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Standards Quarterly Update:

What you need to know now for the future of your network

Welcome to the 32nd edition of the *Standards Advisor*. This report is issued quarterly and provides updates on the standards relevant to the structured cabling industry, and the impact they have on your network design, planning and operations.

This summary represents standards meetings held during the third quarter of 2021 and reports on activities from all aspects of the cabling industry. These activities range from the applications standards (IEEE 802.3 and 802.11 and T11—Fiber Channel) to the cabling standards (ANSI/TIA, ISO/IEC, CENELEC). It also covers new developments in the world of multi-source agreements (MSAs).

71st ISO/IEC JTC1/ SC25 WG3 meeting: September 20-23, 2021, Virtual meeting

Working Group 3 Meeting Highlights

The 71st ISO/IEC JTC1/SC25 Working Group 3 (WG3) meeting was attended by 61 experts and observers from 17 countries including Australia, Belgium, Canada, China, Denmark, France, Germany, Great Britain, Ireland, Israel, Japan, Mexico, Singapore, Spain, Sweden, Switzerland, and the United States.

Working Group 3 resolved a large number of comments to the single pair content in the draft Amendments to ISO/IEC 11801-1 and ISO/IEC 11801-6. The second Working Draft (WD) of the ISO/IEC 14763-5 standard for Sustainability was reviewed, with all comments resolved, and the document will be circulated as a Committee Draft (CD). Comments to the fourth CD of the ISO/IEC 24383 Physical Network Security standard were reviewed, with the recommendation accepted to restructure the document, and a fifth CD will be circulated. There was much discussion and progress in the ISO 14763-3 optical fiber testing revision, and it was agreed to circulate a third CD for comments from national committees.

Other items were also progressed as detailed below.

1. Development of generic single pair cabling specifications

- Comments to the fourth CD of the Amendment to ISO/IEC 11801-1 were resolved and the document was approved to proceed to a fifth CD for circulation.
- The single pair cabling Classes include:
  - Class T1-A-100, T1-A-250, T1-A-400 and T1-A-1000, specified up to 20 MHz
  - Class T1-B, specified up to 600 MHz
  - Class T1-C, specified up to 1,250 GHz
- Single pair Classes T1-A-100, T1-B and T1-C are specified to 100 m, and single pair Classes T1-A-250, T1-A-400 and T1-A-1000 are specified to 250 m, 400 m and 1000 m, respectively.
- The recognized single pair connectors are the IEC 63171-1 copper LC style connector and the IEC 63171-6 industrial connector.
- The specification of PSAACRF for the T1-A classes was replaced with PSAFEXT. This issue is under study for classes T1-B and T1-C.

2. Single pair cable current carrying capacity

- There was much discussion with comments concerning the current carrying capacity of the single-pair channels. A compromise was accepted to keep 2A as the requirement for single pair cabling channels, and to include text stating that channels made from a combination of single-pair and four-pair components will support up to 0.75A.

3. Sheath sharing and single pair cabling

- A request to initiate a Technical Report ISO/IEC 11801-9911 covering the use of four pair cables to support single pair applications was agreed. There are a number of potential issues first highlighted at the Vienna meeting in 2019 that should be addressed during the work. The issues include concerns related to remote powering, bonding and earthing for circuits originating in different PSEs, and others. The Working Draft will incorporate text from the 11801-1 Amendment that states that shared sheath requires an engineered approach, and should be limited to one type of application in the shared sheath, with signal and power from a single equipment source for all pairs, and equipment vendors should be consulted for support. Information on planning and administration, grounding, mitigation, and supported applications will also be added.

4. ISO/IEC 11801-6 Amendment 1, to include single pair cabling

   · Comments to the 3rd CD were resolved, and the document will be circulated as a 4th CD. Single pair cabling specifications from the Service Consolidation Point (SCP) will be aligned with the specifications in the ISO/IEC 11801-1 Amendment.

5. Single pair multi-drop cabling

   · This Technical Report will cover the modeling and specification of multi-drop cabling constructed from balanced 1-pair cabling components intended for use in cooperation with ISO/IEC 11801 generic cabling systems. The drafted New Work Item Proposal (NWIP) for single pair multi-drop cabling was partially reviewed, and the task group will continue work prior to the next WG3 meeting in February.

6. ISO/IEC 14763-3 Testing of Optical Fiber

   · Ad hoc group completed the comment resolution of 2nd CD, and the document (with incorporated resolutions) will be circulated as 3rd CD for comments. Reference connector attenuation specifications are under revision within 14763-3. To harmonize with IEC SC86B specifications, SC25 WG3 has established liaison communication to SC86B WG6 for status update of the multi-fibre multimode and single-mode reference connector attenuation specifications which are currently under development in SC86B WG6.

   · In the MPO cabling testing clause of 14763-3, an "extension" cord is being added to allow the change of launch test cord between pinned and unpinned – to properly connect to the tail test cord. A liaison report to SC86B WG6 also includes this topic and the influence on the overall test limit calculation.

7. Network Physical Security (NPS)

   · Comments for the fourth CD of the ISO/IEC 24383 Physical Network Security standard were reviewed and will be re-circulated as a fifth CD. The document is still at a very early stage, with several empty clauses. The document covers the security of the telecommunications cables, pathways, spaces, and other infrastructure components of the telecommunications physical infrastructure to protect the telecommunications infrastructure from theft, vandalism, intrusions, and unauthorized modifications. The document adds levels of security to cabling, above the installation requirements of ISO/IEC 14763-2.

8. Bonding

   · ISO/IEC 30129 for bonding is due for review. It may be revised or it may be re-affirmed since most of the issues are editorial.

9. New Standard on Sustainability of Cabling Installations

   · The ad hoc reviewed the second Working Draft. The scope of this document includes requirements and recommendations to maximize the sustainability of cabling systems by addressing the cabling design, selection, packaging and transportation of components and related materials, operation and maintenance of the installation, management of waste, and related skillsets necessary for designers, installers and users. It was agreed to circulate a first CD for national comments.

The next scheduled ISO/IEC JTC1/SC25 WG3 meeting will be virtual on February 28, 2022 to March 4, 2022.

TIA TR-42 meeting: No meetings held during Q3, 2021

The next scheduled TIA TR-42 meeting will be a virtual on October 4-8, 2021.

CENELEC TC86BXA meeting: No meetings were held during Q3, 2021

The next scheduled CLC TC86BXA meeting will be held in November 2021.

IEEE 802.3 Ethernet meetings: Plenary meeting—July 12-22, 2021, Virtual meeting Interim meeting—September 13-24, Virtual meeting

Due to COVID-19, IEEE 802 and IEEE 802.3 continue to hold telephonic meetings in place of the scheduled face-to-face meetings. This is expected to continue until at least February 2022, as IEEE 802 has decided to hold the November plenary meetings electronically, and IEEE 802.3 has decided to hold the January 2022 interim electronically.

Single-twisted-pair copper standards

1. IEEE P802.3da Single Pair Multidrop Segments Enhancement Task Force

   · This project is developing extensions to the Clause 147 10BASE-T1S multidrop (10 Mbps shared media) PHY defined in 802.3cg, interoperable with the PHY in 802.3cg. The major objectives the project is working on include the following (for more objectives, see objectives on the IEEE 802.3da site):

   – a. Adding interoperable multidrop power over Ethernet and reach extensions for multidrop to better accommodate building automation.
   – b. Extending multidrop networks to support at least 16 nodes and 50m of reach (32 nodes and 70m are desired, but the objective is only 15 nodes and 50m).
   – c. Defining plug-and-play multidrop powering, and
   – d. Selecting a single equipment connector.
     – The Task Force has adopted a baseline and begun Task Force review of the draft on a protocol for automatically configuring the node IDs associated with the (IEEE 802.3cg) Clause 148 Physical Layer Collision Avoidance (PLCA) protocol;
     – The Task Force is preparing to adopt baseline proposals related to powering a multidrop segment.
     – The Task Force continues to work on defining the electrical parameters for the shared-media 'mixing segment' – wiring

that connects the various multidrop nodes. Specifying the mixing segment to enable greater reach and an increased number of nodes appears to be the most difficult part of the work. The group is forming consensus around an open-source LTSpice model of the mixing segment which needs to be translated into deployment rules.

- The Task Force intends to communicate its work to TIA TR42.7 so that the two can produce aligned specifications for multidrop single-pair use in commercial buildings, when it reaches some conclusions.
- The Task Force adopted a formal timeline resulting in a standard in mid 2023, but it appears that this timeline is in jeopardy.

2. IEEE P802.3cy Greater than 10 Gb/s Electrical Automotive Ethernet Task Force

- This project is developing new electrical (as opposed to optical) PHY specification for 25Gb/s, 50Gb/s, and 100Gb/s Ethernet, at distances of up to 11m, suitable for automotive use. It is primarily driven by requirements for autonomous vehicle networking, and the project scope includes both symmetric and asymmetric transmission (where one of the directions is at a much lower speed).
- The project adopted baselines for link segment electrical parameters, based on channels with shielded differential pair cabling suitable for automotive use, with 8 GHz bandwidth. Both twisted pair or parallel pair constructions are considered. Because it is required to operate in an automotive environment, this cabling differs from existing twinax data center cabling.
- The project also adopted baseline text for much of the PHY clause, using PAM-4 line coding and FEC from the 2.5G/5G/10GBASE-T1 technology (IEEE 802.3ch / Clause 149 of IEEE 802.3). The draft is now being prepared for Task Force review. The Task Force is expected to make refinements of these specifications but is expected to stay with PAM-4 at about 14 GBaud.
- The project adopted a formal timeline which results in a completed standard in Q3 2023, it appears to be on track.
- While motivated by automotive applications, the standard does not limit the application of the PHY and may find use in short-range high-speed applications on shielded balanced pair cabling which could be used as an alternative to direct-attach twinaxial cables.

3. IEEE P802.3dd Maintenance #17: Power over Data Lines of Single Pair Ethernet

- This project has adopted corrections to the specifications introduced by IEEE 802.3bu and IEEE 802.3cg. These address a number of technical and editorial issues found during the implementation of single-pair Ethernet powering using classification.
- Specifically, initial implementations for automotive applications did not use the classification functionality, and the interest and implementation of single-pair powering for in-building applications uncovered a number of specifications requiring minor modification.
- As a maintenance project, no new features (e.g., powering levels) may be added.
- The project progressed to initial Working Group ballot at the September 802.3 Interim.

4. IEEE 802.3 Enhancements to point-to-point Single Pair Ethernet Study Group/IEEE P802.3de: IEEE Time Synchronization for Point-to-Point Single Pair Ethernet Task Force

- The Study Group produced a draft PAR and CSD response for supporting TSN, a near-term project to permit use of the new point-to-point 10 Mb/s Single Pair Ethernet PHYs (10BASE-T1L and 10BASE-T1S) specified by IEEE 802.3cg with the 802.3 specifications used for Time Sensitive Networking. This is expected to be a quick project without any functional changes. This has been approved and is now the IEEE P802.3de Task Force, which is expected to have its first meeting in October 2021, and be relatively short lived – targeting Working Group ballot in November 2021.

5. IEEE 802.3 Greater than 10 Mb/s Long-Reach Single-Pair Ethernet Study Group

- The Enhancements to point-to-point Single Pair Ethernet Study Group was also working on the next speed enhancement for building automation and industrial automation distances with point-to-point single pair Ethernet, likely at 100 Mb/s. With the approval of the PAR for 802.3de, the "Enhancements" Study Group has now transitioned to the "Greater than 10 Mb/s" Study Group, focused purely on this long-range work.
- The Greater than 10 Mb/s Long-Reach Single-Pair Ethernet Study Group has reached consensus on a 100 Mb/s project, but has yet to decide the reach (discussion is between 200m and 590m). It is also considering whether to include 1 Gb/s long-reach PHYs in the project. The existing 100Mb/s and faster single pair PHYs are primarily specified for automotive distances and environments, and this project would look to specify at least one long-reach PHY (likely at 100 Mb/s) for greater than 100m distance.
- The Study Group will proceed past November, and is targeting completing a Project Authorization by the end of the year. A new task force for greater than 10 Mb/s SPE PHYs is expected in Q1 2022.

Optical Fiber Standards

6. IEEE P802.3cp 10G, 25G, and 50G bidirectional access optical PHYs Task Force

- This Task Force developed standards for bidirectional 10G, 25G, and 50G over 10, 20, and 40 km over a single strand of single mode fiber.
- The work of this task force was completed with the approval of IEEE Std 802.3cp-2021 by the IEEE-SA Standards Boards on 16 June 2021.

7. IEEE P802.3cs Central office consolidation (super PON) Task Force

- The main objectives of this Study Group are:
  - Support a passive point-to-multipoint ODN with a reach of at least 50 km with at least 1:64 split ratio per wavelength pair
  - Support at least 16 wavelength pairs for point-to-multipoint PON operation
  - Support the MAC data rate of 10Gb/s downstream
  - Support the MAC data rates of 2.5Gb/s and 10Gb/s upstream
  - Support tunable transmitters
- Draft 2.3 was reviewed by the Working Group.

8. IEEE P802.3ct 100 Gb/s and 400 Gb/s Operation over DWDM Systems Task Force

- This project was split into P802.3ct for the 100G objective and P802.3cw for the 400G objective.
- The main objective is:
  - 100 Gb/s operation on a single wavelength capable of at least 80 km over a DWDM system (100GBASE-ZR).
- DP-DQPSK coherent modulation format will be used for 100GBASE-ZR
- The work of this task force was completed with the approval of IEEE Std 802.3ct-2021 by the IEEE-SA Standards Boards on 16 June 2021.

9. **IEEE P802.3cw 400 Gb/s Operation over DWDM Systems Task Force**
   - This project was split from P802.3ct for the 400G objective.
   - The main objective is:
     - 400 Gb/s operation on a single wavelength capable of at least 80 km over a DWDM system (400GBASE-ZR).
   - DP-16QAM coherent modulation format will be used for 400GBASE-ZR.
   - Draft 1.3 is under review by the Task Force.
10. **IEEE P802.3cz Multi-Gigabit Optical Automotive Ethernet Task Force**
   - This project will define the performance characteristics of an automotive link segment and an optical PHY to support 2.5, 5, 10, 25, and 50 Gb/s over 40 m of automotive cabling.
   - Task Force resolved comments against Draft 1.0.
   - Draft 1.1 is under Task Force review.
11. **IEEE P802.3db 100 Gb/s, 200 Gb/s, and 400 Gb/s Short Reach Fiber Task Force**
   - This project will define standards for 100, 200, and 400 Gb/s over 50 m and 100 m multimode fiber.
   - This will allow for Top-of-Rack switch elimination by connecting Middle-of-Row switches directly to servers (VR).
   - This will also provide switch-to-switch connectivity and support the installed base of multimode fiber (SR).
   - The Task Force agreed to introduce a new suffix "VR" for the 50 m reach, which can be taken to stand for "Very short Reach" or "serVer connectivity."
   - Draft 1.2 was reviewed by the Task Force.
   - Draft 2.0 is under review by the Working Group.
12. **IEEE Beyond 400G Ethernet Study Group**
   - This group will set objectives for 800G and 1.6T Ethernet using 100G and 200G lanes
   - These objectives include:
     - 200G over 1 pair of SMF up to 500 m
     - 200G over 1 pair of SMF up to 2 km
     - 400G over 2 pairs of SMF up to 500 m
     - 800G over 8 pairs of MMF up to 50 m
     - 800G over 8 pairs of MMF up to 100 m
     - 800G over 8 pairs of SMF up to 500 m
     - 800G over 8 pairs of SMF up to 2 km
     - 800G over 4 pairs of SMF up to 500 m
     - 800G over 4 pairs of SMF up to 2 km
     - 800G over 1 pair of SMF with 4 wavelengths over 2 km
     - 800G over 1 pair of SMF up to 10 km
     - 800G over 1 pair of SMF up to 40 km
     - 1.6T over 8 pairs of SMF up to 500 m
     - 1.6T over 8 pairs of SMF up to 2 km

The next scheduled IEEE 802.3 meeting will be virtual in November 2021.

IEEE 802.3 Task Force electronic Interims are expected to continue to be called weekly as needed.

OIF Standards meeting: August 2-6, 2021, Virtual meeting

1. **Common Electrical Interface – 224G Development Project (CEI-224G)**
   - This project will develop a body of knowledge summarized into a white paper that will enable new project launches for specific next-generation 224 Gbps clauses.
   - PAM4, PAM6, and PAM8 modulation formats are being considered.
2. **Co-Packaging Framework Project**
   - The Co-Packaging Framework IA is an umbrella project that will study the application spaces and relevant technology considerations for co-packaging of communication interfaces with one or more ASICs.
   - Draft framework paper is under review by Working Group.
3. **Implementation Agreement for a 3.2Tb/s Co-Packaged Optical (CPO) Transceiver**
   - This Implementation Agreement specifies key aspects and electo-optical-mechanical details of a 3.2Tb/s Co-Packaged Optical Module.
   - This project will draw on 400G-FR4 and 400G-DR4 IEEE standards as well as the CPO JDF.
   - Project was launched at the February meeting.
   - Baseline proposals are being considered.

The next scheduled OIF Standards meeting will be virtual in November 2021.

INCITS Fiber Channel T11.2: August 17-19, 2021, Virtual & Face-to-face meeting

1. **FC-PI-8 (128GFC Serial)**
   - Motion was passed to use IEEE 802.3cu FR (2km) and LR (10km) variants as the baselines for the 128GFC SMF links.
   - Motion was passed to use the MM proposal (modified from June meeting) as the baselines for the 128GFC MMF links. Operating distances remain unchanged as 60m of OM3, and 100m of OM4/OM5. Key changes since last meeting are average launch power (max), overshoot/undershoot (max); receiver sensitivity and adjustment of eye threshold values based on recent 802.3db development.
   - Previous generations of FC standards included a maximum operating distance and loss budget matrix in the annex. The values were derived from the 10GE link model based on the NRZ scheme. Given currently no PAM4 link model is approved by IEEE or Fibre Channel, there is low confidence in the accuracy of these values. Motion was passed to remove such table from document, and to specify maximum link connection loss similarly to other industry standards.
   - Committee reviewed the optical link training proposal that addresses the overshoot/undershoot issue due to required pre-emphasis in 128GFC MMF links. Committee continues to study the optical link training and how to implement it.
   - Committee continues to evaluate the 128GFC link up times and the impact on system level performance for link up/down events. The current 64GFC link up times is 11 seconds, and the estimated link up times is 20 seconds for 128GFC.

The next scheduled INCITS T11 meeting will be virtual/face-to-face on October 5-7 2021, Coeur d'Alene, ID, USA.

IEC SC48B meeting: September 14-15, 2021, Virtual meeting

- The 2nd ED of IEC63171 was started to revise the 2-way data transmission specification that are common among all standards in the series. EMC issues due to power contacts in close proximity to data contacts should be covered. Individual standards shall cover all required specifications not covered in 63171.
- Comments to IEC63171-1 ED2 CD have been received and are being reviewed by our team in preparation for submitting the standard as a CDV.
- IEC60512-2-1 and -2 contact resistance test methods and measurements are found to be confusing. An ad hoc group will be formed to determine improvements to the relevant documents.

The next scheduled IEC SC48B meeting will be virtual/face-to-face hybrid on March 15, 2022, Paris, France.

IEC SC86A meeting: No meetings were held during Q3, 2021

The next scheduled IEC SC86A meeting will be virtual on October 15-25, 2021.

IEC SC86B meeting: No meetings were held during Q3, 2021

The next scheduled IEC SC86B meeting will be virtual on September 17-October 26, 2021.

IEC SC86C meeting: No meetings were held during Q3, 2021

The next scheduled IEC SC86C WG1 meeting will be virtual on October 8-27, 2021.

IEC TC46 SC46C/WG7: September 9, 2021, Virtual meeting

1. **IEC TR 61156-1-3/AMD1 ED1 - Multicore and symmetrical pair/quad cables for digital communications**

   Part 1-3: Electrical transmission parameters for modelling cable assemblies using symmetrical pair/quad cables.
   - A CD has recently been circulated that closes November 19, 2021.

2. **IEC 61156-7, IEC 61156-8 - Multicore and symmetrical pair/quad cables For digital communications**

   Part 7: Symmetrical Pair Cables With Transmission Characteristics Up To 1200 MHz - Sectional Specification For Digital And Analog Communication Cables, and Multicore and symmetrical pair/ quad cables for digital communications.
   - The working draft for IEC 61156-7 has been discussed. The discussion included whether the revision of this sectional specification could be used to include a specification for cables applicable to 25Gb/s transmission requiring that the upper frequency covered by this standard to be extended to 1250 MHz. This was unpopular and not adopted.

3. **IEC 61156-11 ED2 - Multicore and symmetrical pair/quad cables for digital communications**

   Part 11: Symmetrical single pair cables with transmission characteristics up to 600 MHz - Horizontal floor wiring - Sectional specification.
   - During comment discussion, text that explicitly excluded unshielded construction was removed. The requirements are such that an unshielded version is unlikely, but the document no longer explicitly requires shielded construction.

4. **IEC 61156-13 - IEC 61156-13. Multicore and Symmetrical Pair/quad Cables for Digital Communications**

   Part 13: Symmetrical single pair cables with transmission characteristics up to 20 MHz. Horizontal floor wiring. Sectional specification.
   - Similar to the -11 discussion, text that explicitly excluded unshielded construction was removed. The requirements are such that an unshielded version is unlikely, but the document no longer explicitly requires shielded construction.

The next scheduled IEC TC46 SC46C/WG7 meeting will be virtual on April 25, 2022.

ITU-T SG15 WP2 meetings: No meetnigs were held during Q3, 2021

The next scheduled ITU-T SG15 meeting will be virtual on December 6-17, 2021.

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