The Low-Budget Experimental Computer Lab Boosts Students' Research

David Pitts and Vladimir V. Riabov

Department of Mathematics & Computer Science, Rivier University, Nashua, NH, *{dpitts, vriabov}@rivier.edu*
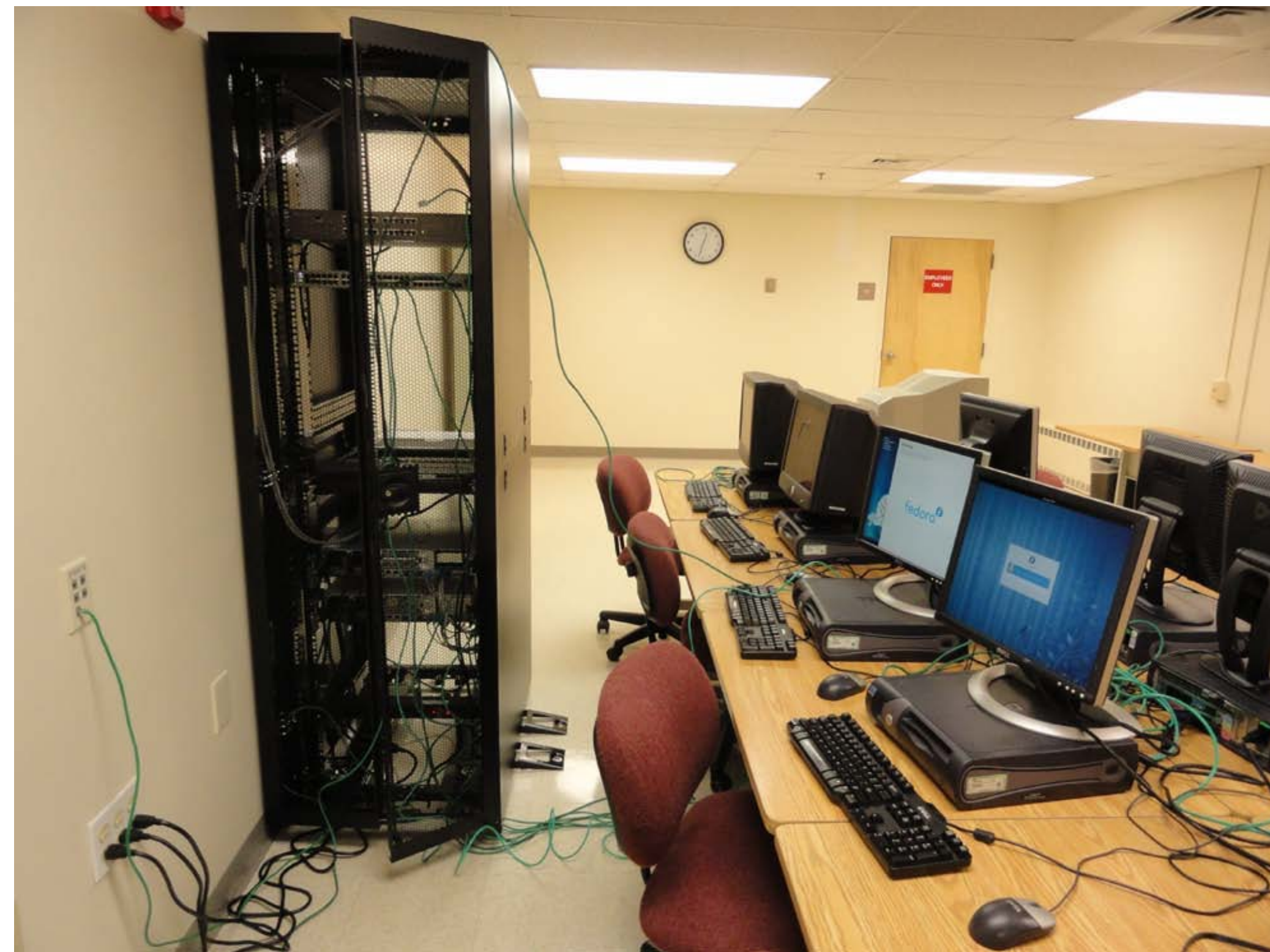
Experimental Computer Lab

The Lab provides students with opportunities:

- to explore various operating systems, computer architectures, databases, multimedia applications, and data communication
- to build-up and analyze different system prototypes
- to work on their research projects.

The Lab allows instructors:

- to design new advanced course lab assignments
- to introduce new CS courses (e.g., Distributed Computing, Parallel Programming, Advanced Networks, Computer Forensic, Data Analytics)
- to offer research projects requiring a dedicated network of systems and which would be undesirable and unsafe to conduct on the University network, including projects involving distributed computing, network "sniffing," cybersecurity, and data mining.

The lab was open in a 200-square-feet room right near the IT Office in fall 2011. Most of the lab equipment (computers, switches, racks, wiring, etc.) was "donated" by the IT Office. The Lab has a lean budget ($1K – $2K annually). ■

Hardware Infrastructure and Software

Clients:
System Model: OptiPlex 780
Processor: 3.00 Gigahertz Intel
Core2 Duo Memory: 4 GB RAM
Hard Disk: 320 GB
Display: ATI Radeon HD 3450 - Dell Optiplex

Servers:
System Model: Dell PowerEdge 2650
Processor: Intel(R) Xeon(TM) CPU
3.06GHz Memory: 2 GB RAM
Hard Disk: 120 GB, 1 TB external.

Switchers:
System Model: Nortel/Avaya
BayStack 5510-48T Port: 48 x
10/100/1000 + 2 x GBIC
MAC Address Table Size: 48K entries
Routing Protocol: RIP-1
Remote Management Protocol:
Telnet Authentication Method:
RADIUS Standards: IEEE 802.3z

Two operating systems are installed on the client machines: Windows-10™ and Fedora™ Linux.

- The VirtualBox™ tool is installed and runs in these operating-system environments.
- All clients are of the dual boot. The default operating system is Fedora™ Linux.

Specialized servers are installed and configured for **database systems**: Oracle 10g Express edition, MySQL 5.2.3, and PostgreSQL 9.3.4.

Two servers with powerful **GTX570 graphic driver** (732 MHz - core clock speed) and the **OpenGL library** are available for **CUDA,** multimedia and graphic projects and research. ■

Software Tools and Environments

Software includes "traditional" and specialized **packages**: GCC, g++, IntelliJ Idea, JDK, NetBeans, PostgreSQL, SQL Developer, Foxit Reader, Android SDK Tools, Eclipse–Android Development Tools, Eclipse–Java Development Tools, Plugin, ActivePerl, Adobe Flash Player, Python, VLC, VMware Player, WinSCP, TELNET, PuTTY, Wireshark, and many others.

Examples of New Courses and Labs:

In **Distributed Computing** classes, students experimented with the development of web services using SOAP and WSDL technologies, culminating in the development of a small application using a web service supported by the National Weather Service. Students also performed a lab using Java's remote method invocation mechanism.

The hands-on activities in Java network programming were designed in the **High Octane Java** course and in the classes on **Parallel** and **Database Programming**.

CS instructors developed a set of hands-on **Computer Networks lab** assignments to replace the OPNET IT GURU virtual labs. Five **computer clusters** connected with Nortel™/Avaya™ 10/100/1000 routing were built and used by students for improving the system performance in their projects.

Projects in computer security, cybersecurity management, multimedia, Internet of Things (IoT), cloud computing, and data analytics. ■

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