

Draft new Technical Report ITU-T YSTR.Concepts-AINN

Study of concepts, characteristics and definitions of artificial intelligence native telecommunication networks

Summary

This Technical Report presents a systematic study on the concepts, characteristics and definitions of 'AI-native' as applied to telecommunication networks. To establish a consistent terminological foundation, this report employs established methodologies, including semantic approach and concept-based analysis, to deconstruct the concept of 'AI-native'. Through this analysis, this report identifies the objects to which 'AI-native' applies and determines its delimiting characteristics. The report then presents considerations on definitions for 'AI-native telecommunication networks' and 'AI-native networks'.

Keywords

AI native, AI native telecommunication networks, AI native networks, concepts, characteristics, definitions

Table of Contents

1	Scope	3
2	References	3
3	Definitions	3
4	Abbreviations and acronyms	3
5	Conventions	3
6	Overview	4
7	Process of concept studies	4
8	Objects and delimiting characteristics of ‘artificial intelligence native’ based on concept studies	6
8.1	Identifying types of ‘artificial intelligence native’ in terms of its objects	6
8.2	Identifying delimiting characteristics of ‘artificial intelligence native’	6
8.3	Considerations about definitions	7
	Annex A Semantic analysis process to derive the concepts	8
	Annex B Concept based analysis to derive technical considerations for AI native networks	10
	Annex C Objects and characteristics about ‘artificial intelligence native’	11
	Annex D Dimensions of AI native networks for technical considerations by concept based analysis	13
	Annex E Technical considerations for AI native networks	17
	Appendix I Relationship between existing definitions of AI and AI-native and the AI-native delimiting characteristics	
	Appendix II Concept relations between telecommunication networks and AI-native	19
	Appendix III Application of the Delimiting Characteristics in Standardization Landscape Analysis	22
	Bibliography	26

Draft new Technical Report ITU-T YSTR.Concepts-AINN

Study of concepts, characteristics and definitions of artificial intelligence native telecommunication networks

1 Scope

This Technical Report includes the following:

- a) Initial findings from the study of concepts, and characteristics of artificial intelligence native telecommunication networks.
- b) Systematic analysis of the concept of 'AI-native' within the context of telecommunication networks to identify its concepts, objects and delimiting characteristics;
- c) Considerations on definitions for 'AI-native telecommunication network' and 'AI-native network'.

Editor's note: What follows is the initial text based on the discussions in FG-AINN meetings, and it has not been reviewed in detail at the Tashkent Q20/13 meeting. The text will be reviewed in the next meetings of SG13. Contributions on this Technical Report are invited.

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.

<TBD>

3 Definitions

3.1 Terms defined elsewhere

This Technical Report uses the following terms defined elsewhere:

<TBD>

3.2 Terms defined in this Technical Report

This Technical Report defines the following terms:

<TBD>

4 Abbreviations and acronyms

This Technical Report uses the following abbreviations and acronyms:

<TBD>

5 Conventions

None

<TBD>

6 Overview

The growing integration of artificial intelligence (AI) into telecommunications networks has given rise to the 'AI-native' paradigm. Although AI-native concepts are being applied more widely within the telecommunications sector, there is still no consensus on their exact scope, constituent elements and defining characteristics. This divergence in understanding hinders the establishment of a coherent framework for capability requirements and technical specifications, and ultimately coordinated standardization efforts.

This Technical Report aims to address these challenges by:

1. Systematically analyzing the concept of 'AI-native' within the context of telecommunication networks to identify its core concepts, objects and delimiting characteristics;
2. Presenting considerations on definitions for 'AI-native telecommunication network', ' and 'AI-native network'.

The document employs a methodology based on well-established terminological principles, primarily using semantic and concept-based analyses (CBA). This approach is informed by [b-ISO 1087:2019] and [b-ISO 704:2022], using existing explanations from relevant standards and draft documents as the main source of reference. The findings were iteratively refined through extensive discussions and contributions within the ITU-T FG-AINN, including nineteen meetings of WG1 (Terminology and Definitions) and three plenary sessions.

This Technical Report provides a foundational understanding of AI-native concepts, the objects and their delimiting characteristics relevant to telecommunication networks.

7 Process of concept studies

This report employs both semantic analysis and concept based analysis approach, with the core conceptual relationships and delimiting characteristics of AI-native telecommunication networks serving as the outputs. These are the process of concept studies related to AINN presented in Figure 1.

The analysis is based on a systematic review of existing explanations of 'AI-native' sourced from various sources. Subsequently, the report employs a primary methodology rooted in formal terminological principles, as detailed in **Annex A**. This approach involves a semantic analysis that deconstructs the inputs into their fundamental components - objects and characteristics - to establish a clear conceptual foundation. This primary method is complemented by the concept-based analysis outlined in **Annex B**, which assists in structuring the technical considerations (see **Annex D**).

Using these methods, the core objects and delimiting characteristics of the 'AI-native' concept are identified, as presented in Clause 2. These identified characteristics, in turn, provide the logical foundation for the considerations on definitions that are presented in Clause 3.

Editor's note: it is needed to introduce figure 2.

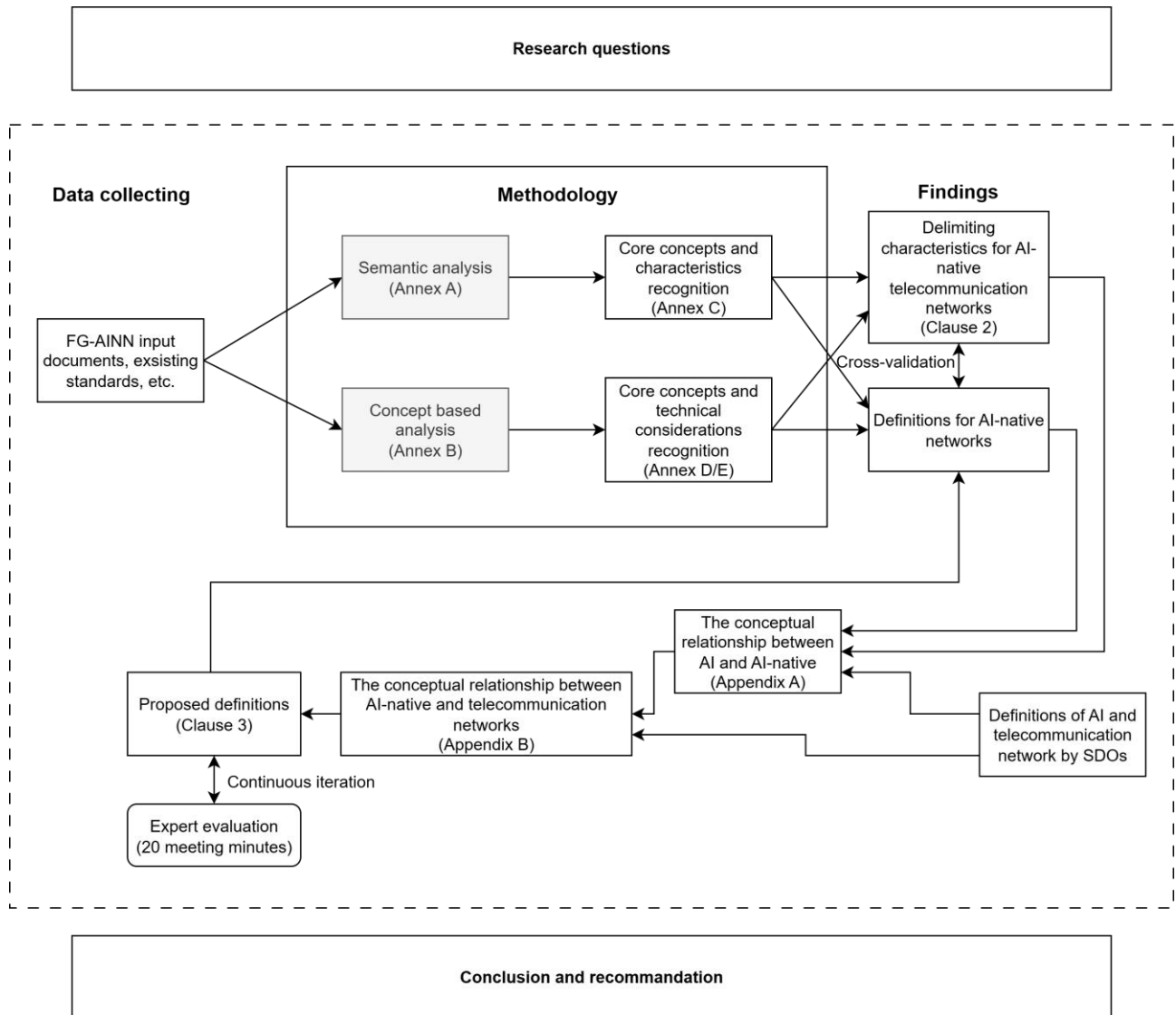


Figure 1 Process of concept studies related to AINN

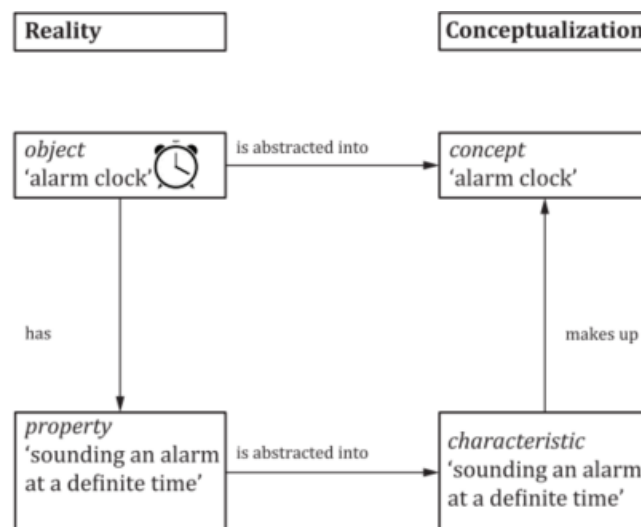


Figure 2 Method for identifying objects and characteristics from concept

(Source: ISO 704:2022, 5.4.1)

8 Objects and delimiting characteristics of ‘artificial intelligence native’ based on concept studies

8.1 Identifying types of ‘artificial intelligence native’ in terms of its objects

Based on object and characteristics about ‘artificial intelligence native’ identified from existing definitions and explanations (see **Annex C**), three types of ‘artificial intelligence native’ are identified as shown in Figure 2. The first type of AI native is “approach (focused on architecture approach”. The second type of AI native is “system, product, service, function and architecture (focused on application and services)”. The third type of AI native is “environment (focused on all components interacting using AI)”.

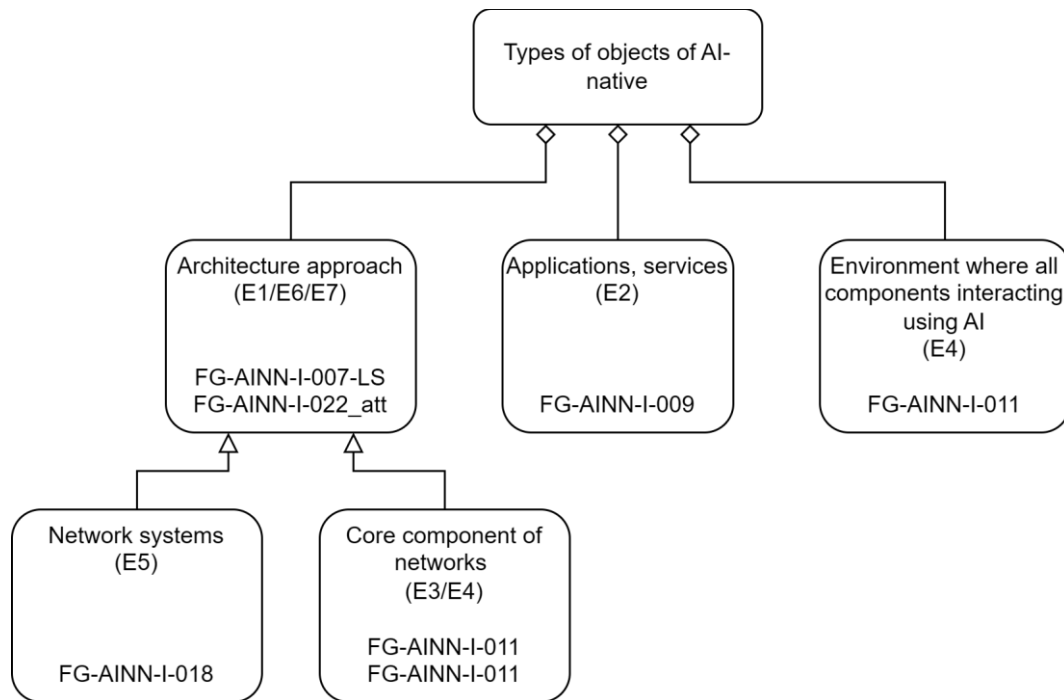


Figure 3 Types of objects of ‘artificial intelligence native’

8.2 Identifying delimiting characteristics of ‘artificial intelligence native’

Based on the analysis of objects and characteristics identified in **Annex C**, three primary delimiting characteristics of 'artificial intelligence native' are derived, as shown in Figure 3:

- 1) *Architecture approaches for deep integration of AI*
- 2) *Engagement of AI in all stages of lifecycle of network components, functions, applications and services*
- 3) *AI itself as a core component*

Delimiting characteristics refers to [essential characteristic](#) used for distinguishing a [concept \(3.2.7\)](#) from related concepts.[b-ISO 1087:2019, 3.2.5]

Essential characteristic refers to characteristics which is indispensable to understanding a concept. [b-ISO 1087:2019, 3.2.3]

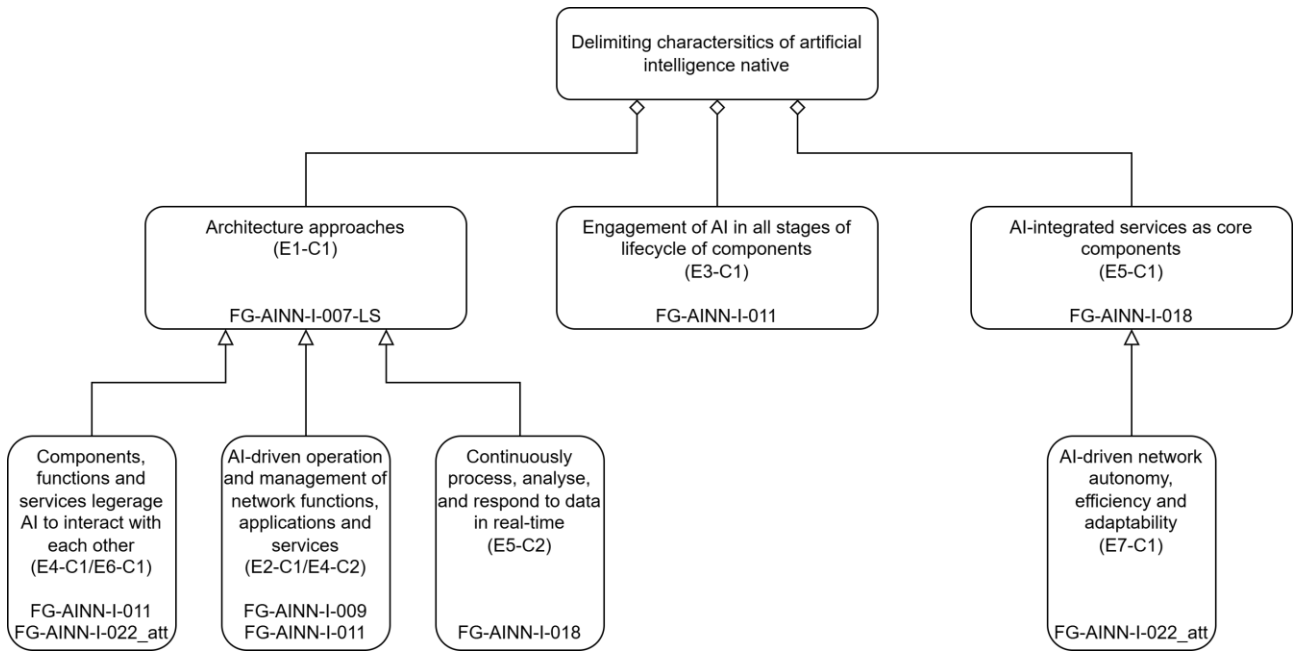


Figure 4 Delimiting characteristics of ‘artificial intelligence native’

8.3 Considerations about definitions

As a result, this report provides considerations on two candidate definitions: AI-native telecommunication network and AI-native network [b-FG-AINN-I-065].

The considerations on candidate definitions are as follow:

AI-native telecommunication network is: "Telecommunication networks integrating AI as a core component, enabling novel value-added services, and enhancing the performance of the network and its services.

NOTE1: Integrating AI refers to use AI technologies as enablers through the entire lifecycle of telecommunication network’s design, deployment, operation, and maintenance.

NOTE2: Enhance performance refers to higher level of autonomy, efficiency, adaptability resource utilization.

NOTE3: AI-native telecommunication network environment refers to all components and entities external to the network interacting with the AI-native telecommunication network including devices and applications.

NOTE4: AI-native telecommunication network value-added services refer to added-value services leveraging telecommunication network communication and computing capabilities. This extends the definition of value-added services based on [3GPTR 21.905]."

AI-native networks is: "networks in which all steps in the lifecycle of network services, applications and functions, and AI pipelines, are managed by AI, using AI, and with specific aim to make AI integration easier in the network.

NOTE5: AI pipelines are machine learning pipelines [b-ITU-T Y.3172] with enhanced support for AI models."

Annex A Semantic analysis process to derive the concepts

Editor's note: to consider the appropriateness of this Annex, at least from the level of detail currently present.

The core terminological concepts and their interrelationships as defined in [b-ISO 1087:2019] and [b-ISO 704:2022] are used in semantic analysis of definitions related to 'artificial intelligence native'. The primary concepts underlying this analysis are: Concept as a "A unit of knowledge created by a unique combination of properties" as defined in [b-ISO 1087:2019], Characteristic: "abstraction of a property" [b-ISO 1087:2019], Object: "anything perceivable or conceivable" ([b-ISO 1087:2019, 3.1.1]) , and Property: "characteristic of an object" [b-ISO 1087:2019, 3.1.3].

The relations among the above four concepts are shown in Figure 4 which is described in ISO 704:2022, 5.4.1:

An analysis of key terms relevant to 'unit of knowledge' and 'characteristics' in definitions of 'maturity' is conducted based on understandings about 'concept' and 'characteristics' in ISO 704:2022 and ISO 1087:2019.

Definition of 'concept' is adopted from ISO 1087:2019, 3.2.7, defined as "*unit of knowledge created by a unique combination of characteristics*".

Definition of 'characteristic' is adopted from ISO 1087:2019, 3.2.1, defined as "*abstraction of a property with "Note 1 to entry: Characteristics are used to describing concepts"*".

Definition of 'object' is adopted from ISO 1087:2019, 3.1.1, defined as "*anything perceivable or conceivable*" with "*Note 1 to entry: Objects can be material (e.g. 'engine', 'sheet of paper', 'diamond'), immaterial (e.g. 'conversion ratio', 'project plan') or imagined (e.g. 'unicorn', 'scientific hypothesis')*".

Definition of 'property' is adopted from ISO 1087:2019, 3.1.3, defined as "*feature of an object*" with "*Note 1 entry: One or more objects can have the same property*".

These concepts are understood to be interrelated: objects have properties, these properties are abstracted into characteristics, and a unique combination of characteristics forms a concept. This framework, which is further elaborated in [b-ISO 704:2022, 5.4.1], informs the analysis of the definitions.

Constraint:

- *each object has at least one property;*
- *each relevant property is abstracted into a characteristic;*
- *each concept is comprised of at least one characteristic;*
- *each object is abstracted into at least one concept.*

Concept formation plays a pivotal role in organizing human knowledge because it provides the means for recognizing objects and for grouping them into meaningful units in a particular field. In order to categorize an object for the purposes of concept formation, it is necessary to identify its properties (see the example below). Objects perceived as sharing the same properties are grouped into units. Once similar objects, or occasionally a single object, are viewed as a meaningful unit of knowledge within a branch of human knowledge, the properties of an object, or

those common to a set of objects, are abstracted as characteristics that are combined as a set in the formation of a concept.

Thus, objects in the real world are identified by their properties. The objects are then abstracted as concepts and the properties are abstracted as characteristics making up the concepts. Abstraction is the process of recognizing some set of common features in an individual set of objects and, on that basis, forming a concept of that set of objects.

The analysis also considers the types of relationships between concepts, as defined in [ISO 1087:2019], which can be shown in UML graph: generic relation, partitive relation and associative relation. Illustration methods are shown in Table 1.

Table 1 Illustration of three types of concept relation in UML graph

No	Type of concept relation	Definition	Illustration
1	generic relation	<p>Concept relation between a generic concept and a specific concept where the intension of the specific concept includes the intension of the generic concept plus at least one additional delimiting characteristic.</p> <p>Note 1 to entry: Outside the terminology community, ‘type of relation’ and ‘is a relation’ are also used instead of “generic relation”.</p> <p>Note 2 to entry: In a generic relation, the subordinate concept is a specific concept and the superordinate concept is a generic concept.</p> <p>[SOURCE: ISO 1087:2019, 3.2.13]</p>	
2	partitive relation	<p>Concept relation between a comprehensive concept and a partitive concept.</p> <p>[SOURCE: ISO 1087:2019, 3.2.14]</p>	
3	associative relation	<p>Concept relation that exists when a thematic connection can be established between concepts by virtue of experience</p> <p>Note 1 to entry: Associative relations are non-hierarchical.</p>	

Annex B Concept based analysis to derive technical considerations for AI native networks

Concept Base Analysis (CBA) is a systematic methodology for generating stable definitions. It involves refining the core object of target concepts through expert research and judgement, constructing a multi-dimensional feature framework and mapping the corresponding technical considerations of each object. The process emphasizes the concepts of 'what is' (core characteristics), 'what to do' (considerations mapping) and 'how to describe' (comprehensive definition) to ensure that the definition accurately covers the current logic and is scalable for future evolution. This approach guarantees that the definition accurately reflects the current logic and can be scaled up for future development.

Based on expert research concept based approach analysis the AI Native Networks from 4 dimensions [source: b-FG-AINN-I-065]:

- (1) Enhancements to the network.
- (2) Knowledge Base (KB)
- (3) Feature specific applications
- (4) AI technologies

Annex C Objects and characteristics about ‘artificial intelligence native’

Table 2 Object and characteristics about ‘artificial intelligence native’

Code	Explanation of AI Native	Type of Object	Characteristics
E1	approaches where AI is deeply integrated into the core architecture of telecommunication networks [b-FG-AINN-I-007-LS]	architecture approaches	Network architecture is enhanced to deeply integrate AI (E1-C1)
E2	systems, products or services where AI is crucial for their operation [b-FG-AINN-I-009]	applications or services	AI is crucial for the operation and management of network functions, applications and services. (E2-C1)
E3	a system, function, or architecture that integrates AI as a core component in all stages—design, deployment, operation, and maintenance—ensuring that AI is a fundamental part of the system’s functionality [b-FG-AINN-I-011]	core components of network	AI is integrated as a core component in all stages—design, deployment, operation and maintenance of network components (functions and applications and services)”(E3-C1) AI is a fundamental part of the network’s functionality(E3-C2),
E4	an environment where all components interact using AI, creating a comprehensive, interconnected network of AI-driven components [b-FG-AINN-I-011]	environment where all components interacting using AI	all components interact using AI (E4-C1) Components in the environment themselves are AI-driven” (E4-C2)
E5	systems where AI is a foundational element, enabling the network to continuously process, analyse, and respond to data in real-time [b-FG-AINN-I-018]	Network system	AI is a foundational element (E5-C1)enabling the real time responses in network by continuously processing, analysing data (E5-C2)
E6	an approach where all components can leverage AI within themselves and interactively with each other [b-FG-AINN-I-022_att]	architecture approach	network components, functions and services leverage AI to interact with each other(E6-C1)
E7	an approach that integrates AI technologies at a fundamental level within	architecture approach	AI integration is for the purpose of enhancing autonomy, efficiency and adaptability etc(E7-C1)

	network architecture to enhance network autonomy, efficiency, and adaptability [b-FG-AINN-I-022_att]		
--	--	--	--

“E” represents the abbreviation of “Explanation”

“C” represents the abbreviation of “Characteristics”

Annex D Dimensions of AI native networks for technical considerations by concept based analysis

In parallel with the above semantic analysis of concept relations between telecommunication networks and AI-native, this part focus on dimensions of AI-native networks for technical considerations based on contribution [b-FG-AINN-I-065], which presents a definition for AI-native networks. This definition emphasizes the inherent network enhancements that support AI integration, the central role of a dynamic Knowledge Base (KB), the use of feature-specific applications, and the continuous evolution facilitated by embedded AI technologies. This AI-driven integration approach, as outlined in [b-FG-AINN-I-065], is intended to significantly simplify the deployment and operation of AI within the network fabric. This aim of this section is to analyze the similarities and differences between this proposed concept and the framework established within this document, particularly in terms of their respective characteristics and conceptual architectures, thereby providing a basis for further analysis.

Following the principles of terminology work outlined in [b-ISO 704], we can analyze the core components of this definition:

Object: The basic object is networks. The term "AI-native" acts as a modifier, specifying a particular subclass of networks.

Delimiting Characteristics: The definition identifies two primary characteristics:

- Comprehensive lifecycle management by AI: The network's core operational aspects ("all steps in the lifecycle of network services, applications and functions, and AI pipelines") are explicitly described as being "managed by AI, using AI". This highlights the pervasive and integral role of AI in the operation and management of the network.
- Facilitation of AI integration: The definition includes a statement of purpose – "with the specific aim to make AI integration easier in the network". This indicates that the network is not just using AI but is fundamentally designed or enhanced to simplify the incorporation and operation of AI capabilities.

Purpose: is "to make AI integration easier in the network". This suggests a design philosophy that focuses on streamlining the deployment, operation, and evolution of AI within the network infrastructure.

The following section will further develop the analysis of concepts related to AI-native networks. Using concept base analysis method, we can create a UML relationship diagram showing the connection between AI-native networks and AI-native telecommunications networks. As a supporting conclusion, the technical considerations for AI-native networks will be presented in **Annex E**.

D.1 Enhancements to the network

Orchestration enhancements: These are enhancements in the network, mainly to the orchestrator and supporting functions. Some examples to these are:

1. uses of AI techniques such as NLP to anticipate the needs of humans, to produce output more understandable to humans.
2. collaborative planning and strategizing (along with humans) and comparison of strategies to achieve the needs of humans including external tool usage.
3. generation and management of simulation scenarios.
4. including abstraction and de-abstraction from intent into workflows and content generation towards the operator.

5. creates complete step-wise changes needed in the network, including design, code, validations and translation of operator personnel's intent to feature specific workflows. This is to be supported with the knowledge base.
6. Analysis of reasons on the validity of the changes based on the KB.
7. complex service decomposition

AN frameworks (including those for AI pipelines): These are enhancements to the AN frameworks [ITU-T Y.3061] (or the integration of the same in the network). It is expected that AN frameworks as described in Y.3061 are extended to include AI pipelines (lifecycle of AI models) in their scope, giving ability to continuously adapt and learn the intelligence during the network operation. These enhancements include the following:

Short term feedback loops: short term monitoring and feedback loops are required to be already part of the network, and they include AI pipelines in their scope.

1. e.g. controllers as in Y.3061. including triggering actions autonomously such as Lifecycle of network operations.
2. e.g. adaptation to handle the changing network conditions.
3. Real time input from the environment and network, including multi-modal data. real-time data from network systems, such as traffic loads, signal strength, and user behaviour.
4. Experimentation and what-if scenario evaluations.

Long term feedback loops: long term loops (e.g. evolution) are required to be part of the network and they include AI pipelines in their scope.

Pervasive ability to instantiate/monitor/modify pipeline node in any NF (Network Function).

Pervasive ability to instantiate/modify a controller in any NF.

Non-AI native network can migrate by using any of the below mechanisms:

1. replacing functionality with AI
2. developing new functions with AI
3. control the non-AI native part of the network with AI (via tool usage)

D.2 Knowledge Base (KB)

KB helps "AI models and solutions" in understanding the network environment, state, actions, algorithms and data as applicable. Examples are:

1. Feature specific state: a history of actions performed in the network related to the feature and the potential implications on future actions can be derived using AI techniques like reasoning.

2. Feature specific action templates: with triggering conditions and policies where applicable. e.g. the level of autonomy applicable for the action. feature specific workflows/lifecycle, tasks, actions are captured in the knowledge base (e.g. network optimization)
3. Feature specific algorithms: optimization algorithms.
4. Feature specific data: knowledge base is built, derived and updated using data and analysis of multimodal, feature specific unstructured, data .
5. Coexistence details e.g. versions of APIs or versions of configuration databases.
6. Short term network state, snap shot of the network state used for training and inference, distil long term learning in the KB.
7. Deeper Domain Expertise.

D.3 Feature specific applications

Feature specific applications use KB, AI models and solutions and network enhancements to build AI native networks.

Some examples are:

- Fault mitigation
- Resource allocation
- Network slicing management
- Traffic optimization
- Privacy-preserving measures, data integrity checks, and secure AI models
- Context-aware model training
- Services and AI pipelines
- Compute-aware: predictive, real-time, resource allocation, GPU offload, hardware resource sharing

D.4 AI technologies

AI technologies integrate the new AI models and solutions in the network.

Some examples are:

- AI models
- AI agents
- AI algorithms
- GenAI
- Tool usage
- Distillation of knowledge
- Reflection
- Cognitive functions
- standardised metadata

- RL
- data and model catalogues
- synthetic data generation

Annex E Technical considerations for AI native networks

Technical Considerations:

- i. It is required that AI pipelines are used to build and manage **enhancements in the network**.
NOTE- Example of enhancements to the network are:
 - orchestration enhancements.
 - AN framework (including those for AI pipelines) enhancements.
 - and enhancements to enable migration and coexistence with non-AI Native networks.
- ii. It is required that AI pipelines are used to build and manage new **AI technologies** which are used in the network.
NOTE- Example of AI technologies are AI models, AI agents, AI algorithms, etc.
- iii. It is required that AI pipelines are used to build and manage **Knowledge Base (KB)** which is used in the network.
NOTE- Example contents of KB are Feature specific states, Feature specific action templates, Feature specific algorithms.
- iv. It is required that AI pipelines are used to build and manage **Feature specific applications**.
NOTE- Examples of Feature specific applications are Network slicing management, Resource allocation efficiency.
- v. It is required that enhancements are made to the network so that KB is integrated in the network.
- vi. It is required that enhancements are made to the network so that Feature specific applications are integrated in the network.
- vii. It is required that enhancements are made to the network so that new AI technologies are integrated in the network.

Appendix I Relationship between existing definitions of AI and AI-native and the AI-native delimiting characteristics

The recommended definition for Artificial Intelligence [source: b-ITU-T M.3080], which is "Computerized system that uses cognition to understand information and solve problems.

NOTE 1 – ISO/IEC 22989:2022 defines AI as research and development of mechanisms and applications of AI systems (Note 1 to entry: Research and development can take place across any number of fields such as computer science, data science, humanities, mathematics and natural sciences).

NOTE 2 – In computer science, AI research is defined as the study of 'intelligent agents': any device that perceives its environment and takes actions to achieve its goals.

NOTE 3 – This includes pattern recognition, the application of machine learning and related techniques.

NOTE 4 – Artificial-intelligence is the whole idea and concept of machines being able to carry out tasks in a way that mimics human intelligence and would be considered 'smart'."

AI is the core technology that AI-native relies on. A fundamental concept within AI is the system that perceives its environment and takes actions to achieve its goals. So there exists a shared bidirectional cycle between the external environment and the internal system, which applies to both AI and AI Native. The following Figure 5 shows the relationship.

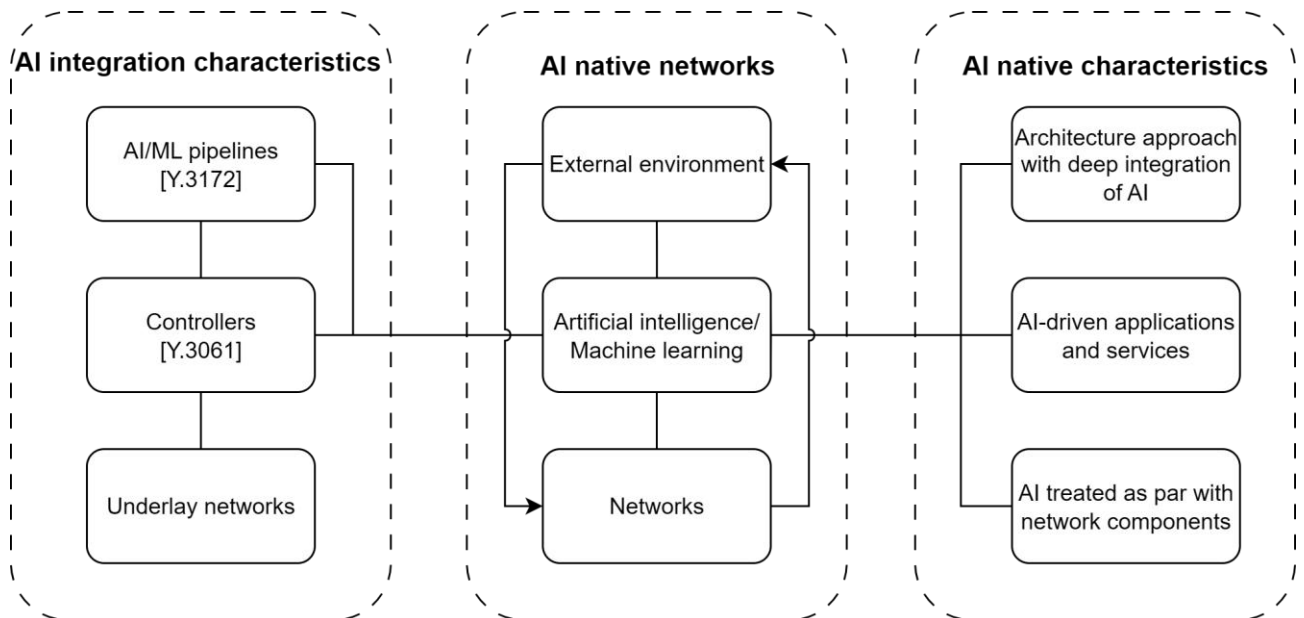


Figure 5 Relations between 'AI' and 'AI-native networks' and 'AI-native characteristics'

Appendix II Concept relations between telecommunication networks and AI-native

II.1 Concepts of ‘telecommunication networks’

From a semantic analysis perspective, according to the ITU-T Y.2091 definition of Telecommunication: “Any transmission, emission, or reception of signs, signals, writing, images, sounds, or intelligence of any nature by wire, radio, optical, or other electromagnetic systems (as defined in the ITU Constitution provision 1012 and in the International Telecommunication Regulations, ITR)”, and the ISO/IEC 20924:2024 definition of Network: “Infrastructure that connects a set of endpoints, enabling communication of data between the digital entities reachable through them,” we can identify the following relationships:

- b. Telecommunication Networks are a sub-concept of Network, and form a hierarchical relationship.
- c. Telecommunication Networks have a part-whole relationship with Telecommunication, meaning that Telecommunication Networks constitute a component of the broader Telecommunication domain, responsible for implementing information transmission and communication functions.

Table 3 provides a detailed analysis of the four definitions of telecommunications network from ITU-T:

Table 3- Object, target elements and characteristics analysis of existing definitions for ‘telecommunication network’

Code	Definition	Object	Characteristics
D1	All the means of providing telecommunication services between a number of locations where equipment provides access to these services [b-ITU-R V.662-3]	Various means of providing telecommunication services; equipment providing access to these services	Provides access to telecommunication services across multiple locations using equipment
D2	Entirety of equipment (comprising any combination of the following: network cable, telecommunication terminal equipment, and telecommunication system or installation) that are indispensable to ensure normal intended operation of the telecommunication system. [b-ITU-T K.72 (06/2011) Revised 02/2012]	Entire set of equipment essential for normal operation	The combination of equipment is indispensable for the intended operation of the system
D3	Entirety of equipment (comprising any combination of the following: network cable, telecom terminal equipment and telecom system or telecom installation) that is indispensable to ensure normal, intended	Entire set of equipment essential for normal operation	The combination of equipment ensures the proper functioning of the telecommunication network

	operation of the telecommunication network. [b- ITU-T K.60 (07/2023)]		
D4	A set of nodes and links that provides connections between two or more defined points to accommodate telecommunication between them) [b- ITU-T Q.9 (11/1988) Revised 01/2009]	A set of nodes and links	Provides connectivity between nodes to enable telecommunication between defined points

By clustering the objects, elements and characteristics analysed, we can identify the objects of telecommunications networks as a set of devices whose primary purpose is to provide telecommunication services.

II.2 Concept relations between ‘telecommunication networks’ and ‘artificial intelligence native’

Telecommunication networks use systems as their fundamental components, forming the basis for information transmission services. The deep integration of AI into the network and the resulting performance enhancements are consistent with AI-native network constructs.

The extensive analysis culminates in the conceptual relationship diagram for AI-native Telecommunication Networks within the attention of this focus group. This high level relationship can be visually represented using UML as follows (mapping coding between concepts shared from definition of AI-native for telecommunication networks):

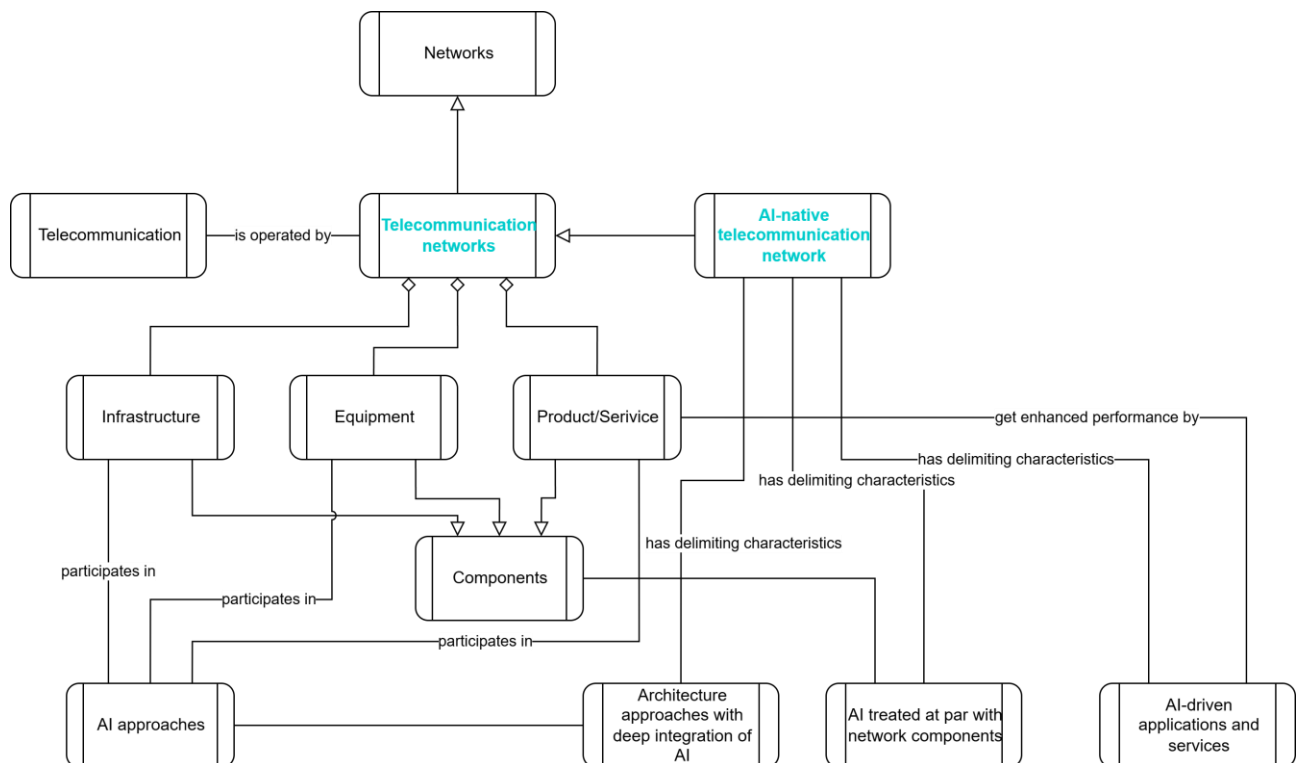


Figure 6 The UML concept system of AI-native Telecommunication Network

Relationships between concepts of AI-native and telecommunication networks are elaborated as follows:

- Telecommunication networks are defined as the synergy of "telecommunication" (the act of transmitting information, according to [ITU-T Y.2091]) and "network" (the infrastructure connecting endpoints, according to [ISO/IEC 20924:2024]), with their core objects being sets of devices primarily aimed at providing telecommunication services.
- AI-native implies a deep and fundamental integration of Artificial Intelligence technologies, positioning AI as a core and essential component within the architecture and operation of telecommunication systems.
- This integration is crucial for significant performance improvements in telecommunication networks, in particular for enhancing autonomy (e.g. enabling zero-touch operations), adaptability (e.g. facilitating continuous learning and dynamic evolution to meet changing requirements) and efficiency (e.g. reducing operational and maintenance costs and enabling intelligent real-time decision making). These improvements impact dimensions such as optimising resource use and benefits, increasing automation and intelligence capabilities, improving agility and enhancing collaboration.
- AI-native facilitates the creation and delivery of novel value-added services (VAS), typically characterised by real-time dynamic adaptation to improve responsiveness and deep personalisation for precise service adaptation to specific scenarios.
- The interaction between AI-native systems and telecommunication networks involves several key characteristics: full interaction with the environment throughout the system lifecycle (including design, deployment, operation and optimisation); deep integration and embedding into the system architecture; and a primary goal to improve the performance of products and services by effectively leveraging advanced AI-driven capabilities.
- In addition, AI-driven telecommunication networks inherently contribute to generic value by increasing the operational transparency of their internal logic and reducing system coupling.

Appendix III Application of the Delimiting Characteristics in Standardization Landscape Analysis

Editor's note: this new content (Appendix III) has been contributed during the Q20/13 meeting in Tashkent, and has not been reviewed.

III.1 Introduction

This appendix provides a summary of the methodology and key findings from the technical report "Standardization Gap Analysis of the FG-AINN". The purpose is to demonstrate the practical application and utility of the delimiting characteristics of AI-native networks, as defined in this Recommendation. The work summarized herein validates these characteristics as an effective framework for analyzing the existing standardization landscape and identifying strategic gaps.

III.2 Analysis Methodology

A systematic methodology was employed to assess the coverage of AI-native concepts within existing and ongoing standards from key Standards Development Organizations (SDOs), including ITU-T, ETSI, 3GPP, IETF/IRTF, and ONAP.

The analysis was predicated on a framework derived directly from the delimiting characteristics of AI-native networks. Each characteristic and its sub-characteristics were assigned a unique code to facilitate a structured mapping process. The key characteristics utilized were:

[D1-C1] integrating AI

[D1-C1-1] as a core component

[D1-C1-2] through the entire lifecycle of telecommunication network's design, deployment, operation, and maintenance

[D1-C2] enabling novel value-added services

[D1-C3] enhancing the performance of the network and its services

[D1-C3-1] higher level of autonomy

[D1-C3-2] higher level of efficiency

[D1-C3-3] higher level of adaptability

[D1-C3-4] higher level of resource utilization

[D2-C1] all steps are managed by AI, using AI

[D2-C2] make AI integration easier in the network

A comprehensive collection of relevant standards was compiled. Each standard was then systematically analyzed and mapped against the coded characteristics to determine the extent to which it addressed each specific aspect of an AI-native network.

III.3 Summary of Findings from the Mapping Exercise

Editor's note: to consider the value of the presented heatmap.

The mapping of several hundred standards against the delimiting characteristics yielded a clear overview of the current state of standardization. The results, often visualized through heatmaps, revealed distinct patterns in standards coverage.

High Coverage Areas: The analysis indicated substantial existing work and a high density of standards related to the foundational aspects of integrating AI into networks. [D1-C1], [D1-C3], [D1-C3-1], [D1-C3-2]

Emerging Coverage Areas: Characteristics pointing towards more advanced and deeply integrated AI functionalities showed moderate but growing coverage. [D1-C1-1], [D1-C2], [D2-C2]

Areas with Limited Coverage: The analysis identified more limited coverage for characteristics that define a fully realized AI-native paradigm. [D1-C1-2], [D1-C1-2], [D2-C3-4], [D2-C1]

Standard coverage heat map (delimiting characteristics)

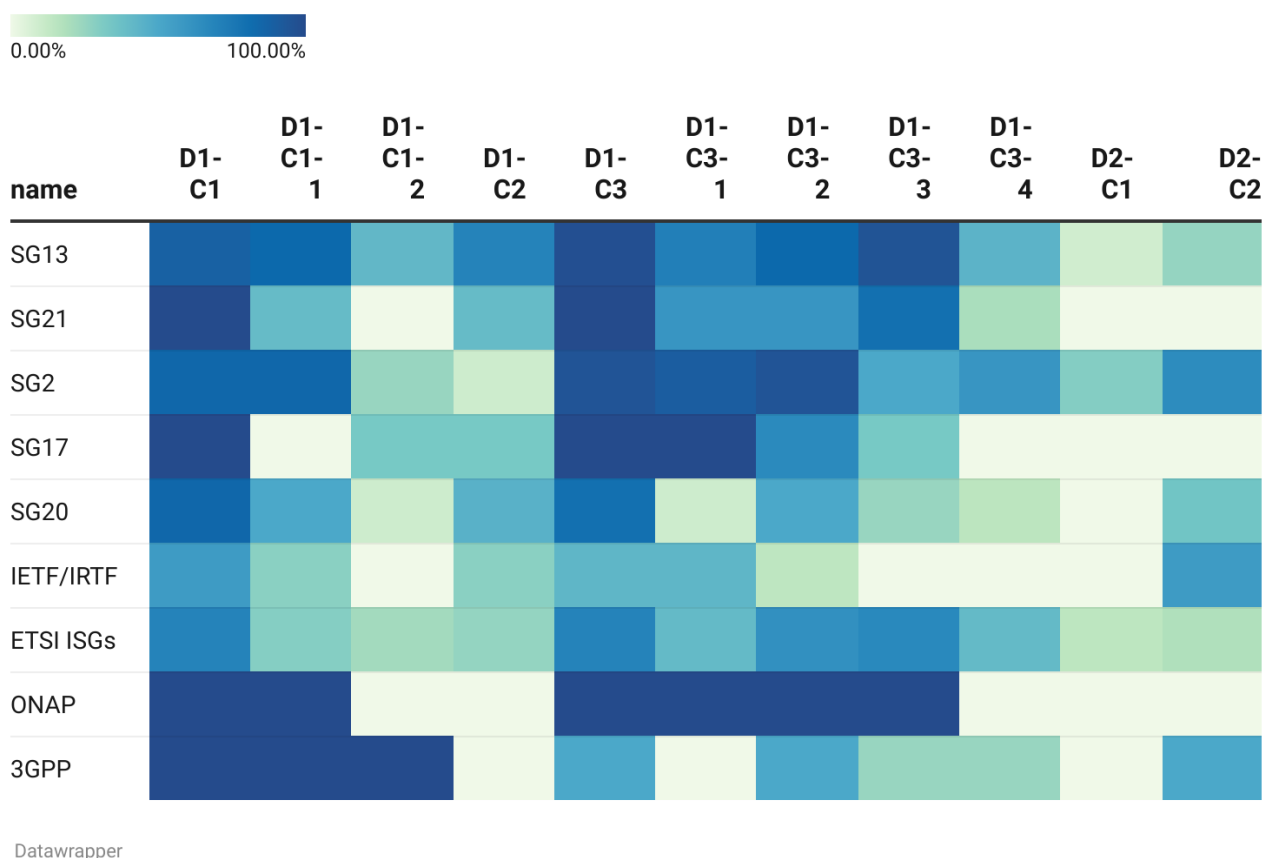


Figure 7 Standards coverage heat map for delimiting characteristics

III.4 Conclusion: Validation of the Framework

The extensive gap analysis exercise confirmed that the delimiting characteristics defined in this Recommendation provide a robust and coherent framework for classifying and

evaluating standardization activities. This structured approach enabled the systematic identification of both mature and underdeveloped areas in the AI-native standardization landscape.

The findings demonstrate that these characteristics are not merely theoretical constructs but serve as a practical and effective tool for strategic analysis, guiding the identification of specific gaps and informing recommendations for future standardization work. The successful application of this framework in a large-scale analysis validates its utility as a foundational element for advancing the standardization of AI-native networks.

Bibliography

- [b-FG-AINN-I-007-LS] FG-AINN-I-007-LS (2024), *LS/i on SPCG Recommendation on new ITU-T Focus Group on 'Artificial Intelligence Native for Telecommunication Networks (FG-AINN)'*
- [b-FG-AINN-I-009] FG-AINN-I-009 (2024), *NWI: Proposal for initiating a new working item for "Requirements definition for End-to-end AI in Networks"*
- [b-FG-AINN-I-011] FG-AINN-I-011 (2024), *Proposing terminology and definitions and requirements for AI Native Systems*
- [b-FG-AINN-I-018] FG-AINN-I-018 (2024), *Build-a-thon proposal: Creating AI Native solutions using open Knowledge Base*
- [b-FG-AINN-I-022_att] FG-AINN-I-022_att (2024), *Introduction to the core concepts in – AINN*
- [b-ISO 1087] ISO 1087:2019, *Terminology work and terminology science — Vocabulary*
- [b-ISO 704] ISO 704:2022, *Terminology work — Principles and methods*
- [b-ITU-T SG13] SG13-TD279/GEN, *Supporting materials for a new FG on AI Native for Future Networks (FG AIFN)*
- [b-ITU-T Y.3172] Recommendation ITU-T Y.3172, *Architectural framework for machine learning in future networks including IMT-2020*
- [3GPPTR 21.905] 3GPP SA TR 21.905 V18.0.0 (2024-03), *Vocabulary for 3GPP Specifications*
- [b- ISO/IEC 17573-2:2020] ISO/TS 17573-2:2020, *Electronic fee collection — System architecture for vehicle related tolling — Part 2: Vocabulary*
- [b- ISO/IEC 15067-3:2024] ISO/IEC 15067-3:2024, *Information technology — Home Electronic System (HES) application model — Part 3: Model of an energy management system for HES*
- [b-FG-AINN-WG1-01] FG-AINN-WG1-01, *Update of the definition of AI-native telecommunication networks*
- [b-FG-AINN-WG1-02] FG-AINN-WG1-02, *Update of the definition of AI-native telecommunication networks*
- [b-FG-AINN-WG1-03] FG-AINN-WG1-03, *Update of the definition of AI-native telecommunication networks*
- [b-FG-AINN-WG1-04] FG-AINN-WG1-04, *Update of the definition of AI-native telecommunication network*

[b-FG-AINN-I-065]

FG-AINN-I-065, *Characteristics, requirements and definitions for AI Native Networks*

A.13 justification for proposed new draft Technical Report ITU-T YSTR.Concepts-AINN "Study of concepts, characteristics and definitions of artificial intelligence native telecommunication networks"

Question:	Q20/13	Proposed new ITU-T Technical report	Tashkent, Oct 28-Nov 6
Reference and title:	ITU-T YSTR.concepts-AINN "Study of concepts, characteristics and definitions of artificial intelligence native telecommunication networks"		
Base text:	TD278/WP1	Timing:	2027-Q1
Editor(s):	Xiaomi An, Renmin University of China, anxiaomi@ruc.edu.cn Fuquan Wen, Renmin University of China, wenfuquan@ruc.edu.cn Jing Yin, Renmin University of China, yinjingqd@163.com Sujit Kumar, India, sujit.kumar88@gov.in Drupad Gupta, India, dupad.gupta@gov.in Qi Sun, China Mobile, China, sunqiyjy@chinamobile.com	Approval process:	Agreement
<p>Purpose and scope (Define what this document will address and its intent or objectives in order to indicate the limits of its applicability):</p> <p>This Technical Report includes:</p> <ul style="list-style-type: none"> a) Initial findings from the study of concepts, and characteristics of artificial intelligence native telecommunication networks. b) Systematic analysis of the concept of 'AI-native' within the context of telecommunication networks to identify its concepts, objects and delimiting characteristics; c) Considerations on definitions for 'AI-native telecommunication network' and 'AI-native network'. 			
<p>Summary:</p> <p>This Technical Report presents a systematic study of the concepts and characteristics of artificial intelligence native telecommunication networks. To establish a consistent terminological foundation, this report employs established methodologies, including semantic approach and concept-based analysis, to deconstruct the concept of 'AI-native'. Through this analysis, this report identifies the objects to which 'AI-native' applies and determines its delimiting characteristics. The report then presents considerations on definitions for 'AI-native telecommunication network' and 'AI-native network'.</p> <p>In terms of direct benefits from the standardization viewpoint, this Technical Report aims, among others, to introduce some key context for future standardization of artificial intelligence native telecommunication networks (e.g., for vocabulary, essential enablers etc.), and to consolidate these context and standardization perspectives with ITU-T membership.</p>			
<p>Relations to ITU-T Recommendations or other documents (approved or under development):</p> <p>ITU-T Y.3102, ITU-T Y.3172, ISO 1087:2019 (Terminology work and terminology science — Vocabulary)</p>			
<p>Liaisons with other study groups or with other standards bodies:</p> <p>ITU-T SG2, SG11, SG17, SG21, SG20, IEEE SA, ETSI ENI, ETSI ZSM, TMF, 3GPP SA1, NGMN</p>			
<p>Supporting members that are committing to contributing actively to the work item:</p> <p>India, Renmin University of China, China Mobile</p>			