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TSDSI-SGN-NIP281-V1.0.0 New Item Proposal

[Form to be used for proposing a new item for standardization, study, or consideration by TSDSI]
[Instructions for filling are given at the end of the Form]

Study/Work Group meeting for which the contribution is submitted	SG-Networks	
Date of Meeting	2nd-3rd June, 2022	
Title	NIP for futuristic architecture of 5G Backbone and Slicing	
NIP Number	*TSDSI-SGN-NIP281-V1.0.0*	
Proposed Outcome *(Please tick anyone)*	Study Item	~~Work Item~~
Supporters:		
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1.   Description

The future wireless communication networks are paving the way for a myriad of applications, each having distinct requirements. A clear and urgent priority of every Indian citizen today is secure, reliable and affordable connectivity. The Covid-19 pandemic has disrupted individual lives, while raising the demand for broadband connectivity. Several schemes under the Government of India aim at improving the existing infrastructure and connectivity, for a digitally empowered country. The 5G WCNs and beyond play a crucial role in fulfilling these objectives.

Advancements in the technology have been accompanied by advancements in the applications, demanding high bandwidths, low latencies, high reliability and better energy efficiency. Lately, video surveillance has experienced a surge in India due to smart city initiatives in different cities, as well as privacy concerns. The scope of these applications includes various verticals like local markets, business complexes, railway/bus stations, and the like. The surge in the use of this technology is accompanied by high expectations for the quality. Apart from surveillance [1] use cases, these verticals also demand undisrupted wireless and internet connectivity to the subscribers in the range.

Defining resources and ensuring appropriate isolation among them, for the specific verticals for the Indian scenario, is thus essential. The 5G capabilities of fast data transfer, ultra-low latency and high reliability can be achieved by network slicing [2], which provisions the service requirements of the various verticals in a customized manner. Network slicing technology which enables sharing common network infrastructure across various verticals and network operators will play a crucial role.

Network Slicing needs to be studied and explored in depth, to identify issues and possible futuristic architecture for the Indian scenario, which is one of the objectives of this NIP. Customized virtual networks are available on a

shared physical infrastructure with network slicing. These customized demands are met by provisioning network slice instances (NSIs), on demand, to the individual applications. In the considered scenario, it will involve making slices available for local markets, for distinct business complexes, campuses, etc., which will help in better connectivity and surveillance of the vertical, while ensuring resources for the same.

The advent of network slicing functionality in 5G deployments offer an opportunity for use in "private networks" as well to service relatively low-end business entitites to enjoy guaranteed services using these private networks as shared resources in a campus/markets/local area. These enterprises are currently using software defined wide area networks (SD-WAN) technology for creating enterprise-wide virtual private networks.

Network Slicing has been widely explored by various standardization bodies, which include NGMN Alliance, ETSI, ITU-T, 3GPP [3]. Several initiatives for slicing the various 5G domains have been studied in literature, but those still lack adequate abstractions. Virtualization of the 5G domains is expected to reduce the complexity of the E2E sliced networks [4].

However, slicing has to be supported by the 5G backbone architecture for its end-to-end implementation. Architecture for the 5G backbone which connects various access networks across the country or worldwide, supporting slicing is still a challenge, especially for the IPv6 address space. The current internet backbone architecture has many limitations, as discussed in [5]. The current 5G backbone architecture envisages using MPLS and segment routing which are not scalable over a large region or globally. NEWIP proposed by a study group steered by China has been criticized for its centrally controlled design [6]. [5] proposes a promising architecture, which needs to be further explored.

Both these aspects, i.e. backbone architecture and slicing, need to be studied and explored in depth to identify issues and possible futuristic architecture for the Indian scenario, which is the objective of this NIP.

2.   Objectives

The fundamental responsibility of the WG would be to generate an enhanced architecture for backbone and slicing in 5G and beyond 5G wireless communication networks. In that direction, the following tasks will be conducted:

- ▪ To survey current status of 5G backbone and slicing architecture and standards, identify the issues and challenges and possible futuristic architectures and directions
- ▪ Architecture and technology used by current mobile operators for backbone routing and slicing including issues and challenges
- ▪ Study of 5G proposed standards and protocols
- ▪ To explore virtualization aspects of SDN and NFV, which are the building technologies for network slicing, along with SDN, NFV interfaces (north, south, east and west bound)
- ▪ To provide a cost-effective solution for the verticals, while considering the QoS challenges in sliced networks
- ▪ Use case demo with unified communications
- ▪ Cooperating with the global SDOs and TSDSI's internal working groups, so as to define enhancements for a common futuristic architecture for transport network and slicing.

Criticality:

The current standard architectures for the backbone networks and network slicing are facing several challenges. Introducing architectural enhancements is important due to the diverse and flexible nature of the 5G networks. The enhanced architecture would target to ensure scalability and fault tolerance for the verticals, while promising a high level of security and privacy. An optimized, flexible architecture, which also ensures isolation among the slices, will ensure resource availability too.

3.   Impact
Timely addressing this work can result in an efficient architecture for the backbone networks and network slicing. Such an architecture will benefit the service providers significantly and provide a higher level of security. A right framework is paramount for the 5G and beyond networks, with cost effectiveness.

4.   Relation with any existing/planned domestic or international standards/TSDSI Roadmap

4.1 Dependence on/modification of any existing TSDSI, national or international standard…..~~Yes~~/No

4.2 Dependence on/modification of any ongoing work in TSDSI, national or international standards organization…….. ~~Yes~~ /No

4.3 Does the proposal relate to any item in the TSDSI Roadmap?..~~Yes~~ /No

4.4 Any other information

<In case the answer to 4.1,4.2 or 4.3 is yes, please provide details of organization/standard/work item/study item and their references to the standards/ongoing work or details of Roadmap item as the case maybe.>

5.   References

1. Deng, W., Song, J., & Gao, J. (2021, August). A QoS Communication Scheme for Video Surveillance in Wireless Mesh Network. *IEEE International Conference of Social Computing and Digital Economy (ICSCDE),* pp. 34-37, 2021.
2. Barakabitze, Alcardo Alex, et al. "5G network slicing using SDN and NFV: A survey of taxonomy, architectures and future challenges." *Computer Networks*, vol. 167, 106984, 2020.
3. Technical specification group services and system aspects; Study on enhanced access to and support on network slice," 3GPP, Tech.Rep. 22835, 2021. [Online]. Available: https://www.3gpp.org/ftp/Specs/archive/22series/22.835/22835-i10.zip.
4. Suresh C Gupta, et al. "Layered Architecture and Virtualization for 5G slicing." *2021 IEEE 5G World Forum (WF)*, 2021.
5. Gupta, Suresh C., Gaurav Gupta, and Huzur Saran. "New Vision for 5G Backbone Network Architecture." *IEEE 3rd 5G World Forum (5GWF)*, 2020.
6. Chen, Zhe, et al. "New IP framework and protocol for future applications." *NOMS 2020-2020 IEEE/IFIP Network Operations and Management Symposium*., 2020.

6.   Level of Urgency
Important

7.   Time plan for completion of work

Timeline	*SG meetings*	*Milestone*

8.   NIP Revision History

SG/WG Meeting	Version