Private LTE: how to overcome challenges and focus on opportunities

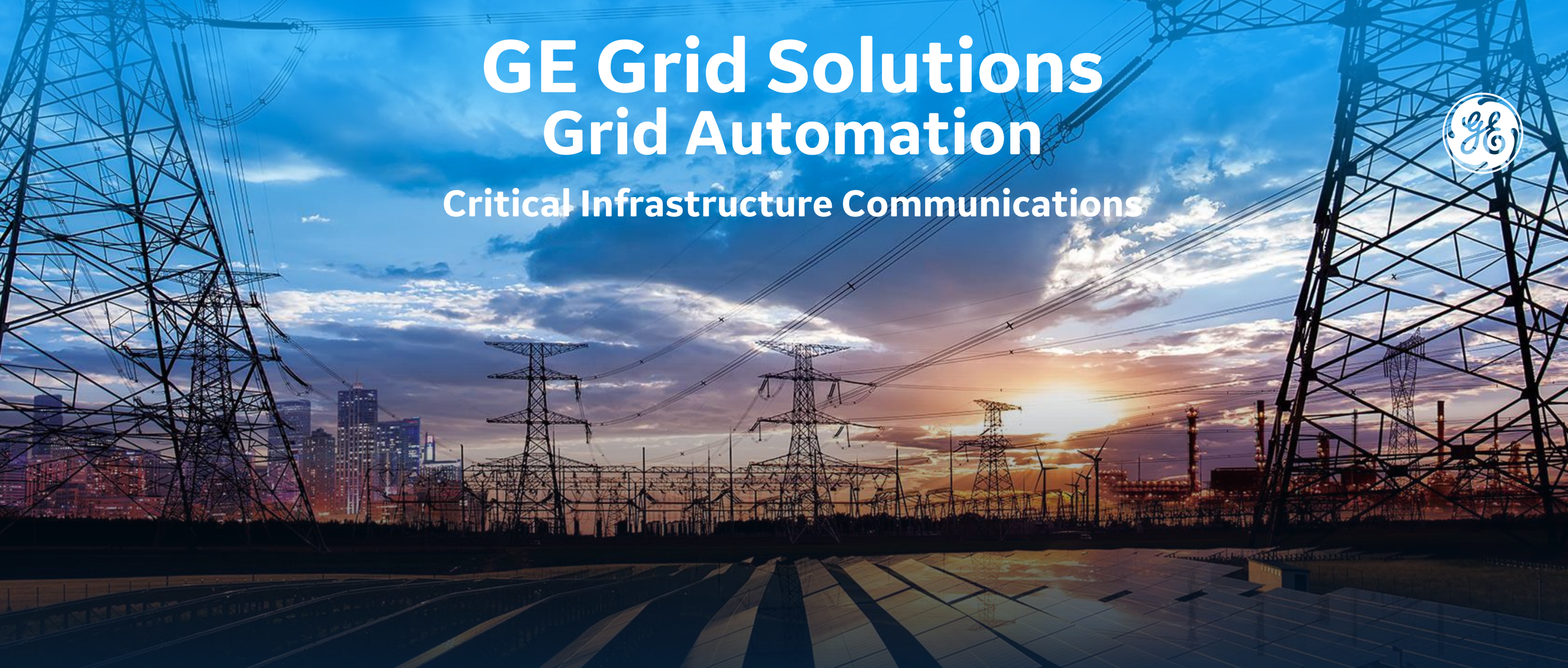
Presented by:

Giovanni Puppo
CIC EMEA APAC Commercial Leader
& ERCIS Sales Director
GE Grid Solutions

Today’s Agenda

- GE CIC Introduction & Portfolio
- Private LTE Overview
- Private LTE Applications
- Private LTE Devices
- Q&A

GE Grid Solutions
Grid Automation
Critical Infrastructure Communications



$3.3B
2021 REVENUE

70+
COUNTRIES

12,000+
GLOBAL EMPLOYEES

3,400
ENGINEERS ACROSS THE GLOBE

1,200+
RECOGNIZED POWER SYSTEM INDUSTRY EXPERTS

90%
OF POWER TRANSMISSION UTILITIES EQUIPPED BY GE

Grid Automation

MONITOR
µs

Edge devices, Data acquisition for protection or asset management

PROTECT
ms

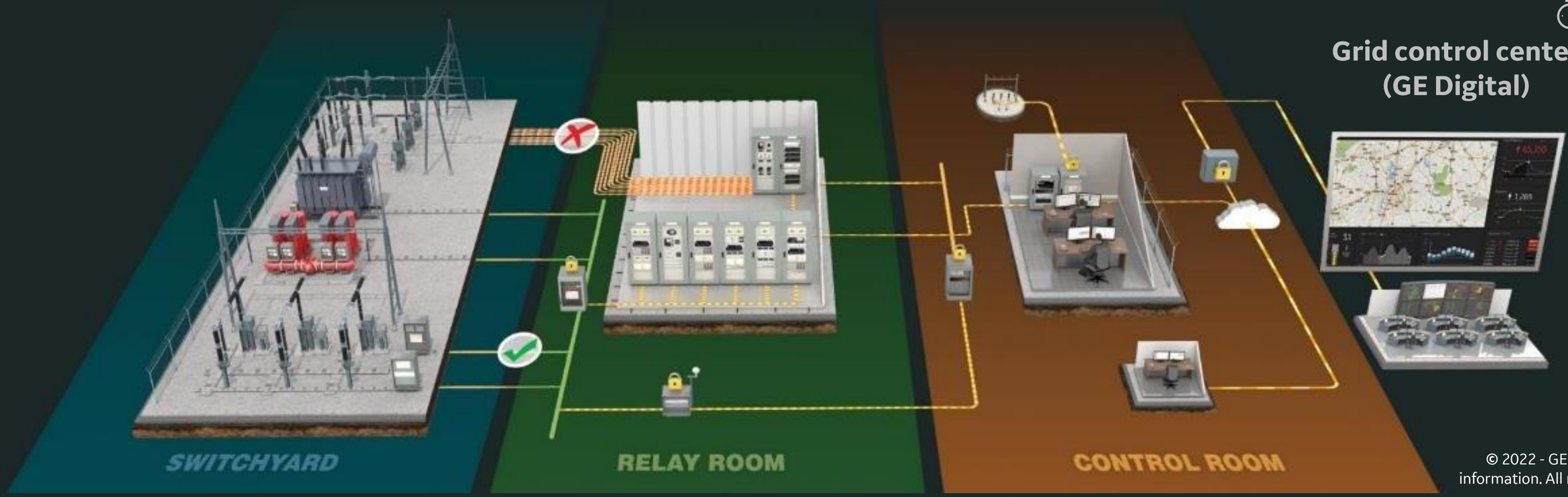
Analyze, instant decisions, send commands to switchyard to execute

CONTROL
100 ms

Operator interface, substation management

s/min

Grid control center (GE Digital)



COMMUNICATE
ms

Share operational data inside substations, between substations and with central control system

Grid Automation

Two product and technology groups:

PAC

Protection, Automation & Control

AAA & Services

Advanced Automation A r r
ff r REN integration. industries & microgrids

Substation Automation

Digital & conventional control systems. ff i . ff multi nctional RTUs. time sync ult recorders. R MUs

R rotection & Control

i ff
Advanced tec nologies r transmission. distribution. rail and industrial a r r

M&C

Monitoring & Communications

R ff Asset er rmance Management

Com r i ensive solution r com r any wide asset r rmance and e cycle management

Monitoring & Diagnostics

ff
Wide range o asset monitoring devices and eet level condition monitoring system

ff Critical In astructure Communication

Communication systems using switc es. r power line carrier. o tical netwo ks and wireless solutions

Monitor – Protect – Control - Communicate

© 2022, GE. Proprietary information. All rights reserved.

Critical Industrial Communications

Our Headquarters

Optical Solutions HQs – Vancouver CANADA

Lentronics HQs: Optical solutions R&D Product Management and Manufacturing

Teleprotection & PLC HQs – Paris FRANCE

TP & PLC HQs: Optical solutions R&D Product Management and Manufacturing

GA Office - Stafford UK

Competence center and factory

CIC Headquarter – Rochester NY USA

- CIC Headquarters
- MDS Headquarters: Wireless Solutions R&D
- Product Management and Manufacturing

GE’s Industrial Communications Solutions

Industrial Wireless Solutions

MDS™ Orbit Platform

Industrial LTE, licensed, and unlicensed Communications. Comes in three form factors: Multiservice Connect Router, Edge Connect Router (ECR), and Outdoor Connect Router (OCR).

Hardened Optical Networks

DXC Platform

Highly configurable multiplexer that supports a variety of interfaces.

Lentronics™ JungleMUX

Purpose-built packet-switch solution for teleprotection with hybrid packet & TDM capabilities.

Power Line Solutions

Gridcom T390

Universal power line carrier for high voltage transmission lines.

E-terrapowercom

Broadband power line modem with integrated switch design for communications on medium and low voltage grids.

Teleprotection

DIP.net

Prompt, dependable, and secure transmission of commands and control signals across the grid. Comes in two form factors: compact and fitted for 19” racks.

GE’s Industrial Communications Solutions

Network Switches and Converters

Managed Ethernet Switches

GE’s series of rugged and secure range of network connectivity hardware.

Managed PRP/HSR Redbox

all-in-one gigabit redundancy solution, which has been specifically designed for the digital substation.

Integration & Professional Services

GE’s CIC Professional Services offers a range of services and project management capabilities that can be tailored to provide a fully engineered, deployed, and supported system to meet application specific needs.

Network Management & Provisioning

GE's network management systems simplify the management and monitoring of Critical Infrastructure Communications products, including Sentinel, PulseNET, EnerVista, and iNMS.

GE MDS Industrial Wireless Solutions

GE Orbit – The Leading Wireless Platform for Utilities

Small size for limited space applications

Multiple wireless technologies and port options in one device

IP67 weatherproof, suitable for hazardous locations

VARIETY OF FORM FACTOR

COMPREHENSIVE SECURITY

FLEXIBLE NETWORKING

WIDE RANGE OF APPLICATIONS

SUPERIOR RELIABILITY

FIRSTNET READY

Anterix ACTIVE

CBRS

DESIGNED • DEVELOPED ASSEMBLED IN THE USA

UBBA Utility Broadband Alliance

450 alliance.org

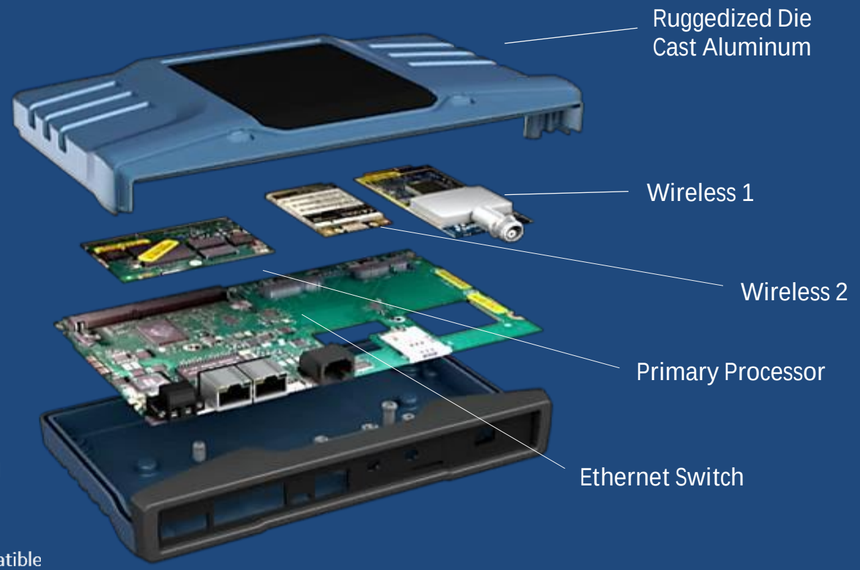
GE Orbit – The Leading Wireless Platform for Utilities

Multiple Interface Options

r r r ff .
r R r
i r ff
r ff r r

R i

A Full Router with up to two Wireless transmission systems in a single unit



- Licensed or Unlicensed band antenna port
- LTE or WiFi connections
- Dual-SIM (GSMA eSIM compatible
- RS-232/485 Serial Port
  Alarm input on serial pin interface
- USB 2.0
- 2-RJ45 10/100 Ethernet Ports
- DC Power 10-60 VDC

*With optional alarm sensor kit

6 x 10/100 Ethernet

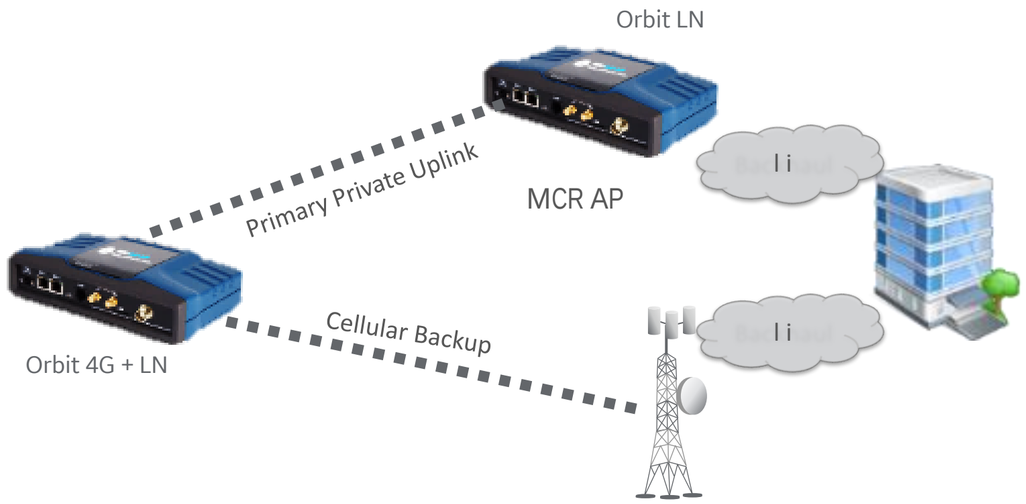
2 x 10/100 Ethernet & 1 x RS-232/485

1 x SFP, 2 x Ethernet , 2 x Serial, 1 x USB

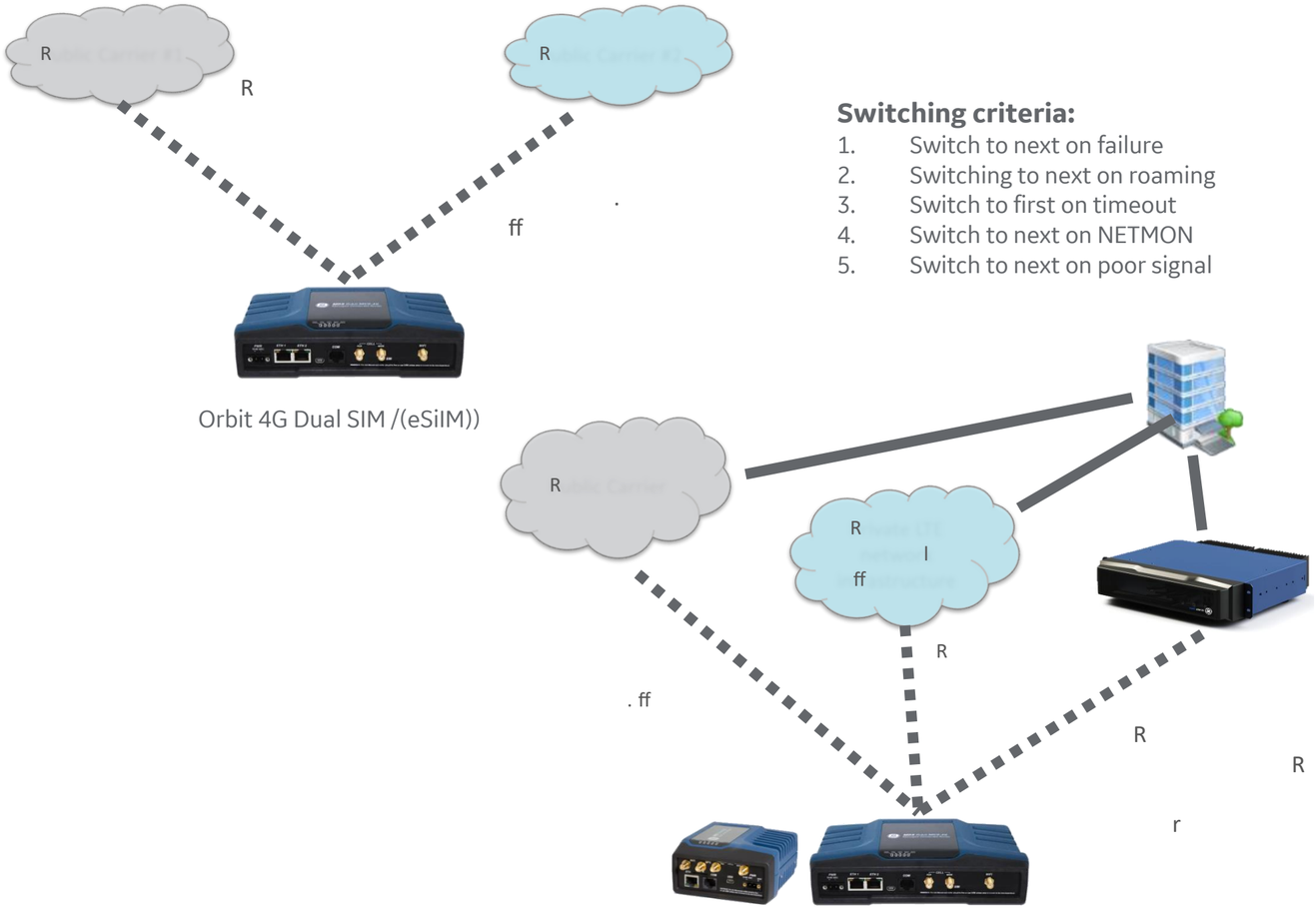
4 x 10/100 Ethernet & 2 x RS-232/485

Multiple Redundancy Configurations

Orbit with LTE and UHF/VHF connections for Private – Public or Private – Private backup options



Orbit DUAL SIM Redundancy configuration – Private LTE + Public LTE backup option



Switching criteria:

1. Switch to next on failure
2. Switching to next on roaming
3. Switch to first on timeout
4. Switch to next on NETMON
5. Switch to next on poor signal

GE Orbit Cellular Models

Model / Region	Protocol/Frequencies	Fallback Support	Approvals / Certification	SIM	GPS
4Gy (EOL 2024)					
4Gb					
4Gc					
4Ga					
4Gd					
4Gb+4Gy8					
4Gf					
4Gg					
5G					

Private LTE projects – current GE CIC footprint

Completed and awarded projects

6 years experience in P-LTE

Over 36,000 installed units

450 alliance.org

The GE Advantage

A Global Leader Providing Tailored Communication Networking Solutions for a Broad Range of Industrial Applications

INDUSTRIALLY HARDENED COMMUNICATION NETWORKS

- >4 MM devices deployed across the globe
- Extended operating temps -40°C to + 70°C
- Products certified to IEEE 1613*, IEC 61850-3, Class 1/Div2 standards. *Requires an external DC to DC converter having floating DC inputs (neither side grounded).
- Products built to IEC-A-610 REV E CL-2 standards
- Manufacturing sites ISO 9001:2008 accredited
- Rigorous HALT / HASS testing on all products delivering highest quality/reliability performance
- Mean Time Between Failure (MTBF) [illegible] MDS solutions

COMPREHENSIVE CYBER SECURITY FRAMEWORK

- Defense-in-depth strategy across energy infrastructure (hardware, firmware, network & user)
- Standards-based encryption, authentication, data integrity verification
- Designed for NERC CIP, NIST SP800-82, NISTIR 7628
- Device security tested and validated
- Wurldtech Achilles L1 Certified

DIVERSE PORTFOLIO FOR APPLICATION FLEXIBILITY

- Licensed and Unlicenced wireless solutions covering a broad range of frequencies including:
  - 100MHz to 38GHz with data rates up to 350Mbps
- Cellular routers and gateways providing 2G/3G/4G LTE and 5G worldwide carrier coverage
- Hardened Optical Networks including MPLS, switching solutions and SONET-SDH, and
- [illegible] Protection and [illegible] carrier solutions

Private LTE Overview

Private LTE Overview

Definition: Deployment of LTE network infrastructure by a private entity for their sole use and operation using privately owned or leased spectrum

What is Private LTE?

- Private version of public 4G mobile operator network
- Owned by corporate enterprise/end user
- Similar broadband data/voice capability as public carriers

Why is it important?

- Maintain control of the network without reliance on public carrier
- Ensure high level of security and network resiliency
- Standards-based technology for multi-vendor interoperability
- Performance to support grid modernization
- Strike the right balance between OpEx and CapEx

Which are the challenges and how to possibly solve them

- Frequencies Allocation
- CAPEX investments
- Operations capabilities

➡ **Build up capabilities through consortiums or agreements in case a single Utility is not prepared to address these challenges by itself**

- When specific frequencies are assigned for P-LTE, the choice of components available in the market forces vendors to purchase them from new/niche manufacturers

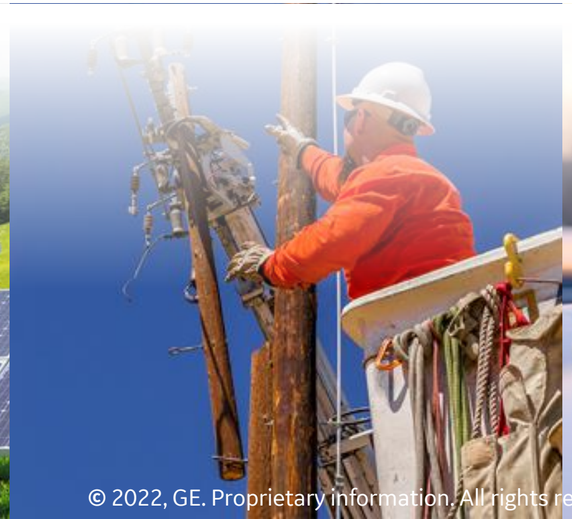
➡ **Make sure to chose Vendors that have the capability and size to ensure end-to-end reliability through large engineering / testing capabilities and components availability through Global Presence and Supply Chain power**

What Problems Are You Trying to Solve?

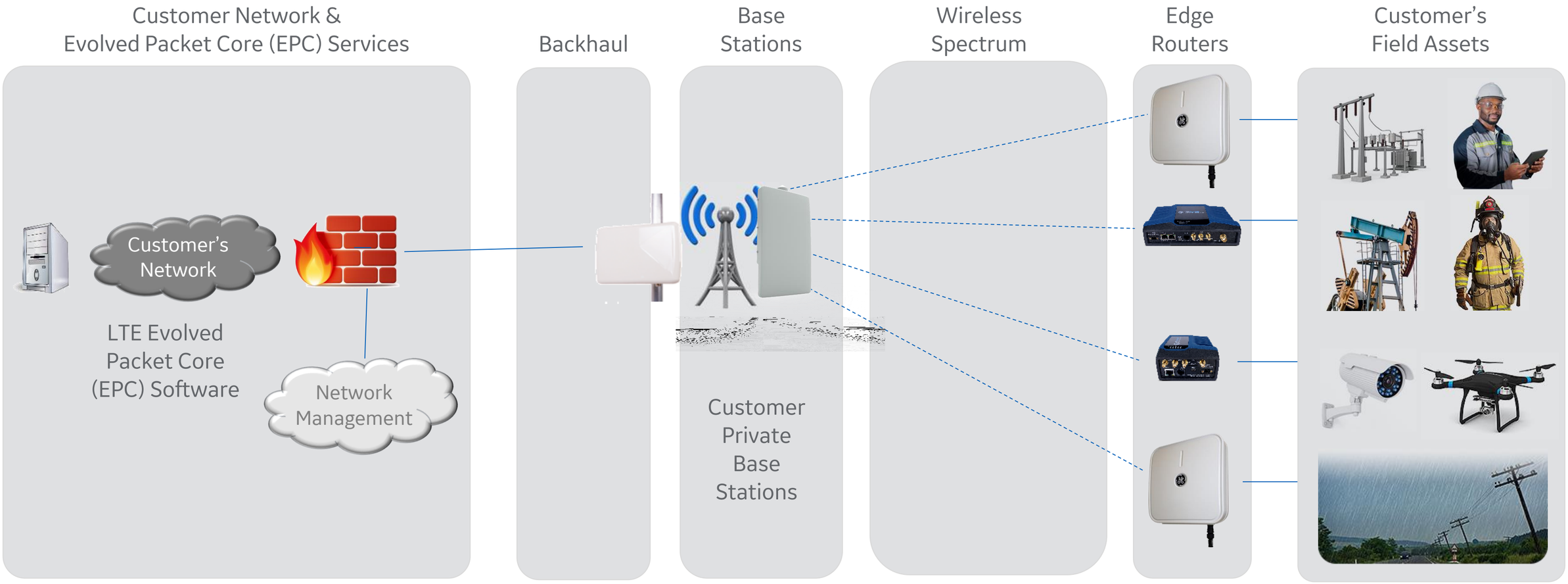
- Renewables & distributed generation (DER)
- AMI backhaul
- T&D substations
- Reservoir management
- SCADA
- Wastewater lift stations
- Effluent monitoring
- Mining

- Fire / storm mitigation
- DA: Volt/VAR optimization
- DA: Self-healing grid / FLISR
- Drilling operations
- Pipeline flow and pressure
- Tank level monitoring
- Video surveillance
- Voice
- Factory automation

- Analytics / Edge computing
- Workforce mobility (storm/fire mitigation)
- EV charging



What Does a Private LTE Network Look Like?



Securing the LTE Network

NETWORK SECURITY

- AES-256, auto key rotation
- IPsec VPN, DMVPN
- SPI firewall
- X.509 certificates
- Wi-Fi WPA/WPA2

USER ACCESS

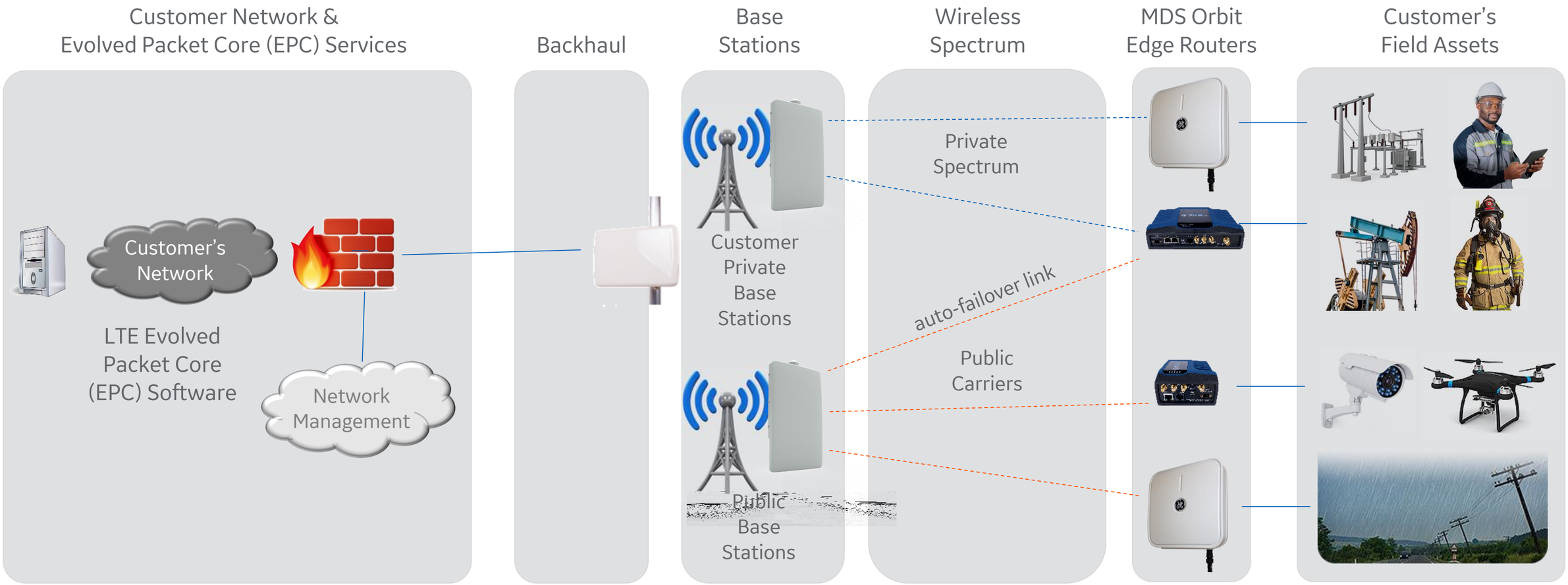
- User authentication (RADIUS...)
- Role based access control
- Configuration restore points
- Secure interface protocols

DEVICE SECURITY

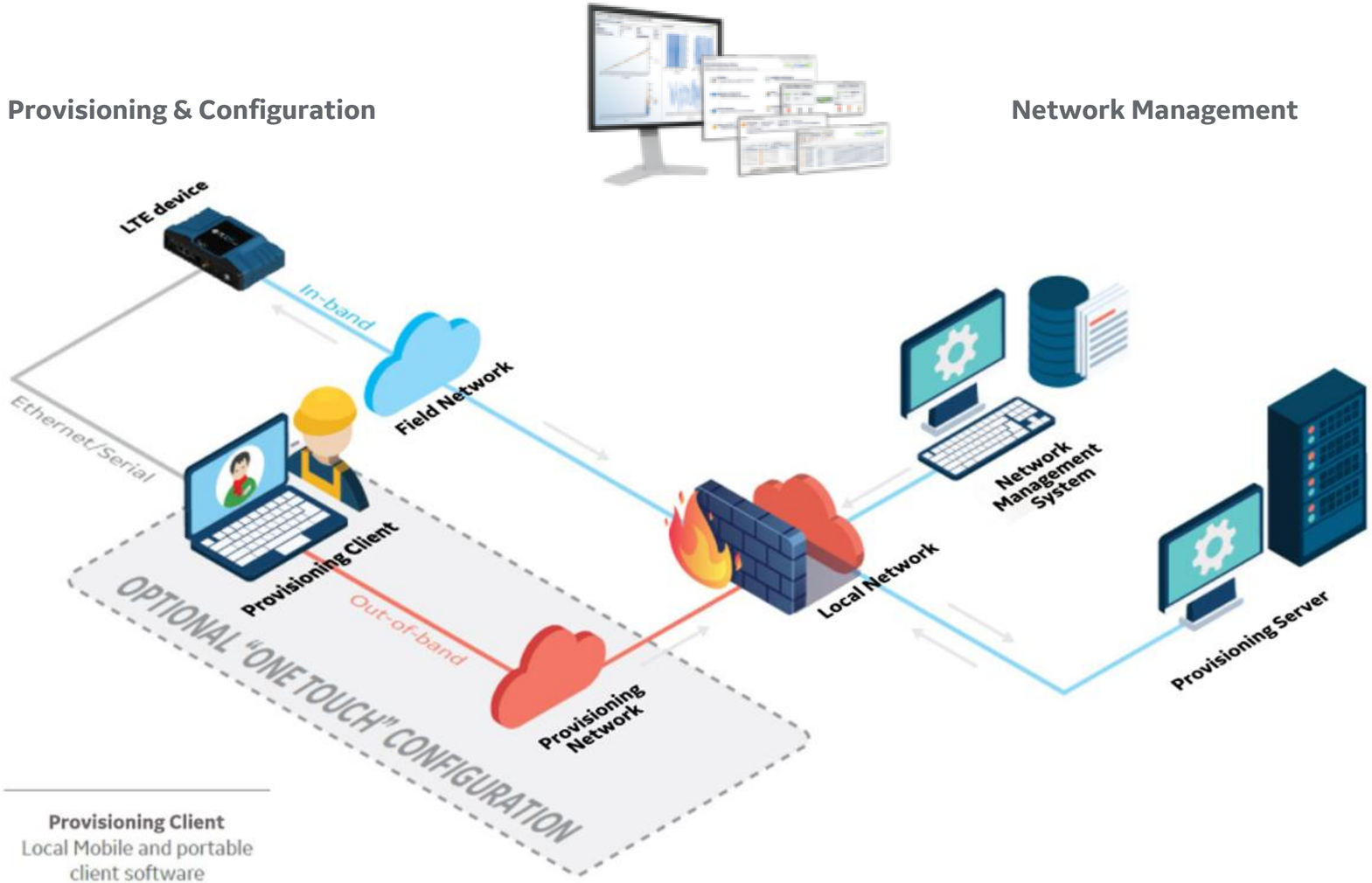
- Device authentication
- Tamper detection
- Physical/logical port disable
- Secure boot/firmware
- Electro magnetic pulse (EMP) compliance

LTE Redundancy Options

Dual SIM multi-carrier auto-switching



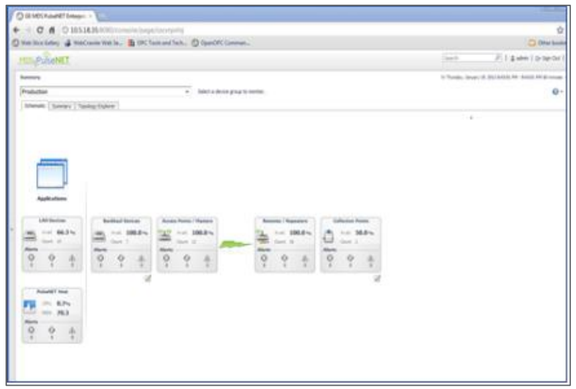
Life Cycle Management, Ease of Deployment



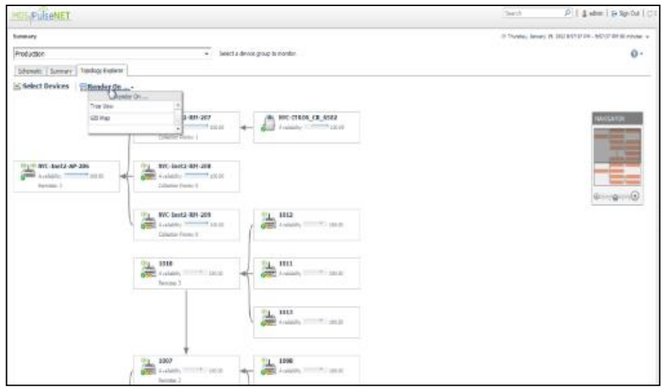
MDS PulseNET
Network Management System

Custom Built for GE MDS Products

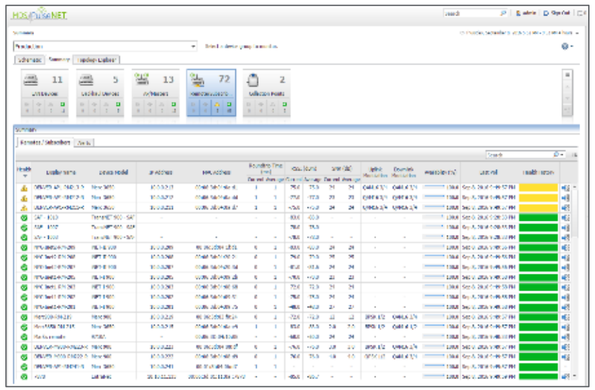
- R *operational visibility* r ff
- *large scale configuration*
- *intelligent operations*
- *low administration*
- ff *proactive management*



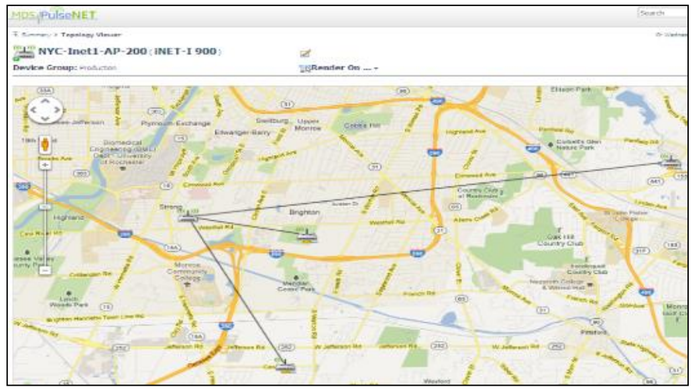
Device Category View



Device Topology View

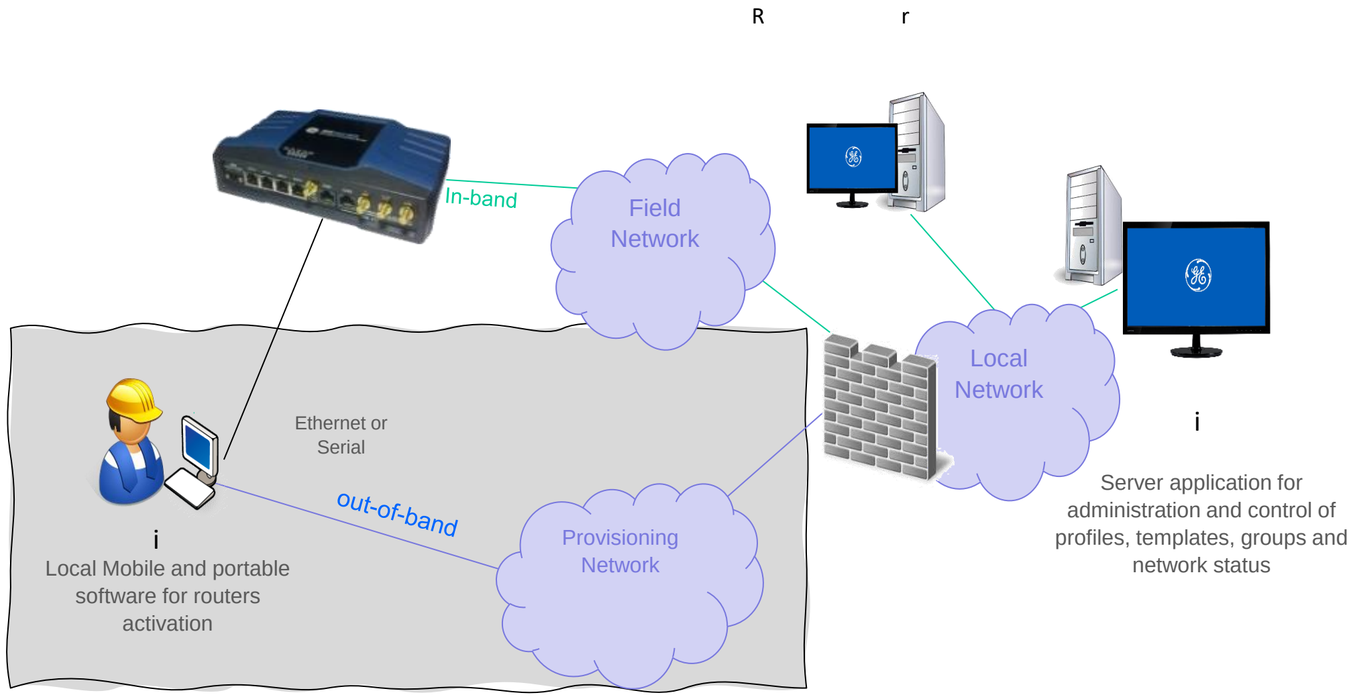


Device Summary View



Device GIS Mapping

MDS LaunchNET – What does it do?



- Automated provisioning of devices for initial deployment
- Allows network engineer to define configuration template(s) applied to large quantity of devices
- Allows technicians to focus on logistics and installs, not learning complexities of network design and configuration interface
- MDS LaunchNET may be standalone or integrated with MDS PulseNET
- One-Touch and Zero-Touch Support

Conclusion

- Private LTE can provide greater control, reliability and security
- Support new and growing applications and use cases
- Various private LTE options to consider globally

GEGridSolutions.com/communications.htm