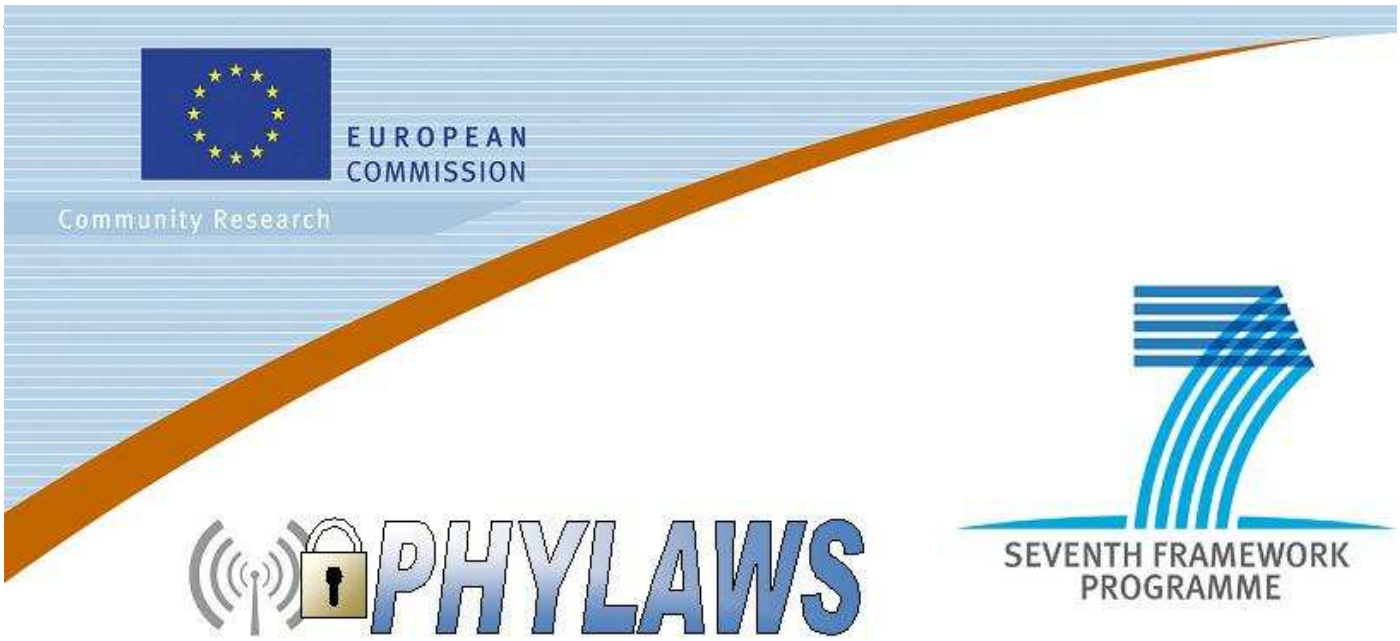

Project PHYLAWS (Id 317562)
PHYsical LAyer Wireless Security

Deliverable D1.10: Standardization intermediate report

FP7 Collaborative Projects, Networks of Excellence, Coordination and Support Actions in Collaborative Projects, Research for the benefit of Specific Groups (in particular SMEs)

Version V1.1 - Date 30 / 05 / 2015

Contractual Date of Delivery: April 30, 2015

Actual Date of Delivery: May 07, 2015

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Work Package: WP1

Dissemination level: PU

Version: V1

Abstract: This deliverable provides the plan for the standardization activities of the PHYLAWS project, as anticipated at month 30 in the amendment n°1 of the project. It covers the partners' realizations and intentions in terms of participation to standardization bodies and to regulatory administrations.

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Executive Summary

Deliverable D1.10 is the second among three reports dedicated to standardization activities of PHYLAWS, given the new work plan after amendment n°1. It provides the past activities relevant to standardization for the start of the project and the future intentions. The activities described here are:

- Dedicated dissemination towards radio communication stakeholders, toward regulators and frequency administrations, toward committed and forum that may influence regulation and standardization bodies in the future

- Contributions to standardization groups

- Contributions to regulatory actions

- Etc.

Authors and Document History

Partner	Contributor / reviewer	Date
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Version	Remarks	Date
D1.10 version 1.0	First reviewed version	07/05/2015
D1.10 version 1.1	Slightly revised version (IEEE references)	30/05/2015

Project Summary

Wireless communications have become a universal way to access information for nearly every human around the world. This domination also presents major risks to society, owing to the widely recognized leaks and unsafe technologies in the current wireless networks. Basically all of the security today relies on bit level cryptographic techniques and associated protocols at various levels of the data processing stack, but these solutions have drawbacks and they are often not sufficiently secure. This difficulty is a major retarder to the progress of the digital society. In the recent years therefore, new approaches have been investigated in order to exploit security opportunities offered by the handling signals operating at the physical layer level. These works have been based on a fundamental analysis of the notion of security in the context of information theory. In a more concrete manner, the potential leaks and possible ways to avoid them have also started to be seriously addressed. The objective of the PHYLAWS project is to elaborate on this knowledge basis in order to develop focused and synthetic ways to benefit from wireless physical layer opportunities in order to enhance the security of wireless communications in an affordable, flexible and efficient manner. Efficient here means simple to implement, requiring easily developed and easily validated algorithms, but it also means techniques that will consume less resources, in terms of energy (especially at the terminal level) and in terms of data consumption overhead (i.e. acting on the overall net spectral efficiency). The project outputs will thus benefit to a variety of existing and future standards for a large set of needs.

This objective will be reached through a suitably sized consortium combining an excellent academic expertise in order to address information theory fundamentals, to design optimal codes, to design furtive signal wave forms and versatile radio access protocols; a major research center for the development and test of several competing techniques; a SME involvement perfectly aligned with the application targets; and a strong industrial involvement highly motivated by security in wireless networks as a manufacturer, as an end-user and as a provider of wireless communication services. The complementary skills inside the consortium will ensure both innovation and impact towards industrial applications, and they will assess validation of the commercial goals and validation of the society use relevance.

The project will benefit from recommendations and advices by an international Advisory Board (AB), constituted of very high level personalities from governmental bodies, standardization bodies or academia. This Board will be one of the cornerstones of the project, based on the recognition that excellent technical developments and demonstrations will not be enough to ensure their wide spreading. Clearly, the project impact will largely benefit from a proper vision, aided by the AB, in order to penetrate standards and existing systems and ensure support from the major stakeholders.

Ultimately, PHYLAWS will facilitate the penetration of wireless technologies in the personal and professional sphere, by guaranteeing a more efficient safe access to the digital world through the future internet. This achievement will strongly impact the lives of citizens and will very much contribute to trustworthy ICT in the following years.

Administrative and contract references

[PHYLAWS_GA-A] PHYLAWS Grant Agreement, referenced FP7-ICT-317562-PHYLAWS version date 2012-07-03, part A

[PHYLAWS_GA-WP] PHYLAWS Grant Agreement, referenced FP7-ICT-317562-PHYLAWS version date 2012-07-03, Work Plan

[PHYLAWS_GA-AM] PHYLAWS Amendment n°1 to Grant Agre ement FP7-ICT-317562-PHYLAWS version date 2015-03-10.

[PHYLAWS_GA-DOW2] PHYLAWS Grant Agreement, referenced 317562 version V2.2 date 2014-12-19 (revised Description of Work - part B of the Grant Agreement).

[PHYLAWS_GA-WP2] PHYLAWS Grant Agreement, referenced FP7-ICT-317562-PHYLAWS version date 2014-12-19 (revised Work Plan).

[PHYLAWS_D.1.1v2] PHYLAWS Management plan – updated version V2 version date 2015-05-31.

[PHYLAWS_D.1.6] PHYLAWS Dissemination plan – version V1 date 2013-01-31.

[PHYLAWS_D.1.7] PHYLAWS Dissemination intermediate report – version V1 2015-05-07.

[PHYLAWS_D.1.9] PHYLAWS Standardization plan – version V1 date 2013-01-31.

Other references

[PHYLAWS_WS] Phylaws Web site: www.phylaws-ict.org and especially parts “deliverable” and “publications”.

[PHYLAWS_AB_D1.12] Phylaws Advisory Board Year 1 Meeting Report.

[RAS_WD1.0] Research Project Collaboration in the area of Radio Access and Spectrum - Working document version 1.0. – January 2013, edited by Paulo Marques and Ronald Raulefs

[RAS_WD2.0] White paper “High capacity PHY for future radio access and 5G”, edited by Paulo Marques.

[RAS_WD3.0] http://ec.europa.eu/information_society/newsroom/image/whatis5g_8919.jpg http://ec.europa.eu/information_society/newsroom/cf/dae/redirection.cfm?item_id=20996&newsletter=137&lang=default

[3GPP&ETSI_SA3_WP] 3GPP SA3 and ETSI (Security Goup): http://www.3gpp.org/specifications-groups/sa-plenary/sa3-security . Meeting calendar of years 2015-2016: http://www.3gpp.org/DynaReport/Meetings-S3.htm?Itemid=449. Contact: Mirko Cano Soveri technical officer of SA3. Mirko.Cano@etsi.org, :+33(0)492944297 +33(0)492944297. Organization of the SA3 Meeting 80 in Talinn (Estonia): contact@eurofriends3.org.

[EDA_WP] EDA web site: http://www.eda.europa.eu/ Contact : Michael Sieber, Head of Unit “Information Superiority”. michael.sieber@eda.europa.eu, +32 2 504 2887 Meeting calendar of EDA Working Groups years 2015-2016:

[WINFORUM_SSAR]: “WINNF Spectrum Sharing Annual Report” WINNF-14-P-0001-V1.0 edition 2014, published by Lee Pucker and al. Web site http://groups.winnforum.org/Reports.

[IEEE_IPTUT]: https://mentor.ieee.org/802-ec/dcn/14/ec-14-0043-00-00EC-internet-privacy-tutorial.pdf

Acronyms and Abbreviations

3GPP	3rd Generation Partnership Project
AB	Advisory Board
CEPT	European Conference of Postal and Telecommunications Administrations
CR	Cognitive Radio
DoW	Description of Work
EC	European Commission
EDA	European Defense Agency
ETSI	European Telecommunications Standards Institute
FP7	7th Framework Programme
GCF	Global Certification Forum
ICT	Information and Communication Technologies
IEEE	Institute of Electrical and Electronics Engineers
IET	Institution of Engineering and Technology
IP	Integrating Project
ISO/IEC	International Organization for Standardization / Information Security Standard
ITU	International Telecommunication Union
LSTI	LTE/SAE trial initiative
NGMN	New Generation of Mobile Network
NoE	Network of Excellence
OMG	Object Management Group
PHYSEC	PHYsical layer SECurity
PO	Project Officer
QUANT	Quantitative
SDR	Software Defined Radio
SME	Small and Medium Enterprise
STREP	Small and medium-scale focused research project
TBD	To Be Defined
WP	Work Package
WRC	World Radio Conference (2018)
Y1	Year 1
Y2	Year 2
Y3	Year 3

Table of Contents

List of figures

Aucune entrée de table d'illustration n'a été trouvée.

List of tables

1 Introduction

This deliverable D1.10 “Standardization intermediate report” is intended to describe at mid-project (month 30) the activities regarding Standardization. Standardization activities are now carried out by the PHYLAWS project over the 48 months of its revised planning duration (WP1, task 1.3, ref [PHYLAWS_GA-AM], [PHYLAWS_GA-DOW2], [PHYLAWS_GA-WP2]).

Task 1.3. is organized in relation to the main aspects of these activities:

- Contributions to standardization working groups (IEEE, ETSI).

- Contributions to regulatory actions (ITU, CEPT, etc.).

- Contribution to industrial initiatives (3GPP, LSTI etc.).

Task 1.3 includes dedicated dissemination actions towards regulators and frequency administrations in order to prepare these contributions.

Note: Following the first review on 2014-01-13 and the redaction of a revised DoW, the coordination dissemination and standardization activities of the PHYLAWS project have recently re-started (official acceptation of the revised DoW occurred by EC Amendment n°1 on 2015-03-10 – se e ref [PHYLAWS_GA-AM], [PHYLAWS_GA-DOW2]).

2 Aims and processing of standardization activities within PHYLAWS

Some quantitative goals relevant to standardization have been defined in the DoW and are recalled below:

Objective	Indicator	Nature
Standardization dissemination	Number of proposal to standardization groups : ≥ 3	QUANT

Table 1: Standardization performance indicators

2.1 Standardization sustained by dissemination of the project

Note that general dissemination activities are not part of this report, being covered by another dedicated tasks (WP.1 Task 1.2, see [PHYLAWS_D.1.1 V2]).

Nevertheless, the partners of the Phylaws project intent to intensively use dissemination in order to sustain standardization activities, by providing written material for presentations of Phylaws background, intents and outputs, which will be dedicated to standardization bodies, to regulatory administrations, etc.

This was achieved during period 1 and period 2 through several contribution to special sessions of conference (PIMRC London, Sept 2013), to forums (Winncomm June 2013 Munich, Winncomm Marsh 2015 San Diego), to Seminar (GDR Isis, May 2014), to Workshops (ICC London, June 2015), etc.

2.2 Standardization sustained by technical results and scientific outputs of the project

Note that standardization activities, to be efficient, need to be sustained by project outputs and project results (even partial – see the initial dissemination plan [PHYLAWS_D.1.6]). Thus effective standardization activities can really start at the middle of the Phylaws project (T0+24 in the revised Working Plan see [PHYLAWS_GA-DOW2]) when first results and publications are available.

In practice, the standardization activities in the Phylaws project are leaded in the following way:

- Period 1 was mainly dedicated to standardization preparation, through contacts, through publications, etc.
- Period 2 initiated standardization actions towards standardizations bodies, regulation administrations and industrial groups (see below).
- Period 3 is expected to strengthen Phylaws standardization actions through papers and presentations that target recommendations relevant to security of wireless networks and future contributions to standards.

During period 2, the project achieved several important developments papers and presentations (see the intermediate deliverable dissemination report [PHYLAWS_D.1.7]) relevant to :

- Measurement of the radio channel in various frequency ranges and in various configurations
- Real-field modeling of the wiretap configuration with a legitimated transmitter, legitimates receivers and eavesdroppers.
- Generation of tag signals and associated interrogation and acknowledgement radio protocol in order
    - to provide prime security pairing of legitimate transmitter and receiver,
    - to provide the radio advantage to the legitimated link when communication starts
    - to enable authenticated radio channels measurement,
    - to enable of artificial noise schemes in order to provide the radio advantage to the legitimated link when communication is going-on
    - to support the enabling of further security mechanism derived from Physec concepts (Secret Key Generation, Secrecy Coding)
- Generation of secret keys from real field radio channel estimates (currently at 2.4 GHz : Wifi 802.11a links, next future at 2G 3G and 4G carriers).
- Significant progresses on the design of secrecy codes in realistic radio environments that would be based on LDPC codes, on lattice codes, on polar codes.

Thanks to this publication portfolio, standardization actions could be initialized at the end of period 2. They should grow up during the project's third period, and especially increase at the end of the project. Note that it is still a major objective for the PHYLAWS consortium to contribute (even in the future years) to existing and to new standards through the main results that will be achieved along the project, especially for industrial partners:

- Celeno company, as designer of secure WiFi components;
- VTT, as a research institute that is very close to 3G/4G/5G devices manufacturers;
- TCS, as a European leader of secure communications and as a manufacturer and user of secure transmission networks.

3 Concrete actions being initialized during period 2

The deliverable D1.9 (ref [PHYLAWS_D.1.9]) provided an initial identification of bodies and administrations relevant to standardization, which could be targeted by the PHYLAWS project.

More concretely, we describe hereafter the concrete actions the consortium had at the end of period 2 in order to contact targeted bodies and administrations.

3.1 Towards 3GPP security group and ETSI Security Cluster.

PHYSEC being not included in the scope of the ETSI security group (information from Scott Cadzow) see [PHLYAWS_AB], the PHYLAWS consortium addressed the security Group SA3 of 3GPP that is linked to ETSI.

Besides the councils of Mr Scott Cadzow (ETSI security group) who participates to our advisory board, a contact was achieved with with Mr Mirko Cano Soveri who suggest the consortium to participate (and may be contribute) to future SA3 meetings.

Thus, the next 3GPP SA3 meetings in Europe we currently plan to participate are the following:

- 2015-08-24, Talinn Estonia
- 2016-02-01, Dubrovnik, Croatia
- 2016-10-27, Sophia Antipolis, France

TCS intends first to register to the next SA3 meeting (Talinn Estonia August 2015). For this meeting, and after some discussion with Mr Mr Mirko Cano Soveri and taking the benefit of the kind councils of Scott Cadzow, the consortium will propose talks and papers relevant to PHYSEC and to Phylaws' first outputs.

3.2 Towards the Wifi Alliance and IEEE 802 Privacy Recommendation Study Group and IEEE 802 Working groups.

IEEE802 has opened a Privacy Recommendation Study Group (PSRG) (see ref [IEEE_802_PRSG]) with the recent sessions hereafter that were relevant to security of internet.

During the IEEE 802 Plenary Meeting San Diego, July 14th 2014 there was a session entitled: "Pervasive Surveillance of the Internet – Designing Privacy into Internet Protocols. Speakers were Ted Hardie (IETF IAB), Alissa Cooper (Cisco Systems), Lily Chen (NIST), Piers O'Hanlon (Oxford Internet Institute), Juan Carlos Zuniga (InterDigital Labs) [IEEE_IPTUT].

An Executive Committee Study Group (EC SG) was created on Privacy Recommendations (2014-07-18). This EC SG was initially chartered to run until March 2015, Expecting renewal for one more cycle. Main topics considered by SG include Threat Model for Privacy at Link Layer, Privacy Issues at Link Layer, Proposals regarding functionalities in IEEE 802 protocols to improve Privacy, Proposals regarding measuring levels of Privacy on Internet protocols, Implications of MAC address changes (randomization of MAC addresses).

An update to IEEE802 WGs occurred at the IEE 802 March 2015 8-13 Berlin: Plenary meeting with a tutorial on IEEE 802 Internet Privacy (see https://mentor.ieee.org/802-ec/dcn/14/ec-14-0043-00-00EC-internet-privacy-tutorial.pdf). This tutorial

- provided an update on the recent concerns about Internet privacy, the actions that (IETF) is taking, and the guidelines that are being followed when developing new specifications (e.g. RFC 6973 - Privacy Considerations for Internet Protocols)
- Highlighted Privacy concerns applicable specifically to Link Layer technologies, and provided suggestions on how IEEE 802 can help addressing them
- Developed the idea of an IEEE 802 recommended practices document, similar to the one produced by IETF (e.g. RFC 6973) was suggested and supported by several IEEE 802 members from different WGs

This tutorial appears to be very interesting to understand the privacy pain points from 802 organization perspective. Also, the EC SG and the PRSG might be a very good opportunity for standardization and dissemination for the PHYLAWS project.

3.3 Towards the Winncomm organization and associated regulators and stakeholders.

First recall that Mr Lee Pucker, head of the Chief Executive Officer of The Wireless Innovation Forum (SDR Forum Version 2.0), is member of the advisory board of the PHYLAWS project.
Answering a suggestion of Mr Pucker, PHYLAWS participated in 2014 to some of the e-meeting for the preparation of the "WINNF Spectrum Sharing Annual Report" (see ref. [WINFORUM_SSAR], and will contribute to the 2015 edition for security aspects relevant to Physical Layer. One interest of this contribution relies in the fact that such reports deeply influence standardization over long term.

In addition the project was invited to present its realizations during the Winncomm forum San Diego (March 2015 San Diego). This was concretized with a conference presentation entitled "A key-free radio protocol for authentication and security of nodes and terminals in advanced RATs" (see ref. [PHYLAWS_WS]) face to a panel composed by US military and industrial experts (for example: Dr Rich North, http://jtnc.mil/Visitor%20Information/North_bio.pdf). The questions and the feedback provided by these experts were very motivating for the pursuit of PHYLAWS's solutions for wireless security and for relevant proposals for standardization of our solutions when they are mature.

3.4 Towards the RAS Cluster.

After a significant contribution into a White paper entitled "High capacity PHY for future radio access and 5G" see ref [RAS_WD2.0], PHYLAWS contributed to online survey or standardization within the cluster and to the new letter papers published by the RAS cluster (see ref. [RAS_WD3.0]) for items relevant to

- Security needs of the future RATS (5G)
- Security enhancement perspectives with PHYSEC concepts
- Radio issues relevant to Full Duplex and massive MIMO RATs (synergies with several protection mechanism on the radio interface derived from PHYSEC concepts)
- Convergence issues at the convergence between physical layer and higher layer aspects.

3.5 Towards the European Defense Agency.

A contact was taken with Mr. Michael Sieber, who is the Head of Unit “Information Superiority” in European Defense Agency [EDA_WP].

Following the positive answer of Mr Sieber, who really appreciated to see that efforts to coordinate researches of the EDA with the European Commission is on the right path, the consortium is awaited in order to present PHYSEC concepts and PHYLAWS solution during future Working groups and future plenary sessions taking place in Automn 2015.

The relevant panels of such sessions and working groups are usually composed of military authorities, of radio and security experts from European Ministries of Defense, of industrials of radio-communications and of communication infrastructures.

From Mr Siebers’s informations, it appears that EDA has certain meeting formats with Member States, such as “Project Teams” or “Capability-Technology Groups (CapTechs)”.

- The CapTechs´ work has been allocated in TRLs up to 4 usually,
- Higher TRLs may be of interest to the Project Team community, where the military planners and users gather.

From our intent to present “innovative solutions” Mr Sieber would recommend about the latter then.

In addition, Mr Sieber precised us that EDA will soon launch a project on “Future Military Mobile Radio Node”, with quite a portion of cognitive radio aspects;

Finally Mr Sieber has agreed with his Project Officers that they will inform the consortium you as soon as the date for their joint **autumn** meeting on Command, Control, Information and Communication will be fixed, and invite us over to present our ideas.

About the standards – EDA has groups which deal with standardisation in general, with possibly some residual ties into SDR issues, and on Radio Spectrum, preparing contributions to the WRC. Mr Sieber suggest we discuss our solutions when we will come to EDA. Mr Sieber will contact next meeting with his standardisation projects officer in this sense.

4 Concrete actions being planned during period 3

Preliminary note: duration of period 3 is 16 months ([PHYLAWS_GA-AM], [PHYLAWS_GA-WP]).

Below is a summary of the action the PHYLAWS consortium intends to plan regarding standardization.

4.1 Towards 3GPP security group and ETSI Security Cluster.

Participate to year 2015 and year 2016 SA3 meetings.

Perform talks and discussions about PHYSEC intends and about intermediate results and final feasibility proof performed in the PHYLAWS project.

Propose contributions for future evolution of 4G standards, for 5G and for WLAN standards.

4.2 Towards ITU-T and ITU-R

During years 2014 and 2015 ITU groups and committed were very busy because of the preparation of CEPT 2016. Better opportunities for discussion of PHYLAWS contribution into future recommendations and in to future standards open only now and concern thus the third period of our project.

4.3 Towards the Wifi Alliance, IEEE 802.11 and 802.22

The organization of IEEE 802 Study groups on internet privacy is described in section. Partner Celeno being present in IEEE 802 WG will continue to follow these groups and will take any opportunities to present attendees, intermediate results and standardization proposal of the PHYLAWS project in the future IEEE 802 meetings:

- Teleconferences planed in June and in July 2015,

- IEEE meeting Bangkok in September,

- IEEE meeting Dallas in November,

- WNG sessions (Wireless Next Gen) which hold every IEEE meeting.

4.4 Towards the RAS Cluster.

The efforts and actions of the PHYLAWS consortium relevant to the RAS cluster during period 1 and 2 will continue over period 3.

4.5 Towards the Winncomm organization and associated regulators and stakeholders.

Present the new realizations of the Phylaws project during the Winncomm forum Europe (October 2015 at the Fraunhofer Institute, Erlangen).

Contribute to the “WINNF Spectrum Sharing Annual Report” 2015 edition for security aspects relevant to Physical Layer.

4.6 Towards the European Defense Agency.

Autumn 2015: Participate to EDA meetings, present our solutions, perform talks and discussions about PHYSEC intends and about intermediate results and final outputs of the PHYLAWS project.

Initiate discussions relevant to Security of communication networks during year 2015 and year 2016.

- With the The CapTechs´ working groups,

- Then with Project Team communities (including military planners and users).

Meet EDA standardization project officers and propose contributions to future standards, especially for Software Defined radios and Cognitive Radios, which are of great interest for EDA.

5 Conclusion

This document described the mid-project views and actions of the consortium on the standardization activities. In addition it plans the actions for the third period of the Phylaws project (duration 16 months). It will be upgraded along the project duration, and a final release (deliverable D.1.11) will be delivered at month 48 (according to amendment 1 [PHYLAWS_GA-AM] and revised DoW [PHYLAWS_GA-DOW2]), giving details about achieved standardization actions during the PHYLAWS project and mentioning the best opportunities and perspectives for the years following the end of the project.

APPENDIX: SKELETON OF CONTACT LETTER TOWARDS STANDARDIZATION BODIES

Dear Mr / Mrs …

I am the coordinator of a ICT-FP7 project, named PHYLAWS (web site: http://www.phylaws-ict.org/), which is relevant to security of public wireless networks. This project aims at proposing security enhancements at the radio interface (when facing any kind of eavesdropper threats) with key-free security schemes derived from Physical Layer Security.

Our team includes several of the best European academics and industries for coding, security and radio access technologies, and our advisory board includes great personalities of radio networks and security such as MM. S. Cadzow, J. Mitola, S. Capkun, P. Mueller, Pucker, Ph. Aubineau.

At mid-project we now have performed many analyses relevant to threats of the Over-The-Air interface of wireless networks and we can now propose several new security improvements:
- *For key-free security pairing of nodes and terminal at the earliest stages for the Radio Access (i.e. before subscriber authentication and before cipher key establishment, even before the channel negotiation in MIMO RATs)*
- *For achieving generation of secret keys and secret codes to be applied to unprotected signaling and access messages,*
- *For better protection of operator's signaling, of subscriber authentication and identification, of billing, of data transmission, etc.*

The techniques we investigate combine Pseudo Noise signals, Artificial Noise and Full Duplex transmission in MIMO RATs, radio protocols derived from systems for Identification of Friend and Foes, Secret Key Generation, Secrecy Coding.

In order to illustrate our approach you will find
- *in the first attached file, an overview of our analyses of security lacks in civilian wireless networks (Winncomm 2013)*
- *in the second attached file, an overview of physical layer security and of its benefits for civilian wireless networks (id.)*
- *in the third attached file, a contribution we propose for key-less security pairing of nodes and terminals and for generation of secret keys from the radio propagation random (presented last week at Winncomm 2015 San Diego, many other papers in progress).*

You have of course much more information at our website http://www.phylaws-ict.org/

Could you please tell me
- *when are the future opportunities in 3GPP for presenting such innovative solution and discuss their interest for ….*
- *which specific expert or working group we should address in order to progress towards future integration in Wireless standards ?*

I thank you in advance for your kind response.

Best Regards.

Signature