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# Fiber Deep Networks and The Lessons Learned from the Field

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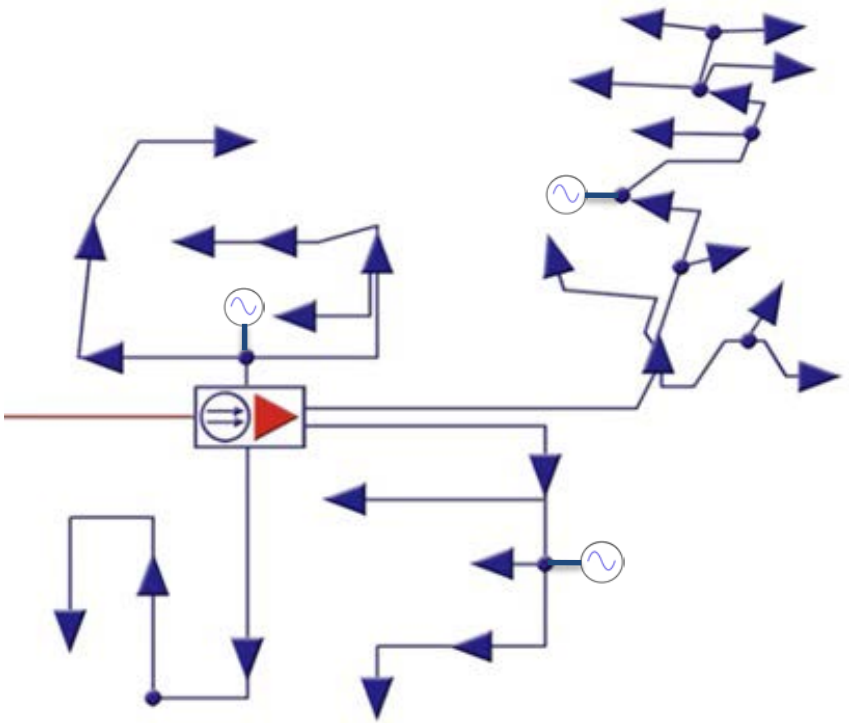
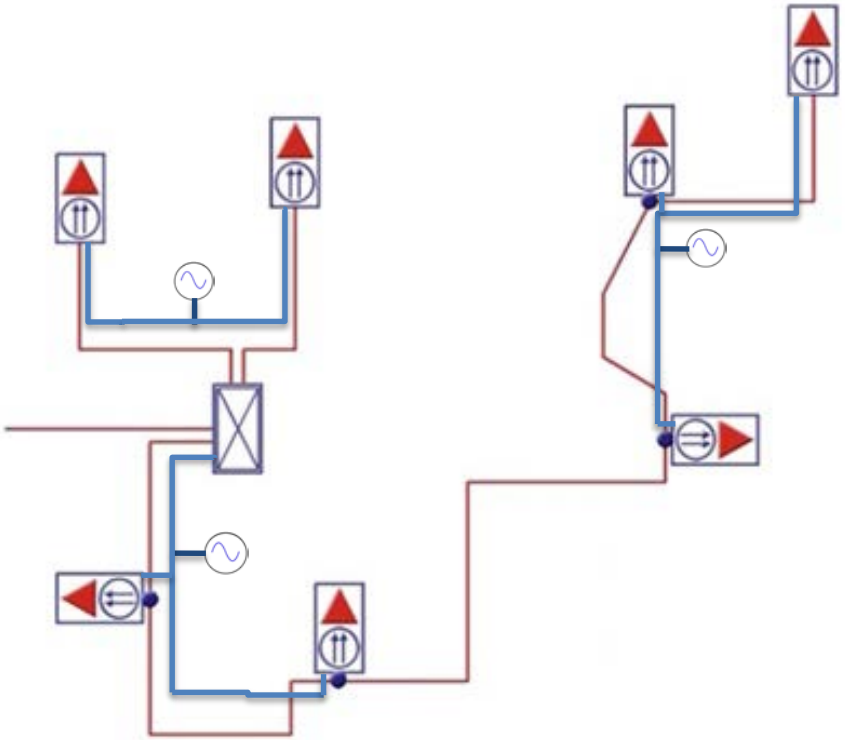
# What is it?

- A calculated step to eliminate amplifiers from the network and focus on smaller serving groups
- Benefits
  - Increase bandwidth
  - Reduction of constant upgrades
  - Plant readiness for future technologies
  - Drives fiber closer to the customer



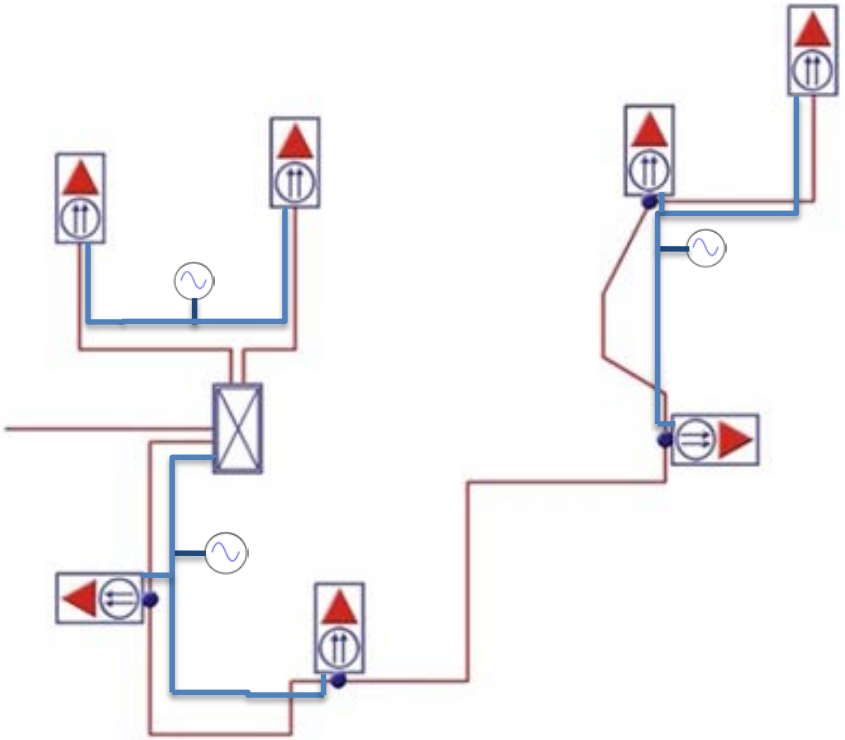
## Traditional HFC Serving Area

- Node + 2 Amplifiers (N=2)
  → Node + 10 Amplifiers (N+10)
- Typical: Node + 4 Amplifiers (N+4)
- Homes Passed ranges from 500 – 2500
- Power Supplies are strategically located to power both the node and amplifiers



## Fiber Deep Serving Area

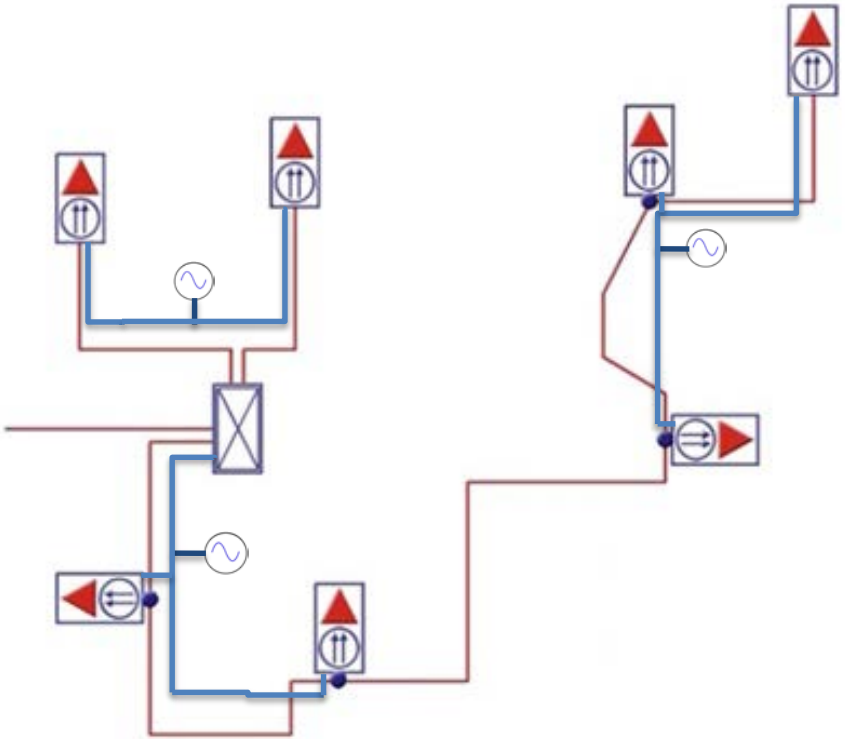
- Node + 0 Amplifiers (N+0) / (N+1)
- Amplifiers are basically removed from network
- Nodes are pushed deeper into network
- Homes Passed per node: 50 – 130
- Powering Options:
  - Centralized
    No change to powering locations
  - Distributed
    Powering pushes out w/ nodes



# Fiber Deep Serving Area

## Distributed Powering

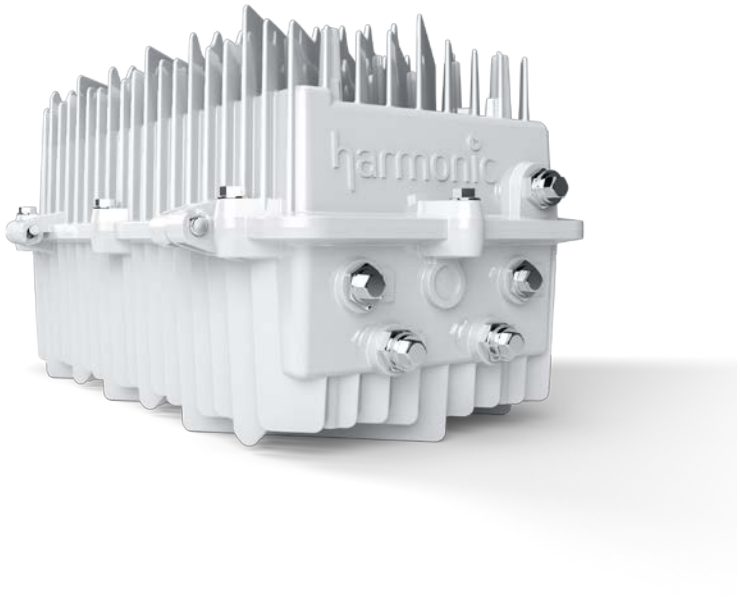
- Co-locating Power Supplies close to Nodes
- Advantages:
  - Higher Power Utilization
  - Future Upgrades
- Disadvantages
  - Fiber Deep Timeline



# Fiber Deep Serving Area

## Centralized Powering

- Power Supplies do not move
- Advantages:
  - No need to permit
  - No additional attachment fees
  - No additional meters
- Disadvantages
  - Power inefficiency due to long runs
  - Potentially underutilized power supplies




# Remote PHY

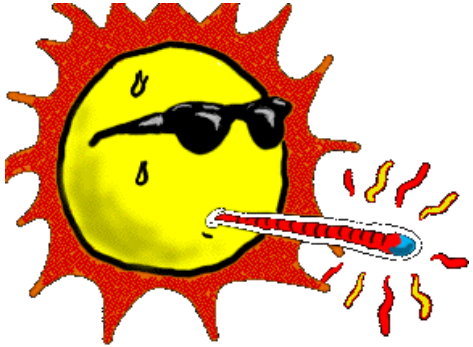
## Basic Concept

- Split the CMTS – Moves the PHY layer into the OSP
- Benefits –
  - Reduces Equipment in the Headend
  - Compatibility with existing CMTS
  - Relatively Simple
- Power Consumption
  - Negligible change
  - From Headend to OSP

# Deployment of Remote PHY Nodes

Key Lesson Learned

- Thermal Impact of Remote PHY Node
  - Testing has shown temperatures greater than 170 F inside of the node
- Power Impact
  - Significant increase to OSP power
  - Understand the load impact and $R^2I$ losses



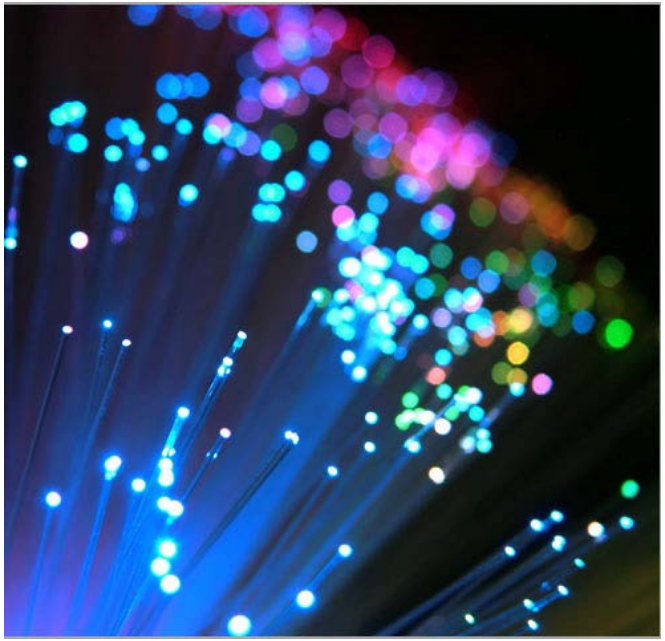
# Lessons From The Field

- Always consider future upgrades.
  - Nodes may still need to be split
  - Design for 140W Nodes
  - Re-run power calculation for 180W Nodes
- Overall Power Consumption
  - Typically no major change
  - Plan for the future
- Build for 180W Nodes
  Do not re-power
  - Implement additional cabling
  - Implement new routings
  - Review topology changes
  - Do not add additional power
- Minimum 50 VAC at the FD Nodes to maintain a healthy plant
- Utilize Power Inserters to bridge distribution legs

## Network Design Considerations – To Fiber or Not to Fiber??

Is it time to go all the way?

- Has the cost of fiber deployments decreased enough?
- Brownfield versus Greenfield
- Is the workforce ready?



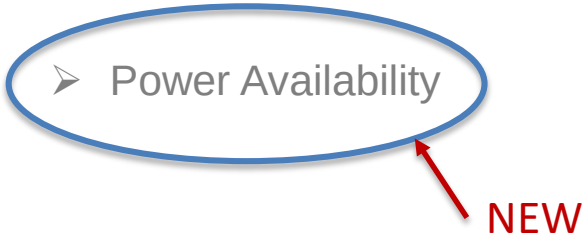
# Fiber to the Home

## Benefits

- Elimination of actives in the OSP
- Future Upgrade Capabilities
- Virtually unlimited bandwidth
  (As technologies progress)

## Detractors

- Cost of Construction
- Labor Force Training
- Power Availability



# Architecture Cost Comparison

## Fiber to the Home

Centralized FDH / MST Aerial Architecture

Estimated cost per home passed: [1]$163

Estimated cost per home connected: [1]$242

5000 Homes @ 40% Connection: $1,299,000

## Fiber Deep (N+3) → (N+0)

Maintain Powering Locations / Aerial Architecture

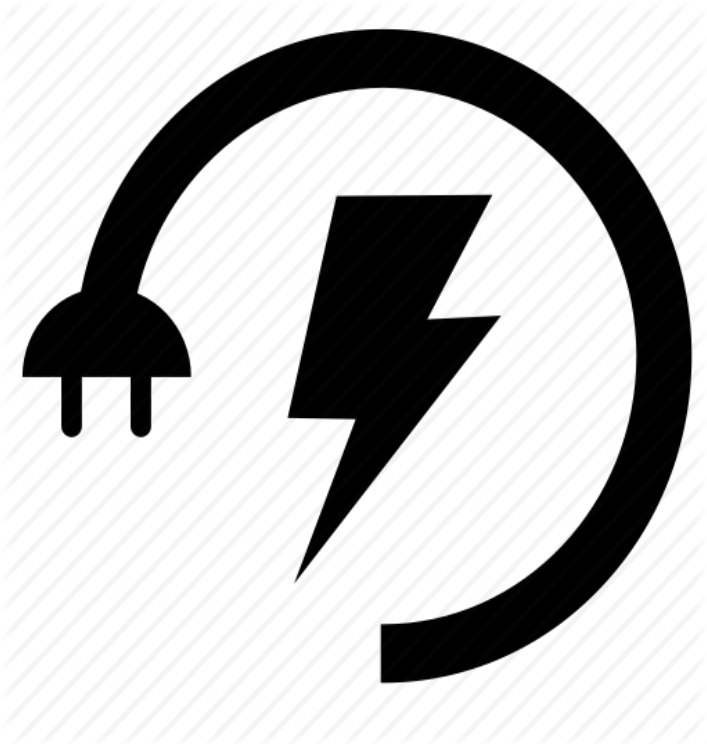
Estimated cost per home passed: $130.5

5000 Homes: $652,500

### Key Take Away:

Significantly lower cost to implement a Fiber Deep architecture!

Note 1: Excludes OLT & ONT Cost



Power Availability – Key to Differentiation

# Power Availability

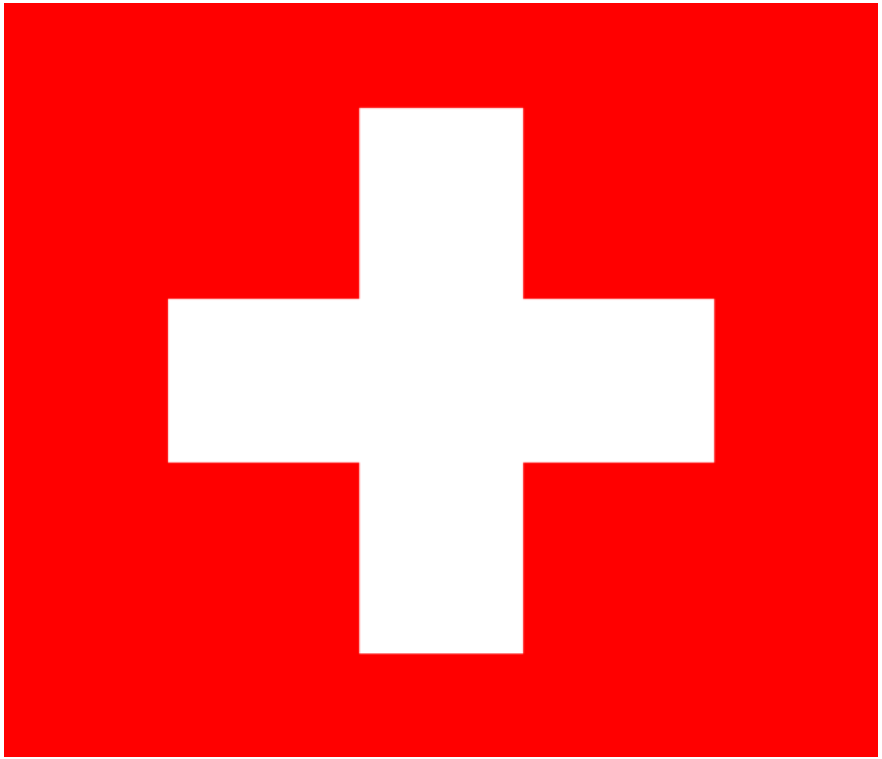
## Key Differentiator & Future Revenue

- HFC Network is the most reliable power network in the US
- Typical 2 Hours of Backup (and growing)
- Strong interest in Business to Business Services

## Business to Business Services

- **S**mall Cell
- **W**iFi
- **I**oT
- **S**ecurity &

  **S**urveillance



# Conclusions

- Fiber Deep is the next phase of the network evolution
  - Maintain power supply locations
  - Design for Remote PHY Nodes
  - Consider future Business to Business Opportunities
- Remote PHY is coming quickly
  - Confirm the enclosure is designed for the required heat dissipation
  - Maintain appropriate amounts of power headroom

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# THANK YOU!

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