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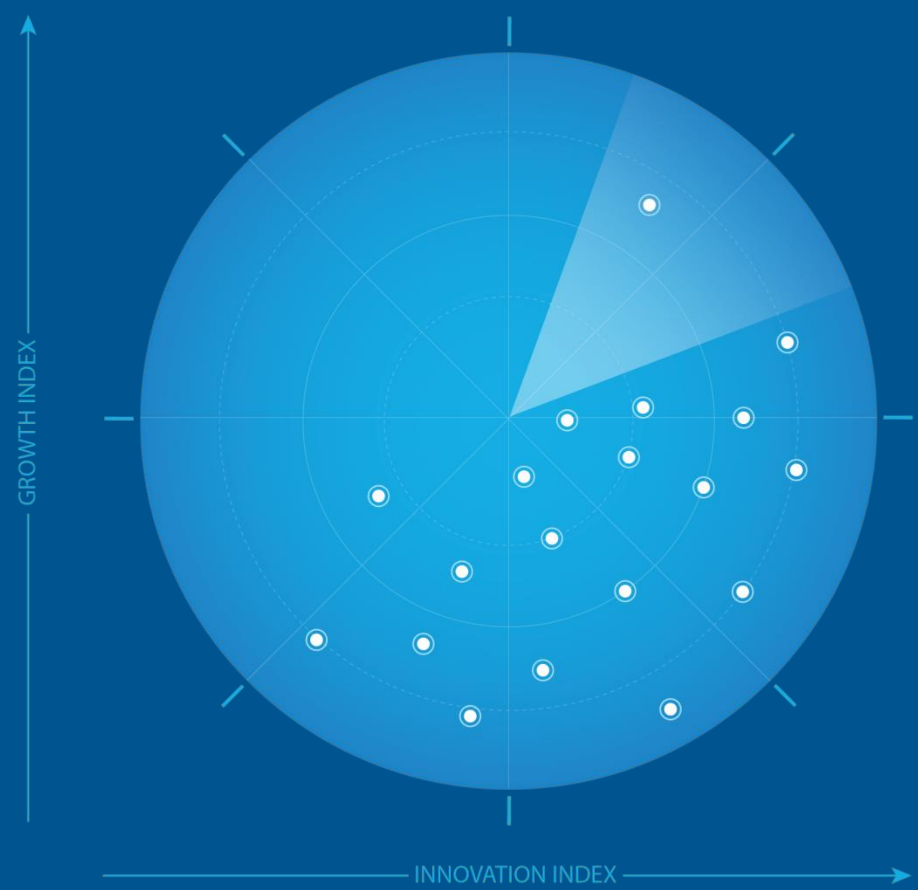
Frost Radar™: 5G Network Infrastructure, 2024

Authored by Troy Morley

A Benchmarking System to Spark Companies to Action - Innovation That Fuels New Deal Flow and Growth Pipelines



May 20243

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Strategic Imperative and Growth Environment

Strategic Imperative

Factors Creating Pressure on Growth

- 5G introduces many disruptive technologies, from new chips and devices to new network architectures, that will affect all areas of network infrastructure.
- The promise of 5G for consumers and enterprises is huge. The impact on communications service providers (CSPs) and their suppliers is equally large (in a good way). Growth opportunities abound.
- 5G core and edge networks are now entirely cloud-based, and the 5G radio access network (RAN) is quickly moving to the cloud. The industry is exploring open interfaces and new architectures for the 5G RAN (which Frost & Sullivan refers to as open and virtual RAN), enabling new suppliers to compete. The 5G RAN industry includes high-power macro cells and lower-power small cells. The 5G transport network ties together the RAN, the edge, and the core and is also cloud-based.
- Functions from the core network and the RAN are moving to edge networks to reduce latency and enable new use cases.

Source: Frost & Sullivan

Strategic Imperative

Factors Creating Pressure on Growth

- While CSPs are heavily investing in 5G, their financial success in this era remains to be seen. This will depend largely on how they monetize the technology and how successful they are with the enterprise segment, which has the potential to grow significantly.
- Device and infrastructure suppliers are succeeding now with CSP investments, but new business models need to be created for the providers themselves to cash in.
- The consumer market, which has been the bread and butter for CSPs, will remain important, but profit margins will remain low.
- The business and enterprise market will become essential to CSPs' success. Network slicing and private wireless networks will be areas of focus. Slicing will become more widespread as 5G networks become stand-alone, utilizing a 5G core network. Because of the financial importance that the business and enterprise market holds for CSPs, Frost & Sullivan remains surprised at how few CSPs have transitioned to 5G stand-alone globally.

Strategic Imperative

Factors Creating Pressure on Growth

- While 2023 saw some slowing of the 5G rollout globally, it continues to roll out faster than 4G did over a decade ago.
- The United States' push to block Chinese suppliers from competing in parts of the world has had a greater impact on 5 G. This primarily affects leading network infrastructure providers Huawei and ZTE. Some suppliers have tried to take advantage of the situation, with Samsung increasing market share in certain geographies and now NEC also looking to expand outside Japan.

Source: Frost & Sullivan

Growth Environment

- Frost & Sullivan believes that global CSPs invested just over $60 billion in 2023 on their mobile and wireless network infrastructure, depending on what is included. This investment will increase at a compound annual growth rate (CAGR) of approximately 2.1% over the next five years. Most of that spending is on the RAN, with smaller spending on transport and core networks. 2023 saw CSPs' network infrastructure spending flattened worldwide, specifically on public cellular networks. Some of that slowdown could be offset by growth in private cellular networks.

- While the 5G era is underway, investments in 2G, 3G, and 4G networks continue. 4G networks remain in the majority and will be for the next few years, so investment is still considerable but is already flattening and will soon begin to decline. Investment in 5G networks will accelerate and become dominant. Investment in 2G and 3G networks is limited and is declining.

Source: Frost & Sullivan

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Frost Radar™ 5G Network Infrastructure, 2024

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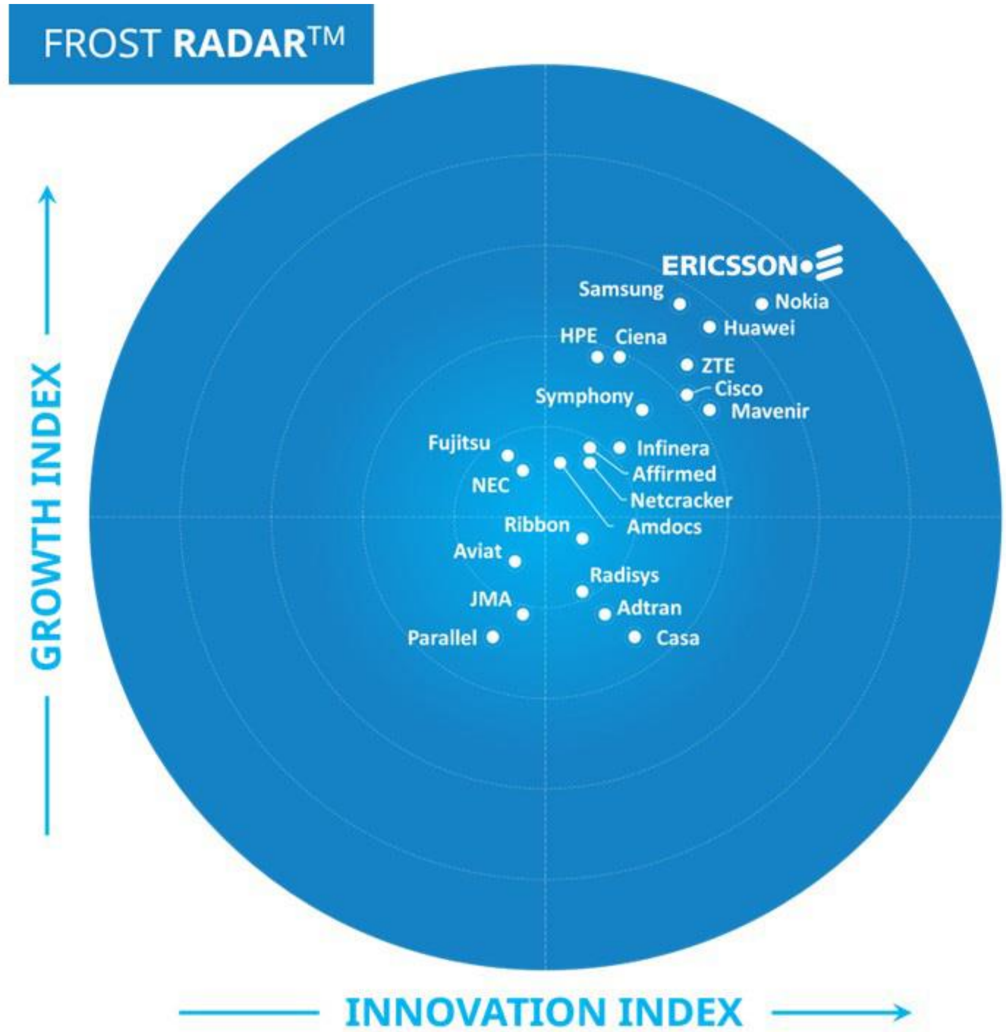

Source: Frost & Sullivan

Frost Radar™
Competitive Environment

- In a global field of more than 100 industry participants, Frost & Sullivan independently plotted the top 23 companies in this Frost Radar analysis. These companies either lead the market overall, lead a segment, or are thought leaders in certain segments.
- The 5G network infrastructure industry is emerging and built upon the established 4G network infrastructure space; therefore, it is unsurprising that leaders from 4G place highly here.
- The architecture of 5G brings the possibility of many suppliers working together in each area of network infrastructure: RAN, core/edge networks, and transport networks. In other words, the core network is likely not from a single supplier but from many suppliers, each providing one or more network functions. This opens the arena to new suppliers. Increased competitive intensity raises the level of innovation.
- The Frost Radar measures growth rates in addition to absolute revenue and combines them with several other factors to measure companies' performance along the Growth Index. The Frost Radar measures innovation for each company by assessing its product portfolio, the scalability of its innovations, the efficacy of its R&D strategy, and several other factors.

Source: Frost & Sullivan

Frost Radar™
Competitive Environment

- In this analysis, Ericsson ranked highest on the Frost Radar, followed by Nokia and Huawei. All were leaders in 4G network infrastructure and continue to lead in 5G network infrastructure. Their offerings include RAN, transport networks, and core/edge networks.
- The top five suppliers listed hold a combined market share of approximately 85%. Most of the rest either focus on a limited part of the infrastructure market or are smaller suppliers (or both).

Source: Frost & Sullivan

Companies to Action:

Companies to Be Considered First for Investment, Partnerships, or Benchmarking

Company to Action: Ericsson

Innovation

- Ericsson has proven its ability to scale its innovations globally with 2G, 3G, 4G, and now 5G.
- For 5G, the company currently reports 160 live 5G networks in 68 countries (the highest number that Frost & Sullivan has seen publicly reported).
- The company invests significant amounts in R&D; this is essential in an industry in which technology is always evolving.
- Ericsson's product portfolio includes all 5G network infrastructure areas and previous generations of network infrastructure.
- Ericsson also offers private networks and actively participates in the O-RAN Alliance.
- The company plans to offer O-RAN-compliant solutions in 2024; Frost & Sullivan believes this will significantly grow open and virtual RAN revenue.
- Ericsson’s strategy continues to center on CSPs’ evolving needs in all areas of the world. However, with its 2020 acquisition of Cradlepoint, Ericsson also is expanding its role with enterprise customers.

Source: Frost & Sullivan

Company to Action: Ericsson

Growth

- As a leader in 4G infrastructure, Ericsson enters the 5G arena with a large customer base.
- The company has done an excellent job keeping its current customers and adding new customers (including significant replacement wins over competitors.)
- Ericsson has a significant customer pipeline that has yet to move to 5G but will over the coming years.
- Ericsson has spent the last few years adjusting its overall strategy to focus on profitability, which enabled it to weather the pandemic and the slowing of the infrastructure market in North America in 2023.

Source: Frost & Sullivan

Company to Action: Ericsson

Frost Perspective

- The 5G era is just beginning but will be long-lived.
- While the company's turnaround strategy has been successful, the battle to continue to grow and maintain profitability is just starting and will need a sustained focus.
- The infrastructure market tends to grow slowly on average, meaning some years will feature positive growth and others will not. Because 2023 was the first year of slowing growth in the 5G era, Ericsson's focus on profitability was highlighted.
- Frost & Sullivan has discussed the importance of the open and virtual RAN movement and the belief that, eventually, open and virtual RAN will be the norm. Ericsson's step into offering open RAN solutions in 2024 will help make this movement a reality.
- Energy efficiency has been a buzzword for a few years and Ericsson continues to tout smaller and lighter solutions that save energy, answering its customers' needs. This will continue with its traditional RAN solutions and accelerate with its new open RAN offerings.
- The market for private 4G and 5G networks has not grown as quickly as expected, but Frost & Sullivan believes there are still great opportunities to be had. Ericsson must work with its CSP customers to target these new opportunities in the enterprise world.

Source: Frost & Sullivan

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Key Takeaways

Key Takeaways

1

Growth opportunities abound in the 5G space, from network infrastructure suppliers to their CSP clients and, in some cases, their enterprise clients and from CSPs to their consumer and enterprise customers. 5G network infrastructure growth is just getting underway and will present opportunities for the next decade or more. This is a large market, worth many tens of billions of dollars annually.

2

The architecture of 5G has moved much of the network infrastructure to be software-driven in a cloud environment. This has opened the market to many new suppliers. Companies that were once called "network equipment providers" still lead, but they face much more competition with the move from hardware (equipment) to software (network functions).

3

Open and virtual RAN covering 5G and previous generations is a niche but will grow significantly over the next decade. 2024 may be the year that open and virtual RAN takes off, as at least two of the leading suppliers of traditional RAN (Ericsson and Nokia) promise open and virtual RAN solutions in the coming months. Private 4G and 5G networks are also small submarkets but will experience strong growth in the coming years. The growth opportunities presented by each should be considered by all 5G network infrastructure suppliers.

Source: Frost & Sullivan

Frost Radar™ Analytics

Frost Radar™: Benchmarking Future Growth Potential

2 Major Indices, 10 Analytical Ingredients, 1 Platform

VERTICAL AXIS

Growth Index (GI) is a measure of a company's growth performance and track record, along with its ability to develop and execute a fully aligned growth strategy and vision; a robust growth pipeline system; and effective market, competitor, and end-user focused sales and marketing strategies.

GROWTH INDEX ELEMENTS

- **GI1: MARKET SHARE (PREVIOUS 3 YEARS)**
  This is a comparison of a company's market share relative to its competitors in a given market space for the previous 3 years.
- **GI2: REVENUE GROWTH (PREVIOUS 3 YEARS)**
  This is a look at a company's revenue growth rate for the previous 3 years in the market/industry/category that forms the context for the given Frost Radar™.
- **GI3: GROWTH PIPELINE**
  This is an evaluation of the strength and leverage of a company's growth pipeline system to continuously capture, analyze, and prioritize its universe of growth opportunities.
- **GI4: VISION AND STRATEGY**
  This is an assessment of how well a company's growth strategy is aligned with its vision. Are the investments that a company is making in new products and markets consistent with the stated vision?
- **GI5: SALES AND MARKETING**
- This is a measure of the effectiveness of a company's sales and marketing efforts in helping it drive demand and achieve its growth objectives.

Frost Radar™: Benchmarking Future Growth Potential

2 Major Indices, 10 Analytical Ingredients, 1 Platform

HORIZONTAL AXIS

Innovation Index (II) is a measure of a company's ability to develop products/services/solutions (with a clear understanding of disruptive Mega Trends) that are globally applicable, are able to evolve and expand to serve multiple markets, and are aligned to customers' changing needs.

INNOVATION INDEX ELEMENTS

- **II1: INNOVATION SCALABILITY**
  This determines whether an organization's innovations are globally scalable and applicable in both developing and mature markets, and also in adjacent and non-adjacent industry verticals.
- **II2: RESEARCH AND DEVELOPMENT**
  This is a measure of the efficacy of a company's R&D strategy, as determined by the size of its R&D investment and how it feeds the innovation pipeline.
- **II3: PRODUCT PORTFOLIO**
  This is a measure of a company's product portfolio, focusing on the relative contribution of new products to its annual revenue.
- **II4: MEGA TRENDS LEVERAGE**
  This is an assessment of a company's proactive leverage of evolving, long-term opportunities and new business models, as the foundation of its innovation pipeline. An explanation of Mega Trends can be found here.
- **II5: CUSTOMER ALIGNMENT**
  This evaluates the applicability of a company's products/services/solutions to current and potential customers, as well as how its innovation strategy is influenced by evolving customer needs.

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