Workshop Objectives

- This workshop focused on topics of common interest regarding emerging standards in the AI/ML world including:
  - AI applications
  - Protocols
  - Higher Speed Solutions
  - Fiber for AI Applications

- The objectives of this workshop included, but were not limited to, enhancing long-standing collaboration and coordination between IEEE 802 and ITU-T Study Group 15 through discussion and information exchange on topics of common interest.

Session 1 – Introduction – AI Applications

- Application of AI in optical networks include fault classification, sensing, intelligent awareness of traffic, and energy-efficient scheduling.
- Optical architectures for AI networks can be optimized through innovations in power efficiency, coherent pluggables, full-fiber systems, and addressing power and faceplate density.
- IEEE 802 Nendica studies AI data center networking and is moving to address backward notification
- Ultra Ethernet Consortium develops Ultra Ethernet Transport for remote memory access in converged scale-up and scale-out
- IEEE 802.11 studies the applications of AI/ML in support of the air interface and is considering AI offload, while WLAN sensing provides data that may be useful for AI analysis

Session 2 – Protocols

- The Ultra Ethernet (UE) Link Layer Retry (LLR) fixes link errors, while the UE Credit Based Flow Control (CBFC) removes congestion losses. Together LLR and CBFC provide reliable delivery across Scale-Up and Scale-Out AI networks.
- Scale-Across extends AI networks over long distances, necessitating congestion control that distinguishes local from remote control loops.
- IEEE P802.1EJ aims to standardize a Back-to-Sender protocol for faster congestion feedback in Scale-Across and Scale-Up networks.
- As traditional synchronization hits its limits, AI/ML replaces static rules with predictive orchestration—improving network performance and operational resilience.
- High-precision time sync in DCs enables data consistency and availability across clusters. Precise sync and deterministic latency enable efficient distributed AI training and operations.
- AI/ML improves transport network efficiency. Enhanced Network Operations (ENOs) tools for planning, optimization, and analysis can interact with management control systems to optimize performance.

Session 3 – Higher Speed Solutions

- Collaborative work between ITU-T SG15 and IEEE P802.3dj related to IEEE P802.3dj successful example!
  - The Dispersion Challenge : Statistical Chromatic Dispersion model of ITU-T G.652 fibre for high-speed IM/DD.
  - ETCC Transmitter Quality Metric (TQM) : Now in the current drafts of ITU-T G.698.2 and IEEE P802.3dj
- Solutions needed going forward
  - 1.6 Tb/s Port capacity – significant market opportunity
    - Leverage 400 Gb/s signaling (IEEE P802.3dv)
    - Potential for 1.6 Tb/s Coherent signaling in AI networks – scale-out (?) and scale across
  - 3.2 TbE
    - Leverage 400 Gb/s signaling (IEEE P802.3dv)
  - Fiber challenges –
    - Performance parameters - Loss / Chromatic Dispersion / Polarization mode dispersion /latency
    - Congestion
- Scaling beyond 800G to Beyond 1 Terabit (B1T) requires future continuing collaboration between IEEE 802.3 and ITU-T SG15
  - alignment on new physical link models
  - ETCC-based TQM methodology
  - Equalization Enhanced Phase Noise (EEPN) mitigation to ensure multi-vendor interoperability

Session 4: Fiber for AI Applications– Takeaways

- Fiber and cable development have not been asked to innovate this fast or in so many applications in over 30 years.
  - The reach of uncooled CWDM transmission in O-band has been shrinking with each datacenter generation.
  - PMD/DGD will likely impair traditional short reach IMDD transmission performance at 400G/lane.
- New and emerging projects are underway or being considered in IEEE 802.3 and ITU-T SG15 to explore new fiber or optical link standards such as new SMF, new MMF, MCF and HCF to address these challenges.
- Many solutions will be tested:
  - CPO, NPO, LPO, Silicon photonics, VCSELs, microLED, etc
  - Which will be adopted remains the big question
  - Each may require new fiber and cable innovations at scale
- “One size fits all” will probably not be sufficient

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Panel Discussion

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Hydration break!

Presentations to be available within days at
https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2026/0711/Pages/default.aspx

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