Leading the Way for 5G

Small Cells Deployment
by Intraway

The impact of codeless provisioning automation in small cells deployment.

Introduction

Mobile networks are under increasing pressure. Here are some facts:

- 80% of mobile traffic happens indoors without the need of an external connection.

- Mobile devices by 2021 will be around 11.5 billion (1.5x the world population).

- Ultra-low latency is required for urgency services or autonomous cars.

- High throughput demand of symmetric 1Gbps will be the standard.

To comply with these growing demands, distributed virtualised network architectures in mobile networks provide significant scaling advantages and flexible deployment options. An example of this is the use of small cells in fixed broadband access networks to scale the capacity and coverage of cellular networks.

The main purposes for small cells are to:

- Improve in-building coverage.

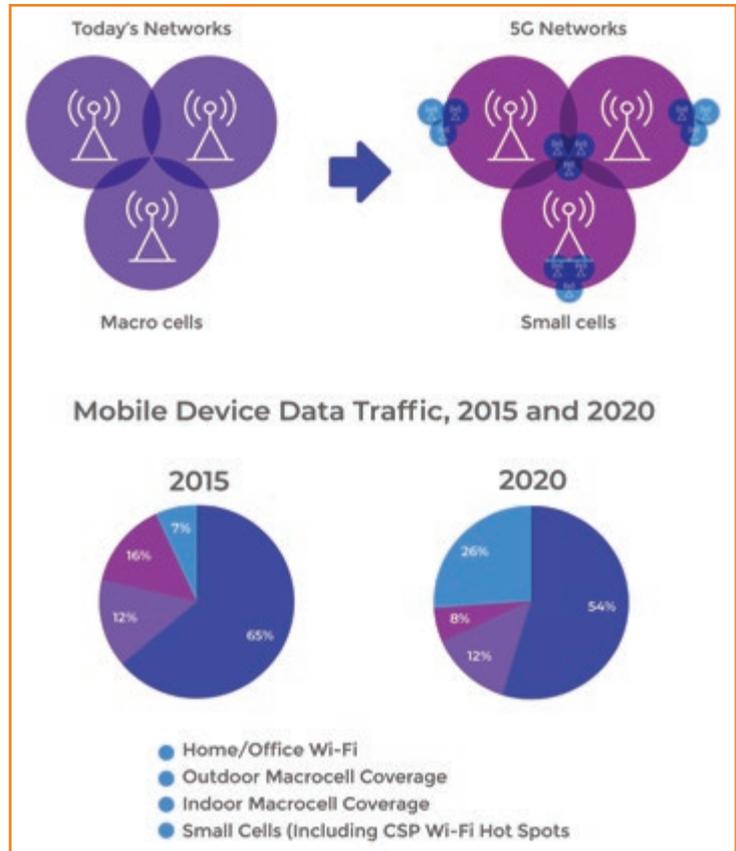- Meet growing demands for more capacity (either indoor or outdoor).

Figure 1: The small cell market is developing at a rapid pace. Communications service providers are rolling out small cells in a variety of environments and their CTOs need to take note of the latest trends.

Figure 2: Installing small cells should be as easy as installing a cable modem

- Improve the subscriber experience.

- Build a platform for value-added services.

Most cellular operators are now committed to small cell network solutions, in one form or another, and have them in their business plans.

As wireless networks evolve to 5G and there are limited opportunities to add new spectrum bands and macrocells, small cells will play a critical role in delivering the high bandwidth, densification and low-latency connections required by the myriad potential 5G use cases.

Small cell deployment mainly solves coverage problems for business clients. Nonetheless, it can be used both in business and residential scenarios with any type of Backhaul (DSL, Cable or Fibre) to treat coverage or capacity issues supporting LTE bands: CBRS 3.5 GHz, LTE-TDD and LTE-FDD licensed bands.

Here we discuss the activation of small cells, the access network and virtualised functions, orchestrating through various inventories, network systems and elements involved in the provisioning automation.

We will discuss how the automation and standardisation of the small cells provisioning ensure quality (reducing the manual turn-up/activation issues considerably), speed up deployment (allowing operators to reach 10x increase factor without hiring additional staff) and how automated provisioning and configuration of the virtualised infrastructure and network elements provide network elasticity, expanded coverage and enhanced QoE at an attractive cost.

By reducing dependency on specialised hardware, operators can also expect to lower Capex and Opex while they speed up service delivery, allowing scalability on demand and responding to network conditions and user needs in real-time, opening the way for 5G and dynamic services.

Regarding complexity of the orchestration, different elements and use cases need to be considered for automation: for management, the HMS/HeMS need to be configured together with the TR-069 ACS and KPI management.

Regarding the Core, the SeGW, HeNB/HeNB GW and location function need to be provided. Core density, core scalability, transport security and multi-vendor small cell management are some additional challenges.

The solution needs to provide simplified management, accelerated time to market and ease of integration with the macro network.

The scenario

5G and IoT are setting high expectations in the customer's mind, raising the bar for service providers. The business case is centred on augmenting the wireless coverage for billions of connections and providing low latency. The only way to achieve that is by deploying hundreds, and even millions, of small cells efficiently and on-time.

Ensuring that those small cells and backhaul links will meet service level agreements at turn-up presents a new challenge. Traditional manual provisioning and testing methods are simply impractical for current and future needs.
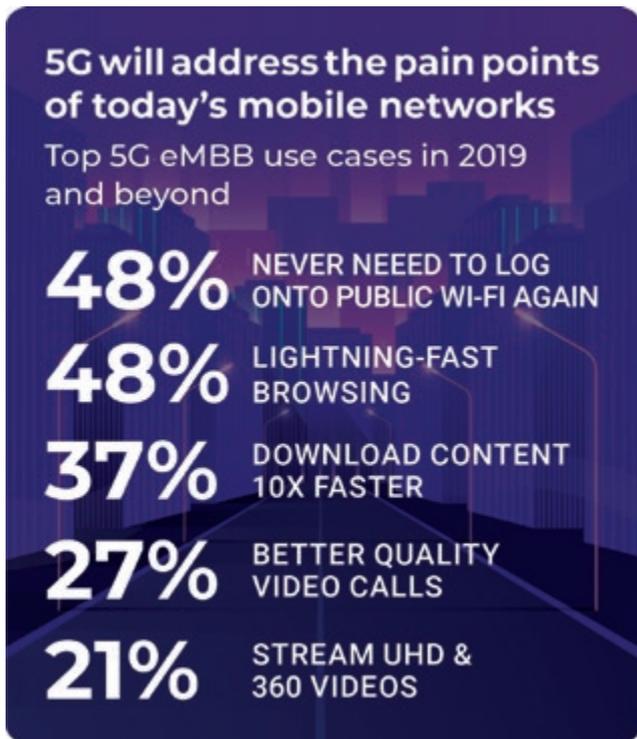
Figure 3

5G is the next-generation mobile networking standard that will build on the global 4G Long Term Evolution (LTE) ecosystem. Its promise goes well beyond high data rates, spectral efficiency, ultra-low latency or massive sensor networks. It enables new service opportunities – from just people communicating on phones to rapid real-time low latency data transmission between things.

With the landscape of 50B IoT devices connected to the network by 2023[1], on-demand remote provisioning and management of mobile connectivity are going to be key factors in catapulting this business to the next level.

According to a Q418 survey of 22 LATAM mobile operators, the top five drivers for densification are:

- Cost-effective way to start 5G deployment in targeted areas.
- Support 'hot zones' of high data usage and high revenue potential e.g smart city, business campus.
- Basis of future IoT and edge-focused services.
- Increased commercial requirement to support indoor cellular e.g. for IoT.
- Lower cost of rural expansion.

Everything is Connected

From 'Smart Appliances' to 'Smart Cities', we will live in a world where everything is connected. We will have better information, more control and insight into everyday things. With sensors everywhere, systems will be able to keep running autonomously.

Every device you own – and some that you don't even know will soon be an instrumental part of your everyday life – will be connected to the Internet. IoT will transform everything we know in the coming years.

From the way we do business to how we manage our household life, our health, security, manufacturing and even our cities, everything will be powered by IoT connectivity

Key findings (from Gartner)

- The majority of communications service providers (CSPs) now agree that small cells are essential to future cellular networks to meet user demands. In countries with a developed cellular infrastructure, most are now implementing small cell strategies to meet both capacity and coverage demands in a cost-effective manner.

- Wi-Fi hotspots are an essential part of communication networks, opening up better business plans for mobile virtual network operators (MVNOs) and over-the-top (OTT) players. CSPs are likely to face new competitive trends.

- Use of Long Term Evolution (LTE) over unlicensed spectrum opens up new opportunities for cellular operators, and the divide between Wi-Fi and LTE starts to become blurred.

- The emergence of small cells has generated new business models and created the need for more partnerships involving CSP equipment vendors, system integrators and property owners.

Small cell deployment challenges

The current fulfillment and assurance processes in mobile operators were designed for macrocells. Those processes limit

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1   Internet of Things - The number of connected devices worldwide 2015-2025. Published by Statista Research Department, Nov 14, 2019, https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/

Deployment Preparation	Service Installation	SLA Monitoring and Maintenance
Complex design and management tasks Planning based on spreadsheets that are prone to errors	Failure to install on time (Turn-up/Activation issues) High percentage of turned up broken (Dead on arrival) Lack of visibility in the final service delivered Customer dissatisfaction)	No visibility into service performance Multiple dispatches to find then fix (Many truck rolls) Large level of effort to isolate troubles (Large mean time to repair)

Figure 4: Small cell deployment challenge

the deployment of cells to around 10/15 cells per day. To meet a goal of 25,000 or even 100,000 in the spam time needed, operators need to scale to at least 100 cell deployment per day. Adding additional staff (or contractors) is not an option.

The deployment entails complexities such as provision IP backhauls from different access technologies (DOCSIS, GPON, DSL etc.), support different network equipment vendors (interoperability) and off-net providers with various technologies.

At a higher level, the small cell deployment and turn-up can be summarised in:

- Deployment preparation.
- Service installation.
- SLA monitoring and maintenance.

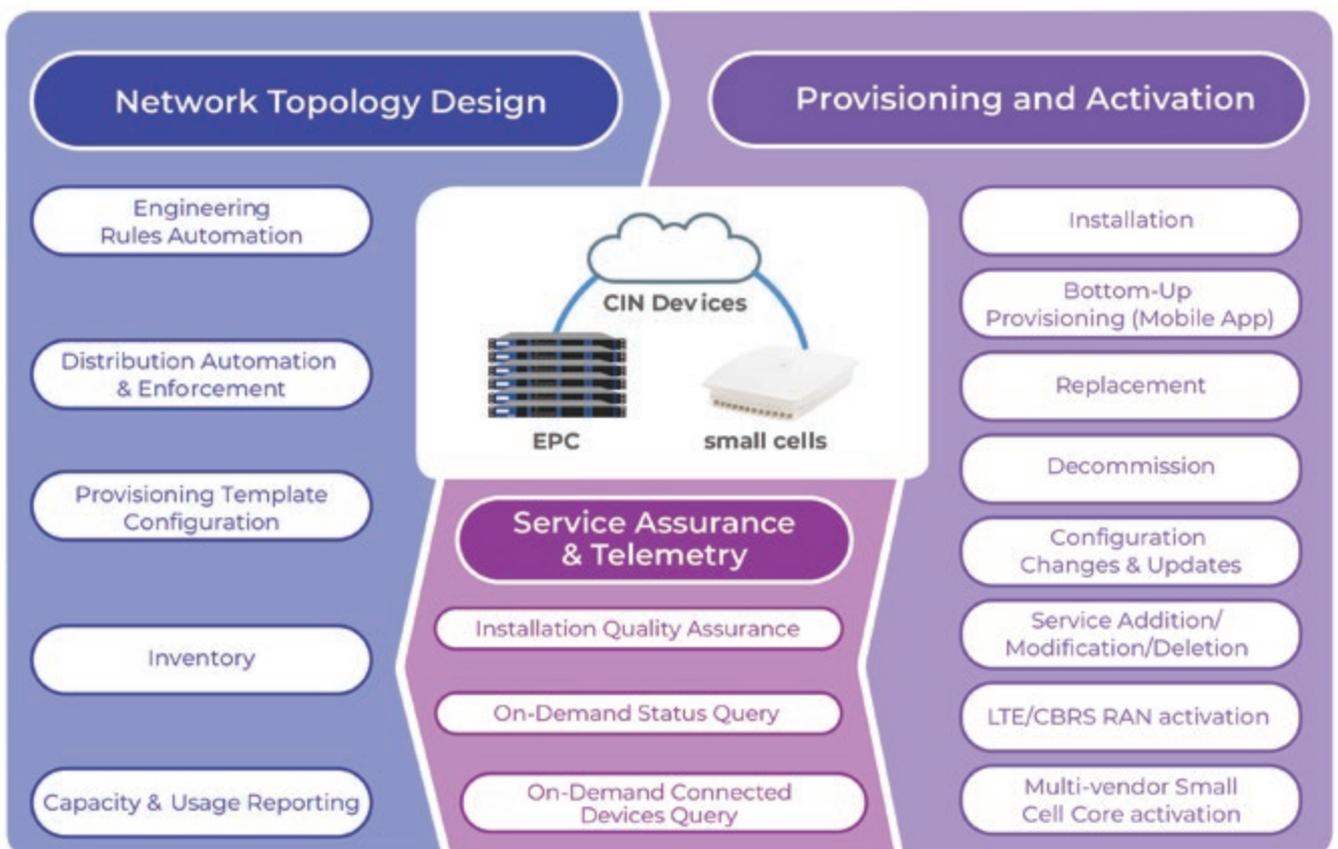Deployment challenges at each stage are described in Figure 4 above.

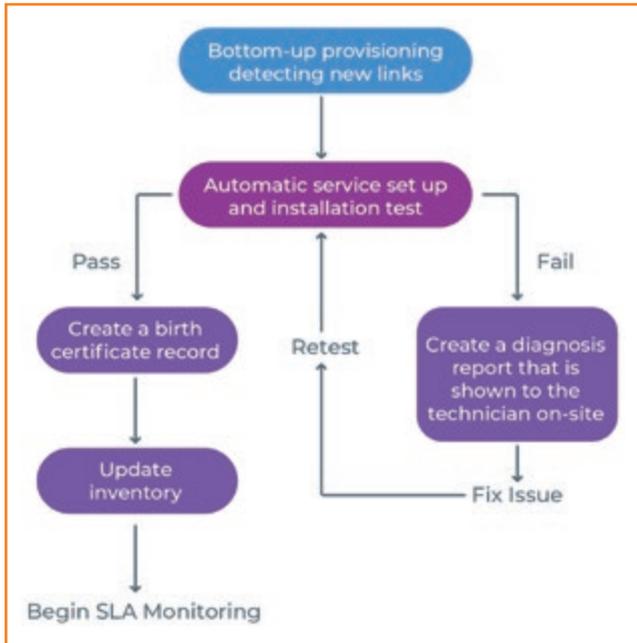**Figure 5: Multi-vendor small cell automation**

Figure 6

Small cell deployment automation

Based on codeless lifecycle service automation and closed-loop assurance, Symphonica automates the small cell turn-up. It offers clear SLA Installation visibility, which automatically benchmarks service quality levels and alerts the technician about any deviations from established benchmarks.

Where previously a technician had to dig through new services and manually configure the equipment and tests, Symphonica enables the operator to automate the service deployment process so that most small cells could be activated automatically.

An integrated solution allows the mobile operator to manage the lifecycle of small cells in a mobile network on top of simple device provisioning. This is:

- Control and automate the E2E fulfillment process.

- Keep an active inventory of implemented elements.

- Interact with operational tools at the mobile operator, such as firmware management, to ensure healthy ops.

- Validate installation parameters and generate birth certificates.

- Provide access to monitoring and telemetry data to external platforms via standard APIs.

- Evolve into the monitoring and telemetry of the small cells in the network, to trigger maintenance or dynamic changes in the network.

- Support the engineering function at migration and network design.

- Provide with a flexible small cell provisioning process which supports custom profiles, hierarchical and geographical deployments.

- Simplify the integration with any Auto-Configuration Server (ACS) for management of the small cell devices using TR-069 protocol.

- Provide operational features such as fault monitoring, device software upgrade, get/set parameters, profiles, configuration files and RPC methods.

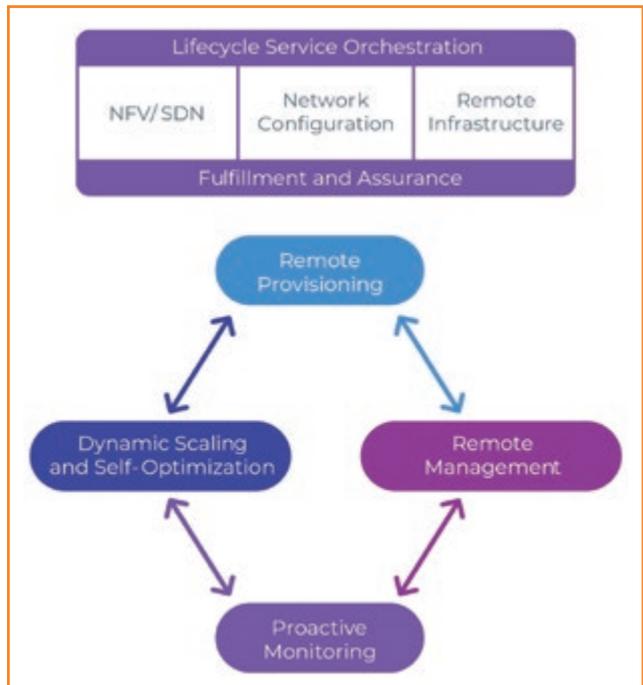- Support of specific management actions on each device, per region, per customer type etc.

Figure 7

> **An integrated solution allows the mobile operator to manage the lifecycle of small cells in a mobile network on top of simple device provisioning.**

> **This emerging type of distributed network architecture requires provisioning of the remote infrastructure to onboard new devices (or nodes) and manage them remotely across its lifecycle.**

- Provide fast integration with multi-vendor equipment.

- Natively support a standards-based northbound integration.

- Guarantee scalability through a virtualised architecture, enabling capacity growth, adding new instances of the software.

- Adopt new ways of network planning, installation and operations support to enable large scale and small cell developments with much lower capital expenditure (Capex) costs.

Small cells and virtual EPC

While some cellular operators are still in the planning or trialling stages, others are ramping up their deployments and expanding into new market areas. Small cells can come in several forms:

- Residential or small or midsize business (SMB) femtocells.

- Indoor or outdoor stand-alone picocells.

- Distributed radio small cells for large locations.
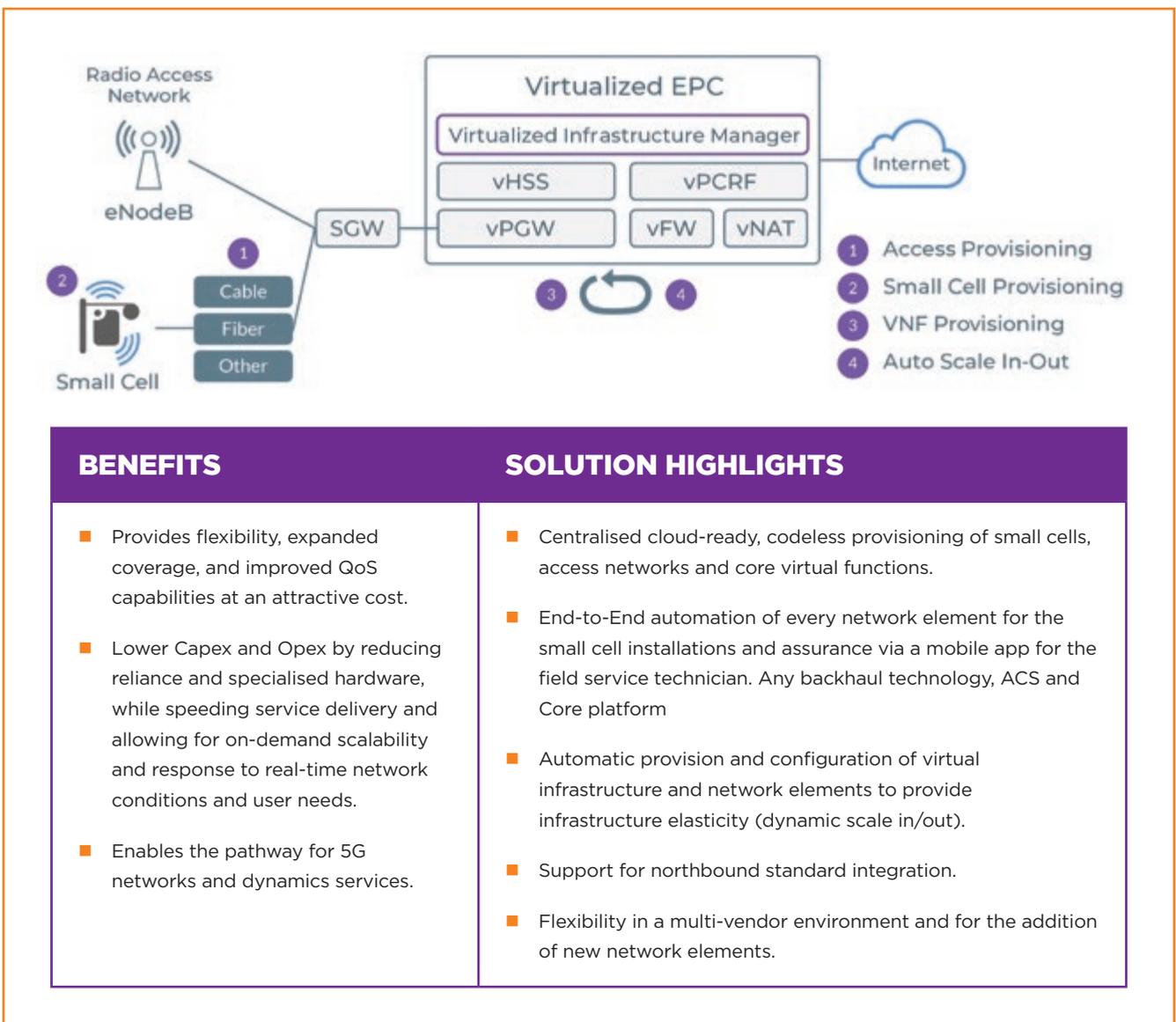
- Carrier-class Wi-Fi hotspots.

BENEFITS

- Provides flexibility, expanded coverage, and improved QoS capabilities at an attractive cost.

- Lower Capex and Opex by reducing reliance and specialised hardware, while speeding service delivery and allowing for on-demand scalability and response to real-time network conditions and user needs.

- Enables the pathway for 5G networks and dynamics services.

SOLUTION HIGHLIGHTS

- Centralised cloud-ready, codeless provisioning of small cells, access networks and core virtual functions.

- End-to-End automation of every network element for the small cell installations and assurance via a mobile app for the field service technician. Any backhaul technology, ACS and Core platform

- Automatic provision and configuration of virtual infrastructure and network elements to provide infrastructure elasticity (dynamic scale in/out).

- Support for northbound standard integration.

- Flexibility in a multi-vendor environment and for the addition of new network elements.

Figure 8

End-to-end provisioning and management – including a mobile app for field service tasks, device remote provisioning and firmware management, fault & performance monitoring, dynamic scaling and self-optimisation.

Distributed network architectures are emerging to provide significant scale advantages and flexible deployment options. An example of this is the use of small cell distributed nodes to scale capacity and coverage of cellular networks.

This emerging type of distributed network architecture requires provisioning of the remote infrastructure to onboard new devices (or nodes) and manage them remotely across its lifecycle.

The solution provides orchestration across various inventories, the network and the element management system that are all involved in the automation of provisioning. This also ensures the quality of installation of new remote devices to the network infrastructure.

Contact
Website: **www.intraway.com**

SYMPHONICA

Codeless provisioning automation for the entire lifecycle of services orchestrated across multiple networks and multiple technology domains.

For service providers looking to scale to provide lighting fast time-to-market and improve operational efficiency, Intraway's Symphonica is a no-code service provisioning solution. With Symphonica, you can focus on growing your business without investing in a budget-heavy and time-consuming deployment project.

- Orchestration and activation of any service from any vendor across any network technology from a single point.

- Accelerate time-to-revenue by enabling zero-touch provisioning, orchestration and service activation of every network element or system from a single platform.

- Create new or customise existing workflows and connectors faster. Design Studio. No coding required.

- Integrate virtually any network element, cloud or on-premise in hours, regardless of the protocol.

- Assure the implementation with intelligent configuration checkups, inventory updates and birth certificates.

- Transition from physical to virtual or distributed infrastructure.