

# The SuperJANET4 Development Programme

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# 4 Agenda

- high level needs
- responding to those needs
  - network engineering
  - bandwidth upgrades
- what next?
- common themes



## Environment

- new research, teaching & learning processes
- broadening of the user base
- demand for more flexible access
- regionalisation of the network
- technology push



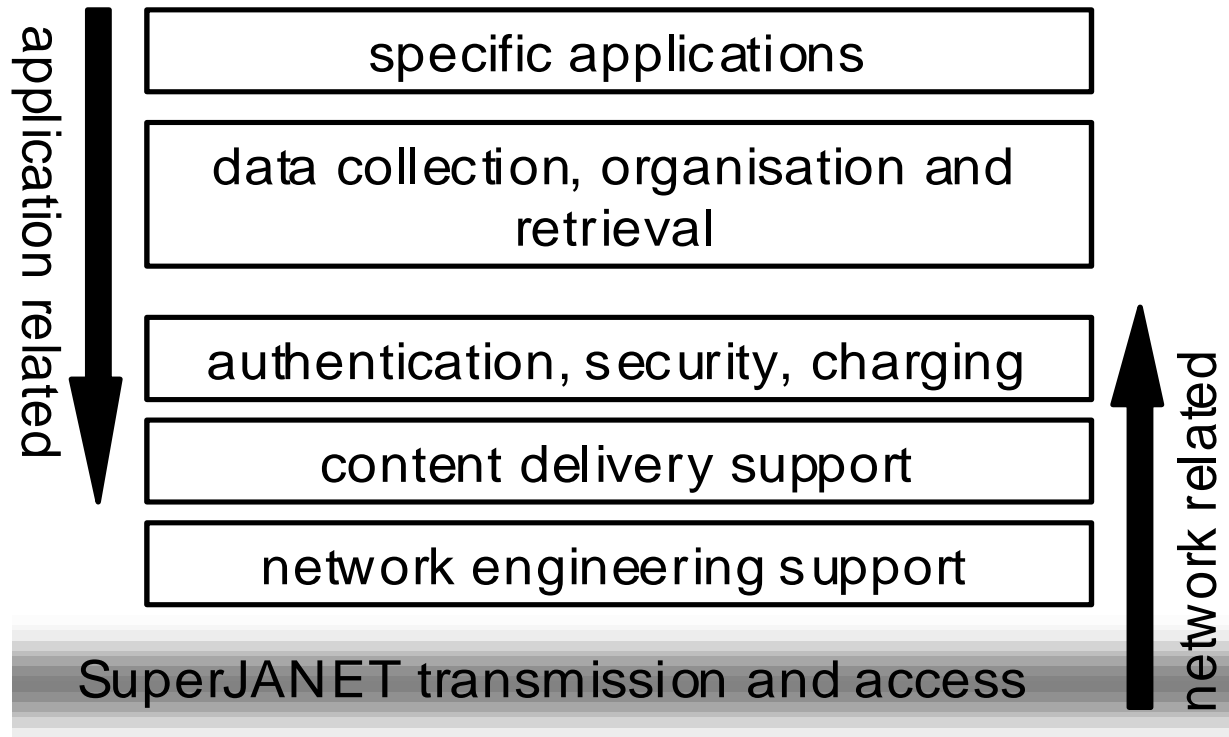
## SJ4 programme objectives

- provide support for:
  - distributed learning and teaching
  - expansion of community to be served
  - emerging e-science concept
  - emerging regional networks
  - the network as mission critical resource
- maintain a world-class infrastructure

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## Supporting new applications

<http://www.ja.net/development/programme.pdf>



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## Initial scope of programme

- network engineering
  - traffic engineering; IP QoS; IPv6; broadband local loop; fixed and mobile wireless; optical switching technologies
- content delivery
  - video conferencing and streaming; caching and mirroring; delivery via digital TV; network hosting
- authentication, security, charging

# Network Engineering



March 2002

Networkshop 30

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## The drive for bandwidth

- postulate: bandwidth will drive the development of applications
  - “because it’s there”
- the network engineer’s job:
  - to provision and manage the delivery of end-to-end bandwidth

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## Network support – generics

- delivery of sufficient bandwidth
- bandwidth management
  - early emphasis on delivering video
  - content and services location
  - bandwidth guarantees
- broadband outreach and mobility
- developments to IP technology

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## IP Quality of Service

- **drivers**
  - video: conferencing and streaming
  - e-science: bulk data transfer
  - voice over IP?
- **present activities**
  - experiments on development network
  - experiments with IP classes of service in conjunction with regional networks



## IP Version 6

- **drivers**
  - outreach and addressability
- **present activities**
  - applications development: support via a tunneling service
  - native IPv6: 6NET project and support for IPv6 in the production network
    - dual-stack or MPLS?



## The local loop

- **drivers**
  - broadband to schools, learning centres and the home
- **present activities**
  - addition of ADSL to JANET portfolio
  - trials of satellite products
  - working with other public sector players

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## Content delivery support

- **drivers**
  - multimedia delivery to the network edge
  - maintaining server response
- **present activities**
  - co-location at C-PoPs
  - videoconferencing over IP
  - caching architectures and technologies

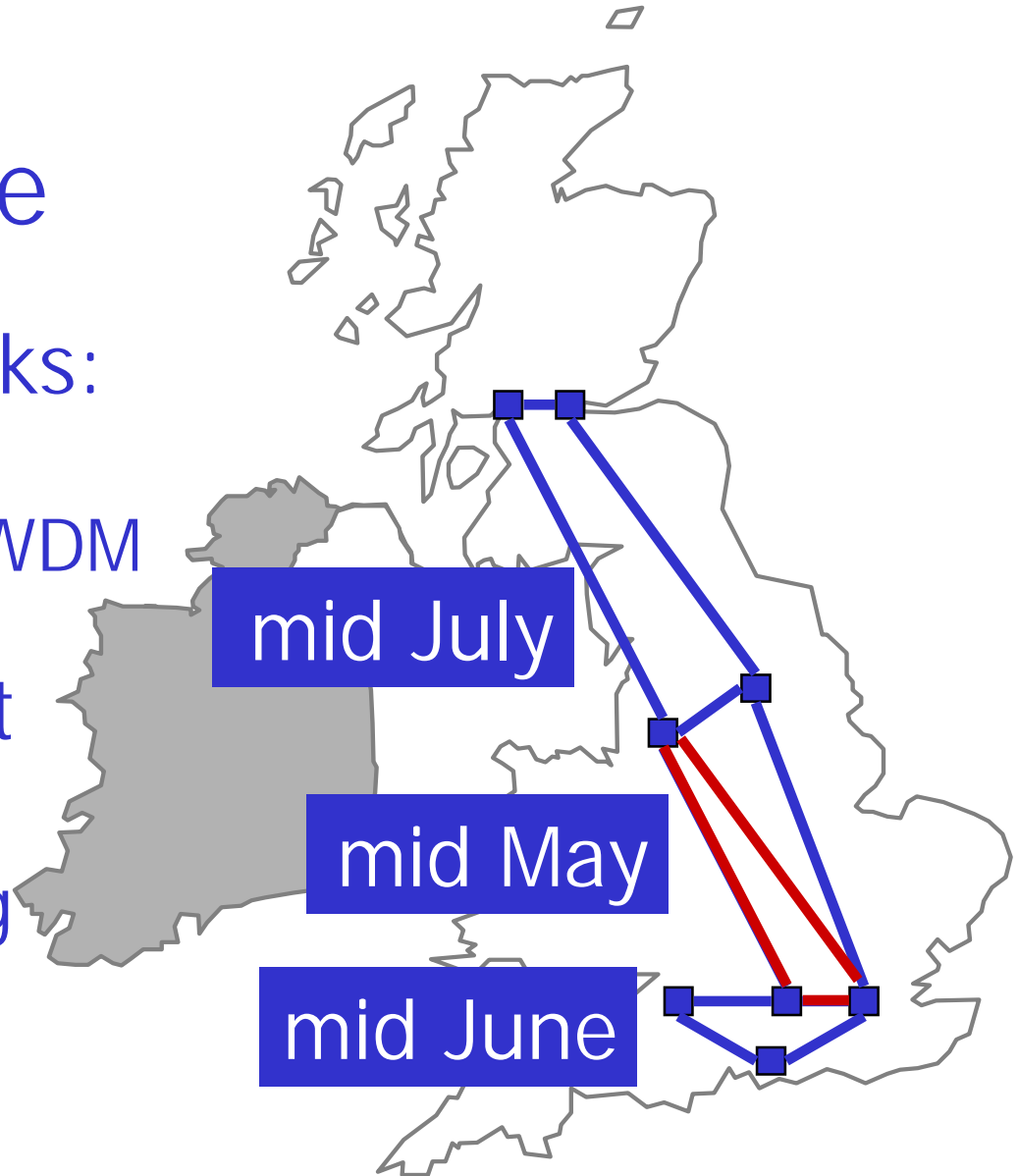
# Bandwidth Upgrades



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## Backbone

- individual links:  
2.5 Gbps SDH  
→ 10 Gbps DWDM
- development network:  
commissioning  
for July



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## Why 10 Gbps now?

- increase in backbone load
- e-science predictions
- international comparisons
  - Abilene
  - GÉANT

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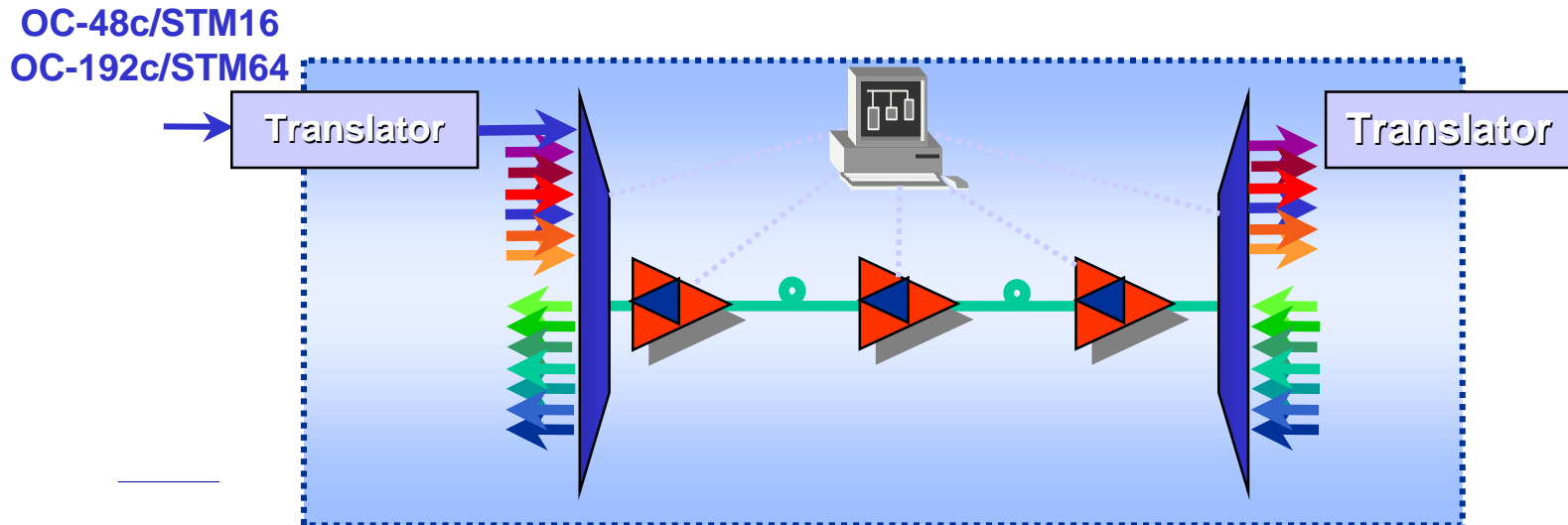
## From SDH to “DWDM”

### SDH virtues

- established protection mechanisms against path loss
- can run over fibre or DWDM path i.e. a “wavelength” or “lambda” ( $\lambda$ )
- **but** ... expensive above 2.5Gbps

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## Optera LH operation



translator: frames data only

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## Protection of links

### **protection over DWDM**

- wavelength cost of provision
- lack of experience in use

### **protection over IP**

- much experience in use
- convergence question

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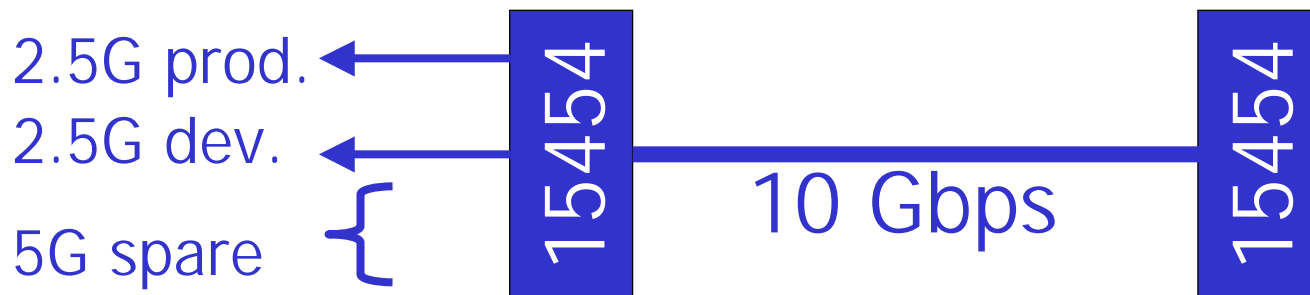
## Links to Regional Networks

- policy: upgrade on need
  - minimise cost of router upgrades
- links at 2.5 Gbps
  - leave for present
- links at 622 Mbps
  - upgrade now to 2.5 Gbps
- links at 155 Mbps
  - find most cost effective solutions
  - Scottish links already being upgraded

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## Link to Manchester BAR

- trial of high bandwidth multiplexer
- allow access to development network
- wider applicability?



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## Bandwidth reserves

- backbone: another 10 Gbps
  - to cope with more load
  - interim availability for development
  - contingency for DWDM protection
- regional network links:  
2.5 Gbps → 10 Gbps when needed
- review with WorldCom in 2003

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## Consequential costs

- costs of switching IP traffic
- impact on regional feeder networks and on local area networks
  - bandwidths  $> 1$  Gbps
- high bandwidth beyond the laboratory and classroom?

## Next Steps:

- what else ought we to be doing?
- optical networking



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## On the horizon ...

- network performance monitoring at high resolution
- the problem of the firewall in a gigabit world of “difficult” applications
- authentication and authorisation: support from the network
- multi-gigabit regional networks

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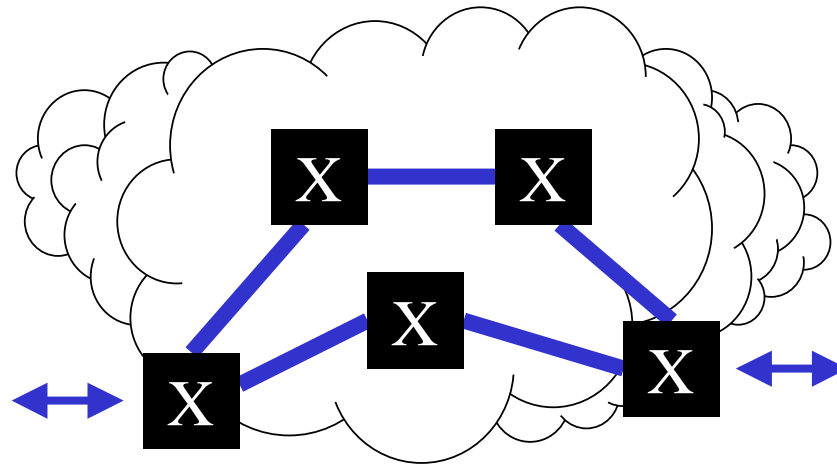
## Optical networking

- end-to-end delivery of bandwidth to demanding applications
- the lure of the  $\lambda$
- optical networks: what's in it for us?
  - economics of provision
  - circuit vs packet switching
  - continuing role of the IP router?

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## IP control of optical network

- router control of optical cross-connects and switches



- test-bed for early trials & simulations?

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## Summary: common themes

- provisioning and managing bandwidth
  - the need for end-to-end bandwidth
  - remembering the edges of the network
- end-to-end collaboration
  - local/regional/national/international
  - technical standards, management policies

**the need for collaborative trials**



## Further information

Web pages for UKERNA's development activities:

<http://www.ja.net/development/>