The 5G Landscape, Part 1: Infrastructure

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5G

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Sitting on the cusp of a new decade that's expected to be profoundly impacted by 5G, the fifth-generation wireless network standard, I'm

pleased and excited to have been invited to launch a regular new column here at Forbes that will dive into the many aspects of this technology, including its reach and influence on businesses, consumers, the tech industry, and society overall. The influence of 5G along with the technology behind it encompass an enormous variety of sub-topics and sub-genres that are bound to provide fodder for discussion and analysis for many years to come. At the same time, just as there is more to life than 5G, so too will you see other non-5G topics covered in this space. Whenever possible, however (as long as it makes sense!), I will try to offer a 5G perspective or angle no matter what the topic. In all cases, my goal will be to provide an explanation of technologies and issues in terms that an intelligent layman can understand. 5G is an enormously complex topic, but my goal here is to avoid a lot of the jargon and acronym-filled traps that plague so much of the current writing on the subject.

To get things started, I want to provide a top-level perspective on some of the key issues currently impacting the newborn 5G industry. It's a big topic, so I'm breaking it into two parts (part two to follow in my next column). In this first part, I will primarily focus on the infrastructure elements that sit at the heart of 5G networks, and in part two, I'll dive into radio spectrum and how it provides the lanes over which 5G data and communications can be transmitted.

At the highest level, it's important to recognize that 5G is at least a decade-long phenomenon and not all the benefits and capabilities that have been promised for 5G are going to be available right away. In fact, part of the reason 5G can be such a confusing and overwhelming topic is that it's been touted as being able to do virtually anything, except maybe make you a sandwich (though it will certainly help deliver one to you if you'd like...). Yes, eventually, the capabilities that 5G will enable will be profound and, quite honestly, likely well beyond our current imagination, but for the next two

years or so, it's basically going to be about faster wireless networks.

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With that in mind, it's important to understand the technologies and core components, as well as some of the companies making them, that go into building cellular wireless networks (sometimes referred to as wireless broadband). Companies like Ericsson, Nokia, and Huawei have been building the network infrastructure equipment that sits at the heart of cellular networks and within cellphone towers for years. A division of Samsung also makes network infrastructure equipment, but they are a much smaller player to date. In addition, traditional networking equipment companies, like Cisco and Juniper Networks, also play a role in routing the data in and through these networks. In many instances, the equipment from these companies connect with wired (or other forms of wireless) backbone or backhaul networks that are used to enhance the capacity and efficiency of the cellular networks.

Frankly, the companies that make network infrastructure equipment aren't typically well-known because they're all behind the scenes—we just don't see things like "the cellular network you're now enjoying is powered by Ericsson." Additionally, the equipment is typically quite complex and difficult for non-engineers to understand. Regardless, it plays an absolutely critical role in the operation of any wireless network. That's a big part of the reason why there has been so much scrutiny recently about Huawei's network infrastructure business outside of China. Governments aren't terribly worried about people using Huawei smartphones, but they do care about even the slightest possibility that such essential, base-level equipment

could be compromised or surreptitiously tapped into from afar.

With 5G, this potential for security risk grows, because in addition to providing the baseline connectivity, 5G cellular towers are expected to incorporate more computing capability. Imagine, for example, the concept of a cloud-based application or service running on your smartphone that doesn't pass through a cell tower on its way back to a cloud data center, but runs entirely within the cell tower itself, thanks to more intelligent and more powerful network infrastructure equipment. That's the kind of scenario that's likely to occur as 5G deployments evolve, and that's why governments and industry players are concerned.

The companies that purchase and install the network infrastructure equipment are the very well-known telco (short for telecommunications) carriers—the AT&T's, Verizon's, T-Mobile's and Sprint's of the world. Most carriers (sometimes also called operators or service providers) are very regional and only operate in a few countries. Many of them outside the US are owned and/or run by their country's governments, including the big three in China: China Telecom, China Mobile, and China Unicom. The carriers, of course, are also the companies that create the wireless plans and other services we use and subscribe to. One important thing to note is that carriers all think differently from one another and often prioritize certain technologies or capabilities (and subsequently price them) in very different ways. For example, the Chinese telecom companies have been deploying 5G networks faster than anywhere else in the world, because they see it as a key long-term economic and technological advantage for the entire country.

For a very long time, carriers have been knocked for being little more than utility companies that provide the "dump pipes" over which all the cellular data traffic travels. Honestly, it's not a very accurate assessment, as many

carriers have built up respectable service businesses that provide additional value beyond just a simple connection. However, when you see or hear about carriers making investments in "adjacent" industries (think AT&T's recent purchase of Time Warner), it's often tied back to the fact that concerns have been raised about the limited profit margins and growth potential for businesses built primarily on utility-like connections.

With the launch of 5G, carriers are chomping at the bit to deliver new types of potentially high profit margin services. Many of these services are being enabled by new edge computing (that is, computer components and software built into things like cellular radio towers that sit at the "edge" of the network) and other capabilities that the latest network infrastructure equipment is starting to incorporate, as mentioned above.

In order for different carriers to simultaneously operate in a given region, they each need to have some of their own "lanes" for carrying data. In the case of cellular networks, those lanes come in the form of dedicated radio frequencies, or spectrum, that are used to send and receive the analog radio frequency (RF) signal data that our smartphones transmit and receive. In my next column, I'll dive deep into what the RF spectrum means to 5G and why it is such a critical aspect of 5G's evolution.

Disclosure: *TECHnalysis Research is a tech industry market research and consulting firm and, like all companies in that field, works with many technology vendors as clients, some of whom may be listed in this article.*