

Recommendation

ITU-T Y.4508 (01/2025)

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

Internet of things and smart cities and communities –
Frameworks, architectures and protocols

Functional requirements and architecture of blockchain-based activity log management for Internet of things (IoT) data processing and management

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

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Recommendation ITU-T Y.4508

Functional requirements and architecture of blockchain-based activity log management for Internet of things (IoT) data processing and management

Summary

There are many Internet of things (IoT) platforms to process and manage the same IoT data in different stages and in different areas. In traditional solutions, each IoT platform usually stores its activity logs for IoT data processing and management (IoT DPM) within its storage separately. These activity logs are separated and managed by the IoT platforms. Therefore, their accessibility and trustworthiness are not guaranteed, and it is not easy to trace the activities related to IoT DPM in the full lifecycle of the activity logs that are stored and managed by different IoT platforms.

In order to trace IoT DPM activities, different IoT platforms may use the same activity log storage and related functionalities. Activity log management (ALM) enabled by blockchain technologies provides functionalities to manage the full lifecycle of activity logs for IoT DPM across IoT platforms. Different IoT platforms can individually save activity logs of IoT DPM in trustworthy shared storage via the ALM for IoT DPM. When they read activity logs of IoT DPM via the ALM, they can obtain all the relevant activity logs of IoT DPM, across their full lifecycle, from trustworthy shared storage via the ALM for IoT DPM, if authorized. The ALM and the trustworthy shared storage are based on blockchain technologies and can protect the activity logs from being tampered with. The ALM can facilitate IoT platforms' storing and tracing of activity logs of IoT DPM across their full lifecycle, transparently and in a trustworthy manner.

Recommendation ITU-T Y.4508 presents a blockchain-based ALM for IoT data processing and management and specifies its characteristics, functional requirements and architecture.

History *

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Recommendation ITU-T Y.4508

Functional requirements and architecture of blockchain-based activity log management for Internet of things (IoT) data processing and management

1 Scope

This Recommendation presents a blockchain-based activity log management (ALM) for Internet of things (IoT) data processing and management (DPM), and specifies its characteristics, functional requirements and architecture.

The scope includes:

- concept, use cases and characteristics of blockchain-based ALM for IoT DPM,
- functional requirements and architecture of blockchain-based ALM for IoT data processing and management.

NOTE – The ALM for IoT DPM uses blockchain technology, but blockchain technology itself is out of the scope of this Recommendation.

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.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of the Internet of things*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 blockchain [b-ITU-T X.1400]: A type of distributed ledger which is composed of digitally recorded data arranged as a successively growing chain of blocks with each block cryptographically linked and hardened against tampering and revision.

3.1.2 Internet of things (IoT) [ITU-T Y.4000]: A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

NOTE 1 – Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

NOTE 2 – From a broader perspective, the IoT can be perceived as a vision with technological and societal implications.

3.1.3 Internet of things entity (IoT entity) [b-ITU-T Y.4811]: A functional entity (e.g., IoT service, IoT gateway) or physical entity (e.g., IoT device, end user device) that participates in activities performed in Internet of things (IoT).



3.1.4 thing [ITU-T Y.4000]: With regard to the Internet of things, this is an object of the physical world (physical things) or the information world (virtual things), which is capable of being identified and integrated into communication networks.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 activity log: A record that indicates an exact behaviour of an entity when processing and managing Internet of things (IoT) data, such as how, where and when an IoT entity processes and manages IoT data.

NOTE – Activity logs are typically used to trace the progress and results of relevant IoT entities (usually IoT services), to process and manage the IoT data in an IoT platform and/or across IoT platforms.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AC-FC	Access Controller Functional Component
AIM-FC	Activity Information Management Functional Component
ALM	Activity Log Management
ALT-FC	Activity Log Tracing Functional Component
DPM	Data Processing and Management
DV-FC	Data Validation Functional Component
FC	Functional Component
IoT	Internet of Things
MM-FC	Module Management Functional Component
PIM-FC	Platform Information Management Functional Component
SIM-FC	Service Information Management Functional Component
TSS	Trustworthy Shared Storage

5 Conventions

This Recommendation uses the following conventions:

- The phrase "is required to" indicate a requirement that must be strictly followed and from which no deviation is permitted if conformance with this Recommendation is to be claimed.
- The phrase "is recommended" indicate a requirement that is recommended, but which is not absolutely required to claim conformance with this Recommendation.

6 Overview of blockchain-based ALM for IoT DPM

There are many IoT platforms to process and manage the same IoT data at different stages and in different areas. For example, assuming there are four IoT platforms (P1 to P4) as shown in Figure 6-1, after one of the IoT platforms (such as P1) generates IoT data (such as data item A), it is then processed by the four IoT platforms one after the other.

In traditional solutions, each IoT platform stores its activity logs of processing and managing data A in its storage separately. These activity logs are separated and managed by the IoT platforms. Therefore, the accessibility and trustworthiness of these activity logs are not guaranteed. In this case,