



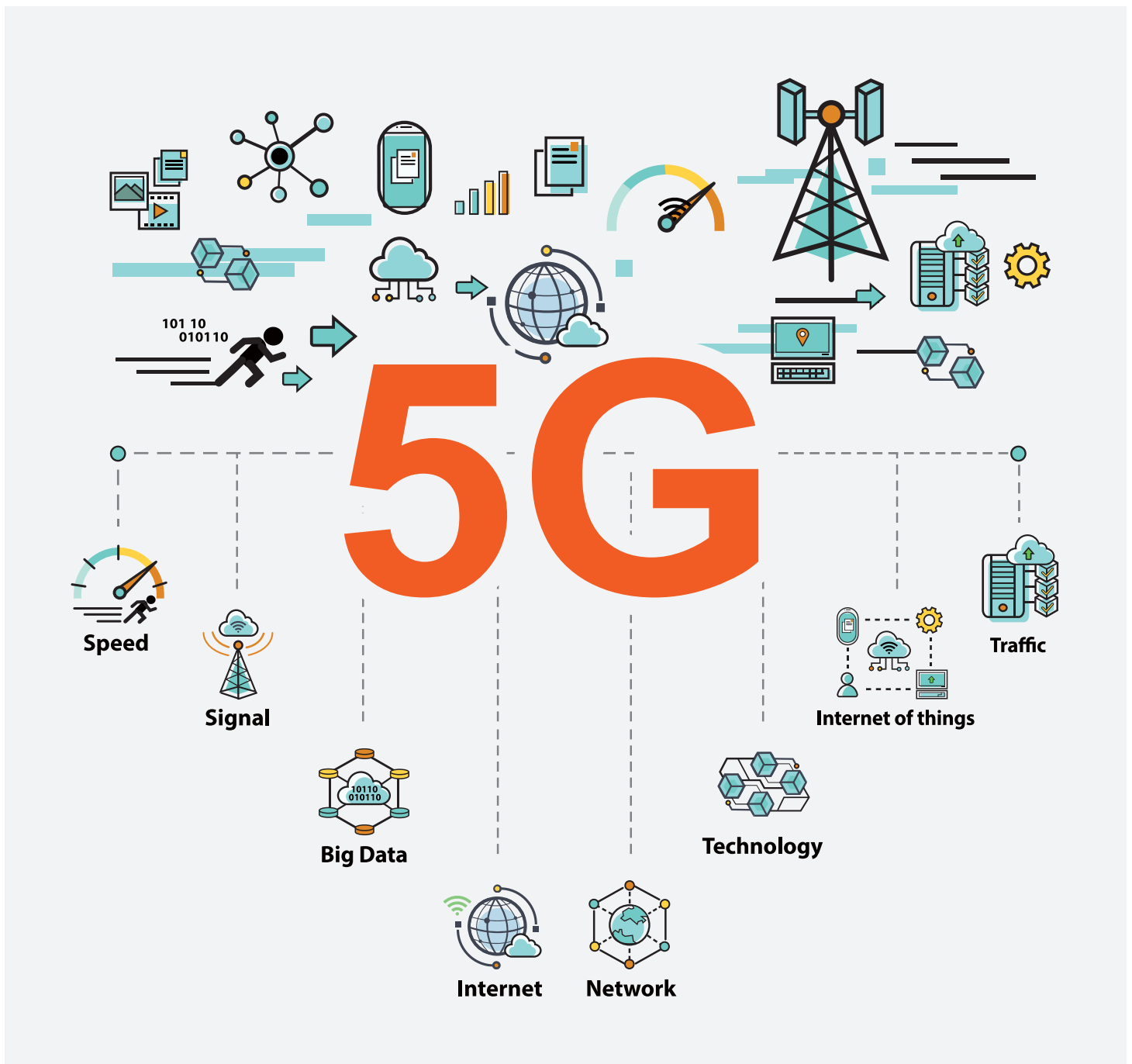
Vertiv™ in the Telecom Space:

Future-proofing Telecom Networks
for 5G Deployment



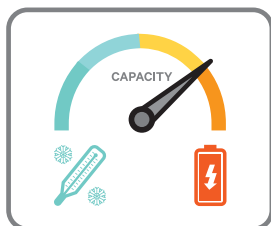
Vertiv™ in the Telecom Space

Anticipation for 5G networks has reached fever pitch as mobile operators are racing against time to be the first to deploy next level ultra-fast, low latency connectivity to billions of mobile subscribers. In fact, 5G will arrive sooner rather than later as initial deployment is expected to arrive as early as 2021. Many countries in Asia are leading the way in developing 5G architecture, including South Korea, Japan and Australia. For telecom operators, this presents a multitude of challenges that needs to be addressed both on Greenfield and brownfield sites. Ultimately, having the right infrastructure is critical for the success of 5G deployment.



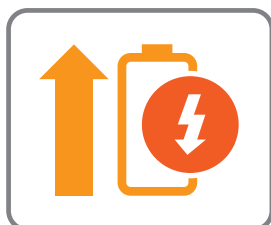
Preparing your network for 5G deployment

Many telecom operators are faced with the challenge of having to improve upon existing sites to get them ready for 5G architecture. For example, the power and cooling systems that exist today will need to be expanded and, in some cases, upgraded, to ensure the long-term reliability, maintainability and profitability of 5G network technology. Energy efficiency strategies also need to be revisited and existing sites reevaluated to ensure 5G preparedness. Below are some areas that telecom operators need to evaluate to ensure they are prepared for 5G:



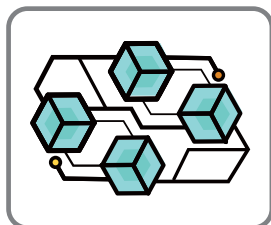
1. Ensuring adequate power and cooling capacity

From minimizing AC-DC conversions; deploying powerful uninterruptible power supply (UPS) systems to handle the spike in power density; upgrading from VRLA to lithium-ion batteries; to investing in new cooling techniques to combat the expected increase in energy costs, operators would need to adopt new solutions to support the demand expected from 5G technology.



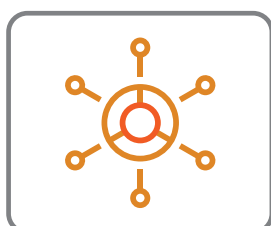
2. Mitigating high energy consumption

Telecom operators will need to get more aggressive in deploying energy-saving technologies to mitigate the impact on operating costs resulting from the higher energy consumption of 5G technology. The move to 5G is likely to increase total network energy consumption by 150-170 percent by 2026, with the largest increases in macro, node and network data center areas.



3. Preparing existing sites for 5G deployment/architecture

While it is expected that the transition from 4G to 5G infrastructure is not immediate, operators would need to reevaluate their existing 4G sites to ensure that these are able to handle the initial phases of 5G deployment. These can be addressed through retrofitting without having to establish or invest in new site deployments immediately.



4. Expanding existing battery capacity for power continuity

According to a report from 451 Research titled, "Telco Study on 5G Reveals Industry Hopes and Fears: From Energy Costs to Edge Computing Transformation," upgrades from VRLA to lithium-ion batteries are expected to increase from 66 percent of those surveyed to 81 percent five years from now. Lithium ion batteries will be an important tool as networks densify to accommodate the shorter distances 5G millimeter waves can travel.

Read the full **451 Research** report and all about the future of 5G deployment at www.Vertiv.com/Asia5G



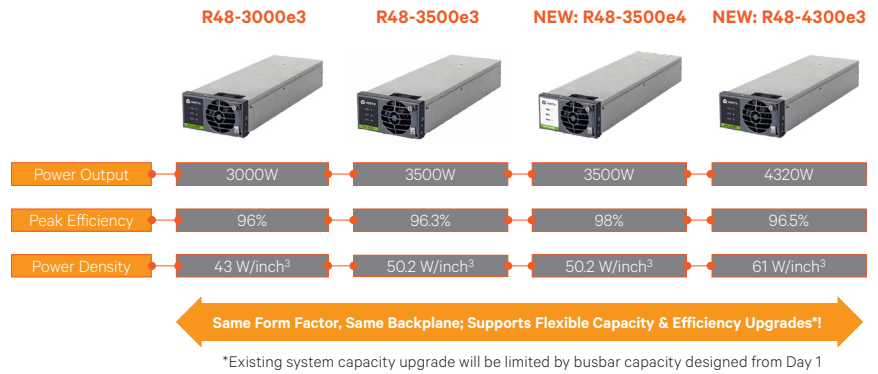
5. Minimizing cost of 5G investment

Ultimately, with the opportunities presented by 5G, operators need to keep in mind how to maximize their investments into 5G architecture. Basic infrastructure readiness, site access and quality interconnection will be the main considerations to efficiently deploy 5G and edge topologies.

Infrastructure Solutions for 5G Deployment

Vertiv has a range of infrastructure solutions to help enterprises and telecom operators transform 5G plans into reality. Deploying data and analytics to design highly reliable and efficient systems that are simple, sustainable, and future-ready, Vertiv collaborates closely with our customers to ensure infrastructure solutions meet the exact requirements of the application.

Solution for Access Macro/Micro Sites



Access Site - 5G Greenfields

More Compact, Smaller Footprint, Highest Power Density for the future-proof power needs

For Indoor & Outdoor Application



Netsure 7100 A91

700A system, 5U

- Easily Adaptable
- High Efficiency
- ECO Mode
- Advanced Battery
- Multiple Communication Interface

For Indoor Application



NetSure 731 CK2

1000A, Indoor Cabinet

- 1000A Power Capacity
- Small footprint at 600mmx600mm
- Single user / multi user management
- Peak efficiency 98%
- Remote monitoring enabled



Vertiv SP33

- 700A, Indoor Cabinet
- 4 battery shelves with protection
- voltage boost 40V to 57V, provides constant voltage to eliminate low battery end voltage issue and supports smaller cable to reduce cabling and installation cost.

Access Site - 5G Overlay Power

High-density mini-sized DC power for embedded application and outside plant enclosure



NetSure™ 2100

60A @48V, 1U high

- Light weight ≤6kg incl. rectifiers, saving room space and installation cost
- Short depth at 240mm to fits in tight space
- 19" rack mount / wall mount enabled



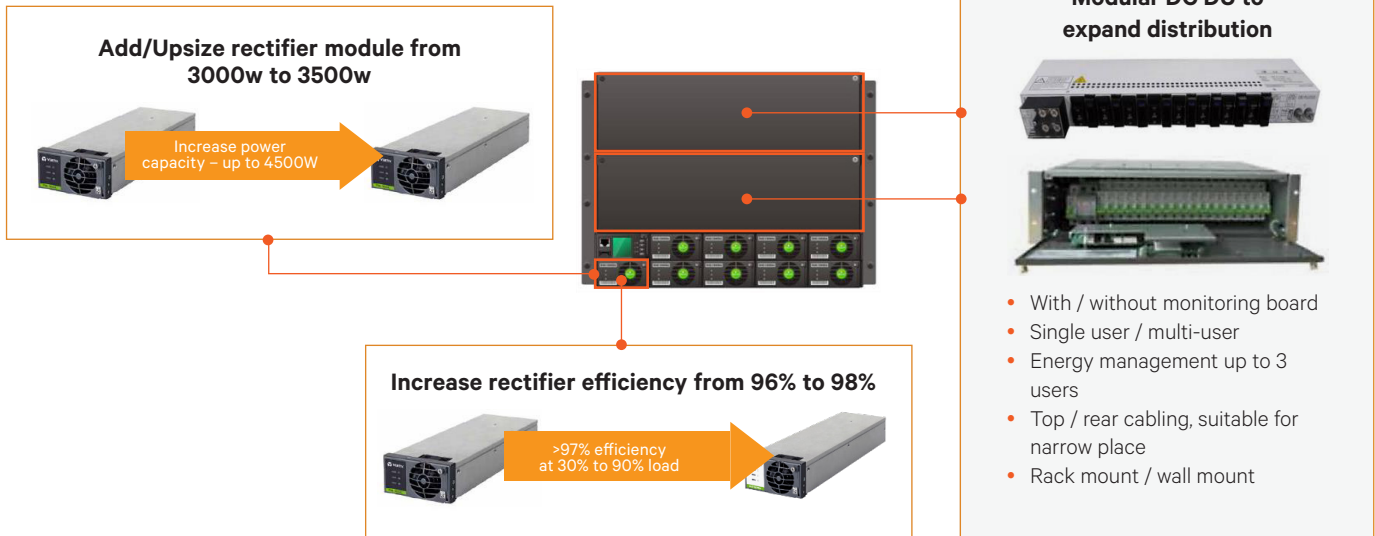
NetSure™ 531 A32

125A @48V, 2U high

- Light weight ≤13kg incl. rectifiers, saving room space and installation cost
- High availability in harsh temperature, able to output full power up to +65°C
- 19" rack mount – suitable for both indoor/outdoor application

Access Site - 5G Upgrade with Modular Architecture

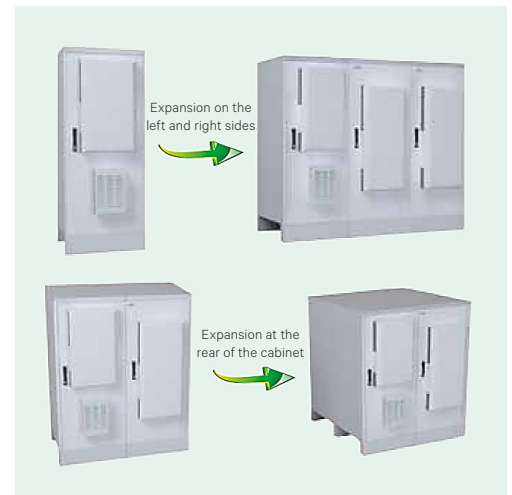
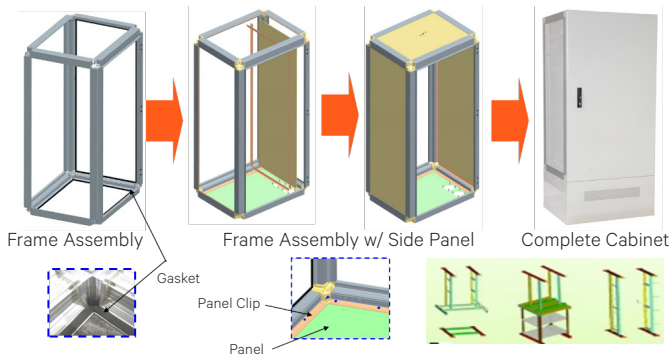
Smooth evolution to 5G with no downtime required in power and load distribution expansion



Access Site - Upgrade with Future Proof Solution

Modular design — Rapid and smooth expansion with business growth

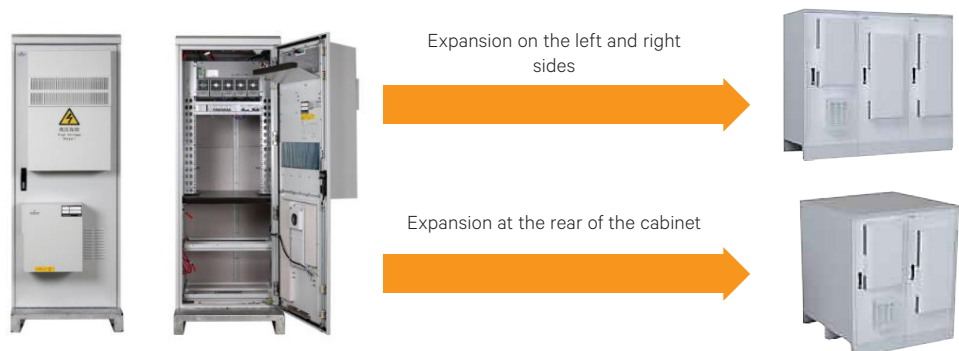
- Multiple cooling options – HEX, FV, Aircond, TEC
- IP55 protection
- Supports flat pack mode delivery - field assembly/disassembly for different application
- Integrates most energy efficient power system with built-in monitoring system

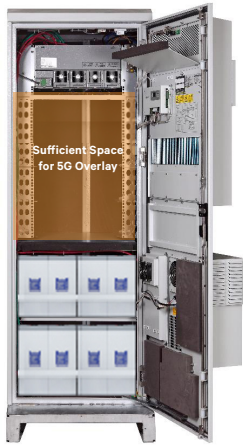


Outdoor Cabinet Expansion

Outdoor total solution

- Power and battery ready
- Space for telecom equipment
- IP55 enclosure
- Size customized for environment

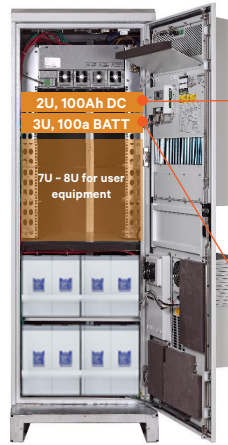




Before

Scenario 1 Fast 5G Overlay Power Solution

- Independent power and backup for 5G band
- No cutover engineering
- Fast & simple deployment



After



NetSure™ 2100
60A @48V, 1U high

or



NetSure™ 531 A32
125A @48V, 2U high

+



Lithium Battery
100Ah, 3U high



Scenario 2 Upsize Power System in the Same Footprint

Upsize Power System in the Same Footprint

- Upsize rectifier system: 200A to 450A/540A
- Replace Lead-Acid Battery to Lithium Battery: 16U, 300Ah to 15U, 525Ah



NetSure™ 731 A91
540A, 5U high

or



NetSure™ 731 A41-S50
6U, 300A

+



Lithium Battery
175Ah, 5U high

Scenario 3 Upgrades to 5G with More Room Space

Upgrades to 5G with More Room Space

Phase 1 - 3G/4G

200A DC Power
300Ah Battery



Integrated Cabinet

Phase 2 - 3G/4G/5G

300A DC Power
400Ah Battery



Integrated Cabinet

Equipment Cabinet

Phase 3 - 5G Expansion

500A ~ 600A DC Power
600Ah ~ 800Ah Battery



Battery Cabinet

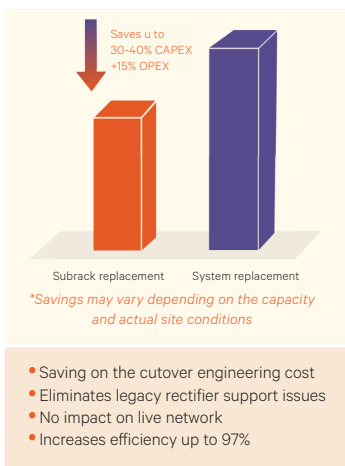
Power Cabinet

Equipment Cabinet

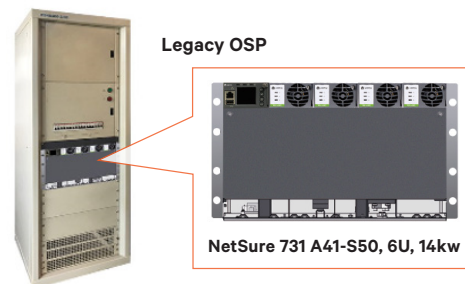
Access Site - 5G upgrade with Retrofit Subrack

Maximize Investment, Minimize Engineering to Enjoy Latest Technology and Higher Efficiency

Indoor Retrofit



Outdoor Retrofit



The Situation: Remote radios are requiring more power

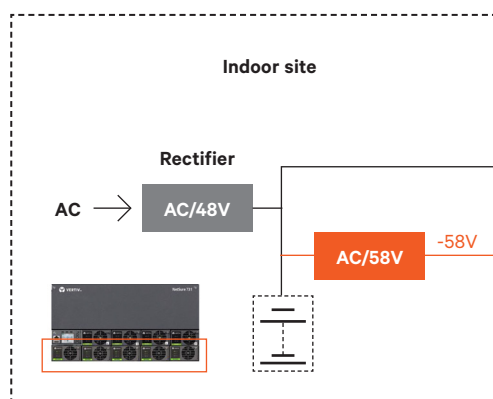
48 VDC rectifier/battery plants provide power to remote radio heads (RRHs) at wireless base stations, which are connected through an extended cable length, up to hundreds of feet.

- Distance between power system and RRHs results in voltage drop (longer cable, higher drop)
- Voltage drop is causing RRHs to shut down before the battery reaches end of discharge
- Voltage drop results in lower operating efficiency
- Required hold-up time is not being met
- As RRHs continue to evolve and require more power, all of these issues will intensify



1500W 48/58V converter

- Isolated topology between 48V and 58V
- Conversion Efficiency: 96%
- Hot pluggable – facilitates future extension
- Ideal for upgrading legacy DC power plants



Allowing voltage drop	Cable size	Loss on cable
43.2-36=7.2V	1	7.2/53.5=13%
58-36=22V	0.24	22/58=38%

Tower

2/3/4G
5G AAU



Benefit of boost: constant voltage, no issue of low battery end voltage. Support smaller cable.



Edge Solution – Modular Remote Power



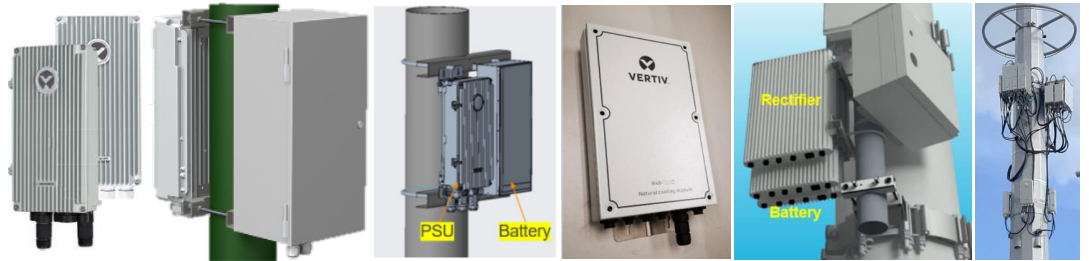
IP55/IP65 Modular Solution

- Natural cooling, silent operation, maintenance-free
- IP55 or IP65, robust environment proof
- 1kW, 2kW module (expandable up to 6kw)
- Power de-rating from 55°C
- AC & HVDC input
- 48Vdc output
- Peak Efficiency 95%
- Max. 6 fuse output



Optional:

- IP55/65 Lithium Battery Box, up to 20Ah
- Sun shield to improve reliability and prolong the life of PSU and battery
- Customizable color for camouflage



IP55 Integrated Cabinet

- Flexible power 1kW ~ 9kW
- Configurable distribution: fuse/MCB
- Easy expansion, hot pluggable
- Battery: different type optional (VRLA, lithium...)
- Remote monitoring enabled
- Pole mount / Wall mount



Data Center Solutions for Telecom Edge Applications



SmartCabinet™ Premium

Self-contained, pre-configured, pre-engineered and factory-tested infrastructure for data centers and telecom networks

Features:

- Fully integrated - Factory assembled and tested for power, thermal management, rack enclosure, power distribution, monitoring and management, and security for IT applications. No dedicated IT room required.
- Dust protection and noise insulation - Fully closed operation, cold/hot air is circulated within the rack for better temperature and humidity control, expanding lifespan of IT equipment, low noise level. Highly suitable for office environment.
- Highly Efficient - Built-in high efficiency UPS and cooling equipment, that uses DC frequency conversion technology for energy savings.
- Fast deployment - Ready to use from day one, removing the need to build, construct and design computer rooms which dramatically reduces the required deployment period compared to a traditional IT facility build.



SmartRow™ Plus

Fully-integrated data center infrastructure in a row-based design

Features:

- Complete Integrated Infrastructure - All products integrated in the system-thermal management, monitoring, racks, optional UPS/Power Distribution and rack PDUs-work together to optimize capacity, efficiency and availability.
- Industry Best Practices - Employs best practices known to work well in top-performing data centers; Hot aisle / cold aisle separation; High availability, high efficiency UPS; Highest efficiency cooling
- Space-saving, minimal footprint - Modularity for flexibility and easier expansion
- Integrated monitoring and control for efficiency in planning and management
- Simplified Project Management - Network of local data center experts and service teams make ordering, installing and servicing the SmartRow Plus solution easy.



SmartAisle™ Pod

Fully-integrated edge data center solution for high density telecom applications

Features:

- Suitable for telecom central offices with existing white space for data center infrastructure
- Fully-integrated design eliminates the need to construct a data center from the ground up - easy to deploy and install
- Integrated with high-efficiency power, thermal management and monitoring units
- Can be scaled up depending on future requirements
- Option for AC or DC Power configurations or CW or DX cooling applications



eBase 2.0

Smart Integrated 5G Access Infrastructure Solutions

Features:

- Energy Efficient: Delivers up to 98% efficiency and coupled with ECO mode algorithm ensures maximum efficiency even at partial load conditions.
- Precision Air conditioning: Reduces cooling power usage through inverter driven and containment cooling system.
- Reliable & Compact Power Supply: Supports -48 VDC / AC power system, compatible with new construction, expansion and transformation of telecommunication sites.
- Intelligent Monitoring: Integrated monitoring such as temperature & humidity, access control, smoke, water leak, fire protection, video surveillance, etc., with RS232, RS485, SNMP, USB, dry contacts and other intelligent interfaces provides a full range of environmental and system operational management.
- Small Foot Print: Efficiently utilizes the vertical space by integrating power, cooling and other infrastructure in a standard rack space. Its advanced design not only saves space but also reduces system complexity. Single cabinet solution occupies floor area of 0.8 m2, two cabinet occupies floor area of 1.6 m2.
- High Ingress Protection: Protection grade is IP 5X, adopts to hazardous telecommunication room environments.
- Aesthetically Appealing Design: IT style design, tempered glass door/metal door options, improves the overall visual experience of the communication room.
- Optional 10.4" LCD Touchscreen Panel: User-friendly display enables easy access to power, cooling, environment, and security information.

Other 5G Solutions: Core System Upgrade

Core Power capacity expansion

NetSure 801 CAA

- Scalable Up to 6000A
- Using R48-5800e 96% high efficiency modules
- NCU Controller
- Top & Bottom Cabling
- Include shunts current detection



Extra Large Power System (XLPS)

- Compact Design
- 210kw per Rectifier Cabinet, max up to 420kw Capacity
- Using G3 High Efficiency Rectifier R48-3500e3
- Compatible with G4 Rectifier R48-3500e4 for 98% efficiency
- Top entry cabling access
- Controller NCU M830B
- Individual shunt monitoring
- Dimension per cabinet: 2200H x 600W x 600D

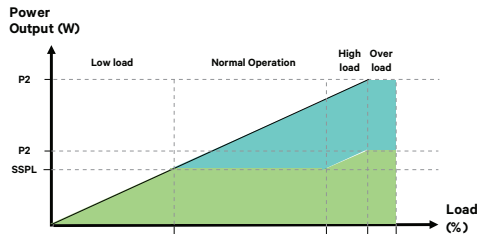


Power Split

Upgrade to high efficient Core Power system with minimum footprint

"Pay as you grow" philosophy realized from Power Split function in NCU

- Allows extension of VERTIV and Non-VERTIV DC power systems
- Easy live interconnection between existing Power system and new NetSure system
- Optimize investment cost and ensure that systems can always be expanded



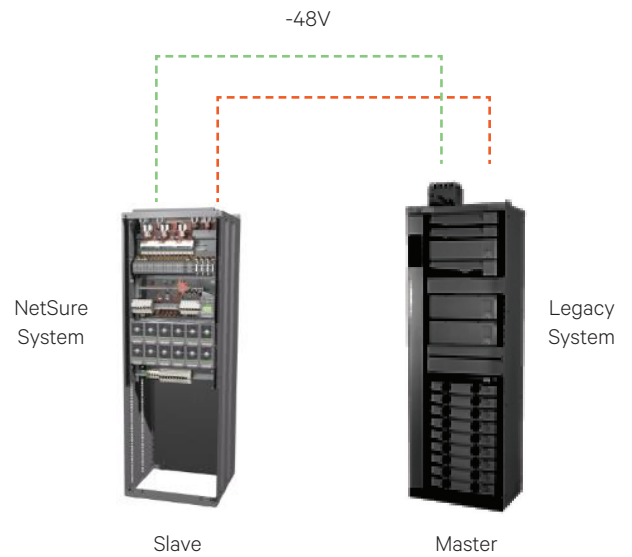
SSPL= Slave System Power Limit

50%~90% Slave system capacity

- Slave system output
- Master system output

P1=Max. slave system output
P2=Max. slave + master output

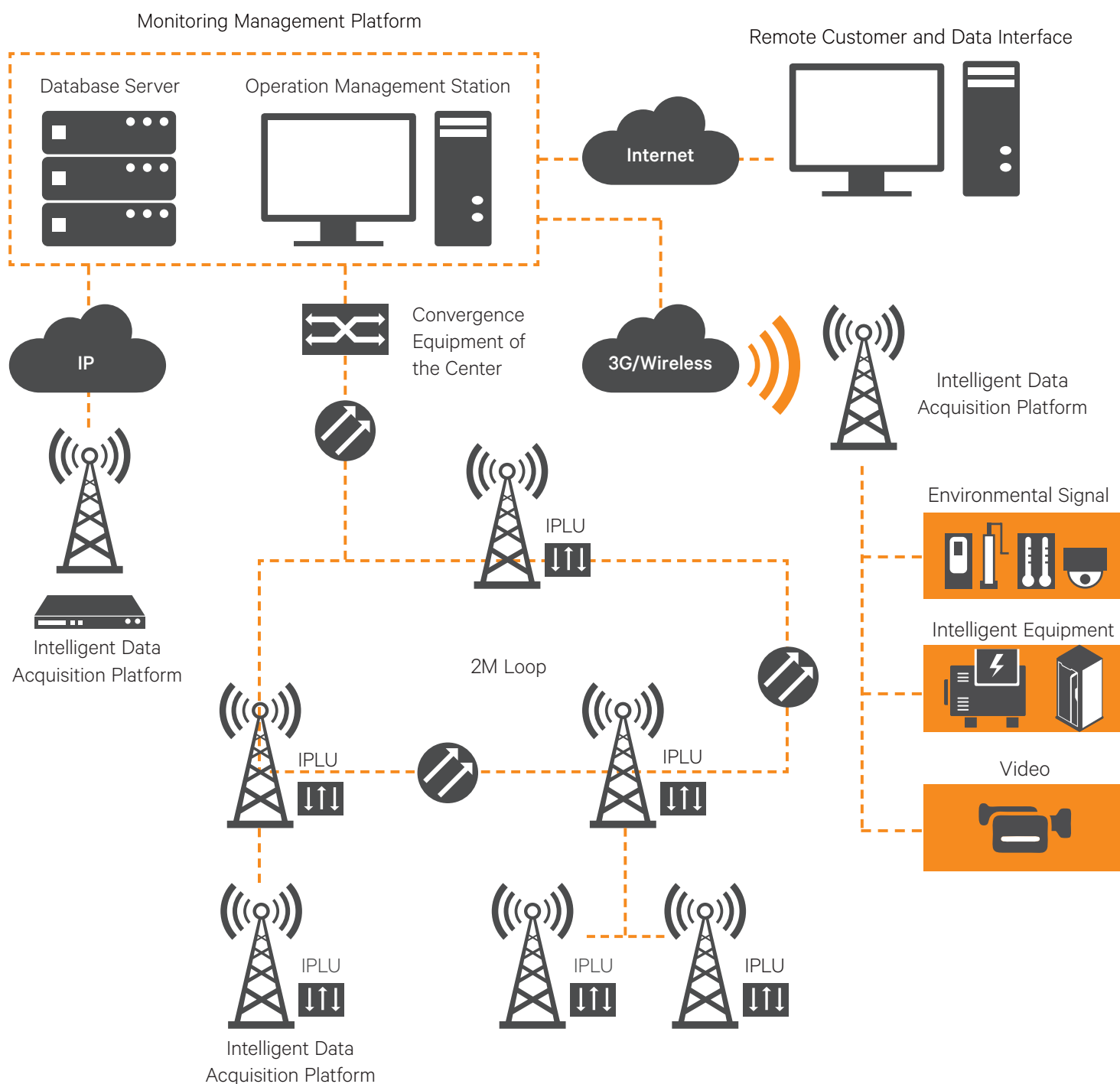
- The total load is shared between the master and slave systems
- The slave will bear the load until it reaches 90% of its capacity
- Additional load will then be borne by the Master system



Site Monitoring

Features

- B/S architecture makes all functions accessible in IE without installing the customer software convenient for accessing the system
- Extra large capacity to support 50,000 BTSs
- Hardware processing unit greatly reduces the number of equipment in the monitoring center, saving space and maintenance workload for the system
- Data flow utilizes an active reporting mechanism enabling timely response
- Multi-channel data transmission enables real-time monitoring, preventing failures caused by database errors
- DS server support multi-unit backup, while the automatic load balance avoids bottleneck of widespread faults caused by traditional monitor master
- Third-level storage safeguard and automatic memory ensures data integrity of the centralized power and environment monitoring system





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