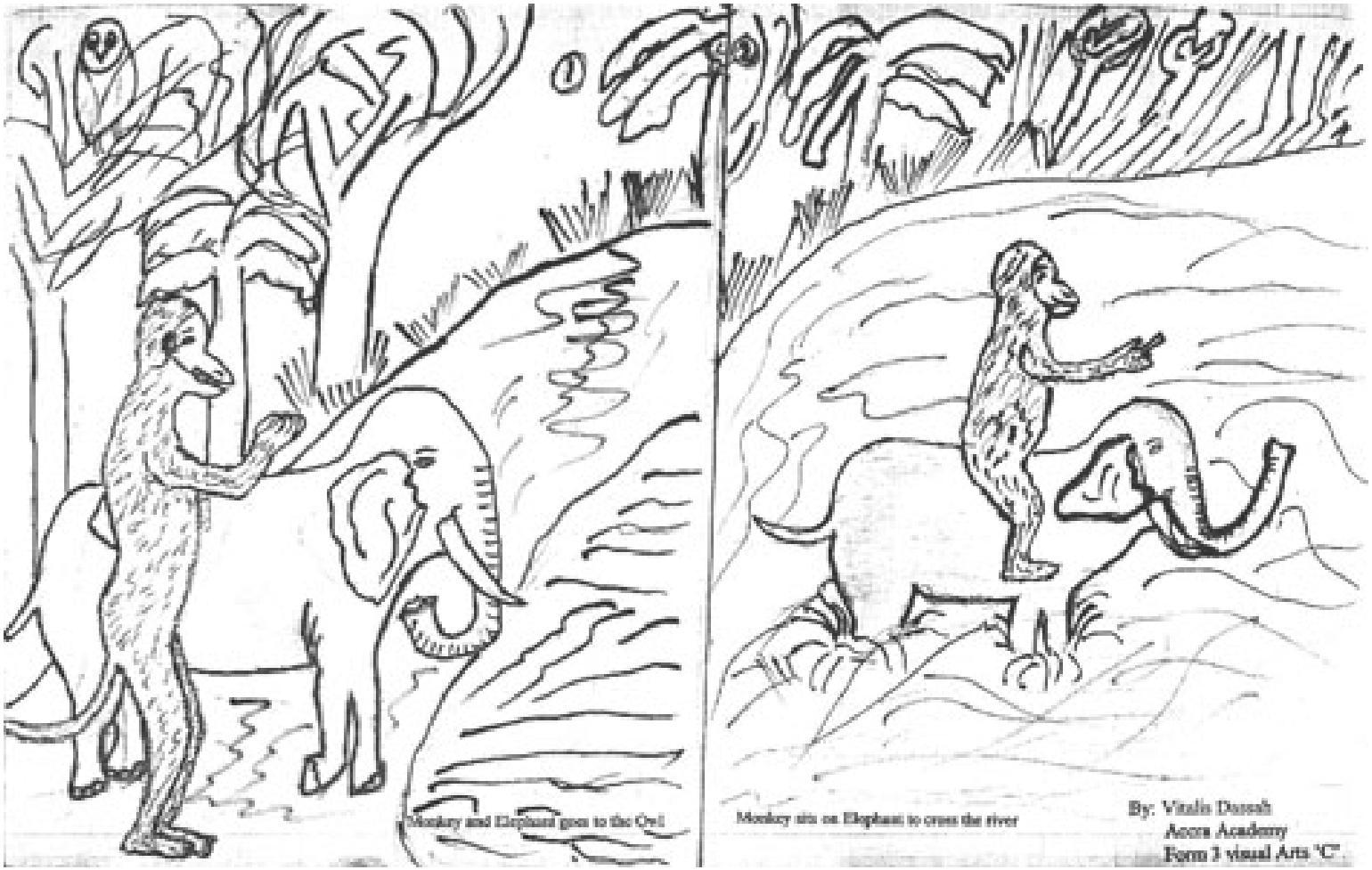
Collaborative Visualization

(Ten years on)

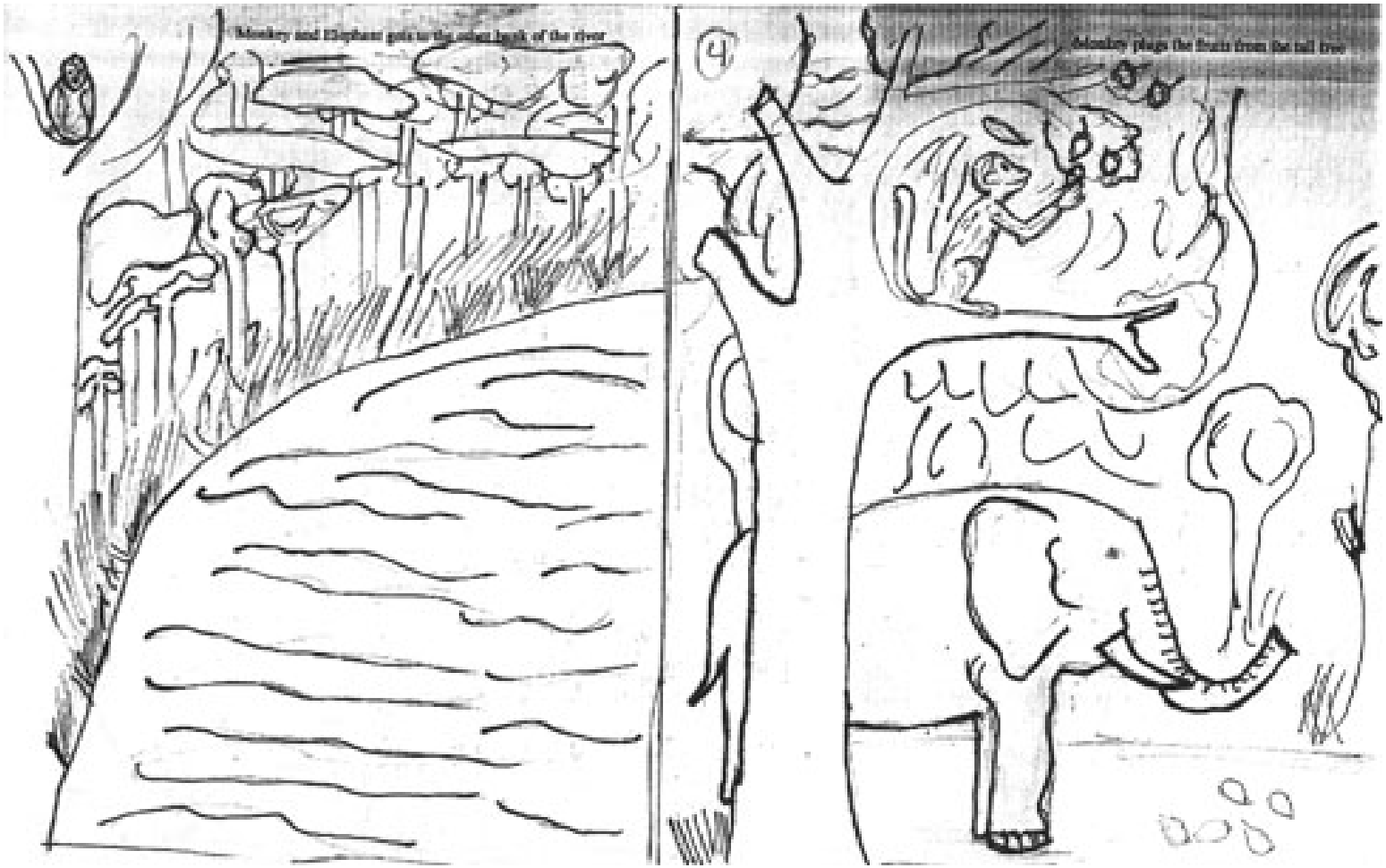
Ken Brodlie

University of Leeds

A Tale


Monkey and Elephant goes to the Owl
Monkey sits on Elephant to cross the river
By: Vitalis Dunsh
Accra Academy
Form 3 visual Arts 'C'

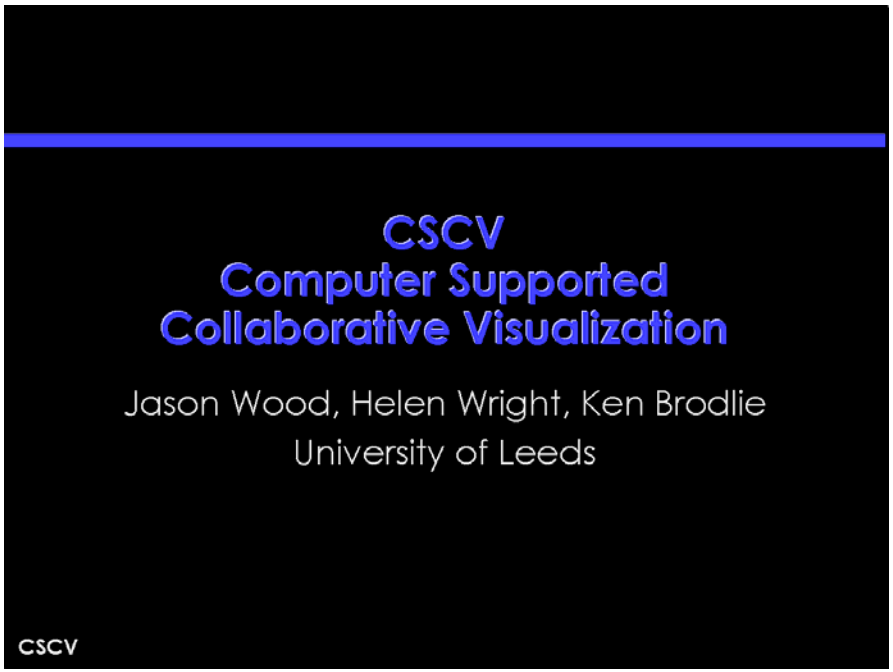
The Monkey Gets the Nuts – Two Heads ARE Better than One

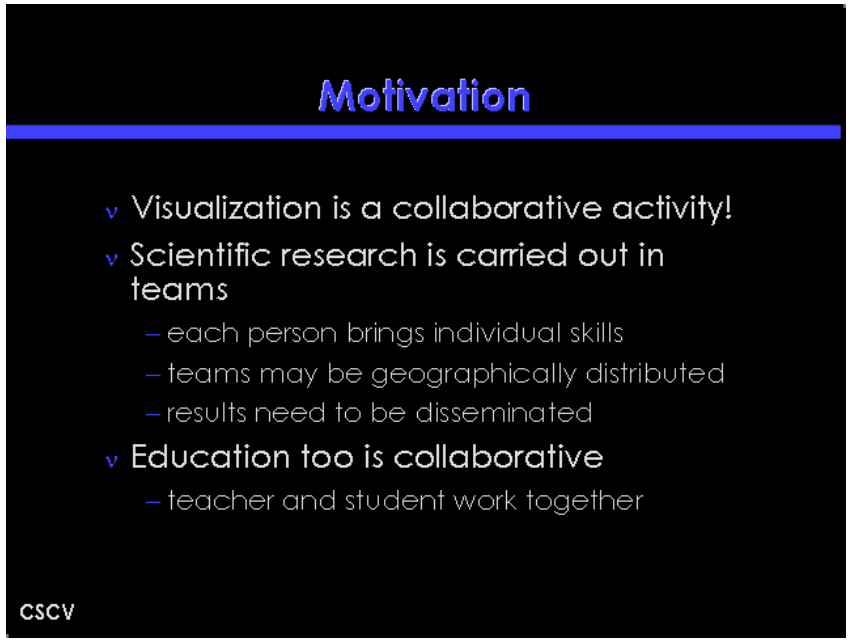


Thanks to Accra Academy, Ghana

Collaborative Visualization – A Decade Ago!

- Collaborative visualization is not a new topic!
- 1995 BCS talk





Ten years on….

An Early Influence – Applegate Matrix

- Applegate put forward a very simple model for CSCW
- After a decade… time to revisit?

PLACE	same	different
different	phone	letter
same	meeting	notebook

TIME

- Structure of talk:

Traditional collaboration
Computer-aided collaboration
Collaborative visualization

Visualization within collaboration
Collaboration within visualization

Same Time, Same Place – Traditional Form

- The dreaded meeting!
- … but a good meeting works well

- Generic: room provides the framework … participants provide the content
- Standards: It works by standardization of language between participants

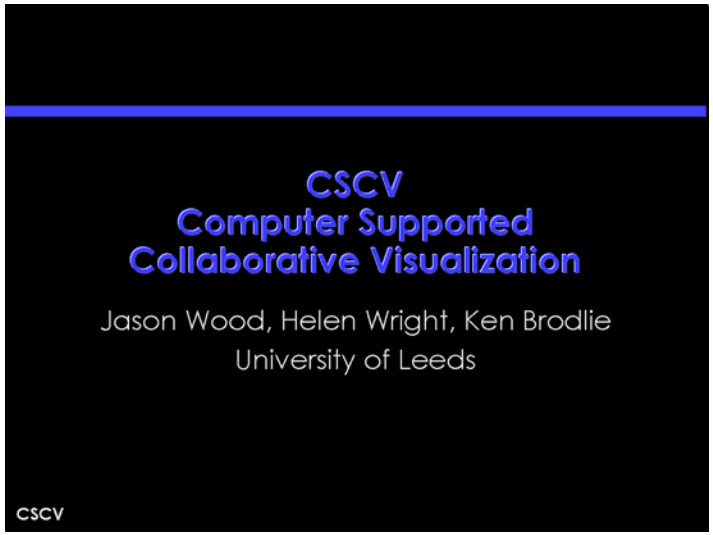
Getting People Together

- Meetings do work…
- Radical collocation has proved highly successful in a number of areas
  - Space missions
  - Safety critical software development
- Productivity doubled
  - Teasley et al, Univ of Michigan

Same Time, Same Place - Computer Version

- You are looking at it!
- Computer + data projector has become ubiquitous

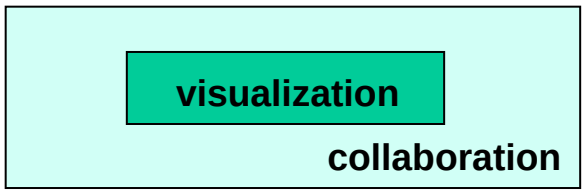
Note this is a development from 1995!

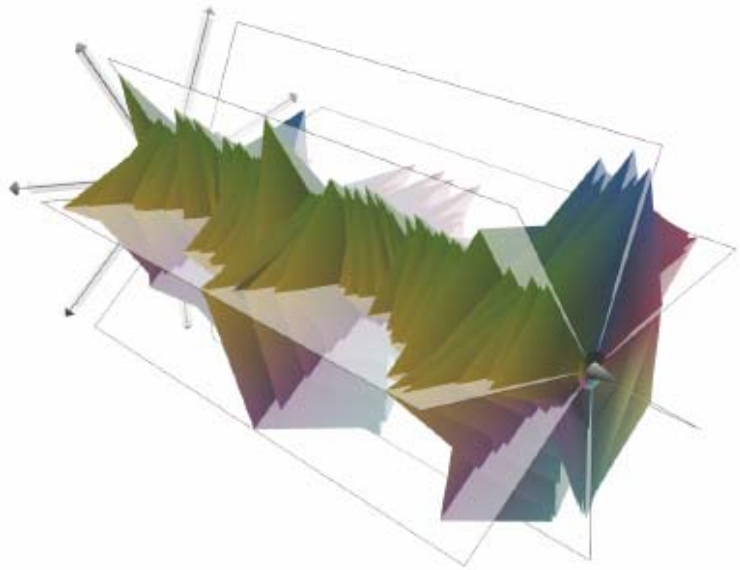


Same Time, Same Place – Collaborative Visualization

- Here I am showing you a time-dependent multivariate visualization … we can discuss it

- I have brought the visualization INTO the collaboration

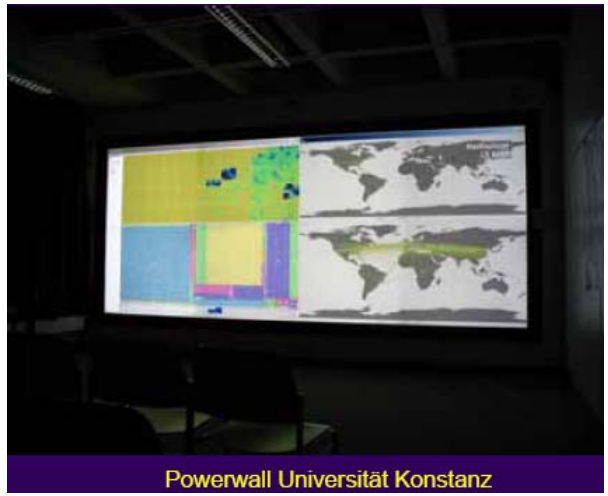




What technique is this?

Same Time, Same Place - New Technology

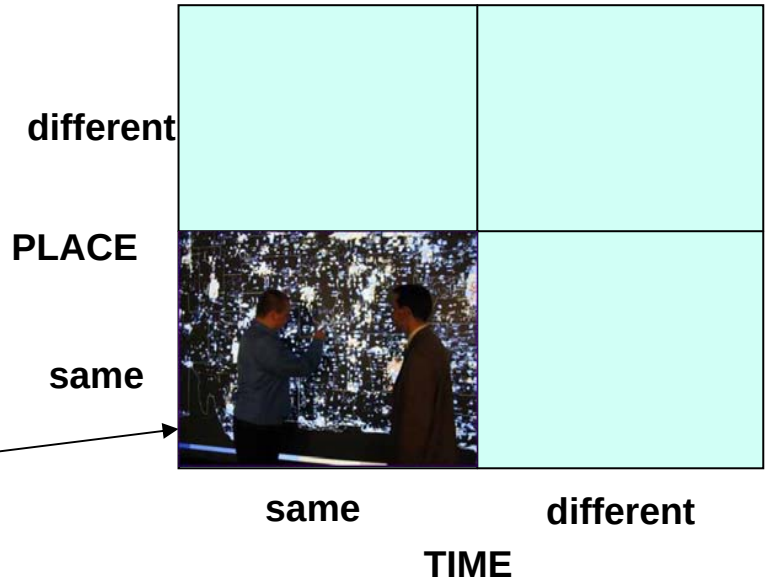
- New technology emerges to support this form of working…
- Powerwalls especially suited to large data sets – visual data mining


Powerwall Universität Konstanz

Same Time, Same Place – Collaborative Visualization Review

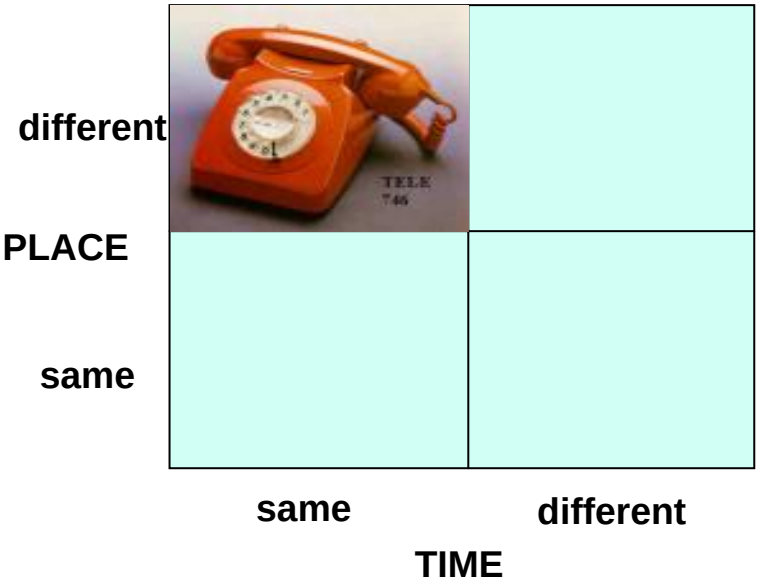
Key Features

- Generic: framework is the room and the computer equipment – content is brought in by the participants
- Standards: Collaboration possible by common language
- Independence: a little
- Awareness: WYSIWIS
- Privacy: hard
- Data integration: multiple views?



Same Time, Different Place – Traditional Form

- The dreaded phone…
- .. but again it works well



- Phone provides the generic framework, participants provide the context
- Collaboration from anywhere in world, using different equipment… because of standards

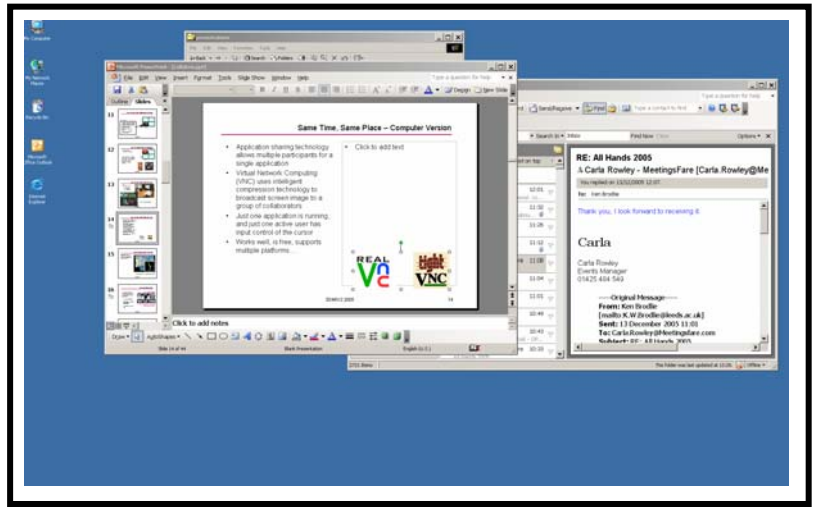
Same Time, Same Place – Computer Version

- VoIP
- Video conferencing
  - One-to-one (VRVS)
  - Group-to-group

.. And of course the Access Grid

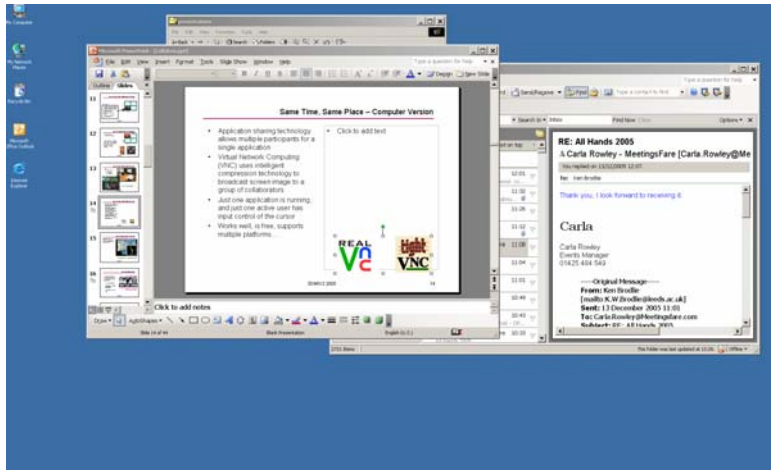
Same Time, Same Place – Computer Application Sharing

- Application sharing technology allows multiple participants for a single application
- Virtual Network Computing (VNC) uses intelligent compression technology to broadcast screen image to a group of collaborators
- Just one application is running, one master user has input control of the cursor
- Works well, is free, supports multiple platforms…



A

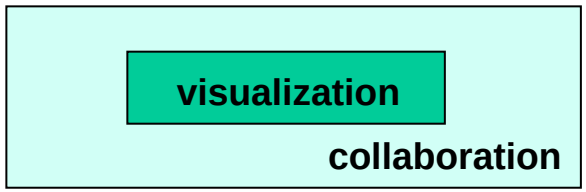
internet

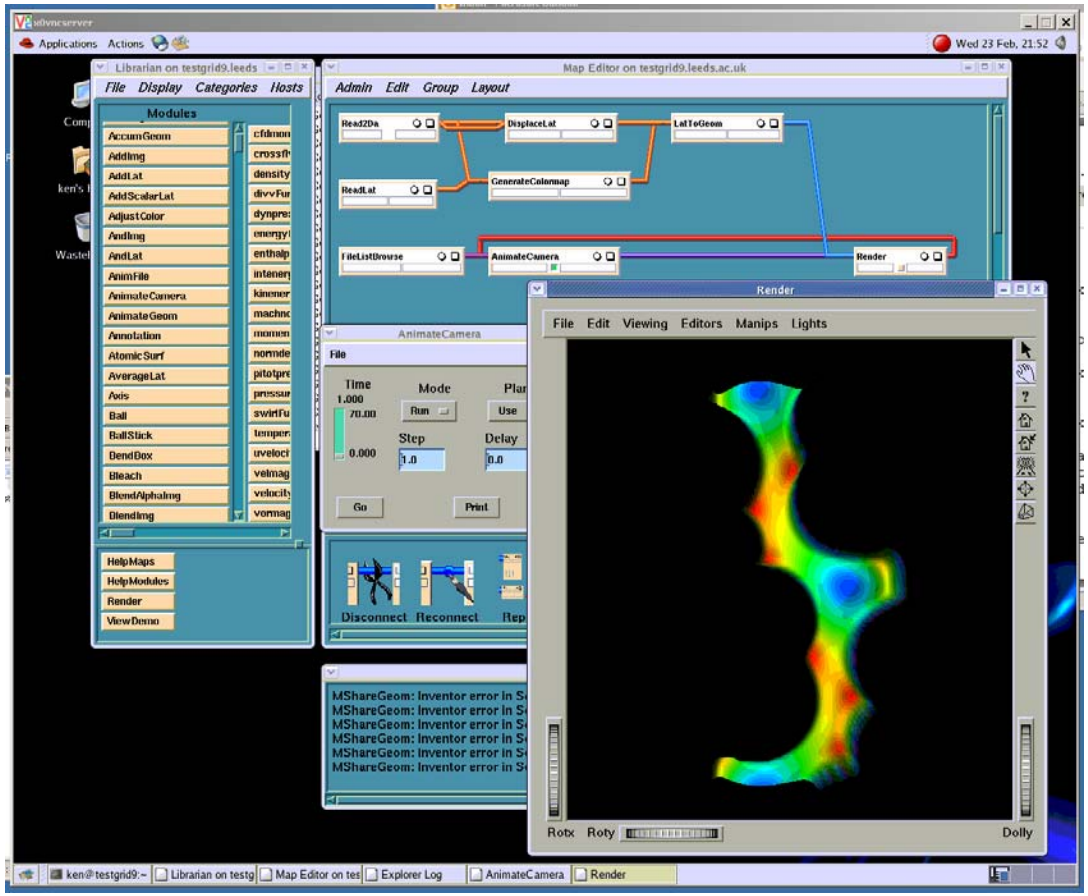


B

Same Time, Same Place – Collaborative Visualization

- We can use VNC for collaborative visualization
- We bring visualization INTO the collaboration



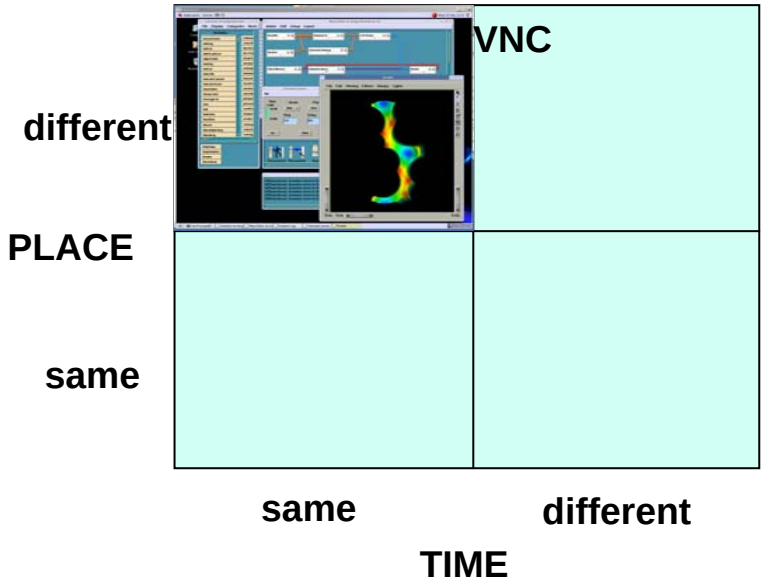


VNC across the world: Christchurch to Leeds

Same Time, Different Place – Collaborative Visualization Review

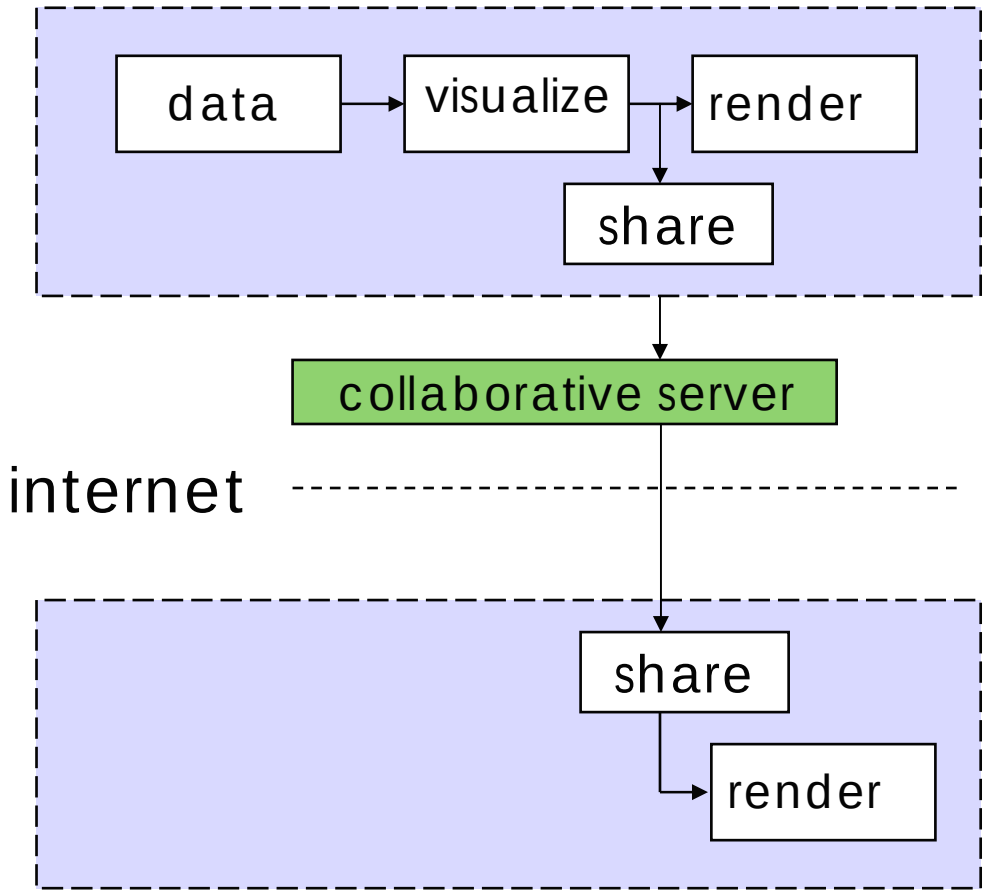
Key Features

- Generic: Operating system provides a framework, participants provide the content
- Standards: ??
- Independence: None
- Awareness: WYSIWIS
- Privacy: no.. though data private
- Data integration: no



Same Time, Different Place – Collaborative Visualization (Take Two)

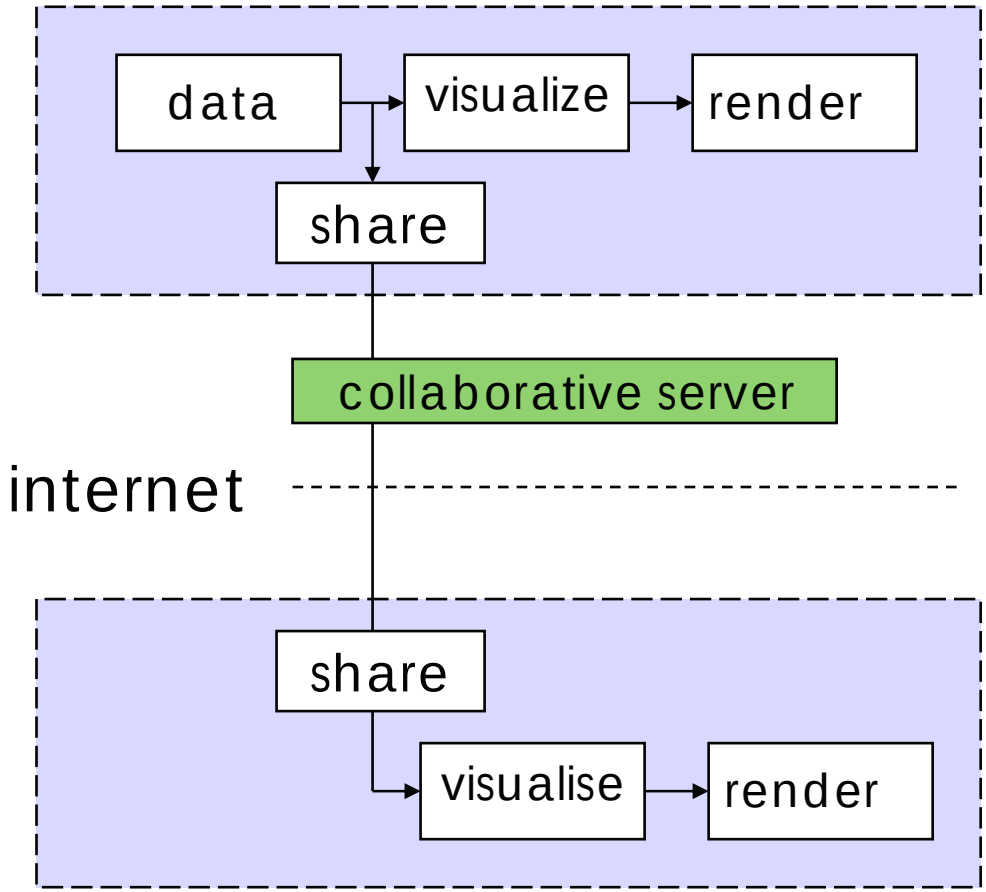
- A different take…
- Start with the visualization…
- .. bring collaboration into the visualization



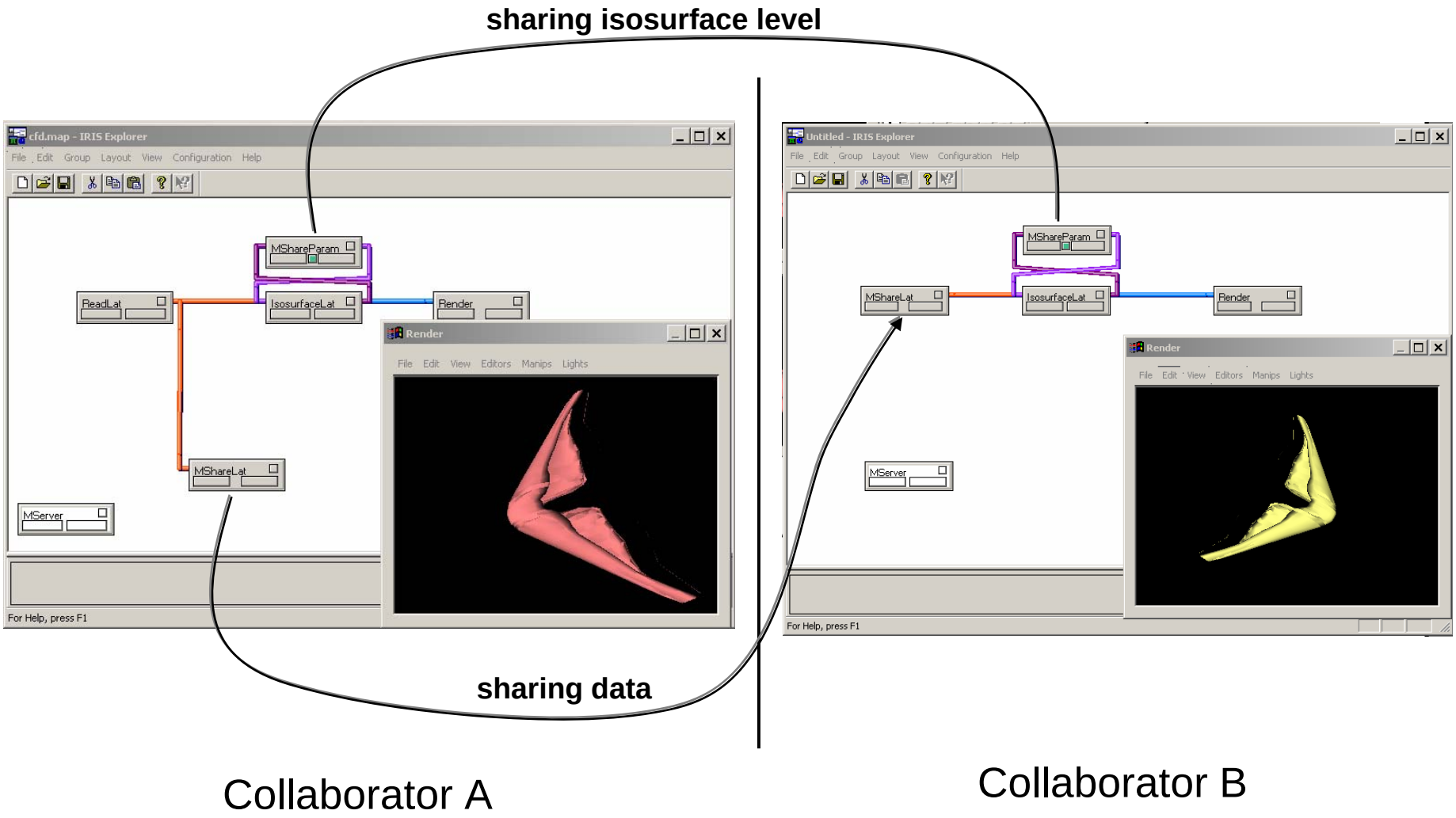
- Example is IRIS Explorer COVISA where collaborative modules can be included in the dataflow

Programming the Collaboration

- It is useful to be able to program the collaboration
  - To adapt to how people want to collaborate
  - To adapt to network bandwidths
- Here raw data is exchanged so a different visualization can be created



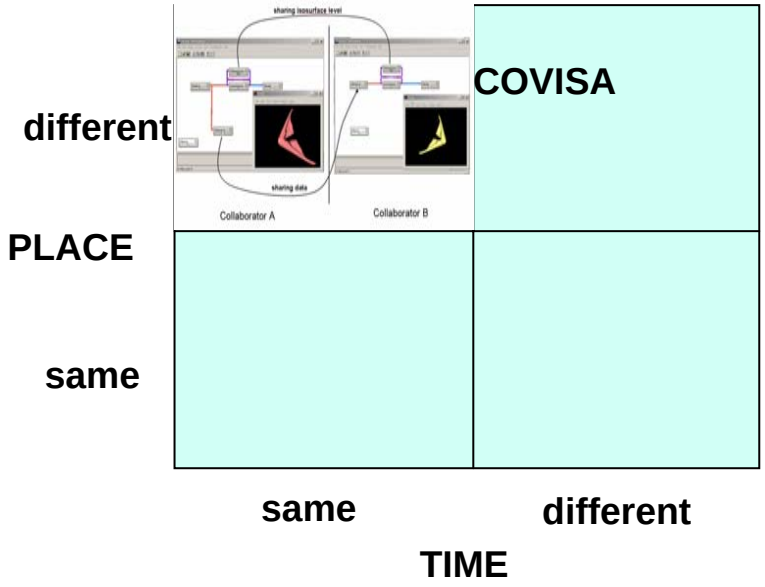
COVISA in action



Same Time, Different Place – Collaborative Visualization Review (Take two)

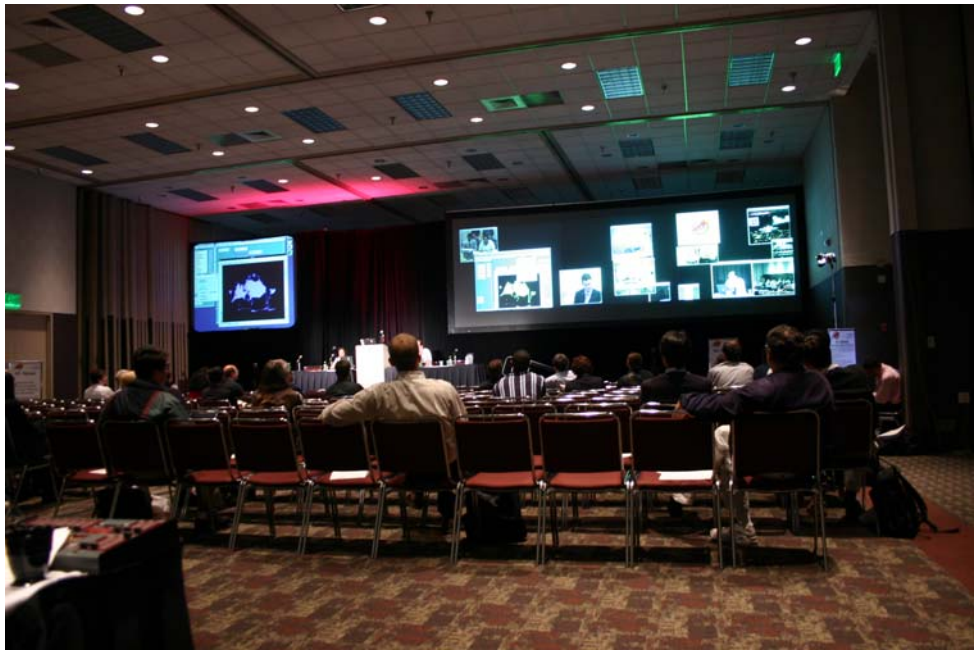
Key Features

- Less generic: IRIS Explorer provides specific framework, participants provide content
- Standards: No…Collaboration only possible between IRIS Explorers!
- Independence: yes
- Awareness: limited
- Privacy: strong – WYSIWILYS
- Data integration: achievable



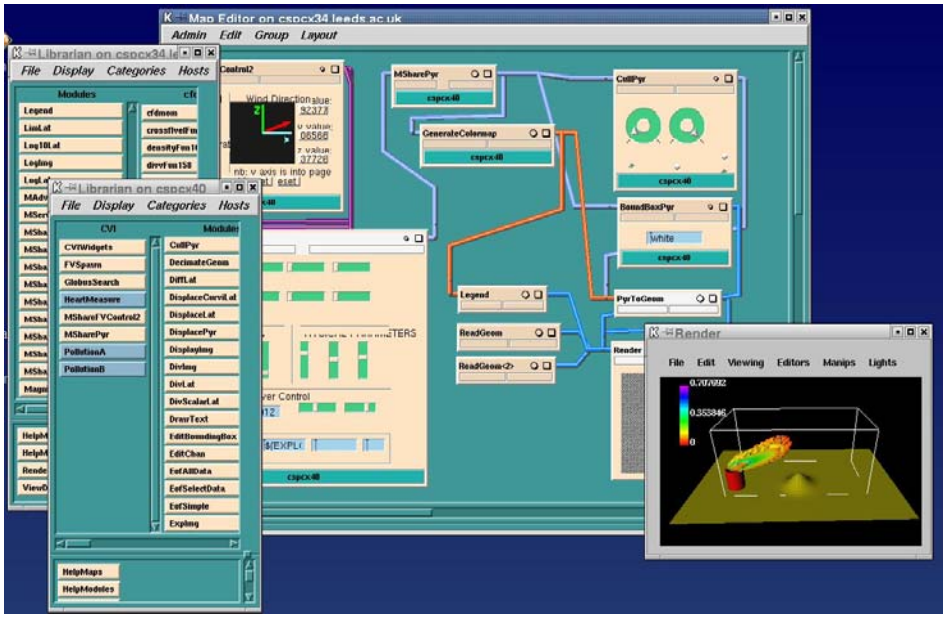
Same Time, Different Place - Visualization

- Mixing the approaches…
  COVISA in AccessGrid



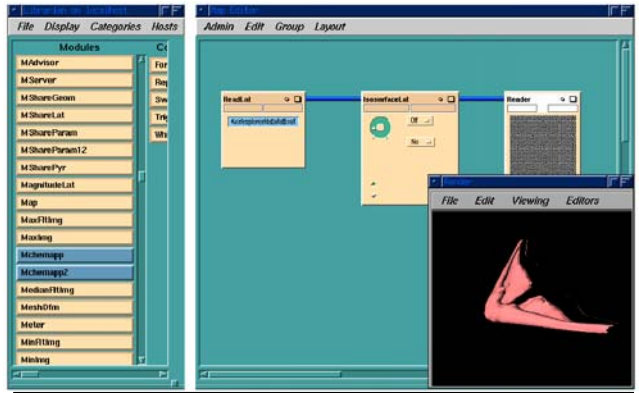
Same Time, Different Place – Computational Steering

- gViz e-Science project looked at driving a remote simulation from a desktop client



Environmental disaster!

visualization environment

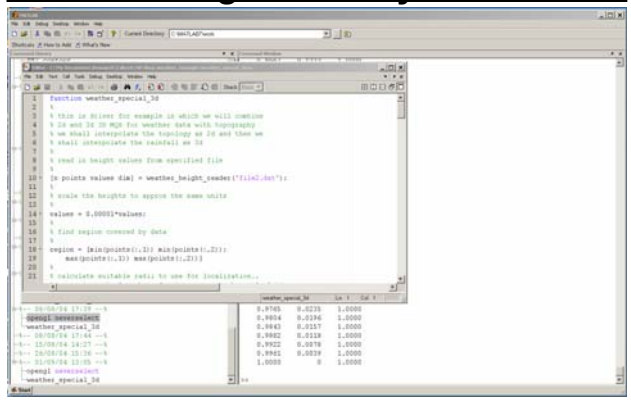


gViz library

control

visualize

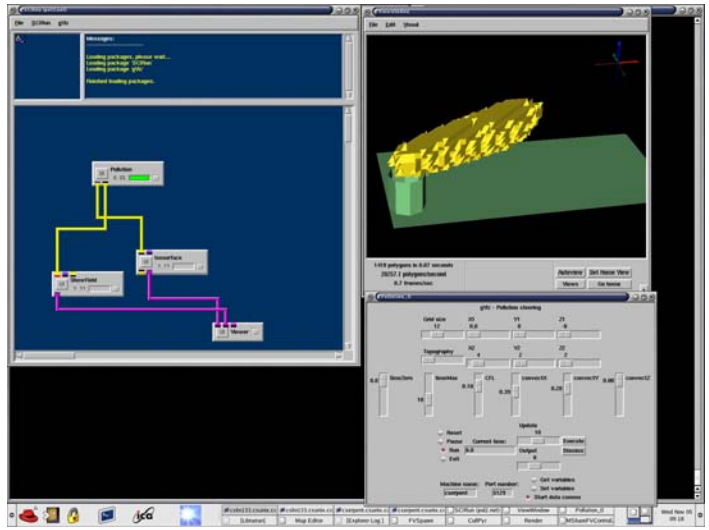
gViz library



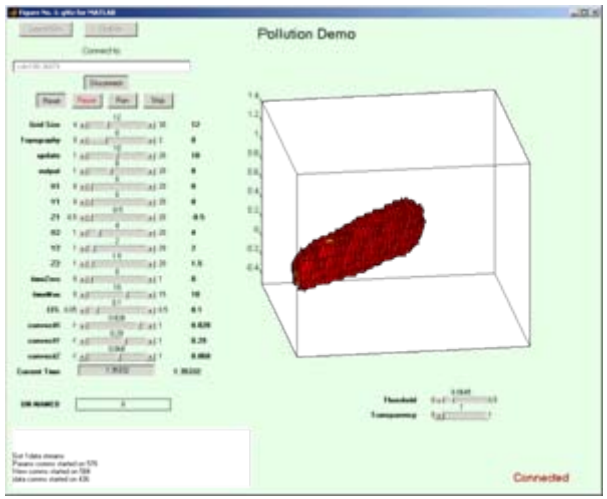
simulation environment

Pollution example with other visualization environments

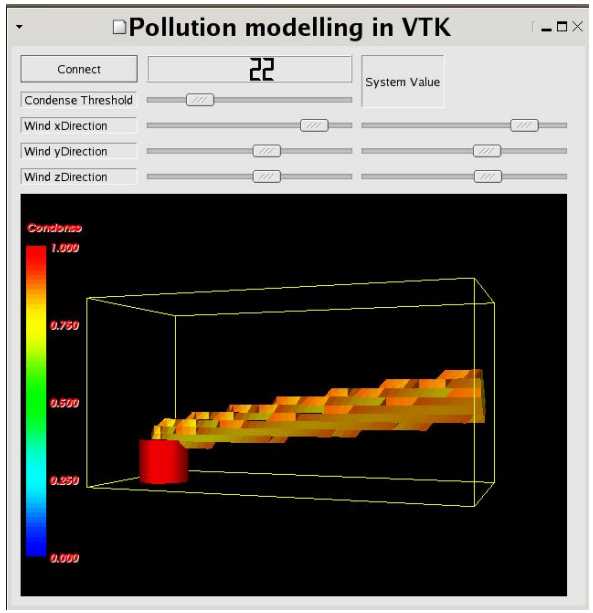
- Different visualization environments can be connected through gViz library to the underlying simulation
- Note that multiple users – with multiple visualization environments – can connect… allowing collaboration amongst a team



SCIRun



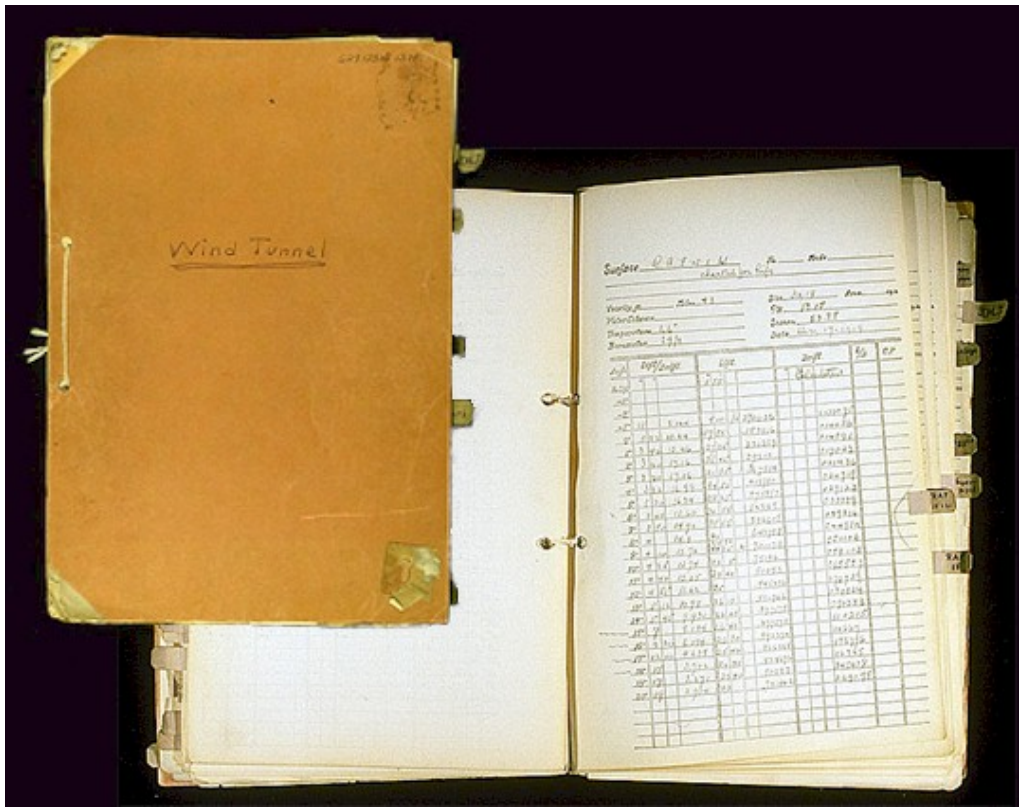
Matlab

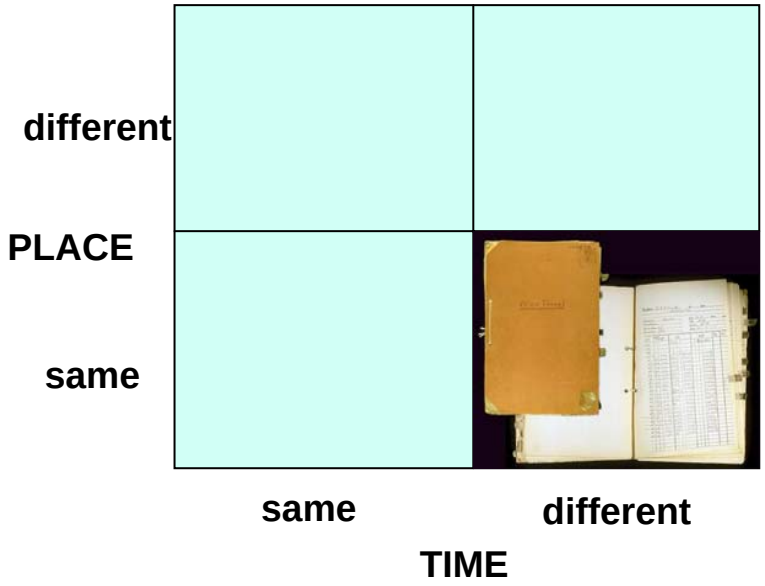


vtk

Same Place, Different Time – Traditional Form

- The notebook…

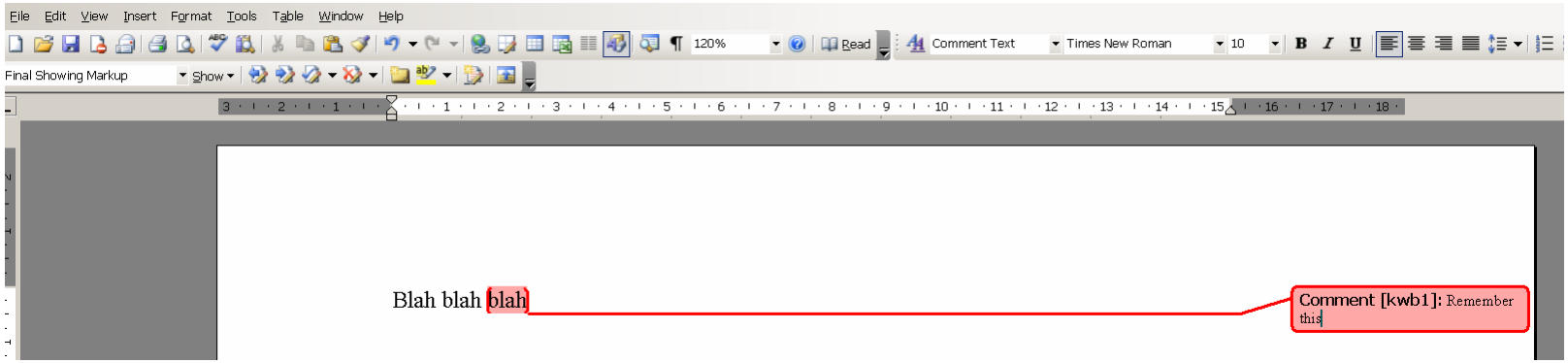




.. Worked well for the Wright brothers

Same Place, Different Time – Computer Version

- Microsoft Notepad!
- Microsoft Word – Post It Notes

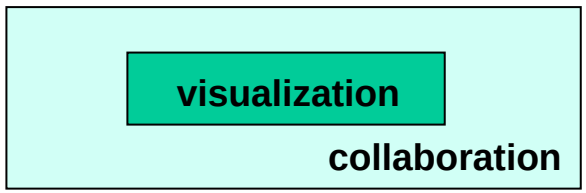


Same Place, Different Time - Visualization

- Not much to report!
- Save your work and continue later…

- Recently skML has been proposed as an XML language for describing dataflow – seeing this as:
  - a map
  - containing links
  - between ports
  - on modules
  - which have parameters

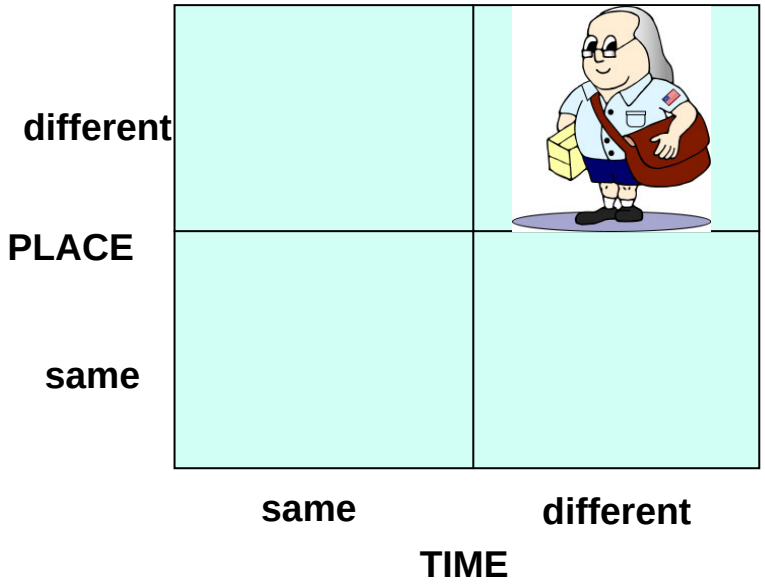
Duce and Sagar, 2004




```
<?xml version="1.0"?>
<skml>
<map>
<link>
  <module name="ReadLat”
    out-port="Output">
    <param  name="Filename">
     testVol.lat
    </param>
  </module>
  <module id=“iso”
    name="IsosurfaceLat"
    in-port="Input">
    <param name="Threshold"
     min="0" max="27">
     1.8</param>
  </module>
</link>
…
```

Different Place, Different Time – Traditional Form

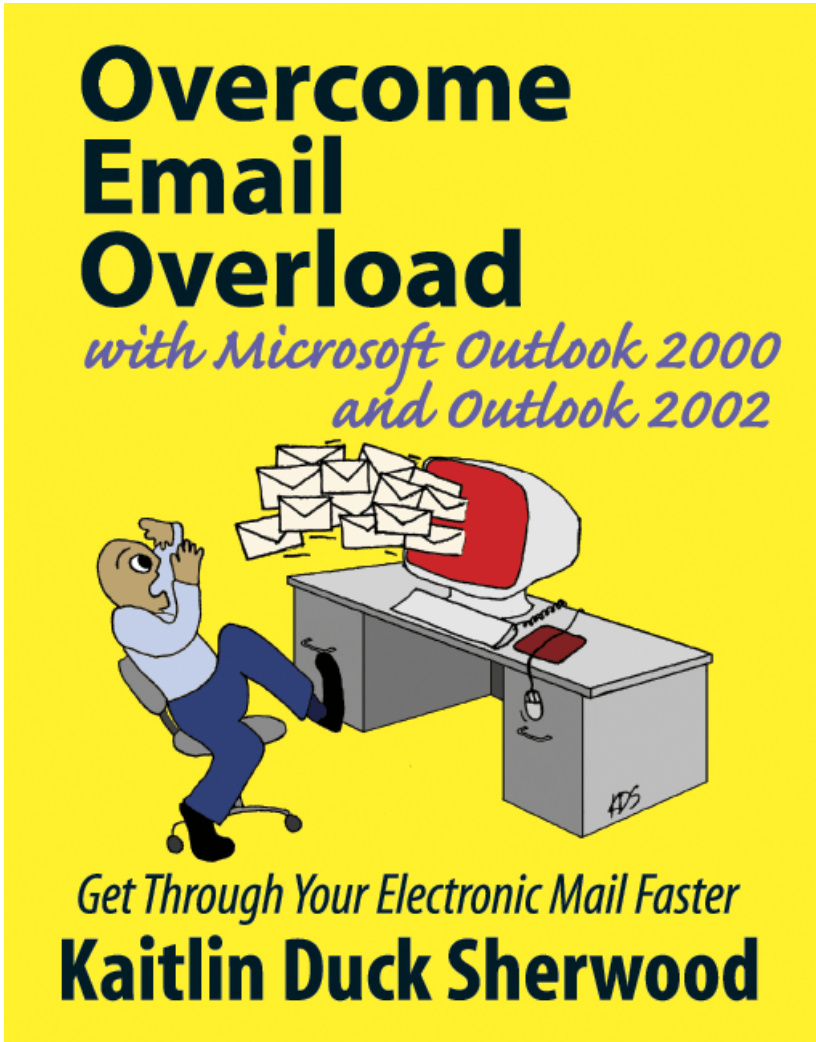
- The letter..
- … works well



Generic: yes
Standards: yes

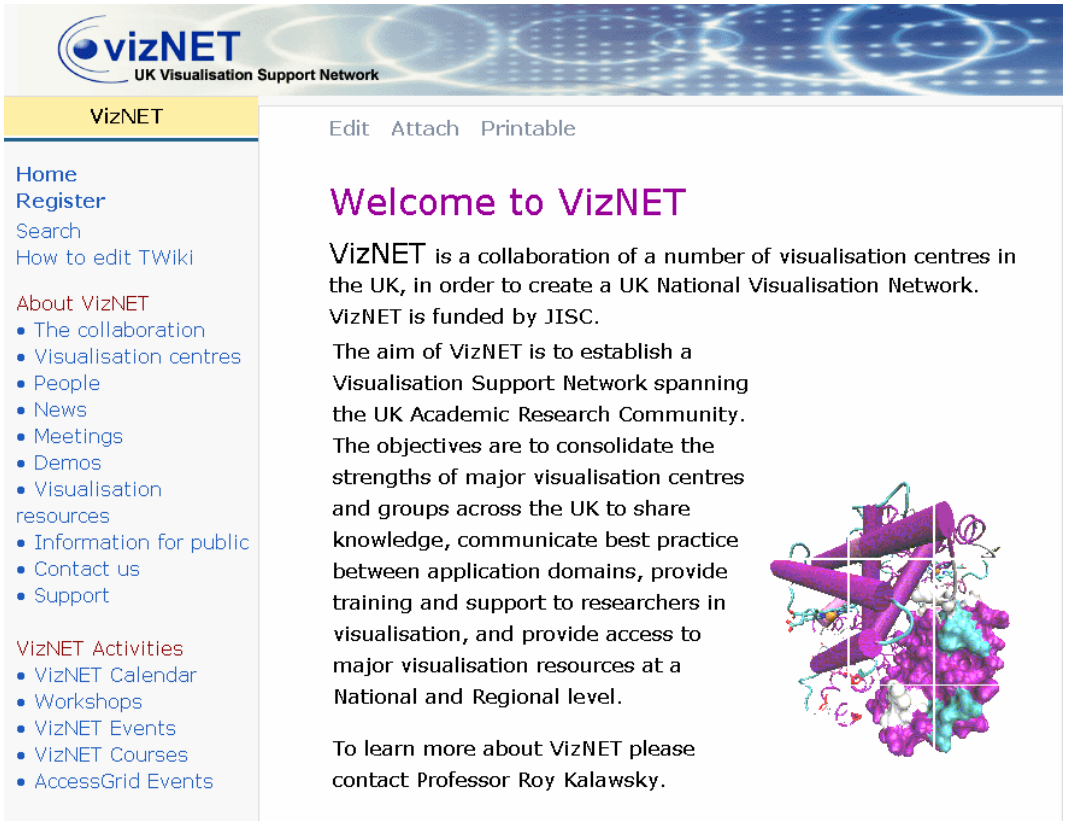
Different Place, Different Time – Computer Version

- E-mail



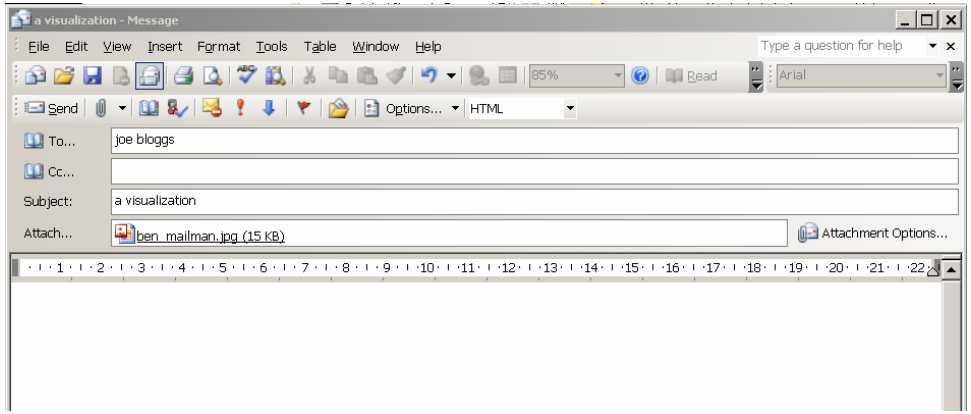
Different Place, Different Time – Computer Version

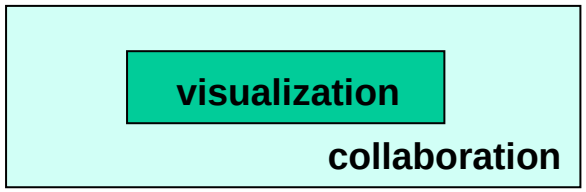
- Web pages…
- .. And now wikis, blogs, ….



Different Place, Different Time - Visualization

- Certainly we can e-mail visualizations…
- … bringing the visualization into the collaboration

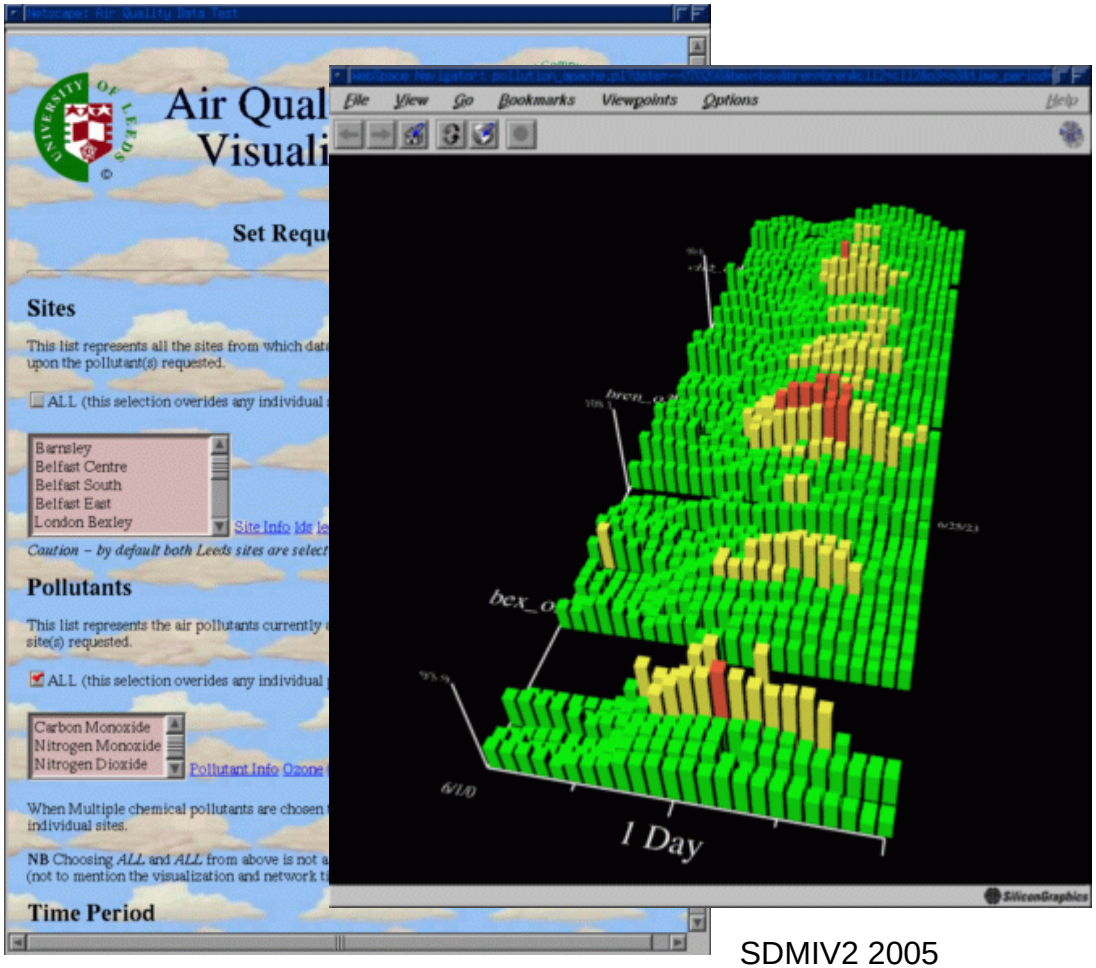


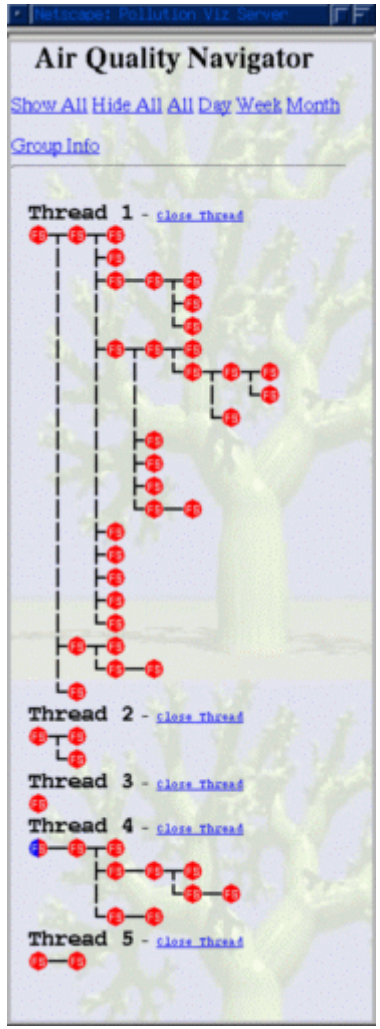


- Is this the most common form of collaborative visualization?
- How much have we tried to make it effective?

Different Place, Different Time – Collaborative Visualization via Web

- Web also a way of sharing visualizations…



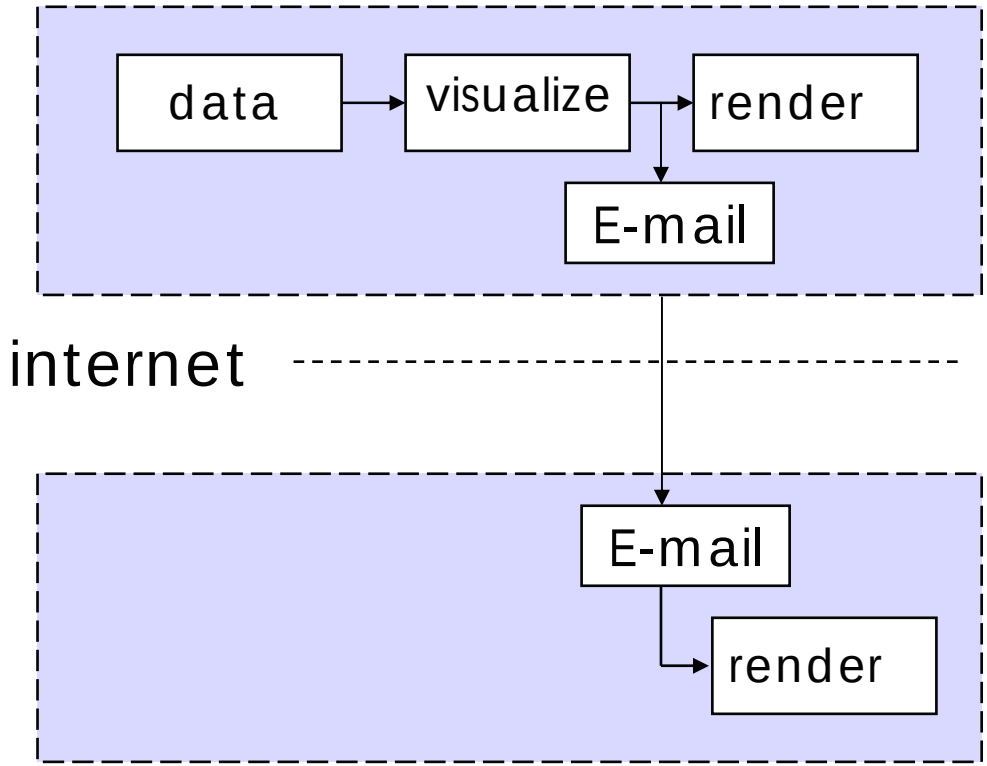


History of collaborative exploration
Jason Wood - 1996

Different Place, Different Time – Visualization (Take Two)

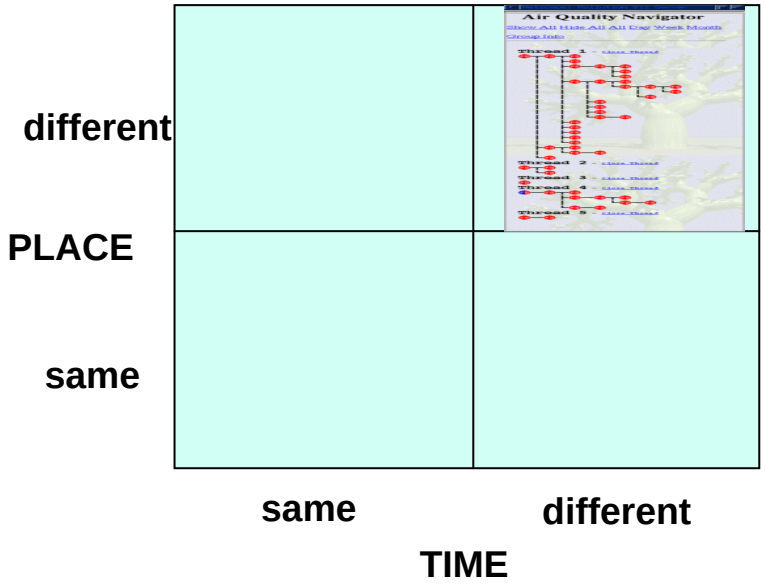
- We can think of bringing the collaboration into the visualization…

- … no-one has tried this?



Different Place, Different Time

- Relatively little attention… deserves more!



Looking Ahead…

- Technology moves inexorably from stationary to mobile..
- .. Phone, computer,…
- Our office will likely move next…
- Will this motivate greater or less collaborative visualization?
- Do we need new models, new tools?

.. And finally

- … even Santa needs collaborators