On the Cusp of a Small Cell New Order

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One reason for deploying small cells that does not get the same attention as the exploding demand for data service is the diminishing improvements in the spectral efficiency of wireless networks with every successive generation. LTE will only provide about twice the spectral efficiency of 3G networks. While this is significant, it is not thought to be sufficient to meet the exploding demand for mobile data. Small cells, defined for the purpose of this article as carrier-deployed outdoor base stations, are thought to be the answer. Deploying small cells allows greater reuse of frequency spectrum because the interference profile of small cells is much lower than that for macro cells. This is called densification of the network where a layer of small cells with coverage area as small as 10 meters are used to inject capacity in areas of high subscriber density and consequently mobile data traffic. Small cells targeted at capacity performance usher the heterogeneous network (hetnet) architecture for wireless networks which is an evolution from a homogenous network based primarily on large macro cells.

Densification of the network is highly anticipated but has been delayed. Outdoor small cells remain an object of great debate with operators actively engaged in field trials. But how do we map the current state into the deployment cycle of a new technology? What do operators see as the challenges holding up small cell deployments? What are their key requirements for small cell deployments? Will they deploy small cells in the same spectrum as macro cells? What type of small cells will be deployed and how do the different backhaul solutions stack up?

A new market research, Small Cells New Order: A Global Status Report, by ExelixisNet and Xona Partners answers these questions based on perspective of leading operators who answered probing questions on their plans for small cell deployments. We are certainly on the cusp of a new order in network architecture – operators are bullish on small cells and the vast majority of those surveyed say 2014 is the year of small-cell deployments. However, small cells are an element of a larger evolution in the wireless network from a homogeneous to a heterogeneous architecture. Seen from a perspective of an evolutionary process as opposed to revolutionary event, fixing a date on small cell deployment timelines becomes a futile activity.

The evolution of the wireless network to a heterogeneous architecture where small cells are a key element is underpinned by a number of developments of which I will mention 4 here in brief:

1. Development and implementation of self-organizing network (SON) technologies. SON is designed to reduce network operation complexity and cost. It is a key technology for network densification. Uptake in small cells and the scale of their deployment is contingent on maturity of SON technologies. The adoption is taking a gradual approach

with initial focus on configuration and provisioning followed by other, more advanced features such as automatic neighbor relation and load balancing.

2. Implementation of interference management techniques to maximize the performance of hetnets. This will take full form in LTE-Advanced (3GPP Release 10 and later) and will factor to a large extent in the scale and adoption of small cell technologies. Most operators do not intend to deploy 3G small cells, opting for multimode LTE small cells.

3. The backhaul industry is making large strides to meet operator requirements and innovative solutions are emerging for small cell backhaul. Yet, this issue remains a challenge that has to be resolved if hetnets are to take full form. The backhaul challenge is fundamentally one of cost. The consensus that a toolkit of backhaul solutions is required is in itself an impediment to small cell deployments because it makes it harder to develop an efficient and fast 'cookie-cutter' installation process. Our study shows that operators are keeping an open mind in looking for a solution. For example, we found that operators' interest in sub 6 GHz unlicensed preceded that of all other wireless backhaul solutions.

4. The deployment of small cells coincides with a process of growing intelligence in the radio access network. An intelligent network is self-aware network: it knows the type of traffic it carries on a user and application basis, and the state and parameters of its nodes as necessary to optimize performance while maintaining fairness between users and applications. LTE enables the intelligent network based on its end-to-end flat-IP architecture, but we are at a relatively early stage in implementing the intelligent network and are set to see greater integration of algorithmic solutions that will provide operators more tools to control traffic including determining what is carried by the a macro cell and small cell layers.

The above are but a few of key evolving developments that will factor critically in the deployment of outdoor small cells. Ultimately, the underlying factor of cost needs to be addressed: our study shows that operators consider it as the number 1 impediment to small-cell deployments and most are busily working out their cost targets and requirements. This in combination with the developments above strongly support the thesis that we are at the cusp of a small cell new order, but one that is characterized as an evolutionary process to a heterogeneous architecture underpinned by a number of key enablers.

More Resources
Press Release: Small Cells New Order - Operators Reveal LTE Small Cell Deployment Plans and Innovations
Brochure: Small Cells New Order (Available for Download)