Small Cells as a Service – rethinking the mobile operator business

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1 Executive summary

Mobile operators (MNOs) face a huge challenge in meeting the data explosion. Small cells are an obvious option to meet such a capacity issue, but it comes with substantial challenges to overcome site provisioning, backhaul and radio interference issues.

This paper presents an alternative approach where independent companies can be stimulated to contribute to the infrastructure deployment through a more organic way thereby assisting in meeting the capacity demand.

Small Cell-as-a-Service has been presented by other papers previously but this idea needs a feasible way of integrating the operations environments of both the MNO and the provider overcoming the network sharing governance challenges seen by traditional RAN sharing schemes.

2 Motivation

It is well known that mobile data is expected to grow rapidly in the coming years. Cisco VNI predicts 13 times more mobile traffic by 2017 (compared to 2012). Other sources present similar expectations.

This scenario impose a great challenge to operators as they face either lack of capacity, or their CAPEX/OPEX goes through the roof as traditional macro base-station networks cannot deal with the capacity and investments in additional base stations tend to be costly. The lack of spectrum also makes it difficult to increase network capacity without adding new sites.

Network analytics show that the majority of mobile data usage - close to 80 percent[1] - is indoor and nomadic, rather than truly mobile. These users are either consumers in residential areas, or more importantly enterprise users at their daily jobs. Achieving necessary indoor capacity is an extra burden to the existing macro network and

[1] Source: Cisco

operators face an obvious competition from enterprise WiFi installations which gives very high bandwidth at very low cost.

So how can operators deal with this situation? What value can they bring to indoor users? How to achieve the needed indoor capacity?

3 Operator situation and challenges

This paper deals with different aspects on how operators can deal with deployment of Small Cells, whilst preserving a value for its customers.

The term small cell is used to denote a number of different concepts. In this paper we mean a base station using licensed based radio access, which includes:

1. Femto cells deployed in residential or enterprise
2. Pico cells in indoor public areas
3. Microcells in urban areas to improve capacity or in rural areas to provide coverage
4. Metrocell deployed in urban areas to remove capacity problems

The need for such Small cells have been projected for many years, whilst at the same time identifying all the cost related challenges that comes with such scenarios. An operator and licensed network has naturally always been centrally planned and centrally operated thereby controlling the performance, interference but also restricting the possible capacity growth that would be enabled by a more organic network deployment.

We could easily compare with the way other types of networks are provided, including fixed broadband and WiFi infrastructure, which utilize a more organic growth.

Over the last 6-8 years there has been trials going on with so called Femto base stations, mostly addressing the residential consumer market. Initially this was restricted by lack of means to handle the radio interference, but through the latest 3GPP releases mechanisms have been included in standards that help managing the spectrum as well as integrating the control functionalities.

As of late 2012, there are quite many operators that have a Femto offering in their portfolio with substantial numbers being deployed headed by Sprint in the US claiming to have more than on e million Femtos in operation. These are mainly in residential deployments and the business models vary, with some operators to offer Femto for free (e.g. Softbank, Japan), whilst other have a monthly fee of 5-10 USD (Sprint, US). We can

compare with Cable TV companies that often offer the Set-top box for free just to enable the service delivery. [2]

Informa Telecoms & Media expects the small cell market to grow significantly from less than 10 million units in 2012 to over 90 million units by 2016. Other analysts predict similar figures. The absolute majority of such base stations will be Femtos according to Informa.

It seems quite clear that a residential Femto solution is feasible, although requiring an attractive commercial package. But that solves mostly the indoor coverage problem in residential areas.

Cisco predicts that around 50% of all Internet data traffic will go over WiFi by 2016, whilst roughly 40% will go over wired and 10% will be mobile (cellular) – although mobile will grow most quickly. As WiFi is very suitable for indoor usage the operator could identify services to help enterprises deploy WiFi solutions. This is out of scope for this document, although having a lot of growth potential.

Alternatively the operator could deploy licensed small cells to address the 10% mobile data demand. Such small cells could be deployed by the operator (indoor or outdoor) or by some other party (indoor or outdoor). This paper deals with how the operator can stimulate small cell deployments in city areas with few residential users.

4 Small Cells or Small Cells-as-a-Service?

The key problems for the operator when deploying small cells is the following:

1. Site provisioning is an increasing problem. Negotiations with land-lords and protests from environmental organizations are examples on problems arising. Making sure the needed power supply exist is other.

2. Backhaul. If a site can be found it most certainly does not have the appropriate backhaul available.

3. Radio performance control. Thirdly, the radio interference issues can be quite difficult to overcome

It is from this background questionable if the operator should deploy Small Cells the same way as macro BTSs are deployed (i.e. planning, site acquisition, cell planning, civil works etc). It will be quite difficult to get such Small Cells profitable, especially as the traffic load of such a Small cell would vary a lot over time of day and the total amount of traffic can at times be quite low.

[2] Source: Informa, Small Cell Market Status

Therefore, alternative ways of deploying such small cell BTSs needs to be investigated. In this paper we call that Small Cells-as-a-Service. I.e. it describes the potential business model of providing Small cell capacity to MNOs as a Service.

4.1 The potential Small Cell-as-a-Service provider

Such an alternative approach should start by identifying actors that through their normal business have a better position in solving the site provisioning or backhaul problem.

Real estate companies have natural assets in providing sites. Electrical power distribution companies naturally have a very fine granular network and channelization that can be utilized for backhaul. Cable companies have a high performance backhaul network. In some countries there are public companies that sit on huge fiber assets that could be expanded into wireless, but for regulatory reasons this would not be allowed unless competition neutrality is applied.

Small Cell-as-a-Service becomes even more interesting for those companies that would anyhow consider investing in wireless coverage and capacity for their internal daily business. In those scenarios the business case of the company would be impacted in case there were possibilities to also offer the infrastructure as a Service to MNOs.

What is common to these companies is that whatever assets they have; it is not full nationwide coverage. This means they cannot naturally become a MNO. On the other hand, those actors can more easily than the operator install and maintain a Small Cell infrastructure.

4.2 Infrastructure sharing concepts

The idea of infrastructure sharing has been around for a long time. 3GPP has included a long range of functionalities to support the idea of that several MNOs share their infrastructure. Such sharing has an obvious advantage, especially in cutting costs for rural coverage. Savings in the range of 20-40% can be foreseen[3]. The main obstacle is related to governance, competition regulation and other non-technical issues. These problems are natural as the concepts of RAN sharing involve actors that naturally compete.

This paper deals with utilizing similar thought, but applying it to a situation where the involved parties do not naturally compete.

We can identify two main conceptual alternatives:

[3] Arthur D. Little: The new reality of Network cooperation

Firstly site sharing, which may or may not include backhaul sharing. In this scenario the provider would install a specific base station for each MNO tenant which lowers the potential gain significantly.

Secondly[4], we could think of MORAN (Multi-Operator Radio Access Network) where the active parts of the network is also shared, but the radio cells and their corresponding spectrum is owned and controlled by the MNO tenant. This is more challenging, but provides more value.

The remaining of this paper focuses on some key conceptual elements needed to enable a MORAN based Small Cell-as-a-Service concept.

5 Small Cell-as-a-Service concept

This section elaborates on some key challenges in providing such a concept.

5.1 Business incentives for organic growth

Learning from the early Femto experiments, it is clear there needs to be a good business incentive to stimulate a Small Cell-as-a-Service market to emerge. Some companies (like cable companies) have less of a step to take to enter into such provisioning business. A more dynamic market would emerge if there would be a possibility to sell over-capacity of your own network that enterprises invest in anyhow.

The land-lord that wants to provide wireless access to its customers can also provide over-capacity as a service to MNOs. Hotels that have wireless access could also provide such capacity as a service to MNOs.

This essentially means that the provider could install the infrastructure, selling that capacity as a service to all MNOs which in turn provide their regular service to the end-users (of which some might belong to the provider company). Such a scenario should bring the benefit of lowering the total costs for wireless usage for the provider company; whilst at the same time improve indoor coverage and capacity for the MNOs.

The key questions in the above scenario are:

- Why not choose WiFi instead? The infrastructure cost for a WiFi device is not much lower than that of a Femto, so the cost is not inherent in the technology. If concepts could be established that enables capacity provisioning to MNOs, the

[4] It would be possible to also consider MOCN or Roaming as alternatives, but those were discarded as they require the provider to have its own spectrum, thus turning the provider into an MNO with all the related work processes needed.

larger coverage attributes of LTE would be beneficial [5]. But it requires a clear business package and a easy management.

- Could this concept be offered from the MNOs? Similar as with Femtos the packaged concept might be offered to the intended provider through the operator. This turns the relation into more of a partnership, and would raise the question of why should the MNO allow multi-tenancy. Only reason would be that this helps the business case as costs become even lower
- Should such a concept be offered from Infrastructure vendors? New entrants in the wireless infrastructure market could decide to create a pre-packaged concept by which enterprise could establish an infrastructure and start to offer capacity to MNOs

5.2 MNO cell planning and OSS integration

The technical concept used would be based on MORAN, but that concept has some challenges. Most significantly would be how the MNO would manage the Cells deployed on the provider's infrastructure.

The key enabler would be to establish a Cloud-like approach. Installed Small Cells might connect to one central operations centre from where their services are enabled and offered. MNOs might connect to such service centre, potentially in a self-service provisioning fashion and request services in certain areas. Such service centre could then expose API´s by which the MNO can configure cells on the Small cells allocated to support the service. Such service operations centre would have to be enabled by the actor that provides the total concept. Examples are equipment vendors or an independent service provider.

Whether the MNO choose to allocate certain dedicated spectrum to Small Cells or integrate them into the total cell grid is a separate issue that is entirely up to the MNO. The challenges for the equipment to be capable to support a big enough spectrum bandwidth are also substantial, but feasible as the output power requirements are limited.

The OSS integration and self service provisioning challenges are obviously substantial, but far from impossible to overcome.

5.3 Provider Infrastructure & Service management

It is clear that the concept described in this paper would require a very simple infrastructure management. Firstly, the infrastructure itself needs to be easy to install and the provider need simple tools to monitor the coverage and traffic enabled in order to optimize antenna directions and places of installation. One could argue that such

[5] See the coverage/ capacity comparisons between LTE and WiFi from Virgin media trials – ref [1]

issues is very complicated, but we should not underestimate regular IT networking people and their ability to learn basics given they are provided suitable tools.

Secondly, the way by which the service operations can be enabled will be important. In the previous chapter a possible setup was outlined. There are alternative ways, especially for larger provider companies and public bodies that might decide to operate such service on their own capitalizing on site or backhauling assets they anyhow have. In any way, the need for systems integration and adaptation is obvious in order to facilitate the service orchestration.

6 About Arctos Labs Scandinavia AB

Arctos Labs Scandinavia is an independent company with wireless professionals offering consultancy services. The team consists only of highly experienced people with a breadth of experience covering RAN, Transport, Core networks and OSS environments. The team has over the years worked for global companies as consultant, as lead architects, product and business management and other roles.

We take on consultancy assignments for operators and equipment vendors to help facilitate the cloud transformation those are facing. Please visit www.arctoslabs.com or contact our CEO mats Eriksson at mats.eriksson@arctoslabs.com in case you want to know more.

7 References:

[1] An assessment of the value of small cell services to operators – Real wireless & Virgin media 2012

[2] Small Cell market status – Informa 2012