

# Data-Gov Wiki: Towards Linked Government Data

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**Abstract.** The Data-gov Wiki is the delivery site for a project where we investigate the role of linked data in producing, processing and utilizing the government datasets found in data.gov. Towards facilitating the Web developers and users access the public government data transparently, the Data-gov Wiki currently features the following: (i) RDF dump of interlinked US government data (over 2 billion triples covering hundreds of data.gov datasets) with dereferenceable URIs; (ii) a Semantic Wiki based user interface mashing up the catalog data published at data.gov, machine generated statistics at TWC and user contributed data that connects the RDF dump to the open linked data; (iii) a number of visual demos illustrating the practical value the linked data.gov datasets as well as the corresponding technical details, and (iv) web services that publish changes in data.gov datasets (e.g. recently added/updated datasets) via RSS and Twitter. Extensions underway include developing interesting applications and demonstrations that show how semantically linked government data can be used to combine information from the different datasets, how it can be used to combine these datasets with information found elsewhere on the Web, and how we can link US data.gov efforts with the UK linked-data release currently under development.

## 1 Introduction

The recently launched data.gov website has released 800+structured government datasets from 49 different US government agencies for public access. Our Data-gov Wiki (<http://data-gov.tw.rpi.edu/>) is the delivery site for a project where we investigate the role of linked data [1] in producing, processing and utilizing the government datasets found in data.gov. The wiki hosts a number of demos/tools and describes the techniques used for making data.gov available using the Web standards developed in the World Wide Web Consortium's Semantic Web Activity.

## 2 General Architecture

To realized linked government data (gov-data) [2, 3], we exhibit the following semantic web based components via Data-gov Wiki:

- convert gov-data into RDF for machine- friendly data access. Currently datasets published in data.gov still need additional parsing to be reused by developers;
- enrich and link gov-data via various data processors (e.g. extraction, normalization, and linking);
- show the value of linked gov-data using interesting applications built on the low-hanging fruit of the semantic web (e.g. SPARQL engine) and the Web in general (e.g. Google Visualization API).

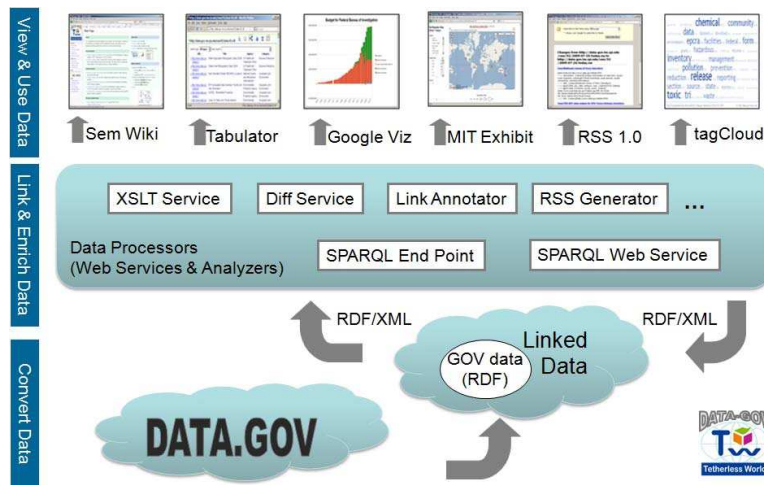


Fig. 1. Semantic Web Architecture for Government Data

### 3 Data Conversion

The datasets from data.gov are typically structured as tables/spreadsheets, and they are published in different formats such as CSV/TXT, Excel, XML, and KML. Currently, we have created 113 RDF datasets covering 300+ datasets listed on data.gov (228 datasets from the EPA are subsets of three big datasets). The translated RDF datasets contribute a total of 2,517,562,411 triples involving 5,672 properties. Our conversion process adopted the following principles: The conversion should be kept minimal, just enough to preserve the structure and content of gov-data, and the converted RDF data can always be enriched by advanced data processors in the future. The converted data should be accessible on the Web; therefore, RDF/XML was chosen for data publishing and all URIs in the converted data are dereferenceable via HTTP protocol. The ontology for the converted data should also be extensible, and we leverage Semantic MediaWiki (SMW) to collect Web users edits. Provenance of the conversion should also be recorded, and we used popular ontologies including Dublin

Core (DC) and FOAF. We also observed some issues in reusing gov-data. For example, some datasets were encoded in hard-to-parse formats, some datasets were published via query-based interactive access points, and some datasets mentioned values that are meaningless without being further interpreted by other datasets. These issues justify the importance of linked data in gov-data reuse. For more details, see [http://data-gov.tw.rpi.edu/wiki/Current\\_Issues\\_in\\_data.gov](http://data-gov.tw.rpi.edu/wiki/Current_Issues_in_data.gov).

## 4 Demos

With the converted RDF gov-data, we then built applications using existing (semantic) web tools. The applications were developed with two purposes: demonstrating the value of the linked gov-data and serving as examples for web developers to learn and adopt semantic web technologies. All applications are listed at <http://data-gov.tw.rpi.edu/wiki/Demos>.

### 4.1 Data catalog on the Data-gov Wiki

Dataset 92 (<http://www.data.gov/details/92>) provides metadata about the datasets listed on data.gov. Each dataset is described by 52 properties. Currently, data.gov provides faceted search (keywords, format, agency, and category) and browsing (100 items per page) for finding datasets. However, users cannot locate datasets using other properties (e.g. title or description), and users can only contribute ratings to the datasets. We leveraged SMW to add some new features to the Data-gov Wiki (see Figure 2):

- Replicating the catalog metadata. We used JENA to convert the RDF version of Dataset 92 into MediaWiki's XML wikidump format and preserve the RDF data using SMW annotations on each datasets wiki page.
- Integrating more metadata. The original metadata about a dataset were enriched by more metadata contributed by manual wiki editing (e.g. issues with a dataset, linked data to dbpedia and geonames [http://data-gov.tw.rpi.edu/wiki/Dataset\\_92](http://data-gov.tw.rpi.edu/wiki/Dataset_92)) and computer programs (e.g. number of triples).
- Enabling customized data access. Users can access data via MediaWiki's keyword search and SMW's query, for example RDF data listing [http://data-gov.tw.rpi.edu/wiki/Data.gov\\_Catalog](http://data-gov.tw.rpi.edu/wiki/Data.gov_Catalog) and faceted browsing <http://data-gov.tw.rpi.edu/wiki/Special:BrowseData/Dgtwc:Dataset>.

### 4.2 Data Visualizations

A number of (interactive) visualizations of the data from data.gov have been built to show (i) how to hook up the converted RDF data with conventional Web tools, and (ii) the value of linked gov-data. We see a generic design for developing gov-data visualization applications following Jeni Tennison's blog (<http://www.jenitennison.com/blog/node/113>, July, 2009):

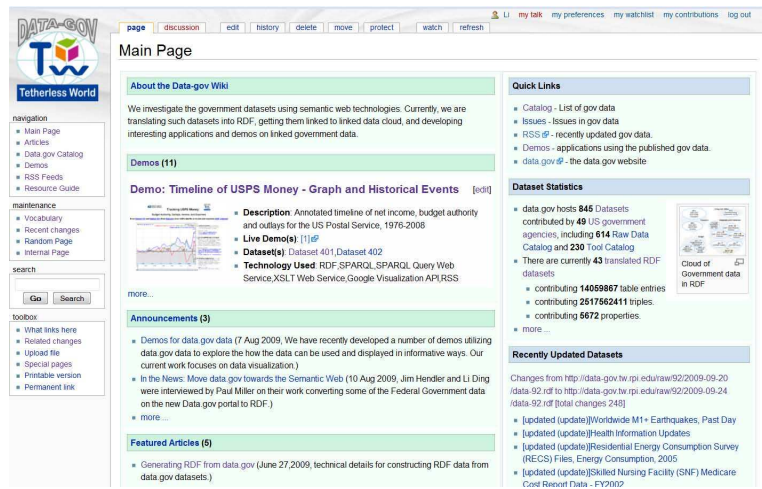


Fig. 2. Main Page of Data-gov Wiki

- Query Data. We execute a SPARQL query with a FROM clause pointing to the linked gov-data through a SPARQL query web service (<http://onto.rpi.edu/sw4j/sparql.html>) and get SPARQL/XML encoded query results.
- Convert Data. We then convert the query results to the specific data structure required by visualization tools in JSON format. For the Google visualization API, we used Jeni's XSL stylesheet with an online XSLT processor, and for MIT Exhibit, we wrote some PHP conversion code.
- Visualize Data. This is conventional Web developing work.

Figure 3 shows a map of earthquakes of magnitude greater than 1M in the past 7 days (dataset 34). The map display uses the faceted browsing functions provided by MIT Exhibit. see [http://data-gov.tw.rpi.edu/wiki/Demo:\\_Interactive\\_Faceted\\_Browser\\_for\\_Earthquake\\_Data](http://data-gov.tw.rpi.edu/wiki/Demo:_Interactive_Faceted_Browser_for_Earthquake_Data)

### 4.3 Data Integration and Linking

Figure 4 plots information about the same government account, the Postal Service Fund, from two different datasets, namely the federal budget authority (dataset 401), budget outlays (dataset 402), income and expense data collected from USPS website, and USPS related news collected from the Web. Examining this figure, interested readers might consider why there is a big drop in 2004 in budget outlays, and how that change can be linked to news released in the same year, e.g. the increases in postage rates or the changes in the USPS's business structure. see [http://data-gov.tw.rpi.edu/wiki/Demo:\\_Timeline\\_of\\_USPS\\_Money\\_-\\_Graph\\_and\\_Historical\\_Events](http://data-gov.tw.rpi.edu/wiki/Demo:_Timeline_of_USPS_Money_-_Graph_and_Historical_Events).



Fig. 3. Worldwide 1M+ Earthquake Map - Past 7 days

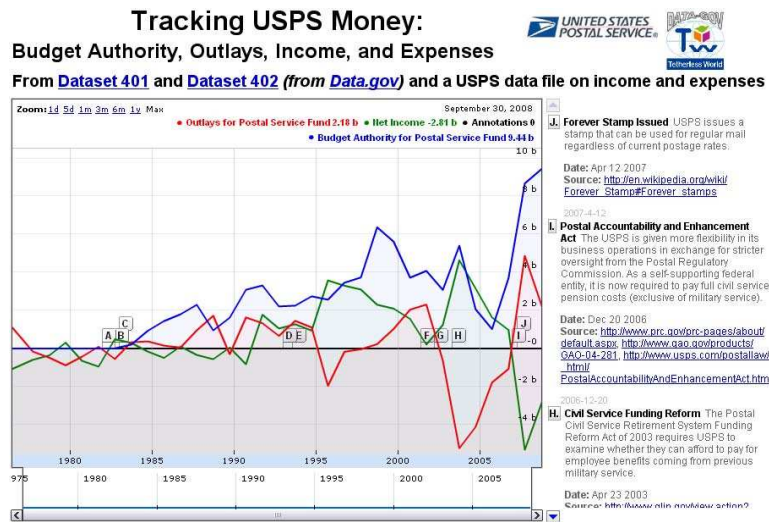


Fig. 4. Budgets of Postal Service Fund (1962-2014)

#### 4.4 Tracking Changes

Tracking the changes of the 800+ datasets listed on data.gov is not an easy job for human users. Unfortunately, data.gov does not offer an RSS feed for their datasets, and Twitterers' attempts to keep track ([http://twitter.com/DataGov\\_Tweets](http://twitter.com/DataGov_Tweets)) stalled on June 17, 2009. Therefore, we used semantic web tools to generate our own RSS ([http://data-gov.tw.rpi.edu/wiki/RSS\\_Feeds](http://data-gov.tw.rpi.edu/wiki/RSS_Feeds)) on a daily basis to keep track of (1) what datasets are available on data.gov and (2) which datasets have been recently added, updated or deleted (see figure 5). The former RSS feed was generated by a SPARQL query (converting vocabulary) and some tweaks on the generated RSS (sorting and placing channel descriptions to meet RSS readers). The latter RSS feed was derived from an online service (<http://onto.rpi.edu/sw4j/diff.html>) that computes and summarizes the difference between two RDF graphs at instance level, where each gov-datas metadata is stored as an instance. see <http://data-gov.tw.rpi.edu/raw/92/diff-data-92.rss> and <http://twitter.com/#search?q=data-gov-wiki>.

**Changes from <http://data-gov.tw.rpi.edu/raw/92/2009-07-19/today.rss> to <http://data-gov.tw.rpi.edu/raw/92/2009-07-24/today.rss>**

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**[\[new\]National Census of Ferry Operators](#)**

```
[add instance] http://www.data.gov/details/454
----> :description . [values]{Contains information on each ferry vessel,
route segments, passenger/vehicle boardings, peak periods, modal
connectivity, terminal information}
----> :title . [values]{National Census of Ferry Operators}
----> dgp92:data_gov_data_category_type . [values]{Tool Catalog}
----> dgp92:data_extraction_access_point . [values]
{http://www.transtats.bts.gov/Tables.asp?DB_ID=616&
DB_Name=National%20Census%20of%20Ferry%20Operators&
DB_Short_Name=Ferry%20Census}
----> :link . [values]{http://www.data.gov/details/454}
```

**[\[new\]TRI.NET data engine for EPA Toxics Release Inventory](#)**

**Fig. 5.** changes of datasets listed on data.gov

## 5 Conclusion

In the Data-gov Wiki, we have published billions of triples and built a couple of interesting applications/demos from gov-data. In most of our demos, a SPARQL web service played an important role in connecting distributed RDF data with conventional Web APIs. The simplicity of this process grants a promising future. Current efforts include converting more gov-data into RDF, developing more interesting applications and demonstrations that show how semantically linked government data can be used

to combine information from the different datasets, looking at ways converted datasets can be linked with information found elsewhere on the Web, and examining linkages between potential US data.gov and UK linked gov-data efforts [4].

## 6 Acknowledgement

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## References

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