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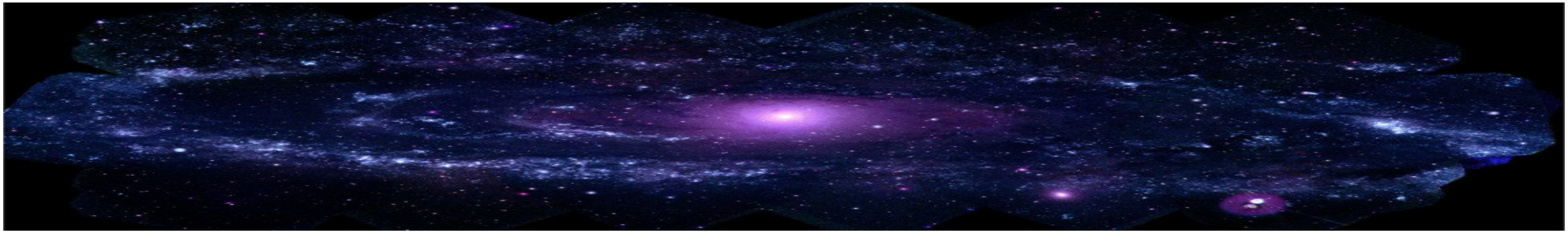
GEPOF for Home Networking



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IEEE 802.3 Interim Meeting

Gigabit Ethernet over POF Study Group

September 8 -12, 2014

Ottawa, Canada

OUTLINE

- Home networking mediums and standards
- GEPOF use cases
  - FTTH home networking applications
  - FTTH MDU applications
  - DOCSIS HFC home networking
- GEPOF home networking requirements

Home networking mediums today…

Twisted pair (Since 1880's)

G.HN

Coax cable (Since 1940)

MOCA

What are in common?

- **Limited spectrum**
- **Limited bandwidth**
- **Vulnerable to RF interference**
- **Vulnerable to EMI**
- **Complexity at PHY & MAC layers**

Power line

Homeplug av

Air or vacuum (better be air)

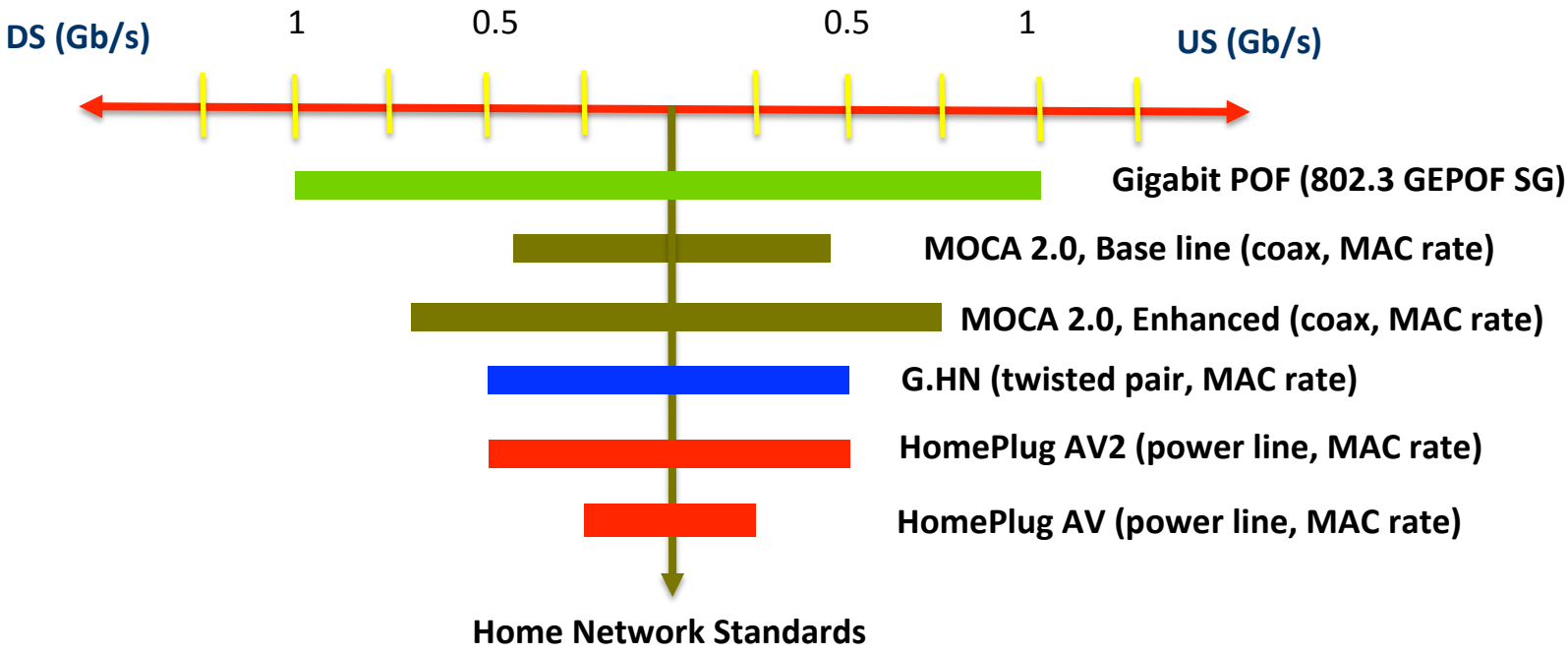
802.11x

… Tomorrow SMART HOME needs future proof networking medium

Home, Smart Home, Gigabit home…

- Advance of FTTH technology enables gigabit services to the home
  - 10G EPON can provide 10 Gbps symmetric shared bandwidth
  - NG-PON2 can provide 40 Gbps aggregated capacities
- Smart Home requires high bandwidth connectivity in home
  - Cloud, 4K video, multi-room DVR, high speed Internet, Internet of things…
- Old home network physical medium has become the bottleneck
- Fiber to the Device (FTTD) is future proof for the Smart Home
- POF is the choice for Fiber in the Home (FITH)

Home Networking Standards and POF



- The PHY rates of copper based mediums are ~ 2X the MAC rates
- GEPOF is expected to have much lower PHY overhead
  - Replace 8B/10B line code with 64/66B line code, reduce ~25% overhead,
  - Or, remove line code all together
  - Optimize FEC (RS, BCH, LDPC)

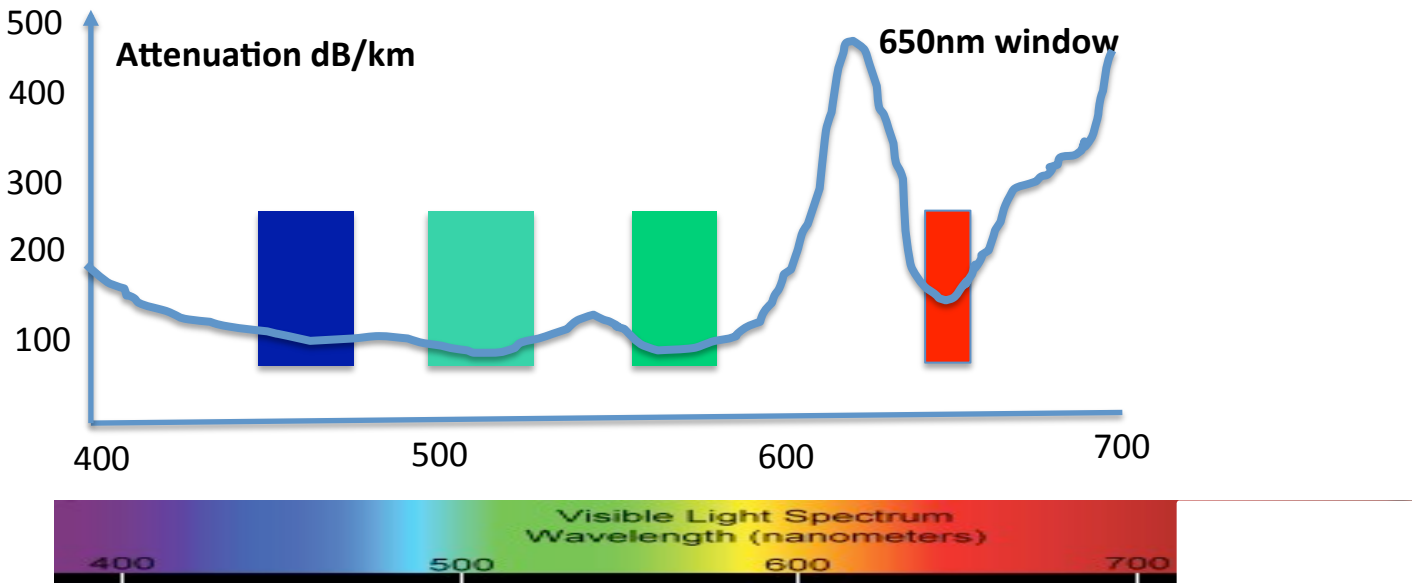
PHY overheads do matter

Low overhead is essential for medium that have limited bandwidth…

medium	Standard	PHY rate	MAC rate
Twisted pair	G.HN	900 Mbps	500 Mbps
Coax	MOCA 2.0 base	700 Mbps	400 Mbps
	MOCA 2.0 Extended	1.4 Gbps	800 Mbps
Power line	HomePlugAV	200 Mbps	80 Mbps
	HomePlug AV2 (SISO)	750 Mbps	300 Mbps

The excessive PHY overhead limits copper based medium for Smart Home networking

POF is future proof



- **The 650nm red window can be used for GEPOF today**
- **More low attenuation windows can be used in the future**

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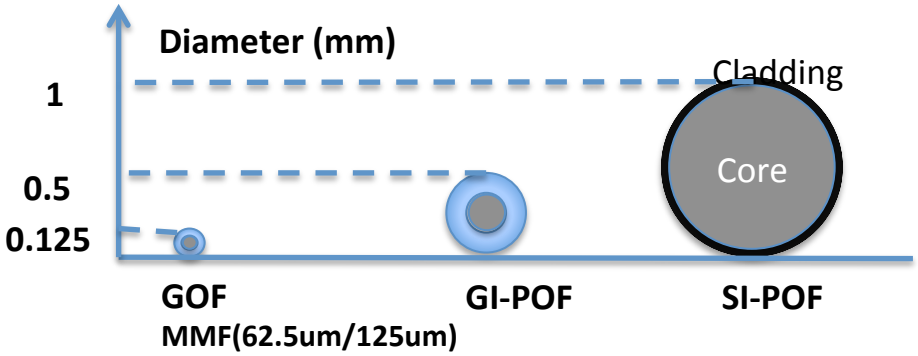
Advantages of POF for Home Networking

Comparison with GOF



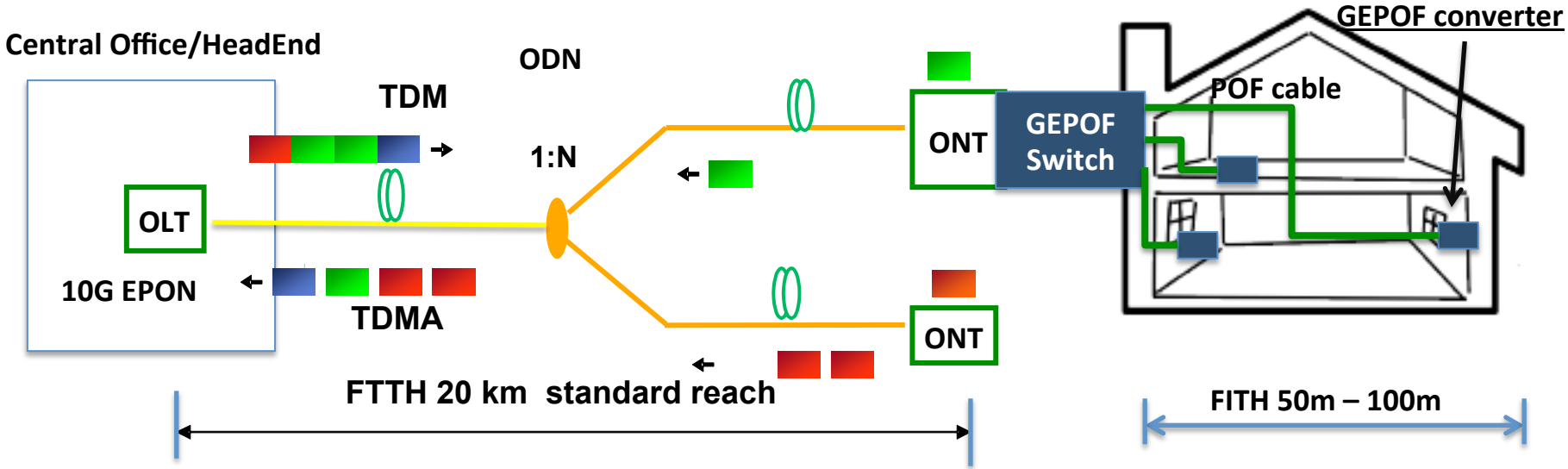
- Large core diameter 750-1000um
  - Low cost connectors
  - Easy installation and termination
- Low cost light sources for POF
  - High speed LED
  - VCSEL

Comparison with copper

- Optical medium
  - Immune to EMI
  - Immune to RF noises
  - Immune to lighting damages
  - Higher bandwidths
  - Future proof

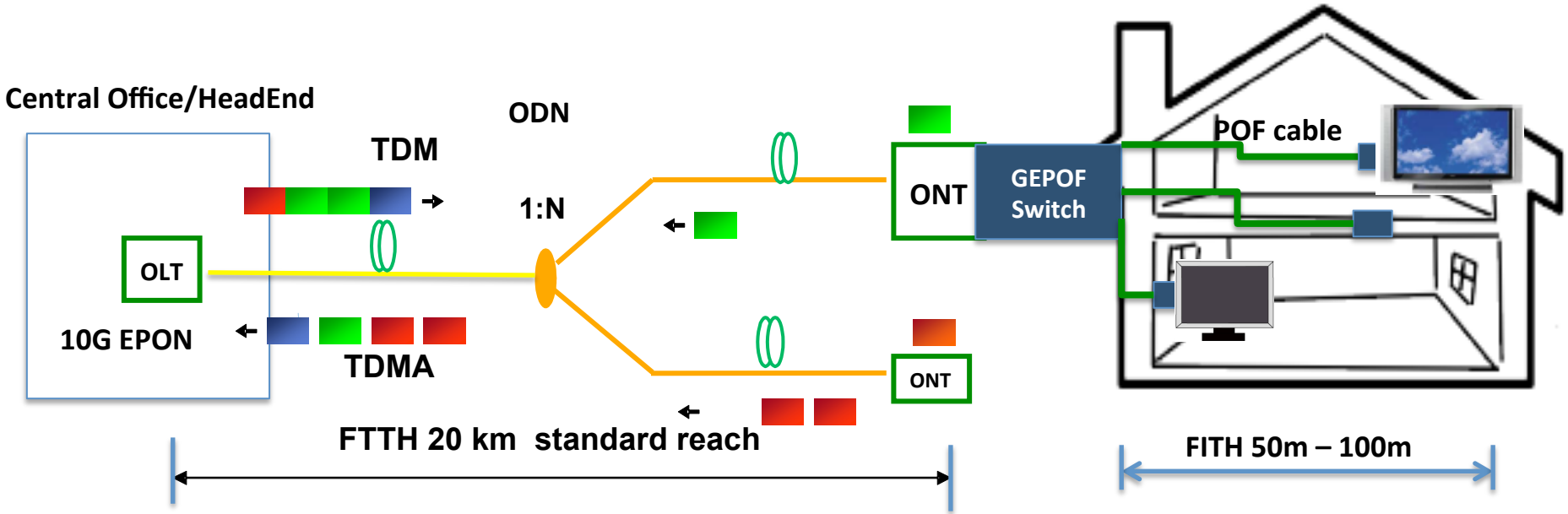
POF is a future proof medium for home networking

GEPOF use case 1: FTTH + FITH



- 10G EPON provides Gigabit service to the home
- GEPOF switch provides P2P Gigabit Ethernet over in home POF network
- Active GEPOF converter replaces CAT5 wallet
  - GEPOF converter can be powered by DC power
  - GEPOF converter can be powered by POE (Power Over Ethernet) from consumer devices

GEPOF use case 2: FTTH + FTTD



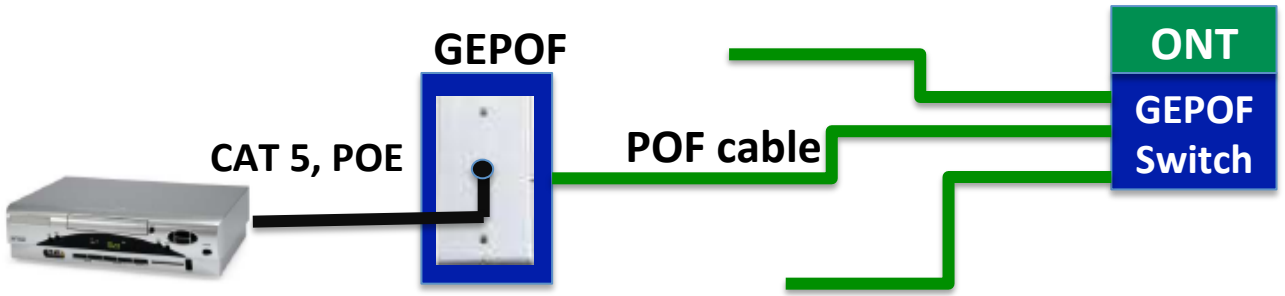
- 10G EPON provides Gigabit service to the home
- GEPOF switch provides P2P Gigabit Ethernet over in home POF network
- Passive POF wallet replaces CAT5
- GEPOF converters are integrated with consumer devices

TV with GEPOF interface

Migration to POF in home networking

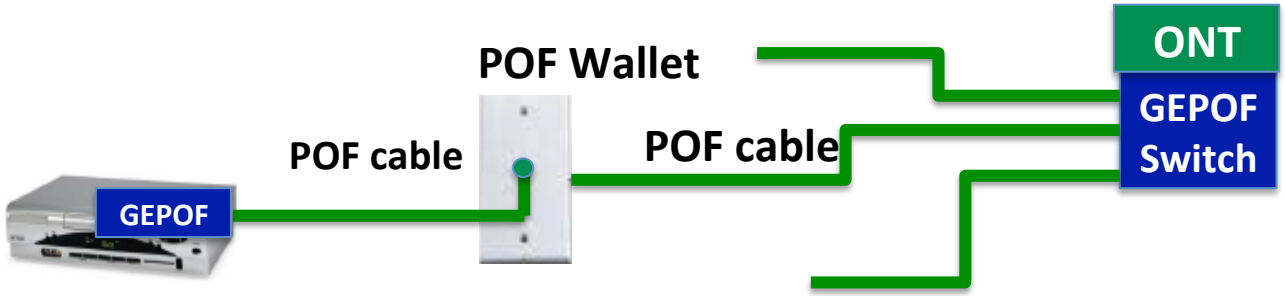
Fiber in The Home - FITH

GEPOF converters are powered by POE from consumer devices

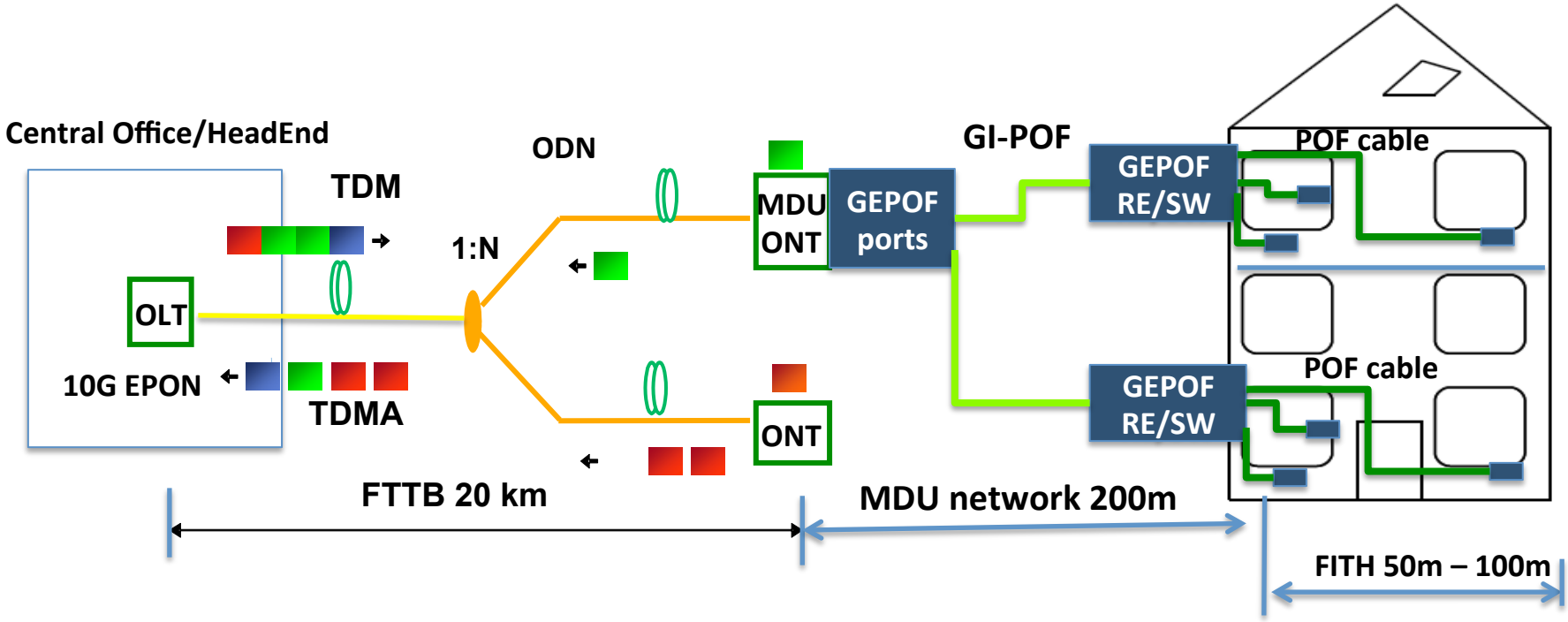


Fiber to The Device - FTTD

GEPOF converters are integrated with consumer devices



GEPOF use case 3: MDU applications



- MUD ONT with GEPOF ports provide GE to multiple homes and/or apartment units over POF cable
- GI-POF may be needed for MDU POF networks in order to achieve Gigabit rates with extended reach (further study)
- GEPOF repeater/switch provide GE to in home SI-POF network

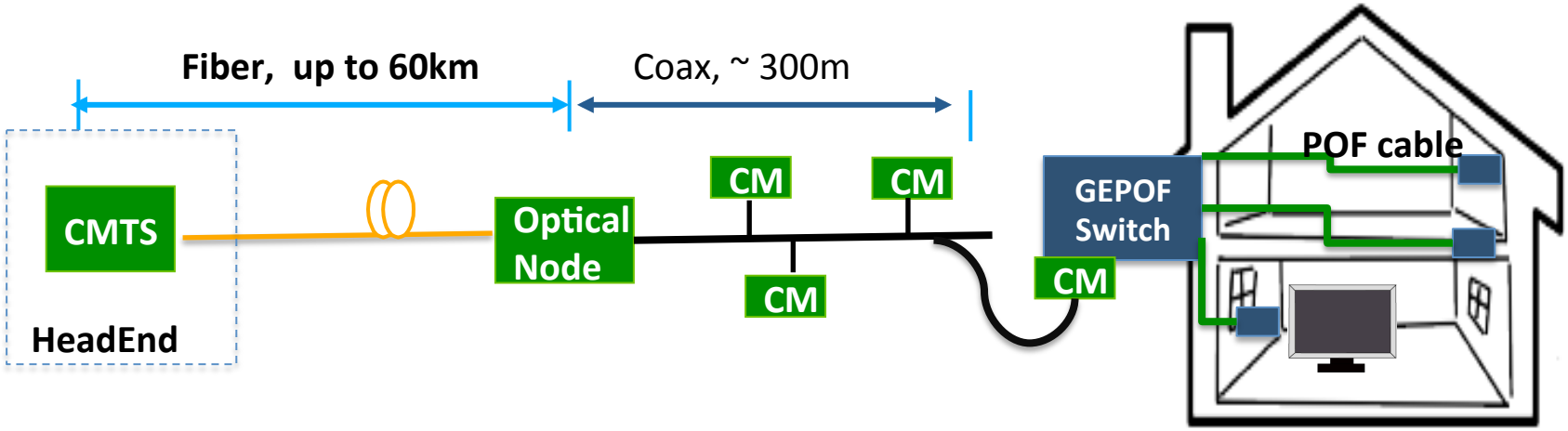
GEPOF use case 4: DOCSIS home networking

Problem

- Even though Coax cable has a shield, it can still be subject to EMI and RF interferences
- Some customer sites experience persistent RF interferences

Solution

- Replace in home Coax cable with POF
- A cable operator in US reported very positive results with POF in this scenario



GEPOF Home networking requirements

	Requirements	POF cable
FITH POF network	• Connections between gateway and devices • P2P topology • Distance: 50m • Date rate: 1 Gbps	• SI-POF cable
MDU POF network	• Connections between MDU units • P2P topology • Distance: 200m • Data rate: 1 Gbps	• GI-POF cable (further study)

The potential markets of POF

- Home networking
  - Replace twisted pair
  - Replace coax cable
- Optical LAN
  - Replace CAT 5 Ethernet cables
- Networking products with GEPOF interfaces
- Consumer products with GEPOF interfaces
- Automotive networking

Summary

- Smart Home needs future proof physical medium for home networking
- POF is a promising physical medium for future proof home networking
- We have discussed 4 GEPOF use cases
  - FTTH + FITH
  - FTTH + FTTD
  - FTTH MDU
  - DOCSIS HFC home networking
- The requirements of GEPOF for home networking and MDU networking are discussed

Thanks

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