Small Cells in Emerging Markets

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Mobile network operators and service providers in developing and emerging markets are turning to small cell solutions to meet surging voice and data traffic demand. Current developments in the technology are rapidly increasing the range of applications for small cells including:

- residential and commercial in-building coverage
- enterprise network mobilisation
- outdoor hotspot coverage at stadia, train stations etc.
- urban area network densification
- rural network backhaul

Limited availability of traditional infrastructure for WiFi data and VoIP offloading in emerging markets means small cells are an increasingly attractive alternative for mobile network operators (MNOs) keen to expand and densify their networks. Competitive prices linked to fast deployment times and the flexibility to operate across different network configurations strengthens the small cell use case.
However, the response to small cells from MNOs in emerging markets has by no means been universally positive and market growth has not been as fast as many in the industry hoped for. This report explores the reasons for this and considers whether it is a short term blip or a longer term issue, and what needs to change if small cells are to become widespread.

We are very fortunate to have contributions from many leading small cell experts and in particular Alan Law, Chair of the Small Cell Forum, who provides a comprehensive and detailed analysis of the applications, advantages and costs of small cells in emerging markets.

The report also includes a range of contributions from small cell specialists in the analyst community, including ACG Research, Current Analysis, Gartner and IDC. I would like to thank all contributors for their support, and also thank our sponsors Cisco and Intracom who have generously provided the means to put this report together and deliver it to our readers.
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Urban Density And Rural Reach: Small Cells In Emerging Markets

By Alan Law - Chair, Small Cell Forum

Early trials and deployments of small cells were heavily focused on developed markets such as the USA and South Korea. However, in many cases, the impact of the new architecture can be even more transformative for operators in emerging economies.

Here, the demand for wireless coverage and capacity is rising as rapidly as elsewhere, but the mobile network operator (MNO) may have limited financial or spectrum resources to meet that demand. Small cells can help address that issue, particularly when it comes to the two biggest challenges of building a mobile network affordably – urban density and rural reach.

The Small Cell Forum plays a vital role in helping MNOs in developing economies to make the leap into a new network architecture. Most of these operators need to be very cautious about how they invest their precious funds and are not in a position to take major risks. It is essential, therefore, that they can gain confidence by learning from the successes of others.

The Forum, through its Release Program and other activities, provides a rich source of best practice studies, deployment guidelines and blueprints, which can reduce cost, risk and time to market – all critical factors for operators in developing markets. Dense urban and rural deployments are the topics of Releases 3 and 4. These, like the other releases on residential, enterprise and virtualization, have proved to be of high value to operators everywhere, particularly in emerging markets.

All Release documents are available to download, for free at www.scf.io
Key Drivers Of Small Cell Deployment:

The importance of urban density and rural reach were highlighted in the results of a survey conducted in June 2015 for the Small Cell Forum. A total of 77 MNOs around the world were asked to list their drivers for investing in small cells during 2015-2020. From a selection of commonly cited drivers, they were then asked to select their top three in terms of significance to the business model over the next 3-5 years. Figure 1 shows the seven drivers which emerged as the most important across the sample, but also the variations between respondents in developed and emerging economies.

In the global sample, there was considerable diversity in the drivers for each operator’s deployment plans. In the subset of responses from emerging economies (39 MNOs), interest was focused more uniformly on three key issues – improved rural services, placed in the top three by 77%; reduced cost of delivering data, cited by 74%; and increased urban capacity, by two-thirds.

Most strikingly, rural coverage was the driver most commonly placed in the top three by emerging economy operators, indicating the significant challenge of getting broadband data services cost-effectively to scattered communities and remote areas. By contrast, in global terms, this was in seventh place, and although cost and capacity were the top two drivers across the board, they were cited by 50% or fewer of the respondents as a top three issue. The relatively low rating of new revenue streams by emerging market operators does not mean this is not important, but most MNOs know that, in order to start to create those new services, they must first address the economics of the enabling network.

There was also significant variation in the priorities of operators in emerging economies in different regions of the world, as Figure 2 shows. Rural coverage most commonly appeared as a top priority for Latin American carriers, and they were also the most interested in improving indoor coverage, while cost issues were most pressing in Africa and India. South East Asian MNOs were driven by urban capacity to a greater extent than other regions.

All these variations present challenges to the small cell industry in creating solutions which are sufficiently uniform to deliver economies of scale, while also catering to the different priorities of different operators and countries. One of the most important roles of the Forum is to enable the creation of unified, standards-based platforms, which reduce the cost and risk of deployment, but with sufficient flexibility to be adaptable to many local and regional scenarios.
areas or business parks. That makes it economically essential to be able to target capacity precisely where it is needed, rather than building a level of macro layer capacity which would be excessive in many areas.

**Improved coverage:**

Similarly, small cells can be deployed opportunistically to fill individual gaps in coverage, particularly in indoor locations or urban canyons.

**Costs:**

Minimizing the cost of ownership of networks is critical to many MNOs in emerging markets. They are working with very low ARPU levels, and while the introduction of mobile broadband services can boost those, there is still an urgent need to keep costs down. Where dense capacity is required, it is more cost effective to add small cells than macro sectors, as various studies indicate.

For instance, consultancy Real Wireless calculates that, as small cells achieve economies of scale with rising deployment (from 2015), they will achieve capex costs of 5-10% of a macrocell, with operating costs of 10-25% (largely depending on backhaul type). Of course, larger numbers will be needed in a dense environment, but in downtown areas in emerging economies, 3-4 per macrocell will be typical. The overall TCO of these networks will be further improved because the strain on the macro network will be eased, freeing up capacity there, and because techniques like SON (self-optimizing networks) are emerging. These will introduce a high level of automation and reduce operating costs further, as will new backhaul options such as wireless links in unlicensed spectrum.

**Urban Density:**

The mobile capacity crunch is often perceived to be a first world problem, but in fact, in central urban areas, MNOs in emerging economies can face greater challenges. Demand for data is often rising even more quickly than in other regions especially where wireless networks are the primary method of accessing internet and media services. However, there is often less infrastructure available to support this, in terms of backhaul, sites or spectrum. Meanwhile, low ARPUs and regulatory policies may – as seen in India for instance – restrict the operator’s options to build out new capacity in a profitable way.

That challenging combination of factors is driving significant interest in small cells, partly because of the Forum’s key role in disseminating the experiences of the first movers to show the majority of MNOs what is possible. Those case studies and work items demonstrate the role that small cells can play in urban mobile roll-outs:

**Targeted capacity:**

Significant pressure on mobile capacity is not universal, but – to an even greater degree than elsewhere – tends to be concentrated in certain usage hotzones, such as downtown
Additionally, with ARPs typically low and competition high, MNOs in some developing economies are often in the vanguard when it comes to harnessing new architectures to support new revenue streams. For instance, Reliance Jio, a new entrant MNO in India, is a Champion of the Small Cell Forum’s work item on the Internet of Things.

**Rural Reach**

As Figure 1 highlighted, reaching rural communities is the single most important driver of interest in public access small cells among MNOs in emerging economies. This is an important area of focus for the Small Cell Forum. It has addressed rural and remote deployment in its Release Program, which brings together a range of resources to support business cases and best practice, and a more economic approach to rural broadband is also an important aspect of its work on virtualization.

The rural and remote market consists of about 650 million users worldwide worth an estimated $163 billion in equipment and service revenues. The largest section of that overall landscape is in emerging economies, where higher percentages of the population typically live outside cities. Over two-thirds of potential 3G/4G subscriber growth lies in rural and remote regions but many carriers have not
yet discovered a convincing business case for deploying networks in such areas.

This is because rural and remote communities are, by their nature, small and scattered, and so do not provide the economies of scale of dense urban populations. In many cases, inhabitants have low income, and the costs of reaching them are high, especially in terms of wireline transport. Hence mobile adoption tends to be lowest in countries with high rural population, as Figure 2 shows.

Yet as subscriber and revenue growth slows, MNOs need to reach these underserved users with more than GSM, especially as they are often under government pressure to do so too.

Flexible Architectures:
Achieving profitable rural broadband access requires a flexible approach to architecture and infrastructure, in order to make the most of what is available. Some vendors have been working on new architectures which are particularly appropriate for the economics of rural communities. For instance, Quortus virtualizes many of the functions of the mobile core network on a local access point or server,

The Small Cell Forum’s business case analysis for rural access calculates that, even with an ARPU of $10 a month and satellite backhaul, the case delivers a positive contribution of $7,000 a month per rural small cell site, whereas a macrocell-based model would fail to break even.
creating a rural small cell with its own local intelligence. This reduces strain on the backhaul and delivers a low cost solution with the network’s capabilities located close to the users, however remote they are.

Parallel Wireless’s approach involves a ‘micro network’ of very low cost antenna units, which cover a village and are all managed by an LTE access controller. This, in turn, is linked by an in-band last mile microwave link to a macro base station between four and 10 miles away.

Such approaches avoid two costs which usually make rural mobile coverage economically inviable. There is no need to install a full-scale cell tower just to serve a small number of people within its range. And there is no need to run underground cables to provide backhaul. Total costs are about 30% of those of serving a community with a macrocell, and average speeds of around 20Mbps are expected.

**Conclusion**

Small cells can go a long way to make the case for deploying mobile broadband in dense urban environments or rural communities, at realistic cost levels for operators in emerging economies. There are still significant challenges, particularly in backhaul, which will remain heavily dependent on satellite in many areas, though even that is improving in terms of cost and performance, and new wireless backhaul options are evolving too, sometimes riding on 2G or WiMAX infrastructure.

In other words, the barriers are being lowered, while the need to add capacity and coverage to mobile networks is becoming critical to operators’ survival. In emerging economies, according to the GSMA, it is extremely tough for non-incumbents to increase their market share by addressing existing customer bases – 90% of emerging market MNOs which had less than 5% share in 2010 still have less than 5% share in 2015.

One of the best ways to improve that situation is to build a distinctive user base where there is less competition. The economics of small cells will increasingly enable smaller, nimbler operators to do that viably in two important areas of potential – offering new services, enabled by dense networks with high QoS; and reaching out to underserved rural customers.

Through sharing the experiences and knowledge of its members, the Small Cell Forum can arm MNOs in developing economies with powerful expertise and confidence to embark on roll-outs where they have the opportunity to launch profitable services for the first time.

Joining the Forum will help to accelerate the process of using small cells to address the challenges of urban density and rural coverage. It brings down the barriers which many MNOs, particularly in developing markets, see in the way of a new platform, and gives them the tools and the confidence to transform their networks and businesses. In this way, new architectures will start to revolutionize the landscape of mobile services in emerging economies.

To join the Small Cell Forum, or learn more about membership, go to [http://www.smallcellforum.org/membership/](http://www.smallcellforum.org/membership/).
About Small Cell Forum

Small Cell Forum works to accelerate small cell adoption to change the shape of mobile networks and maximize the potential of mobile services. Small Cells are low-power wireless access points that operate in licensed spectrum, are operator-managed and feature edge-based intelligence. They provide improved cellular coverage, capacity and applications for homes and enterprises as well as metropolitan and rural public spaces. They include technologies variously described as femtocells, picocells, microcells and metrocells. Small Cell Forum has more than 140 members, including 68 operators representing more than 3 billion mobile subscribers –46 per cent of the global total –as well as telecoms hardware and software vendors, content providers and innovative start-ups.

www.smallcellforum.org

Author Biography

Alan Law

Chair, Small Cell Forum

Alan Law has been involved with Small Cell Forum for over six years, in which time he has chaired the LTE Special Interest Group and represented Vodafone Group on the executive board.

At Vodafone UK, Alan was the technical lead for introducing a new 3G radio access network. This experience Alan found extremely valuable when driving the development of new requirements for future systems that can be deployed and supported in scale. Most recently, Alan has been driving the introduction of a number of new technologies at Vodafone such as femtocell solutions that are now live in 15 markets worldwide. For his technical contribution in Vodafone, Alan has been awarded the title Vodafone Distinguished Engineer; of which there are only nine from over twenty thousand technology staff.

During his time as Chairman of Small Cell Forum, Alan will represent the differing needs and challenges facing operators in each of their respective regions to deliver a global view of operator requirements, as well as driving industry and vendors to ensure delivery on opportunities to enhance customer experience, improve cost efficiencies and enable new market propositions.

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Developing Countries: Next Small Cell Opportunity?

By Elias Aravantinos - Principal Analyst, ACG Research

With the total small cell market anticipated to surpass $1 billion by 2019, developing countries offer a prime opportunity for growth.

Small cells, based on the Small Cell Forum definition, is an umbrella term for operator-controlled, low-powered radio access nodes, including those that operate in licensed spectrum and unlicensed carrier-grade Wi-Fi. Small cells typically have a range from 10 meters to several hundred meters. Types of small cells include femtocells (the smallest), picocells and microcells (the largest). They complement existing 3G and 4G macro networks.

Operators use small cells for either access or backhaul functions. Small cell backhaul is the transmission link between the small cell and the mobile network operator’s core network. Operators are predominately using access, mainly for indoor coverage and in the future for outdoor and traffic offloading. Because of these attributes small cells are an ideal technology for operators in developing countries to use in an effort to expand their networks and meet the growing demand from both businesses and consumers for services and access.

State of the global small cell market

The rapid evolution of small-cell technology has grown in parallel with exponentially increasing user data requirements. According on Cisco’s Visual Network Index, global mobile data traffic will grow tenfold from 2014 to 2019, a compound annual growth rate of 57 percent. Worldwide mobile data traffic will reach 24.3 Exabytes per month by 2019 (the equivalent of 6,079 million DVDs each month), up from 2.5 Exabytes per month in 2014.
This growth is expected to be fueled by the rapid rise in over-the-top content streaming and the rapidly emerging Internet of Things, which will have more than 20 billion connected devices by 2020. Small cells will play a vital role in giving operators and their subscribers seamless data services because of their ability to enable network densification.

ACG Research expects the total small cell market to reach an estimated value of $500 million by the end of 2015. Medium and large enterprises will boost the small cell indoor residential coverage market; the total small cell market is expected to surpass $1 billion by 2019.

The goal is twofold: to greatly increase cellular capacity in high-traffic locations and to improve indoor coverage. The primary applications will be packet voice, other real-time applications and high-value data traffic.

**Developing markets: an opportunity?**

Although current conditions in emerging markets for the telecom industry are somewhat unpredictable and influenced by global macroeconomic developments, consumers and enterprises are demanding more reliable and higher-capacity data. Consequently, mobile data services provided through cellular 3G technologies are prevalent globally.

LTE is emerging in most developing markets, but operators are still working to expand service coverage and increase their subscriber bases, which is not an easy task due to the poor economic conditions in some cases. Additionally, transmission costs are still a prohibitive factor in some markets, but generally there are options and prices for them are decreasing.

The adoption of operator-provided Wi-Fi services has been somewhat limited in many developing markets. This is partly due to the mobile operators’ focus on implementing LTE and because they are unsure how to monetize these services and how or if Wi-Fi potentially could cannibalize other revenues.

**Latin America**

Latin America (LATAM) offers the greatest opportunity for small cell development. Regionally, service providers are upgrading their networks with the goal of making them more cost-effective, as their average revenue per user (ARPU) ranges between $15 to $20. The small cell deployment strategies in Latin America are driven from existing commitments to LTE and a goal to strengthen data

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**Two major trends have been fueling the growth of the small cell market during 2015:**

1) LTE and 3G indoor small cell deployments continue to increase faster than outdoor cells for not only indoor coverage but also for in-voice service enhancement in buildings.

2) Operators focus on public indoor planning/trials to public access venues and hotspots deployments, such as airports, train stations, hotels and shopping malls.
provisioning to a growing number of urban smartphone users. Brazil, Argentina, Mexico, Colombia, Uruguay and Chile will be the leading counties within the region.

Currently in LATAM there is a shift towards data services. The region is showing a healthy 12 percent year over year growth in its Internet population. The economies of Brazil, Colombia and Peru are growing quickly (four to six percent year over year), which could potentially translate into higher ARPU and higher adaptation of postpaid mobile data services.

In Brazil Telecom Italia, TIM, has deployed small cells in its 3G network. TIM plans to implement thousands of small cells nationwide by 2016 to improve coverage and support the growth of voice and data traffic. TIM also plans to integrate femtocells to its 3G network by 2016. Since 2014, TIM Brazil has been deploying enterprise cells, home cells, and metrocells outdoors.

The upcoming World Cup games and Olympics are creating momentum and driving development. To address the anticipated increase in mobile data demand, Brazilian operators are working on shared DAS and dense coverage and capacity solutions, which include Wi-Fi and small cells. Another operator, Oi Brasil, is already deploying femtocells, indoor and outdoor small cells.

Asia Pacific

In Asia Pacific, China, Thailand, Malaysia, South Korea and Indonesia are also deploying small cells. In Thailand AIS operator, which plans to deploy 3000 small cells to enhance the capacity of its 3G network, has started to deploy metro cells outdoor to support service-aware services in an effort to improve the cellular service of Thailand’s tourism-driven economy.

Middle East

In the Middle East small cells are not as popular as LTE yet. However, Etisalat in Egypt has deployed—albeit in in small volumes—a small cells solution to provide better user experience for both voice and data services in enterprise buildings and public venues.

Ooredoo Qatar recently deployed its small cells in hotspots across the country in a trial phase using LTE and 3G small cell solutions in high-traffic indoor and outdoor locations in strategic locations such as café and restaurant rooftops in Doha to ensure additional capacity, coverage and better network availability, as well as reduce latency. Ooredoo Qatar is also using small cells to complement its existing 4G macro network to provide enhanced voice and data services.

Mobile operator Du in UAE signed a memorandum of understanding on a set of common objectives for the development and evolution of 5G and the Internet of Things in its effort to design a mobile advanced network; however, the operator is still in small cells trial phase.

Southern Africa

Major South African operators and Internet service providers have already started seriously considering small cells deployments. Most recently, South Africa-based Cell C has started rolling out and will continue during the next three years its LTE network across the nation. Cell C is initially taking a targeted approach with LTE and will continue to rely on 3G network technologies for less densely populated areas. During that roll-out it will announce its LTE suite of products and services, including some small cells to support indoor coverage in commercial venues.
Small cell challenges

Although small cells appear to be the most attractive solution to enable network densification and fill coverage gaps while making more efficient use of resources, such as spectrum, power, space, the cost component continues to stall widespread deployment. For small cells to be deployed in large volumes and achieve high-cost efficiency the average total cost of ownership needs to be more attractive than that of a traditional macro site.

Small cell deployment scenarios should be highly diverse, ranging from complex installs in indoor buildings to very simple pole/strand mounted small cells outdoors, which will certainly create business opportunities as it opens the door for new entrants such as providers that do work in the outside plant.

Service providers’ small cells build goals should focus on simplicity and business intelligence, which could contribute to significantly less expensive construction costs. Overall, service providers need to develop a simple and repeatable configuration and integration process to meet aggressive deployment timelines and cost requirements.

Conclusion

Small cells offer a cost-effective technology to meet the rapidly increasing demand for mobile broadband services, especially in large and complex indoor areas, offering a better, faster user experience. Although developed market has already adopted the small cell technology, the deployed volumes are slow but are expected to accelerate by 2017 because developing markets are now realizing the benefits of the small cell, especially indoors. There have been so far a few substantial deployments, and ACG predict that the market may start to grow even faster as more SPs realize the potential benefits.

In most developing markets the focus is still on the macro layer, but because small cells complement the existing network, service providers are looking at small cell deployment as a viable option to upgrade their networks. This is where vendors need to step up and assume a crucial role: to help service providers understand the small cell value and develop new business models and services, especially in commercial venues; make service providers understand that small cells are a viable technology that complement existing 3G and 4G macro networks to provide enhanced voice and data services even in the most crowded indoor and outdoor areas in developing markets; and that new business models can produce value-added services and increase ARPU.
Elias Aravantinos

Principal Analyst, ACG Research

Elias Aravantinos is a proven thought leader in cutting-edge technologies and strategic analysis. His market focus is mobility, covering a range of topics including LTE, LTE-A, 5G, SDN, NFV, WiFi, IoT, network APIs and identifying how under-the-radar technologies may disrupt or improve the mobile value chain. He is a pioneer in technology indexes identifying the right KPIs that could help service providers understand the present and future trends.

Mr. Aravantinos’ work expertise and experience is in technology marketing and management consulting for large vendors and Wall Street companies: KPMG in Montvale, NJ, where he lead Identity Management Applications and Services, securing the company’s extranet; Lucent Technologies Lab in Holmdel, NJ, designing a dynamic allocation spectrum model for the next-generation wireless networks, applying computational economics and optimization models; Columbia Institute for Tele-Information in New York, leading a strategic consortium of operators (including Verizon Wireless, Telecom Italia, Korean Telecom) to help them understand the ultra-broadband network and technology requirements (more than 1 Gbps network) to develop a set of wireless and wireline solutions. As a network engineer, working for Intracom Telecom he designed and developed an network automation tool for an in-flight network for Thales in France.

Prior to joining ACG’s mobility division, Mr. Aravantinos has held various technical and management consulting positions in Europe and abroad. He was the microwave and mobile backhaul analyst for Maravedis LLC, a global research boutique, leading the European research into RAN and LTE. As an entrepreneur, he founded ExelixisNet, an independent US consulting firm that implements comprehensive projects on small cells evolution, IP networks transformation, and also providing online marketing solutions to SMBs and coaching a number of early stage start-ups.

He is a professor at the Cityunity College at the MSc program. He has a BS in electrical engineering from the University of Patras and an MBA with honors from Oklahoma City University. He has also studied network economics at New York University.

Elias Aravantinos has published wireless technology articles in academics books, journals and magazines and has been a frequent speaker in academic and ICT conferences.
Interview: From ‘Special Coverage’ to ‘Business as Usual’

By Lorcan Burke

In this interview with James Barton of Developing Telecoms, Lorcan Burke, Director of Global Mobile Service Provider Business Development at Cisco, offers a frank and honest appraisal of some of the most important challenges facing Mobile Network Operators (MNOs) as they consider the deployment of small cells in emerging markets.

What advantages are small cells bringing to the space?

Legacy architecture makes certain options unavailable in mature markets, but this isn’t an obstacle to emerging market operators. There’s also the issue of blending in other consumer services like television into your offering. This might help with consumer ARPU but not with business revenue streams. If you’ve been a mobile-only player, you are relatively insignificant in the enterprise segment, and you face the problem of consumer ARPUs declining.

Operators in a city like Buenos Aires might only have 600-1000 sites for an area the size of London. Fundamentally, that’s not enough coverage and capacity, and the situation is only getting worse as data is growing exponentially. With greater competition and declining prices demand becomes elastic – every dollar you drop, will see an increase in demand, regardless of where you are in the world.

So if demand is on the rise but operators can’t install more sites, how do they meet this demand?

Broadly speaking, demand for traffic is moving indoors, both for consumer and enterprise. While it’s possible to address this demand with Distributed Antenna Systems (DAS), this solution tends to be expensive. Moreover, the pool of technical expertise is relatively small if you’re looking to boost indoor coverage.
The need to provide coverage indoors is being driven by enterprise, and it follows that the proliferation of small cells is therefore being driven by this. Any location where customers are trying to transact requires Wi-Fi, unlicensed radio, or a combination of both.

Across Latin America, most operators are now turning to small cell deployments for indoor coverage – although interestingly this is being led by enterprise rather than residential. To provide coverage in a city the size of Buenos Aires, most operators would have around 500-600 macro sites. You can use repeaters to provide indoor coverage but in effect these are just stealing capacity from the macro sites.

Cisco has a large number of Wi-Fi customers in all markets. These tend to be enterprise customers with Wi-Fi deployed in branches, along with routing, switching and wide-area network-type connectivity. One of the problems we can help to overcome in the overall operational process ends up being site acquisition and installation. Cisco has partners working with the telcos who are the main sales and delivery teams in these markets.

Traditionally most telcos have a very small special coverage team, which they often find inadequate for providing the requisite capacity for indoor traffic requirements. For this reason, they’re often slightly unloved by the rest of the macro radio team!

What are the main factors limiting small cell deployments?

It’s relatively tricky for operators to implement this scale of change across their operations. Large-scale network rollouts were fine a few years ago when consumer ARPU was reasonably large and most traffic was outdoors, but now OPEX is being squeezed.

In Mumbai, for example, there are between 3000–5000 macro sites for an area bigger than London, and with denser user capacity. Macro site availability is limited; there just isn’t space. There are maybe 600,000 high rise residential blocks being built each year, which require indoor coverage, but there are also a lot of new businesses being housed in these buildings.

With so many new builds, but only a limited number of macro sites, how do you deliver the amount of capacity that’s being driven by these mobile users?

You have the options of stealing capacity, using repeaters or bringing a distributed antenna system (DAS) in. With DAS, the issue is that they can’t be installed quickly enough; they’re still quite specialised systems. In practical terms there’s very little difference between installing a Wi-Fi radio or an unlicensed radio except in terms of planning and controlling the power being used by the licensed side.

The ability to do site acquisition for indoor coverage is a problem for a traditional macro radio operator because that’s not the way they’ve ever planned capacity in the network, and they’ve never had to scale their operation to get indoors. If their consumer operations are declining, they can’t scale the operations and the business to acquire indoors, meaning that there isn’t a good business case.

The only option on the consumer side is that capacity has to be self-installed. This removes a major aspect of the operational process on the residential side, but on the enterprise side capacity still has to be planned in some way. In this situation, expansion is still fundamentally driven by KPIs and performance, and if you do anything to mess up the drop call rates then enterprise customers in particular get upset.

It is often the case that end-to-end network customers are so upset about poor indoor coverage that they’ll pay the money themselves for the capital and the installation of the licensed small cells. It is easy to understand why they will do this. If, for example, you have a situation with a sales team in a building handling calls via both their mobiles and the fixed network infrastructure it’s unacceptable to have them missing calls.
For effective capacity increase you need the combination of Wi-Fi and unlicensed radio. Cisco recently did a smart building deployment in Indonesia as a headquarters for a telco. After installing Wi-Fi and small cells for 3G and LTE throughout the building, we were told at the very end of the installation process that we needed to install 2G in the basement car park as the CEO’s driver only had a 2G phone! If you want to get coverage in these radio-blocking areas – and a lot of enterprises still do – then you need a combination of Wi-Fi and small cell deployments.

This particular building in Jakarta was planned to be energy-neutral. The building was triple-glazed for energy efficiency with passive cooling and a smart building management system. Cisco were able to leverage the dense Wi-Fi and small cell deployments to identify where people were in the building and turn on the lights or air conditioning accordingly.

Are we more likely to see small cell use cases in dense urban areas before we see them being used to provide rural coverage?

Backhaul transmission is the real problem for rural small cell deployments. Transmission infrastructure is poor even in dense urban environments like Mumbai and Buenos Aires and worse still in most rural areas. In India for example, even with MNOs such as Reliance rolling out 170,000 LTE sites’ worth of IP RAN, it’s still not enough to meet backhaul capacity demand. The numbers are large, but that will only put them on par with existing operators.

Densifying within that network in order to provide indoor coverage requires a flat, IP-type network to connect all these sites with different microwave-type technologies, but they need to be physically smaller than they currently are.

In cities, a major roadblock is simply getting transmission to the required location and being able to plan relatively dynamically for that. A lot of the time, the traffic capacity will end up being quite spiky at street level. Particularly at indoor level, you can see drops of transmission leap from 3-4000 to around 10,000. Densification is a problem, and operating & planning are both real issues.

If operators can figure out how to make money in cities against the background of these challenges, then the next step is the rural side. This is often not something that they want to do; rather it is more of an obligation as part of their licence terms.

However, if you can use the small cell technology in the right way – i.e. in remote areas where you may not have previously offered coverage – it’s possible to figure out whether it’s financially justifiable to deploy the bigger macro wide-area coverage. If there’s coverage, people will use it to transact, and this digitisation of the economy allows countries to leapfrog steps of economic development.

Do you see the future of small cell tech being tied to the low-power segment?

This depends on the definition of small. For Huawei or Ericsson, ‘small’ is 5 watts. With decent antenna design you could cover kilometres with that amount of power.

More traditionally, ‘small’ Wi-Fi radios are a maximum of around 1 watt and as long as there’s no physical interference this will provide several hundred metres of coverage and can be used to provide alternative mobile access. This type of connection is used in a lot of markets as an alternative to having a macro RAN play. Cable and TV providers looking to get into mobile often take this route as a means of gaining back some of the ARPU that mobile operators have taken from them in the past.

There are interesting commercial models evolving in high-density, low ARPU areas such as slums. Dharavi in Mumbai, for example, has two or three large macro sites for an area which is not physically large, but is home to many millions of people so has enormous capacity demands. It is a self-organising supply chain – there are people who
can produce exact replicas of any piece of equipment with angle-grinding machinery – and since everyone needs a mobile to make money, there’s a high demand for capacity.

No matter how much power they consume, macro sites would not physically be able to provide enough spectral efficiency, so you have to go small. Dharavi is a city of a thousand cities, and it has its own ‘village’ style districts. It is possible to make deals with the community leaders to provide better coverage. In exchange they will host and protect your radio infrastructure and stop the backhaul being stolen.

Operators may not like small cells, but there’s really no choice. We can keep squeezing as much as we can out of spectral efficiency on macro and power, but this is still bigger units at one extreme and you would still have a flat IP backhaul network site acquisition problem.

Staying outdoors and trying to provide coverage indoors is going to involve growing from thousands of sites to at least tens of thousands of sites. If your definition of a small cell is a 5-watt street level unit like Huawei or Ericsson, you just can’t scale your operational processes in the way that they’re currently organised. But, somehow, you’re going to have to figure out how to do that!

There’s no other way of getting radios closer to the people who are generating the demand. As the capacity requirements go up and the cell size shrinks, you can’t use more power because that interferes with whoever else is using power in the same areas.

**Which operators are really pushing small cells?**

Most of the operators aren’t being that public about it and sometimes within organisations there’s a lot of in-fighting. The classic radio guys don’t want to move towards small cells, even though they know they’ll have to eventually. Scaling ‘special coverage’ teams to ‘business as usual’ is a couple of years of operational process change for a large operator!

Two major South American operators are now using this as their way forward for city planning – small cells are becoming ‘business as usual’ for dense area planning. Interestingly, Latin America is probably the furthest ahead in small cell implementation. Their societies work in quite a ‘top-down’ way, so if someone at the top of the business is convinced by a certain way of working, they’ll tell the business that it is what they should do and then the workers go ahead and figure it out.
India has made good progress but really it’s a numbers issue – it will happen, but it’s just not happened yet. In Africa, meanwhile, many operators are figuring out that enterprise is the key to sustainability and that it won’t hurt to begin offering coverage in the vast swaths of unconnected land. Southeast Asia is mixed, but the applications in places like Indonesia are clear and these nations are doing quite a bit in the small cells field.

To sum up, with small cells, it’s not just the licensed part; unlicensed is also important. The advantage of this is that if an operator in India, for example, has only got 5MHz or so of 3G, they can bond as much Wi-Fi as possible to their licensed spectrum. In fact, if you consider ‘Wi-Fi’ as part of ‘small cell’ then there are a lot of people doing it – probably more than are doing the traditional licensed side. This might be because they don’t have to make the macro-planning radio team change their thought process quite so much!

Author Biography

Lorcan Burke

Director Global Mobile Service Provider Business Development at Cisco Systems

Lorcan Burke is responsible for mobile internet architecture for mobile operators and service providers. His specific focus areas are on strategy and architecture for the delivery of Cisco’s small cell and service provider WiFi portfolio, and on leveraging the enterprise channel with service providers.

Prior to taking up this position Lorcan was head of strategy, architecture and innovation at Ericsson where he was responsible for network architecture and strategy at Vodafone Group. He has also served as CEO of communications start up company Adaptive Mobile.

Lorcan Burke has over 20 years of international sales and marketing experience in the telecommunications and IT industries. He holds a Graduate Diploma in Telecommunications Engineering and a BSc in Information Technology from Dublin City University.
The interview starts with an overview of small cell applications and considers some of their advantages.

**DT:** What are the factors that first brought about the need for small cells? How are they being used to address these issues?

Small cells are generally seen as one part business driver, one part technology driver. The technology side is always being pushed forward – you get to a certain point where you can take these giant macro RAN base stations and make them smaller and lower power. On the business side, it’s driven by two things: coverage in places where you don’t have coverage, and capacity in places where you need capacity. These can be the parts of cities where it’s difficult to provide signal with a macro base station – the ‘urban canyons’ – or in-building situations where the signal doesn’t penetrate particularly well indoors.

**Peter Jarich of Current Analysis**: discusses the potential for small cells in emerging markets with James Barton, Editor of Developing Telecoms. The value proposition for small cells in emerging markets is strengthening all the time as their technical abilities increase. However, Jarich believes that the business models still need to develop and a lack of will and a desire to stick with better known alternatives may still be holding the market back.

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There have been solutions for these – distributed antenna systems and repeaters, for example – but while these may help with coverage, they don’t help with capacity. Providing a combination of coverage and capacity is really the issue in hand.

We’ve seen this before with femtocells, which are essentially the residential version of small cells. They are typically deployed to provide coverage within a house, to the extent that operators began using them to boost coverage in order to meet customer complaints.

The coverage aspect comes up increasingly as we transition from 3G to 4G; there are all sorts of different technologies that can help grow capacity, but more than anything the idea of reusing your spectrum by shrinking the size of the cell is a very simple way to address this issue.

Of course, it’s possible to provide much wider coverage via a higher-altitude platform. Some operators have even proposed using drones or tethered blimps to expand their coverage far beyond the capabilities of a tower. These are innovative ideas, but in practice providing coverage to an entire city with one base station means spreading the capacity very thinly. Coverage and capacity are two sides of the same coin – the more coverage you get by expanding your spectrum to a broader set of people, the less capacity everyone gets.

Of course, the reverse is true as well, and so while you still hear proponents of small cells arguing for in-building coverage, the concept that truly resonates is of delivering greater capacity via smaller, lower-power cells. It follows on from the Wi-Fi industry, which long ago spelt out that the important metric is not just data rates, but in fact data rates per square metre. That’s where we are today – it’s about both capacity and coverage.

DT: With the increased prevalence of HetNets and Self-organising networks, are we likely to see an uptick in small cell deployments?

The first hurdle with any technology is that it does what it says on the tin – SON and HetNets are great on paper, but we need to know that they work. It’s been a struggle to demonstrate that these technologies won’t interfere with macro cells and they can be rolled out easily, but there are bigger issues. We can deploy these networks and they’ll self-organise, they’ll work with each other, even inside buildings – they’ll sort themselves out.

The bigger issue is finding the way to deploy these things afterwards – getting approval, backhauling them, supplying power. Admittedly, these will be more of an issue in some places than others – in rural areas for example, power and backhaul will be challenging whereas finding sites isn’t such a problem. Constraints are going to differ.
DT: Small cells are being actively deployed in developed markets – what kind of issues typical to emerging markets might they be able to cope with in ways that traditional infrastructure can’t?

When you have a new technology and it matures, you then find applications that weren’t originally planned for it. At a basic level, small cells are lower power and lower capacity, which delivers lower cost. Additionally, unlicensed spectrum is increasingly being integrated into the products. This means that one value proposition for small cells is that an operator can drop one into an area that previously had no coverage or data access, and light it up.

For example, SoftBank has leveraged some of its products to look at covering more remote areas in Japan – a country with surprisingly challenging geographies, including islands and inland rural areas. Of course, going back to the issues faced by rural areas, power and backhaul are particularly challenging. In these situations there are satellite solutions for backhauling which may be more appropriate.

However, small cells are viable in many rural area settings. An good example is of this IP Access and Ericsson who have delivered 3G small cells to remote villages in Peru. One of the major advantages small cells enjoy is that they can be more easily transported into an area than any large base station which inherently lowers the costs. On balance, small cells are a solution that can be deployed more easily and therefore at a lower price point in emerging markets than the alternatives.

DT: Are small cells key to a connectivity ‘revolution’ in remote regions in developing markets?

It’s a huge value proposition. As I have already said, there is the technology side and the business side of the use case. However, the bigger issue may just be the will to get this done; deployment of small cells in developed markets has taken time, even though the technology has been around for a while. That’s because there are other things that can be done first, and business models haven’t been worked out yet.

These same issues exist in developing markets, but there are more alternatives. If we’re just talking about data access, then Wi-Fi could work – you’ve got long-range and high-powered solutions in this field. Small cells are a great tool and there would be a great use case for any operator with the will to deploy them.

DT: Going forward, will operators start waking up to the potential use cases and business models for small cells in emerging markets?

100% - it’s like any technology, as it matures people will come up with new applications. We see examples of this working – when SoftBank show that it can help with rural coverage, other operators will follow suit. It just takes time for people to absorb the options and understand what they can do.
Over the years, there has been no shortage of solutions aimed at supporting connectivity in emerging markets. There have been deployments of low-cost GSM/3G solutions running on solar power that are easy enough for locals with no engineering qualifications to install. These are all salient points when it comes to infrastructure in emerging markets, and with that in mind it’s easy to see the value of small cells. The technology side is ready; we just need the will on the business side.

Peter Jarich

**VP of Consumer and Infrastructure at Current Analysis**

Peter Jarich manages the firm’s syndicated research into the network equipment and software solutions deployed at telecom service providers along with the consumer services, service innovations and connected devices riding on those networks. This role sees Peter directing the company’s analysts looking into wireline network infrastructure and services, mobile networks and services, and the competitive environment surrounding tablets and smartphones, including Current Analysis’ regular tracking of service innovations, and device marketing dynamics. Peter holds a BA in Economics from Cornell University and a MS in Foreign Service from Georgetown University.
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Technology Shaping the Future
Maximising Small-Cell Backhaul Performance

By Konstantinos Dimopoulos - Senior Product Manager, mmWave

Small-cell deployment is being considered by mobile operators around the world as a means to satisfy the ever-increasing mobile broadband traffic demand in urban areas.

Microwave systems have dominated the backhauling of macro base station sites in most areas of the world for many years. A new generation of systems is now coming out of the development labs of wireless equipment manufacturers. These are being specifically designed to meet the particular requirements and challenges of space and range-limited street-level deployments.

The main operator requirements driving these developments are:

* Small size and attractive equipment form factors - units may be visible at eye-level in public places
* Flexibility - units need to be mounted on walls and lamp posts with basic powering facilities
* Rapid speed of deployment
* Ease of maintainance
* Large reductions in CapEx and OpEx compared to macro-sites

Unlike traditional macro base stations, small-cell base stations are mainly deployed below building rooftop heights. Typically, installation locations include city structures such as street lamp posts, sign posts and building sidewalks. Moreover, they are expected to be deployed at much higher densities than macro cells.
As a result, wireless backhaul links are likely to be subject to obstructions arising from city clutter such as trees, posts and buildings. Such deployment characteristics, combined with the smaller coverage area per cell, create specific mechanical, functional and economical requirements for the small cells and their means of backhauling.

The grid-like nature of the streets and the obstructions imposed by city clutter at street level, necessitate the deployment of a combination of “chain”, “tree”, “star” and “ring” configurations. Such topologies can ideally be accommodated by radio operation in Point-to-Point (PtP), relay and add/drop, and Point to Multi-Point (PtMP) modes, capabilities. In addition, the use of area-licensed MW spectrum and unlicensed 60 GHz spectrum is suited ideally to small-cell backhaul characteristics and requirements.

Software-defined Point-to-Point (PtP) or Point to Multi-Point (PtMP) microwave radios can be used to optimise the performance of small-cell backhaul networks by combining them with PtP 60GHz radios. In a backhaul network design that uses a limited amount of area-licensed spectrum, selectively replacing microwave links with high-capacity 60GHz radio links can facilitate radio planning and improve network capacity.

Currently, mobile operators are closely examining wireless systems that operate in all frequencies for the purpose of Small-Cell backhauling. Of particular interest is the use of PtP/PtMP systems operating in the 26/28/32/42 GHz area-licensed bands, as well as in the 60GHz unlicensed band.

Both PtP and PtMP technologies share the advantage of using either relatively low-cost area-licensed or unlicensed spectrum, which expedites dense link planning while minimising licensing-related delays and costs. Large channel sizes allow for high capacity while high-frequency operation helps to reduce equipment sizes.

Deploying small cell backhaul on area-licensed frequencies takes advantage of both the operator’s investment and the extra assurance that licensed spectrum provides against interference. Area-licensed spectrum, as opposed to per-link licensed spectrum, allows the use of PtMP systems and doesn’t require a separate licensing procedure for planning and installing each link – which is a significant benefit if multiple links need to be deployed within a short time.

PtMP technology improves equipment CapEx and implementation time by reducing the number of deployed units. Spectrum for the bandwidth-rich, area-licensed 26/28/32/42 GHz bands usually comes at a reasonable price - especially considering the dense link deployment intended for small-cell backhaul.

Interference may occur depending on the amount of PtMP spectrum owned and the density of the installed links. This can lower the SINR and force the links to operate at lower capacities than would otherwise be possible. Wireless systems operating at 60GHz can be used to alleviate this difficulty. V-Band (60GHz) technology offers licence-free operation combined with high capacity across many global markets. For backhauling 4G small cells – a cost-sensitive but demanding application – these are considerable advantages, so this alternative solution is gaining significant interest from the mobile operator community.

Unlicensed operation at 60GHz has far smaller potential for interference from closely located links than unlicensed 5GHz systems, regardless of whether the links are owned by the same operator or not. This is due to the characteristics of radiation propagation at 60GHz - attenuation, narrow antenna beamwidths, small reflections – coupled with street-level interference. Fortunately, the multiple channels available in the 60GHz band can be used judiciously to minimise interference even in dense link deployment scenarios.
Microwave and 60GHz spectrum technologies can be combined to optimise the capacity of a small-cell backhaul network while maintaining its robustness.

Combining area-licensed microwave spectrum and 60GHz spectrum can minimise interference and allow for higher capacity/density than would be possible using a single spectrum band. Using licensed microwave spectrum offers increased assurance against interference, while also offering higher tolerance to potential partial obstructions, for example a row of lamp posts, to the link LOS.

StreetNode™, a software-defined radio platform, which was designed and developed by Intracom Telecom is an example of the latest innovative PtP / PtMP systems. StreetNode specifically addresses the challenges of small-cell backhaul, enabling operators to deploy backhaul networks of any complex configuration in the 26 / 28 / 32 / 42 GHz and 60 GHz bands and realizing the benefits of increased network capacity and robustness under a single management system.

Konstantinos Dimopoulos
Senior Product Manager for the mmWave products of Intracom Telecom

Konstantinos Dimopoulos has been promoting and marketing MW and mmWave products for Intracom Telecom for the past 10 years. Before that he worked on the development of transoceanic submarine fibre cable systems for Alcatel Submarine Networks. He holds a BSc degree in Physics from the University of Athens, Greece and the MSc and PhD degrees in Electronic Engineering from the University of Essex, U.K.
Ian Keene of Gartner Research believes that operators need to change their mindset in order to take advantage of small cells, and that regulators have an important role to play in making this happen. Interviewed by James Barton of Developing Telecoms he makes the case for small cells and explores some of the issues that are holding back deployment in emerging markets.

The interview starts with him making the case for small cells in backhaul.

**DT:** How far would you agree that the key applications of small cells in emerging markets would be rural backhaul and densification of urban networks?

You’ve got to have backhaul links there – you either need a fixed line or a short distance to one so that you can use a low-cost wireless link. Microwave backhaul can be four or five times more expensive than a small cell. You also have to look at location, and you tend to see more success in areas where local communities buy in to the initiative in the same way that they would buy into having Wi-Fi – they can see the benefit to it.

However, in emerging markets the business case can fall apart – as it often does for macro sites – when costs start to escalate. Small cells can be low-cost but you need three things: backhaul from the rural location; the ability to site the cell somewhere without reams of legal documents; and access to power. These factors can limit small cell deployments, making it similar to community Wi-Fi – but there are several success stories for Wi-Fi in emerging markets and I think that small cells could follow suit.
Wi-Fi spread as a solution in several Asian markets because there were DSL backhaul lines available, but it is a bit of a mess – it’s unlicensed so anyone can use it, but there’s a lot of interference and it’s not easy to use, as well as offering unreliable performance.

Small cells are a way of providing more reliable performance at a lower cost than macro cell coverage. Particularly in developing markets, it’s challenging to locate a macro cell in a remote area like a field then construct a tower. Power supply, backhaul and operations and maintenance costs can all be very high.

If a cell site isn’t in a densely populated area then the percentage of utilisation is low, and most operators will be deterred from investment if they don’t think it will see enough usage. This is a problem globally, and it’s interesting to see how operators react when regulators threaten to force them into RAN sharing agreements to provide better rural coverage – under these circumstances, they usually leap at the chance to deploy their own small cells in specific locations.

DT: With that in mind, do small cells represent a viable long term solution for rural coverage or are they more of a stop-gap deployed out of desperation?

I don’t see them as a stop-gap, it can definitely make good business sense – you just need to convince the operators of this first. Generally the network planners and CTOs of major operators hate small cells; they see them as a necessary evil in the future but want to delay their deployment for as long as possible. We need to see more use cases of mobile operators installing small cells in rural environments in emerging markets – they’ll be able to demonstrate that it makes good business sense. After all, in these environments network planning is pretty easy – you don’t have to worry about interference because there’s nothing to interfere with!

Operators need to adjust their mindset, and regulators can play a role. In the UK, Ofcom attempted to force RAN sharing – which operators hate – unless they explored other avenues. This incentivises operators to expand their forays into small cell deployments, and if they make profitable revenue from just 100 or 200 communities then you can expect the technology to gain traction. In a remote area, a low-cost small cell that supports a low number of users – 30 to 60, for example – will see much higher utilisation than a macro cell which supports 300-400 users. Even if the macro cell serves a much larger area, the fact that it can only be used a small number of communities means that the investment is not worthwhile.

DT: In cases such as these, it’s clear that small cells make better business sense – so why do operators have such a hostile attitude towards implementing them?

Mobile operators have spent a long time doing business in a certain way – they install macro cells and towers, and therefore have to deal with a relatively low number of cell sites. If they start install small cells, that essentially increases their number of active cell sites tenfold, and their organisations can’t manage that.

Technologies that necessitate changes in management are often met with resistance – software-defined networking is a prime example. The biggest obstacle for deploying this tech – which allows for much faster deployment of services and far lower costs, at least theoretically – is the reluctance to change the organisation. Operators are often unable to hire additional IT engineers and programmers due to shareholder concerns, but similarly can’t replace existing staff due to unions. Retraining is expensive and takes a long time, so there is resistance to overhauling existing technology.

We’ll get there; we’ll see more and more use cases. In countries like India where the frequency band is very small, it means you can’t offer broadband over a macro site network, so reducing the size of the cells allows operators to offer better services – even if it’s just in city centres for the time being. Small cells make better ‘re-use’ of the frequencies available, and with the work of the regulator and the community they can be much lower cost by bringing the services to where people need them most, as opposed to delivering blanket coverage across empty fields or deserts.
Of course, there are currently issues preventing small cell deployment – operators are often obliged to pay hefty fees and go through a lot of procedures before receiving permission to install a small cell in a certain location, and on top of this they’ll often have to provide their own power supply. In this way it doesn’t work, and it needs to emulate the model of rural Wi-Fi which is very low-cost and can deliver immediate benefits to a community.

Most devices have Wi-Fi capability as it doesn’t cost much to make a device compatible. However, not as many devices have 3G, let alone 4G capability – it’s going to take a while for these technologies to be widely available at an affordable price in emerging markets, which may slow down small cell deployments.

DT: Does this suggest that we won’t see widespread adoption of small cells for some time, or is it likely that operators in emerging markets are exploring how to use small cells to solve issues endemic to their regions?

It comes down to the country regulators – if they demand that operators provide even just 2G cellular coverage, particularly if it must reach a certain percentage of a population that’s not concentrated in obvious population centres, that’s when operators will start to look at small cells. If the regulators do nothing and allow operators to continue business as usual, it will be a very slow process.

Backhaul can of course be limiting – if you have to go over long distances then backhaul can really restrict small cell deployments due to the cost. Usage parameters may also be different in emerging markets. In mature markets, up to 90% of communications volume takes place indoors; it therefore makes sense to put your small cell indoors, which makes it more secure.

In emerging markets it may well be that small cells need to be located outdoors, which can create problems. Remote macro cells require a diesel generator to ensure reliability, and people will target this – generator theft is a significant problem. One way around this issue is to employ guards, but this drives up costs.

Author Biography

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Ian Keene is a Vice President in Gartner Research, where his research is focused on telecommunications and networks. His recent work includes research on small cells, Wi-Fi hot spots, and associated network analytics, broadband access and enterprise fiber networks.

Mr. Keene is responsible for worldwide research on broadband access carrier network infrastructure within the Communications team of Gartner Technology & Service Provider Research. Research areas: Wi-Fi hot spots, public WLAN, passive optical LAN, fiber LAN, small cells, broadband access, FTH, VDSL, G.fast, CCAP, CMTS, cable operators, optical fiber, IoT communication networks, Internet of Things communication networks, LPWA and broadband technologies.

Ian Keene has extensive experience in communications and the silicon industry, where he worked in marketing and engineering roles. His experience encompasses networking and telecommunications products, system solutions, and consultancy. He was Research Manager at BICC for 10 years and in addition has had spells at Ericsson and LSI Logic. He holds an Honors Degree in Physics from University College of Wales.
Small Cells - A Long Term Strategy to Address the Exponential Growth of Wireless Data in Latin America

By Ivan Maldonado, Telecommunications Analyst, IDC

Small cells are being promoted by mobile network operators and network equipment providers as a CAPEX- and OPEX-efficient way to deal with the explosive demand for mobile data bandwidth, with Brazil and Mexico leading the way for investment in the technology. They are particularly effective at relieving congested metropolitan areas - where 85% of Latin America’s population is concentrated. In these locations small cells are most effectively deployed in highly frequented areas such as malls, plazas, public parks, tourist centres and airports.

There are a number of factors to be taken into account when considering the potential for small cell deployments.

Consumer LTE Smartphone Demand

It is crucial to consider the consumer demand – and therefore exponential growth - of smartphones with LTE technology. While in 2014 these represented just 10% of total smartphone shipments, the key finding is that LTE devices have become increasingly affordable to the consumer, with an average price of US$562 in 2014. Shipments grew 95% year-on-year during this period in Latin America.
Growth of Mobile Data

It is relevant for telcos examine ways of increasing their revenues from the mobile data segment, which grew by 13% year-on-year during 2014 in constant dollars. Wireless voice fell for the second consecutive year during the same period.

Another megatrend impacting the deployment of small cells in the medium term will be IoT & M2M, because of small cells’ ability to manage interference dynamically across an adjacent cluster working in a range of typically 10–200m and power levels 4W.

Spectrum Availability & Allocation

LTE services cannot be effectively delivered without available spectrum, so it becomes an issue of competition and penetration to reallocate blocks of spectrum in the AWS (Advanced Wireless Services) bands, driving efficiency and economies of scale.

Moreover, spectrum allocations in the region are a key factor affecting data transmission and future small cell deployments. The first allocations were made over the AWS in the 1700-2100MHz bands and frequencies beginning 2500-2690MHz by a number of countries – among them Argentina, Bolivia, Chile, Colombia, Ecuador, Jamaica, Panama, Peru and Venezuela. Additionally, Mexico allocated AWS spectrum between the 1755 to 1770 MHz and 2155 to 2170MHz frequencies, and Brazil between the 1700-2100MHz, 2500-2690 MHz and 3550 to 3700 MHz bands.

Several Latin American countries – including Brazil, Chile and Mexico – released spectrum in the 700MHz band through the transition from analogue to digital television. Spectrum provision is vital to accelerate coverage and encourage investment, as well as providing more services over the network.

LTE deployments are progressing in Latin America. As of November 2013, there were already 25 4G LTE networks in commercial operation across 12 countries in the region, serving around 1.9 million users. Thus IDC is forecasting that by 2018 there will be 49,000 LTE subscribers. Currently, IDC has identified 52 LTE networks operating in the region with 14.3 million subscribers.

The opportunity for explosive growth exists in the small cells market, with growth of up to 200% possible by 2016, reaching 2.317 million sites. This is reliant on the spectrum allocation in countries like Mexico and Brazil; the regulators in these countries will be tendering new blocks of AWS spectrum throughout the first quarter of 2016, encouraged by newly favourable regulatory framework. Growth in Brazil will be driven by the Olympics.
For a long time, small cells have been the inactive player but they are now poised to take centre stage. Operators are looking to different ways of delivering their promises of faster, more reliable networks with the highest quality of experience and superior voice quality via VoLTE. The fall in revenue from traditional services such as wireless voice has resulted in operators looking to capitalize on opportunities in the mobile data market, which is growing at a CAGR of 9% between 2013 and 2018.

Wireless carriers evaluating small cell technologies face a multitude of options. IDC expects that telcos will employ many techniques to further optimize their network and capacity, such as carrier aggregation and SON.

Telcos must make a conscious decision whether to rip and replace network infrastructure versus implementing overlay architecture. Single vendor solutions are virtually nonexistent and there is a clear trend towards heterogeneous networks (HetNets) which may include such diverse elements as WiFi Offload, hotspot 2.0, IEEE 802.11u, femtocells, picocells, micro / metro cells and macrocells.

Ivan Maldonado
Telecommunications Analyst, IDC, Mexico

Ivan Maldonado is involved in research and consulting projects related to business intelligence for ICT at IDC. In addition to conducting in-depth interviews with CXOs his tasks include sizing the telecom hardware market quarterly, forecasting, prediction and benchmarking.

Ivan has a strong background with government agencies, having worked as a research analyst in ProMexico, Mexico’s strategic business agency which promotes foreign direct investment (FDI) and the export of goods and services. While at ProMexico his responsibilities included evaluating Mexico’s competitiveness in attracting FDI also providing detailed analysis on Mexico's cash flows as compared to other BRIC countries. He was also involved in forecasting the future of automotive production, a key industry for Mexico.

Ivan Maldonado has Bachelor Degree in International Relations from the Instituto Tecnologico de Estudios Superiores de Monterrey (ITESM).
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