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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

Modal verbs terminology

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1 Scope

The Internet of Things (IoT) presents a wide and growing range of communications requirements. Certain of these requirements are addressed by systems which are referred to as 'Low Throughput Networks' (LTN) in ETSI documents. The use cases addressed by LTN systems and the LTN systems characteristics are provided in ETSI TR 103 249 [i.1].

LTN systems may be considered to be a subset of Low Power Wide Area Networks (LPWAN), that may include other systems, already existing or developed in the future.

The present document specifies the architecture of LTN systems. It contains requirements and/or recommendations on functional blocks and interfaces that are related to the architecture (i.e. high-level description) of LTN systems.

The present document develops the work done in LTN ISG [i.2] on architecture for LTN systems.

The present document should be read in conjunction with the LTN document [i.1] and related documents, in which details of entities and interfaces are documented.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 300 220-1 (V3.1.1) (02-2017): "Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 1: Technical characteristics and methods of measurement".

[2] ETSI EN 300 220-2: "Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 1: Technical characteristics and methods of measurement".

[3] IEEE EUI-64™: "Guidelines for 64-bit Global Identifier (EUI-64)".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TR 103 249 (V1.1.1): "Low Throughput Network (LTN); Use Cases and System Characteristics".

[i.2] ETSI GS LTN 002 (V1.1.1) (2014-09): "Low Throughput Networks (LTN); Functional Architecture".

[i.3] ETSI EN 303 204 (V2.1.2) (09-2016): "Network Based Short Range Devices (SRD); Radio equipment to be used in the 870 MHz to 876 MHz frequency range with power levels ranging up to 500 mW; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.4] PerOlof Bengtsson, Nico Lassing, Jan Bosch and Hans van Vliet: "Analysing Software Architecture for Modifiability", Research Report 11/00, Department of Software Engineering and Computer Science, University of Karlskrona/Ronneby, Sweden, ISSN 1103-1581.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

LTN family: complete solution within the scope of the LTN standard

NOTE: LTN families are not necessarily interoperable.

LTN standard: technical specifications developed by ETSI which describe architecture and protocols of LTN systems

NOTE: LTN standard comprises one or more families.

LTN system: physical instantiation of an LTN family

NOTE: The geographical deployment of an LTN system may vary on scale between local and global, including discontinuous coverage.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BS	Base Station
DA	Device Application
DL	DownLink
EP	End-Point
IoT	Internet of Things
IP	Internet Protocol
LPWAN	Low Power Wide Area Network
LTN	Low Throughput Network
NA	Network Application
RA	Registration Authority
RP	Relay Point
SC	Service Centre
SRD	Short Range Device
UL	UpLink
UNB	Ultra Narrow Band

4 LTN architecture description

4.1 Overall description

LTN systems comprise a radio network and a core network tailored to the connectivity of IoT devices. Figure 4-1 is the overall architecture description of any LTN system. Blue boxes and blue lines are part of the LTN system, whereas grey lines and grey boxes are application specific.

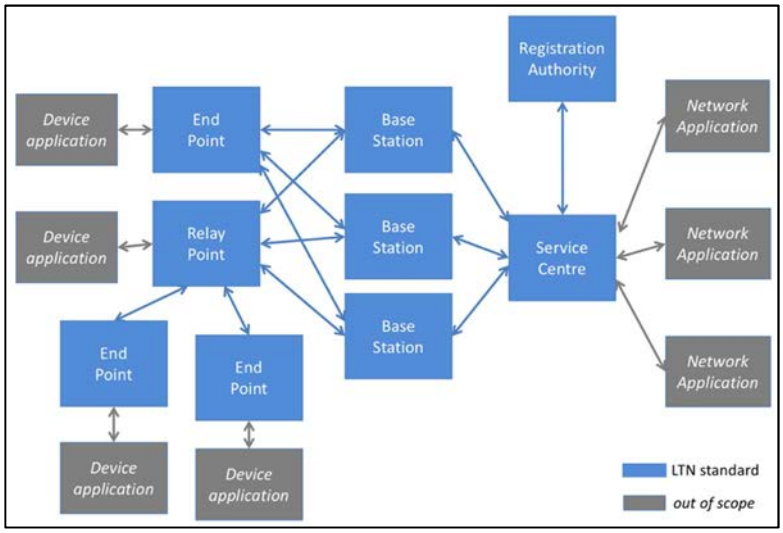

Figure 4-1: Overall architecture description of an LTN system (for information only)

In Figure 4-1, the radio access network, which consists in base stations, exhibits an optional feature where end-points and relay points are received by more than one base station at a time. This feature is named "cooperative reception" in the context of the LTN standard; it is a kind of macro-diversity (see clause 5.1 for detailed description).

4.2 LTN reference architecture

This clause gives the reference architecture as the basis for all LTN families. It is a high-level decomposition into major components with a characterization of the interaction of the components (definition derived from [i.4]). Figure 4-2 depicts the LTN reference architecture in terms of functional blocks (i.e. the components) and their interfaces (i.e. the interactions), as described in the present document.

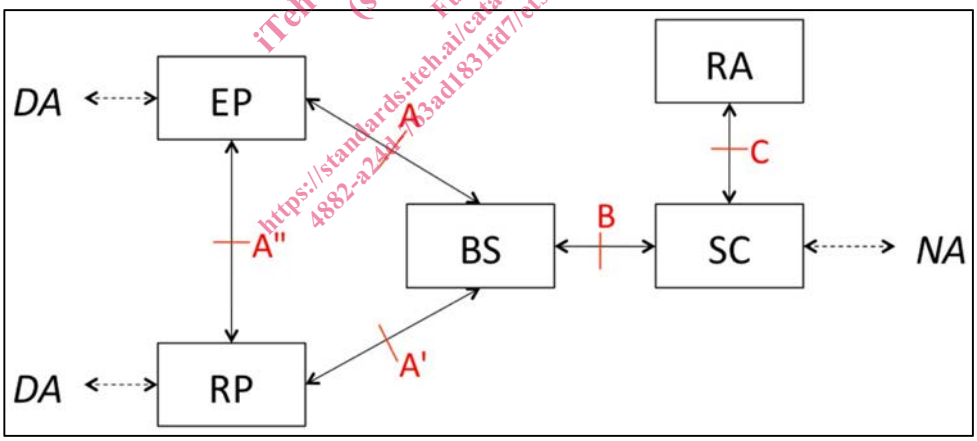

Figure 4-2: LTN reference architecture

The reference architecture depicted in the above Figure 4-2 applies to stand-alone LTN systems. If multiple LTN systems are deployed, interconnection between them may be required for the management of roaming end-points. In such case, the interface D should implement the interconnection between service centres of LTN systems (see Figure 4-3).

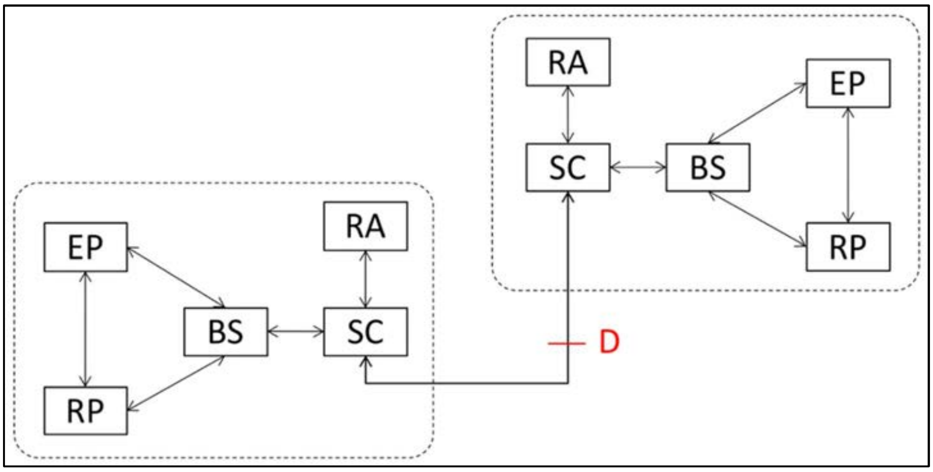

Figure 4-3: Reference architecture for interconnection of LTN systems

4.3 LTN functional blocks

4.3.1 End-point

An End-Point (EP) is a leaf node of an LTN system that communicates application data between local Device Application (DA) and Network Application (NA). It shall connect to a base station over the A interface. If relay points are supported, it shall connect to a relay point over the A" interface.

An EP shall be identified by a IEEE EUI-64™ [3] globally unique identifier.

An EP should run only one single device application and should belong to one single network application at a time.

4.3.2 Relay point

A Relay Point (RP) is an optional node in an LTN system. It shall connect to an EP over A" interface and to a base station over A' interface.

A RP may also communicate application data between local Device Application (DA) and Network Application (NA).

A RP shall be identified by a IEEE EUI-64™ globally unique identifier.

NOTE: A RP is typically a low complexity node supporting a limited number of EPs with limited support for EP mobility.

4.3.3 Base station

A Base Station (BS) is a radio hub of an LTN system. It shall connect to a single service centre over interface B. It shall connect to end-points over interface A and relay points over interface A'.

Base stations should implement provision for reduced service in case of disconnection from the SC.

4.3.4 Service centre

An LTN system shall have a single Service Centre (SC). The SC may perform the following functions:

- forwarding application data packet, both uplink and downlink;
- EP authentication, acting as either the other party of the authentication or a relay between the two authenticating parties;
- configuration and/or subscription management of end-points and relay points;

- support for cooperative reception and duplicate elimination;
- management of base stations;
- management of roaming with other service centres.

A Service Centre shall use:

- interface B for connection to base stations;
- interface C for connection to a registration authority;
- interface D for connections to other LTN system(s) for roaming purposes.

Service centre connects network applications over an Internet-based interface, which is out of scope of the present document.

4.3.5 Registration authority

An LTN system shall include the functionality of a Registration Authority (RA). The RA shall store identifiers and credentials of end-points and/or relay points. It may also store other parameters, such as:

- secret key;
- class of transmit power;
- class of EP;
- frequency capability;
- owner of the EP and/or RP;
- charge/service plan;
- etc.

The RA shall use interface C for connection to SC.

4.4 LTN interfaces

4.4.1 Interface A

Interface A is the air interface between EPs and BS. It shall be the primary air interface of any LTN system. It shall be a unidirectional or bidirectional interface between EP and BS. Interface A shall support EP mobility. It may carry signalling messages.

Interface A shall exhibit the following specific features:

- maximum coupling loss of at least 150 dB;
- random access for uplink transmission of messages;
- half duplex.

4.4.2 Interface A'

Interface A' is the air interface between RP and BS. It shall be a bidirectional or unidirectional interface.

4.4.3 Interface A"

Interface A" is the air interface between EP and RP. It shall be a bidirectional or unidirectional interface.