TM Forum Reference

Autonomous Networks Glossary

IG1258

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Notice

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Introduction

This document provides a glossary of terminology relevant to the published deliverables of the Autonomous Networks (AN) project with the goal to achieve a common glossary across all the AN deliverables and to serve as terminology reference for use across the industry. Where necessary, descriptions providing background for formal concise definitions will also be provided. In addition to terms that are introduced in the AN documents, related terms taken or derived from external industry publications, or existing TM Forum deliverables are also included. For a complete listing of AN deliverables please refer to IG1260 AN Project Deliverables.

Text is *Italics* denotes another term defined within the glossary.

1. Key Terminology

The following table describes the most important normative definitions from the Autonomous Networks project. (Note that *Italicized* terms in definition text point to other terms defined in this guide)

Term	Abbreviation	Definition / Source
Autonomous Domain	AD	An autonomous domain is a system (or set of systems or *agents*) that is capable of *autonomous* behavior (e.g., resolve tasks, adhere to objectives) without manual human intervention. The autonomous domain does this by realizing self-management capabilities using closed control loop mechanisms, using four key phases: awareness, analysis, decision-making, and execution. It is a domain with an administrative governance boundary that defines the scope of encapsulated autonomous behaviors. (IG1230)
Autonomous Network	AN	An Autonomous Network is a system of networks and software platforms that are capable of sensing its environment and adapting its behavior accordingly with little or no human input. *(IG1230 AN Technical Architecture).*
AN Level or *Autonomy Level*	ANL	"AN Levels describe the level of autonomic capability in a given operational workflow or for an autonomous domain (L0->L5). AN Levels identify contextual autonomous capability" *(IG1230 AN Technical Architecture).* AN Levels are a linear scale, 0 through 5 indicating the level of autonomy of an *autonomous network* or *autonomous domain.* Each level is described formally in IG 1218: *"* - *Level 0 - manual management: The system delivers assisted monitoring capabilities, which means all dynamic tasks have to be executed manually.* - *Level 1 - assisted management: The system executes a certain repetitive sub-task based on pre-configured to increase execution efficiency.* - *Level 2 - partial Autonomous Networks: The system enables partial automatic O&M for certain units based on predefined rule/policy under certain external environments.* - *Level 3 - conditional Autonomous Networks: Building on L2 capabilities, the system with awareness can sense real-time environmental changes, and in certain network domains, optimize and adjust itself to the external environment.*

Term	Abbreviation	Definition / Source
		- *Level 4 - high Autonomous Networks: Building on L3 capabilities, the system enables, in a more complicated cross-domain environment, analyze and make decision based on predictive or active closed loop management of service and customer experience-driven networks.* - *Level 5 - full Autonomous Networks: This level is the goal for telecom network evolution. The system possesses closed loop automation capabilities across multiple services, multiple domains, and the entire lifecycle, achieving Autonomous Networks."* The *AN Level Table* that describes those 6 levels of autonomy in terms of human and machine responsibility across the phases of a control loop - see IG1218 or IG1305. The Level table provides a detailed set of metrics that represent multiple aspects of concerns, including control loop phase, and level of human machine interaction (HMI), that in combination,indicate a networks level of autonomy.
Closed Loop	CL	A closed loop or closed loop system is one in which the output of the system is continuously monitored and used to adjust the input in order to maintain a desired output. This feedback can be used to make adjustments to the system automatically, with little or no human intervention.(*Paraphrased from IG1230).* See also *Control Loop.* In control theory, a closed loop system refers to a system in which the output of the system is used to provide a feedback signal to control the input, whereas in an open loop system, the control action is not dependent on the output of the system. The feedback in a closed loop system can be used to adjust the input in order to bring the output closer to a desired state. In the context of autonomous networks, closed loop refers to the same concept, where the autonomous system continually monitors the output and compares it to the desired output, making necessary adjustments to the input in order to bring the output closer to the desired state. Autonomous systems are often closed loop systems because they need to sense and respond to their environment to achieve their goals. It's important to note that both definitions are similar in the sense that they both describe a feedback mechanism. The difference is that the context of control theory can include various kind of

Term	Abbreviation	Definition / Source
		systems, while *autonomous systems* refer to a specific class of systems which are self-governing, self-controlled and self-sustaining systems. To simplify, closed loop in control theory describes the general concept of a feedback mechanism while in autonomous systems it describes how these systems *respond and adapt to the environment to achieve their goals* (see [Autonomous Networks]() definition*)*.
Closed Loop Automation	CLA	Closed Loop Automation (CLA) refers to a type of automation in which a system's output is continuously monitored, and any necessary adjustments are made to the system's input in order to maintain the desired output. In other words, it is a system that receives feedback and uses it to adjust its actions. One example of closed loop automation within telecommunications is in the context of network management. A system could monitor the performance of a network, and adjust the configuration of the network in real-time to ensure optimal performance.
[Intent]()		"Intent is the formal specification of all expectations including requirements, goals, and constraints given to a technical system" (TM Forum, 2022, IG1230 and later on IG1253). "A set of operational goals that a network should meet and outcomes that a network is supposed to deliver, defined in a declarative manner without specifying how to achieve or implement them" (IETF RFC9315, 2020). See Section 4. Intent Terminology for more Intent related terms.
Self-X Capability	Self-X Self-*	Self-X capabilities are a set of abilities that enable an autonomous network to perform tasks (or functions) without the need for human intervention. These abilities include self-configuration, self-diagnosis, self-healing, self-optimization, and self-protection. Self-configuration allows the system to adapt its settings and parameters to changing environments and conditions. Self-diagnosis allows the system to identify and diagnose problems. Self-healing allows the system to recover from problems and return to normal operation. Self-optimization allows the system to improve its performance over time. Self-protection allows the system to defend against cyber-attacks and other security threats. "Self-operation (Self-X or Self-*) capabilities are the main functions to support above business requirements, which include self-serving (self-

Term	Abbreviation	Definition / Source
		planning/design, self-ordering, self-marketing), self-fulfilling (self-organizing, self-managing, self-governing), and self-assuring (self-monitoring/reporting, self-healing, self-optimizing), and so on" (*IG1218 AN Business Requirements and Framework).* See IG1218 for an analysis of these capabilities in relation to achieving AN vision.
[TM Forum Intent Ontology]()	TIO	The TM Forum Intent Ontology (TIO) is a standardized ontology for defining and representing the goals, constraints, and requirements of autonomous networks (a.k.a intents!). It is developed and maintained by the TM Forum, a global industry association that focuses on digital transformation in the telecommunications, media, and entertainment sectors. The TIO provides a highly expressive vocabulary for defining and representing the intents of autonomous systems, and for enabling systems to communicate and coordinate their actions with one another. It is designed to be flexible and extensible, and can be used to represent the intentions of a wide variety of autonomous systems, including networks, resources, services, and applications. The TIO is intended to support the development and deployment of autonomous networks by providing a standardized way to define and represent the requirements of these systems. It is also intended to facilitate the development of tools and techniques for managing and optimizing the performance of autonomous systems, and to support the interoperability of these systems with one another.
Zero-X Experience	Zero-X Zero-*	Zero-touch, zero-trouble, and zero-wait experiences (referred to as zero-X or zero-* for short) are design principles that aim to create customer experiences that are effortless and seamless. "Zero-touch" refers to the idea of designing a system or process that requires minimal or no effort on the part of the customer to use. This could involve automating certain tasks or making it easy for customers to find the information or assistance they need without having to contact customer service. "Zero-trouble" refers to the idea of designing a system or process that causes minimal or no inconvenience or frustration for the customer. This could involve making it easy for customers to resolve problems or issues that arise, or designing

Term	Abbreviation	Definition / Source
		the system in a way that reduces the likelihood of problems occurring in the first place. "Zero-wait" refers to the idea of designing a system or process that allows customers to get what they need as quickly as possible, with minimal or no waiting. This could involve optimizing the speed of a website or app, or providing multiple channels through which customers can access information or assistance. These principles are important to design of autonomous systems and services, such as customer portals and operational support systems (OSS), with the goal of improving the overall customer experience.

2. Autonomy versus Automation

Term	Formal Definition	Source
Autonomy	The capability to make decisions free from human control. (IG1230)	TM Forum
Autonomous	Having *autonomy*. (adjective) (IG1230)	TM Forum
Autonomic	Acting or occurring involuntarily (Meriam-Webster Dictionary). Resulting from internal stimuli; spontaneous (The Free Dictionary)	Dictionary
Autonomicity	Autonomicity is the ability of a system to exhibits the four key objective properties of autonomic systems: self-configuring, self-optimizing, self-healing, and self-protecting - together with the attribute properties, viz., self-aware, environment-aware, self-monitoring, and self-adjusting (not precise or formal definition). The quality of having *autonomic* capability (adjective).	IEEE paper Dictionary
Automated	made to operate by machines or computers in order to reduce the work done by humans (Cambridge dictionary)	Dictionary
Automation	the use of machines and computers that can operate without needing human control	Dictionary
Automatic	Able to operate independently of human control (IG1230)	TM Forum, Cambridge Dictionary

Autonomy means to be independent or to be able to control or govern oneself. It is different from ***automation***, which performs a sequence of highly structured pre-programmed tasks requiring human oversight and intervention. Intelligent autonomy is where operations have learning and adaptive capabilities that allow responses with minimal human interaction, empowering operators to perform higher-level optimization tasks.

Autonomous is an adjective that describes something that is self-governed, self-directed, or self-controlled. It typically refers to things that are able to function independently, without the need for external guidance or direction. In the context of technology, ***autonomous systems*** are those that are able to make their own decisions and take action based on their own internal rules and procedures, rather than being controlled by a human operator or external system.

The terms ***autonomic, autonomy, autonomous and autonomicity*** have been used in various fields such as language, biology, and philosophy. In general, the term ***autonomic*** implies occurring involuntarily, unconsciously, or automatically, or resulting spontaneously from internal causes such as autonomic reflexes. The term ***autonomous*** comes from ancient Greek in the sixteenth century and means having its own laws. According to the Oxford English Dictionary, *autonomous* means the capacity for self-governance or having the freedom to act independently, which also means self-containment and self-direction. ***Autonomicity*** refers to the state of being autonomic.

The term *autonomic computing* was named after the human body's autonomic nervous system of the human body which is responsible for the human body perceiving, adapting to, and interacting with the world in order to manage dynamically changing and unpredictable circumstances.(Source *Kephart, J.O.; Chess, D.M. (2003), "The vision of autonomic computing", Computer, **36**: 41–52, CiteSeerX 10.1.1.70.613, doi:10.1109/MC.2003.1160055*)

3. General AN Terminology

The following table describes other definitions used in the AN project guides. Most of the source definitions are taken from IG1230 Autonomous Networks Technical Architecture.

Term	Definition / Source
AADE Loop	The AADE loop is a closed control loop that is used to guide the design and implementation of autonomous systems. **AADE** stands for **A**wareness, **A**nalysis, **D**ecision and **E**xecution. The AADE loop is an iterative process that involves the following steps: 1. Awareness: In this step, the AN system gathers data and information from various sources, such as sensors, databases, and user input. 2. Analysis: In this step, the AN system processes and analyzes the data to identify patterns, trends, and relationships. 3. Decision : In this step, the AN system uses the insights gained from the analysis to decide on a solution or course of action. 4. Execution: In this step, the AN system executes, tests and evaluates the effectiveness of the solution or course of action, and adjusts it as needed based on the results of the evaluation. The AADE loop is an ongoing process that is repeated as needed to continuously improve the performance of the *Autonomous Network* (AN). It is similar to another AADE Loop (Acquire, Analyze, Design, and Evaluate) described in the field of AI systems. Note that sometimes the term *Perception* is used interchangeably with *Awareness*. Note also that other telecom standards use a similarly defined loop that also have their basis in MAPE-K such as CADE Loop from ETSI ZSM, where C is for (data) Collection rather than Awareness and the MADE Loop from 3GPP where M stands for Monitor rather than Awareness.
Agent	An agent is an intelligent entity that runs independently, acts by itself, is affected by external environments, continuously detects from the environment to improve its capabilities, and combines inference and knowledge representation. An agent has the characteristics of autonomy, reactivity, adaptability, communication, and self-learning. Agents can be software agents, hardware agents, firmware agents, robotic agents, human agents, and so on.
AN Reference Architecture	Defines a set of architectural 'building blocks' that form the self-management capabilities underpinning autonomous platforms and systems. Identifies the formal architecture of AN and the 9 reference points I1-3,F1-3 and K1-3. (IG1251)
Autonomous Agent	An autonomous agent is an autonomous individual that can adapt to and interact with its environment. (see *Agent*)

Term	Definition / Source
Autonomous System	"A system that is capable of performing the functions of sensing, thinking, and acting in the environment without human intervention." (ISO) "An autonomous system is a system that can operate without human intervention and can make decisions on its own based on its programming and sensory input." (IEEE)
Control Loop	A control loop is a type of control system that is used to regulate a process or system by continuously monitoring and adjusting its input in order to maintain a desired output. Control loops are used in a wide range of applications, such as industrial automation, automotive systems, aerospace, and telecommunications. Control loops can also be classified as *open loop* and *closed loop* control systems. Open loop control systems do not have any feedback mechanism, while closed loop control systems have a feedback mechanism. "Control loops are used to enable autonomous systems to adapt their behavior to respond to changes in user needs, business goals, or environmental conditions. A *closed* control loop also refers to an autonomous system accomplishing a task *without a human* taking an active role during task execution" (from IG1230) See also *Closed Loop*.
Domain	A domain is a subset of a specific management area. (See TMF071 ODF Glossary for further definitions of 'domain' concepts)
Explainability	Explainability is the extent to which the internal mechanics of a machine or deep learning system can be explained in human terms *(IG1230)* (Sometimes confused with *Interpretability*) Interpretability is about being able to discern the mechanics without necessarily knowing why. Explainability is being able to quite literally explain what is happening. An explanation is the answer to a why-question (Miller 2017).
Human-in-the-Loop (HITL)	Human-in-the-loop (HITL) refers to a closed control loop where humans are actively involved in the decision-making process and are able to intervene and make decisions in real time as needed. This approach is often used in systems where there is a high level of uncertainty or complexity, and where the system needs to be able to adapt and respond to changing conditions in real time. A Human-in-the-loop (HITL) example is an air traffic control system, in which human controllers are responsible for making real-time decisions about the movement and routing of aircraft based on input from automated systems.
Human-on-the-Loop (HOTL)	Human-on-the-loop (HOTL) refers to closed control loops where humans are not actively involved in the decision-making process but are able to review and override decisions made by the system as needed. This approach is often used in systems where there is a lower level of uncertainty or complexity, and where the system is able to make decisions based on predetermined criteria or rules. A Human-on-the-loop (HOTL) example is an automated trading system, in which human traders are able to review and override trades made by the system based on predetermined criteria. In the

Term	Definition / Source
	context of *autonomous systems,* "Human-on-the-loop" typically refers to humans playing a more supervisory role, monitoring the decisions and actions taken by the autonomous system and potentially intervening if necessary.
Interpretability	Interpretability is about the extent to which a cause and effect can be observed within a system *(IG1230). Interpretable Machine Learning* refers to methods and models that make the behavior and predictions of machine learning systems understandable to humans. Book: Interpretable Machine Learning, Christoph Molnar, 2022-12-14
Machine Learning (ML)	Machine Learning is a subfield of Artificial Intelligence which focuses on using data and algorithms to imitate the way humans learn. Algorithms "learn" to make classifications or predictions without being explicitly programmed from training data input to the machine learning model. The model can then be evaluated for accuracy with data that was withheld from the training set. Human programmers can alter the model for more accurate results, for example by changing the initial parameters of the model and re-training.
Machine Reasoning (MR)	"Machine reasoning is the ability of a computer or machine to perform tasks that require logical and analytical thinking, such as problem-solving, decision-making, and planning. It involves the use of algorithms and logical rules to process and analyze data, and to draw conclusions or make decisions based on that analysis. Machine reasoning is a key component of artificial intelligence and is used in a wide range of applications, including natural language processing, image and speech recognition, and decision support systems." *(Arshdeep, et al. "A Review on Reasoning Techniques in Artificial Intelligence." International Journal of Computer Applications, vol. 168, no. 9, 2017, p. 34.)*
Management Domain (MD)	Management Domain is a grouping of Managed Entities that partitions the managed objects into logical groups and defines a common administrative domain for managing the objects within it. (Paraphrased from TM Forum's GB922 "SID Root Entities" and TR275 "Core Networking Resources Business Entities") "Scope of management that federates together management services, that enables their exposure towards external service consumers and that is delineated by a business, administrative, technological or other boundary (ETSI ZSM007 Terminology)
Management Function (MnF)	"Logical entity playing the roles of service consumer and/or service producer" (ETSI ZSM007 Terminology) See *Intent Management Function.*
Management Service (MnS)	"Set of offered management capabilities" (ETSI ZSM007 Terminology). Explanation: *A Management Function* provides the management capabilities, *Management Service* provides the interface to access the management capabilities, and *Management Domain* provides the environment to manage the network and its services. Example:*TMF921* Intent Management

Term	Definition / Source
	API is a *Management Service* as it provides the interface for intent management capabilities.
Platform	A platform is a collection of systems that collectively provide a well-defined block of business functionality exposed via open APIs *(See TMF071 ODF Glossary for further definitions of 'platform' concepts)*

4. AN Level Terminology

The following table describes terminology related to the measurement of autonomic capability, such as the *AN Level* concept. Terms marked with asterisk are defined in the IG1252 Autonomous Network Levels Evaluation Methodology.

Term	Definition / Source
AN Levels	AN Levels describe the level of autonomic capability in a given operational workflow or for an autonomous domain (L0->L5). AN Levels identify contextual autonomous capability (IG1230).
AN Levels Evaluation Methodology	The AN Level Evaluation Methodology is a framework intended to be used by communication service providers and solution providers to evaluate the level of autonomy (i.e *AN Level*) of their existing network and systems. The methodology is designed to calculate the achieved AN Level for a given process and/or autonomous domain and thus identify areas for further improvement. The methodology may be adapted to suit the specific environment of a service provider, while still remaining valid and applicable. *(IG1252 Autonomous Networks Level Evaluation Methodology)*
AN Effectiveness Indicators	A set of indicators that can be used to evaluate the effect of introducing autonomy capability into telecom systems in terms of business growth, customer experience, and operational efficiency. *(IG1256 Autonomous Networks Effectiveness Indicators)*
Effectiveness Indicator	An effectiveness indicator is a metric that is used to evaluate the performance or effectiveness of a system. It can be used to assess how well the system is achieving its goals or meeting its objectives and can help identify areas for improvement. Effectiveness indicators can be quantitative or qualitative and may be based on a variety of data sources, including observations, measurements, and feedback from users or stakeholders. Some examples of effectiveness indicators might include measures of efficiency (self-X capabilities), accuracy, reliability, safety, and usability/experience (zero-X experiences). Efficiency and experience are the key *AN effectiveness indicators*.

5. Intent Terminology

The following table described terminology related to intent-driven interactions and most of the formal definitions are drawn from IG1253 Intent in Autonomous Networks guide.

Term	Definition / Source
Intent Common Model	"An intent common model specifies domain-independent generic modeling artifacts such as the intent class and expectation class. Intent objects contain a set of expectations, which are distinct and diverse types of requirements allowing to address all relevant concerns" *(IG1253 Intent in Autonomous Networks)*
Intent Expression	The expression of an intent's expectations. An Intent contains a set of expectations expressed in statements using a particular expression language such as Turtle or JSON-LD. This is the basis of the *TM Forum's Intent Ontology* (TIO). (paraphrased from TM Forum GB922 SID information Model, 2021)
Intent Extension Model	Intent extension models are vocabularies that are designed to be used in conjunction with the Intent Common Model or "extend" the Intent Common Model. Intent extension models can add additional capabilities or functionality to an intent common model (defined in TIO), or to augment the existing model's performance in some way, e.g., add some extra expressiveness. There are several ways that intent extension models can be used. For example, they can be used to add domain-specific knowledge or expertise to a model, to enable the model to handle a wider range of input data or scenarios, or to improve the model's performance on a particular task or problem *(Source: TM Forum AN Project)*
Intent Handler	"The intent handler is the role given to the *receiver of* an intent object from an *intent owner*. An intent handler considers the requirements, goals and constraints specified in this intent object when operating the domain and infrastructure it is responsible for. The intent manager in the role of intent handler is responsible to transition the system state to a state that complies with the intent's expectations. An intent handler role does not modify or remove intent - only the intent owner can perform these operations. The intent handler is responsible for notifying the intent owner of the intent fulfillment state through *intent report*(s). *(paraphrased from IG1253C Intent Life Cycle Management and Interface). See Intent Management Function.*
Intent interface	An intent interface is a communication interface or interface layer that is designed to facilitate the exchange of intents between autonomous domains or autonomous networks. It enables systems to communicate their goals, constraints, and requirements to one another, and to negotiate and resolve conflicts or discrepancies between these intents. *(Source: TM Forum AN Project)* "Intent-based interface: interface to phrase the consumer request(s) of what is required in a declarative form" (ETSI ISG ZSM ZSM007 Glossary)

Term	Definition / Source
	Examples of intent interfaces includes: TMF921 (TM Forum), TS28312 (3GPP), and M71 DSL (MEF) (2019).
Intent Management Function	The Intent Management Function (IMF) is the management function of an autonomous domain that is responsible for handling intent requests and for translating that intent into specific actions for the domain to perform. An intent management function assumes the role of *intent handler* by receiving an intent object from an intent owner. An intent management function assumes the role of *intent handler* by receiving an intent object from an intent owner. An intent management function can assume only one of these roles for a given intent. As such, an individual intent has only one owner and one handler. However, a given intent management function playing the role of intent owner for several intents can at the same time be the intent handler for a different set of intents. Intent Management Function is the TM Forum's preferred term for the function for intent-driven management, and it directly references the "*Management Function"* term defined externally by ETSI ZSM and 3GPP SA5. *Synonyms*: Intent Handling Function, Intent Management Element , See *Intent Handler (role).* Intent Management Element (IME) term is used in ETSI ISG ZSM ZSM011.
Intent Negotiation	Intent negotiation is the process of resolving conflicts or discrepancies between intents of multiple parties or systems. It involves exchange of information and compromise to reach an agreement. In autonomous networks, it is used when multiple domains or agents have conflicting intents and need to find a mutually acceptable solution. Negotiation can involve the use of different negotiation strategies, such as making concessions or proposing alternative solutions to influence the intent owner's requirements. It's an iterative process of request-reply interactions before an *Intent Handler* accepts an *Intent Request* from an *Intent Owner.* Intent negotiation is an important aspect of autonomous systems, as it allows systems to adapt and respond to changing circumstances or unexpected challenges, and to coordinate their actions with other systems or agents in order to achieve their goals.
Intent Owner	"The intent owner is the *role* given to the *originator* of the *intent*. It is the entity that creates the intent and formulates all requirements and information within it. The Intent Owner uses this intent to communicate requirements, goals, or constraints to other intent management functions and therefore impact their tasks and behavior. The intent owner is responsible for managing the intent's life cycle. Consequently, the intent owner is the only entity and role allowed to modify intent objects. It is also responsible to actively remove the intent if the requirements it contains are no longer required". *(paraphrased from IG1253C Intent Life Cycle Management and Interface)*

Term	Definition / Source
Intent Report	Intent Reports are exchanged between intent management functions for reporting on the progress (status) or success of the intent being handled (paraphrased from TM Forum GB922 SID information Model, 2021)
Intent Request	The communication of an intent from an *intent owner* to an *Intent handler*
Intent Response	A “report” or “status” from an Intent Handler to an Intent Owner on whether the expectations of an intent were fulfilled.
Knowledge	Knowledge is information that has been processed in such a way that it is meaningful, relevant, and useful. (*Russell .L. Ackoff, ”From Data to Wisdom”)* Ackhoff believed that knowledge was not the same as information, which he defined as "raw data that has not yet been processed or organized in a way that makes it meaningful or useful." Instead, knowledge was the result of taking raw data and processing it through a process of understanding, interpretation, and application. Ackoff believed that knowledge was essential for effective decision-making and problem-solving, and that it was the foundation of all learning and progress. Knowledge is also defined as "analysis of data and information, resulting in an understanding of what the data and information mean" by ETSI ISG Experiential Network Intelligence [ETSI GS ENI 005].
Knowledge Graph	A knowledge graph is a model of real-world entities and their relationships, typically represented as a graph, that is used to represent and organize large amounts of structured and unstructured data in a way that is both human-readable and machine-readable. It is a comprehensive representation of a domain or a set of related domains that contains both data and the relationships between the data elements. It is designed to facilitate the representation, management, and processing of knowledge in a machine-readable format. (*Bhardwaj, et al. "Survey of Knowledge Graph Construction, Maintenance, and Applications." ACM Computing Surveys, vol. 52, no. 5, 2019, p. 1.)*
Model Federation	Model federation refers to the process of combining or integrating multiple models into a single, larger model. This can be done for a variety of reasons, such as to enable a model or ontology to handle a wider range of expressions (greater expressiveness) from multiple domain-specific models. This concept is used in the TM Forum's Intent Ontology (TIO). "The intent modeling proposal recommends using intents from a federation of models. While the intent common model contains general and domain-independent aspects any number of intent expansion and intent information models can be used. They are specific to a domain of intent handling and therefore define what the intent handler of that domain needs to understand and what the intent objects addressing this domain can express." *(IG1253 Intent in Autonomous Networks)*

Term	Definition / Source
TMF921	TMF921 is the TM Forum's short name for the Intent Management API Suite. It is a standardized interface and data model for exchanging intents (goals, constraints, and requirements) of autonomous systems. It uses the *TM Forum Intent Ontology* (TIO) as a formal and unambiguous way of expressing intents. It is a REST-based API that supports intents in a flexible, domain-agnostic manner and allows external ontologies and vocabularies to be federated into the overall intent expression. It supports reporting (see *Intent Report*), and negotiation (see *Intent Negotiation)* and is knowledge-based (RDF). *(Source: TM Forum AN Project)*
Utility	In the context of autonomous systems, *utility* refers to the value or usefulness of a particular system or component to a user, or to the overall network. It is often used to measure the effectiveness or efficiency of a system or component in achieving a particular *goal* or meeting a specific need. As such, the AN project refers to utility as an aspect of intent as it describes "knowledge about what makes an outcome or situation preferential" (IG1253) For example, an autonomous system that is designed to optimize energy consumption in a building may have high utility if it can significantly reduce energy costs and improve energy efficiency. Similarly, an autonomous system that is designed to facilitate communication and collaboration among a group of people may have high utility if it can effectively facilitate communication and improve productivity. Utility can be a key factor in determining the success or adoption of an autonomous system, as users will typically be more likely to adopt a system that is perceived as being valuable or useful to them. (The 'utility' term is used in IG1253)

6. Administrative Appendix

6.1. Document History

6.1.1. Version History

Version Number	Date Modified	Modified by:	Description of changes
0.1.0	03-Jan-2023	Kevin McDonnell, Senior Director, Huawei	Initial draft document
1.0.0	31-Jan-2023	Alan Pope	Final edits prior to publication

6.1.2. Release History

Release Status	Date Modified	Modified by:	Description of changes
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