Larging it for the GRID

Big Networking for Big Science

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Let's go Large

- User in Glasgow wants to access the HGP data
- HGP database:
  - 0.25PB (growing at 1TB/week)
- SuperJANET4 (SJ4):
  - 10Gb/s backbone (still <2.5Gb/s access in places)
- Extreme case – transfer all of the HGP data
- So, **iff** user gets **all** the SJ4 backbone capacity:
  - transfer of HGP data still takes ~55½ hours!
  - no one else can use the network at all during this time
- **Can't do it!** ☹

General problems

- Changing networking landscape:
  - access speeds vs. core speeds
  - over-provisioning may not cut it in the future
- Changing research usage:
  - GRID users: HEP, bio-informatics, etc.
- Changing and (mostly) unpredictable traffic patterns (access and core)
- **Complex system behaviour:**
  - learning curve – technical and operational
  - next generation HE networks (SJ5, SJ6 …)
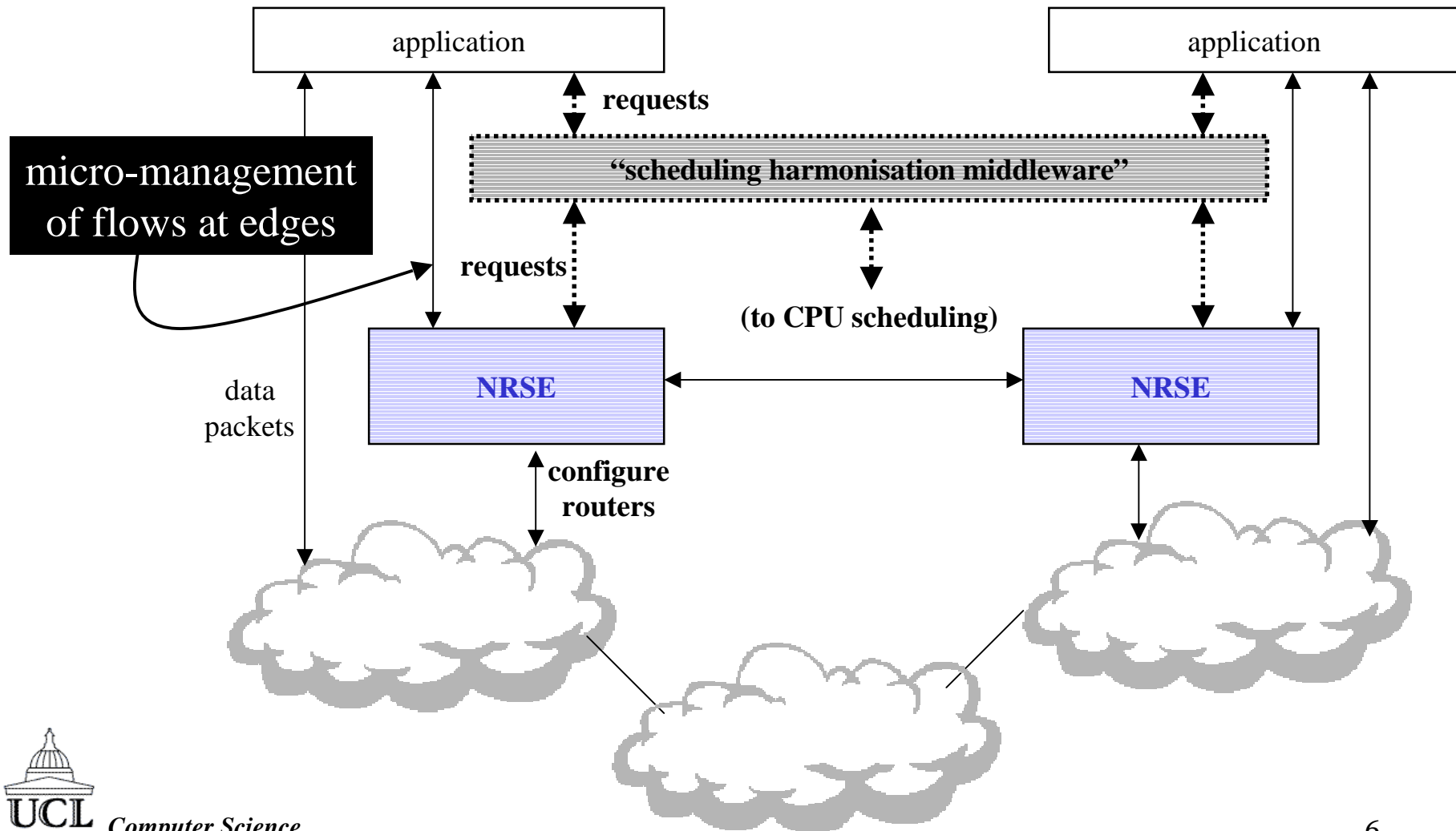- **Lots of systems-oriented research required**

So what can we do about it?

- **Build a new and better network (of course)!**
  - very high capacity (Gb/s   Tb/s   Pb/s)
  - users can have access from their desktop
  - provides (QoS-)controlled access
- Two broad problems to consider:
  - **control**: *how do we mix different types of traffic and still control the traffic flows in the network sensibly?*
  - **capacity**: *what happens when you run a very high capacity network with very high capacity access links?*
- This talk is about the **Research** issues:
  - there are also **Operational** issues! (but that's SEP   )

Control: network edge

- **GRS project (Mar2002 – Feb2004)**
- http://www.cs.ucl.ac.uk/staff/S.Bhatti/grs/
  - EU-DataGrid – http://www.eu-datagrid.org/
- Looking at network resource "scheduling":
  - edge system admission control + core mechanisms
  - "booking" (reserving) network capacity in advance
- Not specific to any particular QoS mechanisms:
  - we will test with DIFFSERV at the edge and core
  - could also use INTSERV, MPLS, (sub-)λ, …
- Will allow edge-to-edge control:
  - including multi-domain and heterogeneous networks

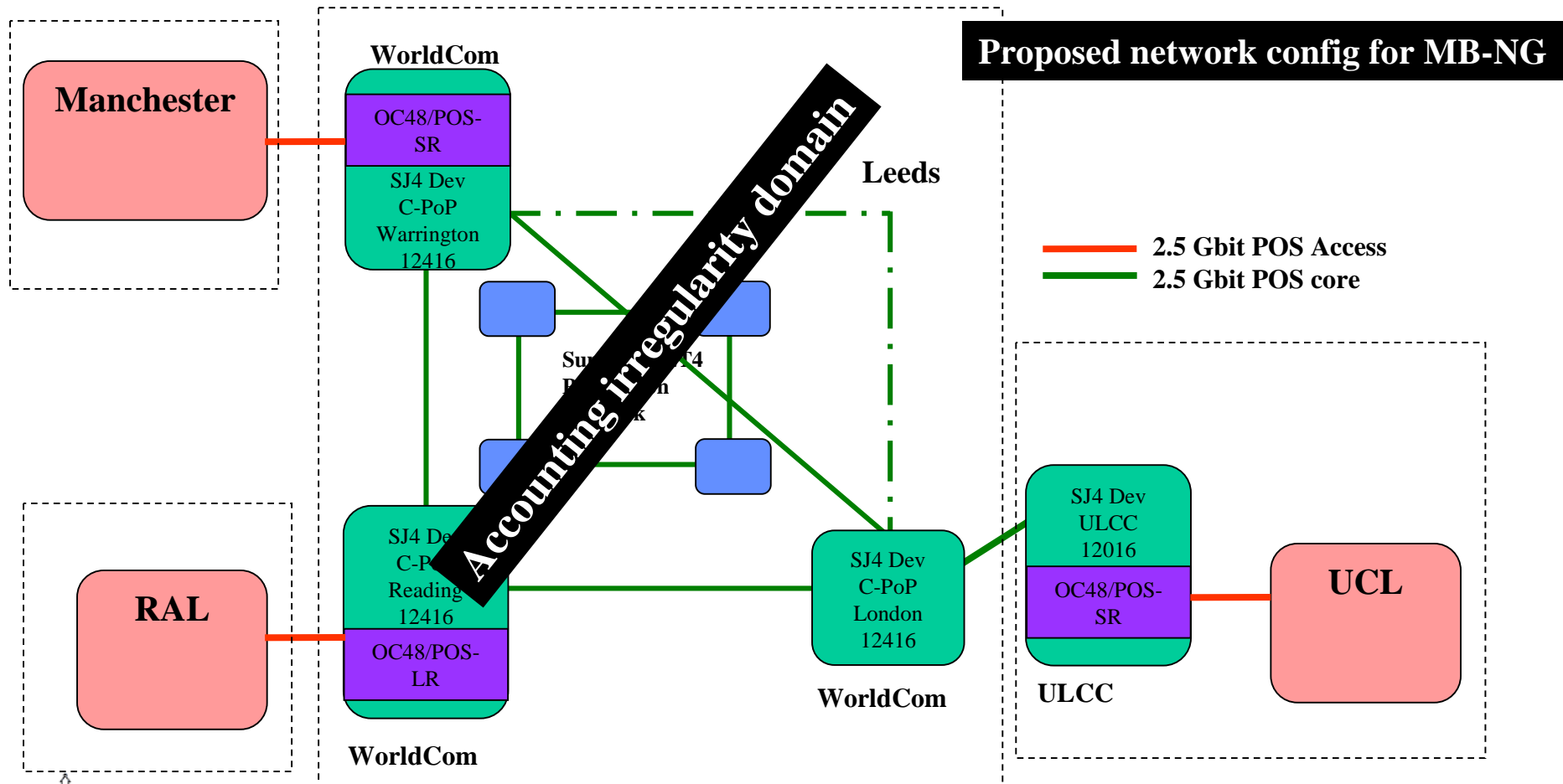*Computer Science*

GRS outline architecture

application

application

requests

micro-management of flows at edges

"scheduling harmonisation middleware"

requests

(to CPU scheduling)

data packets

NRSE

NRSE

configure routers

Control: core network

- **MB-NG project (May2002 – Apr2004)**
- http://www.mb-ng.net/
- Looking at high-speed QoS provisioning using:
  - DIFFSERV
  - MPLS
- UKERNA and Cisco are project partners
- Using SJ4 development network
- Managed bandwidth service for UK academia:
  - site-to-site (possibly end-to-end)
  - **multi-domain**

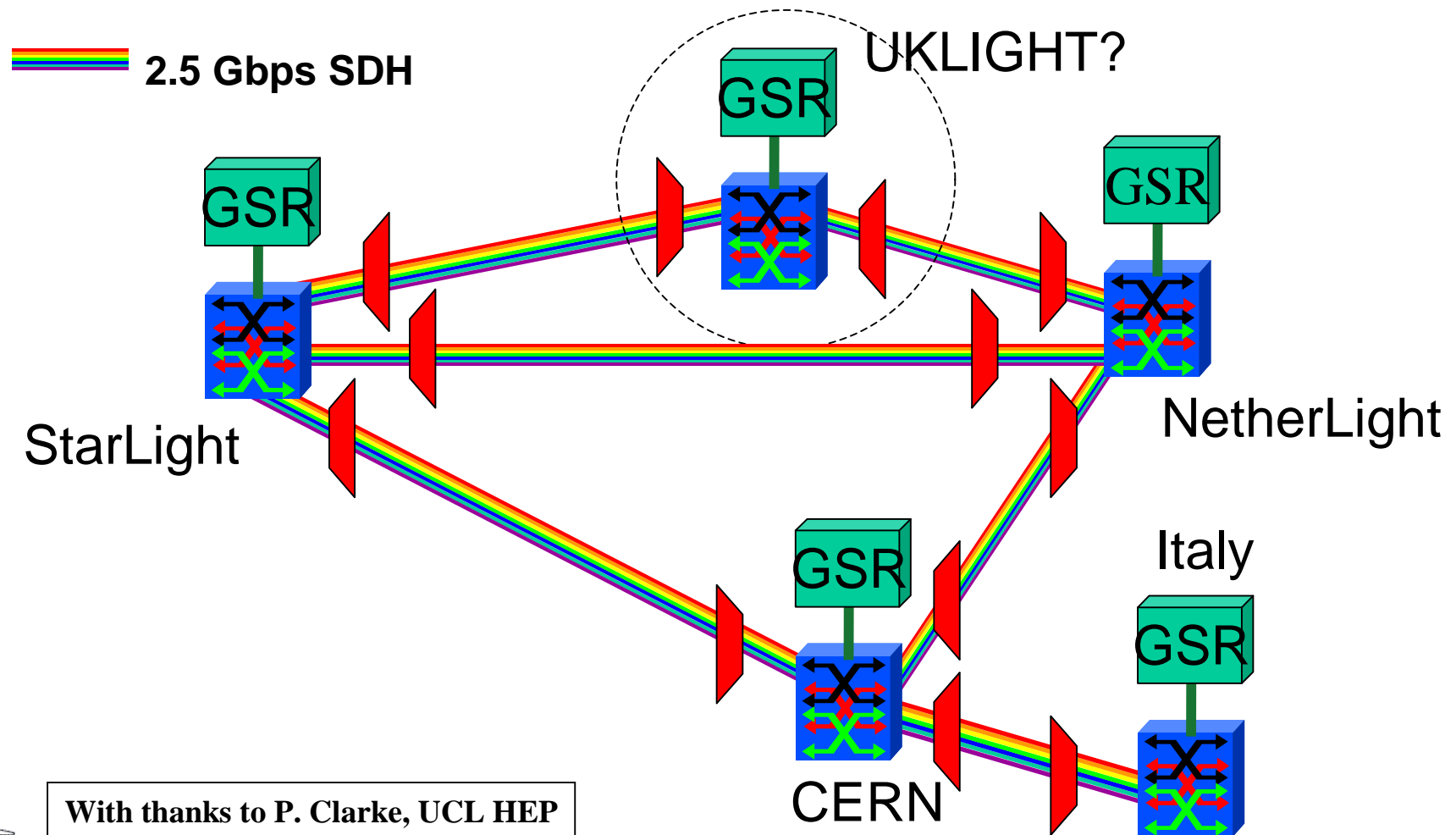*Computer Science*

MB-NG network

Proposed network config for MB-NG

Manchester

WorldCom

OC48/POS-SR

SJ4 Dev
C-PoP
Warrington
12416

Leeds

Accounting irregularity domain

Super...J4
P...n
...k

— 2.5 Gbit POS Access
— 2.5 Gbit POS core

SJ4 Dev
C-P...
Reading
12416

OC48/POS-LR

RAL

SJ4 Dev
C-PoP
London
12416

WorldCom

SJ4 Dev
ULCC
12016

OC48/POS-SR

ULCC

UCL

WorldCom

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Capacity

- **UKLIGHT (kick-off Q4/2002?)**
- http://www.cs.ucl.ac.uk/research/uklight/
- **Provide an optical networking infrastructure for network systems research in the UK**
- Very-high speed (multi-gigabits)
- International connectivity
- Current gang includes:
  - UKERNA, UCL, Cambridge, Aston, Brighton, Manchester, Southampton, Lancaster
- **Needs funding – so show me the money**

UKLIGHT: international

2.5 Gbps SDH

UKLIGHT?

GSR

GSR

GSR

StarLight

NetherLight

GSR

Italy

GSR

CERN

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General research areas: 3 Streams

- Stream 1: revisit "traditional" areas:
    - high performance tuning
    - AAA, QoS mechanisms, transport protocols, routing, performance analysis, accounting, pricing, etc.
- Stream 2: optical/high-speed infrastructure:
    - **communities and community-oriented systems**
    - virtual organisations, active and adaptable systems, integration with optical systems (access to λ?)
- Stream 3: photonics + computer science + nets:
    - optical logic, security mechanisms, routing and traffic control, multiplexing, active networking, etc.

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- GRS:
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- MB-NG:
  - http://www.mb-ng.net/
- UKLIGHT:
  - http://www.cs.ucl.ac.uk/research/uklight/

Questions?

A good way to get answers …