Project Name	**FREYA**
Project Title	**Connected Open Identifiers for Discovery, Access and Use of Research Resources**
EC Grant Agreement No	**777523**

D6.3 Second Annual Report on PID Commons and Sustainability

Deliverable type	Report
Dissemination level	Public
Due date	30 November 2019
Authors	Simon Lambert (STFC)
Abstract	The second report on sustainability summarises the work done between the submission of D6.1 and the end of the second year of the FREYA project towards understanding and defining the PID Commons and the outputs (assets, resources, services) of FREYA.
Status	Submitted to EC 17 January 2020

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.

Disclaimer

This document represents the views of the authors, and the European Commission is not responsible for any use that may be made of the information it contains.

Copyright Notice

Executive summary

Whereas the first report on the PID Commons and sustainability took the form of a general discussion of the issues around sustainability and governance, leading to a clearer understanding of the "what", "who" and "how" and a plan for the next cycle, the present deliverable (reporting on that second cycle) summarises concisely what was done and the results that are emerging.

In addition to an update on the evolving context, the deliverable summarises a categorisation of FREYA's outputs, compatible with EOSC terminology and valuable for sustainability planning; a backcasting exercise undertaken at the end of the period; and some considerations about the nature of the PID Commons itself.
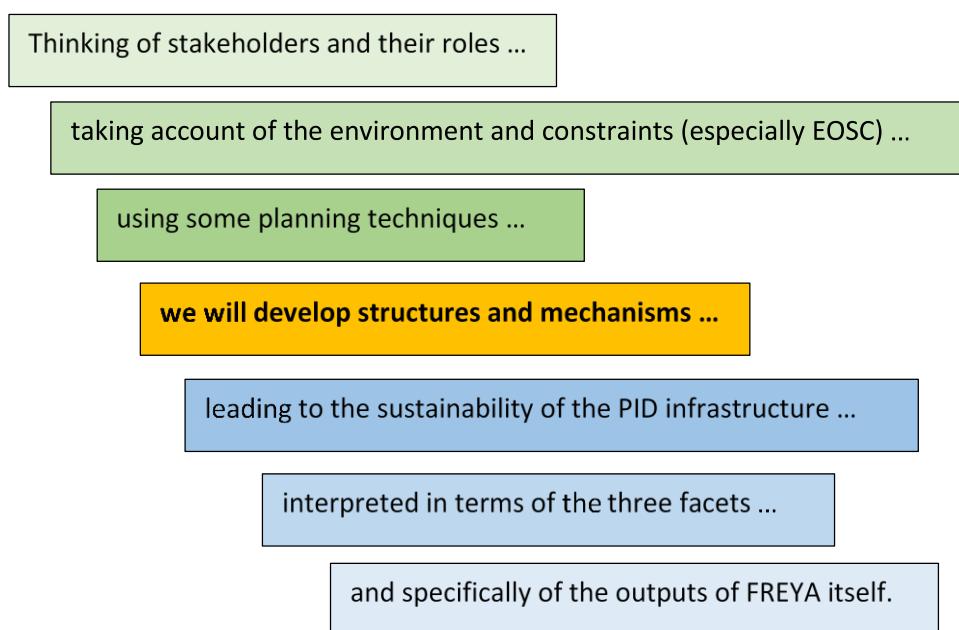
This work will be brought together in a dedicated meeting of FREYA partners in January 2020 to focus on defining the structures and implementations of the PID Commons.

Contents

1 Introduction

The first annual report on PID Commons and sustainability (D6.1)[1] took a broad view of the meaning and requirements on sustainability as they relate to FREYA's own outputs and the PID infrastructure to which FREYA is contributing. The deliverable examined the "what", "who" and "how" of sustainability, considering their scope and implications, and put forward a plan for the next cycle of work. Important contributions of that deliverable were an understanding of three facets of sustainability—maintainability, adaptability and desirability; the need for synergy with EOSC developments to allow positioning and integration of FREYA's outputs; the nature of stakeholders' stakes (reactive, proactive, context-setting); a general model of sustainability planning and a specific proposal for work in the next cycle, shown in Figure 1.

Thinking of stakeholders and their roles …

taking account of the environment and constraints (especially EOSC) …

using some planning techniques …

we will develop structures and mechanisms …

leading to the sustainability of the PID infrastructure …

interpreted in terms of the three facets …

and specifically of the outputs of FREYA itself.

Figure 1 Model of the second cycle of sustainability work (from D6.1)

Given that D6.1 was not in fact completed at the end of the project's first year, but rather at the half-way point, the second cycle has been compressed in time to around six months. However the work does essentially reflect what was presented in Figure 1, and in particular a backcasting exercise was undertaken and is reported in this deliverable, to envision the desired future state when the PID Commons exists and functions and what assumptions, constraints, blockers and intermediate steps that implies.

The EOSC context continues to evolve, of course, a significant event being the EOSC Symposium held in Budapest in November 2019. There some of the major issues confronting the EOSC were aired, including its future legal status, the Federating Core and Rules of Participation. It is clear that the structures and processes of the EOSC are still very much a moving target, and FREYA must engage with the relevant parties to ensure that the project's outputs are aligned with EOSC expectations.

It is worth commenting on the relationship between the sustainability work of WP6 and the exploitation planning presented in D5.10 (a confidential deliverable produced in interim form at the same time as this deliverable). Exploitation planning is primarily concerned with the use of the project's results by the project partners themselves; however, in the context of a project that is building part of a larger

---

[1] https://doi.org/10.5281/zenodo.3250702

infrastructure, as is FREYA in the EOSC, it must also consider the integration of those results in the infrastructure—whether actually helping to build parts of the infrastructure, or producing services and resources that will be available through the infrastructure. There is a close connection between the two sides: as is written in D5.10, "Exploitation and sustainability are complementary activities with different goals. However, there are clear links and dependencies between them. An e-infrastructure could hardly be sustainable if none of the services offered through it could be exploited; and exploitation of results requires assurance that the results and the ways they are delivered are sustainable into the future."

Some of the work done under WP6 has been directly used in the exploitation planning: the development of a three-level model (presented in section 3) of assets, resources and services, based on and compatible with EOSC terminology.

The remainder of this deliverable moves on from the general analyses of D6.1 to specifics of what has been done in the period to the end of the second year. The evolving context is revisited; the model of assets, resources and services is set out; the backcasting exercise is summarised and analysed; and some considerations around the PID Commons are presented. It is worth stating here that the project is planning a dedicated meeting of partners, coinciding with the PIDapalooza conference in Lisbon in January 2020, to produce specific proposals for the structures and implementations of the PID Commons.

2 The evolving context

2.1 EOSC

A major EOSC event took place in Budapest in November, the EOSC Symposium[2], summarised as "Where the EOSC makers and shakers meet", and including plenary sessions and parallel sessions covering many of the pressing issues confronting the development of the EOSC. The FREYA project was well represented, and contributed to sessions in the main event and the following Coordination Days. The following are summaries of some of the most significant issues and developments from the point of view of FREYA, sustainability and the PID Commons.

There is an **EOSC Sustainability Working Group**[3] considering the long-term evolution of EOSC structures. The aim is that the so-called Minimal Viable Prototype (MVP) will transition into full Digital Marketplaces. In fact the marketplaces are likely to be of two varieties: EOSC-Exchange for services/resources based on publicly funded projects such as EUDAT and EGI, and EOSC-Market for commercial offerings. Both will be bootstrapped by the EU. The future legal status of EOSC is being considered, one option being a Strategic European Partnership.

Implications: What will be inside the "central" governance and could receive EU funding? (This is related to the more technical question of the composition of the EOSC Federating Core).

A session was held on **PID policies**. FREYA produced a document that was the basis for the draft of the EOSC PID policies document, put out for public consultation in December[4]. The PID policies work is being undertaken by the EOSC FAIR[5] and Architecture Working Groups[6] together. Both groups have members from FREYA partner organisations who are actively contributing to the developments. A number of issues arose in the discussions:

- Machine usability of PIDs
- Handling a multitude of entities/PID types: introduction of new entities/PID types at varying levels of maturity
- Multiple service providers with their own established governance and business models
- PIDs for both digital objects and real-world entities (researchers, organisations, projects, equipment, …)
- Generic and discipline-specific PIDs

Implications: How to bring together the digital object focussed view of PIDs with the more general view, and concomitantly how to deal with machine usability requirements of PIDs; how to encourage trustworthiness of PIDs and service providers through policies.

There was a plenary session of the **EOSC Rules of Participation**, setting the rights, obligations and accountability of both providers and users of the EOSC. It was noted that Technology Readiness Level, often ascribed to particular services or groups of services and used in the EOSC context as a filter for services in the catalogue, is not the same as service maturity. It is likely that in this area there will be ongoing activity beyond the end of 2020.

---

[2] https://www.eoscsecretariat.eu/eosc-symposium
[3] https://www.eoscsecretariat.eu/working-groups/sustainability-working-group
[4] https://www.project-freya.eu/en/blogs/repost-launch-of-the-initial-persistent-identifier-policy-for-the-eosc
[5] https://www.eoscsecretariat.eu/working-groups/fair-working-group
[6] https://www.eoscsecretariat.eu/working-groups/architecture-working-group

Implications: This is an area of EOSC that needs careful tracking, as it has real implications for how services are presented and made available. As above, questions arise of how established service providers will be able to conform to the Rules of Participation.

2.2 RDA

The 14th Plenary Meeting of the RDA took place in Helsinki in October 2019. FREYA partners were well represented[7]. Two particular developments are worthy of note.

The Interest Group "Open Science Graphs for FAIR Data" is being established, with FREYA team members (Martin Fenner, Amir Aryani) as co-chairs[8]. The stated mission is to 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, but in fact the context is broader, and is of course inspired by FREYA's PID Graph as well as OpenAIRE's Research Graph.

A "Birds of a Feather" meeting was held with a view to setting up another Interest Group of relevance of FREYA, on "Global Open Research Commons". So-called "Open Science Commons" or "Data commons" provide a shared virtual space or platform that provides a marketplace for data and services. The Interest Group[9] will provide a neutral place for discussions and sharing of experience about such commons-inspired organisations.

2.3 Additional background

Since the production of D6.1, a relevant document has been brought to the attention of the FREYA team, produced by the EC's Joint Research Centre in 2015, within the scope of ISA Action 1.17: A Reusable INSPIRE Reference Platform (ARE3NA), and entitled "Governance of Persistent Identifiers"[10]. The context is the INSPIRE Directive (2007/2/EC) establishing an Infrastructure for Spatial Information in the European Community, and so it has a very particular perspective on PIDs, but the report includes quite general reviews and analyses of issues in PIDs and their governance, which will be useful as a kind of checklist in FREYA's work. As an example, here is a list taken from the report of "questions that need to be answered when managing persistent identifiers".

- **What** should be identified? Real-world or spatial object?
- **Who** can assign persistent identifiers? What happens when more than one organisation issue IDs for the same "thing"?
- **Who** is responsible that these identifiers are indeed persistent?
- **Who** has the authority to change them? How is change managed when it involves "things" from multi-objective policies involving multiple organisations?
- **Who** evaluates the impact of the change and decides which is the best way to make the change when data is shared?
- **How** do you govern the objects for which it may be difficult to have persistent ids (model runs, time series, and sensors, frequently changing by the minute)?

These questions, and other content of the report, can be used to challenge and validate FREYA's own thinking on subjects of governance and sustainability.

---

[7] https://www.project-freya.eu/en/events/14th-rda-plenary-meeting

[8] https://www.project-freya.eu/en/events/14th-rda-plenary-open-science-graphs-for-fair-data-ig

[9] https://www.rd-alliance.org/groups/global-open-research-commons-ig

[10] https://joinup.ec.europa.eu/sites/default/files/document/2016-02/are3na-pid_governance_final.pdf

3 Identifying what to sustain: assets, resources and services

D6.1 the First Annual Report on PID Commons and Sustainability, has a whole chapter entitled "What to sustain". This begins by identifying three facets of sustainability of an (e-)infrastructure: maintainability, adaptability and desirability. It considers attributes of PIDs and their supporting infrastructure that have been put forward as desirable and that might or might not be connected with sustainability. At the end, it asks "What, though, are the things that must be sustained?" and tries to answer the question in terms of services. However, examining the project's intended outputs, it is seen that trying to interpret them all as services is inadequate—"It is striking that few of these are really services in the sense of FitSM and EOSC."

An important area of work in the following period has therefore been to analyse more closely the nature of what FREYA is developing and what it will leave behind when the funded project comes to an end. It should be said immediately that the PID Commons is not considered in this way—it is a different kind of entity, an emergent set of structures and mechanisms for coordination and governance of the PID infrastructure, though certainly it will have identifiable structures that will need to be sustained. The purpose of the exercise reported here is to provide a framework for identifying what FREYA is producing, which will therefore need to be part of the infrastructure and sustained in that context. The PID Commons will then be responsible for that sustainability.

The FREYA "Description of the Action" includes an "Asset Management Plan" as one of the four parts of the Dissemination and Exploitation Plan as it was then envisaged[11], recognising that the identification of assets is fundamental.

In fact the word *asset* is key: it has its normal meaning in English, taken here to be "something of value to its holder or anyone who has access to it." Of course we are talking about assets within the "world of PIDs", rather than buildings or office furniture! A key reference is the glossary produced by the EOSCpilot project[12], which also assumes an understood meaning of "asset" but goes on to define two other terms which are relevant to FREYA's outputs (or any other project of a similar nature):

EOSC Resource

Definition: *any asset made available (by means of the EOSC system and according to the EOSC Rules of Participation) to EOSC System Users to perform a process useful to deliver value in the context of the EOSC. EOSC Resources include services, datasets, software, support, training, consultancy or any other asset.*

EOSC Service

Definition: *an EOSC Resource implemented by the EOSC System to provide EOSC System Users with ready-to-use facilities. EOSC Services are supplied by an EOSC Service Provider in accordance with the EOSC Rules of Participation for EOSC Service Providers. EOSC Services are approved by the EOSC Service Portfolio Management Committee and populate the EOSC Service Portfolio and the EOSC Service Catalogue.*

In discussions of the project's outputs, FREYA has adopted the terms "resource" and "service" in the same way, omitting the "EOSC" and any references to it within the definition—this is simply for generality, and does not imply that the EOSC dimension is unimportant. This means that there are three levels: *service* is a subset of *resource* which is a subset of *asset*. In short:

---

[11] The other three being "Benefit Realisation Plan", "Business Plan" and "Communication Plan".
[12] https://www.eoscpilot.eu/eosc-glossary

- an **asset** is something of value;
- a **resource** is an asset that is consciously made available;
- a **service** is a resource that is made available in a "service-like" way (a circular definition but clearly understood: there is a service provider, the service is expected to work, there is some degree of support and maintenance, there might be payment required to use it, …).

An example of a resource that is not a service could be FREYA's PID landscape survey deliverable D3.1[13]. Our analysis is of value to the community beyond the FREYA team, but it is not offered as a service—FREYA presents it as a resource as defined above. There can also be assets that are not resources, typically anything developed by an organisation for its own use but not intended to be made available to anyone else.

This terminology allows precision in thinking about what FREYA is developing, and about other PID-related offerings. By differentiating between an asset and a resource, and a resource and a service, it is necessary to ask questions such as "What is the value of the asset, and to whom? To whom is the resource made available? Through what channels? Does this proposed service really meet the criteria for a service?" There are clear implications for exploitation of FREYA's results. A comprehensive tabular listing has been produced of FREYA's assets, contributed by all partners, which was reviewed at a project workshop on 2 October 2019. This and related developments are discussed in the interim version of the project's Dissemination and Exploitation Plan. This is a confidential deliverable, but Figure 2 gives a flavour of the nature of the assets being considered and analysed.

DIRECT FREYA OUTPUTS: ENTIRELY ATTRIBUTABLE TO FREYA PROJECT OR ENHANCED TROUGH WORK OF PROJECT						
Name and/or brief description of the asset/resource/service

Use "Insert > Note" on the cell for any additional detail. | Main organisations(s) holding the asset or making available the resource/service (if applicable) | Is it an asset, resource or service? | If service, PID foundation service or PID top-up service? | If service, internal (provided to other parts of the same organisation but not outside) or external? | If service, what is its TRL (or will be by the end of the FREYA project)? | Are there sustainabil considerati |
ROR organizational identifiers	ROR consortium	Service	—	External	9 (probably)	Yes
DataCite DOI search	DataCite	Service	Top-up	External	9	Yes
DataCite DOI registration	DataCite	Service	Foundation	External	9	Yes
(PANGAEA pilot application)	PANGAEA	Asset				
Identifiers.org Resolution Services	EMBL-EBI	Service	Top-up	External	9	Yes
Identifiers.org Registry Services	EMBL-EBI	Service	Top-up	External	9	Yes
Identifiers.org Metadata Services	EMBL-EBI	Service	Top-up	External	8	Yes
(STFC pilot application)	STFC	Asset				
(BL pilot application)	BL	Asset				
(DANS pilot application)	DANS	Asset				
ORCID data-claiming service	EMBL-EBI	Service	Top-up	Internal	8	Yes
CERN Analysis Preservation (restricted access - pilot applicatic	CERN	Service	Top-up	Internal	6	Yes
CERN Open Data portal (pilot application)	CERN	Service	Top-up	External	9	Yes
INSPIRE-HEP (pilot application)	CERN	Service	Top-up	External	9	Yes

Figure 2 Screenshot of work in progress on inventory of FREYA's assets

---

[13] https://doi.org/10.5281/zenodo.3554254

4 Backcasting exercise

At the FREYA project's plenary face-to-face meeting held in London on 2–3 December 2019, a backcasting exercise was utilised to advance the work on sustainability and the PID Commons. Backcasting starts by defining scenarios representing future states, and then working backwards in time to connect the present to the future, asking questions such as:

● What intermediate steps will be needed on the way?
● What are the roles of stakeholders in achieving those future states?
● What blockers could there be?

In the backcasting exercise conducted with the FREYA team, three scenarios were assessed by different break-out groups, representing different core aspects of the PID infrastructure.

Scenario A: Community and governance

"There is a thriving PID Forum engaging a wide range of stakeholders (across disciplines and roles in PIDs), The structures and processes of the PID Commons are functioning to provide governance of the PID infrastructure, with acknowledged roles and responsibilities. The governance has led to stability and enrichment of the PID infrastructure."

Scenario B: Infrastructure

"The PID infrastructure is proving to be adaptable and sustainable, with trust in the long-term persistence of identifiers. Relationships with other areas of EOSC are clear and there is productive communication about requirements and opportunities."

Scenario C: PIDs and services

"There is a rich variety of PID services at high TRLs leading to an expanding universe of value-adding PID graphs for many applications. New PID types with rich metadata have been introduced and integrated into the PID Graph concept. The PID Service Registry is being sustained and is regarded as a valuable resource."

These scenarios were intended to be complementary, rather than alternatives, capturing different aspects of the PID world beyond the FREYA project.

Instructions were given to the FREYA partners present at the meeting as reproduced in the slide in Figure 3. The output was a collection of Post-Its written by the participants and associated with the various scenarios.

Running the backcasting exercise

- Divide into three groups, one for each scenario
- OK to move between groups
- Use Post-Its on an area of wall, with scenarios on far right
- Colour-coding? E.g. requirement, assumption, blocker, …
- Think (initially) of attributes rather than things
  – Stability, trust, richness, …
- Work backwards step by step
- Ask "What would need to exist for this state or vision to be arrived at?" or "What actions and assumptions lead us to this future?"
- Look for alternatives
- Explore solutions, identify blockers

Figure 3 Instructions to participants in the backcasting exercise

At the end of the session, the Post-Its were collected and later transcribed. It was found that there were few if any explicit dependencies between the Post-Its (e.g. time dependencies), so they could be analysed separately. Some were labelled with specific annotations such as "blocker" but many were not, meaning that the analysis relied (or gives the opportunity for) interpretation. It was found that there was little "backwards thinking", i.e. trying to establish steps on the way to the future scenarios—rather the exercise became more like brainstorming, reacting to others' remarks and sparking ideas.

The exact content of the Post-Its was transcribed and used for the analysis below. The content presented below does not reflect exactly what was written: it was necessary to interpret, combine, and remove duplicates. Of interest are the themes and cross-links that emerge, not the exact wording of notes that were written in response to lively discussions and were necessarily time-limited. In order to give some structure to the analysis, a number of themes have been identified, to which the individual Post-Its can almost all be related. These are:

- **Assumptions** inherent in the thinking and discussion that took place
- **Possible requirements or desirable features** of the PID Commons
- **Possible options** for what the PID Commons might look like
- **Blockers** that might impede the realisation of the scenarios

Note that the requirements and options are not to be interpreted as definitive statements of "This is what the PID Commons must do" or "This is what the PID Commons must be"—rather they reflect the brainstorming aspect of the exercise, and are offered for consideration in further more rigorous planning.

The following tables present analyses in these terms of the Post-Its from the three scenarios.

Scenario A: Community and governance	
Assumptions	Governance is desirable/possible. Governance or coordination? Necessarily a membership organisation? There are benefits to being a member.
Requirements or desirable features	PID services meet certain standards and can be trusted. Criteria for joining the PID Commons. Funding is required for stability. Decision making process. Gaining buy-in and coordinating efforts.
Options	Narrow vs. broad definitions of Commons. A "PID association", perhaps with steering committee. Elected body representing the Commons.

	A single point for coordinating funding.
	Broad membership, not just PID service providers.
Blockers	Self-interest: what's in it for me?

Scenario B: Infrastructure	
Assumptions	Commercial or non-commercial?
	Scope: focus on academic research; not all PIDs in all sectors.
Requirements or desirable features	New PID types have emerged and become well used and trusted.
	Interoperability.
	Easy to run.
	Non-text data.
	Adequate metadata.
	Adaptability to future technologies such as machine learning.
	Opportunities (for new PID types/services) detected and progressed.
	Relationship to FAIR.
	Importance of PIDs in digital preservation.
	Information security (ot all data can be public).
Options	Bringing communities together that maintain PIDs for some object types.
Blockers	Unclear requirements.
	Funding bodies; lack of investment, lack of commitment.
	No strong voice of PID providers in EOSC.
	EOSC chooses direction opposite to global initiatives.
	Trust in new PIDs is not established.
	Lack of flexibility for PID infrastructure to react to new needs and ways of working.
	Misbehaviour of PID Commons members.

Scenario C: PIDs and services	
Assumptions	
Requirements or desirable features	Different entry points for different use cases.
	Way of searching and interface.
	Global governance structure.
	EOSC integration.
	Defined roles and responsibilities.
	Interoperability, standard formats.
	Guidelines for integration
	Community outreach
Options	Lobby decision makers so that PID Services Registry sustained.
Blockers	Low user adoption.

Some global themes clearly emerge from this exercise, such as:

- Should the PID Commons be a membership organisation, or not?
- Role of the PID Commons in establishing trust
- Motivation for joining the PID Commons—if "joining" is how it operates
- Role of PID Commons in coordination of technical aspects of the infrastructure
- Ability to handle new developments
- Relationship to other bodies: EOSC bodies, funding agencies

These tables will be used as "raw data" for further analysis and planning, for example identifying cross-cutting themes across the three scenarios, and as input for the dedicated meeting to be held in January 2020. They can also be used to validate the thinking about specific organisational structures for the PID Commons: do they recognise the assumptions, fulfil the requirements, relate to the options and take account of the blockers (or have good reasons for not doing so).

5 Considerations for the PID Commons

The previous annual report D6.1 discusses the PID Commons in general terms. It notes that "The PID Commons is an ideal, which could be summarised as 'open collaborative governance structures with empowered stakeholders'. The way to approach the Commons is to take it first as a part of the context in which FREYA's sustainability planning takes place, by virtue of representing ideals of common interest and mutual dependency; but then the structures and mechanisms that implement the Commons will be an outcome of that planning." The deliverable also notes that PID Commons will be a special emphasis of work in the second cycle.

The FREYA partners are planning a high-level project meeting in January 2020, coinciding with the PIDapalooza conference, to formulate concrete ideas on organisational structures for the PID Commons. As input to that meeting, WP6 has produced some boundary conditions and parameters for the PID Commons.

Boundary conditions:

- The fundamental aim of the PID Commons is as stated in the FREYA project summary in the DoW: "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."
- Refining this slightly, the primary concern of the Commons is sustainability—governance and coordination, though very important, is a mechanism and a requirement for achieving sustainability.
- The PID Commons is not a single body or organisation (though there might be a central body that is the essence of the PID Commons), but it does have some existence and identity—it is not completely nebulous, and it will be possible to point to its structures and processes in action.
- The PID Commons should work with appropriate existing bodies such as RDA, EOSC and PID service providers; indeed, these could in some cases form part of the PID Commons.
- The PID Commons should have desirable attributes of openness, representativeness, trustworthiness, etc.
- The PID Commons should itself be sustainable.
- It should add value to what would happen anyway through existing structures and processes.

Given that the PID Commons is more than a concept, in order to be effective it must operate through structures/organisations/bodies of some kind. Some of these will already exist—obvious examples being EOSC governance bodies, RDA (in particular the PID IG) and *pidforum.org* , as well as the FREYA partners and existing PID service providers. It might also be desirable to introduce some new structures to "fill gaps"and take on a coordination role—such as the central body mentioned above.

The sustainability concerns with which the PID Commons must engage are, at the highest level, ensuring the three facets of sustainability identified in D6.1:

- **Maintainability.** The capacity of the infrastructure to continue to operate "as is": running its services, maintaining capacity, dealing with problems.
- **Adaptability.** The capacity of the infrastructure to respond to new opportunities, requirements and challenges, which might arise either on the demand side or the technology side.
- **Desirability.** The capacity of the infrastructure to attract and retain users (in a broad sense, including suppliers of third-party services).

However, these are too abstract as they stand and efforts have been made to further define them. By examining various sources such as the discussion in D6.1, the material referred to therein (such as the Bilder–Lin–Neylon paper), and the draft PID policy that FREYA helped to produce, it is possible to list more specific concerns under each of these headings. This list is a first attempt to reduce abstraction

which will require further refinement as our work progresses; in some cases it is debatable which of the three headings the particular concern belongs under.

- **Maintainability**: service standards; funding; resilience of the infrastructure
- **Adaptability**: core and additional services; PID attributes; technology watch; supplier awareness
- **Desirability**: global developments; user awareness; community involvement; market characteristics; characteristics of PID Service Providers and PID Authorities

It is important to recognise that the PID Commons does not have to be *responsible* for all these things—it must be *concerned* with them at the appropriate level as they affect the sustainability of the infrastructure. It is possible that an adaptation of the Plan-Do-Check-Act cycle might be a way of refining this further.

6 The final year

In the final year of the FREYA project, the two strands of WP6, the PID Commons and pathways to sustainability, will converge and will lead to a clear and validated understanding of the nature of the Commons with roles of stakeholders. The Commons will begin to function in the context of EOSC and global infrastructures.

In WP6 the following activities will be undertaken.

- Engagement with EOSC to track its evolution (and influence where appropriate) in areas such as PID policy and Rules of Participation.
- Intensive working, starting with the planned meeting in January 2020, on specific structures and responsibilities for the PID Commons.
- Conclusion of work on the "what", "who" and "how" of sustainability and linking to roles in the PID Commons.
- Consultation and validation of PID Commons with external stakeholders, especially EOSC.
- Consolidation of the links with exploitation planning in WP5.
- Finalising the PID Commons structure and requirements and launching the PID Commons.