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ITU-T Focus Group on AI Native for Telecommunication
Networks

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

ITU-T



Summary

This technical report summarises the initial findings from the study of core concepts, key characteristics, technical considerations and relevant existing definitions for AI-native and AI-native networks. Based on this study, objects, delimiting characteristics and candidate new definitions for 'AI-native telecommunication networks' and 'AI-native networks' are presented.

Keywords

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

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Technical Report

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

Summary: This technical report summarises findings from the initial study of core concepts, key characteristics, technical considerations and relevant existing definitions for AI-native and AI-native networks. Based on this study, objects, delimiting characteristics and candidate new definitions for 'AI-native telecommunication networks' and 'AI-native networks' are presented.

1 Introduction

1.1 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:

- a) Systematically analyzing the concept of 'AI-native' within the context of telecommunication networks to identify its core concepts, objects and delimiting characteristics;
- b) Proposing candidate definitions for 'AI-native telecommunication network', 'AI-native 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.

1.2 Research flow

This study 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 can be derived from Figure 1.

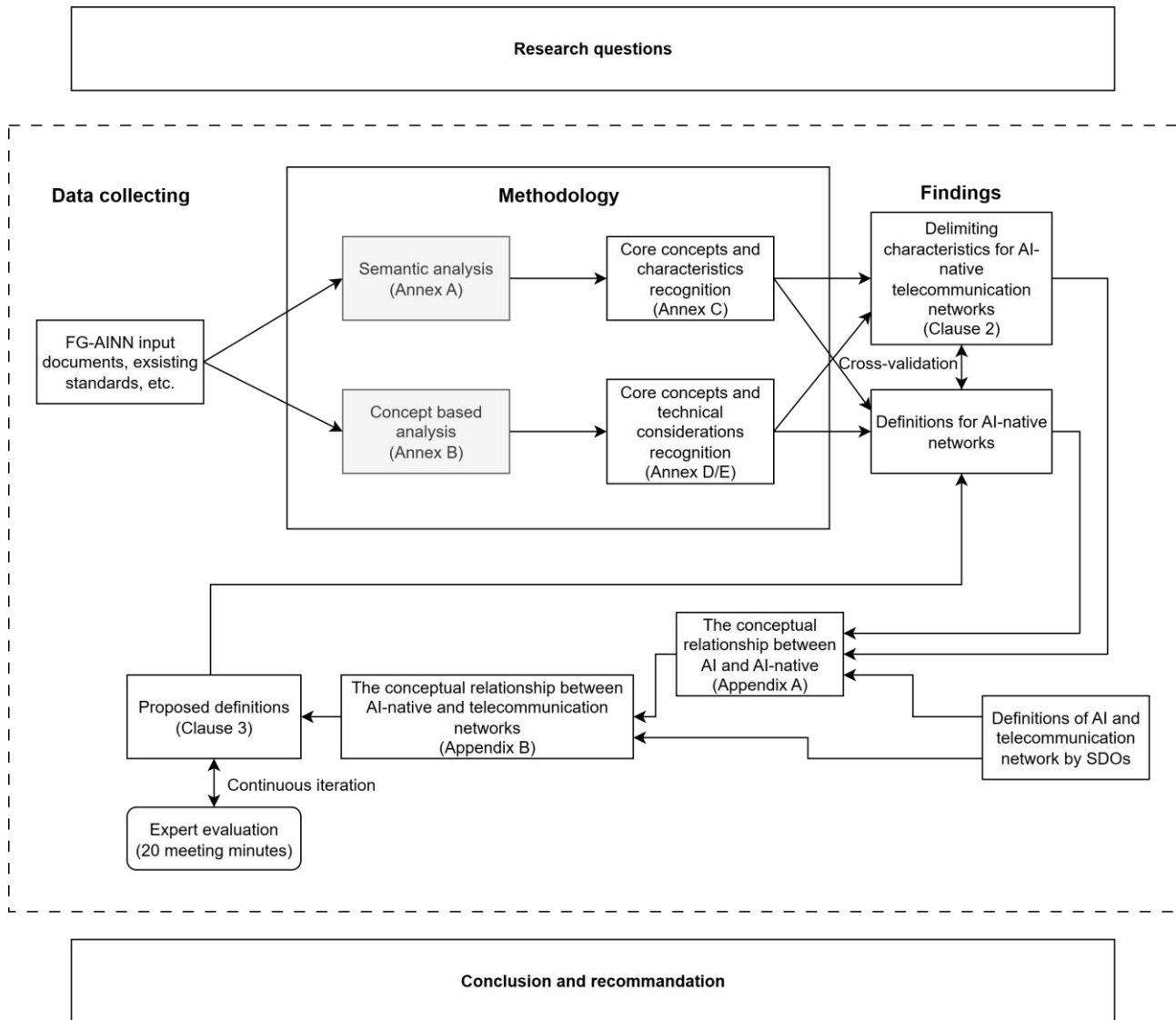


Figure 1 Research flow of this document

2 Objects and delimiting characteristics of ‘artificial intelligence native’

2.1 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)”.

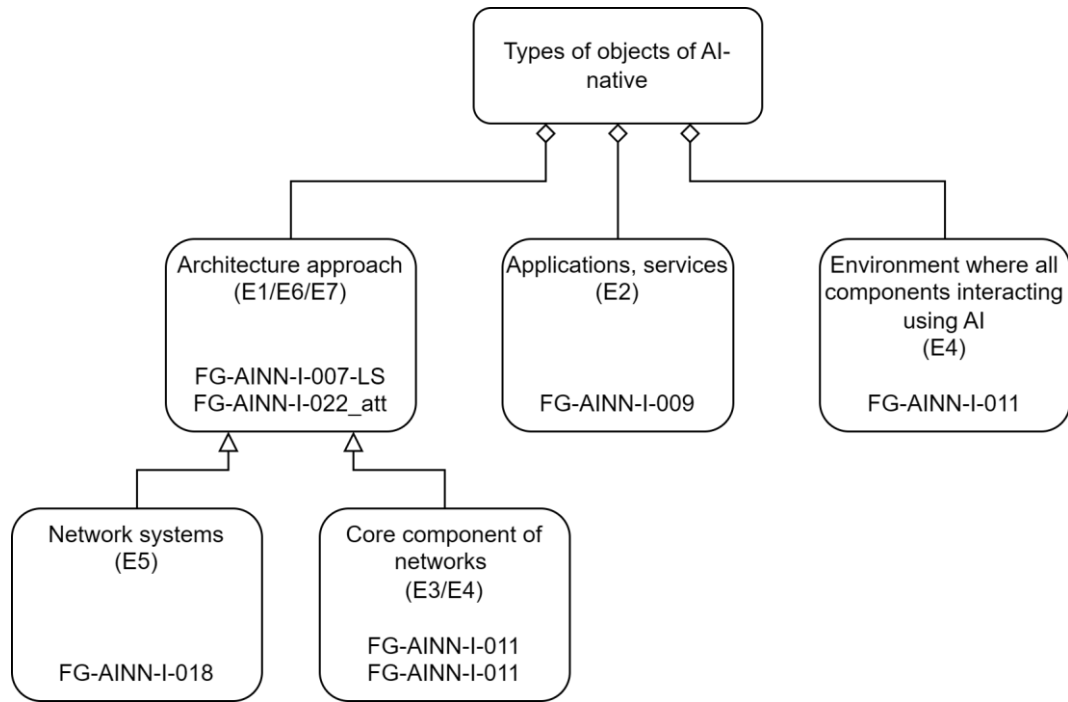


Figure 2 Types of objects of ‘artificial intelligence native’

2.2 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)

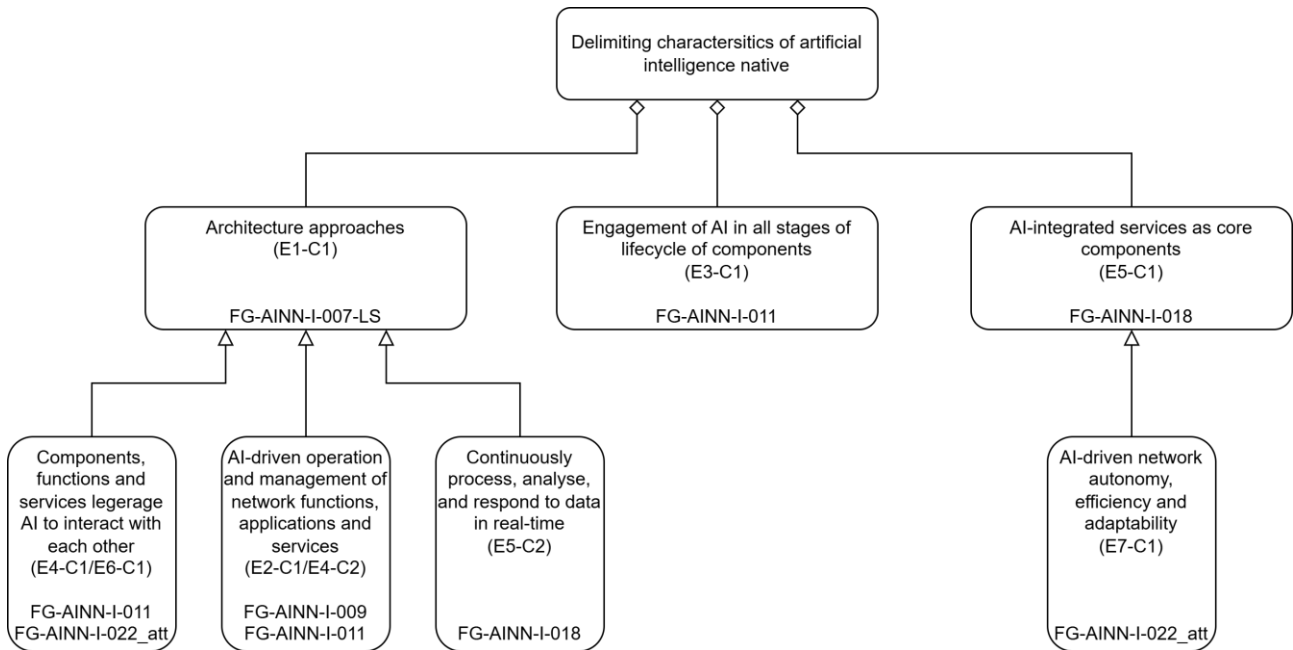


Figure 3 Delimiting characteristics of ‘artificial intelligence native’

3 Proposed definitions

As a result, this report suggests two proposed definitions: AI-native telecommunication network and AI-native network [b-FG-AINN-I-065].

The proposed 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 humans , devices and applications.

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

NOTE1: AI pipelines are machine learning pipelines [b-ITU-T Y.3172] with enhanced support for AI models."

Annex

Annex A Semantic analysis process to derive the concepts

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:

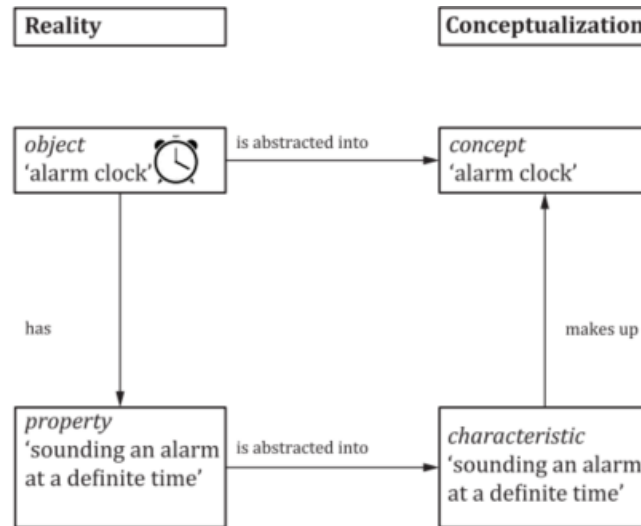


Figure 4 Relations between the object, property, concept and characteristic
(Source: ISO 704:2022, 5.4.1)

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	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. Note 1 to entry: Outside the terminology community, ‘type of relation’ and ‘is a relation’ are also used instead of “generic relation”. Note 2 to entry: In a generic relation, the subordinate concept is a specific concept and the superordinate concept is a generic concept. [SOURCE: ISO 1087:2019, 3.2.13]	
2	partitive relation	Concept relation between a comprehensive concept and a partitive concept. [SOURCE: ISO 1087:2019, 3.2.14]	
3	associative relation	Concept relation that exists when a thematic connection can be established between concepts by virtue of experience Note 1 to entry: Associative relations are non-hierarchical.	

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 Object 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	Network system	AI is a foundational element (E5-C1)enabling the real time responses in network by continuously processing, analysing data (E5-C2)

	[b-FG-AINN-I-018]		
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 network architecture to enhance network autonomy, efficiency, and adaptability [b-FG-AINN-I-022_att]	architecture approach	AI integration is for the purpose of enhancing autonomy, efficiency and adaptability etc(E7-C1)

“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.

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[b-FG-AINN-I-065]	FG-AINN-I-065, <i>Characteristics, requirements and definitions for AI Native Networks</i>

Appendix

Appendix A Relationship between existing definitions of AI and AI-native and the AI-native 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.

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 operation of the telecommunication network. [b- ITU-T K.60 (07/2023)]	Entire set of equipment essential for normal operation	The combination of equipment ensures the proper functioning of the telecommunication network
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.

B.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):

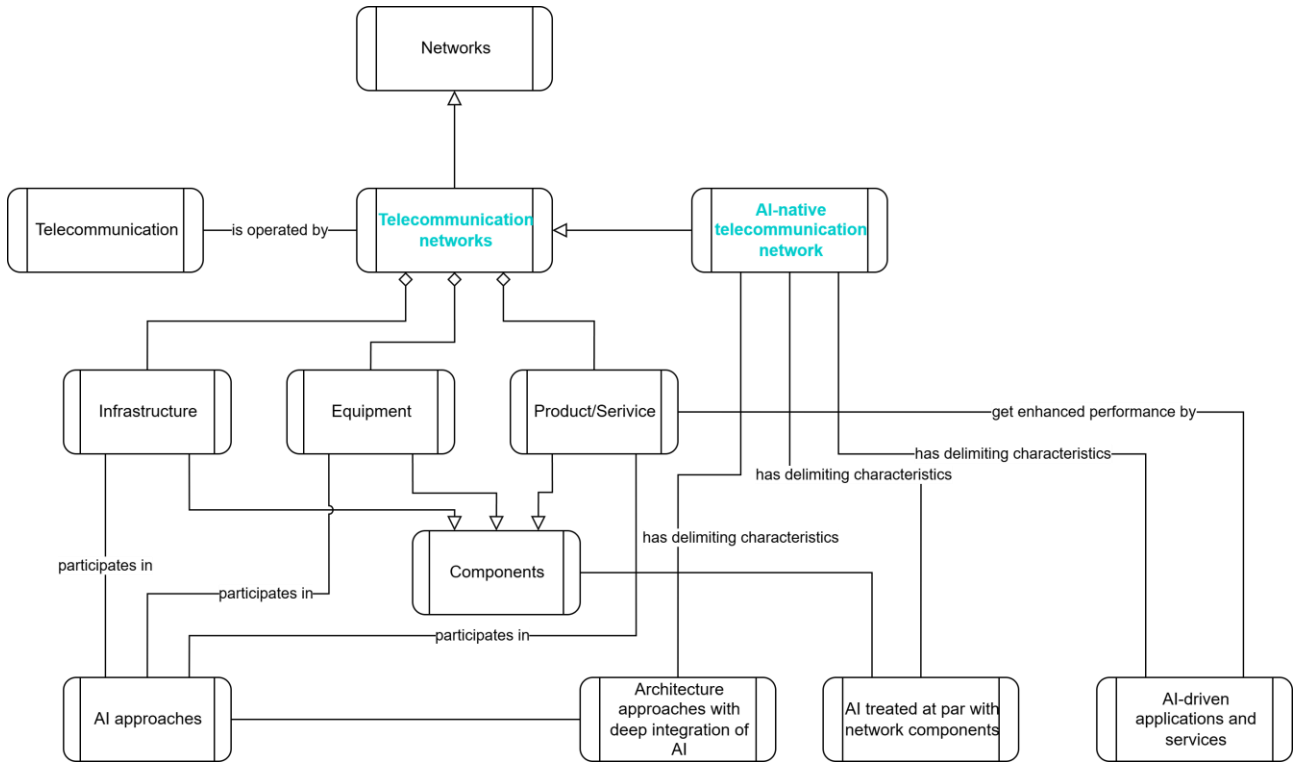


Figure 6 The UML concept system of AI-native Telecommunication Network

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 C History of changes and comments

Version Control	Changes	Comments by experts at WG1 meetings and reasons of changes
R0 (FG-AINN-R0)	FG-AINN-WG1-038 (Nov 11 th 2025 by Xiaomi): (1) Xiaomi An and Jing Yin use semantic analysis to extract AI-Native for telecommunication networks corpus from 22 existing input files of FG-AINN, and finally extract the objects and characteristics related to definitions of AI-native	
R1(FG-AINN-R1)	FG-AINN-WG1-038-R1 (Dec 18 th 2024 by Fuquan): (1) FG-AINN-I-038-R1 builds on previous work by semantically analyzing the AI definitions in ITU-T M.3080 and ISO/IEC 22989:2022. (2) It refines the relationship between AI and AI-Native, emphasizing the common adaptations and unique characteristics of AI-Native, including full-stage engagement, deep system integration, and enhanced performance. These relationships and characteristics are then illustrated with conceptual diagrams to provide transparency and traceability.	WG1 meeting 1 held on Dec 18 th 2024: (1) Marco Carugi noted that FG-AINN-I-038-R1 serves as the methodology for developing concepts and characteristics for producing terminology and gap analysis deliverablese
R2	FG-AINN-WG1-038-R2 (Jan 8 th 2025 by Fuquan): (1) Identified three delimiting characteristics of AI native, namely all-phase engagement, deep integration in the system, and enhanced performance. (2) The proposed definition of AI Native for telecommunication networks is "a system capable of interacting with its environment, deeply integrating artificial intelligence technologies into its development processes, and achieving higher levels of autonomy, efficiency, and adaptability through enhanced performance." (3) Adding Figure 7 "The concept relations between 'AI' and 'AI native'"	WG1 meeting 2 held on Jan 8 th 2025: (1) Vishnu Ram proposed to make it clear what do we mean by “deeply integrating” and “higher level of autonomy”? How important they are in relating to AI native? He also provided advice to check the existed documents and give further clarity or explanations in Notes.(Y.3172-2019/SG13-TD279_GEN/FG-AINN-O-002/FG-AINN-LS1) (2) Riccardo Trivisonno suggested to have further study to check what makes the higher level of autonomy? How to achieve higher level of autonomy? What are the enablers for deeply integrating and what are the indicators for deeply integrating ? (3) Paul Harvey made comments on "achieving higher levels of autonomy" in

R3

FG-AINN-WG1-038-R3 (Jan 15th 2025
by Fuquan):

- (1) A definition for "AI Native for telecommunication network" is proposed, which is "a system capable of interacting with its environment by deeply integrating artificial intelligence as a core component in all stages for enhanced performance". Further study was conducted on the characteristic of "deep integration" and "higher level of performance".
- (2) Adding section 7.1 Further study of the characteristics of 'deep integration'. Deeply integrating AI refers to use AI and related technologies as enablers through all stages. The "deep integration" of AI impacts the architecture, design, deployment, and operation of networks across five dimensions: "real-time decision-making", "ubiquitous intelligence", "cost and benefit optimization", "AI-Native-oriented design", and "self-generation".
- (3) Adding section 7.2 Further study of the characteristics of 'higher level of performance'. Enhanced performance refers to higher level of autonomy, efficiency, and adaptability. "Higher level of performance" is reflected in four aspects: optimising costs and benefits, "enhancing automation and intelligence capabilities", "improving

the definition of AI Native for telecommunication network in the FG-AINN-I-038-R2 report. He suggested that "achieving higher levels of autonomy" "is a required property. depending on the business use case, medium levels may be sufficient".

- (4) Ibrahim Yazici suggested in Concept building for artificial intelligence native for telecommunication networks (FG-AINN-I-038-R2) that the word "deeply integrating" can be replaced by "inherently". However, Vishnu Ram did not agreed to use "inherently", he mentioned all phases engagement into business process and system development process is not a passive approach, as a proactive approach.
- WG1 meeting 3 held on Jan 15th 2025:

- (1) Riccardo Trivisonno asked for clarification about what do we mean by "design". He questioned whether the actual network architecture is designed automatically by AI or with the involvement of AI.
- (2) Vishnu Ram made comments on FG-AINN-I-038-R3 as well. First of all, he questioned what do we mean by "system". Is it internal boundary or external boundary? Does it mean base station and other components interacting with the something else in its environment or individual network functions interacting with its environment? Secondly, he considered the phrase "deeply integrating AI as a core component" a recursive definition that lacked clarity and more details were needed. Thirdly, he found the type of "cost" was ambiguous, suggesting "complexity" as a potentially better alternative. Moreover, He agreed with the question about the meaning of "design" and who undertakes it. Finally, he noted that the term "AI-oriented design" seemed recursive and synonymous with other related terms.

flexibility" and "enhancing collaboration".

R4 FG-AINN-WG1-038-R4 (Jan 18th 2025 by Fuquan):

- (1) Adding section 6.2 "Concept relations between 'telecommunication networks' and 'artificial intelligence native'" based on semantic analysis of the definition of telecommunication networks.
- (2) Adding Figure 8 "The concept system of AI-Native for Telecommunication Network".

R5 FG-AINN-WG1-038-R5 (Jan 22nd 2025 by Fuquan):

This update focuses on addressing issues raised by technical experts at the last meeting.

WG1 meeting 4 held on Jan 22nd 2025:

- (1) Consensus reached and no more comments at this meeting.

- (1) According to the newly added Annex F, 'design' in AI-native can be divided into three categories: Human-led Design, AI-assisted Design and AI-driven Design.
- (2) Based on the definition of AI, the system has both internal and external boundaries, which means it interacts not only with its internal components but also with its external environment.
- (3) In response to Vishnu's suggestion to replace "cost" with "complexity" in the further study of the characteristics of 'higher level of performance', we propose an alternative phrases "resource consumption" to replace it.
- (4) The modified definition for "AI Native for telecommunication network" is: "system capable of interacting with its environment[1] by deeply integrating artificial intelligence in all components and through all stages[2] for enhanced performance[3]." To ensure consistent coding and mapping of the characteristics and objects of the concepts of AI-Native for telecommunication networks in existing standards developed by ITU-T and other SDOs, numbering and coding of these characteristics and

objects are provided, e.g. [1], [2],
[3] ...

R6 FG-AINN-WG1-038-R6 (Feb 5th 2025 by
Fuquan):

- (1) Adding Annex G "The UML concept
system of AI-native for
Telecommunication Network".

WG1 meeting 5 held on Jan 29th 2025:

- (1) Clarissa Marquezan, Antonio De
Domenico and Riccardo Trivisonno
Contributions on the definition of AI-
native telecommunication networks. Based
on the definition of Artificial intelligence
(AI) from ITU-T M.3080 and the definition
of AI Native for telecommunication
network from FG-AINN-I-038 and put
forward. He mentioned that the definition
proposed in FG-AINN-I-038-R5 didn't
include reference to AI-native
telecommunication network value-added
services. In addition, for the sake of
generality and since the discussion on use
case and architecture had not started yet, it
is suggested to delete "components and all
stages" from the definition. Therefore, the
following update of AI native
telecommunication network was proposed
to stress the importance of AI-native
telecommunication network value-added
services: "The AI native
telecommunication network is a network
integrating AI to interact with its
environment, enable novel value-added
services, and enhance the performance of
network and services".
- (2) For Contributions from Clarissa
Marquezan, Antonio De Domenico and
Riccardo Trivisonno on AI Native
Telecommunication Networks and value
added service, Francisco Jose Wilhelmi
Roca mentioned that while the objective, as
Antonio had stated, was to be more generic
or high-level, there were some details he
felt might have been lacking. He
questioned whether it should have been
explicitly stated that the AI-native
telecommunication network was capable of
running AI, either in-house or through a
third-party provider, as he was unsure if the
ability to run AI was implicit in the
definition of integrating AI. Regarding the
added-value services, he was uncertain if
they involved integrating AI-provided
services that went beyond
telecommunication, enabling the network
to serve other parties or offer different
services beyond the added computation.

Moreover, he had doubts about the meaning of "interacting with the environment". He was confused if such interaction was always existed, as in some cases with the AI-native approach, networks could have AI-native functionalities that retrieved telecommunication information and performed actions like displaying something without interacting with the environment.

- (3) Vishnu Ram agreed with Antonio that the definition seemed a bit circular as it depended on the work in other working groups. He suggested adding an editorial note to explain to the reviewer that their work was dependent on or related to the use cases and activities of other working groups, and that it was currently under review. He thought this editorial note could provide the right perspective for the work.
- (4) From previous work, Xiaomi An believed an important characteristic was missing. Given that autonomy and efficiency had been mentioned, she proposed that adaptability was another crucial aspect related to AI. Then, she mentioned that 'enhance the performance' was a necessary characteristic, but with novel value-added services, it might or might not be the case, so it was conditional. She was unsure whether to use 'or' or 'and' in the definition, stating that in the definition, one couldn't use both. Next, she provided the definition from ISO and had a concern about the interpretation of value-added service in ITU. She wasn't sure about the aspect of additional charges. She pointed out that for public services, there might be no charge, while for private services, charges could be applied, which made the concept of adding additional charges confusing. She thought that the term 'additional value' was better than 'additional charges' because 'charge' meant paying money, and if translated into Chinese, it would be more understandable. She emphasized that it was about the creation or production of additional value, which was what 'value-added' really meant.

(5) Paul Harvey first discussed the idea of performance in the definition of AI-native telecommunication networks. He thought the key point of AI-native was about capability and what needed to change to enable that capability. He considered performance a red herring because people always talked about it for every technology, but he didn't think AI-native telecommunication networks were about performance. Instead, it could be about security or easier expansion capacity. He also believed that what Antonio had talked about earlier regarding capability and enabling the new was the key point. Secondly, he pointed out a conflict between autonomy, adaptability, and performance. He explained that autonomy was the property of self-governance and adaptability was a necessary enabler for providing autonomy. He thought autonomy and performance were distinct and didn't necessarily go together as they were presented. His main point was that AI-native referred to capability rather than performance. In his brief response, he thought that AI-native telecommunication networks might be more appropriate compared to AI for telecommunication networks. The latter was more about defining what AI-native was in itself as a quintessential property rather than how it functioned within the context of the telecommunication network.

R7 FG-AINN-I-WG1-038-R7 (Feb 18th 2025 by Fuquan):

- (1) Adding contribution from FG-AINN-WG1-01 / FG-AINN-WG1-02 / FG-AINN-WG1-03/ FG-AINN-WG1-04
- (2) Adding contribution from meeting minutes (b-FG-AINN-WG1-MX) of Feb 5th 2025 with consideration of comments from experts.
- (3) Adding further study on characteristic of enabling novel value added service.
- (4) Adding further study on definitions and characteristics of AI-native for telecommunication networks and AI-native telecommunication networks.

WG1 meeting 6 held on Feb 19th 2025:

- (1) No more comments.

WG1 meeting 7 held on Mar 5th 2025:

- (1) Antonio asked for further explanation of the meaning of "AI-native for" and for an explanation of its difference and connection with "AI-native networks".

- R8** FG-AINN-I-WG1-038-R8 (Mar 9th 2025 by Fuquan):
- (1) Add a description of the relationship between "AI-native for telecommunication networks" and "AI-native telecommunication networks" and a diagram of the relationship (Figure 10) as a response to Antonio's comment in the last meeting.
 - (2) Delete tags in the form "D[n]-[C/O][m]-[k]..." in the conclusion section, in order to avoid making the coding system in FG-AINN-I-047 affect this document of definition.
- R9&R10** FG-AINN-I-WG1-038-R9&R10 (Mar 9th 2025 by Fuquan):
- (1) Modify Abstract based on recent updates.
 - (2) Added section 7.6 and updated chart 10 based on the common thread about AI agents in the 19th March's FG-AINN-WG1 meeting.
 - (3) Change in the presentation of the conclusions
- WG1 meeting 10 held on Apr 2nd 2025:
- (1) Marco asked for further explanation of the method of connecting lines and arrows in UML diagrams.
 - (2) Antonio believes that in Figure10 Characteristics should be connected to AINN and the concept of value added service should be added.
 - (3) Vishnu Ram suggests further explanation of the definition of components and stages from deep integration in all components and through all stages. And suggest further discussion on enhanced performance.
- R11 (FG-AINN-R2)** FG-AINN-I-WG1-038-R11 (Apr 5th 2025 by Fuquan):
- (1) In response to Marco's query on UML connectivity, added UML representation guidelines in 1.2 to clarify diagrammatic conventions.
 - (2) In response to Antonio's suggestion on Figure 10, the characteristics node is now connected to the AI Native Network (AINN) core, and the value-added service concept has been added as a peripheral node.
 - (3) Figure 10 has been moved to another process support document for scope purity requirements.
 - (4) The definitions of AI agents, originally in Section 7.6, have been moved to other process support documents to maintain the focus on architectural fundamentals.
- R12** FG-AINN-I-WG1-038-R12 (Apr 15th 2025 by Fuquan):
- WG1 meeting 13 held on 28th Apr 2025:

- (1) Added a conceptual analysis of the AI-native network and a relationship map with existing conceptual relationships.
- (2) Add AI-native network to the conclusion section.
- (3) Updating the citation list.
- (4) Add “resource utilization” for performance enhancement in the definition.
- (5) Update in response to Paul Harvey's comment.

(1) Vishnu Ram’s editor notes: First, he indicated that he had changed the title of the document to “Study of characteristics of artificial intelligence native for telecommunication network”. Because he believed that the characteristics of AI native telecommunication networks are the nature of what we are describing in this document. The abstract was also changed and the requirements for AINN were added to this part. He pointed out that the definitions of “AI-native telecommunication networks” and “AI-native for telecommunication networks” obtained in this document can be used as candidate definitions for discussion. Additionally, Version Control was moved to the Annex. Second, he thought it would be better to actually give the candidate definitions in Section 1.1 and put the selection criteria to the Annex, which could be useful to readers. In addition, he believed that there are two different methods for analysis of definitions of “artificial intelligence native”, namely semantic analysis and concept based analysis. In Section 1.2.a Semantic analysis, he pointed out that we do not analyze based on process descriptions, but based on actual concepts or some raw material, and suggested moving the process descriptions to the Annex. In Section 1.2.b Concept based analysis, he copied the content based on the concept analysis in the document FG-AINN-I-065 here. Third, in Section 6, he moved the main points obtained from this part after detailed analysis to the top, which gave the overall picture of the conclusions of the concept-based analysis and the semantic analysis. The other content remained unchanged. Fourth, in Section 9, he copied the content about the requirements for AI native networks from the document FG-AINN-I-065.

- R13** FG-AINN-I-WG1-038-R13 (May 5th 2025 by Fuquan):
- (1) Modified formulation of clause 6.
 - (2) Refinement the description of the methodology in the first clause in 1.2.a
 - (3) Moving ‘selection criteria’ and Annex A Definitions of artificial intelligence native to clause 1.
 - (4) Moving detailed semantic analysis process into Annex A.
- R14** FG-AINN-I-WG1-038-R14 (May 25th 2025 by Fuquan):
- (1) Amendment of the title in the light of the discussion at the meeting.
 - (2) Amendments to the catalogue based on the latest document.
 - (3) Amendments to the logic of expression in the methodology section.
 - (4) Moved the clause 8 AI-native network requirements to Annex H to keep the consistency of the document.
 - (5) Add a research flowchart to show the fusion of the two research methods.
 - (6) Add 2.b concept based analysis explanation.
 - (7) Rebuild Table of contents.
- WG1 meeting 15 held on 28th May 2025:
- (1) Vishnu believes that the document should be finalized, including revisions to the details, a review of the conclusions of the final output definitions and their location.
 - (2) Marco believes that the Annex contains no informative content and that it should be moved to an appendix, with the remainder normalized.
 - (3) Vishnu also believes that the content and coding in Table 3 should be optimized to ensure attention is paid to the core content of the article.
- R15(FG-AINN-R4)** FG-AINN-I-WG1-038-R15 (Jun 1st 2025 by Fuquan):
- (1) Move Annex E/F/G/H (further study supplements about ‘deep integration’, ‘enhanced performance’, ‘design’ and ‘value-added service’) to appendix to ensure canonical references to Annex.
 - (2) Replace all references to AI-native requirements with technical considerations.
 - (3) Reformulation of the semantic analysis coding part of the definition in response to expert comments.
 - (4) Adjustment of former clause 6.5 to clause 7 to provide a logical continuity between the further conclusions of the two research methods.
 - (5) Redrawing of figure 3/4/5 to optimize presentation, no content modification.
 - (6) Supplementing the overview text in clause 1.

(7) Doing finalize word review of the document.

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| R16 | FG-AINN-I-WG1-038-R16 (Jun 18 th 2025 by Fuquan):
(1) Format correction and terminology unification | WG1 meeting 15 held on 25 th May 2025:
(1) Review the revisions proposed by Vishnu, which involve modifications to the delimiting characteristics, relationship charts, and conclusions.
(2) Discussion detail could be find in meeting minutes in FG-AINN-WG1-M17 |
| R17 | FG-AINN-I-WG1-038-R17 (Jun 18 th 2025 by Fuquan):
(1) Review the revisions provided by Vishnu and update the documentation.
(2) Update workflow charts and add experts to continuously optimize processes.
(3) Corrected Table 2 Mapping of objects and characteristics related to “artificial intelligence native”
(4) Based on the modification in point 3, the mapping of objects and characteristics in Figures 4 and 5 has been corrected. Accept revision suggestions and redraw.
(5) Add sources for definitions cited in clause 4.
(6) Redrawing the relationship map between AI and AI-native. Accept revision suggestions and redraw.
(7) Following the practice of Table 2, place the definitions from the semantic analysis directly in the table rather than in the Annexs, i.e., move the definitions related to telecommunications networks from Annex D to the table in Clause 5.
(8) Update the diagram in Section 5 regarding the relationship between AI-native and telecommunications networks.
(9) Based on the above modifications, update the relationship diagram between AI-native networks and AI-native telecommunications networks in Clause 6.
(10) The two definitions of 'AI-native for telecommunications networks' and 'AI-native telecommunications networks' were merged based on the | |

results of the meeting to form the final version.

- (11) To maintain consistency in core objectives of this document, remove Clause 7.
- (12) Remove Annex B, C, D because they're no longer needed.
- (13) Remove Appendix B, C, D, E because Clause 7 is removed.
- (14) Move Appendix F to Annex C, because there are clauses in the document that depend on it.

**R19
(141R1)**

FG-AINN-I-WG1-038-R19 (July 8th 2025 by Xiaomi):

- (1) Change the title of Clause 5 to Conceptual relations between “telecommunication networks” and “artificial intelligence native”.
- (2) In Clause 5, add an explanation of the relationship between telecommunications networks and AI-native.
- (3) Optimize the title of clause 6 and clause 4
- (4) Optimize summary statements.
- (5) Add clause relations to the research flowchart in clause 1.

WG1 meeting 20 held on 11th July 2025 (AI for Good Global Summit):

- (1) Antonio questioned whether AI was involved in the entire process, as this did not align with existing use cases. Vishnu then provided a description of 'full lifecycle engagement'.
- (2) It was agreed by all that terminology and definitional issues were important foundations.
- (3) Xiaomi raised a motion that this document should be the outcome of the plenary session.
- (4) Vishnu suggested limiting the scope of the document, retaining only the conclusions and creating a separate document for the process.
- (5) Marco asked how the technical considerations derived from the CBA relate to the characteristics, to which Vishnu responded that this had already been addressed in the 'Objects charts and Delimiting Characteristics charts'.
- (6) The meeting passed a motion that the framework of this document be used as the outcome of this meeting, although the specifics need to be reviewed and discussed further.

R20

FG-AINN-I-WG1-141-R2 (July 11th 2025):

It corresponds to the output FG-AINN-O-XXX of the FG-AINN meeting, 11 July, Geneva

- (1) To keep the article focused on its goals, streamline the main body to include only objects, delimiting characteristics (and their relationship diagrams) and proposed definitions.
 - (2) Simplify the goals in the introduction by removing goal b.
 - (3) Similarly, simplify the descriptions in the Methodology section by retaining only the details in Annex A/Annex B.
 - (4) Move the explanation of the coding section from the original Clause 3 to Annex C.
 - (5) Move the section on the relationship between AI and AI-native to Appendix A.
 - (6) Move the section on the relationship between AI-native and telecommunication networks from the original Clause 5 to Appendix A.
 - (7) Move the section on the relationship between AI-native and telecommunication networks from the original Clause 5 to Appendix B.
 - (8) Move the section on technical considerations for AI-native networks from Clause 6 to Annex D.
 - (9) Former Annex C is now Annex E.
 - (10) Former Appendix A is now Appendix C.
 - (11) Reorganize the full text image labels (front to back).
 - (12) Reorganize the full text table labels (front to back).
 - (13) A research flow figure has been generated based on the new full text content.
-