

Future Networks

Robin Tasker
(robin.tasker@stfc.ac.uk)
20 April 2012



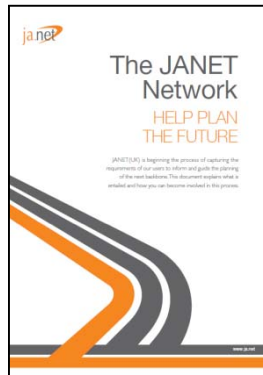
Science & Technology
Facilities Council



Content



Local Area Networking



JANET SIX

Thanks to JANET(UK)



Ethernet Published Today

- IEEE 802.3-2008** IEEE Standard for Information technology-Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
- IEEE 802.3av-2009** Amendment 1: Physical Layer Specifications and Management Parameters for 10Gb/s Passive Optical Networks
- IEEE 802.3bc-2009** Amendment 2: Ethernet Organizationally Specific Type, Length, Value (TLVs)
- IEEE 802.3ba-2010** Amendment 4: Media Access Control Parameters, Physical Layers and Management Parameters for 40Gb/s and 100Gb/s Operation
- IEEE 802.3az-2010** Amendment 5: Media Access Control Parameters, Physical Layers, and Management Parameters for Energy-Efficient Ethernet
- IEEE 802.3bg-2011** Amendment 6: Physical Layer and Management Parameters for Serial 40Gb/s Ethernet Operation Over Single Mode Fiber
- IEEE 802.3bf-2011** Amendment 7: Media Access Control (MAC) Service Interface and Management Parameters to Support Time Synchronization Protocols
- IEEE 802.3bd-2011** Amendment 8: MAC Control Frame for Priority-based Flow Control



Ethernet In Development Today

IEEE 802.3 Next Generation 100Gb/s Optical Ethernet Study Group

Modify the scope of SG to include 40G, adopt:

1. Define a 40Gb/s PHY for operation over at least 40km of SMF
2. Define a 100Gb/s PHY for operation up to at least 500m of SMF
3. Define a 100Gb/s PHY for operation up to at least 100m of MMF
4. Define a 100Gb/s PHY for operation up to at least 20m of MMF

IEEE 802.3 100Gb/s Backplane and Copper Cable Task Force

Scope:

1. Rapid growth of server, network, and internet traffic is driving the need for higher data rates over backplanes and high density, low cost twin-axial copper cables.
2. IEEE Std 802.3 does not currently support 100Gb/s operation on backplane media.
3. There is a market need for a lower cost, lower power, and higher density solution for twin-axial copper



Commodity 10G/40G Ethernet products deployed:

RAL

Core External Network

Extreme X670 switch/routers providing (48*10G + 4*40G) interfaces in 1u operating as fully capable Layer 3 IP routers

Internal Distribution Network

Extreme X670 switch/routers operating a Layer 2 switch

LHC Tier 1 Centre

Force10 9210 with (48*10 G + 4*40G) and Force10 Z9000 with (32*40G) in 1u

JASMIN

Force10 S4810 and Force10 S2410 switches

Glasgow

LHC Tier 2 Centre

Extreme X670 switch/routers operating a Layer 2 switch



Ethernet Futures

IEEE Communications Magazine

Volume: 48 Issue: 7 June 2011

With 100G technologies standardized, in the context of both Ethernet and the optical transport network (OTN, ITU-T G.709), 100G router ports and 100G optical transport interfaces are commercially available. Heavily data-centric users are starting to ask for higher-rate interfaces. First speculations include 400G as well as 1T as the next possible Ethernet standards. Discussion starting on interface technology options for Ethernet and OTN beyond 100G in light of the current 100G standards, taking into account likely evolution paths of interface technologies over the next 10 years.

Verizon has taken a key step towards rolling out 400 gigabit and 1 terabit (1T) Ethernet speeds, demonstrating the ability to run 100G, 400G, and 1T in a field trial. Performed last year on 3,560km of Verizon network fibre in the Dallas area, Verizon and NEC successfully demonstrated the ability to go up to 1TB outside of the lab on existing deployed fibre.

Huawei demonstrated in March 2012 its 200Gbit/s high-speed line card for NE5000E router .. to provide 200GE access and transmission over a distance of 180 km..

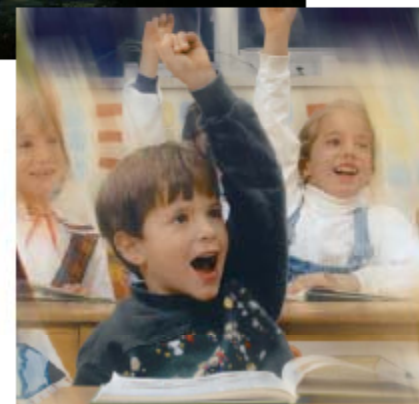
Ethernet Alliance

19 April 2012

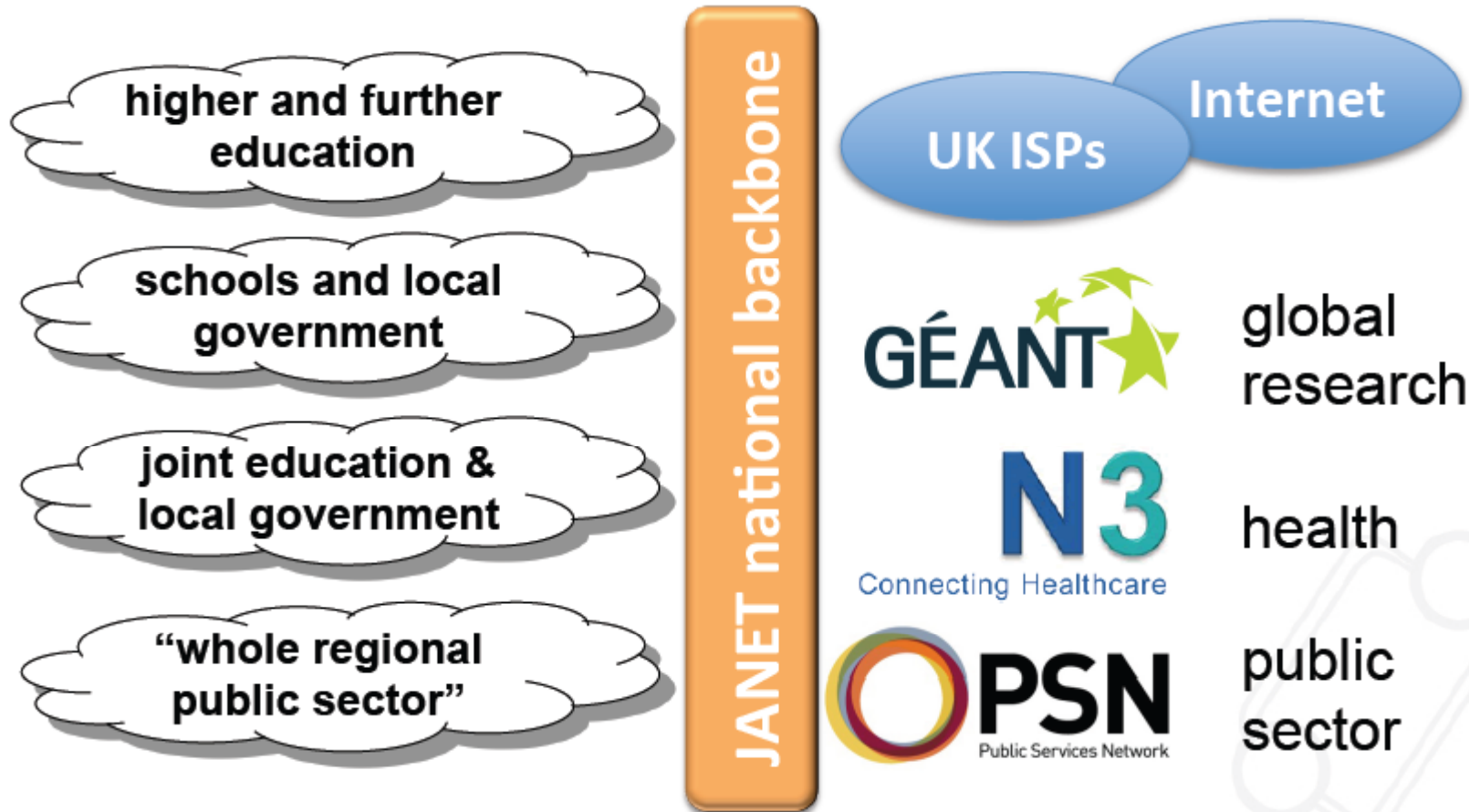
Discussing “Terabits in the Rack and Petabits in the Data Center”

“The UK’s education and research network”

- available to 18M users
 - higher & further education
 - academic research
 - primary & secondary schools
 - adult & community learning
- over $\frac{1}{4}$ of the UK population ...



JANET national and regional architecture



JANET6 Requirements

Reliability	High reliability by minimising single points of failure; flexibly coping with major breaks; resilience to customer organisations
Scalability	Ability to increase bandwidth at controllable cost
Separability	Protection of interests of teaching and learning and research sectors
Flexibility	Responsiveness to additional network service requirements
Functionality	Support for the provision of wide range of services: e.g. High information assurance; Unified comms

End-to end
Across JANET

Backbone services

- evolution of SuperJANET5 “multiple network” model
- extension of multi-service architecture to support
 - commodity IP at 100G+ on backbone
 - e.g. 400G technology expected by 2015
 - less London-centric
 - more automated and responsive lightpath services
 - unified communications
 - higher information assurance
 - working with other public sector networks (“PSN”)

Procurement Strategy

Fibre Procurement

- Lot 1: Fibre Infrastructure in the UK
 - Options: Scotland, Wales, Ireland, Aurora, London, Research
- Lot 2: Fibre Infrastructure in Ireland
- Framework Agreement(s) for 4 years
- Initial order from 5+2 years to 10+5 years



Procurement Strategy

Transmission equipment procurement

- Supply, design, delivery, installation, commissioning, maintenance, training, specialist technical support
- Framework Agreement for 7 years
- Initial order 3 + 2 + 2 years



From requirements to services

- Capacity
 - Exponential growth continues
 - ‘Commodity’ IP networking
 - R&E requirements
 - Must be able to scale the network
 - Not just more channels, but faster channels over the network’s life
 - 100Gbit/s to start
 - 400Gbit/s?
 - 1Tbit/s?



From requirements to services

- Ubiquitous connectivity
 - Access to Janet from anywhere
 - Not all in the scope of Janet6
 - Other activities in the company
 - Feeds the capacity requirements
 - Feeds the external connection requirements
 - Feeds the reliability requirements



From requirements to services

- Research
 - National and global collaboration
 - Interoperation with GEANT and other R&E networks worldwide
 - LHC, SKA, ITER, Bioinformatics, Climate...
 - ‘Data deluge’
 - Services
 - Dynamic provisioning of layer 2 circuits





E-Infrastructure

1. RCUK - infrastructure reviews
2. HPC Paper (Peter Coveney) – e-Science community requirements
3. Tildesley Report , “A Strategic Vision for UK e-Infrastructure “

Proposed a 10 year roadmap for the development and use of advanced computing, data, and networks. JANET a member of the editorial group for network aspects
BIS announcements on e-Infrastructure capital funding last autumn

JISC/JANET Reviews and Future Funding Models

Review of JANET(UK) by Capita Consulting reported that network universality in network provision was key to maintaining an effective research and teaching community, and that this would be at risk from institutions moving away from JANET(UK) to other IP network providers.

The HEFCE's review (the Wilson Report) of the JISC in 2011: the JANET network was recognised in the Wilson Report as 'a major source of competitive advantage to the UK,' **but** also concluded that “JISC should be funded through a combination of grants and subscription/user charges”.

This conclusion indicates that the sector can expect to make a greater contribution in the future through an increased network charge or subscription