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TEARING THE NETWORK APART
The economics of the new RAN to 2018

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"Tearing the Network Apart: the Economics of the New RAN to 2018"

About the report:

Escalating mobile data usage, rising over-the-top competition, massive investments in wireless capacity – all these trends are colliding to create a nightmare scenario for cellular operators. They need to deliver up to 22 times more capacity while coping with flat consumer ARPU, and while there are various technical and commercial strategies to help address the challenge, very few carriers will escape a radical rethink of their networks.

There has been considerable attention paid to small cells, but the macro layer will have to change dramatically too, in order to support massive data loads at a far lower capex and opex cost than before. This has led to the trend to deconstruct the macro RAN progressively, leaving very low-cost, low-power equipment at the cell site and centralizing as much of the intelligence as possible.

The most extreme version of this in current thinking is the Cloud-RAN, where the baseband activities are virtualized on cloud servers. The architecture is in the very early stages, and faces considerable barriers, but we believe it will reach the cellco mainstream by the end of the decade, and will see considerable investment before that point, especially in Asia.

This is because the economics can be extremely inviting, driving cell site costs down sharply and allocating network capex and resources very flexibly, as required by different applications and users. However, those economics will only be realized if the networks are scaled up dramatically, and if some key challenges, such as the need for fiber and the processing architecture, are addressed.

This report analyzes and forecasts the trends which are leading to Cloud-RAN in depth for the period 2013 to 2018, including important elements such as smart antennas, HetNet developments and adoption of relevant LTE-Advanced features such as CoMP. It is based on Maravedis-Rethink's ongoing tracking of the top 100 4G operators in the world; in-depth qualitative studies of 35 tier one mobile carriers; extensive interviews with the entire RAN vendor base and supply chain; and sophisticated modeling.

The result is a detailed examination of how the Cloud-RAN platforms will evolve in the period to 2018, and the economic benefits carriers expect to gain. Based on analysis of current cutting edge deployments as well as the future plans of operators and the ecosystem, the report provides market sizes, forecasts and capex values for the key elements of the Cloud-RAN market.

Executive summary

As mobile operators face rising capex bills to meet mobile data demand combined with falling ARPU, they are turning to radical new network designs. With Cloud-RAN, they will virtualize baseband processing functions for hundreds of sites on a server or base station hotel.

Operators will slash costs by leaving only ultra-low cost equipment at the cell site, eventually driving the equipment cost down below $100 by 2020. This will become vital as they 'densify' their networks with huge numbers of smaller cells, even in the macro layer. The $100 cell site is on the horizon, but it will only be achieved with investment worth $3.45 billion over five years in new servers, LTE RAN equipment, and particularly in software.

Drivers:
Mobile operators are facing a period when users will consume up to 32 times more wireless data by 2018, requiring massive increases in network capacity; but in which ARPU will rise by only 2.5%. A network design which delivers substantial, and well-targeted, capacity, while slashing cost of delivery, is essential to any business model. No single solution will provide all the answers, and carriers will use a combination of tools including Wi-Fi offload, small cells and air interface upgrades. One important tool will be the distributed RAN, in which low-cost, low-power equipment – usually integrated antenna/radio units – are left at the cell site, while the processing is virtualized in a base station hotel or in the cloud.

Economics of C-RAN:
Initially at least, the main attraction of this Cloud-RAN architecture is the promise of a very low-cost cell site, which could be squeezed down to $100 by the end of the decade. There are other enticing aspects to the economics:

- Network resources can be targeted more effectively where they are needed
- Baseband processing, the most onerous part of RAN opex, is reduced
- Self-organizing network (SON) techniques reduce opex further
- Power consumption and cost may be reduced by up to 40%

There are also negatives to the economic aspect of C-RAN, notably the cost of fiber and the servers themselves, as well as shortage of skills in this area, and lack of standards to instill price competition into the ecosystem. These will have to be addressed before there is mass adoption.

The architecture choices:
Early trials and even some commercial deployments have taken place, but these are the preserve of a few pioneering operators, using largely proprietary platforms. China Mobile, Korea Telecom, SK Telecom and NTT Docomo are among the leaders though there is also interest from some European cellcos. While China Mobile, in particular, is laying down many of the initial deployment rules, in reality the

architecture will have to adapt and diversify considerably to support the needs of the mass of cellcos. C-RAN will not suit all, and many will deploy it in a very different way from the 'pure C-RAN' of China Mobile.

By 2018, about 40% of the world's cellcos will have C-RAN deployments in relevant areas, but three-quarters of these will be using a hybrid architecture which combines C-RAN and traditional techniques. The main reasons will be to reduce reliance on fiber and to preserve investment in older technologies. Hybrid C-RANs will often make use of base station hotels rather than virtualizing all the base station functions in the cloud.

Operators are evolving the C-RAN idea further too, so by 2018 there will be 'Super C-RAN architectures'. These typically add further scalability and cost efficiency by extending cell sites' reach using distributed antennas; and by adopting highly flexible architectures in which cells dynamically come on and off, or change size, in response to demand at any one time.

Essential enablers:
There are several essential enablers before Cloud-RAN becomes viable for more than a few pioneers. Each of these, if they do emerge, will change the ecosystem and create opportunities for new classes of equipment. In particular, wide-scale C-RAN will require:

- Lower reliance on fiber, since many operators cannot access fiber at every site, especially as sites get smaller. Key emerging solutions include wireless fronthaul (linking radio/antennas and basebands wirelessly rather than via fiber); wireless implementation of the CPRI standard; and new iterations of distributed antenna systems (DAS). Both these categories will experience considerable growth as a result of C-RAN.
- Full integration with small cells, Wi-Fi and HetNet. The maximum efficiency, performance and cost benefits will only be realized if C-RAN is a fully integrated part of a wider heterogeneous network. Important enablers will include aspects of LTE-Advanced, such as CoMP, which will start to be deployed heavily from 2014; and new flexible networking tools from the major vendors.
- New software and chip platforms. C-RAN economics only make sense if the server-side costs are reduced too, using commoditized chips (x86 in the 'pure' model, but in reality there will be a place for ARM-based processors and DSPs too), as well as standard programming languages. Base station and server chip providers are already adapting their architectures to try to grasp a share of the new market.

Forecasts:
All these trends will reshape the macro-layer RAN market and its ecosystems. The adoption of full-blown C-RAN will be gradual, but the new thinking will have a knock-on effect on the whole RAN supply chain as carriers start to think about their

networks in a new way, focused on low TCO and maximum flexibility. C-RAN will create a new revenue opportunity in a market where traditional architectures are being squeezed. By 2020, we expect about 300,000 macro layer sites to be equipped with C-RAN facilities, and these will be supporting about one million sub-sites connected by fiber or wireless. Those sites will provide an important opportunity for companies which adapt their product offerings to suit.

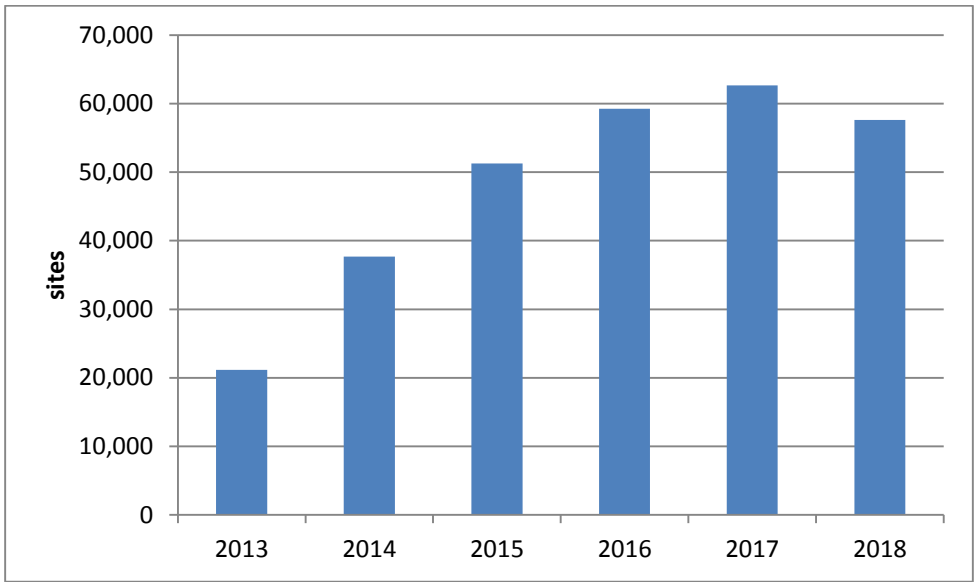

Figure: Macro layer cell sites deployed with C-RAN to 2018

Overall cell site capex will fall sharply during the period as investment shifts to centralized baseband platforms and cell site gear drops as low as $100. However, as those cell sites are reworked, new generations of smart antennas will become the center of the entire network and this segment will see strong growth. The other area of significant capex growth will be the servers to support C-RAN, and the virtualization software. These elements will grow to achieve market value of $2.65bn in 2018, over 75% of the total capex investment in C-RAN (excluding backhaul).

In general, then, the macrocell market will decline in value over the period but within that, the Cloud-RAN architecture will drive increased revenue opportunities for certain categories of equipment which will become vital enablers of the new networks, including smart antennas, wireless fronthaul and LTE-Advanced systems. In addition, there is the potential for a violent shake-up of the RAN ecosystem as investment and control shifts to the data center. This will open the doors for IT companies to increase their sales to carriers, and pose new challenges for the traditional mobile base station providers.

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About Maravedis-Rethink:

Maravedis-Rethink Research is a premier global provider of market intelligence and advisory services focusing on 4G and mobile cloud technologies, regulation and markets.

Its flagship research service is MOSA (Mobile Operator Strategy Analysis), which tracks the top 100 global 4G operators, providing data and in-depth analysis of their technology strategies, capex plans and business models.

Its other key services are RAN, Backhaul and ClearSpectrum, which monitor these three key aspects of the mobile landscape, tracking and forecasting market sizes, regulators' and operators' plans; and technology trends.

Maravedis-Rethink also provides a complete mobile and wireless advisory service including customized research and query, and weekly analyst newsletters Wireless Watch and Faultline (the latter focused on digital media and content, and the quad play).

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Caroline Gabriel has spent 25 years analyzing the technology market, starting as a journalist and then moving into research and consulting. She was European content director at VNU, then Europe's largest technology publisher and co-founded Rethink Technology Research in 2000 to focus on emerging wireless platforms and operator business models. After Rethink combined its research offerings with those of Maravedis, she became the Research Director for the whole venture. In addition, she leads the RAN practice and the Wireless Watch weekly research newsletter.

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