ENTERPRISE ARCHITECTURE FOR THE NATIONAL DIGITAL LIBRARY

V3.0

This specification is part of the Ministry of Education and Culture's National Digital Library project (project number OKM052:00/2011).
CONTENTS

1 INTRODUCTION .............................................................................................................. 4
  1.1 National Digital Library .......................................................................................... 4
  1.2 NDL project management ...................................................................................... 5
  1.3 Agreed architecture model .................................................................................... 7

2 CONCEPTUAL-LEVEL ARCHITECTURE .................................................................. 9
  2.1 Change drivers in the NDL environment ................................................................ 9
  2.2 Architectural principles ........................................................................................ 10
    2.2.1 General principles .......................................................................................... 10
    2.2.2 Functionality-related principles .................................................................... 12
    2.2.3 Data-related principles ................................................................................ 14
    2.2.4 IT system-related principles ......................................................................... 15
    2.2.5 Technology-related principles ....................................................................... 16
    2.2.6 Integration principles .................................................................................... 16
  2.3 Standard portfolio .................................................................................................. 17
  2.4 Stakeholder architectures ...................................................................................... 18
    2.4.1 National policies and legislative perspectives .................................................. 18
    2.4.2 Enterprise architecture work carried out by public administration and the Ministry of Education and Culture ........................................................................................................ 18
    2.4.3 National Architecture for Digital Services ....................................................... 20
    2.4.4 Open Data Programme .................................................................................. 20
    2.4.5 The Open Science and Research Initiative ...................................................... 21
  2.5 Library-level and international projects .................................................................. 21
  2.6 Sectors’ enterprise architectures .......................................................................... 22
    2.6.1 Library sector .................................................................................................. 22
    2.6.2 Archive sector ............................................................................................... 22
    2.6.3 Museum sector .............................................................................................. 23

3 CONCEPTUAL-LEVEL ARCHITECTURE .................................................................. 24
  3.1 Service map .......................................................................................................... 24
    3.1.1 Producing ....................................................................................................... 25
    3.1.2 Administration ................................................................................................ 26
    3.1.3 Use ................................................................................................................ 28
    3.1.4 Preservation ................................................................................................... 29
    3.1.5 External support services .............................................................................. 30
  3.2 Stakeholders .......................................................................................................... 31

4 LOGICAL-LEVEL ARCHITECTURE ....................................................................... 33
  4.1 The impact of strategic policies and principles ....................................................... 33
  4.2 Functional perspective .......................................................................................... 33
    4.2.1 Impact of principles ...................................................................................... 33
    4.2.2 Process map .................................................................................................. 34
    4.2.3 Processes for improving availability ............................................................... 35
    4.2.4 Processes for improving interoperability ....................................................... 36
    4.2.5 Processes for improving digital preservation ................................................ 36
  4.3 Data perspective ..................................................................................................... 37
    4.3.1 Impact of principles ...................................................................................... 37
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.2</td>
<td>Logical data reserves</td>
<td>38</td>
</tr>
<tr>
<td>4.3.3</td>
<td>Name data</td>
<td>40</td>
</tr>
<tr>
<td>4.3.4</td>
<td>Persistent identifiers</td>
<td>41</td>
</tr>
<tr>
<td>4.3.5</td>
<td>National and shared basic data reserves</td>
<td>41</td>
</tr>
<tr>
<td>4.3.6</td>
<td>National metadata service</td>
<td>41</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 National Digital Library

The National Digital Library (NDL) is one of the Ministry of Education and Culture's sector-level content and service packages. It is based around libraries, archives, museums and other organisations that preserve cultural heritage content, as well as the actors responsible for providing their technical solutions. The NDL has many connections to other projects and organisations that store, administer, supply and preserve research datasets.

The NDL project's services enable actors and their stakeholders in the library, archive and museum sectors to efficiently and reliably produce, distribute, utilise and preserve their cultural heritage content in digital format. The specifications produced by the NDL facilitate the introduction of NDL services, the design of ancillary services, and mutual interoperability.

The NDL project's focal areas are:

- maintaining and developing the NDL's Digital Preservation (DP) service and Finna public interface; and identifying developmental requirements for other significant digital services in the library, archive and museum sectors;
- promoting interoperability between IT systems and information architectures in the library, archive and museum sectors by, for example, utilising the National Architecture for Digital Services;
- developing operating models and tools for the creation, administration, utilisation and preservation of digital cultural heritage reserves, and strengthening expertise in this area.

The National Digital Library is implementing items in Juha Sipilä's Government Strategy Programme that concern both improving accessibility to art and culture and investing in the digitisation of public services, which is also one of the Programme's strategic themes. Therefore, this third version of the NDL's enterprise architecture will focus on identifying the impact of the digitisation of society and describing its effects on operating models and mechanisms for processing cultural heritage content. In particular, this will be reflected in the National Architecture for Digital Services becoming one of the key themes in the NDL's enterprise architecture.

The Ministry of Education and Culture's strategic policy involves boosting the development of several research, innovation and creative environments, one of which is the NDL. The NDL will implement national policies for science and culture by improving the accessibility, preservation and interoperability of the digital reserves held by libraries, archives and museums. The NDL will also be a significant enabler in developing a cultural heritage research infrastructure and will thereby promote, for example, the preconditions for online learning environments.

The NDL will implement the objectives set out in the Government Report 'National Digital Agenda for Finland 2011–2020' and the Government Resolution on improving the accessibility and promoting the reuse of digital public-sector information resources. It is thus included as a measure in the Ministry of Education and Culture's future review 'Wellbeing through expertise and creativity'. The National Digital Library's Finna public interface and the digital preservation solution as a whole (the NDL and the National Research Data Initiative/Open Science and Research Initiative's DP) have been chosen as national research architectures in Finland's Roadmap for Research Infrastructures 2014–2020. When defining the NDL

---

1 http://www.lvm.fi/web/fi/julkaisu/-/view/1213693
project’s objectives and focal areas, due attention has been paid to the policies on digital cultural heritage content and research datasets (including any recommended measures that affect Member States) that have been set via the EU’s digital strategy, the European Commission’s proceedings and recommendations, and the conclusions of the Council of the European Union.

This document describes the enterprise architecture for the National Digital Library (NDL) and its impact on the target sector. Specifying the NDL’s enterprise architecture is a long-term descriptive process, and this current version of the document describes the system after the third round of updates. The key objective of enterprise architecture work is to provide sufficient guidance for enabling interoperability between architectures and ensuring the effectiveness of architectural steering. This document is being updated in accordance with the instructions given by the NDL project. Figure 2 presents a system-level overview of the NDL as it appears after the third round of updates.

1.2 NDL project management
The NDL project’s current period runs from 1 May 2014 to 31 December 2016. The project management model consists of named administrative bodies and service solutions (Figure 3).

The National Digital Library project seeks to promote the social impact of cultural heritage and library content in different sectors by developing services and operating models for their creation, management, utilisation and preservation, and by increasing system interoperability and data compatibility.
The NDL’s Finna public interface is under constant development and expansion. It provides easy access to the digital datasets and services of libraries, archives and museums; promotes open access to information; and enables a large number of organisations to dispense with separate user interfaces.

When combined with the National Research Data Initiative/Open Science and Research Initiative’s digital preservation service (ATT-DP), the National Digital Library’s digital preservation service (NDL-DP) forms a sector-level system for digital cultural heritage content and research datasets. The first phase of the NDL’s DP project has resulted in a preservation service for digital cultural heritage content. The second phase is being implemented in 2014–2017 alongside introduction of the service. It will ensure that data remains intelligible and can still be examined by contemporary software in the future.

It is the Ministry of Education and Culture’s responsibility to develop, design and maintain common architectural policies and descriptions relating to the development of core public-sector activities and services in the target sector ‘education, science and culture’. The NDL project will maintain Finna and NDL-DP architectures, and will develop both sector-specific and connective architectural systems for libraries, archives and museums.

The NDL project is being implemented in cooperation with the Open Science and Research Initiative (ATT). In addition to cooperation with the ATT’s DP, the NDL project will promote the collection of, and open access to, datasets for scientific use.

The main administrative body of the NDL is its steering group, whose task is to:

- set policies for the development of the NDL’s DP service; and monitor and identify developmental requirements for the Finna public interface and other significant digital services in the library, archive and museum sectors;
- promote interoperability between IT systems and information architectures in the library, archive and museum sectors;
- develop operating models and tools to improve the creation, administration, utilisation and preservation of digital cultural heritage reserves, and strengthen expertise in this area; and
- identify key developmental trends and drivers in the digital information and service community, and then harness them in the library and cultural heritage sectors.

Figure 2: The NDL project’s administrative model for the period 1 May 2014–31 December 2016
The key themes of the enterprise architecture for the National Digital Library project are:

- maintaining and developing the NDL's DP service and Finna public interface; and identifying developmental requirements for other significant digital services in the library, archive and museum sectors;
- promoting interoperability between IT systems and information architectures in the library, archive and museum sectors by, for example, utilising the National Architecture for Digital Services;
- developing operating models and tools for the creation, administration, utilisation and preservation of digital cultural heritage reserves, and strengthening expertise in this area.

1.3 Agreed architecture model

The NDL project’s enterprise architecture describes how the various elements – organisational units, people, operating processes, information and information systems – relate to each other logically and function as a whole. The enterprise architecture is divided into four levels: principle, conceptual, logical and physical (Figure 3):

- The project’s architectural principles, stakeholder architectures (such as legislation and the standard portfolio), and the limitations and preconditions governing the architecture are described at a principle level. The Kartturi model has been applied, which means that strategic policies have also been described at a principle level for the sake of clarity.
- The project’s stakeholders, concepts and services (such as digital preservation and public interface services and their required support services) are described at a conceptual level.
- The project’s process map, high-level processes, logical data reserves, and integration principles are described at a logical level. The project’s system portfolio is described at a physical level.
- The physical level description combines specifications and design to provide a description of the actual concrete implementation. At this stage, no attempt has been made to describe the implementation of the NDL's enterprise architecture at a physical level – only the system portfolio has been described at a physical level.

This document’s introduction presents an overview of the NDL project and the key changes in this version of the enterprise architecture. The content structure of the document corresponds to the enterprise architecture framework presented in Figure 4, meaning that the key sections of the framework are presented as separate chapters (2-5). This version of the enterprise architecture document seeks to adhere to previous versions in this respect.

In addition to this document and its appendices, the NDL enterprise architecture as a whole also includes input data table templates produced during architectural work and communications materials describing the architecture (targeted at stakeholders).

The enterprise architecture’s key theme is to identify any changes resulting from developments among stakeholders and stakeholder architectures within the NDL’s scope, and include them in the project’s perspectives. When included in the enterprise architecture, these identifiable changes will also be reflected as requirements in the specifications of services requiring interoperability.

Another key theme is the integration model for digital services enabled by the National Architecture for Digital Services. In accordance with the principles of the National Architecture for Digital Services, e-service providers can open up their system interfaces by using user identification and secure data transfers between systems. Most importantly for the NDL, enterprise architecture can also harness software models that enable cost-effective service integration between organisations.
Figure 4 shows the areas to be examined during enterprise architecture work in yellow.

Figure 3: The Kartturi model-compliant framework that steers the specification of enterprise architecture outputs in the NDL project

The description of stakeholders' roles falls outside the scope of this document, whereas limitations and preconditions have been included, as has an analysis of logical IT system services.
2 CONCEPTUAL-LEVEL ARCHITECTURE

The key policies governing architectural work are described at a conceptual level. Conceptual-level architectural policies form a foundation for development and provide detailed steering guidelines. Conceptual-level analyses identify and present the key limitations and principles that have steered architectural design. Conceptual-level architecture seeks to describe the perspectives and policies that will steer architectural work for the NDL and any service packages within its scope.

2.1 Change drivers in the NDL environment

The National Digital Library project is by nature firmly linked to its operating environment. When it comes to keeping up with advancements in memory sectors, the evolution of the NDL should pay attention to developments in its operating environment and the change drivers arising from them. Identifying change drivers relies on forecasting developments in society and analysing their resulting impacts. The NDL programme has identified the following phenomena that impact on the management and utilisation of national cultural heritage content:

<table>
<thead>
<tr>
<th>Trend</th>
<th>Resulting requirements for NDL EA work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic growth is slowing</td>
<td>Limited resources lead to development projects being prioritised, which in turn results in increasing demand for system interoperability and shared services between sectors.</td>
</tr>
<tr>
<td>Changes in work and study</td>
<td>The significance of information retrieval is growing, as is autonomy of place and time. The discoverability and preservation of data are becoming increasingly important social enablers.</td>
</tr>
<tr>
<td>Growing need for openness in society</td>
<td>Openness requires information to be not only accessible but also usable. This is where syntactic and semantic compatibility become vital.</td>
</tr>
<tr>
<td>Digitisation of society</td>
<td>Contents are increasingly being produced in digital format. There is growing demand for digital content to be usable in a variety of contexts.</td>
</tr>
<tr>
<td>User base diversification</td>
<td>Cultural diversity and users' skill levels are increasing, which means that both the way information is used and users' needs are also diversifying.</td>
</tr>
<tr>
<td>Diversification of metadata</td>
<td>Metadata can relate an increasing amount of information. The accessibility, usability and compatibility of administrative and technical metadata is becoming an increasingly important architectural element.</td>
</tr>
</tbody>
</table>
The NDL EA requirements arising from the change drivers listed here have been noted in the analysis of strategic policies relating to NDL work.

### 2.2 Architectural principles

The point of drawing up architectural principles is to help partner organisations achieve a shared understanding of the principles they must adhere to when developing operations and interoperability in areas within the architecture's scope. The guiding principle for all decision-making should be that any deviation from these architectural principles always requires extremely pressing grounds.

The architectural principles of the NDL project have been divided into four categories in accordance with architectural perspectives: common, functionality-related, data-related, and technology-related.

This section will run through the architectural principles identified during enterprise architecture work for the NDL. The principles used in architectural work are by nature long-term and slow to change, and the consequences of any changes are assumed to have an impact on the architecture. EA work for the NDL therefore includes all of the architectural principles identified for the NDL's entire lifecycle. The architectural principles given in this document therefore come from three sources:

- Earlier versions of the architectural principles for the NDL EA
- The general architectural principles of the Ministry of Education and Culture (hereinafter MinEdu)
- Principles newly identified during the NDL project's current period

A few stylistic changes have been made to principles inherited from earlier versions of the NDL EA, but this has not altered their meaning or steering impact.

#### 2.2.1 General principles

<table>
<thead>
<tr>
<th>Principle 1</th>
<th>General principles are joint agreements to which organisations within the NDL's scope must commit with regard to their operations within the NDL's scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanation</td>
<td>As a Ministry of Culture and Education project, the NDL must comply with the architectural principles of the Public Administration Enterprise Architecture. When applying these principles, it should be noted that the NDL's enterprise architecture and its principles also cover any organisation's processes, systems and interfaces that are connected to the NDL.</td>
</tr>
<tr>
<td>Grounds</td>
<td>Compliance with general principles ensures the implementation of two of the NDL's objectives – interoperability and semantic commensurability between different architectures.</td>
</tr>
<tr>
<td>Impact</td>
<td>Public-sector architectural principles must also be considered within any organisations participating in the project, including their back-end systems. The NDL also plays an important role as an architecture builder in the MinEdu's target sector.</td>
</tr>
<tr>
<td>Source</td>
<td>NDL project objectives.</td>
</tr>
</tbody>
</table>
### Principle 2  Commonly agreed standards are used in NDL activities

**Explanation**
Using common standards supports the production of high-quality, reliable and standardised data and metadata. The NDL EA Standard Portfolio describes the common standards and definitions used. Semantic commensurability must be as extensive as possible. The metadata describing certain data types should be as compatible as possible, irrespective of the sector. System integration will rely on a restricted number of technologies.

**Grounds**
Compliance with the standard portfolio enables the provision of consistent services and standardised data, and allows metadata to be developed into shared, open and linked data. Compliance with the standard portfolio supports the standardisation of the NDL-related working methods and processes used by partner organisations, particularly within sectors. Common working methods can be created from nationally and internationally recognised best practices.

**Impact**
Partner organisations must pay attention to the standard portfolio when working on NDL-related systems. The architecture administration model takes maintenance of the standard portfolio into account. Partner organisations must have the opportunity to influence its content.

**Source**
NDL project objectives.

### Principle 3  Management and quality work is linked to the enterprise architecture in order to form a coherent entity for steering operations

**Explanation**
Architectural work is closely linked to other management and quality work. The enterprise architecture also provides a framework for management. Strategic and operative management requirements are considered during architectural work and any related policies.

**Grounds**
The enterprise architecture cannot be a disconnected process, as this would prevent the controlled development of shared services and the utilisation of shared data. It would also be impossible to ensure proper support functions for the solutions under development.

**Impact**
Enterprise architecture supports knowledge management and is utilised in decision making.

**Source**
MinEdu's EA principles.
### Principle 4  Openness during development

**Explanation**
Development work within the target sector is based on openness and wide-scale involvement and commitment. The formation of developer communities and their work is supported. Openness enables the dissemination of solutions and prevents supplier dependence.

**Grounds**
The target sector has an extremely wide spectrum of actors. Development therefore requires methods that deviate from standard management practices.

**Impact**
Associations and the private sector can also be involved in development alongside public-sector actors.

**Source**
MinEdu's EA principles.

---

### 2.2.2 Functionality-related principles

#### Principle 5  Architecture must be both operation- and user-oriented

**Explanation**
Architecture must pay attention to the needs of different user and stakeholder groups in various sub-sectors, and must present models that can be used to implement them cost-effectively and to a high standard.

**Grounds**
Services, operating processes and the data they use can be approached from many different perspectives and requirements. The architecture focuses on the needs of users and those operating in the public interface, and considers the data requirements of design, monitoring and management.

**Impact**
The architecture is practical and pays attention to requirements relating to different services and data.

**Source**
MinEdu's EA principles.

---

#### Principle 6  The NDL's design and service implementation is user-oriented

**Explanation**
NDL services seek to meet users' needs and provide a pleasant user experience. The goal is a system in which users will be able to utilise content openly and interactively in the way best suited to their intended purpose, leaving administrative intricacies in the background.

**Grounds**
The implementation of high-quality, user-friendly services requires due attention to users' needs from the very outset of the design process.

**Impact**
Communications should be proactive and promote transparency. Service use is monitored, and users' requirements and wishes are analysed with the aid of statistics, surveys, etc. This information is used in the design and development of services.

**Source**
NDL project objectives.
<table>
<thead>
<tr>
<th>Principle 7</th>
<th>The NDL's services are common services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanation</strong></td>
<td>All of the sector's common services are provided via the NDL. All sectors must have a need for the service. Cooperation will begin at the design phase. Services required by a single sector or organisation will not implemented using shared resources, but the services will be provided via the NDL.</td>
</tr>
<tr>
<td><strong>Grounds</strong></td>
<td>Common services prevent overlapping functionality and reduce workloads, which leads to greater cost-effectiveness and higher quality. The joint design and implementation of services also helps to standardise working methods.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>Actors’ roles and responsibilities must be jointly defined in the NDL. End users, that is citizens, are provided with access to high-quality data and metadata, and sectors are provided with an infrastructure in which other services can be implemented. The NDL’s technology and expertise are reusable.</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>NDL project objectives.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Principle 8</th>
<th>The NDL guarantees the digital preservation and usability of digital content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanation</strong></td>
<td>The digital preservation and usability of digital content must be ensured. Contents are stored in order to be used, which requires them to remain intelligible. Preservation pays attention to every stage in the data’s lifecycle.</td>
</tr>
<tr>
<td><strong>Grounds</strong></td>
<td>The digital content belonging to partner organisations must be made available to future generations. Preservation will be systematically implemented and will pay particular attention to retaining intelligibility. There is as yet no long-term solution for the preservation of digital content. An operating model, technical specifications and systems for this must be created. A shared solution could achieve considerable volume, which will guarantee the efficiency of centralisation.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>The DP service must be implemented to ensure the preservation of digital cultural heritage content. Preserving the intelligibility of these contents requires the semantic commensurability of metadata.</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>NDL project objectives.</td>
</tr>
</tbody>
</table>
2.2.3 Data-related principles

<table>
<thead>
<tr>
<th>Principle 9</th>
<th>Promoting data access and usability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanation</strong></td>
<td>Above all, implementing this principle requires the semantic commensurability of metadata. This facilitates the retrieval, use and digital preservation of data. The goal is to establish common rules for cataloguing and generating data type-specific, semantically standardised metadata.</td>
</tr>
<tr>
<td><strong>Grounds</strong></td>
<td>The digital preservation of digital content requires commensurable administrative metadata. Efficient information retrieval via the public interface is only possible if the semantic commensurability of metadata is guaranteed. When both technical challenges and copyright issues have been resolved, users will be able to utilise content openly and interactively in the way best suited to their intended purpose, leaving administrative intricacies in the background.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>The semantic commensurability of metadata is a key objective of national-level information architecture.</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>NDL project objectives.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Principle 10</th>
<th>Promoting the use and usability of content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanation</strong></td>
<td>The information produced by organisations in the target sector must be made available for others to use in their own operations and services. Overlapping data collection and production must be avoided. The semantic commensurability of data will be ensured with the aid of information architecture, and access management must be lightweight. Procedures for expanding the official use of restricted data will be developed. Those responsible for data reserves must provide users with established licensing and permit practices for using the information. The use of public data will be promoted via a policy of open, free-of-charge access.</td>
</tr>
<tr>
<td><strong>Grounds</strong></td>
<td>This principle involves the collection and storage of primary-source data that supplies citizens, companies, organisations, authorities, research and education with information within a framework of rules governing access. Public data will be provided for use in the production of new services and content.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>The utilisation of collected data in various processes will reduce the costs incurred by users and other actors, and also improve the quality and up-to-dateness of the data. Open public data offers opportunities for developing commercial and other services outside the target sector.</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>MinEdu's EA principles.</td>
</tr>
<tr>
<td>Principle 11</td>
<td>Data is described according to a set of common rules</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td><strong>Explanation</strong></td>
<td>Common rules for describing data will be drawn up for information architectures in the target sector and its sub-sectors. Target-sector actors will comply with these rules in data transfers between systems. These descriptions will adhere to, for example, international and EU standards and regulations, the NDL's Standard Portfolio, and public administration regulations (such as Public Administration Recommendation JHS 181), and sector-specific guidelines and rules. Data descriptions will also include classifications, so that public data can be separated out from datasets containing restricted data.</td>
</tr>
<tr>
<td><strong>Grounds</strong></td>
<td>The description of data and the commensurability of metadata is an important prerequisite for the creation of user-friendly services and enables a high standard of digital preservation.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>Standardised descriptions enable the versatile use of data and reduce the danger of misinterpretation. They will facilitate service development and enable data to be more easily and reliably combined from various sources.</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>MinEdu's EA principles.</td>
</tr>
</tbody>
</table>

### 2.2.4 IT system-related principles

<table>
<thead>
<tr>
<th>Principle 12</th>
<th>Requirements for national coverage in the target sector will be specified, shared IT systems will be built under the lead of those responsible for sub-sector architecture, and ready-to-use components and services will be made available to basic units.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanation</strong></td>
<td>Common IT systems are needed in areas where national coverage is required for planning and management data, and for services provided to citizens. Basic-level actors in the target area are provided with specifications, ready-to-use components, system solutions and services that they can use in their own operations. Common systems and components are implemented by, for example, the MinEdu/CSC, National Board of Education, National Archives, National Board of Antiquities, and National Library.</td>
</tr>
<tr>
<td><strong>Grounds</strong></td>
<td>The target area contains a very broad spectrum of basic actors with varying information management needs. Providing components and services to basic-level actors increases data standardisation, which in turn facilitates the development of national services and data support for planning and management. Cooperation with companies that provide off-the-shelf software and services for the target sector also affects the level of data standardisation.</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>Influencing the specifications for services and off-the-shelf software helps to make information available for use both in nationwide services and for planning, steering and management.</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>MinEdu's EA principles.</td>
</tr>
</tbody>
</table>
Principle 13  Common IT systems and services comply with service-oriented architecture

| Explanation | Common IT systems and services are designed and implemented in accordance with service-oriented architecture (SOA). This enables a certain IT system or connected service to be used in many processes and services, and also by many users. |
| Grounds | Service-oriented architecture enables extensive reuse of systems and components within the target sector, reduces costs, and accelerates the development of new services. |
| Impact | Well-documented service descriptions and open interfaces and operating models will enable the NDL's services to be used extensively throughout the target sector. This sets expectations for the precision of the EA description's logical configuration. |
| Source | MinEdu's EA principles. |

2.2.5 Technology-related principles

Principle 14  Inter-system operation will rely on a restricted number of technologies.

| Explanation | The idea is to limit technological solutions to a few alternatives per sub-sector, whilst allowing for the special requirements of the various sub-sectors. The technology architecture is aiming for a limited number of different open and well-documented interfaces between IT systems. Recommended technological solutions will be maintained as part of the architecture's essential standard portfolio. Solutions based on open source software will be favoured when selecting technologies. |
| Grounds | Open interfaces facilitate the integration of systems and data transfer. Development based on open source code enables the affordable distribution of solutions to the target sector's heterogeneous actor base. |
| Impact | It will be easy to organise the exchange and shared use of information. EA specifications seek to identify the requirements for different interfaces and candidates for their implementation. |
| Source | MinEdu's EA principles. |

2.2.6 Integration principles

The integration requirements between the NDL's service solutions and organisations' back-end systems are a major aspect of the NDL's enterprise architecture. As a whole, the NDL system must also be integrable into centralised government and public administration services.

The NDL system will harness existing and forthcoming shared public-sector services as extensively as possible. Particular examples of such services that have been identified in this architecture are: ontology services, authentication and online payment services, data exchange layer, reachability information, geographical information services, and availability information.
In the NDL, integration will mainly be steered by the project's Standard Portfolio, which collates the standards used in both the NDL's DP service and public interface. Standardisation seeks to ensure the overall functionality of the NDL system, which requires, for example, the semantic commensurability of metadata recorded by various organisations. Standardisation also seeks to guarantee that services can be transferred to new device and software environments with minimal inconvenience. The standards have been divided into recommendations and mandatory specifications that must be complied with, for example, when upgrading IT systems.

When it comes to digital preservation, the NDL project will produce and maintain specifications that will concretise the selections made in the standard portfolio and define how the selected standards must be applied. These specifications seek to enable data commensurability and interoperability at the level required by digital preservation. The specifications in the enterprise architecture will be paralleled in the standard portfolio. At the moment, these specifications are:

- The NDL's metadata requirements and preparing content for digital preservation
- File formats

Requirements for technical and descriptive metadata are also being defined.

The sector-independent Data Exchange Layer provided by the Government ICT Centre (Valtori) will be harnessed as extensively as possible in the NDL system. In particular, this data exchange layer will be used when utilising recognised basic data reserves in the public sector.

Due attention to regulations, guidelines, recommendations and other policies relating to information security will be paid throughout the NDL system as a whole.

2.3 Standard portfolio

The NDL Standard Portfolio\(^2\) contains the standards used in the NDL's DP service and public interface. The portfolio is a key element of the enterprise architecture work being carried out in the National Digital Library project. The NDL Standard Portfolio is a sector-specific portfolio that adheres to the Government Standard Portfolio contained in the Ministry of Finance's enterprise architecture. This portfolio is governed by Public Administration Recommendation JHS 181, which was approved on 28 October 2011.

The standards mentioned in the portfolio steer all libraries, archives and museums involved in the NDL project, as well as other organisations that will become future users of the project's services. These standards are divided into recommendations and mandatory specifications that must be complied with, for example, when upgrading IT systems (training in the adoption of these standards will also be provided in this case). The NDL project's steering group is responsible for maintaining the portfolio.

The NDL project will produce and maintain specifications that will concretise the selections made in the standard portfolio and define how the selected standards must be applied. These specifications seek to enable data commensurability and interoperability at the level required by digital preservation. The specifications in the enterprise architecture will be paralleled in the standard portfolio.

---

2.4 Stakeholder architectures

Stakeholder architectures contain extensive descriptions of the architecture and the specifications that must be taken into account within it. These may be, for example, legislation, recommendations, guidelines, technical specification or even implementation specifications.

During the design of the National Digital Library, several stakeholder architectures have been identified and considered: enterprise architecture work in the administrative sectors of the Ministry of Finance and the Ministry of Education and Culture, the Government and Public Administration Enterprise Architectures, national and EU policies, legislative perspectives, Public Administration Recommendations, the NDL’s Standard Portfolio, and sector-specific enterprise architectures.

2.4.1 National policies and legislative perspectives

The NDL project complies with national policies and adheres to their key strategies and programmes. The NDL’s enterprise architecture work forms part of this standardisation, and it complies with the EA obligations laid down for public administration.

The National Digital Library is part of a developmental entity that comprises national digital infrastructures and user-oriented electronic service concepts. The project will improve the cross-sector compatibility of IT systems and services in line with national policies, and also increase the competence of actors.

Cultural and scientific policy strategies for the National Digital Library seek to promote network availability and create high-quality digital information resources for culture and science. They also seek to strengthen e-learning environments and research infrastructures.

One of the recognised priority projects in Juha Sipilä’s Government Strategic Programme and Implementation Action Plan is the digitisation of public services. The NDL project adheres to the policies identified in the Government Programme and is therefore in line with government strategy. The NDL project’s relationship to the architectural approach offered by the National Architecture for Digital Services and its compliant infrastructure is a key factor in the integration of the NDL into other digitised public-sector architectures.

Sector-specific legislation defines the obligations relating to cultural content and documents and the compilation, administration, continued availability and preservation of museum collections. Public-sector legal provisions for e-services and their administration impact the NDL’s enterprise architecture at all levels.

Enterprise architecture work has paid due attention to organisations within the Ministry of Education and Culture’s administrative sector, and also to legislation and copyright regulations relating to education, science, culture and libraries.

2.4.2 Enterprise architecture work carried out by public administration and the Ministry of Education and Culture

The Information Management Act requires public administration to design and describe its enterprise architecture in order to enable and ensure interoperability between IT services. This design and description must also comply with the Public Administration Enterprise Architecture. According to the Information Management Act, it is the task of each ministry to steer the development of information management and information management projects within its own administrative sector, and to create and maintain enterprise architectures.

The Ministry of Finance steers the development of information management in both government and municipal administration. The Ministry of Education and Culture is working towards sector-level
interoperability in a number of projects, including the NDL. Within the Ministry of Education and Culture, responsibility for steering and support is held by the unit steering each target sector. The Ministry’s task is to tie high-level public administration and government policies together, engage in enterprise architecture work in target sectors, and organise uninterrupted EA maintenance and specification activities.

The Ministry of Finance leads efforts to identify and specify the Public Administration Enterprise Architecture and the Government Enterprise Architecture. Each ministry represents its sector in enterprise architecture work at government or public administration level.

The Public Administration Enterprise Architecture is used to coordinate and develop interoperability between public administration organisations. The shared enterprise architecture for public administration consists of a common EA for public administration organisations plus shared EAs for target sectors.

The Government Enterprise Architecture is used to steer and support the development of government activities and IT systems in administrative sectors and agencies. The Government Enterprise Architecture consists of a shared government EA plus EAs for target sectors. The target sectors are largely the same as those in the Public Administration Enterprise Architecture. The National Digital Library falls within the Public Administration Enterprise Architecture's (JHKA) target sector 'Education, Science and Culture'.

Enterprise architecture work in the target sector adheres to the Public Administration Enterprise Architecture's policies and specifications. The Public Administration Enterprise Architecture is managed hierarchically – the higher organisational structure steers the lower structure, and lower structures generate change requirements and suggestions for higher structures. The Ministry of Education and Culture appoints an architecture steering group for the target sector and decides who will steer architectural work in its sub-sectors. Along with other large-scale development projects, the National Digital Library plays a key role in determining architectures in the target sector's sub-sectors.

---

3 http://www.vm.fi/vm/fi/04_julkaisut_ja_asiakirjat/03_muut_asiakirjat/20110407Luonno/03_JHKA_Yleiskuvaus_20110404.pdf
2.4.3 National Architecture for Digital Services

The National Architecture for Digital Services (KaPa) is one of Finland's key ongoing national projects seeking to improve e-services for the general public. The KaPa programme's main objective is to enable functional coordination and more efficient shared use of inter-organisational functions. From the NDL's perspective, the KaPa will be highly significant for services requiring user identification. The project should therefore identify which NDL services and functionalities requiring identification can be efficiently provided to different organisations as centralised functions, thereby achieving interoperability and cost savings.

The National Architecture for Digital Services' objective is to define and create a national infrastructure for extensive, interoperable digital services. Most importantly, this infrastructure will facilitate secure, easy and efficient data transfer between both public- and private-sector organisations and services.

The KaPa programme is creating the National Data Exchange Layer; the shared service views required by citizens, companies and authorities; a new national electronic identification solution; and national solutions to manage the roles and authorisations of organisations and natural persons.

From the NDL's perspective, the National Architecture for Digital Services will play a significant role as an enabler in inter-system integration and messaging services based on reliable identification. From the perspective of systems falling within the NDL's scope, the National Architecture for Digital Services and its National Data Exchange Layer security servers will provide a standardised, easy-to-use and cost-effective integration model for different systems. It should be noted that the KaPa architecture is relevant to cases in which system integration requires user identification. The long-term goal is for all key national registers and IT systems to be integrated into the National Architecture for Digital Services' National Data Exchange Layer.

2.4.4 Open Data Programme

The Open Data Programme, which sought to promote open data and its utilisation, was launched by the Ministry of Finance and ended in June 2015. The Open Data Programme sought to accelerate the opening up of data reserves with free-of-charge access to data in machine-readable format and open access rights for companies, citizens and society as a whole by the end of the decade. Its objective was to pave the way for new business and innovation, strengthen democracy and civic society, boost administrative efficiency, and make a more varied range of datasets available to education and research.

After the end of the programme, the promotion of open data will become a permanent aspect of administrative activities. The opening up of public data reserves is increasingly focusing on boosting data utilisation and strengthening data expertise as part of the digitisation of administration.

The programme has created practices and structures to standardise and support the systematic opening up of data reserves. The Open Data Programme also helped to put the EU PSI (Public Sector Information) Directive's objectives for the reuse of public data reserves into practice.

An open data and interoperability service – opendata.fi – seeks to provide centralised information about newly opened data reserves, interoperability specifications and guidelines. The service currently holds information about over 1,500 open datasets.

From the NDL's perspective, the Open Data Programme's main benefit is open access to data and information, and establishing the opening up of data as standard practice in public administration. One of the NDL project's key concepts is to open up data as extensively as possible and for as wide a range of purposes as possible within a framework of access rights. In principle, the NDL will then be implementing the principles and objectives defined by the Open Data Programme.
2.4.5  The Open Science and Research Initiative

The Open Science and Research Initiative (2014–2017) is a Ministry of Education and Culture project that promotes open science and open access to data. Its goal is for Finland to become one of the leading countries for open science and research by 2017, and for the opportunities afforded by open science to be extensively harnessed in society. The project also promotes reliability in science and research, supports the internalisation of new, open working methods within the researcher community, and seeks to increase the social impact of science and research. The Open Science and Research Initiative is based on extensive cooperation between ministries, institutions of higher education, research institutes, and research financiers.

Enterprise architecture work for its projects has been carried out in accordance with standardised working models. The projects intersect at many points: the Open Science and Research Initiative also focuses on data management, discoverability, access, re-use and digital preservation. The projects have identified shared operating models and opportunities at a conceptual level. For many of these, achieving synergy benefits in IT systems and operating models still requires joint decisions and development work. The projects are already engaging in close cooperation on digital preservation and the harnessing of shared solutions. There is good reason to continue the parallel development of enterprise architectures.

2.5  EU-level and international projects

The National Digital Library project complies with EU-level policies and adheres to key strategies and programmes. One objective for the sectors falling within the NDL's scope is to enable the discoverability, usability and accessibility of data and its associated metadata both nationally and internationally. Due to the nature of the sectors within the NDL's scope, the NDL will have interfaces to international services. The key international services that have been identified are Europeana, Orcid and ISNI. A brief description of them can be read in the following subsections.

The measures being implemented in the National Digital Library project fulfil the objectives mutually agreed upon among European Union Member States with regard to the digitisation of cultural and scientific content, digital availability and digital preservation, both nationally and at EU level. The National Digital Library is implementing these goals by strengthening national coordination and synergy between actors; by increasing the accessibility of library, archive and museum content and their searchability on information networks, and sending them to Europeana; and by improving the basic preconditions for both the digitisation of content and the accessibility and digital preservation of digital content.

Europeana is a cultural project funded by the European Commission and EU Member States. It seeks to provide a mechanism for discovering, accessing, using and distributing European cultural content in digital format. The Europeana service provides access to content in the museum, library and archive sectors, as well as a variety of audiovisual collections. Its key objective is to enable access to digital content for as extensive a user base as possible and through as many digital channels as possible. Europeana is the NDL's main international partner organisation and supplying Europeana with data is the NDL's main international focal area.

Over 50 million different objects are available via Europeana: digital images, texts, sound recordings, videos, and 3D objects. The European-wide Europeana service is connected to about 2,300 different memory-sector actors who publish their datasets for public use with the aid of metadata. About 900,000 different objects from Finland are available via Europeana.
2.6 Sectors' enterprise architectures

The National Digital Library's task is to promote interoperability between key IT systems and information architectures in the library, archive and museum sectors. The Ministry of Education and Culture will therefore use the NDL project in the management and steering of architectures in the library, archive and museum sectors within its target sector.

The aim is to organise enterprise architecture work in each sector in a manner appropriate to that sector. Enterprise architecture work in the archive sector is being coordinated by the archive sector's NDL cooperation team, which is chaired by a representative of the responsible organisation (the National Archives). Architecture in the museum sector has been managed and developed under the guidance of the National Board of Antiquities as part of the Museum 2015 project and, in 2016, will be managed as part of the National Board of Antiquities' activities as a national developer in the cultural heritage and museum sector. Architecture work in the library sector is being launched in public library sub-sectors, led by the Ministry of Education and Culture, the National Library, and the Central Library for Public Libraries. Established teams specialising in the development of specifications are working in these sectors, and their work will play a significant role in the creation of both common and sector-specific information architectures.

2.6.1 Library sector

Enterprise architecture work in the library sector has been launched via the National Library's enterprise architecture work. The National Library's enterprise architecture describes the National Library's services, many of which are national services, such as:

- IT system platform services (Finna, Finto, Library System and Doria)
- metadata services (Melinda, Finto)
- services provided in accordance with the Act on Collecting and Preserving Cultural Content (Finnish National Biographies, free copy services, national collections)
- digitisation and preservation services
- other expert services (FinELib, Statistics and impact services)

The National Library and Helsinki City Library (which acts as Finland's Central Library for Public Libraries) are coordinating national development work in the library sector. The NDL acts as a reference architecture for libraries. In practice, Finna and Finna-based e-libraries play a major role in steering the architecture of public libraries. The National Architecture for Digital Services is also a stakeholder architecture for libraries.

2.6.2 Archive sector

The main objective of architecture work is to improve both interoperability in the archive sector and preconditions for harnessing the NDL's services. Progress towards this goal will be achieved by drawing up both functional and structural architecture descriptions for the current and target states, and by adapting the NDL's common architecture specifications for use within the sector. This work is being steered by the enterprise architecture group in the agreed manner, that is, so that the archive sector’s target architecture supports both the focal areas of the NDL project's action plan for 2014–2016 and the NDL enterprise architecture team’s tasks.

The first version of the reference architecture for data management in the archive sector was published in 2014, and it gives a comprehensive representation of archives' data management structures. Its task is to act as a framework that describes and defines practical operating models for archives, and also to steer their implementation. The reference architecture contains interoperability requirements for common
services, data content, software, and technology. The reference architecture's primary purpose is to create an overview of all operations and data reserves in the archive sector, and to provide a detailed examination of critical sub-areas with regard to the functionality of common services.

A revision of the reference architecture was begun in 2015 with the aim of updating stakeholders, stakeholder services, and structures relating to data and its management and use. Key issues include interfaces and operating methods in relation to external search and data portals, such as Finna and Europeana, and interoperability with the NDL's DP service. These updates are progressing in collaboration with the NDL's architecture revisions to ensure interoperability.

During 2016, architecture work in the archive sector will examine common practices in the use of the sector’s standards, such as the transmission of data descriptions (EAD, Encoded Archival Description) and the common digital preservation structure (METS, Metadata Encoding and Transmission Standard). This work will be carried out in 2016 so as to support the specification of impact objectives for the state aid system for private archives.

### 2.6.3 Museum sector

One of the main objectives of the ongoing Museum 2015 project is to draw up an enterprise architecture covering collection management throughout the entire museum sector. The enterprise architecture description drawn up in the Museum 2015 project is firmly linked to the National Digital Library's enterprise architecture, and the Public Administration, Municipal and Government Enterprise Architectures. The project’s enterprise architecture work was carried out by the enterprise architecture working group and resulted in the publication of the Enterprise Architecture for Museum Collection Management Version 1.0 at the beginning of 2013.

In late 2014, the Museum 2015 project relaunched the enterprise architecture working group for museums with the aim of updating and expanding the Enterprise Architecture for Museum Collection Management Version 1.0 into the Enterprise Architecture for Museums. Although the current perspective has been widened in comparison to the earlier publication, it still focuses on collection management. This expansion was carried out by the enterprise architecture working group for museums during 2015. The Enterprise Architecture for Museums will be published in 2016.

---

3 CONCEPTUAL-LEVEL ARCHITECTURE

Conceptual-level architecture descriptions configure which solutions will be implemented, which data they will handle, and which IT system and technology services will be required. They define the key issues in different perspectives that will be specified at a logical and physical level. These descriptions do not really express an opinion on implementation methods.

3.1 Service map

One of the main outputs of the NDL's enterprise architecture is the service map and its configuration of service groups. The service map is used to show the service groups included in the NDL enterprise architecture and enable services to be tied to processes within the logical configuration.

In the NDL enterprise architecture, service concepts are extensively interpreted. A service could be a traditional IT service, an advisory or support service dependant on human resources, or a technical description or specification arising from the NDL that steers partner organisations. In the service map, system-identified services (Finna, DP, Formula) are not classified as services.

The NDL service map is divided into service groups. This configuration seeks to clarify the service system as a whole and help the reader understand the architecture's coverage throughout the lifecycles of different cultural heritage content.

- **Producing**: services that are required to produce, collect, collate and prepare the data that must fed into the NDL. Sector organisations within the NDL's scope are themselves responsible for collating and preparing this data.
- **Administration**: services that are required to enable the production, use and digital preservation of the NDL. These services are by nature core functions of the NDL.
- **Use**: services that facilitate the provision of NDL data to users.
- **Preservation**: services that are required to guarantee the digital preservation of digital content.
- **External support services**: services that are used to enable the services provided by the NDL yet are provided 'as such'.

The service map for the National Digital Library is shown in the diagram below.
3.1.1 Producing

The Producing service group’s key task is to support partner organisations’ voluntary data preparation and metadata generation, so that the NDL’s use and preservation services can receive data. The main objective for services in this group is to ensure data interoperability from the perspectives of both usability and preservation.

The NDL’s enterprise architecture does not describe this service group at more detailed architectural levels, as the responsibility for providing data to the NDL is held by organisations using the NDL’s use and preservation services. However, producing services can be outlined at a general level in two categories:

- **Data composing and preparing services**: A service package that enables partner organisations to enter both data and its associated metadata into common structures that are harnessed in the use and preservation of data.
- **The producing and collecting of digital content**: A service package that helps partner organisations to receive data from primary producers. It supports the storage and maintenance of descriptive, administrative and technical metadata.

Order services in back-end organisations, such as receiving orders for data processing, are included under the collection of digital content.

The more detailed architectural descriptions specified in the Management, Use and Preservation service groups will have an impact on services in the Producing group.
3.1.2 Administration

The Administration service group includes those services that enable and facilitate the use or introduction of the NDL's use and preservation services. The services described in the Administration service group's sphere of influence form the NDL enterprise architecture's core functionality.

Administration consists of three areas as follows:

- Services and specifications for developing content interoperability (standard portfolio)
- Services for promoting content use
- Services for preparing content for digital preservation

3.1.2.1 Data interoperability development services and specifications

Interoperability between different datasets and the extensive usability resulting from this is one of the NDL's key objectives. In this context, data interoperability should be understood in a broad sense: it means not only data usability through different service channels, but also the usability of metadata and the usability of tools and services for processing data in a variety of contexts.

The NDL's common specifications contain specifications and associated services that will be used in both the NDL's public interface and DP service. Common specifications seek to ensure that data and data collections within the NDL’s scope are accessible and available between different utilisation models. Common specifications are not necessarily services in the traditional IT sense, but they can be seen as service elements that improve interoperability and promote other services.

On a practical level, there are two main approaches to improving interoperability: firstly by defining and introducing shared guidelines, operating models and working methods for everyone; and secondly by using common software tools and solutions.

This service group can be considered to include the following services:

- **Name Authority Service**: A service that contains controlled name formats ('name authorities') for persons and organisations. When connected to the public interface or another system, it enables data to be discovered even though the name used in the search differs from that contained in the data. The target state is a common name authority service covering all three sectors. The cross-border exchange of authority data will be enabled by basing the service on common public administration models (the Glossary Group's proposal is based on the EU Core Person specification). Policies concerning the production and exchange of name data are being monitored as part of the preliminary analysis for a shared metadata service for public administration.

- **Standardised descriptive metadata**: The standards for the descriptive metadata recommended for different types of data have been agreed on in the standard portfolio. Metadata that is significant from the perspective of semantic commensurability is presented in accordance with cataloguing rules. The standard portfolio recommends the application of Resource Description and Access (RDA) rules.

- **Competence development**: Multi-organisational competence development covers training in digitisation and the management, preservation and distribution of digital content; the general development of training; and the introduction and internalisation of recommended working methods within organisations. Compliance with standards, quality metadata, and shared practices

---

promote interoperability in data management. In addition to training, competence development also includes other means of making existing data management and distribution more effective, such as the maintenance of network resources and cooperation with international development projects and networks.

- **Standard portfolio**: The standard portfolio's key task is to provide and steer partner organisations' own architecture work by aiming for interoperability through specifications and technology choices.

### 3.1.2.2 Services for promoting content use and their associated support services

From the perspective of data within the scope of the NDL, it is important that the data is used and utilised not only extensively but also in – what would be for the NDL – unanticipated ways. It would then be necessary for the NDL's solutions to provide services that can promote the use of data that has been harvested or preserved for the long-term.

Such services include:

- **Advisory and support services**: It is the responsibility of advisory and support services to further develop the public interface and investigate new opportunities for it. Services collate and process customer feedback to support the planning of further developments. Advisory and support services include usage statistics and reporting. At the very least, these statistics cover search use, sessions, simultaneous users, links to other systems, and the use of other user functions. Consulting services are provided to support partner organisations in their own further development and adaptation, and to facilitate service integration.

- **Integration services and models**: The key content of this service package enables a variety of system integrations that can be defined and implemented using the abovementioned approaches.

### 3.1.2.3 Services for preparing content for digital preservation

Preparation for digital preservation denotes the tasks that are required before data can be entered into the NDL's DP service. This group includes the following service package:

- **Specifications for digital preservation**: The NDL's DP service receives data for preservation in a format agreed on with partner organisations. Requirements for these contents are described in the specifications for digital preservation and cover requirements for both the data and its associated metadata. The specifications for digital preservation are noted in the NDL's Standard Portfolio and their maintenance pays due attention to advancements in data interoperability.

- **Advisory and support services**: The NDL's DP service contains many complimentary advisory and support services that can be adapted to different situations and organisations of different sizes. Providing advisory and support services, drawing up and maintaining guidelines, and arranging training are primarily the responsibility of the NDL's DP service. However, agreements can be made to transfer the responsibility for certain services, guidance and training (and in particular sector-specific training) to the organisations using these services. User organisations are also responsible for their own personnel's competence in using the aforementioned services.
3.1.3 Use
The Use service group’s main task is to ensure that data within the NDL’s scope is cost-effectively accessible to users, user organisations and others in accordance with the usage and access rights governing the data. Use covers the following services:

- Search services
- Ordering services
- Open data services

3.1.3.1 Search services
Search services enable NDL data to be searched using a time-and-location-independent service. Search services are divided into common searches and searches that are specific to certain organisations or groups of organisations. Search services and their implementation and management are implemented as part of the Finna service. Search services are described in more detail in the description of Finna’s enterprise architecture.

As a result of the Finna service, the access mechanisms for libraries', archives' and museums' data reserves have been combined across organisational borders into a national front-end system for data and services. The long-term goal is for the Finna service to be actively used as a source for creative activities, education and research, and to support general access to information.

The key principle of the public interface defined in the NDL project is to avoid the duplication of digital content in different databases. This is avoided with the effective use of the metadata associated with digital content.

Key, priority data (from the perspective of libraries, archives and museums) will be digitised. Originally digital and digitised datasets will be made searchable and usable via the public interface provided by the Finna system. Partner organisations will manage their own content in their back-end systems, from which metadata will be harvested into the public interface. User searches will be directed to the public interface's indexed aggregated database of metadata and, when necessary, the digital object will be obtained from the back-end system and made available to the user. Via the NDL’s public interface, metadata is also made available for searches through Europeana (Europe’s Digital Library).

Finna’s public interface is under continual development and expansion. This service package makes the digital content and services provided by libraries, archives and museums easily and cost-effectively available to stakeholders; promotes open access to data; and will enable a large number of organisations to dispense with their separate user interface solutions.

3.1.3.2 Ordering services
Ordering services cover those services that enable the provision of services for available data. These include services relating to ordering data, managing access rights, and monitoring orders. Ordering services are described in more detail in the descriptions of Finna’s enterprise architecture.

3.1.3.3 Open data services
Open data means the unprocessed data accumulated by public administration, organisations, companies or private persons – or information processed on the basis of this data – and which has been made openly available on the public internet free of charge and without discrimination against any user or stakeholder.
group. The key services with regard to open data are the metadata associated with open data and the management of call level interfaces for open data.

This service group includes the provision and management of the call level interfaces required to open up NDL data in a way that ensures its cost-effective maintenance. This service type is by nature not only software-based (when viewed as call level interfaces) but also a software service (interfaces are maintained in accordance with users’ requirements and wishes).

Formula, which is administered by the National Library, is a service that provides Europeana with data from Finnish archives, libraries and museums.

The organisation that holds the data is responsible for converting the metadata into the format required by Europeana, while the National Library will enter the data into Formula from where it can be harvested into Europeana. Only metadata and previews are transferred to Europeana. Digital objects remain in the organisation’s back-end systems and are linked to Europeana.

Organisations that use the National Library and Formula have signed the Formula agreement in which they have agreed upon the distribution of work between the National Library and its partner organisations, and also on the use of metadata in Europeana in accordance with the Data Exchange Agreement (DEA) signed by the National Library and Europeana.

Europeana publishes the portal’s metadata as free data. This means that any user whatsoever may use the metadata supplied to Europeana in all possible ways, including commercially, in accordance with the terms and conditions of the CC0 1.0 Universal Public Domain Dedication.

Formula is one of the services being implemented in the Use service group.

### 3.1.4 Preservation

The key task of the Preservation service group is to enable the digital preservation of digital content. This service group can be divided into two:

- **Digital preservation services**: The basic task of the NDL's DP service is to reliably preserve data in digital format. The service handles both the technical preservation of the data and measures required to retain its usability. The NDL's DP service will ensure the reliability, intelligibility and immutability of the data.

- **Data packaging services**: A service that can be used to produce data transfer packages for the NDL's DP service and which is provided as part of the NDL's DP service.

The NDL has been focusing on the digital preservation of digital content from the early stages of the project. This work has resulted in the creation of the NDL's centralised and shared DP service. The most important digital or digitised cultural heritage content will be transferred into this service, which will preserve the data in a usable and intelligible format for future generations. Common infrastructure and services reduce costs, increase system integration, strengthen cooperation, and bring the practices of museums, libraries and archives closer together.

In the service map for the NDL's enterprise architecture, the services provided by organisations that use the NDL's DP service are located in the Administration and Preservation service groups in particular.

When combined with the digital preservation service being developed by the Open Science and Research Initiative (ATT-DP), the National Digital Library's Digital Preservation service (NDL-DP service) forms a sector-level system for the preservation of digital cultural heritage content and research datasets. The first stage of the NDL's DP project resulted in a preservation service for digital cultural heritage content.
This DP service implements the Preservation service group and a more detailed description is available in the descriptions of its architecture.

### 3.1.5 External support services

External support services are by nature services that are provided to the NDL from outside its defined sphere of influence and, for this reason, are used to support the NDL's services as such and require no alterations from the NDL's perspective. Some examples of these services are:

- **Integration services**: The main role played by integration services within the scope of the NDL is to provide a guided and well-defined model for using integration services provided by external actors in conjunction with the NDL's services. Public administration has many integration mechanisms, of which the National Architecture for Digital Services (KaPa) and the Data Exchange Layer (VIA) are the most significant from the NDL's perspective. The National Architecture for Digital Services (KaPa) provides messaging services based on trusted and recognised identities between Finna IT systems. By using the Data Exchange Layer (VIA) provided by Valtori, organisations that use NDL services can transfer data as messages between their own systems and the IT systems connected to the data exchange layer. An organisation using the data exchange layer will gain access to a controlled environment capable of processing and sending messages rapidly and reliably between IT systems.

- **Identification and authentication services**: The use of e-services requires reliable and unambiguous identification mechanisms. The National Architecture for Digital Services (KaPa) will provide cost-effective and standard-compliant mechanisms for identifying network service users.

- **VETUMA, the national online authentication and payment service**, is common to the entire public sector and enables online authentication and payment in all connected user services. The service also supports user identification with user IDs and passwords, and enables identification with online banking codes. For public-sector services, the goal is to replace VETUMA identification with the identification services to be implemented in the KaPa programme.

- **Customership management services**: Customership management seeks to provide a connection for partner organisations and the management of their associated NDL-based customer relations. HALTI is a tool managing customer relationships for public interface content and partner organisations.

- **Reachability services**: Reachability information is an up-to-date service for the management of reachability information that is suited to the NDL organisation’s purposes. JULHA is Finland's most comprehensive and up-to-date digital contact directory for the public sector. In addition to service addresses and contact information for organisations, it contains contact information for civil servants.

- **Geographical information services**: The geographical information service is provided by the National Land Survey of Finland and is intended for the submission, processing, editing or hardcopying of geographical information. ‘Geographical information service’ refers to a service application, available via the information network, through which user applications will be able to utilise a particular geographical information resource. Such a resource may, for example, be geographical information content or a particular process relating to the processing of geographical information. A party utilising this service may, for example, be an application programme supporting the end user, or another service.

- **Ontology services**: Finto is a joint project of the National Library of Finland, Ministry of Education and Culture, and Ministry of Finance. Finto is an ontology service that enables users to publish and
browse Finnish glossaries and ontologies. It also provides interfaces for utilising glossaries and ontologies in other applications.

3.2 Stakeholders

The NDL's stakeholders are shown below by service group, divided into service users and enablers.

Stakeholders have been divided up by service group and role, as per the diagram. Any elaborations on roles are mentioned in brackets in the diagrams. The term 'enabler' denotes a producer or administrator of services in the service group, whilst the term 'user' refers to those who use the said services. 'Partner organisations' mean libraries, archives and museums (always on a general level) that are able to utilise the administration and preservation service groups.

The actors who produce NDL data are the parties whose data – either produced or administered – is accessible through the public interface and is to be preserved in the digital preservation system. For data producers, the NDL offers visibility, users, advanced services, and reliable digital preservation. These actors own their data.

For actors that are provided with hosted data, the NDL offers an up-to-date public interface for data retrieval and access to the digital data and services of libraries, archives and museums. These actors either
use data as such or process it for their own purposes in accordance with any restrictions imposed by their access rights.
4 LOGICAL-LEVEL ARCHITECTURE

Principles describing various dependencies and reciprocities in the target state are described at a logical level on the basis of the principle-level and conceptual-level descriptions. This description seeks to create an entity whose principles, services, stakeholders and processes can be used to form a sufficient logical configuration that can be utilised in system design.

In the NDL enterprise architecture, the logical data reserves, integration principles and key processes of the DP service and the public interface (at operating model-level) are described at a logical level. This current version of the NDL's enterprise architecture also presents the NDL's logical configuration.

4.1 The impact of strategic policies and principles
Key strategic policies can still steer architecture at a logical level as per the following summary:

- Logical architecture must enable cost-effective data access and use.
- The NDL's architecture model must enable data use independently of time and location.
- Data discoverability must support efficient metadata management.
- NDL service architectures must enable data use for purposes that generate added financial value, such as systems containing learning materials.
- Architectures within the NDL's scope must adhere to jointly agreed standards, recommendations and practices.
- Architectures within the NDL's scope must support many data distribution channels.
- If required, it must be possible to adapt the provision of data within the NDL's scope to changes in the user base's habits.

One impact on the NDL's enterprise architecture that has arisen from key strategic policies and changes in the environment involves boosting interoperability in the architecture's required services by switching from a sector-specific approach to a model weighted towards joint use.

The idea is to make sector-specific logical entities available to users in more than one sector. From the NDL's perspective, this primarily means centralising shared functions and ensuring their availability. The principle behind a model weighted towards shared use is to place shared functionalities within integration architecture that is accessible to the various sectors. From a technical architecture perspective, the key factor is the development of semantic commensurability and interoperability. Semantically interoperable data can also be harnessed by enabling secure data transfer in the National Data Exchange Layer. The transition to interoperability and joint use will require long-term architectural steering.

4.2 Functional perspective
At a logical level, the functional perspective primarily covers the identification and description of the architecture's key processes.

4.2.1 Impact of principles
In accordance with the NDL's strategic policies, architecture is used to provide common services. In addition to common services, each sector provides sector-specific, architecture-compliant services that are not required by other sectors. This approach prioritises the need for interoperability between sectors. The following policies govern the provision of services that comply with architectural principles:

- The NDL guarantees the digital preservation and usability of digital content
The NDL's services are common services
- A user-oriented approach is being taken to the design and implementation of NDL services.

### 4.2.2 Process map

The NDL's core processes are:
- Improving accessibility
- Improving interoperability and
- Improving preservation.

The main function of this enterprise architecture occurs in these processes. Specifications, standards and Common Services support all of the NDL's core processes.

From the NDL's perspective, the process objective is to provide digital cultural heritage content in a manner and format that enables digital data reserves for culture and science to be efficiently and effectively harnessed over the long term. This requires a focus on the management, distribution and digital preservation of data. The result will support the objectives described by the NDL's identified policies and strategic assumptions.

![Figure 7: The NDL process map](image-url)
Figure 8 Process map in detail

The following sections show the key processes for availability, interoperability and digital preservation.

4.2.3 Processes for improving availability
The stages in the core process for improving availability are shown below.
This core process consists of eight sub-processes as follows:

- Conceptualisation, preparation, and description the for service integration
- Affiliate to the public interface
- Importing metadata into the public interface
- Deployment of the national public interface and potentially a customised user interface
- Opening the imported metadata in the public interface
- Information search
- Opening data, further exploitation, refining (e.g., Europeana)
- Further development of the public interface

### 4.2.4 Processes for improving interoperability

The process for improving interoperability is shown below.

This core process consists of five sub-processes:

- Producing common specifications
- Common mechanisms for producing metadata
- Harmonising of descriptive means across sectors
- Producing common services (such as Standard Portfolio and Finto)
- Common principles for producing digital content.

### 4.2.5 Processes for improving digital preservation

The core process for improving digital preservation is shown in the following diagram.
This core process consists of eight sub-processes:

- Content preparation
- Ingest
- Data management
- Archival storage
- Access
- Preservation planning
- Administration
- Enabling digital availability of content

Each sub-process is described below, along with its stakeholders and the named responsible organisation.

### 4.3 Data perspective

#### 4.3.1 Impact of principles

Using common standards supports the production of high-quality, reliable and standardised data and metadata. The NDL EA Standard Portfolio describes the common standards and definitions used.

**Promoting data access and usability:** Above all, implementing this principle requires the semantic commensurability of metadata. This facilitates the retrieval, use and digital preservation of data. The goal is to establish common rules for cataloguing and generating data type-specific, semantically standardised metadata. Common rules for describing data will be drawn up for information architectures in the target sector and its sub-sectors. Target-sector actors will use these rules for data transfers between systems. These descriptions will comply with international and EU standards and regulations, the NDL’s Standard Portfolio, public administration regulations, and sector-specific guidelines and rules.

**The semantic commensurability of metadata** is a key objective of national-level information architecture. The description of data and the commensurability of metadata is an important prerequisite for the creation of user-friendly services and enables a high standard of digital preservation. Efficient information retrieval via the public interface is only possible if the semantic commensurability of metadata is guaranteed.
4.3.2 Logical data reserves

The description of logical data reserves collates the key data collections in different sectors (from the NDL’s perspective). The NDL project seeks to improve and promote the interoperability and semantic commensurability of these identified logical data reserves. Identifying these shared entities will enable the specification of detailed, concrete requirements for interoperability and development. This will also help partner organisations to identify developmental requirements in their own operations. The key logical data reserves are:

- Datasets
- Descriptive metadata
- Administrative and technical metadata
- Data reserves relating to customers or end users
- Data reserves relating to user rights
- Data reserves containing service requests

The following table collates the logical data reserves with the data and metadata services provided within the NDL framework. The rows depict the key logical data reserves and the columns the services. This table can be used to picture which reserve results from which function, and which function is used in conjunction with it. They have mainly been divided according to source and purpose.

<table>
<thead>
<tr>
<th>ACTIONS / DATA RESERVES</th>
<th>Search services</th>
<th>Ordering services</th>
<th>Open data services</th>
<th>Digital preservation services</th>
<th>Content composition and publishing services</th>
<th>Producing and collecting digital content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>RU</td>
<td>R</td>
<td>CU</td>
</tr>
<tr>
<td>Descriptive metadata</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>CU</td>
</tr>
<tr>
<td>Administrative metadata</td>
<td>R</td>
<td>R</td>
<td>CR</td>
<td>R</td>
<td>CU</td>
<td>CL</td>
</tr>
<tr>
<td>Technical metadata</td>
<td>R</td>
<td>R</td>
<td>CR</td>
<td>R</td>
<td>CU</td>
<td>CL</td>
</tr>
<tr>
<td>Clients and users</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access rights</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>CRUD</td>
<td>CRUD</td>
<td></td>
</tr>
<tr>
<td>Service requests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 12: Logical data reserves, and data and metadata services provided within the NDL framework

4.3.2.1 Datasets

Due to the NDL’s complexity, there are a broad spectrum of data reserves containing datasets administered by libraries, archives and museums and provided in a variety of formats. The NDL’s main objective is to promote the use, usability and preservation of data.
Actors obtain data either via submission or acquisition, and it is this data that is the actual object of use and preservation. Data can be found in a variety of formats and can be grouped into collections. Data format options include:

- Sound
- Image
- Moving image
- Text
- Website (this can include the aforementioned formats), and
- Research data

Two main versions of data can be stored:

- original: the data has been received or acquired by the organisation in its original form
- user copy: the data may have been produced from the original, put on display, or be available for use.

4.3.2.2 Descriptive metadata

Descriptive metadata supplement data and form an essential part of the logical entity that partner organisations usually process in their own systems. Semantic commensurability and the most extensive interoperability for this entity will promote the NDL's objectives. This objective must be promoted with interoperable concept models and the use of sector-specific practices to supplement shared practices.

'Descriptive metadata' are an entity consisting of all the metadata required to discover, identify, select, access and understand the data. They also include important characteristics of the data or a description of its intellectual content and context for use in information retrieval and data identification.

Descriptive metadata are used in conjunction with their data. Descriptive metadata will be supplied to external services so that data in the NDL's scope can be used more extensively. Data descriptions will also include classifications, so that public data can be separated out from datasets containing restricted data. The transfer of descriptive metadata must comply with the standards specified in the standard portfolio.

4.3.2.3 Administrative and technical metadata

In addition to metadata describing the content of the data, administrative and technical metadata are also required for data management. Data reserves for administrative metadata cover

- metadata that is used to manage and preserve digital content
- conditions and restrictions on data use arising either from copyright, the Act on the Openness of Government Activities, the Personal Data Act, or other comparable legislation that restricts the distribution of data
- a description of who holds or owns the data and rights to the data
- legislative and contractual restrictions that affect the use and accessibility of data.

In addition, data reserves for technical metadata contain

- metadata describing features associated with preserving the usability of data
- metadata that relate to the digital preservation of digital content and describe the structure of the content and the relationships between files
- metadata describing the data's internal storage structure
- metadata relating to technical identifiers.
Only one format of technical metadata can be used for each data type. The following formats are therefore recommended for technical metadata:

- Images: MIX (NISO Metadata for images in XML Schema)
- Text: textMD (Technical metadata for Text)
- Audio: AudioMD (Technical metadata for Audio)
- Video: VideoMD (Technical metadata for Video)

The following formats must be used with digital preservation metadata

- PREMIS (Data dictionary for preservation metadata), version 2.1 or later.

4.3.2.4 Customers and end users

These data reserves are used to store information about NDL end users. This information is required to provide services and maintain contact with users. It is necessary to register and identify NDL service users. This information is primarily managed in back-end systems.

4.3.2.5 Access rights

Access to some data types is restricted and can only be granted to users with justified grounds for access. Access rights relate to specific data and are granted to an identified user or user group. Access rights are therefore a way of uniquely identifying and defining the relationship between user and data.

4.3.2.6 Service requests

Service requests are, for example, orders for data or requests for clarification that customers have made for a specific dataset or service. Service requests are generated in IT systems and are used to manage the services provided to users.

4.3.3 Name data

Common name data refers to the common actor ontology (person, organisation, gender) used in cultural heritage sectors and by public administration organisations. It contains the actor’s controlled name formats (‘name authorities’) and other metadata describing the actor entity, including relationships between actors on a variety of bases. A name data service can be used to identify the same actor in different IT systems, even though the name data describing the actor may vary from one system to another. The name data service supports the standardisation of metadata describing actors, and thereby fundamentally improves the quality, usability and accessibility of this metadata.

Name data content production is used not only by data reserves in the library, archive and museum sectors, but also by basic registers in public administration and name data reserves for international actors, such as the ISNI. The ISNI (International Standard Name Identifier) is an ISO-ratified standard that defines international naming and identification models for natural persons, legal persons, and fictitious actors. From the NDL’s perspective, the ISNI’s central value is that it provides a comprehensive, global mechanism for identifying actors. In practice, this means that every actor that connects to the NDL can be identified using an ISNI-defined naming system.

---

In the preliminary analysis for a shared metadata service for public administration, the name data service was also defined as an actor ontology.
In research, it is essential that research, research data, plans, results and outputs can be linked to the researcher who carried out the work. Orcid is a researcher register based on open collaboration. It can be used to link research and research outputs to the appropriate researcher. As it is an international project, Orcid provides extensive coverage of international research and actors in the research field.

From the NDL’s perspective, the main benefit of the Orcid project is that it provides an opportunity to link data supplied via the NDL’s Finna service to international research and researchers. The Orcid system can be used to monitor the use and utilisation of NDL-sector data in international research.

4.3.4 Persistent identifiers

All of the content providers in the NDL project are given a unique and persistent functional identifier for digital content. The primary IDs used are URNs, which can be based on traditional publication identifiers, such as the ISBNs used for books. Persistent identifiers are stored in HTTP URI format, so that they can be used as a permanent URL for the resource.

The standards to be used in defining persistent identifiers are specified in the standard portfolio.

4.3.5 National and shared basic data reserves

Basic data reserves are some of the most important data reserves for society. The data they contain is usually administered by municipalities or government authorities, but it can also be administered by, for example, research institutes or pension institutions. The following four registers, which contain many sub-registers, are usually classified as basic data reserves:

- Population Information System (VTJ)
- Land Information System (KTJ)
- Building Information System (RTJ)
- Business Information System (YTJ)

The use of public-sector basic data reserves is based on a national objective that seeks to create and establish a standardised model for using data reserves with regard to both operating principles and harnessing technology. The shared solution model seeks to create a standardised model for using data reserves, when different data reserve service providers begin building their service interfaces in a standardised manner.

4.3.6 National metadata service

Efficient interoperability requires the guaranteed exchange of information between systems and therefore also organisations. Interoperability between some organisations involves establishing, internalising and using shared working methods when this is a functionally and financially viable solution.

The main objective of the metadata service is to enable semantic interoperability between systems and organisations. The long-term goal is to connect existing public services, which are currently highly varied, to form a logical entity to serve the public sector. Achieving this requires the creation of a common system and coordinated project structure throughout all administrative sectors.

The metadata service can be used by government and municipal IT system providers, developers and designers – as well as the IT systems themselves – to access shared glossaries, name data, metadata specifications, code sets, classifications, and identifiers. These are primarily based on international and general standards.
Metadata and study descriptions can be extensively interpreted via the metadata service. 'Metadata' refers to the key specifications and descriptions of data and content that are being developed in the public sector. The metadata service consists of coordinated and managed metadata and its supporting solutions, which promote semantic commensurability and data compatibility between IT systems.