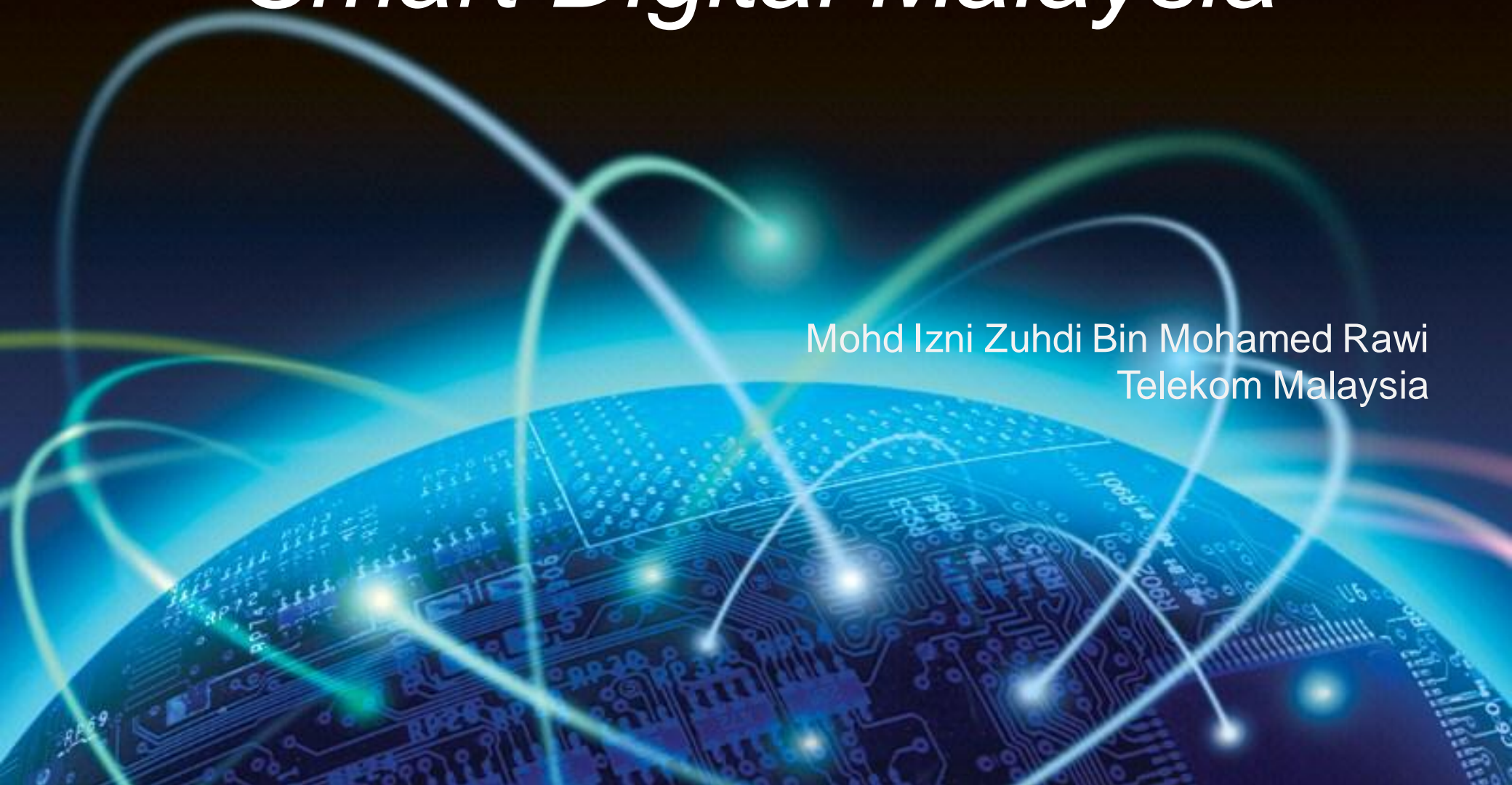


Network Convergence For Smart Digital Malaysia

Mohd Izni Zuhdi Bin Mohamed Rawi
Telekom Malaysia



Converged Network Infrastructure

High Level Network Architecture

Access Networks

Aggregation & Core Networks

Network Application & Control



Connectivity is a key success factor



A ubiquitous network infrastructure is mandatory

Converged Network Infrastructure

✓ High Level Network Architecture

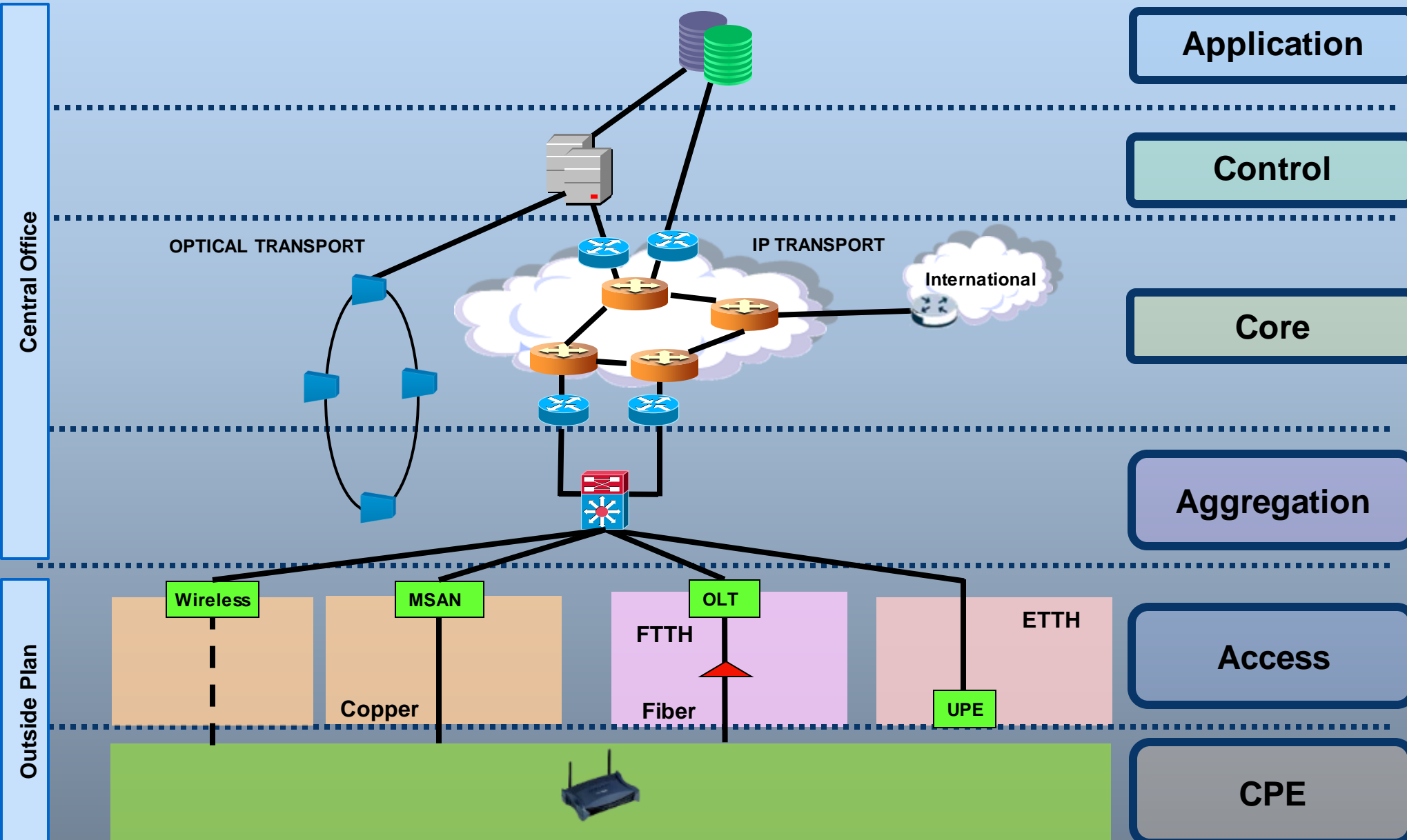
Access Networks

Aggregation & Core Networks

Network Application & Control



HIGH LEVEL NETWORK ARCHITECTURE



Converged Network Infrastructure

High Level Network Architecture



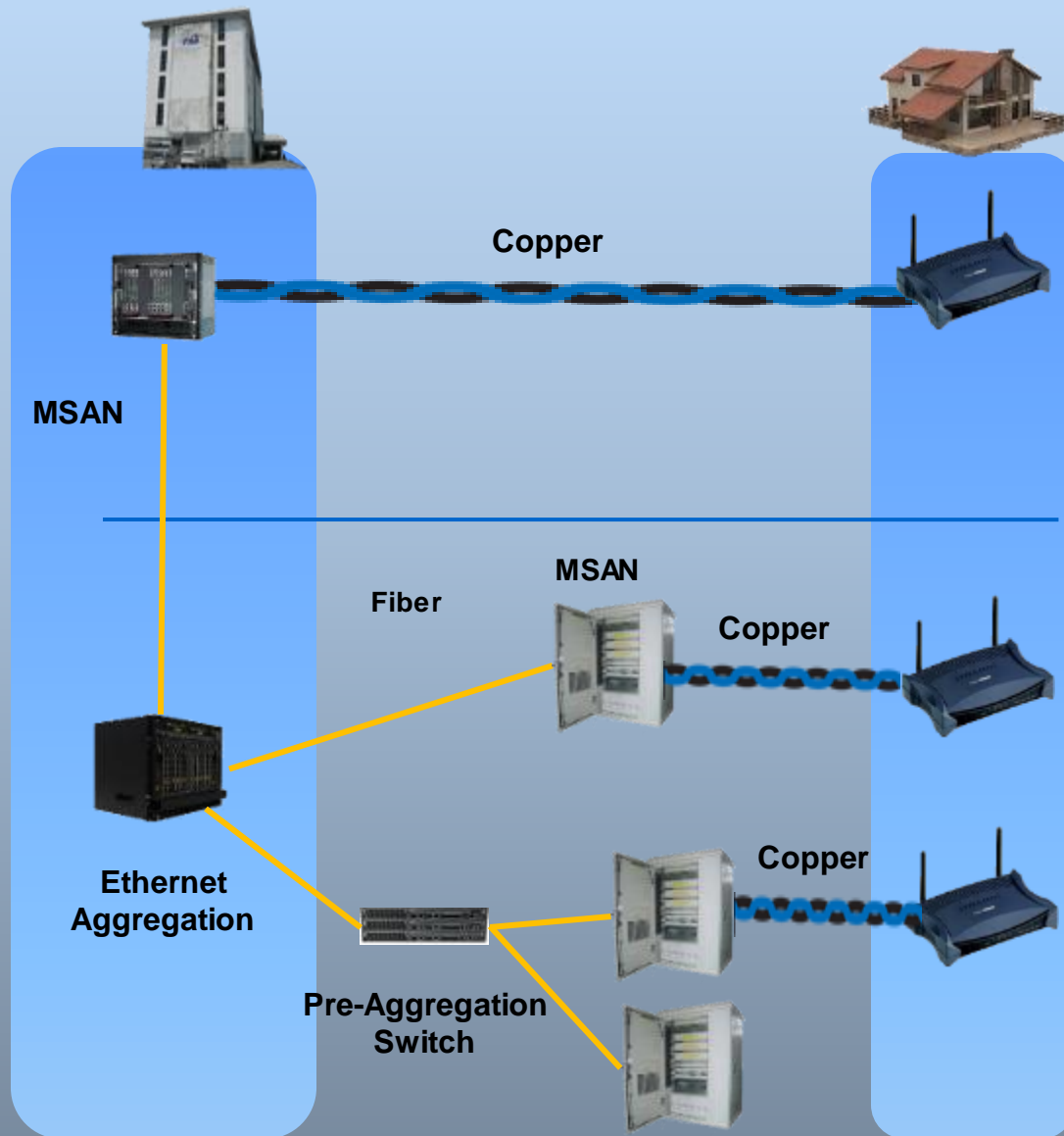
Access Networks

Aggregation & Core Networks

Network Application & Control

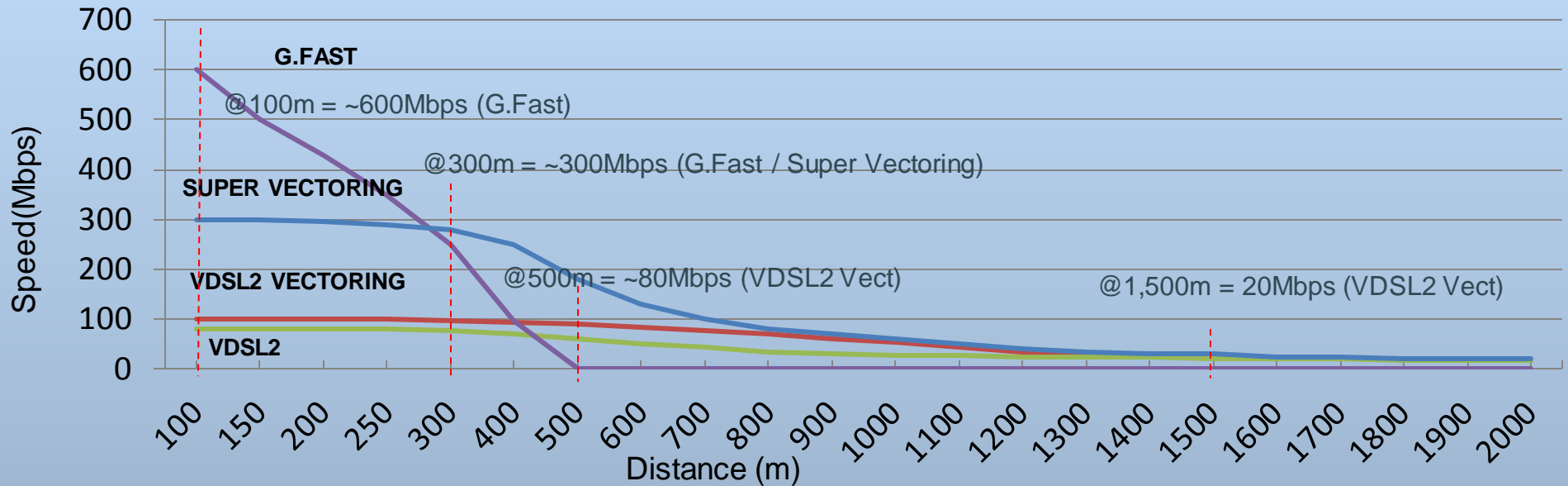


Copper has a few setup. Distance is a key factor.



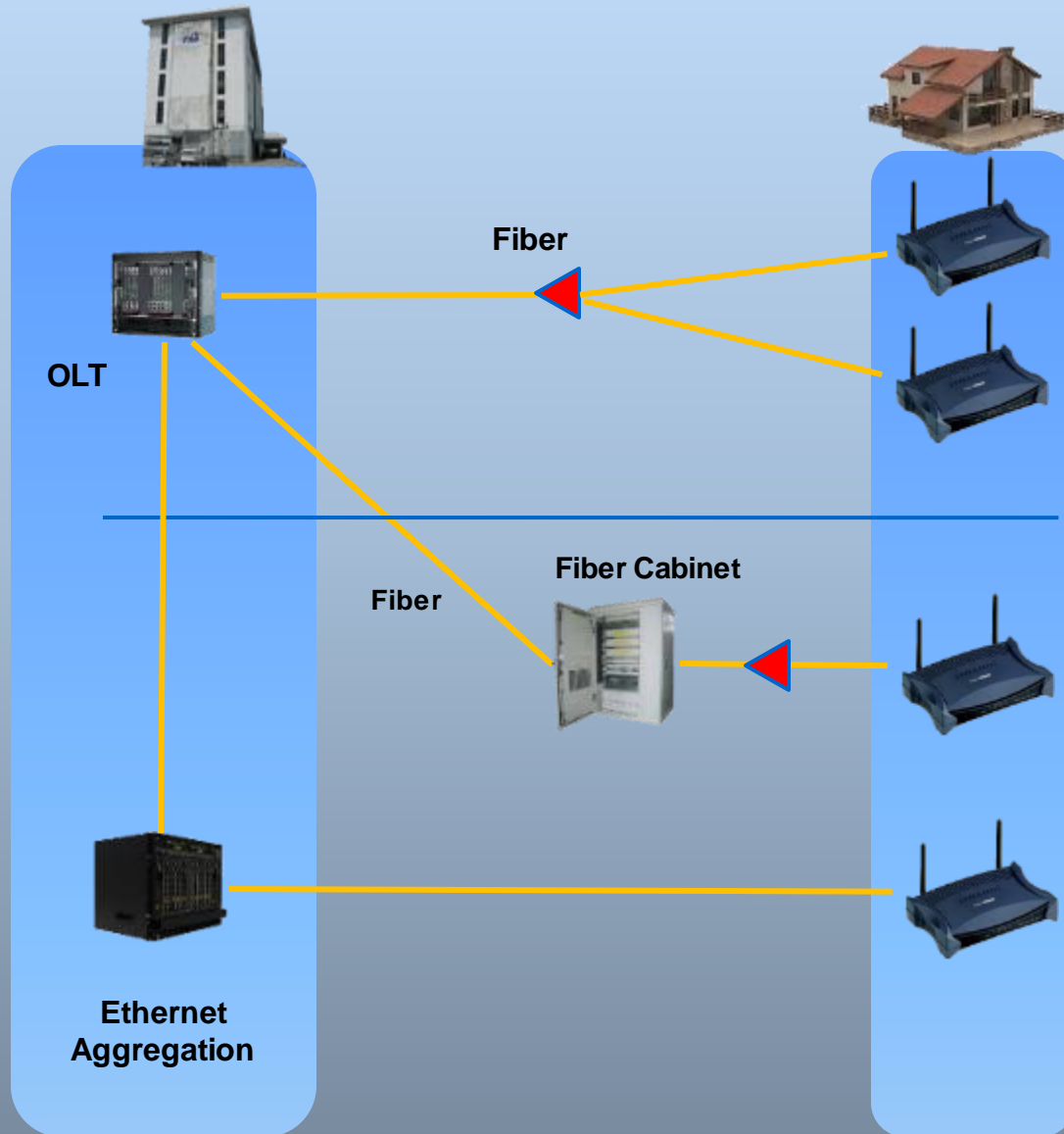
- Overhead and underground cables
- Fiber to the cabinet provides a means to shorten copper distance
- Active equipments like MSAN, Ethernet Aggregation, Pre-aggregation switches adds to the complexity

Modulation technologies and capabilities



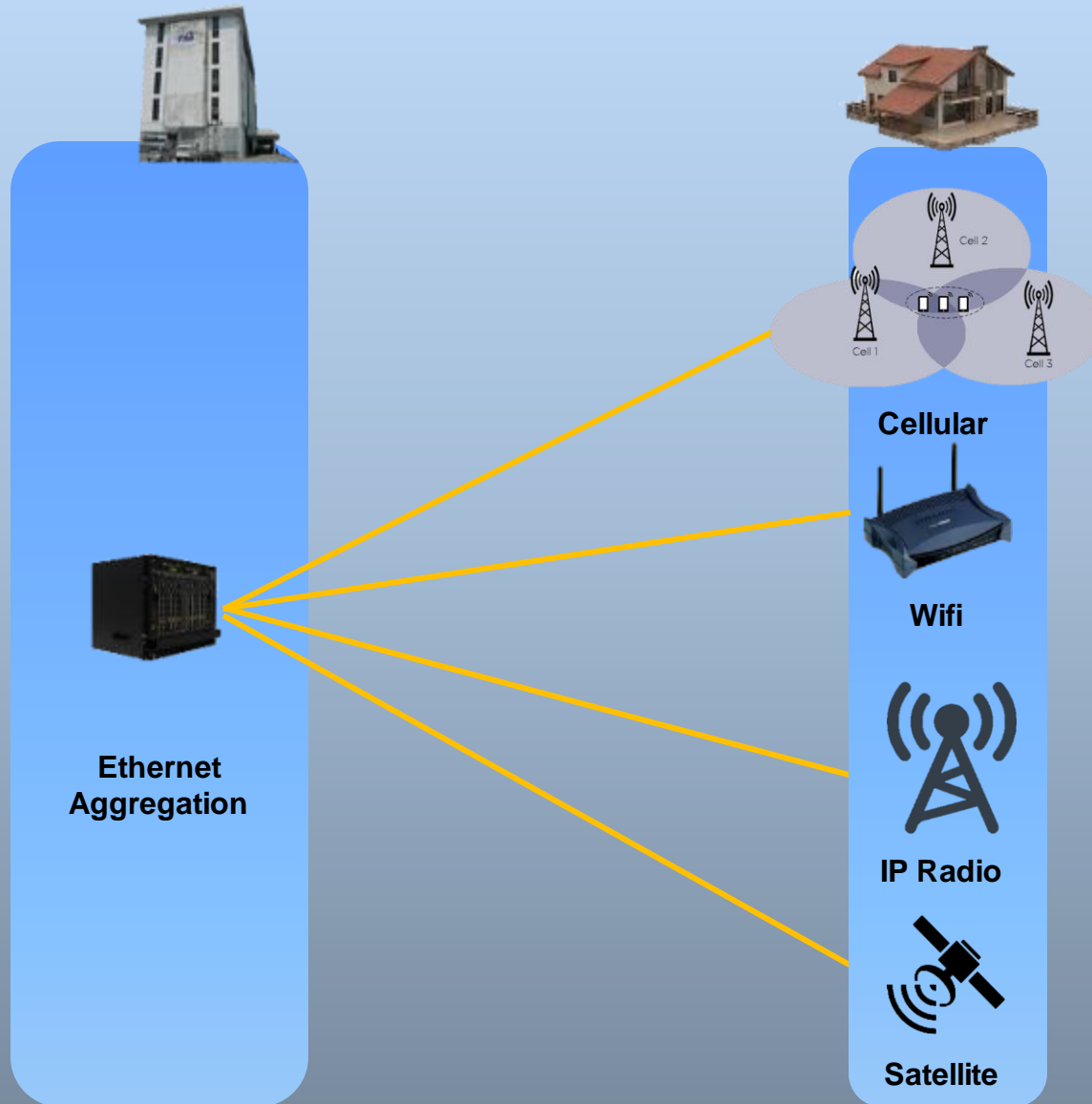
Speed	Technology	Standard	Copper Distance
200M-1GE	G.FAST	Standard & Commercially available	  100Mbps -600Mbps @100m – 300m
100 - 200M	SUPERVECTORING	Standard will be finalized by year 2017	 300Mbps @300m 
50 -100M	VECTORING	Matured & Commercially available	 100Mbps @500m 
20 - 50M	VDSL2	Matured & Commercially available	 20Mbps @1,500m 

Fiber provides a greater span, without compromising bandwidth



- Can transmit signal in tens of km
- Different standards exist :
 - G-PON, GE-PON
 - XG-PON, XGS-PON
- Fiber is 'future proof'
 - Passive optical network does splitting. Not dependent on wavelength
 - Newer standards can co-exist

Wireless provides seamless and spotted coverage



- Cellular coverage is suitable for seamless connectivity
- Wifi provides high bandwidth at transit locations
- IP Radio gives rapid deployment time
- Satellite connectivity enables access at remote areas
- A few emerging specifications for addressing Low Power WAN
 - NB-IoT
 - LoRa
 - Weightless
 - NB-Fi

Converged Network Infrastructure

High Level Network Architecture

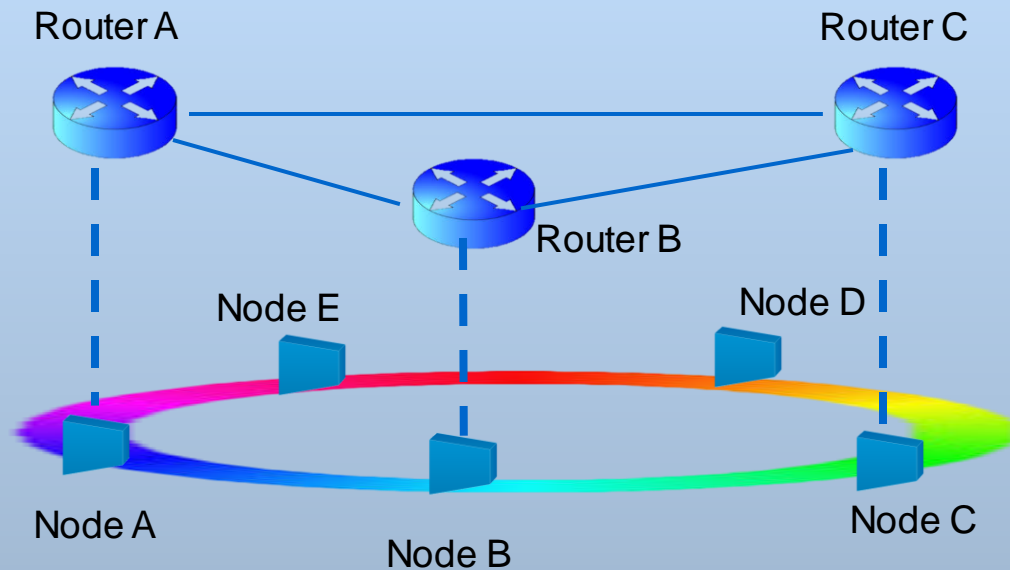
Access Networks

 **Aggregation & Core Networks**

Network Application & Control



Optical and IP transport may not necessarily be aligned



The physical path for:
Router A \leftrightarrow Router C

Path 1:

Node A – Node B – Node C

Path 2

Node A – Node E – Node D – Node C

- Physical paths of optical transport network does not have to correspond to the logical paths of IP transport
- Link protection mechanism typically reside in one of the domains, not both
- Selecting the protection mechanism depends on the design goal
- Technologies such as MPLS, OTN and WSS come into play

Converged Network Infrastructure

High Level Network Architecture

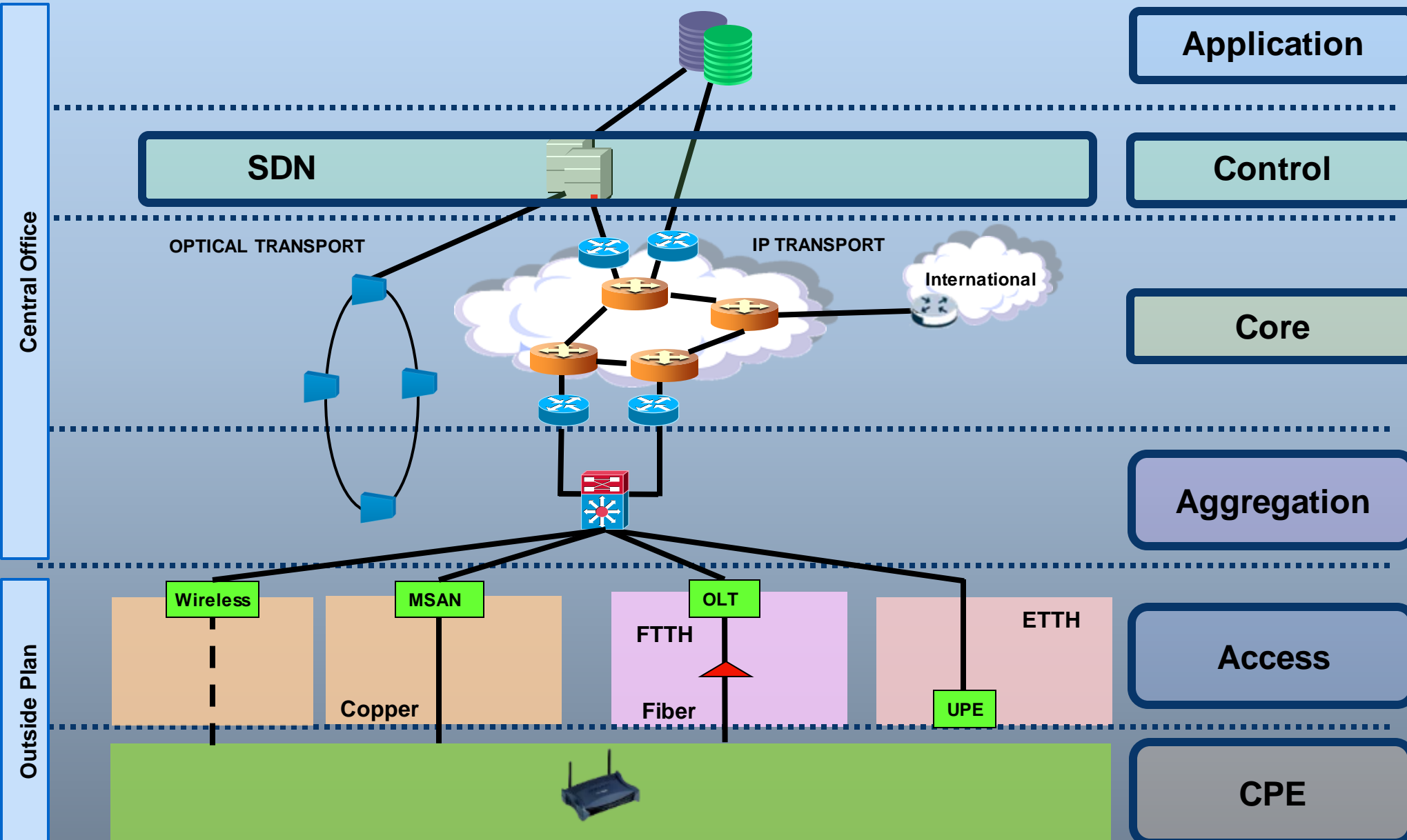
Access Networks

Aggregation Networks

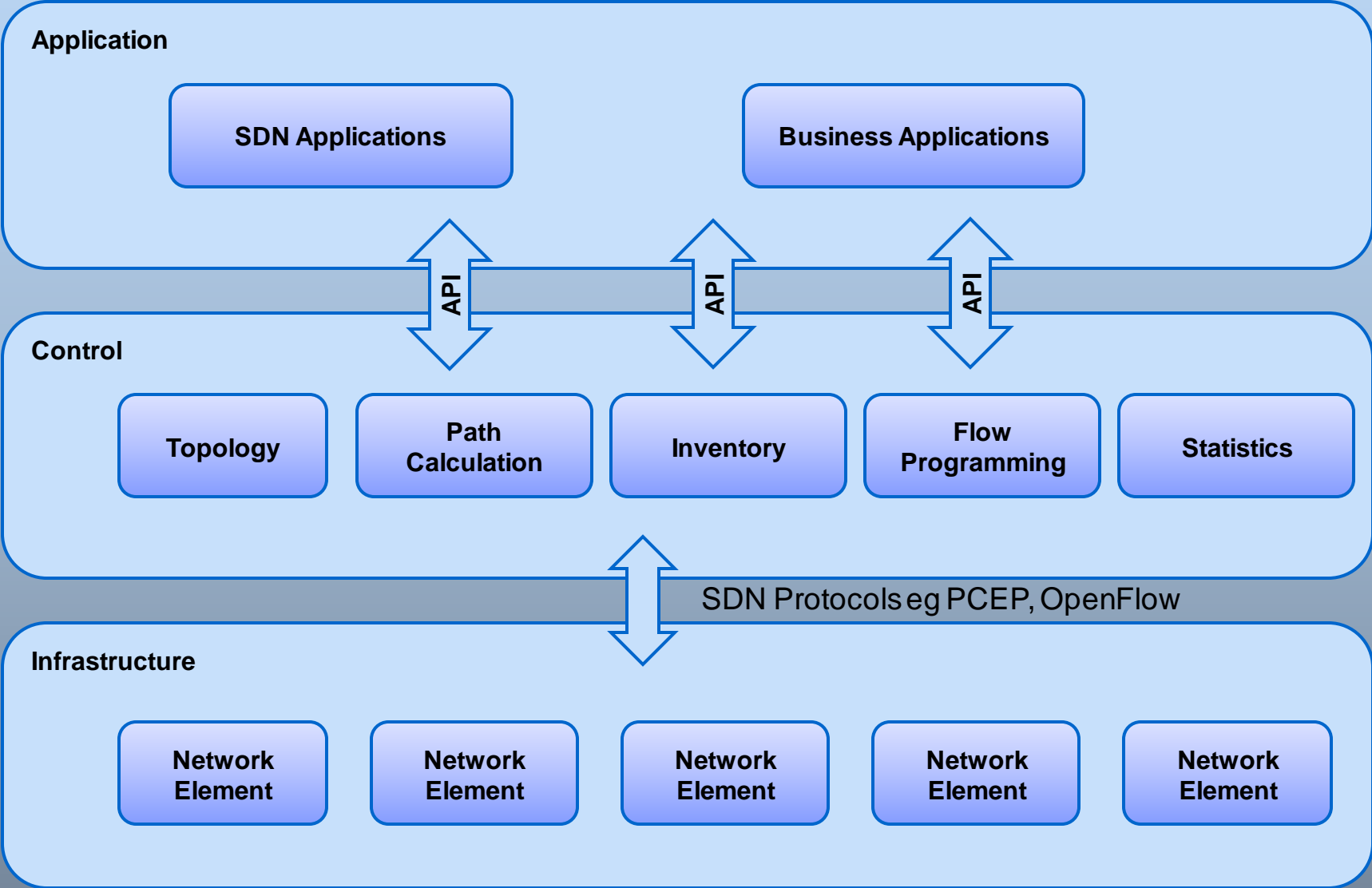
 **Network Application & Control**



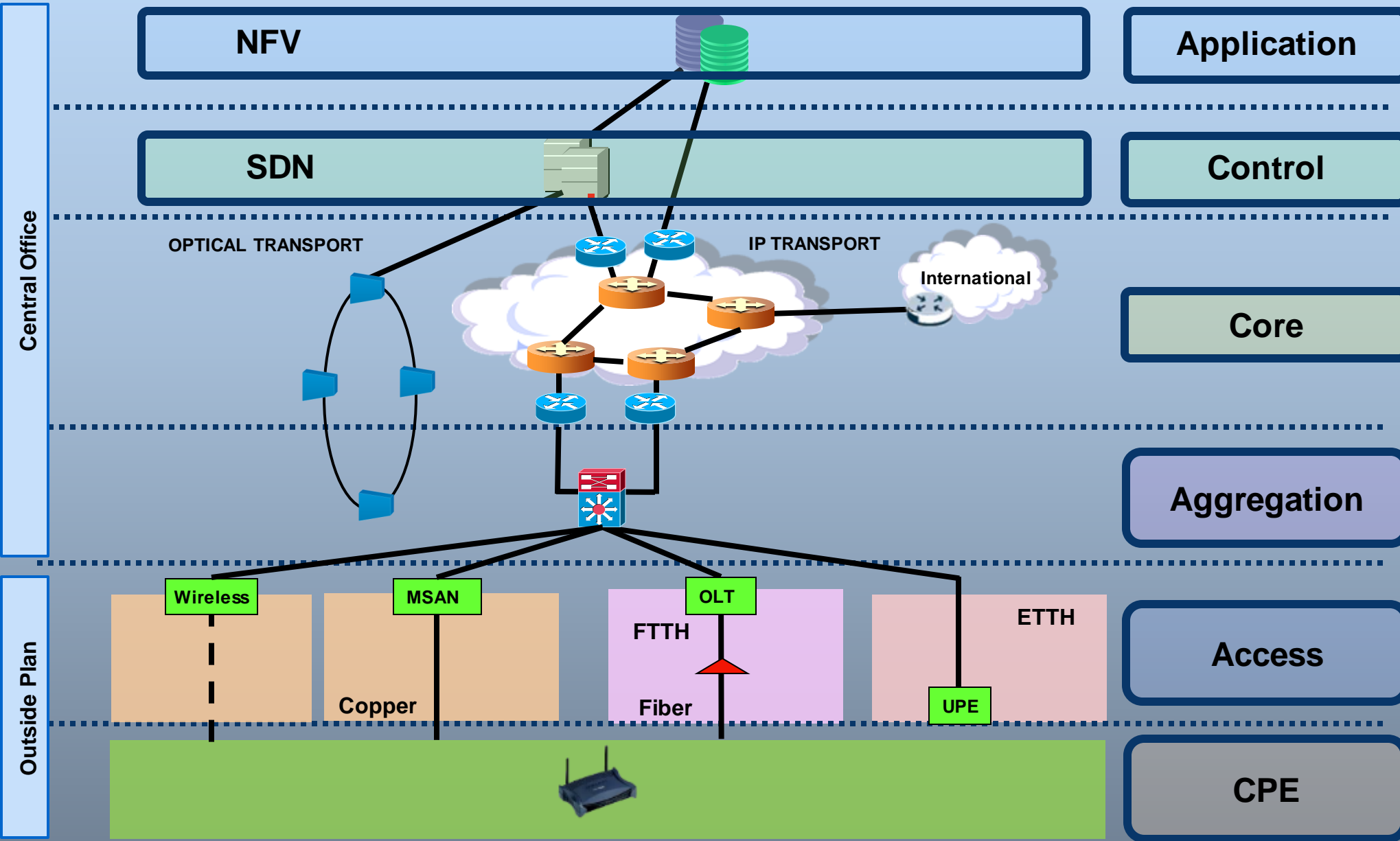
HIGH LEVEL NETWORK ARCHITECTURE



SDN ARCHITECTURE



HIGH LEVEL NETWORK ARCHITECTURE





Thank You