Новые направления стандартизации инфраструктуры телекоммуникаций для сетей доступа

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2017

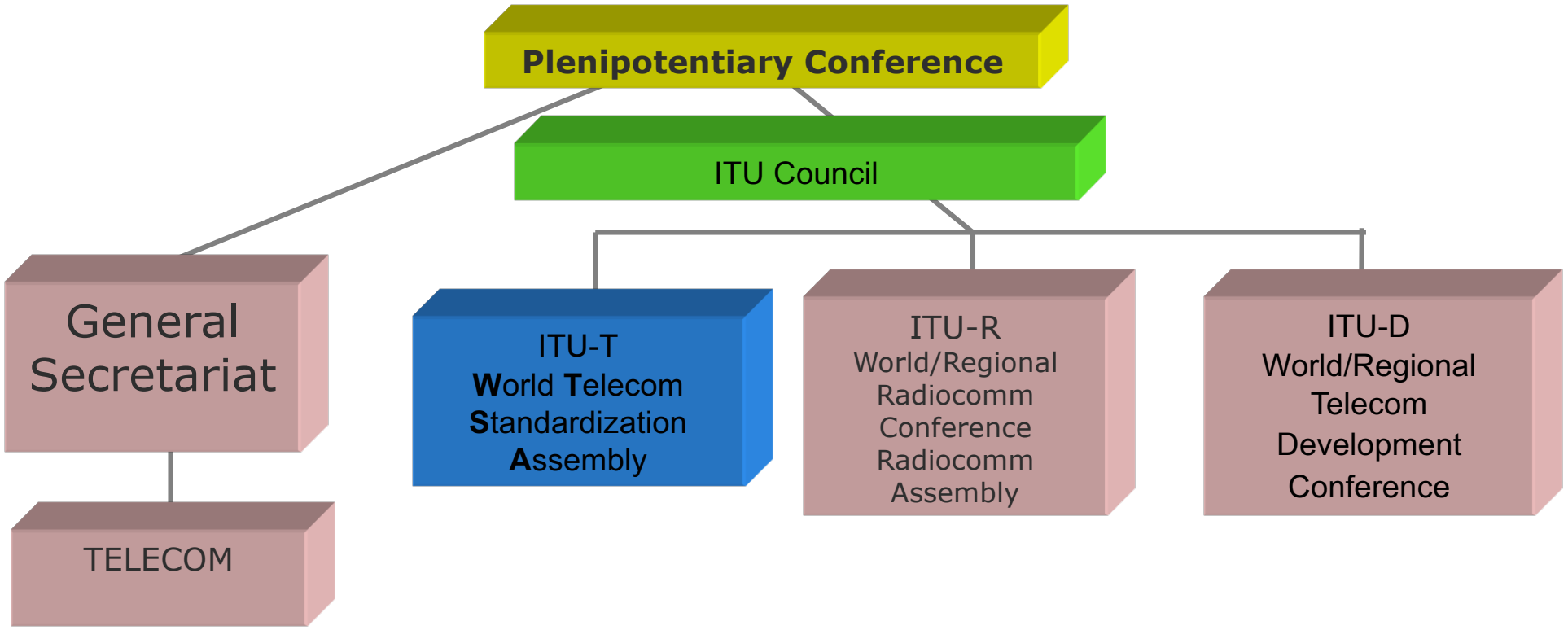
International Telecommunication Union

Committed to connecting the world

укртелеком

ITU Structure

Oldest UN specialized agency (founded in 1865)



International Telecommunication Union

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World Telecommunication Standardization Assembly - 16

The **World Telecommunication Standardization Assembly** is held every four years and defines the next period of study for ITU-T. WTSA-16 was held in Yasmine Hammamet, Tunisia, from **25 October to 3 November 2016** preceded by the Global Standards Symposium on **24 October 2016**

ITU Setting the standard

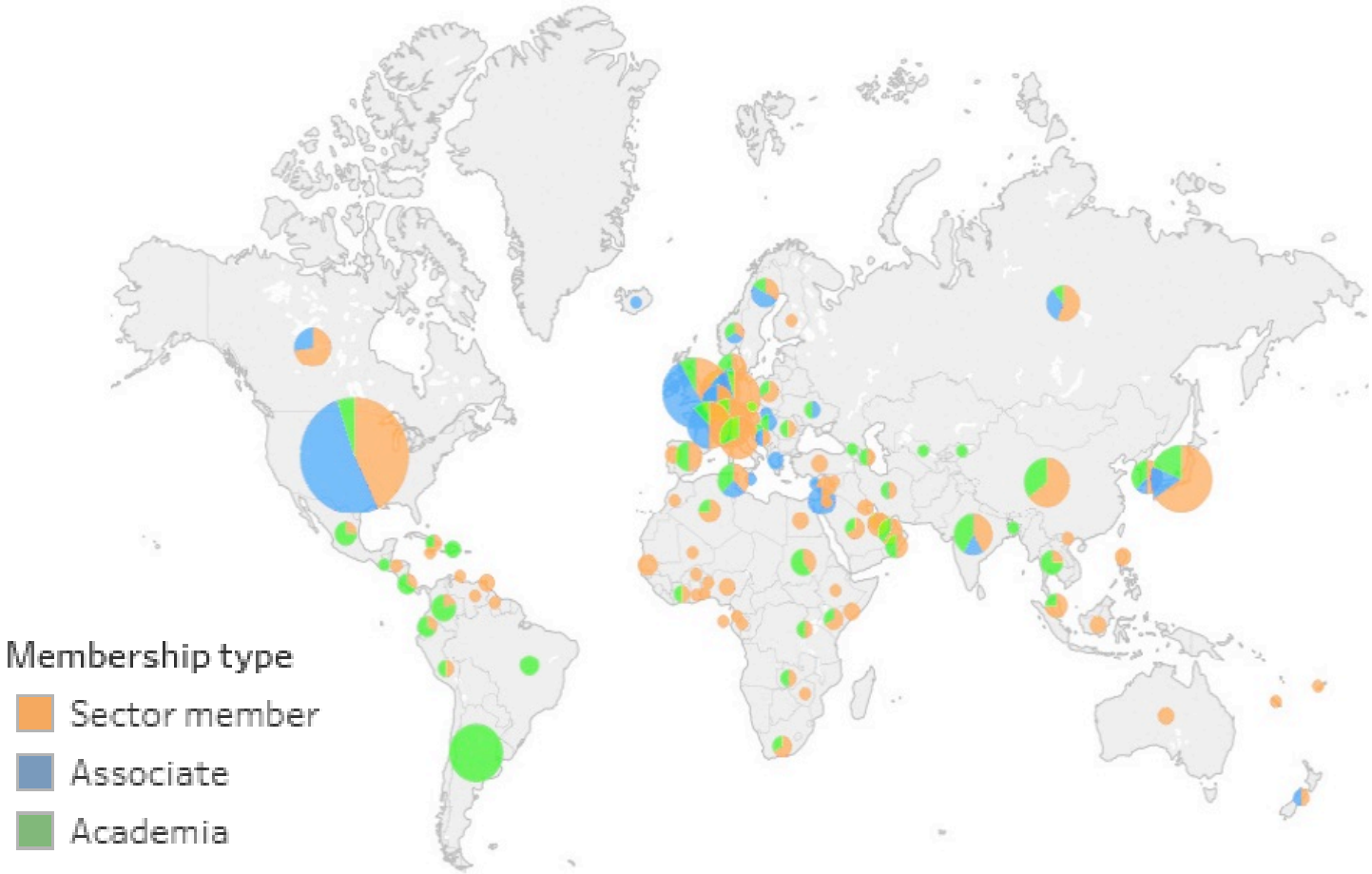
Countries

193

+700

+120

ICT players
Academia



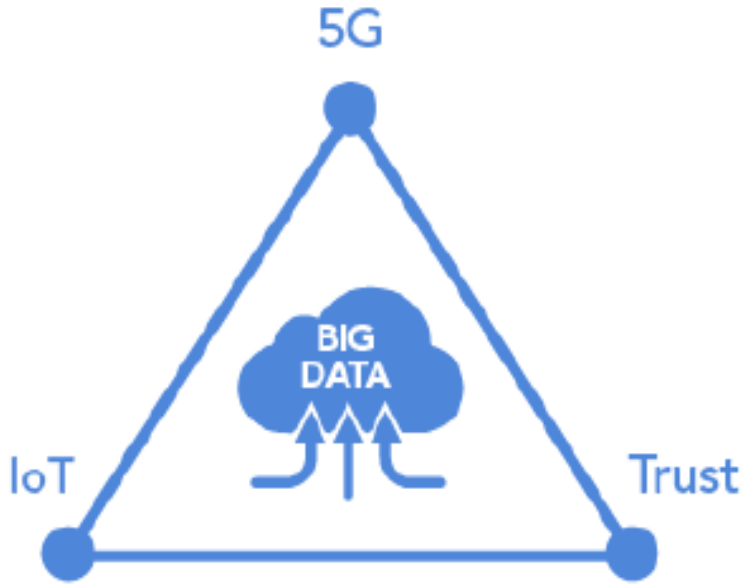
International Telecommunication Union
Committed to connecting the world

The future of our wireless networks depends on the future of our wireline networks

Setting the standard

2020 vision

- The future of standardization will be driven by 5G, IoT and Trust
- WTSA-16 will provide members with a standardization toolkit optimized to assist government and industry in achieving their ambitions for the year 2020 and beyond.



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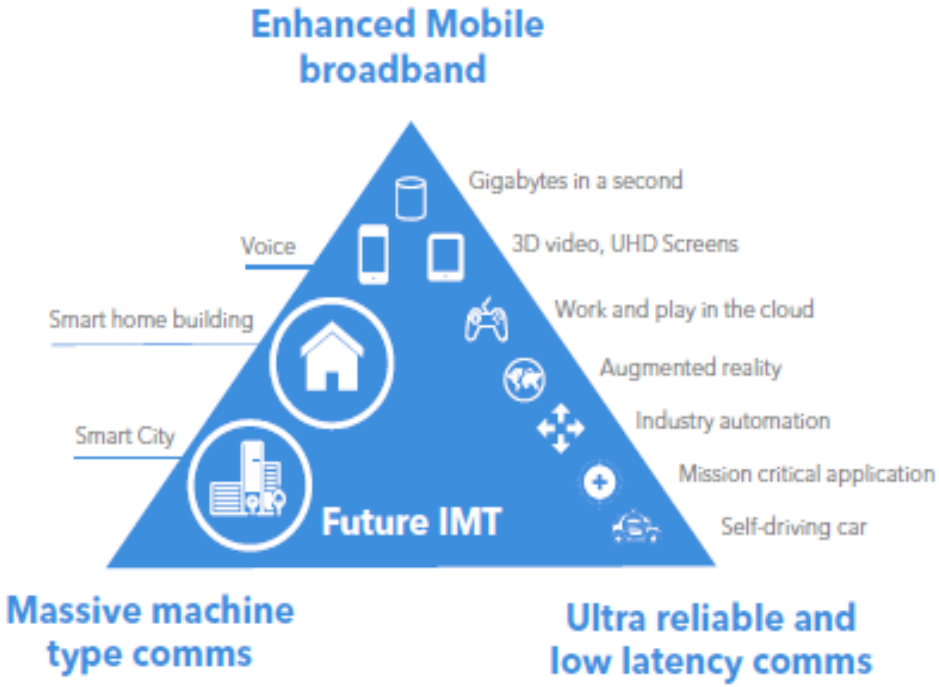
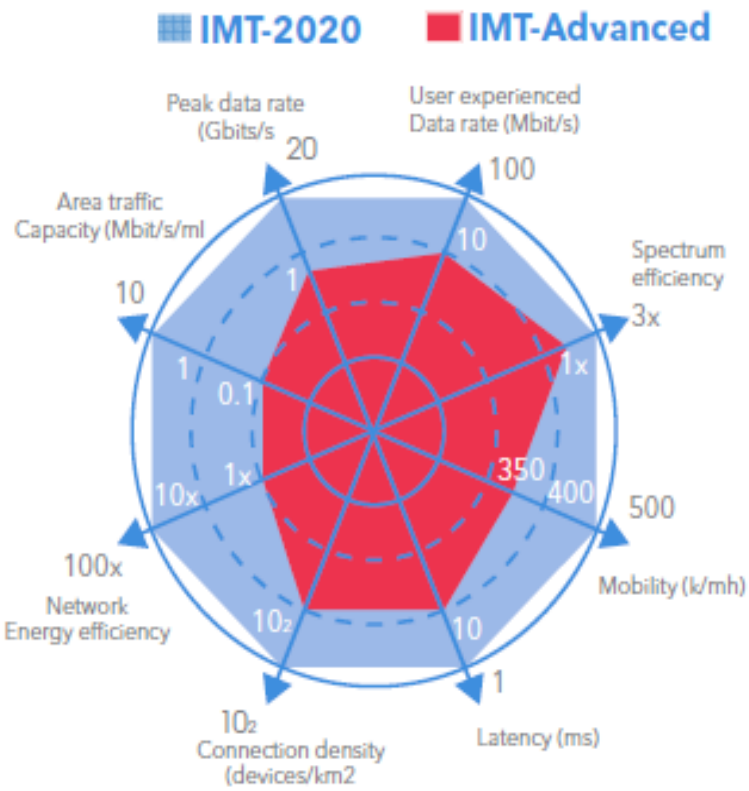
Smart 5G networks





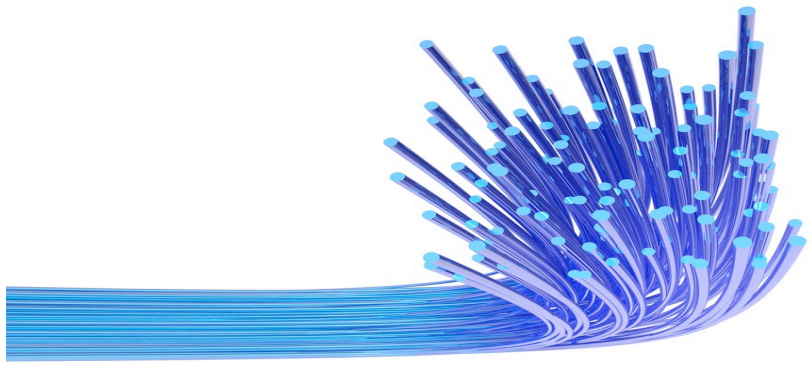
International Telecommunication Union
Committed to connecting the world

Setting the standard

95%

International traffic carried over fibre networks built using ITU standards

ITU-T continues to provide leadership in the standardization of networks, technologies and infrastructures for transport and access.



ИНТЕРЕС К ВОЛС ВОЗРАСТАЕТ НА ВСЕХ УРОВНЯХ

Cebit 2014: Die Datenkrake zähmen

Bundeskanzlerin Angela Merkel (CDU) und der britische Premierminister David Cameron (l) lassen sich am Stand der Telekom Glasfasern erklären.
Foto: dpa

"Измерение информационного общества" (издание за 2016 год)

Индекс развития ИКТ (IDI) – это составной индекс, включающий в себя одиннадцать показателей, составляющих одно контрольное значение, которое может использоваться для мониторинга и сравнения изменений в области информационно-коммуникационных технологий (ИКТ) в различных странах.

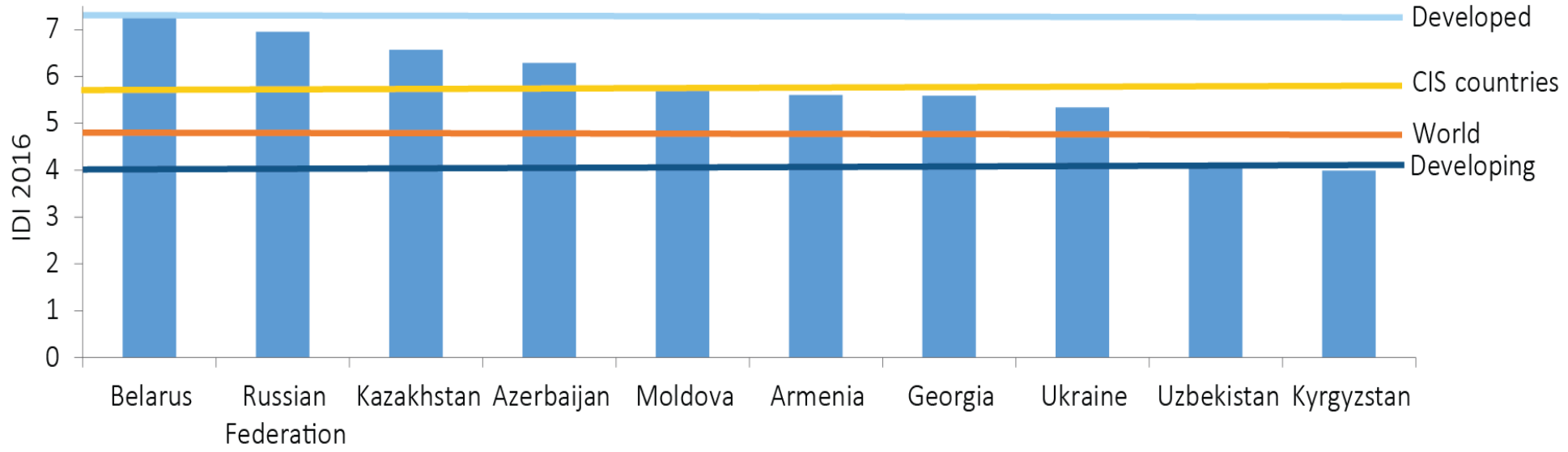
Результаты анализа показывают, что за период с 2010 по 2016 годы все 167 экономик, включенных в IDI, улучшили свои показатели по IDI.

Регион СНГ экономически относительно неоднороден. Десять стран региона предоставляют данные для IDI, исключениями являются Таджикистан и Туркменистан. Четыре страны региона (Беларусь, Молдова, Российская Федерация и Украина) относятся к категории развитых стран, а остальные страны относятся к развивающимся странам.

Две страны региона (Беларусь и Российская Федерация) занимают высокие позиции в рейтинге IDI 2016, в то время как оставшаяся часть представлена в двух средних квартилях рейтинга. Все, кроме двух, имеют уровни IDI выше среднемирового. Однако только одна Беларусь улучшила свои позиции в мировом рейтинге в отчетном году. Все остальные либо сохранили свой глобальный рейтинг, либо ухудшили его.

"Измерение информационного общества" (издание за 2016 год)

Economy	Regional rank2016	Global rank 2016	IDI 2016	Global rank 2015	IDI 2015	Global rank change2016-2015
Belarus	1	31	7.26	33	7.02	2
Russian Federation	2	43	6.95	42	6.79	-1
Kazakhstan	3	52	6.57	52	6.42	0
Azerbaijan	4	58	6.28	55	6.23	-3
Moldova	5	68	5.75	67	5.60	-1
Armenia	6	71	5.60	71	5.34	0
Georgia	7	72	5.59	72	5.33	0
Ukraine	8	76	5.33	76	5.21	0
Uzbekistan	9	110	4.05	110	3.76	0
Kyrgyzstan	10	113	3.99	108	3.85	-5

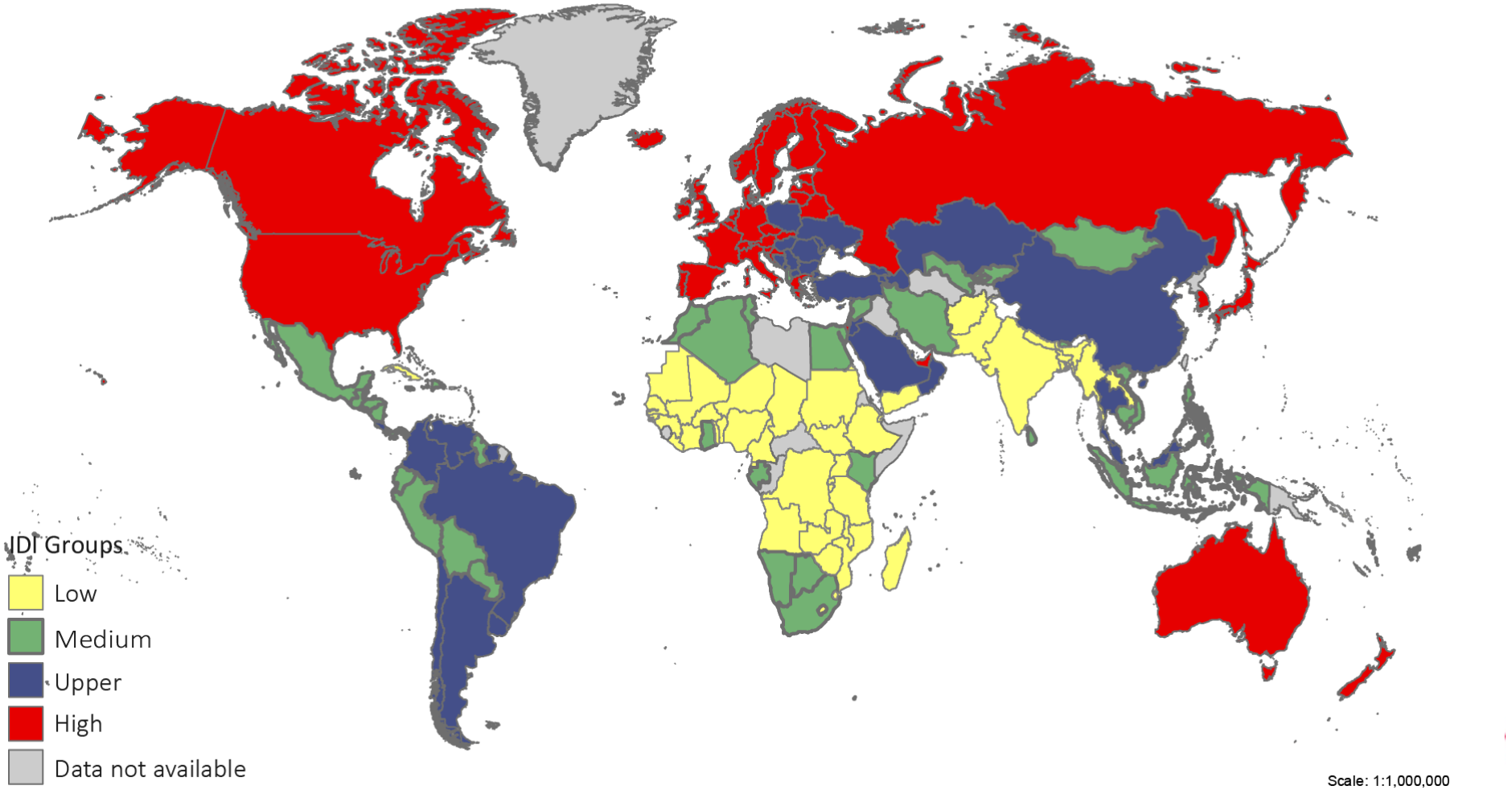


"Измерение информационного общества" (издание за 2016 год)

IDI rankings and values, 2016 and 2015

Economy	Rank 2016	IDI 2016	Rank 2015	IDI 2015
Korea (Rep.)	1	8.84	1	8.78
Iceland	2	8.83	3	8.66
Denmark	3	8.74	2	8.77
Switzerland	4	8.68	5	8.50
United Kingdom	5	8.57	4	8.54
Hong Kong, China	6	8.46	7	8.40
Sweden	7	8.45	6	8.47
Netherlands	8	8.43	8	8.36
Norway	9	8.42	9	8.35
Japan	10	8.37	11	8.28
Armenia	71	5.60	71	5.34
Georgia	72	5.59	72	5.33
Mauritius	73	5.55	73	5.27
Grenada	74	5.43	82	4.97
Antigua & Barbuda	75	5.38	70	5.41
Ukraine	76	5.33	76	5.21
Brunei Darussalam	77	5.33	74	5.25
St. Vincent and the Grenadines	78	5.32	78	5.07

Geographical distribution of IDI quartiles, 2016

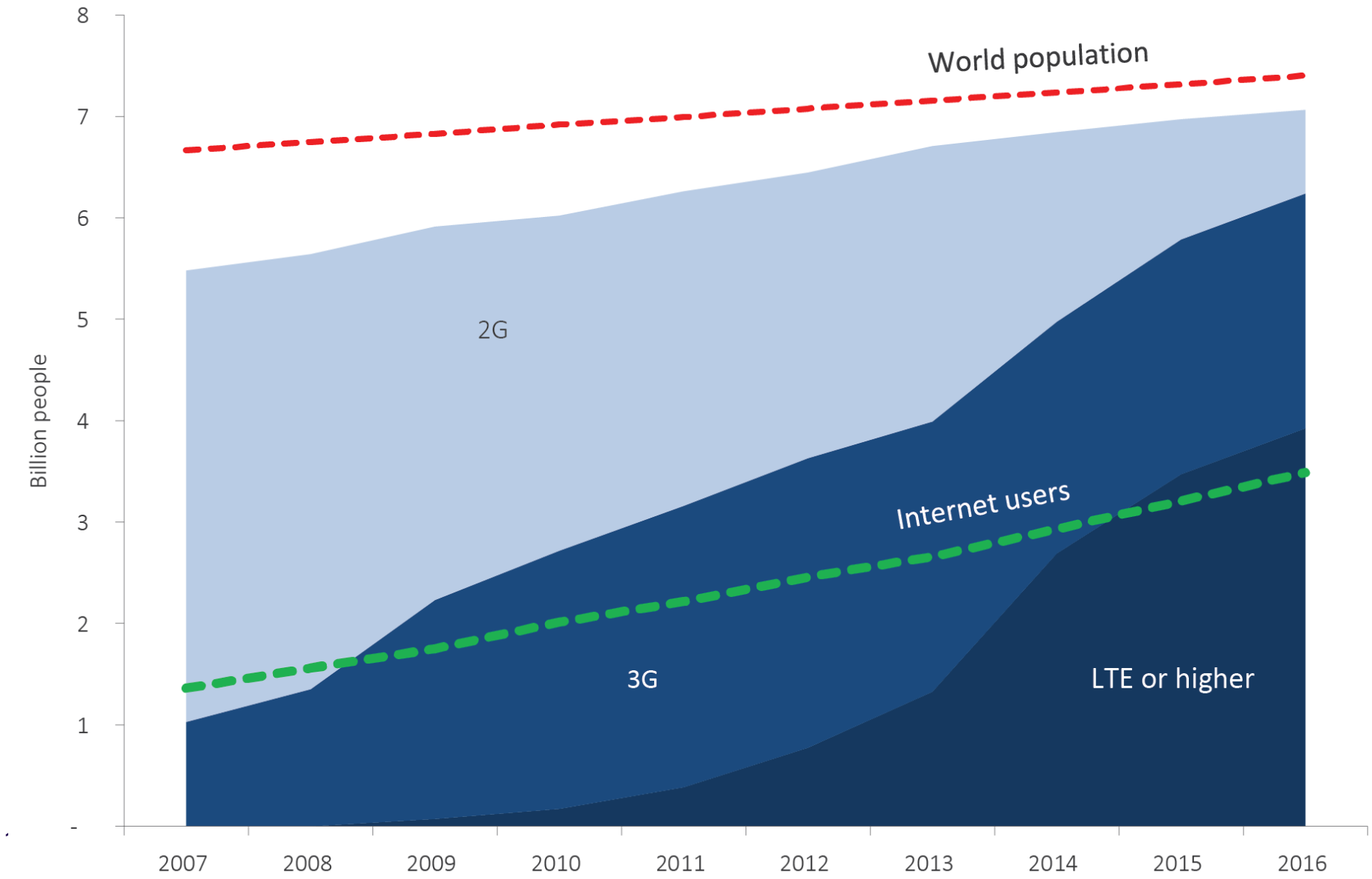


Прогноз развития глобального рынка до 2022 года

Table 1: Estimates of the Global Market: 2015, 2016, 2020 and 2021

	2015	2016	2020	2021	2022
Mobile cellular subscriptions	7.09 bn (ITU) 7.3 bn (GSMA)	7.6 bn (GSMA) 7.4 bn (E)[31]	8.7 bn (GSMA) 9.2 bn (E)	9.0 bn (GSMA) 9.0 bn (E)	9.1 bn (GSMA)
Unique mobile phone users	4.7 bn (GSMA)[31] 4.9 bn (E)	4.9 bn (GSMA) 5.0 bn (E)[31]	5.6 bn (GSMA) 5.4 bn (Cisco)[31]	--/--	
LTE Subscriptions	1.1 bn (GSMA) 1.1 bn (E) 1.37 bn (ABI Research) [32] 1.068 bn (GSA)	1.6 bn (GSMA) 1.2 bn (E)[33] 2 bn (Strategy Analytics[33])	3.2 bn (GSMA); 3.5 bn (ABI); 3.7 bn (E)	3.6 bn (GSMA) 4.3 bn (E)	4.0 bn (GSMA) 5.6 bn (Strategy Analytics)
5G subscriptions	--/--	-/-	2 million	150 million (E)	116 m (Strategy Analytics)
Mobile broadband subscriptions	3.41 bn (GSMA) 3.46 bn (ITU); 48.8% of mobile subscriptions	4.0 bn (GSMA) 3.7 bn (E)[34]	6.2 bn (GSMA) 7.7 bn; 85% of all subscriptions (E)	6.7 bn (GSMA) 7.7 bn (E)	7.1 bn (GSMA)
Smartphone subscriptions	3.3 bn[34] (GSMA) 45% global subscriptions; 40% total mobile subscriptions (E)	3.9 bn (GSMA) 3.4 bn (E)[35]	5.8 bn (GSMA) 6.1 bn subscriptions (E) 70% world's population (E)	6.2 bn (GSMA) 6.3 bn (E)	6.5 bn (GSMA)
Fixed broadband (ITU)	794m	884m (ITU)	1 bn by 2019		
Internet users (ITU)	3.17 bn (ITU)	3.5 bn (ITU)	4 bn by 2019 (Facebook)	4.67 bn (ITU)	
Facebook users	1.59 bn MAU 1.04 bn DAU[35] (Dec 2015)	1.65 bn MAU[35] 1.09 bn DAU*	1.23 bn (EST)	2.39 bn (EST)	

Coverage of mobile-cellular networks in relation to world population and the number of Internet users (2007-2016)



Директива 2014/61/ЄС Європейського Парламенту та Ради від 15 травня 2014 року про заходи, спрямовані на зменшення витрат на розгортання високошвидкісних мереж електронного зв'язку

Визнаючи важливість розгортання високошвидкісної широкосмугової мережі, держави-члени підтримали амбітні цілі щодо широкосмугового зв'язку, визначені в Повідомленні Комісії під назвою "Цифровий порядок денний для Європи - Європейське зростання за допомогою цифрових технологій" ("Цифровий порядок денний"), а саме забезпечення послугами базового широкосмугового зв'язку всіх громадян Європейського Союзу до 2013 року, і забезпечення до 2020 року доступу для всіх європейців до високошвидкісного Інтернету, понад 30 Мбіт/с, а також більш ніж 50% домогосподарств Європейського Союзу доступом до Інтернету зі швидкістю, що перевищує 100 Мбіт/с.

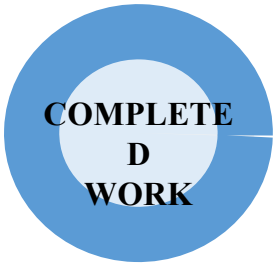
15-я Исследовательская комиссия МСЭ-Т

Сети, технологии и инфраструктура для транспортирования, доступа и жилищ

15-я Исследовательская комиссия МСЭ-Т отвечает в МСЭ-Т за разработку стандартов для инфраструктуры оптических транспортных сетей, сетей доступа, домашних сетей и сетей энергосистем общего пользования, систем, оборудования, оптических волокон и кабелей. Это включает связанные с ними прокладку, техническое обслуживание, управление, испытания, измерительное оборудование и методы измерений, а также технологии плоскости управления, позволяющие осуществлять развитие в направлении интеллектуальных транспортных сетей, включая поддержку приложений "умных" электросетей.

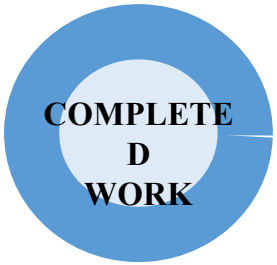
Achievements

WP1 – Broadband Access



G.9802 Generic multi-wavelength PON (G.multi)	40G fiber access (NG-PON2 - G.989)
Symmerical 10G PON (G.9807)	G.9801 Ethernet-based PON (EPON)
G.fast up to 1 Gbps access	VDSL2 vectoring for 100 Mbps; 300 Mbps VDSL2 with 35b profile
Narrowband PLC for smart grid	G.hn home networking up to 1 Gbps
G.9977 mitigation of interference between DSL and G.hn	
Collaboration with BBF	

WP2 – Optical Technologies



Single-mode fibre (G.652, G.654, G.657)

Short-reach (client) 40G and 100G OTN interfaces

Multichannel bi-directional DWDM applications (G.metro)

Multi-vendor interoperable coherent modulation for 100G (G.698.2)

Submarine cable systems including coherent 100 Gbit/s applications (G.97x series)

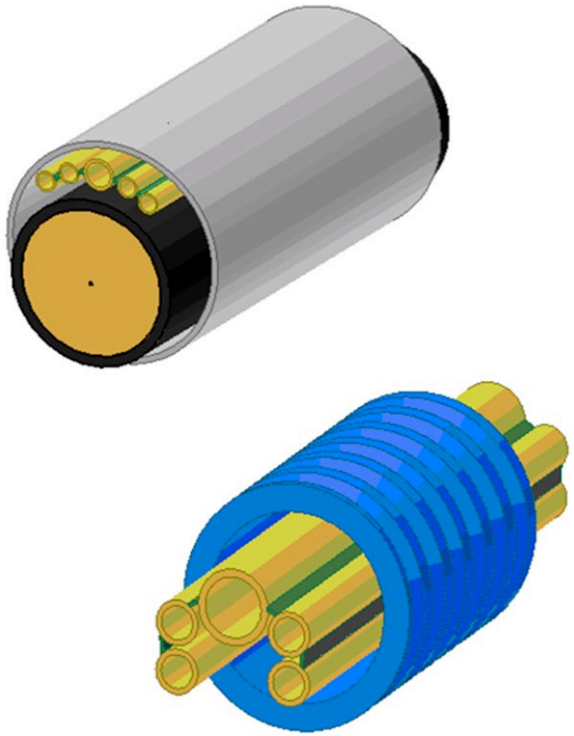
Optical components: optical amplifier, optical splitters and multi-degree-ROADM

Disaster management for survivable networks (L.392)

Renumbering for new technical classification of ITU-T L-series Recommendations

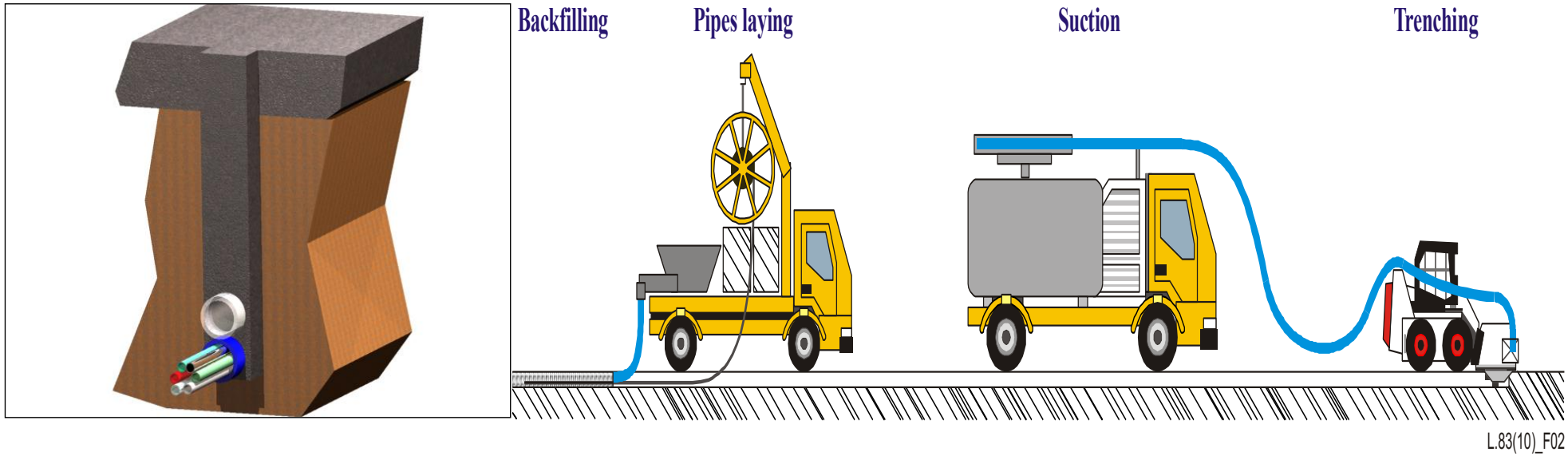
Technical area		Assigned Questions			
	Sub-category	Q7/15	Q8/15	Q16/15	Q17/15
Optical fibre cables (e.g. L.100 – L.199)	Cable structure and characteristics (L.100 –L.124)			10, 26, 43, 58, 59, 60, 67, 78, 79, 87, L.dsa	
	Cable evaluation (L.125 –L.149)			14, 27	
	Guidance and installation technique (L.150 – L.199)			34, 35, 38, 46, 48, 49, 56, 57, 61, 77, 82, 83, 91 (ex L.coi), L.cci	
Optical infrastructures (e.g. L.200 – L.299)	Infrastructure including node element (except cables) (L.200 – L.249)			11, 13, 44, 50, 51, 70, L.oxcon, L.pneid	
	General aspects and network design (L.250 – L.299)			17, 39, 45, 47, 62, 63, 72, 73, 84, 86, 89, 90, 94	
Maintenance and operation (e.g. L.300 – L.399)	Optical fibre cable maintenance (L.300 – L.329)				25, 40, 41, 53, 66, 68, 85, 93, L.wdc
	Infrastructure maintenance (L.330 – L.349)				74, 88
	Operation support and infrastructure management (L.350 – L.379)				64, 69, 80
	Disaster management (L.380 – L.399)				81, 92, L.nrr-frm, L.dm-nrr-mdru
Passive optical devices (e.g. L.400 – L.429)		12, 31, 36, 37, L.fmc			
Marinized terrestrial cables (e.g. L.430 – L.449)			28, 29, 30, 54, 55		

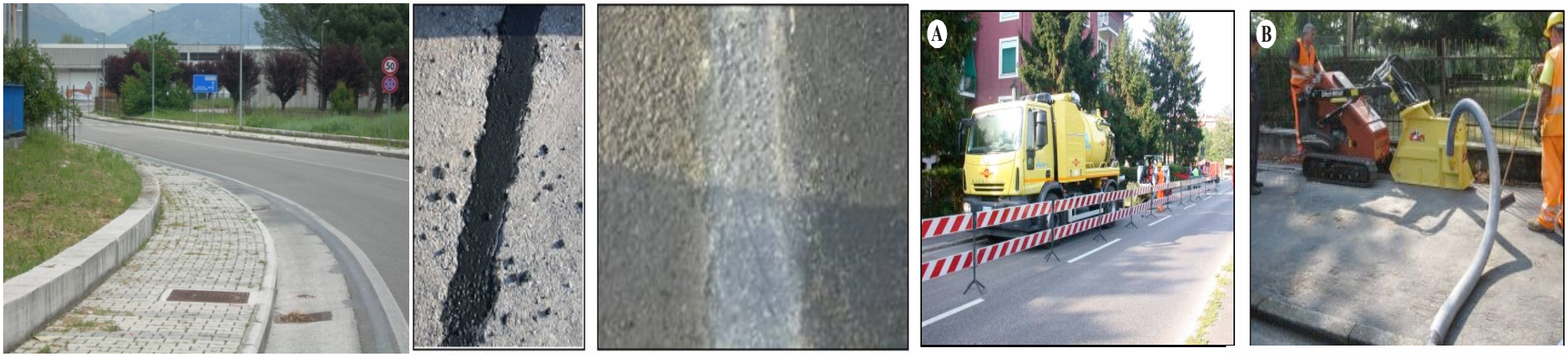
Новые рекомендации серии L



L.162 Microducts technology and its applications

Новые рекомендации серии L





L.155 (ex L.83)Low-impact trenching technique for FTTx networks

Supplement 59 to ITU-T G-series Recommendations
Guidance on optical fibre and cable reliability

Optical cables were first deployed commercially in 1977. Thus, our knowledge of their performance in the field is less than 40 years and much information provided in this Supplement is speculative, although today significant spontaneous fibre breakage in these old fibres is not known. Detailed analysis of attenuation characteristics and mechanical attributes for cabled fibre that have been installed for 25 years indicate that the optical properties are very stable over time. With this background we can use our accumulated field knowledge combined with accelerated aging to estimate the reliability of optical cables.

Reliability falls into two major categories:

- **Mechanical reliability (will the fibre break over the cable lifetime)**
- **Optical reliability (will optical transmission be maintained over the cable lifetime)**

It is hard to separate optical fibre reliability from optical cable reliability as the two are intimately related, but in this Supplement we will focus primarily on the fibre attributes and how they relate to cabled optical fibre.

Future Work

WP1 – Future Work

G.FAST

Next generation
G.fast >2 Gbps

Visible Light
Communication
for home networking

DTA

G.fast dynamic time assignment
(DTA) – downstream/upstream
bit-rates responsive to
customer traffic

Powerline
communication
(PLC)

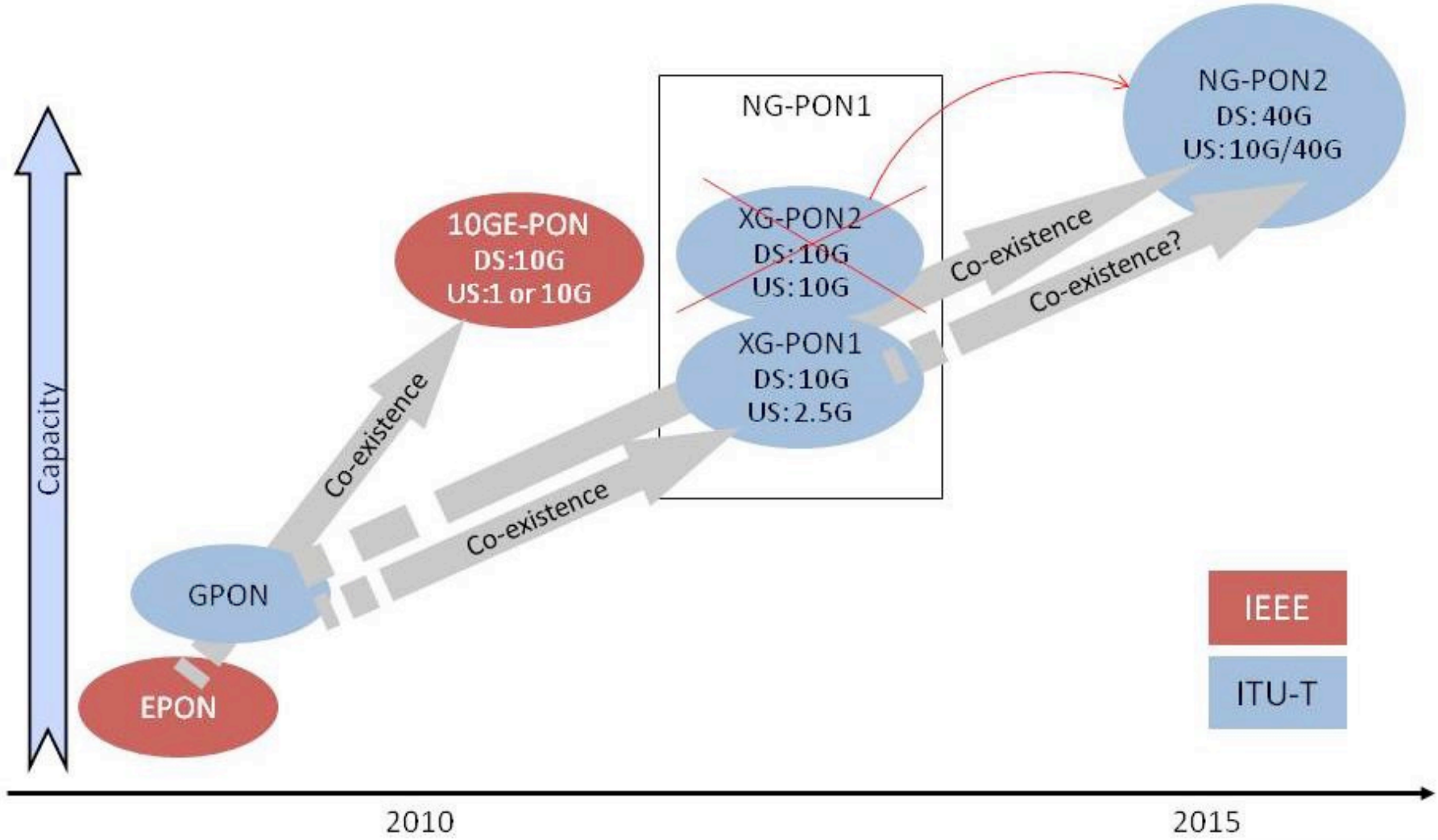
Continue collaboration with
broadband forum

Next generation of
converged fiber access
going to higher speeds

G.Hn

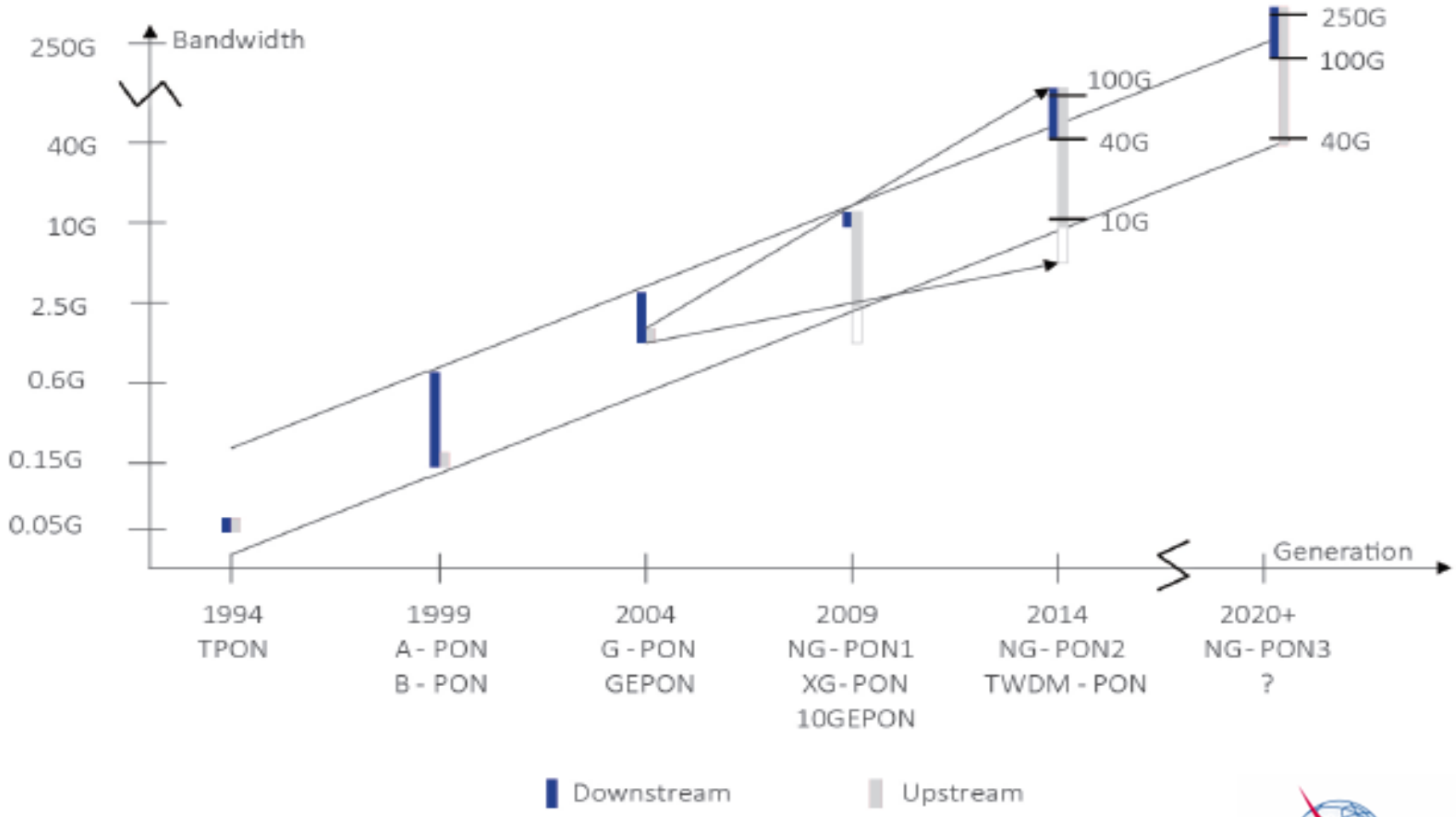
G.hn home networking over
indoor phone, power,
and coax wires >2 Gbps

ЭВОЛЮЦИЯ СТАНДАРТОВ ПО СЕТЯМ ДОСТУПА



Next-Generation Networks in Fixed Broadband

Figure 8: Capacity Trend for Passive Optical Networks (PON)



Source: ITU Telecommunication Standardization Bureau.

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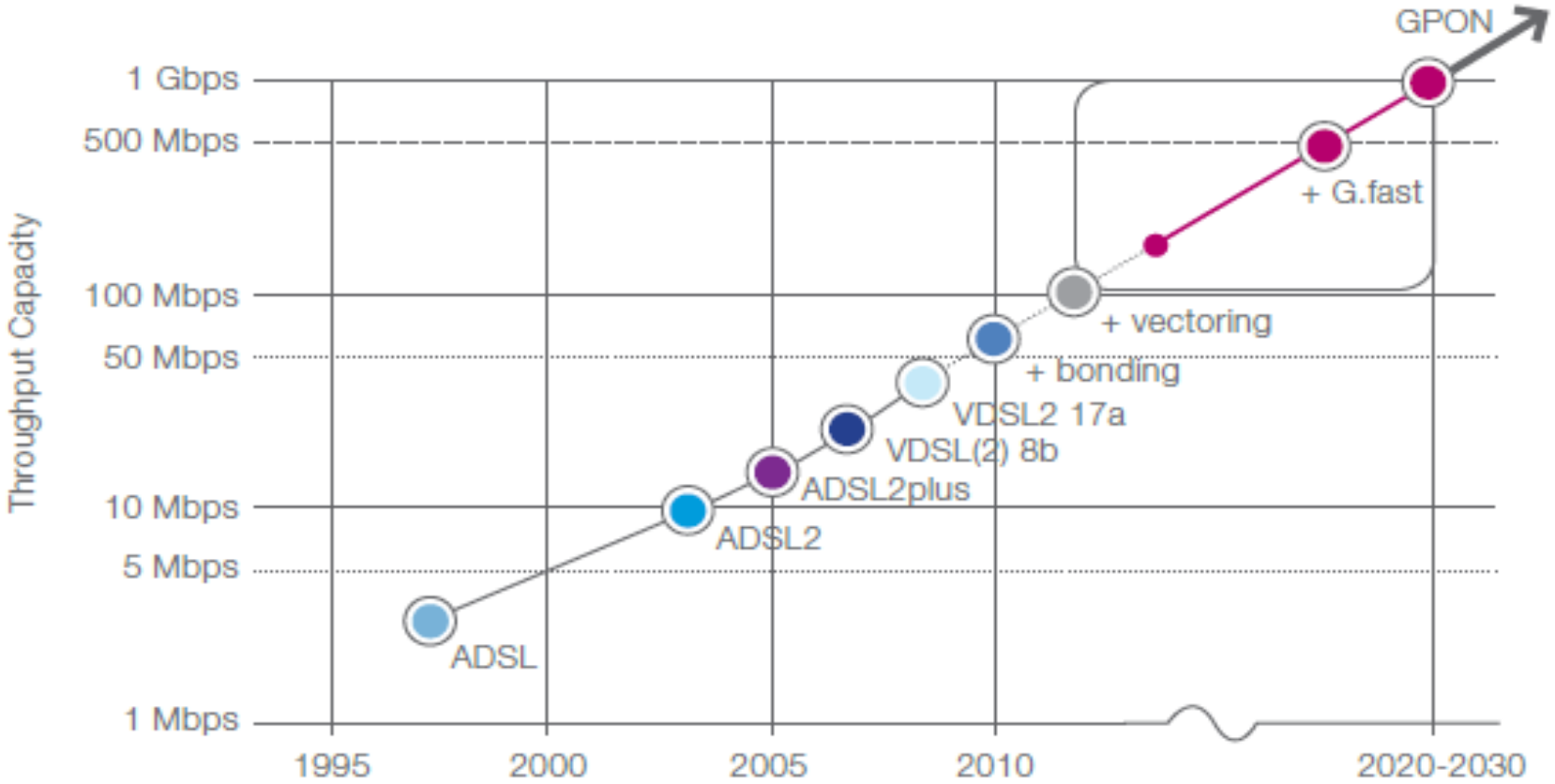
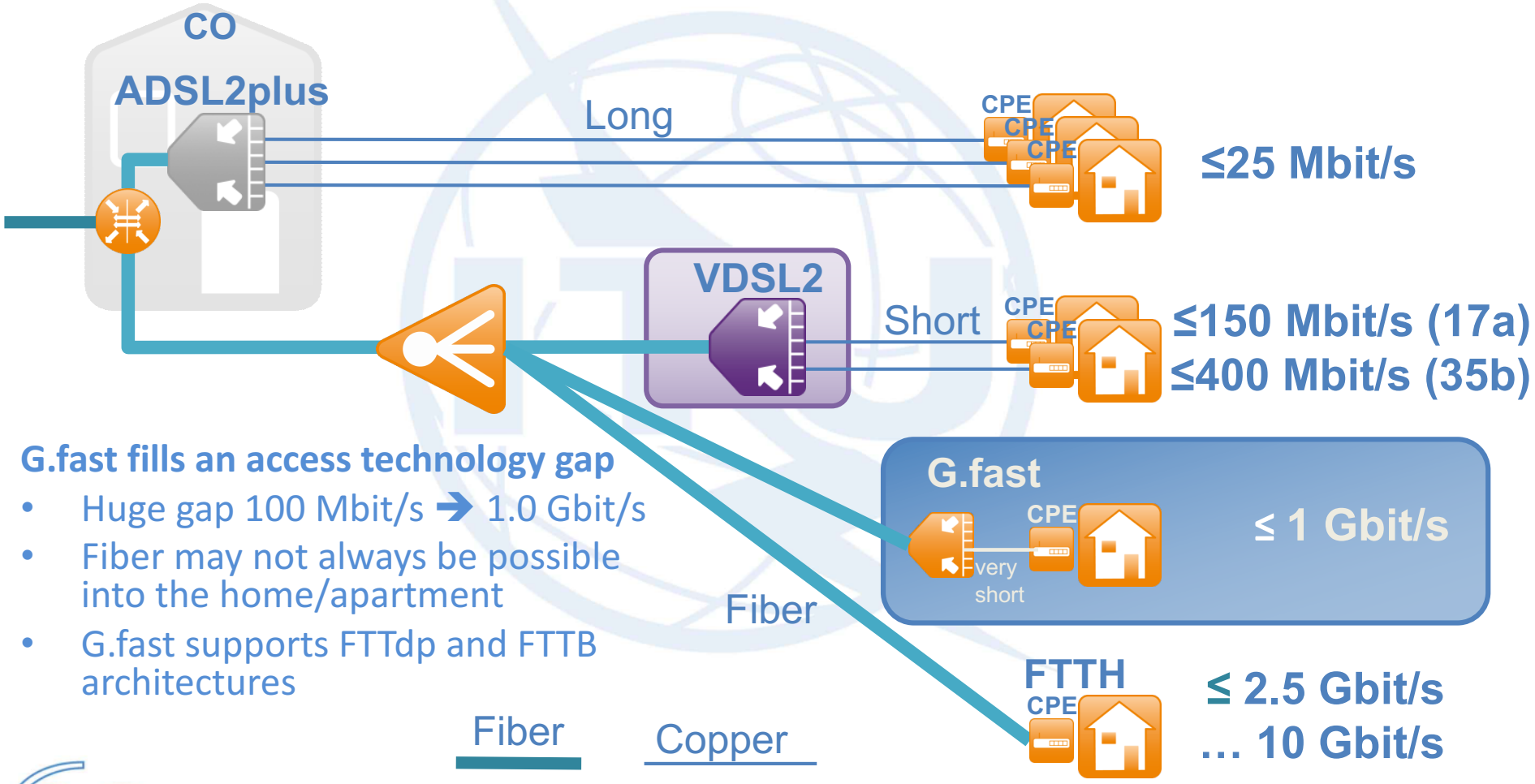
Growth in Speeds for Fixed Technologies



ITU and the OECD have defined broadband as a capacity of at least 256 kbps in the uplink or downlink speed.

Overview Access Network Solutions



G.fast fills an access technology gap

- Huge gap 100 Mbit/s ➔ 1.0 Gbit/s
- Fiber may not always be possible into the home/apartment
- G.fast supports FTTdp and FTTB architectures

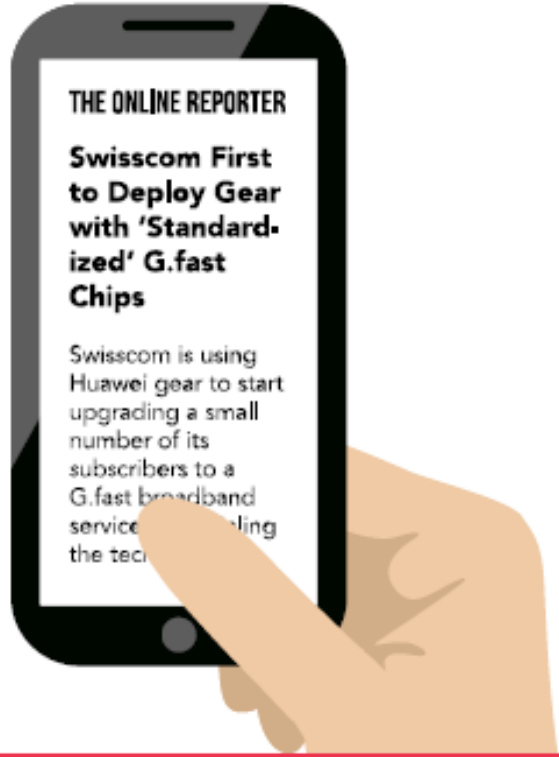
Key Aspects of G.fast

- **Aggregate service rate** (up+down) targets (over 0.5mm copper)
  - 500 Mbit/s at 100m
  - 200 Mbit/s at 200m
  - 150 Mbit/s at 250m
  - Operates up to 400m
- Operates over twisted pair, quad cables, and also coax.
- Customer **Self-Installable** CPE
- **Low power** consumption
- **Robust** with high immunity to disturbers
- **Crosstalk cancellation** for operation in multi-pair cable
- Down/up **asymmetry ratio** is static configuration of TDD split

Setting the standard

Copper X250

Breathing new life into copper…



BREAKING NEWS: G.fast achieves 2 Gb/s over existing telephone lines

1956 2016
CCITT / ITU-T

NG-PON2

The next-generation technology, NG-PON2, is expected to increase PON capacity to at least 40 Gbps downstream and at least 10 Gbps upstream

Some of the proposals under consideration include:

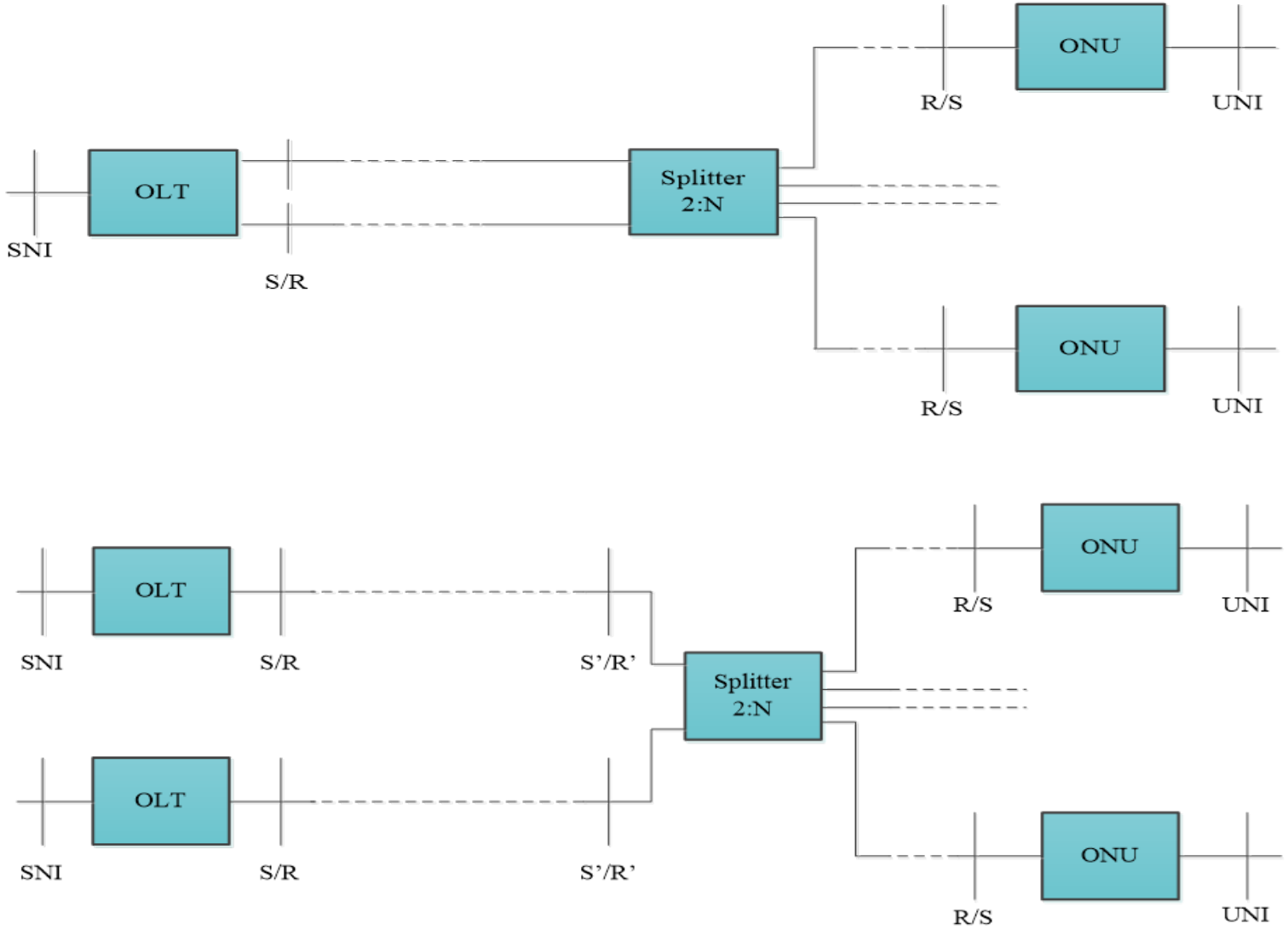
- **40Gbps TDM PON**
- **Time- and wavelength-division multiplexed (TWDM) PON**
- **WDM-PON**
- **Coherent ultra-dense WDM-PON (PON UDWDM)**
- **Orthogonal Frequency Division Multiplexing (OFDM) PON**

Variants of TWDM-PON

Four variants of TWDM-PON are currently being developed by ITU-T Study Group 15:

- **Basic:** 40 Gbps downstream and 10 Gbps upstream capacity, using four wavelengths
- **Extended:** 80 Gbps downstream and 20 Gbps upstream capacity, using eight wavelengths
- **Business:** Symmetrical services, 40/40 Gbps and 80/80 Gbps
- **Mobile fronthaul:** point-to-point WDM overlay

Supplement 51 to ITU-T G-series Recommendations
Passive optical network protection considerations



WP2 – Future Work

Easy and environmentally friendly outside plants

Disaster Management issues

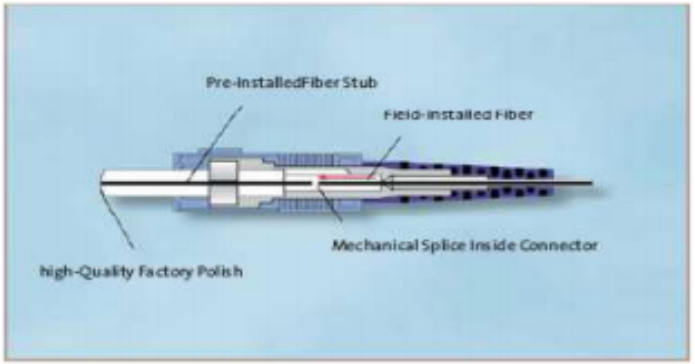
100G and future higher-rate coherent multi-vendor interoperable interfaces

Multichannel bi-directional DWDM applications targeted at lower cost optical solutions for applications including mobile fronthaul and backhaul

200G
400G

Short-reach (OTN client) 200G and 400G interfaces reusing components developed for Ethernet applications

Outside plant and related indoor installation



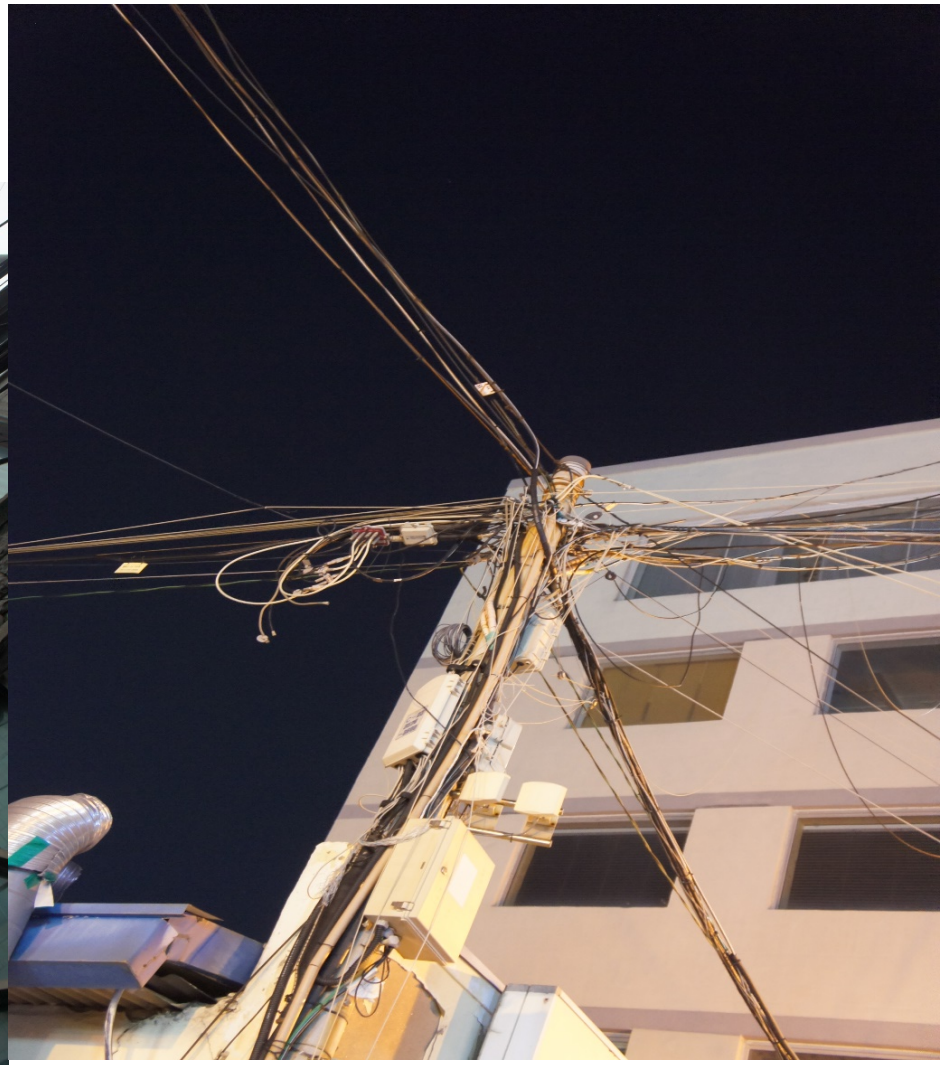
Need of new Recommendation on field mountable connector technologies

- Use of low environmental impact trenching machines

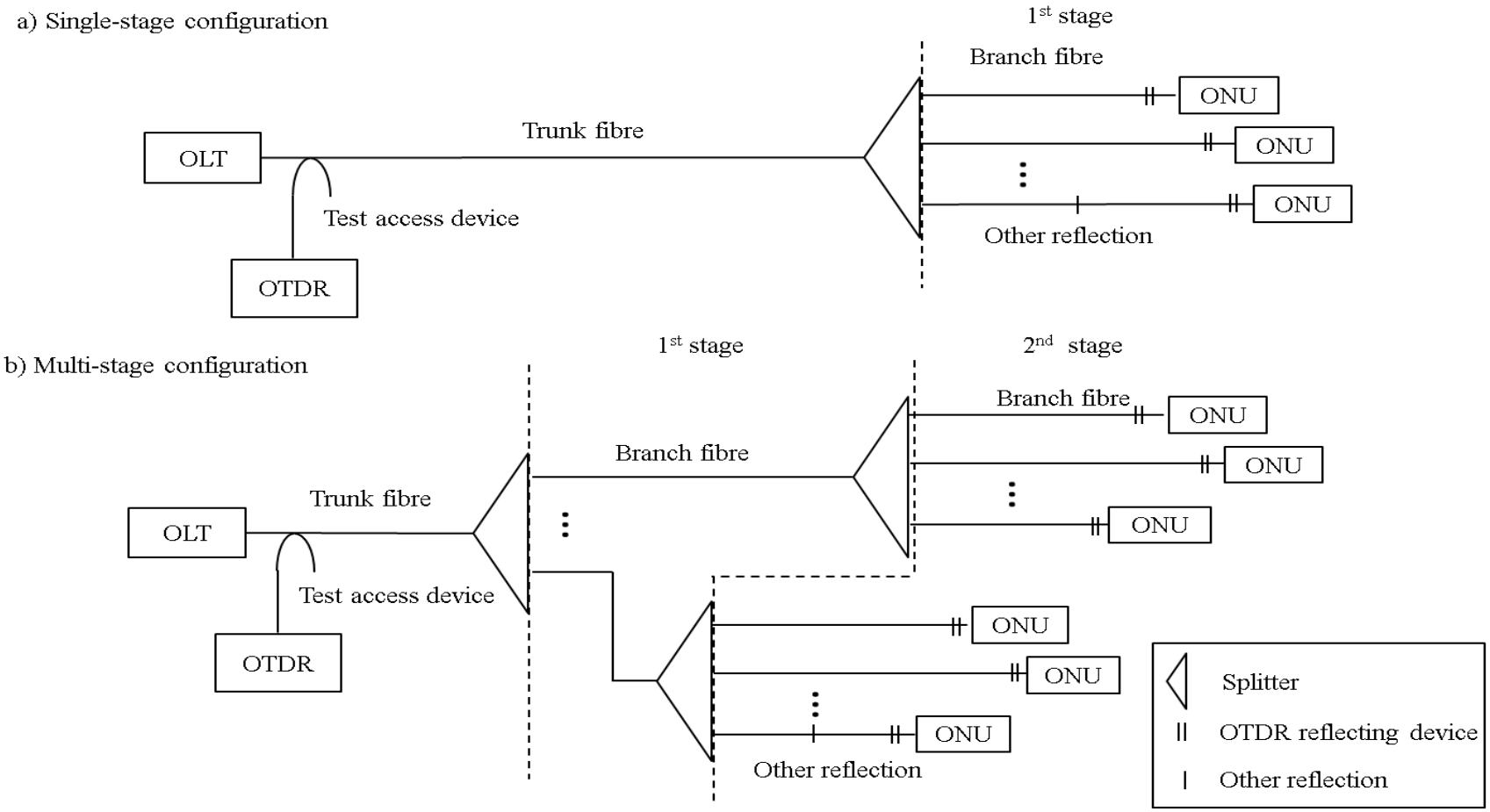
MINIATURIZED

Diameter 10/14 mm (inner/outer)

Outside plant and related indoor installation

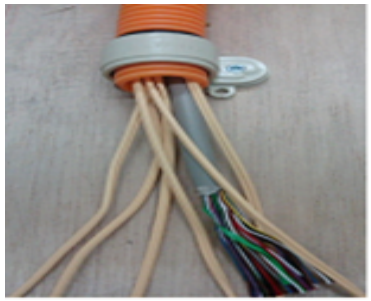


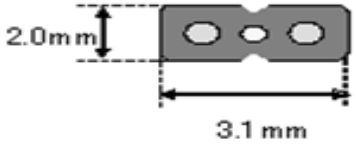
Optical fibre maintenance criteria for access networks depending on topologies of access networks



Network configurations for in-service testing with OTDR reflecting devices

L.59 Optical fibre cables for indoor applications





5.2 Mechanical characteristics

5.2.1 Tensile strength

5.2.2 Bending

5.2.3 Crush

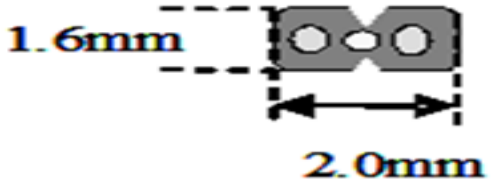
5.2.4 Bending under tension (flexing)

5.2.5 Torsion

5.2.6 Impact

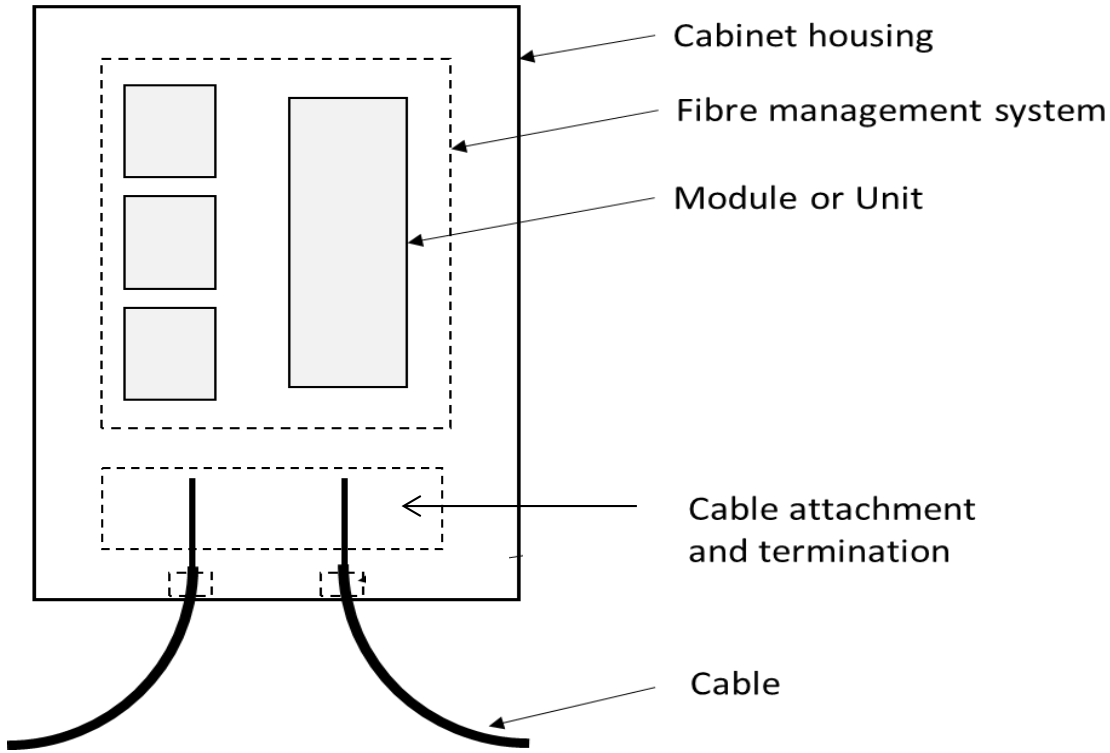
5.2.7 Kink

5.2.8 Repeated bending

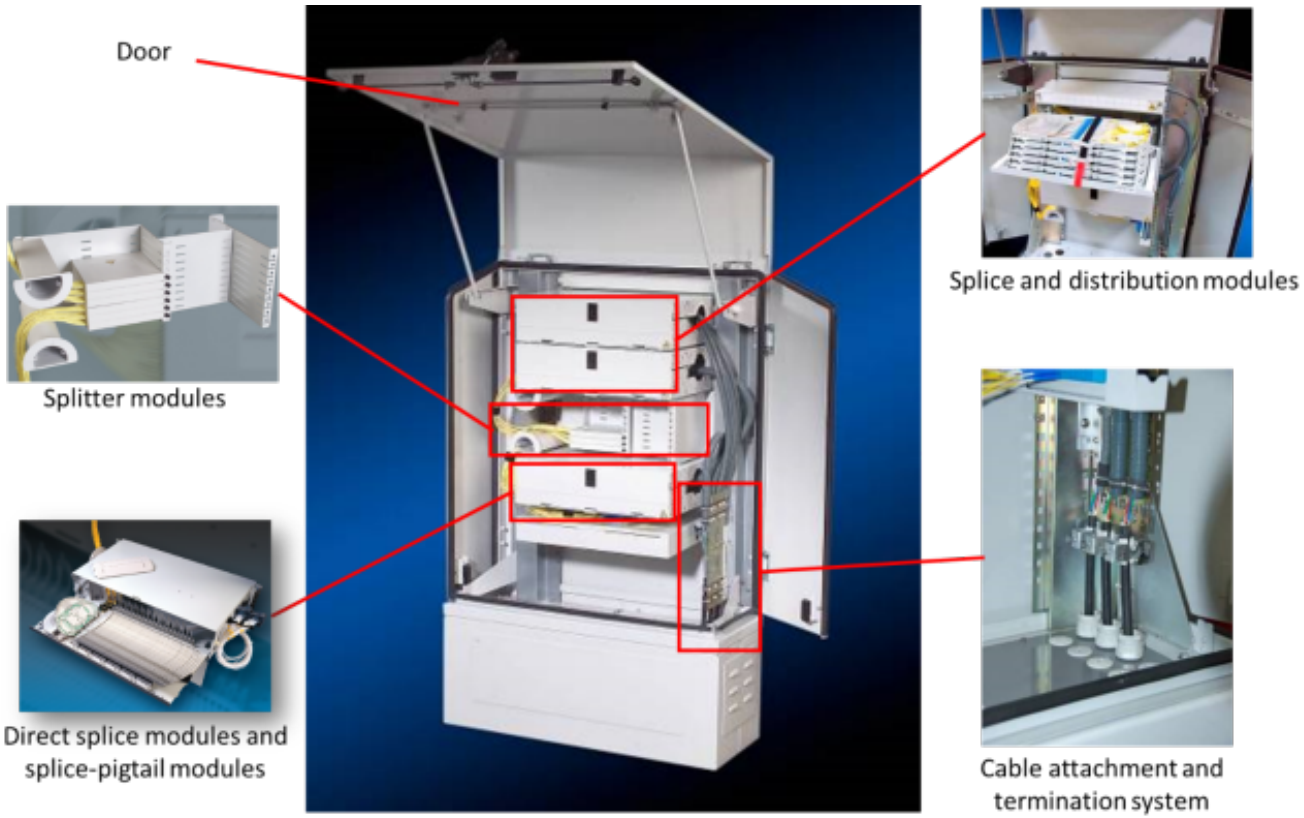


Направления стандартизации

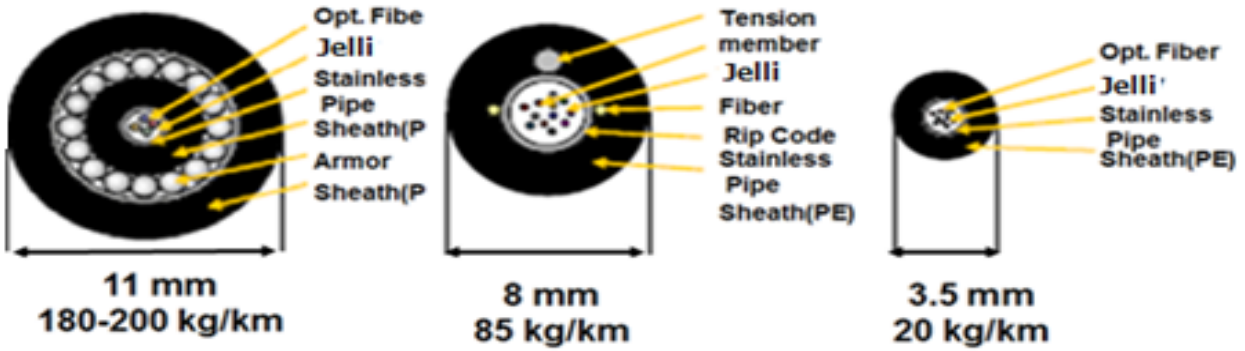
- **L.fmc Field mountable single-mode optical fibre connectors**
- **G.663 Application-related aspects of optical amplifier devices and subsystems**
- **G.672 Characteristics of multi-degree reconfigurable optical add/drop multiplexers**
- **L.oxcon Requirements for Passive Optical Nodes: Outdoor Optical Cross-Connect Cabinet**
- **L.dsa Optical Fibre Cables for Direct Surface Application**
- **L.109 (L.60) Construction of optical/metallic hybrid cables**
- **Requirements for Passive Optical Nodes: Fiber Distribution Box**



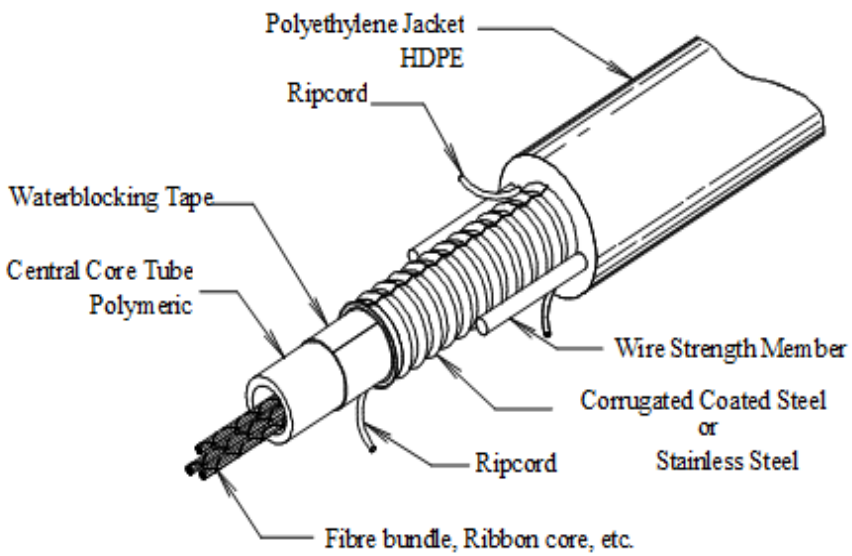
Outdoor Optical Cross-Connect Cabinet



Optical Fibre Cables for Direct Surface Application



Optical Fibre Cables for Direct Surface Application



new Recommendation “Optical fibre cables for in-home directly wall surface applications”

Application Case I

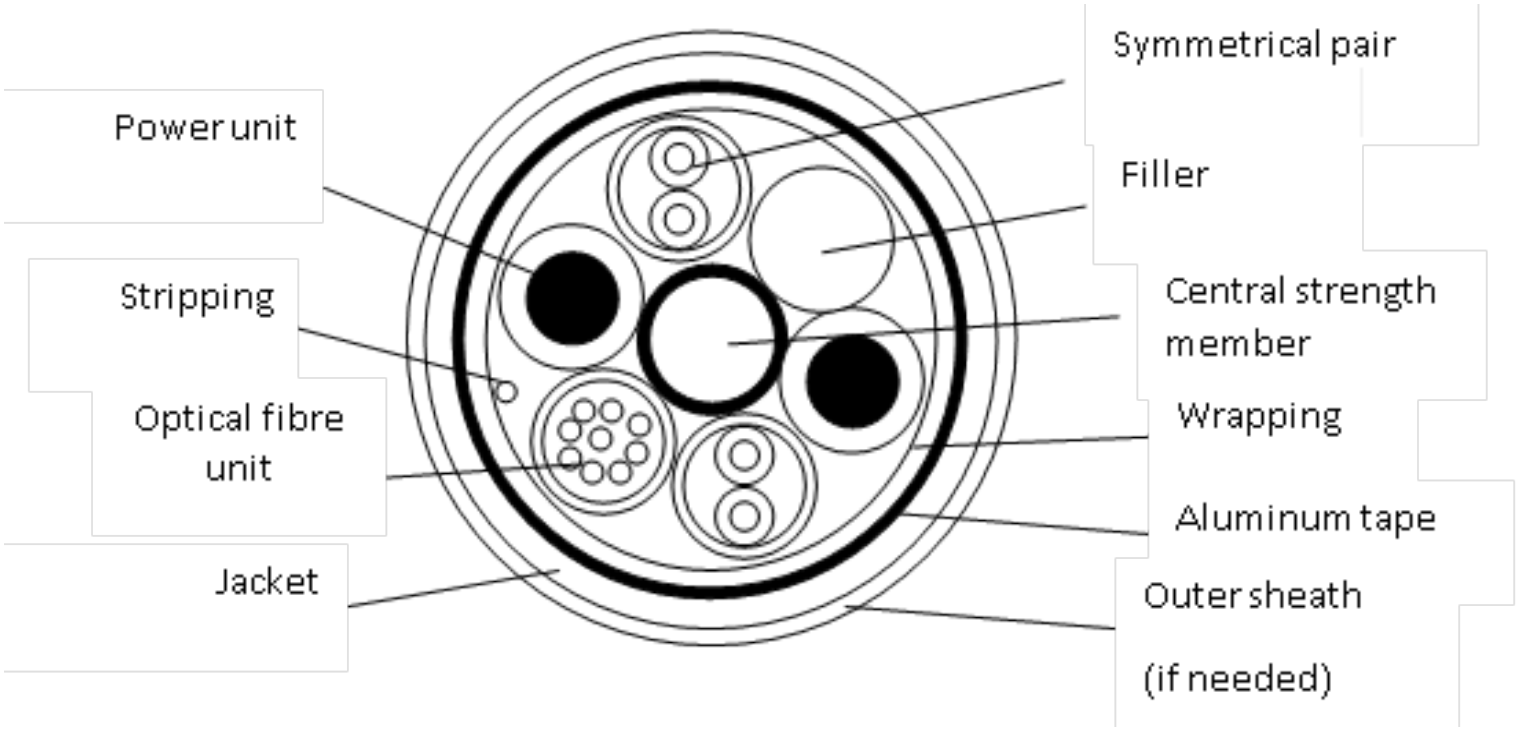
- project in China

new Recommendation “Optical fibre cables for in-home directly wall surface applications”

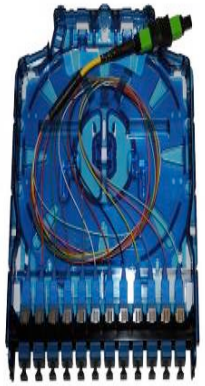
Application Case II

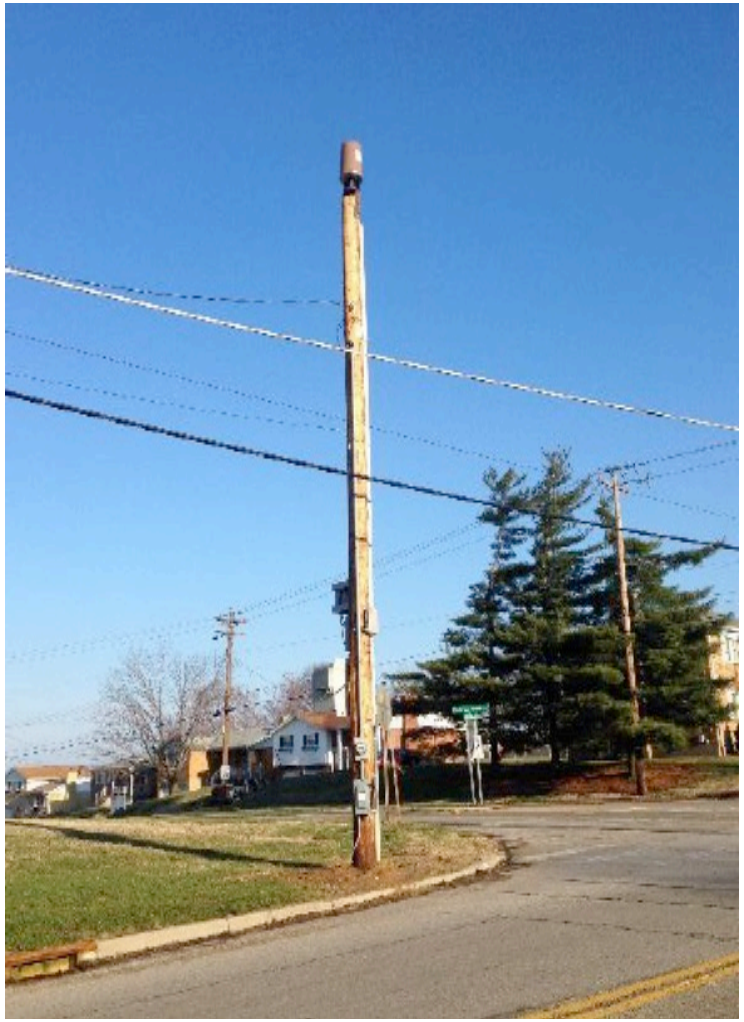
- project in China

Construction of optical/metallic hybrid cables



Modular Technology /Plug-N-Play / Fixed Wireless





Благодарю за внимание!

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