



# Celequest

Business Activity Monitoring for the Real-Time Enterprise

# Solution Brief

## Manufacturing Quality Assurance

### Mitigate Quality Risk with Business Activity Monitoring

In today's fast-paced competitive environment, every product you make is a reflection of your company and brand. The impact of poor quality can have huge ramifications on your company's customer satisfaction, profitability, and brand equity. Today, quality metrics are being incorporated across the enterprise as part of a balanced scorecard that organizations use as a critical business measure. But superior quality does not just happen. Quality management is a business imperative that demands continuous, diligent monitoring of all critical processes throughout the entire manufacturing cycle.

In recent years, two major trends have made manufacturing quality assurance more challenging. The first is that many manufacturers have instituted a build-to-order (BTO) strategy whereby products are built

upon receipt of spontaneous orders without forecast, inventory, or purchasing delays. The second is the increasing practice of collaborative design, development, and distribution among manufacturers, particularly in the automotive, pharmaceutical, high-technology, and general manufacturing sectors. As a result of these trends, businesses must now collect and analyze vast amounts of data from many disparate sources to closely monitor the quality of the manufacturing process. At the same time, they cannot afford costly delays to compute and analyze the data once it has been gathered. Manufacturers need timely information that enables them to make critical decisions and take corrective action in real time when potential quality issues are discovered. Sound difficult to accomplish? That was before Celequest.

# Managing Product Quality in a Collaborative World

The factory of the future isn't what it used to be. Not too long ago, the goals for manufacturing were simple and straightforward: optimize costs, produce high-quality products, and use assets effectively. Vertical integration was a key organizing principle. But as the competitive global environment has evolved, so, too, has the role of manufacturing. A variety of drivers have contributed to the changes in manufacturing, including increased competitive pressures, more demanding customers, downsizing, the globalization of customers and suppliers, shorter product life cycles, and shorter time-to-market. As a result, many companies have employed a strategy of collaborating with different business partners in the design, development, and distribution of their products (see Figure 1).

Although collaborative manufacturing offers distinct cost and time-to-market advantages, it poses several challenges to product quality. First, collaboration itself introduces some inherent quality risk. Collaboration takes place at interfaces between components and subsystems, as well as between people across multiple business partners. Any communication error between the interfaces or people

may result in process deviations that may compromise final product quality. Second, companies no longer rely on suppliers just for raw materials and base components, but they also rely on the supply base for much of the production. For example, in the personal computer industry, several leading manufacturers rely on their suppliers for as much as 80 percent of the product's bill of materials cost. As a result, final product quality depends highly on the quality standards of each supplier.

A build-to-order strategy in a collaborative manufacturing environment also exacerbates quality risk by placing more design variables into the manufacturing process. Because they allow different combinations of product options based on customer demand, BTO systems may result in different and potentially unpredictable interactions among the options. Another contributing factor is the low variety of individual parts and raw materials in BTO operations. To efficiently implement a BTO process, companies must drastically reduce the variety of parts and raw materials to the point where these materials can be procured spontaneously by automatic and pull-based techniques. But a reduction in parts also means that the quality of each part is integral to the overall quality of the finished product.

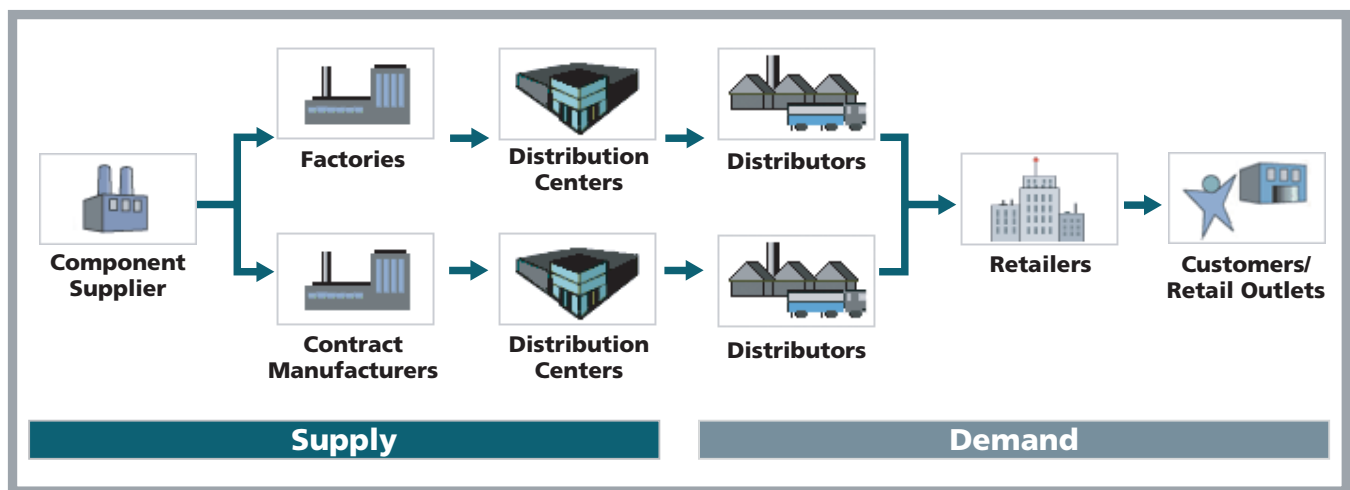


Figure 1. The collaborative supply chain

In today's collaborative manufacturing environment, having a better system of quality assurance is more than just good business, it's an absolute necessity. But monitoring manufacturing quality poses some unique technological challenges and requirements that must be fully met before you can effectively mitigate quality risk.

# Key Requirements for a Manufacturing Quality Assurance System

The single biggest obstacle to deploying a manufacturing quality assurance solution is data: data availability, data quality, and data access. Several factors make it difficult to ensure quality manufacturing:

- Data and events come from many disparate sources, including those of your suppliers, contract manufacturers, and other business partners.
- Data types and formats vary from one source to the next. Business partners in the collaborative supply chain may use different data schemas and systems to track their manufacturing process.
- Large volumes of events and data must be processed from each interface and subsystem used in the manufacturing process.
- Events are often asynchronous and must be synchronized according to time of occurrence. This capability is critical in a manufacturing environment where multiple manufacturing processes occur independently from one another.
- As new suppliers and business partners are added, the solution must be able to accommodate new and changing data types, data models, and business rules.

Given these challenges, the ideal quality assurance solution must have the following characteristics:

- **Continuous.** Critical alerts and reporting of quality metrics must be delivered in real time to enable intelligent decision-making and action.
- **Complete.** A solution must leverage all available sources of data throughout the entire manufacturing process to deliver a holistic view of quality management.
- **Accurate.** Smart decisions must be based on data that accurately reflects the true state of the entire manufacturing process.
- **Optimized.** A solution must leverage existing infrastructure investments without requiring additional data consolidation or integration projects.
- **Flexible.** The quality assurance solution must be able to adapt to different data models, data sources, or changes in the underlying sources. New business rules can be dynamically defined and modified in an iterative fashion to deal with evolving quality and compliance requirements.

# Celequest Architecture

Celequest has taken a new and fundamentally different approach to monitoring manufacturing quality through real-time business intelligence. Instead of focusing on what has happened or what might happen, Celequest focuses on what is happening in the business.

This new approach to business intelligence is called business activity monitoring (BAM). Celequest is the first software platform designed from the ground up to harness the power of BAM for manufacturing quality assurance. Without the cost and latency of traditional business intelligence or data warehousing solutions for tracking manufacturing quality, Celequest provides a solution that improves operational efficiency and profitability.

Celequest monitors material business events that provide visibility into production quality from ERP, SCM, PLM, quality test systems, supplier/contract manufacturer extranets, and other manufacturing subsystems. Individual business events are captured and then related to historical information in data warehouses or applications. When exception conditions are detected against predefined quality metrics and business rules, Celequest generates alerts instantaneously. The result is that critical alerts are produced in real time along with the related metrics and history to take intelligent action. Additionally, Celequest enables quality and production managers to create sophisticated rules for tracking deviations in product quality without requiring technical assistance from the IT team.

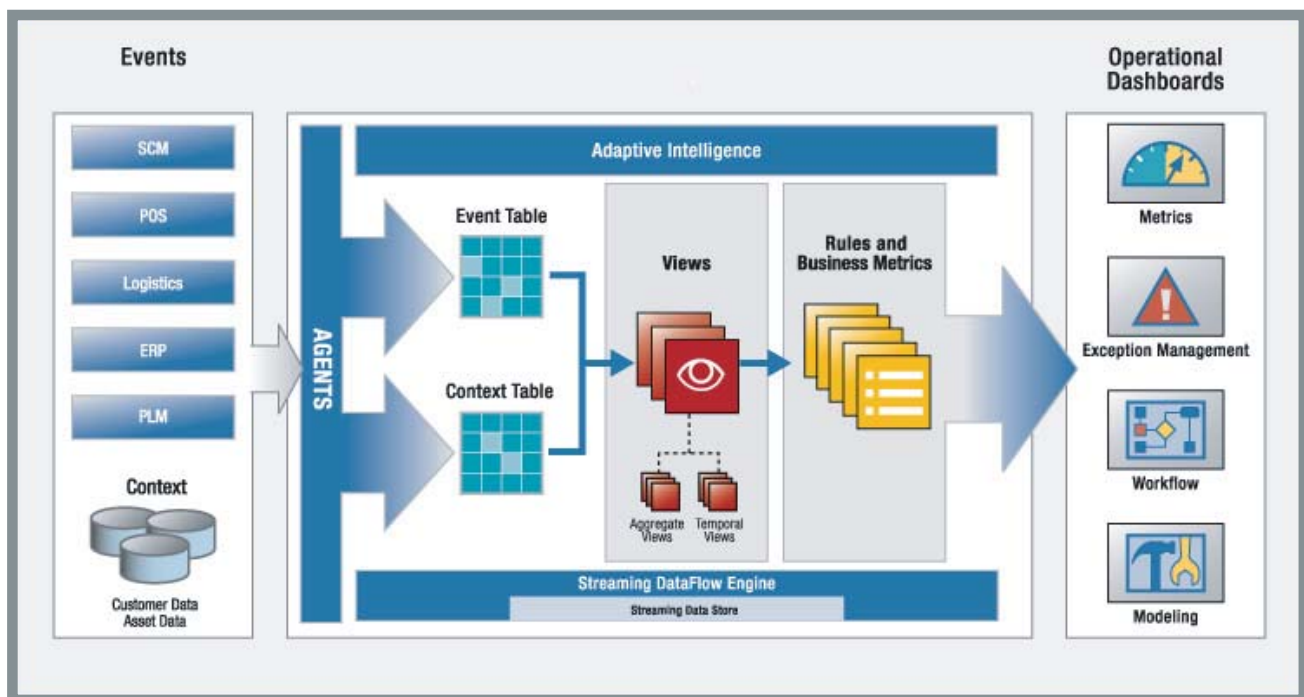


Figure 2. Celequest architecture

Figure 2 shows the Celequest Activity Suite architecture—a next-generation business intelligence platform that is uniquely suited to the stringent demands of monitoring manufacturing quality.

# A Dynamic Architecture

The core capabilities underlying the Celequest Activity Suite include:

- **Streaming DataFlow Engine.** Celequest's patent-pending Streaming DataFlow Engine monitors business events and integrates those events with contextual data from data warehouses or operational systems in real-time. The engine employs an event-driven approach that, unlike traditional batch-driven solutions, pushes key metrics and alerts to business users as events happen, minimizing the latency between events and action. Moreover, the DataFlow Engine can process data gathered from various operations or data sources to provide a complete, higher-value view of critical quality metrics.
- **Adaptive Intelligence.** Celequest's Adaptive Intelligence™ capability provides a flexible dynamic modeling system that enables business users to quickly adapt data models and apply them to live data as it is being streamed into the system.
- **Temporal processing.** Unlike batch-based business intelligence solutions that provide snapshot of operations, Celequest's BAM solution enables you to associate time with events, allowing you to identify trends over time and understand events within the larger business context. Temporal processing also enables the system to distinguish between momentary spikes and real trends. This eliminates false positives and ensures that alerts are sent only when notification and action are truly required.
- **Operational Dashboard.** The Celequest Activity Suite includes an Operational Dashboard that provides real-time visibility into business operations and key risk indicators, allowing users to quickly react to changing market conditions and make timely decisions. The Operational Dashboard can be used to acknowledge alerts generated by the activity server or to initiate actions – such as generating workflows, for example, based on alerts. Each user can personalize his dashboard with the metrics and alerts that are relevant to his job function.
- **Rich, robust analytics.** In addition to receiving alerts concerning business events, Celequest provides detailed metrics and related data that help you process and act on the alerts.
- **Seamless integration.** The Celequest platform easily integrates with operational applications and legacy systems that already exist in your environment via standard interfaces.

# Manufacturing Quality Risk Metrics

The Celequest Activity Suite enables you to easily and quickly define and create business rules for tracking manufacturing quality risks. You can customize them according to the unique quality management standards of your organization. Following are examples of situations in your manufacturing environment you can track using custom business rules:

- **Yield drops.** Alert when the yield has dropped in a particular quality test. Based on the duration of the yield drops, you can take the appropriate action. For example:
  - For a 1-day drop in yield: notify the contract manufacturer of the issue.
  - For a 3-day drop: notify the supply-base engineering and quality groups.
  - For a 30-day drop: notify the product planning and quality groups.
- **Critical component failures.** Alert when a yield drop is accompanied by a high percentage of failures of a critical component.
- **MTBF and MTTF.** Alert when the mean-time between failures (MTBF) or mean-time to failure (MTTF) exceeds the accepted threshold.
- **Impacted products.** When a yield drop is accompanied by a critical component failure and the component is used to manufacture multiple products, the manufacturing process of the affected products may need to be temporarily suspended.
- **Yield drop caused by revision change.** Components are constantly being “revved” in terms of their revision numbers. Compare the yield of the older part revision with the newer revision to ensure that the two production lots are of the same quality.
- **Supplier qualification.** Create metrics that alert on critical performance measurements for a new supplier such as defect rate, on-time deliveries, price/performance, purchasing compliance, and so on.
- **High customer return rate.** Alert when the percentage of Return Merchandise Authorizations (RMA) for a particular product lot exceeds a specified threshold.
- **Inventory turns.** Alert when the number of inventory turns for a product line drops below a specified threshold.
- **Cycle times.** Alert when the cycle time for a product line exceeds the specified time period.
- **Scrap and rework costs.** Alert when scrap and rework costs exceed a specified percentage of sales for a product line.
- **Customer lead time.** For a BTO operation, alert when the lead time for an order exceeds the time period promised to the customer.
- **Delivery times.** Alert when the deliveries of critical components, which are used to produce multiple products, have not been met.
- **ISO 9000.** Alert on various metrics to ensure compliance with ISO 9000 requirements.

# Dynamic Presentation and Workflow

Celequest's patent-pending Streaming DataFlow Engine provides the core capability to monitor real-time business transactions and compare them with historical patterns while updating those patterns as well. To compile a complete and accurate view of manufacturing quality risk, business events and data should be streamed into the DataFlow Engine. The system can process a wide variety of data types and formats from different sources including databases, data warehouses, ERP, SCM, PLM, and custom applications. As events are streamed into the system, the Celequest Activity Suite automatically and instantly delivers real-time updates of what is currently happening, giving you the most up-to-date view of critical manufacturing quality metrics and activities possible. Business users can link into any Excel spreadsheet and Celequest continuously updates the metrics and graphics within the spreadsheet to transform it into an intelligent and live operational dashboard (see Figure 3) for monitoring quality.

Celequest can deliver alerts, metrics, and reports into any workflow or case-management environment. Email systems, RDBMS, Web services, middleware, and custom applications are all acceptable recipients of Celequest information. Alerts can be timed and escalated based on user-defined intervals to maintain the highest levels of vigilance. Additionally, you can create custom workflow rules that automate the escalation of alerts to different users based on their roles and responsibilities for ensuring quality. The Celequest system includes an Operational Dashboard that serves as a central location for viewing and managing alerts as shown in Figure 4.

## Adaptive Data Modeling

Unique to the Celequest Activity Suite is its Adaptive Intelligence™ capability, which allows you to adapt data models easily and quickly and apply them to live data as it is being streamed into the DataFlow Engine. The Celequest BAM solution is uniquely designed to seamlessly support new data models, data types, data sources, and business rules. Conventional business intelligence solutions can take weeks, if not months, to accommodate changes to their data models. The Celequest Activity Suite makes such changes easy without requiring changes to the underlying systems. Quality and production managers can use the Operational Dashboard interface (see Figure 5) to create new rules and quality metrics without having to wait for IT assistance.

The Operational Dashboard employs a spreadsheet-like interface that makes it easy to specify business rules and exception conditions and enables you to adapt those rules as conditions change over time. Conventional business intelligence solutions can take weeks, if not months, to accommodate changes to their data models and most do not support rules that business users can change on their own.

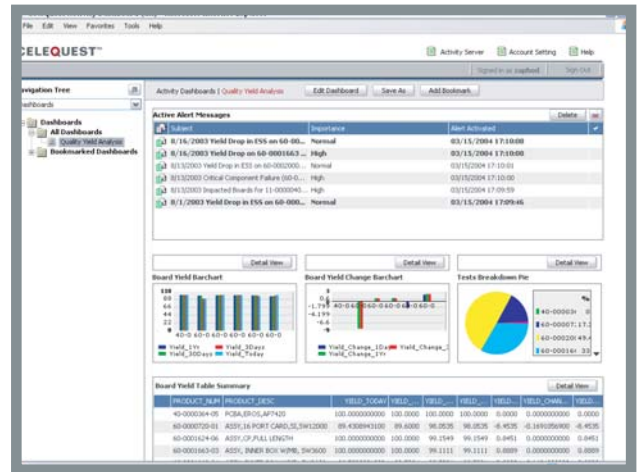


Figure 3. Operational Dashboard, which tracks production quality in real-time

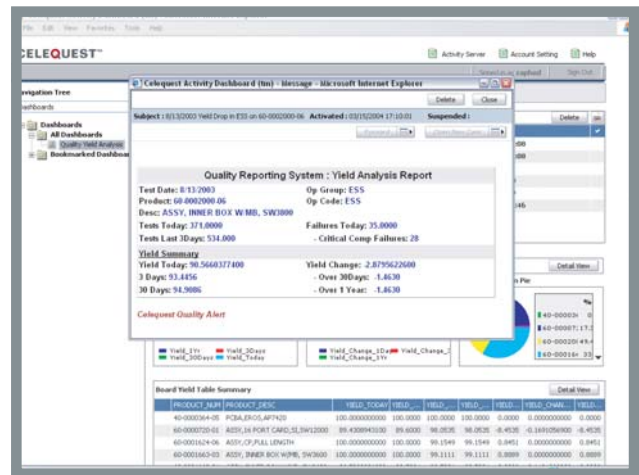


Figure 4. Alerts in the Operational Dashboard

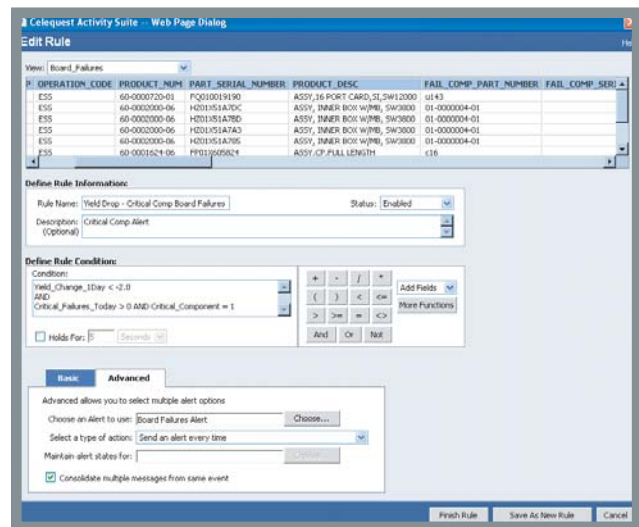


Figure 5. The Operational Dashboard, where custom rules are created

# The Celequest Advantage

As collaboration plays an increasingly important role within the manufacturing supply chain, companies are finding that managing product quality is more complex now that manufacturing activities are distributed across many entities. Celequest Activity Suite provides real-time business activity monitoring to help you meet the difficult challenges of monitoring and managing manufacturing quality assurance.

The Celequest Activity Suite includes Streaming DataFlow Engine and temporal processing capabilities, delivering benefits to both business and technology executives as outlined below.

## Business Benefits:

- Maintain high customer satisfaction and protect your reputation by ensuring that your products are developed with the highest quality.
- Avoid losses resulting from providing poor-quality products that result in costly penalties or refunds to customers, expensive rework, and lost sales to competitors.
- Improve efficiency and profitability. An enterprise wide view of quality risk should be incorporated into operational decision-making to improve efficiency and increase profitability.
- Provide greater transparency into the quality risks facing your manufacturing operations.
- Reduce cost by eliminating the prerequisite of consolidating and integrating data. Celequest provides a complete BAM solution—you do not need to manage a separate ETL tool, rules engine, and alerting tool, nor do you need to integrate them.

## Technology Benefits:

- Increase manageability. Celequest's tools and SQL compliance leverage your existing IT skill set and provide comprehensive graphical tools to manage events, context, rules, and alerts.
- Maintain flexibility and adaptability. Respond to changing quality requirements as they occur. Celequest's Adaptive Intelligence™ dynamically and automatically adapts to changes in data models or business rules based on new suppliers, regulations, or quality metrics to ensure that you are always meeting the specified quality standards.
- Protect your investment by leveraging existing data sources. Using Celequest's DataFlow Engine capability, you can implement true real-time alerting quickly and deploy new monitoring capabilities without having to modify your existing infrastructure.
- Increase maintainability. Celequest's use of a virtual, in-memory database eliminates the need for you to maintain an additional database or data warehouse. Celequest leverages your existing data warehouse/ODS as a context source to simplify the database maintenance requirements of your BAM solution, while reducing cost and time to market.

## CELEQUEST™

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