

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

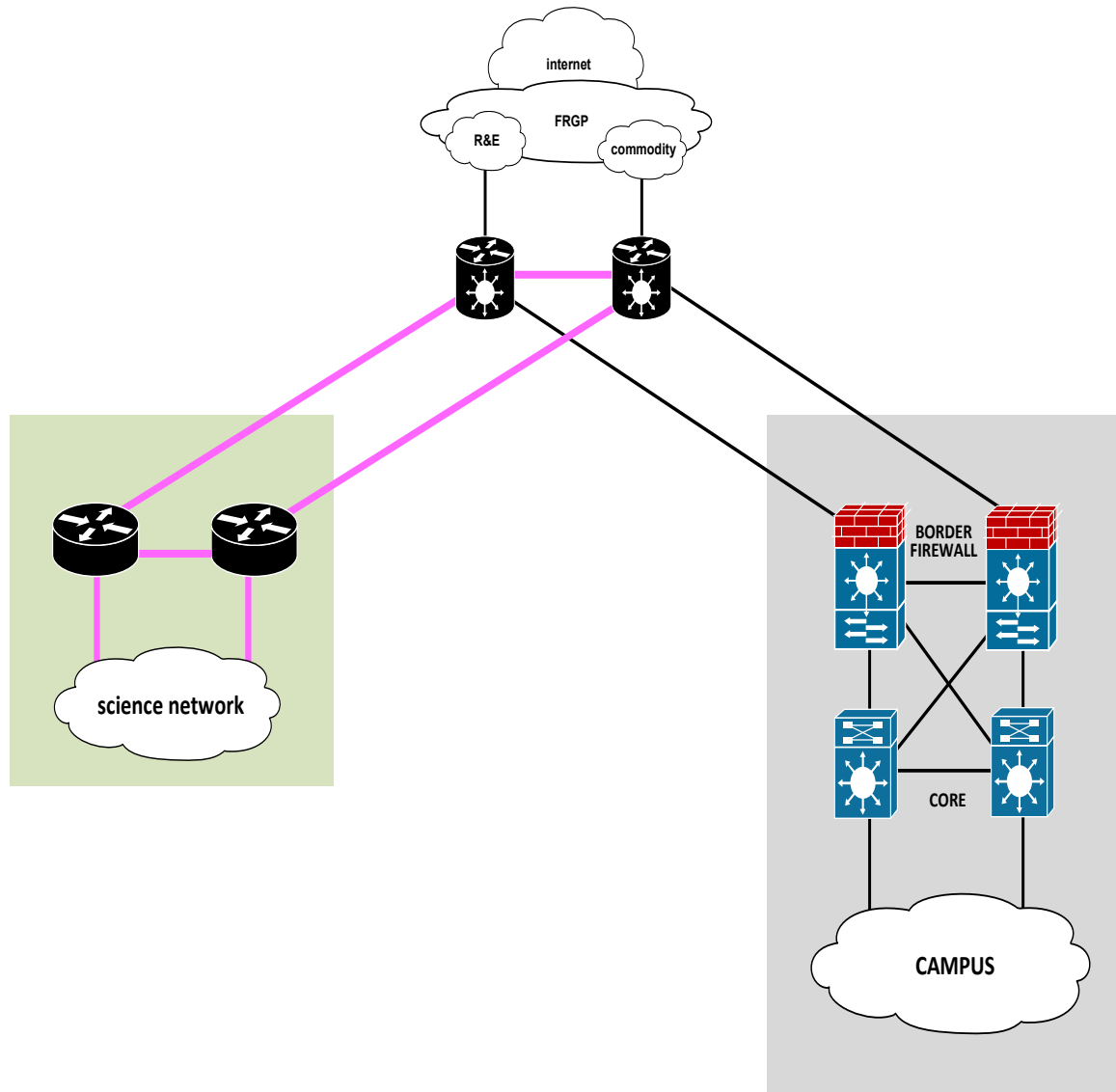


University of Colorado Boulder
New Border

OIT Networking - Confidential & Restricted Data

Created by: Conan Moore
Senior Network Engineer
Office of Information Technology &
Research Computing
University of Colorado at Boulder
303-735-5675
conan.moore@colorado.edu

— 10G
— 40g



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)

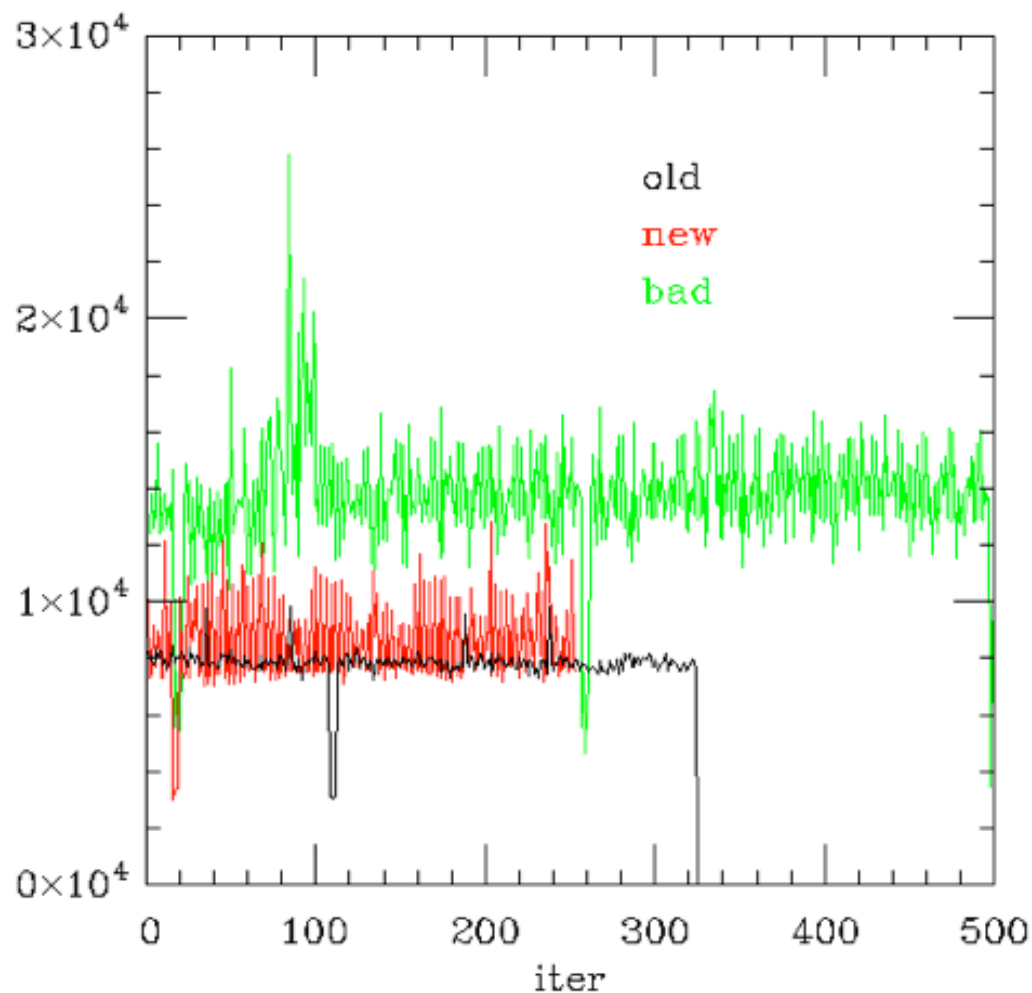
Current Events

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

The screenshot shows a web browser window displaying a Jira issue page. The browser's address bar shows the URL `jira.xsede.org/browse/XCI-36`. The page header includes navigation links for CURC jobs, Office 365, Couch To 10K, No Problem!, Steam Communi..., civilfritz, analysed, and +Pocket. Below the header, there's a search bar and a user profile icon. The main content area features the XSEDE logo and the issue title "Enable L3 resource logins via XSEDE using login allocations". The issue is categorized as "XCI-36". The issue details section shows the following information: Type: XCI New Capability, Status: DEVELOPMENT, Priority: Major, Fix Version/s: Increment RY1 B (Jan - April 2017), ... (1), Component/s: AMIE, ... (5). The "People" section lists the Assignee: Jim Basney, Reporter: Jim Basney, Activity Lead: Jim Basney, and Lead Tester: Shava Smallen. The "Votes" section shows 0 votes and a link to "Vote for this issue". The "Details" section is expanded, showing the "Basic Information" tab. The "Target Operator" is "Campus Resource Operators, XSEDE Enterprise Services", the "Use Case Priority" is "High", the "Public activity link" is <https://software.xsede.org/display/xci-36>, the "Devel Repository" is <https://software.xsede.org/svn/xci/activities/xci-036/trunk/>, and the "Effort and Costs" section shows a table with columns for "Eff" and "Costs".

Browser address bar: `jira.xsede.org/browse/XCI-36`

Page header: CURC jobs, Office 365, Couch To 10K | No Problem!, Steam Communi..., civilfritz, analysed, +Pocket

Search bar: Search

Issue title: Enable L3 resource logins via XSEDE using login allocations

Issue ID: XCI-36

Issue details:

- Type: XCI New Capability
- Status: DEVELOPMENT (View Workflow)
- Priority: Major
- Fix Version/s: Increment RY1 B (Jan - April 2017), ... (1)
- Component/s: AMIE, ... (5)

People:

- Assignee: Jim Basney (Assign to me)
- Reporter: Jim Basney
- Activity Lead: Jim Basney
- Lead Tester: Shava Smallen
- Votes: 0 (Vote for this issue)

Details:

- Target Operator: Campus Resource Operators, XSEDE Enterprise Services
- Use Case Priority: High
- Public activity link: <https://software.xsede.org/display/xci-36>
- Devel Repository: <https://software.xsede.org/svn/xci/activities/xci-036/trunk/>
- Effort and Costs: Eff, Costs

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.

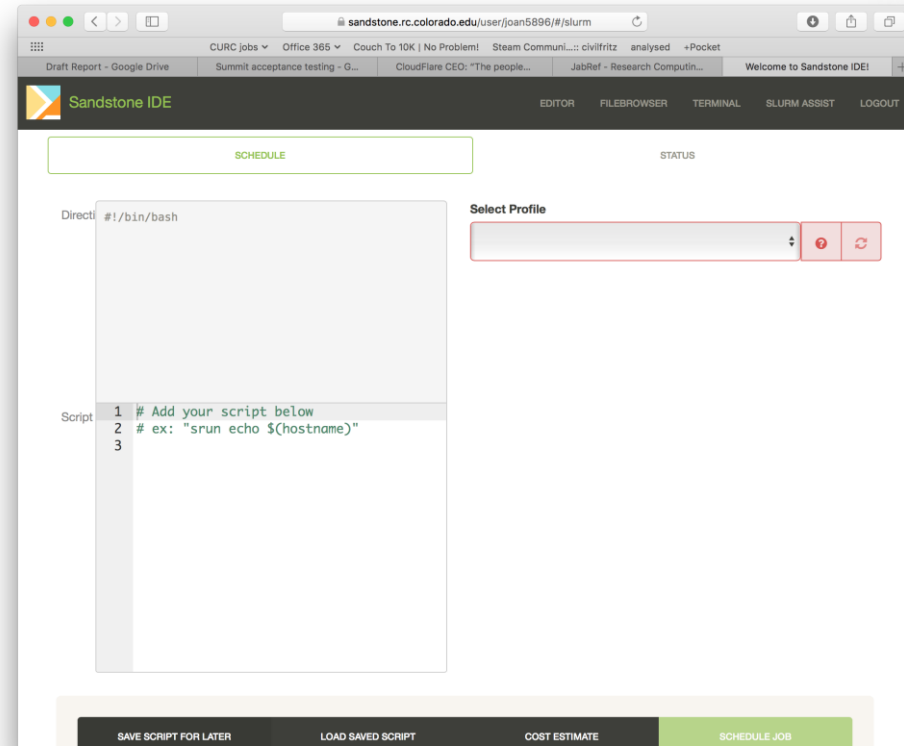
Ongoing development

and upcoming projects

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

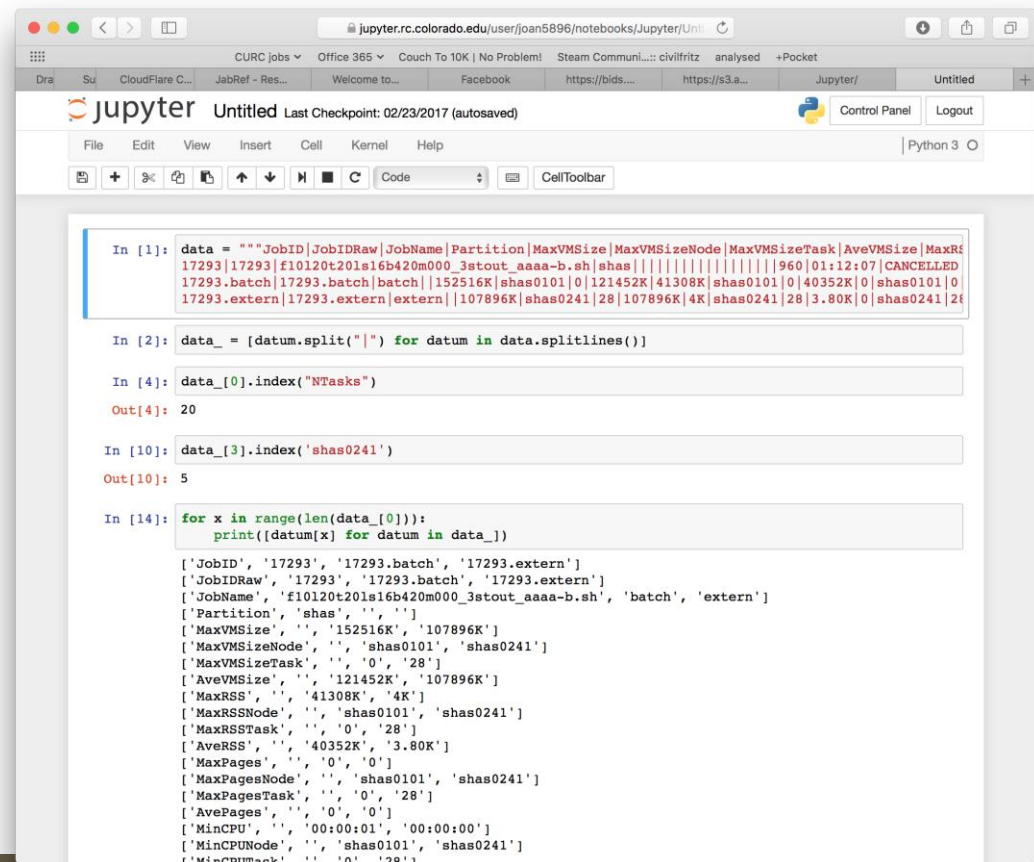
Sandstone HPC

- 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



The screenshot shows a Jupyter notebook interface in a web browser. The browser address bar shows the URL: `jupyter.rc.colorado.edu/user/joan5896/notebooks/Jupyter/Untitled`. The notebook has a menu bar with options: File, Edit, View, Insert, Cell, Kernel, Help. Below the menu bar is a toolbar with icons for file operations, cell execution, and kernel management. The notebook content area displays a series of code cells and their outputs.

```
In [1]: data = """JobID|JobIDRaw|JobName|Partition|MaxVMSize|MaxVMSizeNode|MaxVMSizeTask|AveVMSize|MaxRSS|
17293|17293|f10120t201s16b420m000_3stout_aaaa-b.sh|shas|17293|17293|17293|960|01:12:07|CANCELLED
17293.batch|17293.batch|batch|152516K|shas0101|0|121452K|41308K|shas0101|0|40352K|0|shas0101|0|
17293.extern|17293.extern|extern|107896K|shas0241|28|107896K|4K|shas0241|28|3.80K|0|shas0241|28|

In [2]: data_ = [datum.split("|") for datum in data.splitlines()]

In [4]: data_[0].index("NTasks")
Out[4]: 20

In [10]: data_[3].index('shas0241')
Out[10]: 5

In [14]: for x in range(len(data_[0])):
          print([datum[x] for datum in data_])

['JobID', '17293', '17293.batch', '17293.extern']
['JobIDRaw', '17293', '17293.batch', '17293.extern']
['JobName', 'f10120t201s16b420m000_3stout_aaaa-b.sh', 'batch', 'extern']
['Partition', 'shas', '', '']
['MaxVMSize', '152516K', '107896K']
['MaxVMSizeNode', 'shas0101', 'shas0241']
['MaxVMSizeTask', '0', '28']
['AveVMSize', '121452K', '107896K']
['MaxRSS', '41308K', '4K']
['MaxRSSNode', 'shas0101', 'shas0241']
['MaxRSSTask', '0', '28']
['AveRSS', '40352K', '3.80K']
['MaxPages', '0', '0']
['MaxPagesNode', 'shas0101', 'shas0241']
['MaxPagesTask', '0', '28']
['AvePages', '0', '0']
['MinCPU', '00:00:01', '00:00:00']
['MinCPUNode', 'shas0101', 'shas0241']
['MinCPUTask', '0', '28']
```

PetaLibrary/2

Monday, 31 July 2017

RFP Posted online

Friday, 4 August 2017

Pre-bid Q&A session

Friday, 11 August 2017

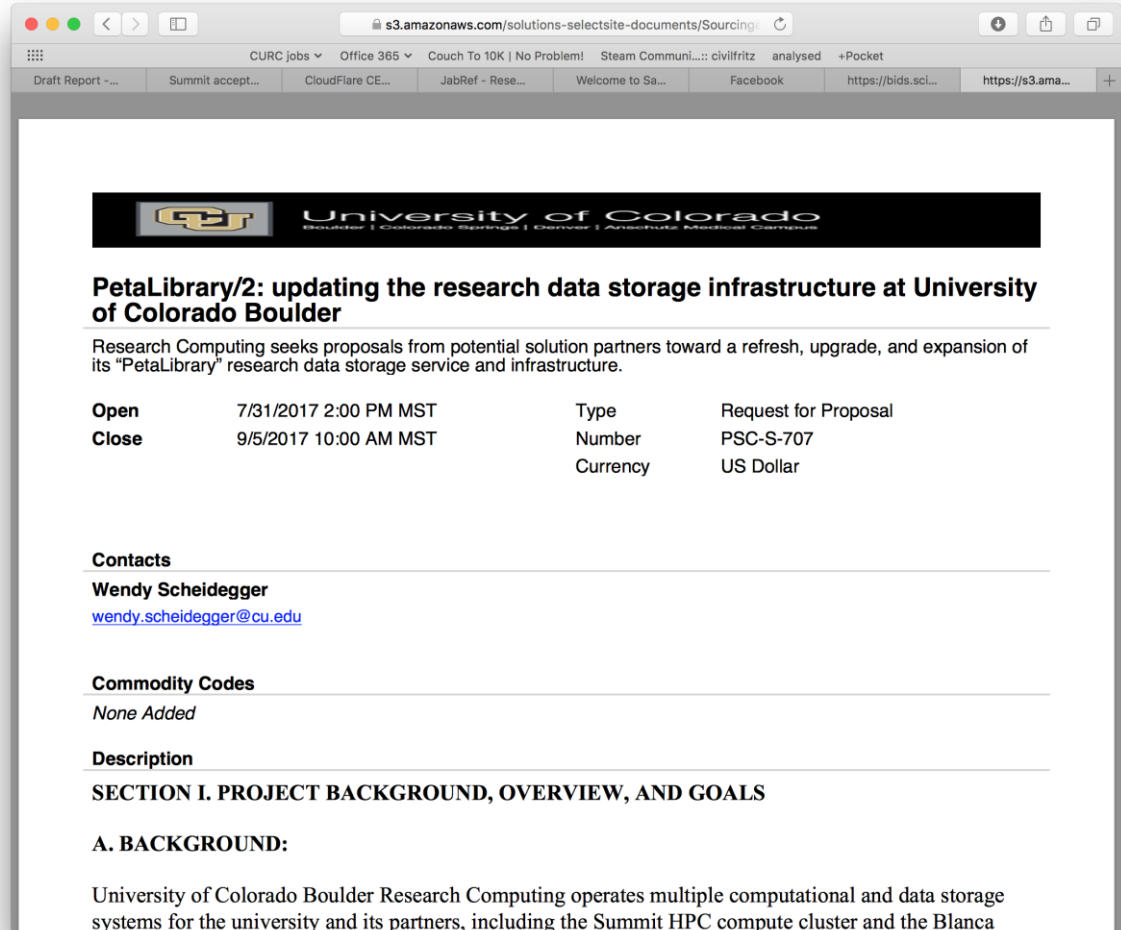
written questions are due

Tuesday, 5 September

RFP responses are due

Late Q1 2018

Production target



The screenshot shows a web browser window with the URL s3.amazonaws.com/solutions-selectsite-documents/Sourcing.... The browser's address bar and tabs are visible. The main content area displays the University of Colorado Boulder logo and the title "PetaLibrary/2: updating the research data storage infrastructure at University of Colorado Boulder". Below the title, a paragraph describes the RFP: "Research Computing seeks proposals from potential solution partners toward a refresh, upgrade, and expansion of its 'PetaLibrary' research data storage service and infrastructure." A table lists the RFP details:

Open	7/31/2017 2:00 PM MST	Type	Request for Proposal
Close	9/5/2017 10:00 AM MST	Number	PSC-S-707
		Currency	US Dollar

Below the table, the "Contacts" section lists Wendy Scheidegger with the email wendy.scheidegger@cu.edu. The "Commodity Codes" section shows "None Added". The "Description" section is titled "SECTION I. PROJECT BACKGROUND, OVERVIEW, AND GOALS" and includes a sub-section "A. BACKGROUND:" which states: "University of Colorado Boulder Research Computing operates multiple computational and data storage systems for the university and its partners, including the Summit HPC compute cluster and the Blanca".

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