Managing the SMW as a git Branch

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Motivation

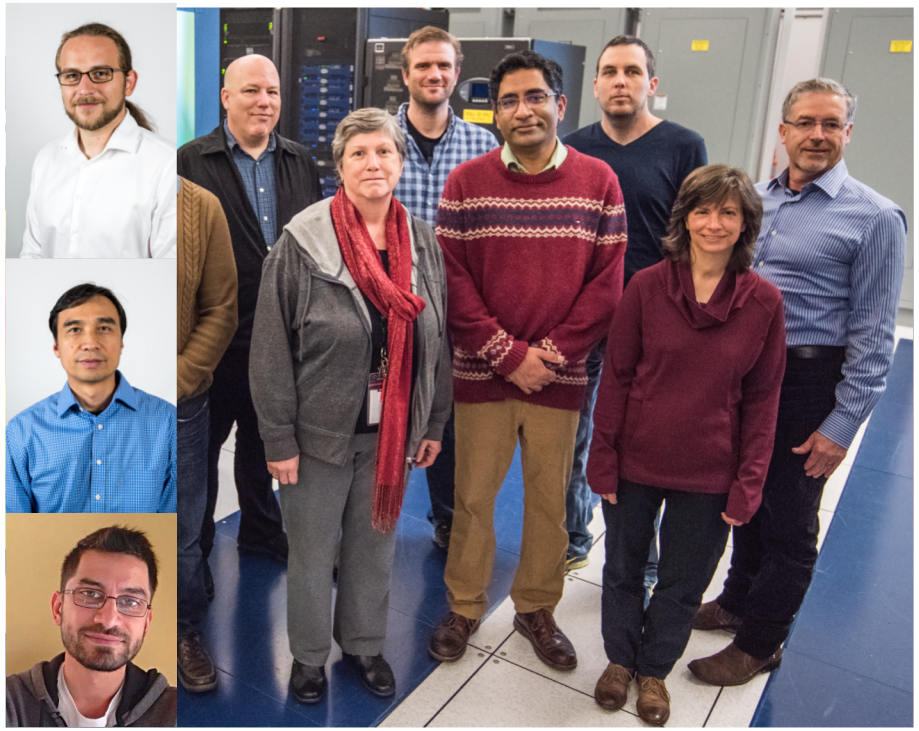
Use modern software engineering approaches and tools to increase effectiveness and efficiency of systems management by:

- Providing a mechanism for NERSC and Cray engineers to collaborate
- Centralize and unify the configuration of multiple systems
- Develop all configurations on test systems and reliably deploy to production
- Use test systems for speculative development and production modeling
- Recover SMW efficiently

This enables a DevOps view and workflow for Cray Supercomputers.

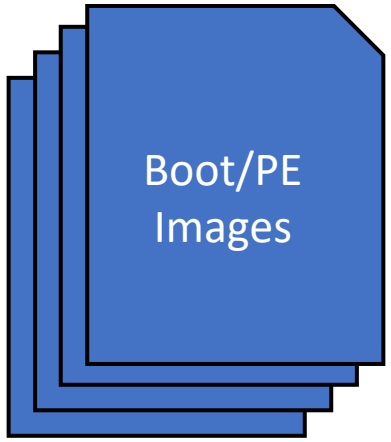
Collaboration on Systems Development

- Operating and Configuring systems is a collaborative effort between
  - NERSC Computational Systems Group
  - Cray On-site support team
  - Other NERSC-staff contributors (Operations, Data Services, Storage, Networking, Security)



Many contributors!

Simplified CLE Workflow



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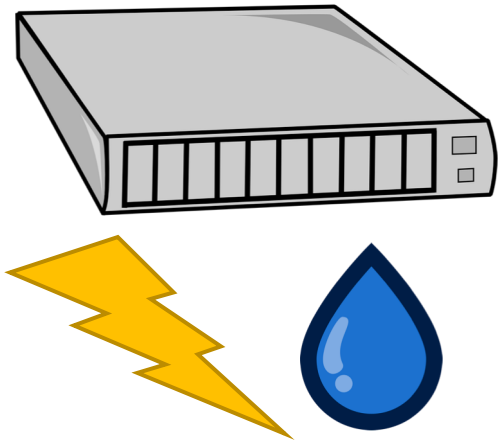

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Booted System!

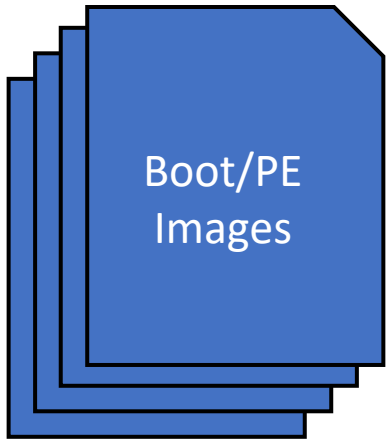
- Image Recipes
- Package Collections
- RPM Repos

- Worksheets
- Custom Ansible Plays/Roles
- Custom Ansible Variables
- Files positioned by SimpleSync

- HSS Configurations
- SMW Configurations
- SMW Software
- Functional Cray XC Hardware
- Power/Water

Iterate on software inputs incrementally over life of the system.

Managed Configurations



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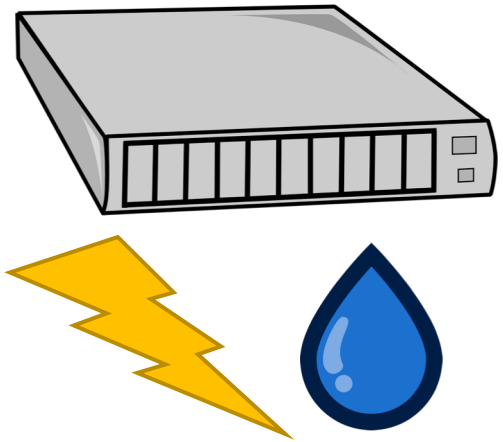

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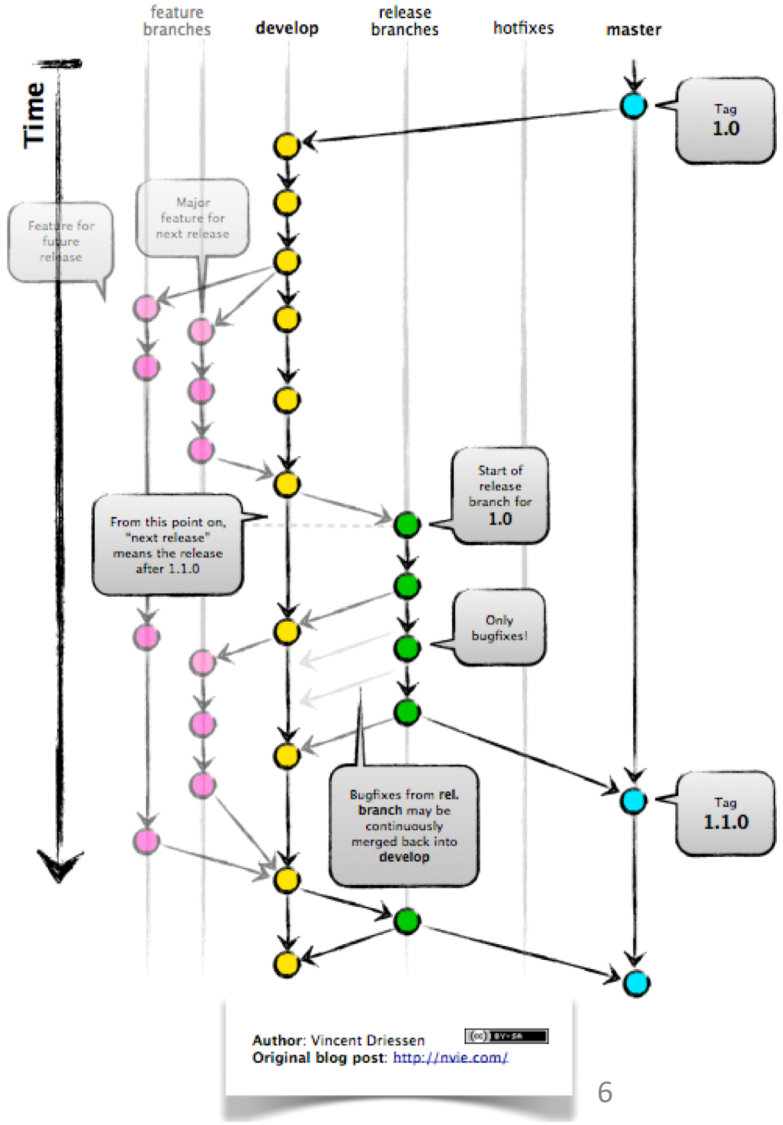
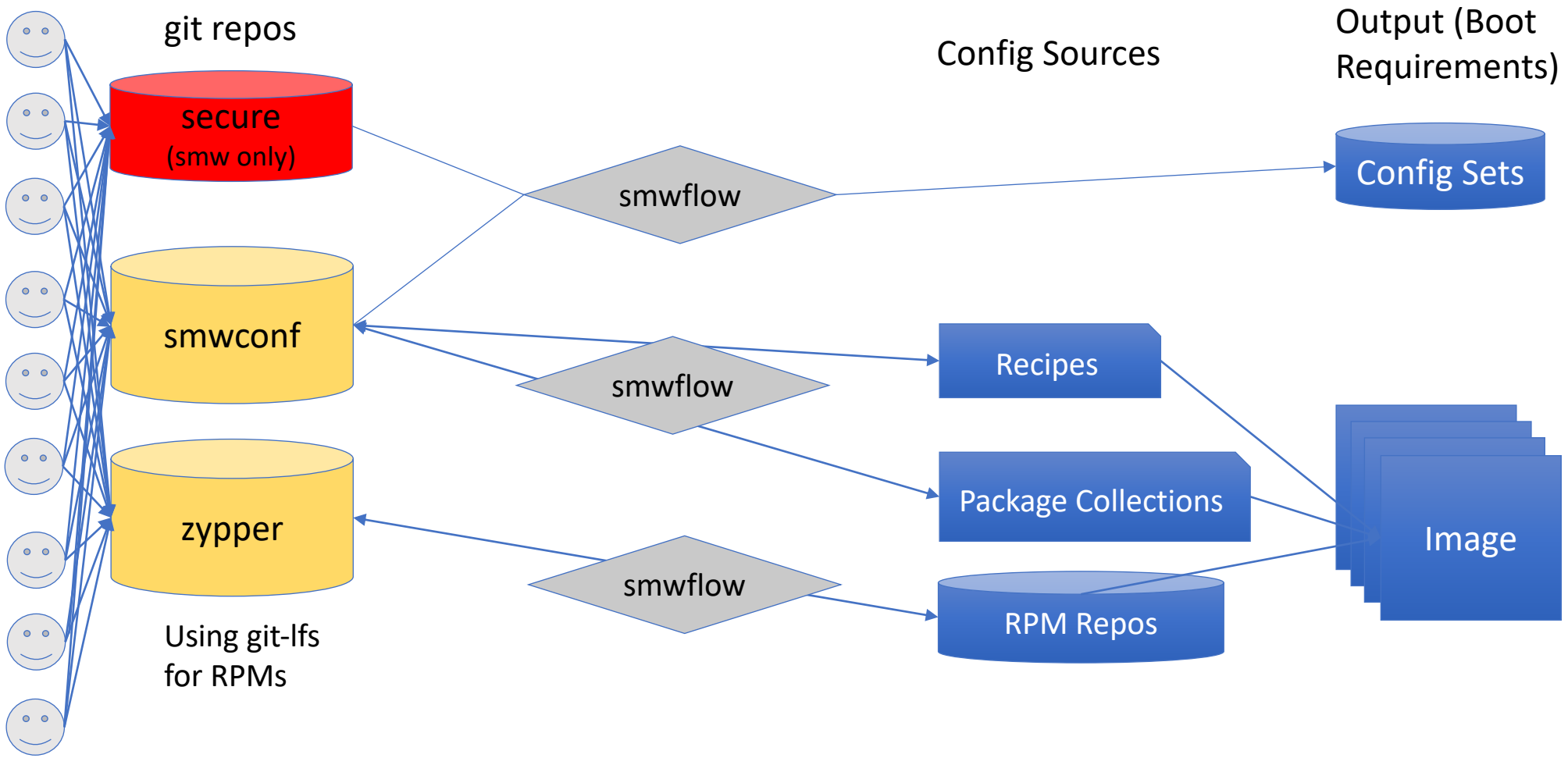
git as a System Management Solution

- In CLE6 most site-customizable are just files
  - Can be stored in SCM
- git branching is ideal for feature development
- Gitflow development style provides natural means to promote development branches to production
- On-site Atlassian Bitbucket/Stash provides change control capabilities
  - Branch level authorizations
  - Read-only keyed access (for smw root accounts)
- Distributed nature of git provides loss and failure resilience



Putting SMW Config in git



smwflow: Software to Control SMW Config

- Subdivides SMW configurations into different object classes:
  - imps: image recipes, package collections, IMPS configurations
    - Also config sets, with sub-classes of “global” and “cle”, and sub-sub-classes for all the various components of the config sets
  - zypper: RPM repositories stored in specialized git repository using git-lfs (Large File Support)
  - hss: Hardware Supervisory System configuration files
  - smw: Base configurations of the SMW itself
- The data (and metadata) of the configuration objects are stored in git
- Within each object class an evaluation hierarchy is supported to allow multiple systems or platforms to share configurations
- Templating of configurations is supported to allow the same base configuration to support multiple systems

smwflow: Operations and Plugins

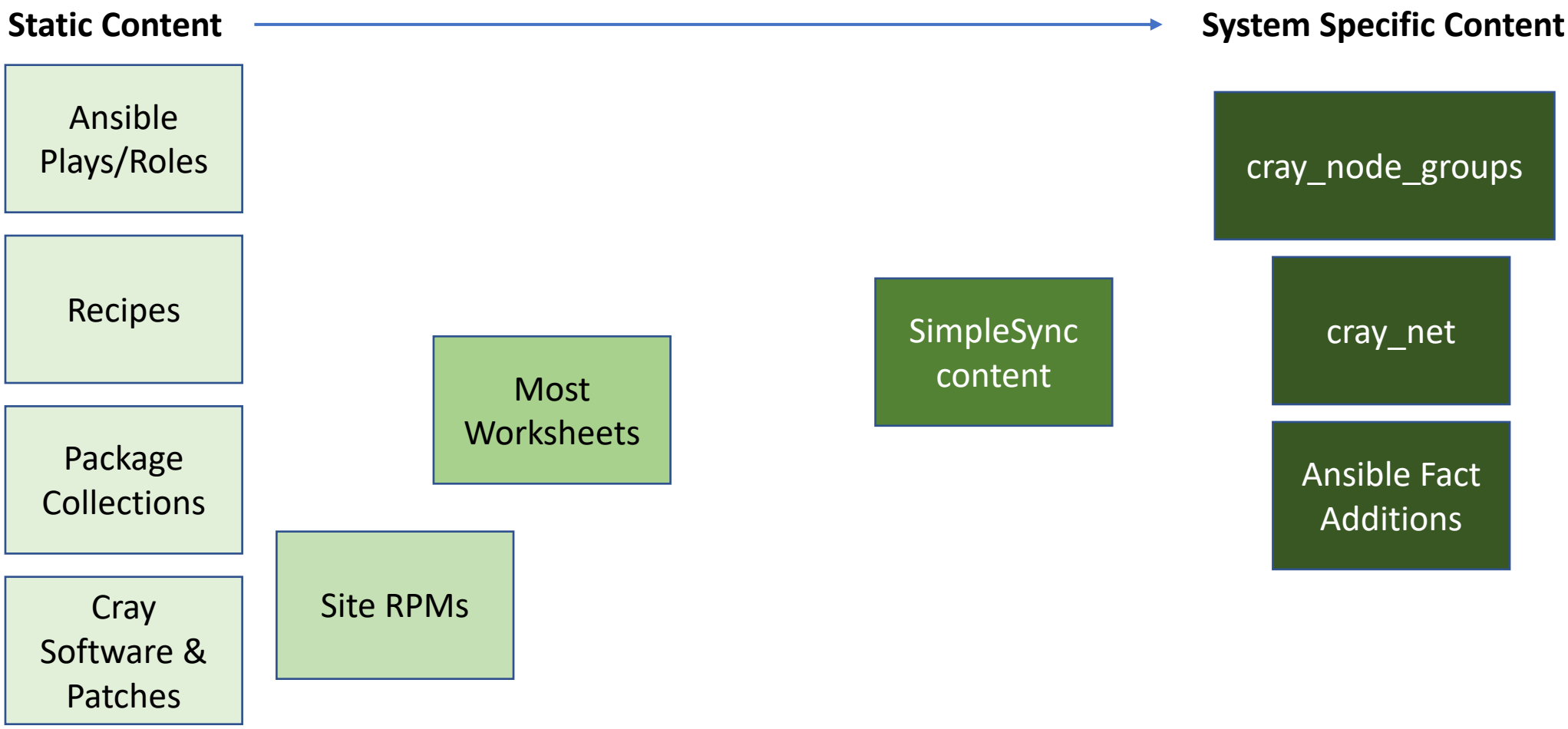
smwflow Operations

import: copy content from SMW to git (fairly stupid)
create: create new config set or map
verify: check that SMW matches git
update: replace SMW configurations from git
objdiff: generate diff of two different git-based files to support merging and templating

smwflow Plugins

- Allow arbitrary code to participate in building custom configurations.
- Enables multi-system configurations (e.g., hostbased ssh auth across systems), or pre-generation of configuration data in SimpleSync

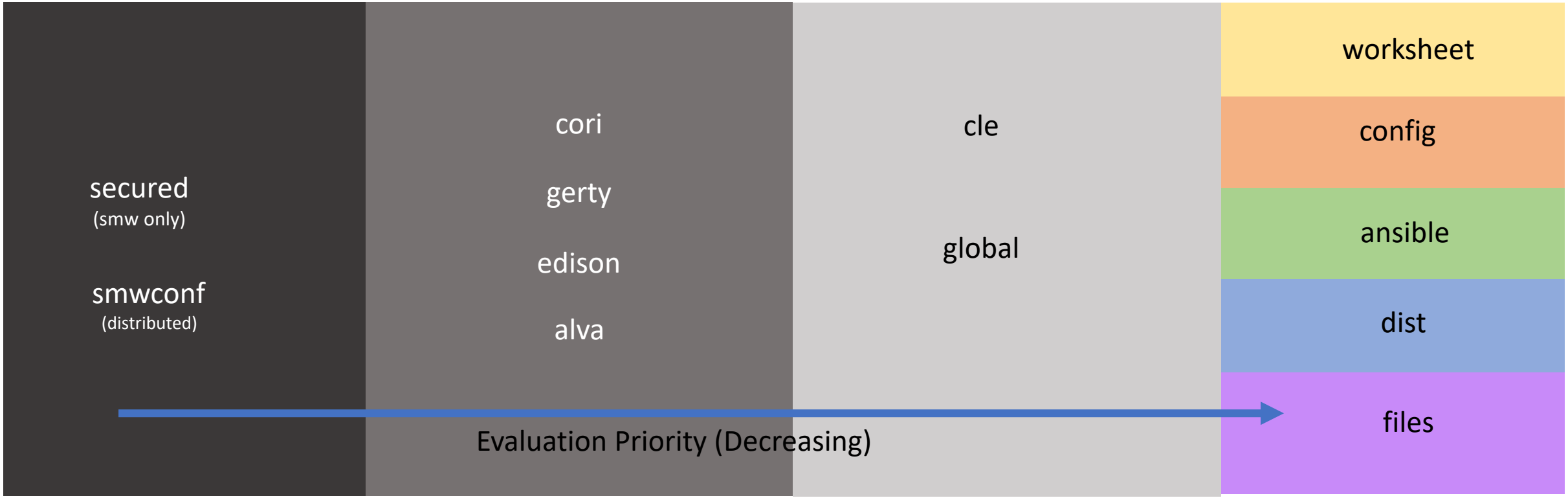
Git for Multi-system Management



Config Set in git: Multi-system

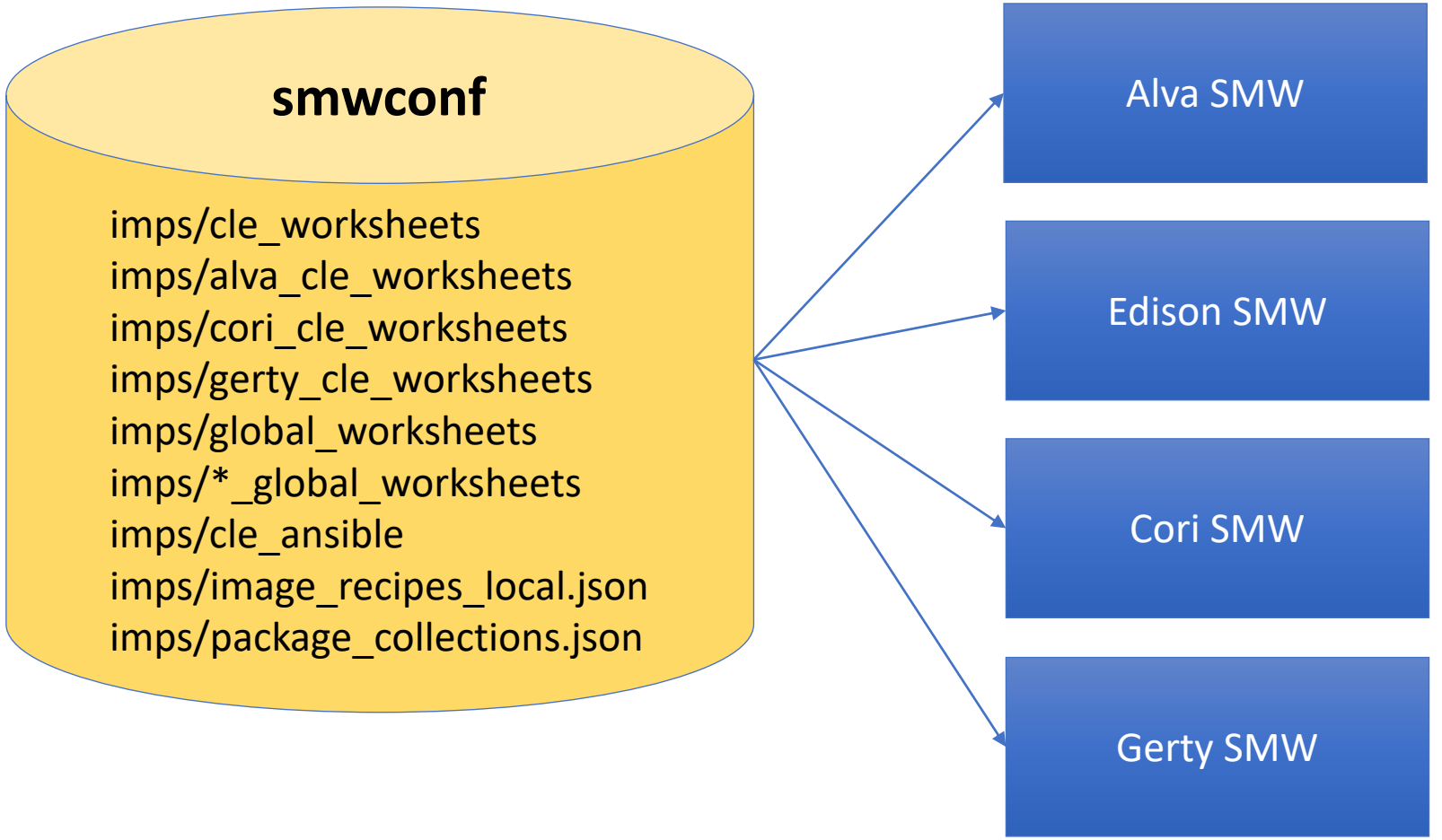
- Hierarchical Assembly from multiple sources

```
<git repo>/imps/(<system>_)?<cfgsetType>_<objectType>
```



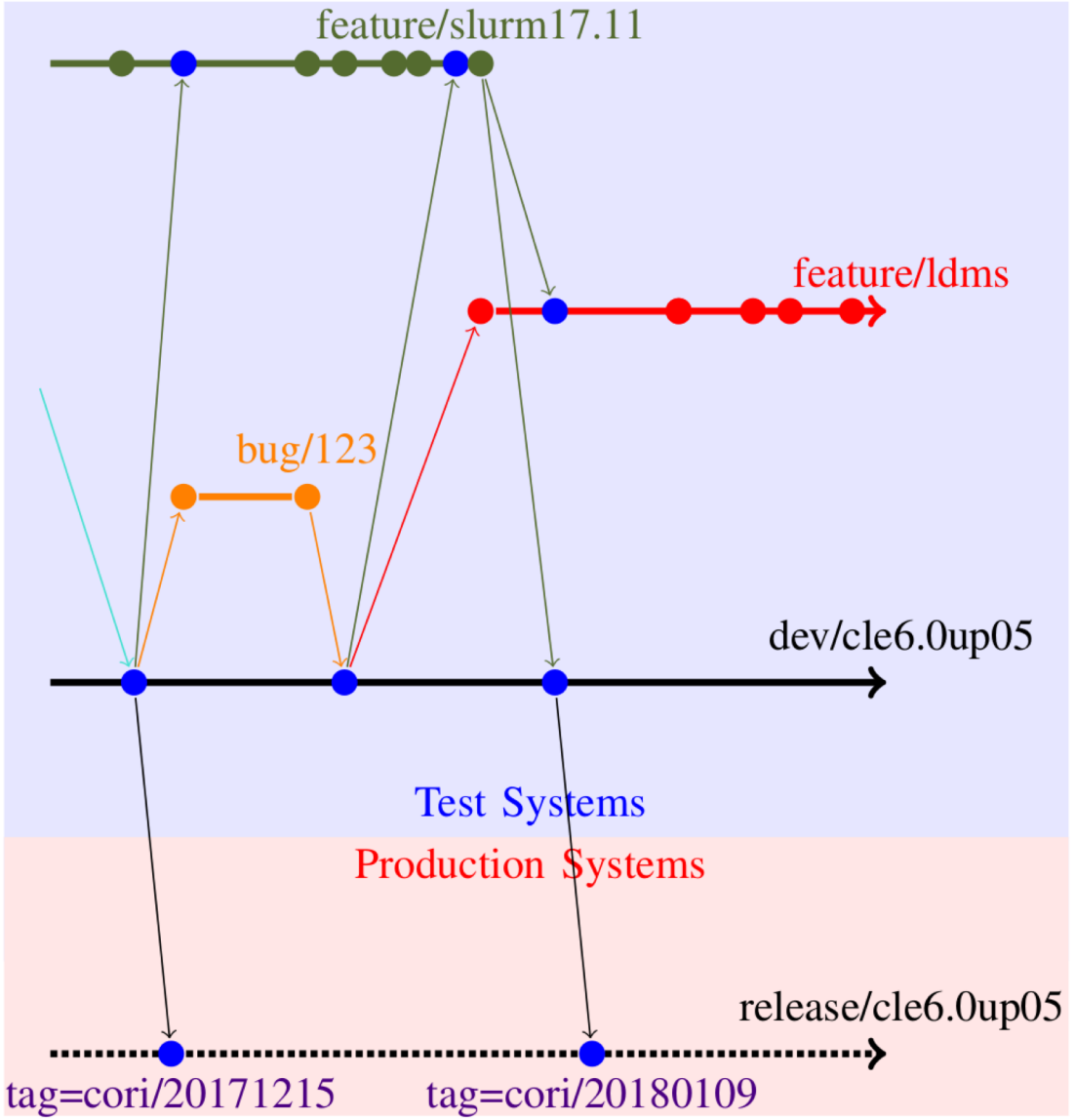
git for Multi-system Management

Most worksheets are shared
All ansible is shared, system specific variables
Recipes and package collections identical across systems



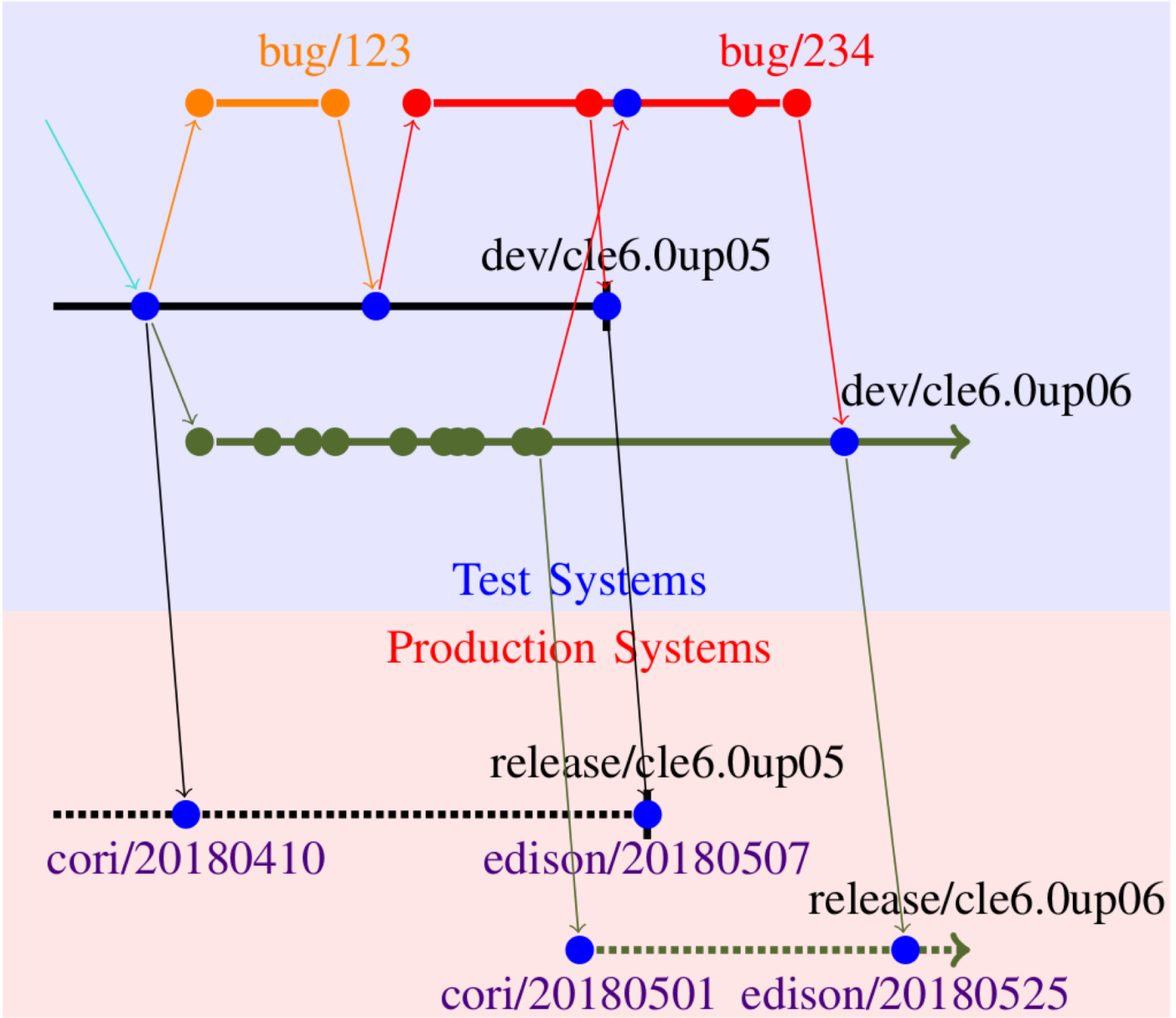
Development to Production

- Did you know?
  - Your TDS is the most exciting system on the floor
  - Your production system is a totally boring endpoint
- Recipes static, must test recipe build through operations on TDS
- TDS iteration → regression testing → iterate on TDS → production



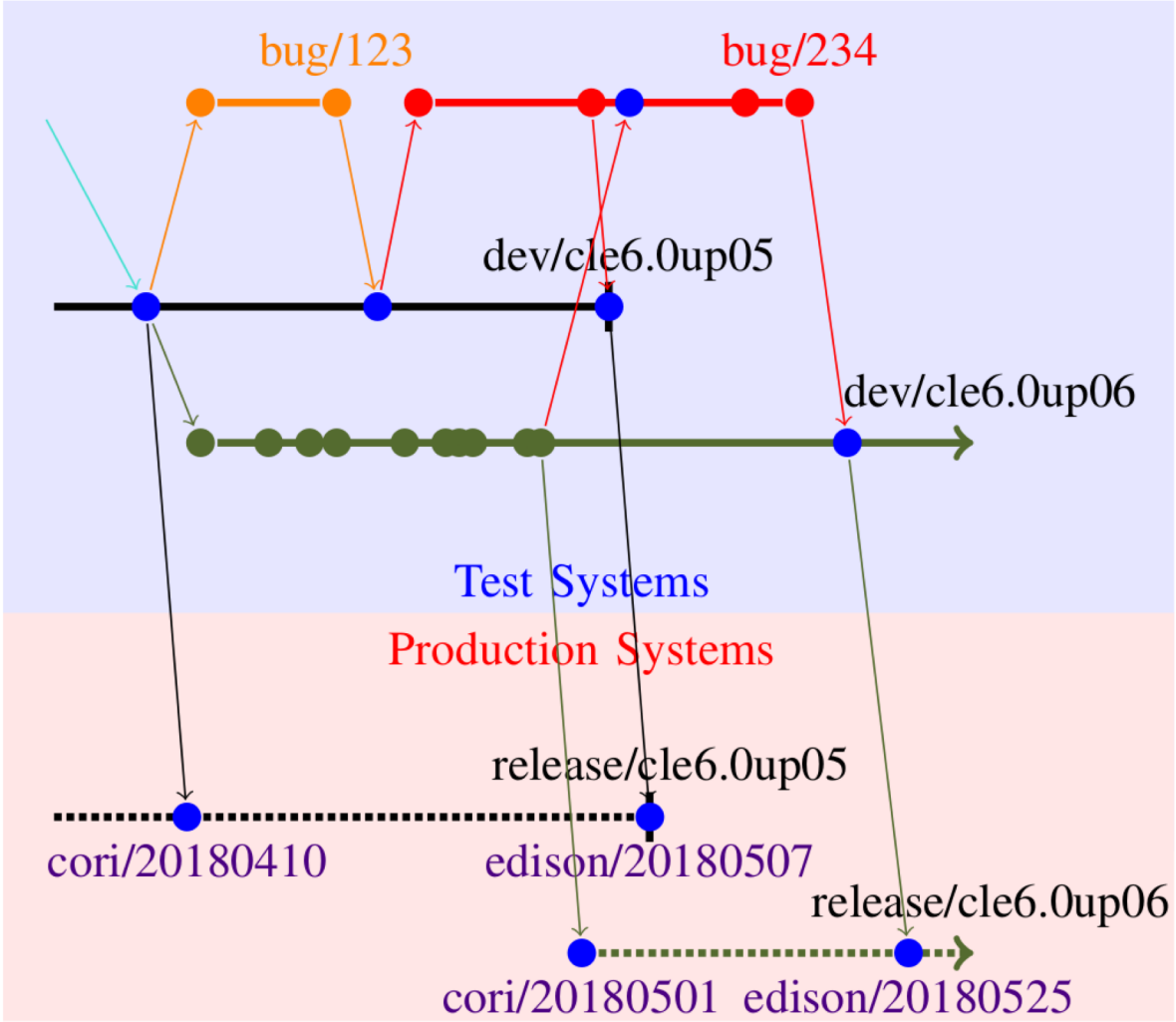
CLE Update Branching

- Track multiple primary development branches
  - One per CLE update level
- Allows version skew between systems
- Allows forward propagation of legacy configurations
- Enables coherent merging of bug/feature branches into multiple devel/release branches through time



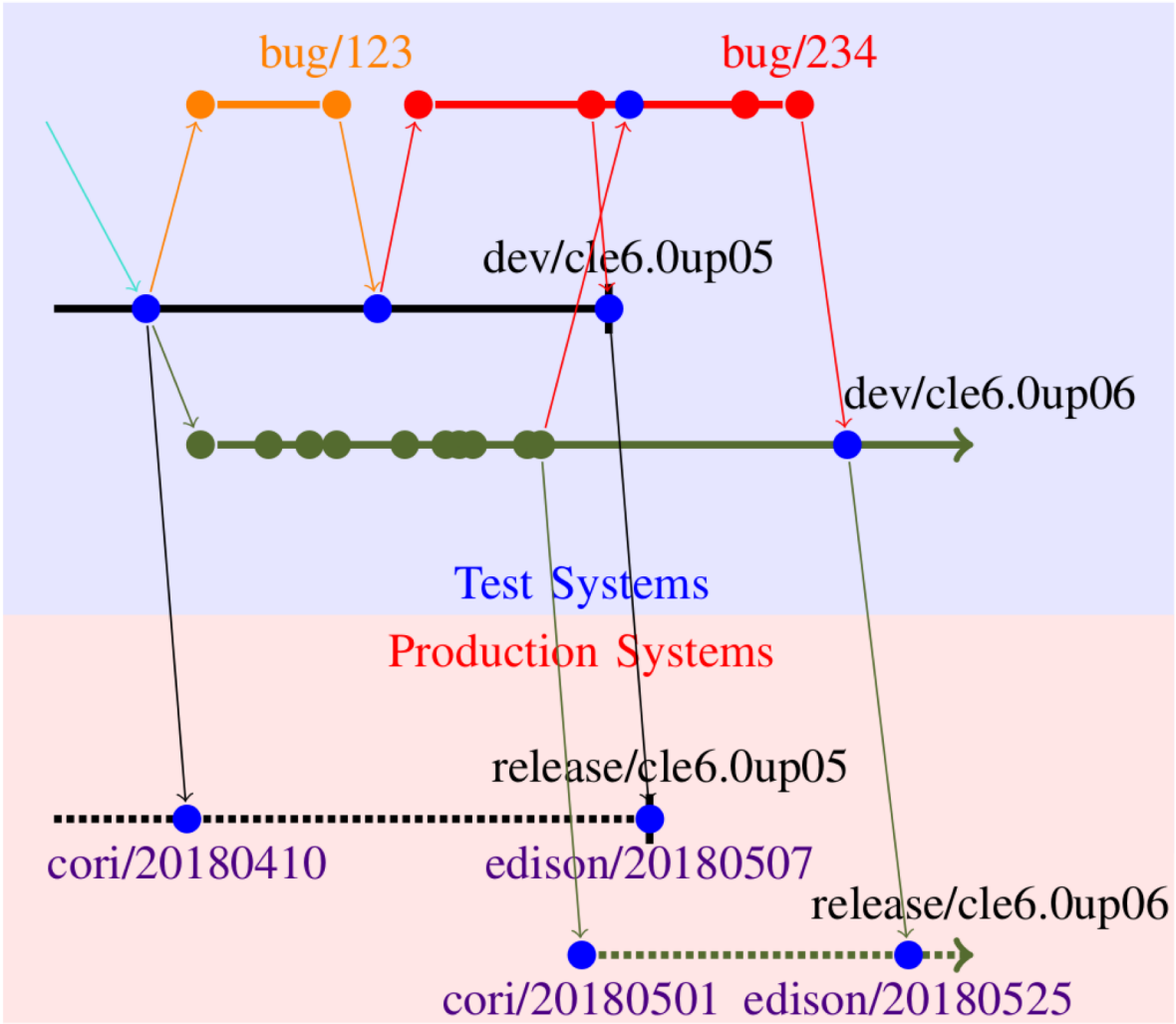
Results: Patch/Minor Reconfig Maintenance

- Average patch maintenance + reconfiguration: **4 hours**
  - 30 minutes shutdown
  - 30 minutes reconfiguration (patches preinstalled and images prebuilt)
  - 8 minutes: automated config set construction
  - 30 minutes bouncing
  - 1.5 hours booting



Results: Fresh Install of CLE6.0up05

- 6.0UP05 Fresh Install: **12 hours** (pipelined)
  - Preinstall SLES 12sp3, prebuild PE and stage
  - 1 hour bootraid bootstrapping
  - 2 hours SMWInstall
  - 1 hour patching (overlap xtdiscover)
  - 6 hours xtdiscover/xtzap/xtbounce
  - 1 hour imagebuild/config set construction (overlap xtzap/xtbounce)
  - 2.5 hours booting



Future Work

- Adding more configurations
- System Management Automation and Continuous Integration
- Secure Commits with GPG
- Automated Configuration Pre-Computation
- (NERSC) Enabling some Rolling Updates
- Boot Performance Tracking / Overall git bisection for any given metric
- (Cray) Improving Cray SMW tools to better integrate with git

Conclusions

- Git branching provides a robust method for:
  - Tracking and managing feature and bug development processes
  - Managing multiple versions of CLE through time
  - Social coding and peer review, collaboration

Conclusion

Cray CMF	+	SMW Configuration Flexibility	+	smwflow (process & software)	+	git branching

Enables:

- Process flexibility in systems management
- Software **process** in systems management
- Multi-system configuration (not required)
- Higher engineer productivity
- Increased system availability and resilience

Getting Started:

https://github.com/nersc/smwflow

PS: still awaiting U.C. and DOE approval for open source
PPS: it'll be available soon.

Questions?

Come to XC System Management Usability BOF
(Event-Large)