Data Management Planning Tool, Version 2 (DMPT2)
Functional and Non-Functional Requirements

Rev. 0.21 – 2014-05-06

1   Introduction

Proactive data management policies and practices are fundamental to ensuring and maximizing proper preservation, publication, sharing, and reuse of research data. Government and private funding bodies are increasingly enforcing requirements that grant proposals include data management plans (DMPs) outlining the grantee's data management intentions. Many research organizations are considering similar requirements for self-funded projects and initiatives, including US federal agencies falling under the purview of recent OSTP directives [11]. The DMPTool2 partners[1] have received funding from the Alfred P. Sloan Foundation for a one year project to enhance the features of the original DMPTool [16] in order to provide a higher level of service to the DMPTool2 stakeholder community.

2   Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 [1].

Key terms (or phrases) emphasized in *Italics* throughout this document are defined in Section § 3.

3   Definitions

The DMPTool2 requirements make references to the following standardized terms. Note that these terms are defined primarily for purposes of clarity and precision in formulating requirements; other, more user-friendly terminology may be desirable for use in the DMPTool2 UI and marketing, training, and outreach materials and activities.

1. *Action*. A specific operation initiated by a *User* using the *DMPT2* UI. Permission to perform *Actions* is controlled by the *User's Role*.

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[1] DataONE; Digital Curation Centre (DCC); Purdue University; Smithsonian Institution (SI); University of California Curation Center (UC3); University of California, Los Angeles (UCLA); University of California, San Diego (UCSD); University of Illinois, Urbana-Champaign (UIUC); University of Virginia (UVa)

2. ***Data management plan*** (***DMP***). A formal statement of the set of policies and procedures intended for the full lifecycle management and curation of research data for purposes of long-term preservation, publication, sharing, access, and (re)use.

   DMP template. A customized list of *Requirement groups* and/or *Requirements* specific to an *Institution's* data management policies. These *Requirements* are applicable to all *DMPs* deemed acceptable to that *Institution*. A given *DMP template* can be associated with an arbitrary number of *Resource templates*, including zero.

3. ***DMPT2***. Version 2 of the DMPTool, supporting the function defined in this document.

4. ***Institution***. An organization or corporate body that functions as any combination of:

   a. The professional affiliation of a *User*; and/or

   b. The originator of *DMP Requirements* as a precondition for grant funding; and/or

   c. The originator of *DMP Requirements* for internal data management purposes.

5. ***Requirement***. A requisite condition for an *Institutionally*-acceptable *DMP*.

6. ***Requirement group***. A collection of related *Requirement groups* and/or *Requirements*.

   NOTE   The *Requirement* and *Requirement group* constituents of a *DMP template* are organized as a list of graph-theoretic hierarchical trees. Within these trees *Requirements* function only as terminal nodes and *Requirements groups*, as non-terminal nodes.

7. ***Resource***. A single component of a *Resource template* providing information related to a *Requirement template* in general, or to a particular *Requirement* or *Requirement group* of the template.

8. ***Resource template***. A customized set of *Resources* that optionally may be related to a specific *DMP template* and/or an *Institution*. There are thus three types of templates:

   a. Related to both a *DMP template* and an *Institution*. These *Resources* are applicable to all *Users* accessing a DMP based on the template and at least one of the following criteria is true:

       i.   Affiliated with the *Institution*; or

       ii. Owners or co-owners of a *DMP* that is owned or co-owned with a *User* affiliated with that *Institution*; or

       iii. Owners or co-owners of a *DMP* based on the *DMP template*.

   b. Related to a *DMP template* but unrelated to an *Institution*. These *Resources* are applicable to all *Users* accessing a *DMP* based on the template independent of their *Institutional* affiliation.

    c.   Unrelated to either a *DMP template* or an *Institution*. These *Resources* are applicable to all *Users* and *DMPs* independent of *DMP* or *Institutional* affiliation.

9.   ***Role***. A set of permissions to perform specific *Actions* granted to an authenticated *User* [13]. *Roles* are assigned in the context of specific *DMPs* and *Institutions*.

10.   ***User***. An individual making use of the *DMPT2* service in any capacity or *Role*.

11.   ***Workflow state***. The position currently occupied by a *DMP* in a multi-stage workflow.

4   Functional requirements

The *DMPT2* SHALL conform to the following functional requirements, grouped for presentational convenience into several high-level categories.

4.1   Identity management (IdM) and *Role*s

1.   A *User* SHALL be associated with four REQUIRED properties:

    a.   Authenticated identity
    b.   Email address
    c.   Institutional affiliation
    d.   Non-empty set of *Roles*

        i.   A given *User* MAY hold various *Roles* in the context of the *User's* single *Institutional* affiliation or relative to different *DMPs*.

    e.   Status: "active" or "inactive"

2.   A *User* MAY be associated with one OPTIONAL property:

    a.   ORCID identifier [12]

3.   A *User* holding the "institutional-administrator" *Role* MAY be associated with one OPTIONAL property:

    a.   Notification preferences, indicating whether or not the *User* SHALL received notifications whenever an *Institutional DMP* is submitted, approved, rejected, deactivated, or deleted.

4.   Two methods SHALL be supported for authenticating *User* identities:

    a.   Using credentials issued, managed, and verified by an external Shibboleth identity provider (IdP) [14], provided that the IdP is a member of the InCommon federation [7] and agrees to release to the *DMPT2* the following attributes:

        i.   eduPersonPrincipalName (ePPN)
        ii.   email

NOTE   A Shibboleth-authenticated *User's* name or email cannot be modified within the *DMPT2* context; such changes MAY be possible in the context of the *User's* local IdP.

  b. Using username/password credentials issued, managed, and verified directly by the *DMPT2.*

    i. A *User* relying on *DMPT2*-managed credentials SHALL be able to edit his/her password and email address.

5. The assignment of a *User* role, and the concomitant permission to perform subsequent *Actions*, SHALL be dependent on successful authentication.

  a. The following *User Role*s SHALL be supported:

    i. DMP-owner
    ii. DMP-co-owner
    iii. Requirements-editor
    iv. Resources-editor
    v. Institutional-reviewer
    vi. Institutional-administrator
    vii. DMP-administrator

  b. The "dmp-owner" and "dmp-co-owner" *Roles* are held by *Users* with respect to specific *DMPs.*

    i. A *User* is automatically granted the "dmp-owner" *Role* relative to a *DMP* when s/he first creates it.

    ii. A given *DMP* MUST have one and only one "dmp-owner" and MAY have an arbitrary number of "dmp-co-owner's", including zero.

    iii. A *User* holding the "dmp-owner" *Role* with respect to a given *DMP* MAY grant or revoke the "dmp-co-owner" *Role* to any *User* with respect to that same *DMP.*

  c. The "requirements-editor", "resources-editor", "institutional-reviewer", and "institutional-administrator" *Roles* are held by *Users* with respect to specific *Institutions.*

    i. A *User* MAY be granted the "requirements-editor", "resources-editor", or "institutional-reviewer" *Roles* by a *User* holding the "institutional-administrator" *Role.*

      (1) A *User* holding the "institutional-administrator" *Role* MAY revoke the "requirements-editor", "resources-editor", or "institutional-reviewer" *Roles* held by other *Users.*

  ii. A *User* holding the "requirements-editor", "resource-editor", "institutional-reviewer", or "institutional-administrator" *Roles* MAY grant that same *Role* to any *User* associated with the underlying *Institution*.

  iii. A *User* holding the "institutional-administrator" *Role* MAY perform any *Action* relative to any *DMP template, Resources template*, or *DMP* associated with the underlying *Institution*.

   NOTE In consequence of this localized authority, the "institutional-administrator" *Role* is not explicitly referenced in subsequent functional requirements concerning permissions to perform *Institutional*-specific *Actions*.

 d. The "dmp-administrator" *Role* is held by *Users* with respect to the DTMPTool2.

  i. A *User* holding the "dmp-administrator" *Role* MAY grant that same *Role* to any *User*.

  ii. A *User* holding the "dmp-administrator" *Role* MAY perform any *Action* relative to any *DMP template*, *Resource template*, or *DMP*.

   NOTE In consequence of this global authority, the "dmp-administrator" *Role* is not explicitly referenced in subsequent functional requirements concerning permissions to perform *Actions*.

6. A *User* account MAY be deactivated by the institutional administrator for the affiliated *Institution*.

 a. A *User* cannot login to a deactivated account.

 b. All data associated with a deactivated account is left intact as of the time of deactivation.

 NOTE There is no supported option to delete a *User* account.

4.2 Institution

1. An *Institution* SHALL be associated with one REQUIRED property:

 a. Full name

2. An *Institution* MAY be associated with six OPTIONAL properties:

 a. Short name, or acronym
 b. Description
 c. Actionable URL and label, for additional description information
 d. Actionable URI (possibly an email address) and label, for additional contact information

e. Logo, in the form of a GIF or JPEG image

> NOTE   Once the *DMPT2* UI layout style has been defined, minimal and maximal image sizes will be established.

f. Institutional review explanatory text

> NOTE   This text, if defined, SHALL be displayed in the context of the mechanism, e.g., submit button, etc., used to submit a *DMP* for a formal or informal review.

3. An *Institution* MAY be associated with another *Institution* that is its organizational parent.

   a. Any requirement explicitly relative to a given *Institutional* is implicitly applicable to all decedent *Institutions*, that is, lower in the parent/child *Institutional* hierarchy.

4. An *Institution's* properties MAY be defined and edited by a *User* holding the "institutional-administrator" *Role* with respect to that *Institution*.

5. The *DMPT2* UI SHALL reflect the branding of a *User's Institutional* affiliation after successful authentication.

   a. Branding SHALL include the name of the affiliation *Institution* and the OPTIONAL descriptive text, URLs, and logo, if defined.

      i. The branding properties SHOULD appear in, or be linked to from, the standard header or footer of all *DMPT2* UI pages.

   b. Affiliated *Institutional* branding SHALL be displayed in addition to, not in replacement of, *Institutional*-neutral *DMPT2* branding.

4.3   DMP template

1. A *DMP template* SHALL be associated with a single *Institution*, the promulgator of the *Requirements* underlying the template.

2. A *DMP template* SHALL be associated with eight REQUIRED property:

   a. Name
   b. Creation date/timestamp
   c. Last modification date/timestamp
   d. Stable actionable URL resolving to the template's landing page in the *DMPT2* UI.

      > NOTE   "Stable" implies that persistence of the URL is assumed, but not guaranteed.

   e. Status: "inactive" (default) or "active"

      i. The status of a *DMP template* SHALL be set to "active" when it is committed.

    f.   Visibility flag: "public" (default) or "institution-only"

        i.   Active "public" templates MAY be selected as the basis for *DMPs* by any *User*.

        ii.   Active "institution-only" templates MAY be selected as the basis for *DMPs* only by *Users* affiliated with the *Institution* associated with the template.

    g.   Version number

    h.   Type: "funder" (default) or "institution"

        NOTE   "Funder" indicates that the requirements in the template are a pre-condition for receiving external grant funding; "institution" indicates that the requirements represent internal institutional policy.

3.   A *DMP template* MAY be associated with six OPTIONAL properties:

    a.   Starting date of *Requirements* applicability
    b.   Ending date of *Requirements* applicability
    c.   Tag

        NOTE   Textual tags assigned by template creators can be useful for collating information resulting from data mining queries.

    d.   Indication of whether or not *DMPs* associated with the template are to be reviewed: "no-review" (default), "informal-review", or "formal-review"

        NOTE   A formal review results in an explicit acceptance or rejection of the submitted *DMP* by an institutional reviewer; an informal review is not associated with either acceptance or rejection, but does provide an opportunity for institutional reviewers to supply comments back to *DMP* owners/co-owners.

    e.   List of actionable URL and label for additional information
    f.   List of actionable URLs and labels for public sample plans

4.   A *DMP template* MAY consist of a non-empty, unbounded, ordered list of *Requirements* and/or *Requirements Groups*.

    Note   A *DMP template* without any *Requirements* cannot be used as the basis for creating a *DMP* in the *DMPT2*. However, it is still useful to be able to provide pointers to additional external information or sample plans indicative of a given *Institution's* data management policies.

    a.   A *Requirements group* MAY be the structural parent of an arbitrary number of either *Requirements groups* or *Requirements*, but not both at the same time.

        NOTE   The hierarchical structure of *Requirements groups* and *Requirements* is intended

to facilitate the display and navigation of *Requirements* in the *DMPT2* UI, especially if the number of *Requirements* is large. No additional inter- or intra-*Requirement* semantics should be assumed.

b. A *Requirements group* SHALL be associated with one REQUIRED property:

   i. Declarative label.

c. A *Requirement* SHALL be associated with four REQUIRED properties:

   i. (Shorter) declarative label
  ii. (Longer) interrogative label

> NOTE   Declarative labels (e.g., "Storage and preservation") can be used for high-level navigation of a *DMP template* in in the *DMPT2* UI and as section headers in viewed or published *DMP*s; interrogative labels (e.g., "What physical and/or cyber resources and faciliaties (including third party resources) will be used to store and preserve the data?") can be used to prompt for specific responses to *Requirements*.

  iii. Designation of obligation

     (1) An obligation SHALL be one of the following:

        (a) Mandatory
        (b) Mandatory if applicable
        (c) Recommended
        (d) Optional

  iv. Type

     (1) A type SHALL be one of the following:

        (a) Text
        (b) Numeric

           (i) A numeric response SHALL be represented as a value and an OPTIONAL text label indicating the unit of measure.

               1. A value SHALL be an integer or real number.

               2. The unit labels SHALL be defined as a special type of enumeration (see § 4.3.4.c.iv.(3)).

     (2) Date

        (a) A date response SHALL be represented as a text string of

the form "*YYYY*", "*YYYY-MM*", or "*YYYY-MM-DD*".

      (3) Enumeration

           (a) An enumeration SHALL consist of a non-empty, unbounded, ordered list of text labels.

           (b) One of the enumeration labels MAY be designated as the default value.

5. The *DMPT2* UI SHALL present a *User* with a browsable list of all *DMP templates* for which s/he holds the "requirements-editor" *Role*.

    a. The browsable list SHALL display the following *DMP template* properties:

        i. Name
        ii. *Institution* associated with the template
        iii. Create date/timestamp
        iv. Last modification date/timestamp
        v. Status
        vi. Visbility
        vii. Stable actionable URL

    b. The *User* SHALL be able to select the sorting criterion of the browsable list to be based on the template name, *Institutional* name, creation or last modification date/timestamp, status, or visbility, specified in ascending or descending alphabetical or temporal order.

6. A DMP template MAY be created, edited, committed, deactivated, or deleted by a User holding the "requirements-editor" Role with respect to a given *Institution*.

    a. A new template MAY be created by copying an existing template for which the *User* holds the "requirements-editor" *Role*.

        i. A copied template MAY be considered either:

           (1) Entirely independent of the copied template, in which case the new template SHALL be given the version number of 1; or

           (2) A new version of the copied template, in which case the new template SHALL be given the version one greater than the copied template, i.e., $n+1$.

    b. A newly created template SHALL have "inactive" status.

    c. A committed template SHALL have "active" status.

        i. If the committed template is a new version, the status of the previous

version SHALL be set to "inactive".

7. There SHALL be a navigable path in the *DMPT2* UI to a list of all active *DMP templates' Institutional* affiliations, names, and links to external information and sample plans, if defined. This list SHALL reference all templates that:

    a. Are marked "public"; or

    b. Are marked "institution-only" and the *Institution* associated with the template is the *User's Institutional* affiliation.

8. The *DMPT2* UI SHOULD reflect the branding of the *Institution* associated with the *DMP template* in certain contexts.

    a. Branding SHALL include the name of the associated *Institution* and MAY include the OPTIONAL descriptive text, URLs, and logo, if defined.

    b. The branding properties SHOULD appear in, or be linked to from, *DMPT2* UI pages specific to the *DMP template*, for example, pages in which responses are elicited for individual *Requirements*.

    NOTE   In terms of the UI layout, it may be useful to consider branding properties as another form of *Resource*, and present them in the same UI context as true *Resources*.

4.4   Resource template

1. A *Resource template* MAY be associated with a single *Institution* and/or a single active *DMP template*.

2. A *Resource template* SHALL be associated with five REQUIRED properties:

    a. Name
    b. Creation date/timestamp
    c. Last modification date/timestamp
    d. Stable URL resolving to the template's landing page in the *DMPT2* UI.
    e. Status: "inactive" (default) or "active"

        i. The status of a *Resources template* SHALL be set to "active" when it is committed.

3. If a *Resource template* is associated with an *Institution* it MAY be associated with three OPTIONAL properties:

    a. URL and label for *Institutional* contact
    b. URL of *Institutional* widget [3]
    c. Indication of whether or not *DMPs* associated with the template are to be reviewed: "no-review" (default), "informal-review", or "formal-review"

4. A *Resource template* SHALL consist of a non-empty, unbounded set of *Resources*.

    a. A *Resource* SHALL be associated with a single *Requirement template* or template *Requirement.*

        i. An unlimited number of *Resources* MAY be associated with any given *Requirement template* or *Requirement.*

    b. A *Resource* SHALL be associated with two REQUIRED properties:

        i. Type

            (1) The following types SHALL be supported:

                (a) Actionable URL for an information source external to the *DMPT2*
                (b) Expository guidance for responding to the requirement
                (c) Example response
                (d) Suggested response

                    NOTE   Example responses illustrate the range of possible answers; suggested responses indicate *Institutionally-*recommended responses.

        ii. Value

    c. A *Resource* MAY be associated with one OPTIONAL property:

        i. URL label

            NOTE   The URL label provides the visible text shown for actionable hyperlink in the *DMPT2* UI.

    d. Each *Resource* SHALL be defined once but MAY be incorporated by reference into an arbitrary number of *Resource templates*.

5. A *Resource template* MAY be created, edited, committed, deactivated, or deleted by a *User* holding the "resources-editor" *Role* with respect to a given *Institution*.

    a. A *Resource* MAY be included in a template by being:

        i. Newly created; or

        ii. Included by reference from the set of all *Resources* associated with the resource-editor's affiliated *Institution*.

    b. A newly created template SHALL have "inactive" status.

    c. A committed template SHALL have "active" status.

    d. If a template is associated with an Institution the OPTIONAL template *Institutional*

URL and label SHOULD be pre-populated from the analogous *Institutional* property (see Section § 4.2.2.d).

6. The *DMPT2* UI SHALL present a *User* with a browsable list of all *Resource templates* for which s/he holds the "resources-editor" *Role*.

   a. The browsable list SHALL display the following *Resource template* properties:

      i. Name
      ii. *Institution* associated with the template
      iii. Create date/timestamp
      iv. Last modification date/timestamp
      v. Persistent URL

   b. The *User* SHALL be able to select the sorting criterion of the browsable list to be any one of the previous properties, specified in ascending or descending alphabetical or temporal order.

4.5 DMP

1. A *DMP* SHALL be associated with:

   a. An arbitrary set of *Users*, each holding the "dmp-owner" or "dmp-co-owner" *Roles* with respect to the *DMP*; and

   b. A single active *DMP template*.

2. A *DMP* SHALL be associated with four REQUIRED properties:

   a. Name
   b. Creation date/timestamp
   c. Last modification date/timestamp
   d. Workflow state transition history

      NOTE   See Section § 4.6 for requirements pertaining to workflow state.

3. A *DMP* MAY be associated with six OPTIONAL properties:

   a. Solicitation identifier
   b. Submission deadline
   c. Stable URL resolving to the *DMP*'s published PDF [9] serialization.

      i. The URL is minted at the time the *DMP* is published.

   d. Published serialization visibility flag: "private", "institutional", or "public".

      i. *DMPs* marked with "private" visibility SHALL be accessible to *Users* holding the "owner" or "co-owner" role for the *DMP* via the stable URL

associated with the published serialization or a browsable list.

ii. *DMPs* marked with "institutional" visibility SHALL be accessible to *Users* affiliated with any of the *DMPs'* owners or co-owners' affiliated *Institutions* via the stable URL associated with the published serialization or a browsable list.

iii. *DMPs* marked with "public" visibility SHALL be accessible to any anonymous (e.g., unauthenticated and unauthorized) *User* via the stable URL associated with the published serialization or a public browsable list.

> NOTE   The policies and mechanisms by which a *User* becomes aware of published *DMP*s' stable URLs are outside the scope of this document.

e. List of comments

i. A comment SHALL be associated with three REQUIRED properties:

(1) *User* supplying the comment
(2) Date/timestamp
(3) Type: "owner" or "reviewer"

ii. "Owner" comments associated with a *DMP* SHALL be visible in the *DMPT2* UI only to *Users* holding the "dmp-owner" or "dmp-co-owner" *Roles* with respect to that *DMP*.

(1) Only *Users* holding the "dmp-owner" or "dmp-co-owner" *Roles* SHALL be able to create "owner" comments.

> NOTE   "Owner" comments are intended for private communication between *DMP* owners and co-owners.

iii. "Reviewer" comments associated with a *DMP* SHALL be visible in the *DMPT2* UI only to all *Users* holding the "dmp-owner", "dmp-co-owner", or "institutional-reviewer" *Roles* with respect to the *DMP*.

(1) Only *Users* holding the "dmp-owner", "dmp-co-owner", or "institutional-reviewer" *Roles* SHALL be able to create "to-reviewer" comments.

iv. Comments SHALL NOT be included as part of a *DMP* view or serialization.

f. Award identifier

> NOTE   Typically this would be the award number assigned by an external funder after acceptance of the proposal.

4. A *DMP* SHALL consist of responses to *Requirements*.

    a. A response MUST be supplied by a *User* for all *Requirements* designated as "mandatory".

        The *DMPT2* SHALL programmatically enforce a response to "mandatory" *Requirements*.

    b. A response MAY be supplied by a *User* for all *Requirement* questions designated as "mandatory-if-applicable", "recommended", or "optional".

        NOTE   It is assumed that conditions of applicability are described in the guidance *Resources* associated with "mandatory-if-applicable" *Requirements*. However, it is the sole responsibility of the *User* to determine whether or not those conditions apply. The *DMPT2* has no effective way of determining applicability and will not programmatically enforce a response to "mandatory-if-applicable" *Requirements*.

    c. While text, date, and enumeration response types SHALL be single-valued, numeric responses MAY be double-valued: the numeric value itself and its OPTIONAL unit label.

5. A *DMP* MAY be created, submitted (if an applicable *DMP* or *Resources template* indicates that the *DMP* is subject to formal or informal review), deactivated, and deleted by a *User* holding the "dmp-owner" *Role*; viewed, exported, and commented on by a *User* holding the "dmp-owner", "dmp-co-owner", or "institutional-reviewer" *Role*s (the latter with respect to the *Institutional* affiliation of the owners); and edited and published (so long as it is not in the "submitted" state) by a *User* holding the "dmp-owner" or "dmp-co-owner" *Role*s for the *DMP*.

    a. A new plan MAY be created by copying an existing plan for which the *User* holds the "dmp-owner" or "dmp-co-owner" *Role*s.

        i. Only *DMPs* that are associated with an active *DMP template* can be copied.

    b. During the creation or editing of a plan a *User* SHALL be able to navigate, and respond to, all *Requirements* of the associated *DMP template* in sequential or arbitrary order.

        i. The sequential ordering of the *Requirements* is equivalent to a breadth-first traversal of the hierarchical tree of *Requirement groups* and *Requirements* defined in the *DMP template*.

        ii. Each *Requirement group* and *Requirement* SHALL be presented in the *DMPT2* UI in the context of all active *Resources template Resources* that

are associated with that *Requirement group* or *Requirement*, or are not associated with any *Requirement group* or *Requirement*, provided that at least one of the following criteria is true:

(1) The *Resource template* is associated with an *Institution* associated with the plan's *DMP template*; or

(2) The *Resource template* is associated with the *Institutional* affiliation of the *DMP*'s owner.

> NOTE   For example, an NSF *DMP template* may be associated with an NSF *Resources template* and UIUC and UVa *Resources templates.* A UIUC *User* would see the *Requirements* in the context of the NSF and UIUC templates; the UVa *User*, in the context of the NSF and UVa templates.

(3) The *Resource template* is not associated with any *Institution*.

iii. Each *Requirement* SHALL be presented in the *DMPT2* UI with an indication of its associated obligation: "mandatory", "mandatory-if-applicable", "recommended", or "optional".

iv. Only a single *User* SHALL be permitted to create or edit a response to a given *Requirement* at a given time; that is, simultaneous creation/editing of a response SHALL NOT be permitted.

(1) The *DMPT2* SHALL maintain a write lock on a *Requirement* response from the time of its creation or initiation of editing until the *User* completes the action, either explicitly, by clicking an appropriately labeled button or link, or implicitly, by navigating to another page in the *DMPT2* UI.

(2) A *User* attempting to create or edit a locked *Requirement* response SHALL receive explicit notification that the *Requirement* response is temporarily locked.

> NOTE   A write lock held by a *User* on a particular *Requirement* does not prevent other *Users* from responding simultaneously to other *Requirements.*

c. A *DMP* view SHALL be a dynamically-generated display of the *DMP* within in the context of the *DMPT2* UI.

i. The view SHALL be well-formed and valid XHTML [21].

ii. A *DMP* view SHALL include the following:

(1) *DMP template* name

      (2) *Institutional name* associated with the *DMP template*

      (3) *DMP* name

      (4) Responses

          (a) The layout of the *DMP* responses SHALL follow the hierarchical structure, if any, of the associated *DMP template*.

             (i) *Requirement groups*, if any, SHALL be represented solely by their declarative labels as hierarchical section headings.

          (b) Each *Requirement* response SHALL be displayed in the context of the declarative label of its associated *Requirement*, used as a section heading.

      (5) *DMPT2* branding

      (6) Branding of the *User's Institutional* affiliation

    iii. A *DMP* view MAY include the following:

      (1) Solicitation identifier, if supplied

      (2) Submission deadline, if supplied

        N<small>OTE</small>   OPTIONAL *DMP* comments SHALL NOT be included in a view.

d. A *DMP* export SHALL be a dynamically-generated downloadable file.

    i. The exported file SHALL be serialized in one of the following formats:

      (1) Plain text

      (2) Rich text (RTF) [10]

          (a) The export serialization SHOULD be as close to the layout structure and appearance of the *DMP's* view as is practicable given the constraints of RTF vis-à-vis XHTML.

e. A published *DMP* SHALL be a statically-generated downloadable serialization of the *DMP*.

    i. The published serialization SHALL be serialized in PDF.

    ii. The published serialization SHALL have the same layout structure and appearance as the *DMP's* view.

    iii. The published serialization SHALL be associated with a stable URL that resolves to the static PDF file.

      iv.   Published *DMPs* with "institutional" visibility SHALL be accessible by any *User* sharing the *Institutional* affiliation with any of the *DMP's* owners or co-owners via its stable URL or a browsable list.

      v.   Published *DMPs* with "share" visibility SHALL be accessible by any *User* via its stable URL.

      vi.   Published *DMP*s with "public" visibility SHALL be accessible by any *User* via its stable URL or a public browsable list.

      vii.   The visibility status of a published *DMP* MAY be changed by a *User* holding the "owner" or "co-owner" *Role* with respect to the *DMP*.

   f.   Once submitted for formal review, a *DMP* MAY be rejected or approved by a *User* holding the "institutional-reviewer" *Role* with respect to that *DMP*.

      i.   The *User* rejecting a *DMP* MUST supply an explanatory "reviewer" comment.

         (1)   The *DMPT2* SHALL programmatically enforce the entry of the comment.

   g.   Once submitted for informal review, a *DMP* MAY be commented upon by a *User* holding the "institutional-reviewer" *Role* with respect to that *DMP*.

6.   A deleted *DMP* SHALL be represented by its MANDATORY and OPTIONAL properties, if defined.

   a.   All *Requirement* responses and published serializations SHALL be irretrievably deleted.

7.   The *DMPT2* UI SHALL present a *User* with a browsable list of all *DMPs* for which s/he holds the "dmp-owner", "dmp-co-owner", or "institutional-reviewer" *Roles*.

   a.   The browsable list SHALL display the following *DMP* properties:

      i.   Name
      ii.   *Institution* associated with the *DMP's DMP template*
      iii.   Create date/timestamp
      iv.   Last modification date/timestamp
      v.   *Workflow state*

   b.   The *User* SHALL be able to select the sorting criterion of the browsable list to be any one of the previous properties, specified in ascending or descending alphabetical or temporal order.

8.   The *DMPT2* UI SHALL support both fielded and keyword searching of all *DMPs* for which a

User holds the "institutional-reviewer" *Roles.*

    a. A fielded or keyword search results list SHALL display the following *DMP* properties:

        i. Name
        ii. *Institution* associated with the *DMP's DMP template*
        iii. Create date/timestamp
        iv. Last modification date/timestamp
        v. *Workflow state*

    b. The *User* SHALL be able to select the sorting criterion to be any one of the previous properties, specified in ascending or descending alphabetical or temporal order.

    c. A given fielded search SHALL be restricted to one of the following *DMP* properties:

        i. Name
        ii. *Institution* associated with the *DMP's DMP template*
        iii. Create date/timestamp
        iv. Last modification date/timestamp
        v. *Workflow state*
        vi. Owner/co-owner
        vii. Solicitation identifier
        viii. Reviewer comment
        ix. Responses

    d. A given keyword search SHALL be relative to all of the preceding fields.

4.6 Actions and workflow state

    1. The following *Role*-authorized *Actions* SHALL be supported:

    a. The following *Actions* SHALL be permitted by *Users* holding the "dmp-owner" *Role* with respect to a *DMP*:

        i. Create a new plan (from scratch)
        ii. Create a new plan (by copying an existing plan)
        iii. Submit a plan for formal or informal review

            (1) A submission SHALL be successful only if it contains responses to all "mandatory" *Requirements*; otherwise the submit *Action* MUST fail.

                (a) Notification of failed submission SHALL include references to all "mandatory" *Requirements* for which a

response was not provided.

> NOTE The "submit" *Action* SHALL only be offered by the *DMPT2* UI if formal
> *DMP* review is required by the *DMP* or *Resources template* associated
> with the *DMP*; the *Action* MUST NOT be offered for plans subject to
> informal review.

    iv.   Delete a plan

    v.   Grant the "dmp-co-owner" *Role* to a *User*

b. The following *Actions* SHALL be permitted by *Users* holding the "dmp-owner" or "dmp-co-owner" *Roles* with respect to a *DMP*:

    i.   Edit a plan

    ii. Export a plan

    iii. Publish a plan

c. The following *Actions* SHALL be permitted by *Users* holding the "dmp-owner", "dmp-co-owner", or "institutional-reviewer" *Roles* with respect to a *DMP*:

    i.   View a plan

    ii. Comment on a plan

b. The following *Actions* SHALL be permitted by *Users* holding the "institutional-reviewer" *Role* with respect to the *Institution* associated with the *DMP's DMP* or *Resources template*:

    i.   Reject a formally submitted plan

    ii. Accept a formally submitted plan

    iii. Review an informally submitted plan

2. The following *Actions* SHALL be permitted to any unauthenticated, unauthorized *User*:

    a. View a published plan with "public" visibility.

    b. Download a published plan with "public" visibility.

3. The state of a *DMP* SHALL transition as a consequence of certain *User*-initiated *Actions*, as defined in Table 1.

State \ Action	Create	Edit	Commit	Submit-formally	Submit-informally	Approve	Reject	Review	Delete
	New								
New		New	Committed		Submitted				Deleted
Committed		Revised		Submitted	Submitted				Deleted
Submitted						Approved	Rejected	Reviewed	
Approved		Revised	Committed						Deleted
Rejected		Revised							Deleted
Reviewed		Revised	Committed						Deleted
Revised		Revised	Committed		Submitted				Deleted
Deleted									

Table 1 – *DMPT2* state transitions

- NOTE   Other *DMPT2 Actions*, such as "view", "export", or "publish" are not included in Table 1 as they do not affect *DMP* state.

4. *Actions* underlying state transitions not defined in Table 1 SHALL NOT be permitted.

5. A state transition SHALL be associated with two REQUIRED properties:

    a. *User* initiating the *Action* underlying the transition
    b. Date/timestamp of the transition

6. A transition to a different state SHALL be accompanied by email notification to all *Users* holding the "dmp-owner" or "dmp-co-owner" *Role*s for the *DMP* except for the *User* initiating the *Action* underlying the transition.

7. A state transition MAY be accompanied by email notification to *Users* designated to received such notifications in either the *DMP template* or *Resource templates* associated with the *DMP*.

4.7   Notifications

1. The *DMPT2* SHALL, subject to *User* preferences OPTIONALLY set for the *Actions* marked with an asterisk "*", below, automatically send out descriptive email notifications to the following categories of *Users* as a consequence of the specific conditions.

    NOTE   Notification preferences can only be set for those *Actions* marked with an asterisk; notifications will always be sent for unmarked *Actions*.

    a. To *Users* whenever:

        i. The *User* account is deactivated.

        ii. A new "dmp-co-owner", "requirements-editor", "resource-editor", "institutional-review", "institutional-administrator" or "dmp-administrator" *Role* is granted or revoked.

b. To *DMP* owners and co-owners whenever:

    i. A new "owner" comment is added to the *DMP* *

    ii. A new "reviewer" comment is added to the *DMP*

    iii. A *DMP* is committed *

    iv. A *DMP* is published *

    v. A submitted *DMP* is approved, rejected, or reviewed

c. To *DMP* co-owners whenever:

    i. A *DMP* is submitted formally or informally *

    ii. A *DMP* is deleted *

    iii. A new co-owner is added to a *DMP* *

d. To *Requirements editors* whenever:

    i. An *Institutional DMP template* is:

        (1) Committed *

        (2) Deactivated *

        (3) Deleted *

e. To *Resources editors* whenever:

    i. An *Institutional Resources template* is:

        (1) Committed *

        (2) Deactivated *

        (3) Deleted *

    ii. A *DMP template* associated with an *Institutional Resources template* is committed.

f. To *Institutional reviewers* whenever:

    i. An *Institutional DMP* is submitted formally or informally

        NOTE   The notification SHALL indicate whether or not the *DMP* is submitted for a formal or informal review.

    ii. A new "reviewer" comment is added to an *Institutional DMP*

    iii. An *Institutional DMP* is approved, rejected, or reviewed *

g. To *Institutional administrators* whenever:

    i. An *Institutional DMP* is submitted *

    ii. An *Institutional DMP* is approved *

    iii. An *Institutional DMP* is rejected *

iv. An *Institutional DMP* is deactivated *

v. An *Institutional DMP* is deleted *

2. A *User* MAY set his/her preferences regarding whether or not to receive specific notifications for the *Actions* indicated by an asterisk "*", above.

3. Email notification SHOULD be suppressed to the *User* effectuating the notification condition even though s/he is a member of the necessary category.

4.8 User interface

1. All *DMPT2* UI pages SHALL provide access to the following information:

   a. *DMPT2* branding
   b. *Institutional* branding, following successful authentication
   c. Terms of use
   d. "About" information for the *DMPT2* and *DMPT2* partners
   e. Privacy policy
   f. Help

2. All *DMPT2* UI pages SHALL provide an opportunity for the following *Actions*:

   a. Contact

      i. *DMPT2* administrator (if not authenticated)
      ii. *Institutional* administrator (if authenticated)

   b. Authenticate

3. The *DMPT2* UI SHALL provide the following pages:

   a. *DMPT2* home page

      i. The *DMPT2* home page SHALL be accessible to all *Users*, independent of authentication or authorization; i.e., it is a public page.

      ii. The *DMPT2* home page SHALL provide access to the following information:

         (1) *DMPT2* blog feed
         (2) List of published "public" *DMPs*, organized by:

            (a) Owner/co-owner *Institutional* affiliation
            (b) *Institution* associated with the *DMPs' DMP templates*

   b. *User* home page

      i. The *User* home page SHALL be accessible to a *User* following successful

authentication.

        (1) The home page also SHALL be accessible to a *User* holding the "institutional-administrator" *Role* with respect to the home page *User's Institutional* affiliation.

ii. A *User* home page SHALL provide access to the following information:

        (1) A list of "My plans"; that is, actionable links to the home pages for *DMPs* for which the *User* holds the "DMP owner" or "DMP co-owner" *Role*.

        (2) A list of "My institution's plans"; that is, actionable links to the home pages for published *DMPs* with with the *User's Institutional* affiliation and *Institutional* visibility associated.

        (3) A list of "Plans to review"; that is, actionable links to the home pages for reviewable *DMPs* in the "submitted" state associated with the *User's Institutional* affiliation (if the *User* holds the "institutional-reviewer" *Role*).

            (a) This list SHOULD provide an indication of whether or not the *DMPs* were submitted for formal or informal review.

        (4) A list of "My requirements templates"; that is, actionable links to the home pages for templates for which the *User* holds the "requirements-editor" *Role*.

        (5) A list of "My resources templates"; that is, actionable links to the home pages for templates for which the *User* holds the "resources-editor" *Role*.

        (6) Notification preferences, if the *User* holds the "institutional-administrator" *Role.*

iii. These *DMP* lists SHALL include the following summary information:

        (1) *DMP* name (up to a fixed limit of characters)

            (a) The *DMP* name SHALL be an actionable link resolving to the *DMP's* landing page.

        (2) *DMP* last modification date
        (3) *DMP workflow status*

iv. Any of the summary information fields MAY be selected as the list's ordering criteria, in ascending or descending alphabetical or temporal

order.

       (1) The default ordering criteria is the *DMP* name, in ascending alphabetical order.

   v. A *User* home page SHALL provide access to the following information:

  vi. A *User* home page SHALL provide access to the following information:

       (1) A list of "My institution"; that is, the *Institution* for which the *User* holds the "institutional-administrator" *Role*.

 vii. A *User* home page SHALL provide an opportunity for the following *Actions*:

       (1) Create new *DMP*.

          (a) From scratch
          (b) By copying an existing *DMP*

       (2) Create new *DMP template* (if the *User* holds the "requirements-editor" or "institutional-administrator" *Role*).

          (a) From scratch
          (b) By copying an existing template

       (3) Create new *Resources template* (if the *User* holds the "resources-editor" or "institutional-administrator" *Role*.

       (4) Grant the "requirements-editor" *Role* to a *User* (if the granting *User* holds the "requirements-editor", "resources-editor", "institutional-administrator", or "dmp-administrator" *Role*).

       (5) Grant the "resources-editor" *Role* to a *User* (if the granting *User* holds the "requirements-editor", "resources-editor", "institutional-administrator", or "dmp-administrator" *Role*).

       (6) Grant the "institutional-reviewer" *Role* to a *User* (if the granting *User* holds the "institutional-reviewer", "institutional-administrator", or "dmp-administrator" *Role*).

       (7) Grant the "institutional-administrator" *Role* to a *User* (if the granting *User* holds the "institutional-administrator" or "dmp-administrator" *Role*).

  c. *Institution* home page

i. An *Institution* home page SHALL be accessible to a *User* holding the "institutional-administrator" *Role* following successful authentication.

ii. The *Institution* home page SHALL provide access to the following information:

(1) All REQUIRED and defined OPTIONAL *Institution* properties (see Sections § 4.2.1 and 2).

iii. The *Institution* home page SHALL provide an opportunity for the following *Actions*:

(1) Add, edit, and delete any REQUIRED or OPTIONAL property.

d. *DMP home page*

i. A *DMP* home page SHALL be accessible to:

(1) *Users* holding the "dmp-owner" or "dmp-co-owner" *Roles* with respect to the *DMP*; and

(2) *Users* holding the "institutional-reviewer" *Role* with respect to the *DMP* if the *DMP* is in the "submitted" state.

(3) *Users* holding the "institutional-administrator" *Role* with respect to the *Institutional* affiliation of any of the *DMP*'s owner or co-owners.

ii. A *DMP* home page SHALL provide access to the following information:

(1) Summary *DMP* information:

(a) *DMP template* name
(b) *Institutional* name associated with the *DMP template*
(c) *DMP n*ame
(d) Creation date/timestamp
(e) Modification date/timestamp

(2) List of comments
(3) List of published versions
(4) Full *workflow state* history

iii. A *DMP* home page SHALL provide an opportunity for the following *Actions*, subject to appropriate *Role*-based authorization:

(1) Grant the "dmp-co-owner" *Role* (if the *User* holds the "dmp-owner" *Role*)

(2) Edit (if the *User* olds the "dmp-owner", "dmp-co-owner", or

"institutional-administrator" *Role*)

    (3) Comment (if the *User* holds the "dmp-owner", "dmp-co-owner", "institutional-reviewer", or "institutional-administrator" *Role*)

        (a) Owner

        (b) Reviewer

    (4) View as XHTML (if the *User* holds the "dmp-owner", "dmp-co-owner", "institutional-reviewer", or "institutional-administrator" *Role*)

        (a) Print

            (i) Initiating the "print" *Action* takes the *User* to the *DMP's* view page.

    (5) Export (if the *User* holds the "dmp-owner", "dmp-co-owner", "institutional-reviewer", or "institutional-administrator" *Role*)

        (a) As plain text

        (b) As rich text (RTF)

    (6) Publish as PDF (if the *User* holds the "dmp-owner", "dom-co-owner", or "institutional-administrator" *Role*)

        (a) With "institution" visibility

        (b) With "public" visibility

    (7) Submit (if the *User* holds the "dmp-owner" or "institutional-administrator" *Role*)

    (8) Delete (if the *User* holds the "dmp-owner" or "institutional-administrator" *Role*)

  e. *DMP* view page

    i. A *DMP* view page is accessible to:

      (1) *Users* holding the "dmp-owner" or "dmp-co-owner" *Roles* with respect to the *DMP*; and

      (2) *Users* holding the "institutional-reviewer" *Role* with respect to the *DMP* if the *DMP* is in the "submitted" (for formal review) or "committed" (for informal review) state.

      (3) *Users* holding the "institutional-administrator" *Role* with respect to the *Institutional* affiliation of any of the *DMP'*s owner or co-owners.

ii. A *DMP* view page SHALL provide access to the following information:

    (1) HTML formatted display of the *DMP*

iii. A *DMP* view page SHALL provide an opportunity for the following *Actions*:

    (1) Print

f. *DMP template* home page

    i. The *DMP template* home page is accessible to *Users* holding the "requirements-editor" or "institutional-administrator" *Role* with respect to the template.

    ii. The *DMP template* home page SHALL provide access to the following information:

        (1) Name
        (2) Version
        (3) Creation date/timestamp
        (4) Last modification date/timestamp

    iii. The *DMP template* home page SHALL provide an opportunity for the following *Actions*:

        (1) Edit
        (2) Delete

g. *Resources template* home page

    i. The *Resources template* home page is accessible to *Users* holding the "requirements-editor" or "institutional-administrator" *Role* with respect to the template.

    ii. The *Resources template* home page SHALL provide access to the following information:

        (1) Name
        (2) Creation date/timestamp
        (3) Last modification date/timestamp
        (4) List of *DMP templates* with which the *Resources template* is associated

    iii. The *Resources template* home page SHALL provide an opportunity for the following *Actions*

        (1) Edit
        (2) Delete

5 Non-functional requirements

The *DMPT2* SHALL conform to the following non-functional requirements.

1. The *DMPT2* SHALL be available for use at the URL <http://dmptool.org/>.

   a. This URL SHALL be the base URL for all URLs visible in the *User's* browser's address bar, hyperlink mouse-over displays, and internal HTML page links, regardless of the underlying hosting server domain or virtual host name.

   b. The *DMPT2* MAY be available for local use at a URL specific to a particular *Institution*, of the general form <http://dmptool.*institution*.*tld*>.

2. The *DMPT2* UI SHOULD conform to the Section 508 (29 USC '794 d) [5] and W3C web content accessibility guidelines (WACG) 2.0 level AA [2].

3. *DMPT2* UI accessibility and usability testing SHOULD be performed with respect to the following web browsers:

   a. Chrome,   version 26.0 or newer
   b. Firefox,   version 20.0 or newer
   c. Internet Explorer, version 7.0 or newer
   d. Opera,   version 12.00 or newer
   e. Safari,   version 6.0 or newer

   Note   The specific browser versions were selected as the oldest supported stable release.

4. The *DMPT2* SHOULD maintain sub-second response time for all *Actions* regardless of the following assumed scaling limits:

   a.   100s of *Institutions*
   b.   100s of *DMP templates*
   c.   1,000s of *Resource templates*
   d. 10,000s of *Users*
   e. 100,000s of *DMPs*

References

[1]   Bradner, S., *Key words for use in RFCs to Indicate Requirements Levels*, RFC 2119, BCP 14, March 1997 <http://www.ietf.org/rfc/rfc2119.txt>.

[2]   Caldwell, Ben, Michael Cooper, Loretta Guarino Reid, and Gregg Vanderheiden, *Web Content Accessibility Guidelines (WCAG) 2.0*, W3C Recommendation, December 11, 2008 <http://www.w3.org/TR/WCAG20/>.

[3]   Caceres, Marcos, ed., *Widgets 1.0: The Widget Landscape (Q1 2008)*, April 14, 2008 <http://www.w3.org/TR/widgets-land/ >.

[4]   Digital Curation Centre, *DMP Online* <http://dmponline.dcc.ac.uk/>.

[5]   General Services Administration, *Resources for Understanding and Implementing Section 508* <https://www.section508.gov/index.cfm?fuseAction=stdsdoc#Web>.

[6]   Getler, Magdalena, Sarah Jones, Kerry Miller, and Diana Sisu, *DMP Online: Evaluation Report*, December 17, 2002.

[7]   InCommon, *InCommon: Security, Privacy and Trust for the Research and Education Community* <http://www.incommon.org/>.

[8]   Integrated Earth Data Applications, *Data Management Plan Tool v. 2* <http://www.iedadata.org/compliance/plan>.

[9]   ISO 3200-1:2008, *Document management – Portable document format – Part 1: PDF 1.7*, July 1, 2008 <http://ww.adobe.com/content/dam/Adobe/en/devnet/pdf/pdfs/ PDF32000_2008.pdf>.

[10]   Microsoft, *Word 2007: Rich Text Format (RTF) Specification, version 1.9.1*, March 20, 2008 <http://www.microsoft.com/en-us/download/details.aspx?id=10725>.

[11]   Office of Science and Technology Policy, *Memorandum for the Heads of Executive Departments and Agencies*, February 22, 2013 <http://www.whitehouse.gov/sites/ default/files/microsites/ostp/ostp_public_access_memo_2013.pdf>.

[12]   Orchid, *About ORCID: Connecting Research and Researchers* <http://orcid.org/>.

[13]   Sandu, Ravi S., Edward J. Coyne, Hal L. Feinstein, and Charles E. Youman, "Role-based access control," *IEEE Computer* 29:2 (February 1996): 38-47 <http://csrc.nist.gov/rbac/sandhu96.pdf>.

[14]   Shibboleth Consortium, *Shibboleth – Home* <http://shibboleth.net/>.

[15]   Smithsonian Institution, *DMPTool –> DAMP: Requirements*, version 0.3, draft – 20 July 2012.

[16]   UC Curation Center, *Data Management Plan Tool* <http://dmptool.org/>.

[17]   UC Curation Center, *DMP Tool Editor Requirements*, March 19, 2012

<https://wiki.ucop.edu/download/attachments/150503448/editor_requirements_Mar19 _rev.docx>.

[18]   UC Curation Center, *DMPTool2 Use Cases* <https://docs.google.com/document/d/ 1iHRJ7CutvqyDGzK1NAQkgTMzk5L1BRFlO8K5WhB4Es4>.

[19]   UC Curation Center, *Home – Data Management Plan online* <https://wiki.ucop.edu/display/DMPo/Home>.

[20]   University of Houston, *Data Management – UH Libraries* <http://info.lib.uh.edu/services/data-management-support>.

[21]   W3C, *XHTML 1.0 The Extensible HyperText Markup Language (Second Edition): A Reformulation of HTML 4 in XML 1.0*, W3C Recommendation, August 1, 2002 <http://www.w3.org/TR/xhtml1>.