

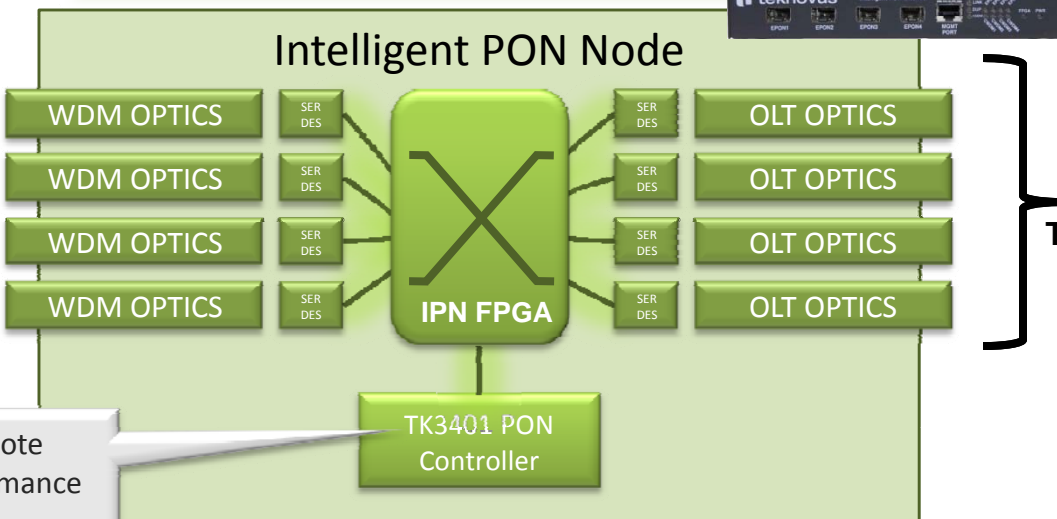
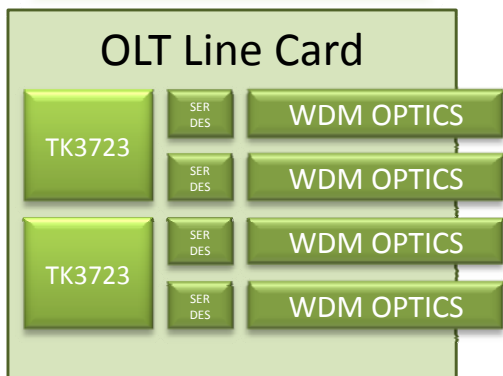
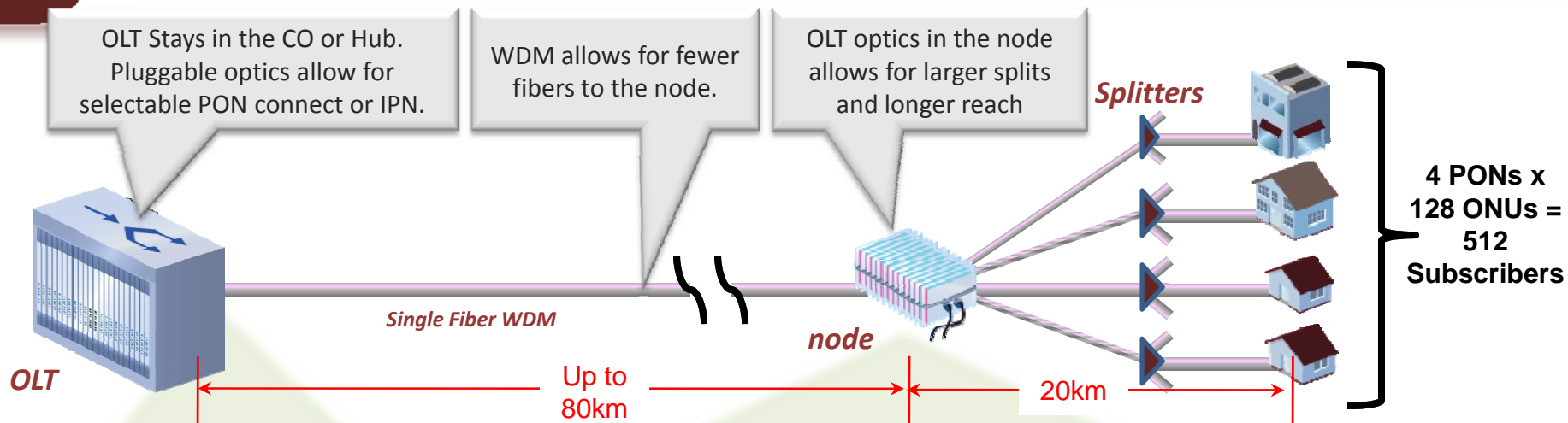
Intelligent PON Node

December 10, 2009

Facing Real Service Provider Issues

- Service Providers are faced with important issues:
 - **Fiber capacity:** as demand for higher-performance service increases, availability of fiber is becoming limited and costs for pulling new fiber are not economical.
 - **Central Office consolidation:** driven by the need to reduce costs and power, many providers want to reduce the quantity of central offices, which is leading to increased CO-to-subscriber distances and need to increase capacity of trunk fibers.
 - **MDU deployment:** MDUs represent a rapidly growing market for high-performance FTTH connectivity but their high-density seems to drive a need for remote OLTs.
 - **Rural/lightly-loaded PONs:** how to establish service economically with minimal OLT ports while consolidating fiber utilization.
- All solutions involve installation of an outside-plant system to extend and consolidate service...

Intelligent PON Node (IPN): Overview



TK3401 registers on link for remote management, upgrade, and performance monitoring

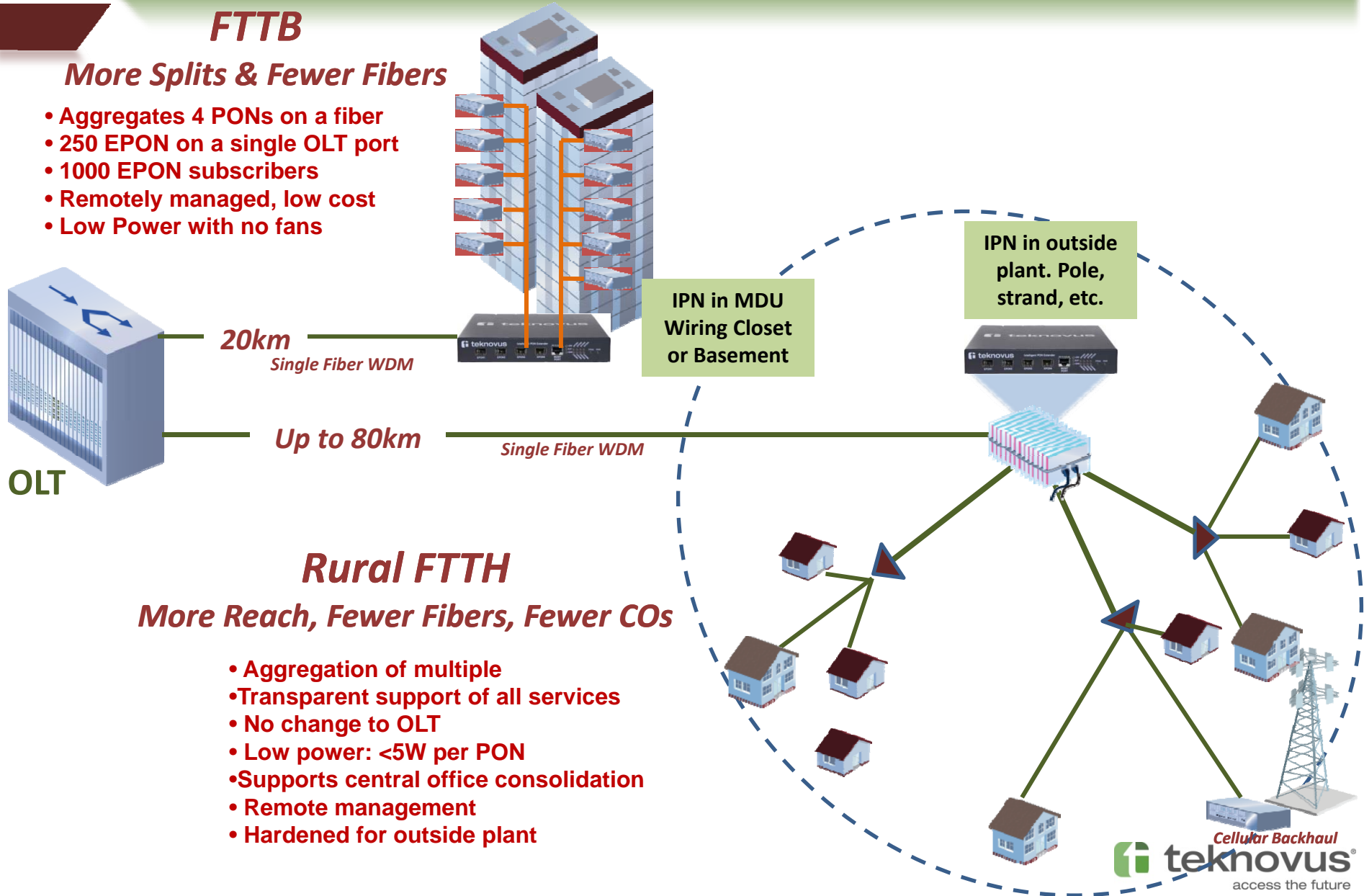


Application of the Intelligent PON Node

FTTB

More Splits & Fewer Fibers

- Aggregates 4 PONs on a fiber
- 250 EPON on a single OLT port
- 1000 EPON subscribers
- Remotely managed, low cost
- Low Power with no fans

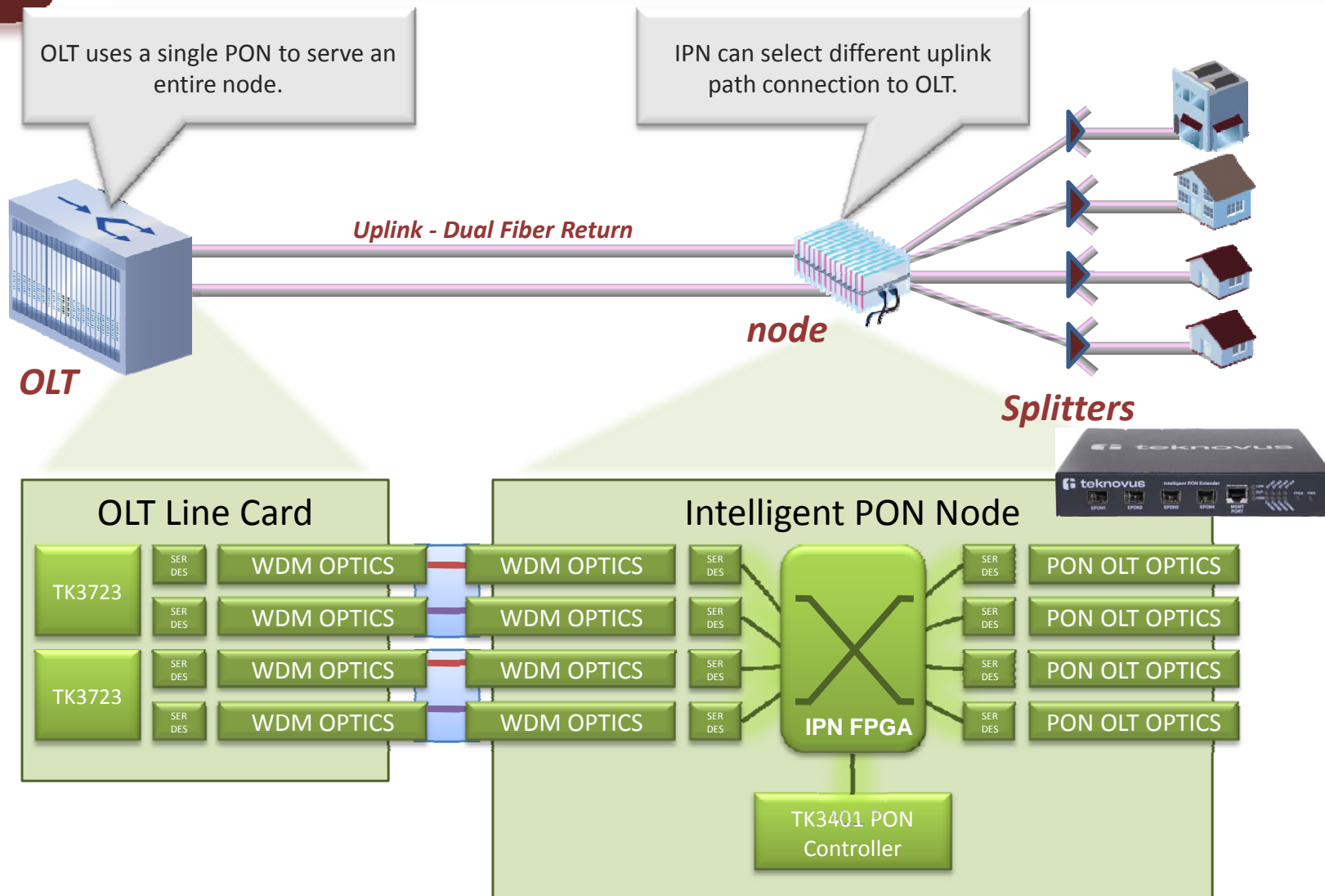


Rural FTTH

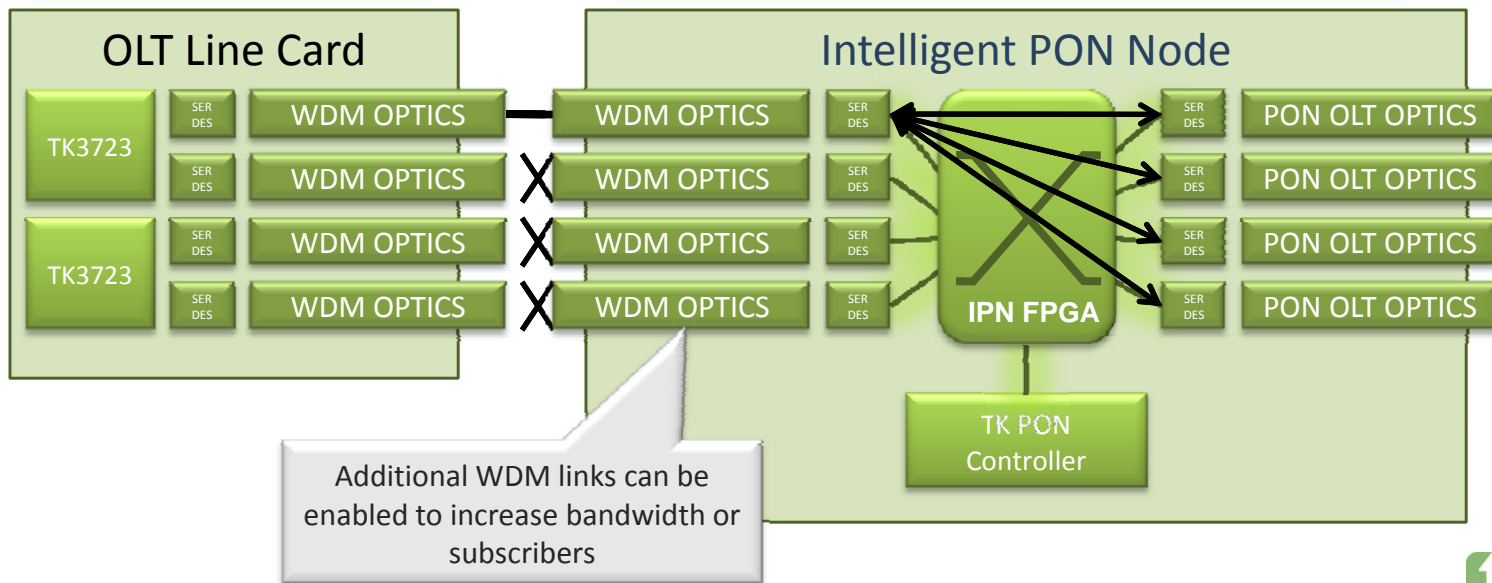
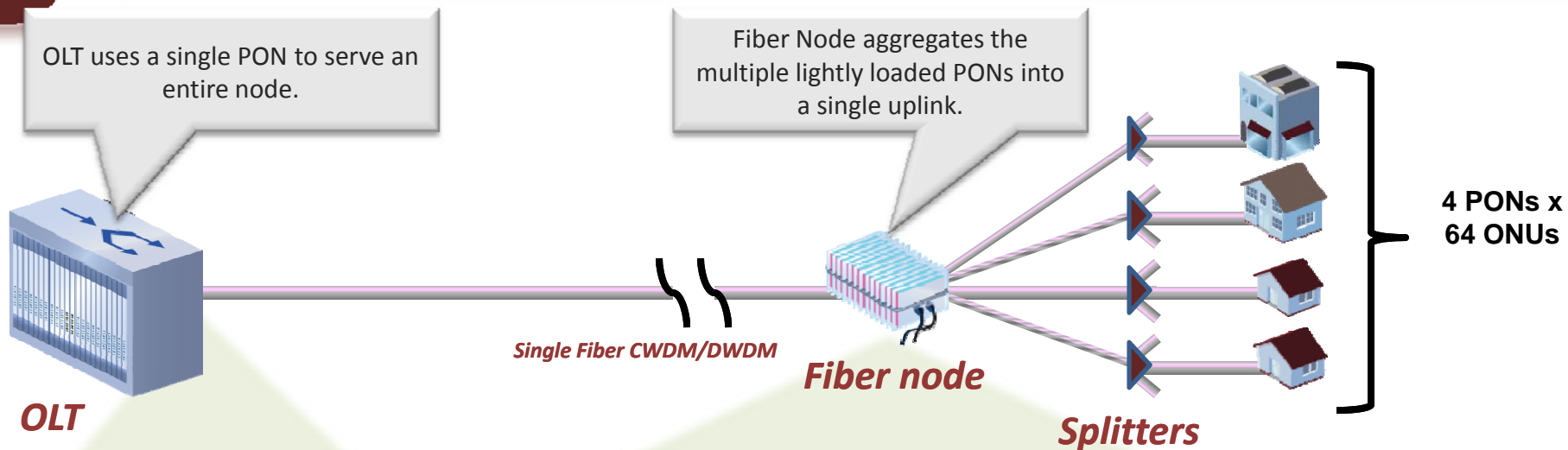
More Reach, Fewer Fibers, Fewer COs

- Aggregation of multiple
- Transparent support of all services
- No change to OLT
- Low power: <5W per PON
- Supports central office consolidation
- Remote management
- Hardened for outside plant

Intelligent PON Node – Protection

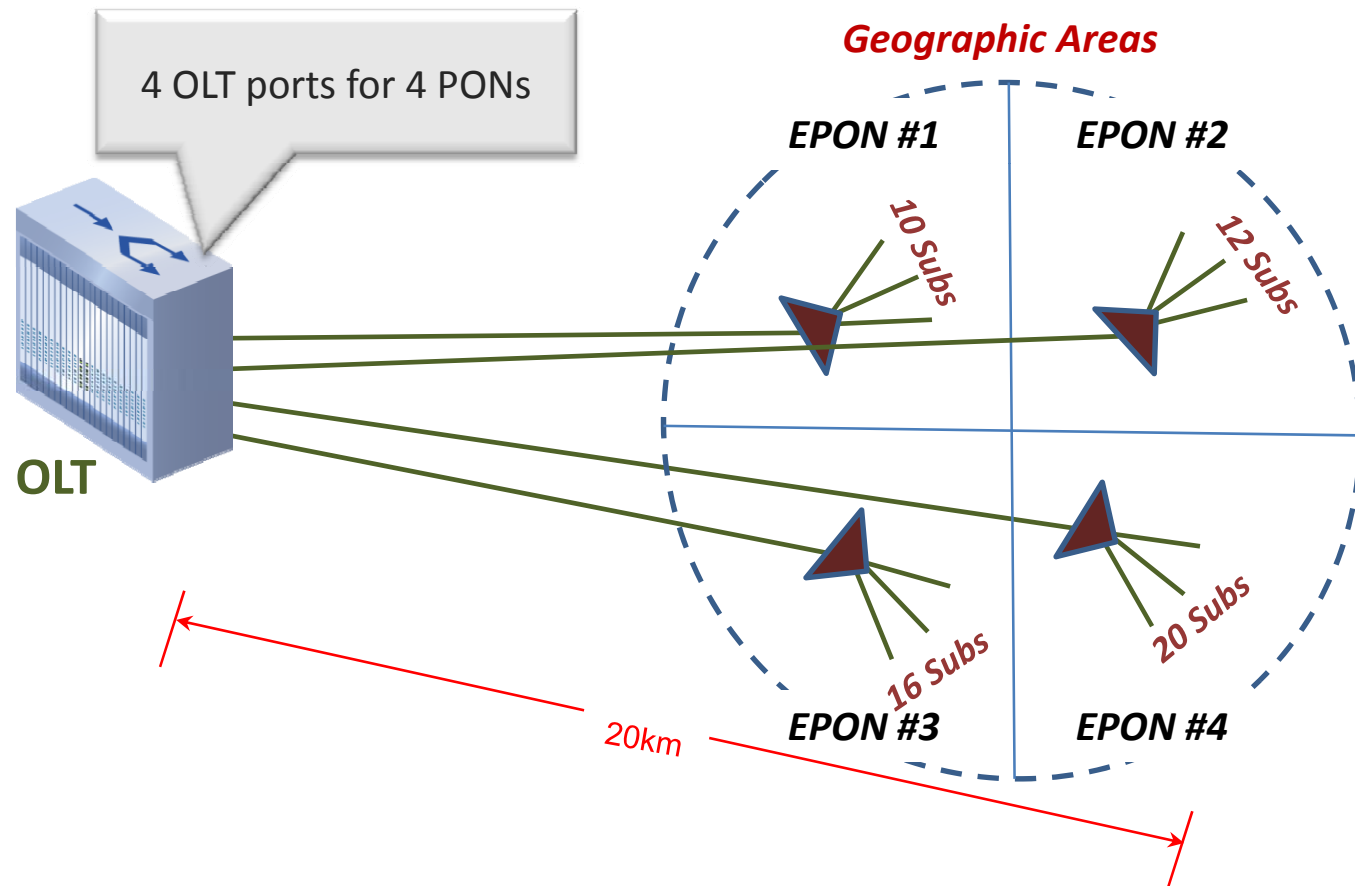


Intelligent PON Node - Aggregation



Rural and Lightly-Loaded Networks

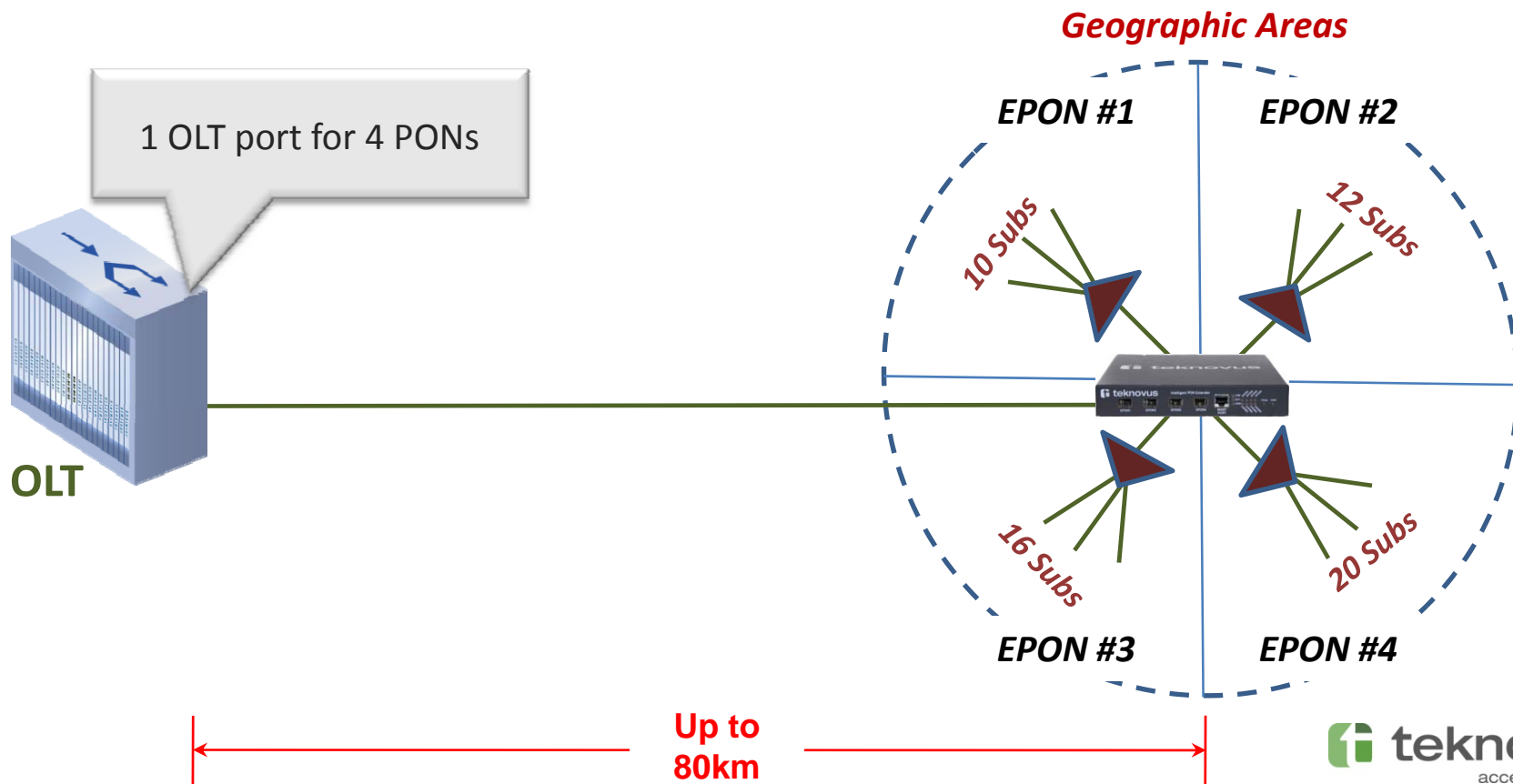
- **Without** the Intelligent PON Node: carriers often have geographic areas with few subscribers, each requiring an OLT port and fiber distribution network:



Rural and Lightly-Loaded Networks

■ With the Intelligent PON Node:

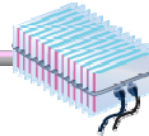
- IPN can service 4 lightly-loaded EPONs with a single OLT port and trunk fiber
- As subscribers are added, the IPN may be remotely reconfigured to add/change OLT ports, add trunk fibers (using WDM)



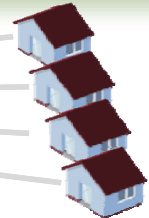
Teknovus' Intelligent PON Node (IPN)



Hub or Central Office

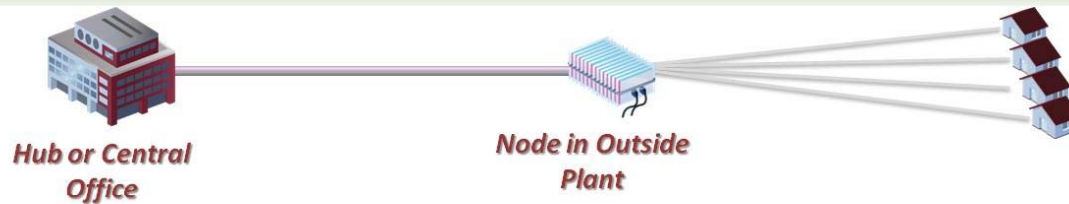


Intelligent PON Node (IPN)



Features	Benefits
Teknovus OLTs support up to 250 subscribers per PON port	Lowest cost/subscriber
IPN supports up to 4 fully loaded PONs	Supports up to 1000 subscribers
IPN crossbar switch architecture	Enables: <ul style="list-style-type: none"> - Load balancing: Conserves OLT ports - Future Expansion - Fast protection switching
IPN supports up to 100km OLT to ONU distance	Economical support of subscribers that would normally be outside service area. Remote OLTs or additional CO's not needed
IPN Controller (TK3401) remote management	Non-service interrupting loopback, diagnostics, statistics, remote upgrade, optical monitoring

Solutions Matrix



	Amplifier	Remote OLT	Intelligent PON Node
Service Reach	< 50km	~50-60km, depending on optics	80-100km
Service Density	No impact	Potentially high; limited by form factor	Very high using WDM optics
Functionality	Very basic: amplification only	Potentially as high as a CO OLT; depends on form factor & remote mgmt support	Highest: protection switching, remote mgmt, signal re-timing
Transparency	Sometimes requires a mating system in CO	Requires trunk communications system, adding cost, complexity, and two more points of failure.	Completely transparent: may be inserted into fiber plant without affecting OLTs or ONUs
Remote Management	Likely little or none. Needs additional mgmt system in CO	Requires additional management communication system and integration into EMS/NMS.	Remotely managed via OLT, full statistics, diagnostics, and loopback
Form Factor (Size, Power)	Small, low-power	Large and power-hungry. May have limited support for field-replaceable modules.	Small, low-power. SFP optics.
Cost/Subscriber	Probably lowest cost, but also lowest performance and functionality.	Highest cost: involves putting an entire OLT out into the field, likely requiring industrial temp operation.	May be same or lower than amplifier solution, due to ability to serve larger number of subscribers.

Summary

- Intelligent PON Node provides a managed extension of the fiber plant with no OLT modification
 - Larger splits
 - Longer reach
 - PON aggregation
- Better solutions for applications requiring remote OLTs
 - Rural OLTs
 - MDU Basement OLTs
 - Pole mount OLTs
- TK3401 PON node controller chip
 - Controller chip with management Ethernet port
 - Embedded software includes FPGA code
 - Supports loopback, aggregation, and remote upgrade
- TKIT-3401X009: Reference design and schematic

