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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,
NEXT-GENERATION NETWORKS, INTERNET OF
THINGS AND SMART CITIES

Big Data

Big data driven networking – Management and control mechanisms

Recommendation ITU-T Y.3655

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Recommendation ITU-T Y.3655

Big data driven networking – Management and control mechanisms

Summary

Recommendation ITU-T Y.3655 specifies management and control (MC) mechanisms for big data driven networking (bDDN). Recommendation ITU-T Y.3655 studies, for bDDN, mechanisms related to general MC aspects, as well as specific management, control and orchestrations.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Big data, big data driven networking, control, management, mechanism.

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Recommendation ITU-T Y.3655

Big data driven networking – Management and control mechanisms

1 Scope

This Recommendation specifies mechanisms for management and control (MC) of big data driven networking (bDDN), including:

- an introduction;
- management mechanisms;
- control mechanisms;
- orchestration mechanisms;
- other related 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.2704] Recommendation ITU-T Y.2704 (2010), *Security mechanisms and procedures for NGN*.

[ITU-T Y.3653] Recommendation ITU-T Y.3653 (2021), *Big data-driven networking – Functional architecture*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 big-data-driven networking (bDDN) [b-ITU-T Y.3650]: A type of future network framework that collects big data from networks and applications, and generates big data intelligence based on the big data; it then provides big data intelligence to facilitate smarter and autonomous network management, operation, control, optimization and security, etc.

3.1.2 policy [b-ITU-T G.7701]: The set of one or more rules that define the action that an MC component takes in response to a set of conditions presented at an interface. More than one policy may be applied (sequentially) to these conditions to determine the final action taken by the MC component.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

bDDN Big Data Driven Networking

DNP	Dynamic Network Probe
E2E	End to End
gRPC	Google Remote Procedure Call
iBE	interface between Big data plane and External
iBM	interface between Big data plane and Management plane
iBN	interface between Big data plane and Network plane
KPI	Key Performance Indicator
MC	Management and Control
ML	Machine Learning
NETCONF	Network Configuration Protocol
NFV	Network Function Virtualization
NMF	Non-negative Matrix Factorization
NMS	Network Management System
OAM	Operations, Administration and Maintenance
OWAMP	One-Way Active Measurement Protocol
SNMP	Simple Network Management Protocol
VNF	Virtualized Network Function
YANG	Yet Another Next Generation

5 Conventions

This Recommendation uses the following conventions.

In this Recommendation, the auxiliary verbs "should", and "may" sometimes appear, in which case they are to be interpreted, respectively, as "is recommended", and "can optionally". The appearance of such phrases or words in an appendix or in material explicitly marked as informative are to be interpreted as having no normative intent.

6 Introduction of management and control mechanisms of bDDN

6.1 Overview of closed loop of management and control mechanisms

See clause 3.1.1 for a definition of big data driven networking (bDDN).

bDDN can increase efficiency while decreasing operating costs. bDDN uses big data sensing, big data analytics, machine learning (ML) methods and network intelligence-related methods to provide capability for self-discovery, self-analysing, self-configuration, self-healing, etc. As a result, bDDN can deliver optimized and customized quality of service inexpensively to the end user. The aim of the bDDN is to eliminate the manual work required to keep networks running. This is also the core target of the MC mechanisms of bDDN.

Network MC is a complex task and involves a cloud centre, core and metro transport network, mobile fronthaul and backhaul network, user applications, etc. It needs to consider not only optimization and orchestration mechanisms, but also running applications on such a diverse and distributed infrastructure. Even by using highly engineered network operational tools, it possibly takes several days or even weeks for upgrades or service deployments to take effect.

Software-defined networking introduces centrally controlled network programmability and software centric flexibility in contrast to traditional distributed control mode. However, the centralized SDN platform is largely focused on static network operations and manual driven control. In contrast to SDN, bDDN uses the big data plane to realize automatic discovery of problems and automatic configuration and optimization of the network.

Figure 6-1 shows the closed loop for MC in bDDN, where network infrastructure, physical or virtual, is continuously monitored using a sensing engine, and real-time network states are exposed to the analytics stage, which in turn feeds into the management plane. The bDDN control platform not only takes centralized and programmable control, but also deploys data driven automation with policy-based orchestration and management.

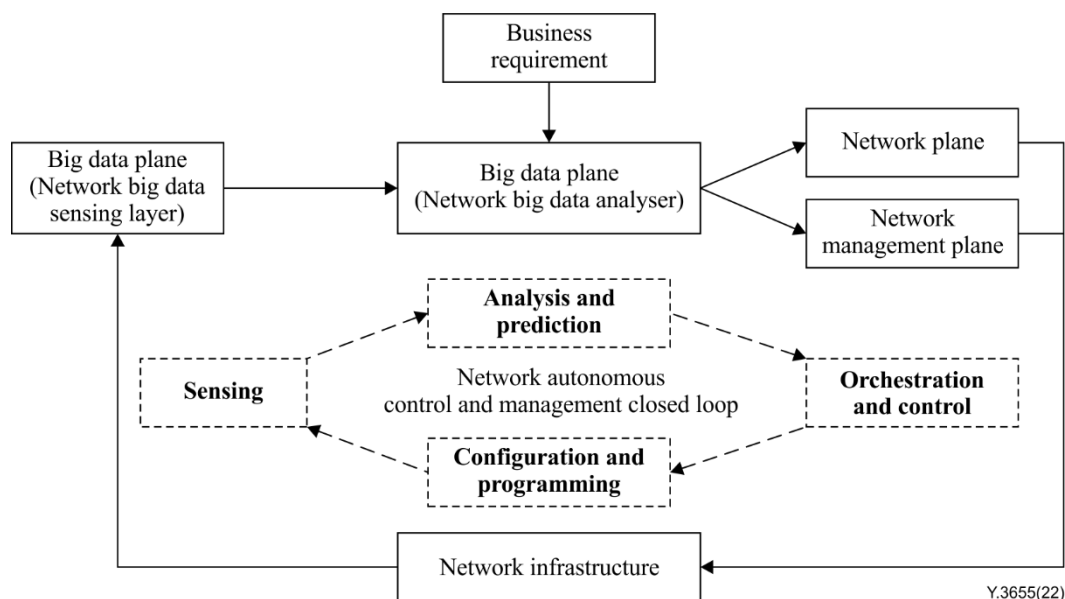


Figure 6-1 – Closed loop of control and management mechanisms

The big data plane is the brain of a network and is fundamental to intelligent networks that can support change in the level of service agility and adaptability. It enables lifecycle orchestration and automation for end-to-end (E2E), data driven network service, working in conjunction with the operation-supporting system and customer-facing support systems. In combination with analytics driven intelligence and policy control, the big data plane can help network service providers make the paradigm shift to the new mode of network operations that is based on sensing, analysis and prediction, orchestration and control, configuration and programming cycles, as shown in Figure 6-1. The sensing aspect monitors and collects network status data, such as network faults and network congestion. The analysis and prediction aspects decide using the big data analyser. The orchestration and control aspect schedules the resource according to the results of the analysis. The configuration and programming aspect self-configures or programs the infrastructure.

Note the importance of closed-loop operation for bDDN as it fundamentally changes the way networks are operated traditionally, empowering truly dynamic and autonomous operation.

6.2 Sensing aspect

Several bDDN mechanisms, which can be realized by a management protocol such as the simple network management protocol (SNMP), a management interface such as a client line interface and log tools such as Syslog, are provided to collect data from a network. These mechanisms have limitations that restrict automation and scalability. One limitation is the use of the pull model, where the initial request for data from network elements originates from the control or management entity. The pull model does not scale when there is more than one network management entity in the network.