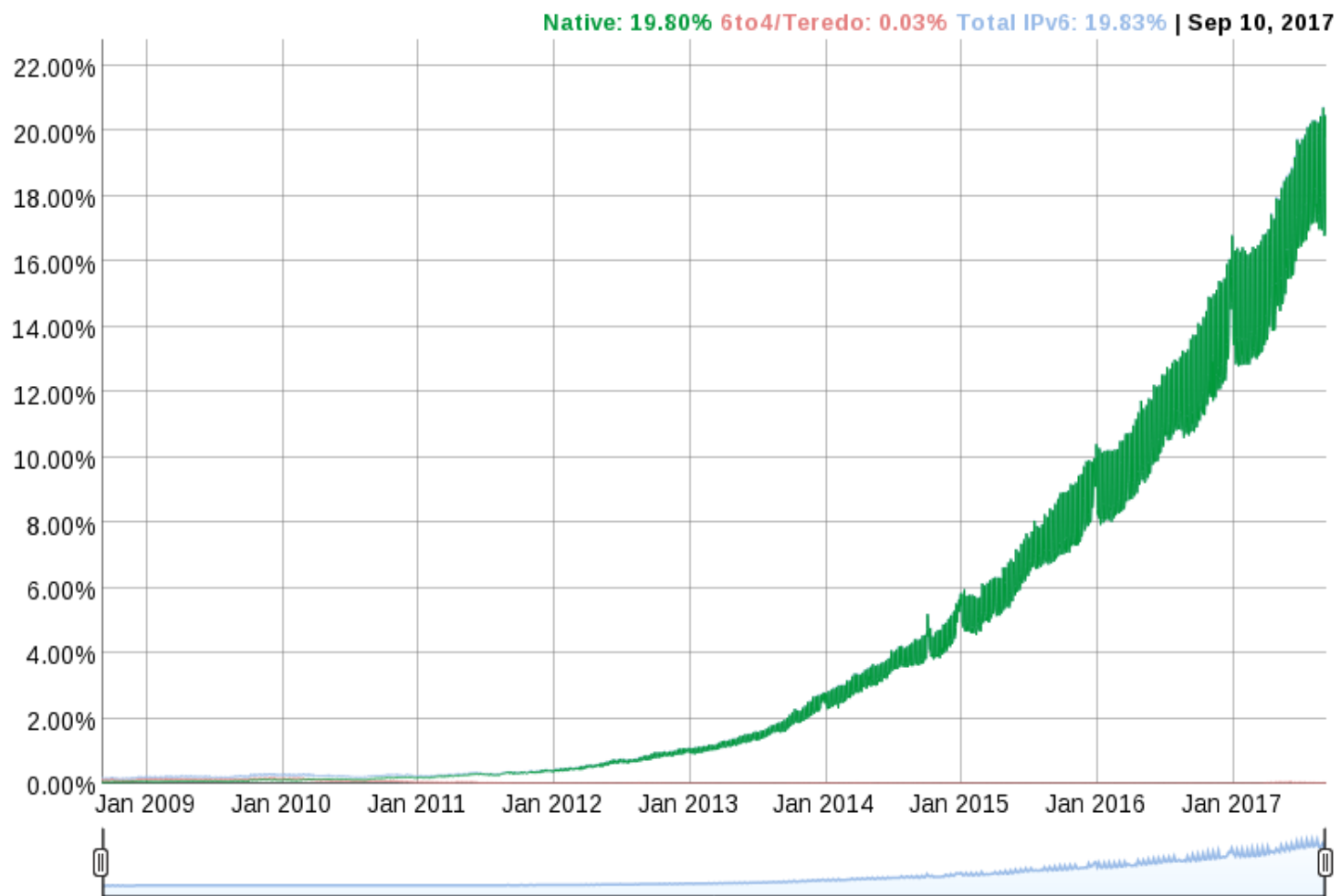


IPv6 update

Duncan Rand
Imperial College London

IPv6 Adoption

We are continuously measuring the availability of IPv6 connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.



UK IPv6
adoption:
18.7%

- Detailed IPv6 & DNSSEC Service Interface Statistics for 20161102 -

Domain	Organization	DNS	Mail	Web	DNSSEC
uk.ac.stfc.	RAL	[4] 1/1/1 [M]	[4] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.brunel.	Brunel University	[6] 2/2/2 [M]	[4] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.imperial.	Imperial College London	[4] 4/4/4 [P]	[4] 4/4/4 [P]	[1] 1/1/1 [P]	<u>S/v/C</u>
uk.ac.qmul.	Queen Mary University of London	[4] 0/0/0 [P]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.rhul.	Royal Holloway University of London	[3] 0/0/0 [I]	[3] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.ucl.	University College London	[4] 1/1/1 [M]	[1] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.lancaster.	Lancaster University	[5] 2/2/2 [M]	[4] 0/0/0 [P]	[1] 0/0/0 [I]	<u>S/v/C</u>
uk.ac.liverpool.	University of Liverpool	[4] 1/0/1 [P]	[2] 0/0/0 [P]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.manchester.	University of Manchester	[4] 1/1/1 [M]	[2] 0/0/0 [I]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.sheffield.	University of Sheffield	[3] 0/0/0 [P]	[5] 4/4/0 [O]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.durham.	University of Durham	[4] 1/1/1 [M]	[4] 0/0/0 [P]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.edinburgh.	University of Edinburgh	[6] 6/6/6 [P]	[3] 0/0/0 [P]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.glasgow.	University of Glasgow	[3] 2/2/2 [P]	[2] 0/0/0 [P]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.birmingham.	University of Birmingham	[2] 0/0/0 [P]	[3] 0/0/0 [P]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.bristol.	University of Bristol	[3] 3/3/3 [M]	[5] 4/4/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.cambridge.	University of Cambridge	[3] 3/3/3 [M]	[0] 0/0/0 [-]	[1] 1/1/1 [P]	<u>S/v/C</u>
uk.ac.oxford.	University of Oxford	[4] 1/1/1 [M]	[1] 0/0/0 [P]	[2] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.stfc.	RALPPD	[4] 1/1/1 [M]	[4] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.sussex.	University of Sussex	[4] 0/0/0 [P]	[5] 0/0/0 [P]	[1] 0/0/0 [I]	<u>U/-/-</u>

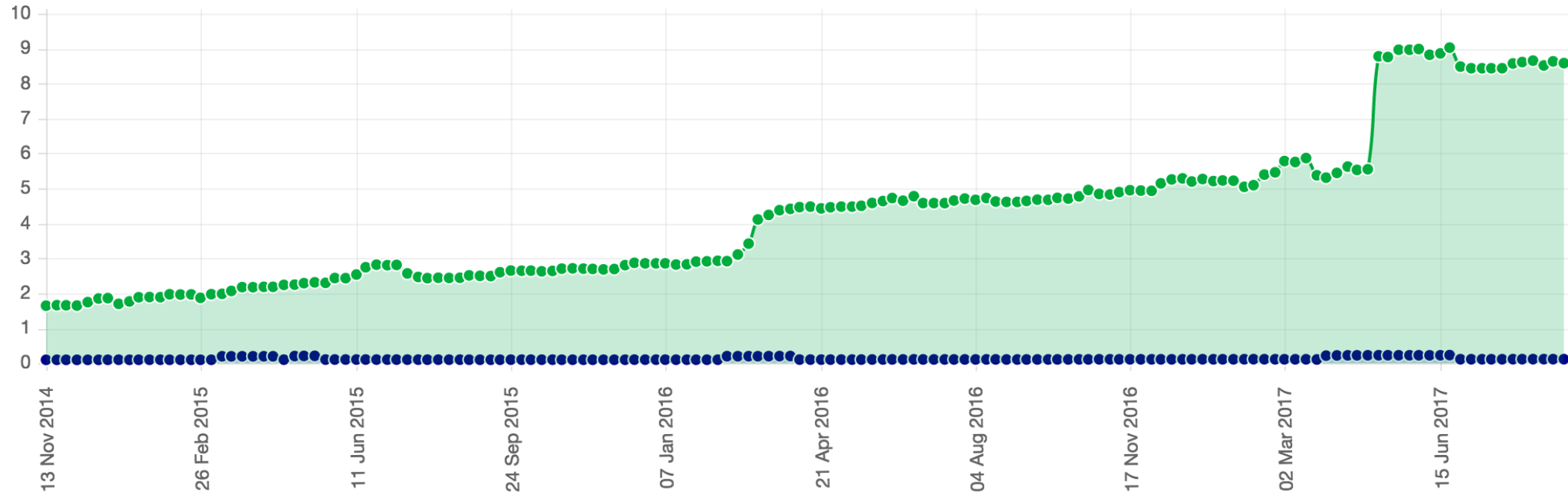
- Detailed IPv6 & DNSSEC Service Interface Statistics for 20170913 -

Domain	Organization	DNS	Mail	Web	DNSSEC
uk.ac.stfc.	RAL	[4] 1/1/1 [M]	[4] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.brunel.	Brunel University	[6] 2/2/2 [M]	[1] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.ic.	Imperial College London	[4] 4/4/4 [M]	[4] 4/4/4 [I]	[1] 1/1/1 [I]	<u>S/V/C</u>
uk.ac.qmul.	Queen Mary University of London	[4] 0/0/0 [P]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.rhul.	Royal Holloway University of London	[3] 0/0/0 [I]	[3] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.ucl.	University College London	[4] 1/1/1 [M]	[1] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.lancs.	Lancaster University	[4] 2/2/2 [M]	[4] 0/0/0 [I]	[1] 0/0/0 [P]	<u>S/V/C</u>
uk.ac.liv.	University of Liverpool	[4] 1/0/1 [M]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.manchester.	University of Manchester	[4] 1/1/1 [M]	[2] 0/0/0 [I]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.shef.	University of Sheffield	[3] 0/0/0 [M]	[5] 3/3/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.dur.	University of Durham	[4] 1/1/1 [M]	[4] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.ed.	University of Edinburgh	[6] 6/6/6 [I]	[3] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.gla.	University of Glasgow	[3] 2/2/2 [I]	[2] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.bham.	University of Birmingham	[2] 0/0/0 [I]	[6] 0/0/0 [I]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.bris.	University of Bristol	[3] 3/3/3 [M]	[1] 0/0/0 [O]	[1] 0/0/0 [P]	<u>U/-/-</u>
uk.ac.cam.	University of Cambridge	[5] 4/4/4 [M]	[1] 0/0/0 [I]	[2] 2/2/2 [O]	<u>S/V/C</u>
uk.ac.ox.	University of Oxford	[4] 1/1/1 [M]	[1] 0/0/0 [I]	[2] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.stfc.	RALPPD	[4] 1/1/1 [M]	[4] 0/0/0 [O]	[1] 0/0/0 [I]	<u>U/-/-</u>
uk.ac.susx.	University of Sussex	[4] 0/0/0 [M]	[5] 0/0/0 [I]	[1] 0/0/0 [P]	<u>U/-/-</u>

WLCG deployment plan: timeline

- By April 1st 2017
 - Sites **can provide IPv6-only CPUs** if necessary
 - Tier-1's **must provide dual-stack storage** access with sufficient performance and reliability
 - At least in a testbed setup
 - **Stratum-1 service at CERN** must be dual-stack
 - A dedicated **ETF infrastructure** to test IPv6 services must be available
 - ATLAS and CMS must deploy all **services** interacting with WNs in dual-stack
 - All the above, without disrupting normal WLCG operations
- By April 1st 2018
 - Tier-1's must provide **dual-stack storage access in production** with increased performance and reliability
 - Tier-1's must upgrade their **Stratum-1 and FTS** to dual-stack
 - The **official ETF infrastructure** must be migrated to dual-stack
 - GOCDB, OIM, GGUS, BDII should be dual-stack
- By end of Run2
 - A **large number of sites** will have **migrated their storage** to IPv6
 - The recommendation to keep IPv4 as a backup will be dropped

WLCG status



- Percentage of IPv6-only endpoints
- Percentage of dual-stack endpoints
- Percentage of IPv4-only endpoints

Fraction of endpoints listed in the CERN central BDII (lcg-bdii.cern.ch) where the DNS returns an IPv4-only (A) resolution (orange line), a dual-stack IPv6-IPv4 (A+AAAA) resolution (green line) or an IPv6-only resolution (blue line). (http://orsone.mi.infn.it/~prelz/ipv6_bdii/) IPv6 update GridPP39 Lancaster Sept 2017

GridPP IPv6 status

- https://www.gridpp.ac.uk/wiki/IPv6_site_status
- 19 sites in the table
 - value in brackets at end indicates change since GridPP35
- 19/19 have discussed IPv6 with local networking team (+1)
- 18/19 have asked for some IPv6 addresses (+3)
- 15/19 have IPv6 addresses (+4)
- 13/19 have set up an IPv6 enabled host (+4)
- 8/19 have an IPv6 enabled DNS (+2)

- 9/19 have a dual-stack perfSONAR host (+2)
- 6/19 have some dual-stack worker nodes (+3)
- 5/19 have some dual-stack grid services (e.g. SRM, xrootd) (+1)

RAL IPv6 status

- Updating services such as Argo, FTS, BDII, Frontier etc to dual-stack
- CASTOR storage will die as IPv4-only
- Dual-stack gateway(s) to Echo CEPH storage
- Don't have proper IPv6 firewall - doing IPv6 via CPU of the firewall (ASICs don't do it)
- Most data traffic goes around the firewall, but would be traversed when WN read xrootd traffic
- However, if the firewall becomes more loaded that would potentially cause problems
- Very low traffic IPv6 level currently

GridPP Tier-2s

- Brunel, Imperial have been dual-stack for some time
- QMUL has dual-stack storage and a few WN in testing
- Liverpool and Lancaster have made good progress recently and have installed dual-stack perfSONAR hosts
- Manchester, Sheffield, Durham, Edinburgh, Glasgow, Bristol and Oxford have an IPv6 presence but little recent progress
- RHUL, RALPPD... should hopefully dip their toe in the IPv6 water soon
- UCL, Birmingham, Cambridge and Sussex lacking in manpower

Brunel IPv6-only worker nodes: update

- Raul has set up an IPv6-only worker node at Brunel
 - Sits behind a dual-stack CE
- Some issues with stale CRLs
 - HEPiX WG tracking this: <http://cvmfs-6.ndgf.org/ipv6/overview.php>
- LHCb : runs production jobs – uploads to a number of dual-stack Tier-1s (PIC, IN2P3, CERN)
- CMS : glidein-WMS testbed able to submit jobs to it
- ATLAS : has also run some ATLAS pilot jobs – not sure of current status

CERN status (Edoardo Martelli, Hervé Rousseau)

- CERN Agile Infrastructure VMs will soon have IPv6 on by default
 - could be useful for testing – all CERN users get an allocation
- EOS
 - Support for IPv6 comes with *Citrine* branch which uses XRootD v4
- EOS-LHCb already dual-stack and EOS-ALICE will move on 18th Sep 2017
- CVMFS
 - Stratum zero (backend) has IPv6 but is not advertised
 - Stratum one (frontend) has had IPv6 for more than a year

FTS transfers using IPv6



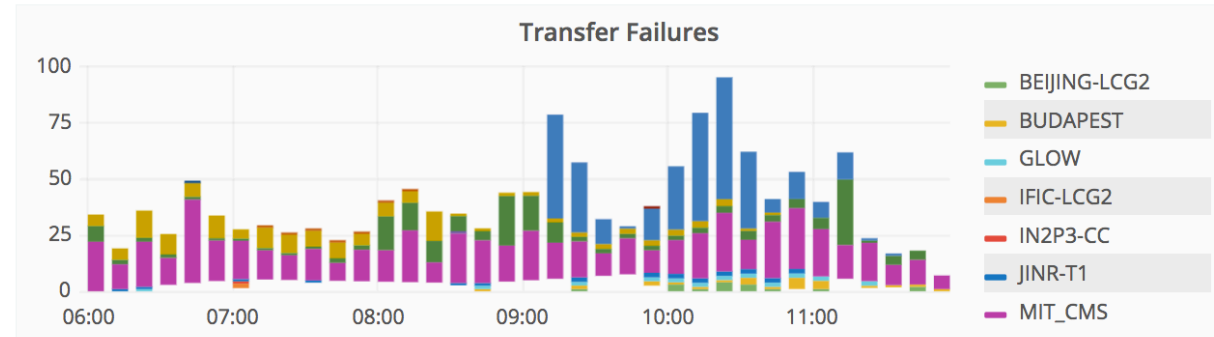
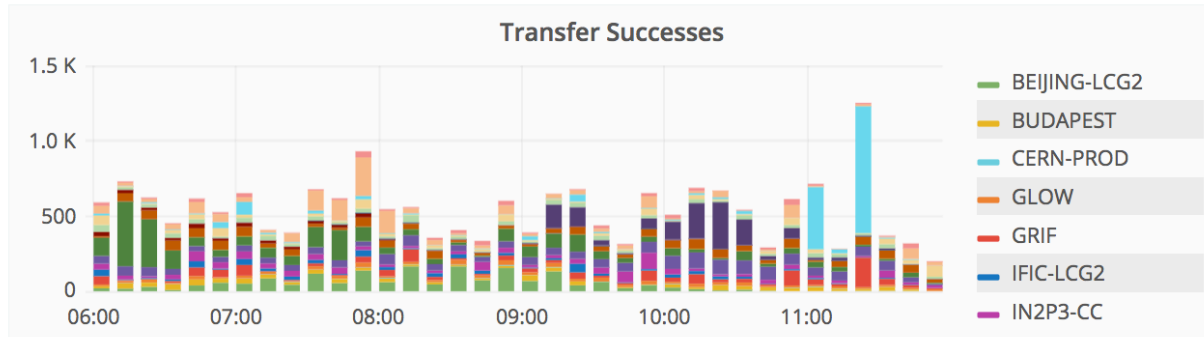
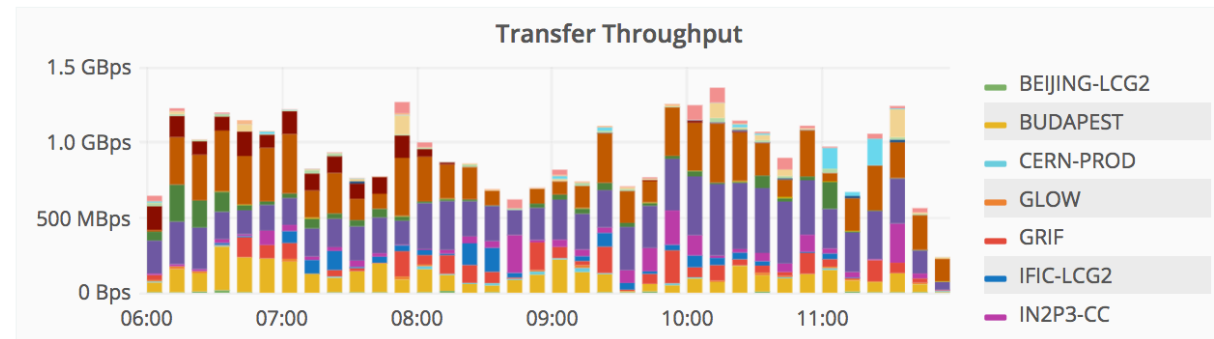
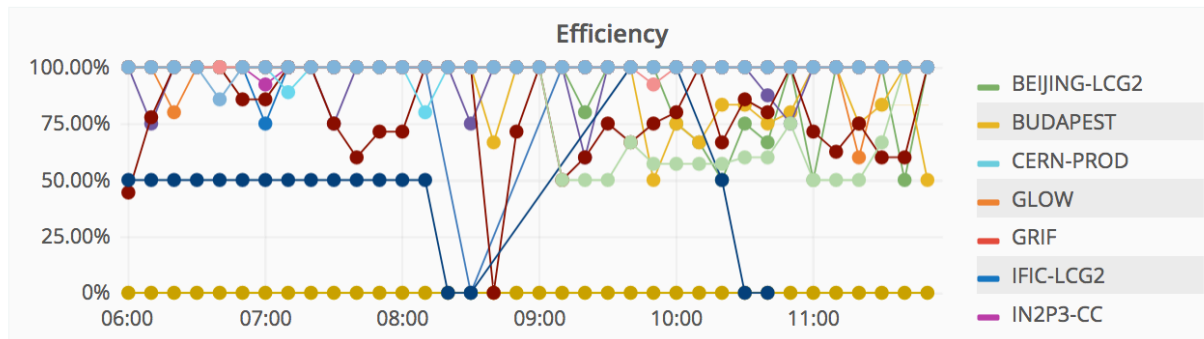
FTS Transfers (30 Days)

Last 6 hours

Group By dst_site VO alice + atlas + cms + lhcb Source Country All Dest Country All Source Site All Dest Site All FTS Server All Bin auto

Filters ipv6 = true +

FTS Transfers (LAST 30 DAYS)



Tier-1 Status

- All Tier 1, except **KR-KISTI-GSDC**, are now IPv6 peering with LHCOPN
- Dual-stack storage slowly being deployed
- Storage plans not currently clear at: FNAL, KIT, Russia, INFN, BNL, ASGC

Sites IPv6 connectivity

Name	Type	LHCOPN IPv6 peering	LHCONE IPv6 peering	LHCONE IPv6 peers	NREN IPv6 peers	IPv6 LAN	dualstack perfSONAR	dualstack storage percentage by 1st April 2017	dualstack storage percentage by 31st May 2017	dualstack storage percentage by 31st July 2017	Network Statistics	Notes	date last update
UKI-LT2-IC-HEP	Tier2		Yes	Janet	Janet	Yes		100					02/17/2017
TRIUMF	Tier1	Yes	Yes	Canarie	BCNET	Yes	Yes	0				TRIUMF MW readiness storage is 100% running on dual stack since April 26. And data transfer is primarily using ipv6 now.	05/05/2017
RAL	Tier1	Yes			JANET	Yes	Yes	0	20	100		IPv6 storage connectivity refers to ECHO/Ceph, Castor will not (ever) be dual stack.	05/23/2017
prague1cg2 (FZU)	Tier2	No	Yes	CESNET	CESNET	Yes	Yes	100			http://netreport.cesnet.cz/netreport/hep-cesnet-experimental-facility2/		02/17/2017
NL-T1-Nikhef	Tier1	Yes	No	GEANT	SURFnet	Yes	No	0	0	100	http://beer.nikhef.nl/cgi-bin/grapher.cgi?target=%2Fparkwachter.ipmi.nik...	Full dual stack coming soon; direct peering with CERN is up.	04/07/2017

<https://hepix-ipv6.web.cern.ch/sites-connectivity>

ALICE

- 71 SEs in 54 sites
- 9 have IPv6 DNS AAAA (6 sites)
- 8 are reachable over IPv6

IPv6 readiness by site								
Site	SE				CE			
	Name	Endpoint	IPv6 address	Reachable	Name	Endpoint	IPv6 address	Outgoing connectivity
1. ATHENS					Athens::LCG	alice.afroditi.hellasgrid.gr	No IPv6 DNS addr	
2. BARI	BARI::SE	alicegrid2.recas.ba.infn.it	No IPv6 DNS addr		Bari::CREAM	vobox-alice.ba.infn.it	No IPv6 DNS addr	
3. BIRMINGHAM	BIRMINGHAM::SE	epgsr5.ph.bham.ac.uk	No IPv6 DNS addr		Birmingham::LCG	epgr10.ph.bham.ac.uk	No IPv6 DNS addr	
4. BITP	BITP::SE	se.bitp.kiev.ua	[2a00:fc00:6:0:0:0:2]	Cannot connect to [2a00:fc00:6...	BITP::LCG_ARC	arc.bitp.kiev.ua	[2a00:fc00:6:0:0:0:9]	
5. BOLOGNA					BITP::LCG	vobox.bitp.kiev.ua	[2a00:fc00:6:0:0:0:1]	
6. BRATISLAVA	BRATISLAVA::SE	lcgstorage04.dnp.fmph.uniba.sk	No IPv6 DNS addr		Bologna::LCG	bovobox.bo.infn.it	No IPv6 DNS addr	
7. CAGLIARI					Bratislava::LCG	lcvboxtwo.dnp.fmph.uniba.sk	No IPv6 DNS addr	
8. CATANIA	CATANIA::SE	prod-se-01.ct.infn.it	No IPv6 DNS addr		Cagliari::LCG	voboxcr.ca.infn.it	No IPv6 DNS addr	
9. CBPF					Cagliari::Cagliari-CREAM	voboxcr.ca.infn.it	No IPv6 DNS addr	
10. CCIN2P3	CCIN2P3::SE	ccxrdralice.in2p3.fr	No IPv6 DNS addr		Catania::Catania-CREAM	vobox.ct.infn.it	No IPv6 DNS addr	
11. CCIPL	CCIN2P3::TAPE	ccxrdralice.in2p3.fr	No IPv6 DNS addr		Catania::Catania_VF	alict-vobox-01.ct.infn.it	No IPv6 DNS addr	
					CBPF::LCG	vobox.cat.cbpf.br	No IPv6 DNS addr	
					CCIN2P3::LCGSGE2	ccwlgalice02.in2p3.fr	No IPv6 DNS addr	
					CCIPL::SLURM	nanlsg12.in2p3.fr	No IPv6 DNS addr	
	CERN::EOS	eosalice.cern.ch	No IPv6 DNS addr					
	CERN::OCDB	eosalice.cern.ch	No IPv6 DNS addr		CERN::aliendb5	aliendb5.cern.ch	[2001:1458:201:b49f:0:0:100:27]	
	CERN::CASTOR2	castoralice.cern.ch	No IPv6 DNS addr		CERN::pcalice92.cern.ch	pcalice92.cern.ch	[2001:1458:202:41:0:0:101:8a68]	
	CERN::TOALICE	castoralice.cern.ch	No IPv6 DNS addr		CERN::WONDERLAND	alientest02.cern.ch	[2001:1458:201:22:0:0:100:19]	
					CERN::CERN_HLT	alihltcloud.cern.ch	No IPv6 DNS addr	
					CERN::CERN-AURORA	voboxalice1.cern.ch	[2001:1458:201:b50e:0:0:100:38]	
					CERN::CERN-TRITON	voboxalice2.cern.ch	[2001:1458:201:b50e:0:0:100:39]	
					CERN::CERN-ZENITH	voboxalice3.cern.ch	[2001:1458:201:22:0:0:100:18]	
					CERN::Altaria	voboxalice4.cern.ch	[2001:1458:201:22:0:0:100:1a]	
					CERN::Phoenix	voboxalice6.cern.ch	[2001:1458:201:22:0:0:100:1f]	
					CERN::CERN-SIRIUS	voboxalice7.cern.ch	[2001:1458:201:b50e:0:0:100:3e]	
					CERN::CERN-MIRAGE	voboxalice8.cern.ch	[2001:1458:201:b50e:0:0:100:3d]	
					CERN::CERN-CORONA	voboxalice9.cern.ch	[2001:1458:201:b50e:0:0:100:3c]	
					CERN::CERN_HLTDEV	alihltcloud2.cern.ch	No IPv6 DNS addr	
					CERN::Nemesi	voboxalice10.cern.ch	[2001:1458:201:b50e:0:0:100:c]	
12. CERN								

IPv6 update GridPP39 Lancaster Sept 2017

<http://alimonitor.cern.ch/ipv6/>

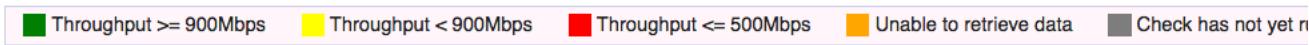
CMS

- Adding a DNS IPv6 test to production ETF instance
- Preparing a SAM storage test for xRootD
 - copy files in and out
 - automatically test all SEs (from IPv6 ETF/SAM3)
- Tracking IPv6 readiness of sites
 - 12 sites “Healthy IPv6 and ready to test”
 - 23 sites “Known issues”
 - 7 sites “Unknown status”
- Also updating WLCG survey:
[https://www.gridpp.ac.uk/wiki/2014 IPv6 WLCG Site Survey](https://www.gridpp.ac.uk/wiki/2014_IPv6_WLCG_Site_Survey)

LHCb

- LHCb will start to monitor site statuses in a similar way to ALICE (using same table and column format)
- Analysis of IPv6 implementation for sites supporting LHCb
 - 21 SEs (6 IPv6 capable)
 - 163 CEs at 76 Sites (15 IPv6 at 6 sites)
 - (Just reporting standard WLCG CEs and excluding LHCb defined vac, DIRAC and cloud (vcycle) sites as none are yet IPv6 capable)
- Ongoing interesting issue uploading output from Imperial dual-stack WN to Sara SE which appears to be specific to some host pairs over IPv6 from the UK and whilst using LHCONE
 - Inability to ping hosts over IPv6 recently confirmed by GÉANT
 - GGUS ticket: https://ggus.eu/index.php?mode=ticket_info&ticket_id=129946

UK Mesh Config - IPv6 Bandwidth Tests



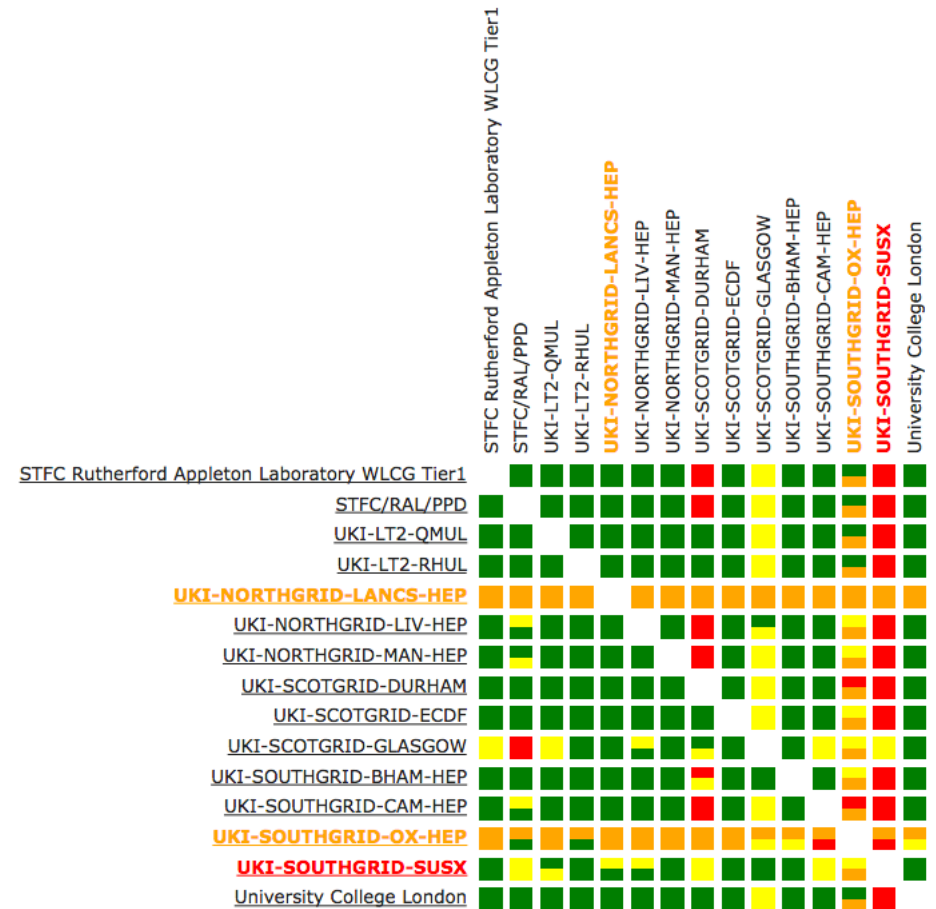
Found a total of 4 problems involving 3 hosts in the grid



UK Mesh Config - IPv4 Bandwidth Tests



Found a total of 3 problems involving 3 hosts in the grid



- WLCG 'dual-stack' and UK meshes are testing over IPv4 & IPv6 where possible
- Other meshes (e.g. LHCOPN and LHC VO's still only testing over IPv4)
- <http://psmad.grid.iu.edu/maddash-webui/index.cgi?dashboard=UK%20Mesh%20Config>

Dirac Network Test Results

Last updated at 27/07/17 21:30:01

Jobs are sent to each site to read 100MB, 500MB and 1,000GB files from each other site using various protocols. The files have been previously replicated to all SEs. The table shows average bandwidth computed from the times taken for each combination (including the local SE). Details of individual jobs are given below.

Protocol: http_ipv6

Protocols: [lcg](#) [http](#) [ipv4](#) [http](#) [ipv6](#) [xrootd](#) [ipv4](#) [xrootd](#) [ipv6](#)

Institutes: [Brunel](#) [IC-HEP](#) [QMUL](#) [RHUL](#) [UCL-HEP](#) [LANCS-HEP](#) [LIV-HEP](#) [MAN-HEP](#) [SHEF-HEP](#) [DURHAM](#) [ECDF](#) [GLASGOW](#) [BHAM-HEP](#) [BRIS-HEP](#) [CAM-HEP](#) [OX-HEP](#) [RALPP](#) [SUSX](#) [EFDA-JET](#) [RAL-LCG2](#)

Ordered by averages (MB/s)

	Brun	Imp	QMUL2	RHUL	Lan	Liv	Man	Shef	Dur	Ed	Gla	Birm	Cam	Ox	PPD	JET	Ave
LCG.UKI-LT2-Brunel.uk	130.8	56.8															93.8
LCG.UKI-NORTHGRID-MAN-HEP.uk	70.8	94.7															82.8
CLOUD.UKI-GridPP-Cloud-IC.uk	64.8	74.5															69.6
LCG.UKI-LT2-IC-HEP.uk	33.4	48.2															40.8
LCG.UKI-SOUTHGRID-OX-HEP.uk		27.6															27.6
LCG.UKI-SCOTGRID-DURHAM.uk	16.9	16.2															16.5

	Brun	Imp	QMUL2	RHUL	Lan	Liv	Man	Shef	Dur	Ed	Gla	Birm	Cam	Ox	PPD	JET	Ave
LCG.UKI-LT2-Brunel.uk	50.1	30.1		18.6	5.8	28.1	47.8				28.1		62.3	0.0	19.0		29.0

IPv6 update GridPP39 Lancaster Sept 2017

Brunel even with new NAT still shows better results over IPv6

Protocol: http_ipv4

Dirac Network Test Results

Last updated at 27/07/17 22:01:20

Jobs are sent to each site to read 100MB, 500MB and 1,000GB files from each other site using various protocols. The files have been previously replicated to all SEs. The table shows average bandwidth computed from the times taken for each combination (including the local SE). Details of individual jobs are given below.

Protocol: xrootd_ipv6

Protocols: [lcg](#) [http](#) [ipv4](#) [http](#) [ipv6](#) [xrootd](#) [ipv4](#) [xrootd](#) [ipv6](#)

Institutes: [Brunel](#) [IC-HEP](#) [QMUL](#) [RHUL](#) [UCL-HEP](#) [LANCS-HEP](#) [LIV-HEP](#) [MAN-HEP](#) [SHEF-HEP](#) [DURHAM](#) [ECDF](#) [GLASGOW](#) [BHAM-HEP](#) [BRIS-HEP](#) [CAM-HEP](#) [OX-HEP](#) [RALPP](#) [SUSX](#) [EFDA-JET](#) [RAL-LCG2](#)

Ordered by averages (MB/s)

	Imp	Brun	QMUL2	RHUL	Lan	Liv	Man	Shef	Dur	Ed	Gla	Birm	Cam	Ox	PPD	JET	Ave
LCG.UKI-LT2-Brunel.uk	68.3	103.1															85.7
LCG.UKI-NORTHGRID-MAN-HEP.uk	108.4	51.1															79.7
CLOUD.UKI-GridPP-Cloud-IC.uk	52.6	51.5															52.1
LCG.UKI-LT2-IC-HEP.uk	55.6	35.8															45.7
LCG.UKI-SOUTHGRID-OX-HEP.uk	36.7																36.7
LCG.UKI-SCOTGRID-DURHAM.uk	11.0	15.4															13.2

Protocol: xrootd_ipv4

	Brun	Imp	QMUL2	RHUL	Lan	Liv	Man	Shef	Dur	Ed	Gla	Birm	Cam	Ox	PPD	JET	Ave
LCG.UKI-LT2-Brunel.uk	35.0	39.3		15.6	15.3	15.0	8.4				17.1		28.0	13.7	19		19.7

Tutorials at Meetings

HEPSYSMAN (summer at RAL)

- Held an 'IPv6 day' before the main meeting
- Tim Chown (Jisc) gave a useful 'Introduction to IPv6'
- Eric Vyncke (Cisco) gave a very detailed session on IPv6 Security

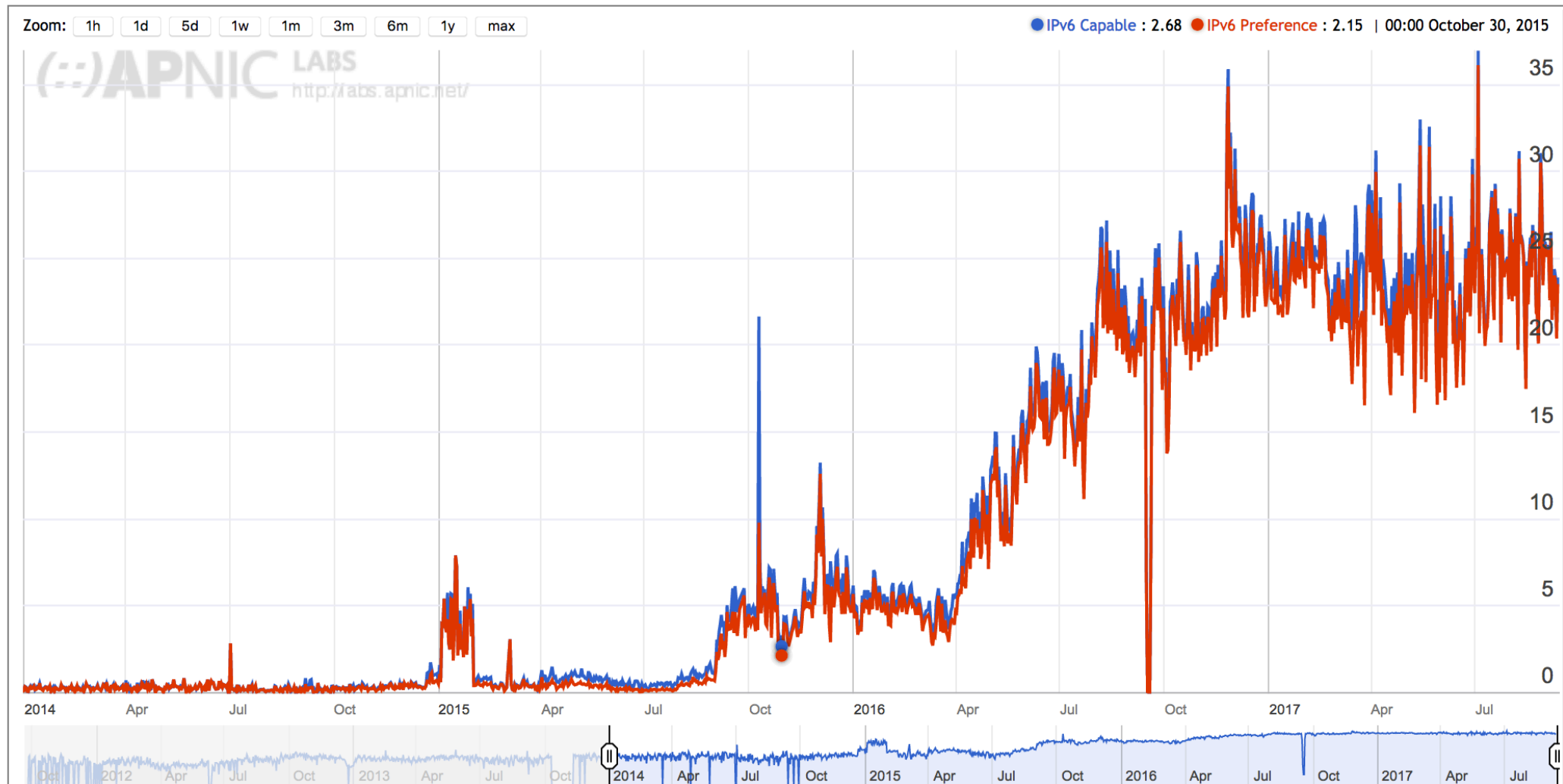
WLCG Workshop in Manchester

- Several talks introducing IPv6 including one from Terry Froy
- Three IPv6 practical sessions (using VMs set up by Terry) including copying files into IPv6-only SE, installing CVMFS/Squid and perfSONAR (by me)

UK IPv6 Council meetings

- Worth attending to see how other organisations are dealing with IPv6
- Oct 2016 meeting included a talk by Phil Mayers from Imperial College on their IPv6 roll out
- Most recent event was security workshop in July 2017
- Sky rolled out IPv6 recently
 - now have ~5M IPv6-enabled customers, dual-stack
- BT have around 2M IPv6-enabled customers
 - Not yet on my home router (HomeHub 5) however...
- <http://www.ipv6.org.uk/>

Use of IPv6 for United Kingdom of Great Britain and Northern Ireland (GB)



Summary

- Still limited dual-stack storage at the Tier-1s but coming slowly
- RAL has made good progress
- Brunel IPv6 WN has been very helpful for LHC VO's
- LHCb can run on IPv6-only CPUs
- Tracking and monitoring best done by the Experiment VOs themselves
- UK Tier-2s are making slow, steady progress but still a long way to go
 - would be good to have more dual-stack worker nodes and storage
- Training (e.g. WLCG workshop) and Documentation (underway)