

CABLE-TEC EXPO® 2017

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# THE NEXT BIG...

DEAL  
CONNECTION  
INNOVATION  
TECHNOLOGY  
LEADER  
NETWORK



DENVER, CO  
OCTOBER 17-20



**Making more with Less: A Case Study in  
Converging Wireline and Wireless Network  
Infrastructures using Distributed Access  
Architectures**

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ARRIS

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## Our Paper

- Greenfield opportunity in underserved cities in Caribbean and Latin America region
- Where the BaU HFC new infrastructure is not a cost effective solution
- DAA solutions enable the convergence of Fixed and Mobile infrastructure helping the solution to be cost effective
- DAA also enabled lowering OPEX due to the convergence
- We develop a model to analyze the options to deploy DAA in a environment with lower speed tiers and high density, showing in the analysis, cost, power and capacity of each option.
- And pointing out some important considerations to the solution be future proof.

## Environment

- High density area cable coverage
- Robbery of units in the field is a concern

## Economical

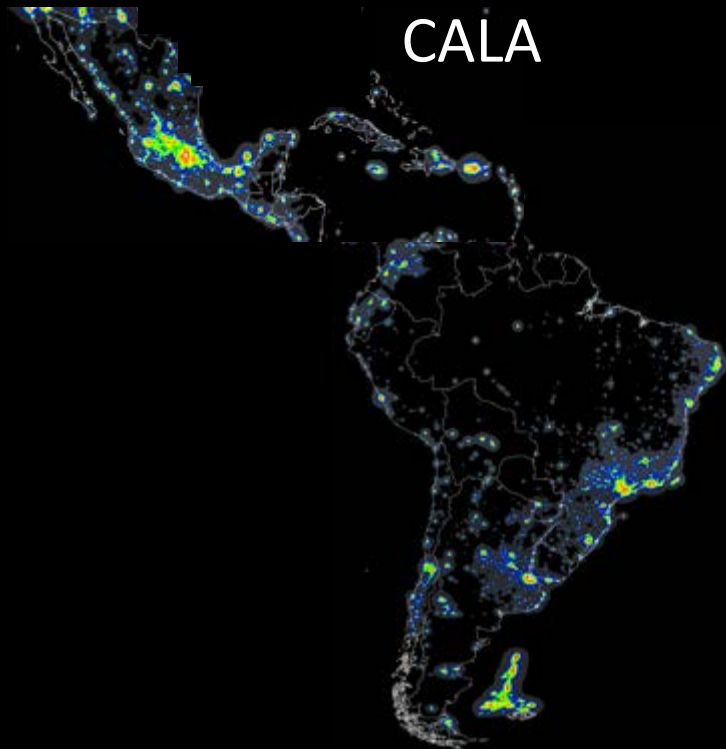
- CAPEX restrictions
- Lower ARPU
- Some consolidation groups with Fixed and Mobile infra

## Service

- DS Bandwidth Grow CAGR is approximately 40 to 50% YoY
- Max Billboard HSD service is 250Mbps

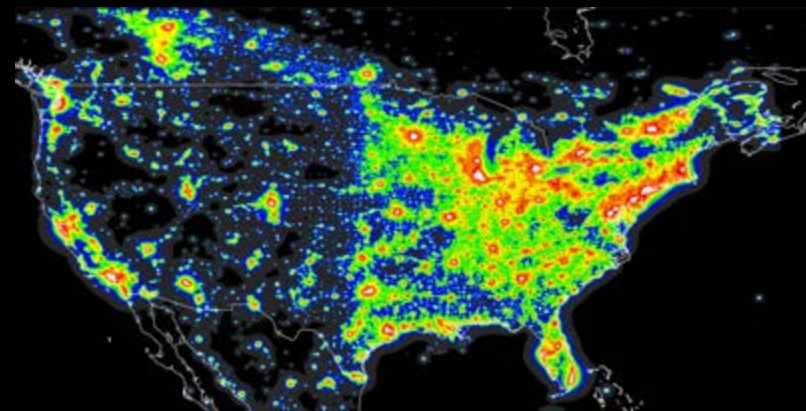
## High Density Cable Coverage

CALA

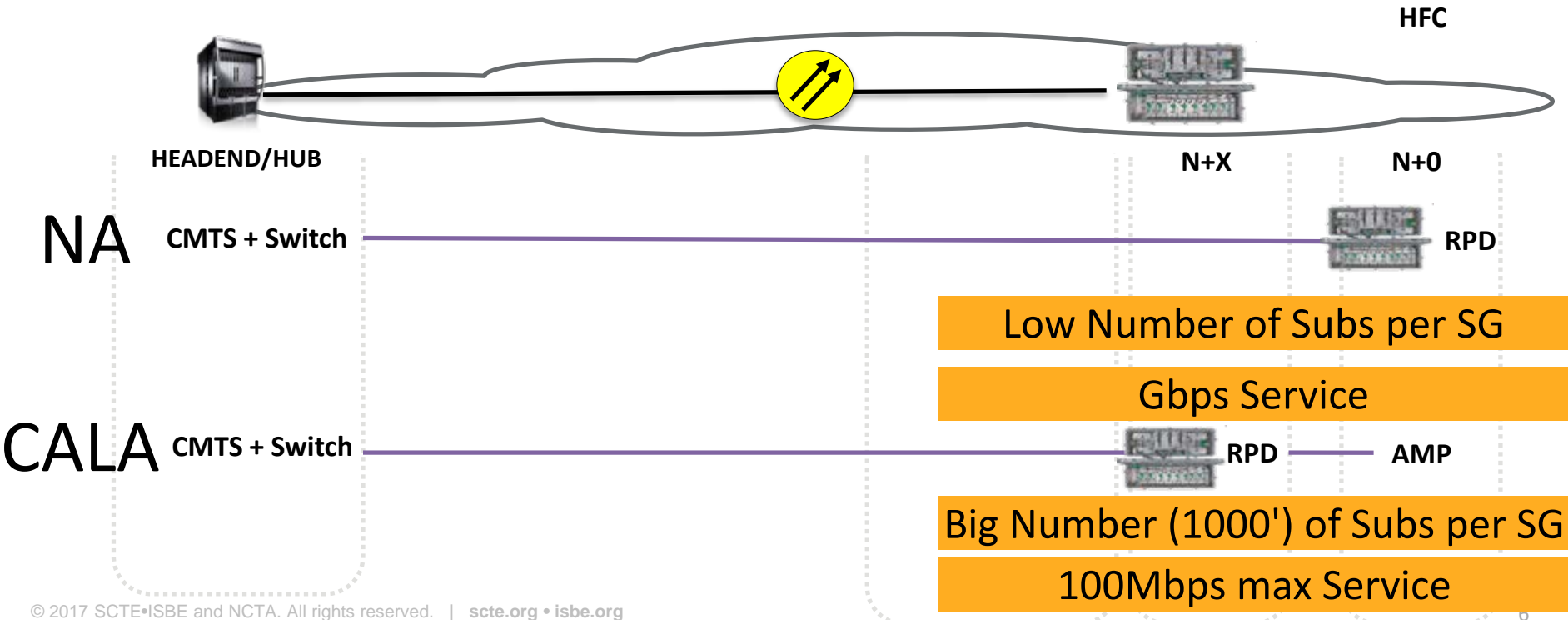


compared

NA



# Differences between CALA and NA



## Technological

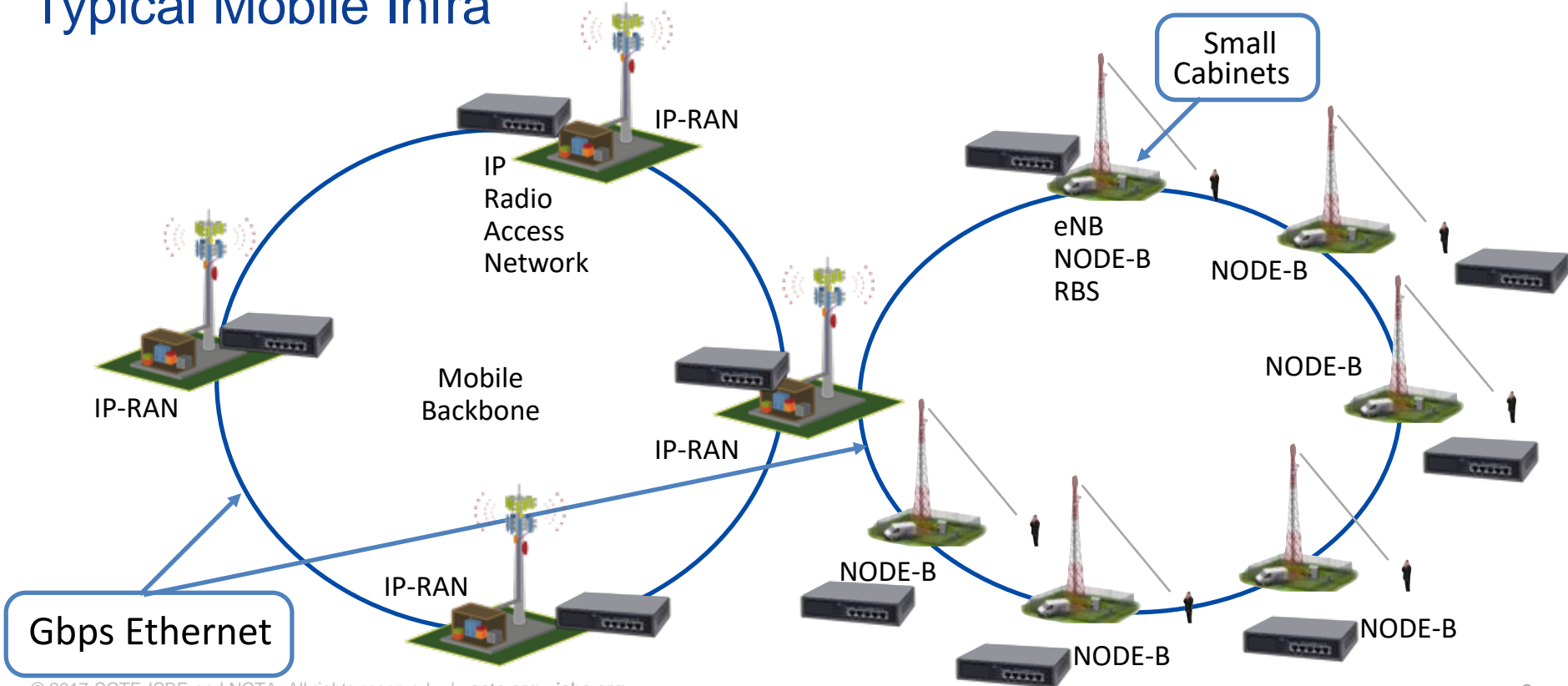
### Fixed Infra

- HFC BAU
- Raging from 250 to 2000 HPs per SG
- Typical <1000 HPs/SG.
- Following CableLabs specs.
- DOCSIS 3.0 becoming the standard.
- FTTH starting, using 2.5GPON.

### Mobile Infra

- Macro Cell architecture
- IPRAN and eNodeB deployments typically using Optical MetroEth Rings
- Consumption cap from 1G to 5GB/month
- Following 3GPP
- 3G and 4G Technologies

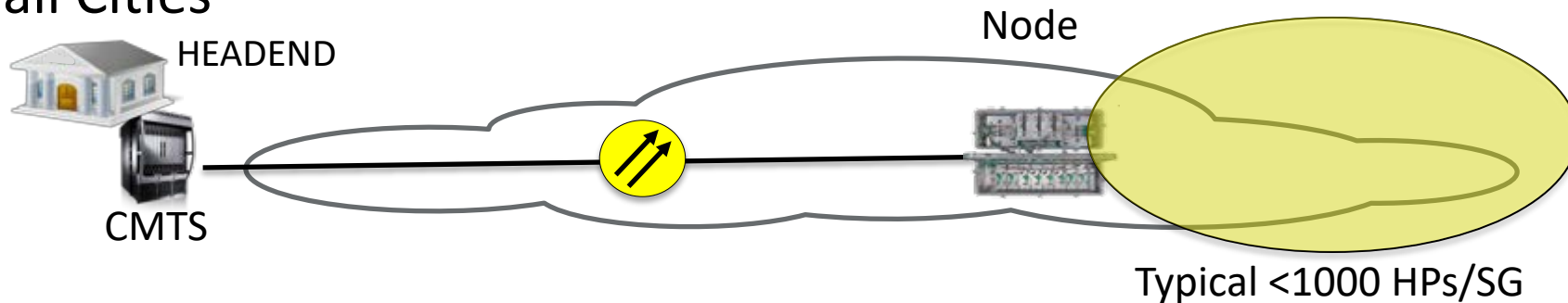
## Typical Mobile Infra



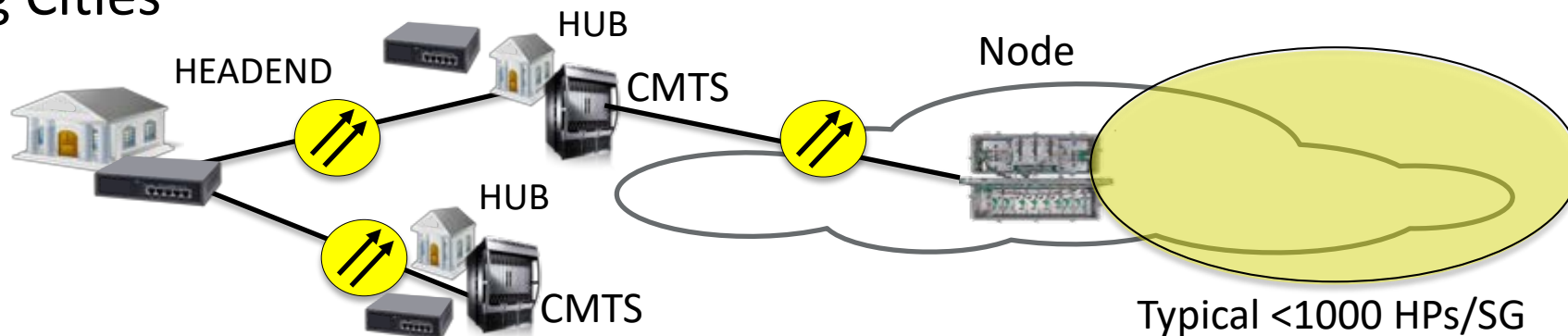


## Typical HFC Fixed Infra

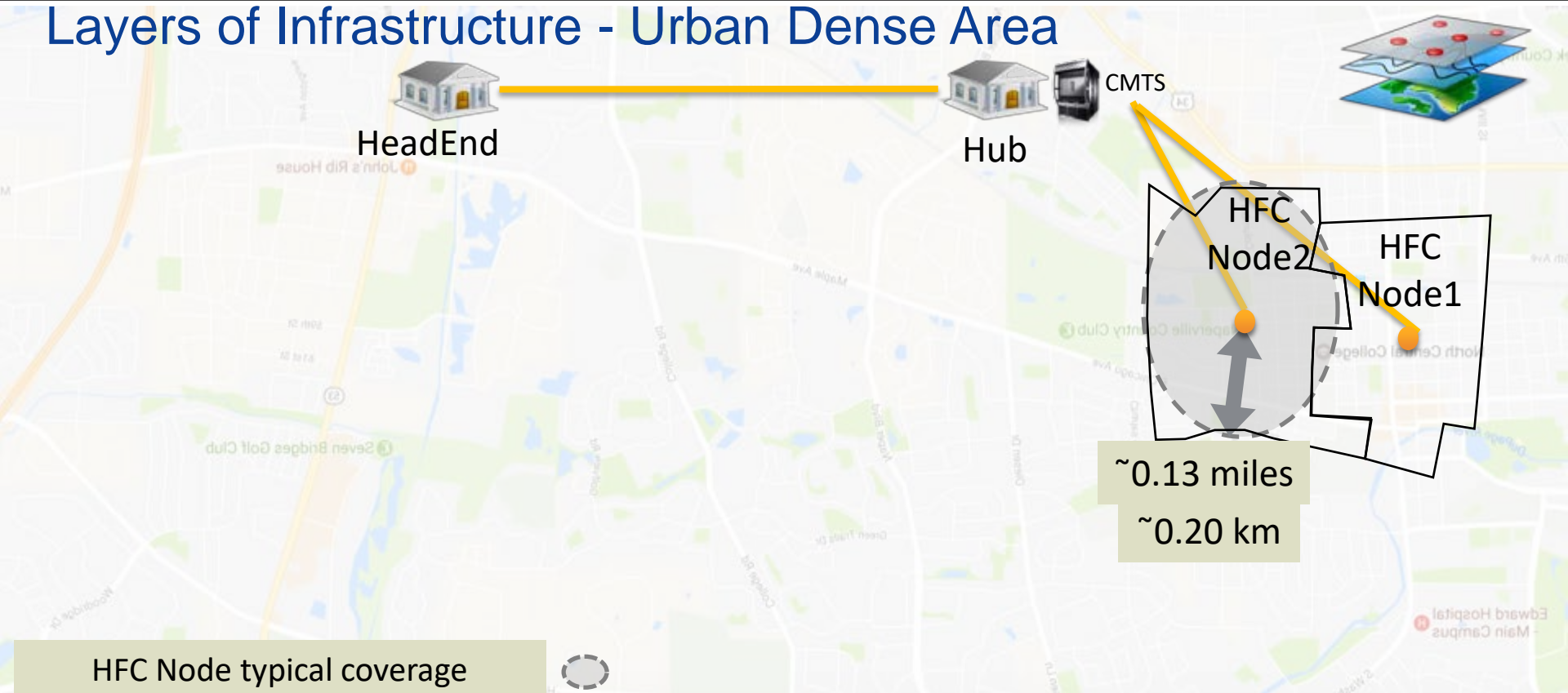
### Small Cities



### Big Cities



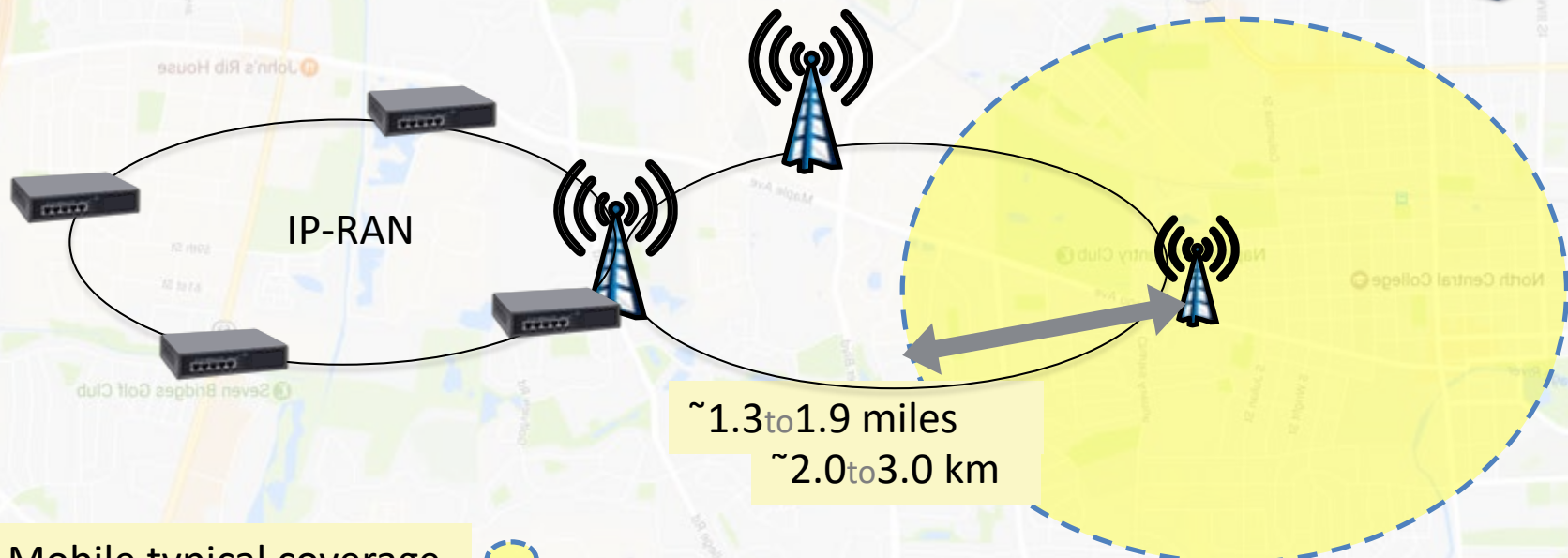
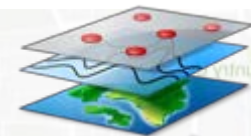
## Layers of Infrastructure - Urban Dense Area



HFC Node typical coverage



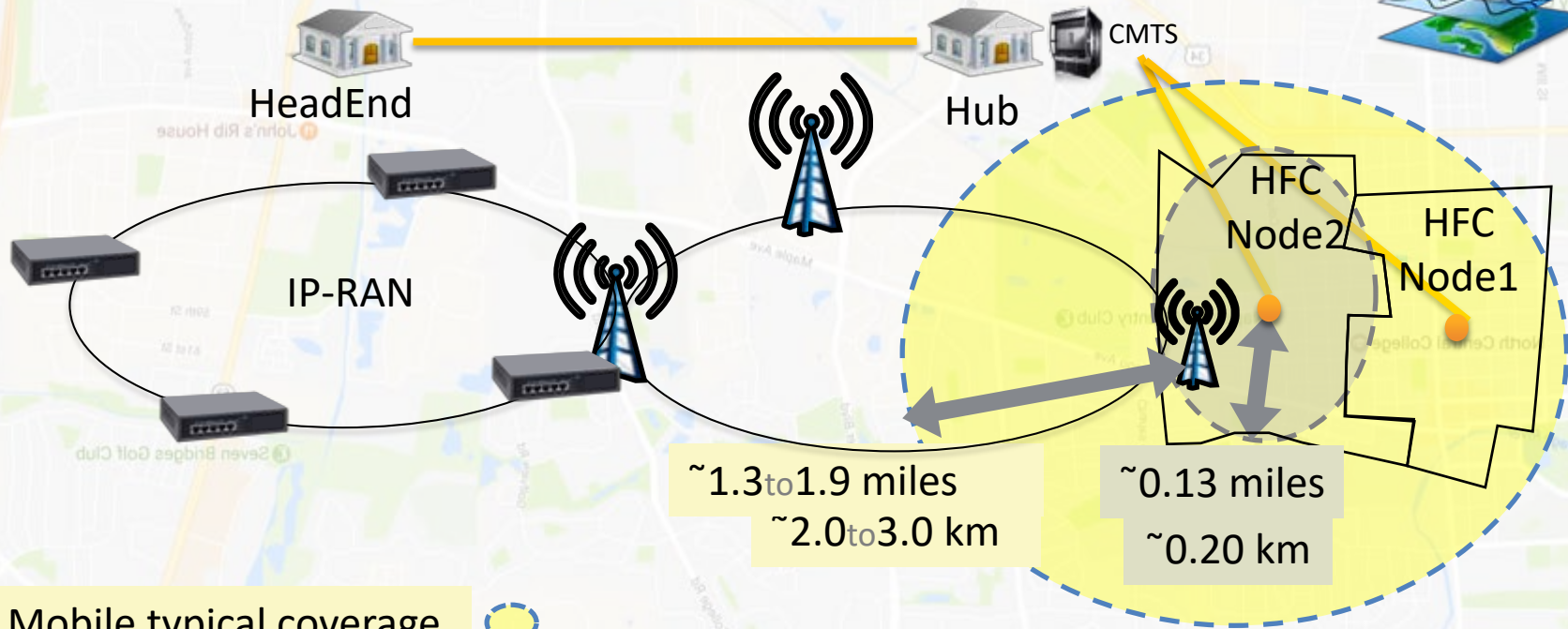
## Layers of Infrastructure - Urban Dense Area



NodeB Mobile typical coverage



## Layers of Infrastructure - Urban Dense Area



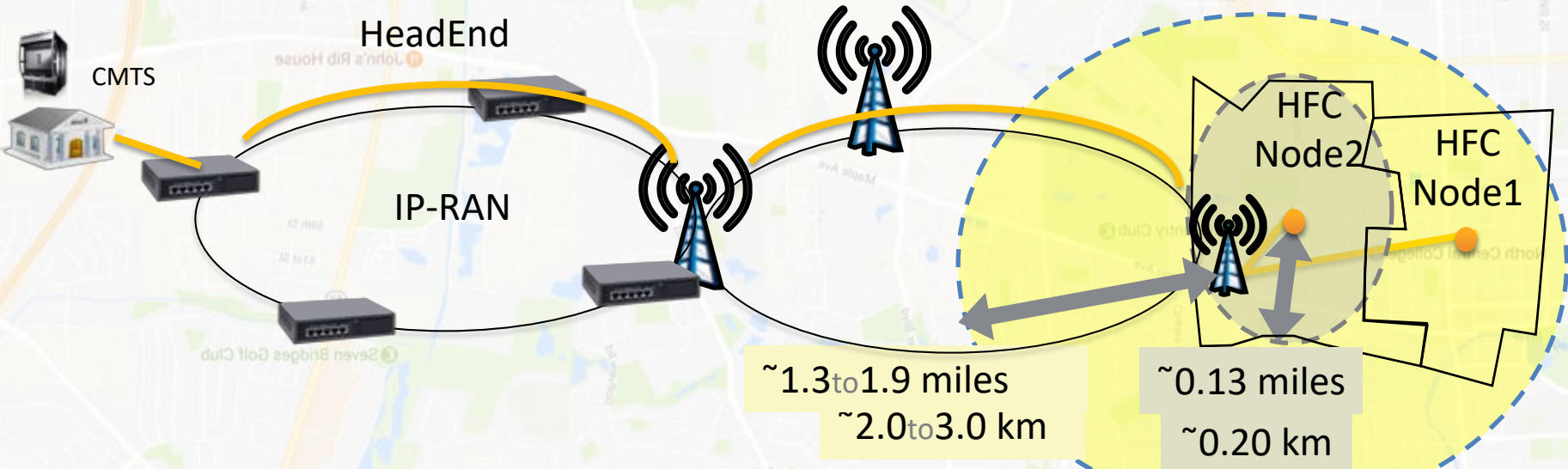
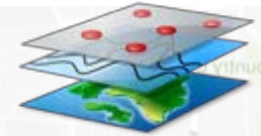
NodeB Mobile typical coverage



HFC Node typical coverage



## Layers of Infrastructure - Urban Dense Area



NodeB Mobile typical coverage

HFC Node typical coverage

# OPTIONS OF INTEGRATION



	JUNDIAI	IP-RAN	NODE-B	N+X	N+0
#1	CMTS + Switch	Use Existing IP infra with QoS	Switch	RPD	AMP
#2	CMTS + Switch	Use Existing IP infra with QoS	Switch		RPD
#3	CMTS + Switch	Use Existing IP infra with QoS	RPD + TX/RX	AM Node	AMP
#4	CMTS + Switch	Use Existing IP infra with QoS	RPD + TX/RX		AM Node

Installation RPD	Field	eNodeB Location
N+X	#1	#3
N+0	#2	#4



N+X  
vs  
N+0

Analysis  
Advantages

Field  
vs  
eNodeB

Analysis  
Advantages

## N+0

Installation RPD	Field	eNodeB Location
N+X	#1	#3
N+0	#2	#4

## N+X

### Pros

- Higher Capacity
- Wireless Small Cell demarcation conquered
- Open the door to FDX and Extended Spectrum DOCSIS in the Future

- Lower Cost
- Wireless Small Cell demarcation can be conquered in the future with strand mount HFC equipment.

### Cons

- Higher Cost

- Less Capacity



## eNB

Installation RPD	Field	eNodeB Location
N+X	#1	#3
N+0	#2	#4

## Field

### Pros

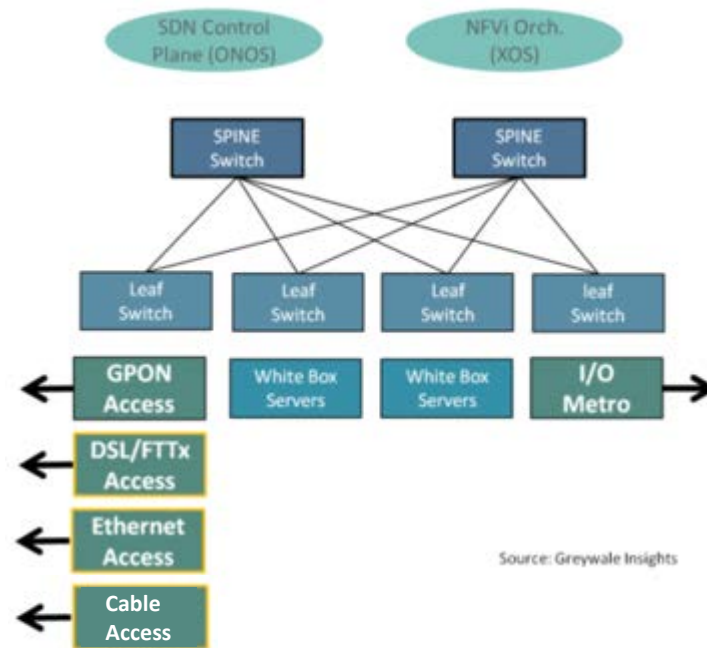
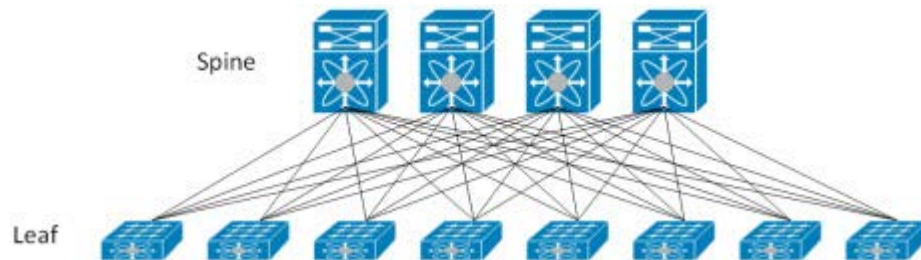
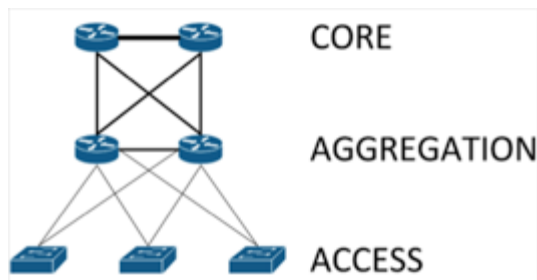
- Easier to upgrade
- Easier to operate and maintain
- More controlled environment for a new technology/solution

- Less infrastructure required in any physical location (such as HUBs, HE or eNB location)

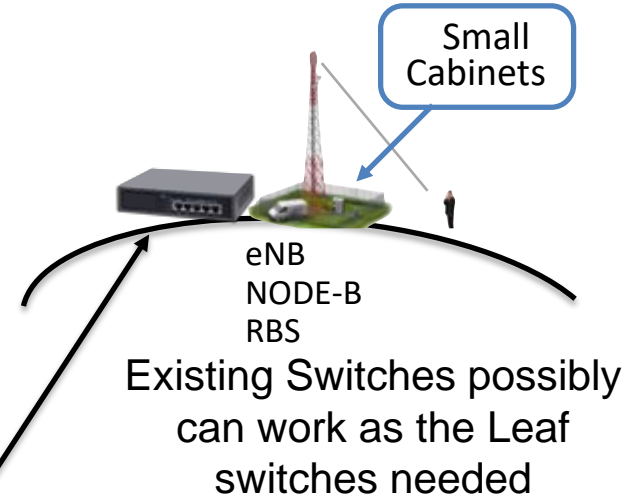
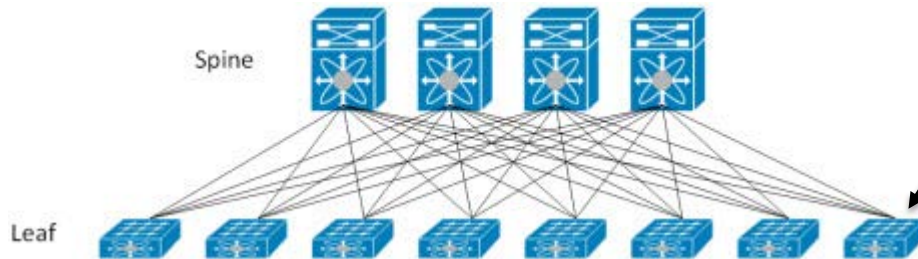
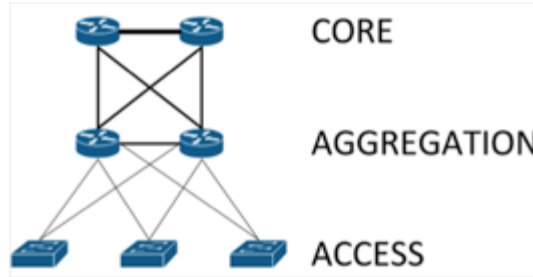
### Cons

- Require minimum infrastructure in the eNB location

- Risk of robbery of units in the field



Source: Greywale Insights



Existing Switches possibly can work as the Leaf switches needed

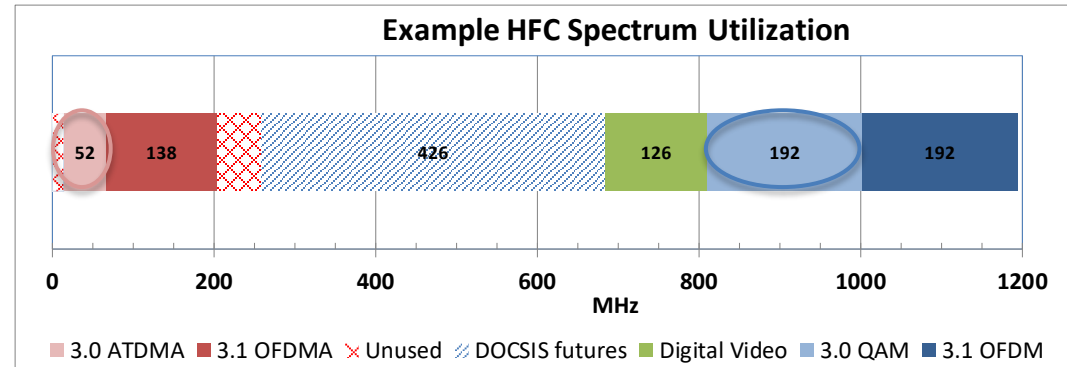
Timing servers based on IEEE1588 that are being used for the eNBs can be reused for RPHY if they are IPV6 capable and forward by the Leaf switches

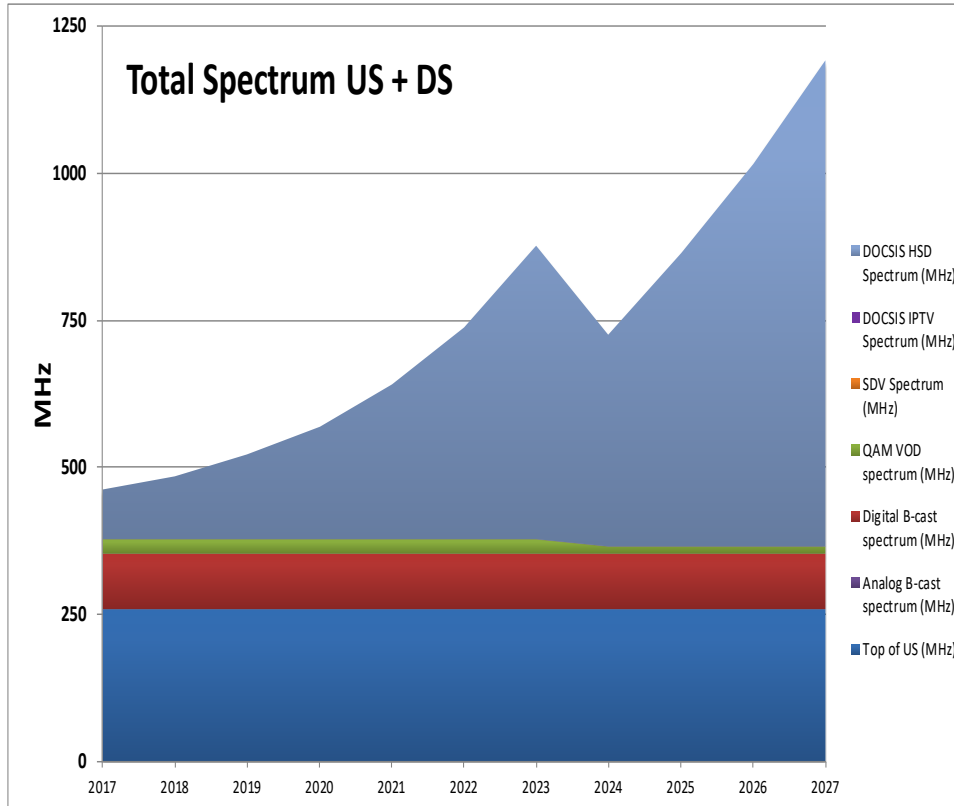
## Services Offered

- Basic Broadband Services
  - 25M/5M to 100M/20M
  - 16x4 DOCSIS 3.0 modems
- Digital Video Services
  - ~100 SD/HD programs
- Extended DOCSIS 3.1 Services:
  - 1 Gbps Symmetric for business services, Wireless backhaul (4G/5G, WiFi) and elite subscribers

## HFC Spectrum Utilization

- 1218 MHz / 204 MHz plant
  - Basic Broadband only needs 192 MHz DS, 52 MHz US to start
  - Plenty of room for Expansion
  - Enables 1G symmetric Day One

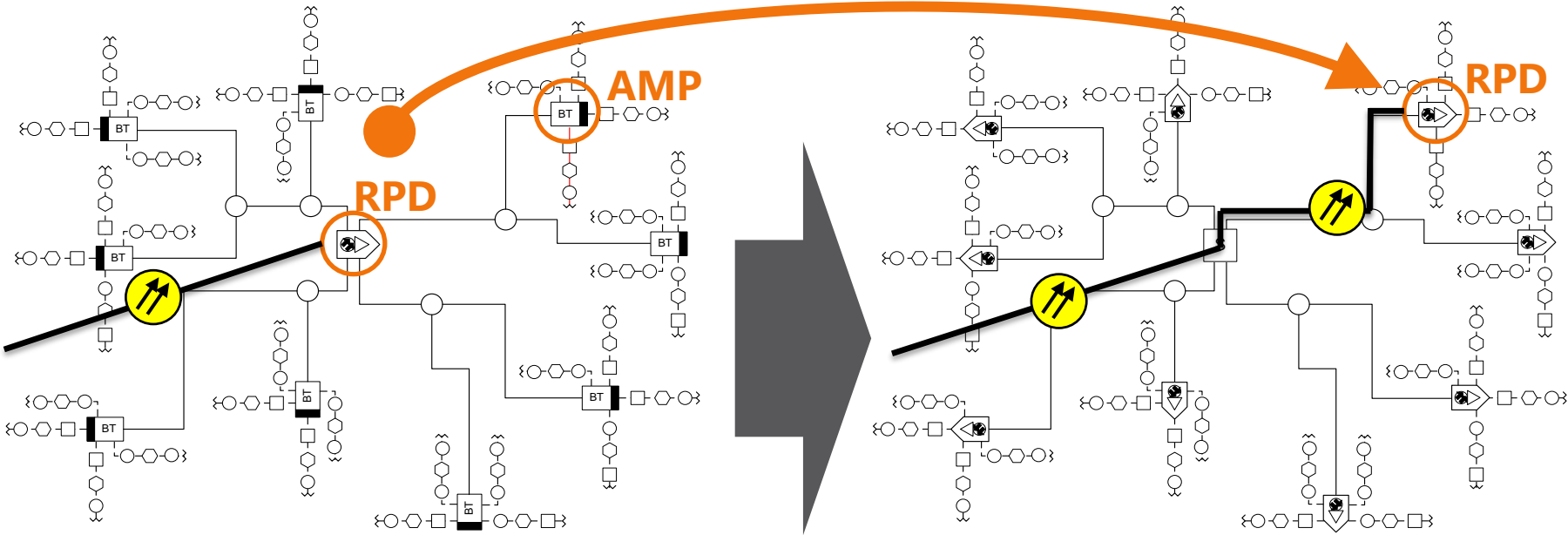


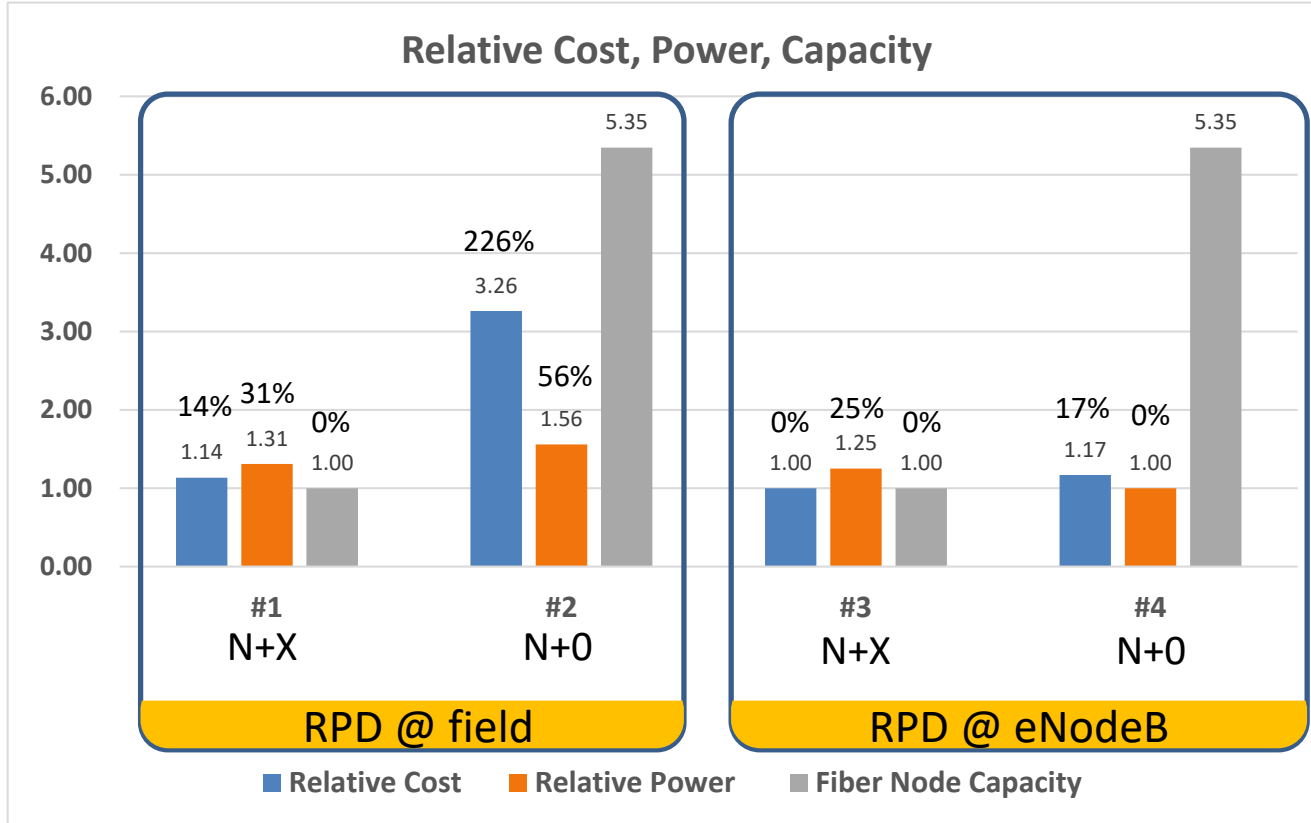


## Capacity Model Results

- 1000 subs per Downstream 3.0 SG
  - Sufficient spectrum until 2024
  - Node Splits &/or D3.1 needed then
- Digital Video can optionally be replaced with IP Video, saving spectrum
- Upstream is not the bottleneck
- Separate D3.1 spectrum supports 1G Symmetric services with minimal spectrum impacts

# FUTURE PROOF OPERATIONALLY DEPLOYED





- Convergence is the name of the game.
- DAA gave us the opportunity to converge due to Ethernet backhaul usage.
- Start with RPD in the eNodeB location and evolve selectively to the field in a N+X and N+0 seems the logical move.
- New technologies will require changes in the MAC and PHY layer and install in a control environment today's seems reasonable.
- In the future RMACPHY can be an option either, needs discussion and standardization.
- Finally, convergence gives options to evolve mobile networks installing 4G and 5G radios in strand mount equipment in the HFC network, creating small cells needed.



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**THANK YOU!**

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