



Delivering Next Generation  
Broadband Access Solutions



# **Nayna ExpressSTREAM Broadband EFM Access System Raj Jain**

Raj Jain is now at  
Washington University in Saint Louis  
Jain@cse.wustl.edu  
<http://www.cse.wustl.edu/~jain/>

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# Overview

- ❑ Ethernet in the First Mile (EFM)
- ❑ Nayna ExpressSTREAM EFM with Quad Play
- ❑ Triple-Band Broadcasts: IP Video, RF Cable TV, RF Satellite TV
- ❑ Key Features
- ❑ Applications: MSO, Carriers, Municipal Governments

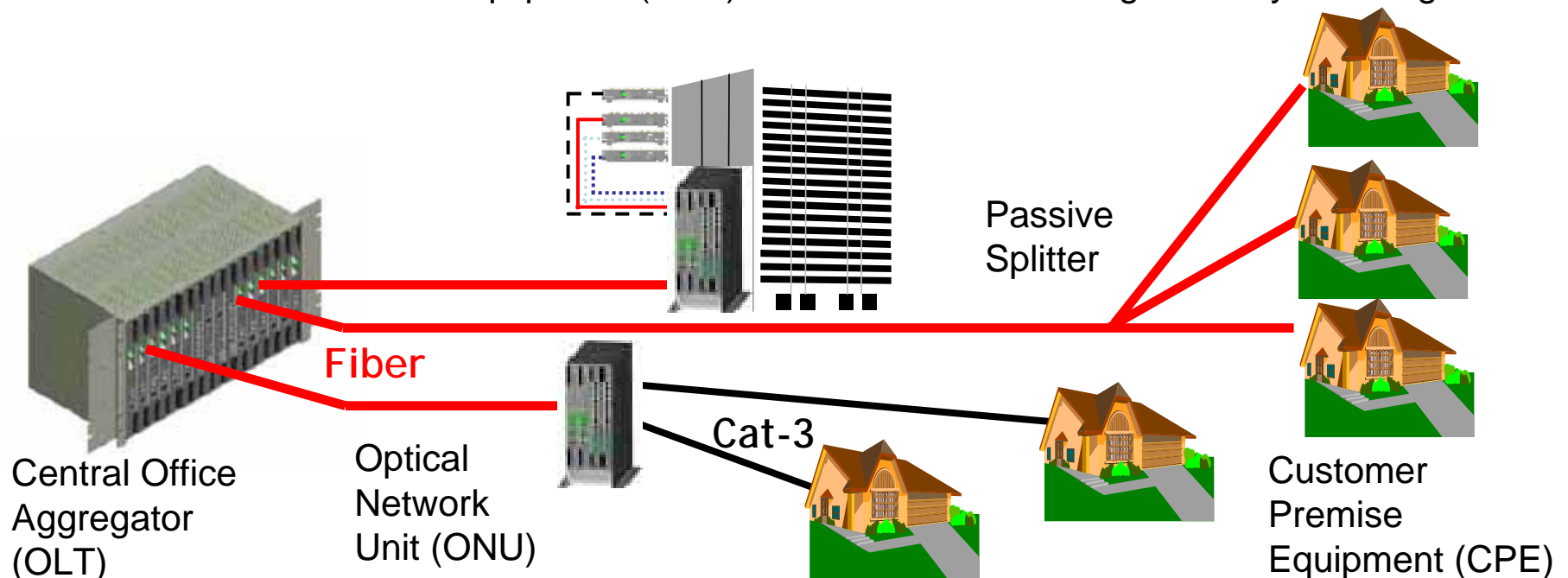
## Nayna Networks Overview

- ❑ Headquarters: San Jose, California
- ❑ Founded: February, 2000
- ❑ Offices: Tokyo for ASPAC
- ❑ Market: Broadband Access
- ❑ Value Proposition: Improve the operator bottom line by lowering CapEx and OpEx
- ❑ Products/Solutions: Next Generation Broadband Access Solutions
- ❑ Team: Networking and Telco veterans
- ❑ Investors: Apex Venture Partners, MKS Ventures, Ignite Group, Pacesetter Capital Group, Van Wagoner Capital Mgt, Kinetic Ventures, ABN Amro Private Equity, Dominion Ventures, Venture Banking Group, & strategic Silicon Valley Investors
- ❑ Patents: 14 Patents awarded + several more filed



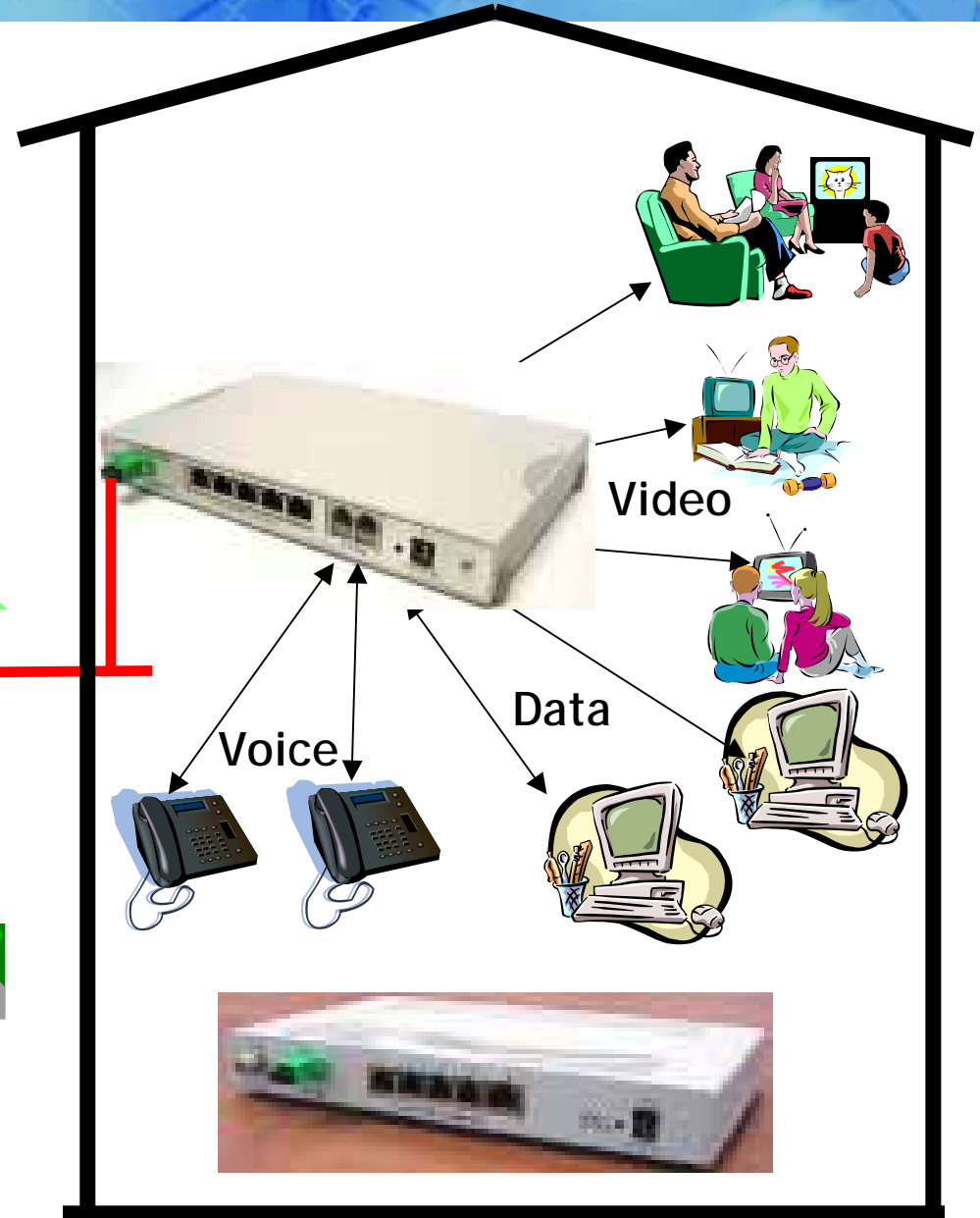
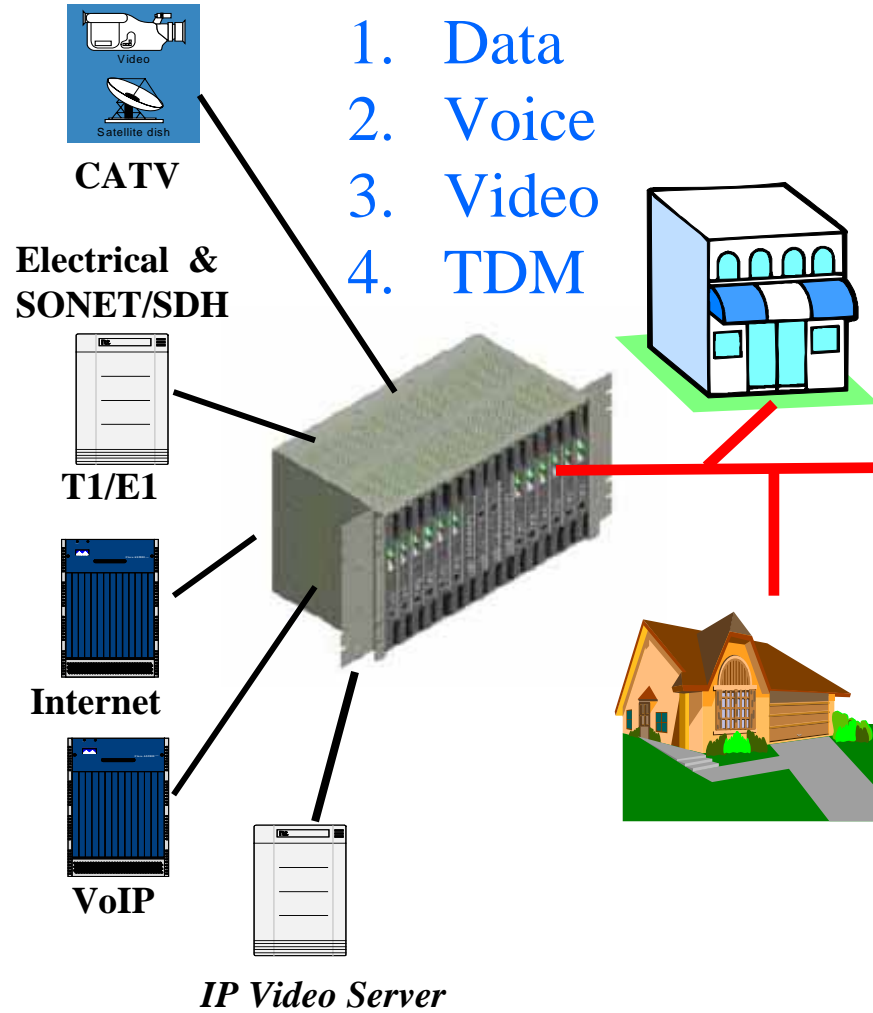
## Ethernet in the First Mile (EFM)

- ❑ **IEEE 802.3ah Standard** Specifies three approaches:
  - Point-to-point bidirectional communication over a single fiber
  - Point-to-Multipoint communication over a single fiber (**EPON**)
  - High-speed data over Cat-3 cables (phone wire)
- ❑ **Nayna ExpressSTREAM** includes all components for EFM:
  - Optical Line Terminal (OLT) at Central Office
  - Optical Network Unit (ONU) at basement or curb
  - Customer Premise Equipment (CPE) for Businesses and single-Family Dwellings



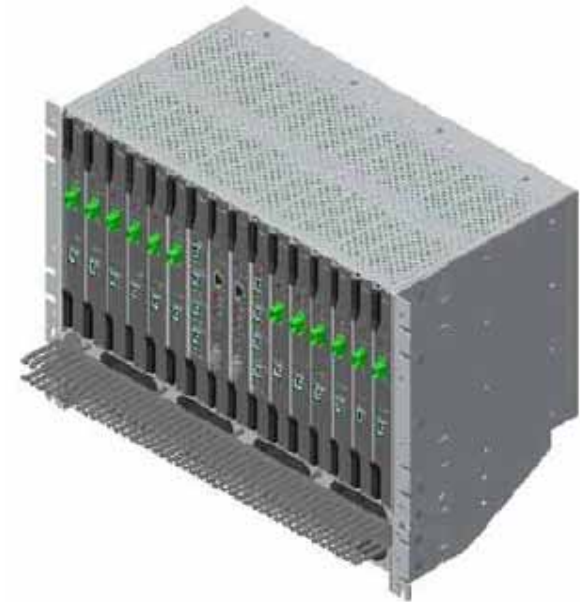


# Nayna ExpressSTREAM EFM with Quad Play

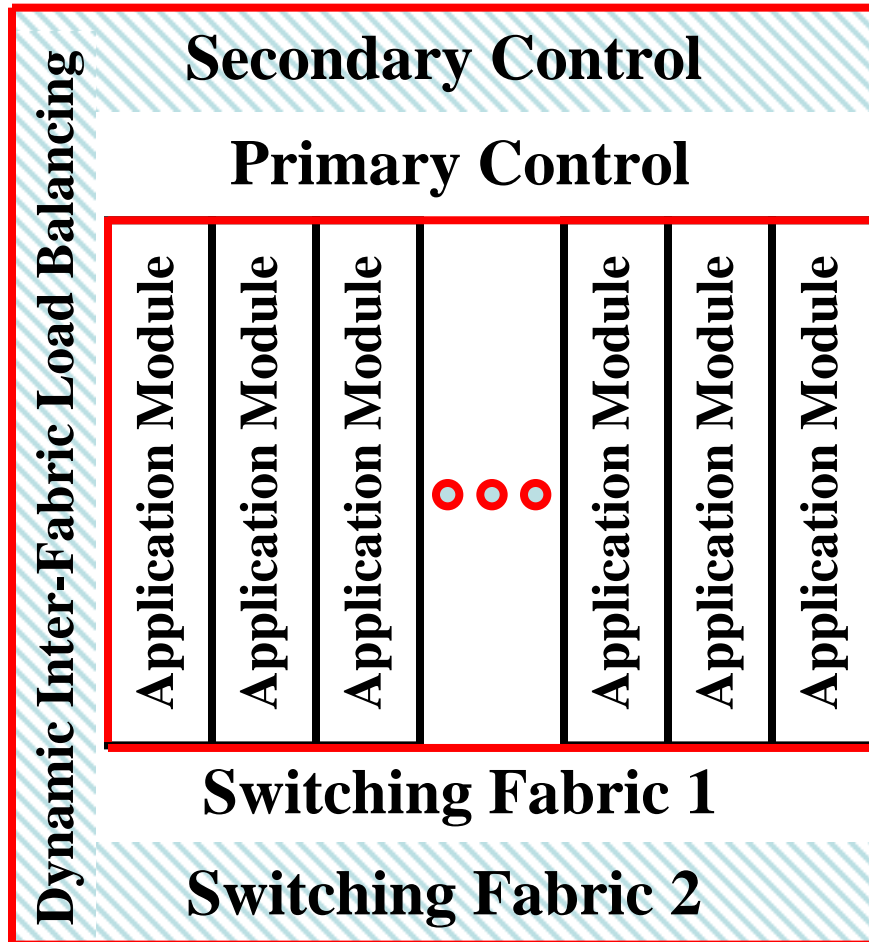


## Unique *SMART Architecture*

- ❑ **Standards Compliant: 802.3ah**
- ❑ **Multi-service: Quad Play**
- ❑ **Adaptable Architecture**  
P2MP, P2P, T1/E1/J1  
Any app. card – any slot
- ❑ **Redundancy Support**  
1:1 fiber redundancy
- ❑ **Topology Flexibility**  
Bus, Passive Star, Active Star,  
Ring, P2P, Add-drop



# System Architecture



- ❑ Redundant Control  
⇒ High availability
- ❑ Redundant Switching  
⇒ high performance and high availability
- ❑ Modular architecture  
⇒ Any application card in any slot  
⇒ Extensible  
New applications can be easily added
- ❑ Intelligent Switching  
⇒ Dynamic Bandwidth Allocation

# ExpressSTREAM Multi-Service CPE Gateways

Triple Play  
Port Rate Controls

Downloadable  
Configurations

Consumer Ready Packaging



Passive Optical  
Network (EPON)  
Uplink

2 POTS



SFP based Transceivers for  
Point-to-Point Uplinks

Complete Range of  
Solutions



10/100/1000 Mbps  
Throughput Performance



RF CATV and Satellite up to 2.1 GHz

IP Video

Service VLANs

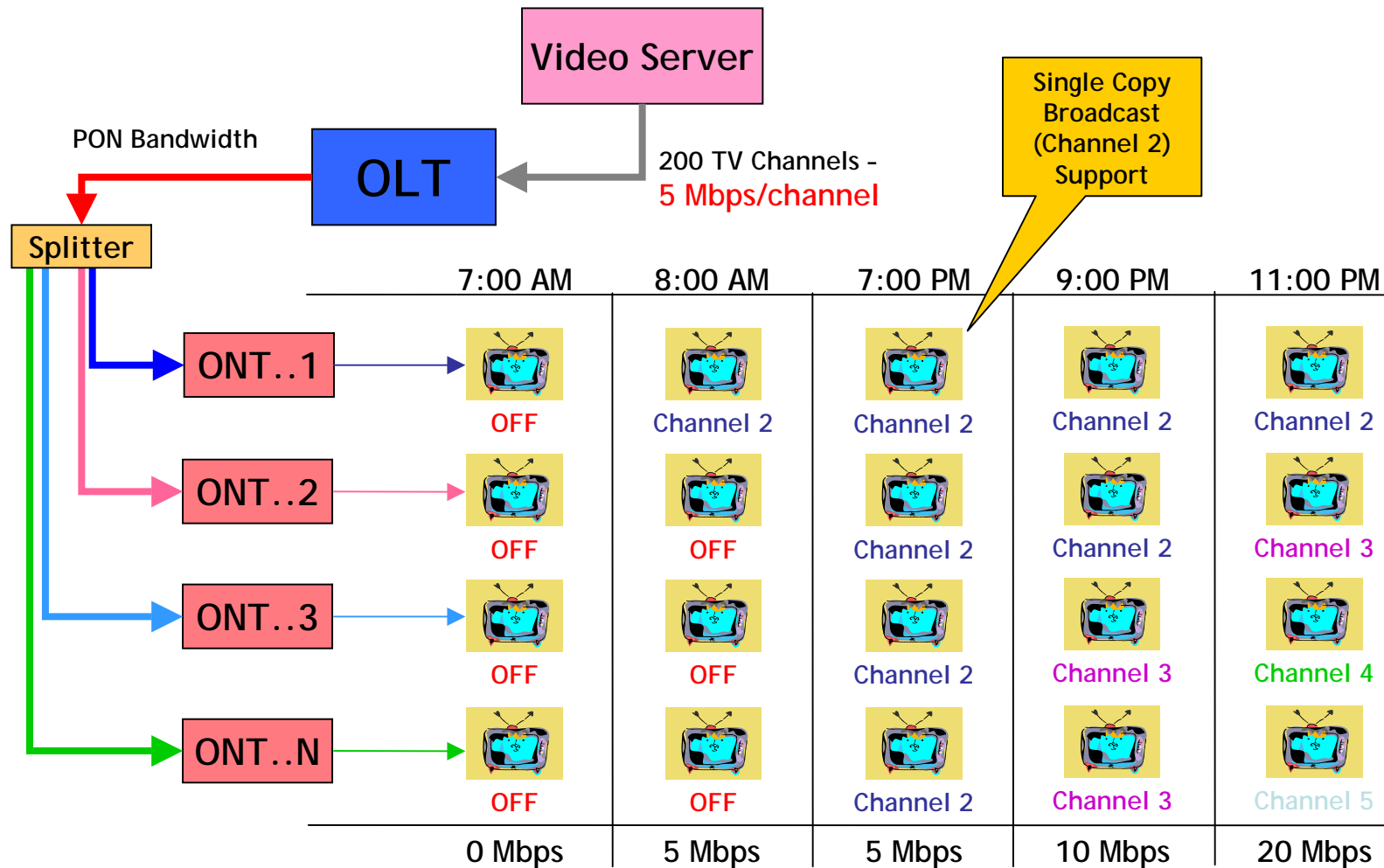


## Optimizations for IP Video

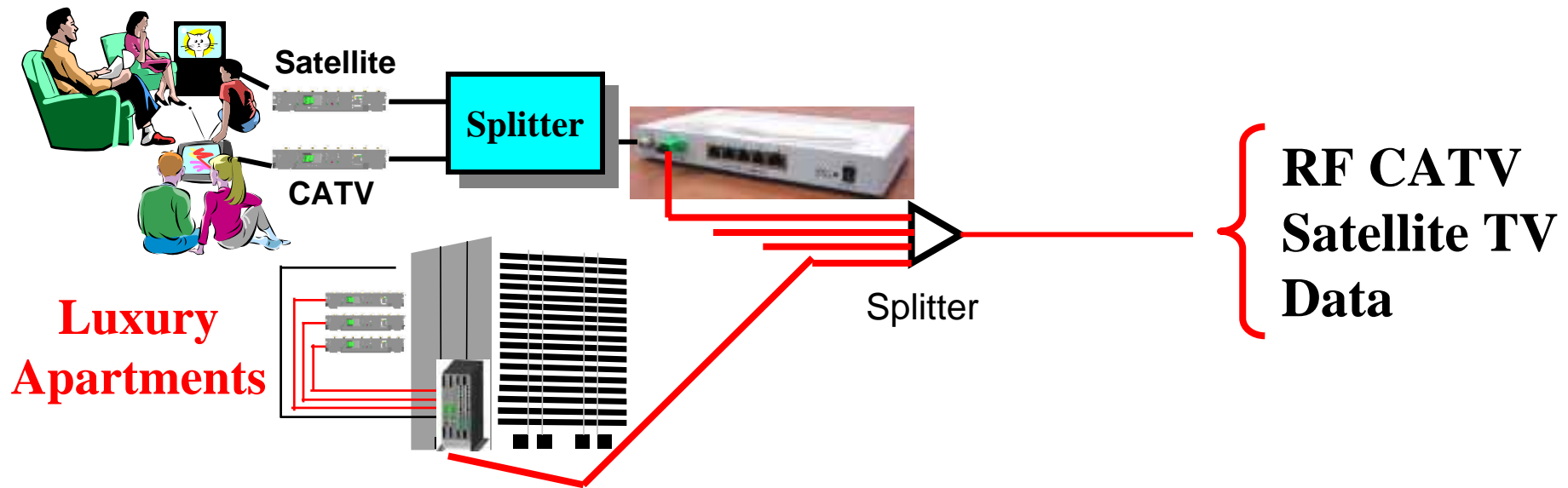
- ❑ Optimized Multicast using Internet Group Multicast Protocol (IGMP)
- ❑ Guaranteed Quality of Service
  - Priorities
  - Scheduling
  - Rate Limiting
  - Dynamic Bandwidth Allocation:  
Guaranteed+Fair Share
- ❑ Virtual LANs
- ❑ Applications: Video on Demand, Remote Education, Video Conferencing, High-end Medical Imaging



# Broadcast TV Bandwidth Optimization over PON



## Triple-Band Broadcasts: Satellite + CATV



- ❑ Normally, apartment dwellers are not able to install satellite dish, satellite may be out-of-sight
- ❑ One satellite dish on the top of a high-rise can feed an entire campus
- ❑ Each luxury apartment has hundreds of CATV and Satellite channels, and Video-on-demand (IP Video)
- ❑ High-speed data + Voice

## Key Features

### ❑ Revenue Enhancing Features:

- Multi-Service Support: Internet, Video, Voice, TDM  
⇒ IEEE 802.1p support, QoS, High-speed switching
- Video: Analog, Digital and IP Video services
- Multiple ISP and VoD service provider support
- Multiple data services with throughput, delay, Jitter
- SLA monitoring
- End-user Authentication: Prevent unauthorized usage

### ❑ CapEx Reduction Features:

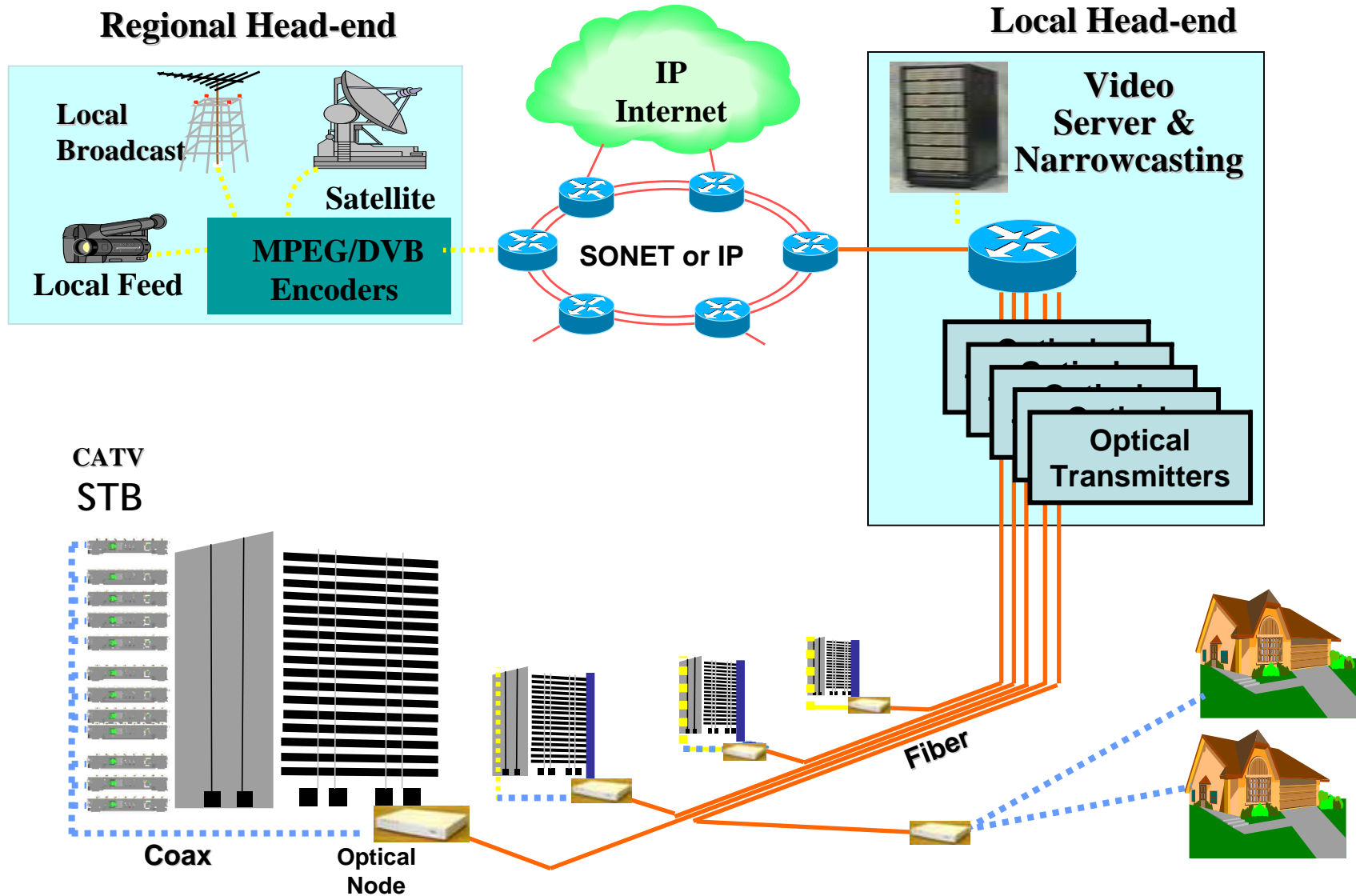
- Support any mix of network topologies: P2P, Bus, Tree, ...
- Optimized multicast traffic throughput (Broadcast Video)



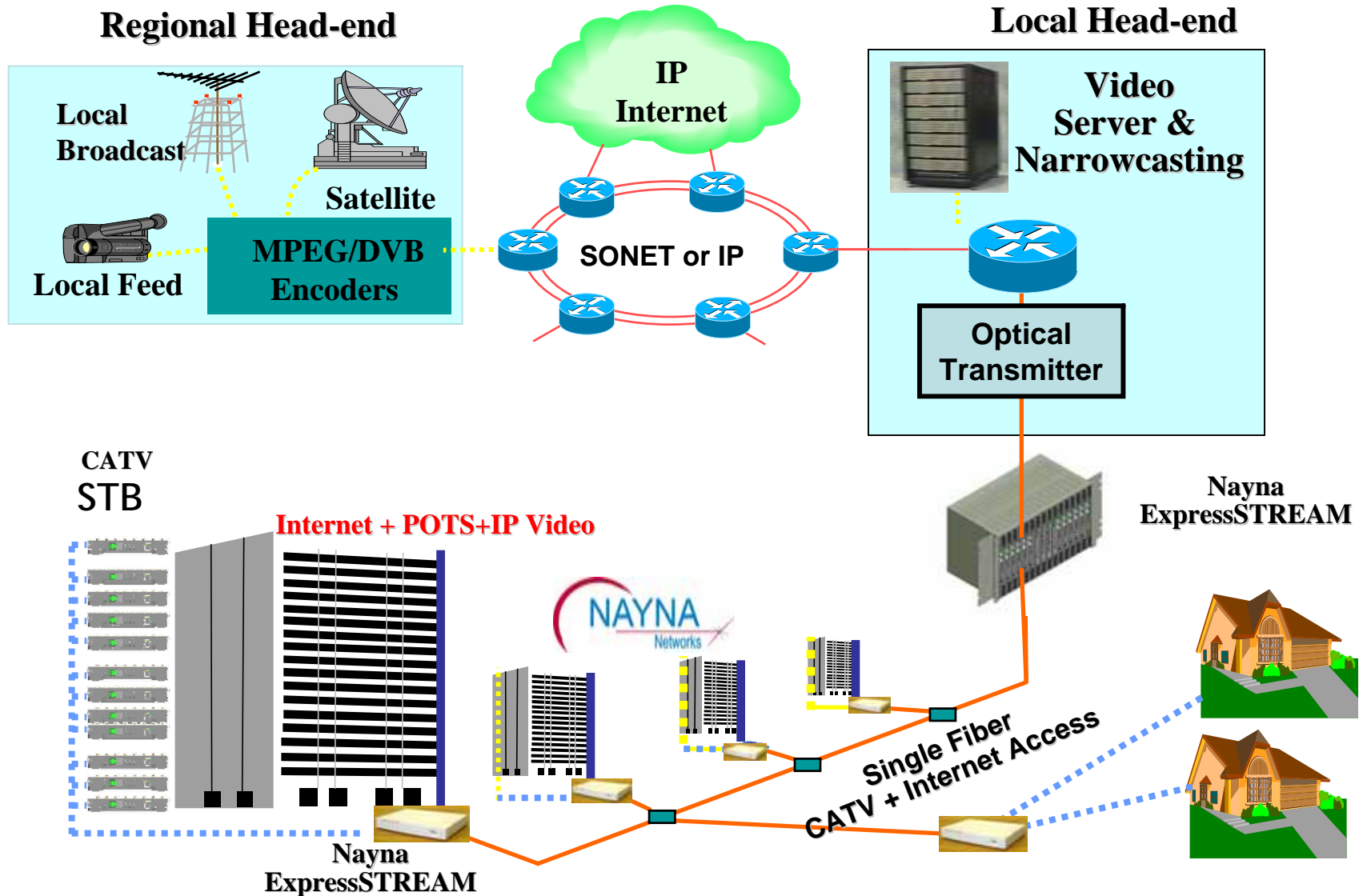
## Key Features (Cont)

- ❑ OpEx Reduction Features:
  - Plug and Play CPE
  - Automatic CPE Configuration from Central office
  - Integration with Carrier OSS via SNMP
- ❑ Customer Satisfaction Improvement Features:
  - Customer privacy and security via VLANs
  - Supports customers' VLANs
  - Redundancy support for high-availability

# Traditional CATV: Hybrid-Fiber Coax (HFC)

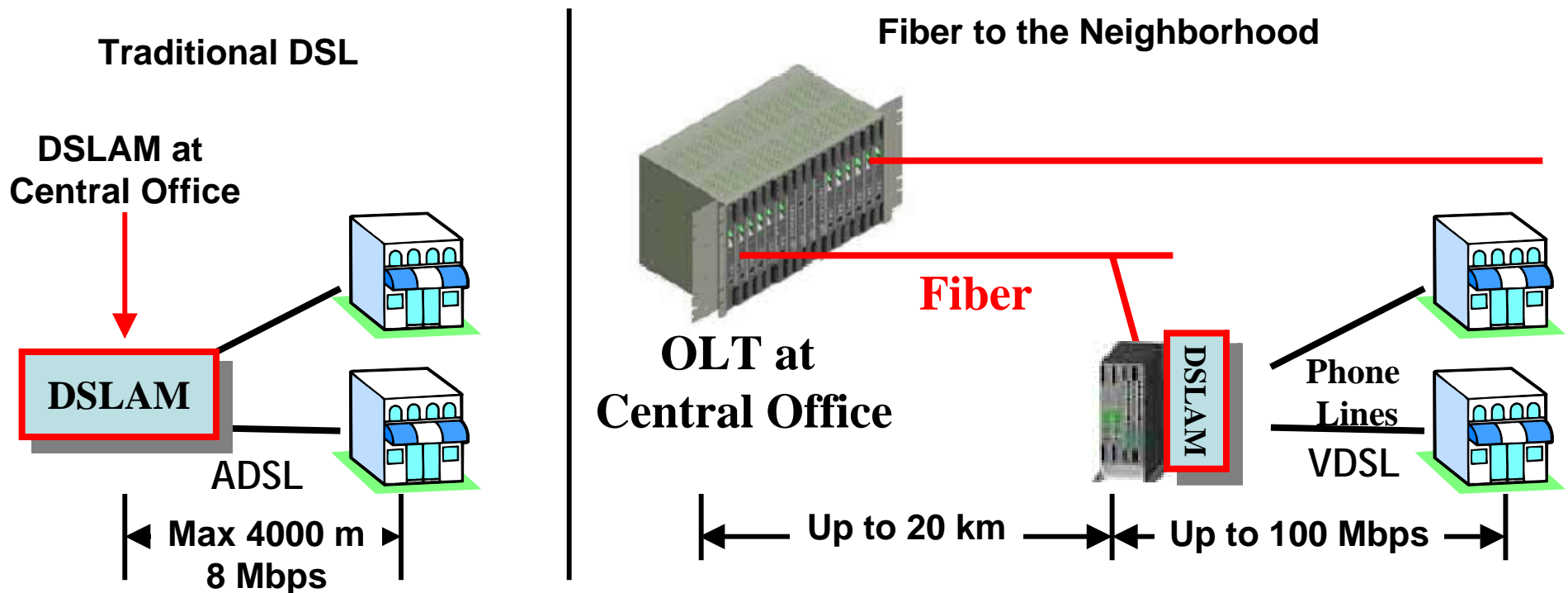


# CATV with EPON: Triple Play on a Single Fiber



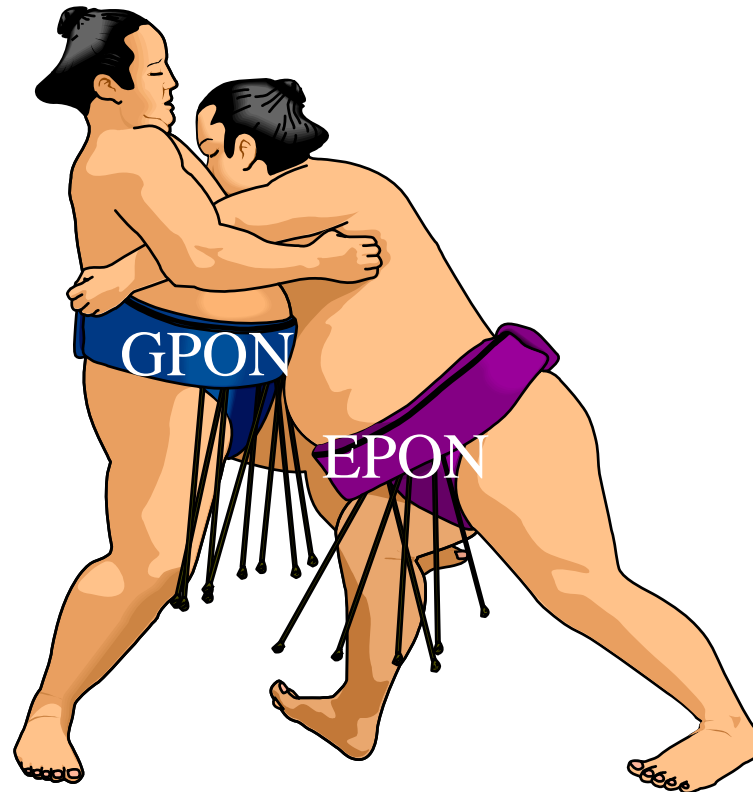
## Carrier Application: EFM + xDSL

- ❑ Fiber to the curb or basement
- ❑ 2-100 Mbps service over copper





## EPON vs GPON



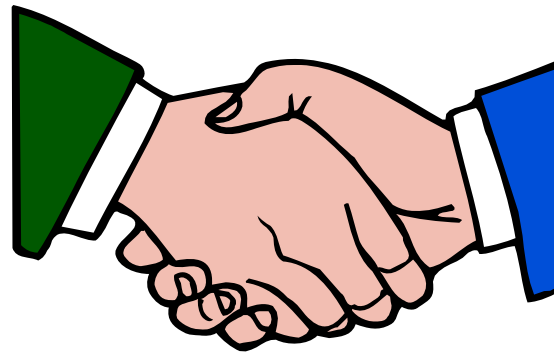
- ❑ Low-cost optics and high volume  $\Rightarrow$  EPON is much cheaper.
- ❑ Compatible with enterprise networks. Easier to maintain.  
EPON being planned by US Community networks and by carriers in Japan, Korea, China

## Summary



1. 2005 will be the year of EFM.
2. EFM reduces OpEx and CapEx for carriers and increase carrier revenue opportunities with value-added services
3. Multi-service support in next-generation EFM products is a key differentiator.
4. Nayna EFM products offer quad-play: Data, voice, video, and TDM
5. Nayna ExpressSTREAM provides a complete solution for multi-service broadband access

# Thank You!



Nayna Networks, Inc.  
180 Rose Orchard Way  
San Jose, CA 95134  
Tel: +1 (408) 956-8000  
Fax: +1 (408) 956-8730

[www.nayna.com](http://www.nayna.com)

Nayna Networks KK  
2-19-2 Nishi-Gotanda  
Sinagawa-Ku  
Tokyo 141-0031 Japan  
Tel: +81 3 5759 2618  
Fax: +81 3 5759 2615

# Backup Slides



## Types of PONs

- ❑ **APON**: Initial name for ATM based PON spec.  
Designed by Full Service Access Network (FSAN) group
- ❑ **BPON**: Broadband PON standard specified in ITU G.983.1 thru G.893.7 = APON renamed
  - 155 or 622 Mbps downstream, 155 upstream
- ❑ **GPON**: Gigabit PON standard specified in ITU G.984.1 and G.984.2
  - 1244 and 2488 Mbps Down, 155/622/1244/2488 up
- ❑ **EPON**: Ethernet based PON designed by IEEE 802.3ah.
  - 1000 Mbps down and 1000 Mbps up.

## GPON vs EPON

GPON	EPON
ATM-based	Ethernet Based
10% Cell Tax $\Rightarrow$ 1 Gbps payload	No segmentation overhead
Legacy	New trend
US RBOCs	US Munis + Asia + Europe
US 10 <sup>th</sup> in Broadband penetration	Asia and Europe are broadband leaders
RBOCs already selected suppliers	Large potential market
ATM Switches Expensive	Ethernet Switches Cheap
Components relatively expensive.	Other components also high volume.
ITU design $\Rightarrow$ Expensive Optics	IEEE Design $\Rightarrow$ Cheap Optics
Re-conversion when connecting to IP backbone	Native mode IP connection
Can connect to SONET backbone	Can connect to SONET backbone
ATM non-existent in Enterprise Networks	Compatible with Enterprise Networks
T1/T3 supported	T1/T3 supported
ATM DSLAM easier to connect	Most DSLAM also have Ethernet or T1/T3 uplinks
ATM personnel difficult to find	Easier to maintain

## PONs vs Point-to-Point:

- ❑ **Reduced OpEx:** Passive network
  - High reliability  $\Rightarrow$  Reduced truck rolls
  - Reduced power expenses
  - Shorter installation times
- ❑ **Reduced CapEx:**
  - 16 -128 customers per fiber. Solves conduit congestion.
  - 1 Fiber +N transceivers vs N Fibers + 2N transceivers
- ❑ **Increased Revenue Opportunities:**  
Multi-service: RF Video, Data, E1/T1, Voice, IP Video
- ❑ **Scalable:**
  - CO Equipment Shared  $\Rightarrow$  New customers can be added easily
  - Bandwidth is Shared  $\Rightarrow$  Customer bandwidth can be changed