Getting-Ready For Secure Software Standard Security Assessment

A Vendor and a Penetration Tester Perspective

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Agenda

Getting Ready For Secure Software Standard Security Assessment

- Overview of the PCI Secure Software Standard
- **Traditional application penetration test**

  vs. **PCI Secure Software Standard testing**
- What should be prepared **before** the technical assessment?
- Security tests and common findings
- Final remarks

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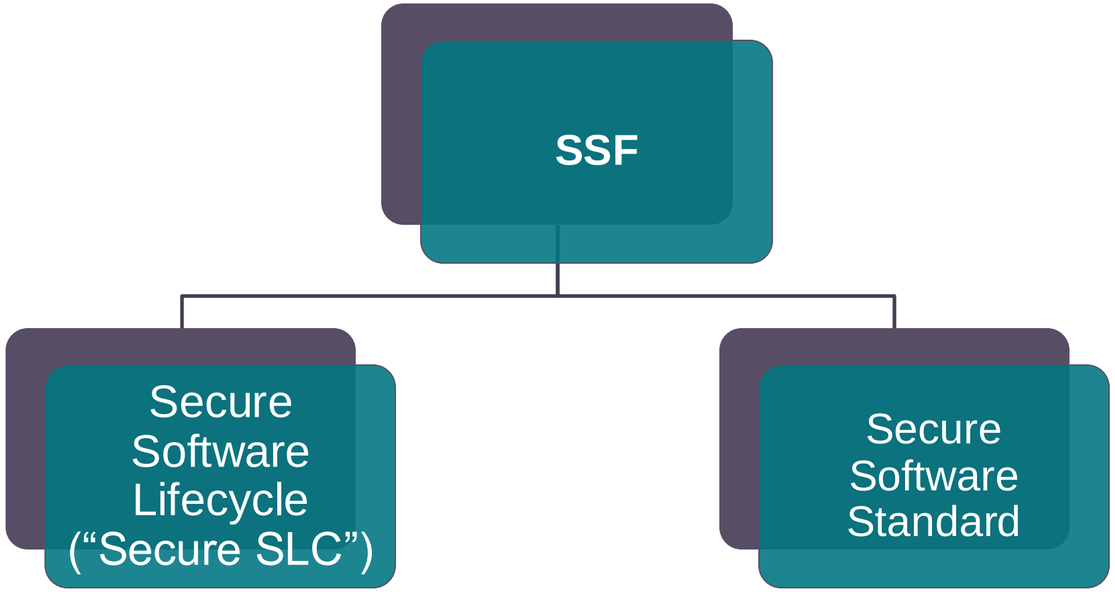
Overview of the PCI Secure Software Standard

PCI Software Security Framework



Critical Assets

PCI SSF Key concepts

These three elements are explicitly considered **critical assets** in the standard

Sensitive Data

Sensitive Functions

Sensitive Resources

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Sensitive Data*

PCI SSF Key concepts

"**Any data** that requires protection from **unauthorized disclosure** (confidentiality) or **modification** (integrity)."

- Cardholder data (CHD)
- Sensitive authentication data (SAD)
- Tokens
- Cryptographic key material
- Authentication credentials
- Internal system information

*Per PCI Glossary

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Sensitive Functions*

PCI SSF Key concepts

Any functionality of the payment software that…

- alters other software **functionality** or **configuration**
- processes **Sensitive Data**
- provides **Security Features**
- interacts **with Sensitive Resources**

*Per PCI Glossary

Sensitive Resources*

PCI SSF Key concepts

- Shared files
- Registry keys
- Environmental settings
- Communication channels
- Cache
- Shared libraries
- System interfaces
- Web services

Sensitive Resources may also constitute **“Sensitive Data”** and may require protection from unauthorized disclosure or modification.

*Per PCI Glossary

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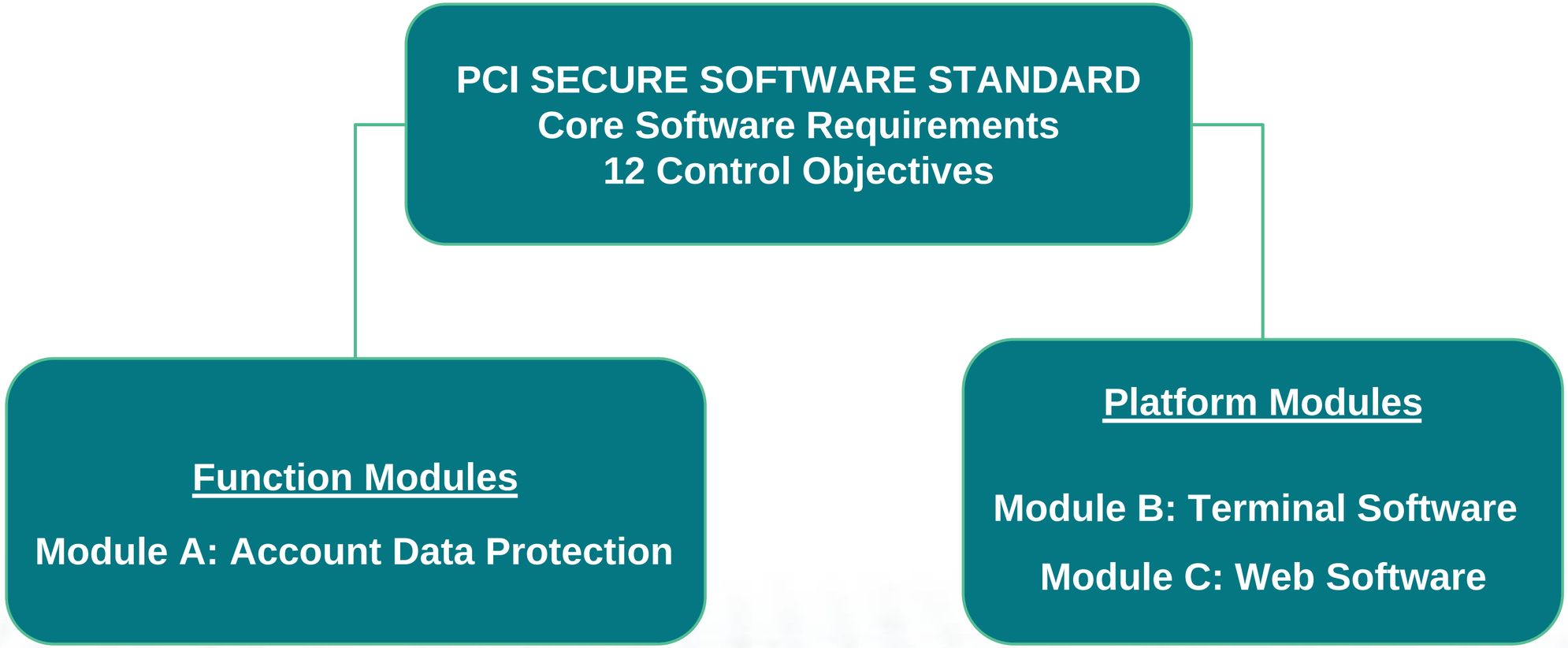
Introduction to the PCI SSF

Standard architecture: Modular requirements



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PCI Secure Software Standard v1.2.1

Core Requirements

Core Requirements must be assessed to all payment software

- **Module A** is required for payment software that handles Account Data
- **Module B** is required for payment software running in PTS devices
- **Module C** is required for payment software that conducts **electronic payment transactions** over the Internet.

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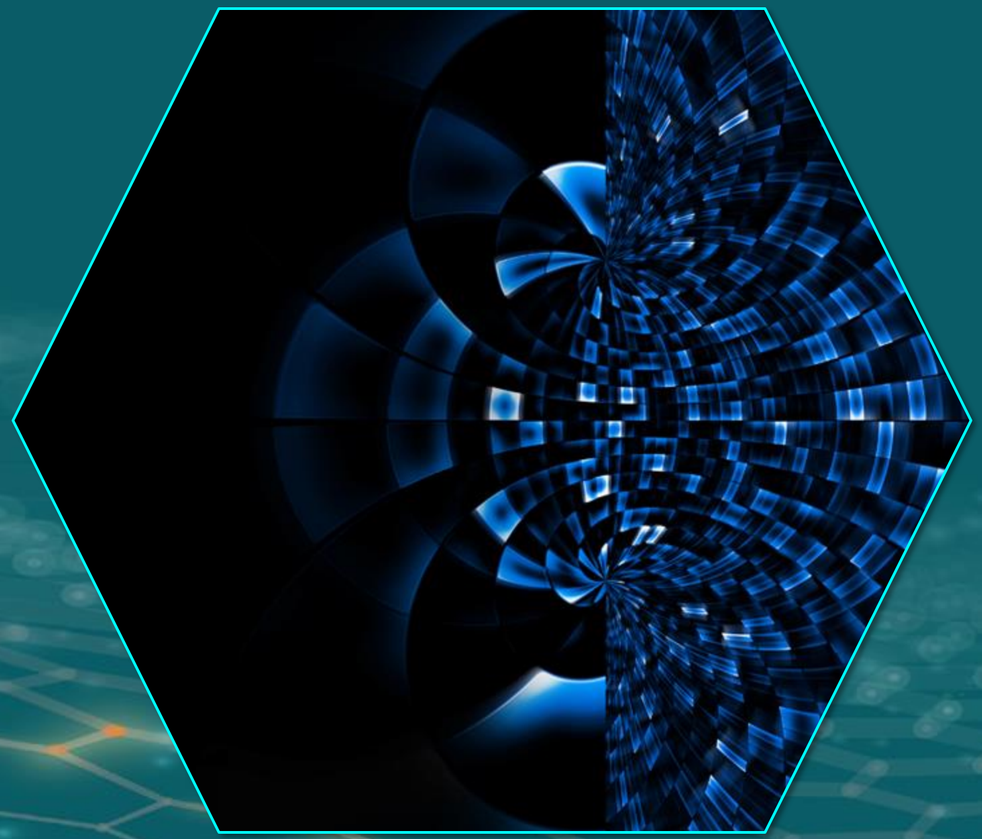

Traditional application penetration test vs. PCI Secure Software Standard testing

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Key Differences

Application Penetration test

- Blackbox /Graybox
- Limited Scope (Usually tested an already deployed solution)
- No access to source code or backend components
- Rules of the engagement
- Technical review

Security Tests for Secure Software Standard

- White Box.
  Access to the servers, databases and components
- Access to Source code to check sensitive functions and coding practices
- Access to secure test review results (e.g. SAST, DAST, components analysis, vulnerability scans, penetration tests)
- Software installation
  (Installation process and configuration)
- Sensitive data handling
  (Development cycle + deployment)
- Forensic review:
  memory dumps and disk images

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What should be prepared before the technical assessment?

Each stakeholder may have different priorities

Vendor - What to prepare

Software Owner

- Document Data Flows of sensitive data
- Understand how to securely install the application (Privileges, Secret management)
- Difference between Mutable and Immutable objects
- How secrets are protected (Database passwords, Secret for private keys or vaults, API keys)
- Clear understanding of authorisation and authentication details

Software consumer - What to check

Software Owner

- Certified environment (e.g. OSs, DBs, components)
- Technical installation process and requirements
- Understand the architecture and communications (Data/Management plane)
- **Operation responsibilities** (e.g. Cloud responsibility model, operations, integrity controls, activity tracking logs and monitoring, threat intelligence…)

Secure Software Assessor

Auditor

- Testing scenarios
  - Identify main data flows
  - Credentials, connectivity
  - Identify attack scenarios
- In scope components
- Front end components, Application components, Backend components (code, installers, documentation)

Security tests and common findings

Assessing the PCI Secure Software Standard testing

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Security Tests

Phases

1. Information Gathering
2. Source Code Review
3. Installation process tests
4. “Production” tests
5. Post-mortem tests / Forensic

Security Tests

1. Information gathering

Input:

- List of Sensitive data, function and resources [CO1]
- Configuration options: files, scripts, internal functions, menu and options, that could impact sensitive data. [CO1]
- Data flows → Key in the process [CO1]
- Application architecture, users (OS, DB, app), firewall rules
- Software Vendor Implementation Guidance [CO12]

Assessor tasks:

- Identify attack scenarios → From the architecture and data flows
- Define required tools/methods to complete tests

Security Tests

2. Secure Code Review

- **Immutable objects** used for sensitive data
  (e.g., String and BigInteger in Java, C#, .net) [CO3]
- Secure memory deletion of sensitive data in sensitive functions
- Secure coding practices: e.g. input validation, error management
- Application follows the guidance for the third-party components
  (e.g. if HSM in use then review/verify the configuration for FIPS 140-2 or 140-3)
- Hardcoded credentials or keys
- Encryption used for sensitive data, including passwords storage
- Use of RNG algorithms to create keys
- Secure connection to other components (DB, HSM, …)

Common findings

2. Secure Code Review

- Use of static entries
- No secure memory deletion of sensitive data:
  - Deletion is left to the Garbage Collector
- Insecure connection to other elements:
  - Connection to the Database using plain text passwords in configuration files
  - Microservices files/APIs

Security Tests

3. Installation Process

- Default users or certificates are required to be changed
- Users and privileges to run the processes
- Scripts and assigned permissions
- Installed components and third-party modules
- Environment variables, registry, others (passwords?)
- Configuration files and the impact in the application or data
- Processes listening before and after the installation
- Network/Firewall permissions

Common findings

3. Installation Process

- Default certificates
- Process requiring to run as a high privileged user
- Creating accounts or keys in bash leaving the password in the history
- Third-party modules installed with default configurations:
  - JBOSS by default (admin/admin)
  - Additional ports, not in use

1. In the folder where the dockerfile resides /home/dockerfiles/WARP_MP/WARP.ear, create a file called build.sh and run.sh. chmod both scripts to 775

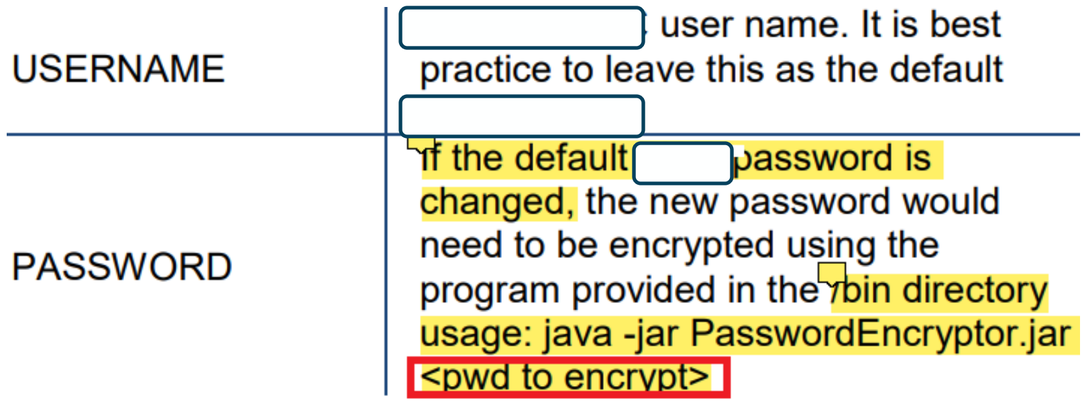
```
touch build.sh run.sh
chmod 775 *.sh
```

TCP	0.0.0.0:5000	0.0.0.0:0	LISTENING	6608
TCP	0.0.0.0:5040	0.0.0.0:0	LISTENING	9668
TCP	0.0.0.0:49664	0.0.0.0:0	LISTENING	1276
TCP	0.0.0.0:49665	0.0.0.0:0	LISTENING	1100
TCP	0.0.0.0:49666	0.0.0.0:0	LISTENING	1884
TCP	0.0.0.0:49667	0.0.0.0:0	LISTENING	3052
TCP	0.0.0.0:49672	0.0.0.0:0	LISTENING	4488
TCP	0.0.0.0:49678	0.0.0.0:0	LISTENING	1204
TCP	0.0.0.0:63807	0.0.0.0:0	LISTENING	4744
TCP	127.0.0.1:10391	0.0.0.0:0	LISTENING	14688

Common findings

3. Installation Process

- Creating accounts or keys in bash leaving the password in clear in the history
- Crontab required under root user calling dangerous scripts (to run zip or backups)



Security Tests

4. “Production” Tests

- Identify any APIs or interfaces exposed by default [CO 2.1.a]
- Authentication for interfaces relying in third parties [CO 2.1.b]
- Transmission of sensitive data relying in third parties [CO 2.1.c]
- Identify known vulnerabilities for the interfaces exposed [CO 2.1.d]
- Check that mitigations are identified by the vendor and guidance is provided in the software vendor threat information.
- information
- Identify third-party modules exposing functions [CO 2.1.e]
- TLS implementation + Transport (e.g. HTTP)

Security Tests

5. Post-mortem tests / Forensic test

- Identify sensitive data in memory: Memory dumps analysis
- Search for account data
- Authentication material
- Sensitive data in logs

Secure Software Standard Security Assessment

Final remarks

- Gathering the correct information of the tested payment application **prior** to the assessment is a key success factor for the validation process.

Based on real assessments' observations, we suggest:

- **Secure integration with 3rd party software** requires special attention.
- Proper **secret management** practices and **cleanup process after installation** are good practices.

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