Effective Strategies for Transport Network Deployments to Support Future Internet Services

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Abstract— **The ultimate goal of communication in future digital world is reliable, anytime-anywhere connection, and is got to be fast. Expectations from future networks will only rise, and there must be key strategic planning issues that must conceder today as we prepare for sustainable and ever – changing future. Connected world is creating major challenges for telco sector. This article presents basic principals for evolution toward a transport network ready to support new service model (cloud services which are hosted in data centers with architecture providing lower cost per bit).**

Key words- Bandwith; Cloud; Expiriance; Internet; ICT; LTE; NFV and Service

I. INTRODUCTION

Ultra-broadband access, big data and network intelligence have fundamentally transformed how information is exchanged and customer services are delivered. As enablers of future connected world and digital society, telcos are transforming into both value chain integrators and network operators, oriented around smart connection and digital service provisioning. This process is with a lot of challenges. The most important is related to traffic, which requires precise analytics regarding customer need, network status and service lifecycle. Smart traffic management at the user level can add flexibility to broadband operations and generate sustainable revenue. Telcos must adapt their operational systems for all- IP world, and such systems must be open, simple and this will require a much higher level of user experience.

Telcos need to redesign their operational processes, coordinate multiple service channels to effectively balance user experience with profit. Under this new model, the resources must be more efficiently designed. To support new service model, transport network must increase its flexibility in terms of automatic configuration and bandwidth allocation. To provide a superior user experience, the network must first be able to support digital services, and this can be realized across the entire infrastructure by virtualization. In the future, Telcos will need to carry out infrastructure virtualization to provide superior user experience, and leverage a series of technologies including Cloud, SDN and NFV to achieve this. In terms of services, new business models enable traditional businesses to provide digital services and cloud services, as well as various kinds of industrial Internet applications, thus maximizing the value of user experience. For end users, it can provide an online digital market place for digital services and products, including telco products and other products. For telco themselves, the future delivery platform can help them achieve development and operations goals, for example developing new services, marketing activities, or providing new sets of solutions through agile operations. Future deployments will embrace a multitude of novel technologies that will significantly change the system architecture and service delivery platforms. However, compared to previous migrations to next-generation technologies, this time the implementation will receive particular attention as a complete telco organization transformation, Figure 1.

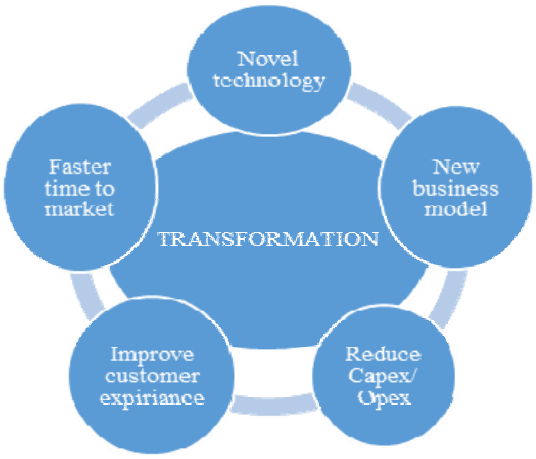

Figure 1. Telcos transformation environment

Current transport networks are designed to support classic services and new service deployment approach is changing the deterministic nature of traffic. Telcos must adapt for massive broadband traffic growth as the telecommunication sector moves from hardware-centric to software-controlled.

Total traffic is increasing significtly bringing unprecedented challenges to current transport network. New transport network architecture in future will enable users to access highly reliable anytime-anywhere services.

II. FUTURE INTERNET TECHNOLOGICAL SCENARIO

With the increase in traffic, content and applications, connectivity has become part of our work and life. The communication industry is approaching point where difference between fixed access (fast and reliable but static) and wireless access (slower and less reliable but flexible) are disappearing. In mobile world, existing 4G move toward 5G and LTE is converged in single LTE Advanced standard. It is possible to transmit data over high speed wireless networks (3G, LTE and in the future 5G) allowing Telco's to use wireless technology exclusively for access and fixed fiber for regional super networks. With LTE deployment, digital society is accelerate and makes mobile Internet the dominant network model. While transitioning to an IP infrastructure help Telcos address their current bandwidth demands; it does introduces some new level of management complexity that can impact service quality and often leads to strong OPEX increase. At the same time, as the scope and nature of services continue to evolve (in mobile from 2G Base Transceiver Station (BTS) to 3G+ NodeB (NodeB is a term used in UMTS equivalent to the BTS) , 4G LTE and now LTE Advance), efficient utilization in migration process requires using a mix of pseudowire, native and hybrid deployments and each require separate end-to-end management. The fifth generation (5G) network will serve as a key enabler in meeting the continuously increasing demands for future wireless applications, including an ultra-high data rate, an ultra-wide radio coverage, an ultra-large number of devices, and an ultra-low latency.

With new 5G deployments, a revolution in access networks is underway. The revolution is driven by the continued transformation of cellular networks offering to portable devices bit-rates and quality of service (QoS) comparable to those traditionally made available only through fixed networks. Driven by demand for video and the proliferation of data centers (DC), more than 75 percent of that traffic will stay in access/metro networks by 2017, as compared to 57 percent today, as forecast in [1]. Accommodating the enormous traffic growth in a cost-effective and service-efficient way is essential for the viability of telecom operators and motivates a major network re-design. In fact, these shifting traffic patterns are the result of bringing content closer to the users to better manage quality of experience (QoE). For instance, the most popular video content can be cached and delivered to users locally over access/ metro networks rather than being accessed from a central cache over the backbone network. Service-oriented Hybrid access Network and Cloud Architecture (SHINE) that orchestrates cloud with heterogeneous access and core networks, dynamically controlling intra and inter DC connectivity is presented in [2]. SHINE also includes an orchestrated management plane to provide elastic and resilient cloud and network resource provisioning, combining resources in geographically separated DCs.

Dynamic network resource allocation will combine both flex grid core and access networks according to traffic needs. Potential use cases addressing different markets of interest for any network operator, namely content delivery, and business, mobile, and fixed broadband access. The emergence of concepts like cloud computing, SDN, and ultimately NFV is expected to raise new possibilities for the management of service functions -SFs with a positive impact in terms of agility and cost. From a telco viewpoint these concepts can help to both reduce OPEX and open the door to new business opportunities. Telcos, with their already established distributed network infrastructure and hosting centers, are ideally positioned to take the lead in this area, as they can easily create a compelling end-to-end cloud proposition that integrates their network management capabilities, adapted to a more agile and cloud service- oriented operation model. However, concepts like cloud computing, SDN, and NFV are paving the way to handling SFs in a much more flexible and agile manner. The telco will play a key role in this scenario, and we have given some insights on how that can be performed in the near future. Special attention has been given to the modeling of SFs toward cloud resources and a platform for managing virtual SFs in a telco cloud infrastructure has been presented [3]

A. Advanced approach in performance measurments

Network planning is undergoing major changes in terms of the technologies and methodologies. As ICT industry becomes increasingly competitive, planning become ever more important. Process of standard telco metrics were initially designed to measure part of network and with new customer oriented approach misses the point. Key Performance Indicator (KPI) is a new standard to provide service oriented approach in performance measurements. KPI measurements provide monitoring the entire End-to-End (E2E) infrastructure from packet or circuit switched core elements to radio access network nodes, and detailed visibility to the underlying transport entities along the entire path of service delivery. This allows Telcos to achieve numerous efficiencies in operating and engineering their networks and also standardize their performance management needs. Migration process in transport shown in Figure 2 is followed by total transformation of ICT industry and business model. New LTE networks is data oriented technology and enables proactive operation and moves focus on improving E2E customer experience through core, radio, and IP planning and optimization.

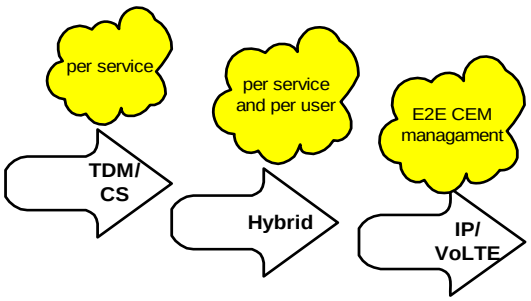

Figure 2. Migration process

Introducing performance measurements in ICT organization shows how to improve whole network efficiency including network design, network deployment, dynamic scaling, service and capacity forecast, and troubleshooting [4], [5]. New mobile network deployments are unprecedented in its complexity and represent a great challenge to MSPs and telco business transformation. Transformation process is very

complex and covers cultural, engineering and business transformation [6], [7]. The main goal is to move from just engineering point of view to customer oriented approach in process of maintaining the strength in core business while unlocking other areas like data analytics, music distribution and payment channels. The general concept of performance indicators is that network elements and probes, which are used as service resource instances, are placed at certain nodes of the network infrastructure to pick up performance-related data, e.g. cumulative counters of protocol events. In constant time intervals or in near real time this performance-related data is transferred to higher level service assurance and performance management systems. It includes the following procedures: performance measurement setting, performance data import, performance data display, performance data synchronization, and performance data northbound export [8].

III. Effective Stretegies for Transport Network Deployments

Telco's occupy a privileged position in the growing digital economy and must evolve in parallel with infrastructure to realize maximum efficiency. Strategy for development of digital future in B&H is given in [9]. Challenges of ensuring a success deployment of future digital infrastructure are significant just as potential to improve economic development and quality of life. To deliver a superior experience to users, networks need a new technology approach. New system approach development strategy seeks to build fully open ICT architecture to enable an industry shift from user experience to value creation across the industry. The continues and fast evolution of technologies as well as user requirements drives to revisit new architecture and network reconstruction. In contrast to traditional management approach, new deployments require to include management as part of the functionality of a managed object. The process of a shift from hardware-centric to software-controlled, service-focused networks is in a progress. Basic principal is to move from simple connectivity to an E2E concept.

In transport part new deployments provides evolution to all- IP with increase in scalability and efficiency. Network part must include E2E capabilities as essential for supporting legacy and IP networks (support converged services). Service part has to deliver all services at a competitive price with profitable margins, including high quality and personalized approach. All resources need to be used more intelligently and efficiently, primarily according to the demands of the service and user. Telcos running different kinds of access, core, transport and service technologies and user experience to a considerable effort in applying their service and business requirements to the network and element management systems of different domain.

Future deployments that support Future Internet-FI (Content +Service management) will reshape the telecom infrastructure in four key ways, as:

- Architecture reconstruction: In the information age, service provision, data exchange, and business activities will all be digitized. Storage, processing, and switching information will happen in data centers alongside business processing and transactions. DC-centered ICT architecture will become the center of the digital era.
- Network reconstruction: After the control and forwarding planes are separated and network resources are virtualized, networks can be managed in a more unified and global way to ensure better resource scheduling, higher efficiency, and simpler software upgrades. With the decoupling of hardware from software and NFV, the functions of network devices will depend on more than a certain piece of hardware. Network elements can share the same hardware platform (a hardware resource pool) to realize flexible resource sharing. In this way, networks can realize service automation and scalability based on service scale, and implement fault isolation and self-healing based on system autonomy. This improves network utilization, deployment, and maintenance efficiency, and accelerates service provision.
- Service reconstruction: As cloud computing technologies mature, cloud services will become more acceptable, creating an enormous market. Different businesses require different cloud services, which opens up countless strategic opportunities. The ICT infrastructure needed by enterprise cloud services is fundamental to telcos. Leveraging cloud computing for business model transformation, telcos will seize the opportunity created as enterprises shift to ICT infrastructure.
- Operational reconstruction: FI oriented operations allow users to enjoy on-demand, real-time, and customized services in an anytime-anywhere way. These features also help telcos offer more intelligent customer services based on big data analysis, understand customer requirements, and carry out precision marketing. Social networking platforms aggregate industry innovations to offer a wide range of services, [10].

New communication model represents two major changes to telco sector. First, the model of communication has changed. One–to-one bidirectional voice and massaging communication are being moved by many–to-many communication. Second, the dominant power of industry is shifted from network centric to open Internet platform, due to the opening of standards and technological advancement, as given in Figure 3. Transport network have to be built upon the following rules, [11]:

- Bandwidth on demand concept, increasing resource utilization based on real time requests
- Multilayer network control
- ICT extensions to path computation in order to achieve optimization of used resources

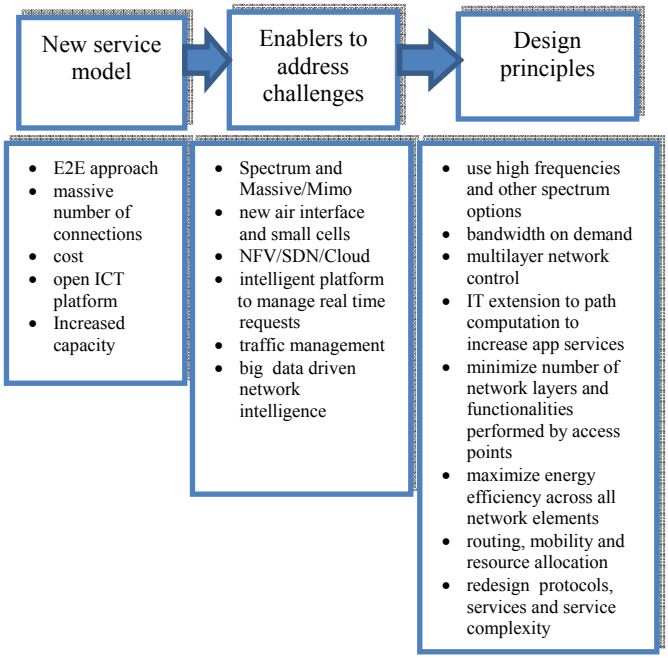

Figure 3. New communication model.

Flexible transport network will help to fulfill requirements of changing traffic demands, adapting to the needs of the service in cost efficient way. Bandwidth on demand concept is the way to adapt resources utilization and dallying as much as possible Capex increase in transport infrastructure. The information age is a time of apparent change, with success becoming increasingly tied to user experience. Telcos will exist and thrive in this fiercely competitive market by creating personalized approach [12].

To build future-oriented telecom networks and operations that customers can carry out business transformations and build a FI approach is ultimate goal for every player in digital society. In this FI model, users access their assigned resources and the application through a telco infrastructure. Telco network is the key point to efficiently connect users to services and applications which now is consumed more independent of where either the resource or user is located. Integrating computing, storage, high-speed networking and management functions, future software platform is making the best choice for converged transport infrastructure.

IV. CONCLUSION

Telcos, as enablers of digital economy, are transforming into value chain integrators oriented to smart connection and digital service provisioning. A lot of challenges remain in this process to enabling strategic transformation to digital world. Telcos must upgrade their infrastructure for digital service delivery, in order to adapt transport network capable to providing the increasing capacity on demand in an elastic and cost-efficient way. This article discusses need for evolution toward a transport network ready to support new service model as well as provide higher bandwidth allocation on demand and optimization of available resources with automatic network configuration.

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