COMPLIANCE AUTOMATION WITH OPENSCAP

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GOALS OF THIS PRESENTATION

1. What exactly is SCAP?
   - Understand the core components
   - Implementations from Red Hat

2. What tools and content are available today and what's in development?
   - For enumerating known vulnerabilities
   - For assessing configurations
   - For single systems, groups of systems, bare metal, virtual or containerized

3. Understand how to install, scan, and remediate using OpenSCAP

LIVE DEMOS DURING THIS PRESENTATION

1. Assess configuration compliance for your RHEL7 nodes
2. Customize a compliance profile with SCAP Workbench, a GUI tailoring tool for SCAP profiles on Linux/OSX/Windows
3. Vulnerability scanning with RHEL using OpenSCAP
4. Deconstruction of each command for complete understanding

SECURITY AUTOMATION

USE CASES

1. **Configuration Management**
   Does your system configuration settings comply with policy?

2. **Vulnerability Management**
   Detect & prioritize known vulnerabilities (software flaws) on a system, determine whether appropriate patches have been applied

3. **System Inventory**
   Identify products installed on the system
   (e.g. hardware, operating system, and applications)

4. **Malware Detection** **[evolving space]**
   Detect presence of malware on a system, allowing zero day signature building for consumption by SCAP tools

WHAT IS SCAP?

AUTOMATION LANGUAGE

AN SCAP PRIMER

- **S**ecurity **C**ontent **A**utomation **P**rotocol
    - Uses standards from all three of the automation families
        - Language, Enumeration, and Risk Measurement
- Collection of Data Formats defined in XML
- Created to provide a standardized approach to maintaining the security of enterprise systems, such as automatically verifying the presence of patches, checking system security configuration settings, and examining systems for signs of compromise.

AUTOMATION LANGUAGE

AN SCAP PRIMER

- We needed standardized formats for automated checklists
- Because we wanted:
  - Standardized inputs (e.g. a compliance baseline, status query)
  - Standardized outputs (compliance reports)
- Provides the enterprise liberty with regards to product choices
  - Avoids vendor lock-in, enables interoperability
  - Federal procurement language *requires* SCAP in some cases (e.g. DHS CDM)

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Languages:
  - **XCCDF**: e**X**tensible **C**onfiguration **C**hecklist **D**escription **F**ormat
  - **OVAL**: **O**pen **V**ulnerability **A**ssessment **L**anguage
  - **OCIL**: **O**pen **C**hecklist **I**nteractive **L**anguage
  - **ARF**: **A**sset **R**eporting **F**ormat

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Languages (explained):
  - **XCCDF**: Checklists for evaluating a system based on the criteria defined within security and/or nonsecurity checklists.
  - **OVAL**: Designed for performing individual security checks, such as verifying security settings, known vulnerabilities, and reporting the results of each check performed.
  - **OCIL**: Checks that collection information from people or from existing data stores.
  - **ARF**: Framework for documenting informations related to a variety of assets.

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Enumerations:
  - **CVE**: **C**ommon **V**ulnerabilities and **E**xposures
  - **CCE**: **C**ommon **C**onfiguration **E**numeration
  - **CPE**: **C**ommon **P**latform **E**numeration

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Enumerations (explained):
  - **CVE**: Enumeration for software vulnerabilities
  - **CCE**: Enumeration of security-relevant configuration elements for applications and operating systems.
  - **CPE**: A structured naming scheme used to identify information technology systems (hardware), platforms (operating systems), and packages (applications).

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Enumerations (examples):
    - **CVE**: CVE-2014-0160 : Heartbleed bug in OpenSSL
    - **CCE**: CCE-3999-0 : Make sure SELinux is enforcing
    - **CPE**: cpe:/o:redhat:enterprise_linux:7

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Risk Measurement:
  - **CVSS**: **C**ommon **V**ulnerability **S**coring **S**ystem
  - **CCSS**: **C**ommon **C**onfiguration **S**coring **S**ystem

SECURITY CONTENT AUTOMATION PROTOCOL

COMPONENTS

THE COMPONENT STANDARDS OF SCAP INCLUDE:

- Risk Measurement (explained):
  - **CVSS**: Metrics to assign a score to software vulnerabilities to help users prioritize risk.
  - **CCSS**: Metrics to assign a score to security-relevant configuration elements to help users prioritize responses.

SCAP COMPONENT INTERACTION

SCAP COMPONENT INTERACTION

CHECKLIST LANGUAGE

XCCDF

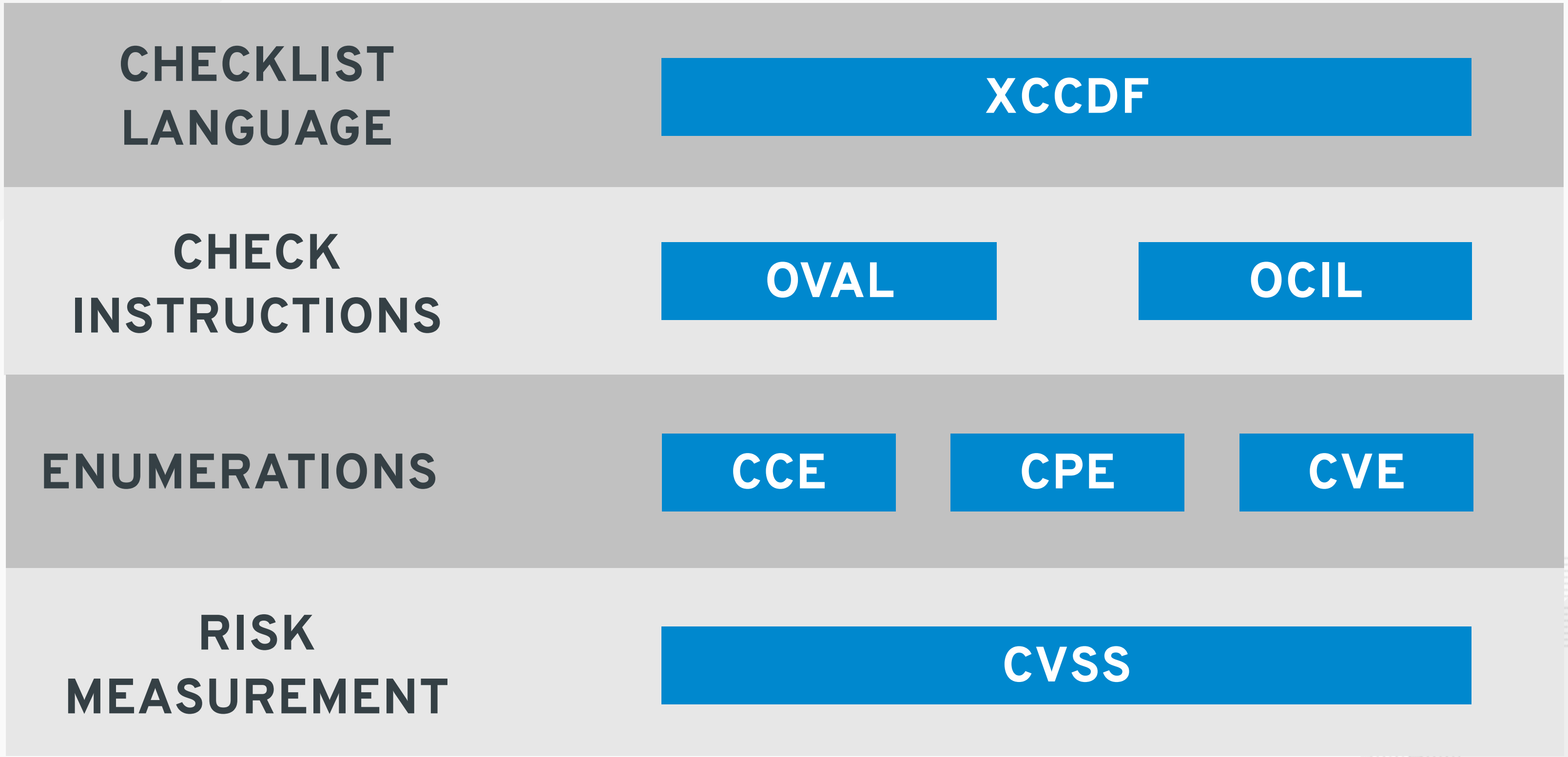
SCAP COMPONENT INTERACTION

CHECKLIST LANGUAGE	XCCDF	
CHECK INSTRUCTIONS	OVAL	OCIL

SCAP COMPONENT INTERACTION

CHECKLIST LANGUAGE	XCCDF		
CHECK INSTRUCTIONS	OVAL		OCIL
ENUMERATIONS	CCE	CPE	CVE

SCAP COMPONENT INTERACTION



CHECKLIST LANGUAGE	XCCDF		
CHECK INSTRUCTIONS	OVAL	OCIL	
ENUMERATIONS	CCE	CPE	CVE
RISK MEASUREMENT	CVSS		

SCAP COMPONENT INTERACTION

CHECKLIST LANGUAGE	XCCDF		
CHECK INSTRUCTIONS	OVAL	OCIL	
ENUMERATIONS	CCE	CPE	CVE
RISK MEASUREMENT	CVSS		
REPORT & RESULTS	ARF		

WHAT IS OPENSCAP?

SECURITY AUTOMATION

AN OPENSCAP PRIMER

- A **framework** of **libraries** and **tools** to improve the accessibility of SCAP and enhance the usability of the information it represents.
- The main goal is to perform **configuration** and **vulnerability** scans of a local system by evaluating both **XCCDF** benchmarks and **OVAL** definitions and generate the appropriate results.

SECURITY AUTOMATION

COMPONENTS

THE COMPONENT STANDARDS OF OPENSCAP INCLUDE:

- Library:
  - **libopenscap** provides **API** to SCAP document processing and evaluation.
- Toolkit:
  - SCAP scanner (**oscap**) is a command line tool that provides various capabilities:
    - configuration scanner
    - vulnerability scanner
    - SCAP content validation and remediation.

RED HAT SCAP TOOLS

OPENSCAP/SCAP SECURITY GUIDE

OpenSCAP : suite of open source tools and libraries for security automation

OpenSCAP Scanner : CLI tool for configuration and vulnerability measurements

SCAP Workbench : GUI front-end for OpenSCAP with remote scanning and policy modification (tailoring).

SCAP Security Guide : Provides pre-built profiles for common configuration requirements, such as DoD STIG, PCI-DSS, CJIS, and the Red Hat Certified Cloud Provider standards.

SCAP Security Guide Docs : HTML formatted documents containing security guides generated from XCCDF benchmarks.

SHIPPING PROFILES

SCAP-SECURITY-GUIDE

RHEL 7.2 (aka, today via SCAP Security Guide v0.1.25)

- PCI-DSS
- RHEL7 Vendor STIG

RHEL 7.3 (est. SCAP Security Guide v0.1.30, upstream released now)

- Department of Justice Criminal Justice Information Systems (FBI CJIS)
- CIA's C2S ("inspired from CIS RHEL7")
- Certified Cloud Provider (CCP)
- FISMA Moderate (NIST 800-53 Medium/Medium/Medium)

Upstream / In Progress

- DoD Baseline for Workstations (aka, GNOME3)
- Need customer input for prioritization of OpenShift, OpenStack, JBoss...

RED HAT SCAP TOOLS

PRODUCT IMPLEMENTATION

OSCAP Anaconda : An add-on for the Anaconda installer that enables administrators to feed security policy into the installation process and ensure that systems are compliant from first boot.

Red Hat Satellite : An on-premise (connected or disconnected) systems life-cycle management tool. Can be an alternative to downloading all of your content from the Red Hat content delivery network and limit the risks of malicious content or access.

Red Hat CloudForms : Manage private clouds, virtual environments, and public cloud security through the full life cycle of systems and apps. This allows other Red Hat products like **Red Hat OpenShift Enterprise** to scan images(containers) for vulnerabilities and policy compliance.

OPENSCAP

HTTPS://WWW.OPENSCAP.COM

HTTPS://GITHUB.COM/OPENSCAP

&

SCAP SECURITY GUIDE

HTTPS://GITHUB.COM/OPENSCAP/SCAP-SECURITY-GUIDE

DEMONSTRATION

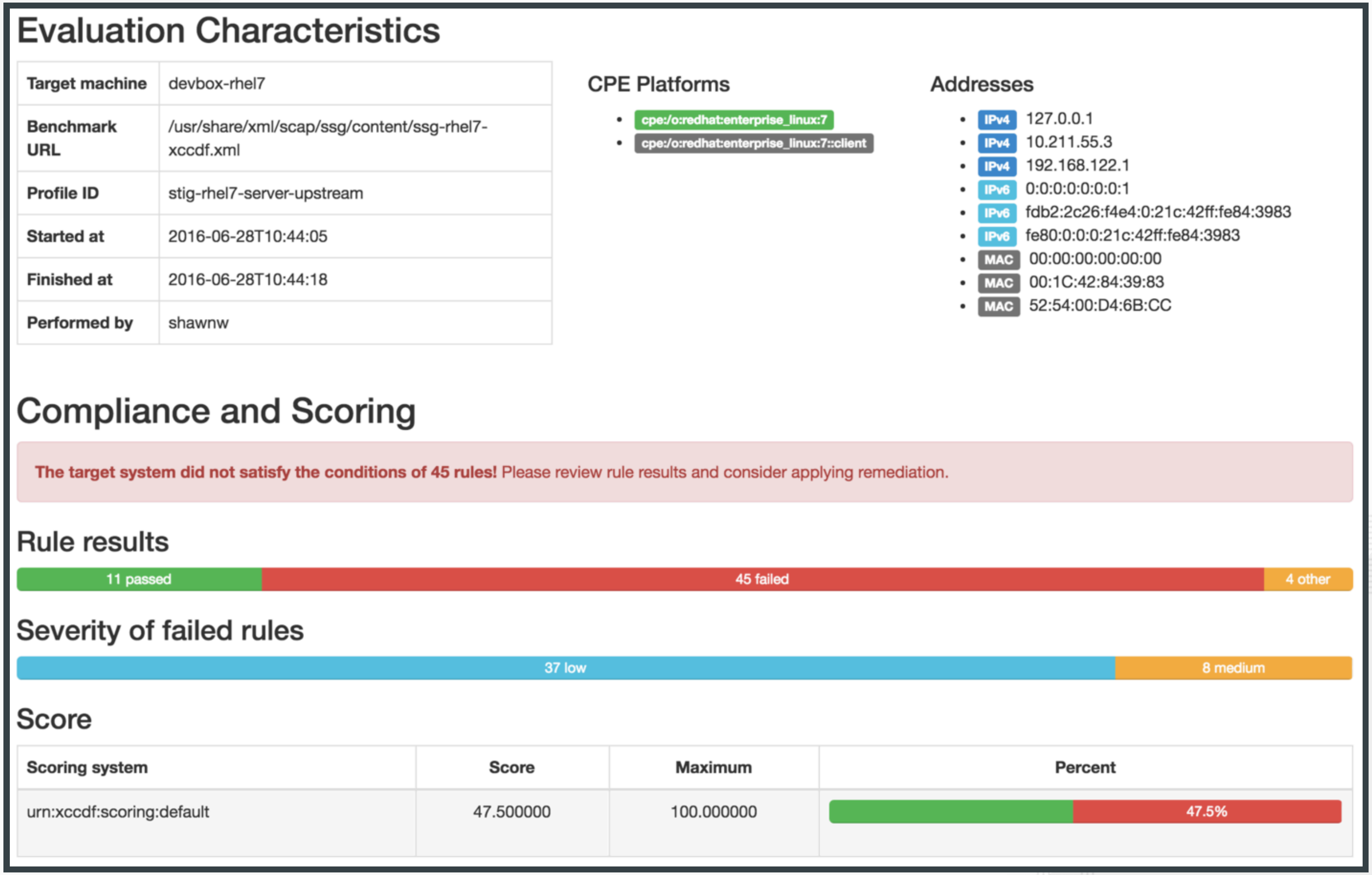
Following slides are supplementals to the live demos.

These should enable you to replicate everything from the live demo.

Send an e-mail if something seems wrong or forgotten.

Contact info included at the end of this deck.

HTML REPORT (1/3)



Evaluation Characteristics

Target machine	devbox-rhel7
Benchmark URL	/usr/share/xml/scap/ssg/content/ssg-rhel7-xccdf.xml
Profile ID	stig-rhel7-server-upstream
Started at	2016-06-28T10:44:05
Finished at	2016-06-28T10:44:18
Performed by	shawnw

CPE Platforms

- cpe:/o:redhat:enterprise_linux:7
- cpe:/o:redhat:enterprise_linux:7::client

Addresses

- IPv4 127.0.0.1
- IPv4 10.211.55.3
- IPv4 192.168.122.1
- IPv6 0:0:0:0:0:0:0:1
- IPv6 fdb2:2c26:f4e4:0:21c:42ff:fe84:3983
- IPv6 fe80:0:0:0:21c:42ff:fe84:3983
- MAC 00:00:00:00:00:00
- MAC 00:1C:42:84:39:83
- MAC 52:54:00:D4:6B:CC

Compliance and Scoring

The target system did not satisfy the conditions of 45 rules! Please review rule results and consider applying remediation.

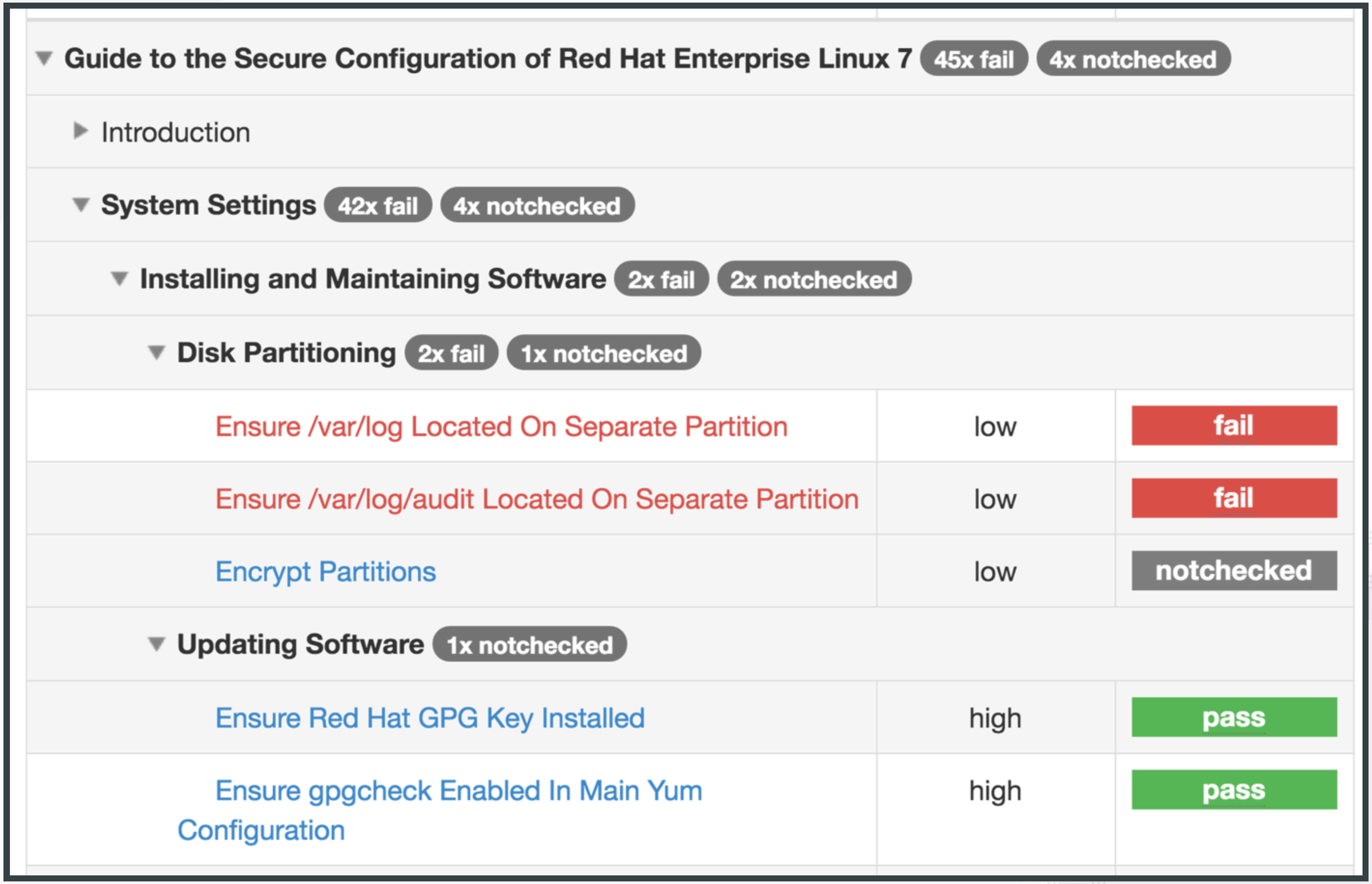
Rule results

Severity of failed rules

Score

Scoring system	Score	Maximum	Percent
urn:xccdf:scoring:default	47.500000	100.000000	47.5%

HTML REPORT (2/3)



▼ **Guide to the Secure Configuration of Red Hat Enterprise Linux 7** 45x fail 4x notchecked

▶ Introduction

▼ **System Settings** 42x fail 4x notchecked

▼ **Installing and Maintaining Software** 2x fail 2x notchecked

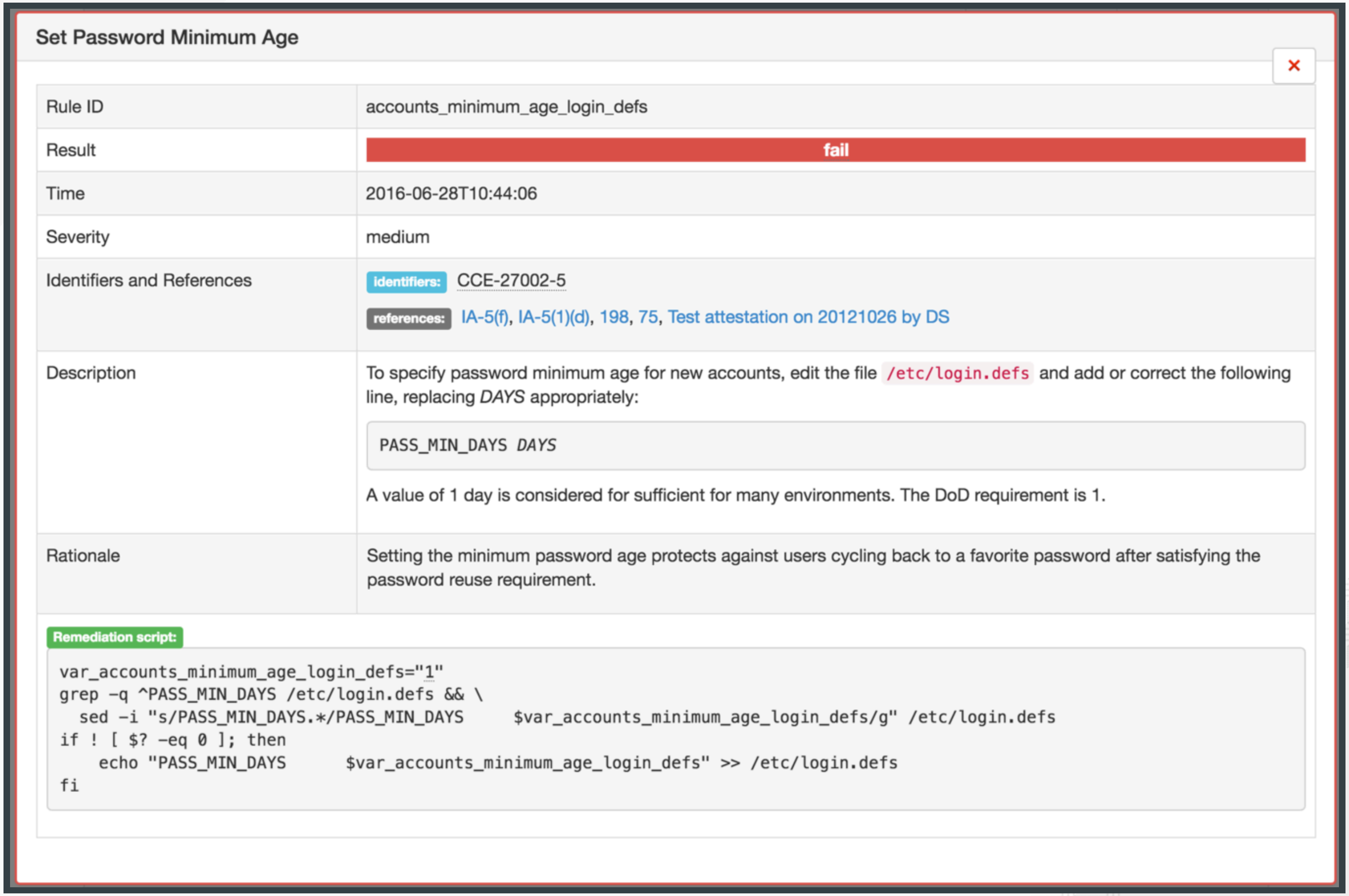
▼ **Disk Partitioning** 2x fail 1x notchecked

Ensure /var/log Located On Separate Partition	low	fail
Ensure /var/log/audit Located On Separate Partition	low	fail
Encrypt Partitions	low	notchecked

▼ **Updating Software** 1x notchecked

Ensure Red Hat GPG Key Installed	high	pass
Ensure gpgcheck Enabled In Main Yum Configuration	high	pass

HTML REPORT (3/3)



Set Password Minimum Age

Rule ID	accounts_minimum_age_login_defs
Result	fail
Time	2016-06-28T10:44:06
Severity	medium
Identifiers and References	identifiers: CCE-27002-5 references: IA-5(f), IA-5(1)(d), 198, 75, Test attestation on 20121026 by DS
Description	To specify password minimum age for new accounts, edit the file `/etc/login.defs` and add or correct the following line, replacing *DAYS* appropriately: `PASS_MIN_DAYS DAYS` A value of 1 day is considered for sufficient for many environments. The DoD requirement is 1.
Rationale	Setting the minimum password age protects against users cycling back to a favorite password after satisfying the password reuse requirement.

Remediation script:

```
var_accounts_minimum_age_login_defs="1"
grep -q ^PASS_MIN_DAYS /etc/login.defs && \
  sed -i "s/PASS_MIN_DAYS.*/PASS_MIN_DAYS     $var_accounts_minimum_age_login_defs/g" /etc/login.defs
if ! [ $? -eq 0 ]; then
    echo "PASS_MIN_DAYS      $var_accounts_minimum_age_login_defs" >> /etc/login.defs
fi
```

INSTALLING OPENSCAP

To install OpenSCAP scanner and the SCAP Security Guide content:

```
# yum -y install openscap-scanner scap-security-guide
```

To install SCAP Workbench, the GUI tailoring tool:

```
# yum -y install scap-workbench
```

To install documentation (optional):

```
# yum -y install scap-security-guide-doc
```

WHAT'S INCLUDED?

Take a look:

```
# rpm -ql scap-security-guide
```

- **/usr/share/xml/scap/ssg/content/**
  Houses SCAP content for automated testing
- **/usr/share/scap-security-guide/kickstart/**
  Sample kickstarts using the Anaconda OpenSCAP plugin
- **/usr/share/doc/scap-security-guide-*/**
  - HTML tables that map NIST 800-53 back to configuration checks, forming the base of RTMs
  - HTML editions of configuration baselines, e.g. "Privileged User Guides"

BREAKING DOWN SCAP

XCCDF: Human-readable prose guidance, expressed in XML
Found @ **/usr/share/xml/scap/ssg/content/ssg-rhel7-xccdf.xml**

OVAL: Machine language for pass/fail unit tests
Found @ **/usr/share/xml/scap/ssg/content/ssg-rhel7-oval.xml**

SCAP Datastream: Combines XCCDF and OVAL into one file.

Found @ **/usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml**

SHIPPING PROFILES

```
# oscap info /usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml
Document type: Source Data Stream
Imported: 2015-10-02T06:17:44

Stream: scap_org.open-scap_datastream_from_xccdf_ssg-rhel7-xccdf-1.2.xml
Generated: (null)
Version: 1.2
Checklists:
  Ref-Id: scap_org.open-scap_cref_ssg-rhel7-xccdf-1.2.xml
    Status: draft
    Generated: 2015-10-02
    Resolved: true
    Profiles:
      xccdf_org.ssgproject.content_profile_standard
      xccdf_org.ssgproject.content_profile_pci-dss
      xccdf_org.ssgproject.content_profile_rht-ccp
      xccdf_org.ssgproject.content_profile_common
      xccdf_org.ssgproject.content_profile_stig-rhel7-server-upstream
    Referenced check files:
      ssg-rhel7-oval.xml

...
```

SHIPPING PROFILES

```
# oscap info /usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml
Document type: Source Data Stream
Imported: 2015-10-02T06:17:44

Stream: scap_org.open-scap_datastream_from_xccdf_ssg-rhel7-xccdf-1.2.xml
Generated: (null)
Version: 1.2
Checklists:
  Ref-Id: scap_org.open-scap_cref_ssg-rhel7-xccdf-1.2.xml
    Status: draft
    Generated: 2015-10-02
    Resolved: true
    Profiles:
      xccdf_org.ssgproject.content_profile_standard
      xccdf_org.ssgproject.content_profile_pci-dss
      xccdf_org.ssgproject.content_profile_rht-ccp   <-- Choose for demo
      xccdf_org.ssgproject.content_profile_common
      xccdf_org.ssgproject.content_profile_stig-rhel7-server-upstream
    Referenced check files:
      ssg-rhel7-oval.xml

...
```

SINGLE-HOST SCAN

```
# oscap xccdf eval \
  --profile xccdf_org.ssgproject.content_profile_rht-ccp \
  --results-arf arf.xml --report report.html \
  /usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml
...
Title   Ensure /var/log/audit Located On Separate Partition
Rule    partition_for_var_log_audit
Ident   CCE-26971-2
Result  fail

Title   Encrypt Partitions
Rule    encrypt_partitions
Ident   CCE-27128-8
Result  notchecked

Title   Ensure Red Hat GPG Key Installed
Rule    ensure_redhat_gpgkey_installed
Ident   CCE-26957-1
Result  pass
...
```

SINGLE-HOST SCAN

IMPORTANT NOTE:

The **ssg-rhel7-ds.xml** file which is **the Source DataStream** with **XCCDF 1.2** built inside. The advantage of **Source DataStream** is that you have everything you need bundled in one file - **XCCDF**, **OVAL**(s), **CPE**(s), and it supports digital signatures.

The evaluation process usually takes a few minutes, depending on the number of selected rules. Similarly to **SCAP Workbench**, **oscap** will also provide you an overview of results after it's finished, and you will find reports saved and available for review in your current working directory.

SINGLE-HOST SCAN

SCAN DECONSTRUCTION

```
# oscap xccdf eval \
  --profile xccdf_org.ssgproject.content_profile_rht-ccp \
  --results-arf arf.xml --report report.html \
  /usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml
```

xccdf eval

- The **oscap** tool calls on the **xccdf** module.
- The **xccdf** module is used with the **eval** operation which then allows us to perform the evaluation.
- The XCCDF module will try to load all OVAL Definition files referenced from XCCDF automatically.
- **man oscap** for more module operations.

--profile PROFILE

- Select a particular profile from the data stream file (INPUT file) at the end of the command.

SINGLE-HOST SCAN

SCAN DECONSTRUCTION (CONT.)

```
# oscap xccdf eval \
  --profile xccdf_org.ssgproject.content_profile_rht-ccp \
  --results-arf arf.xml --report report.html \
  /usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml
```

--results-arf FILE

- Tell oscap that we want the results stored as an Assest Reporting Format (ARF) in a file called **arf.xml**.
- It is recommended to use this option instead of **--results** when dealing with datastreams.

--report FILE

- Write HTML report into **report.html**

/usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml

- This is the INPUT_FILE needed to perform the evaluation.
- Print result of each rule to standard output, including rule title, rule id and security identifier(CVE, CCE).

REMEDIATION

Or scan & fix everything at once (note the --remediate flag):

```
# oscap xccdf eval --remediate --profile \
xccdf_org.ssgproject.content_profile_rht-ccp \
--results scan-xccdf-results.xml \
/usr/share/xml/scap/ssg/content/ssg-rhel7-ds.xml
```

CVE SCAN

VULNERABILITY SCANNER

Download content from Red Hat:

```
# cd /tmp
# wget -c4 http://www.redhat.com/security/data/metrics/ds/com.redhat.rhsa-
RHEL7.ds.xml
```

Run CVE scan:

```
# oscap xccdf eval --results-arf results.xml --report report.html com.redh
at.rhsa-RHEL7.ds.xml
```

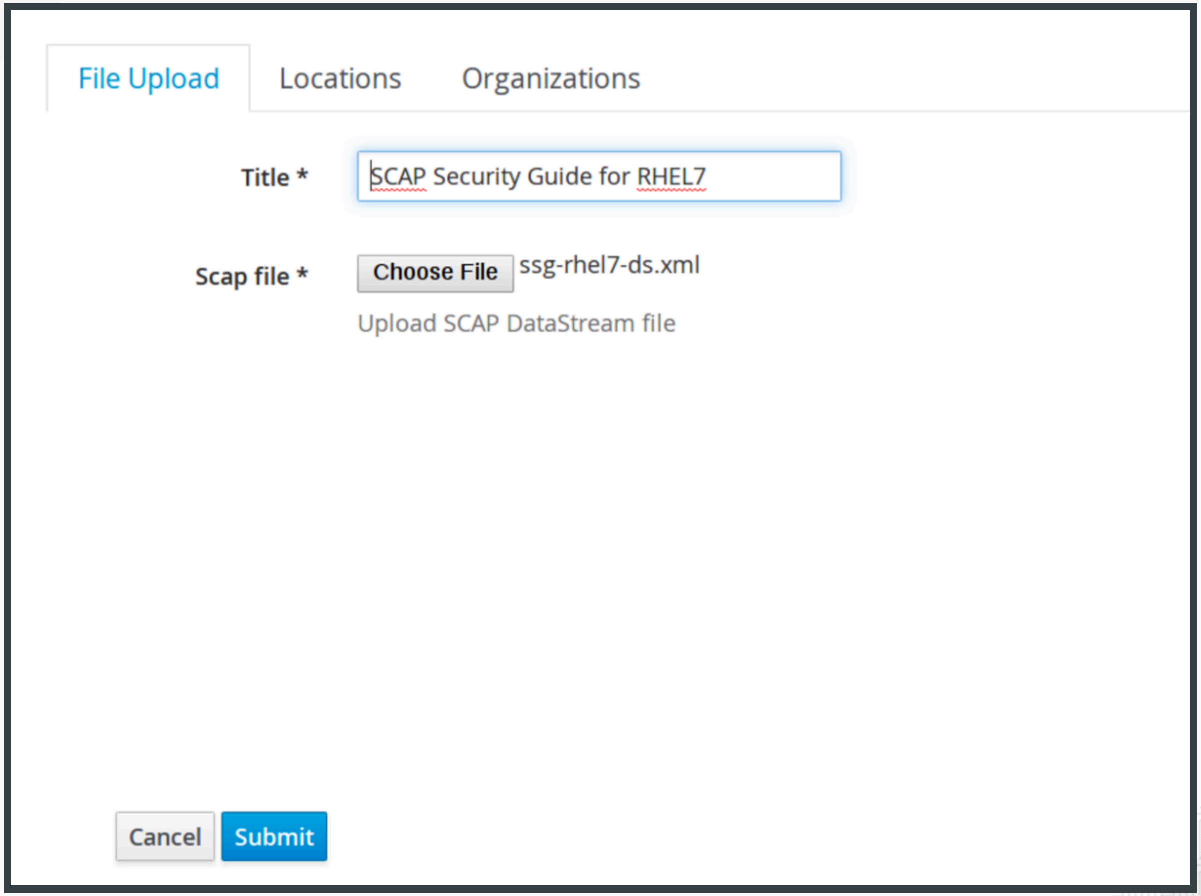
View report

```
# firefox report.html
```

- Only detects vulnerabilities in Red Hat packages
    - Not Supported: EPEL, 3rd party vendor repos, non-RPM packages, CentOS
    - Only detects vulnerabilities fixed in Red Hat Security Advisories (RHSA)

SATELLITE 6

Audit Scanning



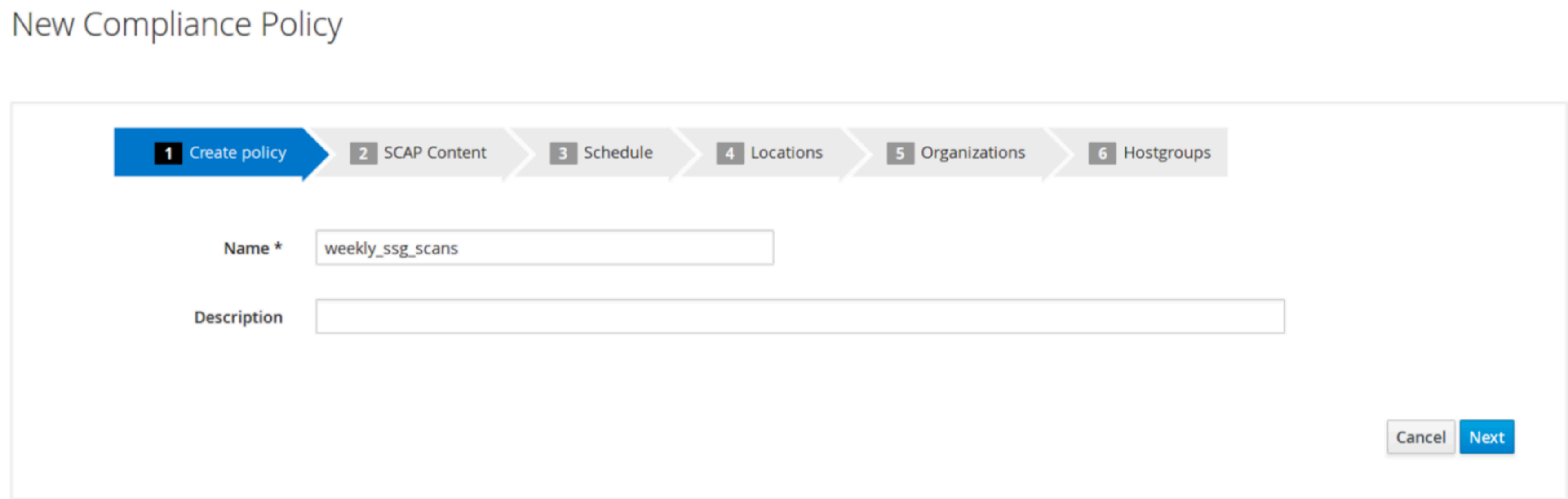
Title * SCAP Security Guide for RHEL7

Scap file * ssg-rhel7-ds.xml

Upload SCAP DataStream file

SATELLITE

Define policies



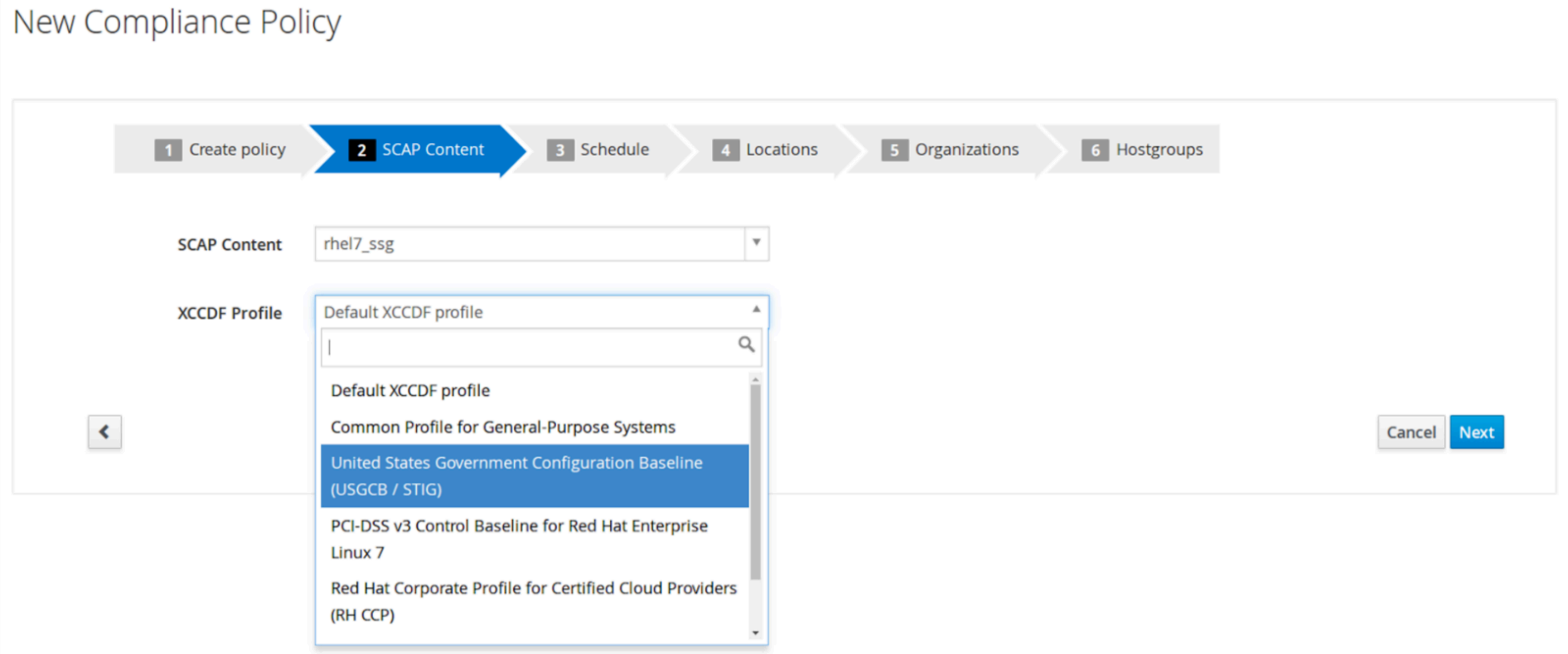
New Compliance Policy

Name * weekly_ssg_scans

Description

SATELLITE

Define policies



New Compliance Policy

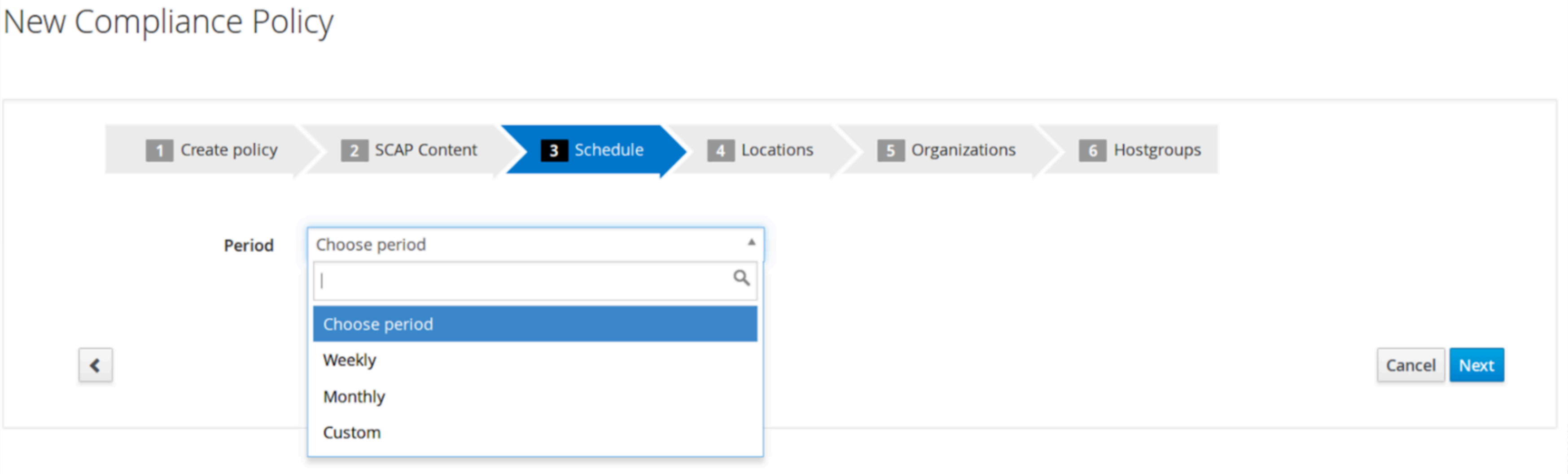
SCAP Content: rhel7_ssg

XCCDF Profile: Default XCCDF profile

- Default XCCDF profile
- Common Profile for General-Purpose Systems
- United States Government Configuration Baseline (USGCB / STIG)
- PCI-DSS v3 Control Baseline for Red Hat Enterprise Linux 7
- Red Hat Corporate Profile for Certified Cloud Providers (RH CCP)

SATELLITE

Define policies

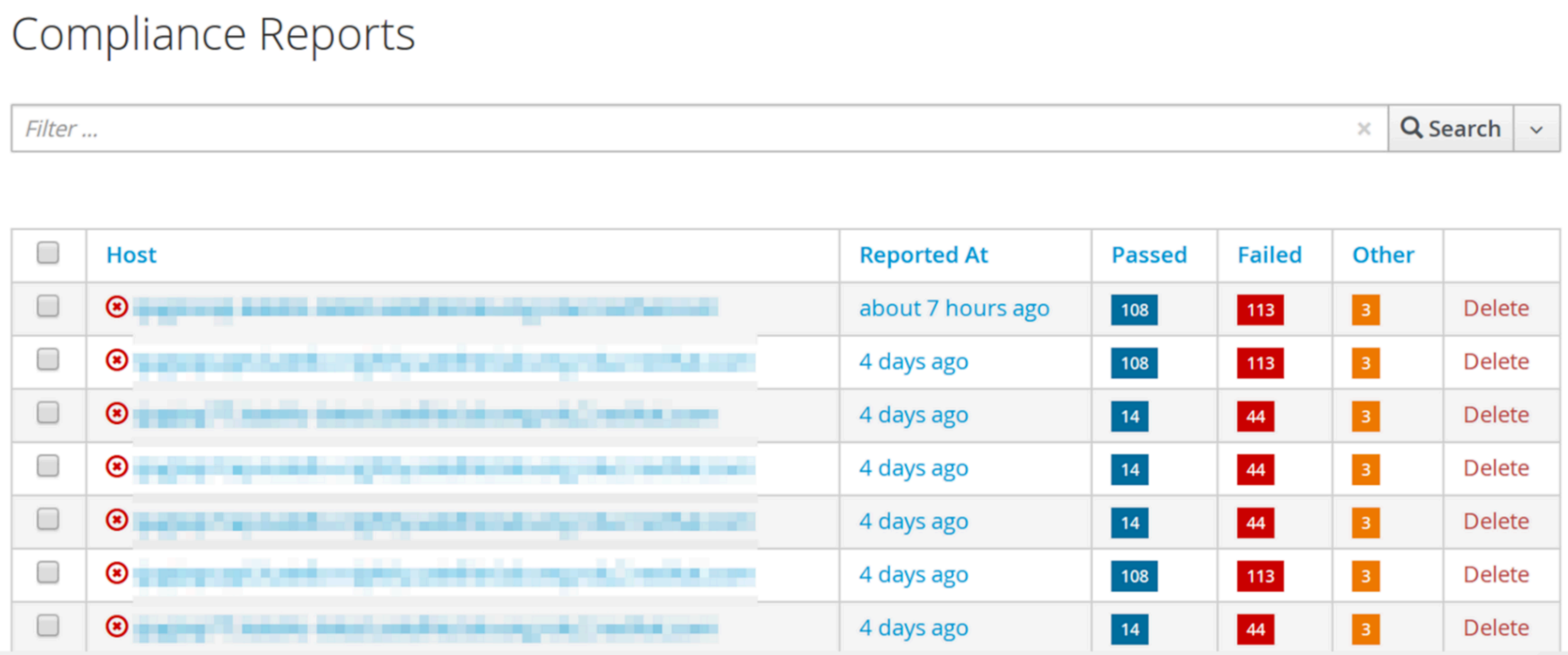


Period: Choose period

- Choose period
- Weekly
- Monthly
- Custom

SATELLITE

See past reports

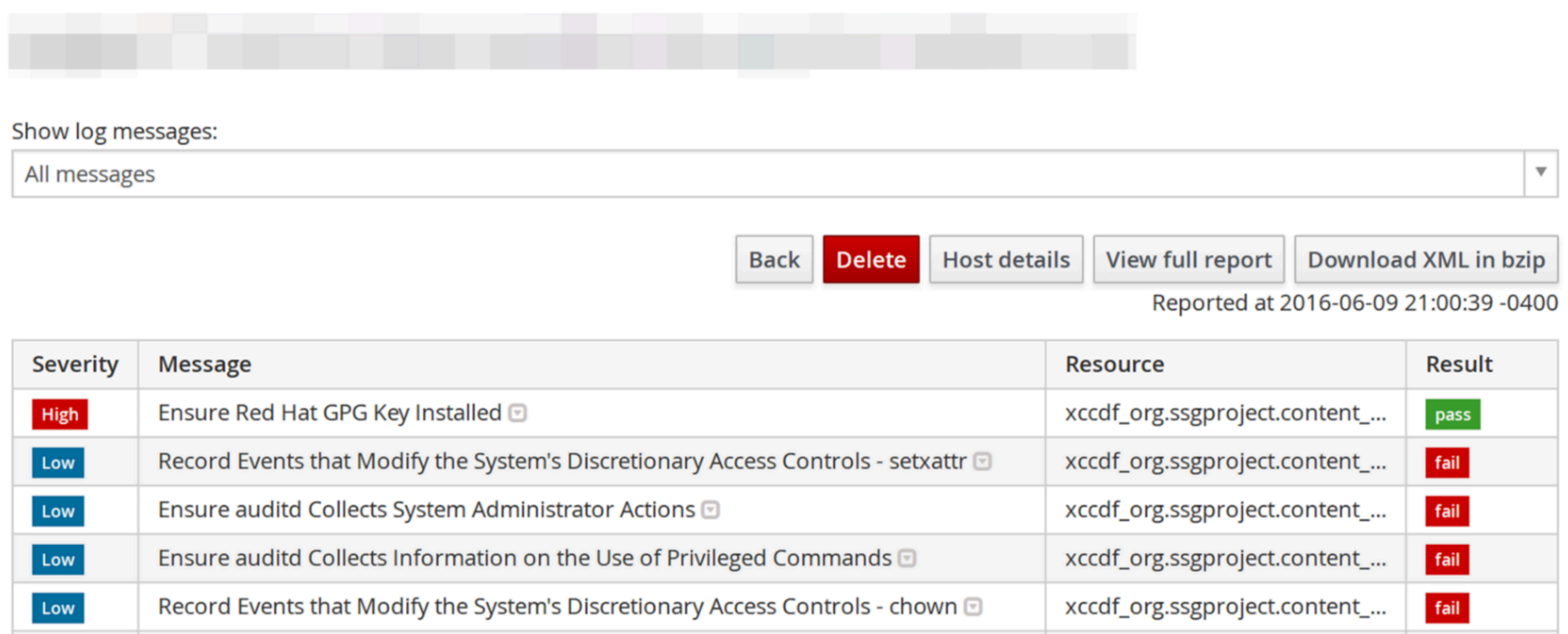


Compliance Reports

☐	Host	Reported At	Passed	Failed	Other	
☐	⊗ [redacted]	about 7 hours ago	108	113	3	Delete
☐	⊗ [redacted]	4 days ago	108	113	3	Delete
☐	⊗ [redacted]	4 days ago	14	44	3	Delete
☐	⊗ [redacted]	4 days ago	14	44	3	Delete
☐	⊗ [redacted]	4 days ago	14	44	3	Delete
☐	⊗ [redacted]	4 days ago	108	113	3	Delete
☐	⊗ [redacted]	4 days ago	14	44	3	Delete

SATELLITE

Browse & filter in the rule result overview



[redacted]

Show log messages:

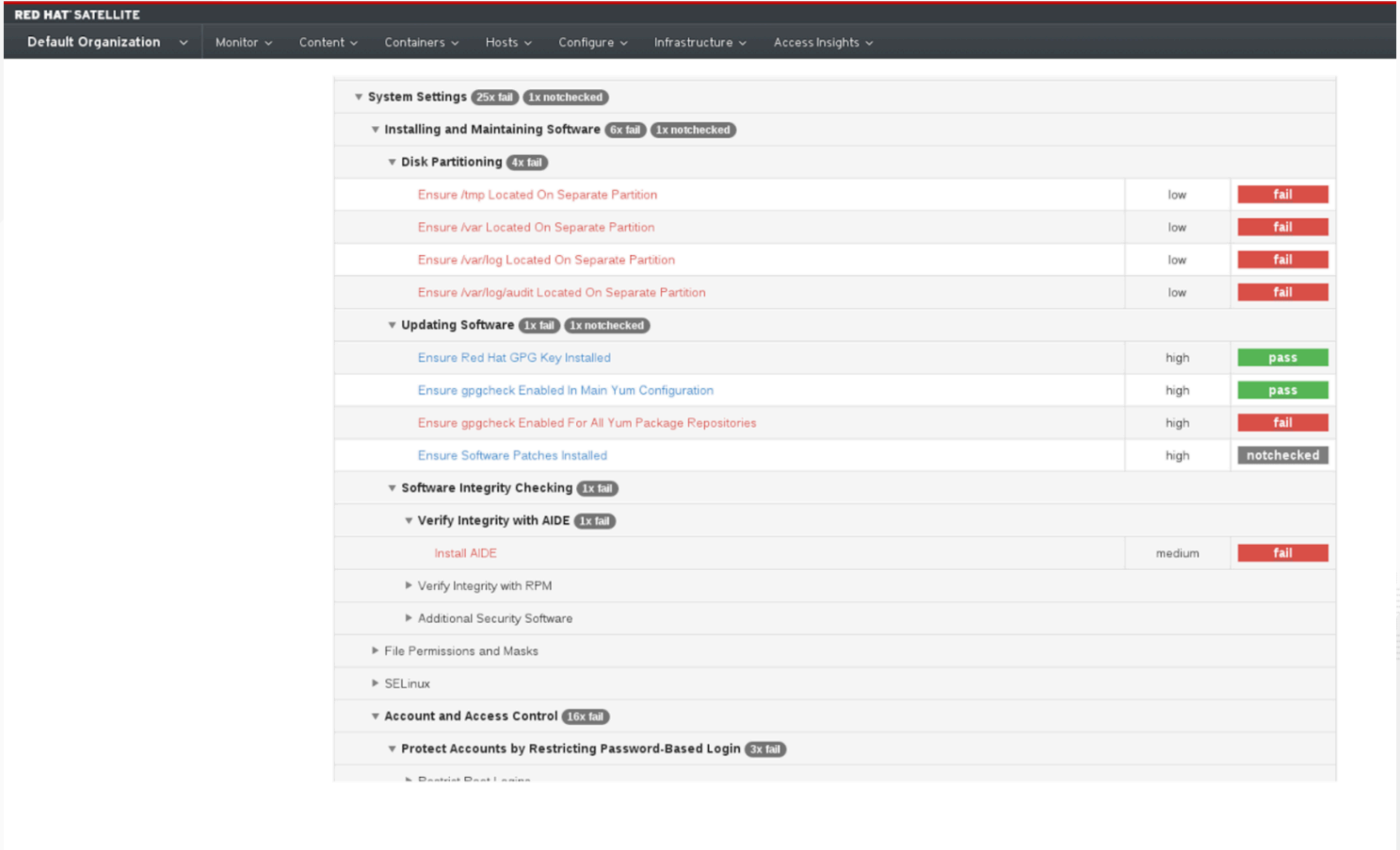
All messages ▾

Reported at 2016-06-09 21:00:39 -0400

Severity	Message	Resource	Result
High	Ensure Red Hat GPG Key Installed	xccdf_org.ssgproject.content_...	pass
Low	Record Events that Modify the System's Discretionary Access Controls - setxattr	xccdf_org.ssgproject.content_...	fail
Low	Ensure auditd Collects System Administrator Actions	xccdf_org.ssgproject.content_...	fail
Low	Ensure auditd Collects Information on the Use of Privileged Commands	xccdf_org.ssgproject.content_...	fail
Low	Record Events that Modify the System's Discretionary Access Controls - chown	xccdf_org.ssgproject.content_...	fail

SATELLITE

Browse HTML reports on per-system views



▾ System Settings 25x fail 1x notchecked		
▾ Installing and Maintaining Software 6x fail 1x notchecked		
▾ Disk Partitioning 4x fail		
Ensure /tmp Located On Separate Partition	low	fail
Ensure /var Located On Separate Partition	low	fail
Ensure /var/log Located On Separate Partition	low	fail
Ensure /var/log/audit Located On Separate Partition	low	fail
▾ Updating Software 1x fail 1x notchecked		
Ensure Red Hat GPG Key Installed	high	pass
Ensure gpgcheck Enabled In Main Yum Configuration	high	pass
Ensure gpgcheck Enabled For All Yum Package Repositories	high	fail
Ensure Software Patches Installed	high	notchecked
▾ Software Integrity Checking 1x fail		
▾ Verify Integrity with AIDE 1x fail		
Install AIDE	medium	fail
▸ Verify Integrity with RPM		
▸ Additional Security Software		
▸ File Permissions and Masks		
▸ SELinux		
▾ Account and Access Control 16x fail		
▾ Protect Accounts by Restricting Password-Based Login 3x fail		
▸ Restrict Root Logins		

CONTACT INFORMATION

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THANK YOU!