Mobile Experts

OPEN RAN: GOOD AND GETTING BETTER

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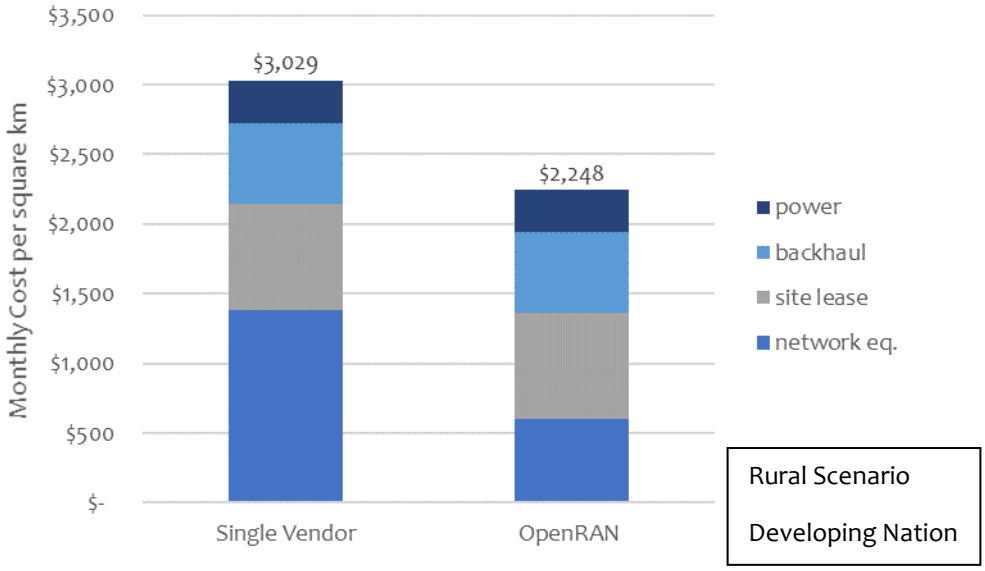
Open RAN interfaces have become an important part of building 5G mobile networks. And it's not just the greenfield networks and third-world networks that will benefit. This white paper provides some details on how Open RAN standards will impact almost every 5G network over the next five years.

Where ORAN Stands Today

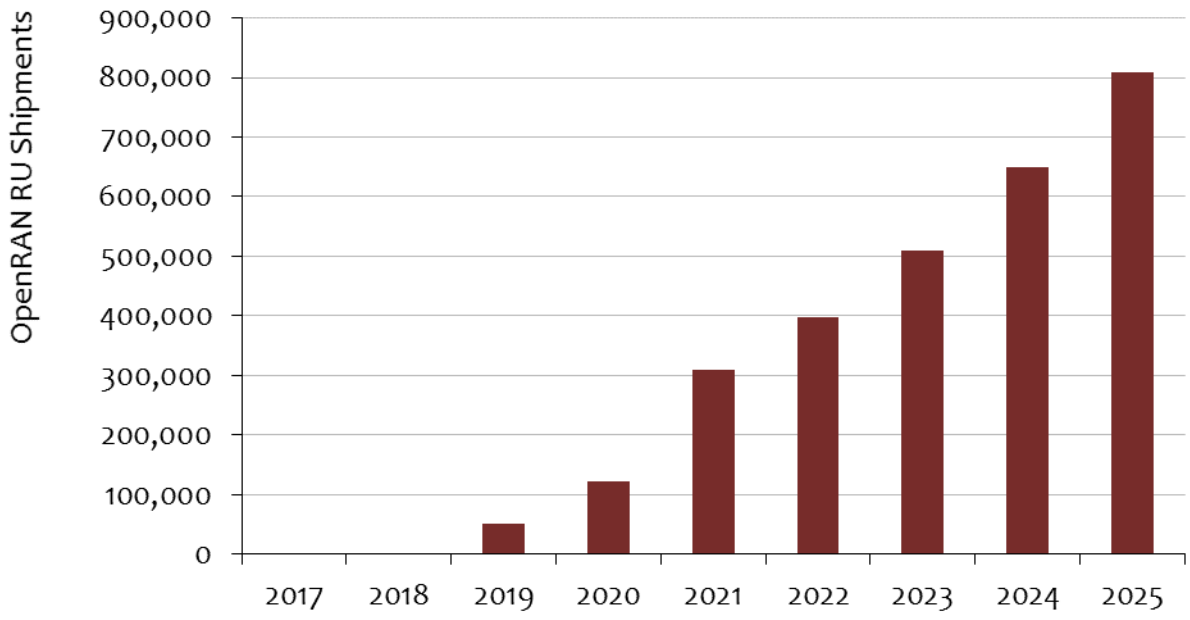
In addition to the greenfield networks that have embraced OpenRAN (Rakuten/Dish) Vodafone, Vodafone Idea, Reliance Jio, Telefonica, MTN, and other operators have also committed to deployment using Open RAN standards to realize cost savings, and future proof their networks, and to add flexibility for vendor mixing (widening the supply chain) . The trials conducted by these major players so far indicate that the technology has reached a level of maturity ***that is ready*** for commercial networks. The best example is Rakuten in Japan, who has deployed more than 5,000 'radio stations' so far and has already upgraded its network from 4G to 5G, using a collection of at least 18 vendors providing individual components of the network. Rakuten was able to sign up more than a million subscribers in its first three months.

Greenfield and multi-national operators are keen to use Open RAN standards because they see significant cost savings. In a greenfield deployment scenario, we calculate that the Total Cost of Ownership can be roughly 26% lower for an Open RAN network, based on more competitive pricing on radio equipment, maintenance contracts, and software.



Because of this kind of cost savings, Mobile Experts predicts that the market will move decisively to use the OpenRAN 'mix and match' approach. The number of OpenRAN-based

RUs deployed by operators and private networks will grow to more than 800,000 Radio Units in 2025, from only 122,000 in 2020.



Challenges for OpenRAN

So far, the OpenRAN story has a happy ending, ramping up to more than 10% of the market in the first few years. But as the story goes on, there are some challenges. The latest release of O-RAN Alliance standards in April 2020 set up interoperability for all of the main functionality of 3GPP standards, but O-RAN specifications do not cover some areas where 3GPP has neglected to standardize operation between different vendors, such as:

- Carrier Aggregation,
- Coordinated MultiPoint (CoMP),
- enhanced Inter-cell Interference Coordination (eICIC), and
- PIM Cancellation.

These features are not critical in greenfield and rural networks, so they don't really affect the initial adoption of Open RAN in the initial market areas. However, these features become important when openness is applied to high-density urban networks. That's where interference levels begin to limit the network, and efficient use of spectrum becomes a key metric for the business case.

High-density urban networks are complicated because big cities already have multiple bands of LTE service today. Adding an OpenRAN 5G network on top of a multi-band LTE network will be difficult to optimize between vendors without coordination at a very detailed level… it's not as simple as simply plugging in 5G on a new band. It's important to

coordinate so that the operator can get the benefits of CA, EN-DC, and PIM cancellation across multiple bands and modes.

Another challenge is for OpenRAN-based small cells to coexist with an incumbent vendor's macro network on the same frequency band. Out of thirty mobile operators interviewed, ALL of them expect to use the O-RAN Alliance specifications to require interoperability in future macro networks, even where they don't expect to buy RUs and DUs from different vendors. The reason for this: the operators want the flexibility to add a third-party RU in the future, either for an in-building application, or an outdoor hotspot, or a special case like a tunnel. OpenRAN with a single network architecture offers this capability, and in fact Mavenir has demonstrated connectivity for specialized tunnel radios already.

In order to make OpenRAN work for two vendors on the same band in a hetnet scenario, the operators will need much deeper coordination of features such as CoMP and Carrier Aggregation. The lack of complete standardization in 3GPP or elsewhere will make this challenge difficult to solve in the traditional RAN committees.

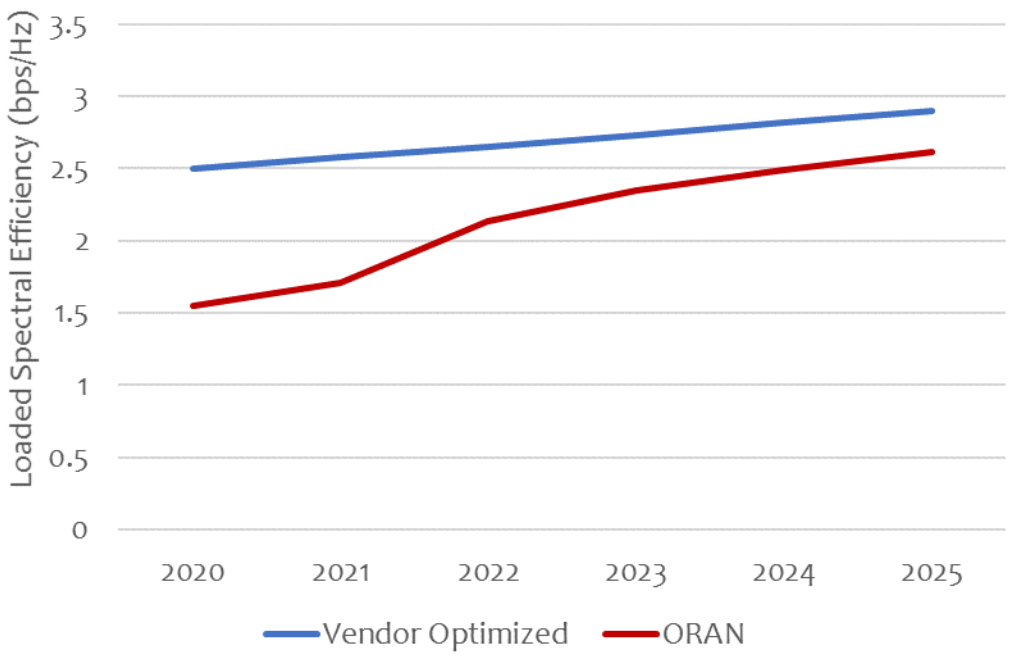
The Industry Can Solve the Challenges and operators need to take control

To deal with the high-capacity challenge, we expect the O-RAN Alliance to continue their development of standards, driving another layer deeper into the technology in order to standardize inter-vendor operation for CA, CoMP, eICIC, and other features. The Alliance may run into resistance from the incumbent OEMs, who rely on these features to differentiate their products, so the operators are likely to use other organizations to apply pressure to the OEMs and bypass any roadblocks. In this way, the Telecom Infra Project (TIP), CPRI Alliance, 3GPP, the Open Networking Foundation (ONF), and other groups may play a role in setting new standards. In particular, ONF has created an SD-RAN project, driven by major players such as AT&T, China Mobile, China Unicom, Deutsche Telekom, NTT, Facebook, and Google, with key participation from other players such as Intel, Mavenir, Radisys, and Sercomm.. As an engineering team, the ONF SD-RAN project is focused on using the RAN Intelligent Controller (RIC) to gain more control over functions within the RAN and use applications with AI/ML to drive performance improvements.

The ONF group is important, as it enables the operators to bypass any obstacles that the incumbent suppliers create. The O-RAN Alliance and ONF groups are a mechanism for operators to take control back from these suppliers ensuring that all interfaces, including those that have been specified by 3GPP are open and are made available free of charge. A good example of this is the X2 interface that is fully specified but kept locked or licensed. Removing these arbitrary license fees will provide further cost reductions and multivendor deployments to roll out more easily in built-out networks.

One way or another, we expect the operators to keep pushing to achieve higher performance in open radio networks. In doing so, over a period of 3-4 years they should be

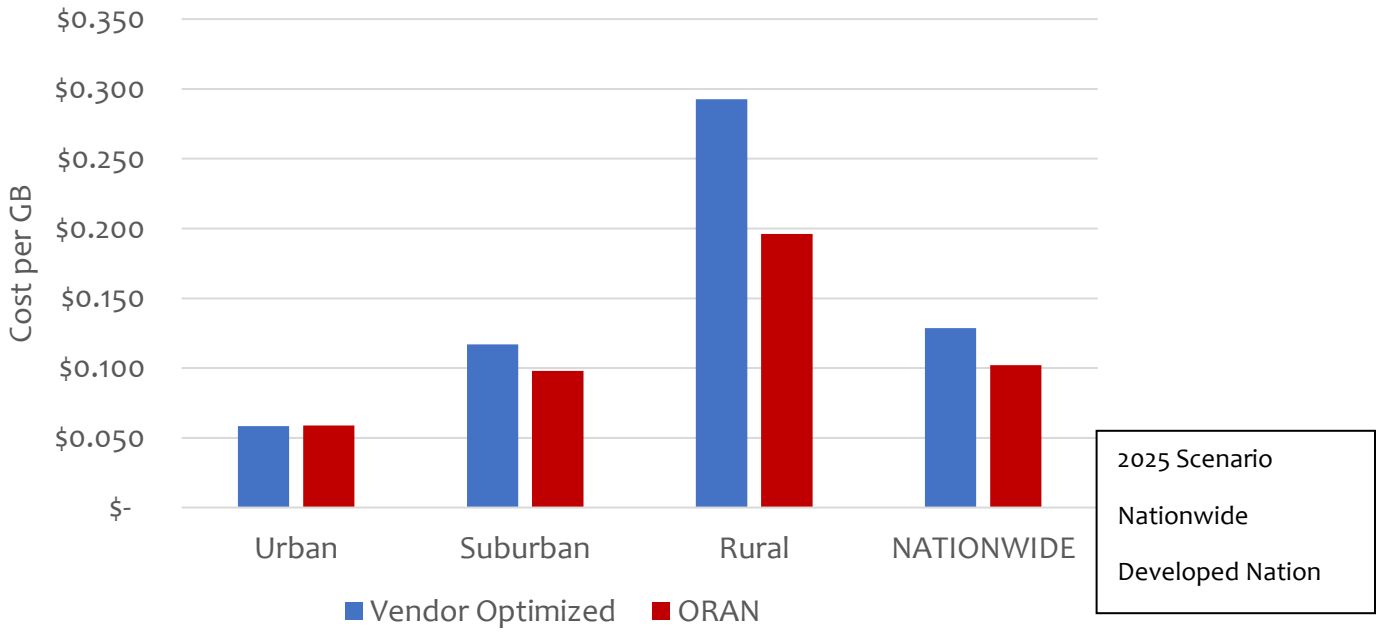
able to achieve competitive performance for high-capacity applications as well as greenfield and rural applications.



What will happen in the mid- to long term

The strong operator support behind ONF and O-RAN Alliance appears to be strongly unified and should be effective at driving performance improvements. Coordination between TIP, 3GPP, ONF, and O-RAN Alliance is good, eliminating the destructive confusion that has happened in other standardization efforts. Essentially, the RAN is now on a trajectory that was followed by Ethernet and by passive optical networking over the years, both of which resulted in cost savings through openness. As a result, we believe that it's possible for the ORAN community to approach the loaded spectral efficiency performance of a single-vendor network within the next 4-5 years.

Of course, we all know from experience that performance is not enough. Because the big vendors control the 2G, 3G, and 4G networks in the field today, they will try to continue to control the compatibility of the installed base with new OpenRAN equipment . (Vendors that play hardball too aggressively can and will be replaced, but that's expensive.) In general, operators will need time to transition their legacy networks, by shutting down 2G and 3G and by upgrading 4G networks to 5G.



By 2025, we expect that ORAN will save money in multiple market segments, including both high-capacity applications and coverage-limited applications. When that happens, the OpenRAN business model will be applied to networks ranging from urban to rural in many mainstream markets. As we apply our cost models to this future scenario, we find that the cost of delivering data will be competitive with (reduced) prices from the top OEMs in the urban case, but cost will be significantly lower in the critical suburban and rural segments.

In the end, the industry is on track to drive OpenRAN from its starting point in greenfield networks into the mainstream markets with highly complex urban networks. The future is bright for OpenRAN.