P802.1CF™/D1.1
Draft Trial-Use Recommended Practice for Network Reference Model and Functional Description of IEEE 802 Access Network

Sponsor

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved <Date Approved>

IEEE-SA Standards Board

IEEE Standards Department
445 Hoes Lane
Piscataway, NJ 08854, USA

Abstract: <Select this text and type or paste Abstract—contents of the Scope may be used>
Keywords: <Select this text and type or paste keywords>

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-0-XXXX-XXXX-X STDXXXXX
Print: ISBN 978-0-XXXX-XXXX-X STDPDXXXXX

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading "Important Notice" or "Important Notices and Disclaimers Concerning IEEE Standards Documents."

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association ("IEEE-SA") Standards Board. IEEE ("the Institute") develops its standards through a consensus development process, approved by the American National Standards Institute ("ANSI"), which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

Photocopies

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at http://ieeexplore.ieee.org/xpl/standards.jsp or contact IEEE at the address listed previously. For more information about the IEEE–SA or IEEE's standards development process, visit the IEEE-SA Website at http://standards.ieee.org.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this draft trial-use recommended practice was completed, the 802.1 Working Group had the following membership:

Tony Jefree, *Chair*
Glenn Parsons, *Vice Chair*

Participant1	Participant4	Participant7
Participant2	Participant5	Participant8
Participant3	Participant6	Participant9

The following members of the <individual/entity> balloting committee voted on this trial-use recommended practice. Balloters may have voted for approval, disapproval, or abstention.

[To be supplied by IEEE]

Balloter1	Balloter4	Balloter7
Balloter2	Balloter5	Balloter8
Balloter3	Balloter6	Balloter9

When the IEEE-SA Standards Board approved this trial-use recommended practice on <Date Approved>, it had the following membership:

[To be supplied by IEEE]

<Name>, *Chair*
<Name>, *Vice Chair*
<Name>, *Past Chair*
<Name>, *Secretary*

SBMember1	SBMember4	SBMember7
SBMember2	SBMember5	SBMember8
SBMember3	SBMember6	SBMember9

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

<Name>, *DOE Representative*
<Name>, *NIST Representative*

<Name>
IEEE Standards Program Manager, Document Development

<Name>
IEEE Standards Program Manager, Technical Program Development

Introduction

This introduction is not part of P802.1CF/D1.1, Draft Trial-Use Recommended Practice for Network Reference Model and Functional Description of IEEE 802 Access Network.

<Select this text and type or paste introduction text>

Contents

Draft Trial-Use Recommended Practice for Network Reference Model and Functional Description of IEEE 802 Access Network

1. Overview

1.1 Scope

1.2 Purpose

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

3. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause. [1]

4. Identifiers

5. Tenets

[1] *IEEE Standards Dictionary Online* subscription is available at: http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

6. Network Reference Model

6.1 Overview

6.2 Reference Points

6.3 Access Network Control Architecture

6.3.1 Multiple Deployment Scenarios

7. Functional Design and Decomposition

7.1 Network Discovery and Selection

7.1.1 AN control entity Domains

The adopted network reference model enables deployments wherein an STA may encounter one or more of the following situations:

a) An Access Network (AN) owned by a single control entity (also referred to as 'integrated AN' deployment case).
b) An AN owned by a single entity but collectively deployed by two or more control entities (also referred to as "AN sharing" deployment case).
c) A region covered by two or more ANs, representing either the "integrated AN" or the "AN sharing" scenario.

The STA SHOULD be enabled to discover all accessible control entities, and SHOULD be able to indicate the selection of the preferred control entity during the establishment of connectivity to the AN. The actual selection mechanism of the control entity employed by the STA MAY be based on various preference criteria, possibly depending on the presence of preconfigured configuration information in the STA.

Preconfigured configuration information in the STA SHOULD include:

a) Information useful for discovery of ANs including channel, center frequency, and PHY profile,
b) information useful for discrimination and prioritization of control entities for service selection including a list of authorized ANs and a list of authorized control entities with a method of prioritization for the purpose of automatic selection,
c) a list of authorized 'share' or 'roaming' affiliation relationships between authorized ANs and control entities and partner ANs and control entities, with a method of prioritization for the purpose of automatic selection, and
d) identity/credentials provided by control entity to which the STA has a trust relationship.

The details of provisioning of configuration information is out of scope of this specification. It may be provided on a pre-provisioned basis or at time of dynamic service subscription of a STA and may be subject to periodic update in a method outside the scope of this standard.

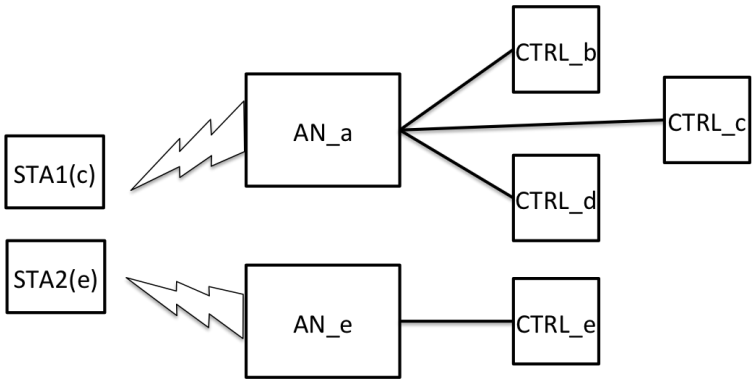

Figure 1—Coverage Area with Overlapping ANs

For example, as shown in Figure 1, STA1 and STA2 discover available control entities and select one based on its configuration information. More specifically, STA1 prefers to connect to AN_a of because it is directly affiliated with STA1's home control entity CTRL_c through AN sharing. And, STA2 prefers to connect to AN_e because it is owned by STA2's home control entity CTRL_e.

A solution framework SHOULD enable STAs to discover the identities of available control entities accessible in a particular IEEE 802 access network coverage area, and indicate their selected control entities to the AN, to which they connect to.

7.1.2 Use Case Scenarios

Access network discovery and selection procedures are usually executed when a STA is used for the first time, for initial network entry after powering on, for network re-entry, when the STA lost connectivity to the previous AN, or when an STA transitions across AN coverage areas. This subsection describes all four use case scenarios.

7.1.2.1 First Time use of STA without control entity identity information available

e) STA detects one or more available ANs.

f) STA discovers available control entities associated with one or more ANs.

g) STA identifies all accessible control entities and selects an AN and an control entity based on some preference criteria.

h) STA performs a special connection procedure with the selected AN for initialization of a subscription.

i) STA becomes authorized on the selected control entity for service subscription only for the purpose to create a trust relationship with the selected control entity.

j) STA creates a trust relationship enabling network access authentication and authorization by the selected control entity.

k) STA acquires and stores the configuration information of the selected control entity.

7.1.2.2 Initial Network Entry after power on or first time use of new configuration

a) STA detects, using the stored configuration information, one or more available ANs.

b) STA discovers available control entities associated with one or more ANs.

c) STA identifies all accessible control entities and, using the stored configuration information, selects or allows a subscriber to select an control entity based on some preference criteria.

d) STA performs an initial network entry procedure with a AN that is supported by selected control entity.

In case of failure, STA reverts to Use Case scenario 1.

7.1.2.3 Network Reentry

Network re-entry is equivalent to establishing connection with the same or another access point of the previously connected AN. Scenario 3 procedures assume that AN and control entity maintain their relationship.

In case of failure, STA reverts to scenario 2.

7.1.2.4 STA transitions across multiple AN coverage area

a) STA has previously completed network entry and is in normal operation with its control entity on an AN.

b) STA discovers, using the stored configuration information, one or more available neighboring ANs.

c) STA discovers that the neighboring ANs have direct or indirect relationships with the same control entity, by which it is currently authenticated and authorized.

d) Due to user movement or other reason, the STA decides to transition to another AN.

e) STA performs an network re-entry procedure with an neighbor AN that has a relationship to the currently used control entity enabling access by the same control entity. This network re-entry will involve a full authentication cycle to re-establish a complete session context with the new AN.

In case of failure, STA reverts to scenario 2.

7.1.3 Discovery and Selection of AN and Control Entity

This subsection presents the procedures for discovery and selection of AN and control entity.

The solution consists of four procedures:

a) AN Discovery

b) Control Entity Discovery

c) Control Entity Enumeration and Selection

d) AN Attachment

AN Discovery refers to a process wherein a STA discovers available AN(s) in its surrounding. *Control Entity* Access *Discovery* refers to the process wherein a STA discovers available control entity(s) deploying the ANs in its surrounding. *Control Entity Enumeration and Selection* refers to a process of choosing the most preferred control entity and a candidate set of ANs to attach to, based on the dynamic information obtained during the discovery phase and information stored in the STA. *AN Attachment* based on *Control Entity Enumeration and Selection* refers to the process wherein the STA indicates its selection decision during connection establishment with an AN deployed by its control entity by providing its identity (potentially in the form of NAI). The enumerated steps are not sequential and need not be completed in their entirety. That is, *Control Entity Access Discovery* and *Control Entity Enumeration and Selection MAY* well be performed by the STA concurrent to running *AN Discovery* procedures. Also, there is no requirement that an STA SHOULD discover ***all*** ANs and control entities in the accessible environment. An STA MAY terminate the discovery process once an AN and a control entity is discovered, which meet the *Control Entity Enumeration and Selection* criteria of the STA. After preempting the discovery process the STA SHOULD proceed with the *AN Attachment* procedure.

7.1.4 Access Technology Specific Procedures

IEEE 802.3

For further study.

IEEE 802.11

For further investigation.

IEEE 802.15

For further study.

IEEE 802.16

AN Discovery

An STA detects available AN(s) by scanning and decoding DL-MAP of AN(s) on detected channel(s). The 24-bit value of the “operator ID” (see 6.3.2.3.2 of IEEE Std 802.16) within the “Base Station ID” parameter in the DL-MAP message is the AN Identifier and is used to indicate the ownership of the AN. The value of the 24-bit “operator ID” SHOULD be assigned as an IEEE Std 802.16 Operator ID by the IEEE Registration Authority. Operator ID/AN ID allocation and administration method, and field formatting are defined in IEEE Std 802.16. If information useful in STA discovery of AN is available in configuration information, it MAY be used to improve efficiency of AN discovery.

Control Entity Access Discovery

The AN SHOULD be served by one or more control entities. In control entity discovery, a control entity identifier can be presented to the STA as a unique 24 -bit control entity identifier. The value of the 24 -bit control entity ID (i.e., control entity Identifier) SHOULD be issued as an IEEE Std 802.16 Operator ID by the IEEE Registration Authority[4]. As both AN ID and control entity ID are allocated from the same number space, the numbers are guaranteed to be unique in both domains. Control entity ID is either a 22-bit globally-assigned ID or a combined MCC+MNC as described in ITU-T Recommendation E.212. Selection of the method used for control entity ID format is implementation specific.

If the STA cannot derive available control entities during scanning from the AN identifier out of the control entity Identifier Flag, detected AN IDs, and the configuration information, then it SHOULD try to dynamically discover a list of control entities supported by the AN.

If the AN and control entity are the same (i.e., there is a one-to-one relationship between these IDs), the AN SHOULD identify this case by setting the least significant 1st bit (1st LSB; the 25th bit of Base Station ID; the control entity Identifier Flag) of the Base Station ID to a value of '0'. For this case, the STA SHOULD assume that the control entity ID is the same ID presented as AN ID.

In the event that more than one control entities are served by a detected AN, or that some regulatory or deployment requirement compels separate presentation of one or more control entity IDs, the AN SHOULD identify this case by setting the control entity Identifier Flag to a value of '1'.

Independently of control entity Identifier Flag value, the AN MAY transmit the control entity ID list and verbose control entity Name List as part of the Service Information Identity (SII-ADV) broadcast MAC management message. Also, the BS SHOULD transmit the list of control entity IDs and Verbose control entity Names as part of SBC-RSP in response to an STA request through SBC-REQ.

If the list of control entity identifiers supported by a AN does not exist in the configuration information of the STA in this phase, or the list of control entity identifiers supported by a AN is changed, e.g. the optional control entity Change Count TLV (control entity Change Count TLV is described in the IEEE Std 802.16) obtained from the network as part of obtaining the control entity ID list, is different with that stored in the configuration information of the STA, the STA SHOULD get the list from the network. Otherwise, available control entity(s) associated with a AN SHOULD be enumerated locally based on the configuration information of the STA.

Control Entity Enumeration and Selection

For automatic selection, an STA makes its control entity selection decision based on the dynamic information obtained within a coverage area (e.g., a list of available control entity Identifiers offering services), and configuration information. The specific algorithms that an STA MAY use to select the most preferred control entity from the list of discovered control entities are out of scope of this release.

For manual selection, the user manually selects the most preferred control entity based on the dynamic information obtained within the coverage area. Manual selection can also enable use scenarios where a non-subscribed user wants to connect to a detected network. For example, the user wants to exercise an initial provisioning procedure with a specific control entity, or it wants to use the network on "pay for use" basis.

ASN Attachment Based on Control Entity Selection

Following a decision to select a particular control entity, an STA SHOULD indicate its control entity selection by attaching to an ASN associated with the selected control entity, and by providing its identity and home control entity domain in the form of NAI. The AN SHOULD use the realm portion of the NAI to determine the next AAA hop to where the STA's AAA packets SHOULD be routed. The STA SHOULD use its NAI with additional information (also known as decorated NAI) to influence the routing of the next AAA hop when the home control entity realm is only reachable via another mediating realm (e.g., a visited control entity).

7.2 Association

7.3 Authentication

7.4 Data Path Establishment

7.4.1 Point-to-Point Link Establishment

The adopted network reference model enables point-to-point link establishment between the terminal and termination point. The termination point is the access network (AN) gateway, i.e. the link is established between the terminal and the gateway.

7.4.2 Layer 2 Operation

If the access network operates in bridged mode there is a transport tunnel and in the tunnel the terminal's MAC address is the source address in Ethernet frames and this can be easily detected in each frame. The transport tunnel establishes the terminal's isolation from the other terminals.

Point-to-point link requires that the terminal does not have direct bi-directional connectivity at the Ethernet MAC layer to any other terminal. This needs to be enforced by the access network nodes such as Access Points or Residential Gateways.

Layer 2 operation is shown in Figure 2. If MPLS is used and multiple MPLS tunnels exist then one specific tunnel for the terminal should be selected. This can be achieved by mapping the terminal's MAC address to one MPLS label.

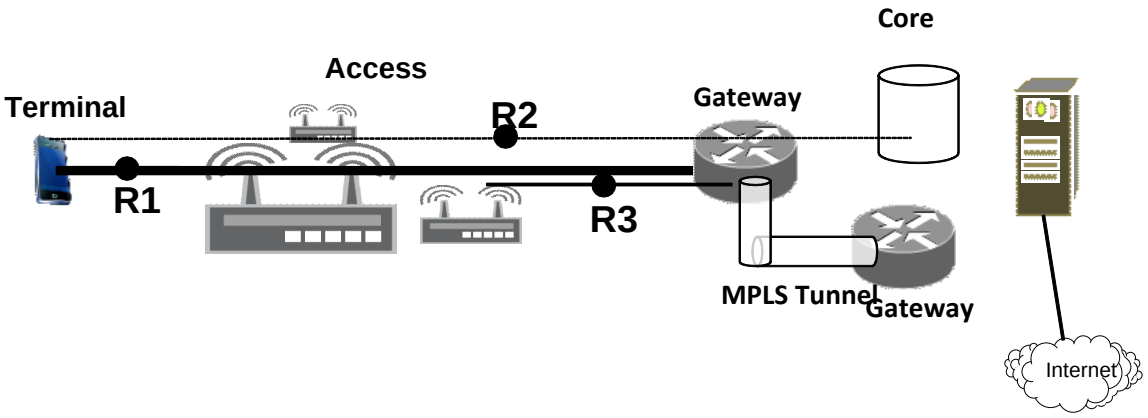

Figure 2—Point-to-Point Link Operation

7.4.3 Layer 3 Operation

If the access network operates in routed mode instead of a transport tunnel an IP tunnel should be used. IP tunnel can be in conjunction with the NAT operation in IPv4.Original IP packet and IP address of the terminal can only be obtained after decapsulation.

If MPLS is used and multiple MPLS tunnels exist then one specific tunnel for the terminal should be selected. This can be achieved by mapping the terminal's original IP address to one MPLS label.

7.4.4 IPv4 and IPv6 Operation

The terminal communicating in IPv4 with other nodes in the same subnet will send an ARP request to resolve IPv4 address of its correspondent. AN gateway must be able to act as ARP Proxy for the terminal inner IPv4 address and as Default Gateway.

For the terminal communicating in IPv6 with other nodes a unique per-terminal prefix needs to be assigned in order to assure point-to-point link operation. The gateway must send periodic unsolicited and solicited Router Advertisement (RA) messages in unicast to MAC address of the terminal.

The terminal either must not be allowed to have duplicate link-local address with another terminal or the gateway must be able to send distinct IPv6 messages to distinct terminals using the unicast MAC address even if the terminals have the same link-local address.

7.4.5 Access Technology Specific Procedures

IEEE 802.3

IEEE 802.3 point-to-point link operation is as described in Layer 2 operation in Section 7.4.2 above.

IEEE 802.11

In order to assure point-to-point operation, IEEE 802.11 Access Point or Residential Gateway with the Access Point must not route frames coming from the terminal downstream to other terminals. Instead such a routing should come from the gateway.

IEEE 802.15

For further study.

IEEE 802.16

IEEE 802.16 is point-to-point and connection oriented at the MAC layer. The details on how IP subnet can be structured using IP Convergence Sublayer (CS) or Ethernet CS are described in RFC 5154.

Annex A

(informative)

Bibliography

Bibliographical references are resources that provide additional or helpful material but do not need to be understood or used to implement this standard. Reference to these resources is made for informational use only.