

Session 1: Copper Broadband Technology Developments

Up to 8 Gbit/s broadband with new ITU standard MGfast



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ITU-T SG15/Q4 experts group

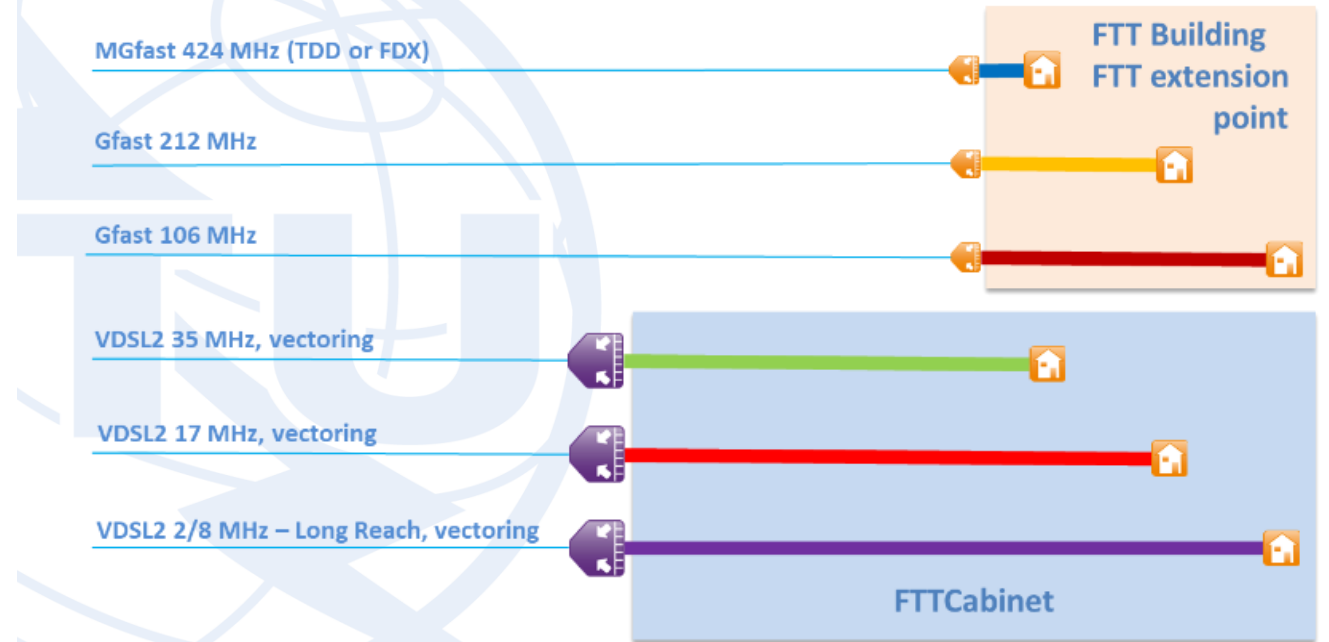
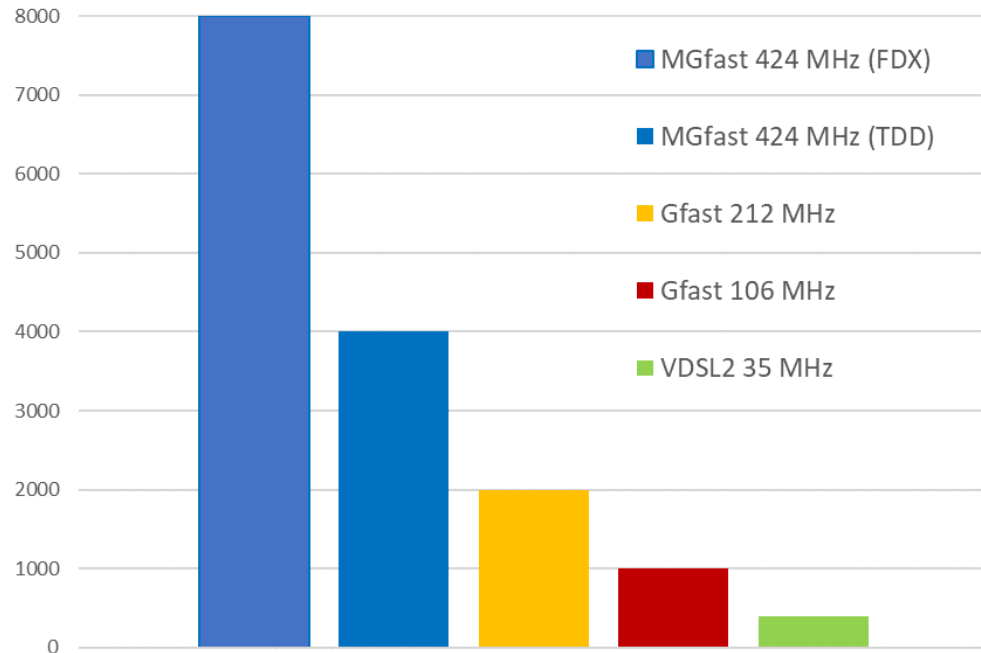
- Study Group 15: Networks, Technologies and Infrastructures for **Transport, Access** and **Home**
- Q4: Broadband access over **metallic conductors** (twisted pair and coax)
- Projects: xDSL, G.(mg)fast, bonding, testing, management
- Main liaisons: **ITU-R, ETSI TC ATTM** and **Broadband Forum**

- G.fast was approved in Dec 2014, revised in March 2019
- **MGfast was approved in April 2021**

TURNING COPPER INTO GOLD
SINCE 1997



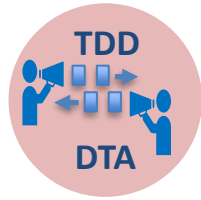
Overview Copper Access Network Solutions



Fiber to the most economical point



MGfast inherits G.fast features



- **Half-duplex** (Time-Division-Duplexing)
- **Easy service rate split down/up**
- Dynamic based on instant traffic needs
- Independent / Coordinated



- **Spectrum notching** for electromagnetic immunity
- Narrowband Radio Interference
- ITU-R defined bands for restricted emission



- **Impulse noise protection**
- Data retransmission
- Repetitive and isolated signal erasures



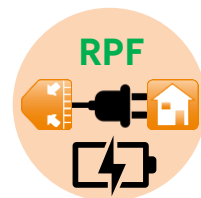
- **Noise cancellation** (Far-end Crosstalk)
- Pre/post-compensate useful signal with predicted noise
- Receiver sees “noise-free” signal
- Higher channel capacity due to lower noise level



- **End user self-installation**
- Deployment made easier (no truck-roll)
- VoIP replacing POTS on access wiring
- Operate in presence of bridged taps



- **Frequency and time synchronization**
- Some apps/deployments need precise network timing
- Deliver “wallclock” at user side with ~10s of nanoseconds precision to network-wide time

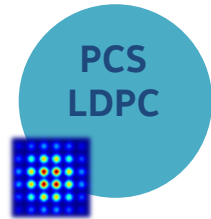


- **Reverse power feeding**
(power DPU from the CPE/premises)
- Defined for point-to-point operation
- Addressed in collaboration with ETSI ATTM

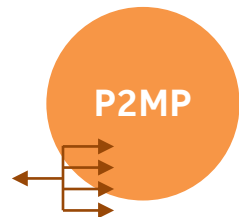
MGfast main new features



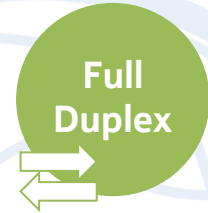
- Up to **4Gbit/s operation** per direction
- Maximize the reach and coverage of a **'universal' 1 Gbit/s symmetric service**
- Co-existence with G.fast



- Low Density Parity Check (**LDPC**) coding
- Probabilistic Constellation **Shaping**
- Gap-to-capacity of $< 2\text{dB}$
- 5-10% data rate increase over TCM+RS



- **Point-to-Multipoint operation** over twisted pair or coax
- DPU resource sharing over multiple CPE
- Flexible Bandwidth Reassignment – each CPE uses part of spectrum
- CPE authentication with IEEE802.1X



- **Support for Full-duplex (FDX)** on twisted pair and coax; nearly doubles the data rate capacity on coax.
- Simultaneous downstream and upstream transmission also requires **vectoring to cancel near-end crosstalk**
- **Data rate increase & RTT latency decrease**

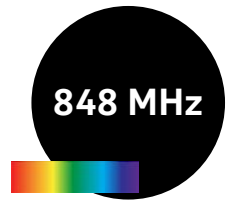


- **Multiple QoS** classes configured per individual line
- Per QoS class configuration of maximum latency
- **Ultra low-latency services ($< 1\text{ ms}$)**
- Differentiation through flexible combining of requested and proactive retransmissions



- **Discontinuous Time and Frequency Operation**
- Reduces complexity of large-scale vectoring systems
- Enables power savings – especially at the DPU
- Reserve part of time slots and higher frequencies for (unvectored) use by one line at a time, as required/implied by traffic needs of individual users

Future enhancements



- **MGfast 848 MHz operation on coax**
- Uses all spectrum under the sat-tv overlay
- **Up to 8 Gbit/s operation** with FDX
- Nearly doubles the data rate capacity on coax



- Using **multi-pair G.fast for backhaul** DPU uplink
- “Back-to-back DPUs” causes near-end crosstalk to be cancelled by vectoring
- Cascade multiple fastback DPUs for longer reach
- Multi-hop TDD alignment causes timing challenge



- **MGfast low power operation**
- DTFO already enables power savings
- Sending signal only when sending data
- Battery operation
- CO2 footprint reduction



- **Faster Dynamic Bandwidth Redistribution (DBR)**
- New procedure for use with p2mp operation
- Better support of user traffic driven redistribution
- Improved capacity re-allocation between multiple devices in the user premises sharing the MGfast bandwidth

Collaboration with Broadband Forum

Transforming the access network with gigabit capable broadband technologies

- **Technology requirements:** early liaison exchange about the what and why
- **FTTdp architecture (TR-301):** smaller nodes, reverse power feed (RPF)
- **Fiber Access Extension:** Gfast/MGfast and G.hn for affordable gigabit-class service to customers that can not be economically reached via fiber to the home (WT/MD-419)
- **YANG models** for Gfast, MGfast, bonding and RPF (TR-355), and DPU Ethernet/IP network functions (TR-383) facilitate introduction into the SoftwareDefined-WAN
- **Certification:** BBF-337 Gfast verifies functional interoperability and basic performance.
- **Performance:** setting the bar for Gfast operation over TP and coax with performance (TR-380) and RPF (TR-338) test plans.
- **Interoperability plugfests:** the engineers' sandbox at UNH
- **Marketing:** Promote/Showcase Gfast/MGfast technology for deployment (BASe)



[ITU-T News : MGfast announcement](#)

[ITU-T Flyer MGfast](#)