

# WPI Common Computational Resources and Infrastructure

Worcester Polytechnic Institute (WPI) provides faculty and students with enterprise level storage, state of the art computational resources, and high speed wired and wireless networks.

In 2011, WPI built a dedicated Research Computing server room for the Life Sciences & BioEngineering Center (LSBC) which currently houses a 600 TB high performance/highly available, extensible Dell/EMC Isilon storage array system to support the research initiatives of the WPI community. In addition, WPI also maintains a high performance Qumulo storage array with a current capacity of 240 TB. This cutting edge network storage array is aimed at performance critical applications such as High Performance Computing (HPC), microscopy, 3D imaging, genomic sequencing, and biomedical research. In conjunction with redundant backup arrays, WPI provides a safe, secure three-tier storage system for research data of all types.

The WPI parallel computing resources, maintained by the Academic and Research Computing (ARC) group, currently include a HPC cluster acquired in part through an NSF MRI grant. The current cluster includes 24 compute nodes with two 20-core Intel Xeon E5-2680 v2 CPUs, 128 GB of RAM, and either two NVIDIA K20 or K40 GPUs. Expansion in 2016 added 10 compute nodes with 36 Intel Xeon E5-2695 v4 CPUs and 256 GB of RAM, as well as 2 compute nodes each with 40 Intel Xeon E5-2698 v4 CPUs, 256 GB of RAM, and 4 NVIDIA K80 GPUs. More recent expansion of the cluster added two additional GPU based compute nodes containing two 3.2 GHz Intel Xeon E5-2667 v4, 512 GB of RAM, and four NVIDIA P100 GPUs in one node and four NVIDIA V100 GPUs in the other. In addition to these new GPU based nodes, 8 CPU based compute nodes with two of the latest 24 core 2.7 GHz Intel Xeon Platinum 8168 CPUs and 256 GB of RAM were also added. In total, the system is comprised of 1,336 CPU cores and 64 GPUs spread across 46 compute nodes. The peak performance rating of the system is well over 100 tera flops. All compute nodes are connected via 56 FDR Infiniband network, with the head node and login node also connected to the 10 Gigabit WPI backbone. The cluster is managed using the Bright Cluster Manager software in conjunction with the Slurm batch manager. In addition to the hardware listed, and the standard HPC software stack (MPI, OpenMP, CUDA, PETSc, Lapack, etc.), the HPC user community also has access to software development training and support, including parallelization and porting of scientific code to new platforms, and information on current and new approaches to parallel code development, through the ARC group. WPI also provides the community with many other high performance shared memory systems.

The staff that composes the ARC group at WPI includes: Academic Computer Applications Scientist, Academic Research Applications Scientist, Computational Scientist, Scientific Computing Systems Specialist, and a Research Data Scientist, all of who work closely with faculty and students engaged in research and academic projects. ARC also provides access, as well as extensive support and training, for all students and researchers to scientific applications such as Matlab, Ansys, Abaqus, Fluent, Comsol, Intel Suite of Compilers, Portland Group Compilers, and a host of other major applications.

WPI currently supports a redundant Ethernet backbone connecting the campus buildings and data Centers. The University servers housed within the IT Data Center are connected via single or 10 gigabit connections. The Isilon Research Storage arrays are connected via redundant 10Gb connections to the University backbone. All academic and residence hall buildings are connected via fiber to the University backbone via dual or quad homed load sharing redundant 10 Gb connections. WPI supports 2Gb connections for commodity Internet currently rate limited to 1 Gbit/s total. WPI also supports 10 Gbit/s connection to Internet2 - the University is classified as one of two GigaPOP connectors for Massachusetts and offers Internet2 connectivity to other universities, K-12 schools, museums, and businesses in the Worcester and Boston areas.