

Network Working Group  
Internet Draft  
Intended status: Informational  
Expires: November 2023

Joachim Wackerow  
DDI Alliance  
May 14, 2023

**A Uniform Resource Name (URN) Namespace for the  
Data Documentation Initiative (DDI)  
draft-urn-ddi-05.txt**

Abstract

This document describes the Namespace Identifier (NID) "ddi" for Uniform Resource Names (URNs) used to identify resources that conform to the standards published by the Data Documentation Initiative (DDI) Alliance (<https://ddialliance.org/>).

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#). Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This document is published for informational purposes. It is an independent submission. It is not an Internet Standard and does not have rough consensus of the IETF community.

This Internet-Draft will expire in November 2023.

Wackerow

Expires November 14, 2023

[Page 1]

## Copyright Notice

Copyright (c) 2023 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document.

Code Components extracted from this document must include Simplified BSD License text as described in [Section 4.e](#) of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Wackerow

Expires November 14, 2023

[Page 2]

## Table of Contents

<a href="#">1.</a>	<a href="#">Introduction.....</a>	<a href="#">3</a>
<a href="#">2.</a>	<a href="#">Conventions used in this document.....</a>	<a href="#">4</a>
<a href="#">3.</a>	<a href="#">Specification.....</a>	<a href="#">5</a>
<a href="#">3.1.</a>	<a href="#">Declaration of Syntactic Structure.....</a>	<a href="#">5</a>
<a href="#">3.1.1.</a>	<a href="#">Description.....</a>	<a href="#">5</a>
<a href="#">3.1.2.</a>	<a href="#">ABNF Grammar.....</a>	<a href="#">6</a>
<a href="#">3.1.3.</a>	<a href="#">Regular Expression.....</a>	<a href="#">8</a>
<a href="#">3.1.4.</a>	<a href="#">Examples of DDI URNs.....</a>	<a href="#">9</a>
<a href="#">3.2.</a>	<a href="#">Relevant Ancillary Documentation.....</a>	<a href="#">9</a>
<a href="#">3.3.</a>	<a href="#">Identifier Uniqueness Considerations.....</a>	<a href="#">10</a>
<a href="#">3.4.</a>	<a href="#">Identifier Persistence Considerations.....</a>	<a href="#">10</a>
<a href="#">3.5.</a>	<a href="#">Process of Identifier Assignment.....</a>	<a href="#">10</a>
<a href="#">3.6.</a>	<a href="#">Process for Identifier Resolution.....</a>	<a href="#">10</a>
<a href="#">3.7.</a>	<a href="#">Rules for Lexical Equivalence.....</a>	<a href="#">11</a>
<a href="#">3.8.</a>	<a href="#">Conformance with URN Syntax.....</a>	<a href="#">12</a>
<a href="#">3.9.</a>	<a href="#">Validation Mechanism.....</a>	<a href="#">12</a>
<a href="#">3.10.</a>	<a href="#">Scope.....</a>	<a href="#">12</a>
<a href="#">4.</a>	<a href="#">Namespace Considerations.....</a>	<a href="#">12</a>
<a href="#">4.1.</a>	<a href="#">URN Assignment Procedures.....</a>	<a href="#">12</a>
<a href="#">4.2.</a>	<a href="#">URN Resolution/Delegation.....</a>	<a href="#">12</a>
<a href="#">4.3.</a>	<a href="#">Type of Resources to be Identified.....</a>	<a href="#">12</a>
<a href="#">4.4.</a>	<a href="#">Type of Services.....</a>	<a href="#">12</a>
<a href="#">5.</a>	<a href="#">Community Considerations.....</a>	<a href="#">13</a>
<a href="#">5.1.</a>	<a href="#">Open Assignment and Use of Identifiers.....</a>	<a href="#">13</a>
<a href="#">5.2.</a>	<a href="#">Open Operation of Resolution Servers.....</a>	<a href="#">13</a>
<a href="#">5.3.</a>	<a href="#">Creation of Software for Service Discovery.....</a>	<a href="#">13</a>
<a href="#">6.</a>	<a href="#">IANA Considerations.....</a>	<a href="#">14</a>
<a href="#">7.</a>	<a href="#">Security Considerations.....</a>	<a href="#">14</a>
<a href="#">8.</a>	<a href="#">References.....</a>	<a href="#">14</a>
<a href="#">8.1.</a>	<a href="#">Normative References.....</a>	<a href="#">14</a>
<a href="#">8.2.</a>	<a href="#">Informative References.....</a>	<a href="#">16</a>
<a href="#">9.</a>	<a href="#">Acknowledgments.....</a>	<a href="#">19</a>
<a href="#">Appendix A.</a>	<a href="#">Example DNS Records.....</a>	<a href="#">20</a>
<a href="#">A.1.</a>	<a href="#">Delegation of the URN Namespace "ddi".....</a>	<a href="#">20</a>
<a href="#">A.2.</a>	<a href="#">Delegation of DDI Agencies.....</a>	<a href="#">20</a>
<a href="#">A.3.</a>	<a href="#">DDI Services.....</a>	<a href="#">20</a>
<a href="#">Appendix B.</a>	<a href="#">Algorithm for DDI Service Discovery.....</a>	<a href="#">22</a>

**1. Introduction**

This document registers a formal namespace identifier (NID) for Uniform Resource Names [[RFC8141](#)] associated with DDI resources in accordance with the process defined in [[RFC8141](#)].

The DDI Alliance is an international collaboration dedicated to establishing metadata standards and semantic products for

describing social science data, data covering human activity, and other data based on observational methods. DDI specifications are free standards that can document and manage different stages in

the research data lifecycle, such as conceptualization, collection, processing, distribution, discovery, and archiving. Documenting data with DDI facilitates understanding, interpretation, and use -- by people, software systems, and computer networks.

The specifications DDI Codebook [[DDIC](#)] and DDI Lifecycle [[DDIL](#)] are expressed in XML Schema, DDI XKOS - Extended Knowledge Organization System [[DDIXKOS](#)] in OWL/RDF, SDTL - Structured Data Transformation Language [[SDTL](#)] in JSON Schema, and the upcoming DDI - Cross Domain Integration (DDI-CDI) in UML. DDI is aligned with other metadata standards like Dublin Core Metadata Initiative [[DUBLINC](#)], Statistical Data and Metadata Exchange [[SDMX](#)] for exchanging aggregate data, ISO/IEC 11179 [[IS11179](#)] for building metadata registries such as question, variable, and concept banks, and ISO 19115 [[IS19115](#)] for supporting geographic information systems.

DDI URNs support reusability of DDI resources inside a single DDI instance and in a distributed network of DDI instances.

The DDI specification is developed and maintained by the DDI Alliance [[DDIALL](#)]. The DDI Alliance is a self-sustaining membership organization whose over 40 member institutions have a voice in the development of the DDI specifications. This memo describing the ddi URN is an informational specification. It is not a standard and is not the product of the IETF.

## **2. Conventions used in this document**

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying [RFC 2119](#) significance.

"DDI": Data Documentation Initiative. The single term is often used as a synonym for the DDI specification.

"DDI agency": An organization which maintains DDI resources.

"DDI Alliance": Alliance for the Data Documentation Initiative (DDI).

Wackerow

Expires November 14, 2023

[Page 4]



### **3. Specification**

This section provides the information required to register a formal namespace according to the registration procedure defined in [\[RFC8141\]](#). The URNs conform to the syntax defined in [\[RFC8141\]](#).

#### **3.1. Declaration of Syntactic Structure**

##### **3.1.1. Description**

The Namespace Specific String (NSS) of all URNs using the "ddi" NID is a globally unique identifier consisting of the DDI agency identifier (registration authority identifier), the identifier of the DDI resource (data identifier), and the version of the resource (version identifier) [\[DDIID\]](#). This structure is according to the International Registration Data Identifier (IRDI) defined in ISO/IEC 11179 Information technology - Metadata registries (MDR) - Part 6: Registration, Annex A [\[IS11179\]](#).

A description of the DDI resource identification is available in the DDI Lifecycle (3.3) Technical Guide, section Identification [\[DDIID\]](#).

The DDI NSS has the following structure:

```
<agency-identifier>:<resource-identifier>:<version-identifier>
```

agency-identifier is the identifier of a DDI agency that maintains DDI resources. This identifier basically follows the rules of reversed domain names and is case-insensitive. This way, the DNS resolution of DDI agency identifiers is supported. The hierarchy of domains descends from the left to the right label in the name; each label to the right specifies a subdivision, or subdomain of the domain to the left. The left-most label of agency-identifier conveys the top-level domain. It SHALL be a country code corresponding to ISO 3166 alpha-2 codes [\[IS03166\]](#) or another top-level domain maintained by IANA [\[TLD\]](#). All two-letter top-level domains are reserved for current and future ISO 3166 codes. Assignment of identifiers for DDI agencies in the requested namespace is managed by the DDI Alliance (see [section 3.8](#). on "Process of Identifier Assignment"). The next subdomain identifies the agency within that top-level domain. Further optional subdomains can follow. The top-level domain and possible subdomains are separated by the full stop character. The full stop character is not allowed within top-level domain names or subdomain names. The top-level domain and subdomains are composed from the limited set of characters for the preferred form of a DNS label ([\[RFC1035\] section 2.3.1](#)). The length of the label and the full name are restricted by DNS rules ([\[RFC2181\] section 11](#)). The

agency identifier is case insensitive ([\[RFC4343\] section 2](#)).

Wackerow

Expires November 14, 2023

[Page 5]

resource-identifier is the identifier of a DDI resource of a DDI agency. The value MUST be unique in the scope of this DDI agency. The resource identifier is case sensitive.

version-identifier is the version of a DDI resource of a DDI agency. The value MUST be unique in the scope of this resource. The resource version is case sensitive.

### **3.1.2. ABNF Grammar**

The following syntax specification for the complete URN uses the augmented Backus-Naur Form (ABNF) as described in [[RFC5234](#)].



## ABNF Grammar

```

; Rules are case-sensitive, if not stated otherwise.
ddi-urn          = urn separator ddi separator ddi-irdi
; urn is case-insensitive, see [RFC8141].
urn              = "urn"
; ddi is the URN namespace identifier.
; ddi is case-insensitive, see [RFC8141] section 2.1.
ddi              = "ddi"
; ddi-irdi is the namespace specific string (NSS).
; ddi-irdi - international registration data identifier,
; see [IS11179] Annex A.2.
ddi-irdi         = agency-identifier separator
                  resource-identifier separator
                  version-identifier
; agency-identifier is case-insensitive. See [RFC4343] section
2.
; For allowed characters see [RFC1035] section 2.3.1.
; For length restrictions see [RFC2181] section 11.
agency-identifier = top-level-domain
                  sub-separator ddi-authority-id
                  *(sub-separator ddi-sub-authority-id)
                  ; length limit is 255 characters
                  ; see section 11 of [RFC2181]
top-level-domain  = dns-label
ddi-authority-id  = dns-label
ddi-sub-authority-id = dns-label
dns-label         = (ALPHA / DIGIT)
                  [ *(ALPHA / DIGIT / "-")
                    (ALPHA / DIGIT) ]
                  ; length limit is 63 characters
                  ; see section 11 of [RFC2181]
resource-identifier = restricted-string
                  *("/"restricted-string)
version-identifier = restricted-string
                  *("/" restricted-string)
restricted-string  = 1*(unreserved / sub-delims / "@")
; Definitions for unreserved and sub-delims from [RFC3986] 2.2.
unreserved         = ALPHA / DIGIT / "-" / "." / "_" / "~"
sub-delims         = "!" / "$" / "&" / "'" / "(" / ")" /
                  "*" / "+" / "," / ";" / "="
separator          = ":"
sub-separator      = "."
; ALPHA and DIGIT are actually defined in the ABNF
specification.
; They are declared here for convenience purposes.
ALPHA              = %x41-5A / ; uppercase letters
                  %x61-7A   ; lowercase letters

```

DIGIT

= %x30-39 ; digits

Wackerow

Expires November 14, 2023

[Page 7]

### **3.1.3. Regular Expression**

The used syntax is the XML Schema flavor which can be easily used in other flavors. These regular expressions implicitly anchor at the head and tail. The following regular expression syntax uses components (component names indicated by angle brackets, i.e. <component>) and is written in free-spacing mode for easier reading (the XML Schema flavor does not support that). Please note that use of multiple quantifiers in regular expressions can result in false outcomes due to so-called greediness. Therefore, there are separate regular expressions for the length restriction and other purposes for the components agency-identifier and dns-label.

```

ddi-urn           := [Uu][Rr][Nn] : [Dd][Dd][Ii] :
                    <agency-identifier> :
                    <resource-identifier> :
                    <version-identifier>

agency-identifier := <top-level-domain> \.
                    <ddi-authority-id>
                    (\. <ddi-sub-authority-id>)*

agency-identifier := .{1,255}

top-level-domain  := <dns-label>

ddi-authority-id  := <dns-label>

ddi-sub-authority-id := <dns-label>

dns-label         := [A-Za-z0-9]([-A-Za-z0-9]*[A-Za-z0-9])?

dns-label         := .{1,63}

resource-identifier := <restricted-string>
                    (/ <restricted-string>)*

version-identifier := <restricted-string>
                    (/ <restricted-string>)*

restricted-string := [A-Za-z0-9-._~!$&'()*+.,;=@]+

```

Wackerow

Expires November 14, 2023

[Page 8]



#### **3.1.4. Examples of DDI URNs**

The examples are taken from the DDI Lifecycle 3.3. documentation. Please note that the resource identifiers are simplified. In real applications, they are much longer for unique identification purposes. They don't relate to DDI types like the examples might suggest.

URN of a Represented Variable

```
urn:ddi:us.ddia1:R-V1:1
```

The DDI represented variable identified by "R-V1" with the version "1" of the DDI agency "ddia1" located in the domain "us" [[DDIEXRV](#)].

URN of a Question Item

```
urn:ddi:us.ddia1:PISA-QS.QI-2:1
```

The DDI question item identified by "PISA-QS.QI-2" with the version "1" of the DDI agency "ddia1" in the domain "us" [[DDIEXQU](#)].

URN as Reference to a Controlled Vocabulary

```
urn:ddi:int.ddi.cv:AggregationMethod:1.0
```

The DDI controlled vocabulary identified by "AggregationMethod" with the version "1.0" in the scope of the DDI agency "ddi" and sub-agency "cv" in the domain "int" [[DDICVAG](#)].

#### **3.2. Relevant Ancillary Documentation**

An introductory article on DDI can be found at [[DDIINTR](#)].

Information on the DDI specifications (DDI-C, DDI-L, XKOS, Controlled Vocabularies, and SDTL) can be found in the standards section of the DDI Alliance website [[DDIALL](#)].

Information on domain names can be found in the relevant RFCs.

- o For an overview, see [[RFC1034](#)].
- o Regarding case insensitivity, see [[RFC1035](#)] [section 2.3.3](#).
- o Regarding syntax, see [[RFC952](#)] section "Grammatical Host Table Specification" B. and [[RFC1123](#)] [section 2.1](#).

- o Regarding size limits, see [\[RFC1123\] section 2.1](#) and [\[RFC1035\] section 2.3.4](#).

### **3.3. Identifier Uniqueness Considerations**

Assignment of identifiers for DDI agencies in the requested namespace will be managed by the DDI Alliance, which will ensure that the assigned DDI agency identifiers are consistent with the directives for unique identification of DDI agencies.

Assignment of URNs for resources of a DDI agency in the requested namespace will be managed by the respective DDI agency, which ensures that the assigned URNs are unique for the scope of the agency.

### **3.4. Identifier Persistence Considerations**

Persistence of identifiers is dependent upon suitable delegation of resolution at the level of the DDI agencies, and persistence of DDI agency assignment. The persistence of the referenced resource is also the responsibility of the DDI agency.

### **3.5. Process of Identifier Assignment**

Assignment of identifiers for DDI agencies in the requested namespace is managed by the DDI Alliance. A registry for DDI agency identifiers ensures through an approval process that the syntax of agency identifiers complies with the associated rules [[DDIREGI](#)].

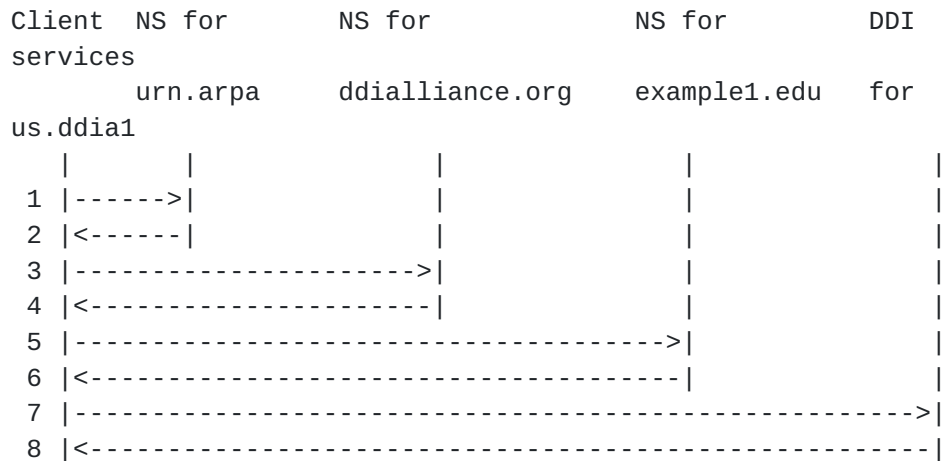
Assignment of URNs for resources of a DDI agency and sub-agencies of a DDI agency in the requested namespace will be managed by the respective DDI agency.

### **3.6. Process for Identifier Resolution**

The DDI Alliance will promote a service discovery system for identifying available services connected to DDI agencies using the Domain Name System (DNS). A DNS request for a DDI agency within the domain `ddi.urn.arpa` is delegated by the DNS servers of the DDI Alliance to the DNS servers of the relevant DDI agency. The response is a list of available DDI services for the agency identifier under which the agency has assigned URNs. The approach is based on the Dynamic Delegation Discovery System (DDDS) [[RFC3401](#)] and especially the straightforward URI-enabled NAPTR (U-NAPTR) [[RFC4848](#)].

The DDI Alliance is responsible for operating or delegating resolution requests to the resolution servers of the relevant DDI agencies. DDI agencies are responsible for operating or delegating resolution servers for the agency identifier under which they have assigned URNs.

Sample Sequence Diagram for receiving a list of DDI services from the example DDI agency "ddia1".



1. The name server (NS) of IANA for the domain "urn.arpa." is reached with the request "ddia1.us.ddi.urn.arpa." for the DDI agency "us.ddia1".
- 2./3. The request is delegated to the name server for "ddialliance.org".
- 4./5. The request is delegated to the name server for "example1.edu" (domain of the DDI agency "us.ddia1").
6. The server responds with a list of NAPTR records [[RFC3403](#)] pointing to available DDI services for the DDI agency "us.ddia1".
7. The client selects an appropriate DDI service and sends a request for a DDI URN to this service.
8. The DDI service responds for example with a DDI object identified by the requested DDI URN.

See [Appendix A](#) for examples of name server records.

### 3.7. Rules for Lexical Equivalence

The DDI agency identifier basically follows the rules of domain names. Domain names are case-insensitive. Thus, the portion of the URN

urn:ddi:<agency-id>

is case-insensitive for matches. The remainder of the identifier MUST be considered case-sensitive.

Wackerow

Expires November 14, 2023

[Page 11]

### **3.8. Conformance with URN Syntax**

The Namespace Specific String conforms to the related section in [[RFC8141](#)]. It is composed from the limited set of characters for an URN NSS [[RFC8141](#)]. Percent encoding is not used.

### **3.9. Validation Mechanism**

The DDI Alliance will promote development of software for validation purposes.

### **3.10. Scope**

The scope is global.

## **4. Namespace Considerations**

There is no available namespace that will allow one to uniquely identify and access DDI resources.

### **4.1. URN Assignment Procedures**

See also above section on Process of Identifier Assignment.

### **4.2. URN Resolution/Delegation**

See also above section on Process for Identifier Resolution.

It is RECOMMENDED to use sub-agencies for flexible administration. For example, delegation of URNs of a sub-agency to different servers would be easily possible.

### **4.3. Type of Resources to be Identified**

The DDI specifications define resources at a granular level, many of which can be identified by a DDI URN.

### **4.4. Type of Services**

Examples of potential services are listed below. The services and appropriate service tags need to be defined in future. The mentioned service tags are from [[RFC2483](#)].

Wackerow

Expires November 14, 2023

[Page 12]



- o DDI repository
  - o I2R (URI to Resource): given a DDI URN return one instance of the resource identified by that URN.
- o DDI registry
  - o I2C (URI to URC, Uniform Resource Characteristics are descriptions of resources): given a DDI URN return a description or a summary of that resource.
- o DDI URN resolution
  - o I2L (URI to URL): given a DDI URN return one URL that identifies a location where the identified DDI resource can be found.
  - o I2Ls (URI to URLs): given a DDI URN return one or more URLs that identify multiple locations of the identified DDI resource.

## **5. Community Considerations**

### **5.1. Open Assignment and Use of Identifiers**

DDI agency identifiers can be registered at the DDI Alliance. The DDI Alliance will maintain a registry of the assigned values for the DDI agency identifier used in the NSS. Information may be obtained from the following address: [secretariat@ddialliance.org](mailto:secretariat@ddialliance.org).

DDI agencies assign URNs and potential sub-agencies within the scope of the assigned DDI agency identifiers.

See also above section on Identifier Uniqueness Considerations.

### **5.2. Open Operation of Resolution Servers**

The DDI Alliance operates publicly accessible name servers for the delegation of DNS requests within the domain `ddi.urn.arpa` to DNS servers of DDI agencies.

### **5.3. Creation of Software for Service Discovery**

The DDI Alliance will promote software for the resolution of DDI agency identifiers and service discovery. See also [Appendix B](#) for the resolution algorithm. A basic resolver library is available [[DDIRESO](#)].

Wackerow

Expires November 14, 2023

[Page 13]

## **6. IANA Considerations**

IANA is requested to update the "ddi" entry in the Universal Resource Names registry to reference this specification.

The registration for "ddi" in the "URN.ARPA" zone is approved. Requests for the domain ddi.urn.arpa will be delegated to the name servers of the DDI Alliance.

## **7. Security Considerations**

URN:DDI identifiers are assigned to resources that are public information, and therefore resolving these identifiers has low security profile.

Registration of DDI agencies is approved by the DDI Alliance. Assignment and resolution of URN:DDI identifiers are controlled by the DDI Alliance and approved DDI agencies. The DDI Alliance SHALL have in place control mechanisms in order to make sure that DDI Agency applications from malicious 3rd parties will not be accepted. URN:DDI resolvers will be protected against eavesdropping and attacks with appropriate tools.

This document introduces no additional technical security considerations beyond those associated with the use and resolution of URNs in general.

The security of the DNS-based resolution of DDI agency identifiers is only as good as the security of DNS queries in general. A full discussion of the security threats pertaining to DNS and possible solutions can be found in [[RFC3833](#)]. Further information on security considerations regarding U-NAPTR can be found in [[RFC4848](#)] [section 6](#). DNS over HTTPS (DoH) [[RFC8484](#)] could be used to increase security by preventing eavesdropping and manipulation of DNS data by man-in-the-middle attacks. The HTTPS protocol encrypts the data between the DoH client and the DoH-based DNS resolver.

## **8. References**

### **8.1. Normative References**

- [DDIC] DDI Codebook, DDI Alliance 2000-2014,  
<<https://ddialliance.org/Specification/DDI-Codebook/>>.
- [DDIL] DDI Lifecycle, DDI Alliance 2009-2020,  
<<https://ddialliance.org/Specification/DDI-Lifecycle/>>.
- [DDIXKOS] DDI XKOS - Extended Knowledge Organization System, DDI

Alliance 2020,  
<<https://ddialliance.org/Specification/RDF/XKOS>>.

Wackerow

Expires November 14, 2023

[Page 14]

- [DDIID] DDI Lifecycle (3.3) Technical Guide, Identification, <<https://ddi-lifecycle-technical-guide.readthedocs.io/en/latest/General%20Structures/Identification.html>>.
- [RFC952] Harrenstien, K., Stahl, M., and E. Feinler "DoD Internet Host Table Specification", [RFC 952](#), October 1985, <<https://www.rfc-editor.org/info/rfc952>>.
- [RFC1034] Mockapetris, P., "Domain Names - Concepts and Facilities", [RFC 1034](#), November 1987, <<https://www.rfc-editor.org/info/rfc1034>>.
- [RFC1035] Mockapetris, P., "Domain Names - Implementation and Specification", [RFC 1035](#), November 1987, <<https://www.rfc-editor.org/info/rfc1035>>.
- [RFC1123] Braden, R., Ed. "Requirements for Internet Hosts -- Application and Support", [RFC 1123](#), October 1989, <<https://www.rfc-editor.org/info/rfc1123>>.
- [RFC2026] Bradner, S., "The Internet Standards Process -- Revision 3", [BCP 9](#), [RFC 2026](#), October 1996, <<https://www.rfc-editor.org/info/rfc2026>>.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC2181] Elz, R. and R. Bush, "Clarifications to the DNS Specification", [RFC 2181](#), July 1997, <<https://www.rfc-editor.org/info/rfc2181>>.
- [RFC3986] Berners-Lee, T., Fielding, R., and L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", [RFC 3986](#), <<https://www.rfc-editor.org/info/rfc3986>>.
- [RFC4343] Eastlake, D. 3rd, "Domain Name System (DNS) Case Insensitivity Clarification", [RFC 4343](#), January 2006, <<https://www.rfc-editor.org/info/rfc4343>>.
- [RFC5234] Crocker, D., Ed., and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", STD 68, [RFC 5234](#), January 2008, <<https://www.rfc-editor.org/info/rfc5234>>.
- [RFC5378] Bradner, S. and J. Contreras, "Rights Contributors Provide to the IETF Trust", [BCP 78](#), [RFC 5378](#), November 2008, <<https://www.rfc-editor.org/info/rfc5378>>.

Wackerow

Expires November 14, 2023

[Page 15]

- [RFC8141] Saint-Andre, P. and J. Klensin, "Uniform Resource Names (URNs)", [RFC 8141](#), April 2017, <<https://www.rfc-editor.org/info/rfc8141>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in [RFC 2119](#) Key Words", [RFC 8174](#), May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8179] Bradner, S. and J. Contreras, "Intellectual Property Rights in IETF Technology", [BCP 79](#), [RFC 8179](#), May 2017, <<https://www.rfc-editor.org/info/rfc8179>>.
- [SDTL] SDTL - Structured Data Transformation Language - Version 1.0, <<https://ddialliance.org/products/sdtl/1.0/>>.
- [TLD] IANA Database of Top Level Domains, <<https://www.iana.org/domains/root/db>>.

## 8.2. Informative References

- [ABNF2RS] ABNF to REGEX Regular Expression Generator, Michael R. Sweet, <<https://www.msweet.org/abnf/>>.
- [ABNFGEN] abnfggen, Jutta Degener, <<http://www.quut.com/abnfggen/>>.
- [ABNFPFE] ABNF Parser, Bill Fenner, <<http://tools.ietf.org/tools/bap/abnf.cgi>>.
- [DDIALL] DDI Alliance, <<https://ddialliance.org/>>.
- [DDICVAG] DDI Controlled Vocabulary for Aggregation Method, <[https://ddialliance.org/Specification/DDI-CV/AggregationMethod\\_1.0.html](https://ddialliance.org/Specification/DDI-CV/AggregationMethod_1.0.html)>.
- [DDIEXQU] DDI Lifecycle 3.3 Technical Guide, Examples, Questions, <<https://ddi-lifecycle-technical-guide.readthedocs.io/en/latest/Examples/Questions.html>>.
- [DDIEXRV] DDI Lifecycle 3.3 Technical Guide, Examples, Represented Variable, <<https://ddi-lifecycle-technical-guide.readthedocs.io/en/latest/Examples/RepresentedVariable.html>>.
- [DDIINTR] Vardigan, M., Heus, P., and W. Thomas. "Data Documentation Initiative: Toward a Standard for the Social Sciences." The International Journal of Digital Curation 3, 1 (2008), <<http://www.ijdc.net/article/view/66>>.

[DDIREGI] DDI Agency Registry,  
<<https://registry.ddialliance.org/>>.

Wackerow

Expires November 14, 2023

[Page 16]



- [DDIRES0] DDI Agency Registry Tools,  
<<https://registry.ddialliance.org/Home/Tools>>.
- [DUBLINC] Dublin Core Metadata Initiative,  
<<https://www.dublincore.org/>>.
- [IS03166] ISO 3166 Country Codes,  
<<https://www.iso.org/iso-3166-country-codes.html>>.
- [IS11179] ISO/IEC 11179 Information technology - Metadata registries (MDR) - Part 6: Registration,  
<<http://metadata-standards.org/11179/>>.
- [IS19115] ISO 19115, Geographic information -- Metadata,  
<<https://www.iso.org/standard/26020.html>>.
- [RFC2782] Gulbrandsen, A., Vixie, P., and L. Esibov, "A DNS RR for specifying the location of services (DNS SRV)", [RFC 2782](#), February 2000, <<https://www.rfc-editor.org/info/rfc2782>>.
- [RFC2843] Mealling, M., Daniel, R., "URI Resolution Services Necessary for URN Resolution", [RFC 2483](#), January 1999, <<https://www.rfc-editor.org/info/rfc2483>>.
- [RFC3401] Mealling, M., "Dynamic Delegation Discovery System (DDDS) - Part Two: The Algorithm", [RFC 3401](#), October 2002, <<https://www.rfc-editor.org/info/rfc3401>>.
- [RFC3402] Mealling, M., "Dynamic Delegation Discovery System (DDDS) - Part Two: The Algorithm", [RFC 3402](#), October 2002, <<https://www.rfc-editor.org/info/rfc3402>>.
- [RFC3403] Mealling, M., "Dynamic Delegation Discovery System (DDDS) - Part Three: The Domain Name System (DNS) Database", [RFC 3403](#), October 2002, <<https://www.rfc-editor.org/info/rfc3403>>.
- [RFC3833] Atkins, D. and R. Austein, "Threat Analysis Of The Domain Name System", [RFC 3833](#), August 2004, <<https://www.rfc-editor.org/info/rfc3833>>.
- [RFC3958] Daigle, L., Newton, A., "Domain-Based Application Service Location Using SRV RRs and the Dynamic Delegation Discovery Service (DDDS)", [RFC 3958](#), January 2005, <<https://www.rfc-editor.org/info/rfc3958>>.

Wackerow

Expires November 14, 2023

[Page 17]

- [RFC4848] Daigle, L., "Domain-Based Application Service Location Using URIs and the Dynamic Delegation Discovery Service (DDDS)", [RFC 4848](#), April 2007, <<https://www.rfc-editor.org/info/rfc4848>>.
- [RFC5385] Touch, J, "Version 2.0 Microsoft Word Template for Creating Internet Drafts and RFCs", [RFC 5385](#), February 2010, <<https://www.rfc-editor.org/info/rfc5385>>.
- [RFC8484] Hoffman, P., McManus, P., "DNS Queries over HTTPS (DoH)", [RFC 8484](#), October 2018, <<https://www.rfc-editor.org/rfc/rfc8484>>.
- [SDMX] SDMX -- Statistical Data and Metadata Exchange, <<https://sdmx.org/>>.



## **9. Acknowledgments**

Many thanks to Arofan Gregory, Dan Smith, and Wendy Thomas from the DDI Alliance Technical Committee, and Peter Koch from DENIC (German Network Information Center) for discussion and input that led to this document.

The following software tools have been helpful in evaluating the ABNF grammar and the regular expressions: an ABNF parser [[ABNFPFE](#)], a tool that creates regular expressions from an ABNF grammar [[ABNF2RS](#)], and a tool that generates random strings that match an ABNF grammar [[ABNFGEN](#)].

This document was prepared using the Word template 2-Word-v2.0.template.dot [[RFC5385](#)].



## **Appendix A. Example DNS Records**

The examples use NAPTR [[RFC3403](#)] and SRV [[RFC2782](#)][[RFC3958](#)] records. The values for the services and flags fields of the NAPTR records will be determined by the DDI application ([\[RFC3403\] section 9.](#)).

### **A.1. Delegation of the URN Namespace "ddi"**

Example records defined at a.iana-servers.net and other authoritative name servers for the domain urn.arpa.

The empty flag indicates that the lookup is not terminal and the next probe to DNS is for more NAPTR records where the new domain is "dns.ddialliance.org".

```
; Delegation to name servers of ddialliance.org
;          order pref  flag  service  regexp replacement
ddi.urn.arpa.
  IN NAPTR 100  10  ""  ""  ""  dns.ddialliance.org.
```

### **A.2. Delegation of DDI Agencies**

Example records defined at dns.ddialliance.org for ddi.urn.arpa.

The empty flag indicates that the lookup is not terminal and the next probe to DNS is for more NAPTR records where the new domain is the DNS server of the relevant DDI agency.

```
; Delegation to name servers of subdomains in ddi.urn.arpa, i.e.
; DDI agencies.
;          order pref  flag  service  regexp replacement
ddia1.us.ddi.urn.arpa.
  IN NAPTR 100  10  ""  ""  ""  dns.example1.edu.
ddia2.de.ddi.urn.arpa.
  IN NAPTR 100  10  ""  ""  ""  dns.example2.org.
ddia3.gb.ddi.urn.arpa.
  IN NAPTR 100  10  ""  ""  ""  dns.example3.ac.uk.
```

### **A.3. DDI Services**

Example records defined at dns.example2.org for ddi.urn.arpa.

The "u" flag states that the rule is terminal and that the output is a URI which contains the information needed to contact that DDI service. The "s" flag states that the rule is terminal and that the output of the rewrite will be a domain-name for which an SRV record SHOULD be queried. See also [\[RFC4848\] section 4.4.](#)

The service N2R returns one instance of the resource identified by the given URN. That service is a repository of DDI resources

Wackerow

Expires November 14, 2023

[Page 20]



available at <http://repos.example2.org/N2R/>; possibly a REST-based service. The service N2C returns a description of the resource identified by the given URN. That service is a registry of DDI resources available at registry-udp.example2.org port 10060.

U-NAPTR permits regular expressions of a form that does a complete replacement of the matched string with a URI, expressed as a constant string. With this limited form of regular expression ([RFC4848] section 2.2.), applications using NAPTR need not implement full regular expression parsers.

```

ddia2.de.ddi.urn.arpa.
;          order pref flag
  IN NAPTR 100 10 "u" "N2R+http"          ( ; service
                                           "!.*!http://repos.example2.org/N2R/!"
;regex
                                           .
                                           ;
replacement
                                           )
  IN NAPTR 100 10 "s" "N2C+udp"          ( ; service
                                           ""
                                           ; regex
                                           _registry._udp.example2.org.
replacement
                                           )
; all subdomains in ddia2.de.ddi.urn.arpa.
*.ddia2.de.ddi.urn.arpa.
ddia2.de.ddi.urn.arpa.
;          order pref flag
  IN NAPTR 100 10 "u" "N2R+http"          ( ; service
                                           "!.*!http://repos.example2.org/N2R/!"
;regex
                                           .
                                           ;
replacement
                                           )
  IN NAPTR 100 10 "s" "N2C+udp"          ( ; service
                                           ""
                                           ; regex
                                           _registry._udp.example2.org.
replacement
                                           )
;_service._protocol.name
; TTL   class SRV  priority weight port  target
_registry._udp.example2.org
  14400 IN   SRV  0      0      10060 registry-
udp.example2.org.

```

Wackerow

Expires November 14, 2023

[Page 21]

## **Appendix B. Algorithm for DDI Service Discovery**

The description is based on the Dynamic Delegation Discovery System (DDDS) algorithm [[RFC3402](#)].

### Application Unique String

The Application Unique String is a DDI URN.

### First Well Known Rule

1. Extracting the characters between the second and third colon (the agency identifier).
2. Normalizing case of that string.
3. Reversing the order of the substrings separated by dots.
4. Appending the string ".ddi.urn.arpa" to the end to get a domain name.

### Valid Databases

The DNS is specified as a DDDS Database for this application which uses the NAPTR DNS resource records to contain the rewrite rules for service discovery.

The DNS is queried for NAPTR records for the domain name which is the output of the First Well Known Rule.

### Expected Output

The expected output is the information necessary to connect to authoritative server(s) (host, port, protocol, or URL) for an application service within a given DDI agency. The result is a list of terminal NAPTR records pointing to services available for the relevant DDI agency.

The application selects the appropriate service and contacts the service for the given URN.

The process can be optimized by an application cache for the NAPTR records of already requested DDI agencies.

### Author's Address

Joachim Wackerow  
c/o The Data Documentation Initiative Alliance (DDI Alliance)  
ICPSR, University of Michigan  
PO Box 1248  
Ann Arbor, MI 48106-1248  
USA

Email: [joachim.wackerow@posteo.de](mailto:joachim.wackerow@posteo.de), [secretariat@ddialliance.org](mailto:secretariat@ddialliance.org)  
Website: [ddialliance.org](http://ddialliance.org)

Wackerow

Expires November 14, 2023

[Page 22]