

# Caliopa The Case

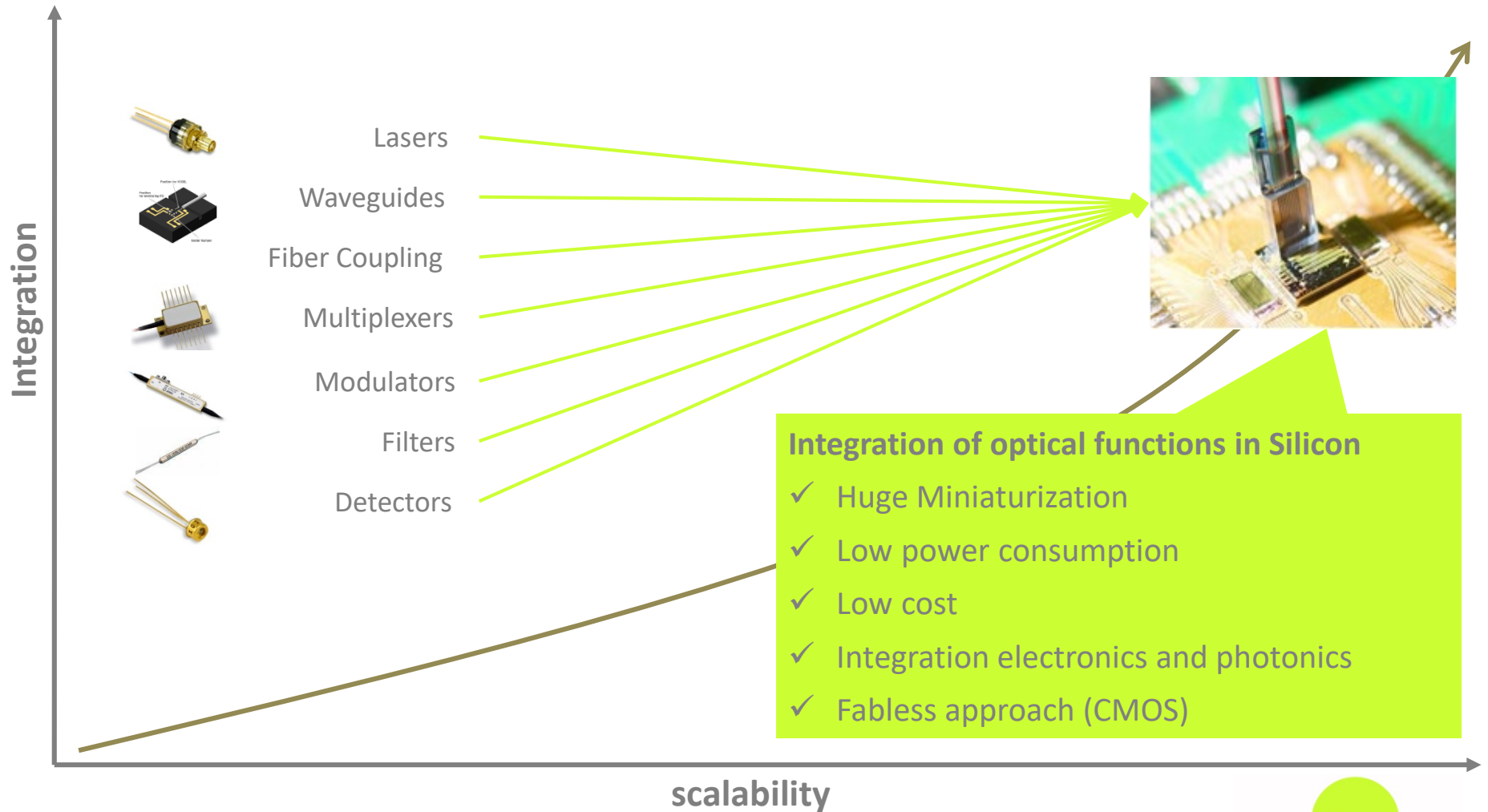
October 2018

# Summary

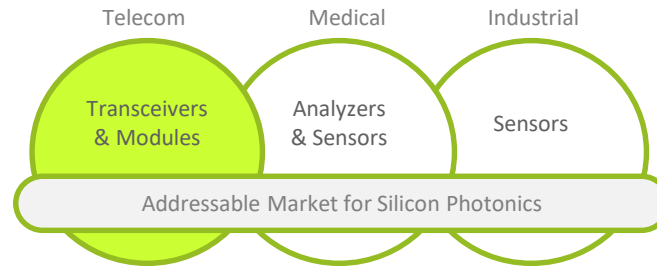
- Caliopa Overview
- The Funding round
- The Exit round
- Lessons learned

# The plan in 2009

# Bringing Moore's Law to Photonics



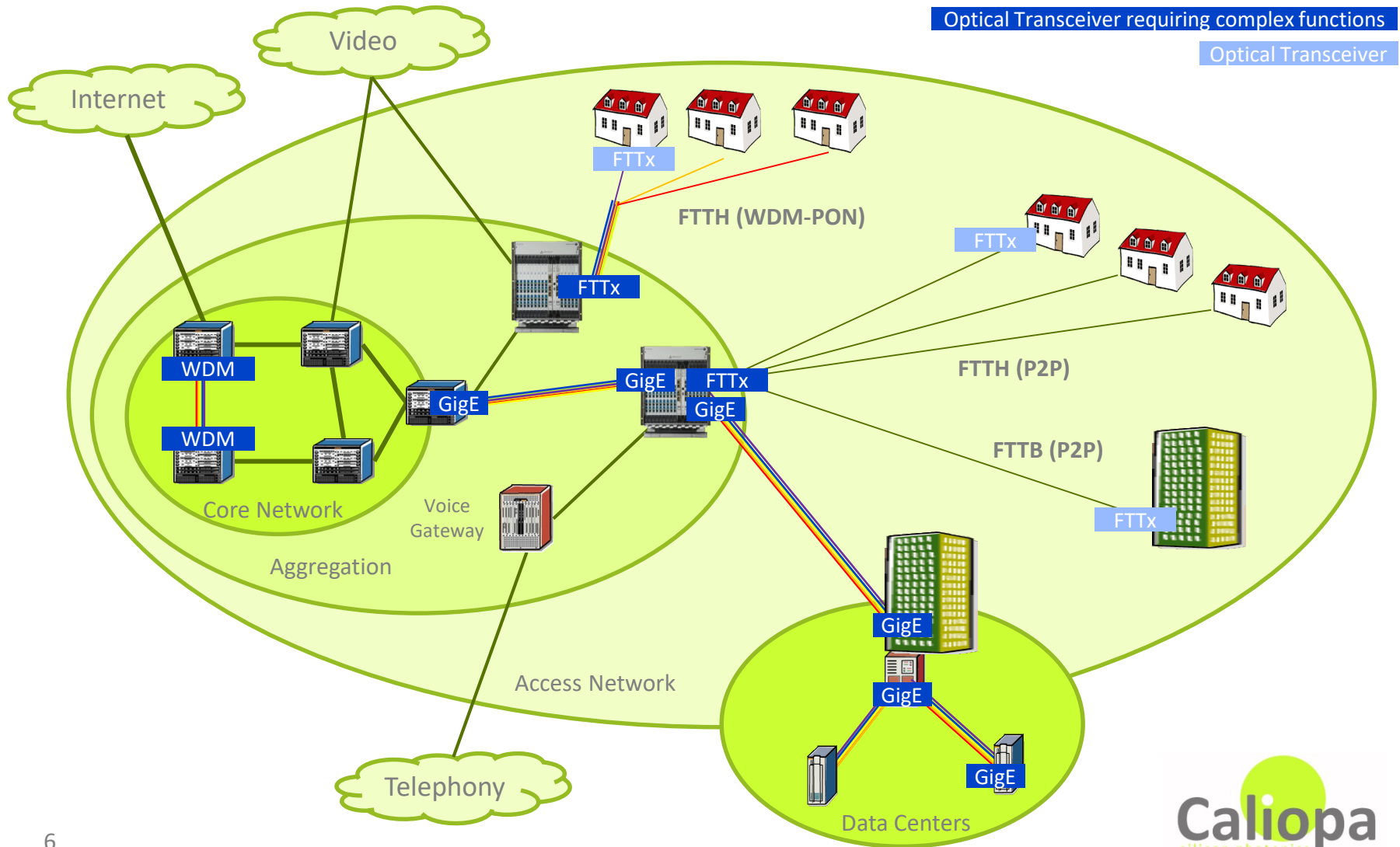
# Mission Statement



Become global market leader in  
advanced optical transceiver modules  
using Silicon Photonics  
for data and telecommunications

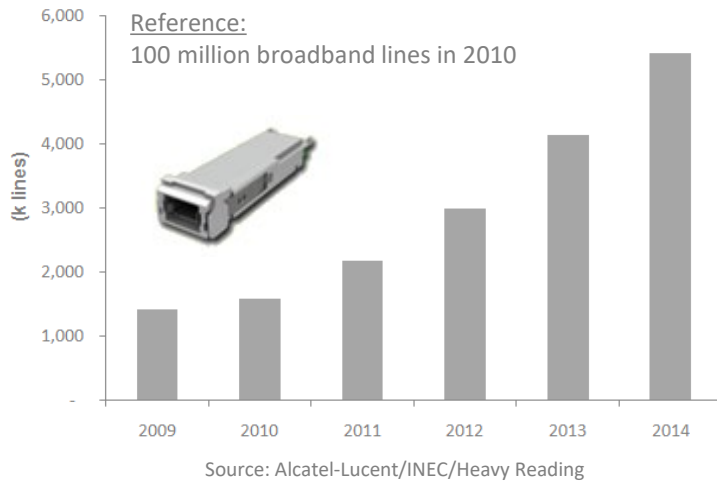


# Market & Applications: Optical Transceivers

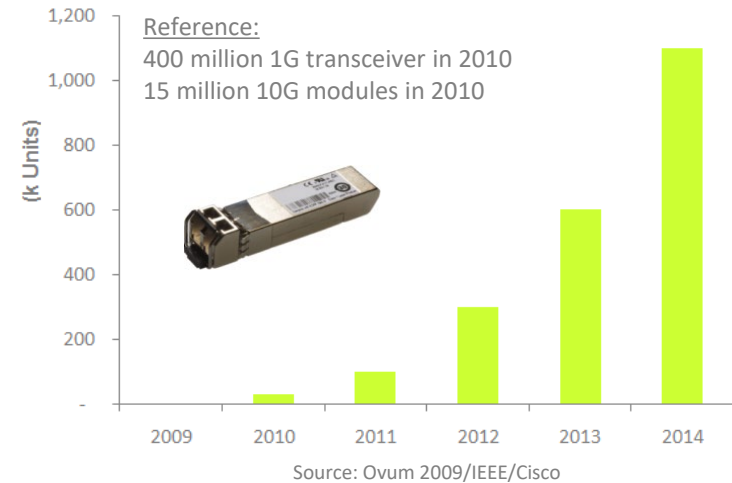


# Addressable Market

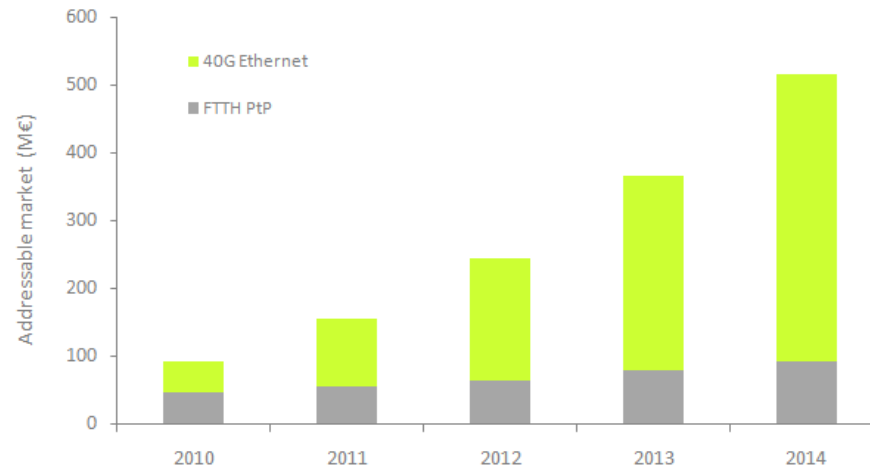
## First Market: Point-to-Point Fiber-to-the-Home



## Second Market: 40 Gigabit Ethernet



## Addressable market (in Value)

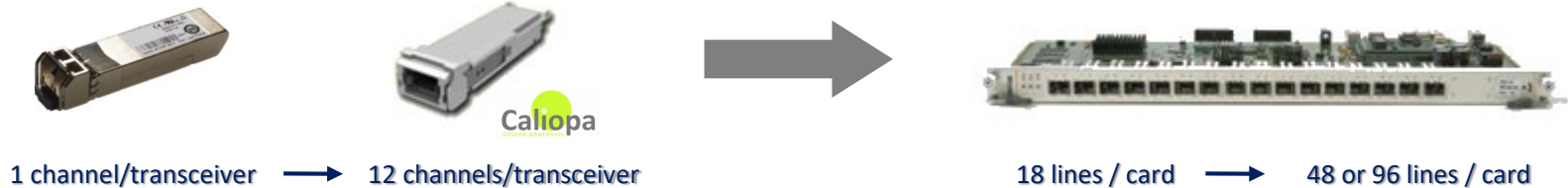


# Point to Point Fiber to the Home

## Caliopa differentiators

- **Higher density**

- 12 channels/module allows up to 5x more channels per line card
  - Alcatel, Cisco and Huawei confirm the need for higher density
- Fiber ribbon input reduces rack cabling complexity



- **Half the power consumption & cheaper**

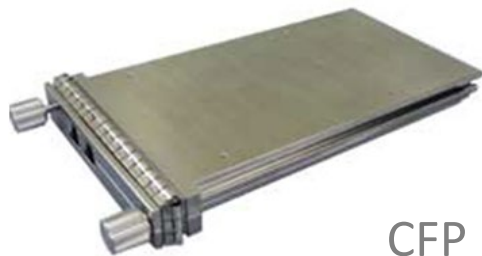
- 50% reduction in power consumption thanks to high efficient laser source (VCSELs)
- 40% Lower CAPEX thanks to cheaper module & optimized use of line card electronics
- 50% Lower OPEX thanks to lower power consumption & floor space



# 40 Gigabit Ethernet Caliopa differentiators

- **Smaller/cheaper**

- Mass deployment of 40G: only with cheap SFP+
  - Can only be implemented in Silicon Photonics
  - Both Cisco and Alcatel confirmed the need for a cheap 40G SFP+ module



CFP

86 x 127 x 14 mm  
Opnext 100GBASE-LR4



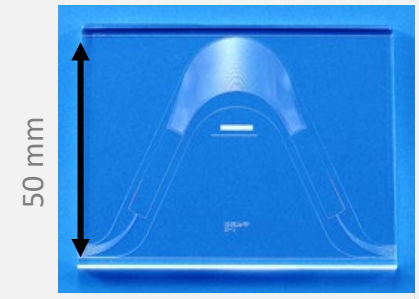
Caliopa  
SFP+

15 x 57 x 12 mm  
Caliopa 100GBASE-LR4

- **Low power consumption**

- Use of efficient lasers (VCSELs)

## WDM implementation



50 mm

Glass



5 mm

InP or GaAs



0.2 mm

Silicon Photonics

# Product Roadmap

Gigabit Ethernet



## 40G Ethernet

- 40GBASE-LR4
- Small (SFP+)
- Low Power & Cheaper
- Shipping: E2012



## 100G Ethernet

- 100GBASE-LR4
- Small (SFP+)
- Low Power & Cheaper
- Shipping: E2013

FTTH



## Multichannel P2P OLT

- 1000BASE-BX10
- Higher linecard density
- Low power & Cheaper
- Timing
  - Prototype : Ready
  - Alpha: Mid 2010
  - Beta: End 2010
  - First delivery: Q3 2011



## WDM-PON OLT

- Cheaper
- Timing: E2014

2010

2011

2012

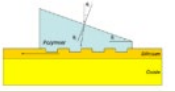
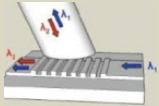
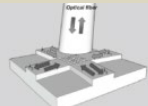


2013

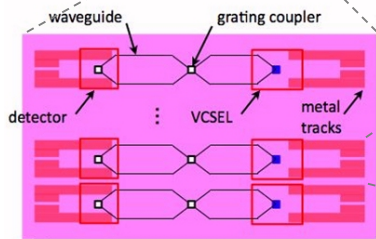
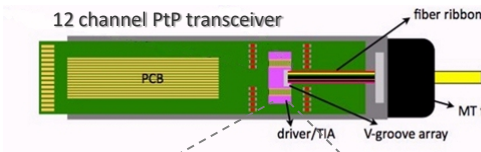
2014

# Caliopa IP & Know-how

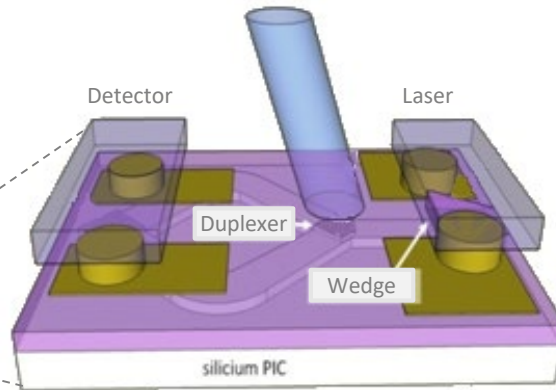
Protects the main challenge in Silicon Photonics: coupling light in and out the silicon

## Patents & Know How

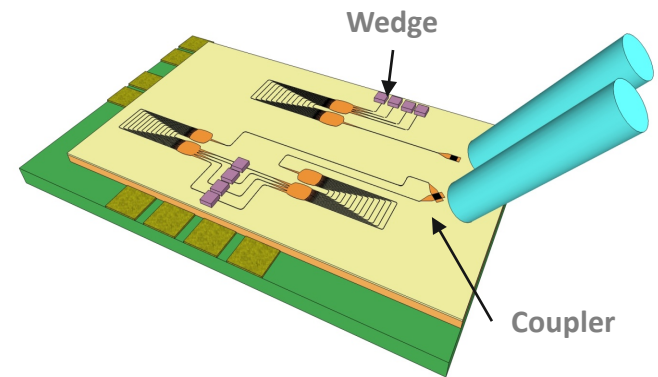
<b>Polymer Wedge</b>  PCT/EP2009/05604	<b>1D duplexer</b>  PCT/EP2009/056049	<b>2D duplexer</b>  PCT/EP2008/054091	<b>2D coupler</b>  US7065272 - EP1353200(*)	<b>Silicon Processing know-how</b> 
Coupling of Laser source to Silicon	Duplex transmit & receive to single fiber => mandatory for FTTH applications		cheaper optical chip production & testing	5 years of experience in implementing Photonics in CMOS



Optical Chip in Silicon



Use of IP for PtP Fiber to the Home

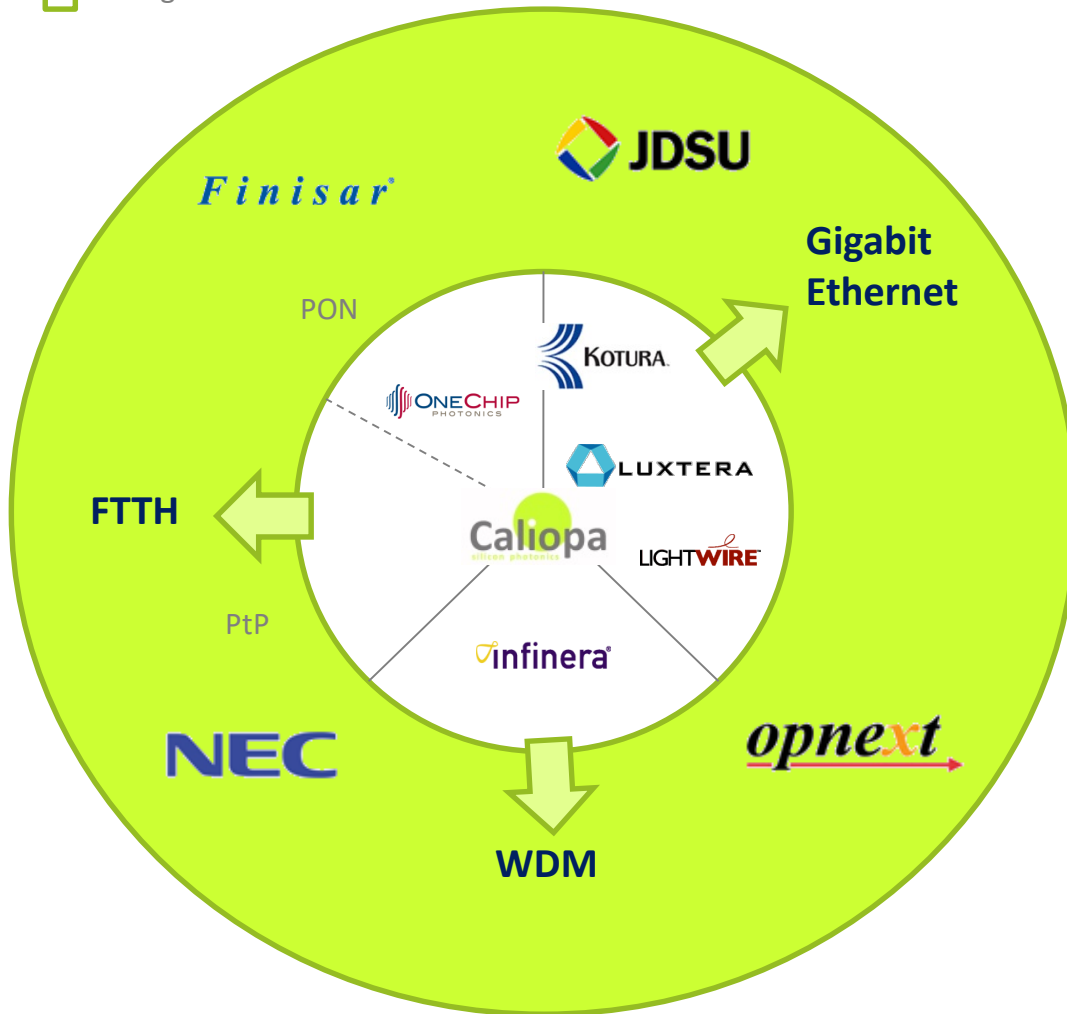


Use of IP for 40G Ethernet

\* Luxtera owns similar patent but for US only

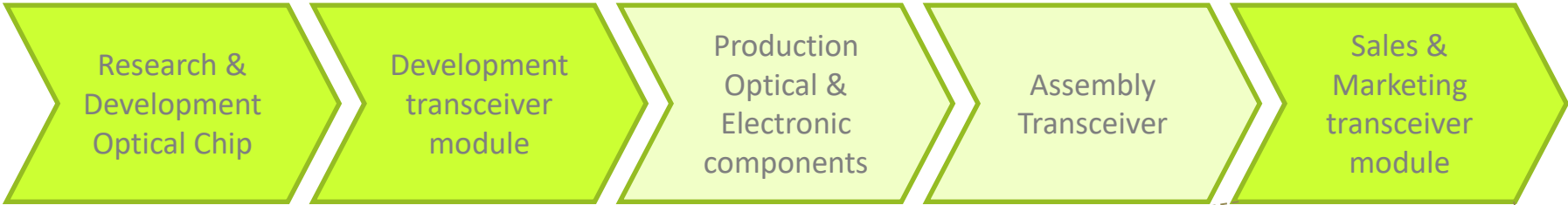
# Competition

- Discrete Photonics
- Integrated Photonics



- Discrete photonics
  - JDSU, Optium, Opnext, Finisar, NEC
  - Limited capacity to integrate
- Alternative Integrated Technology
  - OneChip & Infinera (all in InP)
  - Passive components in glass & active components in InP or GaAs
  - Or all components in InP or GaAs
- Silicon Photonics
  - Luxtera, Lightwire & Kotura
  - Passive optical components in Si
  - Active components in InP or GaAs

# Business Model & Value Chain



■ In-house    ■ Outsourced

Customers



System builders



Service Providers



# Exit - Potential Buyers

## Competition

### Discrete Photonics ('Incumbents')

Disrupting technology is direct threat to core business

*Most likely: Finisar, JDSU & Opnext (\*)*

### Integrated Photonics

Complementary market or technology

*Most likely: Luxtera, Infinera & Enablence*

## Suppliers

Access to transceiver market

Photonic-Electronic integration threatens core business

*Most likely:  
Zarlink, Gigoptix & Phyworks*



## Customers

Huawei has already shown interest to the technology & may want exclusive access  
Alcatel-Lucent  
Cisco

## Adjacent Industries

### Micro Processors

Investing in Silicon Photonics for on- and inter-chip and inter-device communication

*Most likely: Intel , IBM*

### Telecom Semiconductors

FTTH & GE are next steps in their customers product roadmaps

*Most Likely: Broadcom, TI & NXP*

### Others like Automotive, Optical Service & technology providers

Access to technology for application in automotive, optical services or to offer the technology

*Most Likely: Melexis & Cyoptics*

*(\*) more extensive list available*

# Financial needs: original plan (2009)

- Total funding: 6.5 M€ from B2010 until E2012
  - 5.0 M€ from investors
  - 1.5 M€ from Flemish government (IWT)
- A-Round: April 2010 - April 2012
  - VC Funding 2.0 M€ + government funding 1.5 M€
  - Condition: proof of concept FTTH Feb 2010
  - Output:
    - Telcordia qualified product: Mid 2011
    - Customer design-win : Mid 2011
    - Alpha samples 40G Ethernet: Mid 2011
- B-Round: April 2012 - End 2012
  - VC Funding 3.0 M€
  - Condition: working product and customer commitments
  - Output:
    - Product shipping FTTH: Q4 2011
    - EBIT breakeven: Q4 2012

# The reality in 2013



# The creation and funding

- First IOF funding between 2007 and 2010
  - Strong preparation by IOF-er and Prof/researchers
  - EIR/CTO already joined in 2009
  - POC shown by B 2010
- Creation in 2010
  - First looking for money from traditional players (GIMV, Capricorn, BigBang,..): feedback: FTTH too small market; technology too uncertain; NO investment
  - Investment from Baekeland, Fidimec, PMV , founders and private investor
  - Pre money valuation at direct cost (partly in shares, partly as a loan)
  - Non-exclusive license agreement of all patents in field of use
- Funding history
  - 2010: First round 2.5 M€ plus IWT grant 1.5 M€
  - 2011:Second round 1.5 M€ plus cost savings on salary's
  - 2013:Bridge loan discussed plus additional cost savings on salaries implemented

# The team composition

- Composition of young technical specialists coming from the photonics group
- Complemented with experienced management (general management/entrepreneur, technology, commercial/operational)

# Competition and the influence on funding/exit

- US based start ups were funded 3 to 5 times as much as Caliopa (2007-2011):
  - They moved faster but not at a speed of 3-5 times caliopa
  - They forced us for the B round to go for 12-15 M€, in order not to get behind
- Recent (2012-2013) exits of (4 years older) competitors to Cisco and Mellanox reduced the number of available acquisition players

# The Exit Round

- B round needed 12-15 M€; started in Jan 2013
- Discussed with over 100 interested parties: 60 VCs and 40 industrial partners
- Worked with a small but specialised investment banker (Woodside; London, SF)
- Aligned a set of VCs for potential investment
- Huawei and ALU were already interested in our products/technology since 2010 and cooperation projects were defined and considered investing
- Finally Huawei did an offer for full acquisition
- Our conditions were not only financial but also strategic (ie invest in Flanders and continue cooperation) and manpower (grow staff in Flanders)

# Lesson Learned

- Product management is a must to avoid technology defocus
- Technology issues after 1.5 years caused new/additional round of development/investment
- Good board with mix of technology and business experience, necessary patience and able to assess the technology hick-ups
- Strong cash management needed
- Choice between product focus and platform focus was a constant attention: all investment money went into product, but a lot of paper studies were done on the platform
- Significant number of collaborations with universities to work 'cheap' (Valencia, Karlsruhe, MesaPlus,...)
- IP agreement between Caliopa and Imec was a bottleneck but got finally resolved