



ethernet alliance

Ethernet Alliance Technology Roadmap

The Roadmap Subcommittee
Version 2.0

Disclaimer



The views expressed in this presentation are the views of the Roadmap Subcommittee and the Ethernet Alliance.

Agenda

- Speeds, Media and Distance
- BASE-T Speedmap
- Access Roadmap
- PoE Roadmap
- Backplane Roadmap
- 40GbE Roadmap
- 100GbE Roadmap

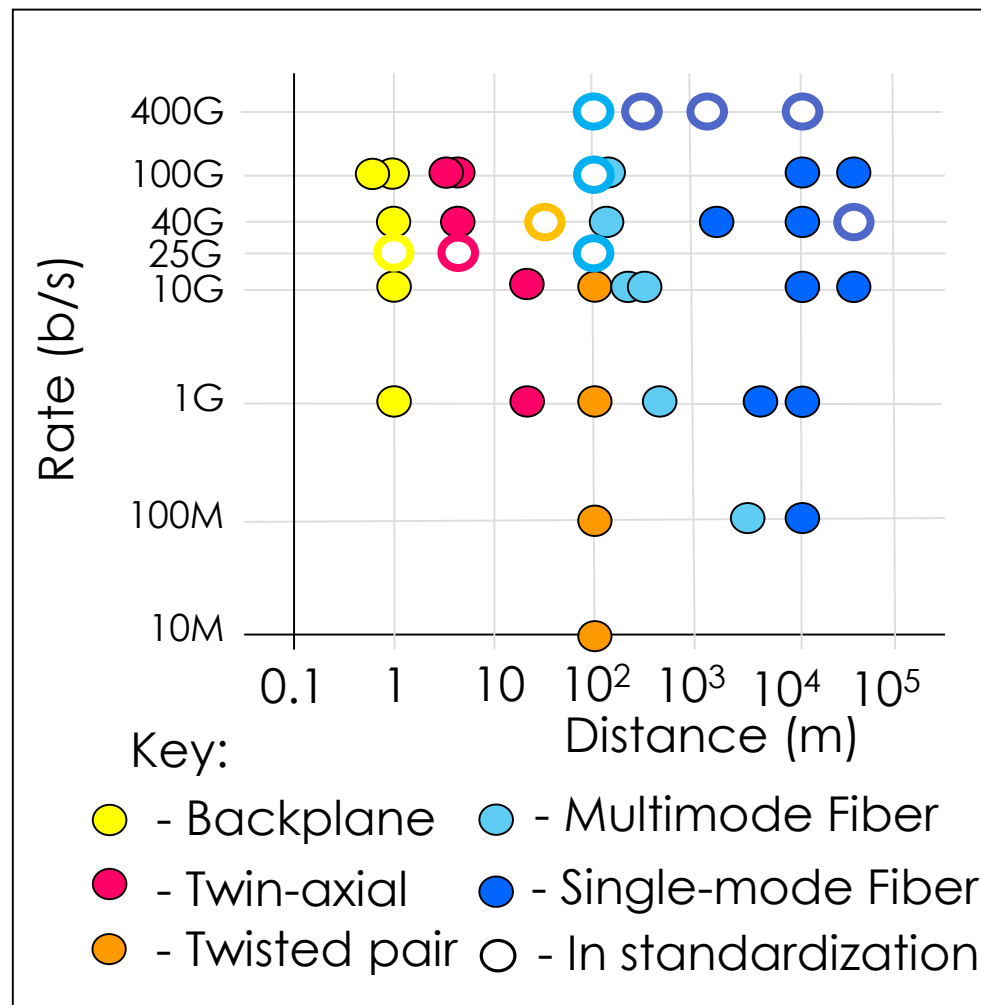
Media Types

- Ethernet operates over a number of technologies defined by IEEE 802.3 including:
 - Backplanes
 - Copper cables
 - Multimode fiber
 - Single-mode fiber
- The roadmaps, reach and speed for each of these technologies is different and will be discussed in this presentation

Distance vs Speed

Ethernet operates at different speeds over different distances depending on the media :

- backplanes up to 1m
- Twinax to 15m
- Twisted pair to 100m
- Multimode fiber to 5km
- Single-mode fiber to 40km



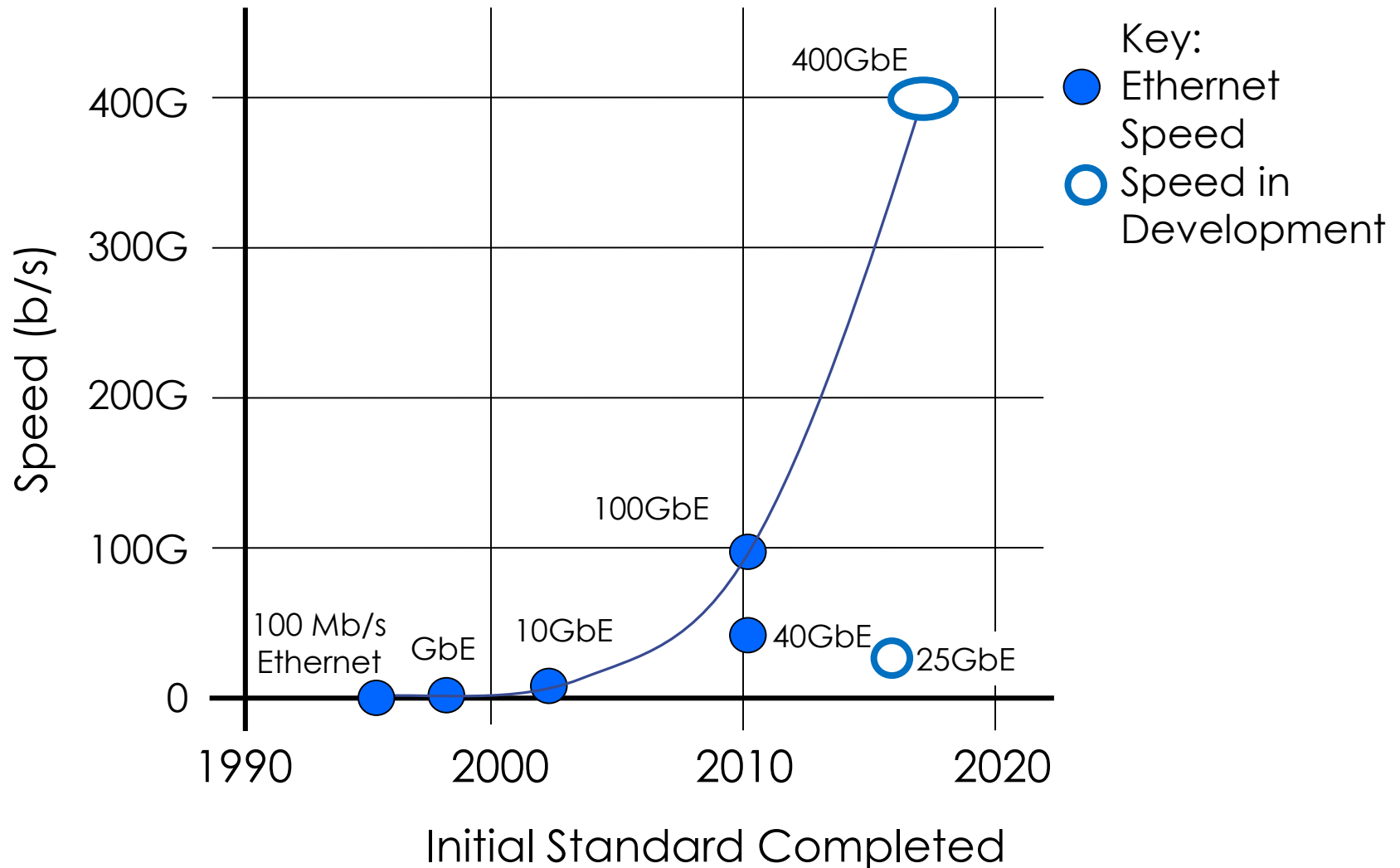
Ethernet Speedmap

Name	Speed	Date Initial Standard Ratified
10Mb/s Ethernet	10 Mb/s	1983
100Mb/s Ethernet	100Mb/s	1995
Gigabit Ethernet	1 Gb/s	1998
10 Gigabit Ethernet	10 Gb/s	2002
25 Gigabit Ethernet	25Gb/s	2016 (est)*
40 Gigabit Ethernet	40 Gb/s	2010
100 Gigabit Ethernet	100 Gb/s	2010
400 Gigabit Ethernet	400 Gb/s	2017 (est.)**

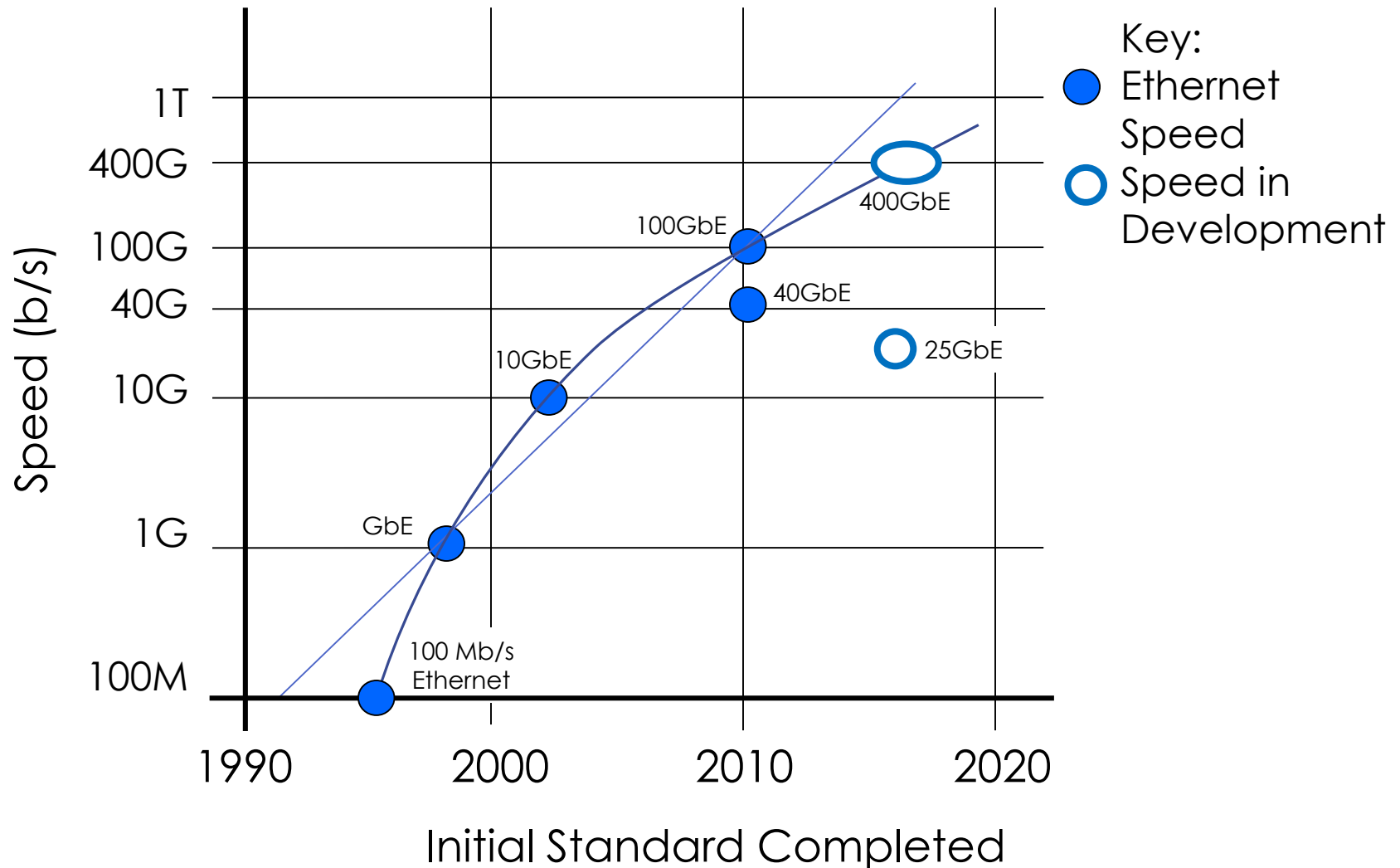
*Estimated on a 2-year standardization process that started with the CFI in July 2014

**Estimated on a 4-year standardization process that started with the CFI in March 2013

Ethernet Speeds - Linear



Ethernet Speeds – Log



BASE-T Speedmap

- This chart shows the speeds of BASE-T technology

Name	Speed	Reach	Twisted Pair Medium	Date Standard Ratified
10BASE-T	10 Mb/s	100 m	Cat 3	1990
100BASE-TX	100 Mb/s	100 m	Cat 5	1995
1000BASE-T	1 Gb/s	100 m	Cat 5e	1999
10GBASE-T	10 Gb/s	100 m	Cat 6 _A	2006
40GBASE-T	40 Gb/s	30 m	Cat 8	2016 (est.)*

*Estimated on a 3-year standardization process that started with the CFI in March 2013 and Task Force schedule

Access Roadmap

- This chart shows the various speeds of Access technology that needs to be confirmed by the Access Networks Subcommittee

Name	Speed	Date Standard Ratified
GEPON	1 Gb/s	2004
10GEPON	10 Gb/s symmetric 10 Gb/s & 1 Gb/s asymmetric	2009
Extended EPON	1 Gb/s 10 Gb/s symmetric 10 Gb/s & 1 Gb/s asymmetric	2013
EPoC	up to 10 Gb/s	2015 (est.)

PoE Roadmap

Name	Power from Power Sourcing Equipment (PSE)	Date Standard Ratified
PoE	15.4W	2003
PoE+	30W	2009
4 Pair PoE	TBD or 60W (min)	2015 (est.)
1 Pair Power over Data Lines	TBD	2015 (est.)

Name	Power at Powered Device (PD)	Date Standard Ratified
PoE	13W	2003
PoE+	25.5W	2009
4 Pair PoE	TBD or 49W (min)	2015 (est.)
1 Pair Power over Data Lines	TBD	2015 (est.)

Backplane Roadmap

PMD Name	Reach or Loss Budget	# of Lanes	Date Standard Ratified
1000BASE-KX	1 m	1	2007
10GBASE-KX4	1m	4	2007
10GBASE-KR	1 m	1	2007
25GBASE-KR	35dB @ 12.9GHz	1	2016 (est.)*
40GBASE-KR4	1m	4	2010
100GBASE-KR4	35dB @ 12.9GHz	4	2014
100GBASE-KP4	33dB @ 7GHz	4	2014

*Estimated on a 2-year standardization process that started with the CFI in July 2014

40GbE Port Roadmap

- Physical Medium Dependent Sublayers for 40GbE

PMD Name	Electrical Interface to Optical Module	Reach	Medium	Date Standard Ratified
40GBASE-CR4	Not Applicable	7 m	Twinax	2010
40GBASE-SR4	XLAUI / XLPPI	100/150 m	OM3/OM4	2010
40GBASE-LR4	XLAUI / XLPPI	10 km	OS1/OS2	2010
40GBASE-FR	XLAUI / XLPPI	2 km	OS1/OS2	2011
40GBASE-ER4	XLAUI / XLPPI	40 km	OS1/OS2	2015 (est.)
40GBASE-T	Not Applicable	30 m	Cat 8	2016 (est.)
40GBASE-SR*	XLAUI-1*	50-100 m?	OM4	2018 (est.)
40GBASE-FR	XLAUI-1*	2 km	OS1/OS2	2018 (est.)

* Potential future development

100GbE Port Roadmap



- Physical Medium Dependent Sublayers for 100GbE

PMD Name	Electrical Interface to Optical Module	Reach	Medium	Date Standard Ratified
100GBASE-CR10	N/A	7 m	Twinax	2010
100GBASE-SR10	CAUI-10	100/150 m	OM3/OM4	2010
100GBASE-LR4	CAUI-10	10 km	OS1/OS2	2010
100GBASE-ER4	CAUI-10	40 km	OS1/OS2	2010
100GBASE-CR4	N/A	5 m	Twinax	2014
100GBASE-SR4	CAUI-4	70/100 m	OM3/OM4	2015 (est.)
100GBASE-LR4	CAUI-4	10 km	OS1/OS2	2015 (est.)

400GbE Reach Objectives



The 400GbE Task Force has the following reach objectives that are subject to Working Group Approval:

- At least 100 m over MMF
 - At least 500 m over SMF
 - At least 2 km over SMF
 - At least 10km over SMF
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- For information on IEEE 802.3 projects, visit:
 - <http://www.ieee802.org/3/>

Summary

- Ethernet continues to improve with new standards and products that expand the Ethernet ecosystem
- Standards are increasing in speed to meet market demands
 - 25GbE
 - 400GbE links
 - 40GBASE-T
- New standards will be developed as they are needed and the Ethernet Alliance helps them progress