

THE USE OF VIRTUAL DESKTOP INFRASTRUCTURES IN A GRADUATE COMPUTER SCIENCE CURRICULUM

David Pitts, Ph.D.*

**Assistant Professor, Department of Mathematics & Computer Sciences, Rivier University
and**

Vladimir V. Riabov, Ph.D.**

Professor & Department Coordinator, Department of Mathematics & Computer Sciences, Rivier University

This paper¹ presents the use of and experience with virtual desktop infrastructure (VDI) [1] in the Masters in Computer Science program at Rivier University. Many of the advantages of VDI in a university setting have been described in [2]. This article focuses on our experience with VDI for Rivier's Computer Science graduate program. In addition to reducing hardware costs and system administration loads, VDIs also provide convenient means for both students and faculty to access software tools and applications from both home and the university. For the Computer Science program at Rivier University, the combination of VDIs and open source software gives us a good way to provide the students with the necessary tools, both in and out of class, and to perform the work that instructors expect. VDIs provide a convenient way to create the specialized Computer Science desktops (CSDs) only for the computer science students (students in other programs use the standard, "vanilla" desktops). Rivier University started using VDI about seven years ago with an in-house IT department and has continued the VDI utilization after adopting an outsourced IT model. The use of VDI became particularly important during an explosion of the graduate program due to a large influx of international students: the program went from around 40 students to almost 600 full-time students at its peak. The accommodation of VDI allowed us to meet the demands of this growth gracefully, quickly adding the necessary computer-based classrooms needed for this larger population of students.

Rivier University's VDI consists of thin-clients (we use Dell Wyse™ thin-clients) that connect to the Rivier's VDI server. There is a separate server for on-campus use versus remote use. The connection to the VDI is managed through the normal Rivier University credentials. Once connected to the VDI, the user is offered a set of virtual desktop pools. For example, Rivier provides University Desktops, Computer Science Desktops, and Faculty/Staff Desktop pools. Selecting of the appropriate pool creates a new virtual desktop for the user.

The Computer Science and University desktops are not persistent [3]. Each time a student logs into one of the computer science desktops, the desktop is created a new VDI. This feature provides some protection against student's misadventures and numerous malware dangers (e.g., viruses and worms) that are ever present. However, at Rivier, faculty are provided with persistent desktop, allowing the replacement of desktop computers in faculty offices with a small Dell Wyse™ thin client.

Another important benefit of VDI is that, through the use of VMWare's Horizon™ View client [4], the Computer Science desktops are available not only through the Dell Wyse™ thin clients, but also through the personal devices (e.g., laptops, desktops, and even iPhones), allowing access to the computer science applications at home as well as on campus. Faculty can work on demonstrations and in-class activities at home on exactly the same environment that students will use during class. Online students, after installing the Horizon™ View client, have complete access to the Computer Science desktops.

Further, for faculty, their persistent desktops replace the VPN that was in use at Rivier University, since the faculty member can connect to her/his persistent desktop from home and immediately have access to the Rivier network environment (e.g., file folders, printers, etc.).

¹ The paper was presented at the 24th Annual Conference of the Consortium for Computing Sciences in Colleges Northeast Region (CCSCNE-2019) (Faculty Poster Session) held in West Haven, Connecticut, April 12-13, 2019.

Another benefit of VDI that we have not yet pursued is the support of virtual desktops with different operating systems installed, such as Linux™ or FreeBSD™. Rather than devoting additional hardware resources or formatting existing systems as dual-boot systems, a new pool of virtual desktops may be created.

While there are many benefits to VDI, deployment of a VDI and set of desktops requires some planning. Applications for a virtual desktop are configured as *layers* [5], which allow the VDI administrators to install application with the necessary dependencies and add them to the OS layer for a specific virtual desktop pool. In the case of Rivier, the “vanilla” University Desktop pool uses a small number of application layers, while the number of layers required for the Computer Science Desktops is about 30 layers. The more layers required by a virtual desktop, the longer it takes to create. When classes of 20-plus students attempted to connect to the Computer Science Desktops simultaneously for a class, the demand on the VDI system can be quite significant. Further, instructors and IT administrators must carefully plan for licenses required to simultaneously run the large number of virtual desktops.

The support and assistance of the IT Office staff (Heidi Crowell, Phil Hardcastle, Bill Schleifer, Josh Senecal, and Kevin Anctil) are highly acknowledged.

In conclusion, VDI has been of great benefit to Rivier University, particularly in support of the sudden spike of the number of students in the computer science programs.■

REFERENCES

- [1] Rouse, M., Steele, C., and Madden, J. Desktop Virtualization, 2017. Online: <https://searchvirtualdesktop.techtarget.com/definition/desktop-virtualization>
- [2] Vieira, S. A. Why Virtual Desktop at CCRI? Finding Sustainability for Desktop Support. In: SIGUCCS '12 Proceedings of the 40th Annual ACM SIGUCCS Conference on User Services, 2012, pp. 81-86.
- [3] Maloney, N. Persistent vs. Non-Persistent VDI, 2018. Online: <http://blog.accessitautomation.com/persistent-vs.-non-persistent-vdi>
- [4] Horizon 7, VMWare, 2018. Online: <https://www.vmware.com/products/horizon.html>
- [5] Wilkinson, D. Citrix Application Layering – User layers, WilkyIT, 2018. Online: <https://wilkyit.com/2018/01/16/citrix-application-layering-user-layers/>

* **Dr. DAVID PITTS** has been an Assistant Professor of Computer Science at Rivier University since fall of 2010. Prior to his joint the Rivier community, Dr. Pitts served on the faculties of the University of Massachusetts at Lowell and Merrimack College. He was a member of the Advanced Research Lab at GTE/Verizon Labs in Waltham, MA for ten years. His teaching and research interests are in the area of system development, including system operating, database, and cloud systems, as well as programming languages. Dr. Pitts earned his Ph.D. in Computer Science at Georgia Institute of Technology.

** **Dr. VLADIMIR V. RIABOV**, Professor of Computer Science and Department Coordinator at Rivier University, teaches algorithms, networking technologies, computer security, software engineering, software quality assurance, object-oriented system design, system simulation and modeling, numerical methods, introduction to computing, and professional seminar in computer science. He received a Ph.D. in Applied Mathematics and Physics from Moscow Institute of Physics and Technology and M.S. in Computer Information Systems from Southern New Hampshire University. Vladimir published about 130 articles in encyclopedias, handbooks, journals, and international and national conference proceedings, including *The Internet Encyclopedia*, *The Handbook of Information Security*, *The Handbook of Computer Networks*, *International Journal of Computers and Structures*, *Journal of Spacecraft and Rockets*, *Journal of Aircraft*, *Journal of Thermophysics and Heat Transfer*, *Congress Proceedings of International Council of the Aeronautical Sciences*, *International Symposia on Rarefied Gas Dynamics and Shock Waves*, *International Conferences on Computer Science and Information Systems*, *International Conferences on Technology in Collegiate Mathematics*, *Conferences of American Institute of Aeronautics and Astronautics*, and others. He is a senior member of ACM and AIAA, and a member of IEEE and MAA.