The complete HetNet portfolio

A conversation with George Zhao, Director of Small Cell Marketing and Michael Lin, Director of Wireless OSS Marketing Huawei

By Frank Rayal

Frank Rayal. Hello, and welcome to this conversation with Michael Lin and George Zhao from **Huawei**. I'm Frank Rayal. This conversation is part of a Senza Fili report on deployments of heterogeneous networks and the latest solutions from the wireless ecosystem that will make HetNets a reality.

Today we're speaking with Michael Lin, Huawei's Director of Wireless OSS marketing, and George Zhao, Huawei's Director of Small Cell Marketing. Huawei is one of the world's leading telecom vendors. I would like to thank the audience for joining us, and Michael and George, welcome to this conversation.

George, I would like to start off by asking you, what is HetNet, in your opinion?

George Zhao. A HetNet is a combination of macro cells and small cells. At Huawei, we have the AtomCell concept, which includes all the small cells with output power less than 10 W. We have the AtomCell micro and pico, and also the indoor pico RRU and carrier Wi-Fi.

Frank Rayal. What do you think are the main challenges in deploying HetNets? What are your customers telling you about the challenges of HetNets?

George Zhao. In the last three years, Huawei has deployed more than 30 commercial HetNets with our customers, and we have got some feedback about the challenges. We think there are four main challenges for deployment. First, it is difficult to find the right position to deploy the small cell. Second, it's difficult to acquire the site and deploy the backhaul for the small cell. Third, because there are many small cells deployed, how to manage the small cells, and how to control the interference between the macro cells and the small cells is a challenge. Then, there is the fourth challenge: if you deploy Wi-Fi, you must consider what the Wi-Fi position is in the HetNet; you must control the Wi-Fi interference.

Frank Rayal. If I may pick one challenge and start with the interference management: what specific solutions have you developed in order to deal with this challenge?

George Zhao. Huawei has both UMTS and LTE HetNet solutions. For UMTS networks, we think we must control same-frequency interference. Same-frequency is the major method of deploying HetNets. So Huawei has functions to control handovers between the macro and the micro cells to decrease the interference between the two layers. For LTE, Huawei has TDM eICIC to control the interference between the macro and the micro layers. Also, Huawei has aICIC, which is used for the micro and the macro boundaries because we know that a small cell has more neighbor areas, so it must have some technologies to control the interference between them. We have also CoMP, to optimize the macro plus the micro. And fourth,

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which I think is very important, is the use of beamforming technologies to control interference.

Frank Rayal. You mentioned eICIC, CoMP and beamforming technologies. These are LTE-Advanced features. Have you already implemented these features, and when do you see them becoming mainstream in HetNet deployments?

George Zhao. Some of these features have been commercially launched, like CoMP and TDM eICIC. For some advanced technologies like aICIC – which is based on Huawei's controller, or we call it eCoordinator, to coordinate several cells – that will be launched next year and is currently in trial stage.

Frank Rayal. Is aICIC a Huawei proprietary implementation?

George Zhao. Yes. It's based on the standard ICIC, but Huawei added some advanced technologies.

Frank Rayal. What are these advanced technologies? Can you share with us how your solution differs from other solutions on the market?

George Zhao. aICIC technology is advanced dynamic ICIC. Dynamic ICIC uses one-third of the resource blocks on neighbor cells. But Huawei's aICIC uses one-sixth of the resource blocks, to reduce the interference area. Also, aICIC can be dynamically switched on and off based on the users in the neighbor areas. We have tested the benefit of interference coordination to be more than 30% of throughput gain in the neighbor areas.

Frank Rayal. Can you speak about the beamforming and how that differentiates your solution from other solutions?

George Zhao. The microcell is a combined system with the antennas and other parts together in one box. So you must have some technology to ease the engineering, and to maintain the microcell. If you have beamforming you don't need the engineer to climb on a pole to change the direction of antennas according to the target areas. Another usage of beamforming is changing the beams to avoid interference from the macro cells. We think beamforming is like downtilt technology for macro cells: it will be a standard technology used in small cells.

Frank Rayal. How about coordinated multipoint? Is that feature already available, or when do you envision that it will be available?

George Zhao. Currently, this year's version included CoMP in our productions.

Frank Rayal. You have mentioned that backhaul is one of the challenges to small-cell deployments. With the increased capacity that these features provide, what do you see as being the requirements to backhaul in small cells?

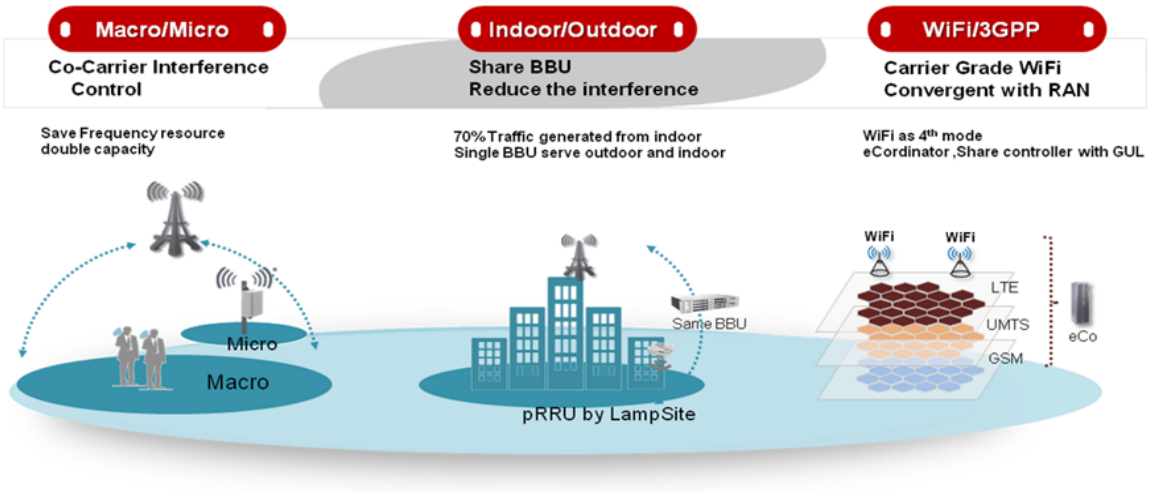

Figure 1. Overview of Huawei's HetNet solutions. Source: Huawei

George Zhao. For the backhaul, we think that the biggest challenge is how to get to flexible backhaul for small cells. The small cell will be installed on a pole. There is no existing backhaul at the location of the small cell, so you must provide options. How to provide flexible backhaul? That is the big challenge. We think that the best way is to use several types of backhaul. It could be fixed-line and wireline backhaul or wireless backhaul. For wireless backhaul, we think it's very flexible and easy to install. From our experience, several types of wireless backhaul can be used, like microwave, even Wi-Fi used in the 5 GHz band. Huawei also provides very good backhaul solutions to using TDD frequencies and point-to-multipoint architecture for small-cell deployments.

Frank Rayal. You mentioned Wi-Fi being integrated into the small cells. How do you see operators using heterogeneous networks together with unlicensed-band solutions and Wi-Fi, where you cannot guarantee the quality of service as much as you can on the licensed band?

George Zhao. We have seen that many of the operators are very interested in unlicensed-band Wi-Fi technologies. We know that Wi-Fi has very good advantages, like providing cheap and very flexible wireless data connection functions. But because it uses the unlicensed frequency band, it's easy to be interfered with. You cannot control the sources of interference. We think Wi-Fi should be used as a seamless extension to the existing HetNet. It must provide some advanced features, like ANDSF. Huawei has advanced ANDSF to determine the macro-cell network load and to let the users know which network is most suitable: Wi-Fi or the 3G or 4G network. The network must decide and tell the terminal. In some areas, Wi-Fi doesn't provide good quality. So you must convince the users to switch back to the 3G network. This is a technology that should be used.

Frank Rayal. You mentioned logistics, installation and the deployment process as part of the challenges of deploying HetNets and small cells. What tools or features are you providing the operators to facilitate this process?

George Zhao. We have traffic-map tools. We can collect and analyze macro-cell network performance data to determine which area is hot and give advice to the operator to choose a site for the small cell. Currently, our tools are accurate to 50 by 50 m, so you can find the hotspot area. Also, if you find a good position, another challenge is how to make it easy to install the small cell. Traditionally, if you install a small cell, you must install some power box or some lightning protection box. Huawei has a solution to combine all the external parts – transport, power, and lightning protection together – to make the pole very clear. It's just one box on the pole and only one cable to connect Ethernet.

Frank Rayal. One of the challenges that you had mentioned was interference management. We discussed that in terms of the features that were included in the base station itself. But there is also another aspect, which is the self-organizing network that even goes into the process of management and configuration of the small cells. Describe to me your philosophy on self-organizing networks.

Michael Lin. The SON concept in LTE networks started in 2008. The 3GPP defines the standards for LTE SON. The SON concept is to transport the repetitive human work to the equipment. For example, ANR (Automatic Neighbor Relation) functions – let the machine do the repetitive work. So this is the basic idea.

We also know that SON has a distributed part which is in the network element itself – for example, eNodeB – and also a centralized part: some functions are in the EMS or NMS level. Huawei has the SingleSON solution. We have some functions in the eNodeBs – for example, ANR, MLB (mobility load balancing) and PCI (physical cell identity).

Also, we have centralized SON functions in the centralized server named SONMaster, for example, CCO (capacity and coverage optimization). SONMaster also has the interface to other vendors' networks such as Ericsson and Nokia Siemens Networks. When an operator wants to deploy just one SON server for whole network, then SingleSON can do this.

Besides LTE, after Release 9 3GPP introduced SON functions to UMTS and GSM networks and also to the small-cell network. So Huawei's SingleSON solution also has multi-RAT and multilayer, which means coordination of macro and small cells.

Frank Rayal. You mentioned being able to interoperate with other vendors. There are some standards that 3GGP has put together to enable that, but probably that is not sufficient. What other things have you done to ensure that you can actually manage network elements from other vendors?

Michael Lin. This is a very good question. To make SingleSON multi-vendor capable, the key is to be able to get other vendor's network data from northbound interface. Although 3GPP defines the northbound interface protocol, when the vendors realize the protocols, they still have their own interfaces. The northbound interface integration is still an industry challenge until now. So this year, in May 2013, Huawei, Ericsson and Nokia Siemens jointly announced the OSSii (Operations Support Systems interoperability initiative). This initiative aims to enhance northbound interface integration, promote the opening of the northbound interface to make integration easy, and also provide pre-integration service to the NMS vendors, which means with OSSii the industry will benefit from better and quicker northbound integration. Any third-party vendors joining OSSii can have the ability for multivendor integration. We already, as part of the OSSii, can share the northbound interface with the other vendors, and we can integrate with other vendors in this process. That means SingleSON has a multivendor capability with OSSii.

Frank Rayal. Michael, what are some of the benefits of your SON solutions? Do you have any metrics in terms of improvements of KPIs that you can share with us?

Michael Lin. Yes. We talked about ANR. Without this function, if the engineer wants to maintain and optimize the mobile network, he has to check the neighbor cells, adding or deleting neighbors on a regular basis. With ANR, this kind of manual work can be reduced by more than 90%, which means the cost and the human labor time are greatly reduced. Also, using the MLB function in an LTE and UMTS overlaid network, the system load can have more than 15% improvement.

Frank Rayal. There is a debate in the industry on distributed versus centralized SON, and on whether SON functions should be supported by third-party vendors versus the equipment vendor. What's your opinion on these two aspects?

Michael Lin. My understanding is that the equipment vendors know their networks best. Although we have the OSSii for multivendor integration, we still think that the equipment vendors like Huawei know the networks best, because a lot of algorithms are inside the network itself. So for the distributed SON functions, like LTE ANR and MLB functions, of course, it's in the eNodeBs. The third-party or the small vendors do not have this kind of capability. They have centralized SON functions – for example, the multivendor capacity and coverage optimization. But there again, until now, there are no commercial deployments for the third parties. But the network equipment vendors have distributed SON functions in commercial networks already, and they also have the centralized SON function with multivendor capability. They can compete with any third-party SON vendors.

Frank Rayal. To deploy HetNet involves deploying a lot of small cells. When will SON be a needed element in this type of network?

Michael Lin. SON is vital to the small-cell deployments. When you talk to the industry and also our customers, they tell us again and again: we think that, for the mass deployment of small cells, one challenge is deployment costs. SON can help reduce those costs. For example, we have plug-and-play functionality in SON for small-cell deployment. As George already said, you install the small cell into the site and you power it on, the rest can rely on SON functions. You don't have to do configuration, or planning, or optimization. All this can be done by SON, which means you just install the small cell and power on, and you've finished your job.

Frank Rayal. Do you see operators deploying SON on the macro cells in the first phase and then moving toward deploying small cells together with SON? How do you see the process of deployment going?

Michael Lin. Naturally we start with the macro cell and then gradually the small-cell deployments pick-up. We think that the SON functions will all be realized in the small-cell deployment as well.

Frank Rayal. One aspect of SON, or the ultimate vision of SON, is to have a fully automated

network. How close we are to having a fully automated network, and what do you think about the trust factor – basically, having operators trust algorithms to run their networks for them?

Michael Lin. SON has two modes. One is fully automated and the other is you can stop and check: SON gives you suggestions and then you decide whether to go or not go. So the operator can choose between these two modes. Also, for the fully automated networks, I don't think this is practical in the near future, because network optimization is very complicated. You can put repetitive optimization of configuration work into the equipment, but you still rely on the engineers for very complicated optimization work.

Frank Rayal. Michael, where do you see yourselves taking the SingleSON solution? What is the vision or future evolution of the product?

Michael Lin. We have already deployed the SingleSON with our LTE network deployments globally. And now we have a lot of SON functions operating in live networks, like ANR, MLB and PCI functions. This year we provide a multilayer, multi-RAT feature, which means we provide GSM, UMTS and LTE network coordination, and also macro-small–cell coordination. At the end of this year, which means Q4, we can provide multivendor integration capability, including Ericsson and Nokia Siemens. Next year, we are going to provide more SON functions, like energy saving. In the future we will continue to enhance our SON functions and performance.

Frank Rayal. Do you see HetNet being more in demand in a certain region of the world, or among a certain type of mobile network operators? Or is it a general requirement of all operators in all regions?

George Zhao. Many operators are very interested in HetNets and small-cell solutions. But we think it is more important for operators who have limited frequency resources, so that they need some technologies like HetNets to boost their network capacity. Also, some areas, like Korea and Japan – where they use a lot of data services – want HetNets to help them with mobile network capacity. They are in the first wave of using HetNets and small cells. But also in other regions and countries, we see the environment building for HetNets, with more and more people using smartphones and mobile data. So I think that HetNets and small cells will become general technology and solutions used in networks.

Frank Rayal. George, we have focused most of the discussion today on outdoor small cells. Can you tell me about what you're doing about indoor small cells?

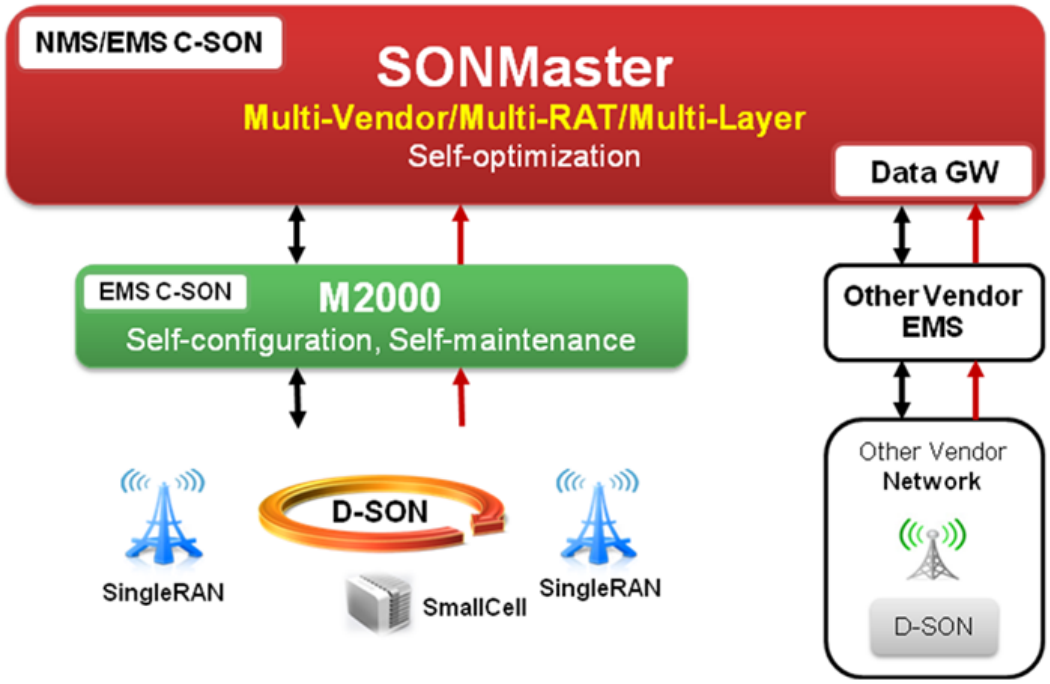

Figure 2. Huawei's SingleSON solution. Source: Huawei

George Zhao. As you know, more than 70% of mobile traffic is generated indoors, so we think the indoor area is very important for HetNets. Traditionally we have DAS systems and pico NodeB for indoor areas. But currently, we think that more and more operators need not just indoor coverage solutions, but indoor capacity solutions, because many of the tablet- and iPhone-generated data traffic is indoors, so we must have some capacity solutions in indoor environments. Huawei thinks the future of the indoor solutions should be multimode support: supporting LTE, UMTS and Wi-Fi all together. You must support multiple frequency bands. Huawei has a solution called LampSite for indoor deployments. LampSite is a pico RRU that supports three radio cards, which can be flexibly combined to support LTE, UMTS or Wi-Fi. Each radio card can support 2 x 100 mW. LampSite is only 3 kg, and it's easy to install on the wall and requires one Ethernet cable to connect it for transport and to provide the power through PoE. So it's a very innovative solution for the future indoor environment.

Frank Rayal. Well, thanks, George, and thanks, Michael, for this very candid conversation. I would like to also thank the viewers for watching this conversation with Michael Lin and George Zhao of Huawei. This conversation is part of the Senza Fili report on the challenges of HetNet deployments, an update on the latest solutions from the wireless ecosystem that will make HetNets a reality. The report can be downloaded from the Senza Fili website at **www.senzafiliconsulting.com**.

Acronyms

3G	Third generation
3GPP	3rd Generation Partnership Project
4G	Fourth generation
aICIC	Adaptive ICIC
ANDSF	Access network discovery and selection function
ANR	Automatic Neighbor Relation
BBU	Baseband unit
CCO	Coverage and capacity optimization
CoMP	Coordinated multipoint
C-SON	Centralized self-organizing network
DAS	Distributed antenna system
D-SON	Distributed self-organizing network
eCo	Enhanced coordinator
eICIC	Enhanced ICIC
EMS	Element management system
eNodeB	Enhanced NodeB (LTE base station)
GSM	Global System for Mobile Communications
GW	Gateway
HetNet	Heterogeneous network
ICIC	Intercell interference coordination
KPI	Key performance indicator
LTE	Long Term Evolution
MLB	Mobility load balancing
NMS	Network management system
NodeB	3G base station
OSS	Operations support systems
OSSii	Operations Support Systems interoperability initiative
PCI	Physical cell identity
PoE	Power over Ethernet
pRRU	Pico remote radio module
RAT	Radio access technology
RRU	Remote radio unit
SON	Self-organizing network
TDD	Time-division duplex
TDM	Time-division multiplex
UMTS	Universal Mobile Telecommunications System

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About the interviewer

Frank Rayal is founding partner at Xona Partners, a boutique management and technology advisory firm specializing in telecom, media and technology. He is a telecom industry professional with more than 20 years of experience working with network operators and system vendors to develop and deploy innovative wireless solutions. Frank co-founded small-cell backhaul pioneer BLiNQ Networks. He held senior product management, marketing and business development positions at Ericsson, Redline, and Metawave. He holds a BS in electrical engineering from Case Western Reserve University, Cleveland, Ohio, and an MASc in electrical engineering and an MBA from the University of Toronto, Canada. He is a senior member of IEEE, and a member of Professional Engineers Ontario.