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Recommendation

ITU-T Y.3121 (01/2023)

SERIES Y: Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

Future networks

Quality of service requirements and framework for supporting deterministic communication services in local area networks for IMT-2020

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Recommendation ITU-T Y.3121

Quality of service requirements and framework for supporting deterministic communication services in local area networks for IMT-2020

Summary

Recommendation ITU-T Y.3121 specifies quality of service (QoS) requirements and framework for supporting deterministic communication services in a local area network (LAN). First, it presents the concept and benefits of deterministic communication services in a LAN consisting of heterogeneous network technologies. Then it specifies a high-level model and associated QoS requirements for inter-technology domain deterministic communication services in LAN. Based on the identified QoS requirements, it identifies a framework and an example operational procedure. Finally, it provides three scenarios and associated use cases as informal material in appendices.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Keywords

Deterministic communication services, functional framework, high-level framework, IMT-2020, inter-technology domain, local area network, QoS requirements.

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FOREWORD

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

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Quality of service requirements and framework for supporting deterministic communication services in local area networks for IMT-2020

1 Scope

This Recommendation specifies quality of service (QoS) requirements and framework for supporting deterministic communication services in a local area network (LAN). It provides a high-level model followed by the QoS requirements. Based on the high-level model and the identified QoS requirements, it specifies a framework and an example operational procedure for deterministic communication services. Finally, it provides three scenarios and associated use cases as informal material in the appendices.

The scope of the Recommendation includes:

- Introduction
- High-level model
- QoS requirements
- Framework
- Example operational procedure

Service scenarios and use cases are described in the appendices.

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.

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 bearer service [b-ITU-T I.112]: A type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

3.1.2 IMT-2020 [b-ITU-T Y.3100]: Systems, system components, and related technologies that provide far more enhanced capabilities than those described in [b-ITU-R M.1645].

3.1.3 local area network (LAN) [b-ITU-T H.322]: A shared or switched medium, peer-to-peer communications network that broadcasts information for all stations to receive within a moderate-sized geographic area, such as a single office building or a campus. The network is generally owned, used and operated by a single organization.

NOTE – In the context of this Recommendation, LANs also include internetworks composed of several LANs that are interconnected by bridges or routers.

3.1.4 teleservice [b-ITU-T I.112]: A type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between Administrations and/or recognized operating agencies (ROAs).

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 technology domain: A sub-network of a local area network adopting a single physical layer and data link layer scheme, with which the devices can send and receive information without an interworking module.

NOTE – The interworking module provides necessary functionalities, e.g., network interconnection, protocols translation, and broadcasting support, for interworking of heterogeneous technology domains in the local area network (LAN).

3.2.2 user device: Equipment for the starting point and ending point of a traffic, owned and operated by users.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

5G 5th Generation Mobile Communication Technology

A2A Application to Application

AR Augmented Reality

CNC Central Network Configuration

CPE Customer Premises Equipment

CPU Central Processing Unit

DS-TT Device-side TSN Translator

HD High Definition

IM Interworking Module

LAN Local Area Network

MT Mobile Terminal

NPN Non-Public Network

NW-TT Network-side TSN Translator

OT Operation Technology

PCF Policy and Control Function

PLC Programmable Logic Controller

PON Passive Optical Network

QoS Quality of Service

ROA Recognized Operating Agency

SMF Session Management Function

TD Technology Domain

TSN Time Sensitive Network

TSN-AF	TSN Application Function
U2U	User device to User device
VR	Virtual Reality
WiFi	Wireless Fidelity

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 document 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 "**can optionally**" and "**may**" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are 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 the specification.

6 Introduction

Deterministic communication service is a type of teleservice [b-ITU-T I.112] with additional capabilities which aim to ensure deterministic communication performances. Compared with best-effort communication, the performance fluctuation of deterministic communication is smaller.

Verticals can get benefits from deterministic communication services. Smart grid is an example. Based on [b-ITU-T Smart Grid], [b-IEEE], [b-Niwas Maskey], [b-Barriquello] and other academic papers, the deterministic communication services may provide the smart grid with more reliable quality of service (QoS) for network communication, not only in metro and core but also in local area. Smart manufacturing is another example. Especially time-sensitive applications and high reliability applications in the local area can benefit from deterministic communication services.

In the local area network (LAN), heterogeneous network technologies can be applied to deterministic communication services. For example, time sensitive network (TSN) may be used for the machine control of the production-line in a factory, as discussed in Appendix II.1; wireless fidelity (WiFi) may be used for cameras, as discussed in Appendix II.2; and 5th generation mobile communication technology non-public network (5G NPN) may be used for connecting the WiFi system with the cameras, as discussed in Appendix II.3.

It is necessary to specify the different technology coordination mechanisms so that different technology domains (TDs) can interact in the LAN supporting the required QoS for deterministic communication services.

7 High-level model

The high-level model of inter-technology domain deterministic communication services in the LAN is shown in Figure 1 where a single LAN can be composed of multiple TDs. For example, 5G NPN is the network technology adopted by one TD, TD A as example, and TSN or WiFi is the network technology adopted by another TD, TD B as example.

The interworking module (IM) is a functional component supporting the deterministic communication service across multiple TDs.

Several deterministic communication service scenarios and use cases are provided in Appendices I and II.

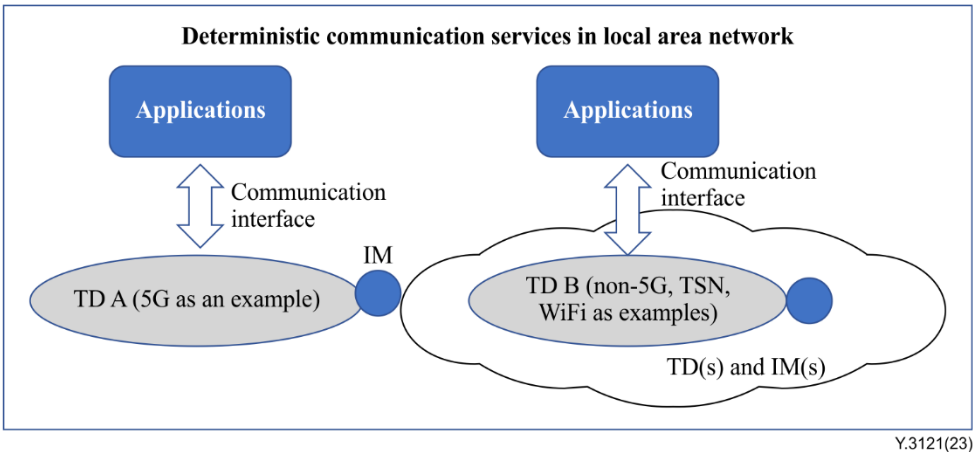

Figure 1 – High-level model of inter-technology domain deterministic communication services in the LAN

8 QoS requirements

In the LAN, there are three QoS metrics groups, as shown in Figure 2.

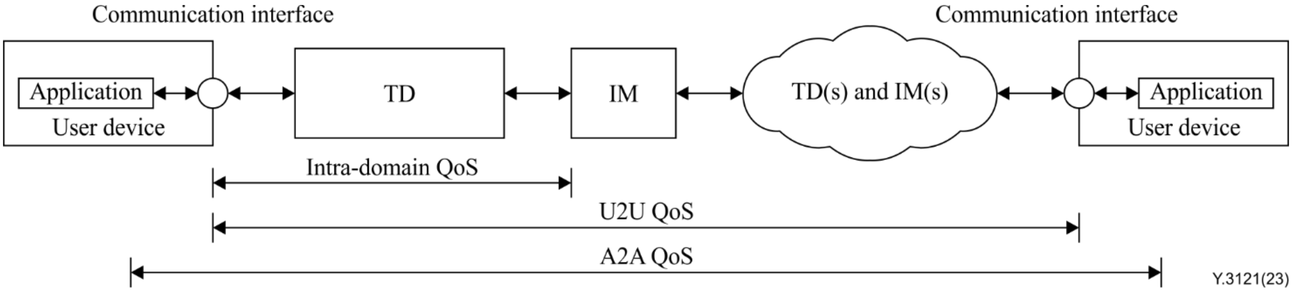

Figure 2 – Three QoS groups

Application to application (A2A) QoS metrics are a set of QoS metrics which indicate both the network and application processing performance between the source application and the destination application.

NOTE – The source application and the destination application are deployed in two user devices connected by LAN.

User device to user device (U2U) QoS metrics are a set of QoS metrics which indicate the network performance between the communication interface of a source application and the communication interface of a destination application.

Intra technology domain metrics are a set of QoS metrics (intra-domain QoS) which indicate the network performance inside a single TD.

Based on these three QoS groups, QoS requirements of deterministic communication services include but are not limited to:

– It is required to support intra-domain QoS in the TD.
– It is required to support the U2U and A2A QoS across TDs.
– It is required to support the awareness of the QoS objectives of applications by the network(s) in a LAN to guarantee A2A QoS.

– It is recommended to provide at least one of the A2A QoS metrics (e.g., application to application latency, jitter, and network bandwidth) to the deterministic communication services in a LAN.
– It is required to interpret A2A QoS metrics and map to the U2U QoS metrics.
– It is required to resolve conflict between the source and destination application's QoS metrics.
– It is required to map the deduced U2U QoS metrics to deterministic communication services in LAN.
– It is required to map the U2U QoS metrics into the intra-domain QoS metrics.
– It is required to support A2A QoS metrics for latency and jitter sensitive applications.
– It is required to support U2U QoS metrics for jitter sensitive only applications.
– It is required to support intra-domain QoS metrics for the applications in a single TD.

9 Framework

The framework is a group of functional entities with associated relationships among them.

Based on the requirements defined in clause 8, the framework of deterministic communication services can be abstracted into TD(s) as shown in Figure 3.

NOTE – The simplest framework of deterministic services can have only one TD. Thus, the functionality of the logical entity, interworking module (IM), can be optional.

The framework consists of two planes (i.e., control and network planes) and user devices.

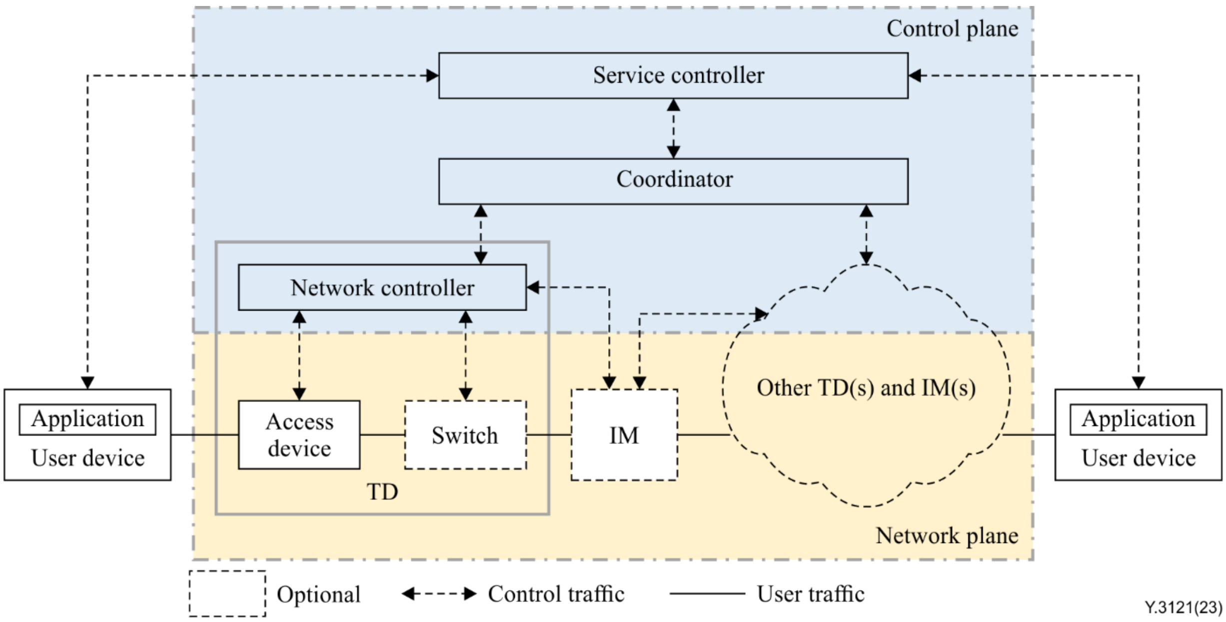

Figure 3 – Framework of deterministic communication services supported by heterogeneous network technologies in LAN

9.1 Control plane

Control plane provides functionality of control and/or management of traffic including service controller, coordinator and network controller.

9.1.1 Service controller

Service controller receives and processes QoS assurance objectives, including A2A and U2U QoS objectives, from applications, then interprets QoS assurance objectives and maps to the QoS metrics. The service controller delivers the QoS metrics to the coordinator based on the status of the coordinator.

9.1.2 Coordinator

Coordinator monitors and configures the network controller(s). It has three main functionalities:

– Monitors status of network controllers, including but not limited to bandwidth, buffer status, central processing unit (CPU) usage.
– Interprets the QoS assurance objective from the service controller and maps to QoS metrics for the network controller(s).
– Configures the network controller(s) according to the QoS metrics and the status of network controller(s).

9.1.3 Network controller

Network controller monitors and configures functional entities in the TD and IM. It has four main functionalities:

– Monitors network resource consumption of the TD functional entities and IM, including but not limited to time slot, buffer and queuing, etc.
– Receives the QoS assurance objective from the coordinator and makes intra-domain QoS policy and QoS metrics for TD functional entities.
– Delivers intra-domain QoS policy, QoS metrics and configuration information to IM.
– Configures the TD functional entities according to the intra-domain QoS metrics and the available network resources.

9.2 Network plane

Network plane provides functionality of deterministic communication for user traffic including the access device, switch and IM.

9.2.1 Access device

Access device is a network adapter that connects the user device to the deterministic communication network. It forwards a datagram from a user device to other TD functional entities. Meanwhile, it provides a QoS guarantee for user traffic, such as flow control, congestion control, etc.

9.2.2 Switch

Switch is a multi-port bridge and a data link layer device, which selectively transmits, redirects or blocks traffic. It is optional when the TD is small such that the functionality of the switch is not required. The switch can be used to support more devices to be connected inside a TD.

9.2.3 IM

IM connects multiple TDs adopting different deterministic communication technologies and providing necessary capabilities (e.g., to convert the format of the packet between TDs) to guarantee the deterministic communication services across TDs.

IM reports to a network controller its network resource consumption status, including but not limited to time slot, buffer and queuing.

IM receives intra-domain QoS policy, QoS metrics and configuration information from the network controller.

9.3 User device

User device is an equipment that hosts user applications, owned and operated by users. It is the starting point or ending point of user traffic, requesting deterministic communication services via the service controller.

Applications, hosted by the user device, may be industrial automation applications, augmented reality/virtual reality (AR/VR) applications, audio and video applications, etc. and can access deterministic communication services via the user device. The QoS objectives, including A2A and U2U QoS, are provided by the application.

10 Example of operational procedure

Based on clause 9, an example of operational procedure for deterministic communication services is shown in Figure 4.

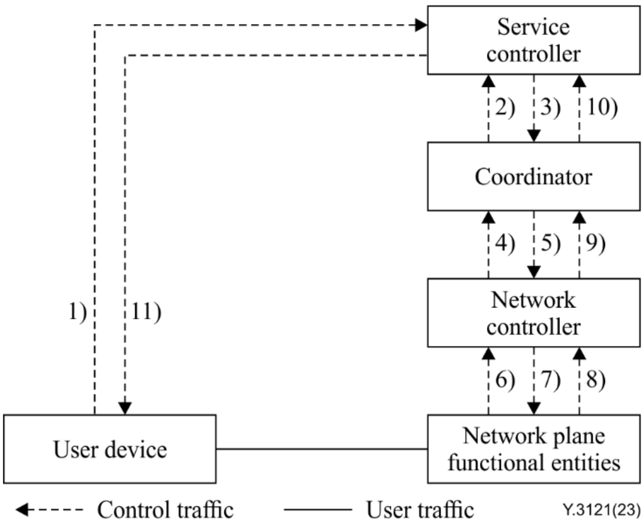

Figure 4 – Example of operational procedure of deterministic communication services

1) The user device requests a QoS assurance objective, either A2A or U2U QoS, to the service controller;

2) The service controller monitors the status of the coordinator, including but not limited to bandwidth, buffer state, and CPU usage;

3) The service controller interprets and maps the QoS assurance objective received from the user device into that of the coordinator, then delivers to the coordinator;

4) The coordinator monitors the status of the network controller(s), including but not limited to bandwidth, buffer state, and CPU usage;

5) The coordinator interprets and maps the QoS assurance objective received from service controller into that of network controller, then delivers to the network controller;

6) The network controller monitors the status of the functional entities of the network plane, including but not limited to time slot, buffer and queuing, etc.;

7) The network controller receives the QoS assurance objective from the coordinator, makes an intra-domain QoS assurance policy and a QoS assurance objective for TD functional entities, then delivers to TD functional entities. The network controller also delivers intra-domain QoS assurance policy, QoS assurance objective and configuration information to the IM;

8) The functional entities of the network plane feed back the results of the QoS assurance execution to the network controller;

9) The network controller feeds back the results of the QoS assurance execution to the coordinator;

10) The coordinator feeds back the results of the QoS assurance execution to the service controller;

11) The service controller feeds back the results of the QoS assurance execution to the user device.

Appendix I

Deterministic communication service scenarios

(This appendix does not form an integral part of this Recommendation.)

I.1 Deterministic communication services in LAN for support of periodic control applications

Small packets, low jitter and high reliability for both upstream and downstream are the requirements from the periodic control applications [b-Eremin] for inter technology domain deterministic communication services.

Deterministic communication services can provide periodic control applications with deterministic network performance, including but not limited to bounded latency, low jitter, and low packet loss. Autonomous vehicles, mobile robots and automated machine control of the production-line are some examples of periodic control applications. Appendix II.1 provides a use case for these scenarios.

Figure I.1 is a conceptual diagram for a deterministic communication service to support periodic control application. As shown in Figure I.I, user devices 1 and 2 are deployed in TD A. The operation technology (OT) OT [b-OT] network may be the instance of TD A. Network technologies adopted by the OT network include but are not limited to TSN [b-IEEE TSN], Profinet [b-Profinet], real-time Ethernet [b-IEC 61784-2], and 5G NPN.

User device 3 is deployed in TD B. The industrial park network may be the instance of TD B. Network technologies adopted by the industrial park network include but are not limited to 5G NPN, WiFi and real-time Ethernet [b-IEC 61784-2].

NOTE 1 – User devices 1 and 2 may alternatively be deployed in different TDs.

NOTE 2 – Although there are common choices of network technologies for TD A and TD B, the case of these two TDs using different network technology is the focus.

NOTE 3 – User device 1 is the logical functionality generating upstream data flow. User device 2 is the logical functionality receiving downstream data flow. User device 3 is the logical functionality of controller for user device 1 and 2.

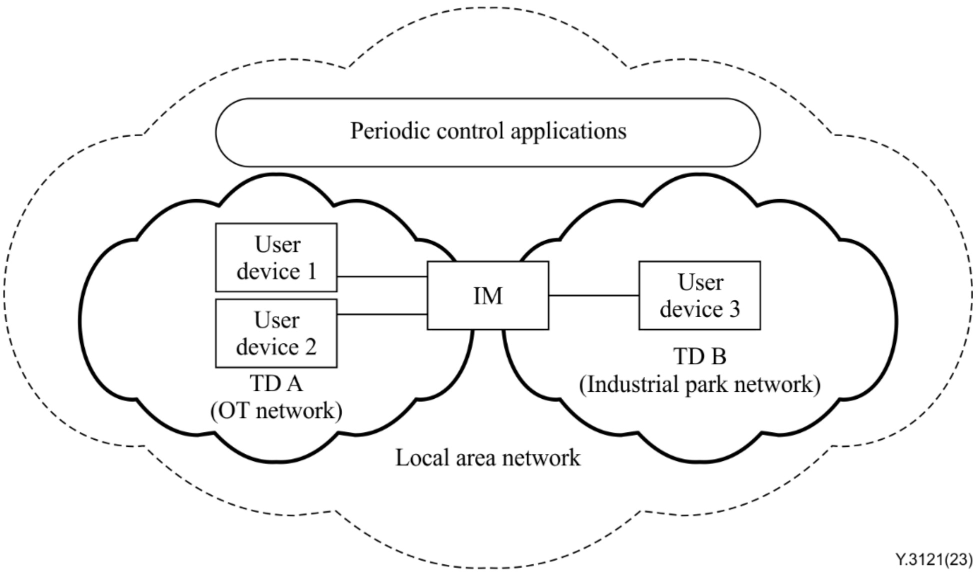

Figure I.1 – Conceptual diagram for deterministic communication service to support periodic control application

I.2 Deterministic communication services in LAN for support of high-bandwidth applications

Large packets, low packet loss and high reliability for both upstream and downstream are the requirements from the high-bandwidth applications for deterministic communication services.

Deterministic communication services can provide high-bandwidth applications with deterministic network performance, including but not limited to high reliability, low packet loss and guaranteed high-bandwidth. HD video monitoring, AR assisted operation and machine vision of production inspection are examples of high-bandwidth applications. Appendix II.2 provides a use case for these scenarios.

Figure I.2 is a conceptual diagram of deterministic communication service scenarios supported by heterogeneous network technologies in a LAN for support of high-bandwidth application.

As shown in Figure I.2, user device 1 is deployed in TD A. The OT network may be the instance of TD A. User device 2 is deployed in TD B. The industrial park network may be the instance of TD B. Network technologies adopted by the OT network and the industrial park network include but are not limited to 5G NPN, WiFi, passive optical network (PON), TSN [b-IEEE TSN] and real-time Ethernet [b-IEC 61784-2].

NOTE 1 – Though there are common choices of network technologies for TD A and TD B, the case that the two domains use different network technology is the focus.

NOTE 2 – User device 1 is the logical functionality with capabilities of generating upstream and downstream data flow. User device 2 is the logical functionality of application server.

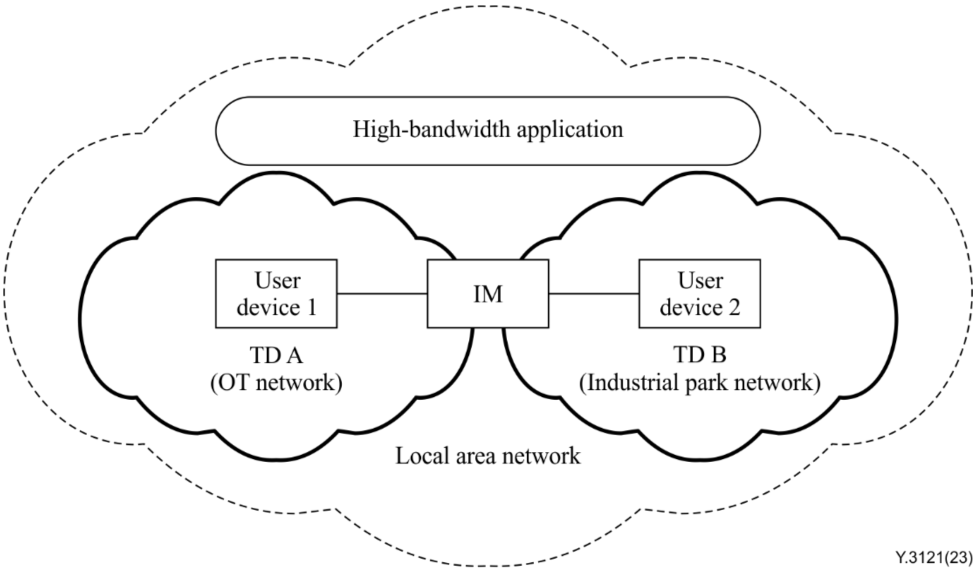

Figure I.2 – Conceptual diagram for deterministic communication service to support high-bandwidth application

I.3 Deterministic communication services in LAN for support of time-sensitive and high-bandwidth mixed applications

Large packets, low packet loss for upstream video traffic plus low latency, high reliability for downstream actuator-control traffic are the quality of service objectives from the time-sensitive and high-bandwidth mixed applications for deterministic communication services.

Deterministic communication services can provide time-sensitive and high-bandwidth mixed applications with deterministic network performance, and can guarantee the network requirements of both video stream and control stream at the same time, including but not limited to bounded latency, low jitter, high reliability, high-bandwidth upstream and low packet loss. Crane remote control in smart ports, unmanned driving in smart factories and coking ovens cooperative remote control in the steel industry are examples of time-sensitive and high-bandwidth mixed applications. Appendix II.2 provides a use case for this scenario.

Figure I.3 is a conceptual diagram for deterministic communication service to support time-sensitive and high-bandwidth mixed applications.

As shown in Figure I.3, user device 1 and 2 may be deployed in different domains of the field. User device 1 may belong to the network of domain A and user device 2 may belong to the network of TD B. The OT network may be the instance of TD A and TD B using different network technologies. User device 3 and user device 4 are deployed in TD C. The industrial park network may be the instance of TD C. Network technologies adopted by the OT network and industrial park network include but not limited to 5G NPN, WiFi, PON, TSN [b-IEEE TSN] and real-time ethernet [b-IEC 61784-2].

NOTE 1 – User devices 1 and 2 may alternatively be deployed in the same TD.

NOTE 2 – Though there are common choices of network technologies for TD A, TD B and TD C, the case that the domains use different network technology is the focus.

NOTE 3 – User device 1 is the logical functionality generating upstream data flow. User device 2 is the logical functionality receiving downstream data flow. User device 3 is the logical functionality of controller for user device 1. User device 4 is the logical functionality of application server for user device 2.

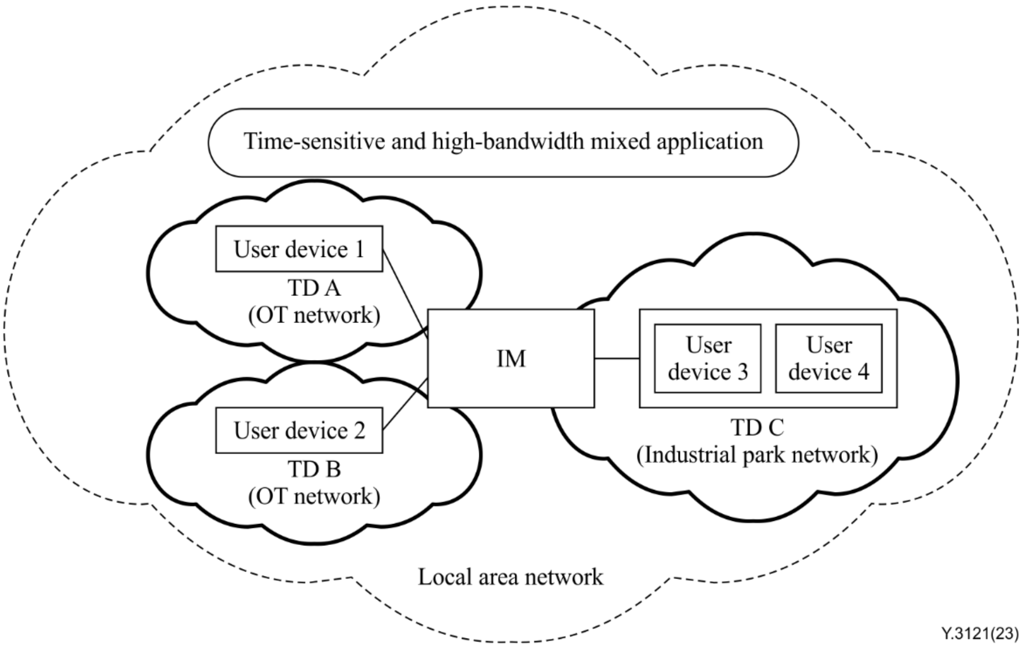

Figure I.3 – Conceptual diagram for deterministic communication service to support time-sensitive and high-bandwidth mixed applications

Appendix II

Use cases of deterministic communication applications supported by deterministic communication services in the LAN

(This appendix does not form an integral part of this Recommendation.)

II.1 Centralized control in industrial Internet

Traditionally programmable logic controllers (PLCs) are deployed near the machines, so PLCs and the machines are connected over short distances. With the help of deterministic communication, the PLCs can be centrally deployed far from their related I/O modules. Centralized control will make cooperation among multiple machines more convenient, because multiple PLCs can be operated from one industrial control computer or cloud computing platform.

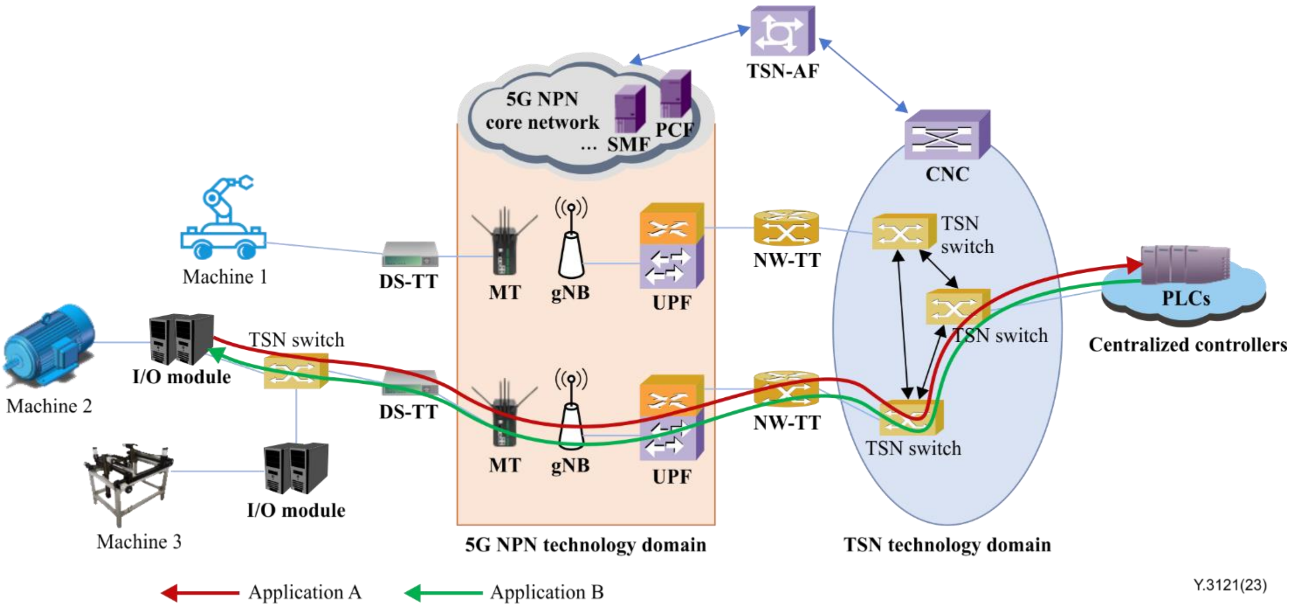

Figure II.1 – Centralized control based on 5G NPN and TSN technology domains

Figure II.1 shows a 5G-TSN based centralized control system in industrial Internet. The PLCs for multiple machines in the production line are deployed in a cloud computing platform, and I/O modules are deployed in the machines. Two technology domains are used in this use case, one is 5G NPN, and the other one is TSN. TSN-application function (TSN-AF) acts as coordinator between 5G and TSN in the control plane. In TSN technology domain, TSN-AF connects to a central network configuration (CNC), which acts as network controller for the TSN switches.

Meanwhile, TSN-AF collects application/port information from the TSN domain and connects to the 5G core network entities such as policy and control function (PCF), session management function (SMF), and so on. In the data plane, the network-side TSN translator (NW-TT) and device-side TSN translator (DS-TT) act as interworking modules (IMs) to support data transmission across the 5G and TSN networks with QoS guarantee, the NW-TT connect to user plane function (UPF) in the 5G technology domain and the TSN switch in the TSN technology domain. For DS-TT, it connects to mobile terminals (MTs) in the 5G technology domain and I/O modules supporting the TSN in machine or TSN switch in the TSN domain.

There are two main applications as shown in Figure II.1. Application A is machine status report, which is sourced from I/O in machines to the central PLC, and this information periodically reports to PLC to learn about the operation status of machine. Application B is control information from the PLC to the remote I/O modules in the machine. Based on the machine status report from machines, the PLC will make decisions for further actions, and then transmit control commands to the related machines. Therefore, both applications A and B are very important for automation control, and the periods for each machine are varied, as a result, the 5G-TSN cooperation networks should provide timely, low-jitter and low packet loss rate QoS guarantee for the transmission of these periodical messages. Table II.1 provides an example set of network performance parameters for centralized control in an industrial Internet (in practice, concrete network parameters may be different) [b-3GPP TS 22.104].

Table II.1 – An example set of network performance parameters for centralized control in Industrial Internet

Use case	Service stream	Periodic or aperiodic	End to end latency	Jitter	Reliability	Precision of time synchronization
Centralized control in industrial Internet	Machine status report	Periodic	5-20 ms	5-10 μs	99.99%	≤ 100 ns
	Signalling of PLCs	Periodic and Aperiodic	5-20 ms	5-10 μs	99.99%	≤ 100 ns

II.2 Video-based monitoring of controlled systems in industrial Internet

With the development of 4K/8K high-definition streaming, machine vision technology based on artificial intelligence (AI) is widely used in industrial scenarios such as product quality inspection, equipment maintenance management and product status identification. Consequently, the question of how to get high-quality video is very important for machine vision applications.

WiFi is the generally used network technology in the industrial field, and many industrial items of equipment, which need to connect to application systems, select WiFi as the access technology. However, WiFi cannot provide QoS guarantees for video transmission, especially when there are several cameras in the same area. The cooperation of 5G and WiFi can provide high-bandwidth, low-jitter and low packet-loss guarantees for multiple high-definition real-time streams transmission.

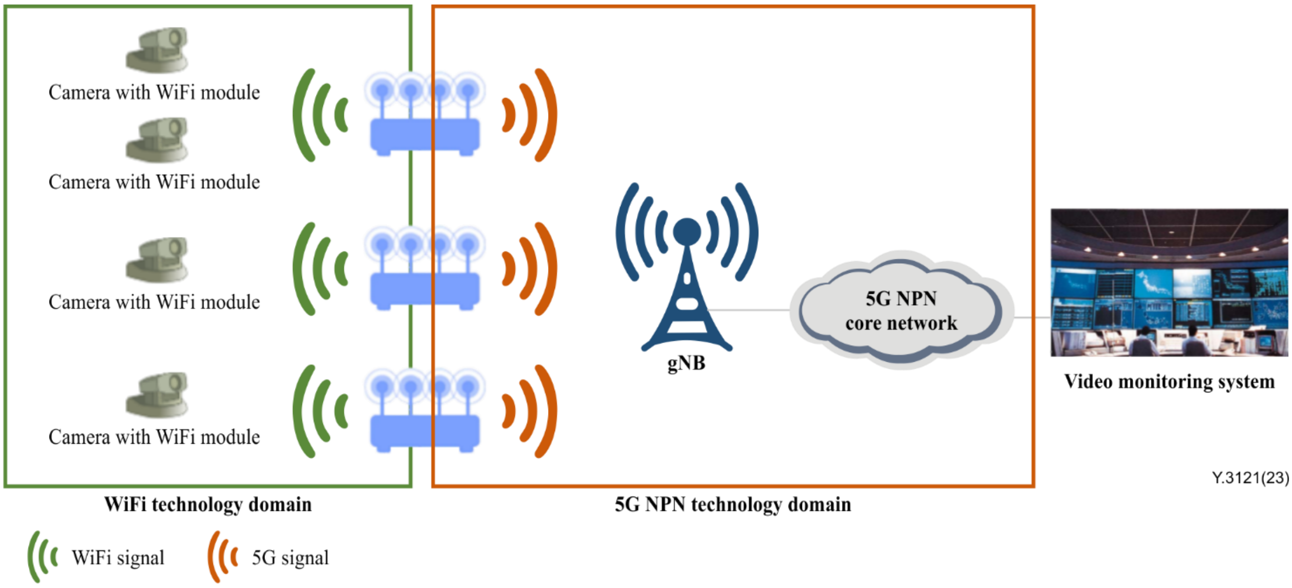

Figure II.2 – Video monitoring based on 5G NPN and WiFi technology domains

As shown in Figure II.2, the cameras with WiFi modules first access the WiFi network, and the 5G-WiFi customer premises equipment (CPE) acts as an interworking module (IM) which can translate the data format of video streams in the WiFi technology domain into the 5G NPN technology domain. Meanwhile, several CPEs with various video streams can request required QoS objectives such as bandwidth, delay, jitter and packet-loss rate from 5G gNB. The 5G gNB can then provide related radio resources for different CPEs with flexible scheduling mechanisms or network-slicing policies. Table II.2 provides a specific example set of network performance parameters for video-based monitoring of controlled systems in industrial Internet (in practice, concrete network parameters may be different) [b-3GPP TS 22.104].

Table II.2 – An example set of network performance parameters for video-based monitoring of controlled systems in industrial Internet

Use case	Service stream	End to end latency	Network rate	Reliability
Video-based monitoring of controlled systems	High-definition Video (1280*720)	10 ms	10 Mbit/s per cameral	99.9%

II.3 HD video based crane remote control

Industrial cranes are large mechanical items of equipment which are composed with mechanical structures, sensors and actuators. In order to improve production efficiency, save labour costs, improve the operator's production environment, and enhance the safety of operations, crane equipment is gradually undergoing automation upgrades. At present, most of the crane equipment adopts centralized remote control, using PLCs and HD real-time video, to complete grabbing and transportation of materials. Remote control of cranes is usually used in harbours, mines and large-scale factories.

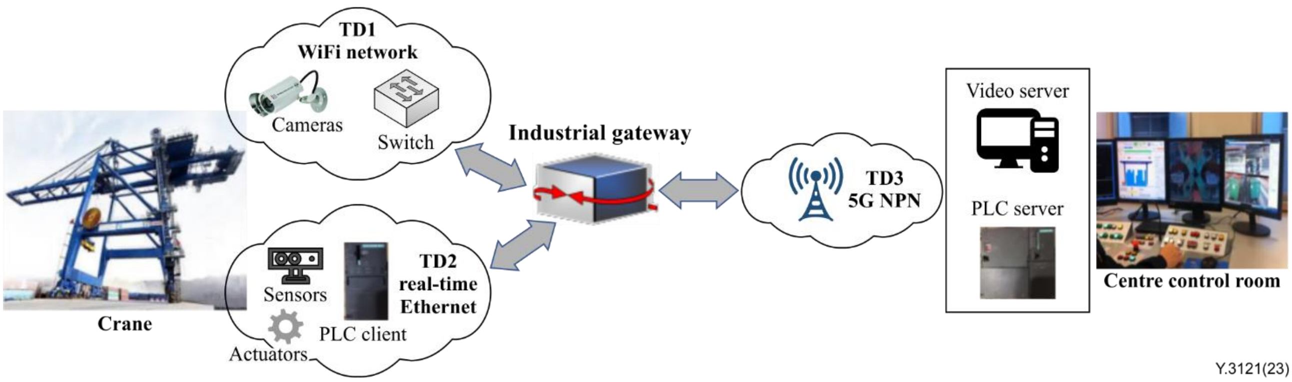

Figure II.3 – Use case of HD video based crane remote control

Figure II.3 shows a use case of crane remote control which needs deterministic communication services, and Table II.3 provides an example set of network performance parameters (in practice, concrete network performance parameters may be different) [b-3GPP TS 22.104]. In the central control room, the operator remotely controls the on-site crane to grab, load, unload and transport industrial materials based on HD video using a lever. Multiple cameras are installed on the crane, and real-time video on-site is transmitted to the video server in the central control room. For uplink video traffic, the LAN is required to provide deterministic services with large bandwidth and low packet loss rate. Moreover, sensors on the crane collect multi-dimensional status information of the PLC client and transmit it to the central control room in the park. The control commands are reversely transmitted to the on-site PLC client through the PLC server to control the actuators of the crane. For downlink control traffic, the local network needs to provide low-latency, high-reliability deterministic services.

Table II.3 – An example set of network performance parameters for HD video-based crane remote control

Use case	Service stream	Speed rate / bit/s	End to end latency	Reliability	Mobility
Crane remote control	HD real-time video	Uplink: ≥ 4M/ per camera, total 40-100 M (1080P) Downlink: ≥ 100 K/per camera	≤ 60 ms	99.9%	Medium speed, m/min
	Control signal	Uplink: ≥ 100 K Downlink: ≥ 100 K	≤ 20 ms	99.999%	

This end-to-end application is considered to be in the LAN, which can be divided into three TDs according to different network technologies. The WiFi network supporting the cameras is considered as TD1. The sensors, actuators, and PLC client connect to TD2 using real-time Ethernet. The video server and PLC server installed in the central control room connect to TD3 using 5G NPN. The industrial gateway serves as an IM to realize the intercommunication between different TDS and ensure the A2A and U2U QoS across TD1, TD2 and TD3.

The crane remote control application system sends the U2U QoS objectives to a cross-domain coordinator. The coordinator converts these U2U QoS objectives into LAN QOS requirements, and configures the network controllers of TD1, TD2 and TD3 according to decisions of cross-TDs policing and controlling. A network controller of the different TDs provides specific network configuration and policing to intra-domain devices, and reports collected network information to the coordinator in time to achieve dynamic network deterministic service guarantee.

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