Applying Gfast technology in an age of fiber integrations

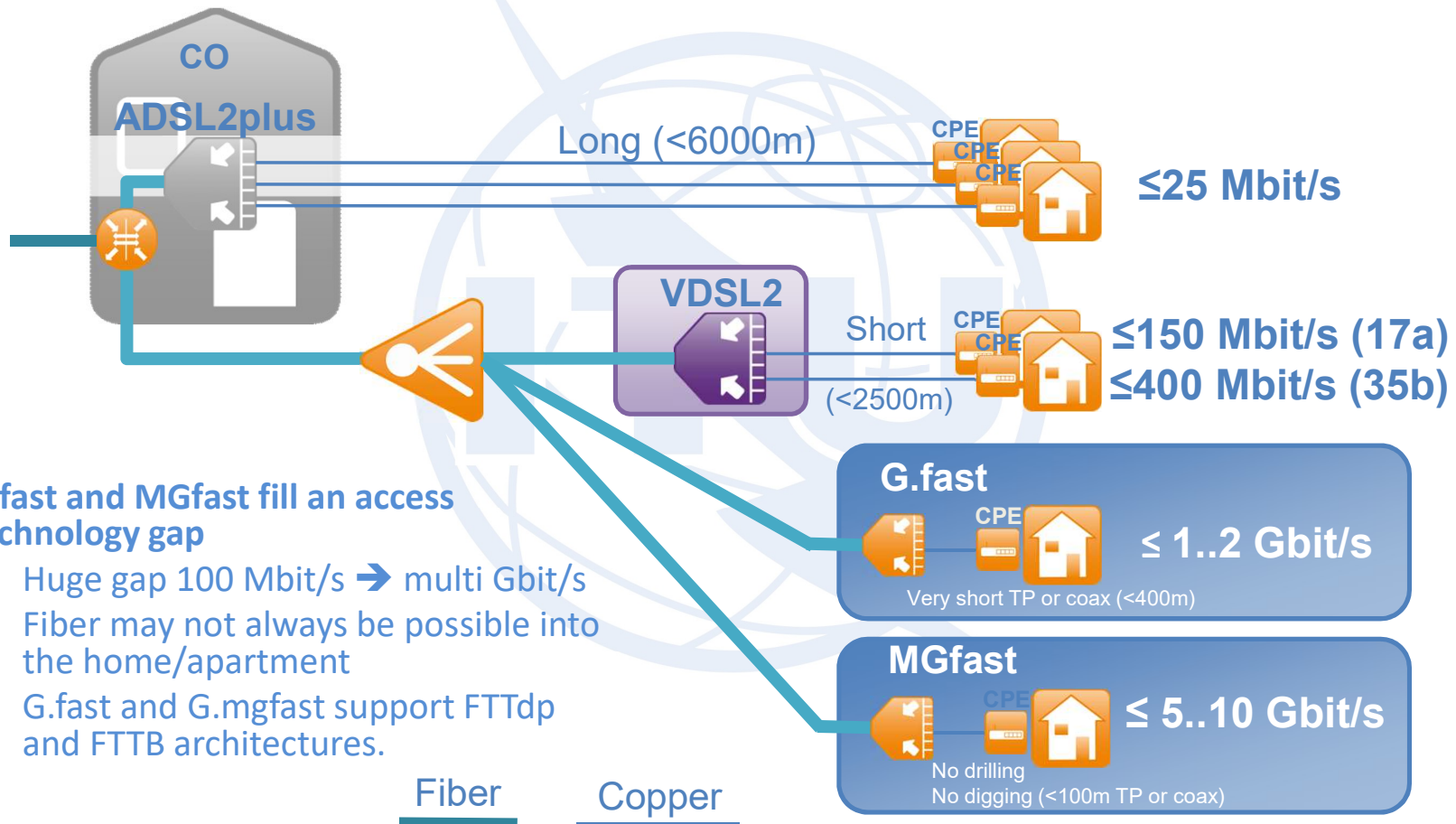## Tom Starr – ITU-T WP1/15 Chairman

Scope of ITU-T WP1/15

- Q2/15: Optical systems for fibre access networks
  - PON (Passive Optical Network)
- Q4/15: Broadband access over metallic conductors
  - ADSL, VDSL, G.fast, MGfast
- Q15/15: Smart Grid access
- Q18/15: Home networking
  - G.hn: home networking over power wires, phone wires, coax
  - G.vlc: visible light communications through the air

Overview of Access Network Solutions with metallic cables

CO

ADSL2plus

Long (<6000m) — CPE / CPE / CPE — ≤25 Mbit/s

VDSL2

Short — CPE / CPE — ≤150 Mbit/s (17a)

(<2500m) — ≤400 Mbit/s (35b)

G.fast and MGfast fill an access technology gap

- Huge gap 100 Mbit/s ➔ multi Gbit/s
- Fiber may not always be possible into the home/apartment
- G.fast and G.mgfast support FTTdp and FTTB architectures.

G.fast

CPE — ≤ 1..2 Gbit/s

Very short TP or coax (<400m)

MGfast

CPE — ≤ 5..10 Gbit/s

No drilling
No digging (<100m TP or coax)

Fiber   Copper

ITU

Key aspects of Gfast

- Works on many types of wire – up to 500m
  - Phone wires (twisted pair and quad)
  - CAT 5, 5e, 6 data-grade wire
  - Coax wire
- Dynamic Time Assignment
  - Automatically adjusts up/downstream proportion from 5/30 to 30/5
  - Independent DTA suitable for coax
  - Coordinated DTA suitable for twisted pair – avoids near-end crosstalk
- Vectoring to cancel far-end crosstalk
- Configurable start and stop frequencies, PSD shaping and notching
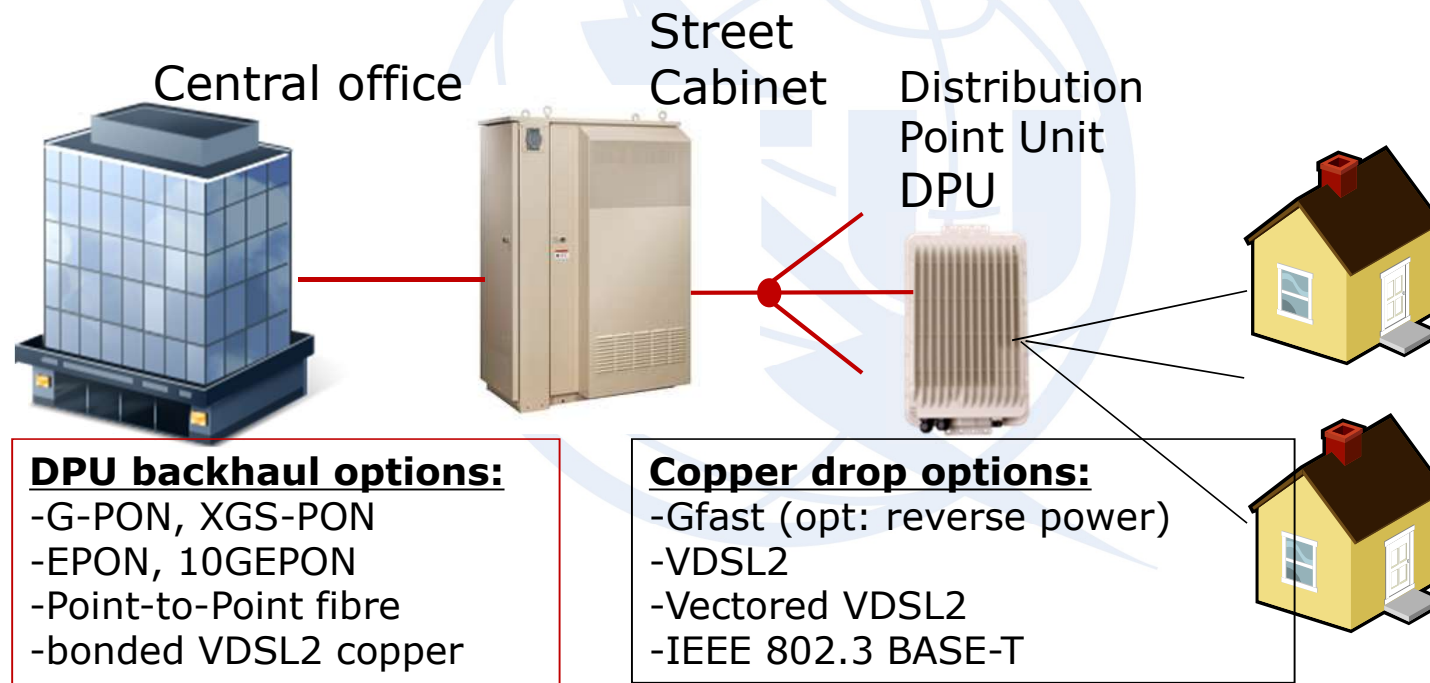- Rapid start-up and retrain

Gfast and MGfast Spectrum and bit rates

- Gfast 106 MHz
  - \> 2M lines deployed
  - Up to 1 Gbps aggregate – TP and coax
- Gfast 212 MHz
  - Deployment started
  - Up to 2 Gbps aggregate – TP and coax
- MGfast 424 MHz
  - 1Q2020 target Consent
  - Up to 4 Gbps – TDD on TP wire
  - Up to 8 Gbps – FDX on coax
- MGfast 848 MHz
  - YE2021 target Consent
  - Up to 4 Gbps – TDD on TP wire
 - Up to 16 Gbps – FDX on coax
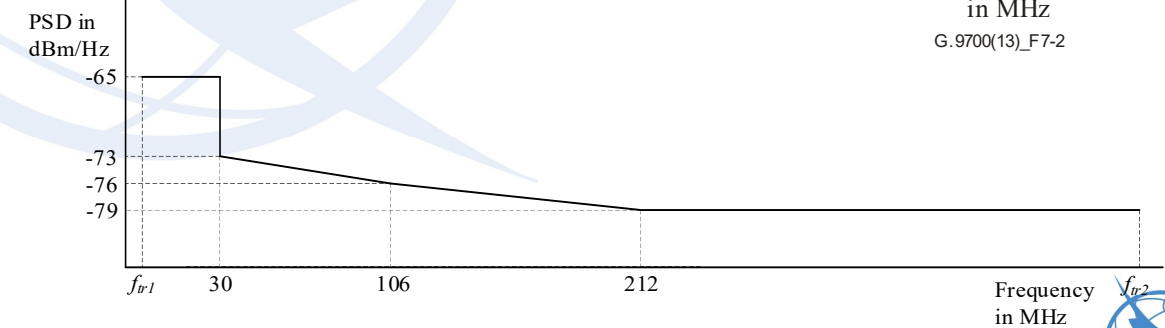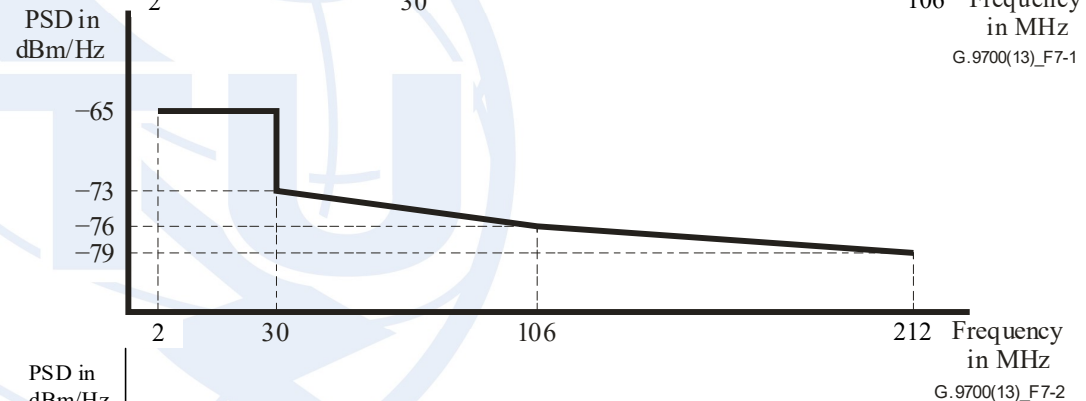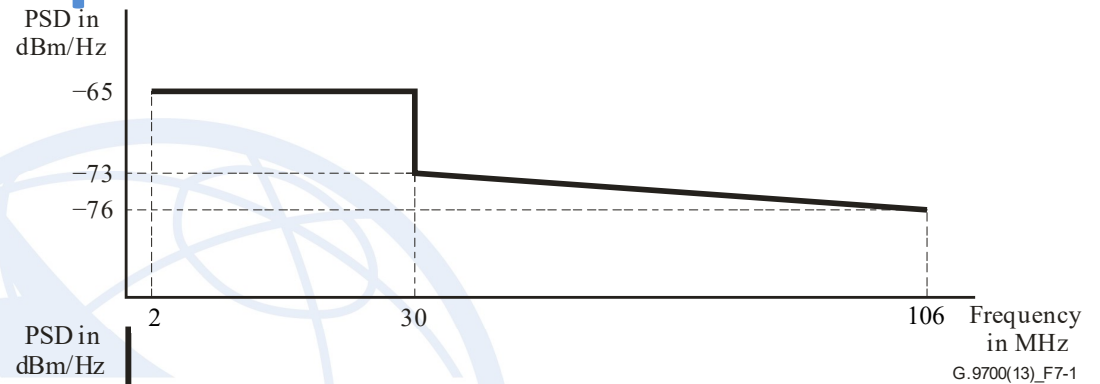
Gfast/FTTdp: Fiber To The distribution point

- FTTdp architecture is specified in Broadband Forum TR-301i2
- One FTTdp architecture benefit is that the DPU equipment typically serves 1-20 lines, making it small enough to place on a pole, in a hand-hole or in a small pedestal or in basement

Central office   Street Cabinet   Distribution Point Unit DPU

DPU backhaul options:
-G-PON, XGS-PON
-EPON, 10GEPON
-Point-to-Point fibre
-bonded VDSL2 copper

Copper drop options:
-Gfast (opt: reverse power)
-VDSL2
-Vectored VDSL2
-IEEE 802.3 BASE-T

Key aspects of FTTdp

- Reverse power feeding (RPF) the DPU from CPE, per ETSI TS-101548-2

- Persistent Management Agent (PMA) acts as management proxy in the event the DPU loses power

- Enables customer self-install of CPE

- Gigabit service deployed faster and at less cost than typical FTTH

- Gigabit service for areas where constructing new cable is not feasible or too expensive
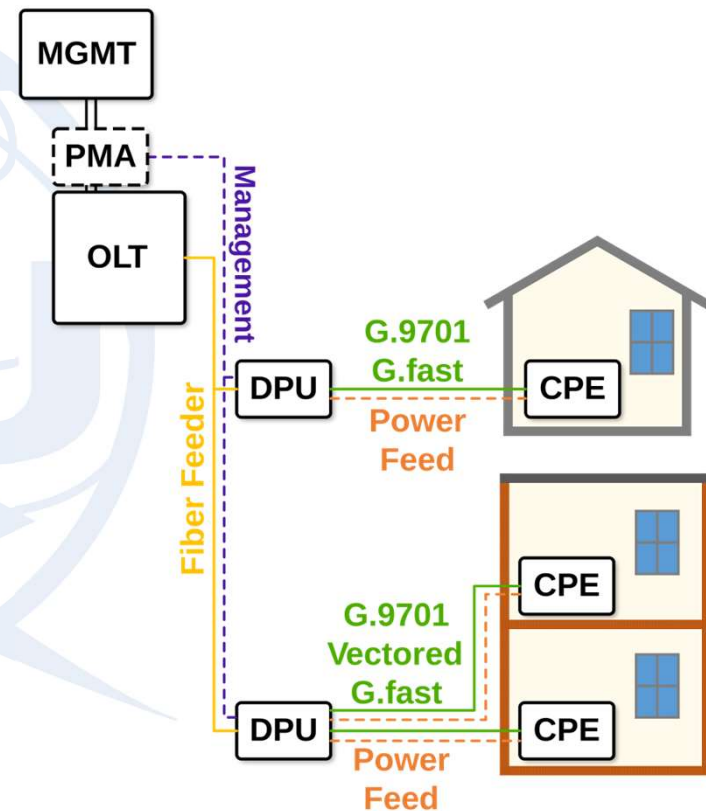
MGfast - Multi-Gigabit fast

— Target

- Aggregate data rates up to 4 Gbps over single TP, 16 Gbps over coax with FDX
- Operation over twisted pair, quad, CAT5, and coaxial cable
- Consent of 424 MHz version 1Q2020

— New for MGfast

- 424 MHz and 848 MHz profiles
- Full-duplex operation (echo cancelled mode) nearly doubles bit-rate on coax
- Topologies: point-to-point and point-to-multipoint
- Advanced coding (LDPC) boosts bit rate up to 8% compared to G.fast coding
- TGV (targeted generalized vectoring) – boosts twisted pair performance
- Ultra low latency (< 1ms) with proactive retransmission
- Four levels of Physical Layer QoS to support network slicing

FASTBACK – copper backhaul from DPU

- ITU-T has started development of G.fastback standard
- Bonding multiple Gfast lines to connect DPU to the fiber-fed cabinet
- Further reduces the need for additional fiber construction
- Multiple, tandem FASTBACK sections extends Gigabit reach up to 1.1km
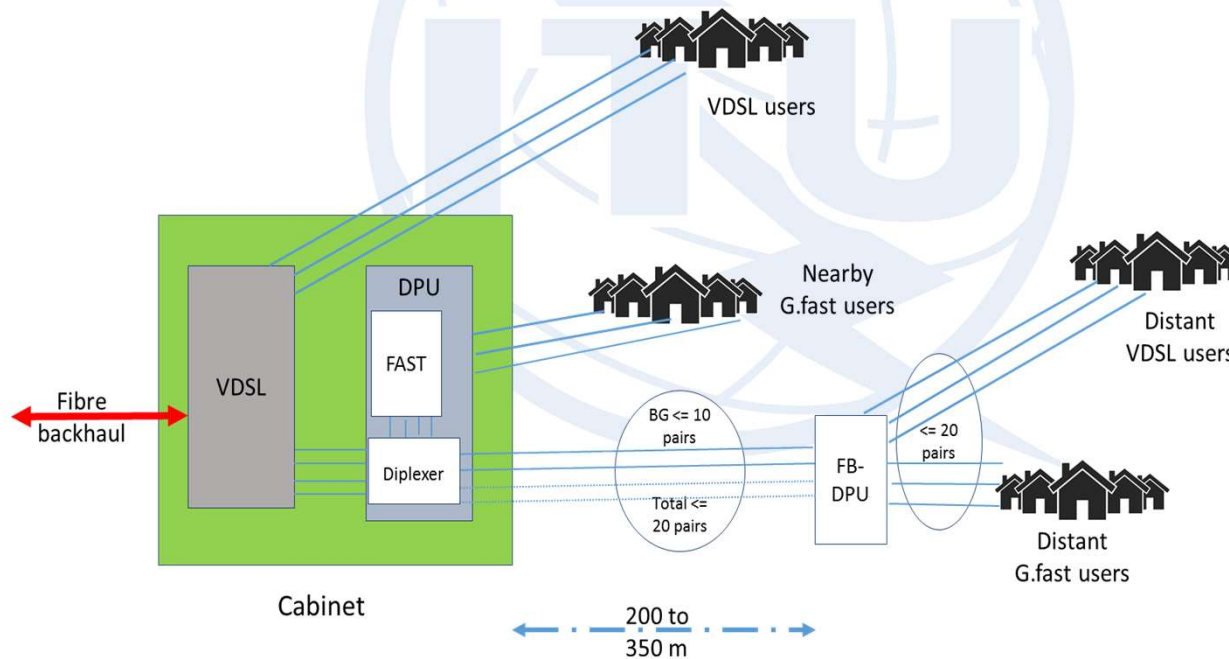
Collaboration with Broadband Forum

- Long standing collaboration with the Broadband Forum
  - BBF test plans have followed up with the ITU-T DSL standards evolutions on ADSL, ADSL2, ADSL2plus, and VDSL2
- Broadband Forum has been recognized by the ITU-T SG15 as a partner in improving the DSL Recommendations
  - Multi-vendor plugfests (sandbox testing) identify shortcomings
- Broadband Forum equipment certification program
  - Detailed testing of the G.fast technology interoperability and functionality
  - Based on ITU-T G.fast specifications G.9700/9701
- Broadband Forum YANG development
  - Interoperability at the VDSL2 and G.fast management interface
  - Based on ITU-T Physical Layer OAM specifications G.997.1/2