

National Aeronautics and Space Administration



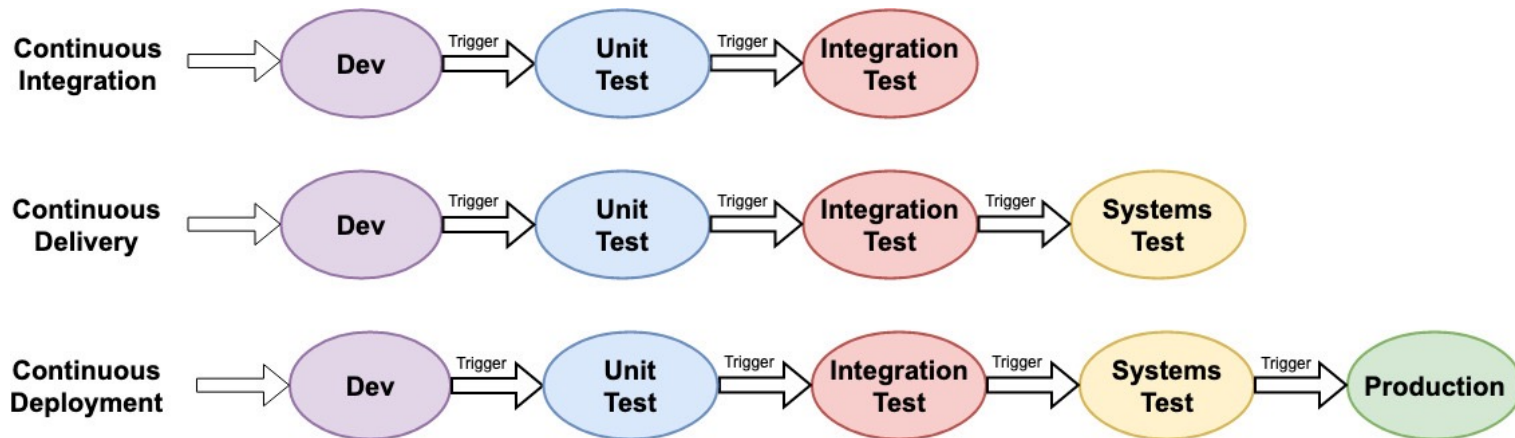
NASA Systems Software Management and Integration

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CI/CD - As applied to systems software?



- Keyword here is ***Automation*** for the “trigger”s
- What tools and why
- How much automation
- Where is improvement needed

Systems Build and Image Management

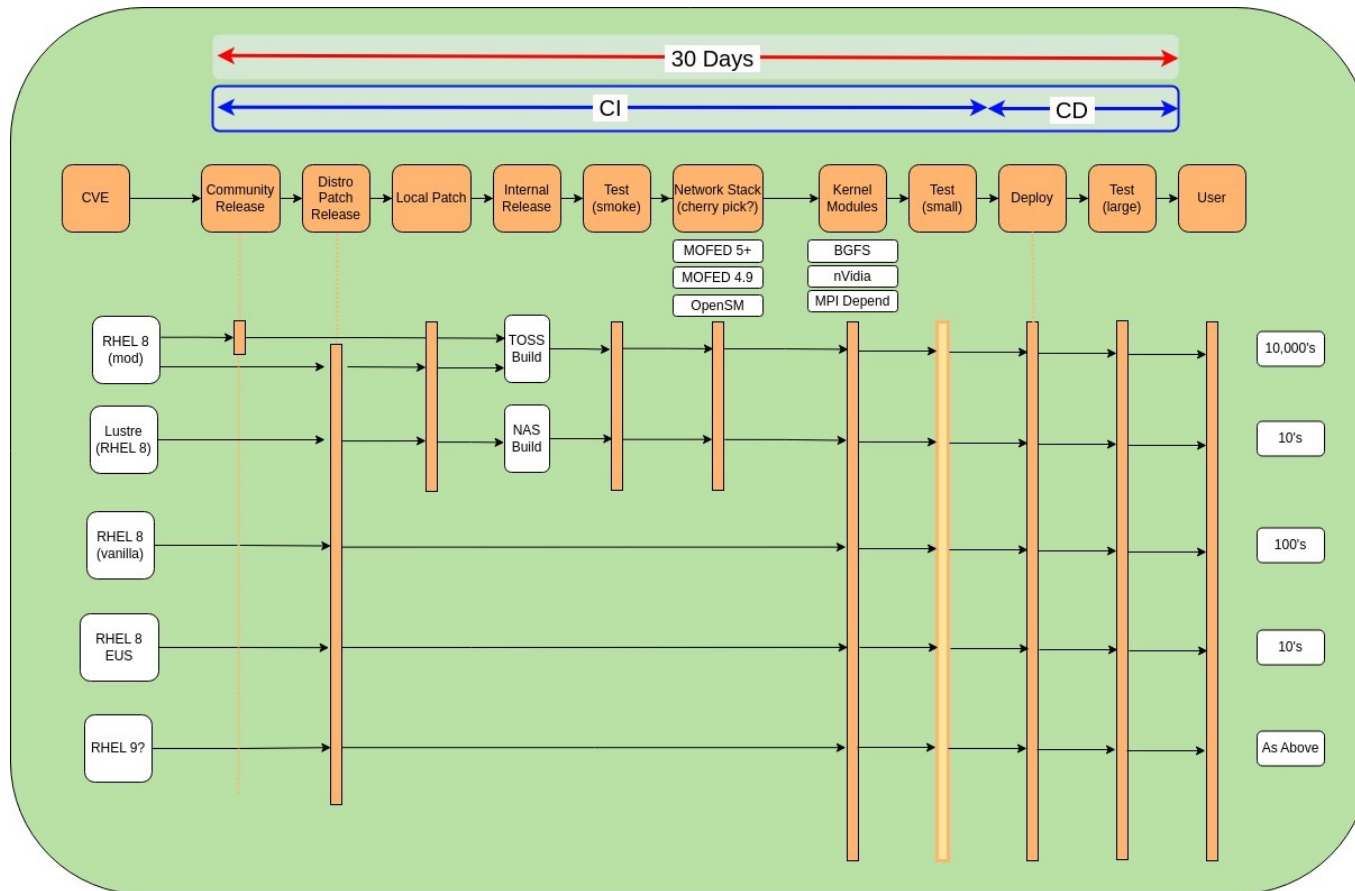


Kernel Updates

- **Policy Driven – 30 Days**
- **Feature Add/Bug Fix**
- **4 Release Streams**
 - 6 different build results
 - Deployed to 20k-ish systems

Notes

- **30 max -> 5 days min**
 - Expedited Critical
- **0 day exploits -> TOSS**
 - SRPM ahead of distro
- **2 versions MOFED**
 - GPU dependent
- **Test**
 - Do what's possible (limited)
 - User based input Test? 30-> 60 days
- **Change Management**
 - Configuration Change Board
- **Progress? Yes**
 - But, ... Big Changes needed!



Changes Needed



Stateless Images -> most systems (e.g. no local configuration)

- Many systems require the image to be pushed out
 - » System Down, HW issue, SW config problem (e.g. ssh config)
- Access to external repo's from inside
- Repeat pulls into local system (e.g. rpm update) different systems for the same update
 - » Find the one that didn't work out of the 200 that did

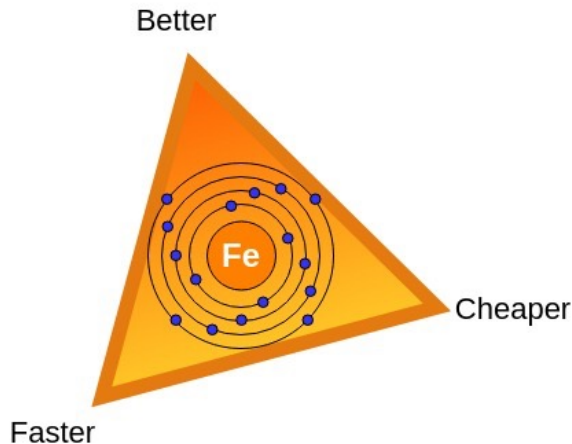
Leverage Containers -> many 'infrastructure' systems can use

Improved Automation

- We clearly have some 'Automation'
- Critical Staff – still arcane and fragile
- Push button ease?

Will require substantial development to improve metrics:

- Reduce downtime/user impact
- Towards 100% compliance (no misses)
- Decoupling of test and deployment
- Faster *and* Reduced effort



Software outside of the “Operating System”



SW installed on the system – most typically installed in ‘modules’ (not base)

- Agency Guidance (executive order(s) re: IT supply chain)
 - » All **‘procured’** software requires “IT Supply Chain approval”.
 - » Process is beyond NASA
- Two Important Assertions
 - » Any software installed on the system has been ‘procured’
Whether it cost money or not - doesn’t matter
 - » Standard of Care
Software installed/accessible on government system
held to a higher standard (than that of users)
- What to do?
 - » NIST guidance
 - » Auditing



“Free software’ is a matter of liberty, not price.” Richard Stallman

cdo/1.9.0	ncl/6.4.0	nco/4.6.7	ncview/2.1.7	octave/4.2.1
comp-aocc/3.2.0		hdf5/1.12.2_nvidia_serial	netcdf/4.4.1.1_mpt	scicon/app-tools
comp-intel/2016.2.181	idl/8.8		scicon/app-tools-1.2	vtune/2019
comp-intel/2018.3.222	jvm/jdk10	netcdf/4.4.1.1_serial	scicon/app-tools-1.2.1	visit/3.1.4
comp-intel/2019.5.281	matematica/12.1.0	netdrms/9.3.1	x2go/stable	vtune/2021.9
comp-intel/2020.0.166	matlab/2021a	nvhpc-nompi/22.3	xxdiff/5.1	
comp-intel/2020.4.304	matlab/2022b	nvhpc-nompi/23.5	scicon/lumber	paraview/5.4.1
cuda/11.0 metis/5.1.0		nvhpc/22.3	scicon/mpiprof	
dakota/6.15 mpi-hpe/mpt		nvhpc/23.5	scicon/mpiprof-gcc	
deprecated/mpi-hpcx-mt/2.10		nvhpc/openmpi-3.1.5	singularity/3.10.2	
fieldview/22.0	mpi-hpe/mpt.2.25	mpi-hpe/mpt.2.23	singularity/3.11.0	
firefox/latest	mpi-hpe/mpt.2.26	nvhpc/openmpi-4.0.5	zip/2.1.1	
grads/2.1.1.b0	mpi-hpe/mpt.2.28_25Apr23_rhel87		parmetis/3.1.1	tecplot/2021r2
hdf4/4.2.12 nas			tecplot/2022r1	
hdf5/1.8.18_mpt	ncl/6.3.0	parmetis/4.0.3	petsc/3.14.5_intel_mpt	totalview/2017.0.12
hdf5/1.8.18_serial		ncview/2.1.9	petsc/3.17.3_intel_mpt_py	visit/3.0.0
boost/1.78	gcc/6.5	gcc/7.5	gcc/8.4	gcc/9.3
gcc/10.3	octave/6.4	pkgsr/2022Q1-rome		
		python3/3.9.12		

- » Order 1000+ executables
- » Order 2000+ libraries

- Good stuff in there
- Can I trust DOE?

Software environments will continue to dramatically increase in diversity and complexity.

- Encouraged – only via singularity
- But security concerns over squashfs broke singularity containers for several months
- Podman in review – not there yet
- Not always workable for parallel codes with specific requirements (e.g. MPI)