IVOA-Astro-RG Workshop

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The Challenge of Data

- Astronomy is an observational science
- Progress is made via understanding gained from the study of the cosmos
- Powerful observatories exist producing observational data across the wavelength domain
  - data comes in many formats
  - levels of complexity
- Data & applications held globally: USA, Europe, Asia
  - heterogeneous data archives
- Research partnerships are also global
- Connecting researchers with data and applications is the challenge for the Virtual Observatory

Science Challenge

- Multi-Wavelength data required
  - key science: e.g. planets, large scale structure, galaxy formation: all needs a combination of data
- More data required
  - survey telescopes create ~TB/night
- More use of database organised resources used

System needs to be fast and easy for the astronomer to use and affordable for the data providers to operate

System use drives increased (sustainable) funding for operations and development of data access system

Solutions: a Flexible Framework

- Create a system that recognises:
  - no one data provider or repository: thus data interoperability
  - application provision
- Requires
  - a system built upon agreed interoperability standards
- Exploits
  - wider IT developments: Grid and WS technologies
    - power of XML/ SOAP etc
  - access to high speed networks
    - but note: backbones ~10Tb/s, desktops ~100Mb/s
  - reduced costs of h/w: all data now on spinning disks

Building the Virtual Observatory:

Global scope
  International partnerships
    Agreeing interoperability standards
      Building regional implementations
   Based on new computational technologies
          Deployed on the fastest networks

IVOA: Stds Enabling Interoperability

- The International Virtual Observatory Alliance http://www.ivoa.net
- A global partnership
- Projects represent global astronomy data providers
- IVOA a forum for interoperability standards
- VO projects build on these standards
- Global reach

IVOA Architecture Analysis

Virtual Observatory Architecture
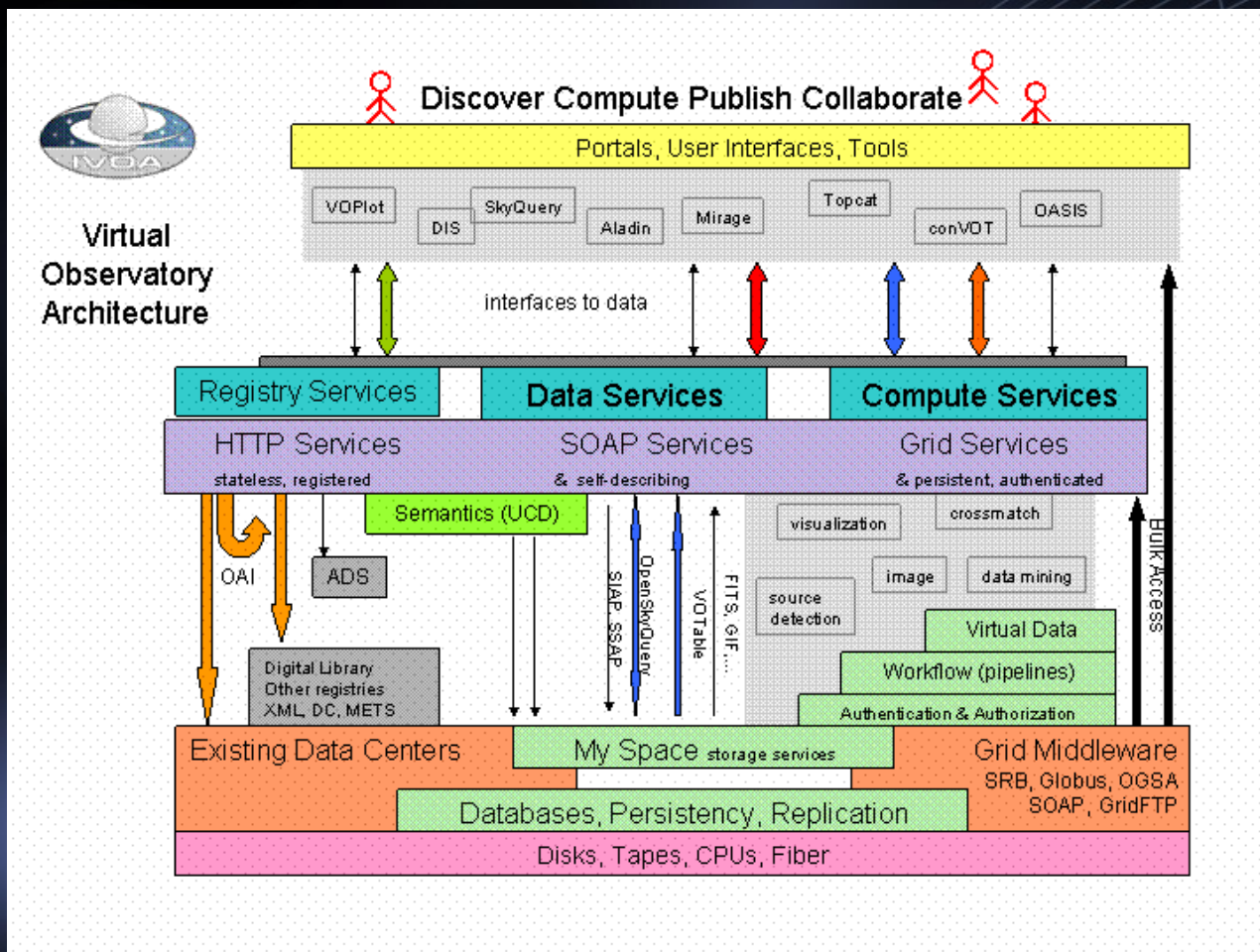
Analysis of a VO:
- Multi-layer
- Complex
- User interfaces thru a portal
- Astro-apps interface to a VO abstraction layer
- Lower level middleware provided by the 'grid' world
  - e.g. SRB
- Hardware at bottom layer

IVOA has working groups to address 'astro' specific 'boxes'

Ref: IVOA Architecture Overview: Williams et al, 2004
IVOA Note 2004-06-14:
http://www.ivoa.net/Documents/Notes/IVOArch/IVOArch-20040615.html

VO Standard Areas

- Standard vocabulary (semantics)
- Standard ontology describing how terms are related
- Standard data model (encoding format) for each type of measurement
- Standard query language for issuing spatial, temporal, and semantic queries across the catalogs.
- Standard access services for retrieving catalog records or image cutouts.
- Standard mechanisms for interacting with storage systems (VOSpace)
- Standard authentication/ authorisation mechanisms
- Standard event notification services.

IVOA Working Groups: http://www.ivoa.net/forum

- Registry:
  - how to 'register' resources: concept of VOResources
- Data Access Layer:
  - Standards for remote data access: e.g. SIAP, SSA
- Data Model:
  - Standards for the actual data: e.g. XML'ing of FITS
- VO Query Language:
  - Standards for 'astro' database access: e.g. Openskyquery, 'circle'
- Unified Content Descriptors: std Vocabulary
  - Standards for common ways of describing data: metadata
- VOTable:
  - XML representation of tabular data
- Grid & Web Services:
  - Interfaces to Grid and Web Service stds: e.g. 'Heartbeat'

GGF and Astronomy

- Current IVOA implementations largely utilise web services, however GGF standards are becoming relevant in a number of areas:
  - Authorisation
  - Transport, e.g. GridFTP
  - Persistent Storage
  - Job Submission
- Use of grid service standards actively under investigation by a number of VO projects
  - AstroGrid
  - USA's NVO

Wider Relevance: Workshop Concept

- Use of IVOA stds vs use of more generic GGF stds
  - implementations in use – supporting large data flows, complext computational environments
- Comparison with other domains, e.g. Medical
  - workflows and application environment
  - server based system with plugable clients for data visualisation
    - potential use from medicine to literature
- Supporting People Systems and Technical Systems
- GGF IVOA Workshop (May 10 2006) presentations looked at specific areas where GGF standards may have relevance in supporting the construction of the Virtual Observatory, and areas of VO feedback to the GGF
- http://www.ivoa.net/twiki/bin/view/IVOA/GgfIvoaMay06
  - http://www.ggf.org/gf/event_schedule/index.php?event_id=4

Virtual Observatory/ GGF Workshop

- The IVOA Challenge: Facilitate Better Science – Now
  - Science: range of astronomy, solar to cosmology
  - Technical: global system – interoperation with external services
  - Political: global community – multiple communities
- Building a solution: The Virtual Observatory
  - Which standards and when
    - IVOA
    - GGF, WS-I
- Workshop Outcomes
  - Solutions to Needs
  - Discussion Forum: Astro input to GGF std WGs
  - Future Links
    - Workflows, Authorisation, Preservation & Storage
  - GGF18: Earth Observations Workshop input

Comments on Workflows: from meeting

- BPEL – Dennis Gannon implementation
  - London – Emmerich work
- WS-Management (relevance to Skynode)
  - WS-eventing
  - WS-transfer
  - WS-enumeration (staged transfer)

Astro-RG: Next actions

- INFO-D – how would they implement VOEvent?
- Auth-Z – use case input
- WS-Naming / VOSpace
- Write up Workshop report
  - note also the relevance of IVOA based implementations to the wider Grid world: especially model of standard access to data via SIAP, OpenSkyNode, etc
- Update IVOA analysis paper
- Next meeting GGF18

Closing

- Key Links
  - Astro-RG @ GGF: https://forge.gridforum.org/projects/astro-rg/
  - IVOA: http://www.ivoa.net
  - AstroGrid: http://www.astrogrid.org
  - NVO: http://www.us-vo.org
  - Euro-VO: http://www.euro-vo.org
- Meeting Materials at:
  - http://www.ivoa.net/twiki/bin/view/IVOA/GgfIvoaMay06WorkShop
  - http://www.ggf.org/gf/event_schedule/index.php?event_id=4