Towards an Open, Secure, Decentralized and Coordinated Fog-to-Cloud Management Ecosystem

D6.3 mF2C annual report on dissemination and standardization (Year 2)

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Executive Summary

The mF2C project is focused on delivering a management framework for the challenging fog-to-cloud domain. This deliverable provides a report of all the dissemination and standardization activities that were performed during the second year of the project. This corresponds to activities tracked under *Task 6.1 Dissemination* and *Task 6.2 Standards*. It includes the details of the different events (scientific, EU related, Industrial, standardization, open source) that partners have participated at as speakers, presenting the mF2C project, or research related to the project. A number of papers have been written which have been published or are still under review for 2019 and these are also captured in this document.

The deliverable reports its second year results on standardization initiatives that it has been monitoring across a variety of communities, industry, and at regional and international levels. This deliverable also provides initial plans for both dissemination and standardization activities for the third year of the project identifying opportunities to engage with the key stakeholders that have now been identified, therefore increasing the potential for successful dissemination of project results.

1. Introduction

1.1 Introduction

This deliverable describes all the dissemination and standardization actions carried out from M13, January 2018, to M24, December 2018, and corresponding to activities developed in Task 6.1 (M01-M36) Dissemination and Task 6.2 (M01-M36) Standards. The activities developed during this second year followed the plan developed in deliverable D6.1 Dissemination strategy and plan (M06) [1], but with some minor adjustments to increase the visibility of the results of the project, such as the increase in the number of proposed mF2C videos. In this second year, we have consolidated the dissemination and standardization activities, but without stop working on creating awareness about mF2C, because this is an ongoing activity during the whole project.

In the case of dissemination, and related to the activities focused on consolidating the diffusion of mF2C results, we have produced 12 new blog entries, 1 Newsletter (another in progress due December 2018), we have 24 conference presentations and 3 journal papers, and we have attended more than 10 events (including scientific, industrial, standardization and EU related events), which means we are in track to reach the associated KPIs at the end of the project.

On the other hand, and also related to the dissemination activities, we have continued to create awareness about the project results with specific actions, such as increasing the activity in social media, re-shaping the website and producing 9 new videos presenting the main ideas of the project.

All of the processes required from the mF2C framework (discover, interconnect, share, manage, etc) require shared understandings and agreed interfaces. Formal standards have a critical role to play in enabling this future. mF2C continues to monitor standards initiatives across a variety of communities, by industry, and at regional and international levels, while looking for opportunities to contribute where appropriate. A report on all these initiatives is documented in chapter 3.

As previously stated in deliverable D6.2 [2], the dissemination target in mF2C are not only the scientific and research community, but also that these dissemination activities will help achieve exploitation and standardization goals. For this reason, this deliverable is complementary to deliverable D6.6 mF2C annual exploitation plans and market analysis (Year 2).

1.2 Purpose

The objective of this deliverable is to provide an overview of the dissemination and standardization activities carried during the second year of the project, starting on January 2018 to December 2018 (M13 to M24). It also provides the trends for the dissemination and standardization activities planned for the third year of the project.

This deliverable is organized as follows: Section 2 is a report of the dissemination activities developed during this second year, as well as the planned for the second year. Section 3 describes all the activities developed during the second year in standardization and the plans for next year. Both sections are divided into subsections according to different categories of activities. Finally, Section 4 concludes and gives the guidelines for the third year of the project.

1.3 Glossary of Acronyms

Acronym	Definition
AI	Artificial Intelligence
ANSI	American Nation Standards Institute
BSD	Berkeley Software Distribution
CIMI	Cloud Infrastructure Management Interface (
ENEA	Operating System Embedded (known by the acronym Enea OSE)

Acronym	Definition
ETSI	European Telecommunications Standards Institute
F2C-DP	Fog to Cloud Distributed processing
FIWARE	Future Internet SoftWare
IETF	Internet Engineering Task Force
IoT	Internet of Things
ISO	International Standards Organization
KETI	Korea Electronics Technology Institute
KPI	Key Performance factors
MEC	Multi-Access Edge Computing
NIST	National Institute of Standards and Technology
OCCI	Open Cloud Computing Interface
OGC	Open Geospatial Consortium
OGF	Open Grid Forum
QoE	Quality of Experience
QoS	Quality of Service
R&I	Research and Innovation
SLA	Service Level Agreement
TIA	Totally Integrated Automation
TLS	Transport Layer Security
TOSCA	Topology and Orchestration Specification for Cloud Applications
USGBC	US Green Building Council
W3C	World wide web consortium
WG	Working Group

Table 1. Acronyms

2. Dissemination of mF2C Results

2.1 Report of dissemination activities

The objective of this section is to provide an overview of the dissemination activities carried out by mF2C during the second year of the project, starting on January 1st 2018 to December 31st 2018 (from M13 to M24), classified according to different categories.

The activities described below are in line with the dissemination strategy and plan defined in D6.1 [1]. The aim of this plan is to disseminate and create awareness about the project, its scientific evolution and advances, its value propositions, product definition and its results to multiple target audiences, trying to ensure reaching to various audiences at the national, European, and global level.

2.1.1 Liaison and collaboration with related projects/groups

In D6.1, we described our dissemination plans and the consortium established a collaboration strategy with related projects. In this second year of the project, we have followed the same strategy, which is summarized in the next bullets:

- Participate in EC conferences, workshops, information days, etc. related to Cloud computing topics in general, especially Fog Computing.
- Support dissemination actions coming from other projects (following in social networks, including in Newsletters, retweet, etc.).
- Create an article in our website. We have created a tab in our website with information about the projects we have set collaboration.
- Organize meetings and workshops and invite related projects.
- Participate in meetings and workshops organized by related projects.
- Promote standardization work.

Table 2 shows the list of projects which mF2C has established collaboration and the focus of the collaboration.

Project	Contact Partner	Collaboration
CloudWATCH2 [3]	Ana Juan Ferrer, Lara López (ATOS)	CloudWATCH2 as a project has already ended. In the meanwhile, Ana Juan (ATOS) represented the project in different meetings introducing the fog-to-cloud concept, while Lara López (ATOS) has participated in the Map of Standards done by the project.
RECAP [4]	Alec Leckey (INTEL) Xavi Masip (UPC)	mF2C and RECAP project will complement each other because RECAP optimizes the application placement from the edge to the cloud. Xavi Masip (UPC) is advisory board member of RECAP.
CIPSEC [5]	Xavi Masip (UPC)	UPC is an active partner in CIPSEC, and a PhD in Security is being developed in the context of CIPSEC. Besides, the need of a hierarchical security architecture has allowed the collaboration of both projects
ReCRED [6]	Eva Marin (UPC)	The ReCRED project objective is to design and implement mechanisms that anchor all access

Project	Contact Partner	Collaboration
		control (AC) needs to mobile devices that users habitually use and carry. This work done in ReCRED may be complementary to the security developed in mF2C between fog and IoT.

Table 2. Established collaboration with mF2C related projects during the second year

During 2018, as a result of the collaboration between CIPSEC and mF2C, we have produced a joint paper; *"Towards An Efficient Key Management and Authentication Strategy for Combined Fog-to-Cloud Continuum Systems",* presented in the CIoT 2018 conference [7], where a distributed key management and authentication strategy is proposed to be applied to mF2C.
In the context of collaboration between mF2C and ReCRED, mF2C was invited to participate with a poster, to the European Cluster Workshop [8], organized by ReCRED in Athens on January 31st 2018.

mF2C is also participating, and leading through Ana Juan (ATOS), in the Future Cloud Cluster [9] of European projects. The main topics of the cluster are: SLAs and QoS; Business Process Management; Service Discovery and Composition; Dynamic Configuration, Provisioning and Orchestration of Resources; Deployment and management of resources; Resilience and Scale; Software defined Cloud and Novel composition models; and Novel Data Storage and infrastructures and services.

Through this participation, the cluster has incorporated edge and fog computing as some of the main topics to be addressed in the following years.

Publications:

Research Roadmap – Ana Juan (ATOS), Xavi Masip (UPC)

This document presents the Cluster vision for 2030 including views on overall Cloud Computing challenges, Technological, Societal and European dimension of the challenges. In addition to this, the document presents initial work on Research areas and its associated research and development areas.
https://drive.google.com/file/d/0B4hHTKjZDMXGSGxoYnh4eXhURzA/view

2.1.2 Scientific Venues

In this subsection, we detail the scientific events that mF2C partners have participated as speakers for presenting the mF2C project, or research related to the mF2C project. This list of attended events is in Table 3.

First of all, the mF2C Project has been invited to the H2020 Project Cluster Workshop, organized by H2020 ReCRED Project, in Athens on January 31st 2018, with participation of 18 H2020 projects, discussing major themes of Security. Due to the overlapping with the General Assembly meeting in Geneva, the mF2C project participated in the poster session, as it is shown in Figure 1.

Then the mF2C project spent relevant effort in the organization of two Workshops that have allowed to promote the project within the International Scientific Community. For the first one, Engineering, BSC and UPC collaborated in the organization of the second edition of the F2C-DP Workshop co-located in EuroPar 2018 [10], on August 28th, 2018, in Turin, Italy. The workshop received 8 scientific papers, well balanced between internal contributions from mF2C and external submissions. After a peer reviewing, 7 papers were accepted and presented in the conference. At the event, about 25 people attended and animated the interactive sessions. The workshop included also a Technical Panel with the participation of Senior Researchers from CNR/ISTI, University of Milan and Barcelona Supercomputing Center.

The second event has been the first ever mF2C Workshop, co-located in the IEEE/ACM Utility and Cloud Computing (UCC) Conference on December 17th, 2018 in Zurich, Switzerland. For this, TUBS,

BSC, Engineering and UPC collaborated in the organization, while XLAB and STFC contributed with several papers. The workshop received 10 scientific papers, with some external submissions from American Universities. After a peer reviewing, 8 papers were accepted and will be presented in the conference. At the event about 15-16 people, mainly coming from universities, attended the workshop and posed some questions to presenters. Then Worldsensing organized a workshop, together with the H2020 Uniserver Project, with the aim of supporting both projects in defining more appropriate business strategies for common topics like edge computing, in line with today's digital transformation. INTEL, ATOS, Engineering, SixSq, XLAB and BSC supported the event. During the workshop a presentation of the mF2C project has been done.

BSC participated at the ACM/IEEE SuperComputing Conference [11] on November 11-16th, 2018 in Dallas, USA, and contributed with some speeches and tutorial presentations on HPC. There was also a dedicated Booth for BSC with mF2C presence.

Several papers have been submitted by UPC and got accepted and presented in major IEEE Conferences, as it is detailed in Table 3.

- The Computing Insights UK 2018, on December 12th, 2018 in Manchester, with active participation of STFC, INTEL and ATOS.
- mF2C has been present in the EU DG CONNECT ICT 2018 on December 4-6th, 2018, in Wien. The Project had a dedicated Booth in Stand C24, Area: Creating Networks & Technology (Hall X4), with a live demonstration.

In summary, about 25 people participated in the Euro-Par hosted workshop with an improvement in the number of participants. Since the defined KPI “Participation in events and conferences” is generic and asks for 50 participants in total, we are going to fulfil the KPI in the final period.

Date	Event	Partners	Contribution
31 January 2018	H2020 Project Cluster Workshop, in Athens organized by ReCRED, with participation of 18 H2020 projects	UPC	mF2C stand with poster
21-25 May 2018	IEEE Mipro 2018 Conference, in Opatija, Croatia [12]	Admela Jukan (TUBS)	people attended and presented a paper
13-14 November 2018	Future Technologies Conference (FTC2018), in Vancouver, Canada [13]	Souvik Sengupta (UPC)	people attended and presented a paper
9-12 September 2018	IEEE 29th Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), in Bologna, Italy [14]	Zeineb Rejiba (UPC)	people attended and presented a paper
15-17 October 2018	IEEE 14th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), in Limassol, Cyprus [15]	Zeineb Rejiba (UPC)	people attended and presented a paper
6-8 August 2018	IEEE 6th International Conference on Future Internet of Things and Cloud 2018, in Barcelona, Spain [16]	Beatriz Otero, Eva Rodríguez (UPC)	people attended and presented a paper

Date	Event	Partners	Contribution
27-31 October 2018	7th IEEE International Conference on Smart Communications in Network Technologies 2018 (SaCoNeT), in El Oued, Algeria [17]	Souvik Sengupta (UPC)	people attended and presented a paper
26-29 June 2018	ACM Smartobjects'18 (MobiHoc), in the UCLA campus, Meyer and Renee Luskin Conference Center, Los Angeles, USA [18]	Jordi Garcia (UPC)	people attended and presented a paper
18-21 June 2018	27th European Conference on Networks and Communications (EuCNC 2018), in Lubjiana, Slovenia [19]	Zeineb Rejiba (UPC)	people attended and presented a paper
12 June 2018	IEEE International Workshop on the Internet of Things: Smart Objects and Services (IoT-SoS 2018), in Chania, Greece [20]	Alejandro Gomez (UPC)	people attended and presented a paper
3 May 2018	IEEE International Conference on Fog and Edge Computing (ICFEC 2018), in Washington DC, USA [21]	Jordi Garcia (UPC)	people attended and presented a paper
26-29 March 2018	IEEE Mobile Cloud Conference 2018, in Bamberg, Germany [22]	Zeineb Rejiba (UPC)	people attended and presented a paper
2-4 July 2018	Cloudification of the Internet of Things (CIoT) 2018 Conference, in Paris, France [23]	Sarang Kahvazadeh (UPC)	people attended and presented a paper
28 August 2018	F2C-DP Workshop in EuroPar 2018, in Turin [10]	Antonio Salis (ENG), Francesc Lordan (BSC), Jasenka Dizdarevic (TUBS), Souvik Sengupta (UPC)	Workshop chaired, people attended and presented a paper
12 November 2018	Joint Workshop with Uniserver H2020 project "Business tips to understand the consequences of the digital transformation and to adapt today strategy model" organized by Worldsensing with the collaboration of IESE Business School, in Barcelona	Antonio Salis (ENG), Matija Cankar (XLAB), Denis Guilhot (WOS), Anna Queralt, Daniele Lezzi (BSC), Marc Elian Begin (SIXSQ), Alec Leckey (INTEL), Lara López (ATOS)	People attended and contributed, project presentation and discussion.

Date	Event	Partners	Contribution
11-16 November 2018	2018 ACM/IEEE Supercomputing Conference in Dallas, USA [11]	Rosa M. Badia, Cristian Ramon-Cortes (BSC)	People attended and contributed with some speeches and tutorials. Dedicated Booth for BSC with mF2C presence.
12-13 December 2018	Computing Insights UK 2018, in Manchester [24]	STFC, INTEL, ATOS	People attended and contributed
4-6 December 2018	DG Connect – ICT 2018 Wien (Austria) [25]	Ana Juan (ATOS), Ales Cernivec (XLAB), Daniele Lezzi, Anna Queralt (BSC), Marc Elian Begin (SIXSQ), Andrea Bartoli (WOS), Xavi Masip, Alejandro Jurnet (UPC)	Attendant with participation to Networking and Information sessions. Preparation of the live demo to be presented during the exhibition
17 December 2018	Workshop mF2C in IEEE/ACM UCC Conference in Zurich [26]	Admela Jukan (TUBS), Jordi Garcia (UPC), Jens Jensen (STFC), Matija Cankar, Saso Stanovnik (XLAB)	Workshop chaired, people attended and presented a paper

Table 3. Scientific venues presented at in year 2

Figure 1 mF2C presence in the H2020 Project Cluster Workshop

Table 4 presents some of the scientific venues proposed by the partners to be attended in the third year of the mF2C project. Basically, partners propose to attend main scientific venues organized by related projects with an established collaboration, as well as to present the mF2C project in plenary meetings of projects with an established collaboration, or to be established. A particular attention will be given to all Project Cluster events that would give chance of cross-pollination.

Event	Partners	Contribution	Target
Conferences organized by or co-located with related projects	ATOS	Attendance, project presentation and chairing.	NetFutures CloudForward Future Cloud Cluster Concertation meetings
National UK events	STFC	Attendance and project presentation	CIUK, SIG-Cloud, etc
Workshop co-located in conferences of the area	UPC and all	Attendance, project presentation and paper presentation	IFIP Networking [27]
Workshop co-located in conferences of the area	UPC and all	Attendance, project presentation and paper presentation	11th International Conference on Ubiquitous and Future Networks [28]
Workshop co-located in	UPC and all	Attendance, paper presentation	2019 IEEE/ACIS 18th International

Event	Partners	Contribution	Target
conferences of the area			Conference on Computer and Information Science [29]
Workshop co-located in conferences of the area	UPC and all	Attendance, paper presentation	22nd International Conference on Information Fusion (Cloud and Edge Computing, Machine Deep and Transfer Learning) [30]
Workshop co-located in conferences of the area	UPC and all	Attendance, paper presentation	20th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing [31]
Workshop co-located in conferences of the area	UPC and all	Attendance, paper presentation	23rd Annual HPEC Conference (Machine Learning, Big Data and Distributed Computing)
Workshop co-located in conferences of the area	UPC and all	Attendance, paper presentation	IEEE Globecom'19 (Cloud & Fog/Edge Computing)

Table 4. Scientific venues for third year

2.1.3 EU-related Venues

In the dissemination plan proposed in deliverable D6.1 [1], we considered as one of the main dissemination strategies to carefully follow several events organised by the European Commission, especially those linked to the topics addressed by mF2C, such as cloud and fog computing, IoT, etc. The objective of these events is support the dissemination of EU-funded projects and to bring them near to potential stakeholders. These meetings help the establishment of actions in collaboration with related projects, because although there is not a specific KPI related to EU related venues, there is a KPI related to: "Number of significant actions in collaboration". The attended EU events during the second year of the mF2C project are listed in Table 5. EU related venues and plans for third year are proposed in Table 6.

Date	Place	Event	Partners	Contribution
4-6 December 2018	Wien (Austria)	DG Connect – ICT 2018 [25]	Ana Juan Ferrer (ATOS), Ales Cernivec (XLAB), Daniele Lezzi, Anna Queralt (BSC), Marc Elian	Attendant with participation to Networking and Information sessions. Preparation of the live demo to be presented during the exhibition

Date	Place	Event	Partners	Contribution
			Begin (SIXSQ), Andrea Bartoli (WOS), Xavi Masip, Alejandro Jurnet (UPC)	
30 May 2018	Brussels (Belgium)	EC NEM General Assembly	Silvia Boi (ENG)	Attendant, moderator of the Key Messages session, organized by Vital Media project

Table 5. EU related venues

Ana Juan from ATOS continued her support to the Future Cloud Cluster of the EU on behalf of mF2C.

This is an EU initiative that aims to merge and agglutinate several research and innovation initiatives (FT7 and H2020) that address next generation Cloud Computing challenges and issues, including different forms of distributed computing like Multi-cloud, Edge, Fog and Mobile computing.

The declared goal is to create a critical mass of projects addressing the mentioned topics, share experiences, collaborate on approaches to foster future research and facilitate their adoption.

mF2C contributed with the research Roadmap, by Ana Juan (ATOS) and Xavi Masip (UPC), which presents the Cluster vision for 2030, including views on overall Cloud Computing challenges, Technological, Societal and European dimension of these challenges. In addition to this, the document presents initial work on Research areas and its associated research and development areas.

The project is supporting also Net Futures [32] and concertation meetings organized by Cloud Watch2, for them more meetings are expected in coming months.

Different partners, namely ATOS, XLAB, BSC, SIXSQ, WOS and UPC, have participated to the DG Connect – ICT2018 [25], held on 4-6 December 2018 in Wien, Austria. The mF2C project had the privilege to get one of the few dedicated booths, where we received a lot of interest among visitors. We received visits and requests for details from researchers, scientists, who were all interested in the themes and issues of Smart Cities, Cloud/Fog and IoT in general, about the project and what we do with the use cases. We ran a demo for a group of young students from the American International school in Wien. We have been honoured to receive the visit of Pearse O'Donohue, Director for Future Networks DG CONNECT, European Commission, who was informed on progress of the project, technical details and had a dedicated live demo. This has been a useful experience, as present the project for different audiences asking for very specific questions, so enabled us to collect a lot of feedback on how to improve our framework.

Table 6 presents some of the target EU venues planned for the third year of the project. Ana Juan from ATOS will continue leading the Future Cloud cluster of the EC, which will give to the mF2C project new opportunities to attend EU venues related to this cluster.

Event	Contribution
Future Cloud Cluster events	Presentations, workshops, chairing, etc.
Net Futures 2018	Presentations, workshops, chairing, etc.
Concertation meetings organized by CloudWATCH	Presentations, workshops, chairing, etc.
Participation to international industrial and EU events	Presentations, workshops, chairing, etc.

Table 6. EU related venues plans for third year

2.1.4 IETF and Standardization Venues

During the past year, some participation to Standardization events have been done. ATOS and Engineering continued their support to AIOTI working groups [33] . During the last period, both ATOS and Engineering attended a WG12 workshop [34] in Brussels and Massimo Bertoncini had a speech *"DLTs and Smart Contracts to increase smart grid flexibility"* [34] , while on WG08 on Smart Cities a meeting has been planned for next year.

Engineering supported also the NIST Technical working group on IoT-enabled Smart City framework [35]. This group includes ETSI, ANSI, TIA, KETI, USGBC among the others and aims at developing a Consensus Framework for Smart City Architectures. During the last period a first paper has been released.

Date	Event	Partners	Contribution
21 March 2018	NSAI SC02 SC11 Cloud Computing. A working meeting covering contributions to ISO/IEC JTC1/SC38 - Cloud Computing and Distributed Platforms [36]	INTEL	Attendance, review and feedback on national contributions to draft ISO SC38 standards.
8 May 2018	NSAI "IoT and Future Networks" mirror subcommittee launch	INTEL	Attendance, suggestions on focus and scope of proposed mirror committee.
25 September 2018	NSAI TC02 SC17 IoT. A working meeting of the new national subcommittee mirroring various IoT standards initiatives including the new ISO/IEC JTC1/SC41 – IoT and related technologies. [37]	INTEL	Attendance, feedback on subcommittee priorities and potential national contributions.
22 October 2018	AIOTI Workshop on Open Marketplaces to spur innovative energy services, in Brussels [38]	Massimo Bertoncini (ENG), Juan Rico (ATOS)	Both attended, Massimo Bertoncini had a speech: "DLTs and Smart Contracts to increase smart grid flexibility"

Table 7. IETF & Standardization venues for second year

The following table summarises the events and working groups various partners are interested in joining for the third year.

Event	Partners	Contribution
More AIOTI workshops and events particularly on Smart cities and Smart cities applications	ENG, ATOS	Heading of WG08 on Smart cities, meetings and workshop participation, presentations, contribution to papers writing

More meetings and workshops on NIST International Technical Working Group on IoT-Enabled Smart City Framework	ENG	meetings and workshop participation, presentations, contribution to papers writing
Standard oriented EC main events or workshops	ATOS, ENG	Presentations, workshops, chairing, etc.
Main events on CIMI	SIXSQ, BSC	Presentations, workshops, chairing, etc.
OpenFog Consortium, ISO/IEC JTC1 Cloud and IoT related meetings, OCCI working groups, Standard oriented EC main events or workshops	INTEL	Presentations, workshops, chairing, etc.
OGC, OGF, W3C relevant standards	STFC	Presentations, workshops, chairing, etc.

Table 8. IETF & Standardization venues planned for third year

2.1.5 Industrial Venues

During the past year INTEL, SIXSQ, ATOS, Worldsensing and Engineering participated in some major industrial events and fair trades. SIXSQ has been selected as outstanding innovation company in the field of Edge, Fog and Cloud Computing technologies and Smart Cities solutions, and participated to relevant events and expos, particularly in HPE Partner Summit and other Smart City related events.

ATOS is increasing their presence in IT 4.0 events, and attended the Smart Agrifood Summit [39] with a booth and some mF2C videos could be watched.

Intel participated in several industrial events organized by *NESSI* [40] and Big Data Value Association [41] .

Date	Event	Partners	Contribution
26 Feb- 1 Mar 2018	Mobile World Congress, Barcelona [42]	INTEL, ATOS	Participation and booth
13-15 Nov 2018	Smart City Expo World Congress, Barcelona [43]	WOS, SIXSQ	Preparation of a video and presentation of the projects during the 3 days of the exhibition, with a specifically dedicated EU project corner in the Worldsensing booth with videos, demonstration and flyers.
9-10 Oct 2018	IP Expo Digital Transformation Europe, Excel London [44]	STFC	Attendee
20-22 June 2018	Smart Agrifood Summit in Malaga [39]	ATOS	Participation and booth with Poster and mF2C video
27-28 November 2018	Field Service Amsterdam 2018 [45]	ENG	Andrea Bardini with an Interactive Workshop: Boost Your Field Service Through Augmented Reality And Wearables

Date	Event	Partners	Contribution
13-15 November 2018	WSO2Con Europe 2018, London [46]	ENG	Marco Mastroianni with speech "Medical Device Integration: The Future is Here"
5-6 November 2018	Reinventing the world – The power of Industry 4.0 in Beograd [47]	ENG	Francesca Bristot with Speech "Automation & Control for digital platform"
13 September 2018	Smart City Day, in Fribourg [48]	SIXSQ	Facilitated workshop on dashboards, demonstrating how to showcase the data relevant to smart city
18-20 June 2018	HPE Discover and Partner Summit, Las Vegas, USA [49]	SIXSQ	presentation of company's intelligent device NuvlaBox that is a key component in edge computing scenarios and Nuvla, the hybrid cloud and edge application management service, ideal for large and small enterprise, as well as public bodies. Marc-Elian Bégin participated to the panel discussion entitled "There is more than a single cloud story: How to capitalize in the platform economy with HPE and Cloud28+", talking about Cloud and Digital Transformation
27-29 November 2018	HPE Discover and Partner Summit, Madrid [50]	SIXSQ	Presentation of solutions for the intelligent edge, with NuvlaBox product family. Marc-Elian Bégin participated to the panel discussion entitled "IoT and AI at the Space Edge: To infinity and beyond", talking about the current state of AI as it applies to industrial processes and deployments that span the globe and beyond

Table 9. Industrial venues held in second year

The following table presents some of the targeted international industrial and EU venues planned for the third year of the project.

Event	Partners	Contribution
IoT week 2019, 17-21 June 2019 in Aarhus, Denmark [51]	WOS	Dedicated booth with mF2C poster and demos
Participation to international industrial and EU events	INTEL	Presentations, workshops, chairing, etc.
Participation to international industrial and EU events	SIXSQ	Fair Trades, Presentations, workshops, chairing, etc.
Participation to international industrial and EU events	WOS	Fair Trades, Presentations, workshops, chairing, etc.
Participation to international industrial and EU events	ENG	Presentations, workshops, chairing, etc.

Table 10. Industrial venues planned for third year

mF2C results will continue to be presented externally, at local, national and international outreach events as the opportunities arise. Such events include the regular site visits from industry, academia and government that the Intel Leixlip site hosts, national research conferences, and Intel exhibits at regional and international events such as Research@Intel Europe, Intel Developer Forum, and Mobile World Congress.

2.1.6 OpenSource Venues

All partners in the consortium have a strong experience developing and promoting open source software. They believe that the open source approach to software development is key for the development and sustainability of business in emerging start-ups, SMEs and large Enterprises. For this reason, they spend a relevant effort and attention in the engagement with Open Source communities.

During the past year, some partners have contributed to the open source communities, particularly XLAB with major contribution to EMMY (XLABs Zero-Knowledge proofs library) and other Security and Privacy Technical Committees.

Engineering continued their support in the FIWARE framework, with participation in some major events.

STFC supported some of the most relevant edge communication and security libraries like OpenSSL, OpenWRT and Mosquitto, interacting with respective communities.

ATOS spent relevant effort to promote their work on orchestration software extensions and is confident to release these project results under an Open Source scheme.

SIXSQ progressed in the development of the Slipstream [52] and Nuvlabox software stack that includes CIMI interfaces[1].

INTEL contributed updates to their various mF2C open-source initiatives including Landscaper and Analytics Engine.

Table 11. Open Source venues for second year lists the Open Source events attended by mF2C partners during the second year's project.

Date	Event	Partners	Contribution
26-28 November	FIWARE Global Summit 2018, Malaga [53]	ENG, ATOS	Attendant & presentation. Deep discussion on Open Source and Smart Cities
30 October 2018	Internet of Things Workshop in Montevideo (Uruguay) [54]	ENG	Speeches: Dario Avallone "FIWARE from an IT company perspective" Lanfranco Marasso "The first Application of Fiware in Antel: the City Enabler" Giovanni Aiello "City Enabler & OASC"

Table 11. Open Source venues for second year

For the coming year, the following table summarises the events and working groups various partners are interested in joining.

[1] https://github.com/slipstream

Event	Partners	Contribution
Open Source oriented main events or workshops	INTEL	Presentations, workshops, chairing, etc.
Events related to OpenWRT, OpenVirtualBox, Mosquitto, OpenSSL	STFC	Presentations, workshops, chairing, etc.
Events related to OASIS TOSCA, ManageIQ, Emmy, OpenStack, Security and Privacy Technical Committees	XLAB	Presentations, workshops, chairing, etc.

Table 12. OpenSource venues planned for third year

2.1.7 Scientific Papers

As stated in deliverable D6.1 [1] and also in D6.2 [2] one of the objectives of the dissemination activity is to publish in different scientific and industrial journals, or participate in relevant conferences, workshops and market exhibitions, as a way to promote mF2C development and transferring knowledge. This can be performed by the consortium, but also by individual partners.

According with the dissemination plan proposed in deliverable D6.1 [1], some KPIs have been defined to evaluate the effectiveness of the work done.

Action	KPI	Measure
Scientific publications	Number of publications (articles, papers, etc.) in conferences and events	20 during the project: at least 3 the first year, 7 the second year and 10 the third one
General publications	Number of publications in journals or other peer reviewed publications	At least 3 per year
Participation in events and conferences	Number of events assisted with a relevant paper	50 during the whole project: 10, 15, 25 during the first, second and third year

Table 13. KPIs associated to scientific publications

In Table 14, we present the list of scientific publications, already published or accepted, for the second year of the project. We have accomplished all the KPIs related to scientific publications in this second year of the project. During this second year of the project, we have three accepted papers in journals, two of them already published, therefore achieving the corresponding KPI. Regarding the number of publications in conference proceedings, there have been 24 accepted and presented papers. It is worth mentioning that one of these papers, published in the SmartObjects'18 conference [55] proceedings, was written in collaboration between all the partners in the consortium.

The total number of publications, considering the two years of the project, is now:

- 8 in year 1. 24 in the year 2, conference publications: 32 conference publications which is good progress, and exceeds the target of 20 set for the whole project, and 50 participations in events and conferences.
- 3 journal publications in the second year: we consider that during the remaining year of the project it will achieve the enough maturity to be able of publish 6 more journal papers and reach the corresponding KPI.

Date	Event/Journal	Partners	Publication
February 2018	Journal paper: Future Generation Computer Systems Journal, Vol.37, February 2018	UPC, TUBS, IBM	"Managing Resources Continuity from the Edge to the Cloud: Architecture and Performance" Xavi Masip-Bruin, Eva Marín-Tordera, Admela Jukan, Guang-Jie Ren [56]
26-28 March 2018	IEEE Mobile Cloud Conference 2018 in Bamberg, Germany. [22]	UPC	"F2C-Aware: Enabling discovery in Wi-Fi-powered Fog-to-Cloud (F2C) systems", by Zeineb Rejiba*, Xavier Masip-Bruin, Eva Marín-Tordera, Alejandro Jurnet Bolarin, Guang-Jie Ren.
3 May 2018	IEEE International Conference on Fog and Edge Computing (ICFEC 2018) in Washington DC, USA [57]	UPC	"Data Preservation through Fog-to-Cloud (F2C) Data Management in Smart Cities", by Amir Sinaeepourfard, Jordi Garcia Almiñana, Xavier Masip-Bruin, Eva Marín-Tordera [57]
21-25 May 2018	IEEE 41st International convention on Information and Communication Technology, Electronics and Microelectronics in Opatija, Croatia [12]	TUBS	"On HTTP Performance in IoT Applications: An Analysis of Latency and Throughput" by Wolfgang Bziuk, Cao Vien Phung, Jasenka Dizdarevic, Admela Jukan
12 June 2018	IEEE International Workshop on the Internet of Things: Smart Objects and Services (IoT-SoS 2018) in Chania, Greece [20]	UPC	"Resource Identity Management Strategy for Combined Fog-to-Cloud Systems", by Alejandro Gòmez, Xavi Masip-Bruin, Eva Marín-Tordera, Sarang Kahvazadeh, Jordi Garcia Almiñana
18-21 June 2018	27th European Conference on Networks and Communications (EuCNC 2018) in	UPC	"Analyzing the Deployment Challenges of Beacon Stuffing as a Discovery Enabler in Fog-to-Cloud Systems" by Zeineb Rejiba, Xavi Masip-Bruin, Eva Marín-Tordera [19]

Date	Event/Journal	Partners	Publication
	Lubjiana, Slovenia [19]		
26-29 June 2018	ACM Smartobjects'18 (MobiHoc) in Los Angeles, USA [55]	ATOS, UPC, BSC, ESA, TUBS, INTEL, XLAB, WoS, STFC, SiXSQ	"mF2C: Towards a Coordinated Management of the IoT-fog-cloud Continuum", by Xavier Masip-Bruin, Eva Marín-Tordera, Jordi García, Ana Juan Ferrer, Anna Queralt, Daniele Lezzi, Admela Jukan, Alexander Leckey, Antonio Salis, Matic Cankar, Denis Guilhot, Cristovao Cordeiro, Jens Jensen [18]
2-4 July 2018	Cloudification of the Internet of Things (CIoT) 2018 Conference, held in Paris, France [23]	UPC, ATOS	"Towards An Efficient Key Management and Authentication Strategy for Combined Fog-to-Cloud Continuum Systems", by Sarang Kahvazadeh, Xavier Masip-Bruin, Eva Marín-Tordera, Jordi García, Alejandro Jurnet, Rodrigo Diaz Rodríguez [23]
6 August 2018	IEEE 6th International Conference on Future Internet of Things and Cloud 2018 in Barcelona Spain [16]	UPC	"Virtualizing the Edge: Needs, Opportunities and Trends" by Eva Marín-Tordera, Xavier Masip-Bruin, Beatriz Otero Calviño, Eva Rodríguez Luna [16]
27-31 August 2018	F2C-DP Workshop co-located in Euro-Par 2018 in Torino Italy [10]	ESA, BSC	"Benefits of a fog-to-cloud approach in proximity marketing" by Antonio Salis, Glauco Mancini, Roberto Bulla, Paolo Cocco, Daniele Lezzi and Francesc Lordan
27-31 August 2018	F2C-DP Workshop co-located in Euro-Par 2018 in Torino Italy [10]	TUBS	"Enhancing Service Management Systems with Machine Learning in Fog-to-Cloud Networks" by Jasenka Dizdarevic, Francisco Carpio, Mounir Bensalem and Admela Jukan
27-31 August 2018	F2C-DP Workshop co-located in Euro-Par 2018 in Torino Italy [10]	UPC	"An Architecture for Resources Management in a Fog-to-Cloud Framework" by Souvik Sengupta, Jordi Garcia and Xavi Masip-Bruin [10]
27-31 August 2018	F2C-DP Workshop co-located in Euro-Par 2018 in Torino Italy [10]	BSC	"Multi-tenant Pub/Sub Processing for Real-time Data Streams" by Álvaro Villalba and David Carrera

Date	Event/Journal	Partners	Publication
9-12 September	IEEE 29th Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC) in Bologna, Italy [14]	UPC	"A Beacon-assisted Direction-Aware Scanning Scheme for 802.11-Based Discovery in Fog-to-Cloud Systems" by Zeineb Rejiba, Xavier Masip-Bruin, Eva Marín-Tordera [14]
8-12 October 2018	Proceedings of the 21st International Multiconference INFORMATION SOCIETY IS 2018 in Ljubljana, Slovenia [58]	XLAB	"Time Series or Relational Database for Edge and IoT" by Anze Luzar, Saso Stanovnik, Matija Cankar
15-17 October 2018	IEEE 14th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob) in Limassol, Cyprus [15]	UPC	"Towards a context-aware Wi-Fi-based Fog Node discovery scheme using cellular footprints" by Zeineb Rejiba, Xavier Masip-Bruin, Eva Marín-Tordera [15]
27-31 October 2018	7th IEEE International Conference on Smart Communications in Network Technologies 2018 (SaCoNeT) in El Oued, Algeria [17]	UPC	"Essentiality of Resource and Service-Task Characterization in the Coordinated Fog-to-Cloud Paradigm" by Souvik Sengupta, Jordi Garcia, Xavier Masip-Bruin [17]
October 2018	Journal paper: Future Generation Computer Systems Volume 87, October 2018, Pages 1-15 [59]	UPC, ATOS	"Towards a Proper Service Placement in Combined Fog-to-Cloud (F2C) Architectures", Vitor Barbosa Souza, Xavi Masip-Bruin, Eva Marín-Tordera, Sergi Sanchez-Lopez, Jordi Garcia, Guang-Jie Ren, Admela Jukan, Ana Juan Ferrer [59]
13-14 November 2018	IEEE Future Technologies	UPC	"Taxonomy and Resource Modeling in Combined Fog-to-Cloud Systems", by Souvik Sengupta, Jordi Garcia Almiñana, Xavi Masip-Bruin [13]

Date	Event/Journal	Partners	Publication
	Conference (FTC) 2018 [13]		
13-14 November 2018	IEEE Future Technologies Conference (FTC) 2018 [13]	UPC	"A Novel and Scalable Naming Strategy for IoT Scenarios" by Alejandro Gómez, Xavier Masip-Bruin, Eva Marín-Tordera, Sarang Kahvazadeh [13]
17 December 2018	mF2C Workshop in IEEE/ACM UCC 2018 in Zurich Switzerland [26]	XLAB	"Transportation ecosystem framework in Fog to Cloud environment" by Matija Cankar, Saso Stanovnik and Hugo Landaluce [26]
17 December 2018	mF2C Workshop in IEEE/ACM UCC 2018 in Zurich Switzerland [26]	ESA, STFC	"Anatomy of a fog-to-cloud distributed recommendation system in airports" by Antonio Salis, Jens Jensen, Roberto Bulla, Paolo Cocco and Glauco Mancini [26]
17 December 2018	mF2C Workshop in IEEE/ACM UCC 2018 in Zurich Switzerland [26]	XLAB	"Maritime IoT solutions in Fog and Cloud" by Matija Cankar and Saso Stanovnik [26]
17 December 2018	mF2C Workshop in IEEE/ACM UCC 2018 in Zurich Switzerland [26]	UPC	"Do we really need cloud? Estimating the fog computing capacities in the city of Barcelona" by Jordi Garcia, Ester Simó, Xavier Masip-Bruin, Eva Marín-Tordera and Sergi Sànchez-López [26]
17 December 2018	mF2C Workshop in IEEE/ACM UCC 2018 in Zurich Switzerland [26]	STFC	"Towards a Secure and GDPR-compliant Fog-to-Cloud Platform" by Shirley Crompton and Jens Jensen [26]
17 December 2018	mF2C Workshop in IEEE/ACM UCC 2018 in Zurich Switzerland [26]	STFC	"Hierarchical Internet of Things System" by Emma Tattershall, Callum Iddon and Jens Jensen [26]
Accepted	Journal paper: to be published in ACM Computing Surveys (CSUR)	TUBS, UPC	"A Survey of Communication Protocols for Internet-of-Things and Related Challenges of Fog and Cloud Computing Integration" by Jasenka Dizdarevic, Francisco Carpio, Admela Jukan, Xavier Masip-Bruin
Submitted	IEEE ICC 2019 [60]	UPC, ATOS	"Balancing Security Guarantees vs QoS Provisioning in Combined Fog-to-cloud systems", by Sarang Kahvazadeh, Xavi Masip-Bruin, Rodrigo Díaz, Eva Marín-Tordera, Alejandro Jurnet, Jordi Garcia, Ana Juan, Ester Simó

Table 14. Papers accepted, published or submitted during second year

Date, Location	Event	Audience
May 2019, Poland	IFIP Networking [27]	Research
May 2019, Larnaca, Cyprus	3rd IEEE International Conference on Fog and Edge Computing (ICFEC 2019) [57]	Research
July 2019, Croatia	11th International Conference on Ubiquitous and Future Networks [28]	Research
June 2019, Roma, Italy	The Fourth International Conference on Fog and Mobile Edge Computing (FMEC 2019) [61]	Research
June 2018, Beijing China	2019 IEEE/ACIS 18th International Conference on Computer and Information Science [29]	Research
July 2019, Ottawa, Canada	22nd International Conference on Information Fusion (Cloud and Edge Computing, Machine Deep and Transfer Learning) [30]	Research
July 2019, Toyama, Japan	20th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing [31]	Research
September 2019, Waltham, USA	23rd Annual HPEC Conference (Machine Learning, Big Data and Distributed Computing)	Research
December 2019, Waikoloa, Hawaii	IEEE Globecom'19 (Cloud & Fog/Edge Computing)	Research

Table 15. Events addressable for paper submission in third year

2.1.8 Workshops and training sessions

As detailed in deliverable D6.1 [1] and D6.2 [2] the organization of workshops, addressed to industry and universities, is a mandatory point as an occasion for showcasing project results to relevant audiences, thus giving a better visibility for all project results. At the same time, specific training sessions could help in disseminating the achieved results; the Summer Camp training is one of them.

According with the dissemination plan proposed in deliverable D6.1 [1], some KPIs have been defined to evaluate the effectiveness of the work done.

Action	KPI	Measure
Assistance to events and conferences	Number of events assisted with a relevant paper	At least **2** per year
Organization of workshops (in collaboration or not)	Number or workshops organized with significant present	**3** workshops organized through the project lifecycle, including co-

Action	KPI	Measure
		organized with similar projects or initiatives
Organization of training sessions	number of training events attended	At least **1** event per year

Table 16. KPIs associated with workshops and training sessions

Given that one workshop (co-located in EuroPar 2017) has been held in year 1, during the second period two workshops have been organized, such that we fulfil the requested target of three workshops in total. Also, two training sessions have been organized, thus reaching the requested number of training sessions.

Speaking about workshops, the second edition of the F2C-DP Workshop has been organized, co-located with the EuroPar 2018 main Conference [10] , in Turin. It focused on new architectures, programming models, applications and systems in the framework of the fog to cloud computing paradigm. In this edition, emphasis has been put on Machine Learning, Deep Learning, BlockChain, Function-as-a-Service, Security and Privacy. The Technical Program Committee was composed by a mix of academic and industrial senior researchers, part of them out of the consortium.

Eight papers have been received, but due to the quality requirements of Euro-Par, only seven papers were accepted. The workshop started with an invited keynote speech from Engineering R&D, papers presentations followed, then a technical panel "Technology requirements and challenges towards a Fog to Cloud architecture, its impact in business models and emerging business scenarios", with questions and answers, closed the workshop.

The second organized workshop is the first edition of the mF2C workshop, hosted in the IEEE/ACM UCC Conference [26] , in Zurich. It has the same focus as the previous one, and got ten papers. After peer review only eight papers have been accepted for presentation. At the event about 15 people, mainly coming from universities, attended the workshop and posed some questions to presenters.

Regarding training, a first internal session has been held by TUBS on the field of the Machine Learning, to be widely used in the project, while the second has been organized by Worldsensing in a joint effort with the H2020 Uniserver Project [62] , to help defining more appropriate business strategies in the field of fog/edge/IoT, in line with the today digital transformation.

Date	Event	Partners	Participants	Contribution
19 Apr 2018	Machine Learning Training Workshop, managed by TUBS	TUBS, UPC, BSC, STFC, ENG, XLAB	Jasenka Dizdarevic, Francisco Carpio (TUBS), Jens Jensen, Shirley Crompton (STFC), Antonio Salis, Roberto Bulla (ENG), Alex Barcelo (BSC), Sarang Kahvazadeh, Zeineb Rejiba (UPC), Matija	People attended and contributed

Date	Event	Partners	Participants	Contribution
			Cankar, Saso Stanovnik (XLAB)	
28 Aug 2018	F2C-DP Workshop in EuroPar 2018, in Turin	ENG, BSC, TUBS, UPC	Antonio Salis (ENG), Francesc Lordan (BSC), Jasenka Dizdarevic (TUBS), Souvik Sengupta (UPC)	Workshop chaired, people attended and presented a paper
12 Nov 2018	Joint Workshop with Uniserver H2020 project "Business tips to understand the consequences of the digital transformation and to adapt today strategy model" organized by Worldsensing with the collaboration of IESE Business School, in Barcelona	ENG, XLAB, BSC, INTEL, WOS, SIXSQ	Antonio Salis (ENG), Matija Cankar (XLAB), Denis Guilhot (WOS), Anna Queralt, Daniele Lezzi (BSC), Marc Elian Begin (SIXSQ), Alec Leckey (INTEL), Lara Lopez (ATOS)	People attended and contributed
17 Dec 2018	Workshop mF2C in IEEE/ACM UCC Conference in Zurich [26]	TUBS, UPC, STFC, XLAB	Admela Jukan (TUBS), Jordi Garcia (UPC), Jens Jensen (STFC), Matija Cankar, Saso Stanovnik (XLAB)	Workshop chaired, people attended and presented a paper

Table 17. Training and workshops attended in second year

Since we reached the target KPIs for Workshops, the effort during the final period will be focused on the organization of the Summer Camp (including the External Advisory Board) and a technical workshop to present a practical demonstration of the mF2C project, then qualified Conferences and Events will be chosen for attendance and paper presentation.

Date	Event	Partners	Contribution
June – July 2019	Summer Camp Training	UPC, TUBS, BSC, ENG, STFC, XLAB, INTEL, SIXSQ, WOS, ATOS	Support for the training sessions, invited speeches
October 2019	Technical Workshop	all	Support for presenting a practical demonstration of mF2C project.

Table 18. Training and workshops planned for third year

2.1.9 Website and Social Media

One of the most effective parts of dissemination and communication activities is the online presence at *www.mf2c-project.eu*. At the beginning of the project, in the dissemination plan proposed in D6.1 [1], we defined the KPIs related to the online presence.

Action	KPI	Measure
Project website	Number of visitors	At least **1.500** visits per year
Social Media channels	Number of followers in Twitter	At least **250** from outside the project
	Number of tweets	At least **100** tweets per year (unique and retweeted)
	Number of YouTube videos	At least **2** videos per year

Table 19. KPIs associated with website and social media channels

One of the first pillars of the online presence is the Project website, used as major contact point for our audience and central information hub for all relevant information, available documents or deliverables, all major milestones and breaking news regarding the project.

Engineering Sardegna (ESA) oversees the maintenance and update of the website. During the first year, the website was designed and deployed with the next sections:

- Home
- Project Overview: with a brief description of the project and the uses cases
- Press room: with the publications of the project, including deliverables, newsletters and open code
- Consortium: This page shows the logos of all the partners with links to individual pages with the introduction of the partner and its role in the project
- News & Events: showing a list of all the news of project as well as all the events where mF2C partners participate
- Related Projects: will show a brief description of the related project with an established connection with mF2C
- Blog: page contains articles of related topics to mF2C addressed to a wide audience
- Contact us: it allows visitors to send a message to mF2C
- In Home page: Connection to mF2C Twitter account the latest published tweets
- In Home page: Form to be subscribed to receive mF2C Newsletters

During the first year, we reached the expected number of visitors in the website, with 1,535 from 700 different users and with 4,200 page views. In the same period, we published about 55 posts.

However, in order to make the website more attractive, the layout was redesigned by ESA with the support of ATOS, being now vertical, as you can see in Figure 2, with a direct access to the mF2C GitHub. Scrolling down in the website now we find the menu, Figure 3 and the latest news, Figure 4. Now the Twitter connection is in each one of the menu pages, as in Figure 5.

At the end of second year the number of total visitors reached more than 7,000, with about 3,700 unique users and about 22,900 page views, as in Figure 6, thus fulfilling the requested KPI. In terms of post we published 125 posts.

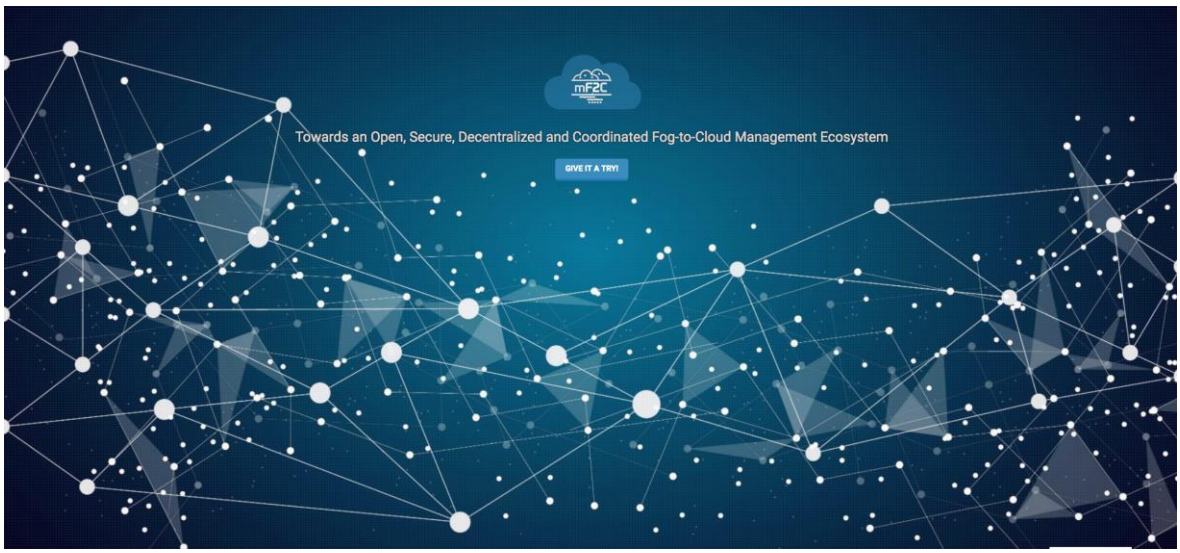


Figure 2 mF2C website

Figure 3 mF2C website menu

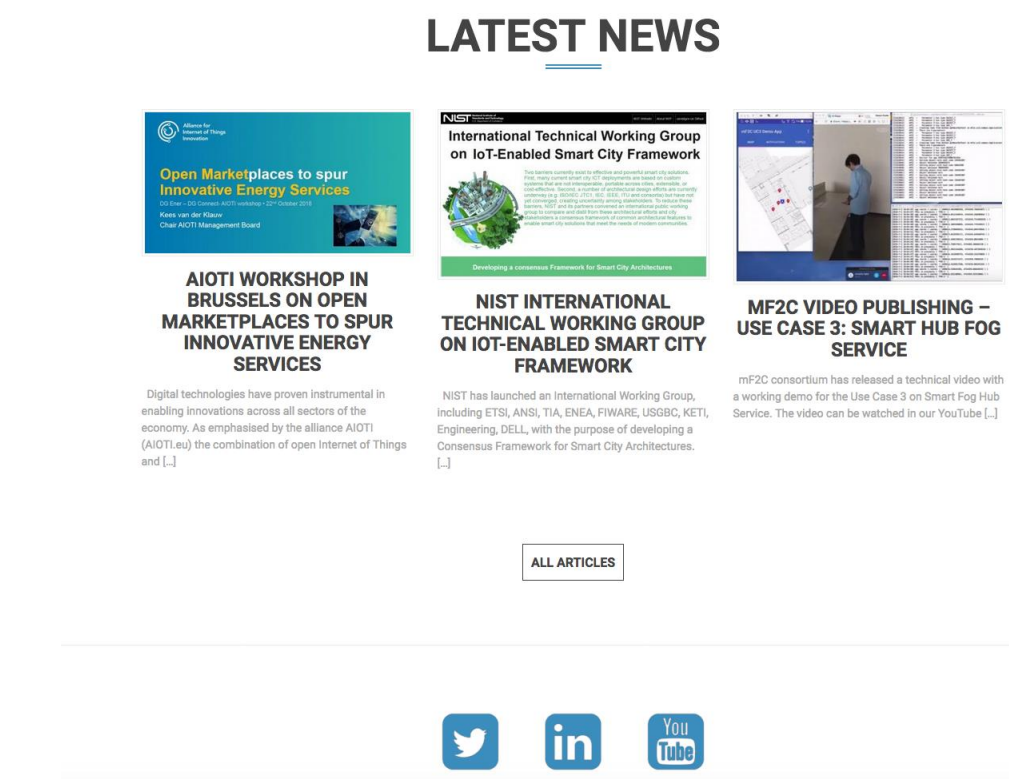


Figure 4 Latest News in mF2C website

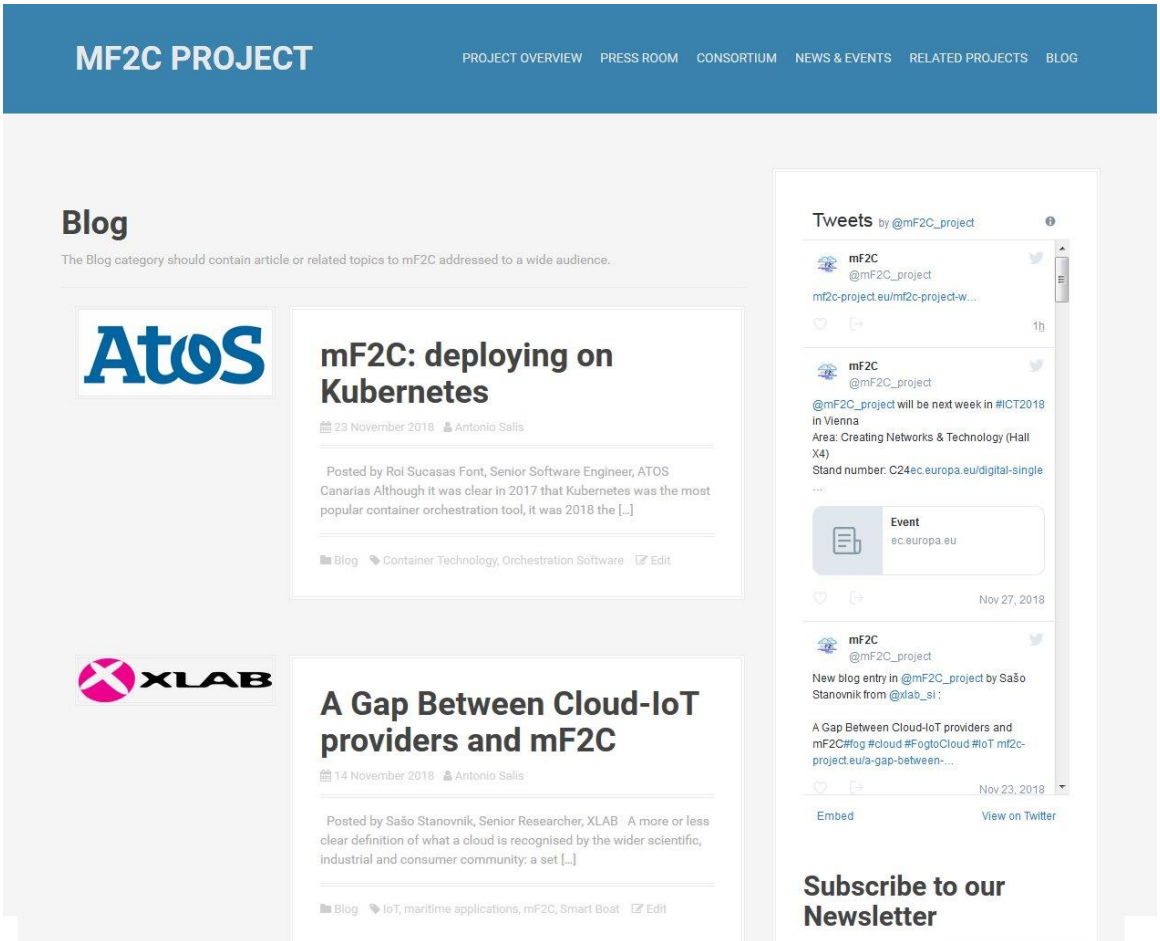
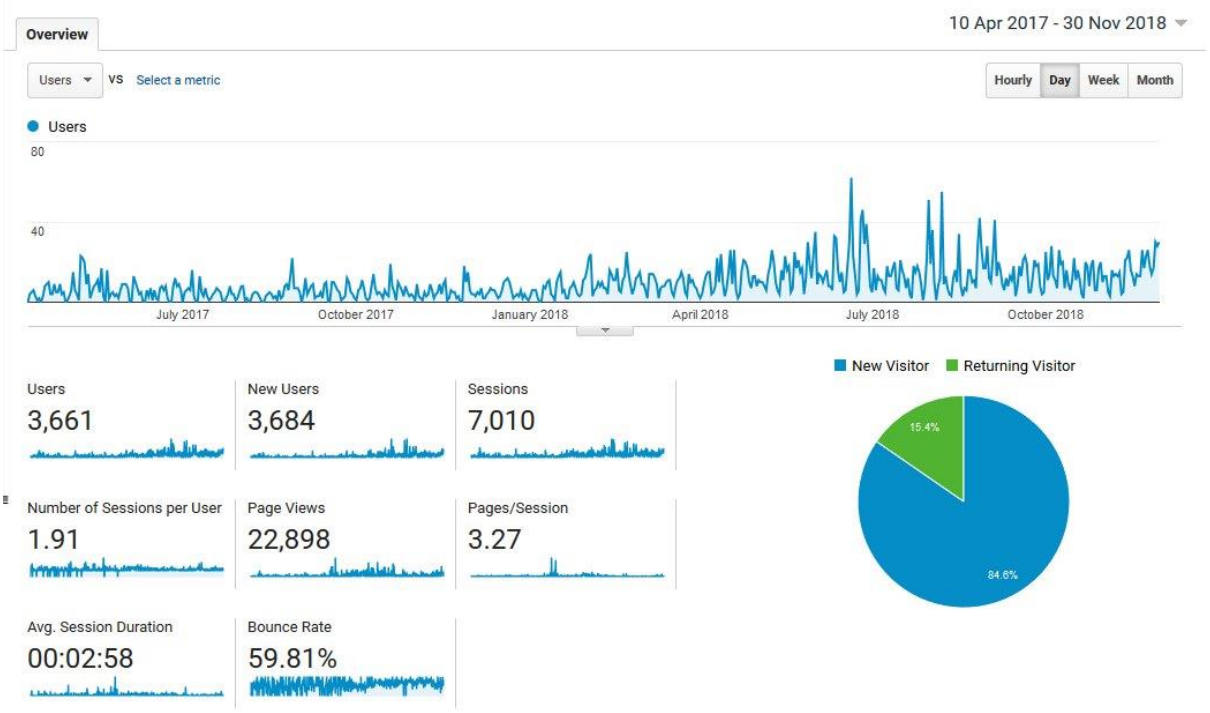


Figure 5 Twitter bar in every page



Country	Users	% Users
1. Spain	506	13.40%
2. France	400	10.60%
3. United States	384	10.17%
4. Italy	351	9.30%
5. India	238	6.30%
6. Germany	194	5.14%
7. United Kingdom	144	3.81%
8. South Korea	120	3.18%
9. Slovenia	87	2.30%

Operating System	Users	% Users
1. Windows	2,217	60.56%
2. Macintosh	498	13.60%
3. Android	437	11.94%
4. Linux	272	7.43%
5. iOS	221	6.04%
6. (not set)	11	0.30%
7. Chrome OS	2	0.05%
8. Windows Phone	2	0.05%
9. BlackBerry	1	0.03%

Figure 6 mF2C Website statistics

Social Media was conceived to give widen visibility and engagement for the project, even taking advantage of the extensive social network accounts already existent within the mF2C partners; and also, to communicate the day-to-day work in the project. Although only Twitter has associated KPIs, at the beginning of the project we created also an mF2C account for LinkedIn (more business oriented) and in ResearchGate (more research oriented). The data of these social networks can be found in Table 20.

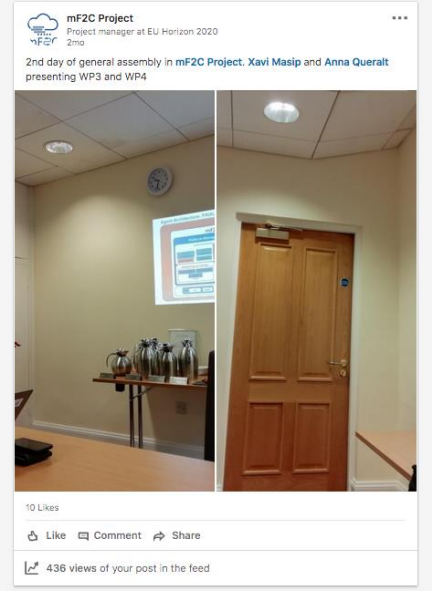
In Twitter, we reached 41.1 K impressions during the second year, achieving a total of 94.5 K impressions (over the two years). We are also in track in terms of number of followers and tweets per year, especially if we also sum up the posts and followers in LinkedIn and ResearchGate. Figure 7 and Figure 8 show some of the more appreciated posts and tweets in LinkedIn and Twitter respectively. As shown, usually the tweets with more impressions are those related to important mF2C events or releases, such as project meetings, project review, blog entries or video releases. Just as an example, the tweet with more impression during 2018 was the one related to the project blog entry written by

WoS, Emergency situation management in Smart Cities, case of study; and in LinkedIn, the post with most views is the post related to our last project meeting in September 2018.

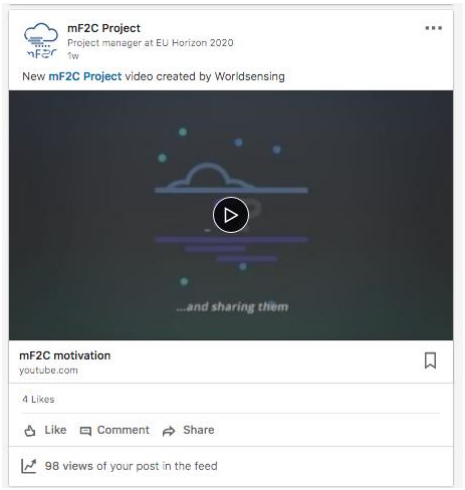
Social media	tweets/posts	Tweets target	Followers	Followers target	Views
Twitter	1st year: 117 2nd year: 167 Total: 284	100 per year	1st year: 80 2nd year: 84 Total: 164 (144 outside of the project)	250 outside of the project	1st year: 47,200 2nd year: Total:
LinkedIn	1st year: 75 2nd year: 86 Total: 181	NO KPI	1st year: 80 2nd year: 61 Total: 141	NO KPI	1st year: 480 2nd year: Total: 1,298
ResearchGate	1st year: 10 2nd year: 15 Total: 25	NO KPI	1st year: 10 2nd year: 3 Total: 13	NO KPI	Total: 208

Table 20. Social networks data for the second year of the project


mF2C Project
Project manager at EU Horizon 2020
4mo
Check our post about our successful M18 review meeting:
mF2C Overview
Success of the mF2C Project at the M18 Review meeting in Brussels
mf2c-project.eu
5 Likes
Like
Comment
Share


mF2C Project
Project manager at EU Horizon 2020
2mo
2nd day of general assembly in mF2C Project. Xavi Masip and Anna Queralt presenting WP3 and WP4
10 Likes
Like
Comment
Share
436 views of your post in the feed


mF2C Project
Project manager at EU Horizon 2020
1w
Check out our new video about the mF2C Project Use Case 2 by XLAB:
Smart Boat Services
...see more
YouTube
youtube.com
4 Likes
Like
Comment
Share
137 views of your post in the feed


mF2C Project
Project manager at EU Horizon 2020
1w
New mF2C Project video created by Worldsensing
...and sharing them
mF2C motivation
youtube.com
4 Likes
Like
Comment
Share
98 views of your post in the feed

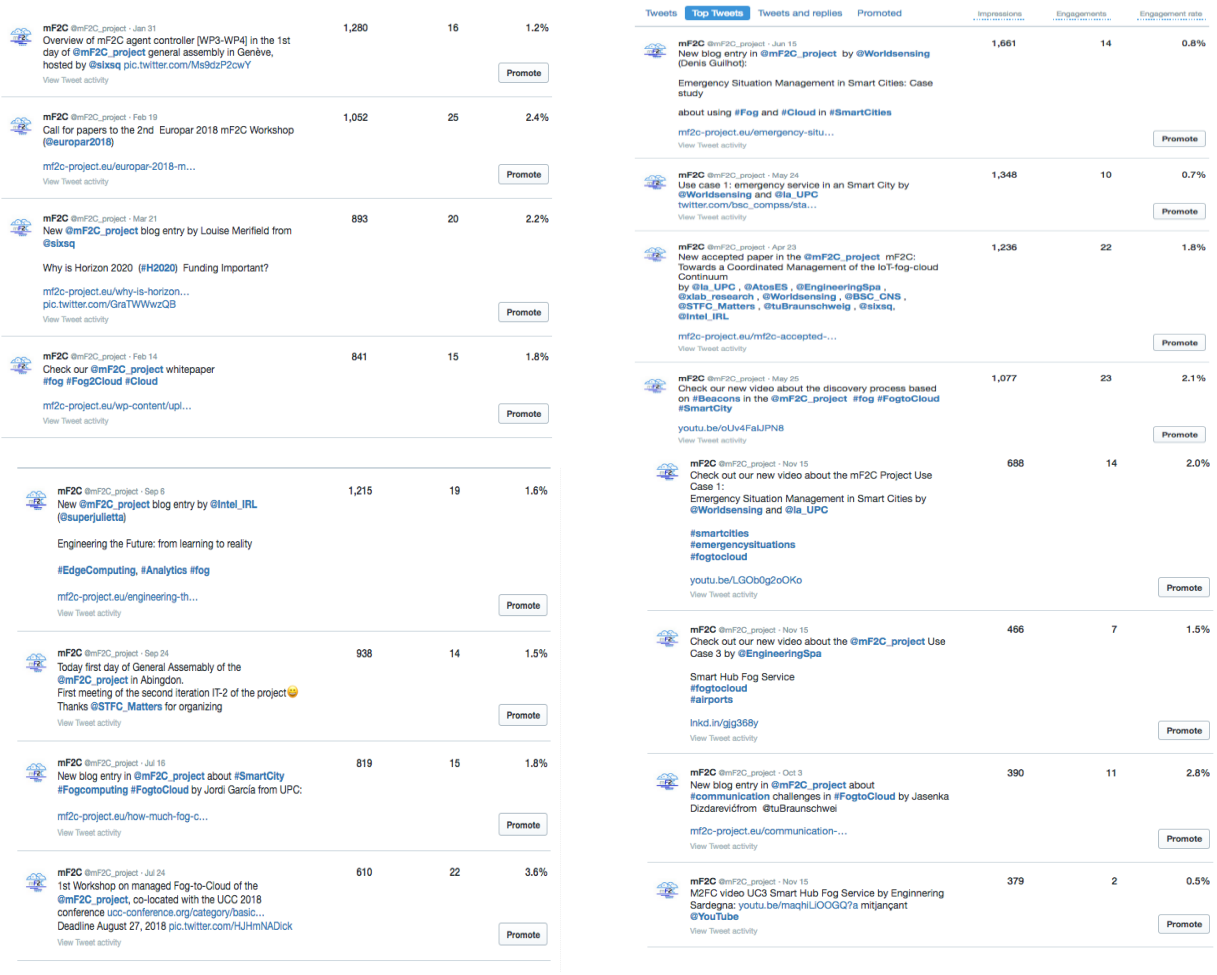


Figure 8 Some of the more appreciate tweets

2.1.10 Promotional Materials

As stated in the project plan, D6.1 [1], and in the last deliverable reporting the dissemination activities, D6.2 [2], one of the means for getting engaged with relevant stakeholders is the preparation of marketing materials, with the purpose of raising awareness about the project and supporting the partners in the different events they may attend. To this end we established some KPIs related to this marketing material to evaluate the effectiveness of the work done.

Action	KPI	Measure
Whitepapers (business and/or scientific)	Number of whitepapers published	**At least one** business-oriented whitepaper and **one** technical/scientific whitepaper
Marketing collateral materials	Number of flyers	At least **1** per year
	Number of posters	**2** (one technical and one business oriented)
	Number of project videos	At least **1** per year

Table 21. KPIs associated with whitepapers and marketing collateral material

On February 2018, the mF2C consortium released a whitepaper with a detailed description of the system architecture [63]. This mF2C technical whitepaper was also sent to the advisory board before the first meeting on February 15, 2018. The KPI related to produce a technical whitepaper has been reached, and we plan for the third year to produce a more business-oriented paper, concurring with maturity of the mF2C system and especially the maturity of the business plan.

Regarding the number of flyers and posters, during the second year of the project we have been using the first flyer and poster produced in 2017, already reported in deliverable D6.2 [2]. We plan, in the third year of the project, to update this material to produce a flyer and a poster more business oriented.

During 2018, we have produced 9 additional videos, which totals to 12 mF2C videos uploaded in the mF2C YouTube channel and mF2C website. Unlike the first year where the idea was to present the consortium and the challenges of the project, in this second year the focus has been, on one hand to present the technical ideas of the project in an unformal way, to reach a wider audience, and on the other hand to present short demos of the use cases. The videos released in 2018 are:

- Registration process explained with cartoons:

https://www.youtube.com/watch?v=q_CKLrj6SqQ&t=1s

- Discovery process explained with cartoons:

https://www.youtube.com/watch?v=oUv4FaIJPN8

- Resource categorization process explained with cartoons

https://www.youtube.com/watch?v=H2Kq2MWPgH8

- mF2C architecture explained with cartoons

https://www.youtube.com/watch?v=kIm2HSpc3S4

- Preservice execution demo: Demos of all the functionalities needed before executing a service (User/device registration, discovery, authentication, leader failure, service registration and service catalogue)

https://www.youtube.com/watch?v=mCEdfkbk8ms

The next three videos correspond to demos of the use cases; and for producing these videos XLAB established a framework and a methodology:

- The first part of the video shows how the different hardware of the use case is mapped in the different layers of the hierarchical mF2C architecture.
- The second part of the video shows a recorded demo of the use case with a voice-off explaining the demo.

These three videos are:

- Use Case 1, Emergency Situation Management in Smart Cities demo:

https://www.youtube.com/watch?v=LGOb0g2oOKo

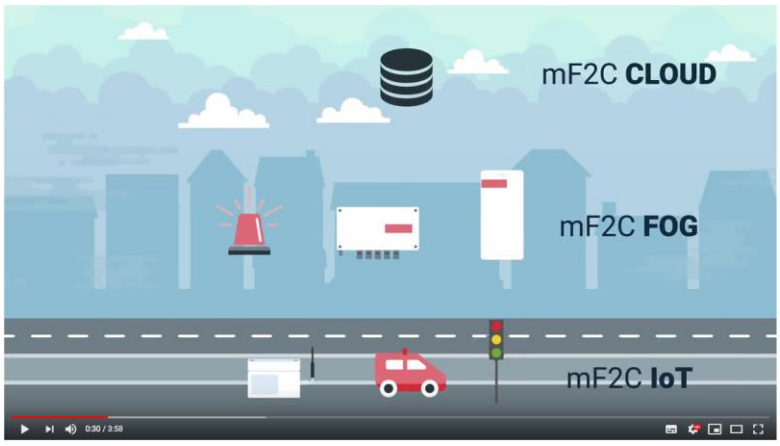
- Use Case 2, Smart Boat Services:

https://www.youtube.com/watch?v=BZxdhwqCfww

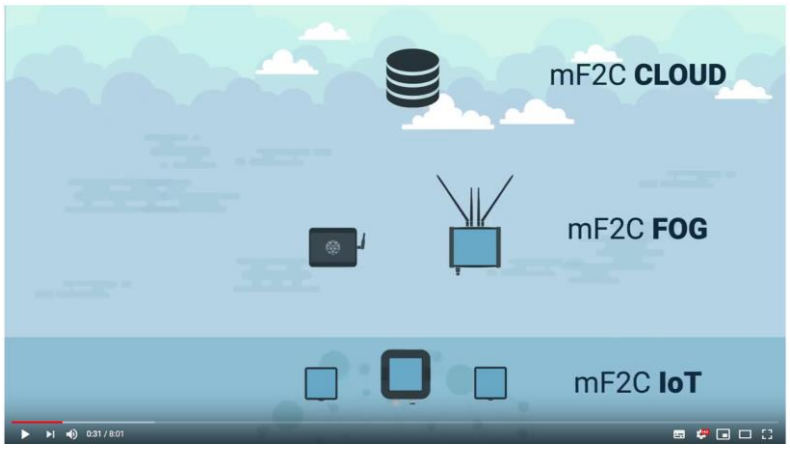
- Use Case 3, Smart Hub Fog Service:

https://www.youtube.com/watch?v=maqhiLiOOGQ

In Figure 9 we have screenshots of the mF2C use case videos in YouTube. The main characteristics of these videos are their simplicity and the easy way that complicated concepts are explained, again to attract a wider audience.



a) Emergency Situation Management in Smart Cities



b) Smart Boat Services

c) Smart Hub Fog Service

Figure 9 Screenshots of the mF2C use cases demos

2.1.11 mF2C newsletter and Blog

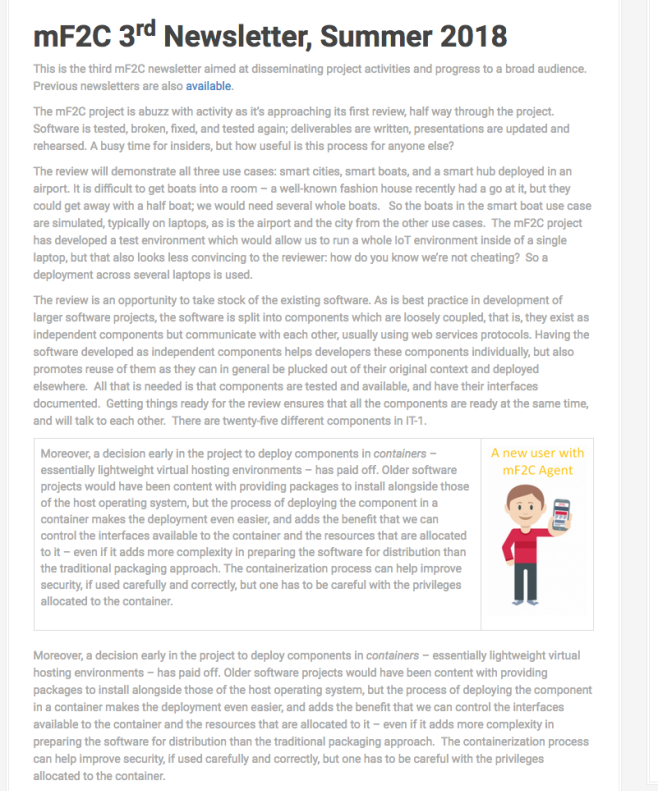
At the beginning of the project and in the project plan described in D6.1 [1] we established two additional strategies to disseminate the ideas of the project.

- The Newsletter: it aims is to inform the subscribed stakeholders about the latest news and results of the project. Its periodicity is approximately twice per year, matching the dates of important events, such as meetings, reviews, etc. The Newsletter is published in the mF2C website, but also sent by email to all the subscribed people.
- The blog entries: the aim of the blog is to communicate and disseminate the ideas of the project, or related to the project, to a wider audience without formalisms or technical explanations.

During 2018, we have produced a Newsletter, in July 2018, written by STFC, and concurring with the first project review in month M18. In this Newsletter, all the goals achieved in IT-1 are summarized. A screenshot of the published Newsletter in the mF2C is shown in Figure 10.

http://www.mf2c-project.eu/mf2c-3rd-newsletter-summer-2018/

At the time of writing this deliverable, we plan to write the fourth Newsletter by December 2018. This Newsletter, apart from summarizing the latest activities within the project, will also include the report about the ICT event in Vienna. The writing of the Newsletter will be overseen by ATOS.



mF2C 3rd Newsletter, Summer 2018

This is the third mF2C newsletter aimed at disseminating project activities and progress to a broad audience. Previous newsletters are also available.

The mF2C project is abuzz with activity as it's approaching its first review, half way through the project. Software is tested, broken, fixed, and tested again; deliverables are written, presentations are updated and rehearsed. A busy time for insiders, but how useful is this process for anyone else?

The review will demonstrate all three use cases: smart cities, smart boats, and a smart hub deployed in an airport. It is difficult to get boats into a room – a well-known fashion house recently had a go at it, but they could get away with a half boat; we would need several whole boats. So the boats in the smart boat use case are simulated, typically on laptops, as is the airport and the city from the other use cases. The mF2C project has developed a test environment which would allow us to run a whole IoT environment inside of a single laptop, but that also looks less convincing to the reviewer: how do you know we're not cheating? So a deployment across several laptops is used.

The review is an opportunity to take stock of the existing software. As is best practice in development of larger software projects, the software is split into components which are loosely coupled, that is, they exist as independent components but communicate with each other, usually using web services protocols. Having the software developed as independent components helps developers these components individually, but also promotes reuse of them as they can in general be plucked out of their original context and deployed elsewhere. All that is needed is that components are tested and available, and have their interfaces documented. Getting things ready for the review ensures that all the components are ready at the same time, and will talk to each other. There are twenty-five different components in IT-1.

Moreover, a decision early in the project to deploy components in *containers* – essentially lightweight virtual hosting environments – has paid off. Older software projects would have been content with providing packages to install alongside those of the host operating system, but the process of deploying the component in a container makes the deployment even easier, and adds the benefit that we can control the interfaces available to the container and the resources that are allocated to it – even if it adds more complexity in preparing the software for distribution than the traditional packaging approach. The containerization process can help improve security, if used carefully and correctly, but one has to be careful with the privileges allocated to the container.

A new user with mF2C Agent

Moreover, a decision early in the project to deploy components in *containers* – essentially lightweight virtual hosting environments – has paid off. Older software projects would have been content with providing packages to install alongside those of the host operating system, but the process of deploying the component in a container makes the deployment even easier, and adds the benefit that we can control the interfaces available to the container and the resources that are allocated to it – even if it adds more complexity in preparing the software for distribution than the traditional packaging approach. The containerization process can help improve security, if used carefully and correctly, but one has to be careful with the privileges allocated to the container.

Figure 10 Third Newsletter published in July 2018

The blog entries produced in 2018, which can be also found in http://www.mf2c-project.eu/blog/page/2/, have been:

- "Paving the road for digital transformation" by Lara López from ATOS, on January 2018.
- "Data management challenges in fog-to-cloud systems" by Toni Cortés from BSC, on February 2018.
- "Why is Horizon 2020 Funding Important?" by Louise Merifield from SiXSQ, on March 2018.

- "The Industry 4.0 revolution and the smart factory" by Antonio Salis from ESA, on April 2018.
- "The Fog of War: Securing and Defending Edge Devices" by Jens Jensen from STFC, on May 2018.
- "Emergency Situation Management in Smart Cities: Case study" by Denis Guilhot from WoS, on June 2018.
- "How much fog computing capacity is there in a real smart city, such as Barcelona?" by Jordi García from UPC, on July 2018.
- "Engineering the Future: from learning to reality" by Giuliana Carullo from INTEL, on August 2018.
- "Communication challenges in fog-to-cloud computing" by Jasenka Dizdarevic from TUBS, on September 2018.
- "A Gap Between Cloud-IoT providers and mF2C" by Sašo Stanovnik from XLAB, on October 2018.
- "mF2C: deploying on Kubernetes" by Roi Sucasas Font from ATOS, on November 2018.
- "Programming applications in fog-to-cloud platforms, the mF2C solution" by Daniele Lezzi from BSC, on December 2018.

For the third year of the project, Table 22 shows the scheduled blog entries.

Date	Partner
January 2019	"Cloud and Edge are part of the same Continuum" by SISXQ
February 2019	"FaaS (Function-as-a-Service) and serverless computing" by ESA
March 2019	STFC
April 2019	WoS
May 19	UPC
June 2019	Intel
July 2019	TUBS
August 2019	XLAB
September 2019	ATOS
October 2019	BSC
November 2019	SISXQ
December 2019	ESA

Table 22. Planned blog entries for 2019

2.2 Dissemination through Open Source

2.2.1 Open Source License

At the beginning of the project, and to ensure the industrial sustainability of the project results, a non-commercial limiting in nature and weak copyleft model (similar to Apache, BSD, or Eclipse Public licenses) was discussed by all partners, which has been also applied during the second year of the

project. Most background IP solutions being imported into the project are actually using the Apache 2.0 licence. A GitHub repository was created at the beginning of the project and it has been continuously updated during the second year. This will drive interest in the project with potentially repeat visitors viewing the project's code repository. It is intended that the project's software releases will be hosted in this repository (now directly connected to the mF2C website), including documentation, generating interest in the project.

2.2.2 Open Source Modules

The common source code repository is hosted on GitHub (https://github.com/mF2C). The project consortium intends to publish several open-source releases throughout the lifespan of the project that will include full source code, usage, installation, and developer documentation. During the first year, we published 11 code releases, and during the second year 10 more, having a total of 21:

CIMI → NEW

Contains the code of the CIMI server for mF2C that is responsible of providing the interface between the different modules in an agent, as well as between agents.

mF2C

Contains the whole code of the agent, which is the code deploying the mF2C system in any device. It contains all the modules and libraries that will be used to in the mF2C Platform Manager and Agent Controller.

mF2C Documentation →NEW

This documentation includes both the developer and user guide for the mF2C System developed in https://github.com/mF2C. Single point of information for all the platform. Contains a user and developer guides.

DataClay

Contains the code for the next generation object store enabling programmers to store objects using the same model as their application.

LifecycleManagement

Contains the code of the Lifecycle Management, which is responsible for managing the lifecycle of the applications to be executed by the mF2C infrastructure. This includes the initialization, the submission and the termination of these applications, among other operations.

Service Management

This module contains the Service Categorization and QoS providing blocks.

User Management

Will store the code for the User Management module, a component of the Platform Manager.

Landscaper

Contains the code for the Landscaper module that is responsible for constructing a graph model describing a computing infrastructure.

Analytics_engine → NEW

Contains the code of the Analytics Engine, which is a framework designed to support data analysis of services deployed in a fog/edge environment. Telemetry and infrastructure topology are used as enablers of different (and flexible) analysis tasks, models and knowledge base construction. It also includes the Landscaper module.

uc3-compss-dataclay-demo → NEW

Contains a helloworld code example (service to be executed in the mF2C system), which goal of this hello world demo application is to drive developers on how they can use COMPSs together with dataClay, which are the most basic tools of mF2C applications.

secLib-java → NEW

Contains a java implementation of the security library. mF2C infrastructure components and mF2C client applications can use this security library to secure the exchange of control and data messages using popular communication protocols such as MQTT, HTTP and BLE, etc. The application also provides utilities for encrypting and tagging data to facilitate compliance with general data protection regulations.

COMPSs

Contains the code for distributed runtime system, COMPSs, which is a programming model which aims to ease the development of applications for distributed infrastructures, such as Clusters, Grids and Clouds.

Resource Management → NEW

Repository with the modules of the Resource Management Block (Discovery, Identification, Resource Categorization, Policies, CAU and CAU leader) inside the Agent Controller, developed by the members of the project from the UPC team**.**

cau-client → NEW

contains the code of the CAU client, which obtains agent certificate via regional CAU, perform TLS handshake with leader CAU and trigger the categorisation block to start the agent categorisation process.

SLA Management

Contains the code for the Service Level Agreement manager, a key module of the Platform Manager; which is currently a lightweight implementation of SLA management, inspired by the WS-Agreement standard.

Telemetry-Monitoring → NEW

Contains the code of the Telemetry and Monitoring. The two main modules of the Telemetry Monitoring are the Distributed Query Engine which is used to query the telemetry probes on the mF2C nodes and the Analytics engine which is used to analyze service performance. Currently, an update version of this block is included in the Analytics Engine.

COMPSs-Test→ NEW

Contains the code of the test application for the COMPSs runtime.

mF2C-UC2-prototype → NEW

Contains the UC2 Smart Boat (Hello world) code prototype, consisting on a simple java pseudo-code to be discussed.

SecLib → NEW

Contains the mF2C security wrapper, currently replaced by content in secLib-java.

Emmy:

A library for sigma protocols and zero-knowledge proofs

E2EE Server

This is a server for storage of files which are encrypted by the E2EE client. It provides REST API for user accounts, data storage, and sharing information between users.

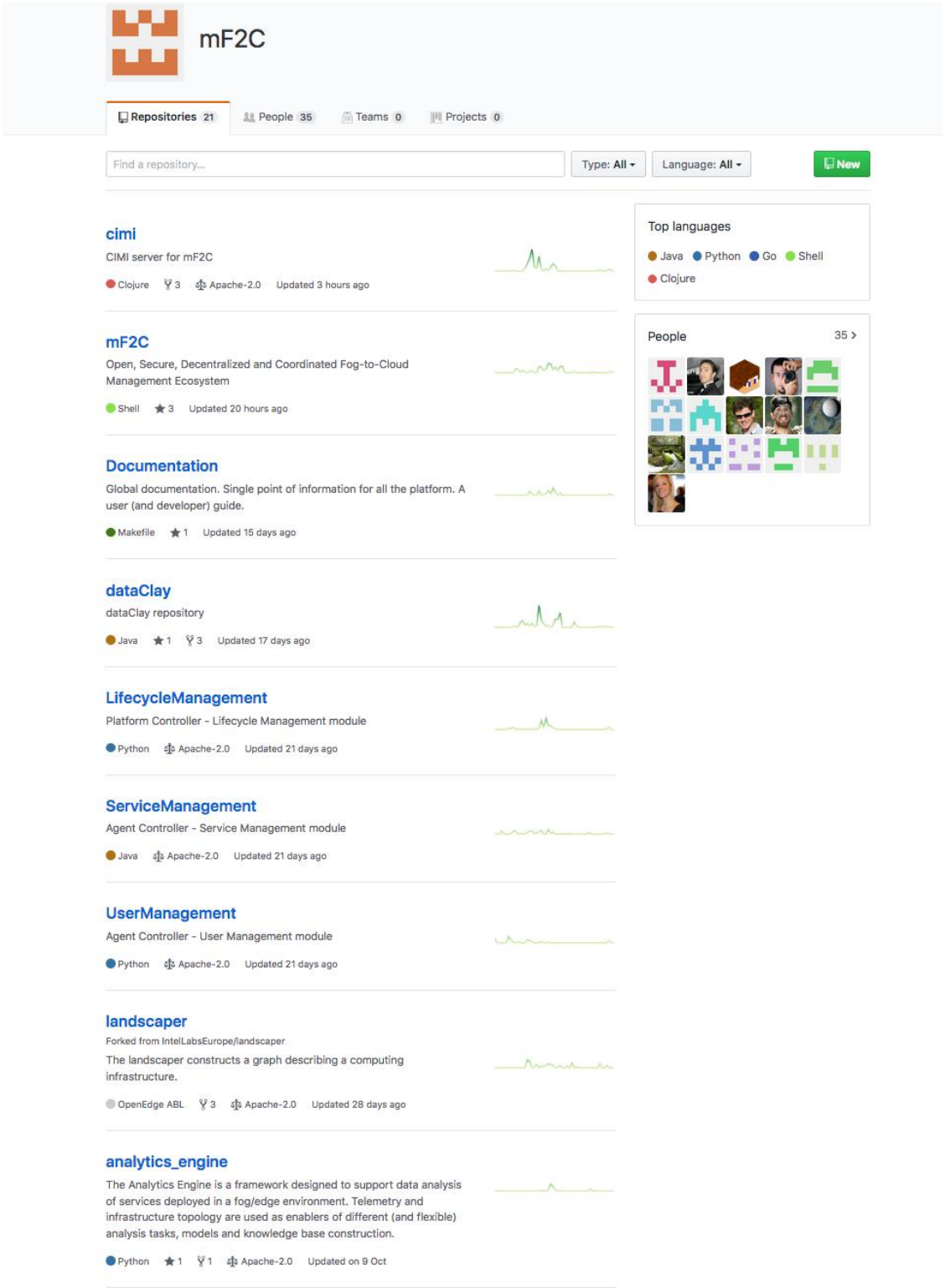


Figure 11 mF2C presence on Github

2.2.3 Development Strategy

The project consortium decided to adopt a development strategy based on standard techniques and approaches best suited for the development of early prototype technologies. For this second iteration of the project, we have continued with this strategy with a minor update which is the adoption of an SCRUM methodology. Key components of this approach include:

- *Re-use of open source software:* The re-use and adoption of existing open source software will be attempted as much as possible, making sure that time is not unnecessarily spent re-implementing components that are already available and so that the development activities can be more focused on the implementation of the innovative features of the platform.
- *Continuous integration and testing:* A central source repository hosted on github.com, has been established. As the amount of code developed increases, a central build/integration/testing infrastructure may be established. This will allow for nightly builds running the latest code merges, executing a series of unit, component, integration and performance tests, and a monitoring and notification facility to keep all development teams up to date on status, failures and issues.
- *Release often:* The open source code and distribution releases for the project developers, external end users and developers.

The mechanisms of collaboration we adopted at the beginning of the project, and still being used for IT-2, were instant messaging, email, conference calls, and collaboration tools such as Slack for shared workspace environment (http://mf2c.slack.com) and Waffle (https://waffle.io/mF2C/mF2C), an automated project management tool for GitHub issues and pull requests https://github.com/mF2C.

In addition to these general communication tools, as code matures, and to ensure the longevity of the results after the project finishes, all finalised designs, developer docs and the integration articles will be available on mf2c.ReadTheDocs.com.

Our initial proposed development strategy for the first year was based upon the branching features of Git. In addition to this strategy and in order of being more reactive and detect possible sources of risks, for the second iteration of the project we enhanced the strategy of development and now we are using the SCRUM Agile methodology, based on 2 weeks' sprints. For applying this new methodology, software modules have been grouped into functional blocks and product owners have been assigned to these, as can be seen in Table 23. The product owners must join the developers call at least every 2 weeks (for the sprint release) to report about the development of the sprint and plan the next sprint.

Functional Block	Product owner
Service Orchestration	Roi (ATOS)
Distributed Execution Runtime	Francesc (BSC)
Telemetry Monitoring	Alec (INTEL)
Resource Manager	Eva (UPC)
Service Manager	Fran (TUBS)
User Manager	Roi (ATOS)
Security	Jens (STFC)
Data Management	Anna (BSC)
Interface	Cristovao (SIXSQ)
Micro-agent	Cristovao (SIXSQ)

Table 23. Product owners for IT-2

3 Standardisation Activities

As introduced in Deliverable D6.2 [2], the initial version of this document, the mF2C project is helping to design and build a framework where mobile, wireless devices can discover each other, interconnect, share resources and manage services appropriately and securely. All of these processes will require shared understandings and agreed interfaces. Formal standards have a critical role to play in enabling this future.

While tackling the challenge of interoperability, standards also have the potential to enhance security, and encourage innovation. Given the rapid advancements of technologies in this space, standards should also be designed with an eye to the future. Extensibility and forward compatibility should be considered to maximise value and opportunity going forward.

mF2C is continuing to monitor standards initiatives across a variety of communities, by industry, and at regional and international levels, and contribute where appropriate. Some of these initiatives are introduced below.

3.1 OpenFog Consortium

The OpenFog Consortium [64] is continuing its pursuit of providing a cross-industry perspective on Fog computing. It has recently formally documented Security Approaches and Requirements, to which the mF2C project has specifically responded. It has also updated its Glossary of Fog Computing Terms.

In August 2018, the OpenFog Consortium reached a milestone with their collaboration with the IEEE [65]. The IEEE published IEEE 1394, the IEEE standard for Adoption of OpenFog Reference Architecture for Fog Computing. The new standard is "*is intended to address the need for an end-to-end, interoperable solution that is positioned along the things-to-cloud continuum. The new standard supports multiple industry verticals and application domains and is designed to enable services and applications to be distributed closer to the data-producing sources and/or the information-consuming users"* [66].

mF2C continues to monitor the OpenFog Consortium and will continue to reflect OpenFog Consortium standards in the mF2C architecture, responding and contributing to OpenFog Consortium initiatives as appropriate.

3.2 AIOTI

The Alliance for the Internet of Things Innovation [33] was launched in March 2015 by the European Commission and Internet of Things stakeholders. Today, the Alliance is an European Association based in Brussels. The overall goal of this initiative was the creation of a dynamic European IoT ecosystem to unleash the potential of IoT. This ecosystem, built on the work of the IoT Research Cluster, encourages innovation across industries and business sectors of IoT, by transforming ideas into solutions and business models.

There are thirteen Working Groups (four horizontal and nine vertical groups), that deal with the main pillars of the IoT ecosystem:

Horizontal:

- WG01 – IoT Research
- WG02 – Innovation Ecosystems
- WG03 – IoT Standardization
- WG04 – IoT Policy
- (SME interests)
- (Blockchain work stream)

Vertical:

- WG05 – Smart Living Environment for Ageing Well
- WG06 – Smart Farming and Food Security
- WG07 – Wearables
- WG08 – Smart Cities
- WG09 – Smart Mobility
- WG10 – Smart Water Management
- WG11 – Smart Manufacturing
- WG12 – Smart Energy
- WG13 – Smart Buildings and Architecture

In this scenario, ATOS and Engineering, as founding member in the consortium, continued their support to AIOTI working groups. On WG08 on Smart Cities a meeting has been planned for the coming year.

3.3 NIST IoT-Enabled Smart City Framework

A list of major standardization entities, led by NIST and including ANSI, ETSI, TIA, USGBC, KETI, ENEA, FIWARE foundation, is working on IoT-enabled smart city framework, with the aim to identify and reduce blocking factors to effective and powerful smart city solutions. NIST and its partners convened an international public working group to compare and distil from these architectural efforts and city stakeholders a consensus framework of common architectural features to enable smart city solutions that meet the needs of modern communities. NIST and its partners just released the first version of the IoT-Enabled SmartCity Framework ("IES-City Framework") for use by smart city stakeholders worldwide. The Framework was developed by dozens of participants from around the world who are seeking methods of convergence and harmonization for smart city deployments.

3.4 Open Connectivity Foundation

The OCF [67] is continuing to drive the specification of standards to enable connected devices to communicate with each other. Of particular interest to mF2C, it has now created an extensive and growing reference set of models to enable the discovery and control of arbitrary devices. These models include definitions of the interfaces to these devices, and are published at http://oneiota.org/.

3.5 Open Grid Forum

mF2C continues to monitor the Open Grid Forum [68] and its Open Cloud Computing Interface working group in particular. The OCCI working group has been relatively inactive in the last 12 months. The possibility of mF2C developing an OCCI extension explicitly to support management of fog deployments still exists but will not be prioritised if the standard appears relatively dormant.

3.6 ETSI

The European Telecommunications Standards Institute [69] continues to be very active in numerous areas of interest to mF2C. As well as a suite of standards that enable 5G, ETSI also has a Multi-Access Edge Computing (MEC) Industry Specification Group [70] which is relevant to mF2C. ETSI-MEC is developing a suite of standards [69] to enable cloud-computing and an IT service network at the edge of the network. As these standards mature, member partners including INTEL will contribute insights from mF2C where appropriate to ensure that scenarios the consortium is envisaging can be realised.

3.7 ISO/IEC JTC1

ISO/IEC JTC1 continues to be the body responsible for defining standards at a formal international level. It continues to refine its set of working groups and sub-committees, and INTEL continue to

monitor the organisation for developments of relevance to mF2C. Since D6.2 [2] INTEL's Phil Wennblom has assumed the role of chairperson of JTC1.

3.7.1 ISO/IEC JTC1 SC38 - Cloud Computing and Distributed Platforms

Although focusing on centralised cloud systems in the past, SC38 is now pursuing a broader work programme with explicit references to Edge Computing in particular. Work Group three dedicated to Cloud Computing Fundamentals has completed development of several relevant standards and is working on a number of relevant technical reports.

Recently published standards include the following:

- ISO / IEC 19086-3:2017 - Service Level Agreement Framework - Part 3: Core conformance requirements
- ISO / IEC 19941:2017 - Interoperability and Portability
- SO / IEC 19944:2017 - Cloud services and devices: Data flow, Data categories and data use

The following standards and technical reports are in development:

- ISO / IEC AWI TS 23167 - Common Technologies and Techniques
- ISO / IEC PDTR 23186 - Framework of trust for processing multi-sourced data
- ISO / IEC NP TR 23187 - Interacting with Cloud Service Partners (CSNs)
- ISO / IEC NP TR 23188 - Edge Computing Landscape

As mentioned in previous deliverables, the standards authored by ISO / IEC JTC1 SC38 are generally high-level and descriptive in nature. Technical specifications of APIs are typically developed by Industry Groups. Various insights and perspectives from mF2C are being fed into the discussions and national body contributions (e.g. to TR23188) via the Irish mirror committee to SC38.

3.7.2 ISO/IEC JTC1 WG10 Internet of Things

This working group of JTC1 was disbanded during the year, with responsibilities for international IoT standards development moving to the new sub-committee SC41.

3.7.3 ISO/IEC JTC1 SC41 - Internet of Things and related technologies

This sub-committee has recently been inaugurated and to date has published two documents of relevance to mF2C:

- ISO/IEC TR 22417:2017 - Internet of Things Use Cases
- ISO/IEC 30141:2018 - Reference Architecture

It is working on a suite of relevant standards including:

- ISO/IEC CD 20924 - Definition and Vocabulary
- ISO/IEC AWI 21823-1 Interoperability for Internet of Things - Part 1: Framework
- ISO/IEC NP 30147 - Methodology for trustworthiness of IoT system/service

Agreement has also been reached between SC41 and SC38 for standards related to Edge computing to be developed in cooperation with each other.

3.8 DMTF

The Distributed Management Taskforce [71] continues to actively develop standards of relevance to mF2C. In particular the CIMI standard employed by the consortium continues to be updated with version 2.51.0 of the schema published in June 2018.

DMTF is also responsible for the RedFish standard. This is currently targeted at management of equipment within a data-centre. mF2C will continue to monitor the standard should its scope expand to include management interfaces to distributed (and potentially mobile) infrastructure.

3.9 OASIS

XLAB continue its participation in TOSCA (Topology and Orchestration Specification for Cloud Applications), and in a variety of OASIS Security and Privacy Technical Committees. They will engage with the broader mF2C consortium should activities of relevance to the consortium arise.

3.10 IETF

STFC team members are monitoring IETF activities, focusing in particular on standards associated with security. These standards are being woven into the mF2C solution where appropriate. Regarding possible contributions to standards, opportunities for developing delegation, particularly in non-web scenarios, are currently being explored.

4 Conclusions

This deliverable reported all the dissemination and standardization activities carried during the second year of the project. During this reporting period, the project consortium focused on ensuring continued awareness of the mF2C project results, research and potential outcomes through its dissemination and standardization plans. This was originally documented in the deliverable *D6.1 Dissemination strategy and Plan* in m06 and then extended in the first year report *D6.2 mF2C annual report on dissemination and standardization (Year 1)* [2]. The consortium continues to implement these activities which will continue onto the final year of the project.

The dissemination activities performed during the second year included sharing information about the project's goals, the plans and what the potential results will be with other related projects. We have been collaborating with these projects, setting the expectation of sharing each other's results and feedback between projects. We have organized and participated in shared workshops and events organized by these related projects. As new results become available, we will ensure we share with these projects our prototype releases, code, papers, etc. Consortium members wrote several scientific papers this year which were published, including some which are still under review for 2019. This keeps the project on track to achieve a key performance indicator set in the planning deliverable (D6.1 [1]) tracking scientific, general publications, and participation in events and conferences. The project will continue to achieve these goals in the final year of the project.

Standardization activities have been performed during the second year, mainly tracking and documenting the relevant working groups and bodies relevant to the project, including fog, cloud, and IoT, etc. The consortium will continue to monitor standards initiatives across a variety of communities, by industry, and at regional and international levels. The capabilities of the mF2C framework (discover, interconnect, share, manage, etc.) require shared understandings and agreed interfaces, so formal standards have a critical role to play to enable these functionalities. Our plans for the future include potentially participating in the evolution of some of these standards to advocate the results of some of the mF2C innovations.

A final version of this report is due in month 36 at the end of the project where we will provide an updated report on our results, metrics, and progress against our key performance indicators.

References

[1] mF2C Consortium, "D6.1 Dissemination Strategy and Plan," [Online]. Available: http://www.mf2c-project.eu/wp-content/uploads/2017/06/mF2C D6.1 Dissemination strategy and plan.pdf.

[2] mF2C Consortium, "D6.2.1 mF2C annual report on dissemination and standardization (Year 1)," [Online]. Available: http://www.mf2c-project.eu/wp-content/uploads/2017/12/D6.2-mF2C-annual-report-on-dissemination-and-standardization-Year-1.pdf.

[3] Cloudwatch Consortium, "Cloudwatch project website," [Online]. Available: http://www.cloudwatchhub.eu/.

[4] Recap Consortium, "Recap Project website," [Online]. Available: https://recap-project.eu/.

[5] CIPSEC Consortium, "CIPSEC Project Website," [Online]. Available: https://www.cipsec.eu/.

[6] ReCRED Consortium, "ReCRED Project Website," [Online]. Available: https://www.recred.eu/.

[7] CIoT Consortium, "CIOT Conference webpage," [Online]. Available: http://www.wikicfp.com/cfp/servlet/event.showcfp?eventid=63269&copyownerid=98233.

[8] mF2C Consortium, "European Cluster Report," [Online]. Available: http://www.mf2c-project.eu/mf2c-partecipation-to-the-european-cluster-workshop-in-athens-on-31-january-2018/.

[9] Future Cloud Cluster, "Future Cloud Cluster | Clusters of European Projects on Cloud," [Online]. Available: https://eucloudclusters.wordpress.com/future-cloud/.

[10] "European Conference on Parallel and Distributed Computing 2018," [Online]. Available: https://europar2018.org/.

[11] "IEEE/ACM SuperComputing Conference 2018," [Online]. Available: https://sc18.supercomputing.org/.

[12] IEEE MIPRO, "IEEE MIPRO Conference website," [Online]. Available: www.mipro.hr/.

[13] "IEEE Future Technologies Conference 2018," [Online]. Available: http://saiconference.com/FTC.

[14] IEEE PIMRC, "IEEE PIMRC Conference," [Online]. Available: pimrc2018.ieee-pimrc.org/.

[15] IEEE WIMOB, "IEEE WiMob Conference Cyprus," [Online]. Available: http://www.wimob.org/.

[16] FIoT Cloud, "Future Internet of Things and Cloud 2018," [Online]. Available: http://www.wikicfp.com/cfp/servlet/event.showcfp?eventid=70270.

[17] IEEE SaCoNeT, "SaCoNeT 2018 EL Oued- Algeria," [Online]. Available: https://saconet.tincnet.fr/.

[18] "SmartObjects 2018 Conference," [Online]. Available: http://www.grc.upv.es/smartobjects2018/.

[19] EU CNC, "EU CNC conference, Slovenia," [Online]. Available: https://www.eucnc.eu/.

[20] IoT-SoS, "IoT-SoS 2018," [Online]. Available: www2.ing.unipi.it/iot-sos2018/.

[21] IEEE CloudBus, "The 2nd IEEE International Conference on Fog and Edge Computing," [Online]. Available: www.cloudbus.org/fog/icfec2018/.

[22] IEEE Mobile Cloud, "IEEE Mobile Cloud 2019," [Online]. Available: http://www.mobile-cloud.net/.

[23] CIoT 2018, "CIoT'18 2018 : 3rd Cloudification of the Internet of Things," [Online]. Available: http://www.wikicfp.com/cfp/servlet/event.showcfp?eventid=63269&copyownerid=98233.

[24] "CIUK 2018, Manchester," [Online]. Available: https://www.scd.stfc.ac.uk/Pages/CIUK2018.aspx.

[25] "DG CONNECT ICT 2018," [Online]. Available: https://ec.europa.eu/digital-single-market/en/events/ict-2018-imagine-digital-connect-europe.

[26] "IEEE/ACM Utility and Cloud Computing Conference," [Online]. Available: http://ucc-conference.org/.

[27] "IFIP Networking 2019 Conference," [Online]. Available: https://networking.ifip.org/2019/.

[28] "International Conference on Ubiquitous and Future Networks," [Online]. Available: http://icufn.org/.

[29] "IEEE/ACIS 18th International Conference on Computer and Information Science," [Online]. Available: https://www.aconf.org/conf_166341.html.

[30] "International Conference on Information Fusion," [Online]. Available: http://www.fusion2019.org.

[31] "International Conference on Software Engineering, Artificial Intelligence, Networking," [Online]. Available: www.acisinternational.org/snpd2019/.

[32] "EU NetFutures," [Online]. Available: https://netfuturesconference.eu/.

[33] "The Alliance for Internet of Things Innovation," [Online]. Available: https://www.aioti.eu/.

[34] "AIOTI Meeting," [Online]. Available: https://aioti.eu/wp-content/uploads/2018/11/Bertoncini-Massimo-eDREAM-Brussels-22-october-2018-final-v2.pdf.

[35] "NIST Smart Cities Architecture," [Online]. Available: https://pages.nist.gov/smartcitiesarchitecture/.

[36] "NSAI SC02 SC11 Cloud Computing," [Online]. Available: https://www.iso.org/committee/601355.html.

[37] "NSAI TC02 SC17 IoT," [Online]. Available: https://www.iso.org/committee/6483279.html.

[38] "AIOTI Workshop on Open Marketplaces," [Online]. Available: https://aioti.eu/open-marketplaces-to-spur-innovative-energy-services-22-october-brussels/.

[39] "Smart Agrifood Summit 2018," [Online]. Available: https://smartagrifoodsummit.com/.

[40] "NESSI Europe," [Online]. Available: http://www.nessi-europe.com/default.aspx?page=home.

[41] "Big Data Value Association," [Online]. Available: http://www.bdva.eu/.

[42] "Mobile World Congress," [Online]. Available: https://www.mwcbarcelona.com/.

[43] "Smart City Expo World Congress," [Online]. Available: http://www.smartcityexpo.com/.

[44] "IP Expo Excel Europe," [Online]. Available: https://ipexpoeurope.com/.

[45] "Field Service Amsterdam 2018," [Online]. Available: https://fieldserviceeu.wbresearch.com/presentations.

[46] "WSO2Con Europe," [Online]. Available: https://eu18.wso2con.com/.

[47] "Reinventing the world," [Online]. Available: https://ntpark.rs/en/2018/09/06/reinventing-the-world-the-power-of-industry-4-0-2/.

[48] "Smart City Day," [Online]. Available: https://www.hes-so.ch/fr/smart-city-11755.html.

[49] "HPE Discover and Partner Summit, Las Vegas," [Online]. Available: https://www.hpe.com/events/discover/gps.

[50] "HPE Discover and Partner Summit Madrid," [Online]. Available: https://www.hpe.com/events/discover/.

[51] "IoT week 2019, in Aarhus, DK," [Online]. Available: https://www.theinternetofthings.eu/2019-global-iot-summit-giots-17-21-june-2019-aarhus-denmark.

[52] SixSq, "Slipstream source code," [Online]. Available: https://github.com/slipstream.

[53] "FIWARE Global Summit 2018, Malaga," [Online]. Available: https://www.fiware.org/event/fiware-global-summit-malaga/.

[54] "FIWARE IoT workshop," [Online]. Available: https://www.fiware.org/2018/10/29/iot-workshop-in-montevideo-uruguay-to-enlarge-the-global-fiware-ecosystem/.

[55] "Proceedings of SmartObjects 2018," [Online]. Available: https://dl.acm.org/citation.cfm?id=3213299.

[56] X. M. e. al, "Future Generation Computer Systems | Vol 72, Pages 1-352," [Online]. Available: https://www.sciencedirect.com/journal/future-generation-computer-systems/vol/72.

[57] "International Conference on Fog and Edge Computing," [Online]. Available: http://www.cloudbus.org/fog/icfec2019/.

[58] International multiconference Information Society , "IS2018 | International multiconference Information Society," [Online]. Available: https://is.ijs.si/.

[59] V. B. e. al, "Future Generation Computer Systems | Vol 87, Pages 1-920 (October ...," [Online]. Available: https://www.sciencedirect.com/journal/future-generation-computer-systems/vol/87.

[60] "IEEE International Conference on Communications," [Online]. Available: https://icc2019.ieee-icc.org/.

[61] "International Conference on Fog and Mobile Edge Computing," [Online]. Available: http://emergingtechnet.org/FMEC2019/.

[62] "H2020 Uniserver Project," [Online]. Available: http://www.uniserver2020.eu/.

[63] m. consortium, "Towards an Open, Secure, Decentralized and Coordinated Fog - to - Cloud Management Ecosystem (mF2C)," [Online]. Available: http://www.mf2c-project.eu/wp-content/uploads/2018/02/Whitepaper_F2C_v2.pdf .

[64] "The OpenFog Consortium," [Online]. Available: https://www.openfogconsortium.org/.

[65] IEEE, "Openfog reference architecture adopted as official standard," Aug 2018. [Online]. Available: https://www.openfogconsortium.org/news/ieee-adopts-openfog-reference-architecture-as-official-standard-for-fog-computing/.

[66] IEEE, "EEE Standard for Adoption of OpenFog Reference Architecture for Fog Computing," [Online]. Available: https://standards.ieee.org/standard/1934-2018.html.

[67] "Open Connectivity Foundation," [Online]. Available: https://openconnectivity.org/.

[68] O. G. Forum. [Online]. Available: https://www.ogf.org/ogf/doku.php.

[69] ETSI. [Online]. Available: https://www.etsi.org/.

[70] ETSI, "Multi-access Edge Computing," 2018. [Online]. Available: https://www.etsi.org/technologies-clusters/technologies/multi-access-edge-computing.

[71] D. M. T. F. (DMTF). [Online]. Available: https://www.dmtf.org/.