

In-Genius:

The first scalable in-memory platform for immediate insights and profitable action from Big Data

Technology that keeps pace with the velocity and volume of our imaginations has always been *tantalizingly* just out of reach. *That's about to change. What did you previously consider impossible?* How would better intelligence change the shape of your industry?

Imagine that instead of just trying to manage volumes of data, your data could provide the basis for real-time insight and intelligent action. Go beyond the limitations of traditional business intelligence with Terracotta In-Genius, the first in-memory platform delivering real-time insights for intelligent action immediately to all of your delivery channels, including web, mobile and point-of-sale.



For a financial services provider, this might mean stopping fraudulent transactions based on complex pattern detection before authorization rather than after the fact. For a retail store, this might mean immediate personalized recommendations not just on the web, but also at the point of sale across all stores. For a logistics company, this might mean real-time supply management routings based not only on package location, but also on historical data, traffic sensors, weather, calendar events and other patterns that emerge from the data.

The emergence—and convergence—of some of the most interesting new technologies in recent years make it possible to gain true insight into the future rather than to simply produce reports about the past. Now you can proactively identify, track and react to patterns in real time.

Think of the difference between a racing pit crew and your local mechanic. Specialized knowledge and predictive ability enables proactive part sourcing, rapid decision-making and instant intelligent action rather than lengthy diagnostics, delays in sourcing replacement parts and difficult schedule management. In the very near future, your car will capture and transmit diagnostics, place an order for replacement parts, consult known product recall information, and schedule maintenance and repair directly, saving time and money. Imagine this type of intelligence at scale, across a fleet of trucks or airplanes, throughout financial systems, law enforcement and any other realm where data can converge at scale in real time to reveal detailed patterns and trigger decisive action.

These principles are at the core of Terracotta In-Genius comprise four of Gartner Group's "Top Ten Strategic Technology Trends for 2013"¹: **Strategic Big Data, Actionable Analytics, Mainstream In-Memory Computing** and **The Internet of Things**. We will explore how these come together in new and exciting ways across various industry verticals and use cases.

Creating a New Class of Applications

Terracotta In-Genius is designed to allow your business to gain competitive advantage by automatically searching and detecting patterns and trends from the flood of historical (data at rest) and dynamic data sources (data in motion), and acting on these opportunities and threats in real time.

When we say that Terracotta In-Genius is "the first in-memory platform delivering real-time insights for intelligent action immediately to all of your delivery channels, including web, mobile and point-of-sale," what do we mean?

Terracotta In-Genius is the first platform of its kind. Enterprise, web and mobile applications integrate with an in-memory Big Data platform providing low-latency messaging and event stream processing of data from any and all sources your business relies upon. Terracotta In-Genius is not simply another way to manage your existing business processes; rather, it is an entirely new set of tools for new kinds of decisions and planning – creating applications that were never possible before.

¹ <http://www.forbes.com/sites/ericsavitz/2012/10/23/gartner-top-10-strategic-technology-trends-for-2013/>

When people talk about the importance of scalability, they are usually talking about performance. With Terracotta In-Genius, we make it possible to scale your imagination, providing a platform for the insights you'd always hoped the data might reveal if you'd had more flexibility to explore it.

To keep pace with your limitless imagination, applications need to be able to handle volumes of data or transactions at the speed of business, or faster. Current products on the market force businesses to compromise between limited real time access to just gigabytes of data, or significantly slower batch access to Big Data. With Terracotta In-Genius, you don't have to live with these compromises. Access tens of terabytes of available data in real-time, enabling broader and deeper data patterns to emerge for increased intelligence across the network.

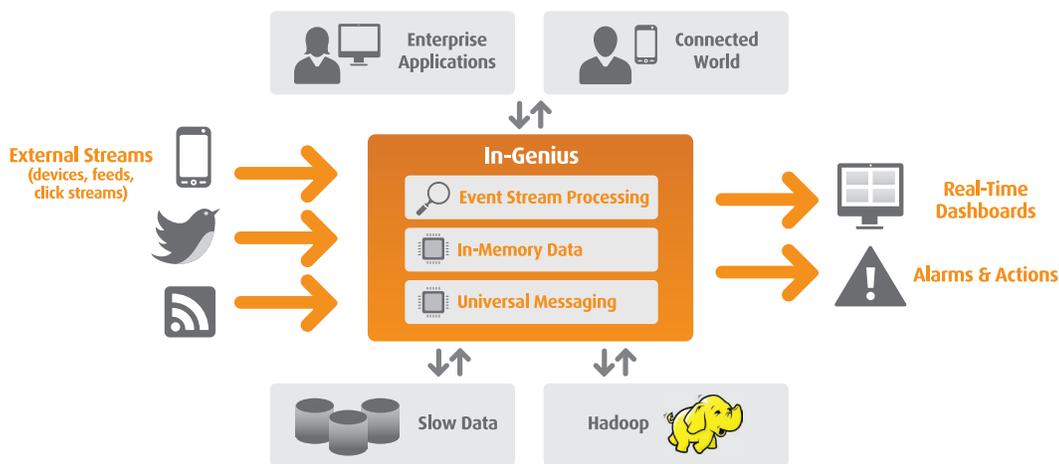


Figure 1: In-Memory Actionable Intelligence Platform – In-Genius

Notably, Terracotta In-Genius harnesses the power of in-memory data management. This shift from disk-based storage to tiered memory architecture enables an entirely different approach to data access and insight. Terracotta In-Genius does not directly manage traditional business intelligence tasks of reporting, OLAP, or data mining, though it works hand-in-hand with applications that do. It is a real-time processing engine that provides proactive notifications and actions based on learned behaviors and patterns that emerge from various data sources. Terracotta In-Genius enables serendipitous discovery of actionable insight, uncovering new opportunities for streamlining efficiencies, maximizing customer relationships, and taking advantage of newly available types of information to make smarter decisions.

For many years, companies have tracked customer data and transactional data. With the rise of new technologies, purchase data from online and brick-and-mortar transactions updates manufacturing conditions in real-time, enabling new possibilities for supply chains and delivery logistics. Social data yields influence clusters and sentiment trends. Eclipsing all of that data is the rise of the Internet of Things, the single largest driver of connected data on the Internet. In 2011, there were over 15 billion web-enabled “things,” such as sensors on appliances or meters, with 50 billion+ intermittent connections. By 2020, it is estimated that the web will have over 30 billion connected things, with over 200 billion intermittent connections.²

This creates an unprecedented amount of structured and unstructured data to process, manage, store—and most critically—act upon. Traditional data storage and processing techniques can barely handle these volumes, let alone make sense of the data in a timely manner. Terracotta In-Genius can

² <http://www.forbes.com/sites/ericssavitz/2012/10/23/gartner-top-10-strategic-technology-trends-for-2013/>

process hundreds of thousands of events per second, identifying patterns and creating data actions based on predicted future behaviors.

Large data stores are typically processed in batches, with vast processors that churn through data overnight and deliver next-day reports. With Terracotta In-Genius, data streams are combined and processed immediately to provide real-time intelligence. Layering information about an individual customer's purchase history and social media activity with seasonal trend, current weather and traffic data and inventory data, In-Genius enables you to recommend actions and offers to best serve that customer at that exact moment.

With multi-directional real-time data at the core of Terracotta In-Genius's actionable intelligence, it is imperative that notifications and data actions be available in real-time in every business channel. From the enterprise to vehicle GPS devices to point-of-sale systems to mobile phones, Terracotta In-Genius brings the data from the vast Internet of Things directly to the business decision at hand, no matter where you are.

Big Data Evolves

Terracotta In-Genius is very much a Big Data platform, but the Big Data category is rapidly evolving. The industry has generally used the term "Big Data" to refer to questions of volume, specifically the storage and access of data sets in the terabyte-and-higher realm. With ever increasing volumes of data being created—2.5 quintillion bytes per day, by some estimates—it's no wonder that technologies like Hadoop, which are designed to distribute and manage these large volumes effectively, get most of the attention when people talk about Big Data. But Big Data is so much bigger than Hadoop.

This is because volume is only part of the picture. Two additional facets must be considered: velocity and variety. Velocity refers to the speed of data accessibility, which gets increasingly faster, moving from seconds to milliseconds to microseconds. Variety explores the multi-directional exchange of data, from traditional email and web transactions to telemetry and sensor inputs as well as social media and mobile outputs. Next-generation Big Data platforms such as Terracotta In-Genius live at the intersection of volume, velocity and variety, working with your existing data structures to extract more intelligence and bring it back to your transactions, logistics and customer relationships in real-time. With Terracotta In-Genius we provide actionable intelligence from operational data (traditional OLTP data sources, or data at rest) and dynamic data from sensors, GPS devices, and other data in motion.

As Gartner notes³, the five richest Big Data sources on the Web include social graph, intent graph, consumption graph, interest graph and mobile graph. The large slow-moving data warehouses of the past are no longer the most reliable or most interesting sources of information about your customers, products or the world around us. It is no longer enough to simply store data and report on trends. A platform that enables emergent data patterns and swarms to direct business decisions moves your business into the future.

Real-time, dynamic intelligence is the promise of Big Data. Terracotta In-Genius propels this with the deep integration of in-memory data management, event stream processing and low-latency messaging, enabling mission-critical decisioning in the millions of milliseconds that make up each day in your company.

³ <http://www.forbes.com/sites/ericssavitz/2012/10/23/gartner-top-10-strategic-technology-trends-for-2013/>

Terracotta In-Genius at work

CASE STUDY: CUSTOMER LOYALTY FOR RETAIL



Figure 2: Customer Loyalty for Retail

A woman walks into her favorite retailer on a bright Friday morning and uses the store's new handheld checkout device to scan items as she puts them into her shopping cart. The retailer knows that this woman usually shops in this store on Friday mornings, and presents pre-cached offers and marketing material within the handheld scanner specifically for her and for other customers likely to show up today. As she scans individual products the device will refine these suggestions based on her previous buying habits (from both her online and brick-and-mortar purchases), and those of other similar customers.

While she shops, it begins to rain outside. Current weather data from the Terracotta In-Genius platform immediately sends new actionable intelligence to all customers currently in the store, letting them know it has started to rain outside and that umbrellas are now available to purchase beside the payment kiosks near the exit.

Online retailers have used sophisticated recommendation engines for years, but retailers have had challenges extending these techniques to their brick-and-mortar stores, and have felt threatened by how nimble online retailers have been able to react to changing market conditions.⁴ Terracotta In-Genius changes this landscape by bringing real-time actionable intelligence to the physical and online channels simultaneously.

Terracotta In-Genius does this by keeping customer history in-memory along with recommendations derived by the analytics engine based on purchase patterns from this customer and other customers like her, as well as seasonality, local and national events and trends, and other relevant data. With more data flowing through the model than a traditional CRM can provide, recommendations are more timely and accurate, increasing customer satisfaction and loyalty.

Business outcomes from the point-of-sale interaction flow automatically through the Terracotta Big Data analytical network, creating a feedback loop that improves future recommendations for this customer and other customers like her.

⁴ <http://www.forbes.com/sites/ciocentral/2012/12/12/why-big-data-is-all-retailers-want-for-christmas/>

CASE STUDY: REAL-TIME FRAUD PREVENTION

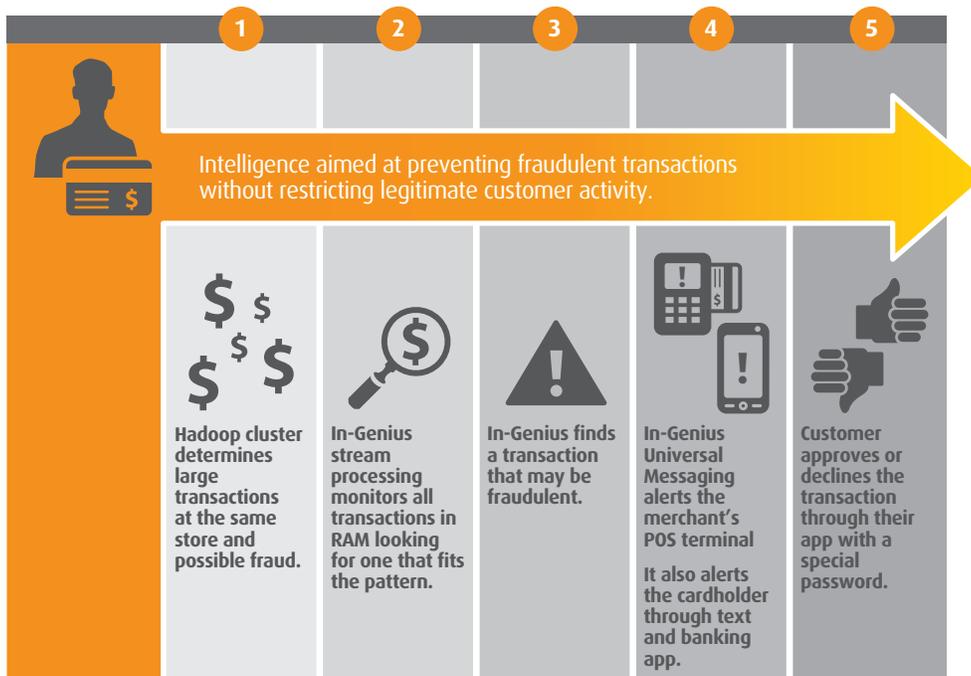


Figure 3: Real-Time Fraud Prevention

Today, a customer gets a call from their credit card company when there has been suspicious activity on the account. The company asks if it was in fact that person who purchased that pair of shoes or the DVD or a tank of gas in another state. Credit card and online payment systems have become highly effective at spotting fraudulent activity immediately and preventing further criminal activity on the account. Alas, detection after the fact is expensive—recent reports from the Department of Justice estimate worldwide credit card fraud at \$5.5 billion each year. Intelligence aimed at preventing fraudulent transactions without restricting legitimate customer activity, even if it is anomalous, would be the “magic bullet” for payment processors.

Terracotta In-Genius enables this by loading patterns of fraud from your company’s analytics systems into memory. These include event streams of transactions, account login attempts, card registrations and assignments, as well as customer and merchant account information with continuous data quality checks.

For the first time, large buffers of historical data spanning past the intra-day barrier can be held in memory, offering broader and more immediate access to known and emerging patterns of fraudulent activity. As patterns are detected, Terracotta In-Genius proactively alerts the system in real-time before the transaction is posted. This shift, from a pull-based model collecting events from the past to a push-based model that actively modifies future events, is one of the most exciting opportunities made possible by Terracotta In-Genius.

CASE STUDY: DYNAMIC DELIVERY LOGISTICS



Figure 4: Dynamic Delivery Logistics

In recent years, vending machines have become much smarter, allowing dynamic pricing and notifying distributors when inventories are low. That's useful, but the machine doesn't have any context. If it's down to two cans of Coke on a hot Saturday afternoon in the break room of an accounting office, it may be fine till Monday morning, but if it's down to two cans on a hot Saturday afternoon in a baseball stadium, it's a problem. In that scenario, a hundred cans might be too low – and the machine has no way of identifying or communicating that urgency.

But what if your vending machines or kiosks had that additional context? What if the machines had weather data and calendar data, and could proactively notify your delivery trucks or maintenance crew in real-time that supplies are low or the machine needs attention? The analytical intelligence of Terracotta In-Genius is perfectly suited to managing supply chain and inventory logistics with just-in-time decisioning to reduce costs and increase ROI.

With Terracotta In-Genius, your kiosk sends transactional data from embedded sensors in real time, which is stored in-memory along with historical transaction data from a specified period, such as a month or a year. Combining this with GPS data streams, weather patterns, specialized context information such as stadium attendance data, and product inventory on every truck in the area yields actionable patterns for Terracotta In-Genius to automatically route the proper truck to the proper kiosk for restocking.

As conditions shift, such as increasing demand throughout the victorious baseball season, Terracotta In-Genius spots those trends and adjusts accordingly to ensure continuous inventory. Combine that with trends in traffic patterns and weather data, and Terracotta In-Genius can reliably and efficiently maintain inventory across your distribution network.

Imagine how this might work for other kinds of inventory logistics: airplane seats, hotel rooms, consumer freight delivery. Each of these multi-billion dollar industries has opportunities to benefit from discovering underlying patterns in existing data and moving toward a more proactive model of decision-making.

Terracotta In-Genius Architecture

Traditionally, customers requiring this sort of functionality had to glue together disparate technologies, but with Terracotta In-Genius's in-memory data platform all functions are tightly integrated, providing immediate business benefit and linear scalability.

- **Advanced Data Access & Management**

Terracotta In-Genius enables data storage with BigMemory, the revolutionary Terracotta technology that provides high-performance data access at scale. With significant investments in continuous improvement in areas of scale, performance, security, and ease of use, BigMemory is proven enterprise technology deployed in multiple industries across the Fortune 2000.

BigMemory is designed to allow businesses to store all application data in-memory for real-time processing and analytics, enabling faster and more efficient transactions as well as significant reductions in IT overhead. Moving data from traditional DBMS structures, Hadoop, OLAP and other business silos to a single repository opens a new world of possibility for the intersection of that data into meaningful patterns for insight.

Unlike other in-memory architectures, BigMemory is designed to scale predictably, restart quickly and perform at the speed required for real-time insight.

- **High Speed Universal Messaging**

Low-latency messaging enables high-volume applications to communicate in microseconds with each other and with the data stores they read from and write to. The Terracotta In-Genius messaging component is provided by Nirvana, which also enables messaging from Terracotta In-Genius to devices of all kind, including mobile, GPS and point-of-sale.

- **Powerful Event Stream Processing**

Event Stream Processing (ESP) is the mechanism by which Terracotta In-Genius aggregates, organizes and analyzes information from the large stores of data in-memory. It processes and produces events for reporting, analysis and action.

- **Mobile and web scale applications**

On top of the data platform sits the messaging layer, updating web, mobile, point-of-sale, GPS and other applications in real-time as intelligence materializes and flows through the system. An analytics dashboard will also serve as a destination for important notifications and reports, interfacing both with Terracotta In-Genius and your other business intelligence systems.

Terracotta In-Genius is more than the sum of these parts, however. The combined power of a tightly-integrated in-memory storage, processing, messaging and analytics at scale removes limitations that in the past have discouraged businesses from making the most of their data. Terracotta In-Genius is a platform for a new class of application development specific to your business. Uncover the unique patterns and hidden intelligence in your data to reveal opportunities for innovation, serendipity and transformation.

How is Terracotta In-Genius Different?

As we've discussed, Big Data solutions need to address three key components: volume, velocity and variety. While many solutions can accept input from and deliver data to a variety of application endpoints, there is often a direct tradeoff between volume and velocity.

Traditional OLAP solutions process data in batches, churning through large quantities of transactional or customer relationship data overnight, or between hours of operation. But this only works if your business goes to sleep each night, and most modern businesses do not.

To address this, businesses have adopted Complex Event Processing (CEP) systems to handle real-time processing on a continuous basis, but CEP systems have been limited by scale, unable to handle more than a few gigabytes of data in real-time.

Large-scale storage and load-balancing for Big Data with Hadoop solves problems of scale, but can't add any actionable intelligence beyond the data processing component. Additionally, the batch-based processing model of Hadoop and other Big Data solutions does not allow for the immediate actionable intelligence that businesses require today. Using Terracotta In-Genius with your Hadoop instance can help make the most of the powerful processes Hadoop offers.

Terracotta In-Genius works with your OLTP, OLAP, CEP and Hadoop systems, as well as your traditional data warehouse environments, your CRM repositories, your ERP systems and other data sources as necessary from your supply chain, customers and the Internet of Things. In doing so, it learns what data matters most, creating instinct-like heuristics to apply to business challenges as they arise.

Terracotta In-Genius is a universal platform capable of reading data from anywhere, creating actionable intelligence dynamically and delivering it to all of the places within a business where it can be applied to effect better business outcomes.

CONCLUSION

The landscape of Big Data is changing. It's no longer enough to simply collect and store information about your customers, products and supply chain.

With Terracotta In-Genius, the power of data extends to new realms to provide new insights. Data that previously lived in silos or far-flung corners of your organization can be aggregated in real time to provide concrete value to you and your key decision makers. For customers who have real-world problems that don't fit neatly into a single database solution or business intelligence platform, Terracotta In-Genius works to extract value from the array of tools you currently use and send insight back to you, wherever you are.

Terracotta In-Genius makes it possible for data to offer true insight into future patterns, propelling your business forward with new possibilities. In addition to understanding and acting on its data in real-time, your business can proactively create tremendous competitive advantage.

FOR MORE INFORMATION:
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About Terracotta, Inc.

Terracotta, the leader in in-memory technologies for enterprise Big Data, is the innovator behind some of the most widely used software for application scalability, availability and performance. Headquartered in San Francisco, Terracotta serves the majority of Global 2000 companies as customers and boasts more than 2.5 million software installations worldwide. The company's flagship BigMemory platform is an in-memory data management solution delivering performance at Big Data scale. Terracotta's other leading solutions include Ehcache, the award-winning de facto caching standard for enterprise Java, and Quartz Scheduler, a leading job scheduler. Terracotta is a wholly-owned subsidiary of Software AG (Frankfurt TecDAX: SOW). For more information, visit www.terracotta.org or follow Terracotta on Twitter, Facebook and LinkedIn.

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