

Preface

Astronomy faces a data avalanche. Breakthroughs in telescope, detector, and computer technology allow astronomical instruments to produce terabytes of images and catalogs. These datasets will cover the sky in different wavebands, from gamma- and X-rays, optical, infrared, through to radio. In a few years it will be easier to “dial-up” a part of the sky than wait many months to access a telescope. With the advent of inexpensive storage technologies and the availability of high-speed networks, the concept of multi-terabyte on-line databases interoperating seamlessly is no longer outlandish. More and more catalogs will be interlinked, query engines will become more and more sophisticated, and the research results from on-line data will be just as rich as that from “real” telescopes. Moore’s law is driving astronomy even further: new survey telescopes now being planned will image the entire sky every few days and yield data volumes measured in petabytes. These technological developments will fundamentally change the way astronomy is done. These changes will have dramatic effects on the sociology of astronomy itself.

Over the past two years the concept of the Virtual Observatory has emerged rapidly to address the data management, analysis, distribution and interoperability challenges. Astronomers world-wide are seeking to build a Virtual Observatory (VO) with international connectivity and capabilities. The Virtual Observatory will be a system that allows astronomers to interrogate multiple data centres in a seamless and transparent way, which provides new powerful analysis and visualisation tools within that system, and which gives data centres a standard framework for publishing and delivering services using their data. This is made possible by standardisation of data and metadata, by standardisation of data exchange methods, and by the use of a registry which lists available services and what can be done with them. The long term vision is not one of a fixed specific software package, but rather one of a framework which enables data centres to provide competing and co-operating data services, and which enables software providers to offer a variety of compatible analysis and visualisation tools and user interfaces.

The first step for the VO projects worldwide, is to develop the standardised framework which will allow such creative diversity. Once in place, the framework must be taken up by data providers to allow them to publish their holdings and make their services and facilities available. The framework will then empower scientists and developers to provide new tools for research and to undertake new

research programs to tackle complex astronomical and astrophysical problems. There are, therefore, three fundamental tasks to be undertaken to make the VO a successful research infrastructure.

1. The completion and deployment of a VO technical infrastructure
2. The uptake of this infrastructure by data providers
3. The support of the research and development community to utilize this infrastructure and data content to discover new knowledge and build new capabilities

A vital first step along the road to address these tasks was taken at our meeting in Munich. During the course of the meeting, the leaders of the AVO, NVO and ASTROGRID projects proposed the formation of an International Virtual Observatory Alliance (IVOA, <http://www.ivoa.net>). This alliance is providing the essential international collaboration and coordination necessary to achieve a unified and universal technical and interoperability infrastructure for the IVO. At this time 14 international projects have joined the IVOA and are working together on a jointly agreed development roadmap with priorities set for the demonstration of new VO capabilities over the next 2–3 years. Astronomy now stands at the edge of a new frontier for discovery, enabled by modern information technology (such as the Grid) and by political and technical collaboration among international partners.

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