ETSI GS NGP 001 V1.1.1 (2016-10)

Next Generation Protocols (NGP); Scenarios Definitions

Disclaimer

The present document has been produced and approved by the Next Generation Protocols (NGP) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG.
It does not necessarily represent the views of the entire ETSI membership.

Reference
DGS/NGP-001

Keywords
core network, cyber security, IoT, mobility,
network, QoE, reliability, security, service,
use case

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status.
Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Copyright Notification

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Next Generation Protocols (NGP).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The scope of the present document is to specify the minimum set of key scenarios for the Next Generation Protocols (NGP), Industry Specific Group (ISG).

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] NGMN: "5G Whitepaper".

NOTE: NGMN specifications are available at https://www.ngmn.org/uploads/.

[2] Recommendation ITU-T Y.2091: "Terms and definitions for next generation networks".

[3] Recommendation ITU-T Y.2720: "NGN identity management framework".

[4] IETF RFC 6830: "The Locator/ID Separation Protocol (LISP)".

[5] IETF RFC 760: "DoD standard Internet Protocol".

[6] ISO/IEC 7498-1:1994: "Information technology - Open Systems Interconnection -- Basic Reference Model: The Basic Model".

[7] World Geodetic System 1984.

[8] ETSI GS NFV 002: "Network Functions Virtualisation (NFV); Architectural Framework".

[9] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[10] IETF RFC 4364: "BGP/MPLS IP Virtual Private Networks (VPNs)".

[11] IETF RFC 4761: "Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling".

[12] IETF RFC 3753: "Mobility Related Terminology".

[13] IETF RFC 7333: "Requirements for Distributed Mobility Management".

[14] IETF draft-ietf-lisp-lcaf-14 (LISP): "LISP Canonical Address Format (LCAF)".

[15] IETF draft-farinacci-lisp-eid-anonymity-00 (LISP): "LISP EID Anonymity".

[16] ETSI GS NFV 001 (V1.1.1): "Network Functions Virtualisation (NFV); Use Cases".

NOTE: ETSI NFV references are available at http://www.etsi.org/deliver/etsi_gs/NFV/.

[17] ETSI GS NFV-MAN 001 (V1.1.1): "Network Functions Virtualisation (NFV); Management and Orchestration".

[18] ETSI GS NFV-SEC 003 (V1.1.1): "Network Functions Virtualisation (NFV); NFV Security; Security and Trust Guidance".

[19] ETSI GS MEC 001 (V1.1.1): "Mobile Edge Computing (MEC) Terminology".

NOTE: MEC references are available at http://www.etsi.org/deliver/etsi_gs/MEC/.

[20] ETSI GS MEC 003 (V1.1.1): "Mobile Edge Computing (MEC); Framework and Reference Architecture".

[21] ETSI GS MEC-IEG 004 (V1.1.1): "Mobile-Edge Computing (MEC); Service Scenarios".

[22] ETSI TS 103 307: "CYBER; Security Aspects for LI and RD Interfaces".

[23] ETSI GS NFV-SEC 009 (V1.1.1): "Network Functions Virtualisation (NFV); NFV Security; Report on use cases and technical approaches for multi-layer host administration".

NOTE: ONF references are available at https://www.opennetworking.org/about/onf-overview.

[24] ETSI TS 132 500: "Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Self-Organizing Networks (SON); Concepts and requirements (3GPP TS 32.500)".

[25] MEC White-paper: "Mobile Edge Computing: A key technology towards 5G", 2015.

NOTE: ETSI whitepapers are available at http://www.etsi.org/technologies-clusters/white-papers-and-brochures/etsi-white-papers.

[26] IEEE 802.1ah™ : " Provider Backbone Bridges".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] 3GPP TR 22.891: "Feasibility Study on New Services and Markets Technology Enablers; Stage 1" (SMARTER).

NOTE: 3GPP™ specifications are available at http://www.3gpp.org/specifications/specifications.

[i.2] 3GPP TR 23.799: "Study on Architecture for Next Generation System" (NexGen).

[i.3] ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Vocabulary for 3GPP Specifications (3GPP TR 21.905)".

[i.4] 5GPPP Whitepaper on Automotive Vertical Sector.

NOTE: 5GPPP specifications are available at: https://5g-ppp.eu/white-papers/.

[i.5] 5GPPP Whitepaper on Energy Vertical Sector.

[i.6] 5GPPP Whitepaper on Factories of the Future.

[i.7] 5GPPP Whitepaper on E-Health.

[i.8] Elements of Mathematics: "General Topology", Berlin, Springer- Verlag, 1990, Bourbaki, N. 1971.

[i.9] "Elements of the Topology of Plane Sets of Points", Newman, M, 1964.

[i.10] "High-Speed Networks and Internets", Stallings, William; Prentice-Hall™, 2002.

[i.11] Risk Nexus: "Overcome by cyber risks? Economic benefits and costs of alternate cyber futures".

NOTE: Available at http://www.cse.wustl.edu/~jain/papers/.

[i.12] "A Binary Feedback Scheme for Congestion Avoidance in Computer Networks with Connectionless Network Layer," ACM Transactions on Computer Systems, Vol. 8, No. 2, May 1990, pp. 158-181, K. Ramakrishnan and Raj Jain.

NOTE: Available at http://www.cse.wustl.edu/~jain/papers/.

[i.13] "Congestion Avoidance in Computer Networks with A Connectionless Network Layer: Part IV: A Selective Binary Feedback Scheme for General Topologies," Digital Equipment Corporation Technical Report No. DEC-TR-510, August 1987, 43 pp., K. Ramakrishnan and Raj Jain.

[i.14] "Timer-Based Mechanisms in Reliable Transport Protocol Connection Management" Computer Networks 5, 1981: 47-56, Watson, R.

[i.15] IETF RFC 4762: "Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling".

[i.16] IETF RFC 4984: "Report from the IAB Workshop on Routing and Addressing".

[i.17] 3GPP TR 23.863: "Support of Short Message Service (SMS) in IP Multimedia Subsystem (IMS) without Mobile Station International ISDN Number (MSISDN); Stage 2".

[i.18] 3GPP TR 22.864: "FS-SMARTER - Network Operation".

[i.19] IETF RFC 6582: "The NewReno Modification to TCP's Fast Recovery Algorithm".

[i.20] IETF RFC 2018: "TCP Selective Acknowledgment Options".

[i.21] ETSI GS MEC 002: "Mobile Edge Computing (MEC); Technical Requirements".

[i.22] ETSI GS MEC-IEG 005: "Mobile-Edge Computing (MEC); Proof of Concept Framework".

[i.23] IETF RFC 7041: "Extensions to the Virtual Private LAN Service (VPLS) Provider Edge (PE) Model for Provider Backbone Bridging".

[i.24] 5G Manifesto for timely deployment of 5G.

[i.25] 3GPP TR 38.913: "Study on Scenarios and Requirements for Next Generation Access Technologies".

[i.26] IETF Charter of IETF DMM documents.

NOTE: IETF DMM Charter references are available at https://datatracker.ietf.org/wg/dmm/charter/.

[i.27] Broadband Forum TR-069: "CPE WAN Management Protocol".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions applying to scenarios that include mobile network architectures given in ETSI TR 121 905 [i.3] and 3GPP TR 23.799 [i.2] apply.

access point: point of access to a network, which in this generic NGP context may be a traditional Wi-Fi access point, 3GPP cellular network base station, RRU supporting a cell or sector or part thereof if the cell is configured as a multi-point access cell

address: identifier for a specific termination point and is used for routing to this termination point

NOTE: See Recommendation ITU-T Y.2091 [2].

application process: instantiation of a program executing in a processing system intended to accomplish some purpose. An application contains one or more application protocol machines

application process name: name of an application process

application protocol: protocol characterized by modifying state external to the protocol by performing remote operations on an object model

NOTE: The minimal set of operations are create/ delete, start/ stop, and read/ write.

application protocol name: name of an application protocol

asymmetric link: link with transmission characteristics which are different depending upon the relative position or design characteristics of the transmitter and the receiver of data on the link

NOTE: For instance, the range of one transmitter may be much higher than the range of another transmitter on the same medium see IETF RFC 3753 [12].

backhaul: transmission system between a base station entity and the cellular core network or Non-Access Stratum

binding a name to an object: function, $Fn(M_{NS})$, that defines the mapping of elements of NS(namespace) to elements of M(object)

NOTE 1: The result of this function is called a *binding*. e.g. In LISP, the binding operation is called mapping.

NOTE 2: For example <ID1, RLOC1> is the mapping of ID1="identity1" to RLOC1="an ip address or any other form of addressing".

care-of-address: IP address associated with a mobile node while visiting a foreign link; the subnet prefix of this IP address is a foreign subnet prefix

NOTE: A packet addressed to the mobile node which arrives at the mobile node's home network when the mobile node is away from home and has registered a Care-of Address will be forwarded to that address by the Home Agent in the home network see IETF RFC 3753 [12].

centralized mobility management: makes use of centrally deployed mobility anchors

NOTE Please see IETF RFC 7333 [13].

congestion avoidance: mechanism that operates the network at the knee of the congestion or response time (or delay) curve to optimize the trade-off between response time and throughput

congestion 'cliff': congestion point of the response time (or delay) curve at which a session collapses

congestion control: Addresses the "social" problem of having various logical links in the network cooperate in order to avoid and/ or recover from congestion of the intermediate nodes that they share. This scheme operates by constantly testing the cliff of congestion collapse which implicitly introduces packet loss in order to seek to reduce the load during periods of congestion, so that the network can recover to an uncongested state.

congestion 'knee': congestion point of the response time (or delay) curve at which as session begins to notably deteriorate

compound connection: connection that includes logical connectivity to more than one access network at a time

connection: shared state between EFCPM-instances, see ISO/IEC 7498-1 [6]

C-RAN: cloud RAN where the physical radio part of a base station termed the RRU has been remoted from its base band equipment termed the BBU via 'fronthaul' transmission and the BBU part connects the composite RAN equipment to the cellular core via 'backhaul'

NOTE: Often multiple RRU communicate with a single BBU to effect RAN optimization at the BBU level across a number of Cells provided by the RRH.

dual connectivity: mechanism whereby a device can access multiple cells/access points at the same time to bond multiple single cell/access point capabilities together to increase available throughput

data transfer protocol:, machine dtp(m): half of the EFCP that performs tightly bound mechanisms, such as ordering, and fragmentation/reassembly

NOTE: One instantiation is created for each flow allocated, see ISO/IEC 7498-1 [6].

Data Transfer Control Protocol, Machine DTCP(M): half of the EFCP that performs loosely bound (feedback) mechanisms, such as retransmission and flow control

NOTE: This protocol maintains state, which is discarded after long periods of no traffic (2MPL). One instantiation is created for each flow requiring either flow control or retransmission control. See ISO/IEC 7498-1 [6].

distance vector: characteristic of some routing protocols in which, for each desired destination, a node maintains information about the distance to that destination, and a vector (next hop) towards that destination

NOTE: See IETF RFC 3753 [12].

distributed application: collection of cooperating APs that exchange information using IPC and maintain shared state

distributed mobility management: not centralized, so that traffic does not need to traverse centrally deployed mobility anchors far from the optimal route

NOTE: See IETF RFC 7333 [13].

D-RAN: traditional RAN where the physical radio part of a base station and its base band equipment are co-located at the base station cell site and connected to the rest of the cellular network with 'backhaul' transmission

EID: Endpoint ID In LISP is the binding operation and is called a mapping.

NOTE: For example <ID1, RLOC1> is the mapping of ID1="identity1" to RLOC1="an IP address or any other form of addressing", see IETF RFC 6830 [4], [14] and [15].

Error and Flow Control Protocol (EFCP): data transfer protocol required to maintain an instance of IPC within a layer characterized by modifying state internal to the protocol

NOTE: The functions of this protocol may ensure reliability, order, and flow control as required.

Error and Flow Control Protocol Machine (EFCPM): task that instantiates an instance of the EFCP for a single flow or connection

NOTE: An EFCPM consists of two state machines loosely coupled through a single state vector: one that performs the tightly bound mechanisms, referred to as the Data Transfer PM; and the other that performs the loosely coupled mechanisms, referred to as the Data Transfer Control PM, see ISO/IEC 7498-1 [6].

flooding: process of delivering data or control messages to every node within the network under consideration

NOTE: See IETF RFC 3753 [12].

flow control: Flow Control is often referred to as ETE Flow control, see definition in ETSI TR 121 905 [i.3].

front-haul: transmission between separated component parts of a traditional base station when it has been functionally split into at least 2 parts and those parts are remote from each other

function chaining: virtual inter-connection of VNFs to form a NS

graph: ordered pair G = (V, E) comprising a set V of vertices or nodes or points together with a set E of edges or arcs or lines, which are 2-element subsets of V

NOTE: i.e. an edge is related with two vertices, and the relation is represented as an unordered pair of the vertices with respect to the particular edge).

grouping service slice: service chain built to render support for a virtual service offering according to a defined subscriber grouping

NOTE: See 3GPP TR 23.799 [i.2] for further information on the 3GPP ongoing definition of Network Slicing.

handover: process by which an active Mobile Node (in the Active State) changes its point of attachment to the network, or when such a change is attempted

NOTE: The access network may provide features to minimize the interruption to sessions in progress. This procedure is also called hand-off. IETF RFC 3753 [12].

home address: IP address assigned to a mobile node, used as the permanent address of the mobile node

NOTE: This address is within the mobile node's home link. Standard IP routing mechanisms will deliver packets destined for a mobile node's home address to its home link. IETF RFC 3753 [12].

Hybrid RAN (H-RAN): optimized form of RAN using concepts from both C-RAN and D-RAN

identifier: series of digits, characters and symbols or any other form of data used to identify subscriber(s), user(s), network element(s), function(s), network entity(ies) providing services/applications, or other entities (e.g. physical or logical objects)

NOTE See Recommendation ITU-T Y.2720 [3].

identity: information about an entity that is sufficient to identify that entity in a particular context

NOTE: See Recommendation ITU-T Y.2720 [3].

Instance Identifier (ID): instance ID is used to define extended forms of EID as a multi-tuple value

NOTE: Where (IID, EID) is one example of an extended EID, see IETF RFC 6830 [4].

IoT(mobileS): mobile capable IoT device with one or more sensors

IoT(mobileSA): mobile capable IoT device with one or more sensors and one or more actuators

IoT(staticS): static capable IoT device with one or more sensors

IoT(staticS): static capable IoT device with one or more sensors and one or more actuators

(IP) address: shorthand for Internet Protocol address

NOTE: See IETF RFC 760 [5].

IPC-process: AP that is a member of (N)-layer and implements locally the functionality to support IPC using multiple subtasks

NOTE: Specific for a layer (N).

link: communication facility or physical medium that can sustain data communications between multiple network nodes, such as an Ethernet simple or bridged)

NOTE: A link is the layer immediately below IP. In a layered network stack model, the Link Layer (Layer 2) is normally below the Network (IP) Layer (Layer 3), and above the Physical Layer (Layer 1), see IETF RFC 3753 [12]

local broadcast: delivery of data to every node within range of the transmitter

NOTE: See IETF RFC 3753 [12].

(2D Geographic) Location: specifies the physical location of a 2D point on the earth using two coordinates: i) latitude and ii) longitude

NOTE: As referenced in World Geodetic System 1984 [7].

(3D Geographic) Location: 2D location specified with an accompanying altitude expressed as metres above sea level or (ASL)

mobility management: solutions that lie at the centre of the wireless Internet and enable mobile devices to partake in IP networks anytime and anywhere

NOTE: See IETF Charter of IETF DMM WG [i.26]. Includes the setup, maintenance(handover) and release of various physical radio resources when the mobility management is operated with at least one end of a group of communicating peers are attached to the network via an air interface.

(N)-address: identifier that is a synonym for the IPC-Process-Instance, which is a member of a (N)-layer.

NOTE 1: An address is only unambiguous within the (N)-layer (and assigned by the (N)-layer).

NOTE 2 This identifier may be assigned to facilitate the operation of the (N)-layer, i.e. location-dependence for routing, see ISO/IEC 7498-1 [6].

(N)-API-primitive: library or system call for a (N)-layer used by an application-process to invoke system functions, in particular IPC functions, such as requesting the allocation of IPC resources

NOTE: See ISO/IEC 7498-1 [6].

N-Concurrent Multi-Access Network: eco-system that includes more than one access network and allows a user device to connect concurrently with more than one of these networks at a time

(N)-Connection-endpoint-id: identifier unambiguous within the scope of an IPC Process that identifies an EFCPM-instance

NOTE: In the Internet, port-id = CEP-id = socket. This also creates several security vulnerabilities, see ISO/IEC 7498-1 [6].

(N)-connection-identifier: identifiers internal to the (N)-layer and unambiguous within the scope of two communicating EFCPMs of that layer

NOTE: The (N)-connection-identifier is commonly formed by the concatenation of the source and destination CEP-ids to identify the two directions of the connection, see ISO/IEC 7498-1 [6].

(N)-Flow: binding of source and destination (N)-connection-endpoints to source and destination (N)-ports

(N)-Layer: collection of processes cooperating as a distributed application to provide inter-process communication (IPC), that create a locus of distributed shared state of a given scope

NOTE: Layers of different rank will generally have different scope.

name: unique string, N, in some alphabet, A, that unambiguously denotes some object or denotes a statement in some language, L. The statements in L are constructed using the alphabet, A

NOTE: May be mapped to an address by a process or application, see Recommendation ITU-T Y.2091 [2].

name-space: set {N} of names from which all names for a given collection of objects are taken. A function, M_{NS}, which defines the class of objects, M, that may be named with elements of NS

NOTE: This is referred to as the scope of the name space. This may refer to actual objects or the potential for objects to be created. A name from a given name space may be bound to one and only one object at a time.

neighbour/neighbor: any other node to which data may be propagated directly over the communications medium without relying on the assistance of any other forwarding node as defined in IETF RFC 3753 [12]

neighbourhood/neighborhood: all the nodes which can receive data on the same link from one node whenever it transmits data

NOTE: As defined in IETF RFC 3753 [12].

(Network) Graph: graph of a network

NOTE: A mathematical description of a network by means of two entities:

i) vertices, which represents the nodes; and