

# High Performance Open Source Database Architecture

## rENIAC Data Engine for Cassandra NoSQL on Dell EMC Infrastructure

### Performance results

# 10X

more efficient performance than a traditional CPU server platform<sup>1</sup>

# 4–8X

reduction in CPU utilization of back-end database nodes<sup>1</sup>

# 18X

lower latency<sup>1</sup>

Today's applications involve ever-increasing amounts of data and stringent latency requirements, putting a large burden on database infrastructures. Burgeoning databases can increase IT costs and demand continuous manual tuning. And no matter how efficiently databases are coded, they can have performance degradation over time.

Field programmable gate arrays (FPGAs) have been accelerating IO-centric applications such as network routers and storage controllers for decades. New server solutions that combine FPGAs with advanced software can provide extreme performance improvements for databases without having to make changes to the existing database software or application architecture.

That's why Dell Technologies and rENIAC<sup>®</sup> teamed up to offer a solution reference architecture that adds significant performance to open-source Apache<sup>®</sup> Cassandra<sup>®</sup> NoSQL databases while removing the complexity of standing up an IT solution from scratch.

### Dell Technologies and rENIAC reference architecture

High Performance Open Source Database Architecture with rENIAC is built on Dell EMC servers and networking. The Dell EMC PowerEdge R740 server provides a perfect balance of Intel<sup>®</sup> Xeon<sup>®</sup> Scalable processors, Intel<sup>®</sup> Arria<sup>®</sup> 10 GX FPGAs, memory and storage. The rENIAC Data Engine (rDE) is comprised of storage, network and compute software engines. It leverages FPGA, CPU and Tiered Storage (DRAM+SSD) to accelerate data workloads and operates as an FPGA-based data accelerator.

It sits between the database client and node, caching the data in flash storage and serving from either local storage or the back-end database. This enables predictable low latency and throughputs that are much higher than a standard database cluster. The solution offers seamless integration with existing databases, improving performance while enabling portability across multiple Dell EMC server-FPGA configurations.

The Dell Technologies [High Performance Open Source Database Architecture](#) outlines the approach to reducing performance bottlenecks on existing databases and evaluates performance advantages. These include 10X more efficient performance and 18X lower latency compared to servers without FPGA acceleration. The document also shows how a small number of rENIAC server nodes can handle a volume of requests that may have previously required hundreds of standard database server nodes, while delivering dramatically lower and more deterministic latency.

<sup>1</sup> [High Performance Open Source Database Architecture](#), August 2020

The table below shows the validated database acceleration solution architecture.

Compute	FPGA	Networking	Software	Use cases
Dell EMC PowerEdge R740 Servers: • 3x database server • 3x rDE server • 2x client server	• Intel PAC featuring an Intel Arria® 10 GX • Intel Acceleration Stack for Intel Xeon CPU with FPGAs	• Dell EMC PowerConnect 8024	• rENIAC Data Engine • Apache Cassandra	• User profiles • Recommendation engines • Product catalogs • Fraud prevention • Artificial intelligence (AI) and machine learning (ML)

## Dell Technologies, Intel and rENIAC

Dell Technologies, Intel and rENIAC bring together an IT solution that solves many of the latency problems of open-source NoSQL databases over time. Intel FPGAs are available in Dell EMC PowerEdge servers, providing a solid foundation to run the rENIAC and Intel acceleration software stack. This allows you to integrate the solution with the peace of mind that you're running on highly optimized and fully engineering-validated configurations that reduce deployment risk.

### Learn more

[delltechnologies.com/referencearchitectures](https://delltechnologies.com/referencearchitectures)

To further speed deployment and reduce risk, Dell Technologies experts are available to help you design a solution for your specific needs. And [Dell Technologies Services](#) — ranging from consulting and education to deployment and support — are available when and where you need them.

## Our solution partners



rENIAC

