ETSI GS NGP 001 V1.2.1 (2017-05)

Next Generation Protocols (NGP);
Scenario Definitions

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Foreword

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

Modal verbs terminology

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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.

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[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".

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[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".

[27] ETSI TS 123 401: "LTE; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (3GPP TS 23.401 Release 13)".

[28] 3GPP TS 22.261: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Service requirements for the 5G system; Stage 1 (Release 15)".

[29] ETSI TS 122 280: "LTE; Mission Critical Services Common Requirements (3GPP TS 22.280 Release 14)".

[30] Society of Automotive Engineers, J3016.

NOTE: This reference is available at http://standards.sae.org/j3016_201401/.

[31] IETF RFC 3246: "An Expedited Forwarding PHB (Per-Hop Behavior)".

[32] 3GPP TS 23.501: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; System Architecture for the 5G System; Stage 2 (Release 15)".

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[i.1] 3GPP TR 22.891: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 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: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 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] Stallings, William; "High-Speed Networks and Internets", 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] Digital Equipment Corporation Technical Report No. DEC-TR-510: "Congestion Avoidance in Computer Networks with A Connectionless Network Layer: Part IV: A Selective Binary Feedback Scheme for General Topologies", August 1987, 43 pp., K. Ramakrishnan and Raj Jain.

[i.14] Void.

[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: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 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: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Feasibility Study on New Services and Markets Technology Enablers - Network Operation; Stage 1".

[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.

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[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".

[i.28] 3GPP TR 38.801: "Study on New Radio Access Technology: Radio Access Architecture and Interfaces".

[i.29] 3GPP TR 36.881: "Study on latency reduction techniques for LTE".

[i.30] Ericsson Research AB, "Service Mobility in Mobile Networks", 2015 IEEE 8th International Conference on Cloud Computing .

[i.31] Nokia: "W01-Third Workshop on 5G Architecture (5GArch 2016) ",Mobility Management Enhancements for 5G Low Latency Services.

[i.32] K. De Schepper, I. Tsang, Bell Labs, B. Briscoe, Ed., "Identifying Modified Explicit Congestion Notification (ECN) Semantics for Ultra-Low Queuing Delay draft-briscoe-tsvwg-ecn-l4s-id-00", Simula Research Lab.

[i.33] Void.

[i.34] 3GPP TR 22.862: "Feasibility Study on New Services and Markets Technology Enablers for Critical Communications; Stage 1" (Release 14).

[i.35] National Highway Traffic Safety Administration's "Preliminary statement of policy concerning automated vehicles" (2013).

NOTE: This reference is available at http://www.nhtsa.gov/staticfiles/rulemaking/pdf/Automated_Vehicles_Policy.pdf.

[i.36] 5GPPP "5G Automotive Vision" white paper.

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

[i.37] 3GPP TR 22.886: "Study on enhancement of 3GPP Support for 5G V2X Services (Release 15)".

[i.38] SAE Mobulus: "Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems".

NOTE: This reference is available at http://standards.sae.org/j3016_201401/.

[i.39] Driverless Future.

NOTE: Available at http://www.driverless-future.com/?page_id=774#ethical-judgements.

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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] and the following 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

NOTE: 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].

autonomous: entity capable of piloting itself based on sensory input and pre-defined behaviours, including collision avoidance, speed limits and geographical constraints

NOTE 1: Used in the context of communications pertaining to an autonomous drone or vehicle in the present document.

NOTE 2: However, a remote piloting capability may be provided via a network to which the vehicle is able to communicate with.

autonomous drone: autonomous vehicle with no human operator on-board

NOTE: The distinction between a 'drone' and an 'autonomous drone' is that in the case of an 'autonomnous drone', the vehicle is piloted through on-board sensor processing, and optionally, and less frequently remote control 'managed by' a human operator. Where: the term 'managed by' indicates that the human operator may be actively monitoring the vehicle's progress, and taking control manually on an event triggered basis, as necessary; or delegating the remote control to a computing process.

autonomous vehicle: vehicle capable of piloting itself, that also has a human operator on-board

NOTE 1: The distinction between an 'autonomous vehicle' and an 'autonomous drone' is the presence of a human operator in the vehicle.

NOTE 2: The 'autonomouse vehicle' is piloted through a combination of on-vehicle sensor readings, which are processed to determine action, and optional interjection from a human operator. An example of this kind of situation is when there is a 'self-driving car' with a human passenger on-board who is capable of piloting the car.

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].

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centralized mobility management: Makes use of centrally deployed mobility anchors.

NOTE Please see IETF RFC 7333 [13].

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

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: control scheme that manages packet congestion, by constantly testing the congestion level that causes the network communications to collapse and responds by introducing packet loss to reduce the load during periods of congestion so that the network can recover to an uncongested state

NOTE 1: The congestion level that causes the network to collapse is often referred to as the ‘congestion cliff’ because the curve of throughput versus load, becomes very steep beyond this congestion level.

NOTE 2: Addresses the "social" problem of having various logical links in a network cooperate in order to avoid and/ or recover from congestion of the intermediate nodes that they share.

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

connected vehicle: vehicle connected to one or more cummunications networks and piloted by a human operator

NOTE 1: The network will allow the vehicle to share data with other connected vehicles and remote servers.

NOTE 2: A Connected vehicle does not need to be autonomous, but is network connected for purposes of assisted navigation, environmental updates, vehicle analysis, infotainment etc.

connection: shared state between EFCPM-instances

NOTE: 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.

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 3753 [13].

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drone: powered vehicle remotely controlled by a human operator

NOTE: To distinguish these entities from radio-controlled planes or cars used by hobbyists, the drone should be a client and/or server of data towards a network: for example, it may send video or sensor readings, or be sent images of objects it will aim to detect in its environment.

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

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

Endpoint ID (EID): in LISP 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: 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

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