



Abstract

Indoor capacity occupies large share of total Mobile Broadband (MBB) capacity. Global statistics show that 70% of voice traffic originates from indoor location, while in MBB era this gap is bigger with as much as 90% of the data consumption happening in indoor locations. In a DAS antennas typically connect to same radio unit, so DAS capacity is limited. Addressing the indoor MBB coverage and capacity requires new indoor small cell solution instead of traditional DAS system.

LampSite represents the next generation of digitized in-building solutions. This new technology extends the existing macro network indoors maximizing customer experience whilst minimizing cost. Lampsite allows operators to exploit high degrees of co-ordination and functionality through macro cell baseband reuse – such as seamless handover, spectrum aggregation, centralized radio resource management and co-ordination, as well as operations management and service performance management.

Traditional solutions in the market, like DAS, suffer from high deployment costs and limited flexibility to support cell splitting and the addition of new technologies. Due to its flexible architecture, LampSite offers a viable alternative since it extends the existing macro network indoors to help reduce cost and complexity incurred from deploying and managing a separate network. Its modular design and multi-technology support is cost effective and efficient, offering a good ROI due to lower costs, easy technology evolution capabilities and the ability to exploit readily available or easy to deploy CAT5/6 cabling.

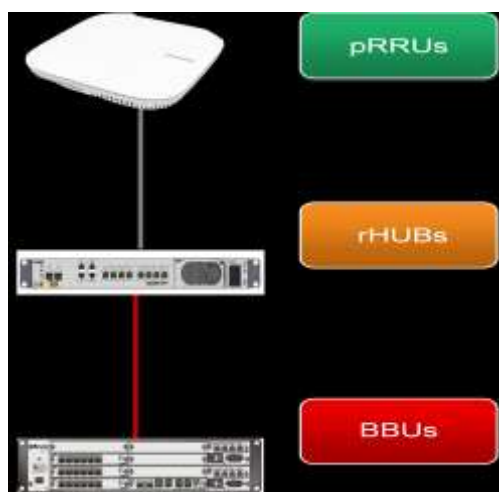
Recent surveys show that the current CAGR for data services is around 113%. Trends show demand for indoor capacity continues to increase and operators are struggling to meet the required objectives of 100% coverage > -85dBm, and MBB rate > 1 Mbps/user anytime, anywhere for indoor. To meet the needs of end customers, especially in the enterprise domain, a new approach is required. LampSite completely transforms the way operators address indoor coverage and capacity challenges today.



Acronyms

3GPP	3rd Generation Partnership Project
BBU	Base Band Unit
CPRI	Common Public Radio Interface
D2D	Device to Device
DCU	Digital Conversion Unit
LTE	Long Term Evolution
MBB	Mobile Broadband
MIMO	Multiple Input Multiple Output
MTC	Machine Type Communication
pRRU	Pico Radio Resource Unit
rHUB	Radio Resource Unit HUB
RAT	Radio Access Technology

LampSite Solution Introduction



Huawei LampSite solution is based on field-proven base stations. LampSite solution incorporates newly-developed RRU HUB (RHUB) and pico RRU (pRRU), and the baseband unit (BBU), using optical fibers and Ethernet cables for connection between CPRI ports. This solution is characterized by large capacity, flexible configuration, simple engineering construction, and a small number of modules, providing better indoor coverage and meeting capacity requirements.

Business Value to Operators

LampSite deployment offers a number of business benefits:

- Better indoor coverage and capacity supporting high speed mobile broadband
- Better user experience translates to an increasing propensity to consume data, which translates to higher revenues for the operator
- Easy expansion and contraction of installed capacity – enabling business flexibility that cannot be achieved with passive DAS installations today.
- Smart enterprise solutions offering future services and independent measures of the effectiveness of working practices (better ways of working).

LampSite offers a rich and seamless mobile experience for end users, indoors and outdoors. Data hungry and revenue generating applications like mobile video, cloud services and on-line gaming are enabled, making way for smart applications powered by cloud and location based services within enterprise, retail and public spaces. This allows new valued added service players to provide end users/enterprise customers with Smart applications/ VAS, enabling new revenue opportunities for operators.



Extension to Existing Infrastructure

Traditional indoor solutions or the ones based on separate architecture do not offer the same value proposition as LampSite. From a technology view point, they are not an extension of operators existing RAN infrastructure and requires a separate set of network elements that are much more costly to put in place and dimension. The evolution to multi technology is either limited (e.g. DAS can't offer Wi-Fi services) or requires separate antennas to be installed.

LampSite is built to ensure the maximum reuse of existing infrastructure to improve return on investment. LampSite works with evolution or advancement of an operator's macro network capabilities automatically, offering significant OPEX savings. Perhaps most importantly for the small cell business case, LampSite can protect macro investment by off-loading in building traffic, creating more capacity on the macro enabling better performance and in turn reducing the need for expansion outdoors. In recognition of the increasing complexity of operator networks, the solution can be deployed in any incumbent vendor region and has the ability to support Multi Operator Radio Access Network and Multi Operator Core Network (MORAN, MOCN), further reducing the investment by various service providers to achieve needed economies of scale.

SON and HetNet capabilities become part of the solution from deployment, catering for changing traffic trends and hotspots indoors. Standard RAN enhancements automatically become part of LampSite solution. LampSite in essence is designed as multi-mode, multi-band, capacity oriented, easy expansion product.

LampSite can also support operators who have invested in traditional DAS deployments through an "overlay" model. In order to upgrade most DAS systems, a new LTE band must be introduced, resulting in high costs (including hardware and man power). For Greenfield deployments, LampSite can reuse existing IT infrastructure such as Ethernet cable/ fiber already available in the building.



Unique Infrastructure Solution

LampSite is unique; representing the industry's 1st "BBU based" design, greatly simplifying the structure of indoor systems and significantly decreasing TCO.

LampSite's ability to be deployed in any vendor macro region, and support for multi technology operations without the need to install multiple antennas, allows for the lowest possible time to market, from months to days.

Even on transmission, LampSite is highly flexible, working with multiple backhaul technologies like FE/GE/xPON and Microwave/eRelay/Wi-Fi. CPRI connection between the BBU and rHUBs can support campus-like deployments in various smaller units spread across a vast area using a distributed architecture.

Advanced features like cell splitting (without any need for physical intervention) to support changing traffic and user distribution in various indoor locations, offers an unmatched user experience with no additional investment or changes to the existing system, minimizing disruption and lowering costs. Through LampSite solution, operator has the ability to see the network and performance up to last radio node unlike with traditional DAS and this is supported using existing Macro network O&M solution.

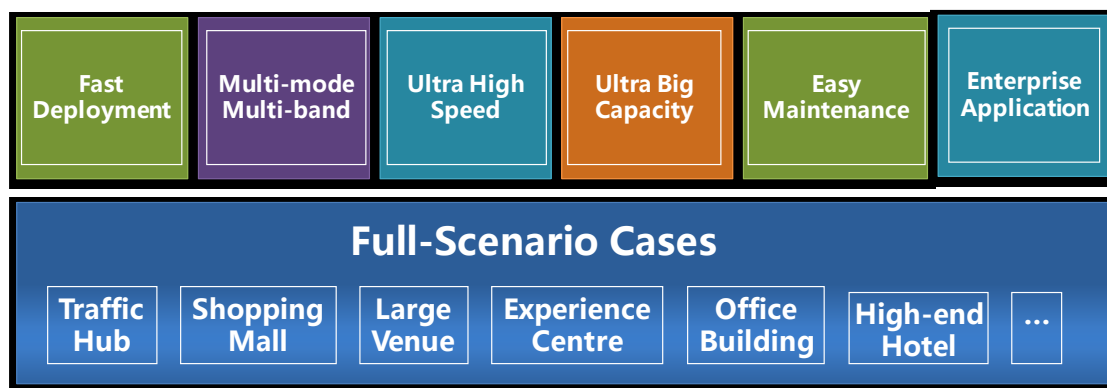
LampSite is highly scalable due to its support of GSM/UMTS/LTE and Wi-Fi technologies within the same modular design without any changes required on the actual units installed on the building floors. The BBU can be shared across indoor and outdoor especially when the macro site is collocated with the LampSite in the same building; hence the capacity can be shared

As part of roadmap, LampSite will support many advanced features:

- Hosting cloud services and enabling smart location-based services for operators and enterprise customers.
- LampSite has the potential to offer new business models and opportunities (B2B, B2C and B2B2c):
 - via Open API (RAN side)
 - Support LIPA protocol and enterprise service enabler. e.g.: IP PBX, security surveillance, Asset management, Building management etc

LampSite Deployment Scenarios

LampSite solution is applicable to multiple markets on a global scale. Many of the operators are struggling to provide a good, cost effective, high-performing indoor coverage and capacity solutions for their retail consumer and enterprise customers. Revenue loss on corporate customer contracts can potentially run into millions of dollars each month primarily because of the delays in deployment/ availability or cost efficiencies of some existing In Building Systems.



LampSite Deployment Scenarios & Benefits

As part of Huawei's small cell product family, LampSite is a solution fit for medium to large horizontal or vertical buildings both in public and enterprise markets, public places and shopping centers indoors, VIP booths in large stadiums and car parks and campus like deployments scenarios.

LampSite targets the main pain points of indoor coverage deployments: **time to market**, **cost**, and **performance**. Today Huawei sees strong market need globally for such in building solutions to cater for data hungry applications in the mobile broadband growth era.

The deployment of LampSite with Vodafone UK offers impressive stats that guarantee marketability of this solution across the Globe:

- 16 radio units deployed across 4 floors
- Whole deployment took less than 3 nights in total
- 1000+ customers spread over 12,000 sq m of office space being served

- 100% coverage above -85dbm with good coverage and data speeds (even in the stair wells and lifts due to softer handovers and high optimization capabilities)
- CS drop call rate is close to 0%.
- Traffic uptake during office hours is around 400+ voice calls per hour and 8000+ PS sessions established avg./hr.
- During busy hours users are getting a data rate of around 10Mbps/2Mbps on DL and UL respectively (good enough for HD video)
- Evolution from UMTS to LTE took around 4 hours for the entire building (16 radio nodes: adding the additional RF module) and addition of the LTE board in the BBU taking a few minutes only.

LampSite ticks all the boxes in terms of support within the same unit for multi technologies/ multi band simultaneously. It also offers different kind of transmission backhaul support, making it quicker, easier and cheaper to deploy in any scenario, hence a perfect fit for the enterprise space. LampSite addresses and provides the answer to the 3 key concerns of enterprise customers. This solution has a great future, meeting operator's market requirements in the enterprise market across OpCos because of its offering on multi RAT multi technology support and MORAN.

LampSite Deployment Update

LampSite is available and serving customers right now. The Vodafone UK roll out is Europe's first commercial LampSite deployment. CUCC Beijing Capital Airport



Peak: **140Mbps**

Average: **110Mbps**

Minimum: **60Mbps**

deployment is world's largest indoor small cell deployment. Beijing Airport target coverage area is as large as 1.4Mn sqm with an annual footfall of 86 Million passengers in the Airport. As depicted in the accompanying picture

LampSite enabled high user experience inside the Airport.

LampSite is currently commercially deployed in multiple markets and also is in trials with a number of global operators.

LampSite addresses operator key concern and this solution has a great future, meeting operator's market requirements in the enterprise market across OpCos.