CU Boulder Research Computing

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CU Boulder Research Computing

- Large scale computing
- High-performance networking
- Research data management and storage
- Consulting and training

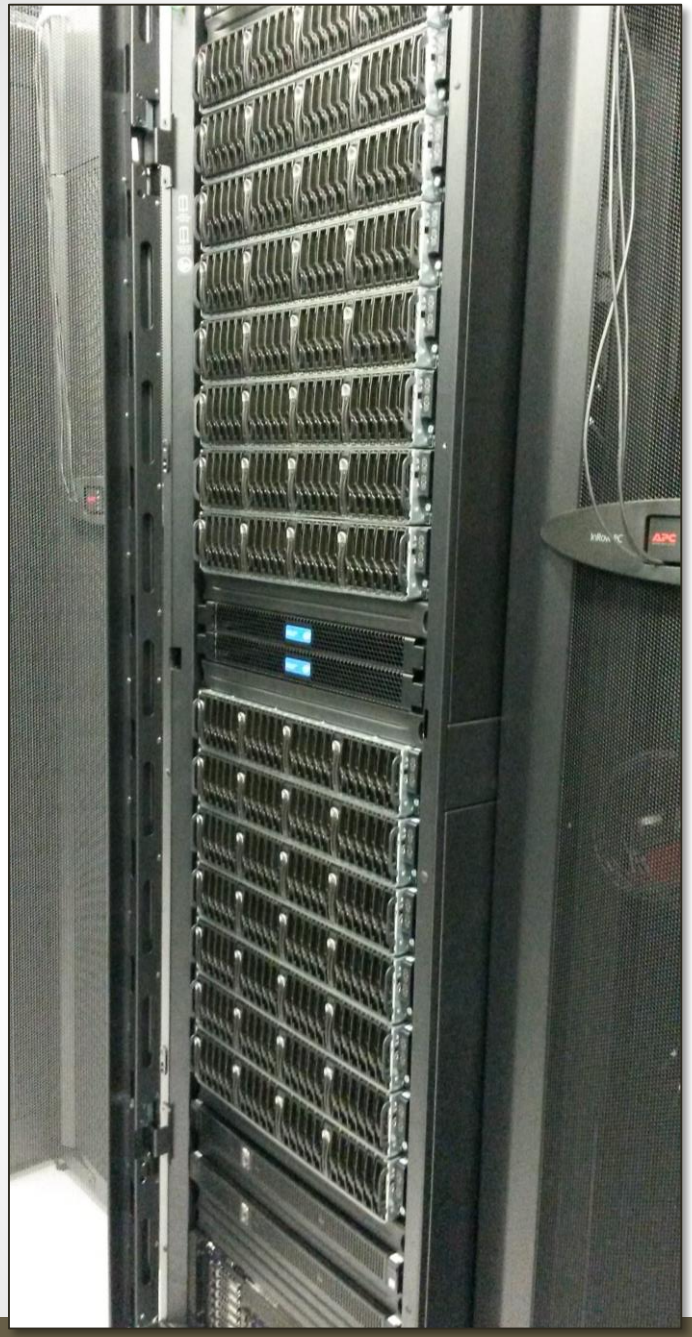
RMACC Summit: A next-generation compute cluster

- Funded via an NSF MRI grant awarded jointly to CU Boulder and CSU
- Installed and tested in second half of 2016
- In full production early February 2017
- Theoretical peak performance nearly 500 TFLOPS
  - Compared with about 170 for Janus
- Mix of established and cutting-edge technology

PowerEdge C6320[p] (shas, sknl)

PowerEdge C4130 (sgpu)

PowerEdge R930 (smem)



DDN SFA14k “GRIDScaler”

Summit specs

- About 500 compute nodes
- shas: 2x12 core, 128 GB RAM ea.
- sgpu: 2x NVIDIA K80 ea.
- smem: 4x12 core, 2048 GB RAM ea.
- sknl: 68 cores (276 threads) ea.
- 1.2 PB parallel scratch storage (GPFS)
- 100 Gb/s Omni-Path network (2:1)

Other compute resources

- “Blanca” condo cluster
  - Buy your own nodes
  - Get priority queue access on your nodes
  - Use other nodes if they’re idle
- “Sneffels” visualization cluster
  - High-performance remote desktop for graphics-intensive applications

PetaLibrary research data storage

- “Active” Storage - $65 / TB / yr
  - For data that is frequently used
  - Always on spinning disk
  - Mounted on all RC nodes
- “Archive” Storage - $35 / TB / yr
  - For infrequently used data that must still be retained
  - Older files are automatically migrated to tape

High-performance network

- “Science Network” and “Science DMZ” for fast access to open research data
- All RC systems are on the Science Network
  - departments can connect as well
- 80 Gb/s Ethernet backbone; 10 Gb/s into departments
- Dedicated border router for research traffic

CU Border: Science DMZ

University of Colorado Boulder
New Border

OIT Networking - Confidential & Restricted Data

Created by: Conan Moore
Senior Network Engineer
Office of Information Technology & Research Computing
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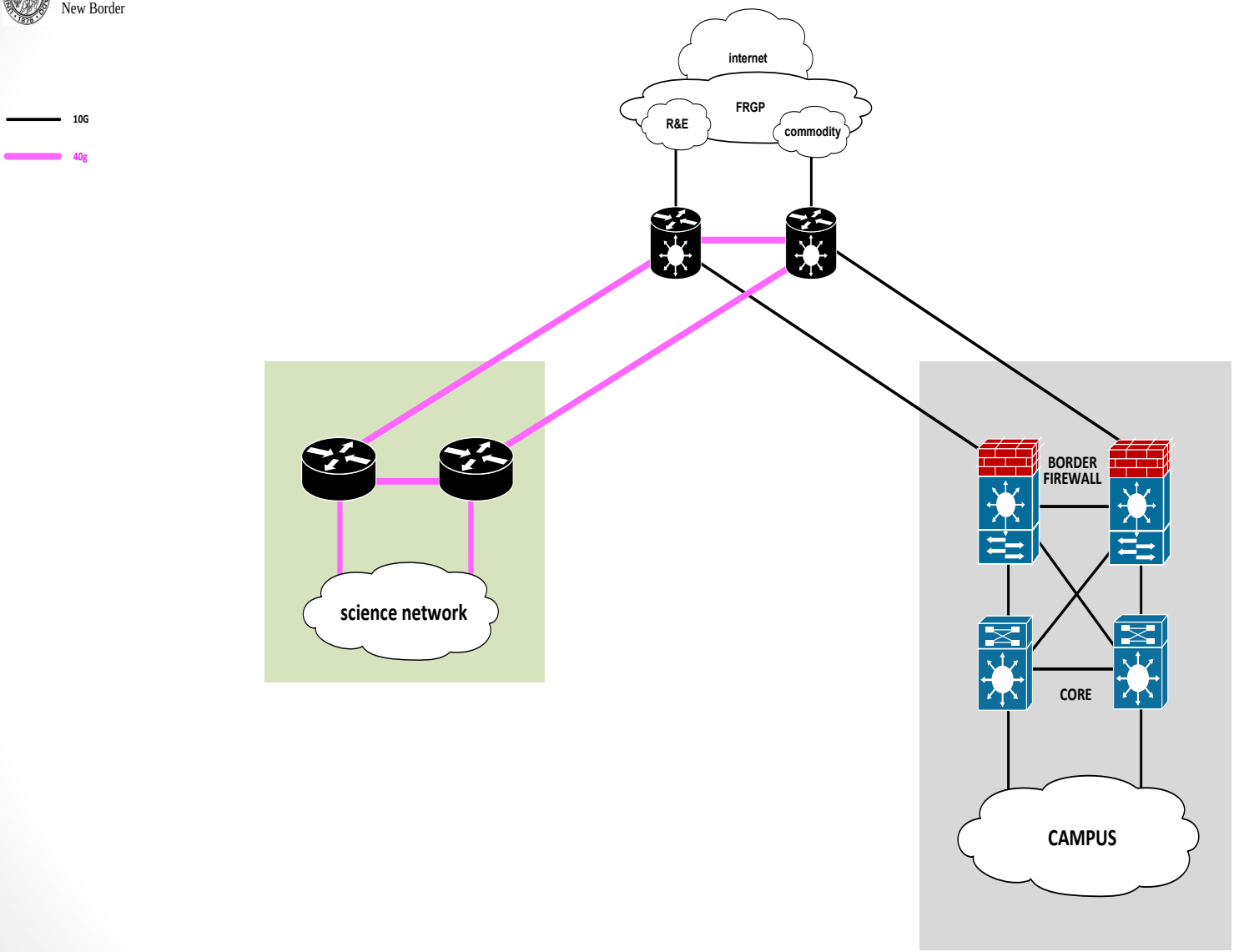


Teaching and Training

- New user seminars – every 4-6 weeks
- Meetups – weekly
- Tutorials
- Workshops
- XSEDE webcasted seminars
- Customized training for groups or depts
- Summer HPC symposium (rmacc.org)

- Consulting on all HPC topics
- Assistance with XSEDE, grants, …

Research Data Management

- Consulting on “data management plans” for grant applications
- Assistance with archiving and publishing data sets
- Discipline-specific support
- Workshops and training
- Newly created “Center for Research Data and Digital Scholarship”
- Email data-help@colorado.edu

Current Events

- Summit acceptance testing results and production experiences
- Summit “condo” contribution
- Janus decommissioning
- HPCF UPS
- RMACC access to Summit via XSEDE
- CESM port and testing

Current Events

Summit acceptance testing and production

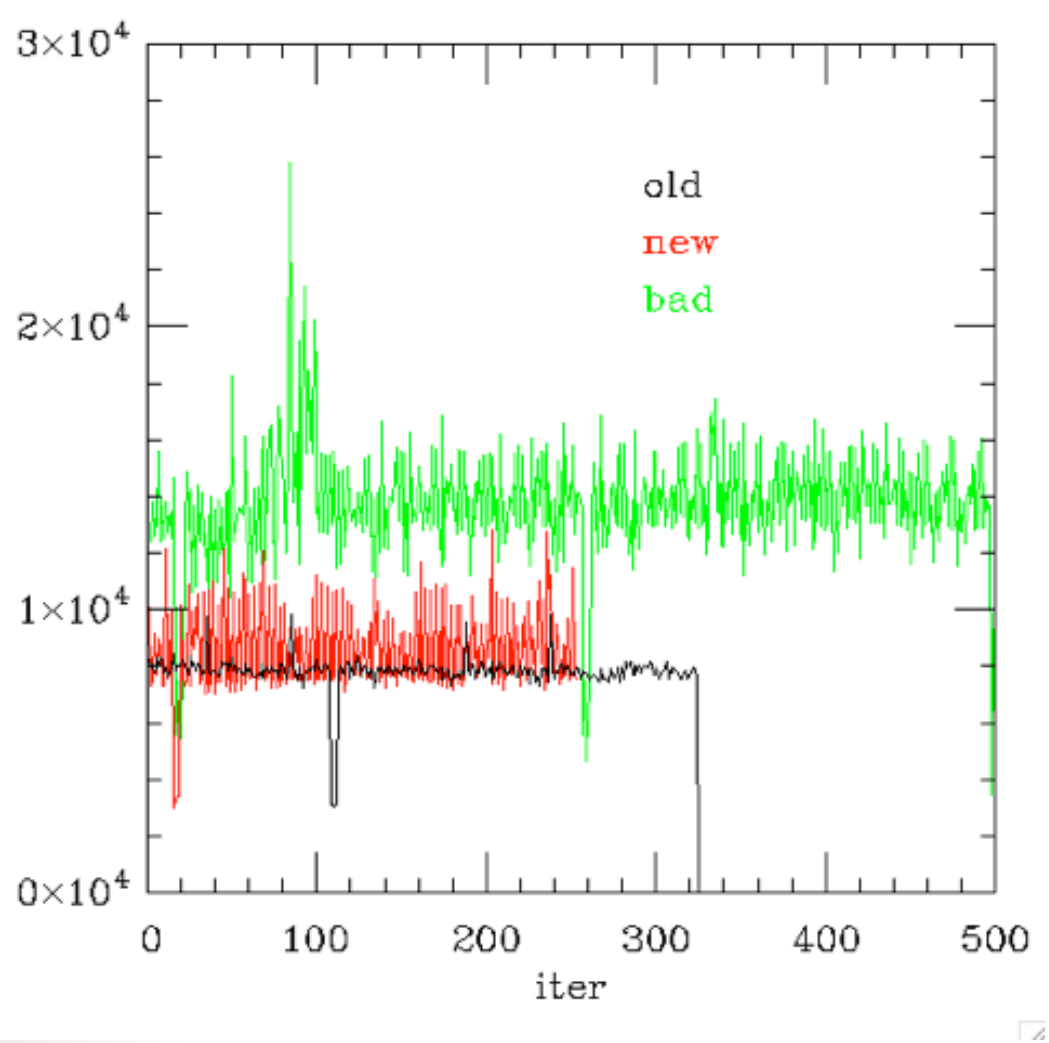
- shas: 762 GFLOPS/node, 279 TFLOPS aggregate (HPL, 380 nodes)
- sgpu: 37 TFLOPS aggregate
- smem: 7 TFLOPS aggregate
- sknl: 1,920 GFLOPS/node
- OPA: 175 Gbps using osu_bibw on shas pairs
  - Eventually saw line-rate on sknl
  - 1.5 us average latency across the fabric
- GPFS (8 MiB block size)
  - >18,000 ops/s for both creation and deletion at all file sizes (mdtest)
  - initial bandwidth tests below acceptance criteria
  - added 50 NL-SAS drives
  - 21,039 MiB/s (write) and 21,875 MiB/s (read) (ior)

Current Events

Summit acceptance testing and production

Current Events

Summit acceptance testing and production



The effects of mmsysmon.py on an OPA-based system.

Current Events

Summit "condo" contribution

- Added 72 shas nodes
- Added 1 sgpu node
- Dedicated shares to condo contributors

Current Events

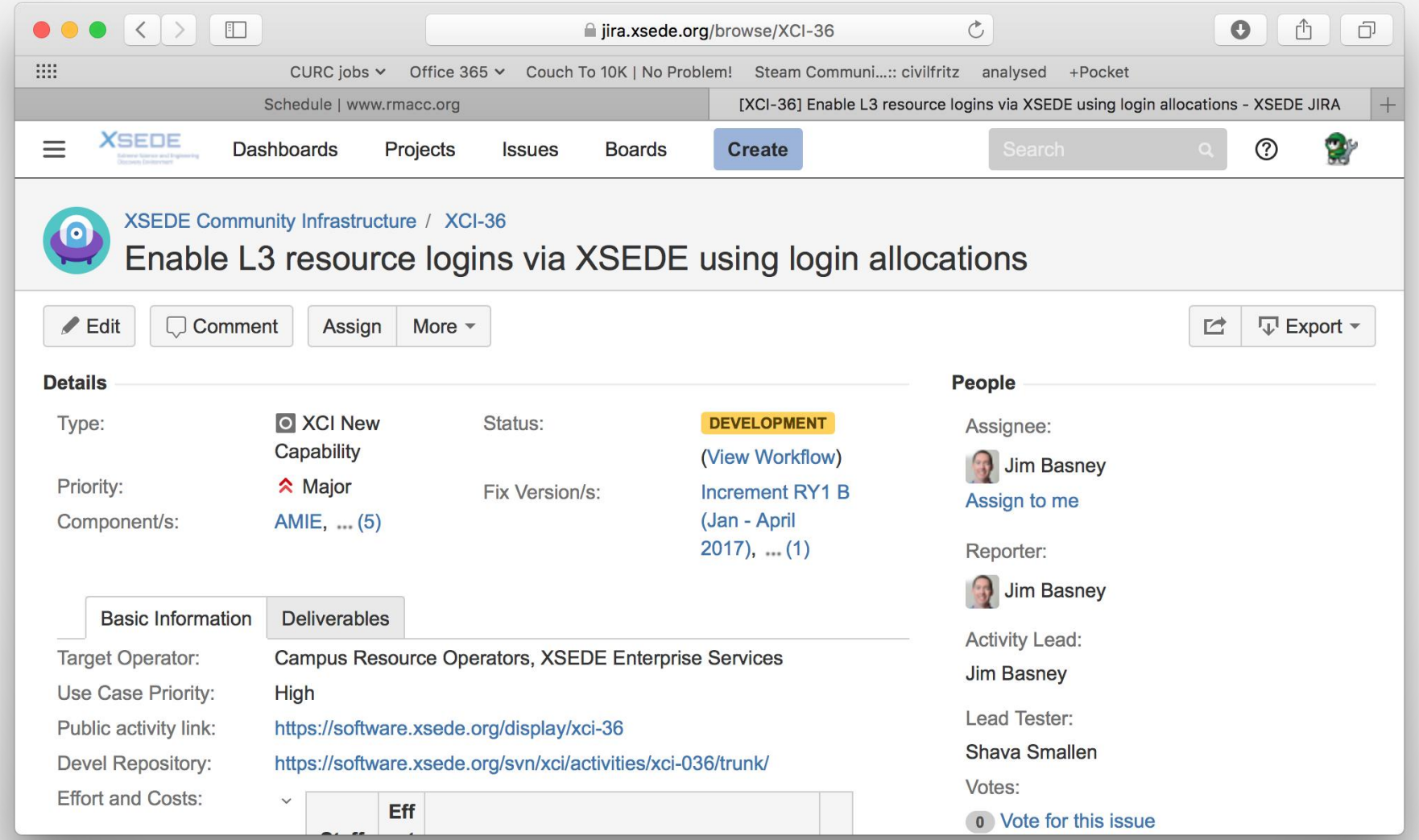
Janus decommissioning

Current Events

HPCF UPS

Current Events

RMACC access to Summit via XSEDE



Current Events

CESM port and testing

- Testing with both CESM-ECT and UF-CESM-ECT showed that Summit is well within the range of failure percents of other CESM-supported machines with fused-multiply-add disabled.

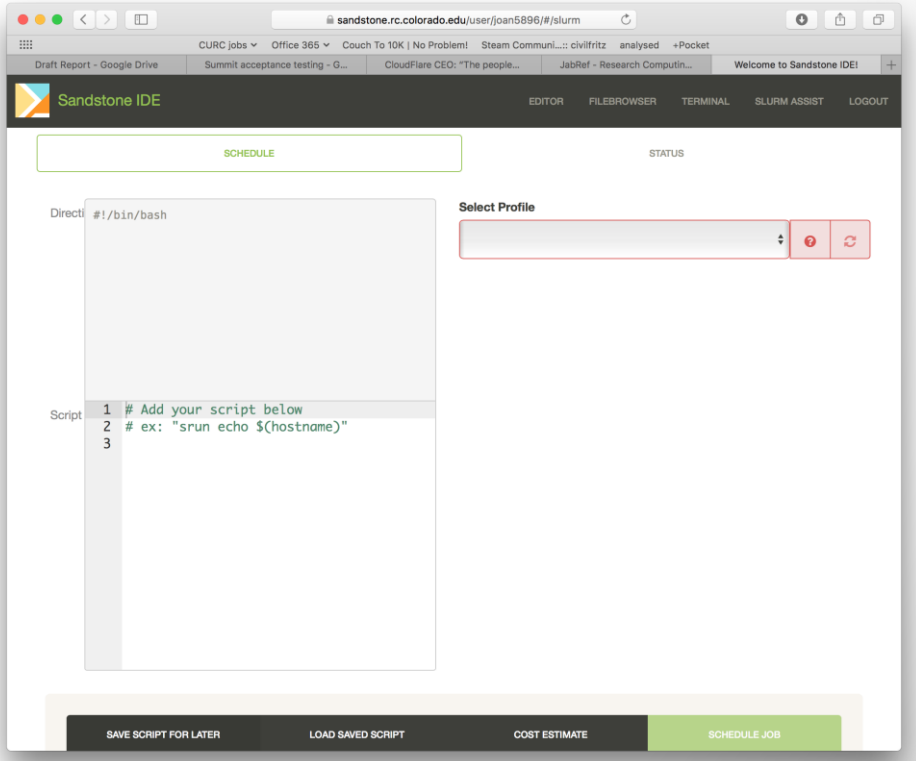
Ongoing development

and upcoming projects

- Sandstone HPC
- JupyterHub
- PetaLibrary/2
- Software provisioning and containerized workflows

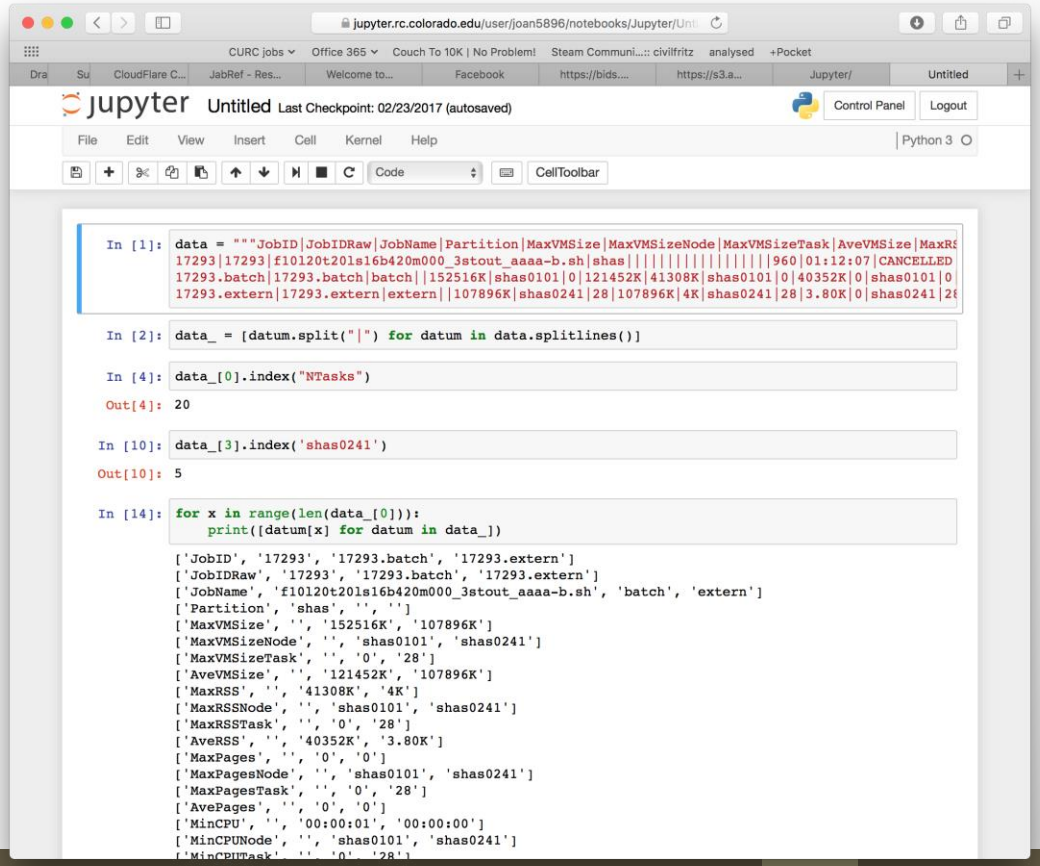
Sandstone HPC

- Web-based, visual utilities that facilitate access to HPC resources
- Code editor, file browser, web terminal, Slurm assistant
- Context-aware help system
- JupyterHub deployment
- Potential future JupyterLab integration



JupyterHub

- Multiple prototype deployments with a small user base
- Virtual and batch-scheduled HPC notebook servers from a single hub
- Continuing efforts to properly deploy for HPC users
- JupyterLab-based deployment coming next



PetaLibrary/2

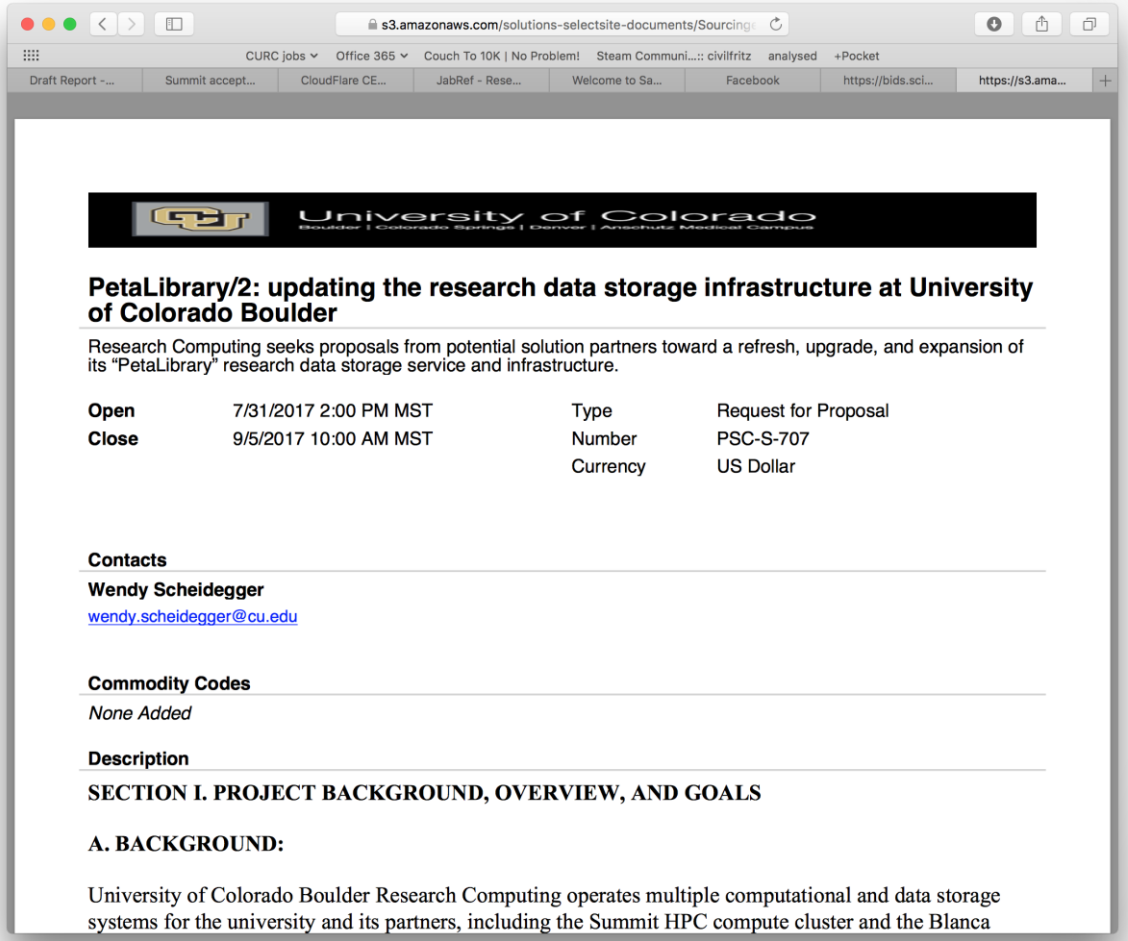
Monday, 31 July 2017
RFP Posted online

Friday, 4 August 2017
Pre-bid Q&A session

Friday, 11 August 2017
written questions are due

Tuesday, 5 September
RFP responses are due

Late Q1 2018
Production target



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