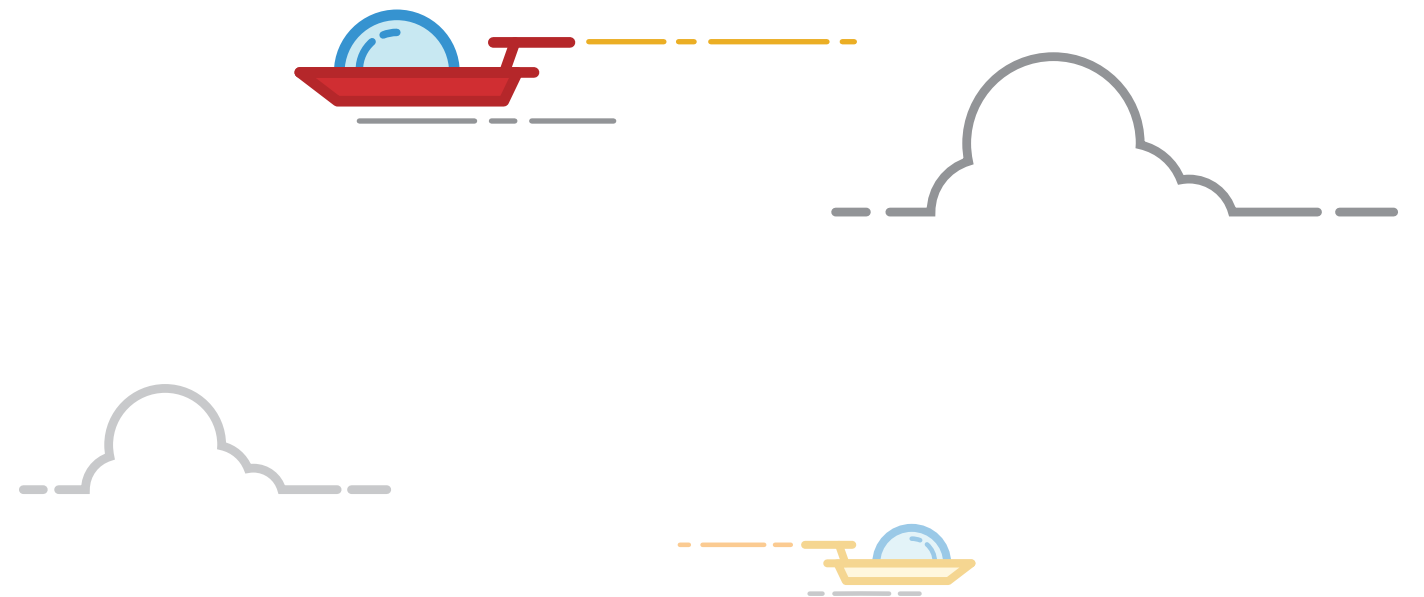# SD-LAN: THE FUTURE OF LOCAL AREA NETWORKS

Traditional Wi-Fi and wired access networks aren't keeping pace with today's rapidly evolving, dynamic wireless-first organizations— but there's a new solution that does.

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Introduction

By 2020, at least 20 billon devices will be connected to the Internet of Things—and many analysts predict twice that number.[1] Whether it's 20 billion, or even 50 billion, that's a lot of devices weighing down static networks and impeding performance.

For organizations, it's not as simple as limiting connections. In today's business world, the connections and flexibility afforded by mobile devices are essential.

But as more and more devices connect to your company network, unintended consequences follow: inconsistent wireless coverage; failed connections to employee, guest, and customer devices; staggered performance when accessing media-rich content; and unmanaged network access. Many companies are finding their legacy wireless LAN unable to run real-time applications, while others desperately need an easier way to handle the growing volume of BYOD, guest, and IoT devices that require access and authentication from the corporate network.

The results? Frustrated users, lost productivity, and serious security risks from relatively low-sophistication devices and an increased attack surface.

This eBook discusses the challenges of access networks and a new solution to those challenges: software-defined LAN (SD-LAN), which expands on the principles of software-defined networks (SDN) and SD-WAN to create increased wired and wireless access network adaptability, flexibility, cost-effectiveness, and scale while also providing mission-critical business continuity.

Only 1 out of 10 IT administrators consider their networks "future-ready."[2]
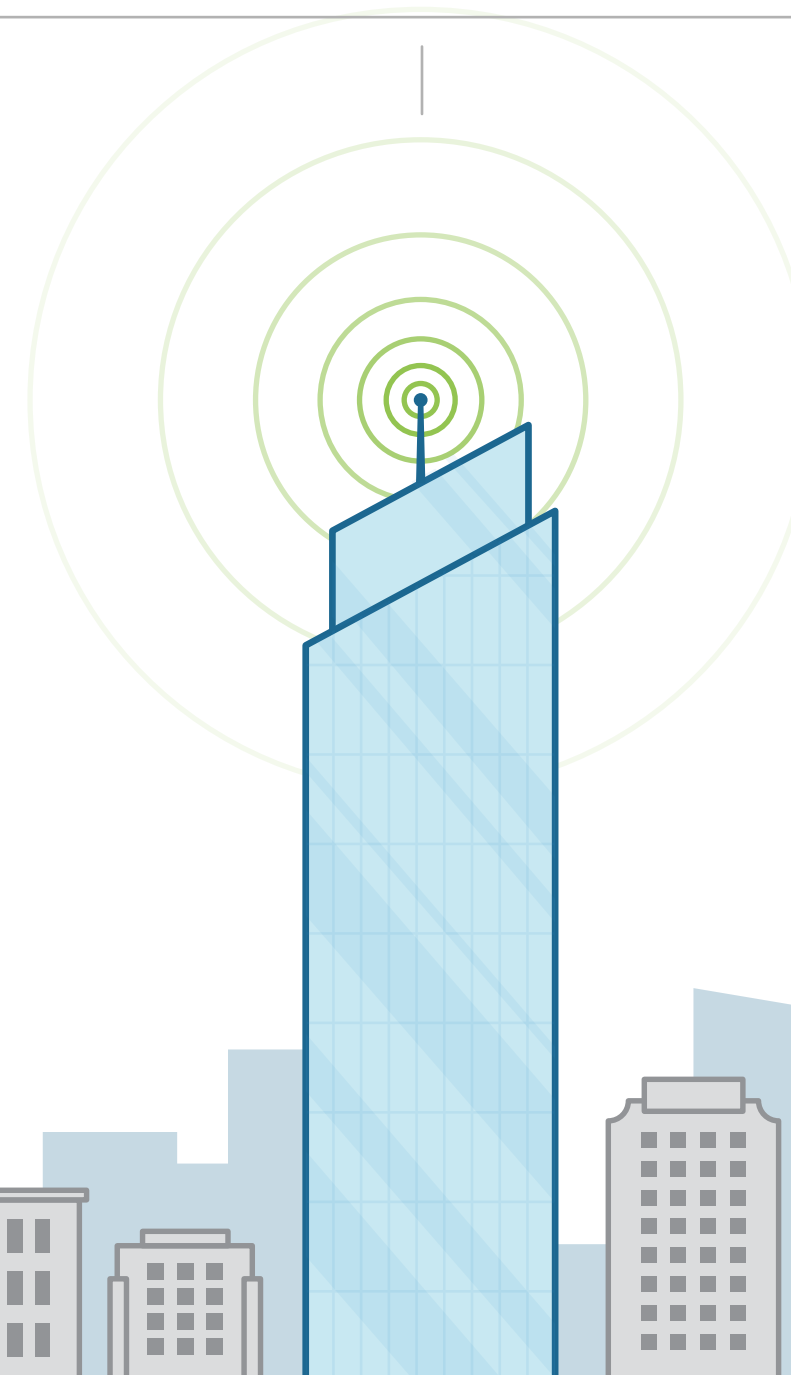
The (rapidly increasing) evolution of access networks

For most of the networking world's history, evolution came through hardware and software innovation. Now, software is driving dramatic changes in networking.[3] More aspects of our environment are digital, mobility is transforming lives, people are more connected than ever, and societal and global trends are contributing to the formation of a new software-defined world.

For enterprises, this mobile connectivity trend is redefining business processes and productivity. So expanding your wireless LAN is, or should be, a top investment priority.

However, with the increased pace of change driven by mobility and a wireless-first world, it is becoming increasingly difficult for vendors to meet demands without a complete rethink of network architecture approaches overall.

Five essential pre-requisites of today's access networks in a world where the only constant is change:[3]

- **Adaptability**—Continuously adjusts to client, application, and infrastructure changes

- **Flexibility**—Easily integrates with existing architecture and applications

- **Cost-effectiveness**—Reduces the cost of acquisition and ongoing operation of the network

- **Business continuity**—Self-optimizing, self-healing, and self-organizing operation

- **Scalability**—Starts small and grows— or shrinks—as requirements change

Key computing trends driving the need for a new network paradigm:[4]

Changing traffic patterns—Applications that commonly access geographically distributed databases and servers through public and private clouds require extremely flexible traffic management and access to bandwidth on demand.

The consumerization of IT—The BYOD trend requires flexible and secure networks.

The rise of cloud services—Users expect on-demand access to applications, infrastructure, and other IT resources.

"Big data" means more bandwidth—Handling today's mega datasets requires massive parallel processing that is fueling a constant demand for additional capacity and any-to-any connectivity.

Security in the Internet of Things—The only way to adequately secure IoT devices is through granular identity and a software-defined approach to security keys.

Given the explosive proliferation of devices throughout the network, IT departments must be able to build an intelligent infrastructure. This infrastructure must continuously adjust and adapt to keep up with the pace of change that mobility and IoT has created and provide reliable access and security to maintain business integrity. Because IoT provides such a large attack surface, adequate security measures through granular identity and a software-defined approach to security keys is vital. Scalability to support this influx of devices is also essential because it enables organizations to grow seamlessly without making major changes to the network, which can be complex and costly.

But in trying to meet today's dynamic networking requirements, network designers find themselves constrained by the limitations of current networks:[4]

- **Complexity that leads to stasis**—Adding or moving devices and implementing network-wide policies are complex, time-consuming, and primarily manual endeavors that risk service disruption, discouraging network changes.

- **Limited scale**—Traditional wireless LAN architectures rely on a centralized controller that has limited capacity, requiring additional components to be acquired as more access points are introduced. This becomes increasingly complex across distributed sites.

- **Vendor dependence**—Lengthy vendor hardware product cycles and a lack of standard, open interfaces limit the ability of network operators to tailor the network to their individual environments.

Unfortunately, the traditional, static way of designing, deploying, and operating access networks doesn't allow the network—or your IT team—to keep up with the dynamic pace of today's connected world. There has to be a better way.

There is: software-defined LAN (SD-LAN).

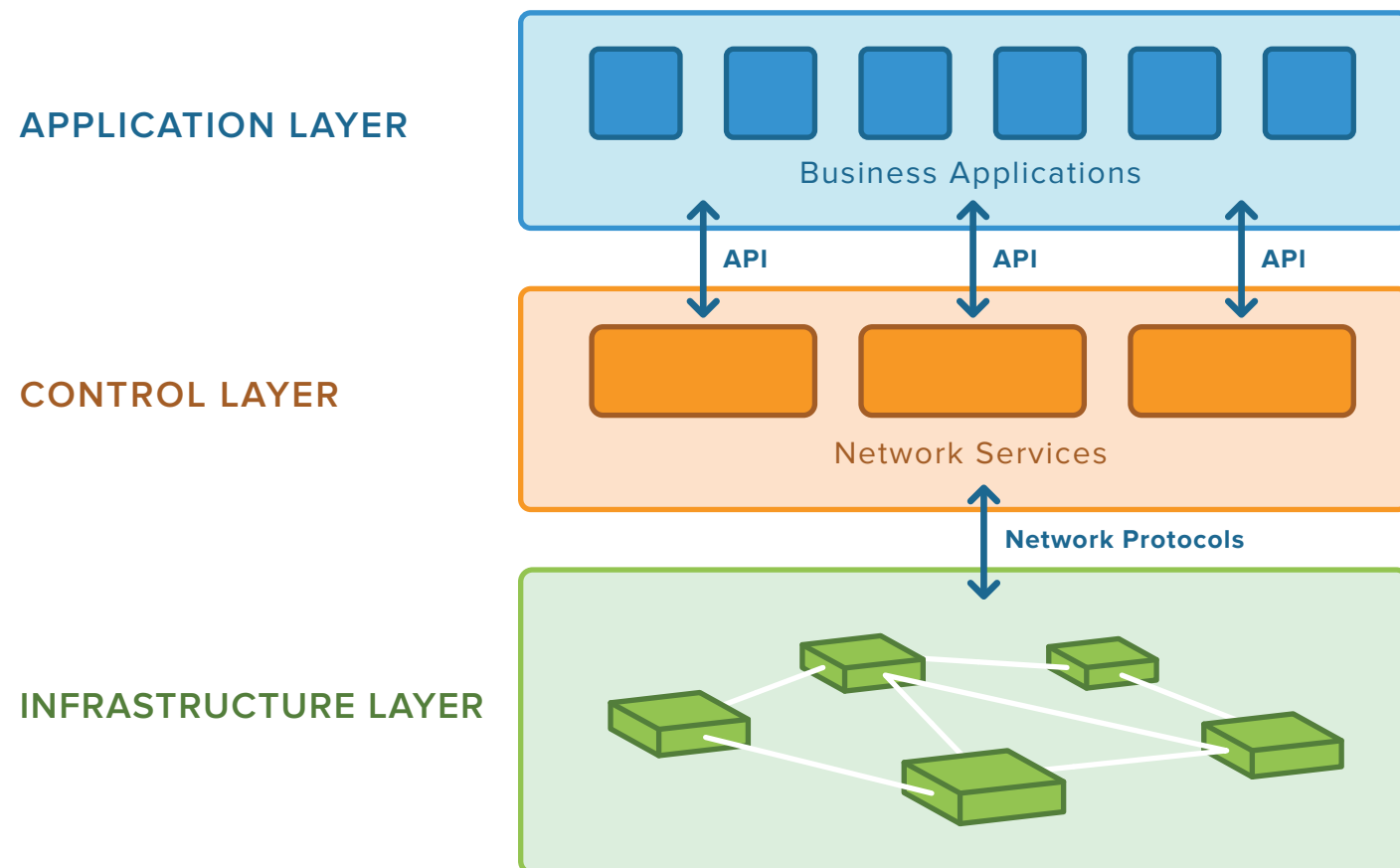40% of total network costs are devoted to maintenance and support.[2]

CHAPTER 2

What is SD-LAN?

To understand SD-LAN, let's first backtrack a bit and look at the architecture and technologies that led to SD-LAN.

Software-defined networking (SDN) is an emerging architecture that decouples the network control and forwarding functions, enabling network control to become directly programmable and the underlying infrastructure to be abstracted fo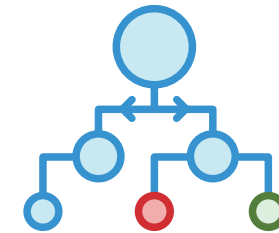r applications and network services. This allows network engineers and administrators to respond quickly to changing business requirements because they can shape traffic from a centralized console without having to touch individual devices. It also delivers services to where they're needed in the network, without regard to what specific devices a server or other device is connected to.[4] Functional separation, network virtualization, and automation through programmability are the key technologies.
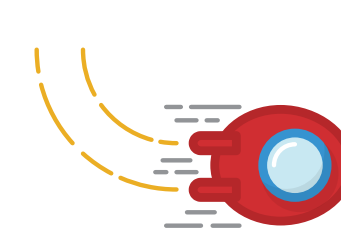
SDN setup:

APPLICATION LAYER

Business Applications

API   API   API

CONTROL LAYER

Network Services

Network Protocols

INFRASTRUCTURE LAYER

Source: Open Networking Foundation, https://www.opennetworking.org/sdn-resources/sdn-definition
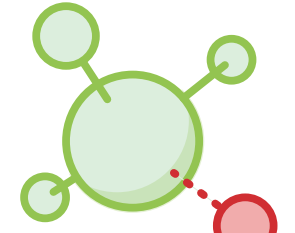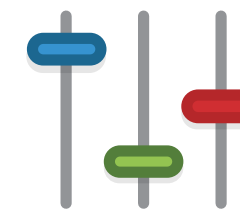
The SDN architecture is:[4]

Directly programmable

Agile

Centrally managed


Programmatically configured

Software-driven

But SDN has two obvious shortcomings: It's really about protocols rather than operations, staff, and end-user-visible features, function, and capabilities; and it has relatively little impact at the access layer (intermediary and edge switches and access points, in particular)—critical elements that define wireless LAN today.

Like SDN, software-defined WAN (SD-WAN) separates the control and data planes of the WAN and enables a degree of control across multiple WAN elements, physical and virtual, not otherwise possible. While SDN is an architecture, SD-WAN is a buyable technology. Much of the technology that makes up SD-WAN is not new; rather it's the packaging of it together—aggregation technologies, central management, the ability to dynamically share network bandwidth across connection points—that is.

Its ease of deployment, central manageability, and reduced costs make SD-WAN an attractive option for many businesses, according to Gartner analyst Andrew Lerner, who tracks the SD-WAN market closely.[6] Lerner estimates that an SD-WAN can be up to two and a half times less expensive than a traditional WAN architecture.

SD-LAN builds on the principles of SDN in the data center and SD-WAN to bring specific benefits of adaptability, flexibility, cost-effectiveness, and scale to wired and wireless access networks—while providing mission-critical business continuity to the network access layer. It is an application- and policy-driven architecture that unchains hardware and software layers while creating self-organizing and centrally managed networks that are simpler to operate, integrate, and scale.

An SD-LAN solution requires five key layers:
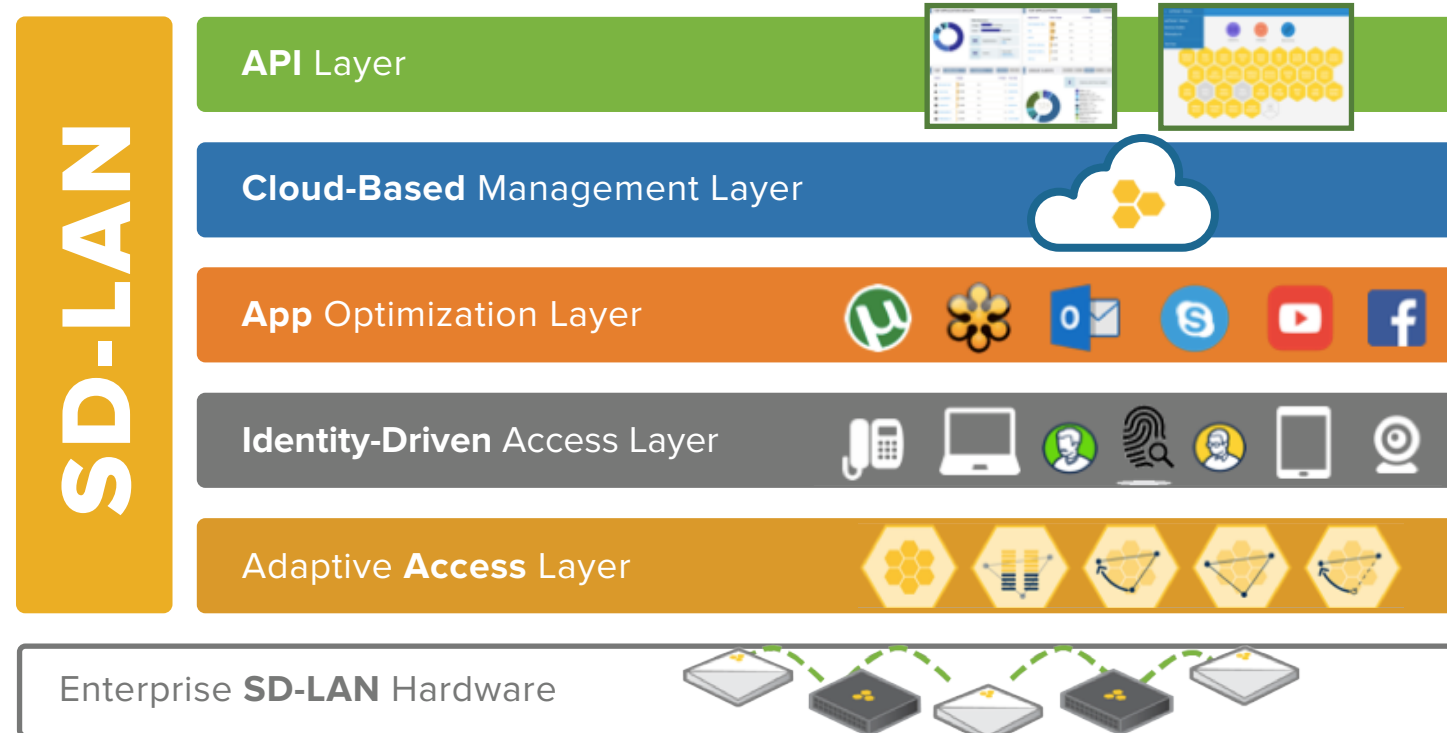
Application optimization prioritizes and changes network behavior based on the apps.

- Dynamic optimization of the LAN, driven by app priorities

- Ability to focus network resources where they serve the organization's most important needs

- Fine-grained application visibility and control at the network edge

Secure, **identity-driven access** dynamically defines what users, devices, and things can do when they access the SD-LAN.

- Context-based policy control polices access by user, device, application, location, available bandwidth, or time of day

- Access can be granted or revoked at a granular level for collections of users, devices and things, or just one of those, on corporate, guest and IoT networks

- IoT networks increase the chances of security breaches, since many IoT devices, cameras and sensors have limited built-in security. IoT devices need to be uniquely identified on the Wi-Fi network, which is made possible by software-defined private pre-shared keys.

Adaptive access self-optimizes, self-heals, and self-organizes wireless access points and access switches.

- Control without the controllers—dynamic control protocols are used to distribute a shared control plane for increased resiliency, scale, and speed

- Ability to intelligently adapt device coverage and capacity through use of software definable radios and multiple connection technologies (802.11a/b/g/n/ac/wave 1/wave 2/MIMO/MU-MIMO, BLE, and extensibility through USB)

- A unified layer of wireless and wired infrastructure devices, with shared policies and management

- The removal of hardware dependency, providing seamless introduction of new access points and switches into existing network infrastructure. All hardware platforms should support the same software.

Centralized **cloud-based network management** reduces cost and complexity of network operations with centralized public or private cloud networking.

- Deployment in public or private cloud with a unified architecture for flexible operations

- Centralized management for simplified network planning, deployment, and troubleshooting

- Ability to distribute policy changes quickly and efficiently across geographically distributed locations

Open APIs with programmable interfaces allow tight integration of network and application infrastructures.

- Programmability that enables apps to derive information from the network and enables the network to respond to app requirements

- A "big data" cloud architecture to enable insights from users, devices, and things

- An open developer program to enable an ecosystem of developers, software vendors, and MSPs

CHAPTER 3

How SD-LAN is changing the LAN landscape

Just *how* can SD-LAN help your organization—how do its specific features specifically serve your needs?

By basing core implementations and policies in software, network shops can realize enhanced configurability, scalability, continuity, and simplified operations while unlocking value beyond connectivity.

Increased operational efficiency

SD-LAN implementations are self-optimizing, self-organizing, self-reorganizing, self-configuring, and self-reconfiguring in response to changing conditions. This limits the day-to-day work of the operations staff largely to policy management and occasional troubleshooting and end-user assistance—which should increase staff productivity.

A single management interface for wired and wireless domains and unified network policies with device templates allow IT to configure any number of Wi-Fi devices and access switches. Access switches have dramatically different requirements than those at the core. The edge is getting more geographically spread out—with more users, more devices, and more locations.

Cumbersome command-line interface (CLI) doesn't work for edge switches anymore; these require easy, UI-based centralized cloud management and unified wired/wireless policies.

Reducing capital and operational cost

The removal of WLAN controller hardware and licensing can lead to dramatic cost savings—without loss of functionality. It can result in significantly lower relative capital expenditure (CapEx), reduction in footprint and associated operational expenditure (OpEx), simplified architecting and installation of access points, ease of ongoing management, and increased solution resiliency and user productivity improvements. With labor-intensive OpEx rapidly outpacing CapEx in today's business environments, SD-LAN offers lower TCO through its cloud-based management. "Let's face it—operations staffs still require all the productivity they can muster; budgets and staffing levels aren't going back to the pre-recession days, so this is where SD-LAN could conceivably really close the deal," writes Craig J. Mathias, a principal with Farpoint Group, an advisory firm that specializes in wireless networking and mobile IT.[7]

Increased scale and flexibility

Software as a Service delivery via the cloud helps companies eliminate the expense of purchasing or maintaining expensive application servers and software. With SD-LAN, this pay-as-you-grow model ensures organizations have the flexibility to scale their networks to match business growth. The cloud management platform scales to support the management and monitoring of thousands of devices from a single console with minimal overhead. Scaling is as easy as adding or removing additional network access points and switches, which greatly simplifies network planning and development.

Planning for change

In dense deployments, such as when access points are in adjacent rooms, administrators may have to switch off their 2.4 GHz radios on every second or third access point to reduce interference. With the adaptive access layer that has software-definable radios, administrators can switch that second radio to 5 GHz, effectively increasing capacity—future-proofing the purchase and ensuring immediate ROI.

An application-optimized network ensures corporate CRM and financial systems get the necessary quality of service. Cloud management, a must-have in today's business environment, allows IT to more easily manage thousands of access points, switches, sites, end users, and devices—and benefits organizations in operation costs and deployment speed for years to come.

Granular network protection

SD-LAN's granularity digs down to the level of individual users and devices and provides insights on location, time of day, and user role. It also includes capabilities important in local operational policies such as BYOD, guess access, and support for IoT. Profile-based management and security implemented at the edge of the network helps minimize risk to the organization. SD-LAN can leverage local authentication mechanisms to determine authorization and encryption keys. Security is single-point-of-control system-wide uniformity, which makes it easier to respond to security threats.

Identity-driven SD-LAN allows administrators to apply fine-grained security policies to individual users on the guest network, complementing the authentication method already in use in the corporate network—a huge benefit for organizations that typically use a single guest SSID with a common pre-shared key that can be compro-

mised. That identity-driven process also creates greater security. With software-defined private pre-shared keys and application visibility and control (AVC) with custom signatures that can be created to monitor apps and apply fireware rules at the access layer, SD-LAN confronts the security concerns created by IoT.

Value beyond connectivity

Location and presence APIs provide tangible benefits in retail, manufacturing, and logistics. Monitoring APIs allow MSPs to offer Wi-Fi as a service and add value with customized network-management dashboards. For schools and colleges, APIs can create easy guest onboarding and sponsorship workflow that are integrated into student and faculty IT portals, making self-serve IT a reality. APIs can be configured for the present and can be added in the future, leading to a truly programmable, future-proof access network.

In summary, SD-LAN offers the following benefits:[9]

- **Reduced complexity**—Automation, policy, and simplicity are applied to operations, bringing big savings in cost, improved reliability, and much more.

- **Reduced costs**—Going beyond improved productivity of your IT team, SD-LAN makes the networks themselves smarter and uses control and management tools to simplify network administrators' lives.

- **App visibility and control**—SD-LAN is a source of data for analytics, such as understanding what apps are doing on the network. SD-LAN can then use this information in conjunction with policies to tune app behavior automatically.

- **Policy-based management**—It's significantly easier to change policies in SD-LAN than it is to whip out the CLI, as well as more cost-effective, reliable, and secure.

- **Improved reliability**—Implementations can proactively deal with reliability issues and network emergencies.

- **Improved security**—Traffic monitoring with customized signatures for IoT app traffic that provides app visibility and control right at the firewall on the access point, and a unique identity for each device.

- **Easy scalability**—SD-LAN techniques can mitigate expensive OpEx. And SD-LANs may soon be able to produce proactive maintenance messages, limiting installation to assuring building codes are met and plugging in a cable. The remaining configuration, management, and tuning will be automatic. The software- and policy-based nature of SD-LAN makes it easy to add new features.
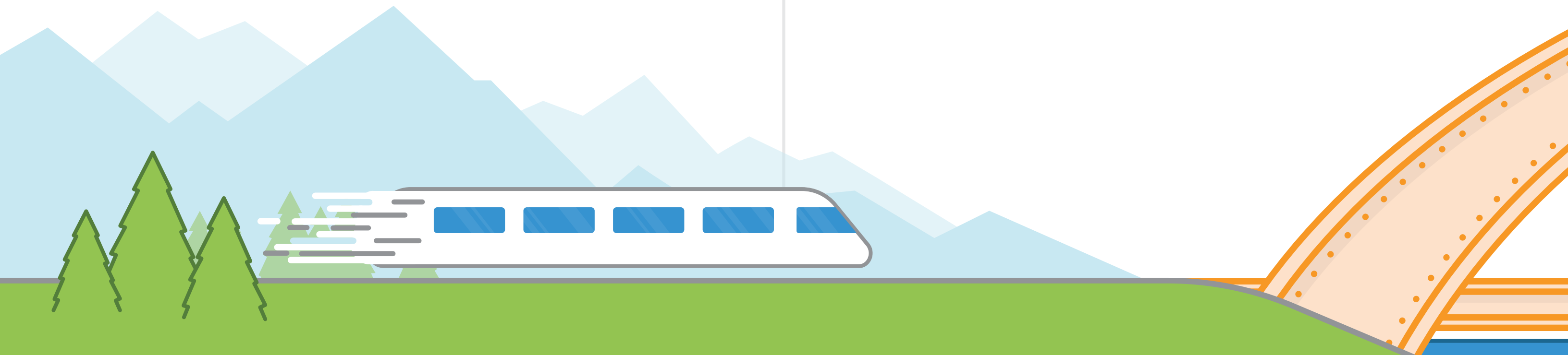
CONCLUSION

The future is here

Without a doubt, SD-LAN offers a strong solution to help your organization keep pace with the dynamic, constantly changing network demands brought on by surging mobility and the Internet of Things.

But at this early stage, it's not ubiquitous technology. In fact, Aerohive Networks is the first company to deliver software-defined access for adaptable, flexible, and cost-effective wireless and wired access networking. Aerohive's SD-LAN solution builds on core capabilities developed over the last 10 years and includes a line of cloud-managed access switches and access points, including the AP250, a Wave 2 802.11ac access point with software-definable dual 5 GHz radios, integrated BLE (Bluetooth Low Energy) beacon technology, and USB connectivity supporting IoT developments. Aerohive's cloud networking solutions centralize network and policy management; drive dynamic application and identity-driven network performance; and provide an open API platform for customized IT and business applications.

With SD-LAN, Aerohive has built software-driven intelligence into every aspect of access networks, including:

- Application visibility and control

- Context-based policies

- Distributed-access infrastructure

- Next-generation cloud management

- Applications and insights

And getting started with Aerohive's SD-LAN solution is simple, requiring only an access point, a switch, and a cloud license.

Aerohive even offers free access points so that you can try SD-LAN for yourself.

TRY SD-LAN ›

"It's important that there be a vision for future-proofing your investment with a big data architecture and the ability to dynamically configure the network with configuration APIs," writes Milind Pansare, strategic marketing director at Aerohive Networks.[8]
"It was customized agility in the data center that enabled Google, Facebook, and Amazon...to create compute environments that provided huge business advantage. The network edge is the next big frontier where business will seek to create competitive advantage and differentiation. After all, that's where consumer experience and workforce productivity are drivers of innovation.

"With SD-LAN, you'll be smart today and ready for the future."

Aerohive
NETWORKS

About Aerohive

Aerohive enables our customers to simply and confidently connect to the information, applications, and insights they need to thrive. Our simple, scalable, and secure platform delivers mobility without limitations. For our customers worldwide, every access point is a starting point. Aerohive was founded in 2006 and is headquartered in Milpitas, CA. For more information, visit www.aerohive.com.

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