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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Future networks

Smart ubiquitous networks – Smart traffic control and resource management functions

Recommendation ITU-T Y.3042



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Recommendation ITU-T Y.3042

Smart ubiquitous networks – Smart traffic control and resource management functions

Summary

Recommendation ITU-T Y.3042 specifies the smart traffic control and resource management functions for SUN. It defines the motivation and identifies the high-level requirements and functional architecture for providing relevant network capabilities. This Recommendation also identifies mechanisms in terms of "smart and ubiquitous" aspects of networks.

History

Edition	Recommendation	Approval	Study Group
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Keywords

Smart resource management, smart traffic control, smart ubiquitous network, SUN.

FOREWORD

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Recommendation ITU-T Y.3042

Smart ubiquitous networks – Smart traffic control and resource management functions

1 Scope

This Recommendation specifies smart traffic control and resource management functions to provide fair usage of network resources using context awareness capability in smart ubiquitous networks (SUN). This Recommendation covers the following:

- Motivation and objectives of smart traffic control and resource management;
- Requirements for smart traffic control and resource management for SUN;
- High-level architecture and functional architecture;
- Control and management mechanisms.

NOTE 1 – Usage of context information is optional and the mechanism details of context awareness capability are outside of scope in this Recommendation.

NOTE 2 – Regulatory aspects of monitoring (e.g., depth of IP packet allowed to be monitored) are outside of scope in this Recommendation.

NOTE 3 – Traffic, means user or service provider traffic and resource, means operational status of network elements (e.g., CPU usage, interface utilization, etc.) in this Recommendation.

NOTE 4 – Controlling traffic includes both application and network layer control. Some examples of application layer controls are video pacing, video transcoding and/or HTTP adaptive streaming (HAS).

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.

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|----------------|--|
| [ITU-T E.600] | Recommendation ITU-T E.600 (1993), <i>Terms and definitions of traffic engineering.</i> |
| [ITU-T Q.9] | Recommendation ITU-T Q.9 (1988), <i>Vocabulary of switching and signalling terms.</i> |
| [ITU-T Y.1541] | Recommendation ITU-T Y.1541 (2011), <i>Network performance objectives for IP-based services.</i> |
| [ITU-T Y.2701] | Recommendation ITU-T Y.2701 (2007), <i>Security requirements for NGN release 1.</i> |
| [ITU-T Y.3041] | Recommendation ITU-T Y.3041 (2013), <i>Smart ubiquitous networks – Overview.</i> |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 smart ubiquitous networks (SUN) [ITU-T Y.3041]: IP-based packet networks that can provide transport and delivery of a wide range of existing and emerging services to people and things. The services provided by the SUN can cover aspects such as control, processing and storage.

NOTE 1 – The network is smart in the sense that it is knowledgeable, context-aware, adaptable, autonomous, programmable, and can perform services effectively and securely.

NOTE 2 – The network is ubiquitous in the sense that it allows access anytime, anywhere, through varied access technologies, access devices, including end user devices, and human-machine interfaces.

3.1.2 context [ITU-T Y.3041]: The information that can be used to characterize the environment of a user.

3.1.3 busy hour [ITU-T E.600]: The continuous 1-hour period lying wholly in the time interval concerned for which the traffic or the number of call attempts is greatest.

3.1.4 (signalling) traffic flow control [ITU-T Q.9]: Actions and procedures intended to limit signalling traffic at its source in the case when the signalling network is not capable of transferring all signalling traffic offered by the User Parts due to network failures or overload situations.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 data cap: Upper limit of the total traffic volume allowed by the SLA contracted between the traffic source (e.g., ISP) and destination (e.g., user).

3.2.2 fair usage: Equal treatment for the same service(s), including application(s), between different users (e.g., end-user, applications) with the same SLA.

3.2.3 heavy service traffic: Traffic level measured in the volume of specific service(s) which overloads network resources at the interface from/to service providers. It has an impact on other service traffic on the same network resource (e.g., degrading the quality).

3.2.4 heavy signalling traffic: Traffic level measured in the volume and frequency that triggers signalling traffic flow control [ITU-T Q.9] (e.g., heavy traffic level caused by keep-alive messages).

3.2.5 heavy user traffic: Traffic level measured in the volume of traffic initiated by an end-user who overloads network resources at the interface from/to the end-user. It affects the traffic quality of other users.

3.2.6 surge traffic: Traffic level measured in the aggregated volume initiated by multiple users which overloads network resources at special events such as an abrupt occurrence of bad weather, a particular sports or music event that attracts a high number of users, etc.

3.2.7 monopolization: Condition of network resource overloads caused by heavy service or user traffic. It affects the traffic quality of other service(s) or user(s).

3.2.8 over-sized traffic: Traffic level that is larger in volume than the recommended size for a service. The recommended volume of such a service should be identified by SLA between the traffic source and destination. It is a special case of heavy service traffic.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

3DTV	3 Dimensional TV
CP	Contents Provider
DSCP	Differentiated Services Code Point
HDTV	High Definition TV
IoT	Internet of Things
IPTV	Internet Protocol TV
ISP	Internet Service Provider
OTT	Over the Top
PDL	Progressive Down Load
POP	Point of Presence
QCI	QoS Class Identifier
QoE	Quality of Experience
QoS	Quality of Service
RA-FE	Resource Analysis Functional Entity
RMAF	Resource Monitoring and Analysis Function
RM-FE	Resource Monitoring Functional Entity
SCD-FE	Smart Correlation and Decision Functional Entity
SLA	Service Level Agreement
SRC-FE	Smart Resource Control Functional Entity
STC-FE	Smart Traffic Control Functional Entity
STCRMF	Smart Traffic Control and Resource Management Functions
STRCF	Smart Traffic and Resource Control Function
SUN	Smart Ubiquitous Network
TA-FE	Traffic Analysis Functional Entity
TMAF	Traffic Monitoring and Analysis Function
TM-FE	Traffic Monitoring Functional Entity
TRAF	Traffic Control and Analysis Function
TRCMF	Traffic Resource Control and Management Function
VNO	Virtual Network Operator

5 Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this Recommendation can still be claimed even if this requirement is present.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option, and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Recommendation.

6 Introduction

6.1 Motivation

Developments of various smart devices (e.g., smartphones, pads, IoT devices, etc.) in user environments of IP networks combined with newly emerging services such as Smart TV, 3DTV, and network gaming have led to increases in service traffic. These smart devices require networks to allocate more resources to support requested bandwidth and various service features including real-time, non-real-time and store-forward.

They are becoming one of the causes for "data explosion". In addition, a small number of users and service providers, generating heavy traffic, can monopolize most of the network's resources. Such monopolization needs to be controlled to ensure fair usage among users. This monopolization leads to degradation of quality of service and, in addition, discourages further advances in smart devices and related services development (see Appendix I). Therefore, more creative ways need to be identified to ensure fair usage of finite network resources.

In mobile environments, developments of smart user devices have enabled various broadband multimedia services which had previously been provided over the fixed network. Such changes in the mobile services cause network overload issues which can result in limited access resources for new users. In this environment, service traffic generated by service providers is transported over fixed networks and is delivered to the end-user devices over mobile access networks. Mobile access capacity is relatively limited compared to fixed access capacity. Therefore, it is noted that incoming traffic from fixed network environments to the mobile access environments needs to be managed for fair usage.

6.2 Objectives

Understanding the relationship among different factors, especially bandwidth, latency and operations complexity is essential for better operation of networks and services. Figure 6-1 shows three different areas of network operations based on the relationships of those factors. Their characteristics are as follows:

Area 1: Under-utilized case: The case where network resources are underutilized, QoS is easy to maintain and network management is simple. However, the network operator needs more users and high bandwidth consuming traffic for economic usage of network resources.

Area 2: Optimally utilized case: The case where optimal balance between high network resources utilization, QoS objectives and low network management complexity is maintained. It is noted that this is a recommended situation for an optimally operated network.

Area 3: Highly utilized case: case where network resources are highly utilized, QoS objectives may not be met and network management complexity is high. Many users in this area may experience difficulties in connecting to the networks and/or use of service. More especially, this situation gets worse in the case of mobile network environments. It is recommended to deploy traffic control and resource management for better service delivery and usage of network resources.

The objective of this Recommendation is to provide a traffic control and resource management function to address issues of Area 3, consistent with needs of Area 2. The needs of Area 1 are a business case and are outside of the scope of this Recommendation.

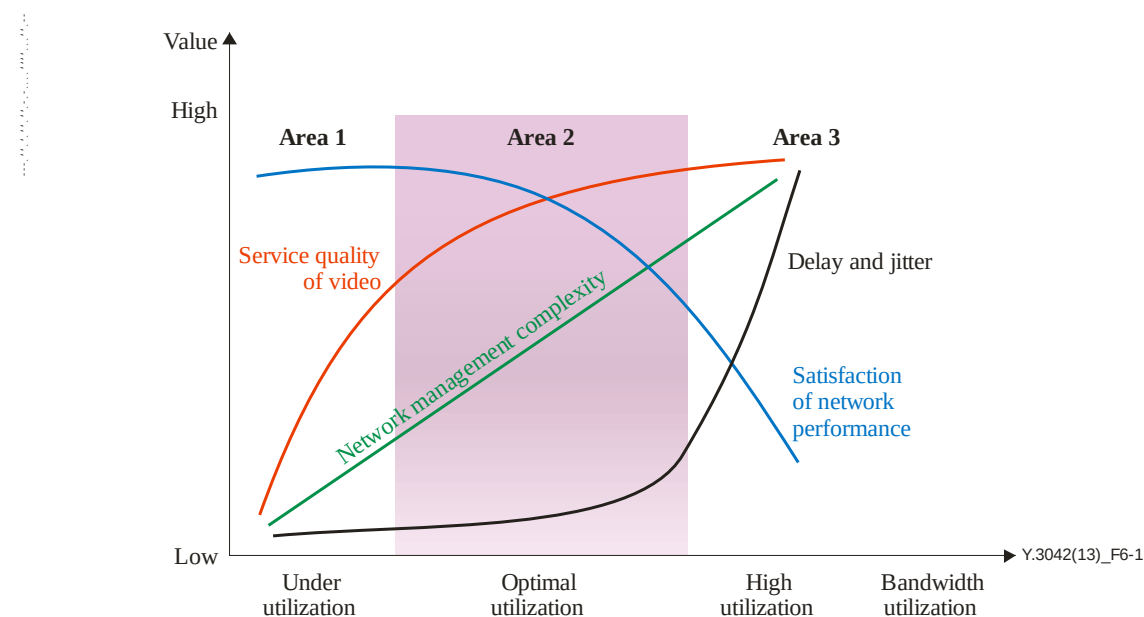


Figure 6-1 –Three different areas of network operation

7 Fine-grained classifications of traffic

There are many parameters used to specify traffic characteristics such as bandwidth, jitter, delay and burstiness, etc. They are defined in [ITU-T Y.1541]. SUN smart traffic control and resource management functions (STCRMF) use these parameters. In addition, [ITU-T Y.1541] defines new traffic parameters and classifications for newly emerged traffic types which have heavy traffic volumes and long duration characteristics generated by smart devices and service providers.