The Office of Information Resources and Technology engineers and operates networks that provide the crucial connections used daily to communicate, collaborate, teach, learn, and research. Few people realize the depth and breadth of Drexel's superior network infrastructure or recognize the unmatched connectivity that it provides.

## Campus Networking

The Drexel campus network infrastructure is provisioned using state-of-the-art, high performance electronics that drive an optical fiber inter-building network. High performance wired network connections link students, faculty, and professional staff to this backbone. A pervasive wireless network provides service inside and outside of campus buildings.

## Wired Network

Each Drexel University office, classroom, laboratory, residence hall, and public space has at least one wired network station supporting up to two jacks connected to the campus network at a speed of 1 Gigabit per second.

## Wireless Network

The DragonFly wireless network provides ubiquitous network access to the University community since 2000. In 2008, the network was upgraded to support the Wi-Fi industry's best performance and greatest level of security. DragonFly3 is the University's preferred wireless network, and is available to students, faculty, and staff. It operates in both 2.4 GHz (Wi-Fi b/g/n) and 5 GHz (Wi-Fi a/n) frequencies and reaches top speeds of 300 Mbps.

The legacy DragonFly network continues to provide service in the 2.4 GHz frequency (Wi-Fi b/g) to support older devices and those not currently capable of supporting the new Wi-Fi standards.

The Drexel Guest Network offers basic Web browsing for visitors and guests.

## External Connections

Demand for bandwidth to the outside world is always increasing. Connectivity outside of the Drexel campus networks is provided by multiple Internet Service Providers (ISPs), Internet2 connections, and peering arrangements with regional research and education optical networks.

## Internet

The majority of the campus external network connectivity is provided by multiple commodity ISPs. These are similar to the providers that are used in your home network; however, these tier-1 providers have direct, unfiltered access to all other networks. Currently, Drexel purchases over 2 Gbps of commodity Internet service and can dynamically accommodate up to 20 Gbps of bandwidth to address any sudden demand.

## Research Networks

Internet2 (**http://internet2.edu**) is a non-profit, advanced networking consortium, operating a revolutionary-class IP and optical network, led by the U.S. research and education community.

Drexel, in partnership with the Three Rivers Optical Exchange (3ROX) of Carnegie Mellon University, is one of twenty "connectors" to Internet2. Both Drexel in Philadelphia and 3ROX in Pittsburgh are connected to Internet2 using 100 Gbps links.

In Philadelphia, 3ROX/Drexel, as the partnership is known, provides Internet2 access to the 14 universities of the Pennsylvania State System of Higher Education (PASSHE), the largest provider of higher education in the Commonwealth of Pennsylvania; the School District of Philadelphia; and the Drexel University College of Medicine. In Pittsburgh, service is provided for CMU, the Pittsburgh Supercomputing Center (PSC), the Pennsylvania State University, University of Pittsburgh, and West Virginia University.

Other Internet2 consortium members, which include 221 U.S. Universities, 45 leading corporations, 66 government agencies and laboratories, 35 regional and state research networks, and more than 100 national research and education organizations representing 50 countries, gain access to the Internet2 network through one of the other 19 Internet2 Connectors.

Internet2 member network traffic is exchanged or routed over a 10/100 Gbps high performance, low-latency national backbone in lieu of using the commodity Internet. This superior connectivity allows for the transfer of massively large data sets, communications using high-definition real-time multimedia data streams, and other advanced networking technologies that could not be sustained over the commodity Internet.

All network traffic at Drexel destined for an Internet2-connected member institution is automatically transported over the Internet2 backbone. There are no end-user or application reconfigurations required to take advantage of the benefits of Internet2 connectivity.

## KINBER

Drexel University is a founding member of the Keystone Initiative for Network Based Education (KINBER). KINBER, a non-profit coalition of education, research, healthcare, economic development, and other non-profit based communities, received a $99 million Federal Broadband Technology Opportunity Program (BTOP) grant to build the optical network in the Commonwealth of Pennsylvania. This network, named PennREN, lights over 1,600 miles of fiber connecting over 70 locations across Pennsylvania.

Drexel representatives serve on the KINBER board, its committees, and workgroups. The University City campus is one of the 70 PennREN locations and the collection of Drexel campus networks will be directly connected to the PennREN network. KINBER expects PennREN to be fully operational by 2015.

## Network Operation Center and Help Desk

Network Infrastructure and Telecommunications, part of the Office of Information Resources and Technology, provides first-level and second-level help desk services for voice, video, and data networking assistance to both end-users and other campus service providers.

The network operations center is staffed 50 hours per week with on-call services available 24 hours per day, seven days per week. Incoming requests are processed via trouble ticketing systems, email, and telephone.

For service requests and trouble reports, call 215-895-6666 or send an email to **networking@drexel.edu**.

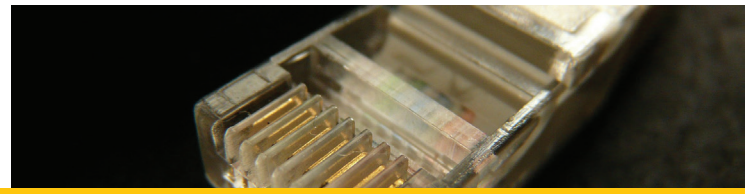
## External Services for Drexel Researchers

Through its relationship with 3ROX and the larger higher education research community, Drexel research faculty may avail themselves of services offered off-campus. Because of the robust, high-speed, low-latency links to 3ROX, the PSC-based services are particularly attractive.

## University Research Computing Facility

The University Research Computing Facility (URCF), a new facility atop Curtis Hall that provides a central location for high-performance computing resources, purchased its first shared resource: a Drexel Cluster, a High-Performance Computing solution from Dell. It offers:

- 2,432 general-purpose CPU cores and 9.5 TB of memory



for a peak speed of over 27 TeraFLOPS
- 43,000 GPU CUDA cores and 0.5 TB of memory for a peak speed of over 63 TeraFLOPS
- 250 TB of storage, including 100 TB of fast scratch

The Drexel Cluster supports scientific computing applications for molecular dynamics, quantum chemistry, bioinformatics, celestial mechanics/astrophysics, fluid mechanics/finite elements, and more. It operates under a "condominium model," where computing resources are allocated according to user shares. Allocations for users without shares are awarded by the URCF board via a proposal review system.

## Storage at Pittsburgh Supercomputing Center

The PSC-developed Data Supercell is a low cost, high bandwidth, low latency, highly reliable, and high capacity disk-based data management solution. It provides academic, corporate, government, and research partners with a convenient and affordable way to store and access their data, including extremely large data sets.

The minimum storage requirement is 10TB. The first copy of data is $250/TB/year; a second copy, if required, is an additional $175/TB/year.

Computing at the Pittsburgh Supercomputing Center
PSC's flagship HPC system, Blacklight, is the world's largest shared-memory system. Its extremely large memory, 16 terabytes, coupled with its familiar Linux operating system and versatile programming models, makes it as easy to use as a PC. Complementing Blacklight are HPC clusters that are ideal for running smaller, loosely coupled analyses.

For additional information on the services from the Pittsburgh Supercomputing Center, contact Cheryl Begandy at (412) 268-5129 or **begandy@psc.edu**.

## XSEDE

XSEDE, the Extreme Science and Engineering Discovery Environment, is a single virtual system, connected via Internet2, that scientists can use to interactively share computing resources, data, and expertise. People around the world use these resources and services — things such as supercomputers, collections of data, and new tools — to improve our planet.

For additional information about XSEDE, contact Ken Blackney, at 215-895-1505 or **Ken.Blackney@drexel.edu**.


Drexel UNIVERSITY

**Korman Computing Center**
Office of Information Resources and Technology
33rd Street (between Market and Chestnut St.)
215-895-2020 or consult@drexel.edu
www.drexel.edu/irt


## QUICK FACTS

**Internet Connections**
Primary: 20 Gbps
Backup: 10 Gbps

**Internet2 Connections**
Primary: 100 Gbps
ION Circuit Enabled

**Regional Connections**
KINBER: 10 Gbps

**Campus Network**
Active jacks: 15,000
Jack connections: 1 Gbps
Building connections:
dual 1 Gbps or 10 Gbps

**Wireless Network**
Access Points: 2,400
Simultaneous users: 8,000
Peak speed: 300 Mbps

**Locations (10 Gbps)**
Academy of Natural Sciences
of Drexel University
Center for Graduate Studies, Sacramento
(150 Mbps, low-latency, high-performance)
Center City Campus
University City Campus
University City
Science Center
Waterfront Technology Center, Camden, NJ
11th Street Family Health Services

**Co-location Facilities (10 Gbps and dark fiber)**
401 N. Broad St., Phila., PA
3701 Market St., Phila., PA

# Networking Resources for Research

*at Drexel University*