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A REVIEW STUDY ON SDN AND NFV INTEGRATION IN MOBILE NETWORK ARCHITECTURE

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Abstract- The major drivers for the mobile core network evolution are to serve the destiny demanding situations and set the manner to 5G networks with want for excessive potential and occasional latency. Different technologies inclusive of Network Functions Virtualization (NFV) and Software Defined Networking (SDN) are being taken into consideration to deal with the destiny wishes of 5G networks. However, destiny applications inclusive of Internet of Things (IoT), video offerings and others nonetheless unveiled can have specific requirements, which emphasize the want for the dynamic scalability of the network functionality. The method for efficient network useful resource operability appears to be even greater essential than the future network element costs. This paper offers the evaluation of various technology inclusive of SDN and NFV that provide specific architectural alternatives to deal with the desires of 5G networks. The alternatives below paying attention on this paper may also vary specially inside the volume of what SDN concepts are implemented to cellular unique features or to move network features only.

Keywords— SDN; NFV; 5G, Virtualization.

I. INTRODUCTION

The foremost motive force for the evolution of the mobile Evolved Packet Core (EPC) networks is to pave the manner to 5G networks with a view to require significantly higher capacity, lower latency and big network get entry to. Furthermore, there can be a couple of sorts of applications with very one-of-a-kind requirements, which emphasize the want for dynamic scalability of the network functionalities. Mobile network operators are dealing with a developing task a way to the explosive grow in data traffic because of the superiority of smartphones and streamed audio and video services. In this new paradigm, the operators want to control the visitors load, and meet growing customer and company expectancies for extraordinary overall performance at the same time as presenting ubiquitous broadband connectivity. Cloud computing and Network Function Virtualization (NFV) are evolving from the standard IT data center applications to the brand-new areas. Cloud computing is a model for allowing ubiquitous, convenient, on-demand network get right of entry to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services). In computation and storage environments there are numerous rising technologies and enablers that might deliver viable processing ability to be applied for the mobile network networks applications. SDN decouples manipulate and data planes leveraging preferred protocols allowing far off control and operation of data planes to third-party elements. A synchronization protocol is needed for communicating each plane; one such protocol is Open Flow. This paper describes the proposed architecture primarily based totally on SDN and NFV and its deployment in a tested to confirm that the simple assumptions for 5G networks are fulfilled.

II. REQUIREMENTS FOR NFV AND SDN INTEGRATION IN MOBILE NETWORKS

Any new technology has to fulfil a fixed of primary assumptions that facilitate the deployment and adoption. Following are indexed a few primary assumptions and the way they are probably relevant to SDN and virtualization technology proposed for 5G networks. These primary assumptions include greater resiliency, progressed performance, lower latency, seamless migration and built-in monitoring. Besides those technical assumptions, the proposed technology needs to make sure right service provisioning with an applicable price discount to operators.

A technology to be a part of 5G need to offer a clear migration route with correct compatibility with the legacy systems.

The integration of SDN and network feature virtualization as proposed technology for 5G need to limit the adjustments in network elements, hence offering a continuing migration primarily based totally on operator needs. This permits the incremental updates of network elements in certain components of the network even as maintaining legacy elements in different components of the network. Security is of maximum significance for 5G networks, because it needs to be taken into consideration for all layers, in network capabilities in addition to physical and virtual elements. Starting with the SDN controller that has access to the complete network architecture, to the real nodes that carry out network features, the system ought to assure a crucial stage of security and excessive availability.

Another essential assumption for a powerful deployment is having correct network monitoring. Besides assessing safety, network monitoring enables verification and validation of Service Level Agreements (SLA), coping with performance (Quality of Service QoS) and consumer experience (Quality of Experience QoE), troubleshooting, and the evaluation of optimizations and use of resources. On one hand, network virtualization unites new necessities for mobile network monitoring however on the opposite and it additionally gives approach for imposing superior network monitoring solutions.

Service provisioning and optimization is any other assumption required to make certain aid availability. This may be performed through a single orchestrator entity. This assumption may be deployed in SDN networks through the use of control applications which have complete view of network configuration. This collectively with status data supplied via means of network monitoring and facts collection structures allow mobile network orchestrator application to optimize service (e.g. latency) and/or resource utilization less difficult than conventional networks that want to depend on signaling. The orchestrator can manipulate a couple of network factors through the control applications, probably from a couple of vendors.

Above all, cost reduction is a prime requirement. Virtualization of the LTE network is predicted to make a contribution on this regard, taking advantage of standardized network elements and higher aid usage with SDN. However, virtualized network elements might also additionally boom they want for greater computing power, greater complicated network management, and create greater complicated value networks. The internet advantages of SDN in LTE networks have to be examined.

III. VIRTUALIZATION AND CLOUDIFICATION IN MOBILE NETWORKS

Virtualization of network elements is one of the important technologies proposed for adoption in 5G networks. Virtualization decouples a system's provider model from its physical recognition in an effort to growth the computation overall performance of a system (e.g., to serve an accelerated quantity of users). The most important gain of virtualization is visible in cloud computing wherein technologically wonderful structures are introduced collectively onto an unmarried virtualized domain (a set of physical servers).

However, distribution of computation over a couple of servers famous the query of load balancing at levels: VM scheduling and load distribution. The VM scheduler of the cloud platform ought to, ideally, distribute the computation evenly among the physical servers, simultaneously preserving the wide variety of required servers as little as feasible to serve all clients. This allocation may be later changed via means of migration of VMs to different servers. The simplest limiting necessities emerge from fault tolerance:

the VMs ought to be allotted to mitigate the results of failing hardware. On the alternative hand, service load balancing shares the work among comparable service elements. If the employees live inside the same cloud, the load need to be allotted evenly to all of them.

Cloud computing may be defined as distributed computing surroundings over a network which has the functionality to run an application or software on many related computer systems on the equal time. The National Institute of Standards and Technology (NIST) defines cloud computing as: "Cloud computing is a model for permitting ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that may be swiftly provisioned and launched with minimum management attempt or service provider interaction.

The cloudification of mobile networks has both drivers and constraints. A motive force for that is the consistent conflict of network operators to preserve their commercial enterprise profitable. One big supply of rate is the usage of committed network hardware to offer the specified offerings. To keep away from this, service providers attain virtualization of network services. The virtualized features in turn could be supplied on the pinnacle of a cloud infrastructure.

A critical part of the cloudification attempt is the choice of underlying technologies that manipulate the computing infrastructure of the cloud. There are a variety of things that have an effect on the choice of choosing the ideal cloud infrastructure. Firstly, the massive quantity of computation, collectively with security concerns, caused the choice of the private cloud method. The private technique permits the location of computing resources in the network architecture, in place of the general public Internet, which ends up in decreased latencies and enhances the control of the general infrastructure. Secondly, the maximum rational choice is to offer an infrastructure cloud. Cloud services are labeled into 3 levels of abstraction: IaaS, PaaS, and SaaS. These levels require different levels of competence from the cloud user.

It is a usual exercise to rely upon open-source platforms to keep away from supplier lock-ins or construct custom functions that enlarge the platform capabilities. NFV is quite complementary to SDN. These subjects are jointly useful however they aren't dependent on each other. Network capabilities may be virtualized and deployed without an SDN being required and vice-versa. Telecom or telco cloud is the cloud tailored for telecoms. The fundamental concept is to make the most of cloud computing as infrastructure for the future mobile network deployment and operation. The goal is to increase the cloud technologies and its benefits to the network, which is likewise the purpose of the ETSI NFV Initiative.

IV. INTEGRATION OF SDN IN MOBILE NETWORKS

There are numerous papers describing the combination of SDN in mobile networks. They endorse including SDN dealers inside the mobile network elements. Soft RAN proposes a centralized architecture as an opportunity to the disbursed control plane presently carried out in LTE networks. It abstracts out all of the base stations deployed in a geographical vicinity as a digital big base station even as thinking about all of the physical base stations as simply radio elements with minimum control logic. These radio elements are then controlled via means of a logically centralized entity which makes control plane choices for all of the radio elements inside the geographical vicinity.

To make sure control-aircraft scalability, a neighborhood agent at the bottom station caches the provider policy for every connected UE. Other work defines that every base station has an access transfer that performs fine-grained packet type on trace from UEs.

The rest of the cellular center includes core switches, which include some gateway switches linked to the Internet. These core switches carry out multi-dimensional packet type at excessive speed, however best for some heaps or tens of heaps of rules. We expect that the packet processing hardware can carry out arbitrary wildcard matching at unique protocol layers e.g. IP or TCP/IP.

V. SDN BASED MOBILE ARCHITECTURE

Currently there are only some in-depth scientific contributions managing mobile network architectures that integrate the principles of cloud computing, SDN and NFV. First architecture proposals - in particular inside the context of Cloud-RAN - consist of the mapping of the network capabilities which can be required for the mixing of mobile networks with SDN generation. These capabilities are only the mobile network control functions, i.e., MME, HSS, PCRF and the control planes of S/P-GW. Additional capabilities consist of transport, load balancing, security, policy, charging, monitoring, QoE or useful resource optimization. These capabilities run at the Mobile Network Cloud as SDN applications and put into effect the favored feature through SDN generation. With this technique, the consumer plane is best composed by means of strategically positioned SDN successful switches and normal switches. SDN switches should both update in part or absolutely the current mobile transport network.

The required EPC network elements run at the cloud to gain from virtualization. Latency constraints should have an effect on the deployment place of a few compute nodes running virtual. Some strategic capabilities can be positioned near the eNBs or maybe on a few switches, developing a decentralized cloud. In the proposed structure, the EPC network elements keep current 3GPP interfaces to desire migration from legacy cell networks. That will permit a continuing migration. Seamless 3-Step Migration Towards SDN Enabled EPS represents a 3-step migration situation the use of Open Flow as SDN communicating protocol. The first use case (i.e. UC1) follows a conventional routed LTE structure, with legacy nodes. The 2d use case (i.e. UC2) introduces the SDN generation for handling layer-2 switched paths at the cell core network, whilst nevertheless retaining the legacy nodes. This situation constitutes a hybrid technique permitting isolation of tenant networks the use of general encapsulation technologies, i.e. VLAN or MPLS. Finally, the 0.33 use case (i.e. UC3) depicts a totally compliant SDN network. This is due to the fact the 3GPP tunneling specifics aren't supported by means of current OpenFlow specifications and consequently had been changed by means of compliant and greater powerful encapsulations. These use instances can coexist permitting hybrid deployments to take benefit of present network appliances.

VI. TESTBED AND RESULTS

The proposed structure is deployed in a testbed in which using the proposed technology which includes NFV and SDN are analyzed towards the simple requirements. The testbed includes eNodeB supplied via means of Nokia, OpenFlow enabled MPLS transfer supplied via way of means of Coriant Oy, site visitors monitoring probe supplied via way of means of EXFO, S/P-GW is open supply nwEPC (SAE Gateway), Ryu SDN controller and the relaxation of the additives (MME, NAT and CES) were carried out via way of means of the studies institution at Aalto. The SW additives are running on Aalto statistics center the use of Openstack Icehouse release. The HW additives are blade servers that run the cloud as a separate FlexNIC with Intel Xeon E5-2665 (2.4-3.1 GHz, 64-bit, eight cores, HyperThreading), 128 GB DDR3-1600 RAM, one hundred fifty GB hard disk storage and 10 Gbps HP Flex-10 networking drivers. In the testbed we've got carried out the 3 eventualities defined in segment V (i.e. UC1, UC2 and UC3) to confirm the simple requirement of migration. A set of probes are protected to guide the tracking requirement and offer non-stop data at the network status. In each UC2 and UC3 we use SDN to feature layer 2 MPLS tagging to the GTP packets so we are able to carry out traffic engineering inside the backbone, so that you can cope with the requirement on service provisioning and optimization. UE data packets are switched from the eNB to the S/P-GW throughout the middle network using numerous paths. Load balancing among OF number 1 and OFS#2 hyperlinks is viable primarily based totally on the MPLS identifiers. In UC3 we display the value discount requirement in which using SDN replaces absolutely the data plane, a part of well-known NW factors which includes SL/P-GW. Most of the NW elements are running in the cloud using commodity servers. Besides value discount, this situation suggests powerful service provisioning and optimization in which extra virtualized centre containers might be delivered to offer NFV features for dealing with particular flows and install new services. These centre containers ought to deflect HTTP packets to proxy servers for top-rated caching or the centre containers ought to pick out suspicious flows and redirect them to firewalls or honeypots to fulfill the security requirement.

VII. CONCLUSIONS

As a foundation for 5G networks, the suggested architecture comprises the integration of SDN and the use of NFV. In order to satisfy the conditions stated as required for the adoption of any new technology in mobile networks, an innovative integration of SDN is presented. A proof-of-concept testbed based on this architecture has been submitted to ETSI. This testbed was built with off-the-shelf eNodeBs and MPLS switches that support SDN. The results suggest that combining SDN and NFV solves some of the requirements for 5G mobile networks. The findings also show that when SDN is utilized in the backhaul, it improves the efficient and optimum utilization of resources while lowering overhead. However, we have discovered several drawbacks in the offered technology.

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