Scaling Security in a Complex World

Wendy Palm

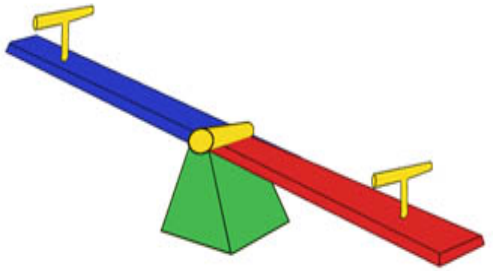
Agenda

- **Purpose**
  - Cray systems are more accessible to “the outside world” than ever before, causing our approach to become correspondingly more concerned with security.
  - Cray now offers a variety of products, and the new security update process simplifies and standardizes this across products.
- **Benefit/Value**
  - New install processes for new products allows site more flexibility.
- **Cray OS security process**
  - Vulnerability classification
  - Timelines
  - Future Plans
- **Summary**
- **Q&A**

Balancing Act

- Security vs usability
- Taking downtime to update vs system availability

- Cray's answer has been to release tested groups of security updates in a regular cadence, with the ability to expedite critical issues.

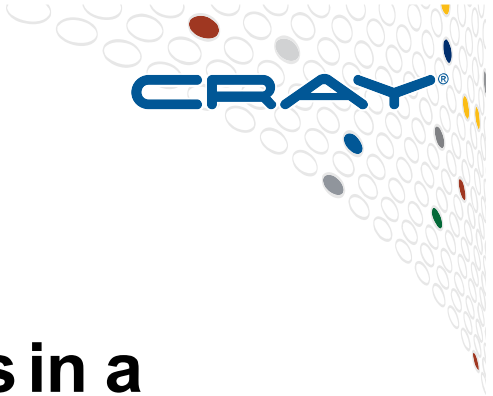


Status Quo isn't enough

- **Cray has more products than ever before.**
- **Sites have multiple Cray products.**
  - And desire similar install/update procedures.
- **Cray customer base is becoming more diverse.**
  - And therefore the systems are used in many different ways, need different packages installed, severity classifications differ.
- **Sites have become more concerned with security.**

The "same old way" just won't cut it anymore.

Security Goal



Provide security updates for all Cray products in a standardized process, on a planned schedule, allowing for priority issues to be handled in an expedited manner.

Cray Changes

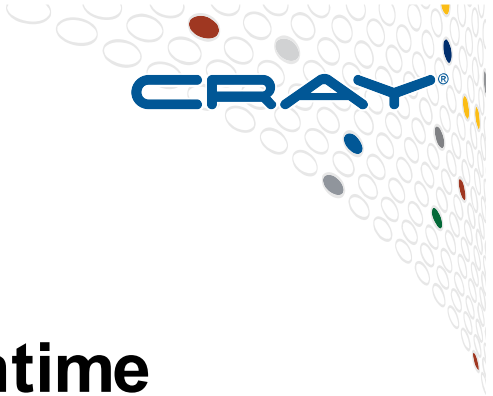
- **Previously, Cray had a single non-dedicated OS security engineer who did all the monitoring, downloading and testing for security updates and when needed, pulled in various developers.**

- **This works for a couple of products, but does not scale well to new products and multiple OSs.**

Cray Changes

- **Cray OS Security team**
  - **No more "single person team" for security**
- **"Early Access" now a standardized process**
  - Previously this was an unpublicized, ad-hoc, unofficial process.
- **More Cray products will be providing security updates.**

Cray Changes



New features targeted to reduce system downtime

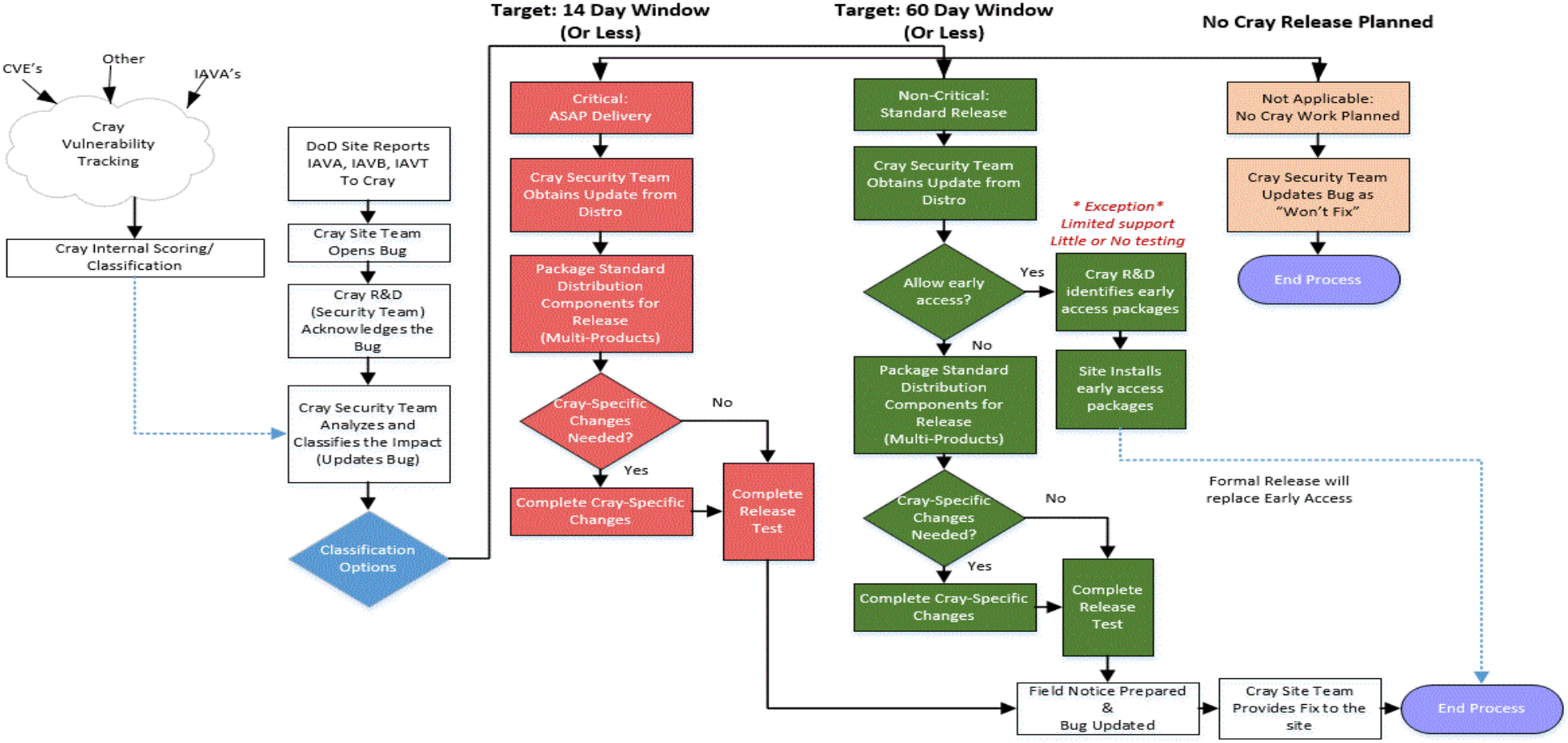
- **Live updates**
- **Rolling reboots**

Cray OS Security Process

Basic process is the same. Cray Security Team will:

- **Receive notification of vulnerabilities**
- **Classify the severity of the vulnerabilities**
- **Get the update(s)**
  - Download binary rpm(s)
  - Get the patch to the developer for Cray-built rpms
- **Test install the update(s) on internal Cray systems**
- **Release the update(s) to sites via Field Notice/Patch**
- **Update(s) are added to future releases**

Cray OS Security Patch Release Process



How is Cray notified of Vulnerabilities?

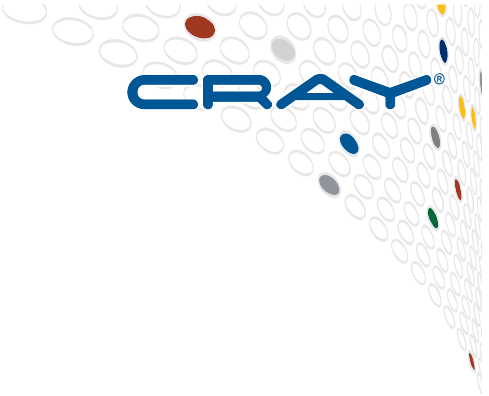
- **Updates from Vendors (Cray actively monitors)**
  - SUSE
  - CentOS

- **Notification from Site**
  - Open a Bug/case, assign to “security”, generic initial description, “public”.
  - Additional commentary and attachments should be as detailed as possible, set to “private”.
  - All communications will be conducted through the bug itself.

Classifying Vulnerabilities

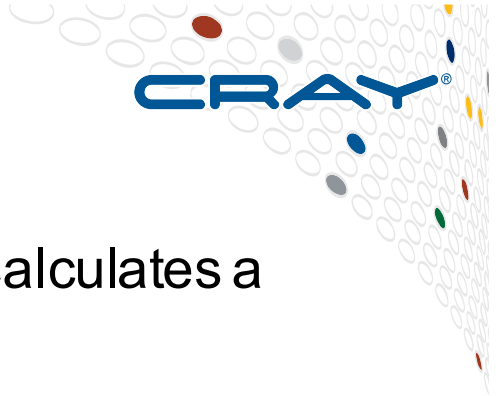
- **Cray Security Team will classify vulnerabilities**
  - High priority task
  - Goal is to have the classification done within 1 business day
    - based upon full availability of required information
- **Three categories**
  - Critical – Provide Fix ASAP
  - Non-Critical – Provide fix in next regularly scheduled Field Notice
  - Not Applicable – No Plan to provide a fix
- **Classifications will be documented in the bug**
  - Site team can work with the Cray Security Team on mismatched expectations on classifications.

CVE



- Common Vulnerabilities and Exposures
- http://cve.mitre.org/
- Dictionary of publicly known information of security vulnerabilities
- Provides a common identifier to enable data exchange between security products and provide a baseline index point for evaluating coverage of tools and services

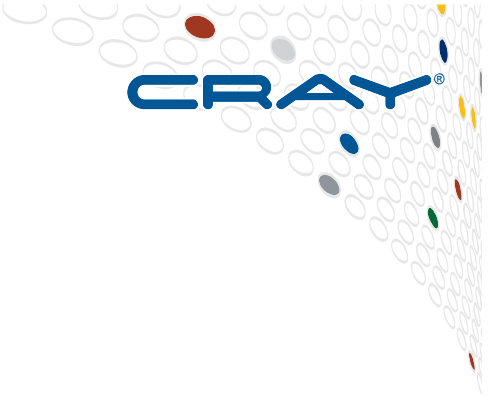
Classifying Vulnerabilities



The CVSS score (Common Vulnerability Scoring System) calculates a numerical value to a vulnerability based on:

- **Access Vector**
- **Access Complexity**
- **Authentication**
- **Confidentiality Impact**
- **Integrity Impact**
- **Availability Impact**
- **Exploitability**

Classifying Vulnerabilities



- **Attack Vector**
  - **Network/Remote**– from outside (website, ssh, telnet, etc.)
  - **Adjacent** – from outside the system, but within the local network
  - **Local** – on the system (current user)
  - **Physical** – need physical access to console/system
- **Attack Complexity**
  - How difficult is it to exploit the vulnerability (**Low/Medium/High**)

Classifying Vulnerabilities

- **Authentication**
  - Does the attacker need to authenticate, and if so, how many times
- **Impact**
  - **Confidentiality** (none/partial/complete)
  - **Integrity** (none/partial/complete)
  - **Availability** (none/partial/complete)
- **Exploitability**
  - Unproven
  - Proof-of-Concept
  - Functional
  - High/Easy

Classifying Vulnerabilities

- **Check CVE database –** see if it's listed, check links
- **Check code patch –** give to developer to evaluate
- **Check other security sites –** several offer good evaluations, some not-so-helpful

- If there is a published exploit with privilege escalation or denial of service, vulnerability severity is set to "critical", a "security scramble" is called and the timeline is accelerated.

Security Update Types

- **Pass-through binary rpms**
  - Rpms that we download directly from the vendor
  - No action by Cray other than the download and install
  - “userland”

- **Cray-built rpms**
  - Requires some action by Cray
  - Build the rpm (CLE kernel)
  - Build dependencies of the rpm (lustre for elogin must match the elogin kernel version)

Security Update Patches – Non-Critical

- **Non-Critical – Timeline Target: 60 Days or Less**
  - **May contain non-kernel and/or kernel updates**
    - May contain Cray-Specific Kernel Modifications
  - **Standard Distribution Updates are Candidates for Early Access Release**
    - Early Access updates will be replaced by the formal Non-Critical Update Release

Early Access

- **Pass-through binary rpms from Vendor**
- **Very little, if any, Cray internal testing**
- **Unsupported by Cray (until official release)**

- **Site may gather rpms from their own local mechanism or request them from Cray**
- **Cray will assist site with installation issues if necessary**
  - If an install is having problems, don't force it – report the problem in a bug

- **This option is provided to assist those sites that have a requirement for a more frequent cadence and are willing to take the risk.**

Security Update Patches - Critical

- **Critical – Timeline Target: 14 Days or less**
  - Same process as non-Critical, but expedited timeline
  - Can contain non-kernel and/or kernel updates
    - May contain Cray-Specific Kernel Modifications
  - No Early Access Release

Security Update Patches - Critical

FN6029, the last kernel critical patch released Jan 2015

- **SMW kernel update – pass through SUSE kernel**
- **Elogin & ESM – pass-through kernel, dependencies**
  - 10 ESL, 2 ESM releases needed getfixes
- **CLE – Cray-built kernel**
  - 15 CLE releases needed getfixes
  - 4.0UP01/2/3, 4.1UP01, 4.2UP00/1/2, 5.0UP01/2/3, 5.1UP00/1/2

Timelines

If a site has delivery commitments that cannot be met by the Cray timelines, you can email os_security@cray.com to ask about the process, but for specific vulnerabilities, requests for early access, please create a bug with those specific requirements. All vulnerability specific communication will be done through the bug.

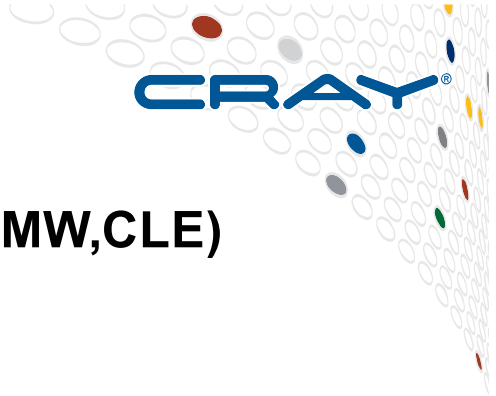
Installing Updates - SLES11

- **Older releases follow the same process as before**
  - Security updates provided in a getfix package with install script
  - Install the rpms via the install script on the SMW
  - Install the rpms via the install script in bootnode root & shared-root
  - Install the rpms via the install script or BCM on the esms & esl
  - Reboot the systems

Installing Updates

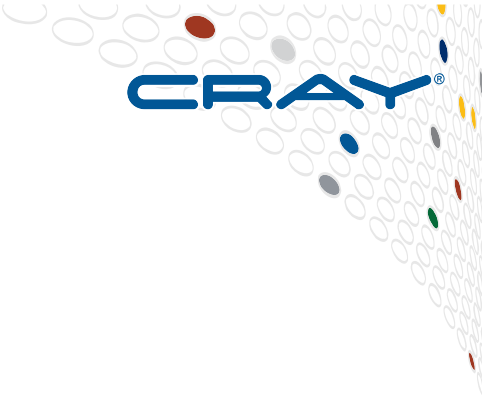
- **All new Cray products follow the same basic process**
  - Security updates provided in an iso, via a patch
  - Load the new rpms into a repository
  - Install the rpms into a image (or the live system)
  - Test update on sample node
  - Boot updates to the whole system

Installation example (SMW 8.0/CLE 6.0)



- **Get SLE patch set (standard patch format, just like SMW,CLE)**
- **The patch set includes:**
  - **SLE_12.SP0.PSX.readme**
    - Patch information
  - **INSTALL**
    - File listing the load, install & deployment steps
  - **SLE_12.SP0.PSX.iso**
    - Rpms that are being updated
  - **SLE_12.SP0.PSX.load**
    - Editable script that mounts the iso, copies the rpms to local repositories in preparation for install and deployment

Installation example (SMW 8.0/CLE 6.0)



SLE_12.SP0.PS04 (glibc update)

smw:# **SLE_12.SP0.PS04.load**

- Site can modify this script to make local changes
- Mounts the iso as /media/SLES_12.SP0.PS04
- Copies patchset to /var/adm/cray/release/patchsets
- Unmounts the iso
- Runs record.patchset

Example

- **Updating SMW**

1. smw# **snaputil create __snapshot_backup_name__**
   - Allows backing out of problematic issues, safety first!
2. smw# **zypper update --dry-run**
   - See what zypper will do without affecting running system
3. smw# **zypper update**
   - Update the rpms in the currently running snapshot

Example

- **Updating CLE**

1. root@node# **zypper update**
   - Update a running node
2. smw# **imgbuilder**
   - Build new images with the updated rpms
   - Note no '--map'
3. smw# **cnode update --filter group=security_test -i …**
   - Boot the test node with the updated boot image

Future plans

Cray's OS Security team is new and still in transition.

It will be a continuing process to make improvements

Future plans may include:

- **Develop proactive approaches**
- **Scanners** – looking to understand sites' various scanners
  - Nessus vulnerability scanner
  - OpenSCAP
  - OSSEC
- **Tracking IAVA's in parallel with sites**
  - Potentially helpful in providing quicker responses and reducing surprises
  - Potential mechanism to map IAVA's to CVE's for better distro results

Summary

Provide security updates for all Cray products in a standardized process, on a planned schedule, allowing for priority issues to be handled in an expedited manner.

- Changes in the install process for newer products allow the flexibility for sites to deal with security updates while minimizing downtime.
- New Security team standardizing process among products.

Things to keep in mind

- **Make sure your entry in the online configuration database maintained by Cray field personnel is up to date.**
  - It's where we get the information to plan the builds of any Cray-built rpms for critical security updates.
  - If your entry is out of date, your patch may be delayed.

Things to keep in mind

- **General security inquiries, questions, advice**
  - Email os_security@cray.com

- **Birds of a Feather, Wednesday 5:15**
  - Vulnerability counts
  - SLES/CentOS lifecycle schedules

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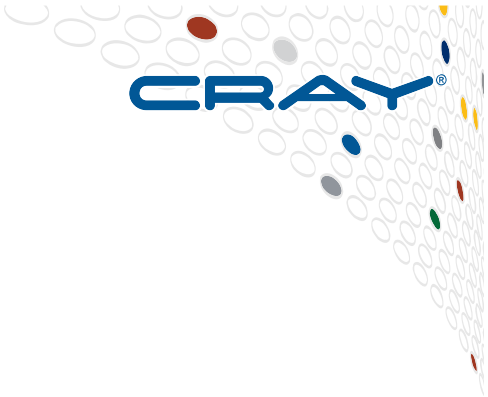


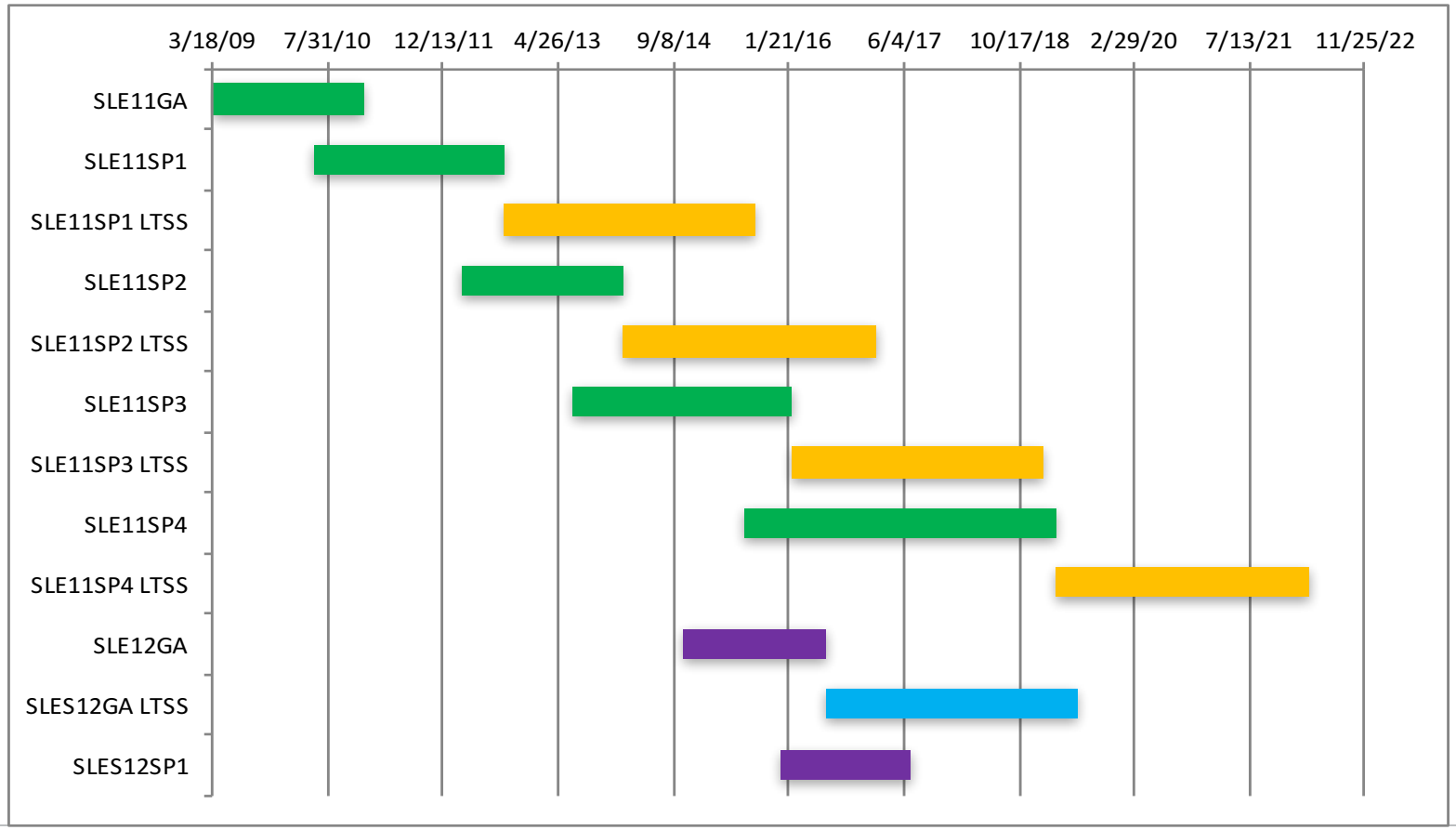
Q&A

Wendy Palm
wendy@cray.com
Technical information from Curt Fawcett & Luke Jacob

SUSE Lifecycle

- **Product supported for 10 years (*SLE11*)**
  - +3 years for extended support (LTSS), but may include only urgent/critical security updates
  - SLE11 released 24 Mar 2009, EOL 31 Mar 2019 (LTSS 2022) (CLE 3)
  - SLE12 released 27 Oct 2014, EOL 1 Oct 2021 (LTSS 2024) (CLE 6)
- **Service packs released every 18 months (*SLE11SP1, SP2, etc*)**
  - Service packs are supported for 6 months past the release of the next service pack
  - +3 years for extended support (LTSS), but may include only urgent/critical security updates
  - SLE 11SP1 released 20 June 2010, EOL 31 Aug 2012 (CLE 4)
  - SLE 11SP2 released 29 Feb 2012, EOL 31 Jan 2014 (CLE 5.0/5.1)
  - SLE 11SP3 released 31 Jan 2013, EOL 31 Jan 2016 (CLE 5.2)
  - SLE 11SP4 released 15 Jul 2015, EOL 31 Mar 2019
- **When support ends, Cray cannot get further updates**

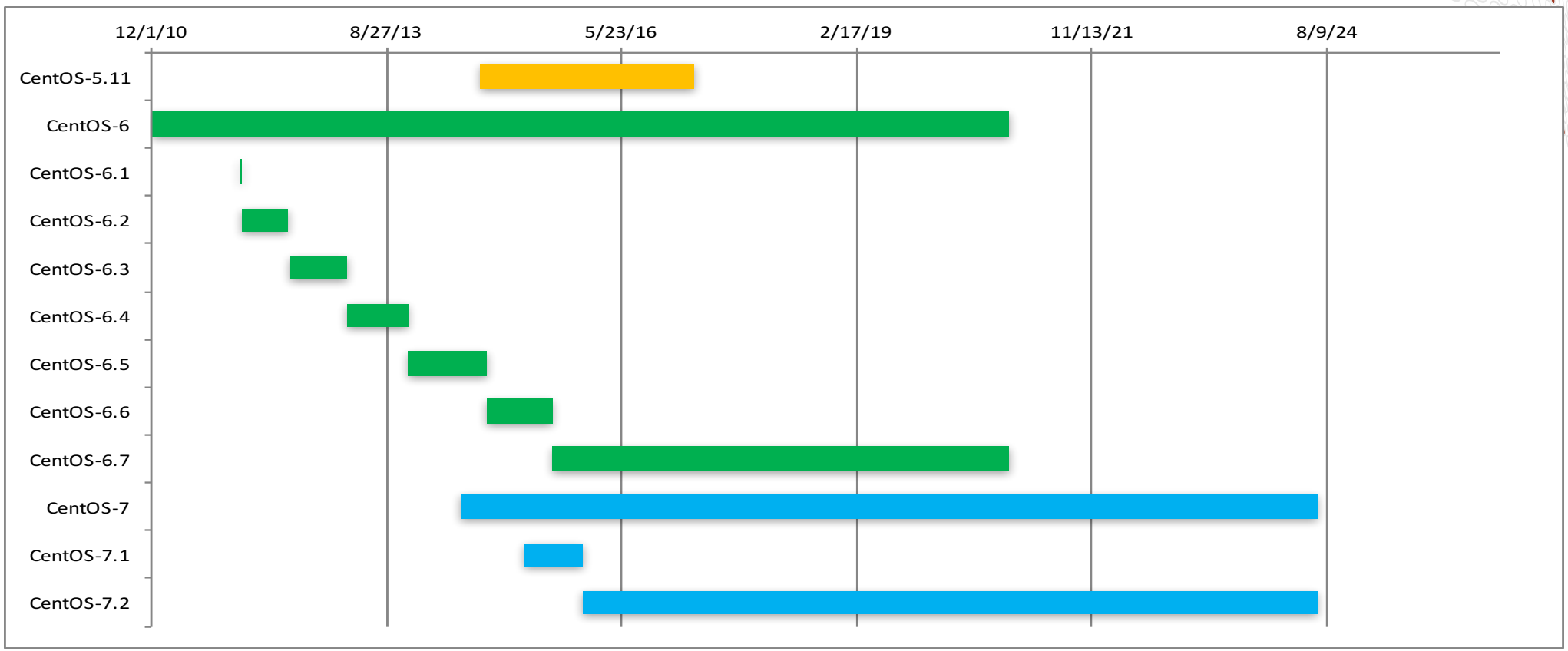
SLE Lifecycle



CentOS Lifecycle

- **Major release supported for 10 years (*CentOS6*)**
  - CentOS-6 released 1 Dec 2010, EOL 30 Nov 2020
  - CentOS-7 released 1 Jul 2014, EOL 30 Jun 2024
- **Minor releases released ~every 10mos (*CentOS-6.7*)**
  - CentOS-6.6 released 28 Oct 2014, EOL 6 Aug 2015
  - CentOS-6.7 released 7 Aug 2015
  - CentOS-7.1 released 2 Apr 2015, EOL 13 Dec 2015
  - CentOS-7.2 released 14 Dec 2015
- **Active support for each release moves to the next release; support is not available for older releases (both Major and Minor).**

CentOS Lifecycle



By the numbers - SLES9

- **SLES9 – released 8/03/2004, ended maint 8/31/2011**

  Most common packages getting updates (in order of frequency)
  java, kernel, clamav, ethereal, mozilla, cups, mysql, libpng, freetype2, ruby, XFree86, libexif, mailman, horde, quagga, tomcat, apache, openssh, gd, python, yast2-packagemanger-devel, km_nss, openssl, samba, tk, pcre.

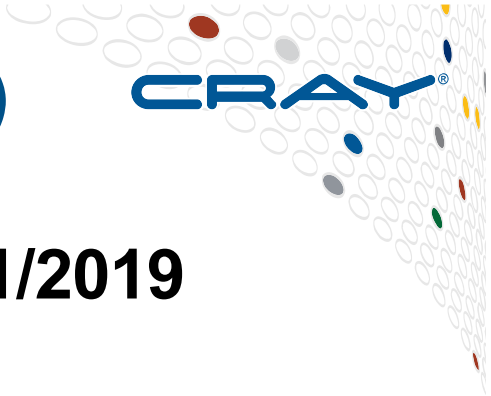
- **SMW 1.5/3.1 & Unicos/lc 1.5/2.0**
  - 948 rpms in dist
  - 54 FNs, 965 updates of 255 rpms, 511 CVEs

- **XD1**
  - 1420 rpms in dist (pretty much all of them)
  - 29 FNs, 1544 updates of 292 rpms, 670 CVEs

By the numbers – SLES10

- **SLES10 – released 7/17/2006, end maint 7/31/2013**
- **SMW 3.1.10/4.0 & CLE 2.1/2.2**
  - 1084 rpms in SMW dist
  - 1299 rpms in CLE 2.1 dist
  - 1025 rpms in CLE 2.2 dist (rpmreduction project)
- **48 FNs, 1812 updates of 380 rpms, 1162 CVEs**

By the numbers – SLES11 (as of 3/23/2016)



- **SLES11 – released 3/24/2009, end maint 1/31/2019**
- **SMW 5/6/7 & CLE 3/4/5**
  - Novell re-organized their rpms – many broke into multiple rpms and many devel rpms got moved into SDK & SLED.
  - 1225 rpms in SMW dist
  - 1788 rpms in CLE dist
  - 1112 rpms in ESMS dist
- **72 FNs, 2415 updates of 637 rpms, 2367 CVEs**

Relevant Security Vulnerabilities