

# NETWORKING THE FUTURE

One of the Leading Resources in the World for Network Know-How

PSC's Advanced Networking group is one of the leading resources in the world for knowledge about networking. Through 3ROX (Three Rivers Optical Exchange), a high-speed network hub, they provide high-performance networking for research and education. Their research on network performance and analysis — in previous projects such as Web100 and current work with the NPAD diagnostic server — has created valuable tools for improving network performance nationally.

More information: <http://www.psc.edu/networking>

## National Transit Rail

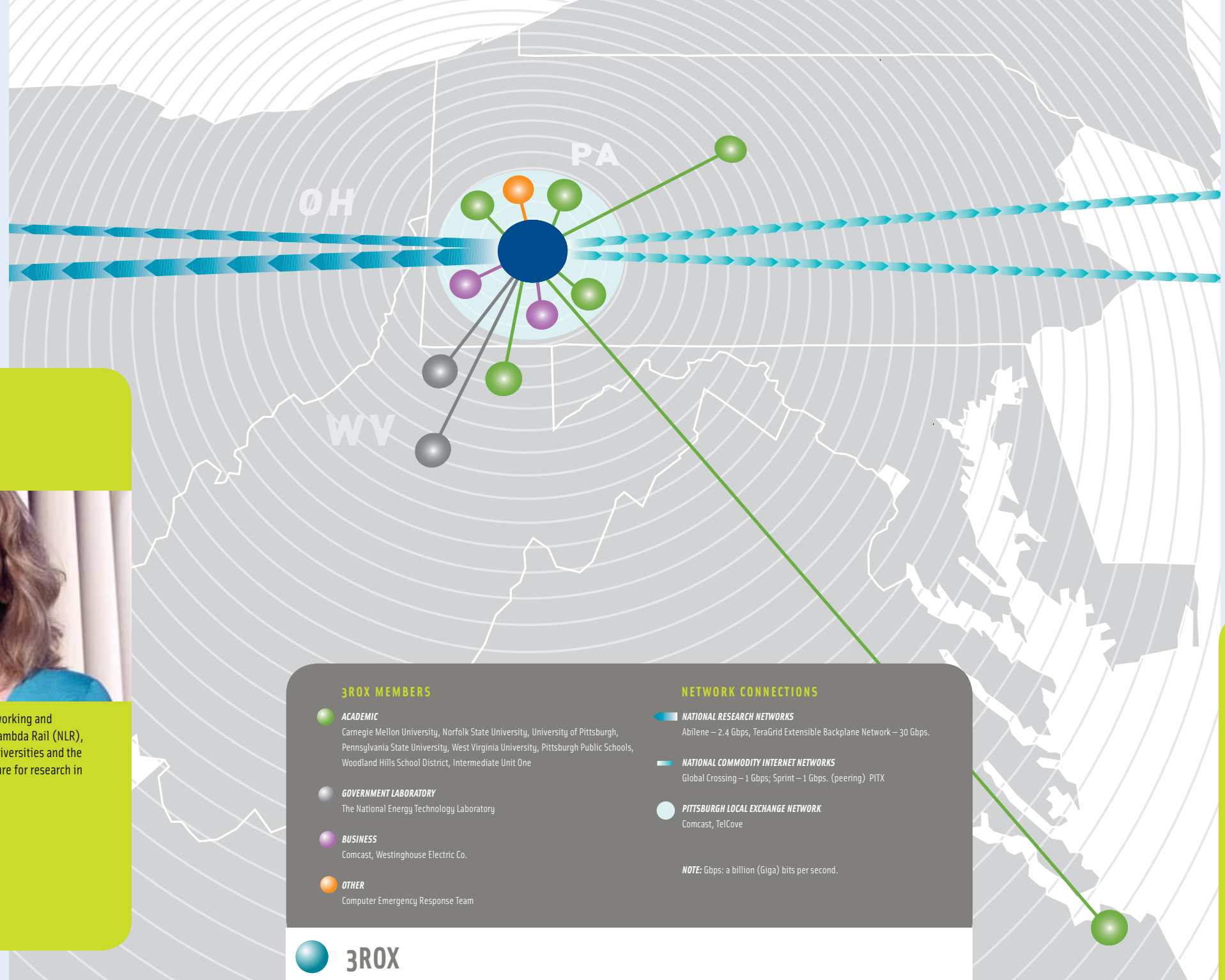


Through National Lambda Rail, PSC is participating with four other NLR members in a new project, the National TransitRail Project, to provide an intelligently managed nationwide peering and transit program. Through NLR's national network fiber infrastructure, the NTR project will work to reduce the number of "hops" required for data to get to its destination.

"NTR represents a new type of service," says PSC network director Wendy Huntoon. "It is direct peering with content providers and internet service providers. The long-term benefit is to provide a better-performing and more cost-effective link to resources than current network connections."



**Wendy Huntoon**, PSC director of networking and director of operations for National Lambda Rail (NLR), a major initiative of U.S. research universities and the private sector to provide infrastructure for research in networking technologies.



<p><b>3ROX MEMBERS</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">●</span> <b>ACADEMIC</b> Carnegie Mellon University, Norfolk State University, University of Pittsburgh, Pennsylvania State University, West Virginia University, Pittsburgh Public Schools, Woodland Hills School District, Intermediate Unit One</li> <li><span style="color: grey;">●</span> <b>GOVERNMENT LABORATORY</b> The National Energy Technology Laboratory</li> <li><span style="color: purple;">●</span> <b>BUSINESS</b> Comcast, Westinghouse Electric Co.</li> <li><span style="color: orange;">●</span> <b>OTHER</b> Computer Emergency Response Team</li> </ul>	<p><b>NETWORK CONNECTIONS</b></p> <ul style="list-style-type: none"> <li><span style="color: blue;">—</span> <b>NATIONAL RESEARCH NETWORKS</b> Abilene — 2.4 Gbps, TeraGrid Extensible Backplane Network — 30 Gbps.</li> <li><span style="color: lightblue;">—</span> <b>NATIONAL COMMODITY INTERNET NETWORKS</b> Global Crossing — 1 Gbps; Sprint — 1 Gbps. (peering) PITX</li> <li><span style="color: lightblue;">●</span> <b>PITTSBURGH LOCAL EXCHANGE NETWORK</b> Comcast, TelCove</li> </ul> <p><small>NOTE: Gbps: a billion (Giga) bits per second.</small></p>
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## 3ROX

Through 3ROX, a high-speed network hub that serves Carnegie Mellon, Penn State, the University of Pittsburgh, West Virginia University, Norfolk State University, the Pittsburgh Public Schools and Woodland Hills School District, PSC provides advanced network resources for education and research. 3ROX connects the universities and PPS to Abilene a high-performance network linking more than 250 U.S. universities and research organizations.

### 3ROX News

This year Norfolk State University became the newest 3ROX member, as 3ROX expanded its network aggregation in the mid-Atlantic region to include Pennsylvania, West Virginia and Virginia. "We're pleased," says PSC network director Wendy Huntoon, "to extend services to one of the historically black colleges and universities." Norfolk State expects to work with other HBCU's in their area to share their Abilene connection through 3ROX.

3ROX this year also added Intermediate Unit One and Woodland Hills School District in the east suburbs of Pittsburgh. As a result, any university-based resources available to the school district, such as distance learning or databases, will have better performance.

Penn State expanded its network capacity by connecting to National Lambda Rail, offering up to 32 "lightpaths" — four are now active — via NLR's infrastructure, increasing its overall bandwidth from 1.2 to 40 gigabytes per second. "With the success of this completion," says Huntoon, "3ROX now maintains an advanced three-way network between Carnegie Mellon, the University of Pittsburgh and Penn State."

## Narrowing the Wizard Gap

The Internet is extremely robust because Internet protocols include recovery procedures that silently self-correct network failures. These procedures hide network problems at the cost of reducing performance. Within a local network, this slowdown is likely to be trivial, but can lead to unacceptably slow wide-area traffic — because the increased network round-trip time multiplies the delay. The self-correction also masks the flaws, making it very difficult to pinpoint the ultimate causes of the reduced performance. With the NPAD (Network Path and Application Diagnostics) Project, PSC network engineers and the National Center for Atmospheric Research have developed diagnostic tools — based on tools PSC developed in a project called Web100 — that analyze and determine the nature of any observed path failures.

The primary audience for NPAD is data-intensive scientific users. “The goal,” says PSC engineer Matt Mathis, “is to easily — and in many cases automatically — diagnose problems that impede performance at this scale.” The diagnostics (called pathdiag) are run through a web interface. With NPAD deployed on a local network, a user can with a couple clicks test the path to a client for flaws, determine whether it will support a long fast flow, and make suggestions how to fix any observed problems.

NPAD, says Mathis, can substantially narrow the “wizard gap” — the gap in available network performance between network wizards and typical users. “Several network researchers have demonstrated 40 gigabits per second under a variety of environments, but this does little to help typical domain scientists with observed median performances of only three megabits per second. The difference is a factor of 10,000, and most of the problems that cause half this gap — the first factor of 100 — can be completely and automatically diagnosed by pathdiag.”

### Pittsburgh Supercomputing Center Workshops (2005-2006)

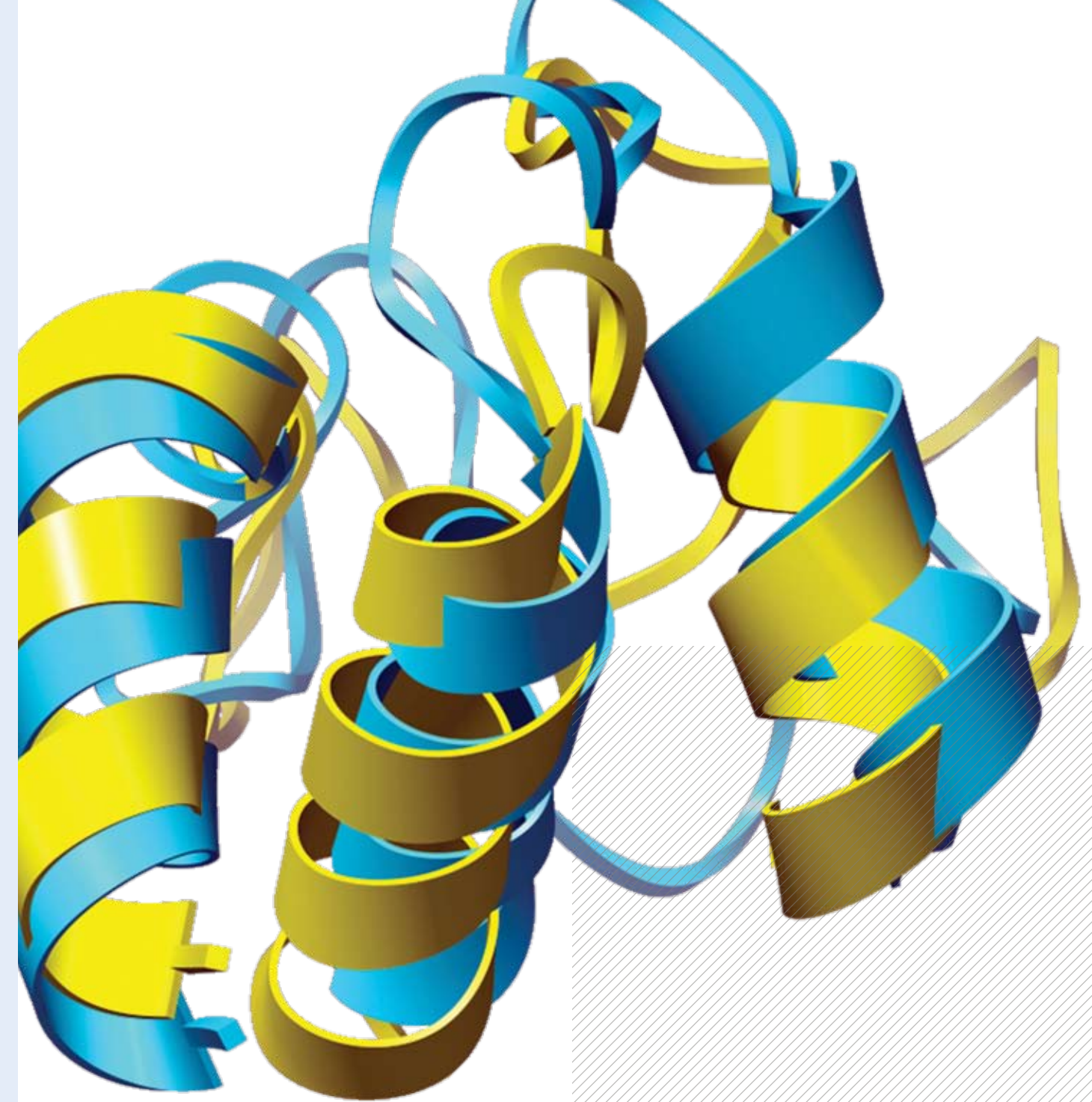
Introduction to the Cray XT3  
 Bioinformatics (for minority-serving institutions)  
 Developing Bioinformatics Programs  
 Computational Methods for Spatially-Realistic Microphysiological Simulations  
 Nucleic Acid and Protein Sequence Analysis  
 Computational Biophysics



A workshop underway in the PSC Computer Training Center, dedicated this year as the David W. Deerfield II Training Center, equipped with 30 “dual-boot” workstations and a projector for overhead display of the instructor’s desktop.



The PSC operational management team playing “railroad tycoon,” a board game of technological infrastructure: (l to r) **Katie Vargo**, manager, scientific computing systems; **John Kochmar**, HPC facilities manager, systems and operations; **J. Ray Scott**, director, systems and operations; **Bob Stock**, associate director; **Gwendolyn Huntoon**, director, networking; **David Kapcin**, manager, financial affairs; **Nick Nystrom**, director, strategic applications; **Rich Raymond**, manager, user support; **Sergiu Sanielevici**, director, scientific applications and user support. Not in photo: **Janet Brown**, manager, networking.



# PROJECTS IN SCIENTIFIC COMPUTING 2006