TOP 10 SECURITY CHANGES IN RED HAT ENTERPRISE LINUX 8

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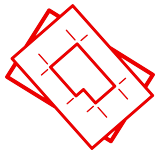
WHAT WE ARE TALKING ABOUT

Red Hat® Enterprise Linux® 8, of course



New, or new to you, features in Red Hat Enterprise Linux 8

Provide some guidance to you about what action to take next

Focused on the security features of Red Hat Enterprise Linux

Not talking about ALL of the security enhancements

We aren't talking about

The full Red Hat Enterprise Linux Roadmap

Open source community leadership

Hardware, software, and cloud provider partnership

Hundreds of existing security features : Common Criteria & FIPS validations, NBDE & LUKS disk crypto, AIDE, IMA, Identity Management, Web SSO etc.

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AGENDA

- Compiler flags and static code analysis
- Consistent and strong crypto policy
- FIPS mode made easy
- Smart cards and HSMs
- TLS 1.3 systemwide
- Libssh: SSH communications
- Software identification (SWID) tags
- Session recording
- Finer-grained SELinux support
- Trusted platform module usage

SECURE DEFAULT COMPILER FLAGS AND STATIC CODE ANALYSIS

More secure by default

- Requirement for Common Criteria and other security certifications
- Static code analysis performed across entire code base
  - Preventing security flaws before shipping and improving the upstream open source
- New compiler flags to prevent stack smashing and mitigate memory corruption
  - Full Address Space Layout Randomization (ASLR)
  - Providing control-flow integrity hardware support
  - Providing full address space layout randomization on all of Red Hat Enterprise Linux via position-independent execution (PIE) and RELRO flags

Guidance

- Use the packages that Red Hat Enterprise Linux ships
- Verify and examine contents using `annocheck`
- Consider using the same defaults, especially if you are building kernel modules

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CONSISTENT AND STRONG CRYPTO POLICY

4 policies

- Solves the problem of ensuring systemwide consistent cryptography settings for addressing compliance requirements
- **Easy to use and easy to automate** - far less error prone

```
# update-crypto-policies --set FUTURE

# update-crypto-policies --show
```

- Sets allowed key lengths, hashes, parameters, protocols, and algorithms

LEGACY

DEFAULT

FIPS 140

FUTURE

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SYSTEMWIDE EFFECTS OF CRYPTO POLICY

Applications and groups that follow the crypto policies

- libkrb5
- BIND
- OpenSSL
- OpenJDK
- GnuTLS
- OpenSSH
- Libreswan
- Python
- NSS

Guidance

- Use the Red Hat Enterprise Linux-provided Crypto libraries and Red Hat Enterprise Linux-provided utilities
- Test with DEFAULT and FUTURE policies
- Consider using SHA256 hashes instead of SHA1

EXAMPLE : TLS 1.1

LEGACY allows TLS 1.1

```
# update-crypto-policies --set LEGACY
# wget https://tls-v1-1.badssl.com:1011/
HTTP request sent, awaiting response... 200 OK
Saving to: ‘index.html’
```

DEFAULT, FIPS & FUTURE Require TLS 1.2 or better

```
# update-crypto-policies --set DEFAULT
# wget https://tls-v1-1.badssl.com:1011/
GnuTLS: A packet with illegal or unsupported version was received.
Unable to establish SSL connection.
```

TRADITIONAL FIPS MODE ENABLING

Very manual, not easily automated, subject to errors

Enabling FIPS 140 mode in Red Hat Enterprise Linux 7

```
# yum install dracut-fips
# yum install dracut-fips-aesni
# dracut -v -f
[Modify boot loader configuration.]
$ df /boot
$ blkid /dev/sda1
[Edit file]
# grub2-mkconfig -o /etc/grub2.cfg
# reboot
```

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FIPS MODE MADE EASY

Less error-prone and used by all federal government customers

Enabling FIPS 140 mode in Red Hat Enterprise Linux 8

```
# fips-mode-setup --enable
# reboot
```

Guidance

- Use the Red Hat Enterprise Linux-provided crypto libraries
- Test with FIPS enabled
- FIPS validation planned for future

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CONSISTENT CONFIGURATION

For smart cards and hardware security modules

Problems

- How can my systems be hardened against Heartbleed-style attacks?
- How do I set up my smart card or hardware security module (HSM) in Linux?
- How do I refer to an object stored in the smart card or HSM?
- How do I protect the integrity of my digital certificates, even in the cloud?

PKCS#11 CENTRALIZED CONFIGURATION

Smart cards and HSM devices all registered and accessed through PKCS#11

Driver registration

- Centrally via p11-kit

```
pkcs11.conf(5)
```

- Opensc is the only card driver

Using Certificates

- PKCS#11 URIs:

```
pkcs11:manufacturer=piv_II;id=%01
```

OpenSSL via openssl-pkcs11

GnuTLS

NSS

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EXAMPLE: SMART CARDS WITH OPENSSH

Use OpenSSH with smart card on Red Hat Enterprise Linux 8

```
$ ssh -i ‘pkcs11:id=%10’ ssh.example.com
Enter PIN for 'SSH key':

$ wget https://www.example.com/ --certificate ‘pkcs11:id=%10’
--private-key ‘pkcs11:id=%10’

$ curl https://www.example.com/ -E ‘pkcs11:id=%10;type=cert’
   --key ‘pkcs11:id=%10;type=private?pin-value=XXXX’
```

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EXAMPLE: HSM WITH APACHE WEB SERVER

How do I set up Apache HTTPD with an HSM on Red Hat Enterprise Linux 8?

HOW TO SET UP

As simple as replacing file names with PKCS#11 URIs in the Apache configuration

```
SSLCertificateKeyFile"pkcs11:token=My%20Token%20Name;id=45?pin-value=XXXX"

SSLCertificateFile"pkcs11:token=My%20Token%20Name;id=45"
```

Guidance

Use a PKCS#11 plug-in for your HSM or crypto device to work with Red Hat Enterprise Linux 8

Especially important if you access a cloud-based HSM

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TLS 1.3 SYSTEMWIDE

Problems

Customers requesting latest in secure networking standards

TLS 1.2 protocol being too slow for today's applications

Solutions

- TLS 1.2 redesigned (4 years in the making)
- Less clutter, faster handshake
- Modern crypto primitives (RSA-PSS, Ed25519)
- Performance: 1-RTT (0-RTT)
- Better privacy against passive observers
- Supported in OpenSSL 1.1.1, GnuTLS, and NSS

SUBSYSTEMS ENABLED WITH TLS 1.3

More coming in future, including Go

- Apache
- GNOME
- Perl
- Python
- Ruby
- OpenJDK

Guidance

- **Update applications** to support new TLS 1.3 protocol (some differences vs. TLS 1.2)
- **Update for OpenSSL 1.1.1** (Not ABI- or API-compatible with existing OpenSSL 1.0.2)
- **OpenSSL 1.0.2** compatibility library provided, but no FIPS, no TLS 1.3

LIBSSH: THE LIBRARY FOR SSH COMMUNICATIONS

Problem

Applications need programmatic access to remote systems

- SSH is the de facto remote access protocol
- Applications need to contact remote systems (Web Console, curl, qemu)
- The OpenSSH client application does not fit all needs
- Libssh is FIPS 140-2 compliant
- Libssh was previously in Red Hat Enterprise Linux 7 extras, And now is in core Red Hat Enterprise Linux 8

Guidance

- Use libssh for remote access to systems from within your applications
- Use the system-supplied crypto libraries (notice a trend yet?)

SOFTWARE ID (SWID) TAGS

Problem

How to perform software inventory management and enforce whitelisting across the enterprise

- SWID tags provide a means to consistently identify software, its origin, and manufacturer
  - Used by StrongSwan, BigFix, Microsoft, and others already
- Works with any of packaging mechanisms (rpm, tar, zip, etc.)
- Defined in ISO/IEC 19770-2:2015 standard
- XML file, digitally signed by Red Hat
- Optional requirement for Common Criteria certification and required for SCAP 1.3 scanners
- Highly recommended for whitelisting for federal governments

EXAMPLE OF SWID TAGS

Top level product tag in RHEL 8

```
<?xml version="1.0" encoding="utf-8"?>
<SoftwareIdentity
  xmlns="http://standards.iso.org/iso/19770/-2/2015/schema.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://standards.iso.org/iso/19770/-2/2015/schema.xsd http
://standards.iso.org/iso/19770/-2/2015-current/schema.xsd"
  xml:lang="en-US"
  name="Red Hat Enterprise Linux"
  tagId="com.redhat.RHEL-8-x86_64"
  tagVersion="1"
  version="8"
  versionScheme="multipartnumeric"
  media="(OS:linux)">
...
```

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WHAT'S NEXT FOR SWID TAGS

What's in Red Hat Enterprise Linux 8?

- Top-level single tag identifying Red Hat Enterprise Linux itself

What's coming?

- OpenSCAP support
- Per-package tags
- Potential for non-RPM content
- Potential for Container meta information
- Tools to generate SWID tags from rpm information

Guidance

- Consider delivering your own SWID tags
- Get involved in our upstream Fedora community
- Talk to us and learn more at TagVault.org

SESSION RECORDING

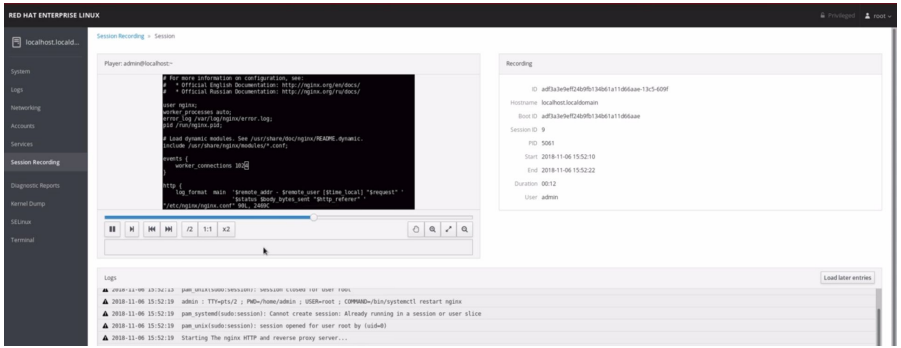
Enabling security compliance and auditing

- A terminal session recording solution integrated with auditing
- Solving the problem of recording both input and output along with environment and state of system
  - Also preserves text window resizing and timing
- Records events as JSON-formatted audit records via file or syslog
  - Allows records to be quickly, securely exported off system for tamper-proofing
- Selectable on a per-user, per-group basis
  - Integrated with sssd and Identity Management
- Playback via terminal and web console

SESSION RECORDING EXAMPLE AND NEXT STEPS

Example

- Playback with actual audit events displayed in-line
- Future integration into centralized logging effort



Guidance

- Consider how to analyze and use this data if you parse audit logs today
- Consider recommending as a security configuration in your deployment guides

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FINE-GRAINED SELINUX CONTROLS

Problem

Preventing inappropriate privilege escalations

- SELinux provides mandatory access control and is enabled by default
- Supports No New Privileges (NNP) in systemd `(nnp_nosuid_transition)`
- New control for preventing a process from changing the limits of another process `(getrlimit)`
- Files have specific control now to prevent certain files from being memory mapped `(file:map)`
- Ability to limit need to override access controls `(dac_read_search)`

Guidance

- Work and test with SELinux enabled - containers require it
- Review our SELinux documentation, Red Hat Summit videos, and more
- Watch for even more enhanced Container-specific SELinux changes

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TRUSTED PLATFORM MODULE (TPM) USAGE

Problem

How to ensure integrity of the core software itself

- TPM 2.0 full support with TCG software stack
- Measurements of kernel taken each boot and stored into TPM PCR
  - No action or attestation yet, just storing the data for now
- LUKS data-at-rest key can be stored in TPM now via Network-Bound Disk Encryption utility (i.e., Clevis)
- Future work includes PKCS#11 API for TPM, virtual TPMs, and Red Hat® OpenStack Platform®

Guidance

- Adopt TPM as a hardware key storage mechanism
- Interested in attestation / hardware root of trust? Look into upstream community Keylime.org

RECAP

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RESOURCES

- Red Hat Product Security *secalert@redhat.com*
- Customer Access Portal *https://access.redhat.com/security/*
- Red Hat Hands-on Security Lab *https://red.ht/securitylabs*
- Red Hat Enterprise Linux 8 *https://redhat.com/rhel/*

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THANK YOU

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DEMO
Session Recording and Crypto Policies

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RED HAT ENTERPRISE LINUX
m1
Session Recording
The intermediate issuer certificate for this site is signed using SHA-1.

</body>
</html>
[root@m1 user]# update-crypto-policies --set FUTURE
Setting system policy to FUTURE
Note: System-wide crypto policies are applied on application start-up.
It is recommended to restart the system for the change of policies
to fully take place.
[root@m1 user]# curl https://sha1-intermediate.badssl.com
curl: (60) SSL certificate problem: EE certificate key too weak
More details here: https://curl.haxx.se/docs/sslcerts.html
curl failed to verify the legitimacy of the server and therefore could not
establish a secure connection to it. To learn more about this situation and
how to fix it, please visit the web page mentioned above.
[root@m1 user]# exit
[user@m1 ~]$ logout
Connection to m1.cockpit.lan closed.
[admin@m1 ~]$ logout
Connection to m1.cockpit.lan closed.
[stef@dragon demo]$