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Visualization Systems for diverse environments

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Background

- In the past, there has been much emphasis on:
  - Algorithms: e.g. volume rendering; isosurfaces
  - Software architectures: specialised; command-based; dataflow; API
- Platforms:
  - Software once requiring powerful workstations, became runnable on PC's too
    - Linux has helped
    - Differences now are mainly to do with data complexity

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Issues now

- (1) Use of Grids - what are the implications for visualization systems; how do we make best use.
- (2) Availability of diverse resources:
  - Compute:** PDA → small laptop → powerful laptop → desktop → Grid (organisation, national, worldwide)
  - Network:** wireless → local broadband → Internet → high speed international connections
  - Screen:** PDA → monitor → wall / Access Grid and monoscopic → stereoscopic

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Some projects

- Visual Beans - EPSRC - finished 2002
- an experiment - using visualization over the Access Grid
- gViz - UK e-science core technology, through EPSRC

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Visual Beans

- Aimed to consider:
  - Resource requirements may change: e.g. data size changes
  - Resource availability may change: PDA on wireless link or high speed desktop on high speed link; collaborators may vary in what they have available
  - Competition for resources e.g. multimedia
- Partners: Lancaster and Oxford Brookes Universities
- EPSRC grant til September 2002

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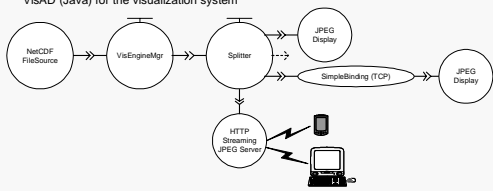
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Visual Beans components

Used CORBA components: can be **substituted**; **migrated**; output can be **split**

Middleware is TOAST (from Lancaster University) i.e. CORBA + continuous flows + open bindings (can insert and move components by program)

VisAD (Java) for the visualization system




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    graph LR
      NetCDF[NetCDF FileSource] --> VisEngineMgr[VisEngineMgr]
      VisEngineMgr --> Splitter((Splitter))
      Splitter --> JPEG1((JPEG Display))
      Splitter --> SimpleBinding[SimpleBinding (TCP)]
      SimpleBinding --> JPEG2((JPEG Display))
      Splitter --> HTTP[HTTP Streaming JPEG Server]
      HTTP --> Laptop[Laptop]
  
```

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 some Visual Beans thoughts

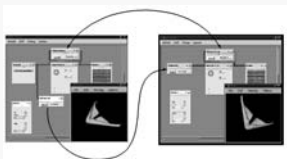
- Visualization components using CORBA have been built
- Parts of the system can run on a PDA
- The TOAST platform from Lancaster provided a basis for substituting and migrating components via a user interface
  - Note: the components need to be available and ready to run on anticipated platforms
- The overhead of migrating a component is not large
- This is one approach (pre-Grid) to heterogeneous computers and networks

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 Collaborative visualization via the Access Grid - based on COVISA

- Access Grid allows group to group communication
- COVISA allows collaborative visualization (University of Leeds - based on Iris Explorer)
- tested COVISA “integrated with” the Access Grid
- 3 or more?




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 gViz project


- gViz: UK e-science core technology project - through EPSRC - has been going 6 months
- with Grid becoming available, how do visualization systems need to change to help users achieve the aims of the Grid and what middleware is needed to bring this about?
- academic partners: universities of Leeds, Oxford and Oxford Brookes
- industrial partners: IBM, Nag and Streamline Computing
- Formal title: “Visualization Middleware for the Grid”

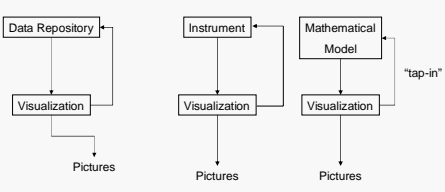
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 gViz

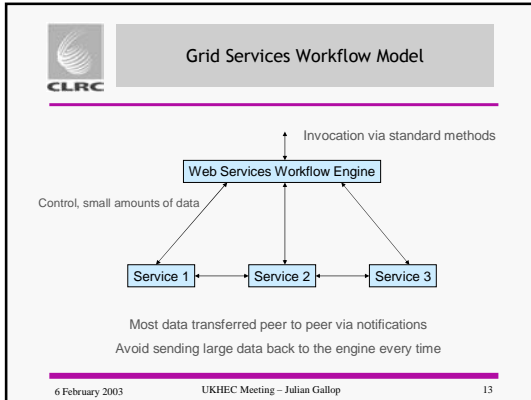
- 2 different visualization systems are being grid-enabled
  - Iris Explorer
  - pV3
- Improve the state of the art in geometry compression
- exploit XML for visualization

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 3 different cases - one approach



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- ### examples of some services that would take advantage of the Grid
- data source service - e.g. data extraction or simulation results or instrument data
  - data mining service
  - visual processing service - this may need intensive computing e.g. 600\*3 cube of points in heart modelling application - tactic may be to calculate isosurface close to the simulation
  - Render - this also could be a service, if a high quality animation is required

- ### Data - what do Visualization Systems Read?
- In general, visualization system X reads:
    - Its own data format
    - Formats of some other popular systems Y,Z, . . .
    - Some general purpose ones e.g. netCDF, HDF
    - Some (e.g. AVS, Iris Explorer) can read wide range of ASCII/binary files by describing the file e.g. velocity in 3D space
      - nDim = 3
      - dims = [6,5,4]
      - nDataVar = 3
      - primType = double
      - coordType = perimeter

- ### Proposed applications of XML in gViz
- To represent:
    - Structure of data input to visualization system or exchanged between parts of application e.g. XDF, STXML, NCML (ML for netcdf), HDF5 XML, preserving any metadata
    - requests to a visualization service
    - visual presentation generated (SVG or X3D)
    - script of the visualization application
    - history of project, involving
      - Set of collaborators
      - Variety of visualization applications

- ### Some guidelines in gViz
- Coarse grained approach to services at first, then (perhaps) finer later
  - As little impact on visualization tools as possible early on, use translators for early adoption
  - Needs to use security solutions offered by the Grid; no new problems introduced by visualization as far as we know
  - Group authentication is an issue, but being addressed in other projects

- ### recent workshops at National e-Science Centre, Edinburgh
- Scientific Data Mining, Integration and Visualization (Nov 2002) - SDMIV
  - Visualization in e-science (Jan 2003) - VESC



### issues that emerged from these workshops 1/2

- foster composable visualization services deployable in OGSA framework (VESC)
- teach visual literacy (VESC)
- ontology for visualization (VESC)
- use XML to describe scientific datasets for interoperability and flexibility (SDMIV, implicit in VESC too)
- investigate and report on visualization & data mining requirements (SDMIV)

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### more issues from the workshops 2/2

- need peer-reviewed datasets (to improve quality control and to reward owners)
- create and maintain and publicise registry of visualization (VESC) and data mining (VESC, SDMIV) resources
- foster collaborative working tools (SDMIV, implicit in VESC)
- need some kind of group (task force) to guide this (VESC)

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### Summary (last slide)

- XML, web services, grid services have their place in visualization - gViz e-science project looking into this
- What future scenarios can we envisage?
  - Control intensive simulation on high performance computer from a PDA via a wireless link?
  - Correlate 2 (or more) large d.b.'s - e.g. 2 time series data archives one with data on the atmosphere, the other with ocean data?
  - Collaboration using data sources found by Grid discovery methods?
  - Be able to make use of legacy, publicly available data archives through XML and web/grid services?

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