                A Uniform Resource Name (URN) Namespace for the
                     Data Documentation Initiative (DDI)
                           draft-urn-ddi-01.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

Copyright Notice

Table of Contents

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.

2. Conventions used in this document

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in [RFC2119].

   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).

"RFC": The basic publication series for the IETF. RFCs are published by the RFC Editor and once published are never modified ([RFC2026] section 2.1).

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. Namespace ID

The Namespace Identifier (NID) "ddi" is requested.

3.2. Registration Information

Version 1
Date: February 11, 2021

3.3. Declared Registrant of the Namespace

Name: The Data Documentation Initiative Alliance (DDI Alliance)
Address: ICPSR, University of Michigan
         PO Box 1248
         Ann Arbor, MI 48106-1248
         USA
Website: ddialliance.org
Contact: Joachim Wackerow
         E-mail: joachim.wackerow@posteo.de,
                  secretariat@ddialliance.org

3.4. Declaration of Syntactic Structure

3.4.1. 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 alpa-2 codes [ISO3166] 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).

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.

3.4.2. 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
```

3.4.3. 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-._~!$&'()*+,;=@]+
```

3.4.4. 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].

3.5. 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.

3.6. 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.

3.7. 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.

3.8. Process of Identifier Assignment

   Assignment of identifiers for DDI agencies in the requested
   namespaceis 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.

3.9. 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".

```
  Client  NS for         NS for           NS for          DDI services
          urn.arpa       ddialliance.org  example1.edu    for us.ddia1
      |        |                |                |               |
    1 |------->|                |                |               |
    2 |<-------|                |                |               |
    3 |------------------------>|                |               |
    4 |<------------------------|                |               |
    5 |---------------------------------------->|               |
    6 |<----------------------------------------|               |
    7 |------------------------------------------------------->|
    8 |<-------------------------------------------------------|
```
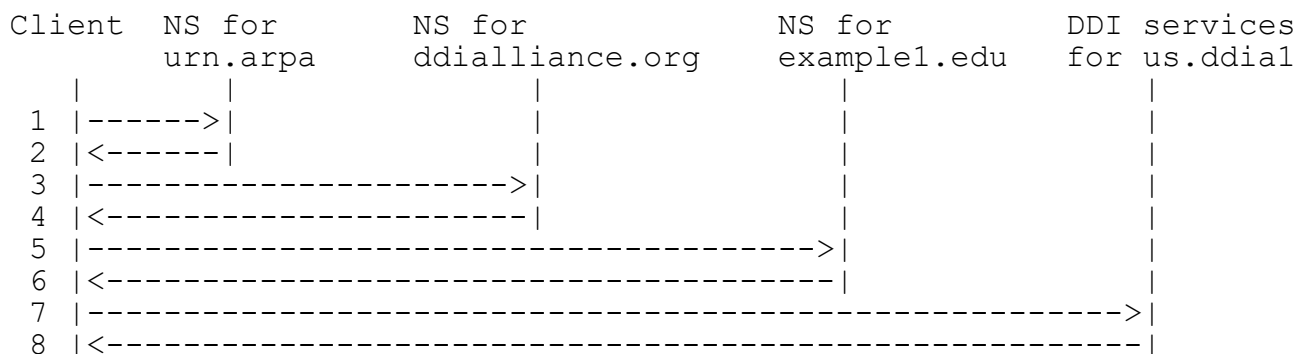
   1.   The name server (NS) of IANA for the domain "urn.arpa." is
          reached with the request "ddia1.us.ddi.urn.arpa." for the
          DDI agency "us.ddia1".

   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.

3.10. 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.

3.11. 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.

3.12. Validation Mechanism

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

3.13. 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 [RFC2169].

o DDI repository

   o N2R: given a DDI URN return one instance of the resource
     identified by that URN.

o DDI registry

   o N2C: given a DDI URN return a description or a summary of that
     resource.

o DDI URN resolution

   o N2L: given a DDI URN return one URL that identifies a location
     where the identified DDI resource can be found.

   o N2Ls: 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.

   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].

6. IANA Considerations

   This document defines an URN NID registration of "ddi". IANA is asked
   to register "ddi" in the URN Namespaces registry.

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

7. Security Considerations

   This document introduces no additional 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.

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>.

   [DDIID]   DDI Lifecycle (3.3) Technical Guide, Identification,
              <https://ddi-lifecycle-technical-
              guide.readthedocs.io/en/latest/General%20Structures/Identif
              ication.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>.

   [RFC8141] Saint-Andre, P. and J. Klensin, "Uniform Resource Names
              (URNs)", RFC 8141, April 2017,
              <https://www.rfc-editor.org/info/rfc8141>.

   [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] abnfgen, Jutta Degener, <http://www.quut.com/abnfgen/>.

   [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>.

   [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/>.

   [DDIRESO] DDI Agency Registry Tools,
             <https://registry.ddialliance.org/Home/Tools>.

   [DUBLINC] Dublin Core Metadata Initiative,
             <https://www.dublincore.org/>.

   [ISO3166] 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>.

   [RFC2169] Daniel, R., "A Trivial Convention for using HTTP in URN
             Resolution", RFC 2169, June 1997,
             <https://www.rfc-editor.org/info/rfc2169>.

   [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>.

   [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>.

   [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>.

   [SDMX]   SDMX -- Statistical Data and Metadata Exchange,
             <https://sdmx.org/>.

9. Acknowledgments

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
   "registry.ddialliance.org".

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

A.2. Delegation of DDI Agencies

   Example records defined at registry.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
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.
```

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 DDI Alliance, ICPSR, University of Michigan
     PO Box 1248
     Ann Arbor, MI 48106-1248
     USA

     Email: joachim.wackerow@posteo.de