



# **Trends in Access Networks**

**Juergen Seidenberg**

**BKtel communications**

**[www.bktel.com](http://www.bktel.com)**



## **Introduction of BKtel**

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**Spin-off from Alcatel in 1998**

**Located in Germany, close to Duesseldorf**

**Analog Transmission on Optical Fibers since 1990**

**Major OEM manufacturer in Europe for 1310 and 1550 nm optical CATV Equipment**

**Currently strong Presence in Europe in China**



## **Introduction of Speaker**

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**Name: Juergen Seidenberg**

**Position: General Manager of Bktel**

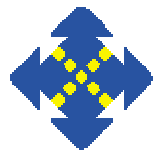
**Education: PHD in Electronical Engineering**

**Experience: Head of Development Dep. for CATV  
transmission systems of Alcatel Cable/Germany**

**Background: Optical Transmission Techniques**

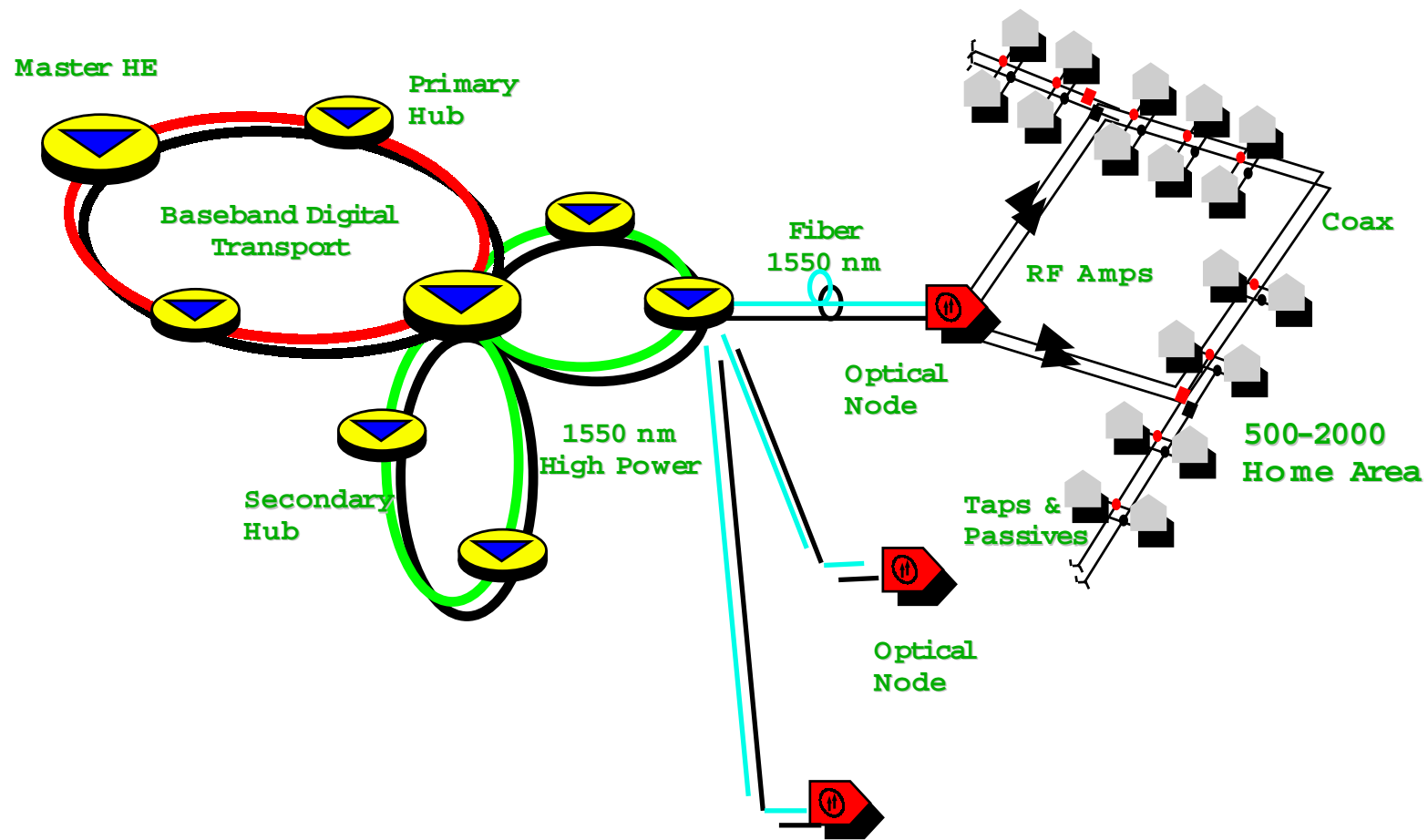
**Email: SEIDENBERG@BKTEL.COM**

**Characterization of Access Network**  
**Status of Access Network Technology**  
**introduced today**  
**Tomorrow's Customer Requirements**  
**Migration of today's networks to future**  
**networks**



# BKtel

## Trunk and Access Network





## **Definition: Access Network**

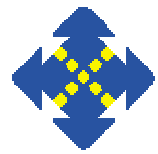
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**Network, which**

**connects the customer network terminal with  
the network provider active infrastructure**

**can be wired: powerline, twisted pair, coaxial,  
fiber cable**

**can be wireless: direct satellite, microwave  
connection**



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## **Properties: Access Network**

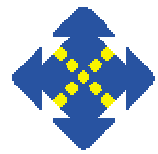
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**Small to medium distance network: 10s of meters up to about 30 km**

**Carries different services: TV, phone, data**

**Reliability requirement grows with kind of service**

**Extremely cost sensitive since cost share factor is very low compared to long distance networks**



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## **Technologies: Phone Service**

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### **Wired:**

**POTs, ISDN: Twisted pair**

**Hybrid fiber coax network: Cable Phone**

**Powerline communications (?)**

### **Wireless:**

**mobile phone technology (GSM, TDMA, CDMA, UMTS ...)**

**Direct Satellite Phone (?)**



# **Technologies: Broadcast TV Service**

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## **Wired:**

**Hybrid fiber coax network**

## **Wireless:**

**Terrestrial transmission**

**Direct Satelite Reception**

**Microwave TV (?)**



## **Technologies: Data Service**

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### **Wired:**

**Twisted Pair: xDSL**

**Hybrid fiber coax: cable modem**

**Powerline Communication (?)**

### **Wireless:**

**Direct Satellite downstream / phoneline  
upstream**

**Microwave Radio**

**2.5 G or 3G Mobile Phone Network**

## **Telcom Operators**

**Networks based on twisted pair cables offering POTs, ISDN and data service with xDSL technology, omitting broadcast TV service**

**Access Network Capacity:**

**Downstream: e.g. 1 Mbit/s**

**Upstream: e.g. 300 kBit/s**

## **Cable Operators**

**Hybrid fiber coax networks offering POTs, ISDN, TV-services and data services with cable phone and cable modem technology**

**Access Network Capacity:**

**Downstream: 800 MHz bandwidth = 2.8 Gbit/s with QAM64**

**Upstream: 50 MHz bandwidth = 165 Mbit/s in QAM64**



## **Status today (3):**

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### **Mobile phone network operators**

**compete with phone services and start to offer data services**

**Access network capacity:**

**depends on technology (2G, 2.5G, 3G)**



## **Status today (4):**

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### **Energy suppliers**

**try to enter the telecom business (phone and data services) by introducing powerline communications**

**Access network capacity:  
not finally known yet**

**Each kind of service has different interface requirements due to the existing, introduced customer equipment**

**phone: analog baseband 2-wire interface**

**TV: SCM - PAL or NTSC unidirectional coaxial cable interface**

**data: Ethernet interface**

**So, What's next?**



# **Tomorrow's Customer Basic Requirements**

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**Reliable Phone Service**

**Sufficient number (40?) of broadcast TV channels or some selectable (4?) dedicated TV channels**

**Data Service in order to achieve a stable, sufficient fast Internet connection**



# **Tomorrow's Customer Dedicated Requirements**

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**Video on demand service**

**Interactive home educating service**

**Picture phone**

**Telecommunication service supporting  
home office**



## **Introduce unique interface for all kind of services**

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**Ethernet interface could be the standard  
for all kind of services**

**Voice over IP could be the solution for  
phone services as soon as the QoS issue  
has been solved**

**The TV set would be replaced by a PC-  
like equipment**

**The VCR would be a DVD recorder**



## How much data needs a customer ? (1)

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### Downstream:

Phone service:	160 kBit/s
data service:	1 Mbit/s
TV (1 channel):	2 Mbit/s (>MPEG2)

### Upstream:

Phone service:	160 kBit/s
data service:	330 kBit/s



## How much data does a customer need? (2)

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**Downstream:**            **~10 Mbit/s    or**  
**40 TV + ~2 Mbit/s**

**Upstream:**            **~0.5 Mbit/s**

## **Telcom Operators**

**will more likely start to introduce fiber optic access networks soon since their twisted pair network capacity will be exhausted rather early.**

**will introduce technology which fits best to their present hardware e.g. APON (ATM over PON?)**

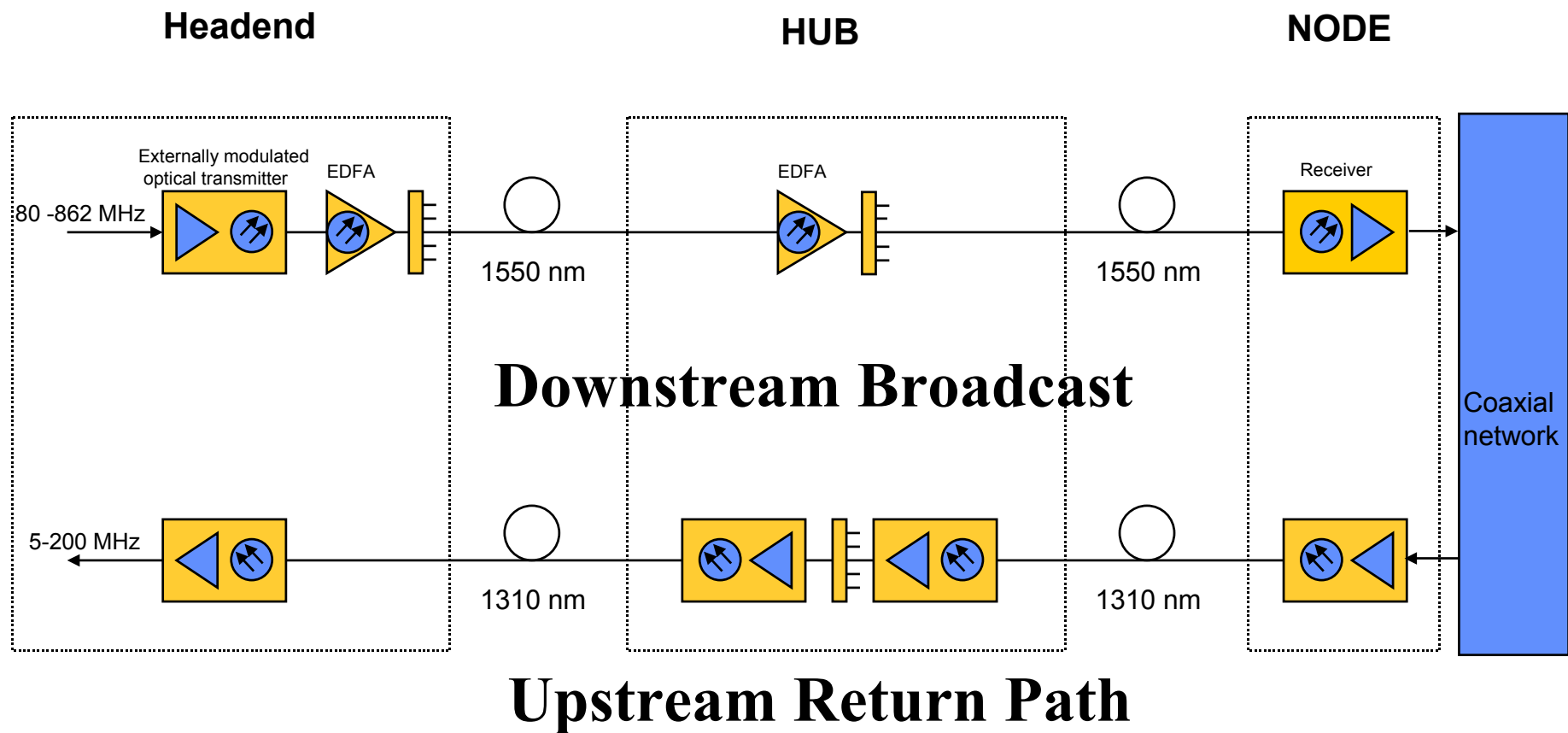
## **Cable Operators**

**will stick to their passive HFC network since the intrinsic data capacity is rather high.**

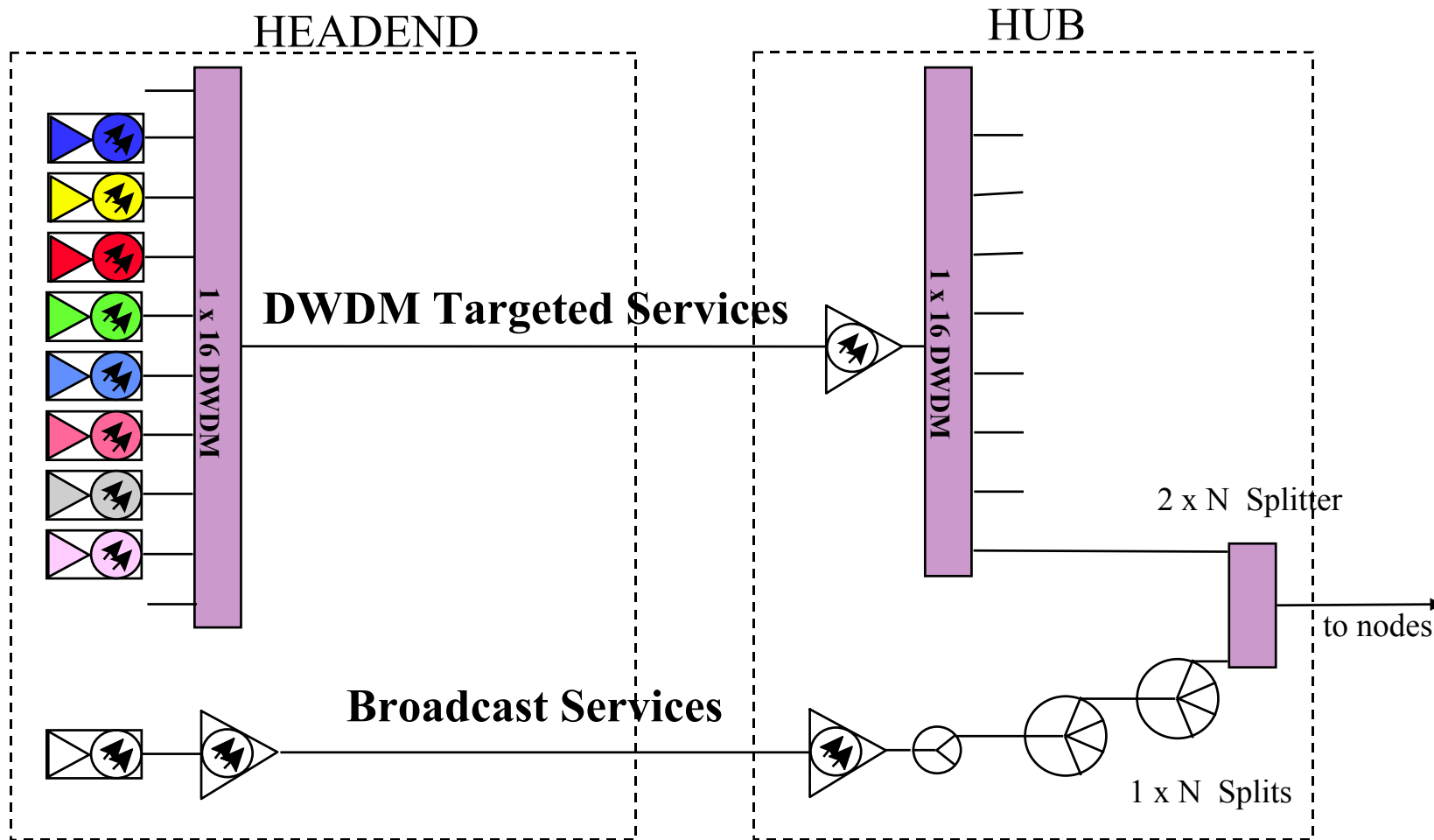
**will introduce network upgrades like ring structures in order to improve the reliability.**

**Will introduce DWDM technology to enhance the capacity of the higher level network parts**

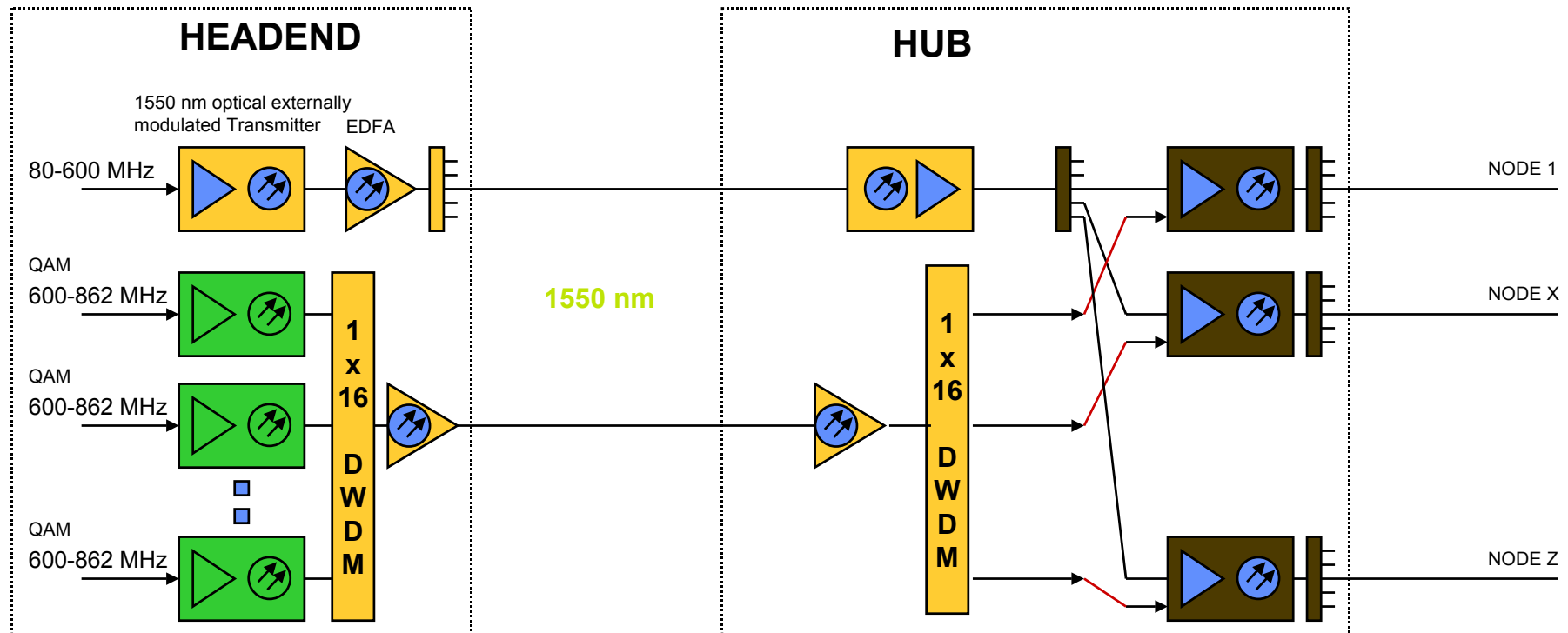
**will finally upgrade to more IP based technology e.g. EPON (ethernet over PON) technology**



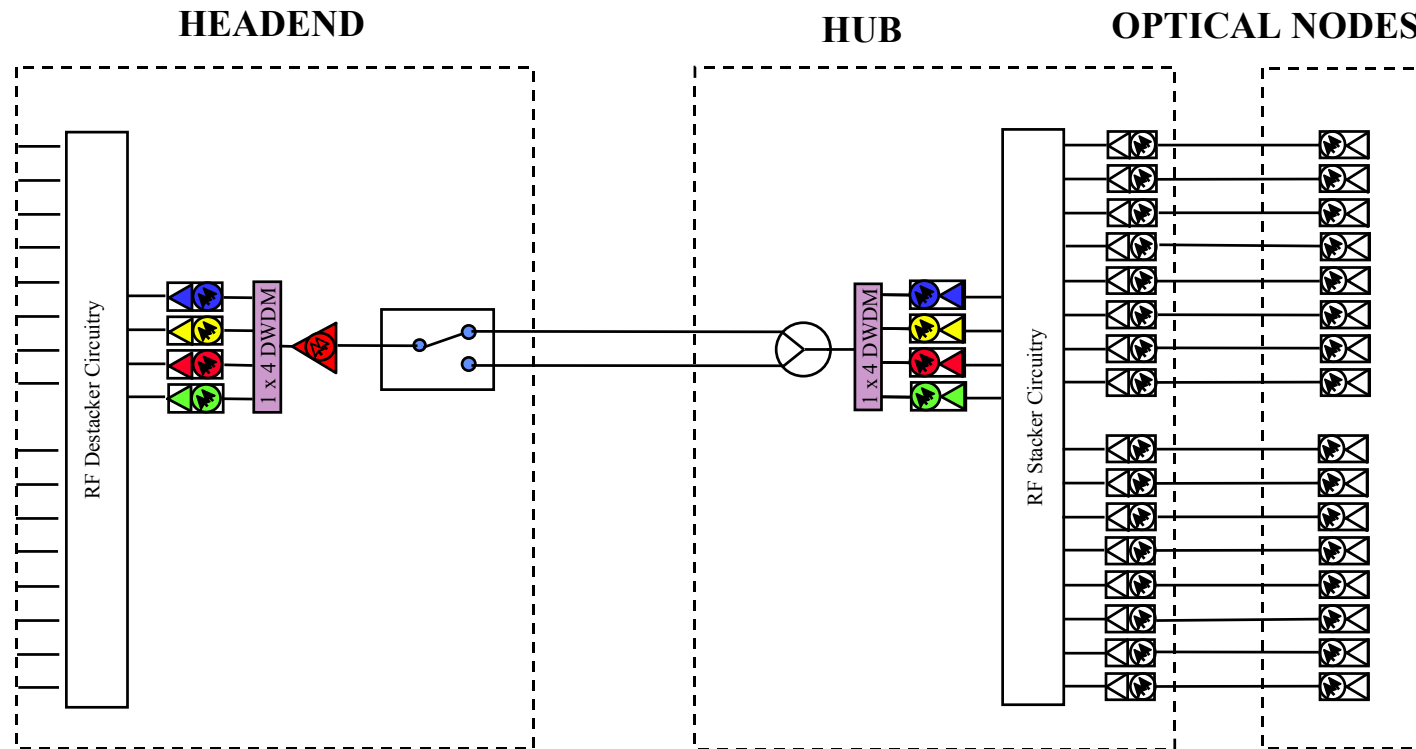
# Topology of Tomorrow's HFC-Networks: Downstream (1)



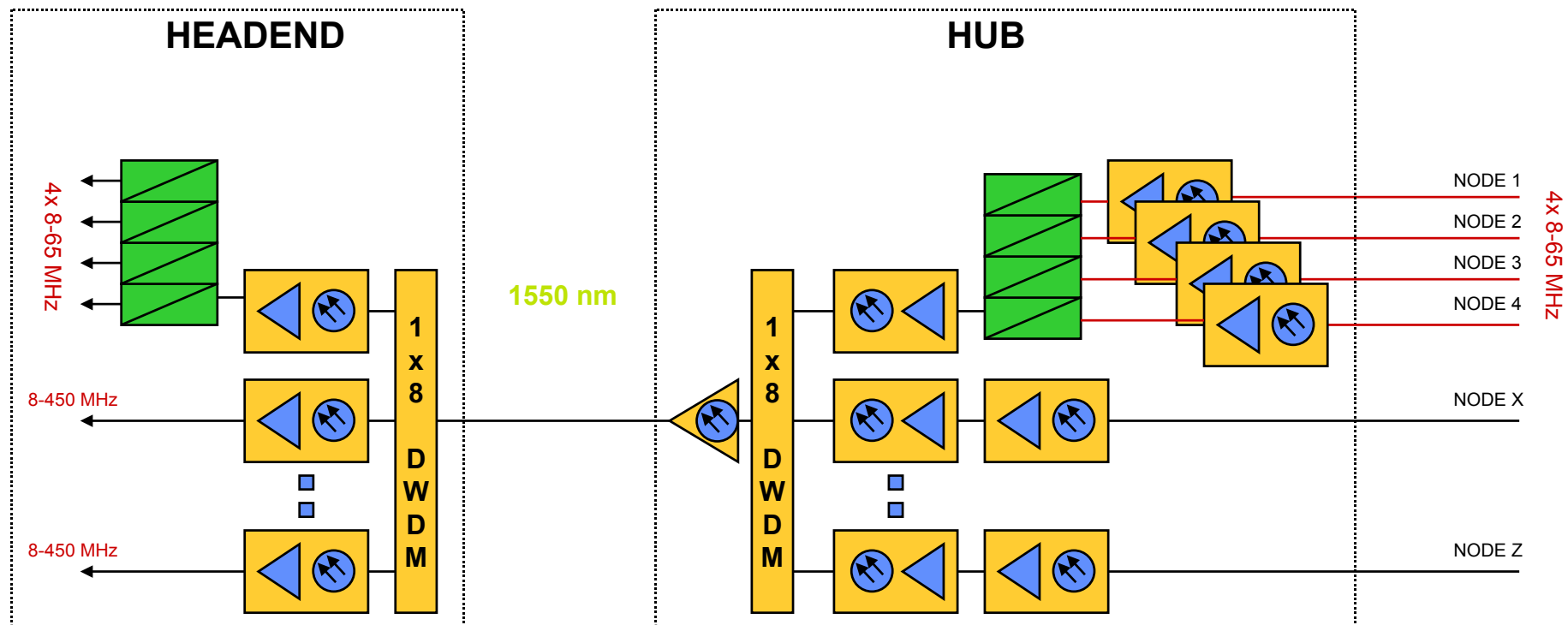
# Topology of Tomorrow's HFC-Networks: Downstream (2)



# Topology of Tomorrow's HFC-Networks: Upstream (1)

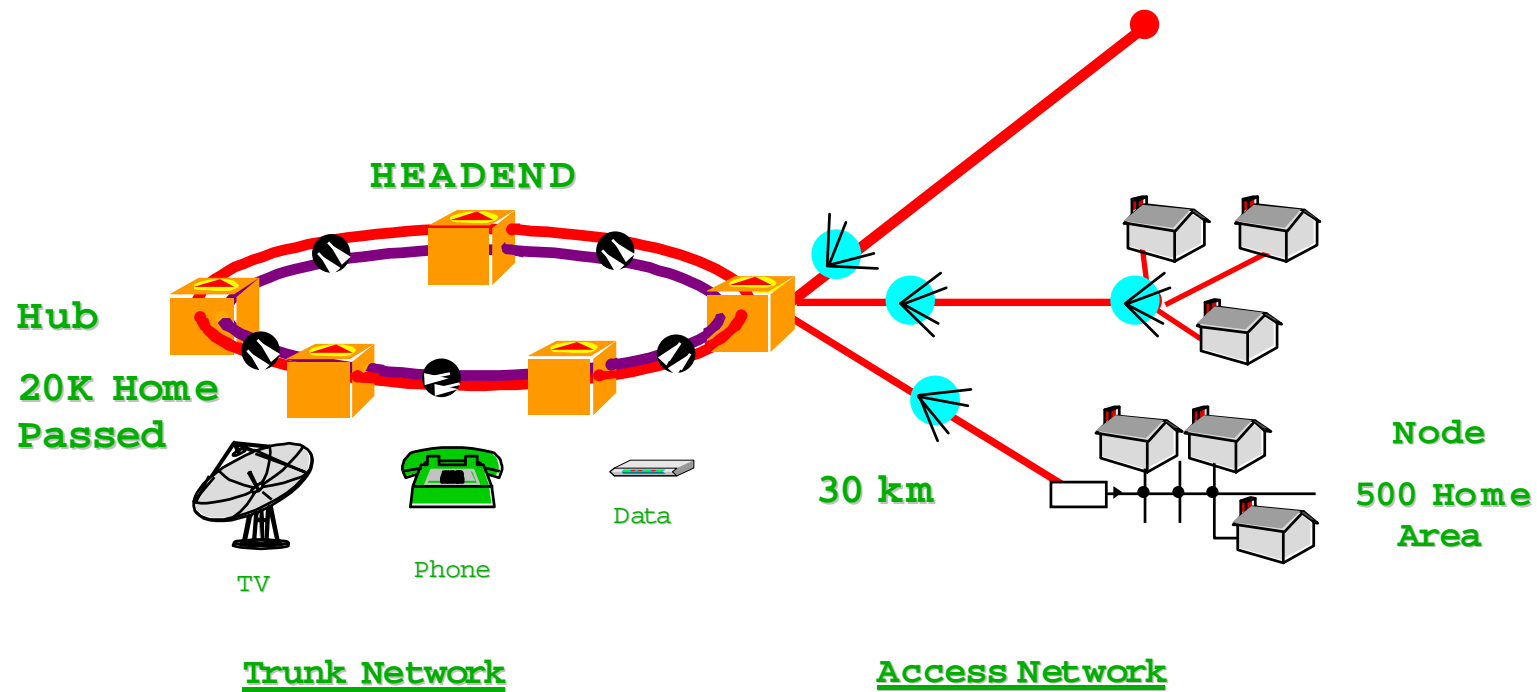


# Topology of Tomorrow's HFC-Networks: Upstream (2)





# Overall Access Network Topology



**The access network transmission capacity needs to be upgraded in order to offer new services**

**The upgrade scenario is not unique but depends on the existing hardware**

**Fiber optics will become more and more important in the access network**

**APON and EPON are approaches towards a future access network and might be used depending on the operators infrastructure**



**Thank you for your attention!**