Fibre-to-the-Home

FTTH Environment for South East Asian
Region & the Road Forward toward
Next Generation FTTH Standards

Topics

- FTTH Definition & supporting technologies?

- FTTH Councils Around the World & FTTH in APAC

- New FTTH Standards
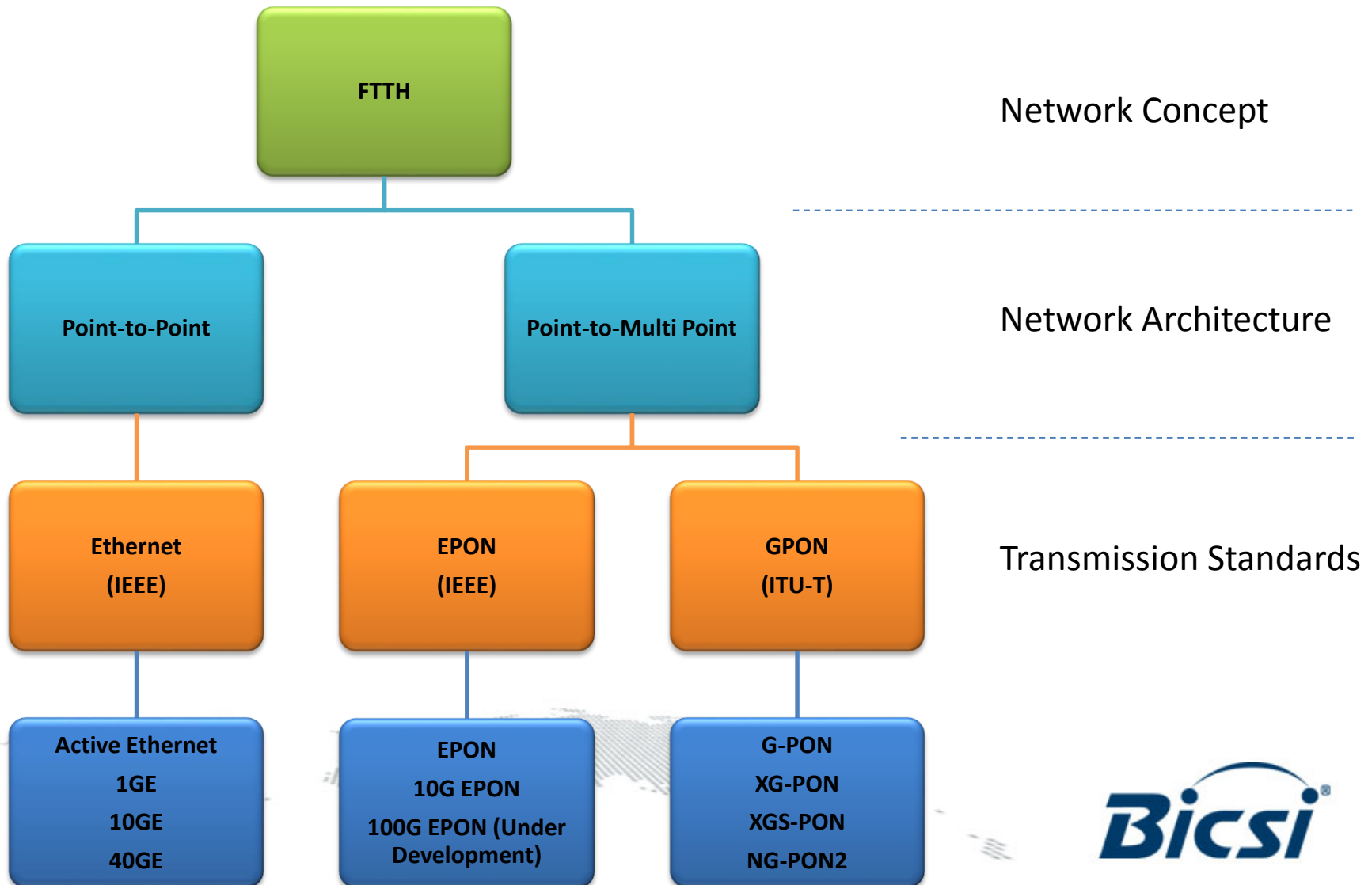
- Key challenges of FTTH deployment

What is 'FTTH'? *(based on FTTH Council definition)*

- "Fiber to the Home" is defined as an access network architecture in which the <u>final connection to the subscriber's premises is Optical Fiber</u>. The fiber optic communications path is terminated on or inside the premises for the purpose of carrying communication services to a single subscriber. In order to be classified as FTTH, the access fibre must cross the subscriber's premises boundary and terminate:

  - inside the premises, or

  - on an external wall of the subscriber's premises, or

  - no more than 2m from an external wall of the subscriber's premises.

- This FTTH definition excludes architectures where the optical fiber terminates in a public or private space before reaching the premises and where the access path continues to the subscriber over a physical medium other than optical fiber (for example copper loops, power cables, wireless and/or coax).

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FTTH Technologies

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                        │     FTTH     │                    Network Concept
                        └──────┬───────┘
              ┌────────────────┴────────────────┐
     ┌────────┴────────┐              ┌──────────┴──────────┐
     │ Point-to-Point  │              │ Point-to-Multi Point│         Network Architecture
     └────────┬────────┘              └──────────┬──────────┘
              │                       ┌───────────┴───────────┐
     ┌────────┴────────┐      ┌───────┴───────┐      ┌────────┴────────┐
     │    Ethernet     │      │     EPON      │      │      GPON       │    Transmission Standards
     │     (IEEE)      │      │     (IEEE)    │      │     (ITU-T)     │
     └────────┬────────┘      └───────┬───────┘      └────────┬────────┘
     ┌────────┴────────┐      ┌───────┴───────┐      ┌────────┴────────┐
     │ Active Ethernet │      │     EPON      │      │     G-PON       │
     │      1GE        │      │   10G EPON    │      │    XG-PON       │
     │      10GE       │      │ 100G EPON(Under│     │    XGS-PON      │
     │      40GE       │      │  Development) │      │    NG-PON2      │
     └─────────────────┘      └───────────────┘      └─────────────────┘
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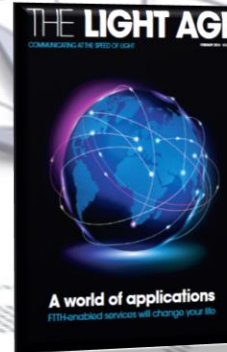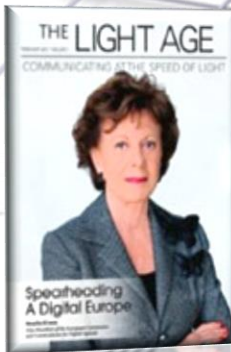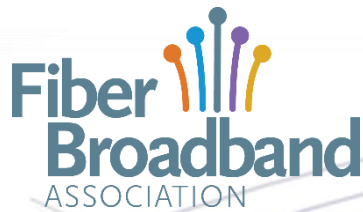
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FTTH COUNCILS AROUND THE WORLD & FTTH IN APAC

FTTH Council Global Alliance (FCGA)

Source: APAC FTTH Council

Alternative ISP and Incumbents are leading the FTTH/B evolution

- A positive evolution: 94 planned FTTx projects in the region

- Incumbents have deployed fibre in a dynamic way from 2015 to 2016 covering with fibre more homes:
  - Alternative ops growth: **6.5%**
  - Incumbents: Growth rate about **22.6%**

Incumbents:

387.5 million
FTTH/B
Homes Passed

National Programs (1) :

5 million
FTTH/B
Homes Passed

Alternative Operators:

270.8 million
FTTH/B
Homes Passed

(1) Australia, New Zealand, Singapore

FTTH/B is taking a bigger place in the APAC Market

This is due to a positive evolution in the deployment and specially in the user's adoption...

297.8 million
FTTH/B subscribers by December 2016 in APAC

436.5 million
FTTH/B Homes Passed by Dec. 2016 in APAC

68%
FTTH/B Take up rate by Dec. 2016 in APAC

68% growth from 2015

12.5% growth from 2015

+23 points from December 2015

Take up rate = FTTH-B subs / Total FTTH-B Homes Passed

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FTTH rollouts and PON Solutions have evolved positively in 2016

**Main Fibre architecture deployed (*) in %
By December-2016**

- FTTB — 23%
- FTTH — 77%
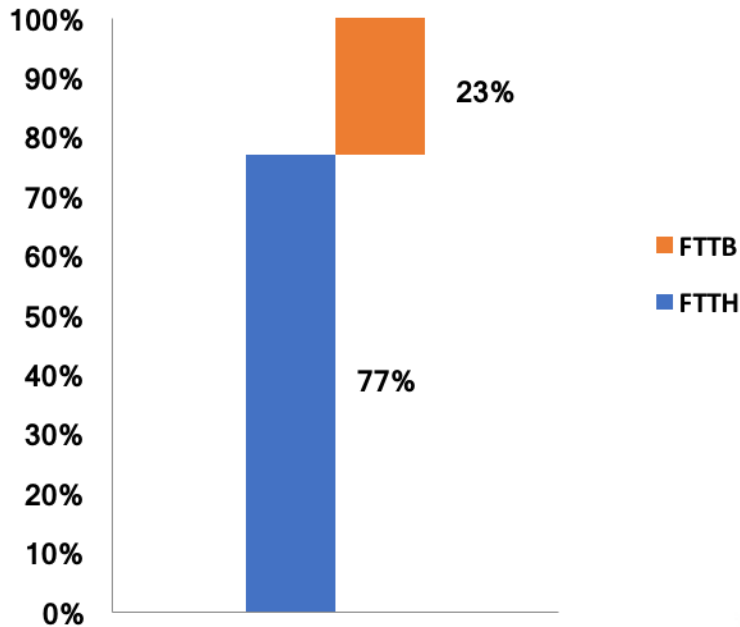
**Main Fibre technology deployed (*) in %
By December-2016**

- Ethernet — 5%
- PON — 95%
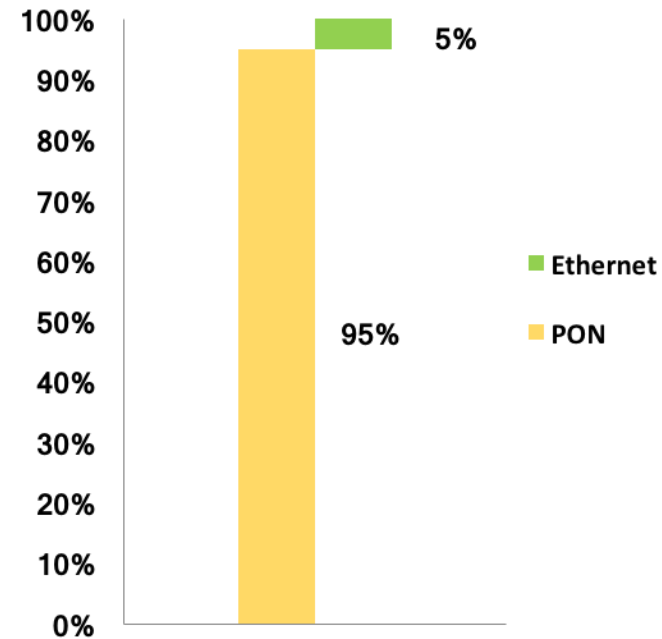
*Home Passed segmentation
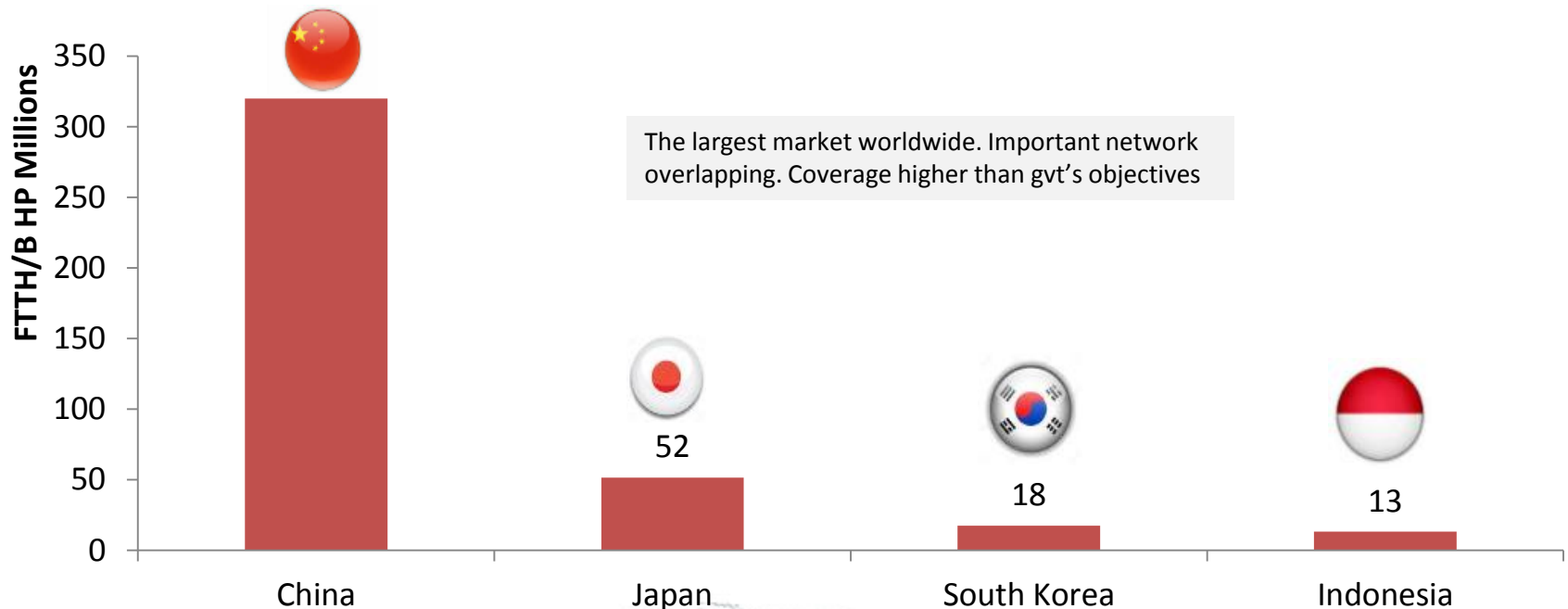
Source: IDATE for FTTH Council APAC

How extensive are FTTH Projects in APAC?

'Homes passed'

"Homes Passed" is the potential number of premises to which a Service Provider has capability to connect in a service area. Typically new service activation will require the installation and/or connection of a drop cable from the homes passed point (e.g. fiber-pedestal, manhole, chamber, utility-pole) to the premises, and the installation of subscriber premises equipment at the premises. This definition excludes premises that cannot be connected without further installation of substantial cable plant such as feeder and distribution cables (fiber) to reach the area in which a potential new subscriber is located.
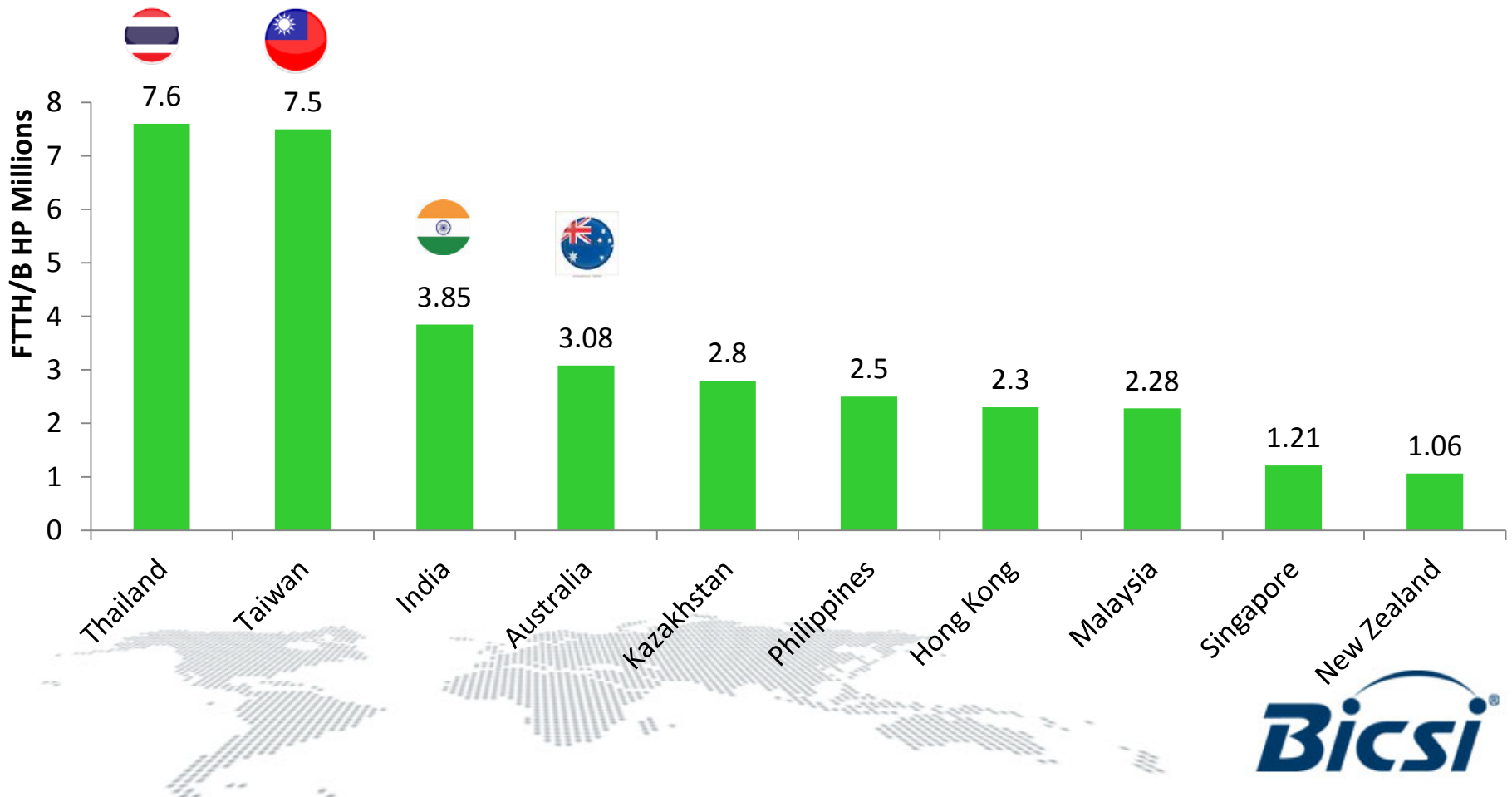
Total FTTH/B Homes Passed by country

The Top-4: China is N⁰ 1 by far due the size of its market. Even though, countries like Japan, South Korea and Indonesia have reached 50 or more than 10 million homes with FTTH/B networks
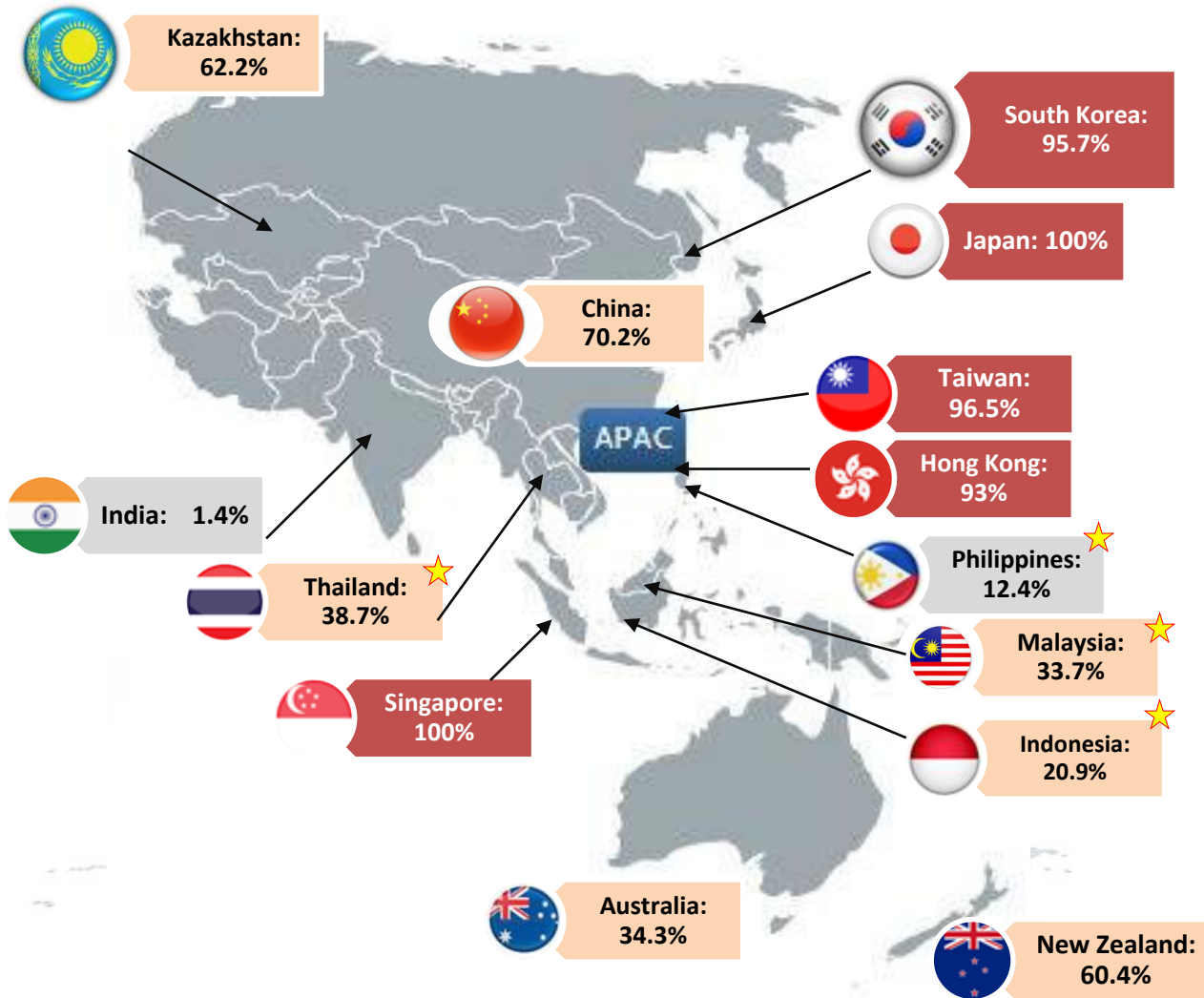
The largest market worldwide. Important network overlapping. Coverage higher than gvt's objectives

FTTH/B HP Millions

- China
- Japan — 52
- South Korea — 18
- Indonesia — 13

Total FTTH/B Homes Passed by country

Also it can be observed several countries that have deployed FTTH/B networks passing more than 1 million homes.

Bar chart — FTTH/B HP Millions:

Country	FTTH/B HP Millions
Thailand	7.6
Taiwan	7.5
India	3.85
Australia	3.08
Kazakhstan	2.8
Philippines	2.5
Hong Kong	2.3
Malaysia	2.28
Singapore	1.21
New Zealand	1.06

Coverage: Top countries in terms of % of FTTH/B Homes Passed in total Households

Kazakhstan: 62.2%

South Korea: 95.7%

Japan: 100%

China: 70.2%

Taiwan: 96.5%

Hong Kong: 93%

India: 1.4%

Thailand: 38.7%

Philippines: 12.4%

Singapore: 100%

Malaysia: 33.7%

Indonesia: 20.9%

Australia: 34.3%

New Zealand: 60.4%

APAC

- **Number of Homes Passed not representative of effective coverage**

- **Here, the ratio represented is % of FTTH/B Homes Passed in total households**

  - 5 countries > 90% !!!
  - 7 countries > 20%
  - 1 country over 10%

Source: IDATE for FTTH Council APAC

'Homes Connected/Subscribers'

"Homes Connected" is the number of premises which are connected to a network.
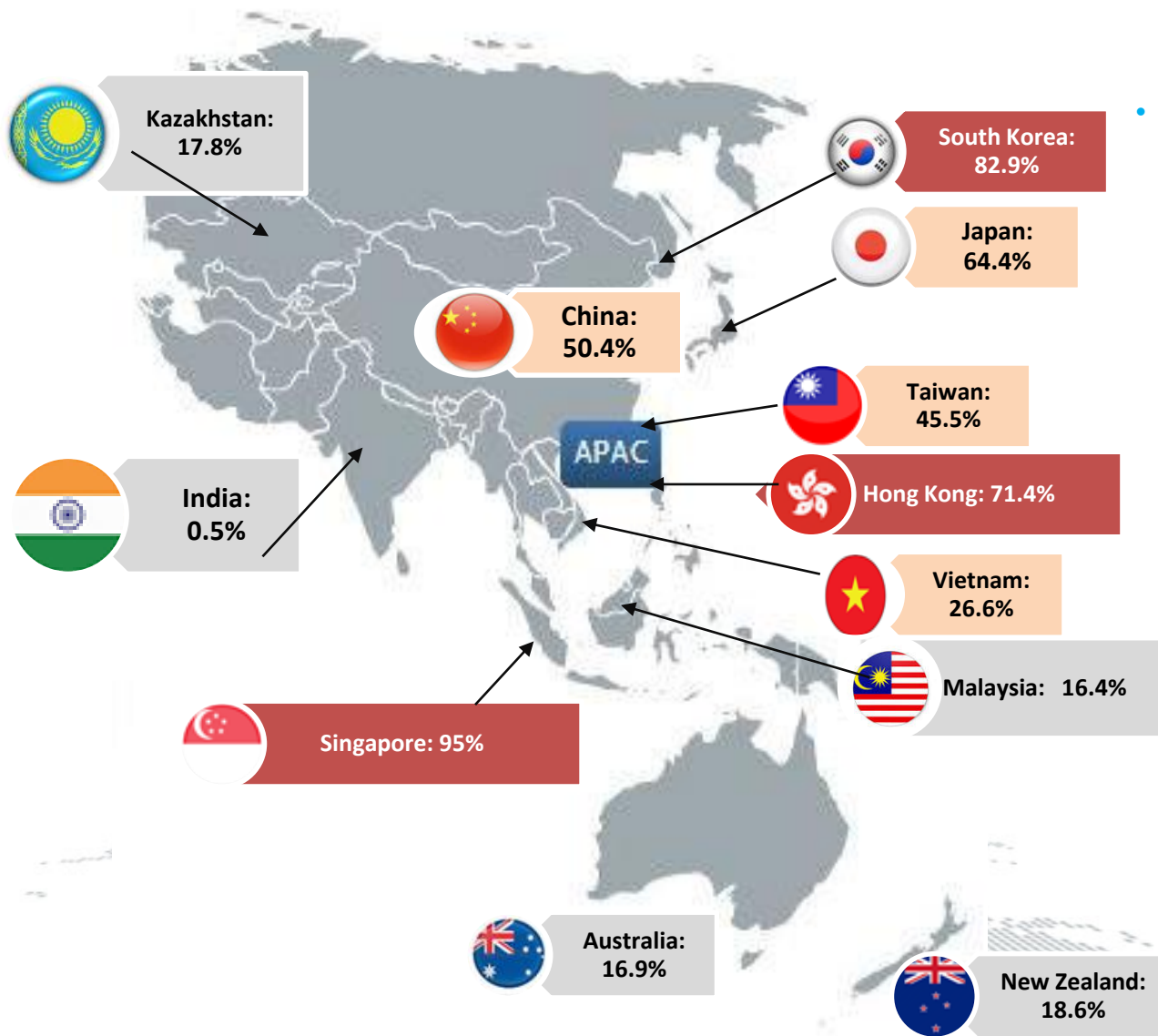
Total FTTH/B Subscribers by country

While China has increased its fibre subscribers and is still the leading country….
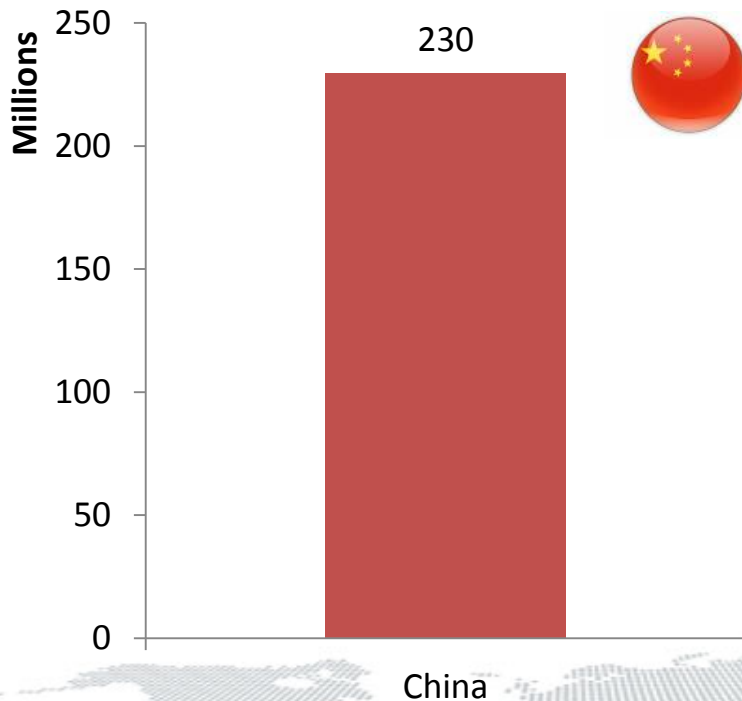
… countries like Japan and South Korea also have more than 30 or 10 million FTTH/B subscribers….
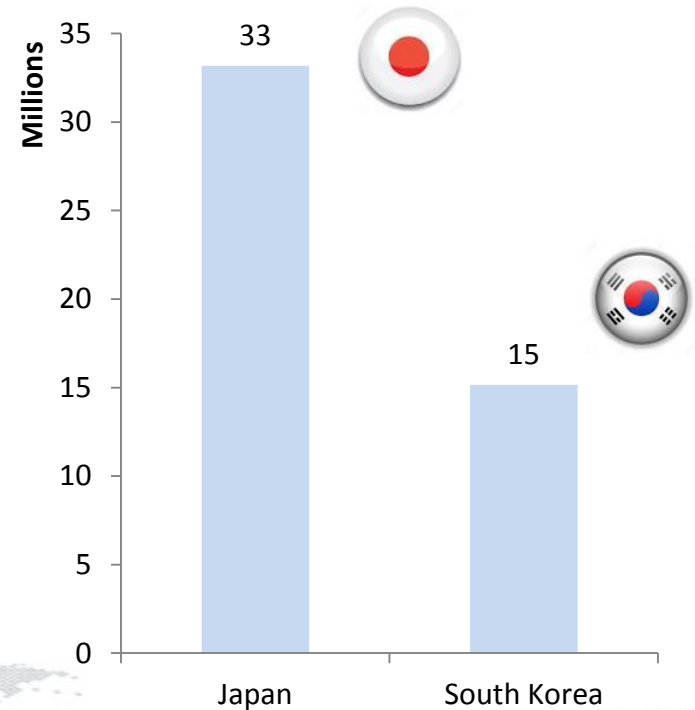
Penetration rates of FTTH/B in the region...

Kazakhstan: 17.8%

South Korea: 82.9%

Japan: 64.4%

China: 50.4%

Taiwan: 45.5%

APAC

Hong Kong: 71.4%

India: 0.5%

Vietnam: 26.6%

Malaysia: 16.4%

Singapore: 95%

Australia: 16.9%

New Zealand: 18.6%

- **APAC has continued the trend to deploy FTTH/B**

- 13 countries among in the Global Ranking:

  - 3 countries with a penetration rate > 70%

  - 4 countries with a penetration rate between 20% and 70%

  - 4 countries with a penetration rate > 10%

Market trends

- **Based on the size of the market, China is the main worldwide market in terms of number of subscribers**
  - 3 players involved on this market,
  - By end 2016 China Telecom and China Unicom are the leaders with 106 and 85 million subscribers respectively.
  - The market level is in line with the **Government's objectives** in terms of subscriptions, and higher in terms of coverage (300 M HP at end 2020)

- **Japan and South Korea are the historical leaders**
  - The markets are still growing but at a lower pace (Japan +22% and SK +6% subs in 2016)
  - Coverage is exhaustive in both countries and the growth is now supported by the switch of end users from one access technology to another

- **Australia, New Zealand and Thailand with the highest growths in terms of subscribers**
  - National program in Australia an New Zealand, with dedicated players involved in the rollout of the new infrastructure and in the commercialization of the new network
  - Thailand with fast evolution with its operator in the FTTH deployment and adoption

- **Other significant markets:**
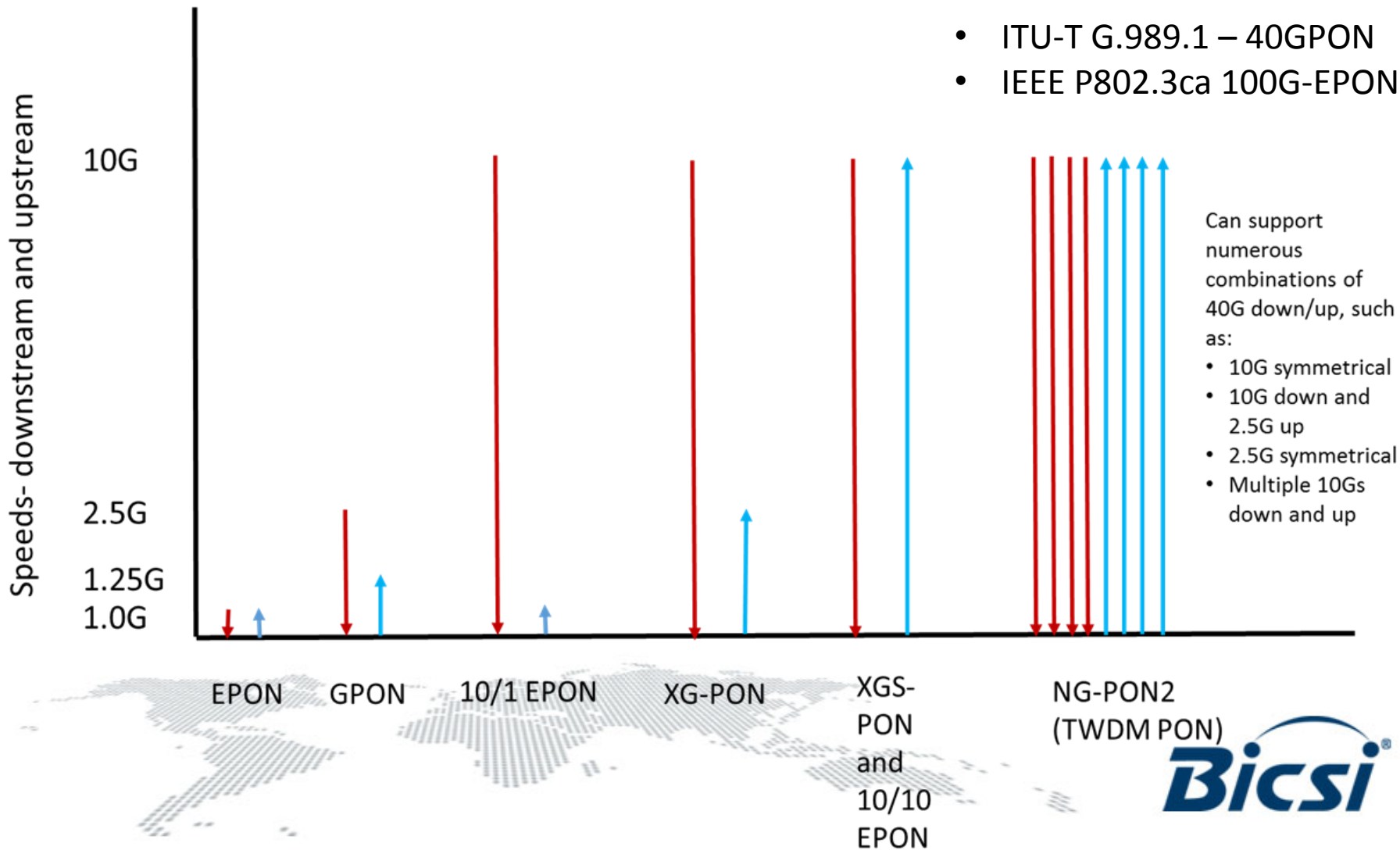 - Indonesia, Taiwan then India and Philippines progressing

Challenges and drivers for FTTH

- **Demography: a huge market potential**
  - India and China are the most populated countries in the world
  - MDUs are dominating in large cities especially in China
  - A huge potential of 550 M population: Bangladesh, Philippine, Vietnam and Pakistan

- **Low competition from other xDSL or Cable networks**
  - The "quality gap" between copper and fibre networks is important: end users need fibre for higher bandwidth
  - Cablecos are less dominating the broadband market than in Europe or in the US … and it's not going to change for now (SARFT in China)

- **A key driver for mass market migration in APAC: NBN programs… the NZ success, now followed by the Australian one, and in 2016 by Philippines**

- **Incumbents leading rollouts in APAC but also some free room for new entrants**
  - Some incumbents are deeply involved in national FTTH/B deployments
  - New entrants in large countries (India), mature markets (HK) or emerging markets (Vietnam)

- **APAC Fibre dynamic is also being pushed by Mobile demands…**
  - Fibre for mobile Backhaul : LTE and metro / small cells … and 5G coming soon in APAC !!

NEW FTTH STANDARDS

Next-gen PON overview

- ITU-T G.989.1 – 40GPON
- IEEE P802.3ca 100G-EPON

Speeds- downstream and upstream

10G

2.5G

1.25G
1.0G

EPON   GPON   10/1 EPON   XG-PON   XGS-PON and 10/10 EPON   NG-PON2 (TWDM PON)

Can support numerous combinations of 40G down/up, such as:
- 10G symmetrical
- 10G down and 2.5G up
- 2.5G symmetrical
- Multiple 10Gs down and up

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NG-PON2 monetization – Why do we need a faster FTTH Technology?

Customers/applications:

- High-ARPU residential, 1G, 2G, and 10G

- MDUs – more bandwidth per unit

- SMBs and enterprises – support growing bandwidth needs along with applications, including redundancy

- MBH – growing demand as wireless data continues to explode
  - Strong fit for small cell MBH (mobile backhaul)
  - Supports wholesale of MBH services with assignment of individual wavelengths to customers

- CPRI-compliant fronthaul – growing demand for cost-efficient fronthaul

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KEY CHALLENGES OF FTTH DEPLOYMENT

Lessons Learnt:
Challenges FTTH Deployment

	Challenge	**Solution**
Competency	Lack of competent manpower needed to to design, deploy & maintain the network	International recognised training and credentials to ensure the competency of individuals
Civil & Construction	Lack of guidelines and best practices are required to deploy fibre plant up to the customer premises	International best practices that not only guarantees proper deployment but also ensure future scalability

Copper/Electrical Installers not used to handling fibre cable
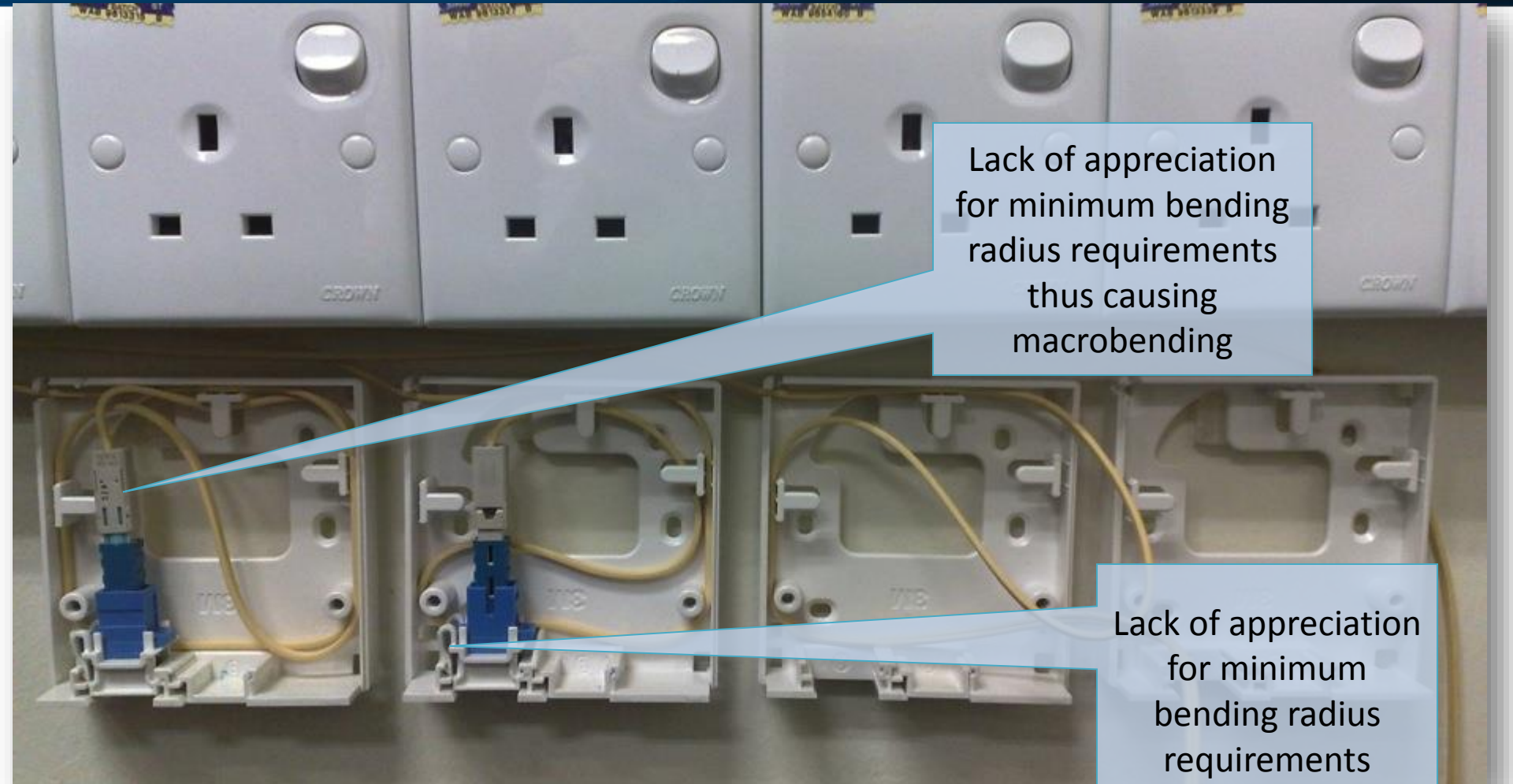
Inexperience contractors finding difficulty working with aerial distribution fibres
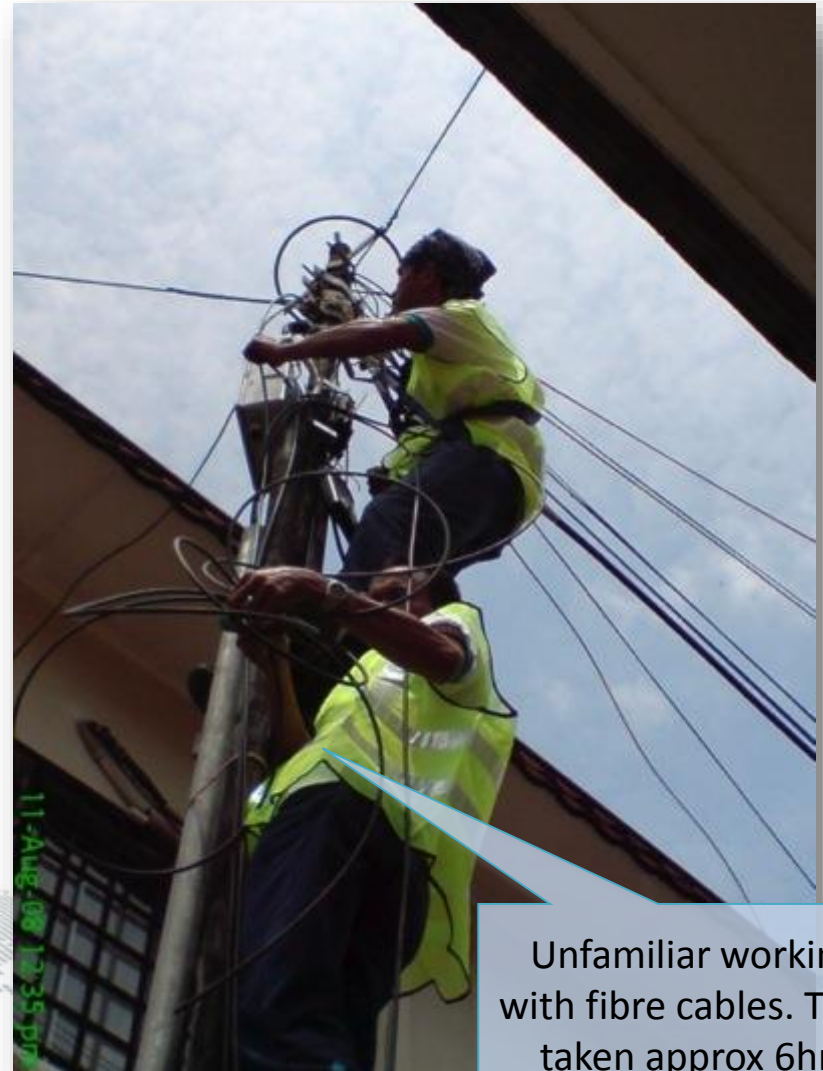
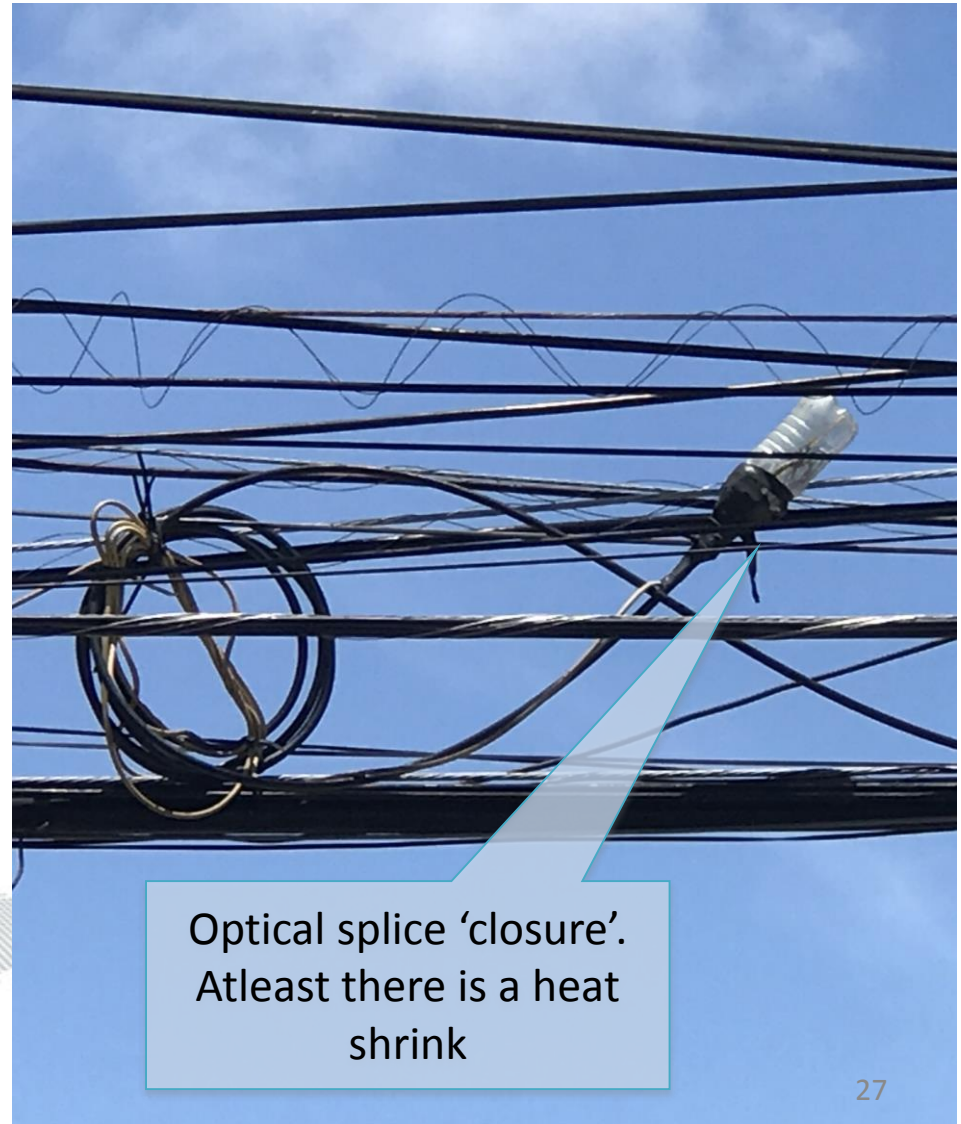Unfamiliar working with fibre cables. Time taken approx 6hrs

24

Lack of appreciation for minimum bending radius requirements thus causing macrobending

Lack of appreciation for minimum bending radius requirements

Minimal understanding of proper optical fiber installation & testing
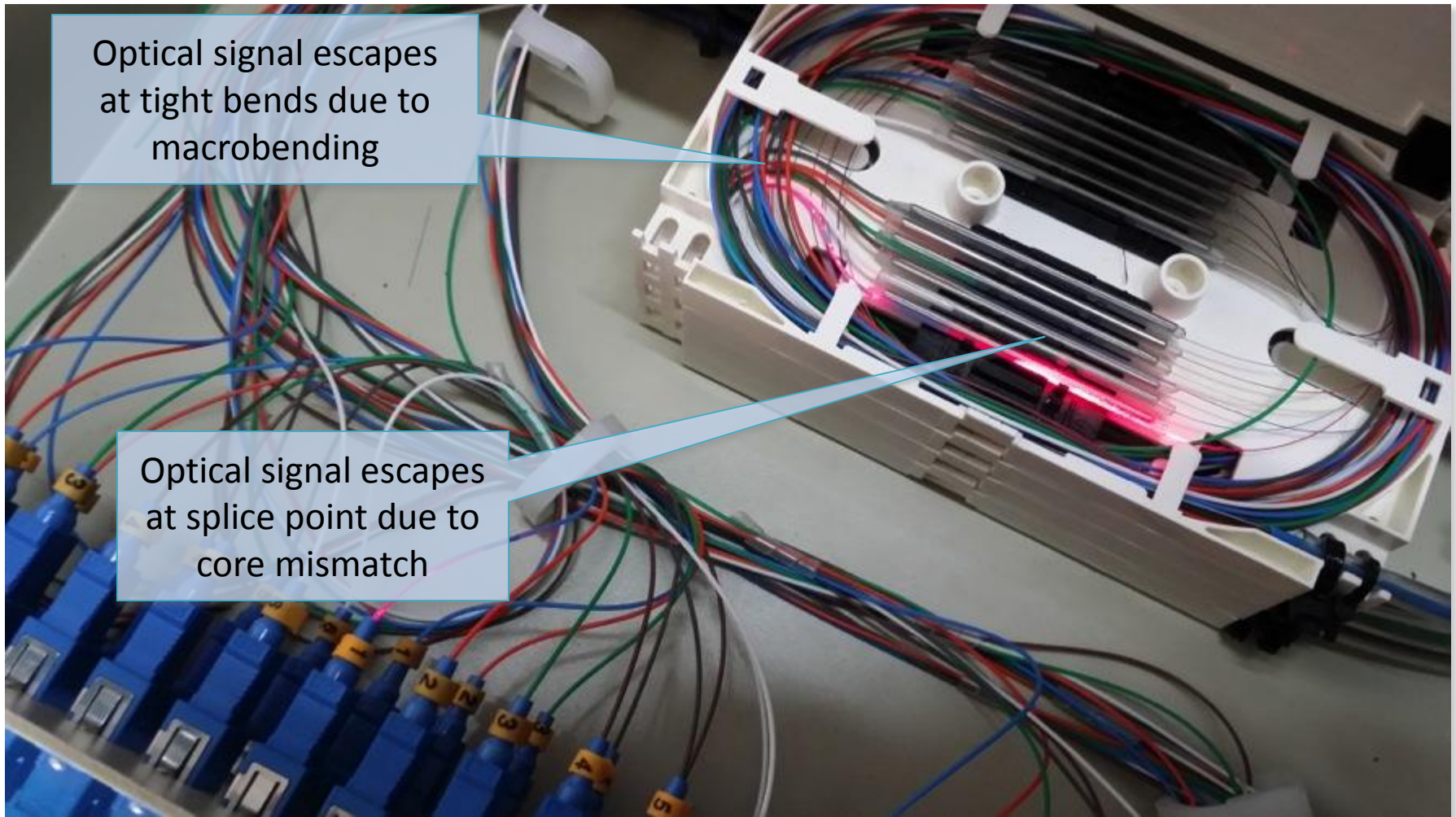
Optical signal escapes at tight bends due to macrobending

Optical signal escapes at splice point due to core mismatch

Minimal understanding of proper optical fiber installation & testing

'Underground' became 'On-the-ground' closure

Optical splice 'closure'. Atleast there is a heat shrink

27

Lack of appreciation for fibre connector cleanliness accounts for 90% of all reported faults

Lack of appreciation for connector care during ODF installation at Central Office

Connector cleaning was not performed leaving finger oil traces on connectors

# Selection of substandard components

Traces of adhesive not removed during polishing
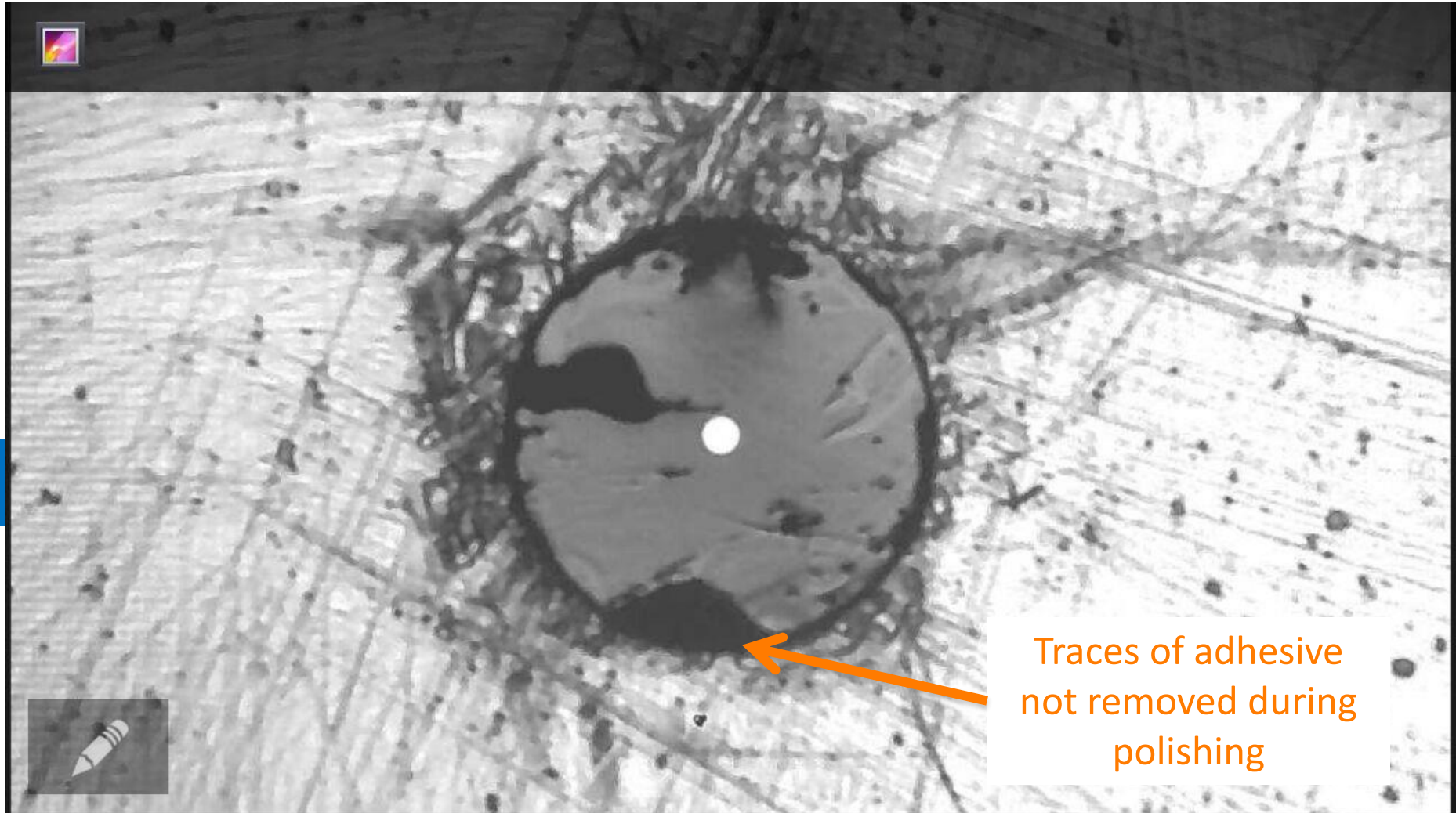
Inappropriate cleaning tool

Fiber optic cleaning kit ...

'Cleaning tissue'

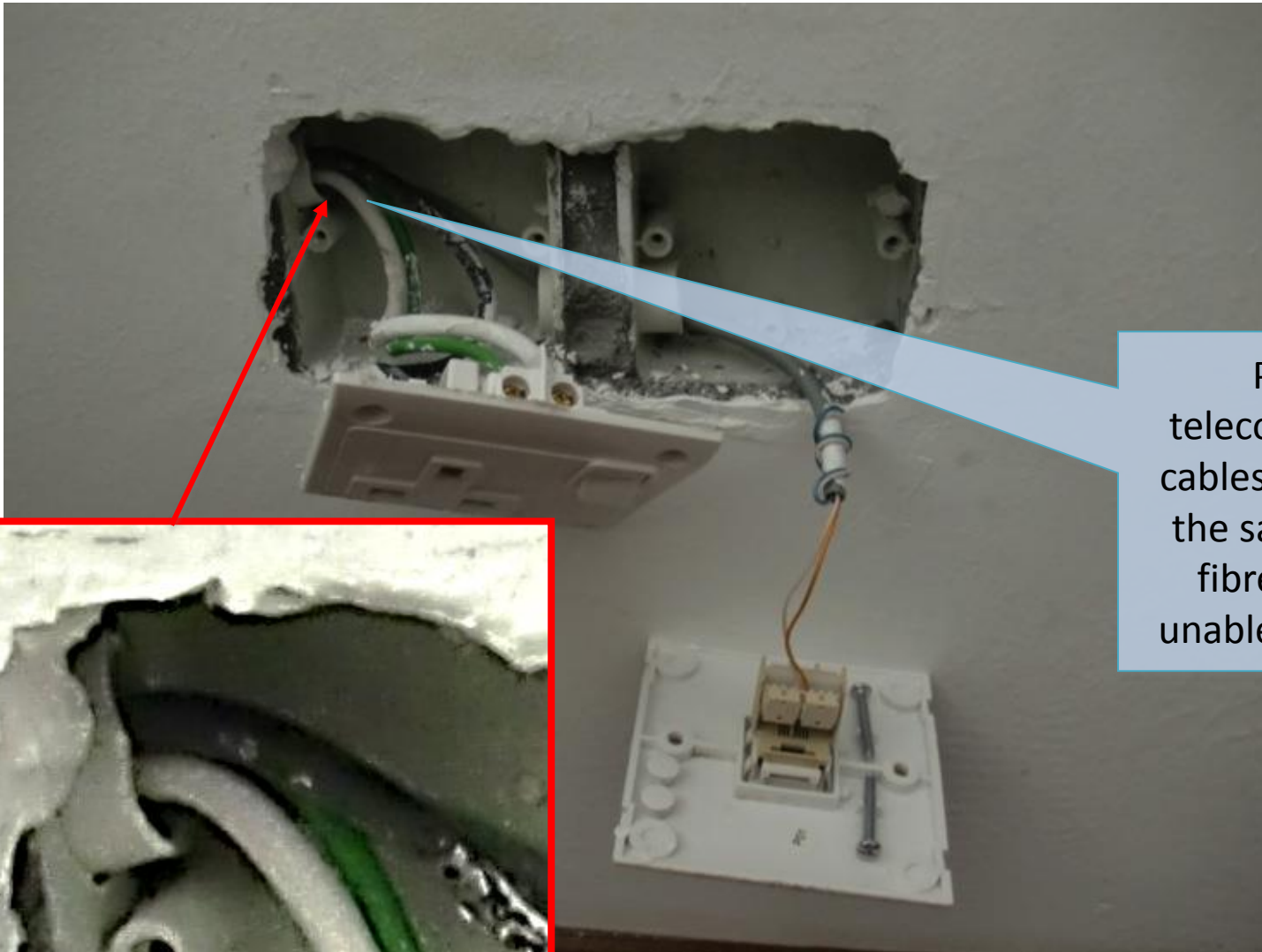Container for cleaning alcohol. NOT mineral water

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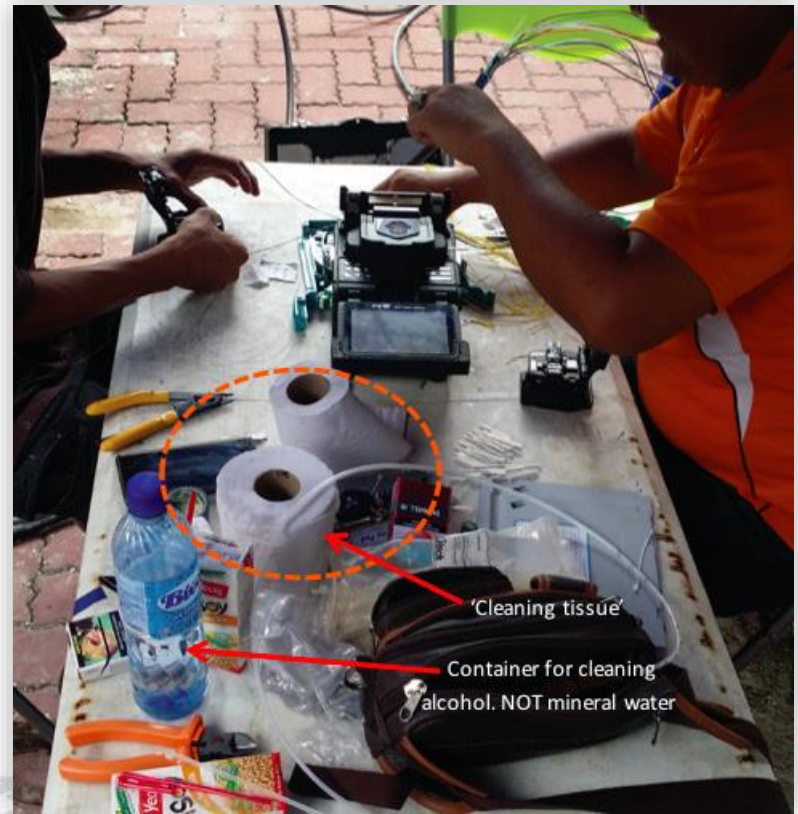
Telecommunications ducts not a priority – NOT Adhering to Building Codes and By-Laws

Lack of proper ducting systems for telecommunications facilities. Telecommunications cables are plastered into the cement wall
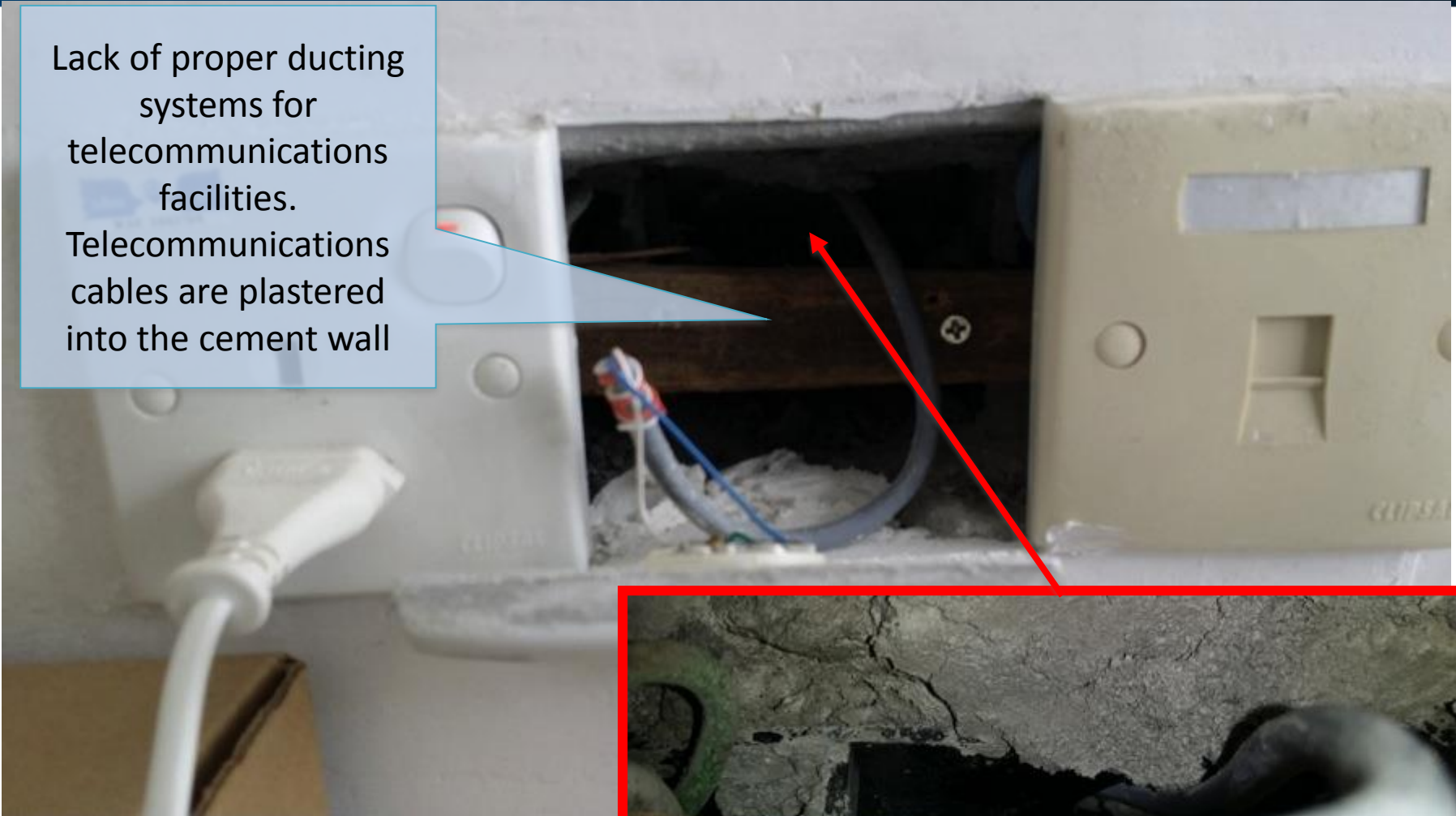
Telecommunications ducts not a priority – NOT Adhering to Building Codes and By-Laws

Power and telecommunications cables are installed in the same duct. New fibre cables were unable to be installed
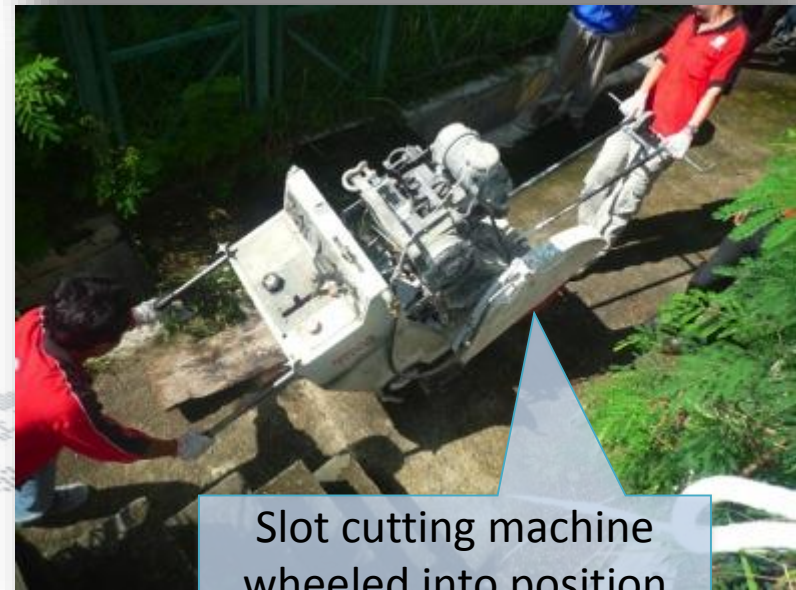
Extensive civil required to bring the services to the customers

Vertical saw cut into external wall of customer premise to allow installation of new ducts

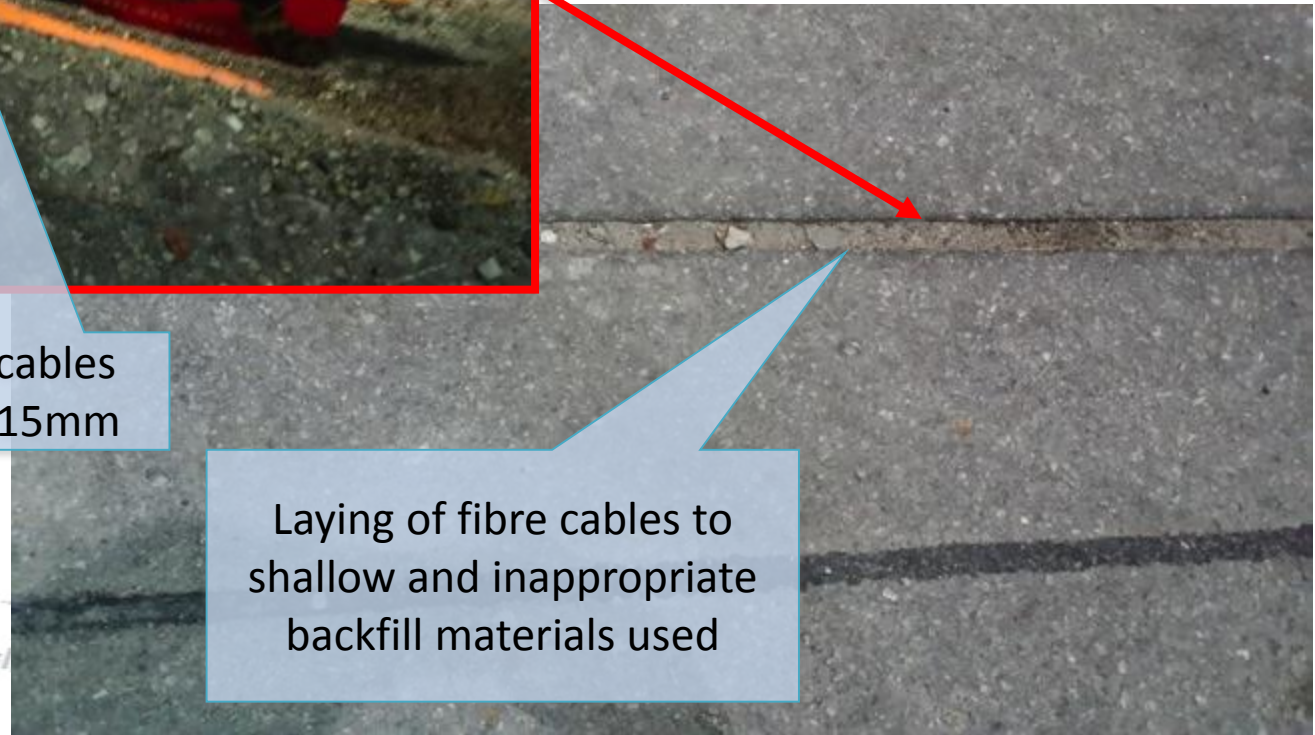Installation of raceways at customer premises

Slot cutting machine wheeled into position

Various quality of civil work (Lack of Audit)

Depth of fibre cables approximately 15mm

Laying of fibre cables to shallow and inappropriate backfill materials used

Various quality of civil work (Lack of Proper Machinery)

1m x 1.5m x 1.5m Pits (WxLxD) are dug approximately 5m a part

Workers manually thrust Galvanized Iron pipe from one pit to another

Conclusion

- Conventional FTTH is still growing strong in SEA especially in countries like Thailand, Indonesia & Philippines

- The next generation of FTTH is underway to cater for non-consumer markets such as SME, Enterprises & Mobile

- Key challenges can be overcome by structured training and accreditation and also adoption of international best practices