Tiber Solutions

Best Practices in Dashboard Design

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Tiber Solutions

- Founded in 2005 to provide Business Intelligence / Data Warehousing thought leadership to corporations and government agencies.
- Deeply skilled in all facets of BI/DW solutions – star schema, ETL, BI, dashboard design, data architecture, information architecture, BI agile development methodology, and MDM/governance.
- Provide hands-on architecture, implementation, and coaching expertise within IT organizations from the CIO to the developers.
- Partner with business executives to co-invent optimal BI/DW applications to dramatically improve their business.

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Customers

- Amethyst Technologies
- Amtrak
- Census Bureau
- Department of Health and Human Services
- Department of the Treasury
- Fannie Mae
- Federal Depository Insurance Corporation
- FrontPoint Security
- Freddie Mac
- Graduate Management Admission Council
- Internal Revenue Service
- Military Health System
- National Institutes of Health
- Occupational Safety and Health Administration
- Office of the Comptroller of the Currency
- SAP Business Objects
- Securities and Exchange Commission

Agenda

- Dashboards –
  - An Opportunity and a Challenge
  - The Process
  - The Art of the Start
  - Design Best Practices
- Tip-Of-The-Iceberg Peril
- Practical Advice

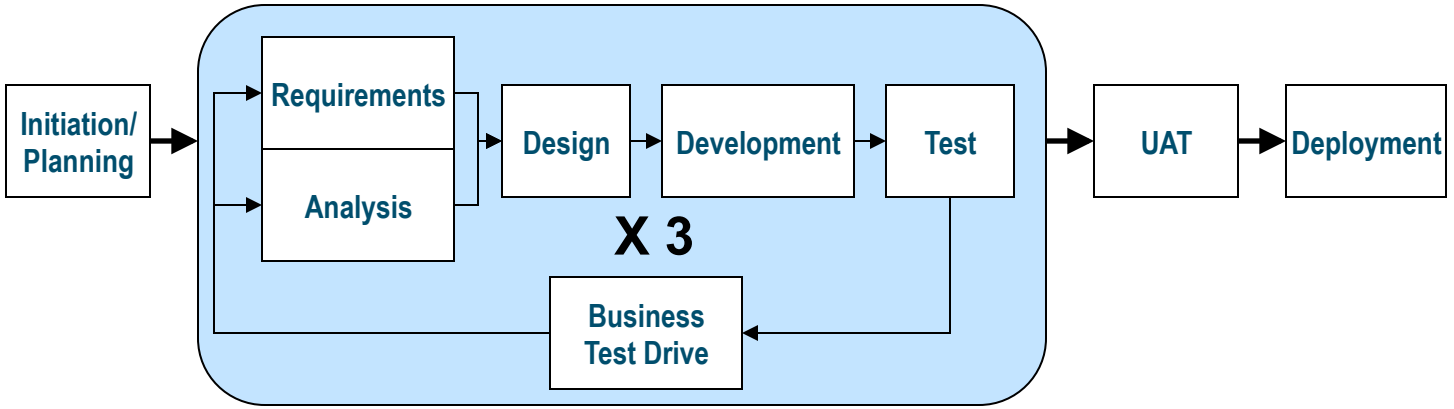
Dashboards – Opportunity and Challenge

- **Dashboards:** Provide the means to visually display relevant, intuitive, and important information at a glance to enable business users to monitor performance and make critical business decisions. **However**…….. this potential is rarely realized.

- **The Opportunity:**
  - Well-designed, dynamic dashboards are exponentially more effective and empowering than standard, static reports.

- **The Challenge:**
  - If great dashboards could be described by one word, the word would be "**intuitive**".
  - Dashboards take high volumes of data from disparate sources, assimilate and aggregate the data, and visually display meaningful information with clarity, precision, relevance, and quick understanding.
  - To transform high-volume, detailed, disparate data into an intuitive, integrated dashboard is not a simple task. It requires finesse, intelligence, and a tightly-integrated business/technical/data skill set.

The Process – Methodology



Benefits

- Business users provide feedback early and throughout the process which guides development.
- Business users see results early.
- Business users begin to understand the enabling capabilities of the tools.
- Business users begin to trust the data.
- Business users begin to invent. They begin to think outside the box.
- The solution is “proven out” and matured throughout the development process.

Collecting Requirements to Fail

Typical Requirement Session Events	Typical Outcome
Several business questions/statements are collected (How many banks are predicted to fail next quarter?).	Business questions/statements are rarely translated into a meaningful design and rarely implemented.
A set of reports that needs to be recreated is collected.	95% of the development time is spent successfully recreating the set of reports.
End users request the ability to create ad hoc queries.	Data model is hyper-designed for a specific set of reports and is very brittle. Most ad hoc queries are not supported.
End users are not involved with the project again until UAT.	End users are unfamiliar, untrusting, and unsatisfied with the application.

The Art of the Start - Requirements

Business Interviews

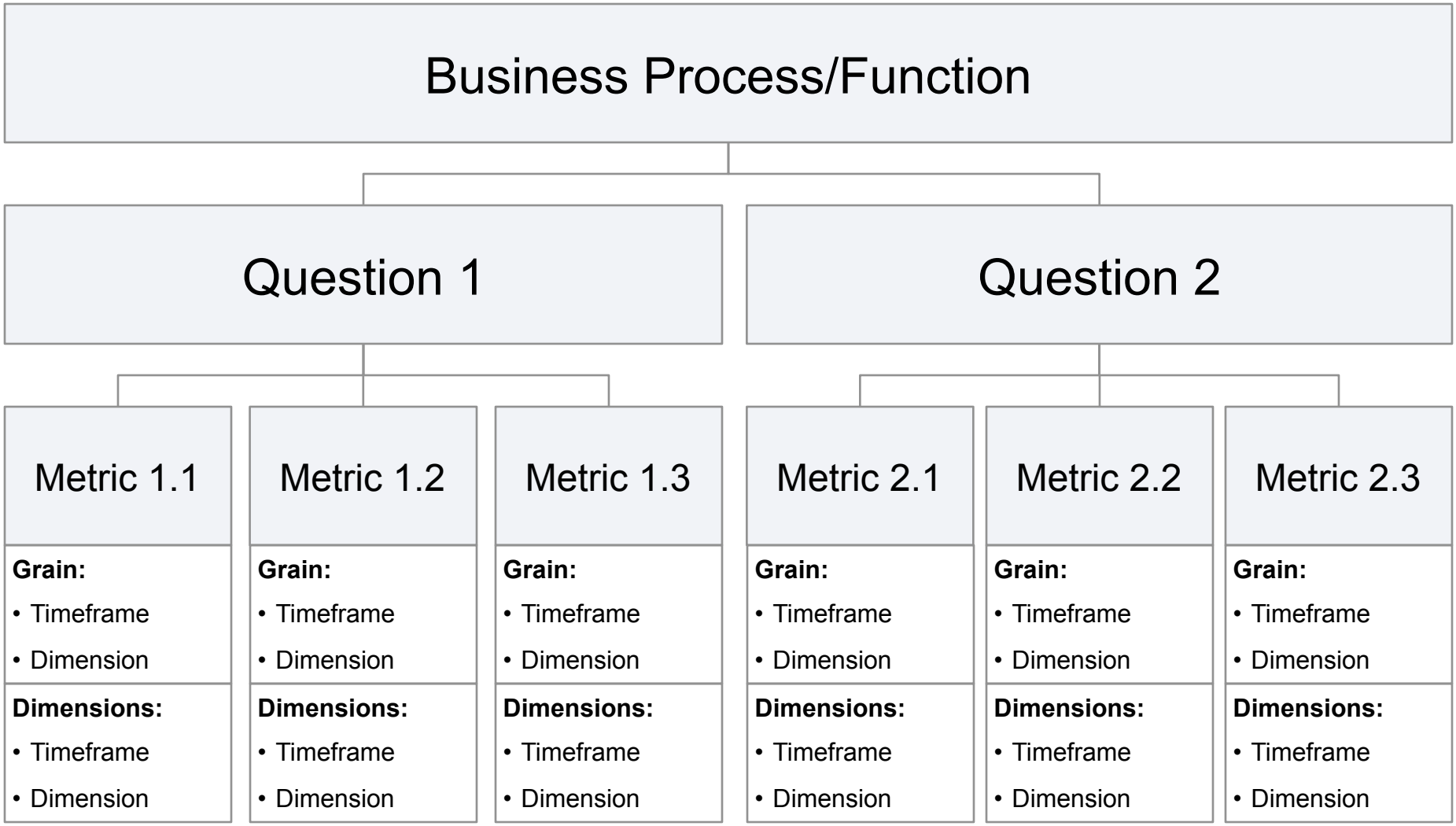
- **Purpose**: To learn about the business, their processes, and their metrics.
- **Approach**: "You don't know anything". Listen actively with no preconceived notions. Even if you think you are familiar with the subject, you will confirm and mature your understanding.
- **Who**: One or two steps up from the operational level, one or two steps down from the CEO.
- **How**:
  - One-on-one
  - Ask a question, get out of the way and listen, steer the interview with the next question.
  - Active listening. Repeat back what you hear to confirm your understanding and instill confidence.
- **Preparation**:
  - Review reports and documentation on business.
  - Prepare a set of initial questions.
  - Come prepared but not overly structured.

The Art of the Start - Requirements

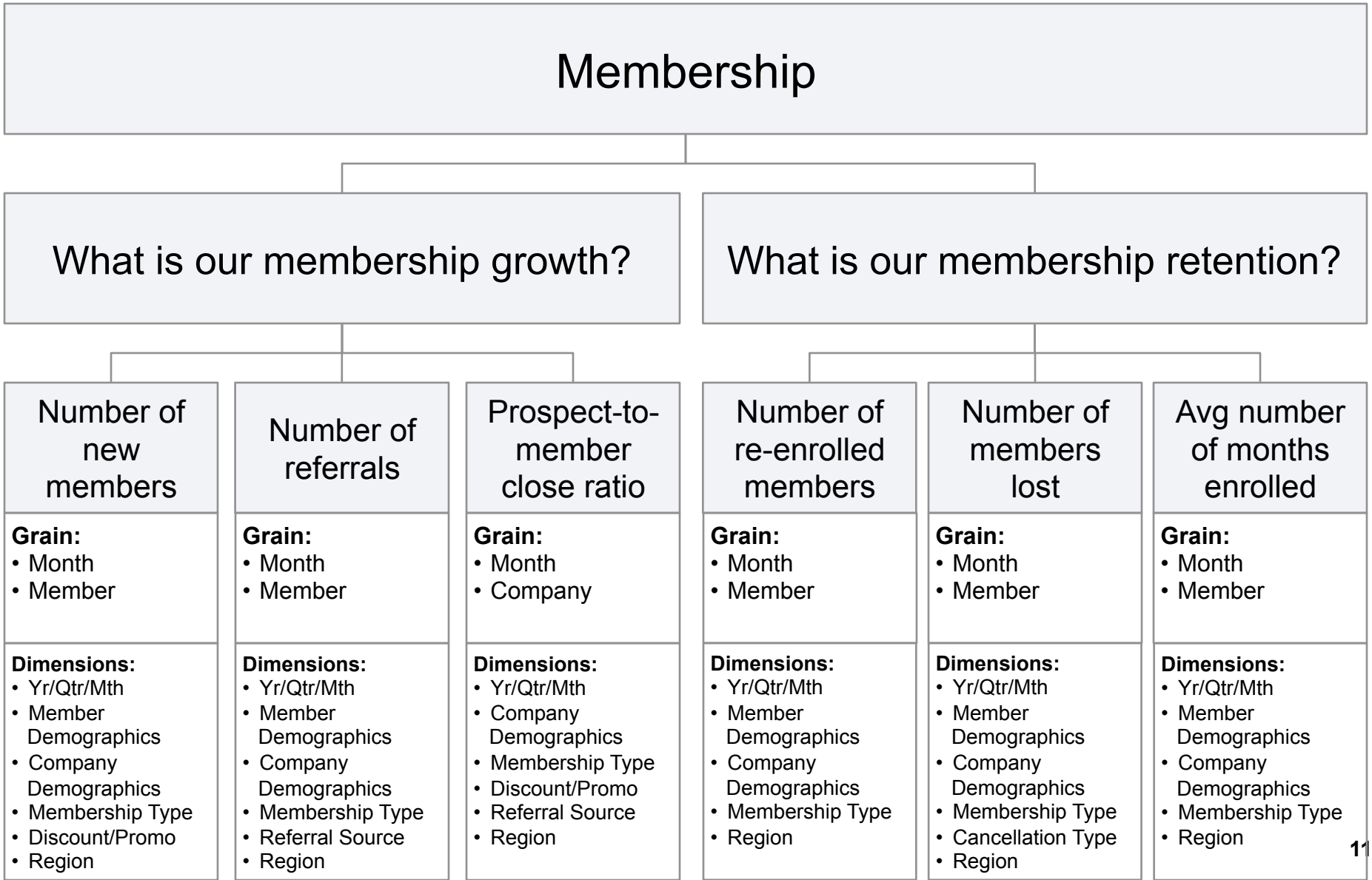
Points to Address During the Interview

- Identification of relevant business process(es)
- Identification of business questions related to business processes
- Identification of the measures (a.k.a., metrics, facts, KPIs) to answer the questions.
  - Aggregated measures – Monthly Net Sales, Profitability, Inventory Levels, Membership Rates
  - Exception measures – Employee Absenteeism, Safety Incidence Rate, Power Outages
- Determine the level of detail (grain) of each metric.
- Enumeration of the dimensions by which the measures are evaluated.
  - Measure by Dim 1, Dim 2, …. Dim N
- An understanding of how this information will be used
  - Visually
  - Next actions taken

The Art of the Start - Requirements



The Art of the Start - Requirements



The Art of the Start - Requirements

Kick-Off Questions:

- What kinds of decisions do you make?
- What kinds of information do you need to make these decisions?
- How do you know you are doing well?
- How are you measured by your superiors?
- What source of information do you rely on to make decisions?
- What is the first thing you look at when you enter the office each day?
- What is the most important report that you rely upon and why?
- What data or capabilities are missing from the report?
- What information can you not get access to today that you require?

The Art of the Start - Requirements

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1		Time												Product						Customer															
2	**Facts**	date	day of week	day of month	day of year	calendar month	calendar quarter	calendar year	fiscal month	fiscal quarter	fiscal year	holiday flag	season	product id	sku	product name	brand name	manufacturer name	unit price	customer account	customer full name	customer last name	customer first name	customer middle initial	street address	city	state	zip code	billing street address	billing city	billing state	billing zip code	salary range	marital status
3	net sales amount	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4	cost of goods sold	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5	gross sales amount	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6	tax amount	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7	discount amount					x	x	x	x	x	x	x	x	x	x	x	x	x	x																
8	promotion amount					x	x	x	x	x	x	x	x	x	x	x	x	x	x																
9	quantity sold	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Benefits

- Full requirement coverage to support dashboard and ad hoc queries.
- Common language between business and developers.
- Easy transition to logical star schema design and test drives

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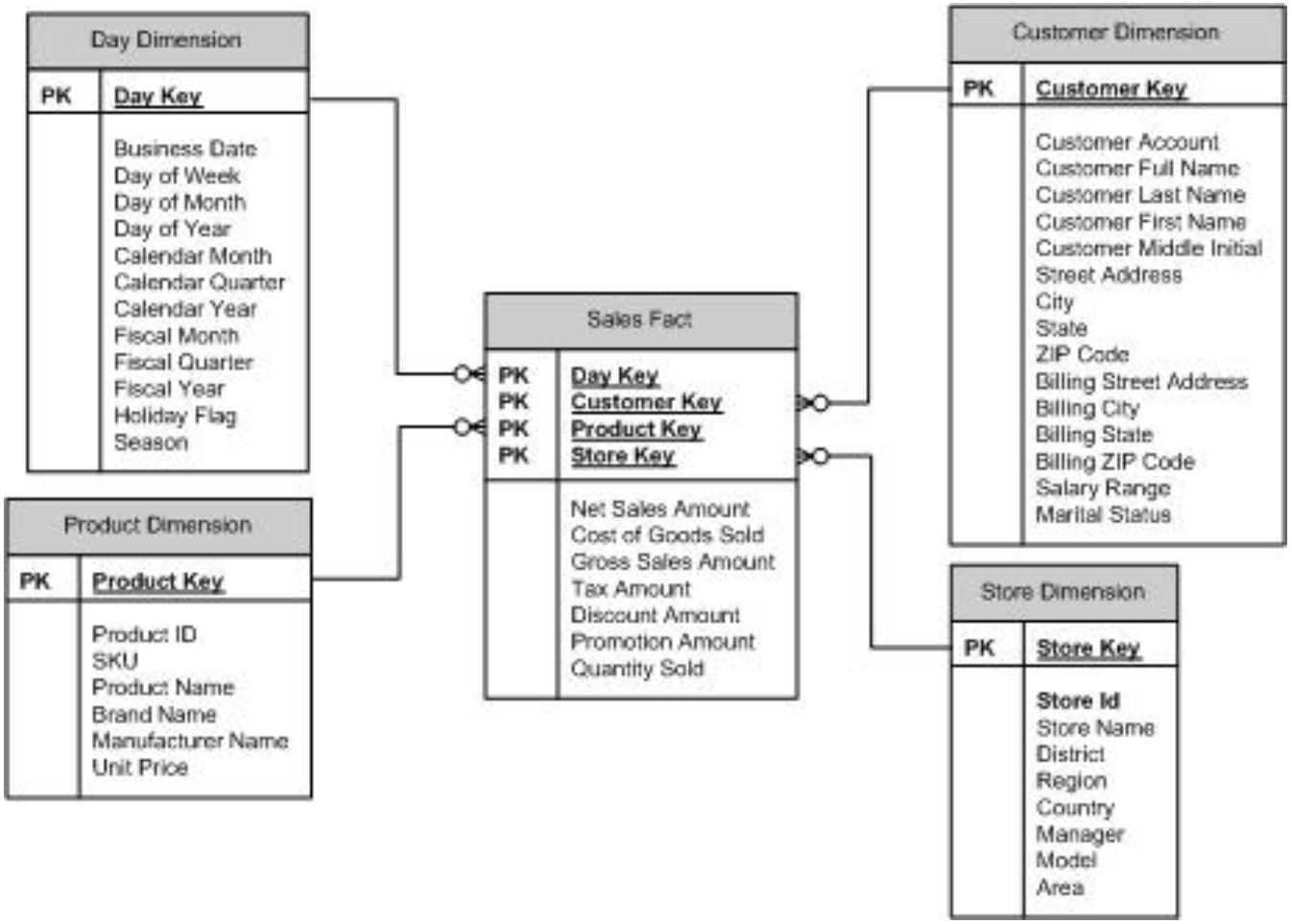
The Art of the Start - Requirements

Star Schema Data Model



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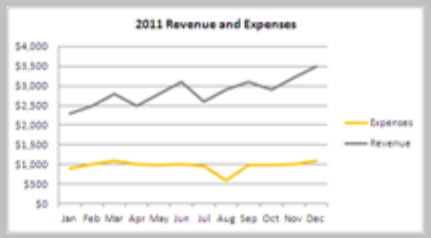
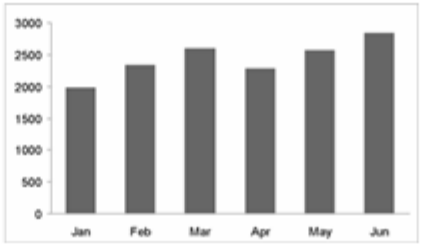
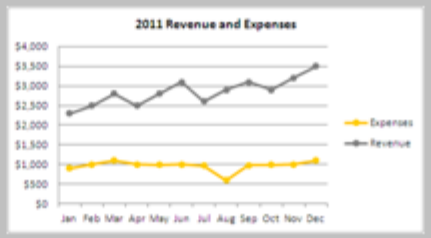
Dashboard Design Best Practices

- There are eight different information types:
  - Time Series
  - Ranking
  - Part-to-Whole in Percent
  - Nominal Comparison
  - Correlation
  - Frequency Distribution
  - Deviation
  - Maps
- Start by identifying which information type the data represents.
- Each information type has only two or three chart types that are appropriate for optimal information display.
- Review the possible chart types and select the most appropriate one.

For more information see Information Dashboard Design by Stephen Few.

Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Time Series Values display how a measure changed through time (yearly, monthly, etc.)	Line Chart to emphasize overall pattern		• Always place time on the horizontal axis. • Start the Y-axis at zero. • A combined line-vertical bar chart is useful when two measures need to be displayed. The line is associated with the left y-axis. The vertical bars are associated with the right y-axis or vice versa.
	Bar Chart to emphasize individual values		
	Line Chart with points to slightly emphasize individual values while still highlighting the overall pattern		

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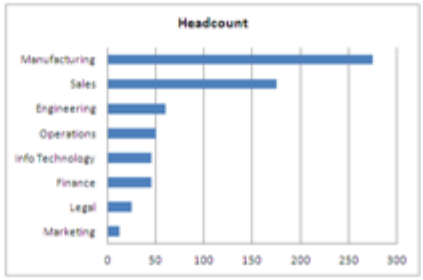
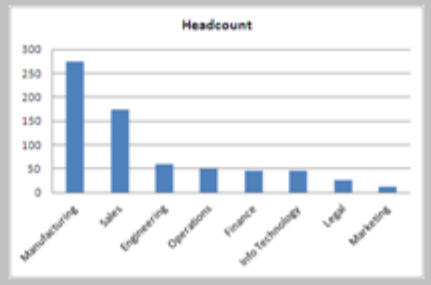
Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Ranking Values are ordered by size (either descending or ascending)	Horizontal Bar Chart		• Sort in descending order to highlight high values. • Sort in ascending order to highlight low values. • Start the quantitative axis at zero.
	Vertical Bar Chart		

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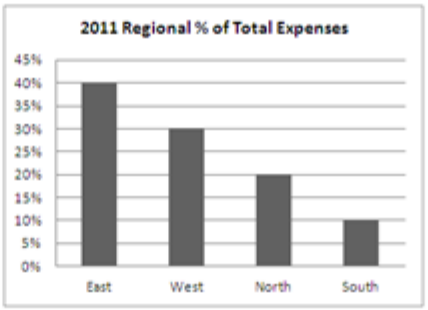
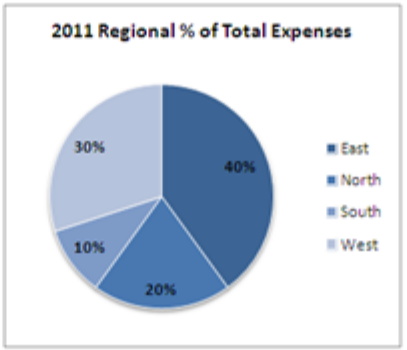
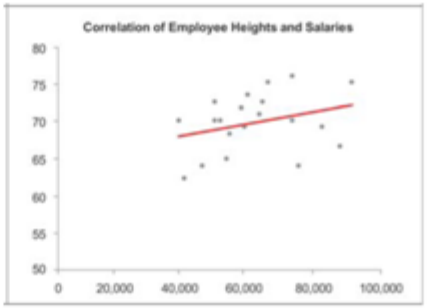
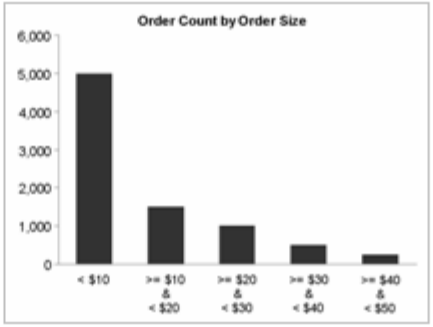
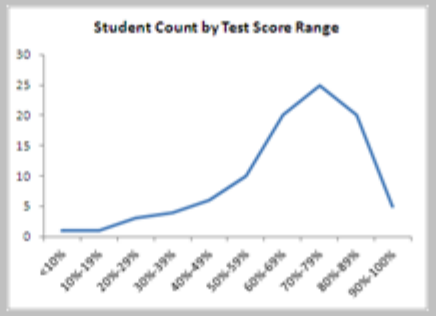
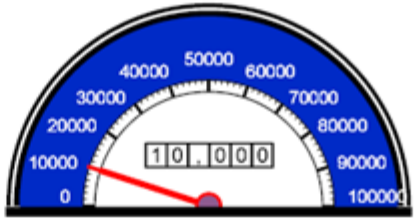
Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Part-to-Whole in Percent Values represent parts (ratios) of a whole	Vertical Bar Chart		• Use stacked bars only when you must display measures of the whole as well as the parts. • Use percent values and not actual amounts in pie charts. • Make sure all percent values are visible in a pie chart. • Start the quantitative axis at 0%.
	Horizontal Bar Chart		
	Pie Chart Note: Pie charts should only be utilized to depict percentage values.		

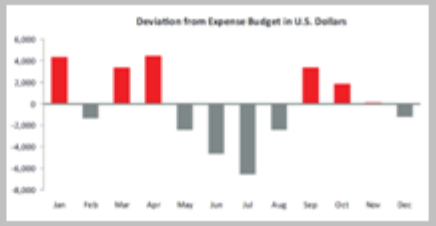
Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Nominal Comparison A simple comparison of values for a set of unordered items.	Vertical Bar Chart		• Start the Y-axis at zero.
Correlation Comparison of two paired sets of values (e.g., the heights and weights of several people) to determine if there is a relationship between them.	Scatter Plot		• Use for 2 quantitative values • Points and a trend line in the form of a scatter plot. • Gartner Magic Quadrant is an example.
	Radar Chart		• Use for more than one quantitative value. Each quantitative value is plotted on a radii or spoke.

Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Frequency Distribution Counts of something per category range	Vertical Bar Chart to emphasize individual values.		• Good for showing the "bell curve" effect. • Start the Y-axis at zero.
	Line Chart to emphasize the overall pattern.		
	Gauge (i.e., speedometer, barometer, thermometer)		• Use for real-time metrics that need to be to remain within a defined tolerance range.

Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Deviation The difference between two sets of values (e.g., the variance between actual expenses and budgeted expenses)	Vertical Bar Charts		• Always include a reference line to compare the measures of deviation against
	Balanced Scorecard – once an organization establishes strategic goals to impact positive change, a balanced scorecard becomes the "report card" for tracking actual values to the strategic goal values.		• Always show goal, actual, and variance values. • Have one KPI per row on the scorecard. • Use trending arrows for month-to-month comparisons.

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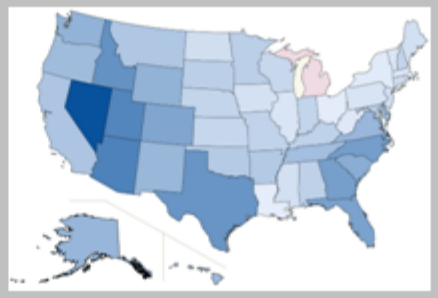
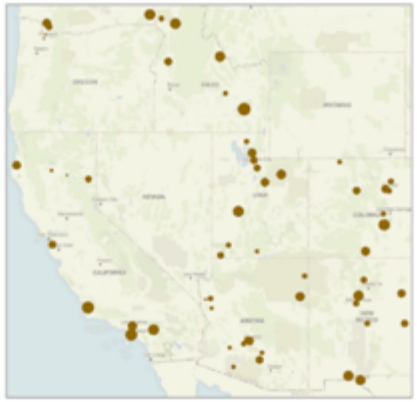
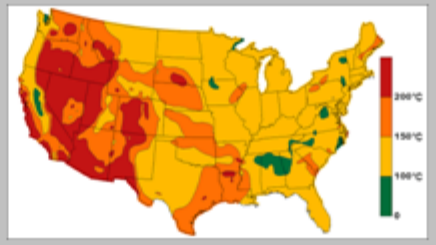
Dashboard Design Best Practices

Information Type/Description	Recommended Chart/Table	Example Chart/Table	Design Suggestions
Maps	Color-Intensity Map		• For Color-Intensity Maps, use the same color varying the shade based on the quantitative amount. Low values are coded with lighter shades. High values are codes with darker shades.
	Size Map		• For Size Maps, use circles that vary in size to encode differences in value—the larger the greater.
	Heat Map		

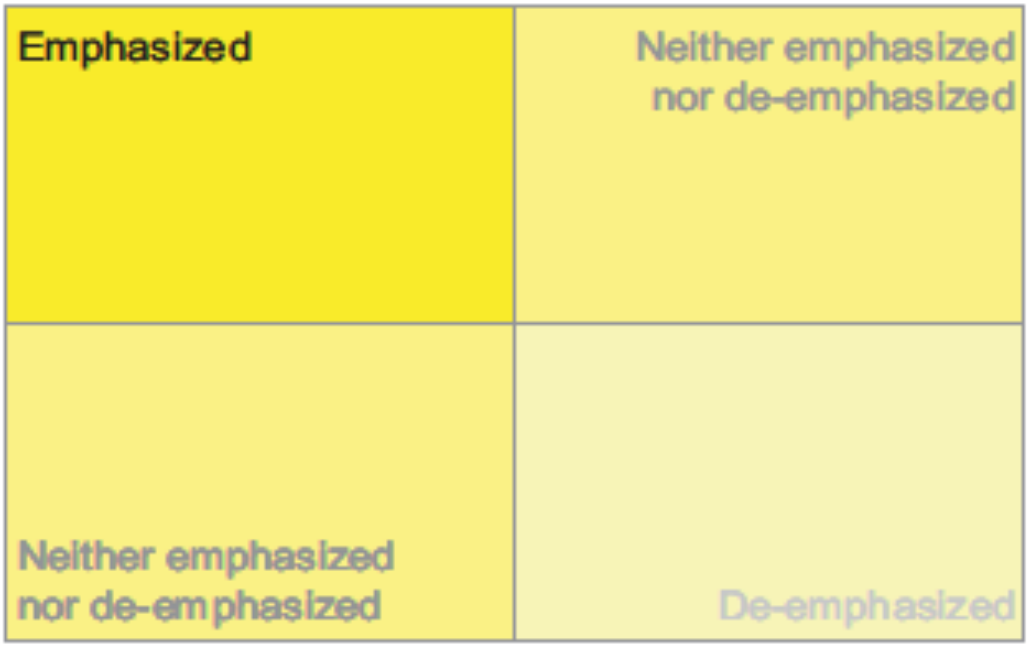
Dashboard Design Best Practices

- A common problem with tables, charts, and dashboards is the excessive presence of visual content that doesn't represent actual data.
- Less is more! Whenever quantitative information is presented, the data itself should stand out clearly, without distraction.
- Reduce the non-data ink. Examples of non-data ink are chart gridlines or chart borders. Reduce means to eliminate or make less visible (for instance, light gray rather than black).
- Enhance the data ink. An example of data ink is the chart line or chart columns.
- Avoid 3D charts. They require non-data ink and in most cases are difficult to read.
- Avoid pie charts. It is usually difficult to interpret angles.
- Generally include the value zero in your quantitative scale, and alert your readers when you do not include zero.
- Include no more than eight data sets in a single graph.

Dashboard Design Best Practices

Dashboard Layout and Positioning

- Position content in places based on importance
- Position content in a logical order
- Don’t force all dashboards into a grid layout



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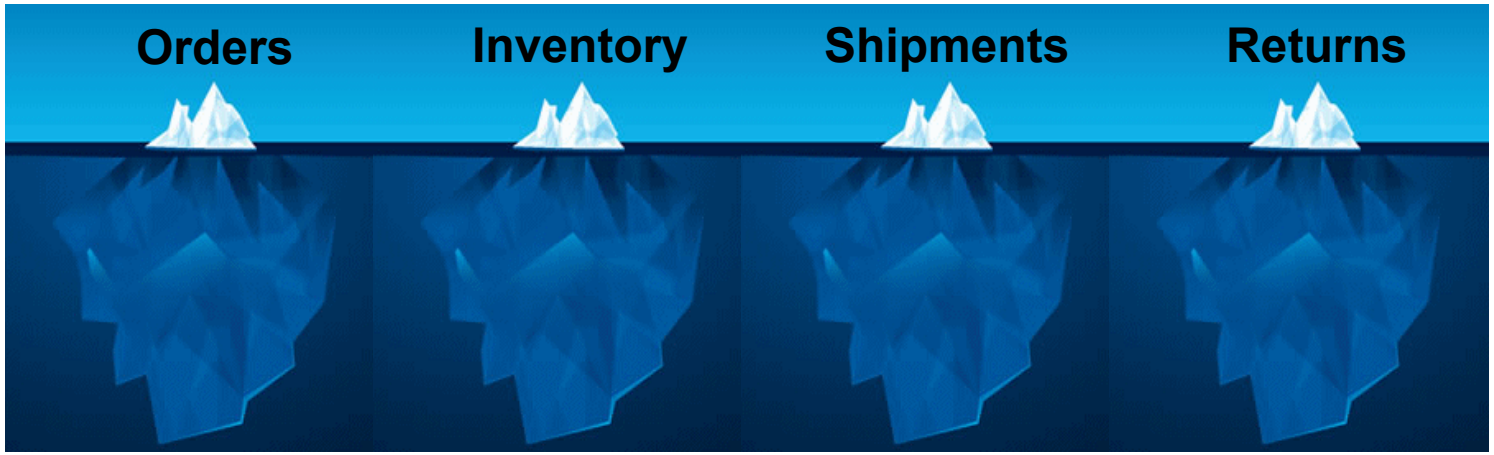
Tip-Of-The-Iceberg Peril

- Many organizations start by developing a multi-subject area dashboard for high-level executives. The driver is to impress executives to gain funding.
- This rarely succeeds for the following reasons:
  - Executives will not be content with a mile-wide-and-inch-deep dashboard application when they spot a questionable or poor performing metric. They want to drill down.
  - Reacting to the executive, the team will begin to develop deeper/wider data content for each dashboard metric to support drill-down analysis. This leads to "siloed" subject areas that do not support cross-subject area analysis.
  - The deeper/wider data content is usually just "loaded" as quickly as possible and not designed based on user analytic requirements forcing the heavy lifting to end users.



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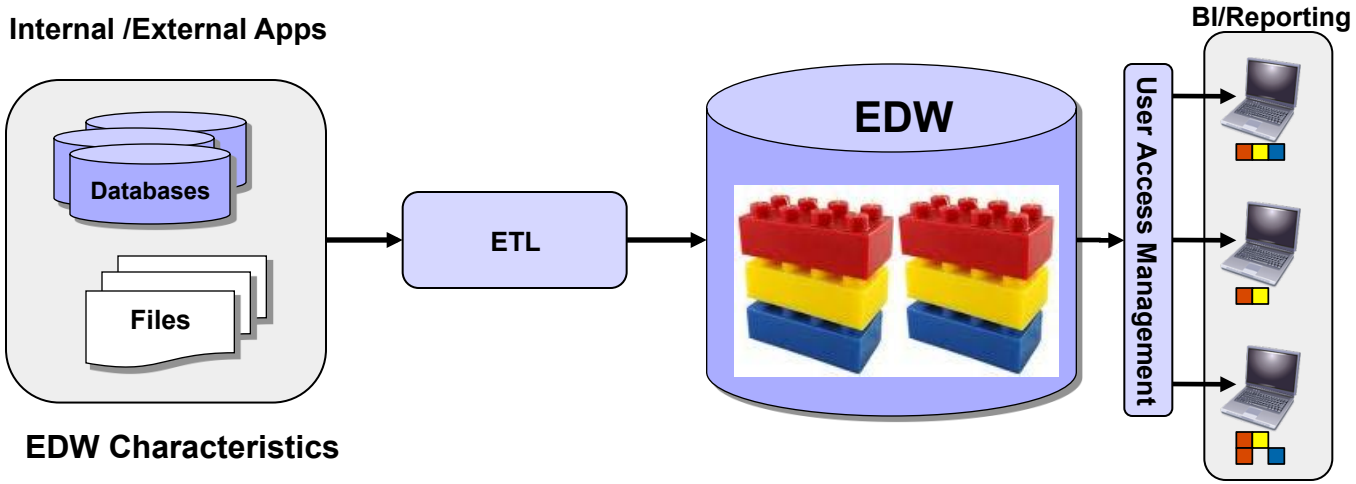
The Foundation – Star Schema



EDW Characteristics

- Star Schema Model
- Atomic (transaction) level of detail
- Developed incrementally by subject area (approx 2-4 month)
- Integrated by using conformed dimensions across subject areas
- Developed iteratively – involving end users early/often in development
- Data marts are “configured” by grouping subject areas into virtual data marts per user group

EDW Purpose

- Reporting/analytics ease of use
- High query performance
- Cross-subject area analysis
- Supports dim and fact reuse and consistency

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Practical Advice

- Start with subject-area dashboards first.
- Establish well-defined roles and symbiotic relationships between business and technical team members.
- Keep it simple and intuitive. Just because a visualization looks cool doesn't mean it is useful.
- If the proposed dashboard can't provide tangible results (e.g., increase revenue or decrease expenses), then don't build it.
- Use a dashboard tool that has an intuitive, powerful user interface, and does not cause technical headaches.
- The smaller the number of project team members and the broader and deeper their skill sets, the better.
- Focus on acquiring a "poster child" on the business side through successful deliveries who can be your advocate to other business areas.
- This is hard stuff – technically, functionally, visually, and people-wise. Partner with an expert who can coach your organization to succeed.

SAP BI Tool Comparison

Characteristics	Web Intelligence	Crystal Reports	Dashboard	Lumira	Explorer
User Type – Development	End User Power User Developer	Developer	Developer	End User Power User	End User
User Type – Execution	End User Power User	End User	End User	End User Power User	End User
Primary Use	Ad Hoc Query Canned Reports	Canned Reports	Dashboards	Dashboards Data Visualization Data Exploration	Data Visualization Data Exploration
Ad Hoc Query Capabilities	Yes	No	No	Partial	Partial
Degree of Flexibility for End Users	High	Low	Moderate	High	High
Leverages Universes	Yes	Yes	Yes	Yes	Yes
Queries data in database real-time	Yes	Yes	Yes	Yes	No
Requires persisting data set (e.g., Information Spaces)	No	No	No	No	Yes
Client/web-based development	Web	Client	Client	Client	Web
Client/web-based execution	Web	Web	Web	Client	Web
“Pixel Perfect” Layout/Formatting	No	Yes	No	No	No
Similar Products	Cognos MicroStrategy	WebFocus		Tableau Qlikview	

Questions

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