Special Hardware Needs of ATLAS Tier 2

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Embarrassingly parallel jobs, up to now

Devoted significant effort to meet the storage requirement

What do we need to achieve in storage:

Need to handle random read dominated IO
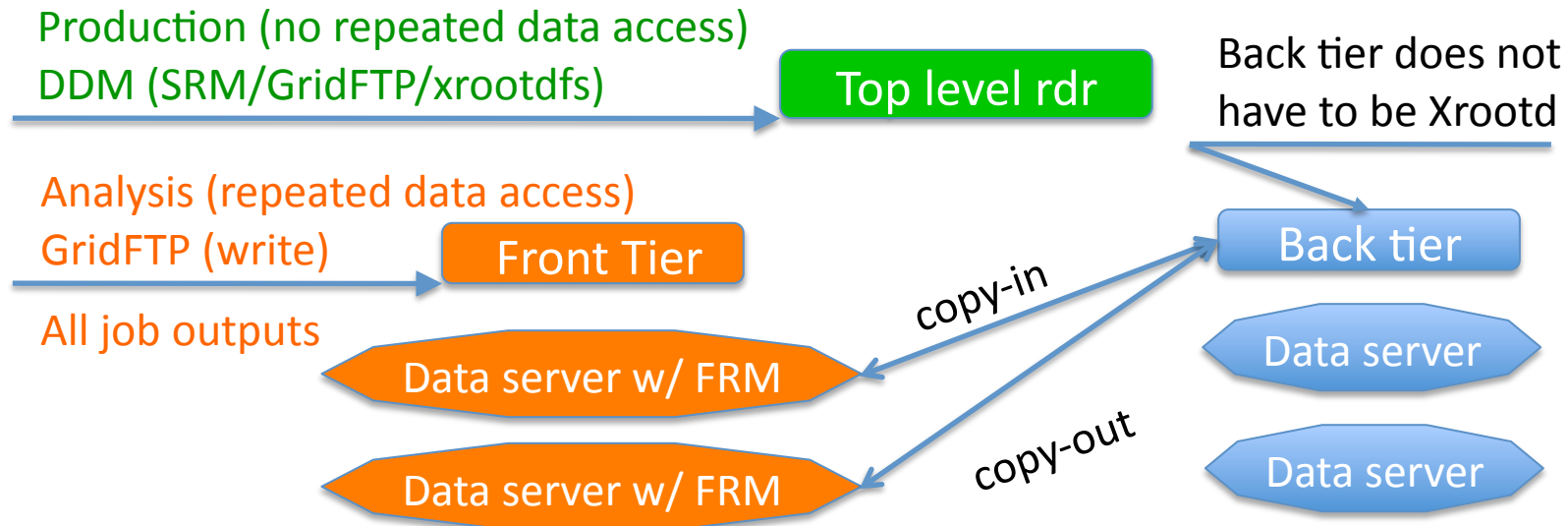IO from user analysis jobs peak at ~200 bytes per read

Must be reliable
Monthly site availability and reliability report to ATLAS and World Wide LHC Computing Grid

Must be cheap
o ATLAS determines CPU and storage pledges Tier 2s
o Tier 2s are competing on cost vs. effectiveness
o Dell provides cheap low end storage, at very low density

# Two-Tier Xrootd Disk Storage   1TB = 10^{12} Bytes

Production (no repeated data access)
DDM (SRM/GridFTP/xrootdfs)

Back tier does not have to be Xrootd

Top level rdr

Analysis (repeated data access)
GridFTP (write)

Front Tier

All job outputs

Back tier

Data server w/ FRM

copy-in

Data server

Data server w/ FRM

copy-out

Data server

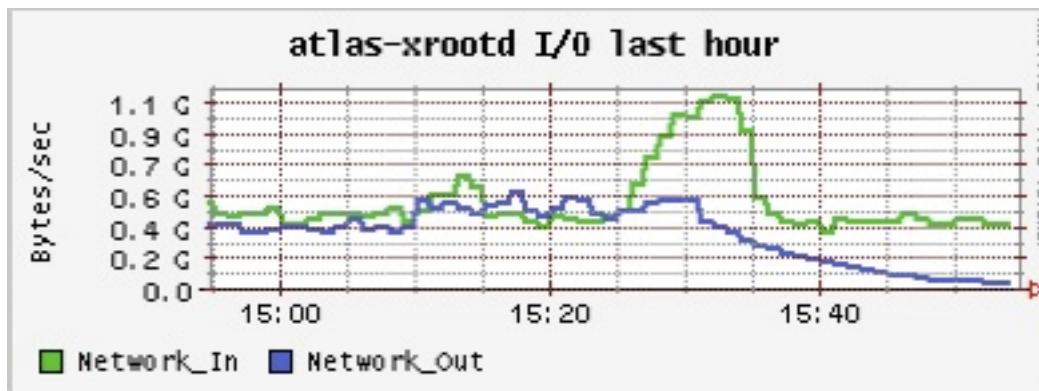Front tier: moves data in and out of the back tier storage
o 650 TB useable in 20 Thumper/Thors,
o 1 raw TB/spindle, 7200 rpm SATA
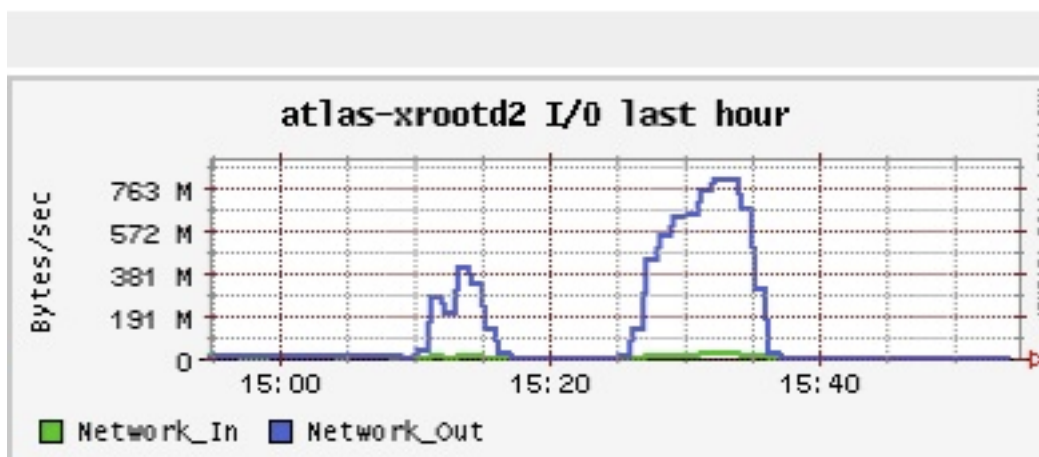o provide 5000 iops/box without hurting WAN data transferring

Back tier:
o 1080TB useable in 42 MD1000s attached to 5 Dell R710s
o 560TB more ordered
o 2 raw TB/spindle, 5400 rpm SATA
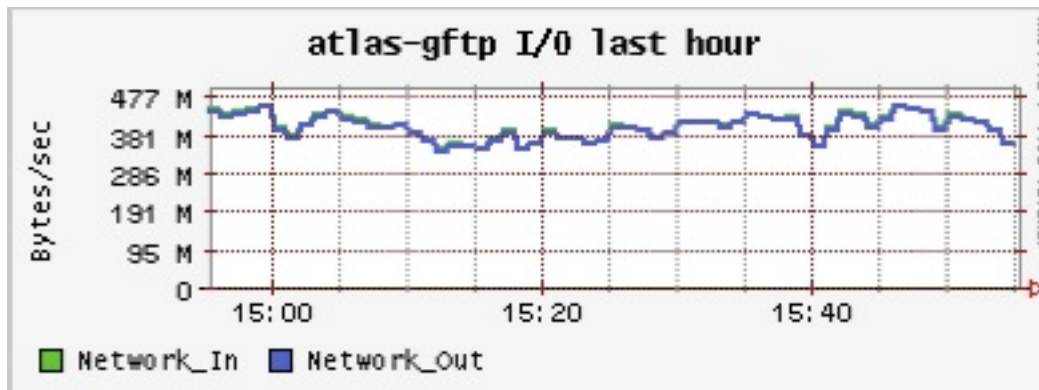
Data in and out via GridFTP

Front Tier

Back Tier

Future storage for ATLAS Tier 2

Actively looking for high density storage at optimum price

Can we utilize SSD to improve random IO performance

Federated Xrootd storage system

o R&D
o Federate multiple ATLAS sites' storage across the WAN
o Free users from data transferring and data management tasks
o Using Xrootd protocol but not limited to Xrootd storages
o Will change the data accessing methods and pattern from users