



APPNEXUS
NETEZZA IN ACTION

Uniting Online Advertisers and Publisher Inventory Aggregators with a Real-Time Ad Buying Platform

As consumers around the world surf the web, we don't think twice when relevant advertisements appear on our screens in a flash. But behind the scenes, there is an intricate and fast-paced ecosystem of advertising publishers, ad inventory aggregators, bidders, advertisers and exchanges that work together 24x7 to match online advertisements with their relevant target audiences in real time for optimal likelihood of conversion. This process is often seamlessly facilitated by AppNexus and its real-time ad buying platform.

Founded in 2007 by industry veterans Brian O'Kelley and Mike Nolet, and funded by leading investors including Venrock, Kodiak Ventures, Khosla Ventures, First Round Capital, Mark Andreessen, Ben Horowitz and Ron Conway, AppNexus delivers a cutting-edge buying platform for the online advertising industry. Historically, buyers of online display ad media have bid on publisher placements in the future. The AppNexus ad buying platform enables the purchase of individual impressions in real time, and changes the online advertising game by:

1. Allowing the analysis of each individual impression using advertiser data
2. Making it possible to assess the value of each impression in real time using conversion data (hundreds of data points on a per-impression basis)
3. Allowing buyers to bid for each impression in real time

What's the Big Deal?

As a result, buyers are able to buy more efficiently with more sophisticated targeting. Importantly, the real-time nature of the AppNexus ad buying platform gives participants an inherent advantage: their knowledge is fresher and more accurate, and as a result, advertising performance metrics increase dramatically. The intensive data analysis involved as bidders and impression levels increase requires a fundamental technology breakthrough, and Netezza delivers. AppNexus provides an efficient, one-of-a-kind, real-time service offering to its clients – a technology innovation that is easier said than done. With prior experience developing similar platforms utilizing tools like MySQL, AppNexus initially considered adopting a similar approach. However, upon learning of Netezza's fundamental technology breakthrough, the company quickly realized that it could achieve its goals with far higher performance, far lower cost and much faster time to market. "Netezza's simple approach to terabyte-scale data analysis means that we are able to invest our resources on innovating at the application tier in order to differentiate our offering," says Mike Nolet, Chief Technology Officer of AppNexus. "So rather than investing time in the



Company Profile:

- AppNexus: provider of a real-time ad buying platform and enterprise-level computing cloud focused on comprehensive, self-service, virtualized hosting on demand

Business Challenges:

- Effective use of online advertising requires sophisticated analytics in real time over rapidly growing data volumes
- Common platforms based on MySQL or Hadoop offer limited performance and TCO at scale

Applications:

- Real-time ad buying platform

Solution Benefits:

- Data loads and data models are updated within 15 minutes; buyers can optimize strategies based on real-time information
- Smooth scalability to process daily requests as they grew from 1.5 million to 400 million in three months
- Maintenance requirements reduced by 92% – from 30 full-time MySQL engineers to three

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CTO
AppNexus

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architectural challenges and maintenance headaches involved in sharding our data across hundreds of MySQL nodes, our Netezza system simply works. Netezza’s simplicity had a huge impact on our ability to launch ahead of schedule.”

When selecting its large-scale data warehouse platform, AppNexus defined performance, scalability and simplicity as critical factors to its success.

- **Performance:** AppNexus delivers advertisements 24x7, 365 days a year. Peak days range in the billions of impressions and AppNexus needed a system that could handle continuous loading of data with extremely low latency for use in the analysis that enables intelligent bidding decisions.
- **Scalability:** As the AppNexus platform grows to serve tens of billions of advertising impressions per month (over 30,000 ad requests per second), its data analysis platform must be able to accommodate this fast and large data volume growth.
- **Simplicity:** To meet its performance and scalability requirements, AppNexus recognized that its ability to easily and continuously add data without requiring exorbitant database administration (DBA) and high costs of ownership would be critical to gaining and maintaining a foothold in the digital media market. This was especially true for a technology startup in the cost-constrained online ad industry.

AppNexus selected Netezza because it offered market-leading performance, scalability and simplicity at a lower total cost of ownership (TCO) than every other alternative.

The End Result: An Innovative Ad Buying Platform

AppNexus has built a real-time ad buying platform – powered by Netezza – which facilitates transactions between aggregators of publisher ad inventory and leading buyers of online advertising. Ads are placed based on the latest information about what ad content, placement and timing generates the highest response and revenue. Netezza delivered on its promise to provide performance, scalability and simplicity. As Nolet testified, “Netezza is crucial to our entire data pipeline.”

Proven Performance

The speed of AppNexus’ data loads and aggregations are one testament to the performance offered by its ad buying platform. AppNexus can load and aggregate all of its data in 15 minutes, whereas a typical data warehouse environment wouldn’t finish data loads for eight to 24 hours. And AppNexus has complete access to query new data immediately. This provides a critical benefit to AppNexus, as the company can update all of its data models within 15 minutes to optimize bidders’ strategies based on near real-time information. In other words, AppNexus can determine on the fly whether or not a particular ad placed on a particular site is generating revenue, allowing buyers to stop running ads that are not contributing to revenues, thus saving them significant costs. While small companies with limited data volumes may be able to run data loads in comparable times, their implementations can’t scale to support the data volumes that AppNexus accommodates today.

Proven Scalability

When AppNexus initially deployed Netezza as its data warehouse platform, the company was processing 1.5 million requests each day. After one month, that number grew to five million, and by its third month requests grew to 400 million requests each day. This is a strong testament of the growth and scalability that AppNexus can accommodate with its Netezza-powered ad buying platform. AppNexus also values Netezza’s ability to multi-task across mixed workloads, enabling users to query the database while data loads are running and support concurrent reporting off of multiple data sources.

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About the elements noted in the diagram:

- The Impression Bus is AppNexus’ globally-distributed front-end ad serving layer that integrates with supply sources, sends out and processes bid requests, delivers the winning ad and logs the result.
- Pack Rat is AppNexus’ log processing pipeline that makes sure all event logs return to a central data center so they can be loaded into the Netezza appliance.
- The raw Impression, Delivery and Click tables are rotated every 72 hours on Netezza, using simple SQL to generate cookie-cutter and custom aggregates on top of the raw log tables. They are queried by AppNexus’ aggregation process and dedicated data analysts.
- The ad hoc reporting and predictive analysis provided by AppNexus’ solution allows it to run billing reports and other analyses which facilitate data-driven decisions about budgeting and optimal bid prices.

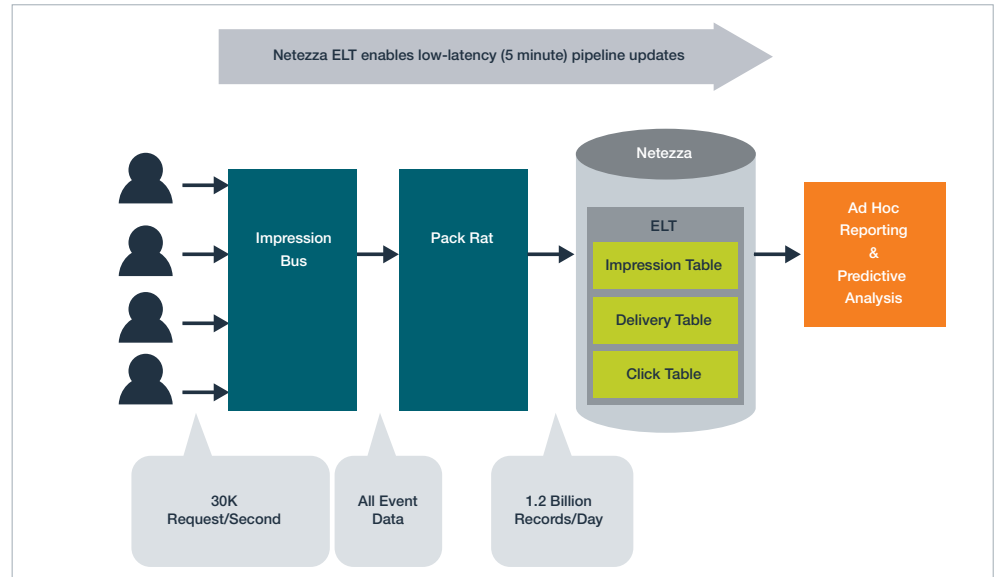
Proven Simplicity

Managing the Netezza data warehouse appliance at AppNexus requires only a fraction of a single person’s time. In comparison, AppNexus’ founders’ previous experience building a similar solution told them that getting equivalent performance and scale with a MySQL approach would require over 30 MySQL engineers to manage the data warehouse. Netezza requires much less database administration and allows AppNexus to query and store much greater data history. AppNexus is processing millions of records 24x7 and, as Nolet stated, “It just works. We’re not engineering around the Netezza database. Most companies have teams of people and all this workflow built around getting the database to work. We don’t use any custom aggregates or Hadoop. We stream data to Netezza and it simply works! We could not have made it to where we’ve gotten today with MySQL or Hadoop.”

So while competitors are busy managing code, clusters and scripts to generate aggregates for Hadoop or MySQL, AppNexus is running a faster, simpler environment allowing it to work toward its ultimate goal of building a platform that corrects fundamental inefficiencies in the advertising industry and transforms the industry’s competitive frontier – moving it away from one in which reach and inventory quality are sufficient to create a competitive advantage, and toward one in which a competitive advantage is created through terabyte-scale data analysis.

Importantly, the AppNexus data pipeline benefits from an ELT (extract, load, transform) approach, whereby it loads data into Netezza first, and then leverages Netezza’s massively parallel architecture to perform data transformations. This way, the transformations are able to take advantage of both Netezza’s massive parallelism and patented use of field programmable gate arrays (FPGAs) to transform the data 10 to 100 times faster than is possible using an external, dedicated platform. Since the data already resides in the data warehouse, no subsequent load is necessary—the data is already where it needs to be for queries and analytics. And importantly, this approach significantly reduces the costs of procuring, implementing and maintaining the AppNexus data pipeline.

The diagram below shows AppNexus’ data pipeline, powered by Netezza to enable real-time data refreshes.



Sharing the Wealth: The AppNexus Cloud

In addition to its high-powered ad buying platform, AppNexus has also opened its technology to clients by offering cloud computing services. With the AppNexus cloud, clients have the capability to stream AppNexus' data to their own data centers using AppNexus' custom Pack and Rat tool and/or they can outsource their entire data center operations to the cloud. The AppNexus "Netezza in the Cloud" offering extends the simplicity of Netezza implementations by offering rapid provisioning, scalability on demand and pay-as-you-go pricing based on utilization. AppNexus hosts rich data about web users – e.g. what ISP they're using, their web browser, how many ads they've seen today – and offers this data to bidders. With the cloud offering, buyers can now add their own website-specific data to the Netezza-powered environment and AppNexus will host the data, run reports for the client and completely manage the environment. The AppNexus cloud allows clients to stream whatever data they want into the Netezza/AppNexus environment. And the cloud offering eliminates typical data warehousing constraints of data volumes and DBA costs while saving data center space and power. This enables clients to leverage the performance and scalability of Netezza's data warehouse along with AppNexus' sophisticated digital media analytics that are running 24x7 so they can constantly update their models and optimize ad placement strategies without worrying about maintaining the data warehouse or paying for more than they need.



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About Netezza

Netezza (NYSE: NZ) is the global leader in data warehouse and analytic appliances that dramatically simplify high-performance analytics across an extended enterprise. Netezza's technology enables organizations to process enormous amounts of captured data at exceptional speed, providing a significant competitive and operational advantage in today's data-intensive industries including digital media, energy, financial services, government, health and life sciences, retail and telecommunications. Netezza is headquartered in Marlborough, Massachusetts and has offices in North America, Europe and the Asia Pacific region.

For more information about Netezza, please visit www.netezza.com.