ENABLING PERSONALIZED LEARNING

A Practical Guide to Developing K-12 Information Networks

Telspan Since 1968
Voice, Data & VoIP Solutions

Alcatel·Lucent
Enterprise

THE NEW AGE CLASSROOM

A growing number of K-12 schools worldwide are adopting new technologies to provide a rich, multimedia learning environment to students. By engaging students through mobile devices and the applications they thrive on, schools are hoping to transform established approaches to teaching and create a more cooperative and collaborative knowledge sharing process. Textbooks are being swapped out for e-books that download content in real time. One-to-one and Bring Your Own Device (BYOD) initiatives are becoming more popular than wired computer labs. Skype™ and Google® Hangouts are fueling new study groups. And virtual field trips are creating new student development opportunities.

While tablets, smartphones, and laptops become more prevalent in the classroom and new technology devices, such as teaching aids, come to market, information technology (IT) teams in school districts worldwide are re-evaluating their network infrastructures to determine how best to support digital learning initiatives and practices. This guide provides a step-by-step approach IT teams can use to design efficient and cost-effective K-12 data networks that can accommodate the technology needs of today and protect network investments by easily adapting to the digital learning vision of tomorrow.

1: Plan for Reliable Digital Learning and Testing Environments

The first step in building a network infrastructure that delivers a high quality user experience in the classroom is to plan for a reliable digital learning and testing environment. This should be based on an accurate assessment of current and future bandwidth requirements for the applications and services the new network will be expected to support.

In most countries, data is available that outlines bandwidth recommendations for specific online activities. For example, many new student testing systems based on computer adaptive technology recommend 5-50 Kbps of bandwidth per user for testing, which adds up to 1.5 Mbps in a classroom of 30 students. However, the education standards bodies in each country may recommend more bandwidth per user. In the United States, for example, the new Common Core curriculum guidelines for a rich digital classroom exceed these test requirements.

"The ultimate power of blended and online learning lies in their potential to transform the education system and enable higher levels of learning through competency-based approaches. Technology-based models can allow for rapid capture of student performance data and differentiated instruction tailored to the specific needs of individual students. By adapting instruction to reflect the skills and knowledge students have mastered, blended and online models have the potential to keep students engaged and supported as they learn and to help them progress at their own pace, leading to dramatically higher levels of learning and attainment."

INTERNATIONAL ASSOCIATION FOR K-12 ONLINE LEARNING (INACOL), OCTOBER 2013

Table 1: Example of computer-based test requirements

	MINIMUM WITH CACHING	MINIMUM WITHOUT CACHING	RECOMMENDED FOR ASSESSMENT AND INSTRUCTION
External connection to the Internet	5 kb/s per student	50 kb/s per student	100 kb/s per student or faster

In addition to sufficient bandwidth, an effective digital learning network infrastructure should also provide:

- **Fair access** to network resources by all students on both wired and wireless networks based on device and access management capabilities
- **Effective traffic management** based on application visibility and control that enables IT teams to prioritize all learning streams and classroom test traffic
- **Secure delivery** of multimedia content based on policy controls that ensure learning multimedia traffic gets priority treatment over other types of traffic

Planning for a network with these features ensures all devices and students have a similar digital learning experience on the network. And it gives IT teams the ability to restrict non-learning traffic, as required.

APPLICATION FLUENT NETWORK PROVIDES NETWORK VISIBILITY AND CONTROL

Alcatel-Lucent provides application layer visibility and control through award winning Application Fluent Network strategies:

- Apps Dashboard offers application visibility and control, and improved diagnostics for latency sensitive applications, such as test traffic, voice and video calls
- Roll-based policy engine enables policy enforcement per application and application group
- Airtime fairness and network access features ensure all devices get their fair share of network access through role-based policy implementations

WOLF CREEK PUBLIC SCHOOLS DRIVES BYOD WITH FULL NETWORK ACCESS AND CONTROL

LOCATION: Alberta, Canada

DETAILS: 27 schools; 7000 students; 1000 staff

CHALLENGE:

- Enable students and staff to fully use social media and their own devices to support learning while still maintaining a high level of security and integrity for the district network and all data.

SOLUTION:

Integrated Alcatel-Lucent access and control solution, which includes:

- OmniPCX™ Enterprise and Unified Communications
- OmniVista™ Management Solutions
- OmniAccess™ Controllers and Access Points

BENEFITS:

- Students can now connect anywhere on campus on any device
- BYOD policy means less PCs for Wolf Creek to purchase
- Full visibility of network and resources enables management of day-to-day usage

2: Deploy Pervasive WLAN

Supporting digital learning, especially in one-to-one environments, requires a Wireless Local Area Network (WLAN) infrastructure that can handle a large influx of mobile devices and the bandwidth-hungry applications running on them. There are several things you can do to prepare for this:

1. PLAN FOR DENSITY

Plan to support three to four mobile devices per student, as well as teacher devices, wireless printers, and other wireless equipment in the classroom. This means that for an average classroom of 30 students the network should have the capacity to support more than 120 devices at any given time.

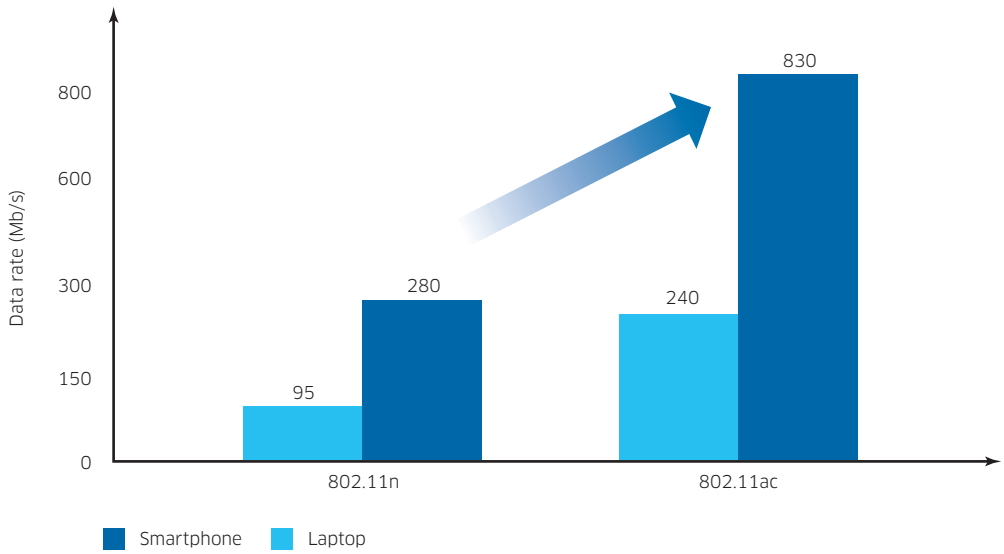
2. ASSESS WLAN BANDWIDTH REQUIREMENTS

Assess classroom application needs by collaborating with teachers to determine what is required to support a rich multimedia curriculum. For example, if your teachers expect to use video-based teaching aids that stream video to multiple devices, you'll need a WLAN network capable of supporting multiple, high quality video streams. The average HD-quality video stream uses 4 Mbps of bandwidth per user and interactive learning games require 1 Mbps of bandwidth per user.

3. MIGRATE TO 802.11 AC TECHNOLOGY

With the arrival of 802.11ac Wi-Fi® technology Gigabit Ethernet throughput is possible on wireless networks. Consider adopting this new standard to address classroom density requirements with a pervasive WLAN network. In addition, this technology provides faster data rates and more reliable connections for all devices, including those based on 802.11n.

Figure 1. Faster data rates are possible with 802.11AC



4. ELIMINATE ROAMING ISSUES

Finally, look for a solution that solves sticky client issues. As students roam between access points (APs), their devices can get stuck on an AP instead of associating with a closer one that has a stronger signal. The ideal digital learning network infrastructure should eliminate this so that poor AP performance does not drag down the entire network.

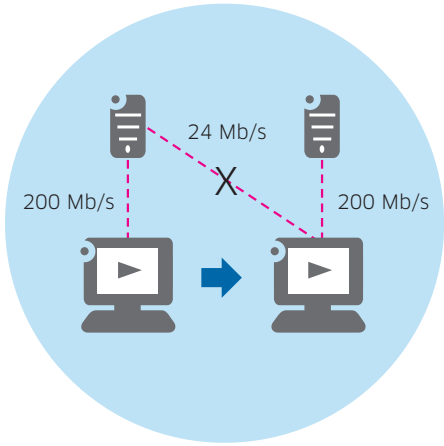
BEST-IN-CLASS SOLUTIONS ENABLE HIGH PERFORMANCE WLAN

The Alcatel-Lucent pervasive WLAN solution offers maximum network architecture flexibility to deliver mobility anywhere – district offices, school premises, remote/satellite premises, and remote connectivity from home.

Our industry-leading WLAN solutions do not require network controllers and our best-in class Instant AP (IAP) solutions come with everything you need to establish a high performing, secure network without worrying about software licenses. As your network grows in complexity, you can easily migrate to a controller-based architecture by simply deploying a controller that will convert your IAPs to controller-managed APs without any rip and replace processes. That's solid investment protection that ensures your network is future-ready for any requirement. And we offer a wide array of APs, from entry level to industry leading 802.11ac and 802.11n APs, which support advanced security and a single set of features at all locations.

To ensure all users get the high performance connection they need, our WLAN solutions include our unique ClientMatch™ RF management technology. ClientMatch monitors all devices and automatically matches them to the right radio on the right AP, boosting overall WLAN performance and delivering consistent, predictable performance to every user while eliminating the sticky client problem. This ensures all users get the highest quality experience and optimizes the overall performance of the network.

Figure 2. ClientMatch technology automatically matches devices to the right AP



RIDLEY SCHOOL DISTRICT ENABLES DENSE TABLET ENVIRONMENT WITH PERVASIVE WLAN

LOCATION: Folsom, Pennsylvania

DETAILS: 5600 students

CHALLENGE:

- Support a one-to-one mobile device learning initiative and state online testing requirements for a dense use, tablet environment.

SOLUTION:

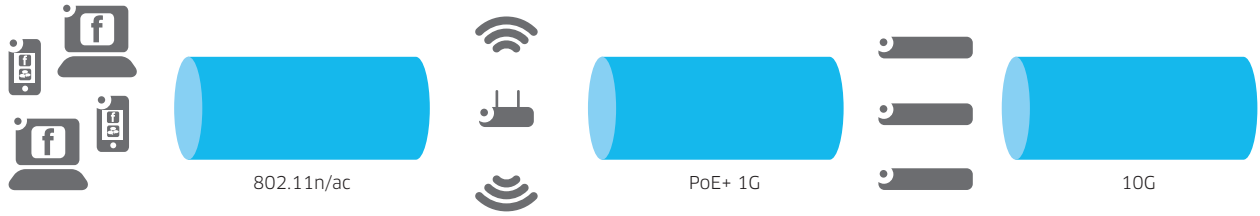
Alcatel-Lucent pervasive WLAN solution built on:

- OmniAccess Access Points

BENEFITS:

- Students can participate in online learning management system and cloud-based curriculum resources using tablets and laptops
- Excellent connectivity everywhere provides full support for online testing

Figure 3. Gigabit Ethernet ports and uplinks eliminate traffic congestion issues



3: Evaluate the Entire Access Network

To support next-generation digital learning applications in the classroom, as well as full mobility for students, choose wired network solutions that are ready to apply policies to users, devices and applications based on the same contextual data as your wireless network. So instead of creating and managing separate access policies for wired and wireless networks, you'll have one consistent set of policies for both. This simplifies your network deployment and management efforts and gives you full control over all traffic.

A wired network solution that allows you to unleash the full potential of Gigabit Wi-Fi enabled by 802.11ac should:

- Avoid traffic congestion with at least 1 GbE port and 10 GbE uplinks at the edge
- Take full advantage of 802.11ac with Power over Ethernet+ (POE+) ports

VERSATILE SWITCHES TRANSFORM ACCESS LAYER

Alcatel-Lucent offers a wide variety of versatile, secure, high-performance wired network access layer switches with advanced policy frameworks. These switches offer:

- Built-in embedded security
- POE+ capability
- In-service software upgrade (ISSU) features
- Application fluent network software

And our flexible deployment approach allows you to pay for 100M/1G today and upgrade to 1G/10G by simply paying for a license upgrade at a later date.

KENNEWICK SCHOOL DISTRICT TRANSFORMS WIRED AND WIRELESS NETWORKS

LOCATION: Kennewick, Washington

DETAILS: 16,000 students

CHALLENGE:

- Support a digital learning initiative by upgrading wired and wireless networks to support Internet in the classroom and access everywhere, while maintaining the security and safety of all students.

SOLUTION:

Integrated Alcatel-Lucent wired and wireless network solution, which includes:

- OmniSwitch Stackable LAN Switches
- OmniAccess Access Points
- OmniPCX Enterprise Communication Server

BENEFITS:

- All students now have wired and wireless Internet access in all classrooms.
- Teachers can now incorporate technology in every lesson
- Safety and security of students is assured with network control over all alerting systems

4: Upgrade the District Core/Server Room/ Data Center Network

An efficient, high performance access network is only as good as the core network it connects to. The core is the most critical part of your digital learning infrastructure because it must support more than 80 percent of all LAN and Wi-Fi user traffic for applications and communications.

To get the full benefit of a next-generation access infrastructure, you'll want to ensure your core network is ready to handle all the traffic coming from the access layer. When planning your new network consider:

- Deploying 10G/40G switches that eliminate bottlenecks and support virtual network design
- Right-sizing with small, high capacity switches that can form a virtual chassis and provide more than seven Terabits/sec of switching capacity
- Streamlining your wired infrastructure by reducing the number layers in your network design and eliminating a separate distribution layer to reduce your capital expenditures (CAPEX) and operating expenditures (OPEX)
- Rethinking Virtual LANs (VLANs) with software-defined, flow-based policies that optimize wired and wireless traffic paths without changing your existing network
- Choosing newly-designed, less power hungry switches with lower power requirements
- Vendors that support pay-as-you-grow strategies that reduce budget pressures, but don't compromise product features

DATA CENTER SOLUTION ENABLES RIGHT-SIZED, VIRTUALIZED NETWORK CORE

The Alcatel-Lucent Data Center solution for digital learning infrastructures provides a simplified network core built on a new generation of switches that have non-blocking, high performance capability. Our OmniSwitch 6900 switches use network virtualization techniques that make a set of switches behave like a single unit, while providing the necessary redundancy, fast recovery on link or switch failure, and full utilization of all links to the access layer. And because these switches behave as a single unit, your entire core network is simpler to manage. You use less space and consume less energy. And the switches are configured with expansion slots that allow you to scale and add higher speed ports all the way up to 40 G, whenever you need to grow.

Plus, our data center solution enables deployment of a two-tier network instead of a traditional three-tier design. This approach and our virtual chassis core technology delivers 30-70 percent CAPEX savings in addition to 30 percent or more OPEX savings over traditional architectures.

GWINNETT COUNTY SCHOOL DISTRICT TRANSFORMS CORE NETWORK

LOCATION: Gwinnett County, Georgia

DETAILS: 165,000 students; 135 elementary, middle and high schools; 30,000 employees

CHALLENGE:

- Better educate the greatest number of the county's pupils and create a more interactive learning environment for homebound students by extending the classroom beyond county campuses

SOLUTION:

Advanced Unified Communication and Collaboration solution built on a more efficient network core, which includes:

- OmniSwitch Stackable LAN Switches
- OmniAccess Controllers and Access Points

BENEFITS:

- Students, staff, and guests have access to a secure BYOD digital learning environment
- Lower total cost of ownership (TCO) in the data center core and the edge infrastructure
- Role-based access control over all user access and traffic

5: Simplify Network Management

Once you have your access and core network designed to support an optimal digital learning environment, you'll want to consider more efficient network management options. Despite having limited IT resources, you can keep digital classrooms running by looking beyond traditional CLI-based network management and opting for a simpler and more cost-effective unified network solution that meets your district needs and can manage both wired and wireless networks. With an integrated management solution, you can better manage the application and device experience of users on networks that extend across geographically dispersed locations – from school campuses to district offices and maintenance yards.

Choose a solution that enables you to provision, monitor and manage:

- Policies across access layer on both wired and wireless networks
- Application fluency across all access networks
- Datacenter/server room elements and resources
- BYOD services (which device, what privilege, when, where, etc.)

This approach will enable you to better manage IT time and resources compared to multiple, siloed point-products that solve only one or two management issues. And to optimize all IT resources, consider a cloud-based management solution, which can reduce the cost and complexity of IT operations by eliminating the need to install and maintain multiple individual management appliances.

UNIFIED NETWORK MANAGEMENT SYSTEM DRIVES EFFICIENCY AND PRODUCTIVITY

The integrated, easy-to-use Alcatel-Lucent OmniVista™ 2500 Network Management System (NMS) provides centralized management, bulk operations, simplicity and scalability that simplifies network management in any digital learning infrastructure. It uniquely combines a full set of end-to-end network operations and security management for unified access with the LAN and Wi-Fi equipment of an Alcatel-Lucent Enterprise networking solution within a single cohesive platform.

The OmniVista 2500 NMS puts a full range of applications, tools and analytics in the hands of network managers. This makes it easier to meet the complex demands associated with new services, fast growing and evolving technologies, such as unified access, BYOD, virtual desktop and constant security threats.

Adding an OmniVista Network Management System to an Alcatel-Lucent Enterprise network infrastructure can:

- Deliver savings of up to 20 percent in costs compared to separate LAN and WLAN infrastructure management
- Optimize CAPEX and enable pay-as-you-grow through node licenses
- Operate on a virtual machine, thereby eliminating the purchase and maintenance of a dedicated server

6: Embrace BYOD and Guest Management with Confidence

Students, teachers, staff and guests that will connect to your new school network with a variety of personal devices will create a difficult access and traffic management challenge. How do you provide wired and Wi-Fi access to these devices and keep the network secure with limited resources? Choose a device onboarding solution that automates and simplifies the onboarding process without sacrificing access security.

With an advanced BYOD solution you can:

- Enforce differentiated network access based on contextual information, such as user roles (students, teachers, staff), device types (laptops, tablets, smartphones), and location (classrooms, common areas, district offices), which enables secure management and enforcement of differentiated policies
- Simplify device onboarding by allowing users to self-enroll and granting network access privileges based on user roles, device types and location
- Consider a simple captive portal that displays a web page, similar to a Wi-Fi hot spot where students can simply accept the connection or sign in using their school credentials, if you want to map traffic back to an individual user
- Opt for 802.1X authentication with Advanced Encryption Standard (AES) security features, which allow users to enter a user name and password or self-enroll by automatically generating and installing device certificates through a web portal with no IT assistance

BYOD AND GUEST ACCESS SOLUTION SIMPLIFIES ONBOARDING, MAINTAINS SECURITY

Alcatel-Lucent offers simplified BYOD and guest access solutions that make it easier to onboard and manage network access for personal devices and guests in any K-12 network infrastructure. These solutions provide:

- Automated device provisioning
- Certificate authorization
- Mobile device management
- Restricted access
- Secure user and device access
- Profiling
- Health checks
- Single sign-on
- Compliance and audit reporting
- Self-registration
- Sponsor enablement
- Bulk registration
- Hot spot/Captive portals
- Bandwidth restrictions
- MAC Caching

7: Leverage Low-Cost Alternatives for Classroom Display/Projection

To enable interactive learning on your new network you'll want to explore network-shared devices, such as Apple TV® or other digital sharing solutions based on Digital Living Network Alliance (DLNA) standards as low-cost alternatives to traditional projectors. Maintaining the security of these devices is critical. You'll want to prevent students from hijacking them to share inappropriate content or cause disruptions in class. At the same time, you'll want to enable teachers to grant access to groups of students to present their projects in class.

Confidently deploy all digital sharing devices on your network by:

- Choosing an access management solution that securely enables network-based digital sharing over the air and supports policy-controlled access enforcement
- Controlling the visibility of AirPlay®, AirPrint™ and DLNA devices to teachers, students and staff, based on a user's role, location and what device they're using

AIRGROUP TECHNOLOGY SIMPLIFIES CLASSROOM DIGITAL SHARING

Apple® devices, such as Apple TV and Apple printers, and other DLNA devices, were designed for easy connectivity in a residential network. When these devices are added to a more complex network environment, such as a school network, they just don't work. This is because there are multiple subnets and VLANS, as well as too many users that should not have access.

Alcatel-Lucent AirGroup™ Network Service enables Apple and other devices based on DLNA standards to be used in any classroom, safely and securely. With AirGroup technology you can control access to these devices through policies that define and limit which devices are shown to teachers and students based on who they are and where they are.

For example, AirGroup allows you to define policies that allow:

- A teacher to access Apple TV in the classroom and auditorium, as well as a printer in the library
- Students to access a library printer, as well as an Apple TV/Projector in the classroom, but not in the auditorium
- District staff to access Apple TV in an auditorium, but not in the classrooms

AirGroup manages access based on VLAN stitching. It also allows users to self-register devices based on pre-defined policies. It does not require any service set identifier (SSID), VLAN or routing table configuration.

Alcatel-Lucent is the first and only vendor to support AirGroup for both wired and wireless devices.

8: Interconnect School Networks and Extend Connectivity

Your new network should be able to go beyond an individual school and interconnect all K-12 school premises with the district office. To ensure this is managed efficiently and cost-effectively, choose a vendor who can provide a one-stop-shop, end-to-end network solution. This will simplify your network design and deployment process and lower your costs. More importantly, it will provide you with a single point of contact for any future service and maintenance requirements.

When considering network extension options, choose:

- Environmentally hardened access switches and access points to provide connectivity around school premises and at outdoor locations, such as play fields or outdoor cafeterias
- WLAN-based point-to-point and/or point to multipoint bridging connections, which offer a great way to extend your entire network to another premise without having to lay cables
- Network solutions that support IP cameras, which you can use to secure school premises

While you're at it, you may also want to consider extending your network connectivity to include school buses and other district vehicles. This will make it easier to:

- Improve safety by enabling tracking and monitoring of vehicles at all times, as well as video streaming from onboard cameras
- Extend teaching applications via the school bus to keep students engaged and connected
- Enable one-to-one computing on route to and from school to enable students to continue working on school projects while they are riding the bus

HIGH CAPACITY, MULTI-FUNCTIONAL SOLUTIONS ENABLE NETWORK EXTENSION

Alcatel-Lucent offers high capacity multifunctional enterprise network solutions that can be used to extend your network anywhere within your school district:

- The Alcatel-Lucent OmniAccess 5850 is ideal for medium to large schools where it can be deployed as a WAN device. Its integrated Wi-Fi functionality can be leveraged to provide Wi-Fi connectivity to smaller sites, as well as to students and staff on school buses. And its 3G/4G capabilities can be used to connect sites back to a district office.
- The Alcatel-Lucent OmniSwitch 6855 is an environmentally hardened wire-rate Gigabit switch that provides outstanding performance when supporting real-time voice, data, and video applications. It includes the same set of security features for access control, policy enforcement and attack containment features that are present in our indoor switch products.
- Our OmniAccess outdoor WLAN APs are designed to extend network access in outdoor locations, such as stadiums, play fields, and parking lots.

9: Empower Teachers

While technology enhances learning, it also creates new challenges for teachers in a digital classroom because students can get easily distracted on their mobile devices. To address this challenge, give teachers greater visibility and control over how mobile devices are used in their classrooms. This is the best way to minimize distractions and ensure that students stay on task.

Choose a purpose-built classroom management system from a solution provider who specializes in classroom applications. Award-winning classroom management systems, such as LanSchool, empower teachers by allowing them to observe and control student device screens, co-browse, block apps and keep everyone focused on learning.

CLASSROOM MANAGEMENT SOLUTION PROVIDES GREATER CONTROL

Alcatel-Lucent offers LanSchool Lite+ free to all WLAN solution customers. This application enables teachers to:

- View and control student activity
- Monitor up to 3,000 students per console
- View thumbnails or full screens
- View battery status
- Co-browse
- Control web access
- View students' active and last application
- View student questions

And LanSchool uses efficient screen capture and transfer methods. For example, if the entire teacher's screen is changing, LanSchool only uses approximately 24 Kbps to transfer that image to the students' screens. This is less than 1 percent of a 100 MB network.

Deliver a Better, Personalized Learning Experience

In this era of personalized digital learning, all users want to have a better multimedia experience, while using the device of their choice. Alcatel-Lucent application fluent network solutions offer excellent value with solid investment protection and seamless high quality experiences. They provide:

- Unified policy with Pervasive WLAN
- Optimized LAN core and edge and network extension capabilities with a wide range of choices
- Simplified network management capabilities

Our digital learning network solutions enable device freedom, whether devices are school-provided, personal, wired or wireless. And our solutions ensure critical assets are secure at all times.

With Alcatel-Lucent digital learning infrastructure solutions you get network designs that can provide reliable learning and test environments, empower teachers in the classroom, and enable low-cost technology adoption for classroom projections.

In addition, we offer professional service auditing, assessment, and design, as well as 24x7 support and training.

Find out how we can help you deploy the optimal digital learning network in your school district:

http://enterprise.alcatel-lucent.com/education

Telspan *Since 1968*

Voice, Data & VoIP Solutions

Our Approach

It is critical for businesses to understand how to utilize new technologies as they emerge. Telspan uses a unique five-step approach to determine your requirements and design the solution that best fits your business.

1. The Study…

2. The Design…

3. The Recommendation…

4. The Implementation…

5. The Relationship…

About Us

Telspan provides complete voice, data and wireless system design, installation and maintenance services. Our clients range all industries including education, retail, medical, law, government and non-profit organizations.

With offices in the northeast, Telspan's service area is complemented by a nationwide network of technicians so that all of your locations can be cared for with one phone call.

*****SPECIAL*****

Contact us today for a free Wireless LAN evaluation!

Telspan, Ltd.

corporate office: South Windsor, CT *regional office:* New York, NY

phone: 860-761-1411

email: info@telspan.net

web: www.telspan.net