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DR POWER

Data Repository for Power system Open models With Evolving Resources

Stephen Elbert, Mark Rice, Olga Kuchar, Laurentiu Marinovici

FERC Technical Conference: Increasing Real-Time and Day-Ahead Market Efficiency through Improved Software
Washington, DC, June 26-28, 2017

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Project Summary

- Provide open-access power grid datasets and the capability to uniquely review, annotate, and curate submitted datasets
- Ensure sustainable model and dataset dissemination and evolution through user-defined dataset creation and validation
- Integrate and extend NRECA's success with Open Modeling Framework (OMF) to include transmission modeling

Collaboratively evolving high-fidelity power system models

Steering Committee

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Type of Organization	Member	Institution
Academic	Daniel Kirschen	U. Washington
Academic	Warren Powell	Princeton University
Academic	Andy Sun	Georgia Tech
Government	Richard O'Neill	FERC
Industry	Yonghong Chen	MISO
Industry	Mani Vadari	Modern Grid Solution
Non-PNNL FFRDC	Jean-Paul Watson	Sandia National Laboratory

Curation Working Group

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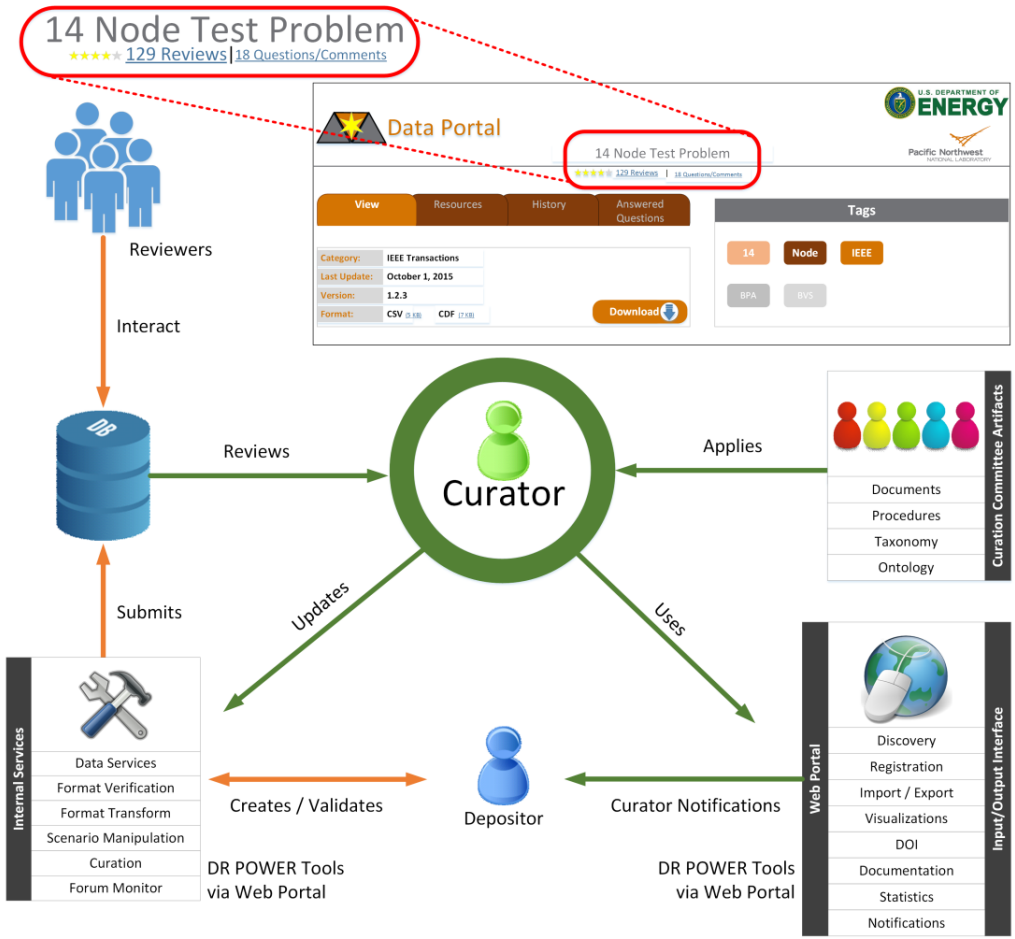
Institution	Member	Expertise
NREL	Bryan Palmintier	GRID DATA Project
U. Michigan	Pascal Van Hentenryck	GRID DATA Project
UIUC	Gabriel Weaver	Model evolution
Furman University	Christopher Blackwell	Multi-versioned data sets with attributes
PNNL	Ruisheng Diao	GRID DATA Project
PNNL	Justin Day	Research Librarian

- Topics
  - Metadata
  - File formatting
  - File versioning
  - Automation tools
  - DOI workflow
- Initial discussions on
  - Automation vs. human-in-the-loop
  - Tools for curation
- Curation specifications drafted

Active Curation



- Based on Digital Curation Center Lifecycle Model
- Curators will review uploaded models
- Curators will help guide model creation
- Community participation in reviews, questions, comments, etc.

Web Portal Version 1.5 (Current)

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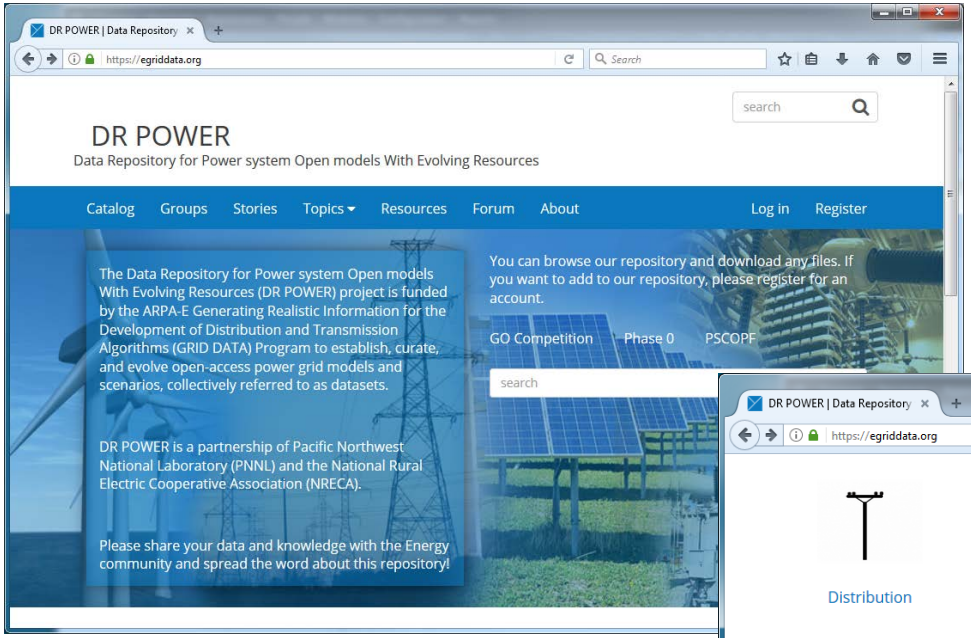
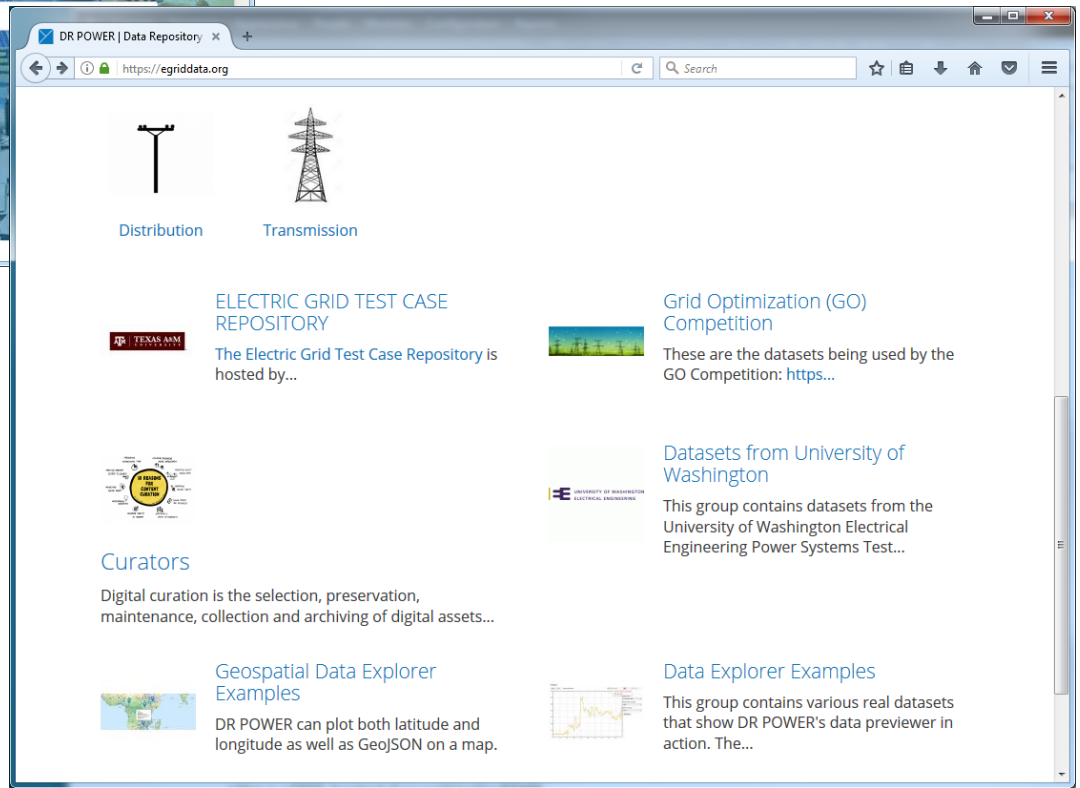
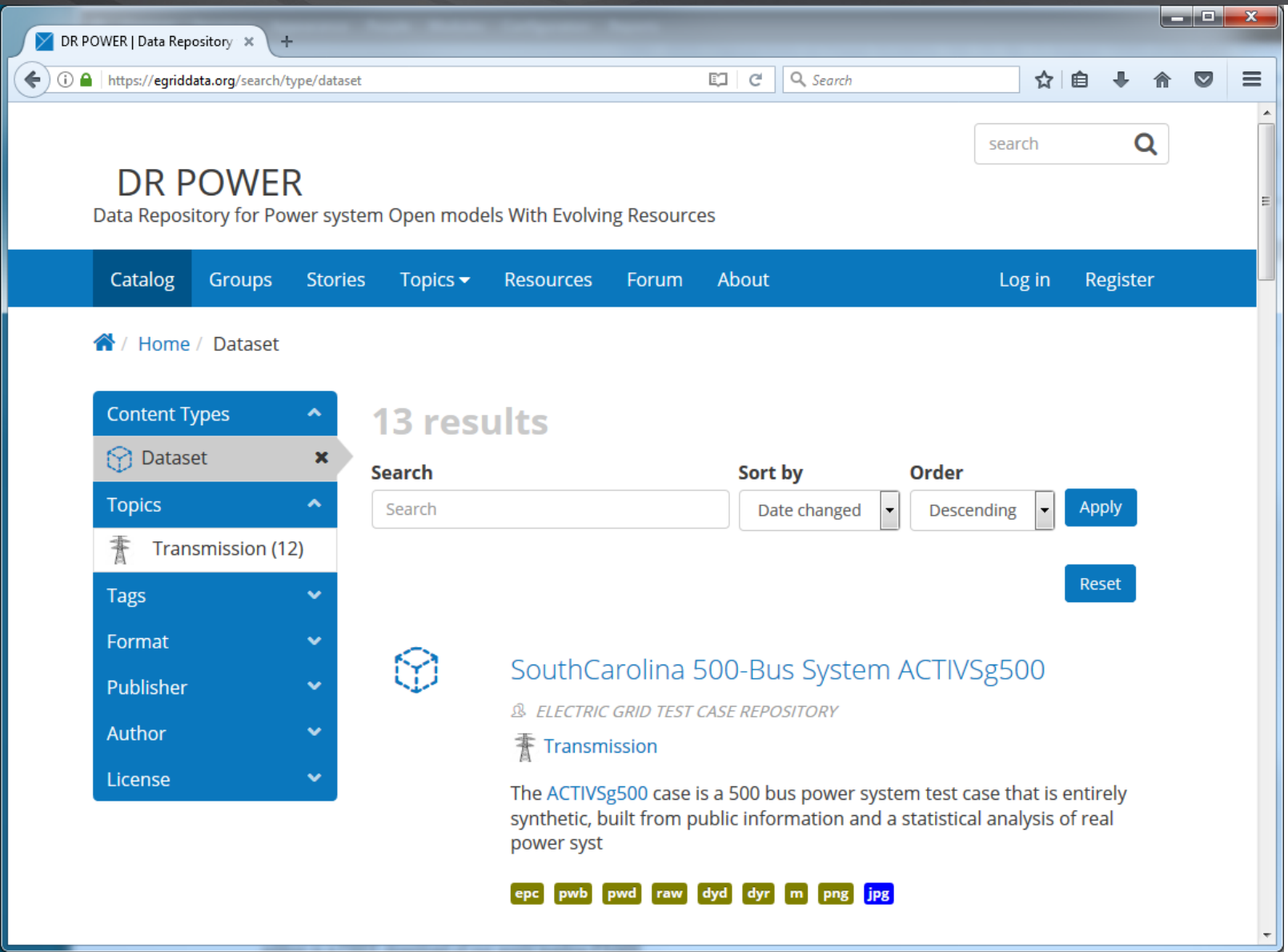
- https://egriddata.org/ deployed with following capabilities:
  - Register users
  - Upload/download datasets
  - Basic search
  - Assign/Update DOI (currently using testing harness; full process but not registered)
  - Extend tagging dictionary
    - Community engagement in curation process
  - Created Curator role for assignment to users
  - Created Curator group and membership process
  - Request conversions of files
  - Site Analytics
- Populating in progress

Home page: https://egriddata.org/





Catalog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13 results
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Sort by
Order
Search
Date changed
Descending
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SouthCarolina 500-Bus System ACTIVSg500
ELECTRIC GRID TEST CASE REPOSITORY
Transmission
The ACTIVSg500 case is a 500 bus power system test case that is entirely synthetic, built from public information and a statistical analysis of real power syst
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Groups

ELECTRIC GRID TEST CASE REPOSITORY

The Electric Grid Test Case Repository is hosted by

4 datasets

Grid Optimization (GO) Competition

These are the datasets being used by the GO Competition:

https://gocompetition.energy.gov/

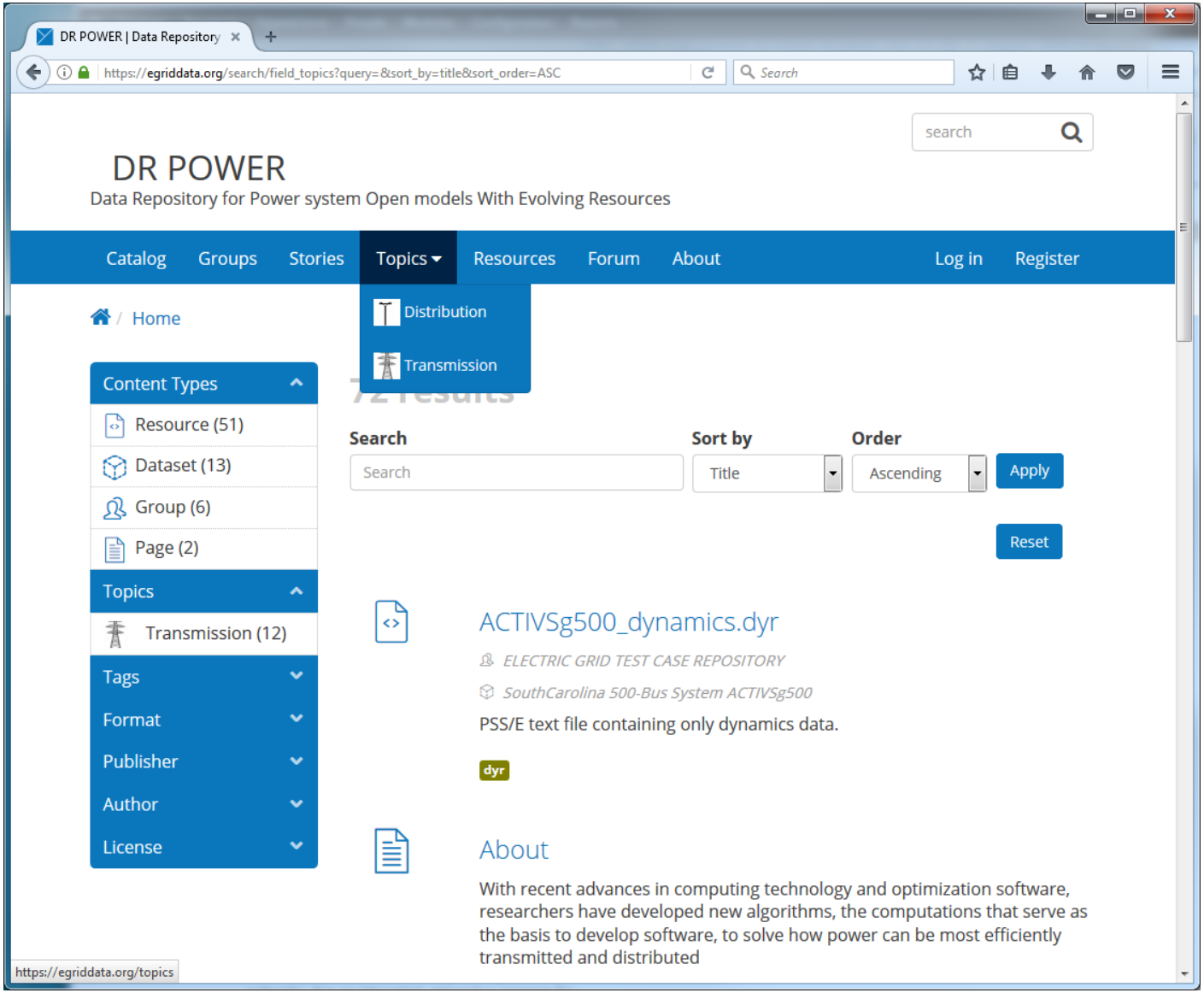
6 datasets

Curators

Digital curation is the selection, preservation, maintenance, collection and archiving of digital assets.

0 datasets

Topics (all)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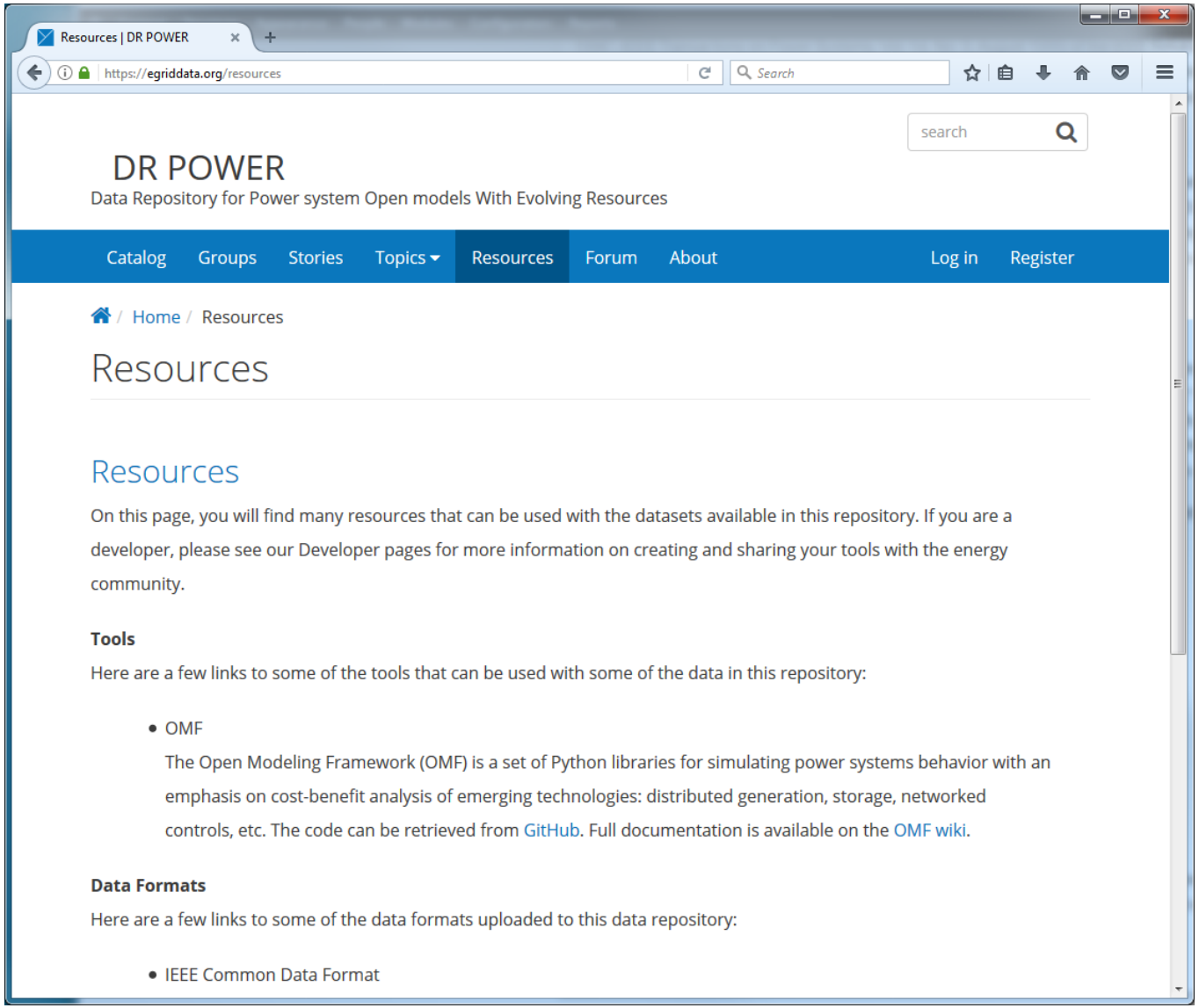
ACTIVSg500_dynamics.dyr
ELECTRIC GRID TEST CASE REPOSITORY
SouthCarolina 500-Bus System ACTIVSg500
PSS/E text file containing only dynamics data.
dyr
About
With recent advances in computing technology and optimization software, researchers have developed new algorithms, the computations that serve as the basis to develop software, to solve how power can be most efficiently transmitted and distributed
https://egriddata.org/topics

Resources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Resources
On this page, you will find many resources that can be used with the datasets available in this repository. If you are a developer, please see our Developer pages for more information on creating and sharing your tools with the energy community.
Tools
Here are a few links to some of the tools that can be used with some of the data in this repository:
OMF
The Open Modeling Framework (OMF) is a set of Python libraries for simulating power systems behavior with an emphasis on cost-benefit analysis of emerging technologies: distributed generation, storage, networked controls, etc. The code can be retrieved from GitHub. Full documentation is available on the OMF wiki.
Data Formats
Here are a few links to some of the data formats uploaded to this data repository:
IEEE Common Data Format

Forum

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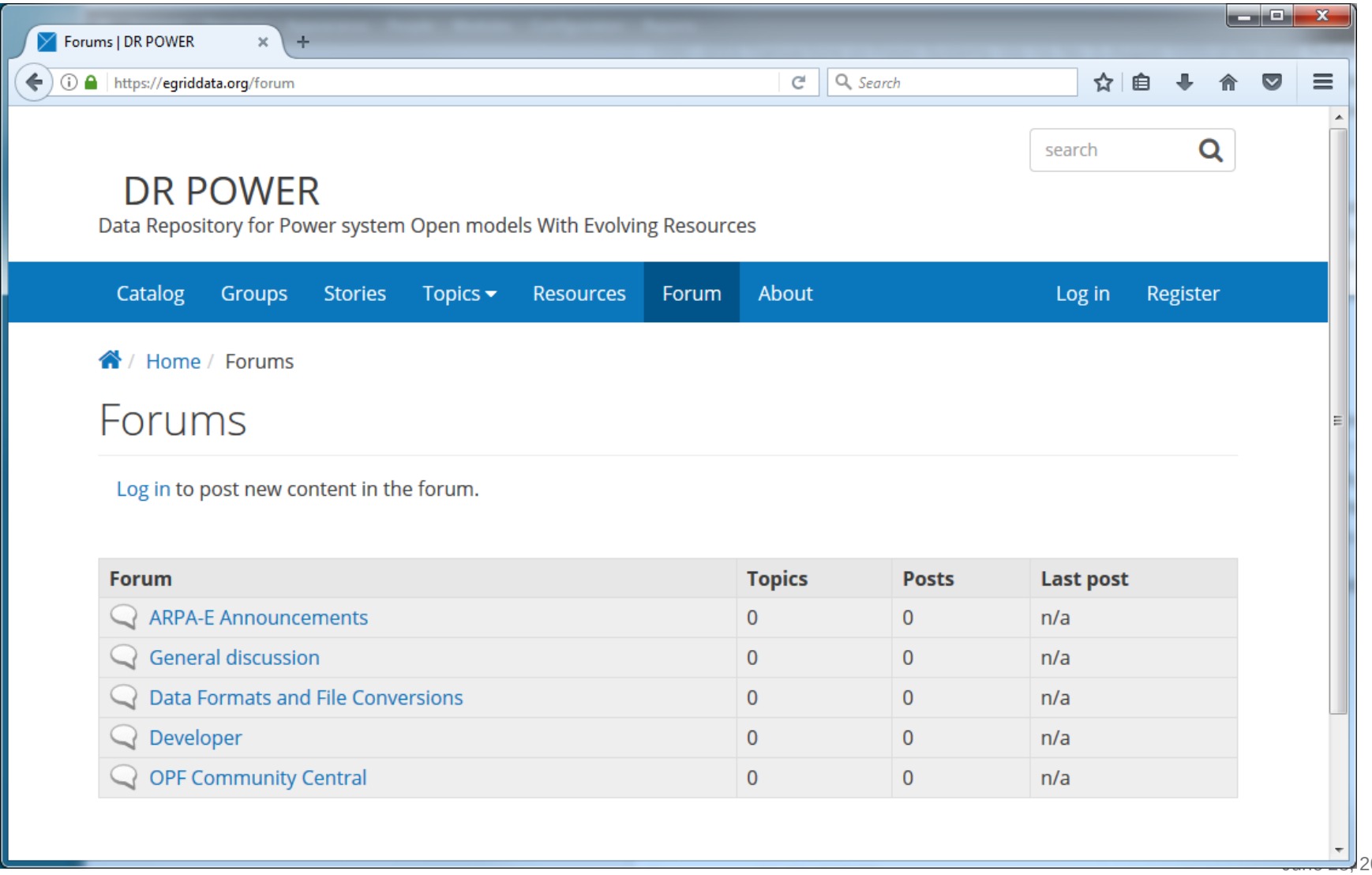

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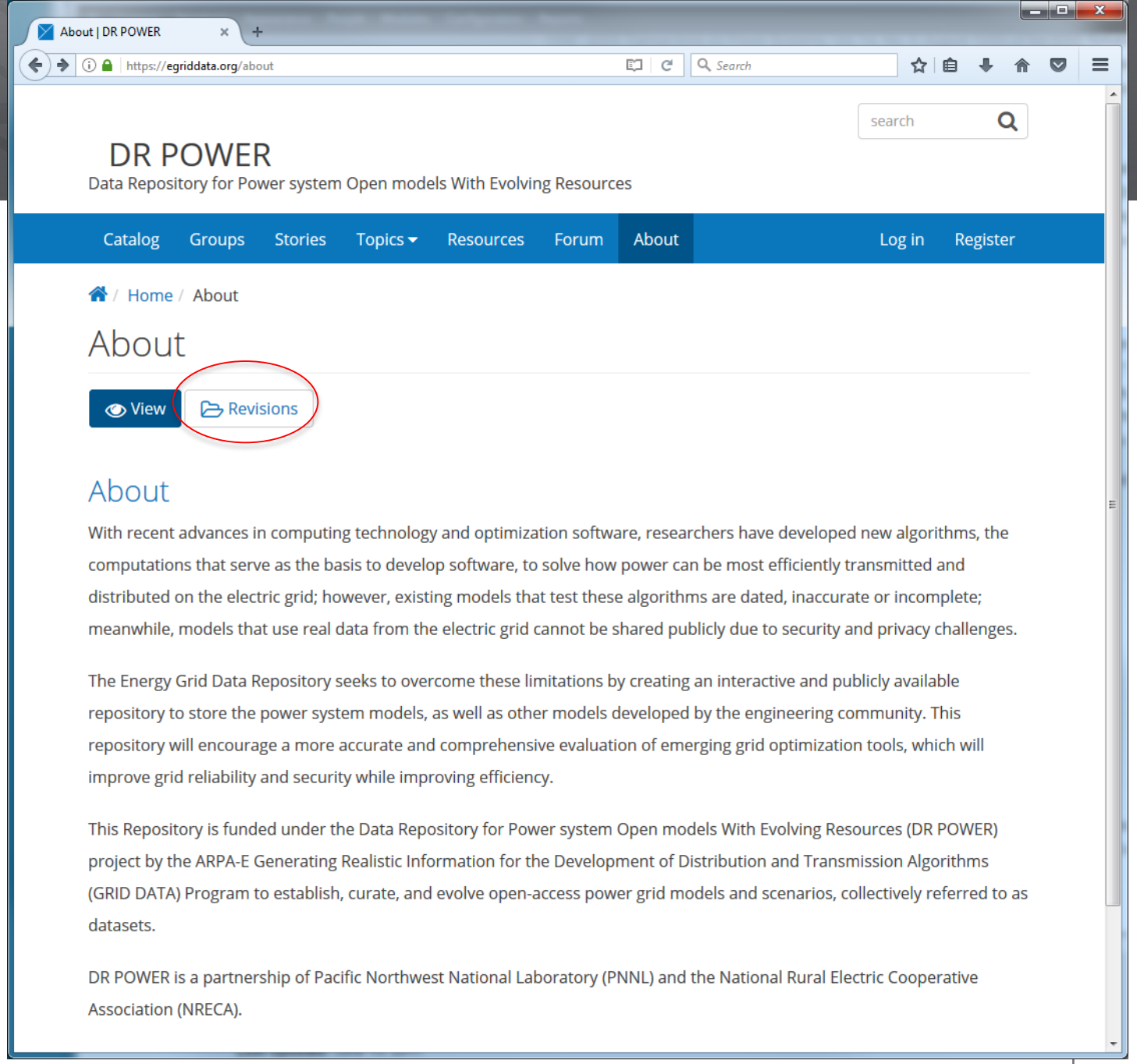
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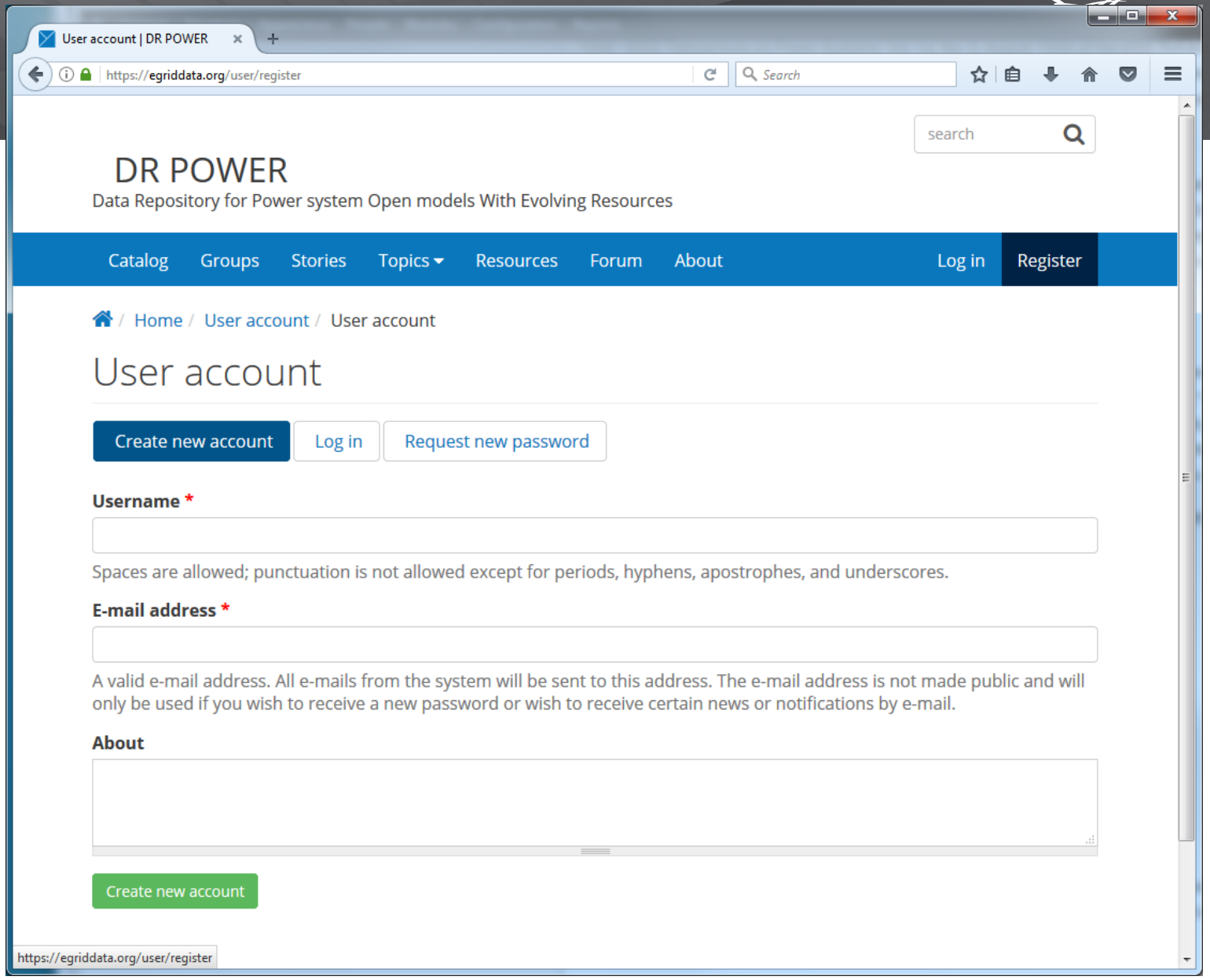
With recent advances in computing technology and optimization software, researchers have developed new algorithms, the computations that serve as the basis to develop software, to solve how power can be most efficiently transmitted and distributed on the electric grid; however, existing models that test these algorithms are dated, inaccurate or incomplete; meanwhile, models that use real data from the electric grid cannot be shared publicly due to security and privacy challenges.
The Energy Grid Data Repository seeks to overcome these limitations by creating an interactive and publicly available repository to store the power system models, as well as other models developed by the engineering community. This repository will encourage a more accurate and comprehensive evaluation of emerging grid optimization tools, which will improve grid reliability and security while improving efficiency.
This Repository is funded under the Data Repository for Power system Open models With Evolving Resources (DR POWER) project by the ARPA-E Generating Realistic Information for the Development of Distribution and Transmission Algorithms (GRID DATA) Program to establish, curate, and evolve open-access power grid models and scenarios, collectively referred to as datasets.
DR POWER is a partnership of Pacific Northwest National Laboratory (PNNL) and the National Rural Electric Cooperative Association (NRECA).

Register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Spaces are allowed; punctuation is not allowed except for periods, hyphens, apostrophes, and underscores.
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A valid e-mail address. All e-mails from the system will be sent to this address. The e-mail address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by e-mail.
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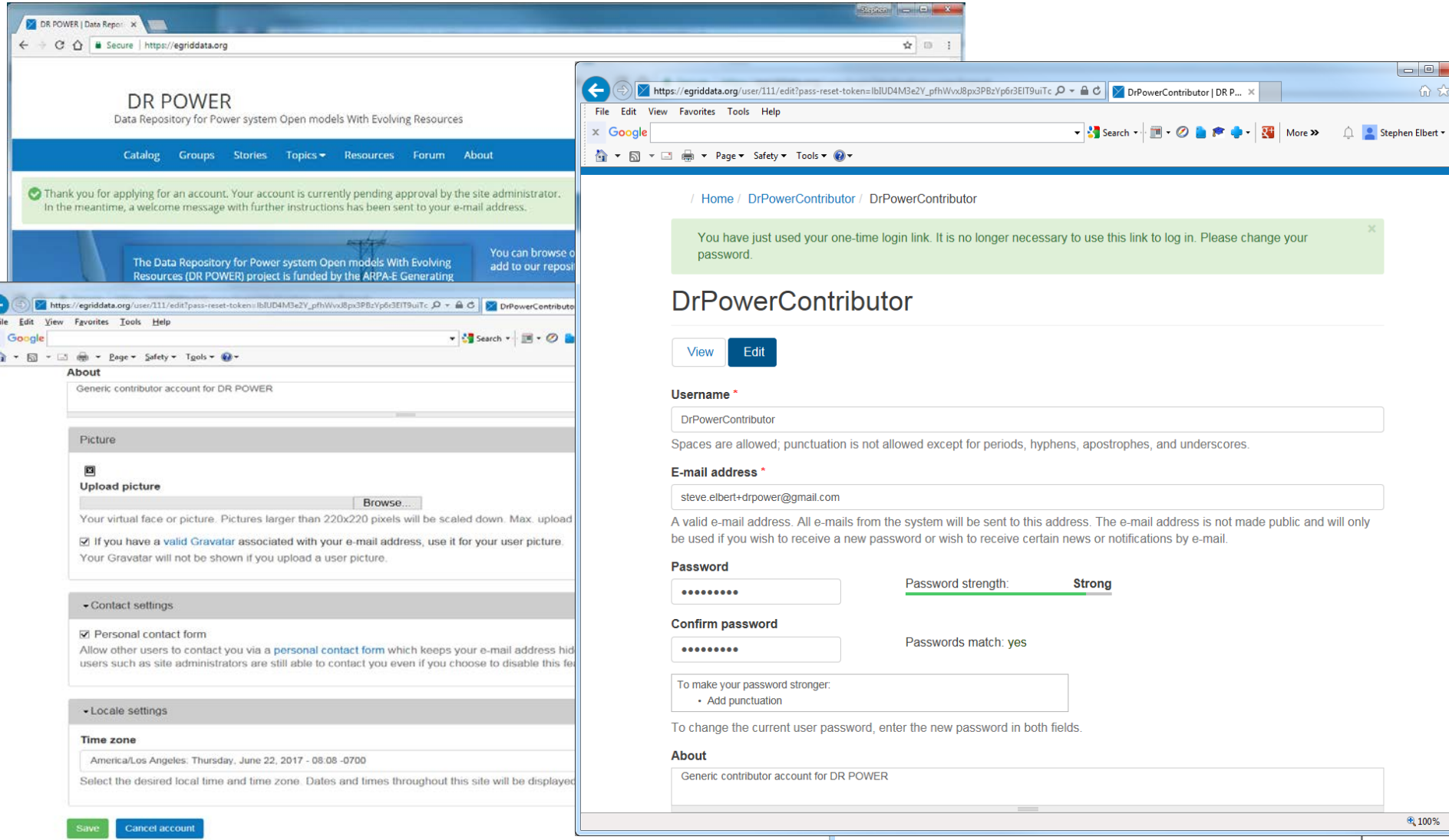

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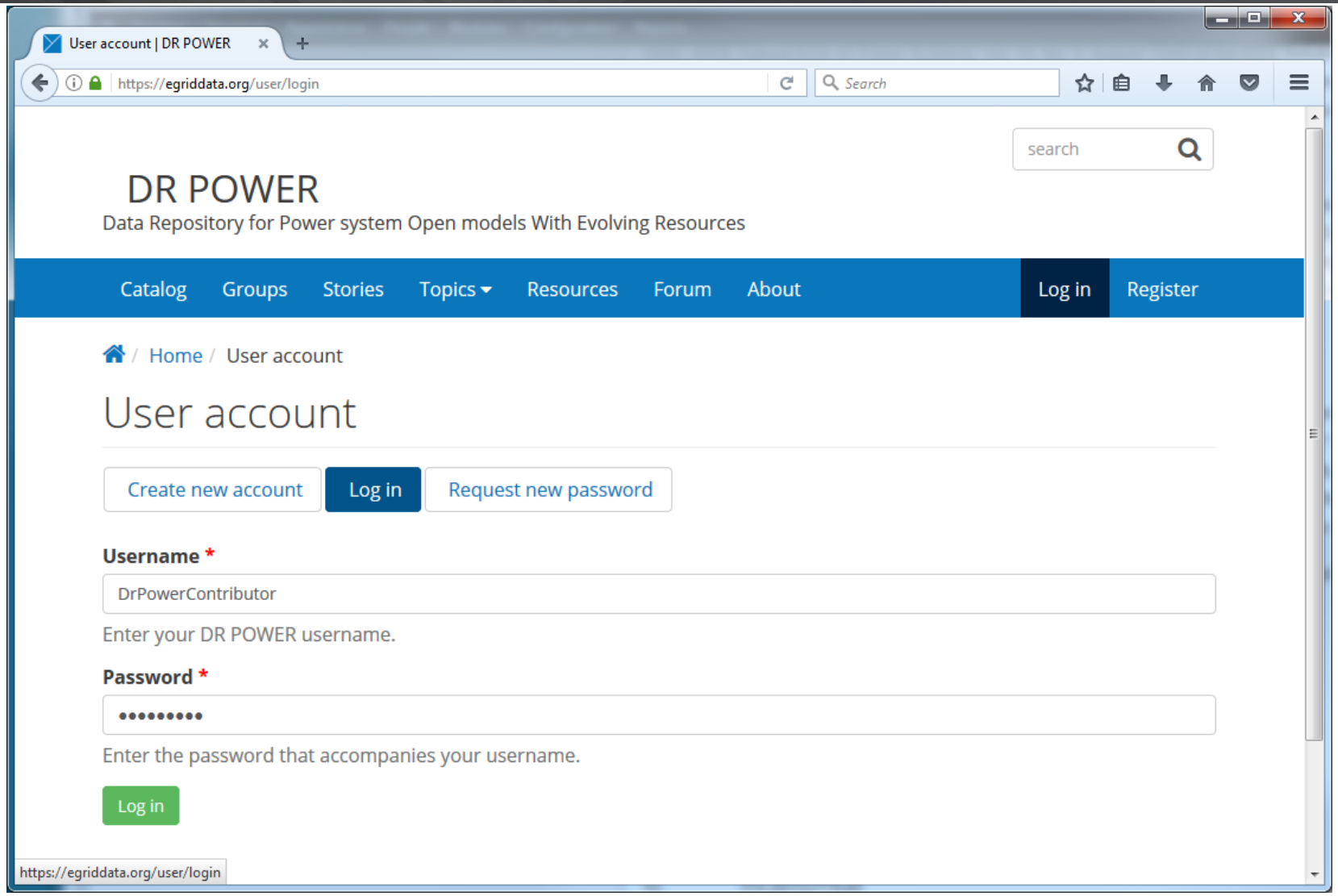
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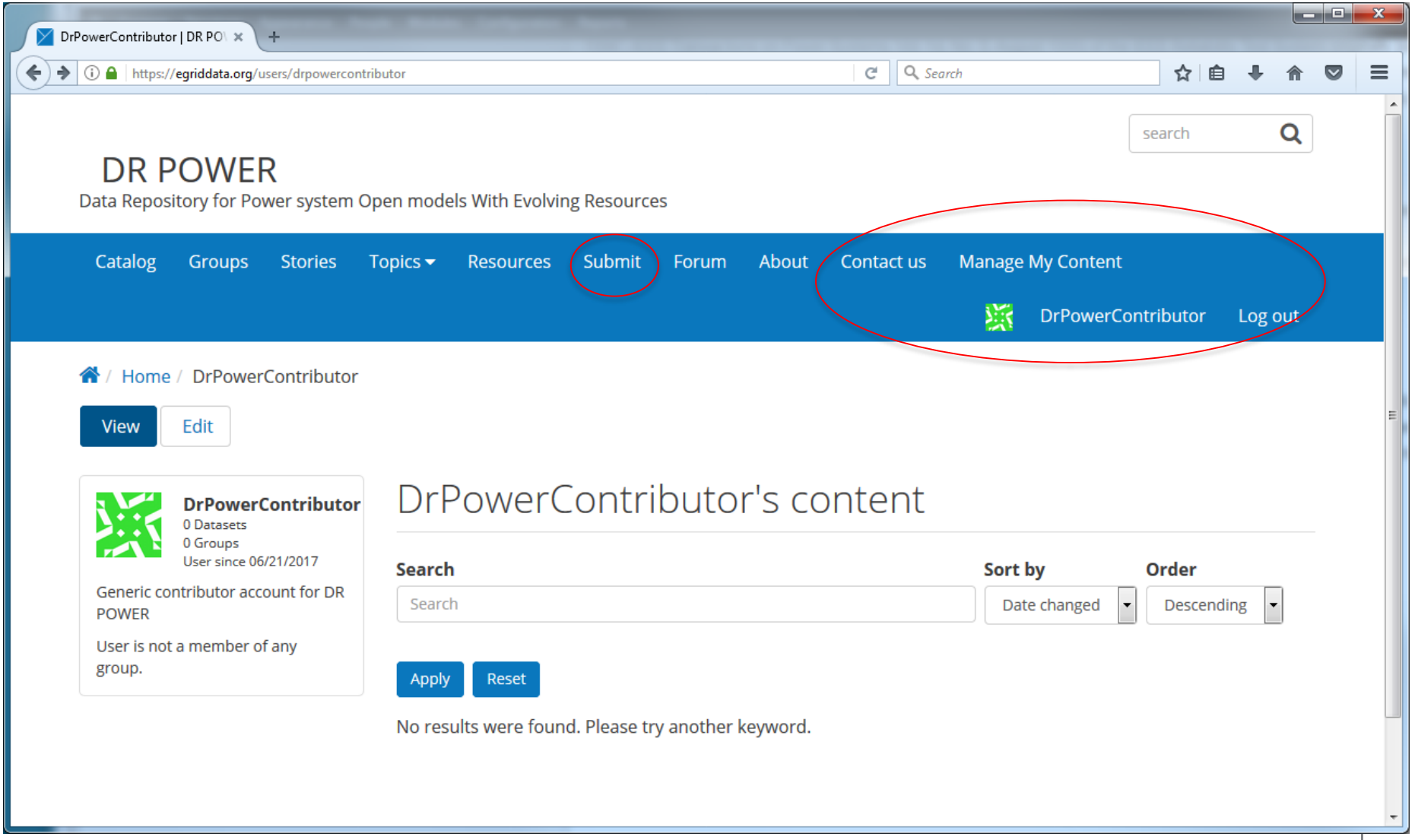
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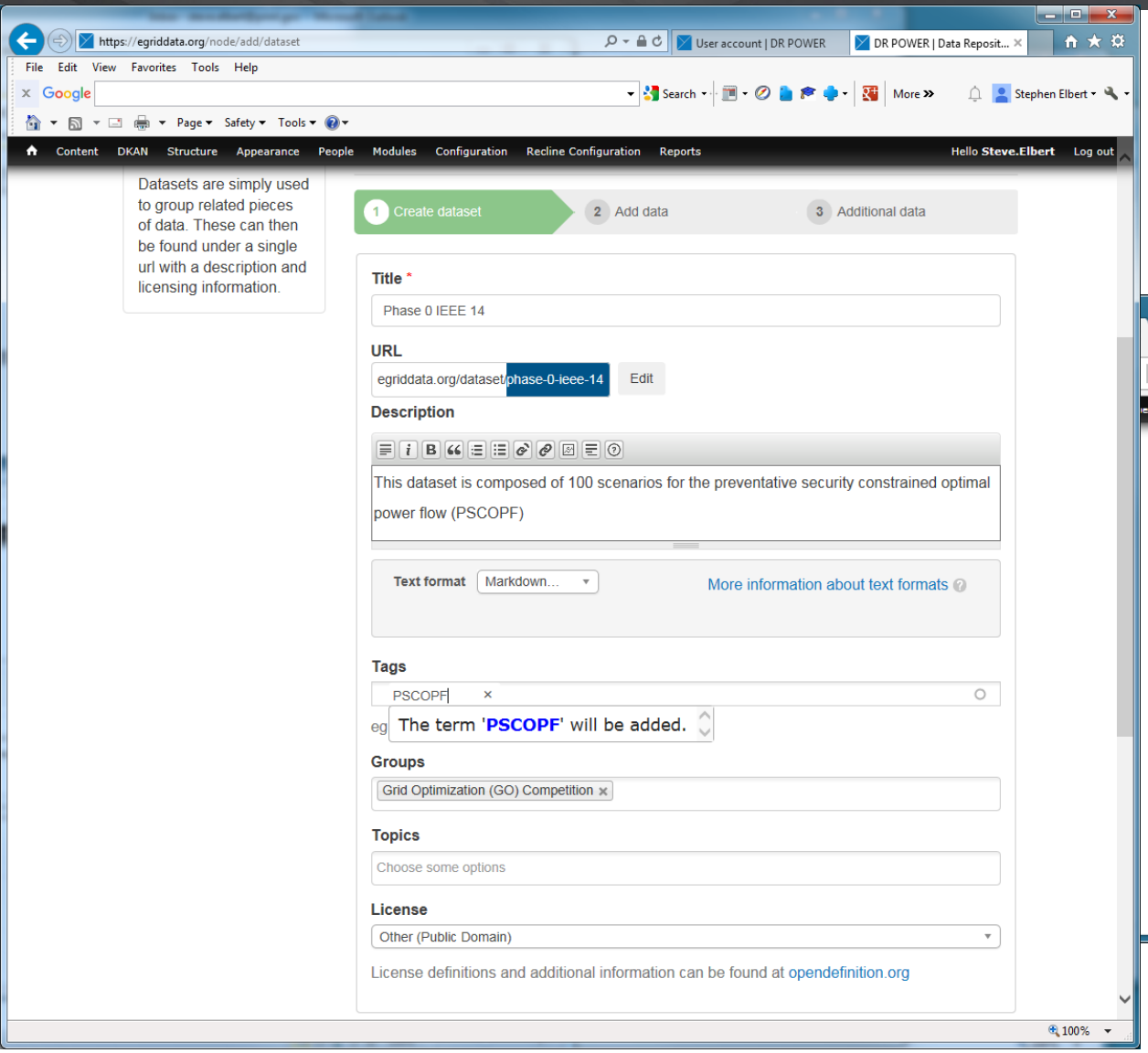
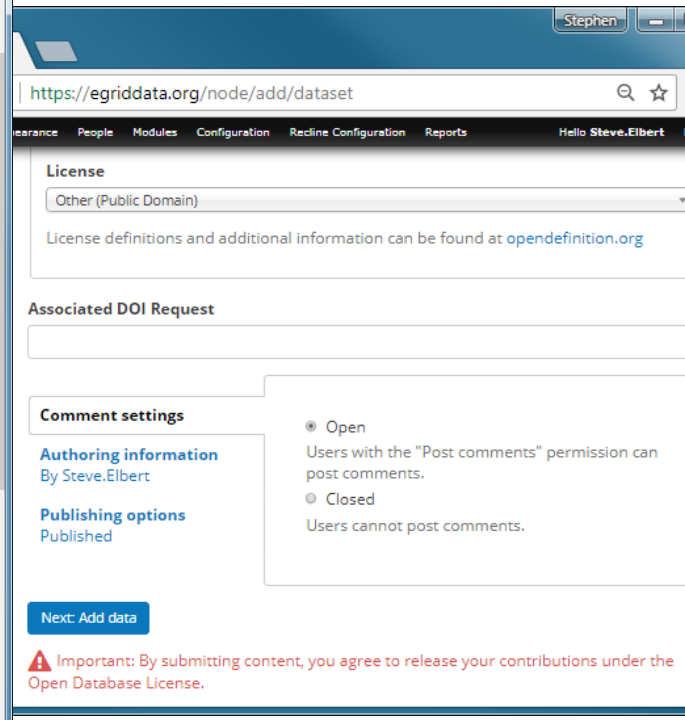
Submit: (1) Create dataset





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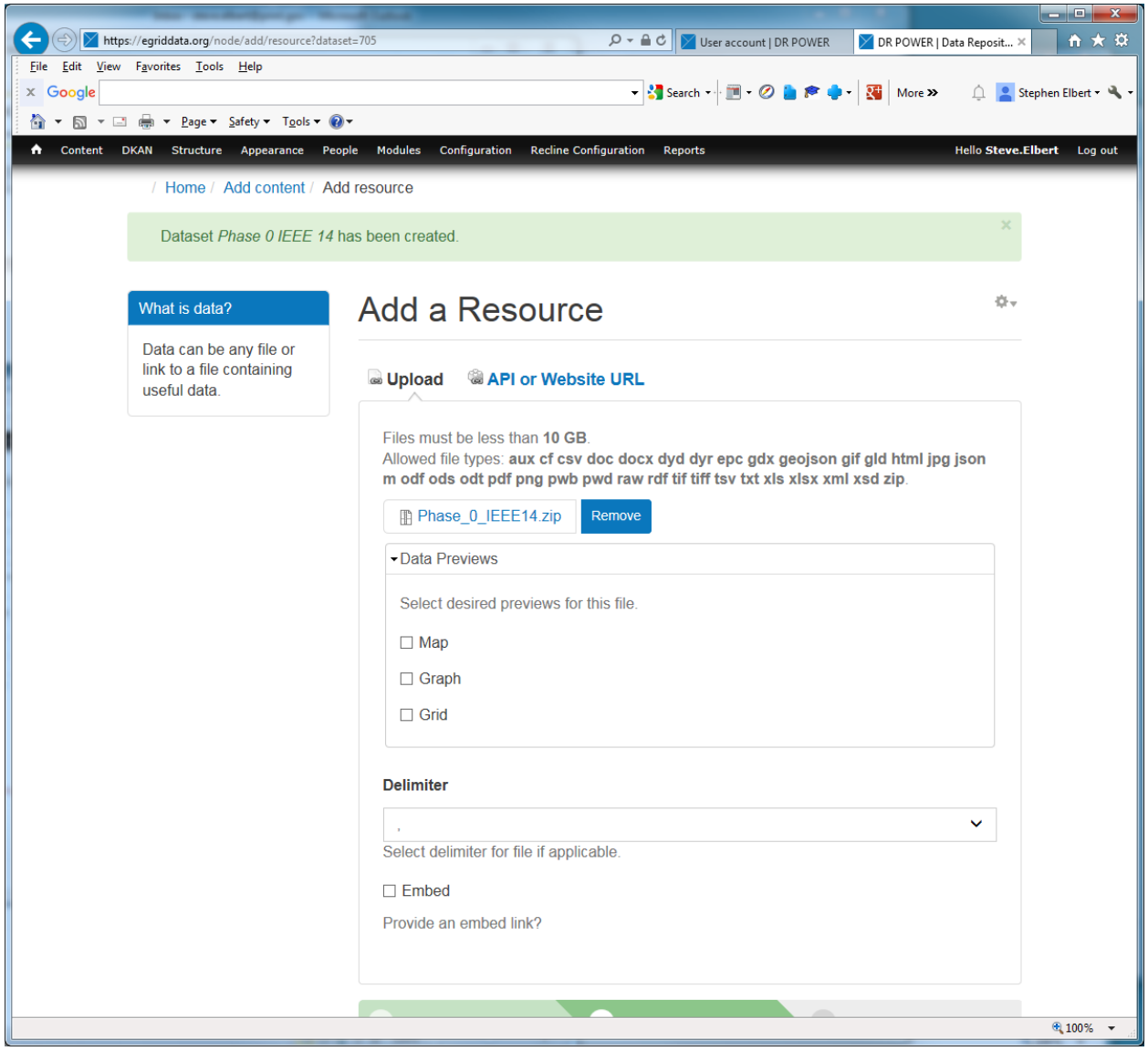
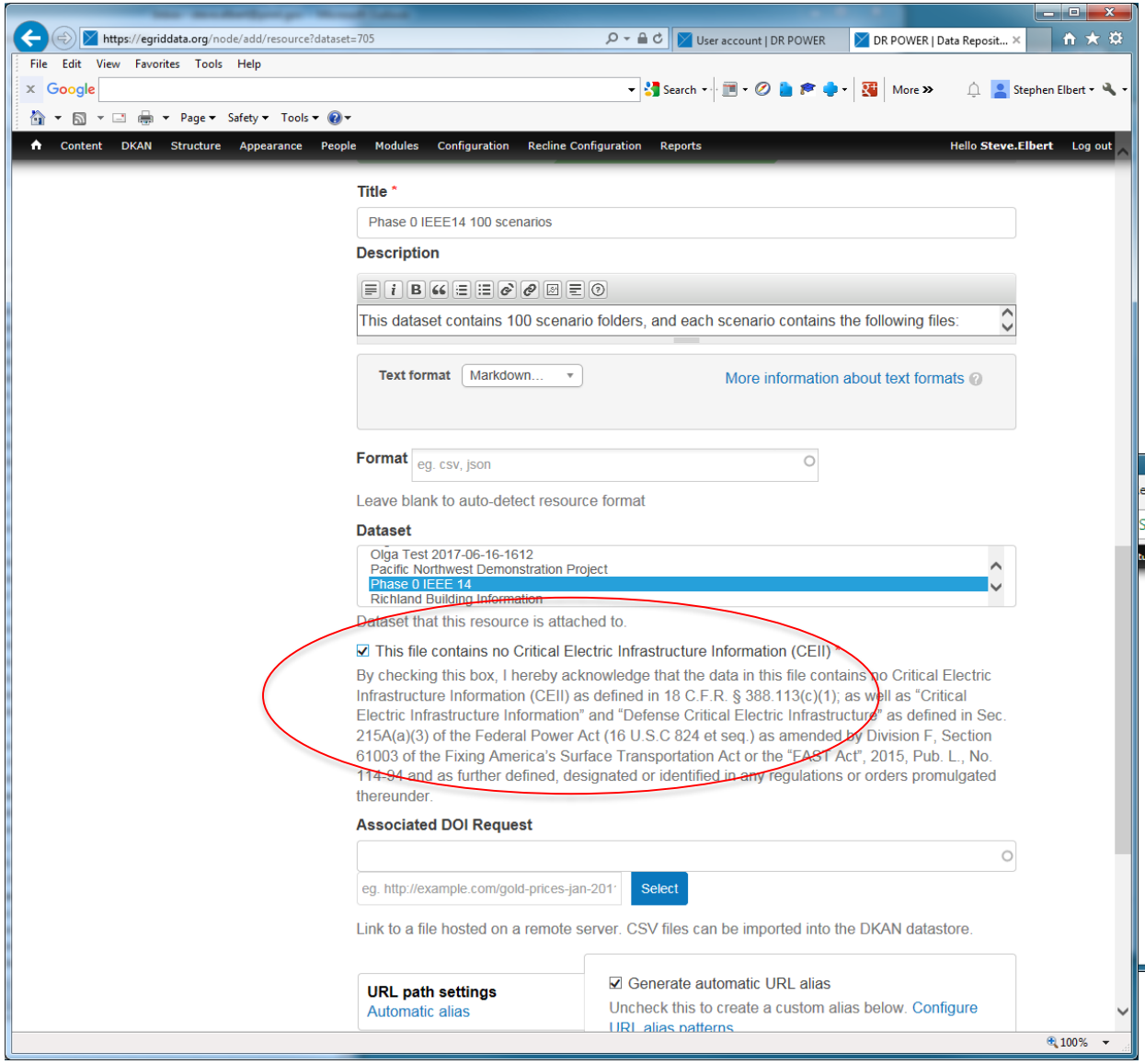
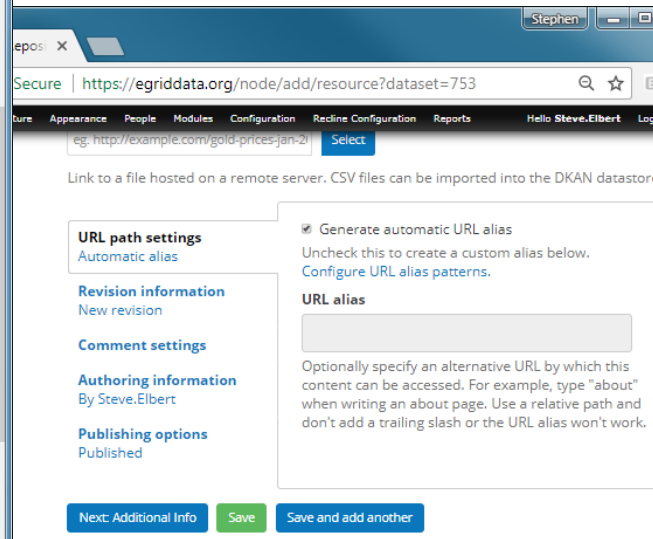
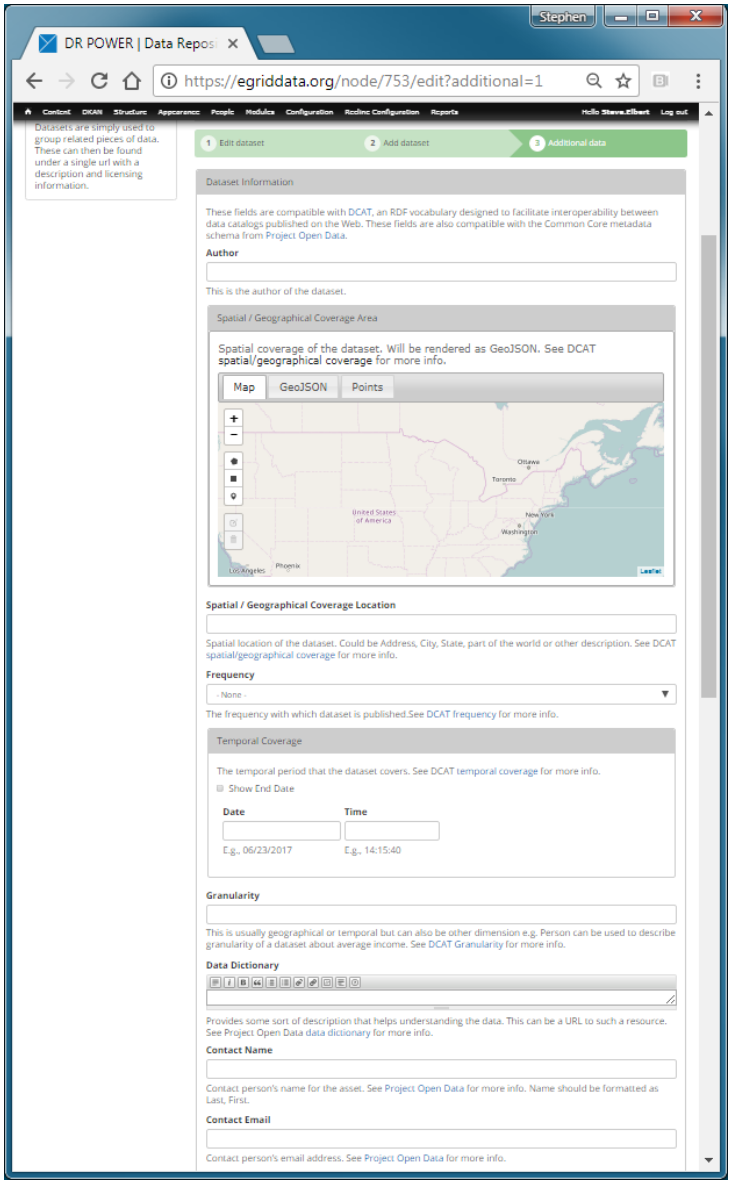


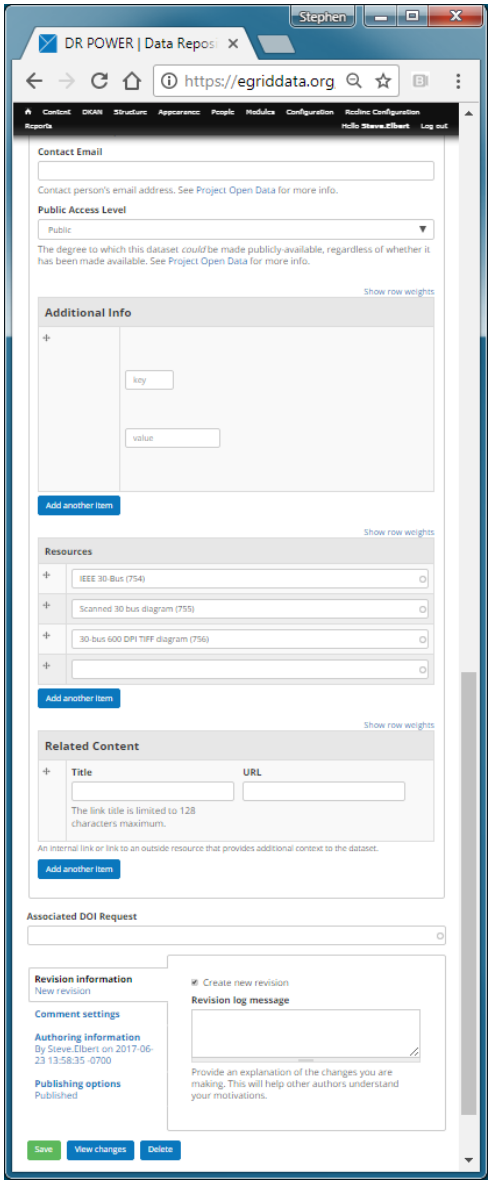
Submit: (2) Add data 2





Submit: (3) Additional data





Create a DOI: Product Description

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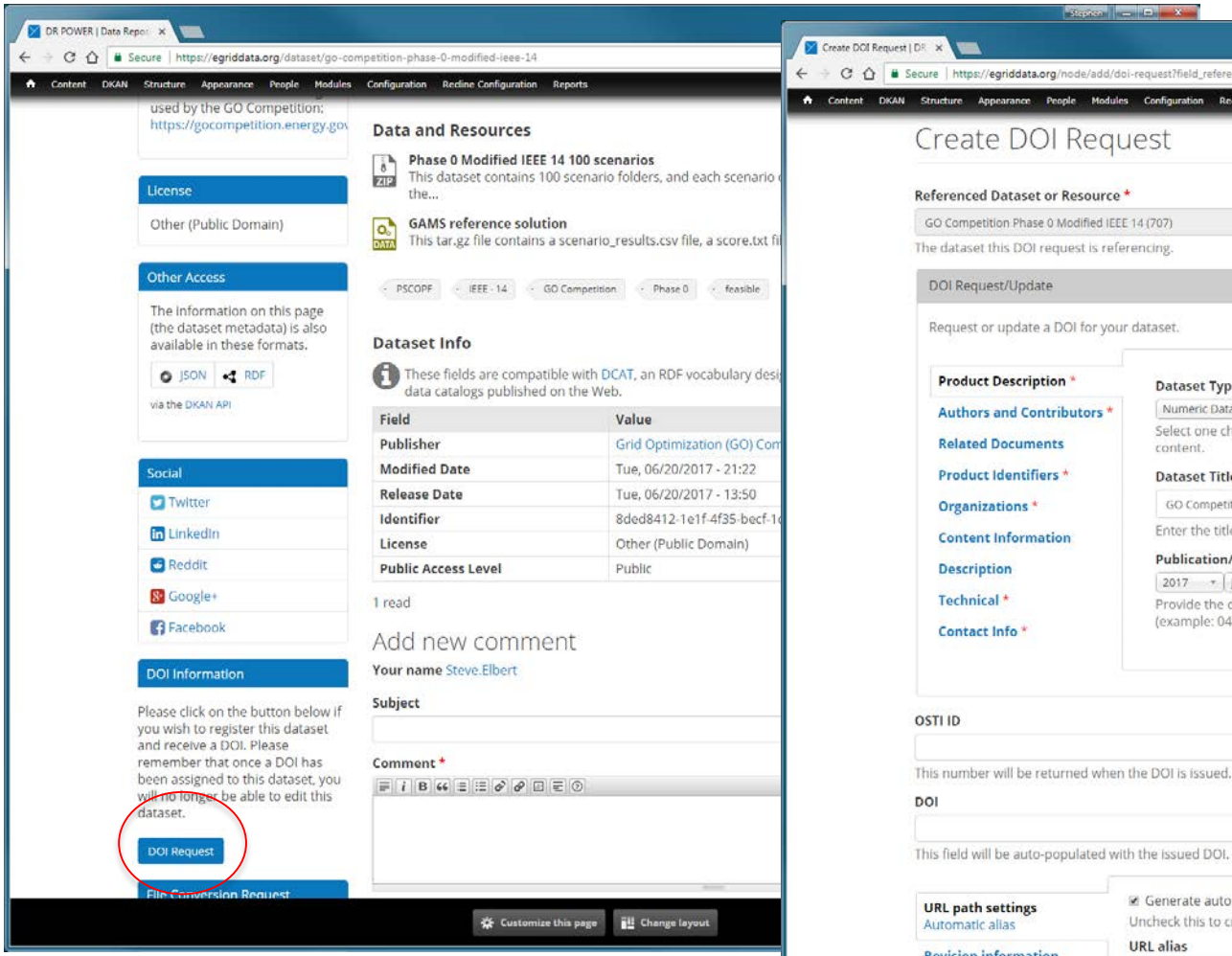
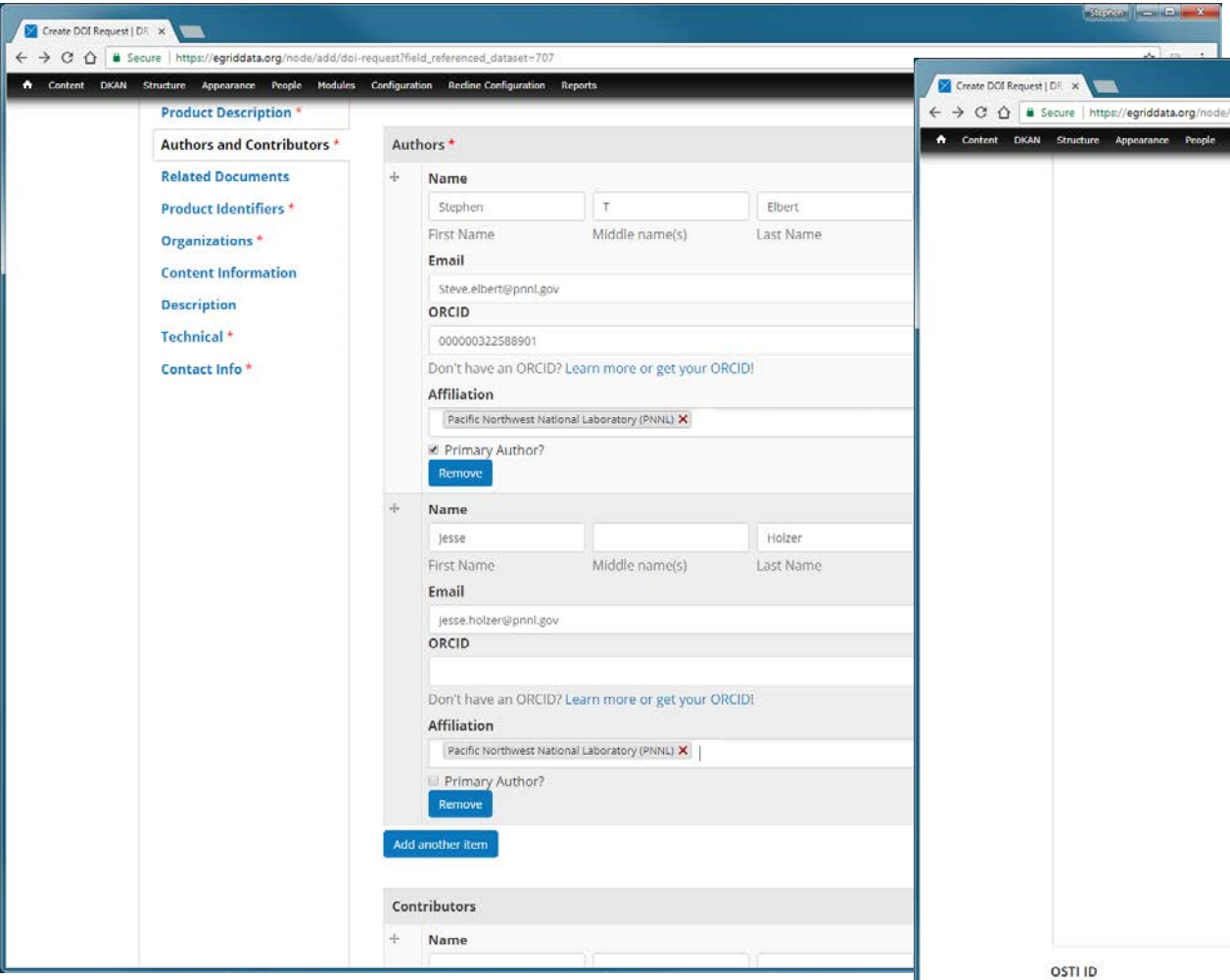
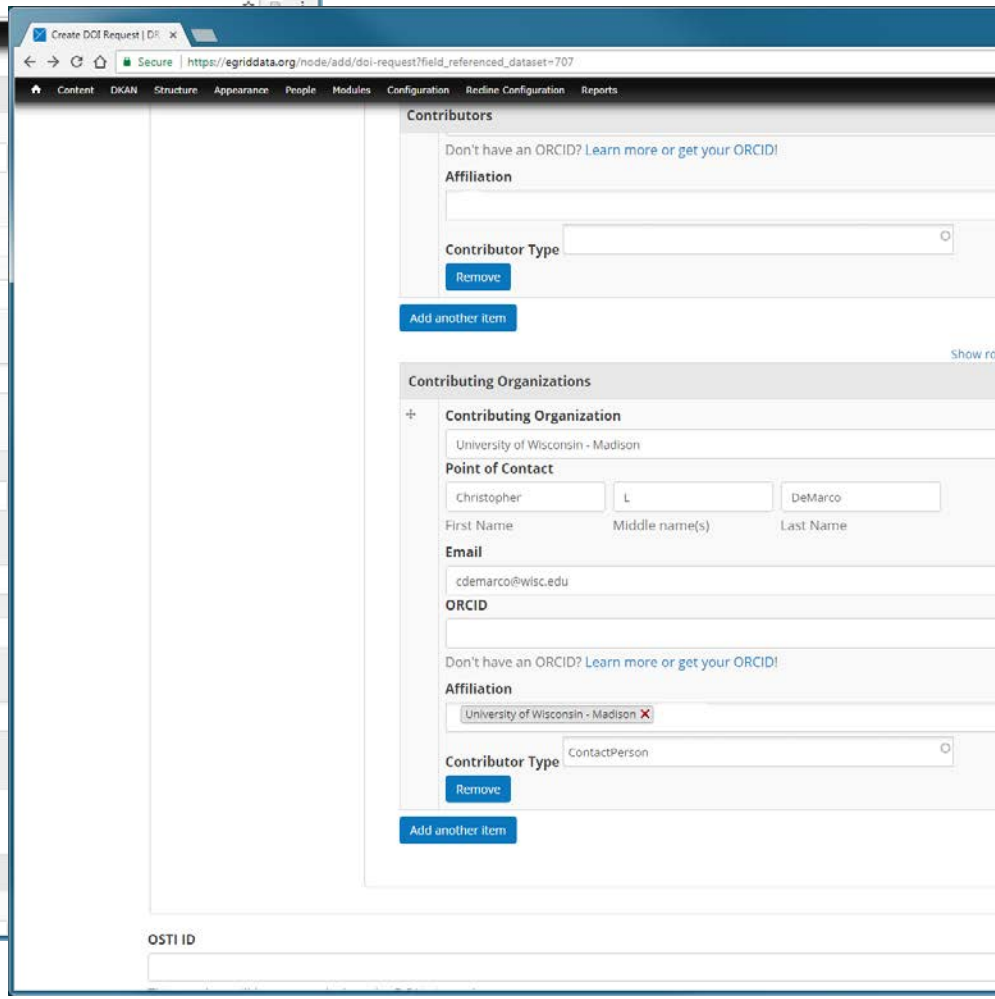
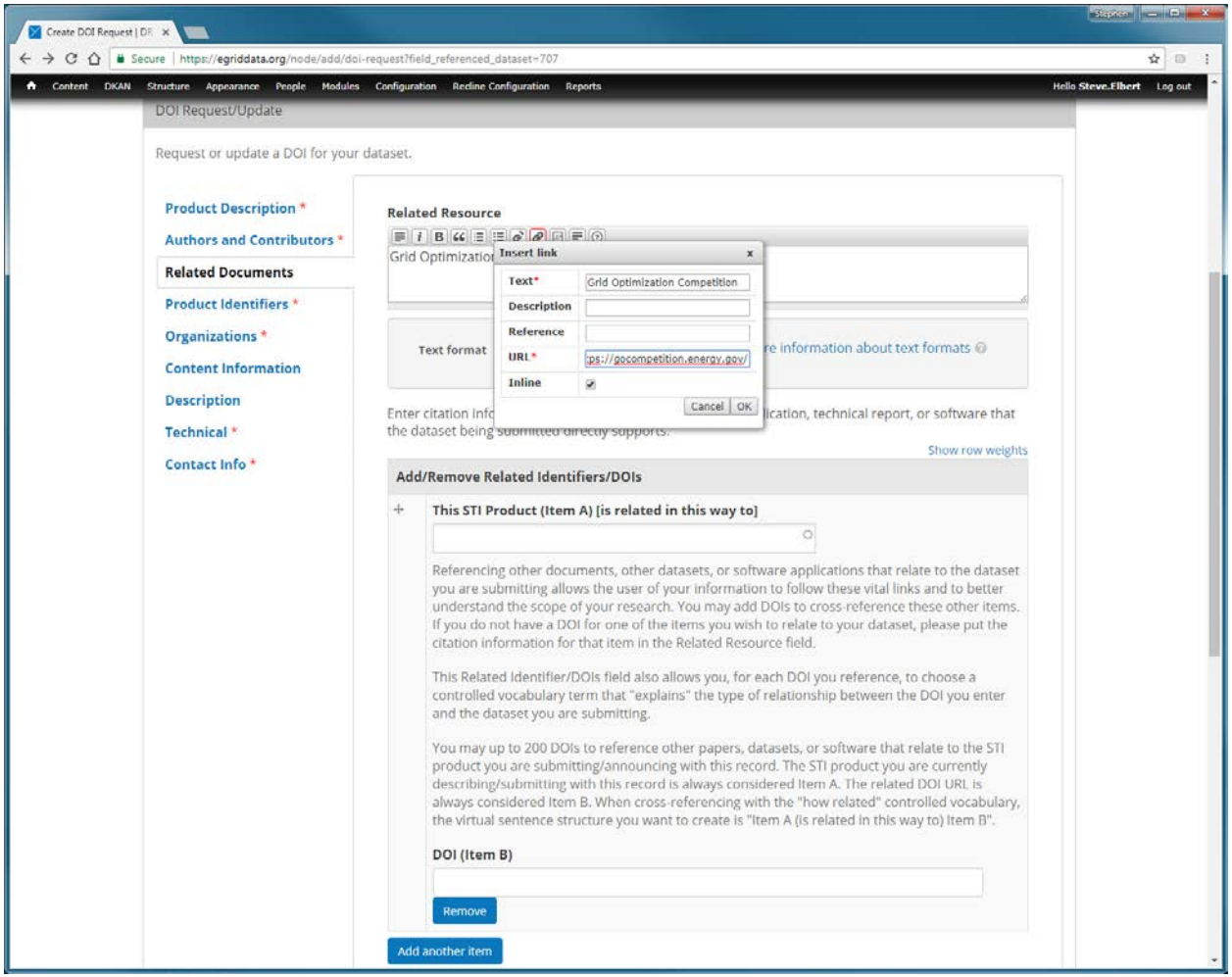


DOI: Authors and Contributors





DOI: Related Documents



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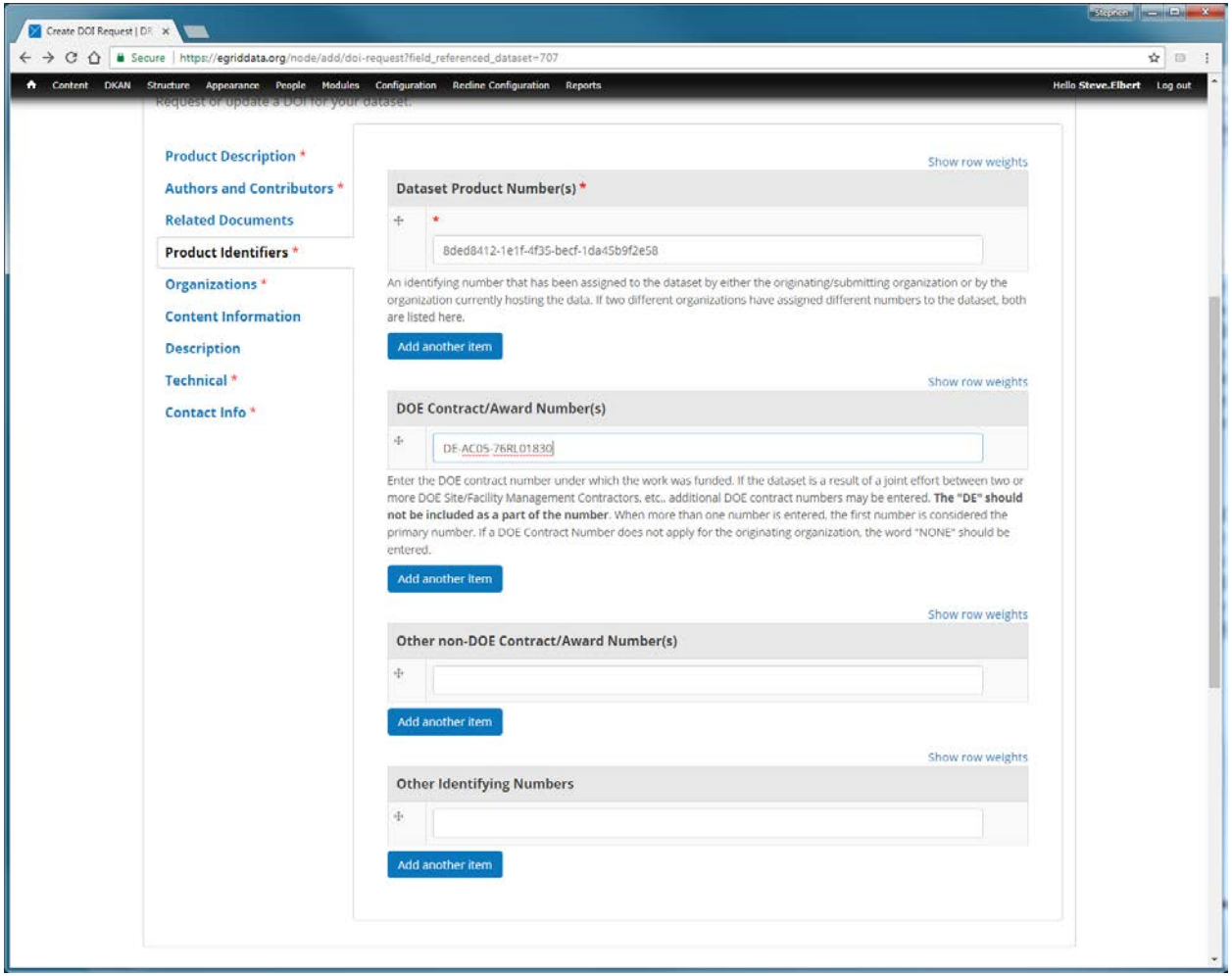

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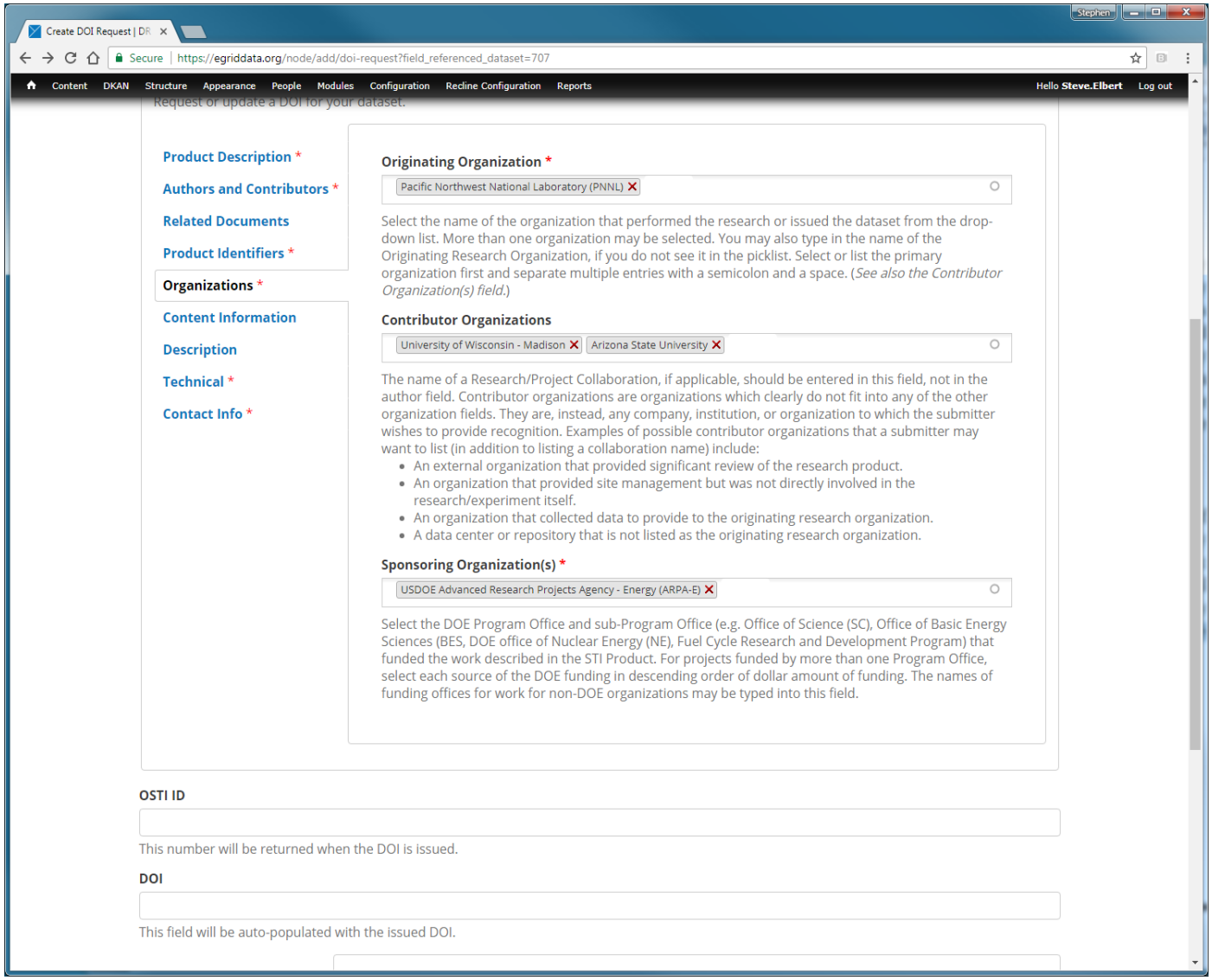
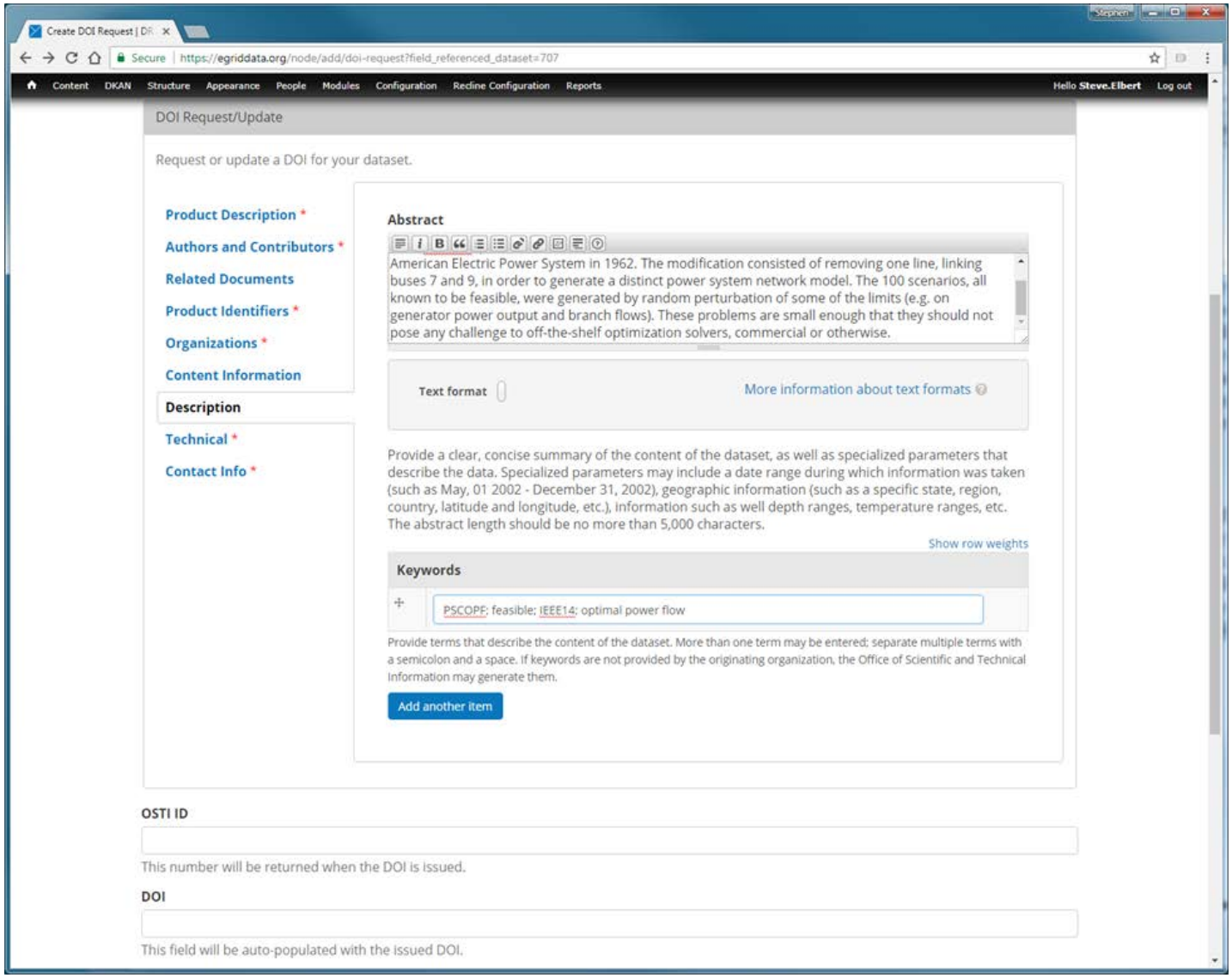


DOI: Description



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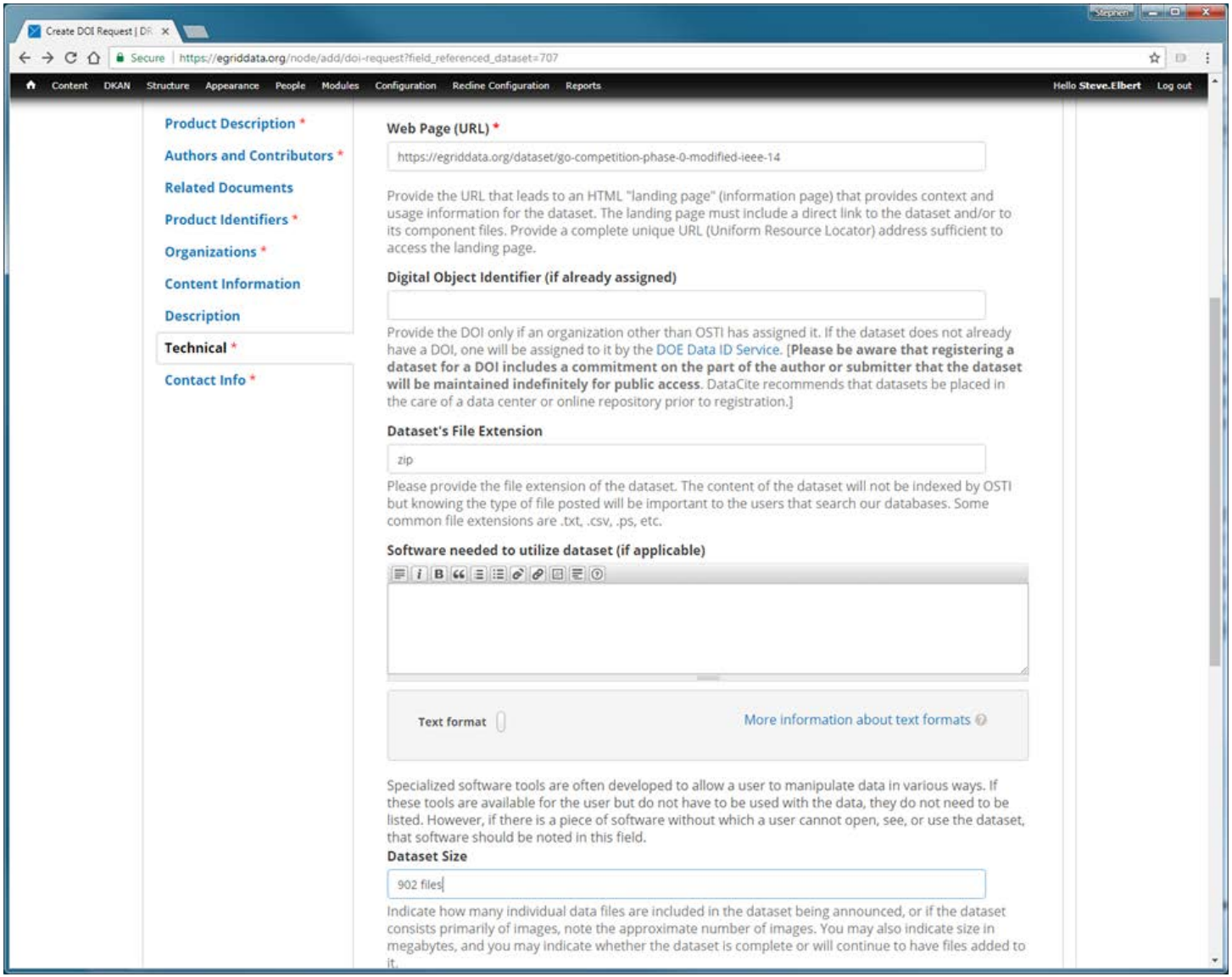
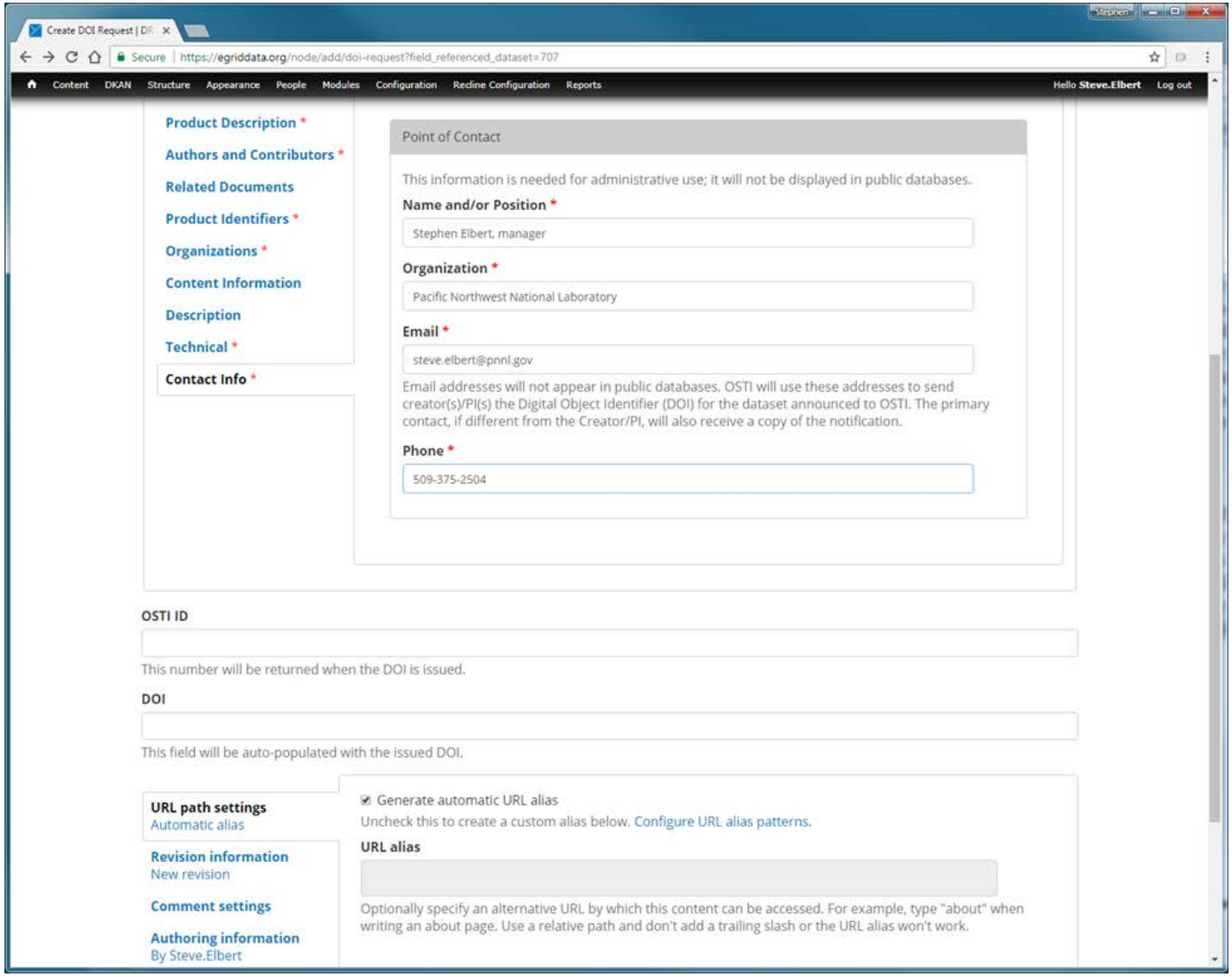
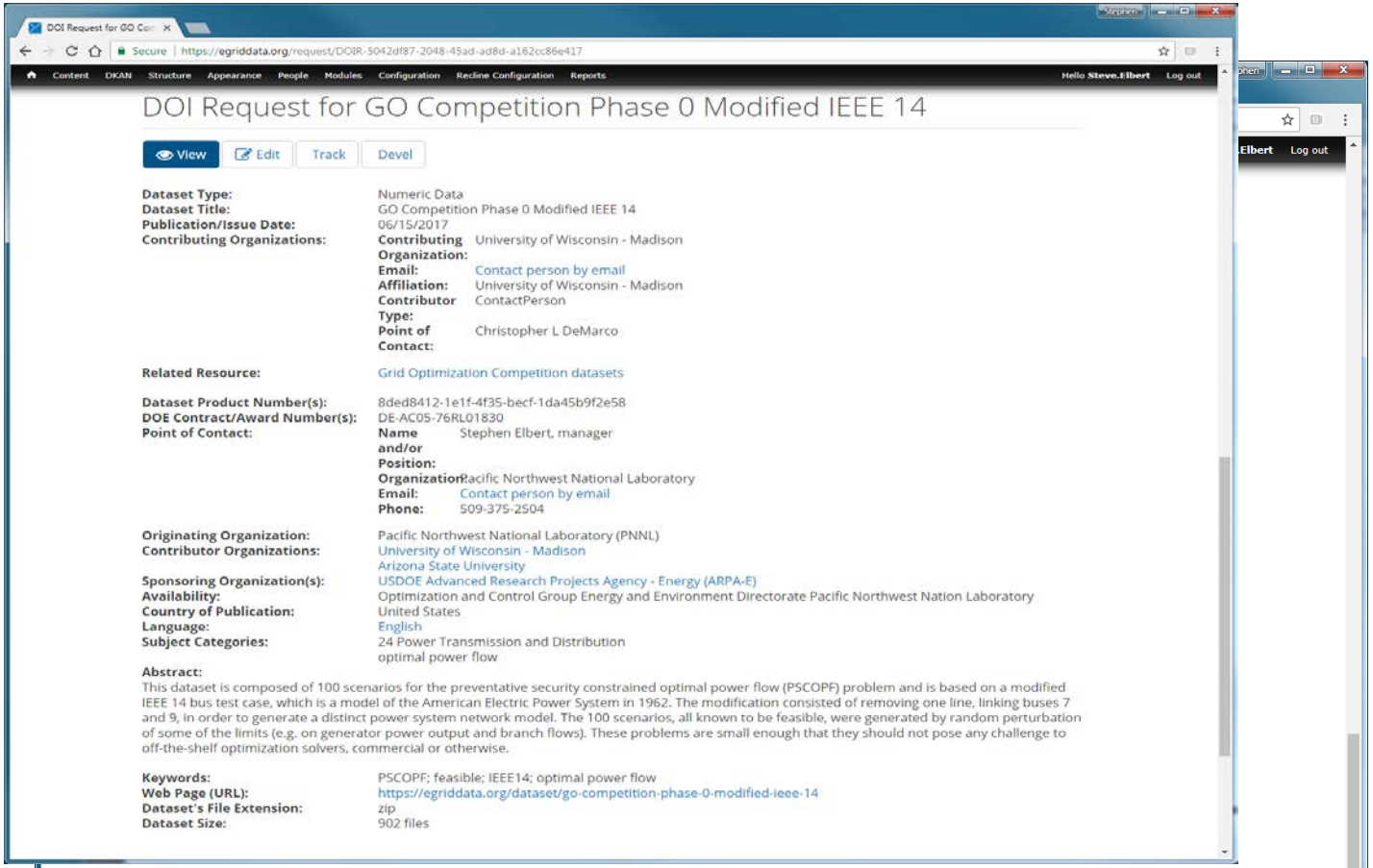


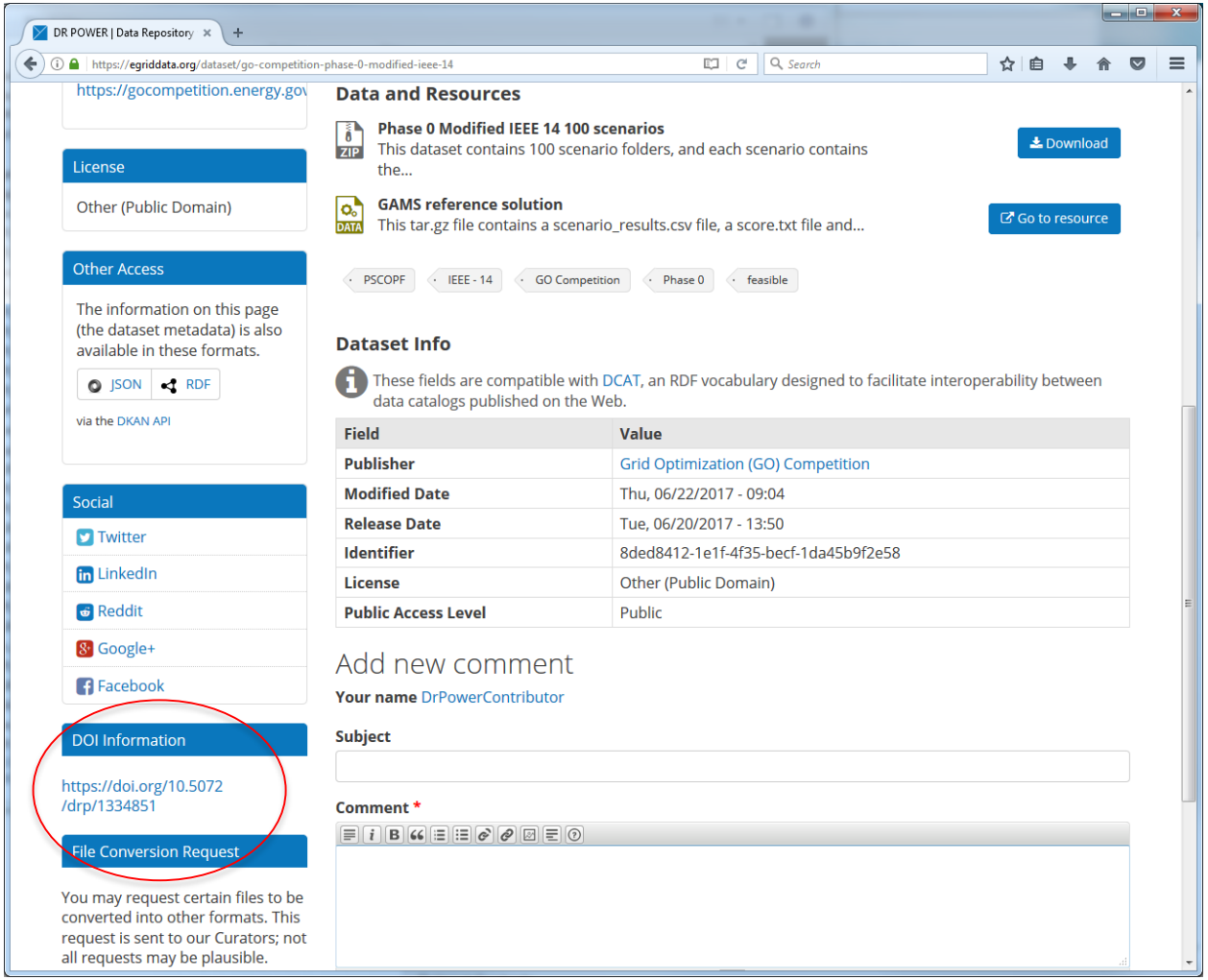
DOI: Contact Info



DOI Request Summary



DOI available

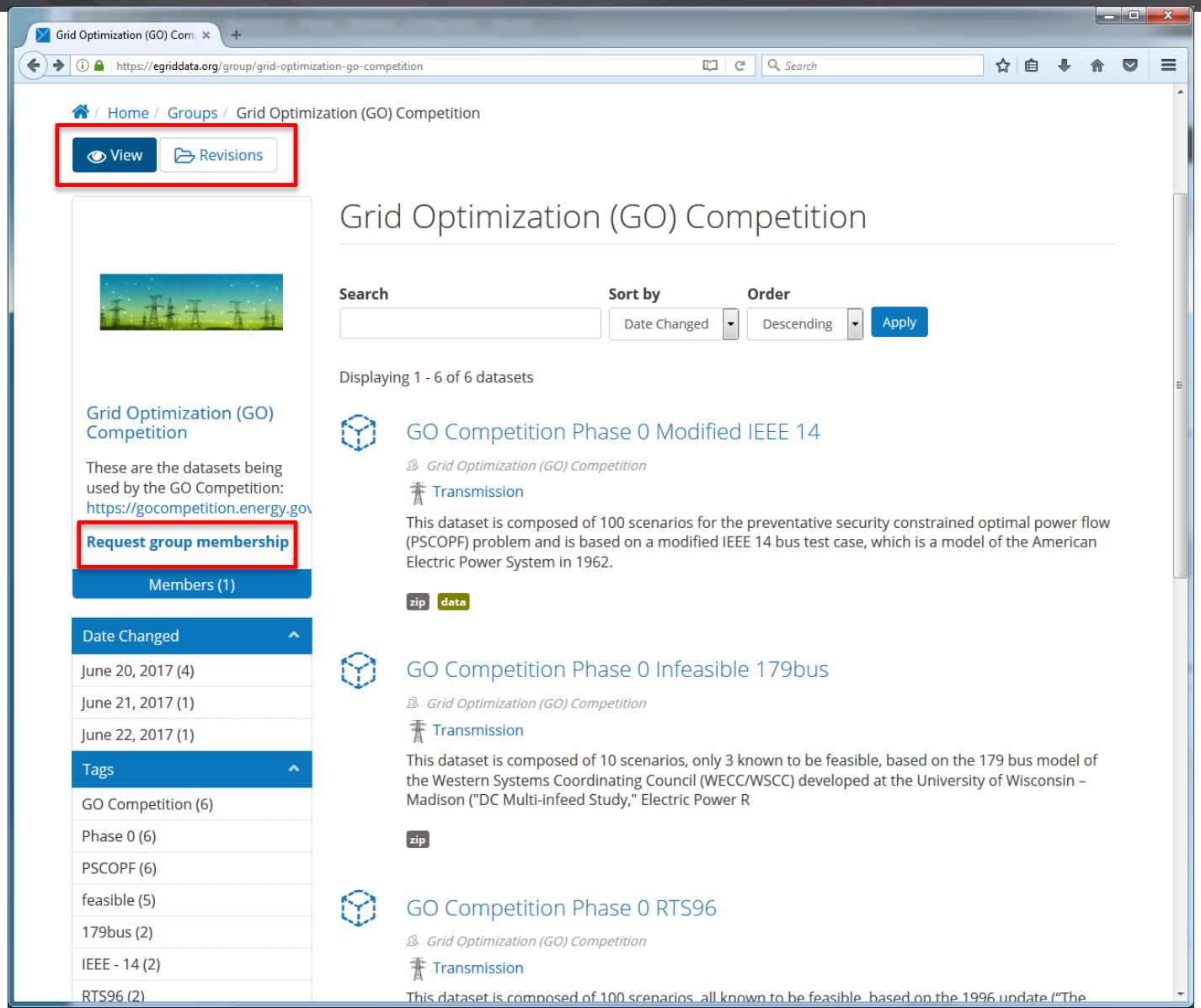


This DOI was generated using the OSTI test harness and is not valid.

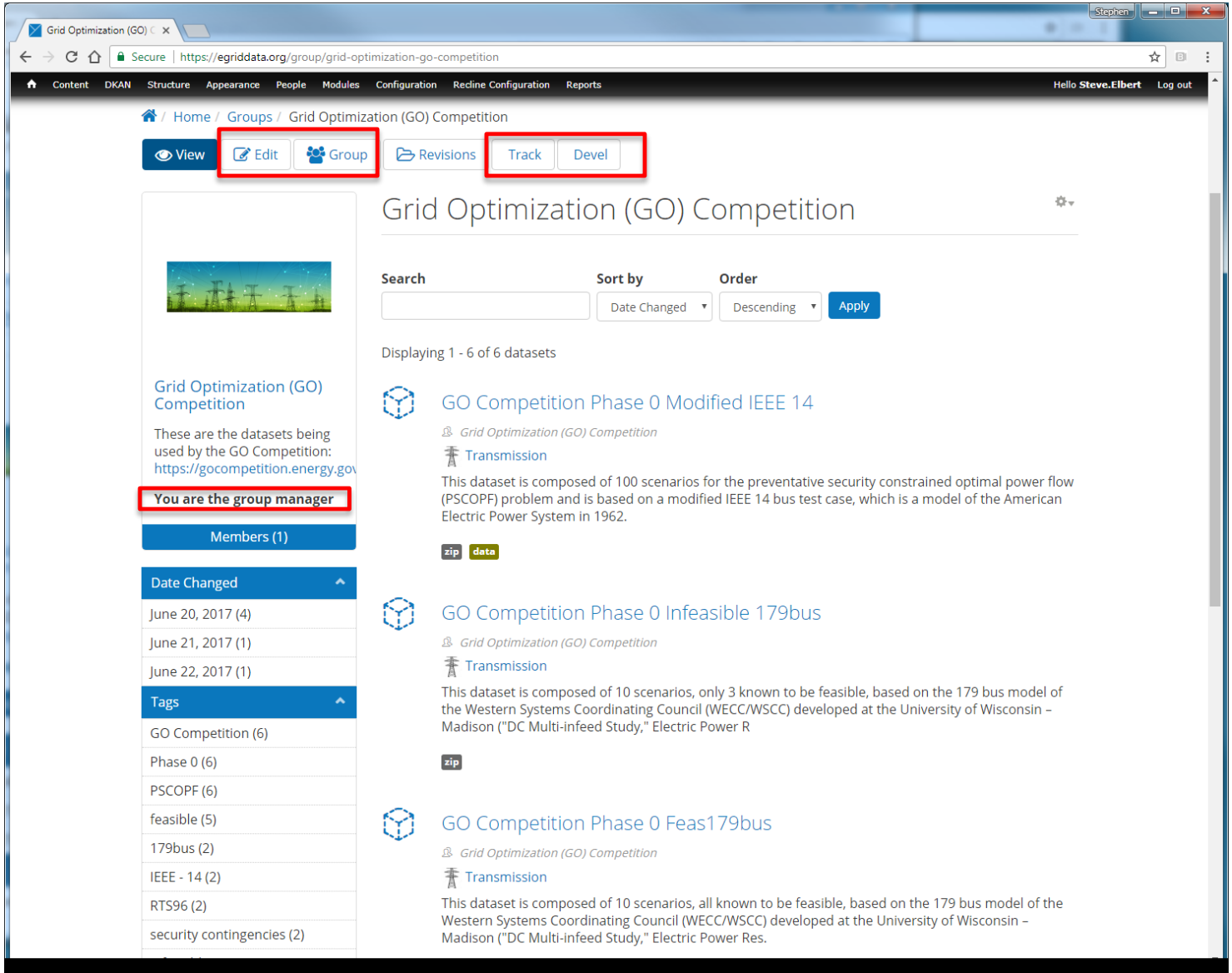
Setting an internal software switch is all it takes to generate a valid DOI.

The policy of who can generate a DOI and when is still under review.

Group: GO Competition (public view)



Group: GO Competition (owner view)



Dataset owner view (top of page)

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DR POWER | Data Repos

Secure | https://egriddata.org/dataset/go-competition-phase-0-modified-ieee-14

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Grid Optimization (GO) Competition

These are the datasets being used by the GO Competition: https://gocompetition.energy.gov

License

Other (Public Domain)

Other Access

The information on this page (the dataset metadata) is also available in these formats.

JSON | RDF

GO Competition Phase 0 Modified IEEE 14

Transmission

This dataset is composed of 100 scenarios for the preventative security constrained optimal power flow (PSCOPF) problem and is based on a modified IEEE 14 bus test case, which is a model of the American Electric Power System in 1962. The modification consisted of removing one line, linking buses 7 and 9, in order to generate a distinct power system network model. The 100 scenarios, all known to be feasible, were generated by random perturbation of some of the limits (e.g. on generator power output and branch flows). These problems are small enough that they should not pose any challenge to off-the-shelf optimization solvers, commercial or otherwise.

Data and Resources

Phase 0 Modified IEEE 14 100 scenarios
This dataset contains 100 scenario folders, and each scenario contains the...
Download

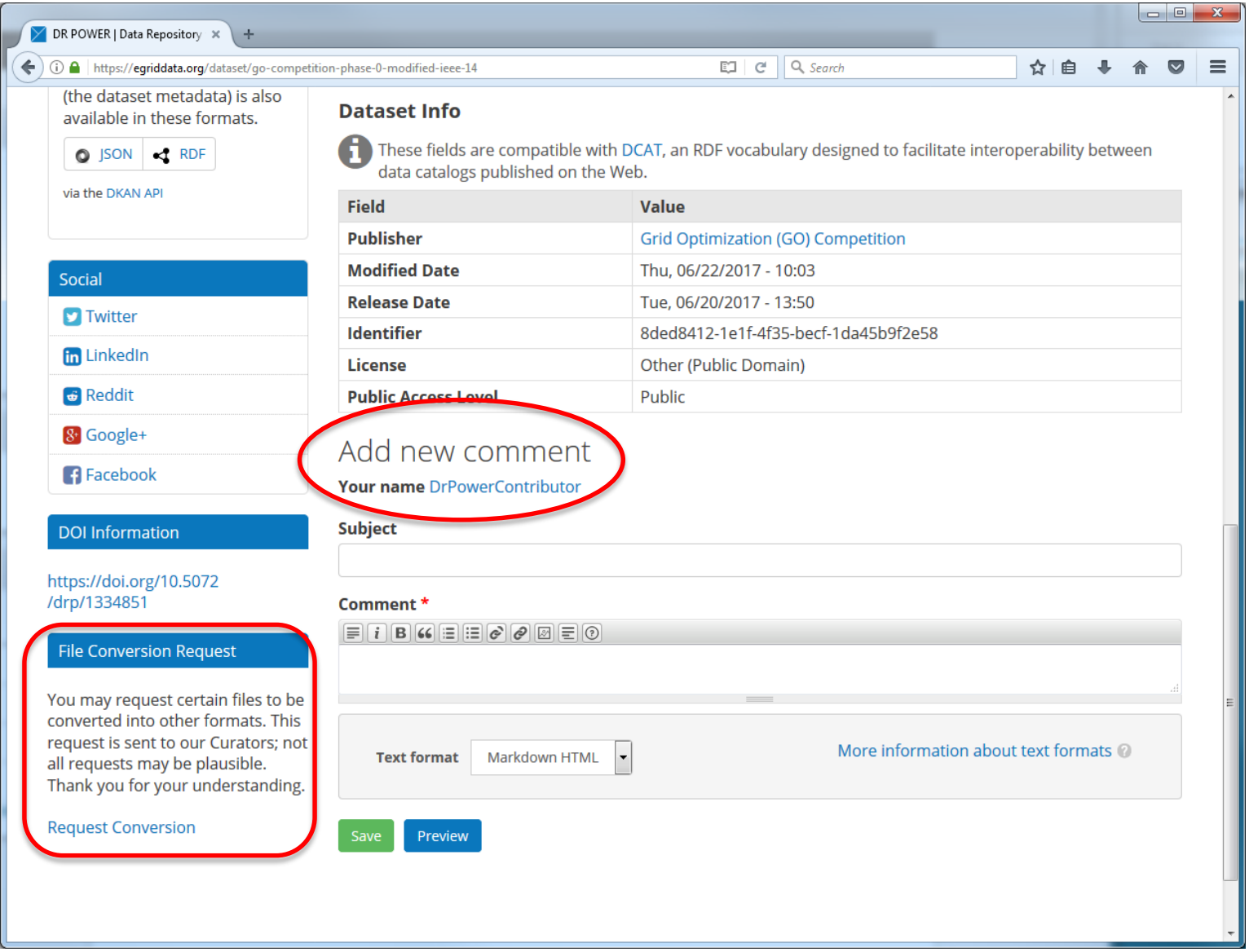
GAMS reference solution
This tar.gz file contains a scenario_results.csv file, a score.txt file and...
Go to resource

PSCOPF · IEEE - 14 · GO Competition · Phase 0 · feasible

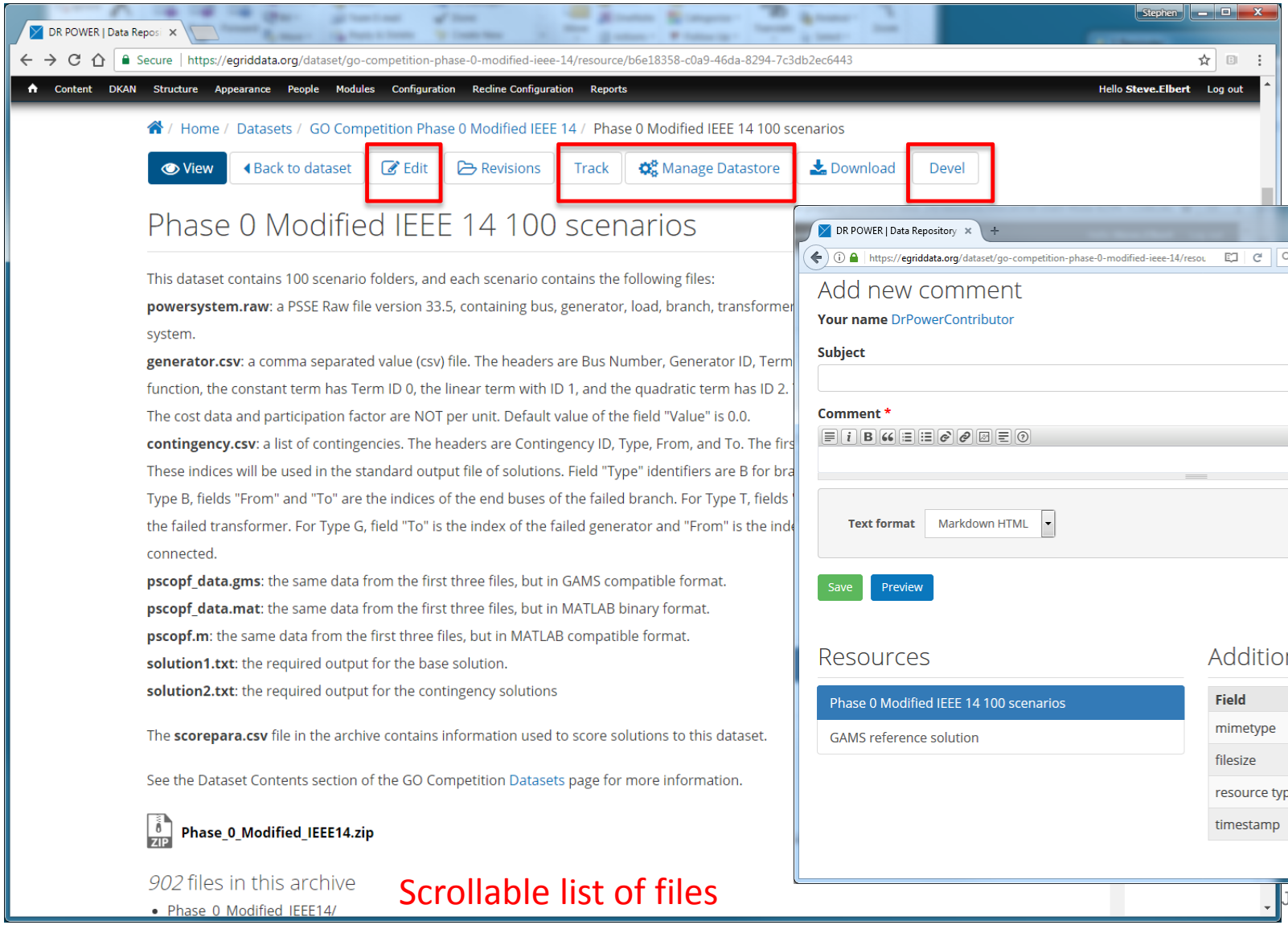
Dataset Info

These fields are compatible with DCAT, an RDF vocabulary designed to facilitate interoperability between data catalogs published on the Web.

Dataset public view (bottom of page)

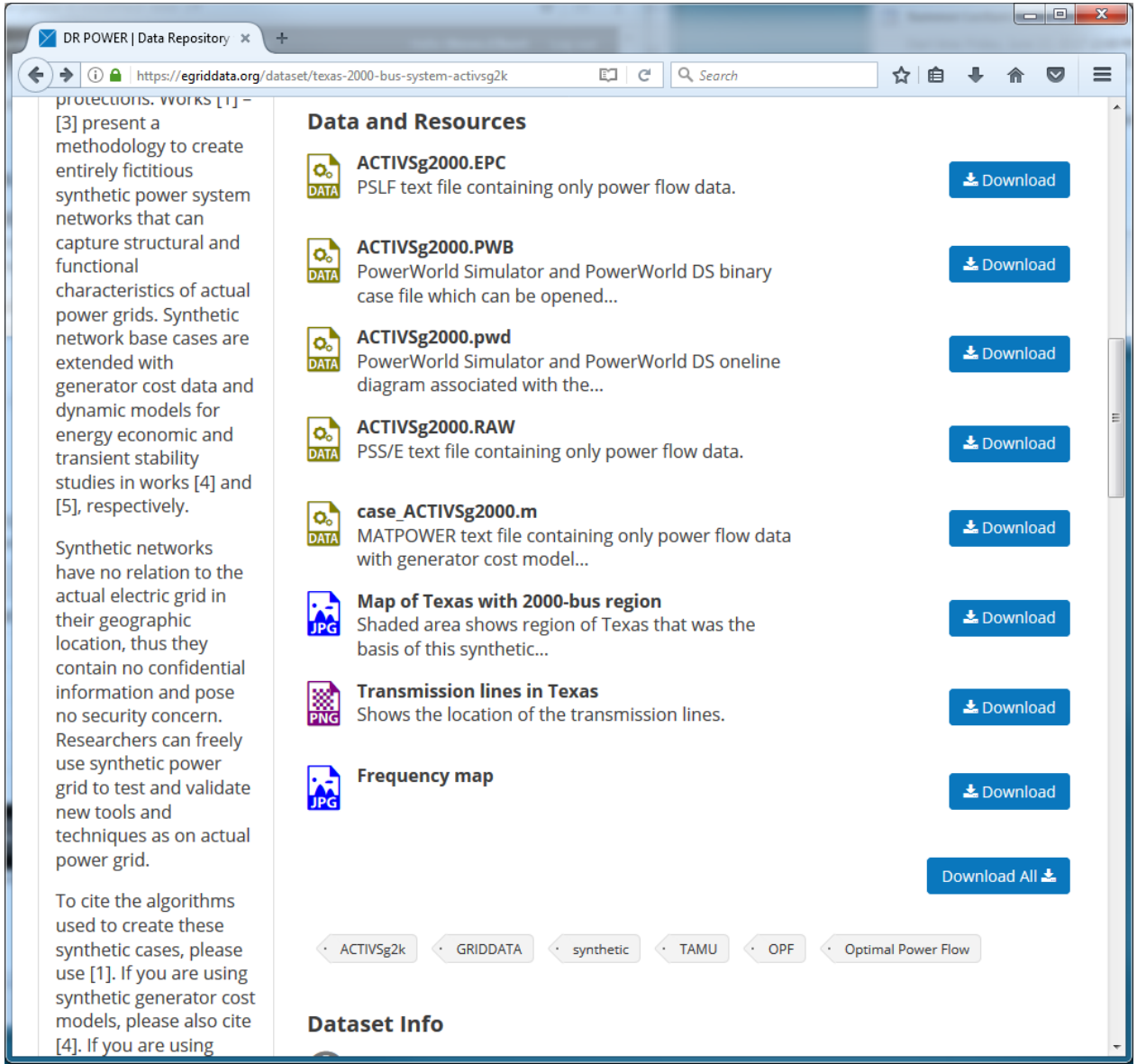


Data file owner view

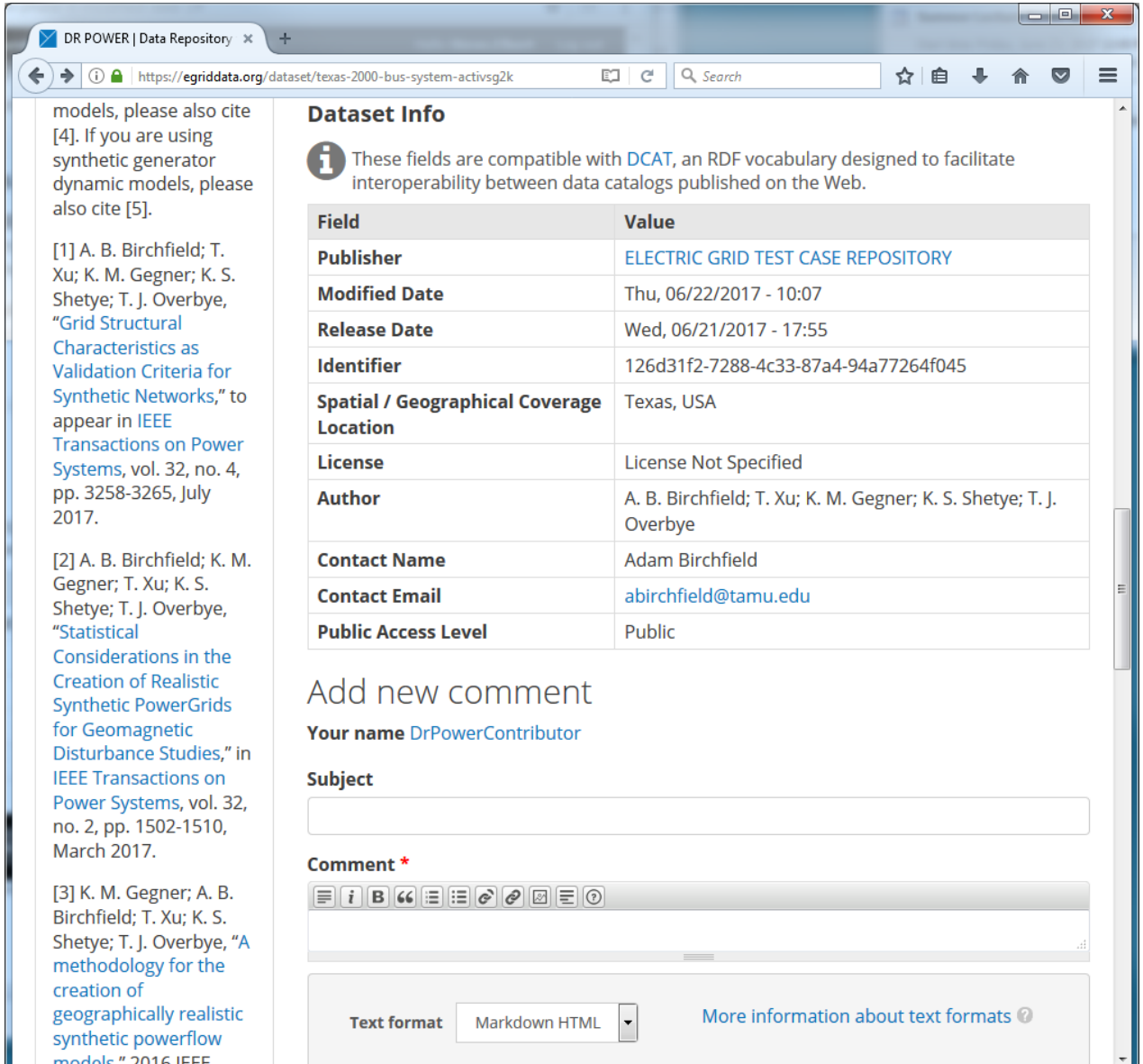


GRID DATA example (top of page)

GRID DATA example (middle of page)



GRID DATA example (bottom of page)



models, please also cite [4]. If you are using synthetic generator dynamic models, please also cite [5].

[1] A. B. Birchfield; T. Xu; K. M. Gegner; K. S. Shetye; T. J. Overbye, "Grid Structural Characteristics as Validation Criteria for Synthetic Networks," to appear in IEEE Transactions on Power Systems, vol. 32, no. 4, pp. 3258-3265, July 2017.

[2] A. B. Birchfield; K. M. Gegner; T. Xu; K. S. Shetye; T. J. Overbye, "Statistical Considerations in the Creation of Realistic Synthetic PowerGrids for Geomagnetic Disturbance Studies," in IEEE Transactions on Power Systems, vol. 32, no. 2, pp. 1502-1510, March 2017.

[3] K. M. Gegner; A. B. Birchfield; T. Xu; K. S. Shetye; T. J. Overbye, "A methodology for the creation of geographically realistic synthetic powerflow

Dataset Info

These fields are compatible with DCAT, an RDF vocabulary designed to facilitate interoperability between data catalogs published on the Web.

Field	Value
Publisher	ELECTRIC GRID TEST CASE REPOSITORY
Modified Date	Thu, 06/22/2017 - 10:07
Release Date	Wed, 06/21/2017 - 17:55
Identifier	126d31f2-7288-4c33-87a4-94a77264f045
Spatial / Geographical Coverage Location	Texas, USA
License	License Not Specified
Author	A. B. Birchfield; T. Xu; K. M. Gegner; K. S. Shetye; T. J. Overbye
Contact Name	Adam Birchfield
Contact Email	abirchfield@tamu.edu
Public Access Level	Public

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Comment *

Text format Markdown HTML More information about text formats

Near-term Goals (by end of July)

- Web Portal will be updated with the following capabilities:
  - New roles defined:
    - Data Contributor – any user can create datasets and upload files.
    - Curation Moderator – any registered user who has been approved by the Curation Supervisor to be a curator.
    - Curation Supervisor – Lead Curator (Laurentiu Marinovici) will supervise curators, communicate curator requirements, and drive the curation process.
  - New upload workflow:
    - Datasets can be created and files added, but this work stays unpublished (not visible to the public). A Data Contributor can continually change and modify the dataset, before releasing it for review by a Curation Moderator.
    - Once a Review Dataset Request has been initiated by the Contributor, any Curation Moderator may review the dataset. If the dataset passes the initial review, the dataset is released to the public and a secondary, in-depth review can be started.
    - During the in-depth review, a Curator and the Author will improve the details of the dataset based on the Curation Strategic Guidelines.
    - After an in-depth review is done, a DOI can be requested at any time by the Contributor.
- Continue populating repository with public domain datasets

Long Term Sustainability

- Opportunities to manage data outside the GRID DATA program:
  - End use load energy consumption (building data)
  - DARPA RADICS program
  - Solar and wind data (e.g. NREL SMARtDaTa)
  - Atmospheric Radiation Monitoring program data
- Critical need for Digital Object Identifier (DOI) creation and management
  - Funding agencies requesting data access via DOI
  - Adoption by IM3 (Integrated Multi-sector Multi-scale Modeling)
  - Institutional support in return for data management technology
  - Software infrastructure: copyright distributed under permissive open source license
- Continual community engagement
  - IEEE Power Engineering Society Test Case Working Group
  - Seeking unique data schema's to prove out concepts of data evolution

Team

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- PNNL
  - Mark Rice (Principal Investigator)
  - Stephen Elbert (Co-Principal Investigator)
  - Jenn Lee (Tech to Market Lead)
  - Olga Kuchar (e-grids.org Web Portal Lead)
  - Laurentiu Marinovici (Data Curation Lead)
- NRECA
  - David Pinney (Open Modeling Framework Lead)
  - Justin Yang (Software Developer)

Backup slides

DR POWER environment

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Electrical power system models and simulations

- Transmission and generation models
- Distribution models
- MATPOWER, MATLAB Power System Toolbox, PowerWorld, Siemens PSS/E, GE's PSLF, GridLAB-D, OMF

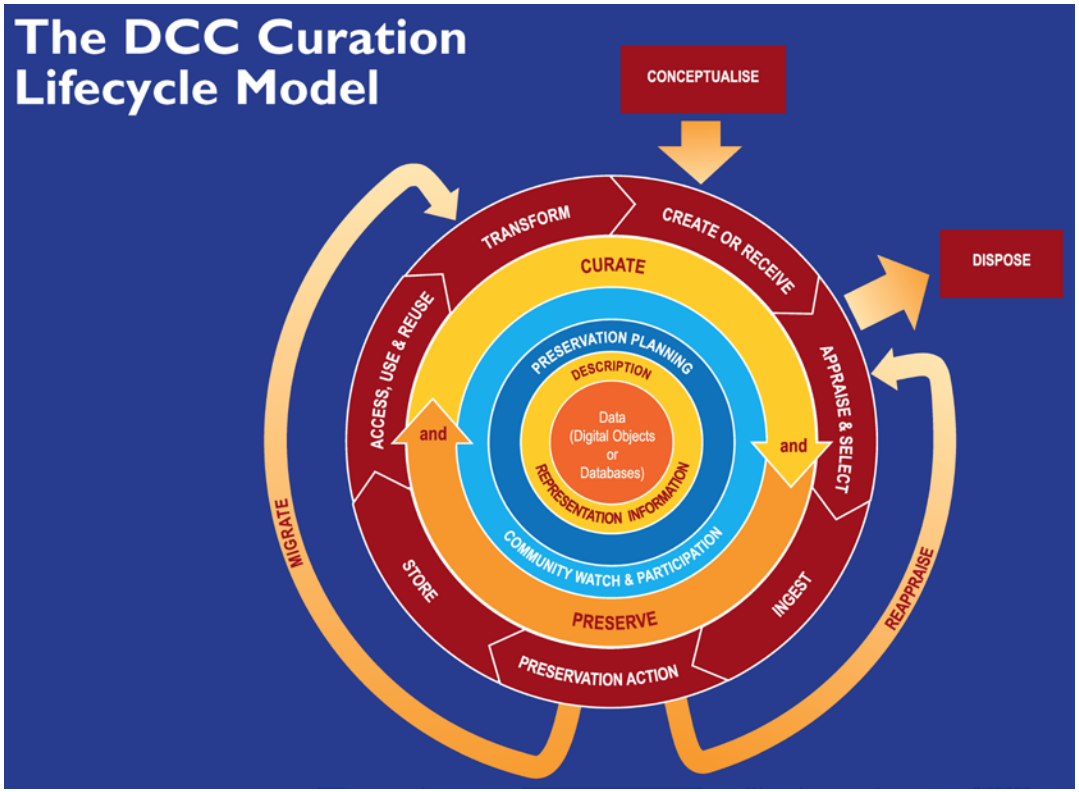
Observations and measurements

- PMU, wind, solar, weather data, etc.

Accompanying material

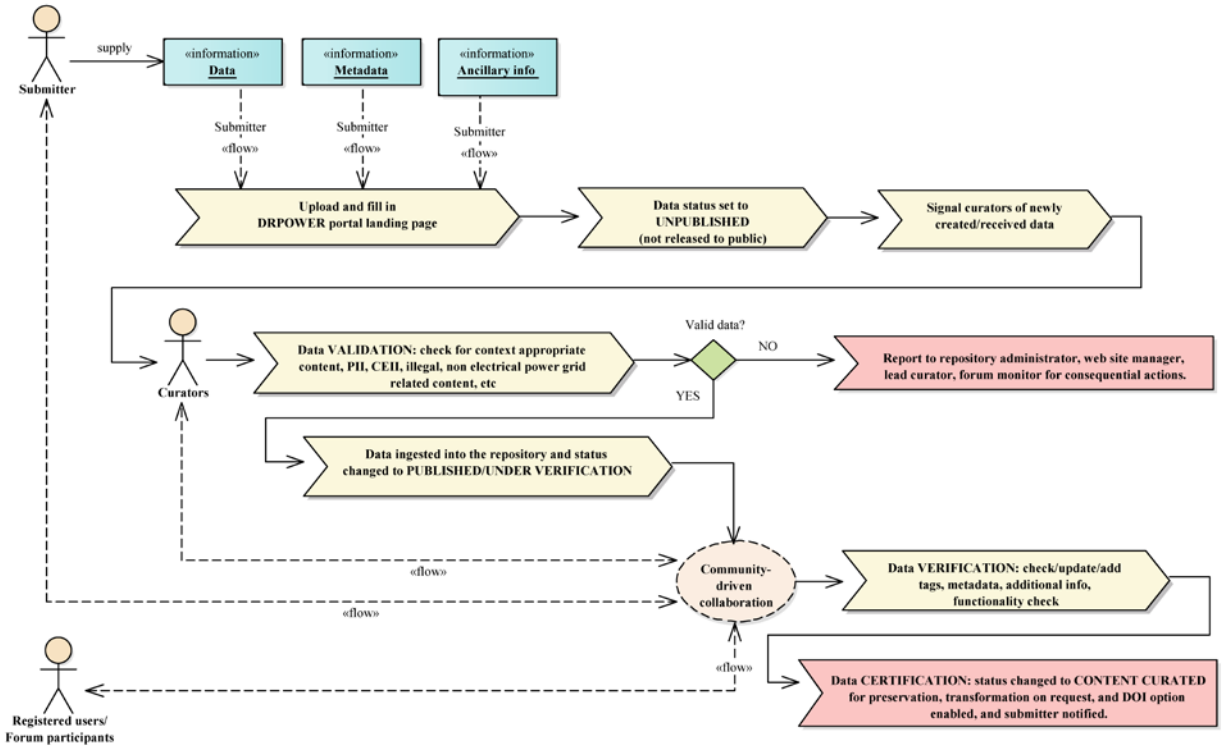
- Graphics and tables
- Instrumentation
- Data dictionaries
- Geospatial information
- References and bibliography, etc.

Curator guidelines



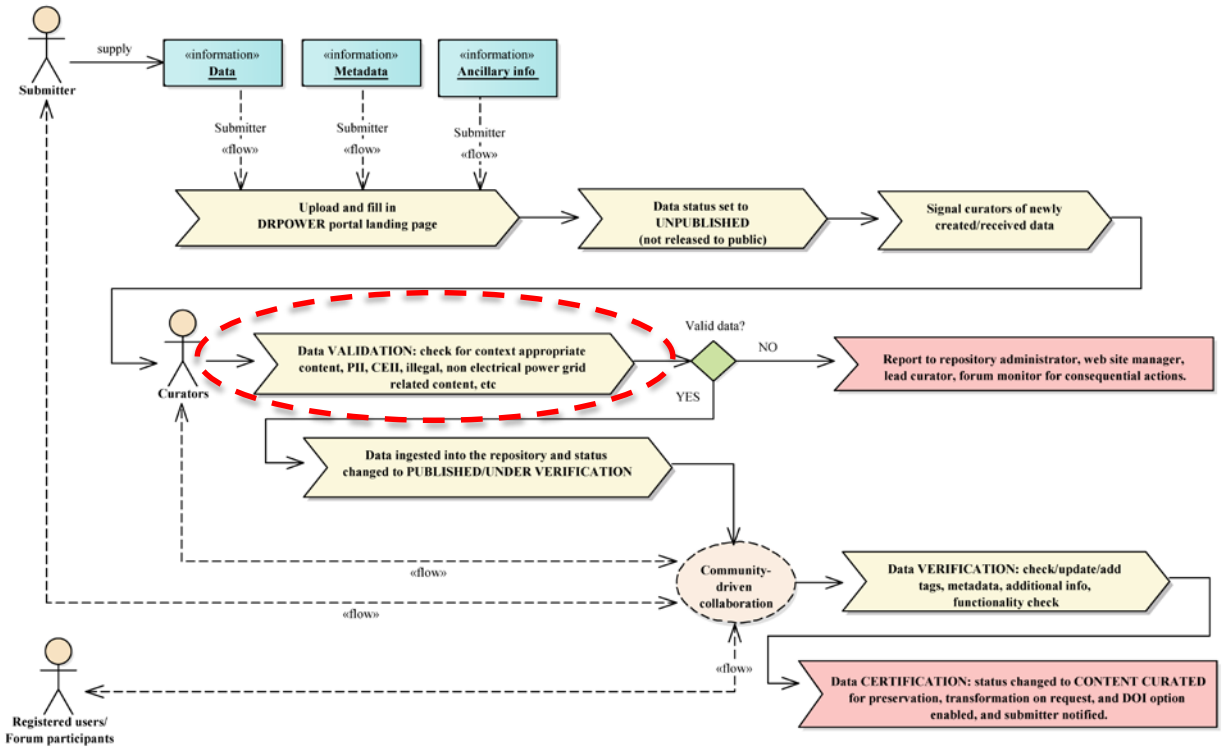
- DR POWER repository
  - Online
  - Community-driven
- Creating/receiving data that needs
  - Upload
  - Revision
  - Modification
  - Tagging, etc.

Appraisal and selection guidelines



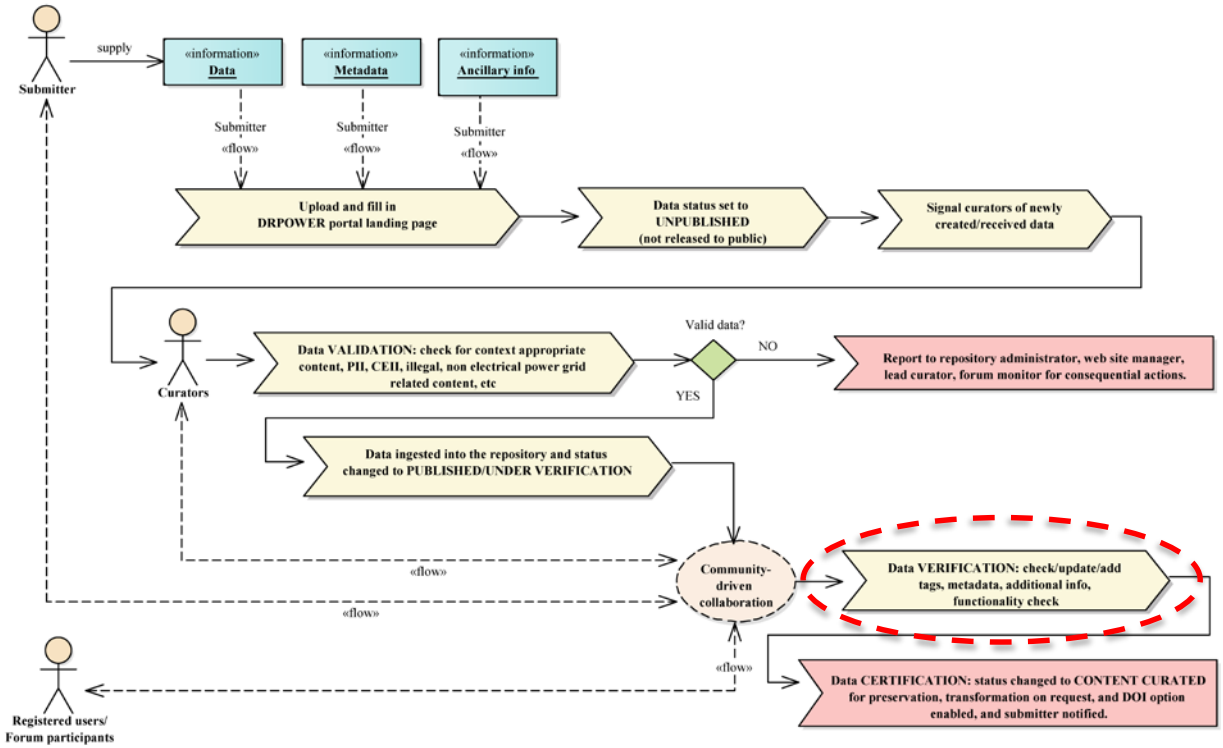
- Validation
- Verification
- Certification
- Transformation

Validation guidelines



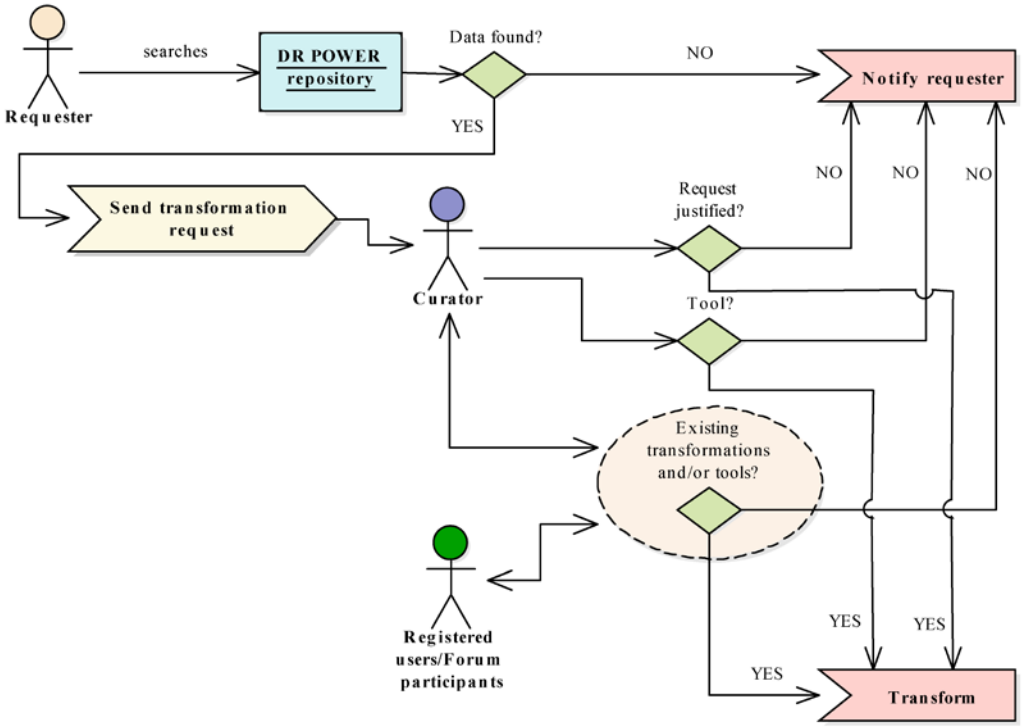
- Unallowable material
  - Legally objectionable language and/or data
  - Personally Identifiable Information
  - Critical Energy/Electrical Infrastructure Information
  - Non-context related material
- Allowable material
  - Transmission, generation and/or distribution networks
  - Models
  - Measurement data
  - Economic aspects

Verification & certification guidelines



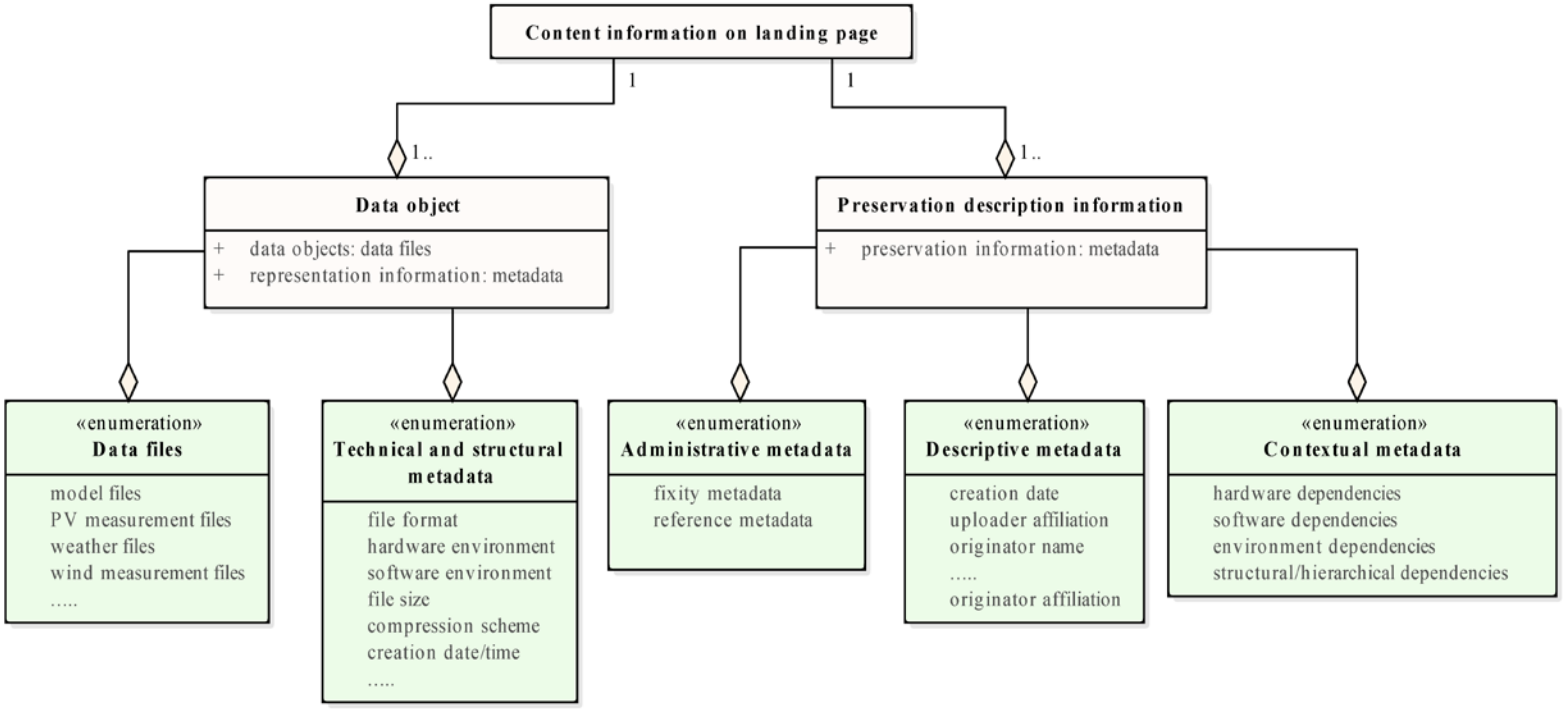
- In-depth check
  - Quality assurance
  - Metadata
  - Tags
  - Readability
  - Running
- User communication
- Certification

Transformation guidelines



- By request
- Questions
  - Meaningful?
  - Of interest?
  - Existing tool?
  - Community interest in building a conversion tool?

Metadata


Content information on landing page
1
1
1..
1..
Data object
+ data objects: data files
+ representation information: metadata
Preservation description information
+ preservation information: metadata
«enumeration»
Data files
model files
PV measurement files
weather files
wind measurement files
.....
«enumeration»
Technical and structural metadata
file format
hardware environment
software environment
file size
compression scheme
creation date/time
.....
«enumeration»
Administrative metadata
fixity metadata
reference metadata
«enumeration»
Descriptive metadata
creation date
uploader affiliation
originator name
.....
originator affiliation
«enumeration»
Contextual metadata
hardware dependencies
software dependencies
environment dependencies
structural/hierarchical dependencies

Curation Development Screenshots

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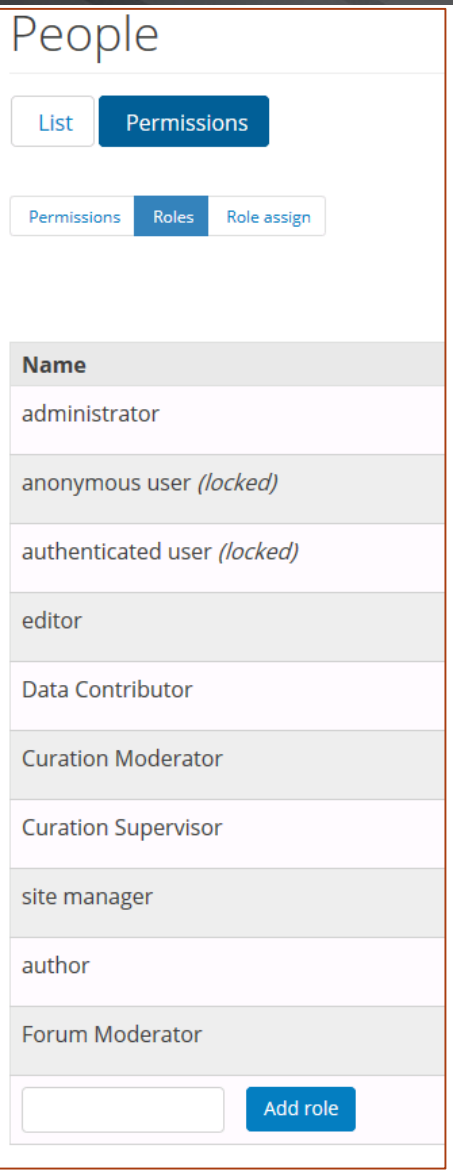

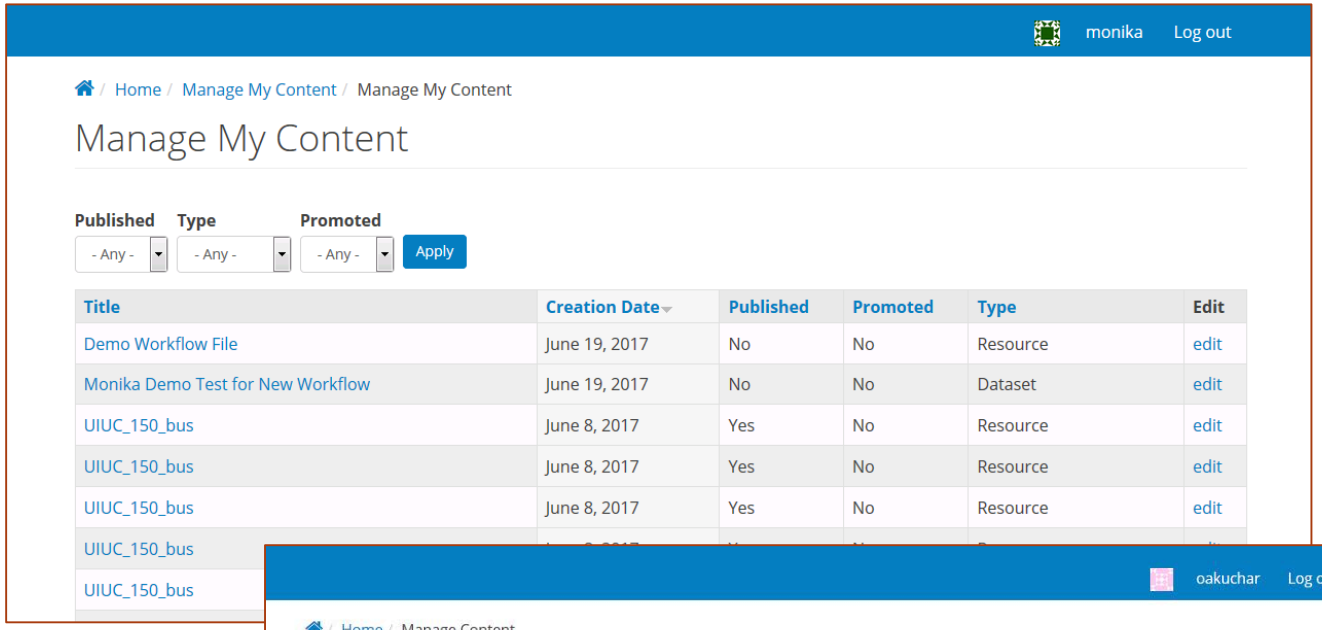

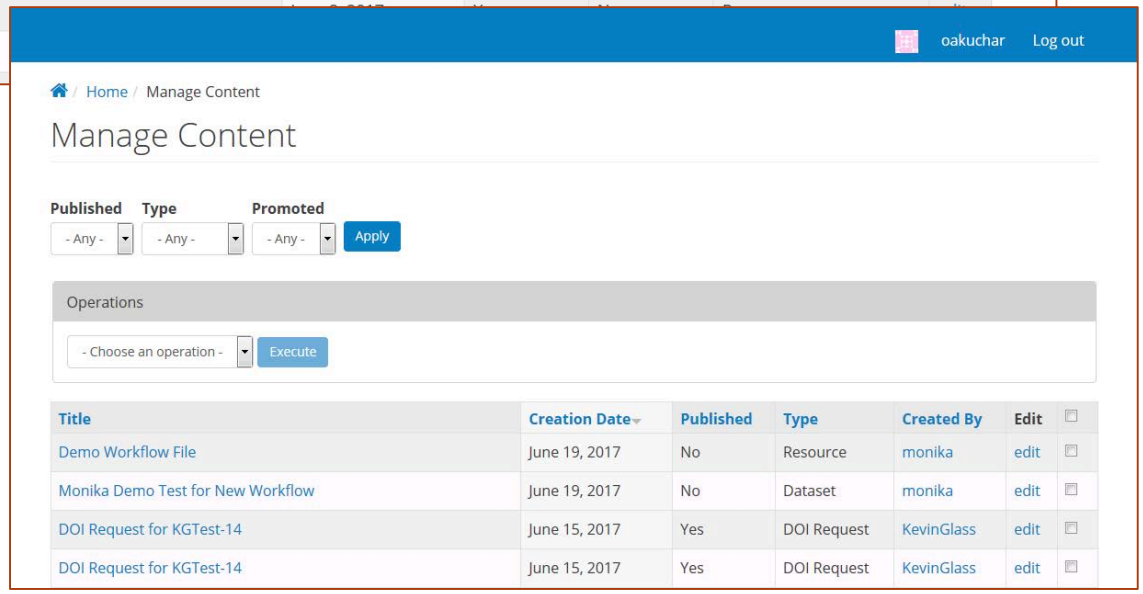

Curation Development Screenshots

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Stale drafts

My content | My drafts 0 | Needs review 0 | Stale drafts 2 | Stale reviews 0

Title **Type** **Groups**

- Any - | - Any - | Filter | Reset

Select all items on this page | Reject | Publish

Title	Revision Author	Groups	Updated	Actions
KGTEST01	KevinGlass	(none)	Tue, 06/13/2017 - 16:33	Edit | Submit for Review
KGTEST01	KevinGlass	(none)	Tue, 06/13/2017 - 16:11	Edit | Submit for Review

Dataset Resource Data Story Data Dashboard