data to estimate the probability of most events
- Modeling systems is complex and requires too much information
- Scope of outcome cost estimates (including things like liability, embarrassment, market share and productivity losses, extortion and remediation costs) is daunting

Two workarounds to estimating risk

One organization has analysts fill out custom forms in Atlassian Jira

- 8 probability factors that model threat and vulnerability
- 6 outcome cost factors that model financial and operational effects per finding
- Relies on human mental simulation of how a low-level problem would affect a large system

Another organization* models cost using would-be bug bounty payout

- Avoids expected loss estimation problem altogether
- Models risk associated with chained attacks that move between different micro-services
  - Have a system that records trust relationships between services
  - Can report threat-risks that are “inherited” from other services

* Held, G.: Measuring End-to-End Security. AppSecUSA 2017. Orlando, FL (2017).

Many systems for measuring & tracking metrics

Ad-hoc personal observations

Manual spreadsheets

Reporting features in commercial software security tools

Basic in-house solutions

- A relational database, sometimes with a Web interface

Elaborate in-house solutions

- Multiple systems and databases
- Automated extract transform and load (ETL) jobs
- One or more data warehouses
- Third-party governance risk and compliance (GRC) software

You need to decide what to measure

Every organization is different

- Different risk tolerance
- Different technology systems
- Different challenges

Measuring security is a process

RECOMMENDED READING

Payne, Shirley. "A Guide to Security Metrics." presented at the 2010 EDUCAUSE Security Conference, Atlanta, GA, April 2010. https://events.educause.edu/sites/default/files/library/presentations/SEC10/SESS05/2010+EDUCAUSE+Security+Conference+-+A+Guide+to+Security+Metrics+-Final.pdf.

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