The production deployment of IPv6 on WLCG

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HEPiX IPv6 Working Group

- Members of the group – **Thanks to them!**

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  And many others in earlier times
WLCG Sites - IPv6 readiness

• World running out of IPv4 addresses
  – RIRs Asia/Pacific, Europe, Latin America/Caribbean run out of IPv4
• We did a WLCG site survey in summer 2014
• Tier 1s: ~75% are IPv6 ready. Rest within 1 year
• Tier 2s: ~20% are IPv6 ready. ~20% within 1-2 year
  – ~60% have no plans yet
• ~10% of sites report lack of IPv4 addresses (in next 1-2 years)
  – Including CERN
• Growth of Virtual Machines and/or Containers
• This is a challenge!
LHC Experiments & IPv6

Most important IPv6-only use case to address

Site providing IPv6-only CPU - Virtual Machines/Worker Nodes

- Need dual-stack *federated storage services*
- And dual-stack *central services* too
  - Central experiment job submission infrastructure
  - VOMS, catalogues, info etc
**ATLAS Request (WLCG GDB Oct 2014)**
- Tier 1s provide dual stack perfSONAR (April 2015)
- T2Ds provide dual stack perfSONAR (August 2015)

**CMS Request (WLCG GDB Sep 2014)**
- Substantial fraction CMS data accessible via AAA through IPv6 by end 2015

**ALICE** runs many dual-stack central services (works)
- testing all their frameworks

**LHCb** job submission (DIRAC)
- Tests started on lxplus-ipv6 (does not break IPv4)
- About to test on DIRAC v6r13
IPv6 testbed – data transfers

• Caltech, CERN, DESY, FNAL, FZU, Glasgow, IHEP, KIT, INFN, Imperial, Lyon, NDGF, PIC, Wisconsin
• Simple GridFTP mesh of tests over IPv6
• Ran for 706 days (ended Feb 2015)
  – Total data transferred ~ 6.8 PB (10 TB per day)
• Useful for: Verifying network stability, routes etc.
FTS3/dCache data transfers

A new testbed mesh via dual-stack FTS3 (KIT)
- CCIN2P3, CSCFI, DESY, KIT, Imperial, NDGF and PIC
- All running dCache (V2.10.x or later)
  - Some dual-stack, some IPv6-only
- Transfers 1 GB files over SRM/gsiftp
- Now works – but performance differences and failures
- Problems along the way included
  - LHCONE/LHCOPN IPv6 peering
  - DNS problems
  - gfal2 – (V2.8.1 does not accept TURLs with IPv6 number)
  - dCache configuration (for hosts with DNS aliases)
FTS3 data transfer mesh

Time to transfer (s)
IPv6 readiness of WLCG software

http://hepix-ipv6.web.cern.ch/wlcg-applications

<table>
<thead>
<tr>
<th>Software Component</th>
<th>Type</th>
<th>Used by Experiment</th>
<th>Version</th>
<th>IPv6 Capabilities</th>
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</table>


Many storage technologies now support IPv6.
**IPV6 Network Monitoring**

**perfSONAR monitoring**

- As we turn on production dual-stack
  - We need to collect IPv6 monitoring data
- Since perfSONAR V3.4 Dual-stack is recommended
  - Add AAAA record to DNS
  - If both ends are dual-stack
    - IPv4 & IPv6 tests will both be run
perfSONAR dashboard

http://maddash.aglt2.org/

Dual-Stack Mesh Dashboard
(does not yet show IPv6 correctly!)
LHCOPN/LHCONE & IPv6

• To get same network performance
  – Need IPv6 data to take the same route as IPv4

• LHCOPN sites should be peering with IPv6
  – By April 2015

• CERN and 5 Tier 1s completed
  – More to come

• LHCONE – IPv6 peering by August 2015
2015 Deployment plan

- LHCOPN/LHCONE IPv6 routing
- perfSONAR dual-stack monitoring
- Gradually deploy production dual-stack data services
  - When LHCOPN/LHCONE peering ready
  - When testing proves functionality and performance
- Important central services to dual-stack
  - Including dual-stack SAM
- Currently ~2% of WLCG services are dual-stack
- Need more work on guidance, e.g. security
Summary

• Deployment of WLCG dual-stack is starting
  – LHCOPN/LHCONE routing
  – perfSONAR monitoring

• Controlled deployment of dual-stack storage
  – And central services

• New members in WG/Testbed always welcome
Links

• HEPiX IPv6 web
  http://hepix-ipv6.web.cern.ch

• HEPiX IPv6 wiki
  https://w3.hepix.org/ipv6-bis/

• Working group meetings
  http://indico.cern.ch/categoryDisplay.py?categId=3538

• WLCG Operations IPv6 Task Force
  http://hepix-ipv6.web.cern.ch/content/wlcg-ipv6-task-force-0

• Paper published in proceedings of CHEP2013
  – For earlier work
Questions?