**IEEE 802.3**

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This article is about the standards working group. For Ethernet frame data format, see [Ethernet frame](https://en.wikipedia.org/wiki/Ethernet_frame).

**IEEE 802.3** is a [working group](https://en.wikipedia.org/wiki/Working_group) and a collection of [Institute of Electrical and Electronics Engineers](https://en.wikipedia.org/wiki/Institute_of_Electrical_and_Electronics_Engineers) (IEEE) standards produced by the working group defining the [physical layer](https://en.wikipedia.org/wiki/Physical_layer) and [data link layer](https://en.wikipedia.org/wiki/Data_link_layer)'s [media access control](https://en.wikipedia.org/wiki/Media_access_control) (MAC) of wired [Ethernet](https://en.wikipedia.org/wiki/Ethernet). This is generally a [local area network](https://en.wikipedia.org/wiki/Local_area_network) (LAN) technology with some [wide area network](https://en.wikipedia.org/wiki/Wide_area_network) (WAN) applications. Physical connections are made between nodes and/or infrastructure devices ([hubs](https://en.wikipedia.org/wiki/Ethernet_hub), [switches](https://en.wikipedia.org/wiki/Network_switch), [routers](https://en.wikipedia.org/wiki/Router_(computing))) by various types of copper or [fiber cable](https://en.wikipedia.org/wiki/Optical_fiber).

802.3 is a technology that supports the [IEEE 802.1](https://en.wikipedia.org/wiki/IEEE_802.1) network architecture.

802.3 also defines LAN access method using [CSMA/CD](https://en.wikipedia.org/wiki/CSMA/CD).



**Contents**

* [1 Communication standards](https://en.wikipedia.org/wiki/IEEE_802.3#Communication_standards)
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* [4 External links](https://en.wikipedia.org/wiki/IEEE_802.3#External_links)

**Communication standards**

| **Ethernet standard** | **Date** | **Description** |
| --- | --- | --- |
| Experimental Ethernet | 1973[[1]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-1) | 2.94 [Mbit/s](https://en.wikipedia.org/wiki/Mbit/s) (367 [kB](https://en.wikipedia.org/wiki/Kilobyte)/s) over [coaxial cable](https://en.wikipedia.org/wiki/Coaxial_cable) (coax) [bus](https://en.wikipedia.org/wiki/Bus_network). Single byte node address unique only to individual network. |
| Ethernet I (DIX v1.0) | 1980 | 10 Mbit/s (1.25 [MB](https://en.wikipedia.org/wiki/Megabyte)/s) over thick coax. Frames have a Type field. This frame format is used on all forms of Ethernet by protocols in the [Internet protocol suite](https://en.wikipedia.org/wiki/Internet_protocol_suite). Six byte [MAC address](https://en.wikipedia.org/wiki/MAC_address). |
| Ethernet II (DIX v2.0) | 1982 |
| IEEE 802.3 standard | 1983 | [10BASE5](https://en.wikipedia.org/wiki/10BASE5) 10 Mbit/s (1.25 MB/s) over thick coax. Same as Ethernet II (above) except Type field is replaced by Length, and an [802.2](https://en.wikipedia.org/wiki/IEEE_802.2) LLC header follows the 802.3 header. Based on the [CSMA/CD](https://en.wikipedia.org/wiki/Carrier_sense_multiple_access_with_collision_detection) Process. |
| [802.3a](https://en.wikipedia.org/wiki/802.3a) | 1985 | [10BASE2](https://en.wikipedia.org/wiki/10BASE2) 10 Mbit/s (1.25 MB/s) over thin Coax (a.k.a. thinnet or cheapernet) |
| [802.3b](https://en.wikipedia.org/wiki/802.3b) | 1985 | [10BROAD36](https://en.wikipedia.org/wiki/10BROAD36) |
| 802.3c | 1985 | 10 Mbit/s (1.25 MB/s) repeater specs |
| 802.3-1985 | 1985 | a revision of the base standard from 1983 |
| [802.3d](https://en.wikipedia.org/wiki/802.3d) | 1987 | [Fiber-optic inter-repeater link](https://en.wikipedia.org/wiki/Fiber-optic_inter-repeater_link) |
| [802.3e](https://en.wikipedia.org/wiki/802.3e) | 1987 | [1BASE5](https://en.wikipedia.org/wiki/1BASE5) or [StarLAN](https://en.wikipedia.org/wiki/StarLAN) |
| [802.3i](https://en.wikipedia.org/wiki/802.3i) | 1990 | [10BASE-T](https://en.wikipedia.org/wiki/10BASE-T) 10 Mbit/s (1.25 MB/s) over twisted pair |
| [802.3j](https://en.wikipedia.org/wiki/802.3j) | 1993 | [10BASE-F](https://en.wikipedia.org/wiki/10BASE-F) 10 Mbit/s (1.25 MB/s) over Fiber-Optic |
| 802.3q | 1993 | [GDMO](https://en.wikipedia.org/wiki/GDMO) ([ISO 10164-4](https://en.wikipedia.org/wiki/List_of_International_Organization_for_Standardization_standards#ISO_10000_–_ISO_10999)) format for Layer Managed Objects |
| [802.3u](https://en.wikipedia.org/wiki/802.3u) | 1995 | [100BASE-TX](https://en.wikipedia.org/wiki/100BASE-TX), [100BASE-T4](https://en.wikipedia.org/wiki/100BASE-T4), [100BASE-FX](https://en.wikipedia.org/wiki/100BASE-FX) Fast Ethernet at 100 Mbit/s (12.5 MB/s) with [autonegotiation](https://en.wikipedia.org/wiki/Autonegotiation) |
| [802.3x](https://en.wikipedia.org/wiki/IEEE_802.3x) | 1997 | Full Duplex and [flow control](https://en.wikipedia.org/wiki/Ethernet_flow_control); also incorporates DIX framing, so there's no longer a DIX/802.3 split |
| [802.3y](https://en.wikipedia.org/wiki/802.3y) | 1998 | [100BASE-T2](https://en.wikipedia.org/wiki/100BASE-T2) 100 Mbit/s (12.5 MB/s) over voice-grade twisted pair |
| [802.3z](https://en.wikipedia.org/wiki/802.3z) | 1998-07 | [1000BASE-X](https://en.wikipedia.org/wiki/1000BASE-X) [Gbit](https://en.wikipedia.org/wiki/Gigabit)/s Ethernet over Fiber-Optic at 1 Gbit/s (125 MB/s) |
| 802.3-1998 | 1998-07 | (802.3aa) A revision of base standard incorporating the above amendments and errata |
| [802.3ab](https://en.wikipedia.org/wiki/802.3ab) | 1999-06 | [1000BASE-T](https://en.wikipedia.org/wiki/1000BASE-T) Gbit/s Ethernet over twisted pair at 1 Gbit/s (125 MB/s) |
| [802.3ac](https://en.wikipedia.org/wiki/802.3ac) | 1998-09 | Max frame size extended to 1522 bytes (to allow "Q-tag") The Q-tag includes [802.1Q](https://en.wikipedia.org/wiki/IEEE_802.1Q) [VLAN](https://en.wikipedia.org/wiki/VLAN) information and [802.1p](https://en.wikipedia.org/wiki/802.1p) priority information. |
| [802.3ad](https://en.wikipedia.org/wiki/802.3ad) | 2000-03 | [Link aggregation](https://en.wikipedia.org/wiki/Link_aggregation) for parallel links, since moved to [IEEE 802.1AX](https://en.wikipedia.org/wiki/IEEE_802.1AX) |
| 802.3-2002 | 2002-01 | (802.3ag) A revision of base standard incorporating the three prior amendments and errata |
| [802.3ae](https://en.wikipedia.org/wiki/802.3ae) | 2002-06 | [10 Gigabit Ethernet](https://en.wikipedia.org/wiki/10_Gigabit_Ethernet) over fiber; 10GBASE-SR, 10GBASE-LR, 10GBASE-ER, 10GBASE-SW, 10GBASE-LW, 10GBASE-EW |
| [802.3af](https://en.wikipedia.org/wiki/802.3af) | 2003-06 | [Power over Ethernet](https://en.wikipedia.org/wiki/Power_over_Ethernet) (15.4 W) |
| [802.3ah](https://en.wikipedia.org/wiki/802.3ah) | 2004-06 | [Ethernet in the First Mile](https://en.wikipedia.org/wiki/Ethernet_in_the_First_Mile) |
| [802.3ak](https://en.wikipedia.org/wiki/802.3ak) | 2004-02 | [10GBASE-CX4](https://en.wikipedia.org/wiki/10GBASE-CX4) 10 Gbit/s (1,250 MB/s) Ethernet over [twinaxial cables](https://en.wikipedia.org/wiki/Twinaxial_cable) |
| 802.3-2005 | 2005-06 | (802.3am) A revision of base standard incorporating the four prior amendments and errata. |
| [802.3an](https://en.wikipedia.org/wiki/802.3an) | 2006-06 | [10GBASE-T](https://en.wikipedia.org/wiki/10GBASE-T) 10 Gbit/s (1,250 MB/s) Ethernet over unshielded twisted pair (UTP) |
| 802.3ap | 2007-03 | [Backplane](https://en.wikipedia.org/wiki/Backplane) Ethernet (1 and 10 Gbit/s (125 and 1,250 MB/s) over [printed circuit boards](https://en.wikipedia.org/wiki/Printed_circuit_board)) |
| [802.3aq](https://en.wikipedia.org/wiki/802.3aq) | 2006-09 | [10GBASE-LRM](https://en.wikipedia.org/wiki/10GBASE-LRM) 10 Gbit/s (1,250 MB/s) Ethernet over multimode fiber |
| P802.3ar | Cancelled | Congestion management (withdrawn) |
| 802.3as | 2006-09 | Frame expansion |
| [802.3at](https://en.wikipedia.org/wiki/802.3at) | 2009-09 | [Power over Ethernet](https://en.wikipedia.org/wiki/Power_over_Ethernet) enhancements (25.5 W) |
| 802.3au | 2006-06 | Isolation requirements for Power over Ethernet (802.3-2005/Cor 1) |
| [802.3av](https://en.wikipedia.org/wiki/802.3av) | 2009-09 | 10 Gbit/s [EPON](https://en.wikipedia.org/wiki/Ethernet_passive_optical_network) |
| 802.3aw | 2007-06 | Fixed an equation in the publication of 10GBASE-T (released as 802.3-2005/Cor 2) |
| 802.3ax | 2008-11 | Link aggregation – moved to and approved as [802.1AX](https://en.wikipedia.org/wiki/802.1AX) |
| 802.3-2008 | 2008-12 | (802.3ay) A revision of base standard incorporating the 802.3an/ap/aq/as amendments, two corrigenda and errata. |
| [802.3az](https://en.wikipedia.org/wiki/802.3az) | 2010-09 | [Energy-Efficient Ethernet](https://en.wikipedia.org/wiki/Energy-Efficient_Ethernet) |
| [802.3ba](https://en.wikipedia.org/wiki/802.3ba) | 2010-06 | 40 Gbit/s and 100 Gbit/s Ethernet. 40 Gbit/s over 1 m backplane, 10 m Cu cable assembly (4×25 Gbit or 10×10 Gbit lanes) and 100 m of [MMF](https://en.wikipedia.org/wiki/Multi-mode_optical_fiber) and 100 Gbit/s up to 10 m of Cu cable assembly, 100 m of [MMF](https://en.wikipedia.org/wiki/Multi-mode_optical_fiber) or 40 km of [SMF](https://en.wikipedia.org/wiki/Single-mode_optical_fiber) respectively |
| 802.3-2008/Cor 1 | 2009 | (802.3bb) Increase Pause Reaction Delay timings which are insufficient for 10 Gbit/s (workgroup name was 802.3bb) |
| 802.3bc | 2009-09 | Move and update Ethernet related TLVs (type, length, values), previously specified in Annex F of [IEEE 802.1AB](https://en.wikipedia.org/wiki/IEEE_802.1AB) (LLDP) to 802.3. |
| 802.3bd | 2011-06 | Priority-based Flow Control. An amendment by the [IEEE 802.1](https://en.wikipedia.org/wiki/IEEE_802.1) [Data Center Bridging](https://en.wikipedia.org/wiki/Data_Center_Bridging) Task Group (802.1Qbb) to develop an amendment to IEEE Std 802.3 to add a MAC Control Frame to support IEEE 802.1Qbb Priority-based Flow Control. |
| 802.3.1 | 2011-05 | (802.3be) MIB definitions for Ethernet. It consolidates the Ethernet related [MIBs](https://en.wikipedia.org/wiki/Management_Information_Base) present in Annex 30A&B, various [IETF](https://en.wikipedia.org/wiki/IETF) [RFCs](https://en.wikipedia.org/wiki/Request_for_Comments), and 802.1AB annex F into one master document with a machine readable extract. (workgroup name was P802.3be) |
| 802.3bf | 2011-05 | Provide an accurate indication of the transmission and reception initiation times of certain packets as required to support IEEE P802.1AS. |
| 802.3bg | 2011-03 | Provide a 40 Gbit/s [PMD](https://en.wikipedia.org/wiki/Physical_Medium_Dependent) which is optically compatible with existing carrier [SMF](https://en.wikipedia.org/wiki/Single-mode_optical_fiber) 40 Gbit/s client interfaces ([OTU3](https://en.wikipedia.org/wiki/OTU3)/[STM-256](https://en.wikipedia.org/wiki/STM-256)/[OC-768](https://en.wikipedia.org/wiki/OC-768)/[40G POS](https://en.wikipedia.org/wiki/Packet_over_SONET)). |
| 802.3-2012 | 2012-08 | (802.3bh) A revision of base standard incorporating the 802.3at/av/az/ba/bc/bd/bf/bg amendments, a corrigenda and errata. |
| 802.3bj | 2014-06 | Define a 4-lane 100 Gbit/s backplane PHY for operation over links consistent with copper traces on "improved FR-4" (as defined by IEEE P802.3ap or better materials to be defined by the Task Force) with lengths up to at least 1 m and a 4-lane 100 Gbit/s PHY for operation over links consistent with copper [twinaxial cables](https://en.wikipedia.org/wiki/Twinaxial_cable) with lengths up to at least 5 m. |
| 802.3bk | 2013-08 | This amendment to IEEE Std 802.3 defines the physical layer specifications and management parameters for EPON operation on point-to-multipoint passive optical networks supporting extended power budget classes of PX30, PX40, PRX40, and PR40 PMDs. |
| 802.3bm | 2015-02 | [100G/40G Ethernet](https://en.wikipedia.org/wiki/100_Gigabit_Ethernet) for optical fiber |
| 802.3bn | 2016-09 | 10G-[EPON](https://en.wikipedia.org/wiki/Ethernet_passive_optical_network) and 10GPASS-XR, passive optical networks over coax |
| 802.3bp | 2016-06[[2]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-2) | 1000BASE-T1 – Gigabit Ethernet over a single twisted pair, automotive & industrial environments |
| 802.3bq | 2016-06[[3]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-3) | 25G/[40GBASE-T](https://en.wikipedia.org/wiki/40GBASE-T) for 4-pair balanced twisted-pair cabling with 2 connectors over 30 m distances |
| 802.3br | 2016-06 | Specification and Management Parameters for Interspersing Express Traffic |
| 802.3bs | 2017-12 | [200GbE](https://en.wikipedia.org/wiki/200GbE) (200 Gbit/s) over single-mode fiber and [400GbE](https://en.wikipedia.org/wiki/400GbE) (400 Gbit/s) over optical physical media |
| [802.3bt](https://en.wikipedia.org/wiki/802.3bt) | 2018-09 | third generation [Power over Ethernet](https://en.wikipedia.org/wiki/Power_over_Ethernet) with up to 100 W using all 4 pairs balanced twisted-pair cabling (*4PPoE*), including 10GBASE-T, lower standby power and specific enhancements to support IoT applications (e.g. lighting, sensors, building automation). |
| 802.3bu | 2016-12 | [Power over Data Lines (PoDL)](https://en.wikipedia.org/wiki/PoE) for single twisted-pair Ethernet ([100BASE-T1](https://en.wikipedia.org/wiki/Fast_Ethernet#100BASE-T1)) |
| 802.3bv | 2017-02 | Gigabit Ethernet over [plastic optical fiber (POF)](https://en.wikipedia.org/wiki/Plastic_optical_fiber) |
| 802.3bw | 2015-10[[4]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-4) | 100BASE-T1 – 100 Mbit/s Ethernet over a single twisted pair for automotive applications |
| 802.3-2015 | 2015-09 | 802.3bx – a new consolidated revision of the 802.3 standard including amendments 802.3bk/bj/bm |
| [802.3by](https://en.wikipedia.org/wiki/802.3by) | 2016-06[[5]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-5) | [Optical fiber](https://en.wikipedia.org/wiki/Optical_fiber), twinax and backplane [25 Gigabit Ethernet](https://en.wikipedia.org/wiki/25_Gigabit_Ethernet)[[6]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-6) |
| 802.3bz | 2016-09[[7]](https://en.wikipedia.org/wiki/IEEE_802.3#cite_note-7) | [2.5GBASE-T and 5GBASE-T](https://en.wikipedia.org/wiki/2.5GBASE-T_and_5GBASE-T) – 2.5 Gigabit and 5 Gigabit Ethernet over [Cat-5](https://en.wikipedia.org/wiki/Category_5_cable)/[Cat-6](https://en.wikipedia.org/wiki/Category_6_cable) twisted pair |
| 802.3ca | 2020-06 | 100G-EPON – 25, 50, and 100 Gbit/s over [Ethernet](https://en.wikipedia.org/wiki/Ethernet) [Passive Optical Networks](https://en.wikipedia.org/wiki/Passive_Optical_Network) |
| 802.3cb | 2018-09 | 2.5 Gbit/s and 5 Gbit/s Operation over Backplane |
| 802.3cc | 2017-12 | 25 Gbit/s over Single Mode Fiber |
| 802.3cd | 2018-12 | Media Access Control Parameters for 50 Gbit/s and Physical Layers and Management Parameters for 50, 100, and 200 Gbit/s Operation |
| 802.3ce | 2017-03 | Multilane Timestamping |
| 802.3cf | 2019-03 | YANG Data Model Definitions |
| 802.3cg | 2019-11 | 10 Mbit/s Single Twisted Pair Ethernet |
| 802.3ch | 2020-06 | Multi-Gig Automotive Ethernet (2.5, 5, 10 Gbit/s) over 15 m with optional PoDL |
| 802.3-2018 | 2018-08 | 802.3cj – 802.3-2015 maintenance, merge recent amendments bn/bp/bq/br/bs/bw/bu/bv/by/bz/cc/ce |
| 802.3ck | (TBD) | 100, 200, and 400 Gbit/s Ethernet using 100 Gbit/s lanes – scheduled for fall 2021 |
| 802.3cm | 2020-01 | 400 Gbit/s over multimode fiber (four and eight pairs, 100 m) |
| 802.3cn | 2019-11 | 50 Gbit/s (40 km), 100 Gbit/s (80 km), 200 Gbit/s (four λ, 40 km), and 400 Gbit/s (eight λ, 40 km and single λ, 80 km over [DWDM](https://en.wikipedia.org/wiki/DWDM)) over Single-Mode Fiber and DWDM |
| 802.3cp | (TBD) | 10/25/50 Gbit/s single-strand optical access with at least 10/20/40 km reach – scheduled for summer 2021 |
| 802.3cq | 2020-01 | Power over Ethernet over 2 pairs (maintenance) |
| 802.3cr | (TBD) | Isolation (maintenance) |
| 802.3cs | (TBD) | "Super-PON" – increased-reach, 10 Gbit/s optical access with at least 50 km reach and 1:64 split ratio per wavelength pair, 16 wavelength pairs – scheduled for summer 2021 |
| 802.3ct | (TBD) | 100 Gbit/s over DWDM systems (80 km reach using coherent modulation) – scheduled for fall 2021 |
| 802.3cu | (TBD) | 100 Gbit/s and 400 Gbit/s over SMF using 100 Gbit/s lanes – scheduled for early 2021 |
| 802.3cv | (TBD) | Power over Ethernet maintenance |
| 802.3cw | (TBD) | 400 Gb/s over DWDM Systems |
| 802.3cx | (TBD) | Improved PTP Timestamping Accuracy |
| 802.3cy | (TBD) | Greater than 10 Gb/s Electrical Automotive Ethernet |
| 802.3cz | (TBD) | Multi-Gigabit Optical Automotive Ethernet |
| 802.3da | (TBD) | 10 Mb/s Operation over Single Balanced Pair Multidrop Segments |
| 802.3db | (TBD) | 100 Gb/s, 200 Gb/s, and 400 Gb/s Operation over Optical Fiber using 100 Gb/s Signaling |

**See also**

* [IEEE 802](https://en.wikipedia.org/wiki/IEEE_802)
* [IEEE 802.11](https://en.wikipedia.org/wiki/IEEE_802.11), a set of [wireless networking](https://en.wikipedia.org/wiki/Wireless_networking) standards
* [IEEE 802.16](https://en.wikipedia.org/wiki/IEEE_802.16), a set of [WiMAX](https://en.wikipedia.org/wiki/WiMAX) standards
* [IEEE Standards Association](https://en.wikipedia.org/wiki/IEEE_Standards_Association)

**References**

 [*"Ethernet Prototype Circuit Board"*](http://americanhistory.si.edu/collections/search/object/nmah_687626)*. Smithsonian National Museum of American History. Retrieved 2014-10-31.*

  [*"IEEE P802.3bp 1000BASE-T1 PHY Task Force"*](http://www.ieee802.org/3/bp/)*. 2016-07-29. Retrieved 2016-10-02.*

  [*"Approval of IEEE Std 802.3by-2016, IEEE Std 802.3bq-2016, IEEE Std 802.3bp-2016 and IEEE Std 802.3br-2016"*](http://www.ieee802.org/3/NGBASET/email/msg00972.html)*. IEEE. 2016-06-30.*.

  [*"IEEE P802.3bw 100BASE-T1 Task Force"*](http://www.ieee802.org/3/bw/)*. 2015-10-27. The work of the IEEE P802.3bw 100BASE-T1 Task Force completed with the approval of IEEE Std 802.3bw-2015 by the IEEE-SA Standards Board on 27 October 2015.*

  [*"[STDS-802-3-25G] IEEE Std 802.3by-2016 Standard Approved!"*](http://www.ieee802.org/3/25GSG/email/msg00556.html)*. 2016-06-30.*

  [*P802.3by 25 Gbit/s Ethernet Task Force*](http://www.ieee802.org/3/by/)*, IEEE*.

* 1.  [*"[802.3\_NGBASET] FW: Approval of IEEE Std 802.3bz 2.5GBASE-T and 5GBASE-T"*](http://www.ieee802.org/3/NGBASET/email/msg00996.html)*. IEEE P802.3bz Task Force. Retrieved 2016-09-24.*

**External links**

* [The IEEE 802.3 Working Group](http://www.ieee802.org/3/)
* [Get IEEE 802.3 LAN/MAN CSMA/CD Access Method](https://ieeexplore.ieee.org/browse/standards/get-program/page/series?id=68)—Download 802.3 specifications.