



## IoRL Deliverable D7.9

### Report on Dissemination Activities

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#### **Abstract**

This deliverable summarises the dissemination activities and efforts in IoRL towards creating public awareness and transferring the knowledge generated in the project to the outside world. The document presents the activities and achievements between July 1, 2018 and May 31, 2019, structured according to the focus groups, delivery channels used and material produced. An outlook to the planned activities in the next period is also provided.

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## **Executive summary**

This document summarises the dissemination activities and actions during essentially the second year of the IoRL project life, from 1<sup>st</sup> July 2018 until end of May 2019 both at project and partner levels. The report has been developed as part of the IoRL project Work Package 7.

During this second period the IoRL project partners continued to make efforts to disseminate the results of the project using the established channels.

Activities performed included, but are not limited to the followings: Conference paper contributions, Exhibitions and demos, Presentations, Media Coverage, Invited talks, Workshops, Flyers, Keynote speeches, Journal papers, Interviews, Position papers, Poster sessions, Brochures, Software, and Video/Film/TV Clip, active participation in and contribution to 5G PPP programme level activities, contributions to 5G PPP documents.

Throughout all these different activities, knowledge and project results have been successfully disseminated and transferred to the outside world in an efficient and effective way.

IoRL dissemination activities are now shifting towards exhibiting and demonstrating integration results at events such as EuCNC 2019, and similar profile suitable events (e.g. SmartGridComm 2019 which will be held between 21 and 24 October, 2019 in Beijing, China).

We would like to emphasise that IoRL will also continue to disseminate its results as part of the 5G PPP. It will collaborate with other 5G PPP projects, as much as possible, to amplify its impact and ensure truly global impact of the 5G PPP programme.

## List of authors

Company	Author	Contribution
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Tsinghua University	Hongxiu Zhao	Activity related structure, collection, consolidation, overall writing
Tsinghua University	Jintao Wang	Contribute figures of this report, overall review
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## Abbreviations

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5G	Fifth Generation (mobile/cellular networks)
5G PPP	5G Public Private Partnership
IoRL	Internet of Radio Light (project)
LiFi	Light Fidelity
mmWave	Millimeter Wave
NFV	Network Functions Virtualization
R&D	Research and Development
SDN	Software-defined Networking
VLC	Visible Light Communication



## Definitions

**Dissemination** means sharing research results with potential users - peers in the research field, industry, other commercial players and policymakers). By sharing your research results with the rest of the scientific community, you are contributing to the progress of science in general. (as per [http://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/dissemination-of-results\\_en.htm](http://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/dissemination-of-results_en.htm))

**Exploitation** is the use of results for commercial purposes or in public policymaking. (as per [http://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/dissemination-of-results\\_en.htm](http://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/dissemination-of-results_en.htm))

## **1 Introduction**

During the second reporting period of IoRL project partners continued to make considerable efforts to disseminate the research and development results of IoRL as broadly as possible using the established effective and proven methods. Essentially we followed through our previously established strategy.

Activities performed included, but were not limited to the followings: Conference paper contributions, Exhibitions and demos, Presentations, Media Coverage, Invited talks, Workshops, Flyers, Keynote speeches, Journal papers, Interviews, Position papers, Poster sessions, Brochures, Software, and Video/Film/TV Clip, active participation in and contribution to 5G PPP programme level activities, contributions to 5G PPP documents. Throughout all these different activities, we believe that knowledge and project results have been successfully disseminated to a broad audience in an efficient and effective way.

We will systematically detail our activities in the following.

### **1.1 The role of dissemination in IoRL**

We would like to reiterate the role and importance of dissemination in IoRL. The project team is absolutely convinced that the outcome of IoRL has the potential to make a major impact and can benefit the whole eco-system. Therefore it is highly desirable to promote IoRL project results and disseminate them during the project period as well as afterwards to as broadly as possible to maximize the impact of its outcome.

It is our ultimate goal to take every possible opportunity to make the concept and the progress of IoRL project known to the public as widely as possible. Considering the fact that many IoRL project partners are from academia, we have found that we can very effectively disseminate our results through technical papers (journal or conference papers), invited talks/keynote speeches, especially within the scientific community. As integration within the project progresses, we expect to demonstrate the potential of our solution more widely, also to the public at large.

## **2 Project identity**

The project has established its identity already in the first period, and continued to use this identity in the second period.

## **3 Stakeholders with an interest in the IoRL solution**

The project has already identified the following groups that have an interest in the IoRL solution and further refined this list during this period:

- Mobile network operators and service providers;
- Facility managers;
- Property developers, construction industry;

- Integrators, integrated solution providers (for communications, etc.);
- Certain vertical sector representatives (such as museums, retailers and hospitals from the health sector);
- Specialist solution providers (on-board/cabin system providers for aircrafts, connectivity solution providers for trains);
- Smart manufacturing solution providers;

## 4 Tools used to plan and monitor dissemination activities

The project uses its adopted collaborative workspace to co-ordinate, prioritise and plan future dissemination activities, especially with regard to exhibitions.

Regarding dissemination monitoring, the project adopted the use of the specific tool designed and provided by Eurescom, the EuresTools® Dissemination Tracker. All dissemination activities planned are entered to the tool and progress with them through their entire lifecycle until publication is monitored and captured using the tool.

## 5 Dissemination activities performed in the period

### 5.1 Overall statistics

Following the predefined dissemination mechanisms: (1) Submission of papers to leading peer-reviewed conferences and journals, (2) Participation in program committees and editorial boards, through which participants can organise special sessions in conferences, special issues, etc., (3) Participation in forums and industrial oriented events, IoRL consortium members have utilized different method to efficiently and effectively introduced the concept of IoRL, shared the project results within consortium and to the outside world, and (4) Submit contributions to International Telecommunication Union (ITU) and share IoRL-related information on ITU's website when interviewed.

All these activities are recorded by the partners using the EuresTools Tracker tool, and fed into the project website at <https://iorl.5g-ppp.eu/publications/>.

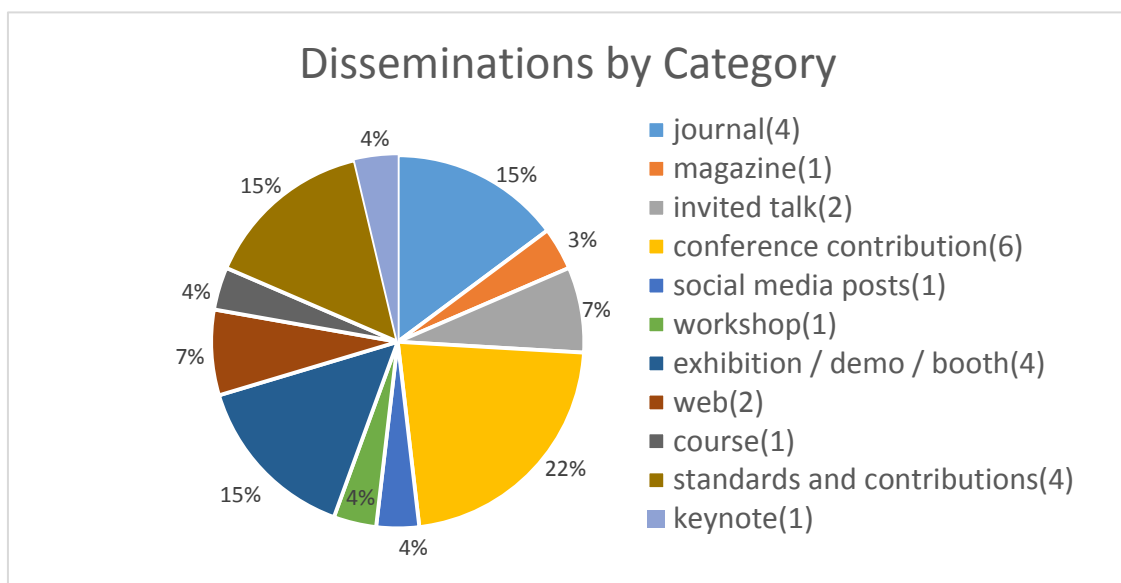
Table 1 list all the dissemination activities by different category, as indicated in the executive summary.

**Table 1 – Dissemination activities by category**

Item	No. of activities
journal	4
magazine	1
invited talk	2

conference contribution	6
social media posts	1
workshop	1
exhibition / demo / booth	4
web	2
course	1
Standards and contributions	4
keynote	1

Figure 5-1 presents the tabulated data from Table 1 in a Pie Chart format.



**Figure 5-1 – Pie Chart of the data from Table 1**

One can clearly see the distribution of different methods for the dissemination. While it shows quite balanced activities, it is no surprise to see that paper contributions, together with presentations still take the majority of the activities. Since the prototype has just been established, we expect to see more results, demonstrations, exhibitions, and other implementation related activities be reported in the future.

In the future, we may see more activities in program committee/editorial board participation and forums /industry-oriented events participation, such as the demonstration planned to be held in Paris during the 2020 IEEE BMSB conference. Like the IEEE BMSB in 2018 in Spain sees the 5G X-Cast special session, when the proposals hosting the next year's

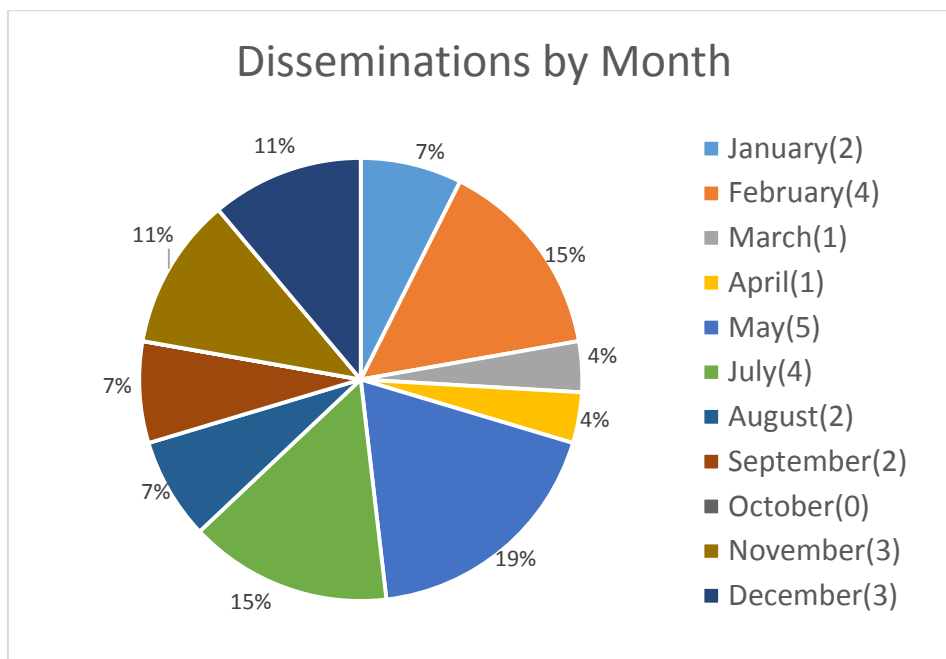
BMSB were evaluated and selected, the project demonstration of IoRL is really a big plus for winning this competition..

After checking the activities by category, we also look at activities distributions by month and the statistic results are shown in Table 2 with Pie Chart in Figure 6-2, respectively. It should be pointed out the since IEEE BMSB conference was reported in the previous document, this report misses the statistics of June.

**Table 2 – Dissemination activities by month**

Month	No. of activities
January	2
February	4
March	1
April	1
May	5
July	4
August	2
September	2
October	0
November	3
December	3

Figure 5-1 presents the tabulated data from Table 2 in a Pie Chart format.



**Figure 5-2 – Pie Chart of dissemination activities by month**

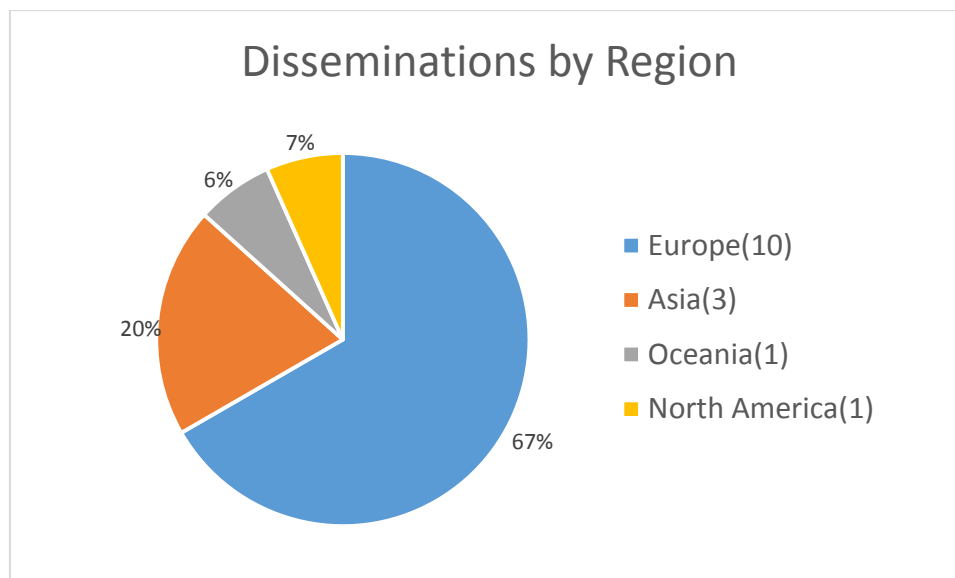
If the data is further analysed, one can see that the activities are not very balanced yet it is quite understandable. Since IoRL project decides not to organize its own conference, partners have to seek the dissemination opportunities by following the schedule of relevant events and wouldn't be able to arrange all activities according to their own working agenda.

Activity distributions by region (continent) are shown in Table 3 and Pie Chart in Figure 5-3, respectively.

**Table 3 – Dissemination activities by region**

Region	No. of activities
Europe	10
Asia	3
Africa	1
Oceania	1

Figure 5-3 presents the data from Table 3 in a Pie Chart format.



**Figure 5-3 – Pie Chart of dissemination activities by region**

Again, it is no surprise to see that the majority of the dissemination activities are conducted in Europe at quite different places, not only the project is EU project but also most partners are from Europe. Chinese partner are also doing a good job in their dissemination efforts. It should be point out that due to the budget issue, European partners won't be able to travel to China frequently which could further help strengthen the collaboration among partners and also achieve better influence of IoRL project on the event participants.

It is interesting to see there is still one event Oceania (Australia), yet no more event in Africa during this report period and there is an event in North America instead. Even the IoRL presence in other continents are quite minimal, we sincerely hope that the impact of IoRL will not be limited to Europe and Asia even though these two continents have great potential to utilize the project outcome, but also becomes truly international. We are highly confident when technologies become more mature, more exposures to other continents will be materialized.

From the activities tracking, we are glad to see all the consortium partners have actively involved into this task in different ways and lots of activities are not solely done by one partner. These are the collective efforts of the team work, especially for the conference contributions (authors are from different partners) as well as some demo/booth activities. Some partners have already taken the backup job during the dissemination efforts. Since it is quite difficult and unnecessary to differentiate the contribution from this partner to this task quantitatively, we decide not to provide the information on the activities from each partner, and would rather treat this as a whole.

## 5.2 Events organised and attended

### 5.2.1 EuroOptics 2018 & EuroSciCon

During 14–17 May 2018 MostlyTek participated in the SPIE – the international society for optics and photonic conference dedicated to systems design held in Frankfurt, Germany. Dror Malka has presented a new concept for splitters based on GaN that enables to speed up by factor 8 the data rates of led devices.

A low-cost design for Red- Green-Blue (RGB) VLC photonic demultiplexer was further presented at EuroSciCon Joint Event on Laser Optics & Photonics and Atomic & Plasma Science. The event was organized by American Journal of Computer Science and Information Technology.

The research on GaN splitters from SPIE 2018 was further extended to include demultiplexers based on Plastical Optical Fiber (POF) which has the great potential for reducing cost of manufacturing the devices. The recent research was presented in SPIE's 2019 Int'l. Symp. on Optics & Optoelectronics, Prague, Czech Republic, 1-4 April 2019.



**Figure 5-4 – Dror Malka with Prof. Gerard Albert Mourou, the 2018 Nobel prize winner in physics**

### 5.2.2 ICT 2018: Imagine Digital - Connect Europe

ICT 2018 took place in Vienna between 4<sup>th</sup> and 6<sup>th</sup> December 2018, organized by the European Commission and the Austrian Presidency of the Council of the European Union. This research and innovation event attracted 4800 visitors and focused on the European Union's priorities in the digital transformation of society and industry. It presented an opportunity for the people involved in this transformation to share their experience and vision of Europe in the digital age.

Sara Cuerva (Ferrovial Agroman), Silvia de la Orden (Ci3) and Lina Shi (Association ISEP - Edouard Branly) have participated at this edition in the stand of the IoRL project, which was



located in the area of "Creating Networks & Technology" with other 5GPP projects. In the stand there was a demo video and different visitors were interested in the project.

### 5.2.3 MWC-2018 Americas

RunEL has a booth at Mobile World Congress 2018 (MWC-2018) Americas dated 12-14 September in Los Angeles, California, USA. In the RunEL stand the Sparq-2020 5G System solution for Base Station that is also used for the IoRL project was displayed.

The RunEL MWC-2018 display included the Distributed Sparq-2020 architecture that consists of the Distributed Radio Access Network (DRAN) and the Remote Radio Light Head Controller (RRLH Controller).

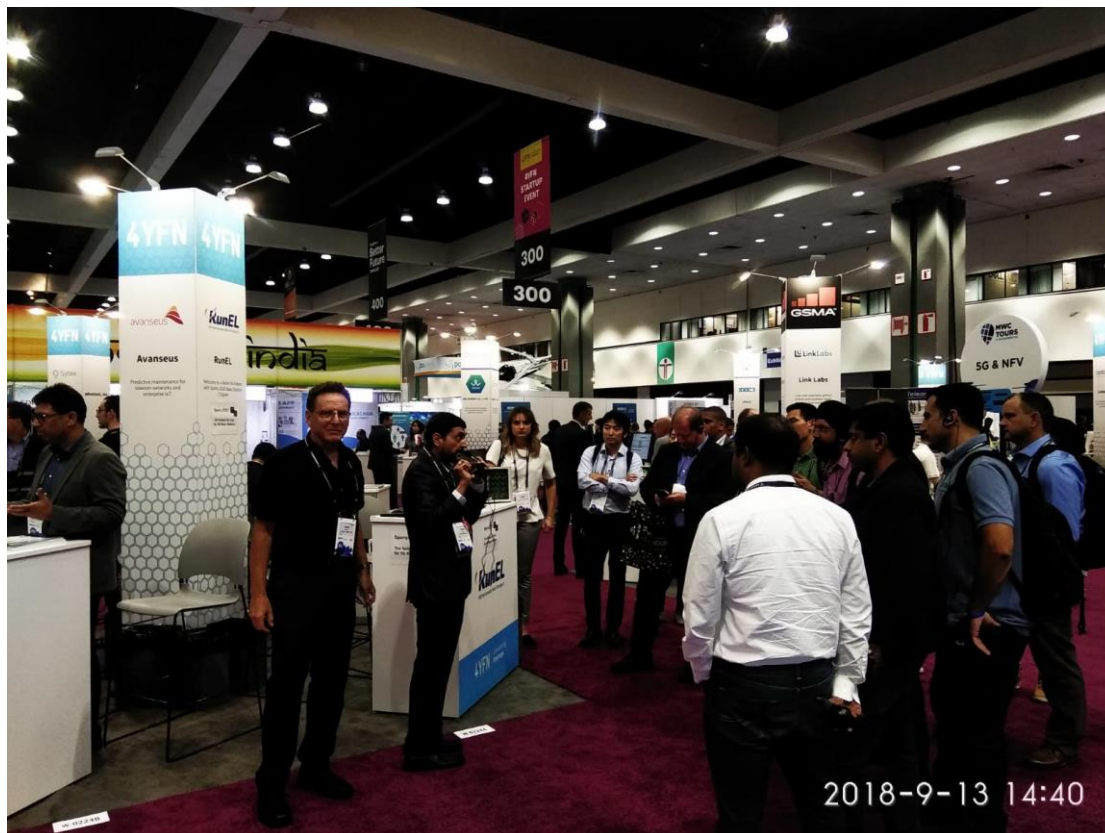


Figure 5-5 – RunEL's Israel Koffman at the stand with visitors at MWC-2018 Americas

### 5.2.4 India-EU Stakeholders' Workshop on 5G Technology

Telecommunications Standards Development Society, India (TSDSI) has been leading efforts to incorporate India specific requirements and solutions from 5G in global forums. The 5G Infrastructure Association (5G-IA) is the voice of the European Industry for the development and evolution of 5G, and thus committed to build global consensus on 5G. Broadband India Forum (BIF), is championing efforts on leveraging 5G technologies for the propagation of broadband in India.

TSDSI and BIF joined hands with 5G-IA to organize a workshop that will bring together technology experts from the EU and India geographies to share their experiences and explore areas of mutual collaboration.

Prof. John Cosmas was invited to present the IoRL project at the “EU-India Exchange on 5G Development: 5GIA -TSDSI-BIF” India Habitat Centre, New Delhi on 5-6 February 2019. The delegation was led by Mr Jean-Pierre Bienaimé, Secretary General 5G-IA. The workshop covered the following topics: mmWave and VLC Building Network Architecture, 5G Architecture and applications, 5G Trials, Interoperability and Test Beds, Rural 5G and Cloud and Satellite viz. 5G.



Figure 5-6 – Prof. John Cosmas presenting IoRL project



**Figure 5-7 – a Prof. John Cosmas, Brunel University with other speakers: Subhas Mondal, Wipro Ltd; Prof. Abhishek Dixit, IIT Delhi; presenting their speaker’s commemorative plaques.**

### 5.2.5 Course given at Peter the Great St. Petersburg Polytechnic University, Russia

Prof. Jian Song was invited to visit Peter the Great St. Petersburg Polytechnic University, Russia from 6th to 13th November 2018 and gave courses on different topics to the undergraduate and graduate students. In one of his courses there, he introduced the concept of visible light communications, and use IoRL project as an example to show how VLC and 5G can be successfully combined to support the home networking applications.



**Figure 5-8**

### 5.2.6 ITU News

ITU conducts interview on the research areas of professors who have been actively involving into ITU activities. Since Prof. Jian Song from Tsinghua University has been working with ITU Radiocommunications Bureau since 2010 and now the vice chair of Working Party 6A and the Editor-in-Chief of ITU’s academic Journal ICT Discoveries, he took the interview in December 2018 discussing the role of Academia and the contributions to the work of International Telecommunication Union (ITU). He mentioned IoRL project in his interview and the interview can be found in the following link: <https://news.itu.int/role-of-researchers-tsinghua-university>



### 5.2.7 Rail Live! 2019 Bilbao

Rail Live! is an exhibition and conference about the impact of digital technology innovation on the rail sector.

IoRL, through Ferrovial Agroman, was present at this event in Bilbao, Spain. This exhibition and conference about the impact of digital technology innovation on the rail sector was a great opportunity to introduce IoRL to people and companies involved in the railway sector, including rail infrastructure managers from several countries.

IoRL leaflets and further information about the project were available at the Railway Innovation Hub stand (stand number 72a) for the visitors.

### 5.2.8 MWC 2019 Barcelona

Mobile World Congress MWC-2019 Barcelona is the biggest cellular technology event in the world today. More than 109,000 visitors from over 198 countries and territories attended MWC19 Barcelona, the mobile industry's premier event. Over 55 percent of this year's MWC attendees held senior-level positions, including more than 7,900 CEOs.

More than 2,400 companies showcased the latest technology, products and services across 120,000 net square metres of exhibition and hospitality space at Fira Gran Via.

RunEL was one of the exhibitors at MWC in Hall-5 stand 5E41-9 as part of the Israel Export Institute Pavilion as depicted in Figure 5-9 below:

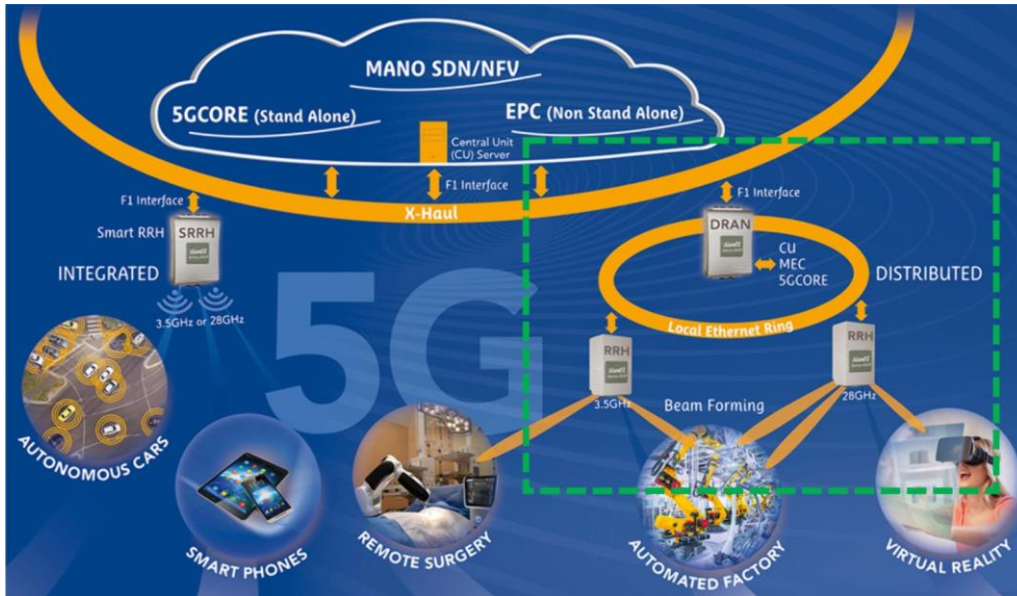


**Figure 5-9 – RunEL stand at MWC-2019 Barcelona**

In the RunEL stand the Sparq-2020 5G Distributed Architecture developed for the IoRL project was demonstrated (see drawing 6-8 below).

The RunEL demonstration included on DRAN that was connected to two RRHs ( or RRLH Controllers) that were connected to two user terminal (UE) emulators at two different frequency bands, one at 3.5GHz and the second at 28GHz.

The purpose of the demonstration was to measure the system down-link KPIs such as latency (less than 100 microseconds ) and EVM ( less than 5% at 6e QAM modulation).



**Figure 5-10 – Sparq-2020 5G Distributed Architecture demonstrated at MWC-2019 Barcelona**

One of the UE emulators used at the demo was provided by Viavi (one of IoRL partners), in order to integrate between the RunEL 5G Base Station ( DRAN +RRLH) and the Viabi UE emulator both companies met in Barcelona a few days prior to the show in order to do interoperability tests ( see Fig-6-9).



**Figure 5-11 – Viavi ( Wei Li) and RunEL ( Israel Koffman) at RunEL stand with IoRL poster**

In addition an IoRL poster (see below Fig-6-10) was displayed at the RunEL stand and IoRL brochures were distributed to the stand visitors



**Figure 5-12 – IoRL poster at RunEL stand at MWC-2019 Barcelona**

A video with the detailed description of the RunEL-Viavi demo at MWC-2019 can be found at Only Office data base at the following link:

<https://onlyoffice.eurescom.eu/products/projects/tmdocs.aspx?prjID=37#1442> or at Youtube at the following link:



<https://www.youtube.com/watch?v=jvCRekwRanw&feature=youtu.be>

### 5.2.9 IEEE ICECS 2018

IEEE ICECS is an international conference dedicated to circuits and systems, held annually in Region 8. The 25th edition will take place in France. ISEP presented first 5G-VLC first integration results and hardware platform in IEEE ICECS conference. It is the first time to present the integration of 5G New Radio (5G NR) with a Visible Light Communication (VLC) downlink architecture. This scheme combines two complementary wireless technologies: upcoming 5G NR and VLC to offer indoor enhanced wireless hybrid access able to provide each User Equipment (UE) with very high data rate and positioning support. The data transmission of the 5G NR frame over VLC has been implemented. This represents a novel approach to transmitting 5G NR over VLC by hardware experimentation based on Universal Software Radio Peripheral (USRP). The experiment results show that the proposed scheme with Quadrature Phase Shift Keying (QPSK) mapping achieves a data rate of 14.4 M bits/s and an Error Vector Magnitude (EVM) of 4.78% for a 55 cm free space transmission span.

### 5.2.10 5G-NS workshop at ARES 2018

A workshop on 5G Networks Security was held in conjunction with the ARES Projects Symposium 2018, held at ARES 2018 (<https://2018.ares-conference.eu/workshops/5g-ns-2018/index.html>), August 27 – August 30, 2018, Hamburg, Germany

With the great success and development of 4G mobile networks it is expected that the 5th generation wireless systems (in short 5G) will be a continued effort toward rich ubiquitous communication infrastructure, promising wide range of high-quality services. It is envisioned that 5G communication will offer significantly greater data bandwidth and almost infinite capability of networking resulting in unfaltering user experiences for (among others): virtual/augmented reality, massive content streaming, telepresence, user-centric computing, crowded area services, smart personal networks, Internet of Things (IoT), smart buildings, smart cities, to name just a few.

The 5G communication is currently in the center of attention of industry, academia, and government worldwide. 5G drives many new requirements for different network capabilities. As 5G aims at utilizing many promising network technologies, such as Software Defined Networking (SDN), Network Functions Virtualization (NFV), Information Centric Network (ICN), Network Slicing, Cloud Computing, etc. and supporting a huge number of connected devices integrating above mentioned advanced technologies and innovating new techniques will surely bring tremendous challenges for security, privacy and trust. Therefore, secure network architectures, mechanisms, and protocols are required as the basis for 5G to address this problem and follow security-by-design rule. Finally, as in 5G networks even more user data and network traffic will be transferred, the big data security solutions should be sought in order to address the magnitude of the data volume and to ensure data security and privacy.

From this perspective, 5G-NS 2018 workshop aimed at collecting the most relevant ongoing research efforts in 5G networks security field. It also serves as a forum for 5G-PPP Phase 1 & Phase 2 projects in order to disseminate their security-related results and tighten & boost cooperation, and foster development of the 5G Security Community made of 5G security experts and practitioners who pro-actively discuss and share information to collectively progress and align on the field.

#### Workshop Chairs

- Wojciech Mazurczyk, Warsaw University of Technology, Poland (IoRL H2020 Project)
- Pascal Bisson, Thales, France (5G-Ensure H2020 Project).
- Krzysztof Cabaj, Warsaw University of Technology, Poland (IoRL H2020 Project)
- John Cosmas, Brunel University, UK (IoRL H2020 Project)

#### 5.2.11 9th FOKUS FUSECO Forum

The 9th FOKUS FUSECO Forum took place in Berlin on 15th and 16th of November 2018 as part of the 5G Berlin week.

Part of the event was dedicated to a 5G workshop in which Dr Zion Hadad, RunEL CEO, presented a paper titled: “Design Considerations for an Ultra Reliable Low-Latency Communication (URLLC) 5G Network” (see [1]).

In the presentation Dr. Hadad described the 5G advances achieved at RunEL in different research programmes, including IoRL.

Adam Kapovits from Eurescom contributed to the FUSECO Forum event with a presentation titled “Providing Improved Indoor 5G Communication – The 5G PPP IoRL Project Solution Including a Supermarket Scenario Demonstration in China” to the Session on 5G Testbeds and Trials in Asia [1].

#### 5.2.12 2018 IEEE 5G World Forum

Adam Kapovits presented the paper “A 5G Radio-Light SDN Architecture for Wireless and Mobile Network Access in Buildings” from John Cosmas et al at the 2018 IEEE 5G World Forum in Santa Clara, California, US, 9-11 July 2018.

#### 5.2.13 NETWORLD 2020

NetWorld2020 is the European Technology Platform for communications networks and services. Communications networks enable interaction between users of various types of equipment, either mobile or fixed. They are the foundation of the Internet. The NetWorld2020 European Technology Platform gathers players of the communications networks sector: industry leaders, innovative SMEs, and leading academic institutions. The NetWorld2020 vision is to contribute to collaborative research programmes on European and national level for collaborative research in the domain of mobile and wireless, fixed and satellite communication networks by a regularly updated research agenda.



Mr. Israel Koffman from RunEL was invited to participate in the Horizon2020 General Assembly that was held in Brussels on November 15th 2018. During the event, Mr Koffman participated in a Panel titled "The Role of SMEs in the new 5G ecosystem" ( see figure below) in which he presented the IoRL project among other 5G projects that RunEL is currently involved ( See more details at:

[https://www.networld2020.eu/wp-content/uploads/2018/11/networld2020-ga-2018\\_agenda\\_v10\\_clean.pdf](https://www.networld2020.eu/wp-content/uploads/2018/11/networld2020-ga-2018_agenda_v10_clean.pdf) ).

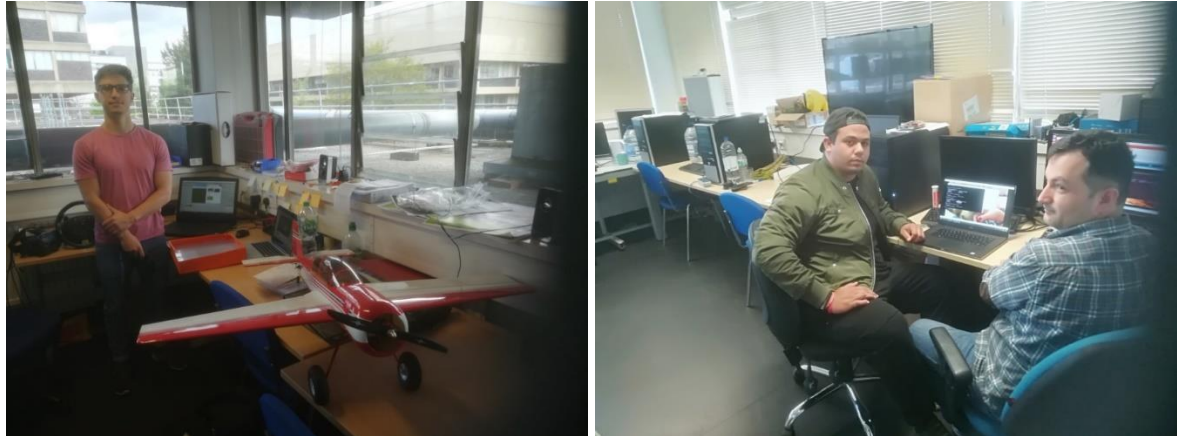
14:45 – 15:30	<p><b>Panel 2: The role of SMEs in the new 5G ecosystem</b></p> <p>5G, with its expansion towards vertical sectors, has the potential be very disruptive. Business models for the current telecoms ecosystem as well as for vertical sectors might change drastically. This may open the door for new players to emerge, and for some SMEs to grab opportunities to become a big player. Some SME representatives will explain how they see this change coming for them and how they are preparing.</p> <p>Moderator: <b>Jacques Magen</b>, InterInnov, SME WG Chair</p> <p>Panellists:</p> <ul style="list-style-type: none"> <li>• <b>Panagiotis Demestichas</b>, WINGS ICT Solutions</li> <li>• <b>Aleksanda Checko</b>, IS-Wireless</li> <li>• <b>Israel Koffman</b>, RunEL Next Generation Mobile Networks</li> <li>• <b>Simon Fletcher</b>, Real Wireless</li> <li>• <b>Jean-Charles Point</b>, JCP-Connect</li> <li>• <b>Pedro Ruiz</b>, Integrasys</li> <li>• <b>Nuria Sánchez Almodóvar</b>, Visiona Ingeniería de Proyectos</li> </ul>
15:30 – 16:00	Coffee break & networking

#### 5.2.14 ICSP19

Gilad Katz from MostlyTek has participated in the International Conference on Communication and Signal Processing (ICCS)P Kiev, Ukraine 17th - 18th May, 2019 organized by ResearchWorld (RW). The paper titled: "Visible Light Communication Analysis for Different Realistic Channels" coauthored by Liron Carmeli, Moshe Ran. ICCSP19 was a prestigious event organized with a motivation to provide a global international platform for the academicians, researchers, engineers, industrial participants and budding students around the world to SHARE their research findings with the global experts. See [www.researchwrlld.org](http://www.researchwrlld.org)

#### 5.2.15 IEEE Broadcast Technology Society Young Professionals Workshop, 2019

On April 15<sup>th</sup> and 16<sup>th</sup> 2019, Brunel University London hosted the fifth edition of the "IEEE Broadcast Technology Society Young Professionals Workshop 2019" on the theme "5G Challenges and Opportunities for Innovation in Broadband Multimedia and Broadcasting". The Chair and Local Organizer was Prof. John Cosmas and the Co-Chair was Prof. Wout Joseph (Ghent University, Ghent, Belgium) who is also the existing Young Professionals Committee Chair. The workshop Chair and Co-Chair and the new Young Professionals Committee Chair Marta Fernandez welcomed the students to the workshop and introduced them to the activities of the Broadcast Technology Society and the benefits of joining.



(a)

(b)

**Figure 5-10 – Brunel University IoRL Research Students in the Wireless networks and Communications Lab**

This year the IEEE-BTS YP Workshop was organized in the **historic town of Uxbridge**, located on the Western boundaries of Greater London and sandwiched between Heathrow Commercial Airport just 30 minutes bus drive to the south and Northolt Royal Airforce Base just 30 minutes bus drive to the north and the home of the Battle of Britain Museum and Bunker.



**Figure 5-13 – Workshop students and speakers at the Battle of Britain Museum and Bunker**

The IEEE BTS Young Professionals (YP), was created to help students transition to young professionals within the IEEE Broadcast Technology Society (BTS) community. The idea was to bring together students and professionals. Indeed, the Workshop was tailored towards

Researchers, PhD, Masters, and Bachelor Students active or interested in future broadcasting networks.

Attendees had the opportunity to participate in a stimulating forum of scientists, to obtain feedback and to start up collaborations. Lectures provided background on 5G wireless communication concepts and particular emphasis was placed on Challenges and Opportunities for Innovation in Broadband Multimedia and Broadcasting.

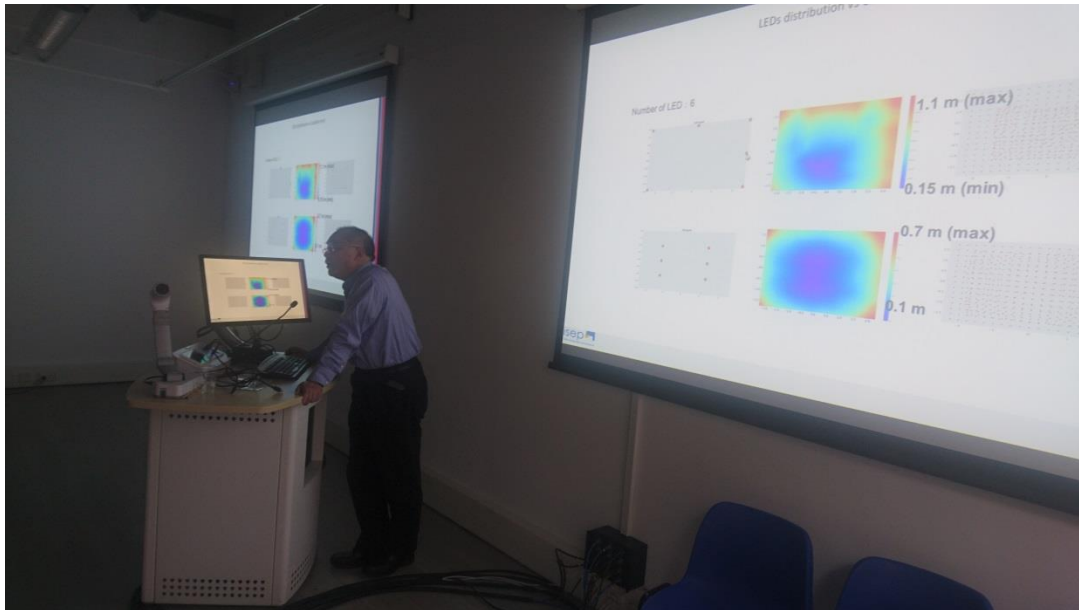
Wout Joseph and Marta Fernandez welcomed the delegates to the workshop at Brunel University with an opening welcome speech. The attendance was a modest success: with a 46 attendance in total consisting of 33 graduates and PhD Students and 13 Professors attending during various stages of the workshop. This has encouraged a number of PhD students to become members for free!



**Figure 5-12 – IEEE BTS Distinguished Lecturer John Cosmas presenting the first lecture.**

**John Cosmas**, Brunel University presented IoRL project as an exemplar 5G architecture concepts such as network function virtualization and software defined networks, Radio Access Network numerology, performance and interface to the Core and issues related to construction and deployment of various services.

**Wei Lei, Viavi Ltd** presented the design of a Software Defined Radio Based 5G NR UE Emulator. The requirements, system design and capabilities of the emulator were first presented, followed by the use cases and network and user interfaces. Typical 5G test results were presented to give the students an idea of the test result capabilities the system is able to generate.



**Figure 5-13 - IEEE BTS Distinguished Lecturer Yue Zhang presenting his talk**

**Yue Zhang, University of Leicester** provided an interesting talk on Visible Light Communication (VLC) positioning and navigation in future 5G networks by first reviewing location based services, then providing an overview of the type and capability of existing positioning systems. He completed his presentation by providing the throughput and positioning performance results of a VLC system.

### 5.3 IoRL publications in the period

The following two tables summarize the IoRL publications in the period and try to assess the impact from a citation point of view of the papers. All the statistics are from Google Scholar.

**Table 6-4 - IoRL journal and book publications**

Publication title	Journal / Book	Partner	Citations	Date
A visible light RGB wavelength demultiplexer based on silicon-nitride multicore PCF	Optics and Laser Technology	MostlyTek	0	2018/7/3
Smart Television Services using NFV/SDN Network Management	IEEE Transactions on Broadcasting	Brunel University	0	2019/1/31
On-axis diffraction-limited design of bi-parabolic singlet lenses	Optik	Jorge Garcia	0	2019/2/18

Network Threats Mitigation Using Software-Defined Networking for the 5G Internet of Radio Light System	Security and Communication Networks	Warsaw University of Technology	0	2019/2/22
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**Table 6-5 - IoRL conference publications**

Paper title	Conference name	Venue	Partner	Citations	Date
A 5G Radio-Light SDN Architecture for Wireless and Mobile Network Access in Buildings	2018 IEEE 5G World Forum	Santa Clara, California, US	UBrunel / Eurescom	0	2019/7/9
RGB Wavelength Demultiplexer Based on Photonic Crystal Fiber	EuroOptics 2018	Prague, Czech Republic conference	MostlyTek	0	2018/7/16
URLLC Network and RAN considerations	9th FOKUS FUSECO Forum (part of the Berlin 5G week 2017)	Fraunhofer FOKUS, Berlin	RunEL	0	2018/11/15
Providing Improved Indoor 5G Communication – The 5G PPP IoRL Project Solution Including a Supermarket Scenario Demonstration in China	9th FOKUS FUSECO Forum (part of the Berlin 5G week 2017)	Fraunhofer FOKUS, Berlin	Eurescom	0	2018/11/15
Experimental 5G New Radio integration with VLC	IEEE ICECS	France	Xun Zhang (ISEP)	0	2018/12/9
Visible Light	International	Kiev,	MostlyTek	0	2019/5/1

Communication Analysis for Different Realistic Channels	Conference on Communication and Signal Processing (ICCSP19)	Ukraine			6
Securing Visible Light Communications with Spatial Jamming	ICC 2019	Shanghai, China	University of Leicester	0	2019/5/20

## 5.4 Press coverage

After creating considerable press attention at the beginning of the project, in the period covered by the report, there was no press coverage generated by IoRL, regrettably.

We expect to change this substantially in the next period when the project will perform its demonstrations, which we consider to be relevant and interesting to the general public and plan to attract journalist and media in general.

## 6 Dissemination material produced

### 6.1 Website

The IoRL website has been set up early on in the life of the project. WordPress was selected as the platform for the IoRL website. The website is hosted by Eurescom and partners have access with editing rights to enter news items on the website.

In the following we present some basic statistics regarding the access and use of the website during the period.



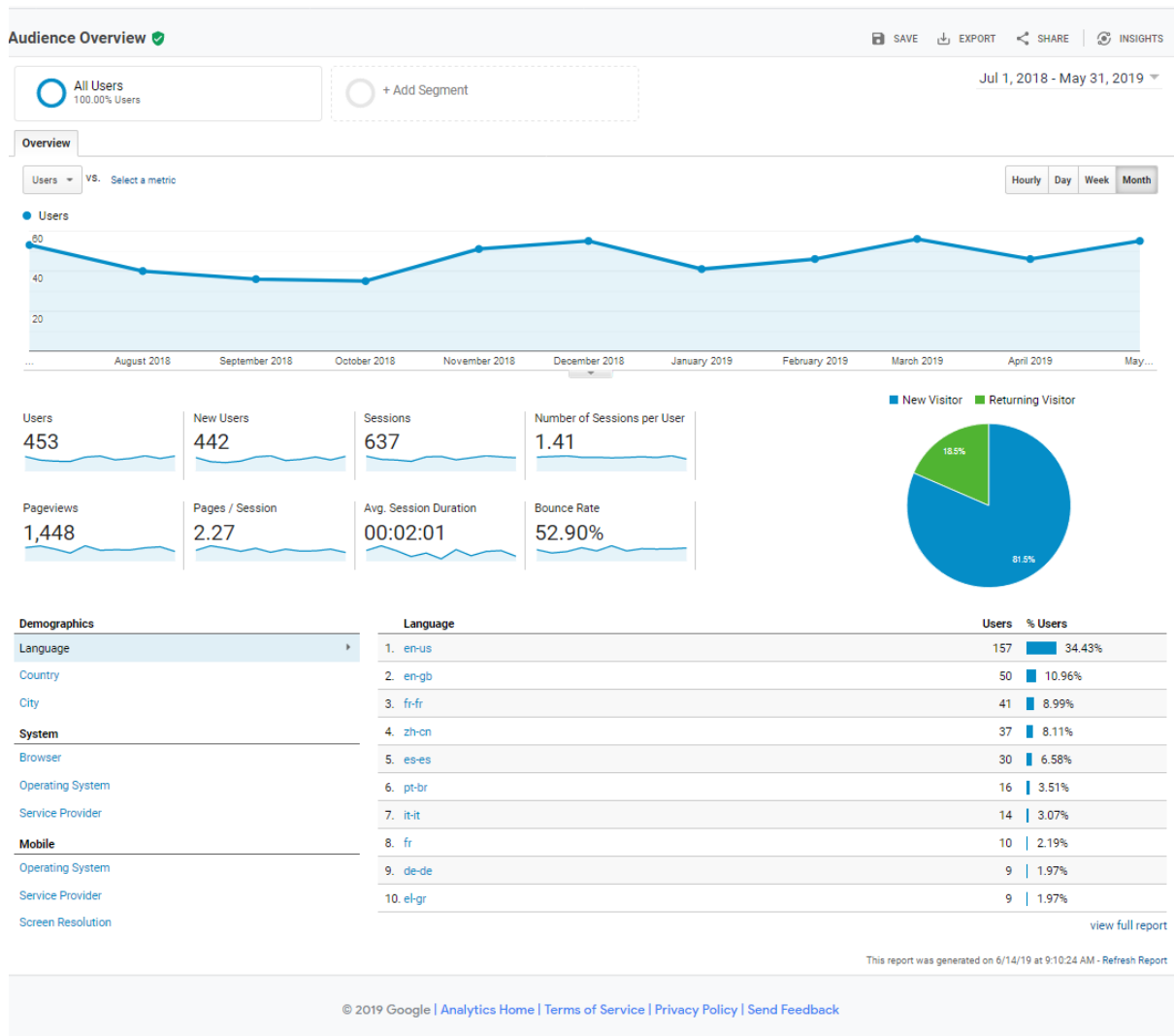


Figure 6-1 – General overview of the IoRL site audience and visitors

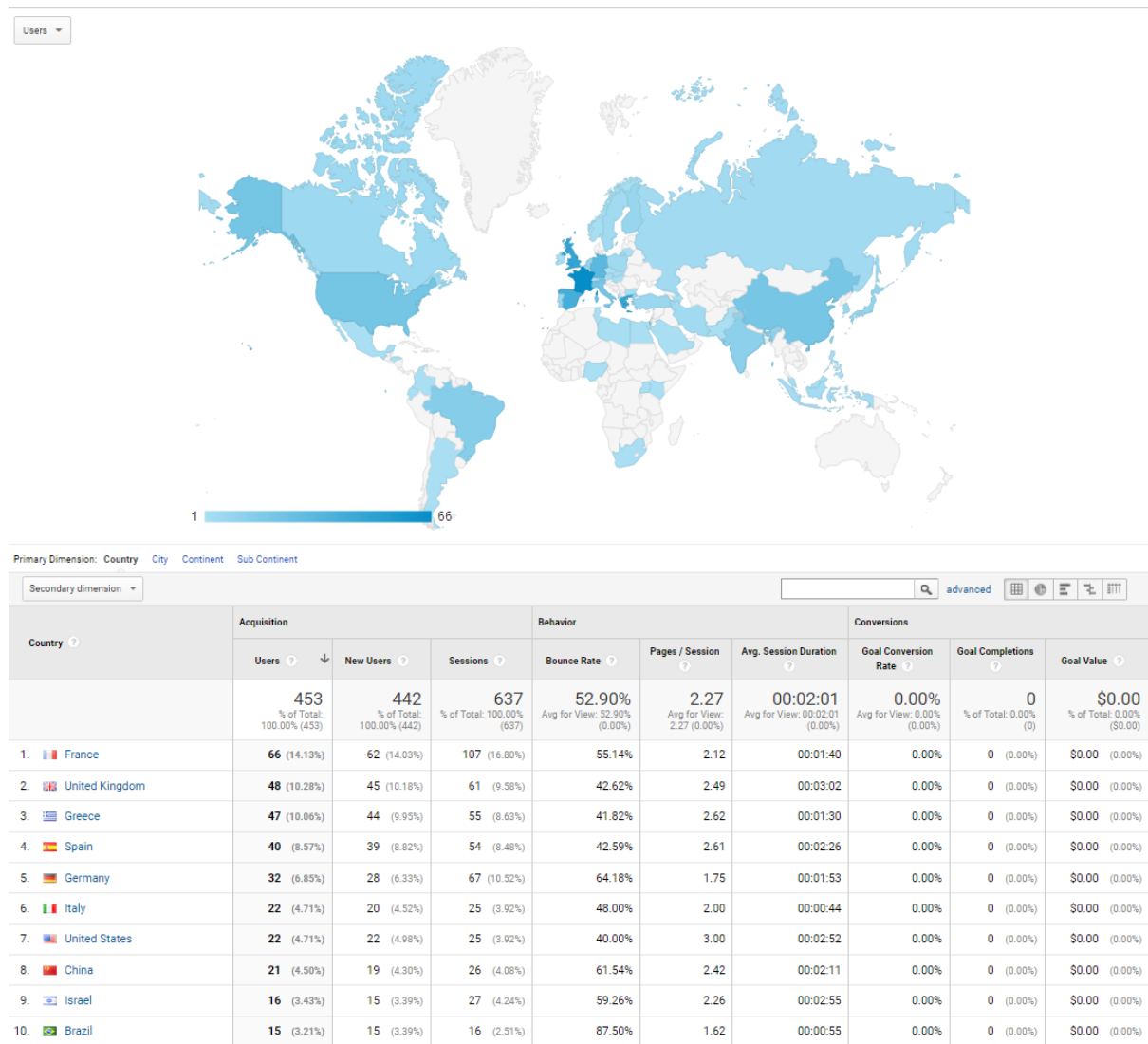


Figure 6-2 – Origin of the interest and hits on the IoRL website



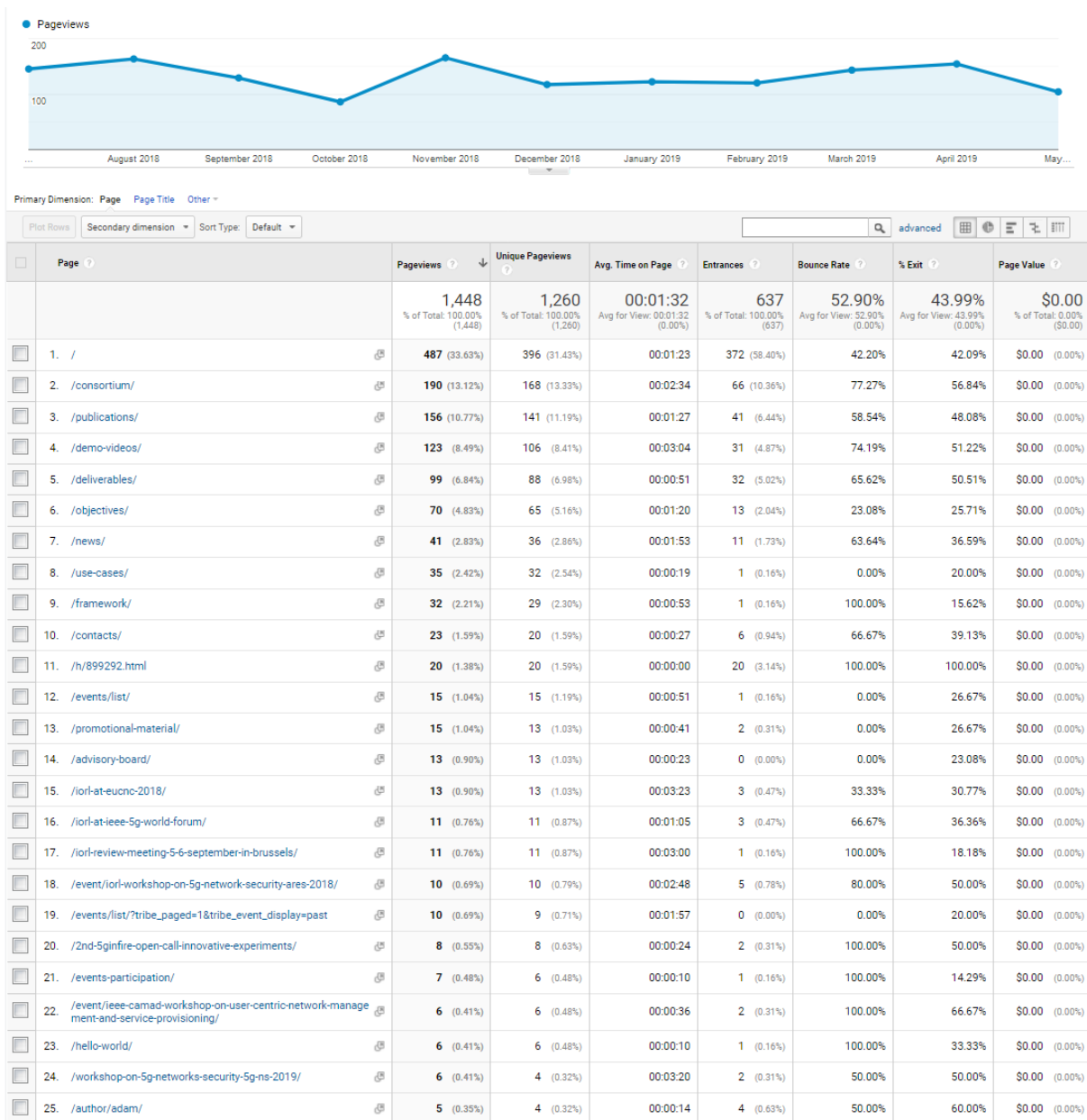


Figure 6-3 – a Distribution of interest across the different parts of the IoRL website

## 6.2 Social media

The project has discussed the use of various social media channels. Social media was assessed as a useful means to address both the general public, but also ICT expert community at large, in a less targeted way. The consortium agreed to use Twitter and Youtube as the two main channels. Facebook was also considered, but eventually discarded as inappropriate.

The account name for the IoRL project is “5GIoRL” on the Twitter. Up until now, 159 tweets are shared on the IoRL Twitter page and it is followed by 55 followers. The posts shared on Twitter page can be accessed using the following link: <https://twitter.com/5GIoRL>. Shared posts include following topics:

- News from IoRL partners about LiFi,
- Major news from 5G PPP and EU Commission,
- Dissemination of symposium, conference and workshop calls,
- Tweets of IoRL members during meetings and conferences.

As an example, screenshot of one Twitter post is added below. This post has viewed by 800 times and clicked 10 times.



**Figure 6-4 – - screenshot of one Twitter post.**

We are planning to share more posts on the Twitter in the future. We will be more active to improve the engagement of stakeholders and to attract attention of new followers.

### 6.3 Flyer and poster

The IoRL poster and flyer were produced in the previous period, but continued to be in use at various events where IoRL was present.

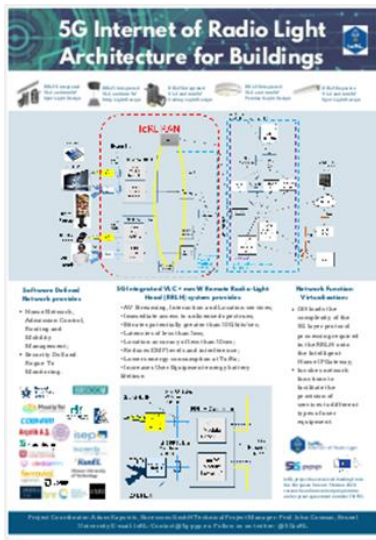


Figure 6-5 - IoRL poster



Figure 6-6 - IoRL flyer page 1

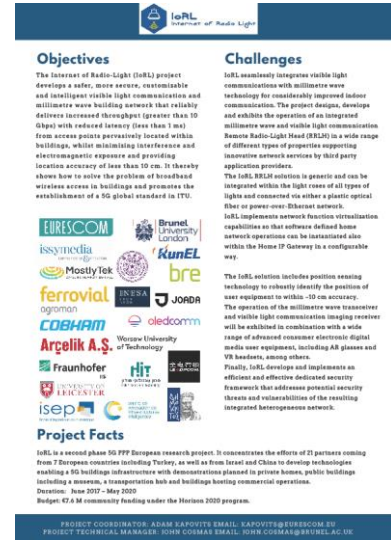


Figure 6-7 - IoRL flyer page 2

Design of the architecture and communication with user equipment are shown visually on the poster. Logos from all partners are placed on the poster along with the IoRL, 5G PPP and EU Commission logos. Project website, social media address and e-mail are shared in order to get feedbacks.

## 7 IoRL dissemination activities as part of the 5G PPP

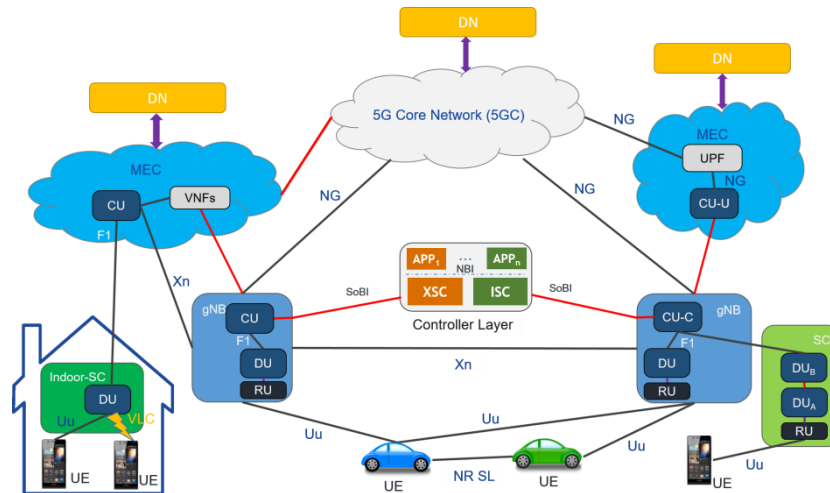
IoRL is part of the 5G Infrastructure Public Private Partnership (5G PPP), a joint initiative between the European Commission and European ICT industry (ICT manufacturers, telecommunications operators, service providers, SMEs and researcher Institutions). The 5G-PPP has now entered to its third phase that includes the 21 projects from the second phase, of which IoRL is one. It is the ultimate ambition of IoRL not only to be successful on its own right, but to be a good team player and taking its fair share in contributing to the overall success of 5G PPP. As such IoRL is committed to participate and contribute to programme level actions actively.

Notably, in the period we report here IoRL has participated in the regular conference calls of the 5G PPP COMMS group. Through this it benefited from learning about relevant events, dissemination opportunities, and teaming up with other projects. It also shared information about its activities, most notably dissemination activities organised, or co-organised.

IoRL has participated in the following joint activities with other 5G PPP projects, or on programme level:

- Contributions to 5G PPP program level cartography updates;
- Contributions to 5G PPP KPI definition;
- Contribution to the Chapter 3 “RAN and Edge Architecture” of 5G PPP joint paper to EuCNC concerning 5G PPP Architecture Working Group. The project incorporated the

IoRL concept within the overall RAN architecture as shown in Figure 7-1. The architecture was then elaborated showing three different options for connecting the IoRL building network to 5G Core, namely VLC-gNB as: Conventional topology All-Connected (AC) deployment; Dual Connectivity (DC) deployment; Distributed Unit (DU) deployment.



**Figure 7-1: Overall RAN Architecture**

- Organisation of the Workshop on 5G Networks Security (5G-NS) workshop co-located with ARES 2018 conference together with 5G PPP Security Working Group representative Pascal Bisson (5G PPP Sec WG chair);
- Co-organisation of a workshop at CAMAD.

IoRL continues to strive to explore synergies with peer 5G PPP projects.

## **8 Summary of dissemination performance assessment and plans for the next period**

### **8.1 Summary of dissemination performance assessment to date**

IoRL is a research and development project that is committed to deliver and demonstrate its envisioned solution in real life situations in four locations. The period covered by this report coincides well with the period in which the project developed the components of its technical solution and went on to integrate them into a laboratory benchtop system. Accordingly, in this past period the dissemination and impact creation moved on from purely disseminating the IoRL concept to disseminating research and development results.

The dissemination activities summarised in the previous report and the statistics clearly demonstrated that IoRL started off very actively promoting its concept and creating awareness about its activities not only within Europe, but worldwide already in this past period. Through these efforts IoRL created a number of links and contacts and established itself well among the 5G PPP phase 2 projects' family.

In this second year, we have been working hard to not only generate more research results but also disseminate the results emerging from our preliminary prototype work.

### **8.2 Plans for the next period**

IoRL dissemination activities will intensify in the coming final phase of the project, when the project will start exhibiting and demonstrating the integration of the development results. Our planned demonstrations will provide excellent opportunities to reach out beyond the expert community to the general public.

Our plans include the organization of a workshop and demonstration together with IEEE Broadband Multimedia System and Broadcasting in 2020. We are in the process to secure IEEE BMSB 2020 to take place in Paris / Issy. Since BMSB is taking place in June, if we succeed, the project will apply for an extension to be able to properly support this demonstration.

Another excellent opportunity will be at SmartGridComm 2019 which will be held between October 21 and 24, 2019 in Beijing, China, where results of IoRL could be demonstrated at the exhibition session.

IoRL will continue to seek and explore synergies with the other 5G PPP projects, and pursue opportunities to jointly disseminate its results along with them, also to the extent of joint demonstrations, when and where possible.

In summary, the above clearly means that the project plans and is committed to further intensify dissemination efforts in the coming period.

## References

- [1] <https://www.fokus.fraunhofer.de/fff2018/agenda/day1>