Small cEllS coordinAtion for Multi-tenancy and Edge services

Grant Agreement No.671596

Topic: H2020-2014-ICT-14
Advanced 5G Network Infrastructure for the Future Internet
Research and Innovation Action

Deliverable D8.2
Data Management Plan

Document Number:	H2020-5GPPP-GA No.671596/*WP8/D8.2/11.01.2016*
Contractual Date of Delivery:	*01.01.2016*
Editor:	Ioannis Chochliouros - Hellenic Telecommunications Organization S.A. (OTE)
Work-package:	*WP8*
Distribution / Type:	Public (PU) / Report
Version:	1.0
Total Number of Pages:	43
File:	*SESAME_Deliverable 8.2_v1.0_Final*

Abstract

The purpose of this Deliverable (D8.2) is to discuss issues and various perspectives for a SESAME-based Data Management Plan (DMP), conformant to the specific requirements that have been identified by the wider H2020 research framework and, within the intended SESAME's explicit inclusion in the Commission's *Pilot on Open Research Data.* The purpose of the DMP is to describe the main elements attributes of the data management policy that is to be used by SESAME, with regard to all the datasets to be generated by this Project. DMP will so describe the format and the way to store, archive and share the data created within the Project as well as the use of the plan itself by the SESAME participants. The data may include, but not limited to, code, publications as well as measured data, for example, from field experiments. The Plan is a living document whose content concerning the data management is updated from its creation (month 6 of the Project) to the end of the Project (month 30). Our approach remains within the context of the existing European strategic framework serving H2020.
Effective research data management is an important and valuable component of the responsible conduct of research. This document provides a DMP, which describes how data will be collected, organised, managed, stored, secured, backuped, preserved, and where applicable, shared.

Executive Summary

The purpose of this Deliverable (D8.2) is to discuss issues and various perspectives for a SESAME-*based* Data Management Plan (DMP), conformant to the specific requirements that have been identified by the wider H2020 research framework and, within the intended SESAME's explicit inclusion in the Commission's *Pilot on Open Research Data.*

In *Section 1* of the present Deliverable, we first introduce the core context and some brief -but quite fundamental- features of the SESAME Project as well as the perspective for properly developing data management, for all SESAME-*specific* information.

Section 2 discusses a wider context upon Project Management activities and/or structure(s) affecting the proper execution of the scheduled SESAME processes. Although it is implicitly relevant to the present deliverable, this section presents the internal governing structures that finally lead to the creation of data -or other kind of information- coming directly from the Project.
It also elucidates internal procedures (such as internal information flows) that may occasionally affect the proper handling of SESAME-based outcome(s), being conformant to the provisions of the Grant Agreement (GA) and the Consortium Agreement (CA).

The subsequent *Section 3* deals with several fundamental aspects about knowledge management and protection strategy within the Project. There, we discuss the applied context for a proper management of knowledge, around the corresponding web portal which is the core of the information exchange internally as well as with any third party (i.e.: legal entity, physical person, authority, etc.). In this section we also discuss the critical aspect of IPR management for a successful realization of the Project.

Section 4 has been dedicated to an extensive and detailed discussion about the Open Access (OA) policy, as promoted and supported by the European Commission, *in particular within the wider H2020 framework*. OA-*based* policies aim to provide readers with access to peer-reviewed scientific publications and research data free of charge as early as possible in the dissemination process, and enable the use and re-use of scientific research results. Such policies should be implemented taking into account the challenge of intellectual property rights.
Policies on open access to scientific research results should apply to all research that receives public funds. Such policies are expected to improve conditions for conducting research by reducing duplication of efforts and by minimising the time spent searching for information and accessing it.
This will speed up scientific progress and make it easier to cooperate across and beyond the EU. Such policies will also respond to calls within the scientific community for greater access to scientific information. OA is a framework that has been accepted by the SESAME project and this also affects the proper structuring of a Data Management Plan (DMP), as discussed in the next section.

Section 5 discusses the essential "core" of the present deliverable and it is about the proper structuring and development of a DMP to serve SESAME within the actual European Community's strategic framework for such purpose. The European Commission has early recognised that research data is as important as publications and has so promoted open access to research data, with the pure aim of serving dispersion and dissemination of knowledge coming from related innovative projects.
This will boost Europe's innovation capacity and give researchers, experts and/or even the citizens, faster access to the benefits of scientific discoveries. The actual *Pilot on Open Research Data in Horizon 2020* aims to improve and maximise access to and re-use of research data generated by projects for the benefit of society and the economy. In this section we also discuss *"how a DMP is structured"* based upon the wider international literature concept, and we further emphasize upon the guidelines and/or requirements proposed by H2020. Then we provide a SESAME-*specific* DMP approach, just to apply the previous context to our Project framework. Alternatively, that part of section -*or even the entire Section 5*- could be the only context of the present deliverable as it is the part of the work that related directly to any DMP requirements.
However, with the aim of properly explaining the underlying European policies requiring the creation and the adoption of a DMP, as well as with the aim of potentially widening -somehow- the approach in order to

elucidate options that may be important for further SESAME progress, we have presented a more analytic discussion, also supported by most of the present bibliographical references in the corresponding area.

Section 6 includes several bibliographic references for further reading.

Version History

Version	Date	Comments, Changes, Status	Authors, contributors, reviewers
0.1	01.11.2015	First Draft	Ioannis Chochliouros, Evangelos Sfakianakis, Maria Belesioti, George Diakonikolaou - OTE
0.2	10.11.2015	Second Draft	Ioannis Chochliouros - OTE
0.3	15.11.2015	Third Draft	Ioannis Chochliouros, Evangelos Sfakianakis, Maria Belesioti, George Diakonikolaou - OTE
0.4	20.11.2015	Fourth Draft	Ioannis Chochliouros - OTE
0.5	30.11.2015	Fifth Draft	Ioannis Chochliouros - OTE
0.6	08.12.2015	Sixth Draft	Ioannis Chochliouros, Evangelos Sfakianakis, Maria Belesioti, George Diakonikolaou - OTE
0.7	15.12.2015	Seventh Draft	Ioannis Chochliouros - OTE
0.8	22.12.2015	Eighth Draft	Ioannis Chochliouros - OTE
0.9	31.12.2015	Ninth Draft	Ioannis Chochliouros - OTE
0.10	07.01.2016	Pre-Final Draft	Ioannis Chochliouros - OTE
1.0	11.01.2016	Final version of the Deliverable	Ioannis Chochliouros - OTE

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Glossary

Acronym	Explanation
4G	4th Generation (of mobile communications)
5G	5th Generation (of mobile communications)
5G-PPP	5th Generation-Public Private Partnership
AB	Advisory Board
APC	Article Processing Charge
ARPU	Average Revenue per user
CA	Consortium Agreement
CC	Cloud Computing
CERN	European Organization for Nuclear Research [Conseil Européenne pour la Recherche Nucléaire]
CESC	Cloud Enabled Small Cell
CTO	Chief Technical Officer
DC	Data Center
DCC	Digital Curation Centre
Diss&Comm	Dissemination and Communication
DMP	Data Management Plan
DoA	Description of Action
DOAR	Directory of Open Access Repositories
DOI, doi	Digital Object Identifier
DoW	Description of Work
EACI	Executive Agency for Competitiveness and Innovation
EC	European Commission
EU	European Union
ERA	European Research Area
ERC	European Research Council
ESA	European Space Agency
ESRC	Economic and Social Research Council
F2F	Face-to-Face
FAQ	Frequently Asked Questions
FP	Framework Programme
FP7	7th Framework Programme
GA	Grant Agreement
GA	General Assembly
H2020	Horizon 2020
HW	Hardware
IA	Innovation Architecture
ICPRS	Inter-university Consortium for Political and Social Research
ICT	Information and Communications Technology
IP	Integrated Project
IP	Intellectual Property
IPR	Intellectual Property Right
ISNAR	International service for National Agricultural Research
IT	Information Technology
JSON	JavaScript Object Notation
KIM	Knowledge and Innovation Manager
KM	Knowledge Management
KPI	Key Performance Indicator
MATLAB	Matrix Laboratory
NFV	Network Function Virtualization

NM	Network Management
NS	Network Service
OA	Open Access
OECD	Organisation for Economic Co-operation and Development
OJ	Official Journal
OpenAIRE	Open Access Infrastructure for Research in Europe
OPNFV	Open Network Function Virtualisation
PB	Project Board
PC	Project Coordinator
PM	Project Management
PM	Project Manager
PMB	Project Management Board
PO	Project Officer
PoC	Proof of Concept
PPR	Periodic Progress Report
PPP	Public Private Partnership
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
QoS	Quality of Service
RCUK	Research Councils UK
RO	Research Organization
ROAR	Registry of Open Access Repositories
RTD	Research and (Technological) Development
SB	Steering Board
SC	Small Cell
SCM	Source Code Management
SDN	Software-Defined Networking
SDO	Standards Developing Organisation
SM	Standardization Manager
SME	Small- and Medium-sized Enterprise
SW	Software
TB	Technology Board
TBD, tbd	To Be Defined
TL	Task Leader
TM	Technical Manager
TSC	Technical Steering Committee
VNF	Virtual Network Function
W3C	World Wide Web Consortium
WP	Work Package
WPL	Work Package Leader
XML	Extensible Markup Language

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1 Introduction

1.1 Preamble

The ***SESAME Project***[1] (***Grant Agreement (GA) No.297291***) *-hereinafter mentioned as the "Project"-* is an active part of the 5G-PPP initiative and targets innovations around three central elements in 5G, as follows:

(i) The placement of network intelligence and applications in the network edge through Network Functions Virtualization (NFV) and Edge Cloud Computing;

(ii) The substantial evolution of the Small Cell concept, already mainstream in 4G but expected to deliver its full potential in the challenging high dense 5G scenarios, *and*;

(iii) The consolidation of multi-tenancy in communications infrastructures, allowing several operators/service providers to engage in new sharing models of both access capacity and edge computing capabilities.

SESAME proposes the Cloud-*Enabled* Small Cell (CESC) concept which is a new multi-operator enabled Small Cell that integrates a virtualized execution platform (i.e., the Light DC (*Data Center*)) for deploying Virtual Network Functions (VNFs), supporting powerful "*self-x*" [2] management and executing novel applications and services inside the access network infrastructure. The Light DC will feature low-power processors and hardware accelerators for time critical operations and will build a high manageable clustered edge computing infrastructure. This approach will allow new stakeholders to dynamically enter the value chain by acting as neutral host providers in high traffic areas where densification of multiple networks is not practical. The optimal management of a CESC deployment is a key challenge of SESAME, for which new orchestration, NFV management, virtualization of management views per tenant, "self-x" features and radio access management techniques will be developed.

After designing, specifying and developing the architecture and all the involved CESC modules, SESAME will culminate with a prototype with all functionalities for proving the concept in relevant use cases. Besides, CESC will be formulated consistently and synergistically with other 5G-PPP components through coordination with the corresponding projects.

1.2 Framework for Data Management

An old tradition and a new technology have been "converged" to realize an exceptional public good. The "old tradition" is the willingness of scientists and scholars to publish -or to make known- the results of their research in scholarly journals without payment, for the sake of inquiry and knowledge and for the promotion of innovation. The new technology is the Internet that has modified our lives in the way we work, we study, we amuse or we perceive the modern digital world. The Internet has fundamentally changed the practical and economic realities of distributing scientific knowledge and cultural heritage. For the first time ever, the Internet now offers the chance to constitute a global and interactive representation of human knowledge, including cultural heritage and the guarantee of worldwide access.

The "public good" they can so make possible is the world-wide electronic distribution of the peer-*reviewed* journal literature, together with a "completely free" and/or unrestricted access to it by all scientists, scholars, teachers, students, and other curious minds. Removing access barriers to this literature will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature *as useful as it can be*, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge.

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[1] In the context of the present *Deliverable D8.2*, the term "Project" refers directly to the specific SESAME Project and its contents. The term "project", *when used*, it refers to any kind of project.

[2] There is a multitude of the so-called *"self-x"* (*or "self-*"*) properties in the international literature. The top most so called CHOP (for Configuration, Healing, Organization and Protection) are extended by the self-explanation and context-awareness. The term usually implicates features of self-organization, self-configuration, self-optimization, self-healing and self-protection. More relevant information for all possible related aspects can be found, *for instance*, at: *https://en.wikipedia.org/wiki/Organic_computing#Self-.2A_properties*.

According to the provisions of the SESAME Grant Agreement (GA)[3], all involved partners "*must implement the Project effort as described in the respective Annex 1 and in compliance with the provisions of the GA and all legal obligations under applicable EU, international and national law".*

Effective research data management is an important and valuable component of the responsible conduct of research. This document provides a data management plan (DMP), which describes how data will be collected, organised, managed, stored, secured, backuped, preserved, and where applicable, shared.
The scope of the present DMP is to make the SESAME data easily discoverable, accessible, assessable and intelligible, useable beyond the original purpose for which it was collected as well as interoperable to specific quality standards.

[3] As predicted in *Article 7.1 ("General obligation to properly implement the Action")* of the GA.

2 Project Management Structure and Procedures

Being a **large contribution Project** of 30-months duration, comprising of **20 partners**[4], and of complexity comparable to traditional large IP projects, the SESAME management structure has been carefully designed based on the coordinator's and partners' experience in running large EC-funded projects, and comprises of a **comprehensive and lightweight management structure.**

The main goal of the management structure, as shown in ***Figure 1*** (below), is to ensure that the Project will reach its objectives, in the scheduled time, and making use of the budgeted resources, while complying with the Commission's regulation and applied procedures.
The well-defined project management (PM) structure ensures a proper level of co-ordination and cooperation amongst the consortium members. Additionally, project management has the following responsibilities: Project administration, project organization, management of the technical progress of the project according to plans, co-ordination with the other EC projects in the 5G-PPP[5] and other interested parties. The Project Coordinator (*OTE*) has already previous experience in managing large European projects that fully qualifies it to lead such an initiative. An intensive horizontal (between WPs) and vertical (between project management and partners) communication and collaboration has been put in place, for the proper and within due time execution of all related actions.
The SESAME-*based* management activities comprise administrative and technical issues, including the legal framework and the organizational structure of the complete Project. Furthermore, a roadmap of meetings and workshops and related activities as well as quality assurance procedures and steering tools are described. The goal of the project management activities is also to "identify and address" potential issues, risks or conflicts emerging across partners, and manage the intellectual property related to both prior knowledge as well as project achievements.

The SESAME partners have significant experience with collaborative projects and have been -or are- already working together with other consortia. All partners have a long-term strategic interest in the field, and most of them have contributed significantly to the R&D topics at the core of the 5G-PPP vision in previous/running projects. Main criteria for the selection of each partners' role were excellence in the field, reliability, experience and commitment, as discussed in more details in the context of the Project's GA.

SESAME consists of eight (-8-) distinct Work Packages, as described in *Section 3.1.2* of the corresponding DoW. A visual representation of the interdependencies between the work packages is given in the Gantt and Pert diagrams, as both appear in *Section 3.1.1* and in *Section 3.1.2* of the DoA, *correspondingly*. The advanced research parts in the Project will be managed by using an agile management, based on decision points and concrete milestones.

In the rest of this Section, we explicitly describe the governance part that identifies the key roles and bodies, the management process, knowledge and innovation management, including the risk assessments.

[4] According to the prepared Request for Amendment where two additional partners are to join SESAME and so to increase to total number of partners-beneficiaries up to twenty.

[5] The 5G Infrastructure Public Private Partnership, in short 5G-PPP, has been initiated by the EU Commission and industry manufacturers, telecommunications operators, service providers, SMEs and researchers. The 5G-PPP will deliver solutions, architectures, technologies and standards for the ubiquitous next generation communication infrastructures of the coming decade. The challenge for the 5G-PPP is to secure Europe's leadership in the particular areas where Europe is strong or where there is potential for creating new markets such as smart cities, e-health, intelligent transport, education or entertainment & media. More information can be found at: *https://5g-ppp.eu/*.

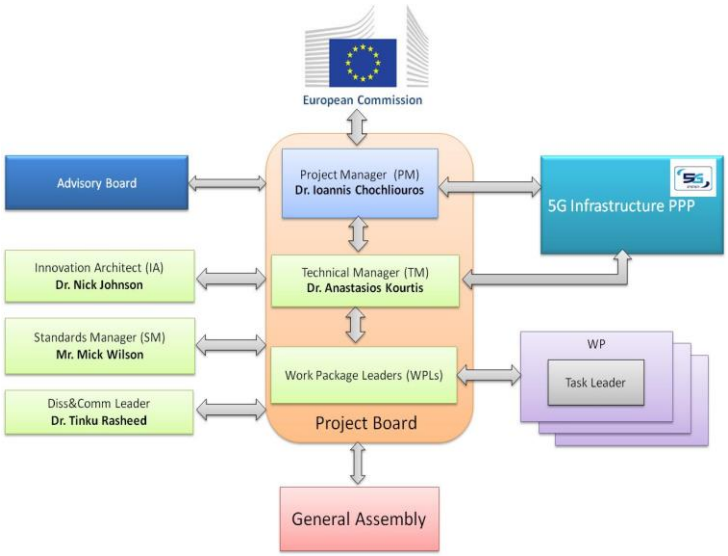

Figure 1: SESAME Management Structure

2.1.1 Management bodies and Organization

The management bodies employed in SESAME comprise persons, committees and other entities that are responsible for making management decisions, implementing management actions, and their interrelation. The management bodies are illustrated in ***Figure 1*** and include:

- PM - Project Manager (Dr. Ioannis Chochliouros, *OTE*, for administrative management);
- TM - Technical and Scientific Manager (Dr. Anastasios Kourtis, *NCSRD*, for technical management);
- IA - Innovation Architect (Dr. Nick Johnson, *IPA*, Knowledge, for innovation & exploitation management);
- SM - Standardization Manager (Mr. Mick Wilson, *FLE*, for standardisation and exploitation management);
- Diss&Comm (Dissemination and Communication) Leader (Dr. Tinku Rasheed, *CNET*, for dissemination and communication management);
- GA - General Assembly (one representative per partner, administrative management);
- PB - Project Board, executive committee acting as decision-implementation body;
- AB - Advisory Board (chaired by PM, for International visibility beyond Europe);
- WPLs - Work Packages Leaders, and;
- TLs - Task Leaders.

Their detailed role and duties are described in the next subsections.

(i) Project Manager (PM)

The Project Manager (PM) for SESAME is Dr. Ioannis Chochliouros, who is a senior manager and department head at OTE. Dr. Chochliouros is leader of *OTE Research Programs* within the *Fixed & Mobile Technology Strategy and Core Network Division,* within *OTE*, since 2005. Dr. Chochliouros who is also exercising the role of the Project Coordinator (PC) has substantial and proven experience in the coordination of both scientific and RTD projects involving many partners and complex research goals and has been involved in decision-making positions in at least 45 (European, national and international) research projects. The main role of the PM is the charge of the overall administrative management of the Project, being the single point of contact with the EC. The PM is responsible for the following tasks *(amongst others tasks as explicitly defined by the EC Grant Agreement and the partner's Consortium Agreement)*: (i) Monitor Project progress on a daily basis, for continuous rating of achievements, objectives, tasks, WPs with global view of the overall Project, ensuring a smooth running of activities and collaboration among all partners, identifying problems and consequences for future research; (ii) Provide the Project Management Plan which describes the project management structure, procedures for communication, documentation, payments and cost statements, procedures to control Project progress and risk management; (iii) Quality procedures and quality assurance (QA); (iv) Coordination between

the EC and the consortium, communicating all information in connection with the Project to the EC; (v) Document transmission to the EC, including all contractual documents and reports related to the administrative, financial, scientific, and technical progress of the Project; (vi) Coordinate and manage the Project's Advisory Board together with the TM; (vii) Participate in the 5G-PPP programme-level Steering Board (SB) as recommended by the 5G-PPP program. In summary, the PC is the legal, contractual, financial and administrative manager of the Project.

(ii) Technical and Scientific Manager (TM)

The Technical and Scientific Manager (TM) for SESAME is Dr. Anastasios Kourtis, Research Director at *NCSRD*. He has more than 30 years of experience in managing and successfully executing research and industrial projects, in particular, at *NCSRD*, he has been an active player from the start of the EC framework programs and most recently within FP7, where he is currently PM of T-NOVA[6] (FP7 ICT) and TM for VITAL[7] (H2020 ICT), CloudSat[8] (ESA) projects. He has a strong background on wireless and wired broadband network infrastructures, multimedia applications, Quality of Service (QoS), network management (NM) and network virtualization. The TM is in charge of the overall scientific and technical management and progress of the Project. He is responsible for the correct execution of the technical activities of the contract, as described in the respective GA. His tasks comprise in particular ensuring timely release, technical high quality and accuracy of technical deliverables. The TM is the "promoter" of the technical achievement of the Project, in association with the PM and the Diss&Comm Manager (i.e., the WP8 Leader), to ensure appropriate Project visibility. He works in close cooperation with the WP leaders and will receive the support of the PM. The TM will also participate in the programme-level Technology Board (TB) established by the 5G-PPP), towards technical planning of joint activities and monitoring the progress against the technical KPIs.

(iii) Innovation Architect (IA)

SESAME has appointed a dedicated Innovation Architect (IA), who will chair the *Knowledge and Innovation Management (KIM) Team* activities in the Project, together with the Standardisation Manager and the Technical Manager. The role of the innovation Architect is to study and analyse both market and technical aspects, and "bridge" the Project research achievements to a successful implementation and deployment in the real world. The Innovation Architect for SESAME will be Dr. Nick Johnson, the CTO of *IPA*. Nick Johnson brings several years of market and mobile-industry experience and background, and has a successful track in productising research and innovation activities and patents, and has the experience and capabilities to recognise (and foster) *"how advanced scientific results can be transformed into products and market opportunities".* Indeed, the Innovation Architect will assist and advise the Project in best responding to emerging market opportunities. In turns, by thoroughly following the evolution of the sector, the new emerging technologies and products from SESAME, and the mutating needs, the Innovation Architect will help bringing all this inside the Project, utilising his position as chair of the KIM activities.

(iv) Standardisation Manager (SM)

SESAME has appointed a dedicated Standardization Manager (SM), who will coordinate the standardisation activities of the Project. SESAME has thus appointed Mr. Mick Wilson, from *FLE*, to undertake the corresponding SM role. The main activity of the SM is to monitor and plan the standardization strategy, together with the Innovation Architect and the Technical and Scientific Manager, and to periodically "monitor and assess" the standardization potential of the scientific results coming from the Project. Mr. Wilson brings several years of experience in Standardization within *Fujitsu Laboratories UK Ltd.*, and has both the knowledge and the ability to quickly "identify" opportunities for standardisation and to match-make between the proper Standards Developing Organisation (SDO) for SESAME-specific innovations. The SM will periodically report to the KIM team about the progress of standardization and open-source development activities within SESAME, which will then be reported to the EC and further, presented to the 5G-PPP *WG on Standardization* with the aim of creating joint opportunities for targeting specific SDO's which need collective strategy from the 5G-PPP board, in order to "push" European interests globally.

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[6] More information about the T-NOVA project can be found at: http://www.t-nova.eu/.
[7] More information about the VITAL project can be found at: http://www.ict-vital.eu/.
[8] More information about the CloudSat projects can be found at: https://artes.esa.int/projects/cloudsat.

(v) Dissemination & Communication Leader (DissComm Leader)

SESAME has appointed a Dissemination & Communication Leader to coordinate the promotional activities and dissemination of the Project. This role will be handled by Dr. Tinku Rasheed, from *CNET*, who is also the WP8 Leader. The *Diss&Comm leader* will be in charge of all the dissemination related priorities in SESAME, and he will also pursue the strategy to have optimum visibility within the 5G-PPP initiative, and beyond, to secure a wide dissemination and awareness of SESAME. The Diss&Comm leader will work closely with the WP8 task leaders, and the PB in order to regularly update and inform about the Diss&Comm activities and will also execute the planned Diss&Comm strategy in a coherent manner together with the PB members.

(vi) General Assembly (GA)

The General Assembly (GA) is the decision-making body of the Project, chaired by the PM and composed of one representative per partner (each having one vote), allowing for the participation of each partner in the collective decisions of the Project. The GA is responsible for the strategic orientation of the Project, that is: overall direction of all activities, reorientation whenever necessary, budget revision and measures taken to manage defaulting partners. To ensure the Project is advancing in time and quality with the work plan, and is adapting as necessary to external changes, the GA will analyse performance indicators and all other relevant information provided by the Project Board and take into account the evolution of the context in which the Project is carried out, notably scientific, legal, societal, and economic aspects, etc. The GA meets twice a year, unless intermediate meetings are in the Project's interest. In this case, GA meetings are held by decision of the PM or by the request of at least 50% of its members. In between meetings, the GA can take decisions by electronic means. The GA tries to reach consensus, but in case this is not possible the GA makes decisions upon simple majority with a deciding vote for the PM representative, *in case of a tie*.

(vii) Project Board (PB)

The Project Board (PB), composed by a reduced number of members, will facilitate the management and monitoring of the Project. It is made up of the WP leaders, and will be chaired by the PM with the assistance of the TM, who will be deputing the PM. Compared to the GA, the PB is "more focused" on the operational management and can have more regular meetings, *when necessary*. It also prepares the decisions to be taken by the GA, ensures that these decisions are properly implemented, and surveys ethical issues. The PB is also in charge of the financial management of the WPs. It is also the responsibility of the PB, as well as of the WPLs, to identify and assess risks and provide contingency plans. The PB is composed of the following people, each of them having both scientific excellence and strong experience in large collaborative research and development projects; Dr. Ioannis Chochliouros (*OTE*, PM, PB Chair, WP1 Leader), Mrs. Maria Belesioti (*OTE*, WP2 Leader), Neil Piercy (*IPA*, WP3 Leader), Antonino Albanese (*ITL*, WP4 Leader), Miguel Anguel Puente (*ATOS*, WP5 Leader), Dr. Eduard Escalona (*i2CAT*, WP6 Leader), Dr. Anastasios Kourtis (*NCSRD*, TM, PB Deputy, WP7 Leader), Dr. Tinku Rasheed (*CNET*, WP8 Leader).
The PB also defines the communication strategy to update partners about the Project status, the planning and all other issues that are important to them, to give maximum transparency to all involved partners and to increase the synergy of the intended cooperation. Interactive management meetings and technical meetings have an important role in the framework of the communication strategy. All information -such as minutes of meetings, task reports and relevant publications- will be communicated to the PM. It is the strategy of the consortium to guarantee a fast and complete flow of information. All partners have the means to communicate by using electronic mail. The PB has bi-weekly meetings (with extra meetings held based on purpose), either by conference call or during Project's face-to-face Plenary Meetings. The PB makes decisions upon simple majority with a deciding vote for the PM representative, *in case of a tie*.

(viii) Advisory Board (AB)

The SESAME consortium will appoint an Advisory Board in order to monitor the SESAME-*related* developments world-wide and ensure visibility of the Project beyond Europe. The consortium plans to invite a maximum of 3-5 members to the AB, which is to be chaired by the PM. The PM and the PB will periodically organise remote conferences with the AB members to update the Project activities and will gather information through semesterial inputs. The AB members will be invited to annual workshops of SESAME and, further, they will be invited to participate to the final Project demos. While preparing the proposal, the SESAME consortium has

already received promising inputs (a few letters of support are already updated in the Annex, Section A2, for the DoA). The AB is composed of the following members: *AT&T* (Dr. Steven Wright); *Samsung* (Dr. Maziar Nekovee); *Fujitsu Japan* (TBD); *ETRI Korea* (Dr. Seung Bang), and; *University of Melbourne, Australia* (Prof. Tansu Alpcan). More stakeholders will be incorporated if the consortium desires to further strengthen its visibility.

(ix) Work Package Leaders (WPLs)

Each work package is led by the WP Leader (WPL), who is responsible for making the day-to-day technical and management decisions that solely affect that WP. The WP leaders' responsibilities include: (i) Leading and coordinating the task activities involved in the WP through the Task Leaders; (ii) Initial quality checking of the WP work and deliverables; (iii) Handling resource/skills balance within the WP subject to agreement of the PB to changes; (iv) Participating in the PB meetings; (v) Highlighting to the PB of potential threats to the technical success of the Project, and; (vi) Reporting progress to the PB and raise amendments, issues and red flags to the TM if needed.

(x) Task Leaders (TLs)

Each Task is led by the Task Leader (TL), who is responsible for the activities performed in his/her task, coordinating the technical work, and making the day-to-day technical decisions that solely affect his/her Task. TLs should report (internally) to the WPL at least once a month on the progress of their task.

2.1.2 Management procedures

Technical and operative decisions will be taken as far as possible informally, and through achieving consensus. The various procedures are designed to ensure that the Project runs smoothly, by ensuring that the goals are clearly defined and understood, the WPs represent a sensible division of the work and comprise the necessary expertise to fulfil the objectives, responsibilities are clearly assigned, and there are transparent lines of communication among the participants. A Consortium Agreement provides explicitly the rules and terms of reference for any issue of legal nature concerning the co-operation among the parties as well as the Intellectual Property Rights (IPR) of individual partners and the consortium "*as a whole*".

For administrative, technical or operative decisions for which no consensus can be reached, the Project will rely on the Project Board.
For decisions regarding budget redistribution, consortium composition or major decisions on the workplan the Project Board is the highest decision making body in the Project. Any project management decision, either technical or administrative, taken by the Project Board is mandatory for all project members, and may not be overruled within the Project.

2.1.2.1.1 Reporting to the EC

SESAME follows the procedures presented in the Project guide to ensure on-time, transparent and high-quality reporting to the EC. Project reporting as well as internal intermediary reporting follows a planning approach with several verifications. This method allows delivery of high-quality reports, providing very accurate insight into the status of the Project. The following reporting will be done: (i) Periodic reports will be provided to the EC (M12+2, M24+2, M30+2); (ii) In between the periodic reports there will be internal semestrial reports for the PM to keep track of the project performance. The periodic report is mandatory in all European projects. Deliverables and milestones follow a procedure with fixed regular reminders, peer review by two (-2-) partners not involved in the specific reporting, checking by the relevant WPL, followed by final validation by the PM and the PB. This procedure results in on-time, high-quality deliverables and milestones.
Periodic Progress Reports (PPRs) will be collated with the reporting periods, prior to each project review and submitted and sent to the Project Officer by the PM. These reports detail the work performed by the partners, the achievements, collaborations, resources spent/planned, and future plans and, together with the Financial Statements, will serve as the main Project Management documentation.

Decision making: The GA provides a forum for discussing management issues and major technical issues. Decisions of the GA are binding for the Project. All reports, such as the periodic reports, any management reports and the deliverables will be discussed and approved before sending them to the EC. Procedures for making decisions at a managerial level, to be taken by the GA, are detailed in the Consortium Agreement.
Day-to-day decisions at the technical level are to be taken by the corresponding WP Leader(s) where needed, after consultation with the PM. The Project Board meetings, which will involve the PM and the principal partners will -*if necessary*- decide on major issues by a majority vote with the PM having the casting vote. All decisions will be taken unanimously, if feasible. If the members cannot come to an agreement, a voting procedure -*as detailed in the CA*- will take place. It is envisaged that full majority would be necessary to achieve a decision. The consortium has planned to physically meet for face-to-face (F2F) meetings at least 3 times a year, where most of the technical meetings (including GA meeting, Joint WP meetings, KIM team meetings, etc.) will be co-located over a period of 2-3 days, at the premises of the project partners (chosen under the principle of giving equal opportunity to each partner to host meetings).

2.1.2.1.2 Progress Monitoring and Quality Assurance

In order to guarantee an optimal allocation of resources to the Project activities, tasks as well as responsibilities and partner involvement have been well defined. The management procedures for monitoring progress and responding to changes have been documented in the Quality Assurance Plan (i.e., the deliverable D1.2, submitted in M2) and executed regularly. This constitutes a cyclic monitoring process to be implemented in the course of the Project. The cycle time will be of six calendar months. The PM is ultimately responsible for the quality control (QC) of the deliverables to the EC, coordinating closely on technical quality checks with the TM. Consequently, the PM can request remedial action and additional reports, should any doubt regarding progress, timescales or quality of work make this necessary. Every contractual deliverable, prior to its submission to the EC, will be the subject of a peer review by persons not directly involved in either the subject matter or the creation of that deliverable. Where necessary the PM could request further work of the partners on a deliverable, to ensure that it complies with the project's contractual requirements.
The PM will organise regular assessment meetings with all the partners, in addition to the PB meetings. These meetings will serve as preparation for the EC review and the necessary periodic reports. The purpose of these meetings will be to report on the progress so far and to redefine (if necessary) the Description of the Action (DoA) for the remaining part of the GA. The PB will regularly handle risk management and contingency plans. The PM and the PB will jointly be in charge for preparing for the regular project reviews with the EU. Specific access will be setup for the project reviewers (to the Project intranet, code repository and the KIM database) to review the Project progress. The consortium proposes the EU to organise three reviews during the Project lifecycle.

SESAME internal information flows: The strategy will be to keep the partners fully informed about the Project status, the planning and other issues that are important with regard to maximising the transparency and increasing synergy of co-operation and efficiency. The communication between partners having closely related work will be more frequent and informal (in ad-hoc meetings, phone conferences and by e-mail) including on-site visits of personnel involved when appropriate. Informal technical interim reports covering topics such as technical requirements, architectural issues, progressing techniques, measurements/simulation practices and so on will be developed if needed and will be distributed among the Project partners. In increasing level of formality, WPLs will regularly call for WP phone calls. As a reference, WP-*level* phone calls will be conducted on a monthly basis. The corresponding WPL will be responsible for fixing the agenda, which will usually include time slots for discussions on upcoming Deliverables. The Deliverable Editor will lead this part of the discussion, while the WPL will lead the general technical discussions around the on-going tasks. After the phone call, the WPL will release the minutes in copy to the TM. In this way, each WPL will report regularly to the TM and will give an overview of the work progress and any arising issues. These lines of communication will ensure that any major deviation from the work plan will be spotted immediately and prompt appropriate corrective action can be taken.
The formal flow of information will take place during Technical meetings (face-to-face), which will be conducted approximately three times a year. The objectives of these meetings will be to discuss technical issues and overall project progress. Representatives will report to the rest of partners, thus highlighting any divergence

from the proposed plan and schedule. The PM will be responsible (with the assistance of TM and WPLs) for the preparation of the agendas, co-ordination of the meetings, and production of the minutes.
On the other side, a project collaborative infrastructure, accessible through the web, has been set-up and used for distribution of documents among partners. This infrastructure will enable all partners to deposit and retrieve all relevant information regarding the Project. Furthermore it will include the capability of collaborative edition of documents, thus improving joint document management within the project. The Project Coordinator has established and will maintain this infrastructure. More detailed information is given in the related SESAME deliverable *D1.1 ("Project Website").*

Deliverables handling: Deliverables will be elaborated as a joint effort among the partners involved in the related WP. Their completion will be under the responsibility of the relevant WPL, who will be assisted by the Deliverable Editor identified in the workplan and will count on the contributions from the other partners. The Deliverable Editor will establish a calendar for the elaboration of the document well in advance of the submission deadline, considering several rounds of contributions and rounds for discussion and refinement. Once the Deliverable Editor and WPL feel that the document is completed, it will be forwarded to the TM, who will check that it is compliant with the quality assurance (QA) directives. If needed, the document will return to the WP domain for complete alignment with the desired quality. Once approved by the TM, the document will be forwarded to PB for formal approval before submission to EC. If comments arise from PB, again the document will return to WP domain and a new iteration will be established. When defining the calendar, the following periods need to be considered: (i) PB validation process starts 10 days in advance of official deliverable submission deadline; (ii) TM review process starts 20 days in advance of official deliverable submission deadline. Therefore, 10 days are enabled for TM to review and comment on the document and the WP to address the comments in case, before the document is forwarded to PB. Editorial guidelines (not only for Deliverables but for all types of documents used in the project), templates and document naming policies will be defined and will be available in the document management platform.

Information dissemination outside SESAME domain: One of the objectives of the SESAME is to raise awareness and impact on a wider community. Consequently, a specific task (T8.1) has been considered in the workplan and a specific dissemination plan with concrete goals for dissemination that will oblige each individual partner to undertake certain activities and actions will be defined, as in the related deliverable *D8.1 ("Plans for Dissemination, Communication, Standardization and Exploitation, Interaction with 5G-PPP"*). The dissemination processes are detailing the SESAME ambitions and means, and describing the overall processes encompassing plans, execution, review and approval, reporting and impact analysis. These will be followed as specified in the CA. Decision on the dissemination level of the project foreground will be made by the PB. Any objection to the planned dissemination actions shall be made in accordance with the Grant Agreement.

Technical problems and conflict resolution: Technical problems will be discussed on the level of each WP. The WPL leader will lead discussions and make decisions, while ensuring that the work plan is respected. The WPL shall report to the TM technical problems or solutions that have or may have influences on other WPs. If a problem cannot be solved on the level of the WP, the TM is responsible of taking a decision to solve the problem amicably. In the unlikely event of conflict not being resolved at TM level, PM and PB will be responsible to mediate in the conflict and to facilitate an end to the conflict. They will act in accordance to what will be established in the Consortium Agreement.

Consortium Agreement (CA): As mandated by EU project contractual obligations, all partners of the consortium needed to sign a Consortium Agreement before the contract with the European Commission is executed. Role of the Project Management (and especially of the PM together with the PB) is to modify and/or update the pre-established CA, based on the possibly changing conditions in the Projects (change of partners, "shift" of responsibilities, change of technical boundary conditions, etc.). The purpose of the actual CA is to specify the internal organization of the work between the partners, to organise the management of the Project, to define rights and obligations of the partners, including -but not limited to- their respective liability and indemnification as to the work performed under the Project, and more generally to define and rule the legal structure and functioning of the consortium. Moreover, the CA also addresses issues such as appropriate management of knowledge in the sense of protection of know-how and more generally of any knowledge and relevant intellectual property rights in any way resulting from the Project. The CA also has the purpose to integrate or "supplement" some of the provisions of the Grant Agreement, for example those concerning Access Rights; as

to the ruling of certain matters, the CA may set out specific rights and obligations of the partners, which may integrate or supplement, but which will under no circumstance be in conflict with those of the GA.

3 Knowledge Management and Protection Strategy

3.1 Management of Knowledge

Information flows within the Project both vertically and horizontally. The "vertical flow" of information comprises principally the administrative issues (e.g., financial progress reports, consolidated reports, meeting minutes and cost claims/advance payments), whereas the scientific and technical information flow is generally more appropriate to a less formal and horizontal process. The core of the information exchange is the SESAME web portal that is visible to SESAME partners (also known as the *Collaborative Working Environment*). Any collaborating partners will acquire free access on a confidential basis to all items displayed in the KM database, unless additional ad-hoc restrictions have been negotiated, in advance. This platform also includes basic workflow tools to automate and simplify the working procedures. For the Project partners, the website provides full access to all achievements in detail, whereas the annual report, publications, and sequence search sections will be open also to the public. Project summary, general information and public reports have will be made available for everybody on the Internet, also as a means to effectively communicate and coordinate, *if possible*, with parties outside the consortium (such as other related 5G-PPP projects or the European Commission (EC)). The EC will receive a special access code to access the necessary reports as well as to access prototypes on the review process, *if and/or where necessary*. The database and periodic reports will greatly help in assembling the Annual and Interim reports for the Commission.

More detailed information about the exact repositories of the Project, corresponding to a public website accessed by any third party and to a private website accessed by authorised physical and/or legal persons is given in the already submitted deliverable *D1.1 ("Project Website")*.

SESAME will continuously host a comprehensive public website (*http://www.sesame-h2020-5g-ppp.eu/*) that will contain all relevant information about the Project.
A public section allows sharing information and documents among all partners, also including any other "third party" (i.e., physical and/or legal persons) that may express interest to access such data and receive information about the scope and the achievements of the SESAME-*based* effort. The public section presents the specific aims, the vision and objectives as well as the goals, the plan, the development(s) and the intended achievements of the Project. It is also used to publish the public deliverables and the papers (as well as other works and/or relevant presentations) that are to be presented or accepted in international conferences, workshops, meetings and other similar activities towards supporting a proper dissemination and exploitation policy of the Project).
Furthermore it includes references to the related 5G-PPP context, as promoted by the European Commission, and potentially affecting progress of the SESAME effort. In addition, the public part includes an indicative description of the profiles of the involved SESAME partners as well as a part for links to other informative areas. There is also an explicit link to a private part of the website, accessible only by the partners or the "*beneficiaries*") of the Project, by using specific credentials (*http://programsection.oteresearch.gr*).
Figure 2 provides an indicative snapshot of the existing part of the public website.

The private part of the website serves as the "project management and collaboration platform" bearing (among others) advanced document management features (e.g. document versioning/history, documents check-in/out/locking, etc.) and a powerful search functionality to ensure efficient work and collaboration among partners.

The SESAME consortium is always proactively taking supplementary measures to raise awareness and encourage the implementation of the technical, business, social and all other concepts developed though the development of the public website.

Figure 2: SESAME Public Section - *Welcome Screen*

3.2 Ethics and Management of IPRs

The SESAME consortium is to respect the framework that is structured by the joined provisions of:

- The *European Directive 95/46/EC* ("*Protection of personal data*")[9], and;
- *Opinion 23/05/2000 of the European Group on Ethics in Science and New Technologies concerning "Citizens Rights and New Technologies: A European Challenge"* [10].

The SESAME partners will also abide by professional ethical practices and comply with the *Charter of Fundamental Rights of the European Union*[11].

The SESAME consortium recognises the importance of IPRs under a basic philosophy as discussed in the following sections: The general architecture and scientific results defined during the course of the Project are public domain research, intended to be used in international fora to advance technological development and scientific knowledge. Basic methods, architectures and functionalities should be available for scrutiny, peer-review and adaptation. Only this way can industry and standardisation groups accept the results of SESAME and this is a procedure already applied in many similar cases of research projects, until today. IPR will be managed in line with a principle of equality of all the partners towards the foreground knowledge and in full compliance with the general Commission policies regarding ownership, exploitation rights and confidentiality.
Valuable IPRs that might come up during the course of the Project from the work in the areas of new technological innovations with direct product use, shall be protected by the consortium and/or single partner entity within the Project. The IPRs shall be shared with reasonable rules, and the *H2020* contract rules shall be strictly adhered to.

For handling patents, the consortium will also apply proven methods used in previous EC projects. The partners will inform the consortium of technologies, algorithms, etc. that they offer for use in the WPs that they have patented, are in the process of patenting, or consider patenting. Similarly, if patentable methods and techniques are generated within Project-*based* activities, the patenting activities will aim to protect the rights

[9] Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995, *on the protection of individuals with regard to the processing of personal data and on the free movement of such data. Official Journal (OJ) L281, 23.11.1995, pp.31-50. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31995L0046:en:HTML*.

[10] More related information can be found at: *http://www.capurro.de/ege.html*.

[11] *Charter of Fundamental Rights of the European Union*. Official Journal (OJ) 2000/C 364, 18.12.2000, pp.1-22. Available at: *http://www.europarl.europa.eu/charter/pdf/text_en.pdf*.

of all partners participating in these specific activities. Lists of patents related to the Project, whether adopted, applied or generated will be maintained for reference, and are to be included in reports submitted to the Commission. The Consortium Agreement (CA) provides rules for handling confidentiality and IPR to the benefit for the Consortium and its partners. All the Project documentation will be stored electronically and as paper copies. Classified Documents will be handled according to proper rules with regard to classification (as described above), numbering and locked storing and distribution limitations.
In general, knowledge, innovations, concepts and solutions that are not going to be protected by patent applications by the participants will be made public after agreement between the partners, to "allow others to benefit" from these results and exploit them. However, where results require patents to show the impact of VITAL, we will perform freedom to operate searches to determine that this does not infringe on patents belonging to others.

The Consortium Agreement provides rules for handling confidentiality and IPR to the benefit for the SESAME Consortium and its partners. All the project documentation will be stored electronically and as paper copies. Classified documents will be handled according to proper rules with regard to classification (as described above), numbering and locked storing and distribution limitations.
The policy, that will govern the IPR management in the scope of SESAME, is driven by the following principles, which will be detailed in the Consortium Agreement: (i) Policy for Ownership and Protection of knowledge; (ii) Dissemination and Use policy; (iii) Access rights for use of knowledge; (iv) Confidentiality; (v) Ownership of results / joint ownership of results / difficult cases (i.e. pre-existing know-how so closely linked with result difficult to distinguish pre-existing know-how and result); (vi) Legal protection of results (patent rights); (vii) Commercial exploitation of results and any necessary access right; (viii) Commercial obligation; (ix) Relevant Patents, know-how, and information Sublicense; (x)Pre-existing know-how excluded from contract.
Nevertheless, many specific IPR cases, that will need a concrete solution from the bases previously fixed, may also exist. In these conflict situations, the General Assembly will be the responsible Body to arbitrate a solution. Furthermore, the IPR strategy and the updates will be monitored by the Knowledge and Innovation Management (KIM) team and during the periodic meetings; any IPR updates will be presented and approved upon consensus of the KIM team.

4 Open Access Policy

Usually, academic research seems to be focused on questions of essential scientific interest, the so-called *basic research*. This is generally intended to merely disclose new scientific and technical knowledge through publications. On the other hand, the *applied research* performed by the industry is normally aimed at commercialising the resulting innovation and therefore intended to increase the company value. To this end, research results are protected through patents and trade secrets[12]. According this kind of distinction, "publication is the most suitable means of knowledge dissemination for research organizations/universities (ROs) as it permits the fastest and open diffusion of research results. On the contrary, patents offer the industry the strongest protection to commercialise their innovation and recover the costs of the research investments.
However, this scenario has been critically changed, and expectations of *"how ROs create and manage their knowledge"* are changing rapidly, as this is increasingly considered by academic personnel as a source of income. This is also due to the fact that universities are encouraged to collaborate with private companies on research projects in different areas, which constitutes an expansion of their research interests into other sectors, such as biotechnology, nanotechnology, ICT and so forth. As a consequence, the boundary between scientific and applied research has blurred and, while the industry dissemination approach did not go through any significant transformation, the ROs' strategy moved away from the traditional "publishing". ROs have in fact started focusing on the opportunity to patent[13] research results, and extract as much value as possible from intellectual property (IP).

The two main means to bring technical and scientific knowledge to the public are patent applications[14] and journal publications[15],[16]. With the advent of the Internet two alternative means are also available for scientists and research companies either to maximise their IP value or to disseminate scientific and technical knowledge. These are: The defensive publications[17] and the ***Open Access* model**[18]. Public Internet is an emerging functional medium for globally distributing knowledge, also being able to significantly modify the nature of scientific publishing as well as the existing system of quality assurance.
Enabling societal actors to interact in the research cycle improves the quality, relevance, acceptability and sustainability of innovation outcomes by integrating society's expectations, needs, interests and values. Open access is a key feature of Member States' policies for responsible research and innovation by making the results of research available to all and by facilitating societal engagement. Businesses can also benefit from wider access to scientific research results. Small and medium-sized enterprises in particular can improve their capacity to innovate. Policies on access to scientific information can also facilitate access to scientific

[12] See the detailed context proposed in the approach: European IPR Helpdesk (July 2013): *Fact Sheet: Patenting v. publishing.* Available at: *https://www.iprhelpdesk.eu/FS_Patenting_v._publishing*.

[13] d'Erme, R. (2013). *"Utility Models: A useful alternative to patents for small businesses".* European IPR Helpdesk Bulletin N°8, January - March 2013. Available at: *http://www.iprhelpdesk.eu/sites/default/files/newsdocuments/IPR_Bulletin_No8_0.pdf#page=3*.

[14] Patenting entails the grant of a set of rights to exclusively use a certain invention (i.e. product or process) for a certain period of time. In return for this monopoly, the IP system asks the patent owner to disclose the technical information describing the invention in order for others to access it and continue to innovate based on it.

[15] Dissemination of scientific knowledge through publication is one of the most common and rapid instruments. Publishing, however, is not always as timely as it may appear as the peer review process can delay the final article publication. Moreover, publishers are often not prone to pay authors of scientific articles who, in turn, are willing to publish for reasons related to their career path, besides the primary wish of disseminating knowledge.

[16] The protection granted by the IP system to an article or publication is copyright, which arises automatically when the researcher writes it. It is worth mentioning that copyright only protects expression of the words contained in the text and its originality, but not the idea underlying the research findings. Therefore, the best ways to prevent others from reusing the inventions stemming from the research is patenting or keeping it as a secret.

[17] More Details can be found at*: http://www.defensivepublications.org* .
For a more concrete approach upon "defensive publishing" also see: Adams, S., and Henson-Apollonio, V. (2002, September). Defensive publishing: a strategy for maintaining intellectual property as public goods. *ISNAR (International service for National Agricultural Research) Briefing Paper No.53.* Available at: *ftp://ftp.cgiar.org/isnar/publicat/bp-53.pdf*.

[18] ***Open Access (OA)*** refers to the practice of granting free Internet access to research articles. This model is deemed to be an efficient system for broad dissemination of and access to research data and publications, which can indeed accelerate scientific progress.

information for private companies. Open access to scientific research data[19] enhances data quality, reduces the need for duplication of research, speeds up scientific progress and helps to combat scientific fraud[20].

In the context of the SESAME Project, expected publications are to be published according to the ***Open Access (OA)*** principles[21]. The consortium will make use of both "green" (or self-archiving) and "gold" open access options to ensure Open Access to most -*if not all*- publications that are to be produced during the life-time of the Project.
Almost all the top publications in the fields related to the Project are expected to be published via IEEE, Springer, Elsevier or ACM that provide authors with both "gold" -with either hybrid publication or open access journals strategy- and "green" open access options.
Major achievements of the Project will be considered to be published in a "gold" open access modality in order to "increase" the target audience. This implies the publication on Open Access Journals or on Hybrid Journals with OA agreement. The Article Processing Charges (APCs) that apply will be covered by the Project budget.
Self-archiving -or "green" open access- peer-*reviewed* scientific research articles for dissemination will be published in scholarly journals that consent self-archiving options compatible with "green" open access, where the published article or the final peer-*reviewed* manuscript is archived (deposited) by the author -or a representative in case of multiple authors- in an online repository before, alongside or after its publication. SESAME will give preference to those journals that allow pre-print self-archiving, in order to "maximise" the visibility of Project outcomes.

In fact, the SESAME consortium follows the guidelines set forth by the EU on its mandate for open access publications to all peer-*reviewed* scientific publications. In order to effectively comply and "guide" the partners to achieve such a high-promising goal, an ***Open Access publication policy and strategy*** is to take place and affect Project's governing documentation and further will be enforced and monitored by the Quality Manager (i.e., the Project Coordinator).

According to this kind of policy, all scientific journals resulting from the Project will be made "open access" (with any exception needed to be approved by the Project Coordinator and validated by the EU Project Officer-PO). Further, for other scientific publications appearing in conference proceedings and other peer-*reviewed* books, monographs or other "grey literature", will be made available to the general public through open access archives with very flexible licensing (e.g., creative commons licenses) for the scientific community (open access archives, such as arXiv (*www.arxiv.org*), researchgate (*www.researchgate.net*), CiteSeerX (*citeseerx.ist.psu.edu*) can be used for this purpose)[22].

In an effort to "maximise" the expected impact with the scientific results and associated data and the software (SW) code produced in the Project, the SESAME consortium will create a dedicated code/data repository in a collaborative open source code management tool (e.g., GitHub[23]) for SESAME to release all the mature

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[19] Economic and Social Research Council (2010). *ESRC research data policy*. Available at: *www.esrc.ac.uk/about-esrc/information/data-policy.aspx*.

[20] High Level Expert Group on Scientific Data (2010, October). Final Report: "Riding the wave: How Europe can gain from the rising tide of scientific data". Available at: *http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/hlg-sdi-report.pdf*.

[21] See further detailed discussion about "Open Access" as IT appears below, in the continuity of the present section.

[22] Publication outputs will be placed either on arXiv or an analogous archive (in accordance to the Registry of Open Access Repositories (ROAR)) and links from the project website to these Open Access publications will be published timely, in order to maximise impact and visibility of SESAME results and its activities.

[23] **GitHub** is a Web-based Git repository hosting service. It offers all of the distributed revision control and source code management (SCM) functionality of Git as well as adding its own features. Unlike Git, which is strictly a command-line tool, GitHub provides a web-based graphical interface and desktop as well as mobile integration. It also provides access control and several collaboration features such as bug tracking, feature requests, task management and wikis for every project.
(See, *for example*: Williams, A. (2012, July). G*itHub pours Energies into enterprise – Raises $100 Million From Power VC Andreessen Horowitz*, Tech. Crunch. Available at: *http://techcrunch.com/2012/07/09/github-pours-energies-into-enterprise-raises-100-million-from-power-vc-andreesen-horowitz/*).
GitHub offers both plans for private repositories and free accounts, which are usually used to host open-source software projects (*https://github.com/about/press*). In recent years, GitHub has become the largest code host in the world, with more than 5M developers collaborating across 10M repositories. Numerous popular open source projects (such as Ruby

software and other data associated to the scientific publications. This will allow the broader community to "access" the open source software and the related data and/or tools, which is used to derive the scientific results presented in the articles and magazines.
For a variety of reasons, this sort of free and unrestricted online availability within the OA framework can be economically feasible, offers to any potential reader astonishing power to "find and make use" of relevant literature, while it provides authors and their works massive new visibility, readership and impact[24].

SESAME will also produce specific outcomes in terms of implementation of individual software components which will be used in scientific publications together with the data collected during experiments done within the complete Project's lifetime. To make software and data used in publications available to the related (academic, business or other) community, such software and data will be made open source or subject to very flexible licensing and available whereby different channels. This potentially includes the creation of repositories in open source code management tools -*such as GitHub, or an "equivalent" one*- where to store the software developed which is in a "mature" stage and updated from time to time, as new stable releases of the code are available. Furthermore, since the SESAME Consortium aims to maximise the impact inside the related SDN and NFV communities, the software will be also made available inside open source initiatives (for example: OpenDayLight, OPNFV, etc.) whenever possible and according to the provisions of both the GA and the CA documents. With this kind of intended policy, SESAME Consortium will disseminate Project-*based* achievements to an audience as wide as possible, and will so allow other parties to replicate the results presented in scientific publications.

Open Access (OA) refers to the practice of granting free Internet access to research articles. This model is deemed to be an efficient system for broad dissemination of and access to research data[25] and publications, which can indeed accelerate scientific progress. Although this model foresees that the knowledge dissemination is on free-of-cost basis, this does not mean that the publication process is entirely free of costs. The underlying philosophy, in fact, focuses on the shift of costs from the reader to the author/publisher, in order to readily access and disseminate publications.

Open Access (OA) can be defined[26] as the practice of providing on-line access to scientific information that is "free of charge" to the end-user and that is re-usable. The term "scientific" refers to all academic disciplines; in the context of research and innovation activities, "scientific information" can refer to: *(a)* Peer-*reviewed* scientific research articles (published in scholarly journals)[27], or; *(b)* research data (i.e.: data underlying publications, curated data and/or raw data).

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on Rails, Homebrew, Bootstrap, Django or jQuery) have chosen GitHub as their host and have migrated their code base to it. GitHub offers a tremendous research potential. As of 2015, GitHub reports having over 11 million users and over 29.4 million repositories (*https://github.com/about/press*), thus making it the largest host of source code in the world. [An interesting approach for the latter comment is discussed in: Gousios, G., Vasilescu, B., Serebrenik, A. and Zaidman, A. (2014). *Lean GHTorrent: GitHub Data on Demand, in* MSR-14 Proceedings (May 31- June 01, 2014), Hyderabad, India. ACM Publications].
For a wider informative scope about GitHub, also see the discussion presented in: *https://en.wikipedia.org/wiki/GitHub*.

[24] Today, there is a strong and world-wide motivation for professional associations, universities, libraries, foundations, and others to consider/assess open access as a "suitable means" of further advancing/promoting their specific missions. However, achieving open access will require new cost recovery models and financing mechanisms, but the significantly lower overall cost of dissemination is a critical reason to be confident that the goal is attainable.

[25] Organisation for Economic Co-operation and Development (OECD) (2007). *OECD principles and guidelines for access to research data from public funding*. Paris, France: OECD. Available at: *www.oecd.org/dataoecd/9/61/38500813.pdf*.

[26] European Commission (2015, October 30). *Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020. Version 2.0.* Brussels, Belgium: European Commission, Directorate-General for Research & Innovation. Available at: *http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf*.

[27] Under the "open access" conceptual framework, the literature that should be freely accessible online is that which scholars offer to the world without expectation of payment but, mainly, with the pure aim of promoting scientific research and innovation. Mainly, this category includes not only their peer-reviewed journal articles, but it also incorporates any un-reviewed preprints that they might intend to "put online for comments" or to "alert" colleagues to important research findings. There are several degrees and kinds of wider and easier access to this literature. By "open access" to this literature, it is meant its free availability on the public Internet, permitting any third users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as

Establishing open access as a valuable practice ideally requires the active commitment of each and every discrete/individual producer of scientific knowledge. Open access contributions include original scientific research results, raw data and metadata, source materials, digital representations of pictorial and graphical materials and scholarly multimedia material.
Open access contributions have to satisfy/fulfil two conditions[28]: (i) The author(s) and right holder(s) of such contributions grant(s) to all users a free, irrevocable, worldwide, right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship (community standards, will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now), as well as the right to make small numbers of printed copies for their personal use; (ii) A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in an appropriate standard electronic format is deposited (and thus published) in at least one online repository using suitable technical standards (such as the Open Archive definitions) that is supported and maintained by an academic institution, scholarly society, government agency, or other well established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving.

The philosophy underlying the open access model is to introduce barrier-free, cost-free access to scientific literature for readers[29]. In the past, restrictions to free access of scientific publications were accepted, as the subscription model was the only practically possible option, as printed journals were the only means of disseminating validated scientific results[30]. While open access advocates free *dissemination* of scientific knowledge, this does not necessarily imply that no costs are involved in the publishing process. Open access does not indulge in the illusion of an entirely cost-free publication process. Communication of scientific results has always been paid out of research funds, one way or another, either directly or indirectly, via institutional overhead charges. That does not change in an open access model. The OA model focuses on taking the burden of costs off the subscriber's shoulders, often by shifting the costs from the reader to the author, so that payment for the process of peer review and publishing is made on behalf of the author, rather than the reader.

Conformant to the OA-*based* approach, the following options can be distinguished: *"Open access to scientific publications* which is discussed in section *(i)* below*,* and; *"open access to research data"* as discussed in *sections 4.1. and 4.1.2,* below:

4.1.1 Open Access to Scientific Publications

Open access to scientific publications refers to "free-of-charge" online access for any potential user. Legally binding definitions of "open access" and "access" in this context do not practically exist, but authoritative definitions of open access can be found in key political declarations on this subject, for instance the *Budapest Declaration of 2002* (*http://www.budapestopenaccessinitiative.org/read*) or; the *Berlin Declaration*[31] *of 2003* (*http://openaccess.mpg.de/67605/berlin_declaration_engl.pdf*).

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data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself. The only restriction on potential intended reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.

[28] According to the detailed context proposed by the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities.*

[29] van Eecke, P., Kelly, J., Bolger, P., and Truyens, M. (2009). Monitoring and analysis of technology transfer and intellectual property regimes and their use Results of a study carried out on behalf of the European Commission (DG Research). Mason Hayes+Curran, Brussels-Dublin, August 2009.

[30] Velterop, M.J. (2004). Open Access: Science Publishing as Science Publishing Should Be, *Serials Review 2004, 30*, pp.308-309.

[31] Following to the spirit of the *Declaration of the Budapest Open Access Initiative*, the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* has been made in order to promote the Internet as a functional instrument for a global scientific knowledge base and human reflection and to specify measures which research policy makers, research institutions, funding agencies, libraries, archives and museums need to consider for such purpose. According to the proposed framework, new possibilities of knowledge dissemination not only through the classical but

These definitions describe "access" in the context of open access as including not only basic elements such as "the right to read, download and print", but also "the right to copy, distribute, search, link, crawl, and mine".

There are two main routes towards open access to publications:

- **Self-archiving / "green" open access** means that the published article or the final peer-*reviewed* manuscript is archived (deposited) by the author -or an authorized representative in case of multiple authors- in an online repository before, alongside or after its publication. Some publishers request that open access be granted only after an "embargo" period has elapsed[32].
  Scholars and researchers need the tools and the assistance to deposit their refereed journal articles in open electronic archives, a practice usually called as *"self-archiving"*. When these archives conform to standards created by the Open Archives Initiative[33], then search engines and other tools can "treat the separate archives as one". Users then need not know which archives exist or where they are located in order to find and make use of their contents.
- **Open access publishing / "gold" open access** means that an article is immediately provided in open access mode as published. In this specific model, the payment of publication costs is shifted away from readers paying via subscriptions[34]. The business model most often encountered is based on one-off payments by authors. These costs (often referred to as Article Processing Charges - APCs) can usually be borne by the university or research institute to which the researcher is affiliated, or to the funding agency supporting the research. In other cases, the costs of open access publishing are covered by subsidies or other funding models.
  Scholars and researchers need the means to initiate a new generation of journals committed to open access and, *consequently*, to help existing journals that elect *to make the transition to open access*. Since journal articles should be disseminated as widely as possible, such new journals will no longer invoke copyright to restrict access to and use of the material they publish. Instead, they will use copyright and other tools to ensure permanent open access to all the articles they publish. Because price is a barrier to access, these new journals will not charge subscription or access fees, and will turn to other methods for covering their expenses. There are many alternative sources of funds for this purpose, including the foundations and governments that fund research, the universities and laboratories that employ researchers, endowments set up by discipline or institution, friends of the cause of open access, profits from the sale of add-ons to the basic texts, funds freed up by the demise or cancellation of journals charging traditional subscription or access fees, or even contributions from the researchers themselves. There is no need to favor one of these solutions over the others for all disciplines or nations, and no need to stop looking for other alternatives.

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also and increasingly through the open access paradigm via the Internet had to be supported. "Open access" has been defined as a comprehensive source of human knowledge and cultural heritage that has been approved by the scientific community. In order to realize the vision of a global and accessible representation of knowledge, the future Web needed to be sustainable, interactive, and transparent. Content and software tools needed to be openly accessible and compatible.

[31] ***Green OA*** foresees that the authors deposit (self-archive) the final peer-reviewed manuscript in a repository (open archive) to be made available in open access mode, usually after an embargo period allowing them to recoup the publishing costs (e.g. via subscriptions or pay per download).

[31] For more relevant information see, for example: *http://www.openarchives.org*.

[31] For this other model named ***Gold OA***, costs of publishing are covered usually by the publisher so that research articles are immediately available free of charge upon publication.

[31] *http://www.powershow.com/view1/1a76ee-ZDc1Z/Five_years_on_powerpoint_ppt_presentation*.form but also and increasingly through the open access paradigm via the Internet had to be supported. "Open access" has been defined as a comprehensive source of human knowledge and cultural heritage that has been approved by the scientific community. In order to realize the vision of a global and accessible representation of knowledge, the future Web needed to be sustainable, interactive, and transparent. Content and software tools needed to be openly accessible and compatible.

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[33] For more relevant information see, for example: *http://www.openarchives.org*.

[34] For this other model named ***Gold OA***, costs of publishing are covered usually by the publisher so that research articles are immediately available free of charge upon publication.

Hybrid model – While several existing scientific publishers have converted to the open access publishing model, such conversion may not be viable for every publisher. A third *("hybrid")* model of open access publishing has therefore arisen. In the hybrid model, publishers offer authors the choice of paying the article processing fee and having their article made freely available online, or they can elect not to pay and then only journal subscribers will have access to their article. The hybrid model offers publishers of traditional subscription-based journals a way to experiment with open access and allow the pace of change to be dictated by the authors themselves[35].

Public institutions are also very interested in the OA system. The European Commission is strongly committed to optimising the impact of publicly-funded scientific research, both at European level (*FP7, Horizon 2020*) and at Member State level[3637]. Indeed, the European Commission acts as the coordinator between member states and within the European Research Area (ERA) in order for results of publicly-funded research to be disseminated more broadly and faster, to the benefit of researchers, innovative industry and citizens. OA can also boost the European research, and in particular offers SMEs access to the latest research for utilisation. The central underlying reasons for an OA system are that:

- The results of publicly-funded research should be publicly available;
- OA enables research findings to be shared with the wider public, helping to create a knowledge society across Europe composed of better-informed citizens;
- OA enhances knowledge transfer to sectors that can directly use that knowledge to produce better goods and services. Many constituencies outside the research community itself can make use of research results. These include small and medium-sized companies that do not have access to the research through company libraries, organizations of professional (legal practices, family doctor practices, etc.), the education sector and so forth.

Misconceptions about open access to scientific publications: In the context of research funding, open access requirements in no way imply an explicit obligation to publish results. The decision on whether or not to proceed to a publication, lies entirely with the grantees. Open access becomes an issue only *if* publication is elected as a means of further realizing dissemination. Moreover, OA does not interfere with the decision to exploit research results commercially, e.g. through patenting. Indeed, the decision on whether to publish open access must come after the more general decision on whether to publish directly or to first seek protection.
More information on this issue is available in the European IPR Helpdesk[38] fact sheet *"Publishing vs. patenting"*[39]. This is also illustrated in ***Figure 3***, below, showing open access to scientific publication and research data in the wider context of dissemination and exploitation[40].

[35] http://www.powershow.com/view1/1a76ee-ZDc1Z/Five_years_on_powerpoint_ppt_presentation.
[36] Further information about the European Commission's strategy on OA can be found at: http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1294&lang=1.
[37] For more details also see: http://ec.europa.eu/research/science-society/document_library/pdf_06/oa-preservation-2011_en.pdf.
[38] The European IPR Helpdesk is managed by the European Commission's Executive Agency for Competitiveness and Innovation (EACI), with policy guidance provided by the European Commission's Enterprise & Industry Directorate-General.
[39] More information is found at: https://www.iprhelpdesk.eu/FS_Patenting_v._publishing.
[40] See the detailed text of *Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020. Version 2.0.* Brussels, Belgium: European Commission, Directorate-General for Research & Innovation.

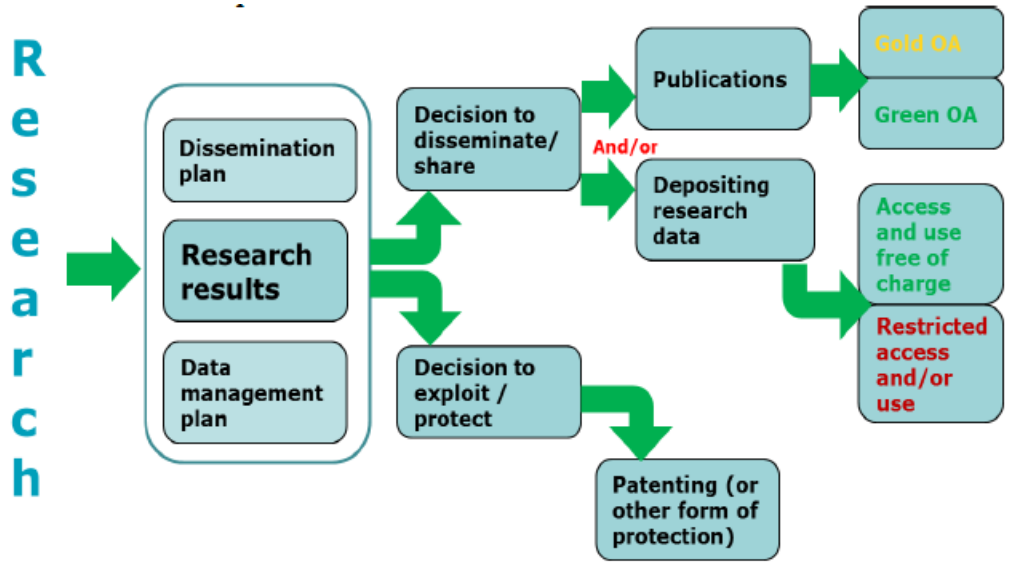

Figure 3: Open access to scientific publication and research data in the wider context of dissemination and exploitation

4.1.2 Open Access to Research Data

Open access to research data refers to the right to access and re-use digital research data under the terms and conditions set out in the Grant Agreement.
The term "research data" refers to information, in particular facts or numbers, collected to be examined and considered and as a basis for reasoning, discussion, or calculation. In a research context, possible examples of data may comprise statistics, results of experiments, measurements, observations resulting from fieldwork, survey results, interview recordings and images. The focus is primarily upon research data that is available in digital form.
Openly accessible research data can typically be accessed, mined, exploited, reproduced and disseminated free of charge for the user.

Public institutions are also very interested in the OA system[41]. The European Commission is strongly committed to optimising the impact of publicly-funded scientific research, both at European level (FP7, Horizon 2020) and at Member State level[42]. Indeed, the European Commission acts as the coordinator between member states and within the European Research Area (ERA) in order for results of publicly-funded research to be disseminated more broadly and faster, to the benefit of researchers, innovative industry and citizens. OA can also boost the European research, and in particular offers SMEs access to the latest research for utilisation.

The central underlying reasons for an OA system are that:

- The results of publicly-*funded* research should be publicly available;
- OA enables research findings to be shared with the wider public, helping to create a knowledge society across Europe composed of better-informed citizens;
- OA enhances knowledge transfer to sectors that can directly use that knowledge to produce better goods and services. Many constituencies outside the research community itself can make use of research results. These include small and medium-sized companies that do not have access to the research through company

[41] Björk, B.-C., Welling, P., Laakso, M., Majlender, P., Hedlund, T., and Gudnasson, G. (2010). Open Access to the Scientific Journal Literature: Situation 2009. *PloS One, 23.06.2010.* http://dx.doi.org/10.1371/journal.pone.0011273.

[42] Further information on the European Commission's strategy on OA can be found at: http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1294&lang=1.

libraries, organizations of professional (legal practices, family doctor practices, etc.), the education sector and so forth[43].

[43] For more information see the content of the EC and national experts workshop report, *"Sharing knowledge: open access and preservation in Europe"*, available at: *http://ec.europa.eu/research/science-society/document_library/pdf_06/oa-preservation-2011_en.pdf*.

5 Data Management Plan

5.1 European Community Strategic Framework for DMP

The European Commission has early recognised that research data is as important as publications[44]. It therefore announced in 2012 that it would experiment with open access to research data[45]. Broader and more rapid access to scientific papers and data will make it easier for researchers and businesses to build on the findings of public-funded research[46].

As a first step, the Commission has decided to make open access to scientific publications a general principle of *Horizon 2020*, the EU's Research & Innovation funding programme for 2014-2020[47]. In particular, as of the year 2014, all articles produced with funding from *Horizon 2020* had to be accessible according to the following options:

- Articles had either immediately to be made accessible online by the publisher ("Gold" open access) - up-front publication costs can be eligible for reimbursement by the European Commission; or
- researchers had to make their articles available through an open access repository no later than six months (12 months for articles in the fields of social sciences and humanities) after publication ("Green" open access).

The Commission has also recommended that Member States take a similar approach to the results of research funded under their own domestic programmes[48]. This will boost Europe's innovation capacity and give citizens quicker access to the benefits of scientific discoveries. Intelligent processing of data is also essential for addressing societal challenges.

The *Pilot on Open Research Data in Horizon 2020*[49] does for scientific information what the *Open Data Strategy*[50] does for public sector information: It aims to improve and maximise access to and re-use of research data generated by projects for the benefit of society and the economy.

The *G8 definition of Open Data*[51] states that *data should be easily discoverable, accessible, assessable, intelligible, useable, and wherever possible interoperable to specific quality standards, while at the same time respecting concerns in relation to privacy, safety, security and commercial interests*[52].

The SESAME project intends to participate in the *H2020 Open Research Data Pilot*[53], which well compliments Project's views on Open Access, open source[54], and providing a transparent view of the scientific process, particularly relevant in science driven by public funds.

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[44] European Commission (2012, July). *Communication on "Towards better access to scientific information: Boosting the benefits of public investments in research"[COM(2012) 401 final, 17.07.2012].* Available at: http://ec.europa.eu/research/cience-society/document_library/pdf_06/era-communication-towards-better-access-to-scientific-information_en.pdf.

[45] European Commission (2012, July). Press release IP/12/790 - *Scientific data: open access to research results will boost Europe's innovation capacity. Brussels, July 2012.* Available at: http://europa.eu/rapid/press-release_IP-12-790_en.htm.

[46] Among the actions taken under the *"Digital Agenda for Europe" (COM(2010) 245 final/2),* publicly funded research had to be widely disseminated through open access publication of scientific data and papers.

[47] European Commission (2012, July). Commission Recommendation of 17.07.2012 on *"An accompanying Commission Recommendation sets out a complete policy framework for improving access to, and preservation of, scientific information" [C(2012) 4890 final, 17.07.2012]*.

[48] The goal is for 60% of European publicly-*funded* research articles to be available under open access by 2016.

[49] European Commission (2013, December). Press release IP/13/1257 - *Commission launches pilot to open up publicly funded research data. Brussels, 16.12.2013.* Available at: http://europa.eu/rapid/press-release_IP-13-1257_en.htm.

[50] See, *for example*: European Commission (2011, December). *Communication on "Open data-An engine for innovation, growth and transparent governance" [COM(2011) 882 final, 12.12.2011].*

[51] G8 Science Ministers' Statement, available at: https://www.gov.uk/government/news/g8-science-ministers-statement. UK Foreign and Commonwealth Office, *June 13, 2013.*

[52] To ensure successful adoption by scientific communities, open scientific research data principles will need to be underpinned by an appropriate policy environment, including recognition of researchers fulfilling these principles, and appropriate digital infrastructure.

[53] Valuable information produced by researchers in many EU-*funded* projects will be shared freely as a result of a *Pilot on Open Research Data* in *Horizon 2020*. Researchers in projects participating in the pilot are asked to make the underlying data needed to validate the results presented in scientific publications and other scientific information available for use by other researchers, innovative industries and citizens. This will lead to better and more efficient science and improved transparency for citizens and society. It will also contribute to economic growth through open innovation. More

This Pilot is an opportunity to see how different disciplines share data in practice and to understand remaining obstacles, as well as part of the Commission's commitment to openness in *Horizon 2020.*[55]
Projects participating in the *Pilot on Open Research Data in Horizon 2020* are required to deposit the research data described below[56]:

- The data, including associated metadata[57], needed to validate the results presented in scientific publications as soon as possible;
- Other data[58], including associated metadata, as specified and within the deadlines laid down in a ***data management plan (DMP)***[59].

Projects should deposit preferably in a research data repository and take measures to enable third parties to access, mine, exploit, reproduce and disseminate — free of charge for any user[60].

The **main requirements of the *Open Data Pilot*** are listed as follows:

- Develop (and update) a Data Management Plan;
- Deposit in a research data repository;
- Make it possible for third parties to access, mine, exploit, reproduce and disseminate data – free of charge for any user;
- Provide information on the tools and instruments needed to validate the results (or provide the tools)

To participate in this initiative, the present *Deliverable D8.2* consisting of a first draft of the projects Data Management Plan has been produced in month 6 (M6) of the Project by WP8, and further evolved as the Project goes on.

information about the related Commission's initiative can be found at: *http://europa.eu/rapid/press-release_IP-13-1257_en.htm*.

54 Generally, open source refers to a computer program in which the source code is available to the general public for use and/or modification from its original design. Open-source code is meant to be a collaborative effort, where programmers improve upon the source code and share the changes within the community. Typically this is not the case, and code is merely released to the public under some license. Others can then download, modify, and publish their version (fork) back to the community. Today you find more projects with forked versions than unified projects worked by large teams. For further reading see, for example: Lakhani, K.R., von Hippel, E. (June 2003). How Open Source Software Works: Free User to User Assistance. *Research Policy 32(6),* pp.923-943. [*doi:10.1016/S0048-7333(02)00095-1*] as well as other informative references in *https://en.wikipedia.org/wiki/Open_source*.

55 The *Pilot on Open Research Data* in *Horizon 2020* will give the Commission a better understanding of what supporting infrastructure is needed and of the impact of limiting factors such as security, privacy or data protection or other reasons for projects opting out of sharing. It will also contribute insights in how best to create incentives for researchers to manage and share their research data. The Pilot will be monitored throughout *Horizon 2020* with a view to developing future Commission policy and EU research funding programs.

56 *https://www.openaire.eu/h2020-oa-data-pilot*.

57 "Associated metadata" refers to the metadata describing the research data deposited.

58 For instance, curated data not directly attributable to a publication, or raw data.

59 A DMP may be also referred to as a "Data Sharing Plan".

60 For example, the ***OpenAIRE project*** provides a ***Zenodo repository*** (*http://www.zenodo.org*) that could be used for depositing data. Also see OpenAIRE FAQ (*http://www.zenodo.org/faq*) for general information on Open Access and European Commission funded research.

5.2 DMP in the Conceptual Framework of the *H2020*

All project proposals submitted to "*Research and Innovation actions*" as well as "*Innovation actions*" had to include a section on research data management which is evaluated under the criterion "Impact". Where relevant, applicants had to provide a short, general outline of their policy for data management, including the following issues listed as *(i)-(iv):*

(i) What types of data will the project generate/collect?
(ii) What standards will be used?
(iii) How will this data be exploited and/or shared/made accessible for verification and re-use? (If data cannot be made available, this has to be explained why).
(iv) How will this data be curated and preserved?

The described policy should reflect the current state of consortium agreements regarding data management and be consistent with those referring to exploitation and protection of results. The data management section can be considered also as a checklist for the future and as a reference for the resource and budget allocations related to data management.

Data Management Plans (DMPs) are introduced in the Horizon 2020 Work Programs according to the following concept: "*A further new element in Horizon 2020 is the use of Data Management Plans (DMPs) detailing what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved. The use of a Data Management Plan is required for projects participating in the Open Research Data Pilot. Other projects are invited to submit a Data Management Plan if relevant for their planned research".*

Projects taking part in the *Pilot on Open Research Data* are required to provide a first version of the DMP as an early deliverable within the first six months of the respective project. Projects participating in the above Pilot as well as projects who submit a DMP on a voluntary basis because it is relevant to their research should ensure that this deliverable is mentioned in the proposal. Since DMPs are expected to mature during the corresponding project, more developed versions of the plan can be included as additional deliverables at later stages. The purpose of the DMP is to support the data management life cycle for all data that will be collected, processed or generated by the project.

References to research data management are included in Article 29.3 of the *Model Grant Agreement* (article applied to all projects participating in the *Pilot on Open Research Data in Horizon 2020*.

A ***Data Management and Sharing Plan***[61] is usually submitted where a project -or a proposal- involves the generation of datasets that have clear scope for wider research use and hold significant long-term value[62]. In short, plans are required in situations where the data outputs "form a resource" from which researchers and other users would be able to generate additional benefits. This would include all projects where the primary goal is to create a database resource. It would also include other research generating significant datasets that could be shared for added value - for example, those where the data has clear utility for research questions beyond those that the data generators are seeking to address. In particular, it would cover datasets that might form "community resources" as defined by the *Fort Lauderdale Principles*[63] and the *Toronto statement*[64].

As noted in the *Toronto statement*, community resources will typically have the following attributes: (i) Large-scale (requiring significant resources over time); (ii) broad utility; (iii) creating reference datasets, and; (iv)associated with community buy-in. For studies generating small-scale and limited data outputs, a data management and sharing plan will not normally be required. Generally, the expected approach for projects of this type would be to make data available to other researchers on publication, and where possible to deposit data in appropriate data repositories in a timely manner. While a formal data management and sharing plan need not be submitted in such cases, applicants may find the guidance below helpful in planning their approaches for managing their data.

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[61] See, for example: "*Guidance for researchers: Developing a data management and sharing plan".* Available at: *http://www.wellcome.ac.uk/About-us/Policy/Spotlight-issues/Data-sharing/Guidance-for-researchers/index.htm*.

[62] Also see: Framework for creating a data management plan, ICPRS, University of Michigan, US. Available at: *http://www.icpsr.umich.edu/icpsrweb/content/datamanagement/dmp/framework.htm*.

[63] For more related information, see: *http://www.wellcome.ac.uk/About-us/Publications/Reports/Biomedical-science/WTD003208.htm*.

[64] Toronto International Data Release Workshop Authors (2009). *Nature 461,* 168-170 (September 10, 2009) [*doi:10.1038/461168a*]. Available at: *http://www.nature.com/nature/journal/v461/n7261/full/461168a.html*.

5.3 Principles and Guidelines for Developing a DMP

A DMP as a document outlining how research data will be handled during a research project, and after it is completed, is very important in all aspects for projects participating in the H*orizon 2020 Open Research Data Pilot* as well as almost any other research project. Especially where the project participates in the above mentioned Pilot, it should always include clear descriptions and rationale for the access regimes that are foreseen for collected data sets[65].
This principle is further clarified in the following paragraph of the Model Grant Agreement: "*As an exception, the beneficiaries do not have to ensure open access to specific parts of their research data if the achievement of the action's main objective, as described in Annex I, would be jeopardised by making those specific parts of the research data openly accessible. In this case, the data management plan must contain the reasons for not giving access".*

A DMP describes the data management life cycle for all data sets that will be collected, processed or generated by the corresponding research project. It is a document outlining how research data will be handled during a research project, and even after the project is completed, describing what data will be collected, processed or generated and following what methodology and standards, whether and how this data will be shared and/or made open, and how it will be curated and preserved[66]. The DMP is not a fixed document; it evolves and gains more precision and substance during the lifespan of the project[67].

The first version of the DMP is expected to be delivered within the first 6 months of the respective project. This DMP deliverable should be in compliance with the template provided by the Commission, as presented in the following *Section 5.3.1*. More elaborated versions of the DMP can be delivered at later stages of the project. The DMP would need to be updated at least by the mid-term and final review to fine-tune it to the data generated and the uses identified by the consortium since not all data or potential uses are clear from the start. New versions of the DMP should be created whenever important changes to the project occur due to inclusion of new data sets, changes in consortium policies or external factors. Suggestions for additional information in these more elaborated versions are provided below in the subsequent *Section 5.3.2***.**
DMPs should follow relevant national and international recommendations for best practice and should be prepared in consultation with relevant institutional and disciplinary stakeholders. They should anticipate requirements throughout the research activity, and should be subject to regular review and amendment as part of normal research project management.

5.3.1 Template for DMP

The purpose of the Data Management Plan (DMP) is to provide an analysis of the main elements of the data management policy that will be used by the applicants with regard to all the datasets that will be generated by the project[68]. The DMP is not a fixed document, but evolves during the lifespan of the project.
The DMP should address[69] the points below on a dataset by dataset basis and should reflect the current status of reflection within the consortium about the data that will be produced.

- **Data set reference and name**
  Identifier for the data set to be produced.

- **Data set description**

[65] UK Data Archive (2011, May). *Managing and Sharing Data. Best Practice for Researchers*. University of Essex, UK. Available at: *http://www.data-archive.ac.uk/media/2894/managingsharing.pdf*.

[66] Brunt, J. (2011). *How to Write a Data Management Plan for a National Science Foundatio*n (NSF) Proposal. Available at: *http://intranet2.lternet.edu/node/3248*.

[67] Support on research data management for projects funded under *Horizon 2020* has been planned through projects funded under the *Research Infrastructures Work Programme 2014-15*.

[68] An interesting conceptual approach is also proposed in: Donnelly, M. & Jones, S. (2011). *DCC Checklist for a Data Management Plan* v3.0. Digital Curation Centre (DCC), UK. Available at: *http://www.dcc.ac.uk/webfm_send/431*.

[69] Also see: Jones, S. (2011). "How to Develop a Data Management and Sharing Plan". *DCC How-to Guides.* Edinburgh: Digital Curation Centre. Available online: *http://www.dcc.ac.uk/resources/how-guides*.

Description of the data that will be generated or collected, its origin (in case it is collected), nature and scale and to whom it could be useful, and whether it underpins a scientific publication. Information on the existence (or not) of similar data and the possibilities for integration and reuse.
Plans should cover all research data expected to be produced as a result of a project or activity, from 'raw' to "published". They may include, *inter-alia*, details of: (i) An analysis of the gaps identified between the currently available and required data for the research; (ii) anticipated data volume; (iii) anticipated data type and formats including the format of the final data; (iv) measures to assure data quality; (v) standards (including metadata standards) and methodologies that will be adopted for data collection and management, and why these have been selected; (vi) relationship to data available from other sources, and; (vii) anticipated further/secondary use(s) for the completed dataset(s).

- **Standards and metadata**
  Reference to existing suitable standards of the discipline. If these do not exist, an outline on how and what metadata will be created.
  What disciplinary norms are to be adopted in the project? What is the data about? Who created it and why? In what forms it is available? Metadata answers such questions to enable data to be found and understood, ideally according to the particular standards of the project-specific scientific discipline.
  DMPs should specify the principles, standards and technical processes for data management, retention and preservation that will be adopted. These may be determined by the area of research and/or funder requirements. Processes should be supported by appropriate standards addressing confidentiality and information security, legal compliance, monitoring and quality assurance, data recovery and data management reviews where suitable. In order to maximise the potential for re-use of data, where possible, researchers should generate and manage data using existing widely accepted formats and methodologies.
  DMPs should provide suitable quality assurance concerning the extent to which "raw" data may be modified. Where 'raw' data are not to be retained, the processes for obtaining "derived" data should be specified and conform to the accepted procedures within the research field.
  Researchers should ensure that appropriately structured metadata, using a recognised or *de facto* standard schema where these exist, describing their research data are created and recorded in a timely manner. The metadata should include information about regulatory and ethical requirements relating to access and use.
  Protocols for the use, calibration and maintenance of equipment, together with associated risk assessments, should be clearly documented to ensure optimal performance and research data quality. Where protocols change, they should be version controlled and the current version should be available and readily accessible. Documentation may include: Technical descriptions, code commenting; project-build guidelines; audit trail supporting technical decisions; resource metadata. Not all types of documentation will be relevant to all projects and the quantity of documentation proposed should be proportionate to the anticipated value of the data.

- **Data sharing**
  Description of how data will be shared, including access procedures, embargo periods (if any), outlines of technical mechanisms for dissemination and necessary software and other tools for enabling re-use, and definition of whether access will be widely open or restricted to specific groups. Identification of the repository where data will be stored, if already existing and identified, indicating in particular the type of repository (institutional, standard repository for the discipline, etc.)[70].
  In case the dataset cannot be shared, the reasons for this should be mentioned (e.g. ethical, rules of personal data, intellectual property, commercial, privacy-related, security-related).
  By default as much of the resulting data as possible should be archived as *Open Access*. Therefore, legitimate reasons for not sharing resulting data should be explained in the DMP.
  Planning for data sharing should begin at the earliest stages of project design and well in advance of beginning the research. Any potential issues which could limit data sharing should be identified and mitigated from the outset. Data management plans should therefore address how the research data will be shared. Any reason for not eventually sharing data should be explained with a justification citing for example legal, ethical, privacy or security considerations.

[70] For more relevant information see the concept proposed in: *Guidance on best practice in the management of research data.* Research Councils UK (RCUK), *July 2015*. Available at: http://www.rcuk.ac.uk/RCUK-prod/assets/documents/documents/RCUKCommonPrinciplesonDataPolicy.pdf.

- **Archiving and preservation (including storage and backup)**
  Description of the procedures that will be put in place for long-term preservation of the data. Indication of how long the data should be preserved, what is its approximated end volume, what the associated costs are and how these are planned to be covered.
  Funding bodies are keen to ensure that publicly funded research outputs can have a positive impact on future research, for policy development, and for societal change. They recognise that impact can take quite a long time to be realised and, *accordingly*, expect the data to be available for a suitable period beyond the life of the project. It has to be pointed out that it is not simply enough to ensure that the bits are stored, but also to consider the usability of the project-specific data. In this respect, it has to be considered to preserve software or any code produced to perform specific analyses or to render the data as well as being clear about any proprietary or open source tools that will be needed to validate and use the preserved data.
  Data management plans should provide for all retained data and related materials to be securely preserved in such a way as to allow them to be accessed, understood and used by any others having appropriate authorization in future.
  Data held electronically should be backed up regularly and duplicate copies held in alternative locations in a secure and accessible format where appropriate.

5.3.2 Additional Guidance for DMP

This can be applied to any project that produces, collects or processes research data, and is included as reference for elaborating DMPs in *Horizon 2020* projects. This guide is structures as a series of questions that should be ideally clarified for all datasets produced in the project.

Scientific research data should be easily:

1. Discoverable

DMP question: Are the data and associated software produced and/or used in the project discoverable (and readily located), identifiable by means of a standard identification mechanism (e.g. Digital Object Identifier)?

2. Accessible

DMP question: Are the data and associated software produced and/or used in the project accessible and in what modalities, scope, licenses[71] (e.g. licensing framework for research and education, embargo periods, commercial exploitation, etc.)?

3. Assessable and intelligible

DMP question: Are the data and associated software produced and/or used in the project assessable for and intelligible to third parties in contexts such as scientific scrutiny and peer review (e.g. are the minimal datasets handled together with scientific papers for the purpose of peer review, are data is provided in a way that judgments can be made about their reliability and the competence of those who created them)?

4. Useable beyond the original purpose for which it was collected

DMP question: Are the data and associated software produced and/or used in the project useable by third parties even long time after the collection of the data (e.g. is the data safely stored in certified repositories for long term preservation and curation; is it stored together with the minimum software, metadata and documentation to make it useful; is the data useful for the wider public needs and usable for the likely purposes of non-specialists)?

5. Interoperable to specific quality standards

DMP question: Are the data and associated software produced and/or used in the project interoperable allowing data exchange between researchers, institutions, organizations, countries, etc. (e.g. adhering to standards for data annotation, data exchange, compliant with available software applications, and allowing re-combinations with different datasets from different origins)?

[71] Ball, A. (2011). *How to Licence Research Data.* DCC, UK. *Available at:* http://www.dcc.ac.uk/resources/how-guides/license-research-data.

5.4 Structuring of a SESAME DMP

Different types of data raise very different considerations and challenges, and there are significant differences between fields in terms of, for example, the availability of repositories and level of established good practice for data sharing. Data generated by the Project will mostly consist of measurement- and traffic data from various simulations, emulations in the CESC platform, and the proof of concept (PoC) experimentation in the SESAME test-bed(s). Without going into full details of the DMP here, there are several standards that can be used to store such data as well as providing the meta-data necessary for third parties to utilise the data.

The overall goal is to as much as possible, use not only open formats to store the data but also open source software to provide the scripts and other meta-data necessary to re-use it.
Similar to the software generated by the Project, some of the data generated may pertain to components, software, or figures considered as confidential by one or more of the partners. The particular data affected by this will be described in the DMP and the reasons for maintaining confidentiality will be provided.

According to the discussion provided in the previous *Section 5.3*, a suitable Data Management Plan (DMP) includes the following major components, as shown in ***Figure 4***, below:

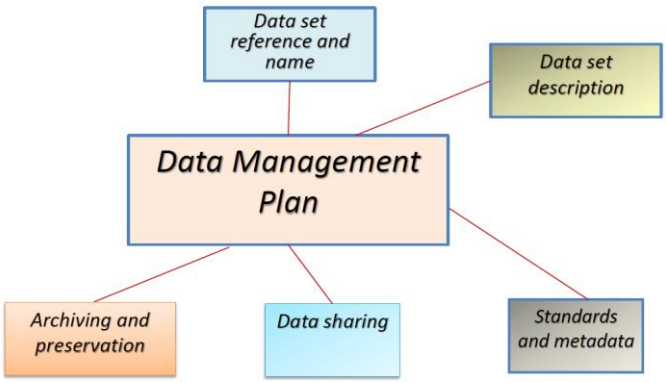

Figure 4: Structure of a Data Management Plan (DMP)

For the case of the SESAME Project, the context becomes as it appears in ***Figure 5***, below:

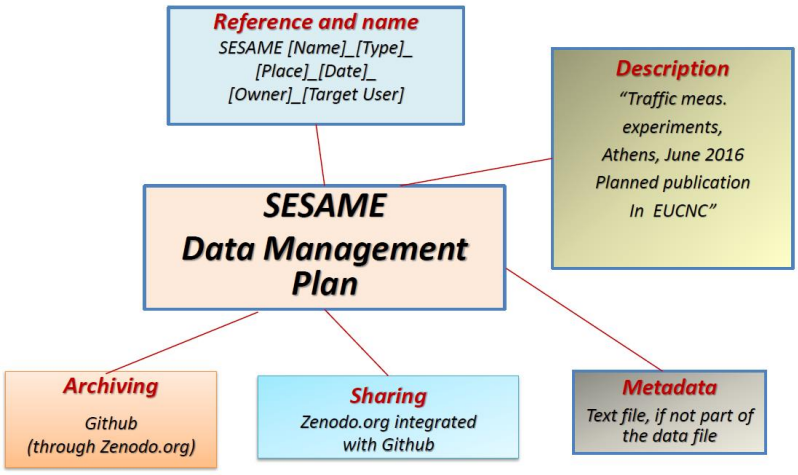

Figure 5: Essential Components of the SESAME Data Management Plan (DMP)

In the following *Sections 5.4.1-5.4.5* we discuss, one-by-one, the essential characteristics -or "modules"- of the SESAME DMP, based on the concept of ***Figure 5***.

5.4.1 Data Set Reference and Naming

The following structure is proposed for SESAME data set identifier:
SESAME [Name]_[Type]_[Place]_[Date]_[Owner]_[Target User]

Where we identify the following fields:
- *"Name"* is a short name for the data.
- *"Type"* describes the type of data (e.g. code, publication, measured data).
- *"Place"* describe the place the data were produced.
- *"Date"* is the date in format "YYYY-MM-DD".
- "Owner" is the owner or the owners of the data (if exist)
- *"Target user"* is the target audience of the data (this is an optional identifier).
- *"_" (underscore)* is used as the separator between the fields.

For example, *"SESAME_Field_Experiment_data_Athens_2015-06-31_OTE_Internal.dat"* is a data file from a field experiment in Athens, Greece that has been performed on 2015-06-31 and owned by the project partner OTE with extension .dat (MATLAB[72]). More information about the data is provided in the metadata (see the following section).
All the data fields in the identifier above, apart from the target user, are mandatory. If one -or more owners- owner cannot be specified, then it should be indicated as: *"Unspecified-owner".*

5.4.2 Data Set Description and Metadata

The previous *Section 5.4.1* has defined a data set identifier. The data set description is fundamentally an expanded description of the identifier with more details.
The data set description that is organized as the metadata takes place in a similar way as the case of the identifier, but with more details and, depending on the file format, it will be either incorporated as a part of the file or as a separate file (in its simplest form) in the text format. In the case of the separate metadata file, it will have the same name with the added suffix *"METADATA".*
For example, the metadata file name for the data file from the previous section will appear as follows:
"SESAME_Field_Experiment_data_Athens_2015-06-31_OTE_Internal_METADATA.txt"
The Metadata file can also designate a number of files (e.g. a number of log files). The SESAME Project may thus consider a possibility to provide the metadata in XML[73] or JSON[74] formats, if necessary for convenience of parsing and further processing. The Project will develop several data types related to the VNF (Virtual Network Function) Descriptors, NS (Network Service) Descriptors, VNF Catalogues, etc., which will be specifically encoded into the metadata format appropriately in order to have consistency in the description and filtering of the data types.

[72] MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and fourth-generation programming language. More information can be found at: *https://en.wikipedia.org/wiki/MATLAB*.

[73] Extensible Markup Language (XML) is a mark-up language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. It is defined by the W3C's XML 1.0 Specification and by several other related specifications, all of which are free open standards. More related information can be found at: *https://en.wikipedia.org/wiki/XML*.

[74] JavaScript Object Notation (JSON) is an open standard format that uses human-readable text to transmit data objects consisting of attribute-value pairs. It is the primary data format used for asynchronous browser/server communication (AJAJ), largely replacing XML. Though it originally derived from the JavaScript scripting language, JSON is a language-independent data format. Code for parsing and generating JSON data is readily available in many programming languages. More detailed information can be found at: *https://en.wikipedia.org/wiki/JSON*.

5.4.3 Data Sharing

SESAME will use the *zenodo.org* repository for storing the related Project data and a SESAME account will be created for that purpose. *Zenodo.org* is a repository supported by CERN and the EU OpenAire project[75]; This is open, free, searchable and structured with flexible licensing allowing for storing all types of data: datasets, images, presentations, publications and software.
Researchers working for European funded projects can participate by depositing their research output in a repository of their choice[76],[77] publish in a participating Open Access journal, or deposit directly in the OpenAIRE repository *Zenodo* - and indicating the project it belongs to in the metadata[78]. Dedicated pages per project are visible on the OpenAIRE portal. Project-*based* research output, whether it is publications, datasets or project information is accessible through the OpenAIRE portal. Extra functionalities are also offered too, such as statistics, reporting tools and widgets – making OpenAIRE a useful support service for researchers, coordinators and project managers. On this portal, each project has a dedicated page featuring: (i) Project information; *(ii)* App. & Widget box; *(iii)* Publication list; *(iv)* Datasets, and; *(v)* Author information.

In addition to that we also identify the following beneficial features:

- The repository has backup and archiving capabilities.
- The repository allows for integration github.com where the Project code will be stored. GitHub provides a free and flexible tool for code developing and storage.
- *Zenodo* assigns all publicly available uploads a Digital Object Identifier (DOI) to make the upload easily -and uniquely- citable.

All the above features make *Zenodo* a good candidate as a *unified* repository for all foreseen project data (presentations, publications, code and measurement data) coming from SESAME. Information on using *Zenodo* by the Project partners with application to the SESAME data will be circulated within the consortium and addressed within the respective work package (WP8). The process of making the SESAME data public and publishable at the repository will follow the procedures described in the SESAME Consortium Agreement.
For the code, the Project partners will follow the internal *"Open Source Management Process"* document. All the public data of the project will be openly accessible at the repository. Non-public data will be archived at the repository using the "closed access" option.

5.4.4 Archiving and Preservation

The *Guidelines on Data Management in Horizon 2020* require defining procedures that will be put in place for long-term preservation of the data and backup. The *zenodo.org* repository possesses these archiving capabilities including backup and will be used to archive and preserve the SESAME Project data.
Further, the SESAME Project data will also be stored in a project-managed repository tool, called as *Sharepoint*[79], which is managed by the Project Coordinator. It has flexible live data storage capability. This repository will directly link to the project website, where access information to different data types can be provided. This will permit the users and research collaborators to have easy and convenient access to the Project research data.

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[75] The FP7 project OpenAIRE with its successor (OpenAIREplus) aim to support the implementation of the EC and ERC Open Access policies. Open access to scientific peer reviewed publications has evolved from a pilot project with limited scope in FP7 to an underlying principle in the *Horizon 2020* funding scheme, obligatory for all *H2020* funded projects. The goal is to make as much European funded research output as possible available to all, via the OpenAIRE portal. In fact, the Open Access Infrastructure for Research in Europe (OpenAIRE) is the recommended entry point for researchers to determine what repository to choose. OpenAIRE also offers support services for researchers, such as the National Open Access Desks. More information can be found at: *https://www.openaire.eu/*.

[76] See the approach discussed in: European Commission - *H2020* (2013, December). *Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020. Version 1.0*. 11.12.2013.

[77] Other useful listings of repositories are the Registry of Open Access Repositories (ROAR, *http://roar.eprints.org/*) and the Directory of Open Access Repositories (OpenDOAR, *http://www.opendoar.org/*).

[78] Detailed information for that purpose is given at: *https://www.openaire.eu/support/faq#article-id-310*.

[79] See the Context of the *SESAME Deliverable D1.1 ("Project Website").*

5.4.5 Use of DMP within the Project

The SESAME Project partners will use this plan as a reference for data management (naming, providing metadata, storing and archiving) within the project each time new project data are produced.
The SESAME partners are introduced to the DMP and its use as part of WP8 activities. Relevant questions from partners will also be addressed within WP8. The work package will also provide support to the project partners on using *Zenodo* as the data management tool. The DMP will be used as a live document in order to update the project partners about the use, monitoring and updates of the shared infrastructure.

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