

# SuperJANET5

## Strategic & Technology Issues

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# Outline

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- Timetable
- Requirements study areas
- Security
- Transmission & Switching
- Nature of Services?
- Segregation or Aggregation?
- Inter-domain Aspects

# Timetable

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end 2005	SuperJANET4 contract ends
mid 2005	transition from SuperJANET4
early 2005	rollout SuperJANET5
mid 2004	launch formal procurement
early 2004	pre-procurement activities
during 2003	requirements gathering; setting up funding
already	workshop, Glasgow, Dec. '02 discussion at JCN, Feb. '03

# Requirements study areas

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- **JANET communities**
- **Network development and integration with regional access networks**
- **Network reliability**
- **Network technologies**

*Also*

- **Procurement aggregation**
  - public sector
  - JANET sector

# JANET communities

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- education, learning, & research
  - primary, secondary, & tertiary
  - adult learning
  - research
  - e-science

*also*

- international comparators
  - important, perhaps especially in research, notably e-science

# Development integration with regional access networks

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- access to development networks
  - including, e.g., UKLight facility
- incorporation of regional access networks into the development cycle
- long-term funding for regional access networks

# Network reliability & technologies

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- **reliability**
  - differing needs of constituent communities
  - protection against supplier failure
- **technologies**
  - technology audit
  - transmission technologies
  - dark fibre?
  - IP routing equipment

# Communities & Roles

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- HEIs
  - universities
  - research institutions
- FE colleges
- Lifelong learning
- Research collaborations
  - Virtual Organisations
- Schools
  - RBCs
- Future? [BSG]
  - .nhs.uk? .gov.uk?
  - .????
- Education & Learning
- Research
  - e-Science
  - network research
- Support
  - administration
    - courses
    - programmes
    - institutional
  - network service
  - service development

# Nature of Traffic / Services

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- Operation
  - routing & signalling
  - remote access to network elements
  - monitoring
- Administration
  - e.g., legal obligations (contractual, regulatory)
- Users
  - grids
- Development
- Research
- End-to-end
- Availability
  - resilience
- Experimental testing
  - pre-operational testing
  - commissioning
  - research experiments
- Security / integrity
  - improper traffic
    - (D)DoS
    - illegal content
    - masquerading
  - hacking network
    - attractive resources

# Security

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- Open network
  - e.g., 802.11b: physically open (trying to fix post hoc)
    - really useful wake-up call :-)
  - inside & outside
- Attractive
  - bandwidth, processors
  - priority services: QoS: IP Premium
- Defence
  - detect
    - some aspects getting harder as traffic is encrypted
  - gross: disconnect, partition
    - stable door solution
  - layered defence
    - physical: ducts, cables
    - transmission & circuit multiplex
      - lambdas (WDM), SDH/SONET (TDM) circuits
    - datalink: switches & VLANs
    - network: VPNs

# Transmission & Switching

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- Transmission
  - dark or grey fibre?
  - dynamic channel provision?
- Multiplexing
  - packet: statistical multiplexing
  - circuit
    - TDM: SDH
    - WDM: coarse (metro), dense
- Optical switching
  - optical channel
    - static channels: currently deployed for JANET by provider
    - dynamic channel provisioning: becoming available
    - optical  $\lambda$ -channel switching: nearly
  - optical packet switching
    - another decade?

# Wave Division Multiplexing

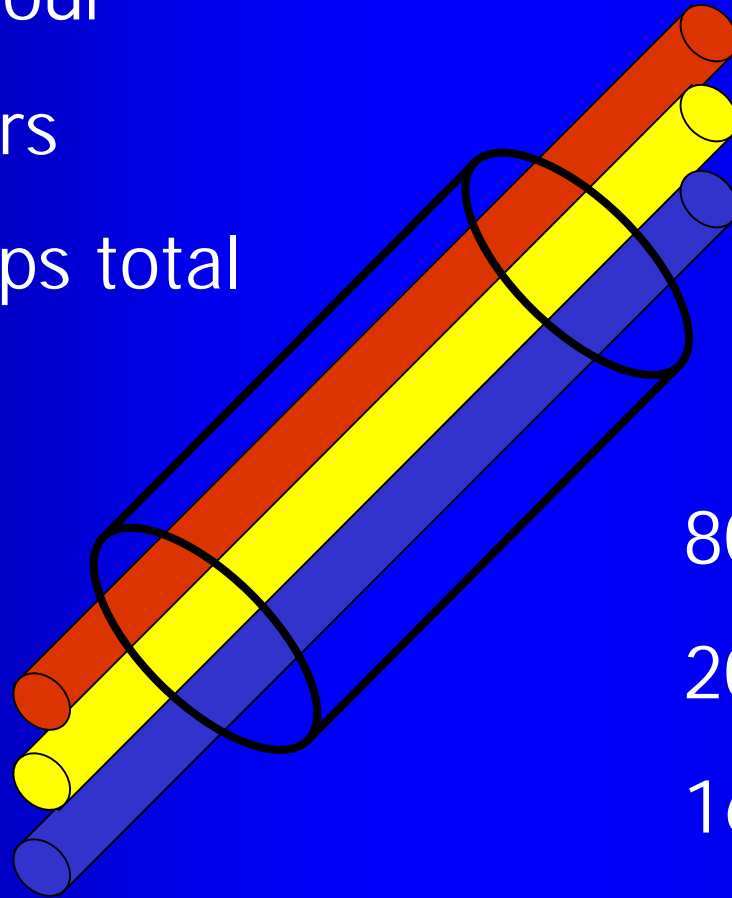
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10 Gbps/colour

16-60 colours

160-600 Gbps total



80-160 Gbps/colour

200 colours

16-32 Tbps total

# GMPLS: origins & goals

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- GMPLS
  - derivative from MPLS
    - QoS controlled routing, traffic engineering of aggregates
    - seek to exploit the best features of packets and channels
      - (remember ATM?)
- Extend & unify control plane model
  - signalling & management
  - packet, TDM, WDM layers

# GMPLS:

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- Purpose
  - aggregation
  - dynamic (rapid) provisioning (BoD)
  - automatic restoration
- Means: enhanced signalling protocols
  - cope with legacy
  - manage paths for specific categories of traffic
  - automated under router control
  - *policy constraints / operator overrides*
- Features
  - shared risk link group
  - signalling carried in IP
  - can be in- or out-of-band

# Nature of Services?

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- Network operation
  - non-hijackable, crucial; low capacity
- Administration
  - secure, reliable; low capacity?
- Teaching & Learning
  - reliable, DoS-proof; medium capacity?
- Service development & network research
  - sequestered from service
- Scientific research
  - high capacity; global community; protect other services

# Segregation or Aggregation?

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- Capacity limits
  - transmission: electronic limit: multiple wavelengths
  - no optical packets yet
- Control the layer below any offered for service
  - segregation for service development, testing, commissioning
  - network research
  - some areas of science: e.g., offer high-capacity circuits
- Security advantages of segregation
  - must ensure control plane secure
- Exercise care how much aggregation

# Inter-domain Aspects

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- Well-developed single-domain technology
- Inter-domain technology in its infancy
  - multicast
  - QoS
  - end-to-end monitoring
  - MPLS ..... GMPLS?
  - dynamic provisioning: bandwidth brokering
- Inter-domain policy negotiation: authentication
  - authorisation: dynamic provisioning, access to resources, roaming
  - security
- All facilities / services need to be extended end-to-end? (regional networks, international)
- Inter-domain peerings may be at differing levels

# Summary

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- Diverse community
- Increasingly complex network
  - aggregating all at one level may be too great a challenge for now
- Segregation
  - NOT just capacity:  
security, inter-service protection
- Inter-domain aspects
  - all (most?) aspects needed end-to-end:  
backbone, regional, end-user