Research

June 2021

Powering the 5G Network: The Platform Matters!

A J.Gold Associates Research Report

"This report will explore some of the issues involved in moving to a 5G stand alone environment, the need for an open and expansive ecosystem, and highlight some of the needed functions and platforms that are powering this transition....."

J.Gold Associates

Contents

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

Introduction

The world is highly dependent on wireless communications. More than 5 billion people around the world are using mobile devices, and more than half of them are smartphones highly dependent on broadband data services. And that's just the beginning. New requirements for connectivity in smart cities, autonomous vehicles, healthcare devices, industrial IoT, AR/VR, etc., will dramatically increase the requirements for high speed and reliable wireless communications and affect nearly every aspect of our work and personal lives. Approximately every 10 years, a new generation of wireless technology makes its way on to the stage with higher speeds and improved data capabilities. We are currently in the process of transitioning from primarily 4G networks into the next generation - 5G.

> ***TREND**: The move to 5G wireless networks and beyond will have major impacts on nearly all businesses going forward. Public networks accessed by consumers will be supplemented with private networks utilized for mission critical applications in many industries. The ability to do network slicing, offer improved quality of service, and enable high speed and low latency connections will fundamentally alter the way data and apps are used and delivered. In the next 3-4 years 5G will dramatically alter business and consumer computing and interactions. An open ecosystem based on a common platform and open standards will accelerate implementations and enable previously impractical solutions. Organizations that don't embrace and utilize 5G will be left behind.*
> *J.Gold Associates LLC.*

4G network infrastructure consists mostly of fixed function equipment, which began deployment 10 years ago. The major carriers have been transitioning their core networks to a virtualized environment over the past 3-5 years to add new features, expand their equipment options and suppliers, and improve operating expenses and network efficiencies. But virtualization alone will not enable the variety and complexity of services that a 5G network requires. What's needed is a 5G standalone core network designed around a service-based architecture thereby enabling new and compelling 5G offerings.

However current implementations of 5G non-standalone networks are dependent on the 4G/LTE infrastructure. This dependence limits the ability to provide all of the enhanced services and features that 5G enables. Relying on the core 4G network did allow the communications service providers to implement 5G services sooner, but over the next 1-2 years, the 4G based infrastructure leveraged for the current 5G systems must be transitioned to enable the full set of features and functions that stand alone 5G promises, including for edge computing and private/enterprise systems. To do so, communications service providers will need to deploy a fully virtualized, cloud-native solution that can power the increasingly complex needs of the network for the next 5-7 years at least, while also allowing the flexibility to add and delete services and capabilities as required. This cannot be enabled by the outmoded fixed function equipment and dedicated computing architectures of the past.

This report will explore some of the issues involved in moving to a 5G stand alone environment, the need for an open and expansive ecosystem, and highlight some of the needed functions and platforms that are powering this transition.

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

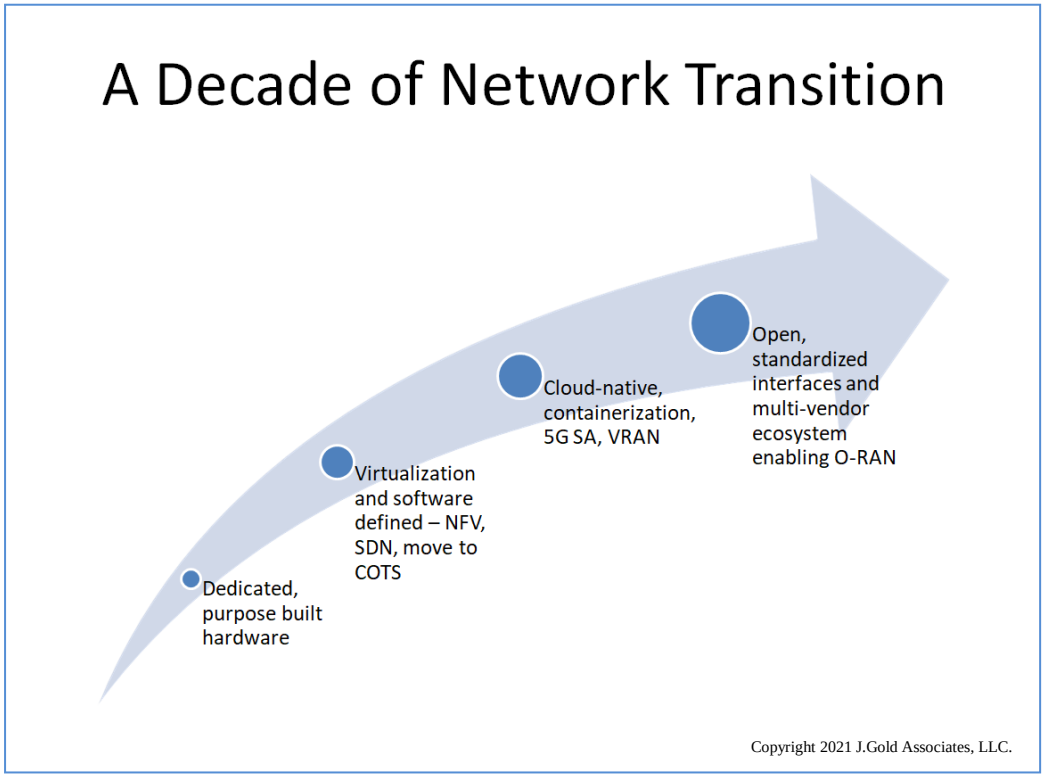
This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

Wireless Networks: A Decade of Transition

Wireless networks (and indeed many wireline networks as well) have been in Digital Transformation for at least the past decade. Hardwired, fixed function platforms and components are rapidly giving way to more flexible and scalable architectures built on off-the-shelf data center class servers and enhanced with the necessary off-the-shelf interface cards and accelerators (e.g., Network Interface Cards –NIC). Mostly proprietary operating systems and software powering network equipment have transitioned to common operating systems, running on general purpose devices such as Intel Xeon Scalable processors, and programmed with standard toolkits optimized for network operations. The result is that what was once the domain of a handful of proprietary network equipment suppliers has now evolved into a full ecosystem of hardware, software and solutions providers.

This move to an off-the-shelf approach to hardware and software platforms creates the ability to realize an open architecture approach that can be relatively quickly implemented, scaled and customized as needed. Further, equipment upgrades are much easier as most machines are now plug-and-play. And similar to the open source revolution driving the cloud, this standards-based openness will ultimately enable a much broader ecosystem of solutions in a plug and play environment. This shift from proprietary to standards based has created more open solutions which is being played out in the core network and accelerating the transition to 5G. We expect that in the next 2-3 years, new RAN initiatives like O-RAN based solutions and Open RAN from TIP will become the preferred methodology for deployments.

Figure 1: A Decade of Network Transitions



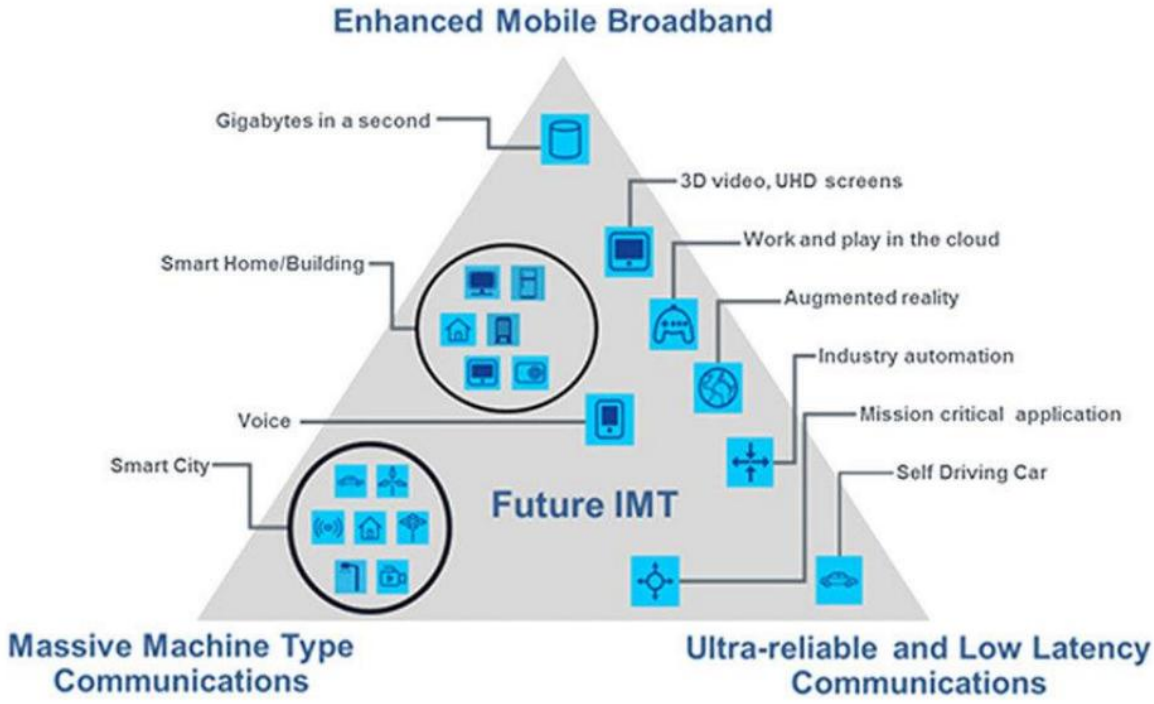
Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

A Variety of Capabilities for an Emerging Market

5G will usher in a new set of services and solutions that were not previously available on wireless networks. Voice communications, while still critically important, will take a smaller percentage of overall connectivity resources in the future than they do now (indeed, with the advent of 4G data services, voice was no longer the primary use case of mobile device users). New markets and new capabilities to power those marketplace solutions will form a critical infrastructure capability that only a 5G (or beyond) network can enable. Figure 2 indicates some of these new services, as envisioned by the 5G working group. We expect many more services to emerge going forward.

Figure 2: 5G Usage Scenarios for International Mobile Telecommunications (IMT) for 2020 and beyond



Source: 5G-PPP Software Network Working Group, From Webscale to Telco, the Cloud Native Journey, July 2018

What's Needed in 5G?

Unlike earlier generation networks, the amount of flexibility and user enablement available in 5G requires a different functional model for both operating the network as well as providing services and solutions. While much of the functionality can be imported from other disciplines (e.g., open source, virtualization, cloud native programming), there are some unique requirements. Table 1 provides an overview of some of the key functional requirements necessary to create a platform that will support 5G connections and services.

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

Table 1: Major Functions Needed to Implement 5G Networks and Services

Features/Functions
Operational Flexibility – ability to enable services specific to user needs, requiring a scalable platform architecture (e.g., network slicing, data/app distribution, Edge computing, QoS, TSN, unique solutions for C2VX, Manufacturing, Healthcare, etc.)
Security – New security solutions are needed in the 5G SA Core above and beyond solutions deployed in the 4G EPC. The new 5G SA core network platform security advantages will be extended to the service nodes, end points and applications/data to protect various mission critical and safety related solutions (e.g., drones, telehealth, autonomous vehicles, smart cities).
Automation and Orchestration – with so many potential options and operational modes, automation is key to operating an efficient network and edge services (e.g., operations monitoring and asset management, individual user and/or organizational configurations, app/data deployment)
Cloud Native Architecture – taking advantage of available apps and computing resources available in public and private clouds to speed time to availability, lower overall cost, and take advantage of a growing ecosystem (e.g., major cloud provider 5G-specific and edge computing initiatives)
Reference Architectures and Toolkits – the need to achieve flexible solutions while enabling fast time to market requires platforms that can be quickly customized and scaled for deployments (e.g., network function reference designs, network software toolkits, programming tools and components, etc.)
Open Standards and Expanded Ecosystem – The need to implement a wide variety of solutions for users and organizations requires a large assortment of solutions that must be available from a variety of sources. An open, interface-based ecosystem approach is the only way to achieve this.
AI Enablement for Network and Services – With increased complexity and need for operational efficiencies, AI will have an increasing role in optimizing networks and services, and enabling better user experiences. Platform and app availability will be key to achieving this.

Copyright 2021 J.Gold Associates, LLC.

Cloud Native vs. Fixed Operations

To meet all of the functional requirements necessary to make 5G a reality, both infrastructure vendors and solutions providers have increasingly turned to a cloud native approach. Indeed, with software architectures that provide a variety of hosted solutions and toolkits to build upon, and the ability to automate, deploy and scale up or down as needed while also reducing time and efforts involved, many service providers have found a friendly environment in the cloud.

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

The contributions of key virtualization players like VMware, IBM Red Hat, and WindRiver, telecommunications-specific solutions providers like Microsoft Affirmed Networks, Altiostar and Mavenir, enabling software such as DPDK and FlexRAN from Intel, and processing systems optimized for telecommunication from Dell, HPE, Lenovo, etc., are becoming critical platforms for virtualized 5G deployments that can be public or private cloud based. Further, all the major cloud providers (e.g., AWS, Microsoft Azure, Google Cloud Platform) have 5G initiatives underway, whether for the core network functions, or more commonly, for the edge computing needs of both communications service providers as well as B2C and enterprise private deployments. Other players, like IBM, Oracle, Salesforce, etc, have also targeted the growing infrastructure needs of public and private 5G implementations.

The choice of platform to run these solutions on, and whether in a public, private or hybrid cloud setting is an important consideration. Cross-cloud compatibility, as well as the ability to easily and compatibly scale from large data center systems down to edge computing, means that the processing platform of choice is critical. Virtually all of these players currently work on Intel-based computing platforms, although some are evaluating portions of their services on alternative processor architectures. And some AI functions are deployed on AI-specific accelerators. However, for the foreseeable future, we expect that at least 90%-95% of all network based cloud functions will be run on Intel-based systems, both in public cloud and in private cloud settings.

Market Opportunity for 5G

While there are various estimations of market sizing and growth for 5G infrastructure market expenditures, we estimate that the market was approximately $18B in 2020, and will achieve $40B-$50B by 2030. In the early stages we expect a disproportionate share to be in the Far East, but within 1-2 years, we expect North America and Europe to catch up and exceed the Far East in equipment acquisition and deployment expenditures.

Table 2: 5G Infrastructure Market Size Estimate

	2020	2030
5G Infrastructure Market Size	$18B	$40B-$50B

Source: J.Gold Associates, LLC.

Time to Market is Critical

With the large amount of hype, and potential new application areas creating new revenue streams, service providers worldwide are rushing to implement 5G capability. Indeed, most service providers are in a highly competitive position in their territories, and competing for clients means there is a strategic need to get up and running quickly. Recently KPMG estimated that spending on the move to 5G for connectivity, hardware, software, and services could create more than $140 billion of new annual revenue worldwide by 2023, so any delays can have enormous potential to reduce service provider, 5G solutions provider and end user solution provider revenues.

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

The key to rapid creation and deployment is not having to invent custom solutions. Finding reference architectures that are proven and can be deployed quickly are critical to remaining competitive. Further, reference architectures can promote diversity of suppliers and allow new entries to emerge (as is now happening), enabling a wealth of applications and functions not otherwise available in a timely or cost-effective manner. Finally, with the need to transport apps and functional software across a wide variety of systems from large data centers down to small mobile edge servers, the need for compatibility and ease of transport is a huge plus for creating and maintaining a highly competitive ecosystem.

We estimate that companies able to leverage existing architectures and platforms, and able to leverage proven toolkits can get to market 2-3 times faster and with higher quality than companies designing from scratch. Further, with a move towards open software and cloud hosted solutions, the ability to flexibly upscale or downscale as needed is much easier than in a dedicated and purpose-built platform.

Conclusions

We believe that there is no way for 5G to meet its full potential unless the entire ecosystem of infrastructure vendors, solution providers, enterprises and service providers move to adopt a platform approach that is open, built on standards and has the ability to scale from large infrastructure in data centers down to smaller edge based servers. Cloud-native and rapid development, consisting of reference designs and optimized toolkits, are critical requirements to deploy quickly, create needed flexibility and achieve needed levels of service. Selecting the key platform architecture for processing elements, cloud-based services, and off the shelf components are the best ways to assure security, compatibility and efficient operation and system integrity. Failure to do so will result in 5G not meeting its potential, and the use of private solutions for 5G becoming untenable.

This research report was commissioned by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates,LLC. .

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

Appendix: 5G Initiatives Currently Underway

Below we highlight some examples of initiatives and deployments recently announced that are currently underway in building out new 5G networks and services:

Major Infrastructure Equipment Initiatives and Market Acceleration – Dell Technologies

"Dell Technologies is launching a cloud-native network infrastructure with a full stack of open, scalable carrier-grade server and software solutions to simplify and accelerate this journey. Today, CSPs can use Dell Technologies validated reference architectures to deploy full-stack telecommunications solutions from partners, including VMware and Red Hat, with optimal Dell hardware, software and services. Dell Technologies is also introducing new reference architectures to span telecommunications edge, core and Open RAN environments. The reference architectures provide full stack guidance, deployment options and operational recommendations for specific use cases to help CSPs quickly and efficiently deploy applications and services enterprises demand. Building upon Dell Technologies infrastructure foundation solutions with VMware Telco Cloud Platform and Red Hat OpenShift, CSPs initially will be able to deploy:

- Core software solutions from Affirmed Networks.
- Private network solutions from CommScope RUCKUS.
- Multi-access edge computing (MEC) solutions with Intel Smart Edge.
- Dell Technologies is collaborating with Mavenir to develop 5G Open RAN software with Dell EMC PowerEdge XR11 ruggedized servers running on Intel Xeon Scalable Hardware.
- Core software solutions from Nokia." (from Dell Press Release)

Updating for the Future – Vodafone

"Vodafone unveiled its strategic vendors – Dell, NEC, Samsung Electronics, Wind River, Capgemini Engineering and Keysight Technologies – to jointly deliver the first commercial deployment of Open Radio Access Network (RAN) in Europe. The company believes the move will spark other large-scale Open RAN launches and spearhead the next wave of digital transformation across Europe. Vodafone's initial focus will be on the 2,500 sites in the UK that it committed to Open RAN in October 2020. It is one of the largest deployments in the world." (Vodafone Press Release)

Leveraging Standardized Platforms: Intel FlexRAN

Standardized platforms are critical to lowering the barrier to entry and achieving rapid time to market and efficient designs. For example, *Intel's FlexRAN* is the most widely adopted vRAN software architecture, forming the foundation of virtually all current vRAN deployments and spurring a vibrant ecosystem for innovation. *Intel's Network Platform* is a technology foundation and software environment that enables network developers to improve their overall network performance through mature building blocks and reference architectures and has been developed and improved over more than a decade.

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

Alternative Computing Platforms to Intel Processors

While there have been a number of announcements in the past of alternative computing platforms for network core and V-RAN functions, both stand alone and in the cloud, we find that virtually no production deployments have occurred on these alternatives. Indeed, some equipment providers and cloud based service providers have indicated virtually 100% of all communications network deployments are running on Intel processors. We do not expect these alternative platforms to make any major inroads in the near term.

Copyright © 2021 J.Gold Associates, LLC. All rights reserved.
www.jgoldassociates.com

This research report is distributed with permission by Intel Corporation. No other parties are authorized to copy, post and/or redistribute this research in part or in whole without the written permission of the copyright holder, J.Gold Associates, LLC. .

About J.Gold Associates

J.Gold Associates provides insightful, meaningful and actionable analysis of trends and opportunities in the computer and technology industries. We offer a broad based knowledge of the technology landscape, and bring that expertise to bear in our work. J.Gold Associates provides strategic consulting, syndicated research and advisory services, and in-context analysis to help its clients make important technology choices and to enable improved product deployment decisions and go to market strategies.

J.Gold Associates, LLC
Northborough, MA 01532 USA
+1 508 393 5294
www.jgoldassociates.com