Dashboard

IT 7113 Data Visualization

http://idi.kennesaw.edu/it7113/

J.G. Zheng

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This lecture notes is hosted at https://www.edocr.com/v/oekl31vr/jgzheng/Dashboard

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Overview

This lecture introduces dashboards and their use in various business cases. A second module will continue on dashboard design patterns and best practices.

- What is a dashboard?
- Elements of a dashboard
- Types of dashboards
  - Comparing with report, visual analysis tool, and scorecard
  - Levels of dashboards
- General design considerations and principles

What is a dashboard?

Dashboard
https://www.google.com/search?q=dashboard&tbm=isch

https://www.fairfaxcounty.gov/demographics/fairfax-county-general-overview

http://visualnomics.com/ArabUprising/

Dashboards from former student projects.

Real-world public dashboard

https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

Dashboard

A dashboard is a **visual-oriented display** of the **most important data and information** needed to achieve defined **goals and objectives**; **consolidated** and arranged on a **single screen** so the information can be viewed at a glance.

Adapted from
Dashboard Confusion by Stephen Few
http://www.perceptualedge.com/articles/ie/dashboard_confusion.pdf

The term “dashboard” originates from the automobile dashboard where drivers monitor the major functions at a glance.

Features of Dashboards (Key Terms in the Definition)

Visual-oriented display	• Dashboard is a data visualization tool • Dashboard is a type of graphic user interface • Dashboards are visually intensive, with many graphics, charts, maps, colors; but they could also have textual information.
Most important data and information	• Usually these are the key data, metrics, and performance indicators (KPI) that a user concerns most on a regular basis. • Because of the space limit, only the most important and relevant data are included in the dashboard
Goals and objectives	• A dashboard is part of a business intelligence and analytics tool used to visualize data and analysis results. • A dashboard serves a very clear goal; all data and information presented serve that goal. • There are different types of goals, for example, monitoring, analysis, reporting, exploration, and communication.
Consolidated	• The data (metrics) presented may come from multiple sources, analysis, and from different perspectives. • They are arranged on the same screen to provide an integrated view.
Single screen (??)	• Most dashboards should fit to one screen without excessive panning, zooming, and scrolling. • If there are more content needs to be placed beyond the screen, then they should be prioritized, and less important content can be displayed on-demand through various means such as using additional secondary dashboards.

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Some Other Terms

- Dashboard sometimes is also called
  - Digital dashboard https://www.qlik.com/us/dashboard-examples/digital-dashboard
  - Data dashboard https://www.klipfolio.com/resources/articles/what-is-data-dashboard
  - Information dashboard https://www.amazon.com/Information-Dashboard-Design-Effective-Communication/dp/0596100167
  - BI dashboard: https://searchbusinessanalytics.techtarget.com/definition/business-intelligence-dashboard
  - Or can be associated with a particular sector or usage, such as business dashboard, health dashboard, traffic dashboard, etc.

- "Information Summary Dashboards" – a bit *different*
  - Dashboard as a more general term is used in
    - Many web portals or systems that offer an overview of the most important information that a user concerns, and commonly used as the landing page/screen of a site or application.
    - A collection of news and updates from a community or centered around a topic, used in many social monitoring purposes.
  - This kind of dashboards are less data centric but more informational.
  - They may include more textual information like alerts, recent activities, messages, updates, to-do list, user profiles, etc., and convenience functional blocks like quick search, inline actions.

- The dashboards we concern in this lecture notes are more data driven, visualization intensive, interactive, and directly support data exploration, reporting, and decision making.

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What Dashboard is **NOT**

- **NOT** a one-time creation to display data
  - It is supposed to be used regularly and optimized for automated data feeding and update
  - Users of the dashboard eventually learn the dashboard and are familiar with the dashboard
- **NOT** just a simple stack of charts
  - It is an integral user interface to show data and information
  - It is a whole piece
    - Serving a common goal
    - Consistent style and interaction
    - Organized and clean
  - It shows branding and organizational image
- **NOT** a lengthy and detailed report
  - Keep it simple and focused with the most important data and information
- **NOT** a place to showcase uniqueness and complexity
  - Simple and direct to help users navigate and analyze
  - Use standard or commonly-understood visualizations rather than unique ones

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The Value of a Dashboard

- Provides a one-place presentation of critical information, so users can quickly understand data and respond quickly at one place.
  - Saves time over running multiple reports.
- Allows decision makers to see a variety of data that affects their divisions or departments
  - This allows decision makers to focus only on the items over which they have control
  - The dashboard is generally customized for each user
- Allows all users to understand the analytics. For non-technical users, dashboards allow them to participate and understand the analytics process by compiling data and visualizing trends and occurrences.
- More: http://www.bidashboard.org/benefits.html

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Dashboard Uses

- Dashboards are widely used in all businesses and organizations internally for various operation monitoring, performance management, and business intelligence/analytics activities at various levels:
  - Operations dashboard
  - Financial dashboard
  - Performance dashboard
  - Sales dashboard
  - Strategy dashboard
  - IT dashboard

- Also commonly used for public information exploration and communication:
  - Public health: https://systems.jhu.edu/research/public-health/ncov/
  - https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6
  - Education: https://gosa.georgia.gov/report-card-dashboards-data/data-dashboards
  - Government publication of information
    - https://www.itdashboard.gov
    - https://data.boston.gov/
    - https://www.fairfaxcounty.gov/demographics/fairfax-county-general-overview
  - System status: http://www.google.com/appsstatus
  - Politics: https://www.nytimes.com/elections/2016/results/president
  - Sports: https://www.atptour.com/en/stats
  - https://public.tableau.com/profile/dash7070#!/vizhome/SummerOlympicsDashboard/Dashboard2

- More examples
  - http://www.idashboards.com/solutions/
  - https://www.klipfolio.com/resources/dashboard-examples

ELEMENTS OF A DASHBOARD

Dashboard = Data/Information + Visual + UI

Elements of a Dashboard

Dashboard = Data/Information + Visual + UI

- Data/Information
  - It's the contents and insights delivered
- Visual
  - Data visuals (charts, etc.) provide effective perception of data
- User interface
  - User interface is the gateway to use a software application
  - A dashboard is a type of software application, or a part of a software application
  - a clean UI that unifies all elements to work together as a whole
  - supporting interactions as needed

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Major Types of Data on a Dashboard

- The data/information on a dashboard is what a user mostly concerns and would like to get that information quickly on a regular basis.
- *Metrics* (or measures, indicators)
  - numerical values that directly reflect the status of an activity, such as sales, enrollment, etc., or calculated based on a formula
- *Key Performance Indicators* (KPI)
  - A KPI is simply a metric that is tied to a target. Used intensively for performance related goals.
- *Textual information*
  - (not typical but can be there) – see the example later

Metrics and KPIs may be a set of single values or grouped in a set to reveal more details and context

- a single value that reflects a key metric, e.g. the profit and revenue of the latest quarter.

or

- a set of values to reflect trends, distributions, forecasts, or other kind of comparisons.

Visualizations on a Dashboard

- Dashboards are visually intensive by definition
- A dashboard generally contains a variety of visual views of data, including:
  - Charts, diagrams, maps
  - Dashboard specific visuals such as KPI card, or standalone numbers: visualized with special formatting or contain embedded visuals.
  - Simple data tables: incorporating conditional formatting or other embedded visuals.
- Not typically on a dashboard
  - Complex graphs and infographic techniques may be perfect for powerful presentation, but not always for a dashboard (especially business-oriented dashboard).
  - Complex tables with detailed and crowded data

Top 10 Domestic Routes by Revenue

		Revenue		Margin		Per Passenger	
From	To	Revenue Dollars	Revenue Percent	Margin Dollars	Margin Percent	Revenue per Passenger	Margin per Passenger
Atlanta	New York	$3,602,000	8.09%	$910,000	9%	245	61
Chicago	New York	$4,874,000	10.94%	$336,000	1%	222	15
Columbus (Ohio)	New York	$2,483,000	5.58%	$1,334,000	14%	202	125
New York	Detroit	$12,180,000	27.35%	$2,408,000	21%	177	35
New York	Washington	$6,355,000	14.27%	$1,230,000	12%	186	36
New York	Philadelphia	$3,582,000	8.04%	-$716,000	-7%	125	-25
New York	San Francisco	$3,221,000	7.23%	$1,854,000	18%	530	340
New York	Phoenix	$2,846,000	6.39%	$1,436,000	14%	555	280
New York	Toronto	$2,709,000	6.08%	$1,088,000	10%	450	175
New York	Seattle	$2,792,000	6.27%	$467,000	4%	448	75
Total Domestic routes		$44,534,000		$10,596,000		272	53

Images from https://blog.itcentralstation.com/how-to-successfully-manage-bi-dashboard-projects/

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A Dashboard Example

Dashboard Header: Logo, Title, etc. – an important UI element

Standalone single-value KPI

Hero Chart

KPI Card

Embedded visual

Chart

Textual info

Simple table with embedded visuals

Originally from
https://web.archive.org/web/20180825151532/http://www.dashboardinsight.com/articles/digital-dashboards/fundamentals/what-is-a-dashboard.aspx

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Another Example

A left-right even layout

Dashboard Header

Single performance value

Chart

KPI Card

Chart

A not-too-complicated table with some details

https://www.datapine.com/blog/interactive-dashboard-features/

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KPI Card

- KPI card features a standalone styled numeric value
  - Commonly used for presenting important values like KPI (key performance indicator)
- Styles and examples
  - Single number without much visual (maybe with some icon or title) https://datavizproject.com/data-type/number/
  - Added context data https://www.geckoboard.com/blog/designing-and-building-dashboards-the-ultimate-guide-to-data-visualizations-part-2/
- KPI can also be presented using KPI performance charts or chart good for individual numbers like
  - Gauge chart https://datavizproject.com/data-type/angular-gauge-chart/
  - Waffle chart https://datavizproject.com/data-type/percentage-grid/
  - Bullet graph https://datavizproject.com/data-type/bullet-graph/
  - Pie/donut chart
  - Progress bar https://datavizproject.com/data-type/progress-bar/

Card is Google's term to describe a way to display multiple piece of data/information as a visually cohesive unit

- A card is like a small space with more complex layout within.
- A popular concept to design information presentation for web and mobile applications.
- Reference: https://material.io/components/cards/

https://investor.bankofamerica.com/fixed-income
Fixed Income Investor Materials 2022Q3

Maps on Dashboards

- Map is a very common visual component on location related dashboards
- Map can be just like one of the charts on a dashboard
  - Example: http://visualnomics.com/ArabUprising/
- Or, it can be an enlarged main visual component that drives major data exploration and analysis.
  - Example: https://www.arcgis.com/apps/dashboards/bda7594740fd40299423467b48e9ecf6
  - https://d5t6zpljmdkvz.cloudfront.net/
- Or, it can occupy the complete screen
  - http://luminocity3d.org
  - https://www.globalforestwatch.org/map
  - https://www.youtube.com/watch?v=Ri5HyHp5-_I

User Interface

- A dashboard is more than just charts! Dashboard is a type of graphical user interface; thus, it follows general UI design principles and best practices.
- Key elements in dashboard user interface
  - Layout: the placement and arrangement of charts, cards, tables and other UI elements on the screen; header, footer, etc.
  - Navigation (menu) system: this includes in-page navigation and cross-page navigation
  - Styles and themes: font, color, design style, image, logo, icons, background, etc.

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UI Features Example

https://searchbusinessanalytics.techtarget.com/definition/business-intelligence-dashboard

How about Interactivity?

- Interactivity is the capability to support user input actions that may dynamically change the view of the dashboard.
  - Interaction can be viewed as part of UI, generally; but some people view UI is more static.
- A dashboard may not be interactive at all, although many modern dashboards provide interaction features.
- Typical interactions
  - Select options
  - Set parameter values
  - Filter and sort data
  - Drill-up, drill-down, drill-across
  - View switching
  - Zoom-in and zoom-out
  - Hover to get details in a pop-up

Interactivity will be covered with more details in module 10.

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DASHBOARD TYPES

Levels/Types of Dashboards

Each of them shares common attributes of dashboards (data + visualization + UI), but each of them has some different purpose, data, and design best practices.

Operational – monitoring: Operational real time view of important indicators.

"Help me do my job"

Tactical – analysis or data exploration: Provides optimized UI and information seeking and navigation feature among data and metrics to support data exploration or analysis.

"Show me the numbers"

Strategic – decision support: As a high-level summary; may be at the top executive level (strategic) or departmental (tactical) levels.

"What's most important?"

Image from http://prezi.com/qvhyfup5z7yz/dashboard-design-making-reports-pop/

More about dashboard levels:

- https://www.datapine.com/blog/strategic-operational-analytical-tactical-dashboards/
- http://www.bidashboard.org/types.html
- http://www.klipfolio.com/resources/articles/operational-analytical-bi-dashboards

Operational Dashboard

- Operational dashboards display real time or near real time data that facilitate the operational side of a business, monitoring operational activities and statuses as they are happening.

- Features
  - Important operational indicators are often based on real-time or near real-time data.
  - Features a few indicators rather than lots of detailed data
  - Focus on current status or performance
  - Action oriented: enable to alert or address issues in time

- Examples
  - https://status.azure.com/en-us/status
  - http://status.aws.amazon.com/
  - https://status.cloud.google.com and https://www.google.com/appsstatus/dashboard/
  - https://www.klipfolio.com/gallery/dashboards/google-analytics-daily-overview
  - https://www.atptour.com/en/rankings
  - https://www.klipfolio.com/resources/dashboard-examples/sales
  - https://finviz.com/map.ashx
  - https://www.usdebtclock.org/world-debt-clock.html

- Most of the operational software include their own dashboard modules. The use of this module bypasses the problem of load time, but normally with a loss of functionality.

- The design of this type of dashboards usually focuses on highly important metrics with simple visuals. Common examples include services status monitoring (call center, reservation, etc.), inventory monitoring, server up-time and utilization, etc.

Analytical Dashboard

- Analytical dashboard is a tactical level dashboard, focusing on presenting (visualizing) analytical techniques and results.
  - Tactical level: mainly support business process and analysis at or across a specific functional level over a period. It is primarily used for intensive data exploration and analysis, used by data analysts and researchers.
  - Main purpose: the purpose is to analyze data and explore patterns through an interactive process. The dashboard usually centers around a key topic or question, providing more details and context (comparison, history, forecast, benchmarking, etc.)
  - It supports various analytical methods including high level analytics such as what if, trending, forecasting, etc. This is a bit different from traditional dashboards, which are primarily used for quick scanning and understating of key metrics.
  - Some separately categorizes it as “visual analysis tools” rather than a type of dashboard. Nonetheless, the design of analytical dashboards is similar to general dashboards to focus on data, visualization, and UI design.

- UI and functional features
  - Very often, there is a main visualization, which is usually a single (or a set of) component that occupies a big portion of the screen as the main UI component, with a large number of data points visualized. Users’ major activity will be repeatedly setting parameters and examining the dynamically updated visuals.
  - The visualization may be more complex with multiple visual layers
  - It provides abundant parameter settings, selections, user inputs, and other UI controls to manipulate the data and visualizations. The number of parameter setting combinations can be quite big.
  - It is not just to visual key metrics, but to visualize patterns, trends, and other complex relationships among data.
  - It uses large amount of detailed level data.
  - It is highly interactive: it fits on one screen, but there are methods to get to additional spaces like zooming, scrolling, pop-up, or navigate to additional pages or screens.
  - Some may provide ad-hoc querying and dynamic visualization generation

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Analytical Dashboard Examples

- More examples
  - https://www.tradingview.com/chart/
  - https://stockcharts.com/h-sc/ui?s=XOM
  - http://almuthmerkel.com/SMEX/
  - https://www.visualcalc.com/retirement-planning
  - https://www.informationisbeautifulawards.com/showcase/4115-2018-fifa-world-cup-match-explorer

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Data/Info Exploration Dashboard

- Focusing on interactive exploration of large and complex data sets from multiple perspectives, but less analytical capabilities
  - Also provide abundant parameters and filters
  - Usually with a visual/chart or map that can show a large number of items, commonly used chart type include scatter plot/perceptual map, and map
  - Accompanied or supplemented by a data table
  - Data are more descriptive (displaying common KPIs, not calculation or analytical methods.)
  - Many are considered dashboard style reports
  - It is highly interactive and usually provides abundant settings and configurations (for adjusting factors and parameters) including filtering or sorting options.

- Examples
  - https://theanalyst.com/na/2021/10/nba-stats-and-player-projections/
  - https://www.georgiainsights.com/esser-budget.html
  - https://georgiainsights.gadoe.org/Dashboards/Pages/Literacy.aspx
  - Google public data explorer https://www.google.com/publicdata/directory
  - https://www.gapminder.org/tools/#$chart-type=bubbles
  - https://ourworldindata.org/explorers/global-food
  - https://ourworldindata.org/explorers/coronavirus-data-explorer
  - Map based:
    - https://d5t6zpljmdkvz.cloudfront.net/
    - http://luminocity3d.org/WorldCity
  - https://www.productchart.com/smartphones/
  - https://finviz.com/map.ashx
  - https://www.google.com/publicdata/explore?ds=j0r9lucsi4q1d_
  - https://public.tableau.com/app/profile/levy2725/viz/2015-163-and-D-ness/Dashboard1
  - https://public.tableau.com/app/profile/harshit.shah/viz/AdventureWorks-SalesDashboard/Dashboard1

Originally from https://www.georgiainsights.com/georgia-school-closures.html

Example of Exploratory Style Dashboard

More details on hovering on any circle.

Many settings and choices.

Large quantity of data points for exploration

https://finviz.com/bubbles.ashx

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Strategic (Executive) Dashboard

- Summary/overview dashboards provides high level summary of business performance indicated by KPIs.
  - Strategic dashboard is a typical example of summary/overview dashboard at the strategic or executive level, which specifically concerns about high-level overview of the state of the business and strategy goals; and used for strategy planning and development.

- Features
  - Monitor the execution of strategic goals and summary of high-level reports, commonly using balanced scorecards or a strategy map
  - typically provide the KPI's (Key Performance Indicators) that a companies executive team track on a periodic (daily, weekly or monthly basis).
  - a high-level overview of the state of the business together with the opportunities the business faces.
  - This dashboard typically provides less detail or context than other dashboards.
  - This dashboard type is not good for more complex why and how questions because it is not good for exploratory analytics.

- Commonly used visual forms in performance dashboards
  - Traffic lights coloring system
  - KPI card
  - Other performance charts like bullet chart or gauge

- Two typical examples
  - Executive KPI dashboard
  - Strategy map dashboard

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KPI Dashboard

- KPI dashboard is a kind of strategic dashboard centered around KPIs.
  - It provides simple and direct views of KPIs without complex charts or much interactivity.
  - May use KPI cards, KPI tables, scorecard tables, or set of bullet graphs or gauges.

- Examples:
  - https://www.boston.gov/cityscore
  - https://public.tableau.com/app/profile/adam.e.mccann/viz/5TypesofDashboards/1KPIDashboard

https://public.tableau.com/profile/adam.e.mccann#!/vizhome/5TypesofDashboards/1KPIDashboard

Strategy Map Dashboard

- A strategy map is a diagram that shows your organization's strategy on a single page. It’s great for quickly communicating big-picture objectives to everyone in the company.
  - https://balancedscorecards.com/strategy-map/
- A strategy map dashboard can visualize balanced scorecard systems

https://www.kpisuite.com/en/kpisuite-platform/sbalansirovannaya-sistema-pokazatele/

Other Types of Dashboard

- Real time dashboard
  - https://www.usdebtclock.org/world-debt-clock.html
- Refer to http://duelingdata.blogspot.com/2019/01/5-types-of-dashboards.html

Choosing Dashboards based on Business Reporting Requirements

Business Questions	Implications	Operational Dashboards	Strategic Dashboards	Analytical Dashboards
What business problem(s) we are trying to solve?	Identify what is driving the need for a dashboard solution and to define the scope of the project.	Data awareness and time sensitive data	Top-line organizational KPIs	Trends or deeper insights
Who will be using the dashboards?	Design, features and required training will change based on the role of the dashboard user.	Line of business managers; business users	Executives; Directors	Business analysts; data analysts; executives
What gaps exist in our performance?	The identification of gaps can be used to develop a set of metrics that will be used as the basis for the development of the dashboard.	Intra-daily performance.	Monthly, quarterly performance	Performance issues, weekly performance
What are our goals?	Before developing metrics, it becomes important to identify what you hope to achieve by using dashboards as well as align those goals to the department's or company's overall strategy.	Employee awareness and tracking against goals	Strategic goals, such as achieving KPI targets	Analytics goals, such as visibility into key process

https://www.klipfolio.com/choosing-the-right-dashboard-report

Dashboard Alternatives

- There are three tools that are similar to dashboards and also use visualizations heavily
  1. Report
  2. Scorecard
  3. Visual analysis/exploration tool
- Many of the above can be considered some style of dashboard with a different focus.
- Some differences are summarized in the article "What is a dashboard"
  - https://web.archive.org/web/20180825151532/http://www.dashboardinsight.com/articles/digital-dashboards/fundamentals/what-is-a-dashboard.aspx

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Report

- Traditional reports contain detailed data in a tabular format and typically display numbers and text only.
  - It is geared towards people who need data rather than a direct understanding or interpretation of data.
  - Its purpose is mainly for printing (with style and themes for presentation or communication) or exporting (raw data).

- Modern reports can be interactive/dynamic (with filters and drill-downs) and visual intensive; but the focus is still on metrics and detailed data. Reports also do not emphasize one-screen requirement.

- Typical report examples:
  - https://www.boston.gov/sites/default/files/file/2023/02/Boston_COVID-19_Vaccination_Report_03Feb23.pdf
  - https://investor.vanguard.com/investment-products/etfs/profile/voo
  - https://www.goodcarbadcar.net/2023-us-midsize-suv-sales-figures/
  - https://www.usaspending.gov/state/alabama/latest
  - https://schoolgrades.georgia.gov/kittredge-magnet-school
  - http://www.crazybikes.com/mrc/CRAZYBIKES.R00090s
  - https://www.trueup.io/layoffs
  - https://theanalyst.com/na/2021/10/nba-stats-and-player-projections/

- Visual intensive report
  - https://dph.georgia.gov/covid-19-status-report
  - https://simplywall.st/stocks/us/media/nasdaq-googl/alphabet
  - https://www.boston.gov/government/cabinets/boston-public-health-commission/covid-19-boston#wastewater-reports

US CAR MANUFACTURER SALES BY MONTH

This sales data table looks at monthly sales performance for all car manufacturer in the United States on a month to month basis for the entire year so far. It includes all major manufacturer who sell vehicles in the U.S market and you can see that the monthly manufacturer sales trends clearly. Seeing the individual manufacturer's sales performance in this way gives you a good sense of the momentum (good or bad).

Manufacturer	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BMW Group	20,559	26,237	33,597	26,437	29,930	34,862	25,843	29,418	30,972	28,402	34,260	38,056
Daimler	23,604	24,447	30,547	25,716	25,716	29,275	27,546	30,218	32,002	32,130	35,964	39,279
Ford Motor Company	188,882	185,353	288,523	209,639	241,888	187,511	189,478	212,214	174,317	187,153	204,431	197,144
General Motors	218,015	212,055	236,314	242,199	267,051	223,047	242,527	271,627	223,125	241,802	259,203	241,902
Honda Motor Company	106,139	115,158	148,599	125,775	145,532	136,101	141,286	173,993	113,825	131,445	133,862	136,586
Hyundai Kia Auto Group	79,396	86,546	119,442	108,410	126,496	122,890	112,331	126,224	98,129	109,036	113,272	117,449
Jaguar Land Rover	10,463	11,816	13,171	9,312	9,358	8,485	8,478	8,730	9,490	10,443	12,472	13,755
Mazda	20,045	23,882	26,934	19,702	26,162	22,628	23,282	27,482	19,839	19,520	24,374	26,491
Nissan Motor Co	109,462	128,102	170,367	102,881	141,733	136,021	107,493	135,398	108,988	110,955	101,156	114,698
Stellantis - FCA	138,062	162,036	200,107	172,900	218,702	206,065	189,879	208,170	170,866	176,638	166,252	179,638
Subaru Corporation	46,072	48,081	61,801	57,288	63,972	61,331	64,108	70,038	61,659	65,531	58,880	62,364
Tesla	8,325	7,650	14,525	11,925	16,350	25,025	19,866	16,025	23,025	18,612	19,301	18,612
Toyota Motor Corp	156,021	173,748	214,947	183,800	222,174	202,352	209,204	248,334	169,656	188,787	207,857	207,372
Volkswagen Group	42,746	44,080	62,173	51,351	59,604	58,339	55,514	61,579	48,200	52,081	56,162	58,483
Volvo	5,854	6,035	9,589	8,367	8,761	8,634	8,765	9,187	8,323	8,807	8,636	12,360
	Σ = 1,172,663	Σ = 1,257,588	Σ = 1,352,128	Σ = 1,355,548	Σ = 1,606,260	Σ = 1,462,664	Σ = 1,417,418	Σ = 1,626,577	Σ = 1,262,712	Σ = 1,384,010	Σ = 1,445,173	Σ = 1,459,184

Individual Investments

Search:

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Show 10 entries

UII	Bureau	Investment Title	Total FY2021 Spending ($M)	Type	CIO Rating	# of Projects
006-000805700	U.S. Patent and Trademark Office	USPTO Enterprise Business Product Line	$95.119	Major IT	4	20
006-000000135	Bureau of the Census	Census - Data Ingest and Collection for the Enterprise (DICE)	$58.774	Major IT	4	10
006-000403700	Bureau of the Census	Census - Schedule A Human Resources Recruiting, Payroll System (C-SHARPS)	$2.150	Major IT	3	5
006-000000129	Economics and Statistics Administration	BEA Estimation Information Technology System (BEA-EITS) for Measuring the Changing US Economy.	$12.176	Major IT	5	4
006-000400700	Bureau of the Census	Census - Economic Census and Surveys	$71.360	Major IT	4	20
006-	U.S. Patent and Trademark	USPTO Trademarks Product Line	$47.941	Major	4	12

Showing 1 to 10 of 158 entries

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Report or Dashboard?

- Modern report are also very interactive and visual intensive. Sometimes the distinction is a bit blurred in some practical cases.

- A dashboard-style “report”, or a report-style “dashboard”, tries to present data in one screen just like a dashboard (a data exploration dashboard) but with a focuses on data exploration and communication rather than monitoring and decision support
  - It mimics the dashboard one-screen style, but it mainly presents detailed data.
  - Examples
  - https://www.georgiainsights.com/esser-budget.html
  - https://public.tableau.com/app/profile/dash7070/viz/SummerOlympicsDashboard/Dashboard2

- Dashboard or report?
  - https://www.cityhealthdashboard.com/ga/atlanta/city-overview
  - https://www.itdashboard.gov/itportfoliodashboard
  - https://analytics.boston.gov/app/imagine-boston
  - https://www.georgiainsights.com/technology-inventory.html

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Scorecards

- A scorecard is special type of dashboard typically with a tabular display of measures/KPIs and their respective targets with visual indicators to see how each measure is performing against their targets at a glance.
  - Scorecards are mainly used for performance monitoring with data directly related to measure, target, status etc.
  - Because of its uniqueness, it is viewed by some as special type of dashboard when used independently.

- Key characteristics
  - Scorecards are mainly used for performance monitoring with data directly related to measure, target, status etc.
  - It mainly uses a tabular layout with embedded visuals like conditional formatting, sparklines (line, bar, or bullet graphs).
  - Limited interactivity (mainly on filtering and sorting to find score items)
  - It is commonly used in another tool like dashboards and visual analysis tools.

- More information
  - https://web.archive.org/web/20180517172348/http://www.dashboardinsight.com/articles/digital-dashboards/fundamentals/a-closer-look-at-scorecards-and-dashboards.aspx

13-Month Trend	Categories	YTD Sales and Contribution Levels		YTD Sales to Target	
	Electronics	120,808	32%		93%
	Hardware	118,733	31%		102%
	Software	52,270	14%		84%
	Peripherals	47,259	12%		97%
	Photo	43,634	11%		113%
	Grand Total	**382,704**	**100%**		**104%**

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Example of Scorecard Style Dashboard

Extreme Scorecard

- An actual example of a giant score card (blurred to hide details)

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Visual Analysis Tool

- A visual analysis tool is functionally similar to an analytical dashboard
  - Also provides a lot of user selections, parameters, analytical tools, etc.
  - Also uses charts and other visuals to present results
  - Some uses visualizations intensively to drive data analysis (termed as visual analytics).
- But it may not look like a dashboard or not arranged as a dashboard
  - Generally, do not have to be one screen
  - May embedded with other content or applications
- Example
  - https://dqydj.com/net-worth-by-age-calculator-united-states/
  - https://www.visualcalc.com/retirement-planning

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Designing and Building Dashboards

- Elements of Dashboard Design: the design of the dashboard involves these six elements:
  - Goals and objectives definition
  - Data/information design
  - Visualization design
  - UI design
  - Interaction design
  - Supporting features (non-functional) design

  - +1 Technology and tool selection

The next learning module will cover more about dashboard design principles, patterns, and development best practices.

- https://www.edocr.com/v/9oqqrzoo/jgzheng/designing-dashboards
- https://www.edocr.com/v/pb9delzd/jgzheng/dashboard-layout

- The design of dashboard applications share many principles in general UI design
  - clarity, efficiency, simplicity, consistency

Attributes of a Good Dashboard

The next dashboard module will cover more about dashboard design principles and layout patterns and best practices.

- Content
  - Data and metrics are the focus, not visuals
  - Provide relevant context and different perspectives
- Layout and position
  - One page/screen fit
  - Clean and organized layout with clear logical groupings
  - Guide user focus and attention using pre-attentive and Gestalt principles
  - Apply layout and positing conventions
- Simplicity
  - "The world of data visualization is changing rapidly, with the trend to use complex graphs and infographic techniques to visualize information in an impactful way. Also the concept of big data is changing our relationship with the world of information. That's perfect for powerful presentation, but not always for a dashboard." originally from http://blog.itcentralstation.com/how-to-successfully-manage-bi-dashboard-projects/
  - Same as charts: don't cram and jam, dense but not cluttered
- Style
  - Beautiful (but not necessarily colorful); with a theme or style
  - The dashboard needs to be integrated into the organization, so it is important to consider corporative aspects: logos, colors, fonts, menu, etc. Are there similar systems? If so, use a similar look and feel.

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Dashboard Tools

- Many visualization tools and BI tools supports the creation of dashboards.

  Extended reading:
  https://www.datapine.com/articles/best-dashboard-software-features

- Enterprise BI platforms usually provide dashboard service as part of the platform as well
  - SQL Server Reporting Service, Cognos, Microstrategy, ArcGIS, etc.
- Visual analysis tools featuring a dashboard component
  - Tableau, Power BI, Qlik View, Spotfire, Klipfolio, etc.
- Programming libraries and frameworks
  - https://plot.ly/dash/
- Cloud services focusing on reporting and dashboards
  - iDashboard, Dundas, DataPine, Zoho
- Excel is just versatile and flexible to do many things
  - https://www.youtube.com/watch?v=eWyGM2KejT4
  - https://www.youtube.com/watch?v=wrho2x6rSNA

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Differentiating Dashboard Products

- The MAD (Monitor-Analyze-Detail) framework generally corresponds to the 3 levels of dashboard
  - https://resources.useready.com/blog/mad-framework-for-actionable-dashboards/
- It can be used to differentiate and select dashboard products

Image originally from http://www.b-eye-network.com/blogs/eckerson/archives/2011/07/differentiating.php

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IT's Role in Dashboard Development

- Many self-service BI and dashboard tools provide easy to use tools for power users to create their own dashboards quickly
- Traditional centralized IT is alleviated but still needed
  - Manage and admin dashboard systems, or BI/reporting systems that contains a dashboard sub-systems
  - Professional dashboard design and development for average users
  - Train users how to use dashboard
  - Provide necessary technical support for power users to create ad hoc dashboards

Key Readings and Resources

- What is a Data Dashboard? Definition, Benefits, and Examples https://databox.com/data-dashboard
- Stephen Few Dashboard Confusion: http://www.perceptualedge.com/articles/ie/dashboard_confusion.pdf
- What is a dashboard? https://web.archive.org/web/20180825151532/http://www.dashboardinsight.com/articles/digital-dashboards/fundamentals/what-is-a-dashboard.aspx
- The Difference Between Strategic, Analytical, Operational And Tactical Dashboards https://www.datapine.com/blog/strategic-operational-analytical-tactical-dashboards/

Additional Good Resources

- Introduction articles
  - https://adniasolutions.com/dashboard-design-principles/introduction-to-dashboards/
  - https://www.tableau.com/learn/articles/dashboards/what-is
  - https://www.klipfolio.com/blog/what-is-a-data-dashboard
  - https://www.datapine.com/blog/digital-dashboard-definition-and-examples/
  - https://www.datapine.com/blog/interactive-dashboard-features/
  - https://dataschool.com/how-to-design-a-dashboard/what-is-a-dashboard/

- Books
  - "Information Dashboard Design" 2nd, by Stephen Few, 2013, http://www.amazon.com/gp/product/1938377001/
  - "Business Dashboards: A Visual Catalog for Design and Deployment", by Nils Rasmussen, et al. ,Wiley, 2009, ISBN 0470413476
  - How to Design a Dashboard https://dataschool.com/how-to-design-a-dashboard/

- More examples
  - https://www.idashboards.com/solutions/
  - https://www.klipfolio.com/resources/dashboard-examples
  - https://www.geckoboard.com/learn/dashboard-examples/
  - https://www.datapine.com/dashboard-examples-and-templates/

- Learning resources
  - https://www.tableau.com/solutions/business-dashboards
  - https://www.klipfolio.com/resources
  - http://www.perceptualedge.com/library.php
  - http://www.bidashboard.org
  - https://www.interaction-design.org/courses/information-visualization-getting-dashboards-right

- Dashboard design
  - Dashboard design: https://www.geckoboard.com/best-practice/dashboard-design/
  - IT 7113 Lecture notes
    - https://www.edocr.com/v/9oqqrzoo/jgzheng/designing-dashboards
    - https://www.edocr.com/v/pb9delzd/jgzheng/dashboard-layout
  - https://www.justinmind.com/ui-design/dashboard-design-best-practices-ux