Research requirements for a Future JANET

2012/13 and beyond

David Salmon - JANET(UK)
40G & 100G slides from Rob Evans – JANET(UK)

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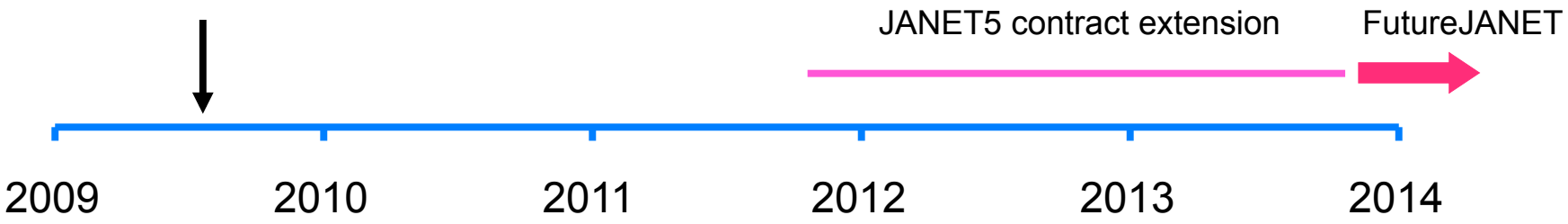
Overview

- Where are we now ?
- Current JANET - SuperJANET5 backbone
  - Architecture
  - Services
  - High capacity
    - 40Gb/s service
    - 100Gb/s trial
- Research infrastructures
  - JANET Lightpath examples
  - JANET Aurora – dark fibre
- Emerging Issues for a future JANET
- Research requirements ?

Approximate timescales

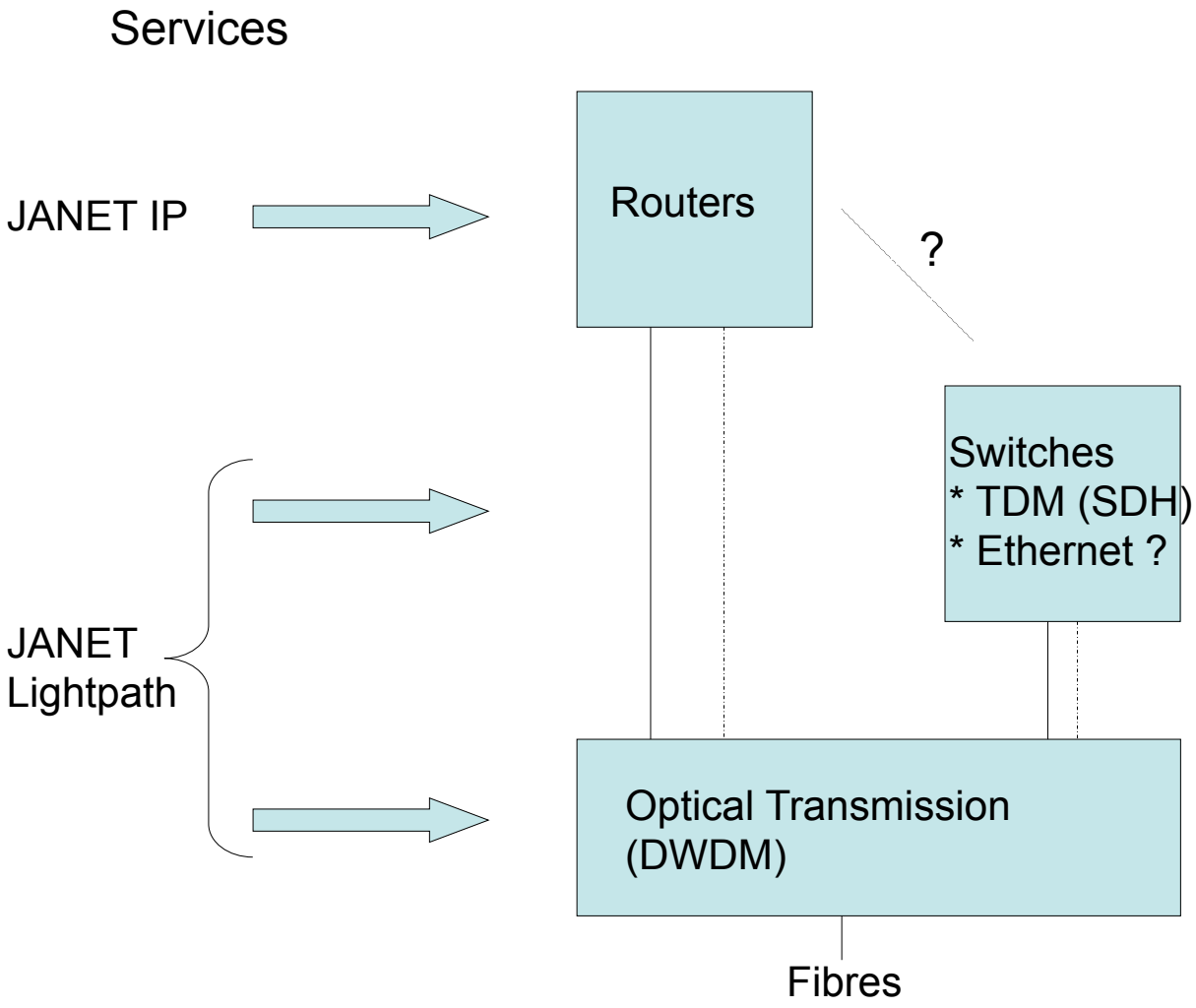


- This Year
  - prepare for contract extension 2011/2013
- Next 1.5 to 2 yrs
  - Gather & understand requirements for "FutureJANET" – post 2013
- 2011/12/13 – procure & deploy "FutureJANET"

JANET Services

- JANET IP
  - High capacity
    - Core at 40Gb/s
  - High reliability & resilience
- JANET Lightpath
  - Mid to high capacity point-to-point circuits
- JANET Aurora
  - Dark fibre research platform

Generic Service Model



Structuring Layer
Circuits
<1Gbit/s – several Gbit/s
(10 – 100+ Gbit/s) in future

Bulk Capacity
Wavelengths
1 – 10 Gbit/s
(100+ Gbit/s in future)

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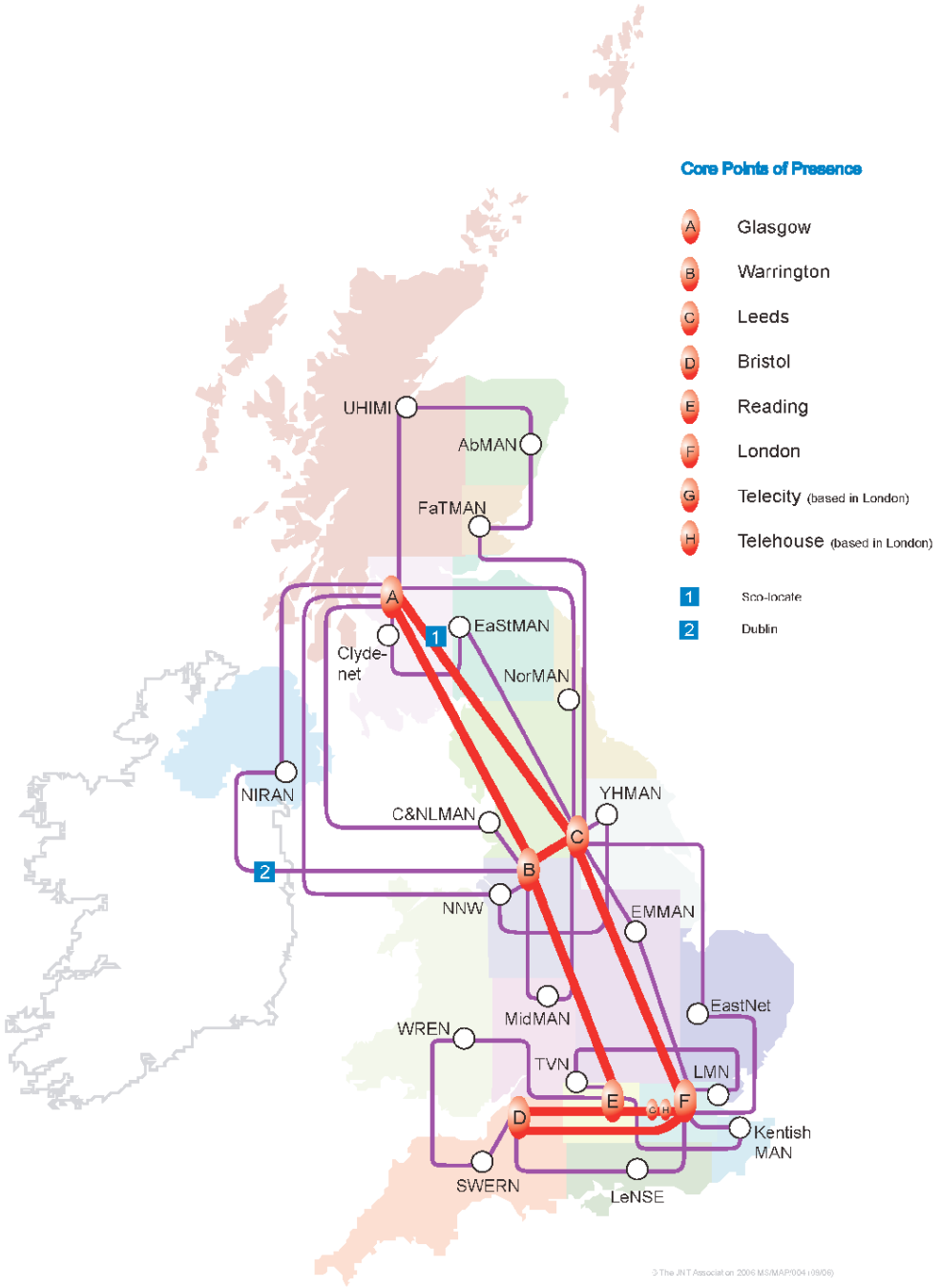
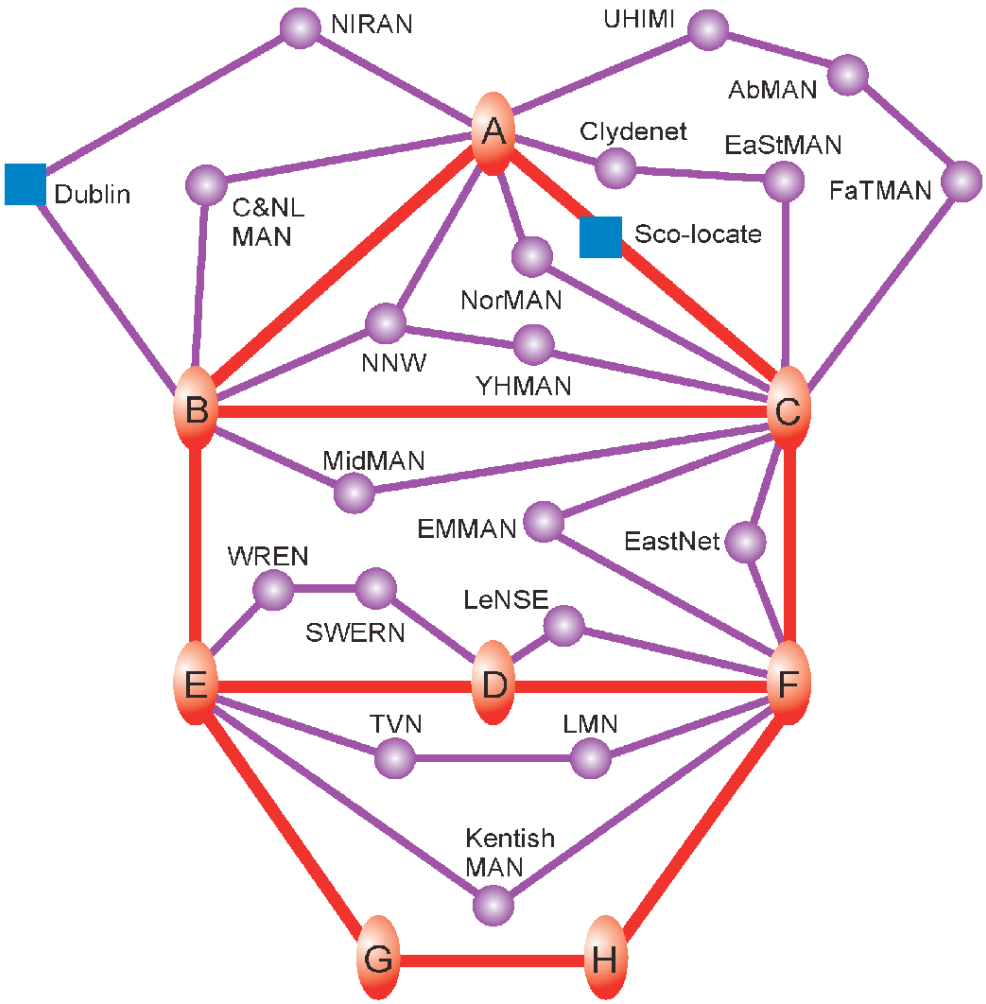

Core Points of Presence
A Glasgow
B Warrington
C Leeds
D Bristol
E Reading
F London
G Telecity (based in London)
H Telehouse (based in London)
1 Sco-locate
2 Dublin
UHIMI
AbMAN
FaTMAN
A
EaStMAN
1
Clyde-
net
NorMAN
NIRAN
C&NLMAN
YHMAN
C
B
2
NNW
EMMAN
MidMAN
EastNet
WREN
TVN
LMN
E
F
D
Kentish
MAN
SWERN
LeNSE



All Core links except AB and AC are 40Gb/s

A Glasgow
B Warrington
C Leeds
D Bristol
E Reading
F London
G Telecity
H Telehouse

Core Points of Presence
Regional Points of Presence
Core Path
Regional Path

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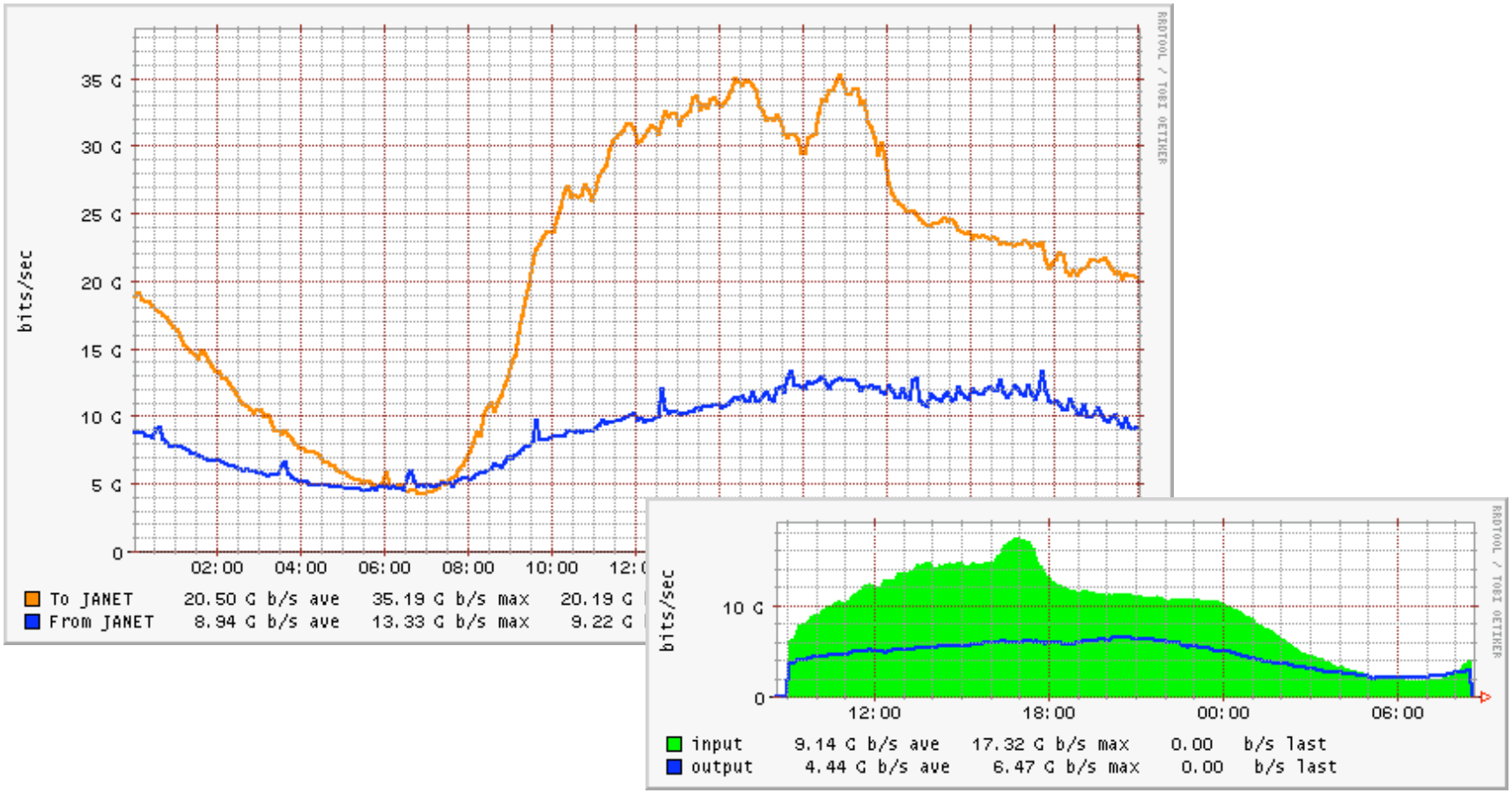
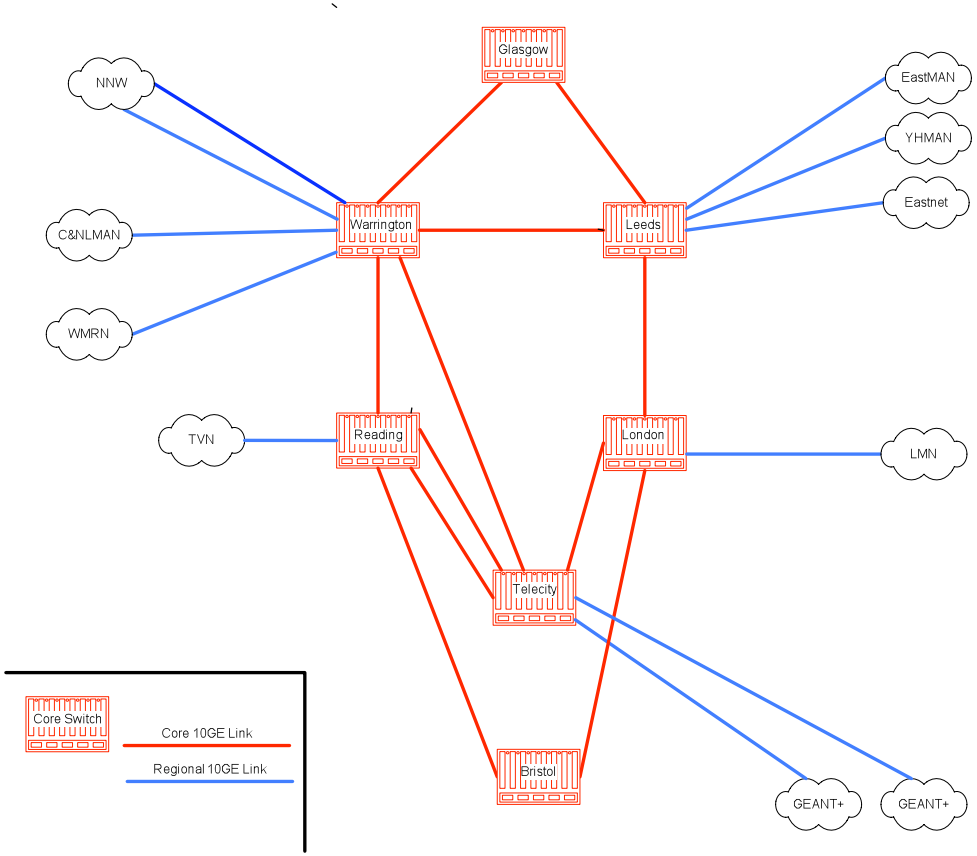
US Inauguration



JANET Lightpath Service

- Dedicated Network capacity for projects
  - Point-to-point circuits
  - Typically about 1Gb/s
- About 30 paths configured
  - Across about 15 projects
- New infrastructure
  - Reviewing provision & reinstatement with projects & US providers



Initial Lightpath Core Topology

- Uses Existing Circuits
- Supports existing lightpaths

EoMPLS

Fine-grained capacity provisioning

100Gbps Transmission Trial

Rob Evans
JANET(UK)

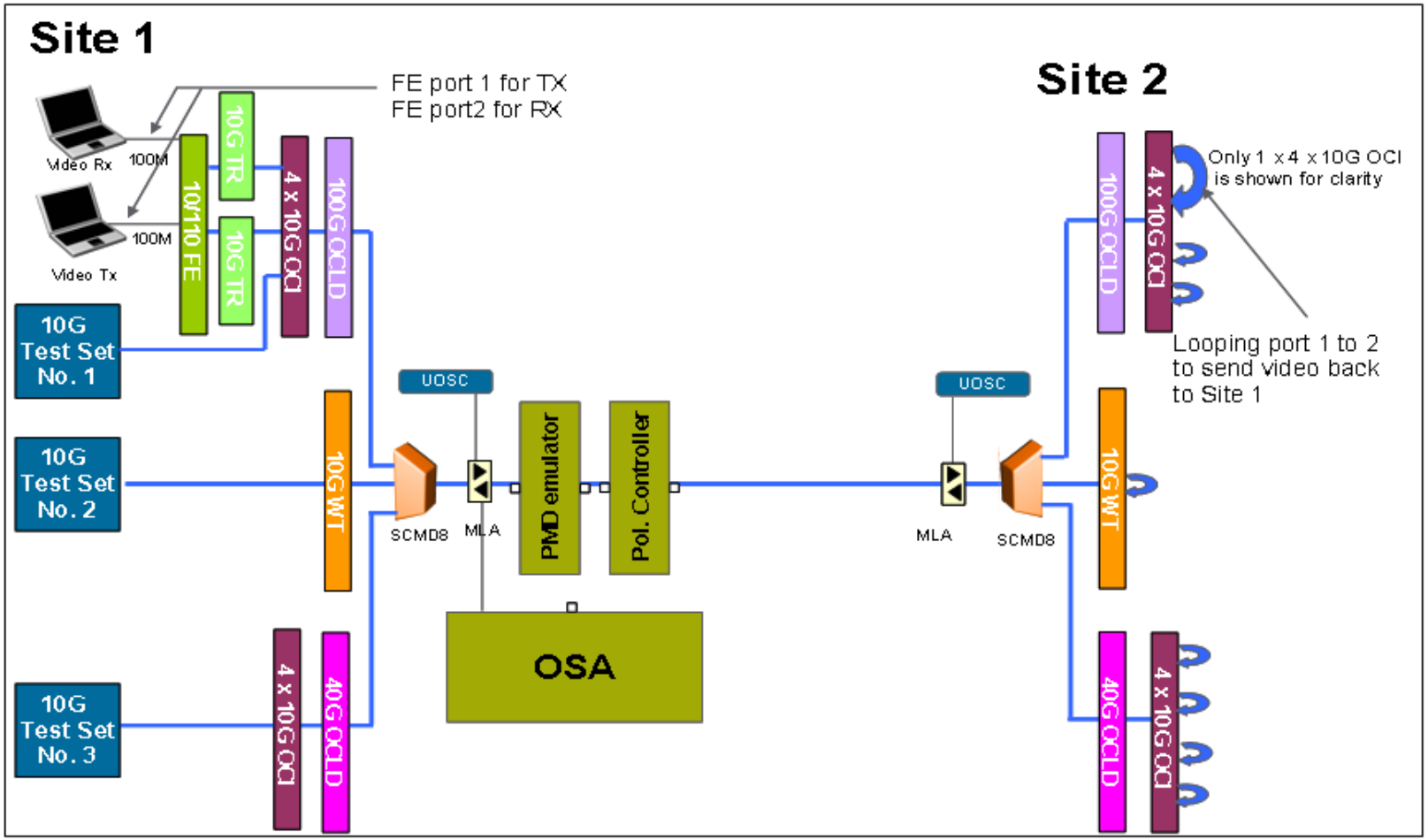
Credit...

- Much of the work here was performed by Verizon and Nortel
  - We were mainly observers
- Especially
  - Tom Sims at Verizon
  - Alan Beard at Nortel

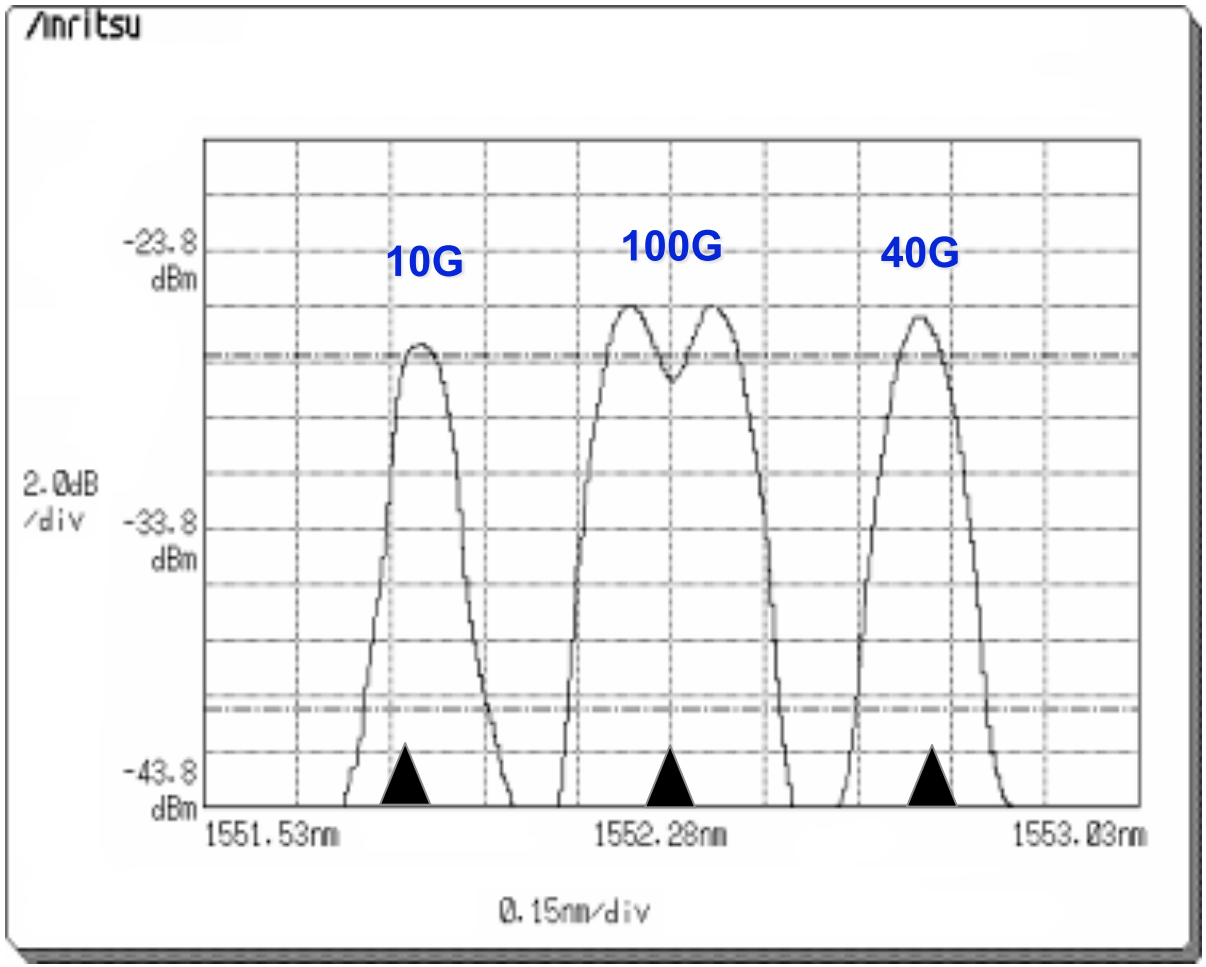
100G Trial

- ~100km dark fibre
  - London to Reading
- Three neighbouring 50GHz channels
  - 100, 40 & 10Gbps
- PMD Emulator
- Ethernet & SDH test sets
- Optical Spectrum Analyser
- ...and the only two 100G Nortel linecards in Europe.

100G Trial


Site 1
FE port 1 for TX
FE port2 for RX
Site 2
Video Rx
100M
Video Tx
100M
10/110 FE
10G TR
10G TR
4 x 10G OCI
100G OCLD
Only 1 x 4 x 10G OCI is shown for clarity
100G OCLD
4 x 10G OCI
Looping port 1 to 2 to send video back to Site 1
10G Test Set No. 1
10G Test Set No. 2
10G Test Set No. 3
10G WT
UOSC
SCMD8
MLA
PMD emulator
Pol. Controller
OSA
UOSC
MLA
SCMD8
10G WT
4 x 10G OCI
40G OCLD
40G OCLD
4 x 10G OCI

100G Trial


Anritsu
10G
100G
40G
-23.8 dBm
-33.8 dBm
-43.8 dBm
2.0dB /div
1551.53nm
1552.28nm
1553.03nm
0.15nm/div

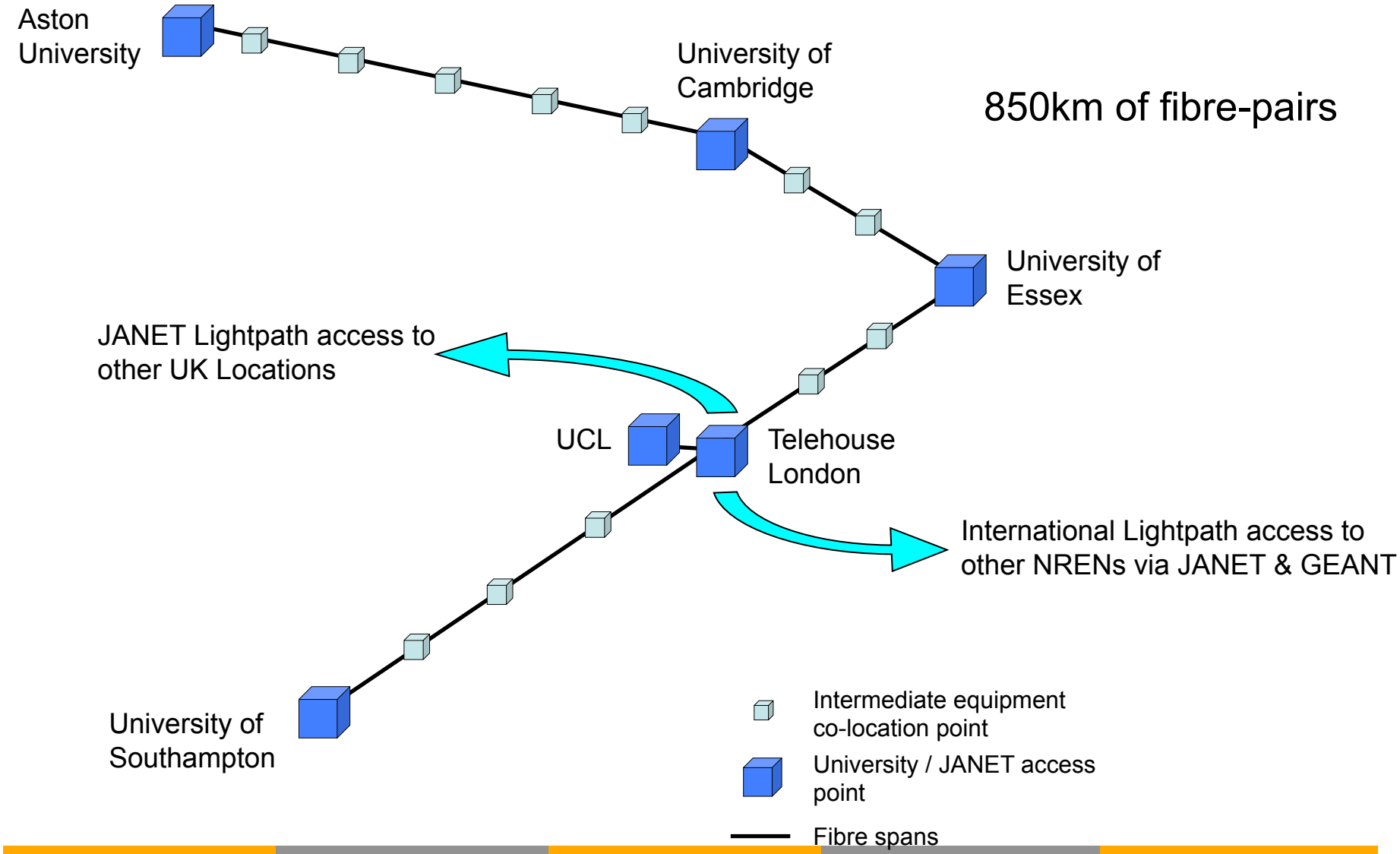
JANET Aurora

A Dark Fibre Facility for Photonics and Optical Networks and Systems Research

What have we procured ?

- Access (lease) a pair of fibres
  - linking Research groups at five Universities
- Access to intermediate locations for installing equipment
  - Researchers will put Optical Amplifiers and Dispersion Compensators in these locations
  - possibly ROADMS/WSS in future

JANET Aurora



University of Essex

School of Computer Science and Electronic Engineering

Field Trial of WDM-OTDM Transmultiplexing employing Photonic Switch Fabric-based Buffer-less Bit-interleaved Data Grooming and All-Optical Regeneration

G. Zarris[1], F. Parmigiani[2], E. Hugues-Salas[1], R. Weerasuriya[3], D. Hillerkuss[4], N. Amaya Gonzalez[1], M. Spyropoulou[5], P. Vorreau[4], R. Morais[6], S.K. Ibrahim[3], D. Klonidis[5], P. Petropoulos[2], A.D. Ellis[3], P. Monteiro[6], A. Tzanakaki[5], D. Richardson[2], I. Tomkos[5], R. Bonk[4], W. Freude[4], J. Leuthold[4], and D. Simeonidou[1]

1 – Photonic Networks Laboratory, University of Essex, U.K.
2 – Optoelectronics Research Centre, University of Southampton, U.K.
3 – Photonic Systems Group, Department of Physics and Tyndall National Institute, University College Cork, Ireland
4 – Institute of Photonics and Quantum Electronics, University of Karlsruhe, Germany
5 – Athens Information Technology Centre, Greece
6 – Nokia Siemens Networks Portugal S.A., Portugal

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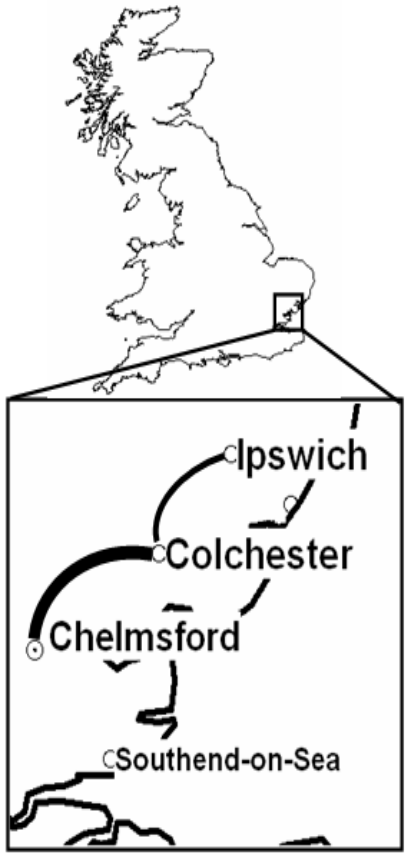
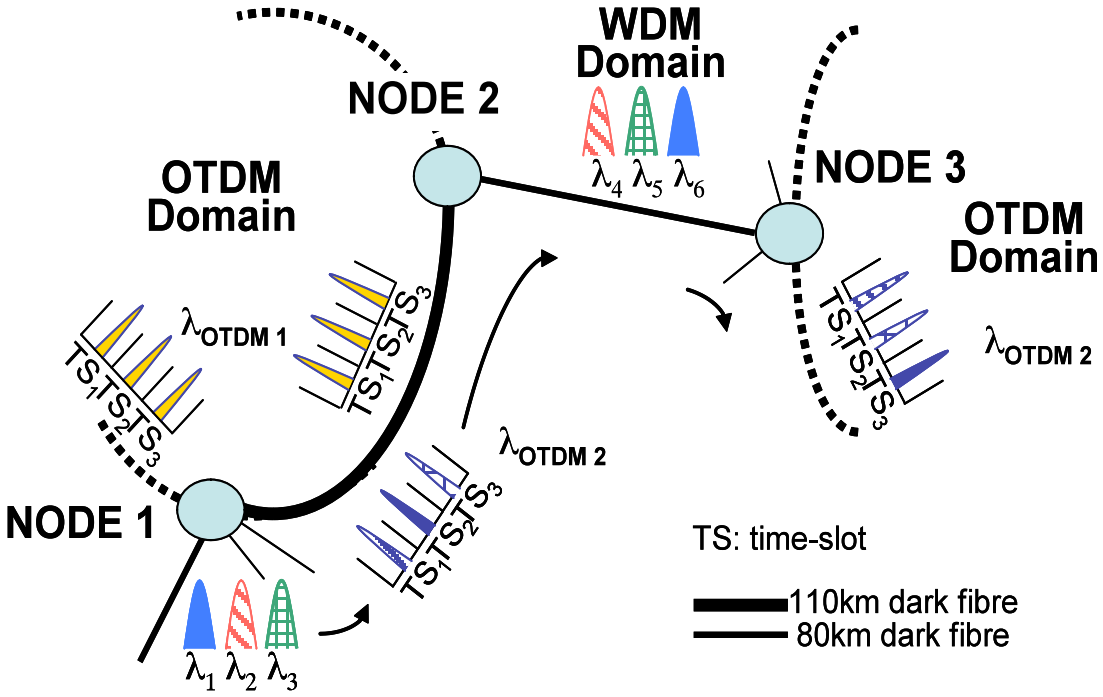
Field Trial





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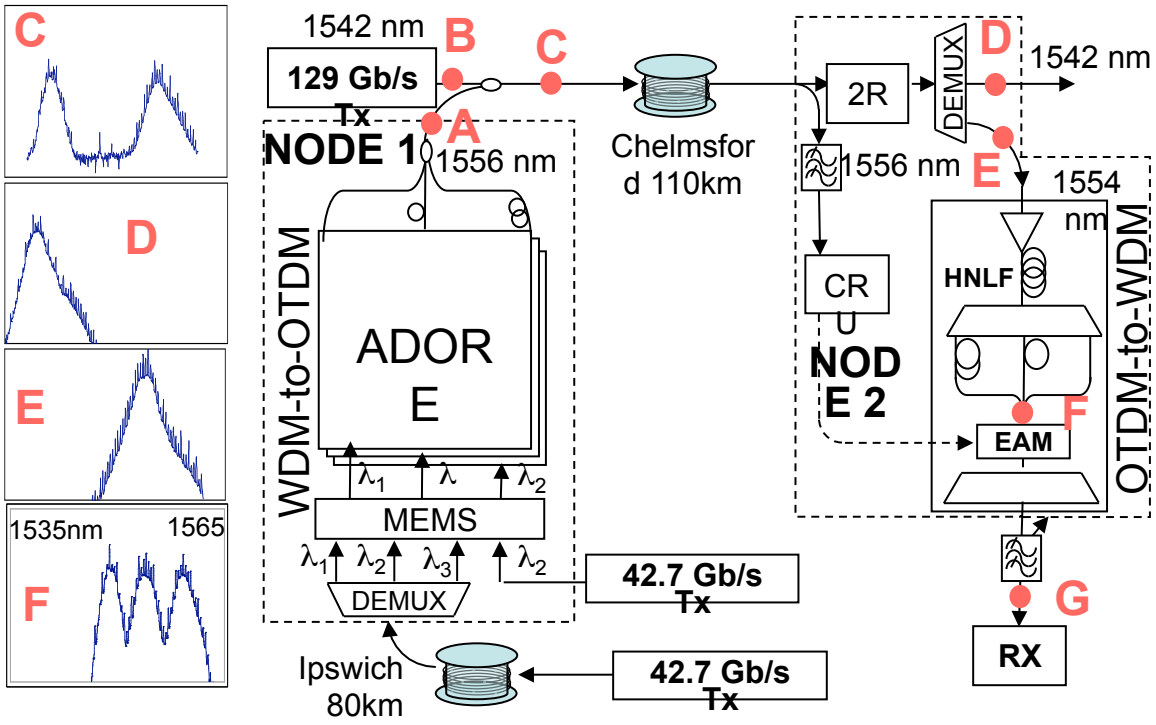
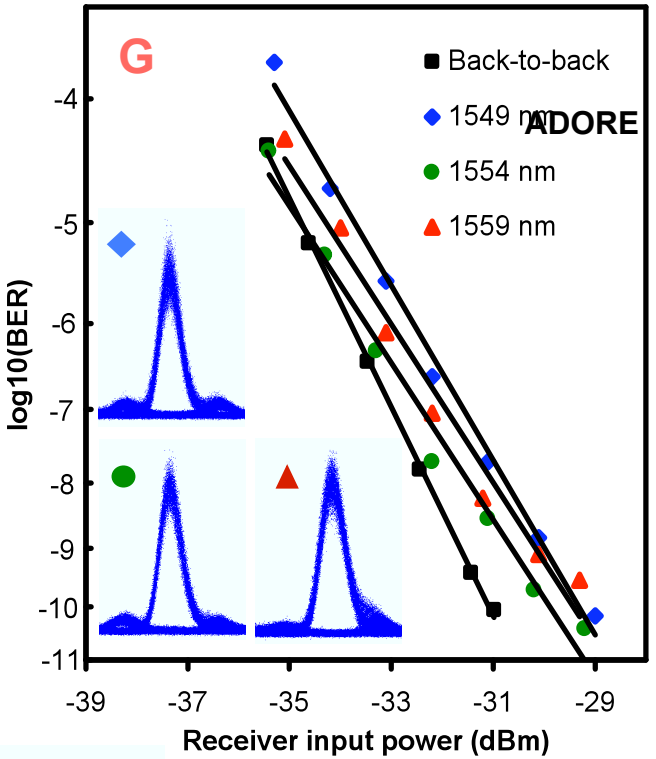
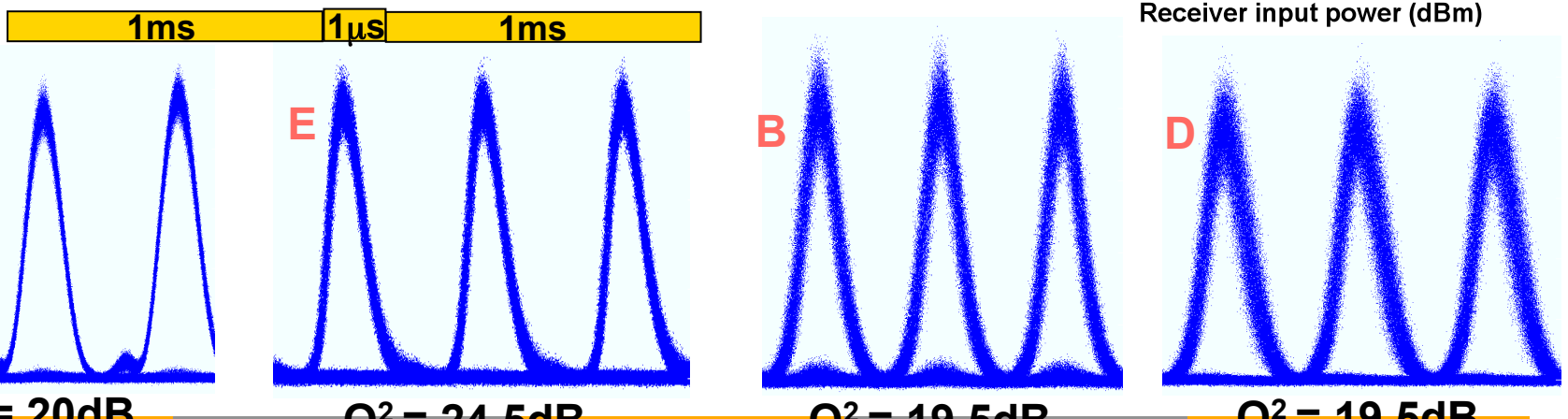
First Experiment







Q^2 = 20dB Q^2 = 24.5dB Q^2 = 19.5dB Q^2 = 19.5dB

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Issues for a Future JANET

Preparing for 2013 to 2020+

Future JANET Issues

- Contract Structures
  - Separate Fibre & transmission components ?
- Fibre options
  - Leases vs. IRUs, mandate fibre characteristics ?
- Capacity
  - 10, 40, 100Gbit/s
- L2 transmission
  - EoMPLS, PBB-TE, MPLS-TP
- IP
  - Traffic scaling, but little technical evolution expected
- Optical Layer Operations
  - Manage directly or subcontract ?

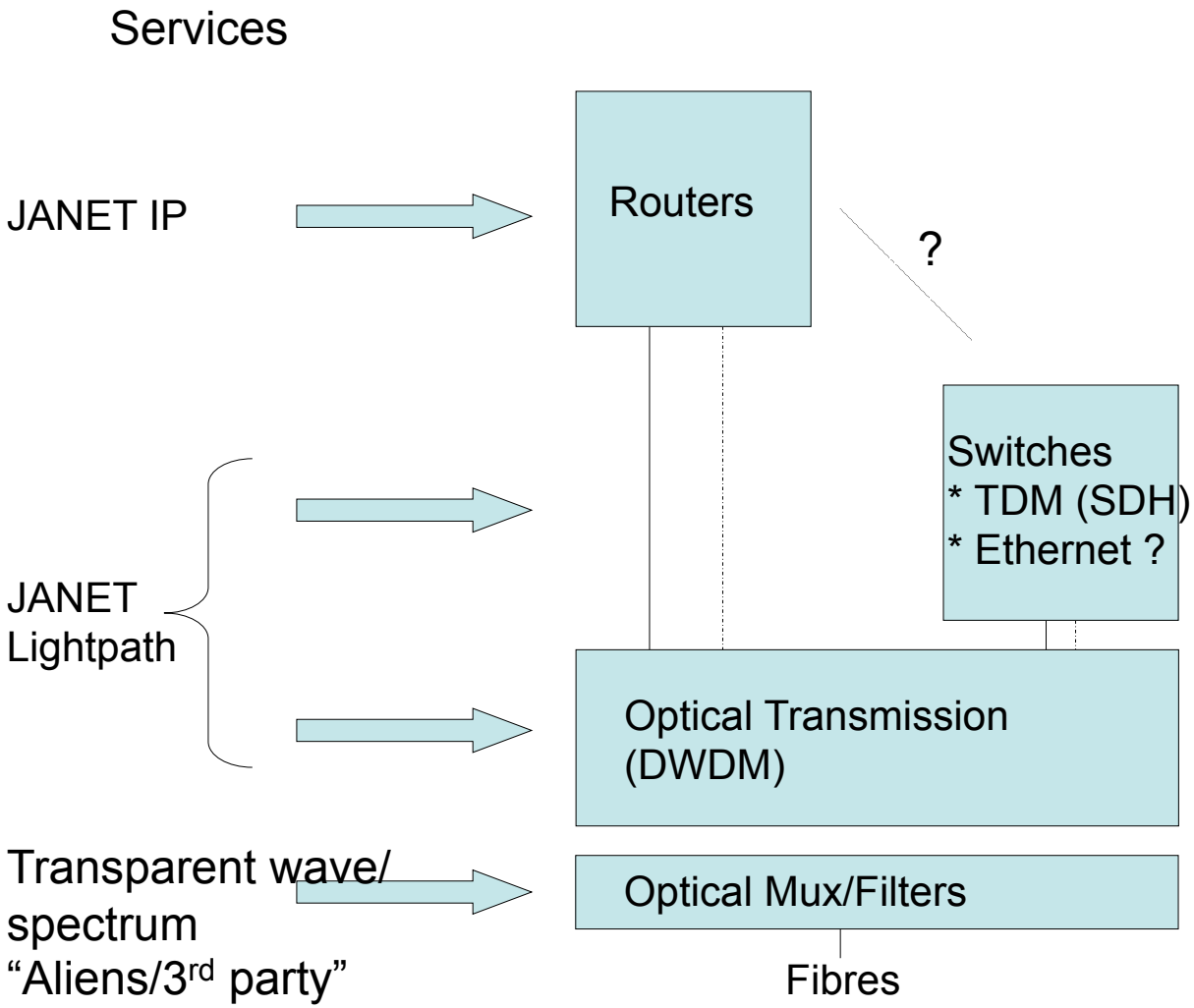
Optical Transmission Layer options

- ROADMS – WSS
- Fully flexible optics
  - Tuneable
  - “Colourless” switching
    - wavelength agnostic
    - any port to any port

Transparent Optical Transmission service ?

- Alien wave admission
  - Power levels
  - Conformance to ITU grid & spacing
- Transmission
  - Range – short vs. long
  - Dispersion compensation
    - Chromatic, PMD (2nd order PMD??)
- Is it technically feasible to operate a network of this nature
- Is it affordable ?
- How would we monitor it
  - Operationally – SLAs etc
  - Traffic – deep packet inspection ?

Future Service Model ?



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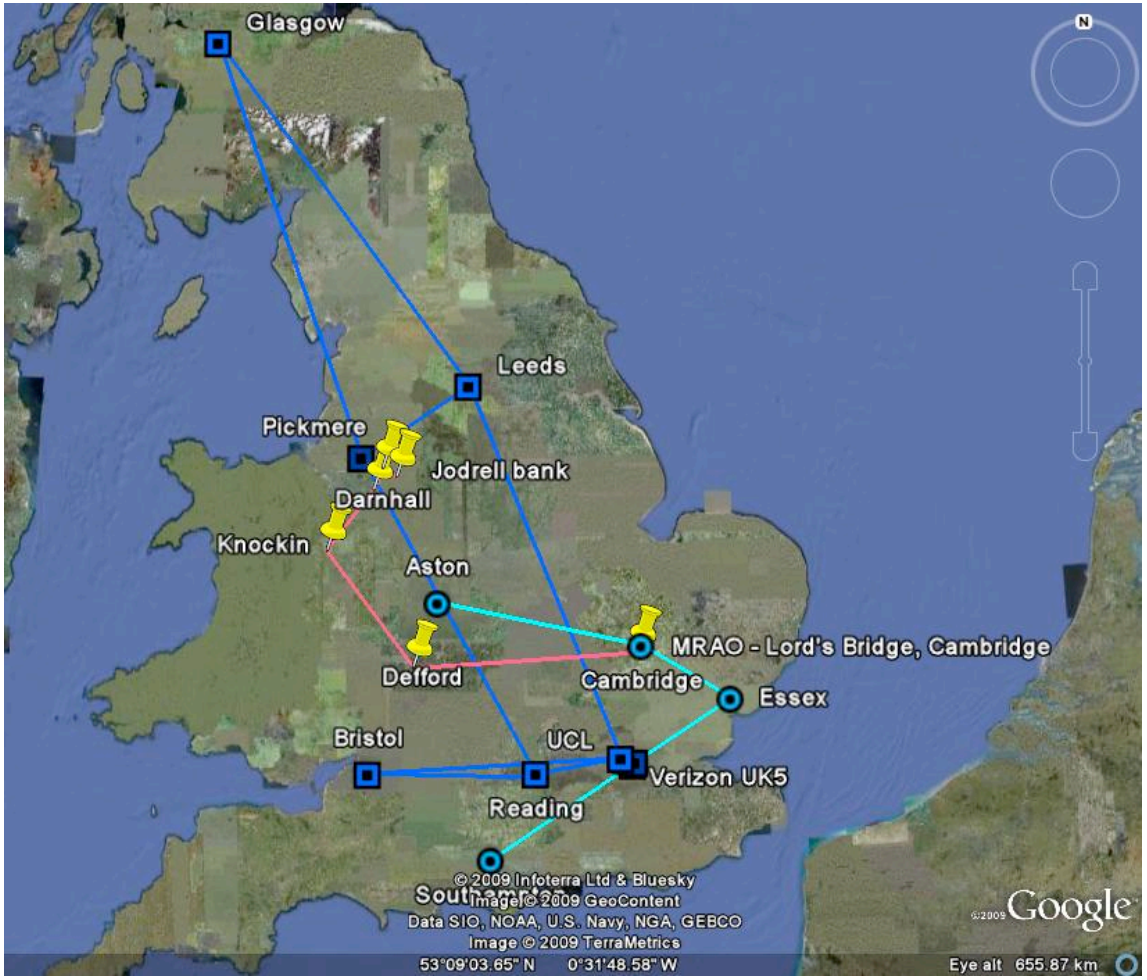
Infrastructures



Summary

- Most evolution expected at the optical level
- “Future JANET” will need to meet all requirements from 2013 to 2020+
- So, on to research requirements…

Research Requirements

Research Requirements

- Supporting research work
  - JANET IP – general networking
- Research infrastructures
  - JANET Lightpath
    - Circuit components for “testbeds” or overlays
  - JANET Aurora
    - Platform for Photonics & Optical systems research
- Access to JANET Traffic Data
  - Policy & legal Framework
  - Practicalities
    - Equipment co-location, management access, data backhaul (MASTS project…)

Connection to other research Infrastructures

- UK
  - Other testbeds – wireless etc..
- EU
  - GEANT, NREN, FIRE programme ?
- US
  - GENI & partners
- Lightpath (circuit) service can do this

Futures

- Explore additional Transport services
  - Transparent optical transport –"Alien waves"
- Equip one "Deep Packet Inspection" location on the IP backbone ?
- Should "FutureJANET" just be more of the same ?
- Are there other things which JANET(UK) could (reasonably ☺) do to support research – particularly in the areas this community is working on.
- Do your international colleagues get different/better support from their NREN ?
- Anything we can learn from the way commercial service providers support research ?

What next ?

- Happy to discuss support & collaboration
- Ideas / input to
  - David.Salmon@ja.net
  - Jeremy.Sharp@ja.net
- Short-mid term
- Longer term – FutureJANET
- Possible research focused event next year – gathering requirements
  - Possibly like St. Neots event in 2002 prior to SJ5 procurement
- Staff post at JANET(UK) to work with me – recruitment soon

End