By Parveen Kumar Agarwal, Director, Sales Engineering, UTStarcom India Telecom

As 5G technology matures and operators prepare for its commercial roll-out, network infrastructure must also be geared up to meet challenges. 5G promises a huge step forward compared with 4G in terms of network and user throughput, capacity, energy efficiency and supported use cases, such as applications including internet of things, machine-to-machine, vehicle-to-everything and augmented/virtual reality. 5G introduces network slicing, a technology that enables network resources to be allocated and tailored. Slicing enables operators to provide the required quality of service, bandwidth and latency to fit different use cases that fall under different service categories, including enhanced mobile broadband, ultra-reliable and low-latency communications, and massive machine-type communications.

New technology, new challenges

Efficient deployment and operation of 5G networks will rely heavily on the ability of transport network infrastructure to meet a complex mix of requirements. Besides very high bandwidth and network densification, the new requirements include low latency, network slicing, accurate timing delivery and service availability among others. Currently, the telecommunications industry is faced with the huge challenge of meeting all these needs in a single transport network infrastructure.

SPN technology brings many benefits

Slicing packet network (SPN) technology defines a new network architecture designed to address these challenges and to provide an optimal highly scalable and flexible transport for 5G and other modern applications. The architecture cleverly integrates high performance Ethernet, flex Ethernet (FlexE), segment routing over MPLS, MPLS-TP and optionally, DWDM technologies with accurate time synchronisation support and SDN control. Coupled with SDN's global network view and its automation capabilities, these networking technologies enable excellent network agility and scalability, soft and hard network slicing, extra-low latency and

timing accuracy, high capacity, and efficient network operation.

The SPN network architecture includes three major logical layers:

• Slicing packet layer: It implements packet forwarding and routing functions. Supports tunnelling mechanisms based on segment routing transport profile (SR-TP), segment routing best effort (SR-BE) and MPLS-TP. Further, it provides mechanism to support various services, including L2VPN and L3VPN that can be encapsulated within SR-TP, SR-BE or MPLS-TP/PW tunnel, and CBR transparent bit stream that can be mapped directly on to a FlexE channel.

• Slicing channel layer: Slicing Ethernet provides channelisation and time slot processing of FlexE groups, supports 66B-block cross-connect for low-latency forwarding and end-to-end channel layer OAM.

• Slicing transport layer: It implements transport based on the standard OIF FlexE or Ethernet IEEE 802.3 using a variety of interfaces up to 400 Gbps. Optionally, DWDM can be used to transport FlexE or Ethernet over large distances.

Segment routing and flexible Ethernet are among the key technologies that help overcome limitations of legacy networks and enable the required flexibility, performance and scalability.

FlexE and its advantages

FlexE, defined by OIF as the FlexE 2.1 Implementation Agreement, updates Ethernet technology to provide a variety of MAC rates that can be equal, smaller or larger than the standard Ethernet rates. The technology supports interface bonding for FlexE groups of multiple 50/100/200/ 400 Gbps interfaces, as well as subrating and channelisation of links with multiple logical FlexE clients within a physical or bonded Ethernet link. With a TDM-like calendar that interacts with the existing Ethernet 64b66b mechanism, FlexE supports TDM multiplexing and mapping of FlexE clients into FlexE groups, providing efficient link aggregation and hard isolation.

Segment routing and its advantages

Segment routing implements the concept of source routing, which enables a sender (source) to define a route that a flow of packets should take through the network as an ordered list of instructions (segments). Thanks to this simple idea, segment routing significantly simplifies networks, eliminating the need for all nodes to maintain state as well as removing the need for complex distributed signalling protocols like LDP and RSVP-TE. It overcomes the scalability issues of legacy networks. SPN architecture uses the standards-based segment routing over MPLS data plane technology, and takes it one step further by implementing SR-TP to make the technology even better suited for carrier-class telecom applications. The combination of SDN-based service orchestration, intelligent path computation with SR policy and SR VPN services provides the foundation for flexible soft network slicing.

SPN technology gains momentum

SPN technology is backed by key industry players, including prominent vendors, operators and standardisation bodies.