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Partie 1AX: Agrégation de lien

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This second edition cancels and replaces the first edition (ISO/IEC/IEEE 8802-1AX:2016), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC/IEEE 8802-1AX:2016/Cor 1:2018.

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IEEE Std 802.1AX™-2020
(Revision of IEEE Std 802.1AX-2014)

IEEE Standard for Local and Metropolitan Area Networks—

Link Aggregation

Developed by the

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 30 January 2020

IEEE SA Standards Board

Abstract: Link Aggregation allows parallel point-to-point links to be used as if they were a single link and also supports the use of multiple links as a resilient load-sharing interconnect between multiple nodes in two separately administered networks. This standard defines a MAC-independent Link Aggregation capability and provides general information relevant to specific MAC types.

Keywords: Aggregated Link, Aggregator, Distributed Resilient Network Interconnect, DRNI, interconnect, Link Aggregation, Link Aggregation Group, local area network, management, Network-Network Interface, NNI

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Introduction

(This introduction is not part of IEEE Std 802.1AX-2020, IEEE Standard for Local and Metropolitan Area Networks—Link Aggregation.)

Link Aggregation allows one or more links to be aggregated together to form a Link Aggregation Group (LAG) so that the Link Aggregation Client can treat the LAG as if it were a single link. Link Aggregation was originally published as IEEE Std 802.3ad™-2000 and subsequently incorporated into the IEEE Std 802.3™, 2000 Edition. In 2008 Link Aggregation was removed from IEEE Std 802.3 and published as IEEE Std 802.1AX-2008. These standards specified the aggregation of full-duplex point-to-point links using IEEE Std 802.3 media of the same speed.

An amendment, IEEE Std 802.1AXbk™-2012, specified changes to the addressing used by the link aggregation control and marker protocols to allow a LAG to span Two-Port Media Access Control (MAC) Relays (TPMRs) and to span Provider Bridged Networks and Provider Backbone Bridge Networks.

A revision, IEEE Std 802.1AX-2014, extended Link Aggregation in three areas. First, it explicitly allowed the aggregation of point-to-point links of any speed using any physical media or logical connection capable of supporting the Internal Sublayer Service specified in IEEE Std 802.1AC™. Second, it specified Conversation-Sensitive Collection and Distribution (CSCD) that provides a mechanism to identify the distribution algorithm in use to map data frames to individual links in the LAG and to convey that information to the Link Aggregation Partner via Link Aggregation Control Protocol Data Units (LACPDUs) containing version 2 type/length/values (TLVs). Third, it specified Distributed Resilient Network Interconnect (DRNI) that allows a LAG to terminate at two or three cooperating Systems so that the LAG provides resiliency to System-level failures as well as link level failures. A corrigendum, IEEE Std 802.1AX-2014/Cor 1-2017, provided technical and editorial corrections to CSCD.

This revision, IEEE Std 802.1AX-2020, makes significant refinements and simplifications to the Link Aggregation Control Protocol (LACP) as well as to CSCD and DRNI. In LACP, the Periodic state machine and Transmit state machine are combined to a single machine, and the Mux machine is optimized to reduce the likelihood of excessive Link Aggregation Control Protocol Data Unit (LACPDU) transmissions. CSCD is refined to eliminate the TLVs that led to LACPDUs greater than 128 bytes in length. DRNI is significantly revised and simplified to support a LAG terminating at just two (not three) cooperating Systems.

Every effort has been made to maintain interoperability, without prior configuration, with LACP implementations conforming to IEEE Std 802.3ad-2000, IEEE Std 802.1AX-2008, or IEEE Std 802.1AX-2014 and with CSCD implementations conforming to IEEE Std 802.1AX-2014. The changes to DRNI, and in particular the Distributed Relay Control Protocol (DRCP), are such that an implementation conforming to this standard will not interoperate with a DRCP implementation conforming to IEEE Std 802.1AX-2014. The DRCP version number in this standard has been changed to version 2, and care has been taken so that a DRCP implementation conformant to IEEE Std 802.1AX-2014 will discard version 2 DRCPDUs as invalid and that implementations of this standard will discard version 1 DRCPDUs.

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are anticipated within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material. Information on the current revision state of this and other IEEE 802 standards may be obtained from

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IEEE Standard for Local and Metropolitan Area Networks—

Link Aggregation

1. Overview

1.1 Scope

Link Aggregation provides protocols, procedures, and managed objects that allow the following:

— One or more parallel instances of point-to-point links to be aggregated together to form a Link Aggregation Group (LAG) so that a Link Aggregation Client can treat the LAG as if it were a single link.

— Conversation-Sensitive Collection and Distribution (CSCD) that specifies a means to identify the distribution algorithm in use to assign frames to individual links in a LAG and to convey that information to the System at the other end of the LAG.

— Distributed Resilient Network Interface (DRNI) that enables a LAG to terminate at a pair of cooperating Systems in order to provide system-level as well as link-level resiliency.

1.2 Purpose

Link Aggregation allows the establishment of point-to-point links that have a higher aggregate bandwidth than the individual links that form the aggregation and the use of multiple systems at each end of the aggregation. This allows improved utilization of available links in Bridged local area network (LAN) environments, along with improved resilience in the face of failure of individual links or systems. In applications connecting separately administered networks, the networks are isolated from each other's fault recovery events.

1.3 State diagram conventions

This standard uses the state diagram conventions in Annex E of IEEE Std 802.1Q™-2018.[1]

When implementation of a state diagram is required for conformance, all states and transitions shown with solid lines shall be implemented. States and transitions shown with dashed lines may be implemented.

If a conflict exists between a state diagram and either the corresponding global transition tables or the textual description associated with the state machine, the state diagram takes precedence.

[1] Information on references can be found in Clause 2.

2. Normative references

The following referenced documents are indispensable for the application of this standard (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this standard 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.

IEEE Std 802®, IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture.[2, 3]

IEEE Std 802.1AC™, IEEE Standard for Local and metropolitan area networks—Media Access Control (MAC) Service Definition.

IEEE Std 802.1Q™, IEEE Standard for Local and Metropolitan Area Networks—Bridges and Bridged Networks.

IEEE Std 802.3™, IEEE Standard for Ethernet.

IETF RFC 1213 (IETF STD 17), Management Information Base for Network Management of TCP/IP-based internets: MIB-II, McCloghrie, K., and M. Rose, editors, Mar. 1991.[4]

IETF RFC 1321, The MD5 Message-Digest Algorithm, R. Rivest, Apr. 1992.

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IETF RFC 3415 (STD 62), View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP), Wijnen, B., R. Presuhn, and K. McCloghrie, Dec. 2002.

ISO/IEC 10165-4:1992, Information technology—Open Systems Interconnection—Structure of management information—Part 4: Guidelines for the definition of managed objects.[5]

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