Engineering for Availability - National Broadband Network Fibre Network Design

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RSPs provide ‘end user’ applications

Consumer
– **Asymmetrical**

High-speed internet
- bursty

IPTV
- streaming
- constant (committed rates)

VOIP
- constant (committed rates)

Business
– **Symmetrical**
– **Business critical connection**
– **Service level guarantee**

Backup of data

Software-as-a-Service

High-definition voice and video conferencing

Online collaboration with remote workers

Industry – e.g. health
– **Symmetrical**
– **Business critical connection**
– **Service level guarantee**
– **Ubiquitous**

Online consultations eprescribability

Remote diagnosis of electronic medical images

In-home monitoring of elderly-chronic disease sufferers

Source: LTE/SAE Trial Initiative (Oct 2009)

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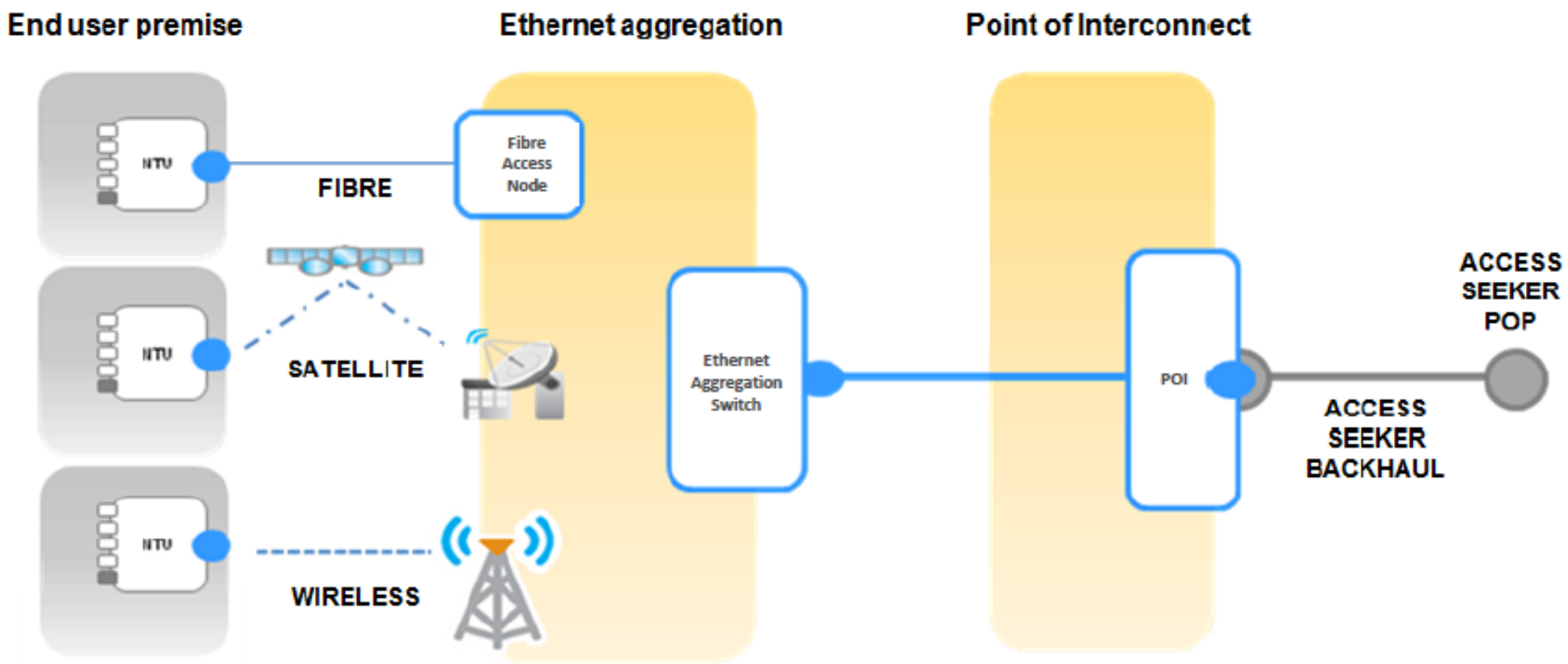
Three technologies – One access interface



Source: LTE/SAE Trial Initiative (Oct 2009)

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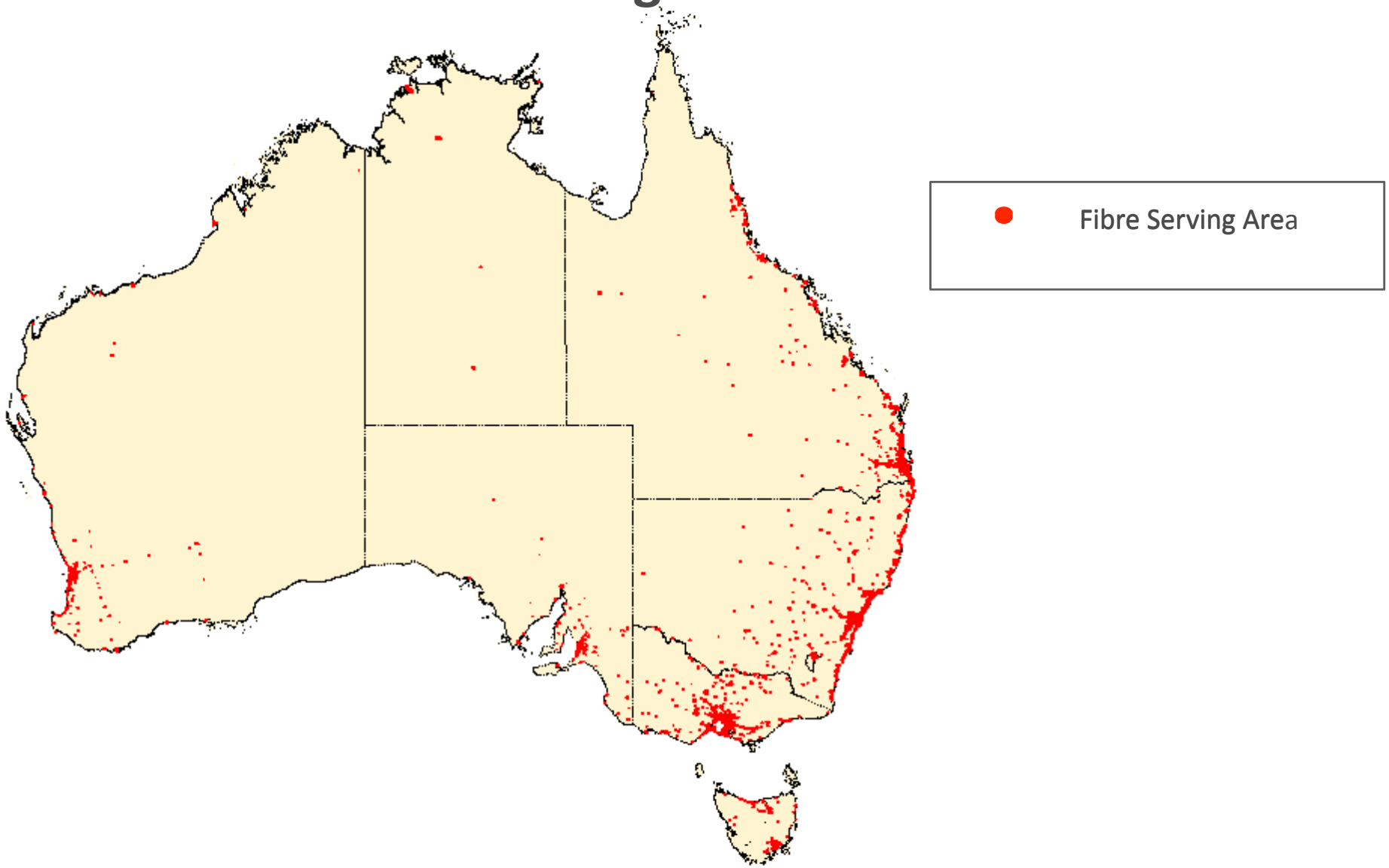
Australia – 93% Fibre Coverage



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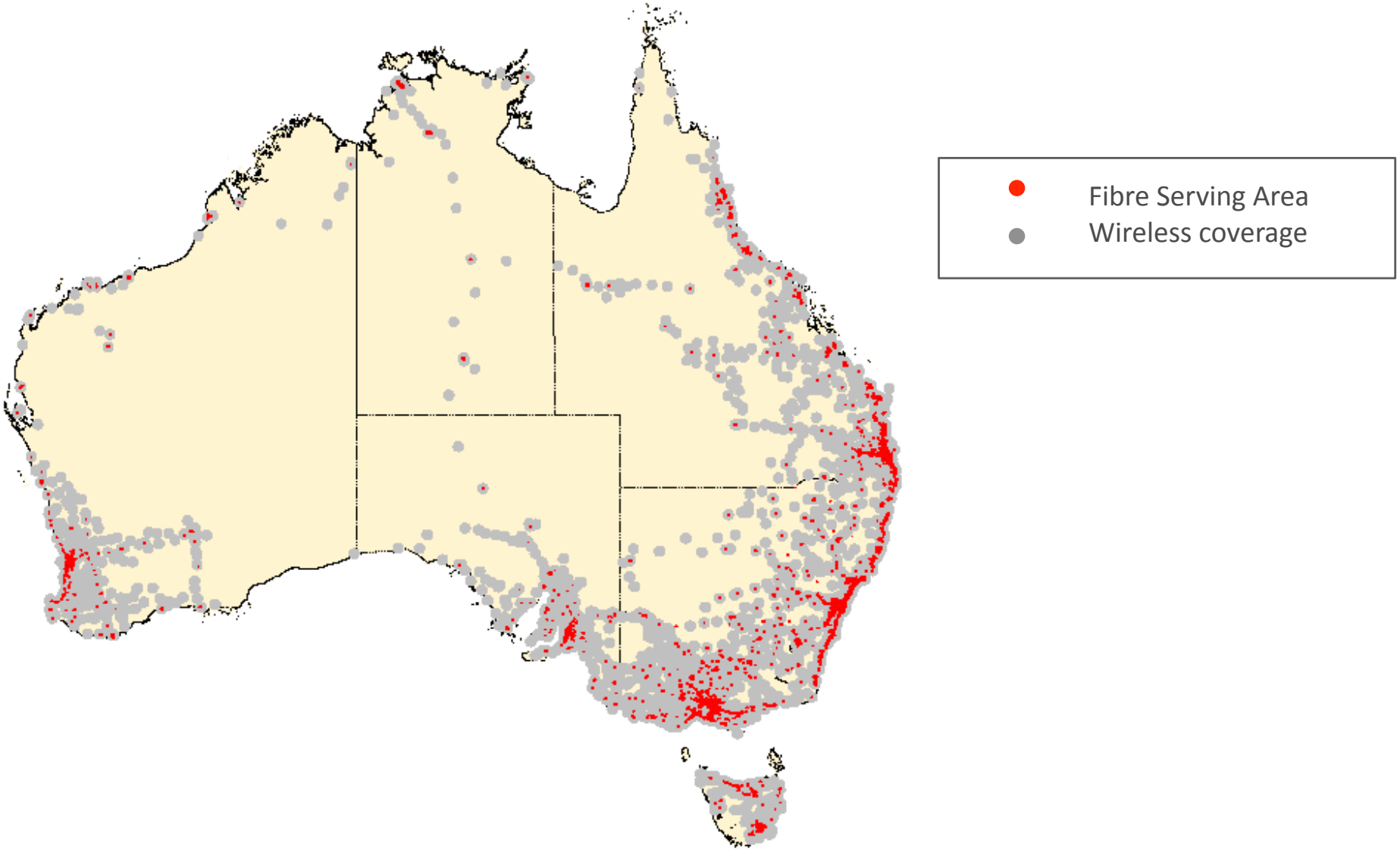
Australia – wireless coverage



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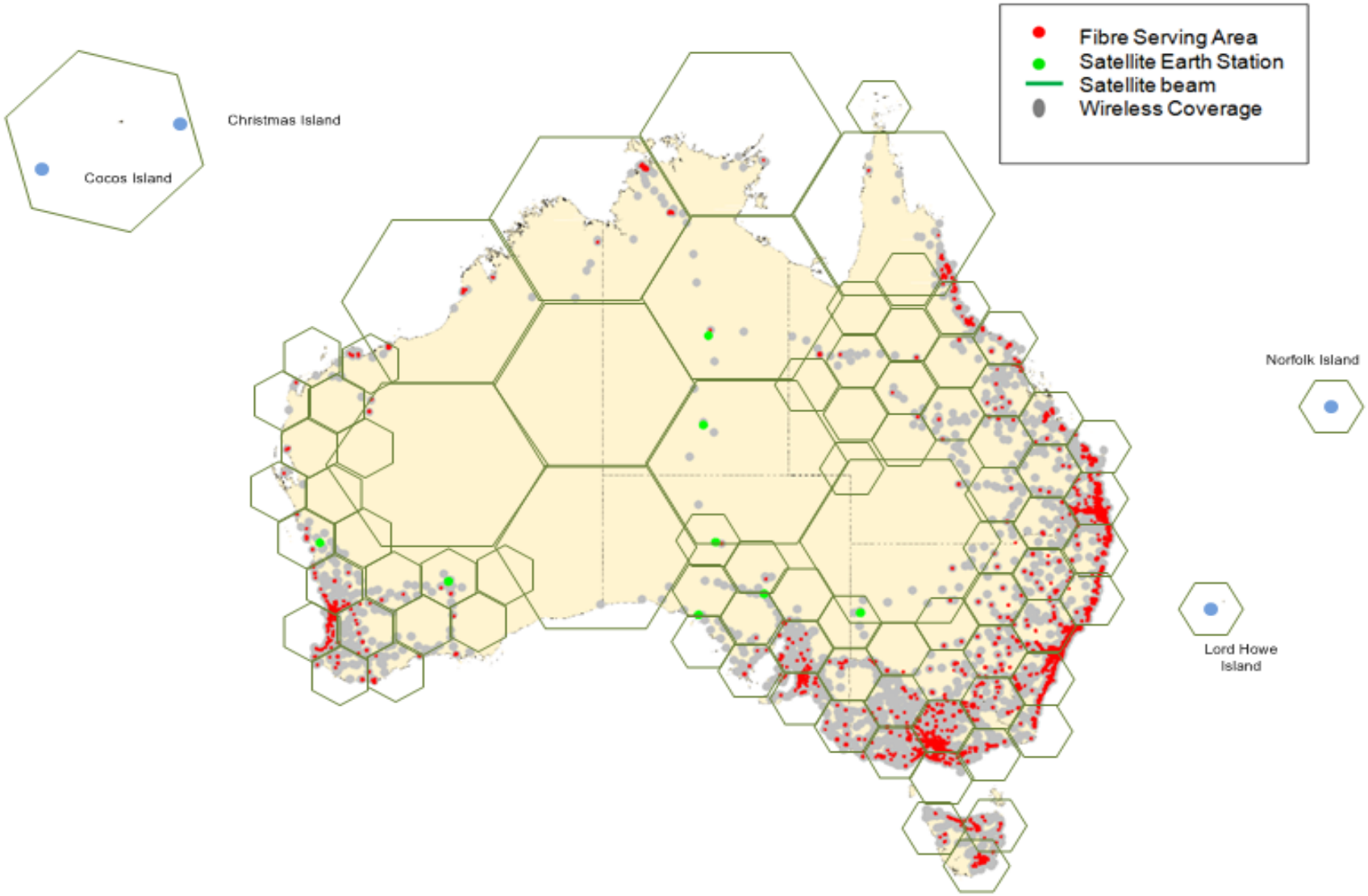
Fibre network + wireless + satellite



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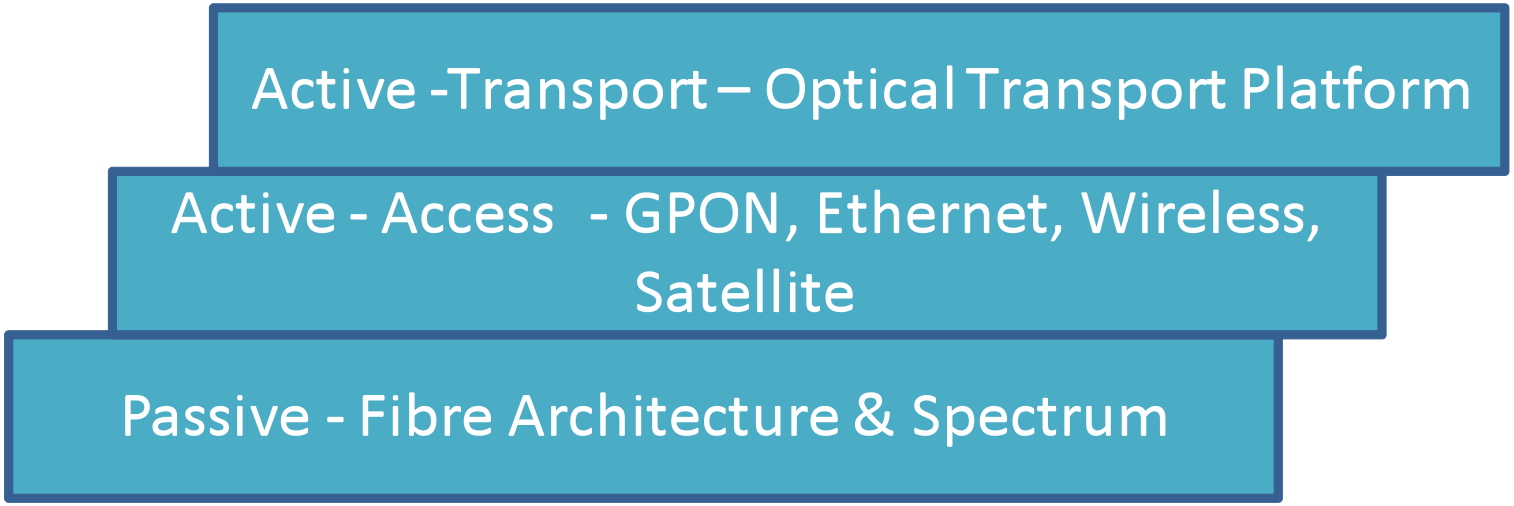
Network Infrastructure

All layers are inter-related



Passive Network - Fibre Lifetime

Lifetime of silica optical fiber is dependent on three parameters:

1.Fatigue or Stress Corrosion Susceptibility Parameter (n-value)
2.Proof testing stress
3.Stress applied on the fiber inside the cable

Lifetime of silica optical fiber can be calculated by below equation:

$$\text{Log}(\ T_f,\text{days}) = -0.931 - 0.21n - \text{Log}(n-2) + (n-2)\text{Log}[\sigma_p\ (\text{GPa})] - n\ \text{Log}\ [\sigma_a\ (\text{GPa})]$$

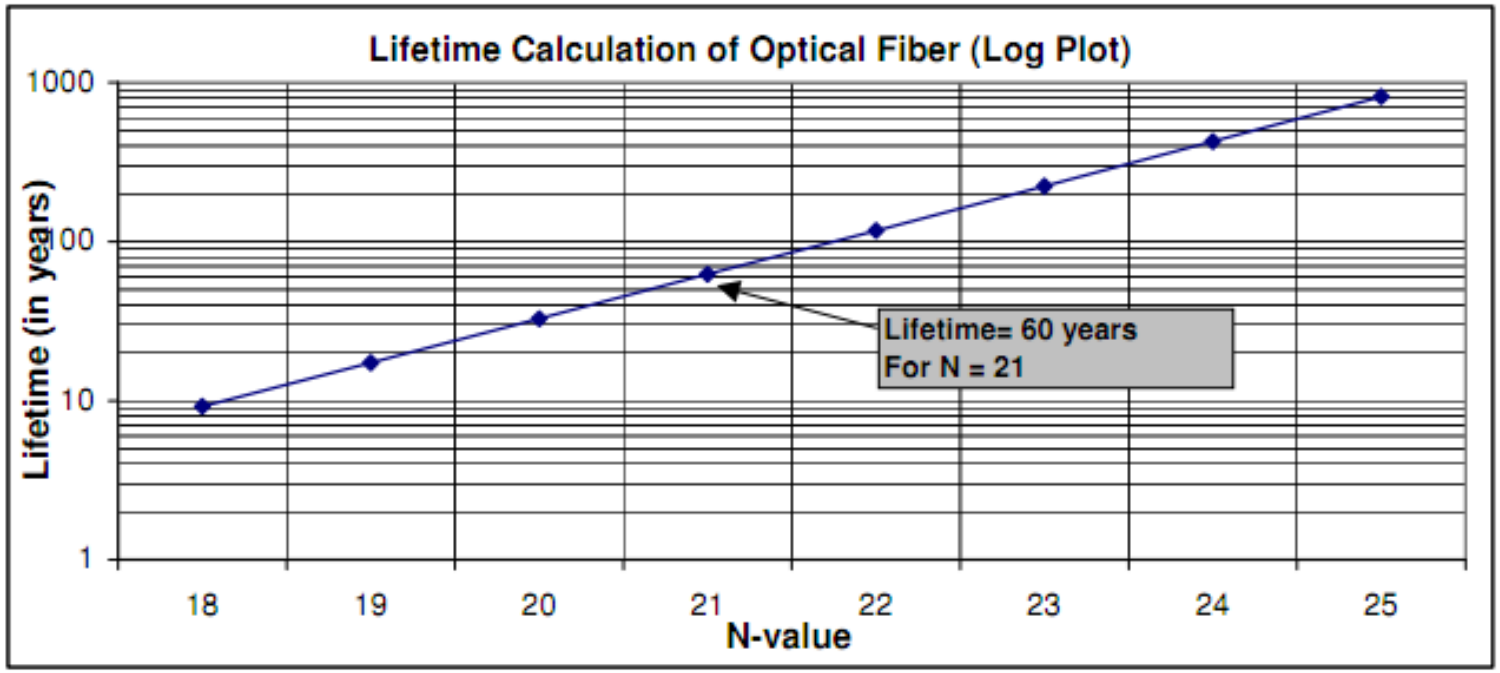
Where,
Tf = Lifetime or Time to failure
n = Dynamic Fatigue parameter
σp = Proof testing stress
σa = Applied Stress

Source: Sterlite Optical Fibre Lifetime Calculation May 2006 AN0001 (Public Release)

Silica Optical Fibre Lifetime

Below figure shows lifetime (in year) vs n-value with below assumptions.

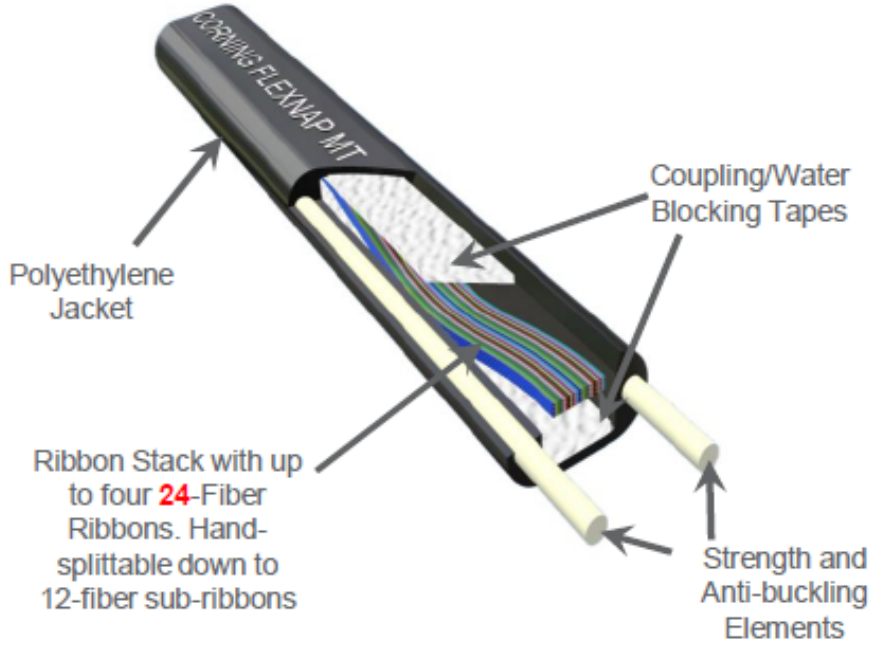
Proof testing stress, σ_p = 0.75 GPa (Sterlite's proof-test machine setting)
Applied Stress, σ_a = 0.23 GPa (288 gm, equivalent to 1/3 rd of 1% strain, This is the typical stress on the fiber inside the cable)

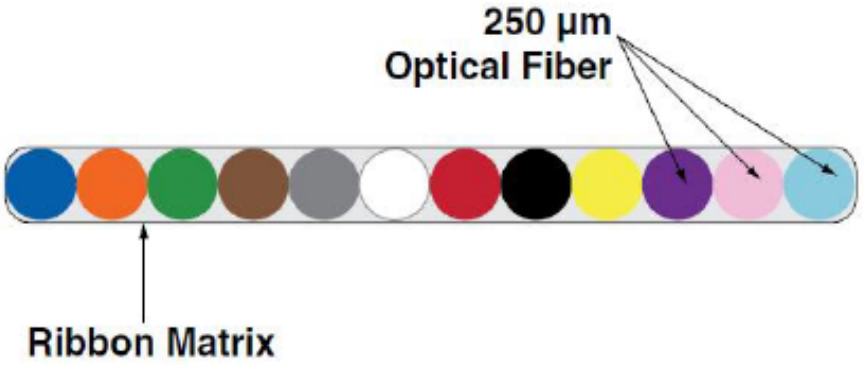


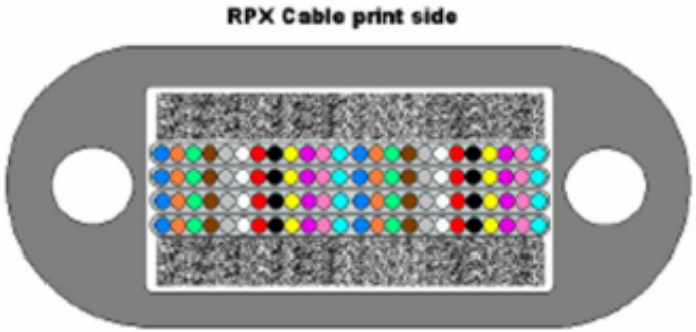
Typical dynamic fatigue value of STERLITE® optical fiber products is 21, which is equivalent to 60 years lifetime.

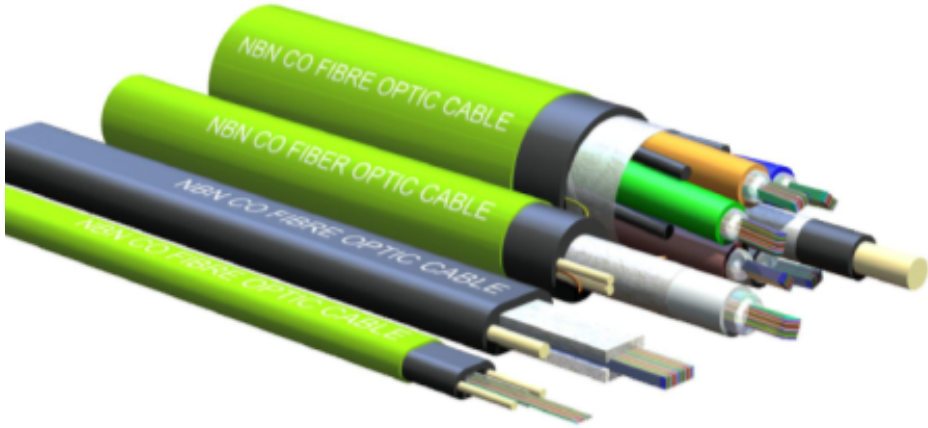
Source: Sterlite Optical Fibre Lifetime Calculation May 2006 AN0001 (Public Release)

NBN Co Ribbon Fibre









Source: Sterlite Optical Fibre Lifetime Calculation May 2006 AN0001 (Public Release)

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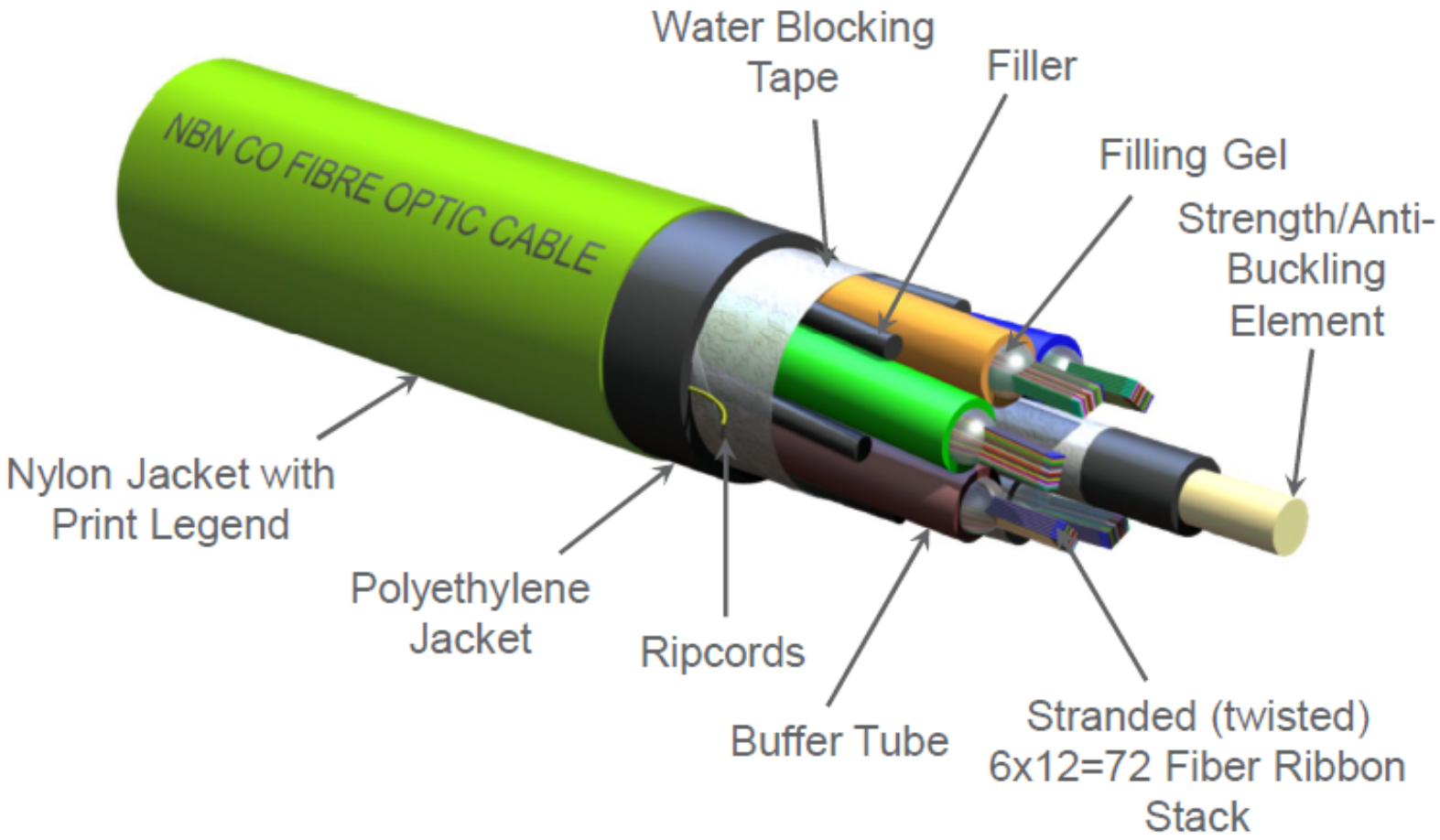
NBN Co Ribbon Fibre

NBN Distribution, Trunk & Transit Cables
288F–864F ALTOS® Ribbon Dielectric



CORNING | Cable Systems | Corning Incorporated | 21

Source: Sterlite Optical Fibre Lifetime Calculation May 2006 AN0001 (Public Release)

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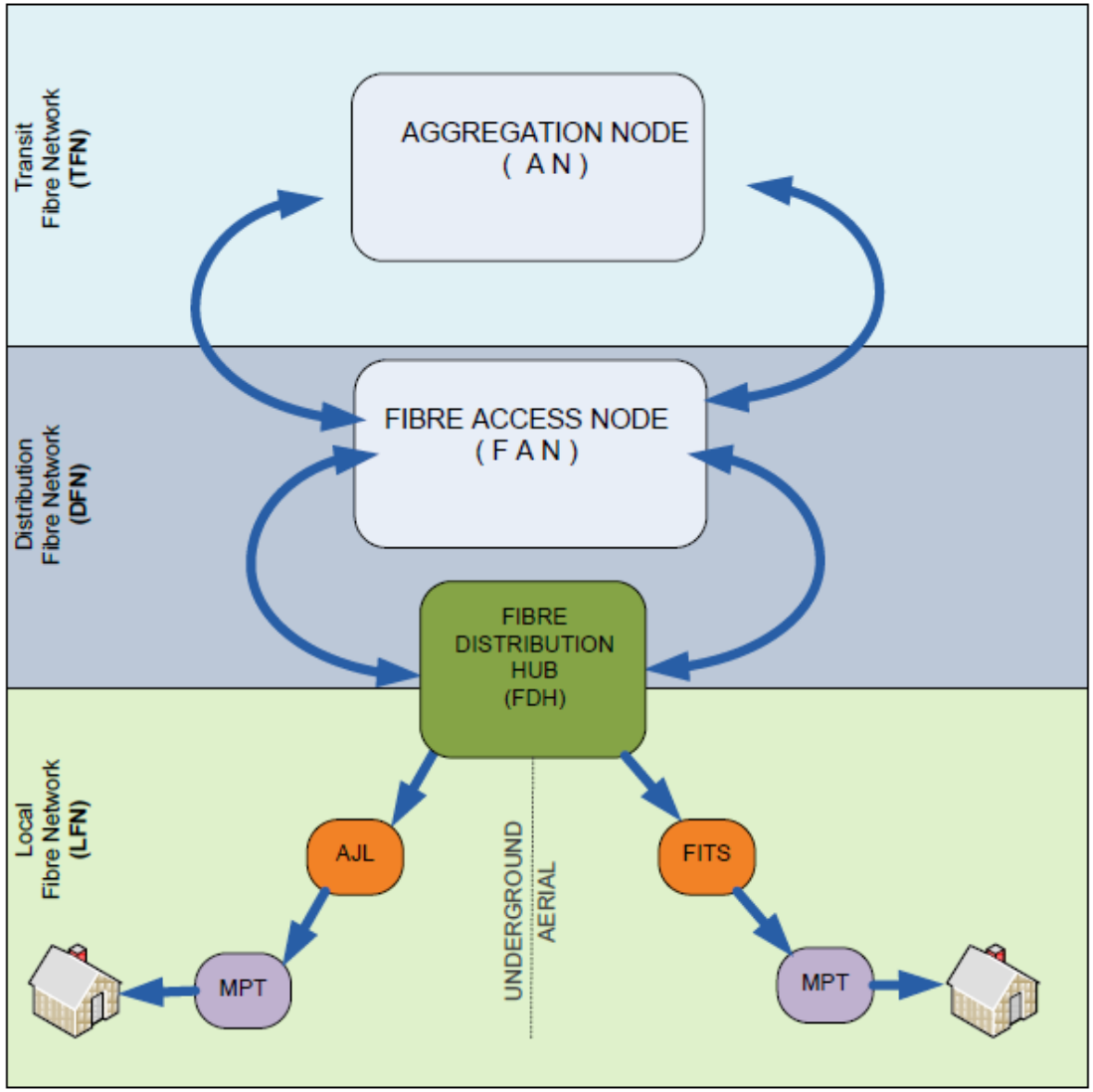
Passive Fibre Structure



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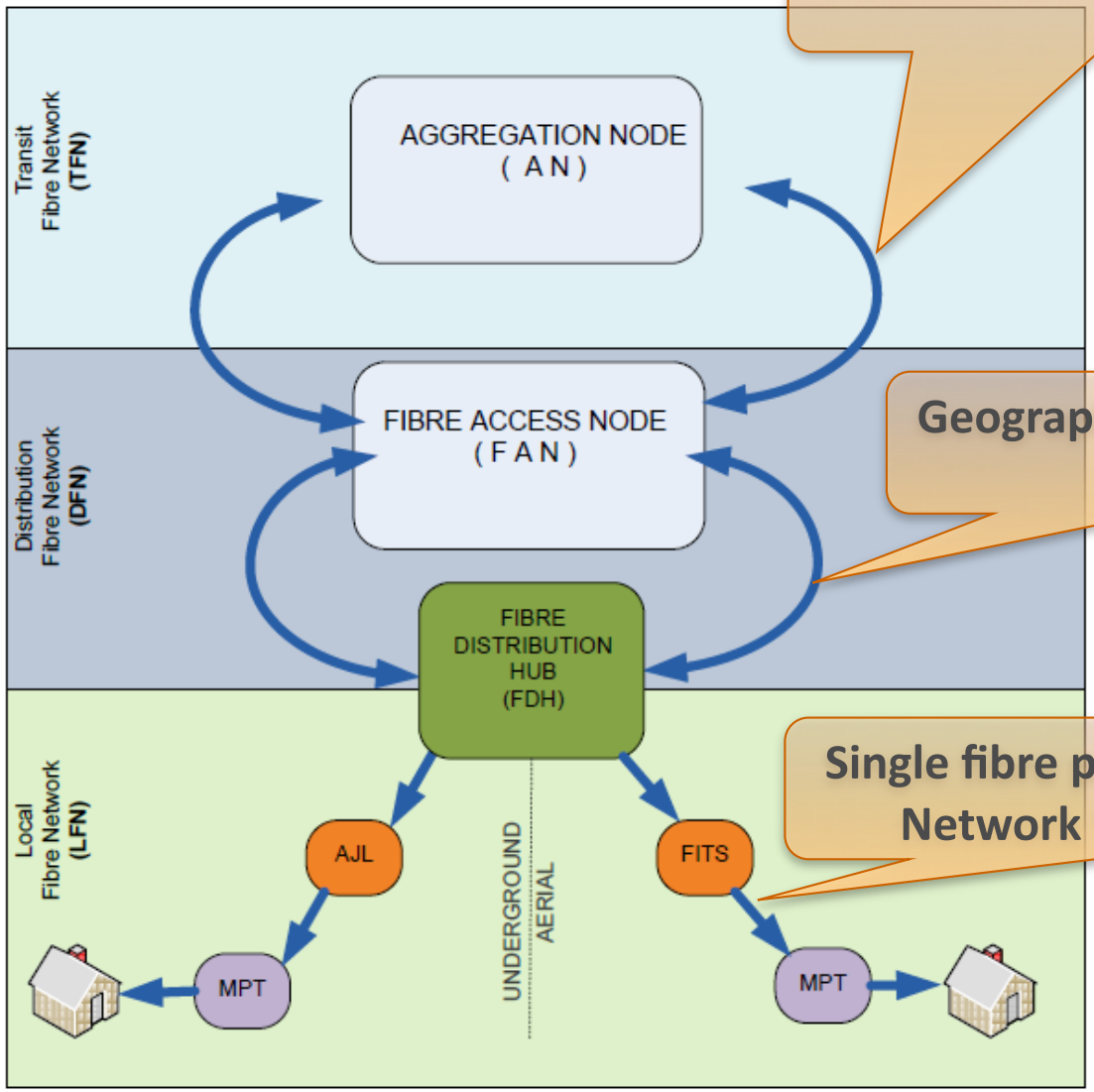
Passive Fibre Structure



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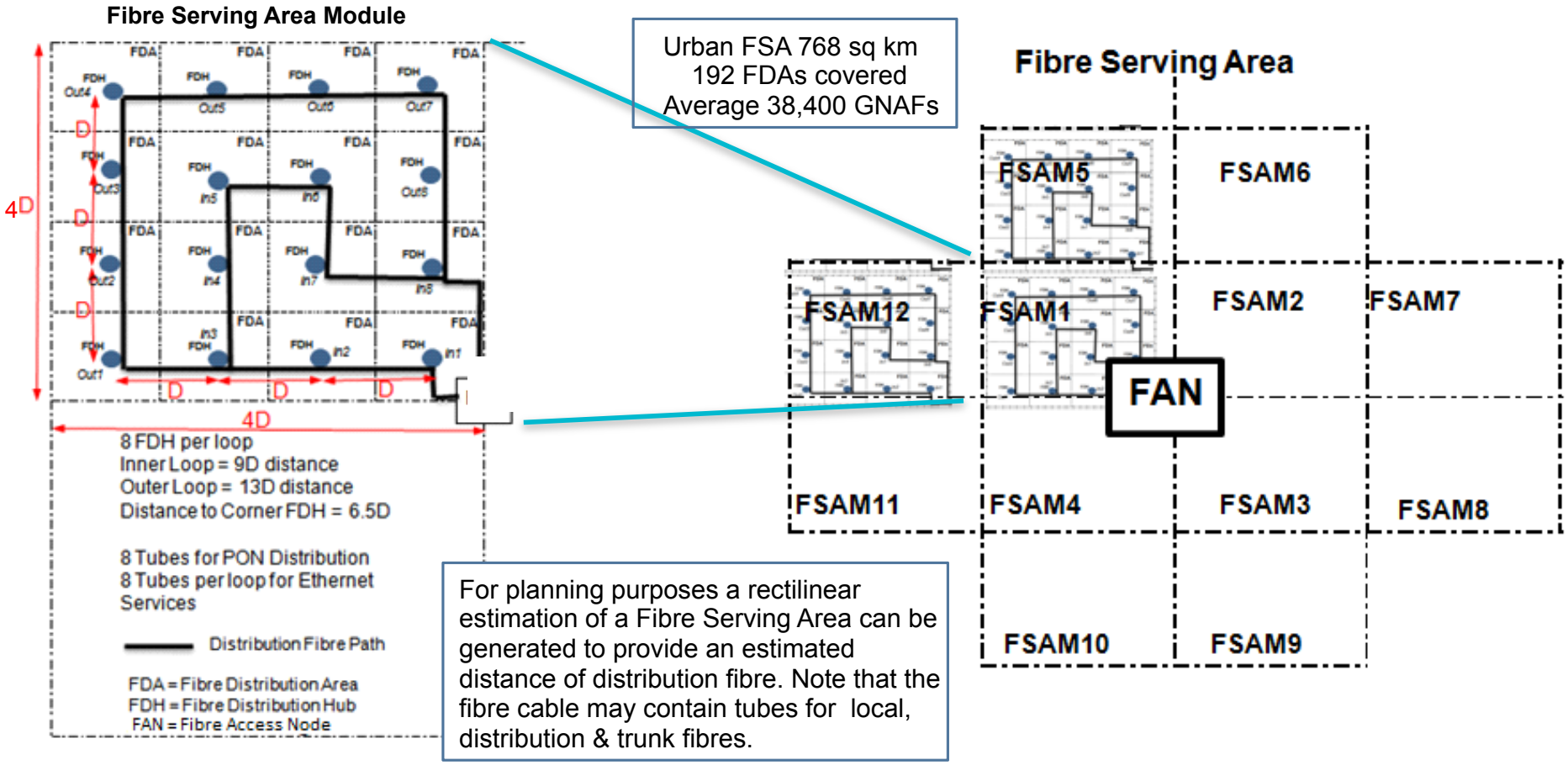
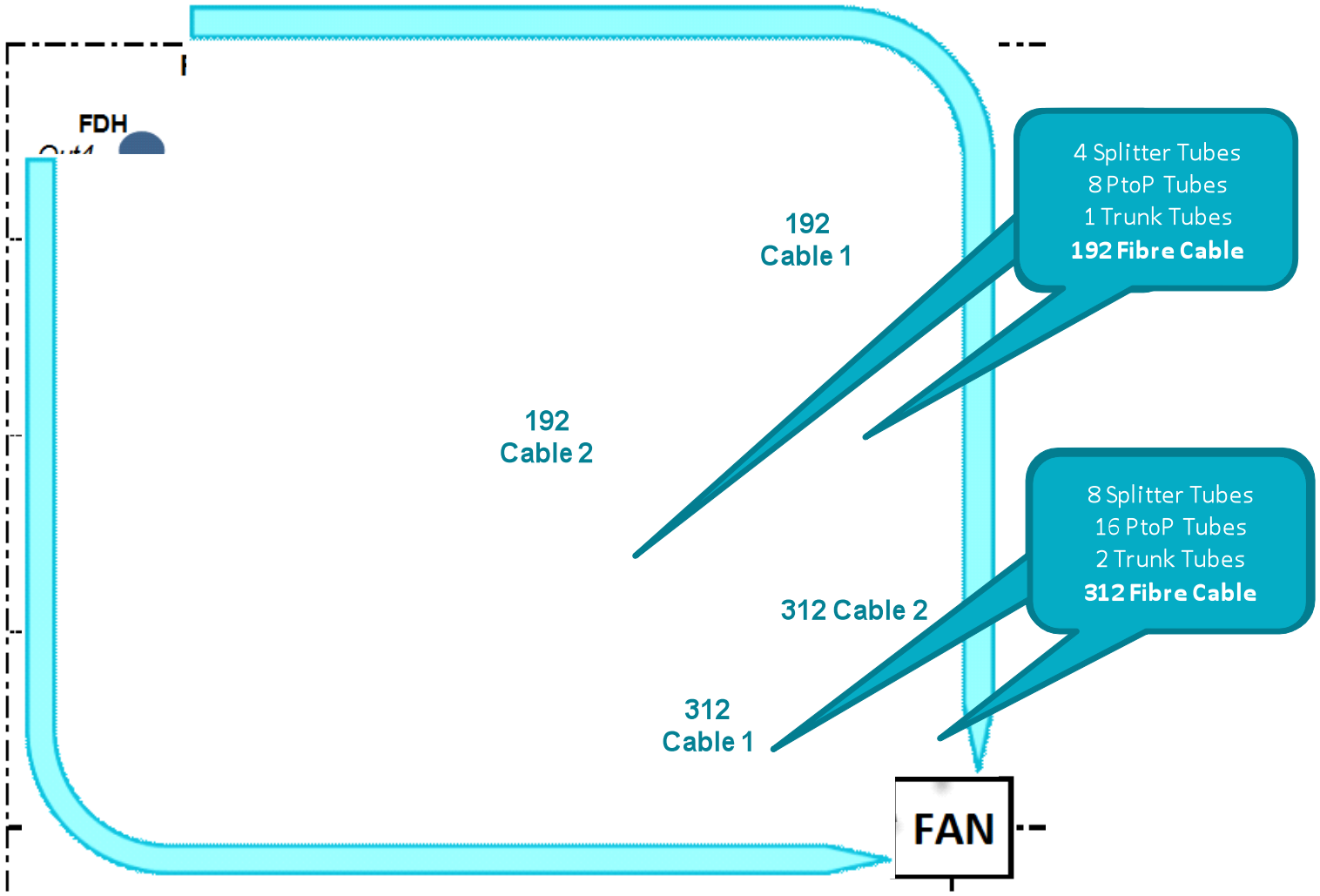
TFN – Regional Transmission Routes

DFN - Fibre Serving Area Structure



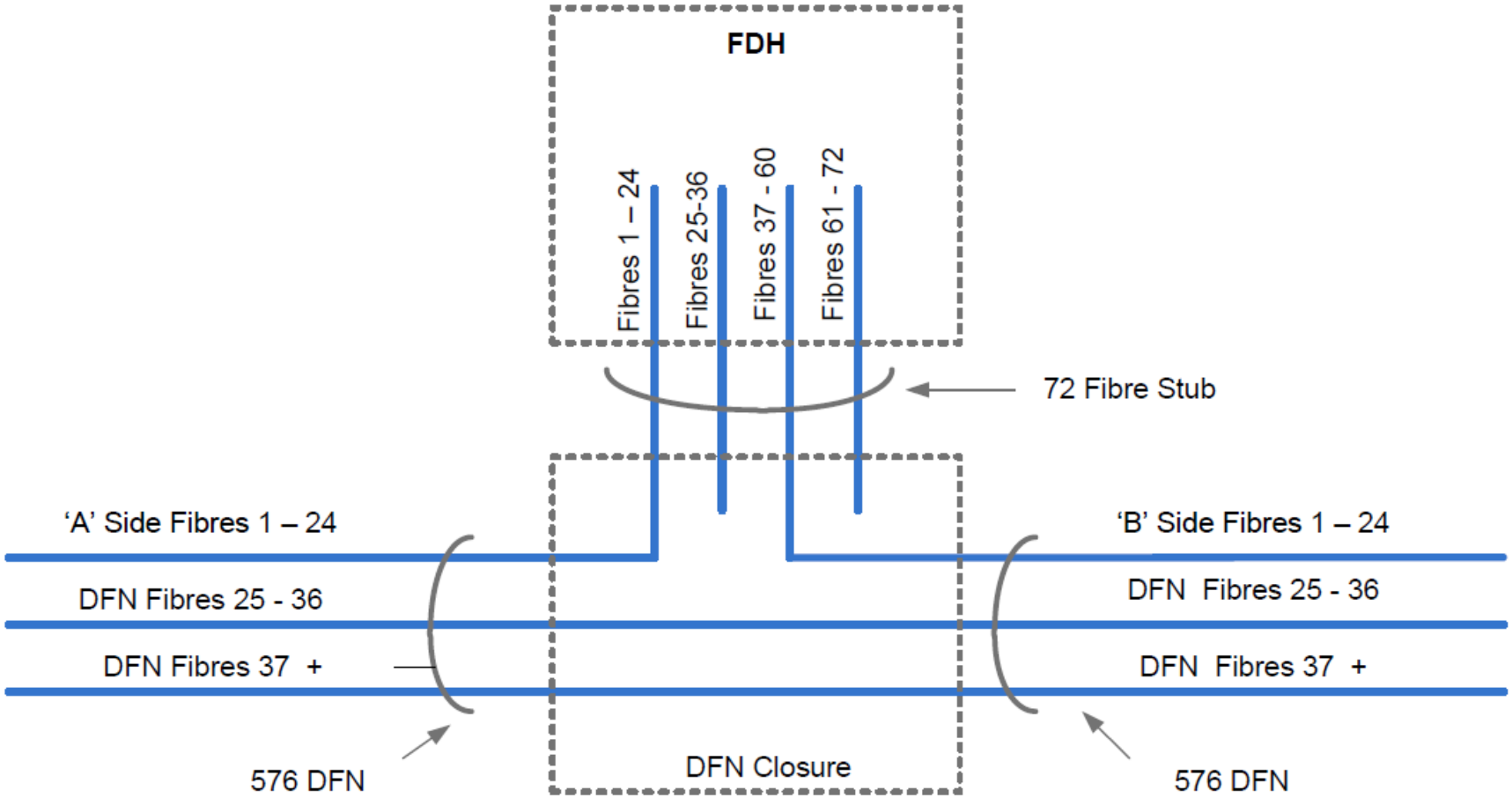
DFN - Fibre Serving Area Module Cables

Fibre Serving Area Module

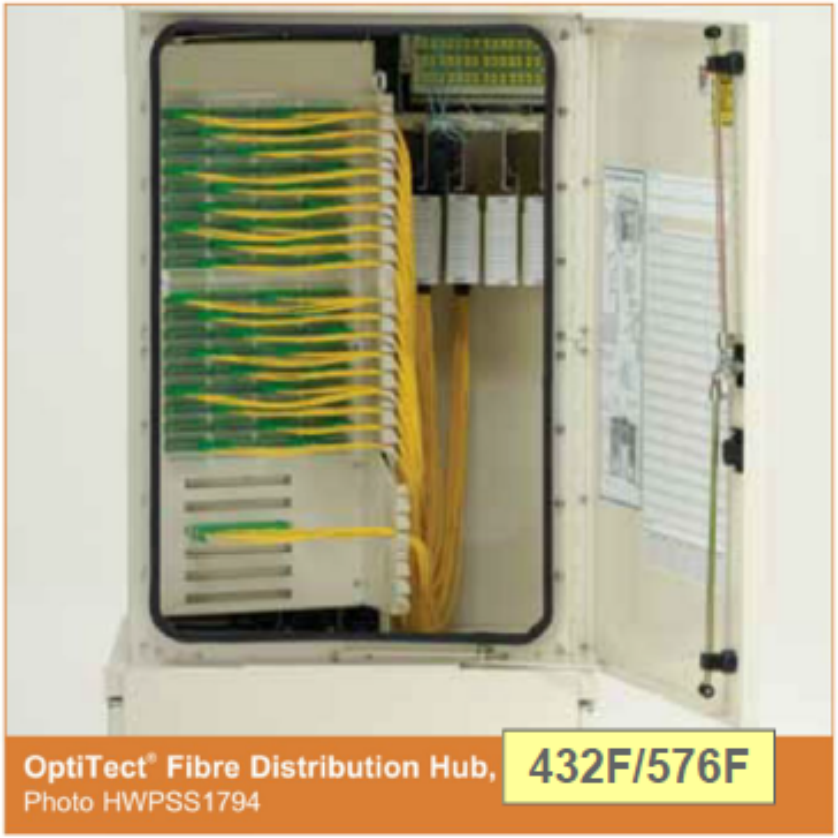


Each loop has 4 Splitter and 8 Point to Point Tubes fed in each direction

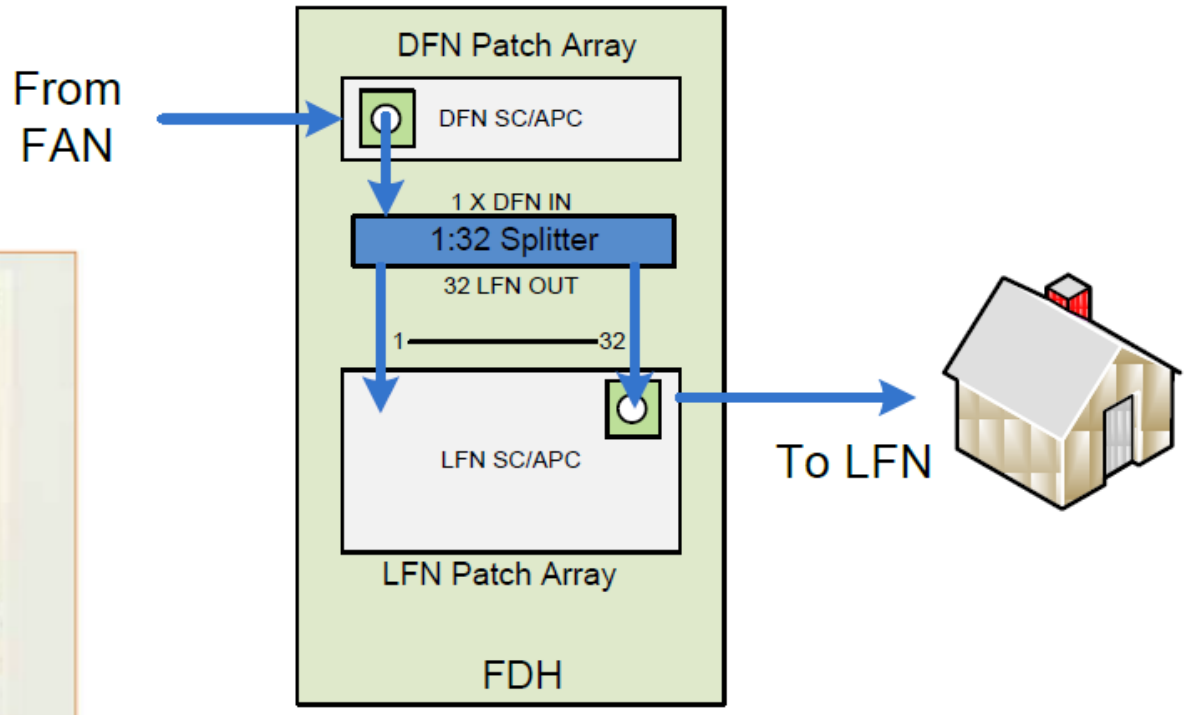
DFN - Passive Fibre Structure – Distribution Fibres



DFN - Passive Fibre Structure – Fibre Distribution Hub



OptiTect® Fibre Distribution Hub, 432F/576F
Photo HWPSS1794



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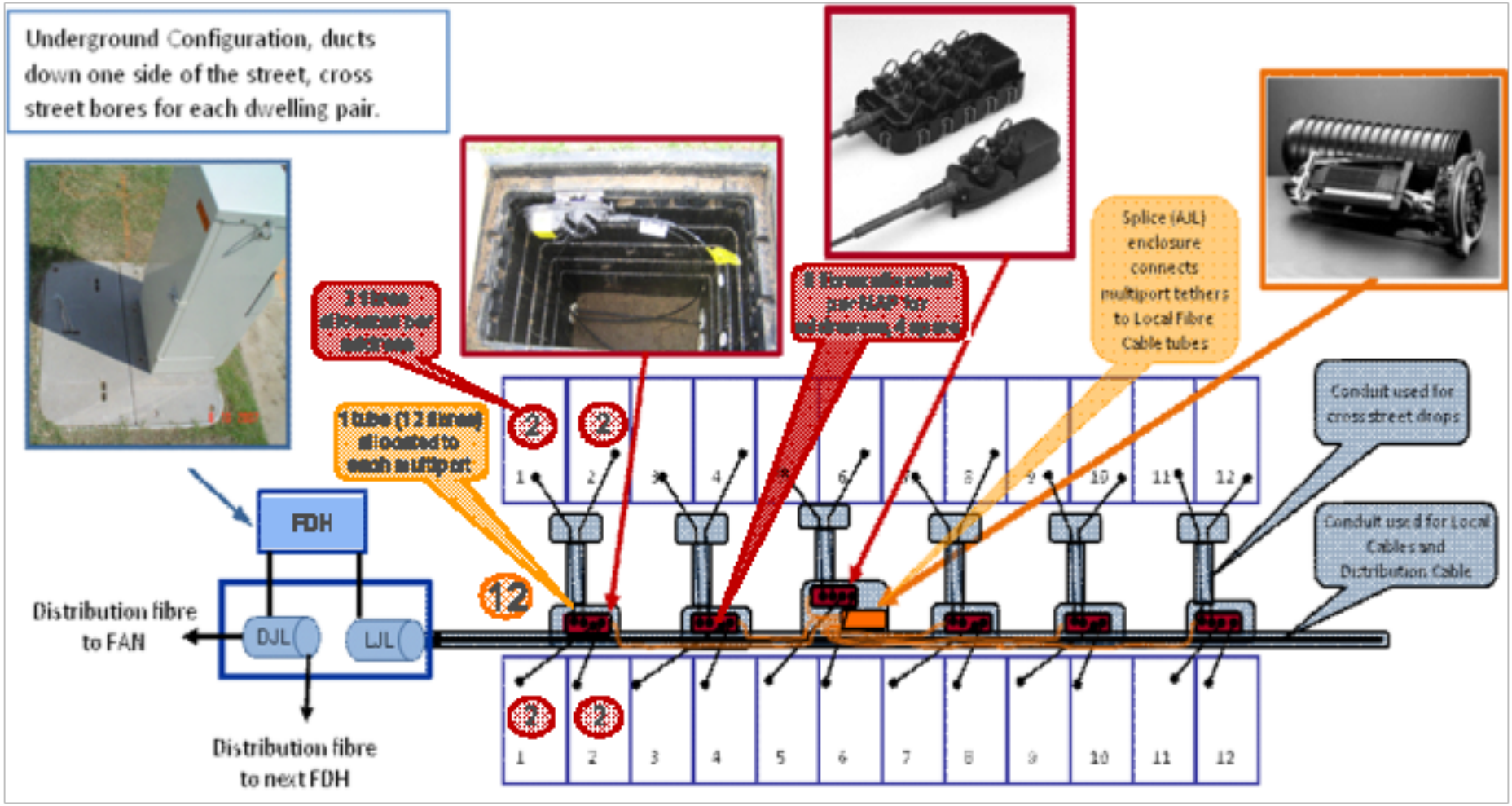
LFN - Fibre Structure—Underground

Local Fibre Allocation

The configuration for underground local fibre is different to aerial, as a 'Star' local access joint is used to provide the multiport tethers from a central pit, feeding pits placed at the property boundary and multiport terminals utilised to provide the same 'plug and play' connections.



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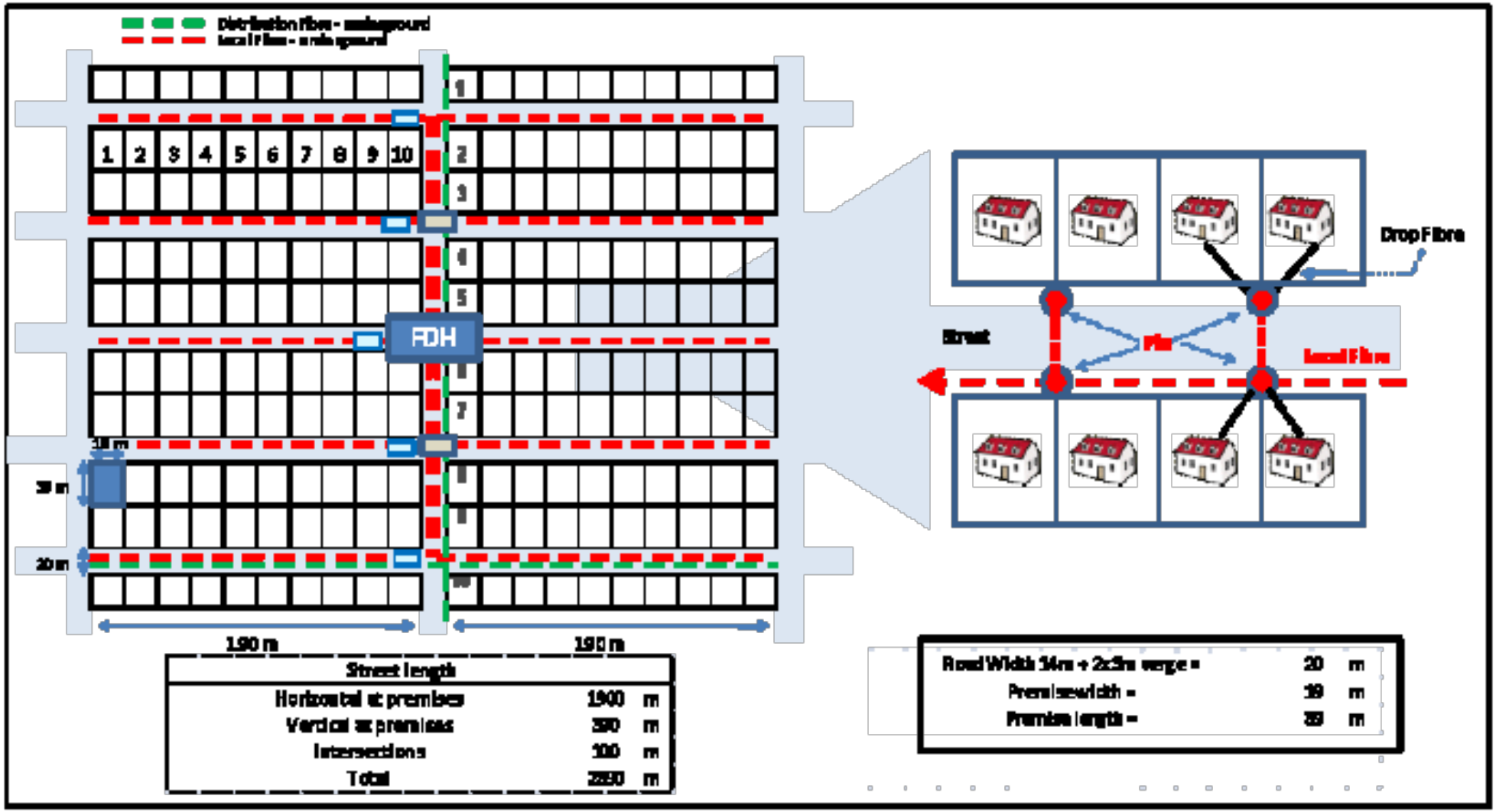
LFN - Fibre Distribution Area Structure— Underground

Local Fibre Design



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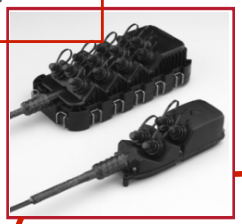
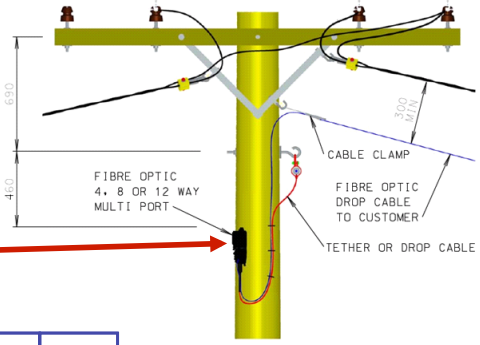
LFN - Fibre Structure—Aerial

Local Fibre Allocation

The provision of Local Fibre capacity provides flexibility to connect up to 2 fibres (with both a working and protection fibre) for point to point services, as well as allowing the evolution of the address use to multi-dwelling units.

Larger Multiport terminals can be 'plugged' in as additional capacity is required.





Splitters are only patched to addresses when required. Pass-through connections provide point to point connectivity

1 tube (12 fibres) allocated to each multiport

Factory installed FlexNAP on cable span

8 fibres allocated per NAP for addresses, 4 spare

Multiports Installed on the required Poles

FDH

Distribution fibre to FAN

DJL

LJL

12

Distribution fibre to next FDH

1 3 5 7 9 11 13 15 17 19 21 23

2 2

2 4 6 8 10 12 14 16 18 20 22 24

2 2

2 fibres allocated per address

Fibre Distribution Hubs (FDH) are planned for 1 fibre per address, plus associated splitter and distribution fibre. Additional pass-through is provided for point to point services.

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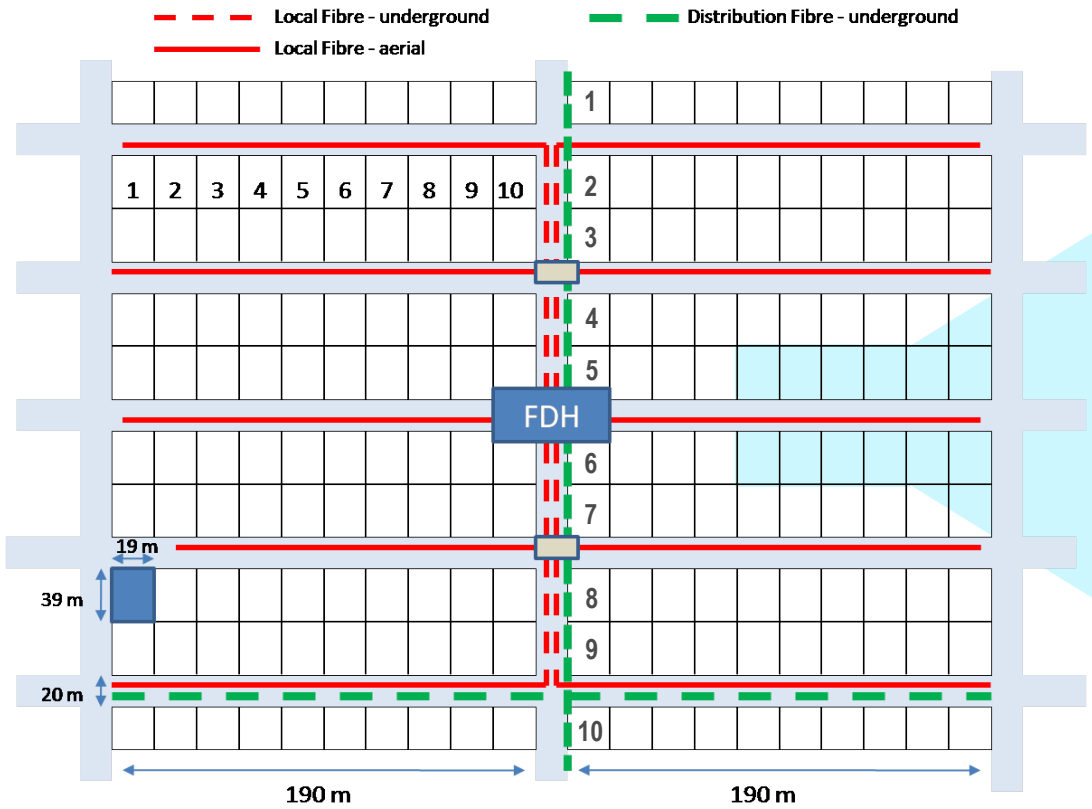
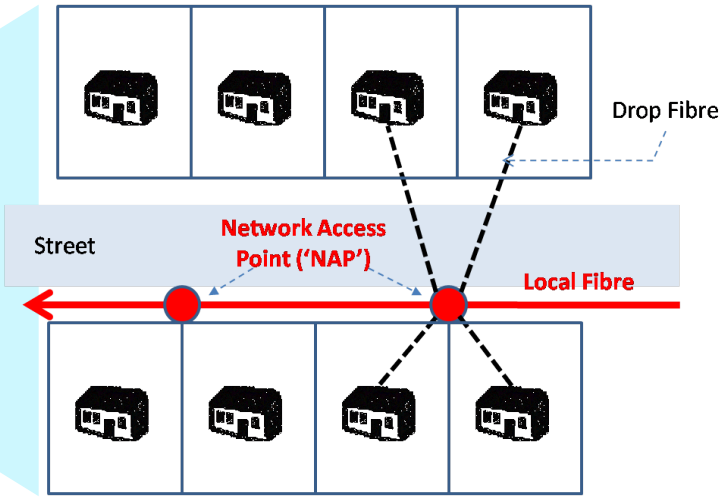
LFN - Fibre Distribution Area Structure—Aerial

Local Fibre Design





Street length		
Horizontal at premises	1900	m
Vertical at premises	390	m
Intersections	100	m
Total	2390	m

Road Width 14m + 2x3m verge =	20	m
Premise width =	19	m
Premise length =	39	m
Pole mount height =	6	m

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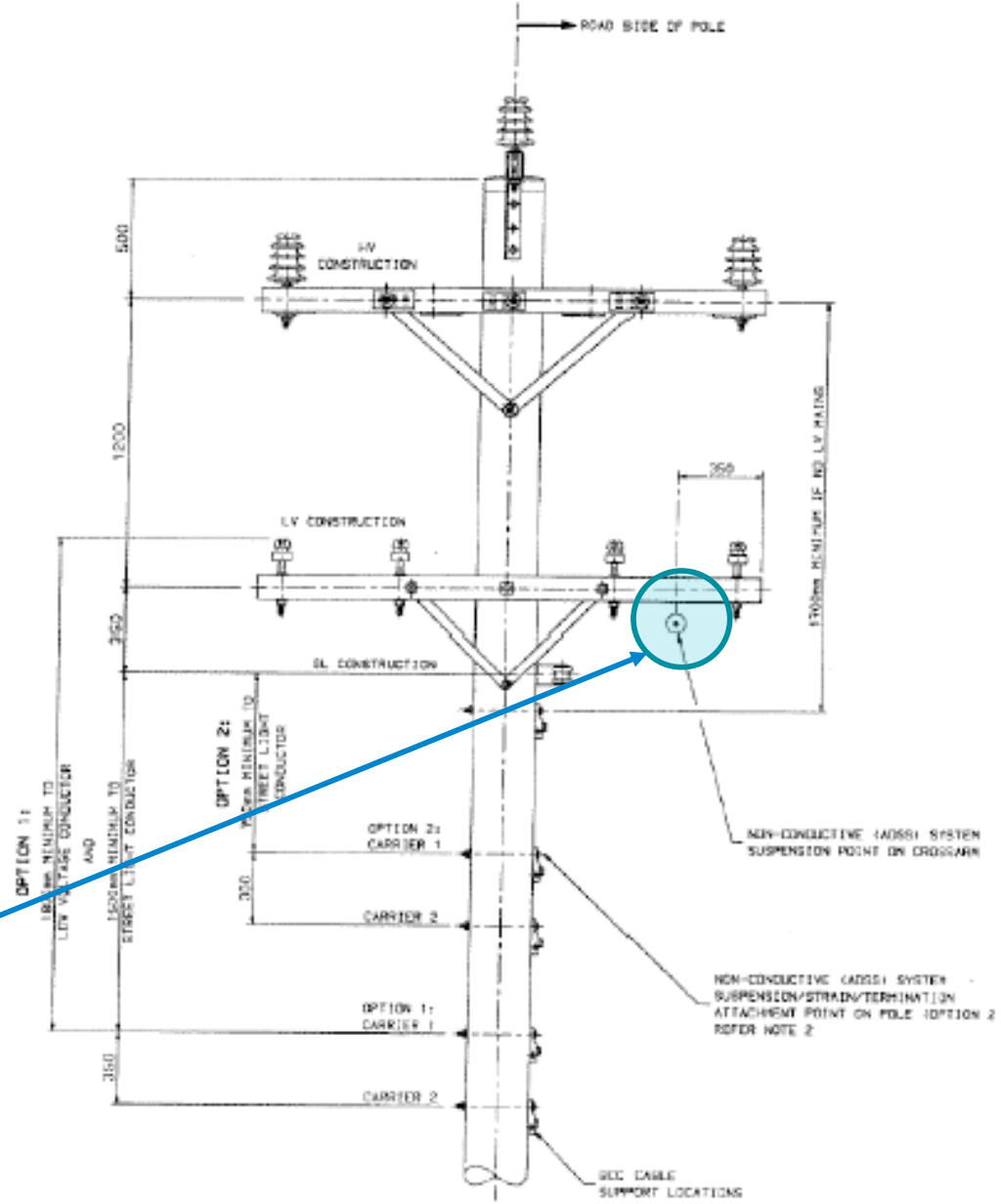
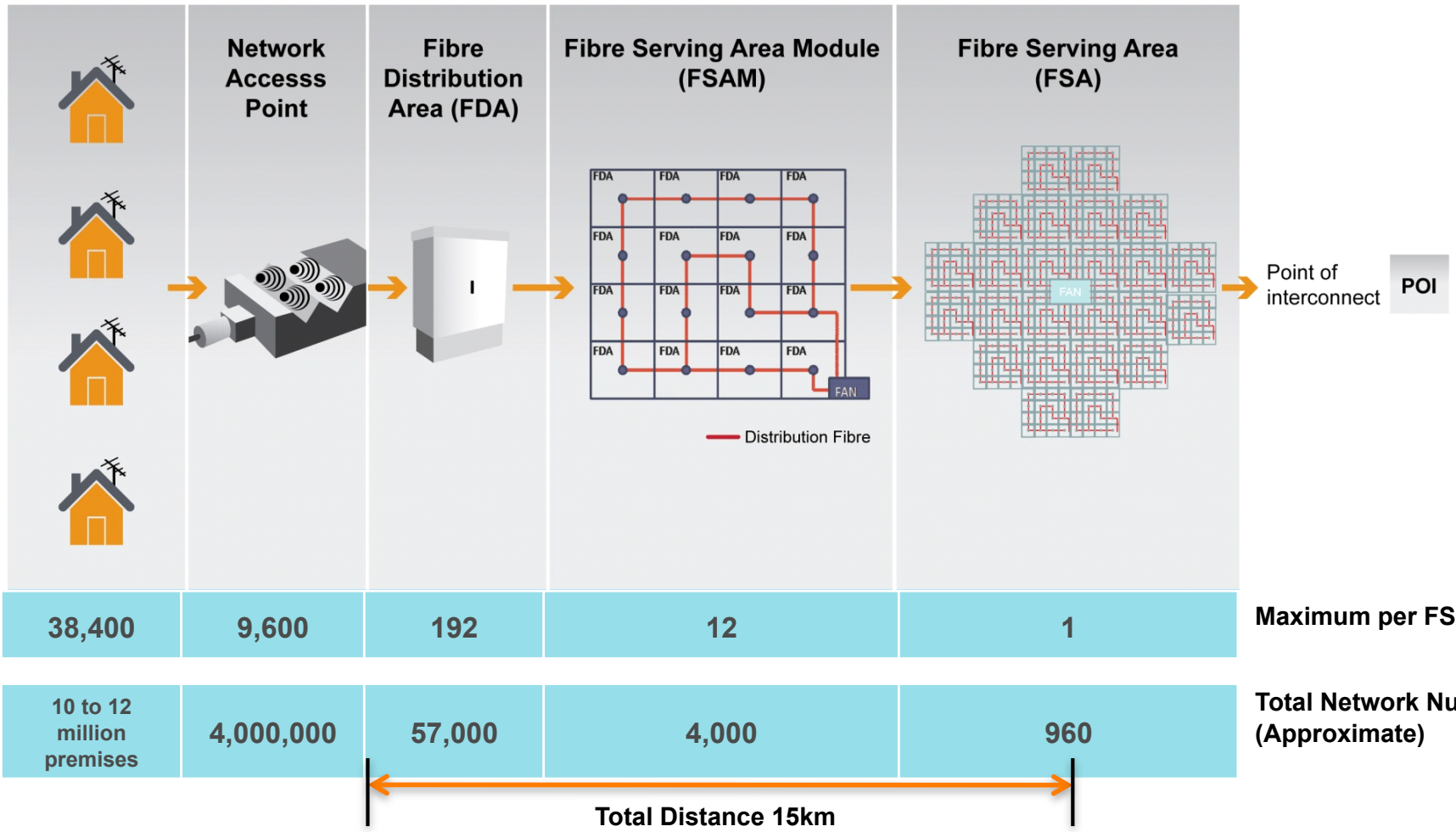
LFN - Aerial Local Fibre

All Dielectric Self Supporting (ADSS) Cable



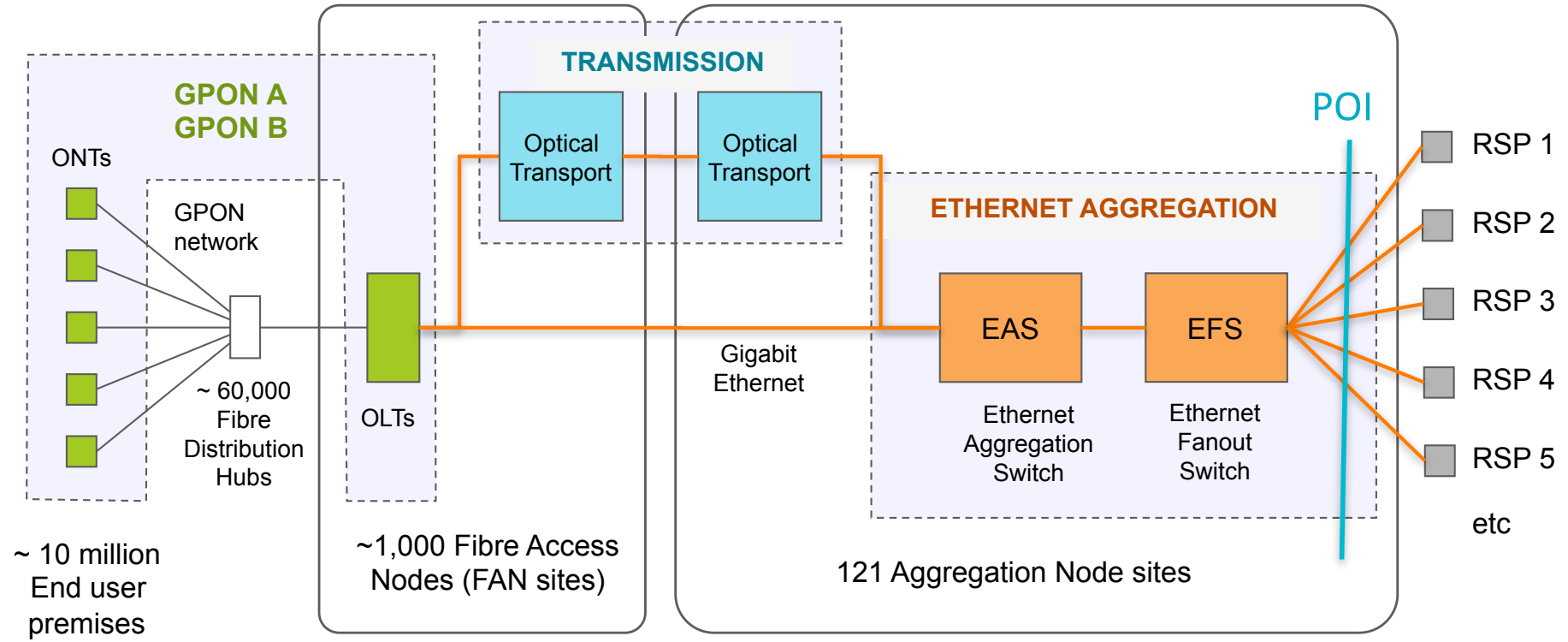
LFN - Aerial Local Fibre

Fibre Architecture - Summary

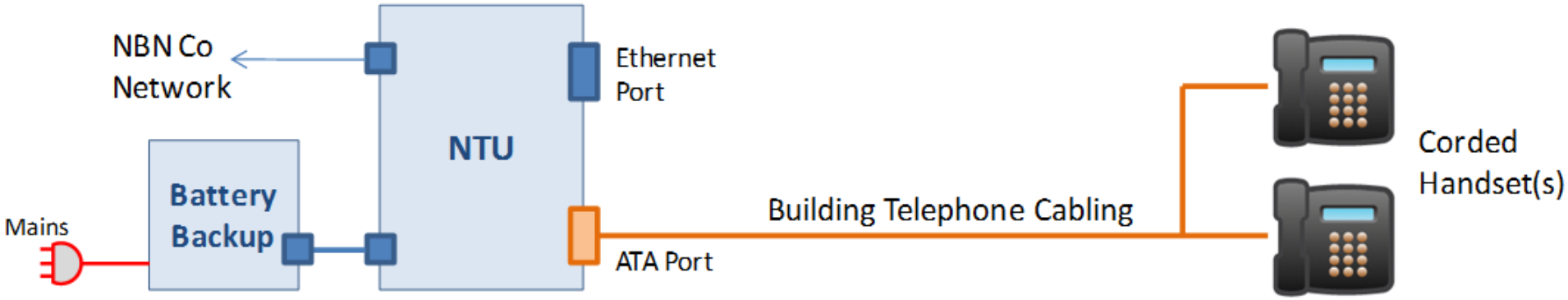


Network design – replicating modules

Active Network Structure



Premises Equipment – Network Terminating Unit [NTU]



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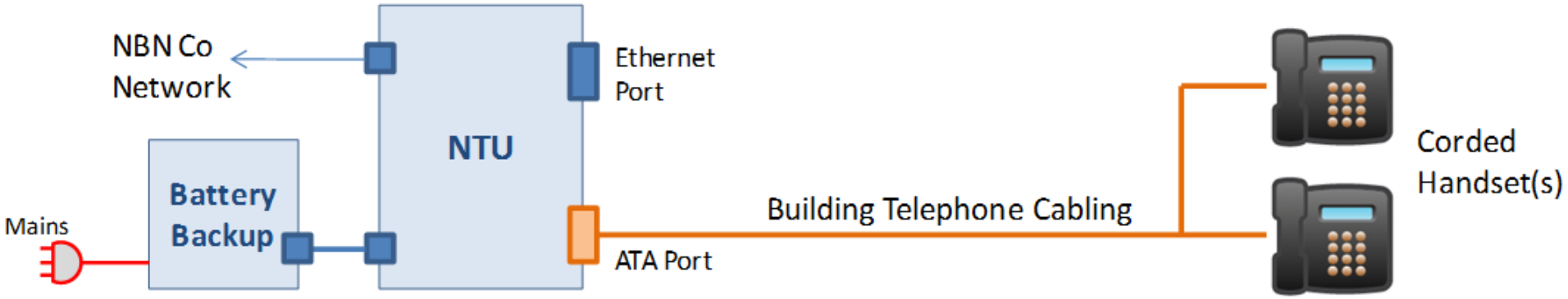

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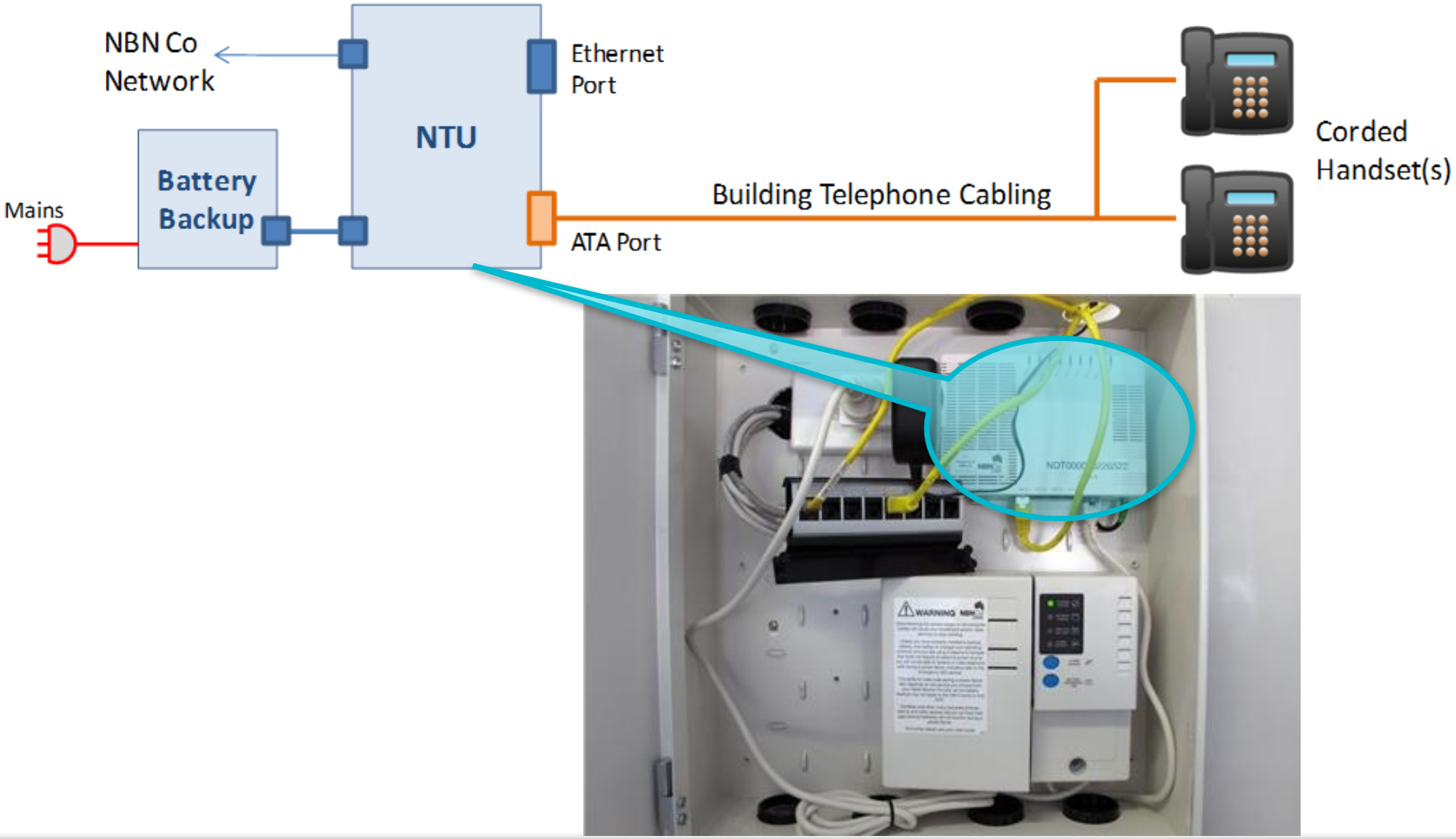

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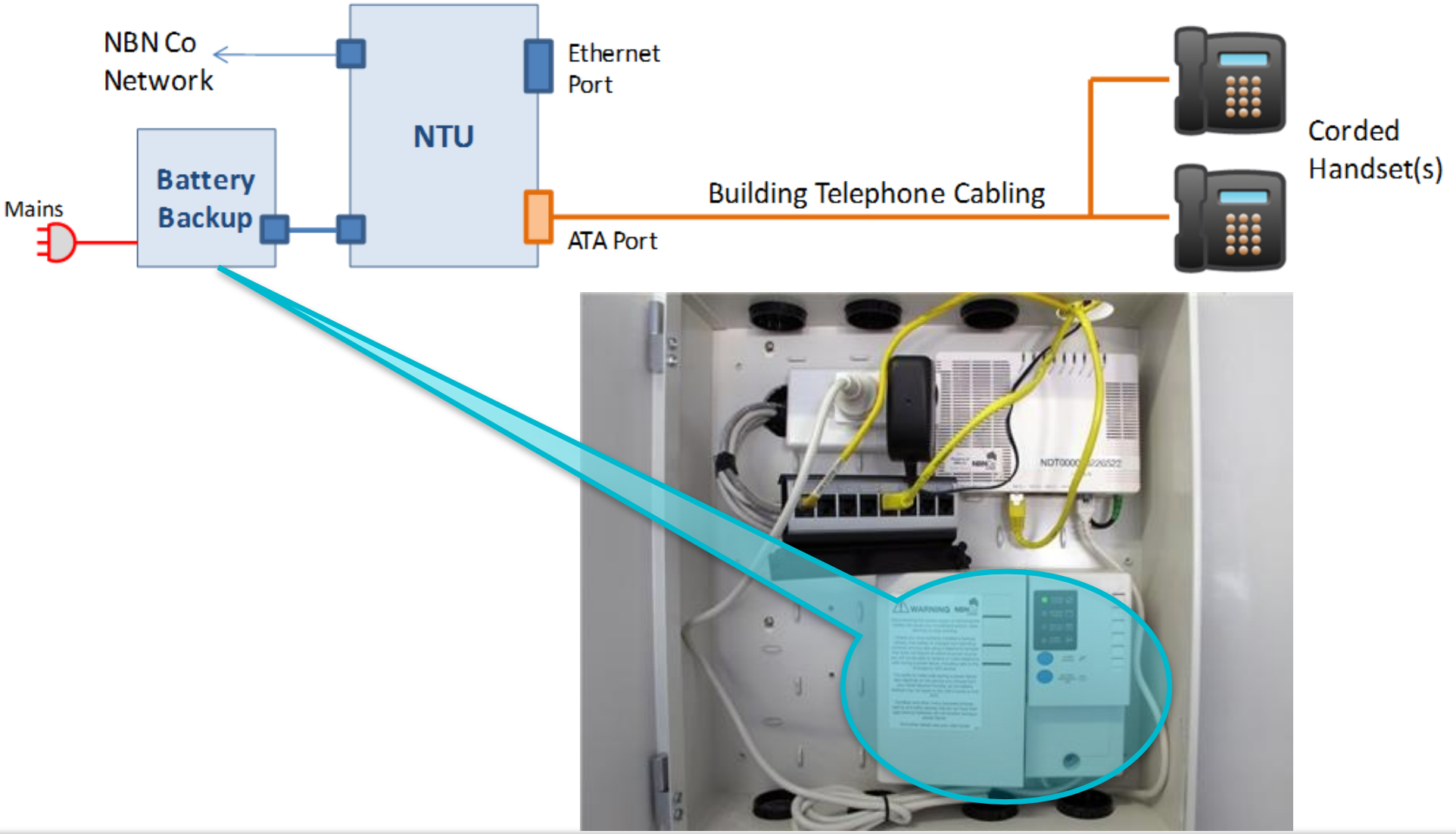
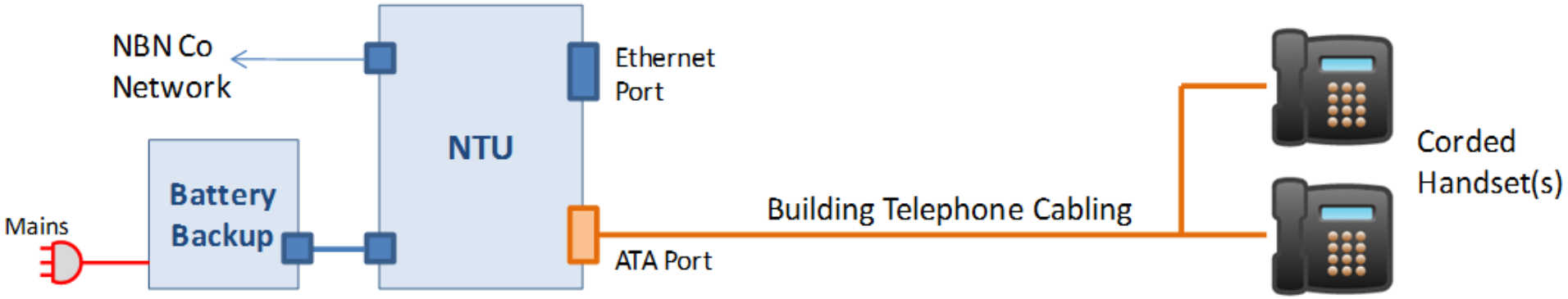
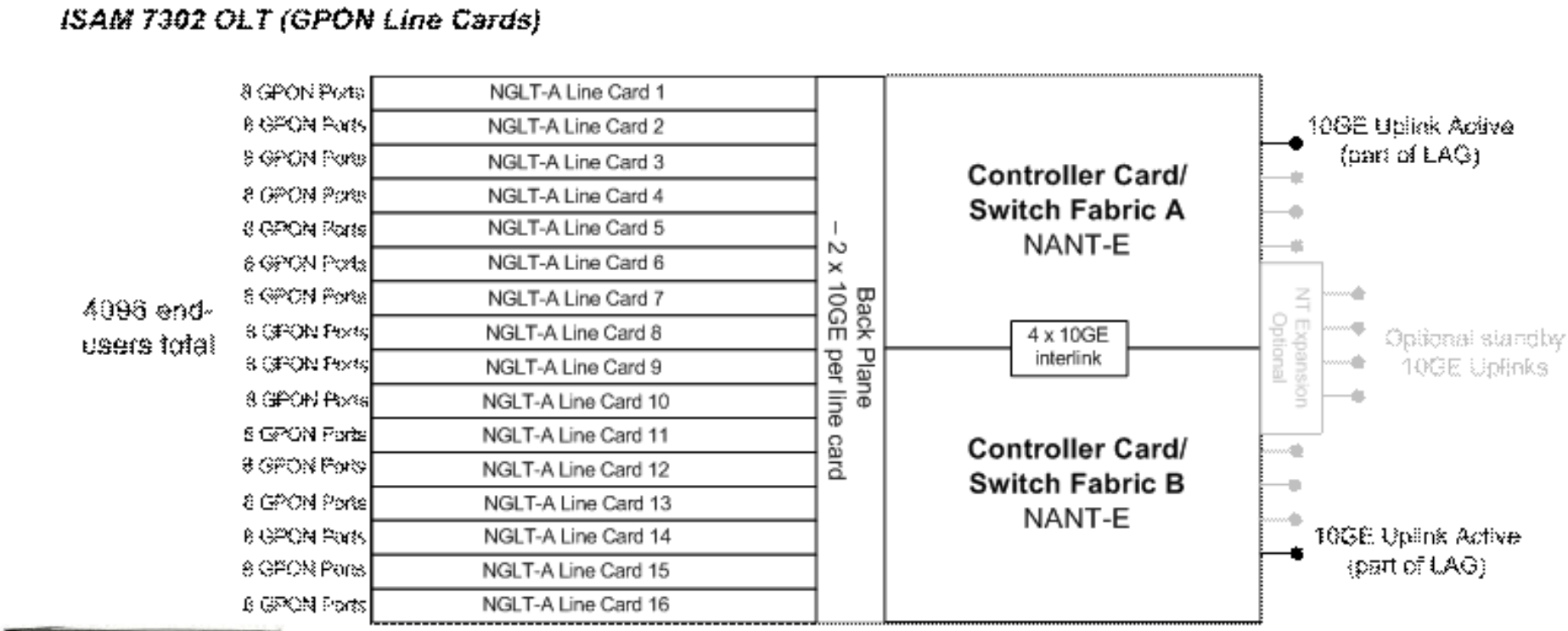


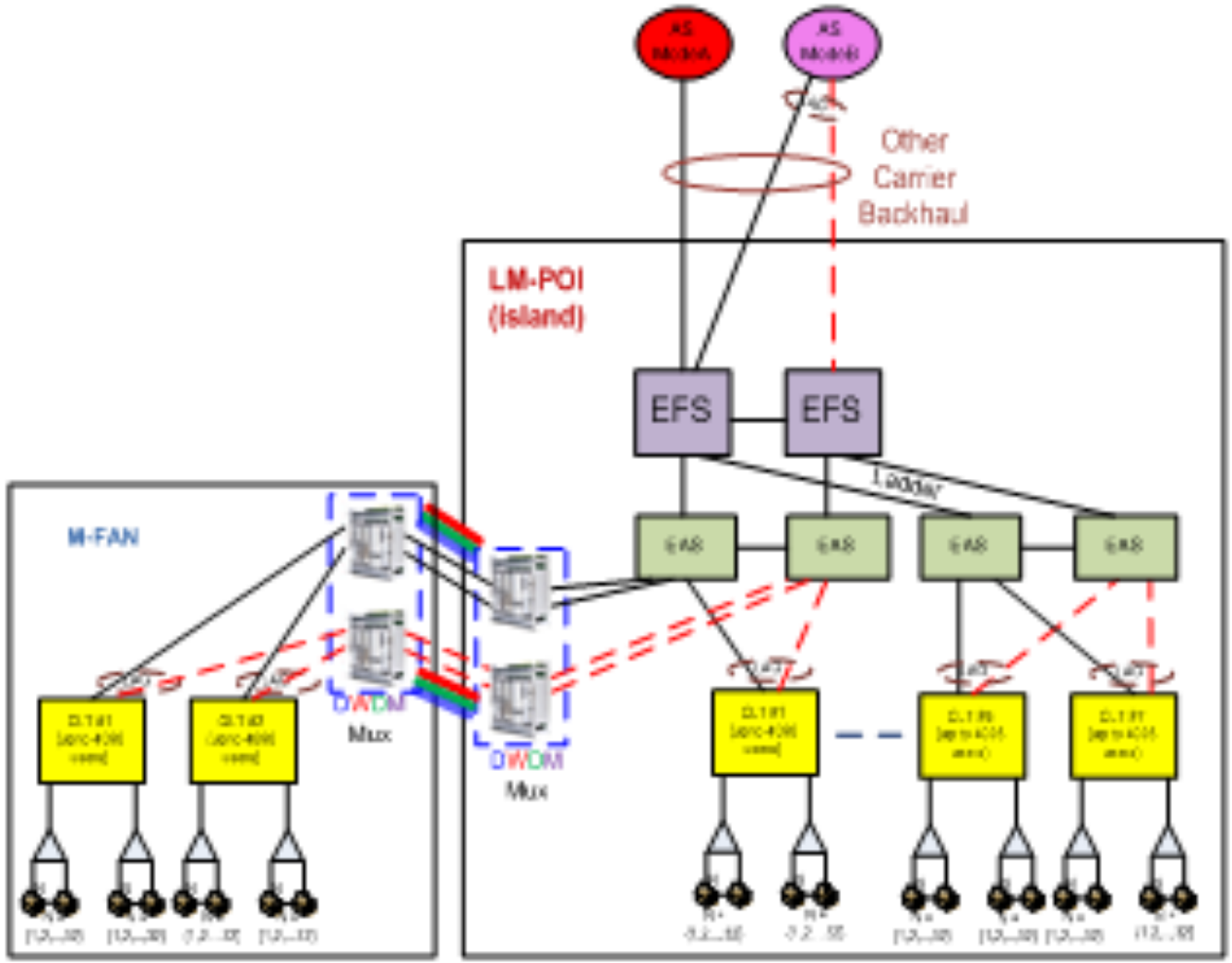
Premises Equipment – Network Terminating Unit [NTU]



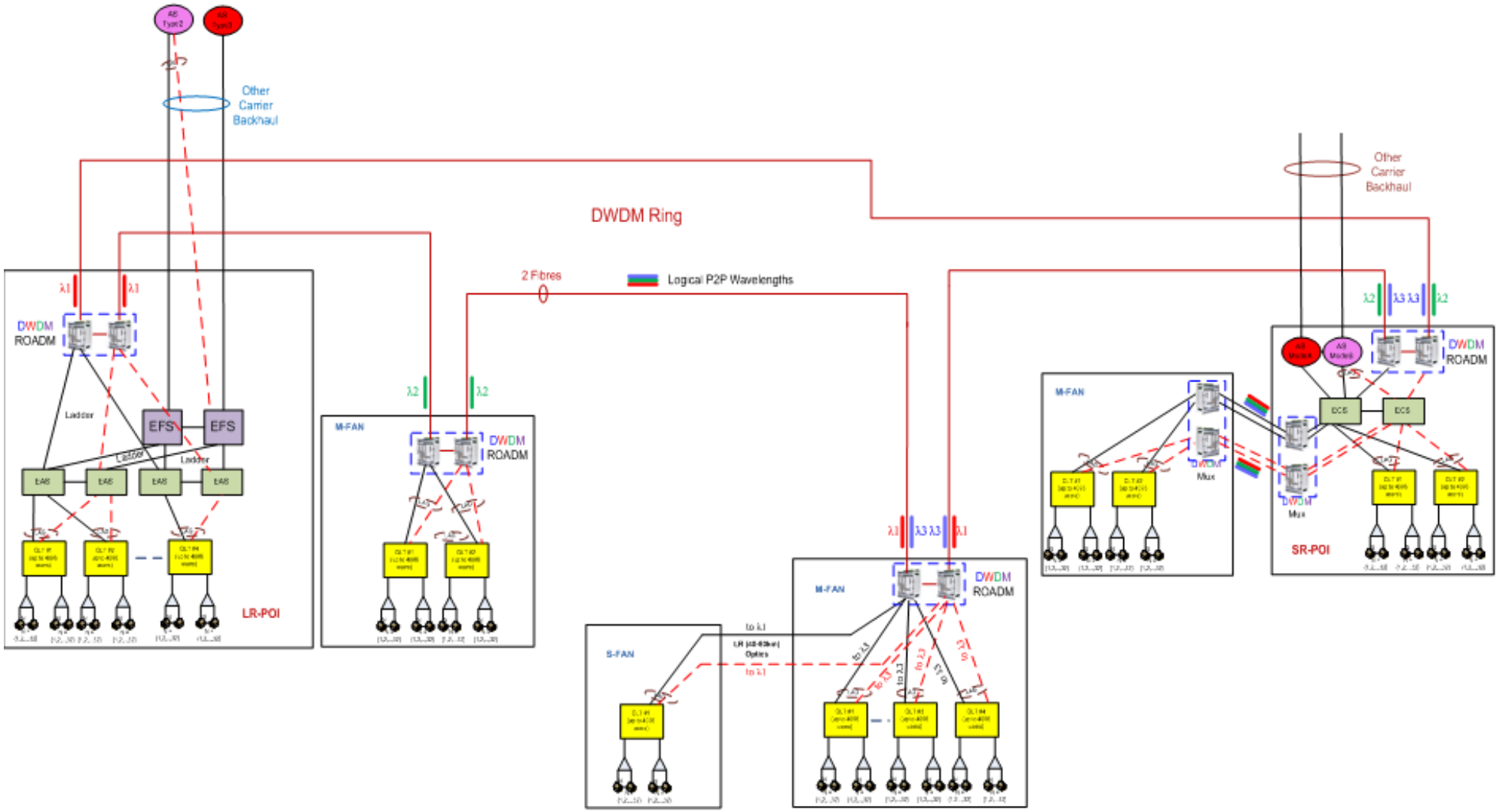
FAN Site – OLT Structure



De-centralised Architecture – Single FAN



De-centralised Architecture – Multiple FANs



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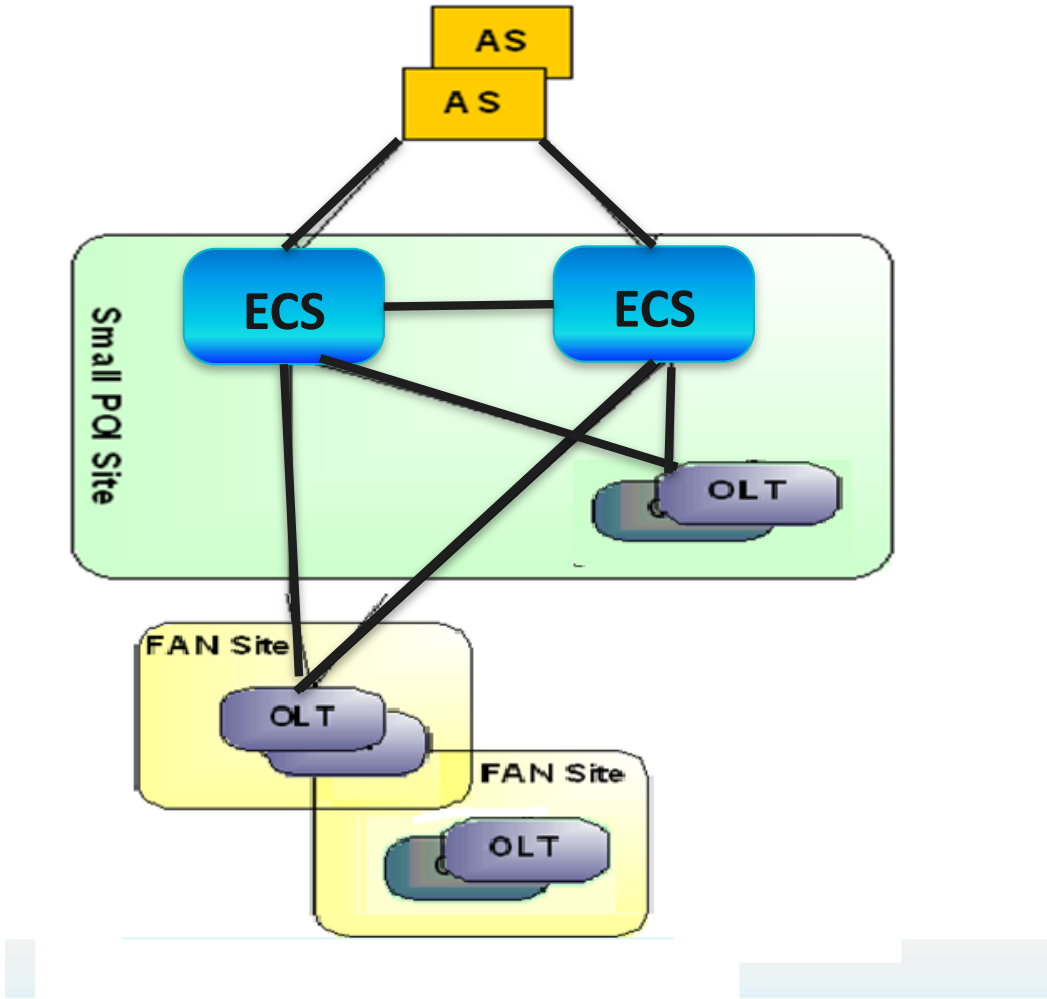
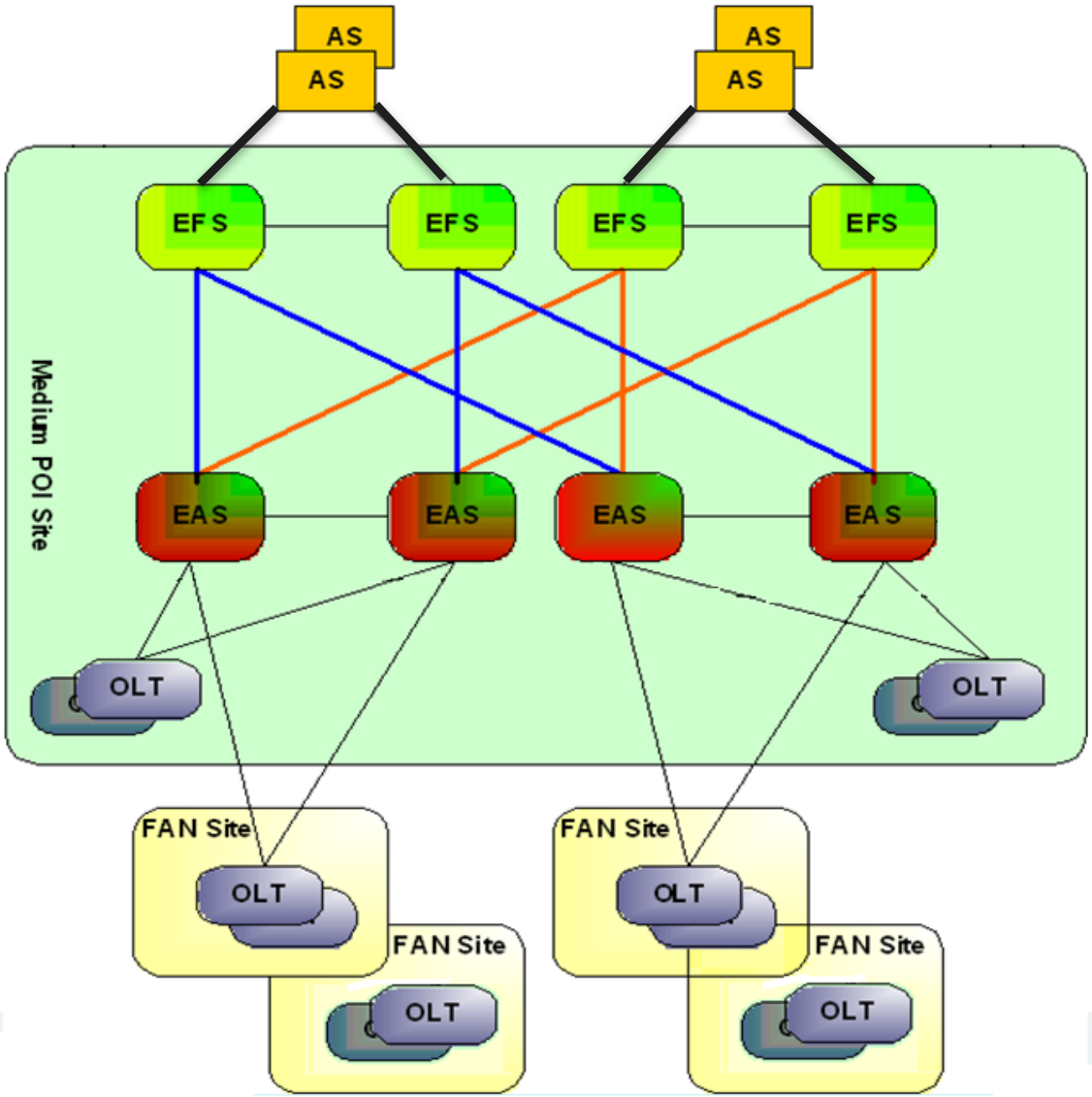
Small Aggregation Node Structure



Medium & Large Aggregation Node Structure



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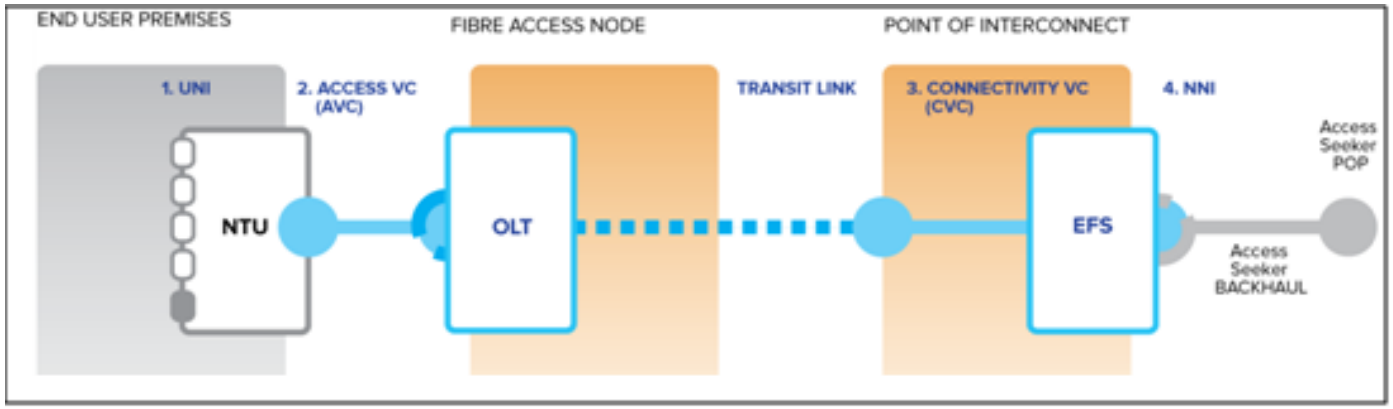
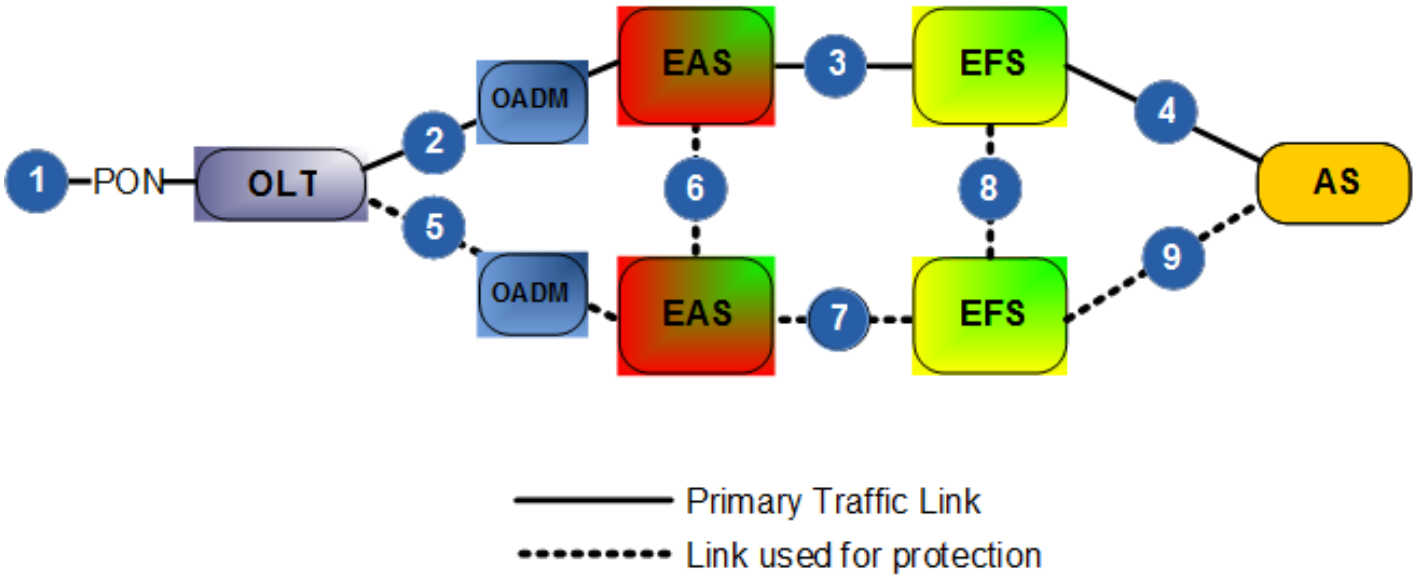
‘End to End’ Active Architecture



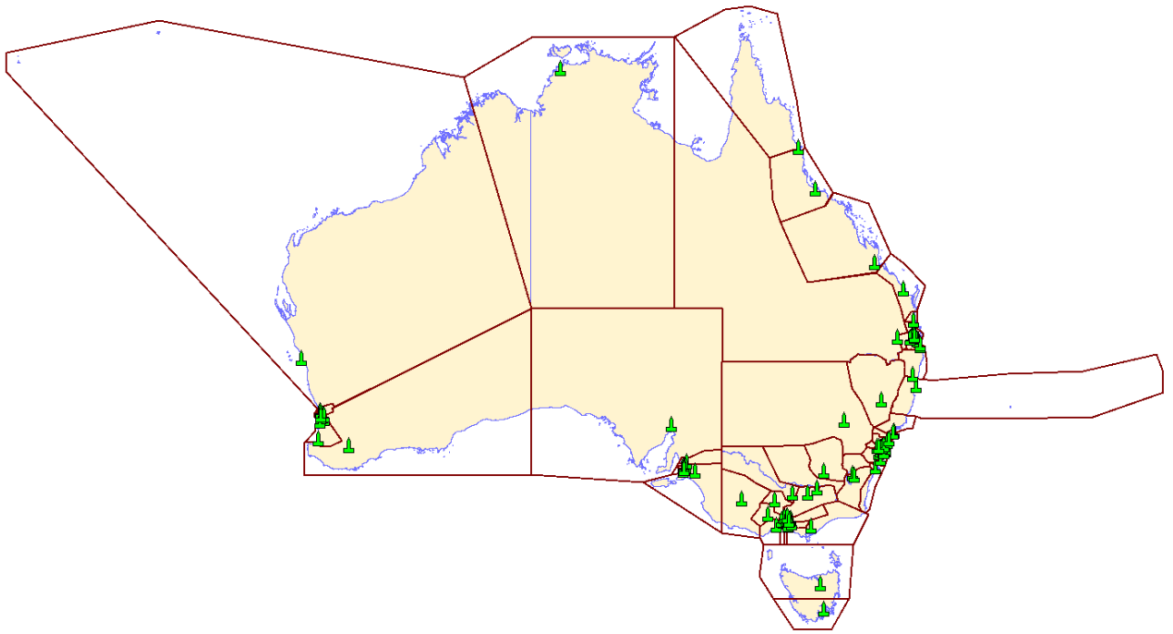


121 Points of Interconnect (POI)

"The Government has determined that a semi-distributed POI structure which extends the NBN Co network to meet with, but not overbuild competitive backhaul routes is the preferred outcome." ***– Statement of Expectations to NBN Co, 17 December 2010.***

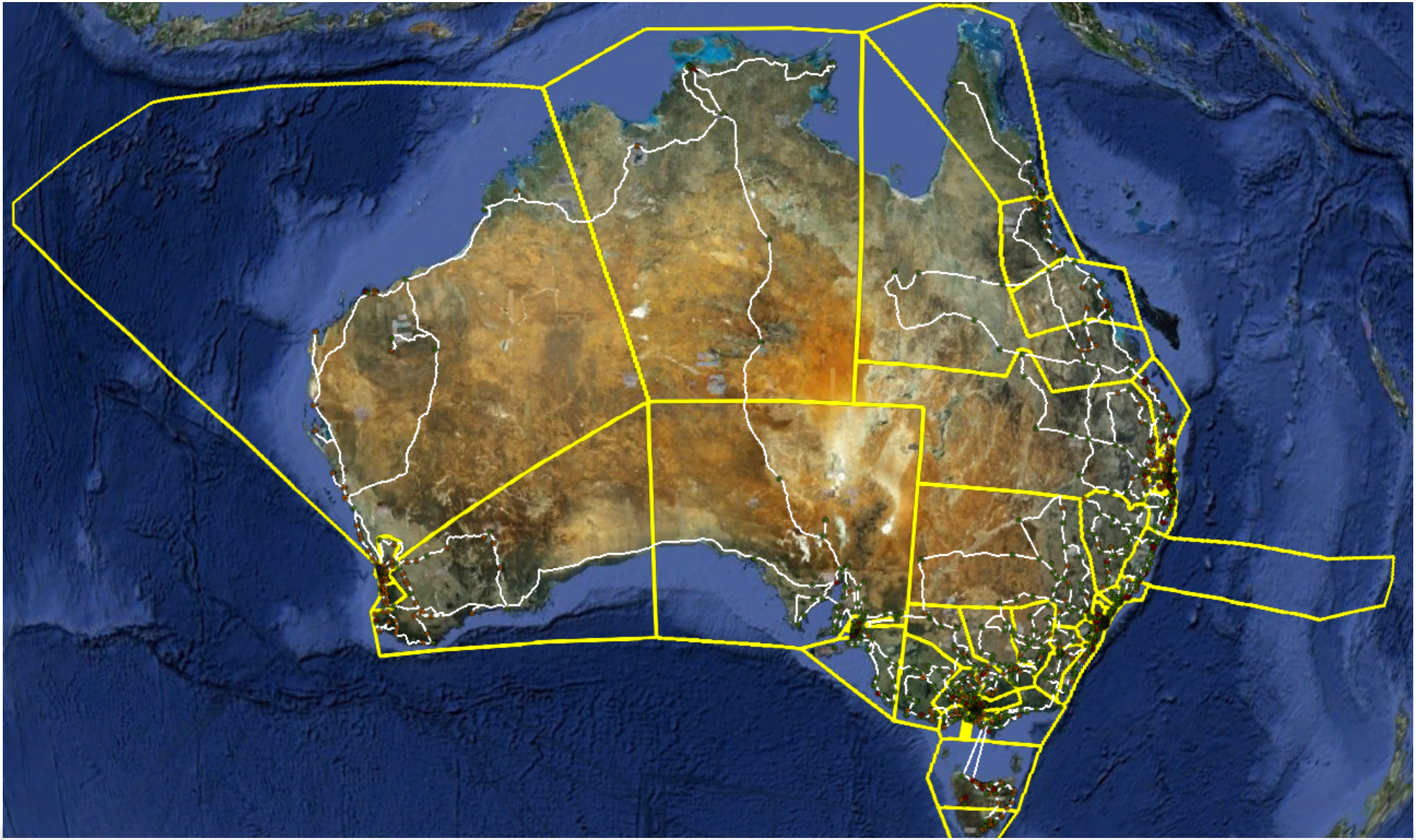
The ACCC has published a draft list of 121 POIs that meet the competition criteria – being 80 metropolitan locations and 41 regional locations.

NBN Co is currently conducting detailed design of the nominated Aggregation Nodes to provide these POIs.



The Government has opted for a semi-distributed POI model

Access Aggregation Regions (AARs)



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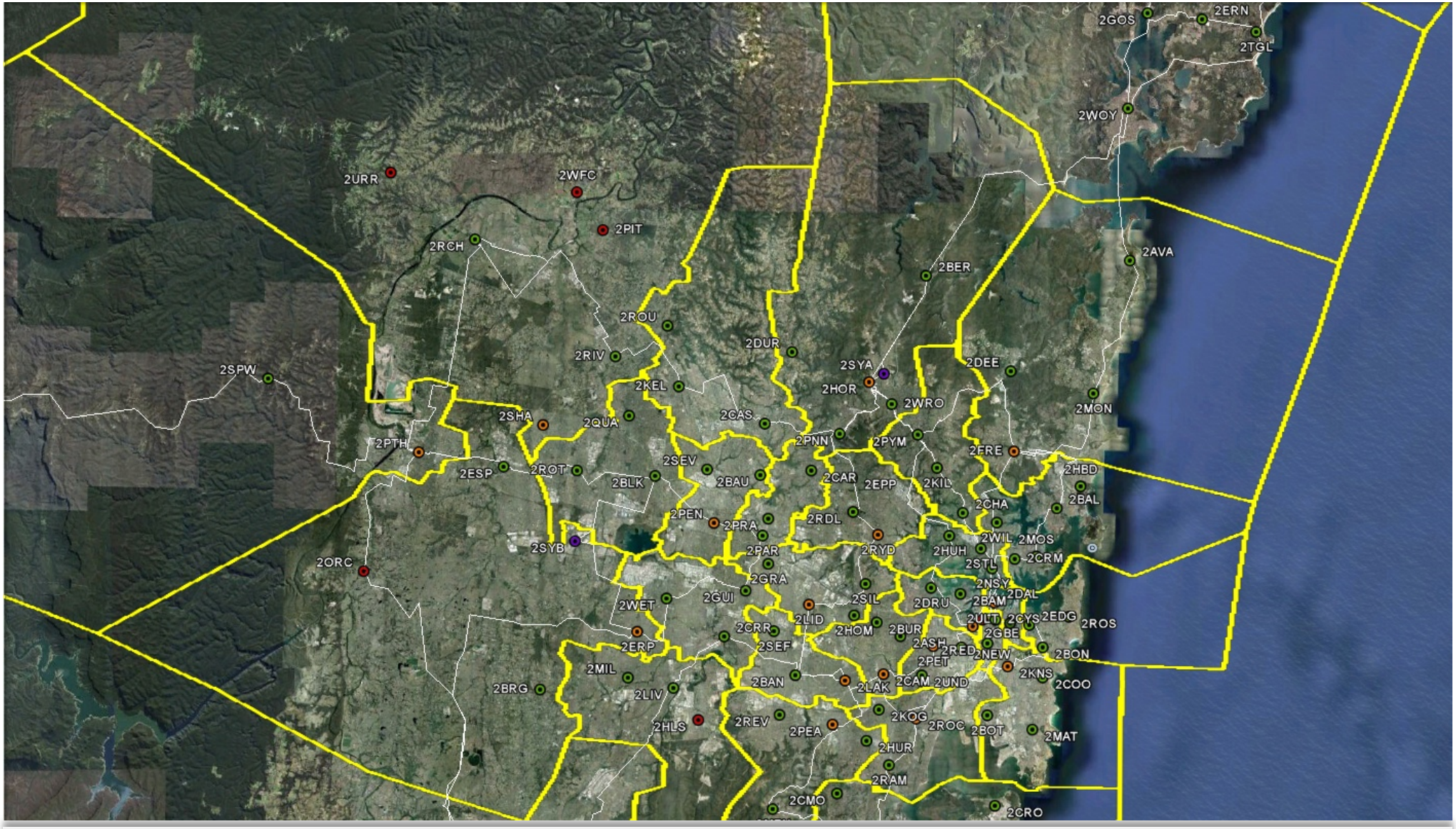
Access Aggregation Regions (AARs) – Sydney



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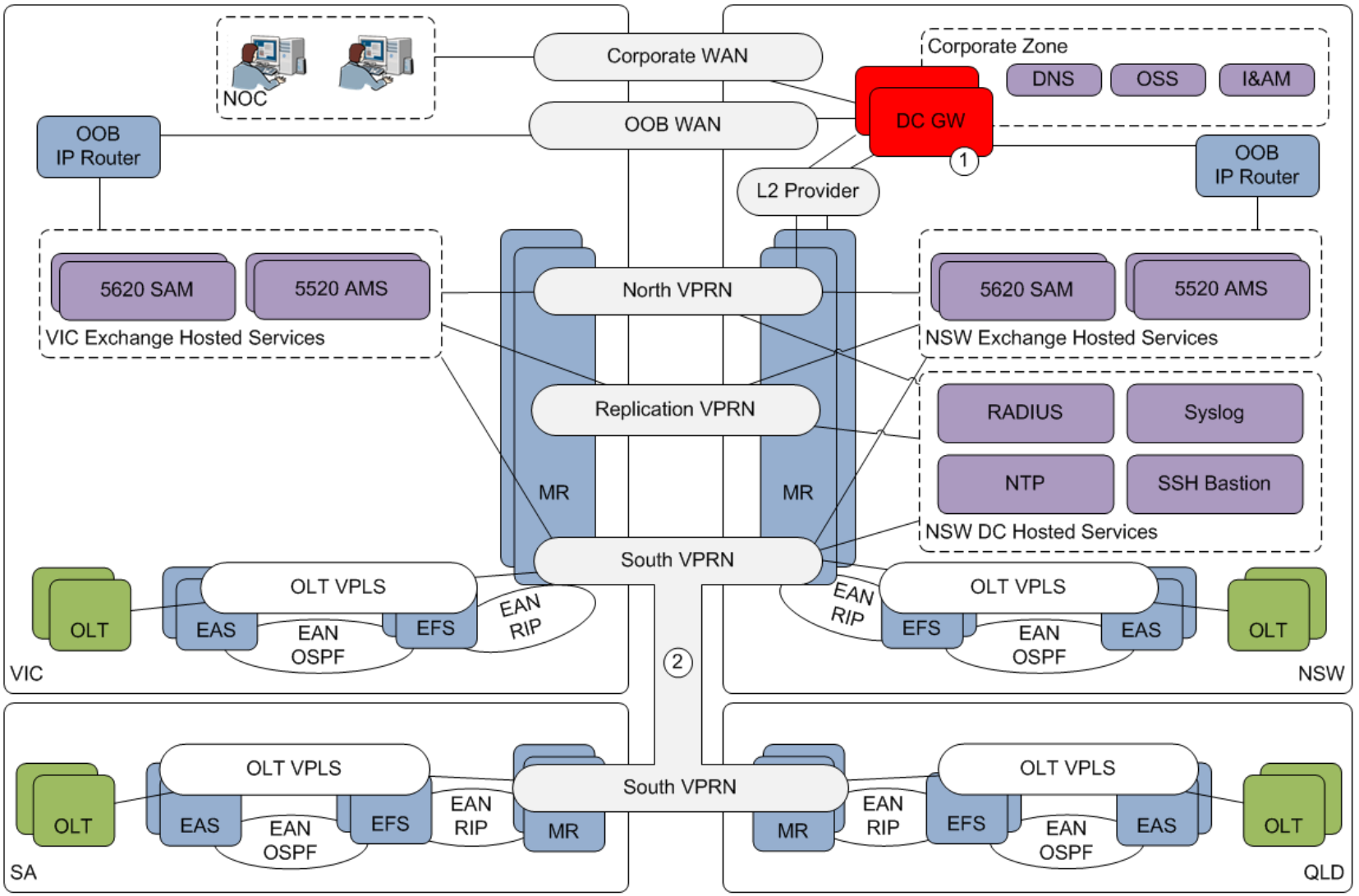
DCN Design – Network Overview



1 Control Point between Corporate, EMS and OOB networks

2 Control Point between NE and EMS networks

Questions?

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