

INTRODUCTION

N5 addresses the need of modern enterprises to derive business insights in real-time from massive volumes of historical and live data and integrate this capability directly into their customer serving transactional applications. Such a capability is foundational for growing trends such as digital transformation and hyper-personalization in which the enterprise's digital assets, primarily their data, needs to be heavily leveraged to enable enterprises to serve their customers in a highly contextual, relevant, personalized, optimized, and timely manner. N5 refers to this real-time derivation and integration of analytics with transactions as **Translytics**. The N5 Translytics Platform, called **Rumi™**, is powering translytical mission critical business applications at Fortune 500 companies.

“Personalized pricing implemented using N5 was instrumental in a 25x increase in loyalty-based revenue.”

N5 and its founders originated from the financial services sector. Rumi™ was developed to power mission critical, real-time risk management applications and ultra-low latency equity trading systems. Rumi™ is designed to enable applications that transact in real-time against big and fast data sets. As the volume, variety and velocity of data processed by enterprises to serve their customers continues to grow exponentially across industries, the company sees this capability (“translytics”) as playing a key role in addressing the issues arising from this trend, enabling enterprises to harness the potential of data in honing their business processes and deepening engagement with their customers.

The company is based in San Jose, California, and, as of the time of this writing it is privately funded. The company's main route to market is via direct sales. It plans to selectively partner with System Integrators and industry vertical VARs. Product pricing is data-driven and subscription based.

WHAT IS RUMI™?

Rumi™ is a software platform that enables enterprises to embed rich, real-time analytical data processing directly in their transactional applications. This enables enterprises to respond in real-time to their customers and, in general, to a business moment, by taking very fast, automated and informed decisions that are arrived at by analyzing in the moment very large volumes of historical and live data in transactions.

Analytical Transaction Processing

As a general pattern, to achieve this, translytical applications run custom developed analytics on and across large volumes and variety of **stored** raw and/or pre-analyzed data (e.g. multi-year transactional history, market data, location data, regional and seasonal data, etc.), and live **streaming** data (e.g. clickstream data, customer behavior and sentiment data, payment data, etc.) in real-time and then use the results to **serve** the customer in a contextually relevant manner. Furthermore, these actionable insights need to be derived and applied with **very low-latency** and within **predictable time limits** to meet the tight transaction response time SLAs. Finally, translytical applications implement high throughput mission critical business processes and, therefore, need to be developed and deployed with **enterprise resiliency** at scale.

To meet this key, integrated need of combined **big data storage, fast data streaming** and **real time data processing and serving**, Rumi™ is architected as a multi-node massively scalable and resilient distributed processing system. Each node functions as a fault tolerant, highly available and elastically scalable micro

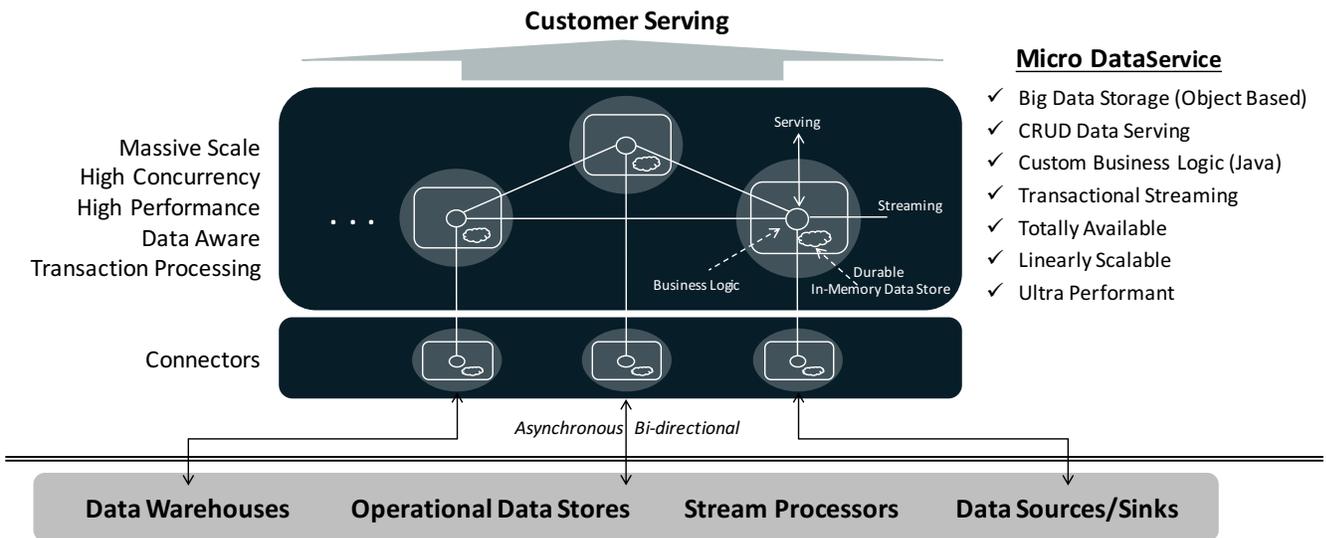


Figure 1

dataservice. Each service houses data with co-located business logic and publishes integrated telemetry for monitoring and diagnostics. A service is independently capable of big data storage, fast data streaming, CRUD and/or analytical data serving. The stream processing and analytical data serving logic is implemented by the service's business logic. This logic is activated by stream messages published by upstream nodes and service requests issued by the service's clients. The system is horizontally scaled by sharding micro dataservices and by deploying multiple concurrently executing micro dataservices interconnected via fire-and-forget message passing provided by Rumi, or over commodity messaging. The overall system of interconnected

Analytical Transaction Processing

services is configured and managed as a single distributed deployment. Such a system of interconnected services (illustrated in Figure 1) is called the Micro DataService Fabric (MDF). Special type of micro dataservices, called *gateway* services are used for bi-directional data connectivity into existing enterprise systems.

Rumi™ is unique in its ability to perform storage, streaming and serving in a single product. Generally, vendor data products implement one of these capabilities. Also as mentioned above, translytical systems need to integrate all of these capabilities to achieve their functionality with very high resiliency to meet enterprise needs. Rumi’s ability to satisfy all of these capabilities in each service, with the ability to distribute the data and processing across the services for highly concurrent, resilient and scalable processing, makes it uniquely suitable and differentiated in solving big and fast data driven translytical problems.

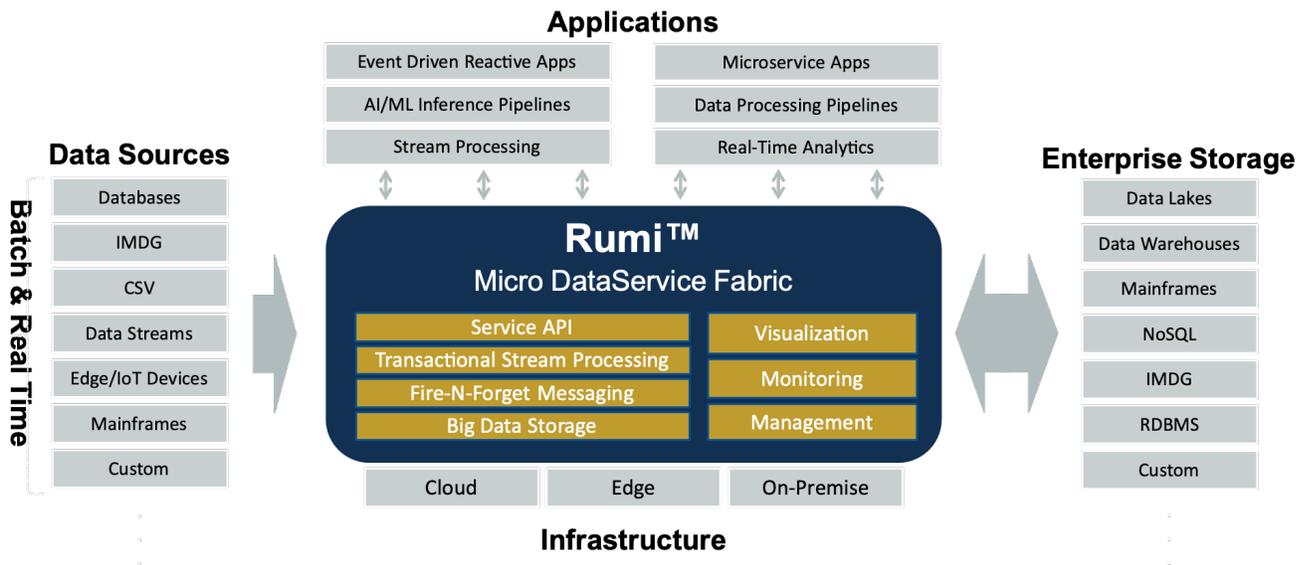


Figure 2

The key innovation of Rumi™ is the MDF on which the application and data are deployed together for execution. High level functionality of MDF is illustrated in Figure 2. The MDF combines in-memory distributed data storage, data streaming, real-time business logic execution and analytical data serving with a microservices based application architecture. This optimizes the platform to enable highly concurrent and scalable big and fast data processing with predictable ultra-low latency performance. NoSQL data modeling is used to make it flexible and efficient to support translytical application access patterns.

Rumi™ has been built from the ground up, to support both the development and run-time execution of translytical applications. The foundational design objective for the platform has been to support highly

concurrent, highly performant (predictable ultra-low latency and high throughput), fault-tolerant and scalable translytical processing on massive volumes of historical and live data. And, to accomplish this while providing an agile environment for translytical application developers to rapidly build and deploy their applications and reduce deployment and operational complexity and cost. Rumi™ can also integrate with AI/ML execution platforms, which are becoming a key element of enterprise operational systems. Rumi™ applications can be deployed in public and private clouds, on-premise data centers and edge data centers. It can be configured on virtualized or bare-metal infrastructure. The current offering supports Java based applications and other programming language support is on the roadmap.

WHAT DOES RUMI™ DO?

With the accelerating trend of data-driven decision making, there is a growing need for enterprises to process larger volumes and variety of data in real-time to arrive at these decisions. For example, businesses want to consider processing and analyzing several years of historical data and integrate this with in-the-moment live streaming data to identify valid and fraudulent patterns and make more timely decisions. The traditional use of batch processing, or creating data lakes and/or data warehouses, to pre-process data for the analytical needs of transactional systems has become cumbersome and costly as the volume, variety and velocity of data needed for these analytical needs continues to grow. Such pre-processing also becomes infeasible when the data needed for these insights is live data or changes more frequently than the batch systems can process.

Rumi™ is designed to process massive volumes and variety of data in real-time and scale such processing as the data size grows. Also, the Rumi™ approach of co-residing application and data together for execution, enables very highly performant analytical data processing and serving. For example, instead of batch based pre-computed analytics on historical data, with Rumi™ massive amounts of such data can be trolled through in-the-moment, processed and integrated with streaming data, and analytics logic applied to complete the business transaction in time. The platform can also support high throughput serving of data, for example, when variety of data needs to be curated based on user defined preferences to deliver information streams as a new business service. Essentially, Rumi™ unlocks the potential of creating scalable and versatile translytical applications to meet the growing and changing needs of the enterprise.

Rumi™ also enables enterprises to rapidly develop and deploy translytical applications. The MDF enables developers to focus on the application's business logic, as complex as needed, whether transactional or analytic or a combination of the two, while the fabric manages all non-functional application details. Rumi™ natively provides the highly available, fault-tolerant and massively scalable environment for the translytical

application. This simplifies the application design and development complexity, by depending on the platform to manage enterprise level resiliency for it.

The Rumi™ approach of co-residing application and data together for execution, contrasts with conventional architectures where microservices contain only the application business logic, while the data is stored and streamed separately. Typically, these other approaches require three or four (depending on the architecture) different products, each with its own code base, to be deployed to provide analogous functionality. Rumi™, by way of contrast, provides a single processing environment with a single code base, thus providing a significantly simpler solution to deploy and operate, along with significantly improved performance and reduced complexity and total cost of ownership.

WHY SHOULD YOU CARE?

There is an increasing demand for *translytics*, the capability to perform and integrate analytics in the same moment transactions are processed. This demand is being accelerated by trends such as digital transformation. Example use cases include hyper-personalization of offers for e-commerce systems, dynamic pricing, ad bidding, real-time payment processing, credit card fraud detection and prevention, real-time data curation for inference data for ML/AI models, processing of fast data streams for risk and timely order management for high volume equity trading, real-time social media data curation based on user preferences, and several industrial automation, IoT and 5G enabled applications.

While some of these requirements are not new, the common cycle of running data through an ETL process and then into an OLAP database or data lake or warehouse, and then making it available to the online transaction processing system, not only results in stale data for analytics but also precludes business use cases in which analytics require live data to be combined with historical data. This is becoming increasingly unacceptable from both a business competitive need and risk management point of view. This situation is further aggravated by the business's need to process larger volumes of data, along with more variety of data from other sources and the need to incorporate streaming data, in real-time for data-driven applications. Traditional solutions are struggling to cope with these requirements. The result being that you either don't achieve the performance and effectiveness that you need, or you pay an inordinate amount of money to do so.

Rumi™ offers several key benefits when it powers data-driven transactional applications. The first is *enhanced business capability*. This is both in terms of the business being able to create new transformative data-enabled services, as well as optimizing and expanding capabilities of existing transactional processes. This is facilitated by Rumi's capability to process and serve big data, fast data and variety of data concurrently, and apply business and analytics logic to it, in real-time, with extremely fast processing speeds and high throughput. Such



capabilities unlock the constraints that enterprise have today for developing in-the-moment action based translytical applications, and, also, enables creating services and delivering customer experiences based on user preferences (e.g. hyper-personalization of services).

“N5 provides the technical foundation needed to enable our customers to live in real-time”

The second is **performance**. Rumi’s unique architectural approach of co-locating data and business logic, the use of in-memory computing for data management, the use of a microservices based architecture for concurrent and scalable compute coupled with advanced engineering yields unparalleled ultra-low latency and high throughput performance.

“N5 provided high availability with performance that we could not get anywhere else”

The third is **agility**. Rumi™ facilitates enterprises to rapidly develop and deploy business capabilities as needed, and, to do so with high productivity. With Rumi™m translytical applications are developed as micro dataservices, where each microservice and the size and type of data to be considered, can be evolved as needed. Developers focus on building the translytical application business and analytics logic, and data modelling, while Rumi™ takes care of all the data management and non-functional requirements of the application. This also simplifies scaling of the application.

“N5 provides our team the agility to quickly build and maintain real-time data curation applications without having to source each component and integrate them. We focus on the business and N5 delivers the results.”

The fourth benefit is **lower total cost of ownership**. This is achieved by a combination of business services optimization, agility and high productivity as discussed above, along with reduced IT costs with Rumi™ deployment. Conventional data processing architectures require numerous data streaming, data serving, data storage, and application development products to be integrated, deployed and scaled independently, to achieve similar functionality. Rumi™ is a single offering that provides this capability at scale with very high

performance, is designed to optimize server and storage footprint, and reduce deployment and operational complexity and total cost of ownership.

“Using N5 resulted in over \$50M in cost reduction. This included not just hardware, network and software savings, but also reduced support and trading risk related cost.”

The fifth is **high resiliency**. Translytical applications typically support mission critical processes of enterprises and therefore any unplanned down times have a direct and tangible business impact. With e-commerce and digital transformation growth, businesses are extending their commercial reach and improving accessibility to customers by being “always open for business”, making high business resiliency a necessity. Rumi™ enables translytical applications to be developed and deployed at scale, and without any compromise to data reliability. Furthermore, Rumi™ provides a fault-tolerant platform for such applications, that takes care of system node and process failures in real-time, with automatic hot switch-over to an alternate node, resulting in continuous operations. Rumi™ also provides capability to support site replication for disaster recovery.

THE BOTTOM LINE

What N5 Technologies calls **translytics**, the real-time derivation and integration of analytics with transactions, is increasingly in demand. Moreover, the acceleration of digital transformation of enterprises is growing this need for deriving real-time insights from large volume, variety and velocity of data, to drive timely business actions, optimize processes and hyper-personalize customer interactions. Traditional vendors will struggle to adapt existing technologies that were originally not intended for this level of complexity and high performance while enterprises will continue to incur high cost, low ROI and missed business opportunities in attempting to solve this need by integrating traditional vendor products in this space. In this context, the benefits of a new approach, designed and developed for translytical applications development and execution – scaling concurrently the applications computing and data storage, streaming and serving capabilities - can be easily appreciated. This is exactly the approach that N5 has taken.