SSL Architecture

hybrid systems, deployments, developer support

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Desired SSL capabilities

- Support a diverse catalog of deployment patterns & models
- Experiment patterns (scalability tests)
- Usability
  - Modality, Reservation
  - Metrics, logging, analytics
- Operation & Support
- Openness
  - to providers to contribute
  - to developers to conduct experiments
- Recording value
  - Analysis platform "blueprints" :
    - Single site/region deployments
    - Multi-region deployment
    - Multi-cloud hybrids – e.g. SSL+GCP+CERN, etc..
  - Demonstrations & archival of demo artifacts

An architecture that implements...

- a community platform
- supports groups and projects
- bespoke resources & configurations
- declarative & reproducible deployments
- services to build & manage artifacts
- scalable up and back down
- reduce cognitive load for developers and deployers

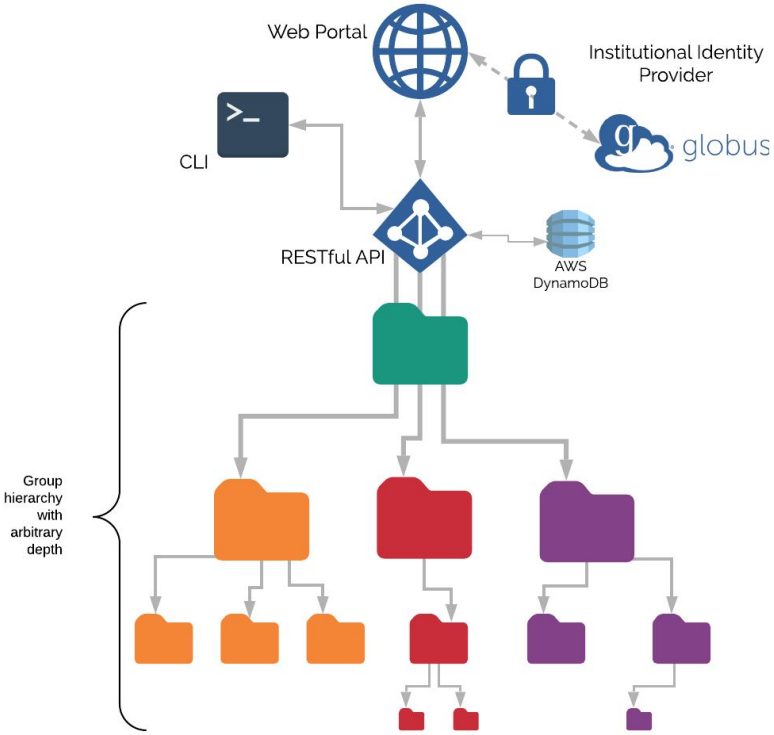
Some ingredients..

Community platform

- Open to all working on software infrastructure in HEP
- CILogon, Globus to provide single-sign on and federated identity
- Lightweight user and group (project) management system
- Infrastructure itself composable, reusable

Groups and projects

- Web and CLI interfaces for user management
- Groups organized as a tree structure with arbitrary depth
- Users can invite others, create sub groups, etc.
- Smart clients inspect the tree and implement appropriate provisioning of resources



Resources

- Mix of bespoke dedicated resources and capability for users to bring allocations on others
- Container-based service orchestration on dedicated resources
- VC3-like technology to connect to HPC/HTC resources for batch
- Facilitate integration of commercial cloud resources when needed

CS cluster – SSL base platform services

- Repurposed UChicago CS research cluster
- Vintage but nice: (~50)
  - CPU: 2 x Intel Xeon E2650 v3 12-core processor, 2.3GHz, 30MB cache
  - DRAM: 16 x 16GB TruDDR4 Memory 2133MHz, 256GB
  - Disks: 2 x 800GB SATA MLC SSD, 1.6TB
  - 10G NICs
- 2x40 Gbps to SciDMZ
- Rebuilding as Kubernetes
- Explore federation to aggregate w/ others

Federated ID access (institutional, CERN account), edge services hosting, Unix account provisioning, LHC software env.

Orchestrating services in the SSL

- Need flexible infrastructure for supporting the workloads we expect from SSL
- Dynamically reconfigure existing hardware to be a HTCondor cluster today, Spark tomorrow, whatever is needed.
- Containerized services are getting a lot of attention in Industry right now– can we take advantage of the momentum?
- Want to "glue" clusters together, but abstract away infrastructure to whatever extent possible – clear a smooth road for the developers
- Potentially mimic cloud native groupings: e.g. create "zones" of resources

Kubernetes (k8s)

- Open source container orchestration platform
- Automate deployment, management, scaling
- Has origins in Google/Borg
- Supported/managed by Cloud Native Foundation
- Declarative model for deployments

Declarative infrastructure

- Want infrastructure built under the SSL to be easily reusable and deployable to other sites
  - No more twikis with install guides!
- Declarative nature of Kubernetes is a good fit and gets us a long way down that road.
- SSL as an incubator for projects which then "graduate" to become full-fledged infrastructures that run on production resources.

Federating platforms

- Expect users to outgrow the dedicated pool of resources we have now.
- Need an interface and mechanism to allow users of the SSL reach into resources at a heterogeneous collection of sites
- Many approaches in the Kubernetes community, waiting to see what survives & what will be most appropriate for us

Extending into HPC/HTC

- Foresee workloads that require some service infrastructure in the SSL, but want to do batch computing elsewhere
- Want to facilitate by using technologies derived from VC3, HEPCloud and others
- Provision compute schedulers, data managers on SSL, schedule workers to HPC resources via overlays

Artifact build and management

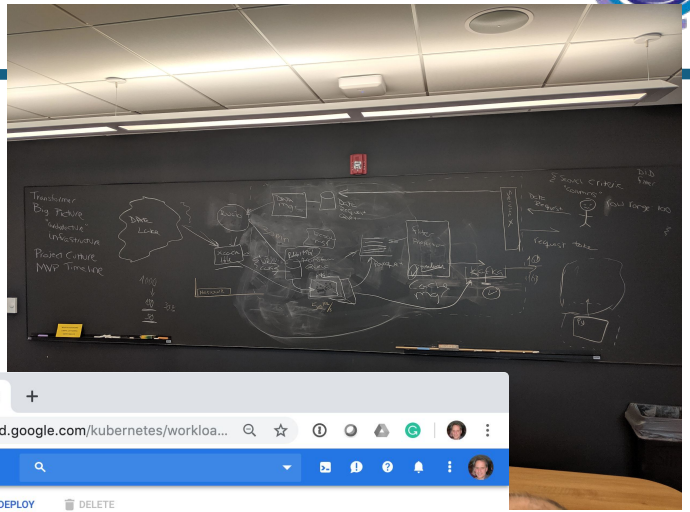
- Provide resources for building and registering containers, compiling software, etc.
- Off-the-shelf tools plugged into SSL resources with a little bit of glue.
  - Why wait 30 minutes for DockerHub to build your container?
- Is this obviated by CERN services? Perhaps more valuable for non-LHC experiments

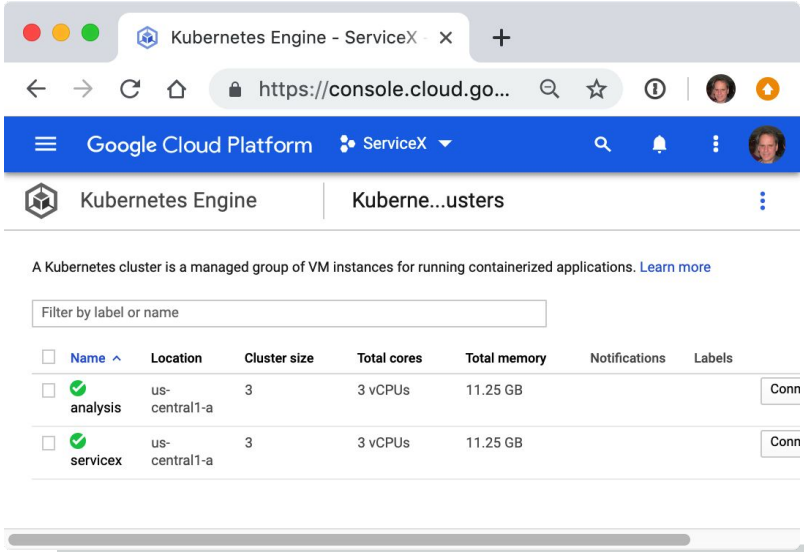
SSL "Glass"

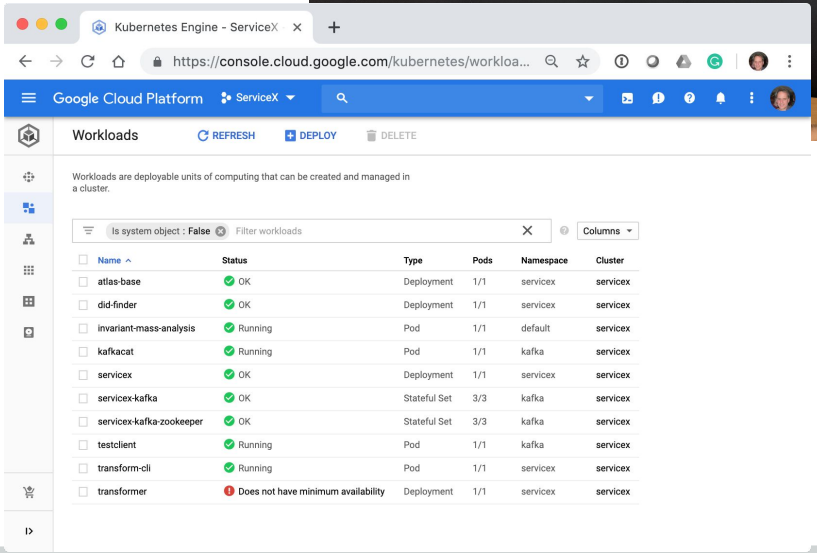
- Portal for visibility and organization
  - groups (projects)
  - resources
  - artifacts
- Metrics, logging, analytics
- Regional, national and international scopes

WBS 6.3 Functional Testing

Until SSL base platform operational we can use GKE for testing. Early deployments for iDDS/ServiceX







Current status

- Group/identity bits are being developed for multiple projects, being repurposed for SSL.
- Kubernetes conversion of River cluster underway.
  - 4 nodes online, backfilling w/ OSG via SLATE
  - Brave early adopters come talk to me afterwards!
- Looking for partners to contribute infrastructure and a bit of effort – experiment with how to federate resources.

Wrap up

- To briefly recap:
  - Institutional Identity and group management
  - Container-based, declarative software deployment and service orchestration
  - Mix of dedicated and non-dedicated resources
  - Exploring options for Federation
  - Building tightly integrated "pane of glass" for it all
- Integrate with industry best practices where practical!

Discussion

- All of this is very nice, but we need to meet the needs of the community.
- We need input from Analysis Systems and others!