
Protocol and measurement support for high-speed applications: Ongoing work in the projects 46PaQ, MASTS & ESLEA

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46PaQ, MASTS & ESLEA

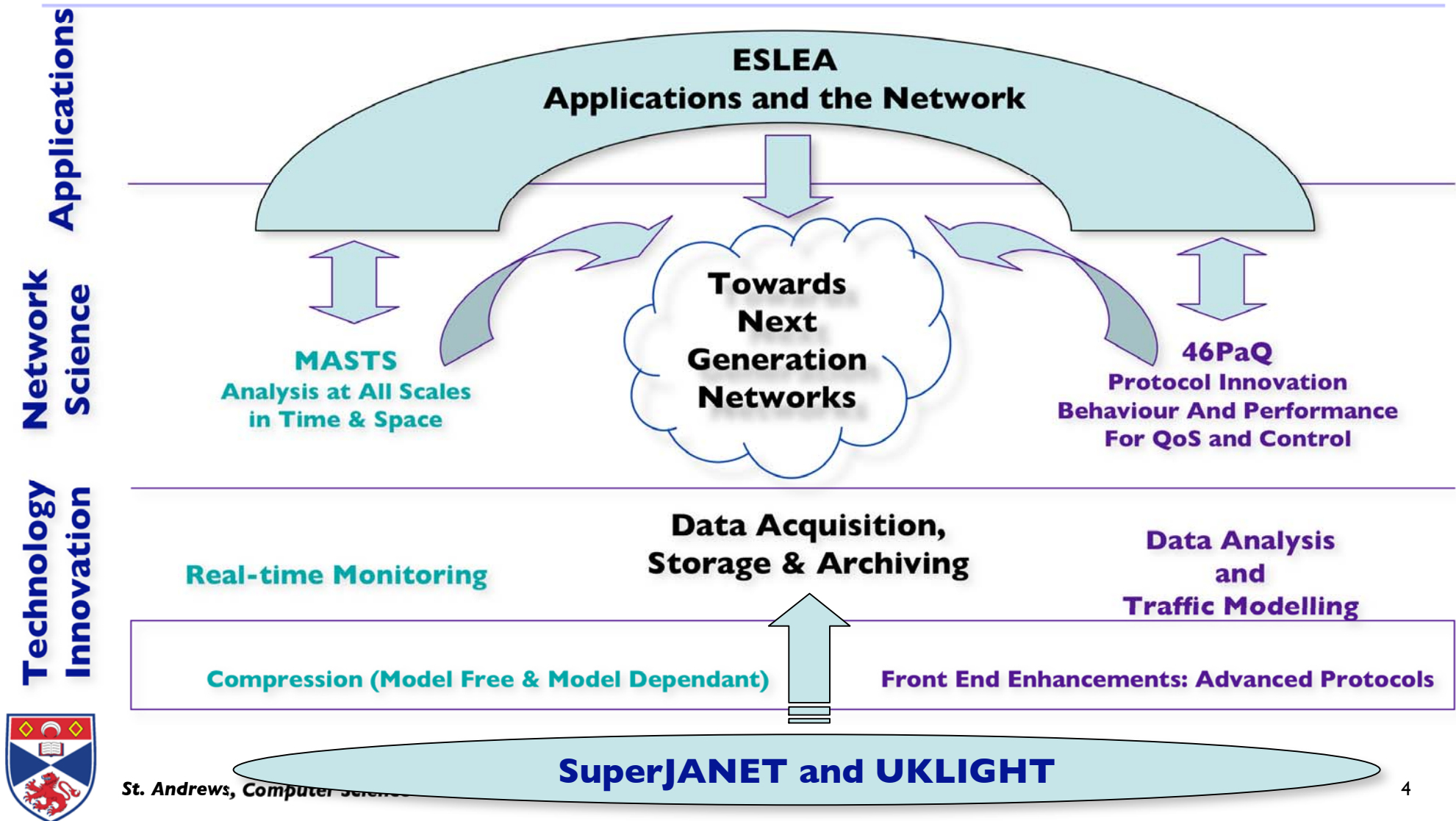
- Overview
- Current Status and Results
- Future Work
- Questions



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UKLIGHT 'network' projects



46PaQ overview [I]

- **IPv4 & IPv6 Performance and QoS**
 - EPSRC
 - 01 Dec 2004 - 30 Nov 2006 (June 2007)
- **Sites:**
 - Computer Science, St. Andrews
 - Computer Science, UCL
 - Computer Science, QMUL



46PaQ overview [2]

- Network & transport protocols at multi-Gb/s:
 - UCL & St. Andrews lead
 - New protocols (e.g. DCCP, TCP ‘extensions’):
 - » Collaboration with **ESLEA**
 - Engineering of the protocols and end-systems
- Traffic monitoring at multi-Gb/s:
 - QMUL leads
 - Multi-protocol analysis:
 - » Collaboration with **MASTS**
 - Traffic modelling



MASTS overview [I]

- **M**eaurement at **A**ll **S**cales in **T**ime and **S**pace
 - EPSRC
 - 01 Sep 2004 - 31 Aug 2007
- Sites:
 - E&E Eng, UCL
 - Computer Science & E&E Eng, Loughborough
 - Computer Science, QMUL
 - Computer Science, St. Andrews



MASTS overview [2]

- Traffic flow statistics
- Growth and scaling of network:
 - Traffic
 - Topology
- Monitoring systems:
 - Data capture
 - Data processing
- Traffic modelling



ESLEA overview [1]

- **E**xploitation of **S**witched **L**ightpaths for **E**-Science **A**pplications:
 - EPSRC, MRC, PPARC
 - 01 Feb 2005 - 31 Jan 2007
- Sites:
 - Many!
 - Edinburgh, London, Oxford, Manchester ...
 - Multi-disciplinary: CS, E&EEng, Physics, Biology ...



ESLEA overview [2]

- Control plane work:
 - Resource reservation (in advance)
- Protocol research:
 - New transport protocols (DCCP)
- Applications:
 - ATLAS - <http://atlas.ch/>
 - CDF - <http://www-cdf.fnal.gov/>
 - VLBI - <http://www.evlbi.org/>, <http://www.jive.nl/>
 - Grid - <http://www.realitygrid.org/>
 - e-Health - <http://www.integrativebiology.ox.ac.uk/>



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46PaQ current experiments

- Connectivity to UKLIGHT:
 - UCL: $2 \times 1\text{Gb/s}$ to Chicago, remote loopback
- 1Gb/s loopback experiments on UKLIGHT from Q1/2005 (London-Chicago)
- High-speed tests within the lab:
 - bi-directional data flows (not just TCP/FTP)
 - multiple data flows (not just single flows)
- Examine end-to-end data path:
 - **Interaction between application, hosts & network**
 - Performance tuning for high-speed operation



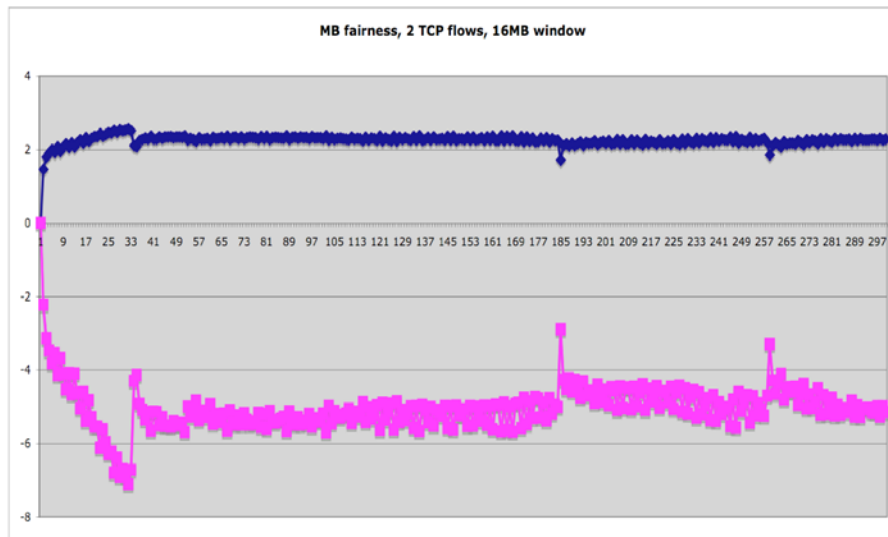
Observations

- Verification of known results
- Protocol performance very much dependant on several parameters (UDP buffer sizes, TCP window size and sender recv buffer size, CPU/HW speed)
 - For TCP, **window size** is important for paths with large **bandwidth-delay products**
- **Tuning of protocol stack and/or application is therefore the most important performance factor**

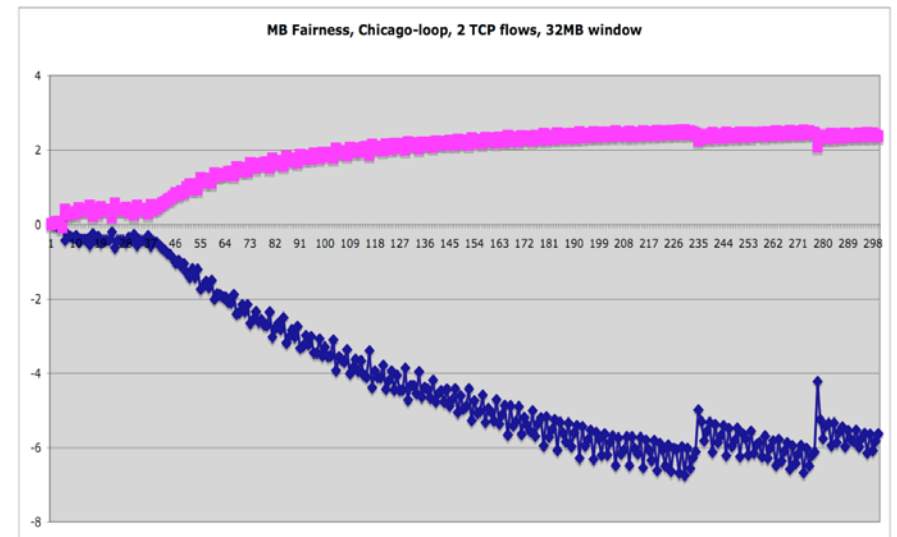


TCP 'Fairness' - Very Early Results

Matched bit-rate fairness (MBF, F_k)



Chicago-loop, 16MB window



Chicago-loop, 32MB window

$$F_k(t) = 10 \log_{10} \left(\frac{N b_k(t)}{\sum_{n=1}^N b_n(t)} \right), \quad k = 1, \dots, N$$

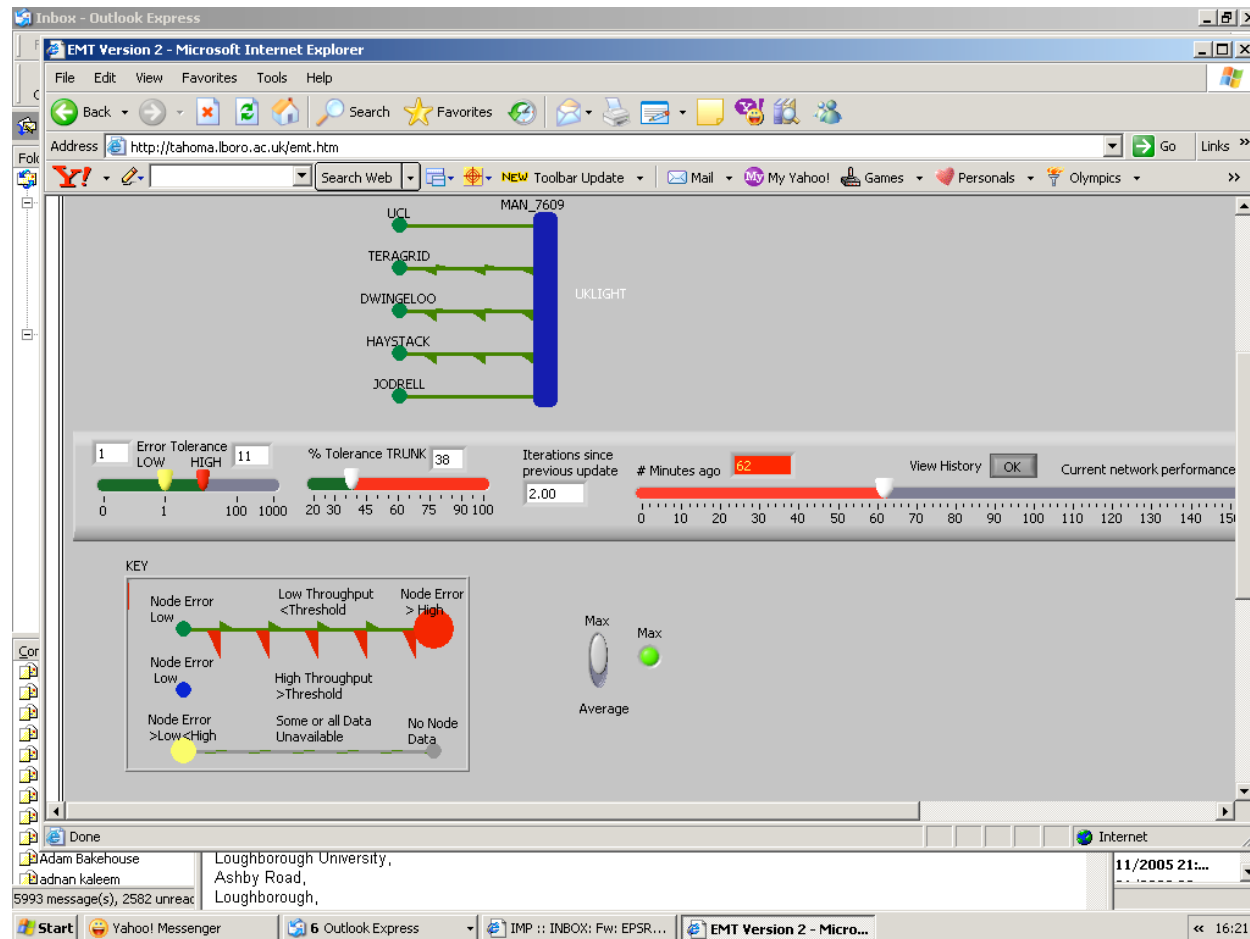


MASTS current work

- Set up network monitoring systems
- UKERNA - AUP for monitoring
- Storage of data:
 - Data has to be moved to processing site
 - Lots of data - summarisation and compression
- Data processing and analysis:
 - How to process? What are we looking for?
- Monitoring of ESLEA links



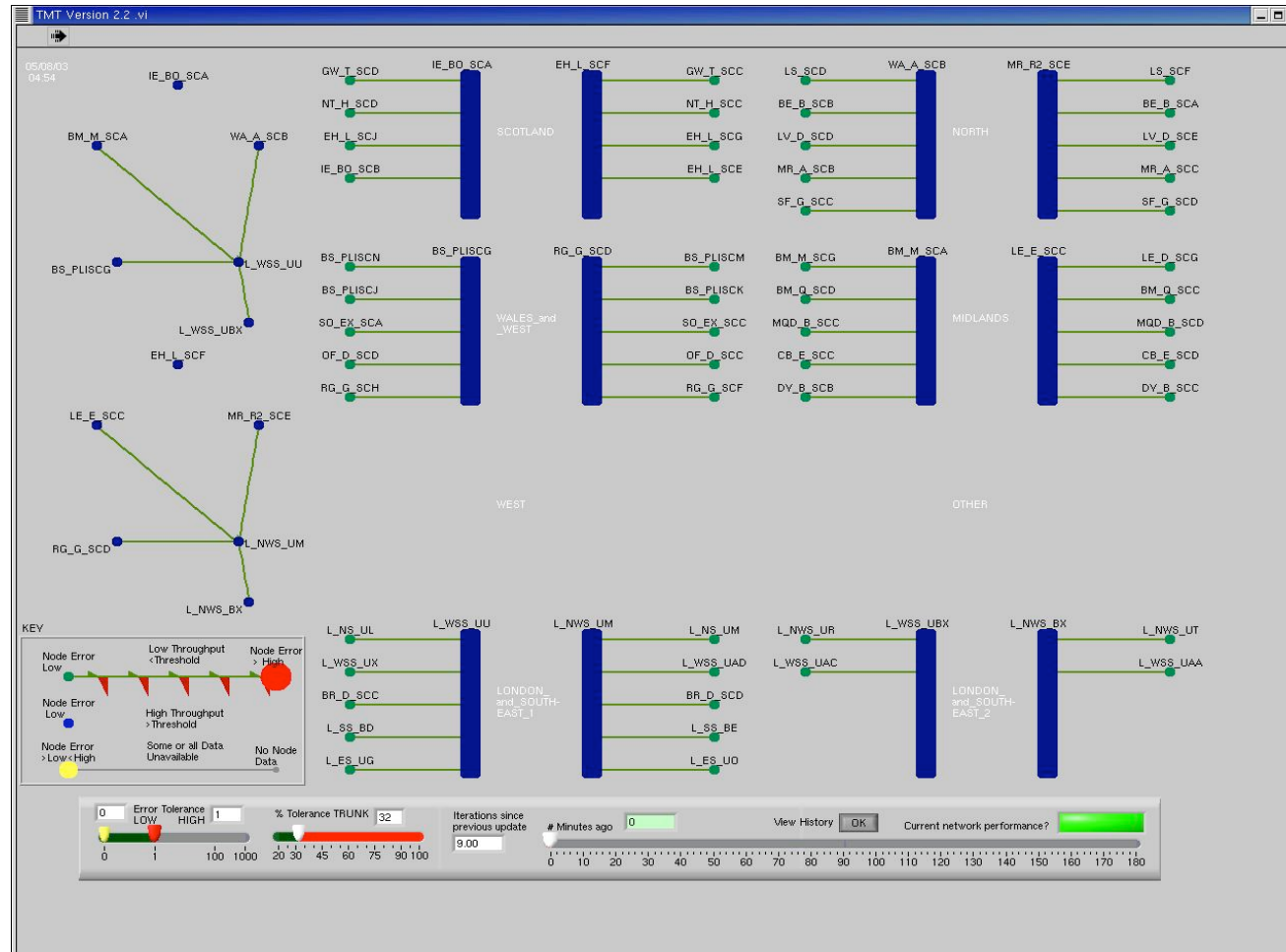
Prototype MASTS monitor



Loughborough University:
David Parish
Iain Phillips
Konstantinos Kyriakopoulos
Mark Whithall



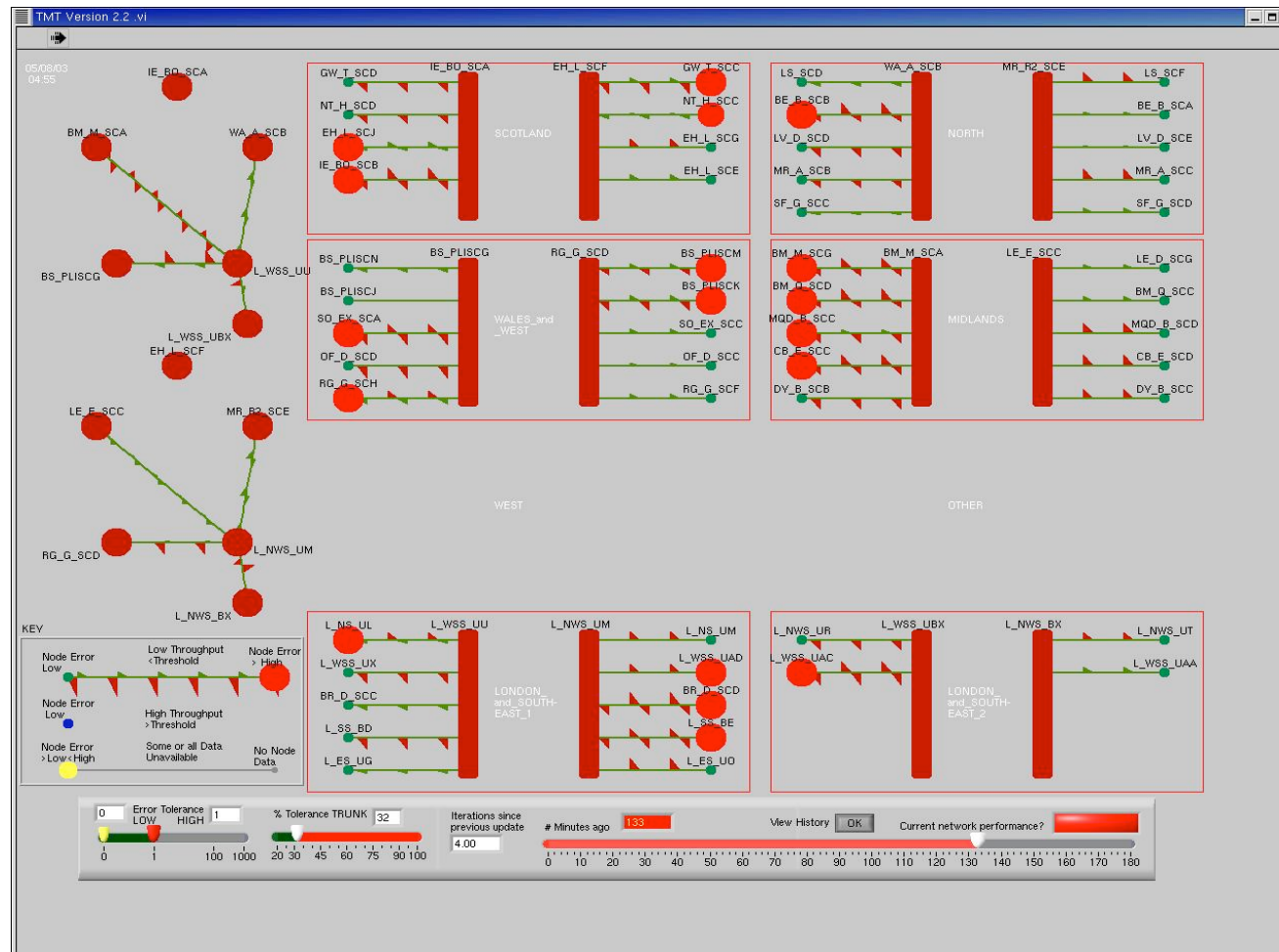
Example: No problems



Example: Some Problems



Example: Serious Problems



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46PaQ

- Starting DCCP experiments
- Interaction with ECN and DIFFSERV
- Performance on IPv6
- Continued co-operation with other projects:
 - MASTS (monitoring)
 - ESLEA (protocol work, e.g. DCCP)



MASTS

- Monitoring systems at UKLIGHT PoPs:
 - Monitor 1Gb/s and 10Gb/s
 - Data storage and archiving
- Traffic and performance analysis:
 - How to monitor performance at such high speeds?
 - Traffic models at different timescales
- Access network vs. Core network



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