ENI PoC #19: Space-Ground Cooperative Network Slicing Progress Update

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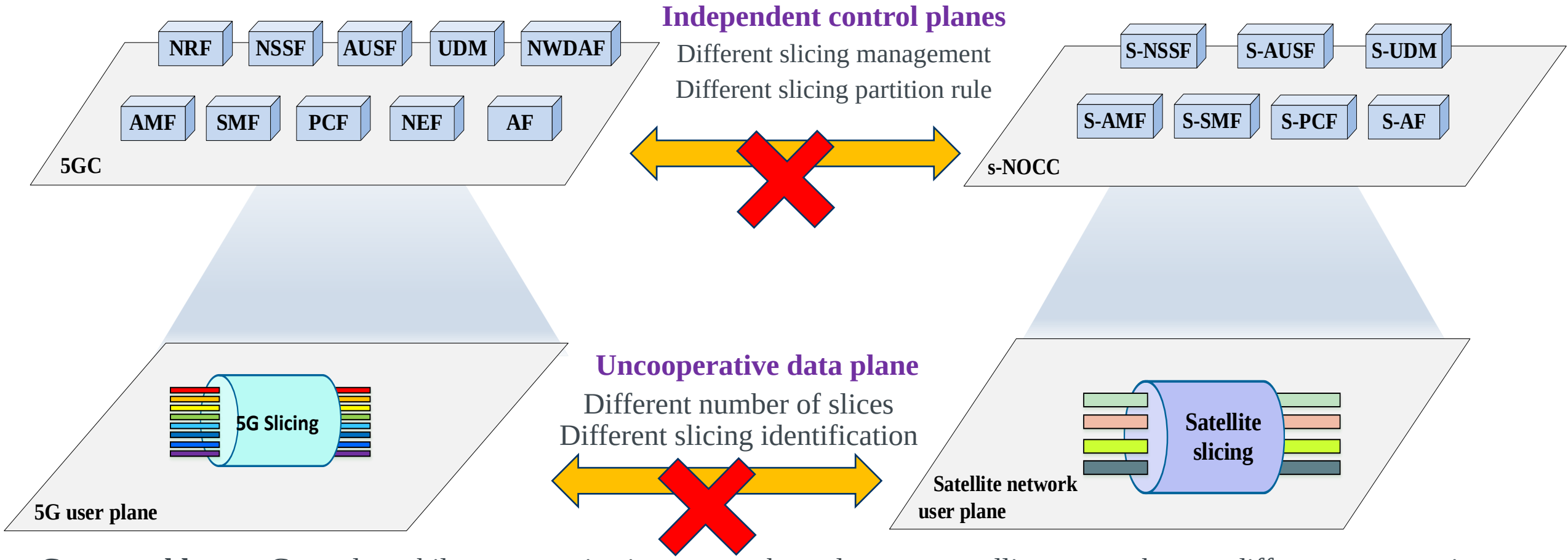
ENI PoC project #19: Space-Ground Cooperative Network Slicing

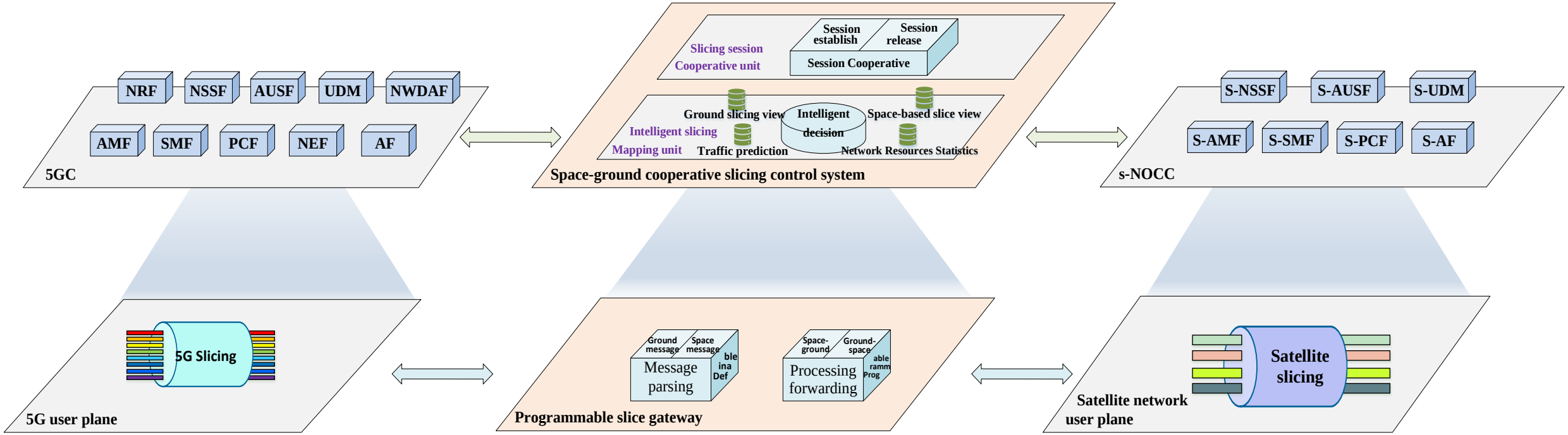
Core problem： Difficulty to interconnect 5G network and satellite network slices



Core problem： Ground mobile communication network and space satellite network are different on service classification of network slicing, number of slices and slicing construction. As a result, the slices of the two networks cannot be directly interconnected.

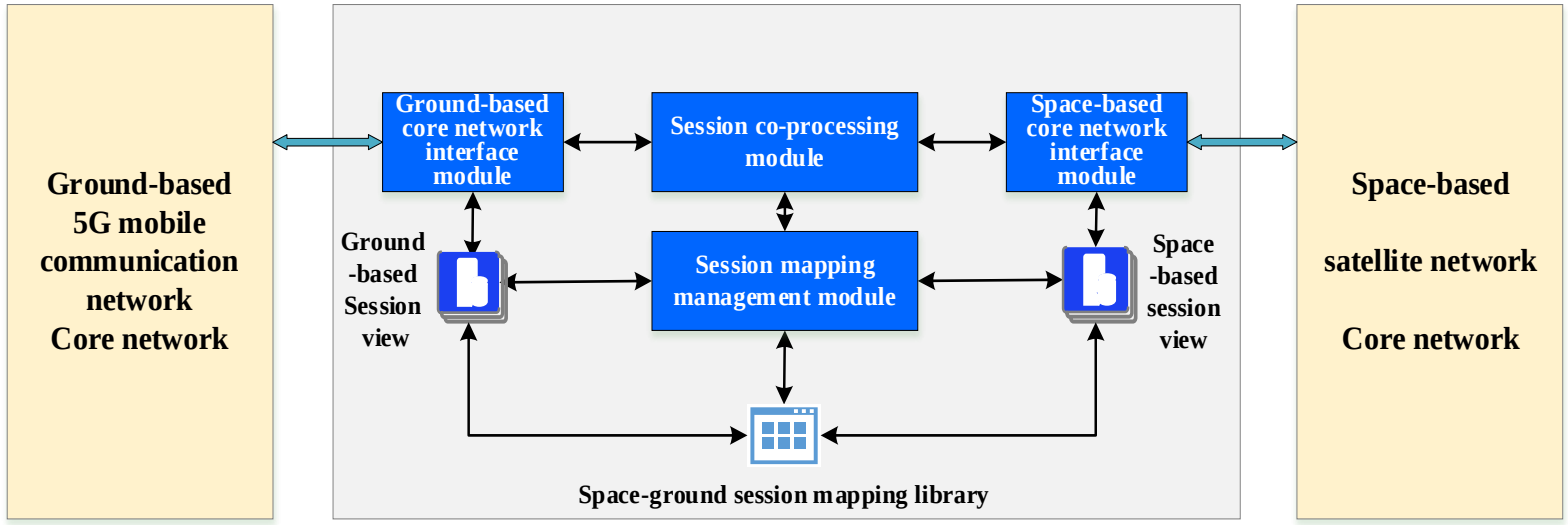
ENI PoC project #19: Space-Ground Cooperative Network Slicing

Innovation 1: Architecture of Space-Ground Cooperative Network Slicing



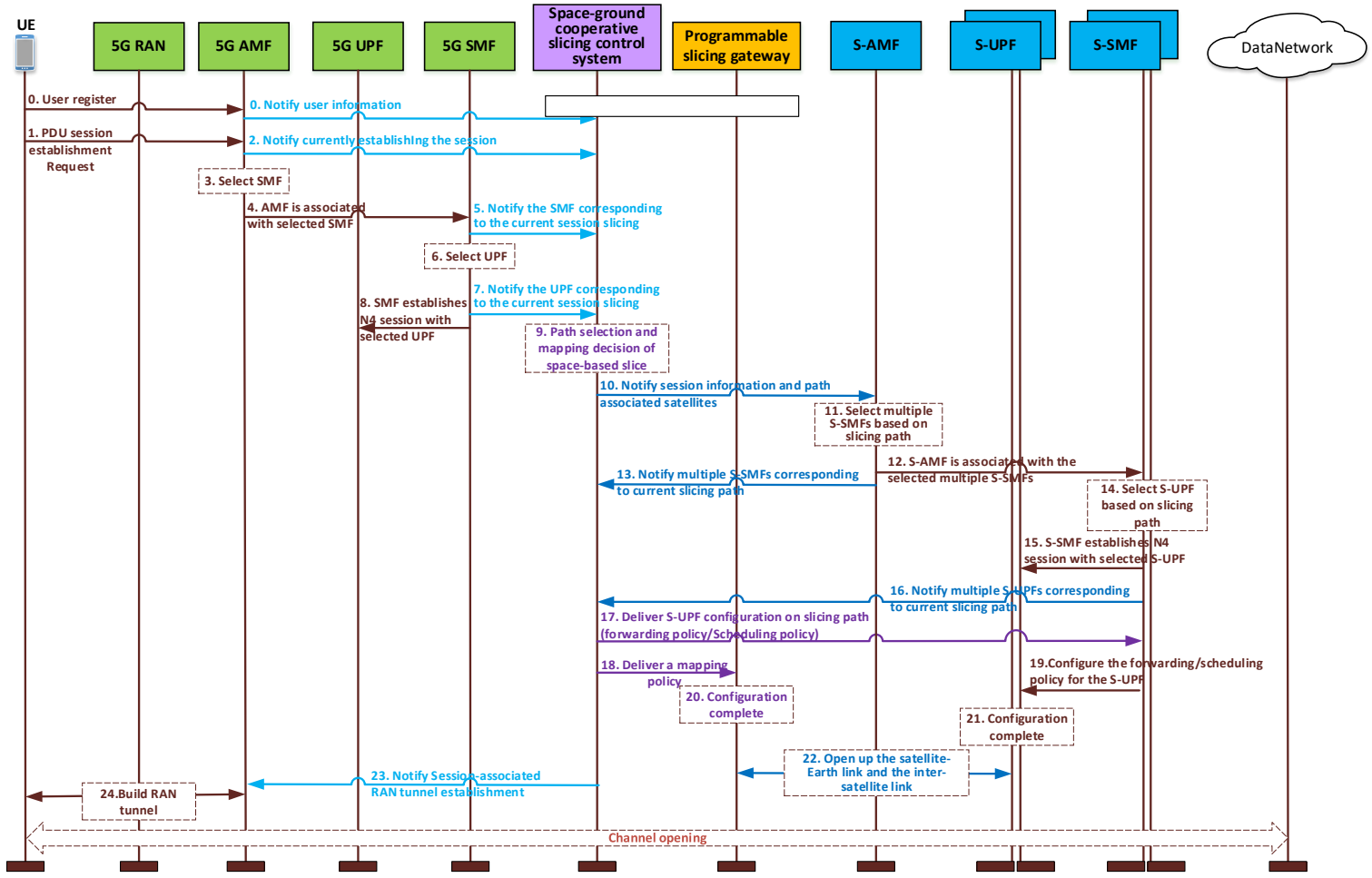
We put a programmable slicing gateway and a space-ground cooperative slicing control system deployed between the ground mobile communication network and the satellite network. On the data plane, it uses definable message parsing and forwarding capabilities to accurately identify and control slicing services, and realize heterogeneous network slicing adaptation. On the control plane, it collaboratively opens the slicing session channel in space-ground cooperative network, and intelligently generates the slicing mapping strategy, to improve the end-to-end slicing service quality of space-ground cooperative network.

Innovation 2: Space-ground slicing session collaboration (Module introduction)



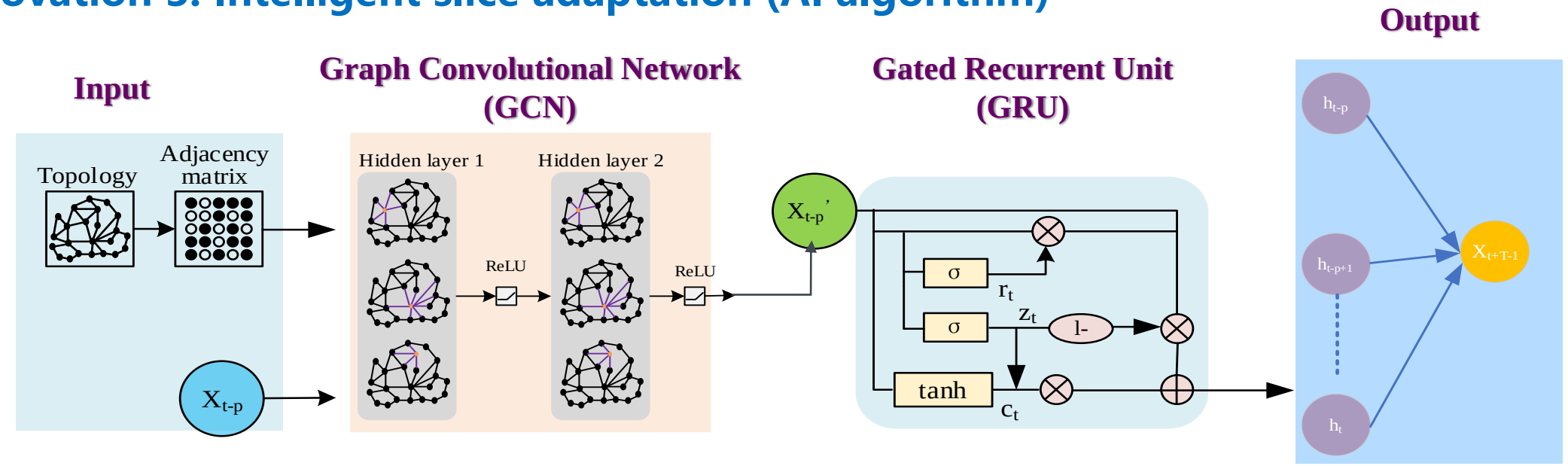
- **Slice mapping management module** is responsible for maintaining the mapping relationship between ground-based and space-based PDU sessions.
- **Session cooperative processing module** can cooperate with the process of establishing, modifying and releasing sessions of ground-based and space-based networks
- **Ground-based core network interface module** is responsible for the interface with the ground-based mobile communication core network.
- **Space-based core network interface module** is responsible for the interface with the space-based satellite network core network.

Innovation 2: Space-ground slicing session collaboration (PDU session establishing)



The space-ground cooperative slicing control system interacts with the space and ground network slicing control planes respectively to maintain the mapping relationship between ground-based PDU sessions and space-based PDU sessions. So the establishing, modifying and releasing sessions of ground-based network and space-based network can be cooperated with each other. The programmable slicing gateway receives configuration policies and establishes PDU session channels from UE to ground-based 5G mobile communication network, space-based satellite network and up to Data Network.

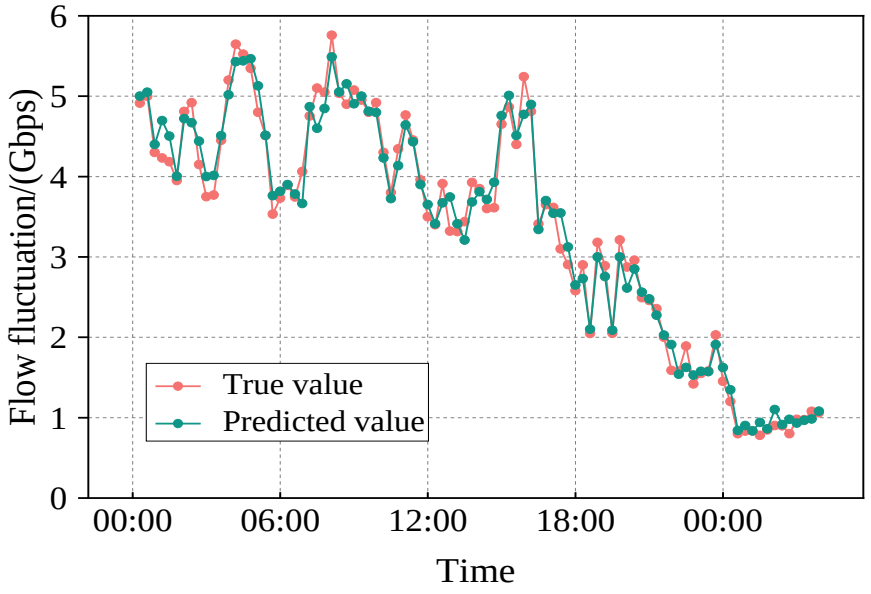
Innovation 3: Intelligent slice adaptation (AI algorithm)

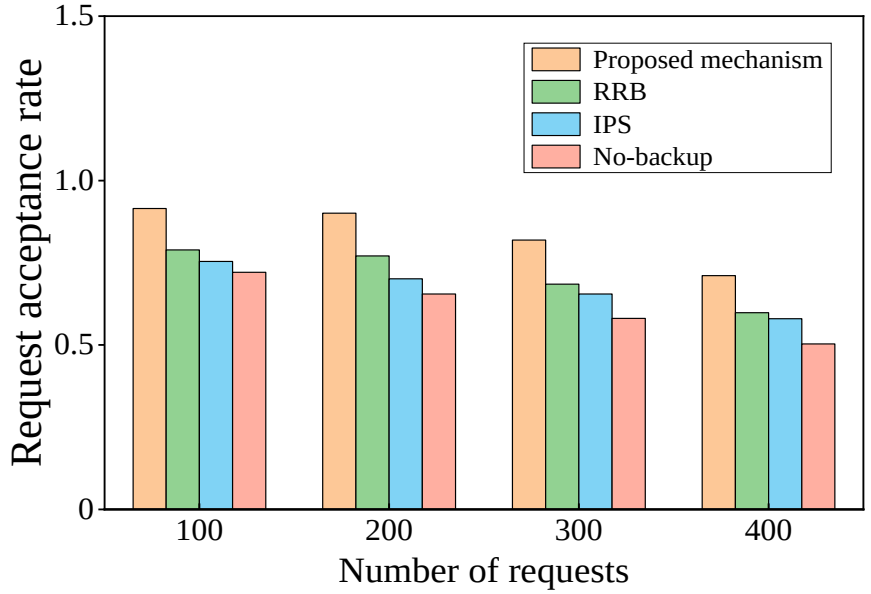


To construct differentiated network slices involving different service characteristics, and realize multi-service integration, an intelligent slice mapping mechanism based on spatial-temporal correlation is proposed based on Graph Convolutional Network (GCN) and Gated Recurrent Unit (GRU).

- The network topological features are captured by GCN to obtain the spatial dependence.
- The dynamic changes of node attributes are captured by GRU to obtain the local time trend of traffic load.

Innovation 3: Intelligent slice adaptation (Simulation results)





Simulation results indicate that, the proposed mechanism can effectively predict the business traffic, thereby improving the service request acceptance rate of the slice adaptation strategy. Thus, the slices of network resources can be matched as needed with the wildly fluctuating traffic in the space-ground cooperative network.