

Link Aggregation Control Protocol - Official Technical Overview & Hardware Datasheet

LINK AGGREGATION CONTROL PROTOCOL (LACP) OFFICIAL TECHNICAL OVERVIEW & HARDWARE DATASHEET

1. EXECUTIVE SUMMARY

The Link Aggregation Control Protocol (LACP), standardized under IEEE 802.3ad (now IEEE 802.1AX), represents a cornerstone technology for carrier-grade and enterprise network infrastructure. This document provides a comprehensive technical specification and hardware implementation overview of our LACP-enabled switching and routing platforms. LACP enables the dynamic bundling of multiple physical network links into a single logical link, delivering increased aggregate throughput, seamless link redundancy, and operational simplicity. Our implementation supports up to 32 member links per aggregation group, sub-second failover detection, and full interoperability with leading vendor ecosystems.



2. ARCHITECTURE & CHASSIS DESIGN

Our LACP implementation operates at the Media Access Control (MAC) layer, utilizing Link Aggregation Control Protocol Data Units (LACPDU) exchanged exclusively between directly connected network nodes. The architecture follows a distributed, stateful control plane model where each participating port maintains its own negotiation state machine. The system supports two primary operational modes:

- ACTIVE MODE: Ports autonomously initiate LACPDU transmission at a default interval of 1 second (fast period) or 30 seconds (slow period).
- PASSIVE MODE: Ports respond only upon receipt of LACPDU from an active peer, conserving control plane resources in standby configurations.

The chassis backplane is non-blocking, ensuring that aggregated link traffic experiences no head-of-line blocking across fabric modules. Each aggregation group (Aggregator) is assigned a unique logical interface identifier, with hardware hash-based load balancing distributes frames across member links using Layer 2/3/4 tuple hashing (source/destination MAC, IP, and TCP/UDP ports).

3. HARDWARE FEATURES

- DEDICATED LACP OFFLOAD ENGINE: Each line card features an ASIC-based state machine processor that handles LACPDU generation, validation, and timer management without CPU intervention. Maximum LACP session capacity: 1024 aggregation groups per chassis.
- FAST FAILOVER MECHANISM: Link fault detection via hardware carrier loss or LACP timeout (3 consecutive missed LACPDUs). Recovery time: < 50 ms for 1G/10G/25G interfaces; < 10 ms for 40G/100G interfaces.
- LOAD BALANCING ALGORITHMS: Programmable hash policies including round-robin, dynamic flow-affinity, and adaptive load balancing based on real-time member utilization.
- PREEMPTION AND PRIORITY: Configurable port priority (0-65535) determines active link selection when exceeding maximum aggregation limits. System priority enables deterministic master/slave negotiation.

4. COMPLIANCE & STANDARDS

- IEEE 802.1AX-2020 (Link Aggregation) — Full compliance including LACP marker protocol.
- IEEE 802.3ad (original specification) — Backward compatible.
- MEF 48 (Carrier Ethernet Service Attributes) — Service OAM and LAG linkage.
- ITU-T G.8032 (Ethernet Ring Protection) — Interoperability with ERPS over LAG.
- RoHS Directive 2011/65/EU — Lead-free and hazardous substance compliant.

TECHNICAL SPECIFICATIONS

Parameter	Specification
Form Factor	1RU / 2RU / 4RU Chassis options
Switching Capacity	Up to 12.8 Tbps (non-blocking fabric)
Power Supply	1+1 or 2+2 Redundant AC/DC (100-240V AC / -48V DC)
Maximum LACP Groups	1024 (carrier license); 256 (base license)
Maximum Member Links per Group	32 (802.1AX maximum)

LACPDU Timer Intervals	Fast: 1 sec (3 retries); Slow: 30 sec (3 retries)
Failover Detection Time	< 50 ms (Fast mode); < 90 ms (Slow mode)
Load Balancing Modes	L2 MAC, L3 IP, L4 Port, L2+L3+L4, Round-Robin
Maximum Frame Size	Jumbo frame support up to 9216 bytes
Operating Temperature	0°C to 50°C (Standard); -40°C to +70°C (Industrial)
MTBF (Mean Time Between Failures)	342,000 hours (Telcordia SR-332)
Protocol Standards	IEEE 802.1AX-2020, 802.3ad, MEF 48, ITU-T G.8032

5. ORDERING OPTIONS

- LACP-PL-1000: Base software license for LACP (up to 8 groups, 8 members/group).
- LACP-ENT-2000: Enterprise license (32 groups, 16 members/group, fast timer support).
- LACP-CAR-5000: Carrier-grade license (1024 groups, 32 members/group,

hitless failover).

- LACP-HW-ACCEL: Hardware acceleration module for CPU offload (requires compatible line card).
- SPARE-PSU-LACP-AC: 1+1 redundant AC power supply, 80 PLUS Platinum.
- SPARE-PSU-LACP-DC: -48 VDC power supply for telecom central office deployment.

Extended warranty and 24/7 global support packages are available through standard OEM procurement channels. Please consult your regional account representative for volume pricing and lead times.

