Beyond Patch and Pray: Security by Design

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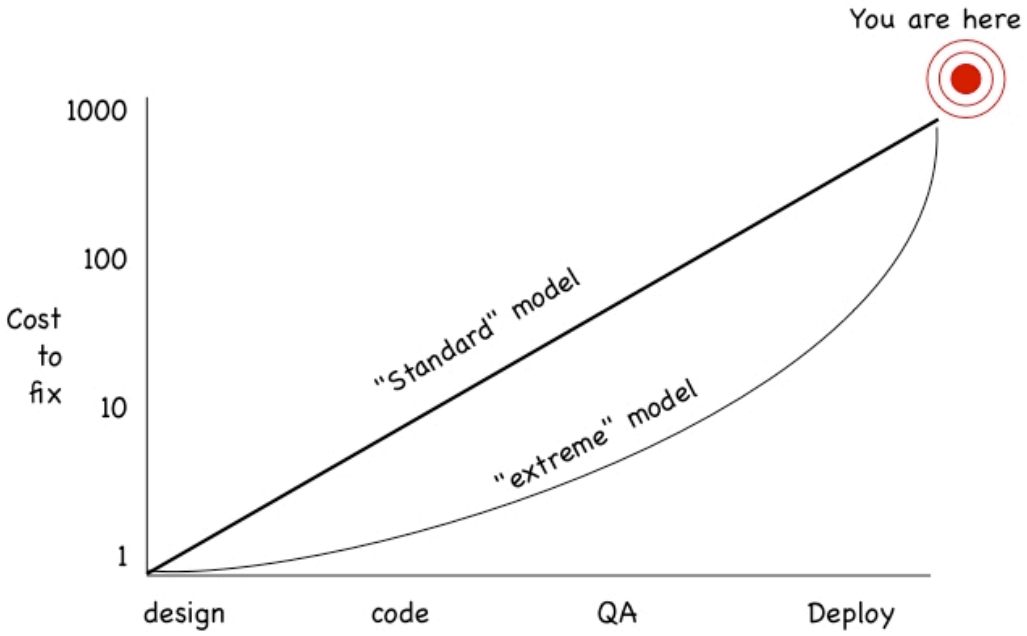
Goal

- Much of today's security seems to cycle through:
  - Penetrate or otherwise find vulnerabilities in deployed systems
  - Fix the issues
  - Pray that you do it before the bad guys or the worms

So?

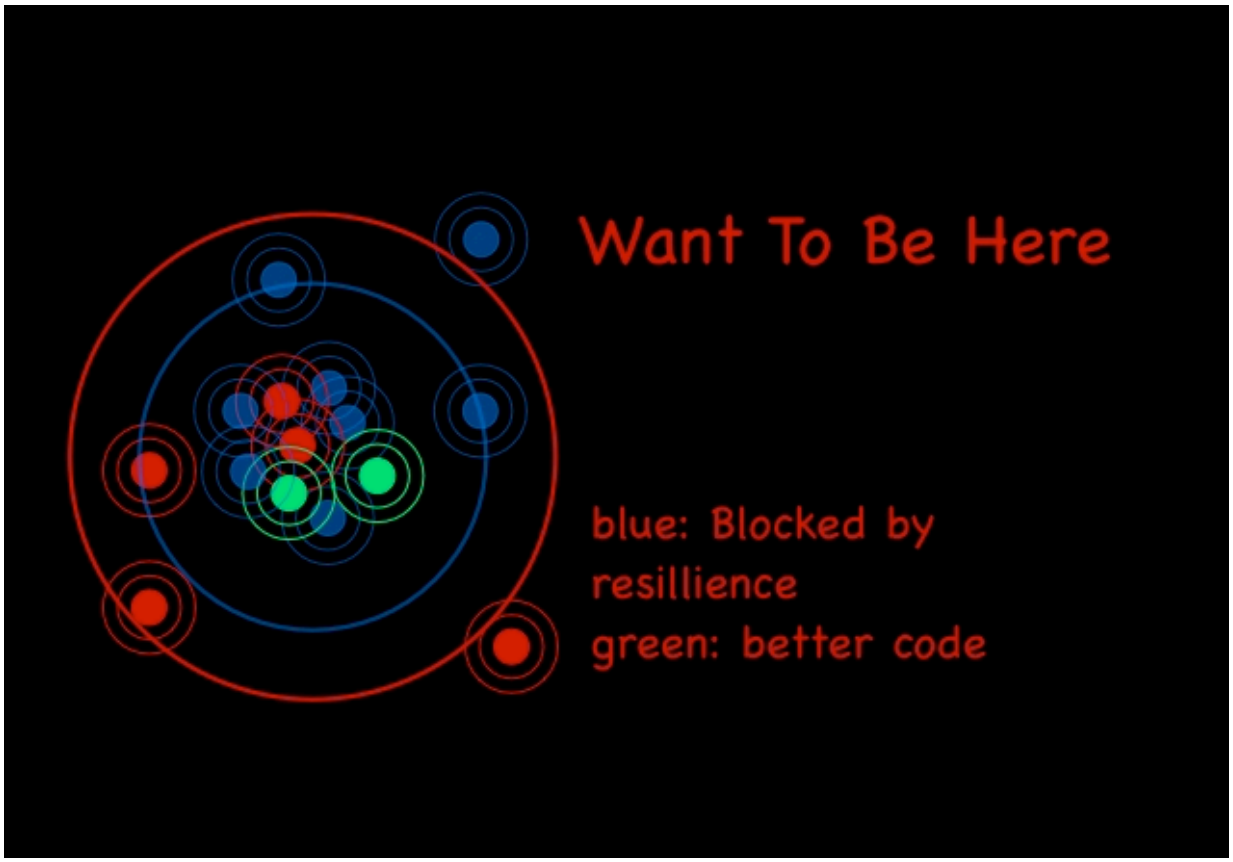
- This is very expensive
- Fixing deployed systems risks downtime
  - Could deploy “patch management” sw
- Or we could look to fix problem from root causes

Bug (and software) Development



How To Move?

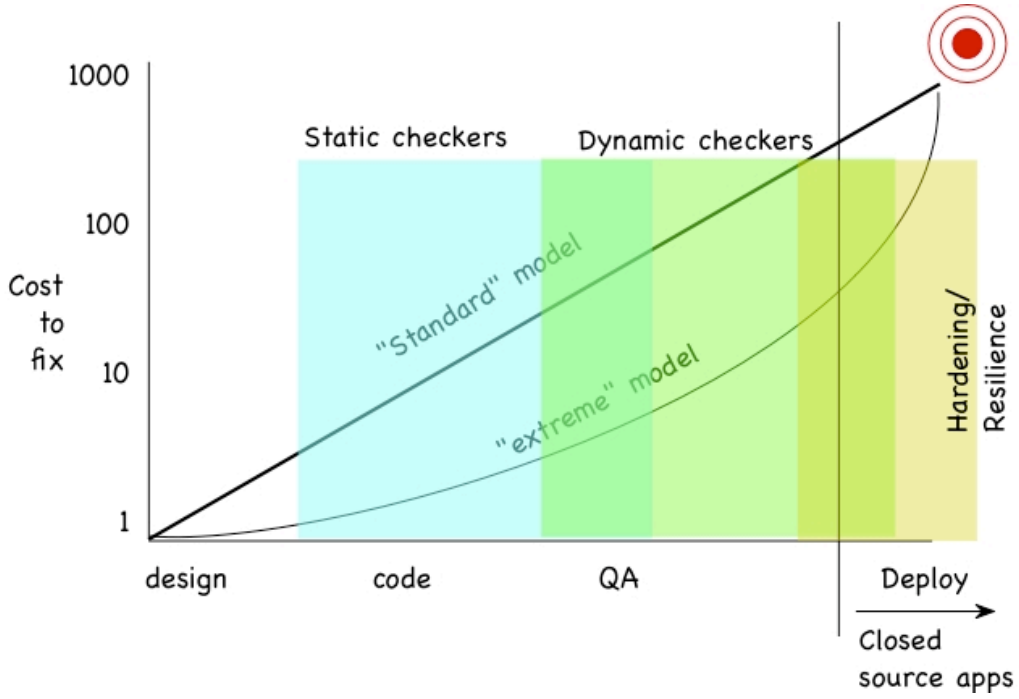
- It’s actually worse than that
- That’s a graph for a single program
- You deploy lots of programs



How To Get There

- Better software tools
  - Internal, external
- Better Deployment tools
  - Security
  - Operations

Where The Tools Fit



Software Improvement

- Static checkers
- Dynamic Checkers
- Languages
- Limits of software improvement

Static Checkers

- Work with source code
- Lots of different languages
- Results generally easier to fix
  - They're associated with lines of code
- High false positive rates
- Find "sins of commission" like strcat()
- Fast

Free Static checkers

- RATS
- ITS4
- Flawfinder

Static Checkers: Slicers

- Compiler-like technology to see what variable could be touched where
  - Perl's taint mode
- Clever techniques to deal with pointers
- Can be perfect on small code (20kloc)
- Much research

Static Checkers: Parsers

- Analyze variables and typing because C doesn't
- Can deal with integer issues well
- Slower
- SPLINT is a free example

Static Checkers: Compilers

- Compile code, and analyze on the way
- Code is not always compiled to your processor
  - Target a VM that has security features
- MOPS
- Dawson Engler's group @ Stanford
- GCC -Wall is not complete

Dynamic Checkers

- Work on binary code
  - Never wonder if the optimizer was too clever
- Find "Sins of Omission" like SQL injection
- Slow! (Can be hours or days)

Dynamic Tools: Fuzzers

- Fuzz, Spike, libwhisker
- Mangleme http fuzzer (added after talk)
  - `http://lcamtuf.coredump.cx/soft/mangleme.tgz`
- Feed noise to the target see if it breaks
- And you're surprised this is slow?

Dynamic: Attack Simulation

- "Second Gen fuzzers"
- Attack tool libraries
- CORE Impact, Metasploit
- Require skilled driver
- Nikto
  - Less powerful, easy to use

Dynamic Tools: Decompilers

- Turn byte code/machine code into something resembling C
- Useful for closed source apps you need
- Need to analyze the decompiled source

Dynamic: Binary Differs

- Not a dynamic tool as much as a static tool for machine code
- Best for finding why a patch happened
- Attack/exploit creation
- Vendor verification:
  - Is this patch effective?
  - Are they being upfront about what's in it?

Language Selection

- Some languages seem to be more prone to security flaws
  - C, PHP
- We may not have found the classes of flaws in Java, C#
- New classes keep showing up (integer underflows, etc)

Things Hard to Measure

- Security design goodness
- Attack surface
  - nmap not enough
  - port 25 seems to have a large surface
  - port 137 does too.

Adding Resilience to Code

- How to
  - deploy
  - operate
- Buggy code *more* securely

Free UNIX techniques

- chroot/jail
- Unprivileged daemon accounts
  - Painful if you need fast code on port 80
- Free security enhanced OSes:
  - OpenBSD, SELinux

Techniques

- Harden the system:
  - Control Attack surface
  - Limit effect of an attack
- Can entail high operational cost for questionable benefit
  - Need to evaluate what happens

More advanced tools

- OS hardening tools
  - Immunix subdomain
  - Sana kernel enhancements
- Application hardening
  - Stackguard & company
  - (Recompile vs kernel modules)

Issues with Hardening Tools

- How to measure their effectiveness
- Configuration effort
- Costs (percieved and real)
  - Cash up front
  - Speed
  - Supportability + Vendor finger pointing

Network Intrusion Prevention

- Throwing Ducks at Baloons
  - Paper by Ptacek and Newsham, 1998
  - Showed how to evade IDSs, IPSs
- The Covert Channel problem

Firewalls Move (back) Up

- Application Firewalls vs packet filters
- Inspection
- Snort Inline

Process Resilience Tools

- How to fail gracefully
  - detect, respond, improve
- Measuring your process
- Architecture and Forensics
  - An ounce of prevention

Selling Your Boss

- Or, Security folks are from Mars, businesspeople are from Wheaton

How You Buy Software

- Functionality, supportability, price
- Can you get security in there?
- Probably requires being able to get lots of complexity into a 1-5 score (or somesuch)
- The above can be used for that

Sample Scoring

- 0-1 point for a good language
- 0-1 point for documented use of tools to check code
- 0-1 point for unprivileged, chroot install
- 0-1 point for logging
- 0-1 point for local analysis

Deployment Budgets

- Cash for wires, hubs, power, air
- Where does security fit?
- What's the real cost of a failure?
  - (Hint, its not $1m, unless you're a large bank)

Deployment Business Cases

- Cost of operations with and without tool X
- Cost of special events:
  - Patching
  - Breakins
  - Worms
- Frequency of special events

Conclusions

- Way back to patching
- Learned how to cut # of patches
  - Better SW
  - Better operations
  - Better sales to management