# FTTH Technology and Standards Roadmap



Calix

ACCESS INNOVATION

# Calix Background and Perspective

## *David Russell, Solutions Marketing Director,* Calix

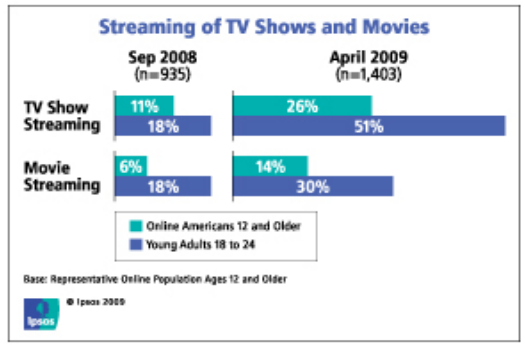
- Responsible for the marketing of Calix' fiber access solutions.
- 2010 Chairman of the FTTH Council Board of Directors

## Who is Calix?

- The largest provider of broadband to rural areas
  - ***40%*** *of US service providers rely on Calix access platforms for DSL and fiber access*
  - ***60%*** *of all U.S. FTTH service providers use Calix*

## Internet bandwidth demands fiber

- Stage 3 of the internet: Textual → graphical → video
  - *Video =Broadcast transitioning to internet based*
- Today=5 Mbps → 5 yrs=100 Mbps → 10 yrs=1 Gbps




## Future proofed infrastructure, no reinvestment required

- ONT functionality now can accommodate 1 Gbps (up/down) in to the home
- Outside plant now cheaper than HFC, requires no reinvestment

# Current FTTH Standards

FSAN Full Service Access Network

ITU

## 2.5 GPON ITU standard G.984

- 2.5 Gbps downstream (1490nm)
- 1.2 Gbps upstream (1310nm)
- Cable TV support (1550 nm)
- Replaced BPON

IEEE

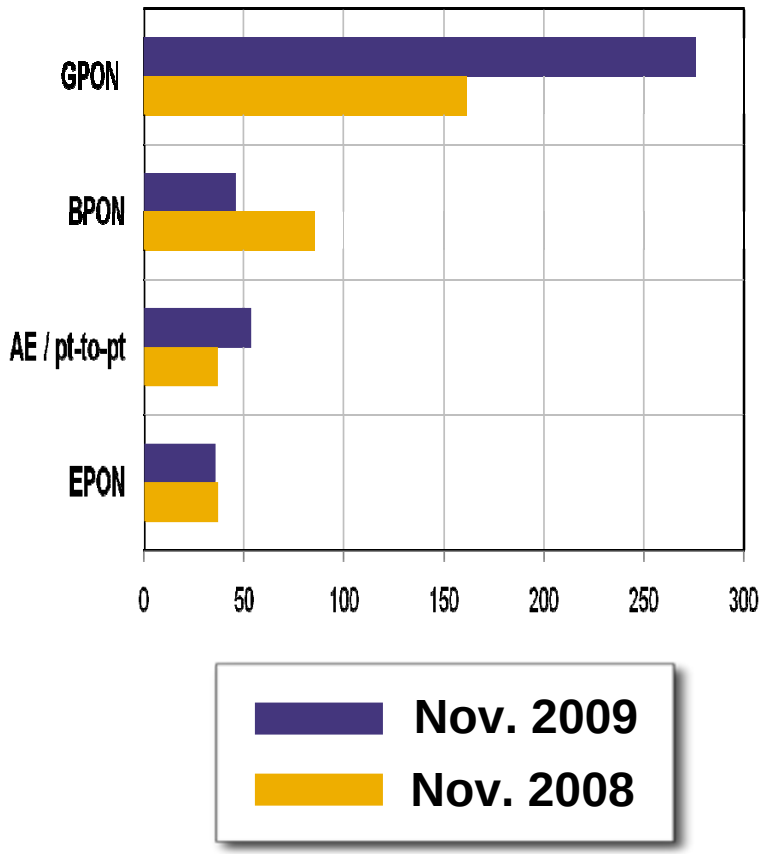
## 1 GE P2P Ethernet IEEE 802.3ah

- 1 Gbps down/up (1490/1310 nm)

## 1 GE EPON IEEE 802.ah

- 1 Gbps downstream (1490nm)
- 1 Gbps upstream (1310nm)
- Cable TV support (1550 nm)

## U.S. Service Providers Deploying Technology



# Next Generation FTTH Standards

## 10G GPON (NGPON1)

- 987.1/987.2 completed in September 2009
  - *10 Gbps downstream (1577 nm)*
  - *2.5 and 10 Gbps upstream (1270 nm)*
  - *Coexists with on the same fiber with 2.5 GPON*
- Full standard by June 2010, deployments in 2012

## Beyond 10G GPON (NGPON2)

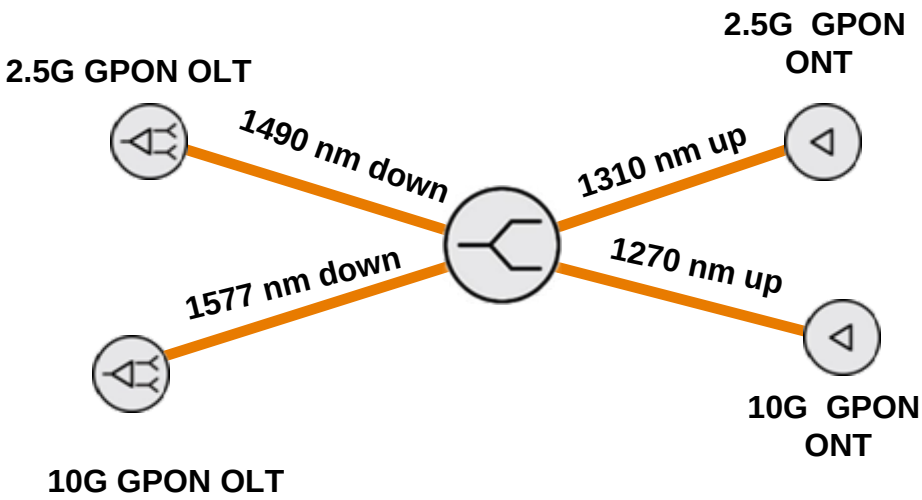
- Thinking/talking /technology presentation stage
- WDM PON is a candidate technology
- Does not require ODN compatibility with today's 2.5 GPON

## 10G EPON (XEPON) 802.3av

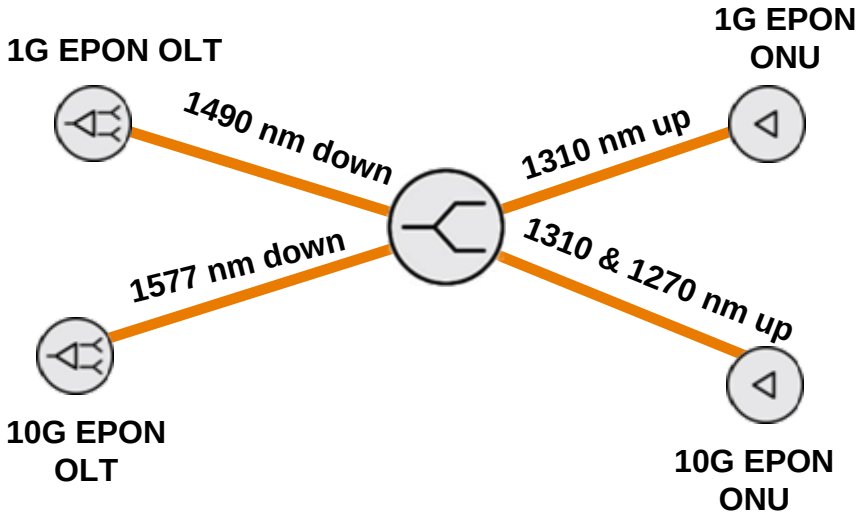
- Ratified in September 2009
  - *10 Gbps downstream (1577 nm)*
  - *1 Gbps (1310 nm) and 10 Gbps upstream (1270 nm)*
- Deployments likely in 2010 and 2011

# Comparing 10G Standards

## 10G GPON




## 10G EPON




| | 10G GPON | 10G EPON |
|---|---|---|
| Bandwidth | 10/2.5, 10/10 shared | 10/1, 10/10 shared |
| Positives | Compatible with existing GPON | First completed |
| Key challenges | 10 Gbps upstream not viable for single family units | 10 Gbps upstream not viable for single family homes; 1 Gbps upstream too little bandwidth |

# NG-PON2 Technology

## Key attributes of technologies coming after 10G PON

- 40 Gbps speeds and higher
- Up to 60 km of reach (GPON today can do 40 km, with limited splits)
- Goal of a wavelength per home

## Candidate technologies

- 40 GB/s TDMA and stacked 10 Gbps PONs- Too brunt force
- OCDMA PON
- WDM PONs- Commercially available, cost improvements needed
- OFDM PON
- Coherent PON- Brilliant proposal, capturing imaginations
  - *Proposed by Nokia Siemens at FSAN meeting 11/2009*

## Key challenges to achieving commercial viability by 2015

- No standard and many competing technologies and interests
- Key challenges in cost and performance of components