



# Webinar on PICs in Data and Telecom applications

27th January 2021

# Agenda

- **Welcome (10 min.)**  
Dr. Victor Dolores-Calzadilla - Eindhoven University of Technology (TU/e)
- **Optical solutions for radio access networks:  
where could integrated photonics help ? (20 min.)**  
Antonio Tartaglia  
System Manager and Technology Expert – Ericsson
- **Open Discussion (15 min.)**  
Giuseppe Coppola – PhotonDelta
- **OIP4NWE Voucher Introduction (15 min.)**  
Prof. Jürgen van Erps - Vrije Universiteit Brussel

# Welcome



**Dr. Victor Dolores-Calzadilla**

Photonic Integration Technology Center  
Eindhoven University of Technology (TU/e)







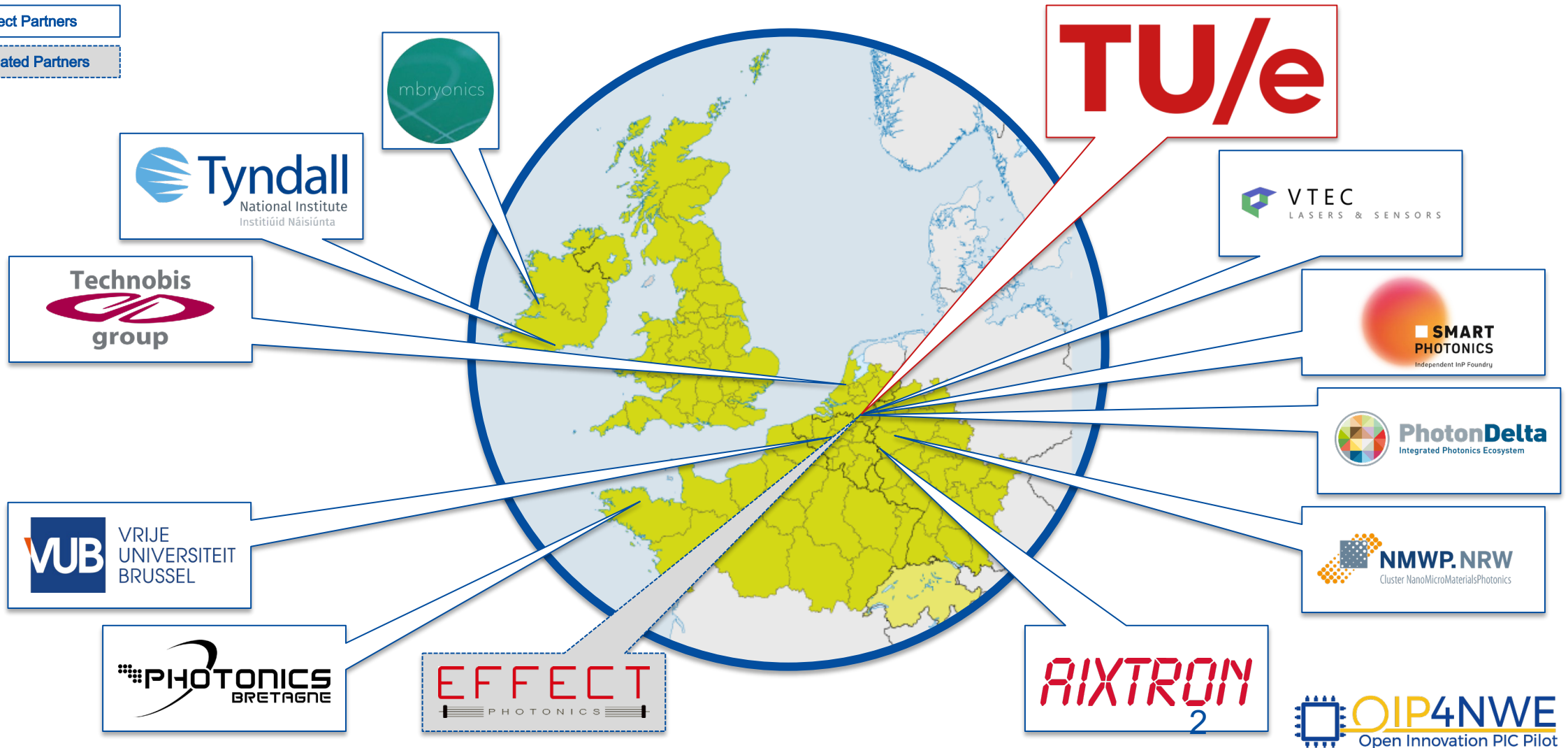
# Open -Innovation Photonics pilot for North West Europe

Victor Calzadilla, TU/e  
27.01.2021

# Open-innovation photonics consortium

Project Partners

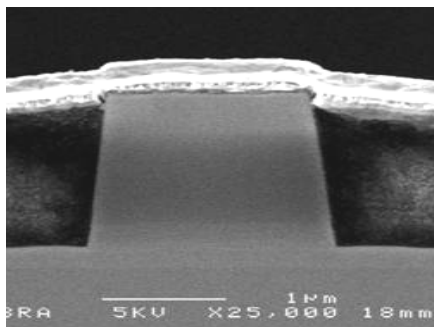
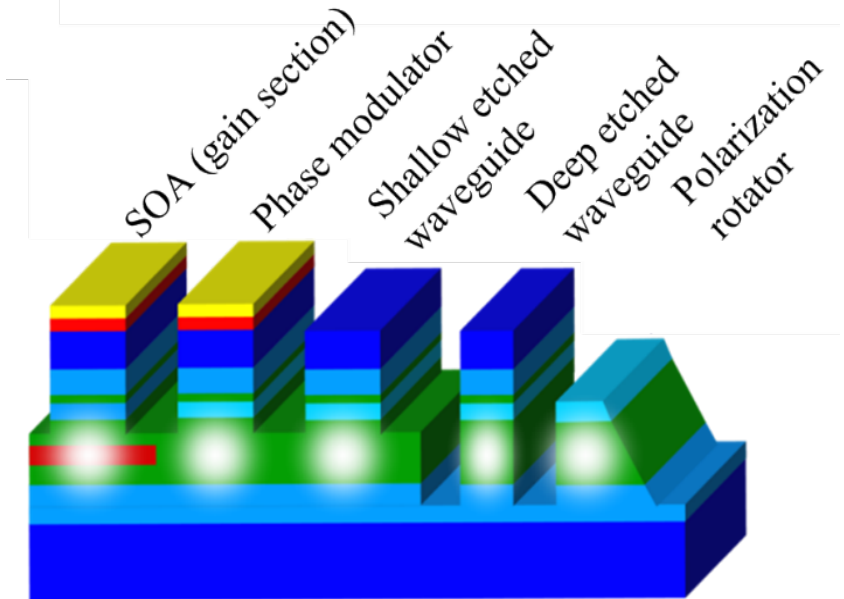
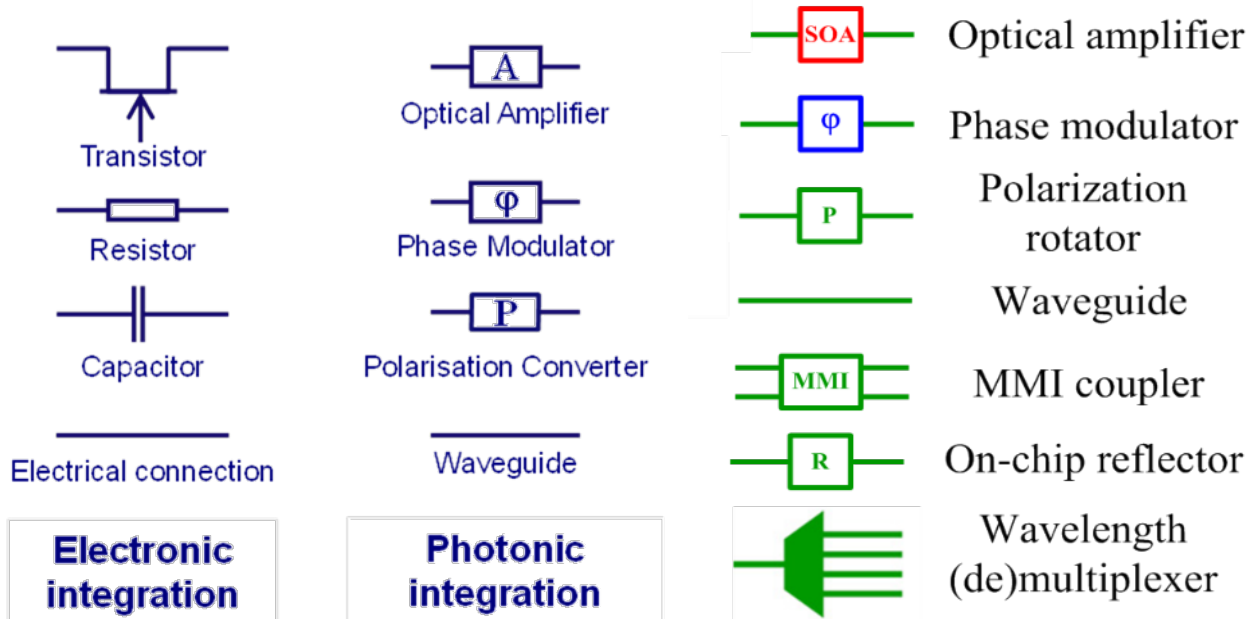
Associated Partners



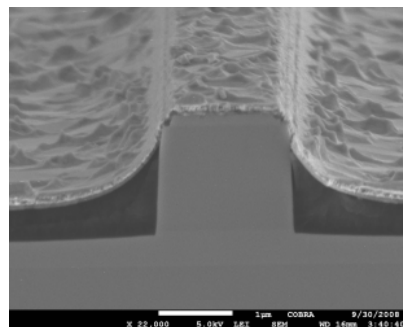
# Our targets

- Contribute to increase maturity and scaling of open access InP Photonic Integrated Circuits (PICs).
- Provide technology support to SMEs looking to mature their PIC -based products through open collaboration
- Establish an open innovation environment for InP PIC technology in Europe:
  - Collaborative ecosystem: researchers, foundries, equipment manufacturers, application developers
  - Working on state -of-the-art equipment development and fabrication methods

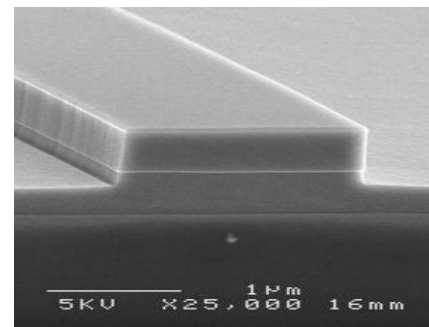
# Generic Photonic Integration in InP



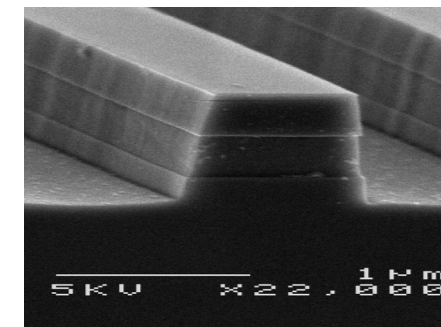
Amplifier



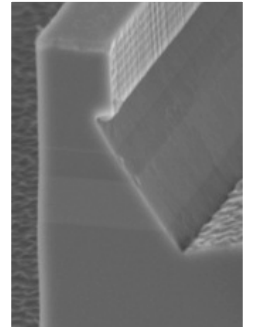
Phase Modulator



Shallow waveguide



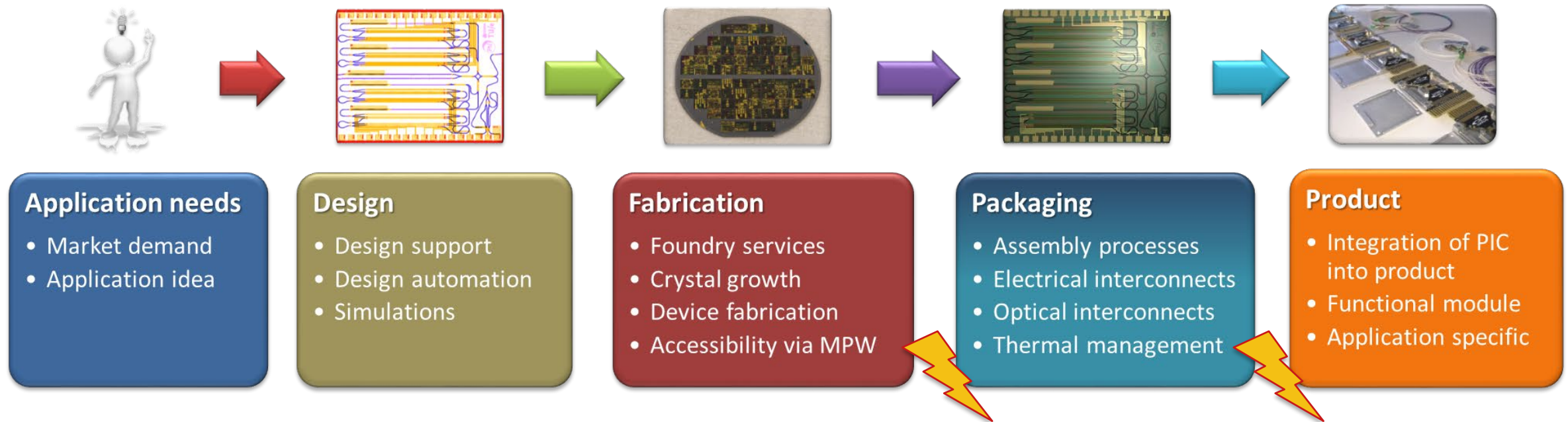
Deep waveguide



Polarization converter

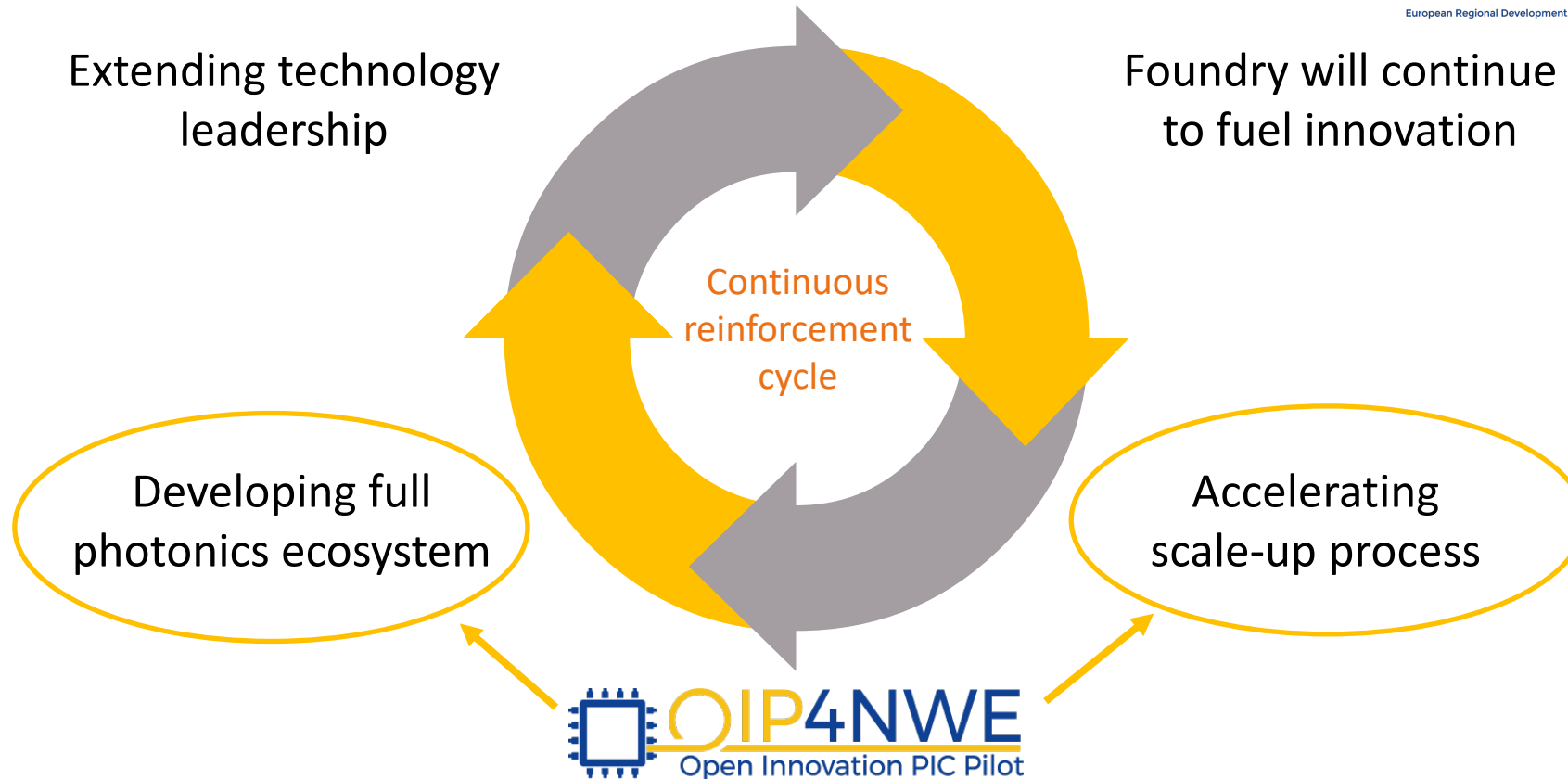


# The design cycle in photonic ICs





# Accelerate PIC industry through open innovation



Photonic Integrated Chips (PIC's) based on Indium Phosphide (InP) will play a key role in the lives of many people as they enable new and improved functionalities, ultimately making our world better, greener and safer

# Design and manufacturing of photonic ICs

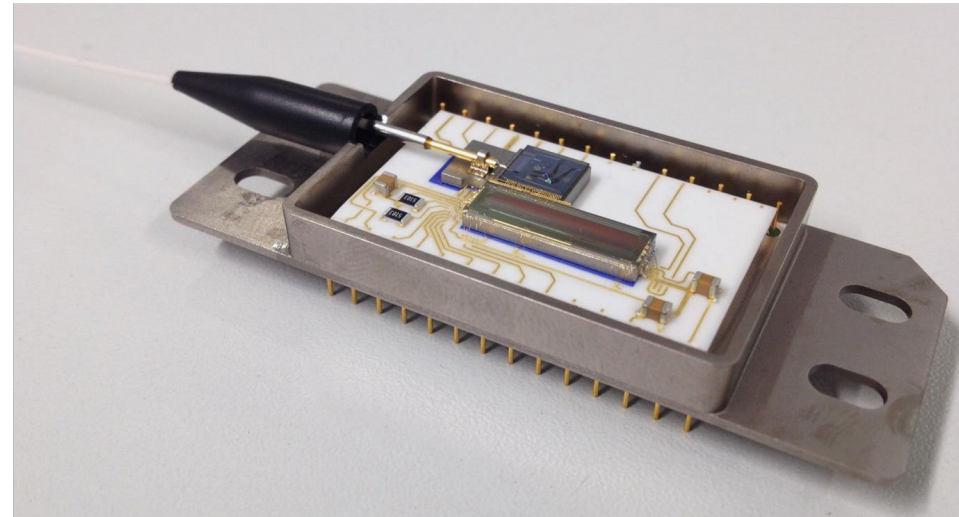
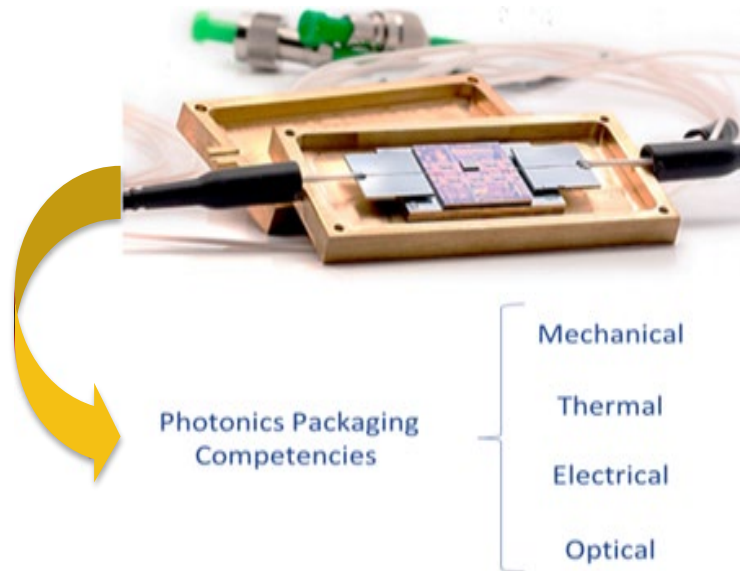
## Process Design Kit with Building blocks

- Broad set of building blocks for Integrated Photonics
- Process Design Kit
  - Design manual and Functional building block description
  - Enables Circuit simulation and Mask design in a full layout -aware design flow
- Technology developments
  - Process improvements
    - Epitaxy
    - Yield
    - Stability
  - Functionality (new building blocks)



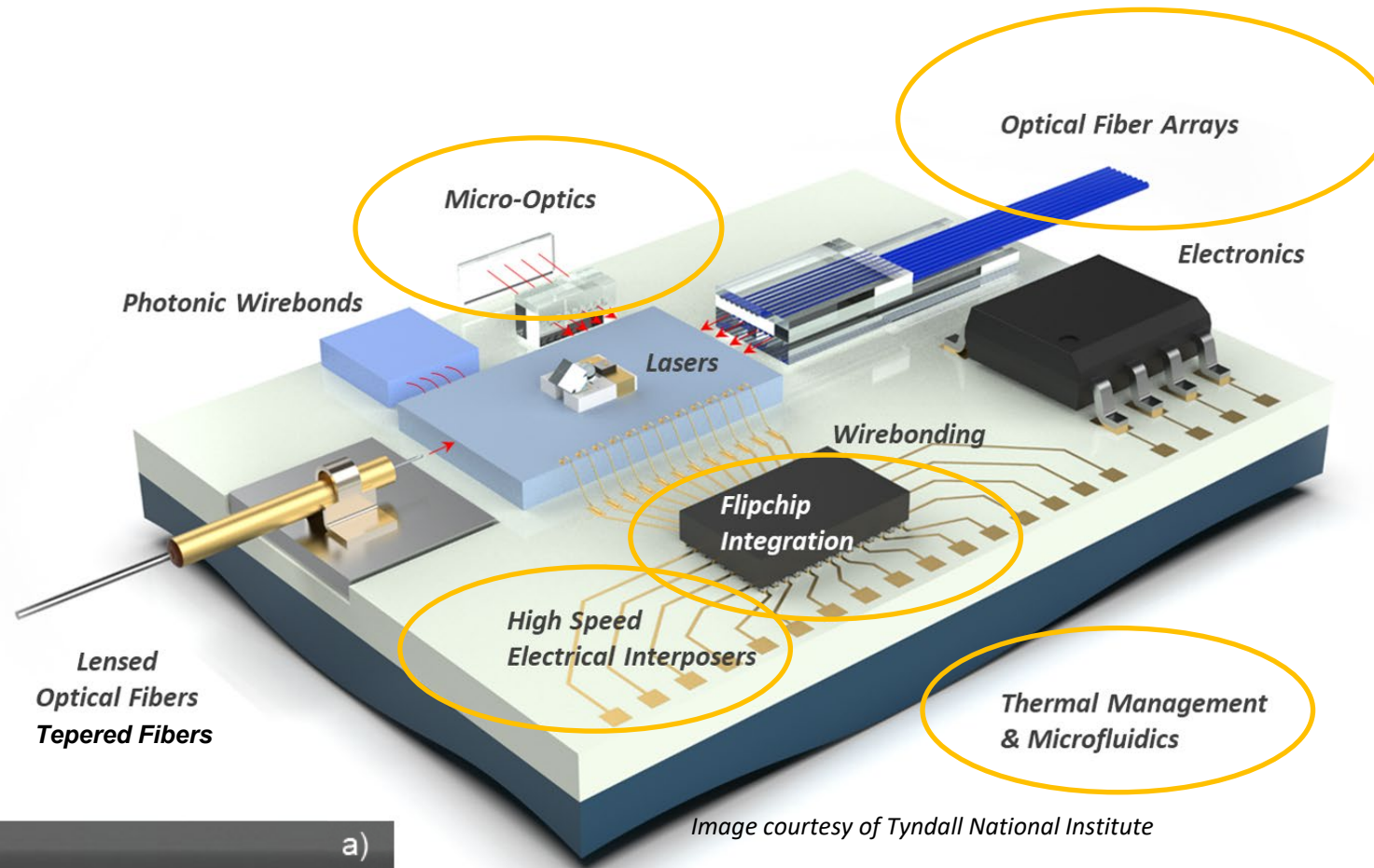
# Packaging of photonic integrated circuits

Photonic packaging is the catch -all term used to describe the range of techniques to make the optical, electrical, thermal, mechanical (and sometimes chemical) connections between a PIC and the outside world.



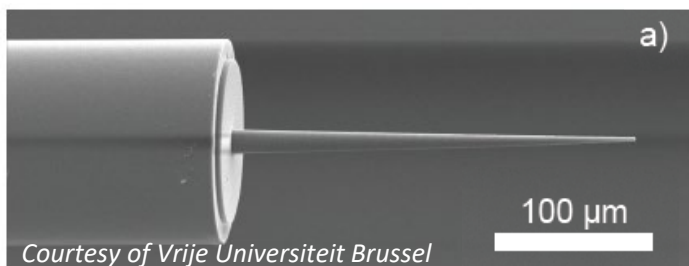
*Images courtesy of Tyndall National Institute*

# Packaging of photonic integrated circuits



Developments in the project:

- Optical connections:
  - Fiber to Edge Coupler (horizontal)
  - Micro-lenses
  - Microfluidic channels
- Electrical connections:
  - Flip Chip Bonding
- Thermal management





# Interreg



EUROPEAN UNION

## North-West Europe

### OIP4NWE

European Regional Development Fund

<http://www.oip4nwe.eu>

# Presentation

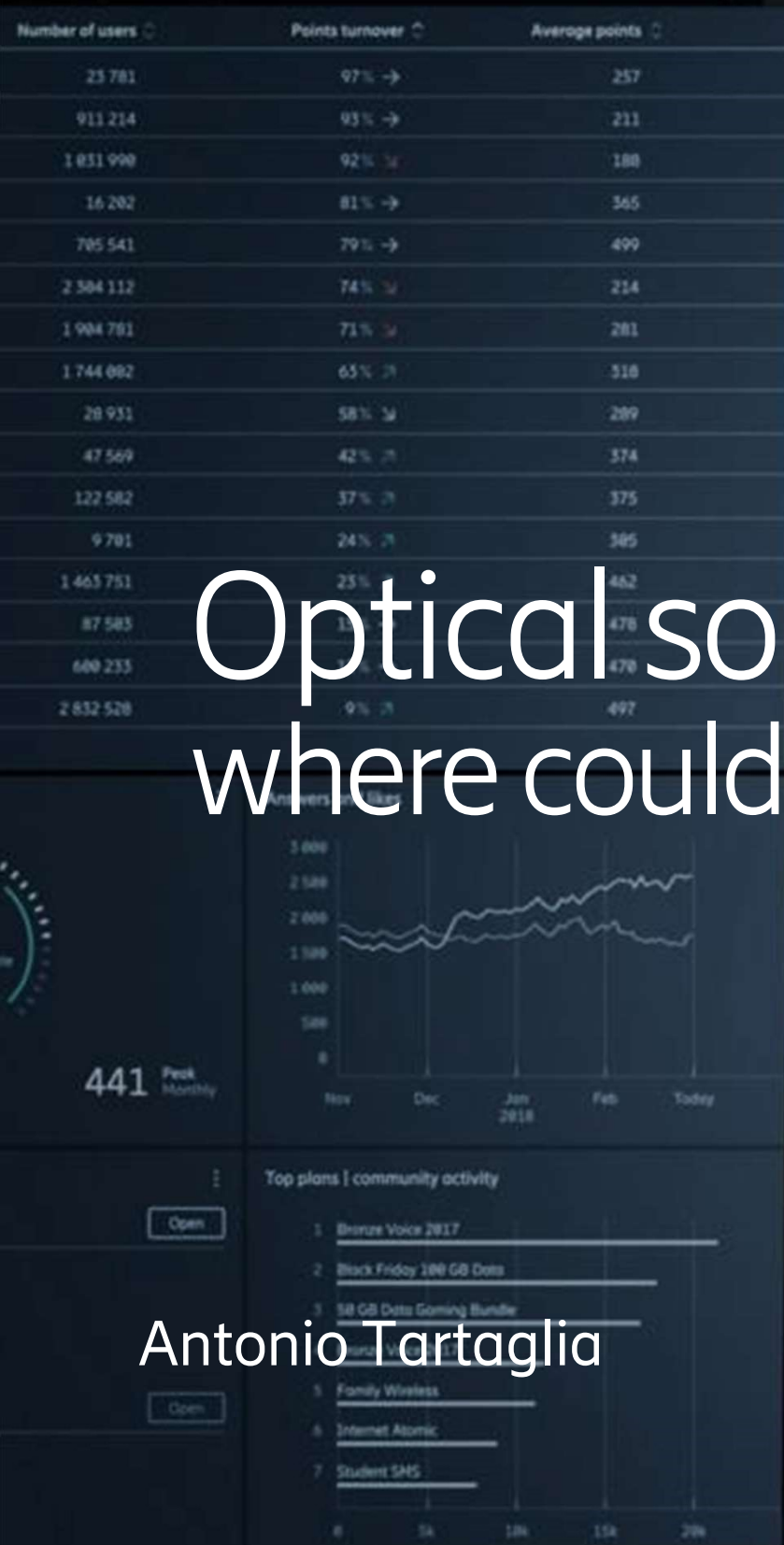
**Optical solutions for radio access networks:  
where could integrated photonics help ?**

**Antonio Tartaglia**

System Manager and Technology Expert – Ericsson

# Optical solutions for radio access networks: where could integrated photonics help ?

Antonio Tartaglia



Business!

Bright, innovative ideas

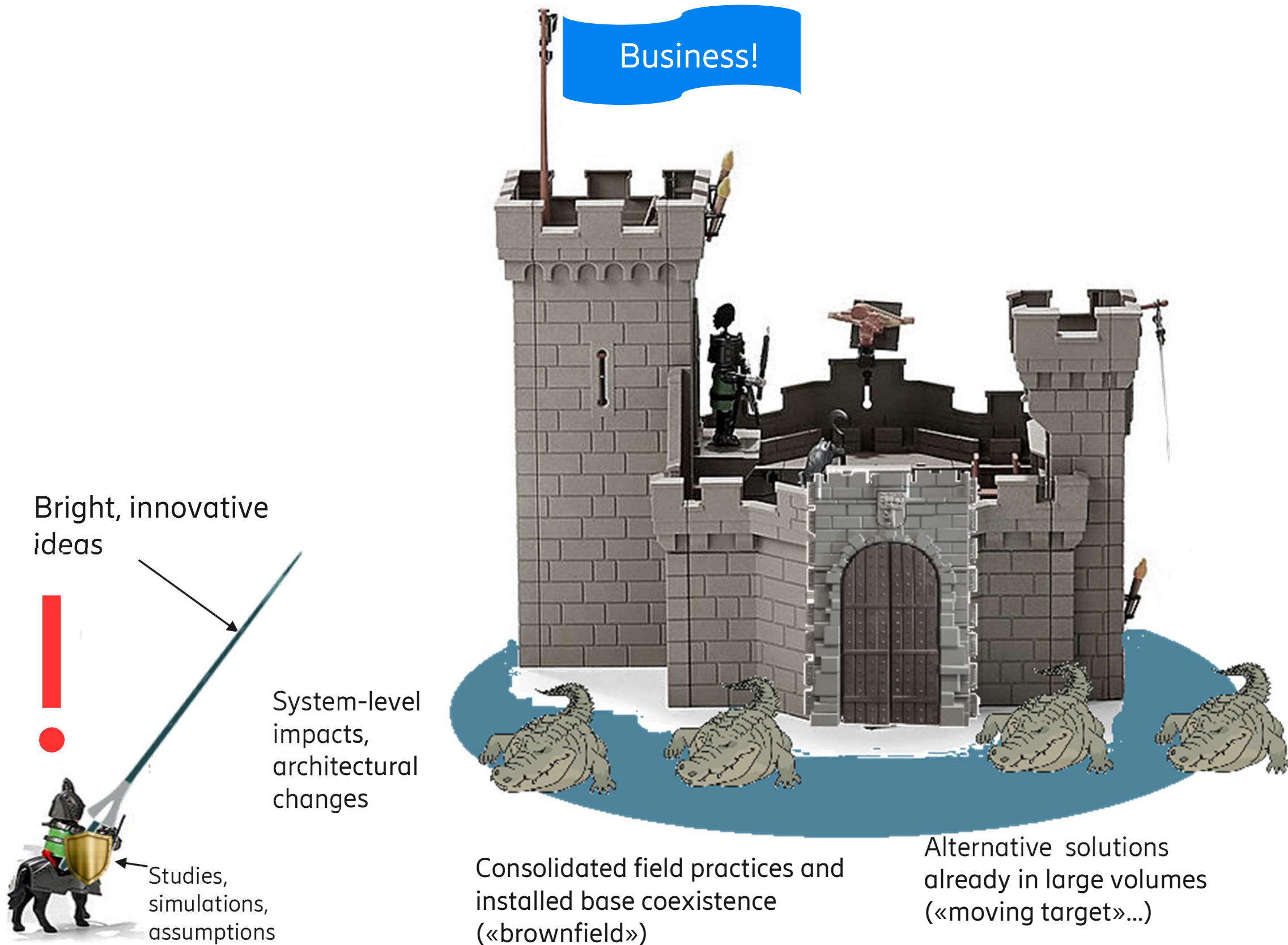
System-level impacts, architectural changes

Studies, simulations, assumptions

Consolidated field practices and installed base coexistence («brownfield»)

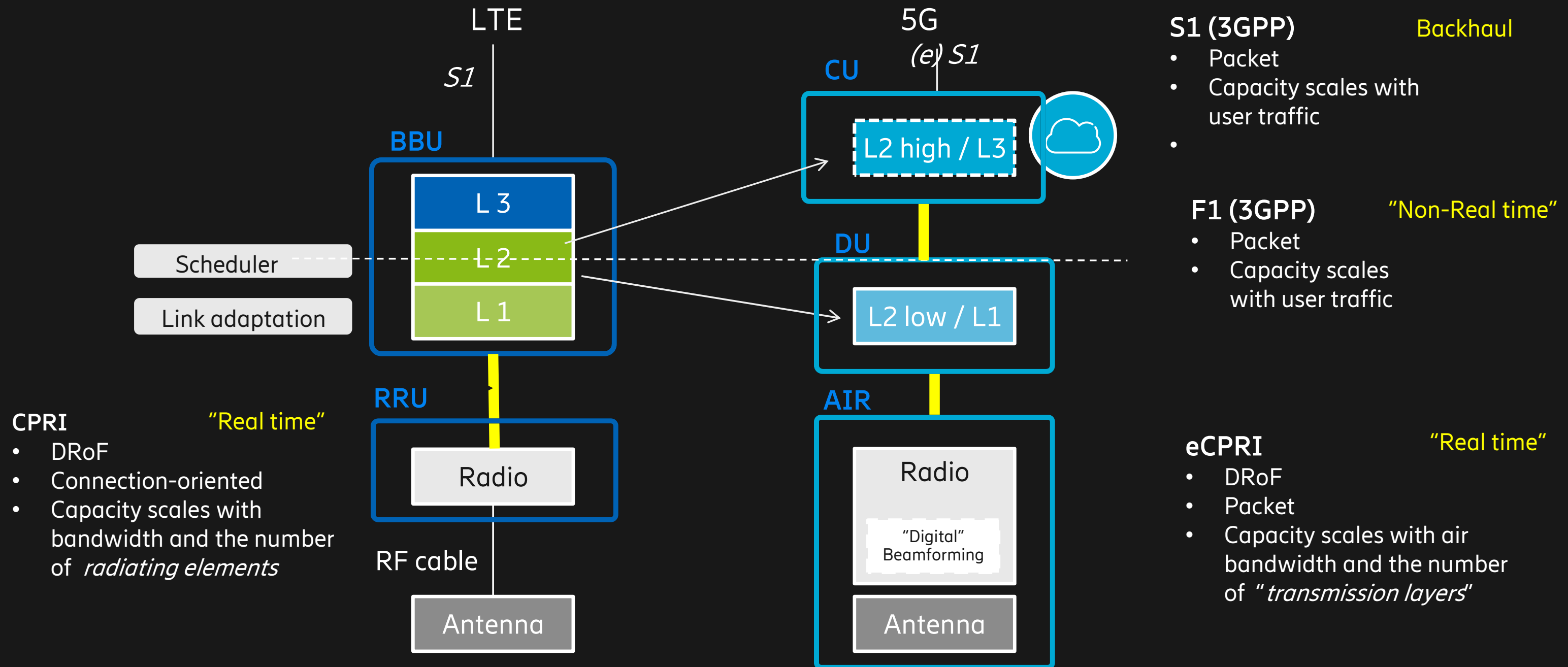
Alternative solutions already in large volumes («moving target»...)

Industrialization and supply chain investments



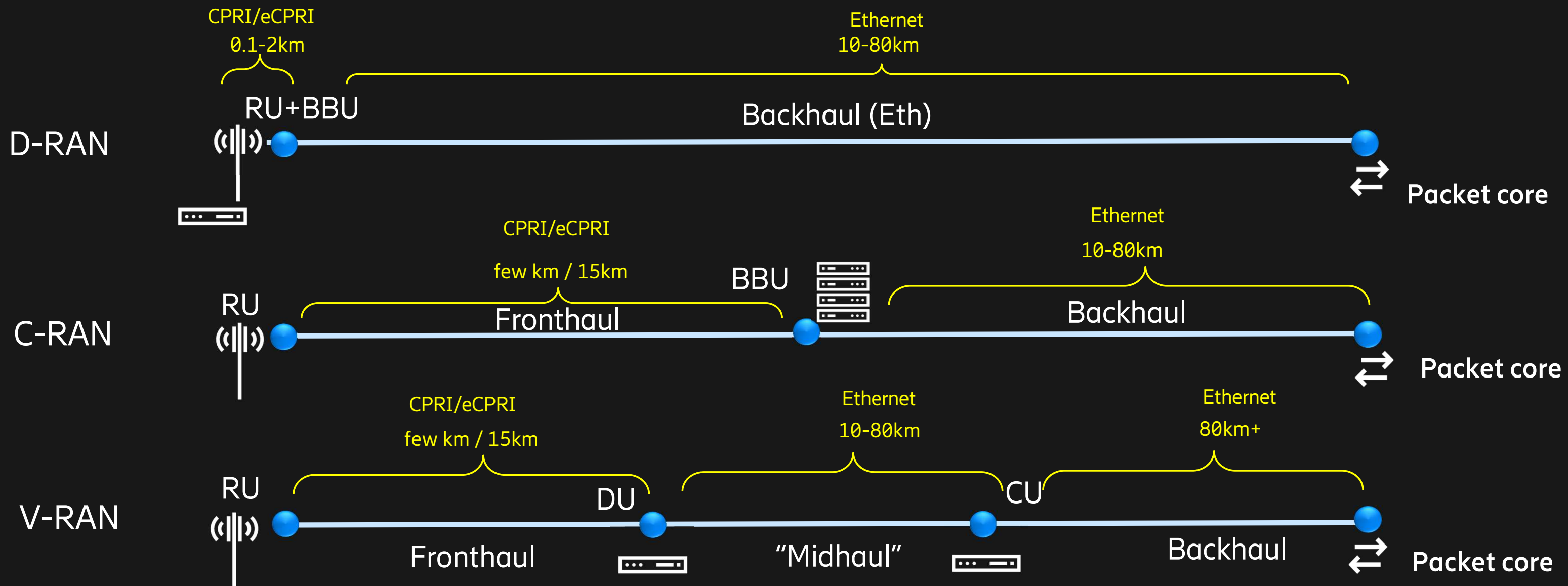


# An example: how RAN functional splits changed the game for optics



# Optical transmission links in RAN

Emergence of a "mobile transport network" segment ( see for instance ITU-T G.8300 )



Outside plant fiber availability is king – a palette of solutions to cover all scenarios is needed

Cabling

Abundant dark fiber

Scarce dark fiber

# Datacom & Radio: both cost sensitive and “high volumes”, but...

## Data center intra-connects

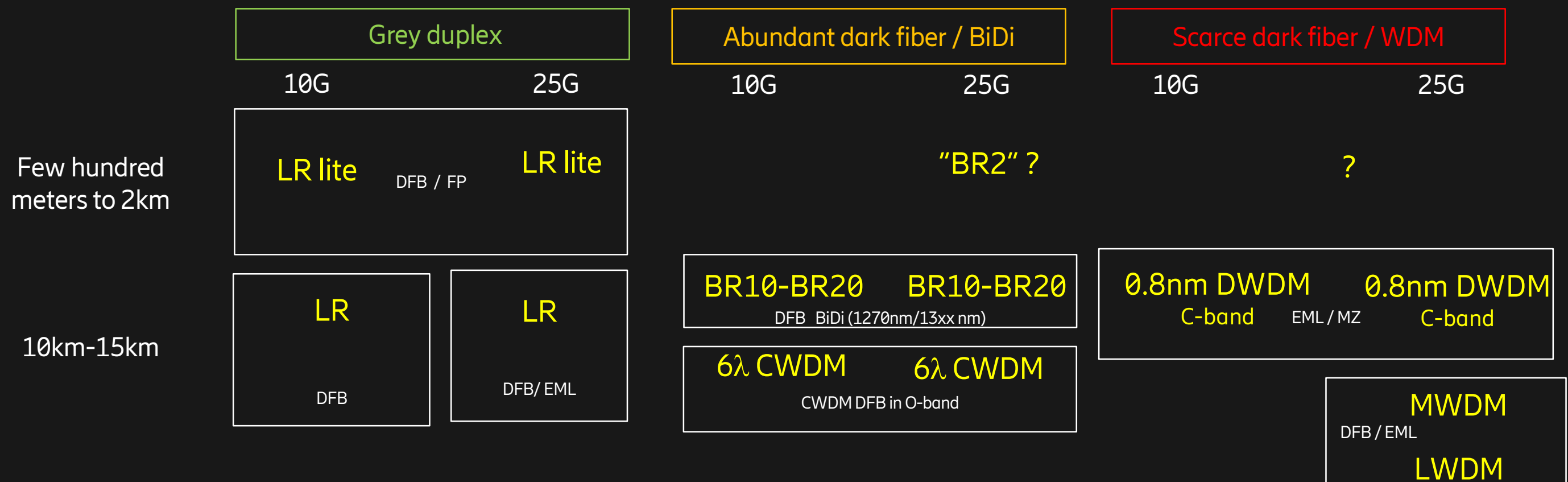
## Fronthaul



Benign	Environmentals	Harsh
3yrs	Technology refresh cycles	5-10yrs
>99.9%	System availability	>99.999%
< 2km	Fiber distance	< 15km
Abundant	Fiber availability	Varying scarcity levels
Pipes «as fat as possible»	Traffic granularity	Mobile site traffic
Low	Importance of sync quality	Very high
Low	Service costs	High
Greenfield	Typical build model	Brownfield



# 10G and 25G pluggable transceivers for fronthaul, today



Next logical step: 50Gb/s

*Relatively* small incremental effort ( + PAM-4, stronger FEC)

Outdoor-grade, duplex fiber / BiDi / WDM variants (maintaining distances for WDM a challenge)



# Open points /1

## Performance-reduced, ultra low-cost solutions in the <2km space ?

Cost *is not* a continuous function of distance ...

But there seem to be some low-hanging fruits - for instance, 25G BiDi

## Tunable WDM transceivers for fronthaul, 10G/25G→50G

Full band / narrow-band, performance/cost tailored to access networks

Low power dissipation at high operating temperature

"Self-tunability" over a wavelength-routed optical infrastructure

*Need for full standardization and inter-operability of solutions*

**Integrated photonics → help with size/power dissipation/cost**

# Open points /2

## The rise of packet fronthaul and the need for “radio friendly” 100G (400G) optics

Packet aggregation paves the way for higher capacity optics

Integrated photonics → enabling, as it was and is for data center optics

Extra challenge:

Outdoor grade

Sync transmission quality

Solutions for fiber-constrained scenarios

Without the cost going through the roof 😊

# More challenges...

## **Adding wavelength flexibility in the access segment, incl. fronthaul**

Programmable/tunable WDM filters for lower OpEx and simplified NRO (automation)

Integrated photonics → at the right cost point for access

## **Coherent in access (20km): daydream, or.. ?**

Trends in shrinking size/reach/cost, now in metro-access.

Maybe soon in data centers intra-connects : when/how in fronthaul ?

Integrated photonics → reduce size and power of the optical front-ends, making room for DSP power

## **Supporting scenarios requiring super-compact radio nodes**

Compact, power density increase, convection cooling

Integrated photonics: → ultra compact "power lean" transceivers

"External laser" architecture and/or integration of novel, temperature-friendly laser structures

Possibly future use cases for CPO ?

Business!



Pilot lines for prototypes  
Public co-funding  
Standardization  
Multi-source agreements

Joining forces against the alligators, crossing the moat is easier 😊





# Open Discussion



**Giuseppe Coppola**

Photon Delta

# OIP4NWE Voucher Introduction



**Prof. Jürgen van Erps**

Photonics Campus Grooik  
Vrije Universiteit Brussel



# Open-Innovation Photonics pilot for North West Europe

**Innovation Support Fund – Call for applications**  
Jürgen Van Erps, VUB

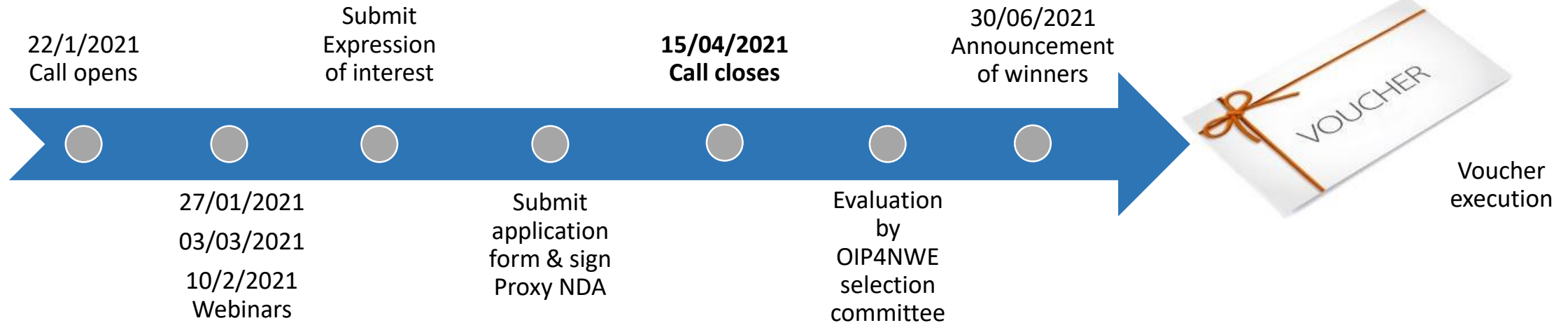


# Innovation Support Fund - Call for applications

Are you an SME in the NWE region wanting to scale up production of PICs to a trial series beyond proof-of-concept demonstration?

Apply now to receive 1 of 7 vouchers providing you with up to 50k€\* support and access to the OIP4NWE open innovation pilot line, covering

- 1) Design verification to check compatibility of the PIC design with the OIP4NWE pilot line
- 2) Manufacturing of the PICs, external optics and packaging



For more information, visit [www.oip4nwe.eu/vouchers](http://www.oip4nwe.eu/vouchers)

\* A financial contribution of 20% will be required from the SME on the total project cost and of 100% for anything above the 50k€ max support.

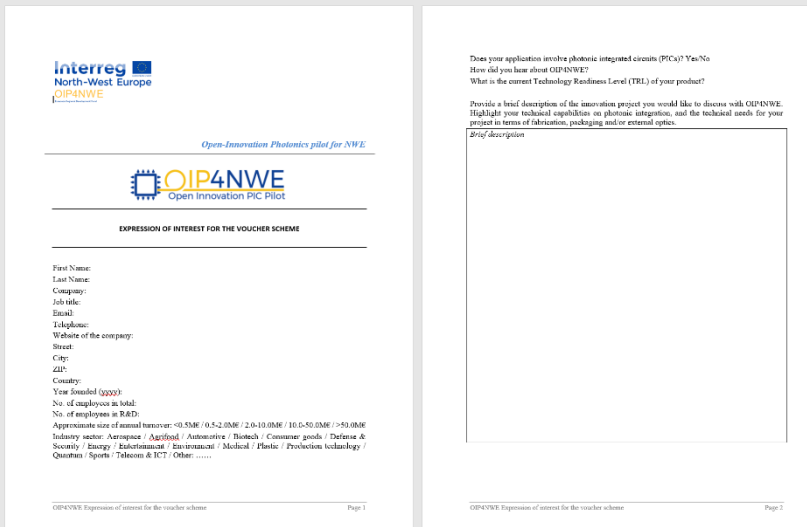
# Requirements for application

1. The applicant should be a **small or medium-sized enterprise (SME)**, according to the European definition, which can be found at <https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition>
2. The applicant should be **based in the North-West Europe** region, as defined on <https://www.nweurope.eu/about-the-programme/the-nwe-area/>
3. The applicant should have demonstrated the technical feasibility of their application proposal, i.e. the applicant should have a PIC design ready and preferably a validated prototype. This means that the technology readiness level (**TRL**) of their current PIC should be 4 or higher. Proposals for proof-of-concept type demonstrators are not eligible.
4. The applicant should **demonstrate a business case** for scale-up to volume production and/or how the funded project will positively **impact** their future business, either through increased revenues or through the creation of new jobs.
5. The applicant should **comply with the minimis criterion for state aid** and provide a self-declaration to that end. A “De Minimis” award letter will be issued by the OIP4NWE consortium when complying.
6. The applicant should **submit a fully completed “Voucher application form”** and should **sign a “Proxy NDA”** to allow evaluation of the proposal by the OIP4NWE voucher selection committee.
7. Voucher recipients should **agree to collaborate on documenting their use case**. This is to be used as dissemination material to attract other users of the pilot line, during as well as after the project.


# Application procedure

→ Fill out a pre-registration “**expression of interest**” form to allow early follow-up and eligibility check prior to preparing a full proposal. Send the form to [voucher@oip4nwe.eu](mailto:voucher@oip4nwe.eu)

→ Fill out application form and send it to [voucher@oip4nwe.eu](mailto:voucher@oip4nwe.eu) before the call closure (15/04/2021)



The image shows two pages of a form titled 'Interreg North-West Europe OIP4NWE Open Innovation PIC Pilot EXPRESSION OF INTEREST FOR THE VOUCHER SCHEME'.  
 Page 1 includes fields for:  
 - First Name, Last Name, Company, Job title, Email, Telephone, Website of the company, Street, City, ZIP, Country.  
 - Year founded (yyyy), No. of employees in total, No. of employees in R&D.  
 - Approximate size of annual turnover: <0.5M€ / 0.5-2.0M€ / 2.0-10.0M€ / 10.0-50.0M€ / >50.0M€.  
 - Industry sector: Aerospace / Agri-food / Automotive / Biotech / Consumer goods / Defense & Security / Energy / Entertainment / Environment / Medical / Plastic / Production technology / Quaternary / Sports / Telecommunications / ICT / Other: .....  
 Page 2 includes:  
 - A question: 'Does your application involve photonic integrated circuits (PICs)? Yes/No'.  
 - A question: 'How did you learn about OIP4NWE?'.  
 - A question: 'What is the current Technology Readiness Level (TRL) of your product?'.  
 - A section for 'Provide a brief description of the innovation project you would like to discuss with OIP4NWE. Highlight your technical capabilities on photonic integration, and the technical needs for your project in terms of fabrication, packaging and/or external optics.'  
 - A 'Brief description' box.  
 - A table with 5 columns: 'Year', 'Task', 'Task 1', 'Task 2', 'Task 3'.  
 - A 'New business and ICT data expected from this project' section.



The image shows seven pages of an application form, numbered 1 to 7.  
 Page 1: 'Interreg North-West Europe OIP4NWE Open Innovation PIC Pilot EXPRESSION OF INTEREST FOR THE VOUCHER SCHEME'. It includes fields for company details and a table for project details.  
 Page 2: 'Brief description' section.  
 Page 3: 'New business and ICT data expected from this project' section.  
 Page 4: 'New business and ICT data expected from this project' section.  
 Page 5: 'New business and ICT data expected from this project' section.  
 Page 6: 'New business and ICT data expected from this project' section.  
 Page 7: 'New business and ICT data expected from this project' section.

# Application form

## Open-Innovation Photonics pilot for NWE



### VOUCHER APPLICATION FORM

Note that fields marked with an asterisk (\*) will be used in public communications about OIP4NWE and the company should be aware of this in advance.

#### Company Information \*

Company name:

Company type:

Main industry sector of the company:

Street:

City:

ZIP:

Country:

Website:

Year founded (yyyy):

No. of employees in total:

No. of employees in R&D:

Size of annual turnover:

First time photonics innovation with PICs? Yes/No

Is there any cause for concern over potential conflicts of interest between the company and any of the OIP4NWE partners or individuals? Yes/No (If yes, please explain)

Are there any current or previous technical or commercial relationships between the company and any of the OIP4NWE partners or individuals involved? Yes/No (If yes, please provide details)

#### Company contact person

Title\*:

First Name\*:

Last Name\*:

Position in the company (e.g. CEO, CTO, etc.):\*

Department:

Email:

Mobile:

Telephone:

#### General project information

Application field\*: Aerospace / Agrifood / Automotive / Biotech / Consumer goods / Defense & Security / Energy / Entertainment / Environment / Medical / Plastic / Production technology / Quantum / Sports / Telecom & ICT / Other: .....

What is the current technology readiness level (TRL) stage of this innovation project?

What is the targeted TRL stage?

What is the current TRL stage of the end product?

Has the company participated before in any EU funded project? Yes/No (If yes, please provide details)

#### Part A - Project description

Abstract \*

*Provide a short overview of the scope/objective of the project*

Context of the innovation project

*Describe the overall system/application for which the innovation project will be conducted*

# Application form

## General description of the innovation approach

*Describe how the scope of the project will be reached*

## Major challenges

*Describe in specific terms the major innovation challenges and why support is needed to solve them*

## Target specifications

*Quantify the target specifications of the innovation outcome*

## Detailed project description

*Provide further details*

/



# Application form

## **Part B - Impact on company's business**

Summary of the key points relating to the business impact of the proposed innovation for the company. Please answer ALL questions below.

### **I. Target Market**

*What is the target market application for this innovation? What does the market evolution (growth projection) look like for this innovation? What major societal challenges does it address?*

### **II. Market Validation**

*What gives the company confidence that there is a good opportunity for its innovation within this market? Does the company have an existing foothold in this market? Does the company have a track record of similar business activities or customers in this market? Has the company already spoken with target customers for this innovation? Please describe. If this is a new market for the company, please explain the track record of the company management in other businesses or markets.*

### **III. Route-To-Market**

*How does the company plan to commercialize this innovation? What will the route-to-market be for the company (product sales, licensing, services...)? How will the manufacturing / production be organized (where, who, ...)? Which sales channels will be used and in which geographic areas will the product be sold?*

### **IV. Competitive Positioning**

*What is the current state-of-the-art in the application domain being targeted by this innovation? What is the state of the competitive environment for this innovation? What are the main competing products for this innovation?*

### **V. Unique Competitive Advantage**

*Why will this innovation offer superior benefits to target customers over the current state-of-the-art? What are the key points relating to the unique selling points of the targeted product for this project?*

### **VI. Financial Business Plan**

*What will need to be done to realize this new business once the project is finished? Does the company have a clear, strong and realistic business plan for the steps it will take to compete successfully in this market? How will the company finance bringing the product to market? The business case MUST include a description of the estimated cost & pricing of the target end product and its attractiveness to the target market when compared to the cost-value proposition of existing alternative solutions. In case it is the intention to attract new Venture Capital to realize the business, explain these plans in more detail including: amount of investment needed, timing, potential candidates, current status, etc...*

### **New Business and EU Jobs expected from this project**

Only direct revenues and direct jobs created by the company within the EU should be considered. Revenues and jobs created by partners or subcontractors should not be included.

# Application form

Forecast figures must be realistic to the company's starting position and the target market application, and must be justified by the company's business plan which has been summarized earlier in the proposal.

Please specify year 1 (ex: 2021)

Note: Year 1 starts at the end of this OIP4NWE voucher project.

	Year 1	Year 2	Year 3	Year 4	Year 5
New revenues in k€					
Additional number of Full Time Equivalent jobs in the EU (cumulative)					

# Selection criteria

Evaluation criteria and associated weight:

## 1. The innovative character of the project (weight 1):

Is the proposed solution new to the market?  
Is the project creating valuable knowhow?  
Are PICs key enabling elements in this project?

## 2. Technical feasibility and quality of the project plan (weight 1):

Compatibility with the OIP4NWE pilot line?  
Current TRL level of the PIC?  
How should the PIC be interfaced with the outside world?  
Is the proposed technological approach in line with the project goals?

## 3. Credibility and level of commitment of the company (weight 2):

Level of financial commitment?  
Does the company have a proven track record of bringing new products/solutions to the market?  
Does the company have a proven track record of successfully completing public or public-private funded project?

## 4. Added value on the business case and potential impact (weight 2):

The target market (target customers/segments, purchasing decision-makers, ...)?  
The market validation (experience and relationship of the company with these customers; is the target market an existing one or a new one)?  
The route to market (what channels will the company use to sell and deliver its products to its target customers?)  
The value proposition (competitive positioning and unique selling point)?  
Financial aspects of the business plan (increase in revenues or new jobs created)?

The selection committee will take into account **geographical distribution in the NWE region** as well as **distribution over different application sectors** of the voucher grantees.

Each criterion is scored with a value from 0 (strongly underperforming) to 5 (excellent). The score is multiplied with the weight.  
**The individual score of each criterion should be at least 2,5/5.**  
**The total score should be at least 20/30.**

# Need more information?



- Visit our website: [www.oip4nwe.eu/vouchers](http://www.oip4nwe.eu/vouchers)
- Contact [voucher@oip4nwe.eu](mailto:voucher@oip4nwe.eu)

# Interreg



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## North-West Europe

### OIP4NWE

European Regional Development Fund

<http://www.oip4nwe.eu>

**Thank you!**