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Abstract	This report is an introduction to business models in use on the Internet and their applicability in the Renardus context. The report has five main strands. It first attempts to define what business models are and outlines some popular business models in use on the Internet, both commercial and non-commercial. A second section includes examples of business models used by other services in the cultural heritage sector. The report then takes a brief look at the business models of existing Renardus Data Providers, both gateways and brokers. It then describes some business models that could be adopted by the Renardus Consortium to help develop a sustainable service.
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EXECUTIVE SUMMARY

Business models have been defined as the "method of doing business by which a company can sustain itself - that is, generate revenue" (Rappa, 2001). Business models can be either commercial or non-commercial, but much of the published literature concentrates on the models used for e-commerce. There have been several recent attempts to formally define and classify these commercial business models used. These show that many of the business models adopted for e-commerce are adaptations of those used by 'traditional' organisations, e.g. retailing or auctions. Even the most well used Internet business models - advertising, subscription and pay-per-use - are largely enhancements of models already used by, for example, television companies and publishers. Where Internet business models differ from traditional ones is an increased emphasis on mediating between third party organisations or on creating 'communities.'

Business models used for digital library services are usually based on the concept of selling access to some unique content. Many of these have evolved from publicly funded research and development projects. Of the three short case studies considered in this report, both JSTOR and SCRAN are research projects that have evolved into services that license access to content, primarily to educational institutions. The other organisation described here, the UK-based Boxmind - which has itself developed a subject gateway - has a business model based on licensing access to a collection of e-lectures and the software used to create them, and on selling related 'communication services' to non-academic organisations. What these all organisations have in common is some unique content that can be used as the basis for a subscription-based business model.

The business models used by subject gateways tend to be dominated by public funding. For example, they can be publicly funded as services, as part of research and development projects, as part of the role of cultural, educational or scholarly institutions, or as part of a membership-based collaboration. There is some scope for the gentle adoption of some commercial business models, e.g., discreet advertising, providing third parties access to selected gateway resources through services like RDN-Include (http://www.rdn.ac.uk/rdn-i/). On the whole, however, most of the subject gateways that are Data Providers to the Renardus Service are publicly funded in some way.

The costs of the Renardus Service are slightly simplified because the costs of running the participant gateways (including providing metadata and classification mapping data) falls largely on the Data Providers. For the Renardus Service itself, the main cost elements would be for staff (for technical support and quality control), equipment and licenses.

There are a number of business models that could be adopted or adapted for use by the Renardus Consortium. Non-commercial models might include sponsorship (by commercial or non-commercial organisations), continued research and development funding, or the setting up of a membership-based consortium. More commercial models that could be investigated at a later date may include advertising or some kind of institutional subscription.

SCOPE STATEMENT

This report is an introduction to business models in use on the Internet and their applicability to the Renardus context. It builds on the preparatory work undertaken in deliverable D8.1, which investigated business issues that might impact the development of a central broker service and its sustainability (Day, *et al*., 2000). It provides additional background for the public deliverable D3.4/D8.3, which focuses on the organisational and business sustainability of Renardus as a European broker service (Peereboom, Day & Huxley, 2002).

Detailed information on the Renardus organisational model and how the project is being taken forward into the post-project phase can be found in other WP3 deliverables, chiefly D3.1 (Peereboom, 2001), D3.2 (Peereboom, 2002) and D3.5 (Peereboom, *et al*., 2002). This report will instead concentrate upon background issues, namely:

- Business models in use on the Internet, both in e-commerce and by the digital library sector.
- Business models in use by existing Renardus Data Providers.
- Business models that could be adopted by the proposed Renardus Service.

It is hoped that this information will help inform the work of the Renardus Management Group and help provide some rationale for the consortium-based organisational structure proposed in deliverable D3.4/D8.2.

PART III - DELIVERABLE CONTENT

INTRODUCTION

This report is an introduction to business models in use on the Internet and their applicability in the Renardus context. It builds on the preparatory work undertaken for deliverable D8.1, looking at business issues that might impact the development of a central broker service and its sustainability (Day, *et al*., 2000).

The report has four main strands. It first attempts to define what business models are and outline some popular business models used on the Internet, both commercial and non-commercial. It will then take a brief look at the business models of current Renardus Data Providers (both gateways and brokers) and then outline some business models that could be adopted by broker services, focussing on potential models that could be adopted by the Renardus Consortium for a sustainable service. A fourth section will include examples of what business models are used by other services in the cultural heritage sector. Finally, the report will outline some business issues that may influence the future development of the Renardus service.

GLOSSARY

Business model
The method of doing business by which organisation can sustain itself, i.e. how it generates revenue, the value of its services or products and its position in the supply chain. The most popular business models used on the Internet are similar to the commercial business models used by non-Internet based organisations, and include advertising and direct payment via subscription or usage.

Data Provider
A service, e.g. a subject gateway or broker service that makes its resource descriptions (metadata) available to the **Renardus Service** (*q.v.*) or for other collaborative activities carried out by members of the **Renardus Consortium** (*q.v.*).

Management Group
A group consisting of representatives of Renardus member organisations that is responsible for management, policy and decision making. Its main responsibility is to ensure the sustainability and further development of the **Renardus Service** (*q.v.*) in the longer term.

PR Group
A group consisting of representatives of Renardus member organisations that is responsible for all activities relating to the dissemination of information, concertation, promotion and support. Its main responsibility is to ensure that target audiences (end-users and potential participants) know about the **Renardus Service** (*q.v.*) and to make relevant information available.

Renardus Consortium
The consortium of organisations involved in the exploitation of the **Renardus Service** (*q.v.*). Members of the Renardus Consortium can either be **Data Providers** (*q.v.*) or organisations that provide technical or commercial expertise. Otherwise they may fulfil some other role in the consortium, e.g. as a sponsor.

Renardus Service
An Internet service that gives integrated access (search and browse) to the combined resource descriptions of participating **Data Providers** (*q.v.*).

Service Provision and Maintenance Group
A group consisting of representatives of Renardus member organisations that is responsible for the service provision and the technical maintenance of the **Renardus Service** (*q.v.*).

1. BUSINESS MODELS USED BY INTERNET SERVICES

1.1 Definitions and taxonomies of business models

The simplest definition of a business model is that it is the "method of doing business by which a company can sustain itself - that is, generate revenue" (Rappa, 2001). This does not mean that a business model is *only* concerned with revenue; it should also relate to the value of services and goods provided and the organisation's position in the product supply chain. Thus Mahadevan (2000, p. 59):

> *A business model is a unique blend of three streams that are critical to the business. These include the value stream for the business partners and the buyers, the revenue stream and the logistical stream. The value stream identifies the value proposition for the buyers, sellers, and the market makers and portals in an Internet context. The revenue stream is a plan for assuring revenue generation for the business. The logistical stream addresses various issues related to the design of the supply chain for the business.*

There are a wide range of business models in use. Rappa (2001) notes that some models are quite simple: a company "produces a good or service and sells it to customers. If all goes well, the revenues from sales exceed the cost of operation and the company realizes a profit." Others are more complicated and are based on organisations as intermediaries or facilitators. The recent growth in electronic commerce (e-commerce) means that at the moment there is quite a lot of interest in Internet business models, both new and traditional (e.g., Jutla, *et al*., 1999; Werbach, 2000; Feeny, 2001).

Table 1: Taxonomy of business models identified by Rappa (2001)

Business model:	***Brief description:***
Brokerage model	Those that bring buyers and sellers together and facilitate transactions (often fee based)
Advertising model	Supported by advertising revenue, a Web site will provide content and services together with advertising (e.g., banner ads)
Infomediary model	Collecting data about consumers and their purchasing habits and selling this information to other businesses
Merchant model	Selling of goods and services on the traditional retail model
Manufacturer model	Direct selling by the creator of a product or service to consumers, cutting out intermediaries
Affiliate model	Offering financial incentives to affiliated partner sites
Community model	Where users themselves invest in a site, e.g. by the contribution of content, money or time. This can be combined with other models, e.g. advertising or subscription
Subscription model	Where consumers (users) pay for access to the site, usually for high added-value content, e.g. financial information, newspapers, journals
Utility model	A model based on metered usage or pay-as-you-go; depends on micropayments

Source: Rappa (2001)

Mahadevan (2000, p. 59) has commented that there have not been very many attempts to formally define and classify business models in the Internet context. However, there have been some recent attempts to organise and classify them. In one attempt, Rappa (2001) has arranged Internet business models into nine generic categories (Table 1). These include some traditional models that have been adapted for use on the Internet; e.g. those based on advertising, retailing or subscriptions, as well as models that have been developed specifically to support e-commerce.

An older taxonomy by Timmers (1998) classified eleven business models that were in use or being experimented with to support Internet e-commerce (Table 2). Timmers classification of commercial business models in use on the Internet mentioned several potential revenue streams. He noted that some models would be able to raise revenue through membership fees (e.g. for 3rd party marketplaces or virtual communities), while others might be based on charging by service or transaction provided.

Table 2: Internet business models identified by Timmers (1999)

Business model:	***Brief description:***
E-shop	Marketing of a company or shop
E-procurement	Electronic tendering and procurement of goods and services
E-auction	Based on electronic bidding, on the traditional auction model but which may integrate contracts, payment and delivery
E-mall	A virtual collection of e-shops
Third party marketplace	Common marketing front-end and transaction support for multiple businesses
Virtual communities	Virtual communities based on communication and information exchange between members, e.g. customers or partners
Value chain service provider	Specialists in specific functions of the value chain
Value chain integrator	Integrator of multiple steps in the value chain
Collaboration platforms	Providers of tools and an information environment for collaboration
Information brokerage, trust and other services	Adding value to data available on the open networks, e.g. searching, customer profiling, etc.

Source: Timmers (1999), Pereira & Fife (2000)

Many of these models are broadly similar to (or are based on) those business models used in traditional (i.e., non-electronic) contexts, e.g. shops, auctions or advertising. The key difference is that the more innovative Internet business models are based on the existence of cheap communication costs. There is, therefore, much interest in services that link different businesses or add some kind of value.

Taking Rappa and Timmers's taxonomies together, many of these commercial (or quasi-commercial) business models will be familiar to those who work in academic libraries and other cultural heritage organisations. For example, publishers have used subscription models for many years to provide journals or monographic series. Libraries have also used intermediaries (brokers) like subscription agents and, more recently, content aggregators like Stanford University's HighWire Press or CatchWord (e.g., Inger, 2001). It is possible also, that some of these commercial business models would be of interest to those cultural heritage organisations that are themselves creating digital content (e.g., Harvard Consultancy Services, 2000). This is, however, not the main focus of this report. Instead, we will attempt to identify business models - including some of those outlined by

Rappa or Timmers - that are of relevance to the funding of subject gateways and cross-gateway broker services like that offered by Renardus.

The most interesting business models from a subject gateway perspective might be Rappa's 'community model' or Timmers's related idea of 'virtual communities.' These, as currently defined, are services that gain support from members contributing effort, content or money. Thus Timmers (1999, p. 6) writes that the ultimate value of virtual communities comes from "the members (customers or partners), who add their information onto a basic environment provided by the virtual community company." If we ignore the specifically commercial aspect, this is broadly similar to Rappa's more generic community model, one based on user investment. As an example of a community model, Rappa (2001) cites knowledge networks:

> *Sites are typically run like a forum where persons seeking information can pose questions and receive answers from (presumably) someone knowledgeable about the subject. The experts may be employed staff, a regular cadre of volunteers, or in some cases, simply anyone on the web who wishes to respond.*

This is broadly the type of model employed by the open-source software movement; described by Ljungberg (2000, p. 208) as "a loosely coupled community kept together by strong common values such that software should be free." Initiatives for co-operation between subject gateways, e.g. the IMesh collaboration (Dempsey, *et al*., 1999) or Renardus itself, could be seen as a similar type of virtual community.

Other business models that may have relevance to subject gateways are Timmers's 'collaboration platforms' (a type of virtual community based on the existence of common tools) and value-added 'information brokers'.

1.2 Commercial business models

Although there are a variety of business models in use by e-commerce organisations, the most basic revenue models used on the Internet are advertising, subscription and pay per use (Randall, 1997, p. 157).

1.2.1 Advertising

Organisations using this model offer advertising space on their Web pages and obtain revenue from the advertiser. They are used in many contexts, and are used, for example, to support many of the popular Internet search services, e.g. AltaVista, Lycos and Yahoo! Many of these services use targeted advertising, so that users will retrieve banner adverts or commercial links related to the particular search string that they entered (Lawrence, *et al*., 2000, p. 26). For example, a user searching for "Rome Italy" on AltaVista will retrieve links for selected travel agents and hotel brokers. Some Web-sites gain advertising revenue through agencies like DoubleClick (http://www.doubleclick.com/us/) but sites who want to use these will need to generate a very high level of traffic. Neal & Kerr (2001, p. 4) note that DoubleClick require a minimum of one million page views per month. Lawrence *et al*. (2000, p. 27) note that the advertising model "is appropriate primarily for service-oriented, online businesses." There is some evidence that the Internet crash has had an adverse impact on business models completely based on advertising (e.g., Lambeth, 2001).

1.2.2 Subscription

The subscription model is similar to that developed over many years by publishers for magazines or scholarly journals. It has also been adopted by digital television providers and by some Internet service providers (ISPs). This model means that a user (or group of users) pays on a regular basis (e.g., annually, monthly, etc.) for access to added value content on Web sites, online magazines or journals, software updates, etc. In the case of journals, many subscriptions are 'institutional,' in that an organisation (e.g. a university library) or group of organisations collectively will pay for giving their members access to a range of 'bundled' publications.

1.2.3 Pay-per-use

The pay-per-use model is based on users paying on demand for the use of a particular service or product. Until now, its adoption has been limited to some extent by the lack of an Internet infrastructure for micropayments.

This may now be beginning to change (Schwartz & Moore, 2001). A type of this model often seen on publishers' Web sites, whereby users are invited to pay for time-limited access to articles on an individual basis. For example, the Emerald service from MCB University Press allows users to pay for access to non-subscribed articles with their personal credit cards.

1.2.4 Other commercial models

The taxonomies developed by Rappa and Timmers suggest that there is a wide range of other Internet business models that could be used by organisations for e-commerce. Many of these (e.g., Rappa's Brokerage and Community models, Timmers's Virtual communities, Information brokerage, etc.) are based on providing links between other organisations or between organisations and their user base. These types of models are predicated on the way in which communication on the Internet is cheap and navigation can be made seamless to the end-user. Lawrence, *et al*. (2000, p. 30) identify a 'Portal model' whereby Web sites offer a variety of Internet services from a single location. Portals typically offer some free services (e.g. search engines, e-mail hosting) but also provide access to other services, some of which may need to be paid for or supported by advertising. Once a portal has a certain number of users, Ward & Gardner (2000, p. 20) note that revenue can begin to be generated in a variety of ways, e.g.: commission on transactions, providing market research services, subscription services, etc.

An interesting variant on the advertising model is the affiliate programme, as developed by companies like Amazon. In these, 'affiliate' Web sites are rewarded for generating links to other Web-sites. They are typically run by commercial organisations, primarily online retailers like Amazon or Barnes & Noble. Affiliates link to the target organisation's Web-site and are paid a small commission or fee when a user visits, registers personal details or purchases an item from that link. Lawrence, *et al*. (2000, p. 29) note that affiliate programmes supporters claim that they make more sense than banner advertising, "which require payment in advance and do not guarantee traffic or sales." Kirriemuir has noted some disadvantages of affiliate schemes, including concerns about endorsement and liability; he also notes that in many cases they generate very low revenues (Kirriemuir, 2001, p. 277). Affiliate schemes are a viable business model for some specialised commercial organisations. The 'shopping comparison portal' Kelkoo generates 60% of its revenues from fees received for leads sent to 'e-tailers,' who pay a combination of fixed or transaction based fees to optimise their visibility on the Kelkoo Web-site (http://uk.kelkoo.com/content/content.jsp?url=/content/general/corpinf.html).

1.3 Non-commercial business models

Naturally, most of the published literature on Internet business models concentrates on those used for e-commerce. It is important to realise that there are a number of non-commercial ways of supporting an organisation or service. These non-commercial models might include direct funding from public sources (e.g. government agencies) or publicly funded research and development.

Most quality controlled subject gateways (e.g., Koch, 2000) are supported primarily by non-commercial models. A previous Renardus report (Day, *et al*., 2000) described some of the business models that were used to support subject gateway services. Following Dempsey (2000), it identified four main business models in use:

- Collective activity through membership
- Shared public investment
- Publicly funded research and development
- Public investment as part of the role of cultural, educational or scholarly institutions

It also mentioned some commercial models that could be used to support these (e.g., subscription and advertising) but noted that business models were not mutually exclusive. It was noted that different types of funding might be appropriate at different stages of the life cycle of a service.

2. BUSINESS MODELS IN USE FOR SUSTAINING DIGITAL COLLECTIONS

There are very few published studies of the business models that are used to build and sustain digital library services. Those that do exist tend to cover areas where digital library services give access to collections or content (e.g. Royan, 2001; Nicholson, 2001). For example, a recent report published by the US Council on Library and Information Resources (2001) described the various business models that underlie the services provided by JSTOR, HighWire Press, Questia Media, the Art Museum Network and some others. The key issue is sustainability. There are, and remain, many initiatives and programmes devoted to the creation of digital services and content. There is much less focus on ensuring that these services and content continue to be economically viable. Some programmes assume that resulting services will continue to be supported by their host institutions, others make no assumptions at all. In this context it is interesting that the UK New Opportunities Fund (NOF) Digitisation initiative expects projects to remain sustainable for at least three years beyond the end of funding and has provided some generic advice on income generation and sustainability (Harvard Consultancy Services, 2000).

This section will provide some case studies of business models used by cultural heritage organisations. None are exact analogies to the Renardus Service, but may contain some lessons for its future development.

2.1 Case studies

2.1.1 Boxmind

Boxmind Ltd. (http://www.boxmind.com/) is company that provides educational content based in Oxford (UK). It was founded by three graduates of the University of Oxford, and is funded by venture capital. The Boxmind Web-site was launched in 2000 and provides two main services. The most prominent of these are a series of e-lectures - multimedia lectures broadcast online with transcripts and added content. Lectures currently available on the Web-site includes some given by Oxford-based academics like Richard Dawkins and Niall Ferguson (both of whom are on the editorial board of Boxmind), as well as by US-based scholars, e.g., Stephen Pinker of MIT and Daniel Dennett of Tufts University. More relevant to Renardus, however, is the secondary service, an "Online Library" that is intended to direct undergraduate students (and others) to a searchable directory of around 17,000 'high-quality' Internet resources. In order to set this service up, through the summer of 2000, Boxmind employed about 30 staff (mostly students) in order to select a core set of resources and to group them according to subject. Resources are categorised into 27 core subject areas, further divided into sub-topics. Each resource has a very short description (approximately two lines) and is rated according to content, presentation and usability. Boxmind puts great store by the selection process (although no selection criteria have been published) and Ferguson (2000) argues that it will make it easier for students and lecturers to find the "tens of thousands of valuable resources that are 'out there', but buried."

The Boxmind business model is based on licensing the e-lectures to institutions (mainly universities) and individuals. The e-lecture archive is available to individuals by subscription (currently £7.00 per month or £80.00 per year). Information on the level of institutional subscriptions is not given. Institutions are also able to license the software produced by Boxmind (the e-lecture authoring suite called "Enlighten") in order to produce their own e-lectures (Birchard, 2001). The company also attempts to offer communication services to non-academic organisations, e.g. providing multimedia versions of internal presentations or annual reports (http://www.boxmind.com/other_services.htm). Basic use of the Boxmind "Online Library" service appears to be free (although there are reading list and saved search features that are reserved for subscribers). The site also appears to be supported by advertising. The Boxmind "Online Library" would appear to be an example of that described by Halliday & Oppenheim (1999, p. 20) as an associate activity intended to attract users to primary products and services. As the focus of Boxmind is primarily the academic sector, a subject gateway type activity makes a useful additional service.

2.1.2 JSTOR

JSTOR (http://www.jstor.org/) - originally the Journal Storage project, now subtitled the scholarly journal archive - started as an experimental project funded by the Andrew W. Mellon Foundation. Its objective was to set up a pilot service that would provide access to older scholarly journals. A full service was launched in 1997, while JSTOR itself was successfully transformed into a not-for-profit organisation with an independent board of trustees (Guthrie, 1998, p. 13).

JSTOR's business model is based on acquiring rights from publishers to digitise and full-runs of the older issues of selected scholarly journals (there is a "moving wall" access-policy that excludes the most recent content). These are then made available on the Web through institutional site licenses. There is currently no direct access for scholars that work outside of institutions, largely because JSTOR views itself primarily as an archive rather than a provider of access (CLIR, 2001, p. 5). That said, JSTOR does help direct individual users to participating publishers. One measure of JSTOR's success is the number of institutions that have been prepared to subscribe to its services. Currently (June 2002), there are 1338 institutional participants who license access to one of the JSTOR collections; almost a third of these are not based in the USA. Fees vary depending on the size and type of participating institution.

2.1.3 Scottish Cultural Resources Access Network (SCRAN)

The Scottish Cultural Resources Access Network (SCRAN) is a resource base made up of selected multimedia objects that have been selected and digitised from the holdings of cultural heritage organisations in Scotland (http://www.scran.ac.uk/). These usually take the form of images, of historic photographs, paintings, three-dimensional objects, etc. The resources are provided by various cultural heritage institutions. SCRAN can give financial help to contributors, but in exchange for a perpetual non-exclusive licence for their educational use (Royan, 1998).

> *The contributor retains all rights in the original material asset and gains full commercial rights in the new digital asset, but SCRAN members are licensed to use that digital asset in any way for non-profit educational purposes, with no further payment to the rights holder.*

SCRAN gives free access to thumbnail images of all resources, but gives access to larger images to members of licensed educational institutions. Royan (2001, p. 41) says that SCRAN "expects to earn the lion's share of its income from exploitation of the IPR in its resource base of hundreds of thousands of multimedia records." Some of the licenses have been agreed on a consortium basis, e.g. SCRAN is fully available to UK higher and further education establishments as part of the JISC Information Environment (formerly Distributed National Electronic Resource). More recently, SCRAN has investigated offering licenses for personal users, as well as the commercial licensing of individual images and the preparation of new products (e.g. CD-ROMs) from the resource base (Royan, 2001, p. 41).

3. BUSINESS MODELS IN OPERATION WITHIN RENARDUS

Halliday and Oppenheim (1999, p. 20) note that there has been very little work published on the economics of subject gateways. There was some useful practical advice published in the *Information gateways handbook* published in 1999 by the DESIRE project (http://www.desire.org/handbook/), but even this didn't include a specific chapter on business issues. Instead it stressed the importance of a "well defined plan, aims and objectives, and a carefully thought out timetable" (Belcher, 1999a), and included specific chapters on staff skills (Belcher, 1999b), publicity and promotion (Belcher & Huxley, 1999) and co-operation between gateways (Place, 1999). The only detailed economic studies of subject gateways formed parts of studies undertaken for the JISC prior to the setting-up of the RDN. An evaluation of the eLib gateways by Haynes *et al.* (1998) analysed three models for the transition of the UK gateways from project to service status. An eLib 'supporting study' by Halliday & Oppenheim (1999) followed this up by estimating the costs (including overheads) of a network of eight subject gateways with a centre. Both studies concluded that gateways could be sustainable with a combination of public funding (e.g., from the JISC) and income generated from other sources, e.g. subscription or sponsorship.

3.1 Business models used by subject gateways

An earlier Renardus deliverable (Day, *et al.*, 2000) outlined a number of different business models in use by gateways. Following Dempsey (2000), it defined four main models that could be used by gateways. In practice there tends to be some overlap between these as gateways seek funding from a range of sources and it can be difficult to differentiate exactly between various public funding streams.

3.1.1 Shared public investment

In the shared public investment model, information gateways are funded as a service by some public organisation, e.g. government agencies. An example of the shared public investment type of model is the UK's RDN. This service is funded by the JISC with additional support from the Economic and Social Research Council (ESRC) and the Arts and Humanities Research Board (AHRB). In Germany, the Deutsche Forschungsgemeinschaft (DFG) funds some subject gateway activities.

3.1.2 Publicly funded research and development

Publicly funded research and development funding is a familiar business model that has been used by many gateways, especially at the start-up stage. For example, some of the UK gateways that now make up the RDN were first funded by JISC as part of the Electronic Libraries Programme. Australian gateways like AVEL and MetaChem were initially part-funded by the Australian Research Council. In addition, research and development projects have also been used to provide software and other support for the development of gateways. Good examples of these are the software tools and guidance (cataloguing guidelines, selection criteria, etc.) produced by projects like ROADS, the Nordic Metadata Project and DESIRE.

The main problem with this business model is that research and development funding tends to be limited in both scope and time-scale. It is therefore good for the short-term funding of first stages of gateway creation and for the development of specific tools, but less useful for the development of sustainable services in the longer term.

3.1.3 Public investment as part of the role of cultural, educational or scholarly institutions

Some gateways are funded as part of the wider role of cultural, educational or scholarly institutions. This business model sees the funding of gateways as a type of public investment by national and research libraries, museums, archives, universities, learned societies, research institutes, etc. This is an increasingly popular business model for information gateways as these institutions begin to recognise the importance of developing Internet-based services for their perceived audiences. Library-based examples might include gateways largely co-ordinated by national libraries (e.g., DutchESS, PADI), academic libraries (e.g. the Finnish Virtual Library, EELS, the Leeds University Library selected Web sites service). Other gateways have been produced by a museum service (e.g. the National Maritime Museum's Port service) or are funded by government agencies.

3.1.4 Collective activity through membership

A less well-tested business model for gateways would be to collaborate through a membership organisation. There are not many examples of this model being used for subject gateways, with the possible exception of the informal IMesh collaboration (http://www.imesh.org/) and gateways' collaboration in specific research and development projects like DESIRE. A more specialised version of this model was used by OCLC for the initial phase of the Cooperative Online Resource Catalog (CORC) database. CORC originated as an OCLC Office of Research project but the system was developed in partnership with a large number of participating libraries (Hickey, 2000).

The advantages of collaboration in the gateway world are well known. In the DESIRE *Information gateways handbook*, Place (1999) has written that collaboration "can help organisations to develop their gateways more efficiently and effectively ... [and] can also help them to sustain the gateways in the longer term." A membership based collaboration may be relatively informal and unstructured (as with the IMesh collaboration), with low entry costs and where the status of being a member is more important than any other consideration. A more formal membership organisation would have higher entry costs or even have some kind of membership fee.

3.1.5 Commercial models

Dempsey (2000, p. 17) also noted two potential commercial or quasi-commercial business models that could be used by subject gateways. These are related to the subscription and advertising-based business models:

- An investment in gateway activity as one component of a range of subscription-type services.

- Supporting gateway activity by advertising or other services based on the value of the attention of visiting users. This model is dependent upon attracting large numbers of visitors to a Web site on the basis that a proportion will be likely to visit advertisers. Many of the large Internet search services rely on this model, although it is also used by some smaller Web-based services.

It is also possible that subject gateways may help draw Internet users to associated Web sites. Halliday and Oppenheim (1999, p. 20) noted that cataloguing the Internet "is an activity undertaken by various types of organisation to attract users to their sites with a view to promoting their primary products/services or enhancing their reputations." They gave some examples, which included:

- BioMedNet Weblink (http://links.bmn.com/), which, "offering pointers to useful sites among many other discipline-based services, is effectively a discipline-based Internet community owned by Elsevier Science and funded, in part by advertising" (Halliday & Oppenheim, 1999, p. 20).

- The Wiley student resource centre (no longer available), which included subject-specific sub-sites centred on specific high-volume texts published by Wiley.

- The Oppedahl & Larson LLP Patent Law Web Server (http://www.patents.com/resource.htm).

Other examples might include the subject-based 'Arenas' being produced by the publisher Routledge (http://www.routledge.com/rcenters/rcen.html). These are an attempt to provide subject-based information for authors and users of Routledge products and are essentially a marketing tool for them. However, many of the Arenas under development will contain links to selected Internet sites. For example, the Routledge Philosophy Arena (http://www.philosophyarena.com/) has been produced in co-operation with the RDN (chiefly the Humbul Humanities Hub) and gives search access to over 350 resource descriptions via RDN-Include (http://www.rdn.ac.uk/rdn-i/).

Some subject gateways themselves contain discreet advertising or notice of commercial sponsors. The RDN hub EEVL, for example, includes some supporters' logos on its home page and records the Web site is sponsored by a specialised software house.

3.2 The business models of existing Renardus services

The following sections will briefly describe the services (Data Providers) that are currently included in the Renardus Service (as of May 2002) and attempt to identity their main funding sources. It is perhaps worth remembering that the sustainability of the Renardus Service is dependent on the continued existence of participant Data Providers. The Renardus Consortium will needs to remain aware of the changing business practices and pressures of its partner services.

3.2.1 Das Deutsche Agrarinformationsnetz (dainet)

The German Agricultural Information Network (dainet) is a searchable catalogue of online information in the subject areas of agriculture, forestry and nutrition (http://www.dainet.de/). It is one of the information services produced by the German Center for Documentation and Information in Agriculture (ZADI), the scientific information institute of the Federal Ministry of Consumer Protection, Food and Agriculture (BMVEL).

3.2.2 DNB-Theses

DNB-Theses is a catalogue of online theses produced by German universities provided by Die Deutsche Bibliothek (DDB) as part of the German national bibliography.

3.2.3 Danmarks Elektroniske Forskningsbibliotek (DEF)

Denmark's Electronic Research Library (DEF) is a project aimed at making the resources in research libraries available electronically to researchers and students (http://www.deff.dk/). The project included the funding of six subject gateways (with more to follow):

- Bizigate (business and economics)
- DetVirtuelle Musikbibliotek (the Online Music Research Library)
- Energygate (energy)
- Food-i (food and nutrition)
- KlinInfo (health and medical sciences)
- TransPortalen (traffic and transportation research)

DEF is a co-operative venture funded by the Danish Ministry of Culture, Ministry of Research and Ministry of Education.

3.2.4 Dutch Electronic Subject Service (DutchESS)

DutchESS (Dutch Electronic Subject Service) is a gateway is for high-quality Internet resources that either relate to the Netherlands or that are of importance to the participating organisations (http://www.konbib.nl/dutchess/). The gateway is a collaborative effort between the Koninklijke Bibliotheek (National Library of the Netherlands) and a number of academic libraries. The gateway originated in 1993 as a gopher-based service and moved to the Web in 1995 as the Nederlandse Basisclassificatie Web (NBW). From 1996-1998, DutchESS received additional support from the funding body Innovatie Wetenschappelijke Informatie (IWI), but the gateway is now co-ordinated by the KB, who provide technical support. DutchESS is described in more detail in Peereboom (2000).

3.2.5 Engineering E-Library Sweden (EELS)

EELS (Engineering Electronic Library Sweden) - this is a gateway for high quality Internet resources in the subject area of engineering (http://eels.lub.lu.se/). It was a co-operative project of the Swedish Universities of Technology Libraries - a consortium of six research libraries.

3.2.6 Finnish Virtual Library (FVL)

The Finnish Virtual Library (FVL) develops gateways for the use of the Finnish academic and higher education community (http://www.jyu.fi/library/virtuaalikirjasto/engvirli.htm). The project, which is partly financed by the Finnish Ministry of Education, was initiated in 1996. The project involves information specialists from a large number of Finnish scientific information services. The FVL Project also co-operates with the Nordic NOVAGate and EELS gateways.

3.2.7 NOVAgate

NOVAGate - a Nordic gateway to selected Internet resources in the fields of forestry, veterinary, agricultural, food and environmental sciences (http://novagate.nova-university.org/). The database is produced and maintained by the libraries of the NOVA University.

3.2.8 Resource Discovery Network (RDN)

The Resource Discovery Network (RDN) is UK-based co-operative network that provides access to high-quality Internet resources selected and catalogued by a number of subject-based gateways organised into faculty-level hubs (http://www.rdn.ac.uk/). The resources can be accessed at several different levels: through individual gateways, through hubs, or through the RDN ResourceFinder cross-search service. RDN is funded by the JISC, while some hubs have additional support from the ESRC and AHRB. Each hub collaborates with a variety of other partners, including university departments, Learning and Teaching Support Network (LTSN) subject centres, professional societies and commercial organisations (e.g., publishers).

Current hubs are:

- BIOME (life sciences and medicine) - hosted by the University of Nottingham (http://biome.ac.uk/). This hub is made up of six services including the OMNI (Organising Medical Networked Information) service, first funded as part of the eLib programme. Other BIOME gateways cover animal health (VetGate), the biological and biomedical sciences (BioResearch), the natural world (Natural Selection), agriculture, food and forestry (AgriFor), and the nursing, midwifery and allied health professions (NMAP).

- EEVL (engineering, computing and mathematics) - hosted by Heriot-Watt University, Edinburgh (http://www.eevl.ac.uk/). EEVL started as the eLib-funded Edinburgh Engineering Virtual Library, led by a team of information specialists from Heriot-Watt University Library (MacLoed, Kerr & Guyon, 1998). Heriot-Watt maintains this original gateway to engineering resources, supplemented with an additional section on aerospace and defence (AERADE). EEVL now includes additional services to cover computing and mathematics.

- Humbul Humanties Hub - hosted by the University of Oxford (http://www.humbul.ac.uk/).

- PSIgate (physical sciences) - hosted by the University of Manchester on behalf of the Consortium of Academic Libraries in Manchester (http://www.psigate.ac.uk/).

- SOSIG (social sciences, business and law) - hosted by the Institute for Learning and Research Technology (ILRT) at the University of Bristol (http://www.sosig.ac.uk/). This includes the Social Science Information Gateway originally funded by the ESRC and (later) by JISC through eLib.

Three new hubs to cover hospitality, leisure, sport and tourism (Altis), geography and the environment (GEsource), and the arts and creative industries (Artifact) are currently (May 2002) under development.

3.2.9 The SSG-FI gateways

SSG-FI (Sondersammelgebiets-Fachinformationsprojekt) are a series of information gateways (or special subject guides) initially funded as a Deutsche Forschungsgemeinschaft (DFG) project, developed and maintained by the Goettingen State and University Library (SUB) in Germany (Fischer & Neuroth, 2000). There are four SSG-FI services that are part of Renardus:

- Anglistik Guide (Anglo-American language and literature) developed and maintained by SUB - part of the Virtual Library of Anglo-American Culture (http://www.anglistikguide.de/)

- Geo-Guide (earth sciences, geography, thematic maps, and mining) developed and maintained by SUB, with the co-operation of the University Library "Georgius Agricola" of the Freiberg University of Mining and Technology (http://www.Geo-Guide.de/).

- History Guide (history with a special focus on Anglo-American history) developed and maintained by SUB - part of the Virtual Library of Anglo-American Culture (http://www.historyguide.de/)

- MathGuide (pure mathematics) developed and maintained by SUB (http://www.MathGuide.de/)

3.3 Analysis

All of the Renardus Data Providers get a significant amount of their funding from public sources. Some have at some time in their life cycle been funded as part of research and development projects. Most are now based on some kind of public investment, either as part of the perceived 'core' role of the host organisation (e.g., dainet, DutchESS, NOVAgate) or funded in part by external agencies (e.g., DEF, FVL, RDN).

Very few gateways rely on any commercial funding, the main exception being the RDN, which has developed fee-based services like RDN-include. Also, some services contain some discreet advertising, e.g. the RDN hub EEVL notes that its Web site is sponsored by a specialised software house.

4. COST ELEMENTS OF THE RENARDUS SERVICE

The Renardus Service is a broker service that gives browse and search access to the resource descriptions created and maintained by Data Providers. The Data Providers are themselves responsible for the databases that they provide and for ensuring their own continued existence. It has been proposed that a Renardus Consortium should be formed to be responsible for the development and maintenance of the broker service itself, for ensuring that the Data Providers meet the specified quality criteria and for collection development. This last may include the inclusion of new Data Providers in the Renardus Service and any technical and other support that this may require. The proposed division of responsibilities between Data Providers and the Renardus Consortium is outlined in more detail in public deliverable D3.4/D8.3 (Peereboom, Day & Huxley, 2002).

A Renardus organisation based on a consortium model has many advantages. Firstly, it continues the collaborative approach of the EU-funded project in which the Renardus Service was first developed. Secondly, it can be easily extended to include new Data Providers, whenever necessary. Thirdly, it provides a clear focus for managed collaboration between subject gateways. Pitschmann (2001, p. 36) has extolled the virtues of such collaboration:

> *Because these projects rely on collaboration among staff at multiple institutions and/or among special project staff, they have accomplished what no individual or single institution working in isolation can achieve: rapid and efficient collection development of nonredundant collections at reasonable cost.*

In order to be properly sustainable, however, Renardus needs to be more than a loose institutional coupling of different initiatives (on the IMesh model). The Renardus Consortium, therefore, will need to be securely based on a formally constituted consortium agreement with additional contracts with Data Providers.

The organisational model defined in deliverable D3.4/D8.3 is based on the existence of a Renardus Core Organisation, consisting of groups for management, service provision and maintenance and PR (Peereboom, Day & Huxley, 2002). The other main units of the model are Data Providers who will be responsible for complying with various technical and organisational requirements, as defined in deliverables D2.2 and D3.3. Meeting the costs of complying with these requirements will be the responsibility of Data Providers themselves and will not form part of the cost elements described here.

The remaining costs are divided between the management, service provision and maintenance and PR groups. The main costs for the Renardus Consortium will be participation in the Management Group and running and developing the Renardus Service itself

4.1 Staff costs

The highest level of expenditure is likely to be for staff costs. In order to provide a *basic* service, it has been estimated that the staffing required for running the pilot (including the integration of a few new services) together with some support for associated systems and tools would total at least 0.5 FTE *per annum*. This would cover both technical support (for server maintenance, the integration of new services and technical support) and general support (to provide support for participating services on mapping data structures to the Renardus data model and classification mapping).

It should be remembered that this figure only relates to running a basic Renardus Service. It does not include the staff costs of the Renardus Management Group (which in the short term could be met by consortium members themselves). It also doesn't include any scope for developing and improving the Renardus Service or for any large-scale integration of new services. It should, therefore, only be seen as a baseline figure.

4.2 Equipment costs

Assuming that some equipment is already in existence, an additional sum per year would be need to be allocated for backup media costs and in the longer-term the cost of a replacement server would need to be also factored in.

4.3 Licence costs

Other costs that need to be considered are the expense of the various licences that Renardus needs to function, chiefly for the use of software (from Index Data and the University of Regensburg) and the DDC (from OCLC Forest Press). The project has already negotiated the use of DDC on a research licence for a short period beyond the end of the project phase of Renardus, but future developments may require negotiation on commercial terms. There may also be legal costs associated with negotiating these licenses on behalf of the Renardus consortium.

4.4 Other costs

Other costs are difficult to quantify. There may be a need for legal advice in drawing up a consortium agreement. Such agreements typically have information on members' rights, obligations and liabilities, on organisation and meeting procedure, etc. The consortium would have to be established under the legal system of one of the EU Member States, and this process could be a lengthy one. Other costs might include travel (e.g., for meetings with potential sponsors) and administration. In the short term, Renardus Consortium participants may be able to help support these costs.

5. POTENTIAL BUSINESS MODELS FOR THE RENARDUS SERVICE

We now have an idea of some of the potential cost elements of the Renardus Service. We will now consider a range of commercial and non-commercial business models that may be used to generate revenue. It is envisaged that there is no one single business model that will fund 100% of the work of the Renardus Consortium, but that different sources of revenue will combine to form what would ultimately become a more sustainable business model.

5.1 A membership-based consortium

Many other organisations in related fields are membership consortia, examples being the CIMI Consortium, the Consortium of University Research Libraries (CURL), the Research Libraries Group, and the TEI Consortium. Adopting this model would need initial support from one or more institutions, or possibly with sponsorship from an external funding body. Eventually, however, the organisation would be able to move to a membership-based model. In return, consortium would need to offer its existing and potential membership tangible benefits or added value. These might include, e.g., a recognisable 'high-quality' gateway branding, software support, some support for the sharing of metadata creation costs, etc. as well as the possibility of increased traffic generated through the Renardus broker service. This model would also require some consideration of finance, i.e. the exact level of funding support that would be required from member services, e.g. for a secretariat or management group. One caveat, it is not clear that the types of organisation that would comprise the membership of such a consortium would be able to afford even a modest membership fee.

5.2 Continued research and development project funding

We have already noted that some kind of public funding financially supports most Renardus Data Providers. One option, therefore, is for Renardus itself to look for some kind of continued public funding. The most likely source of this would be grants for further research and development. This type of funding would not normally pay for the day-to-day running of the Renardus Service, but could be dedicated to the technical development of improvements to the broker or cross-browse interface, or possibly the development of additional services based on the Renardus concept.

5.3 Sponsorship

Another potential business model would be to seek support from a commercial or non-commercial organisation in the form of sponsorship or another type of co-operation. Potential organisations could include content providers or publishers, national and research libraries, etc. Consideration would need to be given to what services could be offered these organisations in return for their sponsorship. Technically, this might mean the development of a service like RDN-Include (http://www.rdn.ac.uk/rdn-i/), whereby a specially configured Renardus search 'box' could be integrated into a sponsor's Web site. Alternatively, it might mean the licensing of

selected content to other content providers, e.g. bibliographic databases or Web indexes. This would need to be done in a way consistent with the intellectual property requirements of Renardus Data Providers.

5.4 Advertising

Advertising is one of the most popular commercial business models on the Internet, one used, for example, to support many Internet search services, e.g. AltaVista, Lycos and Yahoo! However, sites that use the advertising model normally require a very high level of traffic. In addition, some national network acceptable-use policies specifically exclude the adoption of the advertising model. For example, the policy devised by the JISC Committee for Networking expressly forbids the "transmission of unsolicited commercial or advertising material" on JANET (Kelly, 2001, p. 32). Some sites, however, do manage to carry some discreet advertising. For example, the RDN hub EEVL has some supporters' logos on its home page and a note that a specialised software house sponsors the Web-site. The University of London Library Web page (http://www.ull.ac.uk/) has a logo and link to a well-known international bookshop chain. The UK e-journal *Internet Archaeology* (http://intarch.ac.uk/), initially funded as a JISC research project, is soliciting advertisements from "commercial, not-for-profit and academic institutions," assuming that their content is of relevance to readers of the journal (http://intarch.ac.uk/advert/). Outside of the higher education sector, the interface of the British Library Public Catalogue contains the logo of its 'sponsor,' the UK branch of a major Internet bookseller (http://blpc.bl.uk/).

One problem with advertising is its perception. The editor of *Internet Archaeology* has written that there is a perception that "advert-rich sites are associated with free content, free web-hosting, and low quality" (Winters, 2001). With Internet search services like Renardus, it may be considered that advertising could 'contaminate' end-users' faith in the objectivity of the resource descriptions and search ranking algorithms. Advertising would not be an ideal single business model for Renardus, unless it was part of a broader funding strategy.

5.5 Subscription - charging for use of the Renardus Services

A more drastic business model that could potentially be used to support the Renardus Service would be to charge directly for access. This would mean the end of completely free access to the Renardus Service, even if it applied only to some 'value-added' services. This would not normally mean that end-users would be charged per-search or a monthly subscription, but that intermediaries (e.g. higher education libraries, research institutes, etc.) would need to negotiate a licence that would give access to their users. This would require more work on authentication and IP recognition systems, and the development of new 'value-added' services based on the existing Renardus collaboration. At the present time, the Renardus Service is not developed enough to adopt this business model.

6. CONCLUSIONS

Once a successful business model (or range of models) has been chosen, there are a number of issues that should be considered before the development of a formal business plan by the Management Group. Business plans are not just concerned with the financial aspects of an entity, but contain information on organisational structure, marketing plans, the products or services offered and their 'unique selling points,' etc. A formal business plan will need to contain the following:

- *General description*. This would comprise a few paragraphs describing the context and main features of the Renardus Service.
- *Rationale and mission*. This section would contain some paragraphs describing in more detail what the Renardus Service is trying to do and its main target audiences. It would first need to include a justification for quality-controlled subject gateways (including the importance of human intervention in the selection and description of resources) and make some comparisons with general Internet search services like Google. Then, it would need to explain the rationale of the Renardus Service itself; a broker that provides browse and search access to the content of multiple subject gateways. This would need to include some information on how the subject coverage of the Renardus Service will develop in the future.
- *Competitive edges*. This section would outline some of the 'unique selling points' of the Renardus Service. This might include how access to the Renardus Service might complement the existing role of subject gateways, e.g. by offering users of gateways easy access to a larger collection of Internet resources. Other

competitive edges may be inherited from the participating subject gateways themselves, e.g. perceived neutrality in resource selection and description.

- *Business model*. This would explain how independent Data Providers participating in Renardus would give access to the content of their databases and that the Renardus Consortium would only need to be responsible for standardisation and co-ordination, physical hosting of the gateway and marketing activities. It would also suggest how the costs of these might be met, e.g. the sharing of costs between consortium partners, possibly by membership fees from Data Providers, grants or sponsoring partners, etc.
- *Organisational framework*. This section would describe the organisational framework being set up by the project partners, including the Management Group, the setting up of a Renardus Consortium, and the role of Data Providers and development partners. It also would describe the duties of the groups that would need to be set up for Service Provision and Maintenance and PR. It would also outline which organisations are physically running the Renardus Service, which Data Providers are currently involved in Renardus and predictions of future growth.
- *Cost estimates*. This section would contain information on the activities that would need to be funded, e.g. for running a basic service, supporting the integration of existing and new participant services, quality-control, licenses (e.g. for DDC), marketing, etc.
- *Usage expectations*. This would provide some basic Renardus usage statistics together with information from the evaluation process. It would also explain how user growth rates could be extended with the addition of more links to Renardus from participating Data Providers, or through marketing activities.
- *Marketing strategy*. This section would describe the launch of the Renardus Service and note the production of a promotion plan (section 2.4 above). There is some general information on publicity and promotion in the DESIRE information gateways handbook (Belcher and Huxley, 1999) and in an article on EEVL by MacLeod (2000).
- *Estimates of necessary development work*. It is not envisaged that development of the Renardus Service is complete. This section would, therefore, outline and prioritise some ideas for its further development. These might include interaction with harvesting based search tools (e.g. ILRT's Web Search Environments (WSE) initiative), automatic classification, improvements to the user interface, etc.
- *Risks*. This final section would identify the main risks that might endanger the continued exploitation and development of the Renardus Service. These might include new competitors, the non-sustainability of participant Data Providers' business models, or general Internet-based risks like denial of service attacks, hacking, etc.

The Management Group will be responsible for developing a full Business Plan that would be broadly based on this outline. This group will also have the task of keeping it up-to-date and using it as a resource in discussions with potential sponsoring partners and other organisations.

To conclude, a sustainable business model for the Renardus Service is actually likely to be a blend of several different models. Returning to the taxonomy of business models identified by Rappa (2001), one notes what Renardus is currently proposing is close to his 'Community model,' whereby users, (in the Renardus case, Data Providers), "themselves invest in a site, e.g. by the contribution of content, money or time." Additional revenue could then be sought through sponsorship or membership fees, by the provision of services to third parties, or through involvement in more research and development activity.

PART IV - REMAINDER

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8. ABBREVIATIONS AND ACRONYMS USED

AERADE
UK gateway for aerospace and defence resources - part of EEVL engineering

AgriFor
A gateway for agriculture, food and forestry, part of the RDN BIOME hub

AHRB
Arts and Humanities Research Board

Altis
RDN hub for hospitality, leisure, sport and tourism

Artifact
RDN hub for the arts and creative industries

AVEL
Australasian Virtual Engineering Library

BIOME
The RDN hub for the medicine, health and the life sciences

BioResearch
A gateway for the biological and biomedical sciences, part of the RDN BIOME hub

Biz/ed
A Web-based service for business and economics resources hosted by ILRT that includes an Internet resource catalogue. Originally funded as part of JISC's eLib programme, Biz/ed now forms part of the RDN as one component of the SOSIG hub

CIMI Consortium
A consortium of cultural heritage institutions and organisations

CLIR
Council on Library and Information Resources

CORC

Cooperative Online Resource Catalog - an OCLC initiative to build a union catalogue of resource descriptions of Internet resources

CURL
Consortium of University Research Libraries

DDC
Dewey Decimal Classification

DEF
Danmarks Elektroniske Forskningsbibliotek

DESIRE
Development of a European Service for Information on Research and Education - a project funded by the European Union

DFG
Deutsche Forschungsgemeinschaft

DNER
Distributed National Electronic Resource - the JISC's concept of a managed environment for accessing heterogeneous, quality-assured information resources on the Internet

EELS
Engineering Electronic Library Sweden - a gateway for engineering resources provided by a Swedish consortium, the Swedish Universities of Technology Libraries

EEVL
Formerly the Edinburgh Engineering Virtual Library, now the RDN hub for computing, engineering and mathematics

ESRC
Economic and Social Research Council

FTE
Full-time equivalent

FVL
Finnish Virtual Library

Geo-Guide
An SSG-FI subject information guide (gateway) for pure earth sciences, geography, geophysics and thematic maps based at the Goettingen State and University Library

GEsource
RDN hub for geography and the environment

Humbul Humanities Hub
The RDN hub for the arts and humanities

ILRT
Institute for Learning and Research Technology (University of Bristol)

IMesh
International Collaboration on Internet Subject Gateways

IWI
Innovatie Wetenschappelijke Informatie

JANET
Joint Academic Network

JISC
The Joint Information Systems Committee

JSTOR
A digital repository of scholarly journals, originally the Journal Storage project

KB
Koninklijke Bibliotheek

LTSN
Learning and Teaching Support Network

MathGuide
An SSG-FI subject information guide for pure mathematics based at the Goettingen State and University Library

MetaChem
An Australian gateway for chemistry resources

MIT
Massachusetts Institute of Technology

NBW
Nederlandse Basisclassificatie Web

NMAP
A gateway for nursing, midwifery and the allied health professions, part of the RDN BIOME hub

OCLC
Online Computer Library Center, Inc.

OMNI
Organising Medical Networked Information, part of the RDN BIOME hub.

PADI
Preserving Access to Digital Information - a gateway on digital preservation run by the National Library of Australia

PSIgate
Physical Sciences Information Gateway, the RDN hub for the physical sciences

RDN
Resource Discovery Network

RLG
Research Libraries Group

ROADS
Resource Organisation and Discovery in Subject-oriented services - an open-source software toolkit for Internet subject gateways.

SCRAN
Scottish Cultural Resources Access Network

SOSIG
Social Science Information Gateway - the RDN hub for the social sciences, business and law

SSG-FI
Sondersammelgebiets-Fachinformationsprojekt - a project consisting of a series of subject guides (gateways) based at the Goettingen State and University Library

TEI
Text Encoding Initiative

VetGate
A gateway for animal health, part of the RDN BIOME hub

WSE
Web Search Environments