Developing Secure Software in the Age of Advanced Persistent Threats

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Session ID: ASEC-201
Session Classification: Intermediate

RSA CONFERENCE EUROPE 2012

Our Job: Keep our Employer out of the Headlines

Product Security Group

The Journal

Vendor [ABC] issues an emergency patch for its flagship product and urges customers to apply it without delay to address an actively exploited vulnerability

Product impact on customers risk

IT Security Organization

The Journal

Company [ABC] admits to losing sensitive information following a security breach in its corporate network.

Security impact on enterprise risk

March 2011: A breach on RSA's Infrastructure leads to Customer Risk

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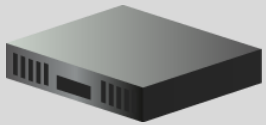
IT Security Organization

The Journal

"RSA urges customers to take immediate steps to strengthen their SecurID implementations …



… following the detection of a sophisticated cyber attack in progress being mounted against RSA"

APTs are Redefining Product Security. How?

Traditional Approach to Product Security

Security Groups in High-Tech Organizations

Product Security Group

Product security assurance programs
(Vulnerability response, Security Development Lifecycle)

Product impact on customers risk

IT Security Organization

Internal security and protection programs
(Employees, systems & IP protection and risk management)

Security impact on enterprise risk

Product Security: Minimize Product Impact on Customer Risk

Product Security Group

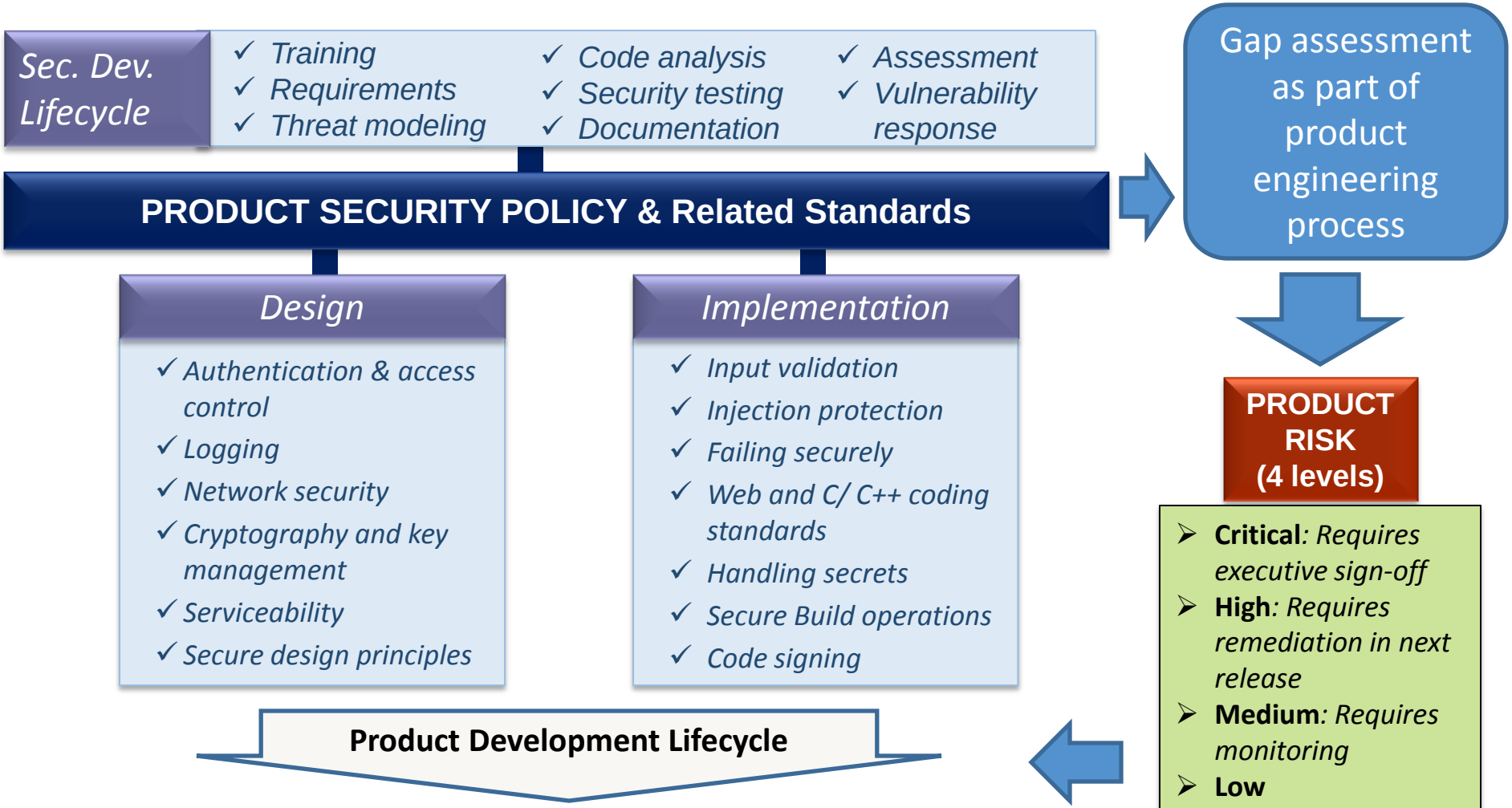
Product security assurance programs
(Vulnerability response, Security Development Lifecycle)

Assume the customer environment is compromised

Minimize risks introduced by products into the customer environment

- Build attack resistant products
- Document products for secure deployment
- Efficiently handle security vulnerabilities and security patches

Product Security Development Lifecycle Focuses on Software Vulnerabilities

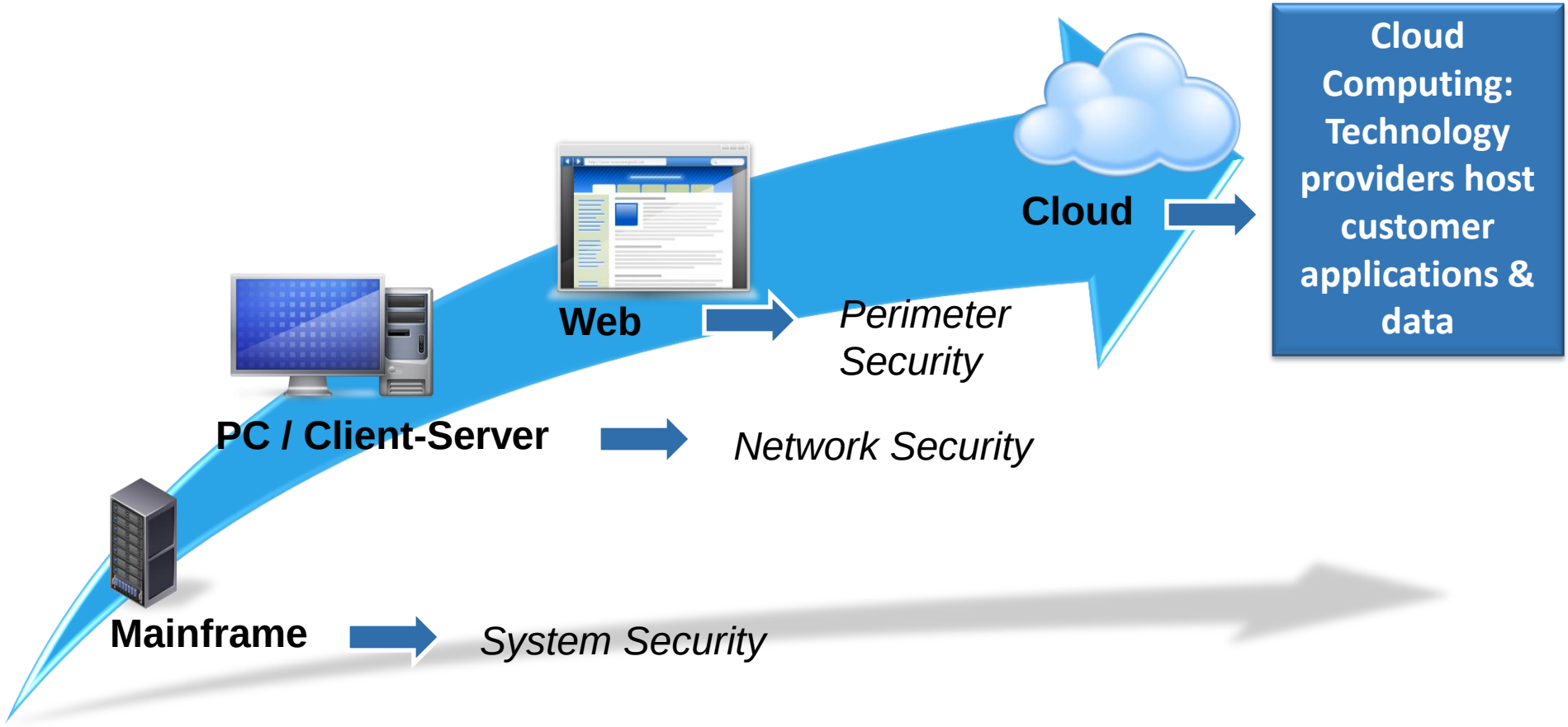


The Changing Landscape

Characteristics of advanced threats

- Single minded, determined and innovative
- Target individuals over systems
- Through reconnaissance will understand your processes, people & systems better than us
- Will exploit ANY weakness
- Countermeasures increase sophistication
- Custom malware, NOT detectable by signatures
- Are not in a hurry will take as long as it takes
- Goal is long term & persistent access
- The perimeter has shifted, all systems now exist in a hostile environment

Evolution of IT Products Creates New Attack Vectors



Implications

Attacks Against Technology Providers Are Impacting Customers

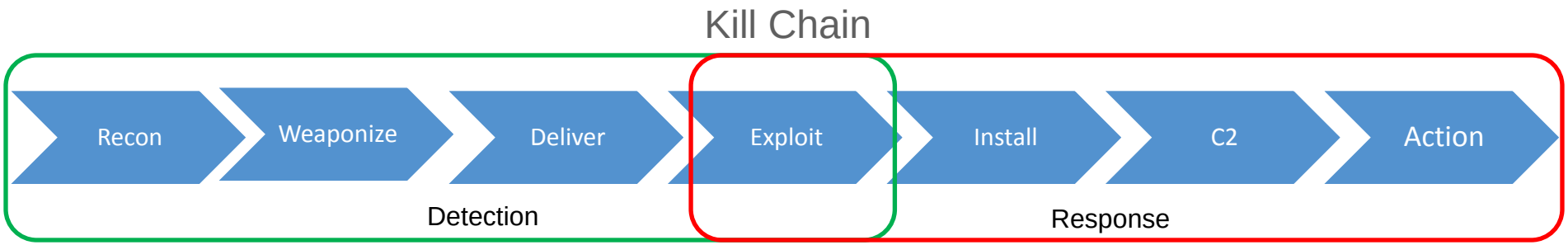
Loss of Intellectual Property	**March 2011:** *"RSA urges customers to take immediate steps to strengthen their SecurID implementations following the detection of a sophisticated cyber attack in progress being mounted against RSA."*
Loss of cryptographic secrets	**April 2011: "***Microsoft issues an update to all supported versions of Windows after Comodo issues fraudulent digital certificates as a result of an attack.***"**
Loss of source code	**January 2012: "***Symantec recommends disabling the pcAnywhere product as a result of a theft of source code***"**
Attacks against cloud services	**July 2012:** *"Data breach at Yahoo results in disclosure of 400,000 user names and passwords"*

Advanced Threats are Often Undetected

94% of companies learn they have been compromised from a third party such as law enforcement

The median length of time an organization has been compromised before they find out is **416 days**

Source: Mandiant M-Trends (2012)



Assume You Are Compromised …

Report *based on* discussions *with the*

Security for Business Innovation Council

An industry initiative sponsored by RSA

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WHEN ADVANCED PERSISTENT THREATS GO MAINSTREAM

Building Information-Security Strategies to Combat Escalating Threats

RECOMMENDATIONS FROM GLOBAL 1000 EXECUTIVES

INSIDE THIS REPORT:

Key characteristics of APTs

How enterprises are making themselves vulnerable

New approaches to information security

Seven defensive measures against escalating threats

"*Consider that no organization is impenetrable. Assume that your organization might already be compromised and go from there.*"

Security for Business Innovation Council (August 2011)

Fighting APTs: Layered Defense, Intelligent Monitoring and Governance

① **Layered defense**

Logs & Events

Identity
Division
Geo Info
Data

Data Enhancement

Location
Department
Regulation
Asset Value

③ **Strong Governance**

GRC

Incidents
Threats
GRC

Early detection

② **Intelligent monitoring and analytics**

Technology Providers Need to Adapt their Product Security Strategy

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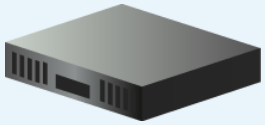

IT Security Organization

Create an integrated governance model

Build intelligent monitoring into products

Design layered defense in products

The New Face of Product Security

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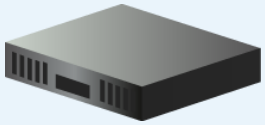

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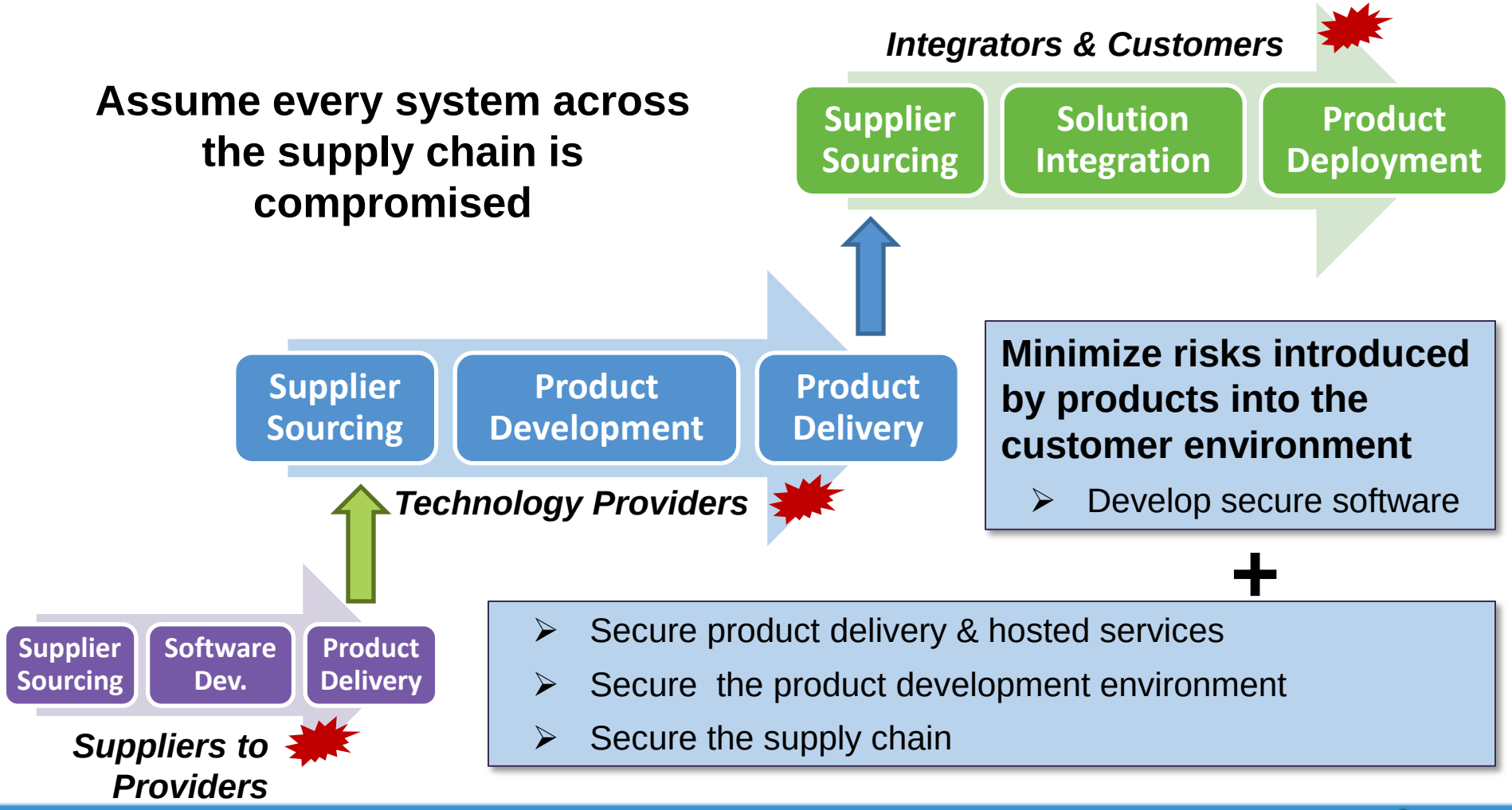
Rethinking Product Security Assuming the Customer and its Supply Chain are Compromised

Assume every system across the supply chain is compromised



Minimize risks introduced by products into the customer environment

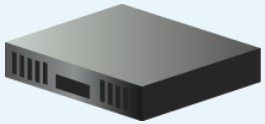
- Develop secure software

+

- Secure product delivery & hosted services
- Secure the product development environment
- Secure the supply chain

Expanding the Security Development Lifecycle into Product Operations

Product Security Group



IT Security Organization

Product Operations:
Hosting, Engineering systems, Manufacturing

Product Governance

Drive standard adoption as part of our Security Development Lifecycle

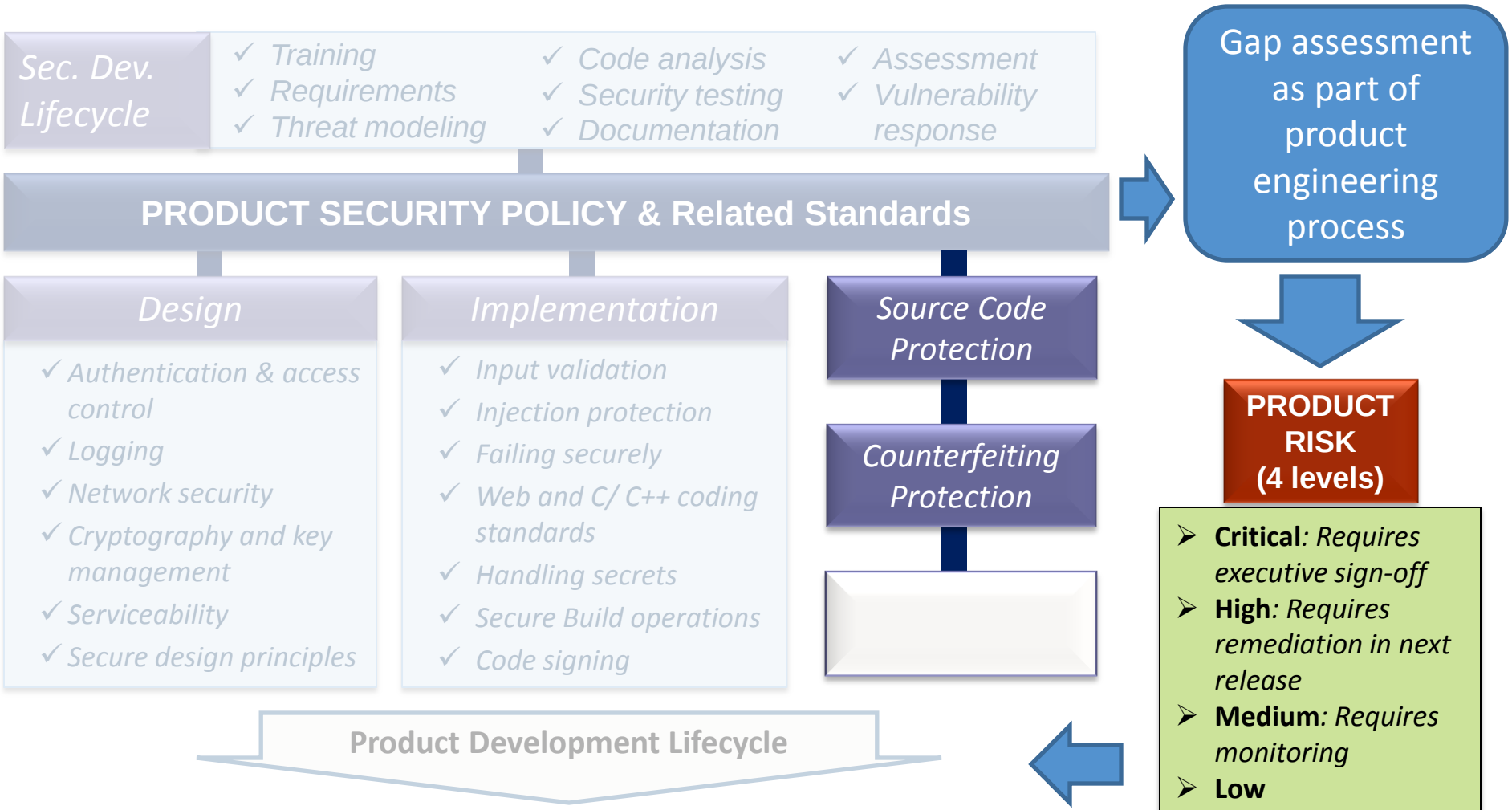
Collaborate on standards for:

- Source code management
- Anti-counterfeiting
- Cloud / Hosting

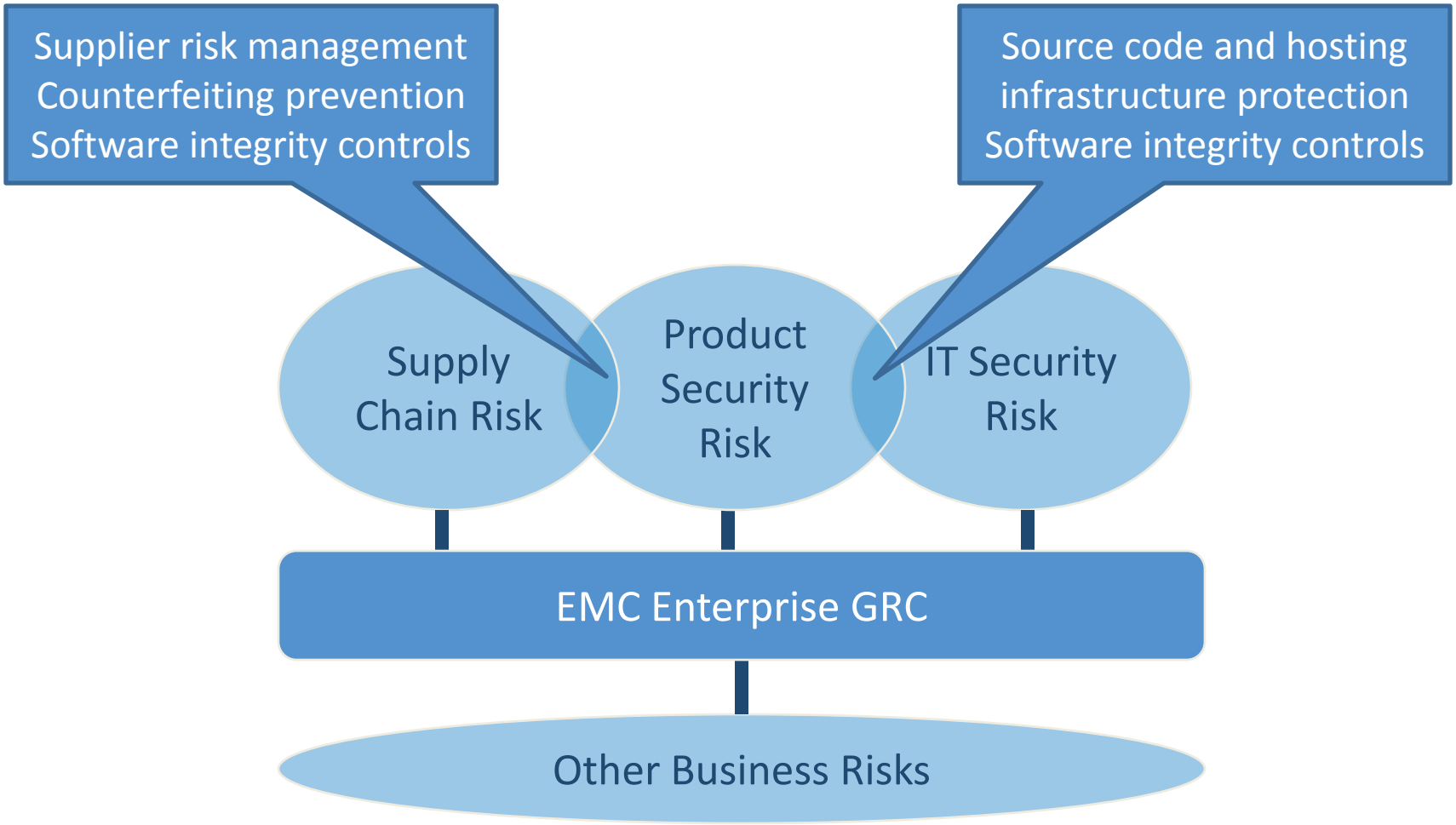
Enterprise Governance

Ensure continuous monitoring as part of the enterprise security management program

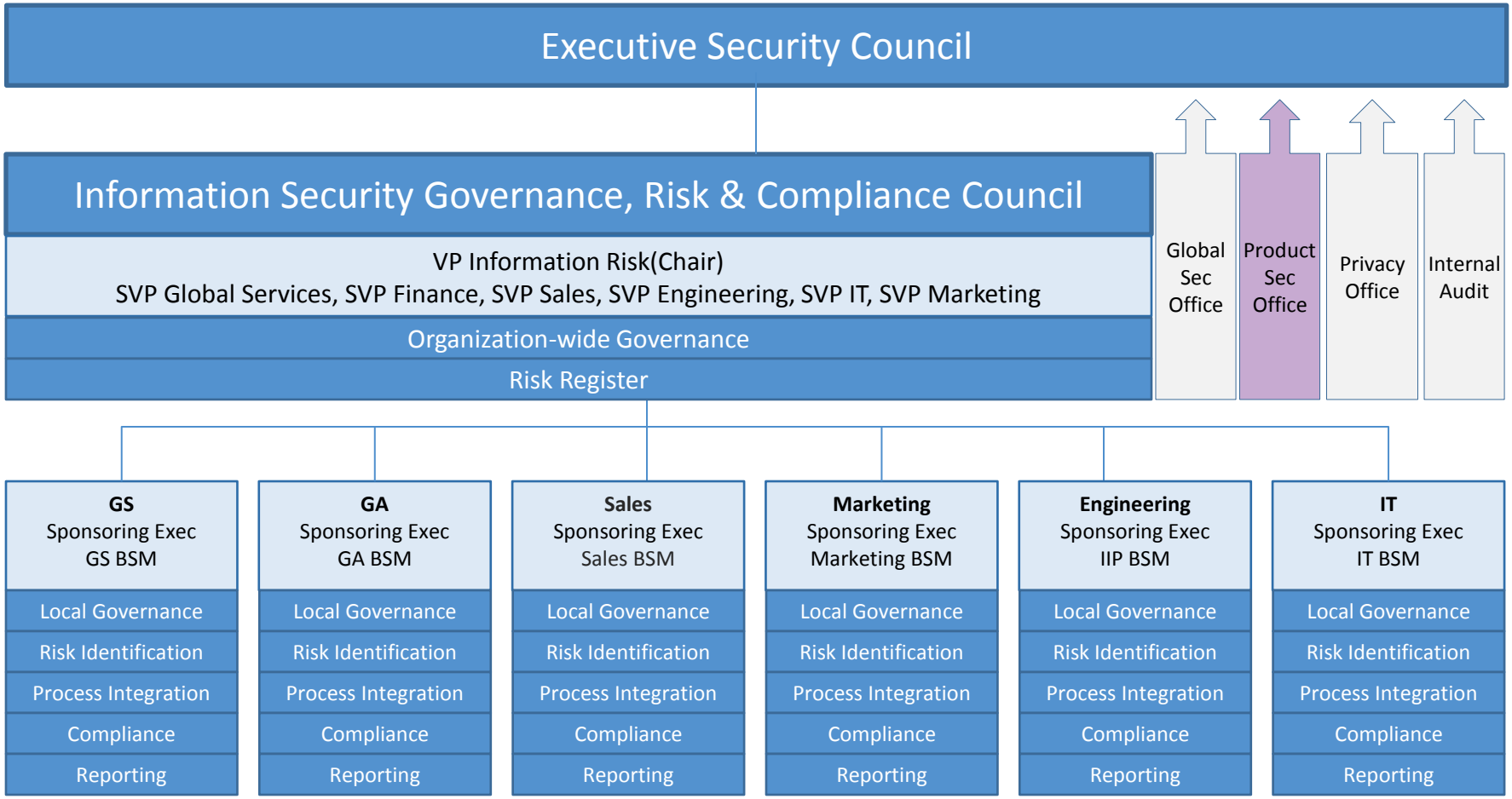
Product Governance: Expanding EMC Security Development Lifecycle



Enterprise Governance: Product Security has Become Part of Enterprise GRC Strategy

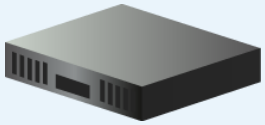


Governance structure



Technology Providers Need to Adapt their Product Security Strategy

Product Security Group



IT Security Organization

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Design layered defense in products

Building Attack-aware Software: Add Intelligence to Security Logs

- Leverage threat modeling to dynamically log software abuse
  - Buffer overflow
  - SQL Injections
- Evolve from logging to debug towards logging for detection and alerting
  - Insert anomaly logging in program logic
- Direction: Design software to leverage the enterprise risk ecosystem
  - Reputation, white lists …

Technology Providers Need to Adapt their Product Security Strategy

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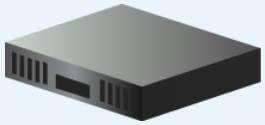

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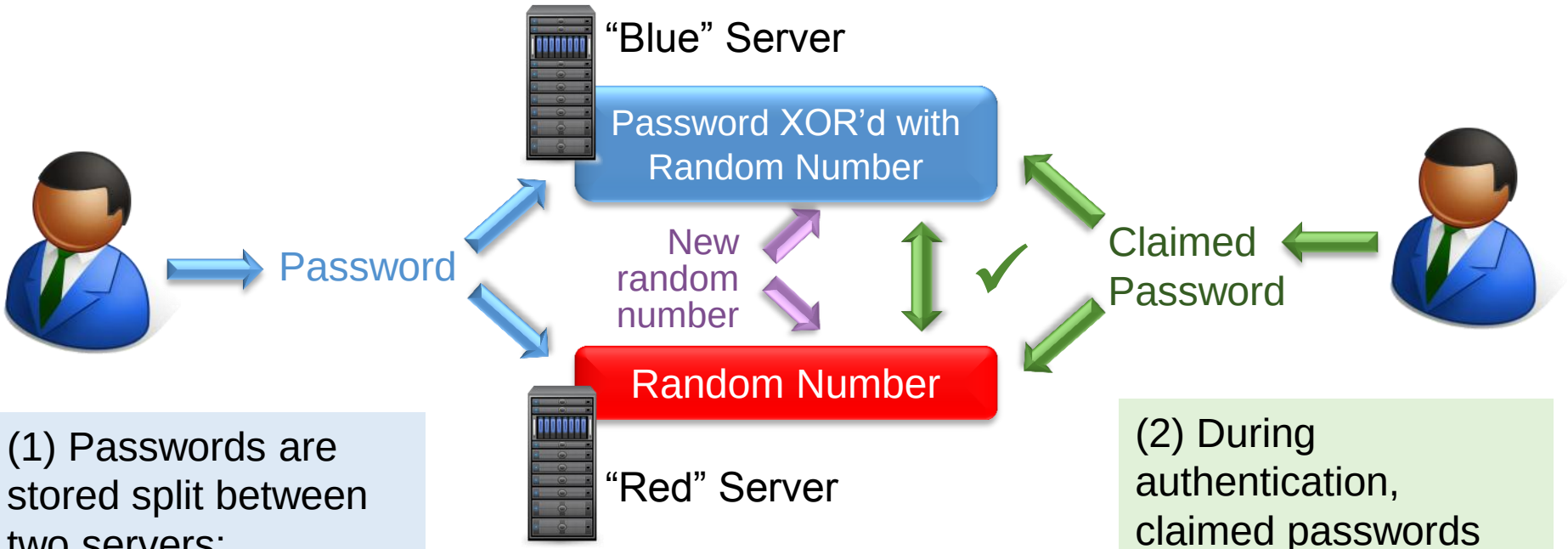
Designing APT-Resistant Software: Split-value cryptographic authentication



(1) Passwords are stored split between two servers: **Compromising one server does not expose the password**

(3) Random number is regularly refreshed to **reduce the windows of time for a successful attack on both servers**

(2) During authentication, claimed passwords are **verified without exposing the legitimate password**

Assume the Source Code is Compromised

- No hardcoded secrets
- Accelerate the adoption of a Secure Software Development Lifecycle
  - Threat modeling
  - Code scanning
  - Security Testing
- Account for source code disclosure in threat modeling
- Build integrity control in source code review and protection
- Pay close attention to comments

```
$secretKey = "London2012";
```

```
Avoid unsafe
string functions
– e.g. strcpy()
```

```
/*
 * To do:
 * Add authentication
 */
```

Build Software Integrity Controls

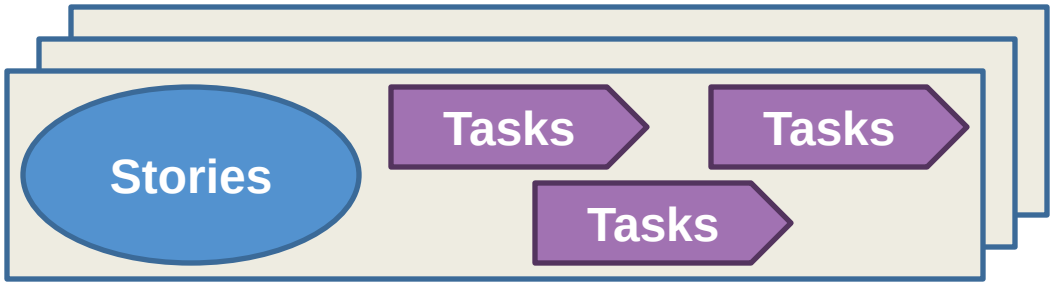
Sourcing & Development

- Source code protection
- Authenticity and integrity control of embedded components
- Backdoor testing and code review
- People, process and supplier controls

Delivery & Execution

- Executable signing
- Malware scanning
- Secure code signing process
- Use of hardware root of trust
- White listing

Developing Software for the Cloud: Security in Agile



Agile Software Development Methodology

Security Stories	Operational Security Tasks	Advanced Security Tasks
• Security focused stories • Associated security tasks	• Targeted at Agile practitioners • Conducted on an ongoing basis	• Most advanced security tasks • Require guidance from security practitioners

Industry Secure Development Practices & CWE

Secure Agile Development Example

Security-focused story	Backlog task(s)	SAFECode Fundamental Practice(s)	CWE -ID
As a architect/developer, I want to ensure **AND** As QA, I want to verify correct permission assignment and maintenance for all critical resources	**[D/T]** When a critical resource is defined or accessed, make sure that the access permissions (programmatic and systemic) to it are left in their most restrictive but useful possible setting. **[D]** Describe correct permissions for the resource in the security configuration guide.	Use least privilege	CWE-732

Source: "*Practical Security Stories and Security Tasks for Agile Development Environment*" (July 2012) - Published by SAFECode (www.safecode.org)

Wrap-Up

Apply: Change Your Software Development Assumptions

Assume every system is compromised

- If you have not done it yet, define a secure software development process and train your developers
- Bridge IT security and software security groups
  - Integrate governance models
- Integrate software integrity controls in your secure software development process
  - Code review for backdoors
  - Verification of source code system security
- Implement a process for controlling integrity and authenticity of external components
  - Start with an inventory
- Implement a secure code signing process
- Build intelligent logging for security, not just for debugging
- Translate your secure software development process in Agile stories

Summary

- Secure product development as grown as an software engineering discipline
- The changing threat landscape and the emergence of cloud are products attack surface
- Technology providers and software development organization need to adapt their secure software development process
  - Change trust assumptions in threat assessment
  - Integrate code integrity controls
  - Develop an integrated governance model
  - Adapt security controls to Agile