

Draft new Recommendation ITU-T Y.CPN-CL-Arch

Requirements and architecture of CPN control layer for network resource in NGNe

Summary

This draft Recommendation specifies the requirements and architecture of control layer for network resource in CPN, which addresses capabilities of resource information collection, resource allocation and network connection scheduling in CPN.

Keywords

Network; Computing power network; Control layer

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Draft new Recommendation ITU-T Y.CPN-CL-Arch

Requirements and architecture of CPN control layer for network resource in NGNe

1. Scope

This Recommendation specifies the requirements and architecture of control layer for network resource in CPN, which addresses capabilities of resource information collection, resource allocation and network connection scheduling in CPN. The scope of this draft Recommendation includes:

- Overview of CPN control layer;
- Service requirements of CPN control layer;
- Capability requirements of CPN control layer;
- Architecture of CPN control layer;
- Security considerations.

2. References

The following ITU-T Recommendations and other references contain provisions, which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.2501] Recommendation ITU-T Y.2501, *Computing power network – Framework and architecture*

3. Definitions

3.1 Terms defined elsewhere

TBD

3.2 Terms defined in this Recommendation

TBD

4. Abbreviations and acronyms

CPN: Computing Power Network

5. Conventions

TBD

6. Overview of CPN control layer

[Editor's Note] This clause gives a general background of CPN control layer.

With the development of emerging technologies, and currently the network connects to multiple types of computing resources such as data centre and edge computing resource pool, and these computing resource may belong to different vendors. At the same time, some users want to associate computing resources with network capabilities, such as low latency. Furthermore, the scheduling of the computing resources grows to be a new technical challenge. To solve this problem, computing power network collects and distributes computing resource information of various computing nodes through network control plane (such as network orchestrator etc) and combines computing resource information and network information to provide users with the optimal computing resource allocation and network connection solution. Computing power network also provides a new commercial model. In this new model, resource providers can sell various resources through the platform, and resource consumers can choose the optimal resources combination solution, thus satisfying business requirements for service integration.

The computing power network control layer (realized by the CPN control plane) has three basic functions: resource information collection function, resource allocation function, and network connection scheduling function:

- Resource information collection function: The computing power network control layer collects a variety of resource information, including but not limited to computing power resource information, network resource information, storage resource information, algorithm resource information, etc. and generates a resource information table.
- Resource allocation function: According to the CPN consumers requirement or processing results from the CPN service layer, the computing power network control layer checks the resource information table, then makes a resource allocation strategy and sends it to the CPN providers. A resource allocation strategy could be notifying the computing power network providers when and how many computing resources will be occupied, and refreshing their resource information.
- Network connection scheduling function: Network connection requirements are obtained according to the resource allocation strategy. Network connection requirements could include among which points the network connection should be established, the bandwidth of each network connection, and the quality of service needed to be provided. According to these network connection requirements, the corresponding network resources are scheduled, and the network connections are established. [ITU-T Y.2501]

7. Service requirements for CPN control layer

[Editor's Note] This sub clause will depict the service requirements for control layer in CPN, including low latency service and high mobility service.

7.1 Requirement of low latency service for CPN control layer

[Editor's Note] This sub clause will give a brief introduction of low latency service and depict the its service requirements for control layer.

7.2 Requirement of high mobility service for CPN control layer

8. Capability requirements of CPN control layer

[Editor's Note] This sub clause will depict the capability requirements of CPN control layer, identifying the detailed requirements of the technical capabilities (networking information

collection capability, resource allocation capability and resource allocation capability) which are necessary to support the services requirements.]

8.1 Network information collection capability requirement

8.2 Resource allocation capability requirement

8.3 Network scheduling capability requirement

9. Architecture of CPN control layer

[Editor's Note] This sub clause will depict the architecture of CPN control layer.

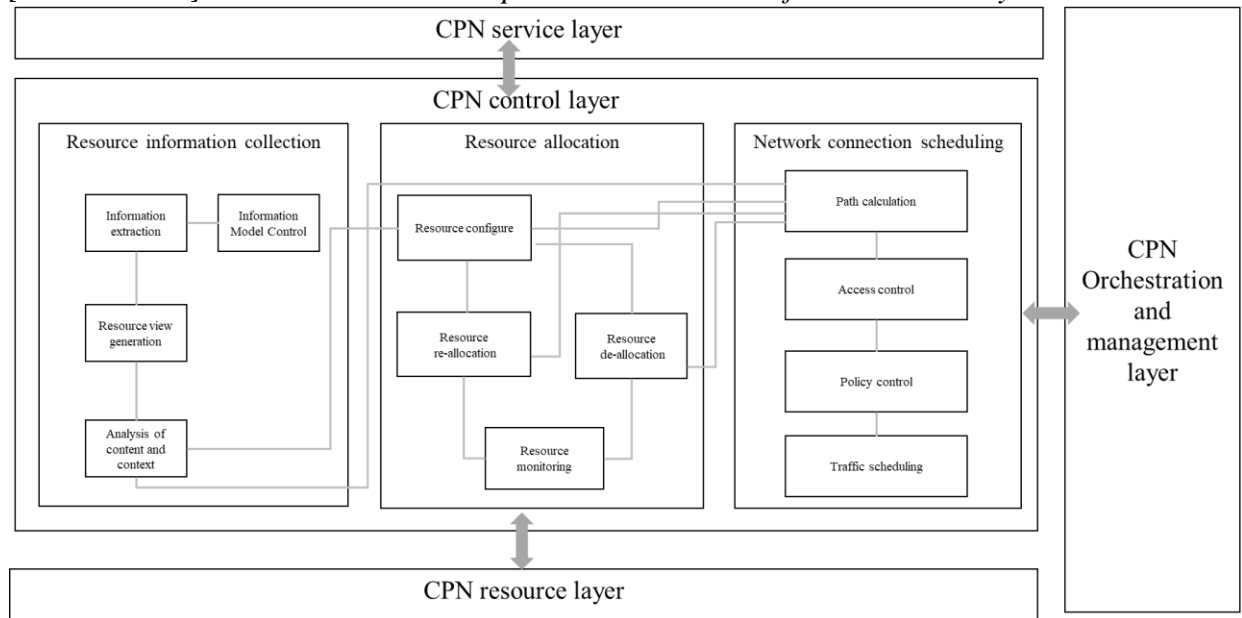


Figure 9-1 Architecture of CPN control layer

9.1 Resource information collection

[Editor's Note] This sub clause will depict the functional component of resource information collection.

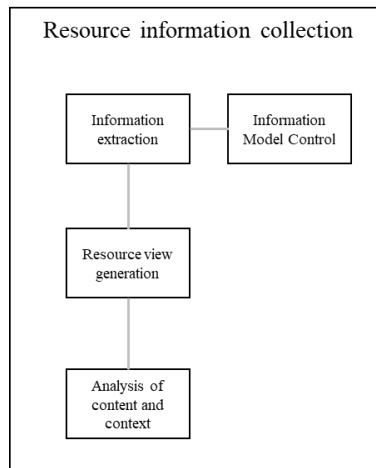


Figure 9-2 Resource information collection functional components

9.2 Resource allocation

[Editor's Note] This sub clause will depict the functional component of resource allocation.

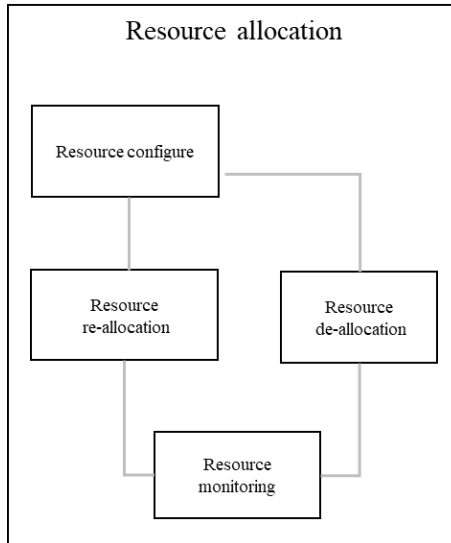


Figure 9-3 Resource allocation functional components

9.3 Network scheduling

[Editor's Note] This sub clause will depict the functional component of network scheduling.

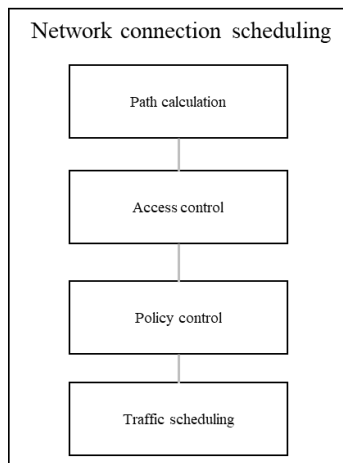


Figure 9-4 Network connection scheduling functional components

10. Security consideration

[Editor's Note] This clause provides the security considerations.

Annex 1

A.1 justification for proposed draft new Recommendation ITU-T Y.CPN-CL-Arch “Requirements and architecture of CPN control layer for network resource in NGNe”

Question:	Q2/13	Proposed new ITU-T Recommendation	Geneva, 23 October-03 November 2023
Reference and title:	ITU-T Draft Recommendation Y.CPN-CL-Arch “Requirements and architecture of CPN control layer for network resource in NGNe”		
Base text:	SG13- TD369/WP3	Timing:	2025-12
Editor(s):	<p>Qianying Zhao, China Telecom, China zhaoqy50@chinatelecom.cn</p> <p>Bo Lei, China Telecom, China leibo@chinatelecom.cn</p> <p>Xing Zhang, BUPT,China, hszhang@bupt.edu.cn</p> <p>Chang Cao, China Unicom, China E-mail: caoc15@chinaunicom.cn</p> <p>Junfeng Ma, MIIT +86-10-62300059 majunfeng@caict.ac.cn</p> <p>Liwei Ma, ZTE Corporation, China, E-mail: ma.liwei1@zte.com.cn</p>	Approval process:	AAP
<p>Scope (defines the intent or object of the Recommendation and the aspects covered, thereby indicating the limits of its applicability):</p> <p>This Recommendation specifies the requirements and architecture of control layer for network resource in CPN, which addresses capabilities of resource information collection, resource allocation and network connection scheduling in CPN. The scope of this draft Recommendation includes:</p> <ul style="list-style-type: none"> - Overview of CPN control layer; - Service requirements of CPN control layer; - Capability requirements of CPN control layer; - Architecture of CPN control layer; - Security considerations. 			
<p>Summary (provides a brief overview of the purpose and contents of the Recommendation, thus permitting readers to judge its usefulness for their work):</p> <p>With the development of emerging technologies, and currently the network connects to multiple types of computing resources such as data centre and edge computing resource pool, and these computing resource may belong to different vendors. At the same time, some users want to associate computing resources with network capabilities, such as low latency. Furthermore, the scheduling of the computing resources grows to be a new technical challenge. To solve this problem, ITU starts the study of computing and network convergence.</p> <p>Q2/SG13 had already released the first computing and network convergence related recommendation Y.2501 which study the framework and architecture of computing power network.</p> <p>As described in Y.2501, Computing power network (CPN) collects and distributes computing resource information of various computing nodes through network control plane and combines computing resource information and network</p>			

information to provide users with the optimal computing resource allocation and network connection solution. CPN control layer has three main functions resource information function, resource allocation function and network scheduling function. And Y.2501 has given a general functional description about it.

The CPN control layer (realized by the CPN control plane) collects the information from the CPN resource layer and sends it to a service layer for further processing. After receiving the processing results from the CPN service layer, the CPN control layer will pre-occupy the resources and establish a network connection.

The computing power network control layer has three basic functions: resource information collection function, resource allocation function, and network connection scheduling function:

- Resource information collection function: The computing power network control layer collects a variety of resource information, including but not limited to computing power resource information, network resource information, storage resource information, algorithm resource information, etc. and generates a resource information table.
- Resource allocation function: According to the CPN consumers requirement or processing results from the CPN service layer, the computing power network control layer checks the resource information table, then makes a resource allocation strategy and sends it to the CPN providers A resource allocation strategy could be notifying the computing power network providers when and how many computing resources will be occupied and refreshing their resource information.
- Network connection scheduling function: Network connection requirements are obtained according to the resource allocation strategy. Network connection requirements could include among which points the network connection should be established, the bandwidth of each network connection, and the quality of service needed to be provided. According to these network connection requirements, the corresponding network resources are scheduled, and the network connections are established.

Since CPN control layer is the most key part in CPN, and Y.2501 has already given a general framework and basic functions, we propose to continue a further study about CPN control layer and give a detailed requirements analysis and architecture on it.

In this new proposal, we plan to study the specific functions of CPN control layer (such as resource collection function, resource allocation function and network scheduling function), and give the functional components of each functions. Based on the materials, we propose to research the requirements and architecture of control layer in CPN in Q2/13.

Relations to ITU-T Recommendations or to other standards (approved or under development):

Some related research activities and corresponding gap analysis about this new item in other organizations and projects are summarized as follows:

(1) Relations to ITU-T Y.2501

Y.2501 studies the framework and architecture of computing power network. It provides the framework and architecture of Computing power Network, specifies its functional entities and defines the functionalities of these functional entities, in addition it also provides general requirements of Computing power Network.

This proposed new work item is about CPN control layer in Y.2501 and focuses on the requirements and architecture of CPN control layer, which is not included in Y.2501. Thus, this new work item won't be overlapping with Y.2501 and will keep aligning with Y.2501 by using it as a reference.

(2) Relations to ITU-T Q.4140

Q.CPN studies the signalling requirement of CPN. It focuses on the signalling among the CPN MANO between SDN controller, CPN MANO between NFV MANO and CPN MANO between OSS.

This proposed new work item is about CPN control layer in Y.2501 and focuses on the requirements and architecture of CPN control layer. This proposed new work item studies the requirements and architecture of CPN control layer while Q.CPN studies the signal requirement of CPN architecture. Thus, this new work item won't be overlapping with Q.4141

(3) Relations to Q.BNG-INC

Q.BNG-INC provides a network solution to dynamically and flexibly schedule computing tasks at the border network gateway based on real-time computing resource performance, network performance, cost and other multi-dimensional factors based on business needs, thereby improving resource utilization, network utilization efficiency, and improving business user experience.

This proposed new work item is about CPN control layer in Y.2501 and focuses on the requirements and architecture of CPN control layer. This proposed new work item studies the requirements and architecture of CPN control layer, Q.BNG-INC focuses on the scheduling. Thus, this new work item won't be overlapping with Q.BNG-INC.

(4) Relations to Y.CNC related work items

CNC related work items focuses on IMT-2020, and CPN focuses on NGNe, thus, we do not overlap with Y.CNC related work items.

(5) Relations to BBF TR-466

BBF TR-466 is a technical report to study Use Cases and High Level Requirements of metro compute networking which limited to MAN (Metropolitan area network). This work item focuses on the requirement and architecture on CPN control, thus, we do not overlap with BBF TR-466.

(6) Relations to IETF CATS

IETF CATS(computing-aware traffic steering) is care about computing routing which focuse on routing protocol such as BGP, and this new work item do not touch protocols, so they do not overlap with each other.

Liaisons with other study groups or with other standards bodies:

SG11, SG2, SG17, IETF CATS

Supporting members that are committing to contributing actively to the work item:

China Telecom, BUPT,China Unicom, MIIT,ZTE