Remediation Statistics: What Does Fixing Application Vulnerabilities Cost?

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Session ID: ASEC-302

Session Classification: Intermediate

Agenda

- An Innocent Question
- Finding a Structure for Remediation Projects
- Methodology
- Remediation Data
- Analysis and Recommendations
- Questions

Fixing a Cross-Site Scripting (XSS) Vulnerability

How long does it take?

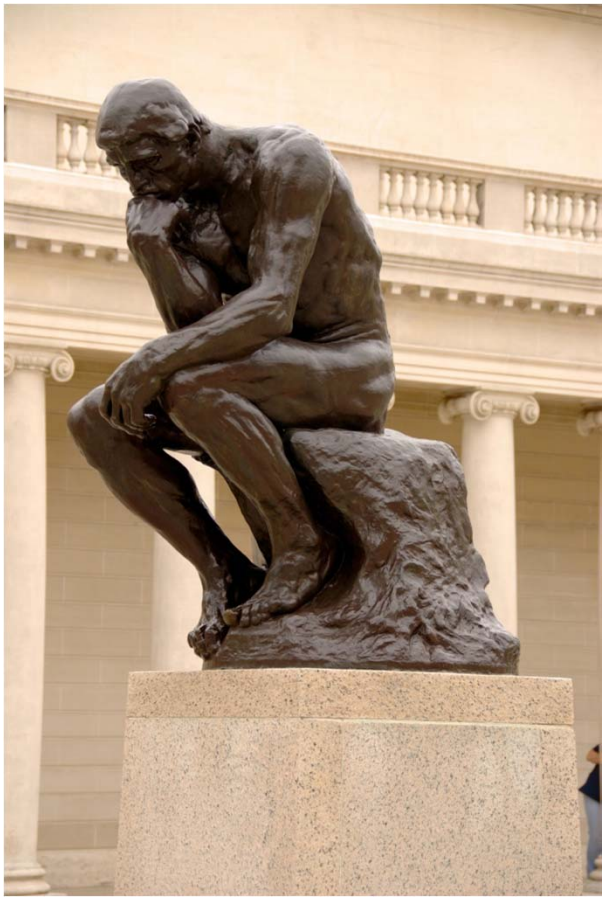
A) 9.6 minutes

B) 16.2 minutes

C) 84 minutes

D) It doesn't matter

E) All of the above



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Remediation Worst Practices

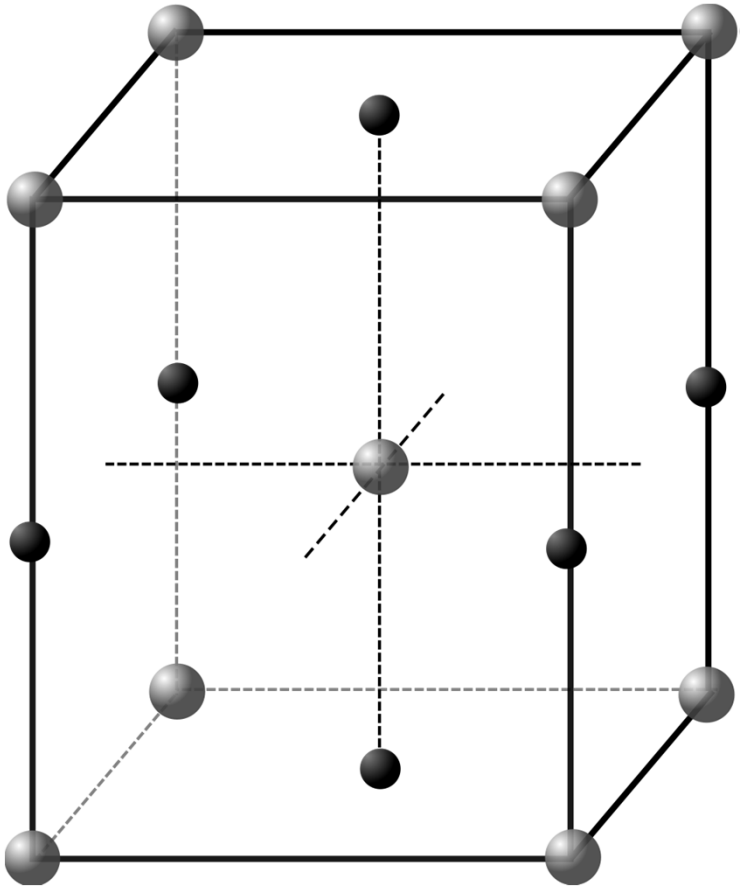
- When the security team:
  - Demands a development team devote time and budget to remediation
  - Provides them with no direction or support
  - Has the development team attempt to make fixes on their own
  - Complains when things don't work out

Remediation Worst Practices

- Result: No new features and half- or non-fixed vulnerabilities
- Good luck getting your next remediation project approved

Finding a Structure for Remediation Projects

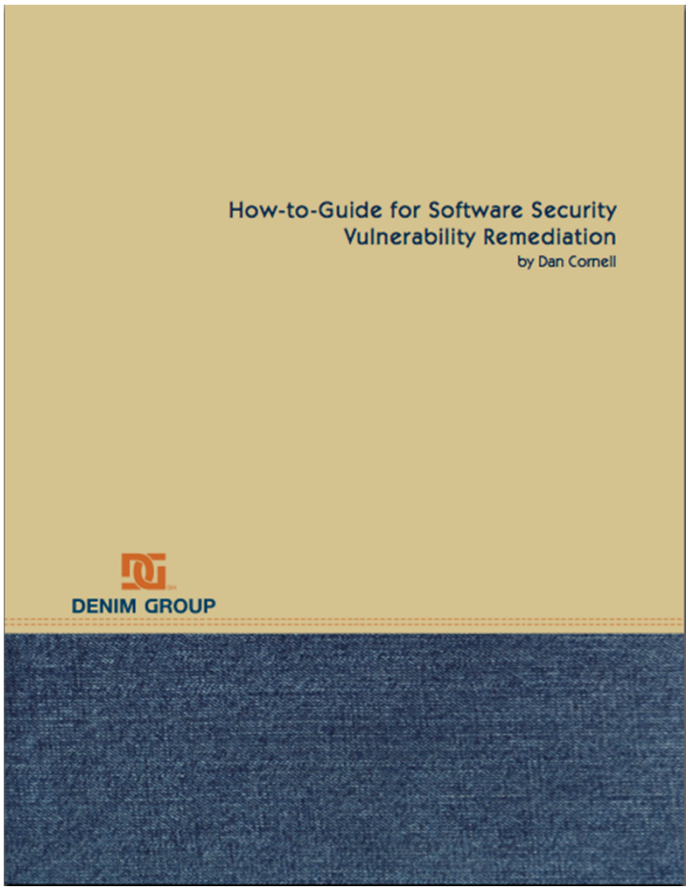
- Desired outcome: predictable and effective remediation projects
  - Predictable: know how long they will take and how much they will cost
  - Effective: targeted vulnerabilities actually get fixed
- A community of stakeholders
  - Security
  - Development
  - IT Audit / Compliance



Remediation Projects

- Inception
- Planning
  - Calculate Risk
  - Agree on Fix and Confirmation Methods
  - Determine Level of Effort
  - Schedule
- Execution
  - Set up Development Environment
  - Fix Vulnerabilities
  - Confirm Fixes and Perform Functional Testing
  - Deploy

Remediation: How To Guide



- Describes methodology for software security remediation projects
- Includes tips and best practices
- **Free** online

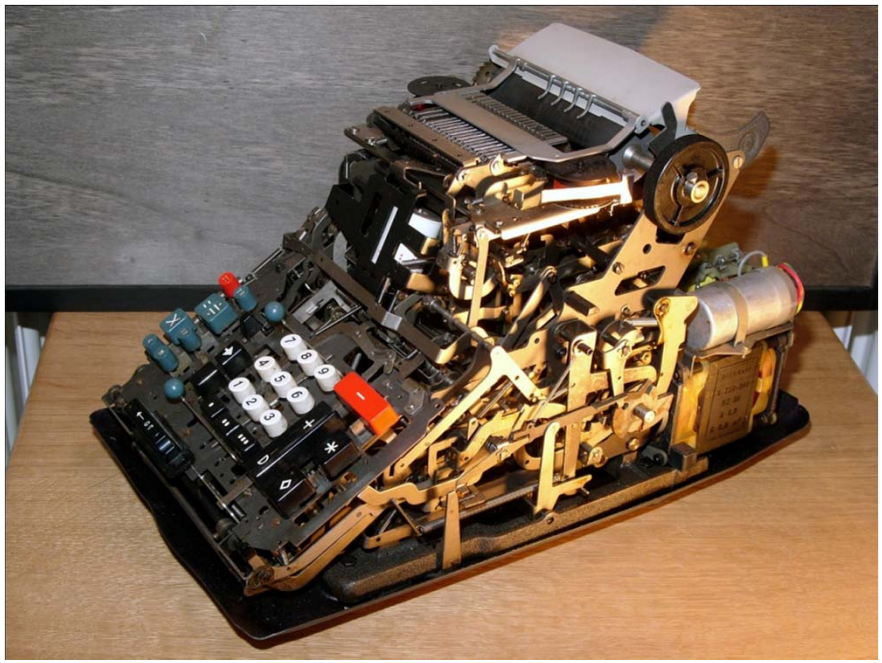
denimgroup.com/howtoguide_download_register.html

That's Great But…

- How long will it actually take me to fix my vulnerabilities?
- Software security remediation projects are software development projects
  - So estimate them as such
- Best practices:
  - Bottom-up estimation
  - Cluster vulnerabilities where possible
- It would be nice to have some data to use as a starting point…

Data!

- Took data from 15 remediated applications
- Two types of analysis:
  - Vulnerability-level (4 applications)
  - Project-level (13 applications)
- Data from Inception and Planning phases was too messy
- Data from Execution phase was useable



The Good (Why This Data Might Be Useful)

- Some data is better than no data
  - As long as you understand potential areas of bias
  - Read "How to Measure Anything" by Douglas W. Hubbard

- Had relatively large sample size for some vulnerability types

The Bad (Some Potential Sources of Bias)

- Relatively small sample size
- Based on a single project type
  - Outsourced software security remediation projects
- Data required cleanup and normalization
- Vulnerability data centered around technical vulnerabilities
  - Most identified by automated static analysis

Vulnerability-Specific Data (20+ Sample Count)

Vulnerability Type	Sample Count	Average Fix (minutes)
Dead Code (unused methods)	465	2.6
Poor logging: system output stream	83	2.9
Poor Error Handling: Empty catch block	180	6.8
Lack of Authorization check	61	6.9
Unsafe threading	301	8.5
ASP.NET non-serializable object in session	42	9.3
XSS (stored)	1023	9.6
Null Dereference	157	10.2
Missing Null Check	46	15.7
XSS (reflected)	25	16.2
Redundant null check	21	17.1
SQL injection	30	97.5

Some Thoughts and Notes

- Apparently deleting code and changing logging methods are easy
- Cross-Site Scripting
  - Vulnerability count tracks with data from WhiteHat, Veracode, other sources
  - Harder to fix reflected XSS than stored XSS
- Lack of Authorization Check
  - Fix consisted of copy/pasting file include into a number of files
- SQL Injection
  - Surprisingly high
  - Reason: fixes were for more complicated SQL injection vulnerabilities

So If I Have 6 Stored XSS Vulnerabilities…

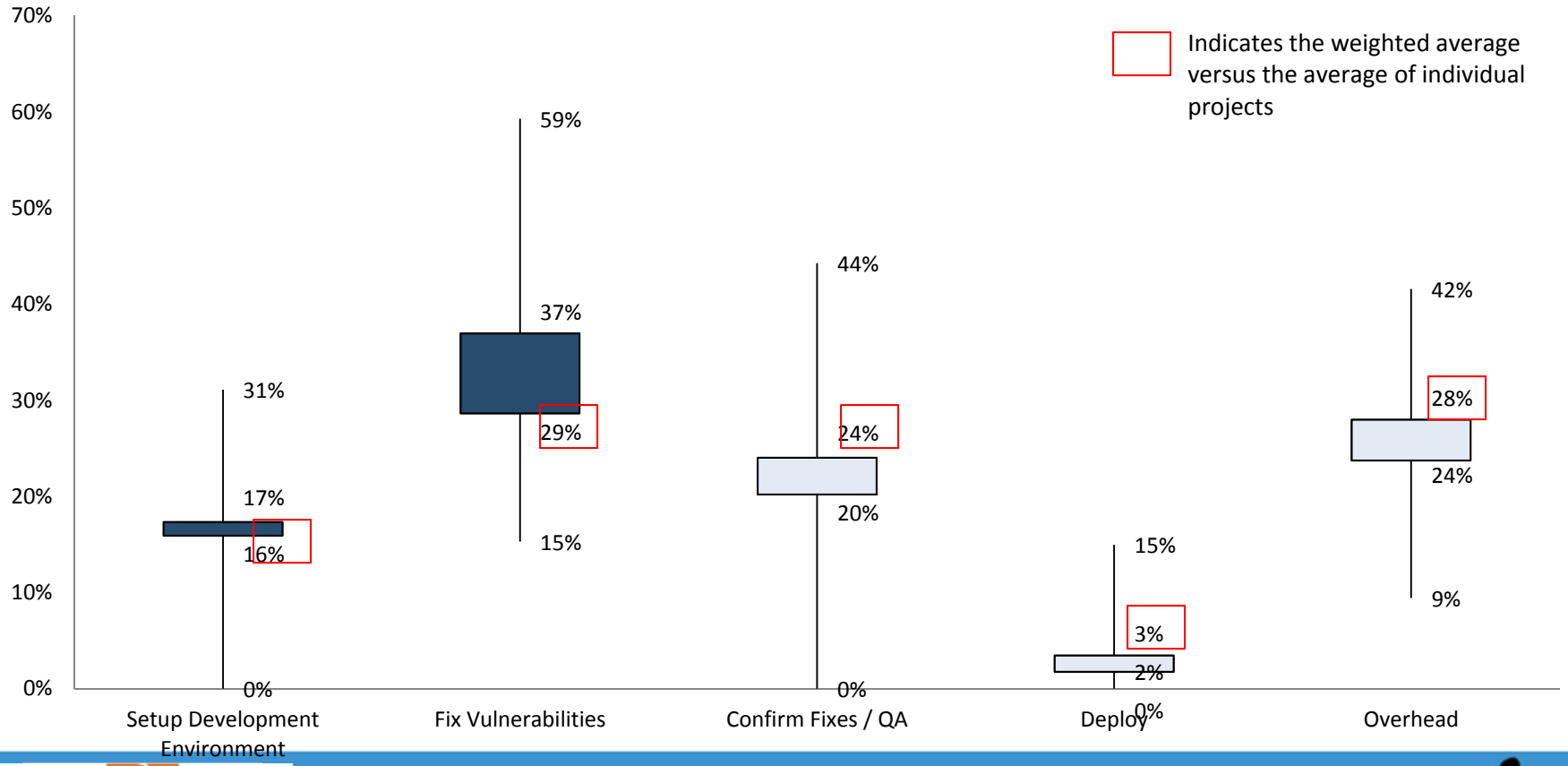
… my remediation project should take about an hour, right?

But wait!

Remediation Is Not Just About Coding Fixes

- This data is from one of four steps in one of three phases
  - "Fix Vulnerabilities" step in the "Execution" phase
- What about Inception and Planning?
  - No great data available yet
- What about the rest of Execution?
  - Set up Development Environment
  - Fix Vulnerabilities
  - Confirm Fixes and Perform Functional Testing
  - Deploy
  - Overhead

Where Is Time Being Spent?



Some Thoughts and Notes

- Setup Development Environment
  - Best case: existing development environment or VM
  - Worst case: Safari expedition to recreate environment setup because organization no longer had this knowledge
    - Instructions on setting up a development environment were a deliverable
- Fix Vulnerabilities
  - This is what people focus on but there is **wide** variation

Some Thoughts and Notes (continued)

- Confirm Fixes / QA
  - Sometimes this took more time than the actual fixes
  - Best case: Existing set of automated functional / regression tests
- Deploy
  - Best case: use an existing planned release
- Overhead
  - Surprisingly high in some cases

Using the Data

- I thought you said to estimate bottom-up?
  - Yes. Do that
  - Use the vulnerability data as a guide for estimation
  - Use the project composition data for validation
  - Use the lessons of the data to try and minimize required investment

What Can I Do To Minimize Remediation Costs?

Avoid introducing vulnerabilities into your software

(You are all welcome for this piece of sage advice)

What Can I Do To Minimize Remediation Costs?

- Have ready access to development environments for the developers doing the remediation
- Automated functional / regression testing helps speed security fixes
- Use planned deployments when possible

Which Vulnerabilities Get Fixed and When?

- Use your data-backed, bottom-up WBS for risk management and planning
- Serious vulnerabilities that are easy to fix? Consider an out-of-cycle release
- Otherwise leverage planned releases

The Outlier

- We remediated **one vulnerability** not included in the study that was **more expensive to fix than <u>all</u> vulnerabilities in the study**
  - Authentication issue in a connected system
- Requirements and architecture vulnerability
  - Automated scanners – static or dynamic: powerless to find it
- Should have / would have been caught by even a basic threat modeling or abuse case session

So Where Does This Leave Us

- Good:
  - We have a framework
  - We have some data
- Less good:
  - The data comes with a number of caveats

- Given a framework and some data you should be:
  - Better able to execute successful projects
  - Better able to estimate projects
  - Better able to minimize project costs

Next Steps For Me

- Release a more in-depth report
- Include more data in the analysis
- Perform deeper analysis
  - Impact of size of project (hours)
  - Impact of number of vulnerabilities remediated
  - Impact of platform
  - And so on…
- Include data on logical vulnerabilities

Apply

- Review your existing vulnerability data
- Create a “back of the envelope” plan to address open vulnerabilities
  - Run different scenarios: “All critical and high” “All public-facing apps” and so on
- Talk to developers
  - How do they set up development environments?
  - When do they do planned releases?
- Fix some vulnerabilities!
  - Application-level vulnerabilities persist for **a long time**

Remediation Resource Center

- Resources for remediating software security vulnerabilities
  - Videos
  - How-to Guide
  - Blog posts

denimgroup.com/remediation

Questions?

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