

IT@Intel

Collaborative Visual Data Analysis Enables Faster, Better Decisions

The Info Wall connects data to decision makers to help guide them to a conclusion or present different possibilities.

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Executive Overview

Intel IT has built a visual data analysis solution that provides unique possibilities for collaboration. The Info Wall is a touch-enabled interactive video wall with a viewing area measuring 5 feet high and 15 feet wide. The Info Wall connects data to decision makers to help guide them to a conclusion or present different possibilities.

To provide the data for the Info Wall, we engaged in an 18-month data cleansing effort, connecting more than 15 years' worth of historical sales data, data from vertical systems, and other newer sources of data, using common measures and dimensions. We also developed an automated data management process that enables us to reduce the time it takes to integrate new data sets from six months to a few hours.

This connected data, rich analytics, and the Info Wall have yielded the following results and benefits:

- Adapt more efficiently to business changes
- Minimize the time to find and address business issues
- Support more interactions with data, enabling people to discover trends, connect the dots, and create information collaboratively
- Promote a culture of near-real-time analysis
- Easily adapt our reporting platform to new sources and types of data

With the introduction of data visualization using the Info Wall there is a potential to improve these benefits:

- A user-, business-, and data-centric design, which makes the Info Wall executive-friendly and reduces the amount of Intel IT's technical involvement
- Standardized data analysis and visualization

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Acronyms

LPD Laser Phosphor Display

Emerging Business Challenge

Decision making is critical for Intel's success because it directly impacts the company's revenue as well as its reputation in the market. The more quickly decisions can be made and the more informed those decisions are, the more Intel succeeds. Increasing the velocity of the decision making process, however, poses challenges:

- **Data can be difficult to retrieve.** Typically, the decision making process involves analysts working with data embedded deep inside various information systems. The analysts roll up that data to top executives during interactive sessions. Executives then ask questions requiring more detail to help them make satisfactory decisions. Many times, the necessary detail is not immediately available, slowing the decision making process.
- **Connecting disparate data can be difficult.** Data resides in different systems (pricing, customer data, billing information, rebate info, and so on), and the same data may have different labels (for example, a text-based product name in one system may have a numeric code in a different system). Connecting all the data—especially when it comprises thousands of rows in multiple data sources and stored at different levels—can be difficult.

Intel IT wanted to develop a solution that presents data in a format that tells a story and guides decision makers to a conclusion or shows different possibilities—all in near real-time. We wanted a solution that would support easy-to-use data visualization activities such as drilling down, zooming in and out, moving assets around, and visually comparing details displayed on a touch-enabled, interactive user interface. We also knew that these features had to be available in a collaborative environment.

Solution

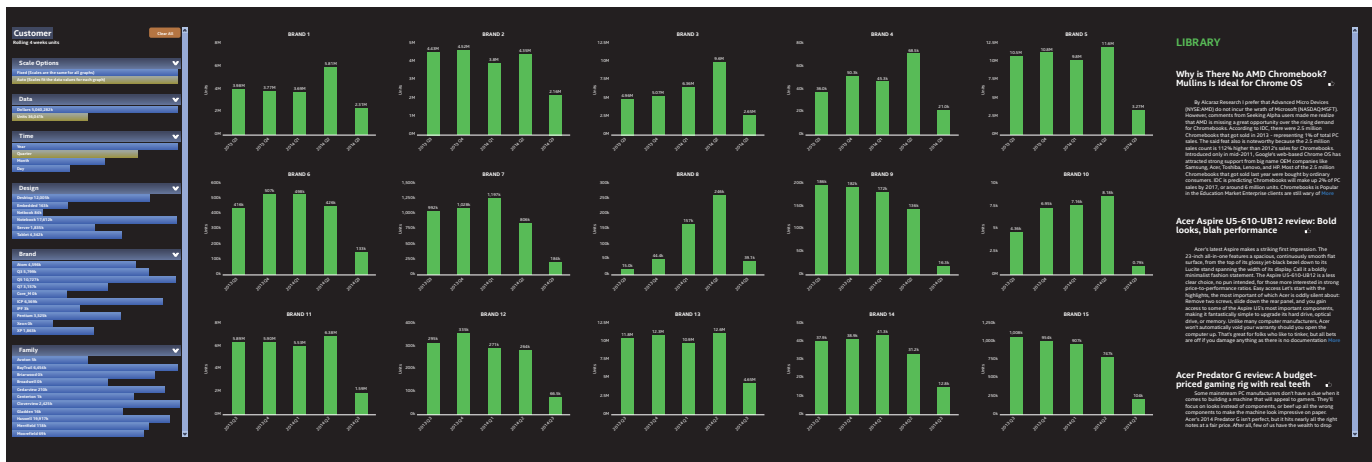
Data plays a significant role in decision making in today's business environment—Intel's business processes use a significant amount of historical data to reach decisions. But data by itself is meaningless; data becomes meaningful information only when it is conveyed in terms of trends and patterns that guide effective decision making. Data visualization is one of the important transformations taking place in the IT industry, helping convert data into meaningful insights.

Intel IT has developed a breakthrough design that harnesses the power of data visualization. This solution is built on Intel® architecture and is called the Info Wall. As Intel's first interactive video wall with a viewing area measuring 5 feet high and 15 feet wide, this unique implementation has enabled new possibilities for business intelligence and data visualization for Intel decision makers. Currently, the Info Wall and data focus on sales and marketing; soon we plan to expand the application of the Info Wall to other Intel areas of activity.

The Info Wall, shown in Figure 1, replaces the traditional way of leading discussions using only presentation slides and pointers to data. We have enabled a new experience by designing a solution that empowers executives to experiment with different scenarios on their own before making decisions. The solution is characterized by the following:

- Executive dashboards create a user experience more like building a story than opening a traditional report.
- Data is summarized and shown at appropriate levels, shielding the complexity associated with the huge repository of connected data.
- Extensive data analysis capabilities enable a logical progression of thoughts and help integrate the key points, conclusions, and notes on-the-fly into the dashboards.
- The solution architecture can adapt to new data sources and support two-way communication between the Info Wall and connected laptops.

When building the Info Wall, we focused on creating an optimal user experience, providing data that was well connected even though it was stored in multiple databases, and supporting advanced data analysis capabilities. We chose a solution architecture that was scalable and energy efficient.



CUSTOMER INFO

Enables what-if analysis and displays the effect of variables in as many windows as desired.

WORKSPACE TILES

Each graph, based on live data, represents a single workspace tile creating a user experience more like building a story than opening a traditional report.

ANCILLARY INFO

Shows publicly available information and recent announcements collected through the Intel library.

Figure 1. The Info Wall helps executives to visually explore an extensive repository of data, empowering them to collaborate and make better-informed decisions more quickly than is possible with standard reports.

Optimal User Experience Empowers Decision Making

As we built the Info Wall we wanted it to be inviting and easy to use. We chose a high-resolution 4K-pixel screen that makes it easy to see all the data. The Info Wall has minimal space between each of the 36 tiles, so that all the tiles form one cohesive picture. The tiles are arranged on the screen 9 tiles wide and 4 tiles high.

Because the screen provides ample real estate, users can show more information than is possible in a slide presentation or on a laptop. The information is clearly visible even from the back of the room. The information that is analyzed and shown on the Info Wall is based on live data stored on servers, not static data that has been pulled physically into an illustration. The Info Wall helps executives to review data, allowing them to collaborate and make better-informed decisions more quickly than is possible with standard reports. Users can also access data from web browsers and private drives. While access is currently limited to laptops, we plan to add mobile access in the near future.

Many users can simultaneously interact with the touch-enabled Info Wall. No projector is needed; the Info Wall itself provides the images and sound. Users can move, shrink, and expand windows simply by touching the screen's interface. They can also annotate content (using circles and notes) and save these changes (as a rendered graphic). The saved content can then be emailed to other Intel employees. For example, a participant might circle a decrease in revenue, type a question, save the annotated image as a graphic, email it to a colleague, and receive a response—all without leaving the room.

As a bonus, the Info Wall features two-way communication. Not only can people manipulate what is displayed on the Info Wall from their laptops—but they can also control what is on the laptop from the Info Wall.

Other features of the Info Wall include the following:

- **Whiteboard.** Users can draw pictures and take notes, save the session as a graphic, and then email it to themselves or to others. This capability provides a better user experience compared to taking a physical picture of a whiteboard session with a smartphone camera.
- **Workspaces.** Whatever users discuss or draw can be saved and then accessed later. Users can also roll back the session up to one hour. (This feature can be disabled if desired.)
- **Ancillary information.** If a user is working on negotiating strategies to win customers, the user can analyze the customer's buying patterns, pricing trends, and the effect of variables on revenue. If the user also wants to know about the customer—such as market positioning, product announcements, and recent organizational updates—windows can present a customer's latest publicly available information collected through the Intel library.

Asynchronous Communication



As users make a change in one window on the Info Wall, other windows immediately reflect that change through asynchronous communication between the Info Wall and the data—enabling a continuous flow of collaboration and data exploration.

The interactive collaboration software that powers the data analytics enables users to have free rein with the Info Wall. They can do what-if analysis and display the data in any format, design, or window layout as they choose. For example, a user has the option to display revenue data in several windows, organized by customer, product family, rebate amounts, and so on.

The Path to Making Information Easier to Access

Prior to building the Info Wall, we relied on gleaning data from various sources that contained 15 years' worth—200 GB—of historical sales data. This inefficient practice made it difficult to access data to make business decisions quickly.

- We were not able to do analysis between forecasting cycles.
- We were not able to do any kind of trending analysis without manually stitching together spreadsheets from multiple forecast cycles.
- Data was stored only in historical spreadsheets and was not accessible through any reporting or query capability.

We wanted to make this data available through a medium that provided a more effective way for users to make decisions. To enable this dynamic medium, we replaced more than 4,000 spreadsheets with a database solution that resulted in over 1,000 data measures and 12 dimensions.¹ In addition, we invested in a multi-year program to improve underlining applications, including sample, demand, revenue optimization, price, deal, and revenue audit management systems (see Figure 2).

¹ A measure is a property on which calculations such as sum, count, average, minimum, or maximum can be made. A dimension provides structured labeling information to otherwise unordered numeric measures, thereby categorizing facts and measures and enabling users to answer business questions. The primary functions of dimensions are filtering, grouping, and labelling. Commonly used dimensions are people, products, place, and time.

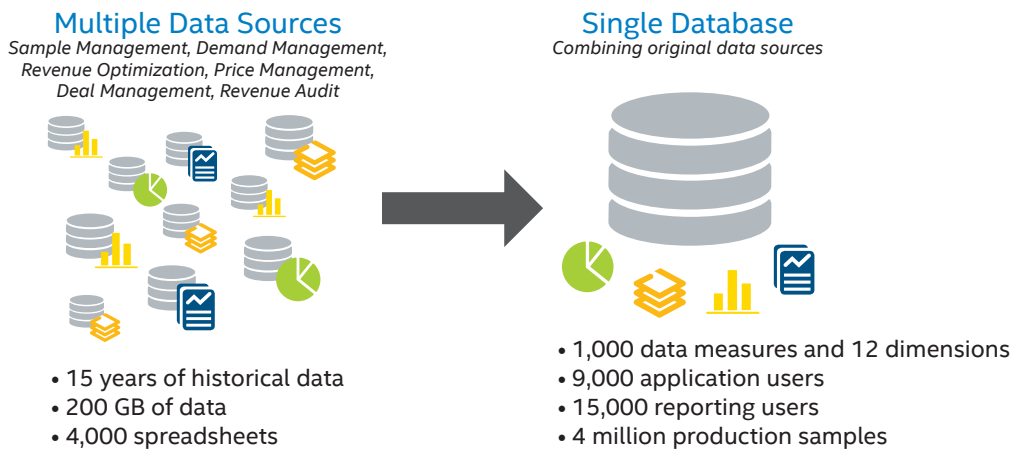


Figure 2. Prior to building the Info Wall, information stored in various sources contained 15 years' worth—200 GB—of historical sales data. In order to make that data more readily available to users we replaced more than 4,000 spreadsheets with a database solution that resulted in over 1,000 data measures and 12 dimensions.



Automated Data Management

Data validation, configuration, and integration processes can be accomplished in a few days instead of six months. About 9,000 application and 15,000 reporting users have access to the data.

Although improving these new applications solved issues within each process area, they did not address the ability to look across these multiple process domains of data and achieve even higher levels of leveraged information or business insights.

It took about 18 months to cleanse and connect all this data—processing each data set and its corresponding master data. This effort involved working closely with the different business units to assist us in resolving questions and discrepancies. We integrated the data into a single view and organized it by various dimensions like customer, product, and time, connecting one data set to the next through common elements. New dimensions, such as market segment, were added to the data to enable analytics. The data includes tracking information for about 4 million production and engineering samples provided to customers.

We have developed an automated data management process that can pipe raw data from a new data set into the reporting layer. Data validation, configuration, and integration processes can be accomplished in a few days, without IT involvement, instead of six months. About 9,000 application users that serve Intel and external customers have access to the data, along with 15,000 reporting users. Although the data is integrated and accessible from the Info Wall, the system remains flexible enough so that users can also use their favorite spreadsheet and analysis tools from their laptops to access the data.

Analysis Capabilities Enable Data Exploration

The Info Wall provides real-time collaboration, where decision makers can analyze data with a click of a button or a simple touch. This latter feature enables more intuitive data analysis than is provided from other tools that rely only on keyboard and mouse interaction. Users can compare actual data to forecasts; examine trends defined by time, customer, or product family; and look at a waterfall visualization of the data. These visualizations also provide the flexibility to compare two time periods or two customers to determine what elements affect revenue. Other reports show how sales and orders are related to rebates. Chart types that can currently be displayed are bar charts, line graphs, and area charts—and users can display many charts simultaneously.

Intel IT builds the reports used by the Info Wall. This approach enables us to create new reports faster, provide a consistent support for touch, and the ability to scale so the results look attractive on the big screen.

Figure 3 shows how the data flows from various business processes to the connected data layers. An interface layer obtains data from various vertical systems (tied to business processes) and loads this data into a central database for analysis. Security is maintained by the security layer, while the semantic/performance layer performs the actual analysis—the results of which are presented on the Info Wall.

Solution Architecture

The Info Wall's user interface works with any data source. Our primary data source is an SQL-based decision support system where we connected all inter-related data relevant to Intel's business processes. This decision support system uses a common architecture platform, meaning servers as well as storage and network appliances run on the same proven Intel® hardware. To enable the Info Wall, we used a variety of technologies, such as HTML5, JavaScript, SQL, data-mining tools, Python, and R.

We based our Info Wall solution on an Intel® Core™ i7-3930K processor² (12M Cache, 3.20 GHz). This processor is cost- and energy-efficient, and generates very little heat. The Info Wall uses Laser Phosphor Display (LPD) technology, which offers the following "green" benefits:

- According to the manufacturer, LPD technology can help reduce total greenhouse gas emissions by minimizing power consumption and cooling requirements up to 75 percent, compared to conventional legacy, large-format displays. Not only does this save energy, but the Info Wall remains cool to the touch and the room temperature stays comfortable.
- A clean manufacturing process helps avoid using harmful chemicals, which in turn lowers recycling and long-term environmental impacts.
- No consumables are used, such as bulbs, filters, and other land-fill and waste materials.

One major challenge we encountered while building the Info Wall was enabling asynchronous communication between the individual Info Wall windows and the data on the server. That is, when a user makes a change in one window, the other windows should reflect that change. We creatively managed this by using

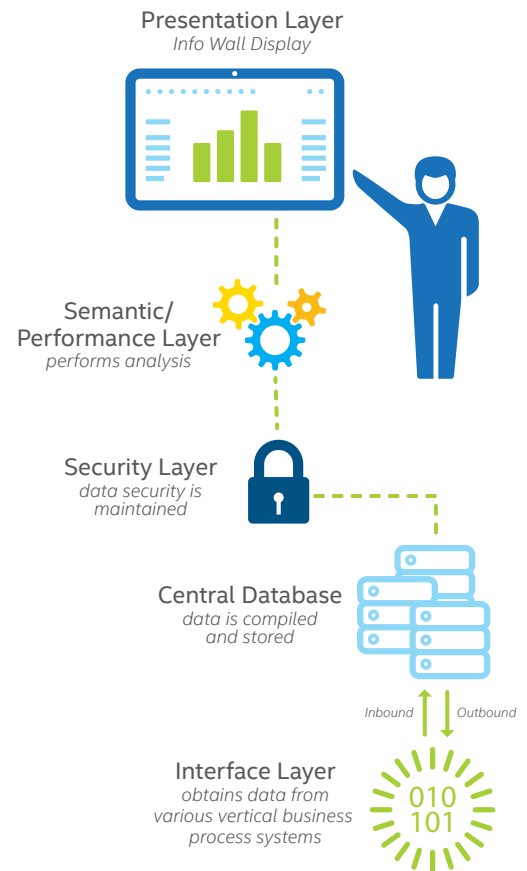


Figure 3. Business processes create data and feed it through multiple data layers, forming the basis for the multi-tiled Info Wall that presents the information to Intel's decision makers.

² Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families: Go to: www.intel.com/products/processor_number

a tool that simplified the process of adding real-time web functionality to applications for asynchronous communication between windows. Asynchronous communication enables users of the Info Wall to continuously explore data and collaborate in real-time.

Results

Benefits of connected data, analytics, and the Info Wall that we have seen include the following:

- Quick and easy access to critical data helps people make the right decisions faster. By reducing the time to find and address business issues, the solution lets Intel adapt faster and more easily to business changes.
- The interactive Info Wall enables users to progressively explore data with simple touch interactions. This exploration provides the right trigger points for collaborating, helping people to discover trends, connect the dots, and create information.
- A culture of near-real-time analysis places the right data at the fingertips of decision makers, empowering them to get answers and facilitates exploring different points of view.
- A flexible design enables us to adapt the reporting platform to new sources and types of data.
- A design that is user-, business-, and data-centric that makes it a user-friendly solution. It also reduces Intel IT's technical involvement.
- Standardized data analysis and visualization shields the complexity of underlying interconnected data, letting decision makers focus on meaningful information, not raw data.

“The Info Wall brought new life to conference room collaboration amongst my staff. Coupled with multiple windows and the ability to compare several sets of data in real time, the Info Wall allows my team to collaborate on business intelligence and quickly get to a recommendation. We are looking forward to its virtual capabilities with new video conferencing features.”

– Jason Grebe
Vice President, Sales and Marketing
Group General Manager,
Business Management Group

Next Steps

We anticipate even more value from the following added features:

- **Mirroring.** This feature could allow users to collaborate in real-time outside the room from where the Info Wall is located. We are beta testing a product that will allow one user to work in the room with the Info Wall and another user to interact simultaneously on another computer (not necessarily the same size screen, and not in the same room as the Info Wall).
- **Expanded side panel information.** This feature may include more sources of published library and web information.

- **Increasing utilization.** This can extend usage to other groups that enable business value, including assisting design win activities, customer collaboration, and marketing analysis.
- **Video conferencing and collaboration software.** These may help users collaborate with audiences outside the room. They are planned for the first half of 2015.

Conclusion

Intel IT has created a solution that brings decision makers within two or three clicks or touches of relevant data. The connected data, analytics, and touch-enabled Info Wall present data to decision makers in a format that tells a story and guides them to a conclusion or shows different possibilities—all in near real-time.

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