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POWERSHIFT® METRO FOR CAMPUS NETWORKS

APPLICATION NOTE

GENERAL CONTEXT

Across school campuses, the use of small cells has become a critical part of the strategy for mobile network operators (MNOs) and Neutral Hosts. Well suited to the dense urban and suburban landscape, small cells fill the coverage and capacity gaps in the macro layer. More than providing reliable wireless connectivity for students, staff and visitors, small cells enable a variety of important services, including security, smart outdoor lighting, smart city applications, etc.

Small cells' suitability to densely populated environments, however, creates deployment and management challenges. One of the toughest is how to supply each cell with the precise amount of power, fiber and backup needed while being able to effectively manage these resources holistically across the network.

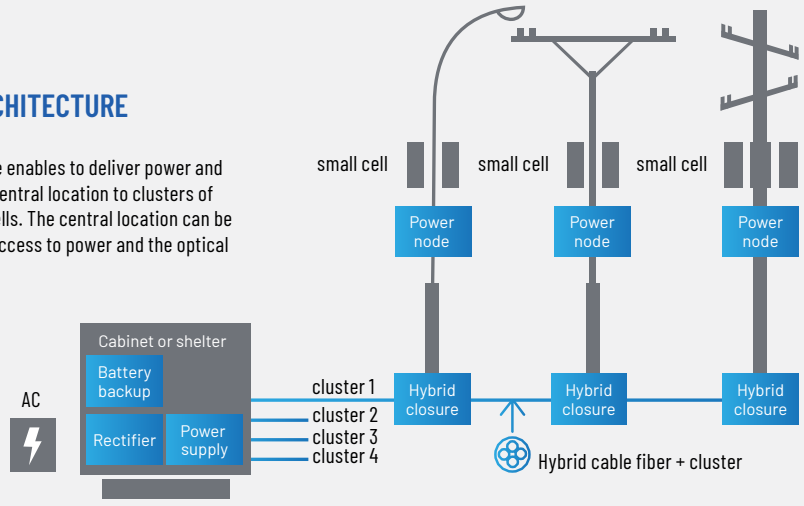
Network challenges

The conventional method of tapping into the nearest grid power source for each cell is impractical in most cases, as even a modest sized campus or venue requires multiple small cells, each with varying power and capacity requirements. Often, cells must be deployed miles from the nearest power grid source. Even if it were possible to cost-effectively reach them all with grid power, each cell would need an alternating current (AC) rectifier and backup batteries. In addition to the technical challenges of providing small cells with power and fiber that are independently managed, MNOs must overcome several other key issues that dictate the degree to which their campus and venue networks will be successful. These include:

- **Compressed deployment windows:** Deployment windows are dictated by the typical schedules of the students and staff. As a result, network installation teams must be able to make the most of their time onsite, working as quickly and efficiently as possible.
- **System management:** Managing small cells individually is impractical. To take advantage of system-wide practices like load balancing and peak shaving, operators need to centralize their management of power, fiber and backup resources at the cell and network levels.
- **Area aesthetics:** Small cells deployed at campuses, venues and communities are all subject to municipal zoning and permitting requirements. Additionally, those who own, manage and regularly use these areas take pride in maintaining a well-kept aesthetic.
- **The cost of complexity:** As network complexity increases, CapEx and OpEx costs—and the risks of outages—increase as well. MNOs must simplify the network where possible, reducing the number of components, cables and connections that need to be deployed, managed and maintained.

SOLUTION ARCHITECTURE

The bus architecture enables to deliver power and backhaul from one central location to clusters of neighboring small cells. The central location can be anywhere that has access to power and the optical network.



Up to four spokes of small cell sites from a single remote location up to 3 km (2 miles) away, including battery backup capabilities

POWER BUS ARCHITECTURE
Enables future flexibility and cost-effective growth

ENERGY MANAGEMENT
Optimized energy usage via bus architecture

FLEXIBLE POWER DELIVERY
Flexible power delivery from 200 to 4000 W per cell site

SAFETY
Licensed electricians not required

System building blocks

Power Hub

The solution is built around the Power Hub, a compact, standalone unit that provides centralized grid power ingress, AC power supply, rectifier and battery backup. One Power Hub supports up to four small cell clusters arranged in a hub-and-spoke architecture.

Powered fiber cable

Each Power Hub provides power and fiber to the cells within multiple assigned clusters. A single powered fiber cable delivers up to 10,000 watts of power and as many as

144 fiber strands to small cells located many kilometers away. The Power Hub can be deployed wherever there is fiber access to power and it does not need to coincide with the ingress location, and it contains enough battery backup to deliver full power to the small cells should the grid power fail.

Fiber-optic splice closure (FOSC)

A FOSC-450D hybrid fiber closure connects each small cell to its Power Hub. It has a capacity of up to 4 drop cables in addition to a feed-through cable. Measuring 30 inches long by 11.5 inches in diameter, it can be deployed in a vault, on an aerial strand or in/on a pole to ensure lowest visibility.

Solution architecture

The PowerShift Metro solution uses a hub-and-spoke architecture, with each Power Hub supplying fiber and power to the small cells in its assigned clusters.

Features and benefits

Fast deployment, lower costs

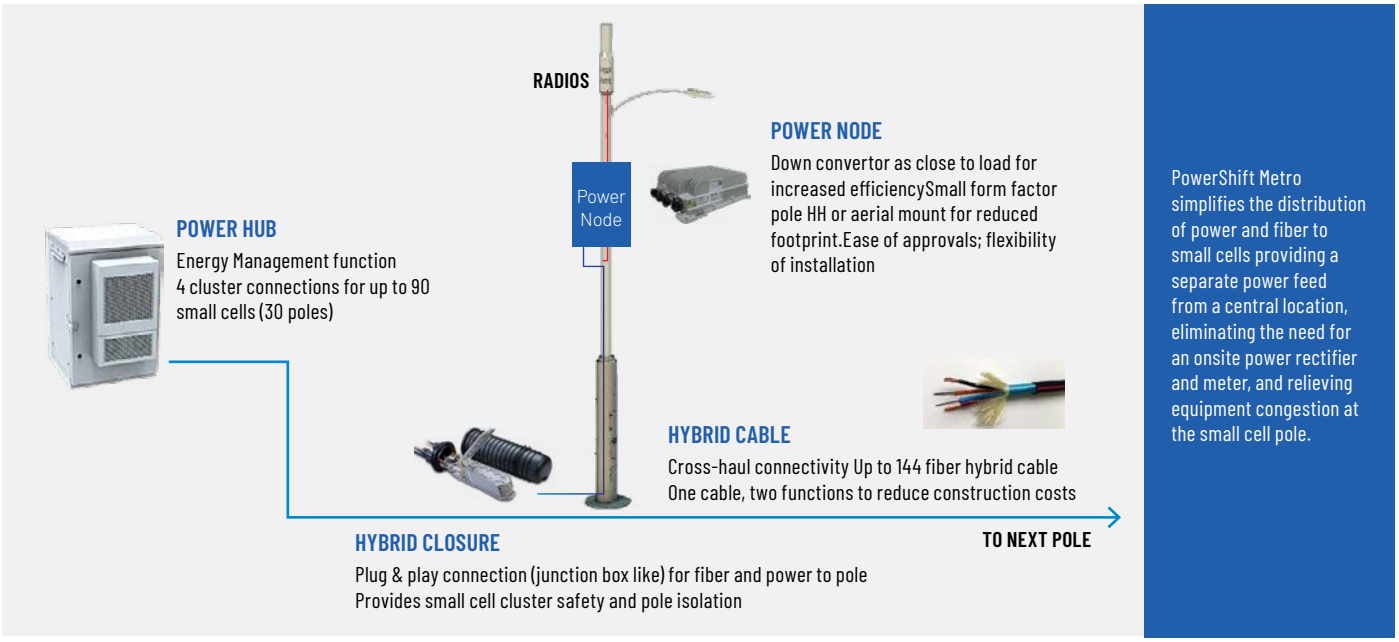
- Powered fiber cable and quick-deploying FOSC reduce cable and construction costs up to 50%
- Factory-connectorized cables provide consistent and reliable plug-and-play efficiency
- Completely modular design and repeatable architecture scale effortlessly and quickly
- Long-reach powered fiber enables ideal cell location for optimized capacity and coverage

Centralized management, individual flexibility

- Configurable conductor and fiber count provides 200-4,000 W and up to 144 fibers per site
- Auxiliary controller shelf (ACS) at each Power Hub centralizes power and backup management
- Power to each cell can be converted to AC and/or DC voltage
- Variable voltage and boosted distributed bus enable peak shaving, load balancing

Low visual impact

- Compact Power Hub and FOSC increase design options for easier permitting
- One Power Hub can service as many as four small cell clusters, up to 30 small cell sites
- FOSC can be deployed via vault, aerial strand or pole to minimize visibility
- Power Hub houses power rectification/backup equipment, minimizing small cell size



PowerShift Metro simplifies the distribution of power and fiber to small cells providing a separate power feed from a central location, eliminating the need for an onsite power rectifier and meter, and relieving equipment congestion at the small cell pole.

Application: Campus network

Scope

The application involves connecting a major North American university campus with a student enrollment of 27,000 students and 1,500 staff and faculty. The campus is in a rural area with an undulating topography. It covers roughly 1,700 acres and consists of 30 buildings, about half of which are dormitory-style residence halls.

Application parameters

Solution must fulfil the following project requirements:

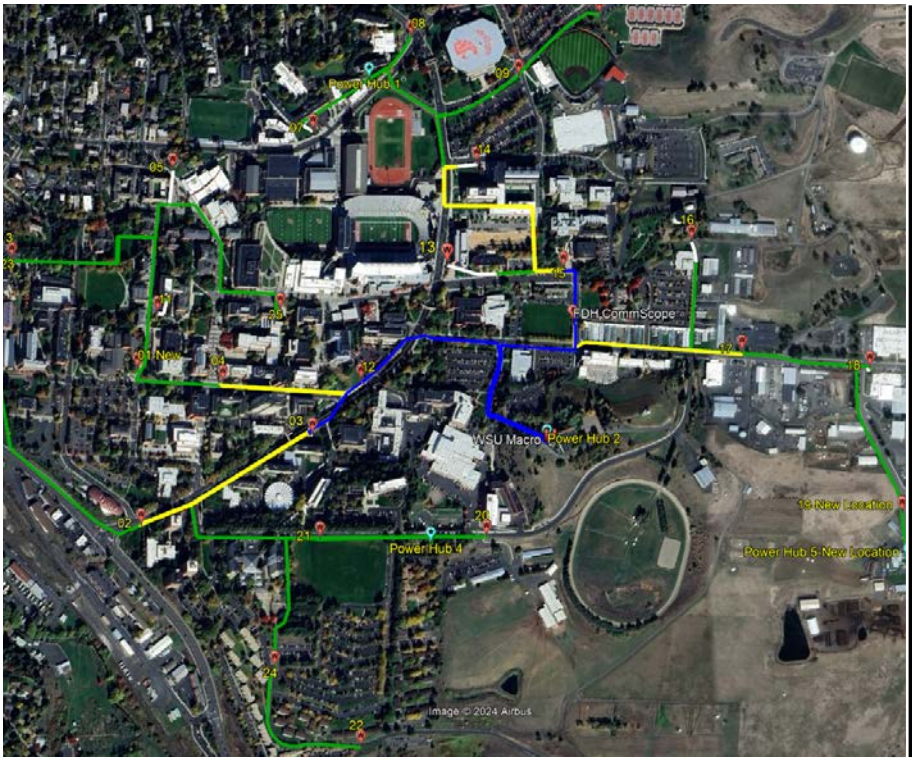
- Provide coverage and capacity using 25 small cell sites and 150 radios (red water drop)
- Use a single-cable solution to deliver power and fiber to each cell location
- Use existing AC power ingress points, located on the campus periphery
- All visible network equipment must match the university's colors
- The system must be installed and commissioned within two months

Key information needs

- Identify optimal small cell locations based on coverage/capacity requirements and RF planning
- Define power hub locations, assuming existing utility feeds
- Define small cell cluster sizes based on power distribution and cable/conduit routing constraints
- Define small cell grouping and location of fiber distribution hubs (FDHs) to support all small cell clusters
- Define fiber distribution paths to small cells within each cluster

Results

- Reduced AC power deployment cost for 25 small cells from around $2 million to around $400,000—greater than 70% savings
- Only four elements are required for PowerShift Metro solution, creating a simple deployment
- Network now has spare power and fiber available for expansion at each FDH
- Power Feeder (Power Hub) at easily accessible AC service
- Color-matched equipment to maintain the spirit of the campus or venue
- All small cells are terminated from the same FDH, creating a single seamless network



SOLUTION DESIGN

Blue Line: Power and FIber feeder cable from central location to FDH(s)

Yellow Line: fiber only distribution cable to connect each small cell cluster

Green Line: Hybrid power fiber cable distributes power from peripheral utility feeds and distrib-utes fiber from inner FDH(s) to every small cell location

Conclusion

Until recently, powering a campus' small cell network required separate AC power drops for each site. Operators often have to reconfigure their network to stay on schedule and within budget. Then there's the question of backup power. When the grid goes down, most small cells don't have the backup power infrastructure that macro sites do. And power's only half the problem. You still need to run fiber.

As demonstrated in this application note, the PowerShift Metro solution provides a more agile, reliable and cost-effective alternative to grid power. Controlled by the mobile operator, it provides a separate power feed from a central location—eliminating the need for an onsite power rectifier and meter and relieving equipment congestion at the small cell pole. The result is significant savings, greater design flexibility, easier management and more.

Check out our solution page about powering wireless networks efficiently.

Since 1937, ANDREW, an Amphenol company, has driven the evolution of wireless technology. Trusted by mobile network operators and enterprises globally, we work closely with our customers to deliver innovative solutions that enhance connectivity experiences both outdoors and indoors. Our dedicated global team is committed to advancing the industry, fueled by the vision that a better-connected future is possible.

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