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SERIES M: TELECOMMUNICATION MANAGEMENT,
INCLUDING TMN AND NETWORK MAINTENANCE

Telecommunications management network

**Requirements for energy saving management of
5G radio access network (RAN) systems with
artificial intelligence (AI)**

Recommendation ITU-T M.3381

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Recommendation ITU-T M.3381

Requirements for energy saving management of 5G radio access network (RAN) systems with artificial intelligence (AI)

Summary

Recommendation ITU-T M.3381 provides requirements for energy saving management of a 5G radio access network (RAN) system with artificial intelligence (AI). Recommendation ITU-T M.3381 explains the requirements of using AI technology to achieve energy saving management for communication units and virtualized hardware resources of a 5G RAN system, via an element management system (EMS) and open interfaces provided by vendors, from the operation support system (OSS) level. In addition, this Recommendation includes process recommendations for sending intelligent energy saving strategies from OSS to EMS and then to wireless equipment.

This Recommendation describes functional requirements for energy saving management of 5G RAN system with AI, and use cases of energy saving management of 5G RAN system with AI.

History

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Recommendation ITU-T M.3381

Requirements for energy saving management of 5G radio access network (RAN) systems with artificial intelligence (AI)

1 Scope

This Recommendation provides requirements for energy saving management of a fifth generation (5G) radio access network (RAN) system with artificial intelligence (AI). This Recommendation explains the requirements of the use of AI technology to achieve energy saving management for communication units and virtualized hardware resources of a 5G RAN system, via an element management system (EMS) and open interfaces provided by vendors, from the operation support system (OSS) level. In addition, this Recommendation includes process recommendations for sending intelligent energy saving strategies from OSS to EMS and then to wireless equipment. This Recommendation covers the following aspects of energy saving management of a 5G RAN system with AI:

- 1) functional requirements;
- 2) use cases.

Requirements for energy saving control directly at the equipment level, requirements for generating energy saving strategies directly at the radio base station, energy saving requirements for non-communication units such as air conditioning refrigeration and hardware material design lie outside the scope of this Recommendation.

2 Reference

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 L.1303] | Recommendation ITU-T L.1303 (2018), <i>Functional requirements and framework of green data centre energy-saving management system</i> . |
| [ITU-T M.3041] | Recommendation ITU-T M.3041 (2020), <i>Framework of smart operation, management and maintenance</i> . |
| [ITU-T M.3080] | Recommendation ITU-T M.3080 (2021), <i>Framework of artificial intelligence enhanced telecom operation and management (AITOM)</i> . |
| [ITU-T Y.3172] | Recommendation ITU-T Y.3172 (2019), <i>Architectural framework for machine learning in future networks including IMT-2020</i> . |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 functional block (in SDL) [b-ITU-T Q.9]: A functional block is an object of manageable size and relevant internal relationship, containing one or more processes.

3.1.2 management [b-ITU-T Y.3100]: In the context of IMT-2020, the processes aiming at fulfilment, assurance, and billing of services, network functions, and resources in both physical and virtual infrastructure including compute, storage, and network resources.

3.1.3 service [b-ITU-T M.3050.1]: Services are developed by a service provider for sale within products. The same service may be included in multiple products, packaged differently, with different pricing, etc.

3.1.4 user [b-ITU-T M.3010]: A person or process applying management services for the purpose of fulfilling management operations.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 energy saving strategy: A plan of action intended to accomplish an energy saving goal.

4 Abbreviations and acronyms

5G	Fifth Generation
AAU	Active Antenna Unit
AI	Artificial Intelligence
AITOM	Artificial Intelligence enhanced Telecom Operation and Management
BBU	Base Band Unite
BSS	Business Support System
CPU	Central Processing Unit
CQI	Channel Quality Indication
CU	Centralized Unit
DU	Distribution Unit
E-OSF	Element management layer – Operations Systems Function
E-RAB	Evolved Radio Access Bearer
EMS	Element Management System
FDD	Frequency Division Dual
GPS	Global Positioning System
IMT-2020	International Mobile Telecommunication-2020
KPI	Key Performance Indicator
MR	Measurement Report
NMS	Network Management System
OAM	Operation Administration and Maintenance
OPEX	Operational Expense
OSS	Operation Support System
PRB	Physical Resource Block
RAN	Radio Access Network
RF	Radio Frequency

RRC	Radio Resource Control
RRU	Remote Radio Unit
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Receiving Quality
SDL	Specification and Description Language
SDO	Standards Development Organization
SINR	Signal-to-Interference and Noise Ratio
SS	Synchronization Signal
TCP	Transmission Control Protocol
TCXO	Temperature Compensated Crystal Oscillator
TDD	Test-Driven Development

5 Conventions

None.

6 Overview of energy saving management of 5G RAN system with AI

This Recommendation provides requirements for energy saving management of a 5G RAN system with AI. First, the most urgent problem to be solved by operators in 5G commercial applications, namely that of energy saving in cost management, is studied, including use cases. In this way, at the OSS level, through the open interface provided by EMS and suppliers, the virtualized hardware resources of communication units and base stations are managed for energy saving to reduce operational expense (OPEX). This Recommendation mainly contains the functional requirements and use cases of energy saving management of a 5G RAN system with AI. This Recommendation explains the requirements of using AI technology to achieve energy saving management for communication units and virtualized hardware resources of a base station, via open interfaces provided by EMS and vendors, from the OSS level. In addition, this Recommendation includes process suggestions for sending intelligent energy saving strategies from OSS to EMS and then to wireless equipment.

7 Framework for energy saving management of 5G RAN system with AI

7.1 Functional block diagram for energy saving management of 5G RAN system with AI

Figure 7-1 is a functional block diagram of energy saving management of a 5G RAN system with AI, including:

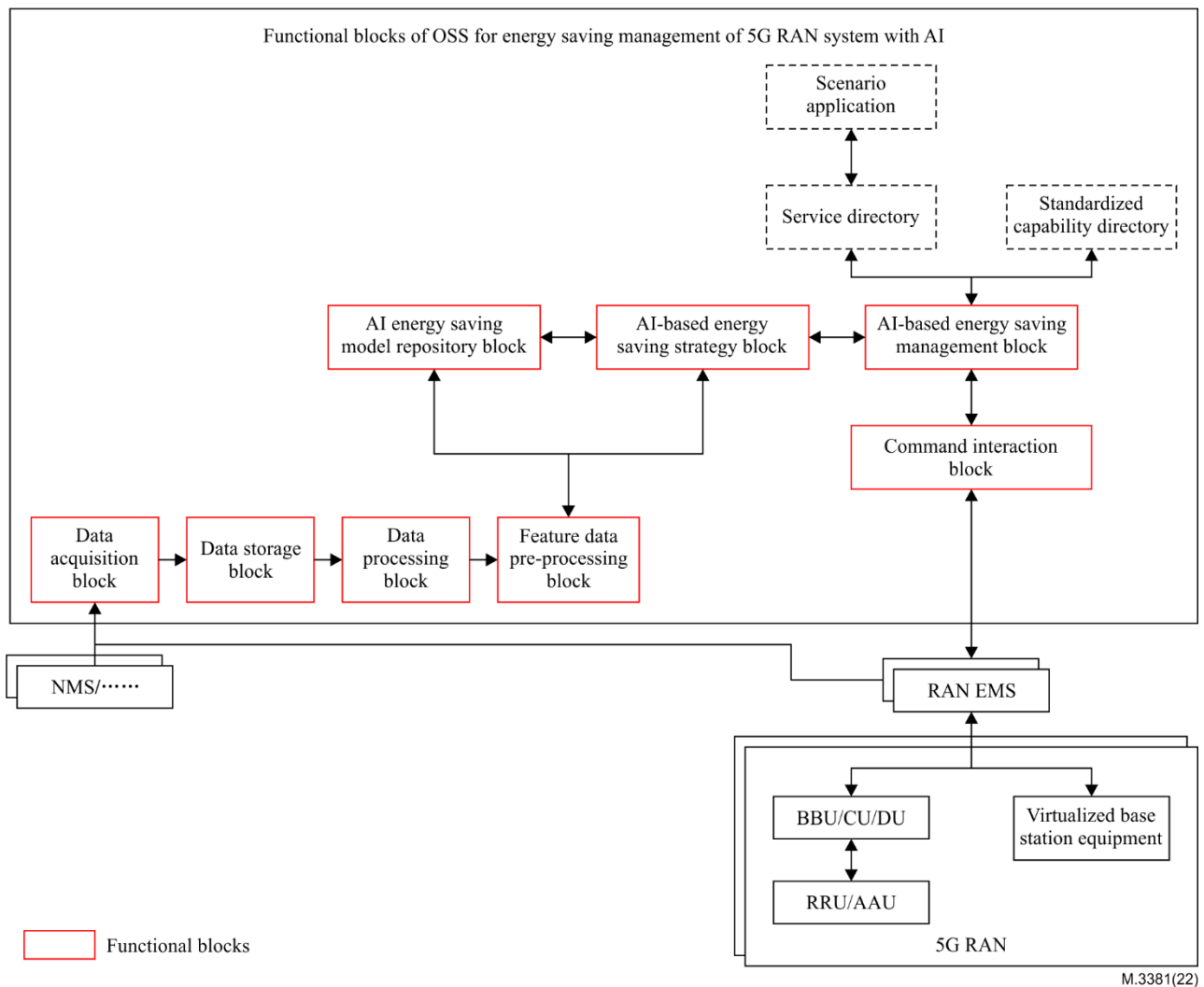


Figure 7-1 – Functional block diagram for energy saving management of 5G RAN system with AI

- 1) Data acquisition block: The data basis of AI model training. Before energy saving, a large amount of data from a RAN EMS, network management system (NMS) or other management system, should be collected in this block. For functions of this block, see clause 8.3.3.2 of [ITU-T M.3041].

NOTE 1 – In Figure 7-1, the main functional blocks for energy saving management of a 5G RAN system with AI have red borders.

NOTE 2 – A RAN EMS, NMS or other management system can come from multiple manufacturers.

NOTE 3 – The ellipsis represents other management systems, i.e., those other than NMS, RAN EMS and OSS. Such systems can also provide energy-saving related data for the OSS.

NOTE 4 – For the relationship of EMS, NMS and OSS, see Annex A of [ITU-T M.3041].

- 2) Data storage block: The data from the data acquisition block should be stored, managed and updated in this block, which provides data for the data processing block. For other functions of this block, see clause 8.3.3.2 of [ITU-T M.3041].
- 3) Data processing block: For the main functions of this block, see clause 8.3.3.2 of [ITU-T M.3041], including data cleaning and tagging.
- 4) Feature data pre-processing block: This block is an important requirement for AI model training, which needs to prepare pre-processed offline feature data to train AI model and online feature data to generate an AI-based energy saving strategy. For other functions in this block, see clause 8.2.4 of [ITU-T M.3080].