XOData® is a light-weight, practical, easily accessible and generic OData API visualizer / data explorer – that is useful to developers as well as business users, business-process-experts, Architects etc.

- Business Analysts or End-Users can utilize Data Visualization and Explorer for Ad-hoc Self-Service Reporting.
- It assists in verification, testing and documentation of OData APIs.

How is it helping?

❖ **Early API Verification / Testing:**
No surprises! Avoid costly re-work and ensure functional testing of APIs to avoid exposing sensitive data accidently.
  o 3000+ developers/analysts using XOData Online (each month)
  o 300+ APIs explored through XOData and added to OData Directory
  o 1800+ downloads of XOData Chrome App.
  o Recommended in openSAP training by SAP & www.odata.org

❖ **API Awareness : Replace Lengthy Documentation of OData APIs with Interactive XOData:**
Make it easy for others to understand your API.
Some example usage as found on web are as below:
  o Time cockpit decided to bet the farm on OData instead of a custom web api. PragmatiQa's XOData shows what you get for free because of time cockpit supporting OData.
    http://www.timecockpit.com/blog/2014/06/03/Power-of-Standards-Why-OData-Shines-in-Time-Cockpit
  o http://api-doc.tourinsoft.com/#/syndication-3x#exploitation
  o http://through-the-interface.typepad.com/through_the_interface/2015/07/visualizing-the-autocad-io-api.html

❖ **Self-Service Interactive Data Exploration/Ad-hoc Reporting & Data Visualizations:**
Individual reports for each conceivable scenario is costly and may not be feasible but most Ad-hoc self-service applications require technical knowledge of SQL etc.
Unlike data-scientists, end-users need simple, interactive and intuitive self-service data visualizations for their ad-hoc requirements.

  ELI LILLY AND COMPANY is an XOData Enterprise customer.

Summary of Features

- ❖ **API Visualization:** It provides interactive (filterable / draggable) model-diagram of datasets for API/data-model awareness.

- ❖ **An interactive OData Query Builder:** OData queries can be made through drop-box selection. It's completely dynamic unlike any other OData UI Framework – so even if your API's metadata changes in future, query builder UI will adjust automatically based on the current metadata. Among other features, it also provides support for expand and selection of individual properties from expanded elements too.

  It supports all the OData versions (including most of the OData V4 requirements) and formats (ATOM/JSON). Multi/Deep-Expand through Query Builder is supported for up-to OData V3. Deep filtering is supported for all OData Versions provided the OData API supports it.
  Support for OData V4 **bounded** entity / function calls is not available through Query Builder UI. Also queries are prepared with 'AND' condition however in some cases, IN operation can be used for 'OR'. Further, manual editing of OData URL is possible for such scenarios.

  The result display tables' layout is also generated dynamically with two modes. On click of [Get All Data] button, the application automatically fetches data in chunks – with built-in intelligence to checks for server or client side paging support to get the data-accordingly in batches. If server side paging is not supported by the API then it uses the client side paging with 5000 (default) records at a time.

    - ○ **UI mode** is for normal display and navigations to related entity details – it supports the display of complex hierarchical data as well.

    - ○ **Data-mode** is for flattening (N:1 and 1:1 relations) and to show the results in an excel like display – so even related entity data from expands can be used for data-visualizations. Please note that 1:N relations can't be flattened however the same outcome can be achieved through reverse-navigation.

- ❖ **In-built interactive Data-visualization module**: User Friendly and Interactive Data Visualizations (Data Charts, Pivot Table and World Map) with Filtering and auto-ranking capabilities for aggregated data received through API Queries.
    - ○ Suitable for light-weight visualizations. Volume of data / performance is restricted by the Browser's memory limit. In other words, targeted Query should be build using Query Builder to receive limited / aggregated data-results, suitable for a client side browser based application.
    - ○ Sum/Count/Avg is supported in both Chart and Pivot. Max/Min is not supported for Pivot table.

- ❖ Also, it's possible to extend/customize XOData –An example implementation of XOData as "Open OData Directory" : http://pragmatiqa.com/odatadir/

- ❖ XOData is a responsive web-application and should work on smaller devices as well e.g. Tablets, Chrome-Book etc. It requires a modern Browser e.g. Recent Chrome/Firefox etc. or IE10+. Chrome App will only work on Google Chrome Environment. Please note that due to the dynamic nature & memory requirements of App, XOData does not support history navigation through Back button of Browser.

- ❖ Some of the latest features which are currently under beta in Chrome App and will be available for Enterprise soon :
    - ○ OData CRUD related features are under progress and as of now only "Create single entity" feature is available in Chrome App. It supports entities with hierarchical complex types & collections.
    - ○ OData API HTTP Request/Response log feature that can be toggled on/off as required.

XOData for Enterprise Deployment: Important Technical Considerations

Infrastructure:

XOData® is built as a generic, client side web application – HTML5/JavaScript (using AJAX for API call). It's a *Single Page Web-Application* (SPA) so hosting it on any web app server should be easy. PragmatiQa can provide support for this but customer's development team will deploy the application on their platform.

It uses standard OData API to avoid dependency on backend and deliberately avoids any platform specific server side components to reduce considerable overhead of duplicate infrastructure/server & server side components. Further, it exploits recent technical advances in client side (provided by Modern Browsers, HTML5 & JavaScript) with the aim to provide consumer level experience.

Same Domain Restriction of Browsers:

If you plan to deploy XOData Application on the same system (sub-domain) from where the OData Service is being served then no further consideration is required with regard to same-origin-restriction of Web-Browsers.

However, in case you need to deploy XOData on a separate server and not on your OData Service provider system (i.e. it will not be served from same sub-domain) then it will require a method to avoid the same-origin-restriction of browsers.

- ❖ If you already have any such web applications (JavaScript AJAX/OData API based) working in your landscape then there should be a proxy/web-dispatcher/API Manager in place to mediate and provide access to your APIs from web applications.
- ❖ Implementing CORS support (server and client side both) is another option.

Authentication Mechanism:

XOData supports basic authentication and can be customized/extended to support other authentication method e.g. OAuth2 implicit. Customer's development team can integrate XOData web application to support desired authentication scheme as per their environment. PragamatiQa can provide support for changes required in XOData application.

Customization:

- ❖ **Look & Feel:** Bootstrap CSS can be generated as per standard customization http://getbootstrap.com/customize/ to change color and other aspects of elements. CSS customization is possible to alter the look and feel of HTML elements.

- ❖ As of now XOData is only available with English Text.

- ❖ **OData Service-list:** A Service-list can be setup. This will provide a much simpler option to the users as they can access all the available OData services from Service List drop-down.

    - OData producer system can provide a Service Catalog API that will provide a list of OData APIs for which user is authorized.
    - Alternatively, a JSON config file that is available in "customization" folder as ServiceList.json – example services can be replaced with Name and Metadata URL of your actual OData APIs.

Getting Started: (*please note that look & feel on some of the screens might be different in latest XOData***)**

- If you are using XOData Chrome App or XOData for Enterprise then provide the connection details on "Connection Tab". Enter login details (username / password) on "Connection" tab and Press [Use this Setup].

- Click on "Choose Access Options" button on the top-bar to select "OData Metadata URL", then enter metadata URL (e.g. http://system:port/serviceName/$metadata) and press [Get Details].
- Please note that the metadata URL is OData service URL added with /$metadata at the end and it provides an XML document with metadata details. You can also check the URL in a normal browser window to verify that URL is correct and accessible.

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Overview of Features with an Example: In this example we will select Northwind OData V4 API. On selection, Metadata XML document of API is parsed and converted to an interactive relationship diagram – that is also filterable to focus on a particular dataset/entity and its related datasets – e.g. in the screenshot below, we are focusing on Order and related entities only.
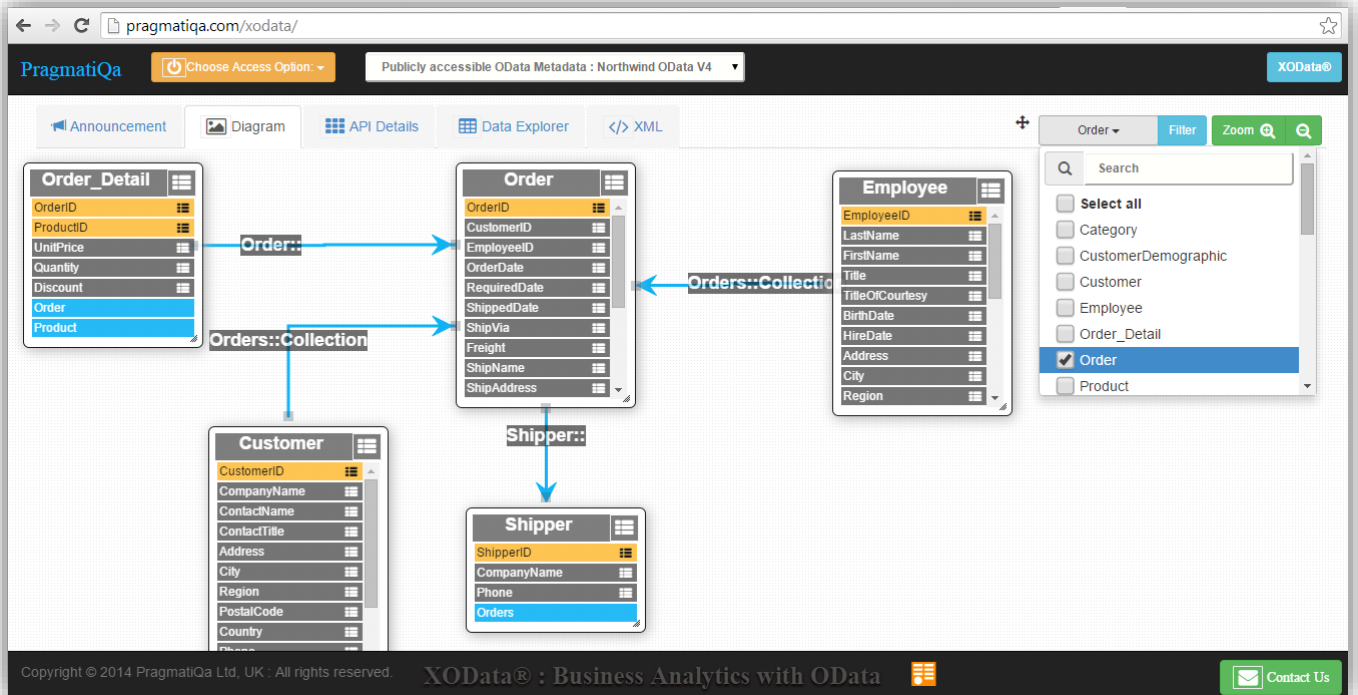
Further details about entity/types/attributes/functions etc. can be seen on Details tab.

On the Data Explorer Tab, OData Queries can be made interactively as below and data can be retrieved :

In the results display, related entities can be retrieved by selecting desired Links from drop-down.

Just to add that above requirement can also be handled by simply expanding Customer initially while building the Query itself – example given below:

Initial selection can be with a restriction of $top but pressing [GET ALL Data] button will fetch the complete results for the query (without $top restriction).Also, it's possible to change the table layout to much more data-friendly and excel like display by changing the setting – see button on the top-right corner [Hide/Show Default Settings then change "Auto Display based on data-size" to "Layout in Data Mode"]

..and now after running the query results will be displayed as below : the table has excel like features for selection/copy (CTRL+A, CTRL+C) etc. Just to mention that data can also be exported to CSV through [Export] Button.

Let's try now with a less restricted query to get relatively large set of data in order to show the data visualization features. There are several types of charts as well as world–map available on the chart type and multiple dimensions/measurements can be displayed on charts apart from filtering /ranking. Charts can be resized by dragging from sides and can be exported as PNG image. Filtering is available by clicking on filter sign on each attributes on Pivot table. Also ranks are calculated automatically that can be used to show - top 10 values etc.

In this case we have interactively selected Order entity and expanded ($expand) with Customer information – also picking just a few relevant attributes ($select). After pressing [Get All Data], 830 records are received.

Now pressing on Graph button and then selecting Dimensions and Measurements with operations (e.g. Count, Sum, Avg. etc.) from drop-down will create interactive visualizations .

Note that Pivot Table should appear along-side each charts – it can be rearranged by drag and drop of attributes on columns / rows and arranging the sequence of attributes – and will also be used for filtering purpose – see the filter icons on each attribute on Pivot table.
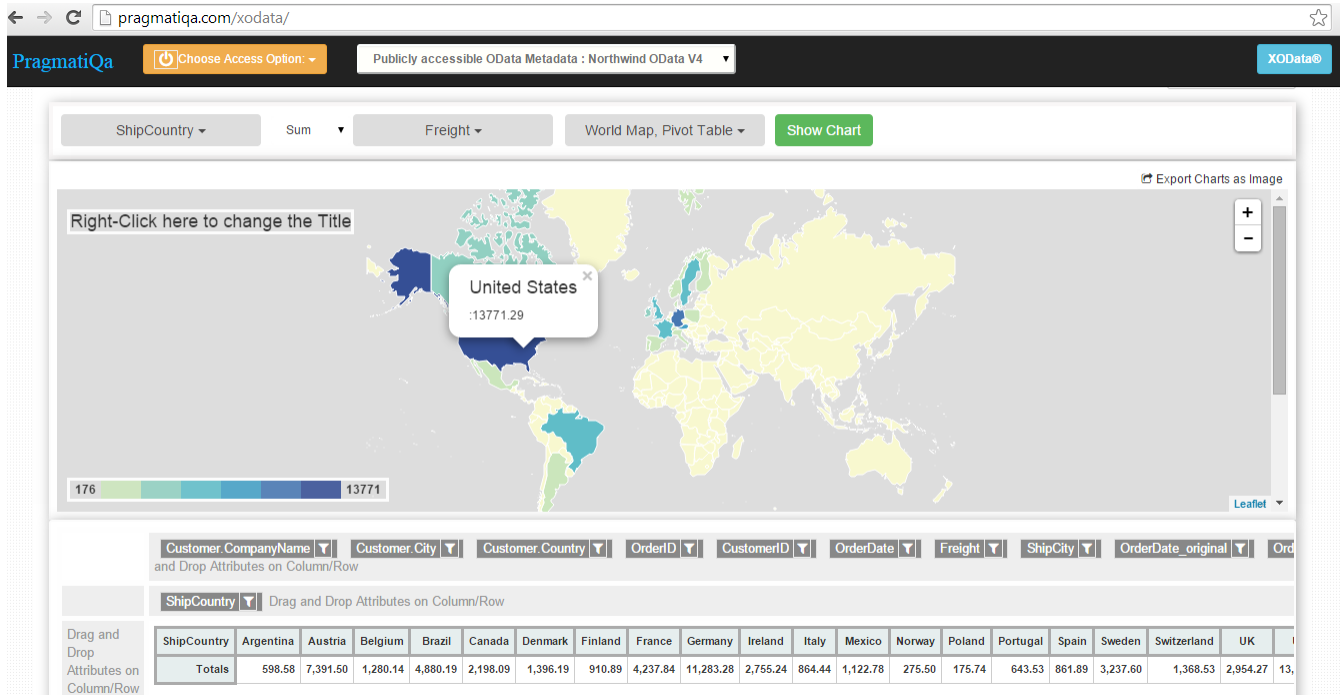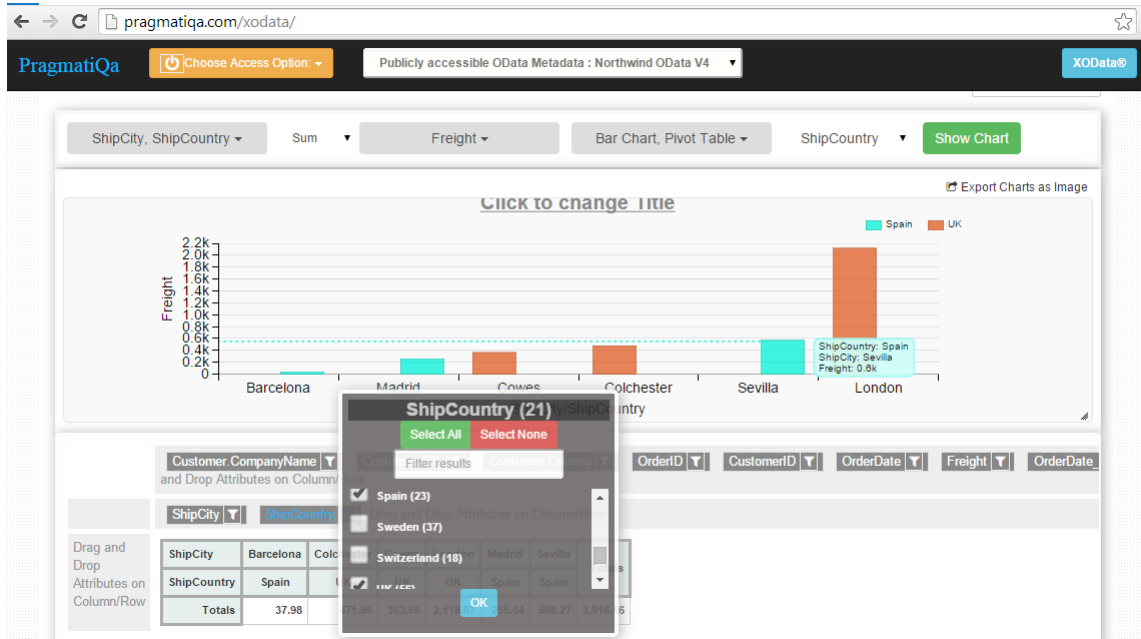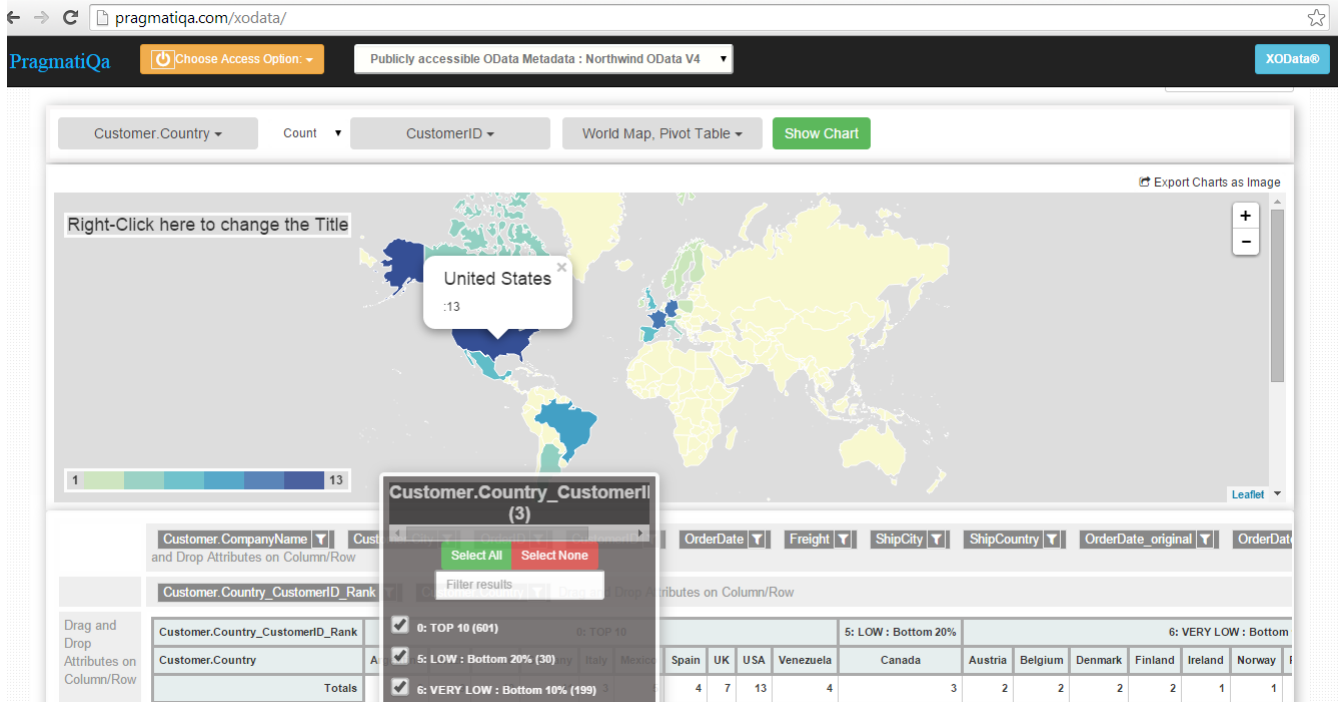
A few examples as below:

Drill down by selecting just one month:
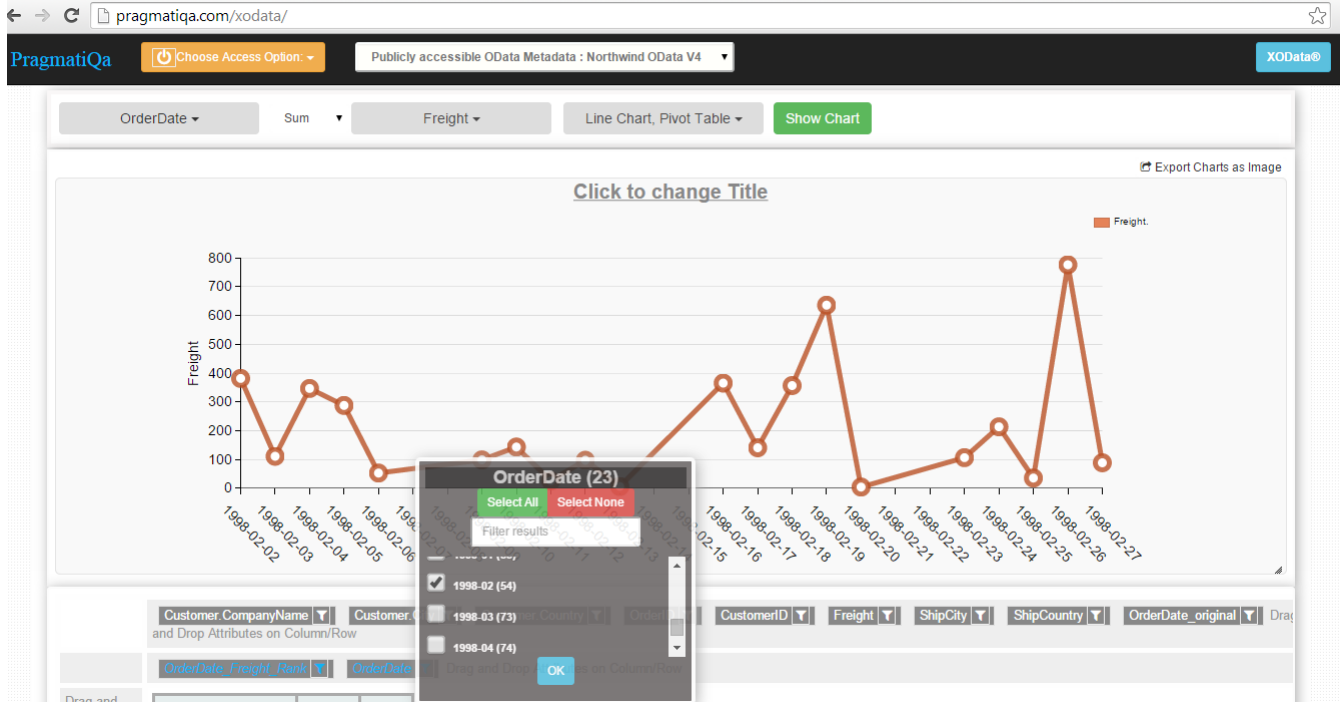
Country-wise freight: (Please remove filters, if required)

Count of customers in each country:

One more example using Invoice entity (different OData query) to show multiple measurements (e.g. Invoice value & Freight charges for top 10 customers) on same graph :