



Reliable Internet Exchange Infrastructure

Building a sustainable IXP network for the Internet Association of Australia

The Internet Association of Australia, or IAA, operates an Internet exchange network that provides peering, virtual leased line (VLL), and cloud access services throughout Australia, with a goal to create better, 100% reliable Internet for the country. Internet peering is the building block of what makes up the Internet, and is critical for businesses, public organizations, and individuals to connect to valuable digital resources. This means the proper critical infrastructure must be in place to support the growing demand for everything from web hosting, to education, video streaming, gaming, and the myriad of other digital services.

But for IAA to keep up with their performance targets – which aim to provide 100% availability and 900Gbps speeds during peak times – they must sustain their infrastructure with frequent improvements, updates, and modernization efforts. This means constantly evaluating which equipment supports their goals, and which equipment holds them back.

IAA's existing network management solution reached end of life and became the focal point of this dilemma. With 35 distributed locations containing Arista, Cisco, and Extreme Networks, and Juniper equipment, not to mention numerous server resources, IAA required a new network management solution that could provide fiber connectivity and true lights-out management to keep their infrastructure operational around the clock. This involved overcoming the following obstacles:

- **Achieving a true out-of-band management network separate from the production network, to provide management access in case of routing errors**
- **Providing a fully remote virtual presence at all 35 points of presence**
- **Providing remote upgrades to network switches and servers, with the ability to remotely recover from failed upgrades, configuration problems, and human error**
- **Running tools locally for packet capturing and troubleshooting**
- **Enabling automation for fast deployments and reduced human intervention**

IAA addressed their problems by deploying the Nodegrid Net SR and Nodegrid Gate SR.

Background

The Internet is made up of many networks from various Internet Service Providers (ISPs), content providers, government agencies, education providers, and corporate networks, which connect to each other via expensive physical links.

Internet Exchange Points (IXPs) were created to help efficiently and inexpensively exchange Internet traffic between these different networks, by serving as a connection hub. IAA operates an Internet Exchange (IX) network and manages six separate IXPs across Australia, and their goal is to not only minimize the cost of their Internet transport, but also to increase the speed and reliability of Australia's Internet.

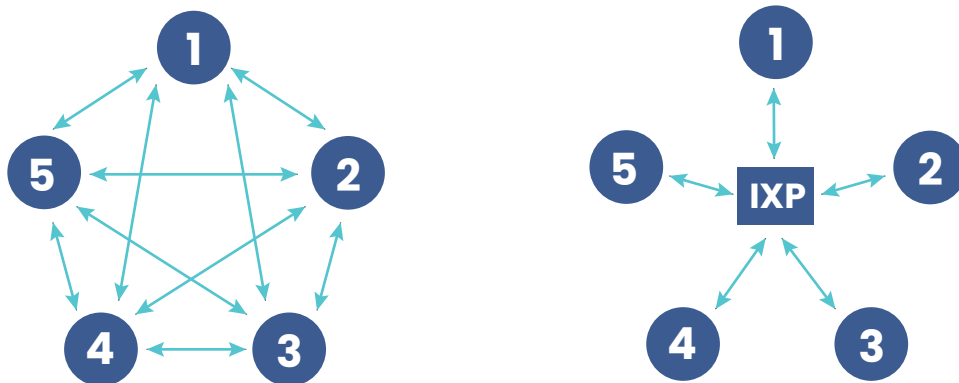


Diagram: ISPs connecting without peering (left); with peering (right)

IAA's infrastructure enables what's called a peering arrangement. Rather than having each ISP arrange separate physical links to every other ISP it connects to (shown in the graph on the left), having an IXP allows ISPs to connect to their peers using one link (shown in the graph on the right). This saves on the number of connections and associated costs, especially as the number of connected ISPs increases.

In addition to peering services, IAA also operates content repositories and caches on behalf of the most popular content services such as Netflix, Google, and Facebook. This means the value to ISPs is even greater as this heavy load traffic comes straight into their networks via the least expensive and quickest path.

For IAA to provide Internet services to its users, it operates six exchange points at 35 Points of Presence (PoPs) across Australia. Each site requires devices from different vendors, including Arista, Cisco, Extreme Networks, and others, to serve both the production network and management network.



The Challenge

As an Internet exchange (IX) operator, IAA must provide high levels of availability to its users.

Their architecture includes a dedicated in-band and out-of-band (OOB) management network, which was primarily made up of aging Cisco equipment. The network is also complex, offering VLANs to its member customers as well as remote peering and direct cloud interconnect services right across Australia to both ISPs and high-profile corporate and government networks.

BEFORE

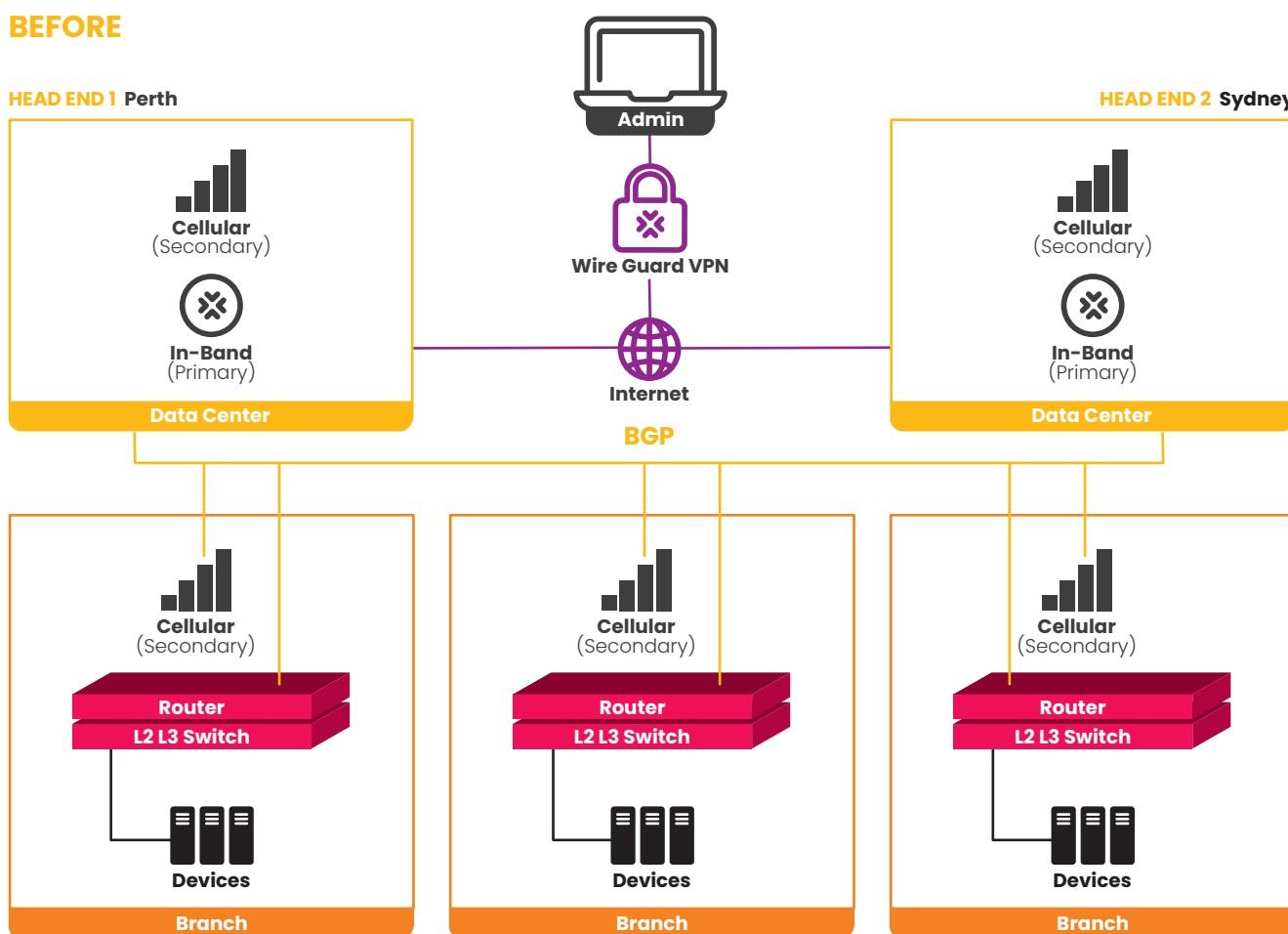


Image: IAA's existing solution required three separate management devices at each branch location

This existing out-of-band management solution required each location to house three separate devices:

- **A router** for managing traffic between networks and enabling multiple branch devices to use the same Internet connection
- **A router** acting as an L2/L3 switch/router to support routing on site and between VLANs
- **An LTE modem** for providing secondary connectivity

However, after learning that their Cisco devices were reaching EOL, IAA re-evaluated their architecture in order to keep up with their modernization efforts.

This helped them to identify several significant challenges:

- With two devices no longer receiving updates or support, their management network would no longer be able to fully support their production network, which would increase their risk of downtime and security breaches
- Having three separate devices at each location increased their risk of downtime, as one failure could cause an outage of the management network
- Having dedicated equipment required teams to manage and maintain more than 100 total devices, which inflated their workload and pulled teams from focusing on business goals
- Their LTE modem provided backup connectivity only for their management network, and could not be used in case of an outage on the production network
- Their existing solution did not support their ongoing automation efforts, which prevented them from improving their services through faster deployments and automated maintenance
- With these problems, their existing solution did not guarantee teams reliable remote access to broken devices, which increased the need for site visits

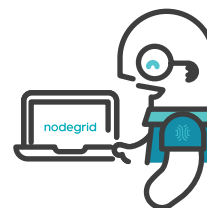
Rather than invest in third party maintenance providers, which can cost up to \$250 or more per device per month, IAA sought to refresh their infrastructure. But the challenges described above would culminate and leave IAA focused on answering one crucial question: “How do we adopt more resilient infrastructure without taking our services offline?”

IAA considered upgrading their EOL devices using a newer offering from Cisco, but ultimately they decided against this since this would leave them facing the same predicament in the coming years. IAA also considered a cloud-based management solution from an existing vendor, but this proved too costly and did not give them the customization they required, such as the ability to use custom automation scripts. They also obtained a proof of concept from another vendor who ultimately wasn't capable of bundling networking, routing, cellular connectivity, and other functions to reduce complexity.

The drawbacks inherent to these alternatives led IAA to seek a solution that would allow them to sustain their critical infrastructure indefinitely, without having to compromise on functionality, simplicity, or resilience.

Their ideal solution would:

- Prevent near-future EOL through a product support lifecycle of more than five years
- Bundle functionalities to reduce complexity and device inventory
- Provide flexible yet secure in-band and out-of-band networking
- Enable critical infrastructure resilience during deployment for 100% sustainable uptime
- Enable easy operation of distributed sites via centralized access and management



The Solution

IAA chose Nodegrid as their solution to replace the existing Cisco appliances and the existing LTE modems, because it would allow them to satisfy all of these requirements.



Image: The Nodegrid Gate SR sits at the top of the rack to provide in-band and out-of-band networking
Source: IAA supplied

The powerhouse of their solution was Nodegrid OS. This Linux-based operating system comes standard on all Nodegrid appliances and features an extended support lifecycle. Nodegrid OS also provides flexibility to implement custom networking and third-party solutions of choice, which enabled IAA to deploy their complex routing and switching architecture incorporating numerous VPNs, ASNs, and VLANs. These capabilities allowed IAA to simplify their design and consider a single device solution, as it allowed them to combine the required in-band and out-of-band functionality into a single, resilient appliance.

For hardware, IAA deployed the Nodegrid Net SR appliance at their Sydney and Perth data center locations, to serve as head-ends of their architecture. The Net SR's modularity gave them the flexibility to right-size their deployment, rather than having to settle for devices that offered too much or too little functionality. They addressed their in-band and out-of-band needs simply by equipping each Net SR with the appropriate modules.



16 Port SFP Module



16 Port Serial Module



Dual-SIM 4G/LTE Cellular Module

- **16-port SFP module** – This module enabled complete in-band management capabilities, by providing full network connectivity to all required device management interfaces through existing fiber connections
- **16-port serial module** – This module provided improved out-of-band management via serial interface, enabling full automation support
- **Dual-SIM 4G/LTE cellular module** – This module provided the increased resilience of redundant backup connectivity to in-band and out-of-band links, via automatic failover access to separate wireless networks

At their over 35 PoP locations, IAA deployed the Nodegrid Gate SR equipped with dual-SIM 4G/LTE cellular add-on. The Gate SR provided them with all of the same features and functionalities as the Net SR, but in a smaller form factor. This ensured that each PoP achieved the same level of resilience and functionality as their larger sites. The Gate SR features eight serial ports and a variety of Ethernet ports, including SFP+ and multiple gigabit interfaces. This single device was able to connect to their entire stack at each location, to accommodate in-band and out-of-band networking.



Image: Nodegrid Gate SR front (left), back (right).
Source: Nodegrid Gate SR webpage

The combination of Nodegrid OS, the Net SR, and the Gate SR would address IAA's concerns for:

- Preventing near-future EOL through a prolonged product lifecycle
- Bundling functionalities to reduce complexity and device inventory
- Providing flexible yet secure in-band and out-of-band networking

The Nodegrid solution also enabled IAA to use their existing Puppet infrastructure to automate and orchestrate the full deployment of their new solution, and manage the implementation from Day 0 through to Day 2. And because Nodegrid is an open, vendor-neutral platform, it hooks into all data center and branch devices.

These capabilities would address IAA's remaining concerns for:

- Enabling resilience – even during deployment – for 100% sustainable uptime
- Enabling easy operation of distributed sites via centralized access and management



The Results

Nodegrid allowed IAA to refresh their Internet exchange management infrastructure, for both in-band and out-of-band networking.

Nodegrid OS served as the foundation which would eliminate their EOL concerns. ZPE Systems employs a large and responsive engineering team, and provides Nodegrid OS releases that continue to support the oldest Nodegrid devices. This resulted in IAA deploying a solution that features:

- A product lifecycle of more than five years
- A combination of at least six major/minor releases annually
- Responsive security patching, with vulnerabilities patched within hours/days (example: log4j patched within one day)
- Consistent product updates which implement and enable current industry best practices

Prior to Nodegrid, IAA’s data center head-ends used load balancing to provide high availability. This, however, required managing more equipment which made it difficult for teams to monitor and maintain their infrastructure. This also required a static IP address at each head-end, which increased both cost and security risks. At each branch location, IAA used a Cisco ISR 2900 router, Cisco ISR 3900 router, and an LTE modem for in-band traffic and out-of-band management. These devices required additional configuration and administration.

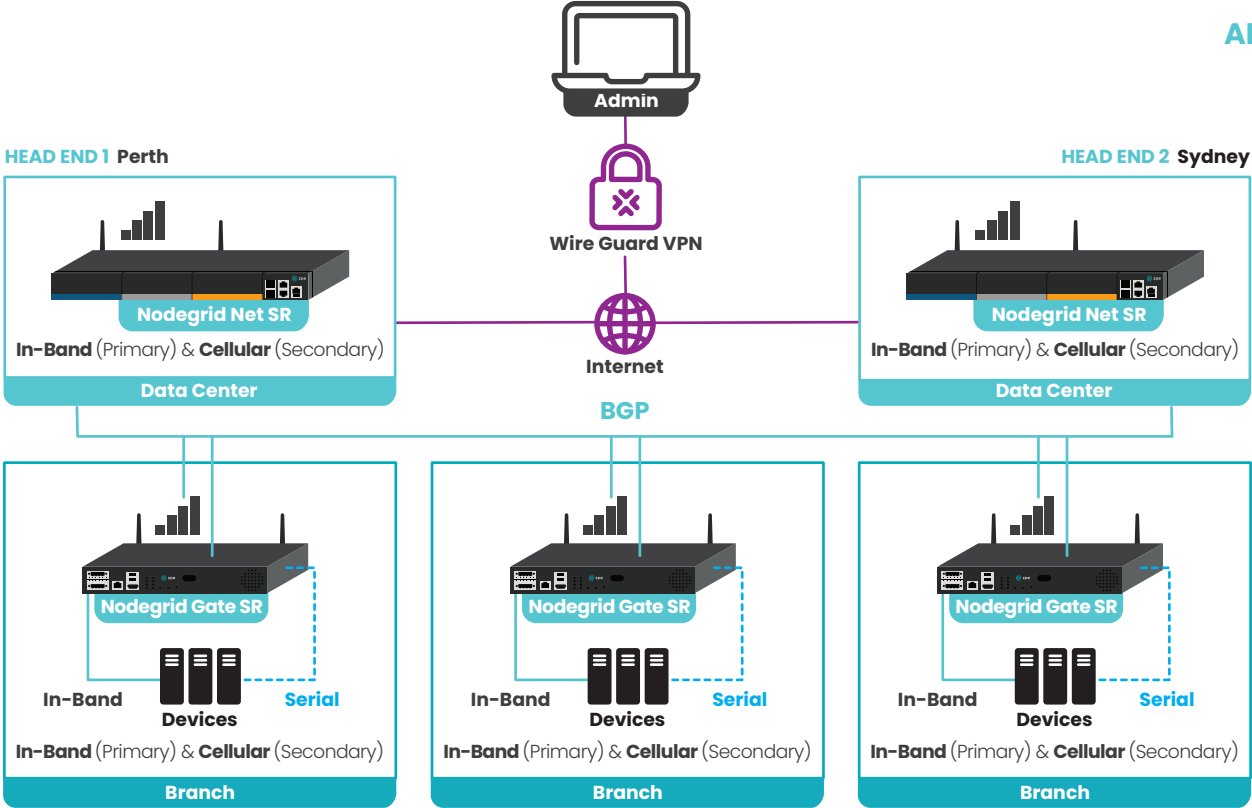


Image: The Nodegrid Gate SR consolidated in-band, out-of-band, and cellular connectivity into one device

With the Nodegrid Net SR and Gate SR, IAA was able to reduce this complexity. These feature-rich boxes not only served their connectivity requirements for serial, Ethernet, fiber, and cellular, but also provided flexible in-band and out-of-band access via Nodegrid OS. Combined with the long support lifecycle of Nodegrid OS, this total solution allowed IAA to deploy a secure and reliable infrastructure that can be maintained beyond the foreseeable future, while serving as the backbone to sustaining 100% resilience and uptime.

At each head-end, the Net SR eliminated the need for load balancing and static IPs. Instead, the Net SR connected to the Internet via fiber and ran a VPLS instance to establish BGP links between each head-end and PoP location, thanks to dynamic routing provided by Nodegrid OS's built-in free range routing (FRR) feature. Nodegrid OS's WireGuard feature also allowed for easy setup and management of multiple VPN tunnels, while the Net SR's dual-SIM 4G/LTE module provided backup connectivity.

At the PoP level, the Gate SR combined the functionality of three devices into one. The Gate SR provided routing, switching, and cellular backup – along with out-of-band management – for every site's target devices. Nodegrid OS's FRR feature allowed IAA to run two BGP sessions to each head-end and customize for redundancy. Should a primary link fail, the built-in WireGuard keeps traffic secure as it fails over to 4G/LTE.

Nodegrid OS is vendor-neutral, even when it comes to automation tools and languages. Rather than having to learn specific skills, IAA was able to automate deployments using their team's existing knowledge of Puppet scripts. Paired with a reduced device inventory of one Gate SR per location, this allowed IAA to rapidly increase the rate at which they could set up their new infrastructure. Teams could put their refreshed critical infrastructure into production without disrupting their commitment to maintaining 100% uptime.

For centralized management, Nodegrid's clustering feature provided an easy-to-use solution despite IAA's distributed infrastructure. By accessing any Net SR or Gate SR, teams could gain easy access to the rest of their sites and devices. Instead of having to memorize location names and IP addresses, Nodegrid enabled intuitive out-of-band management with point-and-click access – whether to a rack of devices at the head-end, or servers and switches at PoP locations.



The Benefits

For IAA, the burden of managing their aging infrastructure would only increase over time. But Nodegrid allowed them to lay the foundation for sustainable infrastructure.

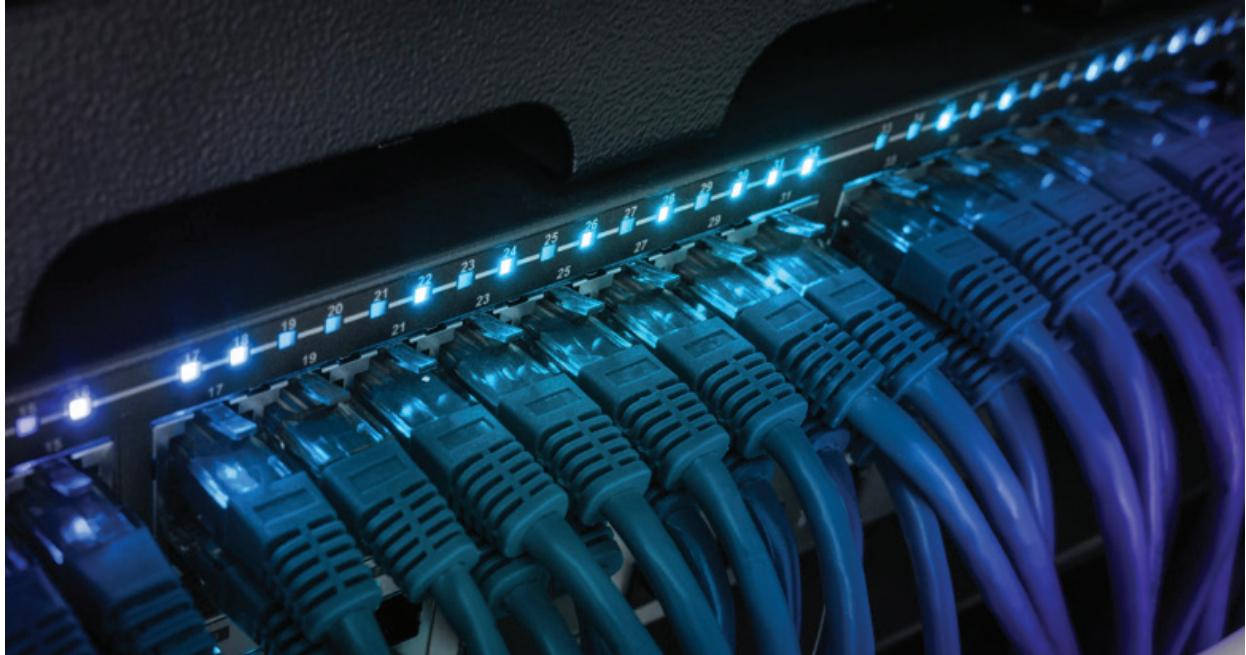
By refreshing with Nodegrid OS, the Net SR, and the Gate SR, IAA satisfied all of their requirements and benefited from:

- The peace of mind of having a solution that will last at least five years
- \$17,500+ in savings per month by avoiding third party maintenance
- 3-to-1 device reduction, which reduced complexity and inventory at each site
- Sustainable in-band and out-of-band networking with a bundled, open platform
- Additional time, IT resource, and cost savings with automation and centralized management

With EOL devices throughout their 35 locations, IAA could have spent \$250 or more per device per month to maintain their existing infrastructure. By opting to refresh with Nodegrid, they avoided this ongoing cost and instead deployed an infrastructure that they and their member customers can rely on for at least five years.

The bundled Nodegrid solution eliminated the complexity and costs associated with load balancing and static IP addresses. The Net SR served as a fast and reliable VPN concentrator at each head-end, with Nodegrid OS simplifying routing between the data center and branch.

The Gate SR reduced the hardware stack at 35 distributed locations, eliminating 70 devices from the management workload. This appliance's variety of interfaces allowed connectivity to Ethernet and serial devices, with dual-SIM cellular failover providing highly redundant backup to both in-band and out-of-band networks.



Source: <https://internet.asn.au/technical/out-of-band-network/>

With Nodegrid OS's built-in FRR and WireGuard features, teams established dynamic and secure primary and secondary links between all sites. This also offers faster troubleshooting, since IAA can now pinpoint failed links and their originating devices, and then recover using Nodegrid's centralized management.

Compared to traditional solutions, another major benefit of Nodegrid is Nodegrid OS's automation freedom. Whereas many solutions require at least one day to set up a single location, Nodegrid OS's automation capabilities allowed IAA to set up sites in just hours. Their teams automated configurations and ultimately deployed all 35 sites in only four days, without having to take their services offline.

If you need sustainable network infrastructure – whether for Internet exchange networks, digital services, hosting, or content delivery – Nodegrid is the solution you can rely on. Six of the top ten global tech giants trust Nodegrid to keep their infrastructure running into the future, and your business can achieve the same resilience. Set up a Nodegrid demo to see how.