SD-WAN and LTE WAN: Made for each other

A case study in using wireless WAN transport and SD-WAN together, the synergies they deliver, how they give an enterprise flexible, less costly connectivity for 6,000 retail locations

Quick Look

This case study answers the question: "Who is the ideal candidate for using only wireless wide area network (WAN) connectivity as the sole transport for a software-defined wide area network (SD-WAN)?" We look under the hood of the technologies, see how their components interact, and reveal the synergies they can deliver.

Problem

A large retail enterprise chain wanted flexible, less costly connectivity for more than 6,000 sites across the U.S. while using the agility of SD-WAN to unlock the full potential of network virtualization's speed and efficiency—and they wanted it fast.

Solution

AT&T Business designed a next-gen network using wireless WAN transport only (AT&T 4G LTE) into the AT&T Common Backbone—the largest network in North America.[1]

Results

AT&T Business designed a next-gen network using wireless WAN transport only (AT&T 4G LTE) into the AT&T Common Backbone—the largest network in North America.[1]

This solution brought 6000+ sites online within a five-month period (average of 400 sites per week) once the overall network design was finalized. This led to:

- Significantly lower failure rates during turn-up than typical wired networks
- Reduced costs with no physical outside lines to be laid into the customer sites, and no inside wiring to install and manage
- Faster gathering and correlation of traffic data, driving rapid reporting and better optimization of each site

Introduction

This case study examines how AT&T Business helped a large retail enterprise in the U.S. bring less costly connectivity into more than 6,000 sites across the U.S. while using the agility of SD-WAN to unlock the full potential of network virtualization's speed and efficiency.

What the company wanted

- A reliable, centrally managed, virtualized network, with redundant pathways to keep data flowing.
- To unify and efficiently manage the network of their sprawling empire with thousands of sites and endpoints in a cost-effective manner.
- To have the traffic data necessary for streamlining and optimizing operations.
- To use transport paths suited for their specific types of data traffic.
- To save money and time while realizing the full potential of existing SD-WAN infrastructure.

Technical overview

AT&T Business designed and proposed using a Cisco SD-WAN (Software-Defined Wide Area Network) platform over 4G LTE (Long Term Evolution) wireless access paths to provide virtualized WAN connectivity to more than 6,000 retail sites across the U.S.

Technology and components within 4G LTE networks

If you're interested in the nuts and bolts of network connectivity, this section provides a deeper dive into the scaffolding upon which we built this solution.

4G LTE describes a network or device that can transmit both voice and data as IP packets across a wireless (radio frequency) network. 4G is shorthand for "fourth-generation." What are the other generations?

- 0G and 1G – Strictly analog voice networks
- 2G – Digital voice networks
- 3G – Transport of both digital data and voice packets, but over distinct paths within the network
- 4G – Both voice and data IP packets can be transmitted across Next-Generation Networks (NGN) along common paths
  - 4G LTE – LTE is the most widespread and efficient version of 4G architecture for interfacing with data.
- 5G – Though 5G isn't part of this enterprise's solution, it and our fiber infrastructure form the core that powers our connectivity.

Network notes

AT&T has the Best 5G Network.[2]

AT&T has the Most Reliable 5G Network.[3]

AT&T has the Best Wireless Network.[4]

AT&T overall wireless voice and data network covers more than 99% of all Americans.[5]

AT&T has the largest network in North America.[6]

AT&T offers the best global coverage of any U.S. wireless provider.[7]

The AT&T global network carries more than 484.9 petabytes of data traffic on an average day (as of 4Q 2021).

SD-WAN and data conversion

Starting at the originating customer premises, the first component to consider is the SD-WAN Edge device.

This is the hardware and / or software that routes and forwards the customer business traffic between the Local Area Network (LAN) at each site and the available LTE networks.

In order to connect to an LTE-enabled network, IP traffic must be converted into a radio frequency (RF) signal. A wireless modem converts outgoing data to an RF signal, which then broadcasts to an antenna.

The antenna relays the RF signal to local mobile network transponders (cell towers). The towers forward the data into the mobile network control elements.

The RF signal is reconverted into an IP signal. Depending upon the geography, this happens either within the Radio Access Network (RAN) transponder equipment or within the mobile control network.

The control network then directs the IP data to its assigned APN (Access Point Name). This is the private network that allows access to the receiving modem and edge device on the other end of the transmission. The APN defines the destination IP address / URL within a gateway device that will connect the data to the designated private network.

Once the data reaches the private network, the handoffs are reversed on the far end of the path. IP data is reconverted to an RF signal and received by the destination wireless modem, which translates the signal back to IP.

In this case study, this is how customer data travels back and forth between the home office and its 6,000 stores via wireless SD-WAN.

Handoffs

The data must navigate 4 key handoffs en route to its destination:

1. Customer LAN to SD-WAN edge device via Ethernet cabling – This handoff is independent of the WAN and holds true for edge devices with either wireless or wireline WAN access.
2. SD-WAN edge device to wireless modem via Ethernet cabling – This is the simplest handoff from a physical installation and logical configuration perspective.
3. Wireless modem to local mobile network via radio transmission – This is the defining handoff for wireless WAN access. Success or failure is driven by presenting a radio frequency signal strong enough to reach the local mobile network transponders.
4. Local mobile network to the AT&T common backbone via the designated APN – If the proper APN has been selected, this connectivity is pre-determined by the applicable mobile network.

At each of these handoffs, we try to create resilient paths to help reduce the effects of a single point of failure.

For example, the wireless modems may be in range of multiple RAN's so that a failure at one cell tower will allow transfer to the next best RF path over a different cell tower.

The most difficult handoff to provide diversity / resiliency for is the fourth one: Local mobile network to the AT&T Common Backbone (CBB) via the designated Access Point Name.

Orchestrating

The Orchestrator works to optimize the path selection on both ends between the customer edge device and the APN gateways. It does this by controlling the interfaces that the traffic passes through on its journey. The orchestrator does not determine CBB routing itself; it simply optimizes the routing on the two endpoints' wireless networks.

SD-WAN and LTE WAN – Made for each other

With a basic understanding of the components involved, we can ask the question: "Who is an ideal candidate to use wireless-only WAN connectivity in an SD-WAN network?"

Wireless communications are typically driven by usage-based billing, although the AT&T Wireless Broadband (AWB) billing can eliminate overage costs. Otherwise, constant and sustained use of wireless links can become expensive quickly. The tradeoff for AWB, however, is potential throttling of traffic with high data usage. However, with certain traffic patterns, SD-WAN and LTE WAN links bring synergies to the table that make them an ideal pairing.

The enterprise in this case study had thousands of sites but only a few variations in site type. This allowed AT&T Business to rapidly develop repeatable templates within the provisioning, configuration, and management tools to reap the full benefits of the SD-WAN and LTE WAN synergies.

The customer's primary traffic flows in this case study were transaction-based flows, such as credit card and point-of-sale transactions, supply chain orders, and inventory checks. These "bursty" transactions, common in many retail stores, are ideal for LTE WAN transport because they don't chew up a lot of bandwidth.

There is another type of business customer that may also be a good candidate for this solution because their primary traffic is also highly transactional and bursty: reservation-based businesses, such as hotels, cruise ships, and airlines.

On the other hand, customers that depend upon frequent or periodic large file transfers or sustained video downloads may still find the dual-LTE SD-WAN solution convenient—but also potentially quite expensive.

Businesses that are good candidates for this architecture will enjoy the following advantages:

1. Architectural elasticity. SD-WAN is based on network virtualization, giving you greater flexibility in selecting transport architectures across the network.
2. Support for meeting demands on the fly. For some simple changes, virtual edge devices may allow you to add or change features / components within the network more quickly, without the delays of provisioning and shipping physical components.
3. Fluidly adjust transport routes. Wireless transport lets you add or change transport links into edge devices more quickly, without requiring the physical installation of additional wireline elements.
4. Cut costs. SD-WAN often reduces capital costs at the customer premises, including the electrical and air conditioning costs for maintaining equipment there. Wireless WAN typically reduces installation costs for outside and inside wiring of transport components.
5. Greater simplicity and repeatability. Virtualization within both SD-WAN and LTE WAN allows you to automate both the transport and the edge components when implementing sites across the network.

Results

The business in our case study experienced the following benefits through the wireless transport over wireline that AT&T Business created for them:

1. Significantly lower failure rates during turn-up than typical wired networks.
   - Wireless communications pass through far fewer physical components than wireline communications and thus are subjected to fewer physical points of failure when setting up the path to their destination.
2. No physical outside lines and no inside wiring to install and manage at customer site.
   - The wireless nature of the transport also reduces the implementation costs and the lead time for delivering the transport circuit and significantly reduces the complexity of the customer site turn-up processes.
3. Tasks involved with provisioning the transport circuit were highly automated.
   - The virtual nature of the connectivity for Wireless WAN allows the ordering and installation workflows to proceed much more quickly without the need for human intervention.
4. Fast deployment.
   - Brought 6,000+ customer sites online within a five-month period.
5. Rapid optimization.
   - The virtual nature of the connectivity drove more rapid gathering and correlation of data, driving better optimization of the customer sites within the network and more rapid reporting to the customer.
6. Simplicity of deployment led to onboarding with minimal issues.
   - Site turn-up events had a greater than 95% first-time success rate.
7. Zero-Touch Provisioning automation processes include the ability to preload configurations into the SD-WAN orchestration tools.
   - Enabled single-truck-rolls to any given site. Plus, automated readiness verification checkpoint processes gave customer greater flexibility in scheduling.
8. Simplified processes led to increased scalability.
   - The reduced physical resource requirements of this solution allowed for an average of over 400 site transformations per week.

These benefits translate directly into significant cost savings, improved experience during and after the implementation, and much quicker returns on investment for the customer.

Conclusion

For the business or organization with the right data traffic patterns, wireless transport and software-defined wide area networks working together deliver powerful benefits and synergies.

Managed SD-WAN solutions from AT&T Business with wireless-only transport combine the power of our network and our award-winning managed SD-WAN. Requiring little or no up-front capital,

our OPEX solution carefully integrates the design, procurement, staging, SIM activation, shipping, installation, and configuration of our equipment on customer premises for a seamless experience.

Customers can select from a robust portfolio of options for 5G or LTE wireless from AT&T. If customers want to bring in their own third-party wireless plans, we support that option as well. We will also work with customers to coordinate their SIM installation and activation prior to the SD-WAN test and turn up.

This integrated customer experience does not stop at enablement. AT&T Business continuously monitors the end-to-end solution and proactively notifies customers when service is interrupted or degraded, and then works those incidents to resolution. We manage and test lifecycle software updates, and customers may reach us by phone or through our Business Center portal for support. We stand behind our services with SLAs for equipment availability and for on-time SD-WAN provisioning.

What's more, for organizations with other data traffic patterns, AT&T Business can work with you to design, deliver, and support a network that will fit your unique situation.

[1]Based on comparison of carrier owned and operated networks. No AT&T on-net coverage in select countries, including Canada. Details: https://www.att.com/international/. Destinations covered: att.com/globalcountries.

[2] AT&T awarded Best 5G Network by GWS OneScore 2021. GWS conducts paid drive tests for AT&T and uses the data in its OneScore analysis. AT&T 5G requires compatible plan and device. 5G not available everywhere. Go to att.com/5Gforyou for details.

[3] Based on nationwide GWS drive test data. GWS conducts paid drive tests for AT&T and uses the data in its analysis. AT&T 5G requires compatible plan and device. 5G not available everywhere. Go to att.com/5Gforyou for details.

[4] AT&T awarded Best Network by GWS OneScore 2021. GWS conducts paid drive tests for AT&T and uses the data in its OneScore analysis. AT&T 5G requires compatible plan and device. 5G not available everywhere. Go to att.com/5Gforyou for details

[5] Based on overall coverage in U.S. licensed areas. Coverage not available everywhere.

[6] Based on comparison of carrier owned & operated networks. No AT&T on-net coverage in select countries, including Canada. Details: https://www.att.com/international/. Destinations covered: att.com/globalcountries.

[7] 5G/5G+ service requires a compatible device and data plan. Service is not available everywhere. See att.com/5Gforyou for details.