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Next Generation Protocols (NGP); NGP Reference Model

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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 present document defines the NGP Reference Model for protocols and protocol architectures. The model provides a common reference that is to be used to specify and inform about enhancements to existing protocols and new protocol designs, across the scope of both NGP contributions and approved documented output.

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

[1] ETSI GS NGP 001: "Next Generation Protocol (NGP); Scenario Definitions".

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

[3] IEEE 802.3™: "IEEE Standard for Ethernet".

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.

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

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

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TR 121 905 [i.1], 3GPP TR 23.799 [i.2], ETSI GS NGP 001 [1], ISO/IEC 7498-1 [2] and the following apply:

application protocol: entity that resides inside an application that specifies and handles the protocol type to which it is communicating

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TR 121 905 [i.1] and the following apply:

NEt( )	Network Equipment
NEy( )	Network Entity
PoA	Point of Attachment

4 NGP Reference Model

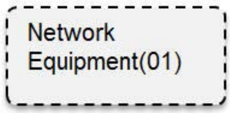
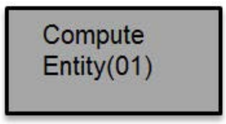
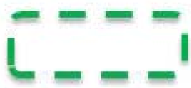
4.1 Introduction

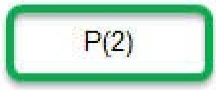
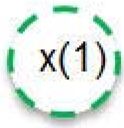
The NGP Reference Model is a generic protocol model that should be used to describe proposed NGP protocols and protocol architectures.

4.2 Model Components

The NGP Reference Model includes the following component parts, as illustrated in Table 1.

Table 1: Model Components

Model Component	Description	Graphical Description	Illustration
Network Equipment	A logical collection of compute entities.	The Network Equipment is represented as a rounded corner rectangular object, with grey fill and a dotted black outline. The Network Equipment should be named with a text label and if there are more than one of these equipments in the illustration then it should include a numeric reference too.	
Compute Entity	An entity that can support one or more Network Entities.	The Compute Entity is represented as a square corner rectangular object, with coloured fill and a dotted solid black outline. The entity should be named with a text label and if there are more than one of these entities in the illustration then it should include a numeric reference too.	
Network Entity	An entity that represents one or more network functions and includes protocols with which it communicates to other protocol peers at other Network Entities. Addresses can be carried in protocols, but are assigned to network entities. Addresses are unambiguous within a layer. (also known as a Network Function in a virtualised 3GPP environment.)	The Network Entity is represented as a rounded corner rectangular object, with coloured fill. The Network Entity has a dotted solid black outline. The entity should be named with a text label and a reference to a valid address.	
Layer	A collection of two or more network entities that share state using one or more protocols. Where: Network Entity is a NEy as defined in the present document NGP Reference Protocol Model definition.	Oblong dotted green outline encompassing the protocol scope of the layer.	

Model Component	Description	Graphical Description	Illustration
Protocol Node	The container of protocol instances within a network entity, which interpret and operate on the header of a particular protocol type. If the header is empty then there are other cases that may operate as follows: i) It is assumed that there is either a default local port-id connected that this entity automatically passes the packet to. ii) There is only one port-id and application connected for the protocol node to pass per flow. iii) The packet is passed to a particular port-id by some other aspect of the communication such as time or frequency.	Represented as a zero fill circle object with a green coloured solid outline. The text label should include an abbreviation of the name of the protocol. It contains zero or more protocol instances inside.	
Protocol Instance	An instantiation of a protocol node (an individual protocol machine). One end of a Connection operating within a Protocol Node and handling its communications state. Identified by a CEPI, unambiguous within the scope of the network-entity. For an NGP compliant protocol there is a one to one mapping between a Port-Id and a Protocol Instance.	Represented as a solid fill circle object with a green coloured dashed outline The text label should include the CEPI.	
Port	The binding between an instance of an application or an instance of a protocol and an instance of this protocol. A Port is identified by a Port-ID unambiguous within the scope of the network-entity. An application or (N+1)-network-entity can have one or more Port-IDs. See note.	Represented as a zero fill circle object with a purple coloured solid outline. The text label should include the Port-ID.	
Application	An entity that performs one or more functions and connects to a protocol node via a port. An application may be i) performing part of the tasks of a network entity and therefore be part of it or ii) managing the network entity (configuration, monitoring) or iii) just using the communication services provided by a network entity via a port-id.	Represented as a zero fill circle object with a turquoise coloured solid outline. The text label should include the Application Name.	
User	An entity (such as a human) that uses an application.	Represented as a zero fill circle object with a cyan coloured solid outline.	

Model Component	Description	Graphical Description	Illustration
Point of Attachment (PoA)	A Port that binds this protocol to a physical interface. A PoA is identified by a Port-ID .	Represented as a zero fill circle object with a purple coloured solid outline. The text label should include the Port-ID. Each PoA has a text label as follows: i) 'P' for Point of Attachment. ii) A letter to indicate which interface technology; this and the outline colour should be as below: - Electrical: e, red. - Optical: o, orange. - LTE (Radio): L, black. - Wi-Fi™ (Radio): W, purple. - 5G new radio: 5, green. iii) The Port-ID in brackets.	
Flow	An instance of a communications service provided by a layer to an application or protocol node. A port-id locally identifies a specific flow within a Network Equipment.	A dotted line between Port-IDs.	
Virtual Connection	The shared state between two data transfer Protocol Instances that supports a flow. Identified by a connection-id (CID) unambiguous within the scope of the communicating network-entities. It is generally formed by concatenating the CEP-ids associated with the communicating protocol-instances.	A dashed line between Protocol Instances.	
Physical Connection	A physical connection between two PoA.	A solid line between PoA of colour matching that of the PoA type.	
Internal software communication	Illustration of intra-NEy communication between model parts.		
NOTE: Some legacy protocols enable multiple applications to be connected to the same 'Port' via multiple local bindings. In this case: - NGP Port (bound to single App(x) instance and identified by NGP Port-ID) = Legacy protocol 'Port' + Local Binding(s). - In this manner managed application multiplexing on to a single NGP Port is able to be modelled in the NGP reference model.			

4.3 Protocol Model

4.3.1 Identification

Each component shall have an identifier which identifies it uniquely within a defined scope.

In the case of a component that is contained within another component, the scope may be the containing component.

4.3.2 Protocol Layers

Multiple Network-Entities may be used to model a layered architecture.

4.3.3 Addressing

Each Network-Entity has an address that is distinct for the scope of the layer.

4.4 Example Cases using the NGP Reference Model

4.4.1 Introduction

This clause introduces common cases that occur in communications systems.

4.4.2 Case(Single Network Equipment, Physical Network Connectivity)

The basic NGP protocol model structure is illustrated in Figure 1.

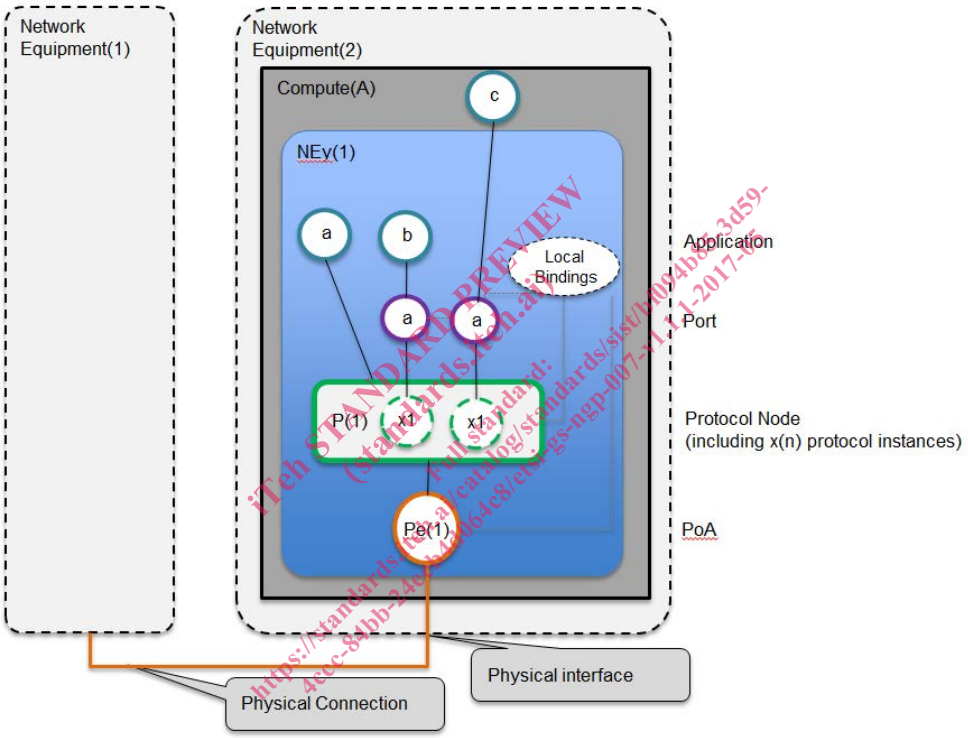


Figure 1: Single Network Equipment, Physical Network Connectivity

Figure 1 introduces the basics of the generic NGP protocol reference model, by showing how it represents two physically separate Network Equipment instances or NEt( )'s.

Several different application options are illustrated in Figure 1, as follows:

- App(a) is a local function that is part of the NEy(1) that manages protocol node P(1) e.g. 3GPP CM or PM.
- App(b) is a communicating function in NEy(1) that uses P(1) to communicate with another peer.
- E.g. a mobility manager in a cellular core NEy.
- App(c) is an application that uses NEy(1) to communicate via its implementation of P(1) with another peer. E.g. a browser.

Inside each physical Network Equipment are compute entities on which logical Network Entities, NEy( ) may be instantiated that enable network connectivity for the Network Equipment.

Applications that use network connectivity at the Network Equipment may be instantiated on any of the compute entities and connected to a network entity containing a communications protocol via a Port.

In cases where a Network Entity has multiple addresses all of the addresses shall resolve to the same Network-Entity.

Network entities can support multiple NGP protocol Ports. A Port provides Applications or other protocols with a communication service provided by a Network Entity. A Port-id is unambiguous within the scope of an entity named by the Address.

Each Network Equipment has one or more Points of Attachment (PoA) which give physical connectivity to other Network Equipment instances. Each which may be Wired, Optical, or Radio of example types: RF-Cellular, Millimetric and/or Wi-Fi™.

Each Application sends and receives data via one or more of the ports in the same Network Entity via a nominated application protocol.

Applications may be user applications or protocol applications that implement various protocol functions in order to adapt the network service provided (e.g. configuring from an unreliable packet service to a reliable byte stream service) and multiplexing data flows for several different applications.

The NGP protocol extent is defined as operating between a Protocol Node, its Ports and any associated applications that implement protocol functionality.

4.4.3 Case(Network Equipment, Protocol Connectivity)

4.4.3.1 Protocol Connectivity Introduction

The basic NGP protocol connectivity model is illustrated in Figure 2.

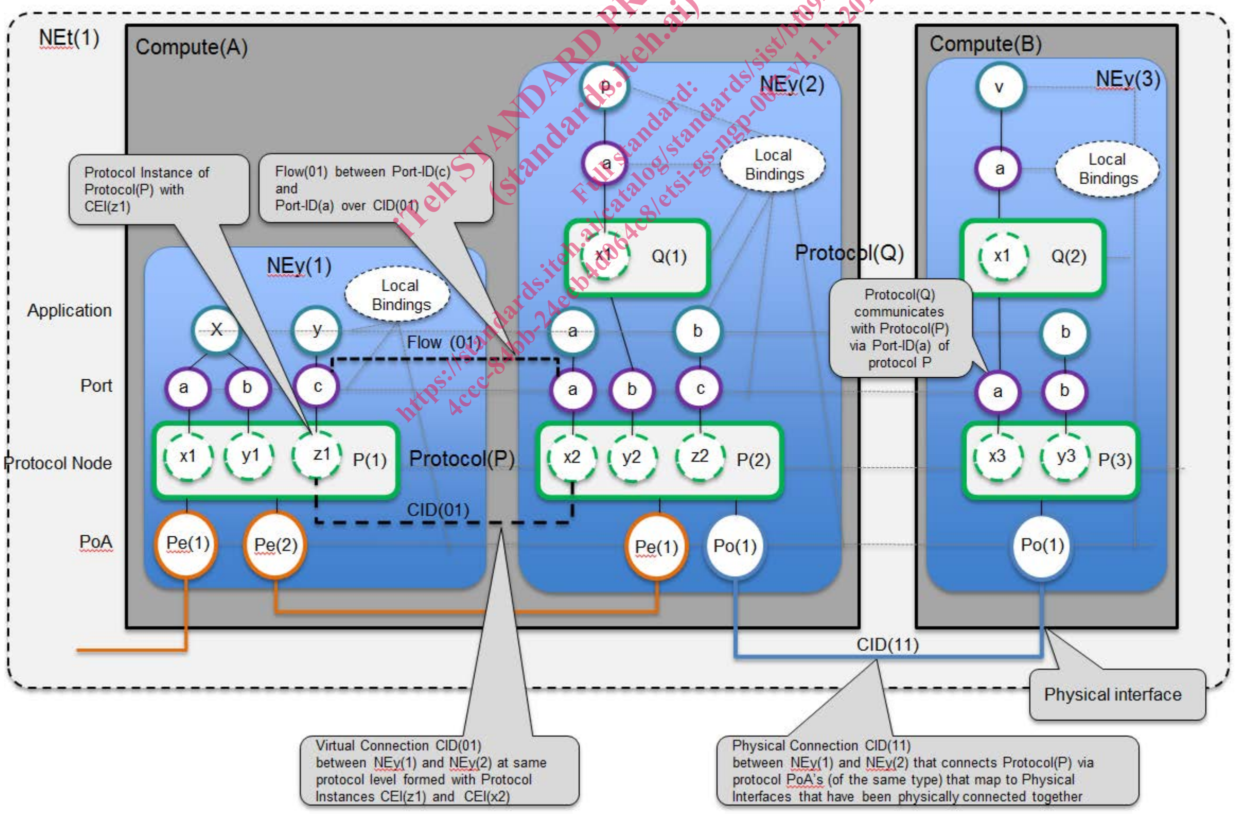


Figure 2: Single Network Equipment, Protocol Connectivity

Figure 2 introduces the case where a single Network Equipment NEt(1) contains a Network Entity NEy(1) and NEy(2) that are both instantiated on the same Compute entity Compute(A).

Each NEy contains a Protocol Node of the same type 'P' with different addresses (1) on NEy(1) and (2) on NEy(2).