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aws PARTNER

CASE STUDY

Federal Aviation Administration

Air Domain Analytics

Air traffic control today is growing ever more complex. Why? Airports are growing, there's more traffic than ever and more congestion, and today's airplanes are more complex. Drones fill the skies, and signals from 4G and 5G towers can interfere with instrumentation.

On the whole, it is becoming more difficult to manage airspace efficiently to keep planes and their passengers safe—and that's why the Federal Aviation Administration (FAA) is pilot testing a revolutionary new solution by Kinetica.

Once implemented, the Kinetica solution will allow air traffic controllers to track air traffic with better fidelity, enabling analysts to visualize the location of all aircraft and any potential hazards in the airspace. This represents a shift from relying on disparate data sources, moving to real-time understanding of what is happening in the air-space—and Kinetica accomplishes this by fusing data from sensors in real time.

As you will see, this solution will not only deliver a more efficient and effective way to manage air traffic nationwide, but it will also enable the FAA and other organizations to make better decisions about other factors that intersect with air traffic control and airspace safety. That includes key decisions like where to place no-fly zones for drones, or how to best place cellular towers to prevent 4G and 5G signals from interfering with instrumentation.

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Challenges and Solutions

Air traffic control is a difficult business, with challenges ranging from the national scale to the day-to-day challenges that analysts face as they track and route individual flights. Kinetica offers solutions to the biggest of these challenges—not only at the individual level, but at the national scale, too.

Highly Distributed Data

Part of the challenge in processing air traffic data comes from the ever-increasing volume of data from growing numbers of aircraft, instruments, and sensors. The other part of the challenge is more organizational in nature. While the FAA is a government organization, each airport acts independently, and each region takes charge of the airspace for that region.

What all this means is that each day, the FAA receives a massive pool of highly distributed data—and that data needs to be processed and fused to create a common operational picture that sectors, regions, and airports can use to ensure airspace safety in each location.

Kinetica's Solution

As the first to leverage GPU technology for processing, Kinetica's solution enables parallelization at a massive scale, using hundreds or thousands of cores per GPU device plus vectorization via Intel AVX-512. Using vectorization as the primary compute model, it can take data-based analytical operations and parallelize them to achieve orders of magnitude higher performance gains on a fraction of the hardware.

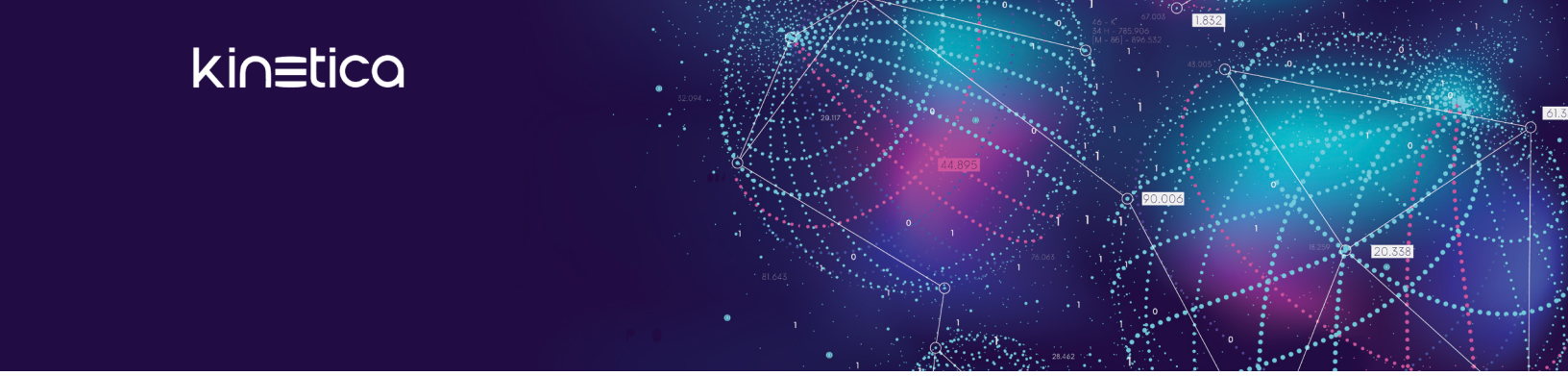
In short, this means that Kinetica can easily ingest billions of data points coming in from airspace all across the nation, then rapidly process them to create easy-to-read visuals displaying flight path information. Kinetica makes it possible to view all flights in the air across the nation—along with each flight's associated sensor readings and data points—in real time.

Creating Order in Congested Skies

Tens of thousands of flights take to the skies in the United States every day. From takeoff to flight to landing, without a doubt, one of the biggest challenges in air traffic control is maintaining safety. Each day, controllers plot flight paths and schedule takeoffs and landings carefully to prevent in-air collisions and other potentially devastating accidents—which becomes more difficult as the number of planes in the air increases.

Kinetica's Solution

Kinetica leverages machine learning models to fuse airspace data, creating a track for each flight in all regions. Using server-side rendering to provide real-time visual data for all air traffic, the system enables users to view a map of North American airspace. From there, controllers can locate tracks and click on individual tracks to see all of the sensors and systems that have contributed data to that track. With access to real-time granular information, air traffic controllers are better equipped to make crucial decisions involving routing, takeoffs, and landings.



Increasing Numbers of Drones

Drones represent another challenge. Businesses and consumers are adopting drone technology at an unprecedented rate for everything from commercial photography to hobbyist forays. As such, drones are adding yet more congestion to the skies—and that can create a potentially disastrous situation.

Kinetica's Solution

Kinetica helps solve this challenge in 2 key ways. First, air traffic controllers can use Kinetica to analyze historical airspace data, using that information to create no-fly zones for drones. Once those zones are created, Kinetica then becomes invaluable for monitoring these zones to ensure that there are no drones in them.

Cellular Signals and Aircraft Instrumentation

Cellular signals pose another potential hazard. Strong signals can interfere with aircraft instrumentation—which is why many flights ask their passengers to turn off their phones. Right now, the FAA is working with cellular providers to understand how cellular signals interfere with instrumentation—and how they can plan the next generation of cellular towers with air traffic safety in mind.

Kinetica's Solution

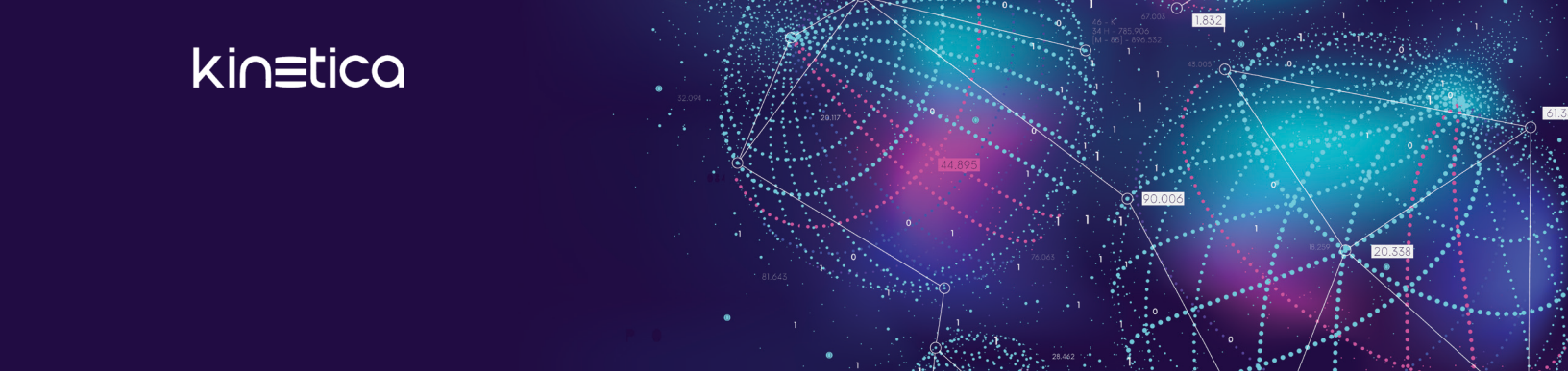
Kinetica's solution for air traffic control, with its vast amount of flight data, stands as an invaluable resource to plan and develop new cellular installations. In fact, top telecoms in the United States have leveraged Kinetica solutions for 4G networking and 5G planning. Where normally it would take several years to do studies so that they could understand where to deploy towers, those same calculations took 50 minutes on a single node with Kinetica.

How Kinetica Works for Air Traffic Control

At its heart, Kinetica is an ANSI SQL 92-compliant database for time and space with a deep focus on real-time analytics and best-in-class location intelligence. Where air traffic control is concerned, data comes in from a variety of different sensors and systems, creating billions of records that need to be processed so as to create a clear operational picture of what is happening in American airspace.

With this system, air traffic controllers can track and analyze objects, using machine learning and analytics to identify objects and create a full picture of what's happening in the skies. From there, Kinetica delivers web mapping service (WMS) compliant visualizations that enable air traffic controllers to easily view and interpret flight paths and their associated data. When split-second decisions matter, analysts can drill down and adjust time periods interactively across billions of data points—a feat that no other solution has been able to accomplish.

Kinetica offers more than real-time data, too. In many cases, it can be difficult to access data from days, weeks, months, or years past—but Kinetica allows easy access to historical data. Analysts can access a calendar view in which they can bring up historical data for future review, which will help air traffic controllers study past events to develop better processes and emergency responses in the future.



What separates Kinetica from other technologies is that it can ingest multiple streaming data feeds at scale from states, countries, or even globally. It's the first technology of its kind to leverage GPU units and CPUs for processing, enabling parallelization at a massive scale, using hundreds or thousands of cores per GPU. It's a distributed analytic database using vectorized query execution to boost performance—which means that Kinetica can store and query data that is constantly changing. Using the same video cards that render modern video games, Kinetica can provide analytics, apply machine learning models, and deliver visuals that enable analysts to better understand and interact with air traffic data.

How Vectorization Works

Vectorized query engines use vectorized execution to improve the performance of query operations. In such an engine, data is stored in fixed-sized blocks (vectors), and query operations are performed on these vectors in parallel rather than on individual data elements.

The result is that the query engine can process multiple data elements simultaneously, which delivers faster query execution and improved performance. This is coupled with the fact that vectorized query engines also reduce the amount of compute and data engineering required, which makes them more efficient and cost-effective.

About Kinetica

Kinetica represents the fusion of Silicon Valley with big government data. Originally incubated by the government, Kinetica now helps many of the world's largest companies solve some of the most complex problems across time and space. These include the U.S. Air Force, USPS, Citibank, T-Mobile, and others. Organizations across the public sector, financial services, telecommunications, energy, healthcare, retail, automotive, and beyond use Kinetica to simultaneously ingest and analyze fast-moving spatiotemporal data to build the next generation of IoT solutions.

Kinetica is a privately held Series B startup, backed by leading global venture capital firms Canvas Ventures, Citi Ventures, GreatPoint Ventures, and Meritech Capital Partners. Kinetica has a rich partner ecosystem, including AWS, Microsoft, NVIDIA, Intel, Dell, Tableau, and Oracle.