

Fully-Converged Quintuple-Play Integrated Optical-Wireless Access Architectures

FIVER proposes and develops a novel integrated access network architecture based employing only OFDM signals for the provision of quintuple play services. FIVER architecture is completely integrated: FTTH, in-home optical distribution and the final radio link become part of the access network avoiding conversion stages providing cost, space and energy savings.

At A Glance: FIVER

“Fully-Converged Quintuple-Play Integrated Optical-Wireless Access Architectures”

FIVER



Project Coordinator

Dr. Roberto Llorente

Universidad Politécnica de Valencia

Tel: +34-96-3877700 Ext 88111

Fax: +34-96-3877827

Email: rllorent@ntc.upv.es

Project website: www.ict-fiver.eu

Partners:

Universidad Politécnica de Valencia (ES), Portugal Telecom Inovação (PT), Corning (FR), University of Essex (UK), Thales (FR), HTW-Dresden (DE), Wroclawskie Centrum Badan EIT+ (PL), Instituto De Telecomunicações (PT), Das Photonics (ES)

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Main Objectives

FIVER develops a novel integrated access network architecture employing only OFDM signals for the provision of **quintuple play services (Internet, phone/voice, HDTV, wireless - WiMAX, UWB and LTE femtocell- and home security/control)**. This architecture is completely integrated: The optical access FTTH, the in-home optical distribution network and the final radio link become part of the access.

FIVER is a **fully OFDM based network**. This permits a cost effective, centralised network architecture where the transmission impairments (both optical and radio) compensation and network management is done only at the Central Office. No further compensation, regeneration or format conversion is required along the network giving the streamlined network architecture capable of handling future services of interest.

FIVER services are fully converged: Both baseband (Gigabit-Ethernet provision) and standard wireless (WiMAX, UWB and LTE) signals are transmitted in radio-over-fibre through the FTTH, the in-building optical infrastructure and also the final user radio link. The use of full-standard wireless signals for optical and radio transmission gives two advantages: Fully standard receiver equipment can be used by the customer, and no ad hoc detection, re modulation or frequency conversion is required. All the transmission compensation algorithms, electro optical subsystems and network management are developed by FIVER consortium.

FIVER is also future-proof. The project **demonstrates HDTV service provision in the 60 GHz radio band** at the last stage. Other wireless services operation in other bands can be included in the FIVER network architecture as long as they are OFDM-based. This is due to the powerful transmission impairment OFDM transmission compensation algorithms developed in the project.

FIVER is a fully OFDM network. This permits a cost effective, fully centralised network architecture where the transmission impairments (both optical and radio) are compensated at the Central Office.

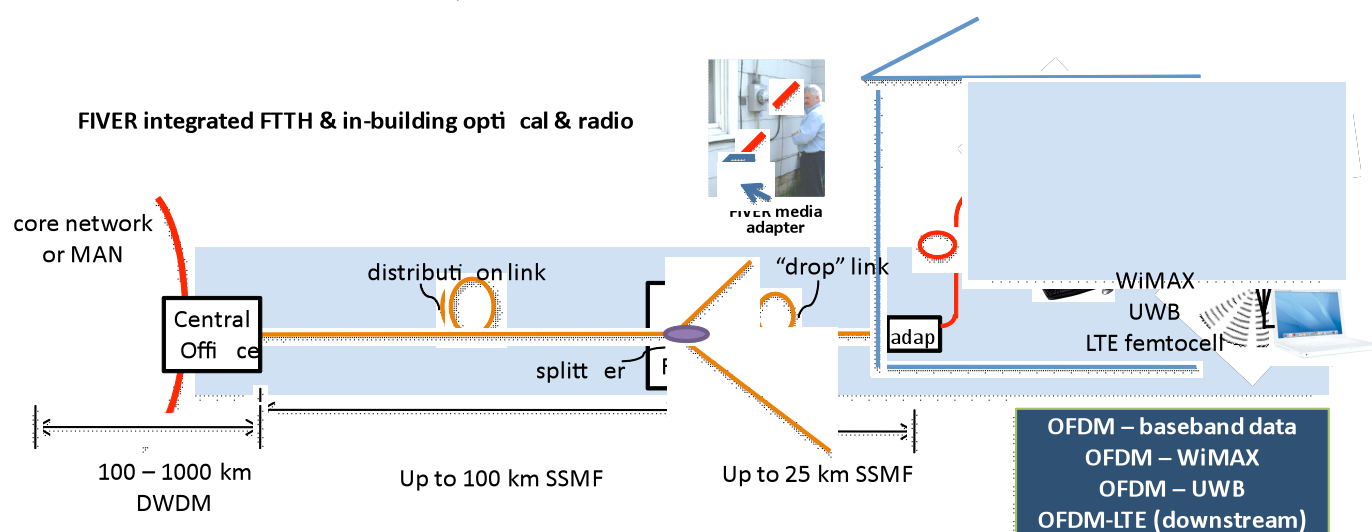
Technical Approach

FIVER develops and demonstrates 5-PLAY capabilities (in an integrated optical and radio network including centralised transmission impairment compensation of the optical path (GVD, PMD compensation) and of the radio path (multipath, interference). The Figure in this page shows the FIVER integrated approach. It can be seen a typical passive-optical network (PON) which consists of an optical line termination (OLT) located at Central Office (CO) which, multiplexes in wavelength (typically 1310/1490nm for audio and data, 1550 nm for video) the services

band must be considered. Collaboration between smart radios also represents an important new direction in network management that would be enabled by FIVER technology.

Expected Impact

FIVER architecture significantly reduces **network deployment costs** and associated costs at user premises. A European well-coordinated approach to design and test these novel FTTH architectures increases the opportunities for Europe to be at the cutting edge of optical access technology.



provided by the FTTH network. After the drop fibre, the optical signal arrives to the optical network terminator (ONT) or optical network unit (ONU). ONTs are usually dedicated to an individual end user. ONU equipment is typically located in a basement or even on a curbside and shared by a group of users. Focusing in a home user configuration, the most costly scenario from the operator point of view, the signal after the ONT is photodetected and demodulated to provide the Internet, audio and video services. FIVER integrates the complete optical path (FTTH & in-building distribution network) and also the user radio path for a converged service provision.

FIVER converged approach distributes baseband (OFDM-GbE) and radio-over-fibre (UWB, WiMAX and LTE) signals. Each baseband or wireless signal is responsible of a given service: Internet data is provide by the baseband signal. HDTV is provided by the UWB wireless signals in radio-over-fibre. LAN connectivity is provided by WiMAX and cellular phone connectivity is provided by LTE in a femtocell configuration. This approach requires careful coexistence studies which are done in the project. Multipath distortion and narrowband interference from other licensed/un-licensed services operating in the same frequency

Improved energy efficiency: FIVER employs UWB for HDTV transmission, This technology exhibits the lowest radiation levels (-41.3 dBm/MHz power spectral density) in the market with very high spectral efficiency (UWB 0.9 bit/s/Hz). Also, the integrated provision of 5-PLAY services (no format conversion, re-modulation or frequency up/down conversion) implies that overall electrical consumption and real state requirements are reduced compared to conventional FTTH.

Electromagnetic pollution will be severely reduced as UWB, WiMAX LTE femtocell and UWB radio in FIVER are intended for short (UWB) and medium (WiMAX, LTE femtocell) range, being radiation more confined than conventional cellular networks based on GSM or UMTS.

FIVER provides more network functionalities i.e. **“more for less”**. This comes from the cross-over (convergence) of OFDM baseband, WiMAX, UWB, LTE wireless and 60 GHz radio. This convergence is done in FIVER with exceptional **FLEXIBILITY**: The overall network architecture is capable of perfect operation with any wireless standard as long as it is OFDM-based, which is commonplace.