

## Recommendation

# ITU-T Y.3062 (02/2025)

SERIES Y: Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

Future networks

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## Trustworthiness evaluation for IMT-2020 and beyond with autonomous network functions

**Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities**

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## Recommendation ITU-T Y.3062

### Trustworthiness evaluation for IMT-2020 and beyond with autonomous network functions

#### Summary

Recommendation ITU-T Y.3062 specifies trustworthiness evaluation for IMT-2020 and beyond with autonomous network (AN) functions. It includes the overview of trustworthiness, evaluation process for trustworthiness, evaluation metrics and related submetrics for trustworthiness, quantitative methods of establishing trustworthiness for trust in AN (TiAN). In the appendices, the details of submetrics are described in general; at the same time, the evaluation methodologies are described for each submetric and there are a series of detailed typical scenario descriptions to make them more understandable and acceptable for trustworthiness evaluation for IMT-2020 and beyond with AN functions.

#### History\*

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#### Keywords

Autonomous network, evaluation, measurement, quantization, trust, trustworthiness.

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# Recommendation ITU-T Y.3062

## Trustworthiness evaluation for IMT-2020 and beyond with autonomous network functions

### 1 Scope

This Recommendation specifies trustworthiness evaluation for IMT-2020 and beyond equipped with AN functions.

The scope of this Recommendation includes:

- Overview of trustworthiness;
- Evaluation process for trustworthiness;
- Evaluation metrics and related submetrics for trustworthiness;
- Quantitative methods of establishing trustworthiness.

In Appendix I, the metrics and submetrics are described in detail with generic descriptions with the related evaluation methodologies; in Appendix II there are a series of detailed typical scenario descriptions to make them more understandable and acceptable for trustworthiness evaluation for IMT-2020 and beyond with AN functions.

### 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.

- [ITU-T Y.3052] Recommendation ITU-T Y.3052 (2017), *Overview of trust provisioning in information and communication technology infrastructures and services*.
- [ITU-T Y.3060] Recommendation ITU-T Y.3060 (2023), *Autonomous networks – Overview on trust*.
- [ITU-T Y.3101] Recommendation ITU-T Y.3101 (2018), *Requirements of the IMT-2020 network*.

### 3 Definitions

#### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 trust** [ITU-T Y.3052]: The measurable belief and/or confidence which represents accumulated value from history and the expecting value for the future.

**3.1.2 trusted autonomous network** [ITU-T Y.3060]: An autonomous network which is trustworthy enough (i.e., able to work correctly as intended) for the network to be authorized to work partly or completely autonomously.

**3.1.3 trust in an autonomous network (TiAN)** [ITU-T Y.3060]: A measurable and quantifiable degree of trustor's confidence in an autonomous network to govern itself with minimal to no human intervention.

**3.1.4 trustor in an autonomous network** [ITU-T Y.3060]: One who/which has the authority to authorize a network and/or the relevant entity to govern itself with minimal to no human intervention.

**3.1.5 trustee in an autonomous network** [ITU-T Y.3060]: A network or a network relevant entity with autonomy capabilities which can be authorized to govern itself with minimal to no human intervention.

**3.1.6 IMT-2020** [ITU-T Y.3101]: Systems, system components, and related aspects that provide far more enhanced capabilities than those described in [b-ITU-R M.1645].

## 3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

**3.2.1 trustworthiness:** A measurable and quantifiable confidence to meet the stakeholders' requirements or expectations.

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AN Autonomous Network

QoE Quality of Experience

TiAN Trust in Autonomous Network

## 5 Conventions

None.

## 6 Overview

For IMT-2020 [ITU-T Y.3101] and beyond, with technology development and systems evolution, network systems are evolving with specific properties, i.e., the abilities to monitor, operate, recover, protect, optimize and reconfigure network systems themselves. The network system/function with self-X properties is also known as autonomous network (AN) and this can generate, adapt and integrate controllers at run-time using network-specific information and can realize exploratory evolution, real-time responsive online experimentation and dynamic adaptation [b-ITU-T Y.3061]. Given the properties of IMT-2020 and beyond with AN function(s), the network is authorized to partly or even totally function and govern itself, without external authorization(s). The trustworthiness of an AN function is a crucial parameter, reference and concern for network staff or operators to make judgments and decisions on authorization.

[ITU-T Y.3052] defines trust as the measurable belief and/or confidence which represents accumulated value from history and the expecting value for the future. As important foundations and reference, [ITU-T Y.3060] specifies a series of **concepts and basic principles (accountability, equitability, explainability, robustness and safety)** for trust related to ANs. [ITU-T Y.3060] includes an overall workflow model for trusted AN (Figure 1).

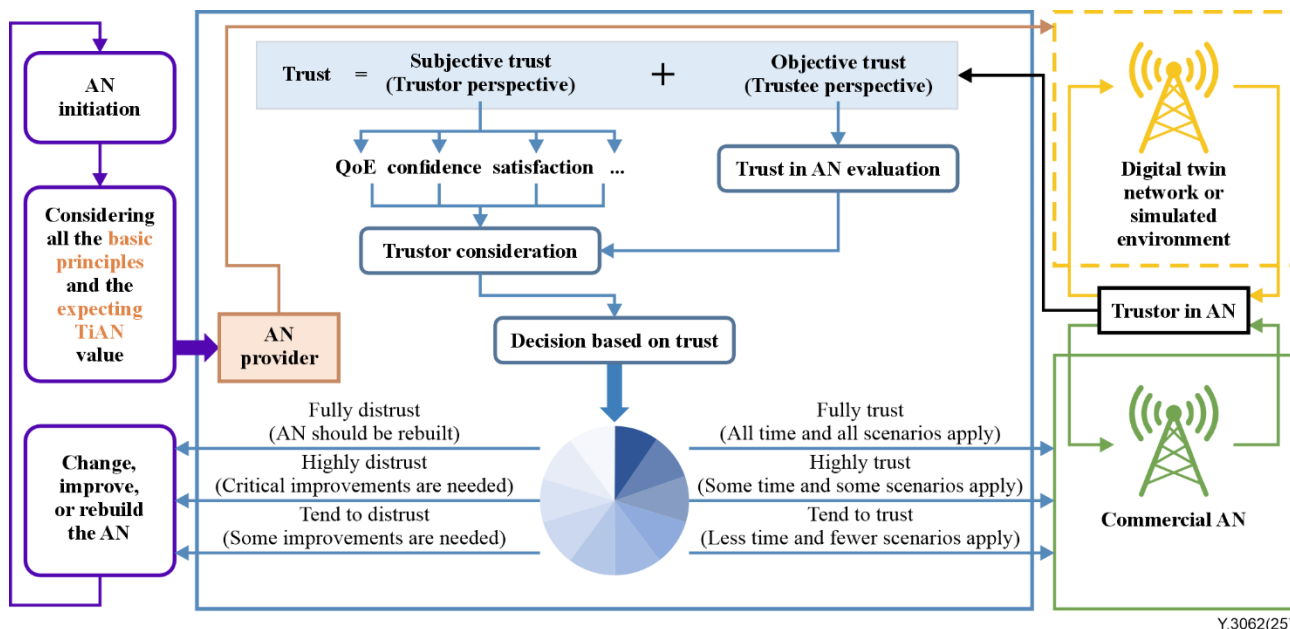


**Figure 1 – An overall workflow model for trusted AN [ITU-T Y.3060]**

Based on the studies and achievements of [ITU-T Y.3060], trust in AN (TiAN), the objective part of trust in an AN, is defined as a measurable and quantifiable degree of a trustor's confidence in an AN to let it be governed by itself with minimal to no human intervention. For IMT-2020 and beyond, TiAN is suggested to be evaluated or assessed quantitatively when equipped with AN functions; the details of TiAN evaluation are described and specified in this Recommendation, including but not limited to the evaluation process, evaluation metrics with related submetrics and quantitative methods.

## 7 General process of TiAN evaluation

In [ITU-T Y.3060], "an overall workflow model for trusted AN" has been illustrated and specified. TiAN evaluation is one of the essential processes in this workflow and is shown in Figure 1 of [ITU-T Y.3060]. During TiAN evaluation, all the processes and steps are recommended to be objective and quantitative, from the very beginning of triggering. The general process of TiAN evaluation is illustrated in Figure 2.

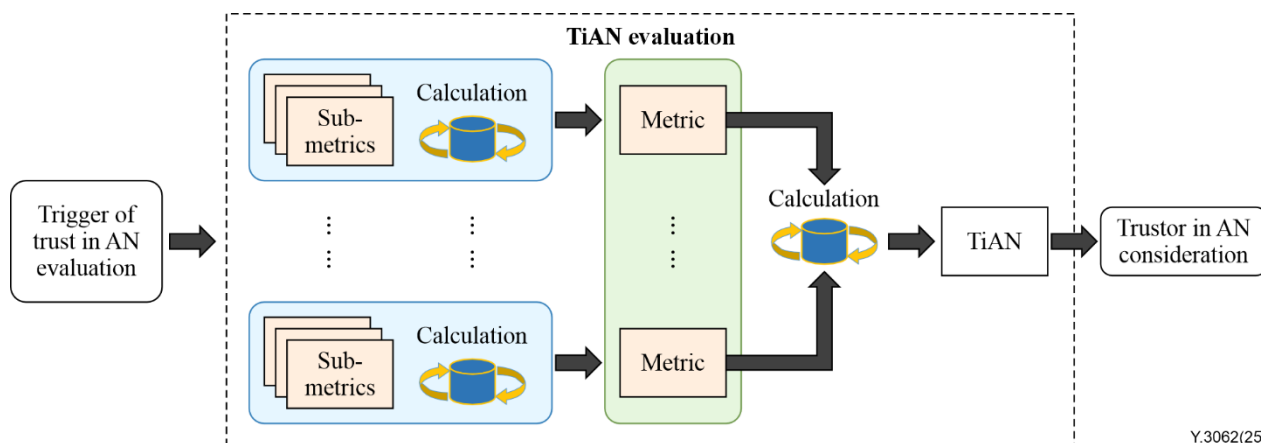


**Figure 2 – General process of TiAN evaluation**

TiAN evaluation is initiated by one or more triggers. After TiAN is triggered, one or more submetrics is assessed before metric calculations. Following that, TiAN is calculated from one or more metrics, as Figure 2 shows. Depending on the TiAN result, the trustor in AN can make the authorizations, judgments, decisions, etc.

The key factors in TiAN evaluation are the following:

- **Environment of TiAN evaluation:** TiAN evaluation can take place in a commercial network or in some test or simulation environment that is mirrored from the commercial network, e.g., digital twin network.
- **Triggering order of TiAN evaluation:** TiAN evaluation can be triggered by a trustor in an AN and by a trustee in AN itself.

The triggering order includes but is not limited to:

- Order triggered before or on the startup of trusted AN;
- Configured order, including periodic orders and aperiodic orders at specific time points;
- Temporary orders at random time points.

- **Trigger of TiAN evaluation:** TiAN evaluation can be triggered by a trustor in an AN and by a trustee in an AN itself.

The triggers include but are not limited to the following:

- A trustor in an AN can trigger TiAN evaluation using some original and some configured/standardized inputs or orders depending on different scenarios.
- A trustee in an AN can also trigger TiAN evaluation(s) itself in order to gain trust from an trustor in an AN if needed.

- **Metrics of TiAN evaluation:** metrics are parameters which are specified to make trust/trustworthiness measurable and quantifiable for an AN, and any metrics in the same TiAN evaluation are suggested to be expressed in the same unit and in the same way; the details are specified in clause 8.1.
- **Submetrics of TiAN evaluation:** each metric is recommended to set a series of related submetrics depending on specific scenarios and conditions; the assessment or evaluation results of submetrics can perform as the input(s) for the related metric. Submetrics in the same TiAN evaluation are suggested to be expressed in the same unit in the same manner, at the same time, the unit and approach for submetric(s) and metric(s) are recommended to be the same within the same TiAN evaluation.
- **Result(s) of TiAN evaluation:** TiAN evaluation result(s) are recommended to be handed over to the trustor in an AN, to give consideration, make decisions or judgments of authorization(s) or progress(es). At the same time, it is suggested to take the same approaches to both submetrics and metrics in the same TiAN evaluation. The details of quantitative methods for evaluating TiAN can be found in clause 9.2.
- **Transparency of TiAN evaluation result(s):** the result(s) of TiAN evaluation are suggested to be open to the trustor in the AN; meanwhile, it is suggested to set limitation(s) on TiAN evaluation result access authorities for trustees in AN.

## 8 Metrics and submetrics for TiAN evaluation

### 8.1 Metrics based on basic principles

Accountability, equitability, explainability, robustness and safety are the basic principles of trusted AN which are specified in [ITU-T Y.3060]; these five basic principles cover the fields of communications, computer science, ethics, psychology and game theory, etc. An AN

(system/function) can be trusted only when all these five basic principles are achieved/satisfied; however, as each of these basic principles are described abstractly in words, it is hard to judge whether they have been achieved/satisfied or not, i.e., it is hard to judge whether the trustee in AN or the AN (system/function) is trustworthy or not, and even how much it deserves to be trusted. In order to make trust for AN (system/function) objective, measurable and quantifiable, TiAN has been proposed and defined as "a measurable and quantifiable degree of trustor's confidence in an autonomous network to govern itself with minimal to no human intervention" in [ITU-T Y.3060]. In this Recommendation, metrics for TiAN evaluation have been refined and specified to make TiAN measurable and quantifiable, according to all the basic principles of trusted AN and the related factors. The five basic principles defined in [ITU-T Y.3060] form the foundation for TiAN evaluation. Each of those five principles is built up from a series of factors that describe its specific characteristics. For each one of the basic principles, there is a one-to-one correspondence with metrics for TiAN that are the quantifiable measurement that supports the overall assessment of TiAN.

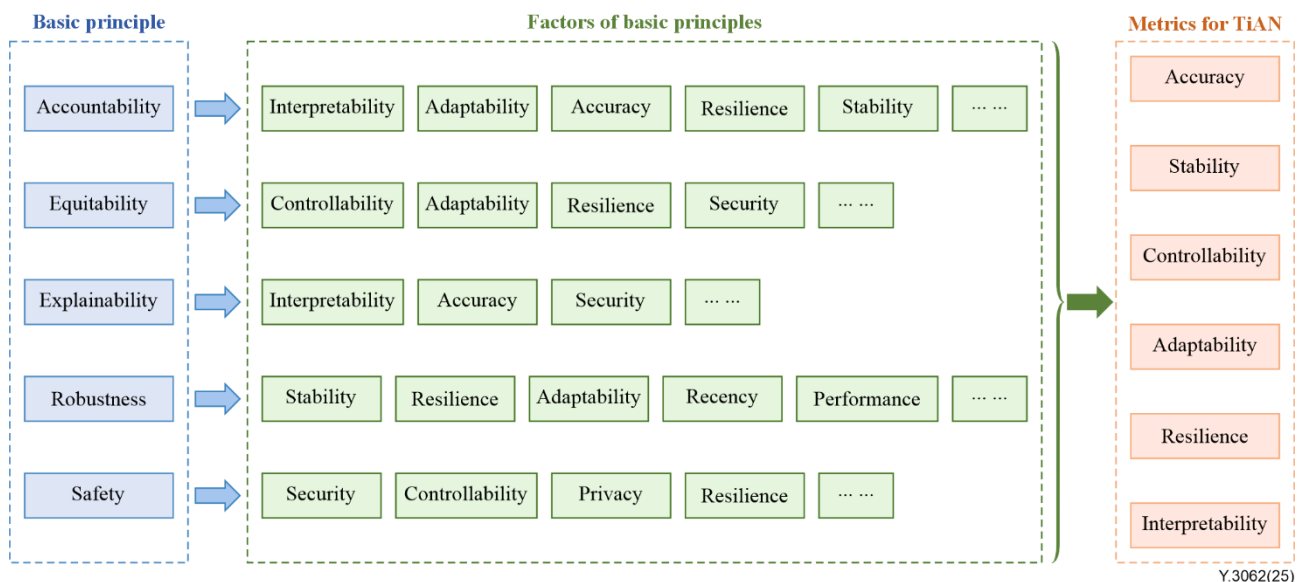


**Figure 3 – Relationship between basic principles of trusted AN and metrics for TiAN evaluation**

### 8.1.1 Factors of basic principles

#### A. Factors of accountability

The basic principle of accountability has been described in [ITU-T Y.3060] and the following are the factors of accountability:

- **Interpretability:** A trustee in AN is supposed to be able to self-interpret to explain what, why and even how something has happened or been processed, so that it can be accurate and clear when tracing or auditing responsibilities. The degree of interpretability can be part of the quantitative performance of accountability.
- **Adaptability:** A trustee in AN is supposed to be able to adapt to the corresponding environment(s); at the same time, the division of responsibilities also needs to adapt to the corresponding environment(s), parameter(s) and requirement(s), etc. The degree of adaptability can be part of the quantitative performance of accountability.
- **Accuracy:** Any executive results of a trustee in AN are supposed to be accurate enough to be trusted; at the same time, the division of responsibilities is also supposed to be accurate and clear enough. The degree of accuracy can be part of the quantitative performance of accountability.

- **Resilience:** A trustee in AN is supposed to be flexible and resilient; when fallback happens it is necessary to fallback/return to the previous responsible entity. The degree of resilience can be part of the quantitative performance of accountability.
- **Stability:** A trustee in AN is supposed to be stable enough and mature enough that the responsibilities can be clearly and accurately divided and it can be audited clearly, directly and correctly when necessary. The degree of stability can also be part of the quantitative performance of accountability.

## B. Factors of equitability

The basic principle of equitability has been described in [ITU-T Y.3060], and the following are the factors of equitability:

- **Controllability:** The trustee in an AN is supposed to be always under the control of the trustor in AN, relevant human personnel or operation entities. At the same time, it is necessary to avoid intended or unintended bias(es) or unfairness by trustee in an AN, i.e., a trustee in an AN is supposed to make no exception in any situation at any time, and it is supposed to be taken over and put under control if there is any bias or unfairness for the trustee in an AN. The degree of controllability can be part of the quantitative performance of equitability.
- **Adaptability:** The trustee in an AN is supposed to adapt to the corresponding environment(s) and related scenario(s), and it is necessary for a trustee in AN to adjust itself to treat all without any bias or unfairness. The degree of adaptability can be part of the quantitative performance of equitability.
- **Resilience:** The trustee in an AN is supposed to return or fall back to a status free from bias or unfairness if necessary. The degree of resilience can be part of the quantitative performance of equitability.
- **Security:** The trustee in AN is supposed to address all the security concerns of a trustor in an AN, during which bias or unfairness may arise with some potential security problem(s) or issue(s) that are supposed to be avoided. The degree of security can be part of the quantitative performance of equitability.

## C. Factors of explainability

The basic principle of explainability has been described in [ITU-T Y.3060], and the following are the factors of explainability:

- **Interpretability:** The trustee in an AN is supposed to express itself to be understood or accepted by people with varying degrees of expertise and capabilities. The degree of interpretability can be part of the quantitative performance of explainability.
- **Accuracy:** The trustee in an AN is supposed to explain itself in an understandable and accurate way. The degree of accuracy is supposed to be part of the quantitative performance of explainability.
- **Security:** The trustee in an AN is supposed to explain itself in a safe way, i.e., prevent unnecessary harm or damage. The degree of security can be part of the quantitative performance of explainability.

## D. Factors of robustness

The basic principle of robustness has been described in [ITU-T Y.3060], and the following are the factors of robustness:

- **Security:** The trustee in AN is supposed to ensure the safety and security of an AN. The degree of security can be part of the quantitative performance of robustness.