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KPIs for Next Generation Protocols: Basis for measuring benefits of NGP

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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

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).

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1 Scope

The scope of the present document is to specify Key Performance Indicators (KPIs) that can be used to compare the efficiency, performance and security of Next Generation Protocols (NGPs) against current networking protocols.

The relative importance of each KPI depends on the scenario in which protocols are being compared. Therefore, this document provides guidelines for weighting the KPIS to help arrive at a meaningful comparison. Scenarios of particular relevance are detailed in ETSI NGP GS 001 [1], with resulting requirements listed in ETSI NGP GS 005 [2].

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] ETSI GS NGP 005: "Next Generation Protocol (NGP); Next Generation Protocol Requirements".

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)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

Key Performance Indicator (KPI): measurable property that significantly impacts business operations as its value changes

3.2 Symbols

Void.

3.3 Abbreviations

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

3GPP™	3rd Generation Participation Project
CERT	Computer Emergency Response Team
IoT	Internet of Things
IP	Internet Protocol
ISG	Industry Specific Group
KPI	Key Performance Indicator
NAT	Network Address Translation
NGP	Next Generation Protocols
PDU	Protocol Data Unit
ROI	Return On Investment
TCP	Transmission Control Protocol

4 Overview

Next Generation Protocols aim to improve on existing protocols in various ways. Any improvement shall be demonstrable and measurable. Hence the need for a set of KPIs with which to measure, and compare, Next Generation Protocols against the protocols they intend to replace.

5 Methodology

Each KPI consists of several characteristics:

- An ID for reference.
- A definition and rationale, to explain why this is a Key Performance Indicator.
- A metric, to indicate the unit of measurement.
- Desired value.

For the most accurate comparison, only the protocols being tested should vary, and other elements (CPUs, network paths, access media, etc.) should remain fixed. This does not apply for hardware-only processing comparisons against software processing.

6 Key Performance Indicators for network protocols

6.1 KPIs for naming and addressing

Table 6.1

ID	Definition and rationale	Metric	Desired value
Add1	Scalability: the number of entities that can be uniquely addressed by the scheme. An address scheme should scale to support the projected addressable entities of the network. The measurement is the count of addressable entities supported by the address scheme itself without external mappings (e.g. NAT).	Integer	A higher number of addressable entities.
Add2	Allocation and reuse: the efficiency of allocating an address to an addressable entity, and of re-allocating that address as required. The latency incurred in allocating/re-allocating addresses impacts network scalability and flexibility.	Time (ms)	A shorter time taken to allocate *n* addresses to *n* entities; a shorter time taken to reallocate *n* addresses.
Add3	Encoding: the minimum bits required to encode the address per the addressing scheme specification.	bits	Fewer bits to encode the address.
Add4	Are the Address semantics overloaded? Host addresses are location-dependent; application names are location-independent. Loose coupling of these simplifies mobility and multihoming.	Yes/no	No.
Add5	Location-independent naming: does the application identifier persist when it has moved to a new host? This hides complexity from other communicating processes.	Yes /No	Yes.
Add6	Ability to set the lifetime of an address.	Yes/no	Yes.
Add7	Ability to allocate addresses to entities not yet attached.	Yes/no	Yes.
Add8	Ability to allocate static addresses.	Yes/no	Yes.

6.2 KPIs for performance

Table 6.2

ID	Definition and rationale	Metric	Desired value
Per1	Void.		
Per2	Latency: the delay between the encapsulation of application data into a network protocol datagram by the sending endpoint; the forwarding of those datagrams to the destination endpoint; and the subsequent decapsulation of the datagram to extract the application data.	Time (ms)	The lower latency (see note 1).
Per3	Predictability/reliability: the ability of the protocols to deliver datagrams without loss or corruption; and to deliver datagrams in order as required.	Lost/corrupted packets as a % of the flow total.	Lower error % (see note 2).
Per4	Jitter: any variation in latency over time. Lower jitter would indicate a more predictable network protocol.	Standard deviation from expected latency.	The lower jitter (see note 3).
NOTE 1: The latency testing for a given scenario may require consideration of, or set values for: • error rate • load • scalability • mobility NOTE 2: This measurement assumes that any network protocol retransmission mechanism is active. Therefore the measurement should allow for such mechanisms to detect and recover from any loss/corruption. NOTE 3: Measurements should be taken over a range of network conditions, including high network load and poor signal (for mobile access).			

6.3 KPIs for mobility

Table 6.3

ID	Definition and rationale	Metric	Desired value
Mob1	Latency to handover The delay to switch access networks whilst maintaining flow continuity.	Time (ms)	The lower time.
Mob2	Overhead of handover The buffer handover when switching access networks (including LTE mobility and LTE <->WiFi mobility).	Bytes	The smaller number of bytes.
Mob3	Packet loss of handover The packets dropped during access network handover.	Integer	The smaller number of packets.

6.4 KPIs for buffering

Table 6.4

ID	Definition and rationale	Metric	Desired value
Buf1	Void		
Buf2	Drop/queue support The ability of the protocol to request that the network either drop or queue packets under resource contention.	Yes/No	Yes
Buf3	Queue occupancy support when choosing optimal route.	Yes/No	Yes
Buf4	Support for configurable scheduling - queuing for a configurable time.	Yes/no	Yes

6.5 KPIs for multihoming

Table 6.5

ID	Definition and rationale	Metric	Desired value
MH1	Do the protocols name the node, and not the network interface? This allows native multihoming and reduces complexity, improves scalability, load balancing and session continuity.	Yes/No	Yes
MH2	Do the protocols support aggregation of content from different destination sources, to provide resilience?	Yes/No	Yes

6.6 KPIs for protocol efficiency

More efficient protocols will improve performance, and should reduce the energy consumed by processing and transmission.

Table 6.6

ID	Definition and rationale	Metric	Desired value
PE1	Protocol efficiency: The ratio of useful data in the payload to overhead has a direct financial impact on communication links; More performant protocols will deliver a higher value per second. NGP protocols shall minimize header complexity and overhead.	Application bits as a ratio of total bits. For cellular systems, protocols shall be compared when transmitted over the same frequency range and encoding scheme, at the point at which the PDU is sent to the radio scheduler, for the non-access stratum only (i.e. for the user data plane only)	A higher proportion of application bits as ratio of total bits
PE2	Processing overheads: instructions The number of instructions required to process the protocol headers. If software, how many machine instructions. If logic, how many gates.	Number of processing steps (Integer)	Lower number