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Red Hat Enterprise Linux 6 Security Feature Overview

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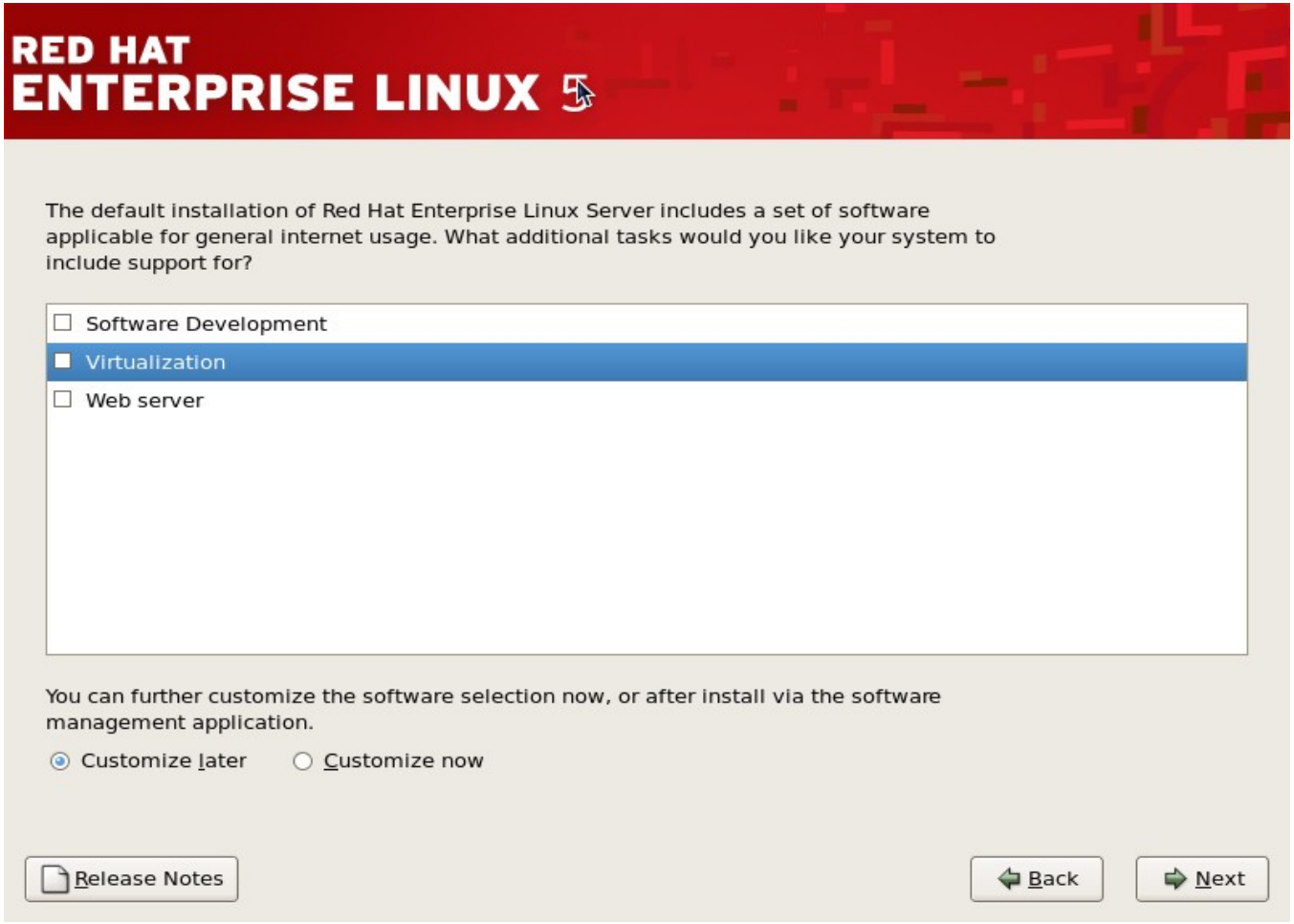
Overview

- Minimal Platform Install
- Libcap-ng
- OpenSCAP
- FIPS-140
- Stronger Hashes
- Common Criteria

Minimal Platform Install

- Goals
  - Reduce Attack Surface
  - Minimize package count
  - Add back things needed for secure operation
    - Need to be able to disable services
    - Cron jobs for maintenance
    - Mail delivery for cron jobs
    - Update packages
    - Iptables, audit, and sshd

Minimal Platform Install



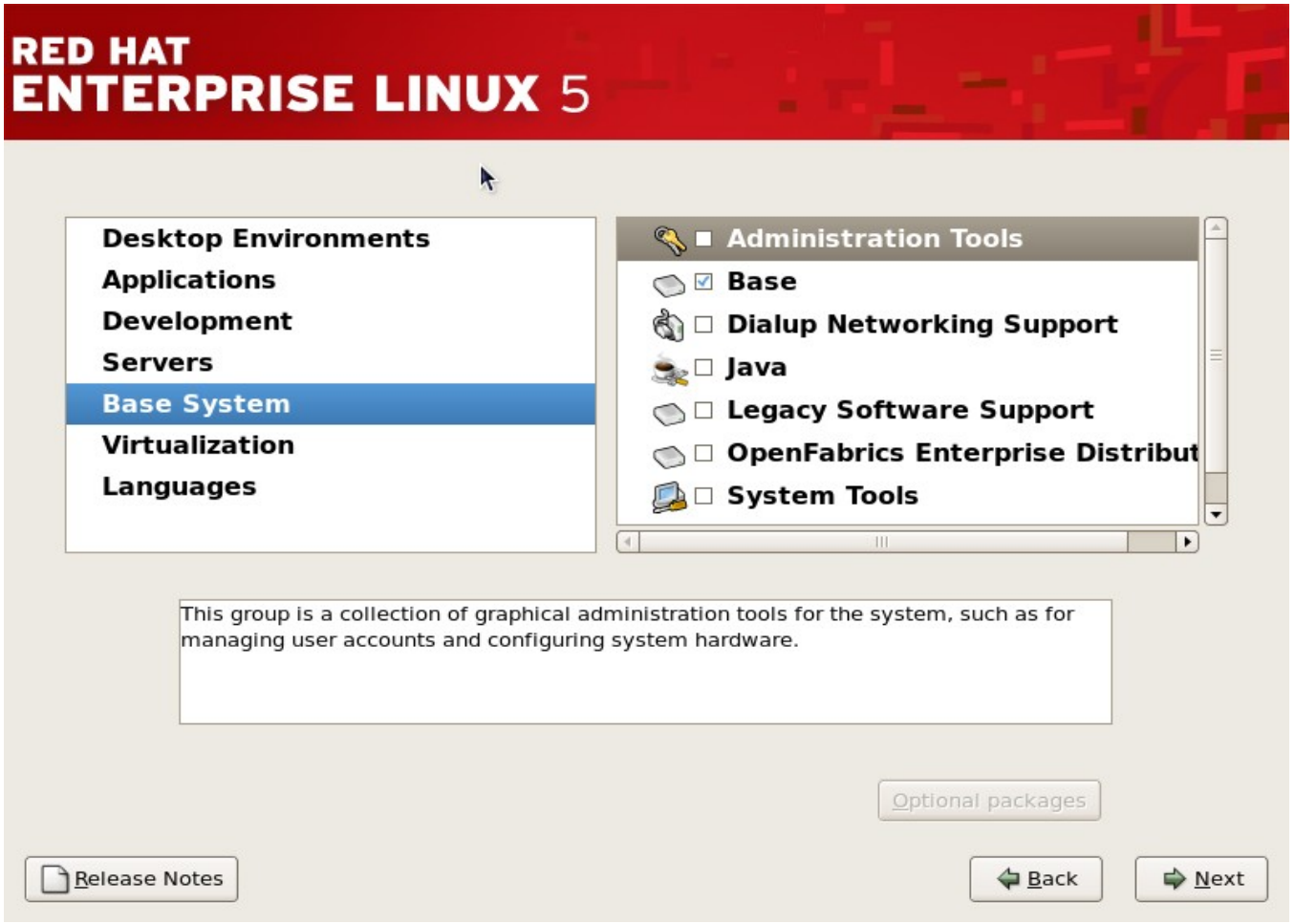
Minimal Platform Install

Minimal Platform Install

RHEL5 (5.5 used for testing)

- Packages - 879
- Setuid - 33
- Setgid - 11
- Daemons - 44
- Networked services - 18
- Space – 2.2 Gb
- Notes: Boots into X even though no packages checked

Minimal Platform Install

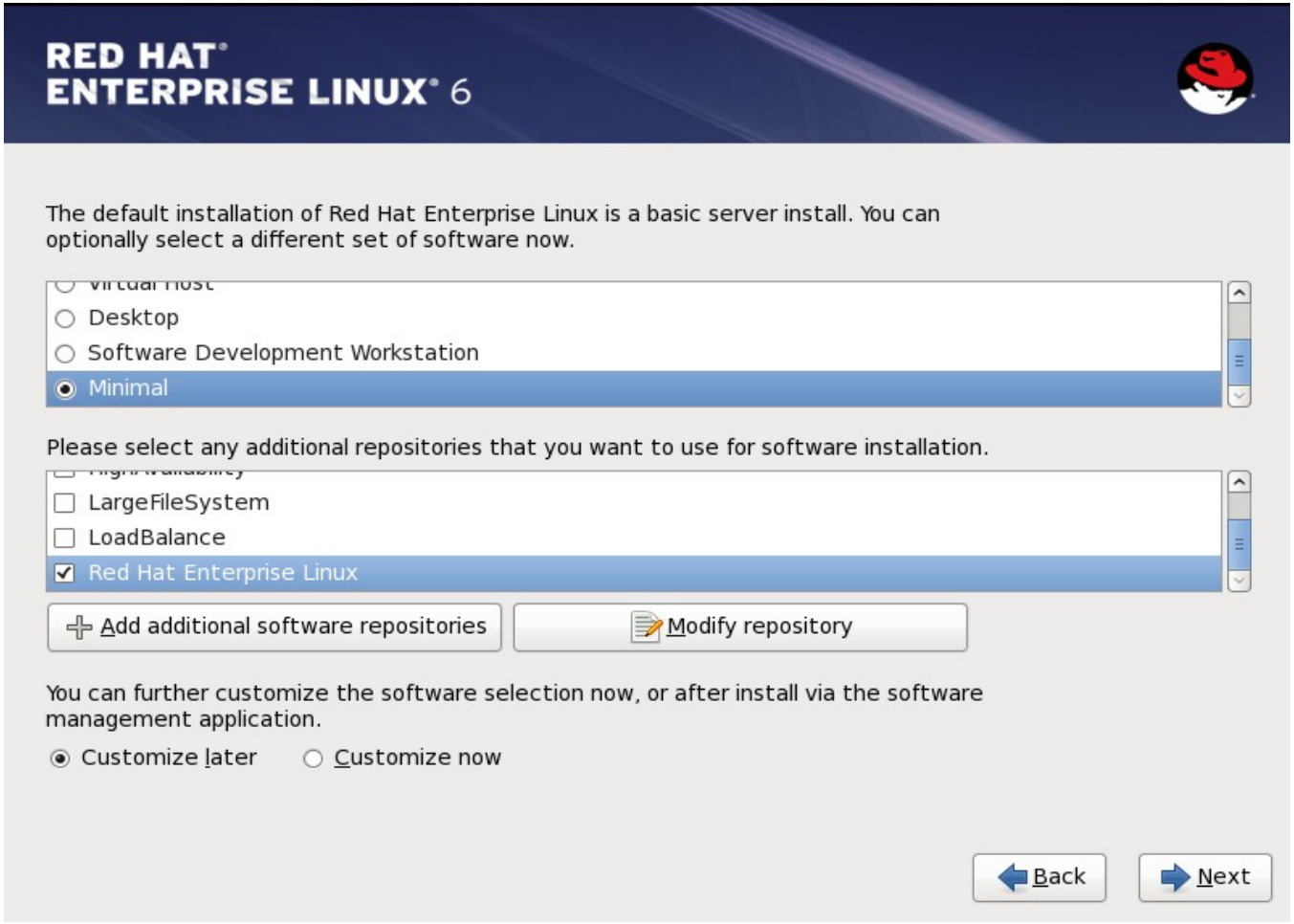


Minimal Platform Install

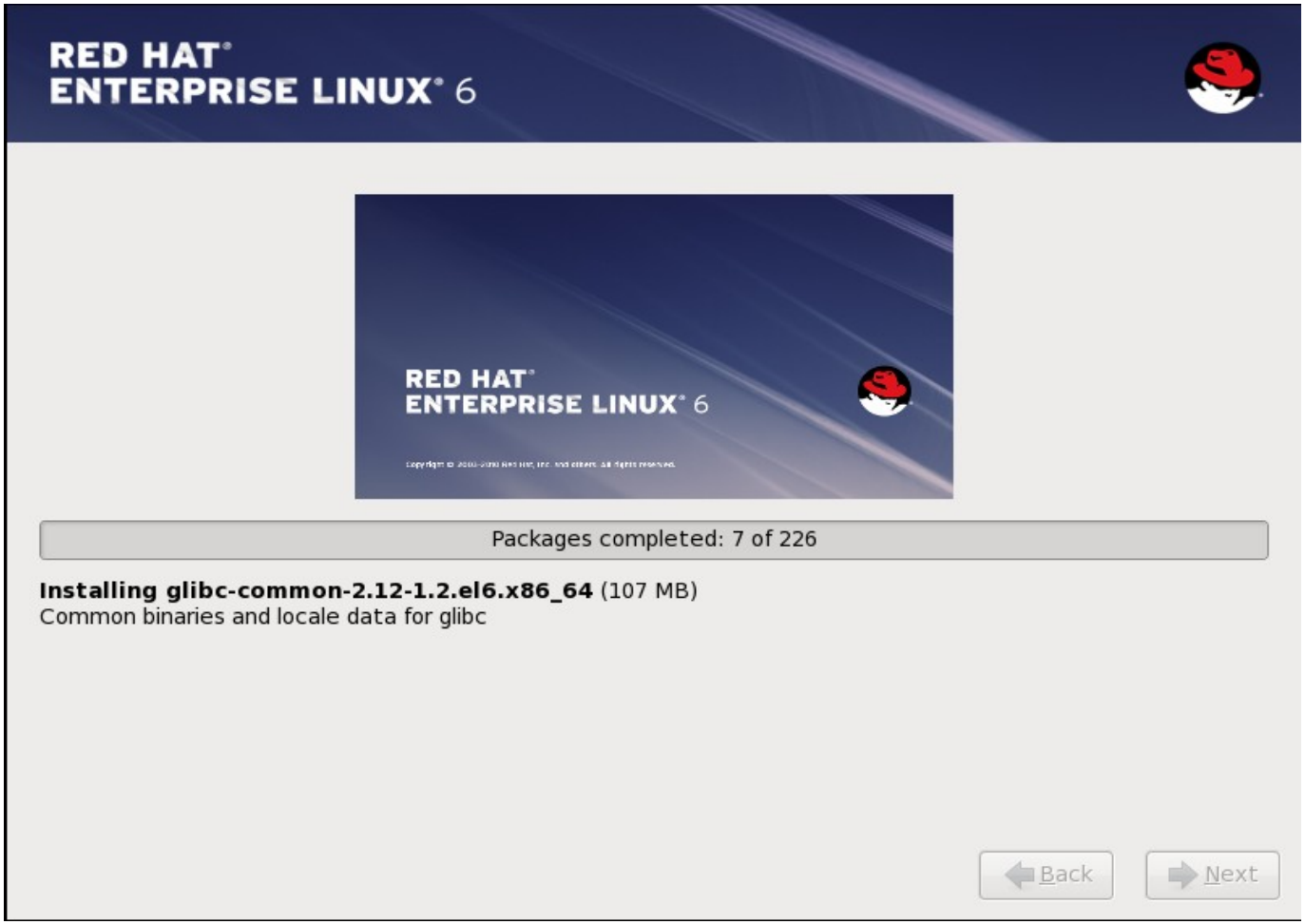
RHEL5 (5.5 used for testing)

- Packages - 437
- Setuid - 29
- Setgid - 9
- Daemons - 39
- Networked services – 16
- Space – 1006 Mb
- Notes: Boots to runlevel 3

Minimal Platform Install



Minimal Platform Install



Minimal Platform Install

RHEL6 (pre-beta2)

- Packages - 226
- Setuid - 20
- Setgid - 7
- Daemons - 13
- Networked services – 5
- Space – 565 Mb
- Notes: Boots to runlevel 3 very quickly

Minimal Platform Install - Summary

	Packages	Setuid	Setgid	Daemons	Network Services	Space
RHEL5	879	33	11	44	18	2200
RHEL5 base	437	29	9	39	16	1006
RHEL6	226	20	7	13	5	565

Libcap-ng

- Posix Capabilities are in the Linux kernel in an attempt to make minimal privilege applications. Few examples:
  - CAP_CHOWN - this overrides the restriction of changing file ownership and group ownership.
  - CAP_NET_RAW - Allow use of RAW sockets, allow use of PACKET sockets.
  - CAP_NET_BIND_SERVICE - Allows binding to TCP/UDP sockets below 1024.
- Model consists of: Effective, Permitted, Inheritable, and Bounding Set.

Libcap-ng

- RHEL5
  - No file system based capabilities
  - Bounding set was system wide
    - Defined as !CAP_SETPCAP
    - Intended use was to prevent module loading after boot
  - Process could drop capabilities & only inheritable capabilities are passed to child processes

Libcap-ng

- RHEL6
  - Adds file system based capabilities
  - Bounding set is per thread
    - Intended use was for containers or jails
    - Threads can remove capabilities from bounding set
  - Now, processes that drop capabilities and have uid 0 can regain all capabilities on execve()

Libcap-ng

- File system based capabilities
  - You can set effective & inheritable
  - pam_cap.so can be used to add capabilities to process tree by setting permitted
  - Combining these, its possible to construct a system that allows one user but not another be able to do certain things.

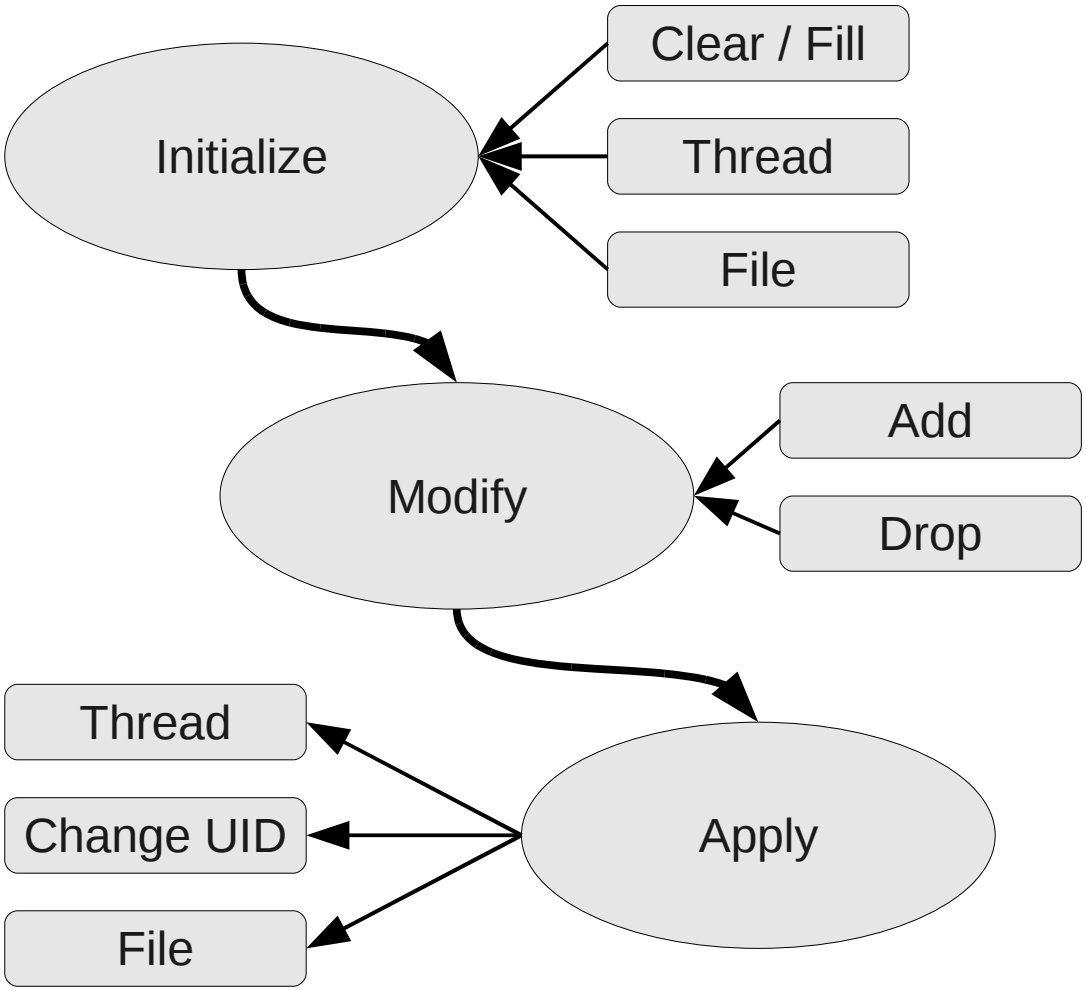
Libcap-ng

- Wanted to reduce attack surface for RHEL6
- Dropping capabilities can be used to make root daemons less powerful
- Libcap is tedious to use
  - Changing uid while retaining capabilities takes about 60 lines of code
- RHEL6 kernel has bounding set, which is not addressed by libcap

Libcap-ng

- Use Cases:
  - Drop all capabilities
  - Keep one capability
  - Keep several capabilities
  - Check if you have any capabilities
  - Check for certain capabilities
  - Retain capabilities across a uid change

Libcap-ng


Clear / Fill
Initialize
Thread
File
Add
Modify
Drop
Thread
Change UID
Apply
File

Libcap-ng

- Keep one capability

```
capng_clear(CAPNG_SELECT_BOTH);
capng_update(CAPNG_ADD, CAPNG_EFFECTIVE|CAPNG_PERMITTED, CAP_CHOWN);
capng_apply(CAPNG_SELECT_BOTH);
```

- Check if you have any capabilities

```
if (capng_have_capabilities(CAPNG_SELECT_CAPS) > CAPNG_NONE)
        do_something();
```

- Retain capabilities across a uid change

```
capng_clear(CAPNG_SELECT_BOTH);
capng_update(CAPNG_ADD, CAPNG_EFFECTIVE|CAPNG_PERMITTED, CAP_CHOWN);
if (capng_change_id(99, 99, CAPNG_DROP_SUPP_GRP | CAPNG_CLEAR_BOUNDING))
        error();
```


Libcap-ng

- New tools to check apps:
  - Pscap – lists all applications with capabilities
  - Netcap – list all networked apps with capabilities
  - Filecap – display or set file based capabilities

- We dropped capabilities in a number of daemons to reduce the attack surface.
- We changed file permissions on important things to require CAP_DAC_OVERRIDE to write to it.

Libcap-ng

```
[root ~]# netcap
ppid  pid   acct      command          type port  capabilities
1     1765  nobody    dnsmasq          tcp  53    net_admin, net_raw +
1     1652  root      sshd             tcp  22    full
1     1449  root      cupsd            tcp  631   full
1     1652  root      sshd             tcp6 22    full
1     1449  root      cupsd            tcp6 631   full
1     1449  root      cupsd            udp  631   full
1     8515  root      vpnc             udp  4500  full
1     1765  nobody    dnsmasq          udp  53    net_admin, net_raw +
1     1765  nobody    dnsmasq          udp  67    net_admin, net_raw +
```


OpenSCAP

- SCAP – Security Content Automation Protocol
- Assist users with configuring IT systems
- Used to automate:
  - Configuring systems
  - Verifying system hasn't changed
  - Verifying a vulnerability
  - Response to new threat

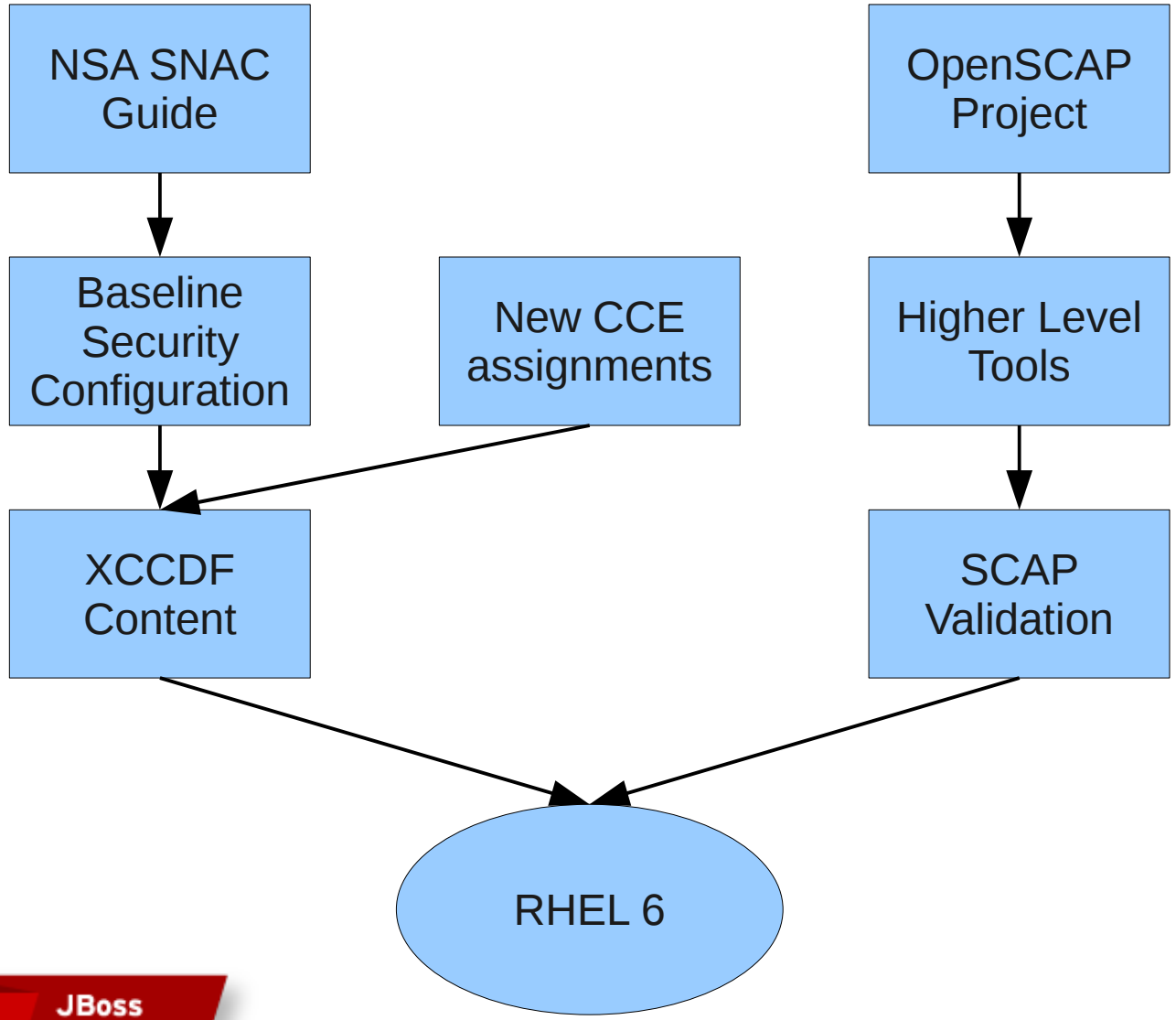
OpenSCAP

- Suite of Standards
  - Extensible Configuration Checklist Description Format XCCDF
  - Open Vulnerability and Assessment Language OVAL
  - Common Platform Enumeration CPE
  - Common Vulnerabilities and Exposures CVE
  - Common Configuration Enumeration CCE
  - Common Vulnerability Scoring System CVSS

OpenSCAP

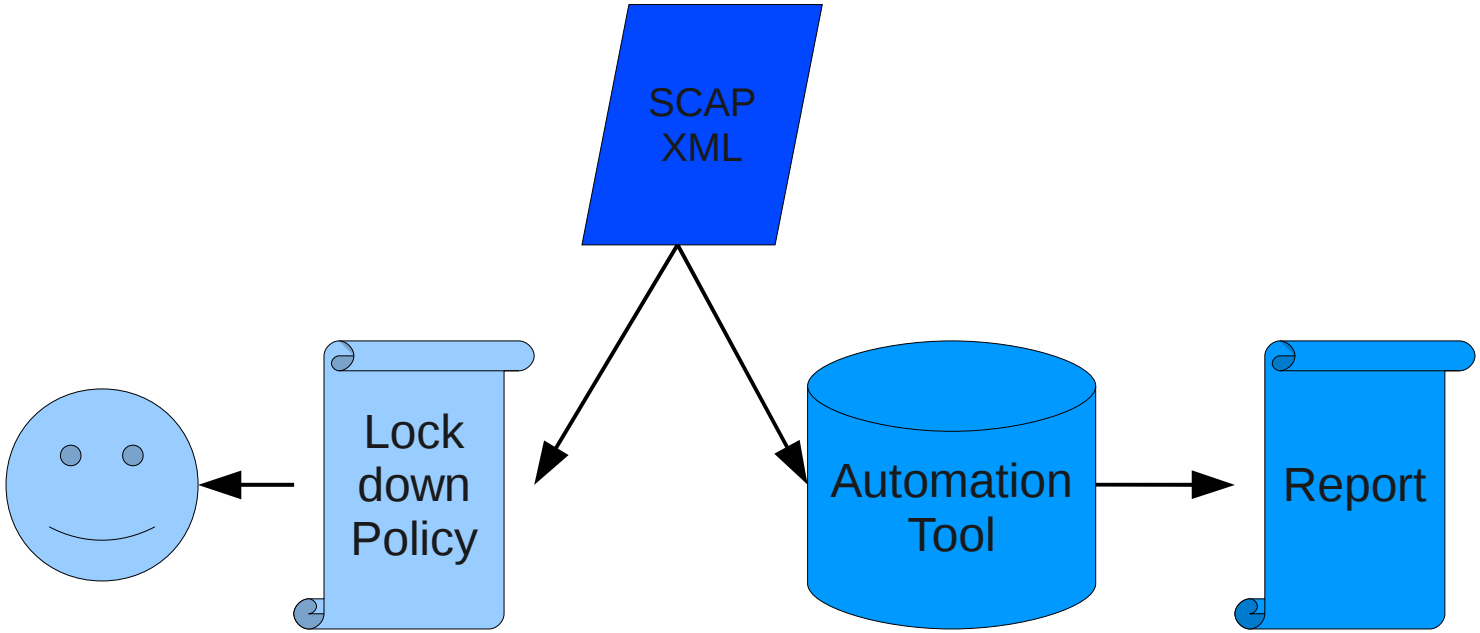
Remembering the acronyms	
What IT systems do I have in my Enterprise?	CPE
What vulnerabilities do I need to worry about?	CVE
What vulnerabilities do I need to worry about right now?	CVSS
How do I configure my systems securely?	CCE
How do I define a policy of secure configurations?	XCCDF
How can I be sure my systems conform to policy?	OVAL

OpenSCAP


NSA SNAC Guide
OpenSCAP Project
Baseline Security Configuration
New CCE assignments
Higher Level Tools
XCCDF Content
SCAP Validation
RHEL 6

OpenSCAP

SCAP allows the creation of text checklists as well as system reports.



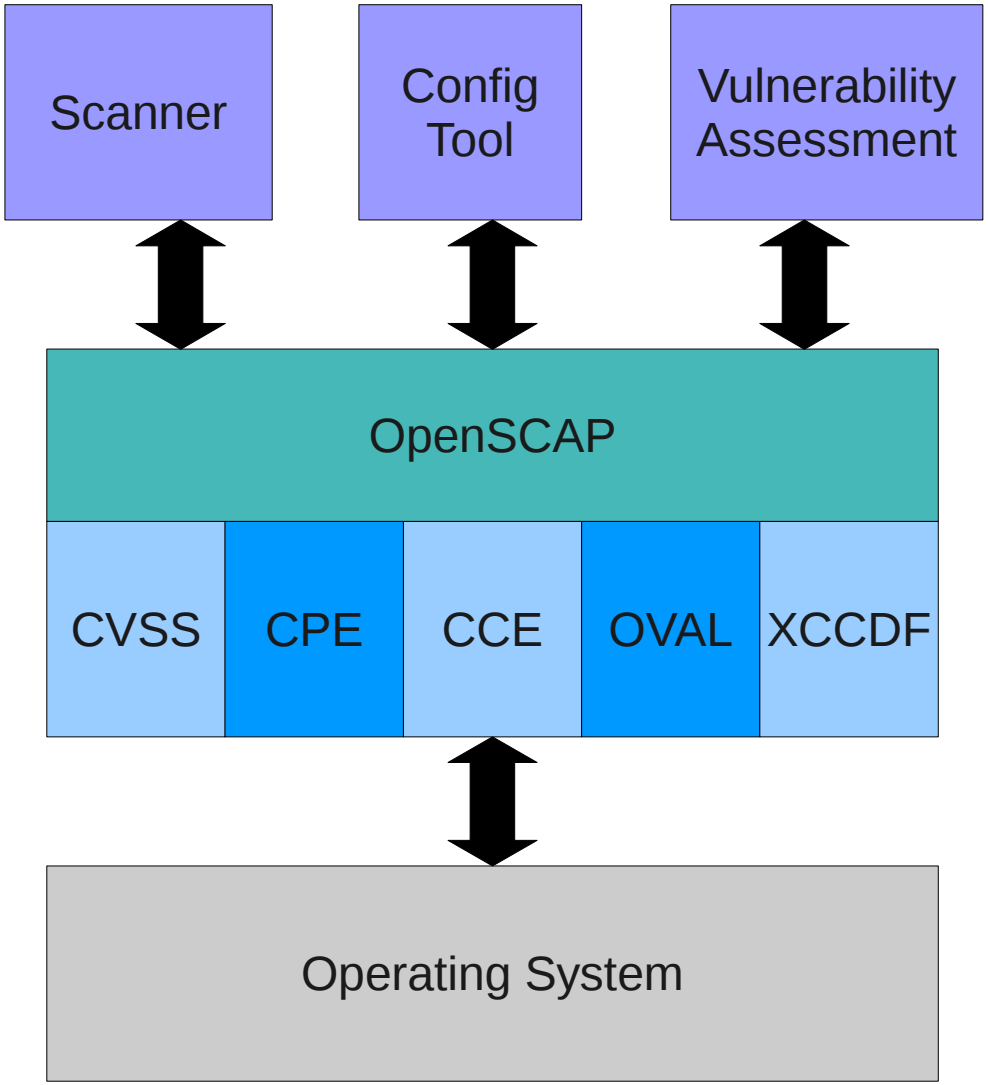
OpenSCAP

- Open source library
- Free to integrate under LGPL
- Cross Platform
- Multiple languages supported
- Unicode tested
- SE Linux friendly design
- Easily extended to new platforms with plugins

OpenSCAP

- Project Goals
  - Make the standards easier to implement through open source libraries and code samples.
  - Work with tool communities to build SCAP standards and models into their offerings.
- Barriers to writing SCAP tools
  - OVAL ~400 pages
  - XCCDF 132 pages
  - Certification

OpenSCAP


Scanner
Config Tool
Vulnerability Assessment
OpenSCAP
CVSS
CPE
CCE
OVAL
XCCDF
Operating System

OpenSCAP

- XCCDF to Kickstart
- XCCDF to Puppet
- Policy Editors
- System Integrity Scanning
  - At bootup
  - At network connect
  - During VM startup
- Adhoc query tool
- Systems Management Integration

Stronger Hashes

- MD5 was being used in many places for integrity or password hashes
- Attacks against MD5 have been getting better
- NIST's Policy on Hash Functions:
    - Federal agencies should stop using SHA-1 for digital signatures, digital time stamping and other applications that require collision resistance as soon as practical, and must use the SHA-2 family of hash functions for these applications after 2010.
- Needed to adjust all tools that touch software from source code to system verification.

Stronger Hashes

- Shadow-utils, glibc, pam, authconfig were done during RHEL5
- Started Project for Fedora 11. Changed:
  - Rpm, koji, spacewalk/satellite, yum, createrepo, pungi, RHN, yaboot
- To do:
  - Changes for grub password hash expected in 6.1

Common Criteria

- RHEL5 was certified under LSPP at EAL4+
- No regressions in security features in RHEL6
- Challenges around protection profiles
  - NIAP – CAPP, LSPP, MRPP, GPOSPP
  - BSI - OSPP

Common Criteria

Common Criteria

- Base
  - Secure Attention Key
- Advanced Audit
  - Some updates regarding remote logging, performance on large files, and search by regular expression
- Advanced Crypto
  - Cryptography must be in separate address space from application that is using it.
- Virtualization
  - VM's must be separated by MAC or UID
  - Auditing: guest start/stop/pause/crash, change in resources, Qemu server accepting connections and authentication use
  - AMTU

FIPS-140

- FISMA -> SP800-53 requires FIPS certified crypto mechanism
- RHEL5
  - Data at rest: kernel (dm-crypt)
  - Data in transit: openssl, libgcrypt, nss, openssh, openswan

FIPS-140

- Libgcrypt needed strict FSM
- Integrity verification using sha256hmac
- Needed Power Up self tests in all places
- Needed Deterministic RNG in kernel
- Needed RNG test for duplicate answer
- Needed key zeroization in openssh / openswan
- Increased DSA key size for module verification
- Disallow some crypto algorithms in FIPS mode

FIPS-140

- On RHEL5, to put into FIPS-140 mode, the crypto officer must regenerate the initrd using the following command:
  - mkinitrd --with-fips -f /boot/initrd-$(uname -r).img $(uname -r)
  - Add “fips=1” to grub kernel boot line
  - Reboot
- To verify FIPS mode:
  - cat /proc/sys/crypto/fips_enabled
- Some other cautions in Security Policies – please read them

FIPS-140

- 2010 brings some changes (SP800-57 part1)
  - Ssh v2 protocol is no longer allowed as key distribution method
  - Diffie-Hellman key exchange must have self test
  - 112 bits of entropy required in RNG
  - Recommended key sizes almost double 1024->2048
  - Recommends some algorithms be replaced:
    - 2 key Triple DES -> 128 bit AES
    - SHA1 -> SHA2

FIPS-140

- Other crypto changes: GPOSPP, FIPS-140-3
  - Audit requirements
  - Non-debugability
  - No implementations in scripting languages
  - Separation of application and key material

Odds and Ends

- Added pam_ssh_agent_auth for remote use of smartcards
- Added scrub for secure disk erasing
- NetworkManager and Openswan integration
- Key Escrow system for encrypted disk partitions

Questions?

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