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INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,
NEXT-GENERATION NETWORKS, INTERNET OF
THINGS AND SMART CITIES

Internet of things and smart cities and communities –
Requirements and use cases

Specific requirements and capabilities of the Internet of things for big data

Recommendation ITU-T Y.4114



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Recommendation ITU-T Y.4114

Specific requirements and capabilities of the Internet of things for big data

Summary

Recommendation ITU-T Y.4114 specifies requirements and capabilities of the Internet of things (IoT) for big data. This Recommendation complements the developments on common requirements of the IoT described in Recommendation ITU-T Y.4100/Y.2066 and the functional framework and capabilities of the IoT described in Recommendation ITU-T Y.2068 in terms of the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to big data. This Recommendation also constitutes a basis for further standardization work such as functional entities, application programming interfaces (APIs) and protocols concerning big data in the IoT.

History

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* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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Recommendation ITU-T Y.4114

Specific requirements and capabilities of the Internet of things for big data

1 Scope

This Recommendation provides specific requirements and capabilities of the IoT for big data. This Recommendation complements the developments on common requirements of the IoT [ITU-T Y.4100] and functional framework of the Internet of things (IoT) [ITU-T Y.2068] in terms of the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to big data.

In order to enhance the IoT system for dealing with the big data challenges in the IoT environment, the big data characteristics of IoT data and the IoT ecosystem from the IoT data point of view are investigated. From the perspective of the IoT data roles, big data challenges in the IoT are described.

The requirements of the IoT for big data are specified addressing different IoT data operations in the IoT which are impacted by big data. IoT data operations include data collection, data pre-processing, data analysis, data transfer, data storage, data query and data visualization.

Building on the identified specific requirements of the IoT for big data, the capabilities of the IoT for big data are then specified.

The scope of this Recommendation includes:

- Overview of big data in the IoT
- Requirements of the IoT for big data
- Capabilities of the IoT for big data

An IoT use case with big data characteristics is provided in Appendix I.

Details on relationships among IoT data roles, IoT business roles, IoT data operations and IoT components are provided in Appendix II.

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.2068] | Recommendation ITU-T Y.2068 (2015), <i>Functional framework and capabilities of the Internet of things</i> . |
| [ITU-T Y.3600] | Recommendation ITU-T Y.3600 (2015), <i>Big data – Cloud computing based requirements and capabilities</i> . |
| [ITU-T Y.4000] | Recommendation ITU-T Y.4000/Y.2060 (2012), <i>Overview of the Internet of things</i> . |
| [ITU-T Y.4100] | Recommendation ITU-T Y.4100/Y.2066 (2014), <i>Common requirements of the Internet of things</i> . |
| [ITU-T Y.4113] | Recommendation ITU-T Y.4113 (2016), <i>Requirements of the network for the Internet of things</i> . |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 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.

3.1.2 big data [ITU-T Y.3600]: A paradigm for enabling the collection, storage, management, analysis and visualization, potentially under real-time constraints, of extensive datasets with heterogeneous characteristics.

NOTE – Examples of datasets characteristics include high-volume, high-velocity, high-variety, etc.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 IoT big data characteristics: IoT data set characteristics of high-volume, high-velocity and/or high-variety related to the challenges of IoT data set operations.

NOTE 1 – The term "volume" refers to the size of the IoT data sets, the term "velocity" refers to the speed of IoT data streams in and out of the IoT data sets and the term "variety" refers to the diversity of IoT data types of the IoT data sets.

NOTE 2 – Additional dimensions of data, such as veracity, variability, etc., may also be associated with the IoT big data characteristics.

NOTE 3 – Examples of operations on IoT data sets include collection, pre-processing, transfer, storage, query, analysis and visualization.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
EHM	e-Health Monitoring
IoT	Internet of Things
QoE	Quality of Experience
QoS	Quality of Service
SLA	Service Level Agreement

5 Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

6 Overview of big data in the IoT

6.1 Data characteristics in the IoT

It is expected that in the future the quantity of connected things will be so huge that the IoT data will constitute a predominant part of the data carried by networks. These IoT data include not only data collected from things via devices and/or gateways within the IoT system and data processed within the IoT system itself, but also data injected from sources which are external to the IoT system (e.g., Web, social networks and industry domain specific information systems).

In order to enhance the IoT system enabling it to deal with big data challenges in the IoT environment, it is essential to investigate application independent characteristics (i.e., common characteristics) of IoT data. Consequently, according to the common characteristics of IoT data, the IoT system is enabled to handle the IoT data by the means of common capabilities facilitating data operations in the IoT.

With respect to traditional data operations, operations on IoT data require additional study due to some unique characteristics of IoT data, named here as "IoT big data characteristics", essentially due to the diversity of collected IoT data types and the broad variety of application scenarios. The prominent IoT big data characteristics are IoT data's high volume (the size of the data sets), IoT data's high variety (heterogeneity of data types and sources) and IoT data's high velocity (the speed of data streams in and out of the data sets). These prominent IoT big data characteristics are the main driver of the requirements study in this Recommendation, helping to identify related common capabilities of the IoT system with respect to the variety of concrete IoT deployments.

6.2 IoT data roles

Based on consideration of the IoT system and the IoT big data characteristics, five key IoT data roles, i.e., the key roles which are relevant in an IoT deployment from a data operation perspective, are identified for the IoT ecosystem as shown in Figure 1.

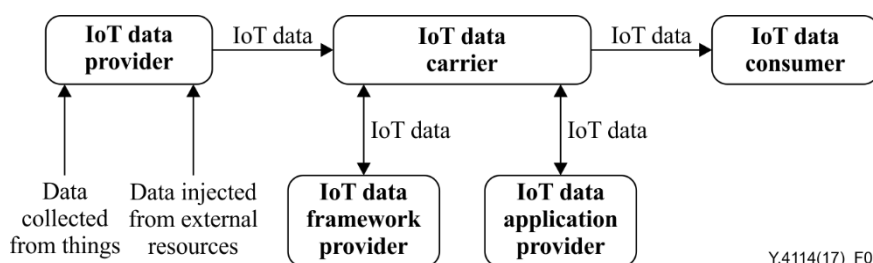


Figure 1 – IoT data roles

IoT data provider: The IoT data provider collects data from things, injects data processed within the IoT system as well as data from external sources and provides them via the IoT data carrier to the IoT data consumer (optionally, the applications provided by the IoT data application provider may execute relevant data operations with the support of the IoT data framework provider).

IoT data application provider: The IoT data application provider provides applications related to the execution of IoT data operations (e.g., applications for data analysis, data pre-processing, data visualization and data query).

NOTE 1 – The applications provided by the IoT data application provider can interact with the infrastructure (e.g., storage cloud) provided by the IoT data framework provider through the IoT data carrier or run on the infrastructure (e.g., scalable distributed computing platforms) provided by the IoT data framework provider.