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SEVENTH FRAMEWORK PROGRAMME

Network of Excellence

NEWCOM#

Network of Excellence in Wireless Communications#

FP7 Contract Number: 318306

WP35.2 – Development and valorisation of human capital

D35.2
Report on second-year mobility and awards

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Document Information

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Abstract:	This deliverable reports on all the activities and achievements within NEWCOM# WP3.5 "Development and valorisation of human capital", over the second year of the project. It includes the launched mobility grants and awards. This year, in addition to the regular mobility grants call, a specific call was launched. This call aims to strengthen inter-track collaboration and exchanges between WP1.x (theoretical) and WP2.x (experimental) workpackages. In each call, six grants of 1500 € were proposed for early-stage researchers in order to spend at least one month in an external institution. In case of awards, the call was launched in 16th October and three prizes will be awarded to NEWCOM# researchers: the Best Paper Award, the Best Student Paper Award, and the Distinguished Research Award (DRA)
Keywords:	Mobility grants, awards, best paper awards, young researcher award, distinguished researcher award

Authors

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0.9	November 12, 2014	Comments to final draft
1.0	November 20, 2014	Final version ready for submission

Executive Summary

This deliverable reports on the activities and achievements within Work Package 3.5 “Development and valorisation of human capital”, over the second year of NEWCOM# project. The aim is to facilitate the development of personal skills and the growth of professional competences in research, through funding scientific visits and awarding research works. This workpackage includes two sections: on mobility grants and awards.

The mobility grants consist of 6 provided grants to young researchers who wish to spend at least one month in one of NEWCOM# EuWiN Labs or an external institution. This year, two calls for mobility grants were launched. In the regular call, six early-stage researchers were selected and given an amount of 1500 €: Paolo Del Fiorentino (PhD Student, CNIT-Pisa) to work on “: Characterisation of the behaviour and performance limits of a cellular network in the presence of relay stations” at Ghent University, Giuseppa Alfano (Experienced Researcher, CNIT-Torino) to work on “Energy Efficient Massive MIMO communications” at Technische Universität Dresden, Marwa Chafii (PhD Student, CNRS-Supélec) to work on “Studies of Generalised Waveforms for Multi Carrier (GWMC) modulation system with low PAPR” at Poznan University of Technology, Najeeb ul Hassan (PhD Student, TUD) to work on “Spatially Coupled codes over Block-Fading Channels” University of Cergy-Pontoise/CNRS, Li Wenjie (PhD Student, CNRS-Université Pais-Sud) to work on “Distributed outlier detection in a wireless sensor network” at CNIT, Alessio Zappone (Young Researcher, TUD) to work on “Energy Efficiency Optimisation in 5G cellular networks Cooperative and Self-Organising Approaches” at the Alcatel Lucent chair on flexible radio. The second call was launched on 12th September.

In the case of awards, the three recipients of first year call for N# Awards were awarded during the N# Awards Ceremony that took place in Bologna at the banquet of EUCNC Conference-NEWCOM# Conference, on Wednesday 25th June. Each of them, the recipients of Young Researcher Award (YRA), Best Paper Award (BPA) and Distinguished Researcher Award (DRA), received 750 € paid directly by the coordinator (CNIT). The second year call for N# Awards was launched on the 16th of October and the deadline for submission is 17th November.

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Glossary

BPA	Best Paper Award
BSPA	Best Student Paper Award
DRA	Distinguished Researcher Award
WP	Work Package

1.Introduction

This deliverable reports on achievements in Work Package 3.5 “Development and valorisation of human capital” during the second year of NEWCOM#. This WP consists of two parts. The first one is the mobility grants which aim at providing a number of actions in order to develop personal skills in research, while the awards aim at promoting and recognising excellence in the N# community. Mobility grants went to PhD, early-stage and experienced researchers to spend at least one month on a scientific visit in a foreign institution, preferably one of NEWCOM# EuWin Labs. It helps them to gain some knowledge about their field of interest. It gives them some knowledge and skills obtained from different perspective of different research team. On the other hand, awards are given to papers and other important achievements obtained within the NoE. It is an important means to recognise hard working researchers within the network and to publicise network achievements.

The focus of this deliverable is the mobility grants and awards granted/to be granted in the second year of NEWCOM#. In the next section, we will describe the steps taken in the second year regarding mobility grants. We explain the role of mobility grants, the process of application and reviewing, and we present the list of applicants, awarded persons and their research topics in the regular mobility grant. We also present the list of applicants to the special Track1-Track2 call for mobility grants. In Section 3, second year of awards are summarised. Conclusions are presented in Section 4.

2. Second year mobility grants

2.1 Introduction to mobility grants

The aim of the mobility grants is strengthening international cooperation research and career development by promoting exchanges of researchers among different institutions. The regular call for mobility grants was opened on 1st of March using the NEWCOM# website [1] and a mailing list. The deadlines for this call were:

- Application deadline: 1st April 2014
- Decision notification: 15th April 2014

The mobility grant winners were notified on 20th May, after reception of all the evaluations. The review committee of the regular mobility grants call was composed of:

- Luc Vandendorpe (UC Louvain)
- Luis M. Correia (INOV)
- Carles Fernandez (CTTC)
- Kenza Hamidouche (CNRS)

Due to the success of the previous mobility grants in terms of research quality, it was decided during the EB meeting at Technion, to launch a second call for mobility grants this year, for joint Track 1- 2 activities. A call for generic *topic* proposals was launched on 15th May but no proposal for generic *topics* were received. Consequently, a topic-agnostic call was launched on September 2014 with the following deadlines:

- Launch: 12th September
- Application deadline: 10th October
- Decision notification: 10th November

2.2 Rules and application process

Before launching the call, three documents were prepared: the guidelines, application form and activity report template. The guidelines give the purpose of the call, which aims to enhance face to face cooperative research and to promote exchanges of researchers among different institutions. To be able to apply, the persons should be young researchers coming preferably from NEWCOM# or associate partners. However, the call is also open to all early-stage researchers from external institutions. The duration of the research visit is not fixed, as long as it is within NEWCOM# duration, but priority is given to stays with a duration of one month or above. This year, two mobility grant calls were launched. For the regular call, six researchers were selected and provided 1500 €. The criteria used during the evaluation process of this first call are as follows:

- Relevance to the objectives of NEWCOM# (links to WPs).
- Feasibility and clarity of the objectives.
- Integration:
  - added value to already existing liaisons;
  - new collaborations;
  - “Cross-fertilisation” (the person who moves should have complementary knowledge with respect to the one of the hosting institution in any case helpful for the research)

- Quality of applicant's CV;
- Proposals coming from NEWCOM# Institutions will be favoured
- Preference will go to female researchers ceteris paribus.

2.3 Second call for mobility grants

The second call was launched in the beginning of September. This specific call aimed to strengthen inter-track collaboration and exchanges between WP1.x (theoretical) and WP2.x (experimental) workpackages. Similarly, the maximum number of grants to be issued was up to six. More specific criteria are used in the evaluation process, by giving priority to the proposals showing inter-track (Track1-Track2) collaboration.

At the end of the first launched call, the project office received 6 applications for mobility grants. All the applicants were from NEWCOM# institutions, 4 PhD students, 1 experienced researcher and 1 young researcher (shown in Figure 2.1). All the applicants were connected with WP1.1 (task 1.1.3), WP 1.3 (task 1.3.2, task 1.3.3), WP 1.2 (task 1.2.3) or WP 2.2 (task 2.2.2). Most of the planned research stays were part of an already ongoing collaboration and there is only one new research activity between CNIT-Pisa and Ghent University. All applications had clear and feasible objectives to solve interesting problems that fit the goals of NEWCOM#. These mobility grants strengthen the existing collaborations and start a new research activity in the aim to establish a long-term collaboration between CNIT-Pisa and Ghent University. Thus, it has been decided that all the following applicants deserved the mobility grant which is of 1500 €:

- Paolo Del Fiorentino (CNIT) – PhD student
  Hosting institution: Ghent University, Belgium
  Subject: Characterisation of the behaviour and performance limits of a cellular network in the presence of relay stations
  Stay duration: 1 month

- Giuseppa Alfano (CNIT-Politechnico di Torino) – Experienced researcher
  Hosting institution: Technische Universität Dresden (TUD), Germany
  Subject: *Energy Efficient Massive MIMO communications*
  Stay duration: 1 month

- Marwa Chafii (CNRS-Supélec) – PhD student
  Hosting institution: Poznan University of Technology, Poland
  Subject: *Studies of Generalised Waveforms for Multi Carrier (GWMC) modulation system with low PAPR*
  Stay duration: 1 month

- Najeeb ul Hassan (TUD) – PhD student
  Hosting institution: University of Cergy-Pontoise/CNRS
  Subject: *Spatially Coupled codes over Block-Fading Channels*
  Stay duration: 1 month

- Li Wenjie (CNRS-University of Paris-Sud) – PhD student
  Hosting institution: CNIT, Bologna
  Subject: *Distributed outlier detection in a wireless sensor network*
  Stay duration: 1 month

- Alessio Zappone (TUD) – Young researcher

Hosting institution: Alcatel-Lucent Chair on flexible radio, Supélec, France, Young researcher
Subject: *Energy Efficiency Optimisation in 5G cellular networks Cooperative and Self-Organising* Approaches
Stay duration: 5 months

Figure 2.2 and Figure 2-3 show the statistics of the applicants' origin and hosting institutions respectively.

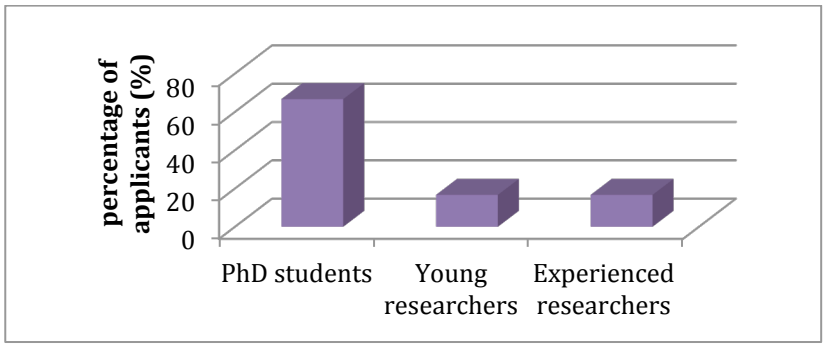

Figure 2.1 Percentage of applicants belonging to certain research seniority groups.

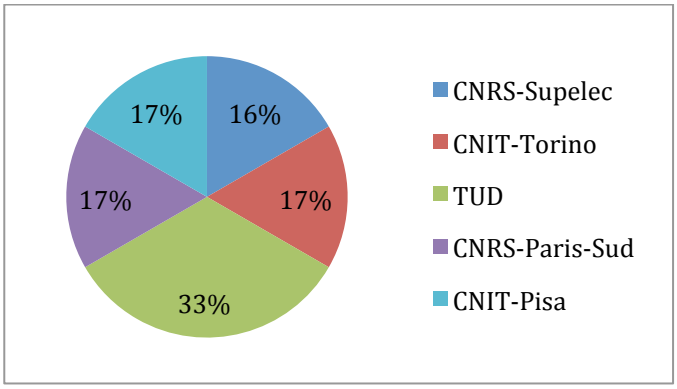

Figure 2.2 Percentage of applicants' origin institutions.

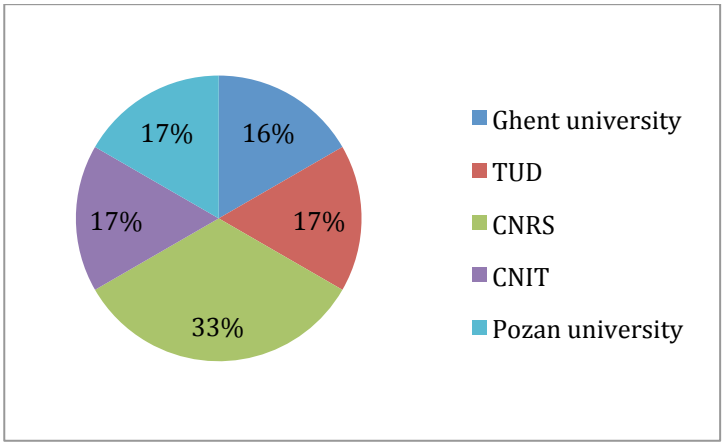

Figure 2.3 Percentage of hosting institutions.

2.3.1 Evaluation process and results

All the applications of the second call were reviewed by the Evaluation Board composed of:

- Luc Vandendorpe (UC Louvain)
- Luís M. Correia (INOV)
- Carles Fernandez (CTTC)
- Kenza Hamidouche (CNRS)

Based on the criteria in the guidelines, a review form was prepared and filled by all the members of the Evaluation Board. They evaluated the relevance of the topics to N# objectives, as well as the feasibility and clarity of the objectives. After gathering all the review reports, a discussion and decision was made on the 20th of May. As the number of the received applications was six and all applications addressed interesting problems from the scientific viewpoint, and the researchers have valuable achievements (respective to the scientific seniority) justifying the high-quality of future publications, it has been decided to accept all applicants.

Results were communicated to the winners by contacting them directly by mail and also announced on NEWCOM# webpage.

As of the time of finalizing this deliverable, three winners returned from their research stay: Marwa Chafii, Alessio Zappone, and Paolo Del Fiorentino. The reports currently available are attached to the deliverable in Annexes D-F.

2.4 Special call for mobility grants

Due to the success of the previous calls for mobility grants in terms of research quality, it was decided, during the EB meeting at Technion, to make an extra call in year two, oriented on joint Track 1-2 activities. A call for *topic* proposals was launched on 15th May but no proposal was received. Consequently, a topic-agnostic call was launched in September 2014 with the following deadlines:

- Launch: 12th September
- Application: 10th October
- Proclamation: 10th November

Before launching the call, the guidelines and application form were modified according to the objectives of this specific call by giving priority to the proposals showing inter-track (Track1-Track2) collaboration in the criteria for the evaluation of proposals.

We received five applications (see table below). Out of them, four applicants were PhD students, and one applicant is a young researcher. The review process is ongoing and the applicants will be notified by November 10, 2014.

Researcher name	Sending institution/ Country	Hosting institution/ County	Duration of the research stay	Starting date
Paolo Del Fiorentino (PhD Student)	Research unit of Pisa (CNIT-Pisa), Italy	CTTC- The Centre Tecnologic de Telecomunicacions De Catalunya, Spain	1 month	February/March 2015
Carmine Vitiello (PhD student)	University of Pisa (CNIT-Pisa)	Eurecom-CNRS, France	1 month	January
Georg Pichler (PhD Student)	Vienna University of Technology, Austria	Supélec-CNRS, France	4 months	1 month in November and 3 months during spring 2015
Yi Chu (Young researcher)	University of York, UK	Eurecom-CNRS, France	1 month	2nd February
Alejandro de la Fuente (PhD student)	University Carlos III of Madrid, Spain	Eurecom-CNRS, France	2 months	April 2015

2.1 First year stays

The research stay of Vincenzo Zambianchi, one of the first year mobility grant winners, lasted until May 2014. His report is attached in Annex A.

3. Second year awards

3.1 Introduction to awards

There are three kinds of awards to be granted each year in order to promote excellence in research within NEWCOM# [2]:

- The NEWCOM# Best Paper Award (BPA)
- The NEWCOM# Best Student Paper Award (BSPA)
- The NEWCOM# Distinguished Researcher Award (DRA).

All applications are evaluated by an *ad-hoc* Awards Committee appointed by the Executive Board. It is chaired by NEWCOM# Scientific Director Marco Luise (CNIT).

3.2 Rules and application process

The rules of the awards have been published on the NEWCOM# webpage and via a mailing list. The call was open on October 16, 2014. Submission deadline is on November 17, 2014 and final decisions by the Committee will be made on December 22. Although Mobility Grants were available not only to NEWCOM# researchers, the awards are limited to researchers working and publishing papers within the NoE. All papers proposed for the award should have acknowledgement to the NEWCOM# project. There are three types of awards:

- Best Paper Award (BPA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers;
- Best Student Paper Award (BSPA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# student researchers. The first author must be under 30 years of age.
- Distinguished Research Award (DRA) to a (group of) researcher(s) belonging to NEWCOM# that has achieved special results in research or dissemination resulting of his/her(their) activity in the project and during project's lifetime.

Each winner will be awarded with 750 € paid by the project coordinator – CNIT. The main selection criteria are:

- Contribution to the advancement to the field of Wireless Communications;
- Relevance to the objectives of NEWCOM# (links to WPs);
- General quality, originality of research, contributions, subject matter, clarity and style of presentation;
- Priority: papers co-authored by researchers belonging to more than one NEWCOM# partner will be given special consideration in the evaluation process.
- Ceteris Paribus, preference will be given to female researchers.
- The gender action, covered by the last criteria, is promised in the Description of Work to cover the DRA, though it has been decided to extend it to other awards too.

The Awards will be physically given during the annual NEWCOM# conference at EUCNC15.

4. Conclusions

In the second year of NEWCOM#, two calls for mobility grants and a call for project awards were launched. The number of applications was six in case of the first call for mobility grants and five for the special Track1-Track2 call. The call for awards was launched a few weeks ago, the number of applicants so far is two for the BPA, and three for BSPA. The origin of the received papers up to now (best international journals and conferences) shows a good development of researchers' skills and coherence between topics investigated within the NoE and worldwide trends.

5.References

[1] NEWCOM#, http://newcom-project.eu/index.php?option=com_content&view=article&id=108&Itemid=200, Date of access: 30/10/2014

[2] NEWCOM#, http://newcom-project.eu/index.php?option=com_content&view=article&id=142:newcom-awards-%E2%80%93-second-call-for-submissions&catid=10&Itemid=132, Date of access: 30/10/2014

6. Annex A: Report of Vincenzo Zambianchi

MOBILITY GRANT
Report

Guest name: Vincenzo Zambianchi
Guest institution: University of Bologna

Host name: Prof. Michel Kieffer
Host institution: CNRS-SUPELEC-Université de Paris Sud

Research topic: Distributed information diffusion techniques applied to advanced estimation theory

Starting date: 07/11/2013
Ending date: 31/05/2014

1. Scope of Work

The scope of the visit was to strengthen the collaboration between the two research groups on the application of distributed information diffusion techniques in the context of distributed estimation theory.

2. Motivation

Following preliminary contacts in November 2012, an agreement between CNIT University of Bologna and L2S CNRS-SUPELEC-University Paris Sud led to the planification of two exchange periods for two PhD students. Research on distributed estimation techniques and distributed outlier detection are at the center of the two actions, respectively. Here, the first one is described in details.

3. Objectives

The objective of the research stay was focused on the determination of eventual advantages in the application of consensus techniques to distributed estimation procedures. In particular, three main areas of interest were identified and explored: (1) Exploitation of consensus techniques in distributed likelihood function evaluation for the case of correlated measurements taken at different locations, (2) application of consensus techniques to solve the open problem of distributed joint learning and estimation, (3) application of consensus techniques to the open problem of distributed computation of non-asymptotic confidence regions.

4. Activities

The initial objective of the stay was to apply consensus techniques to the problem of energetically efficient computation of likelihood functions. The proposed method aimed at being applied to the distributed computation of the likelihood function for the case of

measurements (of the same observable quantity) taken at different locations and in the presence of correlation between measurement noises. The method was compared to the most classic flooding scheme for information diffusion. The comparison was carried out under different sparsity constraints for the noise correlation matrix.

Successively, the focus was switched to the application of again a consensus scheme to the problem of distributed joint learning and estimation. With respect to this scenario, the idea is to progressively improve on parameter learning and field estimation by means of interleaving the two phases. The main technicalities, used in the analysis, are consensus algorithms (for the learning part) and consensus based distributed kalman filtering for the estimation part. Moreover some Lyapunov stability considerations have to be made in order to establish the stability of the proposed approach. This work is still ongoing and will continue even now that the stay is over, hopefully constituting a fruitful reason for the collaboration to last.

Almost in parallel to the second described activity, some efforts were concentrated on the problem of developing efficient information diffusion algorithms to be applied in the context of non-asymptotic confidence regions computation. Initially, consensus and flooding schemes were compared, when applied to the diffusion of the information required by the, recently proposed in literature, SPS algorithm. The SPS algorithm provides non-asymptotic confidence regions for parameter estimation problems, under a linear measurement model. The main advantage of this method is that it produces regions with an exact (and not bounded) level of confidence with only a finite number (in contrast to asymptotic methods, such as Cramer Rao bounds) of measurements being taken into account. A mixed approach has been developed, combining flooding and consensus techniques. It has been shown that, when a fixed maximum amount of data can be exchanged in the network, this approach brings an advantage if compared to pure algorithms. Results were published in “Distributed SPS Algorithms for Non-Asymptotic Confidence Region Evaluation” in the 2014 EUCNC conference.
Based on the experience that was previously gained on consensus information diffusion, a new algorithm was successively designed. It proves to be very efficient on ordered topology, such as random trees and clustered network. The principal feature of its working principle is a network coding-like tagging system, to aggregate information coming from different sources. Then, an algorithm, which retrieves information from the received one, was designed and applied to maximise the number of measurements taken into account in the confidence region computation. The proposed algorithm is fully distributed, this clearly being of main interest when working in the context of wireless sensor networks. Moreover some original results were proved, stating that a confidence region can be computed also when the information diffusion process is truncated at any stage, keeping the same level of confidence as the one produced when all information is taken into account. The computation of non-asymptotic confidence regions is again based on the SPS algorithm. All the cited results are now being finalised for a journal paper submission.

5. Results

a. Scientific results

The paper titled “Distributed SPS Algorithms for Non-Asymptotic Confidence Region Evaluation” was published in the EUCNC 2014 conference proceedings.

Another paper will be submitted during the summer.

b. Collaboration results

The collaboration reinforced the two research groups relationships, via both a continuous communication effort, as testified by the attached minutes of meetings, and a reciprocal exchange in knowledge background.

C. Dissemination

Our activities were partly published in the already cited EUCNC paper and there is hope for more publications to follow.

6. Plans for Follow-up

The stay at University of Bologna, in Cesena, of Wenjie Li, PhD student at L2S, is programmed for the months of June-October 2014.

7.Annex B: Second year call for mobility grants

Seventh Framework Programme

MOBILITY GRANTS

Call for applications and guidelines – Second year

Opening of the call: 1st March 2014

Project acronym: NEWCOM#
Type of contract: NETWORK OF EXCELLENCE.
Contract N°: 318306
Project URL: http://www.newcom-project.eu/

GENERAL ASPECTS	
Purpose	The aim of the mobility grants is to enhance face to face cooperative research and to promote exchanges of researchers among different institutions.
Participants	Young researchers (typically early stage researchers) preferably from N# beneficiaries or associate partners, not excluding external institutions.
Duration	The duration of the research stay is not fixed, as long as it is within NEWCOM# duration. Priority will be given to stays with a duration of 1 month or above.
Budget	The total budget allocated for each grant is € 1.500,00.
Number of grants	The maximum number of grants to be issued in the second year is six.
Claim and Proof	The grant will be directly paid to the winner by the coordinator CNIT. Within 60 days from the end of the stay the researcher will send to the project Office a short activity report as well as a certification by the hosting institution with starting and ending date of the stay.
EVALUATION OF PROPOSALS	

Criteria	• Relevance to the objectives of NEWCOM# (links to WPs).
	• Feasibility and clarity of the objectives.
	• Integration:
	  ○ added value to already existing liaisons;
	  ○ new collaborations;
	  ○ "Cross-fertilisation" (The person who moves should have complementary knowledge with respect to the one of the hosting institution in any case helpful for the research)
	• Quality of applicant's CV;
	• Proposals coming from N# Institutions will be favored
	• Preference will go to female researchers *ceteris paribus*.

Procedure	Each project will be evaluated by the Mobility Panel to be appointed by the Executive Board. In case of conflicts of interest, the corresponding member(s) of the Panel will be replaced by a person chosen by the Executive Board.
Supporting Documentation	Application Form and Applicant's CV

SCHEDULE

- Proposal Submission: 1st April 2014
- Decision Notification: 15th April 2014.

APPLICATION FORM AND SUBMISSION INSTRUCTIONS

The applicants should send the Proposals to the NEWCOM# Office project_office@newcom-project.eu

The application form can be found at: http://www.newcom-project.eu under the 'Mobility' section.

8.Annex C: Special Call for mobility grants

Seventh Framework Programme

MOBILITY GRANTS

Call for applications and guidelines – Special Call (Y2)

Opening of the call: 12th September 2014

Project acronym: NEWCOM#
Type of contract: NETWORK OF EXCELLENCE.
Contract N°: 318306
Project URL: http://www.newcom-project.eu/

GENERAL ASPECTS	
Purpose	The aim of mobility grants is to enhance face to face cooperative research and to promote exchanges of researchers among institutions. This special call is aimed to strengthen inter-track (i.e., Track1, Track2) collaboration.
Participants	Young researchers (typically early stage researchers) preferably from N# beneficiaries or associate partners, not excluding external institutions.
Duration	The duration of the research stay is not fixed, as long as it is within NEWCOM# duration. Priority will be given to stays with a duration of 1 month or above.
Budget	The total budget allocated for each grant is € 1.500,00.
Number of grants	The maximum number of grants to be issued is six.
Claim and Proof	The grant will be directly paid to the winner by the coordinator CNIT. Within 60 days from the end of the stay the researcher will send to the Project Office a short activity report as well as a certification by the hosting institution with starting and ending date of the stay.
EVALUATION OF PROPOSALS	

Criteria	• Relevance to the objectives of NEWCOM# (links to WPs).
	• Feasibility and clarity of the objectives.
	• Integration:
	  ○ added value to already existing liaisons;
	  ○ new collaborations;
	  ○ "Cross-fertilisation" (The person who moves should have complementary knowledge with respect to the one of the hosting institution in any case helpful for the research)
	• Quality of applicant's CV;
	• Proposals coming from N# Institutions will be favored
	• Proposals showing inter-track (Track1-Track2) collaboration will be prioritised.
	• Preference will go to female researchers *ceteris paribus*.

Procedure	Each project will be evaluated by the Mobility Panel to be appointed by the Executive Board. In case of conflicts of interest, the corresponding member(s) of the Panel will be replaced by a person chosen by the Executive Board.
Supporting Documentation	Application Form and Applicant's CV

SCHEDULE

- Proposal Submission: 10th October 2014
- Decision Notification: 10th November 2014.

APPLICATION FORM AND SUBMISSION INSTRUCTIONS
The applicants should send the Proposals to the NEWCOM# Office project_office@newcom-project.eu

The application form can be found at: http://www.newcom-project.eu under the 'Mobility' section.

9. Annex D: Report of Marwa Chafii

MOBILITY GRANT
Report

Guest name: Marwa Chafii
Guest institution: Supélec (France)

Host name: Adrian Kliks
Host institution: Poznan University of Technology (Poland)

Research topic: Studies of Generalised Waveforms for Multi Carrier (GWMC) modulation system with low PAPR

Starting date: 26/05/2014
Ending date: 23/06/2014

1. Scope of Work and Motivations

Orthogonal Frequency Division Multiplexing (OFDM) is a technique to send information over several orthogonal carriers in a parallel fashion. Compared to single-carrier modulation, this system shows a better behavior against frequency selective channels and gives a better interference reduction. It allows an optimal use of the bandwidth thanks to the orthogonality of its carriers. These are among the reasons why this technique has been adopted in many standards such as Asymmetric digital subscriber line (ADSL), Digital Audio Broadcasting (DAB), Digital Video Broadcasting-Terrestrial (DVB-T/T2), Long Term Evolution (LTE), WiMAX etc. However, the OFDM signal presents large amplitude variations compared to the single carrier signal, because it is the sum of many narrowband signals in the time domain, with different amplitudes. Based on this fact, in-band and out-of-band distortions occur during processing of the signal in a non-linear device, like High Power Amplifier (HPA). To study these high amplitude fluctuations, the Peak-to-Average Power Ratio (PAPR) has been defined. The multi-carrier modulation systems (Wavelet OFDM, OFDM, FBMC) present different PAPR performance, thus we propose to investigate in designing a new optimal waveform which has the optimal PAPR performance.

According to these PAPR considerations, this research stay covers activities of NEWCOM# WP1, task 1.3.2. In addition, this work falls in a green radio scenario for which the PAPR mitigation result is an increase of the power amplifier efficiency.

2. Objectives and Activities

The objective of this stay is to study the peak to average power ratio (PAPR) for different multi-carrier systems (OFDM, Wavelet OFDM, FBMC). In our previous work, we have proved that the PAPR depends on the waveform used, in other terms, by changing the modulation waveform, the PAPR performance can be improved.

Other key parameters are also analysed in this study as the Bit Error Rate (BER), different channel models and their influence on the transmitted signal, different constellations, etc.

Based on the assumptions discussed above the whole stay has been spit in two phases. The first step of this stay was dedicated to discuss our previous work on the PAPR distribution of Generalised Waveforms for Multi-Carrier modulation system (GWMC). In a second step, we have implemented a Simulator for the transmission chain based on different waveforms. The key characteristics have also been evaluated.

3. Meetings

The meetings between my host and me were regular: every two days we discuss the progress of the work and the next step of the study. We had also a regular exchange by email to share some good references and to discuss some conclusions, which was very helpful for me.
I had also several discussions with my supervisors in Supélec, who were following my work in my host institution.
I met the professor Krzysztof Wesolowski, the Dean of the Faculty of Electronics and Telecommunications, I presented for him my work and we had a fruitful discussion about it.

4. Results

We had several constructive discussions about the joint Time-Frequency analysis in multi-carrier systems, and some ideas about potential new waveforms for GWMC system with low PAPR. Moreover, several discussion on the influence of the transmission channel on the system with different waveform used have been carried, in particular the multipath and Doppler effects have been considered, the inaccuracy in frequency generation, the non-ideality of electronic devices etc. Furthermore, the key aspects of Gabor signaling and Weyl-Heisenberg communication have been discussed, as well as the ways and the need of calculation of dual windows (i.e. that used at the receiver side).

In addition, we implement a Simulator to study and compare the following multi-carrier systems: The conventional OFDM, the Wavelet OFDM and the FBMC. The comparison in terms of the PAPR and the BER, was performed for different constellations, different channel conditions and different number of carriers.

We had a main discussions about both the theoretical and practical study of the Wavelets. For the first part, we discussed the different Wavelet Transforms: Discrete wavelet Transform, Continuous Wavelet Transform, Wavelet Packet Transform, Complex Wavelet Transform, etc. For the second part, we discussed the differences between the wavelet implementation in some papers, and specially how to process the data into two sets of coefficients: CA (approximation coefficients) and CD (detail coefficients). The relationship between the level of the wavelet decomposition and the number of carriers (frequency) was also investigated.

5. Plans for Follow-up

After having a good background about multi-carrier modulation waveforms, the next step is to design a new waveform that achieve some predefined conditions as a low PAPR, a good time-frequency localisation, etc.

This step can be formulated as a solution of a constrained optimisation problem, but the challenge will be the implementation of the new waveform, and the reconstruction of the signal in the receiver side. A study of the entire transmission chain should be investigated, in order to compare the performance of this new waveform with other multi-carrier systems.

10. Annex E: Report of Alessio Zappone

MOBILITY GRANT
Report

Guest name: Alessio Zappone
Guest institution: Technische Universitaet Dresden (TUD), Germany

Host name: Mérouane Debbah
Host institution: Alcatel-Lucent Chair on Flexible Radio, Supélec (CNRS), France

Research topic: Energy Efficiency Optimisation in 5G cellular networks: Cooperative and Self-Organising Approaches

Starting date: 18/06/2014
Ending date: 25/07/2014

1. Scope of Work

The scope of the mobility was to study the energy efficiency of 5G networks. One of the most promising techniques that have been proposed for the implementation of 5G networks is the use of dense and heterogeneous networks. The idea is to cope with the sheer number of devices to serve, by a massive deployment of femto-base-stations and relay stations in key areas of the network, thus resulting in improved coverage, reliability, and robustness to failures of one node. From an energy-efficient perspective, this approach is attractive because it shortens the distances between nodes, thus leading to higher data-rates at lower transmit powers. However, in order for the overall energy efficiency to increase, the additional infrastructure nodes will have to consume a low amount of energy, which requires energy efficiency optimisation. Moreover, an additional challenge is represented by the large number of devices to serve, which poses the following fundamental trade-off. On the one hand, a centralised optimisation procedure would be preferable from a performance point of view, but on the other hand it would require a too heavy network infrastructure and overhead, given the large number of devices to coordinate.

2. Motivations

Energy-aware optimisation of wireless communication networks has become a very popular research topic due to the impressive growth that wireless communications have been experiencing. Indeed, the number of devices connected to the internet is larger than the size of the world population. By 2020, there might be more than 50 Billion devices or more than 6 devices per person connected to the internet. The IP traffic forecast for 2014 is more than 60 Exabytes (10006 Bytes) per month. Most connections will be wireless because most devices are small and mobile. Since every piece of data consumes transmit power as well as circuit and operating power, the energy consumption of information and communication technology (ICT) infrastructure consumes more than 3% of the world-wide energy, out of which about

60% is consumed by base stations which causes about 2% of the world-wide CO2 emissions. But also the pure number of mobile devices leads to a significant energy consumption at the terminal side with growing tendency.

In order to counteract these developments of increasing energy consumption in communication infrastructure, different goals are set: GSMA (green manifesto) demands a reduction of CO2 emission per connection by 40% until 2020. NGMN also declares energy saving as a top priority. In 5G networks, the goal is set to 1000 times higher data rates with the same power consumption, i.e., a net increase of energy efficiency by a factor of 1000.

3. Objectives

The main objective of the mobility action is to foster a long-term collaboration between TUD, Supeléc, and University of Pisa, in the field of energy-efficient small-cell and heterogeneous cellular networks. This mobility plans to investigate the design of energy-efficient resource allocation algorithms to optimise the overall energy efficiency of heterogeneous networks. Both centralised and distributed approaches are to be considered. In the former case, the problem is to be formulated as a fractional optimisation problem, while in the latter the network nodes are to be modeled as autonomous, self-organising entities, and non-cooperative game theory is to be employed. In particular, novel resource allocation algorithms for 5G networks are to be devised.

4. Meetings

Research meetings between Alessio Zappone (TUD) and Luca Sanguinetti (Supélec) have been performed on a regular basis to organise the research activity. Moreover, weekly meetings with Prof. Mérouane Debbah were carried out to discuss and plan the ongoing work. Giacomo Bacci (University of Pisa) has also spent one week at Supélec (from 21/07/2014 to 25/07/2014) to participate in the face-to-face interactions necessary to organise the work.

5. Activities

The research has also dealt with the problem of competitive, energy-efficient resource allocation in wireless networks. The problem has been modeled as a generalised non-cooperative game and the problem of determining the existence of an NE has been analysed. This forms the object of ongoing work. The research activity has been carried out through face-to-face interaction between the involved researchers. In particular, discussions between Alessio Zappone (TUD), Luca Sanguinetti (Supélec), Giacomo Bacci (Univerity of Pisa), and Mérouane Debbah (Supélec) ensured the execution of the planned research and a transfer of knowledge among the involved researchers and institution. The activity has been fouled on the preparation of a conference paper to be shortly submitted to an international conference.

6. Results

a. Scientific results

The main result of the mobility has been to develop a framework for energy-efficient resource allocation in wireless networks. The obtained framework is general in the sense that it applies to the leading technologies that have been proposed as candidates for 5G networks, such as small-cells, heterogeneous networks, massive MIMO. Moreover, for each of this technologies, both centralised and user-centric performance measures have been considered, subject to QoS constraints. In particular, two algorithms have been devised. The first one is designed to optimise the global energy efficiency of a network, defined as the sum-achievable-rate divided by the total consumed power. Instead, the second algorithm is designed to optimise the minimum of the individual energy efficiencies of the network nodes, thereby performing a worst-case energy-efficient design.

b. Collaboration results

The mobility has involved researchers from threes different institutions: TU Dresden, Alcatel-Lucent Chair on Flexible Radio, Supélec, and University of Pisa. A collaboration between these three research groups has been fostered. As already mentioned, the research activities started within the mobility are still ongoing and it is anticipated that carrying them out will strengthen the already existing collaboration.

c. Dissemination

The results produced during the mobility will be submitted for possible publication to next year's International Conference on Communications (ICC) to be held in London. In particular, the following paper is in preparation:

A. Zappone, L. Sanguinetti, G. Bacci, E. A. Jorswieck, M. Debbah, "A Framework for Designing Energy Efficient 5G Technologies".

As the research activity progresses, a journal paper will be prepared to contain all the findings of this research track.

7. Plans for Follow-up

As previously mentioned, the research direction analysed during this mobility will be further investigated with the aim of producing a journal paper contribution. To this end, the collaboration between TU Dresden, Supélec, and University of Pisa will continue in the near future. In particular, new research visits will be carried out between the researchers and institutions involved in this mobility. This will both lead to new publications (journal and conferences), and to strengthening the collaboration formed during this mobility.

11. Annex F: Report of Paolo Del Fiorentino

MOBILITY GRANT
Report

Guest name: Paolo Del Fiorentino
Guest institution: CNIT – University of Pisa (CNIT-PI), Italy

Host name: Prof. Marc Moeneclaey
Host institution: University of Gent (UGent), Belgium

Research topic: radio resource allocation algorithms in cognitive radio networks with imperfect channel state information

Starting date: July 1st, 2014
Ending date: July 31th, 2014

6. Scope of Work

The joint research activity between CNIT-PI and UGent deals with resource adaptation (RA) techniques for cognitive radio (CR) OFDM systems employing bit interleaved coded modulation (BICM) with the presence of many mobile sources and decode-and-forward (DF) relay nodes (RNs), considering an imperfect knowledge of channel state information (CSI).
The reference scenario is a CR system made of an unlicensed (secondary) transmitter-receiver pair operating in the same band as a licensed user (primary), plus other primary users that operate over the adjacent bands and several DF RN.
The activity aims at devising RA methods, which select the best modulation, code rate and transmission power for each OFDM subcarrier at the transmitter and at the selected DF relay with the goal of maximising the "goodput" (GP) metric for the "transmitter-relay" and for the "relay-receiver" links. This metric allows to characterise in more a suitable way the actual performance of a packet-oriented communication system and it is defined as the number of information bits delivered in error-free packets per unit of time.
A link performance prediction (LPP) methodology allows us to get an estimate of the GP, referred to as expected GP (EGP), which represents the objective function of the RA problem. In order to get an accurate performance prediction, we extend to the imperfect CSI case the promising effective signal-to-noise ratio (SNR) mapping (ESM) technique *k*ESM, as originally proposed in [1]. Then, the proposed LPP method will be exploited as the core of a novel RA strategy in a dual and after multi-Hop transmission system with the presence of several active RN in a CR environment. After, a new EGP function should be defined, which consider the total GP performance from the transmitter to the receiver trough some of the RN and we could use it to define a new best relay selection technique.

7. Motivations

The actual mobile networks are formed by macro-cells with a central base station (BS) and a certain number of mobile users (MUs). These types of networks were designed to ensure coverage of large geographical areas and to handle a low-speed data exchange. Our work is aimed at using RNs, which forward the traffic from a MU to a BS and vice versa. Therefore, a

cellular network could both guarantee a better quality of service (QoS) at the MU and reduce the power consumption of the BS-RN and RN-MU links exploiting the novel RA technique that is devised in the framework of this JRA. Furthermore, the focus in on RNs because they do not require a connection to the backhaul network and are small, low-cost and low-power, so that they allow a flexible dislocation through the coverage area of the wireless service.

8. Objectives

The objective is to derive a RA technique by resorting to mathematical theory of convex optimisation applied to the scenario described in section 1, considering several relays in DF mode, SUs and also featuring a relay selection technique.
The EGP function [1] will be exploited as the object function. The link performance prediction (LPP) technique in [2], called IC-*k*ESM, which is used to describe the EGP, will be improved. In particular, the new IC-*k*ESM should consider imperfect CSI whereas in [2] the LPP method takes into account the outdated CSI problem. To do it, a new channel model is exploited [3]. After, we will define a new EGP function, depending the new IC-*k*ESM function, which should be able to predict the performance in a dual or multi-Hop transmission system, using DF RNs. So, we will study a new best relay selection model.
A joint paper will be prepared for the IEEE ICC 2015 conference that describes the last scientific results obtained.

9. Meetings

- Discussion about the actual work plan on the JRA 1.3.3.D between CNIT-Pisa and UGent,
  Friday 4 July, 2014, Gent, Belgium,
  Paolo Del Fiorentino (CNIT-Pisa), Jeroen Van Hecke (UGent)

- Discussion about the actual work plan on the JRA 1.3.3.D between CNIT-Pisa and UGent,
  Tuesday 22 July, 2014, Gent, Belgium,
  Paolo Del Fiorentino (CNIT-Pisa), Jeroen Van Hecke (UGent)

10. Activities

The work was started with a preliminary meeting between Paolo Del Fiorentino and Jeroen Van Hecke during the first day of my visit. We outlined the future research activity: system models, performance metrics, open issues in our topic, goals, possible solutions and also mathematical and software tools.
In practice, the work focused on the development of a Matlab simulator of a CR BIC-OFDM transmission system with the presence of a single DF RN and RA algorithms.

11. Results

a. **Scientific results**

The model IC-*k*ESM [1] was improved exploiting the channel model of the paper [2], because the old IC-*k*ESM takes into account only outdated CSI. The novel LPP IC-*k*ESM scheme has the capability to evaluate the EGP at the transmitter in a more accurate way, thus enabling a more robust and competitive RA strategy. Now, real impairments are considered as imperfect channel estimate, time varying channel and outdated estimates. The proposed approach is also robust as the channel correlation coefficient decreases and also outperforms the RA based on the previous method. Preliminary numerical results seem to validate the correctness of the new model. They are obtained using a direct link BIC-OFDM transmission system with imperfect CSI with only the presence of a SN and a DN. The IC-*k*ESM technique was tested combining adaptive modulation and coding (AMC) and optimal power allocation (OPA) algorithms.

b. Collaboration results

This scientific visit led to the establishment of joint research activity on the medium to long term. Indeed, the activity carried out some really interesting combining the expertise of Paolo Del Fiorentino and Jeroen Van Hecke, during the month of visit. This has thus led to both a submission of a paper to the ICC 2015 conference and the definition of a research activity in the medium term that will see Paul Del Fiorentino involved in a scientific visit to UGent twelve month during the next year (which is always of interest to N #).

c. Dissemination

The results achieved so far in the JRA were diffused in the scientific community through the publication of two conference papers: [2] and [3].
The results obtained in this visit to Gent are preliminary, but thanks to the opportunity of mobility grant, this activity research is continuing with the aim to achieve the goals fixed in the first meeting and to submit an article to the ICC conference in 2015, with deadline September 15, 2014.

12. Plans for Follow-up

A system model will be developed with Matlab program to simulate a CR BIC-OFDM transmission system with DF Relay and multiple Primary Users (PUs). At the same time, a new PA algorithm will be implemented, which should take into account the new IC-*k*ESM model and the CR environment. We decided to consider the relay technology, because they serve toward various objectives, such as enhancing data rate coverage and enabling range extension over cellular networks.
Finally, we are planning other visits in 2014-2015 in order to achieve the aim described previously.

13. Attachments

- Minutes of the Meeting held on Friday 4 July, 2014, at Gent, Belgium
- Minutes of the Meeting held on Tuesday 22 July, 2014, at Gent, Belgium
- Summary of the scientific work.

14. Bibliography

[1] Stupia, I; Lottici, V.; Giannetti, F.; Vandendorpe, L., ”Link Resource Adaptation for Multiantenna Bit-Interleaved Coded Multicarrier Systems”, *Signal Processing, IEEE Transactions on*, vol.60, no.7, pp.3644, 3656, July 2012

[2] Paolo Del Fiorentino (CNIT-PI), Riccardo Andreotti (CNIT-PI), Vincenzo Lottici (CNIT-PI), Filippo Giannetti (CNIT-PI), Jeroen Van Hecke (UGent), Marc Moeneclaey (UGent), “Link Resource Adaptation for BIC-OFDM Systems with Outdated Channel State Information”, European Wireless (EW) Conference 2014, May 14-16, 2014, Barcelona, Spain.

[3] Jeroen Van Hecke (UGent), Paolo Del Fiorentino (CNIT-PI), Filippo Giannetti (CNIT-PI), Vincenzo Lottici (CNIT-PI), Luc Vandendorpe (UCL), Marc Moeneclaey (UGent), "Resource Allocation for Multicarrier Cooperative Cognitive Radio Networks with Imperfect Channel State Information", IEEE PIMRC 2014, September 2-5, Washington, USA.

Signature

Paolo Del Fiorentino

12. Annex G: Call for Awards

Seventh Framework Programme

2nd BEST PAPER, BEST STUDENT PAPER and DISTINGUISHED RESEARCHER AWARDS

Call for submissions

Opening/Closure of the call: October 16/November 17, 2014

Project acronym: NEWCOM#

Type of contract: NETWORK OF EXCELLENCE

Contract N°: 318306

Project URL: http://www.newcom-project.eu/

GENERAL ASPECTS	
Purpose	The aim of the awards is to encourage (especially, young) researchers to publish their research work and to promote a healthy competition among researchers and institutions.
Participants	The papers must have originated from NEWCOM# researchers and contain the acknowledgement of NEWCOM# support.
Budget	The budget allocated to each award is 750 euro. Three awards will be issued during the second year of NEWCOM#: • 2nd Best Paper Award (BPA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers; • 2nd Best Student Paper Award (BSPA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers. The first author must be under 30 years of age. • 2nd Distinguished Research Award (DRA) to a (group of) researcher(s) belonging to NEWCOM# that has achieved special results in research or dissemination resulting of his/her(their) activity in the project and during project's lifetime.
Prize-giving	The prize will be issued to the winner by the coordinator (CNIT)
EVALUATION OF PAPERS	
Criteria	• Contribution to the advancement to the field of Wireless Communications; • Relevance to the objectives of NEWCOM# (links to WPs); • General quality, originality of research, contributions, subject matter, clarity and style of presentation; • Priority: papers co-authored by researchers belonging to more than one NEWCOM# partner will be given special consideration in the evaluation process. • Ceteris Paribus, preference will be given to female researchers
Procedure	Two Committees will evaluate the submissions: • Each paper will be evaluated by the BPA Committee, formed by external distinguished experts. • The Distinguished Research Award will be evaluated by a sub-committee of the Executive Board Both Committees will be chaired, without voting privilege, by the NEWCOM# Scientific Director.
Schedule and	For the BPA and BSPA awards, the applicants must send a PDF version

Documentation	of their paper(s) to the NEWCOM# Office at project_office@newcom-project.eu by the submission deadline indicated below. For the DRA award, instead, the applicants must provide a short document (max. 1 page) describing the achievements as a result of his/her/their involvement in the project plus CV(s). Submission deadline: November 17, 2014 Notification of the ranking: December 22, 2014. Award materially presented to winners during the 2nd NEWCOM# Annual Event.

Comments and suggestions for the improvement of this document are most welcome and should be sent to:

project_office@newcom-project.eu

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