



SuperJANET5, an overview

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SuperJANET 5 Project

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Introduction

- What we said we wanted
- What we've procured
 - Infrastructure
 - Routers
- What are we going to do now?
 - Deployment
 - Migration

Past and Present Challenges



- SuperJANET4
 - Network capacity increased by two orders of magnitude
 - Strengthened design and management to meet increase in user base
 - Still a “one size fits all” network
- SuperJANET5
 - End-to-end network delivery and reliability to the end user
 - Meeting the needs of an increasingly diverse user base that has a very broad spectrum of requirements
 - Development vs production stability



Requirements Analysis

- Q2/3 2003
- Identified a number of areas for study
 - Architecture and Services at Multiple Network Layers
 - Network Infrastructure
 - Network Equipment
 - Reliability
- Wider consultation
 - Requirements analysis paper produced & issued
 - Community workshops
 - International comparisons

Consultation Carried Out



- Requirements analysis paper
- Requirements analysis launch event
- RNO workshop
- Research sector workshop
- Reliability questionnaire
- Articles in:
 - UKERNA News; ALT Newsletter; JISC Inform
- Discussions with key stakeholder groups:
 - UCISA; e-Science; FERL; Regional Networks



Issues raised

- Network reliability
- Latent bandwidth demand
- Protection of interests of the teaching & learning and research communities
- Participation of Regional Networks in delivery to institutions
- Network monitoring services to applications

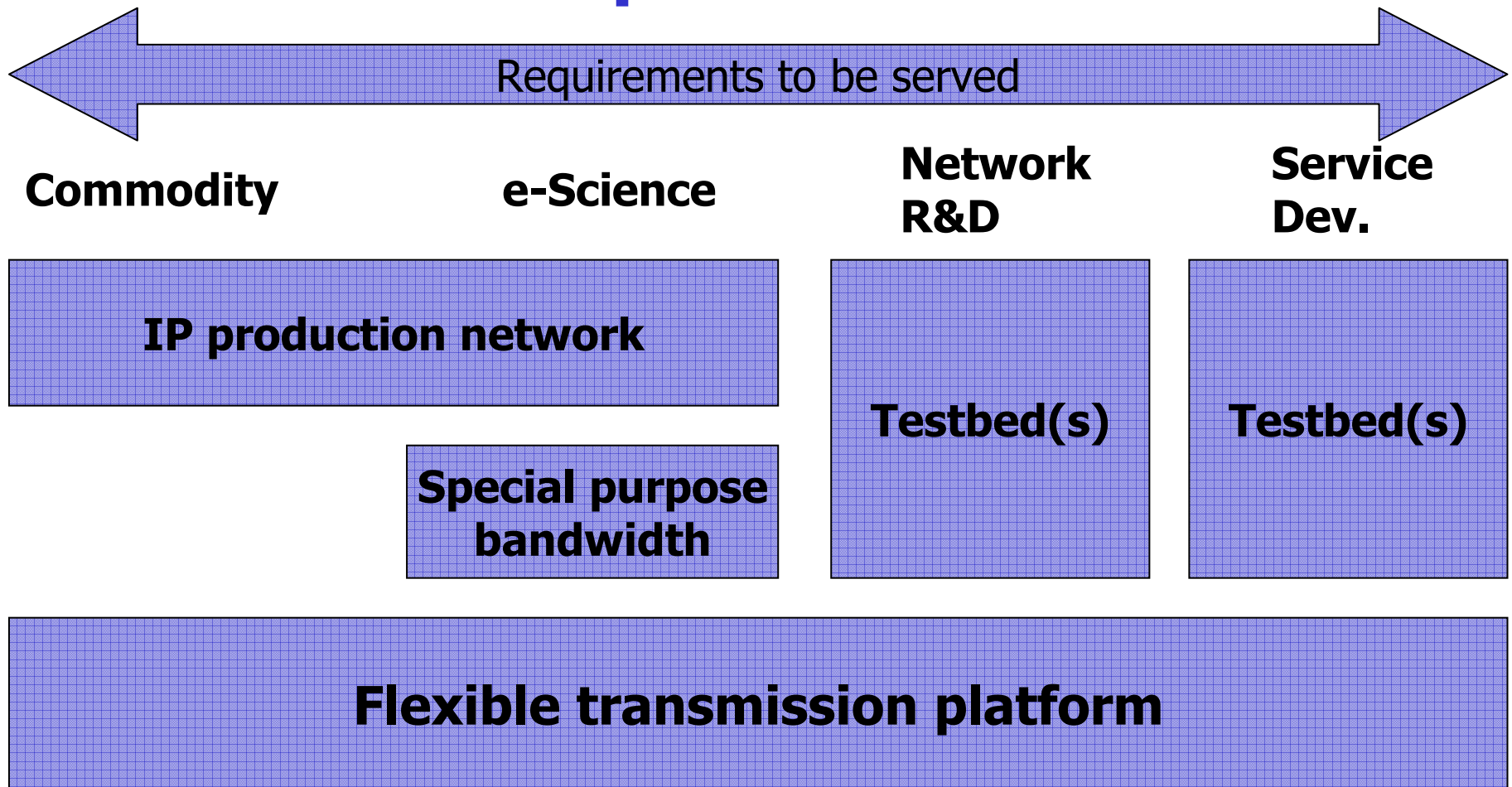


Translate Simply to....

- RELIABILITY
- SCALABILITY
- SEPARABILITY
- FLEXIBILITY
- VISIBILITY

END-TO-END

An architecture that responds to the requirements





Multiple Services

- IP Production Network
 - Ubiquitous network
 - High availability and reliability
 - Simple engineering for reliability
- Special Purpose Bandwidth
 - User requirements not compatible today with the IP production service
 - Point-to-point circuits
 - Reliable, Possibly to IP production standards
- Testbeds
 - 'Breakable' networks



Why multiple services

- Reliability
 - Stability
 - Strict change control
 - Don't fiddle
 - Don't introduce bugs
- Development & Flexibility
 - Change
 - New software (free bugs)
 - Takes a very long time if you want to minimise disruption

“You’re never alone with Schizophrenia”



- Very high levels of reliability and the development of advanced services are **mutually exclusive** over a one-size-fits-all IP service
- Multiple service streams are essential

Flexible Transmission Platform

Design characteristics



- Transmission channels configured and managed at our control
- Allows multiple service offerings from a single coherent network infrastructure
- Scalable to higher bandwidth at a predictable and manageable cost

Routers “The Next Generation”



- Carrier class reliability
- “Five Nines” availability (99.999%)
 - Less than 5.5 minutes of down time a year
- Building block for a better overall service
 - Does **NOT** mean that JANET becomes 99.999% available
 - Other problems will almost certainly ensure this



How to achieve “Five Nines”

- Modular h/w and s/w architecture
 - Reduced chance of adding bugs
 - Non-intrusive upgrades
 - Automatic failure detection and rapid recovery
- Eliminate single points of failure in the router
- Partitioned system offering multiple “virtual” routers per platform
 - May enable multiple IP service streams in a single chassis

What we've procured





Infrastructure

- Negotiated Procedure under public procurement regulations
 - We know what we want but not how to get it
- Pre-qualification
 - Q4 2004
 - Six suppliers short-listed
- Negotiate form of ITT with all six
 - Q1 and 2 of 2005



Infrastructure

- Produce and launch ITT
 - June 2005
 - Only to short-listed suppliers
- Award Contract December 2005
- MCI (now Verizon) the preferred supplier



Routers

- RFI process
 - Informal talks with suppliers in Q3/4 2003
 - RFI document issues in early 2004
- Evaluating features of carrier class routers
- NOT a procurement
- Hands-on testing of
 - Chiaro Enstara, Cisco CRS-1, Juniper T-640, Procket PRO 8000



Routers

- Open procurement launched in Sept 2005
- Contract signed with Lucent Technology
 - This morning
- Juniper T-640 routers
 - Carrier Class
 - >1000 in service world wide
 - 40 Gbit/s demonstrated by Juniper and Verizon
 - Available as a product now
 - Very good deal, Driving down the cost of ownership

Juniper T-640



February 2006

SuperJANET5 Overview

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What does this mean in practice?

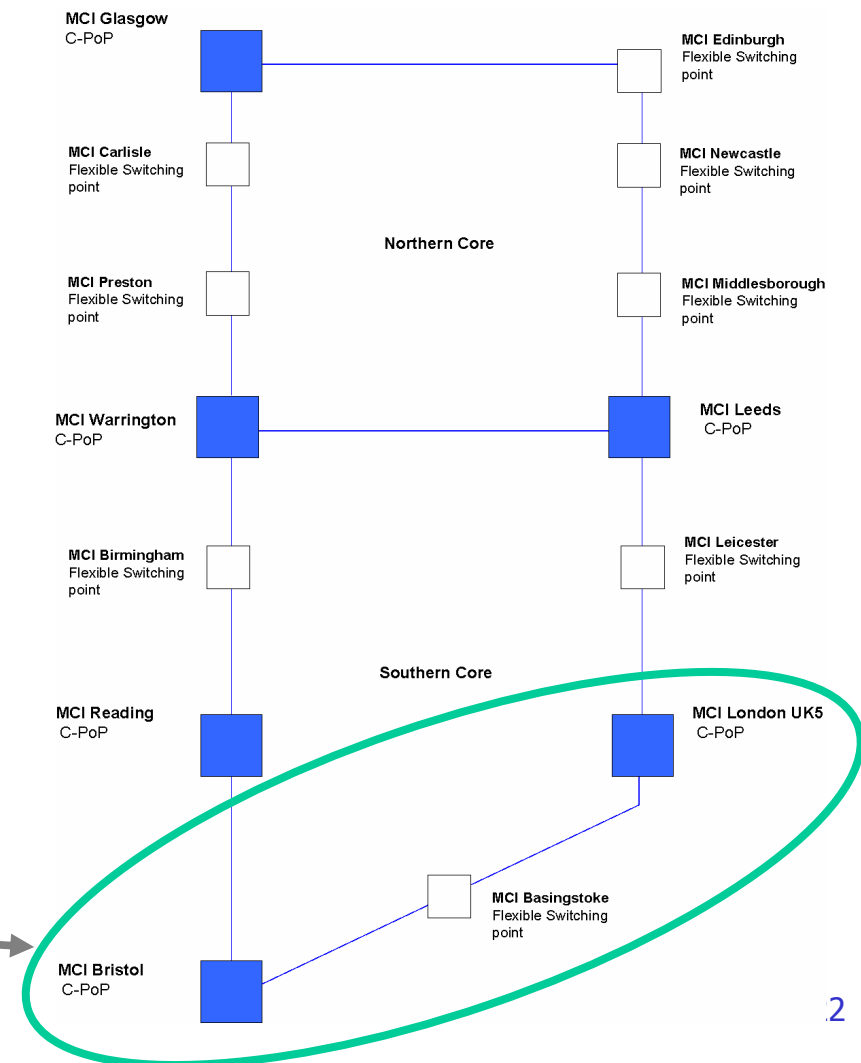


- Fibre infrastructure dedicated to SuperJANET5
 - Single pair of fibres
 - Unprotected
- Dedicated transmission infrastructure
 - Operated by Verizon initially
 - UKERNA may manage wavelength provision later in the project
- WDM technology
 - Deployed in the core and out to the Region

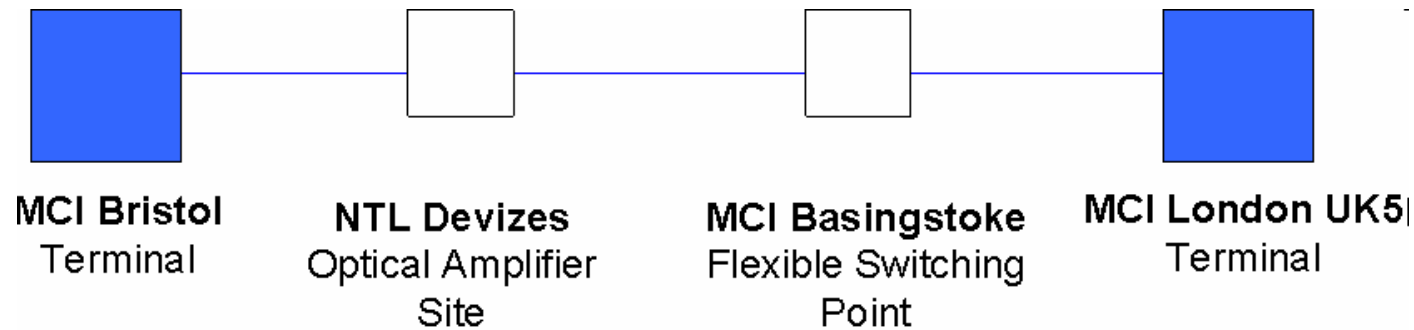


Core Network Design

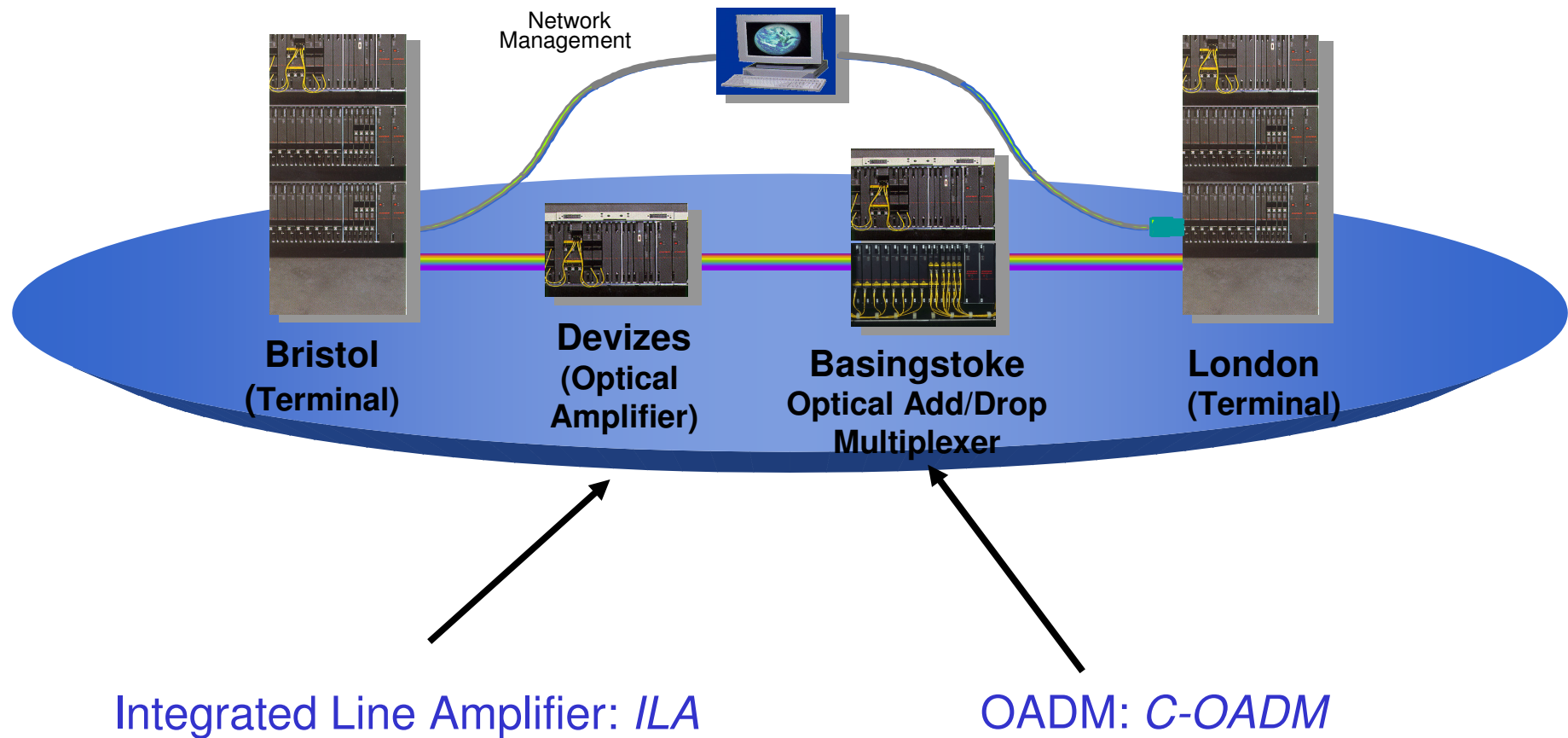
- Core Network consists of three basic components:
- Core Terminal sites – Six blue locations
- Flexible OADM sites (Optical Add Drop) – Eight white locations
- Optical Amplification sites – Eleven locations, not shown



Ciena CoreStream Regional



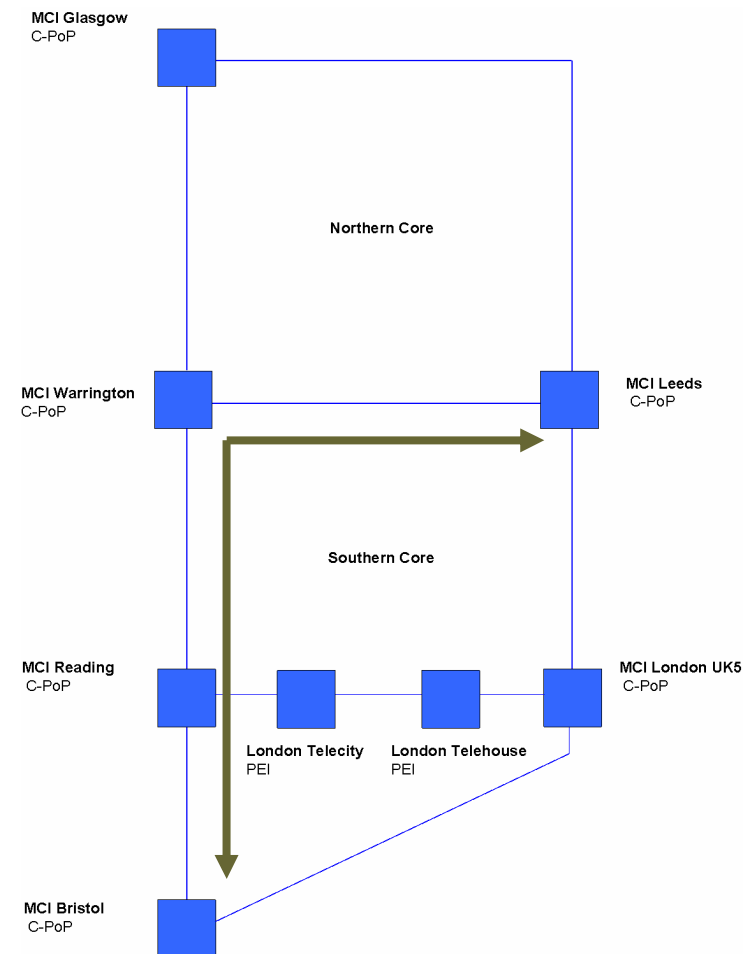
Ciena CoreStream Regional





Core Traffic Provision

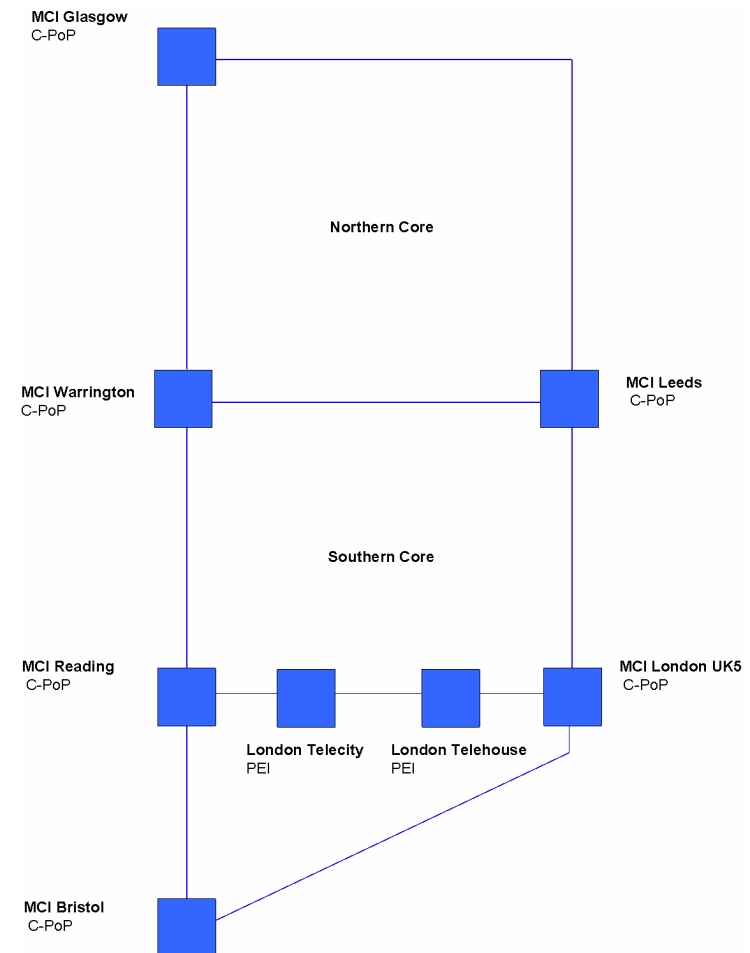
- 10G Wavelengths are provisioned using two transponders only
- No Regeneration needed
 - Each wavelength has to be regenerated separately
 - Optical amplification still needed every 80 KM or so





Core Traffic Provision

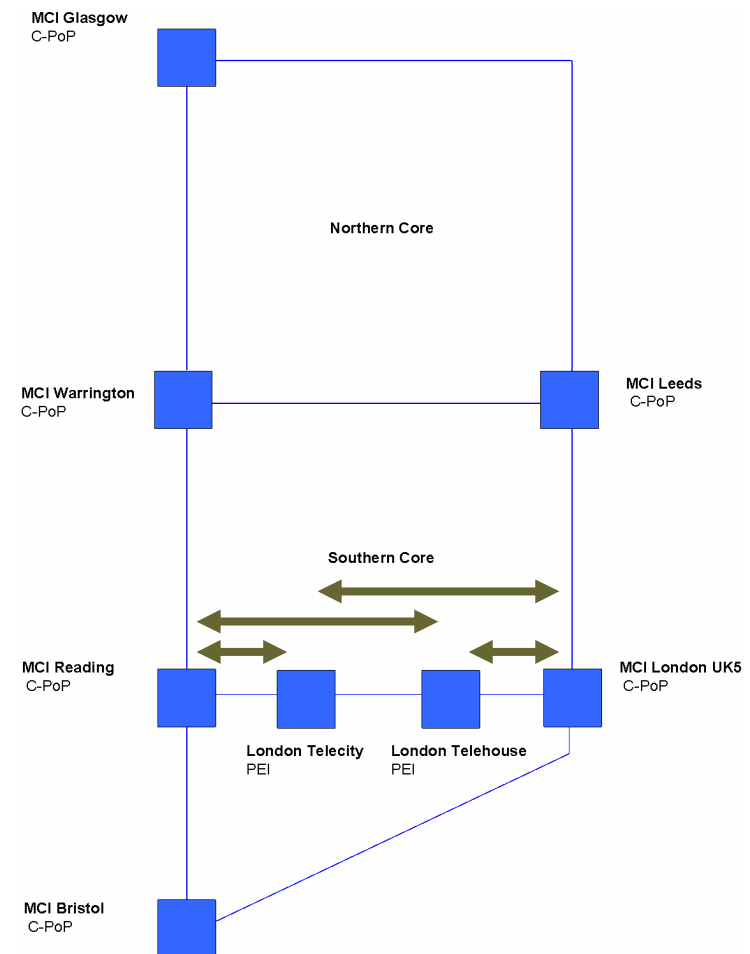
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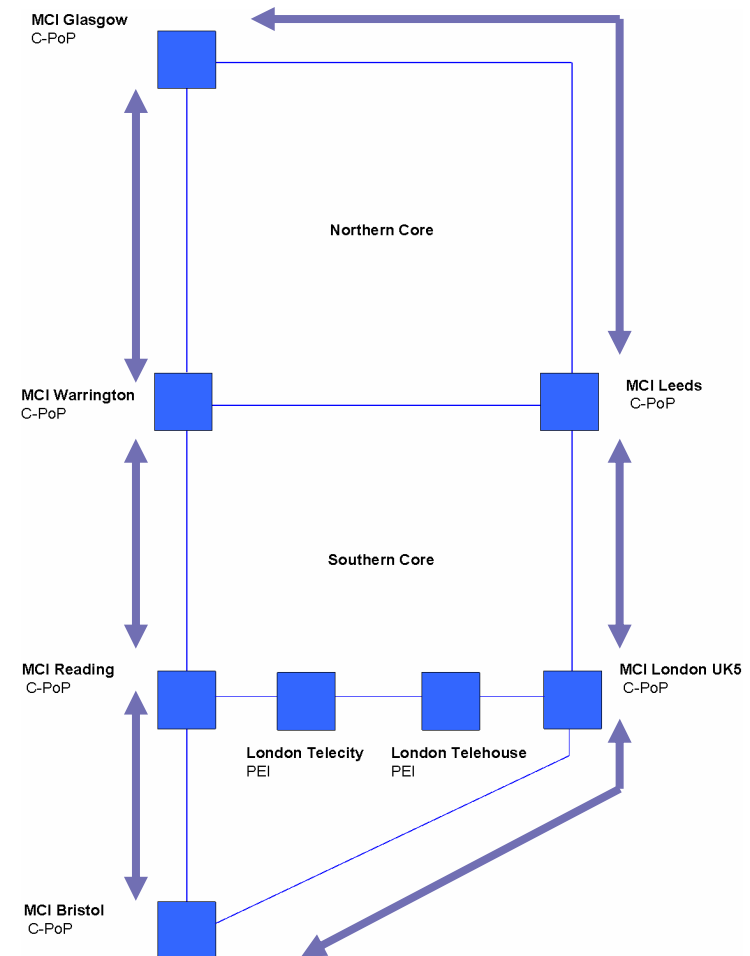
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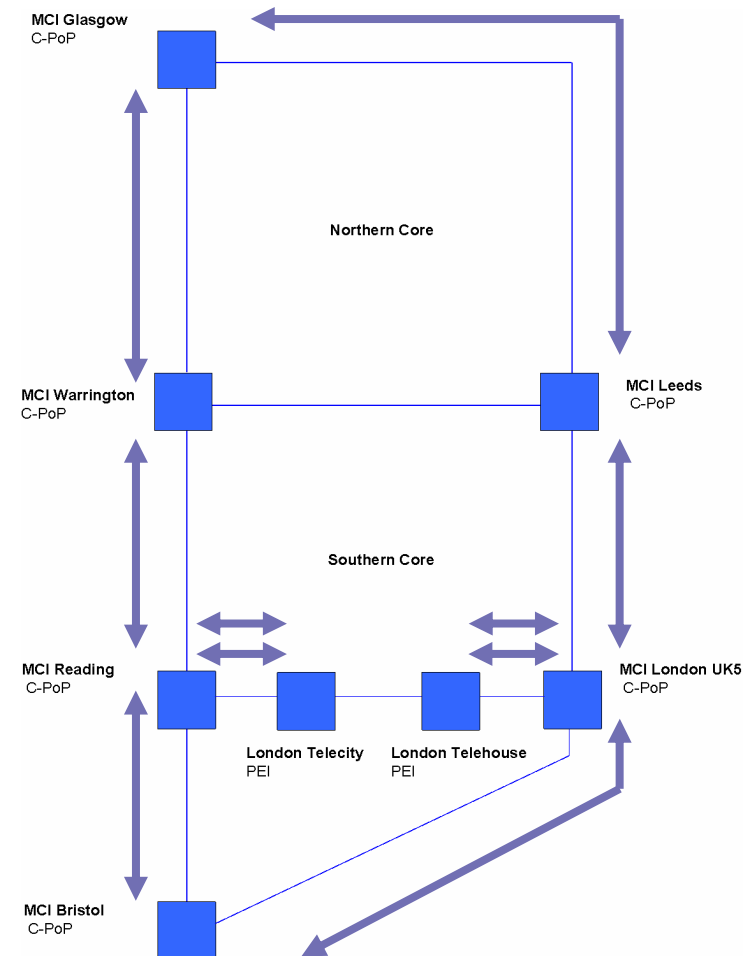
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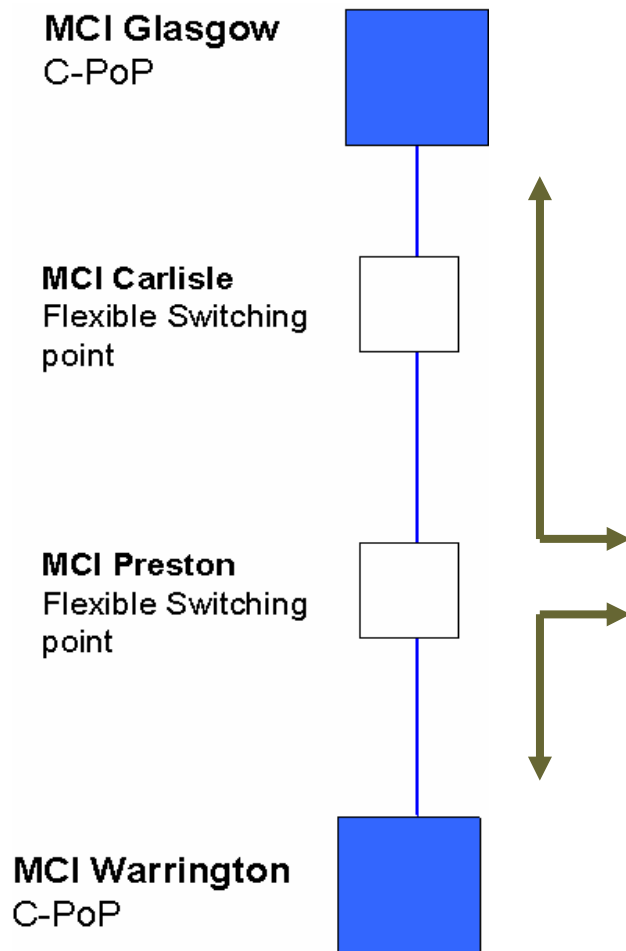
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- Development traffic – identical to IP network with 1 x 10G between Terminal locations, except....
- different configuration of 2x10G to London PEI





Ciena OADM Operation

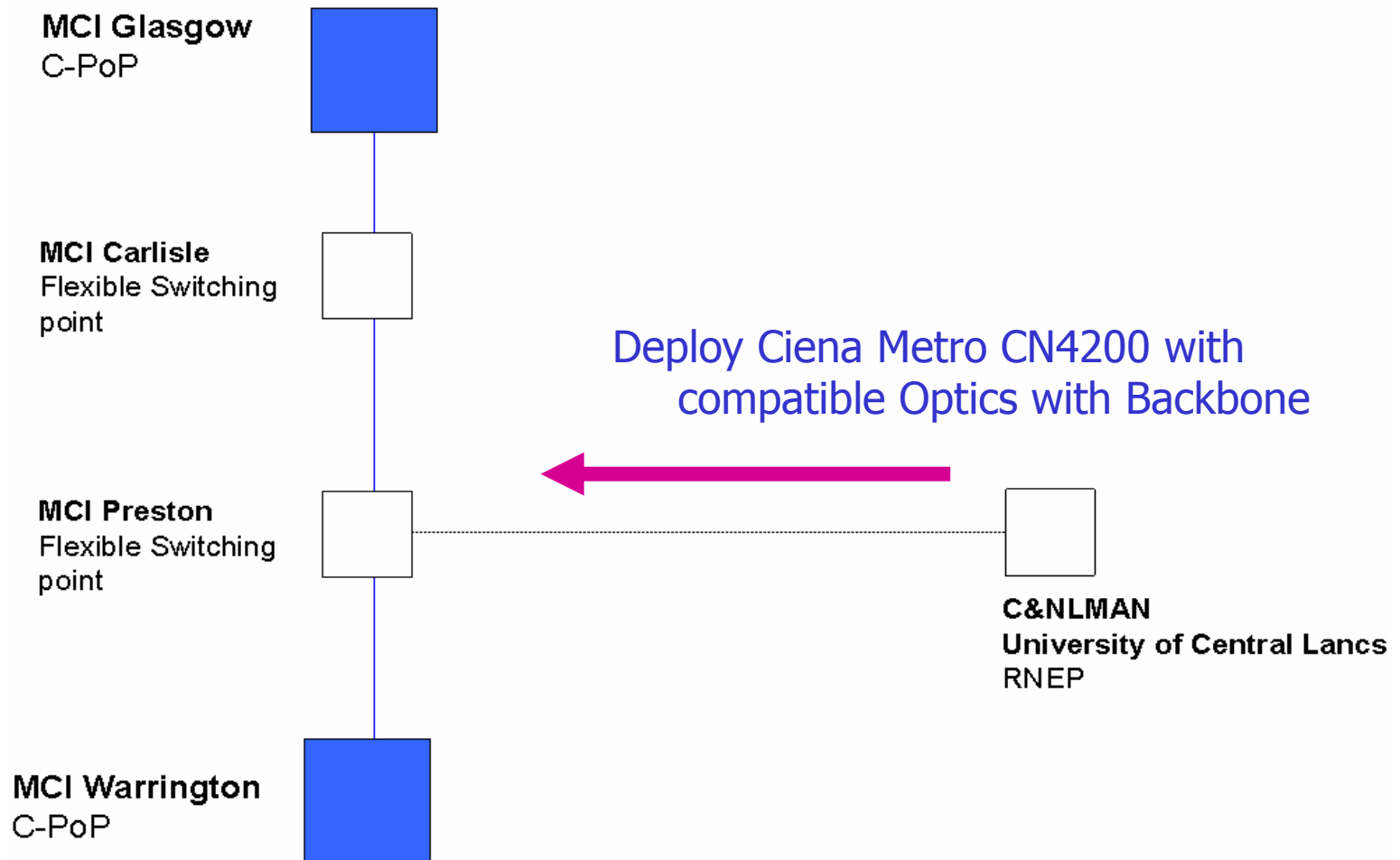


- Ciena supports 80 x 10G wavelengths between Terminals
- 80 Wavelengths grouped into 10 Bands of 8 Channels per Band
- OADM drops/adds one Band of 8 x 10G wavelengths

Require Optics compatible with CoreStream product

- Example: Preston has access to 8 Wavelengths North and 8 Wavelengths South

Ciena OADM Operation



Ciena CN4200 Platform

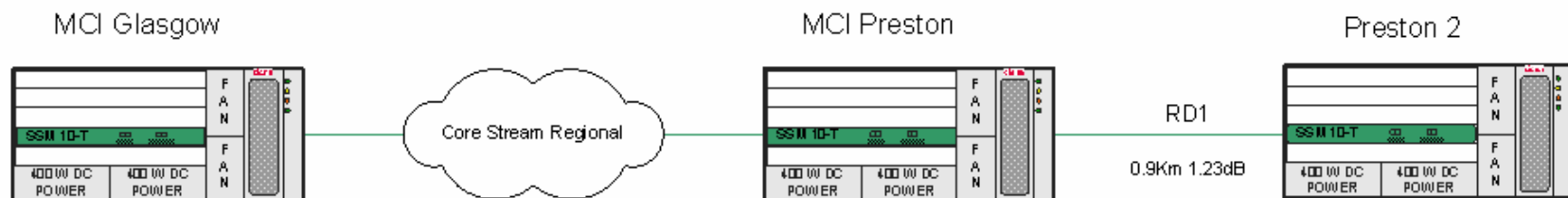


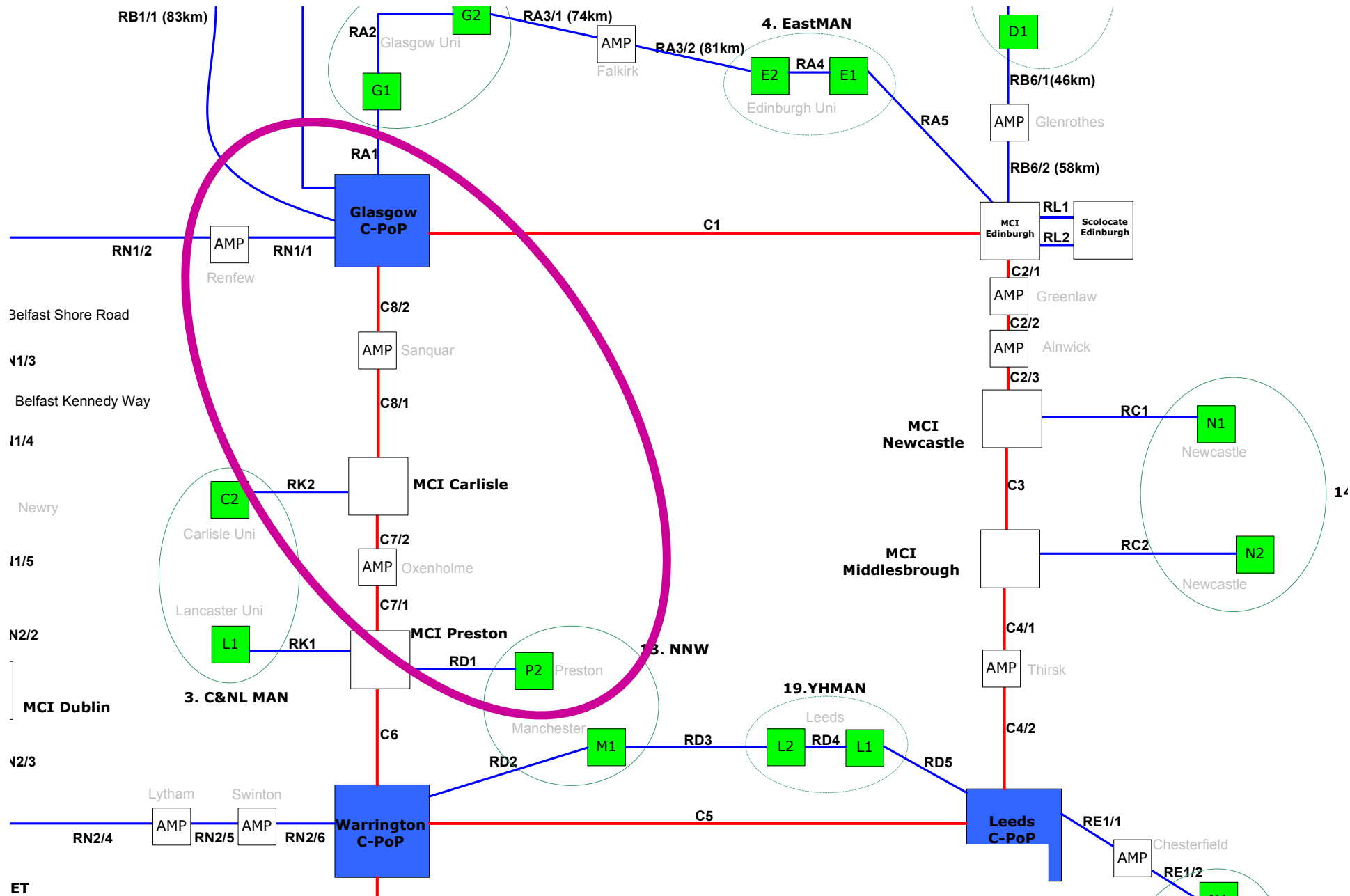
Regional Network Design



- Linear chain configurations
- Networks are either carried over fibre, or connected into Core Network at OADM sites

Regional Network Carried over CoreStream OADM System

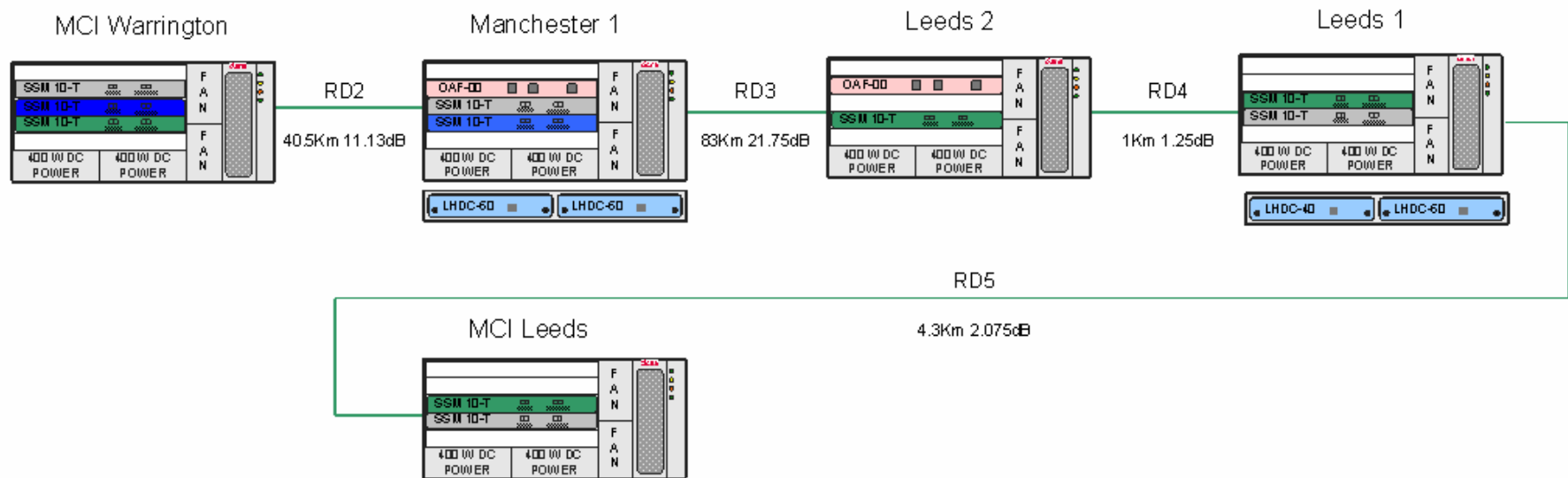


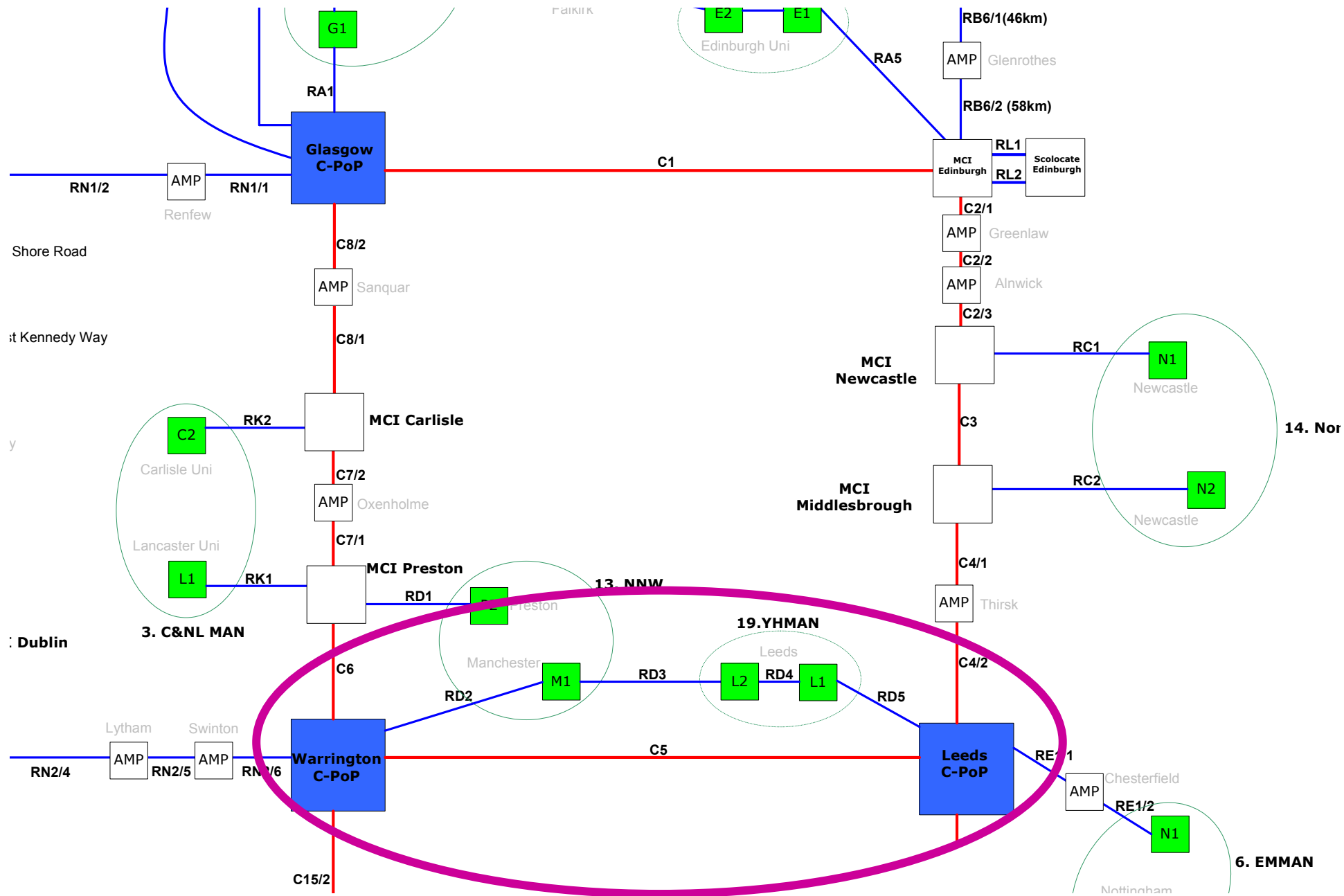


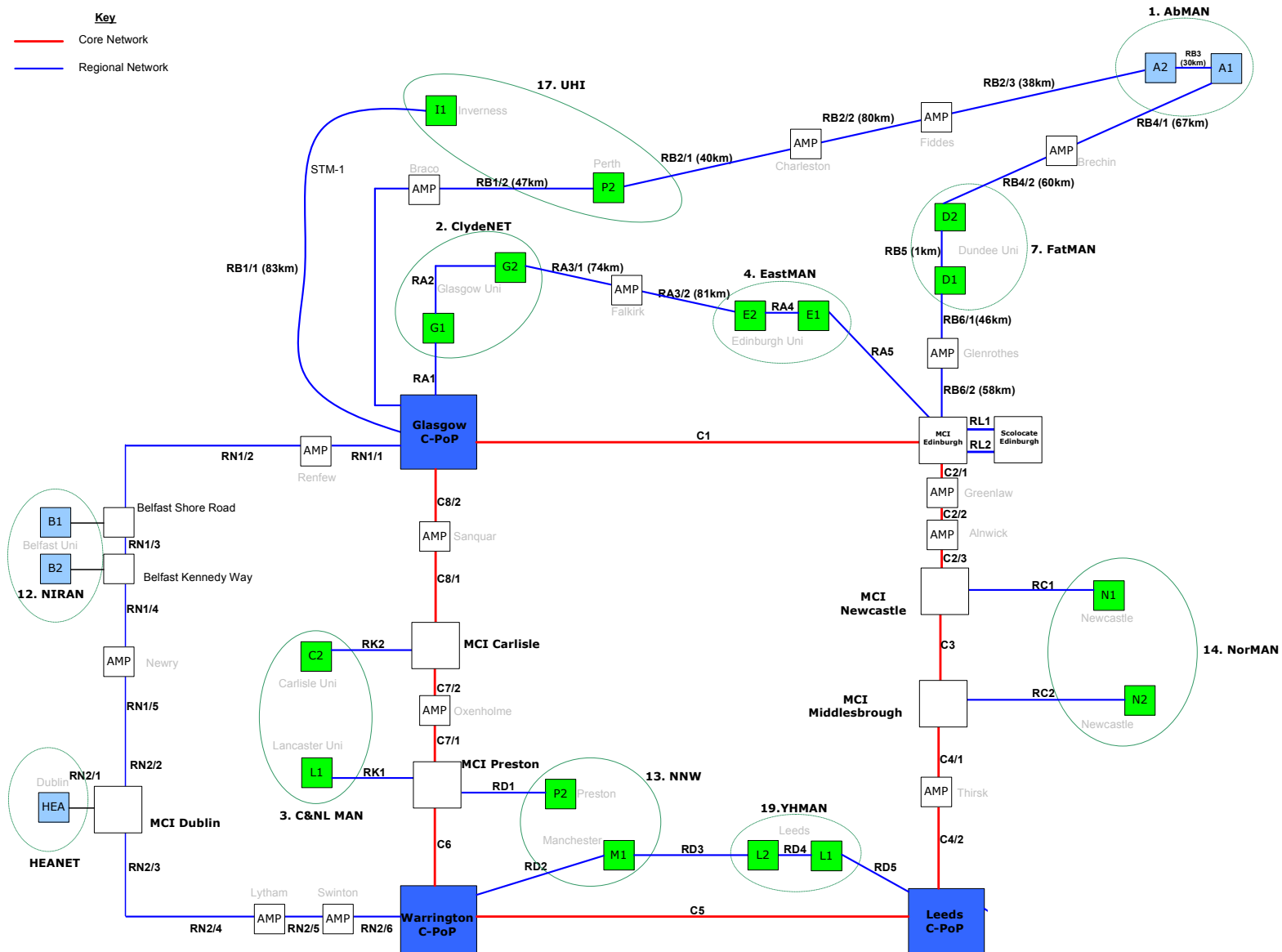
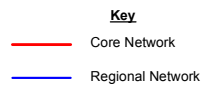
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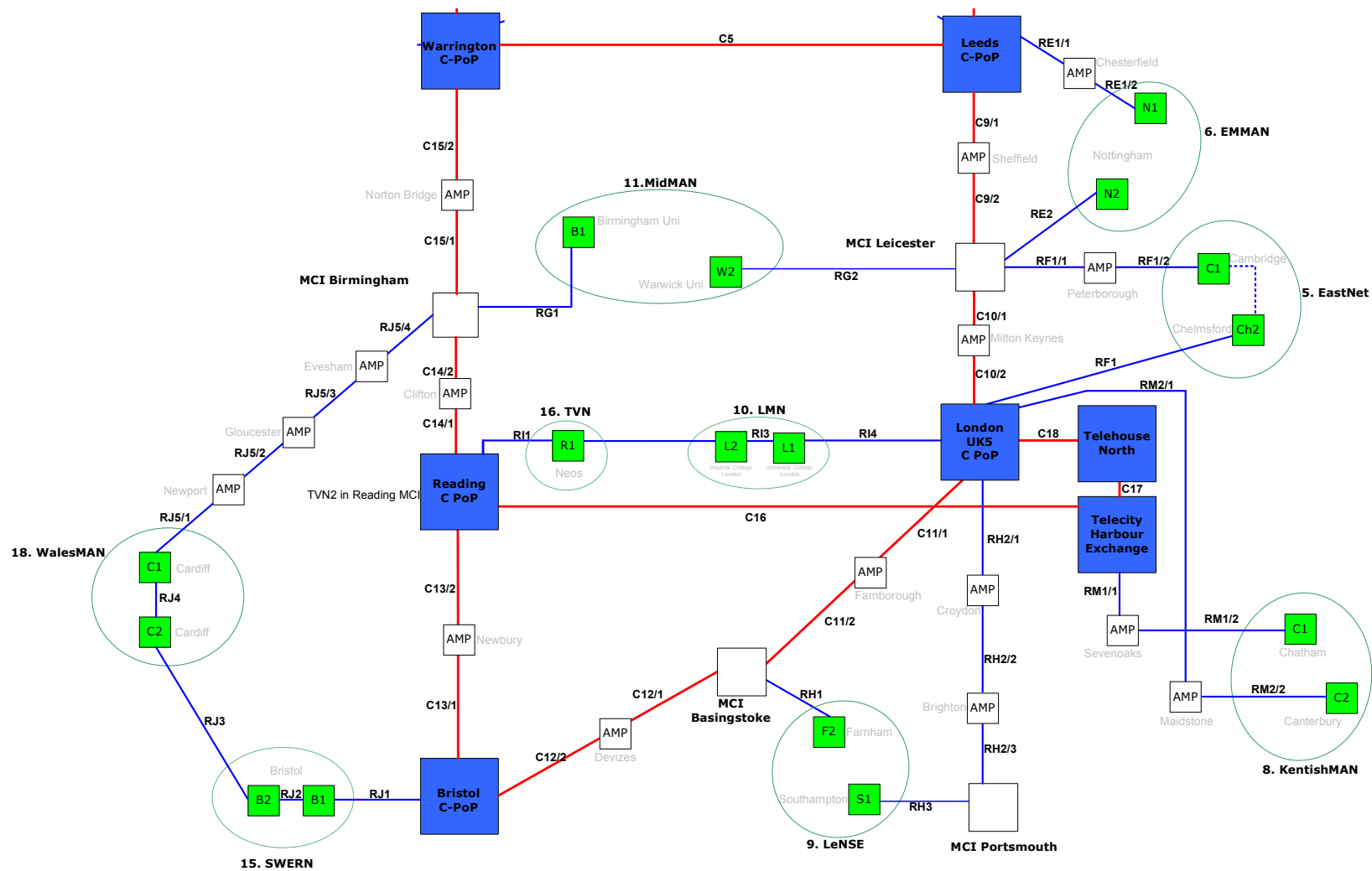


Regional Network Carried over collector arc











Reliability

- Reduce single points of failure
 - Duplication of critical equipment
 - Diverse fibre routing in the core
 - Dual connection of Regional Networks
 - SDH technology
 - Rapid failure detection and recovery
 - Detect latent problems



Reliability

- Reduce complexity
 - Simplify IP design
 - Reduce number of backbone routers
- Carrier class equipment
 - Ciena optical technology
 - Juniper T-series routers
- High availability



Scalability

- Ability to expand capacity
 - Where it's needed
 - When it's needed
- 40 Gbit/s trial in early 2007
- Predictable cost
 - Marginal cost for transmission channels
 - Significant discount for router equipment
 - Not clawed back in maintenance charges



Separability

- Hard multiplexing of bandwidth channels
- Production services completely protected
 - Banding of channels could even allow GMPLS experiments over the core



Flexibility

- Deliver bandwidth quickly
 - In weeks rather than months
 - P⁶ is still necessary
- With a variety of interfaces and bandwidths
 - 10 and 2.5 Gbit/s SDH
 - 10 and 1 GE (LAN-PHY and WAN-PHY)
- Temporary arrangements may be practical

Visibility



- Requirement to monitor network in more detail
- Operational monitoring
- Research projects
- Optical taps

What are we going to do now?





SJ5 delivery Timetable

- Core links RFS by 30th April 2006
 - Includes UKERNA acceptance testing
 - Telehouse & TeleCity part of the core
- UKERNA Acceptance testing
 - Agilent network testers
 - Loops in the right places
 - Links are ready to go when routers delivered



SJ5 delivery Timetable

- Test router to ULCC in March
 - Use to build initial configurations
 - Familiarisation for the NOSC
 - Enhances training courses March/April
- Core routers RFS by 31st May
 - Pre-staging by Lucent to eliminate DOA hardware
 - Pre-configured, plug-and-go



SJ5 delivery Timetable

- All RN links RFS by 31st June
 - Expect some before this date
 - Acceptance using Agilents or Core Routers
 - Connection of SJ4 to SJ5 at Docklands mid June
- Migration of RNs will begin ASAP
 - Non regional services have to migrate as well

Arrangements for migrating



Cease resilient links between Docklands and SJ4 core

- Will be done in early June
- Connect SJ4 to SJ5 at Docklands
 - Will be done in mid June

Arrangements for migrating



- Migrate sites connected to Cosham, Bristol, Glasgow and Edinburgh C-PoPs 1st
 - Reduce ongoing router maintenance costs
 - Free up 10 Gbit/s equipment for re-deployment
- Cross connect links to bypass old core routers while maintaining SJ4 resilience
- Will then move RNs from remaining C-PoPs

Arrangements for migrating



- Avoid migrating during clearing
 - An ambition, NOT a promise
 - EastNET will probably have to ☹
- EastNET must connect by end of September
 - Existing ntl contract terminates on the 30th

How's it going?



- Very well thank you.....
- University of Kent, Canterbury
 - Longest SJ5 dig
 - From the A2 into the campus
 - Through the mating ground of.....



The Great Crested Newt

- Verizon talking to DEFRA and the world expert
 - Who happens to work at UKC



Gone for, and GOT!



- RELIABILITY
- SCALABILITY
- SEPARABILITY
- FLEXIBILITY
- VISIBILITY

END-TO-END



Questions?