SLATE Project Update

slateci.io

Shawn McKee for the **SLATE Project**

HEPiX Fall 2019 Meeting - Amsterdam

October 18, 2019

The SLATE Project

SLATE: **S**ervices **L**ayer **A**t **T**he **E**dge

(Funded by NSF Aug 2017, Award #1724821)

- An NSF DIBBs award, "SLATE and the Mobility of Capability"
- Equips the SciDMZ with a service orchestration platform, federated to create scalable, multi-campus science platforms
- Underlayment-as-a-service (UaaS) for platform builders & science gateway developers

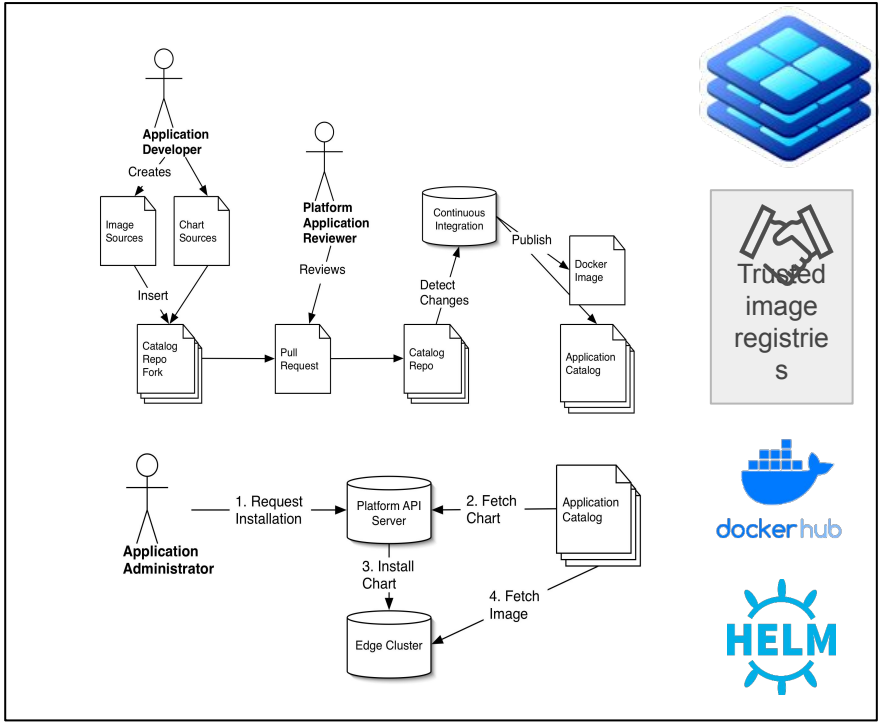
This talk will provide a review of **SLATE** as well as new updates since the spring talk:
https://indico.cern.ch/event/765497/contributions/3351206/

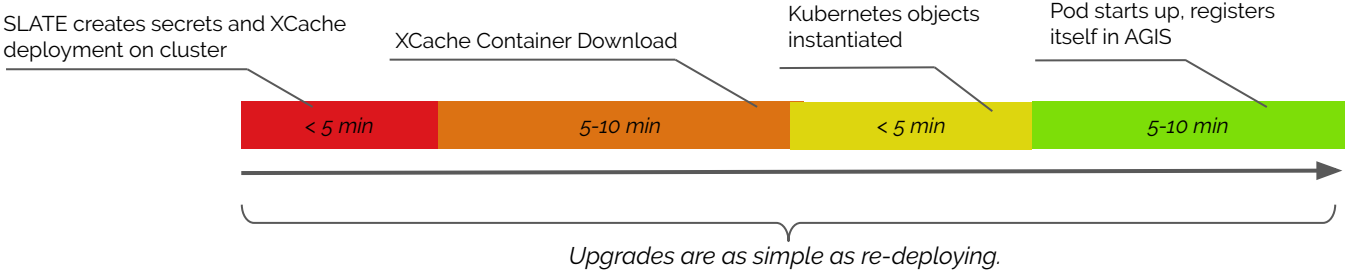
Introduction to SLATE

- **Service delivery** via **container orchestration** in edge networks
- The **challenges** are many
  - security and trust of container images
  - adoption of a new operations model
- The benefits are:
  - **ease ops burden on site admins**
  - **more quickly deploy updates and new services**

SLATE in a Slide

- SLATE - a value added K8s distribution
  - Support for CVMFS, ingress controller (multi-tenant, scoped privileges), Prometheus monitoring, **curated application catalog w/ Jenkins CI**
- Site security & policy conscious
  - SLATE works as an unprivileged user
  - Single entrypoint via **institutional identity**
  - Site owner controls group whitelists & service apps; **retains full control**
- With OSG, WLCG, trustedci.org & others working to establish a "CISO compliant" security posture and **new trust delegation model**





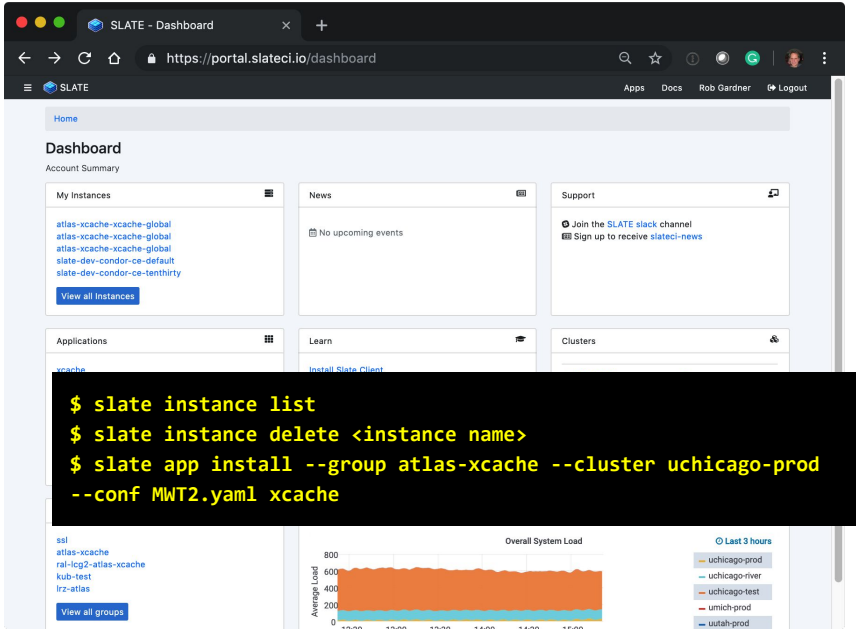
A data caching network deployed in less than 20 minutes.

Towards a NoOps Model with SLATE

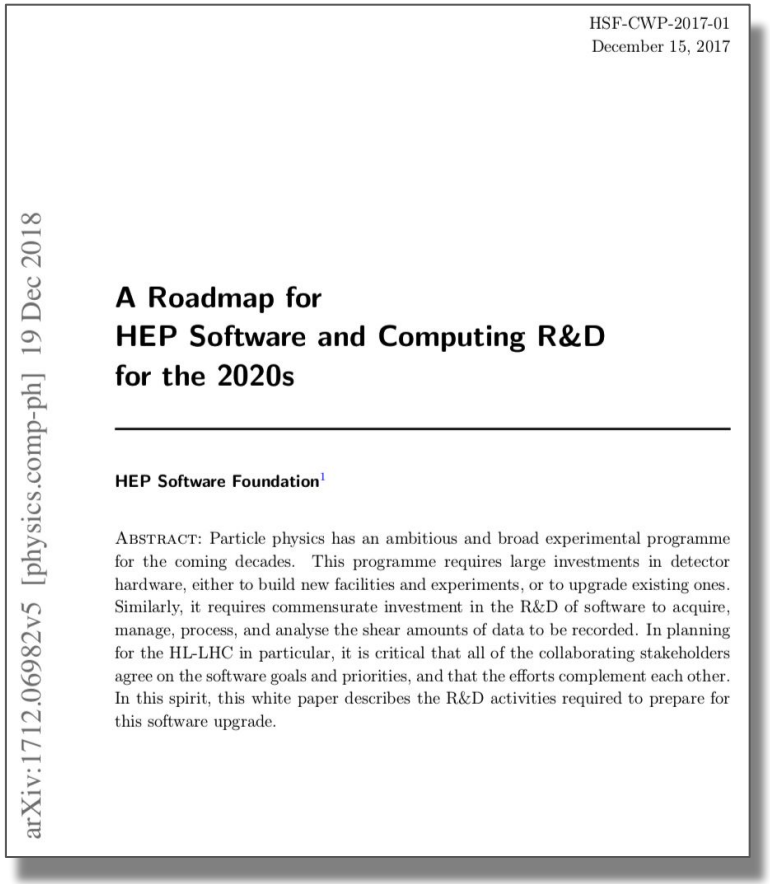
NoOps - *the concept that an IT environment can become so automated and abstracted from the underlying infrastructure that there is no need for a dedicated team to manage **software** in-house.*

- Remotely manage edge services at sites by **expert teams** from **trusted organizations**
- Deploy updates more quickly & introduce new services more easily
- Save time and effort for local site admins via **NoOps**
- Edge federation via lightweight server/client overlay using **Kubernetes**, the industry leading container orchestration platform

- Software catalog, with push button deploy using vetted **Helm charts** (*Curated Config-knobs for Admins*)



A New Motivation: The HL-LHC Era Challenge



HSF-CWP-2017-01
December 15, 2017

arXiv:1712.06982v5 [physics.comp-ph] 19 Dec 2018

A Roadmap for HEP Software and Computing R&D for the 2020s

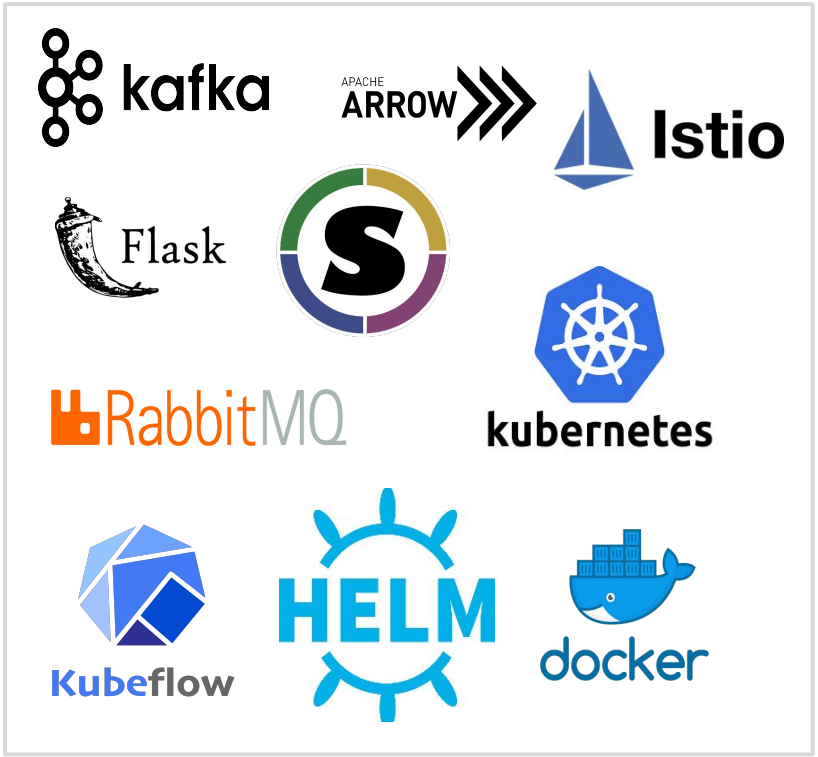
HEP Software Foundation[1]

ABSTRACT: Particle physics has an ambitious and broad experimental programme for the coming decades. This programme requires large investments in detector hardware, either to build new facilities and experiments, or to upgrade existing ones. Similarly, it requires commensurate investment in the R&D of software to acquire, manage, process, and analyse the shear amounts of data to be recorded. In planning for the HL-LHC in particular, it is critical that all of the collaborating stakeholders agree on the software goals and priorities, and that the efforts complement each other. In this spirit, this white paper describes the R&D activities required to prepare for this software upgrade.

*"**Evolutionary change towards HL-LHC is required**, as the experiments will continue to use the current system. Mapping out a path for migration then requires a fuller understanding of the costs and benefits of the proposed changes. A model is needed in which the benefits of such changes can be evaluated, taking into account hardware and human costs, as well as the impact on software and workload performance that in turn leads to physics impact."*

https://arxiv.org/abs/1712.06982

Our infrastructure needs to evolve and it seems clear it'll be in an open ecosystem - but HOW?



Alessandra Forti @ NYU, June 2019

MANCHESTER 1824

GridPP UK Computing for Particle Physics

Not our software anymore

- EDG/EGEE/EGI/OSG/WLCG/....
  - HEP dictated the middleware development direction
  - Grid is a HEP product
- Containers eco-system is not our sw/infrastructure anymore
  - More people use it, fix bugs etc
  - Easier to integrate with other infrastructures
  - Development not in our control, need to be part of the open source community
- Example of a successful collaboration CERN/Openstack

We will need to evolve our facilities like we evolve our software- SLATE has a role to play

A fundamental **redesign** of our Tier2 complex is needed to provide **flexibility** to innovate services (CI/CD pipelines), **reproducibility** to ensure reliability, and **security** to sustain new operations models

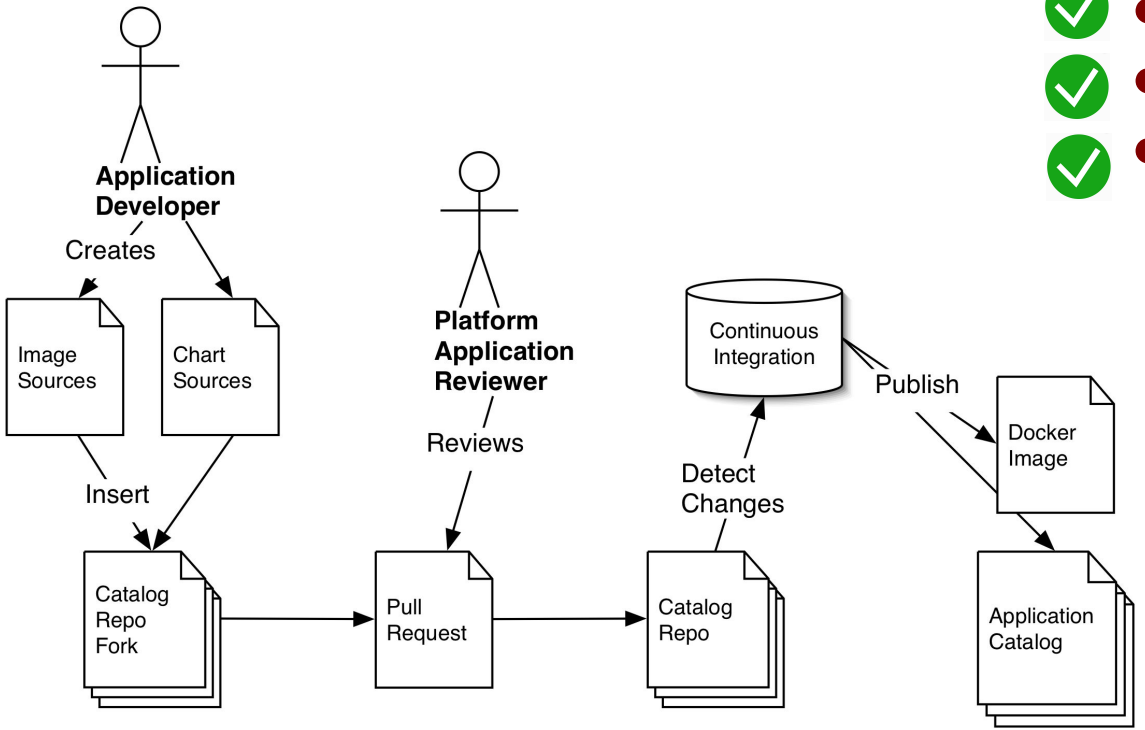
Challenges..

- **Site policies**
- Antiquated trust models
- Legacy services
- Legacy admin practices
- Social resistance

(As far as we know, photo is public domain)

SLATE Requires a New Trust Model

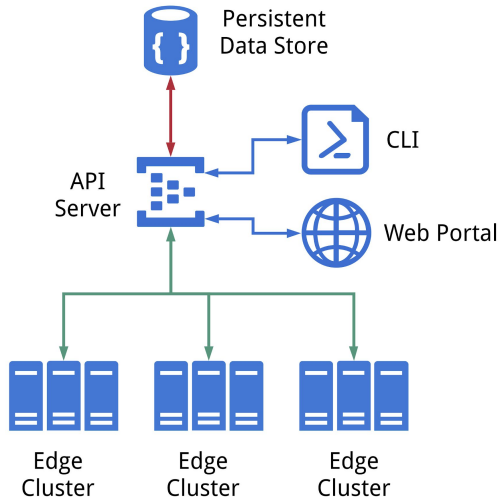
… to gain adoption, site incentives are needed



- TrustedCI.org engagement
- OSG container security
- WLCG SLATE security working group formed (see David Crook's presentation)

The SLATE Architecture

- Lightweight federation and application catalog layer on top of **Kubernetes**
  - Security-conscious, site autonomous
  - Sites retain administrative control
- Single entrypoint using institutional identity
- Simple UNIX-like permissions model (Users + Groups)
- **Application catalog** provides natural boundary between configuration knobs users actually want to change and complex Kubernetes configurations
- SLATE is an infrastructure **and software**



Create & manage your own federation over independently managed Kubernetes clusters

General SLATE News

- New applications added to the stable catalog
  - perfSONAR Testpoint
  - GridFTP
  - Globus Connect v4
  - Faucet SDN controller
- HTCondor-CE close to being ready
- New clusters at: **Clemson**, **UWashington, IU**
- Other applications, improvements here: https://portal.slateci.io (have a look!)

SLATE status at US sites

- **AGLT2** (UM), **MWT2** (UC) have SLATE nodes
  - XCache up and running, being tested and managed by deployment team
  - Frontier-Squid caches
- **SWT2** in progress; **NET2** planning
- At **MWT2** is also starting to migrate existing site services to **SLATE**
- Deployed on IRIS-HEP SSL cluster at UChicago

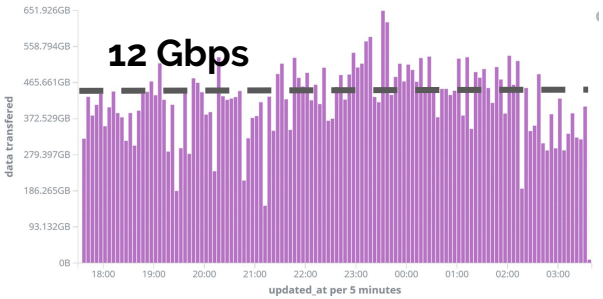
Vulnerability patching via SLATE

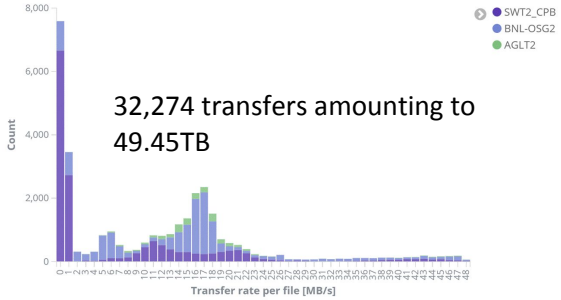
- OSG announced a vulnerability in Frontier Squid on July 26
  - **you *have* all updated right?** ☺
- SLATE instances were all updated within the hour, simply via:

```
for i in $(slate instance list | grep squid | awk '{print $4}');
do
   slate instance restart $i
done
```

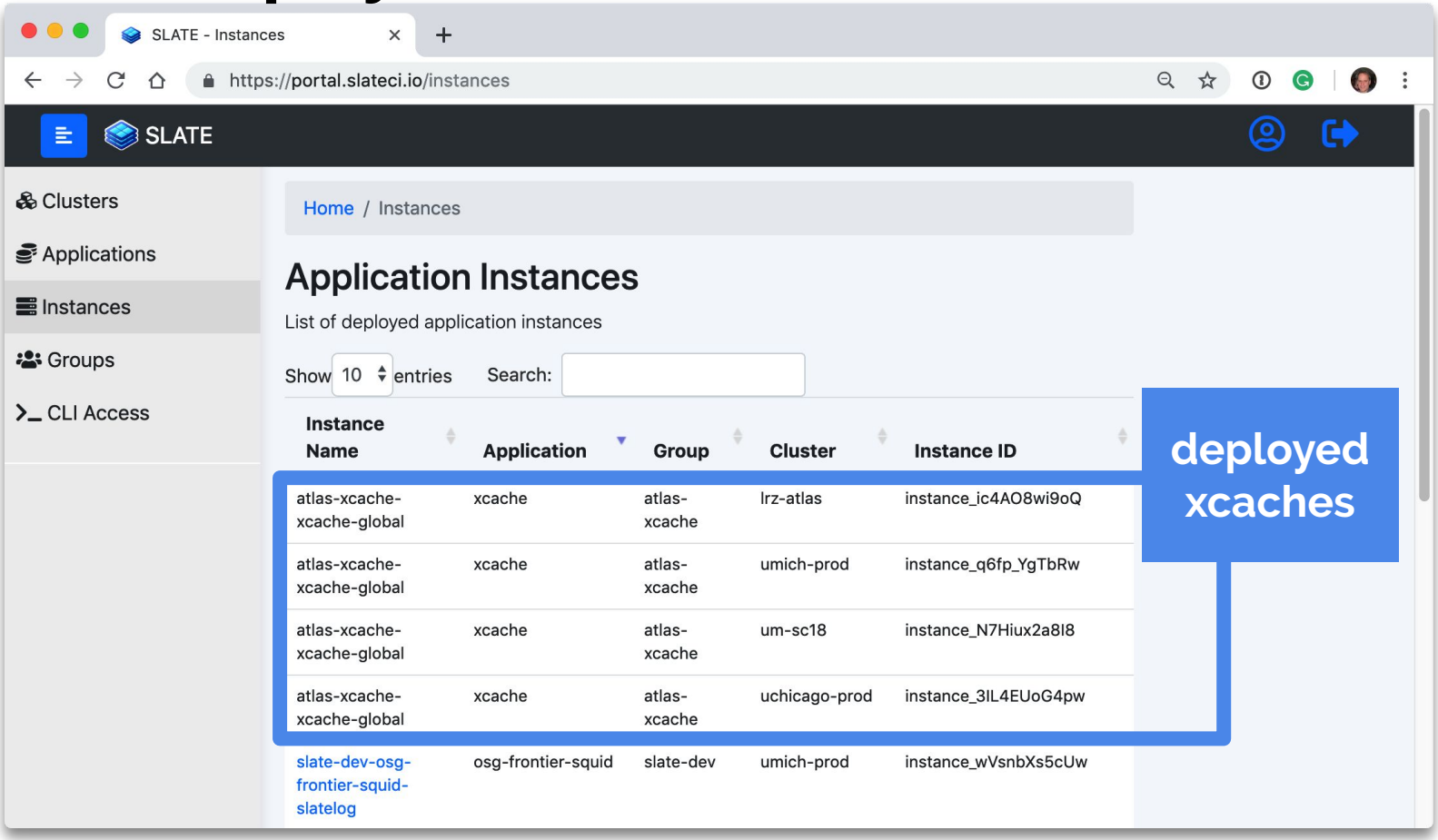
SLATE and XCache

- **ATLAS** is using **SLATE** to deploy an XCache-based (XRootD caching) cache network at sites
- Have been working with **ESNet** to deploy XCache *in* the network fabric, one cache up & running in production
- **Cache deployment done entirely by XCache team** - Operators in **ESNet** needed only set up the host and firewall rules for us.





SLATE Deploy XCaches



XCache updates

- Even simpler
- Completely transparent to site admin.

```
$ slate instance list
$ slate instance delete <instance name>
$ slate app install --group atlas-xcache --cluster uchicago-prod --conf MWT2.yaml xcache
```

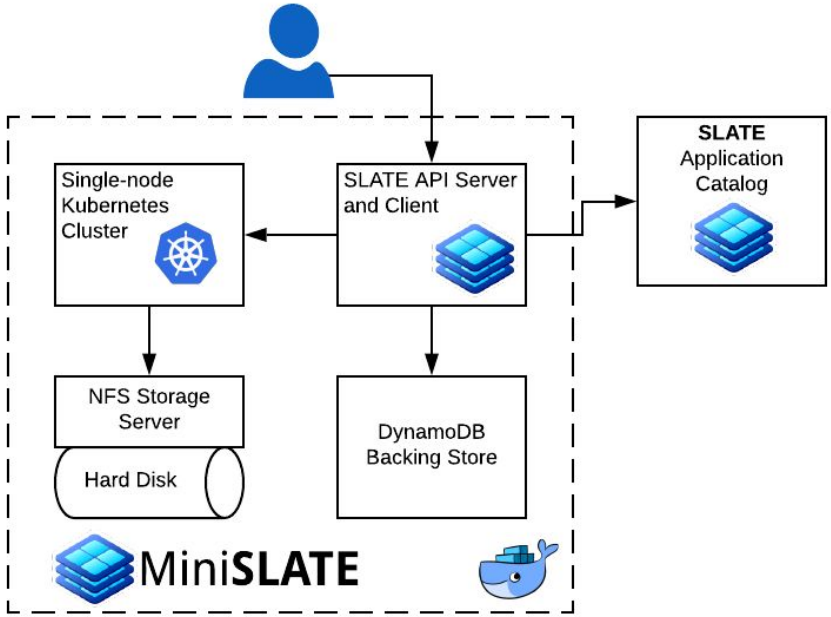
Additional benefits:

- Automatic core dump collection (part of XCache)
- Containerized environment makes it easier to debug

MiniSLATE

A development environment for SLATE

- **Create a stand alone, miniature SLATE federation for development**
- Follows an Infrastructure as Code pattern
- Enclosed within Docker
  - Little dependency clutter
    - Python, Docker, Docker-Compose
  - Environment consistency
- Completely Destructible
  - Destroy and recreate at will
  - Mount code from host safely
- Batteries Included
  - Full development kit
  - All required software and useful tools are installed when the Docker image is built

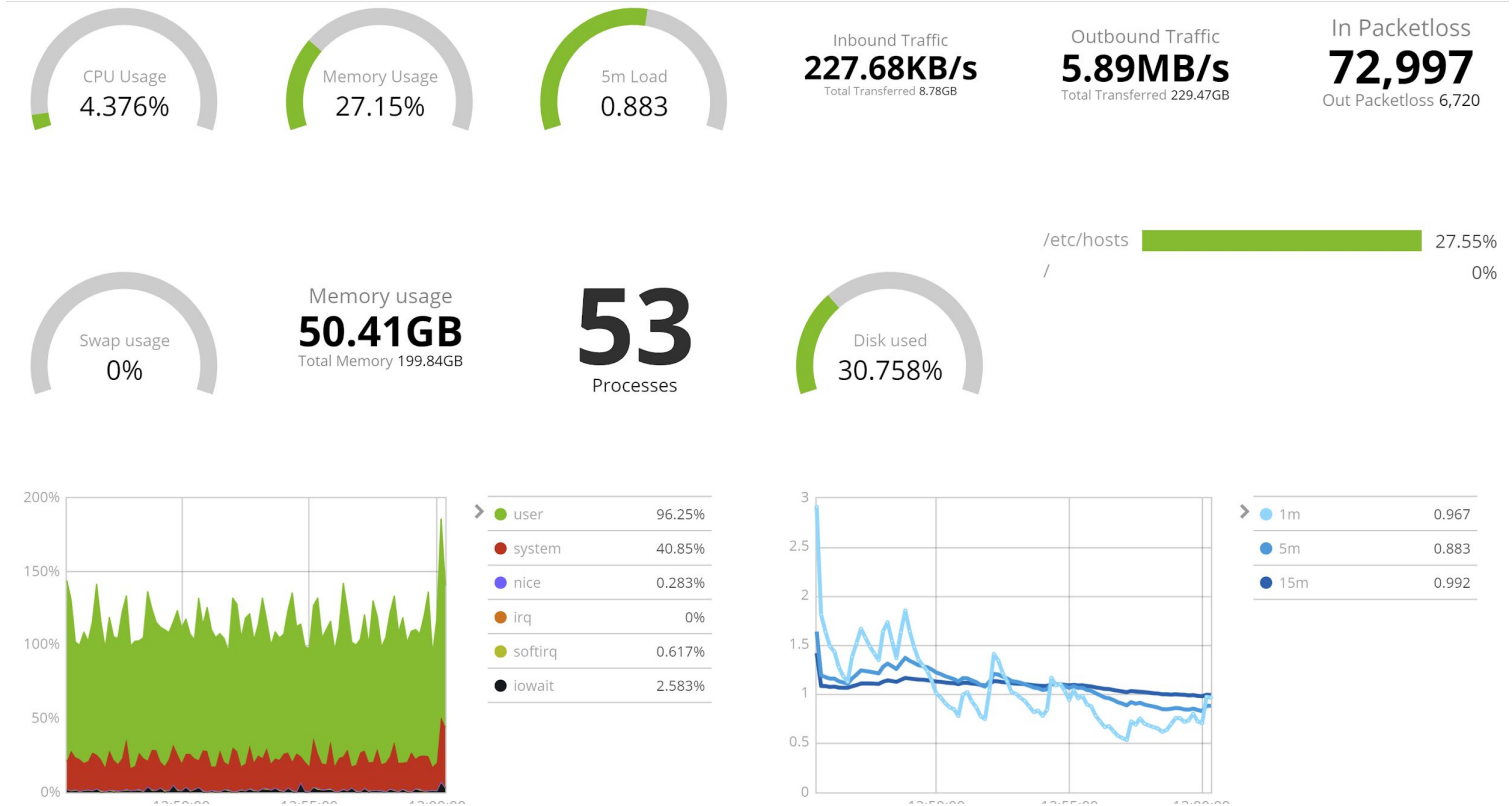


Installing Mini**SLATE** (https://github.com/slateci/minislate)

```
$ git clone https://github.com/slateci/minislate.git
Cloning into 'minislate'...
$ cd minislate
$ ./minislate init
(...)
DONE! MiniSLATE is now initialized.
$ ./minislate slate app install nginx --group ms-group --cluster ms-c

Installing application...
...
Successfully installed application nginx as instance ms-group-nginx-default with ID
instance_tey72YzGYuw
```

SLATE Monitoring - ES & Kibana

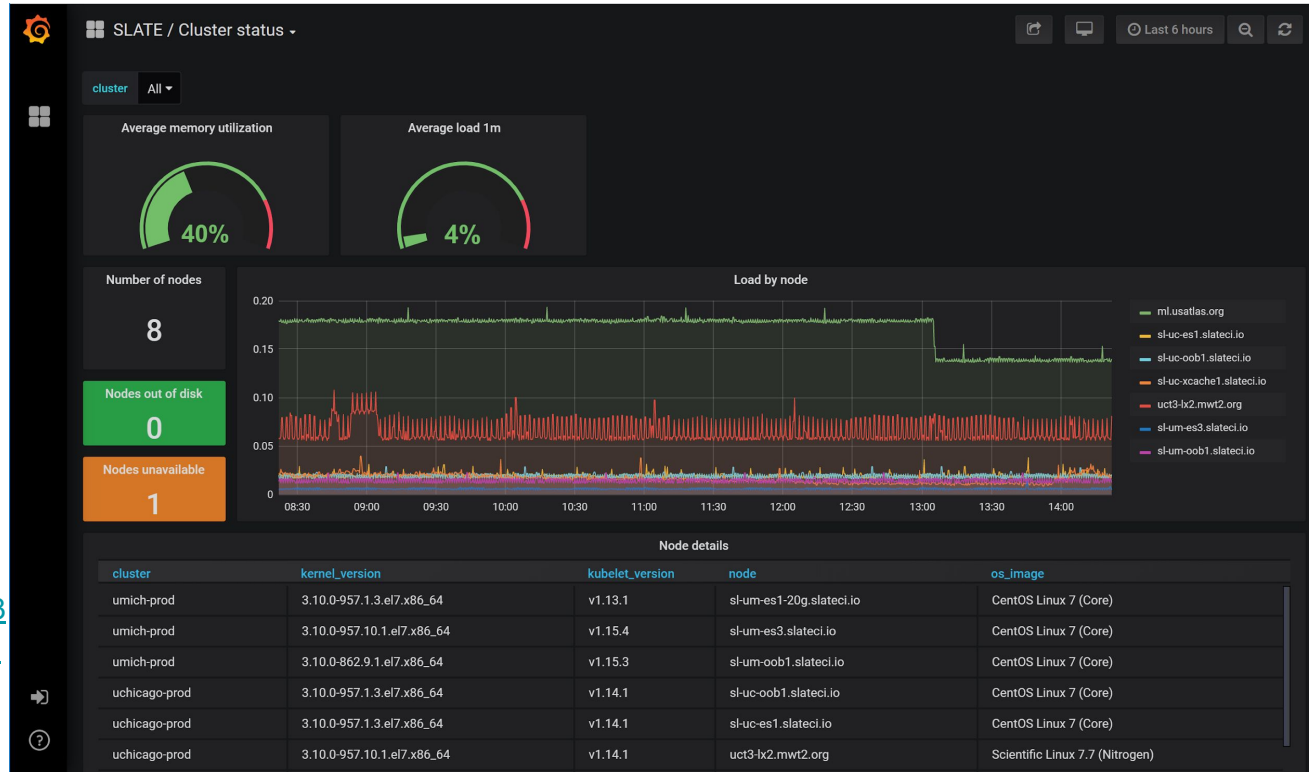


SLATE Grafana Dashboards - Beta Version

We have set up our SLATE clusters to report metrics for display by Grafana

We are collaborating with the OSiRIS project, hosting monitoring data in OSiRIS S3 buckets

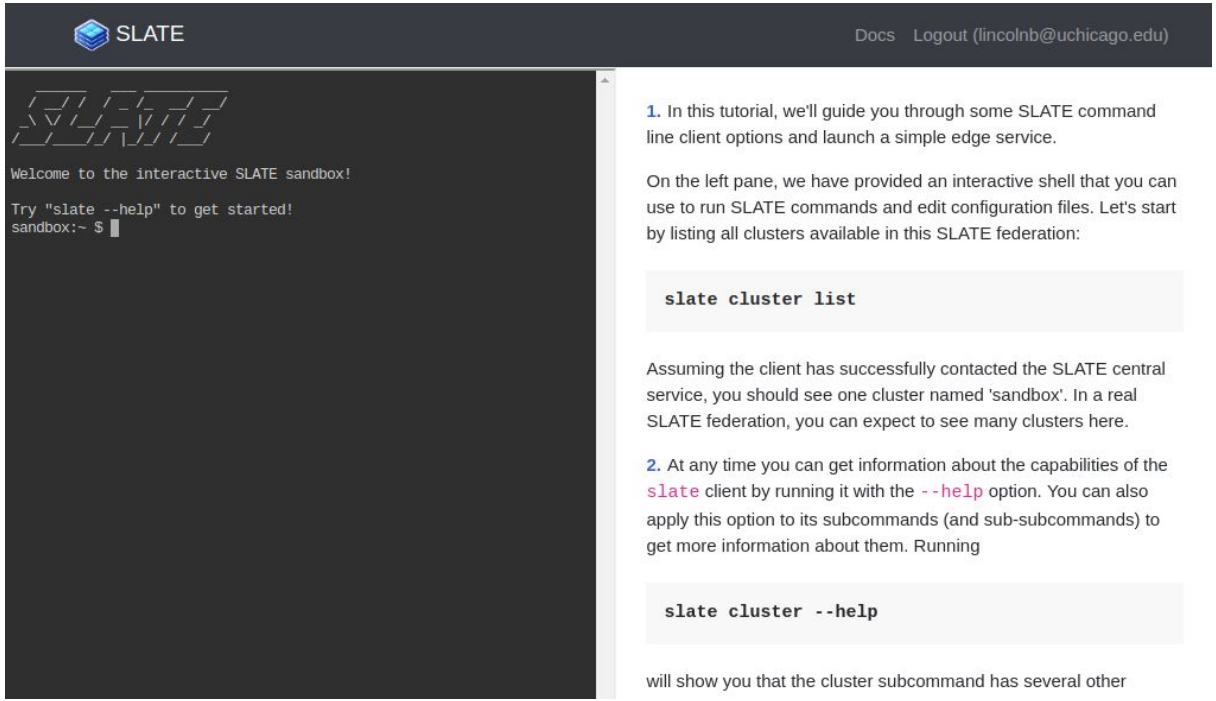
Live dashboard link -> http://monitoring.umich-prod.slateci.net/d/3T3FQKnZk/slate-cluster-status?orgId=1&var-cluster=All



Interested? Get a feel for SLATE via the SLATE "Sandbox"

- Start a tutorial environment inside a kubernetes pod with the slate client
  - **Runs an instance of the SLATE API and exposes the cluster**
- **Anyone** can make a temporary account, try out the command line interface, and deploy a simple web server application

https://sandbox.slateci.io/



SLATE provisioning options

- **SLATE**Lite (for a quick evaluation using Docker):
  - https://github.com/slateci/slatelite
- Zero to k8s+**SLATE** script on a bare edge server:
  - Installs everything necessary starting from a fresh CentOS system
    http://jenkins.slateci.io/artifacts/scripts/install-slate.sh
- "Managed" install
  - **We** will SSH to your site, set it up, and hand you the configured machine.
- Full install
  - **You** install Kubernetes, download **SLATE** client and register your cluster
- **Please try it out at your site!**

Conclusion

- While the **grid model** and **software** will evolve, certain principles will always remain in our domain:
  - **distributed trust, resource aggregation & sharing, central & local ops**
- But we need **new** ones too:
  - **declarative, reproducible infrastructure** (as code)
  - federation operations (towards "NoOps")
  - open source technology alignment and leverage
- Initial efforts are promising but will require broad community buy-in and contributed efforts
- **SLATE** is eager to contribute to **next-gen TierN design**

Acknowledgements

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Many thanks to my **SLATE colleagues** for much of the content of the presentation, especially **Rob Gardner** and **Lincoln Bryant**!

Questions?

Extra slides

Analysis Systems & DOMA SSL Blueprint

- June 21-22, 2019 @ NYU
- Engagement with AS team, SSL team and representatives from NCSA, SDSC, NYU Research Computing, Google and RedHat (26 participants)
- Key outcomes (doc):
  - **Kubernetes as "common denominator"**
  - **Federated "substrate" project identified**