XCache - XRootd Cache for CMS in SoCal

DOMA Caching Meeting

Sep 18 2018

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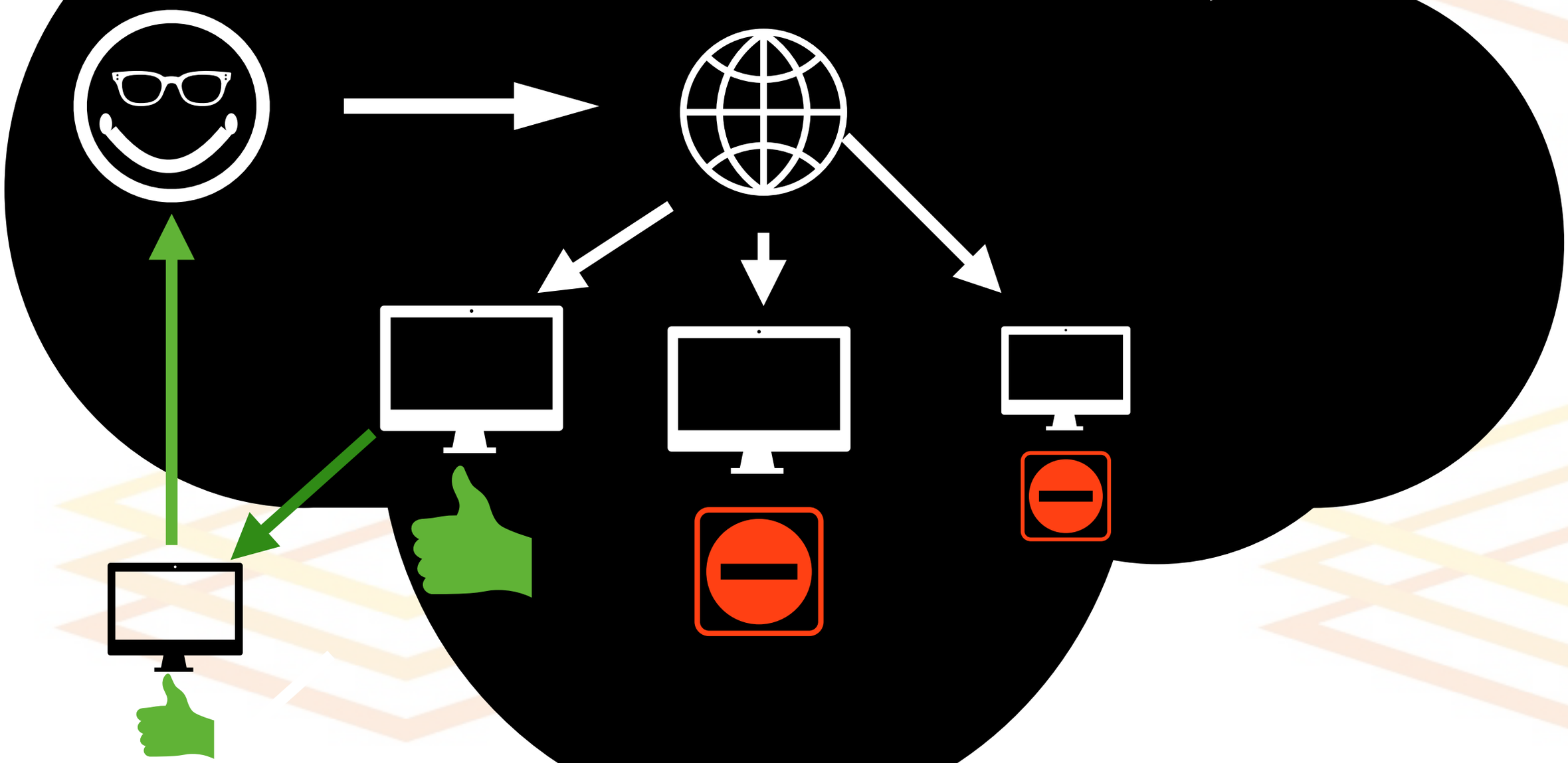
Terrence Martin, Frank Würthwein, Alja Tadel, Matevž Tadel, Justas Balcas

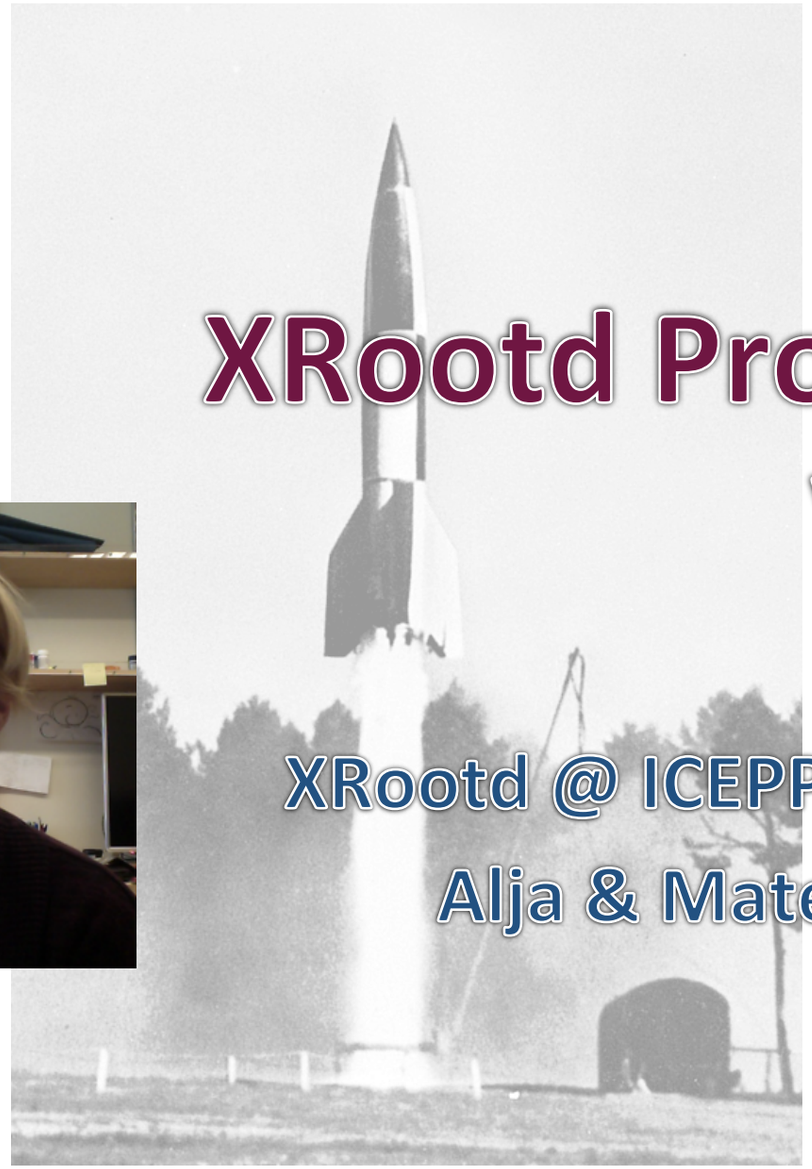
Motivation

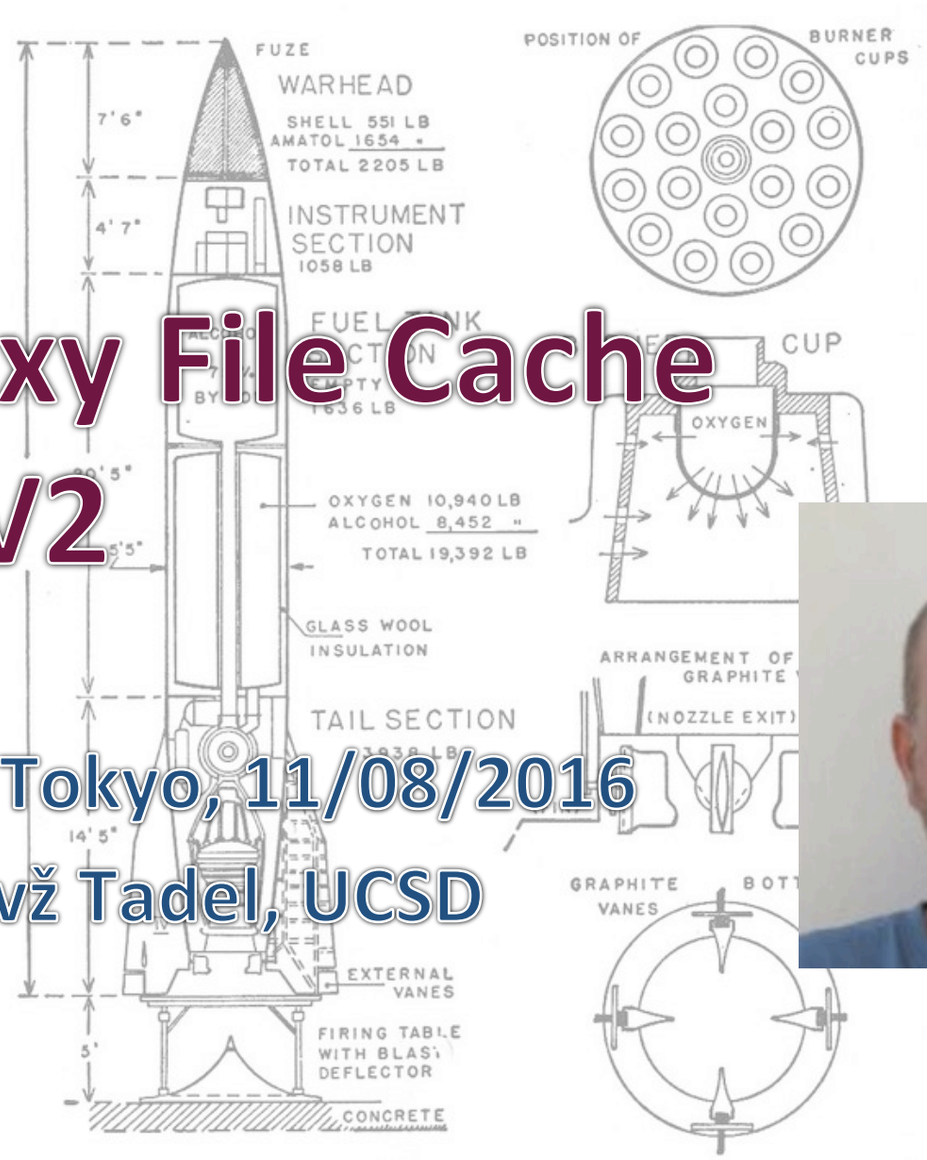
- Have all the MiniAOD of Run 2 easily available for CMS users in SoCal
- First step on potentially merging UCSD and Caltech's namespace.
- Profit from the PRP 100 Gbit connection and 3ms latency between sites.

Usual Federation



The idea of an Xrootd cache cluster was presented on Xrootd Tokyo meeting





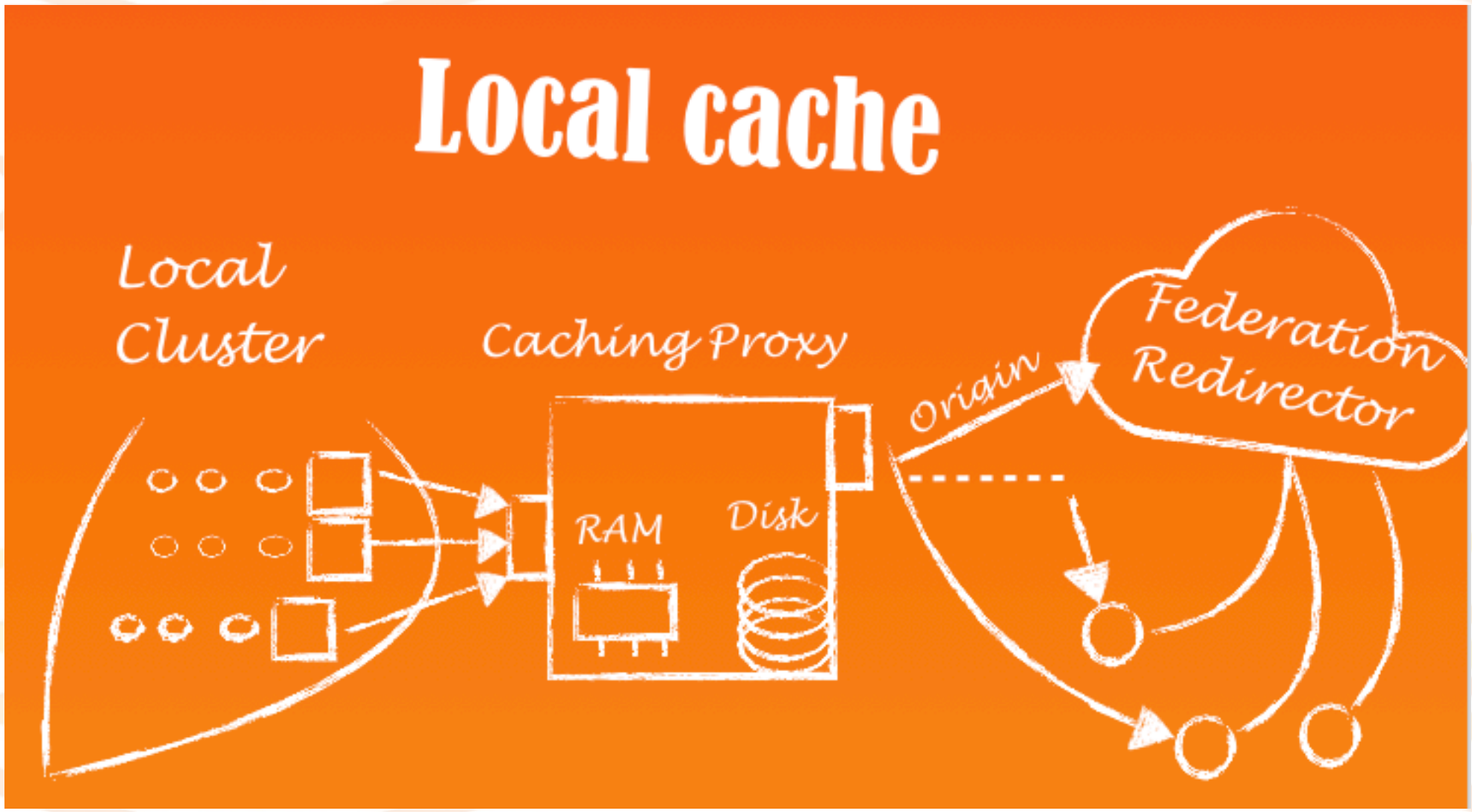
XRootd Proxy File Cache V2

XRootd @ ICEPP Tokyo, 11/08/2016

Alja & Matevž Tadel, UCSD

Full talk available: here

Xrootd Local Cache



On ACAT 2017 the Xrootd cache cluster was scale tested. Full paper here.

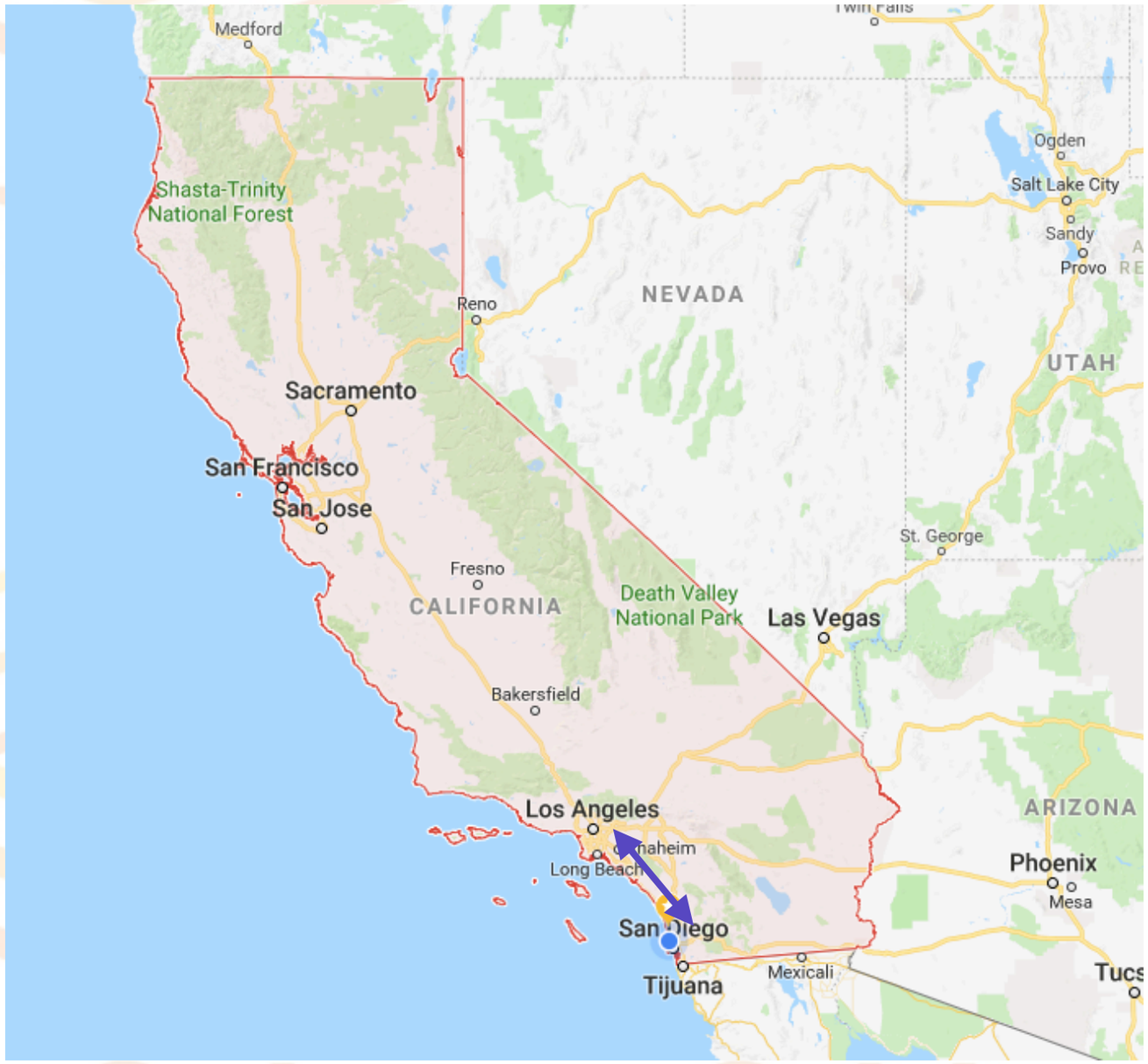
An Xrootd proxy cluster

Edgar Fajardo, Alja Tadel, Matevž Tadel, Frank Würthwein, Ben Steer, Terrence Martin

ACAT 2017

21-25 August 2017
University of Washington, Seattle

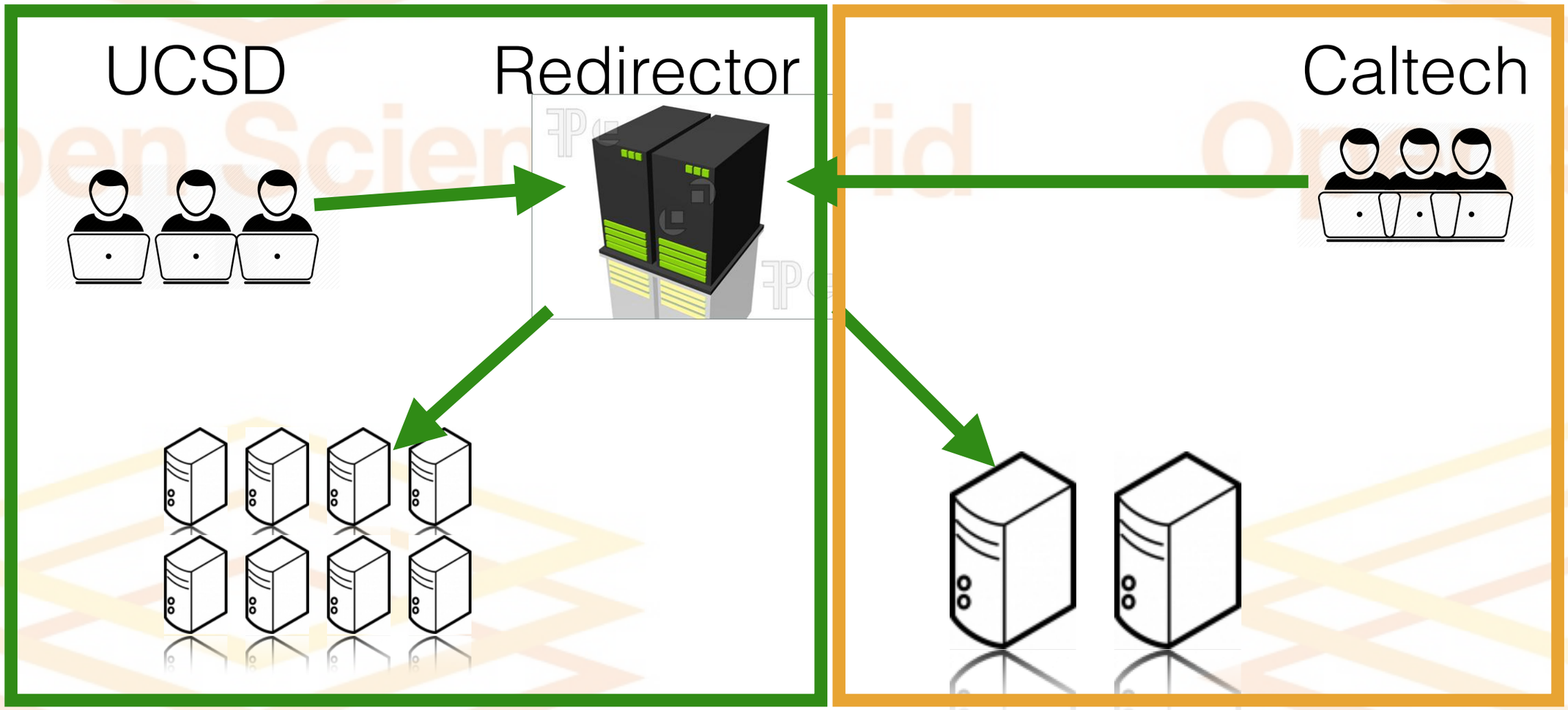
Two caches become one



- 120 miles
- 100 Gbit/sec
- 3ms

UC San Diego

SoCal Xrootd Cache (2018)



Jobs at UCSD and Caltech transparently use the cache

SoCal Xrootd Cache specs

	UCSD	Caltech
Nodes	11	2
Disk Capacity node	12x2TB = 24TB.	30 x 6TB disks (HGST Ultrastar 7K6000)
Network Card	10 Gbps	40 Gbps
Total Capacity	264 TB	360 TB

Space Needs

Datasets	Size (TB)
/*/Run2016*-03Feb2017*/MINIAOD	182.8
/*/RunIISummer16MiniAODv2-PUMoriond17_80X_*/MINIAODSIM	502.5
/*/*RunIIFall17MiniAODv2*/MINIAODSIM	211
/*/*-31Mar2018*/MINIAOD	137.9
Total	1041

Scaling tests

- We had a Monash University student (Ben Steer) that performed some scale testing on the UCSD cache.
- Thorough results of the scale tests can be found here
- The most important aspects are in the following slides
- Tests were revisited for HEPIX on spring 2018.
- UCSD student (Caitlin Hung) performed acceptance testing on the Caltech side.

Scaling Tests Description

- Baseline test used jobs reading at twice the CMS job usual spec 2MB/sec.
- We ran at different scales 1000/2000/3000/4000 jobs.
- Tests run jobs that simulate actual use of the system by clients using tool xrdfragcp (like xrdcp but controlling read rate)

How to test it?
Use a sleeper pool

Not like this one:

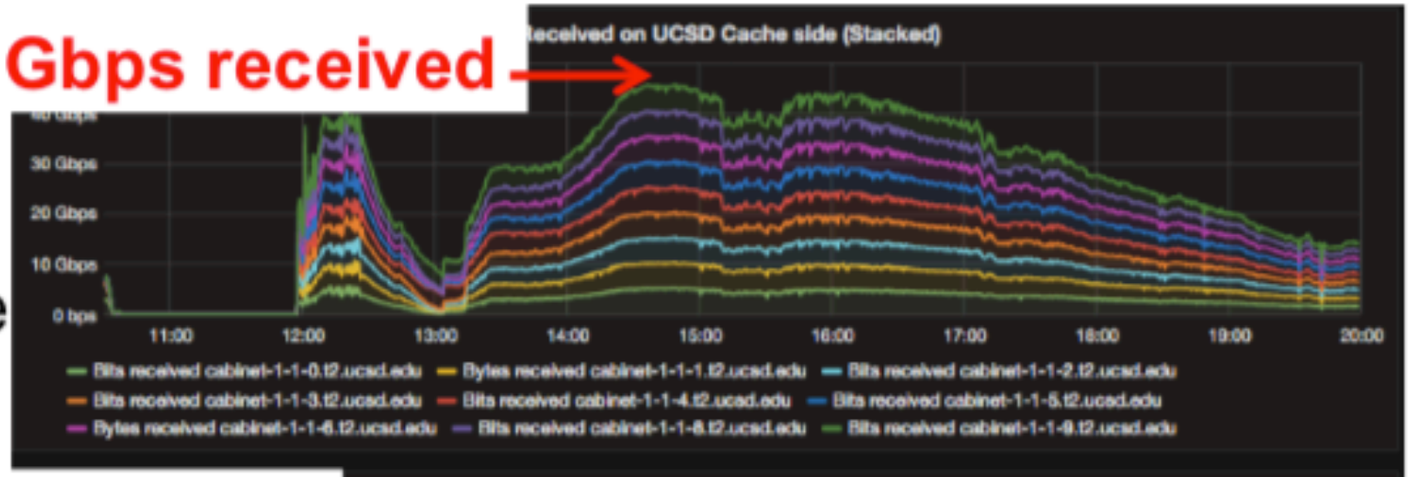
Like This one:

A worker node

Aggregate view of all 9 NICs

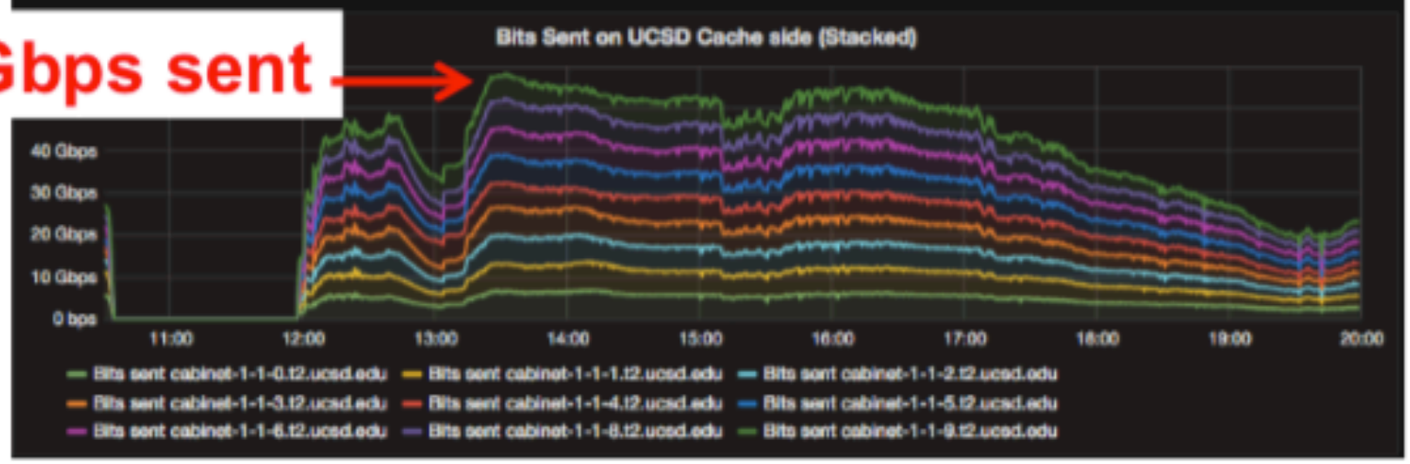
Peak of 45 Gbps received

Bits received means IO from WAN to cache



Peak of 57.8 Gbps sent

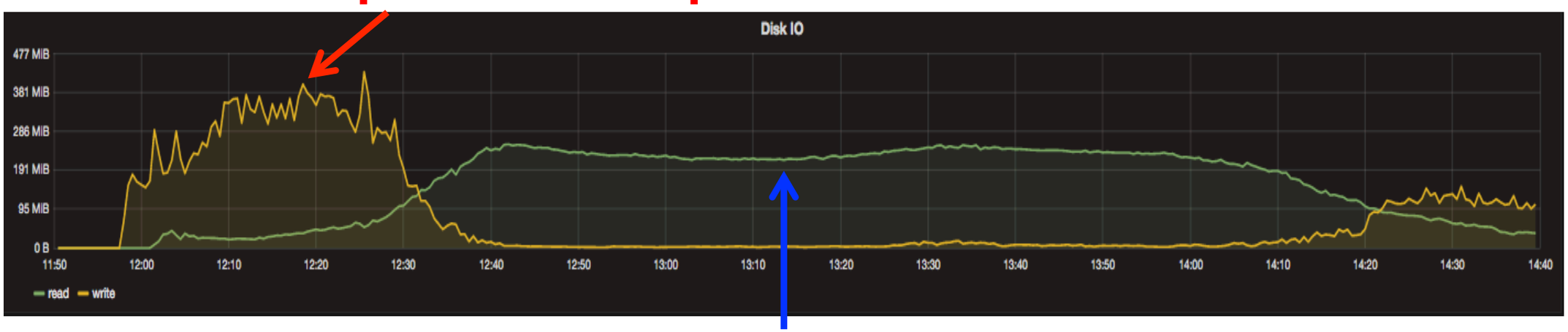
Bits send means IO from cache to jobs



Bits read from disk cache = Bits send – Bits received

Single Server View

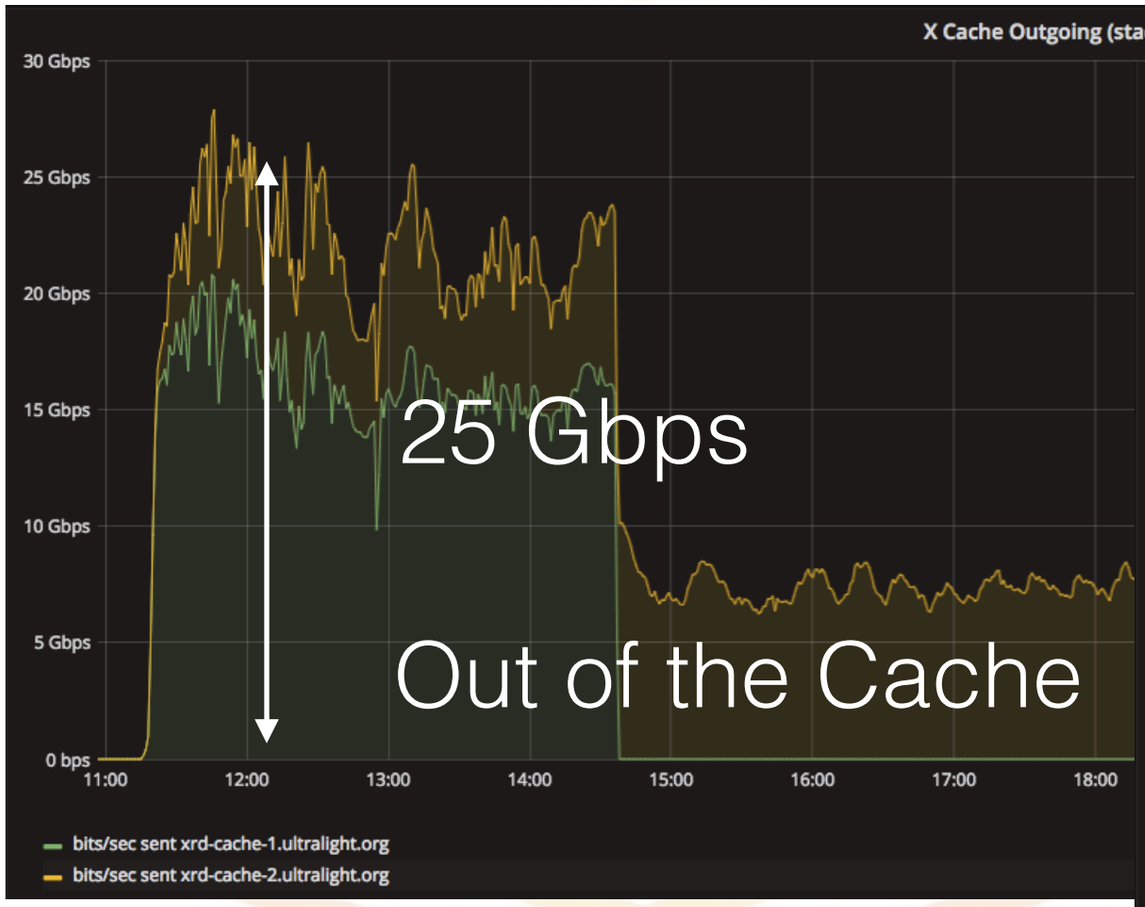
write to disk peak at ~3Gbps

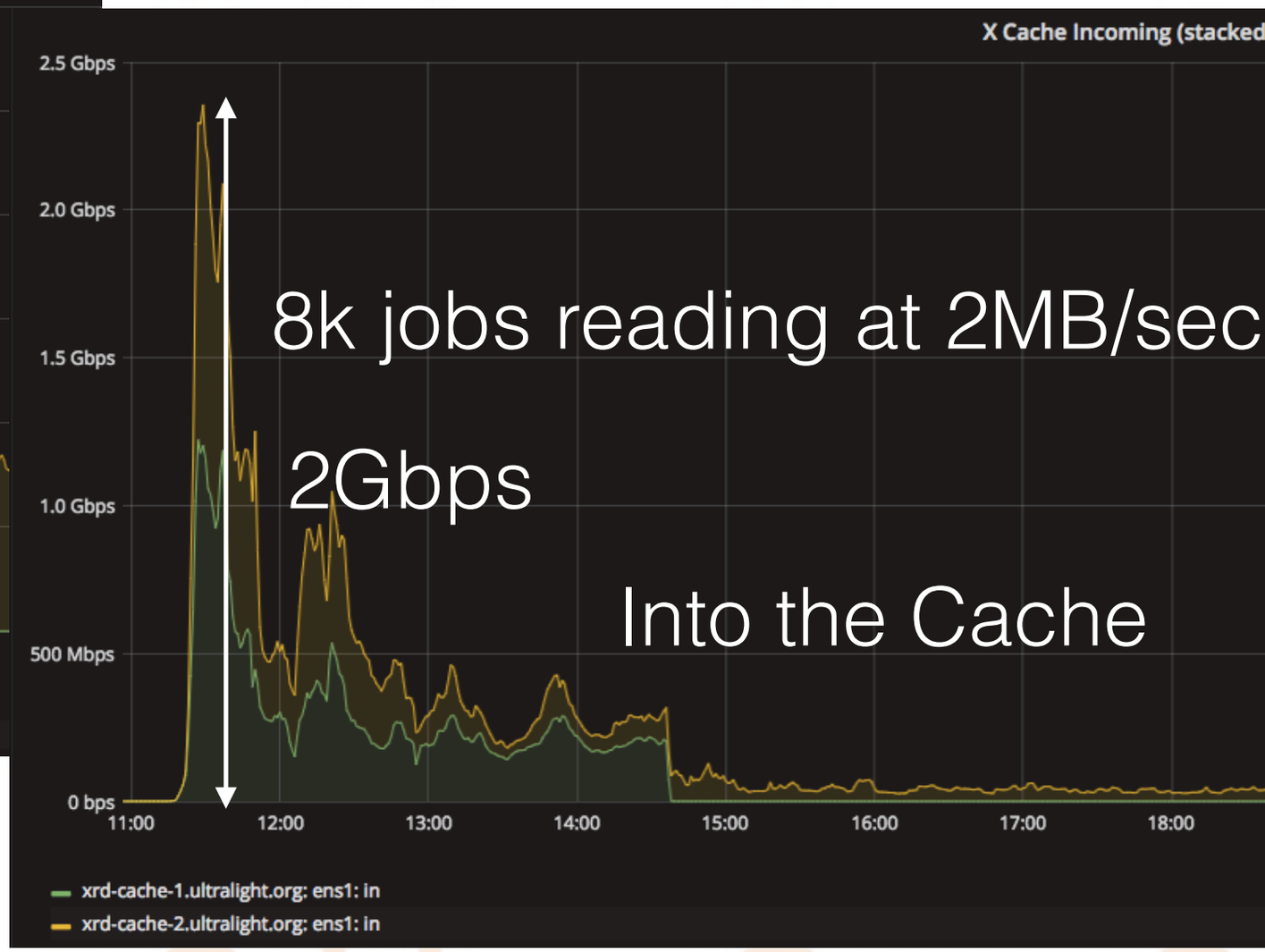


Reads from disk pretty steady at ~2Gbps

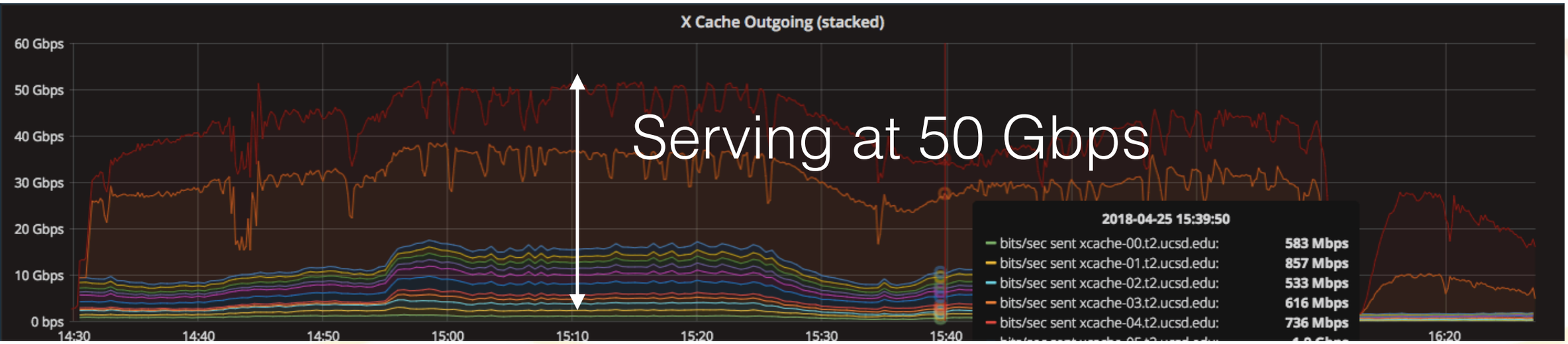
Note: both reads and writes are limited by complicated interplay of cache behavior, hardware performance, and requests from jobs.

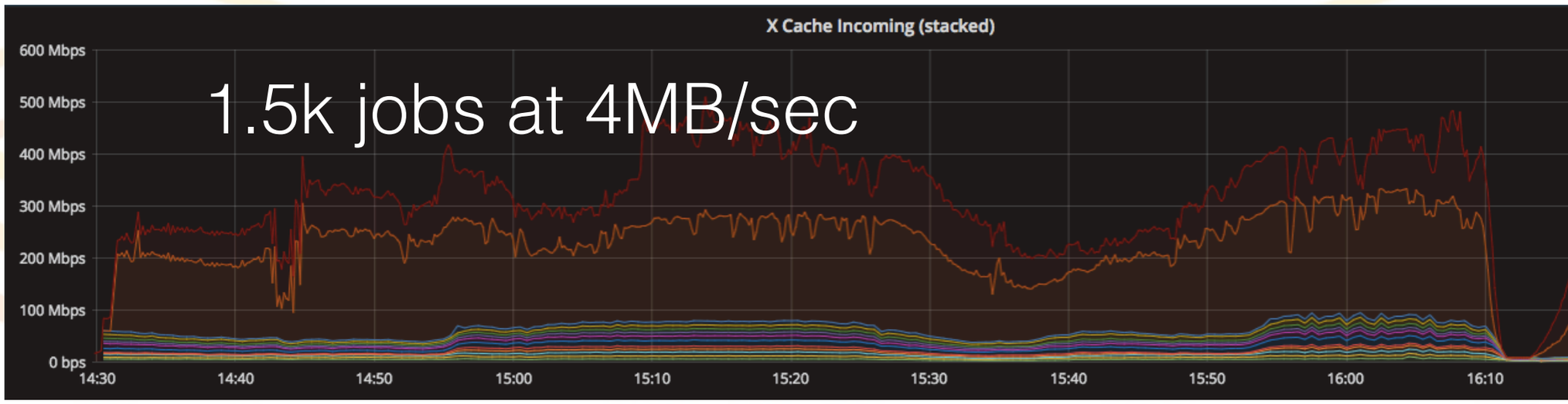
Scaling tests (Caltech Only)



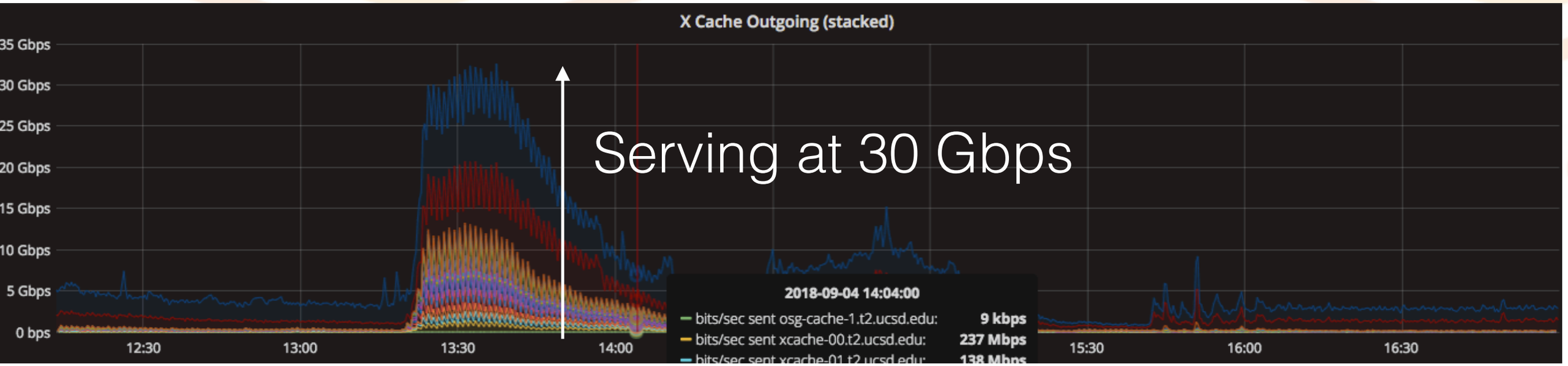


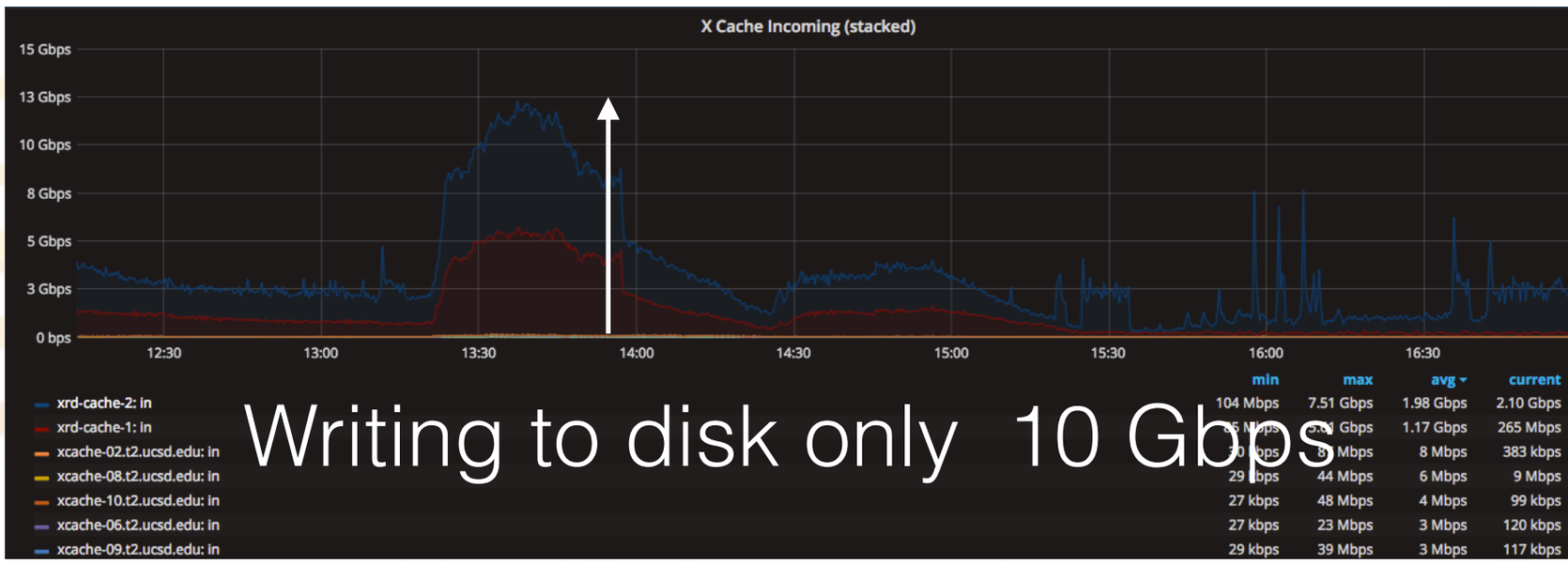
Scaling tests (Both sites)





Production performance





Writing to disk only 10 Gbps

How to bring the cache in production

Storage: Rule in storage.xml

```
<lfn-to-pfn protocol="direct" destination-match=".*"
    path-match="/+store/(data/Run2016[A-Z]/[^/]+/MINIAOD/03Feb2017.*)"
    result="root://xrootd.t2.ucsd.edu:2050//store/$1" />
  <lfn-to-pfn protocol="direct" destination-match=".*"
    path-match="/+store/(mc/RunIISummer16MiniAODv2/[^/]+/MINIAODSIM/
PUMoriond17_80X_.*)"
    result="root://xrootd.t2.ucsd.edu:2050//store/$1" />
```

Computing: New group in frontend

```
<group name="overflow-xcache-socal" enabled="True"><start_expr='(regexp("/*/
Run2016.*-03Feb2017.*/MINIAOD", DESIRED_CMSDataset) || regexp("/*/
RunIISummer16MiniAODv2-PUMoriond17_80X_.*/MINIAODSIM", DESIRED_CMSDataset))>
```

Future Work

- Having other Tier3's in SoCal use the cache: i.e T3_US_UCR (OnGoing)
- Going out of California: Colorado
- What about NorCal? T3_US_UCD
- Learning how to operate a collection of Caches at all US Tier 2's, which polices? each site own policy?
- Grow cache size on the fly with kubernetes.

Questions?

Contact us at:

1-900-Xrootd-Cache-Masters

Just Kidding

Contact us:

emfajard@ucsd.edu

Thank You