

# Network Visualization for UKLight

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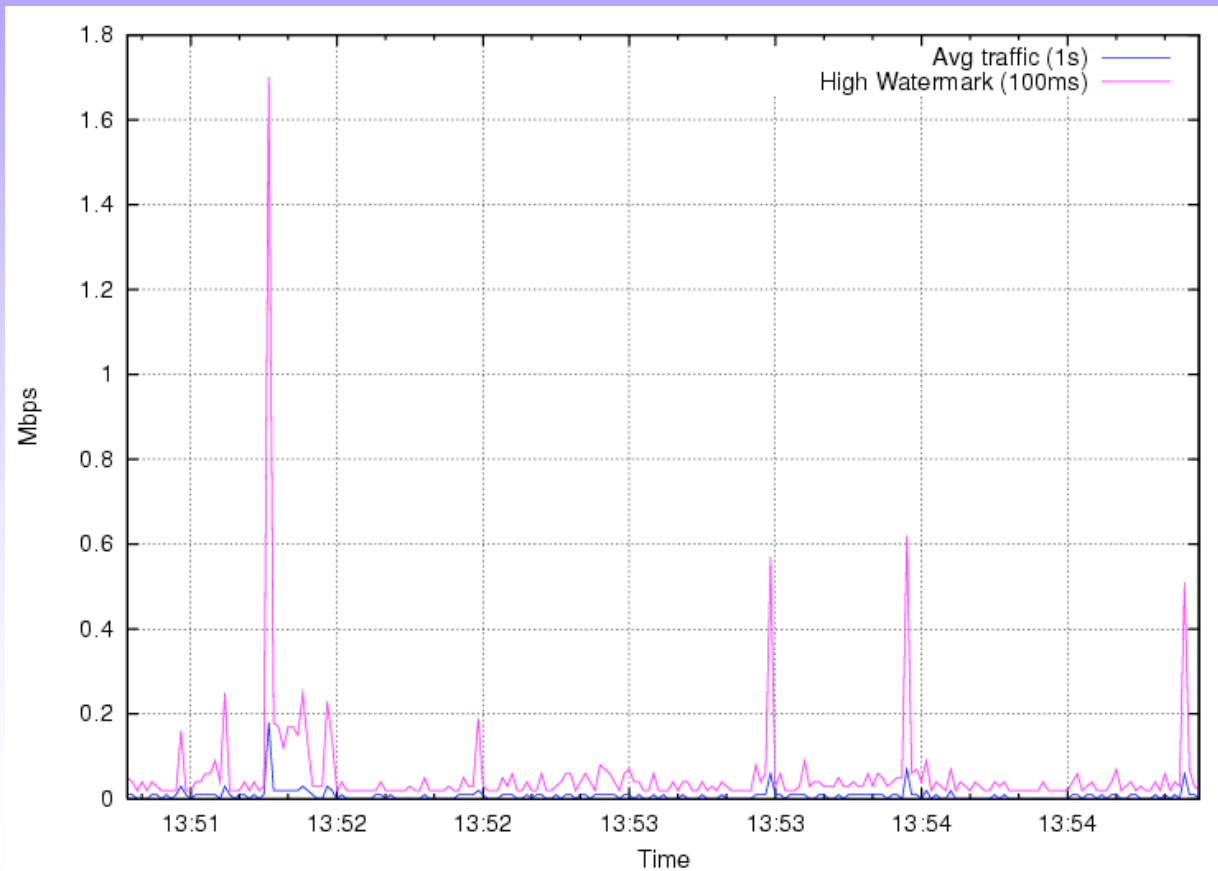
# Contents

- Why use visualisation for networks?
- Guidelines
- Previous Work
- Motivation and Issues for visualisation
- Summary

# Link Utilisation Data

1120053077	1135	5750
1120053078	786	4550
1120053079	446	2960
1120053080	598	4960
1120053081	398	2960
1120053082	701	5510
1120053083	1054	3790
1120053084	476	2960
1120053085	726	2960
1120053086	602	2960
1120053087	678	2960
1120053088	4156	20610
1120053089	813	2960
1120053090	624	2960
1120053091	1183	5610
1120053092	841	5130
1120053093	841	7390
1120053094	937	7390
1120053095	1178	10760
1120053096	624	5220
1120053097	3903	31830

# Link Utilization Data



## Why use visualisation for networks?

- Computers are great at processing vast amounts of data and presenting it in a visual form
- Humans have great visual capabilities
- Visual data maps are a powerful tool for presenting large amounts of information
- Allow humans to do intuitive and creative aspects of networking
- Speed up interpretation of data
- Visualization is task and viewer dependent

# Visualization Guidelines

- Visual Information-seeking Mantra
  - “Overview first, zoom and filter, then details-on-demand”
- Shneiderman’s (1996) seven abstract user tasks
  - Overview
  - Zoom
  - Filter
  - Details-on-demand
  - Relate
  - History
  - Extract

# Visualization Guidelines

- Carr's (1999) guidelines for visualization design
  - Visualization is not always the best solution
  - User tasks must be supported
  - The graphic method should depend on the data
  - Three dimensions are not necessarily better than two
  - Navigation and zooming do not replace filtering
  - Multiple views should be coordinated
  - Test your designs with users

# Types of Visualization

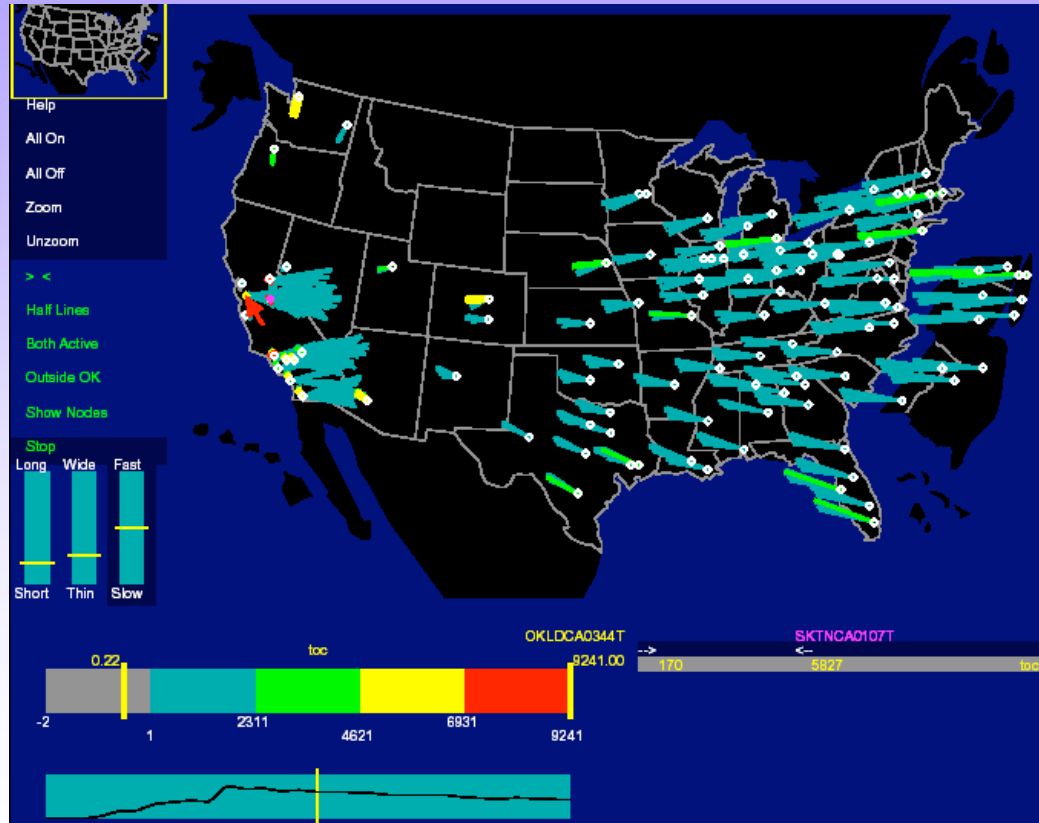
- Three main type of network visualization
  - Geographic
    - Information presented in geographical context
  - Abstract Topology
    - More focus on relationships between nodes
  - Plot-based
    - Data about individual points in the network



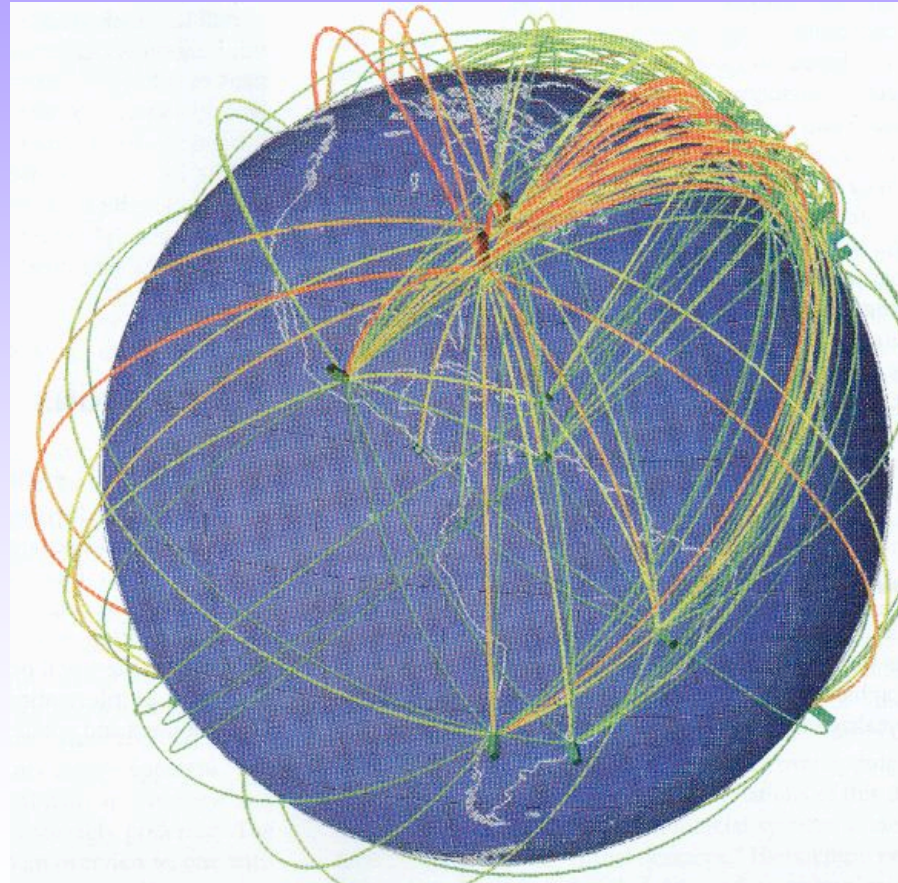
# Geographic Visualization

- Information presented in geographical context
- Each node located in its 'real' location
- Data represented by:
  - Glyph at location (n degrees of freedom)
  - Edges between locations (colour, width)
  - Histogram at location

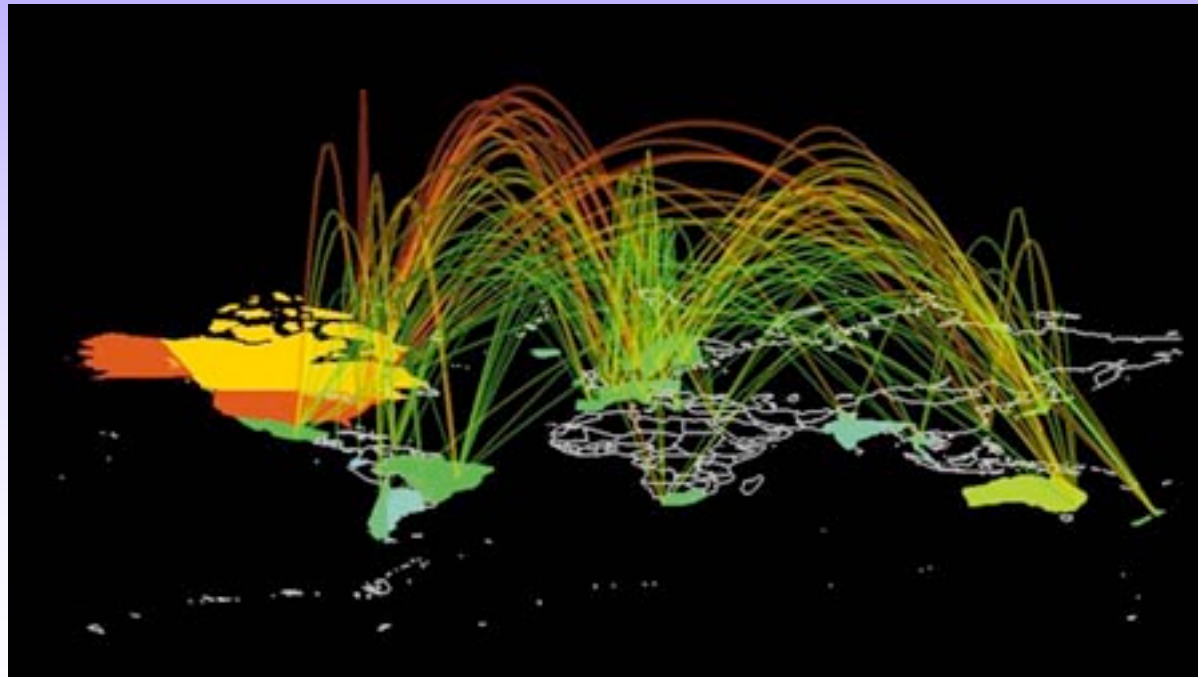
# SeeNet – Becker et al (1993)



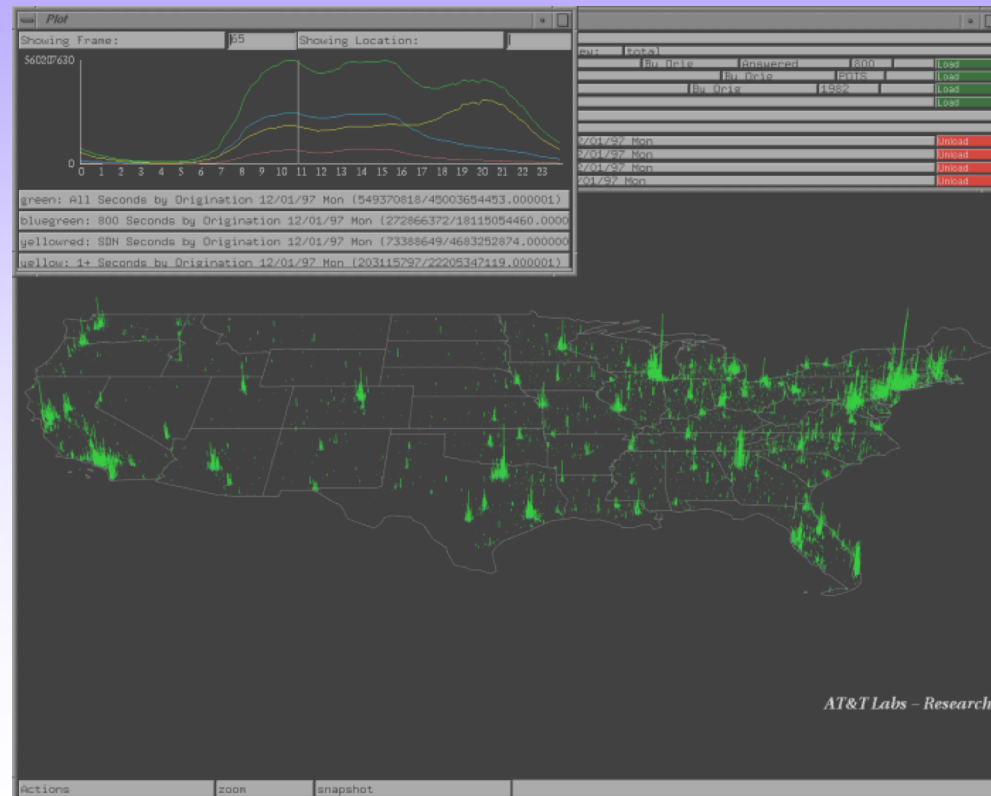
## SeeNet3D – Cox et al (1996)



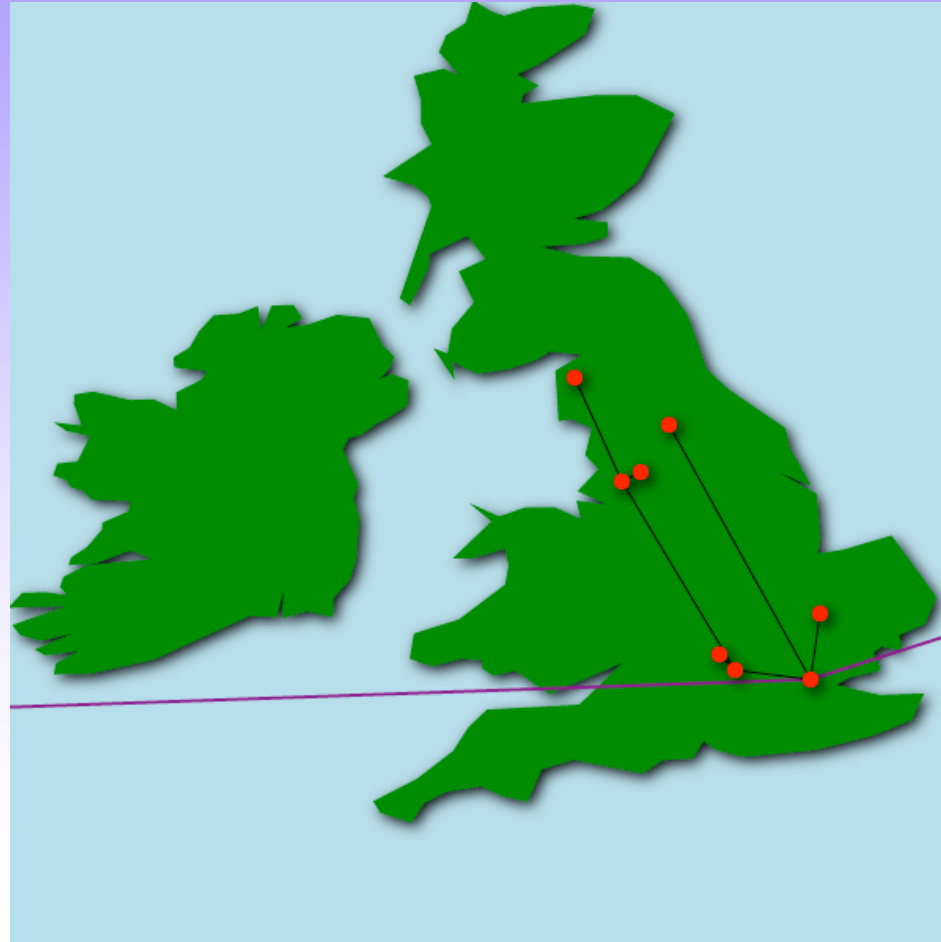
## SeeNet3D – Cox et al (1996)



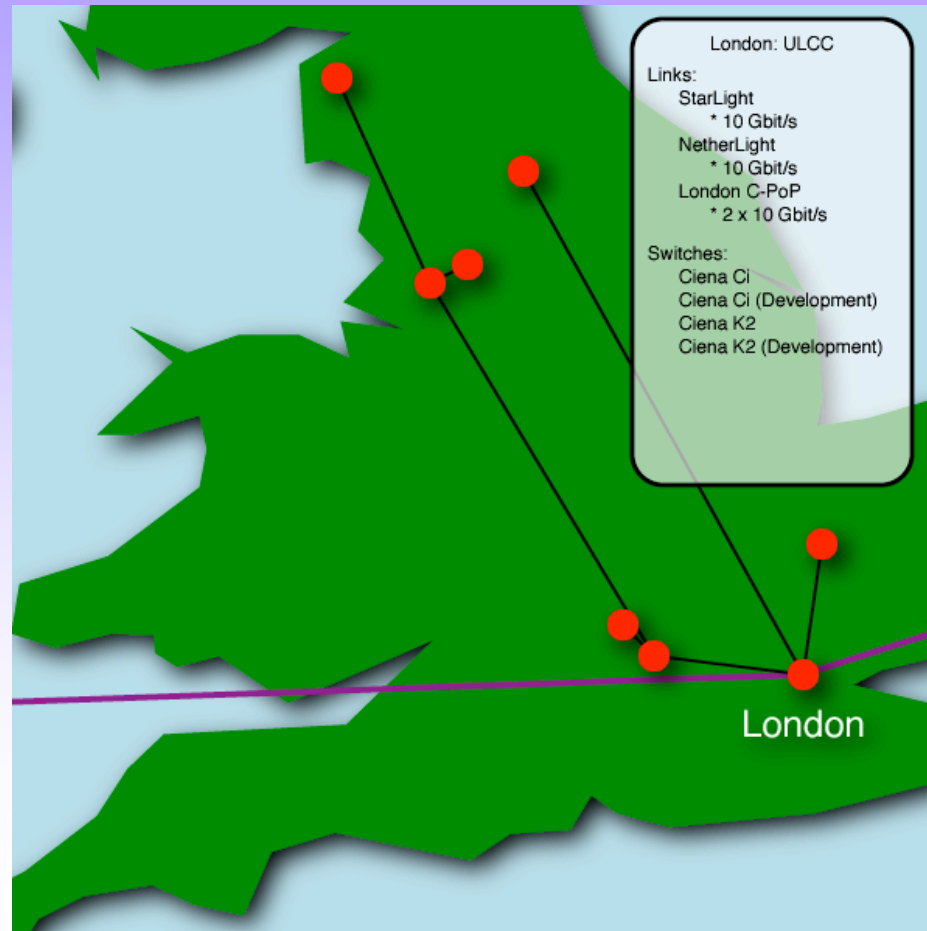
# Swift – Koutsofios et al (1999)



# UKLight



# UKLight

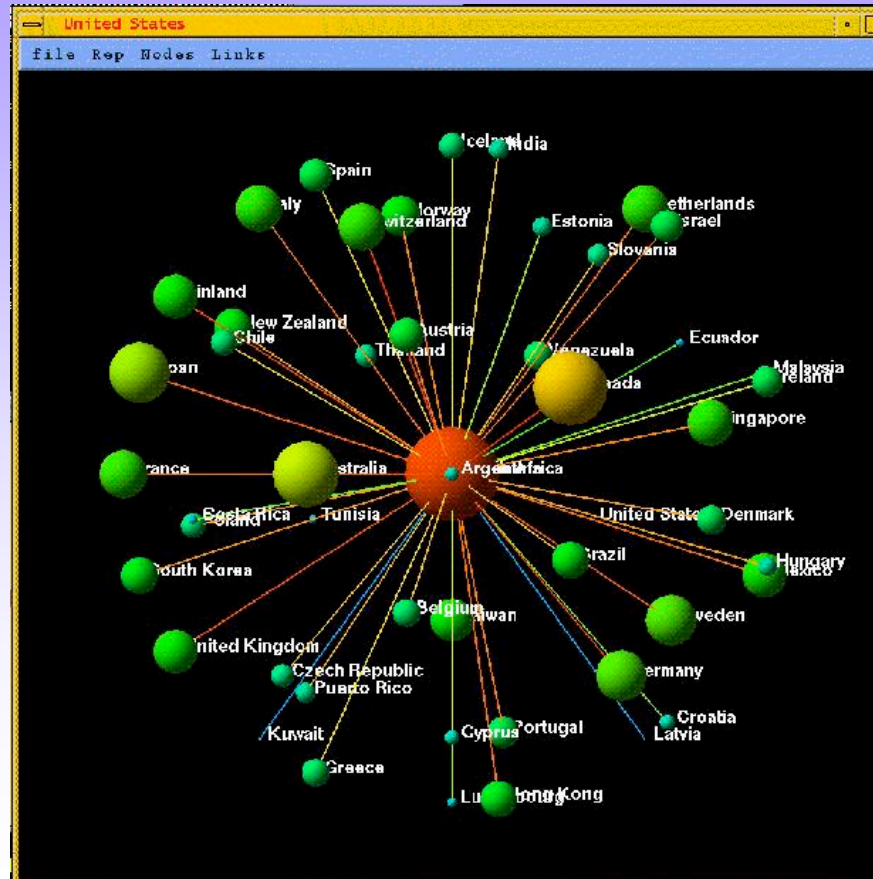


# Abstract Topology Visualization

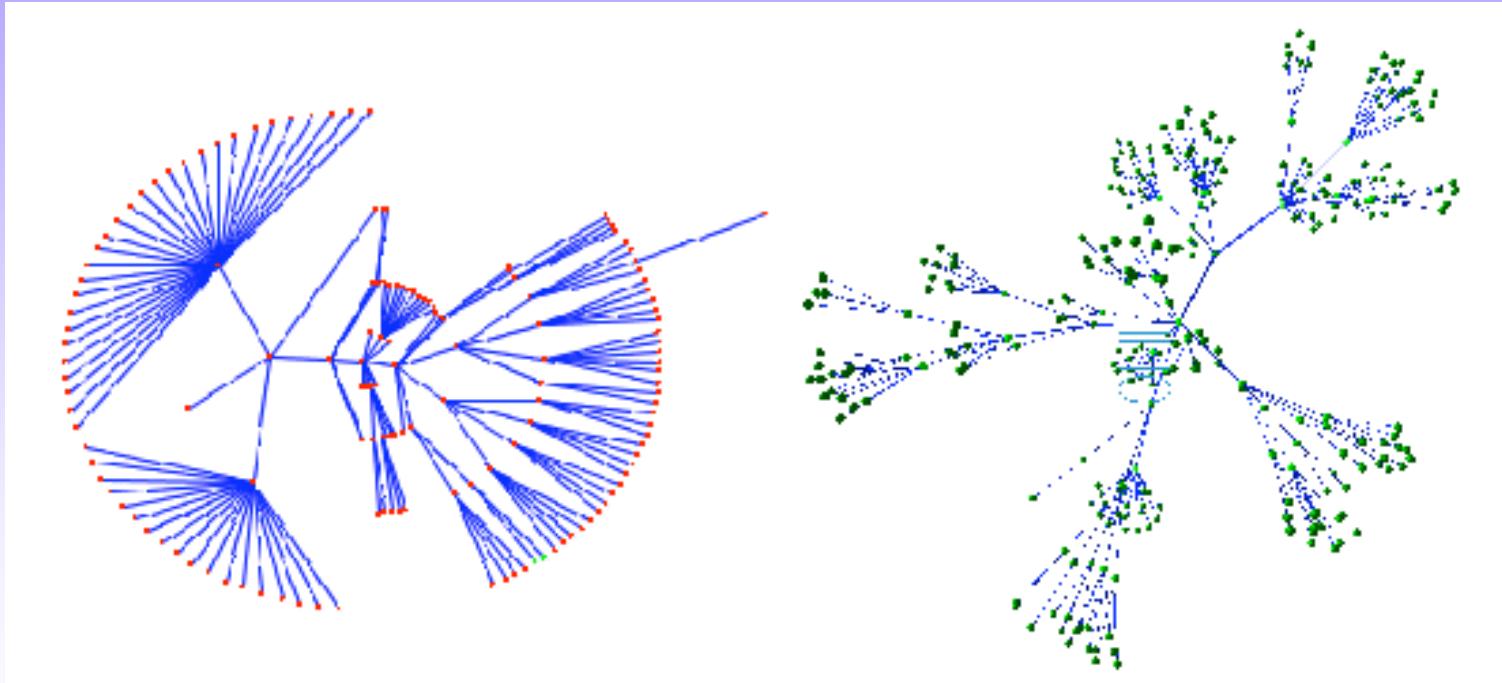
- More focus on relationships between nodes, independent of physical location
- Layout becomes a major issue
- Glyphs representing locations
- Colour and width varying on links between nodes



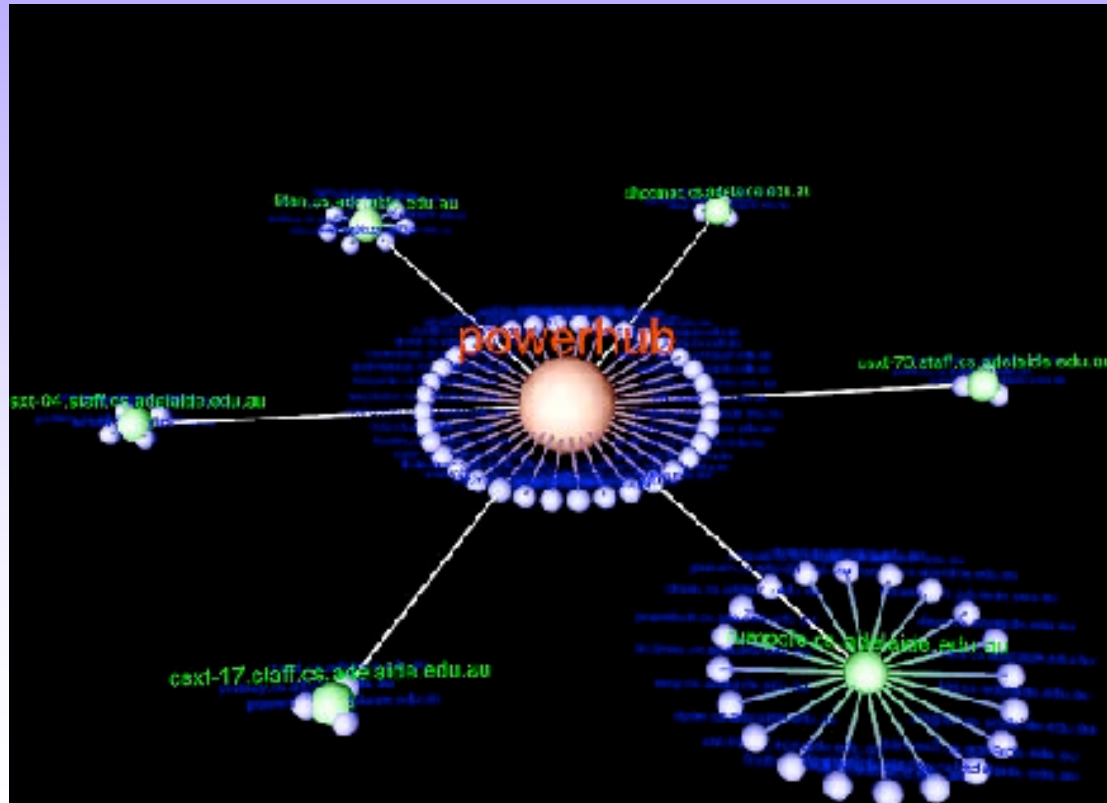
# SeeNet3D – Cox et al (1996)



# Zschech et al (2000)

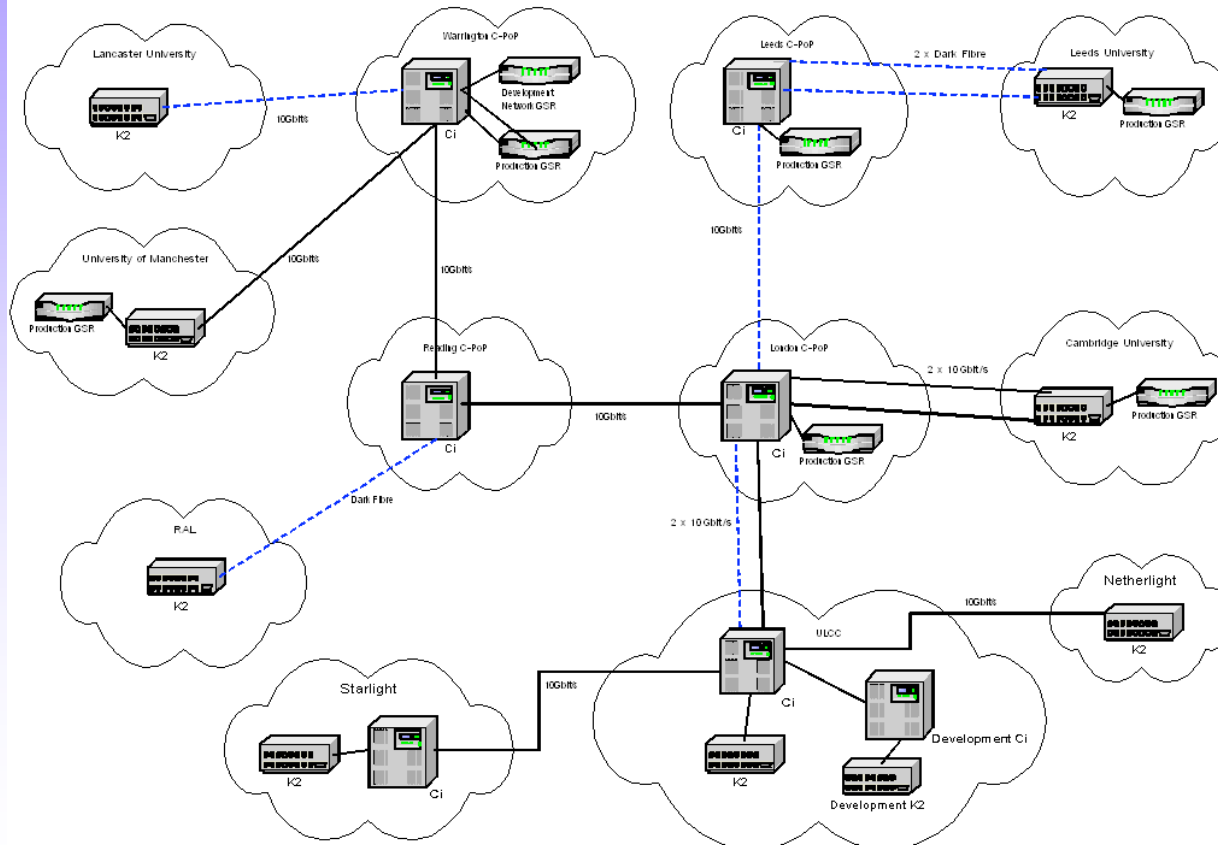


# Zschech et al (2000)



# UKLight

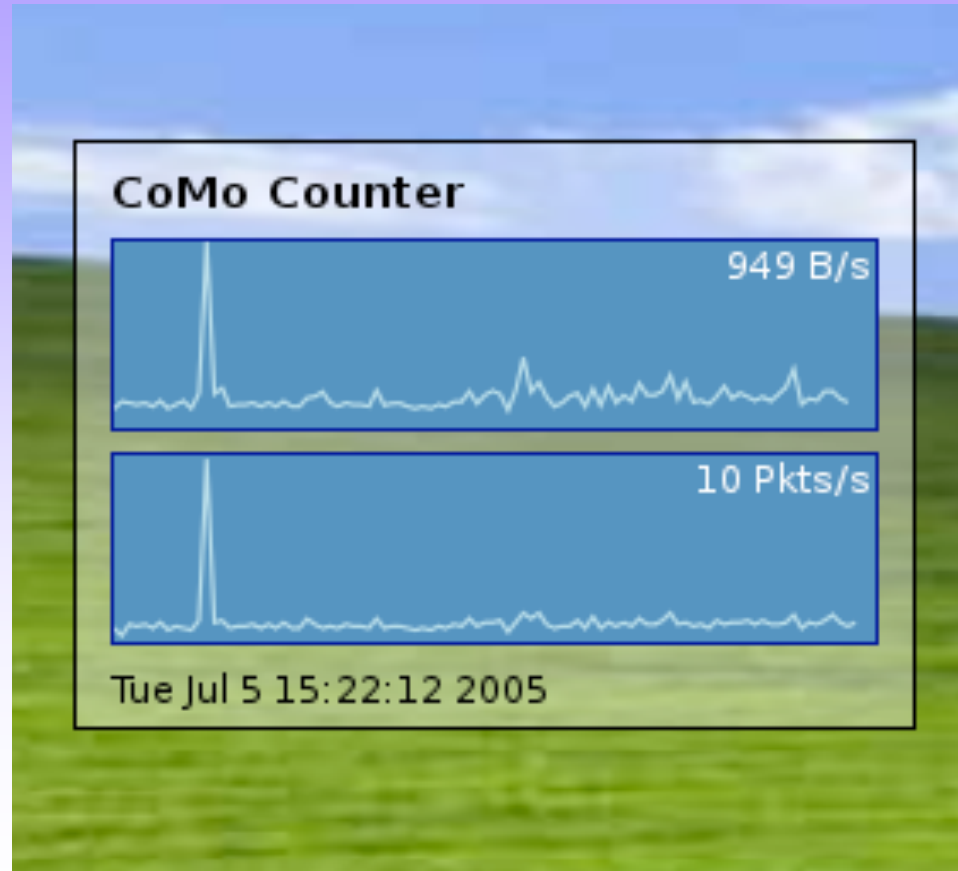
UKLight & the extended development network -  
Phase 1 & Phase 2



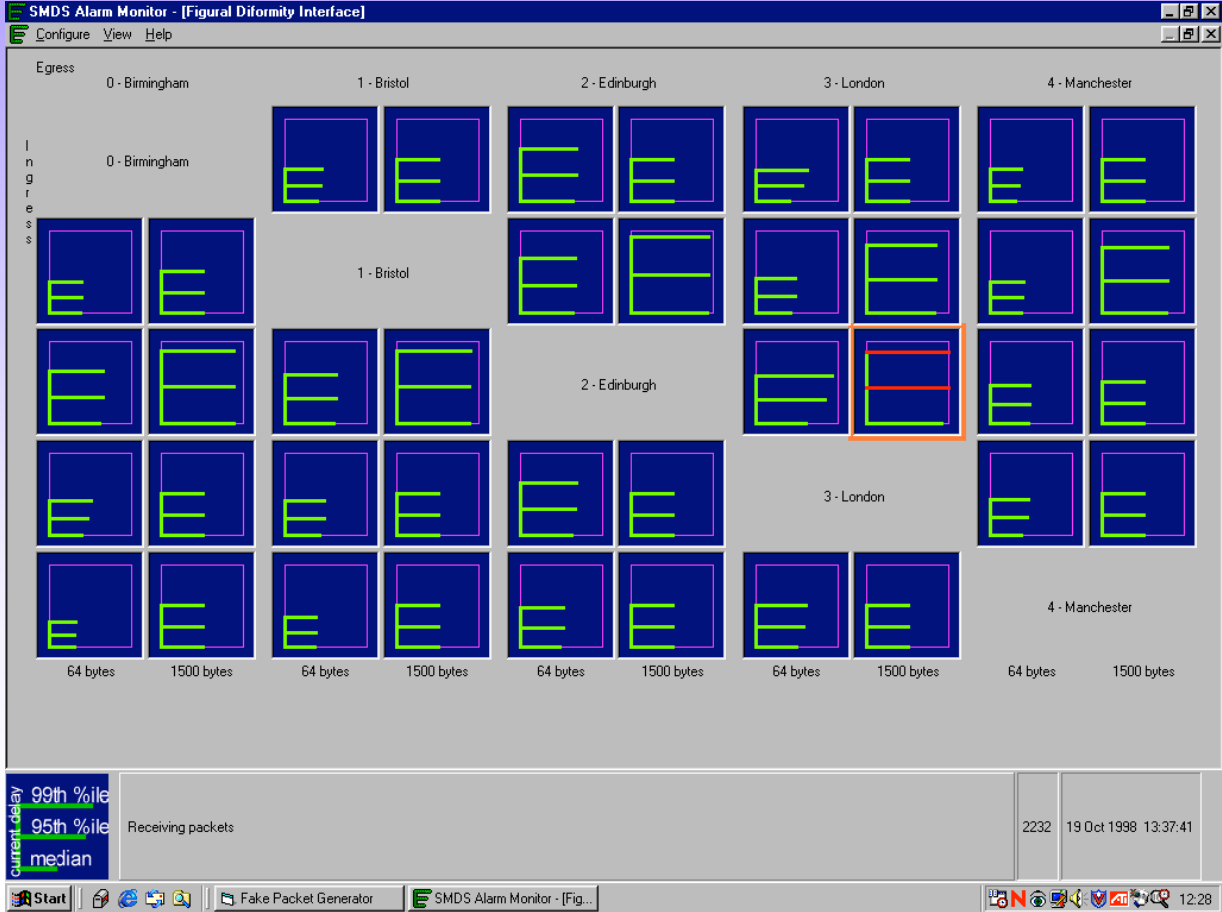
# Plot-based Visualization

- Data about individual points in the network
- Plots over time (*e.g.* delay, loss)
- Histograms, pie charts (*e.g.* port, protocol)
- Icon plots (FDVs – Figural Deformity Visualization)

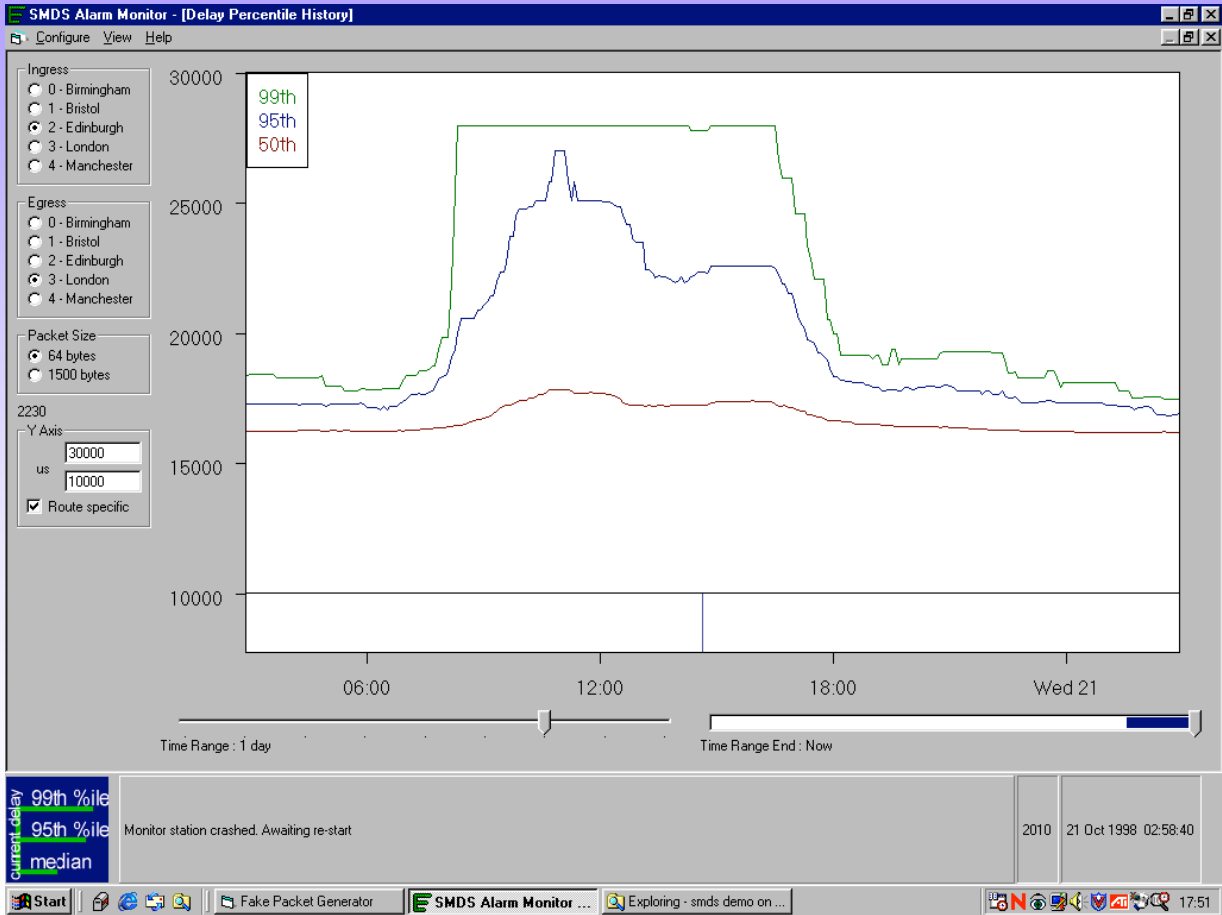
# CoMo Counter gDesklet



# FDV

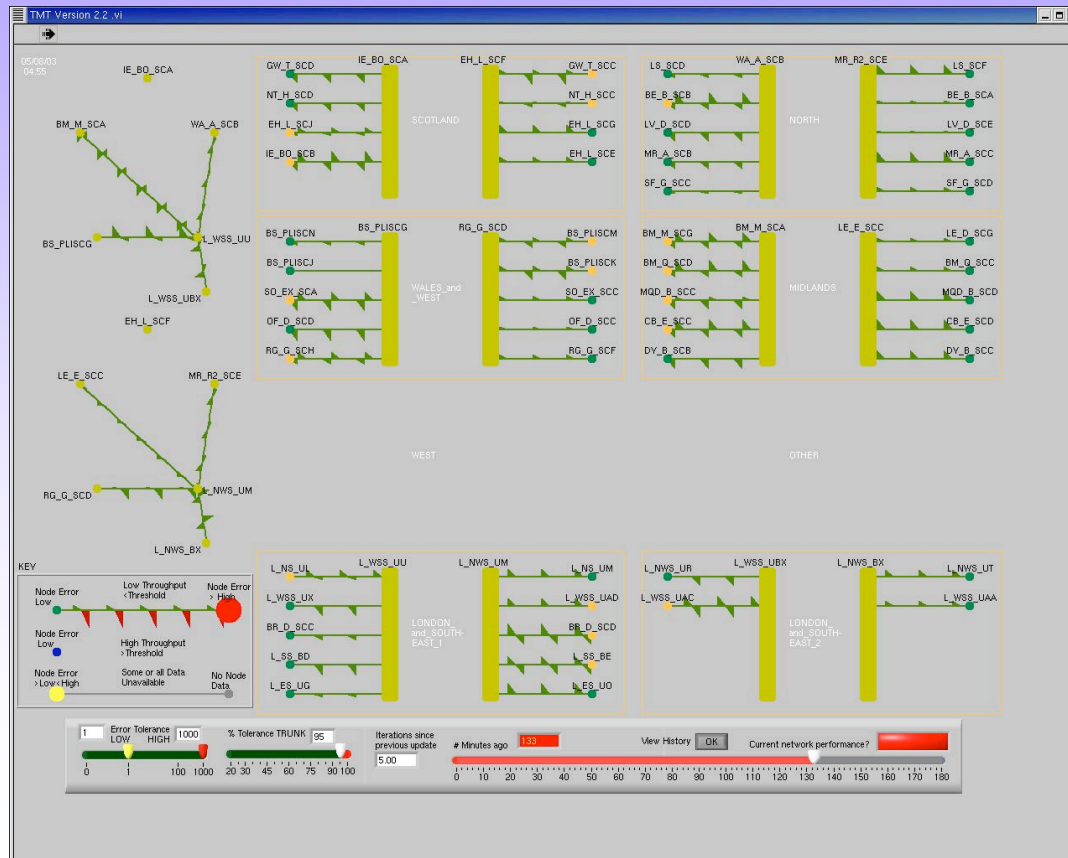


# FDV 2





# TMT



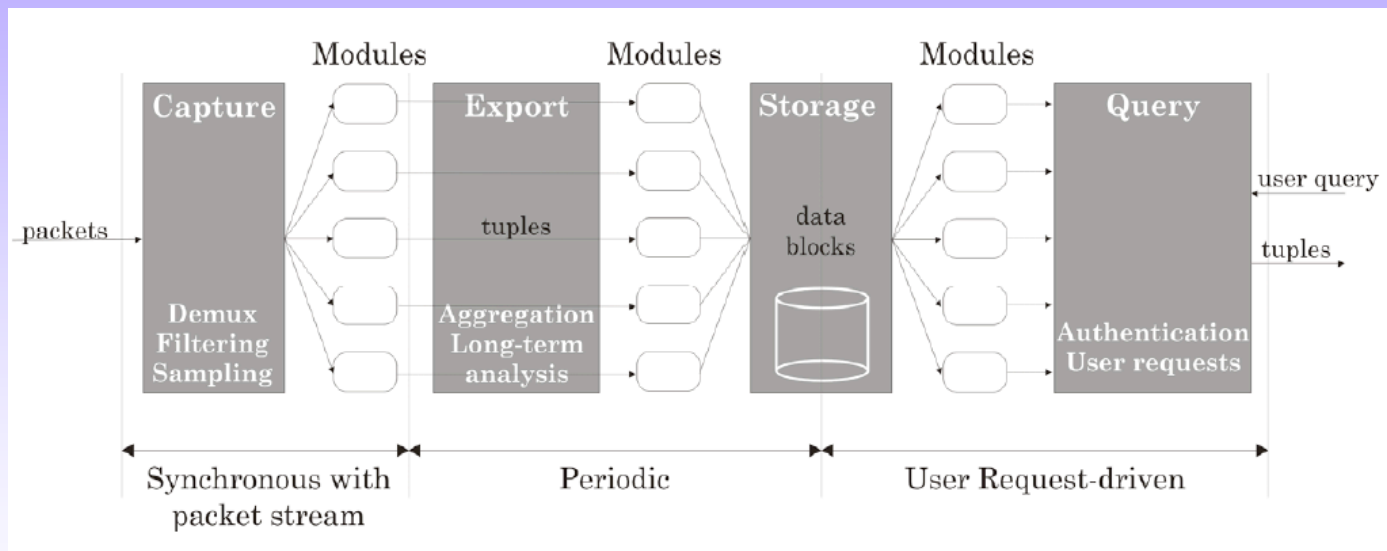
# Motivation

- Provide a view of UKLight data
- Don't know who the users are going to be
- Don't know what they will want to do
- Need a dynamic, user-driven visual interface
  
- Workflow
  - Defines the users roles and their needs form the visualisation

# Intel CoMo System

- CoMo = Continuous Monitoring
- General purpose passive network monitor, currently in development
- Provides basic functionality with a programmer interface
- Users write modules to perform tasks
- Four main processes: Capture, Export, Storage and Query
- Currently data access in text form via HTTP

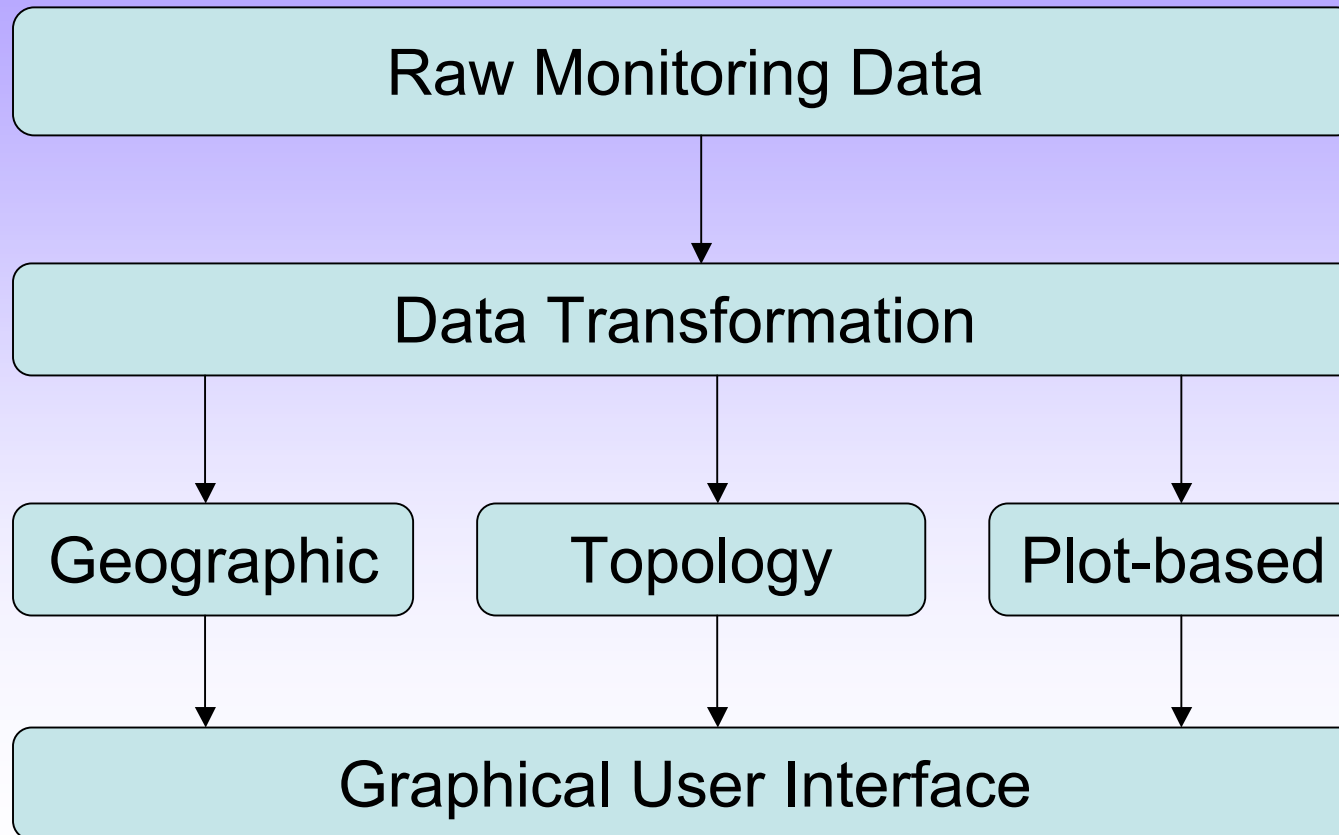
# CoMo – Data flow view



# Practical Issues

- Three levels
- Data transformation
  - Transforming monitoring data into a convenient intermediate form
- Visualization
  - Present the data visually
- User Interface
  - User interaction with the visualizations

# Framework



# Summary

- Guidelines for visualization development
- Types of visualization
  - Geographic
  - Abstract Topology
  - Plot-based
- Preliminary examples from MASTS
- Visualisations plans
  - CoMo