



The Past, Present and Future of Academic Networking

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Tim Kidd Production Services Director
UKERNA



Topics



- What is JANET?
- The Past
- The Present
- The Future – Challenges
- The Future – SuperJANET5





UKERNA: basic facts

- UK Education & Research Networking Association
 - not-for-profit company limited by guarantee
 - operated as a public-sector organisation
- headquarters: CCLRC, Chilton
 - administration, management, customer service, development ...
 - complement ca. 90 staff
 - other network operations via ULCC

UKERNA objectives

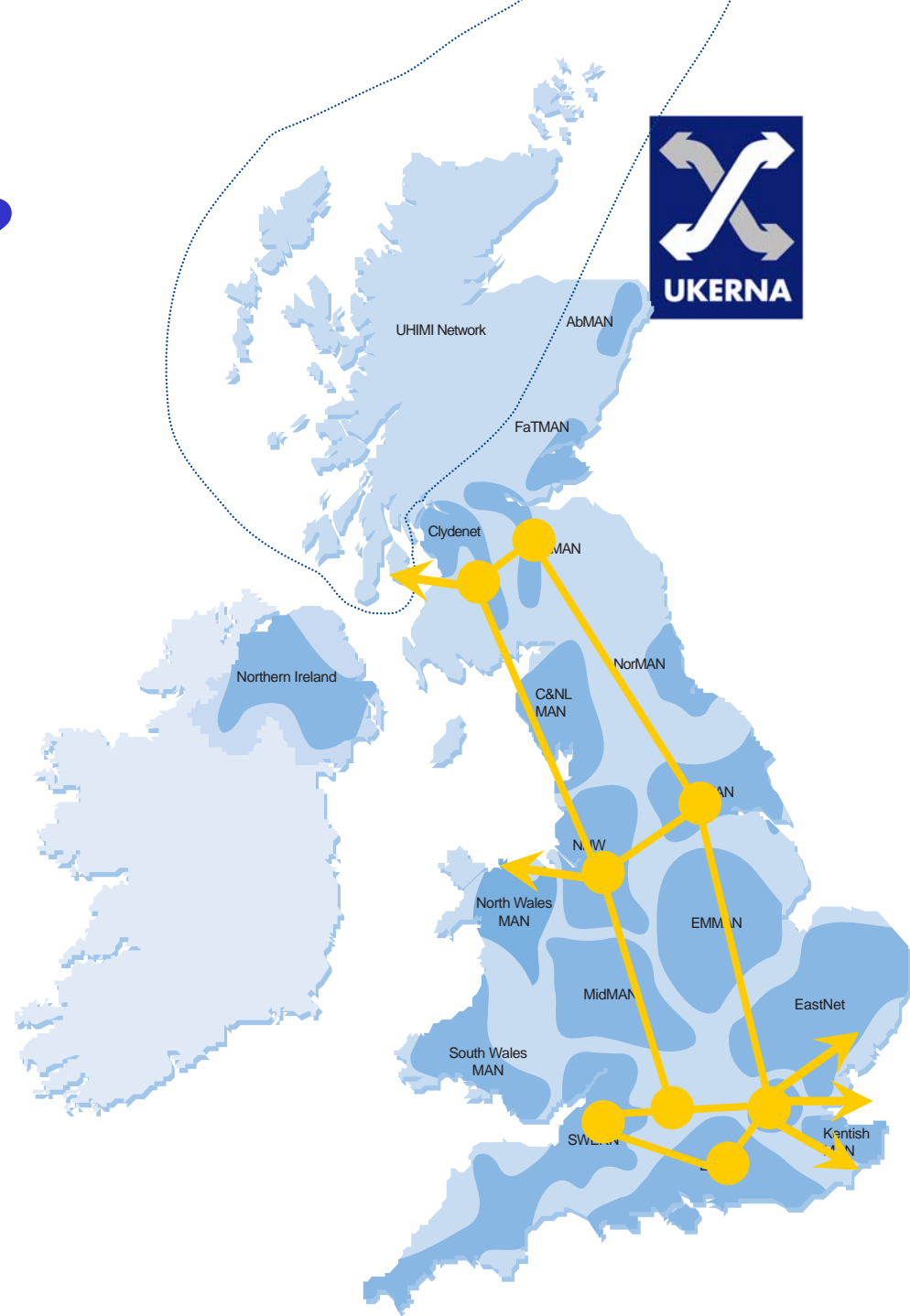


Advancing and supporting the UK's education and research network

“To take responsibility for the networking programme of the education, learning and research communities in the United Kingdom; and to research, develop and provide advanced electronic communication facilities for use within these communities, and to facilitate the electronic connectivity of these communities to external third parties.”

What is JANET?

- 19 regional networks.
- 10Gb core across UK.
- >20Gb external connectivity.
- \approx 1,000 sites.





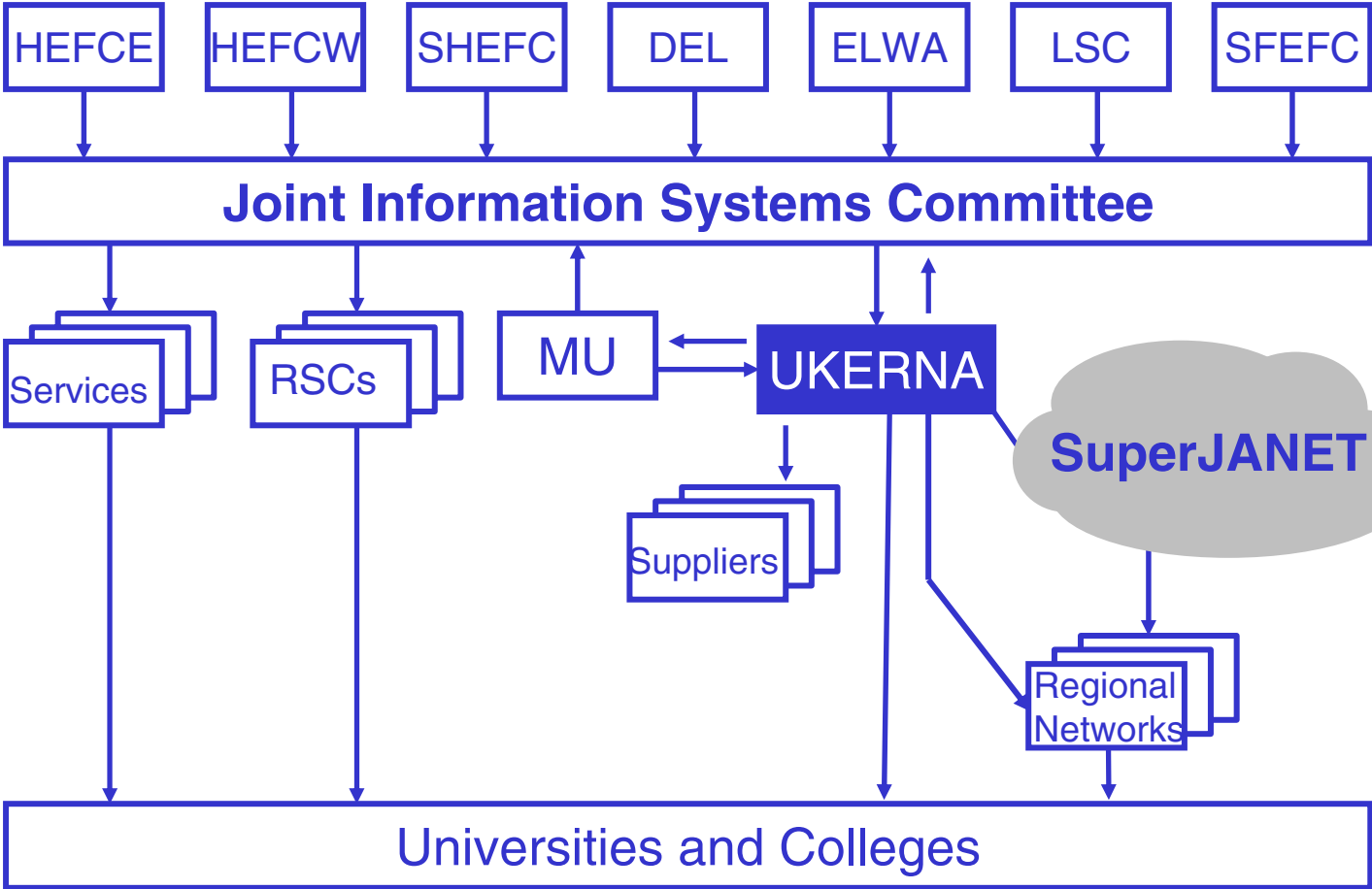
Who Uses JANET?

- Higher Education Institutions
- Further Education Colleges
- Research Council Establishments
- Schools (collectively or individually)
- Other organisations where there is clear benefit to HE, FE or RC community.





Who funds JANET?



Topics



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The Dawn of JANET



**Late
1970s**

1984

**Late
1980s**

**Early
1990s**

**Early
1991**

SRCnet
regional
research
networks

JANET born
X.25 network
serving 50
sites @9.6kbit/s

X.25 network
2Mbit/s backbone
64kbit/s access
200 sites

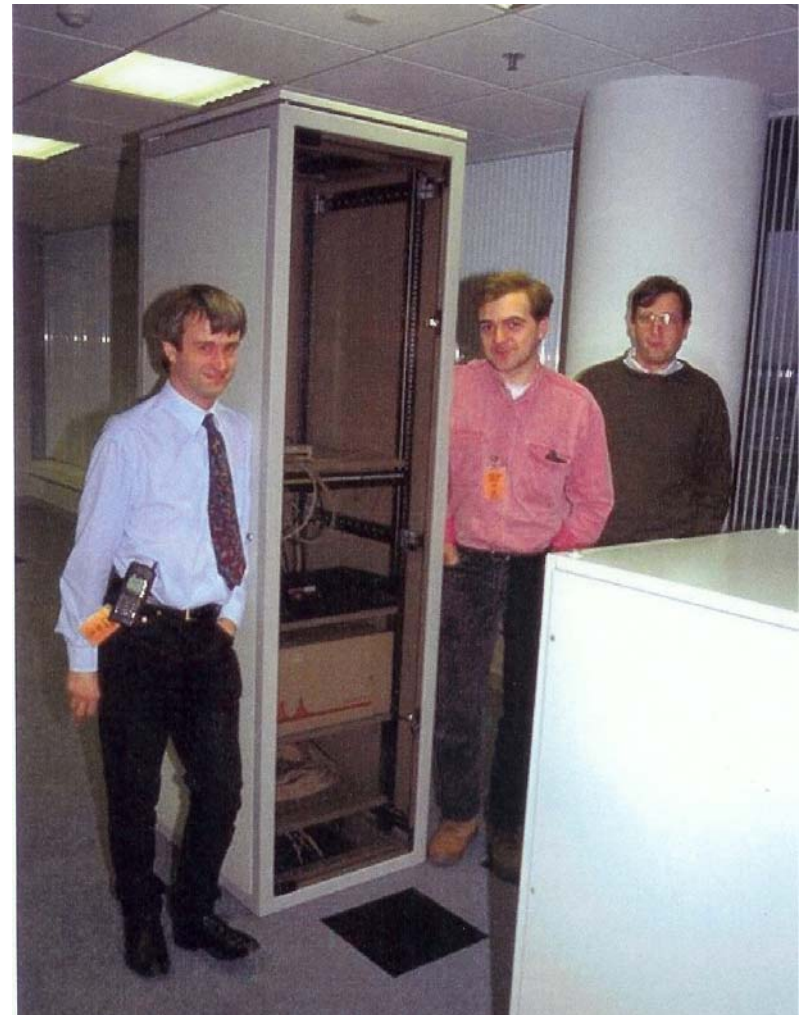
X.25 network
8Mbit/s backbone
2Mbit/s access

JANET IP Pilot
(over X.25)

JANET protocols

- Coloured Books
- ISO OSI vs TCP/IP
- Protocol wars ...
- Gateways
- Killer application
- 10 months later ...

LINX



JANET comes of age



1992

1995

Late
1990s

2001

2006

SuperJANET
34Mbit/s PDH

SuperJANET II
IP over ATM
155Mbit/s
backbone

SuperJANET III
general bandwidth
upgrade

SuperJANET4
10Gbit/s core

155Mbit/s - 2.5Gbit/s
links to regional networks

SuperJANET5

SMDS network

first regional networks

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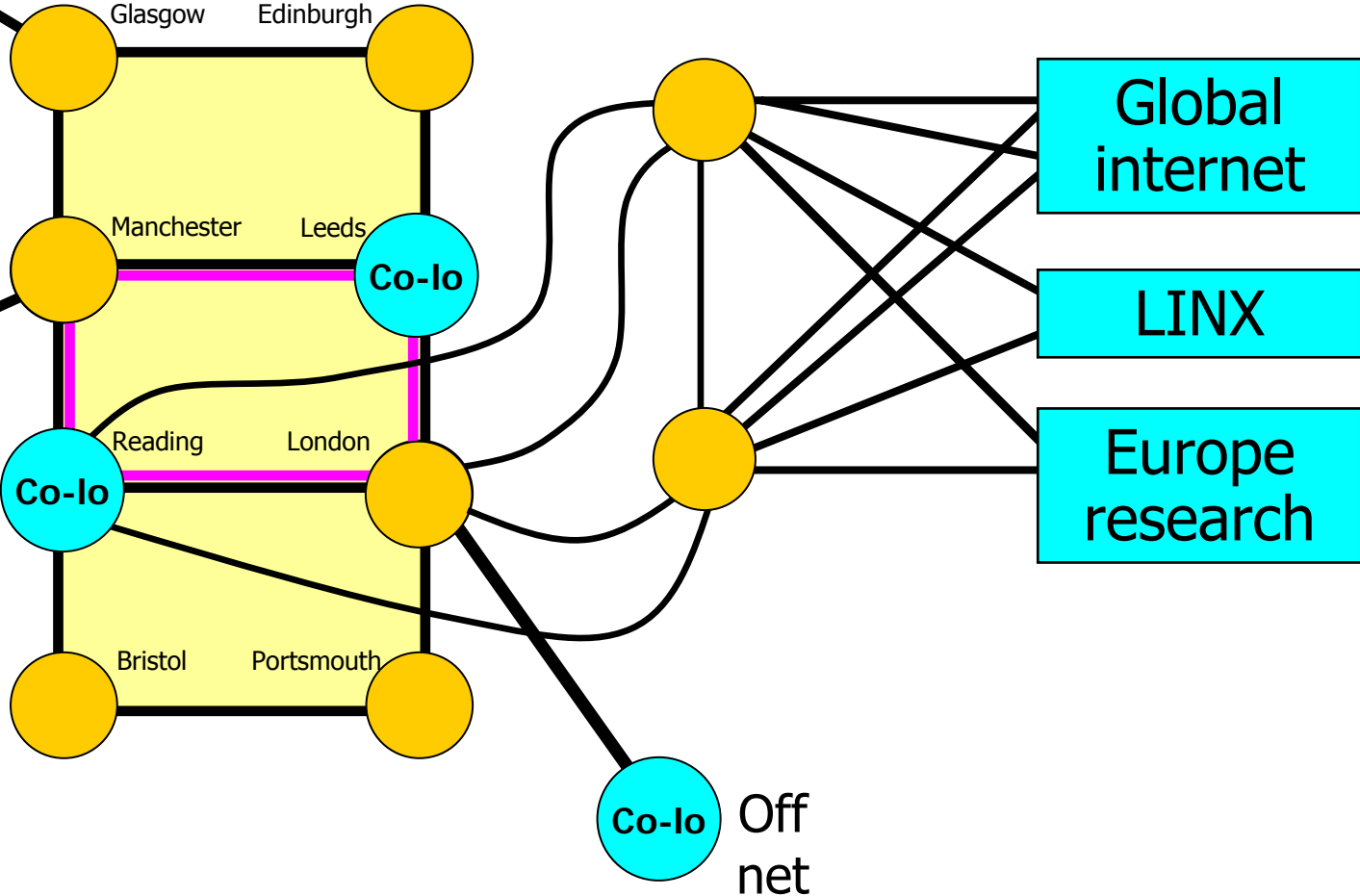




Network Infrastructure

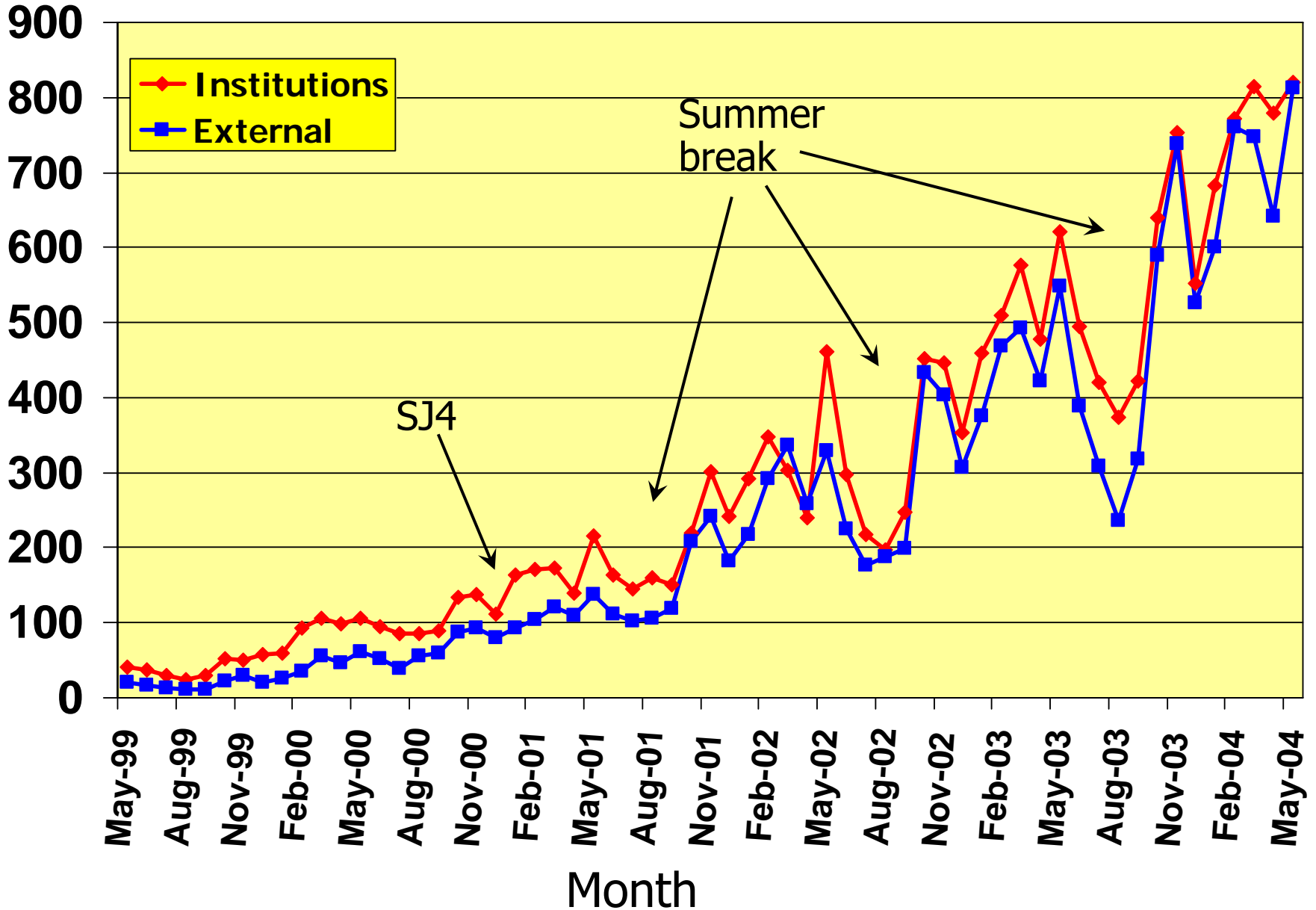
WorldIX

MaNAP



TBytes

JANET Usage



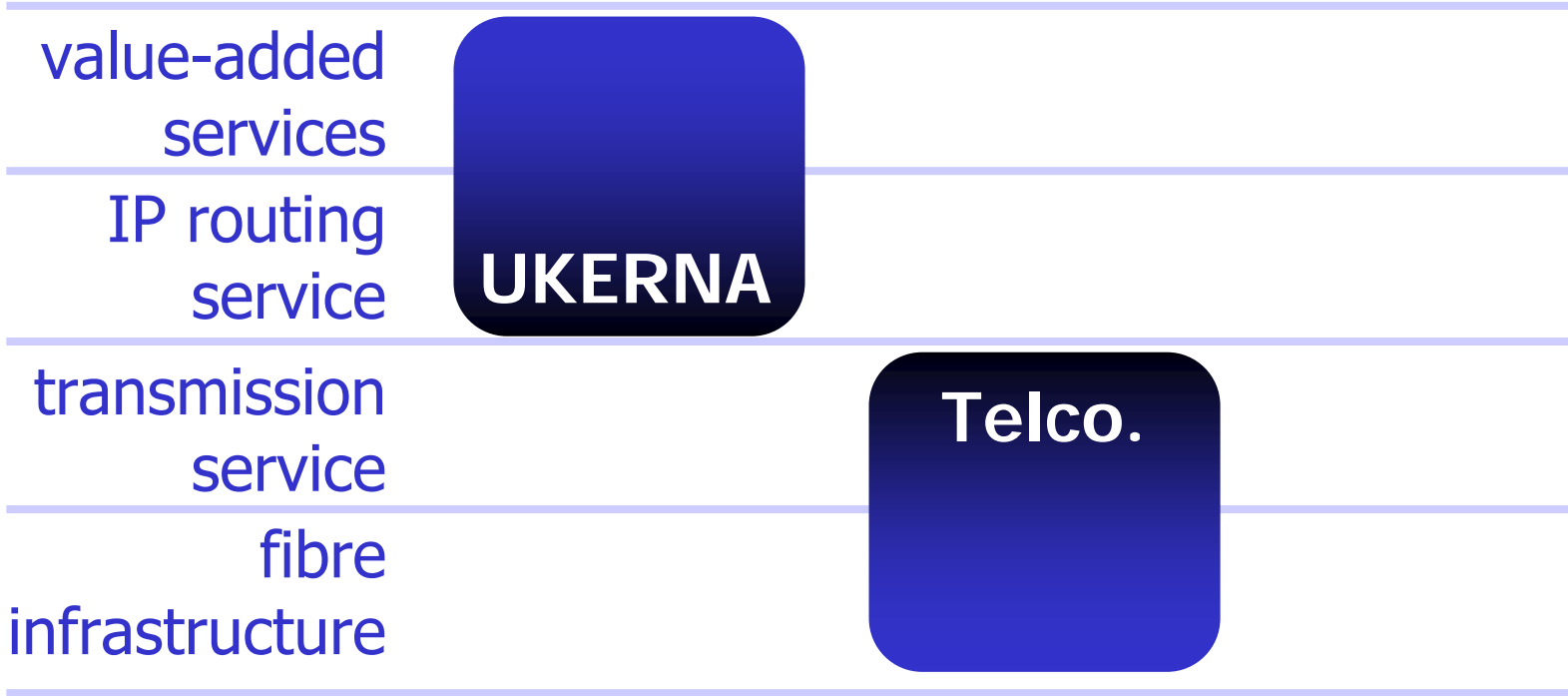


Acceptance testing – a fairly noisy business!





Current market position



RM EasyMail Plus



Email



Address



Options



Log Out

Mail | tk@rmtest.ja.net

Mailbox Usage: 0% 100%

26-Jan-2005

Quick Links ? Help

Create

Reply

Reply All

Forward

Check Mail

Move/Copy

Change Status

Search

Folders

Delete

Empty Deleted

Folders

- My Email
 - Inbox (9)
 - Outbox

My Email - Inbox

1-9 of 9

Show 1-9

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	From	Subject	Date	Size
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Thomas Meyer	Web server update.	26-Jan-2005 10:50	2 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Kate Nunn-Price	Procurement information	26-Jan-2005 10:49	48 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jessica Wu	RE: Please reply	26-Jan-2005 10:44	4 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	JCS: Naming	New domain name as requested.	26-Jan-2005 10:46	2 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	JCS: Connections	Connections test	26-Jan-2005 10:48	1 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lynda Mayne	webmail	26-Jan-2005 10:46	1 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Russell Nelson	Hello World	26-Jan-2005 10:44	2 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tim Kidd	Testing 1	26-Jan-2005 10:39	2 KB
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tim Kidd	RE: test	26-Jan-2005 10:39	4 KB

My Email - Inbox

1-9 of 9

Show 1-9

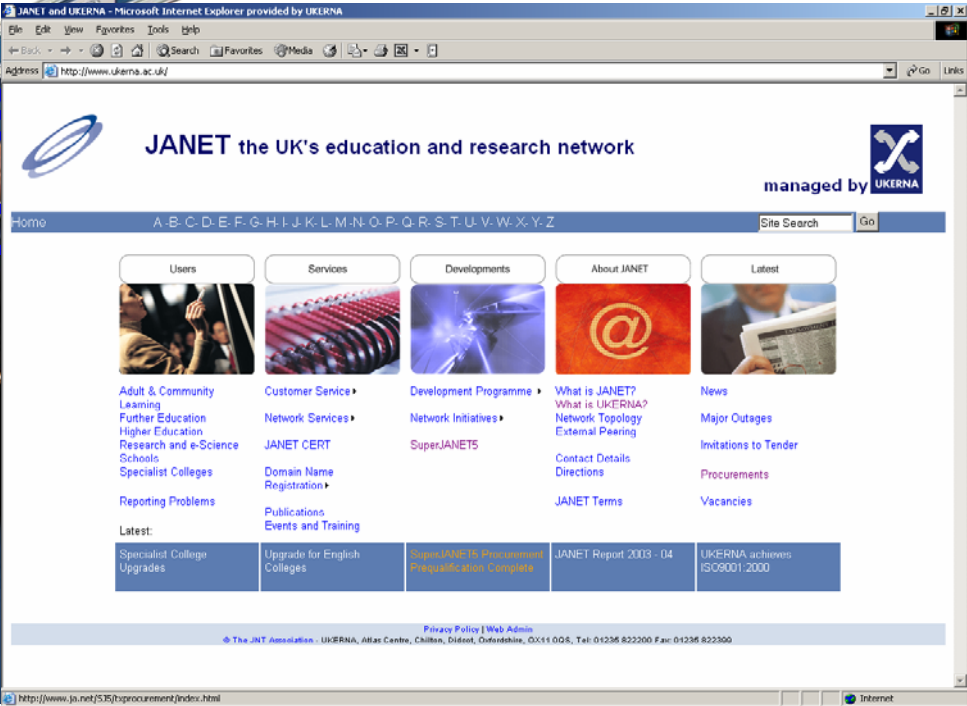




Other Services

Training

Workshops & conferences





Developments

Content delivery
infrastructures

IPv6

**Network
Access**

Video
Conferencing

Multicast

UKLight

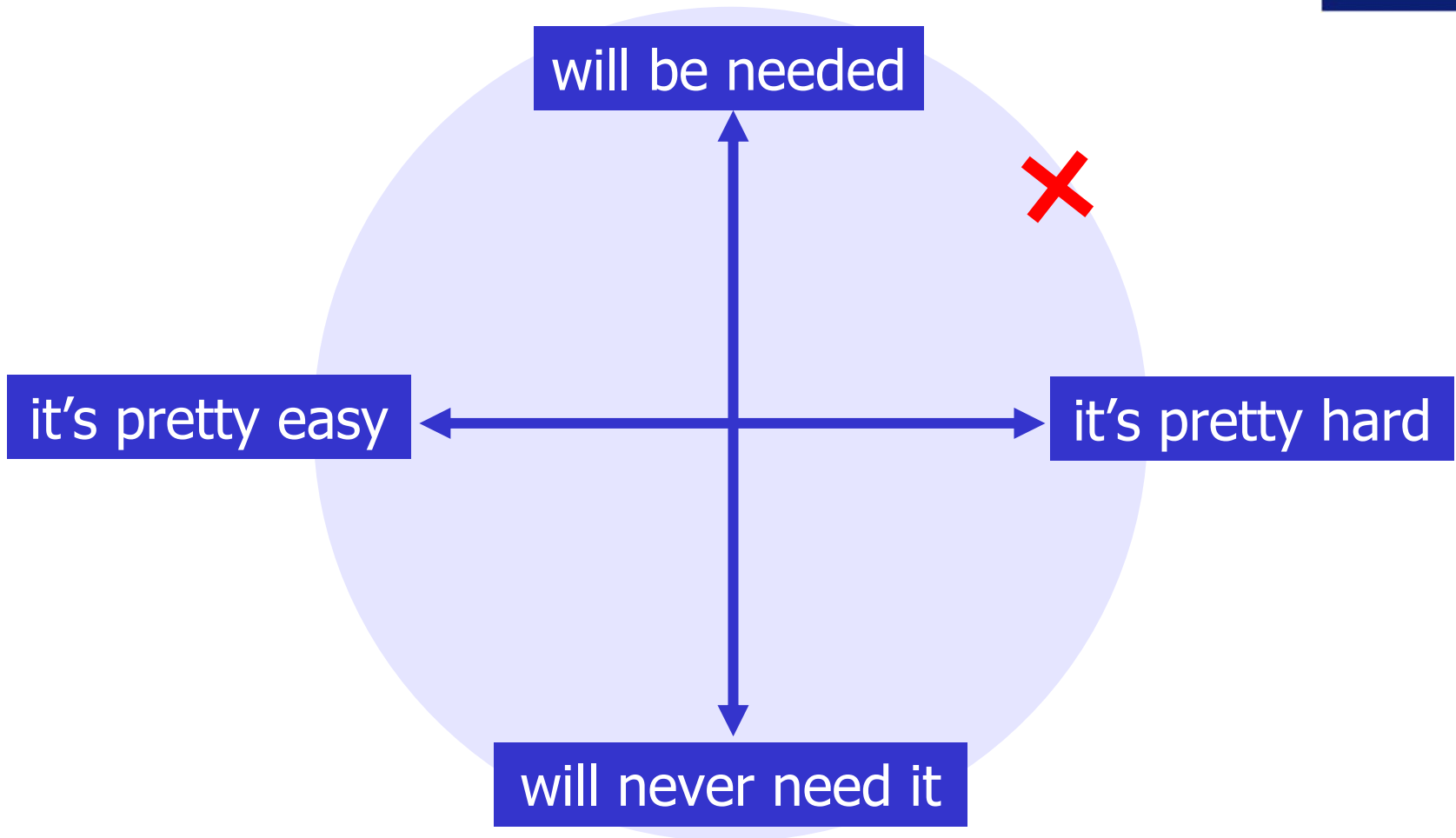
IP QoS

Classes of IP forwarding service



Less than Best Efforts	for non-critical traffic - protecting other service classes
Best Efforts	current class of service on JANET
IP +	for streaming video, interactive applications – Assured Forwarding
IP Premium	for videoconferencing, voice over IP – Expedited Forwarding

Implementation





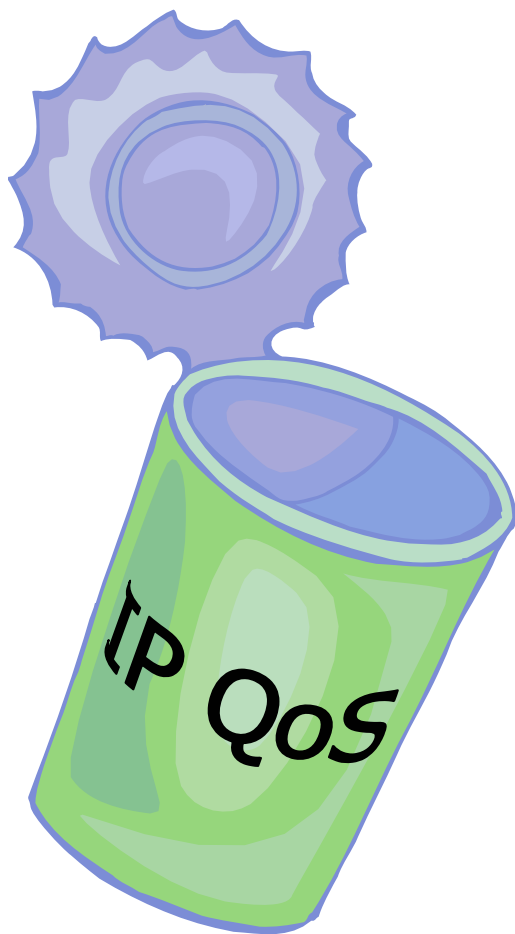
Implementing IP service class

- policy decisions and router implementation
 - relative proportions of different classes
 - service agreements and packet marking
 - policing on ingress: queue, drop or remark?
 - queuing and shaping on egress ...

Some implementation statistics for JANET ...

70	SuperJANET backbone routers
18	HE/FE regional networks
10	RBC networks

Progress to date



- It does what it says on the can
- The benefit is for sites with low bandwidth
- Next phase is to examine support issues



Network Access

- peering with ISPs
- investigating emerging technologies
- local-loop unbundling
- support for mobile IP
- high-quality gateways for remote access?

reaching the individual student

- adult and community learning
- interconnecting schools networks
- workplace-based learning?
- applications interworking

reaching the whole of UK education

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Challenges...



- Widening the community.
 - Schools
 - Adult Community Learning

Education networks



10 regional networks
144 local education authority networks

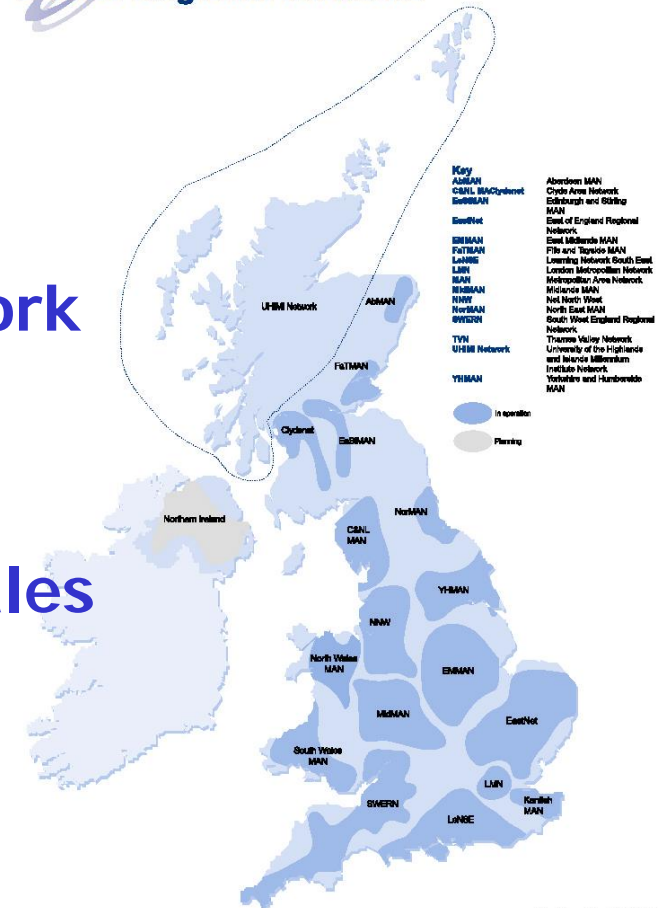
Scottish Schools Digital Network

- built over SuperJANET in Scotland
- 32 local authority networks

Lifelong Learning Network Wales

- attached to SuperJANET in Cardiff
- 22 unitary authority networks

JANET Regional Networks



Challenges...

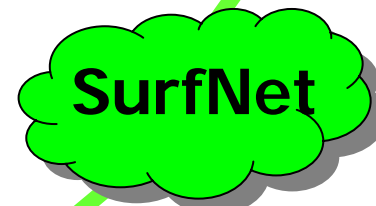
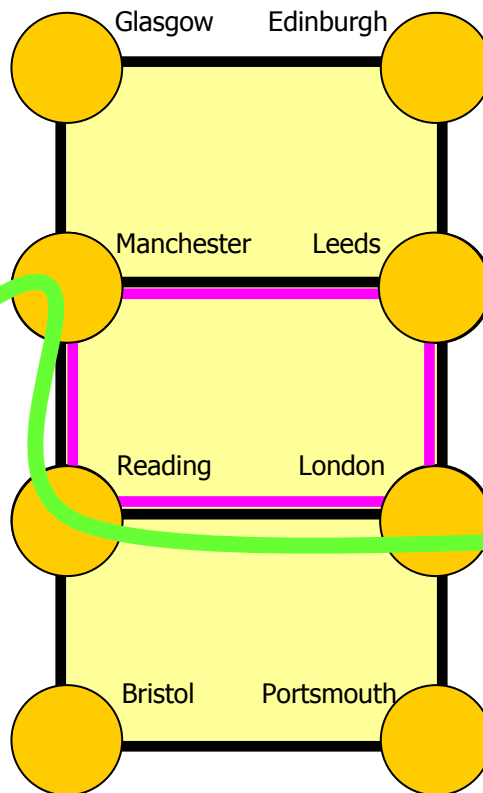


- Widening the community.
 - Schools
 - Adult Community Learning
- Supporting e-research.



Jodrell
Bank

JIVE



Joint Institute for Very Long
Baseline Interferometry in Europe

It doesn't always work out as it should...



Ingenuity Award 2004



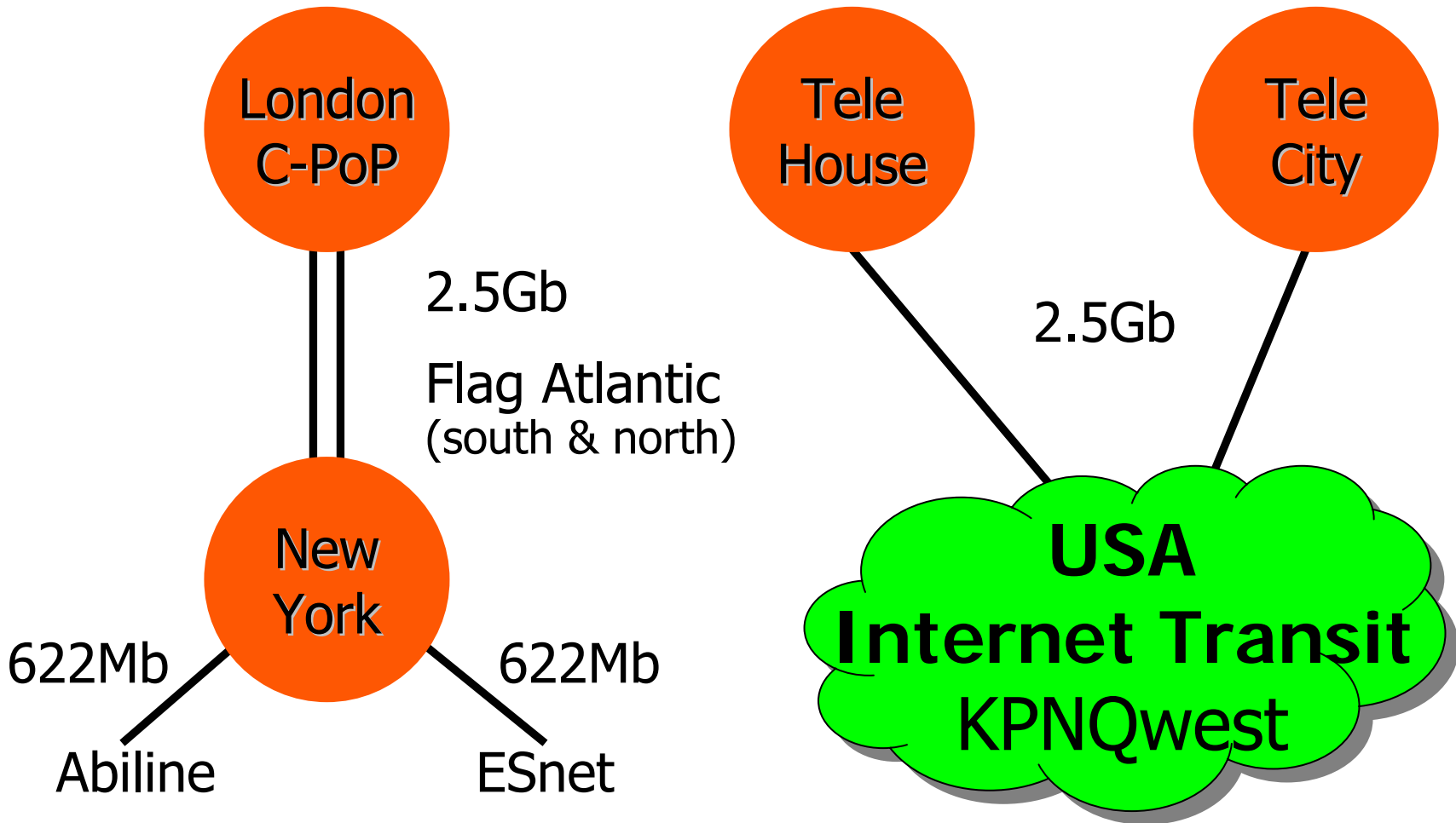
Ingenuity Award 2004



Ingenuity Award 2004



Global Internet Connectivity February 2002



The Time Line



20 May

Teleglobe (UK) in administration.

The Time Line



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31 May	KPNQwest (UK) really is in administration. Agree & install WorldCom transit.

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SuperJANET5 Requirements

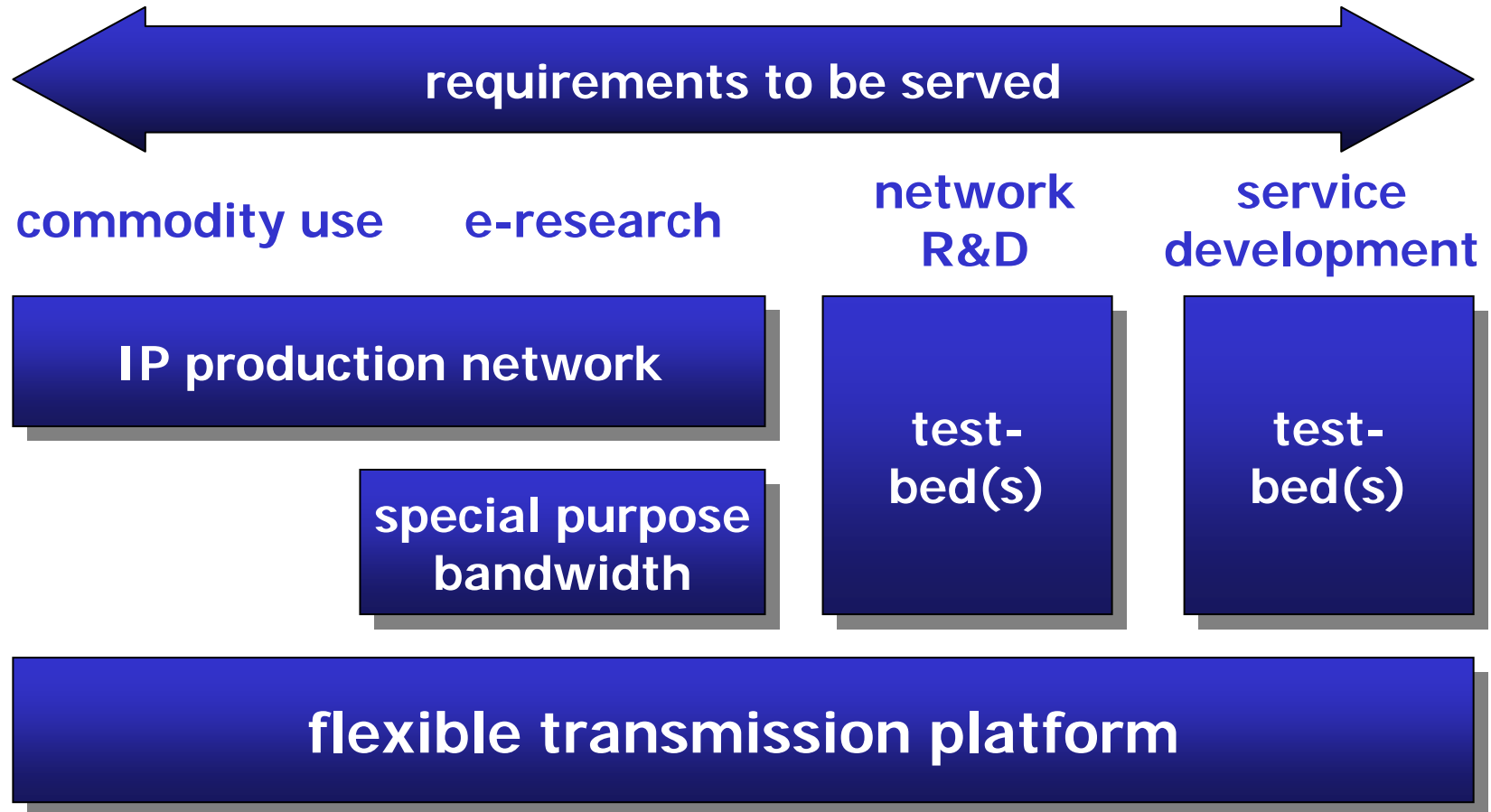


end-to-end across JANET

Reliability	improve by building in more resilience
Scalability	ability to increase bandwidth at controllable cost
Separability	protection of interests of teaching & learning and research sectors
Flexibility	responsiveness to additional network service requirements



An overall architecture





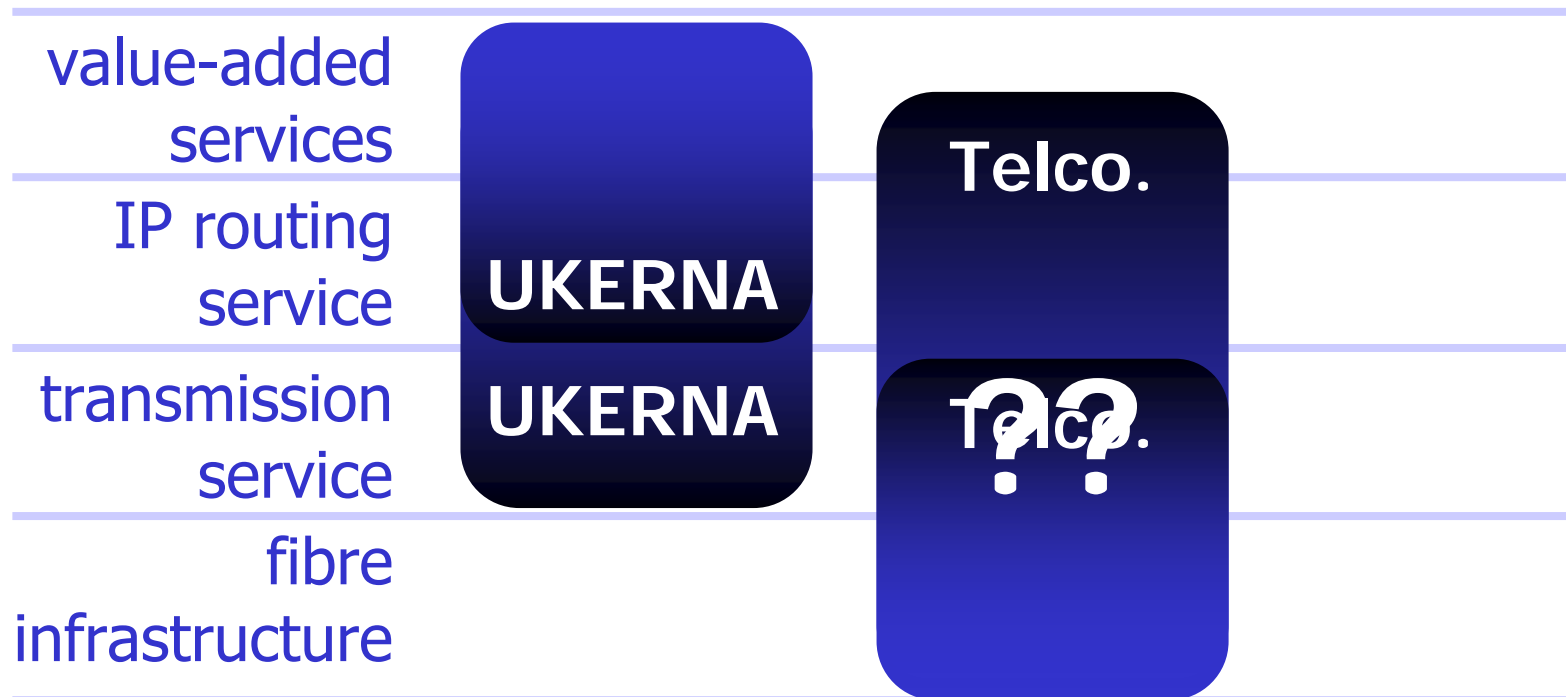
Key objective ...

flexible transmission platform

- visibility to UKERNA in day-to-day operation
- capacity planning and cost control by UKERNA
- early adoption of new optical technologies, as and when these arrive



The market challenge ...



value-added
services

IP routing
service

transmission
service

fibre
infrastructure

UKERNA

UKERNA

Telco.

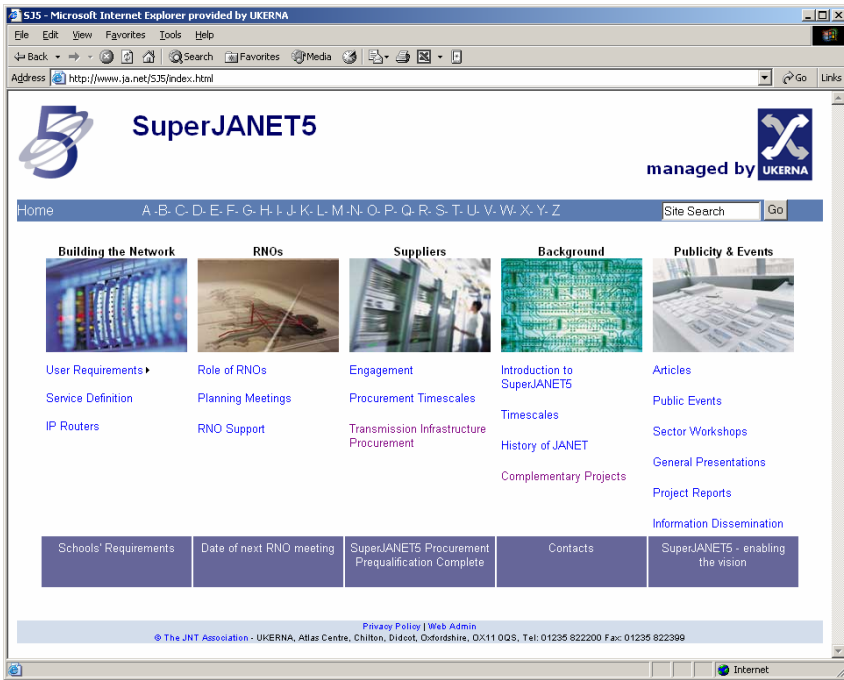
Telco.
? ?



Summary



- Academic networking as a driver of technology
- Academic networking as a driver of university and college core missions
- From DIY to mainstream
- Looking forward to the next twenty years...



<http://www.ja.net/SJ5/>



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



<http://www.ja.net/documents/janetreport/report2004.pdf>

