IEEE P802.3ba

40 GbE and 100 GbE Standards Update

Switch and Data®

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NANOG 47

Per IEEE-SA Standards Board Operations Manual, January 2005

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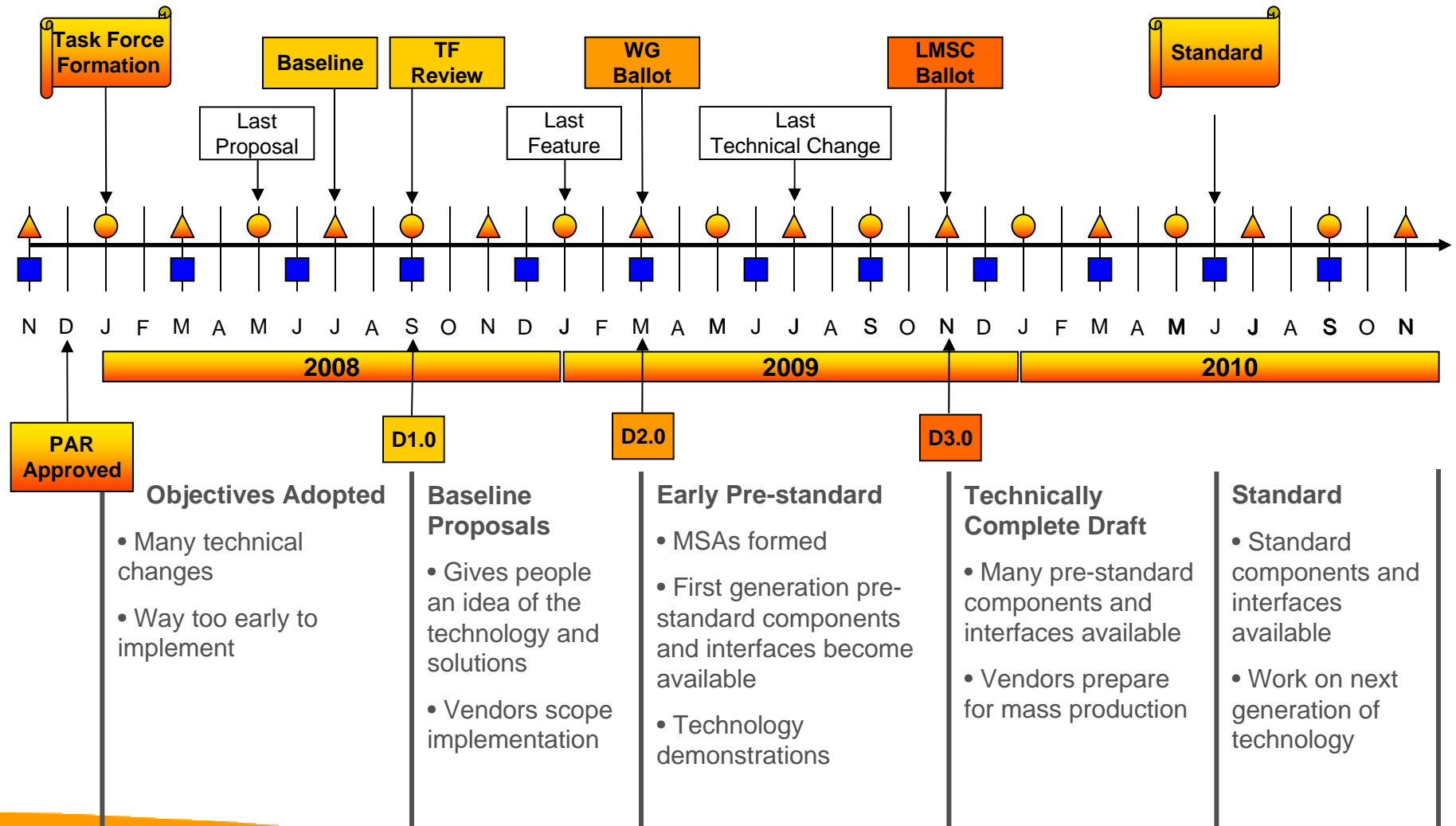
Summary of Recent Developments

- Lots of activity to finalize the new standards specifications

  - Much changed in 2006 – 2008 as objectives were first developed

  - After Draft 1.0, less news to report as the Task Force started Comment Resolution and began work towards the final standard

  - Finished Draft 2.2 in August, crossing Is and dotting Ts

  - Working towards Sponsor Ballot and Draft 3.0

- On schedule: the 40 GbE and 100 GbE standards will be delivered together in June 2010

Summary of Reach Objectives and Physical Layer Specifications – Updated July 2009

Physical Layer Reach	1 m Backplane	7 m Copper Cable	100 m OM3, 125 m OM4 MMF	10 km SMF	40 km SMF
40 Gigabit Ethernet					
Name	40GBASE-KR4	40GBASE-CR4	40GBASE-SR4	40GBASE-LR4	✘
Signaling	4 x 10 Gb/s	4 x 10 Gb/s	4 x 10 Gb/s	4 x 10 Gb/s	
Media	Copper Backplane	Twinax Cable	MPO MMF	Duplex SMF	
Module/Connector	Copper Backplane	QSFP Module, CX4 Interface	QSFP Module, CFP Module	CFP Module	
100 Gigabit Ethernet					
Name	✘	100GBASE-CR10	100GBASE-SR10	100GBASE-LR4	100GBASE-ER4
Signaling		10 x 10 Gb/s	10 x 10 Gb/s	4 x 25 Gb/s	4 x 25 Gb/s
Media		Twinax Cable	MPO MMF	Duplex SMF	Duplex SMF
Module/Connector		CXP Module	CXP Module, CFP Module	CFP Module	CFP Module

IEEE P802.3ba Task Force Timeline – What it Means to You

Task Force Formation

Baseline

TF Review

WG Ballot

LMSC Ballot

Standard

Last Proposal

Last Feature

Last Technical Change

N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N

2008   **2009**   **2010**

PAR Approved

D1.0   **D2.0**   **D3.0**

Objectives Adopted
- Many technical changes
- Way too early to implement

Baseline Proposals
- Gives people an idea of the technology and solutions
- Vendors scope implementation

Early Pre-standard
- MSAs formed
- First generation pre-standard components and interfaces become available
- Technology demonstrations

Technically Complete Draft
- Many pre-standard components and interfaces available
- Vendors prepare for mass production

Standard
- Standard components and interfaces available
- Work on next generation of technology

Marketing Timing and Standards Process/Technical Compliance

4

Getting Closer in 2009

- Final Draft 2.x will be technically complete for WG ballot

- Technical specifications are finalized
  - Last technical change in July 2009

- First generation pre-standard components have hit the market
  - Media modules (cables readily available already)
  - Test gear
  - Network gear

- Technology demonstrations and forums
  - Test equipment vendors had early demos in May 2009 at Interop
  - 40 GbE and 100 GbE CFP demos in September 2009 at ECOC
  - Ethernet Alliance white papers and education efforts

QSFP Modules

- Created for high density short reach interfaces
  - Targeted for data center applications

- Used for a variety of Ethernet and InfiniBand applications including 40GBASE-CR4 and 40GBASE-SR4
  - 4 channels
  - Low power consumption

Mellanox QSFP Assemblies

CXP Modules

- Created for high density short reach interfaces

    – Targeted for data center applications

- Used for 100GBASE-CR10, 100GBASE-CS10 and InfiniBand 12X QDR

    – 12 channels

    – 100 GbE uses 10 of the 12 channels

- 45 mm long x 27 mm wide, slightly larger than an XFP

    – Small compact form factor enables high density but limits distance

Finisar C.wire CXP Assembly

CFP Modules

- Optimized for longer reach applications

- Used for 40GBASE-SR4, 40GBASE-LR4, 100GBASE-SR10, 100GBASE-LR4 and100GBASE-ER4
    - Dense electrical connector enables a variety of interfaces

- 120 mm long x 86 mm wide, about twice as wide as a XENPAK

- Riding heat sink
    - Optional, gives vendors flexibility
    - Low friction, easy for operators to insert or remove modules
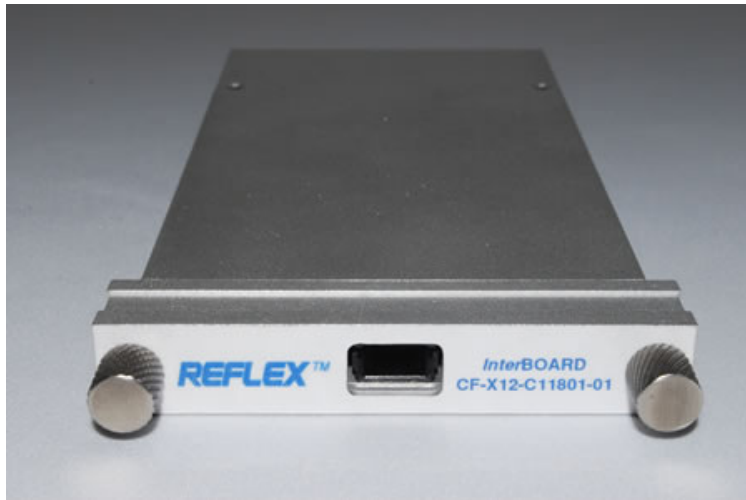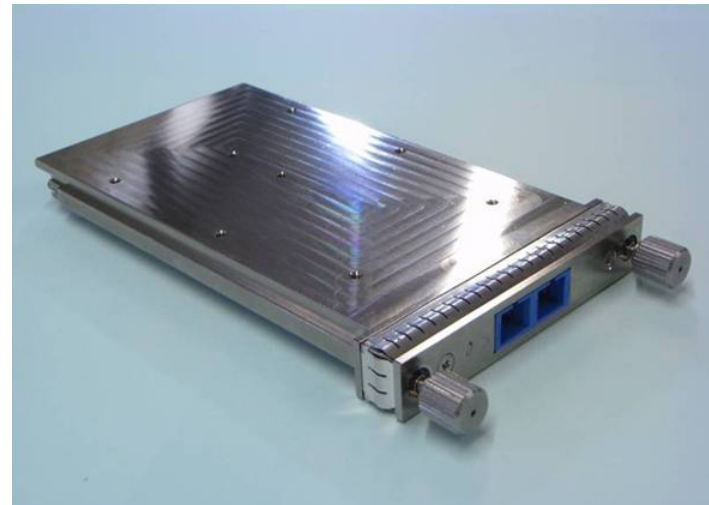

Finisar CFP Assembly

CFP Module Examples
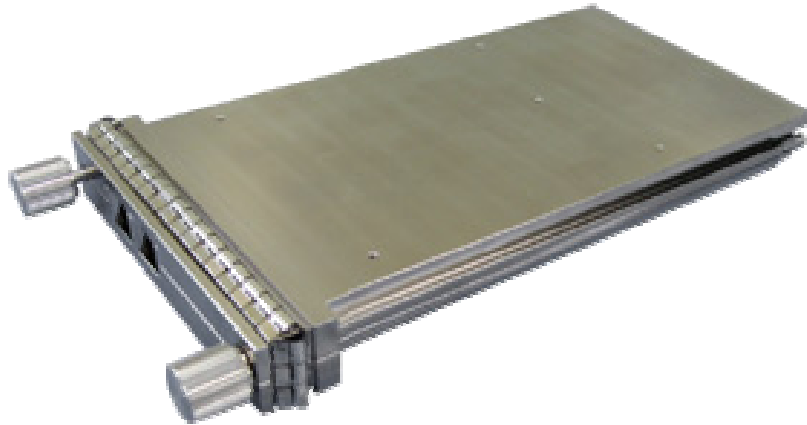

Opnext 100GBASE-LR4

Reflex Photonics Dual 40GBASE-SR4

Reflex Photonics 100GBASE-SR10

Sumitomo Electric Industries 40GBASE-LR4

MPO/MTP Cable Assemblies

- MPO = "Multi-fiber Push On"

- Wide variety of high density cabling options

  – MPO to MPO

  – MPO cassette for patch panels

  – MPO breakout into SC, LC, etc

- 40GBASE-SR4

  – 12 fiber MPO cable, uses 8 fibers

- 100GBASE-SR10

  – 24 fiber MPO cable, uses 20 fibers

- Will make crossconnects a challenge
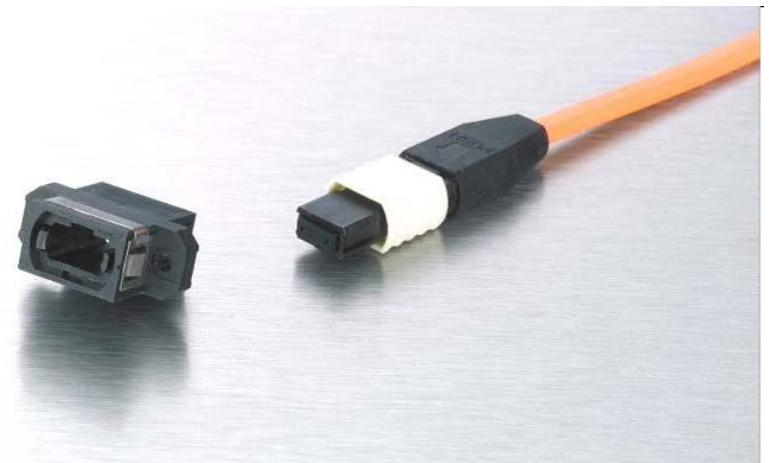
Fibernet MTP/MPO Assembly

Switches and Routers

- Several vendors have announced 100 Gbps/slot capacities and future plans for 40 GbE and 100 GbE

  – Alcatel-Lucent, Brocade, Cisco, Force10, Juniper, etc

- Juniper announced the first 100 GbE interface

  – Expected to be deployed in customer pilot networks before the end of 2009

- Industry expects more pre-standard interfaces in Fall 2009 and Spring 2010

Juniper 100 GbE Interface

What You Should Expect for 2010

- First generation technology will be expensive and low density

    – Technology cost choices were chosen to allow 100 GbE to be cheaper than 10 x 10 GbE

    – Initially a niche application for those that really need it and can afford it

    – In the near term, n x 10 GbE LAG may be more cost effective

- Density will improve as switch/router vendors develop higher capacity systems

    – Reasonable density requires > 400 Gbps/slot for 4 x 100 GbE ports

- Cost will decrease as new technology becomes feasible and volume increases

Future Meetings for 2009 and 2010

September 2009 Interim
- September 21 – 24, Chicago
- Draft 2.2 comment resolution, work towards Sponsor Ballot

November 2009 Plenary
- November 15 – 20, Atlanta
- Draft 3.0 and Sponsor Ballot

January 2010 Interim
- TBA

March 2010 Plenary
- March 14 – 19, Orlando

Meeting information: http://ieee802.org/3/interims/index.html

More Information is Here

IEEE P802.3ba 40Gb/s and 100Gb/s Ethernet Task Force

http://grouper.ieee.org/groups/802/3/ba/index.html

What You Should Do

- Look at your network growth and needs in the next couple of years

- Ask for roadmaps
  - Optical gear and switch/router vendors
  - Server vendors
  - Transport and IP transit providers, IXs
  - Others?

- Figure out what is missing and ask for it
  - Will it work with your optical network?
  - What about your cabling infrastructure?
  - 40 km 40 GbE?
  - Ethernet OAM?
  - Jumbo frames?

What's Next

- There will be demand for other PMDs outside the scope of 802.3ba

  – Standard defines a flexible architecture that enables many implementations as technology changes

- Expect more MSAs as technology develops and becomes cost effective

  – Serial signaling specifications for 40 Gigabit Ethernet (1 x 40 Gb/s) and 100 Gigabit Ethernet (1 x 100 Gb/s)

  – Duplex MMF specifications

  – 25 Gb/s signaling for 100 Gigabit Ethernet backplane and copper cable applications

- Incorporation of Energy Efficient Ethernet (IEEE P802.3az) capabilities to reduce energy consumption during idle times
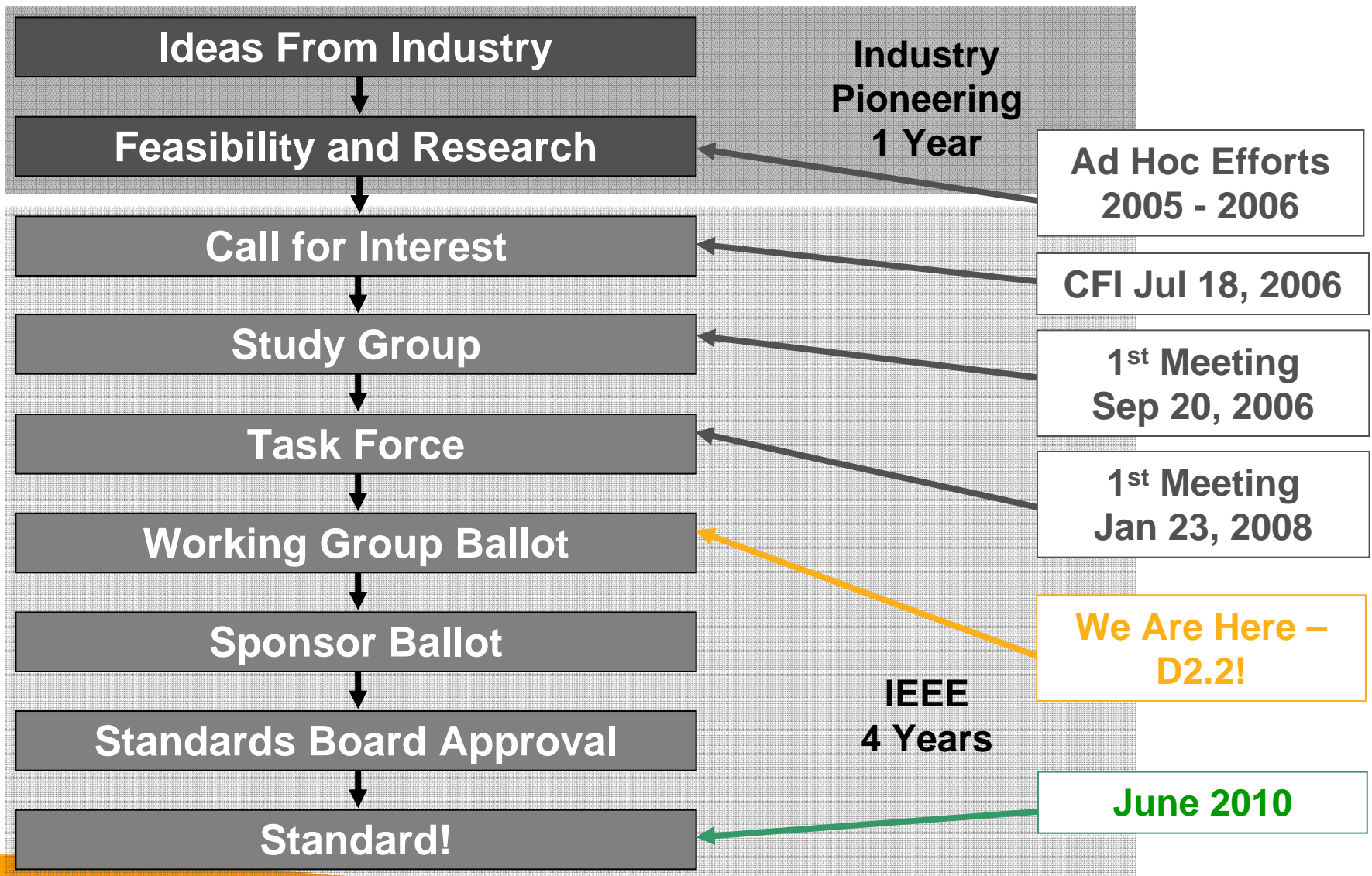
Crystal Ball

- No one is asking for networks to be slower, traffic will continue to increase

- The need for Terabit Ethernet is already being discussed in the industry and by network operators

- Ethernet will continue to evolve as network requirements change

Questions?

Many Interesting References Follow
This Slide!

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Where are we now after ~4 years?

Process Step	Timeline	Milestone
Ideas From Industry	**Industry Pioneering 1 Year**	
Feasibility and Research		**Ad Hoc Efforts 2005 - 2006**
Call for Interest		**CFI Jul 18, 2006**
Study Group		**1st Meeting Sep 20, 2006**
Task Force		**1st Meeting Jan 23, 2008**
Working Group Ballot		**We Are Here – D2.2!**
Sponsor Ballot	**IEEE 4 Years**	
Standards Board Approval		
Standard!		**June 2010**

803.3ba Nomenclature Suffix Summary

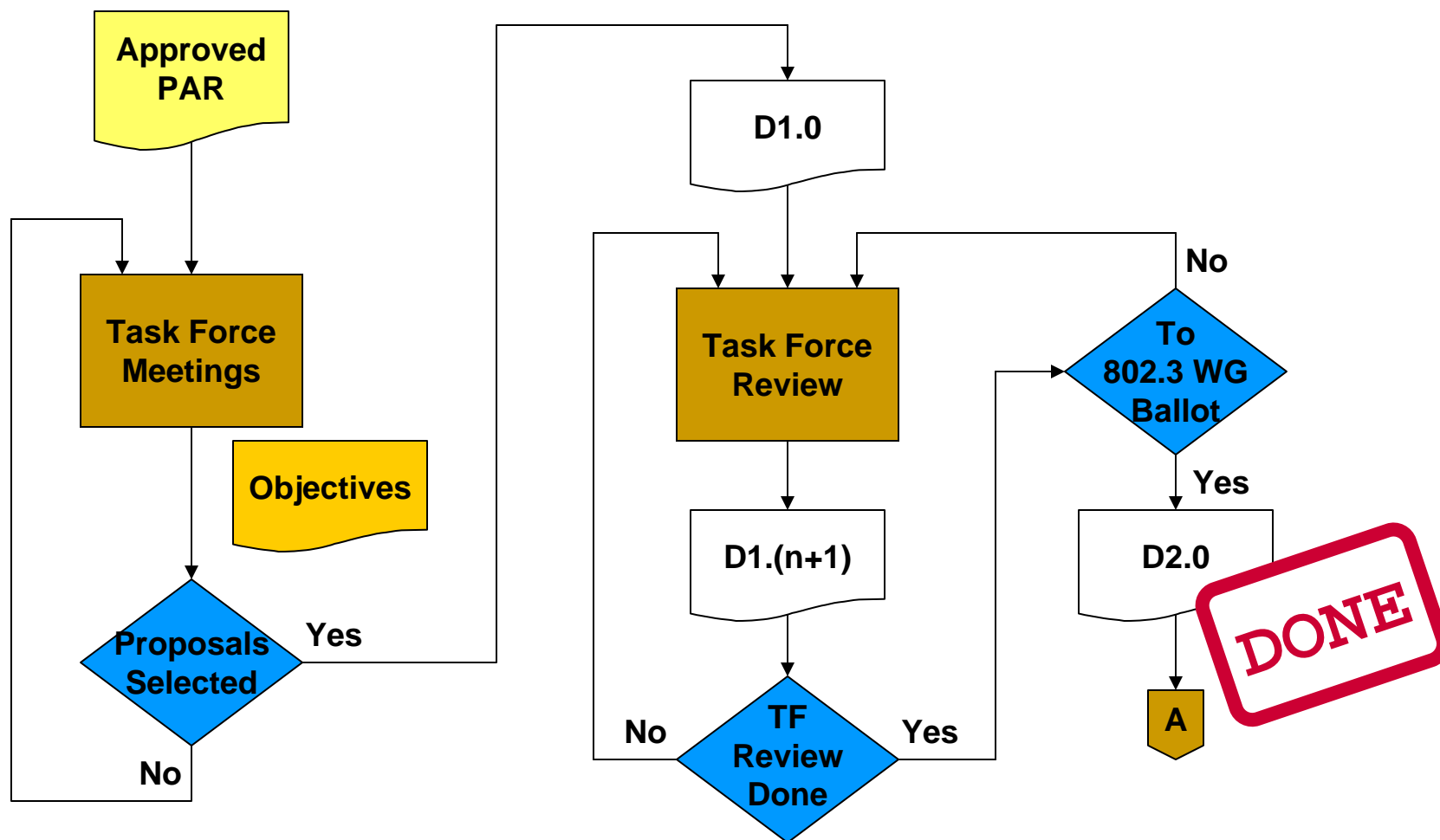| Speed	Medium		Coding Scheme	Lanes	
	Copper	Optical		Copper	Optical
40G = 40Gb/s 100G = 100Gb/s	K = Backplane C = Cable Assembly	S = Short Reach (100m) L = Long Reach (10km) E = Extended Long Reach (40km)	R = 64B/66B Block Coding	n = 4 or 10 n=1 is not required as serial is implied	n = Number of Lanes or Wavelengths

Example: 100GBASE-ER4

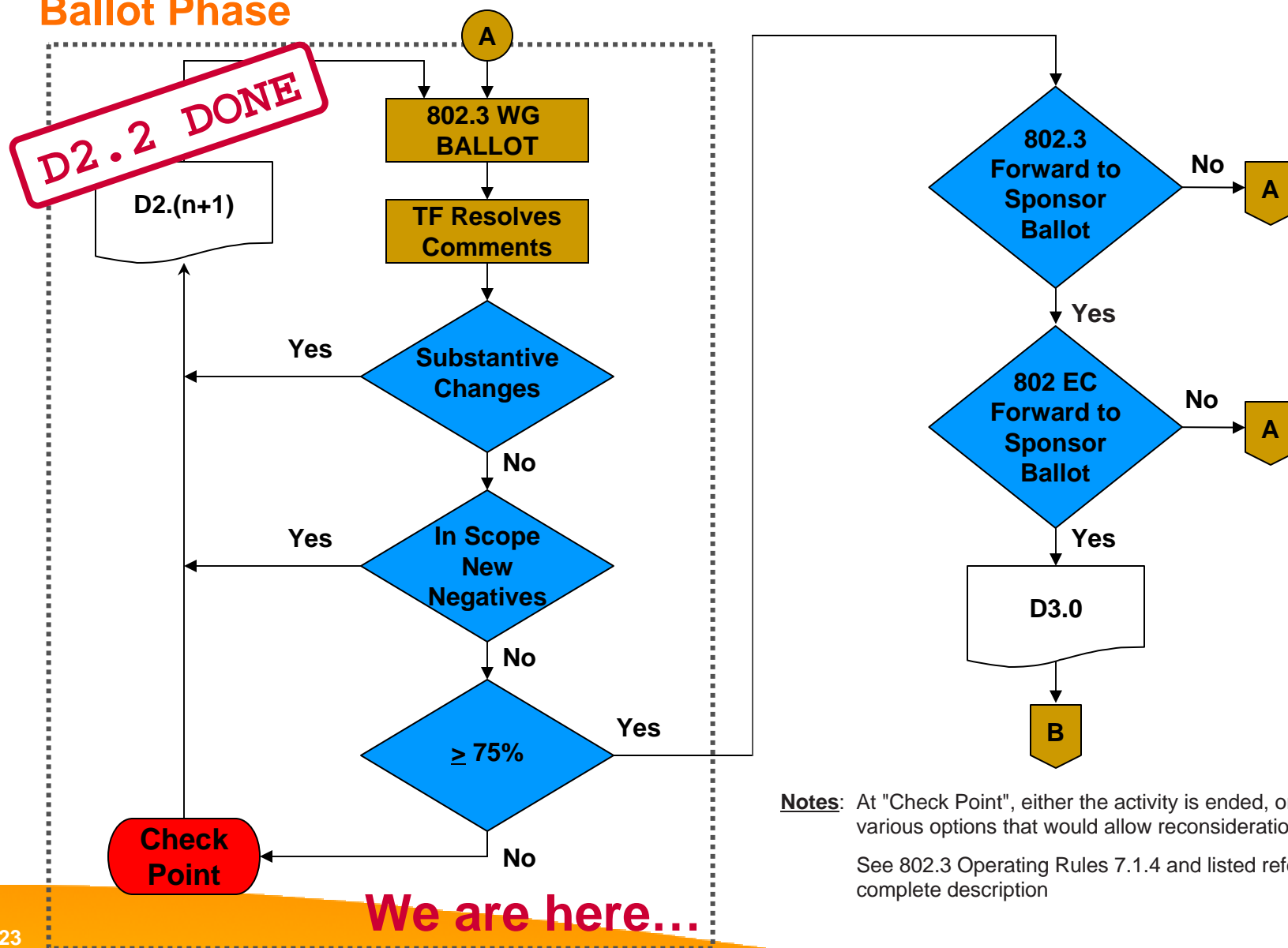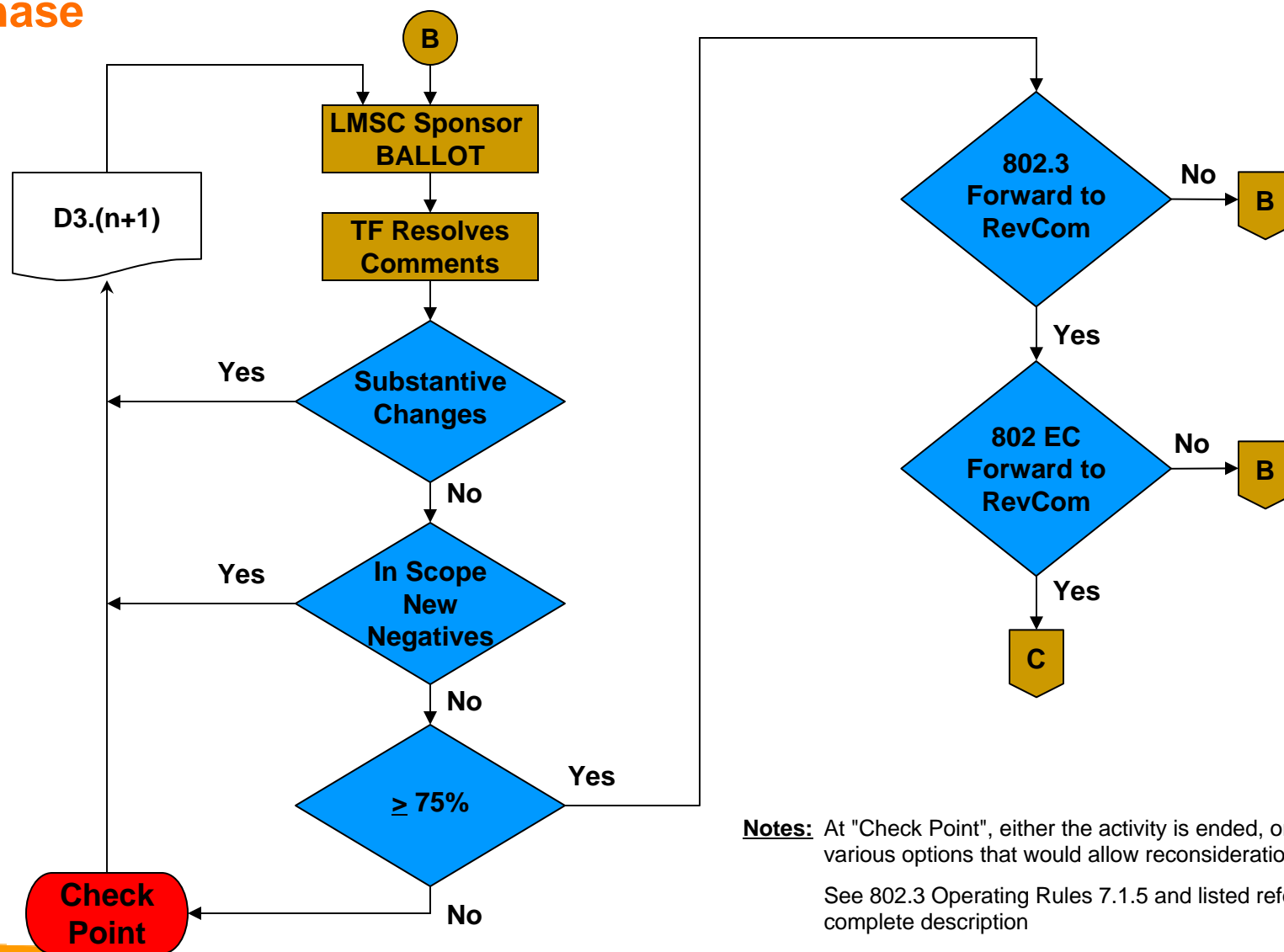# Overview of IEEE 802.3 Standards Process (1/5)- Study Group Phase
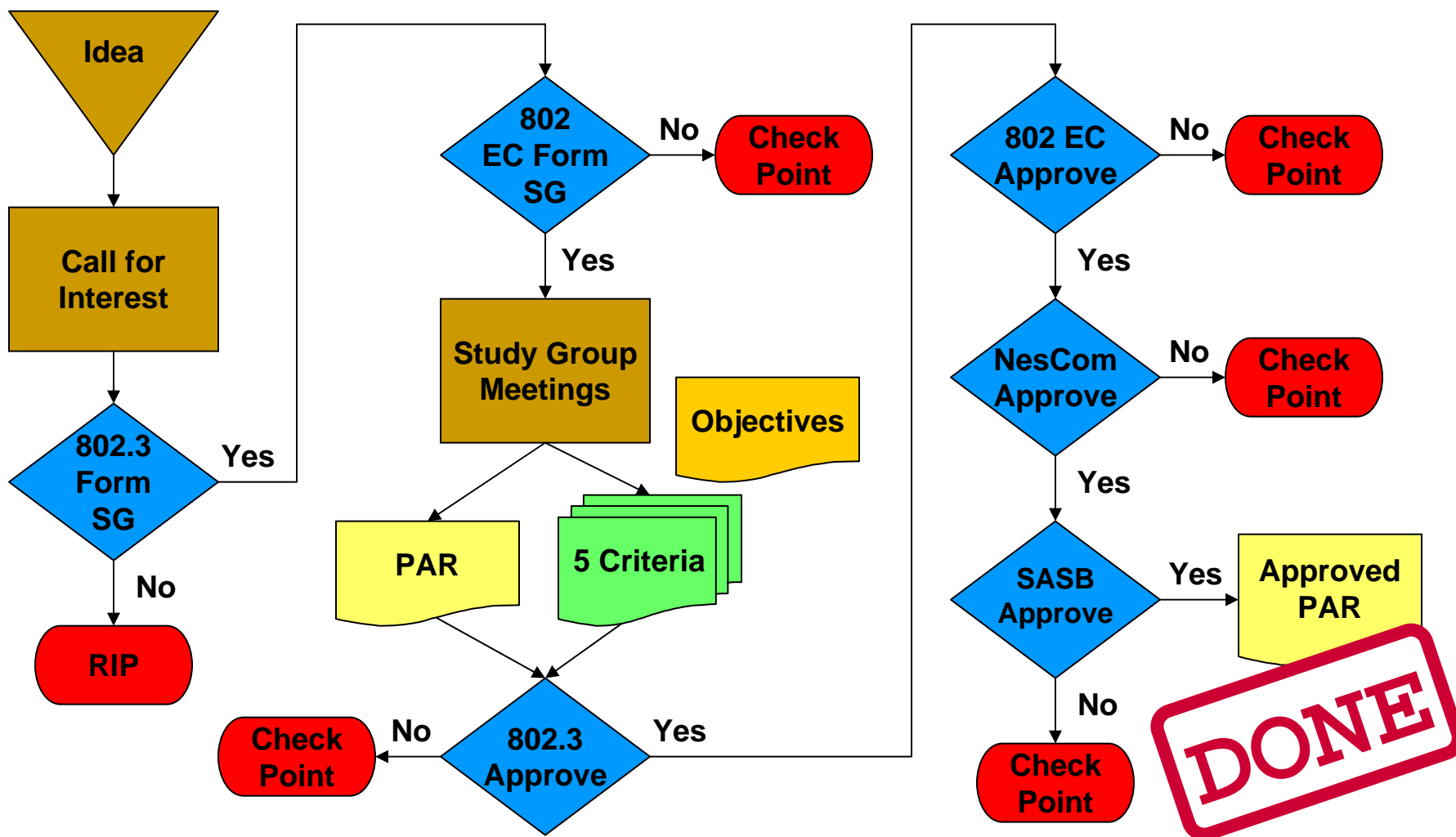
Note: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

Overview of IEEE 802.3 Standards Process (3/5) - Working Group Ballot Phase

A

802.3 WG BALLOT

TF Resolves Comments

Substantive Changes — Yes

No

In Scope New Negatives — Yes

No

≥ 75% — Yes

No

D2.2 DONE

D2.(n+1)

Check Point

We are here…

802.3 Forward to Sponsor Ballot — No → **A**

Yes

802 EC Forward to Sponsor Ballot — No → **A**

Yes

D3.0

B

Notes: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

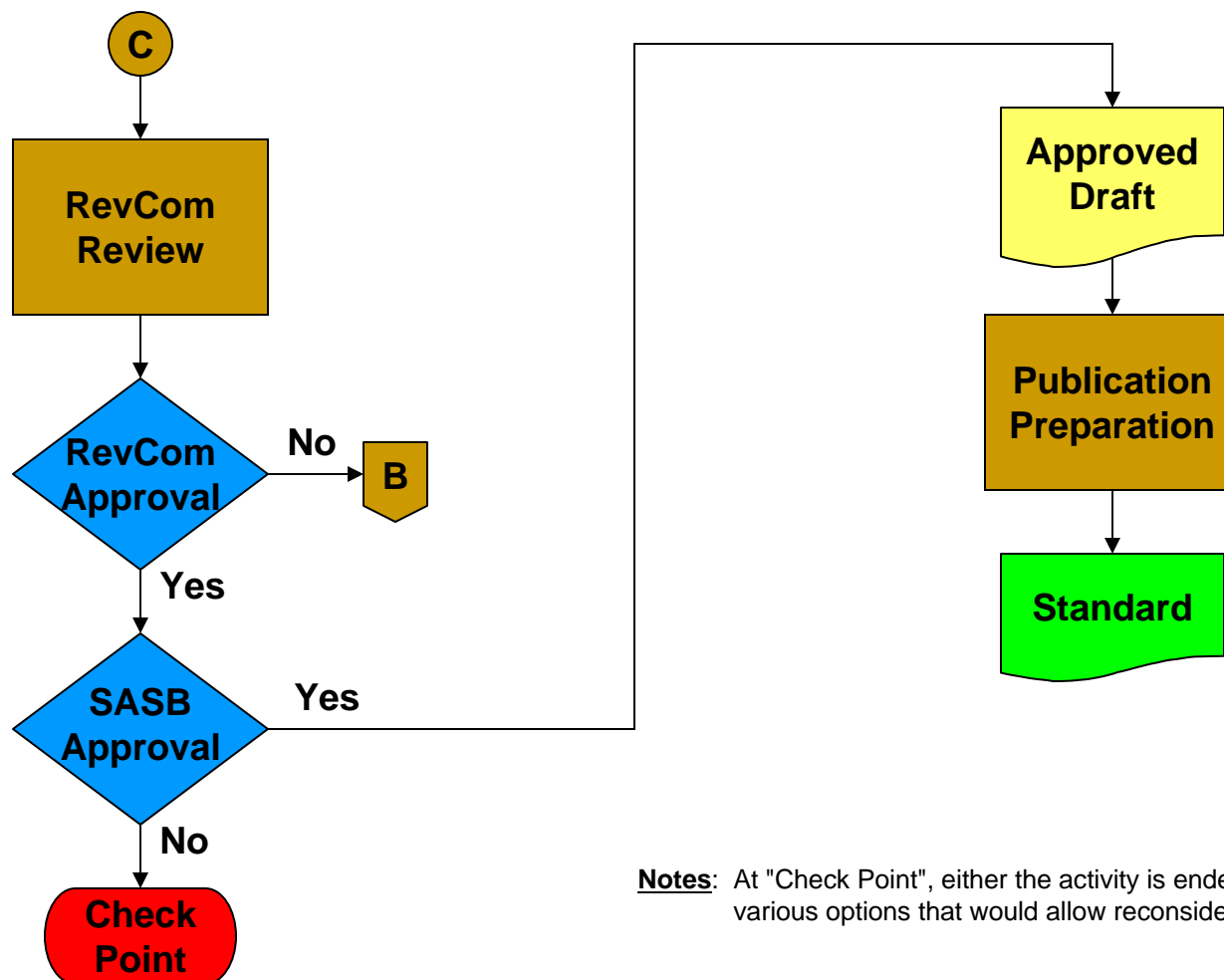See 802.3 Operating Rules 7.1.4 and listed references for complete description

B

LMSC Sponsor BALLOT

D3.(n+1)

TF Resolves Comments

Substantive Changes — Yes

In Scope New Negatives — Yes

No

No

≥ 75% — Yes

No

Check Point

802.3 Forward to RevCom — No → **B**

Yes

802 EC Forward to RevCom — No → **B**

Yes

C

Notes: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.

See 802.3 Operating Rules 7.1.5 and listed references for complete description

Overview of IEEE 802.3 Standards Process (5/5) - Final Approvals / Standard Release

Notes: At "Check Point", either the activity is ended, or there may be various options that would allow reconsideration of the approval.