Automation for Education Networks

Use Juniper Zero Touch Provisioning to Simplify Network Deployment, Improve Uptime, and Reduce OpEx

Education Zero Touch Provisioning Solution Overview

Digital learning tools, Internet resources, and collaboration have become an essential part of education today. In K-12 schools, blended learning and one-to-one computing programs are reshaping the classroom and engaging today's tech-savvy children. In higher education, bring your own device (BYOD) is the norm, and students expect to use their smartphones, tablets, laptops, game consoles, and other Wi-Fi devices in classrooms, dorm rooms, and everywhere in between.

Educational institutions can meet the unprecedented demand for connectivity with high-performance, highly reliable campus and data center network solutions from Juniper Networks. By taking advantage of Juniper's automated network configuration and deployment capabilities, schools can deliver the network experience students, faculty, and administrators expect, while simplifying network operations and lowering operational expenses (OpEx).

Challenges

An explosion of mobile devices, a growing appetite for applications and media, and rising security concerns are placing new burdens on education networks. To meet these challenges, schools are expanding their networks to meet student and faculty expectations for high-performance and highly reliable, always-on connectivity.

The school network is mission-critical, and downtime cannot be tolerated when class assignments, lectures, research projects, or even late-night gaming parties are involved. The diversity and richness of educational applications are growing as learning increasingly leverages interactive curricula, collaboration tools, streaming media, and social media. The success of the Common Core assessments depends on connectivity, too. In higher education, universities and colleges that have poor quality, non-ubiquitous network access, quickly discover that this is affecting their enrollment rates.

The number of Wi-Fi devices and the types of devices that students bring to a university or college campus are exploding. Students commonly have three or more devices—smartphone, tablet, laptop, gaming device, or streaming media player—and expect flawless connectivity. In addition, higher education is deploying wireless IP phones for better communications, IP video cameras to enhance physical security, and sensors for a more efficient environment. The projections for the Internet of Things, which will connect hundreds of billions of devices in a few short years, are nothing short of staggering.

Trends

With student, faculty, and administrator expectations for connectivity rising, the complexity and cost of networking is growing exponentially. In addition to this growth, the "adding on" of networking equipment to old designs is causing the network to become increasingly fragile. IT budgets are tight, and technology requirements are expanding faster than funding.

What if schools took a step back and had a unique opportunity to proactively design their networks to meet their challenges today and tomorrow? What if deploying the network was easy, not a manual, time-consuming chore? What if your initial design and build could scale for years to come, without having to build configurations on the fly every time? What if networks were easier to plan and build, configure and deploy, visualize and monitor—and had automated troubleshooting and comprehensive reporting?

It's time to modernize how educational institutions design, build, and maintain networks, taking advantage of automation and modern management tools to create scale, consistency, and efficiency.

Juniper Networks Zero Touch Provisioning Solutions for Education Networks

Juniper Networks zero touch provisioning solutions help educational institutions simplify network deployment and troubleshooting, improve uptime, add capacity more easily, and reduce OpEx.

For the campus, the Popup Campus automation workflow uses zero touch provisioning with Juniper campus and branch solutions, including partner wireless LAN solutions, Juniper Networks® EX Series Ethernet Switches, Junos® Space Network Director and Service Now to deliver scalable, future-proof campus solutions.

For the data center, you can use the same technology to deploy top-of-rack switches as you need to create scale for your highly demanding applications.

Juniper's zero touch provisioning allows you to provision new Juniper Networks switches in your network automatically, without manual intervention. When you physically connect a switch to the network and boot it with a default factory configuration, it attempts to upgrade the Juniper Networks Junos operating system software automatically and auto-install a configuration file from the network.

This initial configuration can be just enough to get your switch on your network and can then alert your network operations team, via Junos Space Network Director, that it is available and ready to receive its final configuration via templates. Alternatively, with Juniper's advanced automation capabilities, your initial configuration file can be used to kick off an advanced configuration process that will automatically generate complete configurations as well as integrate with third-party management solutions that fit the needs of your organization. These new processes can greatly reduce your deployment time as well as decrease your overall resource cost.

Figure 1 demonstrates how we have been configuring our network equipment for years. We start with unboxing the equipment. Once unboxed, the network engineer then begins to build a configuration from scratch or uses a previous configuration from a similar device, where configuration variables are replaced (by hand) to create the new configuration. This configuration is then installed onto the new switch, which in turn is then repackaged and shipped or installed in its permanent location.
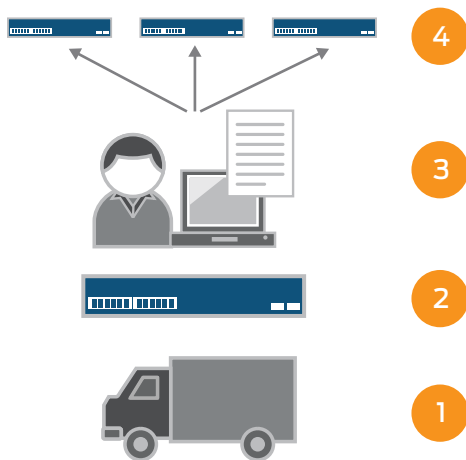

Figure 1: The old way requires someone to manually install a configuration on each device either during staging or during deployment.

Figure 2 demonstrates ZTP or zero touch provisioning. To begin the installation process, a device is simply unboxed with a factory default configuration, installed on the network, and powered up. Once the device is running, it will request an address via Dynamic Host Configuration Protocol (DHCP), where it will get a response containing one or more vendor-specific attributes (VSAs). These VSAs will define the version of Junos OS that the device should use, upgrade if necessary, and then install an initial (bootstrap) configuration on the device. In the simplest form of the Juniper ZTP process, the device then sends a message to Junos Space Network Director and an operator can push previously defined templates to configure the device.
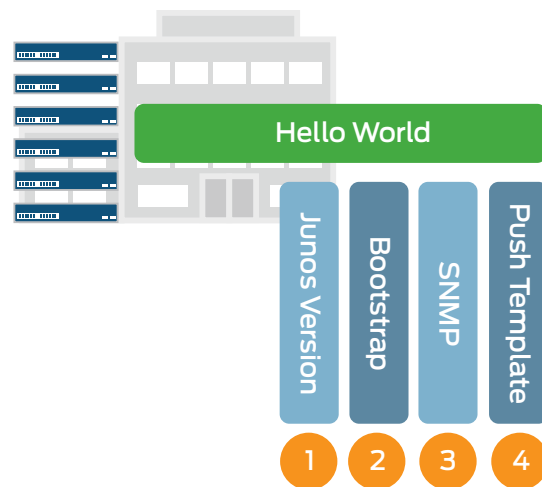

Figure 2: The automated way allows a switch to install its basic network configuration itself, while an operator deploys templates via Junos Space Network Director.

This is where some vendors have limitations in their ability to deliver a fully customized zero touch experience. With Juniper's extensive automation capabilities, you can build a fully customized solution that fits the needs of your education environment, maximizes the efficiency of your limited resources, and ensures minimum downtime by reducing the steps in the troubleshooting process.

Figure 3 depicts this process. You will note that Steps 1 and 2 are identical. However, the bootstrap configuration passed to the Junos OS device in Step 2 contains instructions for the device to reach out to a network connected server and pass on a unique identifier. This can be any number of attributes like the IP address of an interface, Link Layer Discovery Protocol (LLDP) information, and serial number, just to name a few.
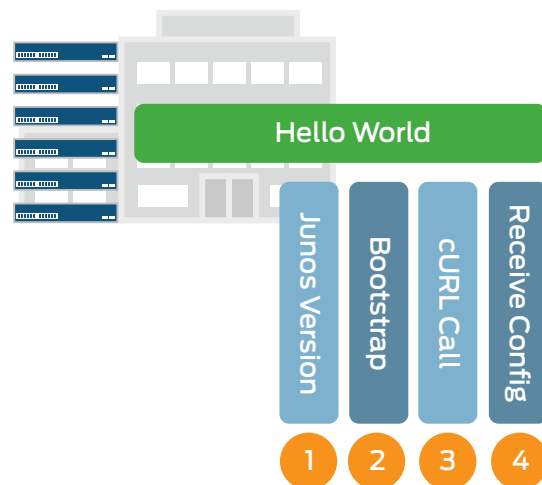

Figure 3: Demonstrates a more customized approach to ZTP, or "Advanced ZTP."

In Figure 4, a cURL call in Step 3 reaches out to (in this case) some type of webserver, which then takes the passed unique attribute and creates a configuration via installing device or location-specific variables to a template. This results in a device-specific configuration based on your business logic. Once the configuration is built, you can then pass it to the device directly via the Advanced ZTP server, or you can use the Junos Space API to pass this configuration via Junos Space. Using Junos Space will also allow you to import the device into inventory for further management and monitoring. This process allows for far more flexibility and ensures that your device gets the appropriate configuration without relying on an operator to push a device-specific template or templates, something that will ultimately result in more opportunity for human error.
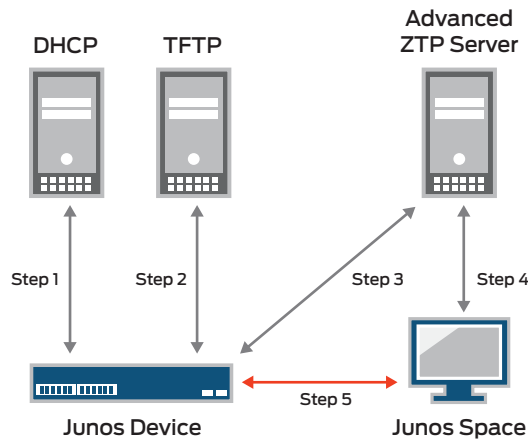

Figure 4: Depicts the process from the server point of view. Please note Steps 4 and 5 are optional as Junos Space is not a requirement.

With the flexibility of Junos OS automation, neither Junos Space nor Junos Space Network Director is a requirement. This allows your business to integrate the management of your Juniper networking equipment with the management solution of your choice. You can do this directly via standard protocols to the Junos OS device, or via integration of the Junos Space APIs, utilizing Junos Space as an intermediary between your higher level management platform and your Juniper networking equipment.

Table 1. Juniper Networks Zero Touch Provisioning Solution for Education Benefits

Solution	Benefit
Deployment	Reduces time and operational cost of the deployment of your data center or campus network.
Scale	Once you create the initial design, your organization or one of Juniper Networks' partners can build an automated deployment solution that will allow you to add network equipment without reengineering your configurations. This could result in a future-proof network that you can roll out efficiently over time.
High availability	When an issue inevitably occurs, rather than troubleshooting an individual piece of equipment, which can elongate downtime, simply use a cold sparing model where a failed switch can be replaced by "smart hands" and receive a location default configuration and operating system. This eliminates hardware issues and can allow you to install minimum running parameters to restore service quickly.
Common network services (no special servers)	ZTP relies on common network services such as Trivial File Transfer Protocol (TFTP) and DHCP that exist already in most networks today.

Summary—Save Time with Automated Deployment from Juniper

Free IT staff from time-consuming network configuration and monitoring tasks with Juniper Networks' zero touch and advanced zero touch provisioning. By taking advantage of automated network configuration and deployment capabilities, schools can deliver the network experience students, faculty, and administrators expect, while simplifying network operations and lowering operational expenses.

It's time to modernize how educational institutions design, build, and maintain networks, taking advantage of automation and modern management tools to simplify the job. Juniper's ZTP makes it easier to deliver the always-on, highly reliable connectivity that students, faculty, and administrators need today, and will continue to need into the future.

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