



SENTURUS

Using Query Folding to Improve Power BI Performance

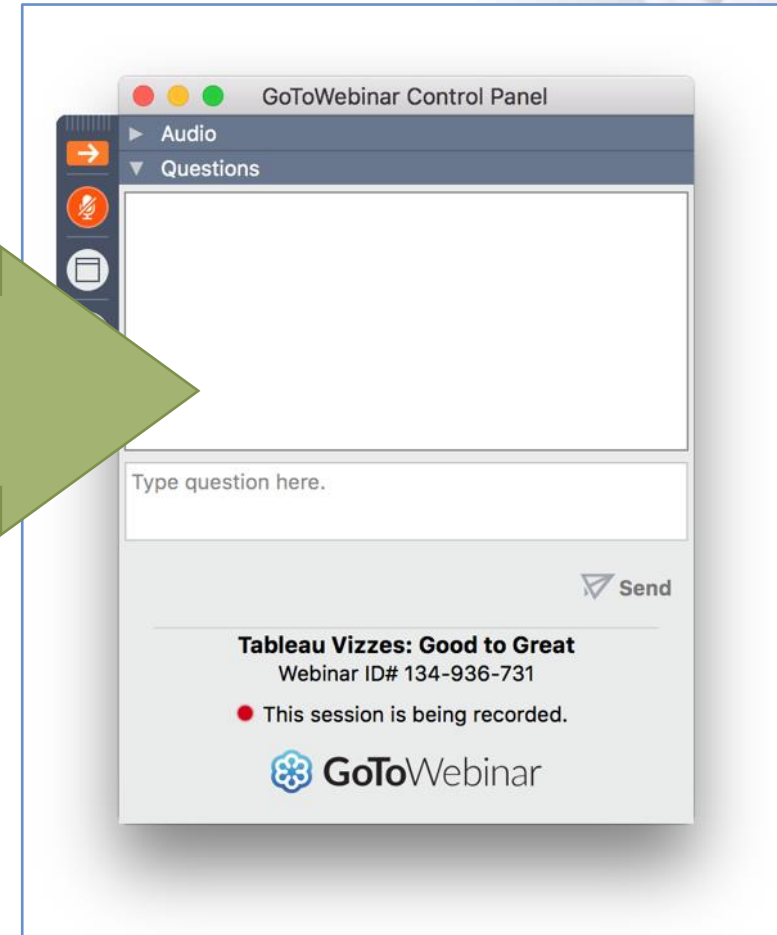


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Agenda

Introductions

Discussion on query folding

- Overview of query folding
- Review sources that can achieve folding
- Determine when a query can be folded
- Indicators of folding
- Preview of Query Plan

Demo

Senturus overview and additional resources

Q&A



Introductions

Pat Powers

Data Scientist, Consultant and Trainer
Senturus, Inc.

Why?

- Improved performance
- Better query optimization
- Faster results in reporting and dashboards
- **HAPPIER END USERS**



Overview of query folding

- Query folding is an important part of data modeling in Power BI
- With each type of table mode type (Import vs. Direct vs. Dual), folding can improve performance
- To achieve efficiency in your model designs, fold whenever possible



Query folding goals

- The goal of query folding is to offload as much as possible to the data source versus processing locally
- The **built-in functionality** of folding translates the M script to a native SQL language that can be interpreted and executed by the data source

Definitions

Folding

The process of taking queries and pushing them back to the data source for processing

Import model tables

Tables loaded and imported into memory

DirectQuery tables

Tables from a source not loaded into memory and instead read directly

M functions and query folding

- When you use Get Data and load data into Power Query, M functions known as accessing data functions are used
- These functions connect to your source in the native language

Advanced editor

```
1 let
2   Source = Sql.Database("senturus-azure.database.windows.net", "AdventureWorks2017"),
3   #"Navigation 1" = Source[[Schema = "Sales", Item = "Customer"]][Data],
4   #"Expanded Person.Person" = Table.ExpandRecordColumn(#"Navigation 1", "Person.Person", {"BusinessEntityID", "Person
    "EmailPromotion", "AdditionalContactInfo", "Demographics", "rowguid", "ModifiedDate", "HumanResources.Employee",
    Password", "Person.PersonPhone", "Sales.Customer", "Sales.PersonCreditCard"}, {"BusinessEntityID", "PersonType",
    "AdditionalContactInfo", "Demographics", "rowguid.1", "ModifiedDate.1", "HumanResources.Employee", "Person.Busine
    "Person.PersonPhone", "Sales.Customer", "Sales.PersonCreditCard"})),
5   #"Expanded Sales.Customer" = Table.ExpandTableColumn(#"Expanded Person.Person", "Sales.Customer", {"CustomerID", "P
    Person", "Sales.SalesOrderHeader", "Sales.SalesTerritory", "Sales.Store"}, {"CustomerID.1", "PersonID.1", "Store
    Person", "Sales.SalesOrderHeader.1", "Sales.SalesTerritory.1", "Sales.Store.1"})),
6   #"Replaced value" = Table.ReplaceValue(#"Expanded Sales.Customer", null, 999, Replacer.ReplaceValue, {"PersonID"})
7 in
8   #"Replaced value"
```

Data functions

Accessing data functions

Article • 10/10/2022 • 7 minutes to read • 6 contributors [Feedback](#)

These functions access data and return table values. Most of these functions return a table value called a **navigation table**. Navigation tables are primarily used by the Power Query user interface to provide a navigation experience over the potentially large hierarchical data sets returned.

Name	Description
AccessControlEntry.ConditionToldentities	Returns a list of identities that the condition will accept.
Access.Database	Returns a structural representation of an Microsoft Access database.
ActiveDirectory.Domains	Returns a list of Active Directory domains in the same forest as the specified domain or of the current machine's domain if none is specified.

- A list of the functions can be found at:
<https://learn.microsoft.com/en-us/powerquery-m/accessing-data-functions>
- All the source functions go back in the native language
- The steps following are the ones it will analyze to see if they can be folded

Three outcomes of query folding mechanism

Full query
folding

Partial query
folding

No query
folding

Transformations that support folding

Remove
columns

Rename
columns

Filter rows
(static or
parameterized)

Grouping and
summarizing

Expansion to
achieve joins

Non-fuzzy
merging

UNION ALL

Simple logic
custom
columns

Pivot/unpivot

Data sources

Can fold

- Relational databases
- OData feeds
 - SharePoint lists
- Exchange
- Active Directory

No fold

- Flat files
- BLOBS
- Web sources

Transformations that prevent folding

Merged queries from different sources

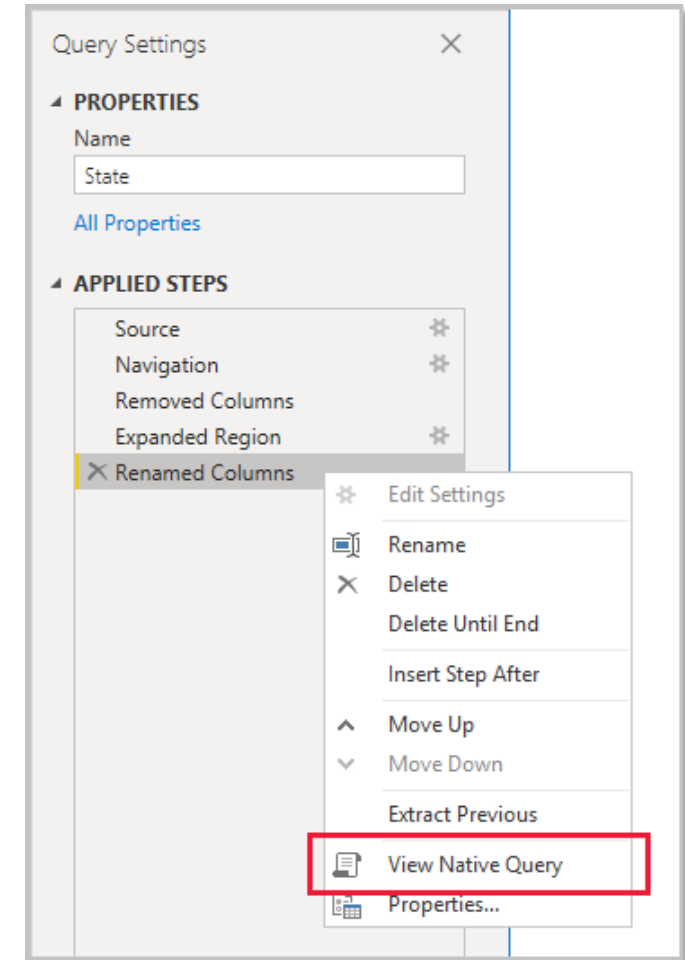
UNIONS based on different sources

Complex logic custom columns

Adding index columns

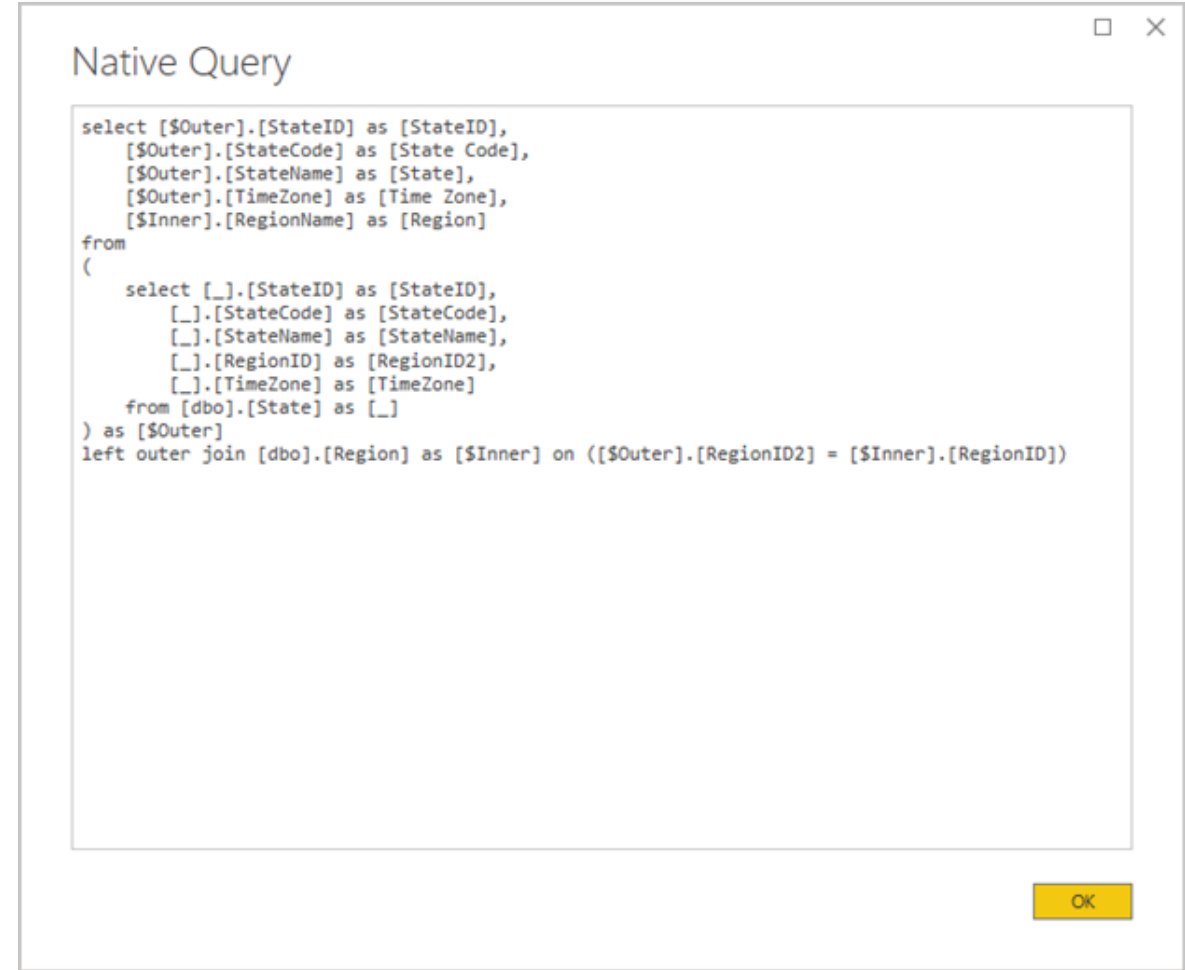
Know when to fold them...

- Using PQE, it's possible to know when a query can be folded
- Under Query Settings → View Native Query



Know when to hold them...

- If the option is greyed out, not all steps can be folded
- However some steps can be folded
- Use the native query option to see where the sequence stops








The screenshot shows a window titled "Native Query" with a standard Windows interface (minimize, maximize, close buttons). Inside the window is a text area containing a SQL query. The query is a complex nested select statement with a left outer join. At the bottom right of the window is a yellow "OK" button.

```
select [$Outer].[StateID] as [StateID],
[$Outer].[StateCode] as [State Code],
[$Outer].[StateName] as [State],
[$Outer].[TimeZone] as [Time Zone],
[$Inner].[RegionName] as [Region]
from
(
    select [_.].[StateID] as [StateID],
    [_.].[StateCode] as [StateCode],
    [_.].[StateName] as [StateName],
    [_.].[RegionID] as [RegionID2],
    [_.].[TimeZone] as [TimeZone]
    from [dbo].[State] as [_]
) as [$Outer]
left outer join [dbo].[Region] as [$Inner] on ([$Outer].[RegionID2] = [$Inner].[RegionID])
```

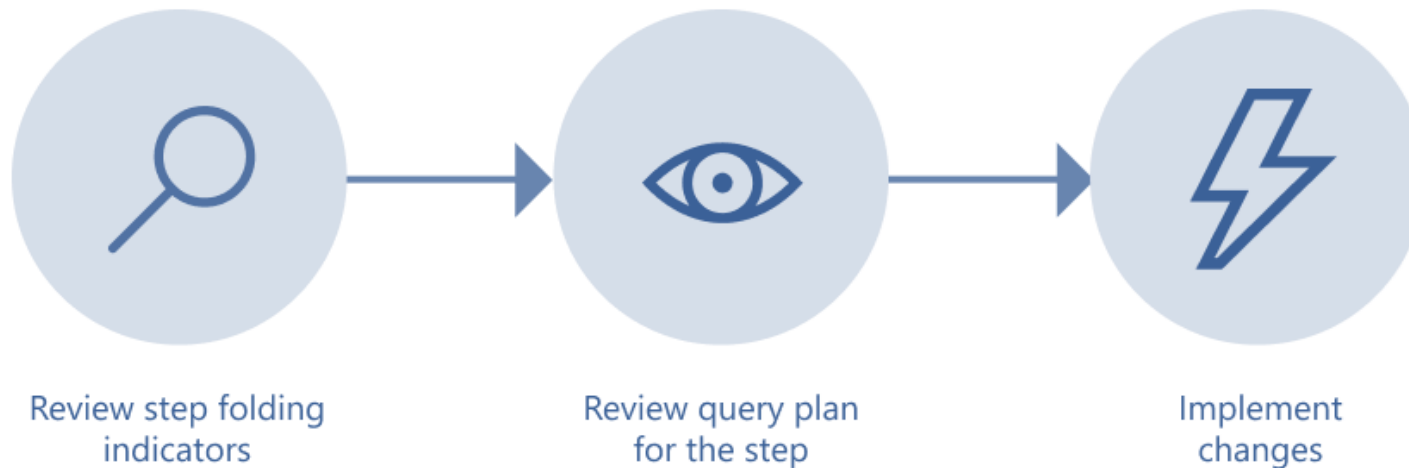
Indicators

- Step diagnostic indicators can give better insight into what can and cannot be folded
- Three type of indicators:
 1. Dynamic
 2. Opaque
 3. Unknown
- Indicators are non-sequential

Indicator	Icon
Folding	
Not folding	
Might fold	
Opaque	
Unknown	

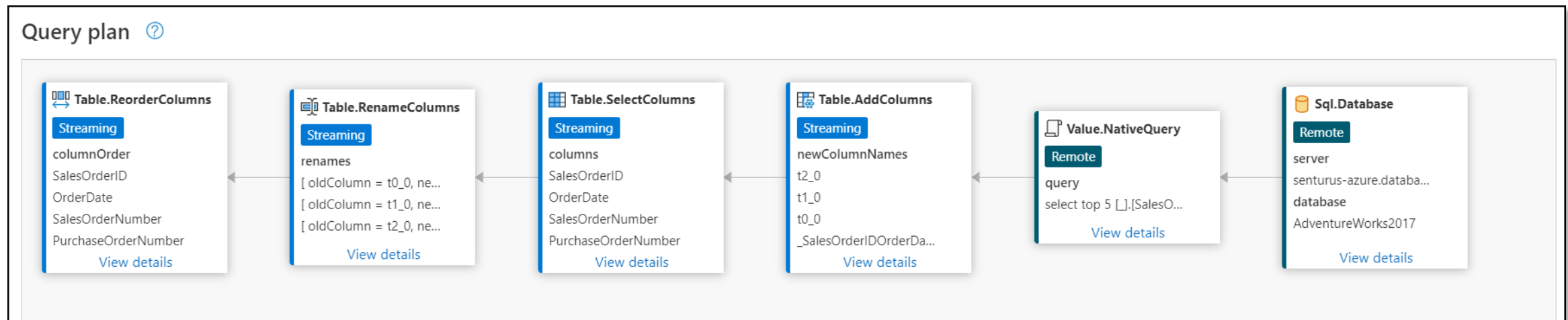
Query Plan

- Query Plan for Power Query provides a better view of your query's evaluation
- Available in Power Query online



Query Plan

- Start with the indicators
- Review the query plan per step
- Implement alternate methods





Query folding demo

Summary

Use built in functionality to examine, understand and optimize queries

Folding can provide improved overall performance and should be used whenever possible

Leverage indicators and Query Plan to determine the best method of optimization

Senturus and Power BI

- Improve performance
- Reduce total cost of ownership
- Report sharing strategy
- Determine correct tools within the suite
- Migrate to the cloud
- Train



Additional resources

Unbiased product reviews



Technical tips



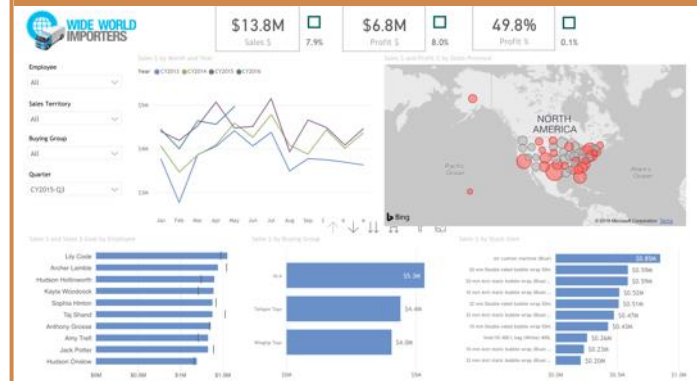
Insider viewpoints



More on this subject



Product demos



Upcoming events



Upcoming events

What's New in Cognos 11.2.4

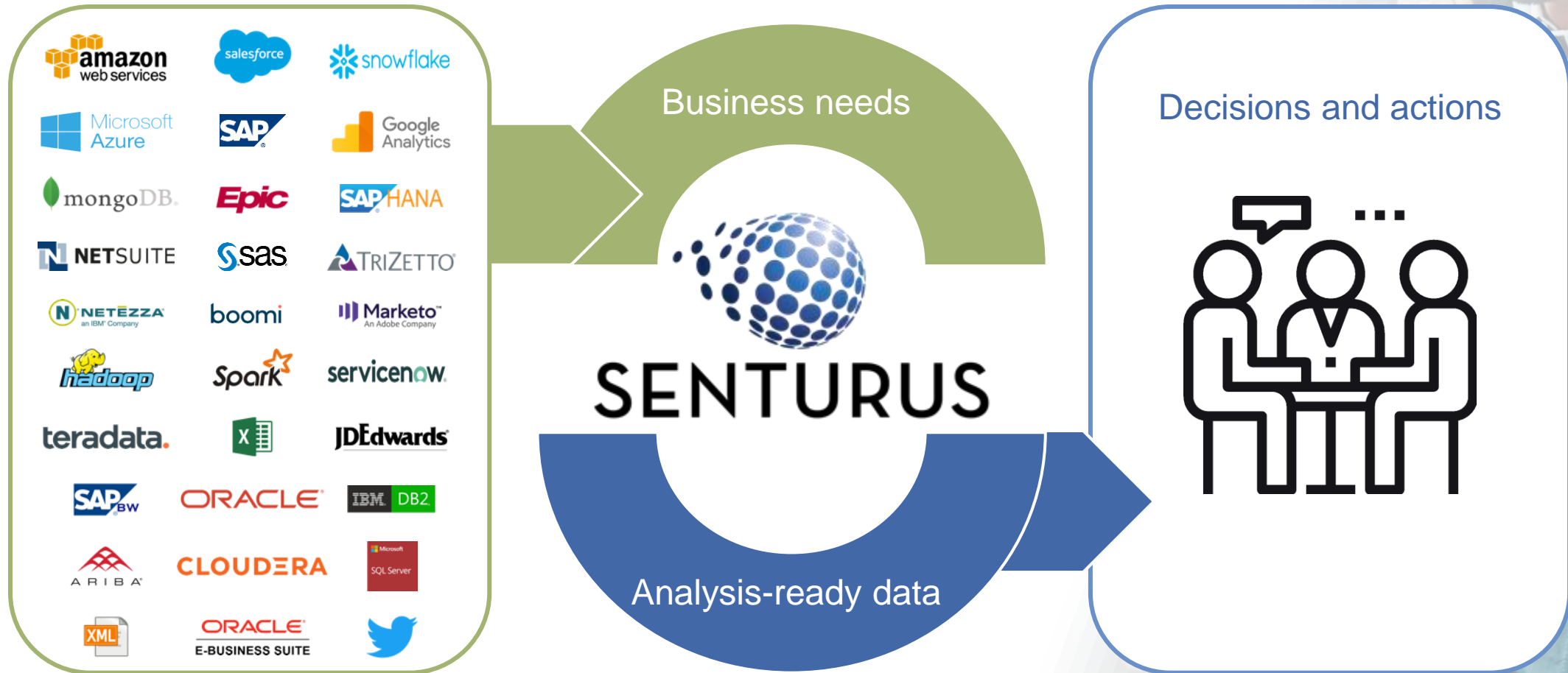
Thursday, Jan 19, 11am PT/2pm ET

Register: <https://senturus.com/events/whats-new-in-cognos-11-2-4/>

Dashboarding Comparison: Power BI, Tableau & Cognos

Thursday, Jan 26, 11am PT/2pm ET

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1350+ clients

3000+ projects





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See job descriptions: <https://senturus.com/why-senturus/careers/>

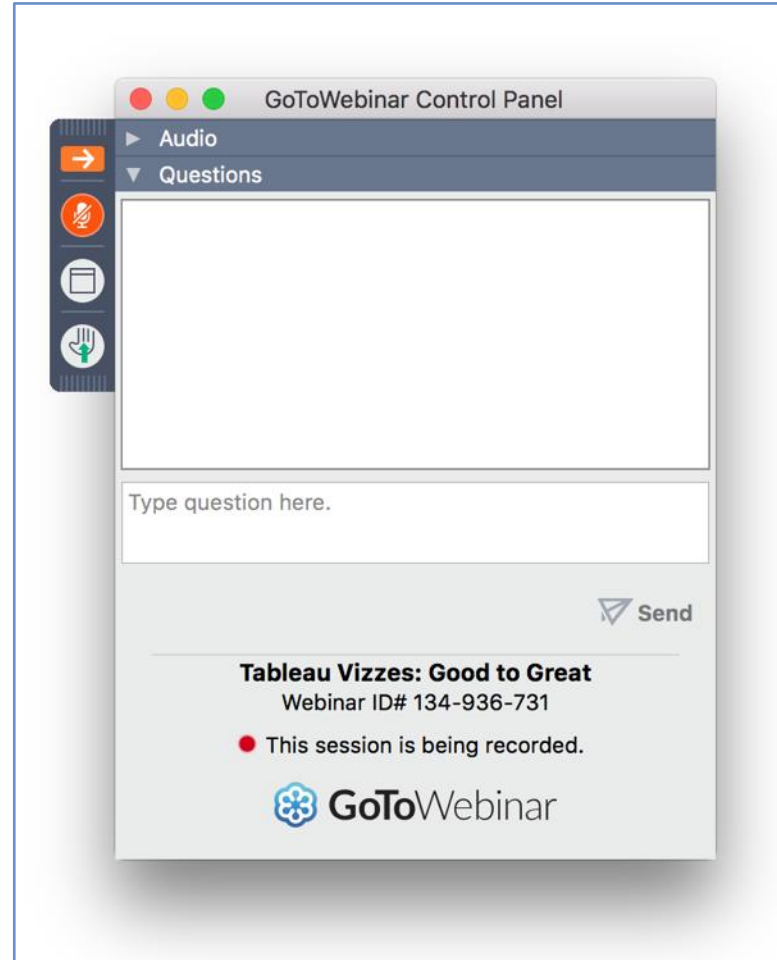
Send your resume to: jobs@senturus.com

Q & A

If your question or issue is broader than what we are able to answer today, contact us at:

info@senturus.com

and we will set up a free consultation.



Thank You



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