zpe®

CASE STUDY

Re-architecting the Internet while lowering costs and increasing agility

Automating edge deployments & lights-out management helps Vapor® IO deploy their Kinetic Grid® platform worldwide.

"Nodegrid keeps our costs down and extends everyone's capabilities. The automation lets our suppport teams do specialized jobs, so our engineers can devote more time to delivering customer value." — Frank Basso, EVP of Operations, Vapor IO

Vapor IO provides autonomous network and data center infrastructure at the network edge. Their Kinetic Grid platform — which consists of edge data centers interconnected by a fiber backbone — supports the largest communication providers, cloud operators, content delivery networks, and other enterprises across 36 major U.S. markets, and recently expanded to Europe, starting in Barcelona, Spain.

Vapor IO's goal is to leverage the work of the Open Grid Alliance (which the company co-founded) and re-architect the traditional core-to-edge Internet into a distributed, ubiquitous, edge-to-edge web that serves end users with reliable, low-latency digital services. The capabilities of this new Internet include providing SLA-backed routing, up to twelve-nines reliability, 100-microsecond latency, and terabits-per-second bandwidth.

With potentially thousands of PoPs, Vapor IO needs to run operations remotely and as efficiently as possible, which means innovating around lights-out automation. They needed a solution that would avoid the complexity of old, unsupported gear from multiple vendors to close the following operational gaps:

- Reducing deployment times using automation, streamlining the nearly eight hours of manual setup at new sites
- Maximizing revenue and leasable rackspace by reducing their own equipment stack, which occupied at least 5RU at each site
- Achieving true lights-out management by minimizing the total points of failure and the management workload
- Minimizing overhead with more efficient procurement, planning, and development for new use case requirements

Continue reading to see how the modular Nodegrid Net SR solved these problems.

Background

The Internet was created from the core out.

Global hyperscalers built their data centers to provide the infrastructure for companies to host their digital platforms from centralized locations. Delivering digital services to end users — whether they be enterprises, consumers, or government agencies — traditionally involves passing through a regional internet exchange (IX) and then last-mile access networks that serve users at the edge.

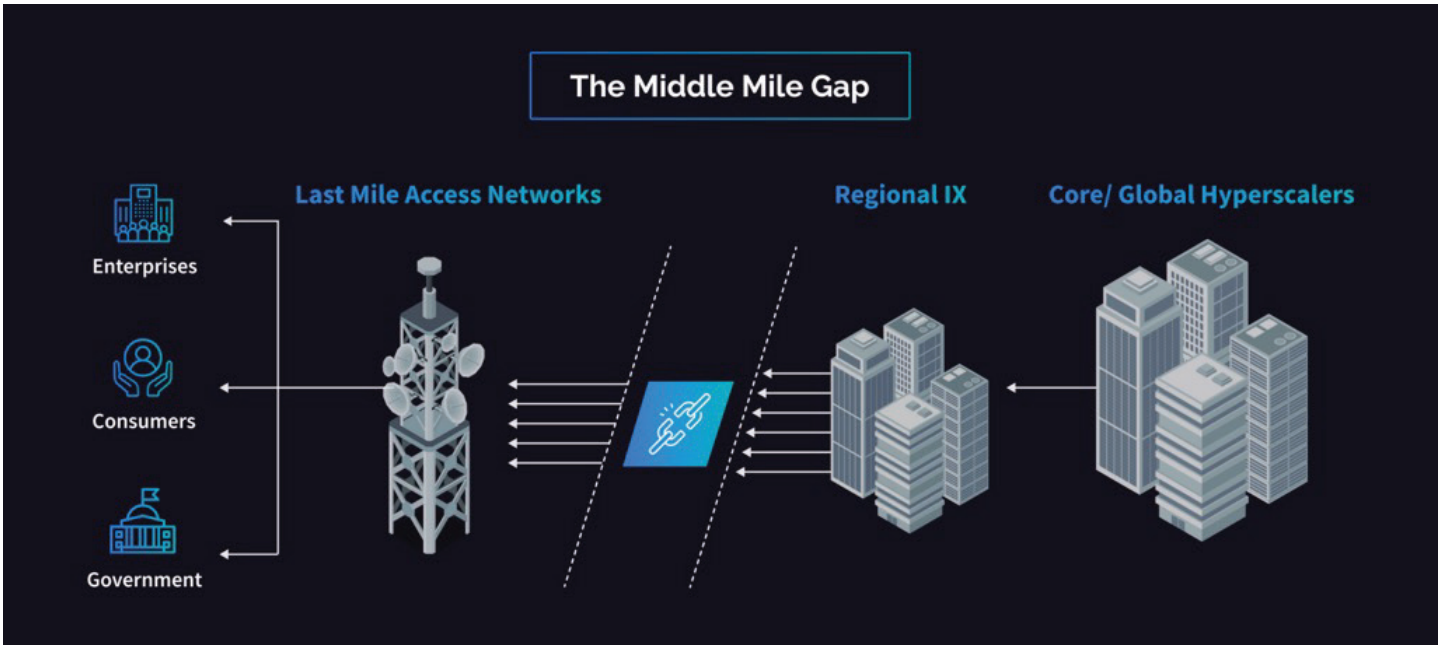


Image: Core-to-edge architecture featuring the middle-mile gap. (Source: Vapor IO media kit)

The problem is, this traditional north-south span creates a middle-mile gap between the IX and last-mile networks that makes it difficult or impossible to support low latency, high bandwidth applications (e.g., real-time computer vision) with traditional internet delivery.

To solve this, Vapor IO has defined 'the Internet we need,' and has set out to re-architect the Internet by building a carrier-neutral, edge-to-edge platform. This platform consists of edge data centers that provide core functionalities like computing and networking, which lay the foundation for an Internet that's ubiquitous, SLA-backed, and offers microsecond latency and terabits-per-second bandwidth.

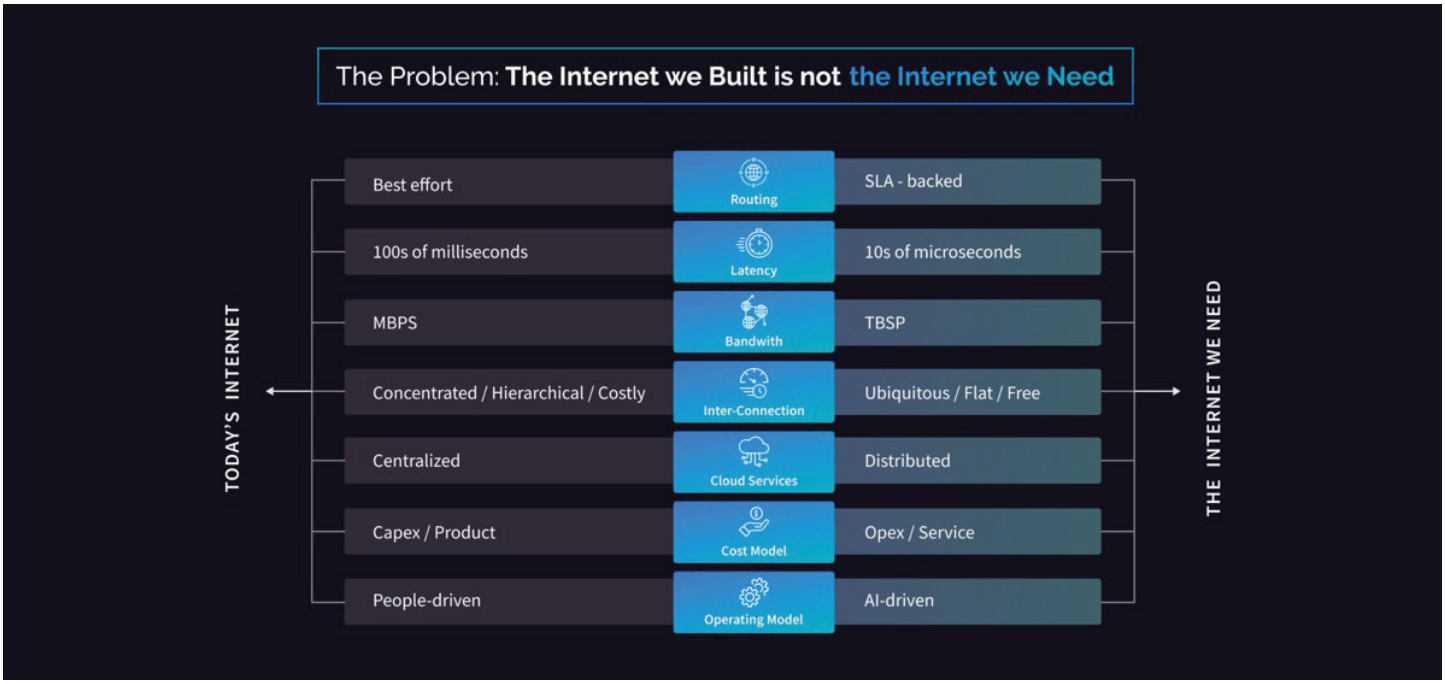
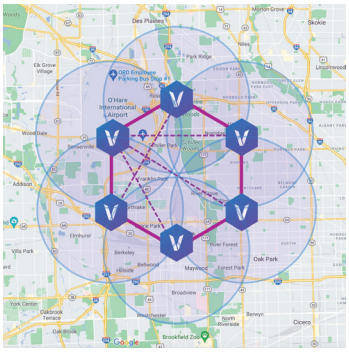


Image: Comparing today's Internet to the Internet we need. (Source: Vapor IO media kit)

Vapor IO's autonomous data centers are deployed within major metropolitan areas and are interconnected by a fiber backbone (imagine a large, regional data center colocation divided into six smaller buildings, spread across a city or county, and interconnected via a fiber mesh). Enterprises and service providers can place their equipment and software on the Kinetic Grid and take advantage of the in-region networking, security, and Points of Presence.

The most notable use cases today recognize the Kinetic Grid's ability to deliver on-premises performance and security with the economics of the cloud. In other words, the thousands of workloads that are today locked on-premises can be relocated on the Kinetic Grid, operated cost-effectively on shared infrastructure, and delivered back to the consuming enterprise in the form of a service. For example, a retailer that wants to use computer vision to do loss prevention and inventory tracking could purchase this as a service (e.g., per camera per month) from one of Vapor IO's customers. This makes it possible for enterprises to truly achieve a zero-server footprint on-premises.



This web of edge data centers creates Vapor IO's Kinetic Grid, which serves nearby metropolitan areas as well as neighboring suburban and rural markets. Some ideal use cases for enterprises include near-prem computing and private 5G.

Problem and Gaps

Vapor IO has proven their ability to build grids of autonomous, fiber-connected data centers. Their ultimate goal for operations is to deploy lights-out data centers all over the world and optimize the costs required to maintain these sites. Crucial to this goal is having the ability to collect billions of data points at each location, which allows software automation to monitor and control physical and virtual devices.

This is done via Vapor IO's Synse software, a pluggable, open-source platform that unifies telemetry and control of sensors, environmental systems (fan speeds, HVAC), security measures, and other SCADA systems. Synse was built to simplify low-level protocols, enable manual control, and bring environmental telemetry to the surface for monitoring and system optimization. It allows network and facility information to be collected locally and sent out for proactive monitoring.

However, as Vapor IO scaled, they faced the problem of reducing the cost and complexity of their own management infrastructure.

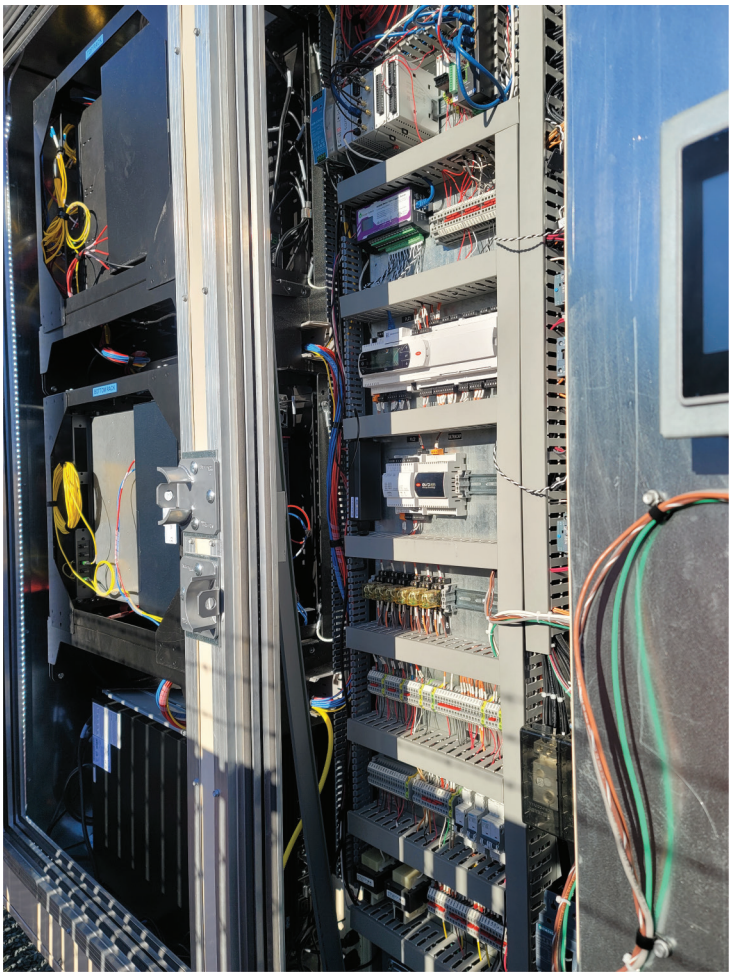


Image: Common equipment stacks housed in Vapor IO's virtual ethernet module (VEM) units.

Each site must support in-band and out-of-band connectivity, as well as an open VPN tunnel to popular cloud providers. The management infrastructure they had in place — which was built by a third party who required a yearly contract — was becoming difficult to deploy and manage. Their equipment consisted of unsupported gear from multiple vendors, and included:

- Cellular modem with third party
- Subscription out-of-band router
- Out-of-band switch
- Out-of-band serial console
- Out-of-band laptop/compute node

One of the company's core values is to further business goals by making constructive changes and avoiding unnecessary complexity. The legacy management infrastructure only added complexity, and as demand increased, they would need more staff to maintain it. To solve this, they would have to be proactive in closing several significant gaps:

- Each edge data center required at least five separate management devices that were not integrated together. Deployments required a skilled technician to be on site for an entire workday. This time sink would multiply in direct correlation to the total number of new sites to deploy.

- The ability to lease rackspace directly translates to revenue. But each site required Vapor IO to deploy at least 5RU to support its own devices. As demand increases, this dead space translates to millions in lost revenue, on top of additional power and cooling costs.

- Having disparate solutions not only increased the total points of failure, but also meant more devices to manage. This increased the likelihood of failures/outages that would require truck rolls, and also increased the ongoing operational workload required to keep many management devices running.

- A multi-vendor environment meant added overhead and rigidity that complicated procurement, project planning, and development of new designs. This made it difficult to adapt to different use cases and customer requirements.

The company evaluated solutions from a popular networking vendor. In order to support in-band, out-of-band, and an open VPN tunnel, this vendor needed to write custom code. Moreover, the networking vendor's solution features were not integrated together, and despite the custom code, Vapor IO would still need special programming skills to take advantage of these features, since they were not integrated into the vendor's management software UI.

Vapor IO needed a management solution that would support their vision for a new Internet as well as their core values. Their ideal solution would:

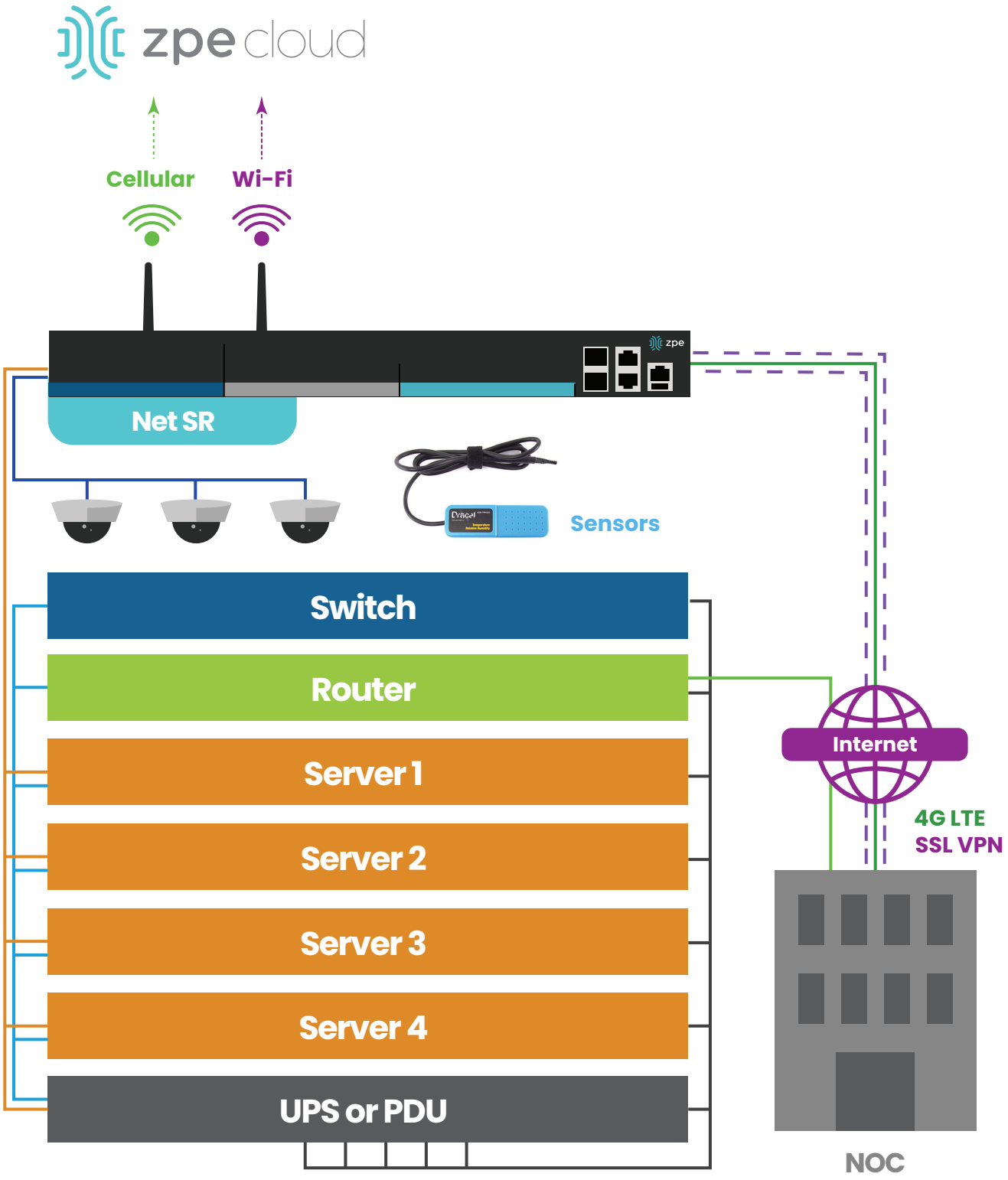
- Leverage automation to make deployments autonomous and reduce setup times as much as possible (deployed equipment should “simply start working”)
- Bundle functionalities to consolidate dead space and maximize leasable rackspace
- Allow for separation of data connectivity for dedicated purposes, such as for in-band, out-of-band, and SCADA integration
- Support edge-native automation and maximize remote management capabilities, to enable edge workload autonomy and remote remediation
- Minimize overhead with fully integrated features
- Future- proof deployments by providing a virtualization environment capable of running custom workloads to allow for agility when implementing new uses cases.

Solution

Vapor IO chose the Nodegrid Net SR because it satisfied their requirements. It also supported their core values of making constructive changes and avoiding unnecessary complexity.

Image: Front/rear views of the Nodegrid Net Services Router with expansion modules for Ethernet, LTE, serial, storage, and USB.

The Net SR allowed the company to deploy exactly the solution they needed, while collapsing so many functions into 1RU. This multi-function box served as much more than a networking device, as it bundled all of the in-band and out-of-band capabilities they required, while its onboard, Linux-based Nodegrid OS gave them the ability to deploy Guest OS, Docker workloads, network monitoring, and virtualized solutions directly on the device.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Wi-Fi
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Net SR
Sensors
Switch
Router
Server 1
Server 2
Server 3
Server 4
UPS or PDU
Internet
4G LTE
SSL VPN
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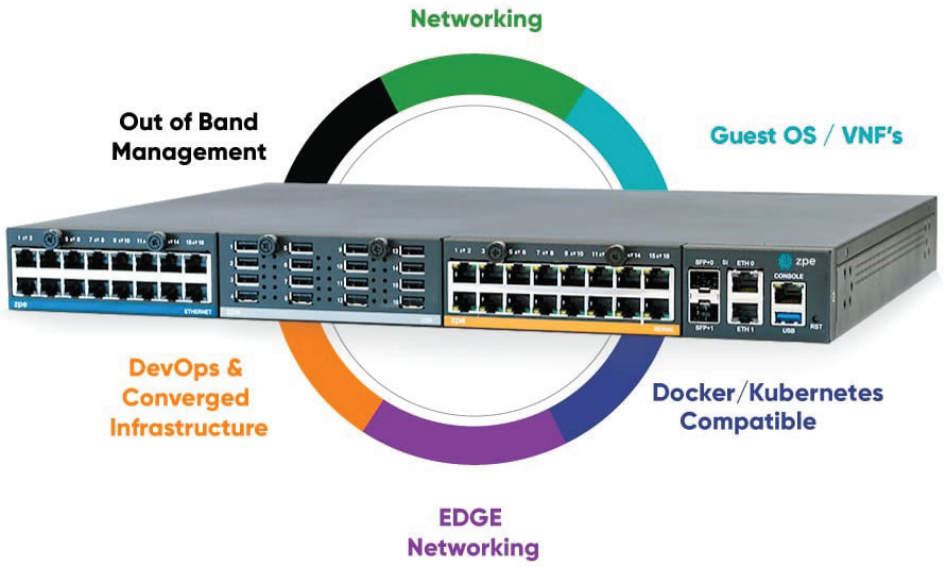

The Net SR would be the first device installed at each site, which would establish cellular connectivity for powering up and testing all other resources at the site. The device would also connect to the production fiber backbone and allow the same interface to be used for testing the fiber spans and optical systems. To do this, Vapor IO outfitted the Net SR with the following modules and upgrades:

- 16-Port Ethernet Expansion Card: For connecting to networking devices including routers, switches, and PDUs at up to 1GbE speeds.

- 16-Port Serial Expansion Card: For gaining management access to servers and network equipment.

- M.2 / SATA Expansion Card with dual-SIM LTE module: For establishing cellular connectivity that allows staff to connect to each site and bring remaining resources online. This module allows separate wireless carriers for redundancy and load balancing.

- Storage Expansion Card: For storing software/firmware updates, data logs, and configuration information. This module features local & remote user permissions for added privacy.

- Memory upgrade to 32GB of RAM: For running required third-party applications locally on the Net SR.

- Virtualization License: For enabling a full virtualization stack on the Net SR. This allows Vapor to run third-party applications as Docker containers or full VMs, and to run many Salt Proxy minions for configuration and management of all locally-deployed hardware.

- 16-port SFP module: For enabling each site to connect to Vapor IO's fiber backbone.

These capabilities were on top of the Net SR's standard features, like its multi-core Intel CPU, 8GB RAM, and 32GB storage capacity. Essentially, the Net SR served as an in-band device, out-of-band device, and compute node capable of serving the necessary automation and management roles

Results and Benefits

The Net SR provided Vapor IO the bundled, fully-integrated management solution they needed at their edge data centers. The multi-function hardware and open Nodegrid OS resulted in a solution that features:

- Integration with third-party and custom automation solutions, to enable true zero touch provisioning

- Routing, switching, cellular, out-of-band, and computing in a single device

- Support for edge-native automation integrated with SCADA systems, which can be carried out via Docker containers and Salt minions to proactively monitor sites

- Full integration of features, from in-band to out-of-band to virtualization, to enable new designs to be implemented efficiently

Prior to deploying the Net SR, Vapor IO required five separate management devices which filled 5RU worth of rackspace at each location. Because these devices came from different vendors and the overall solution was built by a third party, it was incredibly difficult to make everything work together.

Their existing management infrastructure was far from turnkey, as they needed to install and provision separate cellular modems, routers, switches, serial consoles, and compute nodes. Skilled technicians were needed for these tasks, which would typically require an entire workday to complete. This involved establishing cellular connectivity to the site, then testing every network and compute resource. Once a site was certified through their QA process, they would then need to turn up the production network, test fiber spans, switch to in-band for normal operations, and then use the local compute resource to manage their network and automation capabilities.

After deploying the Net SR, their deployment and management processes became streamlined. Vapor IO realized the following results and benefits:

- One-hour deployment times, due to the Net SR's Nodegrid OS integrating with their automation solutions and running Docker containers.
- 5-to-1 device reduction, due to the Net SR's built-in capabilities for cellular, routing, switching, out-of-band, and computing.
- More leasable rackspace, as the Net SR reduced 5RU's worth of devices to 1RU.
- Time and cost savings, as the Net SR and Nodegrid OS provided a fully-integrated feature set for true lights-out management of in-band and out-of-band.

Image: Frank Basso, EVP of Operations at Vapor IO, stands near a newly installed VEM-180 unit.

"I run a lean team. Other vendor solutions couldn't integrate to save us any real time or money. Nodegrid is like having extra engineers on the team.

Now, we deploy in an hour using one box instead of five, and it fits into our CI/CD pipeline so well that we can do proper lights-out management of all our sites.

I'm still finding more ways that it frees up my engineers and trims costs." ***— Frank Basso***

Vapor IO reduced deployment times from nearly eight hours to one hour. The Net SR allows less-skilled technicians to install and power on the device, which then establishes a cellular connection that remote teams can use to provision the rest of the site. Additionally, the Net SR can deploy telemetry and SCADA systems directly on the device using Docker containers, including the required Synse-native collectors that feed information to the Synse platform. Rather than requiring 160 hours to deploy 20 sites, as with their previous management infrastructure, this plug-and-play solution allowed them to bring all 20 locations online in 20 hours.

The 5-to-1 device reduction meant that they now had 4RU more to lease to customers, which meant they could maximize revenues. On top of this, the single Net SR made it easier to achieve their goal of lights-out management, as it connected to their configuration database and Synse platform. This meant the Net SR was able to receive configurations, decisions, and automation/orchestration jobs from Synse and execute tasks locally. These include normal operations tasks, as well specialized tasks, such as alerting Vapor IO's teams of impending issues, outages, or needed troubleshooting.

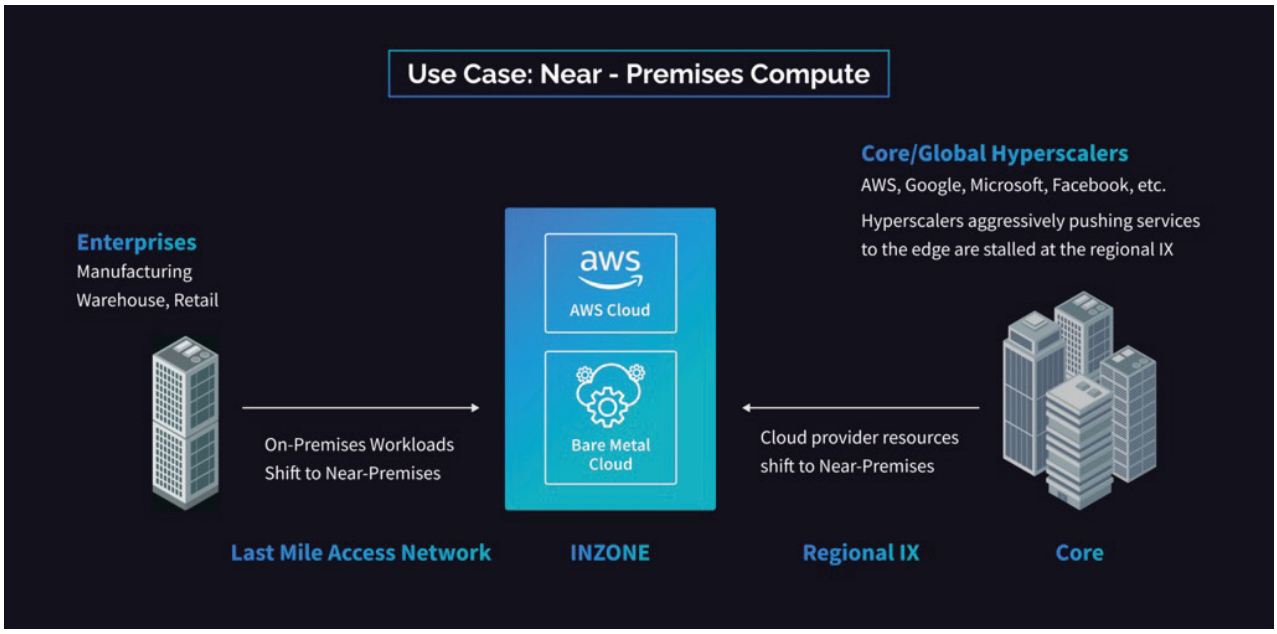

Image: Use case showing near-premises computing, where cloud provider resources and enterprise on-prem workloads shift to near-premises. (Source: Vapor IO media kit)

Because the onboard Nodegrid OS supports in-band and out-of-band, along with computing and memory resources for virtualization, Vapor IO was able to minimize their overhead. They could plan, develop, and implement new designs by deploying virtualized solutions, such as for SD-WAN or security. Along with this, the Net SR's modularity gives them the flexibility to perform upgrades and changes simply by installing new modules into the device. They can optimize each edge data center for the use cases required in each market, such as for near-prem computing or private 5G.

ZPE Systems' solutions are helping Vapor IO re-architect the Internet with extremely lean operations. Though there's now more emphasis on empowering last-mile networks and edge computing, tech leaders from every industry recognize the benefits of having streamlined infrastructure and operations.

Visit our Network Automation Blueprint page for the reference architecture Vapor IO and Big Tech use to achieve this, and set up a Nodegrid demo for help with your digital transformation.