



**BNP PARIBAS**

# Advanced Workshop: Designing Efficient Workbooks

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17/10/2019



**My workbook  
is slow!**



**Why ???**



# Best Practices for Designing Efficient Tableau Workbooks

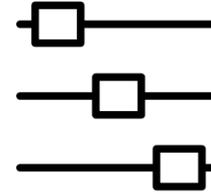
Tableau 10 Edition

Alan Eldridge  
Tableau Software

<https://www.tableau.com/learn/whitepapers/designing-efficient-workbooks>

# In a Nutshell...

Performance is *\*not\** an after-thought



There is no one “Silver Bullet” ...

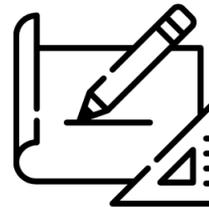


If it isn't fast in database, it won't be fast in Tableau

If it isn't fast in desktop, it won't be fast in Server



Design Choices correlate to Performance



**Interpretation:**

[“Avoid”, “Minimize”] ≠ “Do Not Use”

**Key points – Look for this symbol!**

>> ‘everything in moderation’



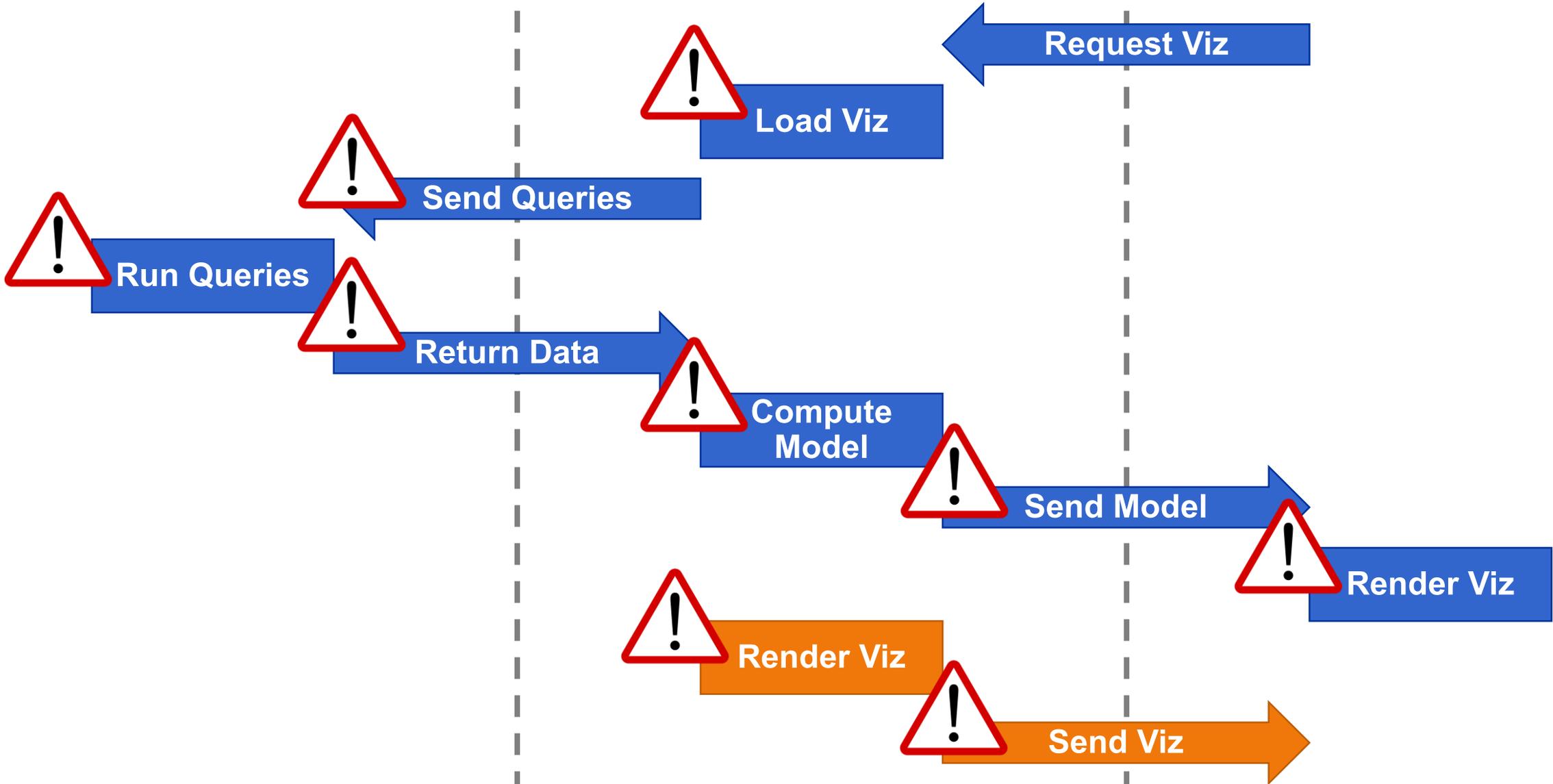
# Why Is My Workbook Slow?

The bottom of the slide features several horizontal, wavy lines in shades of orange and yellow, creating a decorative border.

# DATA

# TABLEAU

# BROWSER



# Concept: Visual Pipeline



Frequency

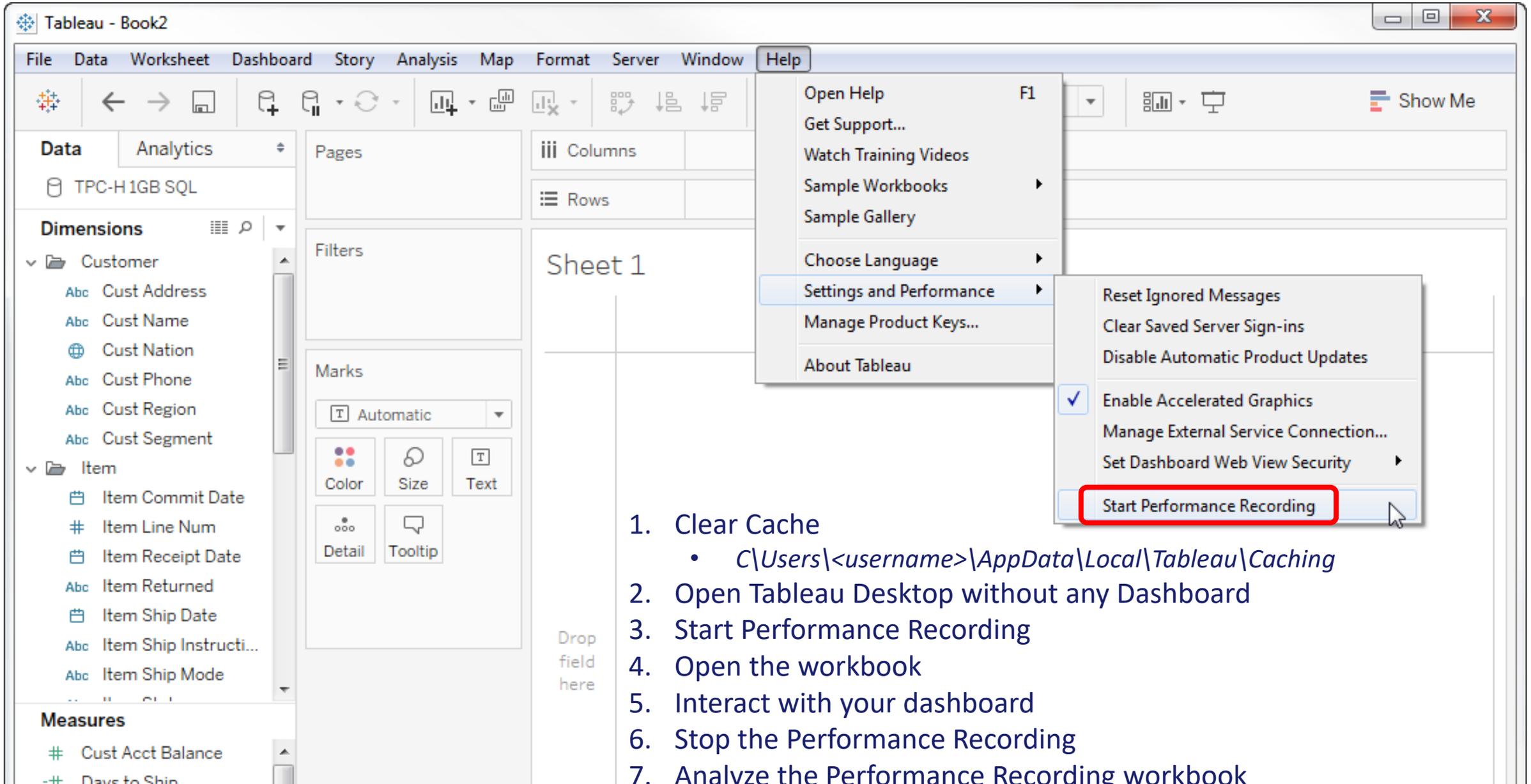
Changeability

# Finding the Problem



**When possible troubleshoot  
using Tableau desktop even if  
the complaint is about Server  
;-)**

# Performance Recorder



The screenshot shows the Tableau Desktop interface with the Help menu open. The 'Start Performance Recording' option is highlighted with a red rectangle. The interface includes a menu bar (File, Data, Worksheet, Dashboard, Story, Analysis, Map, Format, Server, Window, Help), a toolbar, and several panes: Data (Analytics), Dimensions (Customer, Item), Measures, Columns, Rows, Filters, and Marks. The main workspace is labeled 'Sheet 1'.

1. Clear Cache
  - `C:\Users\\AppData\Local\Tableau\Caching`
2. Open Tableau Desktop without any Dashboard
3. Start Performance Recording
4. Open the workbook
5. Interact with your dashboard
6. Stop the Performance Recording
7. Analyze the Performance Recording workbook

# Performance Recorder

[https://help.tableau.com/current/server/en-us/perf\\_record\\_interpret\\_server.htm](https://help.tableau.com/current/server/en-us/perf_record_interpret_server.htm)

The screenshot displays the Tableau Performance Recorder interface. The main window is titled "Tableau - PerformanceRecording" and contains a "Performance Summary" section. Below this, there is a "Timeline" chart showing various events over time. The x-axis represents "Time (s)" from 0 to 240. The y-axis lists the "Workbook", "Dashboard", "Worksheet", and "Event". The events are color-coded: green for "Executing Query", blue for "Computing Layout", and purple for "Geocoding".

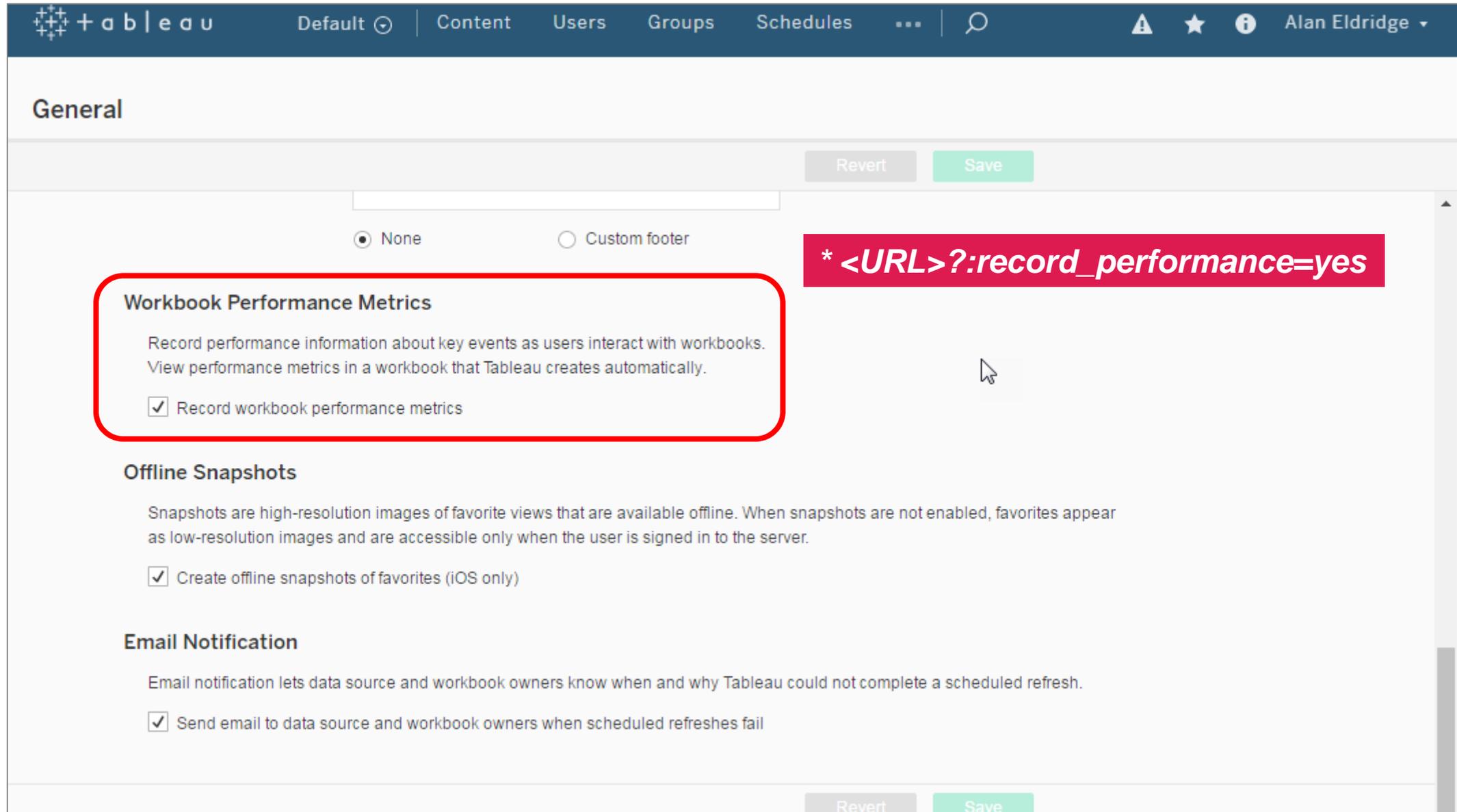
Below the timeline is a section titled "Events Sorted by Time" which shows a horizontal bar chart of the top events. The x-axis is "Elapsed Time (s)" from 0 to 80. The y-axis lists the event names and their durations.

Event	Elapsed Time (s)
Executing Query	79.95
Executing Query	49.12
Computing Layout	48.91
Executing Query	48.85
Executing Query	48.00
Computing Layout	34.61

At the bottom of the interface, there is a "Query" section showing the SQL query used for the recording:

```
SELECT [ProductSubcategory].[ProductSubcategoryName] AS [ProductSubcategoryName],  
SUM([Sales].[SalesAmount]) AS [TEMP(Calculation_669066032378990592)(220937425)(0)],  
SUM([Sales].[TotalCost]) AS [TEMP(Calculation_669066032378990592)(2530702300)(0)]  
FROM ([Sales])
```

# Performance Recorder



The screenshot shows the Tableau Performance Recorder settings page. The top navigation bar includes the Tableau logo, a search bar, and user information for Alan Eldridge. The main content area is titled "General" and contains several sections: "Workbook Performance Metrics", "Offline Snapshots", and "Email Notification". A red box highlights the "Workbook Performance Metrics" section, which includes a checkbox for "Record workbook performance metrics" that is checked. A red callout box points to the URL parameter `* <URL>?:record_performance=yes`. The page also features "Revert" and "Save" buttons at the top and bottom.

Tableau Performance Recorder Settings

Default | Content | Users | Groups | Schedules | Alan Eldridge

## General

Revert Save

None Custom footer

**Workbook Performance Metrics**

Record performance information about key events as users interact with workbooks. View performance metrics in a workbook that Tableau creates automatically.

Record workbook performance metrics

**Offline Snapshots**

Snapshots are high-resolution images of favorite views that are available offline. When snapshots are not enabled, favorites appear as low-resolution images and are accessible only when the user is signed in to the server.

Create offline snapshots of favorites (iOS only)

**Email Notification**

Email notification lets data source and workbook owners know when and why Tableau could not complete a scheduled refresh.

Send email to data source and workbook owners when scheduled refreshes fail

Revert Save

**\* <URL>?:record\_performance=yes**

# Finding the problem ... after Performance Recorder

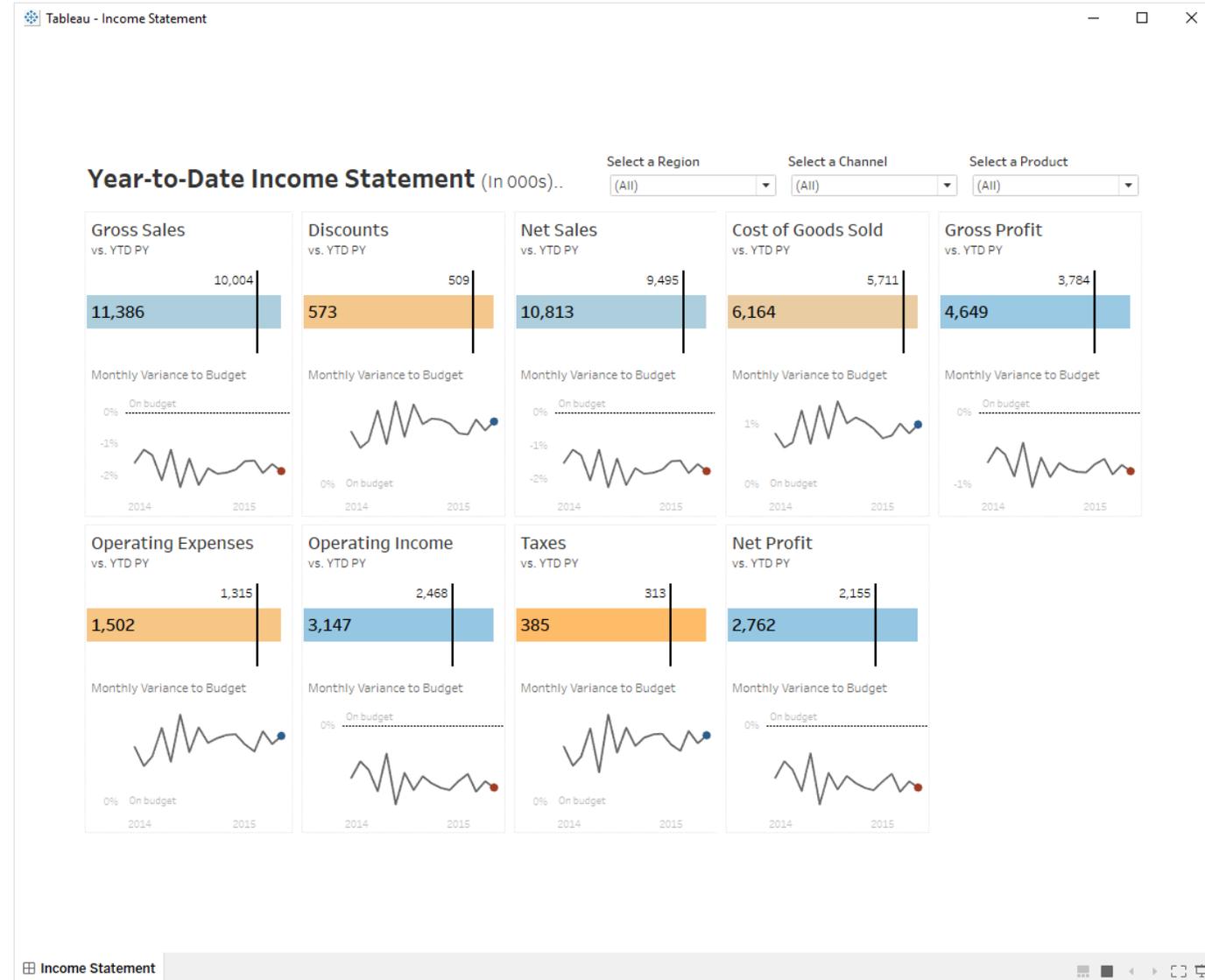
- Log files
    - Desktop Analysis
    - Tableau Log Viewer
    - Log Shark
  - Server Performance Views
  - Browser Tools / Network Tracers
  - TabMon
  - ..... and .....
  - Tableau Server Management Add-On 😊
- Errors
- Usage
- Platform
- 360° View for Perf

# Presentation



# Presentation Layer

## Concerned with Dashboards Worksheets



# Dashboards

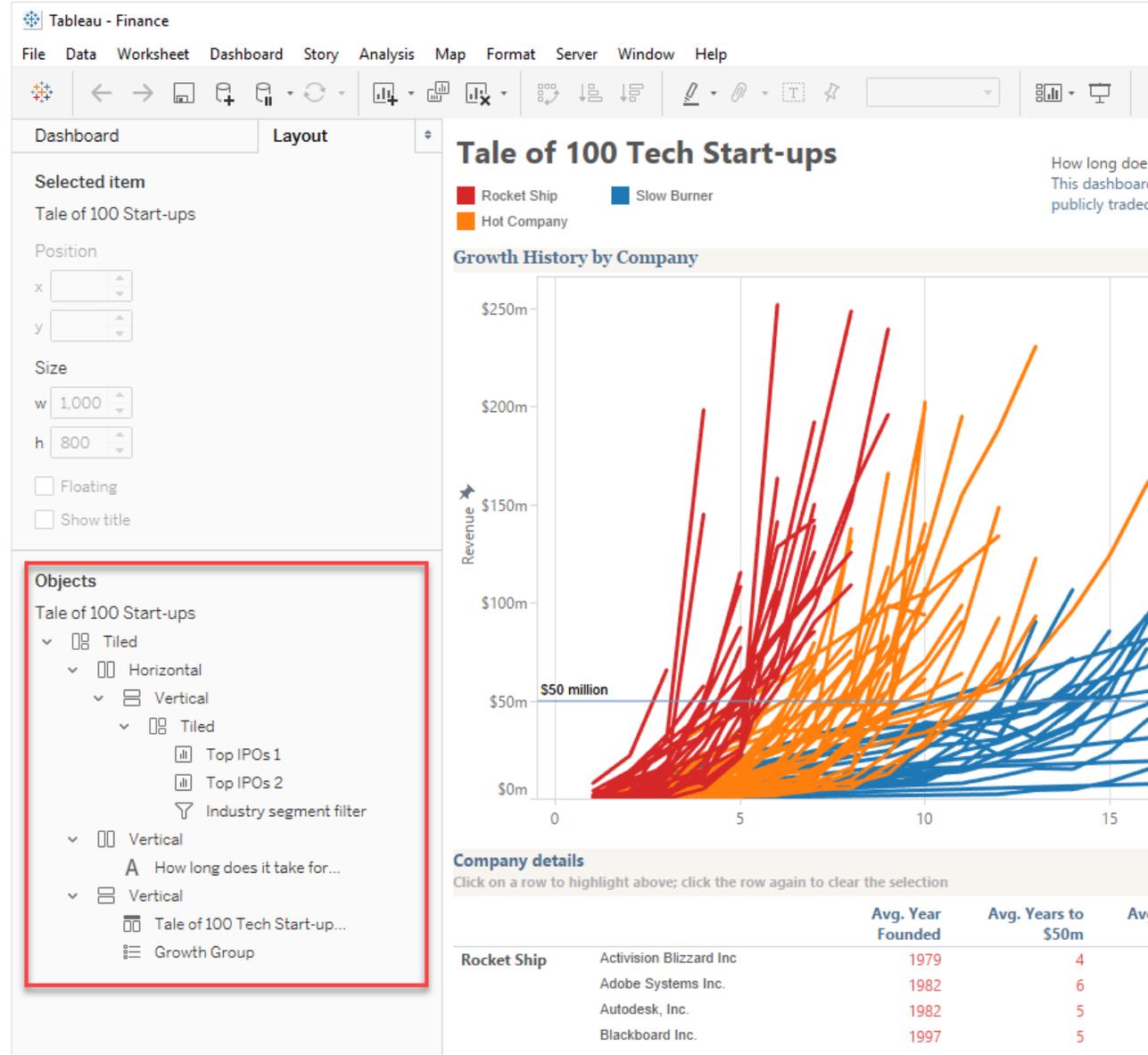
Made up of zones

Can be data driven

Worksheets, filters, parameters, page controls, legends

Or non-data driven

Text, images, web content, blanks, layout containers

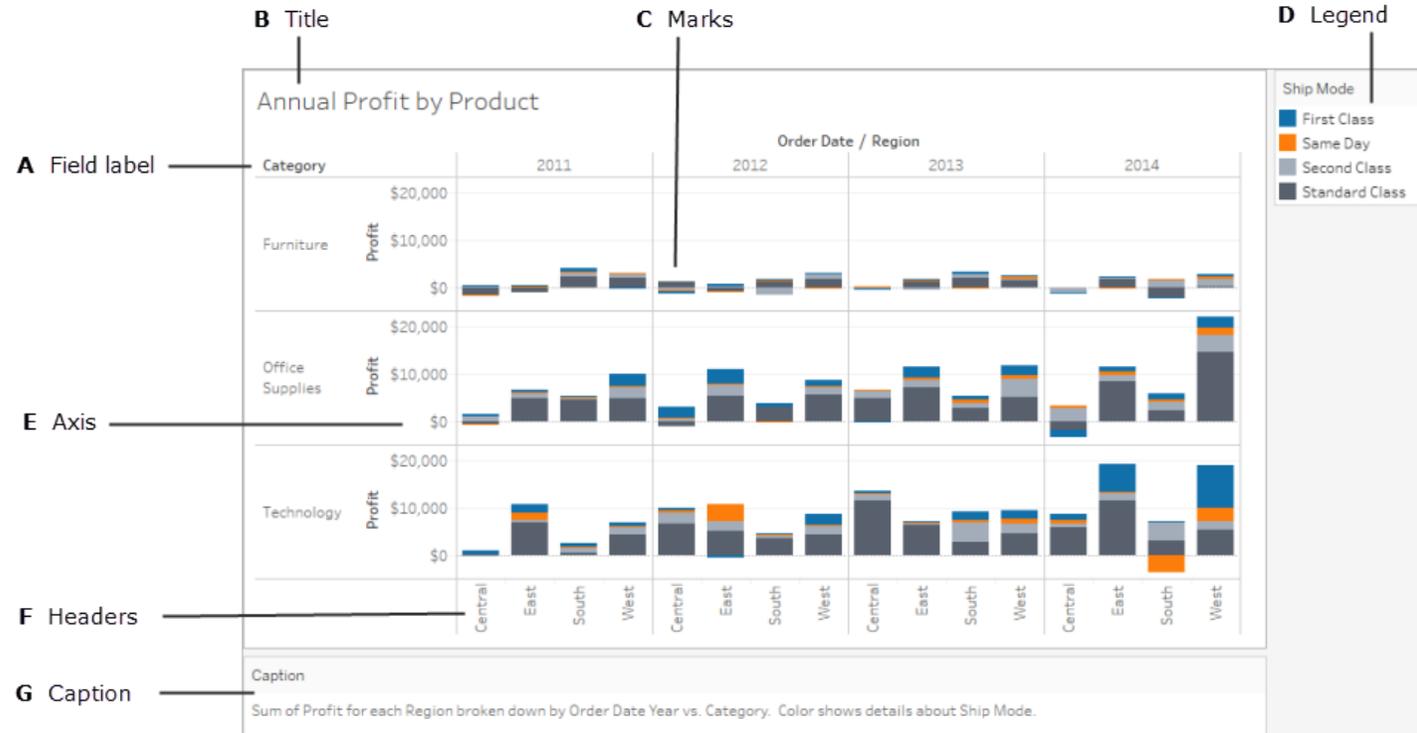


# Worksheets

The main data driven zone is the worksheet

It's made up of

Headers, axes, panes, cells, marks, titles, captions, field labels, legends



# Worksheets—Best Practice



## Minimise the number of marks

Don't retrieve data you don't need

Don't render data you can't see

Data Source	Population	Health Indicators	Care Spend
208 marks	row by 1 column	SUM of AVG(Birth Rate): 429.6%	

### Report

1 January 2007 to 31 December 2009

Country	State/Provi..	Manufactur..	Product Subcategory	Number of Rec..	Discount Qty	Return Qty	Sales Qty	Sales Amount	Total Cost
Armenia	Armenia	A. Datum Corporation	Digital Cameras	478	650	65	5,572	\$1,108,653.35	\$466,541.25
			Digital SLR Cameras	168	213	25	1,800	\$787,512.60	\$301,312.61
		Adventure Works	Coffee Machines	103	147	8	1,234	\$395,323.16	\$182,878.75
			Desktops	132	175	17	2,688	\$1,180,397.13	\$573,141.84
			Lamps	200	271	23	2,504	\$457,661.48	\$201,625.19
			Laptops	147	149	17	1,655	\$1,063,995.11	\$466,333.34
			Monitors	118	149	8	1,402	\$365,090.00	\$140,086.10
			Televisions	192	223	22	2,188	\$1,012,333.39	\$422,717.62
		Contoso, Ltd	Air Conditioners	169	246	21	1,944	\$644,426.55	\$288,255.79
			Cameras & Camcord..	280	378	38	3,472	\$180,302.13	\$84,091.42
			Cell phones Accesso..	136	178	19	36,660	\$382,150.71	\$188,036.20
			Coffee Machines	121	180	18	1,376	\$482,541.26	\$213,484.69
			Computers Accessor..	586	857	87	7,006	\$224,248.27	\$101,217.42
			Digital SLR Cameras	146	207	24	1,619	\$726,252.40	\$278,736.55
Home & Office Phon..	463		659	66	5,029	\$144,073.31	\$63,894.04		
Home Theater Syste..	230		349	33	2,592	\$1,083,322.30	\$496,309.57		

**Store Name**

- Contoso Albany Store
- Contoso Alexandria Store
- Contoso Amsterdam Store
- Contoso Anchorage Store
- Contoso Annapolis Store
- Contoso Appleton Store
- Contoso Arlington Store
- Contoso Ashgabat No.1 St..
- Contoso Ashgabat No.2 S..

**% of Total Sales Amount**

**Product Subcategory**

- Water Heaters
- Smart phones & ...
- MP4&MP3
- Lamps
- Digital SLR Cam..
- Cell phones Acc..
- Bluetooth Head..
- Washers & Drye..
- Refrigerators
- Movie DVD
- Home Theater S..
- Digital Cameras
- Car Video
- Air Conditioners
- VCD & DVD
- Recording Pen
- Monitors
- Home & Office P..
- Desktops
- Cameras & Cam..
- Touch Screen Ph..
- Projectors & Scr..
- Microwaves
- Fans
- Computers Acce..
- Camcorders
- Televisions
- Printers, Scann..
- Laptops
- Download Games
- Coffee Machines
- Boxed Games

**Country**

- Armenia
- Australia
- Bhutan
- Canada
- China
- Denmark
- France
- Germany
- Greece
- India

**State/Province**

- Ahal Province
- Alaska
- Alberta
- Alpes-Maritimes
- Armenia
- Bas-Rhin
- Bavaria
- Beijing
- Berlin
- Bern

**Manufacturer**

- A. Datum Corporation
- Adventure Works
- Contoso, Ltd
- Fabrikam, Inc.
- Litware, Inc.
- Northwind Traders
- Proseware, Inc.
- Southridge Video
- Tailspin Toys
- The Phone Company

**Product Subcategory**

- Air Conditioners
- Bluetooth Headphones
- Boxed Games
- Camcorders
- Cameras & Camcorde..
- Car Video
- Cell phones Accessori..
- Coffee Machines
- Computers Accessori..
- Desktops

# Worksheets—Best Practice



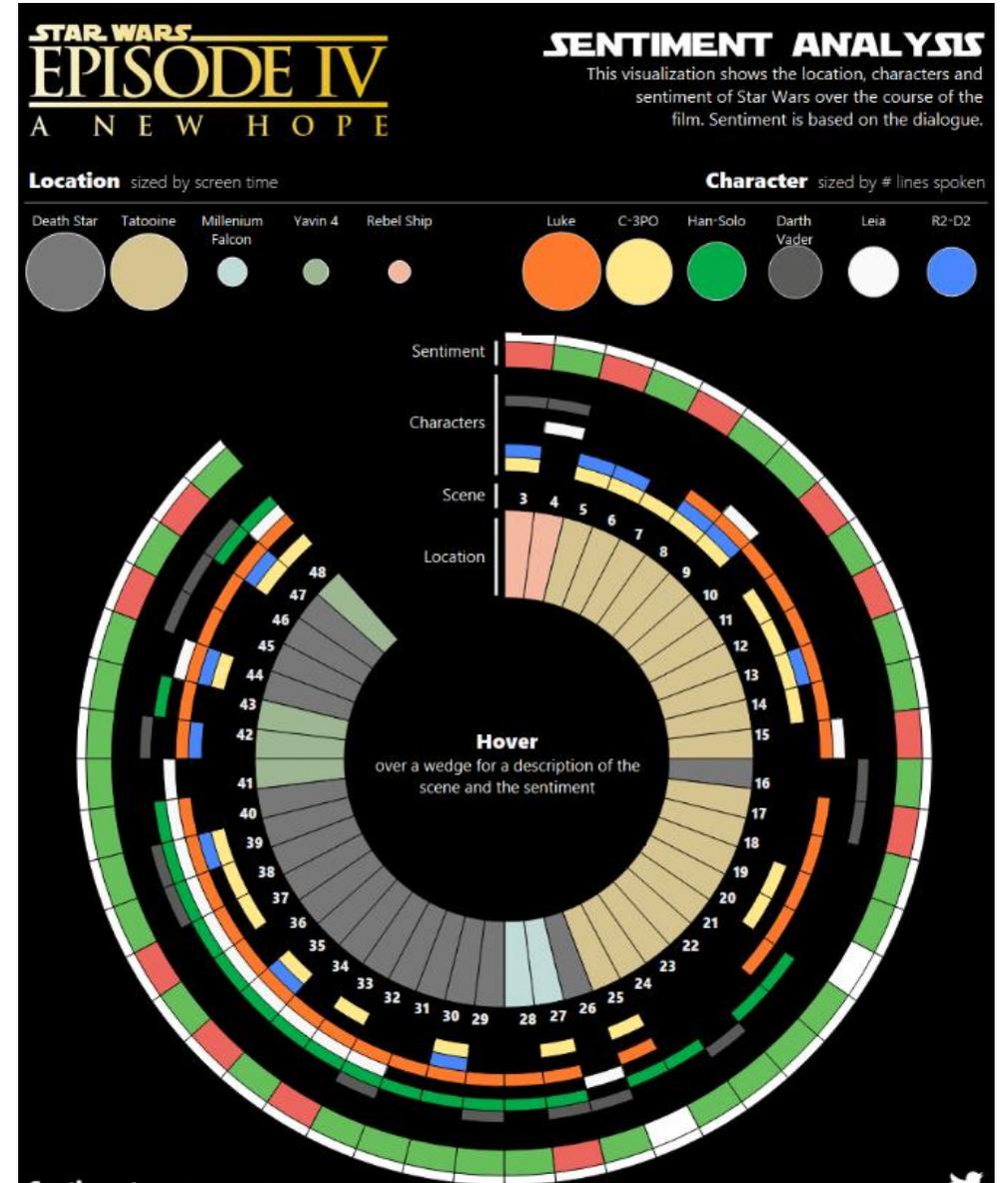
Not all marks are the same

## Avoid:

Polygon marks

Manufactured chart styles like donut, Sankey, sigmoid curved lines, etc.

Maps, if you don't really need them—tiles can take time to load



# Dashboards

## Interacting with dashboard elements can trigger events

Filters

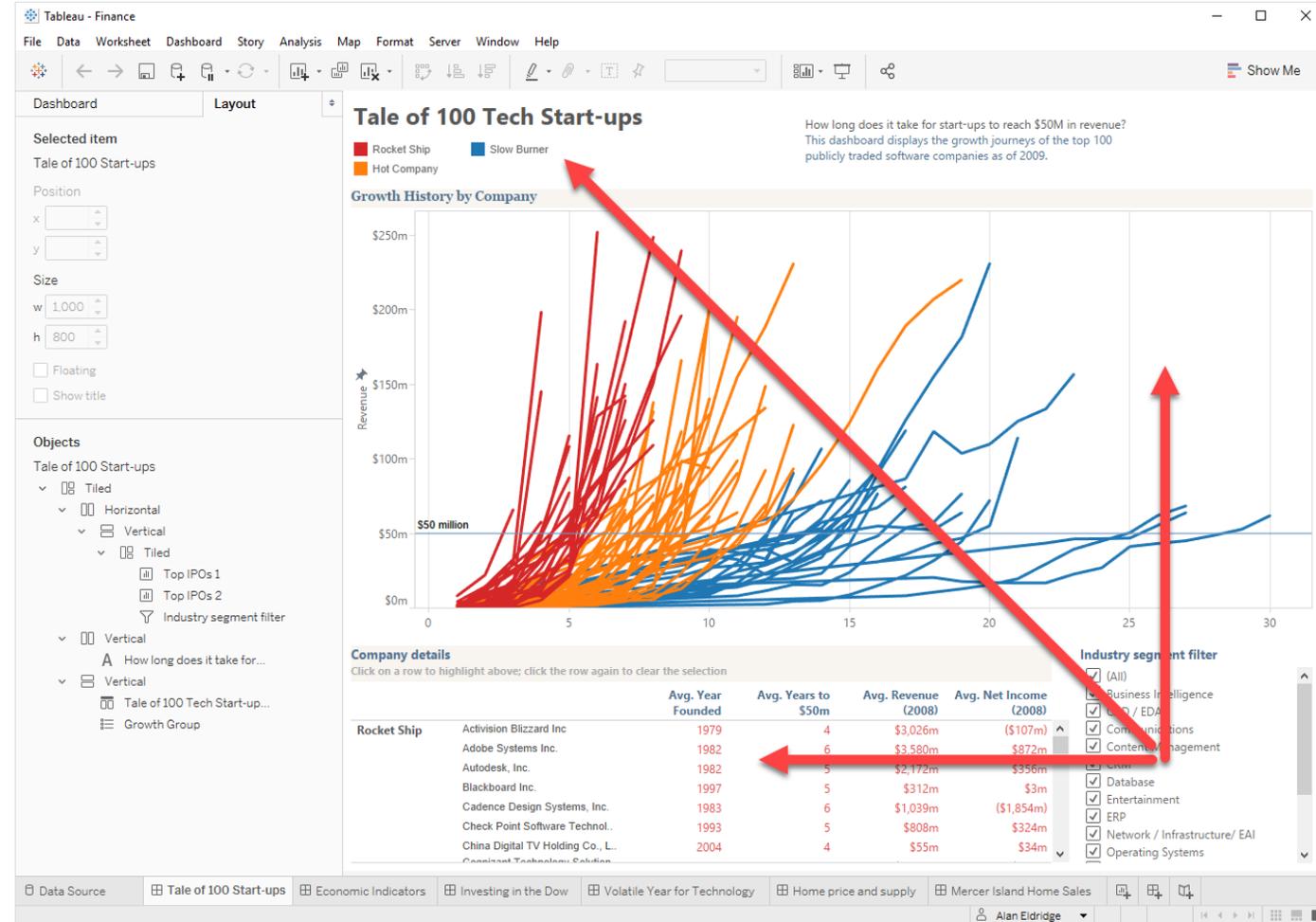
Parameters

Highlighting

Pages

Actions—filter, highlight, URL

## Can cause other dashboard elements to update





# Dashboards—Best Practices



Minimise the complexity of each zone

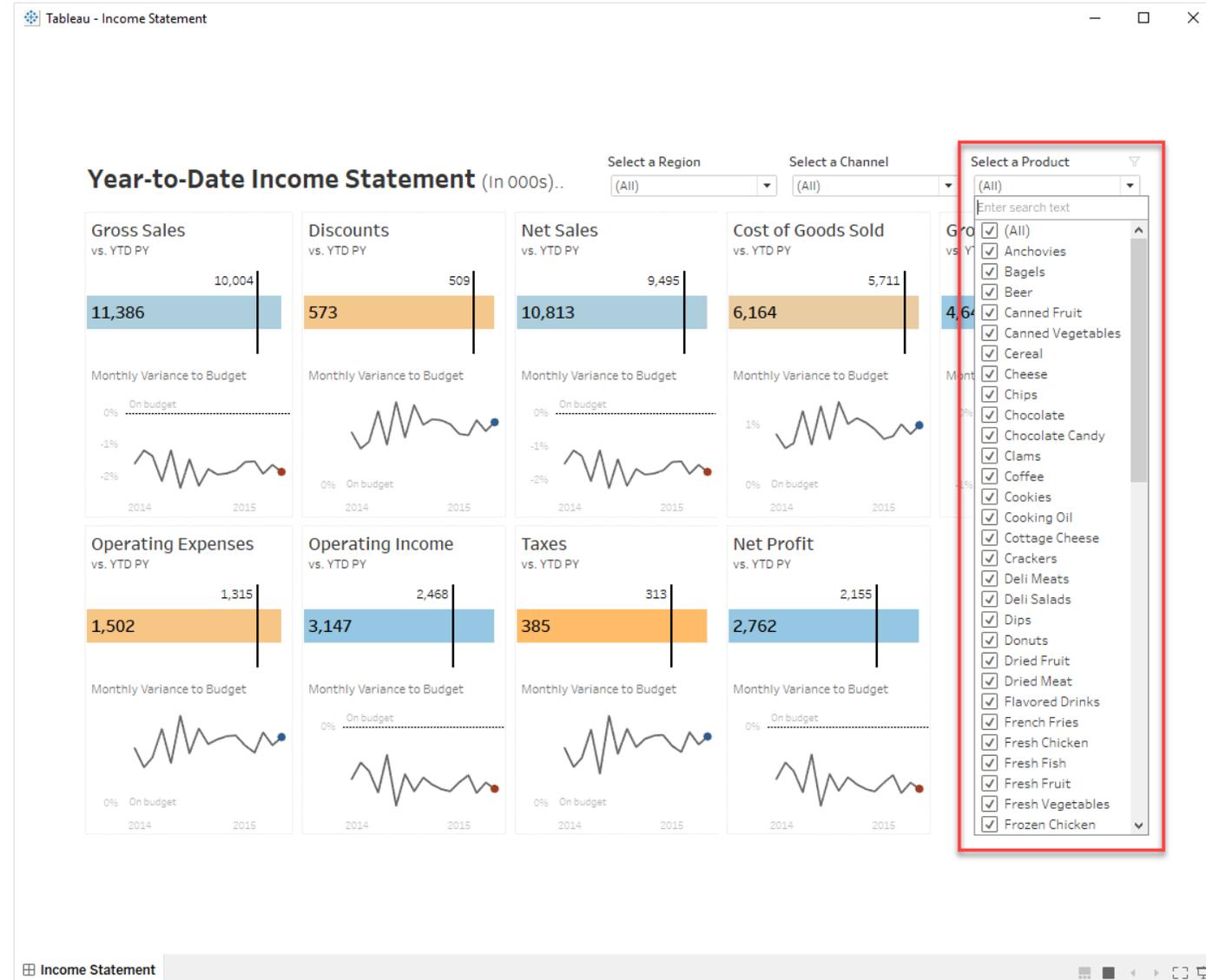
Keep worksheets as simple as possible

**Avoid:**

Large, enumerated filters, parameter lists, legends

Large, high resolution images

Complex embedded web parts



# Dashboards—Best Practices



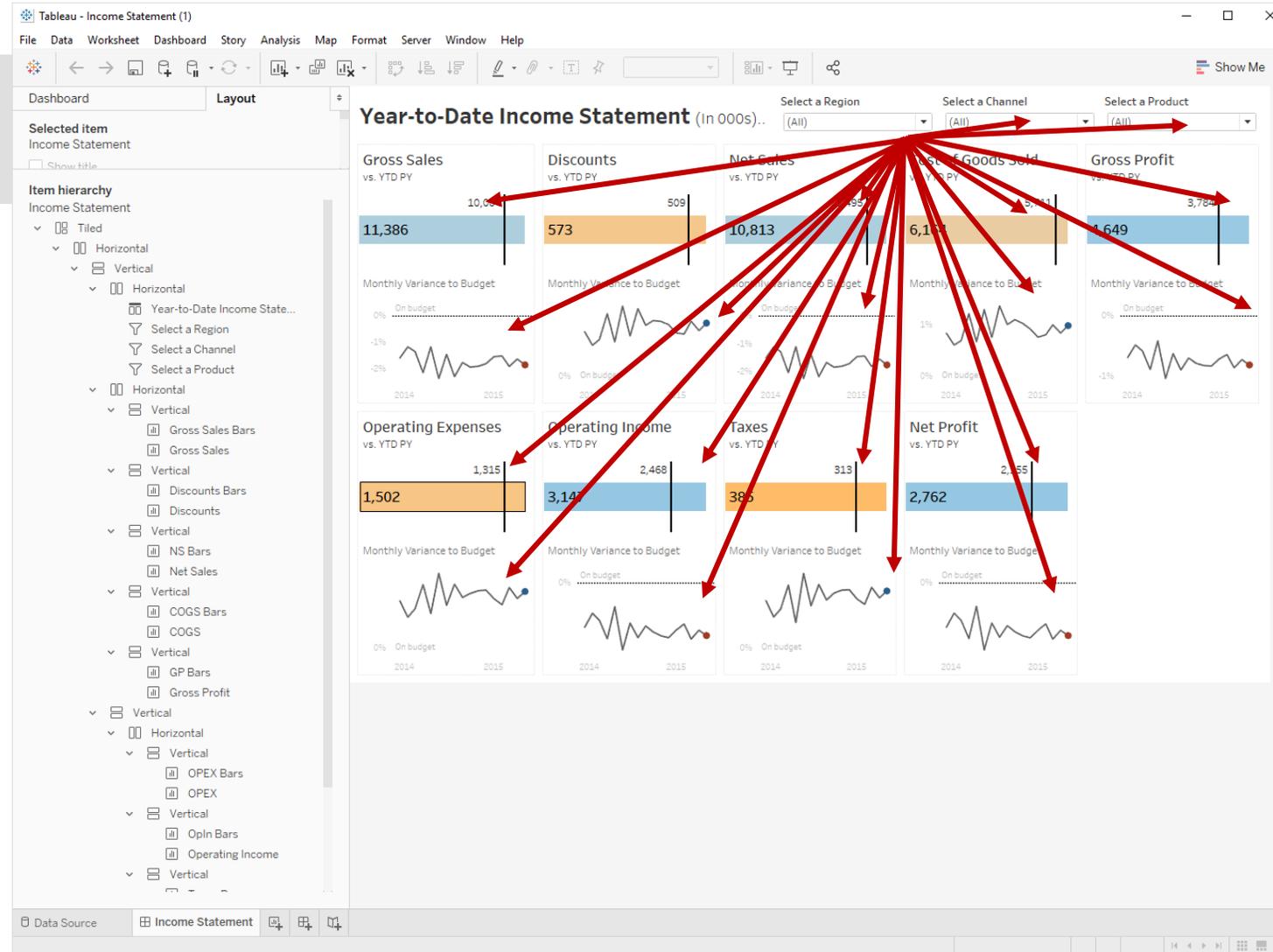
Minimise the scope and impact of updates

Be conscious of the impact of:

Global filters

Filters that apply to all sheets on a dashboard

Filters with “show relevant values”



# Dashboards—Best Practices



Maximise the effectiveness of caches

## Try to:

Set dashboards and stories to fixed size

Use client-side rendering where possible

The screenshot shows a SQL Editor window with a query and its output. The query is:

```
select http_referer from http_requests where http_referer like '%$size$'
```

The output pane shows a table with the following columns:

	http_referer
	character varying(255)
1	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
2	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
3	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
4	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
5	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
6	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
7	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
8	http://localhost/vizql/showadminview/tabbed admin views/BackgroundTasksforNonExtracts?size=1272,1055&embe
9	http://localhost/views/Superstore/Overview?size=1263,531&embed=yes:showVizHome=no:bootstrapWhenNotified=yes
10	http://localhost/views/Superstore/Overview?size=1263,531&embed=yes:showVizHome=no:bootstrapWhenNotified=yes
11	http://localhost/views/Superstore/Overview?size=1263,531&embed=yes:showVizHome=no:bootstrapWhenNotified=yes
12	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1247,521&embed=yes:showVizHome=no:bootstrapWhe
13	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1247,521&embed=yes:showVizHome=no:bootstrapWhe
14	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1247,521&embed=yes:showVizHome=no:bootstrapWhe
15	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1247,521&embed=yes:showVizHome=no:bootstrapWhe
16	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1247,521&embed=yes:showVizHome=no:bootstrapWhe
17	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1903,931&embed=yes:showVizHome=no:bootstrapWhe
18	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1903,931&embed=yes:showVizHome=no:bootstrapWhe
19	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1903,931&embed=yes:showVizHome=no:bootstrapWhe
20	http://jswickard4/views/Attribute-Customer-Name/Sheet1?size=1903,931&embed=yes:showVizHome=no:bootstrapWhe

The output pane also has tabs for Data Output, Explain, Messages, and History. The Data Output tab is selected. The output is displayed in a table format with 20 rows. The first 8 rows have a red box around the 'size' parameter in the URL. The last 8 rows have a red box around the 'size' parameter in the URL.

# A Sidebar on Caching...

Tableau tries to reuse as much of its work as it can

There are many caches:

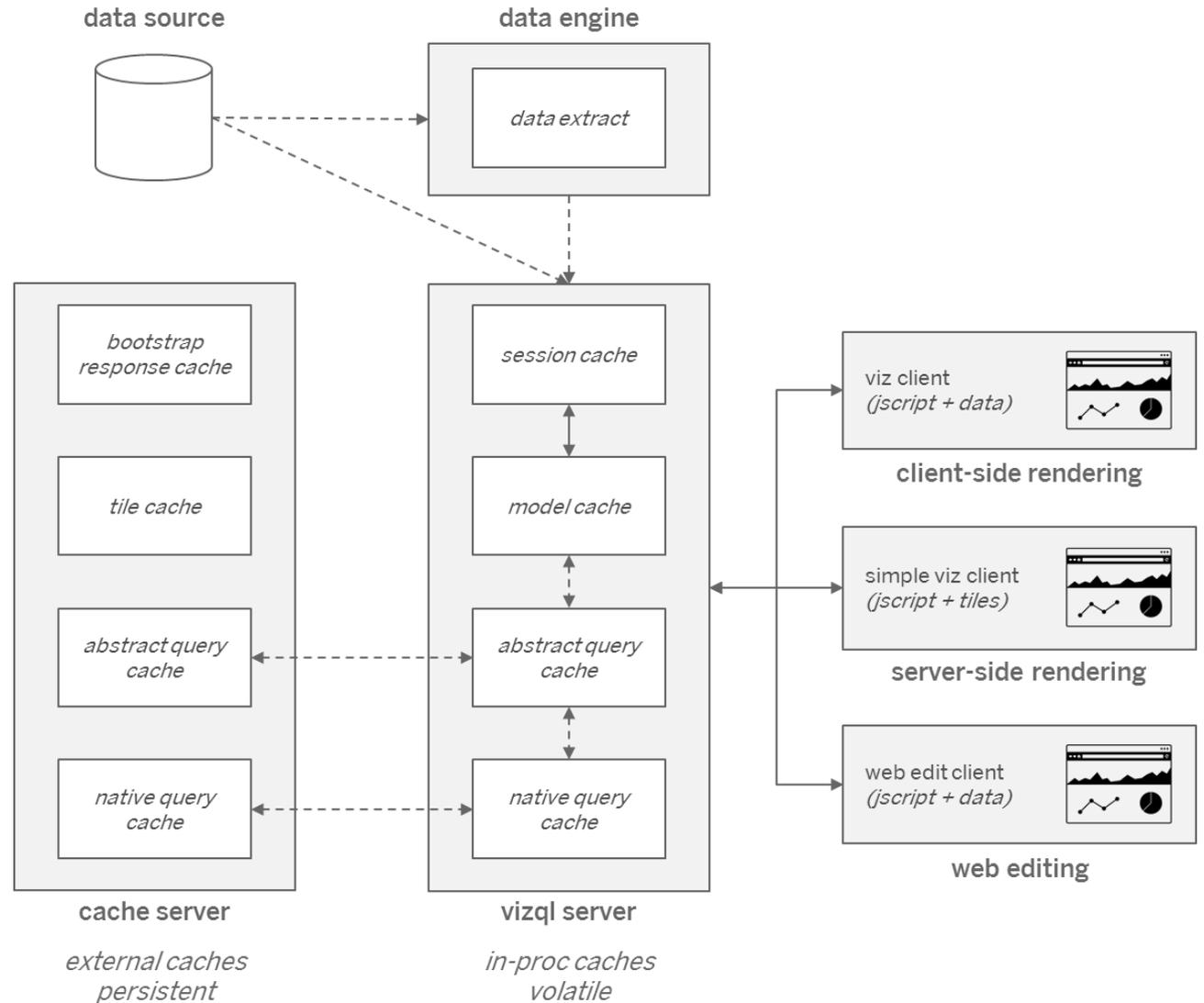
Browser data cache

Model cache

Tile cache

Query cache

Bootstrap response cache

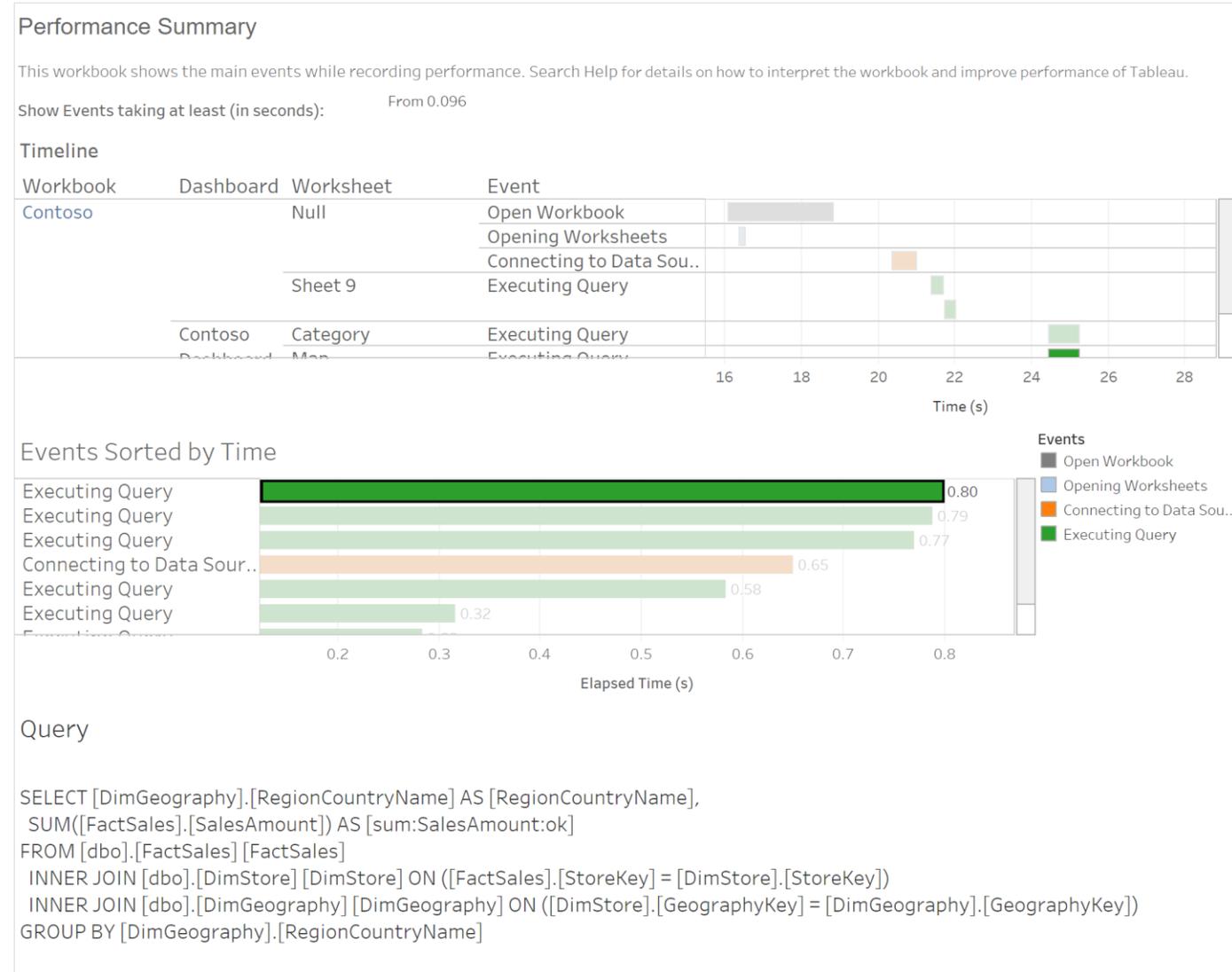


# A Sidebar on Query Optimisation...

Tableau is very clever and will try to reduce the number and complexity of queries it has to run

## It uses:

- Abstract queries
- Parallel queries
- Query fusion
- Constant folding
- ...





# Dashboard Design: by the example

The screenshot shows a Tableau report dashboard with the following components:

- Report Dashboard**: The main title of the dashboard.
- Country**: A list of countries with checkboxes for selection. The list includes: (All), Null, Armenia, Australia, Bhutan, Canada, China, Denmark, France, Germany, Greece, India, Iran, and Ireland.
- State/Province**: A dropdown menu for selecting a state or province, currently showing a scroll bar.
- City**: A field for selecting a city.
- Manufacturer**: A field for selecting a manufacturer.
- Product Subcategory**: A field for selecting a product subcategory.
- Sales by Month**: A visualization area for sales data by month.
- Sales by Product**: A visualization area for sales data by product.

The dashboard is displayed in a window titled "Tableau - Report" with standard window controls (minimize, maximize, close) in the top right corner. The bottom of the window shows a tab labeled "Report Dashboard" and a set of navigation icons.

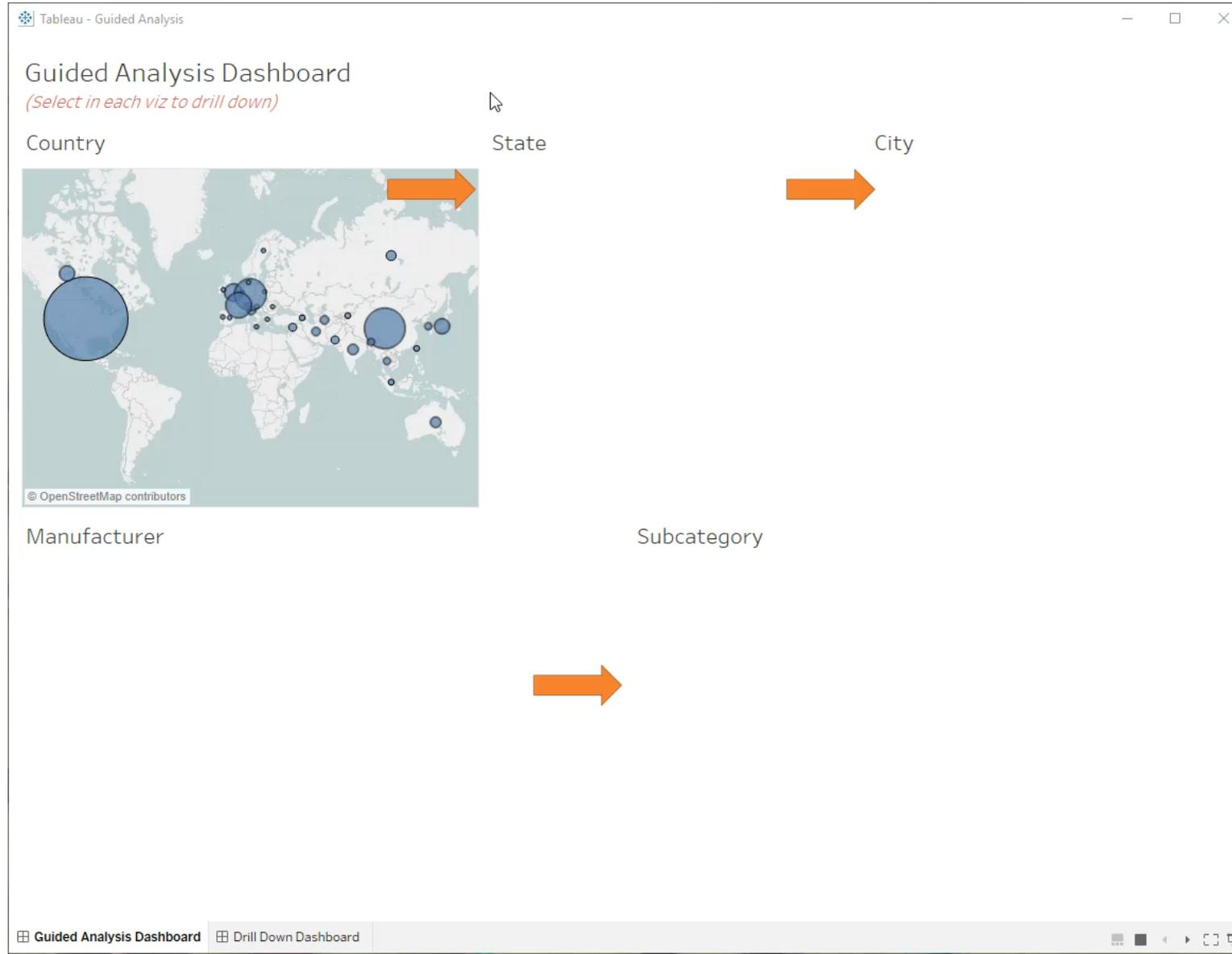
# Dashboard Design: by the example

The screenshot shows a Tableau report dashboard titled "Report Dashboard". It features several filter panels: "Country" with "United States" selected; "State/Province" with "Washington" selected; "City" with "Seattle" selected; "Manufacturer" with "Fabrikam, Inc." selected; and "Product Subcategory" with "Camcorders" selected. A dark blue overlay box in the center contains the text: "Queries run: 203" and "Total query time: 19.7 secs". Below the filters, a table shows "Total Cost" values for various categories, with the current selection highlighted at \$2,174.0K. At the bottom, a "Sales by Product" table lists various Fabrikam Budget Movie-Maker models with their respective Sales Amount, Discount Amount, Return Amount, and Total Cost.

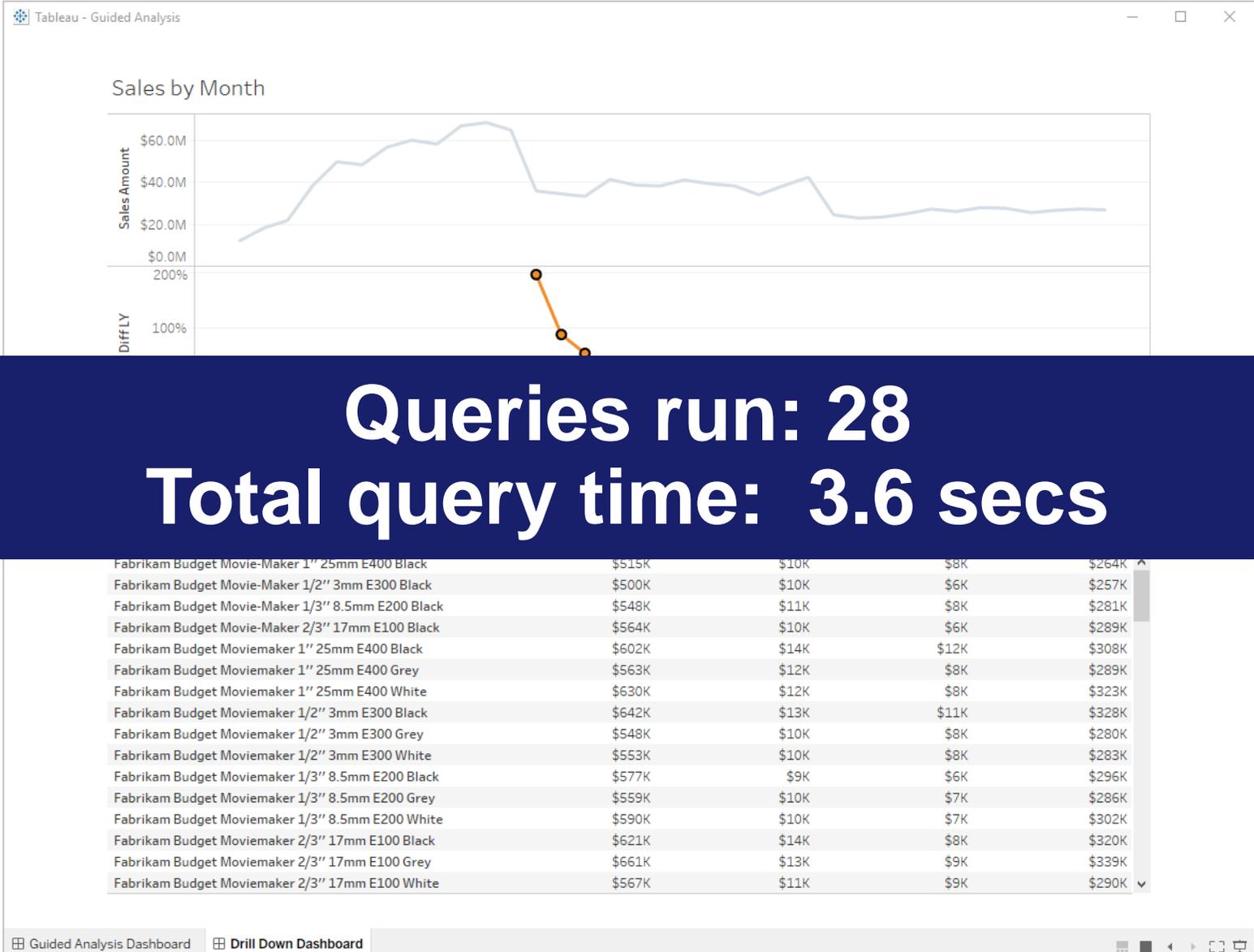
**Queries run: 203**  
**Total query time: 19.7 secs**

Product Name	Sales Amount	Discount Amount	Return Amount	Total Cost
Fabrikam Budget Movie-Maker 1" 25mm E400 Black	\$45.2K	\$0.4K	\$0.0K	\$23.2K
Fabrikam Budget Movie-Maker 1/2" 3mm E300 Black	\$15.4K	\$0.2K	\$0.0K	\$7.9K
Fabrikam Budget Movie-Maker 1/3" 8.5mm E200 Black	\$21.8K	\$0.3K	\$0.0K	\$11.3K
Fabrikam Budget Movie-Maker 2/3" 17mm E100 Black	\$21.9K	\$0.3K	\$0.0K	\$11.3K
Fabrikam Budget Moviemaker 1" 25mm E400 Black	\$44.2K	\$0.5K	\$0.0K	\$22.8K
Fabrikam Budget Moviemaker 1" 25mm E400 Grey	\$15.0K	\$0.1K	\$0.0K	\$7.7K
Fabrikam Budget Moviemaker 1" 25mm E400 White	\$29.9K	\$0.5K	\$0.0K	\$15.5K
Fabrikam Budget Moviemaker 1/2" 3mm E300 Black	\$30.1K	\$0.3K	\$0.5K	\$15.2K
Fabrikam Budget Moviemaker 1/2" 3mm E300 Grey	\$19.2K	\$0.2K	\$0.9K	\$9.5K
Fabrikam Budget Moviemaker 1/2" 3mm E300 White	\$19.2K	\$0.2K	\$0.9K	\$9.5K
Fabrikam Budget Moviemaker 1/3" 8.5mm E200 Black	\$27.0K	\$0.2K	\$0.4K	\$13.6K

# Dashboard Design: by the example



# Dashboard Design: by the example



# Analytics



# Analytics Layer

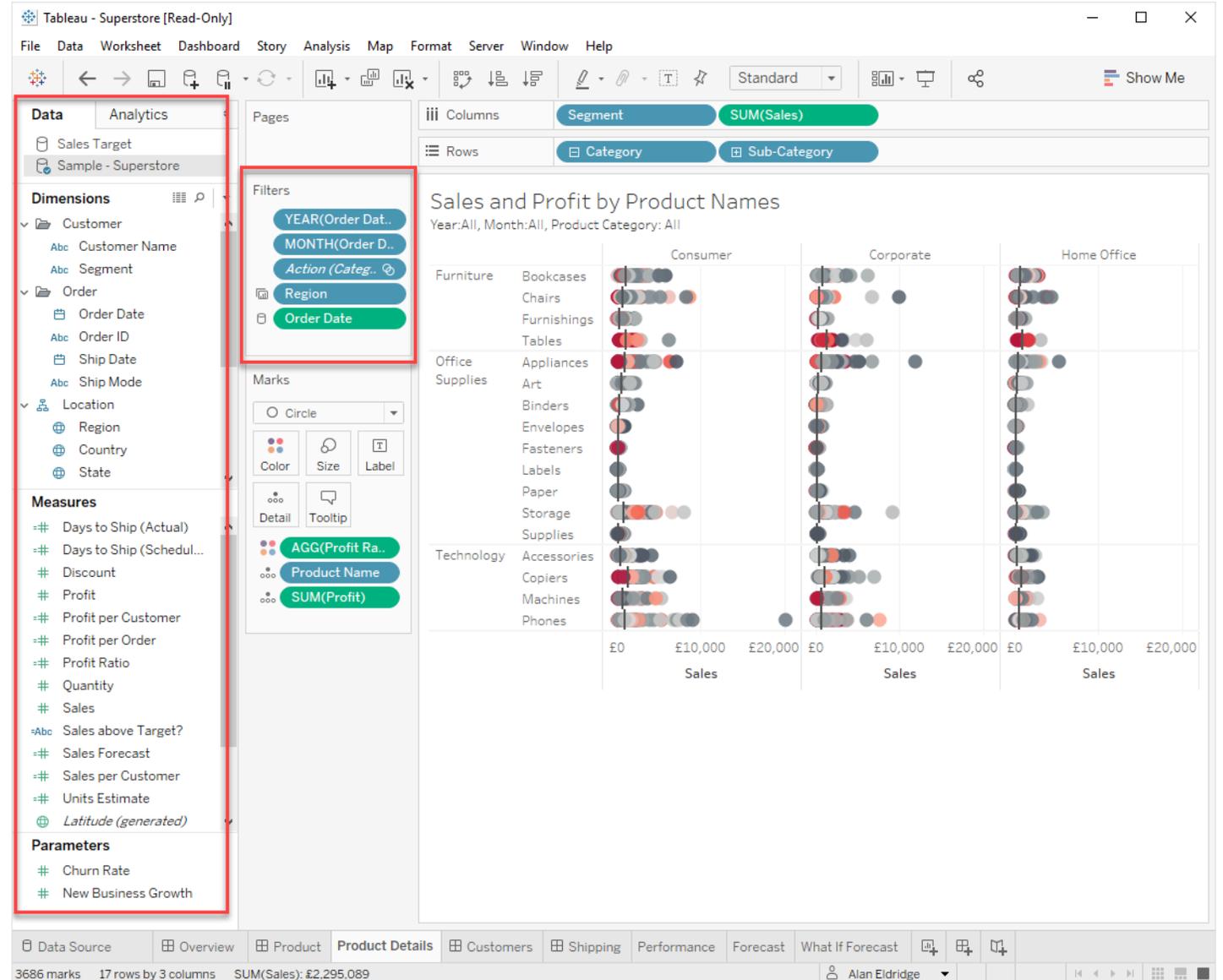
## Concerned with:

Data elements

Filters

Calculations

Working across data sources



# Data Elements



Native vs. Converted Type

**Minimise data type casting**

**Convert at the data source  
if possible**

Dimensions



Date Iso



Number (decimal)

Number (whole)

Date & Time

Date

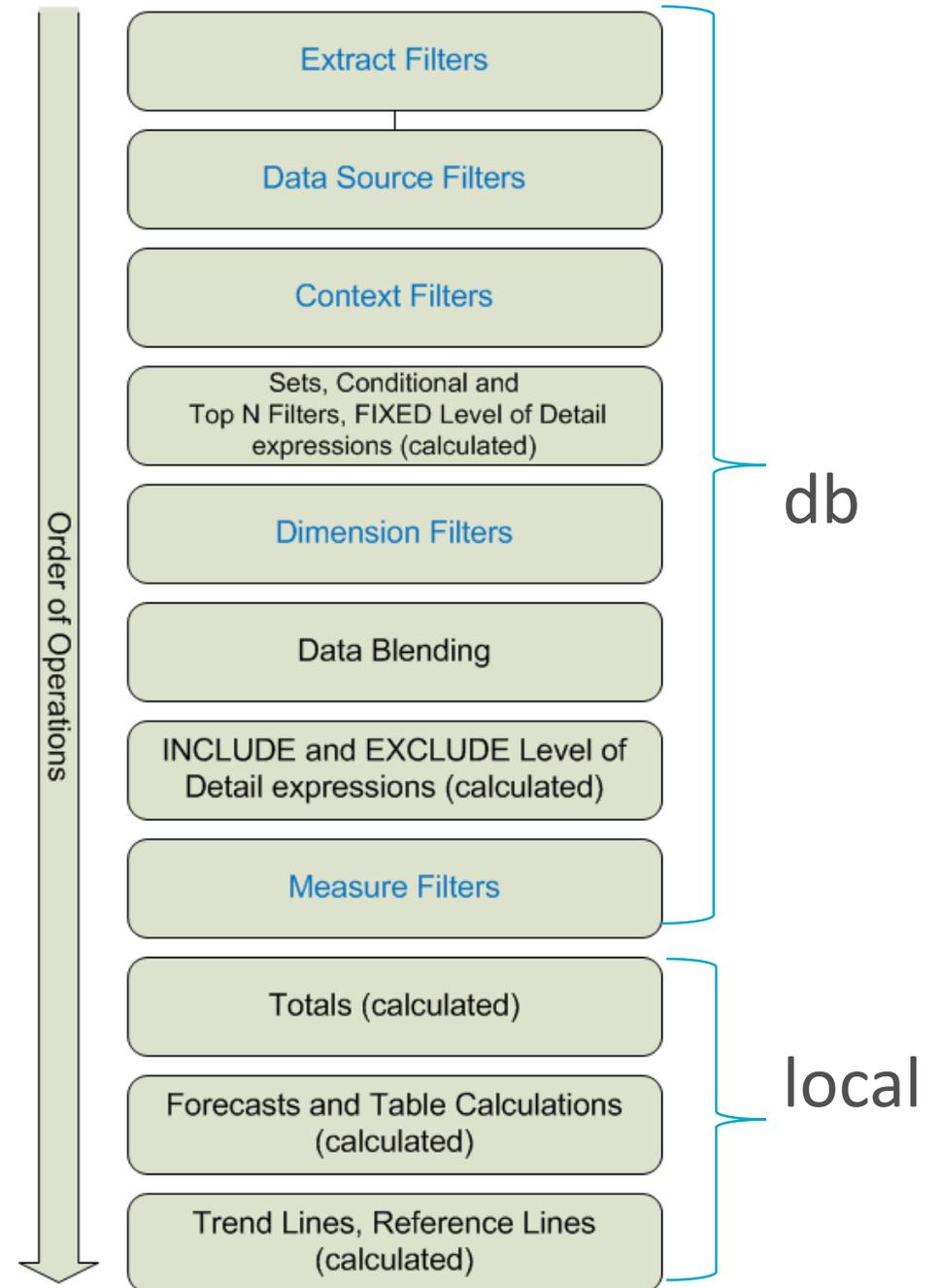
String

Default

# Filters

Are applied at different stages within the computation pipeline

Some pass through to the data source, others are applied after



# Filters



Use the most appropriate type of filters

Discrete vs. ranged

Enumerated vs. non-enumerated

Aggregate vs. row level

Dates!

Slicing filters

Sets

Cross data source

Customize > show “Apply” button

*“Begin with the End in Mind”*

Filter [Inclusions (Sa1 Main16, Ste Name16)]

General Condition

Select from list  Use all

Enter search text

- 10102100701, New South Wales
- 10102100702, New South Wales
- 10102100703, New South Wales
- 10102100704, New South Wales
- 10102100705, New South Wales
- 10102100706, New South Wales
- 10102100707, New South Wales
- 10102100708, New South Wales
- 10102100709, New South Wales
- 10102100710, New South Wales
- 10102100801, New South Wales

All None  Exclude

Summary

Fields: [Sa1 Main 16][Ste Name 16]  
Selection: Selected 5980 of 57523 values  
Wildcard: All  
Condition: None  
Limit: None

Reset OK Cancel Apply

# Filters

The screenshot displays the Tableau Desktop interface with a map of Western Australia. The map is titled "Discrete Attribute" and shows numerous brown dots representing data points. A "Filter [Ste Name16]" dialog box is open, showing a list of Australian states and territories with "Western Australia" selected. The dialog box includes tabs for "General", "Wildcard", "Condition", and "Top", and a "Summary" section at the bottom.

**Tableau - Book1**

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Columns: Longitude (generated)  
Rows: Latitude (generated)

Dimensions: SA1\_2016\_AUST

Filters: Ste Name16: Wester..

Marks: Circle

Color Size Label

Detail Tooltip

Ste Name16  
COLLECT(Geo...  
Sa1 Main16

Measures: Areasqkm16, Geometry, Latitude (generated), Longitude (generated), Number of Records, Measure Values

Ste Name16: Western Australia

Filter [Ste Name16]

General Wildcard Condition Top

Select from list Custom value list Use all

Enter search text

- Australian Capital Territory
- New South Wales
- Northern Territory
- Other Territories
- Queensland
- South Australia
- Tasmania
- Victoria
- Western Australia

All None Exclude

Summary

Field: [Ste Name16]  
Selection: Selected 1 of 9 values  
Wildcard: All  
Condition: None  
Limit: None

Reset OK Cancel Apply

# Filters



Use “*Only Relevant Values*” Sparingly

Filter list is refreshed when any other filter is updated

Queries can span all tables in the model

Reduce effectiveness of Join Culling

Consider filtering from smaller data source

Apply to >> All Using Related Data Source

January 2018 feature: All Values in Hierarchy (Cascading Filters)

- All Using Related Data Sources
- All Using This Data Source
- Selected Worksheets...
- Only This Worksheet

- Only Relevant Values
- All Values in Hierarchy
- All Values in Database

- Edit Filter...
- Apply to Worksheets ▶
- Format Filters...
- Customize ▶
- Show Title
- Edit Title...
- Single Value (list)
- Single Value (dropdown)
- Single Value (slider)
- Multiple Values (list)
- Multiple Values (dropdown)
- Multiple Values (custom list)
- Wildcard Match
- Only Relevant Values
- All Values in Database
- Include Values
- Exclude Values
- Floating
- Fixed Height
- Edit Height...
- Select Layout Container
- Deselect
- Remove from Dashboard

# Filters



Understand impact of User Filters

## Apply filters based on the user's identity

“Create user filter...”  
or ISMEMBEROF()

Can have a dramatic effect on scalability as caching cannot be shared

Use prudently!

The screenshot shows a Tableau dashboard interface. At the top, the title is "Superstore Sales Analysis" with a circular icon containing a bar chart. Below the title, it says "WORKBOOK • By Admin User • 2,848 views • ☆ 2 • Extract: Feb 28, 2017, 12:29". A navigation bar below the title shows "Views 2", "Data Sources 2", "Refresh Schedules 0", and "Subscriptions 2". Below this, there is a dropdown menu showing "0 selected". The main content area displays two view cards, each titled "User Specific View" and featuring an icon of two people. The first card is labeled "Superstore Dashboard" with "2,044 views" and a star icon with the number "2". The second card is labeled "Customer Detail" with "804 views" and a star icon with the number "0".

# Filters

## Filtering

Reduces the result set

## Zooming

Doesn't change the result set, just the marks being rendered

The screenshot displays the Tableau Desktop interface for a map visualization. The main view is a map of Melbourne, Australia, with various meshblocks colored according to their category. The interface includes a menu bar at the top, a toolbar, and several panes:

- Data Pane (Left):** Shows the data source 'MB\_2011 Extract'. Dimensions include GCCSA Code, GCCSA Name, Latitude, Longitude, Meshblock Category, Meshblock Code, PointID, PolygonID, SA1 7Digit Code, SA1 Main Code, SA2 5Digit Code, SA2 Main Code, SA2 Name, SA3 Code, SA3 Name, SA4 Code, SA4 Name, State Code, State Name, Type, and Measure Names. Measures include Latitude (generated), Longitude (generated), Number of Records, and Measure Values.
- Columns Shelf:** Contains 'Longitude'.
- Rows Shelf:** Contains 'Latitude'.
- Filters:** Includes 'GCCSA Name: Great...' and 'Type: Vertex'.
- Marks:** Set to 'Polygon'. Includes options for Color, Size, Label, Detail, Tooltip, and Path. Selected marks are 'Meshblock Cat...', 'Meshblock Co...', 'PolygonID', and 'PointID'.
- Meshblock Category Legend:** Lists categories: Agricultural (green), Commercial (blue), Education (orange), Hospital/Medical (red), Industrial (grey), Other (purple), Parkland (light green), Residential (brown), Transport (dark grey), and Water (light blue).
- Map:** Shows a street grid with a search bar containing '3000, Australia'. The map is zoomed in on a specific area.
- Bottom Status Bar:** Shows '521330 marks' and '1 row by 1 column'. A red arrow points to the 'Data Sources' tab.

# Calculations



Understand where calculations are computed

## Many types of calculations

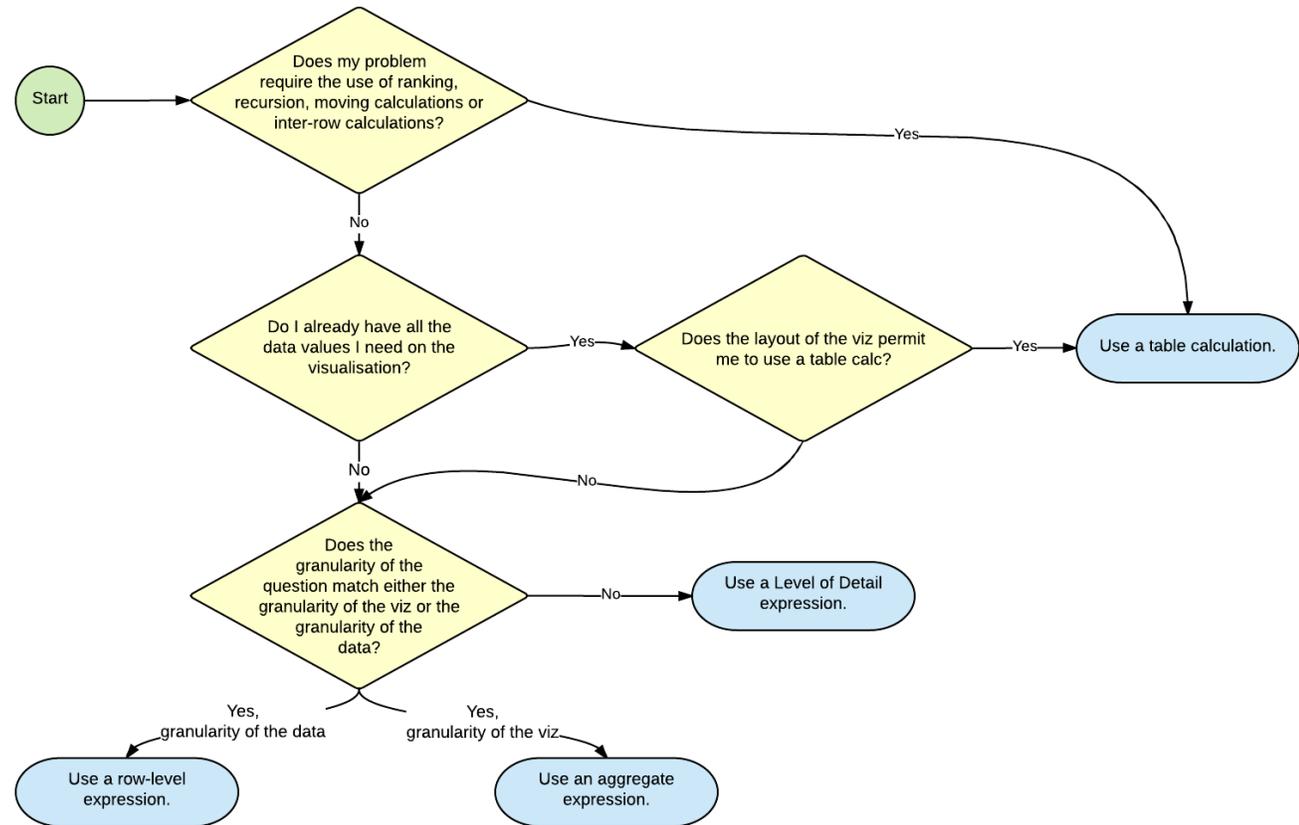
Row-level, aggregate, level-of-detail, table calcs

All apart from table calcs are passed to the underlying DB

## External function calls (R/Python/MatLab) can be slow

Data is serialised to/from

Correct “compute using” can have dramatic impact



# Calculations



Understand Impact of Data Types and Functions

**Numbers > dates, Booleans > strings**

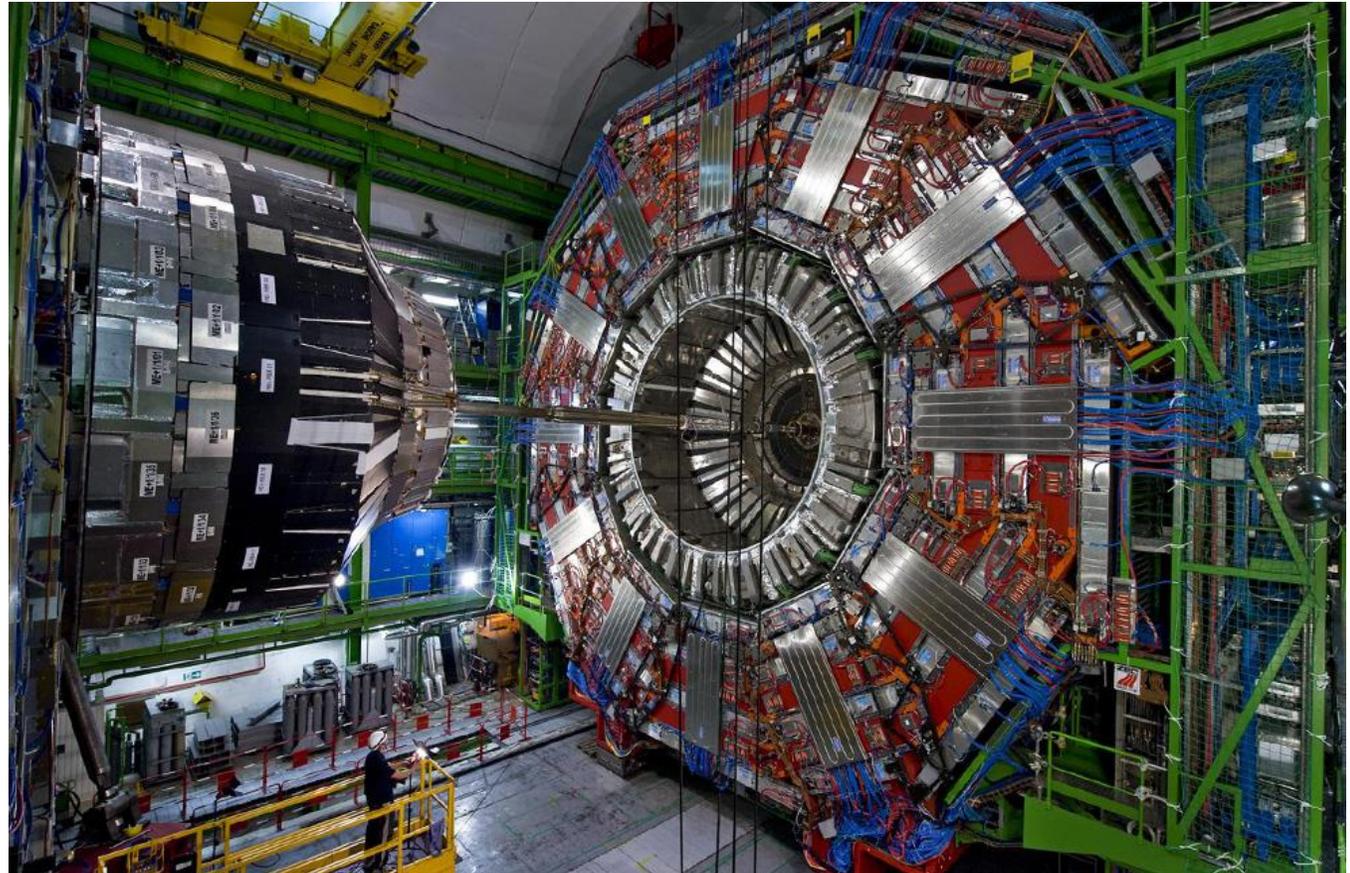
Expensive aggregation types:  
COUNTD(), Percentile, etc.

MIN(), MAX() > ATTR()

**LODs execute in the database**

Create subqueries

Can be expensive over  
large data



# Calculations

×

```
case [Choose]
  when "A" then SUM([Sales Amount])
  when "B" then AVG([Discount Qty])
  when "C" then MIN([Sales Qty])
end
```

The calculation is valid. Sheets Affected ▾

We always evaluate all of them!

```
SELECT SUM([FactSales].[SalesAmount]) AS [TEMP(Calculation_2537215499680038912)],
       (MIN([FactSales].[SalesQuantity])) AS [TEMP(Calculation_2537215499680038912)],
       COUNT_BIG([FactSales].[DiscountQuantity]) AS [TEMP(Calculation_2537215499680038912)],
       SUM(CAST(([FactSales].[DiscountQuantity]) as BIGINT)) AS
[TEMP(Calculation_2537215499680038912)]
FROM [dbo].[FactSales] [FactSales]
GROUP BY ()
```

# Calculations

```
case [Parameters].[Data]
  when 'Enrollment (Headcount)' then [Count]
  when 'Enrollment (Seats)' then if count({Fixed [SurCl], [Sur P] :
max([Sur P])})> 10 then count({Include [SurCl], [Sur P]: max([Sur P])})
END
  when 'Headcount (Running Sum)' then RUNNING_SUM(Sum(IF {Fixed [SurP (usv
FACT STDNT ENRL)], [Filter 3]: MIN([SurT (usv FACT STDNT ENRL))} =
      {Fixed [SurT (usv FACT STDNT ENRL)], [Filter 3]: MIN([SurT
(usv FACT STDNT ENRL))} THEN 1 ELSE 0 END))
  when 'Class Sections' then countd([SurCl])
  when 'Instructors' then countd([Instructor ID])
  when 'FTE' then round(sum({Fixed [Sur PIYCT], [SurCl]: min([Units
Taken])/15}),1)
  when 'Weighted SCH' then round(sum({Fixed [Sur PIYCT], [SurCl]:
min([Weighted SCH])}),0)
  when 'Tuition and Fees' then round(sum({Fixed [Sur PIYCT]: min([Tuition
and Fees])}),0)
  when 'Tuition and Fees (Average)' then round(avg({Fixed [Sur PIYCT] :
min([Tuition and Fees])}),0)
  when 'FTE/Instructor' then round(sum({Fixed [Sur PIYCT], [SurCl]:
max([Units Taken])/15})/countd([Instructor ID]),1)
  when 'Age Value' then round(avg({Fixed [Sur PIYCT]: min([Age
Value])}),1)
  when 'FTE/Enrollment' then round(sum({Fixed [Sur PIYCT], [SurCl]:
min([Units Taken])/15})/[Count],3)
  when 'HS GPA' then round(avg({Fixed [Sur PIYCT] : min(case
[HS_GPA_Exists]
  when 'Y' then [HS GPA]end ))},2)
  when 'ACT_COMP' then round(avg({Fixed [Sur PIYCT] : min(if [ACT_COMP] >
0 then [ACT_COMP] end ))},2)
```

```
  when 'Full-time' then round(countd(case [Academic Load]
  when 'Full-time' then [Sur P] end)/[Count],3)  when 'Current Score'
then round(AVG([Cv Current Score]),2)
  when 'DFWI' then round(countd(case [Dfwi]
  when 1 then [Sur P] end)/[Count],3)
  when 'Math completion this year' then round (COUNTD(case [College Math
Completion]
  when 'Completed College Math this year' then [surp] end)/[Count],3)
  when 'CUR_GPA' then round(avg({Fixed [Sur PIYCT] : min([CUR_GPA])}),2)
  when 'Semester GPA Variance' then round(VARP({Fixed [Sur PIYCT]:
min([CUR_GPA])}),2)
  when 'Cum_GPA' then round(avg({Fixed [Sur PIYCT] : min([Cum_GPA])}),2)
  when 'Good Academic Standing' then round(countd(case [Academic Standing]
  when 'Good' then [Sur P] end)/[Count],3)
  when 'Financial Aid' then round(sum({Fixed [Sur PIYCT]:
min([Amount])}),0)
  when '1-term Retention' then round([Count 1-term ret]/[Count],3)
  when '1-term Retention or Graduation' then round([Count 1-term ret or
grad]/[Count],3)
  when '1-yr Retention' then round([Count 1-yr ret]/[Count],3)
  when '2-yr Retention' then round([Count 2-yr ret]/[Count],3)
  when '3-yr Retention' then round([Count 3-yr ret]/[Count],3)
  when '4-yr Retention' then round([Count 4-yr ret]/[Count],3)
  when '4-yr Graduation' then round([Count 4-yr grad]/[Count],3)
  when '5-yr Graduation' then round([Count 5-yr grad]/[Count],3)
  when '6-yr Graduation' then round([Count 6-yr grad]/[Count],3)
END
```

# Calculations



Use native features over calculations

**Groups**

**Sets**

**Bins**

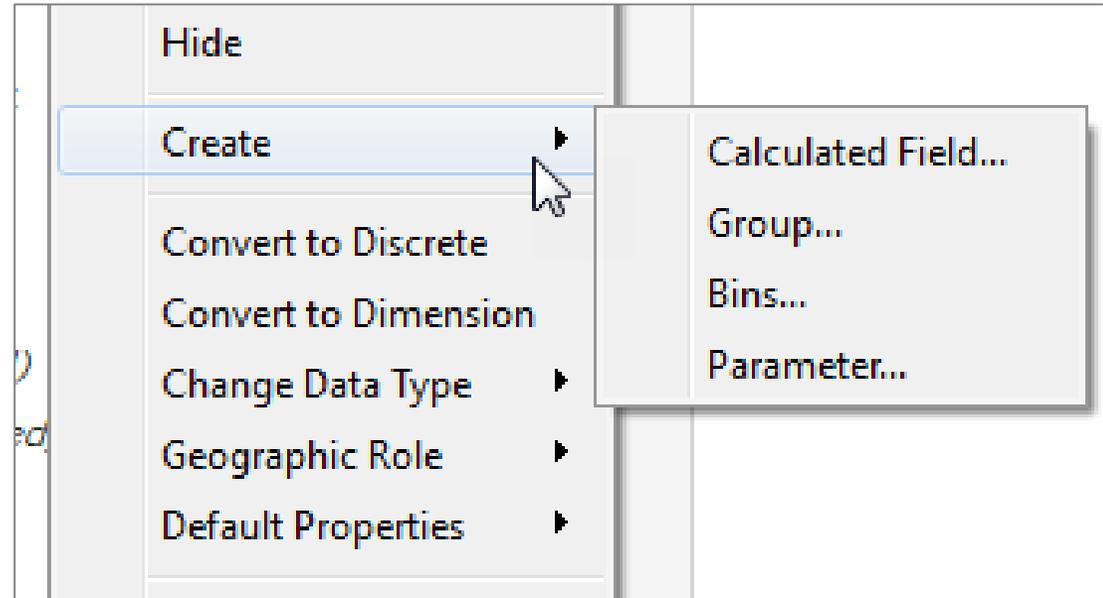
**Custom date fields**

**Combined fields**

**Aliases**

**Reference lines**

**Analytics (clustering, trend lines, forecasts)**



# Calculations



Consider efficiency of your calculations

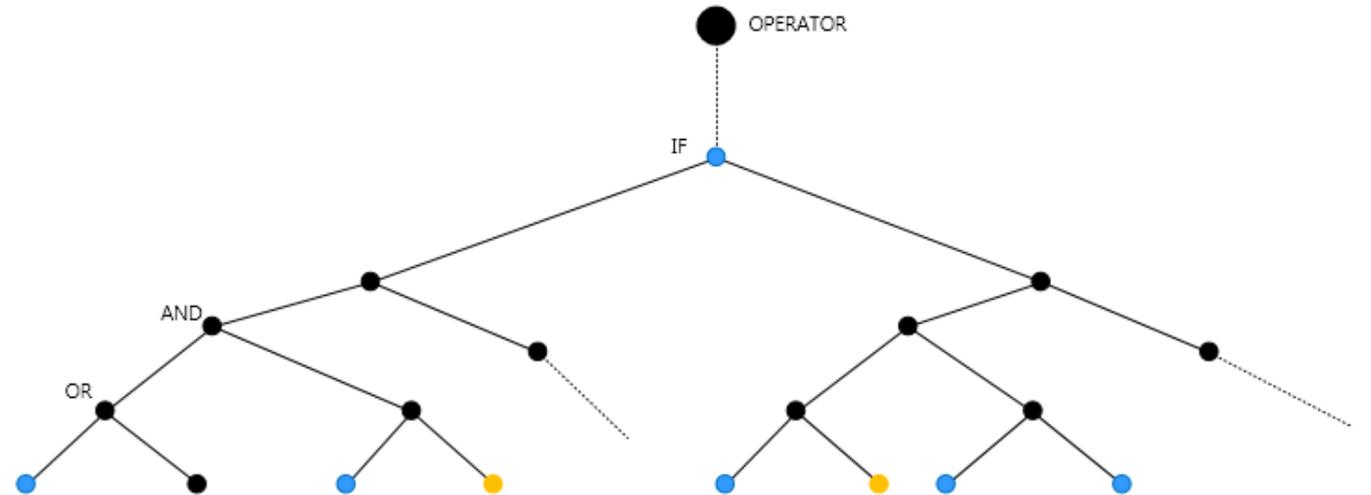
**CASE or Groups > IF .. IF ... IF...**

**ELSEIF > ELSE IF**

**REGEX for strings!**

**Sets**

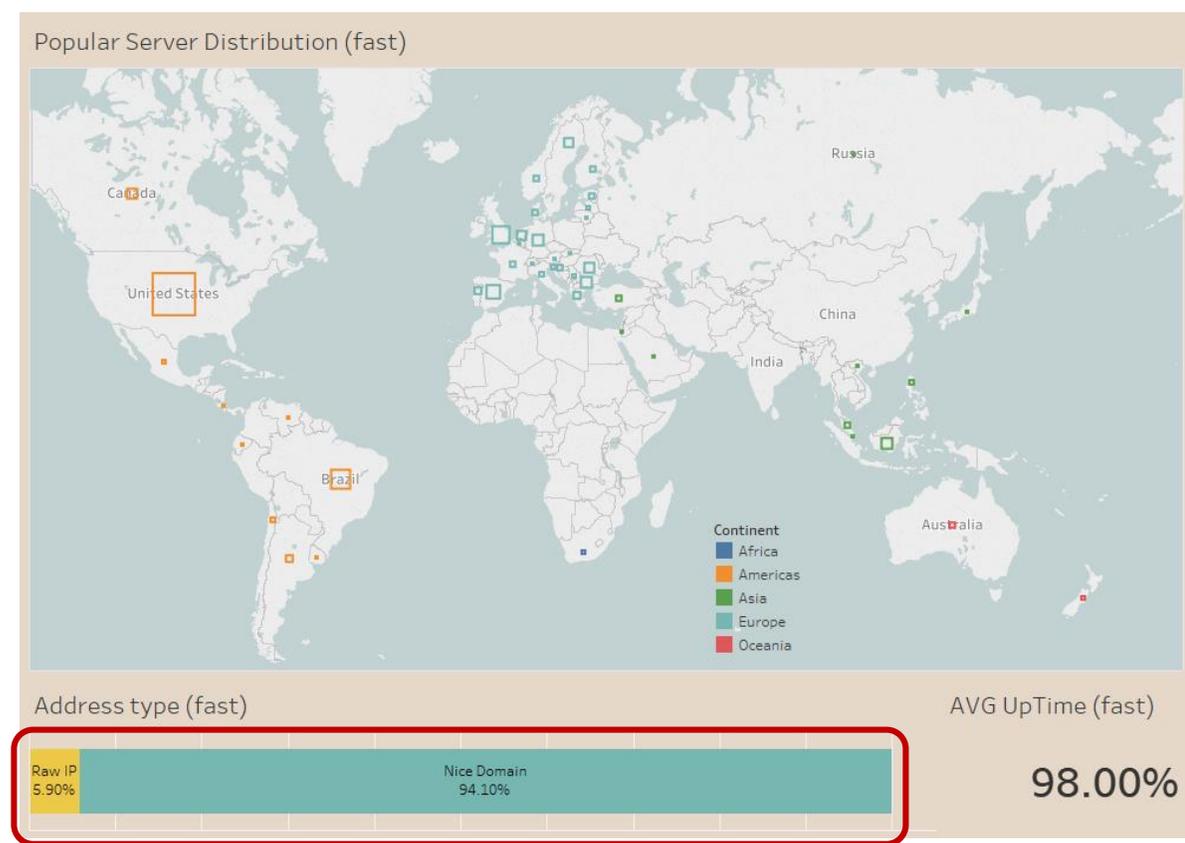
**Calculation “Explosion”**



# Calculations

## Calculation “Explosion”

```
C:\Users\aeldrige\Documents\Dropbox\My Stuff\Hidden\Efficient 10.3\minecraft_servers.txt - Notepad++ [Administrator]
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
minecraft_servers.txt x
858 857|Laaksocraft|Laaksocraft.com|100|333|1.11.2|Finland
859 858|DrugLegends|druglegends.net|98|333|1.11.2|United States of America
860 859|MyFunCraft|play.myfuncraft.us:25565|100|332|1.11.2|United States of America
861 860|Asgard Ascension|play.asgard-mc.net|100|332|1.11.2|United States of America
862 861|DragCraft.EU|79.124.17.195:25565|100|332|1.11.2|Bulgaria
863 862|ModVortex - SkyFactory 3|play.modvortex.com|95|332|1.10.2|Canada
864 863|Zenith Legacy|Autismrealms.us|100|330|1.11.2|United States of America
865 864|ChaosOP|ChaosOP.net:25565|97|330|1.8.8|United States of America
866 865|Owl Academy|mc.owl.academy|100|329|1.11.2|United States of America
867 866|Mozartrealms|pvp.mozartrealms.com|98|329|1.11.2|United States of America
868 867|RetardedMc.tv|mc.retardedmc.tv:25565|89|329|1.11.2|Germany
869 868|AedisMC|mc.aedismc.nl|100|327|1.11.2|Netherlands
870 869|Citybuild.minecraft.gs|Citybuild.minecraft.gs:25565|94|327|1.10|Germany
871 870|Unlimited Network|unlimitedmc.net|93|326|1.11.2|United States of America
872 871|[AdventurePvP]- 1.8 Factions/mcmmo/auctions|play.adventurepvp.eu:25565|85|326|1.8|Bulgaria
873 872|Mineday.eu|5.62.98.70:25565|100|325|1.8.8|Germany
874 873|MithrandirCraft|play.mithrandircraft.com|100|324|1.11.2|Spain
875 874|direwolf20.goreacraft.com|direwolf.goreacraft.com|100|324|1.7.10|United Kingdom
876 875|Minecraft Bulgaria|play.minecraft-bg.com|100|323|1.11.2|Bulgaria
877 876|Rhapsodies Of Survival|rhapsodiesofsurvival.mcserver.ws:25565|100|321|1.11.2|United States of America
878 877|[ThriveMC] Christian Based! Shop|play.thrivemc.us|94|321|1.11.2|United States of America
879 878|LionMC.nitrado.net Faction/Rütbe/Editci 1.7.X-1.8.X|LionMC.nitrado.net:67|320|1.7.10|Turkey
880 879|Freebuilders|23.226.68.37:25565|100|319|1.11.2|United States of America
881 880|JeepCraft|play.jeepcraft.net|100|319|1.11.2|United States of America
882 881|Grydon Kingdom|grydonkingdom.dmch.nl:25617|93|319|1.8.8|Netherlands
883 882|Tanelorn|luckykingdom.ddns.net|100|318|1.11.2|United States of America
884 883|GalacticPvP|Play.GalacticPvP.Net|95|318|1.8.8|Netherlands
885 884|Mihion|mc.mihion.dk|93|318|1.11.2|Denmark
886 885|MomentCraft _ 1.5.x (jogar.momentcraft.com.br)|jogar.momentcraft.com.br:25565|100|317|1.5.2|United States
887 886|CombatCraft|pvp.combatcraft.com.br|96|317|1.11.2|Brazil
```



# Calculations

## Calculation “explosion”

The image illustrates a 'calculation explosion' in Excel, where a single calculation triggers a chain of other calculations, resulting in multiple overlapping dialog boxes. The dialog boxes shown are:

- Address\_IsValidIP**:

```
NOT (ISNULL([Address_Segment1_AsInt])) AND
NOT (ISNULL([Address_Segment2_AsInt])) AND
NOT (ISNULL([Address_Segment3_AsInt])) AND
NOT (ISNULL([Address_Segment4_AsInt])) AND
[Address_Segment1_AsInt] >= 0 AND
[Address_Segment1_AsInt] <= 255 AND
[Address_Segment2_AsInt] >= 0 AND
[Address_Segment2_AsInt] <= 255 AND
[Address_Segment3_AsInt] >= 0 AND
[Address_Segment3_AsInt] <= 255 AND
[Address_Segment4_AsInt] >= 0 AND
[Address_Segment4_AsInt] <= 255 AND
[Address_Segment5_IsMissing]
```
- Address\_Segment5**, **Address\_Segment4**, **Address\_Segment3**, **Address\_Segment2**, **Address\_Segment1**: These dialog boxes are partially visible, showing the start of their respective calculation logic.
- Address\_RemoveProtocol**:

```
IF FIND([Address_RemoveProtocol], [Address_RemoveProtocolAndPort])
ELSE
MID([Address_RemoveProtocol])
END
```
- Address\_LowerCase**:

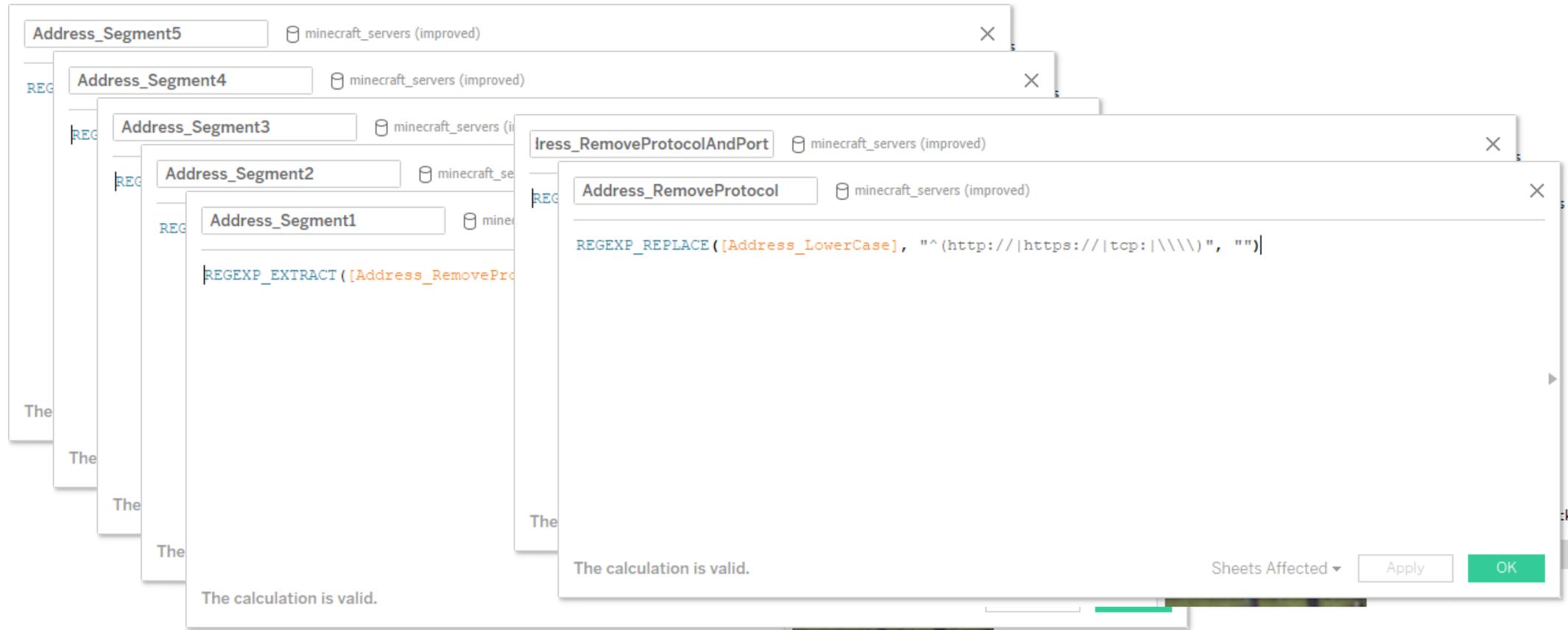
```
IF STARTSWITH([Address], "(") AND ENDSWITH([Address], ")") THEN
LOWER(MID([Address], 2, LEN([Address]) - 2))
ELSEIF STARTSWITH([Address], "ip=") THEN
LOWER(MID([Address], 4, LEN([Address]) - 4))
ELSE
LOWER([Address])
END
```
- Iress\_RemoveProtocolAndPort**:

```
IF
```

Each dialog box includes a status bar at the bottom with the text "The calculation is valid.", a "Sheets Affected" dropdown, and "Apply" and "OK" buttons.

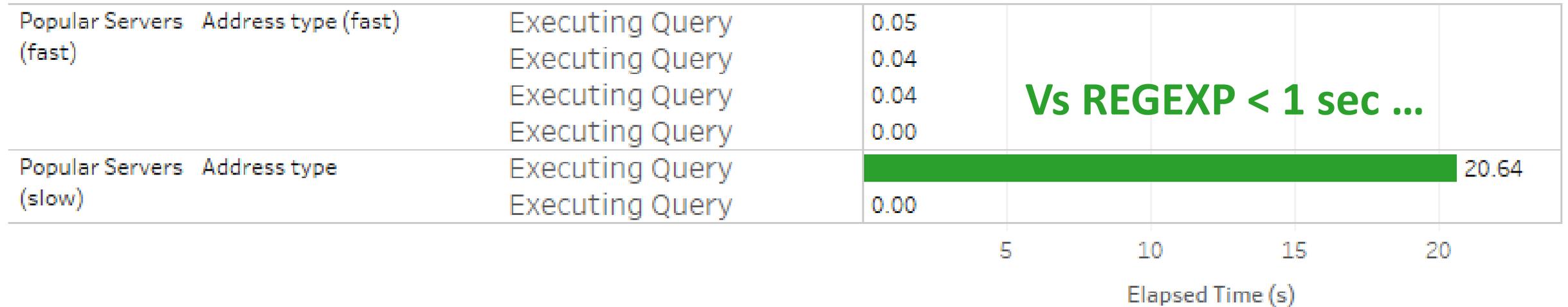
# Calculations

## Calculation efficiency



# Calculations

## Calculation efficiency



# Working Across Data Sources



Use data blending wisely

## Blending

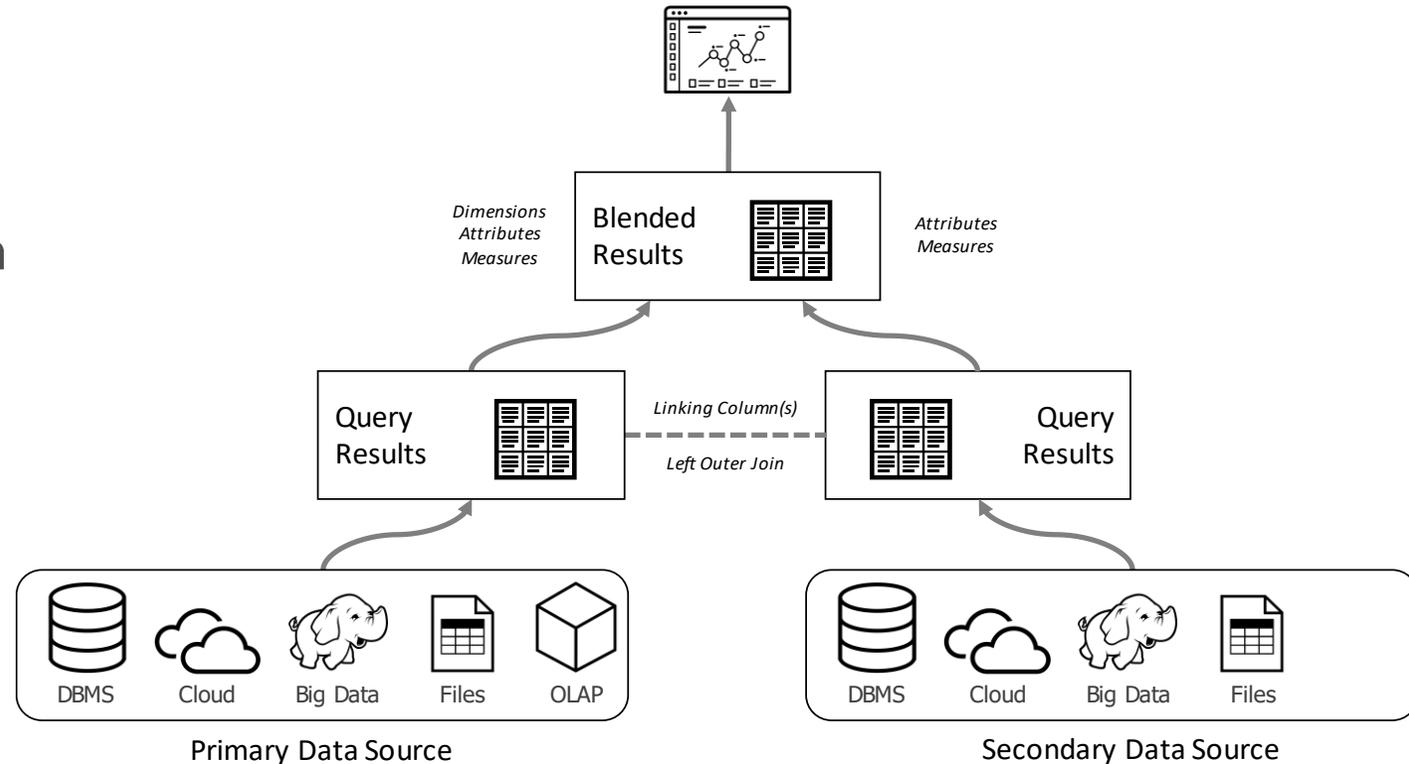
Aggregate, then join

Different to (cross-database) joins which are at the record level

## Don't blend on high-cardinality dimensions

Consider a cross-database join instead

**Use primary groups/aliases to eliminate blending for label lookups**



# Data



# Data Layer

Concerned with:  
Data connections  
Connection models  
Extracts

The screenshot shows the Tableau interface for a Superstore data source. On the left, the 'Connections' pane lists 'sql.databender.net,14333 Microsoft SQL Server' and 'Superstore Returns Text File'. The 'Database' is set to 'Superstore'. The 'Table' pane shows a list of tables including 'dimCustomer', 'dimDemographic', 'factOrders', etc. The main workspace displays a data model diagram with 'factOrders' connected to 'Superstore Returns.csv' and several dimension tables: 'dimCustomer', 'dimLocation', 'dimProduct', 'dimSegment', and 'dimShipMode'. 'dimCustomer' is further connected to 'dimDemographic'. Below the diagram, a table displays data from the 'dimCustomer' table.

Customer Name	Gender	Marital Status	Department	Occupation	Education Level
Kunst Miller	Female	Married	Sales	Librarian	Undergraduate
Sandra Glassco	Male	Single	Engineering	Dental Hygienist	Postgrad
Scot Wooten	Male	Single	Human Resources	Staff Accountant II	Secondary
Chad Sievert	Male	Rather Not Say	Human Resources	Community Outreach ...	PHD
Toby Braunhardt	Female	Single	Support	Account Coordinator	Secondary

# Connection Types



Connection type performance varies

## Many data source types

Not all created equal

E.g., Native > ODBC

## Embedded > published?

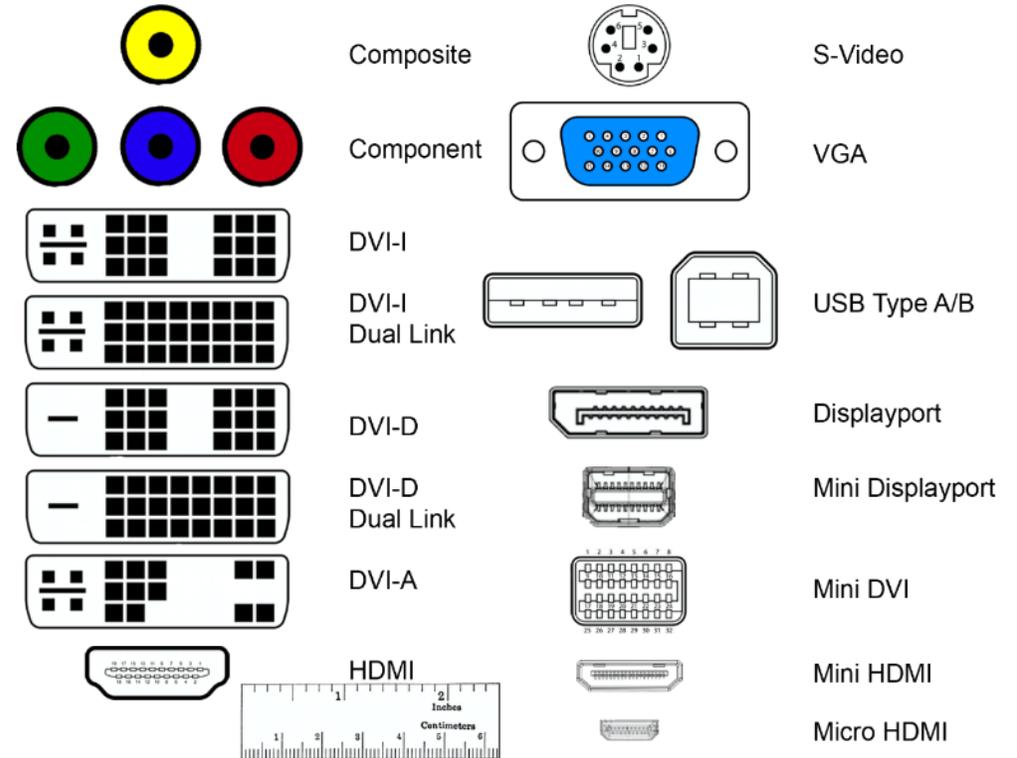
Embedded can be faster

Acceleration views

## Direct vs. bridged (Online)

Query bridge can be extract or live

Data engine



# Data Connections



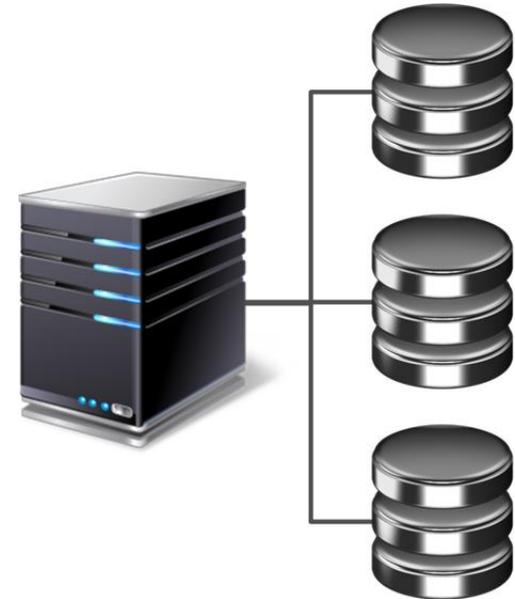
Try not to move too much data

**Having your data in one place is faster than pulling it from multiple sources**

Joining

Blending

Data integration (cross-database joins)



# Connection Models



Trust Tableau to do its job

## Avoid custom SQL and stored procedures where possible

If you can, deconstruct monolithic custom SQL to be discrete, table-focused custom SQL statements

Use an extract to materialise them so the custom SQL is run only once



# Custom SQL

## Quarterly

### Custom SQL Query

```
/* TYPE ABCD */
SELECT 'ABCD' AS CATEGORY, REGION, FLAG, YEAR, QUARTER, MEASURE,
MEASURE_ID, AMOUNT
FROM DB.FACT_TABLE
WHERE CATEGORY NOT IN ('Not available','Unknown','Not applicable')
AND (MEASURE_ID IN (301,604))
AND AS_AT_DATE = <Parameters.As At Date>
GROUP BY CATEGORY, REGION, FLAG, YEAR, QUARTER, MEASURE, MEASURE_ID
```

UNION ALL

```
SELECT 'ABCD' AS CATEGORY, REGION, FLAG, YEAR, QUARTER, 'AA ' ||
MEASURE, MEASURE_ID, AMOUNT
FROM DB.FACT_TABLE
WHERE CATEGORY IN (SELECT CATEGORY FROM DB.DIM_TABLE_A)
```

```
FROM DB.FACT_TABLE
WHERE CATEGORY IN (SELECT CATEGORY FROM DB.DIM_TABLE_B)
AND MEASURE_ID = 504
AND AS_AT_DATE = <Parameters.As At Date>
GROUP BY CATEGORY, REGION, FLAG, YEAR, QUARTER, 'BB ' || MEASURE,
MEASURE_ID
```

UNION ALL

```
/* TYPE WXYZ */
SELECT 'WXYZ' AS CATEGORY, REGION, FLAG, YEAR, QUARTER, MEASURE,
MEASURE_ID, AMOUNT
FROM DB.FACT_TABLE
WHERE CATEGORY NOT IN ('Not available','Unknown','Not applicable')
AND (MEASURE_ID = 302
OR MEASURE_ID = 605)
AND AS_AT_DATE = <Parameters.As At Date>
GROUP BY CATEGORY, REGION, FLAG, YEAR, QUARTER, MEASURE, MEASURE_ID
```

UNION ALL

```
SELECT 'NWXYZ' AS CATEGORY, REGION, FLAG, YEAR, QUARTER, 'CC ' ||
MEASURE, MEASURE_ID, AMOUNT
```

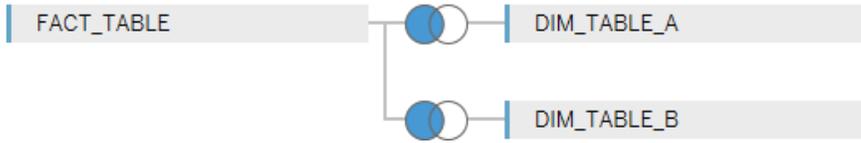
```
FROM DB.DIM_TABLE_A)
AND AS_AT_DATE = <Parameters.As At Date>
GROUP BY CATEGORY, REGION, FLAG, YEAR, QUARTER, 'CC ' || MEASURE,
```

```
SELECT 'WXYZ' AS CATEGORY, REGION, FLAG, YEAR, QUARTER, 'DD ' ||
MEASURE, MEASURE_ID, AMOUNT
FROM DB.FACT_TABLE
WHERE CATEGORY IN (SELECT CATEGORY FROM DB.DIM_TABLE_B)
AND (MEASURE_ID = 505)
AND AS_AT_DATE = <Parameters.As At Date>
GROUP BY CATEGORY, REGION, FLAG, YEAR, QUARTER, 'DD ' || MEASURE,
MEASURE_ID
```

**Time to open TWB: ~5 mins**

# Custom SQL

Quarterly



Category 2

Measure 2

```
/*  
if (  
t  
e  
t  
elseif ([category] <> 'Not available' and [category] <> 'Unknown' and [category] <> 'Not applicable')  
and ([Measure Id] = 301 or [Measure Id] = 604)  
then [Measure]  
elseif not ISNULL([category (DIM TABLE A)])  
and [Measure Id] = 504  
then 'AA ' + [Measure]  
elseif not ISNULL([category (DIM TABLE B)])  
and [Measure Id] = 504  
/*  
t  
e  
t  
elseif ([category] <> 'Not available' and [category] <> 'Unknown' and [category] <> 'Not applicable')  
> 'Not applicable')  
t  
e  
t  
and [measure id] = 505  
then 'DD ' + [Measure]  
end  
The ca  
The calculation is valid.
```

Apply OK

**Time to open TWB: < 10 secs (30x!)**

# Connection Models



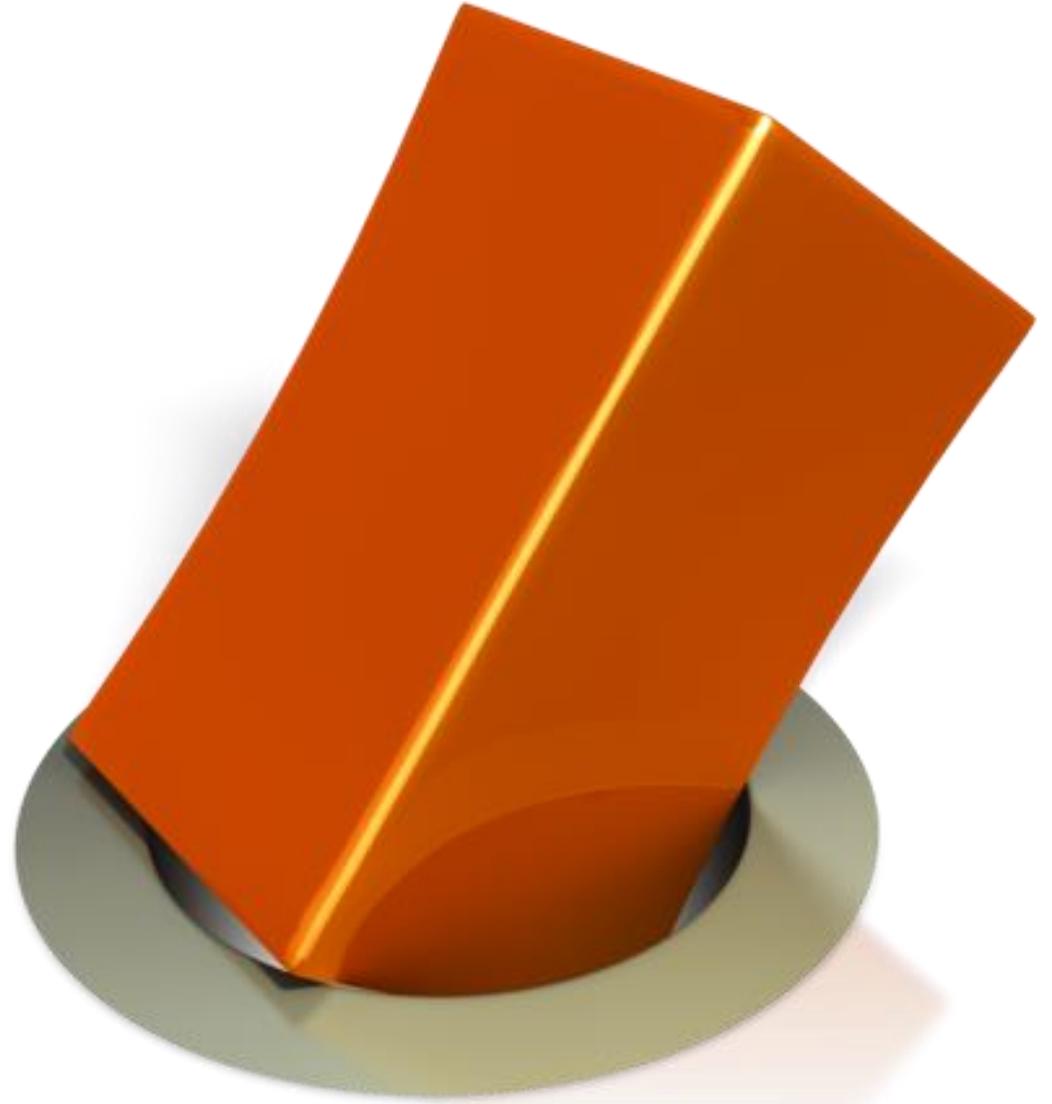
Try to have your data in the best “shape” for your analysis

**The less you have to  
manipulate your data,  
the faster it will be**

Union

Pivot

Calculations



# Data Connections



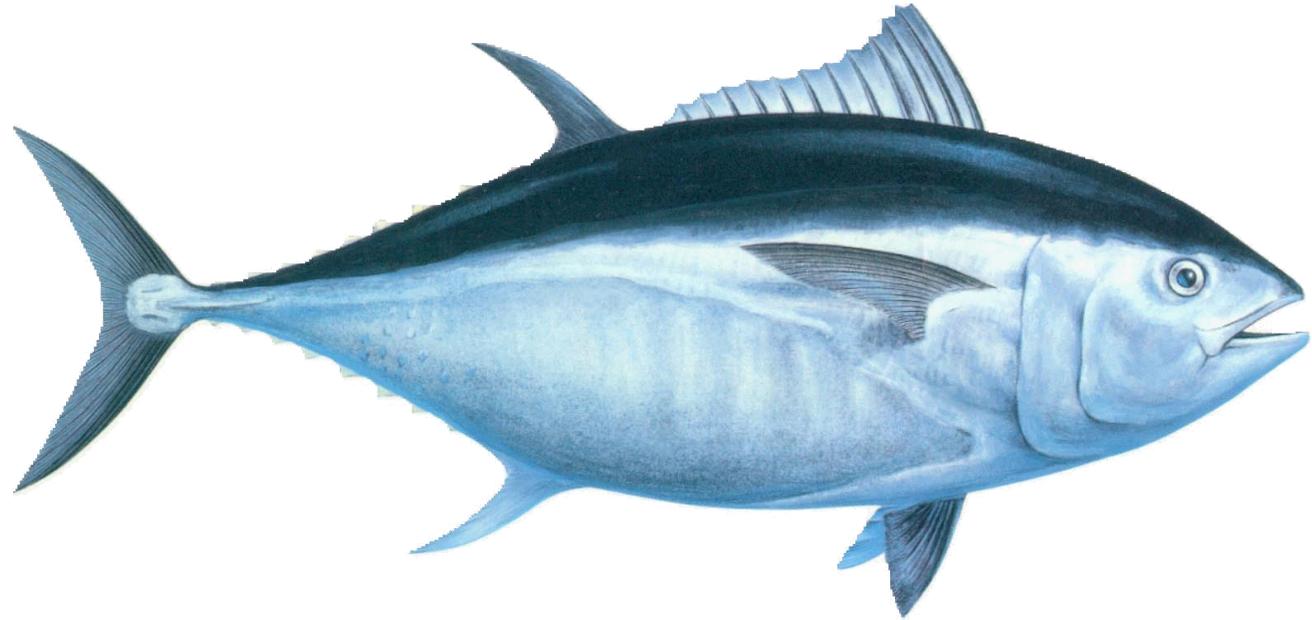
Tune your database for optimal performance

**Indexes on  
joining/filtering dimensions**

**Define columns as NOT NULL  
when possible**

**Referential integrity =  
join culling**

**If no “hard” RI, then “Assume  
Referential Integrity” on Data  
menu**



# Connection Models



Use Data Server for governance

**Have data experts optimise the connections; share with business users as published data connections**

**Share extracts across multiple workbooks**



# Connection Models



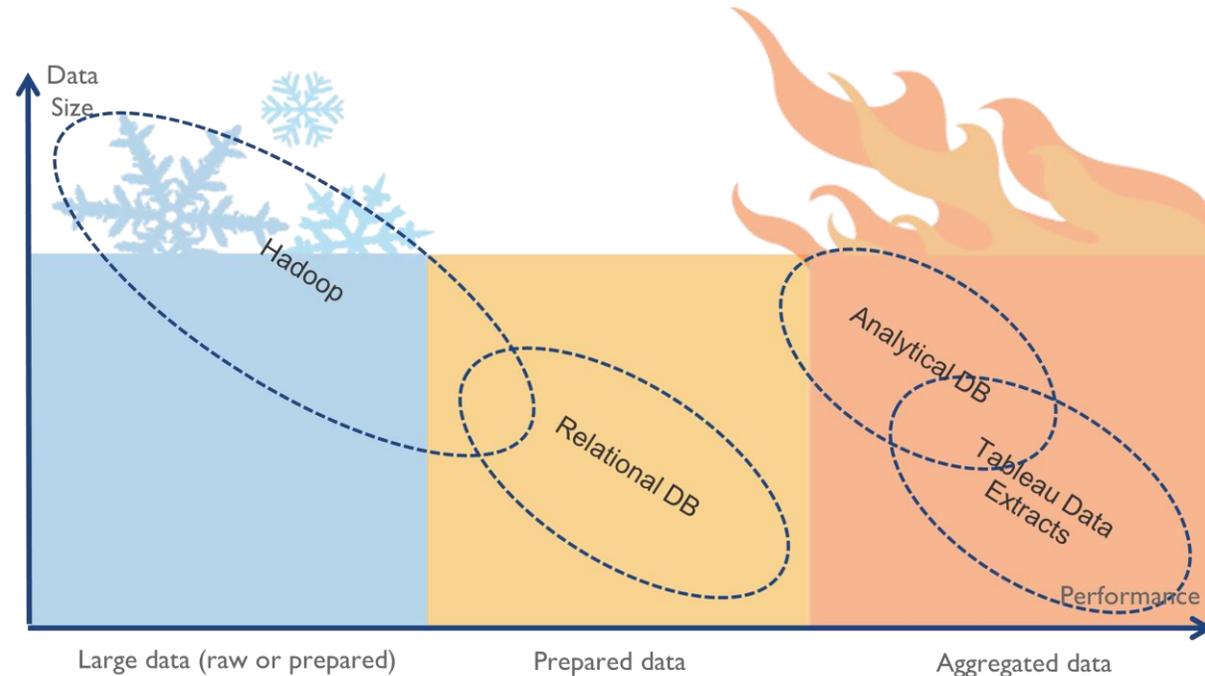
Use cold/warm/hot strategies for big data

Aggregated extracts for high-level analysis

Live/extract connection to DBMS for mid-level analysis

Live connection to Big Data for detail reports

Start at high level and drill down to detail



# Extracts



Extracts are an easy way to make things go faster

**Hide unused fields!**

**Aggregated**

**Filtered/sampled**

**Materialise row-level calculations**



# Extracts



Hyper data engine keeps getting better!

**Faster extract creation and refresh**

**Larger extracts**

**Improved query performance**

**Normalised extracts!**



**KEEP  
CALM  
AND  
GET  
HYPER**

# Concept: Visual Pipeline



# Platform Layer

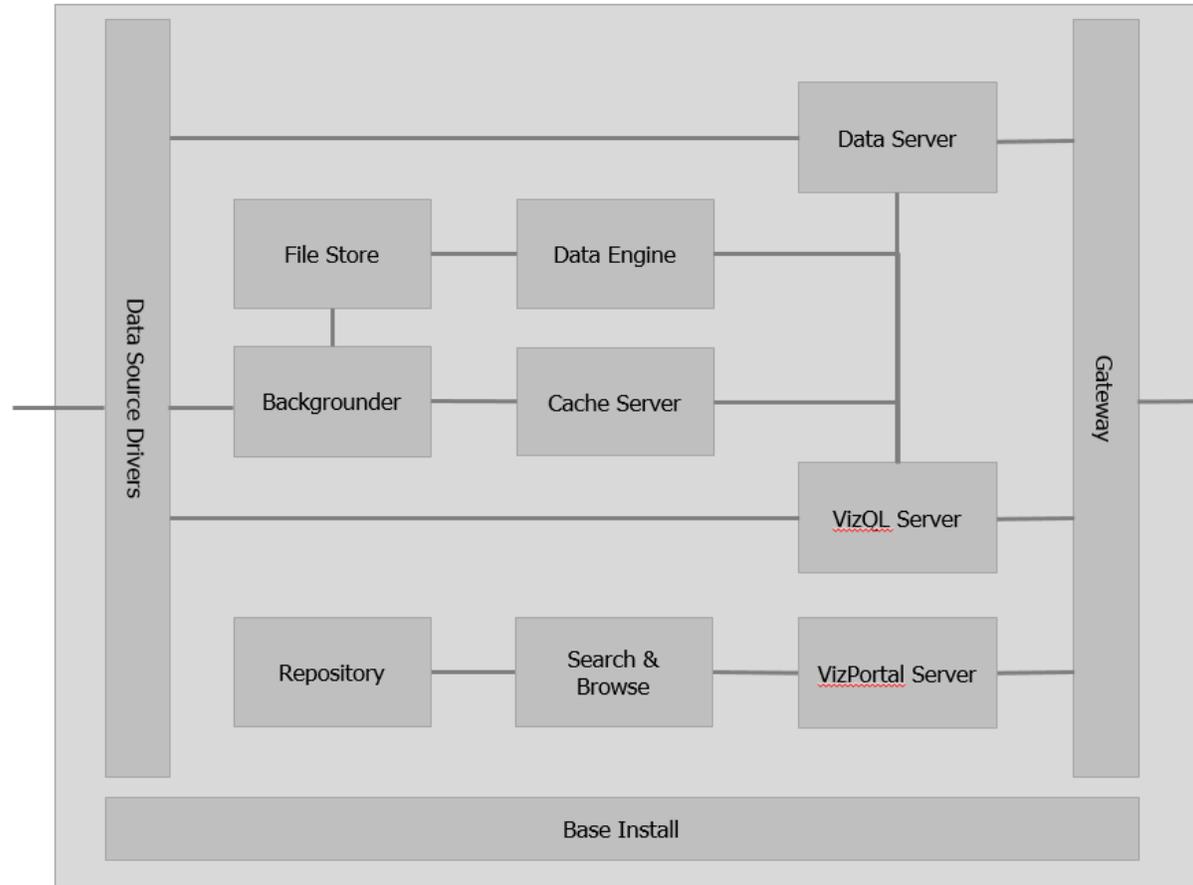
## Concerned with:

- Environment configuration
- OS
- Hardware

**Data**



**Tableau Server**



**Clients**



Browser/Mobile



Tableau Desktop



Command Line Tools



# Environment



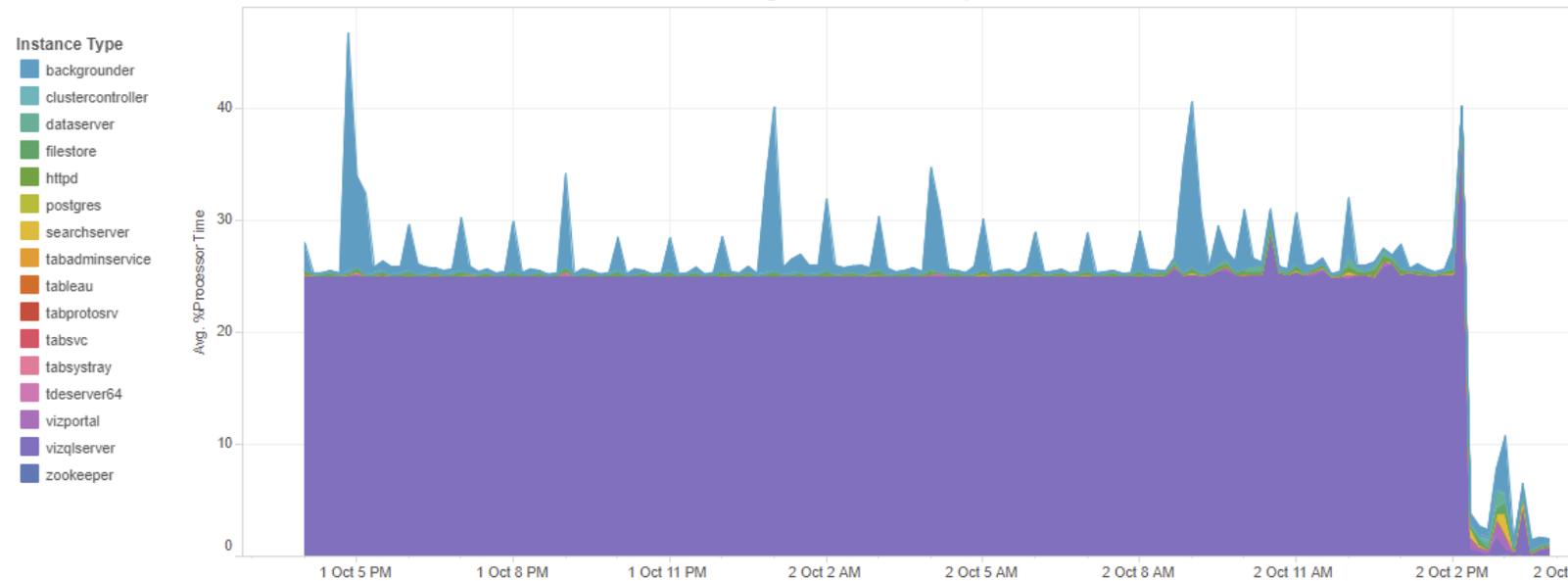
## Monitor!

### CPU Utilization By Service

Displays information about process-specific CPU utilization, as captured from PerfMon. The **Process - % Processor Utilization** PerfMon counters are scaled by # of logical cores on the system and can be amplified by multithreading, so these values should be used for relative system benchmarking only.

Machine:  Time to view:  Minute Interval:

Avg. CPU Utilization By Service



Avg. CPU Utilization By Service - All Nodes

Histogram of the Tableau services that consume the most processor resources across all nodes.



# Environment



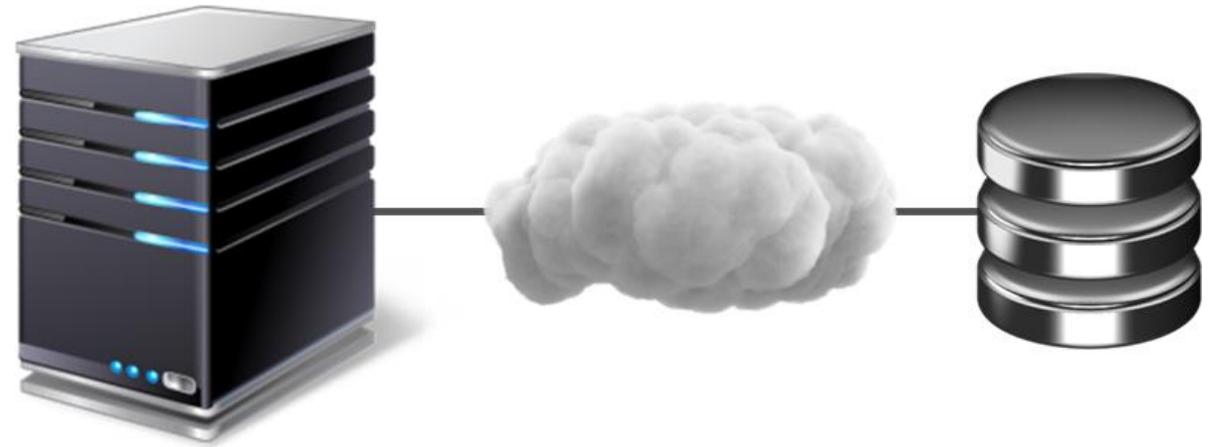
Be prepared to test both on the server and remotely

## On the server:

- Closer to the data
- Find configuration, data and workbook design issues

## Remote to the server:

- True end-user experience
- Find network issues



**Slow on Desktop → Slow on Server**

# Environment



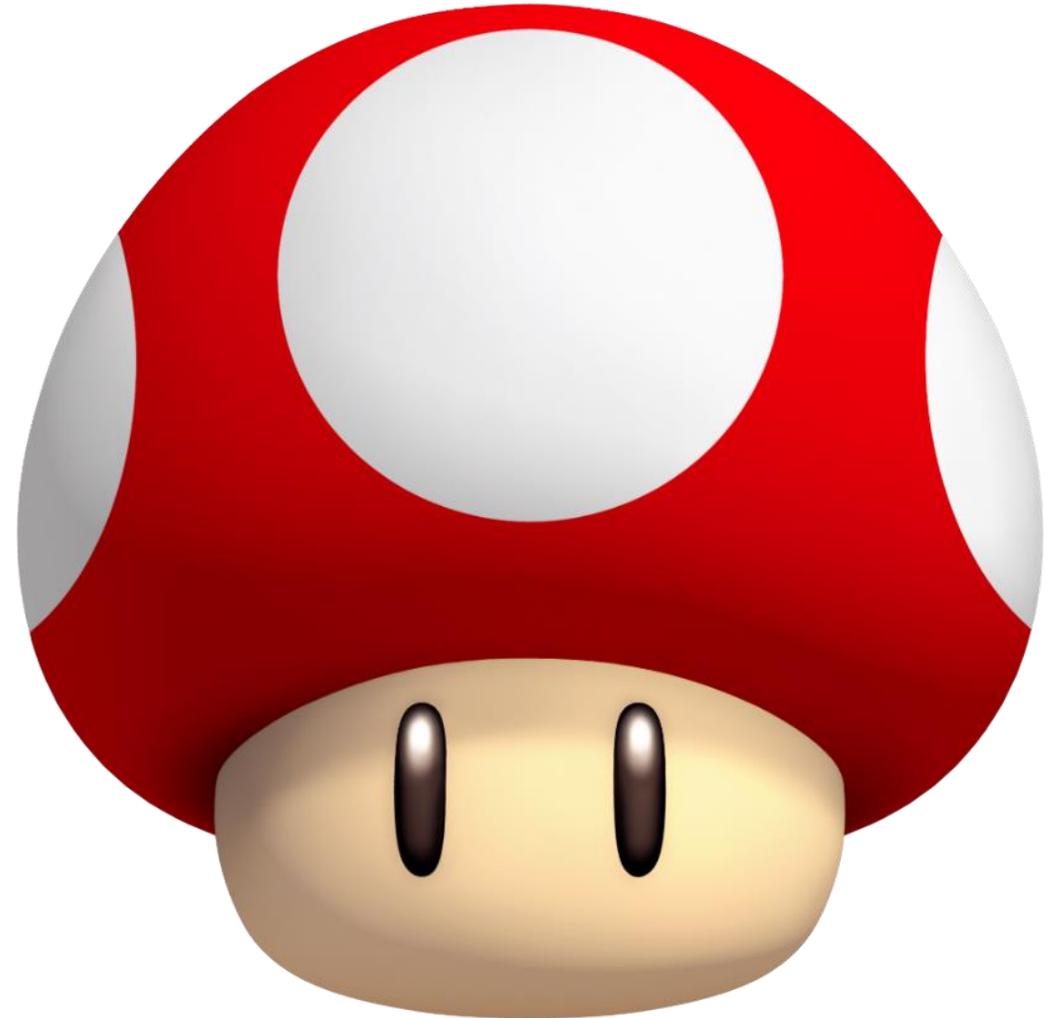
Upgrade!

## Software:

Desktop and Server  
Performance improvements  
Bug fixes

## Hardware

RAM, CPU  
Fast disk, esp. with extracts  
Fast network



# Environment



You gotta keep 'em separated

**Keep interactive  
users and extract  
refreshes separated**

VizQL vs. backgrounder

Consider a dedicated extract  
processing node



# Environment



**Know virtualisation**

**Don't run on oversubscribed virtual machines (CPU or RAM)**

**Virtual has a performance overhead (10-20%) vs physical infrastructure**

**If using cloud VMs (AWS, Azure, GCP) use the right instance and disk types**





QUESTIONS?



Thank you !

# Agenda

---

**09:30 – 10:00** - Updates on the Tableau Community at BNP Paribas

**10:00 – 10:30** - Newest and upcoming features of Tableau

**10:30 – 10:45** - Break

**10:45 – 12:15** - BNPP Testimonials: BNP Paribas Fortis, BDDF, Real Estate

**12:15 – 13:30** - Lunch

**13:30 – 14:45** - Workshop of your choice

Tableau Desktop Hands-on (beginner) **OR** Designing efficient workbooks (advanced)

**15:00 – 16:15** - Workshop of your choice

Tableau Prep Hands-on (beginner) **OR** Data Modelling (advanced)

