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Real Time Analytics

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What is Real-Time Analytics?

Real time analytics refers to the process of preparing and measuring data as soon as it enters the database. In other words, users get insights or can draw conclusions immediately (or very rapidly after) the data enters their system.

Real-time analytics allows businesses to react without delay. They can seize opportunities or prevent problems before they happen.

By comparison, batch-style analytics may take hours or even days to yield results. Consequently, batch analytical applications often yield only "after the fact" insights (lagging indicators). BI Insights from real-time analytics can allow businesses to get ahead of the curve.

Who Uses Real-Time Analytics?

Examples of real-time analytics include:

- Real time credit scoring, helping financial institutions to decide immediately whether to extend credit
- Customer relationship management (CRM), maximizing satisfaction and business results during each interaction with the customer
- Fraud detection at points of sale
- Targeting individual customers in retail outlets with promotions and incentives, while the customers are in the store and next to the merchandise.

Benefits of real-time data

Real-time analytics can be incredibly useful for today's businesses. Here are some of the benefits that these tools can offer.

Tracking customer data. See the latest time-sensitive customer data and craft an immediate response. Real-time analytics reveals when and why your customers behave as they do, and how to optimize their satisfaction.

Cost efficiencies. Real-time analytics can help improve profitability by saving money across the organization in areas like hiring and retention, employee engagement, and of course, reducing the workload of the IT department.

that will give you a competitive advantage.

Faster response time. A sudden market fluctuation can mean big opportunities for businesses. Real-time analytics can ensure that you get ahead of situations that might cost money or conversely, could be a big money-maker.

Real-time testing. With immediate answers at their fingertips, businesses can forecast with confidence and optimize their data to find the best options. Split-testing or A/B testing can be carried out with ease to make big decisions clearer.

See it in action:

What is Real-Time Analytics' Biggest Challenge?

To be immediately useful, real-time analytics applications should have high availability and low response times. They should also be able to handle large amounts of data, up to and including terabytes. Yet they should still return answers to queries within just seconds.

"Real-time" also means handling changing data sources, which may spring up as market and business factors change. In short, they should also handle big data. (Learn more about big data basics here). Real-time big data analytics are already used in financial trading.

They use data from financial databases, social media, and satellite weather stations to instantly inform buying and selling decisions.

Empowering End-Users

Businesses are becoming increasingly digital. Real-time big data analytics must handle growing quantities and diversity of data. Different technologies exist to help meet these demands.

Some are based on specialized appliances (hardware and software systems). Others use special processor/memory chip combinations, or in-database analytics (the database has analytics capabilities embedded in it).

However, it is also possible to use ordinary computer systems and any data source. The real-time analytics application must simply be designed to leverage the full power of standard processors and memory.

This makes real-time analytics more affordable. When the application is also user-friendly, it puts the power of real-time business intelligence directly into the hands of business users. This is also where it should be, for the greatest business benefit.

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DEFINITION

real-time analytics

Kate Brush, Technical Writer

Real-time analytics is the use of data and related resources for analysis as soon as it enters the system. The adjective *real-time* refers to a level of computer responsiveness that a user senses as immediate or nearly immediate. The term is often associated with streaming data architectures and real-time operational decisions that can be made automatically through robotic process automation and policy enforcement.

Whereas historical data analysis uses a set of historical data for batch analysis, real-time analytics instead visualizes and analyzes the data as it appears in the computer system. This enables data scientists to use real-time analytics for purposes such as:

- Forming operational decisions and applying them to production activities -- including business processes and transactions -- on an ongoing basis.
- Viewing dashboard displays in real time with constantly updated transactional data sets.
- Utilizing existing prescriptive and predictive analytics
- Reporting historical and current data simultaneously.

Real-time analytics software has three basic components:

- an aggregator that gathers data event streams (and perhaps batch files) from a variety of data sources;
- a broker that makes data available for consumption; and
- an analytics engine that analyzes the data, correlates values and blends streams together.

The system that receives and sends data streams and executes the application and real-time analytics logic is called the stream processor.

How real-time analytics works

Real-time analytics often takes place at the edge of the network to ensure that data analysis is done as close to the data's origin as possible. In addition to edge computing, other technologies that support real-time analytics include:

- Processing in memory -- a chip architecture in which the processor is integrated into a memory chip to reduce latency.
- In-database analytics -- a technology that allows data processing to be conducted within the database by building analytic logic into the database itself.
- Data warehouse appliances -- a combination of hardware and software products designed specifically for analytical processing. An appliance allows the purchaser to deploy a high-performance data warehouse right out of the box.
- In-memory analytics -- an approach to querying data when it resides in random access memory, as opposed to querying data that is stored on physical disks.
- Massively parallel programming -- the coordinated processing of a program by multiple processors that work on different parts of the program, with each processor using its own operating system and memory.

In order for the real-time data to be useful, the real-time analytics applications being used should have high availability and low response times. These applications should also feasibly manage large amounts of data, up to terabytes. This should all be done while returning answers to queries within seconds.

The term *real-time* also includes managing changing data sources -- something that may arise as market and business factors change within a company. As a result, the real-time analytics applications should be able to handle big data. The adoption of real-time big data analytics can maximize business returns, reduce operational costs and introduce an era where machines can interact over the internet of things using real-time information to make decisions on their own.

Different technologies exist that have been designed to meet these demands, including the growing quantities and diversity of data. Some of these new technologies are based on specialized appliances -- such as hardware and software systems. Other technologies utilize a special processor and memory chip combination, or a database with analytics capabilities embedded in its design.

Benefits of real-time analytics

Real-time analytics enables businesses to react without delay, quickly detect and respond to patterns in user behavior, take advantage of opportunities that could otherwise be missed and prevent problems before they arise.

Businesses that utilize real-time analytics greatly reduce risk throughout their company since the system uses data to predict outcomes and suggest alternatives rather than relying on the collection of speculations based on past events or recent scans -- as is the case with historical data analytics. Real-time analytics provides insights into what is going on in the moment.

Other benefits of real-time analytics include:

- **Data visualization.** Real-time data can be visualized and reflects occurrences throughout the company as they occur, whereas historical data can only be placed into a chart in order to communicate an overall idea.
- **Improved competitiveness.** Businesses that use real-time analytics can identify trends and benchmarks faster than their competitors who are still using historical data. Real-time analytics also allows businesses to evaluate their partners' and competitors' performance reports instantaneously.
- **Precise information.** Real-time analytics focuses on instant analyses that are consistently useful in the creation of focused outcomes, helping ensure time is not wasted on the collection of useless data.
- **Lower costs.** While real-time technologies can be expensive, their multiple and constant benefits make them more profitable when used long term. Furthermore, the technologies help avoid delays in using resources or receiving information.
- **Faster results.** The ability to instantly classify raw data allows queries to more efficiently collect the appropriate data and sort through it quickly. This, in turn, allows for faster and more efficient trend prediction and decision making.

Challenges

One major challenge faced in real-time analytics is the vague definition of real time and the inconsistent requirements that result from the various interpretations of the term. As a result, businesses must invest a significant amount of time and effort to collect specific and detailed requirements from all stakeholders in order to agree on a specific definition of real time, what is needed for it and what data sources should be used.

Once the company has unanimously decided on what real time means, it faces the challenge of creating an architecture with the ability to process data at high speeds. Unfortunately, data sources and applications can cause processing-speed requirements to vary from milliseconds to minutes, making creation of a capable architecture difficult. Furthermore, the architecture must also be capable of handling quick changes in data volume and should be able to scale up as the data grows.

The implementation of a real-time analytics system can also present a challenge to a business's internal processes. The technical tasks required to set up real-time analytics -- such as creation of the architecture -- often cause businesses to ignore changes that should be made to internal processes. Enterprises should view real-time analytics as a tool and starting point for improving internal processes rather than as the ultimate goal of the business.

Finally, companies may find that their employees are resistant to the change when implementing real-time analytics. Therefore, businesses should focus on preparing their staff by providing appropriate training and fully communicating the reasons for the change to real-time analytics.

Use cases for real-time analytics in customer experience management

In customer relations management and customer experience management, real-time analytics can provide up-to-the-minute information about an enterprise's customers and present it so that better and quicker business decisions can be made -- perhaps even within the time span of a customer interaction.

Here are some examples of how enterprises are tapping into real-time analytics:

- **Fine-tuning features for customer-facing apps.** Real-time analytics adds a level of sophistication to software rollouts and supports data-driven decisions for core feature management.
- **Managing location data.** Real-time analytics can be used to determine what data sets are relevant to a particular geographic location and signal the appropriate updates.
- **Detecting anomalies and frauds.** Real-time analytics can be used to identify statistical outliers caused by security breaches, network outages or machine failures.
- **Empowering advertising and marketing campaigns.** Data gathered from ad inventory, web visits, demographics and customer behavior can be analyzed in real time to uncover insights that hopefully will improve audience targeting, pricing strategies and Conversion rates.

Examples

Examples of real-time analytics include:

- **Real-time credit scoring.** Instant updates of individuals' credit scores allow financial institutions to immediately decide whether or not to extend the customer's credit.
- **Financial trading.** Real-time big data analytics is being used to support decision-making in financial trading. Institutions use financial databases, satellite weather stations and social media to instantaneously inform buying and selling decisions.
- **Targeting promotions.** Businesses can use real-time analytics to deliver promotions and incentives to customers while they are in the store and surrounded by the merchandise to increase the chances of a sale.
- **Healthcare services.** Real-time analytics is used in wearable devices -- such as smartwatches -- and has already proven to save lives through the ability to monitor statistics, such as heart rate, in real time.
- **Emergency and humanitarian services.** By attaching real-time analytical engines to edge devices -- such as drones -- incident responders can combine powerful information, including traffic, weather and geospatial data, to make better informed and more efficient decisions that can improve their abilities to respond to emergencies and other events.

Future

The future of pharmaceutical marketing and sales is being greatly impacted by the use of real-time analytics. It is expected that more pharmaceutical companies will begin using emerging technologies and implementing real-time analytics instead of relying on traditional methods to gain deeper insights into customer behavior and the market landscape. This has the potential to reduce costs through accurate predictions while also increasing sales and profit by optimizing marketing.

Higher education is also changing with the use of real-time analytics. Organizations can start marketing to prospective students who are best fit for their institution based on factors such as test scores, academic records and financial standing. Real-time, predictive analytics can help educational organizations gauge the probability of the student graduating and using their degree for gainful employment as well as predict a class' debt load and earnings after graduation.

Unfortunately, the consistently increasing amount of machines and technical devices in the world and the expanding amount of information they capture makes it harder and harder to gain valuable insights from the data. One solution to this is the open source Elastic Stack; a collection of products that centralizes, stores, analyzes and displays any desired log and machine data in real time. Open source is believed to be the future of computer programs, especially in data-driven fields like business intelligence.

This was last updated in November 2019

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customer-managed relationship (CMR)

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data residency

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Alex Bekker

Head of Data Analytics Department, ScienceSoft

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Published: Apr 2, 2018

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While real-time analytics and big data are both trending, it seems that real-time big data analytics, which is their combination, should be a very promising initiative, and many businesses should be desirous of it. Let's find out if this is really so.

You will find this article richly supplied with the examples of real-time customer big data analytics. We've done so for the reasons of ease and consistency. Though there are more areas where real-time data analytics can be applied.

Let's start from defining the term

If you are going to skip this section because you think there can't be two definitions of real-time, please don't be surprised – there are. In fact, the definition of real-time is extremely vague and it differs a lot from company to company or, to be more exact, from business task to business task.

Our big data consulting team has come up with the following definition:

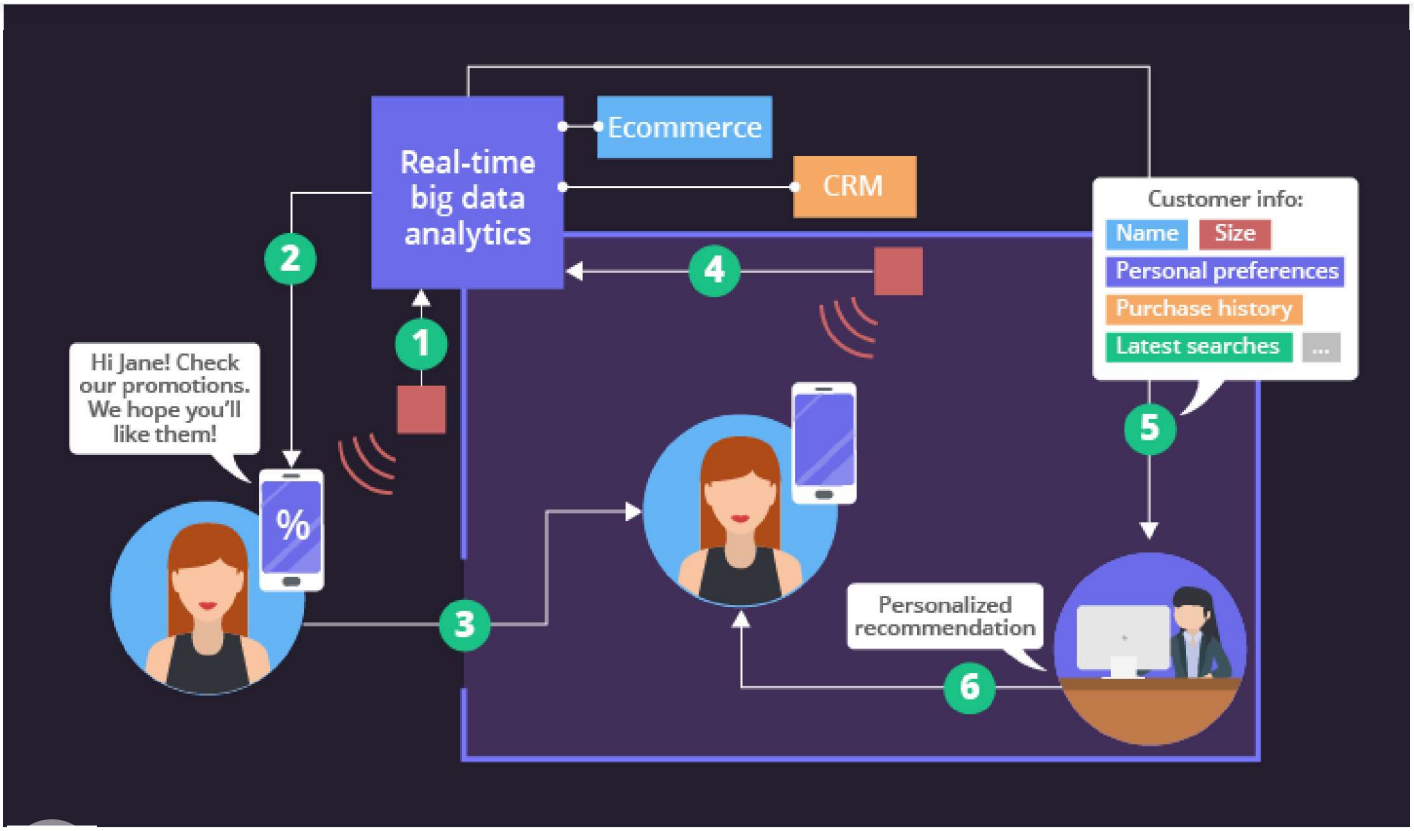
Real-time big data analytics means that big data is processed as it arrives and either a business user gets consumable insights without exceeding a time period allocated for decision-making or an analytical system triggers an action or a notification.

As real-time is often confused with instantaneous, let's clarify the time frames for data input and response. As far as data input is concerned, the real-time processing engine can be designed to either push or pull data. The most widespread example is a push option with an incessantly flowing high-volume data (also known as streaming). However, the real-time processing engine is not always capable of ingesting streaming data. Alternatively, it can be designed to pull data by asking if any new data has arrived. The time between such queries depends on business needs and can vary from milliseconds to hours.

Correspondingly, the response time also varies. For instance, a self-driving car requires a very fast response time – just several milliseconds. If we deal with sensors installed, say, to a wind turbine and they communicate a slowly growing gearbox oil temperature, which is still below the critical level but higher than normal, we need one-minute response time to change blade pitch, thus offloading the turbine and preventing machine breakdown or even fire. However, a bank's analytical system would allow several minutes to assess the creditworthiness of an applicant; and a retailer's dynamic pricing can take up to an hour to update. Still, all these examples are considered real-time.

Real-time big data analytics as a competitive advantage

Although in general organizations value managing data in real time, not all the companies go for real-time big data analytics. The reasons could be different: the lack of expertise or insufficient funds, the fear of the associated challenges or overall management team's reluctance. However, those companies who implement real-time analytics can gain a competitive advantage.

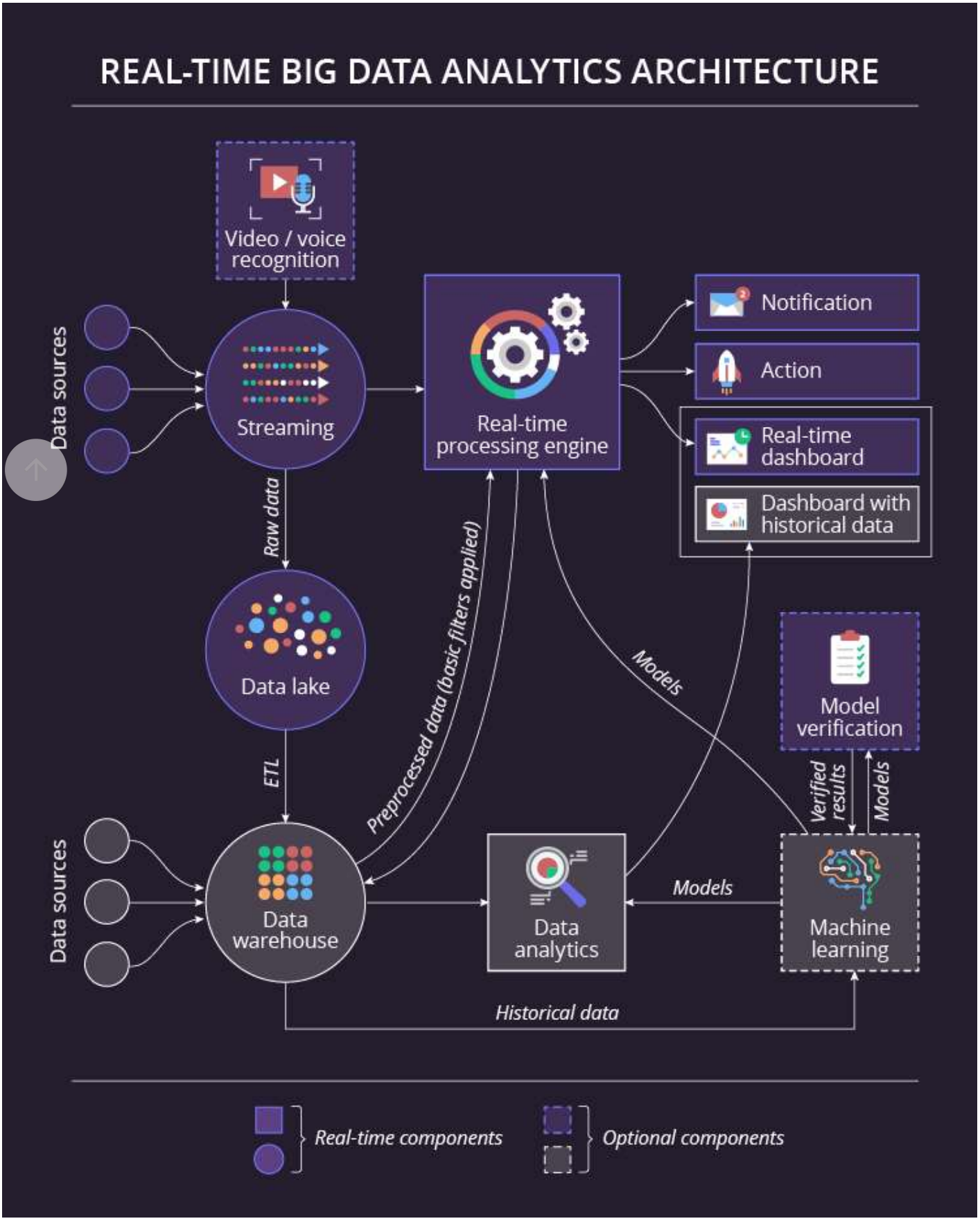


Let's say you are a fashion retailer who would like to take the advantage by delivering a top-notch customer service. Analyzing big data in real time can help bring this great initiative into life. For example, once a customer is passing by a retailer's store, they get a push notification on their smartphones that serves to incentivize them to enter. Usually, it's a personalized promo offer that is based on the customer's purchasing or even surfing history on the website. Once a customer is in the store, the staff gets a notification in their mobile apps. This makes them aware of the customer's latest purchases, overall style preferences, interest in promotions, a typical spend, etc. It looks like a win-win situation for both customers and retailers, doesn't it?

An ecommerce retailer can also achieve better performance by analyzing big data in real time. For instance, they can reduce the number of abandoned carts. Say, a customer has gone that far, but for some reason, they've decided not to finalize their purchase. Still, there are good chances to incentivize them to change their mind. The system is turning to the customer's profile data, as well as the purchasing and surfing history to compare the customer's behavior with the conduct of other customers from the same segment and their response to different actions in a similar situation. Based on the analysis results, the system chooses the most suitable of all the possible actions – for example, offers a discount.

A typical architecture for real-time big data analytics

Let’s have a look at how a typical real-time big data analytics solution works. To make the explanation more vivid, we will accompany it with an example that is illustrative for everybody, as, now and again, we all assume the role of a customer.



this in multiple ways, for example, by implementing face recognition.

With this only **data source**, the retailer can do a simple analysis, like calculate how many male and female customers are currently in the store. However, the retailer will not satisfy themselves with one data source only. Even to know how many of the customers have come for the first time and how many are regulars, another data source is needed, for example, CRM. The general context will also be helpful, for instance, the information about the store's opening hours.

After processing, real-time data finds its way to a **real-time dashboard** or turns into either a **notification** or a **system's action**. We've already provided the example for the first case, when the retailer can understand how many customers are in the store at the moment. Let's look at another option in detail. Say, a customer has formed a shopping list in the mobile app and is moving around the store. Based on the customer's current location data (gathered by beacons and processed by the same real-time analytics), the app can prompt the most optimal way along the sales floor so that they can grab everything that is on their list.

Let's continue with the above mentioned example to explain the contribution of **machine learning**. By the way, machine learning itself does not happen in real time. It's an elaborate process, and the system requires significant time to analyze an enormous volume of data, which usually covers the period of 1+ year, from different angles to come up with valuable models and patterns. These models help the system to make real-time decisions. Now, to the example: the system has already analyzed customer profiles and segments they belong to, their behavior model, the purchasing history, the response to marketing campaigns, etc. and built a model that enables personalized recommendations. And while the customer is walking in the aisles, the system can notify them about promo offers or related products that the customer will find interesting.

The concept of machine learning also requires **model verification applications**, as they enable a constant improvement of the models' accuracy. Additionally, they improve the quality of the input data by allowing a basic filtering from erroneous or noisy data.

Now let's turn our eyes to data storage. It consists of two components: a **data lake** and a **data warehouse**. The former is the place to store all the raw data or the data that has undergone a very simple processing. A data warehouse allows making big data 2-10 times smaller by extracting, transforming and loading only some data from the data lake.

In a word, a retailer cannot live by real-time analytics alone. You can see some other important components of the scheme that fall out of real-time. Still, they are critical if the retailer wants to get valuable and deep insights. For example, a **data analytics** module, which

algorithms and statistical models driven by data analysts. Indeed, this process can take hours or more, but the results are worth waiting. Correspondingly, the retailer's **analytical dashboards** will always contain not only real-time but also historical data.

To sum it up

If thoroughly planned and properly implemented, real-time big data analytics definitely can become a competitive advantage. Taking into account how different the interpretations of real-time can be, it's important to have a clear understanding of the company's requirements to the analytical system.

In the article, we've described a typical architecture for real-time data analytics solution. Before taking it as an example, check whether it will cover your short-term and long-term business needs. If for some reasons, it does not, you may always turn for professional advice on how to tailor it.

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