

## **KINBER Facilities, Equipment and Other Resources**

The Keystone Initiative for Network Based Education and Research (KINBER) is a 501(c)(3) non-profit corporation that owns and operates a statewide fiber-based research, education and community network across Pennsylvania. In 2010, KINBER was awarded \$99.67 million in funds from the National Telecommunications and Information Administration and along with \$29 million more in in-kind and private support, KINBER built a 1,800-mile fiber optic network and established the regional network PennREN to fuel cooperative projects and provide high-speed network access to organizations across Pennsylvania. Since PennREN was placed into operation in 2013, KINBER's network has grown to connect over 100 organizations at 1GE, 10GE and 100GE. For many of these organizations, PennREN connectivity replaced a slower connection to the commodity network and their first opportunity to connect to a regional or national research and education network since the mid-1990s.

### PennREN Regional Network Infrastructure

The core PennREN network is a pair of fibers lit using ADVA DWDM equipment, currently capable of supporting 40 waves and expandable to 80 waves with the purchase of additional hardware. PennREN uses Juniper MX480s to provide at least three 10GE waves from east to west across the entire network. KINBER deployed its first 100-Gigabit wave in September 2017.

Two routing nodes existing on the backbone are located in carrier hotels in Pittsburgh and Philadelphia. These nodes provide gateways to wide area network resources as well as the routing to all the PennREN Layer3 services. Each routing node houses two MX480s. One MX480 is connected to the backbone DWDM network and controls the different services PennREN offers. Each of these platforms connects to a second MX480 responsible for the Layer3 routing to/from/between members' commodity Internet services. Additional services can be configured on the appropriate platforms as PennREN grows its service offerings.

One hundred sixteen nodes on the backbone contain active electronics used to connect members and are referred to as PennREN Points of Presence (PoPs). These nodes are equipped with various Juniper and ADVA equipment supporting both 1GE and 10GE direct connections as well as connections through KINBER provisioned dark fiber.

Most organizations connect via 1GE or 10GE to a service node MX480 or an access node switch (Juniper EX3300, ADVA FSP150). The network design allows for the provision of multiple discrete services on a single port. Example services include commodity Internet service, peering and caching, member-to-member connections, etc.

PennREN has deployed perfSONAR platforms at twenty-eight KINBER service nodes. The perfSONAR platforms are part of the PennREN perfSONAR mesh, which runs hourly OWAMP and BWCTL tests over a 1GE interface. In addition, the platforms have 10GE interfaces, used for debugging purposes. The PennREN perfSONAR mesh is

publicly available and is used by both KINBER staff and member organizations to understand backbone performance.

### PennREN NOC

The PennREN NOC is provided through the collaboration of the KINBER Engineering staff, our partners at Indiana University based GlobalNOC, and contracted remote hands and eyes support. This collaboration allows KINBER to provide state-of-the art, customizable support services for its users. The GlobalNOC is a premier operational partner for many of the world's most advanced research and education networks and operates out of two regionally diverse locations in Bloomington and Indianapolis Indiana. The PennREN NOC provides a 24/7/365 staffed Service Desk as the first line of support for KINBER members. All customer requests utilize the PennREN NOC phone number, email or the webpage. The Service Desk manages problem response and resolution, dispatching Tier II or Tier III Engineering, hands and eyes support, fiber maintenance and problem escalation based on the priorities and protocols specifically associated with the PennREN network. PennREN NOC maintains a general portal at <http://noc.pennren.net>, which includes real-time statistics, avenues for open trouble tickets, and reportable information on the PennREN network. KINBER continuously monitors and tracks its backbone traffic levels, with traffic graphs available on the PennREN NOC website. All PennREN connected organizations have access to the PennREN NOC tools, which include monitoring and statistical data on both the individual customer services as well as the overall PennREN Backbone. These tools are also available from the <http://noc.pennren.net> page.