ICT-601102 STP TUCAN3G

Wireless technologies for isolated rural communities in developing countries based on cellular 3G femtocell deployments

5th Quarterly Management Report
Reference Period (*from 01.02.2014 to 30.04.2014*)

Project coordinator

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Consortium composition

1 UPC
2 URJC
3 PUCP
4 UCAU
5 FITEL
6 IPA
7 TdP
8 EHAS
9 TIWS
10 CREP
11 KINNO

1 – Project status: Technical plan and corresponding achievements

WP1: Management

1A1: Administrative management

- UPC has been continuously linking EC and consortium, and maintained management and communication infrastructure (website, mail lists, RSS, dropbox, twitter). UPC has also cooperated with URJC in evaluating risks and reviewing documents before delivery to the EC.

- URJC, as technical coordinator, has helped in the organisation of the fourth project meeting, held in Lima in June 2014.

1A2: Technical management

- UPC has coordinated the activities of 4A2 and 4A3.

- URJC reviewed milestone M43 and deliverables D31 and D52 on technical management perspective. As a part of standard procedure of technical coordination, URJC accomplished monthly activity tracking through Redmine tool, milestone and deliverable tracking, risk analysis for this quarter.

- PUCP has carried out coordination meetings with FITEL, URJC and TdP for technical coordination of WP6.

- UCAU has coordinated activities in WP7.

- FITEL

- EHAS

WP2: Requirements and specifications

The activities of WP2 have concluded.

WP3: Business case study

3A1: Market study

- UCAU

- FITEL

- TdP

- CREP During this period, CREP worked on the first version of the component for identification of customer segments, channels and relationships according to information recorded on the D31. CREP made an analysis about who might be the customer for this model, currently there are two options: a direct operator or a new company created as a result from TUCAN3G. During the whole process we have always concerned about the vision of the beneficiary of the model, but in this period we considered the elements for the sustainability of the model.

- IPA

- EHAS has supported the coordination of activity 3A1 collecting the results of the market research from all the partners involved. EHAS has also reviewed these documents before delivery to KINNO (responsible of 3A1) to integrate them in D31. Besides, due to the delay of this WP and in order to speed up the performance of the Business Model, EHAS has met with KINNO in Athens to discuss the reorganization of the activities and the efforts of the partners.

- KiNNO has formulated inputs, drafting the latest version and finalizing the deliverable D31.

3A2: Product definition

- FITEL

- TdP contributed with the Product and Services Definition coordinating with internal departments in order to search possible services in rural areas.

- EHAS has started to develop the Value Proposition that TUCAN3G will offer to the customers, analyzing the benefits provided by the connectivity in this regions in order to define the business strategy. Besides, EHAS

has been requesting and coordinating with the rest of the partners the first inputs that must be considered for the Business Model, as the identification of customer segmentation, customer relationships and channels.

3A3: Models for funding and return on investment

- UCAU
- FITEL
- TdP
- EHAS

3A4: Business model design and verification

- UCAU
- FITEL
- IPA
- TdP
- EHAS
- CREP
- KINNO

WP4: Access network optimization

4A1: Network dimensioning

The activities of 4A1 have concluded.

4A2: Femtocell network optimization and monitoring

- UPC has been working in the development of a technique for the assignment of users to HNB's taking into account the status of the batteries of the HNB's and the energy harvesting. Such technique guarantees that the voice and the Rel-99 users receive the required bitrate and, at the same time, tries to maximize the utility perceived by the HSPA data-users. Such technique is applied in a mid-term temporal basis using the mean channel values. UPC has also finished with the design of a robust threshold (in terms of the estimated traffic load) for switching ON/OFF the HNB's located at the same tower when the nominal traffic profile is known up to a given modeling error. Additionally, UPC is investigated algorithms for extending the cell range of HNBs dynamically as a function of the traffic demand. This solution would allow to automatically switching off all HNB with a low load, in case this load can be transferred to neighboring cells after having extended their coverage area.
- URJC novel algorithms for frequency and primary scrambling code assignment were designed and tested. Modified algorithms are under development. Discussions with UPC were held to incorporate battery dynamics to the problem of power loading and user assignment.
- IPA provided a working document for review by TdP and its network suppliers on possible candidate options for deploying a 3G Packet switched only underlay to the existing 2G CS only deployment in the Ste Clothilde area. This is also linked to work in WP6. Further work has been carried out towards D42, including a partners conference call, looking at improved autonomous network configuration with a focus on identifying new neighbour cells and improving handover performance, particularly via making use of UE measurements. A number of candidate mechanisms have been identified and are being further investigated.

4A3: Access and transport network interoperability

- UPC has been working in the development of a channel state-aware packet scheduling for the 3G access network, that takes into account that the backhaul is capacity limited. Two cases are being considered: the full buffer case, that assumes that all the users have always information bits to be transmitted, and the case of packet based traffic. In both cases, the utility function to be maximized is a weighted sum of the rates served

to the users. The full buffer case is a simplified case that allows getting insight of the impact of both the quality of the access network and the backhaul in the resource allocation problem. The packet based traffic case is a more realistic case that allows evaluating not only the data rate under which the users are served, but also other figures of merit such as the delay, jitter, etc.

- URJC: Numerical simulations testing different offloading mechanisms were concluded. Results confirm that transport networks are likely to be saturated. Switching to 2G networks and reducing the encapsulation of voice traffic emerge as two alternatives to mitigate the problem. Different alternatives for admission control and network/energy aware scheduling were investigated. Preliminary simulations were run. Different ways to supply information of the transport network to the access network were investigated. Preliminary algorithms that incorporate the state of the transport layer into the real-time scheduler for the access network were designed.

- IPA held a conference call with URJC on the joint approach to backhaul management and the options that may be practically realizable in a test deployment given technical, resource and practical limitations. Work is continuing on analytical work towards D43. Work is also underway to consider the range of architectures (standards-compatible and non-compatible) for offload, with particular reference on regulatory constraints such as LI.

- TdP

4A4: Beyong 3G-based access

- UPC
- URJC

WP5: Transport network optimization

5A1: Usage terms of WiFi, WiMAX and VSAT links

- URJC
- PUCP
- UCAU. Testing of HTB queues for traffic shape (only WiFi) was made in the UCAU testbed. Also, comparative testing of ingress filtering versus using of egress queue discipline was made in the UCAU testbed.
- TIWS

5A2: Heterogeneous transport network architecture for the backhaul

- URJC: After finishing milestone M52 in the previous term, a testbed has been prepared in laboratory in order to validate experimentally the proposals made in M52. The testbed, the experiments and the results are presented as expected in deliverable D52, which was due by the end of M15 but was finally submitted three weeks later. The experiments were successful, validating that the proposed backhaul architecture permits to manage a multihop backhaul with shared resources for several HNB, offering a good quality of service to telephony and to signalling traffic as well as a best-effort behavior for data traffic.
- UCAU
- TIWS

5A3: Transport network optimization

- URJC: Preliminary tasks have been done related to the revision of possible solutions for the interface between the backhaul and the access networks. We have also studied the feasibility of measuring diverse parameters in the backhaul nodes in order to manage the dynamic behaviour of the network.
- PUCP
- UCAU
- TIWS

- PUCP: First efforts in task 5A3.6, related to establishing the relationship between the CAPEX of backhaul installations and the performance and power consumption of the backhaul. Concretely, PUCP has started to elaborate the development of characterization of CAPEX to energy consumption and CAPEX to throughput for WiLD and WiMAX systems.

WP6: Demonstration platform

6A1: Technical and operational design

- PUCP has shared the Final Design of the Napo and Balsapuerto networks and has discussed it jointly with URJC
- FITEL
- IPA carried out further work on the design of the network, with particular reference to the Ste Clothilde area and whether the 3G underlay is possible (see WP 4A2). Also further work on the equipment specification.
- TdP contributed to define Trujillo city as the location to install the IP Access RNC.
- EHAS

6A2: Compatibility tests

- UPC.
- URJC
- PUCP has finished the elaboration of detailed list and the respective quotations of the equipment and materials for demonstration platform. PUCP has elaborated start index of D62. PUCP in coordination with TdP has advanced the equipment homologation process. It is waiting for the response of Government.
- FITEL
- IPA
- TdP contributed in this task enhancing the compatibility test for operation, management and configuration connect IP Access RNC to TdP´s voice and data core network and the integration guide to install and integrate IP Access Equipment in TdP´s Node in Lima for the validation of the model designed by TUCAN3G in a real scenario. Besides, TdP coordinated the initiation of the homologation process with the MTC (Ministerio de Transportes y Comunicaciones).
- TIWS

6A3: Pilot network deployment

- PUCP has finished a detailed plan of installations in the target networks and finished the elaboration of M61 Upgraded Networks, this document is in the review process.
- FITEL
- IPA
- TdP
- EHAS
- TIWS has coordinated the installation of two VSATs with different technology and frequencies sited in Rey Juan Carlos I University (one in Ka band and the other in Ku band). These VSATs are going to be used for the testing phase in the rest of the WP6.

6A4: Interconnection to the operator's network

- PUCP
- FITEL
- IPA
- TdP

- EHAS has contributed to review the networks design, and has started to work on the integration of all test protocols to evaluate the compatibility and functionality of the interconnection of the access network and transport network.
- TIWS

6A5: Validation

- PUCP
- UCAU
- FITEL
- TdP
- EHAS
- TIWS

WP7: Dissemination and knowledge utilisation

7A1: Dissemination

- UPC submitted papers as shown in section 4.1.
- URJC submitted papers as shown in section 4.1.
- PUCP has disseminated TUCAN3G information in its meetings with officials from the Ministry of Education (March, 18th) and Ministry of Social Inclusion (April, 15th)
- UCAU Contributed to final review and submission of D71 "First interim dissemination/standardisation report and plan".
- FITEL
- IPA
- TdP contributed with the creation of the working item in order to collect, discuss and reflect the TUCAN3G project in ETSI.
- EHAS has been monitoring the selected congresses that will be held on the 1st semester of 2015 in order to close the agreement to co-locate the TUCAN3G workshop. Three congresses have been identified as potential holders of the workshop.
- TIWS
- CREP An abstract was built with the title: "TUCAN3G, construction of a viable business model for telephony in remote rural areas". This abstract was sent to the Fourth Congress of technological management and innovation COGESTEC 2014, which will be held in November in Cartagena_Colombia.
- KINNO

7A2: Standardisation

- UPC has subcontracted Mariana Goldhamer for the standardization activities in ETSI-BRAN.
- UCAU continued with actions for keeping track the activities of the IEEE 802.11 Working Group.
- IPA worked with the other partners and 4GCellEx on tactics and specification for standardization activity within ETSI BRAN

7A3: Use of knowledge

- FITEL
- IPA
- TdP
- TIWS
- KiNNO

2 – Unattained planning items and rationale

Item description	Action Items
Changes in schedule of deliverables	D42 scheduled in M15 (Apr 2014) has been delayed to M18 D43 scheduled in M17 (Jun 2014) has been delayed to M20
Changes in schedule of milestones	Milestone M33 scheduled in M15 (Apr 2014) has been delayed to M20 Milestone M53 scheduled in M16 (May 2014) has been delayed to M20
Red flags	
Any other issues or problems that might affect achievement.	Delays in the delivery of funding by FITEL are putting off the purchase of equipment and hence activities in WP6. The current view is that funds might be available by mid August 2014.

3 – Deliverables and milestones finished as planned

Deliverables and Milestones in the reporting period		
Document code and title	Originally planned	Actual delivery month
D31	M8	M15
D43	M11	M14
D61	M8	M14
D71	M12	M13

4 – Dissemination

4.1   Articles published, presentations at conferences, TV broadcasts, etc.

- **Submitted papers**
  - URJC
  - I. Foche-Perez , J. Simo-Reigadas, I. Prieto-Egido, E. Morgado and A. Martinez-Fernandez, "A dual IEEE 802.11 and IEEE 802.15-4 network architecture for energy-efficient communications with low-demanding applications", submitted to EURASIP Wireless Communications and Networking
- **Accepted papers**
  - UPC
  - Jaume del Olmo Alòs, Antonio Pascual Iserte, Josep Vidal, Olga Muñoz Medina, Adrián Agustín, "3G Access Network Dimensioning in Isolated Rural Areas Base don Femtocells", EUCNC 2014 (European Conference on Networks and Communications). Bologna (Italy), June 2014.
  - Javier Rubio, Antonio Pascual Iserte, Jaume del Olmo Alòs, Josep Vidal, "Dynamic Base Station Switch On/Off Strategies for Sustainable Wireless Networks", IEEE SPAWC 2014 (IEEE International Workshop on Signal Processing Advances in Wireless Communications), Toronto, June 2014.
- **Presentations**
  - URJC
  - J. Simo-Reigadas, E. Morgado, E. Municio, I. Prieto-Egido and A. Martinez-Fernandez, "Assessing IEEE 802.11 and IEEE 802.16 as backhaul technologies for rural 3G femtocells in rural areas of developing countries", European Conference on Networks and Communications EUCNC 2014, Bologna, Italy, June 23/26, 2014 (Accepted as poster)
- **Press releases (use the links on text to access the documents)**

4.2   Web Sites

The project website (www.ict-tucan3g.eu) was setup in Dec 2012 and has been continuously updated since then.

An RSS channel has been included.

4.3   Other relevant information: Patent applications, guidelines standards, Masters, PhDs….

5 – Meetings Held

Meetings, Phone Conferences, Conferences or Workshops attended

Partner	Dates	Meeting place	N° of persons	WP/Task/expected results/details
URJC, UCAU, TIWS	17/2/2014	Phone conf	8	WP5/5A2. General planning of the tasks assigned to UCAU, TIWS and URJC in 5A2. Detailed agenda of the second part of this activity after M52. Exchange of efforts between URJC and UCAU: URJC compiles the final document D52 and UCAU assumes a revision of tools for measuring QoS in real networks for 5A3.
PUCP, URJC	8/4/2014	Virtual	3	WP6: final design of demonstrations platforms in Napo and Balsapuerto
PUCP, TdP	8/4/2014	TdP Office	4	WP6 /various items: homologation process; technical facilities for installation
URJC, PUCP	10/4/2014	Phone conf	4	WP5/6A2.4, 6A2.7, 5A3.5 and 5A3.6. Discussion about the consequences of D52 on WP6, specially through tasks 6A2.4 and 6A2.7. Transfer to URJC of part of the effort in task 5.A3.5 and supervision of 5A3.6.
IPA, URJC, UPC	10/4/2014	Phone conf	5 (1 IPA)	D42 Conference call between UPC (chair), URJC, IPA on D42 way forward
KiNNO, EHAS	28/04/2014	Athens	5	Pending tasks in WP3 were analysed and a new plan of the activities and tasks in WP3 was designed. The tasks were distributed among partners with a concrete definition of the expected result.
4A2 partners	10 April 2014	Skype teleconference	---	Meeting for the coordination of the activities carried out in the framework of task 4A2 and discussion about the contents to be included in deliverable D42.

6 – Resources Employed/Expenditures

Reference Period: "1 Feb 2014" to "30 Apr 2014"
Effort for the reference period per WP and per Participant (Person-Months): planned vs. actual spent

Participant	WP1 plan	WP1 spent	WP2 plan	WP2 spent	WP3 plan	WP3 spent	WP4 plan	WP4 spent	WP5 plan	WP5 spent	WP6 plan	WP6 spent	WP7 plan	WP7 spent	Total per participant plan	Total per participant spent	Total Cumulative plan	Total Cumulative spent	Justification (if needed)
1 – UPC	0,84	0,84	0,00	0,00	0,00	0,00	2,58	2,58	0,00	0,00	0,00	0,00	0,45	0,45	3,87	3,87	17,8	19,6	
2 – URJC	1,20	1,30	0,00		0,00		1,75	1,75	3,00	3,45	0,21	0,30	0,15	0,45	6,31	7,25	26,7	32,0	
3 – PUCP	0,10	0,10							0,90	0,90	0,74	0,74	0,05	0,05	1,79	1,79	21,5	13,3	
4 – UCAU	0,10	0,10							0,50	0,25			0,42	0,42	1,02	0,77	4,9	4,6	Starting of 5A3 is delayed
5 – FITEL															0,00	0,00	2,5	1,9	
6 – IPA							0,75	0,50	0,25	0,05		0,01			1,00	0,56	6,1	3,7	WP6 delay. D42/43 delay
7 – TdP					0,88	0,88	0,25	0,00			0,54	0,54	0,05	0,05	1,72	1,47	8,6	8,3	
8 – EHAS					0,75	1,00					1,00	0,70	0,00	0,20	1,75	1,90	15,3	11,4	
9 – TIWS											0,10	0,10			0,10	0,10	2,9	2,6	WP5 delay
10 – CREP					0,10	0,10							0,15	0,15	0,25	0,25	2,5	2,5	
11 – KINNO						1,05									0,00	1,05	1,7	5,5	
Total per WP	2,24	2,34	0,00	0,00	1,73	3,03	5,33	4,83	4,40	4,60	2,84	2,43	1,27	1,78	**17,81**	**19,01**	Grand total for the ref. period		
Total Cumulative from start of the project	12,05	13,70	16,52	14,80	9,22	12,17	22,55	23,92	19,31	20,26	23,36	12,23	7,30	8,41	**110,31**	**105,47**	Grand total from start		

Expenditures for the reference period per Participant (k€, EURO*1000): planned vs. actual spent

Participant	Durable equipment plan	spent	Subcontracting plan	spent	Travel and subsistence plan	spent	Consumables plan	spent	Protection of knowledge plan	spent	Other Specific Costs plan	spent	Total per participant plan	spent	Total Cumulative plan	spent	Justification (if needed)
1 – UPC													0,00	0,00	10,5	10,5	
2 – URJC													0,00	0,00	2,3	2,2	
3 – PUCP													0,00	0,00	22,8	22,8	
4 – UCAU													0,00	0,00	7,9	8,2	
5 – FITEL													0,00	0,00	0,0	0,0	
6 – IPA													0,00	0,00	0,0	0,0	
7 – TdP													0,00	0,00	0,0	0,0	
8 – EHAS					1,50	1,34							1,50	1,34	5,3	4,4	
9 – TIWS													0,00	0,00	0,0	0,0	
10 – CREP													0,00	0,00	8,3	7,6	
11 – KINNO													0,00	0,00	0,8	7,3	
Total per cost item	0,00	0,00	0,00	0,00	1,50	1,34	0,00	0,00	0,00	0,00	0,00	0,00	**1,50**	**1,34**	Grand total for the ref. period		
Total Cumulative from start of the project	10,52	10,37	0,00	0,00	42,72	48,01	4,64	4,64	0,00	0,00	0,00	0,00	**57,88**	**63,01**	Grand total from start		

7 – Changes in personnel

Personnel leaving the project		
Name	Partner	WPs involved
Ozge Albaz	URJC	WP1, WP4 & WP5
Javier Ramos	EHAS	WP3, WP6

Personnel joining the project			
Name	Partner	WPs involved	Expected participation (in months)
Luis Miguel López Ramos	URJC	WP4	2,5
Luis Fernando Solórzano	EHAS	WP3	3
Alan Whitehead, Head of System Architecture Group	IPA	WP4	3 (elapsed time)
Srikant Ravuri, Senior System Architect	IPA	WP4	2 (elapsed time)
Joseph John, Project Manager	IPA	WP4, 6	1 (elapsed time)

Luis M. Lopez-Ramos received the Telecommunication Engineering degree with highest honors from Rey Juan Carlos University (URJC), Madrid, in 2010; and the Multimedia and Communications Master degree from Carlos III University of Madrid, in 2012. Since 2010, he is pursuing the PhD degree in the Department of ICT,

URJC. In 2013 and 2014 he was a visiting researcher at the University of Minnesota, USA. His main research interests are Reinforcement Learning and Optimization applied to Signal Processing, and Cognitive Radio and Electrical Power Networks. He is the author of several journal and conference papers. He has organized several courses on engineering tools as well as a seminar on ICT for Energy Efficiency.

Luis Fernando Solórzano is a Telecommunications engineer with several years of experience as an advisor facilitating strategic decision making and analyzing the disruptive potential of emerging technologies worldwide. He is recognized as an innovator consistently capable of generating ideas for product development. He has experience in protecting IPR and providing insightful patent search reports to analyze innovations created by competitors, suppliers and partners. He has demonstrated expertise in open innovation and EU research policy. He built a worldwide technology scouting network to provide technology trend reports for executives and established relationships with other telecom operators, suppliers and universities under collaborative research projects. He has taken action to raise funds for projects under the European Commission FP7 research program leading a working group in the NEM initiative (an European Technology Platform). Comfortable with uncertainty and change and explorer of new ideas, he plans to continue his engineering career dedicated to social innovation and technology for human development.

Alan Whitehead is currently leading IP.access' Systems Architecture team. He has a BSc in Pure Science from University of Newcastle upon Tyne and has over 30 years' experience of developing telecoms products including X.25, X.400, ISDN, Mobile Data, Fixed Wireless Access, 2G, 3G mobile phone technologies. He has held senior roles in telecoms consultancies, network operators and equipment vendors.

Srikant Ravuri is a Senior System Architect and Feature Leader at IP.access. He has worked on 3G and LTE small cell design and development for several years, with particular specialization in radio features, radio configuration and optimisation, including working on SON.

Joseph John is a project manager and also Team Leader of the Configuration Management, Build and Release Team at IP.access. He has been working in these areas for over 8 years on 2G, 3G and LTE systems.