Let's stay indoors for full connectivity

Small Cell is packed with features for full indoor connectivity: E2E digitalized architecture, high capacity, high yield, fast deployment, and strong evolution potential.

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According to GSMA's recent Mobile Economy 2016 report, the CAGR of mobile data traffic over the next five years will hit 49 percent, and the global average user will consume 7 GB of mobile data per month by 2020. In Europe that will stand at 12 GB, while in North America, it will reach a massive 22 GB each month. More than 80 percent of this will be generated indoors.

The great indoors

Research by Huawei mLab on user dwell time reveals that people spend more than 60 percent of their time indoors. Here, they have higher requirements for mobile services, especially 2K and 4K video and loading times, in stationary or slow-moving scenarios.

We can also expect the first wave of commercialized ultra-broadband

services including virtual reality (VR) and augmented reality (AR) to take place indoors.

The amount of traffic generated in super-high traffic areas during major events can be hundreds of times higher than network averages. On the first day of Mobile World Congress 2016, for example, attendees transmitted 828 GB of mobile data in the convention hall.

Indoor coverage is tough

Big changes in user service models, available spectrum, and the 4G, 4.5G, and 5G eras means that the traditional analog indoor coverage solution – Distributed Antenna System (DAS) – can't make the grade.

Changes in service models: The shift from synchronistic voice services to data services and an accompanying shift in operators' revenues are accelerating, placing greater challenges like service bursts and the tidal effect on DAS.

Changes in spectrum resources: The mobile data surge is pressuring spectral resources, leading to the use of high frequency bands, including 1.8 GHz, 2.1 GHz, 2.3 GHz, 3.5 GHz, and even unlicensed 5 GHz spectrum. Although these bands are now the mainstream in mobile broadband (MBB) network construction, they're not suitable for DAS, which suffers high transmission loss in high-frequency bands through DAS coaxial feeds. High-frequency spectrum is reducing the efficiency of the outside-in model, where indoor traffic depends on outdoor macro network absorption because it increases building penetration losses in outdoor macro networks. This is also intensifying DAS's capacity bottleneck.

Accelerated technological evolution: 1G-to-2G evolution took 20 years, 2G-to-3G evolution 10 years, and 3G to 4G just 5 years. Over this time, speeds have evolved from tens of Kbps to several Mbps. The pace of evolution of new technology is accelerating in the 4G era, and subscriber speeds have evolved quickly from several Mbps to hundreds of Mbps. Meanwhile, the commercial application of some 5G tech in 4G networks has caused a speed leap from megabits to gigabits. DAS's analog radio frequency (RF) architecture makes it extremely difficult to incorporate it into multi-antenna and high-order technologies without large-scale changes to existing networks.

As a traditional indoor coverage solution, DAS can meet the demands of 2G/3G era voice and mid-to-low-speed data services. But against a surge in indoor MBB requirements in the 4G/4.5G era, DAS has become a developmental bottleneck for indoor MBB due to the lack of network capacity, scalability, and poor evolution potential, limiting demand for subscriber services. In the future, DAS will even restrict the evolution of operator networks. With E2E digital architecture, high capacity, high yield, fast deployment, and evolvability, Small Cell is the new linchpin technology for building a fully connected indoor world.

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Huawei's indoor vision: From x to y

Digitalized network architecture: From centrally placed signal source of the analog system to RF digital processing elements extended to the front end in digital systems. The high number of passive components in analog systems causes high interference and limits capacity, while expansion requires onsite re-modification, but digital systems can greatly lower interference, improving MIMO performance and enabling on-demand capacity expansion through software-defined frequency ranges.

Digitalized O&M: From the black-box type management of analog systems to the precise monitoring of faults and service volumes on each node to enable O&M and visualization across the whole indoor system, improving O&M efficiency.

Digitalized service capability: From a focus on voice services and meeting coverage the demands of analog systems to focusing on digital services, meeting capacity demands, and providing value-added service capabilities. This will increase operator revenues through opening the capability of their digital pipelines and fostering cooperation with application developers.

Sustainable future evolution: From analog's difficulty with upgrades to the smooth software upgrades of digital. This enables new technologies, such as distributed MIMO, 256QAM, LAA, and the latest 5G-oriented wireless cloudified architecture, so spectral efficiency and network capacity can constantly improve.

Flying high with LampSite

Indoor scenarios are more complex and diverse than outdoor ones. Network construction in indoor scenarios must also be more closely aligned with owners, requiring diverse solutions to meet the varying service demands of different segments.

Medium-to-large public areas, such as stadiums, transportation hubs, conference centers, and shopping malls, are priority areas for operator investment due to their size and high crowd densities. Digital solutions based on CloudBB architecture like Huawei's LampSite are the best choice for many operators worldwide in this kind of scenario. LampSite supports multiband multimode, large capacity, flexible expansion, rapid deployment, E2E management and control, and long-term smooth evolution with new technology.

The world's largest deployment of LampSite is at Beijing International Airport, the world's second largest airport, with 220,000 passengers per day and nearly 84 million a year. Deployment was completed in three months, with 2,200 LampSite pRRUs providing comprehensive 4G coverage of the terminal departure and arrival halls, baggage claim hall, VIP lounge, office area, and even the airport parking lot and basement area. Total deployment time was reduced by more than two-thirds compared with traditional DAS deployment. The new solution delivers peak user download speed of 140 Mbps, with figures showing yearly data traffic 27 times higher

after deployment, indicating greatly enhanced user experience and thus profits for the operator.

Other successful examples where LampSite has been successfully commercially deployed include exhibition halls for the Barcelona Mobile World Congress, Beijing National Stadium, China's National Centre for the Performing Arts, Beijing Workers' Stadium, Zhengzhou Railway Station, Jakarta's main airport, Singapore's Marina Bay Sands hotel, and Qatar Villaggio shopping mall. These examples show how this indoor network construction strategy has gained worldwide recognition.

Small and medium businesses, such as coffee shops, retail stores, and restaurants, have comparatively large capacity requirements. Many deploy Wi-Fi networks, but due to protocol and technological limitations, they cannot meet the requirements of HD voice and video-driven MBB services, particularly in scenarios with high numbers of users. User experience tends to be very poor.

The Pico solution leverages multiband multimode to integrate Wi-Fi and single-node fast networks. Based on Iub interfaces, Pico supports automatic network discovery, Plug and Play (PnP), and automatic planning and configuration to re-use existing Wi-Fi AP's sites, transmission, and power supplies to provide optimal MBB services and maximize hotspot value. For these kinds of scenarios, Pico is the optimal solution based on cost-performance ratio.

As LWA and LAA technologies mature, Pico can tap into the potential of unlicensed bands in the future for increased capacity and better user experience.

A Thai operator successfully deployed Huawei's Wi-Fi-integrating Pico solution in its stores. New equipment deployment and service launch was completed in just two weeks in more than 100 of the operator's service centers. This was possible because the solution fully utilizes the existing Wi-Fi AP's site and transmission and power supply resources, and benefits from PnP and zero on-site configuration capability. Following deployment, actual user peak rates exceeded 130 Mbps, greatly improving network user experience. The operator plans to carry out large-scale deployment of Pico in thousands of its other stores, 7-Elevens, and coffee shops in Thailand.

When it comes to home scenarios, immature business models have hampered the success of the Femto home base station solution, despite trials by many mobile operators. In the foreseeable future, Wi-Fi will continue to be the primary home MBB solution.

As well as providing an excellent MBB access experience, indoor digitalized networks yield more value-added services like indoor navigation, visitor flow statistics, and precision advertising. In indoor venues with digital systems, operators and owners can create new revenue streams through opening network capabilities, which in turn enables service innovations such as digital shopping malls, airports, and stadiums, and maximizes the value of digital networks and data traffic.

Upgrading for the win

Indoor mobile networks are critical for operators in the MBB era, not only providing tremendous opportunity but also raising a series of challenges. Upgrading the traditional analog network ecosystem will not be achieved overnight and in isolation. Instead, realizing the concept of indoor digitalization will require a concerted effort, impetus from multiple industries, and even cross-industry partnerships. It will even be necessary to break up the chain of interests in traditional analog networks before the upgrade, so business success can be achieved for all.