



## EMBRACE

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### Partners:

- Ekinops, France
- IMT Atlantique, France
- iXBlue, France
- MPB Communications, Canada
- Orange SA, France

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### Project Website

[www.celticnexteu/project-embrace](http://www.celticnexteu/project-embrace)

## Efficient Multi-Band network Architecture and Components for Petabit/s Elastic networks

EMBRACE aims at the design and development of multi-band WDM systems capable of carrying at least 150-Tbps and ideally operating between 1300 and 1700-nm thanks to a new generation of optical amplifiers and high-speed transceivers. A field trial bringing together these different elements should take place on Orange's fiber infrastructure in France at the end of the project. The project will contribute to the partners' business development by allowing the launch of new product lines and should provide a competitive advantage to the EMBRACE partnership.

### Main focus

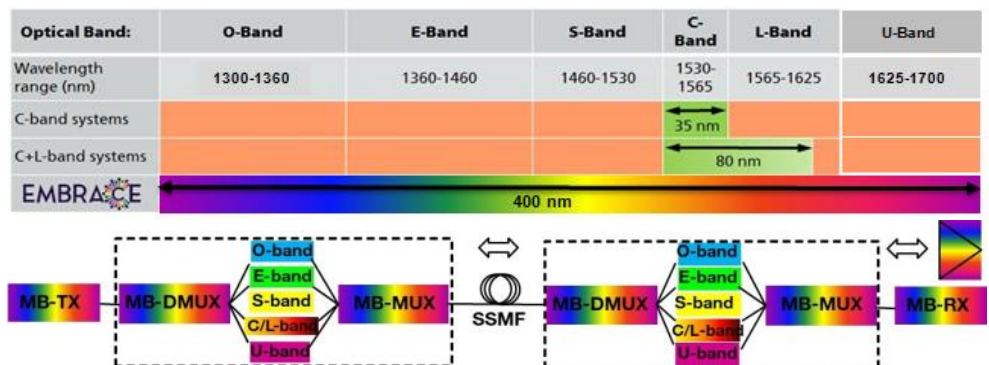
Optical transport networks today operate on C-band where typically about a hundred WDM channels carrying a total of ~24 Tbps are lighted-on. However, traffic growth of around 25-30% per year is putting pressure on the optical network infrastructure and forcing operators to use increasingly spectrally efficient WDM systems while expanding fiber transmission bandwidth over modern fibers (which have spectral attenuation of less than 0.35 dB/km over the 1300-1700 nm region) via multiband systems becomes obvious/relevant, as this solution reuses already deployed fiber infrastructure (compared to other options such as multi-core/multi-mode fiber which requires a complete replacement of existing fibers). EMBRACE aims to lay the first stone in Europe on the implementation of such multiband WDM transmission systems.

The key elements of EMBRACE will be the multi-band optical amplifiers, associated band/wavelength MUX/DMUX and transceivers. Beyond the C+L-band Erbium-doped fiber amplifiers, S- and U-band optical amplifiers will be designed and manufactured while distributed Raman amplifiers will be assembled to counteract the effect of stimulated Raman scattering between the various bands and equalize the multi-band WDM multiplex. S- and U-band amplifiers will be based on discrete Raman amplification technique. Band/wavelength MUX/DMUX will also be provided along with the required transceivers. The objective of EMBRACE is to deliver a WDM system capable of carrying 150-Tbps at least (i.e., 6-fold more than C-band systems currently in use) over three or four bands (i.e. S-, C-, L- and U-band) and to evaluate it during a field trial over the Orange's fiber infrastructure.

### Approach

EMBRACE will be decomposed in various steps:

- ◆ Design and assembly of S- and U-band amplifiers.
- ◆ Design and assembly of distributed Raman amplifiers
- ◆ Design and assembly of band / wavelength MUX/DMUX
- ◆ Design and assembly of multi-band transceivers



- ◆ Engineering and techno-economic studies
- ◆ Lab test and field trial of the EMBRACE multi-band WDM systems bringing together all the elements manufactured.

## Main results

EMBRACE will deliver multi-band fiber amplifiers, distributed Raman amplifiers, MUX/DMUX, and transceivers addressing the 1450 to 1650-nm bandwidth that will be assembled to make the S+C+L+U multi-band WDM systems. The system will be tested in the lab and in the field over typically three or four 80-km spans with an expected total throughput of 150-Tbps at least.

## Impact

EMBRACE will allow partners to become more familiar with multi-band WDM communications and its constitutive elements/subsystems (amplifiers, MUX/DMUX, transceivers). A key point will be the evaluation of performance and identification of limits of such systems. Demonstrating that fiber infrastructure currently in use is capable supporting them will also be an important aspect of EMBRACE. The project must contribute to the business development of partners by allowing the launch of new product lines.

## About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World“ paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the inter-governmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies

or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

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