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# SDL That Won't Break the Bank

Steve Lipner
Executive Director
SAFECode
Lipner@SAFECode.org

# Overview

- Introduction
- SDL history and origins
- SDL big picture
- SDL for smaller organizations
- Basic Principles
- What to do next
- Some final basics
- Conclusions

# Introduction

- This briefing is targeted at organizations that are getting started with SDL
  - New organizations with limited resources
  - Small organizations
  - Organizations that haven't paid attention to software security
- For bigger organizations that are big targets – perhaps a useful guide to getting started
  - But should expect to wind up doing everything

# SDL History and Origins

# SDL Pre-History



- First there was Windows
- Then there was the Security Response Center
- Then there was Code Red, Nimda, UPnP
- Then there was Trustworthy Computing
- Then there was the Windows Security Push
  - Trained everybody
  - Deployed the tools we had
  - Told everybody to stop work, do security reviews, fix bugs
- Pre-ship “audit” confirmed effectiveness of what was done
- Effectiveness led to commitment to create sustained process

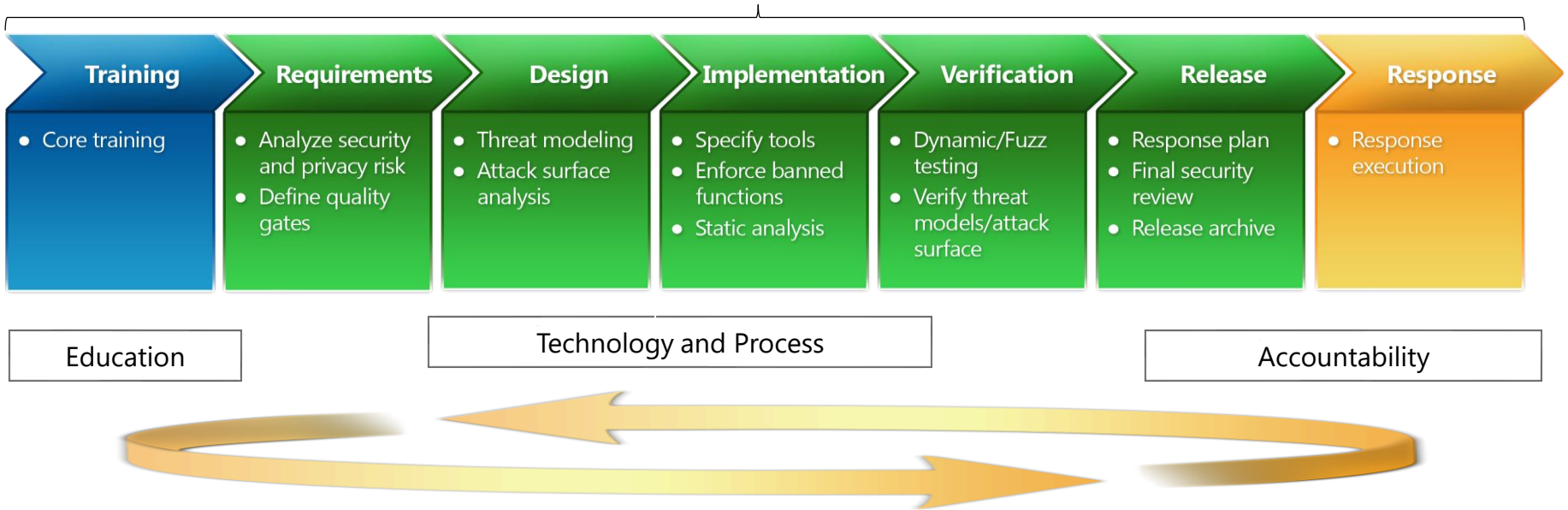
# Creating the SDL



- Initial SDL (v 2.0) derived from Security Push
  - Train engineers
  - Identify things the engineers must do to create secure software (more about this later)
  - Distribute “must do” activities throughout development cycle
- Final Security Review was the successor to the “audit”
  - Did the engineering team do the SDL?
  - Any major problems left?
  - Not “test security in at the end”
- Updated SDL on a (more or less) regular cadence
  - New classes of vulnerabilities
  - New techniques for secure development

# SDL Big Picture
# (or picture of a big SDL)

# SDL Process Overview




Microsoft Representation, roughly 2008

# SAFECode Fundamentals



- Design
  - Secure Design Principles
  - Threat Modeling
  - Perform Architectural and Design Reviews
  - Develop an Encryption Strategy
  - Standardize Identity and Access Management
  - Establish Log Requirements and Audit Practices
- Secure Coding Practices
  - Establish Coding Standards and Conventions
  - Use Safe Functions Only
  - Use Current Compiler and Toolchain Versions and Secure Compiler Options
  - Use Code Analysis Tools To Find Security Issues Early
  - Handle Data Safely
  - Handle Errors
- Manage Security Risk Inherent in the Use of Third-party Components
- Manual Testing
  - Perform Manual Verification of Security Features/Mitigations
  - Perform Penetration Testing
- Automated Testing
  - Use Static Analysis Security Testing Tools
  - Perform Dynamic Analysis Security Testing
  - Fuzz Parsers
  - Network Vulnerability Scanning
  - Verify Secure Configurations and Use of Platform Mitigations
  - Perform Automated Functional Testing of Security Features/Mitigations
- Manage Security Findings
  - Define Severity
  - Risk Acceptance Process
- Vulnerability Response and Disclosure
  - Define Internal and External Policies
  - Define Roles and Responsibilities
  - Ensure that Vulnerability Reporters Know Who to Contact
  - Manage Vulnerability Reporters
  - Monitor and Manage Third-party Component Vulnerabilities
  - Fix the Vulnerability
  - Identify Mitigating Factors or Workarounds
  - Vulnerability Disclosure
  - Secure Development Lifecycle Feedback

# SDL for Smaller Organizations

# What If You're Not Microsoft?



- First SDL processes were created at big companies
  - I've talked about Microsoft
  - Other SAFECode member companies
  - Other large companies
- For a big company
  - You write a lot of code
  - Products are under heavy scrutiny by vulnerability researchers – and attackers
  - Security problems create intense customer pressure
  - Policy may be "do what it takes"
- For a small company
  - "Do what it takes" is probably unaffordable

# Smaller Organizations Advantages and Disadvantages



+ Maybe less scrutiny
+ Maybe less critical to customers (or maybe not!)
+ Probably smaller, simpler product family
• May depend more on code other organizations write
- Probably smaller security team
- Probably less budget for security tools and training
- Maybe less management commitment to product security

# Basic Principles

# Basic Principles For SDL



- The developers are responsible for creating secure software
- The security team supports the developers
  - Training
  - Tools
  - Consultation
  - Validation (but not “penetration testing security in”)
- Rely on root cause analysis and continuous improvement
  - Know why vulnerabilities occur
  - Figure out how to prevent them
  - Update your process, tools, training

# What To Do Next

# So What To Do?



- Following slides suggest measures to incorporate in a “starter” SDL
- These are in (my estimated, rough) priority order and show
  - What
  - Why
  - How (and resources)
- I’m assuming an established organization with shipping products that wants or needs to create an SDL
  - For a new organization starting out on a new product family, recommendations would be in a slightly different order
- Your mileage will vary
  - It’s worth sharing with others in the industry – BSIMM, OWASP, SAFECode, or even the other software security teams in your area

# Have A Response Process



- Be prepared to accept vulnerability reports
  - Have an email alias and a website, answer reports
  - Fix reported ***and related*** vulnerabilities timely and correctly
  - Do root cause analysis
    - Why did we have this vulnerability?
    - ***How can we adapt our development process to prevent prevalent vulnerabilities?***
- Response process is a key input to the definition of your SDL!
  - It's a good source of input on the state of your software security
  - It also helps build customer confidence even if you don't have an SDL
- ISO 29147 and ISO 30111 are valuable guides for response

# Track Security Bugs



- Have a way to know what you've done
  - Fixing individual code bugs
  - Executing parts of your SDL process
- If you don't know what you've done, you're flying blind
  - When things go wrong, you don't know why
  - You don't have a good idea what parts of your process are working – you may not even have a process
- The more integrated SDL tracking is with your development bug tracking, the better
  - Add the bug types, causes, effects
  - There are some commercial tools for common tracking systems

# Have a Rating System and Bug Bar



- Think about the severity of different kinds of vulnerabilities and know which are “must fix”
  - Would you delay shipping to eliminate this problem?
  - Security bugs get rated by severity in the tracking system
- Not all vulnerabilities are created equal
  - Impact and exploitability matter
- Impact will depend on the product and how it’s used
  - Simpler severity rating system is probably better
  - You will probably underestimate ease of discovery and exploitation
  - Microsoft bug bar is a useful reference

# Secure Third Party Code



- Select secure third party code and be ready to deal with vulnerabilities in components
  - “Secure” based on CVE history, reputation, developer having an SDL process
  - Cases range from embedding a product to copying a snippet of source code
  - Have an inventory
  - Have a plan to evaluate and respond
- Nobody builds everything themselves any more
  - ***This is possibly more important than dealing with vulnerabilities in code you write***
- See SAFECode guide on third-party components
- Some commercial tools to help with component management

# Do The Easy Stuff

- Adopt secure development options that are “free”
  - Built into your tools
  - Little or no impact on developers, performance
  - These are no-brainers
- The secure development options are there because they address common vulnerabilities
  - Maybe you won’t experience them, but they’re *common*
- Examples
  - Building with compile and build time mitigations such as ASLR and DEP
  - Banning unsafe C/C++ APIs

# Motivate the Organization



- Not just the security team – get executive buy-in
- Get your engineering staff signed up to shipping secure code
  - It's 2018 – this shouldn't be necessary but…
  - "Why would anyone do that?"
  - "Tell them not to do that."
- Developers must understand that product security is
  - Important
  - Their job
- Message has to come from someone they'll believe, and the message has to be serious (back to executive buy-in)

# Train the Developers



- Once the developers are motivated, tell them what they need to do
  - Their college CS or SWE program didn't tell them ☹
  - Training needs to be targeted to your developers, technology, products
- You're counting on the developers to produce secure software – not the security team
- Free and commercial resources are available (although targeted to your technology and product is better)
  - OWASP
  - SAFECode

# Have A Secure Design



- Design or architect the product to protect itself and the users' data
  - I remember a client-server product that did all the security on the end user desktop – effectively no security at all, and no easy way to fix it (re-architect the product)
- Designed-in bad security is expensive to fix, and probably impossible to fix quickly
- The best design analysis technique is threat modeling (see below) but copying a secure architecture may also be a practical way to start

# Use Platform Security Features



- Don’t roll your own security features if security isn’t your business
- Many products require security features
  - Encryption
  - Identity and Access Management
  - Logging and Auditing
  - All are likely to be provided by platform or framework
- Use the platform features in a secure way
  - This is cheaper than rolling your own, and safer!

# Minimize Attack Surface



- “Attack surface” is jargon for exposed interfaces
  - Open ports
  - Unprotected files
  - Unauthenticated services
- If you close attack surface, you have to worry less about vulnerabilities in a component
  - Users still have to use your product – but there’s no reason to expose something that’s not used
- You can reduce attack surface with settings or code
- See the SDL book (free download) for more on attack surface
- Scanners can tell you what attack surface you’ve exposed

# Avoid Code Vulnerabilities (1)



- Vulnerabilities from code-level errors are major source of problems
- Lots of languages and frameworks, lots of tools and techniques
- Some techniques (organizations with mature SDL do all)
  - Train your developers to avoid dangerous coding constructs
  - Use safe libraries (string handling, input and output sanitization, XSS safety)
  - Run code analysis tools
  - Run testing tools
  - Code-level penetration testing

# Avoid Code Vulnerabilities (2)



- Don’t get overwhelmed
- Your technology narrows the problem (no buffer overruns in managed code)
- Response incidents and root cause analysis focus your effort
  - Train on the problems you (***or other companies like you***) have
  - All buffer overruns? You’re already using safe libraries – probably time for static analysis and maybe fuzzing
  - All XSS? Maybe time for new libraries and testing
- Trying to do everything is great, but starting out, you need to prioritize

# Avoid Code Vulnerabilities (3)



- Integrate security into development
  - Ideally, use desktop tools rather than run tools at the end
  - Integrate security tests into your pre-deployment tests
  - If you wait for the security team to run the tools and tests, the developers won't have time to fix the bugs – "we have to ship!" – this is critical for Agile and DevOps
- Select tools cautiously
  - Your developers will hate false positives (Google Tricorder aims for 90% true positive)
  - Many tools take a lot of "training" for your code base and application
- Lots of tool options
  - Free/OSS (OWASP, Linux Foundation CII)
  - Free tool scans if you're building OSS code
  - Commercial products
  - Services (vendor runs the tool and gives you results

# Threat Model

- Threat modeling goes after design level errors
  - Describe your design, then think about what can go wrong in a structured way
  - STRIDE vulnerabilities
  - Evaluate potential vulnerabilities and fix the important ones (see “Bug Bar”)
- Design level vulnerabilities are less common than code level, but they still occur
  - Can be very serious when they happen (see “Secure Design”)
  - Do a high level threat model first, then come back for details
- Lots of books, guides (SAFECode guide to tactical threat modeling), free and commercial tools, consultants

# Some Final Basics

# Verify You've Done the SDL



- Understand security before you ship or deploy
  - Whether you're releasing an OS every three years or an update to a website this afternoon
- The bug tracking system should have a bug for every requirement (and for investigating/fixing every tool find)
  - If the bugs are fixed, you've done the process
  - If not, it's time for a discussion about risk
- Penetration testing consultants?
  - Maybe – but know why you're using them
  - If you use a consultant, make them teach you to fish – not do the fishing for you!!!
- I've listed verification late – that's where it sits in the schedule – but even if you only adopt a minimal SDL, you should verify that you've done it

# Have A Bug Bounty Program



- A bug bounty is a great complement to (or component of) a response process and SDL
- You pay external researchers for finding and reporting vulnerabilities
  - Great input to your root cause analysis and SDL updating
- It's not a substitute for having an SDL process
  - A good way to have the same experience over and over…
  - So if you're not doing at least some of the design and code parts of the SDL process, don't expect a bug bounty to add much to your product security

# Conclusions

- SDL is an effective way to integrate security from attack into your software
- Full SDL process has a lot of parts, but adoption can be staged or tailored for affordability
- Principles are important
  - The developers build code that's secure
  - Root cause analysis drives your priorities
- A few basics to get started
  - Response process and root cause analysis
  - Management of third party component security

# Resources



- BSIMM - https://www.bsimm.com/
- Howard and Lipner SDL book - https://blogs.msdn.microsoft.com/microsoft_press/2016/04/19/free-ebook-the-security-development-lifecycle/ (free)
- ISO 29147 - http://standards.iso.org/ittf/PubliclyAvailableStandards/c045170_ISO_IEC_29147_2014.zip (free)
- ISO 30111 - https://www.iso.org/standard/53231.html (paywall)
- Linux Foundation Core Infrastructure Initiative - https://www.coreinfrastructure.org/programs/tooling/
- Microsoft SDL v5.2 - https://msdn.microsoft.com/en-us/library/windows/desktop/cc307748.aspx
- Microsoft SDL Bug Bar - https://msdn.microsoft.com/en-us/library/windows/desktop/cc307404.aspx
- OWASP resources (documents, tools, training) - https://www.owasp.org/index.php/Main_Page
- SAFECode documents - https://safecode.org/publications/
- SAFECode training - https://safecode.org/training/