



# Hands-on Experience with Virtual Labs:

Virtual production environments for safe, affordable technology training

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## Overview

Proverbial wisdom tells us that there is no substitute for real experience. When it comes to providing a rich and compelling interaction with a technology, letting students experiment with an application can truly make the sale or drive home key learning points. Virtual Labs (vLabs) enable users to go beyond a static demonstration or simulation. Students can make mistakes and experiment in a real environment, gaining practical experience by working with a technology first hand.

vLabs are a combination of multi-tiered software environments, at-the-ready server-side and technology applications, and automated scheduling configurations, which support an overlay of structured training design. Almost any hardware or software configuration can be mirrored with the vLab technology—even custom environments or proprietary application modules—to meet your specific technology training needs.

We will explore how vLabs can be used to enliven and complement other training modalities and also serve as an effective pre-sales demonstration tool. In addition, associated benefits of vLabs, such as eliminating the risk to client-side infrastructure and reducing overall costs, will be discussed.

## Where Do vLabs Fit?

The diverse methods of training delivery each have their place in a blended learning environment. Until recently, online learning has consisted of two primary modalities: asynchronous and collaborative.

**Asynchronous**, self-study e-learning allows students to study at their own pace, at times and places that are convenient for them. These courses immerse students in the software environment, providing a high degree of interactivity to reinforce basic skills and the ability to repeat lessons as necessary. Examples of this type of learning range from linear PowerPoint-based instruction materials to highly complex online simulations, where training branches into various scenarios based on students' decisions.

**Online collaborative learning**, including instructor-led web-based training that leverages web-conferencing tools, creates a virtual classroom environment where learning takes place synchronously in real time. Students can ask questions, interact with instructors and their peers, and enjoy the benefits of a “traditional” live classroom lecture.

In addition to these two modalities, IT trainers also supplement their programs with reference materials, such as e-Books, for just-in-time answers to technical questions. The combination of these learning tools, based on program objectives, budgets, and student preferences, typically constitutes a blended approach to training. These approaches, however, still present training in a manner where students absorb knowledge passively.

It is well known that student retention rates are directly linked to the degree of active participation. vLabs provide a real environment where students can experience and use a software or hardware technology in real time—not via simulations that are often isolated from the larger context of learning. By allowing students to interact with a live environment, vLabs provide an experience similar to working on a production network at a company. This approach builds confidence and enables students to “think on their feet,” actively practicing the techniques assimilated either through the asynchronous or online collaborative learning model.

## Benefits of vLabs

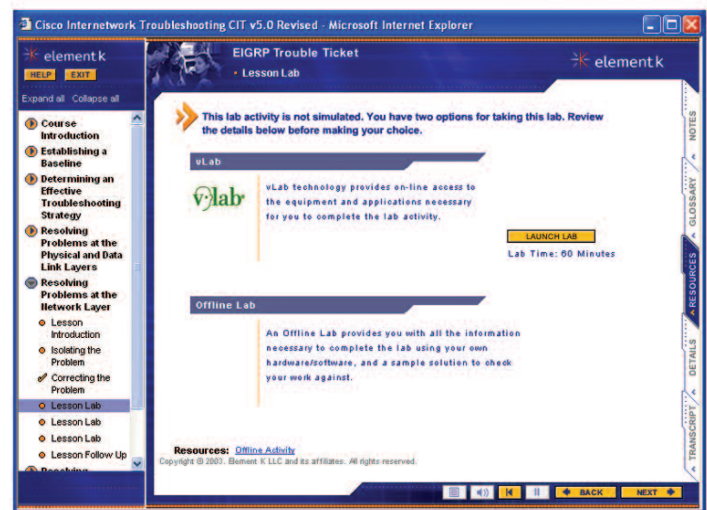
From a student's perspective, the benefits of hands-on personal training offered by traditional labs are clear. Lab modules provide targeted technology training that is invaluable. However, potential costs /risks of setting up servers and software for novice users to train with are often enough to dissuade most organizations from investing in such a solution.

In a vLab, students have all the advantages of traditional labs, operating in a dedicated environment to fully experience and reinforce hard skills they have acquired. They are free to explore, make mistakes, and engage their skills without risk to critical and costly equipment. In addition, there are no setup / maintenance costs from the organization's perspective. If students get stuck at any point in the lab, not only do they have access to online content with suggested approaches to accomplish the lab objective, but they can restore individual systems within the virtual environment on their own without the time-consuming and dangerous rework necessary on actual systems. In addition, an instructor can monitor the vLab in real time and offer help as though he or she were sitting in the same physical classroom as the student.

- Performance Assessment:
  - Create a lab report for Client/Server and Cisco labs. This report conveys the depth of the student experience to the instructor and can be used as the basis for determining a grade.
  - Skills-based assessment for select Cisco labs: In advanced technology tasks such as internetworking, multiple-choice questions cannot sufficiently assess student learning. vLabs offer a highly advanced assessment engine that can automatically grade a student's work by collecting the device state. Collected data is compared to the author's assessment data and a grade is generated.
- Anytime, anyplace individual access. This flexibility often eliminates the need to sit through an entire day or week of training.
- On-demand practice for numerous IT skills.
- Centralized hardware and automated application image management.
- Cost savings associated with administration and capital purchases.
- Opportunity for enterprises to focus on core aspects/objectives of their organization instead of procurement, implementation, maintenance, and upgrade of technology systems.
- Quicker return on investment.
- Infrastructure and technology can support pre- and post-sales training as well as educational training needs.

## The Element K vLab Solution

The vLabs management system controls deployment, scheduling, device control, assessment, and an extensive catalog of labs. There is no need for clients to manage lab resources or orchestrate delivery. Students simply select from a list of labs available to them and can either launch the lab via the on-demand solution or schedule it for some later point in time. Unlike traditional labs, which must be configured and completed at a given location, vLabs are available anytime, anyplace. In addition, labs may be integrated with other types of learning tools, incorporated into courses, or integrated with a learning platform to facilitate a blended learning experience, as shown in *Figure 1*.



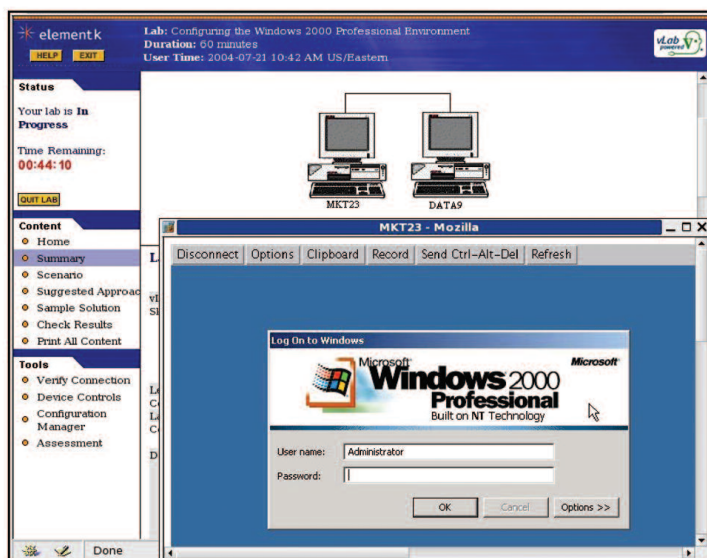
*Figure 1: A lab embedded within a course.*

Upon launching a lab, the system goes through an initialization process. Once equipment preparation is complete, the student is presented with a highly intuitive interface, shown in *Figure 2*. Using this interface, the student can easily follow the lab content to learn lab objectives.



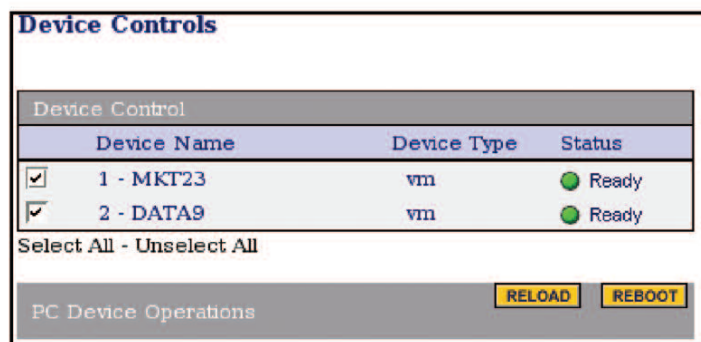
*Figure 2: A lab in progress.*

Students directly connect to the device upon clicking the device icon. *Figure 3* demonstrates connection to a remote workstation.



*Figure 3: Opening a remote console window for a Microsoft device.*

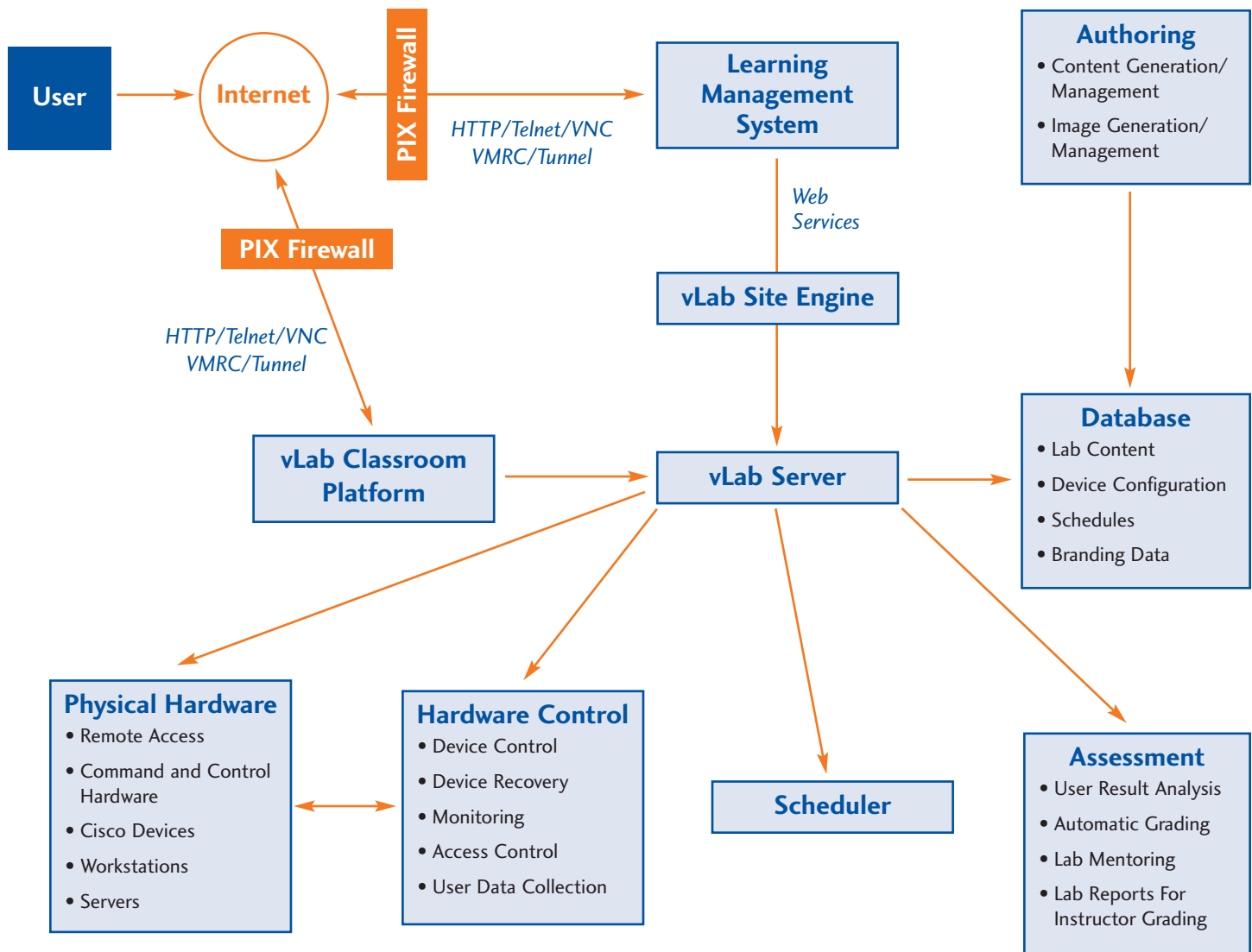
Students are given the ability to reboot / reload any device within the virtual environment at any point in the lab via the device control window (*Figure 4*). This is useful if something undesirable has taken place and rebooting the device is the only option.



*Figure 4: Device control window.*

## vLab Technical Architecture

Components of the vLab system are diagrammed in *Figure 5*:



*Figure 5: vLab component diagram.*

## vLab Features

### Integration:

vLabs are readily accessible through Element K's learning platform, KnowledgeHub™, which can be branded and personalized. Furthermore, via the vLab API, vLabs can integrate seamlessly into an LMS, website, or technical courseware package.

### Easy Access:

Students access devices through their browsers with ActiveX or Java plug-ins. No external programs are required. Element K also provides proprietary tunneling software that enables device access from behind extremely restrictive firewalls.

### Security:

Pods are configured to be "air gapped" between the client and host networks. Thus, a student learning a new routing protocol cannot accidentally take down the local network by injecting bogus routes, nor will a student taking a Microsoft lab launch a virus onto the local network.

## vLab Environment

Students have the following options available to them within the vLab environment:

- Root access to operating systems running within each virtual device
- Complete access to software applications
- Internet access for http, telnet, and ftp exercises
- Access to network share for storage / retrieval of user files

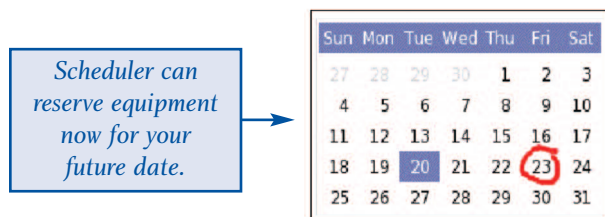
Other features include the following:

### Automated Hardware Control

Hardware control software manages loading and cleaning of the virtual and Cisco devices. Intelligent software automates the task of recovery and device preparation for the next user no matter what actions the previous user has taken. Both Cisco and Client / Server labs can also be easily restarted by a student via the Reload button in the device control window. In a matter of seconds, everything within the student's network is reset to the initial state, with no physical intervention required by support staff.

### Scheduling

An advanced scheduler automatically handles all resource management. A lab can either begin immediately, if resources are available, or the student can schedule the lab for a future time period, as shown in *Figure 6*.



*Figure 6: Advanced scheduling.*

### Authoring

With Element K's content and image management system, labs can be created in less than a day. The content authoring system is web-driven, eliminating the need for complex XML editors. The author enters the content into forms, syntax checks the work, and previews before publishing.

Device image creation is also easy via the image-authoring tool. The author simply selects the base operating system, configures the device with the required applications, and then presses the Save button.

### Customization Options

Not only can custom labs be developed for proprietary applications, but custom dedicated environments can be setup either at Element K, behind your firewall to address any security concerns, or closer to the end user to optimize performance. Any of these options would be able to leverage all capabilities of the vLab platform.

### vLab Classroom

With vLab Classroom, instructors can teach students, residing in geographically dispersed locations, in a synchronous learning environment with ease. With real-time shadowing capability, instructors have a window into everything the students are doing for the duration of the lab session. This solution is used as a replacement for classroom gear by "bricks and mortar" training organizations and as the infrastructure for IDL (Integrated Distance Learning) courses.

### Performance Assessment

Via the Performance Assessment tool, organizations have the ability to measure not only student performance on Custom, Cisco, Windows, Unix, and Linux labs, but also effectiveness of the overall vLabs program. Too often, organizations spend a significant amount of money and time establishing a learning program without any means of assessing true effectiveness of that program.

With this capability, students would be required to create a lab report as they progress through the performance-based lab. The report would then be delivered by the application to the lab reviewer with text and virtual machine screenshots taken at various points throughout the lab. The lab report conveys depth of the student experience to the lab reviewer and could be used as the basis for determining a grade. A built-in word editor and screen capture capability make for a seamless process. With respect to Cisco labs, configuration files for each of the Cisco devices are captured automatically by the application. The report, which includes Cisco configuration information, is emailed by the application to the lab reviewer upon completion of the lab.

For a set of Cisco labs, the highly advanced Assessment Engine automatically evaluates a student work by collecting device state. Collected data is compared to the author's assessment data and a grade is generated, providing real skills-based assessment.

## Lab Content/Products

With over 25 years in the training and development industry, Element K has been leading the market with innovations in content delivery. As the first online learning provider to offer vLabs as part of an integrated learning solution, Element K has placed emphasis on delivering training modules based on real-world applications and issues. Our vLab content is created by a team of world-renowned network experts, all of who are vendor certified as instructors and/or consultants in their fields. The content is customizable to meet your needs and may be presented either as stand-alone labs or integrated into e-learning courses. Real-time instructor moderation, sample solutions and lab assessment tools all provide differing levels of support to students at every step of the process.

### • Lab Content

Lab exercises within a vLab contain the following parts:

#### Scenario

A case-based exercise comprised of four sections:

- 1) Assignment: Gives a brief description of the lab exercise that must be performed during the session.
- 2) Story: Presents the challenge to set the scene for the exercise.
- 3) Notes/Conditions: Presents network details that offer hints on how to solve the problem presented in the lab.
- 4) Network Diagram: Illustrates network hardware related to the lab exercise, thereby providing a visual description of the equipment used in the scenario.

#### Suggested Approach

This section provides students with a list of steps they can take as they attempt to meet the lab's objectives. No solutions are provided. Rather, it offers hints that create a roadmap to help students arrive at the appropriate problem resolution.

#### Sample Solution

Detailed sequence of tasks to solve each step in the Suggested Approach section are recommended.

#### Check Results

The Check Results mentoring option offers students a self-assessment feature. The student is either presented with a completed file for cross comparison or a sub-task that would demonstrate successful completion of the original exercise.

### • Microsoft and Cisco vLab Exercises

The objective is to achieve readiness for Cisco and Microsoft certifications.

Each lab in the Microsoft offering helps students practice a certain aspect of designing, configuring, or administering Windows systems. Microsoft labs map to the MCDDT, MCSA, and MCSE test objectives.

Cisco labs enable students to practice key tasks, such as telnetting to another site and remotely configuring actual networking / internetworking gear. Cisco labs map to CCNA, CCENT, CCDP, and CCIE certification objectives.

Element K offers over 1,500 vLab exercises in the following topics, in addition to labs based on custom applications.

Microsoft	Network & Security	Certification/Non-Microsoft
Microsoft® Windows® XP Operating System	Interconnecting Cisco Network Devices (ICND)	Lotus Notes 6
Microsoft® Office 2003	Cisco Internetwork Troubleshooting (CIT)	WebSphere
Microsoft Windows Server 2003	Building Cisco Multilayer Switched Networks (BCMSN)	IBM® Lotus® Domino® 6/6.5
Microsoft® Windows NT® 4.0	Cisco's Command Line Interface	IBM® Lotus® Domino Designer® 6/6.5
Microsoft® Windows Server™ Active Directory	Cisco Routers and Catalyst 1900/2820 Series Switches	IBM® Lotus® Domino® 7
Microsoft® ADO.NET	Managing Network Performance with Custom Queuing	Cascading Style Sheets (CSS)
Microsoft® ASP.NET 2.0	Cisco Certified Network Associate (CCNA)	COM+ Applications
Microsoft® Visual Studio® .NET	Cisco Certified Entry Networking Technician (CCENT)	ASP.NET 2.0
Microsoft® Visual Studio® 2005	CCNP Building Cisco Remote Access Networks (BCRAN)	Visual C# .NET
Microsoft® ASP.NET	Cisco Voice over IP (CVOICE)	Java Server Pages
Web Service Architectures and Technologies	Building Scalable Cisco Internetworks (BSCI)	Crystal Reports 9.0
Microsoft® BizTalk® Server 2004	Building Scalable Cisco Networks (BSCN)	Extensible Markup Language (XML)
Visual Basic .NET	AppleTalk Tunneling	XML Web Services
Microsoft® Windows SharePoint Services	Routing Information Protocol (RIP)	Security+ Certification
Microsoft® SQL Server™ 2005	Internet Gateway Routing Protocol (IGRP)	A+ Certification
Microsoft® Internet Security and Acceleration Server 2004		Network+™ Certification
Advanced Microsoft® .NET Application		Linux+™ Certification
<i>Many, many more!</i>		<i>Many, many more!</i>

These vLabs provide the perfect opportunity for students to safely and effectively hone their skills through independent study according to their development paths. This learning wrapper, along with a platform that enables automation, scheduling, assessment, remote shadowing, device control, and control over content / images via the authoring environments, makes for a solution that is unmatched in the market.

## Hosting and Support Services

Element K's vLab product is hosted at Frontier's Tier 1 Web Hosting Facility in Rochester, NY. This Cyber Center delivers a secure, fault-tolerant environment and offers the following support:

### Zero downtime

Redundant power supplies, network infrastructure, and self-healing SONET network ensure that our Internet traffic is never interrupted.

### Bandwidth

With burstable bandwidth, Element K can accommodate traffic spikes on demand and plan for any future vLab growth needs.

### Security

Designed to withstand any act of man or nature, the Frontier Cyber Center provides 24/7 peace of mind with multiple layers of security:

- Technical safeguards include anti-virus, anti-spam, and the routine patching of production systems to meet current best industry standards.
- Physical safeguards including access to the co-location facility meet the highest industry standards. This includes security guards, multiple mantraps, surveillance cameras, and biometric hand scanners.
- Intrusion detection / prevention systems and firewalls are strategically placed throughout the network.

### Monitoring

In addition to our Network Engineer support team, Frontier's Network Operation Center technicians keep a watchful eye on our servers and internetworking devices.

### Support

- Element K offers 24x5 support for all vLabs customers.
- Element K SMEs are available/accessible for all second-level support.

## Conclusion

vLabs provide a dynamic, hands-on experience that has been proven to help students retain and deepen hard technical skills gained through other forms of learning. Offering 24x7 remote access to live equipment, professionals can get the practice they need without risking damage to their organization's infrastructure. Almost any hardware or software configuration can be mirrored with the vLab technology—even custom environments or proprietary application modules—to meet your specific technology training needs. In addition, a large number of vLabs that support all major Cisco®, Microsoft®, CompTIA®, and Linux® certifications are offered by Element K. To find out more about how your organization can benefit from vLabs, contact your Element K sales representative at [www.elementk.com](http://www.elementk.com) or 1.800.434.3466.