University of Washington
eScience Institute Initiative

October 2007
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The new era of "eScience"

eScience marries computer science with other fields of science and engineering. Advanced visualization is one key component of eScience.

We are at the dawn of a revolutionary new era of "eScience." Rapid advances in technology are transforming discovery in nearly all scientific fields, in two important ways. First, massive experiments are being carried out by simulating the real world using computer systems with thousands of processors. Second, large numbers of tiny but powerful sensors are being deployed to gather data on the sea floor, in the forest canopy, in gene sequencers, in buildings and bridges, in living organisms. These approaches share a common trait: they produce enormous amounts of data that must be captured, transported, stored, organized, accessed, mined, visualized, and interpreted in order to extract knowledge. *This "computational knowledge extraction" lies at the heart of 21st century discovery.*

Goal of the UW eScience Institute Initiative

Unfortunately, many scientists – even the very best scientists – are not well versed in these new computational techniques. Up until now, for example, one could be a world-class oceanographer without having access to modern computational techniques. Not in the future, however! The competitiveness of the University of Washington requires that we rapidly make these new computational techniques available across the campus.

This is the goal of the UW eScience Institute Initiative. First, we must make UW a leader in advancing the technology and tools that help scientists with their data problems, through hiring faculty in key areas such as data visualization, data mining, database management, etc. Second, we must provide both infrastructure and consulting expertise in these areas to help UW researchers with their specific data-related research problems, by hiring a core group of shared technical and research staff.

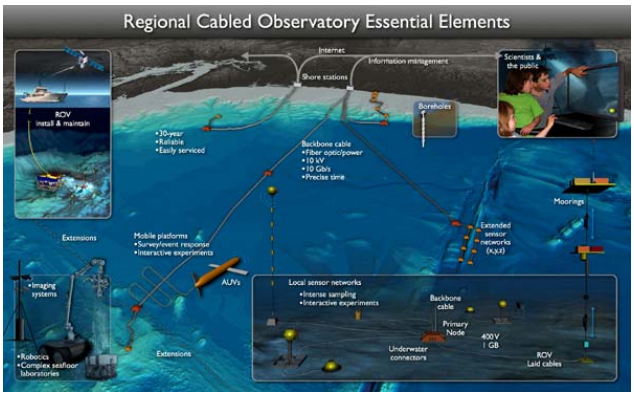
This is a *strategic investment* that will *impact all of UW*, and that will *pay for itself many times over each year* through increased competitiveness for Federal research dollars.

Initial focus: Environmental Sciences and the NEPTUNE project

We will launch this initiative with a focus on the environmental sciences – specifically, the NEPTUNE project.

Understanding the processes at work in the world's oceans is essential to the stewardship of our planet. Oceanography, though, has always been a "data-poor" science – oceanographers go to sea in ships and collect data that is very sparse in both space and time. Thanks to the vision of UW oceanographer John Delaney, the National Science Foundation has launched the Ocean Observatories Initiative, and is likely to award $130 million to the University of Washington to

construct NEPTUNE, the first Regional Cabled Observatory, on the Juan de Fuca plate off our coast. NEPTUNE will place thousands of physical, chemical, geological and biological sensors on 2000 kilometers of fiber optic cable on the sea floor, continuously streaming enormous volumes of data back to shore for analysis. NEPTUNE will transform oceanography from a data-poor to a data-rich science. It will help unlock secrets about the ocean's ability to absorb greenhouse gases, and about how stresses on the seafloor cause earthquakes and tsunamis along Pacific coastlines. It will help improve weather forecasting, and the management of valuable fish stocks such as salmon. The direct and indirect economic impact of this facility and its management by the UW will be tremendous for the nation and the State of Washington.



Professor John Delaney conceived the NEPTUNE project, a key element of the National Science Foundation's flagship oceanographic research initiative for the coming decade. NEPTUNE will deploy thousands of robotic instruments on a fiber optic grid on the seafloor off the Washington coast.

To win this award and conduct the project, UW must rapidly enhance its capabilities to capture, transport, store, organize, access, mine, visualize, and interpret this torrent of data. *Hence the urgency of this request.* This will allow the University to lead the nation in the transformation of ocean sciences research and education. It is also critical to the University's ability to win future grant awards in the area of environmental science, such as becoming the northwest node for the NSF's upcoming National Environmental Observatory Network. These capabilities will be widely valuable across the campus in the future – NEPTUNE is a precursor to the direction that much of science will be going over the next decade.

The specific request

$2.025 million in carryforward state funding is requested in FY2009. The UW will match this funding with $1.1 million in local support. State funding will be used to support:

- A senior-level, nationally-known director for the overall eScience Initiative;
- Three senior faculty who will work as part of the Environmental eScience Institute to: (1) establish and lead cross-collaborations in eScience, (2) generate new funding, and (3) educate students with the skills needed for eScience based projects.
- Two Ph.D.-level research scientists who will provide expertise in visualization and database/data mining – critical areas for NEPTUNE and other data-driven environmental science projects.
- Technical specialist to provide submarine and sensor network expertise.
- Research time for existing faculty to become involved in NEPTUNE and other environmental projects.
- Network hardware to support specialized core computing, visualization, and networking.