SYSTEMS ENGINEERING RESEARCH CENTER

SERC TALKS

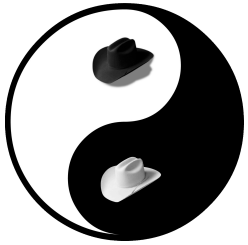
WELCOME

"What are the Top Ten Software Security Flaws?"

Gary McGraw, Synopsys

Vice President Security Technology

October 4, 2017 | 1:00 pm ET



- ❑ Today's session will be recorded.
- ❑ An archive of today's talk will be available at: www.sercuarc.org/serc-talks/
- ❑ Use the Q&A box to queue questions, reserving the chat box for comments, and questions will be answered during the last 5-10 minutes of the session.
- ❑ If you are connected via the dial-in information only, please email questions or comments to Ms. Mimi Marcus at mmarcus@stevens.edu.
- ❑ Any issues? Use the chat feature for any technical difficulties or other comments, or email Ms. Mimi Marcus at mmarcus@stevens.edu.

The Systems Engineering Research Center (SERC) is a federally funded University Affiliated Research Center managed by Stevens Institute of Technology.

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Avoiding the Top Ten Software Security Flaws

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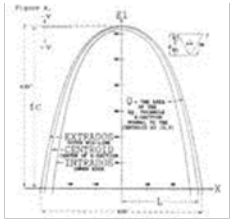
IEEE CSD Mission

The IEEE CSD will gather software security expertise from industry, academia, and government. The CSD provides guidance on:

- Recognizing software system designs that are likely vulnerable to compromise.
- Designing and building software systems with strong, identifiable security properties.
- http://bit.ly/ieee-CSD
- https://cybersecurity.ieee.org/center-for-secure-design/

On Bugs, Flaws, and Defects

gets()



attacker in the middle

BUGS

FLAWS

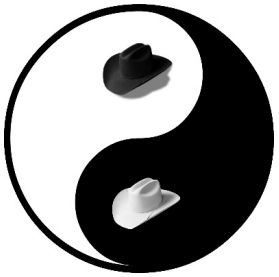
- Architectural risk analysis
- Customized static rules
- Commercial SAST Tools: HP Fortify, Coverity, etc

Avoiding the Top Ten Flaws

- Earn or give, but never assume, trust
- Use an authentication mechanism that cannot be bypassed or tampered with
- Authorize after you authenticate
- Strictly separate data and control instructions, and never process control instructions received from untrusted sources
- Define an approach that ensures all data are explicitly validated

- Use cryptography correctly
- Identify sensitive data and how they should be handled
- Always consider the users
- Understand how integrating external components changes your attack surface
- Be flexible when considering future changes to objects and actors

1. Earn or give, but never assume, trust



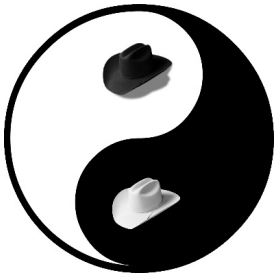
Earn or give, but never assume, trust

✓Make sure all data from an untrusted client are validated

✓Assume data are compromised

- Avoid authorization, access control, policy enforcement, and use of sensitive data in client code

2. Use an authentication mechanism that can't be bypassed



Use an authentication mechanism that can't be bypassed

✓Prevent the user from changing identity without re-authentication, once authenticated.

✓Consider the strength of the authentication a user has provided before taking action

✓Make use of time outs

- Do not stray past the big three
  - Something you are
  - Something you have
  - Something you know
- Avoid shared resources like IP numbers and MAC addresses
- Avoid predictable tokens

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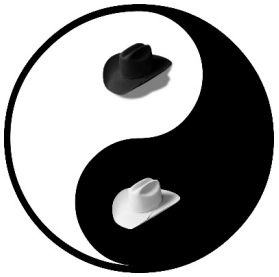
3. Authorize after you authenticate



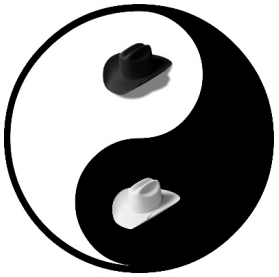
Authorize after you authenticate

✓Perform authorization as an explicit check

✓Re-use common infrastructure for conducting authorization checks

- Authorization depends on a given set of privileges, *and* on the context of the request
- Failing to revoke authorization can result in authenticated users exercising out-of-date authorizations

4. Strictly separate data and control instructions, and never process control instructions from untrusted sources



Strictly separate data and control instructions, and never process control instructions from untrusted sources

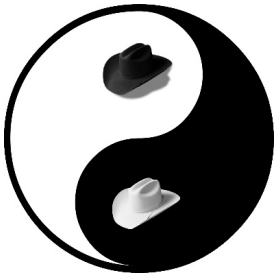
✓Utilize hardware capabilities to enforce separation of code and data

✓Know and use appropriate compiler/linker security flags

✓Expose methods or endpoints that consume structured types

- Co-mingling data and control instructions in a single entity is bad
- Beware of injection-prone APIs
  - XSS, SQL injection, shell injection
- Watch out for (eval)

5. Define an approach that ensures all data are explicitly validated



Define an approach that ensures all data are explicitly validated

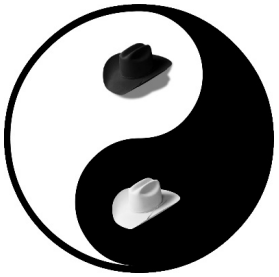
✓Ensure that comprehensive data validation actually takes place

✓Make security review of the validation scheme possible

✓Use a centralized validation mechanism and canonical data forms (avoid strings)

- Watch out for assumptions about data
- Avoid blacklisting, use whitelisting

6. Use cryptography correctly



Use cryptography correctly

✓Use standard algorithms and libraries

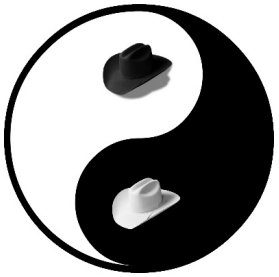
✓Centralize and re-use

✓Design for crypto agility

✓Get help from real experts

- Getting crypto right is VERY hard
- Do not roll your own
- Watch out for key management issues
- Avoid non-random “randomness”

7. Identify sensitive data and how they should be handled



Identify sensitive data and how they should be handled

✓Know where your sensitive data are

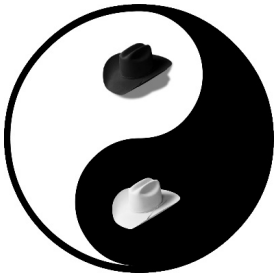
✓Classify your data into categories

✓Consider data controls
- ✓ File, memory, database protection

✓Plan for change over time

- Do not forget that data sensitivity is often context sensitive
- Confidentiality is not data protection
- Watch out for trust boundaries

8. Always consider the users



Always consider the users

✓Think about: deployment, configuration, use, update

✓Know that security is an emergent property of the system

✓Consider user culture, experience, biases, …

✓Make things secure by default

- Security is not a feature!
- Don’t impose too much security
- Don’t assume the users care about security
- Don’t let the users make security decisions

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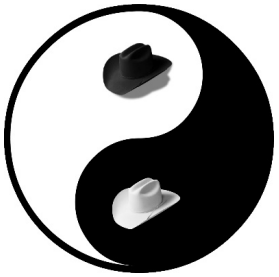
9. Understand how integrating external components changes your attack surface



Understand how integrating external components changes your attack surface

- ✓Test your components for security
- ✓Include external components and dependencies in review
- ✓Isolate components
- ✓Keep an eye out for public security information about components

- Composition is dangerous
- Security risk can be inherited
- Open source is not secure
- Don’t trust until you have applied and reviewed controls
- Watch out for extra functionality

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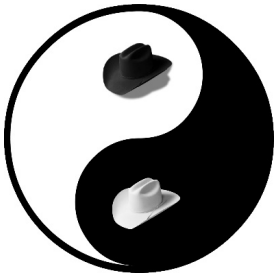
10. Be flexible when considering future changes to objects and actors



Be flexible when considering future changes to objects and actors

✓Design for change

✓Consider security updates

✓Make use of code signing and code protection

✓Allow isolation and toggling

✓Have a plan for “secret compromise” recovery

- Watch out for fragile and/or brittle security
- Be careful with code signing and system administration/operation
- Keeping secrets is hard
- Crypto breaks

Center for Secure Design Early Contributors

Organization	Individual
Athens University of Economics and Business	Diomidis Spinellis
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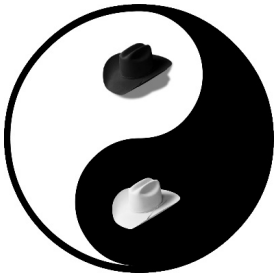
EMC	Izar Tarandach
George Washington University	Carl Landwehr
Google	Christoph Kern
Harvard University	Margo Seltzer
HP	Jacob West
McAfee, Part of Intel Security Group	Brook Schoenfield
RSA	Danny Dhillon
Sadosky Foundation	Iván Arc
Twitter	Neil Daswani
University of Washington	Tadayoshi Kohno

Where to learn more



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Silver Bullet + Writings

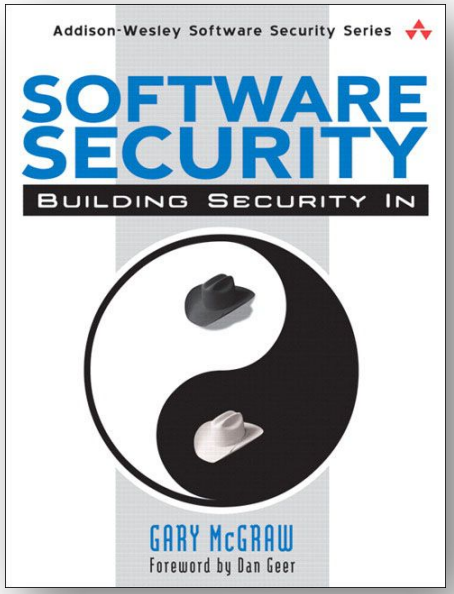
- Monthly Silver Bullet podcast with Gary McGraw: www.synopsys.com/silverbullet

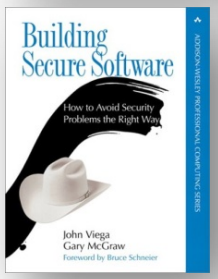
- Writings, Blogs, Music

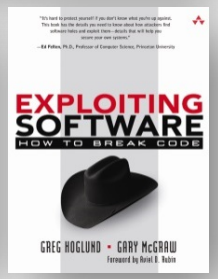
  garymcgraw.com

The Book + BSIMM8

- How to DO software security
  - Best practices
  - Tools
  - Knowledge
  - bsimm.com
- Cornerstone of the Addison-Wesley Software Security Series: www.swsec.com







Addison Wesley

BSIMM8

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Build Security In

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  http://bit.ly/ieee-CSD
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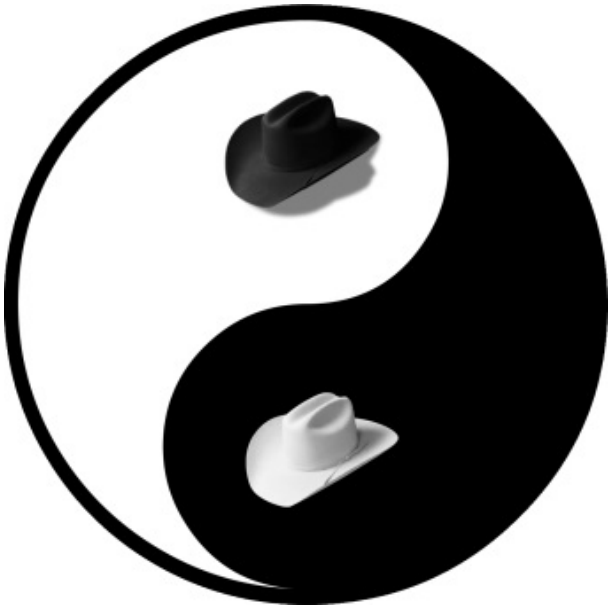

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SERC TALKS

UPCOMING TOPICS:

Cybersecurity Series

"The Dilemmas of Cybersecurity -- Why is Everything Broken?"

Dr. William Scherlis, Institute for Software Research, Carnegie Mellon University

November 1, 2017 | 3:00 pm ET

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