Research on SDP Key Technology in 5G Mobile Communication System

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Abstract. With the fifth generation mobile communication system research all-round, mobile communications company will according to the different network deployment, and related business needs through the software defined radio network control, and through data separation, the characteristics of the networked service section for customization to provide users with reasonable network services, in order to achieve flexible data transmission, network server sliced by SDP network function in the traditional mobile communication network data transmission protocol stack, combining with the code level analysis of input and output from the design, so as to achieve expected.

1. research status of SDN technology in 5G mobile communication system
In 5G mobile communication system, SDP technology is widely used in recent years, among which NFV and SDN technology are important components and play a role in promoting the development of communication technology. As a new network technology that can change the existing network structure, SDN technology enables more and more network operators to develop their own basic network facilities. This technique can help to implement the SDP protocol stack. The idea is to separate network structure and data storage, and further divide it into control implementation layer, technology application layer and base layer. The software and hardware are integrated and coordinated to achieve data unification. For better understanding, the details are as follows: 1SDN framework structure.
2. **SDP platform based on SDN technology**

Application of mobile network in software definition involves central controller. With regard to the central controller, service transmission will be carried out through protocol units and functional network elements to complete the logical function nodes of each other and reach the link connection process. Virtual function network underlying communications equipment to connect with the controller, according to the following figure 2, network section diagram you can see, from the logical level, network section have independent service function, for the network business, its role is not interaction between ability of end-to-end independent control, to achieve a virtual network construction. In terms of network deployment, it can share and transmit data in the network, set up network services and network slices in contrast, and realize the purpose of network service optimization through its resource allocation.
According to the network service slice, the wireless customized network is all based on the same physical network. Its custom wireless network function can realize the network resources, and according to the different needs of the business, from the network central controller for data transmission, so as to realize the optimal deployment of network section, ensure network resources of customized service and customized network output section can be carried out in accordance with the business end-to-end, guarantee the advantage of customized network the chip, can according to the different performance of different business transmission, data transmission business transfer protocol stack different functional units to provide efficient transport service.

2.1. MyNet prototype platform
As shown in figure 3, the user layer and data layer of MyNet can be seen from the MyNet prototype platform. Its prototype platform has various modules, such as "Software Defined Toplogy, SDT", "Software Defined Resource Allocation, SDRA", SDP controller, "Service Gateway, SGW", v-u-sgw function, and "(eNB)" protocol stack, etc. For details, see figure 3 below.
2.2. overview of SDP platform

SDP controller can receive connection service. In "Machine Type Communication, MTC", SDP Request, SDPR service Request can be made. Traditional protocol processing can be carried out from one of the protocol function modules to complete specific protocol stack. Part of the protocols are regenerated to reach the SDP protocol stack. This platform performs specific data processing according to different requirements and generates processing paths. As shown in figure 4, SDP platform system can be seen as an extension technology of SDN and protocol stack. Protocol stack can access integrated control by eliminating redundant function modules, so as to achieve access and non-access layer function implementation. See figure 4 for details.
Figure 4 summarizes the key technical applications of 5G development in SDP. In the network element protocol, any connection end of network topology can be further decomposed to help complete QoS customization. In terms of protocol function, network topology function can be upgraded to make up for network element function. Ability to perform network load balancing in central controller. It can support heterogeneous network.

2.3. relationship analysis between SONAC and SDP

Table 1 shows that the composition of the SONAC system is directly related to the SDP. SDP as transport protocol in the SDN stack, the main communication network architecture, can carry on the special service request with SONAC, specific in SDT special network logical topology, the topological structure of SDP based on the rules of logic network resources scheme, resulting in a mapping scheme, the user data protocol transmission effectively, guarantee the virtual protocol stack to achieve daily service requirements. According to the main introduction table of the interface in Table 2, entities between network elements can work with each other and complete data transmission more clearly. See Table 2 for details.

Table 1. SONAC system function table

| The sequence | function | describe | The system input |
|--------------|----------|----------|-----------------|
| 1            | The network custom | According to the network requirements filled by users in the UI interface, the corresponding network solution can be constructed, and the pre-defined solution template can be invoked to provide customized end-to-end network services according to the network requirements. | Expected network time, network location, number of required devices, network throughput, expected rate of devices, security level, service type, tariff range, etc. |

Figure 4. SDP platform system

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Complete the construction of dynamic loop link topology between service network SGW and wireless base station, and adjust the capability and function of SGW node dynamically.

The service type, the number of device connections in the region, the timely delay response constraint, the number of available resources, and the forwarding ability of inter-link nodes.

Complete the flexible, efficient and intelligent mapping process of communication network architecture from logical topology to physical resources.

Virtual network logical topology, physical resource pool, network mapping strategy.

According to specific business requirements, different communication protocols and interaction processes are dynamically configured for end-to-end network nodes

Service load, available network resources, data flow rate, communication delay requirement in the underlying node.

NFV is friendly and compatible with each other, and USES NFV Orchestrator to control and apply the underlying physical mesh resource pool.

NFV API

It is friendly and compatible with SDN, and USES the industry-unified SDN Controller to transmit node data and manage network forwarding strategy.

SDN API

| interface   | agreement | Agreement no. | Related entities         | Interface functions                                      |
|-------------|-----------|---------------|--------------------------|----------------------------------------------------------|
| SI-MME      | SIAP      | 36.413        | eNodeB - MME             | For transport session management and mobility management  |
| SI-U        | GTPv1     | 29.060        | eNodeB SGW               | Build a tunnel between GW gateway and eNodeB to transmit data packets |
| S11         | GTPv2     | 29.274        | MME-SGSN                 | Use GTP protocol to build tunnels and transmit signaling between MME and SGSN |
| S4          | GTPv2     | 29.274        | SGW-SGSN                 | Use GTP protocol to build tunnels and transmit signaling between SGW and SGSN |

3. Controller deployment algorithm based on spectral clustering
In the network, the weight of graph edge can be defined according to the user's mobile behavior. This method can greatly reduce the switching times between controllers. Meanwhile, each region can be personalized in the spectral clustering algorithm to ensure more balanced load of controllers on average. See the schematic diagram of controller deployment algorithm of spectral clustering in figure 5 below for details
According to the regional correlation matrix of $N \times N$, $W$ can be used to represent the user’s mobile behavior in the $N$ region, specifically expressed as:

$$W_{N\times N} = (w_{ij}) = \begin{bmatrix}
    w_{11} & w_{12} & \cdots & w_{1N} \\
    w_{21} & w_{22} & \cdots & w_{2N} \\
    \vdots & \vdots & \ddots & \vdots \\
    w_{N1} & w_{N2} & \cdots & w_{NN}
\end{bmatrix}$$  \hspace{1cm} (1)

Simultaneously satisfied:

$$\sum_{i=1}^{N} w_{ij} = 1, \quad j \in A_j$$  \hspace{1cm} (2)

In the definition of degree, we can get the degree matrix $D$ of $N \times N$, which is assumed to be a diagonal matrix and can be denoted as 0 outside the main diagonal. The formula is as follows:

$$D_{N\times N} = (d_{ij}) = \begin{bmatrix}
    d_1 & 0 & \cdots & 0 \\
    0 & d_2 & \cdots & 0 \\
    \vdots & \vdots & \ddots & \vdots \\
    0 & 0 & \cdots & d_N
\end{bmatrix}$$  \hspace{1cm} (3)

Simultaneously satisfied:

$$f^T L f = f^T D f - j^T W j = \sum_{i=1}^{n} d_i f_i^2 - \sum_{i,j=1}^{n} w_{ij} f_i f_j$$

$$= \frac{1}{2} \left( \sum_{i=1}^{n} d_i f_i^2 - 2 \sum_{i,j=1}^{n} w_{ij} f_i f_j + \sum_{i=1}^{n} d_i f_i^2 \right)$$

$$= \frac{1}{2} \sum_{i,j=1}^{n} w_{ij} (f_i - f_j)^2$$  \hspace{1cm} (4)

The above results satisfy the movement frequency between $N$ regions, and the data among them are normalized, that is, the regional correlation matrix that represents the mobile behavior of users.

4. Conclusion

According to the background of 5G, the SDP network is deeply explored. The SDN network in SDP is summarized and its technical characteristics and architecture are elaborated. It summarizes the challenges and opportunities of network services in the future, the prospect of intelligent development of network, and the user-oriented SDP network architecture with customized services, so as to meet the
diversified service needs of mobile users. Based on the above ideas and combined with the research of related technologies, the better realization of customized network services.

References

[1] xiaojuan.Xu Research on key technologies of network optimization for 5G mobile communication system [D]. University of electronic science and technology of China, 2017.
[2] zhihuan. tan Virtual customized network technology in wireless access network [D]. University of electronic science and technology of China, 2017.
[3] zhipan.Fang Research on key technologies of virtualization of 5G system access network [D]. University of electronic science and technology of China, 2016.
[4] anming. Dong Transceiver design of multi-user MIMO wireless communication system based on interference management [D]. Shandong University, 2016.
[5] Lingyun.zhou Research on resource allocation method of SDN network [D]. University of electronic science and technology of China, 2018.
[6] Guixian. Xu Beam forming technology research of large-scale MIMO system [D]. Beijing University of posts and telecommunications, 2017.
[7] Jingsheng. Cui Power allocation optimization design and performance analysis of non-orthogonal multiple access system [D]. Southwest Jiaotong University, 2018.
[8] lu,pan gao chengliang, chenguang, jin lei cao Research and application prospect of key technologies of VoLTE terminal multimedia color bell business [A]. TD industry alliance, mobile communication magazine.
[9] yan. Zheng Research on macro-femtocell two-layer network interference management method based on wireless resource allocation [D]. Harbin Institute of Technology, 2016.