EGI-Engage

Concept of EGI Marketplace

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Abstract

This document provides an analysis for the EGI marketplace requirements from different organisations (EGI participants, service providers – current and prospective ones, and user groups) and a proposal for the conceptual framework, business processes, business models, and recommendations of future work to be carried out. Requirements were collected through an ample consultation process, involving also other e-Infrastructures.

The EGI marketplace has the ambition of becoming the platform where an ecosystem of EGI-related services can be promoted, discovered and shared, including EGI offered services as well as discipline and community specific tools and services enabled by EGI and/or provided by third parties under defined agreements.

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TERMINOLOGY

A complete project glossary is provided at the following page: http://www.egi.eu/about/glossary/

Contents

1 Introduction

Europe's ambitions are to create a:

i. Connected single digital market in which the free movement of goods, persons, services and capital is ensured and where individuals and businesses can seamlessly access and exercise online activities under conditions of fair competition, and a high level of consumer and personal data protection, irrespective of their nationality or place of residence [1];
ii. Unified research area, an open space for knowledge, research and innovation; this European Research Area (ERA) will enable researchers, research institutions and businesses to work and co-operate freely across borders [2].

The technologies (instrumentation, expertise, etc.) required to perform and support all aspects of research are becoming increasingly sophisticated and subsequently more resource intensive; in addition, the trend is that research is increasingly interdisciplinary and interconnected and often spanning multiple research groups as well as institutions, further necessitating the need to share resources.

These trends lead towards a more open science and research process involving the use of open data, open code, annotation, data-intensive science, open access, and new forms of collaboration. Therefore, the sharing of technical resources, scientific knowledge, associated data and expertise at the institutional as well as the international level is of strategic importance to all researchers. This is also reinforced by open access policies that are being applied to a growing number of types of resources and for which guidelines are being defined (e.g. see [3,4]).

To support this vision, EGI proposed the Open Science Commons[1], an overarching policy designed to overcome the barriers preventing the implementation of the ERA. The Open Science Commons seeks to encompass all the elements required for a functioning ERA: research data, scientific instrumentation, ICT services (connectivity, computing, platforms and research-specific services such as portals), and knowledge. If successfully implemented, the Open Science Commons will stimulate larger collaborations and accelerate scientific discovery, ultimately bringing greater benefits for society.

Developing the Open Science Commons policy means, first of all, opening resources and lowering barriers to access. This can be achieved by adopting open standards for interfaces or formats, and open licenses for content-related resources. Resources from different domains should be easy to pool together and integrate into wider research processes. Secondly, there is need for rules to govern access to resources and their management. Thirdly, appropriate business models need to be in place to ensure long-term preservation of the research results, and that capacity can be expanded in line with user demand. Implementing this vision (and ensuring its healthy development) will require all key stakeholders to contribute — from funding agencies to the private sector, and from research infrastructures to knowledge institutions.

[1] http://go.egi.eu/OSC

Looking at this prospective, the emergence of various research infrastructures that will need access to communication, computing, and data infrastructures to perform collaborative compute- and data-intensive science is evident. Such research infrastructures would benefit from a shared e-infrastructure that offers the generic capabilities communities need to build their own research platforms. Important elements of this ideal shared e-infrastructure are already present, but further work needs to be done both at the technical level (for greater integration) and at the organisational/governance level (for shared governance, harmonised access policies, and suitable business models that ensure long-term availability).

Even though services are available, it may be difficult for researchers to discover them. EGI attempts to address this issue by developing a marketplace as a service concept for research resources delivered as a Software-as-a-Service (SaaS) solution. Electronic markets can play a central role in an open science commons, facilitating the exchange of research knowledge, ICT resources, services, as well as payment options along side the traditional free at point of delivery model. This means creating a platform where the availability of services can be advertised together with the related access policies and service levels. In addition, the marketplace can enhance visibility for resource and service providers, raising awareness of what they can provide as well as helping to promote cross-disciplinary research.

In particular, the following potential benefits can be expected from developing a digital marketplace:

- Ensure efficient resource usage at the institutional, national, and international level.
- Allow cost sharing with accounting, billing, and enabling of fair usage of resources.
- Facilitate resource discovery at the institutional and inter-institutional level.
- Allow researchers and institutions to focus on value creation as opposed to maintaining redundant resources.
- Researchers can discover expertise that can be tapped into based on usage of resources registered.
- Remove administrative burdens from technology platforms allowing them to focus on technology delivery.
- Increase competitiveness by providing a low cost of entry to expensive technologies for small academic institutions and businesses.
- Facilitate inter-disciplinary research by providing access to technologies typically considered outside of a particular field.
- Avoid re-developing the same solution (tool duplication).
- Provide opportunities for collaborative improvements of services and resources.
- Possible reduce costs by facilitating complex application implementation and integration (e.g. issuing of persistent identifiers, providing links between resources and services).

This document is structured as follows: section 2 presents background information related to cloud computing services and marketplaces; section 3 provides an overview of the adopted methodology; which is described in detail in section 4 and 5.

2 Background

In this section, some background information is presented regarding the cloud concept and the marketplace, and how they relate to each other.

2.1 Electronic Marketplace Models

The core functionality of a marketplace is to provide a uniform service interface to discover and match application and service offerings from providers and sources (e.g. published by different stores) with demand of consumers. This core functionality provides a basis for extended services depending on the domain and nature of the target markets.

Electronic markets play a central role in the economy, facilitating the exchange of information, goods, services, and payments. In the process, they create economic value for buyers, sellers, market intermediaries, and for society at large.

There are several types of e-marketplaces [6]. The major Business-to-Consumer (B2C) e-marketplaces are storefronts and Internet malls. B2B e-marketplaces include private sell-side e-marketplaces, buy-side e-marketplaces, and exchanges.

1. **Electronic Storefront**
   An electronic or Web storefront refers to a single company's website where products and services are sold. It is an electronic store. The storefront may belong to a manufacturer (e.g. geappliances.com, dell.com), to a retailer (e.g. walmart.com, wishlist.com.au), to individuals selling from home, or to another type of business.
   A storefront includes several mechanisms that are necessary for conducting the sale. The most common mechanisms are an *electronic catalogue*; a *search engine* that helps the consumer find products in the catalogue; an *electronic cart* for holding items until checkout; *e-auction facilities*; a *payment gateway* where payment arrangements can be made; *a shipment* court where shipping arrangements are made; and *customer services*, including product and warranty information.
2. **Electronic Malls**
   In addition to shopping at individual storefronts, consumers can shop in electronic malls (e-malls). Similar to malls in the physical world, an e-mall (online mall) is an online shopping location where many stores are located. For example, Hawaii.com is an e-mall that aggregates Hawaiian products and stores. It contains a directory of product categories and the stores in each category. When a consumer indicates the category he or she is interested in, the consumer is transferred to the appropriate independent storefront. This kind of a mall does not provide any shared services. It is merely a directory. Other malls do provide shared services (e.g. choicemall.com). Some malls are actually large click-and-mortar retailers; others are virtual retailers (e.g. buy.com).

In general conversation, the distinction between a mall and a marketplace is not always clear. In the physical world, malls are often viewed as collections of stores (i.e. shopping centres) where

the stores are isolated from each other and prices are generally fixed. In contrast, marketplaces, some of which are located outdoors, are often viewed as places where many vendors compete and shoppers look for bargains and are expected to negotiate prices.

On the Web, the term marketplace has a different and distinct meaning. If individual customers want to negotiate prices, they may be able to do so in some storefronts or malls. However, the term e-marketplace usually implies Business-to-Business (B2B), not B2C. Two types of e-marketplaces can be distinguished: private and public.

Private e-marketplaces are those owned and operated by a single company. Private markets are either sell-side or buy-side. In a sell-side e-marketplace, a company sells either standard or customised products to qualified companies; this type of selling is considered to be one-to-many. In a buy-side e-marketplace, a company purchases from many suppliers; this type of purchasing is considered to be many-to-one.

So adapting these well-known e-marketplace models and examining cloud service providers delivering commodity services will help us define the appropriate business model for a "Science as a Service" (SciaaS) platform.[2]

2.2 Cloud Enabling Research Resources

Cloud computing has recently emerged as a new paradigm for hosting and delivering services over the Internet. Cloud computing is attractive to business owners as it eliminates the requirement for users to plan ahead for provisioning, and allows enterprises to start small and increase resources only when there is a rise in service demand.

In a cloud computing environment, the traditional role of service provider is divided into two: the infrastructure providers who manage cloud platforms and lease resources according to a usage-based pricing model, and service providers, who rent resources from one or many infrastructure providers to serve the end users.

Cloud computing employs a service-driven business model. In other words, hardware and platform-level resources are provided as services on an on-demand basis. Conceptually, every layer of the architecture described in the previous section can be implemented as a service to the layer above. Conversely, every layer can be perceived as a customer of the layer below. However, in practice, clouds offer services that can be grouped into three categories: software-as-a-service (SaaS), platform-as-a-service (PaaS), and infrastructure-as-a-service (IaaS).

The advantages the cloud offers a business are many. The biggest is probably in terms of savings: with a cloud-based software-as-a-service (SaaS) solution, users pay a price based on how heavily they use the service. This means that traditional financial barriers to entry are virtually non-existent. As a result, the cloud is a more efficient way to pay for computing resources.

[2] Renee DiResta, "Science as a service," O'Reilly, January 30, 2013, http://radar.oreilly.com/2013/01/science-as-a-service.html

By defining the appropriate business model research resources needed by researchers to deliver "Science as a Service" as a SaaS solution can be cloud-enabled.

A cloud marketplace provides customers with access to software applications and services that are built on, integrated with or complement the cloud provider's offerings.

- A cloud-based marketplace enables researchers to allow cost sharing with accounting, billing, and enabling of fair usage of resources.

Examples of cloud marketplaces include:

- AWS Marketplace - helps customers find, buy and use software and services that run in the Amazon Elastic Compute Cloud (EC2) - https://aws.amazon.com/marketplace
- Oracle Marketplace - offers a comprehensive list of apps for sales, service, marketing, talent management and human capital management - https://cloud.oracle.com/marketplace
- Microsoft Windows Azure Marketplace - an online market for buying and selling Software as a Service (SaaS) applications and research datasets - https://azure.microsoft.com/en-us/marketplace/
- Salesforce.com's AppExchange - provides business apps for sales representatives and customer relationship management (CRM) - https://appexchange.salesforce.com/
- Computenext: https://www.computenext.com
- Deutch Beurse Cloud Exchange: https://cloud.exchange/en/

In order to do this, EGI must build upon the well-established e-marketplace[3] models for the platform to succeed.

[3] Beat F. Schmid, and Markus A. Lindemann, "Elements of a Reference Model for Electronic Markets," IEEE, January 17, 1998, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.195.1349&rep=rep1&type=pdf

3 Methodology

The challenge to provide a marketplace for research resources is not just a technical challenge, it also requires understanding the needs of researchers and resource providers, as well as developing a business model to make it sustainable. In this activity,

- A survey and several interviews were conducted to get the requirements from researchers and research resource providers.
- In addition service scenarios for resource usage and resource providers to develop detailed requirements were defined.
- Other related research marketplaces were examined to understand how our activity compares to them.
- A Business Model to describe and classify an EGI marketplace and in an "open science commons" space was defined.

3.1 Related work

Other marketplace activities in research were examined to understand their scope and functionalities. This is not a comprehensive list, but hopefully representative.

3.1.1 FI-WARE Marketplace

FIWARE is an open initiative, co-funded by the EC, to support European SMEs and Web Entrepreneurs. The FI-WARE Marketplace is an innovative idea to bring a collection of tools that can be used by developers to establish marketplaces or deliver Software as a Service (SaaS) tools. It in itself is a marketplace of tools that can be used to develop complex software solutions.

The FIWARE Catalogue[4] contains a rich library of components (Generic Enablers) with reference implementations that allow developers to put into effect functionalities such as the connection to the Internet of Things or Big Data analysis, making programming much easier. All of them are public, royalty-free and open source.

The Generic Enables services provided by the catalogue are:

- **Data/Context Management:** Easing access, gathering, processing, publication and analysis of context information at large scale.
- **Internet of Things Services Enablement:** Make connected things available, searchable, accessible, and usable.
- **Advanced Web-based User Interface:** 3D & AR capabilities for web-based UI.
- **Security:** Make delivery and usage of services trustworthy by meeting security and privacy requirements.

[4] http://catalogue.fiware.org/

- **Architecture of Applications / Services Ecosystem and Delivery Framework:** Co-create, publish, cross-sell and consume applications/services, addressing all business aspects.
- **Cloud Hosting:** Provides computation, storage and network resources to manage services.

The FIWARE Catalogue will be extended to include domain-oriented enablers to be combined with those serving general purposes (Generic Enablers - GE). They will cover functionalities that are specific and will help accelerating development of applications, in certain domains.

The FIWARE initiative also provides an e-Learning cloud platform containing training courses, webcasts, and presentations regarding the FIWARE GEs.

To ensure long-term sustainability, FIWARE is proposing a Foundation for creating an open source community to support European SMEs and Web Entrepreneurs.

The main sector of exploitation of FIWARE solutions is the Smart City area where 40 large Cities in Europe have already subscribed a specific MoU to use FIWARE solutions. In addition, according to H2020 LEIT work plan for the period 2016-2017, Smart Cities are the most promising field trials for FIWARE services.

Many opportunities are arising for collaborations with the EGI community as an existing ecosystem of resource, technology, and data providers coupled with extensive expertise throughout a number of research domains.

These opportunities plan to be explored through a joint analysis of the common elements, both technical (e.g. EGI Federated Cloud) and non- technical (e.g. business models, SME support and competence centres) to define possible synergies.

3.1.2 GEANT Cloud Catalogue

As a pan-European research and education network, GÉANT is the gateway for cloud providers to deliver their services to 10,000 institutions, supporting 50 million users and researchers in more than 40 countries.

All cloud providers are invited to include their cloud services in the catalogue, in order to present these to the research and education community. The basis for this online directory is a coordinated list of pan-European core requirements that cloud service providers are expected to meet.

The catalogue, with its structured listing of cloud providers' answers to the cloud requirements, offers to the research and education community clarity about providers' capabilities, which helps when procuring cloud services (subject always to their domestic procurement legislation and applicable EU threshold values).

There is no charge to be registered in this marketplace and relationships are done directly between resource provider and those seeking services.

The GEANT Cloud catalogue[5] comprises services in the following areas:

- Collaboration suites

[5] https://catalogue.clouds.geant.net/

- Real-time communication
- File Storage and Synchronisation
- Infrastructure as a service

3.1.3 UberCloud Marketplace

The UberCloud[6] is the online community and marketplace where engineers and scientists discover, try, and buy Computing Power as a Service, on demand. Engineers and scientists can explore and discuss how to access and use the additional computing power in the cloud to solve their demanding design and development problems, and to identify the roadblocks and solutions, with a crowd-sourcing approach. More than 2500 companies and individuals from 72 countries are participating in the UberCloud Community, among them 50+ cloud resource providers, 80+ application software providers, and hundreds of industry end-users, consulting firms, and consultants.

UberCloud offers a marketplace of HPC in the cloud packages known as "containers" with documented use cases. It has created a community of more than 3000 SME representatives working hand-in-hand to increase actual adoption of the available services.

The UberCloud Marketplace is unique in that it comes from the perspective of the researcher interested in solving specific problems.

The types of services provided in the catalogue include software licenses, computing resources, storage capacity, expert consulting, and training courses.

It offers a high quality set of "experiments" describing how to solve different computational problems that researchers may be interested in. These experiments often map to the software providers in their catalogue (e.g. ANSYS, OpenFOAM), which can use various Infrastructure as a Service (IaaS) resource providers also listed in their catalogue. The catalogue also lists expertise and training that may be of use. The UberCloud uses a brokerage model for use of these services and benefits from a portion of the fees paid for the services discovered via the UberCloud marketplace.

3.1.4 Science Exchange

Science Exchange[7] is a marketplace for scientific collaboration, where researchers can order experiments from the world's best labs. Their mission is to improve the quality and efficiency of scientific research by using market-based incentives to promote collaboration between scientists.

Science Exchange is unique in that it offers any type of service (DNA sequencing, data storage, computational analysis, etc.). It has over 6000 offerings listed and works via a brokerage model.

In August 2012 Science Exchange partnered with the open-access scientific publisher Public Library of Science (PLOS) to launch the Reproducibility Initiative, a program developed to assist researchers in validating their findings by repeating their experiments through independent

[6] https://www.theubercloud.com
[7] https://www.scienceexchange.com/

laboratories. The program is facilitated by the Science Exchange platform, which matches scientists with experimental service providers according to areas of expertise.

The company is working to build out a central database that lets researchers look up where they can outsource an experiment, and how much it will cost them. It also processes the transactions, so researchers and universities don't have to worry about making sure their payment systems are all integrated with each other (Science Exchange makes it money by taking a commission on each transaction). Average experiment prices are around $5,000 — and despite the commission, universities oftentimes save money, because they can find core facilities with lower fees.

The universities with underutilized core facilities, which typically charge higher fees, can close them without having to worry too much about their faculty leaving, since they'll be able to more easily outsource their experiments.

Science Exchange functions like a freelance marketplace utilizing a model similar to Elance or ODesk. For example, a researcher posts an experiment they would like to outsource and then receives bids from experimental service providers. The researcher selects a bid, and Science Exchange facilitates communication, project management and payment via its platform. The company receives a service fee based on the value of the project.

The type of services in the catalogue range from biological experiments to data analysis and experimental design, as well as training and teaching courses.

3.1.5 Internet2 Net+

Internet2 Net+[8] works in a similar manner as the GEANT Cloud Catalogue in that it aggregates different cloud offerings that meet a set of standards.

Internet2 Net+ provides a portfolio of cloud offerings tailored to research and education. It helps institutions accelerate the adoption of cloud solutions, equipping and mobilizing more quickly the very users who are advancing scholarship and science.

In addition in most cases special pricing and conditions are defined for participants of Internet2. These offerings are primarily targeted at the institutional or department level. Inquiries about the cloud services are funnelled through Internet2 and then to the partner like a broker but Internet2 does not take a portion of the fees.

Internet2 Net+ offers a unified portfolio of reliable cloud and trust solutions, enabling responsive, mobile services at scale and especially tailored for R&E's diverse community of users.

The types of services made available are:

- Software as a Service (SAAS)
    - Allows research and education (R&E) institutions to reduce IT costs by outsourcing hardware and software maintenance and support to their cloud providers. This allows the reallocation of IT operations costs away from hardware/software spending and personnel expenses, and toward meeting other goals. The ability to

[8] http://www.internet2.edu/vision-initiatives/initiatives/internet2-netplus/

rapidly deploy new apps to private clouds allows technology teams to focus on needs and goals outside the IT department.

- Security and Identity services
  - Net+ provides open-source software designed to support access, collaboration, and interoperable identity management infrastructures for the R&E community.
- Video, Voice and collaboration (VVC)
  - NET+ combines video and voice through the cloud, allowing for frictionless communication between educators, researchers and learners.
- Digital Content for Research & Education (DCRE)
  - Many institutions still manage content and research with paper-based processes, disconnected point solutions, and home-grown databases. As creators, editors and consumers of this content become more and more distributed, new approaches are required. NET+ DCRE solutions integrate and streamline the many tasks involved in sharing information in a way that is accessible anywhere.

3.1.6 Helix Nebula Marketplace

The Helix Nebula Marketplace (HNX)[9] enables a number of suppliers seek to offer their services, in a competitive but compatible manner, primarily to European research organisations. Helix Nebula currently delivers IaaS services, and further service extensions are in preparation, including:

- **Data management**: the structure for storing and replicating data, and the middleware to manipulate and manage it, such that it is advertised, made available (only) to, and useable by, those who are its targeted users.
- There is an intention that **scientific data** from a range of sources can be made available via coherent means, such that cross-field synergies may emerge, leading to scientific breakthroughs and benefits to society as a whole.
- Certain European public infrastructure facilities (e.g. EGI, GEANT) will be connected into the Helix Nebula environment, allowing its users to adopt a hybrid cloud approach, making use of both public and commercial services via the same interface.
- Information (or **Data Analytics**) as a Service, building an environment to extract useful information from the hosted data and make it available as a service, possibly as a paid service, to authorised users.

These services are tightly integrated with SlipStream from SixSq and agreements are primarily done at the organizational level to use these services.

3.1.7 Analysis

This document examines other electronic marketplaces targeted at the research sector or with the aim to facilitate innovation such as FI-WARE, GEANT, UberCloud, Science Exchange, Internet2, and Helix Nebula Marketplace. These activities are very diverse and can provide insight into this activity. It can be seen by this examination that there is a preference towards the brokerage model

[9] http://hnx.helix-nebula.eu/

and the focus is solely on the pay-for-use concept[10]. We examined in the context of brokerage (broker intermediary involved), free services (ability to offer free resources), IT resources (offering research related IT Services), general science resources (such as core facilities), and local lab resources (sharing of local lab resources with or across groups).

	brokerage	free services	IT resources	general science resources	local lab resources
FI-WARE Marketplace	X	X	X		
GEANT Cloud Catalogue	X	X	X		
UberCloud Marketplace	X		X		
Science Exchange	X		X	X	
Internet2 Net+	X		X		
Helix Nebula Marketplace	X		X		

Comparison of Related Activities

Based on this it can be observed that there is a gap for provisioning of local lab resources and general science resources. As well it can be seen that the current activities focus heavily on IT resources. There is an opportunity to create a marketplace that is comprehensive including instrumentation, data, ICT and knowledge to support the entire research lifecycle.

3.2 Interviews with potential users

One survey and several interviews were performed with sixteen large resource providers, projects and research communities[11]. The survey feedback and interviews helped determine if there is interest in a marketplace solution from each perspective, and the requirements for such a solution.

3.2.1 Need for Marketplace for Researchers and Resource Providers

When asked about improving the discoverability of resources for researchers and if research resource providers would benefit from a marketplace for research resources the following totals were reached:

[10] https://wiki.egi.eu/wiki/EGI_Pay-for-Use_PoC

[11] EGI.eu, Barcelona Supercomputing Center, SURFSara, EMBL-EBI, VENUS-C, France Grilles, DARIAH, STFC, MTA SZTAKI, Cyfronet, GRNET, CSC, the Lifescience Grid Community, Neugrid, iMarine, WeNMR

Do you know researchers, research projects, or research communities that would benefit from discovering research services/resources in a marketplace?	94%
Do you know researchers, research projects, or research communities that would benefit from providing services/resources in a marketplace?	81%

Need for a Research Discovery and Provisioning via a Marketplace Concept

Based on this result, it can be seen that there is a strong feeling that researchers could benefit from facilitated resource discovery and research resource providers could benefit from providing services into a marketplace.

3.2.2 Form of the Marketplace

When asked in what form the marketplace could be provided the following responses were given:

EGI marketplace	94%
Into a "open science commons" space	88%
Private marketplace (e.g. separate portal)	50%
Branded community marketplace	50%
Technology-specific marketplaces (e.g. Ansible Galaxy, Docker Hub Registry, etc.)	44%
Other	31%

Feedback on the Forms of Marketplaces of Interest

From this, it can be seen that most respondents would be interested in advertising resources into an EGI marketplace and in an "open science commons" space. However, there is also significant interest in private and branded marketplaces. Ideally, a marketplace solution should be able to accommodate these multiple cases with one solution by allowing publishing in multiple marketplaces at one time.

3.3 Customer Analysis

3.3.1 Research Communities

3.3.1.1 Customer/User Profile

(Potential) Customer of the service	EGI User Communities, Research and Technology Organisations (RTOs), Universities, International Organisations of European Interest (e.g. EIROForum members) …
(Potential) User of the service	Researchers, especially those doing computer-aided studies.
User profile (pains/gains)	"I need to discover and access the best IT services, data, instrumentation and research resources to perform multi-disciplinary research" Pains: • Tools for performing research are expensive • Difficulty of finding the right service

	• Fragmented information related to resources Gains: • Easy discovery of services suited to the specific needs of the research community • Collaboration across different organisations • Increase productivity • Possibility of easy and advanced filtering and information on capability and service levels • Pay for use to rent research resources other than buying them

3.3.2 Resource Providers

3.3.2.1 Customer/User Profile

(Potential) Customer of the service	EGI.eu Federation Participants, SMEs, International Organisations of European Interest (e.g. EIROForum members) …
(Potential) User of the service	Resource Providers

User profile (pains/gains)	"I would like to increase the visibility of my services and acquire new clients"
	Pains:
	• None knows the services and how to find them
	• Advertising my services can be very expensive
	• Need of developing a platform for requests, authorisation, usage, accounting, and billing
	Gains:
	• Ability to create a resource or service and make it easily available to others
	• Possibility to define quotas and statistics
	• Increase effectiveness and manageability of service
	  ○ Better resource planning
	• Increase strategic benefit of service
	  ○ Better fit to customers
	• Increase visibility of services
	• Easy maintenance of services' lifecycle

3.3.3 Marketplace Operators

3.3.3.1 Customer/User Profile

(Potential) Customer of the service	EGI.eu Federation Participants, SMEs, International Organisations of European Interest (e.g. EIROForum members) …
(Potential) User of the service	Marketplace operators

User profile (pains/gains)	"I would like to increase the visibility of my services and acquire new users with very little effort"
	has a mandate to enable facilitate research communities to discover and access resources
	Pains:
	Difficulty to connect different resource
	• None knows the services and how to find them
	• Advertising my services can be very expensive
	• Need of developing a platform for requests, authorisation, usage, accounting, and billing
	Gains:
	• Ability to create a resource or service and make it easily available to others
	• Possibility to define quotas and statistics
	• Increase effectiveness and manageability of service
	  ○ Better resource planning
	• Increase strategic benefit of service
	  ○ Better fit to customers
	• Increase visibility of services
	• Easy maintenance of services' lifecycle

3.3.4 Essential Features of a Marketplace

In order to determine the important or essential features of the marketplace, the participants indicated which features of a marketplace would be essential/important and those that were not important. The responses are indicated here:

Rate the following functionalities:	**ESSENTIAL / IMPORTANT**	**NOT IMPORTANT**
service description	100%	0%
direct link to the service	100%	0%
filter by...	87%	13%
status of the service: up & running, down, etc..	87%	13%
visibility/access rules by user, group, organization, department, community, project	75%	25%
categorization of EGI affiliation (e.g. integrated, endorsed, external)	56%	44%
user rating	50%	50%
visibility/access rules by VO	44%	56%
prices	37%	63%
negotiation phase	31%	69%
visitors of this service have also viewed	25%	75%

Rating of Importance of Features in a Research Marketplace

Based on a threshold of 50% we have assigned in order of priority:

1. Service description

2. Direct link to service
3. Filter by
4. Status of the service
5. Visibility/access rules by user, group, organization, department, community, project
6. Categorization of affiliation
7. User rating

These functionalities will then serve as the starting points of the proposed solution.

3.4 Service Scenarios

In the course of the EGI-Engage project, different marketplace usage scenarios were developed based on the experience of EGI working with research resource users and providers. Different scenarios were developed from the perspective of the end user, resource provider, and platform administrator. These usage scenarios were then used to elucidate needed features and formulate detailed requirements for the system.

The scenarios of use that individual resource providers use to fund their activities are extremely diverse (pay for use, free at point of delivery, academic, commercial, co-financed, etc.). The solution developed will need to have the ability to allow for all the different usage models, and the resource provider will need to decide which tools to use based on how they finance the provisioning of their services. In addition, many times resource providers use a mixture of scenarios to fund their activities.

The following marketplace user stories have been assembled by EGI based on the requirements from the e-Infrastructure space. These have been analysed and the detailed requirements summarised in Appendix I.

3.4.1 Service Marketplace User Stories

3.4.1.1 User Story 1

- The service provider publishes a service
  - The service provider (SP) registers a new service in the service catalogue
  - The SP can assign a service level agreement (SLA) to the new service
  - The SP assigns a price to the new service (can be zero for free services or different prices for different user segments like SMEs, internal users, external academic users, etc.)
  - The SP can define a policy to access the service
  - The new service is available in the service catalogue
- The customer discovers the existing services
  - The customer accesses the service catalogue and gets the list of offered services
  - The customer can look for a service with specific characteristics/requirements (search engine) and compare
  - The customer can read the details of a service: description, how to accept SLA and penalties for underperformance of SLA, price, SPs list, creation date, last update, etc.

3.4.1.2 User Story 2

- The customer directly selects and buys a service
  - The customer accesses the service catalogue and looks for a service
  - The customer chooses the service to buy
  - The customer may negotiate the SLA through a broker or accept a pre-defined SLA associated to the service
  - The customer buys the service
- The customer selects a service through a broker
  - The customer lists the requirements that should be satisfied by the service they are looking for
  - The broker identifies the best service according to the customer's requirements
  - The broker offers the selected service to the customer
  - The customer evaluates the offered service, may negotiate the SLA through a broker or accept the pre-defined SLA
  - The customer buys the service

3.4.1.3 User Story 3

- The customer reviews and rates a service and/or a SP
  - The customer selects a service from the list of bought services
  - The customer reviews and rates the service and/or the SP
- The customer wants to check the status of his orders
- The customer consults the consumption/usage
- The customer manages the service
- A SP manages the published services
  - A SP registers into the service catalogue
  - Hides previously published services / changes the conditions associated / highlights the services / announces a maintenance break

3.4.1.4 User Story 4

- A SP checks the information associated to services
  - The SP controls the accounting information related to their services (usage, number of users, average consumption) and they can control either by service published or total

3.5 Requirements

Number			Requirement
01	**Service Management**		
	01	**Service Provider**	
		01	**Provider registration:** Marketplace holders can register a resource provider.

		02	**Service registration:** The service provider is able to register a service in the service catalogue and can specify detailed information and display options for his service including: • Service name • Service description • Service instructions • Service visibility • Assign pricing • Usage policy • Picture • Highlight service • Hide a service • Check order status
		03	**Usage policies and SLAs:** The service provider is able to manage service level agreements and usage policies for his services: • Create service level agreements • Modify service level agreements • Assign service level agreements to services • Modify terms of usage and policies
		04	**Availability:** The service provider can define a time window for when his services are unavailable: • Define unavailability (Time and Day, e.g. 2015-07-03 8:00 AM to 5:00 PM) • Inform users
		05	**Reporting**: The service provider is able to view usage reports for users, groups and communities that are using his service. The usage report shows data about: • Number of users • Services used • Service consumption
		06	**Tickets**: The service provider is able to manage his tickets: • reply to tickets • close tickets • delete tickets
	02	**User**	
		01	**Tickets**: The user is able to open support tickets.
		02	**Publications:** Claim publications that were possible as a result of services (e.g. backend integrated with OpenAIRE, the reproducibility experiment in Science Exchange)
		03	**List:** The user can list all services they have access to see details (pricing, how to access, SLAs, associated information, creation date, last update, etc.): • Services • Applications

			• Appliances
		04	**Search**: The user is able to search and filter for resources on the basis of: • characteristics • search term • virtual organization
		04	**Status:** The user is able to view the status of services: • Availability (available, unavailable, service outage, maintenance, etc.)
		06	**Policies**: Negotiate the SLA through a broker or accept the pre-defined SLA associated to the service
		07	**Policies:** The user can accept or decline usage policies.
		08	**Contact**: The user is able to contact the service provider via messages.
		09	**Rating:** The user is able to review and rate services and service providers: • rating and commenting system
		10	**Usage**: The user is able to view his own usage information including: • Services used
		11	**Documentation**: access documentation (knowledge base)
		12	**Finance**: The user is able to review incurred expenses and pay for a service.
		13	**Resource access:** request authorization to access one or more services
	03	**Directory Manager (organizations, groups, departments, projects, communities)**	
		01	**Reporting:** The directory manager is able to view reports for: • Resources available to his virtual organization / users • Resources used by his virtual organization / users • Resources booked by his virtual organization / users • Number of users • Services used • Consult consumption / usage
	04	**Administrator**	
		01	**Provider management**: The administrators is able to manage resource provider requests: • Accept resource provider request • Decline resource provider request (with reason) • Disable a provider (with reason)
02	**Access Management**		

	01	**Service Provider**	
		01	**Service access request**: The service provider can manage service access requests for an individual user, group or community: • Allow access • Decline access (with reason)
		02	**Directory management:** The service provider can manage all users, groups and communities that have access to his service: • List of all members • Remove members • Invite members
		03	**Usage limits**: The service provider can manage usage quotas for his resources and assign them to users, groups and communities: • Define quota (e.g. time) • Assign quota
		04	**Service access:** The service provider is able to publish his services in the service catalogue and can manage to whom his services are visible as well as hide services: • Users • Groups • Virtual organizations • Everyone
	02	**Directory Manager (organizations, groups, departments, projects, communities)**	
		01	**Directory requests:** A directory manager can manage membership requests for users: • Accept membership request • Decline membership request (with reason)
		02	**Directory management:** The directory manager is able to manage the memberships: • List of all members • Remove members • Invite members • Promote member to administrator
	03	**User**	
		01	**Provider registration:** Request Users can request to become a resource provider.
		02	**Directory search:** search for suitable VO
		03	**Directory requests:** The user is able to request access to: • Services • Virtual Organizations • Groups
	04	**Administrator**	

		01	**Directory administration:** Able to manage all aspects of the directory to support directory managers and users.

4 Concept

The EGI Marketplace should provide functionalities necessary for bringing together offering and demand for making research.

These functions include basic services for registering business entities, publishing and retrieving offerings and demands, searching and discovering offerings according to specific research communities requirements as well as lateral functions like reviewing, rating and recommending.

The Marketplace would provide researchers with a uniform interface to discover and match application and service offerings from providers and sources (e.g. published by different stores) with demand of consumers.

Besides the core functions, the Marketplace may offer value because of its "knowledge" about the market in terms of market intelligence services, pricing support, advertising, information subscription and more.

How a marketplace functions in a legal, policy and business framework is an incredibly complex topic within a single country, let alone across national borders. There are two perspectives on this, that of the marketplace provider and that of a resource provider.

In many instances, a marketplace provider will act as a broker. For this, the option is to go with an offering of a “marketplace as a service” to complement the EGI marketplace business functions where needed. By offering a marketplace as a service, individual marketplace providers can determine the business model that fits best. The establishing marketplaces will also need to establish their own policies and terms of use.

4.1 Service Overview

Service Name	**Marketplace**
General description	The Marketplace provides functionality necessary for bringing together offering and demand for making research. These functions include basic services for registering business entities, publishing and retrieving offerings and demands, search and discover offerings according to specific research communities requirements as well as lateral functions like review, rating and recommendation.
Value Proposition (pain relievers / gain creators) for researchers	• Facilitate resource discovery at the institutional and inter-institutional level. • Collaborative improvement of services and resources. • Facilitate inter-disciplinary research by providing access to technologies typically considered outside of a particular field. • Increase competitiveness by providing a low cost of entry to expensive technologies for small academic institutions and businesses. • Allow researchers and institutions to focus on value

	creation as opposed to maintaining redundant resources. • Researchers can discover expertise that can be tapped into based on usage of resources registered.
(pain relievers / gain creators) for resource providers	• Ensure efficient resource usage at the institutional, national, and international level. • Remove administrative burden from technology platforms allowing them to focus on technology delivery instead of administration. • Allow cost sharing with accounting, billing, and enabling of fair usage of resources.
(pain relievers / gain creators) for marketplace operators	• Avoid re-developing the same solution (tool duplication). • Possible reduction in costs of by facilitating complex application implementation and integration (e.g. issuing of persistent identifiers, providing links between resources and services).

In this section, the Business Model Canvas is used to analyse, develop and describe business models.

The canvas below describes business models through nine basic building blocks that show the logic of how an enterprise functions in a simple, relevant, and intuitively understandable way while not oversimplifying the complexities. The canvas covers four main areas of a business: customers, offer, infrastructure, and financial viability. In the following sections, short descriptions of a possible marketplace platform for each building block are provided [5].

<table>
<tr>
<td rowspan="2">KEY PARTNERS
• Academic institutes
• Academic collaborations
• Cosortium members</td>
<td>KEY ACTIVITIES
• Marketplace platform management (Platform that enables users to share, discover and book research resources)</td>
<td rowspan="2">VALUE PROPOSITION
• Providing a proven, reliable and feature rich management tool for any research resources.
• Enables and optimizes resource sharing in and between organizations
• Free tool
• Direction of tool can be driven by participating in consortium
• Support for consortium members</td>
<td>CUSTOMER RELATIONSHIPS
• Self-service platform
• Consortium members</td>
<td rowspan="2">CUSTOMER SEGMENTS
• Researchers and research labs
• Organizations and institutes
• Consortium members</td>
</tr>
<tr>
<td>KEY RESOURCES
• Marketplace platform</td>
<td>CHANNELS
• Web platform
• Consortium</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
• Marketplace platform management and development
• User support</td>
<td colspan="2">REVENUE STREAMS
• Grants
• Partner contributions
• Consortium subscription</td>
</tr>
</table>

Canvas Business Model for the Marketplace Platform

Customer Segments: The marketplace platform is targeted at the niche segment of research resource providers and users of these resources in academia or industry. These can be as small as an individual lab to a resource provider serving multiple institutions across national boundaries.

Value Proposition: The platform will offer resource providers all the tools they need to manage their resources. The basic functionality will be available to all resource providers (resource listing, access management), and additional features can be turned on as needed (e.g. billing, invoicing, resource restrictions). Normally, similar commercial tools can be costly, so there is tremendous value to have a free tool and a low barrier for entry.

Channels: The concept is to work with resource providers to integrate their resources. Then it is assumed that other resource providers in proximity will adopt the solution. It will also be promoted at meetings relevant to different resource providers segment (e.g. microscopy, core technology facilities).

Customer Relationship: The administrator of the system will work directly with organisations, communities, and resource providers. The consumers will have a direct relationship with the resource providers.

Revenue Streams: Initially, the primary usage of the tool will be free supported through a number of current funding mechanisms (e.g. EC projects, EGI.eu participants fees). However, has the Marketplace matures and functionality added, revenue options will be explored, such as sponsored services for increase visibility, sponsorship levels (e.g. platinum, gold, silver) with defined benefits, subscription fees, and indirect revenue streams such as being a vehicle to pay-for-use resource provision (currently being developed within the e-GRANT tool).

Key Resources: Compute and storage (grid, cloud), data, software, data, applications and knowledge resources (e.g. training), lab resources, coming from academic institutions, NGIs and industrial partners.

Key Activities: The most important activity will be on problem solving for the short term, so as to focus on developing a solution that meets the diverse needs of resource providers and satisfying end user's needs. Integration with existing EGI tools will be paramount, understanding not only the technical issues, but also strategic decision making on what is made available via the marketplace and how.

Key Partnerships: Research infrastructures and communities, NGIs, tool developers (existing and new), universities, industry.

Cost Structure: The business model will be cost driven in order to have enough funding to continue to develop the solution. This is currently funded by grants previously mentions, but will need to be augmented with payment models to ensure long-term sustainability.

Through comparing several different related business models from existing businesses (e.g. Red Hat, Booking.com, SB Grid, Google), all business models are shown to be very different, but all of them are successful at what they do and the results can be seen in Appendix II. Not one solution could be found that would cover all of EGI's needs, but key elements from each business demonstrated which can be used to generate the new business model.

The Blue Ocean Strategy method introduced by Kim and Mauborgne[12] is a perfect extension for the Business Model Canvas. In conjunction, they provide a powerful framework for questioning established business models and creating new, more competitive models. The Blue Ocean Strategy is a method for questioning value propositions and business models. The Business Model Canvas provides a visual "big picture" that helps understand how changing one part of a business model impacts other parts. The Blue Ocean Strategy is about creating completely new industries through fundamental differentiation as opposed to competing in existing industries by adapting established models. The idea is to create new, uncontested market space through value innovation instead of outdoing competitors in terms of traditional performance metrics.[13]

To achieve value innovation, an analytical tool with a four actions framework emerged:

1. **Eliminate** factors that the industry takes for granted.
2. **Reduce** factors below the industry standard.
3. **Rise** above the industry standard.
4. **Create** factors that the industry never has offered[14].

Four action framework questions (eliminate, create, reduce, raise) about each business model building blocks were reflected upon and the implications for the other parts of the business model were looked at.

One conclusion is that EGI could eliminate or transform grant participants and partners into consortium members. At the same time, EGI would need to create new value propositions to make it attractive for customers to become consortium members by making them a part of the project and therefore can take influence on the platform development. Furthermore they can take advantage of support of the platform. To make the platform sustainable, a new revenue stream from consortium members could be generated.

Conclusions of the Business Design Analysis

The value proposition of receiving something free of charge has always been very attractive with the freemium approach as an expectation of most users of web-based services. The demand generated at a price of zero is many times higher than the demand generated at any other price point. The questions are how an organisation that offers free products or services generates revenue when they offer them for free. Part of the answer is that the costs of offering certain services and products, such as online web and storage services, have fallen dramatically[15].

There are several known patterns that make integrating free products and services a viable business model option. Each pattern has its own characteristics but they all have one thing in common: at least one customer segment continuously benefits from the free-of charge offer. This section looks at two of these patterns: free offer based on multi-sided platforms and free basic

[12] Chan Kim and Renée Mauborgne, Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant (Harvard Business School Press, 2005)
[13] Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers (John Wiley & Sons, Inc., 2010), p. 226
[14] Ibid., p227
[15] Ibid., p. 90

services with optional premium services (the so-called freemium model, which provides basic services free of charge and premium services for a fee).[16]

4.1.1 Multi-sided Platform Model

Multi-sided platforms are platforms that bring together two or more distinct but interdependent groups of customers. The platform must attract and serve all groups simultaneously in order to create value as intermediary by connecting these groups. Credit cards, for example, link merchants with cardholders; newspapers link readers and advertisers; video gaming consoles link game developers with players. Multi-sided platforms often face a "chicken and egg" dilemma because the platform's value for a particular user group depends substantially on the number of users on the platform's "other sides." One way to solve this problem is to lure one segment to the platform with an inexpensive or free value proposition in order to subsequently attract users of the platform's "other side." The key elements for a multi-sided platform are to understand which side to subsidize and how to price correctly to attract customers.[17]

4.1.2 Freemium Model

Freemium stands for business models, mainly web-based, that blend free basic services with paid premium services. The freemium model is characterised by a large user base benefiting from a free, no-strings-attached offer, event if many of these users never become paying customers. Usually less than 10% of all users subscribe to the paid premium services. The premium users subsidise the free users. This is possible because serving additional free users only generates a small marginal cost. The key elements for a freemium model are the average cost of serving a free user, and the rates at which free users convert to premium customers.[18]

The concept of a e-marketplace is aligned with the vision of the European Commission of creating a single digital market for Europe[19] and can help increase the competitiveness of European research.

[16] Ibid. p. 90
[17] Ibid. p. 78
[18] Ibid. p. 96
[19] European Commission, "Digital Single Market," http://ec.europa.eu/priorities/digital-single-market, accessed August 2015.

5 Recommendations

The platform planned will enable sharing and discovering of research resources, which in essence becomes a marketplace of marketplaces of free and fee-based research resources using a cloud model and adaptation of common e-marketplace models for cloud services.

5.1 One-Shop-Stop Concept

The original goal of this activity is the establishment of an EGI marketplace of research related services for science, ideally applying the one-shop-stop concept. In order to develop a one-shop-stop concept, EGI must develop a solution that allows resource providers to register and provide any type of relevant research resource within the marketplace without any barrier of entry. Then tools within the system the resource providers can control visibility and access to these resources to create distinct views on their resources. These may be local to their organisation or from a community. In essence, a marketplace as a service model will need to be developed for resource providers, and for the user a personalised environment is provided to help discover and use these resources.

In academia, research resources are often provided free (e.g. internal facilities, national resources) or based on project funding. In some cases, resources are offered internally or externally for a charge, most times with a different cost structures for each. Therefore, using a brokerage model where a portion of the fees is used to fund a marketplace infrastructure is not always suitable. In addition, the goal would be to have as many participants in the marketplace as possible, and the expectation from users today is that an Internet based tool is offered free of charge. Different approaches can be used to allow the tool to be offered for free and with no brokerage fee. As there will be many different business models for resource providers, individual resource providers must be able to select which one they use or even use multiple types (e.g. free to a particular research community and pay for use to researchers outside a community). The marketplace should put no constraints on the business models used by resource providers.

5.2 Legal, Policy and Business Framework for a Marketplace

This activity involved the analysis and development of a legal, policy and business framework for a marketplace. The legal, policy and business framework is an incredibly complex topic within a single country, let alone across country borders. In this context, it is best for the marketplace as a service platform to not set any restrictions in terms of policy, but let individual resource providers be responsible to comply to legal requirements and policies that may apply to them. This is already the case for services such as Booking.com, eBay, etc. However, the marketplace solution will need to provide tools to facilitate resource provider's compliance to applicable policies and laws. This can be done by offering tools for handling requests, controlling access, controlling visibility of information, accepting usage guidelines before using resources, accounting, and billing functionality as needed for different cases. These functionalities can be developed with individual

resource providers, and generalized so that other resource providers can take benefit from the solutions that are implemented.

5.3 Allocation of Capacity to Research Communities in Collaborations

In discussion with various communities, the activity examined scenarios for allocating capacity to research communities in collaborations with pilot user communities (user-driven scenario development). In doing so, the activity has gathered a set of requirements that will be provided as input into the development of the solution. These mostly centred around visibility and access control, allowing for internal and external usage of research resources.

5.4 Incentive Mechanisms for Resource Centres to Provide Capacity

All research organisations have resources they share or can share between research groups, as well as national and international research resources that are shared between institutions. However, researchers may not be aware of these resources or they are not shared more widely because the tools do not exist to easily share them. In order to facilitate and incentivise resource providers to share resources, the marketplace platform must be able to easily list research resources and provide tools to resource providers to facilitate providing resources. The tools must be optional so a resource provider can select those that are applicable for their use case. These tools can be such things as: visibility restrictions, access restrictions, custom portals, statistics reporting, usage restrictions, billing, etc. These tools must be flexible and simple enough for an individual lab to share resources internally and powerful enough for large pay for use resource providers to provide resources for a fee.

5.5 Analysis of Revenue Streams for Resource Providers

Each resource provider will have different target audiences. However, there are many different approaches in how they generate a revenue stream to fund their activities. This is as diverse as being able to demonstrate the impact of the resource with citations, demonstrate usage and demand with statistics of usage, co-funding of research grants, and fully funded by paying for usage. The marketplace tool will need to support all these models and help different resource providers implement best practices to help them sustain or increase revenue streams.

5.6 Integration with Other Marketplaces

It is of interest to allow users of the marketplace to discover resources from other marketplaces, and in some cases it may be of interest to have resources within the marketplace solution exposed to other marketplaces. However, as in most cases as demonstrated in the analysis of related projects these generally target large resource providers, so there is not a high degree of overlap. Therefore instead of focusing initially on this integration the marketplace to other marketplaces this will be done on an opportunity basis based on requests from resource providers or users of the system, or potential collaborations with other marketplaces. This can be done either by

importing resource listings from other marketplaces (e.g. GEANT cloud) or providing tools to integration with others (e.g. Helix Nebula).

5.7 Outputs of the Pay-for-Use Activity

The EGI Pay-for-Use project has demonstrated the heterogeneity and complexity of offering of research resources for a fee (e.g. sharing of nationally funded infrastructure to international participants). Resource providers have defined policies for their target audience, and in some cases they can extend to offer underutilised resources to people outside of that audience.

6 Conclusions

This document has outlined the various marketplace models available on the market today and has matched it to not only the research and academia landscape as it pertains to e-Infrastructure, but also specifically to the needs of EGI.eu.

The conceptual model includes initial business models that will be developed as the functionality is agreed, implemented and matured, which will result in identifiable revenue streams to support them.

The characteristics of the marketplace solution can be summarised as:

- The marketplace should be designed as a "marketplace as a service" with a robust service model. In this way labs, organisations, national and international academic resource provider, research consortiums, and commercial entities can use it to advertise services internally and to others as desired. This can be done by allowing for portals to be created where resources can visible for select set of people (e.g. organisational level, consortium, nationally), while allowing some of these resources to be exposed to other large portals (e.g. regional business development portals).
- It will need to be able to support simple listing with redirects to other services, or as sophisticated as providing tools for helping manage the resources offered (e.g. usage restrictions, usage metrics, invoicing).
- The tool will need to offer abilities to federate with local, national, international, and social authentication systems. This should also include authentication systems of commercial entities.
- The ability to restrict visibility of the resources by user, group, organization, department, project and community (e.g. consortiums).
- There should be no barrier of entry into the system for resource providers, but mechanisms to ensure quality and relevance of the offers must be put in place in marketplace. Anyone should be able to list any research relevant resource with very few restrictions (e.g. resource providers must comply to license restrictions of the resource they provide, they must obey applicable laws and organisational policies).
- Any users must be able to register and login into the system in order to view resources appropriate for them.

7 References

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Appendix I. Comparison of Business Models

Subject		EGI Marketplace	Google	Booking.com	Red Hat	SBGrid
Business Model Type		**multi-sided platform**	**multi-sided platform**	**multi-sided platform**	**Freemium**	**Freemium**
Customer Segments	Mass market	No	No	No	No	No
	Niche market	Yes	No	No	No	Yes
	Segmented	No	No	No	Yes	No
	Diversified	No	No	No	No	No
	Multi-sided-platform	Yes	Yes	Yes	No	No
Value Propositions	Newness	Yes	Yes	Yes	Yes	No
	Performance	No	Yes	No	Yes	Yes
	Customization	Yes	No	No	Yes	Yes
	Getting the job done	Yes	Yes	Yes	No	Yes
	Design	No	No	No	No	No
	Brand/Status	No	Yes	Yes	Yes	No
	Price	Yes	Yes	Yes	Yes	Yes
	Cost reduction	Yes	No	Yes	Yes	Yes
	Risk reduction	Yes	No	No	Yes	Yes
	Accessibility	Yes	Yes	Yes	No	Yes
	Convenience/Usability	Yes	Yes	Yes	Yes	Yes
Channels	Sales force	No	No	No	Yes	No
	Web sales	No	Yes	Yes	Yes	Yes
	Own stores	No	No	No	No	No
	Partner stores	No	No	No	No	No
	Wholesaler	No	No	No	No	No
Customer Relationship	Personal assistance	Yes	No	No	Yes	Yes
	Dedicated personal assistance	No	No	No	Yes	Yes
	Self-service	Yes	Yes	Yes	Yes	Yes
	Automated-services	Yes	Yes	Yes	Yes	Yes
	Communities	Yes	No	No	Yes	Yes
	Co-creation	No	No	No	Yes	Yes
Revenue Streams	Asset sale	TBD	No	No	No	No
	Usage fee	TBD	No	No	No	No
	Subscription fees	TBD	No	No	Yes	Yes
	Lending/Renting/Leasing	TBD	No	Yes	No	No
	Licensing	TBD	No	No	No	No
	Brokerage fees	TBD	No	Yes	No	No

Subject		EGI Marketplace	Google	Booking.com	Red Hat	SBGrid
Business Model Type		**multi-sided platform**	**multi-sided platform**	**multi-sided platform**	**Freemium**	**Freemium**
	Advertising	TBD	Yes	No	No	No
	Grants and consortium contributions	TBD	No	No	No	Yes
Key Resources	Physical	Yes	Yes	Yes	No	Yes
	Intellectual	Yes	Yes	Yes	Yes	Yes
	Human	Yes	Yes	Yes	Yes	Yes
	Financial	No	No	No	No	No
Key Activities	Production	No	No	No	Yes	No
	Problem solving	Yes	Yes	Yes	No	Yes
	Platform/Network	Yes	Yes	Yes	No	Yes
Key Partnerships	Strategic alliances between non-competitors	Yes	Yes	Yes	Yes	Yes
	Competition: strategic partnerships between competitors	Yes	Yes	Yes	Yes	Yes
	Joint ventures to develop new businesses	No	Yes	No	Yes	No
	Buyer-supplier relationships to assure reliable supplies	No	No	No	No	No
Cost Structure	Cost driven	Yes	No	Yes	Yes	Yes
	Value driven	No	Yes	No	No	No
Epicentres	Offer-driven	Yes	Yes	Yes	Yes	Yes
	Customer-driven	Yes	Yes	Yes	Yes	Yes
	Finance-driven	No	No	No	No	No