



# Evolution of Video formats and impacts on Medium

SMPTE Atlanta

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remote from Montreal, 17<sup>th</sup> of May 2021

# Who am I ?

**Renaud Lavoie**

At a glance, I am a technology passionate, and an entrepreneur, an inventor who contributed to the 38 patents of Embrionix.

After working for 7 years at MIRANDA, I started Embrionix, my second business, which grew drastically and quickly (recognized by Deloitte, Fast50 in 2016).

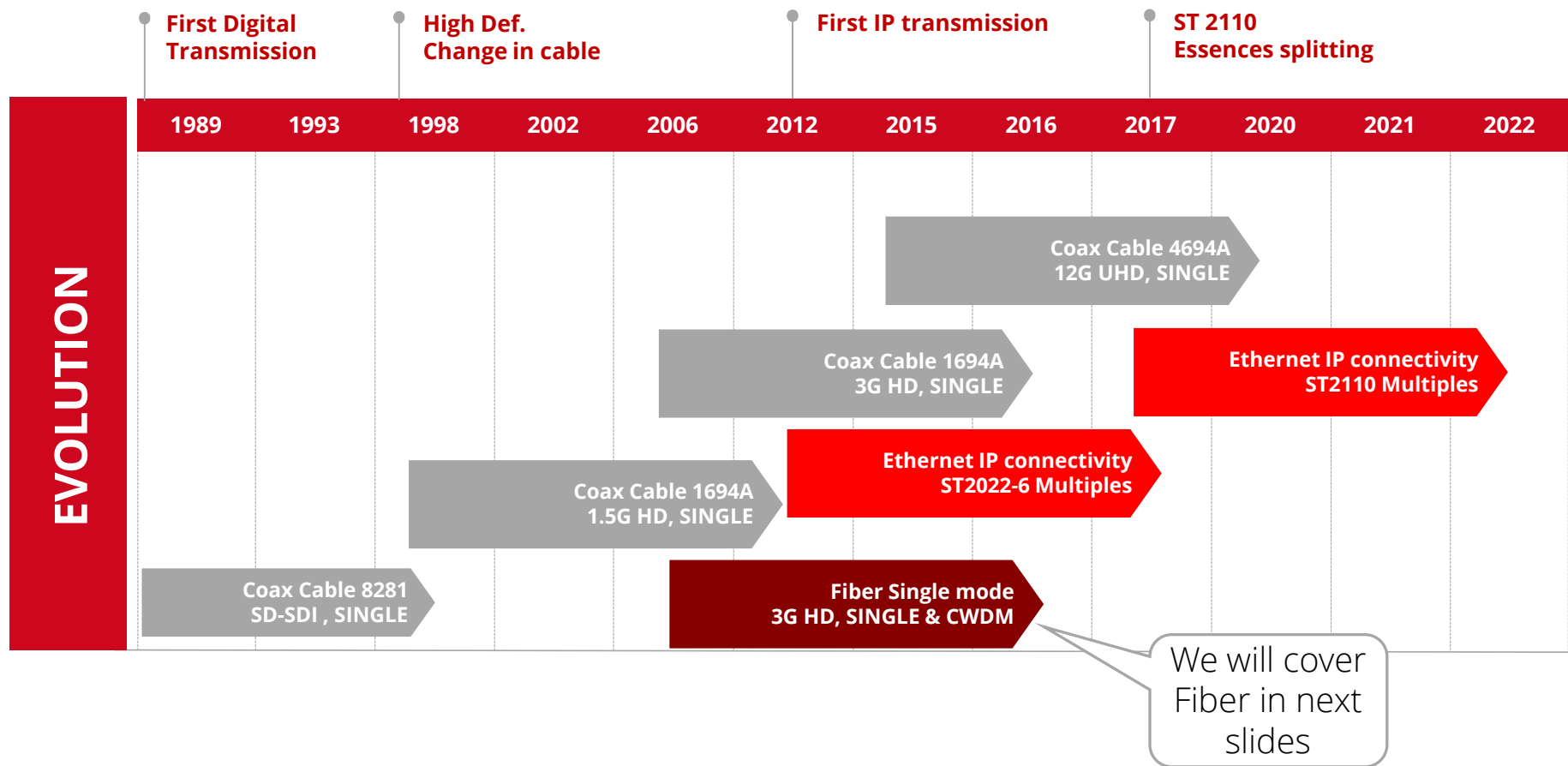
Embrionix was working on changing the broadcast, by simplifying the infrastructure in big sports events.

Riedel acquired Embrionix in 2019! Then I became Senior VP technology for Riedel

Let's go back...

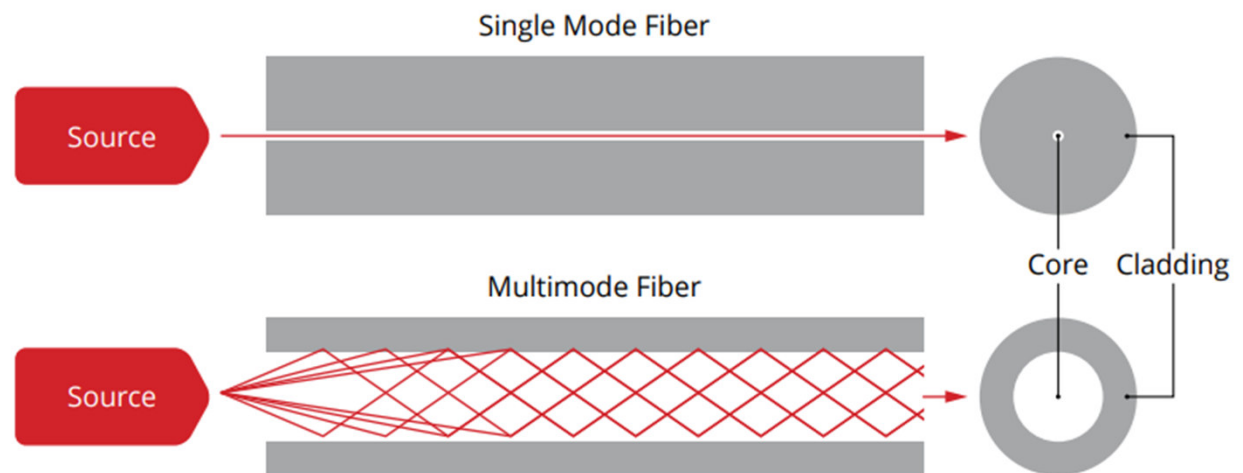


# SDI evolution timeline



## Evolution in fiber optics

- First demonstration : 1965 (20dB/km)
- Corning was able to produce & build fiber at rate 50 meters per second , 1983
- In 1991 Photonic crystal fiber was created ... next few slides.
- Multimode fiber existed in 1970
- Single mode fiber in 1980



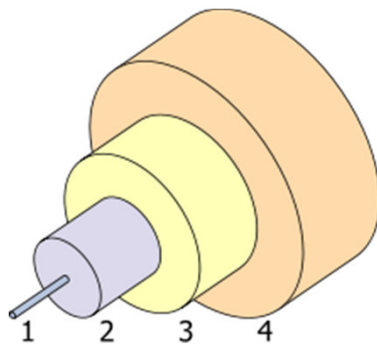
## Type of fiber : Single mode (mono mode) versus Multimode

Optical fiber designed to send only 1 mode of propagation.

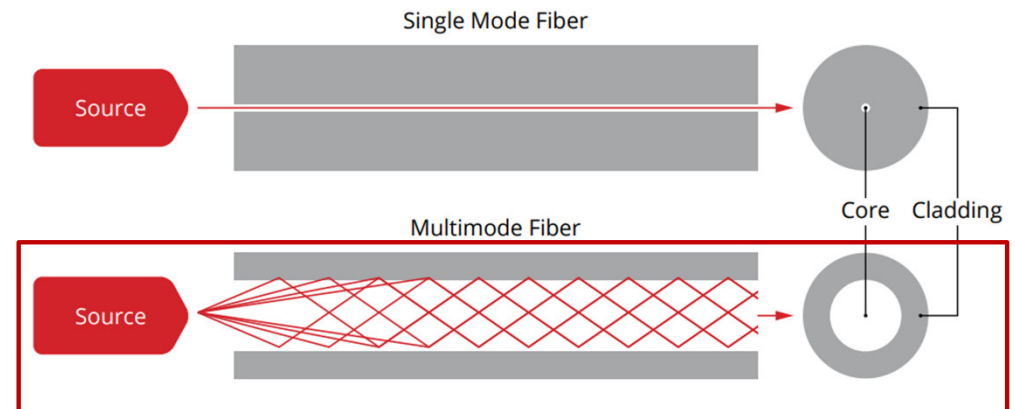
Laser type are Fabry Perrot (FP) and Distributed feedback (DFB)

Multimode fiber to send multiple modes of propagation.

Laser type Vertical cavity surface emitting laser (VCSEL)



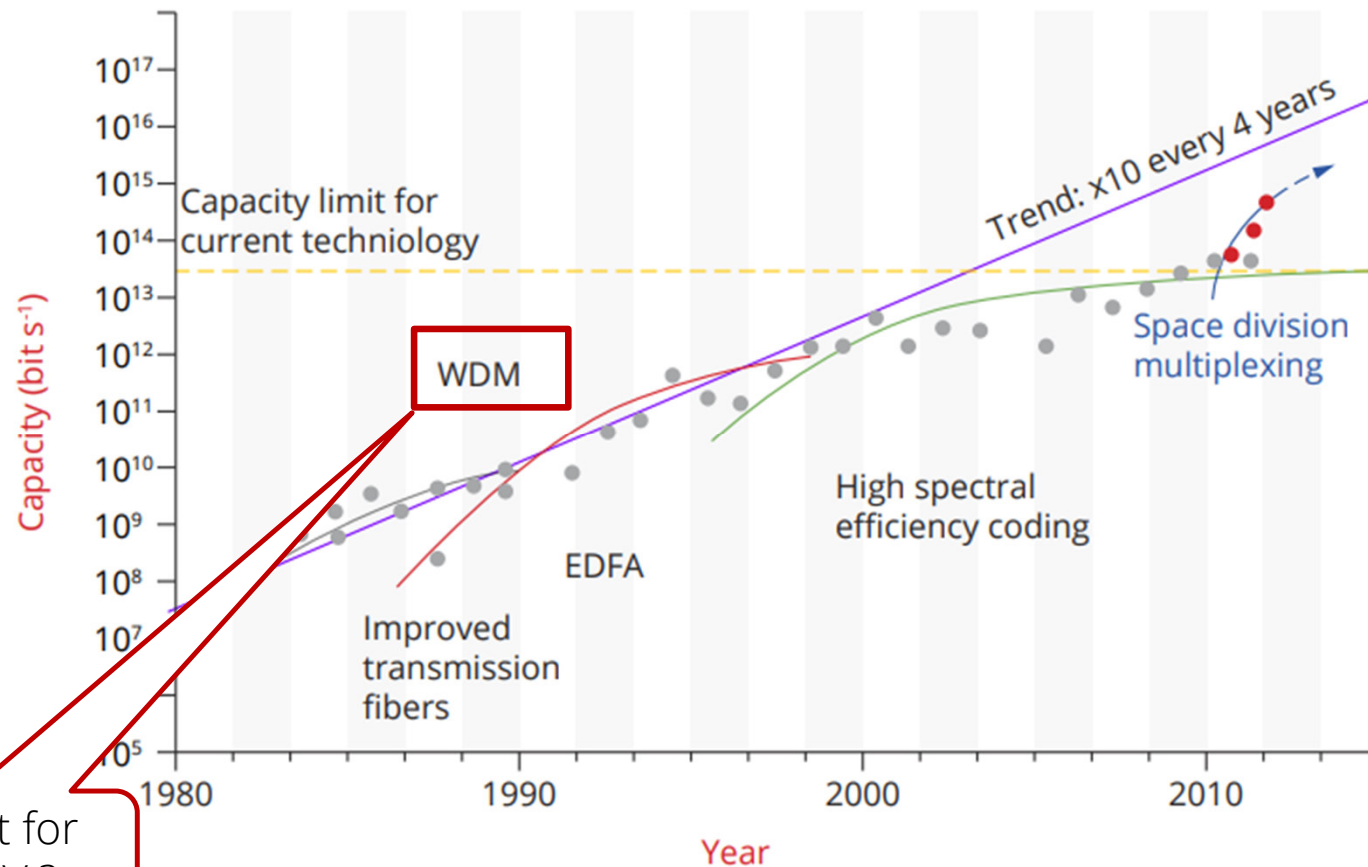
1. Core 8–9  $\mu\text{m}$  diameter
2. Cladding 125  $\mu\text{m}$  diameter
3. Buffer 250  $\mu\text{m}$  diameter
4. Jacket 900  $\mu\text{m}$  diameter



Lower cost  
Lower distance  
Less popular in Media/AV



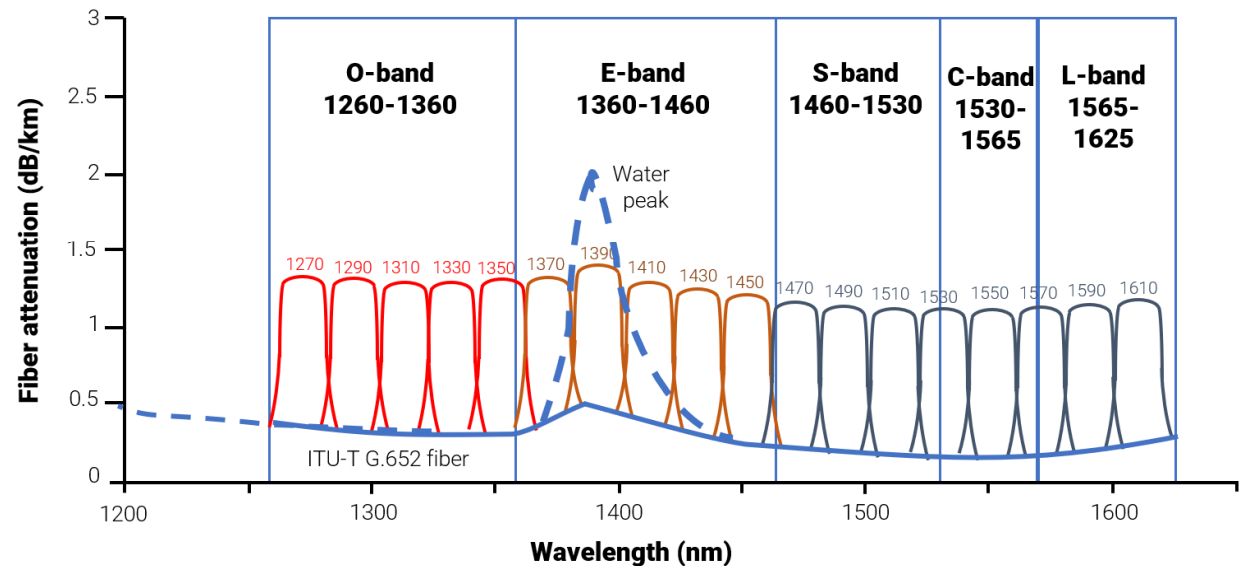
## Evolution of speed in optics



## CWDM explained

- Coarse Wavelength Division Multiplexing is dividing the fiber optical channel into 18 bands (shown)
- In each band one DFB laser will lase in the middle of the filter
- Media/AV customers can use all the 18 wavelengths for customers

**CWDM wavelength grid as specified by ITU-T G.694.2**





**For geek and  
curious only!!**

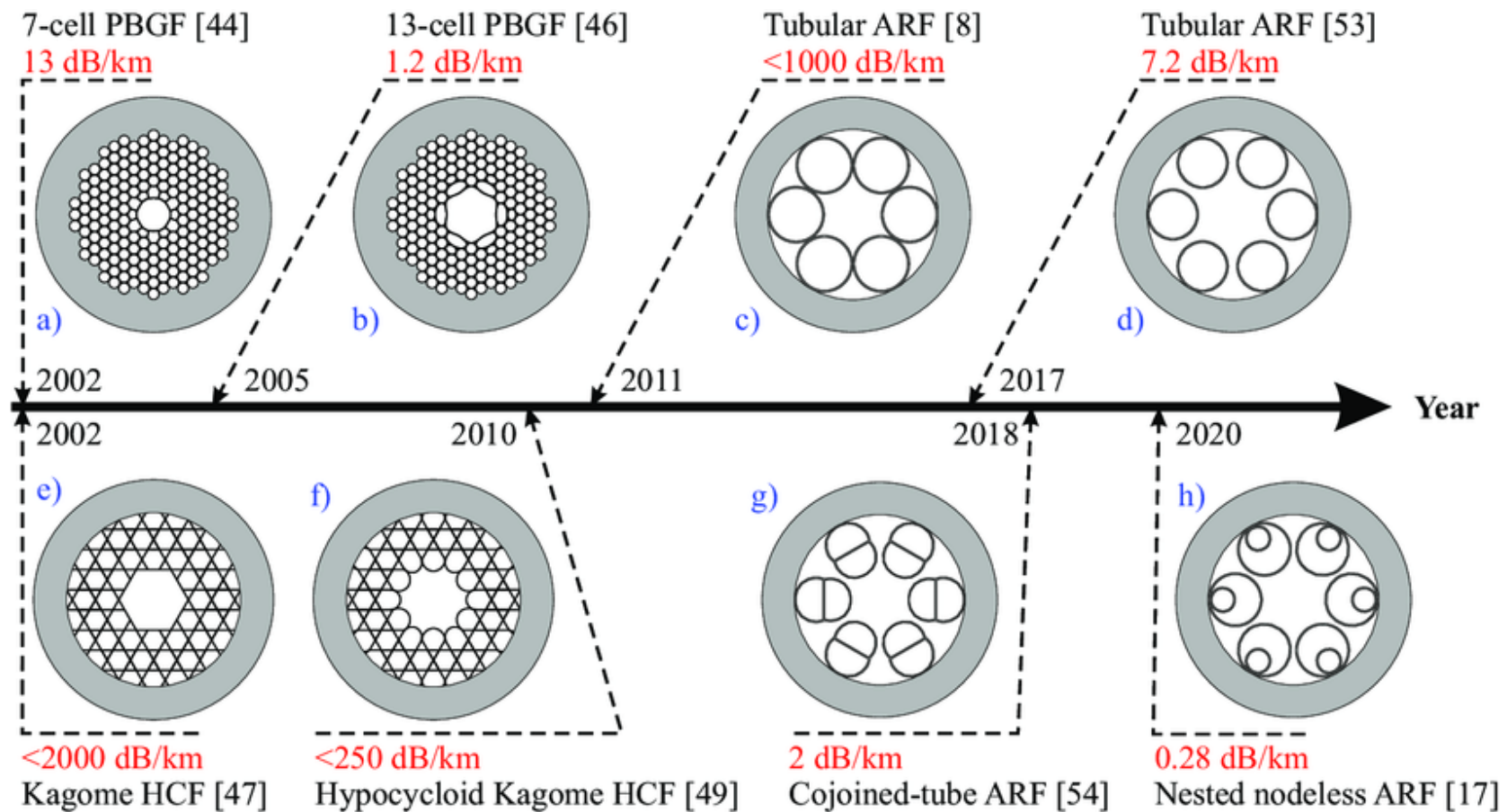


## Hollow-core Photonics

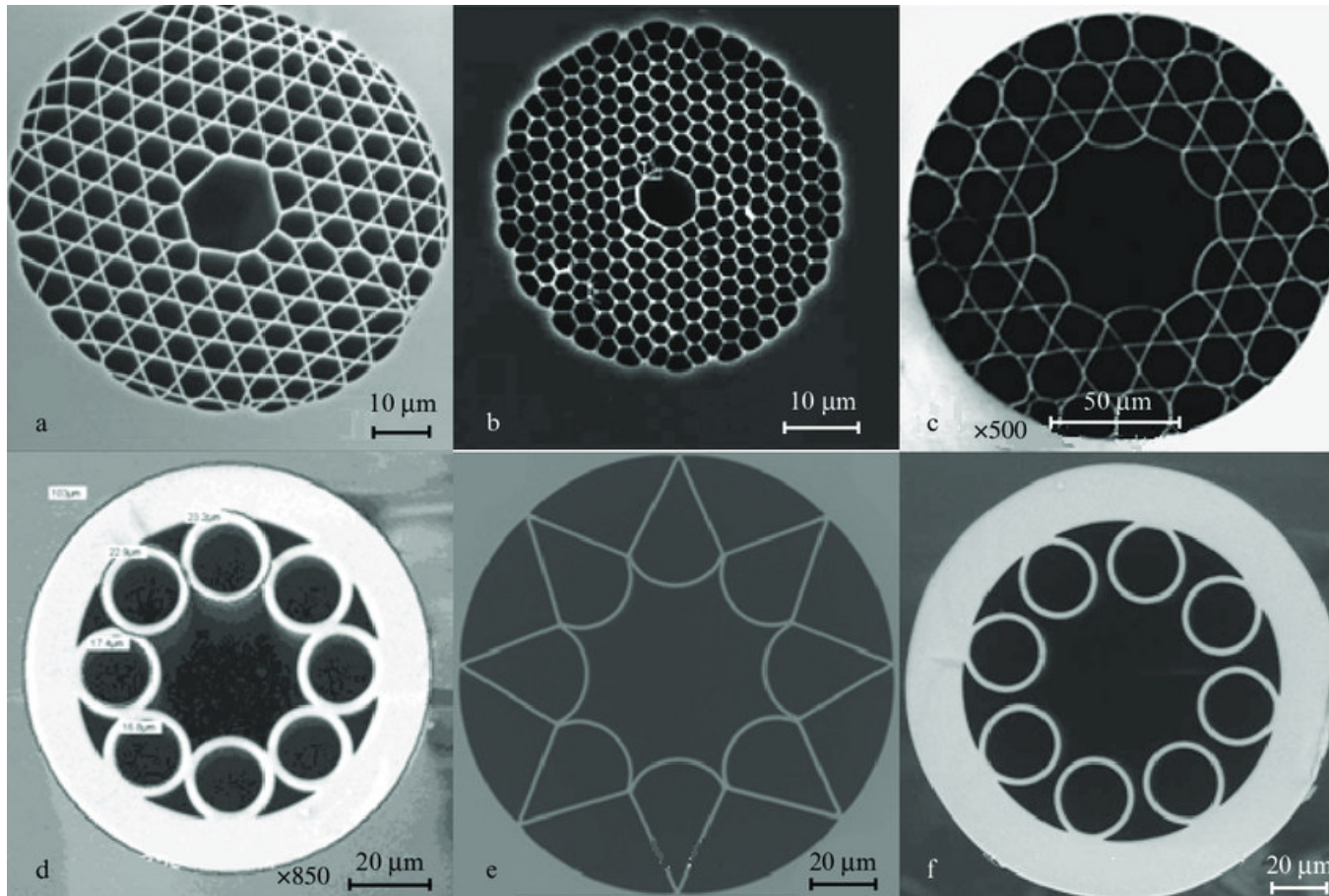
- DARPA has succeeded in creating **hollow-core** photonic-bandgap optical fiber.
- Light travels along its length at around 99.7% the **speed of light**.
- **30% improvement** over conventional optical fibers (silica glass).
- Consider when transmission speed is important

The secret to  
hollow-core fiber is doing away  
with the cladding and replacing it  
with photonic crystals.

# Hollow-core fibers



## Real views of Hollow core



## First learning...

- Speed evolution = medium changes
- Adding signals = new way of transporting multiples channel in single connection!

We will see next the Multiplexing in IP world

What is the next step for Media / AV

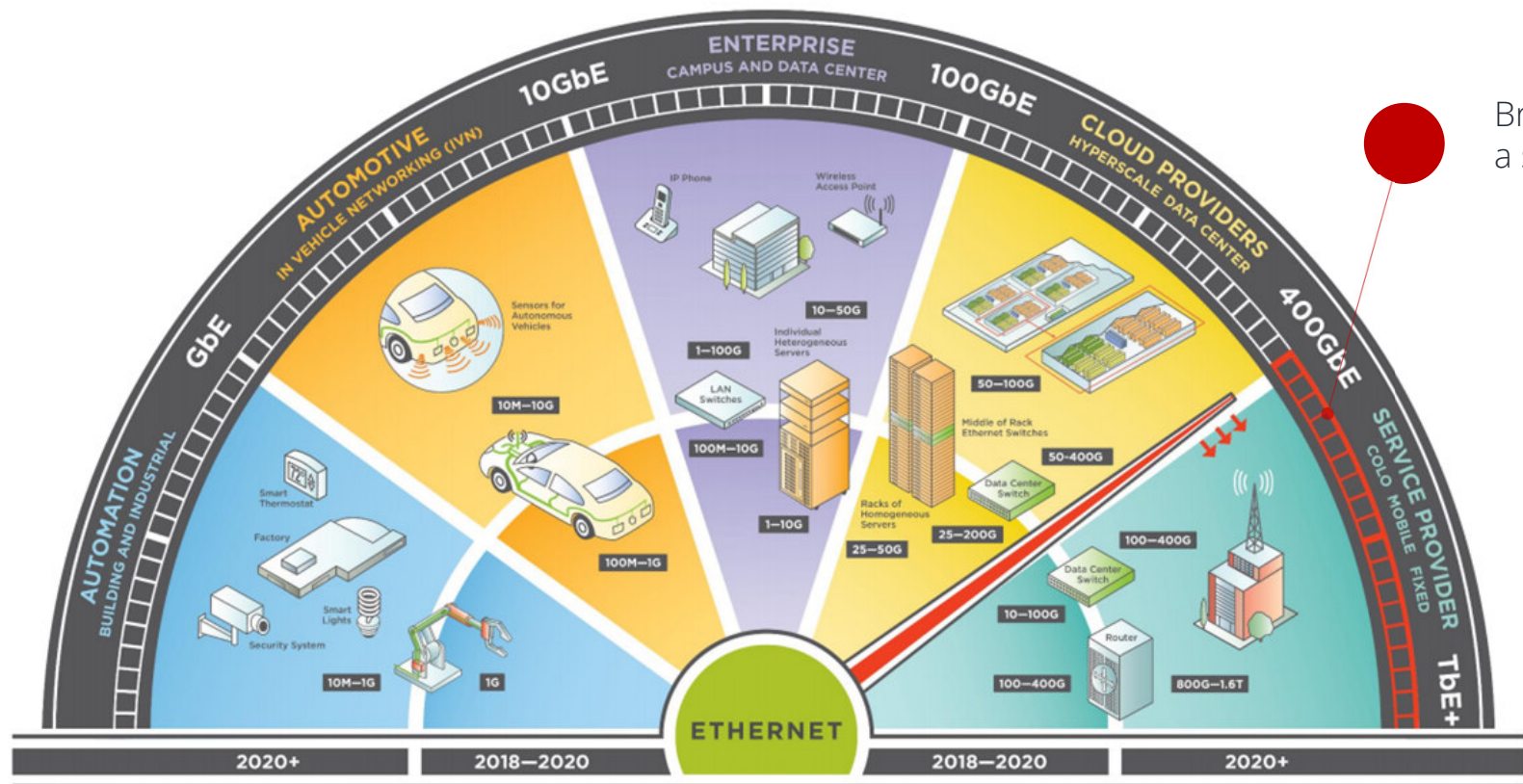
A long-exposure photograph of a city street at night. The street is wide and paved, with white chevron markings in the center. On either side, there are multi-lane highways with blurred light trails from cars in various colors (red, yellow, blue, white). In the background, several tall city buildings are visible against a dark blue sky. The overall scene conveys a sense of motion and modern urban infrastructure.

**IP**



# THE BIGGEST BANDWIDTH ADDICT

The ethernet Alliance released in 2016 the Ethernet links roadmap



# THE LINKS PATH

The ethernet Alliance released in 2016 the Ethernet links roadmap

## Previous plateau

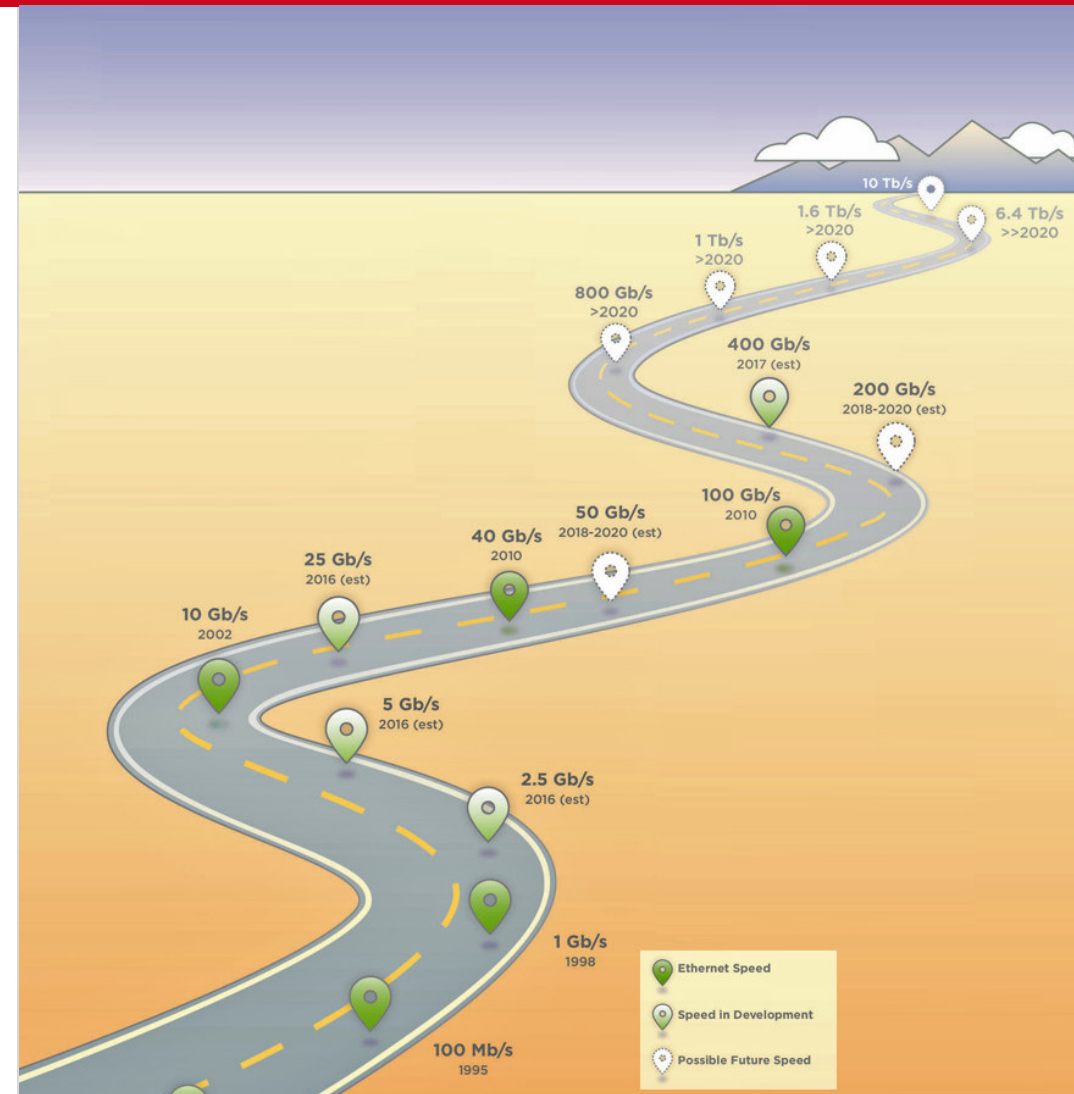
- Between 2002 to 2016, the new link was 2.5 times faster. Going from 10Gbps to 25Gbps.

## Hockey stick growth

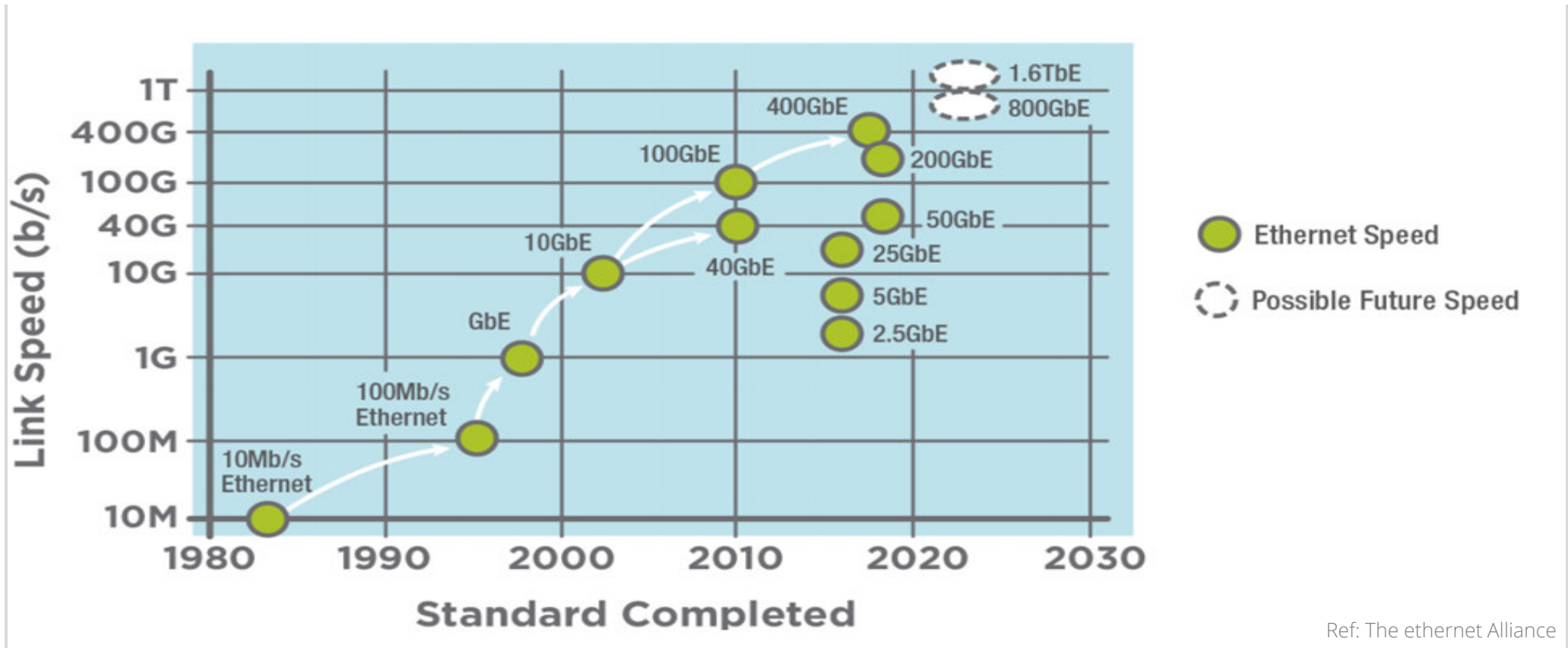
- Since last 5 years, pluggable speed accelerated drastically going from 25G to 100G per lane.

## Back to Modulation

- Previously NRZ was used to transmit the signal, now we are using PAM-4 and in the future PAM-8. I will be addressed it later.



# SPEED, SPEED, SPEED



## TWO WAYS TO GO FASTER



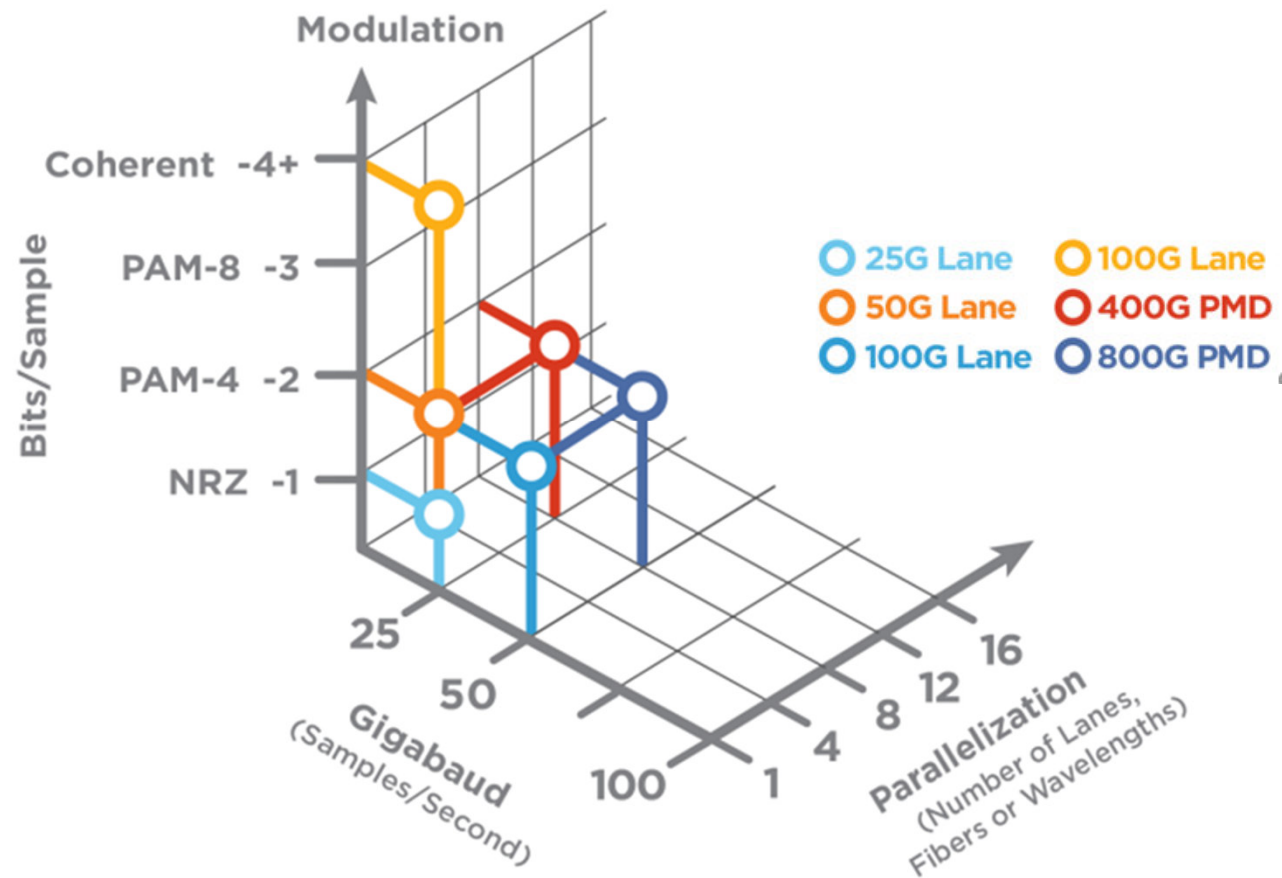
Multi-steps



Multi-lanes

## Why not combine both?

By combining PAM/Coherent + number of lanes, we can create up to 800Gbps links





## Positive test of 112Gbps lane





## PAM VERSUS COHERENT OPTICS

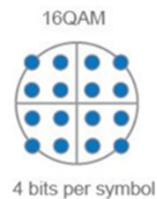
- The goal of both PAM and coherent optics was to give more bits per symbol.
- e.g. the PAM-4 will enable 4 steps (2 bits) per symbol, creating at 25Ghz : 50Gbps lanes



### PAM-4, -8

Is a pulse amplitudes modulation, which represent multiples amplitude levels.

Targeted for short haul



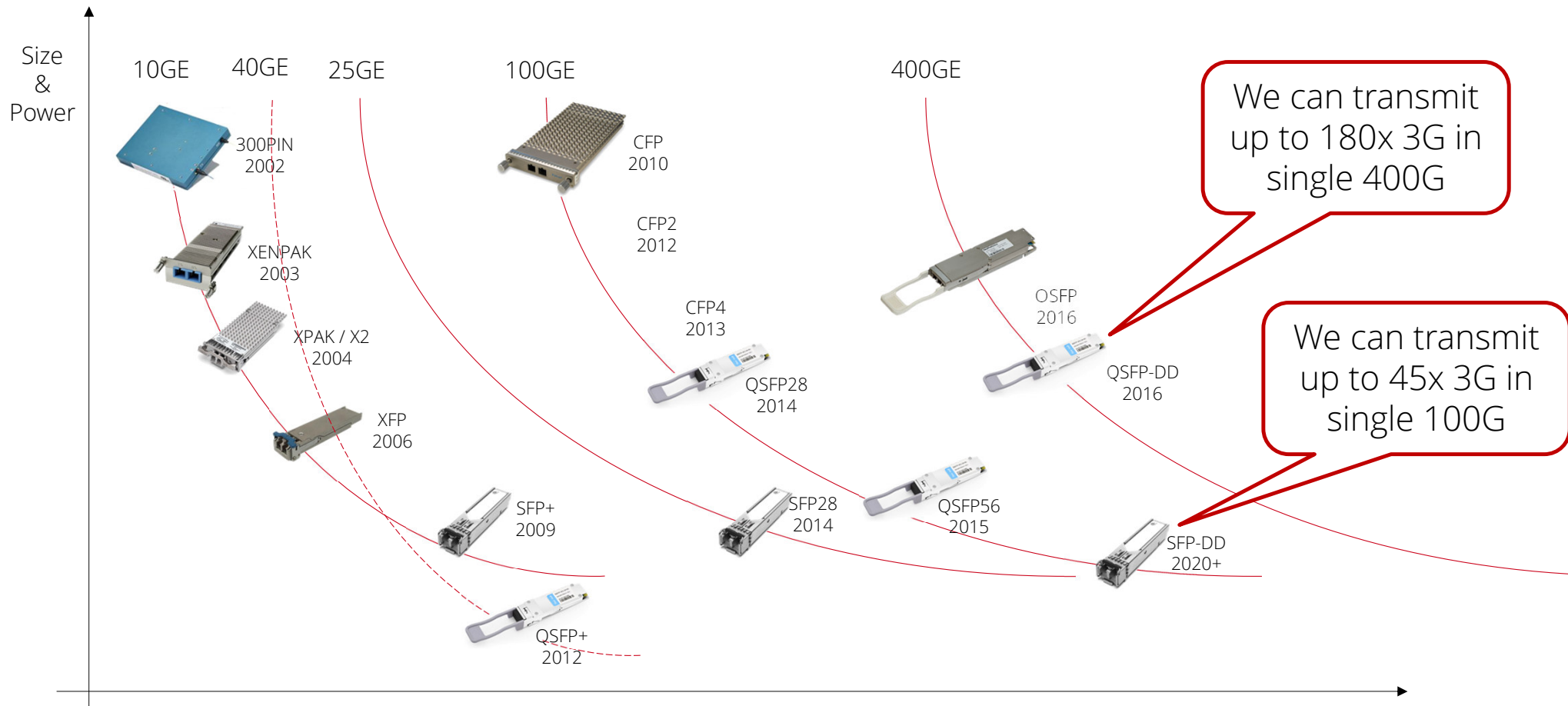
### Coherent

Is more advanced modulation: modulated amplitude, light phases and two polarizations.

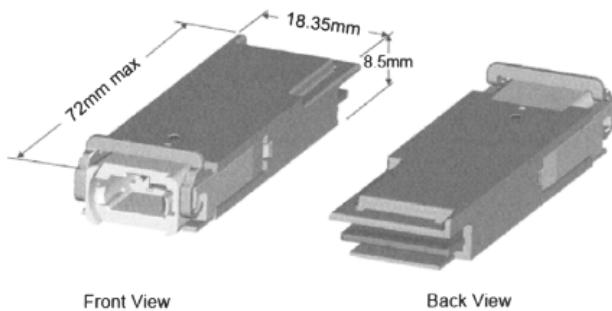
Targeted for long haul



# Form factor evolution in Ethernet

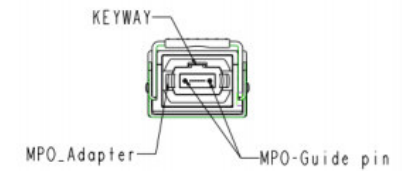
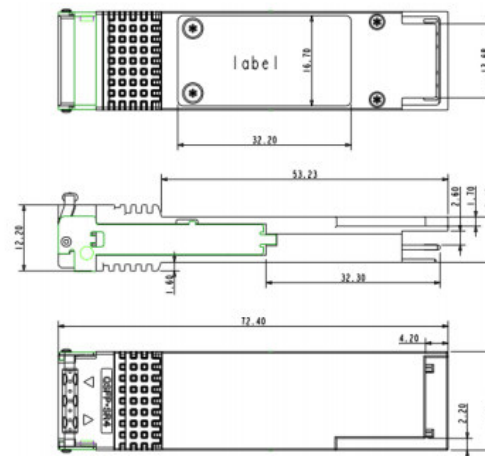


The 2 most popular ones you might have to deal with

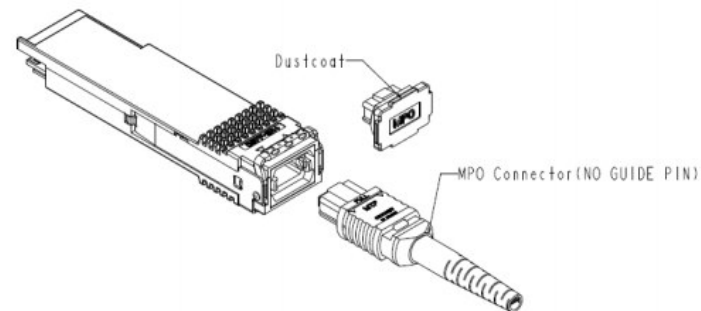


QSFP28, QSFP-DD

#### Mechanical Dimensions



III<sup>2</sup>



The 2 most popular ones you might have to deal with : SFP28

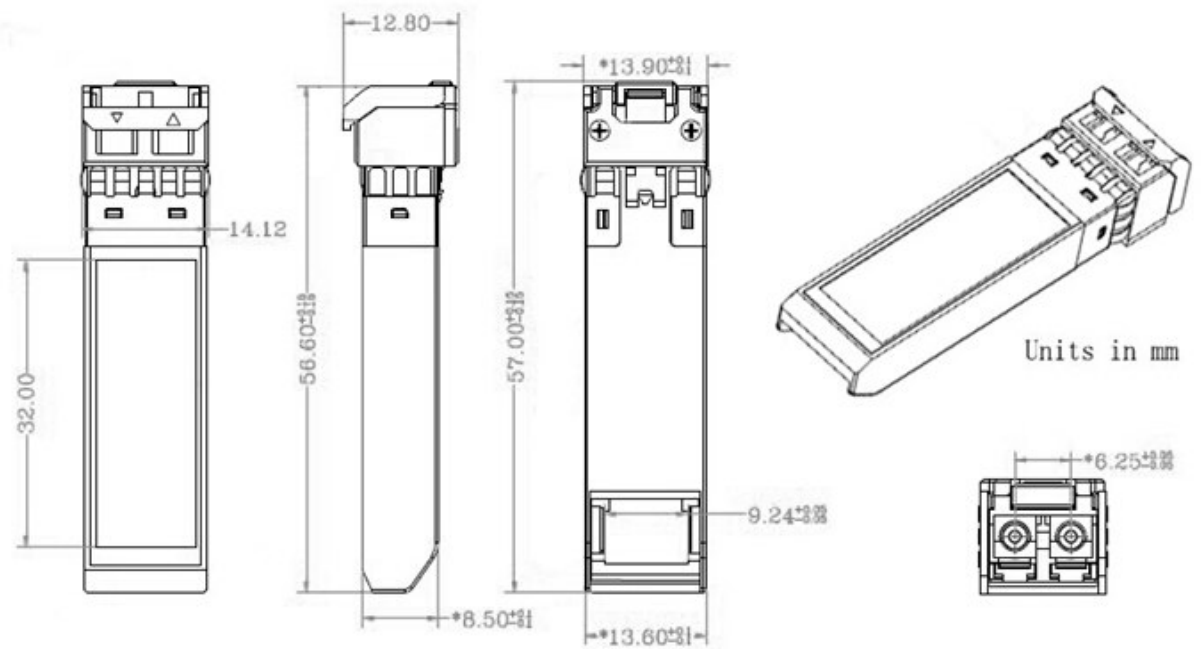
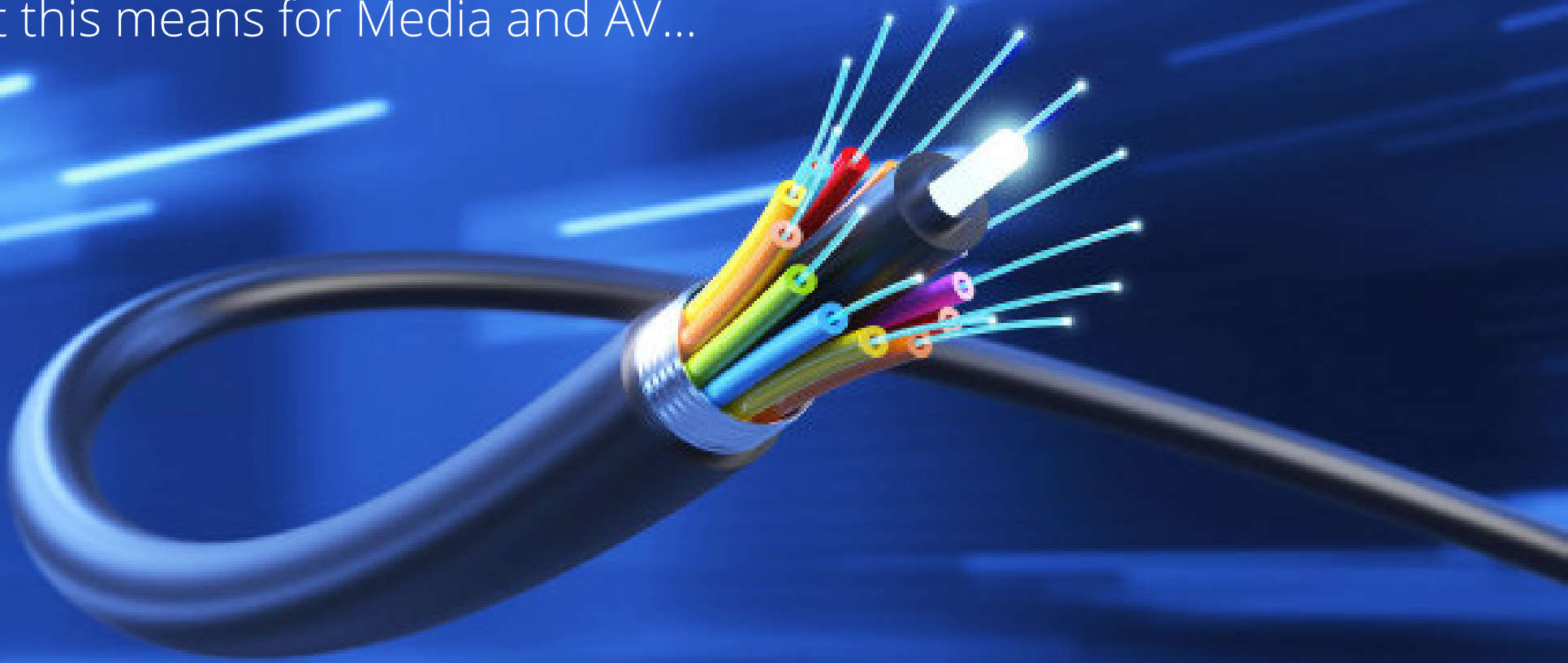


Diagram of Mechanical Dimensions

What this means for Media and AV...



In numbers...



In  
**800Gbps**  
**740+ UHD\*\*\***

The Road to High-speed connections  
will enable Broadcasters to reduce  
drastically the cabling.

\* 3840p59.94 bandwidth in IP  $\approx$  10.5Gbps

\*\* 1080p59.94 bandwidth in IP  $\approx$  2.6Gbps

\*\*\* JPEG-XS compression at 1:10



**Other great impact...**

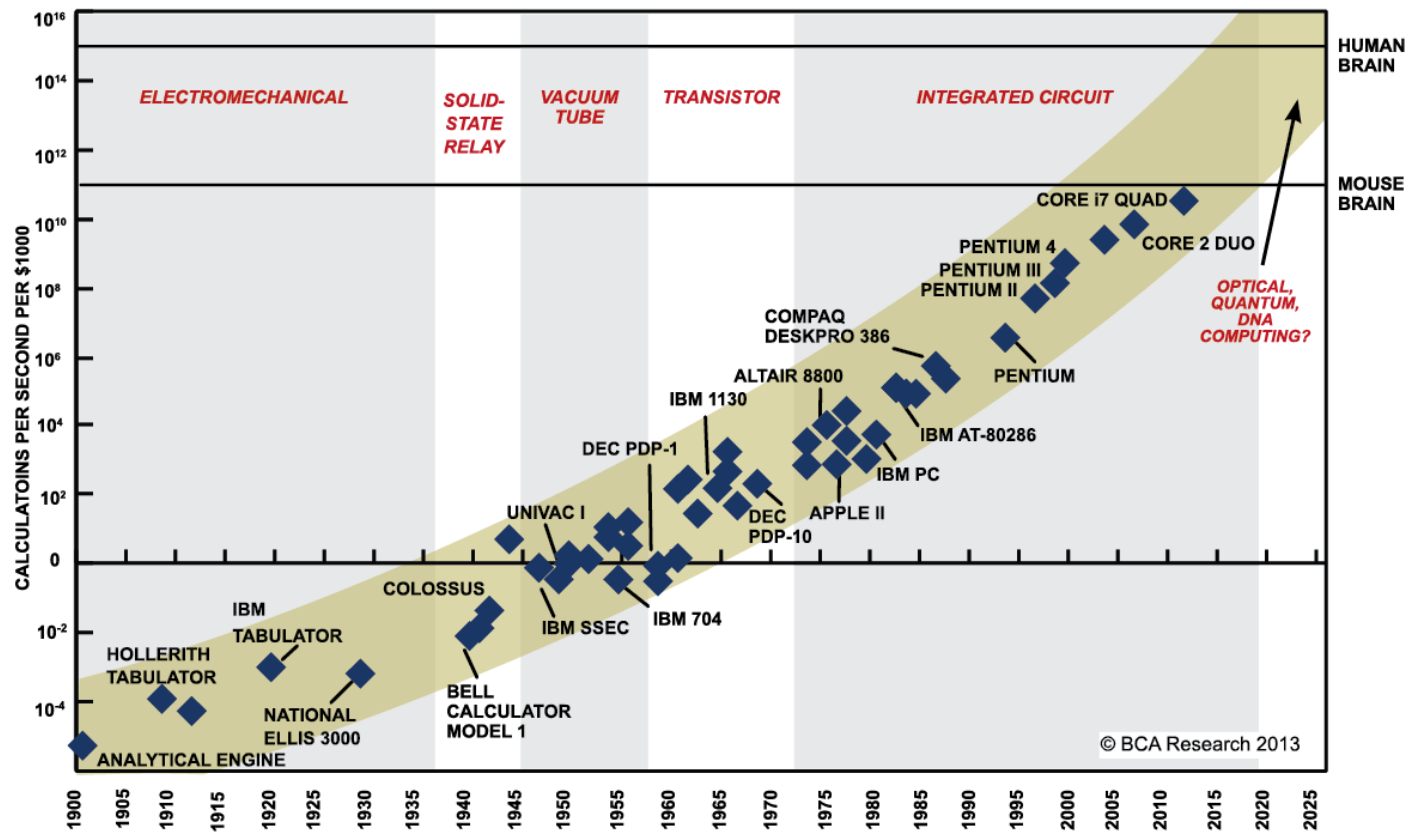
**Moore's Law**



**Copyright Disney**

**Moore's Law** refers to **Moore's** perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved. **Moore's Law** states that we can expect the speed and capability of our computers to increase every couple of years, and we will pay less for them.

# Progression of processing power



SOURCE: RAY KURZWEIL, "THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY", P.67, THE VIKING PRESS, 2006. DATAPPOINTS BETWEEN 2000 AND 2012 REPRESENT BCA ESTIMATES.

# Roadmap to tiny tiny Transistor

## Miniaturization

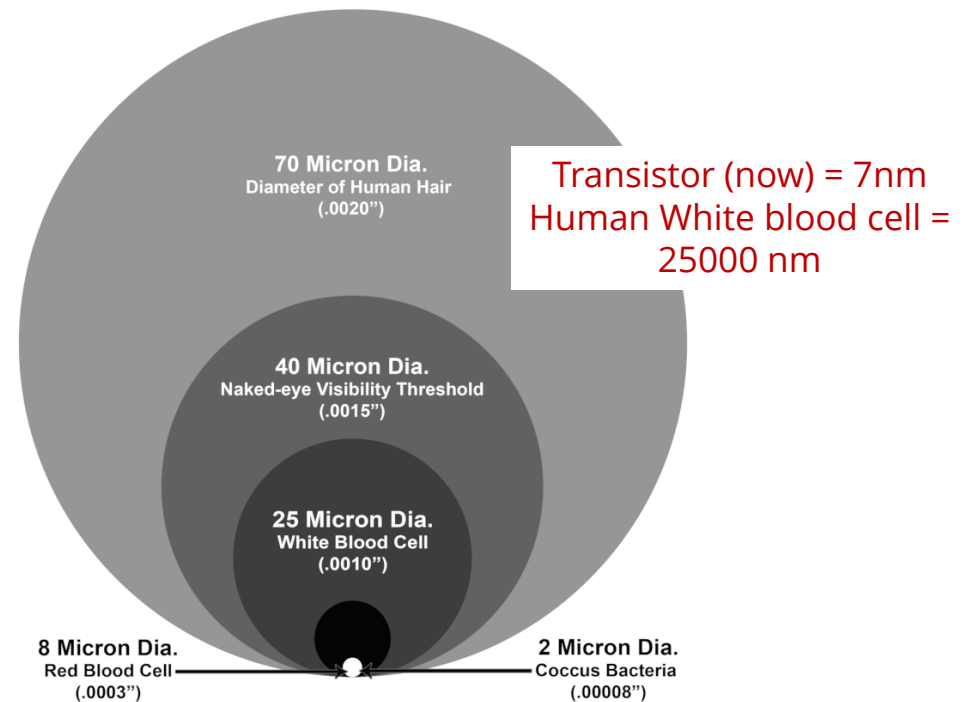
- With Intel 10nm and TSMC 7nm transistors, the density is 90 millions transistors per millimeters.

## Example

- The Core-i5 from Intel at 22nm has 1.4 billions transistors.

## What this means

- Basically, this means pluggables can do way more processing when combined with speed !



Transistor = 3500 x smaller than White blood cell

# EARLY DAYS ADVANCED PLUGGABLES

At the start of 'intelligent pluggable' basic functions were used,  
monitoring for network and small conversion for Broadcast and AV (SDI to HDMI or CVBS)

**SMART**

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**TWAMP**  
Providing Layer 3 Service Assurance

**OAM**  
Enhancing Network Performance

**TSoP**  
Delivering SONET/SDH over Ethernet

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Synchronizing mobile network backhauls

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Migrating your network from legacy TDM technology to Packet has become as simple as replacing a regular transceiver with a Smart SFP™

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Need to support SyncE over a copper connection using SFPs? The Chronos Smart SFP™ TS is intelligent for SyncE in both directions.

**Service Assurance**  
Manage your SLAs with our vendor independent service assurance solutions. The Ethernet OAM and IP OAM Smart SFP™ are NIDs inside an SFP.

Telecom

**HDMI/DVI TO SDI CONVERTER SFP (emSFP)**

SYSTEM ON A CHIP (SoC) | IP GATEWAY SFP | VIDEO SFP OPTICAL | VIDEO SFP COAXIAL | AUDIO SFP COAXIAL | CONVERTER SFP | ACCESSORIES

**EB34TD1R-Sx**  
HDMI 4/3G-SDI emSFP Converter, Single Receiver [MSA or Non-MSA], HDMI Type D \*\*\* NRND \*\*\*

[Description](#) [Features](#) [Benefits](#) [Ordering Information](#)

\*\*\* Not recommended for new design \*\*\* Please see our EB34TD1R-Sx instead

The EB34TD1R-Sx is an electrical video SFP (emSFP) receiver module designed to convert HDMI to an SDI signal output without scaling artifacts. The EB34TD1R-Sx is an HDMI A / DVI-I to SDI video SFP converter. This video SFP is designed to convert HDMI 1.4 or DVI 1.0 input to a legal SMPTE SDI (S, HD/SD-SDI) signal without scaling artifacts. Converter is built-in inside the video SFP and standalone.

This HDMI/DVI video SFP contains frame buffer to suppresses the accumulated low and high frequency jitter (timing and alignment jitter). Up to 2 channels out of the 8 HDMI embedded audio PCM channels are re-embedded in the SDI stream.

\*\*\* Not recommended for new design \*\*\* Please see our EB34TD1R-Sx instead

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EB34TD1R-Sx Datasheet

**BLOCK DIAGRAM**

Media / AV

## Second learning...

- Moore law = More processing
- Adding signals = new way of transporting multiples channel in single connection is TDM in IP !

We will see the new Advanced pluggables



An abstract graphic of a tunnel formed by a series of concentric, semi-circular arches that recede into the distance, creating a strong sense of perspective. The arches are light gray and set against a slightly darker gray background. A bright light source at the far end of the tunnel creates a strong glow and casts long, soft shadows on the floor of the tunnel.

The evolution of pluggables for media applications

# PTP GRAND MASTER PLUGGABLES

## Miniaturization

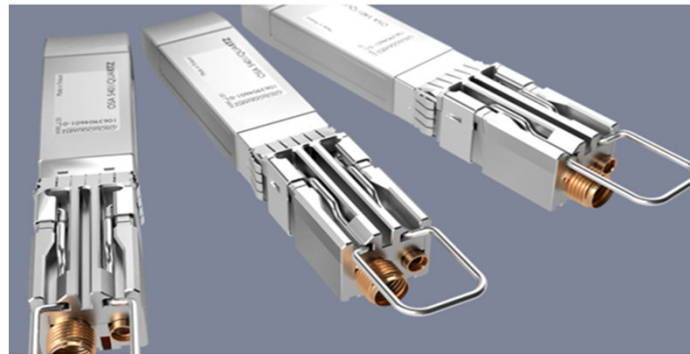
Now available PTP grand master including L2 and L3 multicast

## Fully integrated

GNSS receiver enabling PRTC and IEEE 1588v2 Grand master

## Save space and cost without compromise

Our OSA 5401 is a highly accurate and uniquely efficient small form-factor pluggable (SFP) GNSS receiver and grandmaster clock with the smallest footprint and most compact design on the market. With its entirely new timing distribution architecture, it meets the stringent synchronization requirements of today's radio access networks. The device's small size and low-touch provisioning enables it to be deployed in the most space-restrictive locations. It's also a low-cost solution that consumes minimal energy and needs no additional power source or real estate.



## A huge range of functionality

Our OSA 5401 combines small size with high performance and features a vast amount of advanced functionality.

# EXTREMELY ADVANCED PLUGGABLES

## **Minutuarization**

- Now SFPs can be viewed as Microservices

## **Software-Defined**

- Based on pure processing devices, the advanced SFPs are software-defined.



J2K & JPEG-XS  
Compression

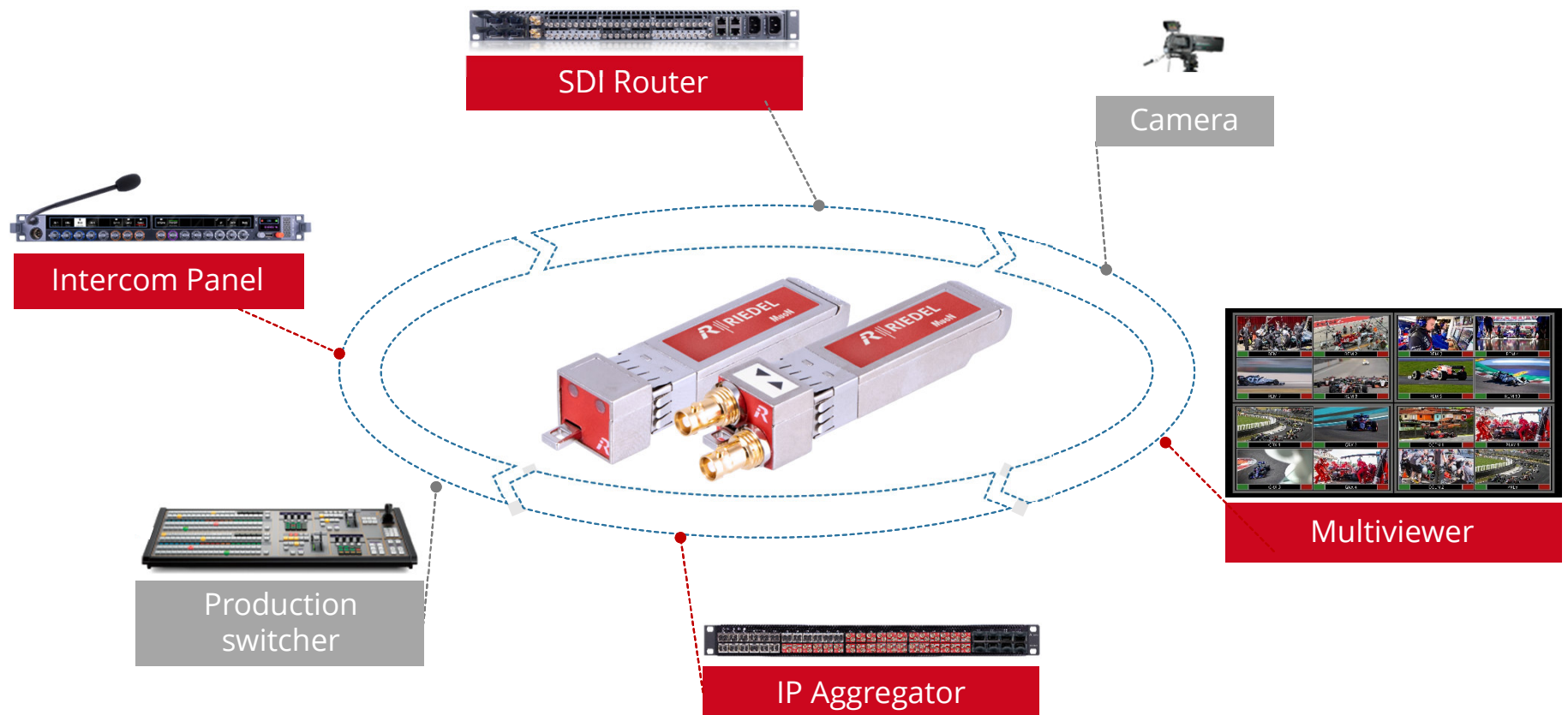
Audio Router

Gateway  
SDI-ST2110

UDC  
Converter

MultiViewer

Encap /  
Decap



SFP aren't just connection point anymore,  
SFP are full grown solutions.

# Software-Defined Processing

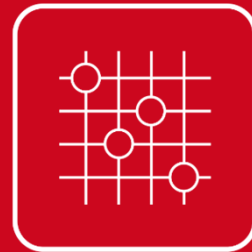
not just a...

# GATEWAY



not just an...

# AUDIO ROUTER





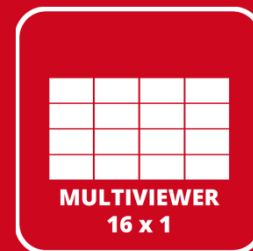
not just a...

# CONVERTER



not just a...

# MULTIVIEWER



not just an...

S F P



IP PROCESSING



IP CONNECTIVITY



# MEDIORNET MUON

IP Processing & IP Connectivity



Q&A  
Thank You!

