ARRIS

CREATING ROOM TO GROW FOR HUB-BASED SERVICE EXPANSION

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INTRODUCTION

With a major hub that was experiencing a high demand for service, space challenges were becoming an issue for a large cable operator in North America. The multiple system operator (MSO) needed to ensure it could keep pace with subscriber bandwidth demand and support new business service opportunities while ensuring continued customer satisfaction. In order to create the space needed for routine node splits and new commercial services infrastructure, the service provider began developing a plan to build a new, larger hub location. The operator wanted to deploy a CCAP solution to ensure a highly consolidated, highly scalable hub environment, and approached ARRIS to explore the option of using its new E6000 CER solution as the backbone of this new hub. To execute the plan, the MSO assembled an internal team of subject matter experts, partnered with ARRIS as a system integrator, and enlisted additional vendors to provide infrastructure solutions.

In the summer of 2013, as ARRIS began readying to deploy the E6000s in the new hub location, its Global Services team identified a new approach to an established practice that had the potential to achieve all of the operator's goals, while avoiding the delays and expenses of building a new hub. This approach harnessed ARRIS' experience in bringing together world-class technologies in the existing hub location, in a way that maximized space utilization and used operational resources efficiently. This approach to high-density hub evolution is believed to be the first of its kind deployed in the industry, resulting in the room for growth that the service provider needed to expand bandwidth and deploy new business services for years to come. This case study documents the process of evolving a hub with little remaining space into a high-density service platform with room for years of growth and support for new business service offerings.

The Problem: Floor Space Limitations Inhibit Service Capacity

This service provider's hub, which is located in a densely populated downtown area (Figure 1), traditionally provided service to residential subscribers. In recent years, population changes and economic growth in the area have increased demand for residential and business services significantly. To accommodate this growth, the

Figure 1: The Downtown Location of the Hub

service provider had to quickly update the hub's capacity and infrastructure.

The MSO had to make the best use of the existing floor space to accommodate new equipment designed to help the company expand capacity. They needed the space to split nodes and provide commercial and enhanced residential service. If not handled effectively, the situation could have thwarted the service provider's growth potential and made it more difficult to expand service offerings in the area. This includes increasing service capabilities to compete with fiber-based and satellite providers, and extending its portfolio to include Ethernet business services, which represented a significant opportunity for the MSO. For all of these reasons, the team overseeing the hub proactively sought a solution that would accommodate continued improvements in their customers' experience.

The Cause: Rapid Service Expansion in the Hub

In its 10-year lifespan, the hub has been in a constant state of evolution. This is the natural result of the ongoing process of adding customers, deploying new services, and improving network performance. Whether launching new premium channels, offering VoD services, or splitting nodes, as new capabilities were required, new racks were deployed, new equipment was installed, and new cabling was strung. While the evolution of the hub made it possible for the MSO to meet its customers' service requirements, it required it to change its long-term hub evolution plan.

Over time, the hub became filled with equipment, (Figure 2) and the corresponding cabling was routed to meet immediate needs. The architecture of the hub called for like equipment

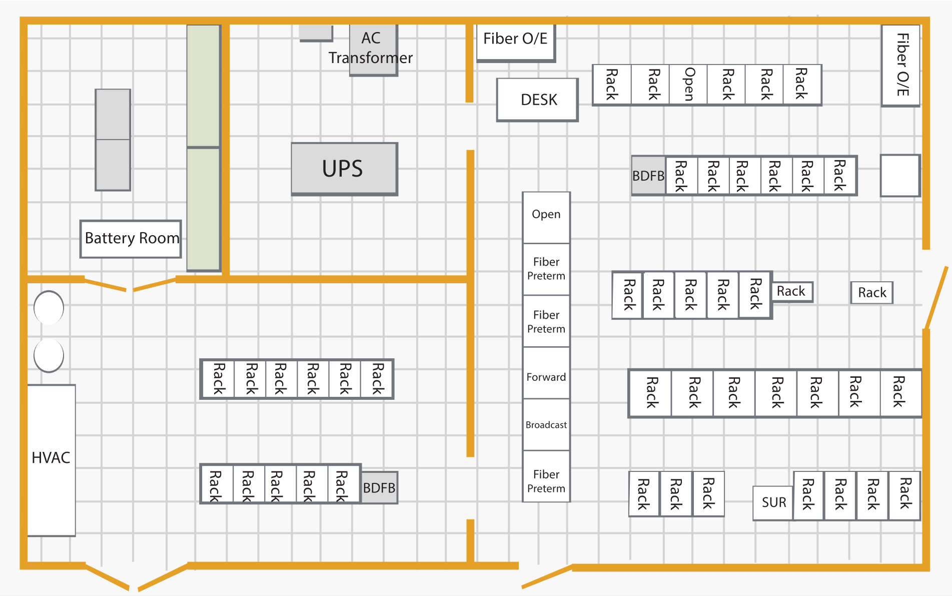


Figure 2:

The Floor Plan of the Hub Before the High-Density Hub Evolution Project to be deployed in close proximity, so all the high-speed data infrastructure was co-located, as was the video on demand equipment, broadcast video gear, optics and telemetry resources. To ensure capacity, efficiency and operating demands well into the future, the service provider decided to build a new hub that would allow it to expand and support its service portfolio for downtown residents and businesses.

The Mandate: Build a New Hub Location Architected Around CCAP

The cable operator's plan for a new downtown hub centered on transferring approximately half of the 400 service groups from the existing hub to this new location. In effect, this would enable the service provider to double its hub space, increase its service capacity, and make room for approximately five years of growth. In addition to leveraging the floor space of an entire new building, the MSO also intended to deploy a high-density CCAP platform as the foundation of its new hub architecture, enabling significant improvements in space utilization for both the existing hub and the new building as well.

As the planning commenced, the project timeline and budget quickly came into view. With real estate acquisition, regulatory approvals, environmental studies, permitting, construction and infrastructure deployment, it would require at least two years and a significant monetary investment to establish a second hub location downtown – if everything went according to plan. In addition to the construction costs, the opportunity costs would be significant. There would be no node splits, no service expansion, and no support for new business services until 2015, which was not an acceptable situation to the MSO.

As the planning process unfolded and the experts from the MSO and ARRIS began architecting the new CCAP-based hub design, an alternative to new hub construction emerged, and brought with it the potential for significant cost and time savings. The idea: to leverage the latest advances in system density along with a unique architectural approach to hub construction in order to better utilize the footprint of the existing hub. Executed properly, this high-density hub evolution approach promised to give the cable operator the space it needed to once again begin splitting nodes, expanding its service offerings, and launching new Ethernet-based business services – without breaking ground on a new hub facility.

HIGH-DENSITY HUB EVOLUTION: AN ALTERNATIVE TO NEW HUB CONSTRUCTION

Together, the operator and ARRIS developed a high-level plan that would enable significant consolidation without impacting service to existing subscribers. This included the development of strategies for grouping infrastructure components logically, utilizing floor space efficiently, building infrastructure non-invasively, and migrating users methodically. At the core of the plan was a new approach to hub architecture known as the high-density POD, referring to a complete system that is Planned and designed, built Offsite, and Delivered and integrated into the existing operation

Re-thinking Hub Design with a POD-based Architecture

The high-density POD was envisioned as a self-contained mini-hub that hosts the entire infrastructure needed to deliver video, voice and data services to a given set of subscribers. This includes DOCSIS transport, edge QAM, VoD, cloud DVR, conditional access, set-top signaling, ad insertion, plant monitoring & maintenance, optical transport, splitters and combiners. By bringing together all of the equipment needed to support a well-defined group of subscribers, and leveraging advanced high-density solutions, the POD-based architecture promised to meet the service provider's goal of alleviating the space limitations in the hub, while improving operations as well. However, this architecture had never before been implemented, requiring the development of a detailed plan to avoid disruptions to the MSO's existing subscribers.

The team began by identifying the service groups that would be included in the initial POD. They created an inventory of all of the services and subscribers within those groups, and every piece of infrastructure that was being used to support them. They built diagrams, illustrating how all of the pieces fit together in the current environment, and developed several methodologies for how those same services could be delivered to those same subscribers using the POD-based architecture. After nearly three months of planning and review, the layout of POD 1 was complete, (Figure 3) and the design proved that the infrastructure for 112 service groups and 120 nodes could be distilled from 16 racks down to four using this new approach.

Phase I: Offsite Construction of POD 1

There were several challenges in migrating subscribers to an entirely new infrastructure. Most importantly, the migration had to be transparent to the subscribers it affected, but it was also critical to minimize the impact on the operational staff in the hub. This meant construction on POD 1 would need to occur at an offsite location, and the entire POD would need to be fully staged, wired and tested before being delivered to the hub and activated. This unique approach improved quality control for the POD build, enabled service for existing subscribers to continue uninterrupted, and ensured that the new POD build would not interfere with the activities of the hub's operational staff.

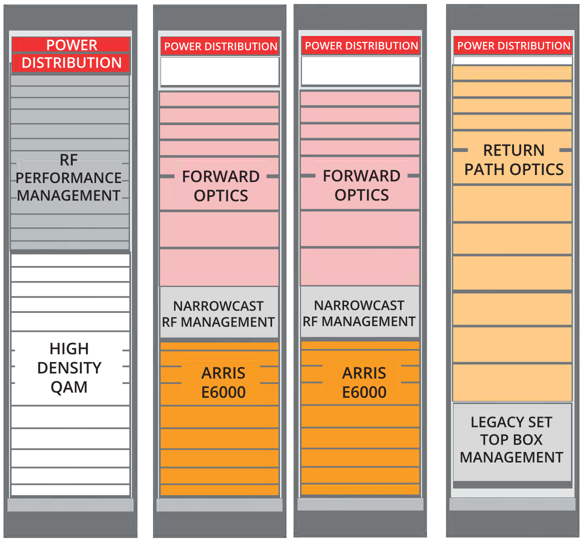


Figure 3: The Completed Layout of POD 1

To begin construction, the racks were laid out, factoring in the service provider's preferences for cable management, and marking out any physical obstructions that factored in for final assembly in the hub. The installation of equipment began with the ARRIS E6000 Converged Edge Router, which was chosen to provide broadband service while enabling the density required in a highly consolidated hub. Edge QAM, VoD and cloud DVR equipment were then added, followed by the ARRIS ARPD (Advanced Return Path Demodulator) infrastructure for set-top box signaling and plant monitoring and maintenance equipment. Finally, the optical transmit/receive solutions and splitting/combining trays were installed. Throughout the construction process, the operator and ARRIS collaborated to ensure that the equipment layout and cable management systems were well optimized for real-world deployment.

To connect the infrastructure in the POD, the existing coaxial cable was replaced by mini-cable, contributing to the overall space savings. This system was designed to help eliminate any strain on equipment and connections, and enable rapid cable identification to speed maintenance, troubleshooting and node split activities. In addition, since the POD design centralized all equipment for a given number of service groups, cabling for the various equipment components no longer needed to travel between rooms or across the hub. That means that all of the cabling leaving the POD is now being used for powering or to connect subscribers, resulting in additional space savings. This new cabling system has become the standard for all of the operator's future hub builds, enabling the company's operational staff to learn one wiring system that can be applied to any hub.

With hub construction completed, the POD was then tested to ensure all of the services operated as expected. For this testing, ARRIS and the MSO worked closely together, following an agreed upon methods of procedure (MOP) to validate that all cables and connectors were functional and all services were operational. Service testing required the connection of set-top boxes, cable modems, EMTAs and other CPE devices to each transmit and receive port in the POD, on which mock services were provisioned, deployed and measured to ensure proper operation under real-life conditions. In addition to service validation, this testing phase provided both ARRIS and the operator with a final opportunity to adjust the POD design for maximum performance and efficiency. Since the POD was constructed offsite, the personnel and equipment required for this rigorous testing did not interfere with the hub's ongoing day-to-day operations.

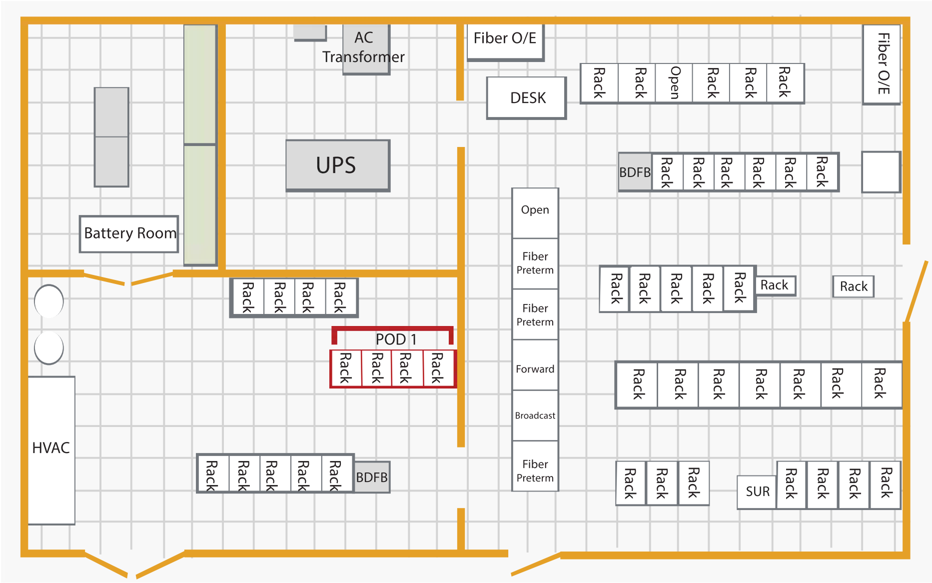
Phase II: Hub Implementation of POD 1

Once the off-site construction and testing of POD 1 was completed, the service provider and ARRIS could begin moving it into the hub. This process began by preparing a temporary space in the hub that allowed the new equipment to be installed without removing infrastructure that was still supporting live customer traffic. With this space ready, the team began methodically deconstructing POD 1, carefully labeling and packaging its components for delivery and assembly in its new location. The four racks of equipment were broken down into four unique sections to ensure that the material for each rack remained distinct and easily found. The equipment and racks were packaged in rigid shipping crates and loaded onto an Air-Ride trailer truck to reduce the stress of the journey. Once on-site, the build process was executed extremely efficiently, due to both the experience of the team and the well-organized nature of the construction and packing processes.

In a matter of days, the new equipment was unpacked, racked, wired, configured and operational. This enabled the team to conduct final testing and begin migrating subscribers to the new equipment quickly. Less than eight months after the initial design of the POD-based approach to hub consolidation, the MSO was supporting live customer traffic using this unique architecture (Figure 4).

Figure 4:

The Floor Plan of the Hub After the Installation of POD 1



Phase III: The Deployment of POD 2 and Beyond

As soon as POD 1 was shipped to the hub, off-site construction began on POD 2. By following the well-organized construction plan, the build moved even faster than that of its predecessor. Once POD 1 was fully deployed and all traffic was migrated to it, some of the decommissioned infrastructure that formerly supported its subscribers was repurposed for the construction of POD 2. This included transmitters, receivers and signal monitoring units, and enabled significant cost savings for the operator. The equipment that was not redeployed was delivered to the MSO's smaller hubs to support service expansion in those regions, adding to the cost-effectiveness of the hub evolution project and bringing an improved customer experience to multiple locations. When possible, the packaging from new equipment was repurposed to transport decommissioned gear, and federal, state and local laws were followed for any materials that needed to be disposed as a result of the build.

Approximately four weeks after the deployment of POD 1, POD 2 was delivered and installed in its permanent location within the hub. Following the same procedures they did with the first POD installation, the team members constructed and tested POD 2 before migrating subscribers and removing the equipment that once supported them. Once again, all decommissioned equipment was earmarked for redeployment in subsequent PODs in the hub or within smaller hubs around the US.

Following the same protocols, the MSO and ARRIS created a total of four PODS in the hub to support its existing residential subscribers. With each POD, they honed their procedures, getting more efficient in the construction, migration, decommissioning and redeployment processes until the final customer migration to POD 4 occurred on April 23rd, 2014. With the high-density hub evolution project complete, the hub was now a highly dense, operationally efficient service launch point with enough free space to accommodate years of future growth and new service opportunities (Figure 5).

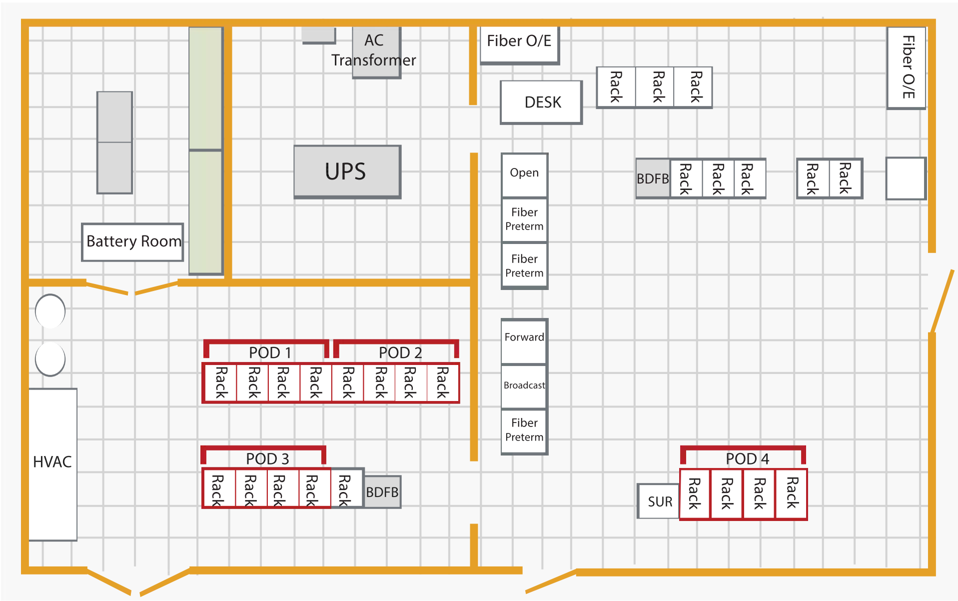


Figure 5:

The Floor Plan of the Hub after the Installation of PODs 2-4 and Wreck Out

THE RESULTS: ROOM TO GROW AND OPERATIONAL ADVANTAGES

The high-density hub evolution project has propelled the service provider forward for downtown residential and business service growth. This hub is now poised for three to five years of expansion. Where residential broadband rates left the door open to fiber-based competition, there is now a pathway to deliver nearly half a Gigabit to the home. Where maintenance and troubleshooting were complex and time consuming, they are now streamlined and simplified. Where it was once impossible to pursue business opportunities, Metro Ethernet is opening new market opportunities.

A Footprint for Service Expansion

From August 2013 until April 2014, the team worked to migrate approximately 400 nodes onto new high-density PODs. When completed, the free space in the hub equated to an expansion in usable footprint of over 40%. The improvements in footprint and node service capacity are depicted in Table 1. When compared to the initial plan of building a new hub downtown, the high-density hub consolidation project enabled this operator to resume service expansion 16 months faster, at an estimated cost savings of $1.5M.

	Before Hub Evolution	After Hub Density Evolution	
		Current State	Future State
Racks in Use	59	33	59
HD PODs	NA	4	10
Nodes Served	368	576	1440

Table 1: Footprint and Service Capacity Metrics for the Hub

As a result of the high-density hub evolution project, the service provider noted a significant improvement in the number of optical transport nodes (OTN) that it considered highly utilized – an early warning indicator used to identify nodes in need of splitting. Figure 6 depicts the reduction in highly utilized OTN ports following the migration of POD 1, dropping from 32.24% before the migration to 13.46% after. Additional reductions in this measure were noted following the remaining POD migrations.

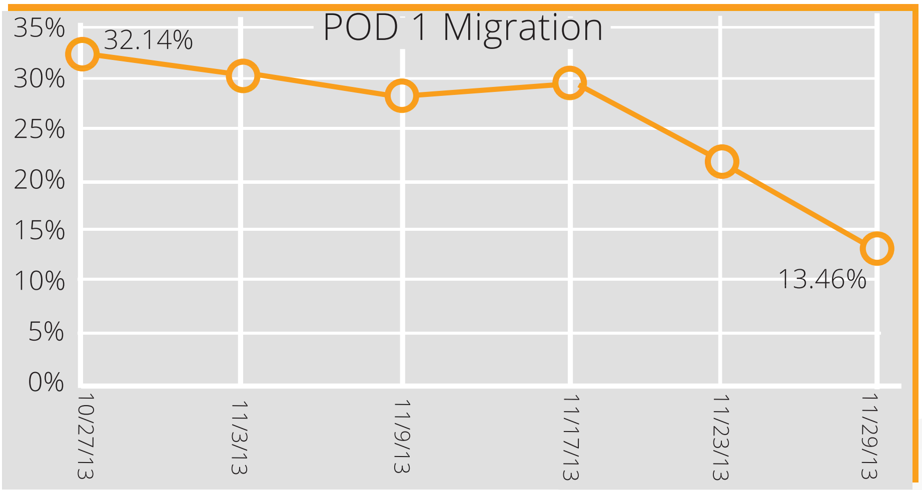


Figure 6:

The Percentage of Highly Utilized OTN Ports in the Hub Over Time

At current growth rates and system densities, the high-density hub evolution project provided the service provider with enough foot print for three to five years of growth – the same time horizon that was targeted for the new hub construction project (Figure 7). However, advances in high-density hub equipment have the potential to further increase the lifespan of the hub. For example, increasing the downstream DOCSIS ports per rack, migrating edge QAM resources into the CCAP chassis or consolidating optics into the CCAP chassis all have the potential to improve densities and generate additional hub space in the future.

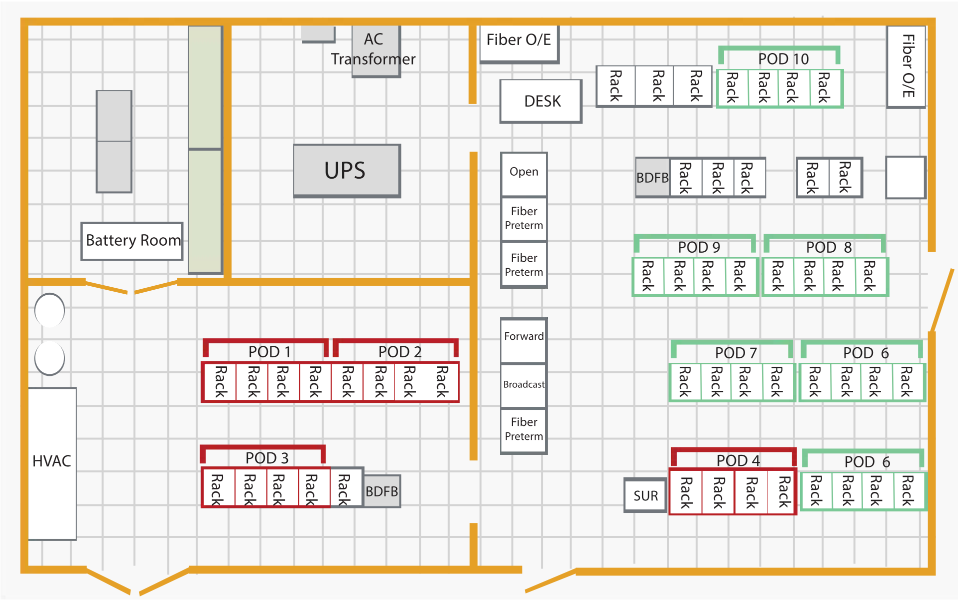


Figure 7:

The Floor Plan of the Hub Showing Room for 3-5 Years of Service Growth

An Architecture for Operational Simplicity

In addition to freeing up capacity for service growth, the high-density hub consolidation project has provided the MSO with an architecture that simplifies and streamlines its day-to-day operations. With the entire infrastructure for a given service group consolidated into a single POD, maintenance and troubleshooting activities can now be performed without traveling between racks or rooms, and the well-organized, color-coded cabling system enables connections to be located quickly and easily. Together, these advantages have significantly reduced the number of staff required and the amount of time it takes for nearly every operational task.

In addition, the high-density PODs are pre-wired for future node splits, which can now be executed by adding cards to the CCAP chassis, and without re-wiring. When combined, the operational advantages are expected to produce an estimated $1M in savings over the lifespan of the hub.

CONCLUSION

As the service provider and ARRIS worked to re-architect this hub, they went beyond developing a short-term solution and created a new set of protocols that would become the foundation for best practices in high-density hub evolution. Harnessing the expertise of both teams in service delivery, system integration and hub operations, the companies created an architecture that could be replicated in existing and new hubs across the world to maximize capacity, minimize space utilization and streamline operations. While the long-term benefits of this architecture are still coming into focus, what is clear is that the POD-based approach to high-density hub evolution has become the new gold standard in capacity expansion for this service provider.

About ARRIS Global Services

ARRIS Global Services helps customers plan, design, implement and operate their networks and business processes. Services include installation of network elements; operational, technology and strategic consulting; staff augmentation; strategic outsourcing; and defining and integrating complex, multi-vendor solutions.