



Data Centres Optimization for Energy-Efficient and Environmentally Friendly INternet

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Dissemination and Standardization Initial Results

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Editor list: Alex Galis

Dissemination Level

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| <input checked="" type="checkbox"/> | PU: Public |
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List of Contributors

| Participant | Contributor |
|-------------|-----------------------------------|
| IRT | Domenico Gallico, Matteo Biancani |
| Nextworks | Andrea Gronchi |
| Synelixis | Artemis Voulkidis |
| WIND | Reale Aniello, Spada Maria Rita |
| GRNET | Evangelos Angelou |
| SIEMENS | Septimiu Nechifor, Alina Nistor |
| I2CAT | Amaia Legarrea |
| UCL | Alex Galis, Stuart Clayman |

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Abstract

This deliverable is part of Work Package 6 “Innovation exploitation and impact creation” and defines the project strategy, roadmap and results for the dissemination and standardisation activities. The dissemination roadmap is based on the expected project outputs, and it includes:

- **Reports;** a short description of all activities that each partner might perform during the life cycle of the project.
- **Press releases and Whitepapers;** introducing the project vision and strategy, the key developments undertaken and the accomplished results
- **Presentations of the project and its results,** to be presented by the project speakers for each presentation of the project they will make
- **Poster/brochure** to be used for project dissemination by consortium partners
- Moreover a project **Web Site** and others **communication tools** (such as social network groups) will be used as primary means for the dissemination.

Regarding scientific dissemination, an internal project tracking system is created, where relevant events (exhibitions, conferences, workshops, journal's/magazine's CFPs) of the project is maintained.

This deliverable includes the current results and a plan for the standardisation activities, where a comprehensive list of standardisation landscape defacto & de jure bodies is identified. For each of them, potential contribution activities have been reported and updated during the lifetime of the project.

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Abbreviations

| | |
|----------|--|
| DC | Data Centre |
| DoW | Description of Work |
| EC | European Commission |
| EUCNC | European Conference on Networks and Communications |
| ETSI | European Telecommunications Standards Institute |
| ESO | European Standards Organisations |
| FI | Future Internet |
| FI - PPP | Future Internet Public-Private-Partnership |
| IPR | Intellectual Properties Rights |
| ISO | International Organization for Standardization |
| ITU | International Telecommunication Union |
| ITU-T | ITU Telecommunication Standardization Sector |
| ITU-T FG | ITU-T Focus Group |
| MEC | ETSI Mobile-Edge Computing |
| NFV | Network Function Virtualisation |
| PM | Person Months |
| WP | Work package |
| PMO | Project Management Office |
| QCT | Quality Check Team |
| SGAM | Smart Grid Architecture Model |
| TMC | Technical Management Committee |
| TCEE | ETSI Technical Committee “Environmental Engineering” |

Executive Summary

DOLFIN objective is to improve energy efficiency in Data Centres (DCs) through coordinated energy management functions and active interaction with the smart grid network. A fundamental aspect of the project is the creation of awareness around the innovative approaches designed to reduce and optimize the DCs energy consumption, together with their benefits in terms of operative costs and improved automation.

DOLFIN consortium is strongly focused to guarantee a strong impact of the project achievements in the most relevant research and industrial communities, spanning across several categories of stakeholders in the cloud, DC and network area, but also involving the SmartGrids network environment. Work Package 6 (WP6) is responsible to coordinate this effort, through a wide range of activities that include:

- establishing suitable internal and external dissemination channels, to facilitate collaboration and promote the DOLFIN solution in academic and industrial communities;
- monitoring the progress of the standardization activities in the DOLFIN technical areas to guarantee the alignment of the project results with the latest standards and identifying potential contributions to target standardization bodies;
- monitoring the evolution of the market trends and defining individual or joint exploitation plans for industrial and scientific results.

This deliverable describes results for dissemination (chapter 1) and standardization (chapter 2) achieved during the first and second year of the project. Plans for the next final period are also provided. These standardization and dissemination results and plans will be revised as deliverable D6.5 during the year 3 of the project, in order to maximize the impact of the DOLFIN outcomes according to the latest activities.

1. Dissemination results and plans

Current and future data centres comprise diverse cloud management and autonomic functions. The envisaged solutions accommodate the need for effective energy management with a view to:

- Improve capital and operational effectiveness for DC operators through the use of a common organization, automation, and operation of all energy functions across the different domains
- Migrate from an ecosystem of separate energy management functions towards a related coordinated arrangement as represented in the following figure.

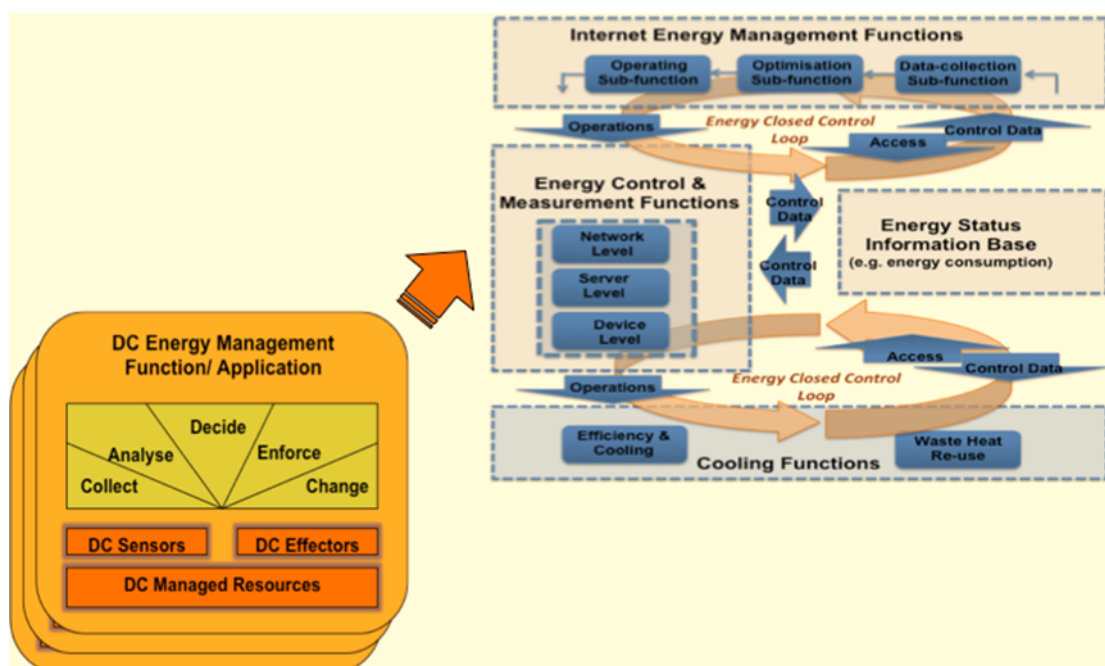


Figure 1 - Migration from separate energy control loops to a coordinated arrangement of multiple DC energy control loops

DOLFIN considers dissemination as of prime importance, since we believe that “going green” is not only a matter of cost effectiveness and competitiveness, but also a matter of attitude and quality of life. This attitude has to permeate to all involved stakeholders, to IT system designers and developers and to managers making strategic decisions.

The primary objective of dissemination is to promote the DOLFIN activities to external audience, in this sense the main target are focused on industrial and academic community in Europe and the world that spans across individual researchers, developers, providers and stakeholders involved or interested not only in what concerning the green Data Centre (DC) aspects, but also the innovation

that are identified, developed and documented in DOLFIN, with the aims to introduce new models and functionalities in a DC environment.

The main actors in green DCs who can be targeted by dissemination actions by DOLFIN can be classified in:

- Industry
- Public organizations and regulators
- The scientific community at large (academia and research centres)
- Funding agencies
- Media contacts

With regards to industry, the group primarily includes DC operators, network and cloud operators (in most cases, these are also the service providers), and system vendors. For this large community, a structured list of dissemination events and standardization groups apply, with the need to use the appropriate dissemination means to maximise the impact.

The project team has defined and set up a set of different means used for external dissemination, which are detailed in the following sections. This extends from website, social networking, newsletters, press and whitepapers, technical publications on specialized books or journals, participation to events, workshops and international conferences promoted from the EU, etc.

1.1. Dissemination channels

Each subsection of this paragraph shows the main initiatives undertaken or planned for the specific dissemination subject. Given the multi-year duration of the project, this document will be subject to changes over time, that will aim to keep updated and tracks the information contained herein, during the life cycle of the project.

1.1.1. Public Web Site

The public Web-site has been published on January 2013 and it represents the main entry point for project's communication and dissemination activities. Besides the "Overview" and "Project" sections that provide information about the project's description and scope, the website includes other two sections, namely "Dissemination" and "News and Event", which are periodically updated with relevant information on communication and dissemination activities as soon as they are made available.

In the last period the "Dissemination" section has been updated by publishing and uploading the final versions of two public Deliverables, namely D3.1 "Data Centre energy consumption optimization platform (eCOP) (Design)" and D4.1 "Synergetic Data Centres for energy efficiency (Design)".

Also the "News and Event" section has been updated with information about the events where project's partners took part, namely the "Green Grid EMEA Forum 2014" event held in Brussels, and the "3rd International Workshop on Smart City and Ubiquitous Computing Applications" held in

Larnaca, Cyprus. The related publications presented during these events have been reported in the “Publication” sub-section of the website.

On August 2015 the website has been provided with a useful Word Press plugin which enables the analytic reports on the website. With the data gathered from the tool, the project’s partners can keep track and monitor all the website’s visits in order to have a complete and accurate overview on the project divulgation, and a real-time acknowledgement on our communication strategy and activities.

In the following snapshot of September 2015, taken from the Word Press Statistics plugin, is reported the overall number of visits.

| Summary | | |
|-----------------------|---------|--------|
| User(s) Online: | 1 | |
| | Visitor | Visit |
| Today: | 30 | 58 |
| Yesterday: | 102 | 245 |
| Last 7 Days (Week): | 1,168 | 3,496 |
| Last 30 Days (Month): | 2,556 | 33,866 |
| Last 365 Days (Year): | 9,889 | 43,240 |
| Total: | 9,889 | 43,240 |

Figure 2- Visits summary

In order to have an overview on the number of visitors during the last month (period from 16/Aug to 15/Sept/2015), below is reported the “Hits Statistic” chart:

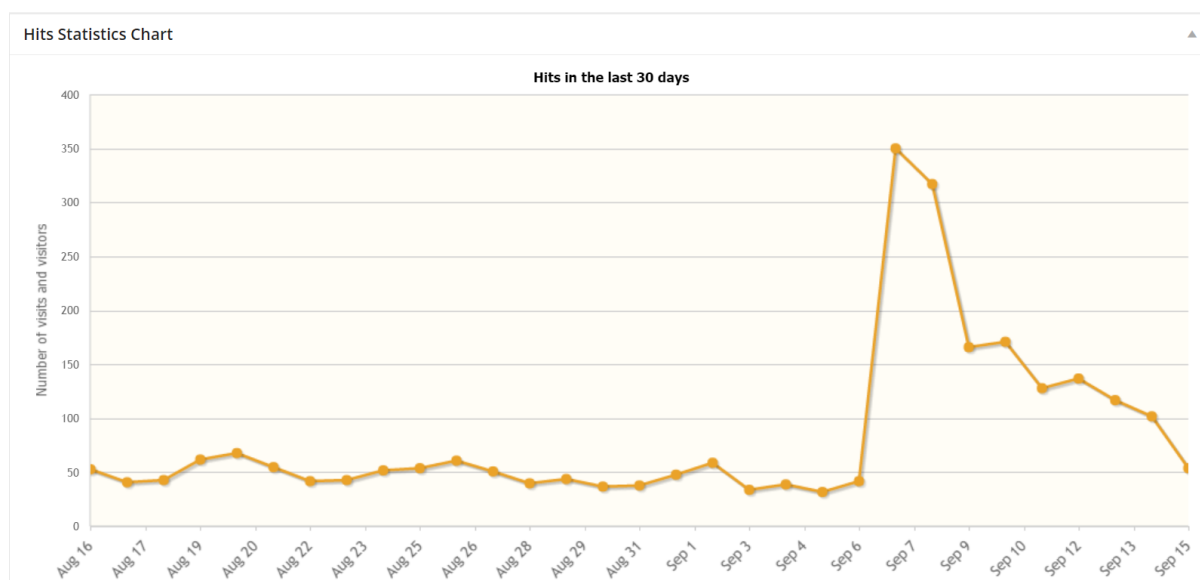


Figure 3- Number of visitors in the last month

Another useful information regarding the online presence footprint is provided by the “Top Countries” reports. Following are listed the top 15 countries from which the DOLFIN website has been visited:
















| Rank | Flag | Country | Visitor Count |
|------|---|--------------------|---------------|
| 1 |  | United States | 161 |
| 2 |  | Romania | 118 |
| 3 |  | India | 93 |
| 4 |  | Ukraine | 88 |
| 5 |  | Philippines | 76 |
| 6 |  | Serbia | 66 |
| 7 |  | Brazil | 62 |
| 8 |  | Pakistan | 60 |
| 9 |  | Russian Federation | 50 |
| 10 |  | China | 49 |
| 11 |  | Israel | 48 |
| 12 |  | Italy | 47 |
| 13 |  | Germany | 47 |
| 14 |  | Greece | 47 |
| 15 |  | Canada | 38 |

Figure 4- Visitors per country table

These statistics demonstrate a global presence of DOLFIN and interest in tackled research areas spread across different countries.

1.1.2. Whitepapers

Whitepapers have the main purpose to provide a short overview of the DOLFIN impact in the real world of DC industry and green telecommunication services. The whitepapers are excellent means to describe the DOLFIN project and promote the concepts and results beyond the DOLFIN ecosystem, bringing these concepts within a real market and business scenarios.

In the more common form, the whitepapers are used as a marketing tool, so the information contained are often accompanied by use cases that allow to represent, through logical and well-structured arguments, the potential of the system (and related technologies) as a solution to concrete business problems.

In the specific case of DOLFIN, whitepapers will have as target industries, scientific communities and other entities that have interests in the areas directly or indirectly affected by the project, such as: Green IT and Green DCs, SmartGrids, Cloud Computing and Virtualization systems, Building Management Systems, etc.

The consortium has decided to issue at least one whitepaper during the Year 3 in which major results will be collected and made available to the scientific public community. Major role in coordinating the editing efforts for this activity will be put by the Network and Data Center

operators in the consortium who represent the primary stakeholders of DOLFIN solutions. Interoute will take the lead of the whitepaper editing activity in Year3.

1.1.3. EC Conferences & Cluster Meetings

1.1.3.1. DC-CLUSTER COLLABORATION

The DC Cluster Collaboration initiative¹ constitutes an attempt of the EC to coordinate a group of eight (8) FP7 projects related to energy efficient, Green DC operation and DC-Smart Cities interaction. The goal of the DC Cluster Collaboration is to establish sets of well-defined metrics to render the quantification, evaluation and comparison of the projects' results feasible, from a combined technical and financial perspective. Apart from the identification of well-established DC energy efficiency metrics, the DC Cluster activities include the determination of new ones, to address the increasing need for applying effective ways to assess the efficiency of DC operation not only in terms of energy, but also of flexibility, cooperation with other DCs, CO2 savings and reduced energy expenses. In addition to identifying and theoretically establishing these new metrics, the DC Cluster aims at also coming up with concrete methodologies for measuring these metrics in real-field trials and verifying the results in an unambiguous way. The DC Cluster-defined metrics and the respective methodologies developed will be evaluated and validated during the projects trials and proper actions will be taken in order to standardise (some of) the Collaboration results.

DOLFIN actively participates in the DC Cluster activities. Specifically, DOLFIN was involved in Task 1, assisting in the identifying of the already existing metrics and methodologies. DOLFIN also participated in analysing the energy metrics and methodologies and determining their limitations. Notably, DOLFIN (UCL) acted as one of main coordinator of this task 1 – an additional deliverable to the DoW contract was produced as common DC Cluster collaboration activity- and participated in Tasks 2 and 3 of the DC Cluster. DOLFIN acted as both coordinator (SYN) and developing project (SYN, UCL, I2CAT) in Task 4 of the DC Cluster, being responsible for the determination of the measurement and verification plans of the metrics. DOLFIN is currently active (with NXW as main representative partner) in establishing the complete dissemination plan of the DC Cluster which is part of Task 5 activities. Last, as soon as integration is over and the first project results are gathered, all DOLFIN developing partners are going to provide feedback with respect to the measurement and verification processes already established within the context of Task 4, actively contributing in DC Cluster Task 6.

1.1.3.2. European Conference on Networks and Communications (EUCNC)

EuCNC is a technical and scientific conference open to the world research community, sponsored by the European Commission, in the area of Telecommunications, focusing on communication networks and systems, and reaching services and applications. It aims at showcasing the results of the consecutive programmes on R&D and projects co-financed by European programmes, as well as presenting the latest developments in this area. EuCNC is structured to permit open interactions and cross-fertilization across technical domains. It works towards a) Vision, challenges, scenarios and roadmaps for Future Internet (FI) research and b) the development of prenormative principles, concepts, design, architectures, recommendations and functional specifications of key FI system components and their interfaces.

¹ DC Cluster Collaboration, <http://projects.dc4cities.eu/projects/smart-cities-cluster>

DOLFIN will have an active participation in the next EUCNC in 2016, presenting final results on energy efficiency optimization solutions in Data Centres, to the European research community.

1.1.4. Publications

Publications are one of main instruments, through which DOLFIN approach and results will be promoted to the international scientific and technical community. Publications typically provide a mean to disseminate specific topics, or a specific set of functions and concepts that are integral and essential part of the ecosystem proposed by the project itself.

The publication is a valued tool not only to divulge the overall description of DOLFIN, but also to present solutions and results with the aims of facilitate the dissemination and sharing of knowledge. Three main types of publications means are provided:

- conferences papers
- technical books
- journals papers

In the next paragraphs are provided a list of potential publications planned during the lifetime of the project.

1.1.5. Participation in other relevant events

In addition to participate in initiatives (events, workshops and conferences) clearly identified within the dissemination roadmap, the Consortium is planning to participate in other industry events related to energy management at large during Y2 and Y3.

The following table shows the list of potential initiative of interest for DOLFIN.

| Event / participation description | DOLFIN partner involved | Planned |
|--|-------------------------|---------|
| Courses and seminars related to Building Management, i.e. participating to activities promoted by the ISTI institute of CNR. Within this Home and Building Management scenario, it will be possible to present DOLFIN as important reference testbed to encourage the development of energy management systems and Smart Grid integration in industrial and domestic fields. | NXW | Y2 & Y3 |
| Events organized by the Net-Y business network of which Nextworks is a member. These activities will allow to take advantage of common events and publications to expand the concepts expressed in DOLFIN to other industrial contexts. | NXW | Y3 |
| The Smart Grid Stakeholder Group (SGSG) has been established in June 2009 to create a liaison between the industry organisations involved in the evolution and roll out of the Smart Grid. The Group is open to all industry organisations who have or who intend to have an involvement in the Energy or ICT/Future Internet arena. | SYN | Y2 & Y3 |
| Network Softwarization conferences & workshops | UCL | Y2 & Y3 |

Table 1 : Participation in other relevant events

1.1.6. Newsletters

The newsletters have the intent to expand disseminate DOLFIN ideas, progressing of activities and results, providing also relevant project updates, in term of new objectives accomplished from each partners of the DOLFIN consortium.

For the moment, the consortium has decided not to invest resources in issuing newsletters, being most of the focus on implementation and validation. Moreover, whitepapers are deemed more appropriate to describe and promote solutions, being updates on project results and activities just conveyed on the project Web Site. Nevertheless, the opportunity for issuing up to two newsletters will be considered during the Year 3.

1.1.7. Workshops

DOLFIN plans to organize technical workshops and events with the aim of publicising and disseminating the project results and solutions, also fostering collaborations with other European and International projects. The organization of such events is also an attractive strategy to bring together academia and industry, both to share ongoing work and to disseminate and interact, seeking for new synergies and collaborations. The DOLFIN workshops, possibly co-located with relevant European and international conferences, will therefore provide a forum for service & content providers, equipment manufacturers, and academia to discuss requirements, challenges and solutions for next-generation data centres.

1.1.8. Social Networks

DOLFIN also aims to be active within the social networking. Twitter (@DOLFIN_FP7) and LinkedIn (DOLFIN-FP7) accounts have been created and are maintained up-to-date with project activities and news. They are also used to promote latest discussions, publications and demonstration events related to energy management inside data centres at a global scale. Although current followers are mainly other European projects and individuals with interests in data centre and cloud realms, the consortium intend to continue pushing for a wider reach to other industry partners.

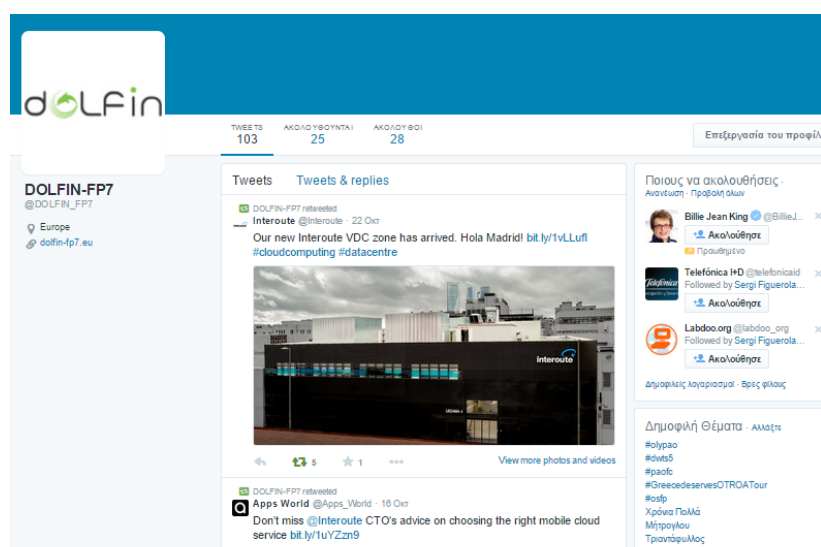


Figure 5- Twitter account

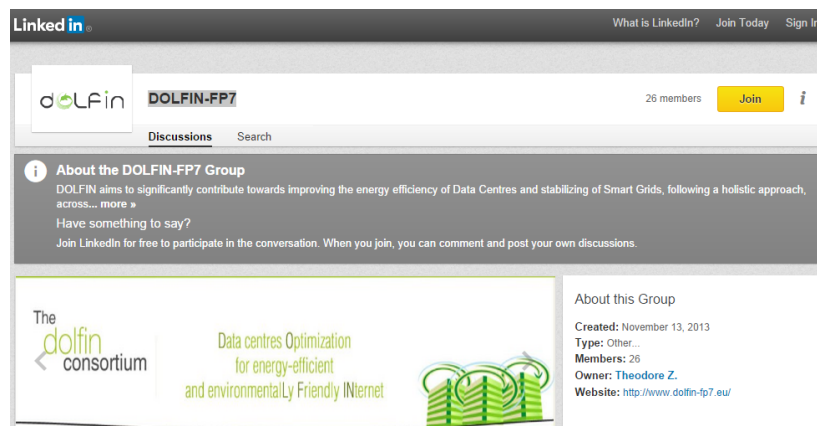


Figure 6- LinkedIn account

1.1.9. Projects Liaison Activities

DOLFIN recognizes that Energy Efficiency may be achieved only in a collaborative manner. Therefore, liaison activities with relevant projects have been initiated and are already in progress. These activities go well beyond the DC Cluster Collaboration initiative. In more details:

- **GEYSER project (FP7 ICT-609211).** The GEYSER project aims to design, implement and validate a technological and conceptual framework for green energy-sustainable networked Data Centres acting as Energy Prosumers within a Smart City /Smart Grid integration paradigm.

The relevance between the GEYSER and the DOLFIN projects is quite obvious and close collaboration will be for the mutual benefit of the projects. Therefore, Synelixix as the technical coordinator of DOLFIN has close communication with Engineering, Coordinator of the GEYSER project, in order to share ideas and technical approaches. Of course, special care has been taken so that no IPR issues rise via this communication.

Discussions on a potential common architecture between the two projects continued during Year 2, mostly led by the DOLFIN Technical Manager, Dr. Theodore Zahariadis..

- **FINESCE project (FP7 ICT-604677).** FINESCE (Future INternet Smart Utility ServiCEs) is the smart energy use case project of the 2nd phase of Future Internet Public Private Partnership (FI-PPP) programme funded by the European Union within FP7. From 2013 until 2015, FINESCE will contribute to the development of an open IT-infrastructure to be used to develop and offer new app-based solutions in all fields of the Future Internet related to the energy sector.

The project has organized and runs a series of field trials at trial sites in 7 European countries. Among them, the trial site in Terni, Italy performs experiments in Energy grid management in a smart city via an energy marketplace. Though DOLFIN concentrates on the Data Centre site, it also interfaces a smart grid interface, while links with an energy market place would be beneficiary for the project. Thus, Synelixix keeps close links between the two projects in order to maximize information flow.

Discussions about exchanging information on a common smart grid API also continued during Year 2, led by Synelixix.

- **XiFi project (FP7 ICT-604590)** XIFI is a project of the European Public-Private-Partnership on Future Internet (FI-PPP) programme. XIFI paves the way for the establishment of a common European market for large-scale trials for Future Internet and Smart Cities through the creation of a sustainable pan-European federation of Future Internet test infrastructures. The XIFI open federation leverages existing public investments in advanced infrastructures and support advanced large-scale deployment of FI-PPP early trials across a multiplicity of heterogeneous environments and sector use cases that should be sustained beyond the FI-PPP programme.

XiFi federates already 18 cloud infrastructures all over Europe. DOLFIN (represented by Synelixis) is following these developments in order to find out if results from the DOLFIN can directly apply on XiFi federation extending the FIWARE Ops²

1.1.10. Other dissemination activities

Industrial partners also plan to use their networks of technological partners and customer-related events to publish and make available gathered knowledge and experiences in DOLFIN.

In particular, project results are disseminated via the company intranets and in employees' seminars and courses, customers' training and products' offerings, scientific and commercial workshops and exhibitions.

In particular, WIND has organized several meetings throughout this first and second year of the project, aimed at sharing project results and evolution with WIND Information Technology Managers. These managers are in charge of deciding about the internal adoption of the DOLFIN solution and are the most qualified to create the appropriate conditions for a correct evaluation of it. In addition, a first contact with the Marketing Dept. at WIND has been established and the DOLFIN project briefly introduced. It was underlined that SMEs or other enterprises using WIND as Telco operator could benefit from the saved resources and be able to concentrate on other business opportunities. WIND has also involved its Business Strategy group to share the project approach and define a possible endorsement process, initially within the company itself and potentially in other companies of the Vimpelcom Group. As a principal member of Vimpelcom, WIND has a role of promoter to all companies in the group and its experience could provoke interest in various local contexts according to the level of attention to this topic in individual countries. The internal company website is also being kept up-to date with the reports ensuing from project developments.

Interoute has also interacted with their company CTO and top management (CEO and Board of Directors), both established in London, presenting DOLFIN updates in periodic quarterly meetings. Aim of these meetings was to discuss potentials for exploitation of DOLFIN ideas in Interoute data centers. Updates on project activities have been also provided in the Interoute intranet, accessible to all employees across different countries. Finally, Interoute Italy have cited DOLFIN in many company news published on Italian newspapers, thus making DOLFIN part of the promotional campaign used to further consolidate Interoute image and positioning in the Italian TLC market.

² FIWARE Ops is a collection of tools that ease the deployment, setup and operation of FIWARE instances by Platform Providers. It is designed to help expanding the infrastructure associated to a given FIWARE instance by means of federating additional nodes (Data Centres) over time and allowing cooperation of multiple Platform Providers.

1.2. Planned Dissemination Activities

A detailed table of scientific journals that will be targeted by the DOLFIN consortium is given below.

| Journal | Publisher | Thematic Area | Journal Information |
|---|--------------------------|---------------------------------------|---|
| IEEE Communications Magazine | IEEE | Network | dl.comsoc.org/ci1/ |
| Transactions on Networking | IEEE/ACM | Network | www.ton.seas.upenn.edu |
| Computer Networks | Elsevier | Network | www.elsevier.com/locate/comnet |
| Applied Energy | Elsevier | Open Access Journal Energy Efficiency | http://www.journals.elsevier.com/applied-energy/ |
| Sustainable Energy, Grids and Networks | Elsevier | Open Access Journal Energy Efficiency | http://www.journals.elsevier.com/sustainable-energy-grids-and-networks/ |
| Energy Efficiency | Springer | Energy Efficiency | http://www.springer.com/engineering/energy+technology/journal/12053 |
| Journal of Computer Networks and Communications | Hindawi | Open Access Journal Networks | http://www.hindawi.com/journals/jcnc/ |
| International Journal of Sustainable and Green Energy | Science Publishing Group | Open Access Journal Energy Efficiency | http://www.sciencepublishinggroup.com/journal/archive.aspx?journalid=169&issueid=1690305 |
| The Data Centre Journal | DCJ Magazine | Data Centres | http://www.datacenterjournal.com/ |

Table 2: Scientific journals targeted by the DOLFIN consortium

Moreover, we will try to organize a Special Issue dedicated to Energy Efficient Data Centres in a high prestigious magazine, with significant citation index such as IEEE Communications Magazine.

A list of scientific conferences that should be targeted by the DOLFIN consortium is given below:

| Conference | Type of Audience |
|--|-----------------------|
| ECOC; European Conference on Optical Communications is the largest conference on optical communication in Europe, and one of the most prestigious and long-standing events in this field. | Research and Industry |
| IFIP/IEEE International Symposium on Integrated Network Management | Research and Industry |
| ICC; IEEE International Conference on Communications | Research |
| IEEE GLOBECOM; IEEE Global Telecommunications Conference | Research |
| Supercomputing | Research and Industry |
| INFOCOM; IEEE International Conference on Computer Communications | Research |
| IEEE NetSoft 2015; will be the first of a series of annual events established as part of the IEEE Software-Defined Networks initiative of the IEEE Future Directions Committee to build an IEEE-wide community in this area across multiple IEEE societies and councils http://sites.ieee.org/netsoft/ | Research and Industry |
| CLUSTER; IEEE International Conference on Cluster Computing | Research |
| CLOUD COMPUTING; International Conference on Cloud Computing, GRIDs, and Virtualization | Research |
| CoNEXT; ACM International Conference on Emerging Networking Experiments and Technologies | Research |
| CoopIS ; International Conference on Cooperative Information Systems | Research |
| GRID; IEEE/ACM International Conference on Grid Computing | Research |
| ICS; ACM International Conference on Supercomputing | Research |
| ICPADS; International Conference on Parallel and Distributed Systems | Research |

| Conference | Type of Audience |
|---|-----------------------------|
| CNSM; The International Conference on Network and Service Management (CNSM) | Research |
| Task Force Smart Grids (European Commission DG Energy) | Research/Utilities/Industry |
| The Green Grid (TGG) Forum EMEA | Research/Utilities/Industry |
| Smart Grids European Technology Platform | Research/Utilities/Industry |
| Smart Grid Stakeholders Group (SGSG) | Research/Utilities/Industry |

Table 3: Scientific conferences targeted by the DOLFIN consortium

A proposal for participation and organization of events in the form of workshops and panel discussions in conjunction with major conferences can be found in the table below:

| Actual Date | Conference | Type of Audience | DOLFIN Participation | DOLFIN partner responsible / involved |
|--------------------|---|--|--|---------------------------------------|
| 25-29 April 2016 | IEEE/IFIP Network Operations and Management Symposium Istanbul // Turkey // 25-29 APRIL 2016 / Workshop on 5G and management (5GMan) - http://noms2016.ieee-noms.org | Scientific & Development Communities Conference is sponsored by IEEE Communications Society, and IFIP | Energy Efficient and Green Software-defined Infrastructures – topics | UCL |
| 6-10 June 2016 | 2nd IEEE Network Softwarization (NetSoft) 2016 - "Softwarization of Networks, Clouds, and Internet of Things". 6-10 June 2016, Seoul, Korea, http://sites.ieee.org/netsoft/ | Scientific & Development Communities Conference is sponsored by IEEE Communications Society, IEEE Computer Society, IEEE Signal Processing Society and IEEE Consumer Electronics society. | Energy Efficient and Green Software-defined Infrastructures – topics, sessions, keynotes and workshops in the conference | UCL |
| 20-22 October 2015 | ICT 2015 - Innovate, Connect, Transform, on 20-22 October 2015 in Lisbon, Portugal http://ec.europa.eu/digital-agenda/en/ict2015-innovate-connect-transform-lisbon-20-22-october-2015 | Scientific & Development Communities | Proposal for a Networking Session - Energy Efficient Software Defined Infrastructures for Networks & Clouds | All Dolfin partners |
| 9-11 December 2015 | TRON Symposium 2015 – 9-11 December 2015 Tokyo http://www.tronshow.org | Scientific & Development Communities | Energy Efficient and Green Software-defined IoT - topics and sessions | UCL |
| 13-17 April 2015 | 1st IEEE Conference On Network Softwarization – "Software-Defined Infrastructures for Networks, Clouds and Services" including "Energy Efficient and Green Software-defined Infrastructures" as a topic. http://sites.ieee.org/netsoft/ Venue: University College London. http://sites.ieee.org/netsoft/ | Scientific & Development Communities Conference is sponsored by IEEE Communications Society, IEEE Computer Society, IEEE Signal Processing Society and IEEE Consumer Electronics society. | Energy Efficient and Green Software-defined Infrastructures - topics and session in the conference | UCL |
| 1-3 December | 19 th IEEE International Workshop on Computer Aided | Scientific & Development | Simulation of features of an Energy Efficient Data | Synelixis |

| Actual Date | Conference | Type of Audience | DOLFIN Participation | DOLFIN partner responsible / involved |
|-------------|--|---|---------------------------------|---------------------------------------|
| 2014 | Modelling and Design of Communication Links and Networks (IEEE CAMAD) Athens, Greece http://www.ieee-camad.org | Communities Conference is sponsored by IEEE Communications Society | Centre (including VM migration) | |

Table 4: Events that the DOLFIN consortium is planning to organize/participate

1.3. Dissemination Activities executed in Year 1 and Year 2

Overall, during Year 1 and Year 2, DOLFIN has been well represented and has raised a lot of interest at the different events where it has been presented. The audience of the events has in general showed a lot of interest to the project hence encouraging further DOLFIN participation in the most relevant events during the remaining two years of its lifetime.

The table below summarizes the participation of the DOLFIN consortium to events, workshops and conferences during the first year of the project lifetime.

| Actual Date | Conference | Type of Audience | DOLFIN Participation | DOLFIN partner responsible / involved |
|------------------|--|--------------------------------------|---|---------------------------------------|
| Year 1 | | | | |
| 23-25 Sept. 2013 | 5th International Conference on Mobile Networks and Management (MONAMI 2013), Cork, Republic of Ireland, http://mon-ami.org/2013/show/home ; http://link.springer.com/book/10.1007/978-3-319-04277-0?wt_mc=alerts.TOCseries | Scientific Community | Software Enabled Future Internet – Challenges in Orchestrating the Future Internet | UCL, SYN |
| 11-13 Nov. 2013 | IEEE SDN4FNS (Software Defined Networks for Future Networks and Services), Trento, Italy; http://sites.ieee.org/sdn4fns/ | Scientific Community | Softwarization of Future Networks and Services - Programmable Enabled Networks as Next Generation Software Defined Networks | UCL, SYN |
| 20 March 2014 | DC Cluster Collaboration Workshop, Barcelona, Spain | Scientific & Development Communities | Contributions and activities of the DC Cluster Collaboration- 1st Cluster report | UCL |
| 28th March 2014 | 11th IEEE Workshop on Managing Ubiquitous Communications and Services part of PerCom 2014- Budapest; http://ubiquitous-management.org/mucs/2014/program.php | Scientific & Development Communities | Keynote presentation "Software Defined Systems for Management of Ubiquitous Communications and Services - How and What to Virtualize and Programme" | UCL |
| 9 May 2014 | 1st IEEE / IFIP International Workshop on SDN Management and Orchestration - at IEEE/IFIP | Scientific Community | Organisation & paper | UCL |

| Actual Date | Conference | Type of Audience | DOLFIN Participation | DOLFIN partner responsible / involved |
|-------------------------------|--|--|---|---------------------------------------|
| | NOMS 2014 conference in Krakow 5-9 May 2014 | | | |
| 20 May 2014 | 10th Smart Grid Stakeholder Group Meeting, Graz, Austria | Industry, Smart Grid Stakeholders | Attended the meeting | SYN |
| 23-26 June 2014 | EuCNC'2014 (European Conference on Networks and Communications) http://www.eucnc.eu Venue: Bologna, Italy | Scientific & Development Communities | Analysis & Results - Poster | UCL, IRT, NXW |
| 10 Sept. 2014 | DC Cluster Collaboration workshop, Brussels | Scientific & Development Communities | Leading project in the Task 4 activities of the DC Cluster Collaboration | SYN, UCL |
| 24-26 Sept. 2014 | Wireless World Research Forum | Scientific & Development Communities | Keynote presentation "Softwarization of 5G Network and Service Infrastructures - Current State, Upcoming Trends and Key Challenges" | UCL |
| Year 2 | | | | |
| 1-3 December 2014 | 19 th IEEE International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (IEEE CAMAD) Athens, Greece http://www.ieee-camad.org | Scientific & Development Communities Conference is sponsored by IEEE Communications Society | Simulation of features of an Energy Efficient Data Centre (including VM migration) | Synelixis |
| 2 nd December 2014 | Workshop on Cloud and Server Support for Wearable Computing /11th International Conference on Mobile and Ubiquitous Systems. London. 2nd December 2014 - http://www.dcs.bbk.ac.uk/~gr/iot-ecosystems/ | Scientific & Development Communities | Keynote presentation "Softwarization of Network. IoT and Service Infrastructures – Current State. Upcoming Trends and Key Challenges" | UCL |
| 13-17 April 2015 | IEEE NetSoft 2015 (Software Defined Infrastructures for Networks, Clouds, IoT and Services) 13-17 April 2015 London (4 tutorials, 40 papers, 7 demonstrations, 3 workshops) - 160 participants - endorsement and support from the Dolfin project | Scientific & Development Communities | Organasing and hosting | UCL |
| 10 th April 2015 | "A Service-Aware Virtualized Software-Defined Infrastructure" - Lefteris Mamas, Stuart Clayman and Alex Galis- publication in IEEE Communications Magazine in April 2015 (Volume 53, Issue 4), pp 166-174, ISSN 0163-6804; DOI: 10.1109/MCOM.2015.7081091 | Scientific & Development Communities | Paper publication | UCL |
| 8 th April 2015 | DC Cluster meeting in Barcelona | Scientific & Development Communities | Attended workshop | SYN |
| 29 June -2 July 2015 | EuCNC 2015 EU commission organised conference - http://www.eucnc.eu | Scientific & Development Communities | Attended conference | UCL |

| Actual Date | Conference | Type of Audience | DOLFIN Participation | DOLFIN partner responsible / involved |
|----------------------------|--|---|--|---------------------------------------|
| 14 th July 2015 | Datacentre Transformation - Facilities, ICT & Cloud – Manchester UK, http://dtmanchester.com | Scientific & Development Communities | Contribution to a DC – Cluster presentation | SYN, UCL, IR, |
| 21 -23 July 2015 | Siemens Digitalization Days 2015 | Business drivers, product owners, R&D communities | Attended Conference & present to business drivers projects ideas | SIE |
| 21-23 September 2015 | ITU-T Focus Group on 5GNetwork Softwarization – IMT 2020 – Turin (http://www.itu.int/en/ITU-T/focusgroups/imt-2020/Pages/default.aspx) | Standards Communities | Keynote Presentation on 'Challenges in 5G networking softwarization' | UCL |
| 26-27 October 2015 | EAI International Conference on Cloud, Networking for IoT, Rome http://cloudnriot.org/2015/show/home | Scientific & Development Communities | Invited Dolfin paper | SYN, UCL |
| 28 October 2015 | Green Grid EMEA Forum 2014 | Industry, Scientific & Development Communities | DOLFIN presentation | SYN |
| 6-10 December 2015 | IEEE International Workshop on Green Standardization and Industry Issues for ICT and Relevant Technologies (GSICT) of Globecom 2015 | Scientific & Development Communities | Paper Publication | SYN |

Table 5: Events that the DOLFIN consortium has already organized/participated

A detailed list of the papers published or submitted during the first and second year of the DOLFIN lifetime is given below:

Year 1

1. Galis, A (UCL), Rubio-Loyola, J., Clayman, S. (UCL), Mamatas, L. (UCL), Kukliński, S., Serrat, J., Zahariadis, T. (SYN), "Software Enabled Future Internet – Challenges in Orchestrating the Future Internet, 5th International Conference on Mobile Networks and Management" (MONAMI 2013), Cork, Republic of Ireland, 23-25 Sept 2013, <http://monami.org/2013/show/home>; http://link.springer.com/book/10.1007/978-3-319-04277-0?wt_mc=alerts.TOCseries
2. Galis, A. (UCL), Rubio-Loyola, J., Clayman, S. (UCL), Mamatas, L. (UCL), Manzalini, A., Kukliński, S., Serrat, J., Zahariadis, T. (SYN), "Softwarization of Future Networks and Services - Programmable Enabled Networks as Next Generation Software Defined Networks", IEEE SDN4FNS (Software Defined Networks for Future Networks and Services), Trento, Italy; 11-13 Nov 2013, <http://sites.ieee.org/sdn4fns/>
3. A. Manzalini (Telecom Italy –Italy), R. Saracco (TI Italy), C. Buyukkoc, (AT&T Labs USA_, P. Chemouil – (Orange France), S. Kukliński (Orange Polska Poland), A. Gladisch (Deutsche Telekom Germany), M. Fukui (NTT Japan), W. Shen (NTT- Japan), E. Dekel (IBM Israel), D. Soldani (Huawei Germany), M. Ulema (Manhattan College USA), W. Cerroni (University of Bologna Italy), F. Callegati (University of Bologna Italy), G. Schembra (University of Catania – Italy), V. Riccobene (University of Catania Italy), C. Mas Machuca (Technische Universität

München Germany), A. Galis (University College London, U.K.), J. Mueller (FhG FOKUS Germany) “Software-Defined Networks for Future Networks and Services - Main Technical Challenges and Business Implications” - IEEE SDN4FNS Whitepaper – open access @ <http://sdn.ieee.org/articles-publications.html>

4. Clayman S. (UCL), Maini E. (UCL), Galis A. (UCL), Manzalini A. (TI), Mazzocca N. (UF), “The Dynamic Placement of Virtual Network Functions”, IEEE/IFIP NOMS 2014 / SDNMO 2014 – 9th May 2014 Krakow; <http://noms2014.ieee-noms.org>; <http://clayfour.ee.ucl.ac.uk/sdnmo2014/>
5. Matteo Biancani (IRT), Theodore Zahariadis (SYN), Poster for “DOLFIN - Data Centres Optimization for Energy-Efficient and Environmentally Friendly INternet”, EuCNC 2014

Year 2

6. L. Mamatas, S. Clayman and A. Galis- “Software-Defined Infrastructure” - IEEE Communications Magazine in April 2015 (Volume 53, Issue 4), pp 166-174, ISSN 0163-6804; DOI: 10.1109/MCOM.2015.7081091
7. S. Clayman, L. Mamatas, A. Galis “Very Lightweight Software-Driven Network and Services Platform (VLSP) Operations and Evaluation ” - submitted on 31st August 2015 to the Special Issue of the International Journal on Network Management (IJNM) on Software-Defined Operations - [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1099-1190](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-1190)
8. L. Mamatas, S. Clayman, A. Galis “A Flexible Information Service for Management of Virtualized Software-Defined Infrastructures ” - submitted on 31st August 2015 to the Special Issue of the International Journal on Network Management (IJNM) on Software-Defined Operations - [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1099-1190](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-1190)
9. L. Mamatas, S. Clayman, A. Galis “Experimenting with Management Information Orchestration for Virtual Software-Defined Networks” submitted on 31st August 2015 for publication in the Elsevier Computer Networks journal - <http://www.journals.elsevier.com/computer-networks/>
10. A. Aravanis, A. Voulkidis, J. Salom, J. Townley, V. Georgiadou, A. Oleksiak, M. Porto, F. Roudet, T. Zahariadis “Metrics for Assessing Flexibility and Sustainability of Next Generation Data Centers”, accepted for publication in IEEE International Workshop on Green Standardization and Industry Issues for ICT and Relevant Technologies (GSICT) in Globecom 2015 ('GC'15 – IEEE GSICT'), will be published in the Proceedings of IEEE GLOBECOM 2015 and IEEE Xplore.
11. A. Aravanis, P. Karkazis, A. Voulkidis, T. Zahariadis, “On the Minimization of the Energy Consumption in Federated Data Centers”, invited for publication in EAI International Conference on Cloud, Networking for IoT systems (CN4IOT 2015).

1.4. Internal communication channels

In order to facilitate the internal communication within the DOLFIN consortium several tools have been implemented including a general mailing list, a code repository, a Dropbox folder and conferencing tools. All these dissemination channels for internal information sharing have been set up according to the initial description in the project DoW (Description of Work).

1.4.1. Mailing list

GRNET hosts the general mailing list that the consortium uses for day to day communication: dolfin@lists.grnet.gr. The list allows the people subscribed to send emails to the list and blocks emails coming from addresses not subscribed, this way, spamming to the list is avoided.

1.4.2. Dropbox folder

It was agreed amongst the partners of DOLFIN consortium that the most appropriate way of sharing and version handling of documents was using the tool Dropbox. Previously, a similar document sharing system by Interoute was used, but since its support was discontinued in April 2015 the consortium decided to move to Dropbox. The screenshot in Figure 7 shows the current home of the Dropbox folder. In May 2015 the folder in the previous system was migrated to Dropbox successfully and since then, the document and information sharing for DOLFIN is carried out using Dropbox.

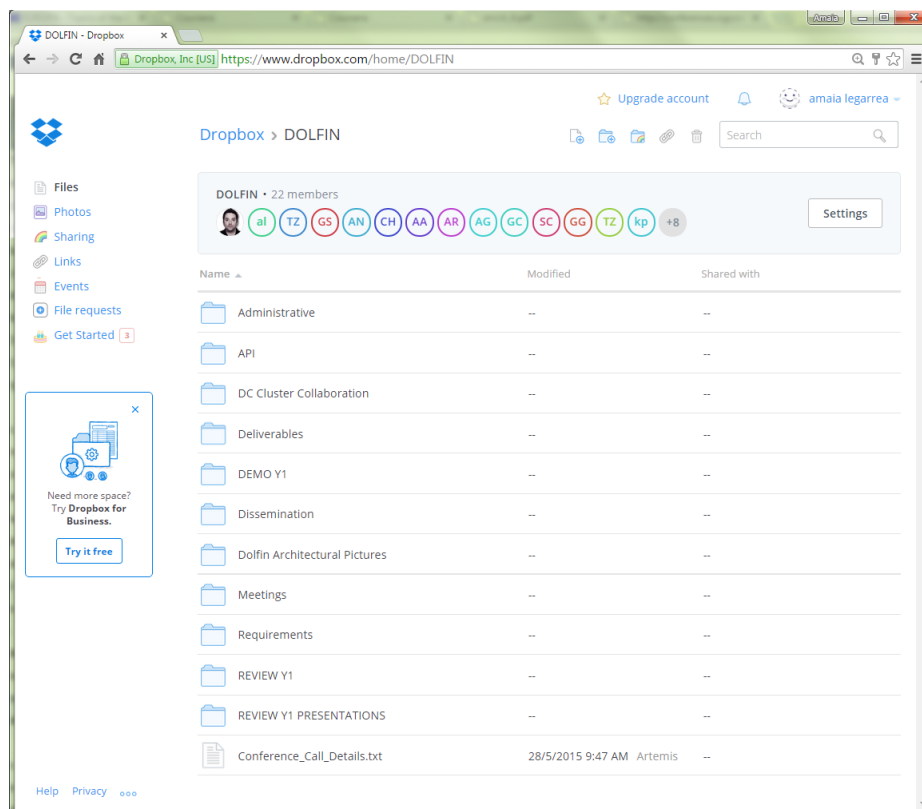


Figure 7- Dropbox Folder screenshot

1.4.3. GIT Repository

A Git repository has been set up for DOLFIN developers to ease the distribution version control of the developed software. The Git repository used by DOLFIN is based in the STASH product, by Atlassian and managed by i2Cat. A screenshot of the home page is provided in **Error! Reference source not found.**

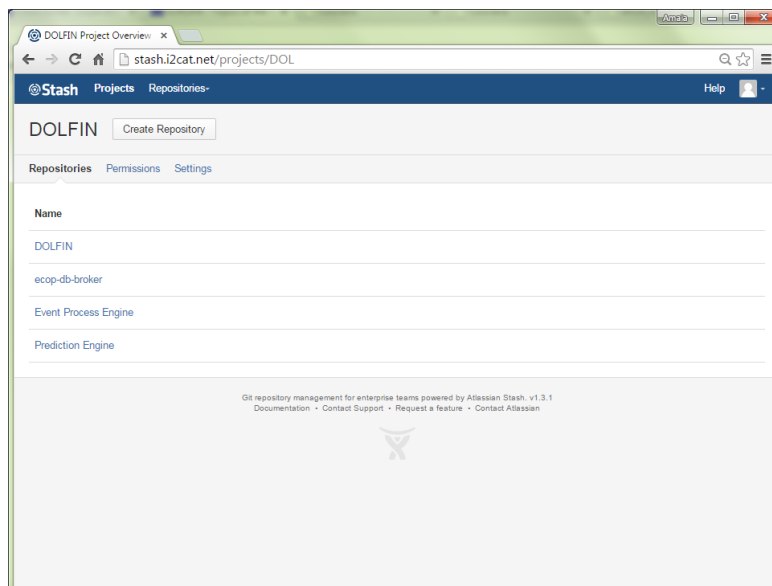


Figure 8 – STASH Git repository screenshot

At the moment, three modules of software have been included in the repository: the eCOP DB Broker, Event Receiver Engine and the Prediction Engine. It is expected that as the project and WP5 progress, more modules are developed and they will be included in new sub repositories.

1.4.4. Conferencing Tools

At the moment DOLFIN consortium meet up weekly in a virtual conferencing tool provided by Cisco (WebEx). This tool allows screen sharing to any of the participants, messaging, video-conferencing and recording the discussion. Figure 9 presents a screenshot of the actual weekly call.

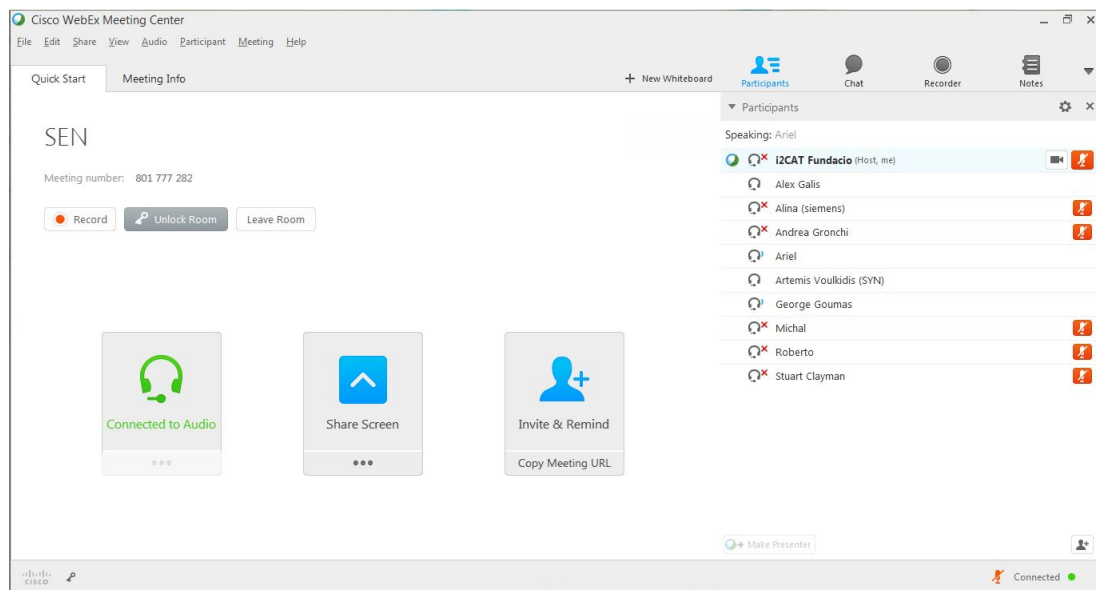


Figure 9– WebEx Conferencing tool screenshot

2. Standardisation Landscape - Results and Plans

DOLFIN consortium brings together partners that are present in standardisation bodies and will create significant impact contributing to the relevant work groups. Usually, contributions to standards are submitted by project partners or jointly by a group of partners, which actively participate in the respective bodies. All DOLFIN contributions will be based on the actual work plan of the respective standards body, the availability of suitable material to these bodies and the actual interests of the project partners.

2.1. Main Defacto / De Jure Standardization bodies

To realise the vision of green DCs and their integration in Smart Grids for a sustainable Internet growth, which has a very broad scope, the cooperation and coordination among different standardisation bodies is required. This is why the three European Standards Organizations (CEN/CENELEC/ETSI) created a Joint Working Group (JWG), which produced a report that outlines Europe's standardization views in the area of Smart Grids, taking due account of existing global activities. Smart Energy, Smart Grids and their relationship with the Future Internet have motivated a significant number of very significant international and European standardization bodies to address the issues related with standardizing the Smart Grid and Smart Energy Interfaces.

SIEMENS is involved in almost all standardisation bodies related to Smart Grids, telecommunication and information infrastructures and future Internet architectures and have a strong potential to push DOLFIN results in these bodies, as shown in Table 6. Among them, the most suitable groups will be chosen and DOLFIN will focus on them. All partners will assist in preparing contributions of high quality to create the maximum possible impact.

| Standardisation De Jure / Defacto body | Relevance for DOLFIN | DOLFIN partner involved |
|---|----------------------|--|
| CEN/CENELEC/ETSI | Medium | SIEMENS |
| Green Grid Alliances | Medium | SIEMENS (Contributor member) |
| ETSI Technical Committee "Environmental Engineering" (TCEE) | Medium | GRNET (partner of the FP7 IP ECONET project) |
| ETSI Network Function Virtualisation | Medium | UCL |
| ETSI Mobile Edge Computing | Low | UCL |
| ITU-T Future Networked Systems Group | Medium | UCL (is a vice chair of ITU-T FN Group) |

| Standardisation De Jure / Defacto body | Relevance for DOLFIN | DOLFIN partner involved |
|---|----------------------|-------------------------|
| ITU-T IMT2020 Focus Group | High | UCL |
| Open Source Solutions : Open Daylight, Open Stack, Open NFV | High | UCL |
| Smart Grid Stakeholder Group | Medium | SYN |
| The Green Grid Forum | Medium | SYN |

Table 6 : Standardisation focal areas

For each standardization committee identified in the Table 6, will be introduced a detailed section where will be described the activities and the contributions of DOLFIN in the specific standardisation body.

2.1.1. CEN/CENELEC/ETSI

The European Commission requested the three European Standards Organisations (ESOs), CEN, CENELEC and ETSI, to develop a framework to enable European Standardisation Organisations to perform continuous standard enhancement and development in the field of Smart Grids, while maintaining transverse consistency and promote continuous innovation.

CEN/CENELEC is relevant for DOLFIN due to the fact that it covers as focus the energy efficiency from both Smart Grid point of view and Green Data Centres one. If for the Smart Grids aspects first established activities of a join work group (CEN/CENELEC, ETSI) in July 2011 leading to the release of first set of consistent standards in the end of 2012, for Green Data Centres the activity is on a level of coordination groups delivering a standardisation landscape. This is the effect of current convergence and maturity for this industry, connected to the wealth of research and developments in Cloud Computing and management, and the advent of Big Data analytics field.

Therefore, based on proposed architecture and further results DOLFIN monitor and consider contributing in both relevant activities tracks: Smart Grids and Green Data Centres.

DOLFIN keeps under observation following specifications for Smart Grids as expressed as technical artefacts around defined SGAM (Smart Grid Architecture Model) as detailed in <ftp://ftp.cen.eu/EN/EuropeanStandardization/HotTopics/SmartGrids/First%20Set%20of%20Standards.pdf> (section 10.1.1) with a current focus on:

- EN 13321 series, EN 13757 1- 5- relevant for Metering Interfaces and Demand & Production flexibility
- EN 61968 (all parts) – relevant for aggregated market place systems

Nevertheless standards listed are evaluated for contribution based on DOLFIN implementation progress.

Regarding Data Centres aspects it can be observed that topics related to Energy Management and protections are shared and applicable within peer domains such as telecommunications (e.g. EN 50600-2-4) and building automation (e.g. EN 50600-2-5). Currently CEN/CENELEC refers as relevant standard at European level: ETSI TS 105174-2-2. DOLFIN will observe potential domain related improvements and propose them to be included in relevant standards.

2.1.2. Green Grid Alliances

The Green Grid Association is a non-profit, open industry consortium of end users, policy makers, technology providers, facility architects, and utility companies that works to improve the resource efficiency of information technology and DCs throughout the world.

This body is relevant for DOLFIN regarding its work in agreed metrics area and energy management.

During last years the group has published a number of position papers focused on server energy management. The outcomes are published as recommending. Currently relevant ones for DOLFIN are:

- Recommendations For Measuring and Reporting Overall Data Center Efficiency Version 2 - Measuring PUE for Data Centers (May 2011) - See more at: <http://www.thegreengrid.org/en/Global/Content/Regulatory-Activities/RecommendationsForMeasuringandReportingOverallDataCenterEfficiencyVersion2#sthash.n6DGjrtk.dpuf>
- ENERGY STAR® for Computer Servers Version 2.0 Data Set Feedback and Recommendations (May 2013)

2.1.3. Joint Technical Committee (JTC) – JTC 1/SC 39

JTC 1/SC 39 is a joint subcommittee established between ISO (international Standard Organisation) and IEC (international Electrotechnical Commission) on “Sustainability for and by Information Technology”. It has developed drafts for metrics assessing energy efficiency of data centres. At the moment PUE (power usage effectiveness) metric standard is being developed.

This body is relevant for DOLFIN regarding its work in agreed metrics area and energy

2.1.4. ETSI Technical Committee “Environmental Engineering” (TCEE)

DOLFIN is targeting to contribute to Working Item (WI) for the standardization of the Green Abstraction Layer (GAL). GAL is an architectural interface/middleware that will give a flexible access to the power management capabilities of the future energy aware telecommunication nodes to effectively exploit the capability of adapting the energy consumption of the network nodes with respect to the load variations. It will provide:

- definitions of the power supply interfaces of all telecommunication equipment, installed in telecommunications centres, access network and in customer premises,
- and definitions of equipment practice for telecommunication equipment installed in telecommunication centres.

DOLFIN results in telecommunication equipment management towards energy efficient operations are very relevant to the objectives of the TCEE. DOLFIN members intend to follow and monitor TCEE activities.

2.1.5. ETSI Network Function Virtualisation

ETSI NFV has produced a number of standard specifications including:

- GS NFV-PER 001 Network Functions Virtualisation (NFV); NFV Performance & Portability Best Practises
- GS NFV 001 Network Functions Virtualisation (NFV); Use Cases
- GS NFV 002 Network Functions Virtualisation (NFV); Architectural Framework
- GS NFV 003 Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV
- GS NFV 004 Network Functions Virtualisation (NFV); Virtualisation Requirements
- GS NFV-PER 002 Network Functions Virtualisation (NFV); Proofs of Concepts; Framework

DOLFIN results in energy management concepts, energy control platform deployment, and interfaces would be provided to the ETSI NFV. UCL is following and monitoring ETSI NFV activities.

2.1.6. ETSI Mobile Edge Computing

ETSI Mobile-Edge Computing (MEC) initiative started at the end of 2014 and it offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the mobile network. It has produced so far a white paper on the concept of Mobile-edge Computing and the related key market drivers, and to discuss the business, consumer and technical value/benefits that this technology offers. This white paper³ discusses the enablers, the requirements and challenges including energy and resource efficiencies for Mobile-edge Computing.

DOLFIN results in energy management concepts, energy control platform deployment, and interfaces would be provided to the ETSI MEC. UCL is following and monitoring ETSI MEC activities.

2.1.7. ITU-T IMT-2020 Focus Group/SG13: Future 5G networking

ITU has established in 2015 a new Focus Group to identify the network standardization requirements for the '5G' development of International Mobile Telecommunications (IMT) for 2020 and beyond-IMT2020⁴. The network studies are hosted by ITU's Standardization Sector (ITU-T), benefiting from the strength of ITU-T standardization in wireline communications. It aims at virtualisation of all 5G networking and servicing functions and system optimisations for all compute, networking and storage resources and facilities, inclusive of energy optimisation of 5G compute & connectivity infrastructure.

DOLFIN results in energy information base concepts & energy control platform deployment would be provided to the ITU-T IMT2020 FG / SG13 group.

UCL is contributing to this group in the areas of architecture and network softwarization.

³ ETSI MEC White Paper - https://portal.etsi.org/Portals/0/TBpages/MEC/Docs/Mobile-edge_Computing_-_Introductory_Technical_White_Paper_V1%2018-09-14.pdf

⁴ ITU-T IMT2020 Focus Group - <http://www.itu.int/en/ITU-T/focusgroups/imt-2020/Pages/default.aspx>

2.1.8. ITU-T Future Networked Systems Group/SG13: Future networks including cloud computing, mobile and next-generation networks

ITU-T FN group has produced a number of reports which were approved by ITU-T as recommendations (e.g. standards)

- ITU-T Y.3001 Recommendation (Q4 2011) – "Future Networks: Objectives and Design Goals". This Recommendation describes objectives and design goals for Future Networks (FNs). This Recommendation assumes that the target timeframe for FNs fall approximately between 2015 and 2020. In the appendix, this Recommendation describes technologies elaborated in recent research efforts that are likely to be used as an enabling technology of each design goal. It is downloadable at: <http://www.itu.int/rec/TREC-Y.3001-201105-I>.
- ITU-T Y.3011 Recommendation (Q1 2012) – "New Framework of network virtualization for Future Networks". This Recommendation describes the framework of network virtualization for Future Networks (FNs). It is downloadable at: <http://www.itu.int/rec/TREC-Y.3011-201201-I>.
- ITU-T Y.3021 Recommendation (Q4 2014) – "New Framework of energy saving for Future Networks". This recommendation describes the framework of energy saving for Future Networks (FNs). It first presents the need for energy saving of networks themselves, and reviews potential technologies. The document then identifies major functions and their cyclic interactions, analyses possible impacts of introducing the technologies, and itemises the high-level requirements for introducing the technologies. It is downloadable at: <http://www.itu.int/rec/T-REC-Y.3021-201201-I>
- ITU-T Recommendation Y.3300 (2014) - Framework of software-defined networking <https://www.itu.int/rec/T-REC-Y.3300-201406-I/en>

DOLFIN results in energy information base concepts, energy control platform deployment, and interfaces with the Energy Efficient DC ecosystems will be provided to the ITU-T FN / SG13 group.

UCL acted as vice chair of ITU-T FN group.

2.1.9. Ad hoc Working Groups

In this category we categorize Working Groups, which do not provide directly standards but recommendations instead. These groups include:

- **DC Cluster Collaboration initiative**, which constitutes an attempt of the EC to coordinate a group of eight (8) FP7 projects related to energy efficient, Green DC operation and DC-Smart Cities interaction. The goal of the DC Cluster Collaboration is to establish sets of well-defined metrics to render the quantification, evaluation and comparison of the projects' results feasible, from a combined technical and financial perspective.
- DOLFIN actively participates in the DC Cluster activities. Specifically, DOLFIN was involved in Task 1, assisting in the identifying of the already existing metrics and methodologies. DOLFIN also participated in analysing the energy metrics and methodologies and determining their limitations. Notably, DOLFIN (UCL) acted as one of main coordinator of this task 1 – an additional deliverable to the DoW contract was produced as common DC Cluster collaboration activity. Moreover, DOLFIN acted as both coordinator (SYN) and developing

project (SYN, UCL, I2CAT) in Task 4 of the DC Cluster, being responsible for the determination of the measurement and verification plans of the metrics. Last, DOLFIN participates in Task 5 activities of the DC Cluster and will continue contributing to the already established measurement and verification methods of the DC-Cluster introduced KPIs in the context of Task 6.

- **The Green Grid (TGG).** The Green Grid (TGG) mission is to drive effective and accountable resource efficiency across the entire ICT ecosystem. The Data Centres (DCs) is a special area, which need to be highlighted. The DCs have changed considerably as the evolution of information technology has enabled it to become the critical nerve center of today's enterprise. As business demands increase, so does the number of DCs facilities which are running into resource limits related to power, cooling, and space, making the resource efficiency of DCs an important topic of discussion. As a global consortium comprised of end-users, policy-makers, technology providers, facility architects, and utility companies, The Green Grid aims to address this significant topic.

DOLFIN is actively monitoring the TGG activities and SYN will participate in the TGG EMEA Forum 2014, on October 28 - 29, 2014 in Brussels, Belgium. The agenda will build on The Green Grid's "industry firsts" in several strategic areas, including work on the Data Center Maturity Model, Lifecycle of the Data Center, Utility and Resources, and ICT Benefits to Society and Environment.

- **The Smart Grid Stakeholder Group (SGSG)** has been established in June 2009 to create a liaison between the industry organisations involved in the evolution and roll out of the Smart Grid. The Group is open to all industry organisations who have or who intend to have an involvement in the Energy or ICT/Future Internet arena. This network is intended to be the forum to:
 - Share new technological, marketing, business and regulatory/standardization information in EC member states and worldwide
 - Make technological and market announcements targeting mutual benefit of the participants
 - Advance the mutual understanding between the energy and ICT industries on common challenges and technical/engineering solutions,
 - Form new cooperation / strong consortia for common research activities, including common or federated trial implementations,
 - Build strong alliances, e.g. for targeted standardization activities, and
 - Identify new mutual beneficiary business opportunities.

DOLFIN has been represented by SYN in the 10th SGSG meeting that took place on the 20th of May, 2014, and was co-located with the Smart Grids Week in Graz, Austria. The main focus has been to foster information, knowledge exchange and networking between the Smart Grid, energy production, distribution and consumption, and the ICT industry. SYN used the forum for information exchange between experts and champions in the related areas of interest that comprise energy efficiency and interfacing with the Smart Grid.

2.1.10. Open Source Solutions

The following are open source solutions for software defined infrastructures (networks, clouds, services)

- Open Daylight – software defined infrastructure platforms that enable control and programmability <http://www.opendaylight.org>
- Open Stack - Open source software for building private and public clouds - <http://www.openstack.org>
- OPNFV - Open Platform for Network Function Virtualisation solutions <https://www.opnfv.org/>

DOLFIN system results which are open solutions in particular UCL's source solutions in energy management concepts and systems will be provided to the OPNFV and Open Daylight.

3. Conclusion

This deliverable has described the results and plans for the dissemination, communication and standardization activities defined for the Year 1 and Year 2 of the project, aimed at ensuring wide impact of DOLFIN outcomes in the most relevant European and worldwide communities.

DOLFIN dissemination targets audience from academic and industrial communities, in the network, cloud, DC and smart grid network arena, spanning from individual researchers and developers, to DC, network and cloud operators, cloud service providers and system vendors. The consortium has identified a set of target international conferences, journals and events where the project results will be published or presented. The consortium has already published some joint papers and continue participating in international workshops and events with posters, presentations and keynotes.

Technical workshops or special sessions, possibly co-located with international conferences, are under consideration for Year 3 to promote collaboration with other EU projects and research initiatives leveraging on consolidated DOLFIN results in terms of implementation and validation. In this area, liaison activities with three FP7 projects (GEYSER, FINESCE, XiFi) have continued to be run to share the initial results and identify potential collaborations.

The strong involvement of some DOLFIN partners in standardisation bodies like CEN, CENELEC, ETSI and ITU-T or the Green Grid Association consortium is a key point to create significant impact in Working Groups related to the DOLFIN technical topics. Plans for potential contributions in these SDOs have been revised during Year 1 and Year 2 according to the availability and maturity of project results to be promoted and discussed in these SDOs. Moreover, DOLFIN is expected to contribute in open-source initiatives, like OpenDaylight /OpenStack /Open NFV.

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