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D5.5 Second Report on the PID Forum

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Abstract	This report provides an overview of the activities of the PID forum and the interactions with major stakeholders in the second year of FREYA.
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FREYA project summary

The FREYA project iteratively extends a robust environment for Persistent Identifiers (PIDs) into a core component of European and global research e-infrastructures. The resulting FREYA services will cover a wide range of resources in the research and innovation landscape and enhance the links between them so that they can be exploited in many disciplines and research processes. This will provide an essential building block of the European Open Science Cloud (EOSC). Moreover, the FREYA project will establish an open, sustainable, and trusted framework for collaborative self-governance of PIDs and services built on them.

The vision of FREYA is built on three key ideas: the **PID Graph**, **PID Forum** and **PID Commons**. The PID Graph connects and integrates PID systems to create an information map of relationships across PIDs that provides a basis for new services. The PID Forum is a stakeholder community, whose members collectively oversee the development and deployment of new PID types; it will be strongly linked to the Research Data Alliance (RDA). The sustainability of the PID infrastructure resulting from FREYA beyond the lifetime of the project itself is the concern of the PID Commons, defining the roles, responsibilities and structures for good self-governance based on consensual decision-making.

The FREYA project builds on the success of the preceding THOR project and involves twelve partner organisations from across the globe, representing PID infrastructure providers and developers, users of PIDs in a wide range of research fields, and publishers.

For more information, visit www.project-freya.eu or email info@project-freya.eu.

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Executive summary

This public deliverable is FREYA's second report on the PID Forum, a platform for engagement, interaction and discussion between FREYA and the PID community. It describes the development, activities, and stakeholder reach of the PID Forum during the second year of the project. Major advancements in the past year include the creation of *PIDForum.org*, a global online discussion platform about persistent identifiers for the research world, and FREYA's increased involvement in the Research Data Alliance (RDA) with the formation of the Open Science Graphs for FAIR Data Interest Group. We also describe how we increased the focus of our engagement activities even more towards collaboration with the Horizon 2020 projects forming the European Open Science Cloud (EOSC), including EOSC-hub and OpenAIRE Advance. We provide an overview of FREYA's presentations and workshops at events, including descriptions of highlighted events, as well as our engagement activities via online channels including *PIDForum.org*, the FREYA project website, Twitter, and webinars. Furthermore, the report discusses how we engaged with key stakeholder groups, in particular the EOSC projects and the RDA, and describes the developments in FREYA's Ambassador Programme. The report concludes with an overview of future plans for the final year of the PID Forum.

Contents

1   Introduction

1.1   The PID Forum

As one of the three FREYA pillars, the PID Forum is the platform for engagement, interaction and discussion between FREYA and the PID community. The two main goals of the Forum are to foster collaboration with a wide range of stakeholders for co-designing PID services, and to maximise uptake of services and results by the global community. It is strongly linked to the Research Data Alliance (RDA), the European Open Science Cloud (EOSC), and other research infrastructures. Continuous engagement with stakeholders via the PID Forum informs the community about developments in FREYA regarding standardisation and best practices. The PID Forum activities encourage stakeholders to be involved in the development of PID services, including the development of the PID Graph (WP2,4) and the extension of the PID services and assessment of new PID types (WP3), and facilitate the uptake and sustainability of the FREYA outputs as an integral part of the overall research infrastructure (WP6).

1.2   WP5 goals and KPIs

The primary aim of WP5 is to engage with research infrastructure communities and stakeholders external to FREYA, so that the necessary service extensions and improvements developed and demonstrated by the other WPs will be beneficial to the ecosystem as a whole, and will be adopted by a wider audience.

WP5 contains the following specific goals, in which the PID Forum plays a central role:

- Develop and implement FREYA's communication plan, i.e. establish and sustain standard communication tools (via website, activity on social networks and other media) to offer continuous exchange/information/support around PIDs, and to disseminate and exploit the project outputs (Task 5.1).
- Plan and execute the PID Forum as part of the RDA to engage infrastructure communities to discuss PID related requirements and standardization/protocols (Task 5.2). This task results in the three yearly reports on the PID Forum, including the present report.
- Coordinate with partners in the e-infrastructure realm, e.g. RDA and EOSC, to enable co-design of PID innovations (Task 5.3). This task is carried out through the PID Forum.
- Develop and refine training program for a wide range of stakeholder groups to stimulate extensive PID uptake (Task 5.4)
- Build on the PID Ambassador Programme to raise awareness and provide training, particularly to reach end users (Task 5.5). The FREYA Ambassadors will be actively involved in the PID Forum, including strengthening community-specific engagement.

Based on these tasks, FREYA has established a number of Key Performance Indicators (KPIs) for WP5 in the FREYA Description of Work that are used to measure the success of engagement via the PID Forum. Table 1 shows the relevant KPIs and provides a summary of the achievements of the second year of the project. In addition, several KPIs were specified for the communication actions at the beginning of the project in D5.2 "Stakeholder & Communication Plan"; these are shown in Table 2.

KPI	Target	Year 2 (November 2018 - October 2019)	
Number and distribution of participants in the PID Forum	Steady increase throughout the project. Representation of all defined stakeholder groups. Active participation by FREYA partners in six RDA Working Groups/Interest Groups.	**PIDforum**.org: 327 registered users and on average 6860 page visits per month. The **Knowledge Hub** has now been included in the PID Forum. **PID IG members:** 158. Participation in 15 RDA groups. **Ambassadors:** 32 from 18 countries. **Website visitors (unique):** On average 597 visitors from 44 different countries each month.	+
PID Forum organization	Workshops and presentations at 10+ events per year, three of which are PID-related events and four service provider events per year. At least one session on each RDA Plenary and continuous offline activity. At least half of the RDA sessions will be jointly organized with other EOSC-building projects or e-infrastructures.	FREYA members gave 40 presentations and workshops at 31 different events. FREYA contributed to two sessions at the 13th RDA plenary in Philadelphia (including a Birds of a Feather (BoF) session on the Research Data Graphs and a presentation in the PID IG on the progress of FREYA). At the 14th RDA Plenary in Finland FREYA co-organised the "Open Science Graphs for FAIR data" session with OpenAIRE and other e-infrastructures. We also organised a co-located event "Project FREYA: connecting knowledge in the EOSC".	+

Table 1 PID Forum Key Performance Indicators (KPIs) and achievements as of end of October 2019

Communication Activity	Target FREYA	FREYA Year 1 (Dec 2017 - Oct 2018)	FREYA Year 2 (Nov 2018 - Oct 2019)		Total
Blog Posts	70 [23 per year]	13	32	+	45
Twitter Followers	1000 [in total]	944	378	+	1322
Tweets	500 [167 per year]	110	328	+	438
YouTube videos	10 [3-4 per year]	3	4	+	7

Table 2 Overview of planned social media communication activities and achievements in 2019

1.3   The PID Forum in FREYA's second year

In the first year of the project, WP5 created the Stakeholder & Communication Plan (D5.2), established the PID Forum, and carried out many engagement activities at events and online to promote the project and connect with stakeholders. Most of the activities in this early stage of the project were organised with the main aim of creating awareness about the project and its goals, but a start was also made on gathering input from the community to inform the work in other WPs. In particular, WP5 and WP3 collaborated on several occasions to consult the PID Forum for feedback on user stories for new and emerging PID types. A complete overview of the PID Forum activities during FREYA's first year can be found in D5.3 "First report on the PID Forum"[1].

In FREYA's second year, we continued to evolve the PID Forum, with several key developments in our approach compared to the first year. Firstly, a major advance is the creation of the online PID Forum at PIDforum.org (Section 3.1). Secondly, the focus of our activities has shifted even more towards engagement and collaboration with the EOSC-related projects (detailed in Section 4.1), and we also expanded our active involvement in the RDA with the creation of the Open Science Graphs for FAIR Data Interest Group. Thirdly, as the work in the other WPs has further progressed, the engagement activities have moved from a general view of the project to a more in-depth approach around concrete outputs, for example around the advancements of the PID Graph (WP2, 3, 4) and new and emerging PID types (WP3). WP5 has increasingly used the PID Forum to exchange ideas with and collect feedback from the project's main stakeholders and the wider PID community to inform the work in the other WPs. Furthermore, in the second year WP5 has begun developing training materials (also see D5.4 "Initial Training Materials"[2]) and organising training events (see Section 2) in direct connection with the PID Forum. Finally, the number of FREYA Ambassadors has continued to grow and they have been actively involved in the PID Forum activities (Section 4.4).

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[1] https://doi.org/10.5281/zenodo.2414527
[2] https://doi.org/10.5281/zenodo.3462140

1.4   Outline of this report

This report provides an overview of the activities around the PID Forum in the second year of the FREYA project. Section 2 describes FREYA's engagement activities in the form of presentations, workshops, and other events, and includes descriptions of highlighted events. In Section 3, we describe our engagement activities via online channels, including PIDForum.org, the FREYA website, Twitter, and webinars. Section 4 discusses how we engaged with key stakeholder groups, in particular EOSC and RDA. Furthermore, we describe our geographical and disciplinary reach and the FREYA Ambassador Programme in FREYA's second year. Finally, in section 5, we conclude with an overview of the next year of the project and the future plans for engagement via the PID Forum.

2 PID Forum events

2.1 Overview and approach

In the second year of the project, FREYA members have presented the project, its outcomes and progress via 40 presentations or workshops at a total of 31 different events in 15 different countries. We aim to organise our events to encourage interaction with and input from the audience, so that we can use them to gather feedback on FREYA's work in the other WPs. For example, we often include audience breakout activities or discussion sessions, and we use interactive audience participation tools such as Mentimeter[3]. In this section we highlight several events we organised in the RDA, the EOSC, and the global community. A full list of all events organised by FREYA in its second year can be found in Annex A.

2.2 RDA

RDA 13th plenary, Philadelphia: Birds-of-a-Feather session "Research Data Graph"

Earlier this year, FREYA partners joined an international group of approx. 400 data professionals, researchers, industry leaders, entrepreneurs, and policymakers in Philadelphia for the RDA's 13th Plenary Meeting (April 2-4, 2019). The overall theme of the plenary "With Data Comes Responsibility", put a much-needed and interesting twist on things, highlighting the need to enforce transparency on multiple levels — beyond merely providing source code for data applications. This is particularly important when dealing with machine learning algorithms which may base future decisions on a bias inherent to the training dataset (e.g. male/female bias), leading to an indirect reinforcement of the pattern.

FREYA held a well-attended "Birds of a Feather" meeting on the theme of Research Data Graphs. A total of 55 people attended the BoF meeting and, after a short introduction by Vasily Bukanov (FREYA), there followed presentations by Amir Aryani (Research Graph), Paolo Manghi (OpenAIRE), Adrian Burton (Australian Research Data Commons), and Tina Dohna (FREYA), which spurred questions and discussions in the audience. Several participants were eager to find out more about ways to integrate the graph architectures in their own infrastructures. The questions and discussions around integrating graph architecture made it clear that the community has already recognised the advantages of applying graph principles when connecting related but distributed digital research records. There was also some discussion on how best to align the existing research graphs and to provide guidance and transparency to the community. Frances Madden (FREYA) concluded the presentation with a mentimeter questionnaire that helped the session organizers (Martin Fenner (DataCite), Frances Madden (BL), Vasily Bukanov (STFC), and Tina Dohna (PANGAEA)) to gauge the audience's interest in following this initial meeting and discussion with more directed RDA activity in the form of an Interest or Working group (see Figure 1). As an outcome of the meeting an RDA Interest Group was founded, which will meet for the first time at the 14th RDA Plenary in Helsinki.

The BoF was an excellent place to start gathering an overview of the different graph architectures and their capacities outside of FREYA, and to connect with other projects and actors in the field of research graphs. The next meeting at the 14th RDA Plenary (Session Chair: Martin Fenner) will be used to decide how we can move forward together.

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[3] https://www.mentimeter.com
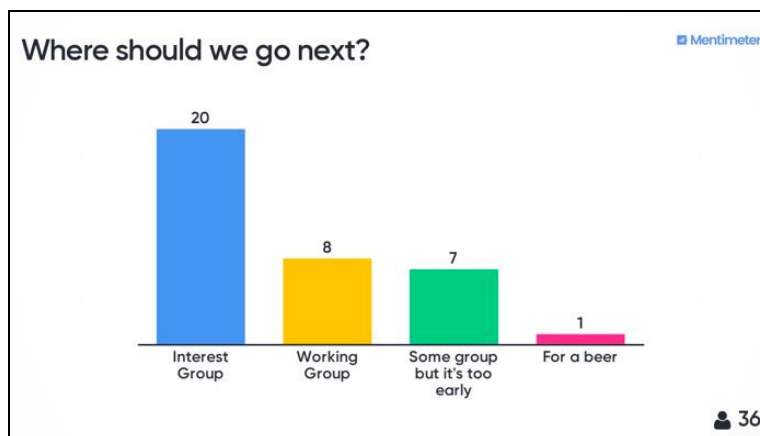
Figure 1 Results of audience input via mentimeter in the "Research Data Graphs" BoF at the 13th RDA plenary meeting. The audience had a clear preference for forming an RDA Interest Group.

RDA UK - JISC workshop, London

On 16 July, FREYA partnered with the RDA UK Node to organise a workshop around persistent identifiers. Held at the Wellcome Trust in London, the workshop provided the opportunity to highlight the RDA's PID-related and the FREYA project's outputs to the UK research data community. With over 70 attendees from the UK and further afield, such as France and Germany, the workshop was very successful in communicating the synergies between the RDA and FREYA.

The day began with an overview of the PID landscape. Chris Brown from JISC spoke about JISC's involvement with PIDs, followed by an overview of several RDA interest groups including the proposed new Open Science Graphs for FAIR Data Interest Group, of which the PID Graph developed in FREYA is a core component. Several PID providers gave updates, including ORCID, Crossref, and the British Library, which is consortium lead for the UK's DataCite membership. After lunch we heard from several FREYA partners about how they are using the PID Graph, such as Europe PMC's support for pre-print versioning and STFC's graph of PhD theses. Juan Bicarregui, also from STFC, provided an overview of how the European Open Science Cloud was going to be built.

The afternoon included breakout sessions where attendees discussed the utility of the PID Graph and the RDA's role in this. One of the key findings was that many of the delegates were unclear about what the PID Graph can do and what problems it can solve. It has the potential to solve many problems for a variety of users but one of the main uses and examples is the capability to improve tracking research outputs and build connections between the different entities. There were requests for information about how to use the Graph and some examples of queries. These findings were fed into FREYA work and have resulted in a renewed effort to communicate the PID Graph's potential to a wide range of users.

RDA 14th Plenary, Helsinki: FREYA co-located event "Connecting knowledge in the European Open Science Cloud"

On 21st October 2019 FREYA organised a co-located event at the 14th RDA plenary meeting. A total of 35 participants registered, from diverse backgrounds in the research and e-infrastructure communities. With this event we showcased the work FREYA has done so far, with the aim of enabling interested stakeholders to use the services developed within FREYA, in particular the PID Graph. The half-day event started with a series of short presentations introducing PIDs and why they are useful, followed by a short overview of the project, the PID Graph, and the types of established and new PIDs we work with in the context of use cases.

Then a two-hour interactive tutorial session on how to query the PID Graph with Jupyter notebooks introduced GraphQL and its application to the PID Graph, and was followed by an introduction to Jupyter

notebooks. Subsequently, we gave two demo sessions with pre-written Jupyter notebooks: one on PID Graph Key Performance Indicators (KPIs), where the DataCite GraphQL API is queried to fetch summary statistics about the nodes and connections in it[4]; and one retrieving and visualising all publications, datasets, and software by a particular researcher, using their ORCID iD (Figure 2)[5]. The participants were encouraged to play around with the notebooks themselves by altering the code with their own queries.

The final hour of the event was dedicated to the role of PIDs in the EOSC and sustainability in general. After a short introductory presentation c, participants were invited to come up with answers to questions around this topic, for example, "What PID infrastructure would you expect as part of the EOSC?" and "How could the offerings of the EOSC support the creation of rich PID Graphs?". The ideas were contributed on post-it notes and used for a central discussion. The event closed with an introduction to the PIDForum.org, where the audience was invited to continue the discussions after the event.
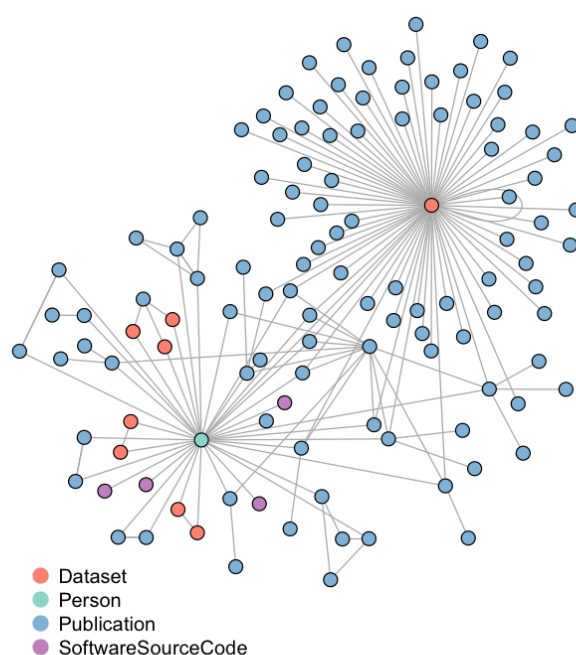
Figure 2 Visualization of publications, datasets and software of a researcher using DataCite GraphQL API

RDA 14th Plenary, Helsinki: Open Science Graphs for FAIR Data Interest Group

Following the successful Birds of a Feather at RDA 13th Plenary in Philadelphia, the Open Science Graphs for FAIR Data Interest Group's first meeting took place at P14 in Helsinki on 25 October 2019. Despite being in the last scheduled session of the conference, the session was well attended by approximately 40 people. Following presentations of various types of graphs in context including from euroCRIS, ERC and TIB, there was a discussion around next steps for the interest group. Several questions were asked about what the group should cover and the consensus was that it should work on interlinking between graphs and should cover both high level concept graphs as well as Knowledge graphs. The group were all given the action to sign up to the mailing list to continue the discussion after the meeting.

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[4] https://doi.org/10.14454/3bpw-w381
[5] https://doi.org/10.14454/628m-3882

2.3   EOSC events

FREYA - EOSC-hub workshop, Amsterdam

Following an initial face-to-face meeting between several FREYA and EOSC-hub members during EOSC-hub week in Prague in March 2019, we organised a joint workshop to discuss possibilities for collaboration between the two projects (also see Section 4.1). The workshop took place 8-9 July 2019 in Amsterdam and was attended by 17 people, eight EOSC-hub members and nine FREYA members. After two short introductory presentations about the projects by coordinators Simon Lambert (FREYA) and Tiziana Ferrari (EOSC-hub), we started the workshop with a session about the FREYA PID Service Registry that is being developed in WP2, and the process of onboarding this registry to the EOSC portal. The rest of the first day was dedicated to discussing the relationship between FREYA's PID Graph and EOSC-hub's B2handle service, and the possible uses of PID Graph functionality for EOSC-hub services. On the second day we had four discussion sessions with the following topics: the governance of PID services in the EOSC; the evaluation and adoption of PID services by EOSC-Hub research communities and thematic services; collaboration on training between FREYA and EOSC-hub; and future perspectives for collaboration in relation with the upcoming EOSC-building funding calls in 2020 (INFRAEOSC-03 and -07). The meeting was concluded with the formulation of several action points around the discussed topics and next steps.

EOSC projects coordinating workshop, Brussels

FREYA contributed to the EOSC meeting and workshop in Brussels on 9-10 September organised by two Eurocommission departments: The Directorate-General for Communications Networks, Content and Technology (DG CONNECT) and Directorate-General for Research and Innovation (DG RTD). The event was aimed at developing closer links among the projects that contribute to the development of the European Open Science Cloud (EOSC). EOSC Secretariat and heads of the EOSC Working Groups presented the current EOSC status and requested participants to share their views of the EOSC architecture, rules of engagement, and other topics.

A dedicated session was devoted to the EOSC governance, with FREYA leading a discussion about the interaction between established governance models and EOSC's emerging model. FREYA's interest in this topic is natural as several of our partners, notably PID infrastructure providers such as DataCite, Crossref, and ORCID, have their own global business models and governance structures, so ensuring that these well-established governance structures can productively interact with the EOSC in a European context has to be discussed and defined. The topic attracted the interest of the workshop participants beyond the PID ecosystem, and resulted in a number of recommendations for EOSC to consider.

Apart from the structured discussions, the workshop was a good opportunity for networking across the entire spectrum of projects and organisations involved in the EOSC development. A few ideas, such as minting PIDs for EOSC services, proved to be more important than was previously thought, so FREYA is now better informed on the priorities of other EOSC actors and can plan appropriately for further project-to-project communication and joint activities.

Services to support FAIR data workshop series (Prague, Vienna, Porto)

In April 2019, two workshops were held to formulate recommendations on how services and infrastructures can better support the implementation of the FAIR data principles (one during EOSC-hub week in Prague, Czech Republic, and one in Vienna, Austria). FREYA participated in both workshops by presenting the role of PIDs in making data FAIR. The input and conclusions from both workshops were analysed to form the basis for a draft report "Services to support FAIR data: Draft report and recommendations". As a conclusion to these workshops, a third was organised during the Open Science Fair in Porto, Portugal, in collaboration with OpenAIRE, FAIRsFAIR, RDA Europe, EOSC-hub, and FREYA.

The objective of the workshop was to prioritise the recommendations gathered by the community in the two preceding workshops, and then to move beyond recommendations to formulate some clear, pointed actions along with a view on who should be taking these forward. The participants were split up into three

break-out groups — service providers, research institutions, and libraries. The groups worked on prioritising the recommendations, formulating actions to implement the top recommendations, and identifying the stakeholders who should be responsible for these actions. This was followed by a panel discussion, during which the panellists shared their personal views on the prioritised recommendations and actions. The discussion in the final part of the session focused on responsibilities and roles of different stakeholders. User requirements were put forward as strong incentives, as was the professionalisation of data management and the role of data stewardship. Often neglected in discussions, national libraries can and should be more involved in discussions and events around FAIR. Another critical point was the opportunity and responsibility of services to simplify the process of making data FAIR. It was concluded that this is not the sole responsibility of the researcher but should be a common effort between research institutions, funders, service providers, and experts. The results of the breakout groups and panel, in combination with the conclusion of the previous workshops, will be used as input to a final report with recommendations on services to support FAIR data, which is intended for submission to the EOSC Working Group on FAIR.

The International Research Data Community Contributing to the EOSC, Helsinki

This event was organised on 22nd October 2019 by EOSCSecretariat, EOSC Executive Board and the Research Data Alliance and was collocated with the 14th RDA plenary in Helsinki to provide an opportunity for the international community to contribute to the development of the EOSC. The event had approximately 250 attendees both from Europe and further afield. Following the morning sessions which set the EOSC in context and gave an update on the progress of the EOSC Executive Board and its working groups, FREYA took a role in the afternoon's breakout sessions organised by the different EOSC Working Groups, namely the Architecture Working Group's session on a persistent identifier policy for EOSC. After an introduction from Anders Conrad (DEIC) about the work of PID Task Force to date, Brian Matthews (FREYA) gave an update on FREYA's work on creating a PID Policy including thoughts on the scope of a policy for the EOSC. Frances Madden (FREYA) then ran a feedback exercise on the most important elements to be contained in a PID policy, namely machine actionability and versioning. A lively discussion about the coverage and level of the policy followed which will be used as input into the EOSC PID Policy which is due to be delivered in a draft form in early 2020.

2.4   Other events

PIDapalooza 2019, Dublin

The third PIDapalooza Festival, co-organised by the California Digital Library, and FREYA partners Crossref, DataCite, and ORCID, took place 23-24 January 2019 in Dublin, Ireland. FREYA (co-)organised a total of five sessions. On the first day, we gave a session on community engagement, in which we first presented the ins and outs of the FREYA Ambassador Programme, and then gave the stage to Nicole Kearney (Biodiversity Heritage Library), the winner of our ambassador competition. The first day also saw the official launch of PIDforum.org (during the festival opening), as well as a session introducing the online forum, which is aimed at bringing together a community of best practice around PIDs beyond the FREYA project (see section 3.1). During this interactive session we gathered lots of useful feedback from the audience, such as ideas for topics on the forum and communities to reach out to, which served as input for further developing the forum. FREYA also joined a session reporting back on the international PID Workshops that took place in Singapore and London (described in D5.3). The final FREYA session focused on the PID Graph and the FREYA use cases for new PID types. We discussed how FREYA has collected PID user stories during the first year of the project, and how we use these as input for developing the PID Graph. The user stories have been added to the PIDforum.org[6] for further comments and additions.

2.4.1.1   3rd international PID workshop, Portland, USA

The North American PIDs for Research Workshop was held in Portland Oregon on the 5-7 May and hosted by the California Digital Library (CDL) in partnership with the ARDC. Stakeholders were drawn from across

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[6] See https://www.pidforum.org/c/user-stories

the world, in particular the North American digital research community. The desired outcomes of the workshops were to find broad agreement and develop a unified approach to identifying and communicating:

- PID benefits: Communicating the value of PIDs to different stakeholders (e.g. repository managers, research funders, publishers)
- PID workflows: Identifying and articulating where PIDs add value in research workflows
- PID impacts: Understanding the impact PIDs can have
- PID systems: Being able to identify what a good PID system looks like

The workshop included a group exercise to describe current and ideal PID workflows, which was an excellent opportunity for the group to examine the potential for connecting existing PIDs and also identify the gaps in workflows that would benefit from a new or repurposed PID.

These pitches were then more seriously developed into key communication points about PIDs and discussion around the need for consensus, standardisation, and clear articulation of benefits. Wider points here included: a preference for coordination over convergence, shared development of international PID governance, and investigating common PID infrastructures.

A key outcome of this workshop was to build community by bringing together diverse stakeholders for discussion about shared needs and structures. This yielded great discussion about further activities to continue the momentum of the workshop, and there was also agreement about a number of more specific steps and agreements. These mirrored the outcomes of the previous workshops in Singapore and London and included:

- A PIDs workshop outcomes paper for the Research Data Alliance (RDA) Plenary 14 in October 2019
- Conscious consensus-building across the sectors about the value of PIDs
- Consideration of the formation of a PIDs technical interest Group for RDA
- General agreement about the need for standardisation and interoperability across PID systems

Force 2019, Edinburgh

FORCE2019 was held in Edinburgh, UK on 15-17 October 2019. This is an annual meeting of the FORCE11 community[7] that provided an excellent overview of efforts seeking to change "the ways scholarly and scientific information is communicated, shared and used". The role of persistent identifiers was mentioned in many talks as indisputable to the "future of research communication and e-Scholarship". Speakers introduced a swathe of initiatives aimed at recognising all manner of contributions to scholarly research, including: a strong focus on software citation and how this differs from data citation; the CRediT taxonomy for recognising the variety of "author" contributions to a scientific study; a proposal for an "openness profile" to document contributions to open scholarship; the publication of Registered Reports that rate the strength of a research question as more valuable than the ensuing results. The FREYA project presentation[8] introduced the concept of the PID graph, as well as our work to recognise emerging identifier types and foster their development and adoption. FREYA work was also presented as part of a pre-conference workshop ("working with ROR data"), posters ("Global Grant IDs in Europe PMC"), panel discussions ("Data usage, sharing, citation and metrics"), and talks (Crossref's "Creating a richer picture of research support with grant IDs").

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[7] https://www.force11.org/about
[8] https://doi.org/10.5281/zenodo.3514572

2.5   Upcoming events

PID NL workshop, The Hague, November 2019

On November 20 2019, FREYA and RDA-NL, in collaboration with 4TU.ResearchData, DataCite, ORCID, and SURF, will organise a one-day event dedicated to PIDs. This workshop will provide an overview of the value of PIDs and the different PID types available. The morning will be dedicated to demonstrations of PID implementations and examples of how to successfully increase PID awareness. The afternoon will feature parallel hands-on sessions developed around specific perspectives on PIDs, such as preservation, PIDs and life sciences, and the PID Graph. This event is mainly intended for professionals such as information specialists, librarians, repository managers, and policy makers, but anyone with an interest for PIDs and their practical applications is welcome to attend.

PIDs for Humanities workshop, London, December 2019

This workshop, co-hosted by FREYA, UCL Centre for Digital Humanities, Institute of Historical Research - School of Advanced Study, and DARIAH, will take place on December 4. It aims to provide an overview of the ways in which historians can build and manage their online profile as a researcher, using tools such as ORCID IDs. It will also cover best practices and methods of citing digital resources so that their work is connected and discoverable by others. The afternoon will be an opportunity for researchers to share their experiences in terms of   successes and challenges when working with digital resources, and to hear from journal editors about their work and how they cite digital objects. The workshop is primarily aimed at early career historians but other humanities researchers are also welcome.

Software Graph Hackathon, London, December 2019

FREYA and the Software Sustainability Institute are holding a day long hackathon on 4 December, to help us understand how persistent identifiers are being used for software. Through an interactive session utilising existing access points to the PID Graph (e.g. GraphQL API, Jupyter Notebooks etc.), participants will identify the connections and potential impacts of software in research. The hackathon is aimed at PID enthusiasts, research software engineers, bibliometricians, and anyone who is interested in PIDs and understanding research publications. The aim of the event is to raise awareness of the PID Graph and encourage uptake of it by early adopters.

PIDapalooza 2020, Lisbon, January 2020

PIDapalooza 2020 is organised by California Digital Library, Crossref, ORCID, and DataCite. As in previous years, the conference will consist of interactive sessions, this time around the themes:

- Putting Principles into Practice
- PID Communities
- PID Success Stories
- Achieving Persistence through Sustainability
- Bridging Worlds - Social and Technical
- PID Party!

FREYA has been accepted to host a session on the PID Forum, to discuss the development of PIDForum.org since its launch during PIDapalooza 2019, and to gather feedback from the community on how to continue to grow the forum's success. Moreover, a session on the Ambassador Programme has also been accepted which will include a talk by the winner of this year's ambassador competition. Last but not least, the FREYA team will also host sessions on the EOSC PID policy work, and the PID Graph and software at PIDapalooza 2020.

3   PID Forum online

3.1   PIDforum.org

The PID Forum was initially mainly set up via the RDA plenaries and other international events bringing together key stakeholders of FREYA, as well as via our participation in relevant RDA groups. During the first year of the project WP5 realised that there was also a need for an online discussion space to facilitate continuous two-way interaction with the PID community. This would allow ongoing exchanges with the community outside the face-to-face meetings, as well as the participation of members of the community that do not have the chance to attend PID Forum events for geographical and/or economical reasons. In FREYA's first year we decided to use the online mailing list of the RDA Persistent Identifier Interest Group (PID IG) for this purpose. However, it appeared that this mailing list is not used actively enough to fulfill this function in a useful way.

During FREYA's second plenary meeting at EBI in Cambridge in December 2018, we decided to look into developing our own platform for the online PID Forum. We chose the Discourse platform for the forum, which is a widely used[9] open source Internet forum and mailing list management software application, and includes many useful functionalities that suit our requirements very well. Before moving ahead with creating the forum, we discussed the issue of sustainability with FREYA's PID provider partners DataCite, Crossref and ORCID, who agreed to continue hosting and maintaining the forum after the lifetime of FREYA, in case the forum is successful. PIDforum.org was launched in January 2019 during PIDapalooza (Dublin), where we announced it during the festival's opening ceremony and held an interactive session to request feedback from the community on how to best develop the forum (see Section 2.3).

Figure 3 shows a screenshot of part of the forum's landing page. We set up the forum with several categories, in which topics can be created, including categories for PID Best Practices, PID news and blogs, PID related events, PID Graph, PIDapalooza and more. The forum and topics are visible to anyone who visits the site, but only registered users can post or reply to a topic. The forum currently has 15 users with administrator and moderation rights, with at least one admin from each FREYA partner.
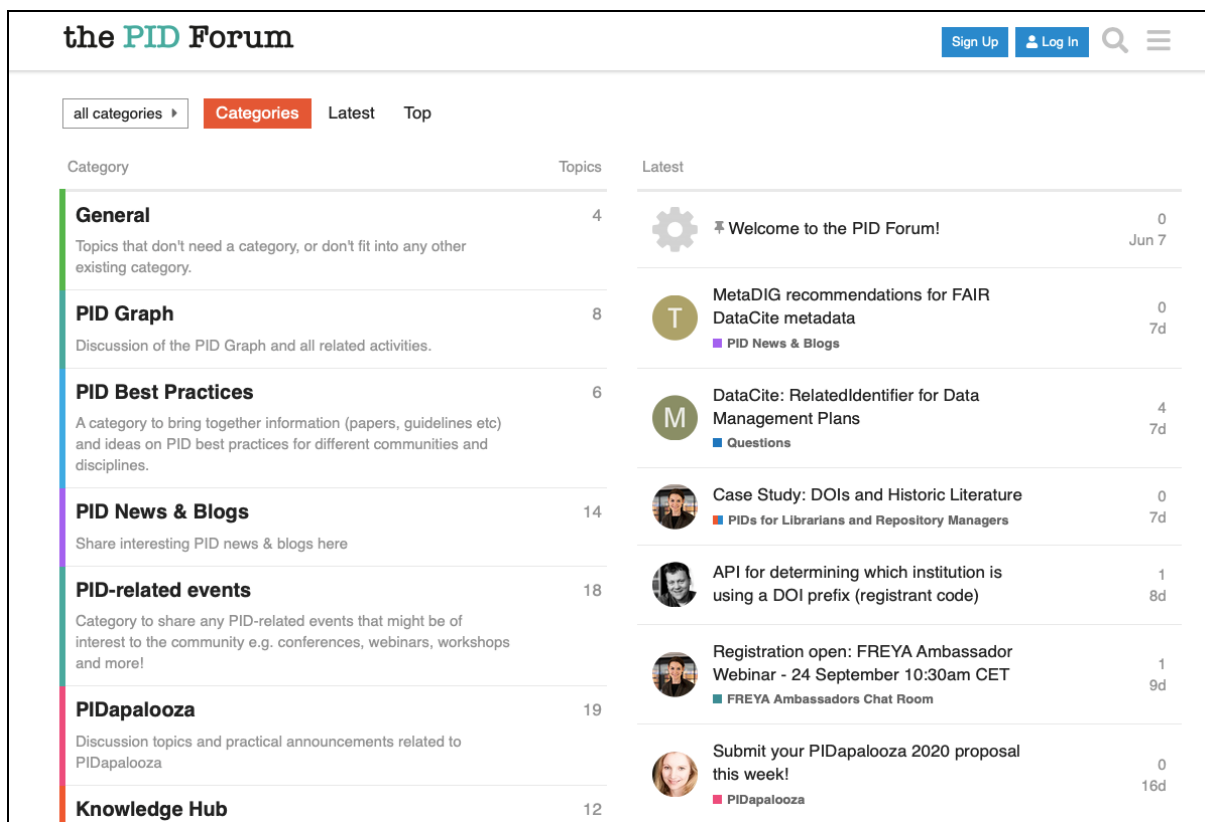
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[9] https://www.discourse.org/

Figure 3 The landing page of PIDforum.org

In the course of the second year we decided to move FREYA's Knowledge Hub to the forum, to make the content visible for a wider audience and to facilitate feedback on the content from the community (also see D5.4 "Initial Training Materials"). We also moved the Ambassador's Slack channel and FREYA's Slack channel for internal communication to the Forum (the latter as a closed group, not visible to other users or site visitors). In addition, other community discussion channels have also moved to the forum (as closed groups), including DataCite's Community Forum, and the PIDapalooza organising committee.

The number of registered users has steadily grown since the forum was launched, as of the end of October 2019 the total number is 327 (Figure 4). Figure 4 also shows the number of page views per month since the forum's launch, with a total of 68601 page views as of the end of October 2019.
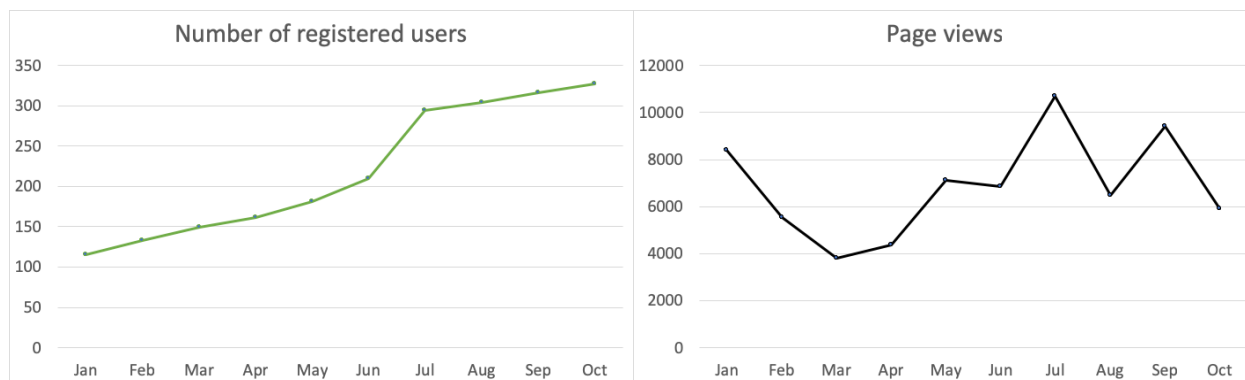

Figure 4 Number of registered users of the PID Forum per month (left) and number of page views of the PID Forum per month (right)

3.2   Website and social media

In addition to the online discussion platform PIDforum.org, FREYA has several online channels for communication and dissemination: the FREYA website, Twitter and YouTube channel.

Website

The FREYA Website is the main window to showcase what the projects is developing and has to offer to the PID community and beyond. It provides information on the project and its partners, upcoming and past events, the Ambassador Programme, the project's results and outputs, and includes a news and blog section. During the second year we have also added a section on the PID Graph. The Project Outputs page has recently been updated with a complete list of the project deliverables, webinars' recordings and the event materials developed as part of presentations or workshops. Every resource is also available via Zenodo.org and is assigned a DOI. In the second year of the project we have published over 25 blogs on our website. These include blogs in the "Meet the FREYA partners" series, blogs on developments around the PID Graph and other FREYA results, reposts from partner blogs, and guest blogs, e.g. from our ambassadors. On average, the FREYA website attracts 439 unique visitors a month and, compared to the first year of the project, the number of visitors has been increasing (see Figure 5).

Figure 5 Number of unique visitors of the FREYA website per month

Twitter

Twitter is an important, low threshold communication channel that the FREYA project uses to interact with the broad research community and disseminate the project's results. The FREYA Twitter account has more than 1200 followers (see Figure 6 below), ranging from individual researchers and scholars interested in Open Science, to research infrastructures such as CESSDA, DARIAH or ELIXIR as well as other (European) project including FAIRsFAIR, EOSC-Hub and OpenAIRE-Advance.

FREYA uses Twitter, for instance, to disseminate news and information about the project, announce events and request feedback on the project's results. Moreover, Twitter is also used to stay updated about the developments in other projects and initiatives related to PIDs and the European and global research infrastructure. We also actively retweet relevant posts from our project partners and sister projects, EOSC-Hub, OpenAIRE-Advance, FAIRsFAIR and RDA Europe, to promote their work within the broader PID community.
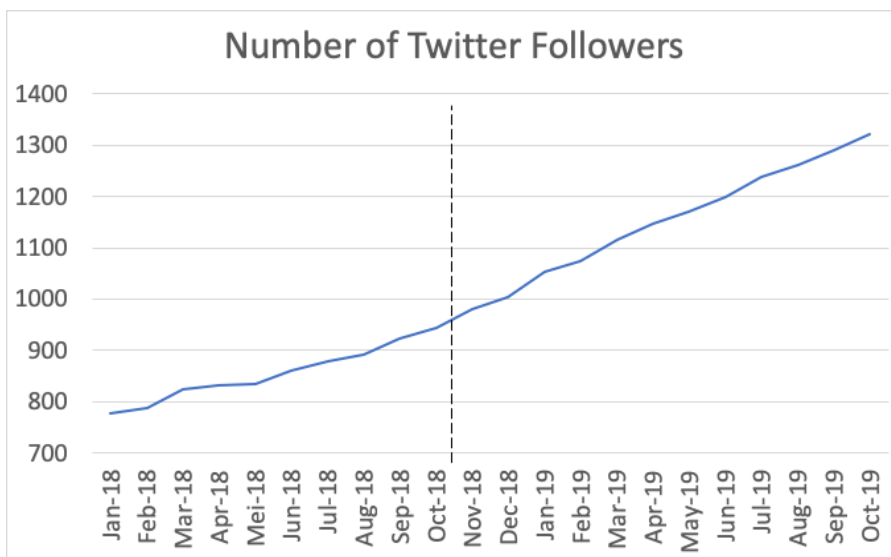
Figure 6 Number of Twitter followers throughout the FREYA project
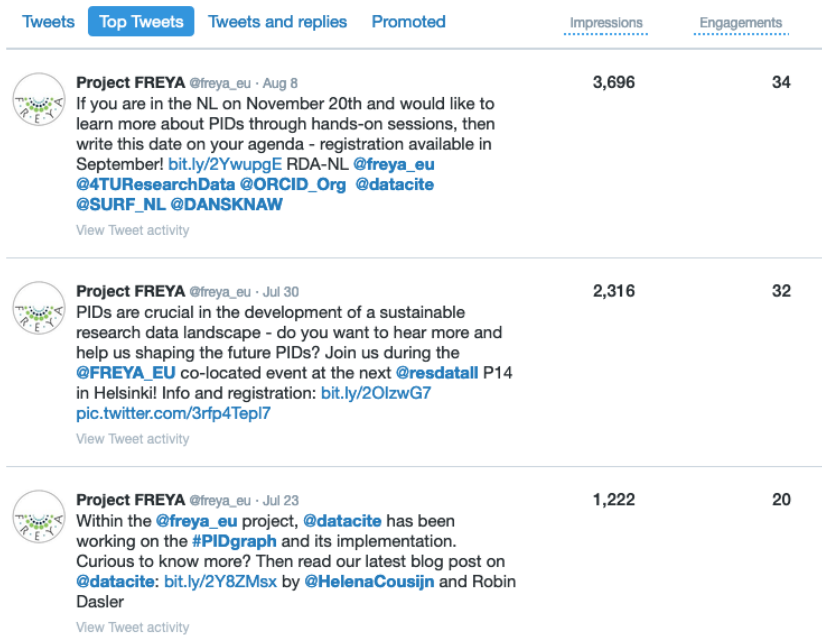
Figure 7 Selection of three top tweets and associated metrics. "Impressions" indicate the number of times users saw the tweet on twitter and "Engagements" indicate the total number of times a user has interacted with a tweet.

The impact of our tweets varies but our top tweets have been seen more than 1200 times (see Figure 7 above). To further estimate the impact of our Twitter communications, we collect information about the number of followers, profile visits, retweets and likes each month (see Table 3 below). On average, the FREYA twitter account receives 433 profile visits each month.

	Number of new followers	Number of profile visits	Number of retweets	Number of likes
Average	26	423	20	31
Range	6 - 47	63 - 937	3 - 42	4 - 65

Table 3 Overview of key metrics from the FREYA Twitter measured each month

YouTube

The main goal of the FREYA YouTube channel[10] is to make the recordings of the FREYA webinars available online. These videos have been assigned a DOI and are available on Zenodo.org[11]. As of the end of October 2019 our YouTube channel has 52 subscribers.

3.3   Webinars

In FREYA's second year, we hosted four webinars. We organised two webinars for the ambassadors and a Freya midterm webinar. We also co-organised a webinar with OpenAIRE. All the webinars are available on the FREYA YouTube channel.

Joint OpenAIRE–FREYA webinar

A joint OpenAIRE-FREYA webinar was held on 10 January 2019. The webinar, which had 71 participants, focused on requirements for new PID services (WP3), for which FREYA collected user stories from their respective communities and networks. FREYA also presented the work on the PID Graph (WP2) and how the FREYA partners are contributing to realizing this vision with the PID Graph demonstrators (developed in WP4). Iryna Kuchma presented how OpenAIRE uses PIDs for discovery, enrichment, and linking of research results.

Third FREYA Ambassadors webinar

Our third webinar for the ambassadors took place in March 2019, with a total of seven ambassadors (plus panelists) attending, including Brigitte Hausstein (GESIS Leibniz Institute for the Social Sciences Cologne), who presented on her experience promoting PIDs in her network. This webinar was also the occasion to introduce two new FREYA developments to the ambassadors: new PID services (WP3) and the online PID Forum at PIDforum.org.

FREYA midterm webinar

The FREYA midterm webinar was held on 9 May 2019, with the aim of showcasing the project's achievements in its first half. We presented the advancements around the PID Graph and its demonstrators, requirements for new PID types, and the developments in FREYA's engagement and training activities. Around 40 people from all over the globe, including researchers, project officers and policy makers, attended the webinar.

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[10] https://www.youtube.com/channel/UCQ5Jp19cvtVLPxUB2WVO5CA
[11] https://zenodo.org/search?page=1&size=20&q=freya

Fourth FREYA Ambassadors webinar

The fourth webinar for the ambassadors was held on 24 September 2019, with a total of nine participants and six panelists attending. Three ambassadors introduced case studies and applications of PIDs in their research and professional fields. Nicole Kearney of the Biodiversity Heritage Library, Australia discussed the importance of PIDs not only for newly created resources, but for legacy data as well. Luc Borota from Thunken presented Cobaltmetrics, a citation aggregator developed by their team that collates hyperlinks and PIDs referencing digital objects. The service is creating a graph of URIs which aligns with FREYA's work creating a PID Graph. Finally, Paloma Marin Arraiza (Vienna University of Technology) presented the activities of ORCID Austria.

4   Stakeholder engagement and outreach

In the project's Description of Work and in our Communication and Stakeholder Plan (D5.2, internal document), FREYA specified five stakeholder groups relevant to the project: service providers, research stakeholders, users, structural stakeholders, and commercial stakeholders[12]. Of these, two groups are particularly relevant for the PID Forum, namely service providers and research stakeholders. The EOSC-related projects and Working Groups as well as the RDA are the most important communities for FREYA engagement within these two stakeholder groups. Given the importance of the EOSC for FREYA, the EOSC governance and executive board are also important (structural) stakeholders that FREYA aims to engage with, in particular in the last year of the project where FREYA's results need uptake from the broader community and integration with the EOSC. Table 4 below gives an overview of our interaction with the EOSC, RDA, and other key stakeholders that our engagement activities target.

Main stakeholders targeted by PID Forum engagement		
Stakeholder categories and groups		**Examples of stakeholders**
Service Provider	(PID) Service providers	- ORCID members - DataCite members - National PID providers
	EOSC Projects, E-infrastructures	- EOSC-hub - EOSC Secretariat - OpenAIRE-Advance - FAIRsFAIR - RDA Europe 4.0
	EOSC Working Groups	- WG Landscape - WG Sustainability - WG Architecture - WG FAIR - WG Rules of Participation
Research	Research data communities	- RDA - WDS - National communities
	Research infrastructures	- CESSDA - DARIAH - FORCE

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[12] It is possible that these stakeholder groupings will be slightly revised in the course of work in the last year of the project.

Structural	EOSC	● EOSC governance board ● EOSC executive board

Table 4 Overview of the Main FREYA stakeholders targeted by PID Forum engagement

4.1   EOSC

One of FREYA's main aims is to build a sustainable PID infrastructure as a core component of Open Science in the EU (and globally), with the view that PIDs are crucial building blocks within the emerging European Open Science Cloud (EOSC). Therefore, interaction with the other main EOSC-building projects is essential for FREYA's success and forms the main focus of WP5's engagement activities. In its second year, FREYA has engaged in many ways with these projects, in particular with the "core" EOSC projects, EOSC-hub and OpenAIRE, and increasingly with FAIRsFAIR, RDA Europe 4.0, and EOSC Secretariat. Here we give an overview of the main developments in our interaction with these projects.

EOSC-hub

The EOSC-hub project[13], currently the largest EOSC project, brings together multiple service providers (including the EGI Federation, EUDAT CDI, and INDIGO-DataCloud) to deliver a common catalogue of research data, services, and software for research. In the past year, FREYA has led several discussions about possibilities for collaboration between the projects. During EOSC-hub week (10-12 April 2019, Prague), several members from both projects came together for our first face-to-face meeting, with the aim of identifying topics on which we can work together. During this meeting, we identified four points for possible collaboration:

1. The inclusion of FREYA services into the EOSC-hub service catalogue, based on the PID services registry to be developed in D2.3
2. The relationship between FREYA's PID Graph and EOSC-hub's B2handle service
3. Training and engagement: inclusion of FREYA training materials in the EOSC-hub catalogue, co-organising training and engagement events
4. A recommendation paper led by EOSC-hub, with input from EOSC projects including FREYA, on our joint vision of EOSC federated (PID) services

Following this meeting, we organised a two-day face-to-face joint workshop (8-9 July, Amsterdam) to continue working on these points (see section 2.2 for a summary of the workshop). Work on the four lines of collaboration is still ongoing and will continue via different FREYA work packages (WP2, WP3, WP5 and WP6). For WP5's part, FREYA has already included several training materials in the EOSC-hub catalogue, and co-organised a workshop with EOSC-hub and other EOSC projects during the Open Science Fair (16-18 September, Porto, see Section 2.2).

OpenAIRE

The mission of OpenAIRE[14] is to shift scholarly communication towards openness and transparency, and to facilitate innovative ways to communicate and monitor research. FREYA collaborates with OpenAIRE in two major ways. Firstly, on training: we co-organised two training events, a webinar (see Section 3.3), and a training workshop on the use of PIDs during the Open Science FAIR (see Section 2.2). FREYA WP5 has also co-authored the training guide "How can identifiers improve the dissemination of your research

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[13] https://www.eosc-hub.eu/
[14] https://www.openaire.eu/

outputs?"[15], published by OpenAIRE in May 2019. Our second route of interaction with OpenAIRE is on the alignment of research graph initiatives, including FREYA's PID Graph and the OpenAIRE Research Graph. This collaboration, led by Martin Fenner (FREYA) and Paolo Manghi (OpenAIRE), has led to the formation of the new RDA Interest Group "Open Science Graphs for FAIR data" (see section 4.2 below) and several engagement and training events around this topic (Section 2, 3) .

EOSC Secretariat and the EOSC Working Groups

The EOSC Secretariat project[16] addresses the need to set up an operational framework supporting the overall governance of the EOSC. The EOSC Governing Board, together with the Executive Board, has identified EOSC priorities around which five Working Groups (WGs) have been established: Architecture, FAIR, Landscape, Rules of Participation, and Sustainability[17]. These WGs form an official part of the EOSC governance structure that will ensure a community-sourced approach to the current challenges of the EOSC.

FREYA has representation in two of these Working Groups:

- In the FAIR WG, FREYA is represented by Rachael Kotarski (British Library)
- In the Architecture WG, FREYA is represented by Vasily Bunakov (STFC) and Martin Fenner (DataCite). Brian Matthews (STFC) is also a member of the Architecture WG as UK national representative.

A key initial objective of these two groups is to jointly draft a proposal for a PID Policy for the EOSC Governance, with an initial proposal to be completed by the end of 2019, and a revised version by the end of 2020. Each of the WGs has established a Task Force for this purpose. The FAIR WG Task Force is co-chaired by Rachael Kotarski, and the Architecture WG Task Force is co-chaired by Brian Matthews, with Vasily Bunakov and Martin Fenner as members; these Task Forces are working together to prepare the Policy recommendations. FREYA has prepared an initial scoping document[18] for submission to these task forces, which was well received. FREYA will continue to work with these WGs to prepare the PID Policy.

Other EOSC projects

FREYA has engaged and collaborated with several other EOSC projects in its second year. Our midterm webinar (Section 3.3) focused specifically at EOSC projects, including the ESFRI cluster projects such as EOSC-Life and SSHOC. We participated in the first two workshops in the series "Services to support FAIR data", organised by EOSC-hub, OpenAIRE, FAIRsFAIR, and RDA Europe 4.0, and were a co-organiser of the third one (Section 2.2). We also collaborated with FAIRsFAIR on a training session during the Open Science Fair (Porto), and interacted with RDA Europe 4.0 via the national RDA nodes of the UK and the Netherlands (see below). FREYA has joined the EOSC Training Community of Practice, which includes the projects OpenAIRE, FAIRsFAIR, EOSChub, RDA Europe 4.0, EOSC-Life, SSHOC, and other EOSC-building projects.

4.2   RDA

The RDA community is another key stakeholder group for FREYA, as many professionals working with PIDs from various disciplines from around the globe come together in RDA Working (WGs) and Interest Groups (IGs), and during the biannual RDA plenaries. FREYA interacts with the RDA in multiple ways to ensure exchange and uptake of the project's work with ongoing RDA initiatives.

At the start of the project, we conducted an analysis of all relevant RDA groups focusing on PID-related topics (See D5.3). We updated the analysis for FREYA's second year and identified 10 IGs and seven WGs that are considered relevant for FREYA. Table 5 gives an overview of these groups, and indicates which

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[15] https://www.openaire.eu/how-can-identifiers-improve-the-dissemination-of-your-research-outputs
[16] https://www.eoscsecretariat.eu/
[17] https://www.eoscsecretariat.eu/eosc-working-groups
[18] Scoping a PID Policy for the EOSC. Note submitted to the EOSC Architecture and FAIR WGs, 23 Sept 2019

FREYA partners take part in them. Involvement of FREYA partners varies — from group leadership and active involvement in the group's work, to group membership in order to stay informed. FREYA's wide-ranging involvement in these various groups ensures that we interact with a diverse and global representation of research stakeholders about the project's results and ongoing work. Below we highlight our interactions with several RDA groups that played a key role in the development and dissemination of FREYA's work in the second year of the project.

Persistent Identifier IG

FREYA is especially well-represented in the Persistent Identifier Interest Group (PID IG)[19], with co-chairs from ORCID and ARDC, and member representation by seven other FREYA partners. The purpose of the PID IG, which has 158 members as of November 2019, is to synchronise identifier-related efforts, address important and emerging PID-related topics, and coordinate activities, including appropriate RDA Working Groups, to practically solve PID-related issues from the engaged communities. FREYA contributed to the PID IG meetings during the 13th (Philadelphia, US) and 14th (Helsinki, Finland) RDA Plenary meetings (see Section 2.1), and uses the PID IG online discussion list for engagement with group members.

Persistent Identification for Instruments WG

The Persistent Identification for Instruments WG[20] has been particularly relevant for the work in WP3. This WG's aim is to explore a community-driven global solution for the unique identification of measuring instruments used in the sciences. The WG collected use cases for persistent identification of instruments (see below), aligned the collected metadata, and developed a metadata schema. The schema is available on GitHub[21] and its maturation was supported, among others, by FREYA partners STFC and PANGAEA. The working group built its work on use cases provided by both its members and external contributors, to ensure that the devised schema could solve as many of these use cases as possible and benefit the diverse community of instrument users.

The current list of use cases: March 2019.

1. GEOFON by Javier Quinteros (November 2017)
2. HZB by Rolf Krahl (November 2017)
3. NIF by Veah Tapat et al. (December 2017)
4. IREA-CNR by Alessandro Oggioni et al. (January 2018)
5. SENSOR.awi.de by Ana Macario et al. (April 2018)
6. Marine SWE by Robert Huber et al. (May 2018)
7. ORCID by Tom Demeranville (May 2018)
8. ICOS Carbon Portal by Claudio D'Onofrio et al. (June 2018)
9. BODC by Louise Darroch et al. (July 2018)
10. ESO by Dominic Bordelon et al. (August 2018)
11. FZJ Central Library (JLSRF) by Claudia Frick (September 2018)
12. PANGAEA by Anusuriya Devaraju et al. (September 2018)
13. EuroGOOS/PSMSL/GLOSS by Louise Darroch (October 2018)
14. LTER-Europe by Alessandro Oggioni et al. (October 2018)
15. UK Polar Data Centre by Alex Tate (February 2019)

PANGAEA contributed to two use cases, covering aspects affecting the data infrastructure directly (use case 12) or indirectly (use case 5) and is closely linked to another (6), because it integrates the sensor.awi handles for instruments in its dataset metadata. Another FREYA partner, ORCID, provided another important use case that helped shape the final schema. ORCID plans to create a new section, called "Research Resources" in the ORCID record that holds information about "things that researchers use for their research". The section will contain connections to resources that are not generally cited by

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[19] https://www.rd-alliance.org/groups/pid-interest-group.html
[20] https://www.rd-alliance.org/groups/persistent-identification-instruments-wg
[21] https://github.com/rdawg-oidinst/schema

researchers within article reference lists, which will vary by domain. These connections require that the resource be associated with a persistent identifier, preferably one that is resolvable to a landing page with more information about the resource. ORCID plans to adopt the schema developed for instruments to address this use case. FREYA partner STFC has been actively participating in the WG, and will be an early adopter of PIDs for instruments.

Open Science Graphs for FAIR Data IG

A major development in the second year of the PID Forum was the formation of the Open Science Graphs IG[22], initiated by FREYA's Martin Fenner (DataCite), in collaboration with Paolo Manghi (OpenAIRE), Wouter Haak (Elsevier), and Amir Aryani (Research Graph). Following the Birds-of-a-Feather session, "Research Data Graphs", during the 13th RDA Plenary meeting in Philadelphia, it was decided to go forward with creating an IG (also see Section 2.1). The goal of the Open Science Graphs Interest Group (OSG IG) is to build on the outcomes and broaden the challenges of the Data Description Registry Interoperability (DDRI) and Scholarly Link Exchange (Scholix) RDA Working Groups, in order to investigate the open issues and identify solutions for achieving interoperability between services and information models of Open Science Graph initiatives.

RDA national nodes: Netherlands and United Kingdom

RDA Europe, the European plug-in to RDA, is mandated to ensure that European political, research, industrial, and digital infrastructure stakeholders are aware of, engaged with, and actively involved in the global RDA activities. One of the objectives of the RDA Europe 4.0 project is to consolidate a European network of National Nodes, in order to foster adoption of RDA outputs at a regional level. There are currently national RDA nodes for 13 European countries[23]. FREYA collaborated with the national nodes of the UK (July 2019) and the Netherlands (upcoming) by co-organising workshops on the use of PIDs in these countries. A description of these workshops can be found in Section 2.1 and 2.4.

RDA Groups	FREYA representation
Data Discovery Paradigms IG	BL, CERN, DANS, DataCite, Pangaea
Data Fabric IG	DANS
Metadata IG	ARDC, BL, CERN, STFC
Open Science Graphs for FAIR Data IG	ARDC, DataCite
PID IG	ARDC, BL, CERN, DANS, DataCite, EBI-EMBL, ORCID, Pangaea, STFC
RDA/WDS Publishing Data IG	BL, CERN, DANS, STFC

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[22] www.rd-alliance.org/groups/open-science-graphs-fair-data-ig
[23] https://www.rd-alliance.org/rda-europe-national-nodes-second-call-new-nodes-open

Research data needs of the Photon/Neutron Science IG	STFC
Research Data Provenance IG	[no FREYA representative]
Software Source Code IG	BL, ORCID
Vocabulary Services IG	ARDC
Data Usage Metrics WG	BL, CERN, DANS, DataCite, Hindawi
Data Versioning WG	[no FREYA representative]
Metadata Standards Catalogue WG	BL, DataCite
Persistent Identification of Instruments WG	DataCite, ORCID, PANGAEA, STFC
PID Kernel Information WG	DANS
RDA/WDS Scholarly Link Exchange WG	ARDC, Crossref, DataCite, EMBL-EBI, Pangaea
Research Data Repository Interoperability WG	CERN, DANS

Table 5 Overview of the relevant RDA Groups and FREYA representatives

4.3   Other stakeholders

In addition to the EOSC-related projects and the RDA, FREYA interacts with other research (data and infrastructure) communities to disseminate results, receive feedback, and seek collaboration, and we are active at many events (see Section 2 and Annex 1) in order to reach these communities.

For the global community working on PIDs, and therefore also for FREYA, PIDapalooza is a major annual event (held since 2016) for interaction. During PIDapalooza 2019, FREYA was well-represented with five sessions on various topics (see Section 2.3). FREYA also interacted with the global PID community via a series of international PID workshops, of which the third and last was held in Portland in May 2019 (see Section 2.3). PIDForum.org was primarily set up to provide an online space for interaction for the global PID community, in order to facilitate discussion and collaboration beyond conferences. By setting up PIDForum.org FREYA has extended its engagement with these stakeholders considerably (Section 3.1).

Other global stakeholder communities FREYA engages with include: FORCE11, a community of scholars, librarians, archivists, publishers, and research funders that aims to facilitate the change toward improved knowledge creation and sharing[24]; The Carpentries[25], a fast-growing organisation that builds global capacity in essential data and computational skills for conducting efficient, open, and reproducible research; and the digital preservation community, e.g. via the Open Repositories conference (Hamburg, June 2019) and iPres, the International Conference on Digital Preservation (Amsterdam, September 2019).

FREYA also regularly engages with disciplinary stakeholders, via events, such as, for instance, the upcoming "PIDs for Humanities" workshop in London in December 2019 (see section 2.4 for more information), via our disciplinary partners (e.g. EBI-EMBL for life sciences, CERN for particle physics, British Library for humanities), and via FREYA's Ambassador Programme (see the following section for more information).

4.4   FREYA ambassadors

The Ambassador Programme provides a mechanism for engaging with PID enthusiasts working in a broad range of subject areas, enabling the project to be amplified across disciplines. In the second year of the project we added nine new ambassadors, bringing the total number up to 32, which is in line with the KPI defined in the project's description of work. While the call for ambassadors remains open, FREYA has recently decided to focus ambassador recruitment on underrepresented areas such as South America, Asia, and Africa.

Engagement with the ambassadors has been consistent throughout the year, including holding several webinars, two specifically for ambassadors (see Section 3.3). These webinars have been well attended, by 11 and nine attendees respectively, who have provided useful feedback s. The webinars are recorded and the ambassadors have told us that the recordings are a valuable resource.

In May 2019 we made the decision to migrate the ambassadors' discussion space on Slack to PIDForum.org, to further enable discussion and collaboration there. While use of this space by the ambassadors has so far been low, it is proving a useful method to engage with the community. We also use a mailing list specifically for the ambassadors, which has been used for more private discussions such as input for research proposals in preparation. The ambassadors have also provided input for the creation of training materials, through a survey to establish topics of interest, and feedback on the materials through a webinar (see D4.4 "Initial Training Materials").

We have continued to hold the annual FREYA ambassador competition to fund a place at PIDapalooza (like FREYA's predecessor project THOR). In 2019, Nicole Kearney from the Biodiversity Heritage Library in Australia was the winner. She attended the conference and gave a presentation about her work on the role of persistent identifiers in making out-of-copyright literature open access (also see her blog on this topic on the FREYA website[26]). This proved a useful networking opportunity for Nicole to engage with stakeholders for whom this topic is relevant. It also enabled her travel to a conference she would otherwise have been unable to attend. In addition, her conference presentation provided an opportunity to showcase the ambassador programme itself. We are running the competition again for PIDapalooza 2020, this time around the theme of PID Communities.

The two-way interaction between the ambassadors and the project has resulted in FREYA being mentioned at conferences on libraries and research management in Australia and South Africa, which has broadened awareness of FREYA internationally.

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[24] https://www.force11.org
[25] https://carpentries.org/about
[26] https://www.project-freya.eu/en/blogs/blogs/historic-literature-dois-pidapalooza

4.5   Disciplinary and geographic reach

FREYA's activities are of importance for the global scientific community, and we aim to reach scholars all across the world and to engage with various disciplines. We do so by participating in a variety of national and international events, as well as through our funded and unfunded partners, and via the FREYA ambassador programme.

Global PID Community

Following on from the first year of the project, FREYA continues its work in close contact with the RDA, actively participating in different RDA groups and hosting co-located events at the RDA plenaries (see 2.2 and 3.2). In 2019, FREYA participated in the third global PID workshop (see 2.3) which was held in Portland, USA, and which followed two workshops held in Singapore and the UK. The ambassador programme has grown further in the second year of the project, and FREYA currently has 32 ambassadors from 18 different countries (Figure 8).
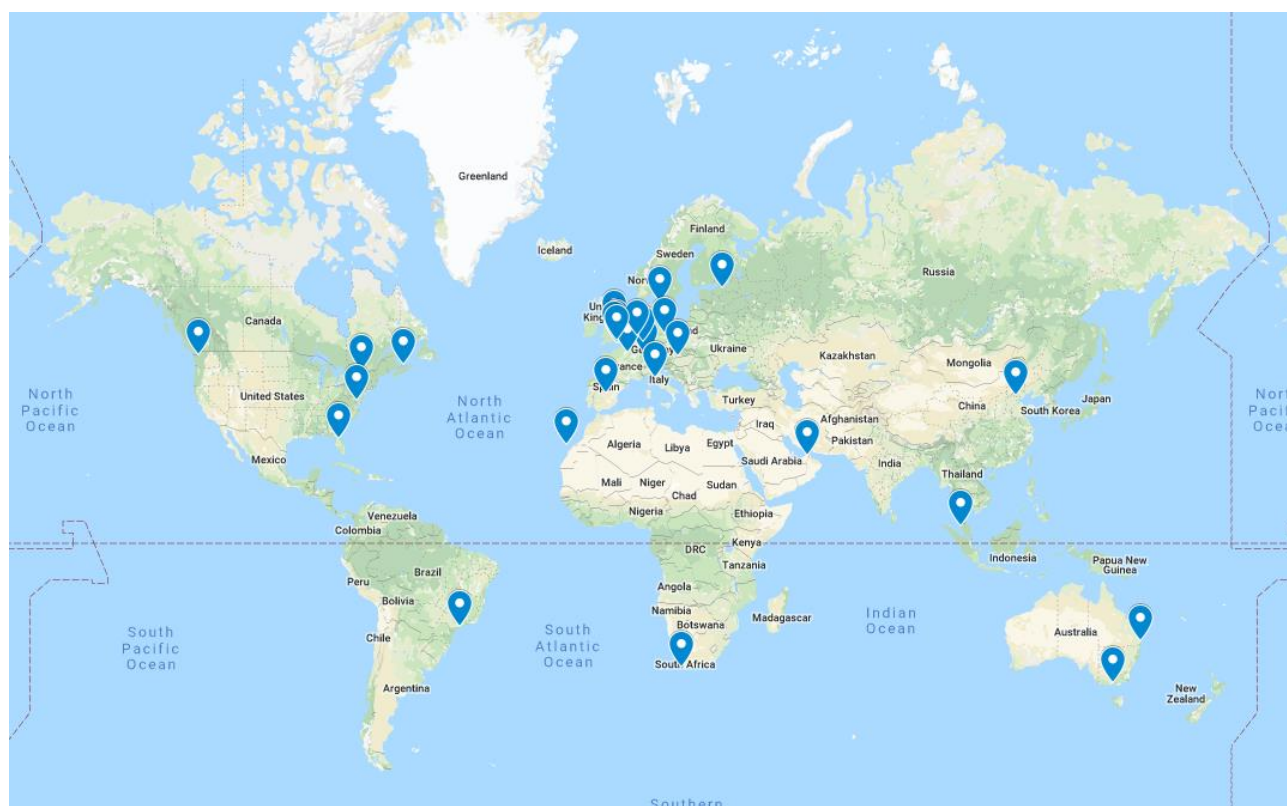
Figure 8 Map of the home countries of the FREYA Ambassadors. Currently, FREYA has 32 ambassadors from 18 different countries.

FREYA continues to use social media including twitter and the project website to reach the global community. The FREYA twitter account is followed by more than 1,200 people from various countries and disciplines, and the FREYA website attracts an average of 439 unique visitors from 40 distinct countries each month. See Figure 9 below for details on the geographical spread of website visitors.
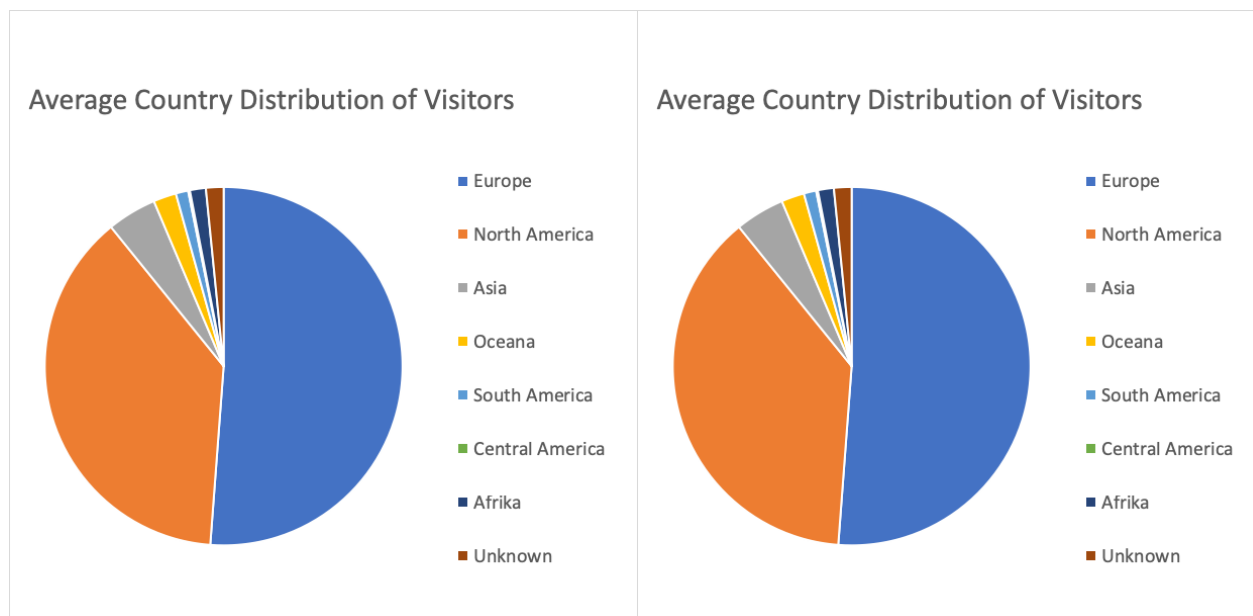
Figure 9 Overview of the geographical distribution of FREYA website visitors per month (left) and the number of distinct countries that visited the FREYA website during the first two years of the project (right)

Cross-Disciplinary PID Community

The FREYA disciplinary partners (i.e., CERN for high-energy physics, EMBL-EBI for life sciences, PANGAEA for earth and environmental sciences, DANS and the British Library for the social sciences and humanities) provide a direct connection to specific disciplines. Through the project partners, FREYA is represented at different disciplinary events, where we interact and exchange with the specific communities (see Annex 1 for an overview of all events). In addition, the FREYA ambassadors play an important role in reaching additional disciplines that may not be represented in the FREYA consortium. Ambassadors are encouraged to share their experiences and exchange ideas and challenges, for instance during the FREYA ambassador webinars and by submitting entries to the FREYA ambassador competition[27]. Lastly, PIDforum.org is used to reach a broad audience of scientists and scholars, and PID-related discipline-specific information is discussed and shared there[28].

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[27] www.project-freya.eu/en/news/newsitems/freya-ambassadors-competition-2019-now-open-for-entries
[28] See for instance: https://www.pidforum.org/t/persistent-identifiers-and-the-humanities/331 or https://www.pidforum.org/t/identifiers-for-the-21st-century-plos-biology-paper/249

5   Future plans

For the third year of the project, we aim to continue the development of the PID Forum as a platform for collaboration and exchange for the PID stakeholder community, mainly via the RDA and PIDForum.org, and through collaboration with the EOSC-building projects and other communities and disciplinary stakeholders. In the first year and especially the second year of the project, gathering input from our stakeholder community was key for the development of the work in FREYA's other WPs (WP2, WP3, WP4), with many of our engagement activities being focused on achieving this co-design of services. As the project progresses towards its final year and its results are maturing, our focus will gradually shift towards uptake of outputs by the community via training and dissemination activities. Ensuring the sustainability of the project's results via the PID Commons - the third pillar of FREYA next to the PID Graph and the PID Forum, which addresses the sustainability of the PID infrastructure resulting from FREYA beyond the lifetime of the project - will become an important topic in the final year of the project. WP5 will work closely with WP6 to ensure the sustainability of the PID Forum, the training materials, and the project's results in general by promoting awareness and uptake.

RDA and EOSC

The new RDA IG "Open Science Graphs for FAIR data" will further mature and grow, which will promote development and uptake of the FREYA PID Graph, as well as strengthening our collaboration in this area with OpenAIRE and the other organisations involved. FREYA will continue to expand our involvement in the RDA by participating in relevant existing and new groups and the RDA plenaries. We will further advance our vision of PIDs as an essential part of the EOSC by strengthening our collaboration with the EOSC building projects, in particular EOSC-hub, OpenAIRE, FAIRsFAIR, and the EOSC Secretariat. Our work on the EC PID policy will be further developed via our involvement in the EOSC FAIR and Architecture working groups. FREYA's outputs will be integrated as much as possible into the emerging EOSC, for example, via inclusion in the EOSC portal[29].

Training

FREYA's final training materials (D5.6) will be delivered in the coming year, and a key part of the development process will be the various training events, which will yield additional materials as well as providing feedback on the materials that have already been created. These events will continue our collaboration on training with the other EOSC projects, and we will enhance this further through exchanging relevant resources, particularly in relation to the disciplinary communities with which the projects engage. In addition, as the work on the PID Graph in the different WPs is maturing, training materials and activities will be created around it, encouraging its development and uptake by stakeholders. We will also develop and organise training around the Research Organisations Registry (ROR) initiative, a new identifier for organisations also featured in the work of WP3 and WP4, as well as working with disciplinary partners to provide training for researchers and other users in their specific communities.

PIDForum.org and other online channels

We will continue to grow the user base on PIDForum.org via our events and other promotion, and we will encourage an even wider range of communities to join and actively participate in the forum. We will also continue to develop the Knowledge Hub on the forum as part of our training programme, adding content for different stakeholders and inviting the online community to provide feedback and contributions. We plan to hold at least three more webinars in FREYA's final year, as well as continuing our online dissemination activities via YouTube, Twitter, and our website.

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[29] https://www.eosc-portal.eu

Annex A: Overview of all FREYA events in Year 2

Date	Event	Type	Place	Description
05/11/2018	RDA 12th Plenary	Presentation	Gaborone, Botswana	Update of the FREYA project and presentation of the PID Forum to the community during the IG PID meeting.
14/11/2018	Crossref LIVE18	Presentation	Toronto, CA	Presentation on data citations, PID and FREYA
22/11/2018	EOSC-Pilot event	Presentation	Vienna, AU	Presentation and representation of FREYA
04/12/2018	ICT 2018 conference	Exhibition	Vienna, AU	FREYA was present with a booth on "Open Science at the service of industry, civil society and research"
16/01/2019	ESIP Winder Meeting	Remote Presentation	Online	Short talk (remotely) about PANGAEA's metadata and how they link to other sources using PIDs mentioning the work done in FREYA.
23/01/2019	PIDapalooza 2019	Presentation	Dublin, IR	An Introduction to the FREYA Project
	PIDapalooza 2019	Presentation	Dublin, IR	Presenting FREYA training and ambassador Programme
	PIDapalooza 2019	Presentation	Dublin, IR	Introduction of PIDforum.org
	PIDapalooza 2019	Presentation	Dublin, IR	Demonstrator of the PID Graph Demonstrator: Narcis, representing the Dutch Research Information System
	PIDapalooza 2019	Presentation	Dublin, IR	PID workshop
30/01/2019	ESFRI-EOSC Liaison Workshop [invite only]	Presentation	London, UK	Networking Event
02/04/2019	RDA 13th plenary meeting	Presentation	Philadelphia, US	Presentation on the progress of the FREYA Project
	RDA 13th plenary meeting	Births of a Feather session	Philadelphia, US	Presentation of the progress of the PID Graph
07/04/2019	Biocuration2019	Poster presentation	Cambridge, UK	Presentation to introduce FREYA to the bio-curation research community
09/04/2019	EOSC-hub week	Workshop	Prague, CZ	Presentation about FREYA to the EOSC stakeholders
24/04/2019	OpenAIRE FAIR RDM workshop	Workshop	Vienna, Austria	Research Data Management workshop, including best practices on PIDs.
30/04/2019	HUBSconference 2019	Poster presentation	Hinxton, UK	Presentation of FREYA Poster during networking lunch
06/05/2019	PID workshop in Portland, Oregon	Workshop	Portland, US	Workshop that brought together international PID experts and leaders of PID systems in scholarly

				communications.
13/05/2019	Software Citation Workshop	Workshop	London, UK	Presentation on the importance of PIDs in software citation
20/05/2019	JATS-Con 2019	Poster presentation	Hinxton, UK	Unambiguously Identify Research Organizations in JATS with ROR IDs
27/05/2019	Research policy monitoring in the era of Open Science and Big Data - OpenAIRE	Presentation, Panel Session	Ghent, BE	Collaboration between Infrastructures, policy makers and funders in open science
13/06/2019	OpenRepositories2019	Presentation	Hamburg, DE	Presentation of a Demonstrator of the PID GRAPH
21/06/2019	Dataverse Community Meeting 2019 at Harvard University	Presentation	Boston, US	Presentation about FREYA, Dataverse and the PID-Graph
24/06/2019	CarpentryConnect	Presentation	Manchester, UK	Lightning talk about FREYA to introduce it to the Carpentries community
10/07/2019	Creating platform-driven eInfrastructure innovation on EOSC: EU e-infrastructures clustering workshop	Presentation	Athens, GR	FREYA and e-infrastructures: opportunities for collaboration
16/07/2019	RDA UK & FREYA PID workshop	Workshop	London, UK	A joint workshop with RDA UK and the FREYA project, focussing on persistent identifiers (PIDs).
16-20/9/2019	IPres	Presentation	Amsterdam, NL	Presentation on Digital Preservation and Sustainability of E-Infrastructures"
	IPres	Presentation	Amsterdam, NL	Presentation about PIDs & Preservation and how to Incorporating persistent identifiers in a preservation strategy
16-18/09/2019	Open Science Fair	Training	Porto, PO	Workshop on the role of PID in Open Science
	Open Science Fair	Workshop	Porto, PO	Workshop in collaboration with the project FAIRsFAIR
	Open Science Fair	Workshop	Porto, PO	Open Science Graph Interoperability Workshop
16-17/10/2019	Force2019	Presentation	Edinburgh, UK	The FREYA project: Collaborating to link people, papers, data, to new things
15-18/10/2019	DAMDID 2019 and DACOMSIN workshop	Presentation	Moscow, Russia	Graph Representation of Materials Research on Diamond Light Source, and the role of PIDs
21/10/2019	RDA P14 Helsinki	Co-located event	Helsinki, FI	Half-day event to encourage a discussion on the use of PIDs in the context of the EOSC

	RDA P14 Helsinki	Session	Helsinki, FI	Session of the Open Science Graphs for FAIR Data IG
28-31/10/2019	MTSR 2019	Presentation	Rome, IT	Metadata integration with labeled-property graphs, and the role of PIDs
06-08/11/2019	ETD2019	Presentation	Porto, PO	Using Persistent Identifiers to Track PhD Outcomes
20/11/2019	Challenges in the Scholarly Publishing Cycle 2019	Presentation	London, UK	Introducing FREYA to academics and librarians
20/11/2019	PID NL - A workshop on the use of Persistent Identifiers in the Netherlands	Workshop	Den Haag, NL	PID NL - A Workshop On The Use Of Persistent Identifiers In The Netherlands.
26-28/11/2019	EOSC Symposium 2019	Symposium	Budapest, HU	Participation in the EOSC Symposium and coordination meeting.

Annex B: FREYA ambassadors

Name	Affiliation	Country
Melroy Almeida	Australian Access Federation (Australian ORCID Consortium Lead)	Australia
Claudia Alen Amaro	Instruct-ERIC	UK
Janet Anderson	University of Brighton	UK
Alojz Androvic	Slovak Centre of Scientific and Technical Information	Slovakia
Paloma Marín Arraiza	TU Wien	Brazil
Elton Barker	Open University	UK
Luc Boruta	Thunken (Cobaltmetrics)	USA
Valerie Brasse	EuroCRIS	The Netherlands
George Duimovich	Carleton University	Canada
Suzanne Dumouchel	CNRS	France
Antonella Fresa	Promoter	Italy
Stephen Grace	London South Bank University	UK
Jord Hanus	University of Antwerp	Belgium
Brigitte Hausstein	GESIS	Germany
Reyna Jenkyns	Ocean Networks Canada	Canada
Birger Jerlehag	Swedish National Data Service	Sweden
Mohammed Kaabar	Universiti Sains Malaysia	Malaysia
Nicole Kearney	Biodiversity Heritage Library Australia (Museums Victoria)	Australia
Rolf Krahl	Helmholtz-Zentrum Berlin für Materialien und Energie (HZB)	Germany

Mark Leggott	Research Data Canada	Canada
Leonardo Jose Mataruna-Dos-Santos	American University in the Emirates	UAE
Julio A. Martínez Morilla	University of Las Palmas de Gran Canaria	Spain
Eva Mendez	Universidad Carlos III de Madrid	Spain
Fiona Murphy	Consultant	UK
Suresh Pannerselvam	University of Florida	USA
Irina Radchenko	ITMO University	Russia
Maria de Montserrat Rodriguez-Marquez	University of Surrey	UK
John Salter	White Rose Libraries; University of Leeds	UK
Muriel Swijghuisen Reigersberg	Open University	UK
Clifford Tatum	SURF Market	The Netherlands
Guo Xiaofeng	Chinese DOI Center	China
Niklas Zimmer	University of Cape Town	South Africa