

100G w sieciach szkieletowych i miejskich *100G for Long Haul and metro networks*

The Ekinops 360 Multi-Reach Optical Transport Platform

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3.2 TERABITS PER SECOND CARRIER CLASS TRANSPORT

ETHERNET, SONET/SDH, FIBER CHANNEL, UNCOMPRESSED HD/SD-SDI/ASI VIDEO FLEXIBLE MULTI-PROTOCOL AGGREGATION



□ Key challenges to transport 100Gb/s

- ⇒ Those systems should be deployable over existing 10Gb/s systems using 10G link engineering design rules

□ Typical 10G link engineering rules are:

- ⇒ Chromatic Dispersion (CD) tolerance of 800 ps/nm
- ⇒ Polarization Mode Dispersion (PMD) Tolerance of 10ps (Mean DGD)
- ⇒ Optical reach up to 2000km
- ⇒ Operation at 50GHz channel spacing
- ⇒ Transit through multiple cascaded ROADMs



❑ OSNR performance Coherent versus Direct detection

- ⇒ Binary PSK : only 0,7dB in favor of coherent detection
- ⇒ Quaternary PSK offer 2,5dB more with coherent detection
 - Allows OSNR increased to go more than 1500kms
 - Allows 50GHz spacing

❑ Advantage of coherent detection

- ⇒ Phase information passes into the electrical domain at receive side
 - Analog/digital filters can be used for PMD and CD compensation
 - A single channel can be filtered from many DWDM channels by tuning the local oscillator (tunable laser at received side)



□ Design criteria that must be meet:

- Optical reach > 2000km done
- Support 50GHz DWDM channel spacing done
- No change to existing DWDM equipment done
- Non traffic affecting upgrades on existing 2,5/10/40Gb/s done
- Must not induce crosstalk penalty on existing DWDM channels limitation
- Power per channel must be $\sim +2\text{dBm}$ done
- Chromatic Dispersion tolerance of $\pm 800\text{ps/nm}$ 50000ps/nm
- Polarisation Mode Dispersion tolerance of 10ps (mean DGD) 30ps
- Ability to express channel through ≥ 5 cascaded ROADMs@50GHz spacing done
- Ability to express channel through ≥ 25 cascaded ROADMs @100GHz spacing done
- Automated dispersion tuning done
- Full band Lasers on 50GHz grid done
- Must be bit to bit transparent for the 100GbE client interface, no flow control or packet loss at transport layer done
- Must be "plug and play" and installable by existing technicians "no PhD with screwdrivers" required for installation done

□ 100G already at the second generation

⇒ 1st Generation

- PM QPSK, DP BPSK, ...
- OSNR 16/17dB

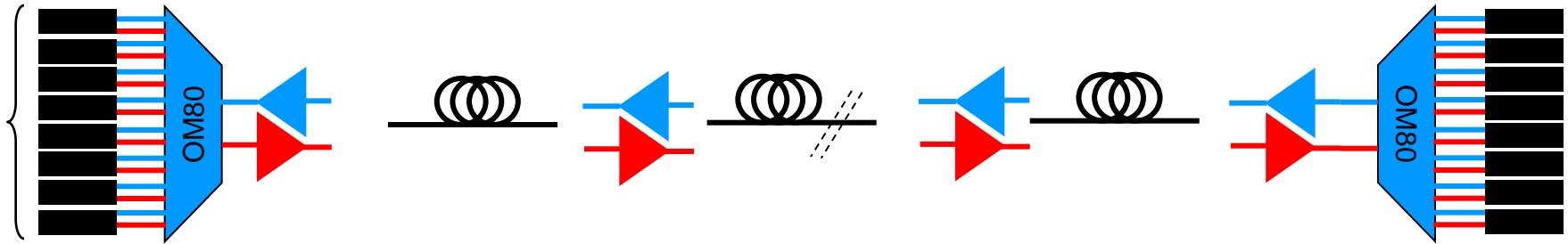
⇒ 2nd Generation

- DP QPSK
- OSNR 14dB

⇒ 3rd Generation

- DynaFEC
- OSNR 12dB

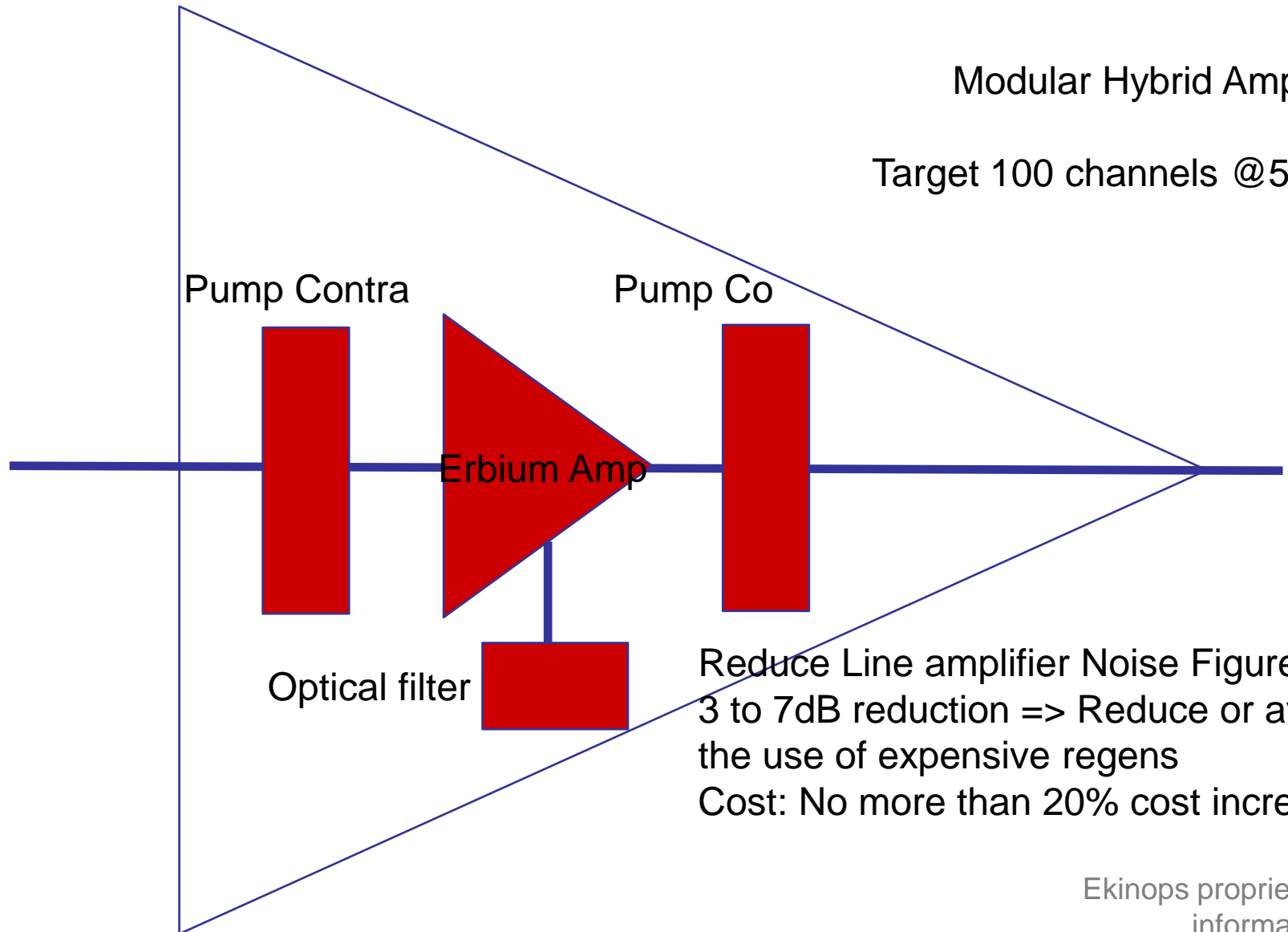
Impact of 100G Transport



3000 Km link /10 channels

	10G	100G	
Line	~3M€	~2,7M€	
No Regen	0,1M€ (3,1M€)	1,3M€ (4,0M€)	12dB
One Regen	0,2M€ (3,2M€)	2,6M€ (5,3M€)	14dB
Two Regen	0,3M€ (3,3M€)	3,9M€ (6,6M€)	16dB

Clearly Minimum OSNR is the key target:
 Ekinops is working on 2 directions:
 DynaFEC to reduce OSNR limit and Low Noise Amps





New 100G Platform



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New 100Gb/s chassis



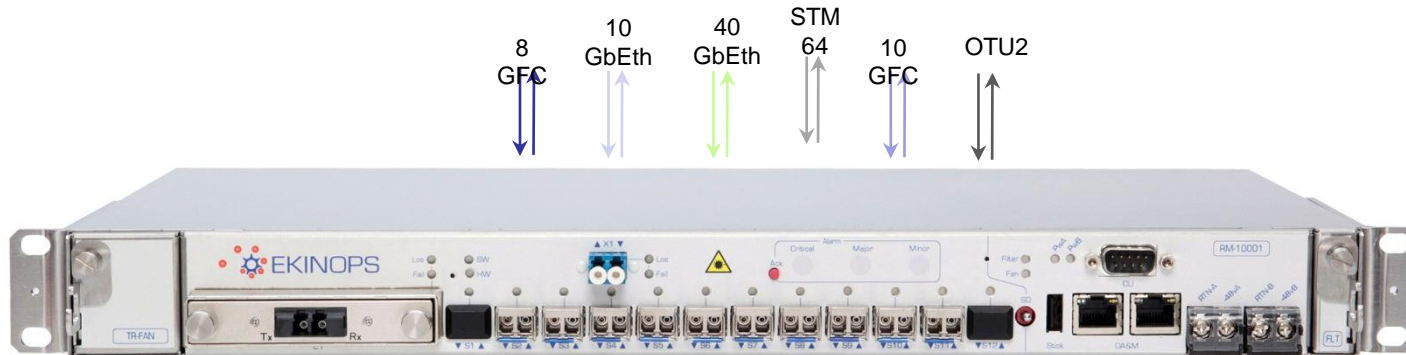
1 single chassis – 2 configurations



□ Key differentiating factors and benefits

- ⇒ Very compact **form factor**: the Ekinops 100G product fits into a **1 RU chassis**:
- Allows service providers to incrementally use space and dollars only when they need to increase the capacity of their network
 - Ideal for space constrained applications or for carriers looking to deploy only a few 100G cards in a small amount of space

Ekinops 100G offering



□ Key differentiating factors and benefits (cont'd)

⇒ The same hardware platform can be used either as a 100G **transponder** or as a **Muxponder**. All that's needed is a firmware change

□ RM 10001: 100GTransponder

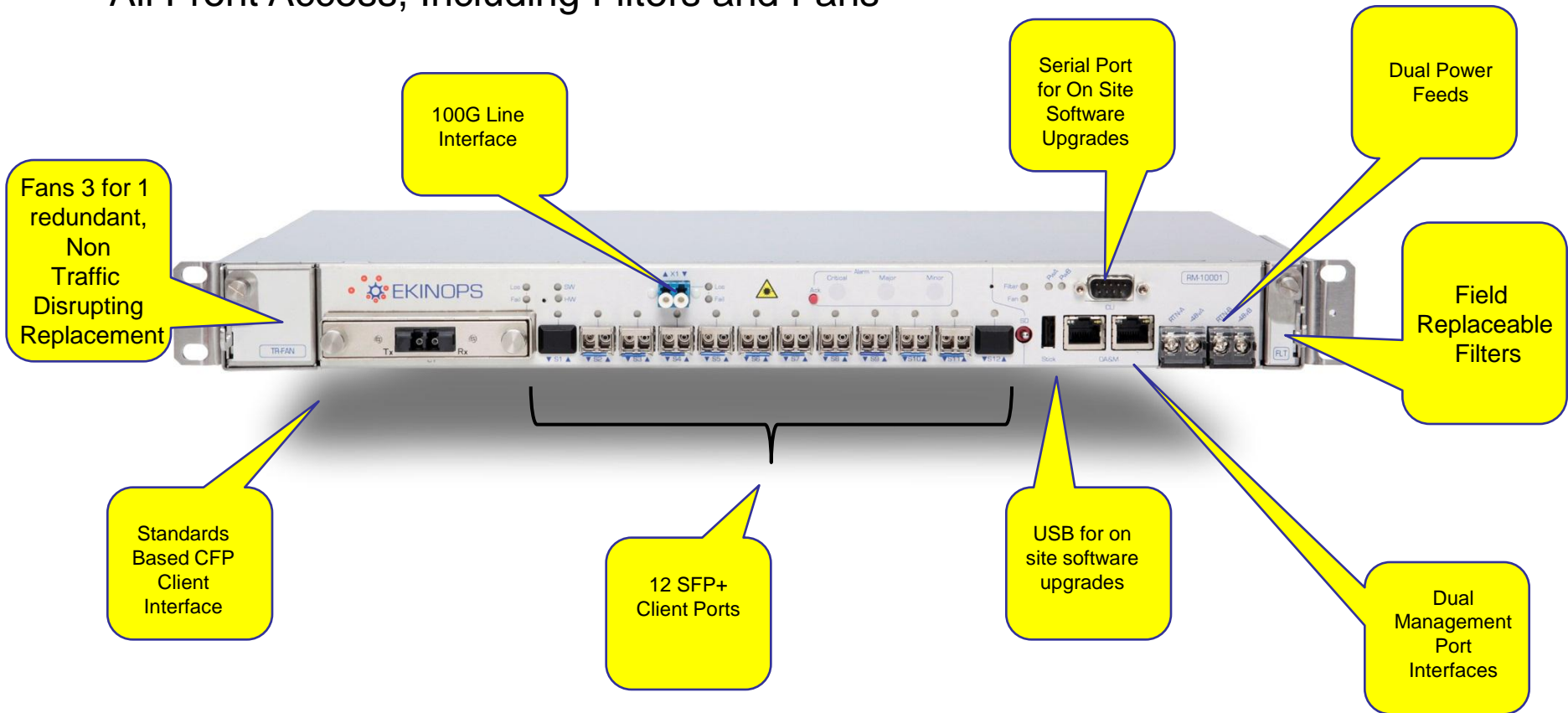
- 1 client port at 100G, 1 line port at 100G

□ RM 10012: 100GMuxponder

- 10 clients ports at 10 GbE, 1 line port at 100G
- Evolution to Multi protocol version in 2012
- Up to 12 clients ports available for multi-bit rate aggregation

Release 7.0: 100G 1 RU standalone Chassis

All Front Access, Including Filters and Fans



Standards based OTU4 Line Interface

100G Long Haul transponder



Release 7.0

□ Utilizes the same hardware as 10G and 40G lines (filters, amps, etc.)

⇒ Compatible with all our MUW/DMUX, including the non Flat Top Mux

□ Target distance:

- ⇒ 100G DP-QPSK modulation format line interface and coherent receiver, tunable 100G, 100 GHz & 50 GHz grid compatible
- ⇒ Up to 1500 km
- ⇒ 200 km on a single span (Without Raman),
- ⇒ 2000+ with hybrid amplification

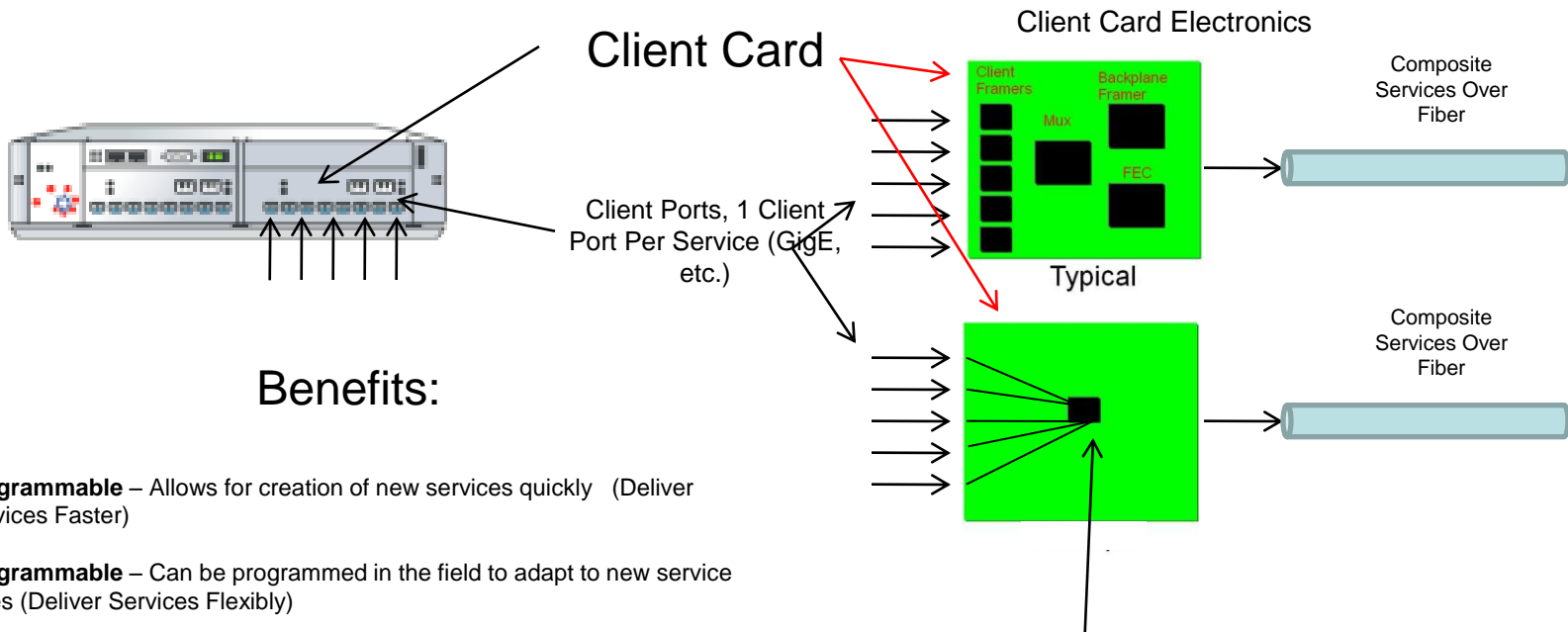
□ Consumption: less than 200W

□ 2 Different application on the same 1 RU chassis:

- ⇒ 100G Native transponder/CFP Interface
- ⇒ 100G Muxponder, with Up to 12 client ports
 - Initial release, 10 client ports used for 10GbE

□ Applications: Upgrade Existing Ekinops Deployments, Green field, Foreign Wave over existing systems

T-Chip (Transport on a Chip) Technology



Benefits:

Programmable – Allows for creation of new services quickly (Deliver Services Faster)

Programmable – Can be programmed in the field to adapt to new service types (Deliver Services Flexibly)

Ease of Manufacturing – Fewer chips on the board (Deliver Services Faster)

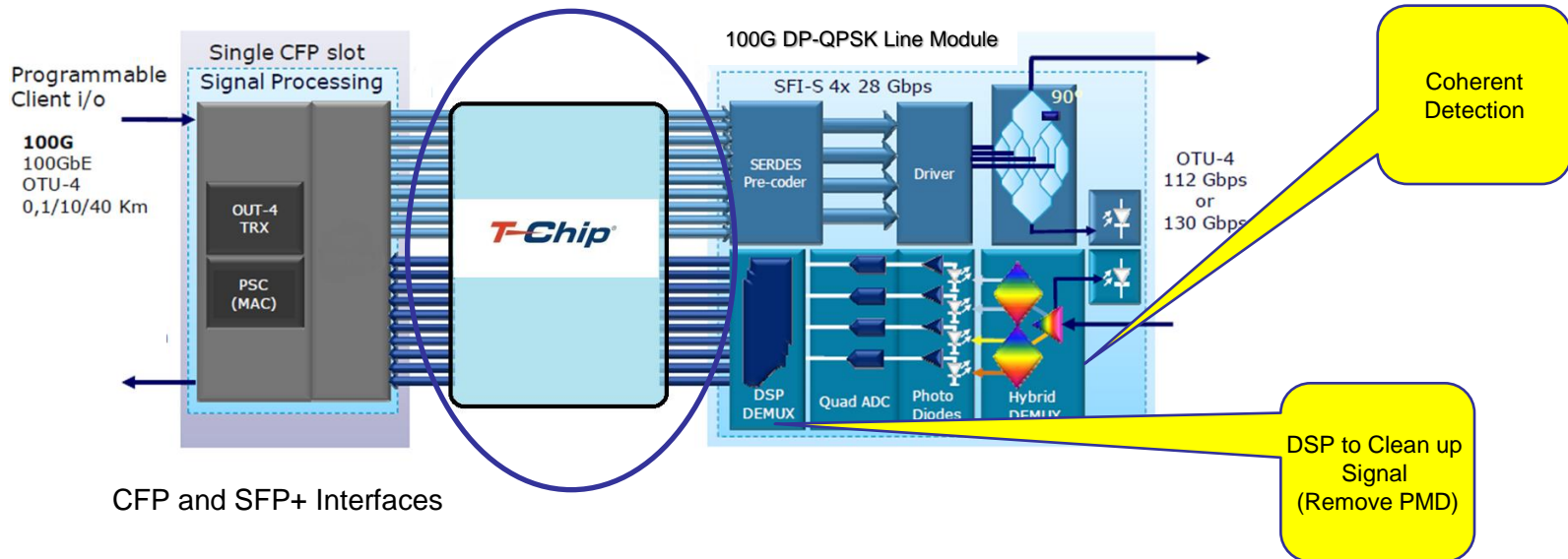
Lower Power Consumption – Fewer chips to draw power (Deliver Services more cost effectively)

Less Space – Cheaper to house equipment (Deliver Services more cost effectively)

In general, fewer chips = lower cost

T-Chip® *TRANSPORT ON A CHIP TECHNOLOGY*

How can we get better OSNR performance?



- ❑ T-Chip adds FEC in addition to the FEC defined by the 100G/OTN standards
- ❑ T-Chip is also allows for better aggregation than other solutions
 - ⇒ In fact, we can take advantage of everything we have done at 10G!
- ❑ In general, T-Chip allows us to do things ahead of the market

Long Haul Line Interface Specifications

Parameter	Min	Typ	Max	Unit	Note
Mechanical					
Optical Connector		LC/UPC			
Electrical					
Power Consumption		100	120	W	
Data Rate OTU-4V mode		127.156		Gb/s	
Optical					
Frequency Range	191.35		196.10	THz	96 channels
Output Power	-1		2	dBm	
Input Power	-18		+5	dBm	
Required OSNR 0.1nm			14	dB	
CD Tolerance	40,000			ps/nm	May work up to 55,000ps/nm
DGD Tolerance	100			ps	
SOP Tracking Speed	50			kHz	
Optical Bandwidth Tolerance	28		>100	GHz	

□ Key differentiating factors and benefits (cont'd)

- ⇒ And finally, just like at 10G, Ekinops will provide the **lowest Total Cost of Ownership** by significantly reducing the cost of each 100G wavelength
 - Based on market price information from Ovum and if cost of space and cost of commons are taken into account, the Ekinops 100G solution is **30% less than market price**

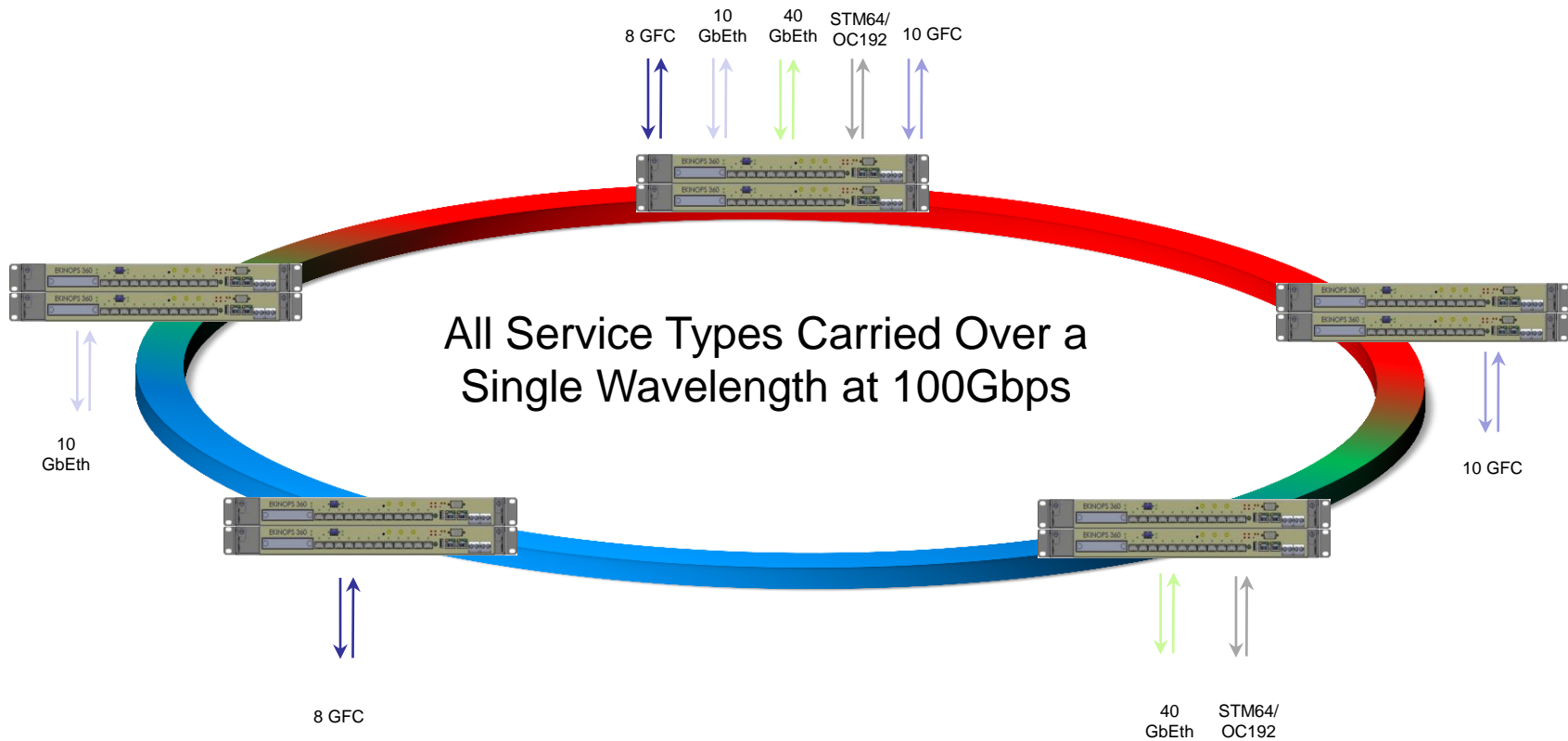


Ovum Report: ***Optical Networks Volumes and Revenue History and Forecast***

Regions Included: North America, Europe, Middle East, Africa, Asia-Pacific, South & Central America

Dated June 8, 2011

RM 10012MP: Multi-Protocol Aggregation LH coherent



Cost Effective Multiplexing of any mix of service types over a single wavelength
(Utilize the C1008MP for lower rate Aggregation)

□ Key differentiating factors and benefits (cont'd)

- ⇒ The Ekinops 100G solution will come in two versions so service providers can **meet all 100G transport requirements** with the same architecture, management and supplier, **regardless of distance**:
- A **long-haul** version that will deliver 80 channels on a 50 GHz grid
 - A **metro / regional** version that will deliver 40 channels on a 100 GHz grid at a much lower cost

Key challenges for Metro/Regional networks

□ Key challenges to transport 100Gb/s in metro networks

- ⇒ Short distances between nodes
- ⇒ Focus on low cost duo that metro networks often deployed by using:
 - Passive DWDM components
 - DWDM optics installed in equipment (XFP)

□ Typical 10G link engineering rules are:

- ⇒ Chromatic Dispersion (CD) tolerance of 800 ps/nm
- ⇒ Optical reach up to 1000km
- ⇒ Operation at 50GHz or 1000GHz channel spacing
- ⇒ Transit through multiple cascaded ROADMs/OADMs

100G Metro Advantages

- ❑ Low cost
 - ⇒ Minimum 50% lower compare to coherent

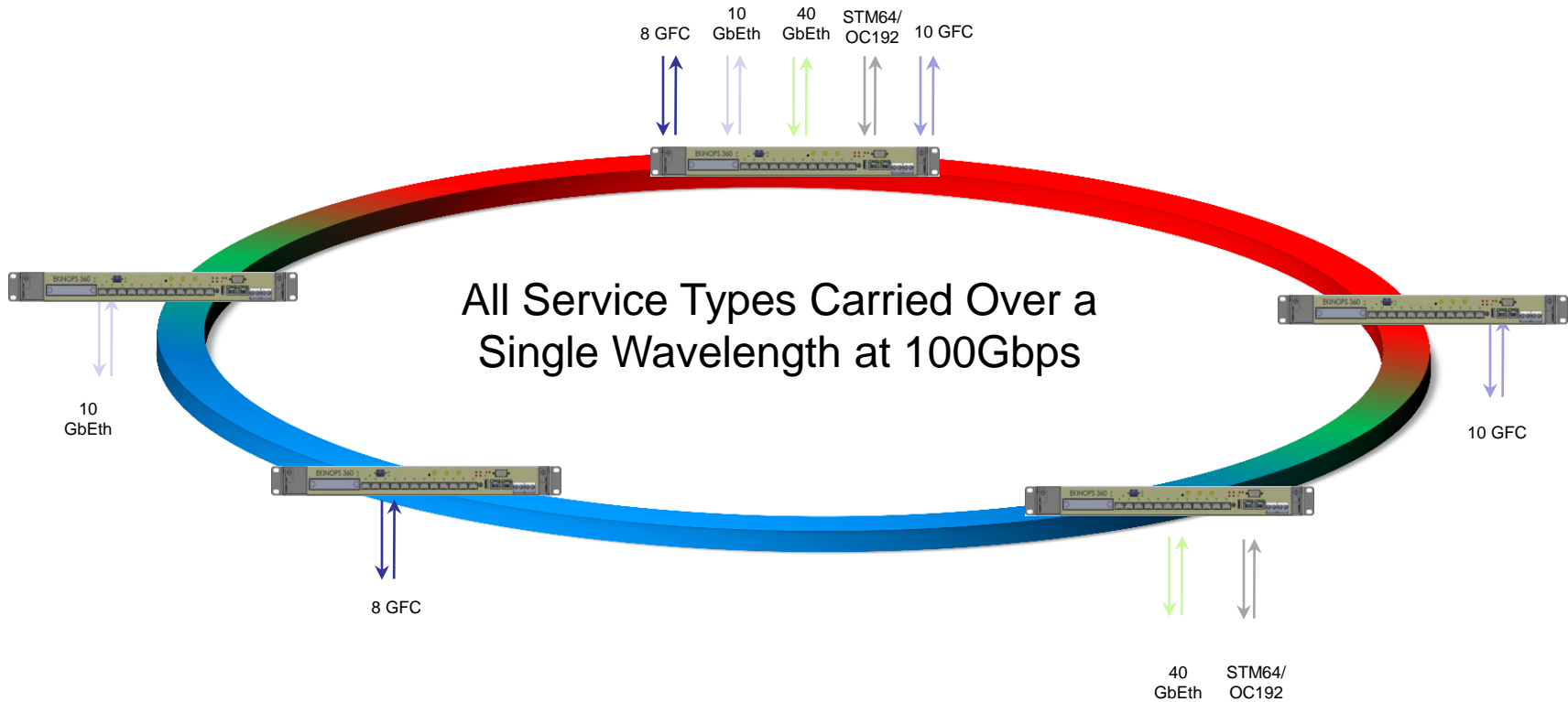
- ❑ Low consumption
 - ⇒ Minimum 70% lower compare to coherent

- ❑ Low latency
 - ⇒ No DSP processing

- ❑ ADM capability inside a 100GbE channel with 25GbE granularity !
 - ⇒ Simple optical extraction without the need to demodulate/remodulate a full coherent 100GbE
 - ⇒ This is a very cost effective way of delivering 10G service versus competitors

- ❑ Full 100GbE ADM with 2 line ports (East/West) in 1RU box

RM 10010MP: Multi-Protocol Aggregation ADM Metro



Cost Effective Multiplexing of any mix of service types over a single wavelength
(Utilize the C1008MP for lower rate Aggregation)

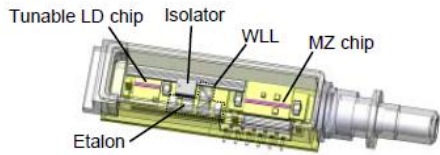


□ RM 10012: 100GMuxponder & ADM

- 10 clients ports at 10 GbE, 1 line port at 100G
- Evolution to Multi protocol version in 2012
- Up to 12 clients ports available for multi-bit rate aggregation
- ADM functionality – second 100G port

1 single chassis – **2** configurations

100G Metro Line Interface

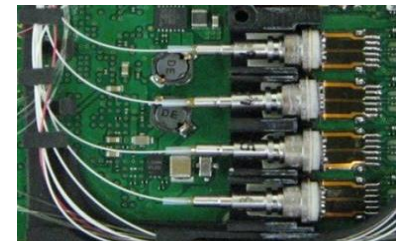
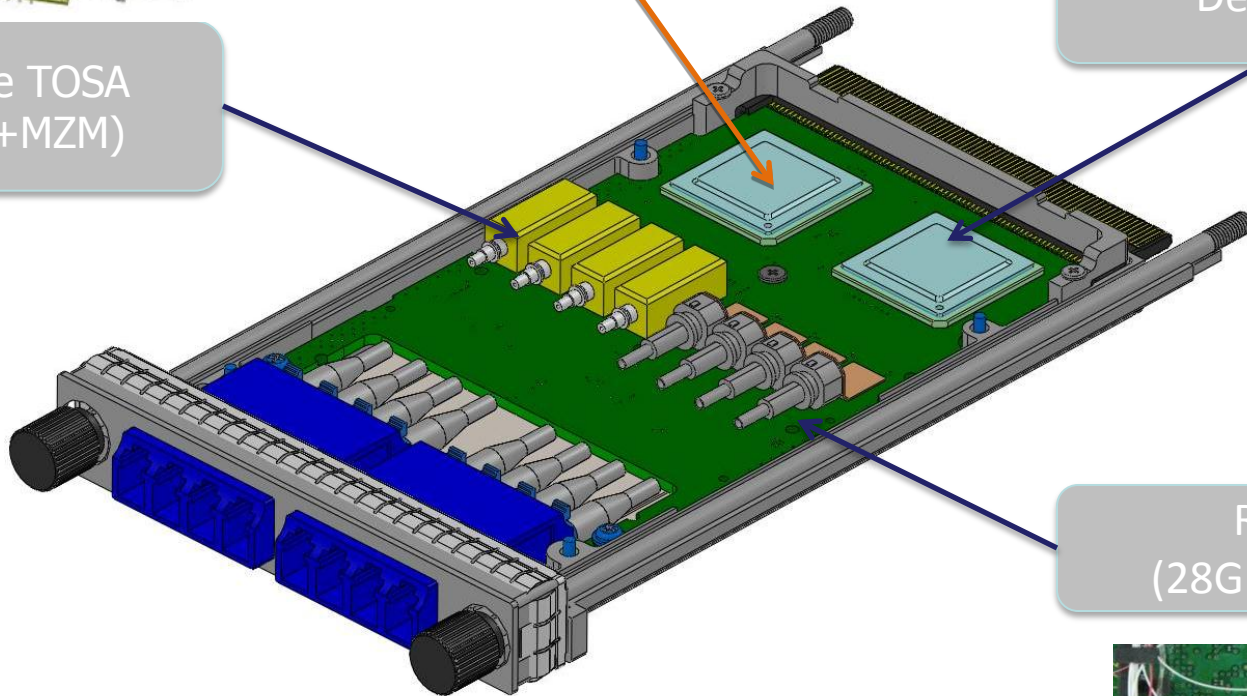


Tunable TOSA
(Laser+MZM)

Mux w/ ODB
precoder

Demux

ROSA
(28G PD+TIA)



100G Metro DWDM Specs



	4x28G in 2 ITU channels With MLSE receiver and high Rx sensitivity
OSNR (dB*0.1nm)	16
CD (ps/nm)	+/-700
DGD (ps)	20
Rx Sensitivity (dBm)	-18
Spectral Efficiency (10GB/s/ITU)	5
Power (W)	21

Why Ekinops?



- ✓ Very compact **form factor**: the Ekinops 100G product fits into a **1 RU chassis**
- ✓ The same hardware platform can be used either as a 100G **transponder** or as a **Muxponder**
- ✓ Utilizes Ekinops **DynaFEC** technology to **increase the 100G distance performance** and **reduce latency** beyond that of standard 100G transponders
- ✓ The Ekinops 100G solution will come in two versions so service providers can **meet all 100G transport requirements** with the same architecture, management and supplier, **regardless of distance**.
- ✓ And finally, just like at 10G, Ekinops will provide the **lowest Total Cost of Ownership** by significantly reducing the cost of each 100G wavelength

Who is Ekinops



Building Cost Effective Optical Networks

- ❑ Private company, founded in 2003
- ❑ Headquarters in Lannion, France
- ❑ Pre-Sales & Post-Sales: Europe, US, APAC
- ❑ Innovative vendor of **Layer 1 optical aggregation & transport equipment** for University, Enterprise, and Service Provider Networks
- ❑ **Dynamic Optical Transport Solutions**
- ❑ Patents Held In Optical Aggregation and Transport



EKINOPS 360
Modular, scale investment
as you grow.
www.ekinops.net



□ Today Ekinops is involved in 3 European projects

⇒ **100GFlex (with Orange Labs)**

- **Multi band OFDM at 100Gb/s and above**
- 100Gb/s @ 50GHz
- Add/Drop capabilities for Metro Networks

⇒ **EO-NET (with Bell Labs/ALU)**

- **Elastic Optical NETWORKS**
- Developing Elastic concept in DWDM networks for an optimum resource usage

⇒ **SASER (with NSN)**

- **Optimized Hybrid Amplifier (Erbium/Raman)**
 - **For 100G /400G/1T transport.**

Tried and True

Deployed Globally , Enterprises, Service Providers, Municipals, Research and Education





EKINOPS
Optimizing Optical Networks

Thank you

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Ekinops Proprietary information

www.ekinops.net