



XYZ FTTH Project

*Engineering Solution, Network
Architecture & Material List*

August 2020

Document Management & Control



This document provides an overall picture of PakGIS standard solution as FTTH Network Architecture and related components. The information contained herein are subject to review and change whenever required.

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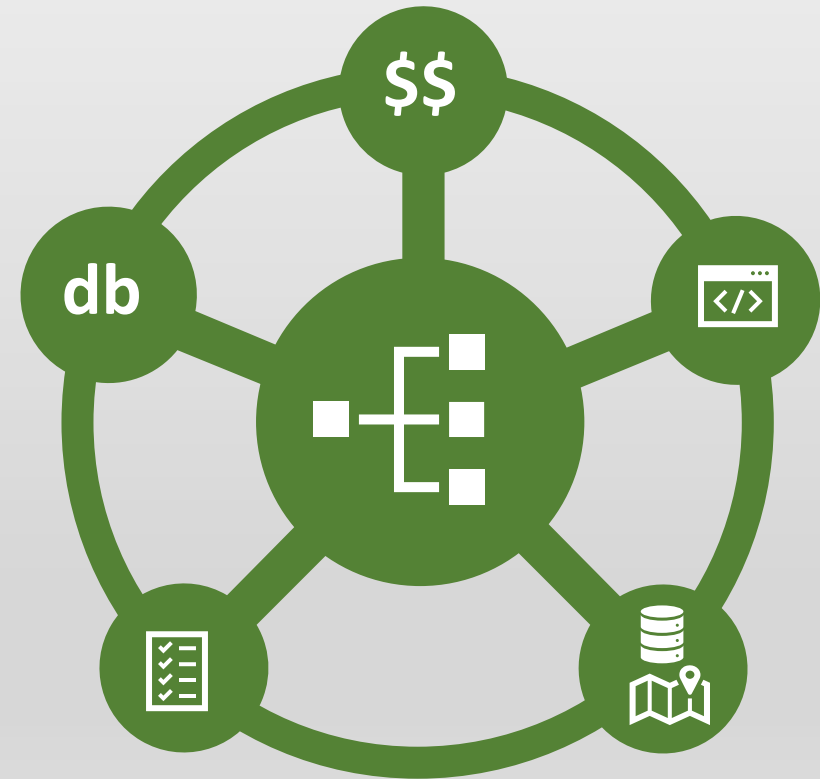
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Introduction



- This document is a high level proposal for an FTTH Network,
- This is built on the bases of best practices and PakGIS global experience harvesting.
- This document covers network architecture and related items. Always there are multiple input drivers which define design guidelines, they are connected to each other as a mesh.
- Important components for FTTH design guidelines are:
 - Network Architecture
 - Customer Demand in terms of bandwidth
 - Spare Capacity
 - Material easy availability in the market
 - RoW and deployment easiness
 - Net 20 years expansion robustness
 - Optimized cost and deployment time
 - Applicable standard for UG & Aerial concepts
 - End to End link loss (db)
 - Material list
 - Nomenclature and Codification
 - GIS database / schema
- There is always interdependency of all above components



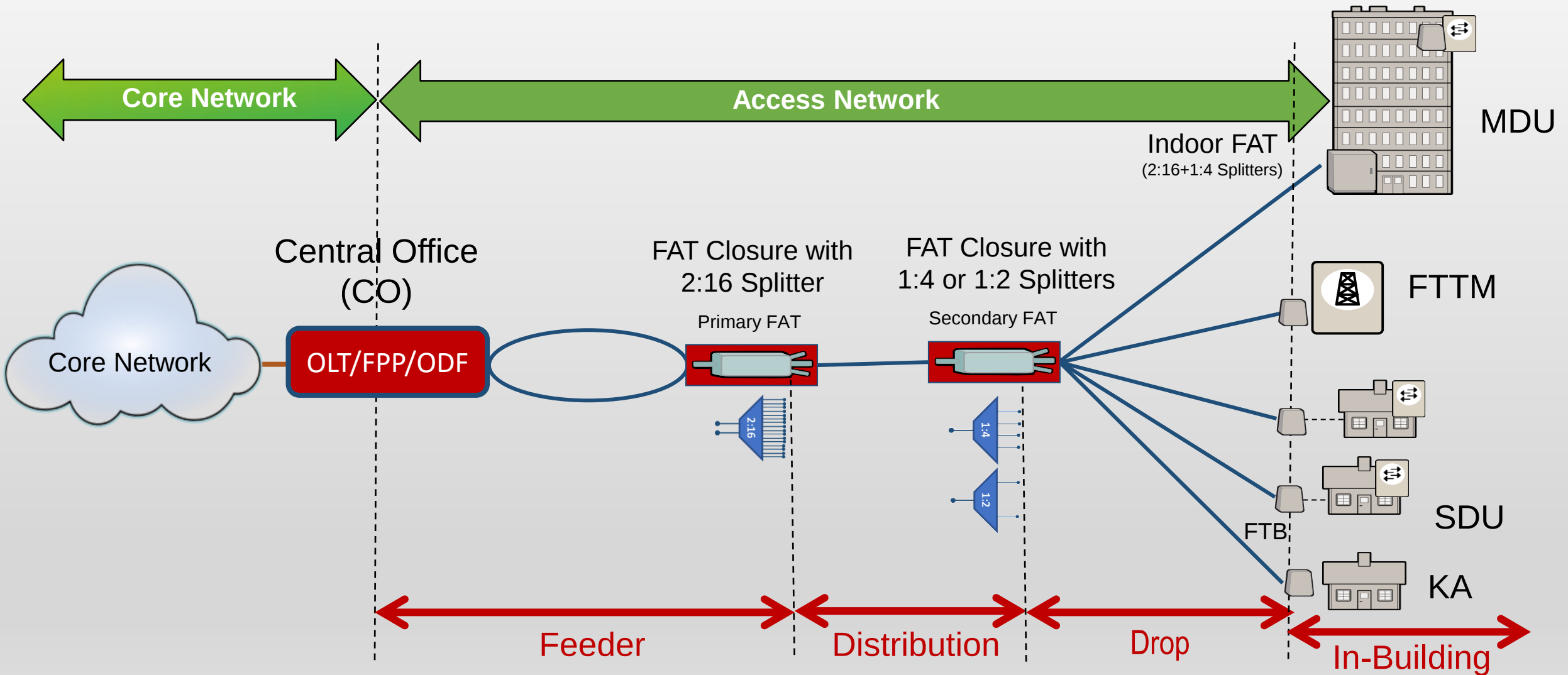
End to End Splitting Ratio vs BW Calculation



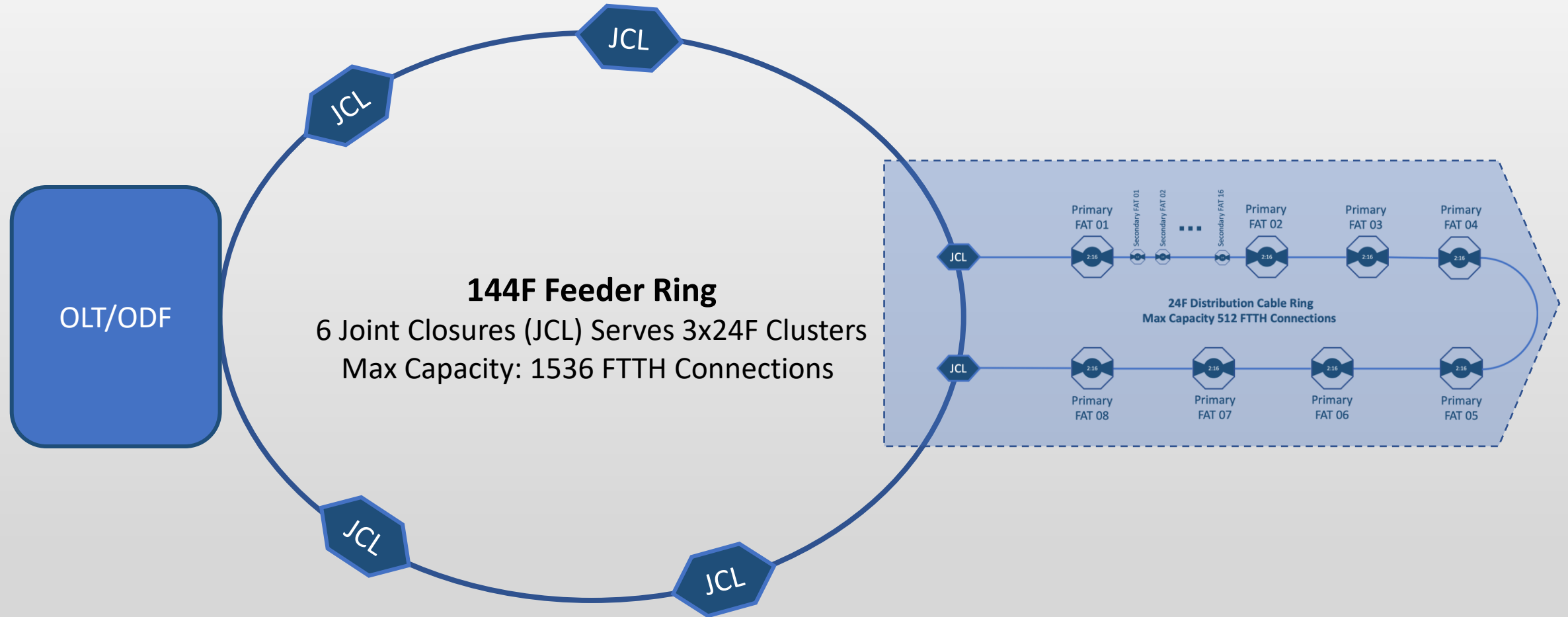
Technology	First Level Splitting	2nd Level Splitting	End to End Splitting	Connection BandWidth	Applicable Packages with Overbooking
GPON 2.4G	2:16	1:4	2:64	38Mb/s	Upto 100Mb/s Residential
GPON 2.4G	2:16	1:4	2:64	38Mb/s	Upto 50Mb/s Commercial
GPON 2.4G	2:16	1:2	2:32	76Mb/s	Up to 200Mb/s Residential
GPON 2.4G	2:16	1:2	2:32	76Mb/s	Up to 100Mb/s Commercial
GPON 2.4G	2:16	-	2:16	163Mb/s	Upto 400Mb/s Residential
GPON 2.4G	2:16	-	2:16	163Mb/s	Up to 200Mb/s Commercial
xGPON 10G	2:16	1:4	2:64	163Mb/s	Upto 400Mb/s Residential
xGPON 10G	2:16	1:4	2:64	163Mb/s	Up to 200Mb/s Commercial

- Recommended Architecture with 2:64 splitting, where OSP remain same and end to end equipment drives the customer demand.
- More flexibility in terms of bandwidth and most optimized network resources usage.
- OSP materials with very much precise and optimized list
- In case of special customers who need high BW, 2nd level splitting could be avoided and to use end to end 2:16 split

FTTH Network Architecture – Distributed Splitting

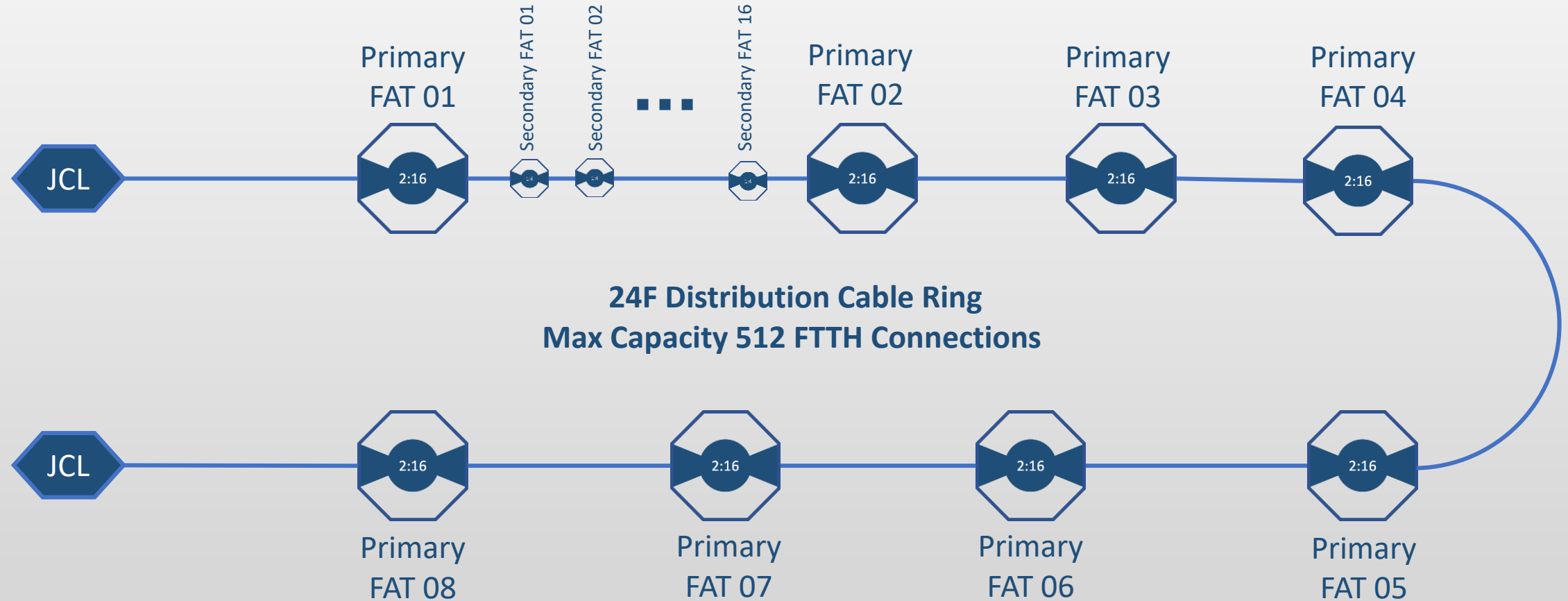


Feeder Network (288F/144F/48F Ring)



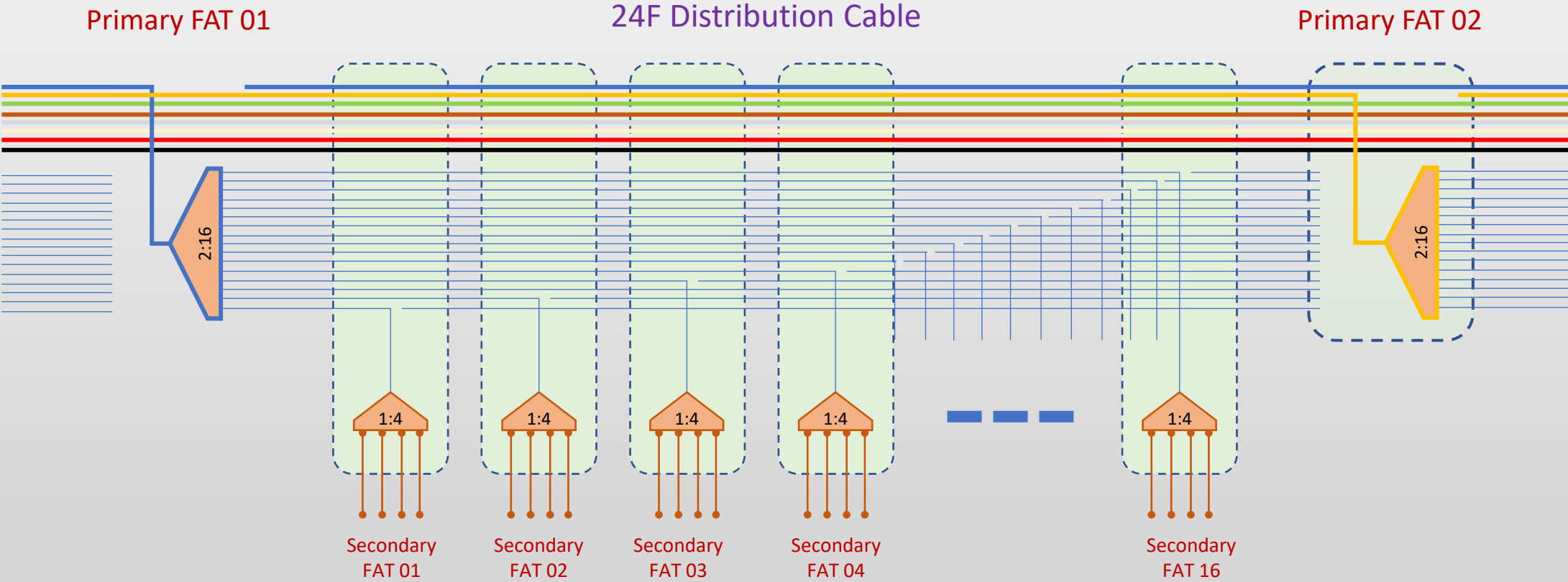
Note: Can have 288F Ring with 12 JCLs and 6x24F Clusters serving, total capacity: 3072 FTTH Connections

Distribution Network – 24F Cluster

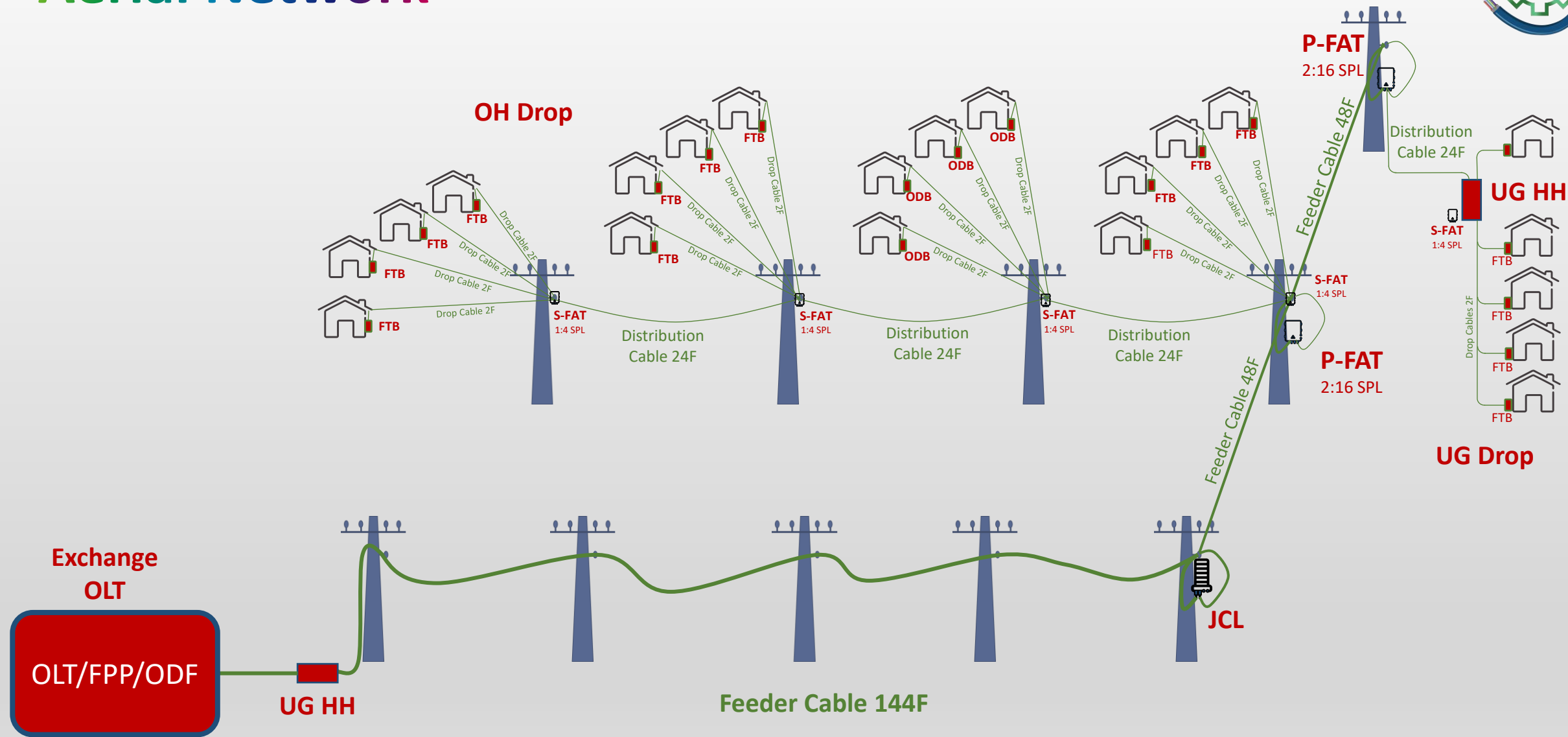


Note: For MDUs or Special Customers, one or multiple Primary FAT could be installed inside telecom room

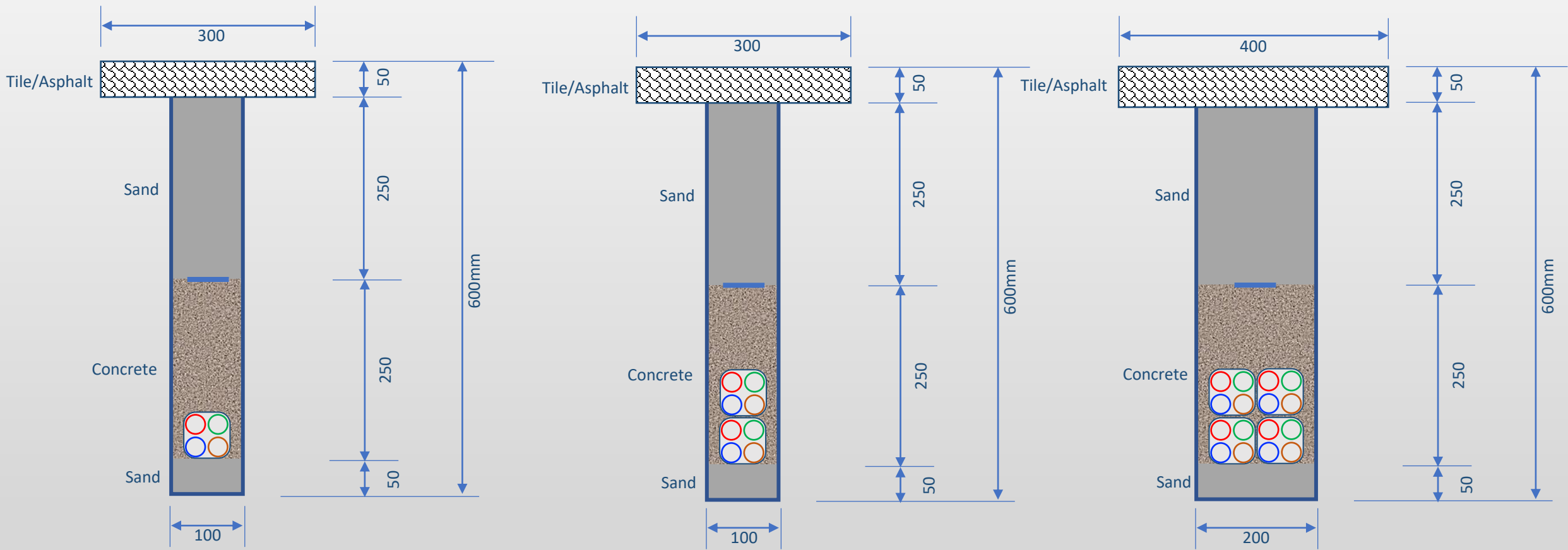
Distribution Network Fiber Connectivity



Aerial Network



Trench Profiles



Symboles and Nemonclature



1. Primary FAT with 2:16 Splitter



2. Secondary FAT with 1:4 Splitter



3. Secondary FAT with 1:2 Splitter



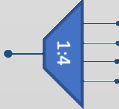
4. Secondary FAT with no Splitter



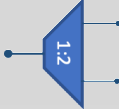
5. 2:16 Splitter



6. 1:4 Splitter



7. 1:2 Splitter



8. Fiber Optic Joint Closure (JCL)



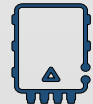
9. Fiber Optic Cable



10. Fiber Termination Box (FTB)



11. FAT Closure Aerial



12. Pole



13. JCL Aerial



14. UG MH



UPL/Material List/Stacking Units



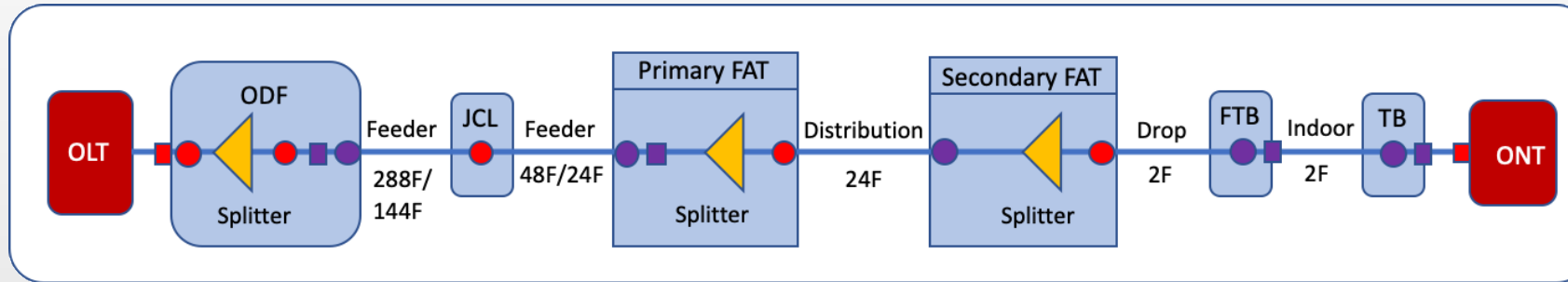
Item Code	Item Class	Item Description	Unit	Unit Price (USD)	Quantity	Total Cost (USD)
FTTH-01	GIS Based Design	Survey & Design Per Building (Distribution & Drop)	EA			
FTTH-02	GIS Based Design	Survey & Design per meter (Feeder & P2P)	EA			
FTTH-03	GIS Based Design	As-Built Per Building (Distribution & Drop)	EA			
FTTH-04	GIS Based Design	As-Built per meter (feeder & P2P)	EA			
FTTH-05	OSP Civil	UG MH (5' x 5') supply & installation	EA			
FTTH-06	OSP Civil	UG HH (JRC12) supply & installation	EA			
FTTH-07	OSP Civil	UG HH (JRC4) supply & installation	EA			
FTTH-08	OSP Civil	UG Duct HDPE-100 4x25/20mm bundle supply & installation	meter			
FTTH-09	OSP Civil	UG Duct HDPE-100 8x25/20mm bundle supply & installation	meter			
FTTH-10	OSP Civil	UG Directional Drilling (HDD) 6 inch	meter			
FTTH-11	OSP Civil	Trenching & Backfilling including warning tape and marker post	EA			
FTTH-12	OSP Civil	GI Sheet Pole (25 feet) supply & installation	EA			
FTTH-13	OSP Civil	OSP Civil Testing	meter			
FTTH-14	OSP Cable	288F Micro Cable G.657A (UG Duct) supply & installation	meter			
FTTH-15	OSP Cable	144F Micro Cable G.657A (UG Duct) supply & installation	meter			
FTTH-16	OSP Cable	48F Micro Cable G.657A (UG Duct) supply & installation	meter			
FTTH-17	OSP Cable	24F Micro Cable G.657A (UG Duct) supply & installation	meter			
FTTH-18	OSP Cable	2F Micro Cable G.657A (UG Duct) supply & installation	meter			

UPL/Material List/Stacking Units



Item Code	Item Class	Item Description	Unit	Unit Price (USD)	Quantity	Total Cost (USD)
FTTH-19	OSP Cable	144F Micro Cable G.657A (Aerial) supply & installation	meter			
FTTH-20	OSP Cable	48F Micro Cable G.657A (Aerial) supply & installation	meter			
FTTH-21	OSP Cable	24F Micro Cable G.657A (Aerial) supply & installation	meter			
FTTH-22	OSP Cable	2F Micro Cable G.657A (Aerial) supply & installation	meter			
FTTH-23	OSP Cable	OSP Cable Testing	meter			
FTTH-24	OSP ODN	288F Splice Closure supply & installation	EA			
FTTH-25	OSP ODN	144 Splice Closure supply & installation	EA			
FTTH-26	OSP ODN	48F Splice Closure supply & installation	EA			
FTTH-27	OSP ODN	24F FAT Closure without splitter supply & installation	EA			
FTTH-28	OSP ODN	512F indoor FAT Wall Mounted Rack	EA			
FTTH-29	OSP ODN	2:16 PLC Splitter supply & installation	EA			
FTTH-30	OSP ODN	1:4 PLC Splitter supply & installation	EA			
FTTH-31	OSP ODN	1:2 PLC Splitter supply & installation	EA			
FTTH-32	OSP ODN	48F ODF Patch Pannel 19" supply & installation	EA			
FTTH-33	OSP ODN	144F ODF Patch Pannel 19" supply & installation	EA			
FTTH-34	OSP ODN	288F ODF Patch Pannel 19" supply & installation	EA			
FTTH-35	OSP ODN	300mm x 1000mm 44U ETIS Rack	EA			
FTTH-36	OSP ODN	FTB 2F supply & installation	EA			

End to End Link Loss



Legend

- Connector Splice
- Connector
- Splice

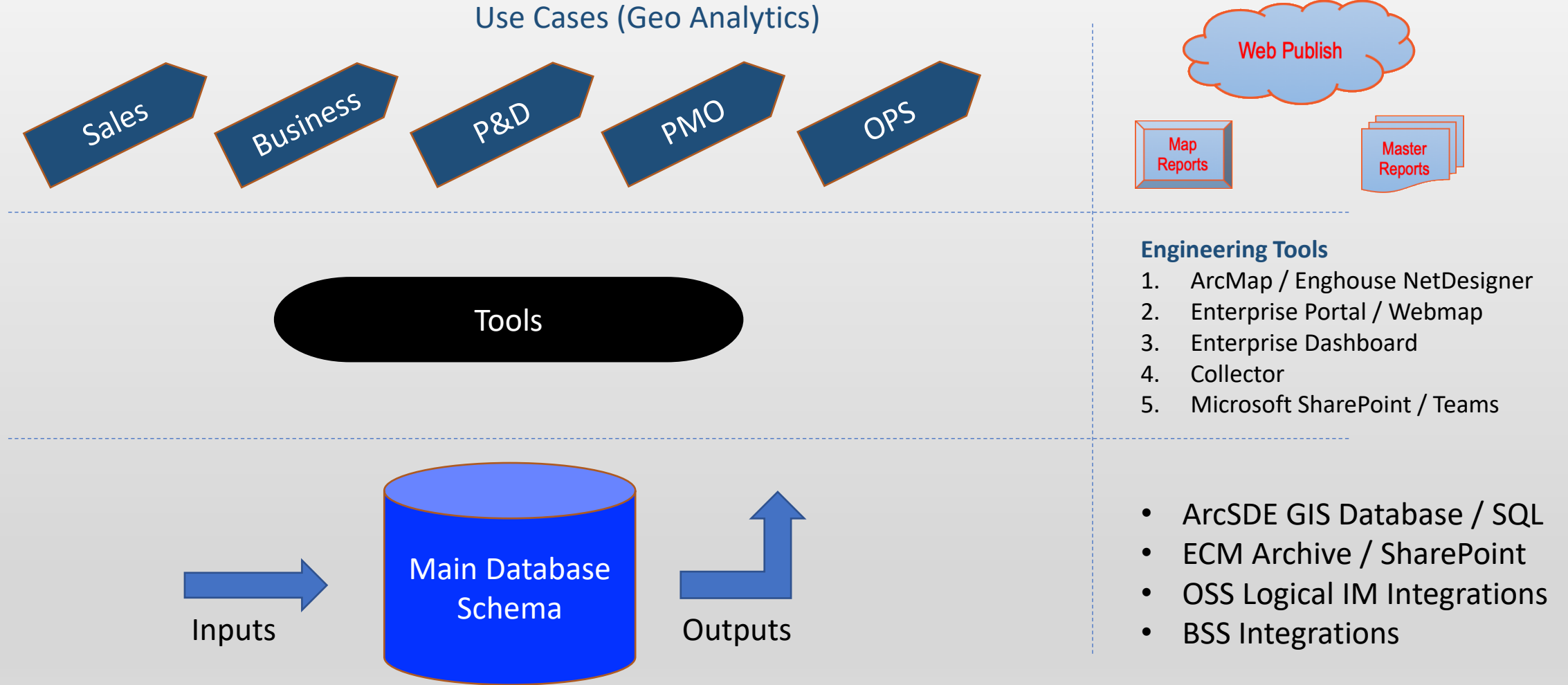
FTTH Link Loss Calculation				
Event Name	Loss Definitions	Range	No of Events	Total Loss
OLT to ODF	Connector	0.3	1	0.3
OLT to ODF	Connector	0.3	1	0.3
ODF to Feeder Cable	Connector & Splice	0.35	1	0.35
OFC (Feeder)	OFC length (km)	0.3	7	2.1
OFC to Closure	Splice	0.05	2	0.1
OFC (Feeder)	OFC length (km)	0.3	5	1.5
OFC to FAT	Connector & Splice	0.35	2	0.7
Splitter	2:16	12	1	12
OFC (Distribution)	OFC length (km)	0.3	2.7	0.81
OFC to FAT	Connector & Splice	0.35	2	0.7
Splitter	1:4	6	1	6
OFC (Drop)	OFC length (km)	0.3	0.35	0.11
FTB Termination	Connector & Splice	0.35	1	0.35
2F Indoor	OFC Length (Km)	0.3	0.1	0.03
TB	Connector & Splice	0.35	1	0.35
ONT Input	Connector	0.3	1	0.3
Total Link Loss (db)				26.00

Notes:

- End to End Splitting 2:64 (2 stage or 3 stage splitting)
- Distributed ssplitting using PakGIS network architecture
- Feeder + Distribution + Drop Length + Indoor = 15 Km
- End to end db loss: 26db
- Component losses considered as:

Item	Loss (db)
Connector & Splice	0.35
Connector	0.3
Splice	0.05
Fiber (db/km)	0.3
Splitter 2:16	12
Splitter 1:4	6

GIS / Engineering Tools & Usecases

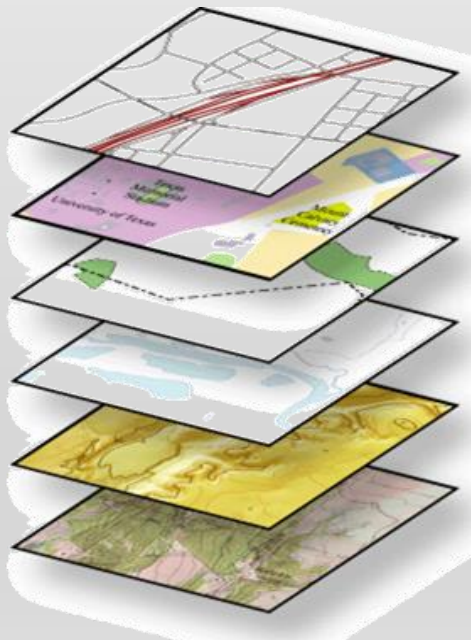


GIS Database /Inventory Architecture



- Telco Dataset
- Land base Dataset

Telco



Ducts and Cables

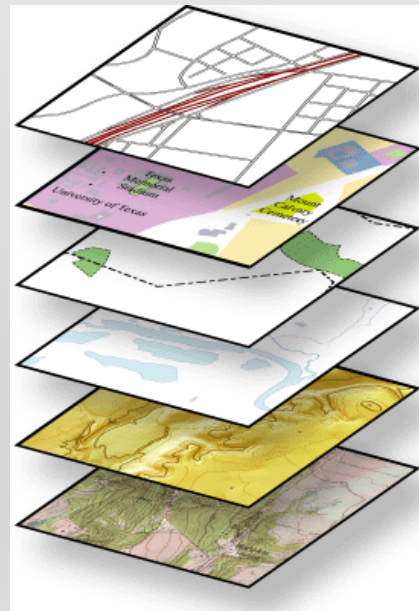
Equipment's

Structures

Buildings

Telco Boundaries

Landbase



Roads

Sector Boundaries

City Boundaries

State Boundaries

Parcels

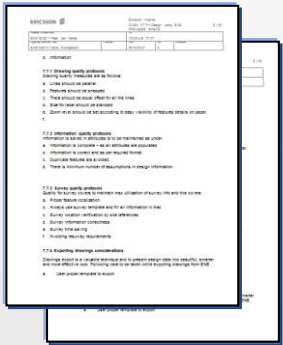
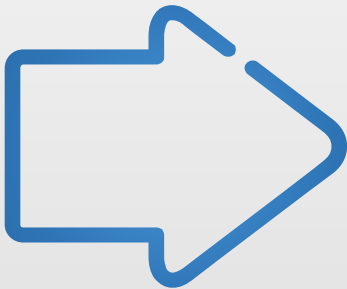
Physical part

- Location
 - Building
 - Rack

Logical part

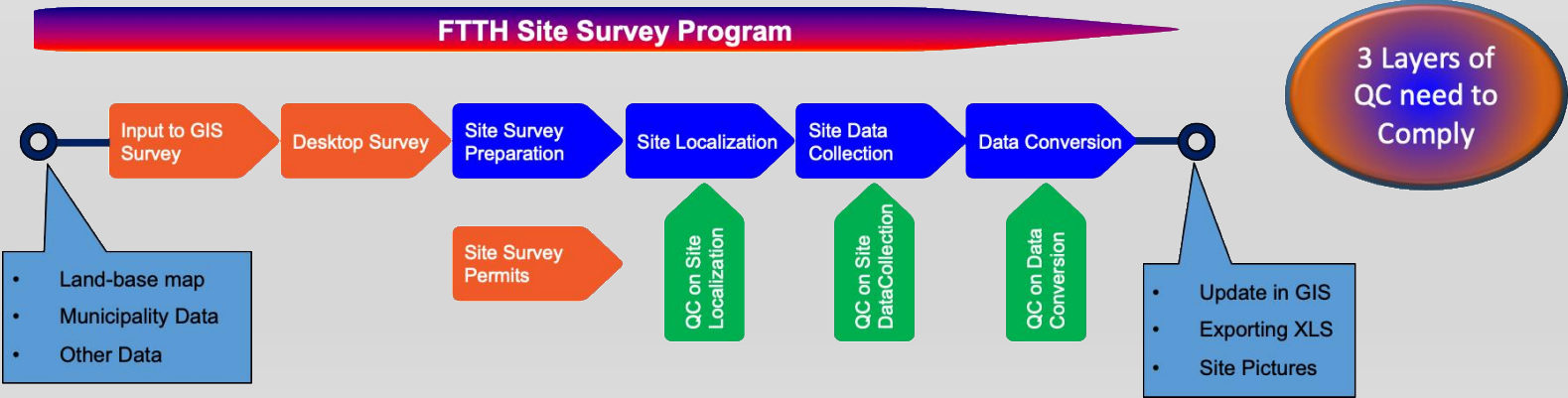
- Equipment
 - Slot
 - Card
 - Port

FTTH Site Survey Innovation



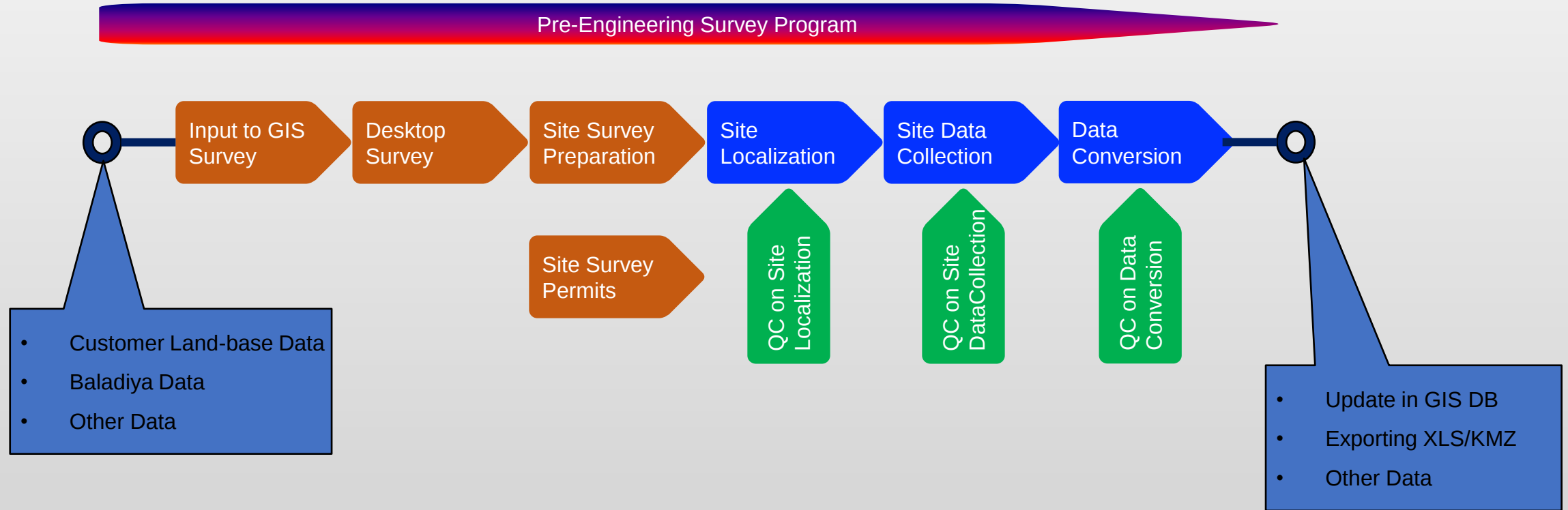
- Paperless Survey
- Fully integrated GIS Survey
- Fastest and Correct Survey

FTTH Site Survey Process



Pre Loaded Buildings and
Parcels with PakGIS Coding

Pre-Engineering Site Survey Process





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