"*Standardization activities*"

Year two update

D7.4

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Partner Name	Short name	Country
JCP-Consult	JCP	FR
Research and Education Laboratory in Information Technologies	AIT	GR
Alcatel-Lucent Deutschland	ALUD	DE
Deutsche Telekom AG	DTAG	DE
Telefónica Investigación y Desarrollo	TID	ES
University of Hertfordshire	UH	UK
Karlsruhe Institute of Technology	KIT	DE
Universitat Politècnica de Catalunya	UPC	ES
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Abstract:

This document reports on the Standardization related activities in the ACCORDANCE Consortium. As a cumulative document, this is the Year 2 update to D7.2.
In year two, ACCORDANCE evolved with a preferred solution, over concurrent approaches that were also investigated in the past year one. This preferred approach was promoted into FSAN in several contributions.

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1. Standardization landscape (as from D7.2, Yr1)

The ACCORDANCE approach covers solutions for the wireline as well as for the wireless part of the telecommunications network. This entails the relevance of fora and standardization groups from both areas, namely FSAN / ITU-T as well as 3GPP and others.

Wired access, where fiber optic access is part of, is dominated by the IEEE and the ITU-T standardization bodies.

IEEE 802.3 have finalized the 802.3av 10Gbps EPON specification in Sept 2009 and are having currently no successor activity towards higher capacities in the last mile.

The FSAN forum, the initiative of network operators and vendors, has a worksplit into NGPON1 and NGPON2 era networks respectively. The NGPON1 (XG-PON1) activity addresses 10G PON systems and reach extension. It is capacity-class-wise comparable to the IEEE 802.3av 10G specifications.

FSAN's NGPON2 activity is dedicated however to the next generation access after 10Gbps PONs and is thus the corresponding future-oriented wireline access forum for the ACCORDANCE network architecture. Although FSAN is not a standards definition organisation, their output is submitted to ITU-T SG 15 Q2 to facilitate the development of global PON standards.

The single FSAN Working Group is called Optical Access Network (OAN). Within OAN are the following active Task Groups: Interoperability Task Group and Next Generation PON (NG-PON) Task Group.

From the FSAN website (http://fsanweb.com):

"Moreover, under the generic term "NG-PON2″, the Task Group will investigate upcoming technologies enabling a further bandwidth increase and able to solve the issues encountered in the "1G" and "10G" PON technologies deployments. NG-PON2 will also study new architectures that might involve some affordable plant evolutions, to take the benefit of the maturing WDM technologies and the necessary adaptations for the access"

This is the area being targeted by the ACCORDANCE architecture. NGPON2 networks are expected to be rolled out from 2015 on.

2. Consortium activities

Year1:

The ACCORDANCE project is still in its infant state and is striving for assessing and determining preferred topologies, multiplexing schemes and parameter sets. It is therefore problematic to present sound proposals to standardization fora at this time. It is more important to monitor directions and requirements that are arising from standardization bodies and to learn operators consolidated requirements in an early state. The ACCORDANCE consortium is therefore in the listen mode and has presented the ACCORDANCE basic idea at an NGPON2 workshop to FSAN in the February 2010 FSAN meeting in San Francisco.

Year2:

In the second project year ACCORDANCE concluded on the investigated OFDM/OFDMA flavours and decided to further elaborate and promote primarily the "Solution 1" approach. The advantages of the active solution have crystallised and actions could be taken to present the preferred concept to the targeted Standardization organisation for converged metro/access networks, FSAN.

2.1 ACTIVE CONTRIBUTIONS

Year1: 2010

The ACCORDANCE project has been introduced to the FSAN initiative members in the frame of a broader NGPON2 session presentation by Alcatel-Lucent on the FSAN 2010 San Francisco meeting in February 2010.

Due to the project early stage back in February 2010, only a general overview of the basic idea was presented highlighting the activity on OFDM-based access networking and convergence (Fig. 1). Note that FSAN contributions are confidential and cannot be copied here.

The requirements concerning next generation optical access networks have been put up to discussion in the FSAN operator community.

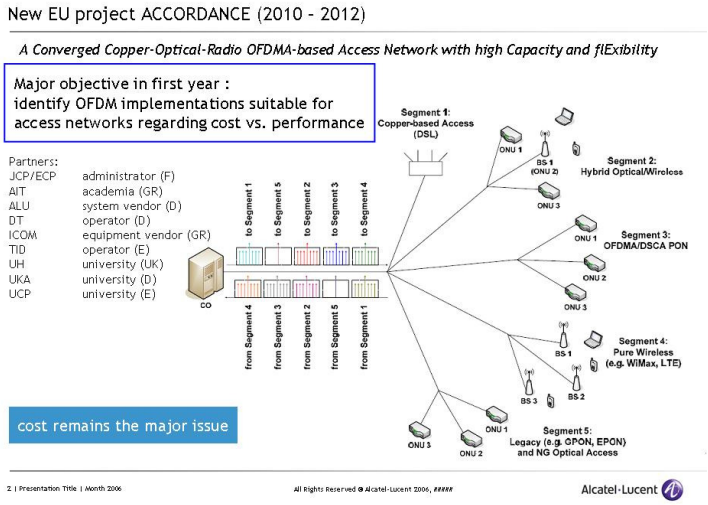


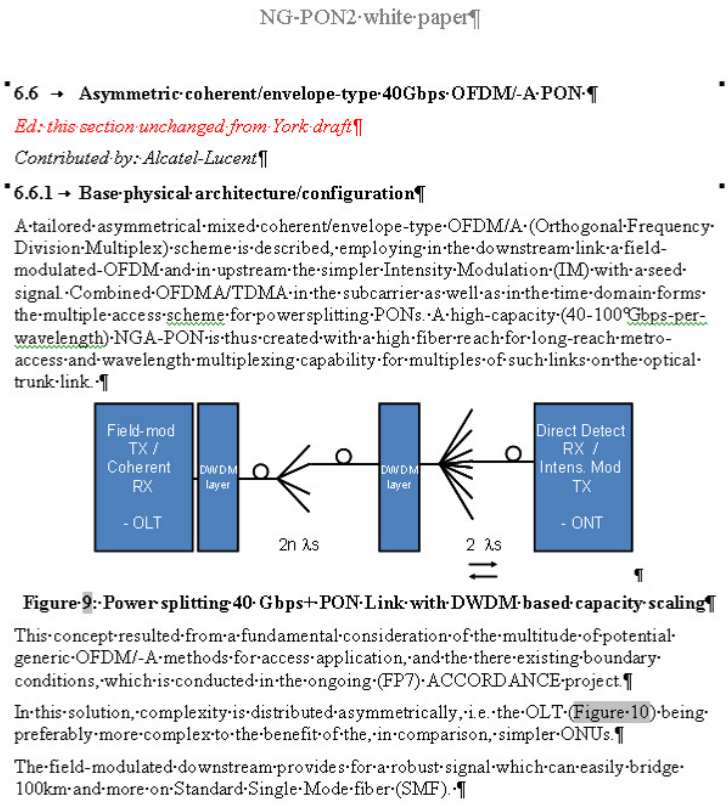
Figure 1: Section of FSAN San Francisco February 2010 meeting contribution by Alcatel-Lucent

Year2: 2011

In year two, the Accordance preferred concept has been presented in a more detailed way to FSAN during the May 2011 Berlin meeting "OFDM for NGPON2 Network Convergence". This was a vendor contribution by Alcatel-Lucent (ALUD). The presentation addressed the multi-service (converged) networking idea, capacity upscaling, and the fixed/mobile networks integration, besides the strengths of OFDM networking in this context. The cost tailored ACCORDANCE approach with mixed coherent/envelope processing has been introduced and expected performance was presented. Tentative implementations of OLT and ONUs functions have been sketched, before giving also an outlook to an all-optical ONU pre-selection concept for future processing bandwidth reduction and finally an assessment of the technology requirements.

Figure 2: Berlin FSAN meeting 2011 contribution by Alcatel-Lucent

In parallel, Alcatel-Lucent placed the ACCORDANCE network concept also in the FSAN Vendor White-Paper currently in preparation by the FSAN community. Based on the Berlin meeting vendor presentation, a chapter has been contributed that outlines in more detail concept and capabilities. The contribution by the ACCORDANCE project was one of three in total that are dealing with OFDM based metro/access networks. Since the other two OFDM-based technology contributions (from the US and Asia) are describing different approaches, however under the general OFDM signal-type use, a harmonization is underway at end of year 2.



NG-PON2 white paper

6.6 → Asymmetric coherent/envelope-type 40Gbps OFDM/-A PON

Ed: this section unchanged from York draft

Contributed by: Alcatel-Lucent

6.6.1 → Base physical architecture/configuration

A tailored asymmetrical mixed coherent/envelope-type OFDM/A (Orthogonal Frequency Division Multiplex) scheme is described, employing in the downstream link a field-modulated OFDM and in upstream the simpler Intensity Modulation (IM) with a seed signal. Combined OFDMA/TDMA in the subcarrier as well as in the time domain forms the multiple access scheme for power splitting PONs. A high capacity (40-100 Gbps-per-wavelength) NGA-PON is thus created with a high fiber reach for long reach metro-access and wavelength multiplexing capability for multiples of such links on the optical trunk link.

Figure 9: Power splitting 40 Gbps PON Link with DWDM based capacity scaling

This concept resulted from a fundamental consideration of the multitude of potential generic OFDM/-A methods for access application, and the there existing boundary conditions, which is conducted in the ongoing (FP7) ACCORDANCE project.

In this solution, complexity is distributed asymmetrically, i.e. the OLT (Figure 10) being preferably more complex to the benefit of the, in comparison, simpler ONUs.

The field-modulated downstream provides for a robust signal which can easily bridge 100km and more on Standard Single Mode fiber (SMF).

Figure 3: FSAN Vendor Whitepaper draft chapter (excerpt), contributed by Alcatel-Lucent

2.2 CaON CLUSTER ACTIVITIES

Accordance partners (UPC and ALUD) are participating in the standardization related activities of the CaON cluster. CaON White Paper efforts were supported by ALUD by creation of presentation describing ACCORDANCE activities in the standardization field, and participation in the "CaON Standardization Task Force" kick-off telco at 28th of Nov. 2011.

A presentation is planned to be given by ALUD at the "Future Network and Mobile Summit" event in 2012 (Berlin/ Germany).

2.3 PASSIVE MONITORING

2.3.1 Wireline: FSAN/ITU-T:

Alcatel-Lucent, Deutsche Telekom and Telefonica Spain are continuously attending FSAN meetings and are contributing the respective active topics (Call for Proposals) on the vendor and on the operator side. From Alcatel-Lucent as well as from Deutsche Telekom, a project participant is represented in the FSAN meetings. In 2010 Telefonica I+D worked close to Telefonica's representative in order to translate to this forum ACCORDANCE activities interesting for their Business Units, but from 2011 Telefónica I+D has begun attending to FSAN meetings.

Specifications and recommendations arising from FSAN work find their direct way into the ACCORDANCE project work.

Year1: 2010

Four FSAN meetings have been held in **2010**. The first in February was held in **San Francisco**, and the previously mentioned presentation on OFDM with the chart about ACCORDANCE was held by Alcatel-Lucent. Other vendor and operator companies presented also their view on OFDM in general. The second meeting in April in **Peking** did not call for NGPON2 contributions. On the third meeting in September in **Munich**, presentations on expected power budgets for 2015 from two FSAN member companies were given. The last meeting in 2010 took place in **Las Vegas** and was held in November. One presentation was given on an OFDM transmission experiment. Another technical presentation was describing the possibility for frequency domain equalisation in an OFDM system.

An important milestone will be the operators' **White Paper on NGPON2**, which should give the expected parameters for the comparison of different modulation techniques. This is expected to be finalised in beginning of 2011. Deutsche Telekom has an active role in this white paper activity.

Year2: 2011

Four FSAN meetings have been held in **2011**. The first in January was held in **Tokyo** with contributions on OFDM-PON Transceiver for NG-PON2 (ZTE) and Power Consumption Analysis of DSP-based OFDMA-PON for NGPON2 (NEC). The second meeting took place in May in **Berlin** and the previously mentioned presentation "OFDM for NGPON2 Network Convergence" related to ACCORDANCE was given by Alcatel-Lucent as a vendor contribution. Other vendor and operator companies presented also their view on OFDM in NG-PON2 systems in general. The third FSAN meeting was held in September in **York**. Three contributions on OFDM PON have been provided to White Paper on NG-PON2 technologies:

1. Asymmetric coherent/envelope-type 40Gbps OFDM/-A PON (ALU)
2. OFDMA and WDM-OFDMA PON for NG-PON2 (NEC)
3. OFDM-PON Architecture and Technology (Joint contribution by: Fujitsu Semiconductor Europe, Hisense-Ligent, ITRI, NeoPhotonics, Vitesse, ZTE)

The last meeting in 2011 took place in **San Diego** and was held in November. Presentations were given on component power consumption also including OFDM concepts.

FSAN finalized the White Paper on NG-PON2 operators' requirements in 2011 and has started the work on a second White Paper (Vendor WP) on NG-PON2 technologies describing the most relevant technology candidates for NG-PON2. This White Paper is expected to be finalised in Q1/2012. It is the basis for the technology selection process that is currently prepared by the FSAN operators.

2.3.2 Wireless: 3GPP & WiMAX Forum

Year1: 2010

Naturally, backhauling the base stations is addressed by 3GPP for the standardization of LTE and LTE advanced. However, only general requirements are defined, here. The actual implementation of the backhauling network is open as long as it fulfils these requirements. So, momentarily no active intervention is possible and needed. Alcatel-Lucent has active members in 3GPP standardization and Telefonica I+D is also tracking its activities So, changes with impact to ACCORDANCE will directly be communicated to the consortium.

Due to the architecture of the ACCORDANCE network some changes within the physical/MAC layer definition of LTE/LTE advanced may become necessary. As soon as this occurs, a respective contribution to 3GPP will be prepared and delivered.

In a more general view, the technical and operational requirements of next generation wireless mobile broadband base stations are globally determined by ITU. While 3GPP and WiMAX Forum mainly work towards the certification and promotion of LTE and WiMAX technologies respectively, standardization and industrialization of IMT-Advanced recommendations are currently ongoing by both organizations for LTE-Advanced and WirelessMAN-Advanced. In particular, the WiMAX Forum is investigating the harmonization of IEEE 802.16 Task Group m standardization activities. INTRACOM Telecom is currently tracking the standardization activities of IEEE 802.16m and the specifications produced related to this relevant standard by the WiMAX Forum. Potentially important applications and impacts of this standardization processes to the ACCORDANCE architecture will be identified and communicated to the consortium. Technologies and techniques defined in IEEE 802.16m, WiMAX Forum and ITU IMT-Advanced that might have significant impact to ACCORDANCE network and/or are exploitable candidates for PHY/MAC layer convergence of fibre and wireless will be recognized and if deemed necessary a relevant contribution to organizations and standardization bodies will be planned and provided.

Year2: 2011:

No distinct actions and updates in the wireless areas.

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