



WHITEPAPER

White Box Networking in Remote and Branch Offices



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With hundreds or thousands of locations to be connected, managing network services in remote or branch offices can be a significant challenge. Network services support everything from internal and guest Wi-Fi to Internet access, internal data networking, VoIP phones and video. All of these services have to be delivered and managed in a cost-effective way, but many solutions require rolling an IT truck to each location (prohibitively expensive) or adopting expensive proprietary hardware along with onerous support contracts.

Pica8 offers a different solution – white box switches and networking software that support all the features a branch office needs with remote management, but without the high cost and without vendor lock-in. This paper describes Pica8's approach to remote and branch office networking.

Remote and Branch Office Networking Challenges

Branch office networks have several common elements. Branches are hundreds or thousands of miles away from the corporate headquarters, and there are typically no trained IT people on site in each branch. Rather, these networks are centrally controlled and administered from the corporate data center.

Recognizing the need for trouble-free, centrally-managed networking infrastructure many years ago, branch office equipment vendors built proprietary, fully-integrated systems to handle networking chores. The problem with this approach is that entrenched vendors with proprietary hardware/software architectures demand high costs as they extend their contracts with locked-in enterprise customers. In addition, full-service 24x7 solution support (hardware, software, interoperability and applications) adds to the cost, exacting the steepest possible pricing from enterprise customers.

White Box Networking: A New Approach to Branch Office Networking

Over the past ten to fifteen years, the IT industry underwent a transformation. Rather than buying proprietary servers with proprietary operating systems, enterprise IT departments began buying "white box" servers from suppliers like Quanta and Dell, and running standard operating systems like Linux on them. Today, it's far less common to see customers buying servers with proprietary operating systems pre-installed on them.

A few years ago, mega-scale data centers like Google, Facebook and Amazon wanted to replicate the white box server paradigm with network switches, so they defined standard Ethernet switch architectures that allowed them to buy switch hardware from the best source and put their own switch software on it. Since these companies made very large investments in switching software development teams, they could make this work.

Today, enterprises of all sizes are buying white box servers and running Linux or other operating systems, and this trend has now migrated down to networking switches. A number of open networking software companies like Pica8 have emerged, offering enterprises a standards-based, full-featured network operating system (NOS) for use with white box switches.

By using white box switches, enterprises can separate hardware purchase decisions from software decisions, just as is done with application software and servers. This freedom of choice drives costs down.

The first place these economies were realized was the data center, where the savings are multiplied by the large quantity of Top of Rack switches. Enterprises are recognizing that the same savings are possible anywhere there are numerous, similar switches. Remote and Branch Offices are a perfect fit – with many identical locations, no on-site IT support, and the need for a flexible approach to fit emerging business requirements while conserving precious budgets.

Our network operating software is called PicOS™ – the Pica8 Operating System – and it brings a broad range of networking capabilities to white box switches.

PicOS in the Remote and Branch Office

Pica8 has focused on bringing the best capabilities of open networking to the Remote and Branch Office. Besides the cost savings, there are several things needed to satisfy networking in this environment.

Branch offices, particularly today's retail stores, must support a dynamically changing set of demands, including:

- Data – transactional support for the business – must always be the highest priority
- Voice – IP phones require Power over Ethernet (PoE), plus enough protected bandwidth to ensure call quality
- Video – surveillance cameras, plus advertising and promotional video – also have specific bandwidth requirements
- Wi-Fi – not only supporting retail employees, but also allowing store customers to browse, check product details, and interact with new retail applications
- Emerging new immersive technologies – new ways of selling are quickly evolving
- Emerging WAN strategies, including SD-WAN – replacing traditional dedicated links while offering much higher speeds
- Whatever's next – for example, virtual or augmented reality – demands on branch offices will continue to advance



Figure 1. PicOS in the Remote or Branch Office.

Pica8 network operating software includes many features which have been developed to support this challenging environment. We continuously work with leading customers to adapt our powerful feature set to emerging branch office requirements. Some features we've provided include:

- Advanced, granular QoS – giving network architects the tools they need to prioritize and protect classes of traffic
- Device detection and PoE management – PicOS can recognize approved device types and provide power to them, both simplifying the installation process and preventing un-authorized devices from getting powered on.
- Unapproved devices can be blocked from the network.
- A rich set of switching protocols and management interfaces are supported
- CrossFlow – Pica8's merging of OpenFlow with standard protocols – provides a set of tools which can be used to create unique and powerful solutions.

Hardware-independent switching software in the remote and branch office enables secure network services as well as repeatable, template-based, automated, centrally-delivered network element management. Thus, network management efficiency is extended from the data center to branch and remote office networks. This allows enterprises to minimize branch and remote office CapEx and OpEx while significantly enhancing application availability and performance.

Pica8's Networking Software

By using Pica8's networking software, PicOS, on white box switches, enterprises can unwind the vendor bundle, thereby introducing significant value via the introduction of:

- Hardware price competition
- Use of the best-designed platform
- A full suite of hardware features
- Elimination of first-line support costs for tech-savvy enterprises

With Pica8 and other open switching software sources, this strategy is available to anyone. The industry has seen adoption across data centers, telcos, and enterprises. Today, network management and switch software give network managers visibility into and dynamic automated control over network bandwidth, route congestion, outages and bandwidth allocation to ensure maximum uptime.

How PicOS Works

Pica8's PicOS switch software is an intelligent Network Operating System. PicOS is optimized for remote and branch office networks. It offers autonomous, comprehensive Layer 2 (L2) switching and Layer 3 (L3) routing protocols, QoS for real time media prioritization, support for IEEE 802 standards, as well as automated deployment and configuration.

Platform-independent switching software offers a new wave of application and data security as well as management in the LAN and WAN. The already difficult-to-manage WAN has become more complex with the rise of SaaS and BYOD. Management of switching software plays a pivotal role in raising security, performance and reliability in the remote and branch office. Challenges in the LAN and WAN are addressed with automated network provisioning and flexible linking between LANs and data centers via LAN-WAN network management.

PicOS CrossFlow: Enhanced Packet Control & Modification

Native to every PicOS-based switch, PicOS implements a flexible packet control method whereby normal L2/L3 switching and routing can be modified based on the network manager's CrossFlow processing instructions. These instructions are executed by the switch's processor prior to L2/L3 switching/routing. CrossFlow supplements normal L2/L3 processing without needing an external controller. It can read packet contents, examine L2/L3 headers, and even parse user-defined fields for application-specific use in L2/L3 processing, optimizing traffic for other network elements or the enterprise's remote or branch office applications.

Furthermore, PicOS supports centralized control of provisioning, security (including AAA authentication and TACACS+), DoS prevention, ACLs, SSH and SSL. Automated remote management is supported via standard networking interfaces plus OpenFlow and Pica8's CrossFlow (see below). Alternate network uplinks are managed automatically.

Centralized, programmable network and virtualization management, coupled with platform-independent switching software can easily adjust to the rapidly-changing needs of businesses. This can lower costs and limit wasteful provisioning, as well as provide flexibility and innovation for networks.

PicOS' portability to new and improved future hardware platforms is assured by Pica8's use of the Open Network Install Environment (ONIE). This is a standardized method for loading new NOS code to bare metal network switches from multiple manufacturers conforming to the Open Compute Project (OCP) Switch designs.

PicOS supports industry-standard software and switching silicon. It implements a broad set of networking protocols using the software architecture illustrated in Figure 2. The core software suite is contained in the modules within the gray block, while support of new platforms is enabled by hardware abstraction in the vASIC layer. This enables PicOS to quickly add the latest and best silicon and hardware to the PicOS hardware compatibility list.

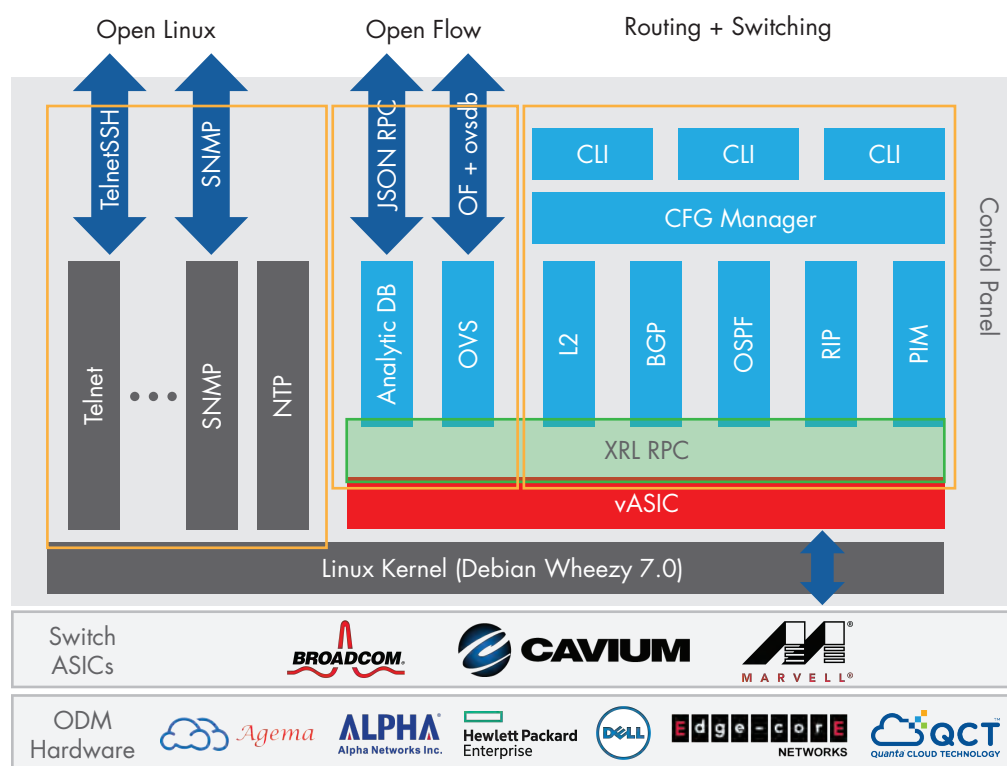


Figure 2: PicOS architecture. PicOS can run on multiple silicon versions and multiple hardware vendors' switches.

The Economics of White Box Networks

Due to the virtualization of network, compute and storage, enterprises now reap the economies of scale available from centralizing the data center within large complexes containing multiple processors in thousands of servers, just as the mega-scale data center operators like Amazon, Microsoft, Google and Facebook do.

Where there are large numbers of similar branch office installations, the economics of platform-independent switching software executed on white box hardware are compelling, and companies have begun to achieve savings and operational advantages by deploying this approach. Figure 3 shows a comparison of a remote office architecture based on Cisco equipment versus the same architecture deployed with a white box switch and PicOS.

| Cisco Switch | Cisco Discounted Pricing | Pica8 Open Solution (White Box + PicOS) | Pica8 Discounted Pricing | CapEx Dollar Savings Per Unit | CapEx Percentage Savings |
|--|--------------------------|--|--------------------------|-------------------------------|--------------------------|
| 48 Port UPoE NM-4-10G PW-C1 - 1100WC/2 | \$7,785 | Edge-core AS4610-54P PicOS 1G Bundle | \$3,639 | \$4,146 | 53% |
| 3 Year Smartnet Cost | \$2,119 | 3 Year Edge-core Warranty PicOS 1G Bundle 3 Year M&S | \$1,259 | \$860 | 41% |
| Cisco 3 Year TCO | \$9,904 | Pica8 Edge-core 3 Year TCO | \$4,898 | \$5,006 | 51% |

Figure 3: 3-year TCO savings: PicOS versus proprietary architecture

PicOS Automated Provisioning

Pica8's remote and branch office switch software delivers key benefits that provide IT operational productivity, accelerate deployment activation, improve network security and raise uptime reliability.

- Zero-touch provisioning – employees just plug in the switch and it configures itself; no need for on-site IT personnel
- Remote administration of all policies, including OpenFlow-powered ACLs and QoS
- Enterprise security, including access control – Pica8 supports industry-standard access control protocols to only admit authorized users to the network, per a centrally administered access policy
- Automation – as needs change, the enterprise can update and add features to its branch office solution from a centralized location. Pica8-provided tools allow changes to be easily rolled out across branches.

Supporting White Box Switches in the Enterprise Branch Office

PicOS-compatible white box switches include models made by Agema, ALPHA, EdgcorE, Quanta Cloud Technology, and others. These companies also make switching hardware for most major OEM switch vendors. In addition, brite-box (branded white box) switches are available from HPE and Dell. These white box and brite box switches give customers a broad range of choices, are mature and have very low failure rates.

Some enterprises may still be reluctant to deploy generic ODM hardware without a major networking equipment vendor's brand name. However, Pica8 offers high-quality software and hardware support to its customers in order to alleviate these fears. PicOS generates diagnostic messages, allowing remote diagnosis of hardware failures and software issues. Pica8 can offer full hardware and software support services, including immediate hardware replacement and repair, so that enterprises never have to worry about hardware failures or vendor finger-pointing.

For customers who choose to buy direct from a Partner ODM, the first line software and hardware support is delivered by Pica8 via phone and/or email. If needed, Pica8 tech support uses remote access to the switch to quickly isolate hardware failure and software issues. Then, the normal RMA process is used for returning the equipment to the PicOS-compatible hardware vendor. Pica8 will perform a root cause analysis to aid in our continuous product improvements.

Conclusion

Networking to the enterprise remote or branch office is complex and expensive, and enterprises want alternatives to proprietary hardware/software platforms. PicOS white box switching software addresses the expense by running on multiple white box switching platforms from several manufacturers.

PicOS solves the expense of automation and maintenance as well: by automating branch office networking and providing centralized policy control, Pica8 solutions enable fast, comprehensive, and cost-effective networking, eliminating use of on-site personnel for the bulk of IT management and raising IT staff productivity with built-in automation and remote management.

We at Pica8 stand ready to bring cost-effective switching to remote or branch offices, and to simplify remote networking with robust switching software.

To get started, please contact us at:

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