Game changing economics for Small Cell Deployment

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Mobile data traffic growth drives the case for small cell deployment

It’s self evident that the dramatic growth in mobile data traffic shows no signs of abating – the plethora of tablets, smartphones and other wireless devices supporting a huge range of applications continues to place increasing demands on mobile networks worldwide. Average global mobile data traffic is expected to grow by 13x between 2012 and 20171. Much of this traffic is concentrated in urban areas.

While LTE goes some way to satisfying demand, it will be spatial frequency reuse through many more smaller cells which will deliver the highest capacity of anything up to 50x today’s capacity or more overall2.

This paper focuses on metrocells which will be directly planned and commissioned by service providers or 3rd parties, predominantly in urban high density hotspots such as city centers, airports and shopping malls. While the equipment cost of small cells is much lower than large macrocell towers, the business case for successful large scale deployment of small cells relies on the reduced total cost of deployment and operation, which includes planning, installation and on-going maintenance.

Given this and the sheer complexity of deployment options, there is a clear need for new, game changing economic models for small cell deployment.

Current situation vs. need

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<tr>
<th>Current Situation</th>
<th>Drives</th>
<th>Need</th>
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<tr>
<td>Growth in demand</td>
<td>Locate small cell sites</td>
<td>Hotspot identification combining radio planning with commercial data</td>
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<td>High rollout costs</td>
<td>Cost reduction</td>
<td>Reduce deployment cost and skill levels through advanced process management</td>
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<tr>
<td>Backhaul complexity</td>
<td>Need to simplify</td>
<td>Automated high level feasibility and rollout processes</td>
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<td>(many options)</td>
<td>High volume scalability</td>
<td>Reduce installation time with guided field force tools</td>
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<tr>
<td>Large numbers of small cells</td>
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A difference in terminology

The term small cell has been interpreted differently throughout the industry and can include a number of different types of small cellular radio equipment within the HetNet. Small cells can include DAS (Distributed Antenna Systems), RRU (Radio Remote Unit), Pico, Nano, Femto (typically very small residential units) and metrocells. In this paper, we refer to metrocells as public access small cells of less than 5 Watts RF power, installed either outdoors on street furniture or indoors inside shopping malls, stadiums, transport hubs and the like.

The HetNet (Heterogeneous Network)

Metrocells and RRUs are individually planned to target capacity hotspots and coverage not-spots. Each site has to be carefully assessed to ensure worthwhile return on investment – the short range and coverage area increase the importance of the precise location.

Historically network rollout projects are pre-planned manually for each type of project. The sheer variety and volume of small cell network project types leads to the need for a more dynamic and automated, catalog driven project management approach.

It is forecast that the number of metrocells alone will exceed the total installed base of cellsites worldwide by 2017, causing disruptive changes in the speed and efficiency required to install them. Service providers will need to respond quickly to remain competitive.
Site Selection – Identifying small cell locations that will make a difference

Using analytics tools to pinpoint experience hotspots
With small cell coverage footprints of 100m or less, targeting each location accurately makes the difference between a new installation delivering a good ROI (Return on Investment) or being a low value distraction. Network planners need sophisticated geo-location based analytics tools to pinpoint the source of traffic hotspots from network data analysis. Accuracy can be further refined using geo-located services such as Twitter and/or correlation with visible Wi-Fi networks. Reports can be generated based on time of day, device type, service type, value and many other factors.

With changing usage patterns, device types and innovative new services, the future is hard to predict. A comprehensive, accurate and detailed insight into current network usage is an essential capability to identify critical hotspots and changing network usage patterns.

Determining where and when to deploy new small cells
Optimization of the existing radio access network should be carried out first before planning the deployment of additional small cells to ensure maximum efficiency. The choice of where and when to deploy each new small cell is currently not straightforward. Three methods of assessing the economic benefit of a new small cell are:

- **Traffic volume handled in Gbytes per day.** Where heavy users are in close proximity to the small cell, the full benefit of higher modulation schemes can deliver peak data rates. Forecasting achievable data rates from the RF conditions increases not just traffic capacity but end user satisfaction from the higher speeds.

- **Traffic resources released from the macrocell.** Disproportionate RF capacity is needed to deliver data at the cell edge, penetrating in-building or around street furniture. The cost of a Gbyte of data at the cell edge can be far higher where advanced higher order modulation techniques can’t be used. Proper analysis can justify a better ROI for small cells with lower total traffic throughput than others, when considered in this wider HetNet context.

- **Value of traffic handled.** Where it is possible to associate the end user value for the data used, a closer link to the true ROI can be achieved. Aspects can include assessing the types of service being used (roamers vs business email vs recreational video) and/or relating to the customer ARPU.

Not all small cells are deployed purely for capacity reasons. A stronger focus on the end-user experience, particularly for higher value customers, is replacing the KPIs (Key Performance Indicators) with QPIs (Quality Performance Indicators). This leads to improvements in coverage, especially at the cell edge, and real-world throughput, especially where capacity constrained.

### Congestion and experience are location dependant

<table>
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<th>5% of locations carry 50% of traffic</th>
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<td><img src="image" alt="Traffic Distribution" /></td>
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<th>15% of locations are responsible for 85% of problems</th>
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Backhaul takes a front seat – while complexity increases

Backhaul – the transmission that connects cellsites into a service provider’s core network – typically makes up around 30% of the total CapEx cost of a macrocell RAN (Radio Access Network). Some analysts forecast that this could grow to as much as 50% for street level metrocell deployments. Metrocells typically have their own dedicated backhaul with agreed QoS related SLA objectives. A wide variety of new and existing wireless backhaul vendors and technologies are competing for this purpose, increasing the complexity and sheer choice of options.

The technical winner in an ideal environment would be fiber connections, which can far exceed technical requirements on both counts. However, in many cases this simply isn’t practical because of the cost, timescale or planning restrictions to run the fiber to each site. There is a complex trade-off between higher equipment costs of wireless links against higher running costs for leased fiber. Recent reports from NGMN® (Next Generation Mobile Network) and Small Cell Forum® both propose a toolkit approach, whereby a mix of different technologies is used to address a range of scenarios.

Wireless backhaul technology examples:

- Non-Line-of-Sight (NLoS) is most relevant to connect small cells which are hidden or located without a clear line-of-sight view to a nearby hub. The limited availability and high cost of the low frequency spectrum required for such links (below 6GHz) reduces the capacity – both in terms of individual link speed and geographic area capacity.

- Microwave Point-to-Multipoint (P-MP) is attractive because fewer physical units are required – only one at the central hub rather than two for each link. The total capacity can be shared across multiple small cells in each coverage area, responding to peak demand by individual cells.

- Millimeter wave at 60GHz has previously been avoided because of the relatively short range (500m to 1km) of the technology. Fitting the profile of Metrocell backhaul, this becomes a benefit, allowing high frequency reuse and thus very high total area capacity.

- Other technologies including free space optical and Wi-Fi have also been marketed for small cell backhaul.

With many other backhaul technology choices such as DSL and fiber, time and costs can vary dramatically across the various options. Digging up streets to pull fiber can be a very labour intensive and costly activity requiring planning consent and access rights. There is a clear need to simplify and automate the backhaul feasibility and selection process in order to reduce costs and speed up small cell rollout. Automated project planning tools with guided user behaviour can facilitate this process with significant time and cost savings.
Equipment cost is only part of the picture

The chart below indicates the metrocell rollout cost distribution for a typical urban metrocell deployment in 2015. These figures will vary from region to region and country to country.

Metrocell Rollout and Operations Cost Forecast 2015

The chart gives an indication of the relative proportions of the different elements involved and the cost impact across small cell hardware, planning and installation, backhaul and site leasing costs, which are of about equal weight. Other operational costs not shown involve proactive remote monitoring and possible site visits for upgrades and maintenance.

In the next few years, the cost of small cells and wireless backhaul will drop significantly, while operational processes, workforce skillsets and zoning restrictions will be optimized with the help of automated planning and process management tools from vendors like Amdocs.

Each factor in the installation process needs to be optimized and operate on a right first time basis. There are many factors which determine the best location, including RF coverage, capacity demand, site availability and physical impact. Trade-offs have to be made between these factors and this is where planning automation can help.

The consequences of poor planning can be severe. In a situation where the network planning or site survey was invalid prior to the installation, an entire area of small cells may need to be repositioned, redeployed and/or equipment replaced which can lead to huge unnecessary costs. Alternatively, poor performance may lead to a low return on investment because the equipment isn’t carrying the level of traffic intended. Automated, catalog driven project management tools help to avoid this situation from happening by guiding and optimizing the selection process.

Another key area where process management is important is the control of third party orders where threats to time, cost and quality (TCQ) are defined by SLAs between the service provider and network equipment providers or other licensed operators who may be contracted to supply the network.

Clear information about the network, equipment configuration and project status need to be recorded, communicated and tracked throughout the project to ensure ‘right first time’ deployment. At the same time, third-party SLA objectives and governance procedures need to be implemented and monitored for efficient execution and problem management.
Amdocs’ ‘five key elements’ for successful small cell deployment

Experience hotspot identification
Accurate identification and location of high value user experience hot spots is key to ensuring ‘right first time’ deployment of small cells. This important step must be included in the end-to-end process and may use a combination of radio planning and commercial data (such as usage statistics, business value, user behaviour and profiles).

Automated high level design feasibility
Selecting the optimum backhaul option for each small cell is crucial in meeting deployment cost/time criteria. This stage of the process needs to be automated and assisted to rapidly achieve the most efficient design while staying within budget. Automated process tools can advise the user on the best backhaul option to choose.

Catalog driven rollout process
With so many repetitive tasks required to deploy small cells, Amdocs employs a catalog driven rollout process where a particular small cell backhaul network can be designed once and deployed many times using an industrialized ‘cookie cutter’ approach, similar to that found in a factory production line.

Dynamic project and process management
Large scale deployment of small cells requires stringent project management across multiple projects involving hundreds of people. This complex scenario requires highly flexible project management methodology which can quickly adapt to changing requirements while continuously monitoring complete end-to-end process flows. The Amdocs approach allows for automated project plan generation and dynamic change management based on unforeseen project exceptions, rollback or deviations.

Guided task management for field operations
Guided task management software applications supported on portable devices ensure field workers have all the right information at their fingertips along with their daily task list. These remote task management clients are connected to a central workforce management system and allow field workers to deploy small cells more rapidly and cost effectively, without the need for highly specialised skills.

Conclusion
With mobile data traffic continuing to grow exponentially, service providers worldwide need to increase network capacity and performance to remain competitive. The introduction of large numbers of public access small cells will be an essential strategy to achieve this. Analysts forecast there will be more public access small cells by 2017 than all of today’s base stations worldwide.

The practical implications of such widespread and rapid change in network construction impact the processes and tools which service providers use. With up to 10 times the number of small cells serving dense urban areas covered by a single base station today, the rate of small cell rollout will need to be anything up to 50 times faster than new macrocell deployments.

New deployment practices will need to speed up, de-skill and up-scale compared to today. New software tools have an important role to play in achieving that. The benefits are not just to be found in direct savings from planning staff costs alone, but the long term rewards of designing and building a network fit for purpose by making the right choices, first time, every time.

Who to contact
For more information about the Amdocs small cell solution, please contact Amdocs OSS Division at: AmdocsOSS@amdocs.com

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1. Cisco VNI Forecast
2. 3GPP Workshop on Future Radio, June 2012
3. Planning for Small Cells, Mentum
4. Femtocell Analyst Forecast Shootout, ThinkSmallCell
5. Small Cell Backhaul Vendor Landscape for Metrocells
6. Crucial Economics for Mobile Data Backhaul, Senza-Fili Consulting
7. NGMN Backhaul Requirements For Small Cells
8. Backhaul Technologies for Small Cells, Small Cell Forum
About Amdocs

For more than 30 years, Amdocs has ensured service providers’ success and embraced their biggest challenges. To win in the connected world, service providers rely on Amdocs to simplify the customer experience, harness the data explosion, stay ahead with new services and improve operational efficiency. The global company uniquely combines a market-leading BSS, OSS and network control product portfolio with value-driven professional services and managed services operations. With revenue of $3.2 billion in fiscal 2012, Amdocs and its 20,000 employees serve customers in more than 60 countries. Amdocs: Embrace Challenge, Experience Success. For more information, visit Amdocs at www.amdocs.com.

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