

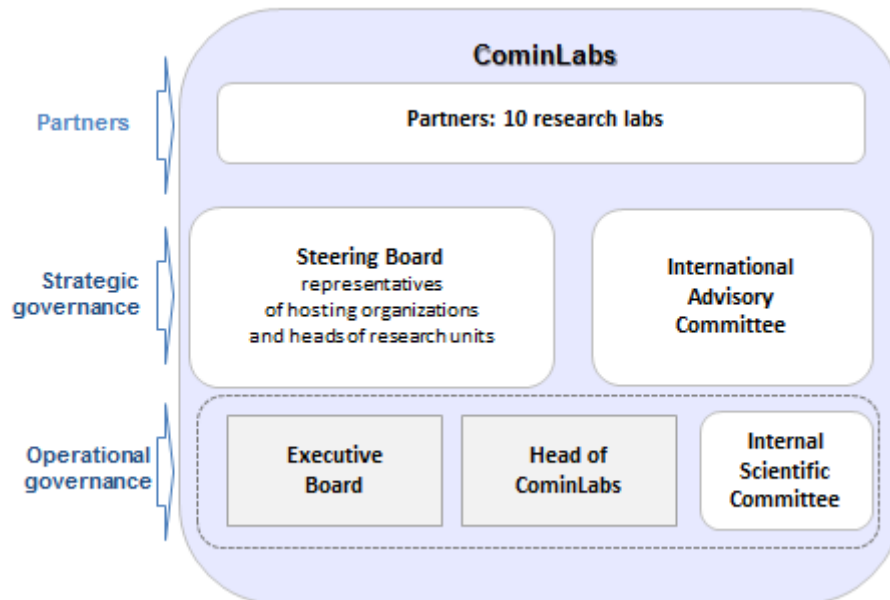


Le rapport d'étape doit être rédigé en anglais (une version française pourra être jointe).

Il ne doit pas excéder 22 pages.

1. ETAT D'AVANCEMENT DU PROJET / PROGRESS OF THE PROJECT

1.1 Governance (initiation, organization and project governance, management and monitoring systems, way of involvement of concerned research units' directors)



The overall governance of the CominLabs is organized in two levels: strategic level and operational level, as represented in the above Figure.

The **Steering Board** (SB) collects the representatives of the 15 institutions involved in the CominLabs. The heads of the 10 partners (research labs) participating to CominLabs are invited members of the SB, and so are representatives of the Bretagne and Pays-de-la-Loire regions. The SB approves the scientific strategy, roadmap and funding plan for the considered period, including project selection and funding. The SB is chaired by the CTO of Université Européenne de Bretagne (UEB), formerly Christian Roux and now Yvan Lagadeuc. The SB meets two times a year.

The **International Advisory Committee (IAC)** is an original and important body of 9 international experts. Its composition can be found at <http://www.cominlabs.ueb.eu/fr/governance>. The IAC advises CominLabs leadership for the selection of the new projects and activities funded by CominLabs, and evaluates the progresses of these projects. The IAC is a key instrument for us; it requires a significant involvement from our experts.

The **Head of CominLabs** consisted of Albert Benveniste and Dominique Massaloux until March 2014, and consists now of Patrick Bouthemy, Claude Jard, and Ramesh Pyndiah. The **Executive Board** is a small group of senior scientific colleagues helping the directors. The **Internal Scientific Committee (ISC)** is a larger group of CominLabs scientists (about 20 people), which contributes to brain-storming activities regarding research plans, the seeding and preparation of future projects, and assists the head in monitoring ongoing projects.

1.2 Recherche/Research

CominLabs gathers 10 labs over a wide territory (Bretagne-Nantes) and covers a pretty wide scope, ranging from optics and electronics (antennas) to web-based applications, through telecoms

and ICT for health. Given the size of the scientific population of the set of partners, the level of funding forbade to spread it all over this population. It was therefore natural to adopt a project-oriented style of operation with a focused funding. Still, we did not want our project program to be yet another source of funding, with the burden of proposal writing as usual. The processes of project construction and selection as well as the monitoring of ongoing projects are thus important matters. They are detailed in subsequent sections of this report (2.A.2 and 2.A.3).

Over the period 2011-2014, 5 calls have been organized, with a total of 42 submissions, which is an indication of the commitment of the colleagues over the labs partners of CominLabs, and sometimes beyond. 16 projects were selected which represents a reasonable acceptance rate of almost 40%. A sixth call was issued early 2015 and a last call is planned for 2016.

Compared to our initial plans when starting CominLabs, some areas are below expectations (particularly multimedia), whereas other areas have emerged as strong tracks for our community (ITC for health and security being the strongest two). To strengthen these areas beyond the life of CominLabs, we have decided to structure our projects portfolio into 7 topics, and to immediately launch and support two of them as **tracks**, the strongest ones (ICT for Health, Security & privacy) and later on two more tracks (connected things, ICT & energy in networks). Tracks are further discussed in Section 2.A.6.

Regarding perspectives, CominLabs leadership plans to focus its efforts on the following:

- Further strengthening the main tracks; building beyond-CominLabs communities; supporting spinoff activities for both education & training, and innovation;
- Sustaining areas that we feel should be better represented, particularly data analytics for multimedia and environment, where we have only 1 project so far, despite strong assets;
- Pushing support for international activities; so far the main success has been the CominLabs chair;
- Having researchers from Social Sciences still better involved. This community was present in the CominWeb development, nevertheless it is participating to only two ongoing projects so far: Limah project (several teams from law, cognitive psychology, ergonomics and sociology domains), Sherpam project (from social psychology). Social sciences teams were part of 4 submissions in the 2015 call albeit with no success. Interestingly enough, researchers in economy were involved in one proposal.

Overall, CominLabs is considered highly positive by our scientific community. It has contributed to establishing the 10 partner labs as a community, which was far from being the case before. CominLabs is not perceived as yet another bureaucratic burden on the shoulders of the researchers. Instead, it is acknowledged for a number of new and sometimes surprising collaborations, which matches our initial objectives.

1.3 Formation/Training

The focus in the 2011 proposal was on global opening to the world and multidisciplinary activities. Education is an important aspect of CominLabs, considering that education is becoming a huge issue for the web, that an essential question for Internet is education and that a virtuous cycle research-teaching is to be supported. We decided to reserve 15% of the ANR budget to finance activities in this field. In addition, Master students participating to the research projects of CominLabs were funded on this budget.

The Education Program in CominLabs is chaired by Colin de la Higuera, Professor at Nantes University, chair for Curriculum Development Programme in European Network PASCAL (2003-2012) and President of the French Informatics Society (until 2015).

The goals of the Education program were refined in :

- Organizing preparation, coordination and following of education projects;
- Running a transverse education project (COCO), linked to the CominWeb project;
- Encouraging research projects to contribute to the education activities by producing advanced teaching modules for the Master level issued from their results.

At the end of 2014, we launched three significant actions:

- The 3D-MOOC project (Telecom Bretagne, ENS Rennes, and 3 SMEs), which builds a library of 2D and 3D modules with two use cases: renewable energy with Guyot Environment (recycling of cars) and the Ile de Sein project on the energy transition. A method is developed for the indexing and composition of scenarios from these modules both for teachers and students.
- The COCo platform (University of Nantes, Region of Pays de la Loire): the CominOpenCourseware (COCO) project aims at building and animating a platform for disseminating and promoting both rich media (video-centered) open courseware and to test ideas related to research in the use of video annotations and machine learning technologies in e-learning.
- The construction of a CominLabs course entitled "The brain function: transdisciplinary and multiscale approach".

Implementing the program and motivating researchers to initiate activities in the field of education has proved a difficult task. Very few projects were proposed despite a clear incentive to do so. It is (now) unsurprising: research on these topics is restarting in France. The likely reasons are that researchers may have other priorities, and it is not clear whether teaching departments, in France, welcome research to interfere.

There are nevertheless reasons to be positive. First, we believe that COCo is a success. COCo presents a nice combination of active research, prototype development, and is now a plausible partner for national and international projects. Secondly, Internet of education is emerging as a complex theme of research inside the different research communities (i.e. it is a question for researchers in cloud, in databases, in machine learning, in natural language processing). We are close to these communities and to all that is happening. The 3DMOOC project may have a follow-up in the digital education program for secondary schools of the Ministry of Education. Being aware of this, we decided to rephrase our goals:

- To have an activity in research over "internet of education";
- To promote projects related to this question in CominLabs;
- To help facilitate the production of internet tools for education.

CominLabs has established links with various local players in training (Cellule MOOC of Télécom Bretagne, Loustic consortium in Brest and Rennes, the UEB campus program, and the Linked-Media research team at IRISA-Inria) and has participated to dedicated events like the thematic school in Brest « MOOC and EIAH ».

In order to keep the link between the activities of CominLabs and various teaching departments of institutions, we have set up the Committee for Teaching and Education (CTE), composed of one representative per institution. CTE is a forum for discussing current projects in institutions and allows CominLabs to position its activity among them.

In response to our invitation to extend the activities of research projects by a related training activity, the S3PM project is now forming an ambitious proposal (involving researchers in psychology too) on digital tools to support the training of scrub nurses. We also want to launch another large research project related to education, presumably on learning analytics.

1.4 Valorization/Result exploitation

For the first period 2011-2014 of CominLabs, the budget part dedicated to “valorization activities” (in the broad sense) was mainly used to hire engineers in projects which develop experimental platforms. Indeed, these platforms, whose constituents may be software, hardware or/and sensors, are seen as a prerequisite to envision proof-of-concept, innovation evidence and possibly industrial transfer at the end of the research projects.

We keep monitoring innovation opportunities in the ongoing CominLabs projects. We are in close relationship with the SATT Ouest Valorisation on that subject and we decided in 2014 to set biannual meetings between the CominLabs leadership and the SATT. A first patent was filed in December 2013 (S3PM project). Other patent opportunities are investigated in several projects (Hemisfer, Pervasive, Predictive, S3PM, TEPN). We also asked experts of the IAC to assess the 16 ongoing projects launched in 2012 and 2013, and in particular, to identify opportunities for innovation.

The 3D-MOOC project comprises as partners three SME which contribute to the project achievements and plan to exploit the project results. One of the projects launched in 2015 involves the IRT b<>com and Orange Labs as partners.

A first meeting with IRT b<>com head has taken place in March 2015 to define how the collaboration between CominLabs and b<>com could be organized on a larger basis, especially around the CominLabs tracks for the next years.

Besides, we have just established a collaboration with the Rennes node of the EIT ICT Labs to benefit from its innovation and entrepreneurship program for young researchers in ICT and to promote it to CominLabs PhD students and postdocs. The first event is the (free) participation of CominLabs PhD students to the two-day seminar devoted to the ‘Raising Awareness in I&E’ module of the EIT ICT Labs doctoral school. More substantial actions are planned for the future which will be co-funded by CominLabs as the participation to the 5-day module on business opportunity recognition for researchers in ICT or to other courses on entrepreneurship.

1.5 Rayonnement, actions de promotion du LabEx

CominLabs is made fully visible through its web site <http://www.cominlabs.ueb.eu/>. The site covers management activities, research activities (with details on project results through their own pages), and events. Advanced services are offered, e.g., LookinLabs for searching CominLabs competencies, and a private cooperative platform. In addition, a newsletter (also visible on the site), with two issues published so far and a third one in preparation. Activities regarding the Web site are part of the CominWeb research project, whose total budget over the whole duration of CominLabs is about 640k€.

CominLabs has established the *CominLabs Days*, which are open days for the scientific community. Two issues have been organized so far in June 2013 (see <http://www.cominlabs.ueb.eu/first-cominlabs-week>) and March 2015, with the participation of International Advisory Committee (IAC) members. The total cost of 2013 issue was about 15k€. A special event http://web.ueb.eu/Divers/documents/CR_131216_OuestIRTLabex.pdf, called “journées Ouest-IRT-Labex”, was organized by us in Dec. 2013, where three other Labex (MER, Lebesgue, CAMI) and two IRTs (b<>com and Jules Verne) participated. As a consequence, joint research projects have since then been launched with MER and Lebesgue.

Albert Benveniste was invited to panels regarding the Labex program at CNRS-headquarters and the GRETSI 2013 (National Conference in Signal & Image processing, 480 participants).

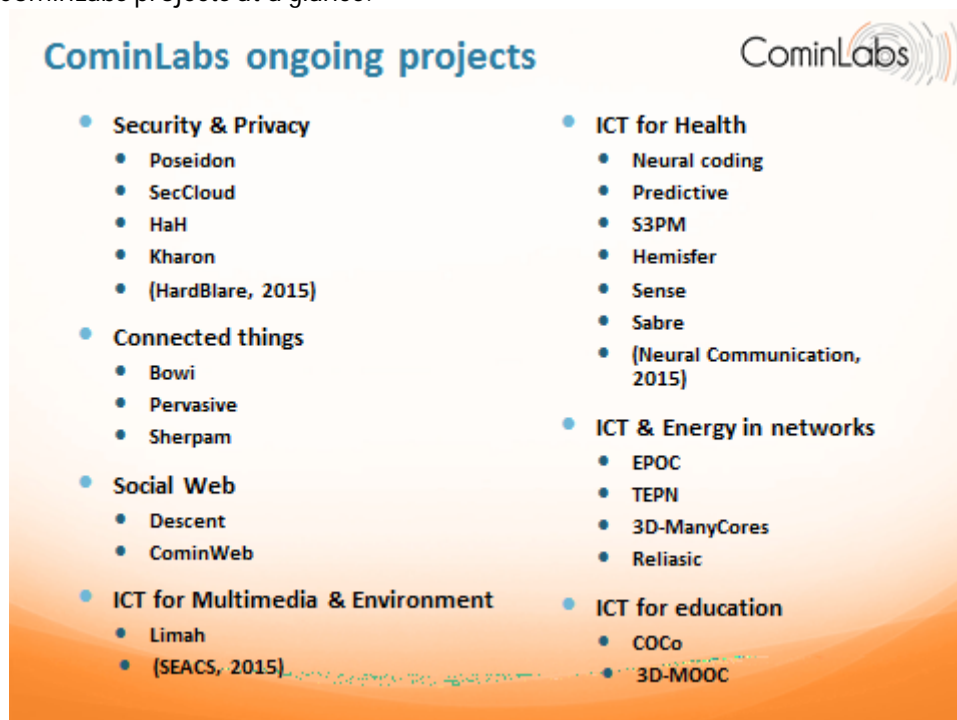
In the framework of TEPN-project and CominLabs chair, a MoU was signed between Supelec and the Zhejiang University in China, and the 3rd International Workshop Next-GWIN on Next generation Green Wireless Networks was organized in October 2014, Rennes, with 135 registered participants, co-chaired by Honggang Zhang, CominLabs chair, and Jacques Palicot, a member of TEPN CominLabs project.

2/ Label and associated funding impact

A) Scientific achievement description

1. CominLabs projects

Detailed project descriptions are available at <http://www.cominlabs.ueb.eu/fr/projects> . Here we show CominLabs projects at a glance.



The infographic displays the CominLabs logo and lists ongoing projects categorized into several areas:

- Security & Privacy**
 - Poseidon
 - SecCloud
 - HaH
 - Kharon
 - (HardBlare, 2015)
- Connected things**
 - Bowi
 - Pervasive
 - Sherpam
- Social Web**
 - Descent
 - CominWeb
- ICT for Multimedia & Environment**
 - Limah
 - (SEACS, 2015)
- ICT for Health**
 - Neural coding
 - Predictive
 - S3PM
 - Hemisfer
 - Sense
 - Sabre
 - (Neural Communication, 2015)
- ICT & Energy in networks**
 - EPOC
 - TEPN
 - 3D-ManyCores
 - Reliasic
- ICT for education**
 - COCo
 - 3D-MOOC

Extended titles and basic facts for each project are given next.

Labeled in May 2012 (effective start end of 2012):

3D-MOOC

3D-massive online open courses, an open library of granular process able 3D contents
Partners : Telecom-Bretagne, ENS Rennes, Tietronix (SME), APIX (SME), 3D Stereo Prod (SME)
Funding: 293k€ (293k€ from CominLabs)

BOWI

Body world interaction, towards an accurate gesture and body movement estimation using very-small and low-power wearable sensor nodes

Partners: Inria Rennes, UBS-LabSticc, University Rennes 1 – IETR, University Rennes 1 – Irisa, Télécom Bretagne – LabSticc

Funding: 761k€ (544k€ from CominLabs, 217k€ from Région Bretagne)

CominWeb

CominLabs collaborative platform with advanced services

Partners: Inria Rennes with participation of all partners for the requirements

Funding: 638k€ (638k€ from CominLabs)

Neural Coding

Identification of cortical networks from high-resolution EEG: application of the mental information theory

Partners: Télécom Bretagne, Inserm – LTSI

Funding: 295k€ (245k€ from CominLabs, 50k€ from Région Bretagne)

Poseidon

Protection of outsourced or mutualized data and content

Partners: Télécom Bretagne – LabSticc, CNRS- LabSticc, Télécom Bretagne – LaTIM, University Rennes 1, Inria Rennes, Supelec Rennes, University Rennes 1 – Irisa

Funding: 341k€ (251k€ from CominLabs, 90k€ from Région Bretagne)

Predictive

Predictive models for patient personalized treatment management

Partners: Inserm – LaTIM, University Rennes 1 / CHU Rennes – LTSI

Funding: 401k€ (273k€ from CominLabs, 128k€ from Région Bretagne)

SecCloud

Comprehensive language-based approach to the definition, analysis and implementation of secure applications developed using Javascript and similar languages

Partners: Inria Rennes, Supelec Rennes, EMN Nantes – LINA

Funding: 445k€ (338k€ from CominLabs, 107k€ from Région Bretagne)

Labeled in November 2012 (effective start in 2013):

Great (CominLabs Chair)

Green cognitive radio for energy-aware wireless communication technologies evolution

UEB/CominLabs Chair Professor : Honggang Zhang (Zhejiang University, China)

Partners: Supelec – IETR

Funding: 80k€ (80k€ from CominLabs)

Pervasive RFID

RFID devices for pervasive computing and distributed applications

Partners: Inria Rennes, University Rennes 1 – IETR

Funding: 244k€ (169k€ from CominLabs, 75k€ from Région Bretagne)

S3PM

Synthesis and simulation of surgical process models

Partners: Inserm – LTSI, Inria Rennes, Insa Rennes – Irisa

Funding: 298k€ (203k€ from CominLabs, 95k€ from Région Bretagne)

TEPN

Energy proportional networks

Partners: Supelec – IETR, Télécom Bretagne – Irisa, Inria Rennes, Insa Rennes – IETR

Funding: 827k€ (557k€ from CominLabs, 270k€ from Région Bretagne)

Labeled in June 2013 (effective start fall 2013):

COCo

CominOpenCourseware : Leveraging annotations in video-centered pedagogical resources, creating open multimodal content for knowledge diffusion, exploring new techniques for e-learning

Partners: University Nantes – LINA

Funding: 337k€ (237k€ from CominLabs, 100k€ from Région Pays-de-la-Loire)

Descent

Plug-based decentralized social network

Partners: University Rennes 1 – Irisa, Inria Rennes, University Nantes – LINA

Funding: 355k€ (310k€ from CominLabs, 45k€ from Région Bretagne)

EPOC

Energy proportional and opportunistic computing systems

Partners: EMN – LINA, Télécom Bretagne – LabSticc, INSA Rennes – Irisa , ECN – Ircyyn, ENIB – LabSticc, CNRS – Irisa

Funding: 468k€ (378k€ from CominLabs, 90k€ from Région Bretagne)

Hemisfer

Hybrid EEG-MRI and simultaneous neuro-feedback for brain rehabilitation

Partners: CNRS – Irisa, Inria Rennes, University Rennes 1 – CHU Rennes, Inria Sophia-Antipolis (Maureen Clerc)

Funding: 455k€ (410k€ from CominLabs, 45k€ from Région Bretagne)

Sense

Sparse neural coding & bionic vision system

Partners: UBS – LabSticc, Télécom-Bretagne – LabSticc, UBS – Irisa

Funding: 428k€ (293k€ from CominLabs, 135k€ from Région Bretagne)

Labeled in October 2013 (effective start mid 2014):

Limah

Linking media in acceptable hypergraphs

Partners: CNRS – Irisa, University Nantes – LINA, Télécom Bretagne – IODE, University Rennes 2 – Prefics, University Rennes 2 – CRPCC

Funding: 538k€ (403k€ from CominLabs, 135k€ from Région Bretagne)

Labeled in February 2014 (effective start fall 2014)

3D ManyCores

3D many-core architectures based on optical network on chip

Partners: University Rennes 1 – Foton, Inria Rennes, University Rennes 1 – Irisa, ECL – Institut des Nanotechnologies de Lyon

Funding: 607k€ (372k€ from CominLabs, 235k€ from Région Bretagne)

H-A-H

Hardware and arithmetic for hyperelliptic curves cryptography

Partners : CNRS – Irisa, University Rennes 1 – IRMAR (Lebesgue labex)

Funding: 141k€ (96k€ from CominLabs, 45k€ from Région Bretagne)

Kharon

Discovering Android malware with information flow monitoring

Partners: Inria Rennes, ENS Rennes – Irisa, University Rennes 1 – Irisa, Supelec Rennes

Funding: 264k€ (166k€ from CominLabs, 98k€ from Région Bretagne)

Reliasic

Towards next generations of architecture and design flow to perform signal processing applications with unreliable components, case study on GPS architecture

Partners: UBS – LabSticc, University Nantes – IETR, University Rennes 1 – Irisa, Télécom Bretagne – LabSticc, CNRS – Irisa, UBO – LabSticc, Utah State University (Chris Winstead)

Funding: 538k€ (403k€ from CominLabs, 135k€ from Région Bretagne)

Sabre

Seizing advances in BCI from high resolution EEG imaging in runtime

Partners: Télécom Bretagne – LabSticc, Inria Rennes

Funding: 527k€ (457k€ from CominLabs, 70k€ from Région Bretagne)

Sherpam

Sensors for health recording and physical activity monitoring

Partners: University Rennes 1 – LTSI, ENS Rennes – Irisa, UBS – Irisa, University Rennes 2 – CRPCC, ENS Rennes – M2S, University Rennes 2 – CHU Rennes

Funding: 475k€ (340k€ from CominLabs, 135k€ from Région Bretagne)

Some comments on rejected submissions

We do not comment on the quality but only on the topics covered. For each research track, we indicate the number of rejected submissions: Security & privacy: 2; Connected things: 5; Social web: 2; ICT for multimedia & environment: 4; ICT for health: 5; ICT & energy in networks: 4; ICT for education: 0.

2. Processes for launching and selecting projects

It is our opinion that existing funding programs, while being effective at stimulating activity, fail to optimize the scientific outcome of the research community. From the very beginning, CominLabs has put this as its top concern. Processes for selecting, establishing, and running CominLabs projects have been designed with this objective.

For each call, we first begin with a 4-month period during which a wiki is open for publishing draft submissions. These are reviewed by CominLabs leadership and a handful of senior researchers (Internal Scientific Committee), with the objective of in-depth improvements, addressing foreseen administrative obstacles (related to possible participation of non-CominLabs teams), suggesting new collaborations (this has proved successful in several cases).

Finalized submissions are reviewed by the IAC experts over a period of 6 weeks. Then, a 2 or 3-week discussion period follows between IAC and CominLabs leadership. Reviews as well as subsequent discussions leading to a final recommendation are recorded in detailed *Evaluation Reports* (over 50 pages). The important point is that these evaluation reports are provided to the Steering Board for decision and to all proposal investigators. This had two benefits: (1) transparency is beyond state of practice, which caused total acceptance of the decisions, and (2) the feedback for the evaluation was used by several applicants for an improved re-submission that was successful at the next call.

Overall, our project programs are seen as scientific seed forums, not as yet another source of money.

3. Evaluation of ongoing projects by the International Advisory Committee

These evaluations apply only to the 16 projects launched in 2012-2013. We report here verbatim the feedback from our IAC experts.

Summary Report of the IAC on CominLabs, March 27, 2015

0. Introduction

On March 23 and 24, 2015, all members of the IAC participated in the events, lectures, poster sessions, discussions and evaluations of the program of CominLabs, at the INRIA facilities in Rennes, France. Two members of the IAC participated via electronic access. Prior to this meeting all IAC members in teams of 2-3 participated in detailed reviews via teleconference or video conference of all 16 current projects. During the on-site visit IAC members in groups of 2-3 held shorter review meetings with each project.

The IAC members would like to thank very much all researchers and staff of CominLabs for all their hard work and efforts that went into preparing for these presentations and reviews. The IAC members also very much appreciated the openness and enthusiasm of the CominLabs researchers to participate in intense questions and answers periods during the various activities described above.

1. General Feedback Comments

There was general agreement in the IAC that CominLabs has made excellent progress in its research program. There was strong evidence of excellent research work and results, very good collaboration among researchers in the various research projects and cross-disciplinary research work. Despite the fact that the various projects did not all start at the same time (thus they have been operating for different time periods) and the great diversity of topics covered, there was general consensus among the IAC members that the overall effort and program of CominLabs, as has developed to date, is very successful. Novel ideas and concepts have been included or emerged in all projects. The overall output measured by publications, test beds, experiments, the involvement of younger researchers, international impact and collaborations, and other forms of KPIs, is excellent. Several of the projects also built innovative test beds and infrastructures that have been used to test, validate and demonstrate the research results. The CominLabs leadership and all researchers are to be complimented for achieving the current state of development and performance.

The IAC members would like to note that CominLabs leadership and researchers adopted the recommendations of the June 2013 review to: (a) establish a short list of tangible outcomes for each project for measuring progress and success; (b) the establishment by CominLabs leadership of several measures and review instruments to evaluate individual project progress and successes and associated funding. The IAC members very much appreciate the challenges involved, but at the same time strongly believe that these processes helped achieve the current successful state of CominLabs.

Further the IAC members appreciate the positive response, as evidenced by the present reviews, of CominLabs to their June 2013 recommendation to involve researchers with expertise from behavioral, social, medical and human sciences in the research program.

2. The Path Towards the CominLabs Mission

Excellence in ICT Research of Importance to Society

The current research program of CominLabs has achieved very good progress towards this part of its mission. Excellent and innovative results include: novel neural network-based associative memories (SENSE), far-reaching neurofeedback-based brain therapies utilizing joint EEG/fMRI sensing (Hemisfer), an innovative platform for disseminating and promoting rich media open courseware content from a combination of domains (COCO), a remarkable system to develop centralized collaborations in the million-plus scale (DeScenT), novel cognitive radio techniques for green wireless communications (GREAT), innovative security schemes for JavaScript (SecCloud), the pioneering demonstration of cliques existence in the brain (Neural Coding).

Community Building

All current projects appear to be successful in this respect, at different levels of success as expected given the diversity of the topics and of their operating periods since initiation. CominLabs has managed to develop collaborative projects that would not have occurred otherwise. The next step is to increase cross-project collaboration.

Innovation

Although some progress towards achieving this part of the CominLabs mission were evident in the present reviews, the current CominLabs projects presented were mainly focused on the technical feasibility of the research and in the establishment of test beds or prototypes. The IAC members highly recommend the establishment and launching of systematic innovation and technology transfer policies via collaboration projects with industry and SMEs, which will impact regional economic development.

Education

The educational programs of CominLabs are ambitious and an integral part of the overall program. So far they have focused on developing innovative tools for the Internet of Education and the acceptability of such tools by teachers. A Committee for Teaching and Education was set up to coordinate efforts and address barriers and solutions. Further development and acceleration of progress is needed in this area.

3. Looking into the Future Development of CominLabs

The IAC members support strongly the proposed plan to further consolidate the research program of CominLabs by clustering related research projects into a small number of research tracks. Such an organization will facilitate cross-project interactions and bring substantial benefits, including the substantial strengthening of the transformational and structuring effects of CominLabs, and the ability to attract substantial additional funding from EU and other sources.

The IAC members also support strongly accelerating and substantially strengthening efforts in education, including the launching of a Working Group and a large research project on learning analytics. Stronger linkage to CominLabs projects is recommended.

End of verbatim.

4. Zooming on some projects and actions

Transdisciplinary research projects

A major motivation for CominLabs was, for tackling new fundamental challenges, to establish strong bridges between different areas of ICT that are not used to cooperate, at least in France. Typical examples of such bridges in ongoing CominLabs projects are: optical networking and data center middleware; antennas and ubiquitous applications over connected things; EEG data processing and coding theory; Surgical process ontologies, formal methods in computer science, and virtual reality. We now develop in more detail a few highlights.

Antennas and ubiquitous applications over connected things

Pervasive (or ubiquitous) computing is a vision where computing and real-world are tightly merged, thus giving to every object a digital role. Several technological revolutions made this to happen: 1/ Internet ubiquity, 2/ progresses in smart embedded devices, including RFID. RFID chips are small, passive, and cheap, making it possible to attach them in almost anything. Although very limited, RFID allow things to interact through short-range wireless communications. The TACOMA Inria team has been exploring an approach where data structures and computing processes are directly hosted and supported by physical objects and their interactions, instead of relying on a remote information system. Because pervasive computing require devices to operate in a more unpredictable environment, limitations of existing RFID technology become a bottleneck.

The **Pervasive RFID** project (<http://www.pervasive.cominlabs.ueb.eu/>) addresses this challenge, by gathering skills in microwave and antenna design, in combination with skills in distributed systems and ubiquitous computing. In particular, novel antenna systems are developed offering higher diversity (both spatial, in polarization, and in pattern) and versatility capabilities, while keeping simple and requiring a very low-cost feed network. In parallel, virtual numerical models for these antennas are developed for use in combination with a hardware test bed. On the other hand, new technologies are developed to offer redundancy in RFID signal analyses (e.g., the miss of some RFID tag signals, due to ill-positioning of objects).

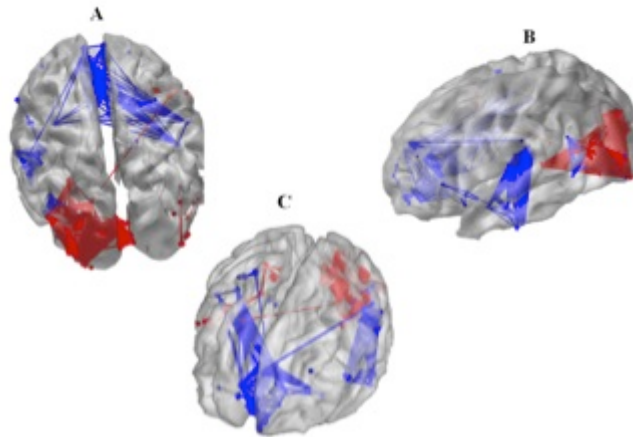
The combination of skills offered by this project is unusual in the French academia, and this research would have had difficulties getting otherwise supported. We believe that this new collaboration should find its way to industrial exploitation, either through spinoff or industrial transfer. We firmly believe that this will survive CominLabs.

EEG data processing and coding theory for the identification of cortical networks

CominLabs has top quality skills in coding theory (Claude Berrou is a co-inventor of turbo-codes and is now developing a mental information theory) and in EEG signal processing. While no link existed between the two subjects before CominLabs, an opportunity for a collaboration emerged as the result of the brain storming activity that was organized during the 1st year of CominLabs.

The objective of the **Neural Coding** project (<http://www.neural-coding.cominlabs.ueb.eu/>) is to go beyond state-of-the-art in brain connectivity estimation. The focus is on the identification of brain circuits from real EEG data recorded with a high temporal resolution, either with healthy patients or with patients subject to epilepsy. The aim is to validate the *mental information theory* developed by Claude Berrou and to take benefit from it.

The picture below shows brain connectivity represented as cliques in graphs of correlated EEG 256-sensor measurements. Cliques in graphs of cortical networks are hypothesized as being the vehicle of information storage in the brain, by the mental information theory. Theoretical studies have proved that this information storage mode is resilient and robust; it is clearly adapted to cortical networks. The above three pictures correspond to the reaction of a patient to three different kinds of stimuli. While these results are in agreement with the state of knowledge in EEG analysis, they offer a significant refinement and progress.



The results obtained by this project provide a first validation of the mental information theory. One remarkable result is the achievement of a dense spatial reconstruction along with the high temporal sampling of EEG signals, which opens the way to investigate the dynamics of the connections. Further work is required for a deeper validation, by addressing coding and communication of mental information jointly. This is the subject of a newly accepted CominLabs project.

Irrespective from the link with mental information theory, this project has developed a proof of concept of a new technology in multi-EEG signal processing, in which the focus is on correlations between signals, not the individual signals themselves. The area has now become a new research axis for LTSi, a partner lab of CominLabs involved in this project.

To conclude, we see this as a best example of what CominLabs likes to produce, namely highly innovative, high-risk, but still relevant, research.

Surgical process ontologies, formal methods in computer science, and virtual reality

Surgical education relies on an old "see one do one (and teach one)" paradigm. It is now considered that surgical education should rely on computer based systems with simulation capabilities. All aspects of the surgical decision making processes should be part of such computer based teaching systems. Researchers emphasized the importance of both conceptual and procedural knowledge in the decision making process. Some are explicit (mainly data, information and knowledge about the patient) and some are implicit, such as the surgical process expertise. A surgical teaching system should take into consideration such procedural knowledge and expertise.

The main objective of the **S3PM** project (<http://www.s3pm.cominlabs.ueb.eu/>) is to study methods allowing the modeling of surgical procedural knowledge from surgical cases observations. This project proposes to study a solution for the computation of surgical procedural knowledge models from recordings of individual procedures, and their execution. The objective is to develop an enabling technology for procedural knowledge based surgical simulation systems. The project targets particularly *scrub nurses* and involves teams from the Rennes hospital.

The two pictures below display Operating Room 3 at the neurosurgical department of the University Hospital in Rennes (France), top, and its virtual counterpart, bottom, in the Immersia platform of Inria Rennes and Irisa. The surgical process scenarios are mined from experiments, with the aid of ontologies, in the form of a special class of Petri nets inferred by a novel *workflow mining*

algorithm developed by Benoît Caillaud, a specialist in formal methods (he was never involved in any research related to health before CominLabs).

A first patent has been submitted on this framework and a project of virtual teaching and training of scrub nurses is in preparation and will be supported as a follow-up activity by CominLabs.

Again, this is an excellent example of what CominLabs seeks to produce, namely: selection of a practical relevant target, identification, through project preparation phase, of the skills and approaches that could contribute to the success, and development of new research in each contributing area to get the needed breaks. It should be emphasized that a first version of this project was submitted and rejected. Based on the feedback from IAC experts and in-house brain storming involving CominLabs leadership, the team on formal methods was invited to join for the second submission, which was successful.

Education project

The COCo project (<http://www.coco.cominlabs.ueb.eu/>) has conducted experiments in:

- Video Course/Lecture Enrichment: several courses and seminars were recorded and are available on the Web. They are enriched with the corresponding slides (that serve as navigation

- Emergence of a Scenarized Seminar: during the CNRS summer school "MOOC and EIAH", we had the opportunity to organize a workshop regarding video annotations as a way to prepare the scenarization of a MOOC. About 50 people exchanged knowledge and opinions through live annotation (using the tool COCoNotes Live) of Marcel Lebrun's conference. The results with the synchronization of the recording are available on the Web.

- Leveraging Annotations in MOOCs: a MOOC concerning digital addiction, organized by the University of Nantes and the CHU of Nantes, is currently ongoing. During the weekly webinars, the tool COCoNotes Live will be used to allow participants to comment, ask questions, etc. After the webinar, participants will be able to annotate the video and use direct pointers to video fragments in EdX forums.

The COCo project uses and further develops current research in various domains like video annotation, human computer interface, user activity analysis and machine learning. One work in progress is the multimodal alignment. It aims at aligning the content of an article with its presentation.

Making CominLabs an open body

From the very beginning we have seen CominLabs as an open body. Despite the funds we have targeted at CominLabs partners primarily, several projects involve teams from outside the 10 CominLabs labs (3D-Many Cores (<http://www.3d-opt-many-cores.cominlabs.ueb.eu/>) involves a team in optics from Lyon, and Hemisfer project (<http://www.hemisfer.cominlabs.ueb.eu/>) involves a team in image analysis from Sophia-Antipolis. Support to these teams is provided through mechanisms of co-supervision, for doctorants and post-docs.

Also, we are pushing cross-collaborations between different programs of the PIA. In December 2013, we organized a joint workshop (<http://www.cominlabs.ueb.eu/fr/retour-sur-les-journees>) with IRT b<>com (<http://b-com.com/>) and Jules Verne (<http://www.irt-jules-verne.fr/>), and the Labex MER (http://www.labexmer.eu/en/labexmer?set_language=en), Lebesgue (<http://www.lebesgue.fr/>), and CAMI (<http://cami-labex.fr/>).

As a consequence, two of our newly established CominLabs projects are co-supported by MER and Lebesgue.

5. International impact C5.16290 1154.31 n1551.71p31 np1.71o.6631157 D10

Regarding our international attractiveness, fifteen of our PhD students out of the forty recruitments and seven out of seventeen post-docs recruitments come from a foreign university. Let us also note that Prof. Chris Winstead from Utah State University is involved in the Reliasic project.

We envision more international activities for the next period (2015-19). For instance, several projects have planned workshops or summer schools to disseminate their results and to consolidate their investigation domain. The strong involvement of our IAC members (4 of them are from other European countries, and 3 from USA) and their subsequent knowledge and appraisal of CominLabs activities also contribute to CominLabs international impact.

6. CominWeb: making distributed research in CominLabs manageable

Cooperative research faces today the challenge of increasing bureaucracy and “data deluge”¹: proposals, reports, and project building cause an explosion in contents replicates with only slight variations, a reshaping of contents to adjust specific needs, the compliance with sophisticated enterprise or administration processes, and all of this results in an increasing time spent by the scientist over email and internet. The wild use of email aliases in cooperative activities has turned the generated email to SPAM. We envision a management of cooperative research under the slogan of zero-spam/zero-proposal/zero-report/zero-deadline. “4-zero management” is made possible thanks to existing advances in Web technology, recent progresses in research in the area of Social Network technologies, and innovative views on the Web-scale management of unstructured and structured data. **CominWeb** (<http://www.cominweb.cominlabs.ueb.eu/>) is a platform that aims at enabling 4-zero management of cooperative research activities.

Many of the projects of CominLabs have a strong trans-disciplinary nature. The search for competencies and knowledge is therefore a need. Exposing competencies beyond CominLabs is also a need. Hence, CominWeb shall serve as a *Competency Warehouse* and offers to this end the deployed **LookinLabs** service (<http://www.lookinlabs.cominlabs.ueb.eu/>). LookinLabs answers the following questions: 1) who has competencies on a topic described, either as a set of free keywords, or using plain text such as the introduction of a scientific or technical paper; and 2) what are the publications of CominLabs researchers relevant to this topic. A key point in LookinLabs is that no data base of keywords was filled by researchers. Information is simply mined from up to date publication data-bases, using big data technologies. To avoid

Draft publications are of particular interest, as they complement data bases of publications with ongoing work.

As any government funded program, CominLabs must report to its funding agency (Agence Nationale de la Recherche, ANR). This has been and is a costly duty for EU funded Networks of Excellence (NoE), leading to a number of requests, by the heads of such NoEs, to the participating people, for reporting activities. CominLabs bears similarities with such NoEs. It is therefore required that CominWeb facilitates the scientific aspect of reporting activities and reduces its cost. (Financial reporting is a separate matter, not considered here.) We have deployed a simple service that drags, from standard publication data bases, those acknowledging CominLabs. We are currently experimenting a clustering technology for producing draft sections of an activity report from the publications of the year. This draft service (not deployed yet) is called **ReportLabs**.

CominWeb is developed on top of the Liferay framework (www.liferay.com) for constructing Web portals and collaborative platforms. It offers an intranet with collaborative services as usual (we do not see this as a strong contribution since we do not expect our colleagues to change their habits and tools unless we offer much better). With reference to this technology, the concept of "roles" and access rights that goes with it is not powerful and flexible enough. It is our plan to develop more versatile means on top of Liferay. This will allow us to manage access rights and recommendations in a finer way.

7. CominLabs research tracks: surviving the end of CominLabs

The CominLabs proposal was structured according to seven research axes related to societal challenges: digital environment for the citizen; user centric images and media of the future; ICT for personalized medicine; neural coding; energy and resource efficiency in ICT; the social web; security and privacy, see <http://www.cominlabs.ueb.eu/fr/research>. The table at the beginning of Section 2.A depicts the **CominLabs Research Tracks (CRT)** that we use now to structure the CominLabs projects – this corresponds to a smooth deviation from the CominLabs proposal. We recall them here for completeness:

Security & Privacy
Connected things
The social Web
ICT for multimedia and environment
ICT for Health
ICT & energy in networks
ICT for education.

Among them, *Security & Privacy* and *ICT for Health* appear to be the strongest ones. We have decided to first experiment our new notion of CRT for these two ones and lift them to communities that should survive CominLabs.

With tracks over the 2015-19 period, we want to capitalize on the skills developed, to allow for cross-fertilization and cross-project interactions, and to pursue the following goals (keeping in mind that CominLabs is not a simple means of financing and not just a concatenation of projects):

- Strong and distinctive competencies of CominLabs must be pushed forward;
- The transforming and structuring effect of CominLabs must be made explicit and further exploited;
- We want to prepare for the future, in-line with the structuring of research and higher education that is taking place in Brittany and Pays-de-la-Loire regions.

Regarding *Security & Privacy*, we want to take advantage of the industry-oriented program established by Region Bretagne on this sector. Brittany has strong industrial assets including large companies and a defense national lab (DGA-MI) located close to Rennes. A "Pôle d'Excellence Cyber" has just been created (December 2014) with the financial support of the Ministry of Defense (DGA) and Region Bretagne and the participation of the institutions involved in CominLabs. Our objective is to make the CRT on Security & Privacy to become the "exploratory research department" of that program. Bretagne representatives have supported this idea presented in our Steering Committee.

ICT for Health is already an area of excellence in the Brittany-Nantes territory. The sector is, however, stronger in academic and hospital research than industries. Strong ties exist with large international companies (Sorin being the main instance). Our academic labs are involved in several entities of the PIA (Programme Investissements d'Avenir). Through its establishment as a CRT, this track will benefit from wider skills, not traditional in the ICT4Health community.

Making all of this happen is on our agenda for the coming period. A possible implementation could be as follows. CominLabs leadership will appoint a scientist among its Internal Scientific Committee for each research track. He/she will lead the track, relying in particular on the members of the CominLabs projects involved in the track, he/she will detect further work to be done, facilitate better opening work with the community of human and social scientists when relevant, make the results and skills available using the tools of CominWeb. Specific funding will be dedicated to these actions.

B) Ressources humaines/Human resources

Overall, CominLabs has impacted positively the recruitment of high caliber scientists (professors, postdocs and PhD students) in Brest, Rennes, Nantes and Lorient. CominLabs is systematically cited in all calls for open positions in the ICT sector since 2012 by member institutions of CominLabs and in 2014 we observed a strong improvement in the number of very good candidates for professor positions.

Three young and extremely promising young professors and one top senior professor from outside Brittany – Nantes area have been recruited at Telecom Bretagne in 2014.

To quote another example, CominLabs was clearly an additional attractiveness item for hiring people in Rennes, for positions at University of Rennes 1, INSA Rennes or CNRS. A dozen of recruitments were made over the recent years related to CominLabs scientific themes as cloud computing, social networks, interacting objects, web-scale services, ICT and health, energy and resource efficiency in ICT, security and privacy, big data.

The quality of our postdoc and PhD thesis candidates has also improved but is more difficult to evaluate.

C) Moyens financiers, effets leviers/Financial resources, leverage effect

The Region Bretagne ("Brittany council") financially supports CominLabs in a long-lasting and substantial way, for a total of about 2M€ so far. All the PhD theses of the CominLabs projects carried out in partners (research labs) located in Brittany are co-funded by Region Bretagne within its ARED program. Four postdocs are also co-funded per year by Region Bretagne within its SAD program. The Region Bretagne is following CominLabs activities with interest and is a permanent invited member of the steering board.

One PhD-thesis in Nantes is co-funded by the University of Nantes. The Region Pays-de-la-Loire is co-funding the COCo education project (100k€).

The international chair was also partly supported by European funding (Feder program).

Finally, the institutions provided CominLabs with additional support through all the permanent people involved in the CominLabs projects and the experimental platforms, as the virtual reality immersive platform Immersia, the 3T-RMI platform NeurInfo, exploited in several CominLabs projects.

D) Labex Impact on its ecosystem policy

Let us first recall that CominLabs has the ambition to produce research results on new issues developed within original consortia. The originality consists in particular to form “unlikely-to-occur” consortia with experts in electronics, computer science and biomedical signal processing. From this point of view, the added value CominLabs is already obvious. Many projects are making researchers collaborate who probably would not have worked together without the existence of CominLabs.

We also had the wish to develop relationships with other Labex, present on our territory. Different joint meetings led to the emergence of joint projects. In the area of security, the HAH project involves members of the Labex in maths located in Rennes and Nantes (Lebesgue Center) on cryptographic questions. Moreover, the SEACS project just accepted in 2015, gathers CominLabs researchers in image analysis, statisticians from Labex Lebesgue in Rennes and members of the Labex MER in Brest, on issues related to the digital modeling and processing of oceanography information.

CominLabs has been associated with the construction of the Idex UBL+ proposal. A number of areas of excellence identified in the UBL+ proposal concerning digital studies bear directly on the work and reputation of CominLabs:

- In the field of cyber-security, where several CominLabs projects cover the subject, from electronic devices to social aspects through software issues, as well as mathematics involved in cryptography.
- In the domain of connected objects, where CominLabs projects address the issue of sensors networking (across the human body and at the level of the Internet of things). The wireless and energy efficiency concerns are key points.
- In developing digital technologies for health, specifically targeting personalized medicine.
- At the interface with the field of Humanities and Social Sciences, where CominLabs wishes to increase its impact through projects, including questions related to the big data issues, to the human interaction with digital artefacts, and to the multimedia domain (indexing and browsing).

Specifically, the CominLabs will contribute greatly to the UBL+ axis « Man in the heart of Digital Society », and several other UBL+ axes clearly identified, « Oceans, land-sea interface and societies in transition » (modeling, big data), « Birth and life of materials and structures (future digital factory) and « Health research » (imaging, bioinformatics, connected objects). CominLabs therefore relies on UBL+ to continue to contribute in its areas of excellence and expand its interdisciplinary opening, facing major societal challenges.

CominLabs is also expecting boosted support for its education actions from UBL+, through the School of Transdisciplinary Studies, knowing the pervasive nature of ICT over other sciences. The Institute for Open Innovation should be also helpful to enhance innovation activities.

Let us finally mention that the existence and the activities of CominLabs are strong points in the scientific policy of partner labs. For instance, IRISA highlights the involvement of its research teams in CominLabs on its website (<http://www.irisa.fr/en/page/external-structuring-programs>).

3/ IMPACT SOCIO ECONOMIQUE / SOCIO-ECONOMIC IMPACT

3.1 Partnerhips with social and economic actors (industrial actors, competitiveness clusters, fundations...) and established agreements; start-up creation; hosting of industrial actors in the Labex for instance

The 3D-MOOC project comprises as partners three SME which contribute to the project achievements and plan to exploit the project results. Predictive project is establishing contact with Philips and Varian companies (through SATT Ouest Valorisation) for possible transfer. The newly selected Neural Communication project involves b<>com and Orange Labs partnership.

We have plans for exploiting the advanced services of the CominWeb platform (particularly LookinLabs and MonitorLabs). We plan to equip the HAL nationwide bibliographical database with LookinLabs (scale is not a problem, neither is the coverage of all domains; the main bottleneck is expected to be the acquisition of bib-Ids for all researchers). We believe that LookinLabs and MonitorLabs can be a significant plus for several industrial sectors. Large consulting firms (Arthur-Andersen and others) who gather thousands of researchers with diverse skills and possess huge data bases of documents, are the primary target. Large systems industries collecting many different skills would be, generally, a relevant target. We have asked a member of our International Advisory Committee (IAC) who is working at SAP to provide us with the requirements for making LookinLabs usable at SAP. For the moment, we foresee an open source offer in the form of a kit with the key components and development guidelines.

Finally, several CominLabs teams concerned with ICT for Health have close collaboration with hospitals (CHU Rennes and CHU Brest) and several CominLabs projects have clinicians directly contributing to their work-packages (Hemisfer, Predictive, Sherpam, S3PM). Besides, scrub nurses of CHU Rennes will test the developed training tool during the last year of the S3PM project.

3.2 Relationship with the SATT (Tech-Transfert Societies), where possible, IRT (Technological research instituts) or ITE (Technological research instituts in the field of energy) and with other transfer systems involved in higher education and research institutions

As aforementioned, we organized in December 2013, a two-day workshop with the Labex Lebesgue (maths), the Labex Mer (oceanography), the national Labex CAMI (Computer assisted medical interventions), and the two IRT, b<>com and Jules Verne. This fruitful meeting was the opportunity to present the respective activities of the six structures, to exchange information, and to identify topics and means for future collaboration.

We have launched an effective direct interaction with the SATT Ouest Valorisation. A first meeting was held between the CominLabs leadership and the SATT in December 2014 to define a global policy and the type of actions. We decided to have regular meetings of that type with a six-month periodicity. A first patent was filed in December 2013 (S3PM project). Several patent

opportunities are currently studied in different projects (Hemisfer, Pervasive, Predictive, S3PM, TEPN). Some of them are investigated by Inria service for innovation and transfer.

A first meeting with b<>com head (CTO) has taken place in March 2015 to define how the collaboration between CominLabs and b<>com could be set on a large basis, especially around the CominLabs tracks for the next years. Several members of b<>com have participated in the CominLabs days of March 2015 for a better knowledge of CominLabs projects and current results. A first concrete collaboration has been launched through the Neural Communication project labeled in February 2015, b<>com is co-funding one postdoc. Possible transfer from S3PM project is also under study.

Establishing these relationships required that CominLabs research activities were advanced enough. Now it is the right time to do it and it will develop over the period 2015-2019.

3.3 Commercial relations with European public-private partnership research institute, within the Framework Programmes, etc.

Nothing to quote.

3.4 Promotion measures for knowledge dissemination ; schedule, durability of the measures (excluding publications in scientific journals)

In October 2014 the chair of excellence of Professor Honggang Zhang organized the 3rd International Workshop on Next Generation Green Wireless Networks in Rennes (Next G-WiN) in Rennes. This workshop attracted 135 participants from 20 countries with extremely positive feedbacks from several participants. The program proposed 21 oral presentations (including 5 keynote speakers) et 5 demonstrators. The chair also contributed to the organization of panels and workshops at international conferences in 2013 (ICC, ICUWB and GreenCom) and also several invited talks.

The CominWeb initiative constitutes in itself a major and

COMMENTAIRES LIBRES / FREE COMMENTS

CominLabs has benefited from the freedom given by the Labex framework. The CominLabs leadership acknowledges the labex concept for its flexibility and efficiency. It allowed CominLabs being very well received by our research community and not seen as just an additional funding opportunity, as we initially wanted. It also permits a real scientific monitoring of research project construction. There are very few additional structures on top of research labs offering such benefits.

So far CominLabs had a strong community building effect both in Electric Engineering (EE) and Computer Sciences (CS) domains. The EE community over Brittany-Nantes was quite scattered with some rivalries. The running of CominLabs and its cross-partner projects has drastically changed this. One can say that CominLabs already had a strong effect in strengthening the EE-CS area in its territories. Overall, CominLabs appears as a light weight, flexible, and adaptive structure, with excellent RoI.

Here follow some more practical comments related to the writing of this report:

- Indicator reporting raised a number of issues.

We had questions about ETPT ratios ("full time equivalent"). Normalizing by the duration of the Labex taken from its official launch does not seem to us really appropriate, since people (PhD students, postdocs, engineers) could be hired from September 2012 at the earliest. We supplied ETPT numbers following the prescribed rule. Nevertheless, we also provide here ETPT numbers with September 2012 as starting time point, that is, for a duration of 28 months: ETPT is then 6.68 for postdocs and 19.41 for PhD students.

Since peer-reviewed publications in conferences with proceedings collecting papers of several pages each (not just abstracts) are a usual and important practice in our scientific community, we reported their numbers in the second column of the Publication table (maybe a different use than expected).

- Let us point out that we have collected publications only related to CominLabs projects, not to teams of labs partners as a whole.

- It is globally difficult to estimate the Labex leverage effect in quantitative terms.

- Regarding the economic impact of the Labex, it is definitively not easy to explicitly separate the Labex contribution from those of the partner laboratories and institutions.

In the triangle research / training / innovation, CominLabs has clearly positioned as being closer to research.