

Disaggregating Telco in 5G Era

Evolution of Infrastructure Services

Lenovo

Preface

Telcos” have been driving key technologies of the future to provide better connectivity for society. 5G is the latest and yet the greatest version of this evolution in the field of Mobile Networks addressing the need for connectivity.

Technology advancements with 5G have made it possible to provide connectivity beyond people, which includes Internet of Things (IoT) devices, Machine-to-Machine (M2M), Including different industrial needs from very low latency communication to supporting a large number of connected devices. The advancement to 5G is making it possible to position 5G for vertical industries where Telco & IT have become closer [1]. As a result, collaboration needed in the area of some diverse domains and best-of-breed technologies is influencing standards, complex technical integration and implementations to further corporate strategies in digitization and as well modernization of Telco infrastructure in this journey. Network modernization and digitalization is an example of these collaboration areas now deemed as a pre-requisite for Telco to collaborate and compete with IT in the area of new business opportunities,[2].

In the early 2010s, digitalization initially emerged with the help of smart phones and broadband internet access, where operators started to explore newer, greater ways to communicate with their customers. Furthermore, Communication Service Providers (CSP) were aggressively forced to digitalize due to disruptors positioning themselves in the asymmetric competition, [3]. However, 5G (Standalone) and its capabilities made digitalization mandatory for Telcos where any CSP needed to have a Digital Service Provider (DSP) strategy with 5G connectivity enablement. In this paper, we define a structured strategy of digital transformation in line with disaggregation enablement and the role of Telco infra in this journey.

Telco Digital Transformation

The digitalization of the telecom industry necessitates business-oriented transformation that extends beyond technology but also to streamline processes and people. Technology aims to enable businesses to be agile, innovative and customer centric for a smoother customer interaction and experience. The journey towards digital transformation in Tier-1 Telcos commenced in the latter half of the 2010s. Over last decade, the Telco segment has realized that digitization is a must-have to survive in the bi-modal Telco convergence in the 5G era.

Digitalization Success Factors

Transforming the legacy within Telco is a complex activity, given that telcos have operated and evolved on those processes and technologies for decades. People and process dimensions of digitalization makes this journey even more complex. Telcos have faced failed or underachieving journeys, [4] in the last ten years especially in the phase of triple/quad-play services enablement of DSPs. Those are mainly due to the lack of well-defined expected outcomes, performance indicators and roadmaps with short/mid-term achievements. This resulted in lack of team motivation as the programs progressed, and incredibility was built with C-Level sponsors.

In this journey it is crucial to define the strategic drivers and common goals that are directly mapped to the enablement strategy. Despite having diverse motivating factors and a myriad of priorities that may be different market by market, there exists a common agenda for most telecom operators to digitalize with the need to accommodate customer demands and the ever-evolving need to accommodate game-changing technologies like Artificial Intelligence and Machine Learning. Despite the drivers (or the priorities of those) would change in different markets, those can be given as below applicable for most telecom operators:



Customer Experience: Enhancing customer experiences with the help of data and AI/ML

Time to Market: Agility of bringing new services, offers or tech to the market, being competitive against disruptors



Total Cost of Ownership: Reducing the cost of owning the tech end-to-end (E2E) for lifecycle, empowered by automation

Vendor Dependency: Disaggregation horizontally, vertically achieving diversity in ecosystem, unified supply chains.



Security: Avoiding any vulnerability in the era of cloudification, disaggregation and open interfaces.







Sustainability: Maintaining sustainable solutions not only limited to energy efficiency but also E2E carbon footprint DSPs should establish clear strategies that align to market specific dynamics introducing incremental tangible improvements driven by Key Performance Indicator (KPI) in a stepwise progressive manner. Implementation of new technologies are needed where data and automation are at the core of this journey to operate increasingly complex networks with reduced effort and to ensure future-proofing. This shall further be supported by introduction of proper processes used by trained professionals.



Disaggregation and Cloud as the Enabler of Digitalization

DSPs strive to achieve a “Micro” Service Oriented Architecture with clear separation of concerns to avoid limitations as services scale and maintain those in a cost-efficient manner. This brings the necessity of disaggregation where services and platform layers can be scaled independently.

Advancements in Cloud Computing and implementations in IT influenced Telco have impacted standardizations and practical implementations. This empowers disaggregation, [5] as one of the critical enablers of digitalization. It brings certain benefits over monolithic implementations as some can be given as below:

 TCO Optimization	 Break Vendor Lock-In	 Deployment Flexibility
 High Level of Automation	 Platform Innovation	 Ease of Repair

Nowadays, disaggregation is being discussed in two planes; vertical and horizontal.

Horizontal and Vertical Disaggregation

While there are significant differences in architecture and implementation methods between horizontal and vertical disaggregation, both aim to achieve benefits stated in the previous section. Currently, horizontal disaggregation is more mature and easier to implement due to the advancements

in standardization being driven by Standards Developing Organizations (SDOs). Moreover, vertical disaggregation is still seen as a concern. However, it represents the last mile Telco needs to take especially in today's cloud era. This approach makes it possible to deploy telco workloads with agility under complete control of TCO and supply chain, [6].

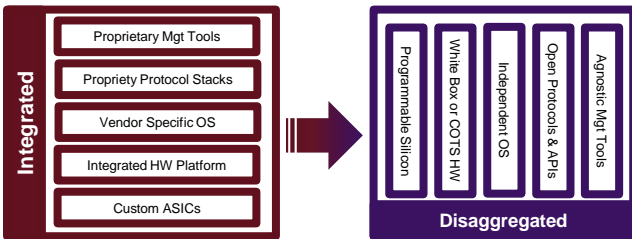


Figure 1 – Vertical Disaggregation; Integrated Systems vs Disaggregated Systems

Setting the Right Strategy for Vertical Disaggregation

Planning, deploying and managing disaggregated workloads requires a mindset shift both for processes and people skills. Adaptation of the new technology into the corporate framework is not a straight-forward process in the telecom sector. Therefore, establishing the right strategy with step-wise enablement of certain capabilities are crucial to meet short-to-long term goals. A proven method applicable for this scenario is to start with internal IT Cloudification, followed by Disaggregating Telco Workloads and finally enable Profitable Scaling with Edge Computing business cases.

Cloudify Internal IT: Starting with non-business critical IT workloads to adapt DevSecOps practices, processes adaptations and upskilling marks a solid beginning. Further roadmap planning of those service modernizations are critical to minimize disruptions to the business particularly in the very early phases. Services scoped in this phase would include ERP, SCM and CRM then telco-specific workloads as OSS, BSS. At this stage readiness of data centers are as well crucial to get prepared for further cloudification of network functions at scale.

Disaggregate Network Functions: This is the phase bringing mass scale benefits stated in the previous section as the number of workloads expected to shift is greatly higher

than previous phase. Besides, it is the critical stage to fully embrace new technologies to avoid customer impact. Network functions disaggregation would start with Core Network functions especially with 5GC launches, further planned for RAN regardless of vRAN/oRAN. Datacenters planning and network functions placement optimization are important activities to avoid bottlenecks as network scale. Furthermore, hybrid/multi cloud strategies shall be set in the early stages of this phase.

Profitable Scale at Edge: Use cases at the edge are still evolving for Telco. Selective use cases enablement with market interest is suggested. Potential initiatives include IoT aggregation, AI & Analytics at edge, industrial-grade 5G Private Wireless, Non-Terrestrial Networks (NTN) oRAN and radio data optimization.

Role of Infrastructure Services

The Telecom industry has been grappling with the drawbacks of black-box platforms and the challenges of keeping pace with the rapid innovation seen in the IT sector to meet today's business needs. This pain point has driven operators to explore new alternative approaches especially around white-box and open platforms. Nowadays technologies like openRAN, Software-Defined Networking (SDN) introduce openness and flexibility with the help of programmable hardware as General-Purpose Processors (GPP), Field Programmable Gate Arrays(FPGA). This eliminates the bottleneck of multiple vendors developing all new network features which historically would have taken at least couple of months. Disaggregation enables decentralized and open software-development where feature development sprints are measured in weeks rather than months.

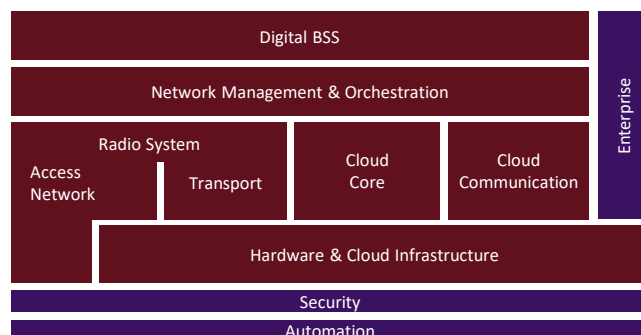


Figure 2 – Telco Blueprint Architecture in Cloud Era

Regardless of cloud enablement strategy, disaggregating infrastructure and platform

services from network functions is a critical milestone, [7] for next-gen Telco to overcome challenges mentioned earlier. Apart from that, enterprise level strategies for infrastructure yield greater benefits to supply chain, operational excellence, lower lifecycle costs and vendor independency. Recent developments in wireless communication technologies enables this disaggregation for entire telco blueprint except antennas, Radio Units (RU), in Access

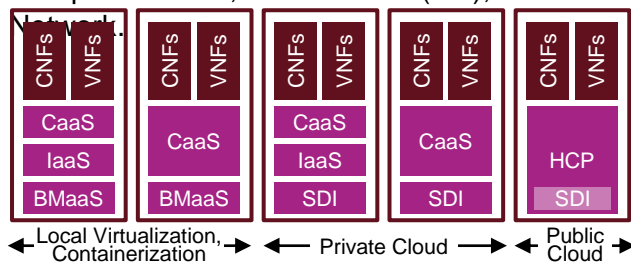


Figure 3 – Disaggregated Deployment Options

Operators have the flexibility to decide on deployment options per architecture strategy, workload needs or infrastructure readiness. However, it is crucial to enable certain services from the infrastructure layer.

Software Defined Infrastructure (SDI) or Bare-Metal as a Service (BMaaS) layers exposed by Hardware & Cloud Infrastructure domain shall be **robust**, highly available and achieve very low latency between its components and towards upper layers. Secondly, those shall not be specifically customized per workload, domain needs or vendor strategy; Commercial of the Shelf (**COTS**) approach shall be made enabled for greater benefits. On the other hand, those shall be made verified for telco workloads preferably with multiple vendors to achieve maximum **interoperability**. **Automation** supported with Artificial Intelligence/Machine Learning (**AI/ML**) is another key feature to manage telco like highly complex and dynamic environments. Auto-discovery, zero-touch deployments & provisioning, firmware updates are important for SDI, BMaaS layers. Similarly, those layers shall simplify operation and maintenance providing a **single pane of glass** to monitor and manage individual tenants or complete data centers. Finally, the infrastructure layer shall provide maximum **energy efficiency** to optimize Total Cost of Ownership (TCO) and reduce carbon footprint.

Vendors or Partners?

Disaggregation simply means a richer ecosystem and at least tens of new vendors for each service layer provider. However, awarding contracts to numerous vendors consumes extensive number of resources in case of time and effort, rendering it a not cost-effective process. In the meantime, complex system integrations expose risk to operators where procured technology does not always meet the E2E expectations during deployment phases. This would result in re-iteration of RFX process which might not fulfill the agility needs of today's business expectations. Hence, selecting technology partners to innovate together via leveraging proof of concepts, embracing agile methodologies by breaking projects into smaller tasks and modernizing procurement practices around disaggregation is key to lead in the highly competitive environment.



Figure 4 – Partner Selection Process, TM Forum [8]

Lenovo as a Trusted Partner

Lenovo aims to become the most trusted partner for telcos, empowering operators' intelligent transformation and helping to solve humanity's greatest challenges. Lenovo operates in 180 Markets globally, having 18 R&D locations and 35 manufacturing sites globally. Infrastructure Solutions Group in Lenovo provides latest technology server, storage, networking and SDI solutions at scale:



Think Agile: Hyperconverged solutions that simplify IT infra and accelerate time to value, freeing teams to focus on core business and new capabilities.



Think System: Sustainable computing platforms offering unmatched value, flexibility, and industry-leading efficiency to meet enterprise workloads' mission-critical demands with legendary quality and reliability.



Think Edge: Designed and built with the unique requirements for Edge Computing, it is versatile

enough to stretch the limitations of server locations, providing a variety of connectivity and security options.



TruScale: Infrastructure as a Service enhances ability to scale hardware, software and support capabilities as rapidly changing infrastructure needs evolve.

Lenovo's infrastructure solutions and on-top services deliver Smarter Technology for All from **Edge to Cloud, Analytics and AI** being reliable, open, secure and sustainable tailored for Telco specific needs.

Lenovo further supports its infrastructure solutions with state-of-the-art software components enabling future proof technologies.

Conclusion

Digitalization is not a goal, rather a journey for the Telco and disaggregation is a key enabler for it. Future's DSPs need to achieve both horizontal and vertical disaggregation with infrastructure solutions forming the core of their architecture whether situated in the data-center, near or far edge. A proven infrastructure solution shall be open, robust, highly automated and energy efficient to meet Telco specific needs.

Lenovo's tailored AI-optimized technology infrastructure solutions with best-in-class software capabilities are committed to deliver the latest technologies harmonized with excellence; helping Telco to boost their digitalization journey. Notably, Lenovo distinguishes itself as the sole data center provider with end-to-end manufacturing owning the entire supply chain for everything built to deliver a level of security and seamlessness that no one else can, anywhere in the world.

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Providing the most comprehensive **AI-optimized infrastructure** with best-in-class AI software natively integrated its services, Lenovo is committed to delivering technology that improves human outcomes. Lenovo is not developing tech for tech's sake; it is purposeful in delivering human-centered innovation.

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