QUAD
Solutions Limited

RIQUADRO SOLUTION OVERVIEW

RIQUADRO

SOLUTION OVERVIEW

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1 INTRODUCTION

The information systems of banks and financial institutions, regardless of their size, are characterized by increasing complexity linked to the continuous need for technological, regulatory and business innovation. These systems consist of a set of application chains through which information is altered and processed either manually or automatically.

The increasing complexity requires, at an organizational level, the creation of global control structures with "end-to-end" chain and data skills and competences, able to manage both technological and application aspects.

In order to have a continuous vision and an effective and reactive management of daily business events, it is necessary to intervene globally on the system by adequately increasing the following two factors:
- control
- monitoring

In this context, RIQUADRO is proposed as a flexible solution capable of running the business processes of banks and financial institutions in real time, regardless of size and in all applicable areas.

2 PRODUCT DESCRIPTION

RIQUADRO is an integrated suite that provides end-to-end control of data, messages and flows. It is a highly configurable and customizable solution, allowing the user to model the product according to their needs. It is extremely versatile and adapts easily to small application parks and complex information systems.

In addition to ensuring ease of use and extensive customization, the use of RIQUADRO also allows for:

- the efficiency of the Customer's production processes;

- lowering of the assignment and troubleshooting times;

- the reduction of unforeseen disbursements due to non-compliance with system cut-offs

- an increase in the performance of operational processes

RIQUADRO consists of a set of self-contained and perfectly integrated modules:

- Monitoring: monitors business processes in real time, allowing proactive anticipation of anomalous situations in application chains.

- Reconciliation: performs reconciliation of the numerical data of heterogeneous applications, allowing in a simple way the quadrature of any application park.

- Matching: performs the analysis and matching of complex information. Facilitates reconciliation and data matching operations by trying to keep manual intervention to a minimum.

3 ARCHITECTURE

The following diagram shows the main components of the solution.

The system collects information from an application park or database, triggering a process of information normalization to supply the internal database.

Then, in real time, RIQUADRO updates the dashboards and connected client applications while sending alarms, notifications and reports in different formats and modes.

General Architecture
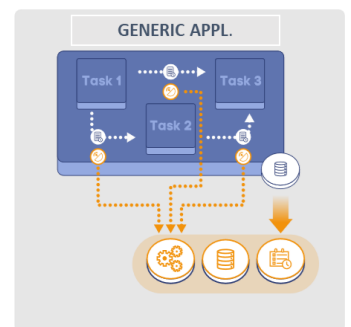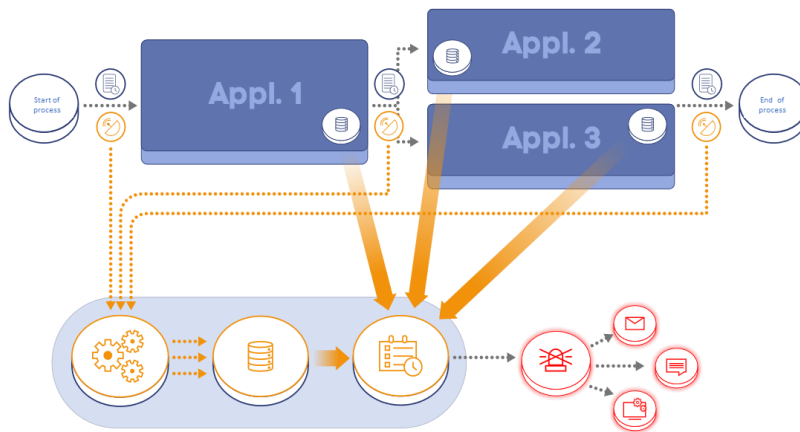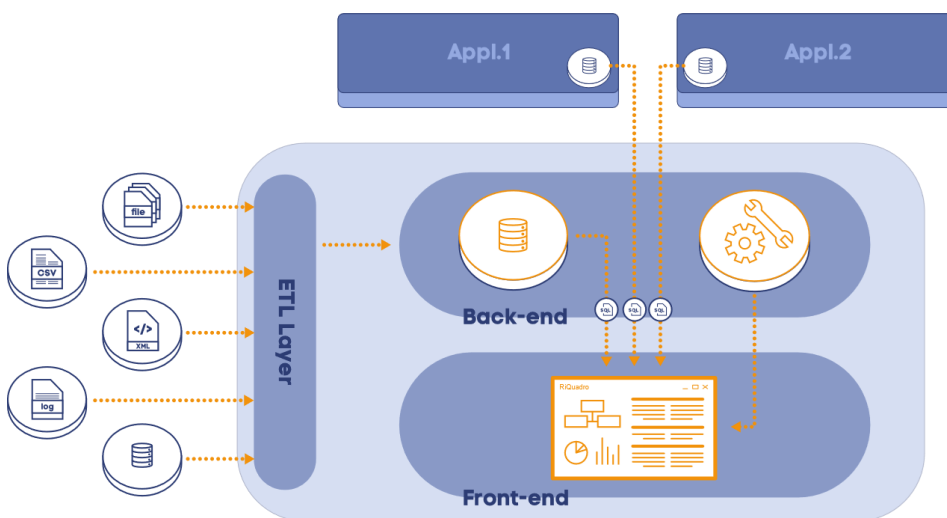
4 ELEMENTS OF THE SOLUTION

4.1   Monitor Engine

The RIQUADRO engine represents the heart of the product whose macro-functionality is summarized in the management of information procurement, management of information analysis, management of monitoring and investigation rules and management of the alerting system.
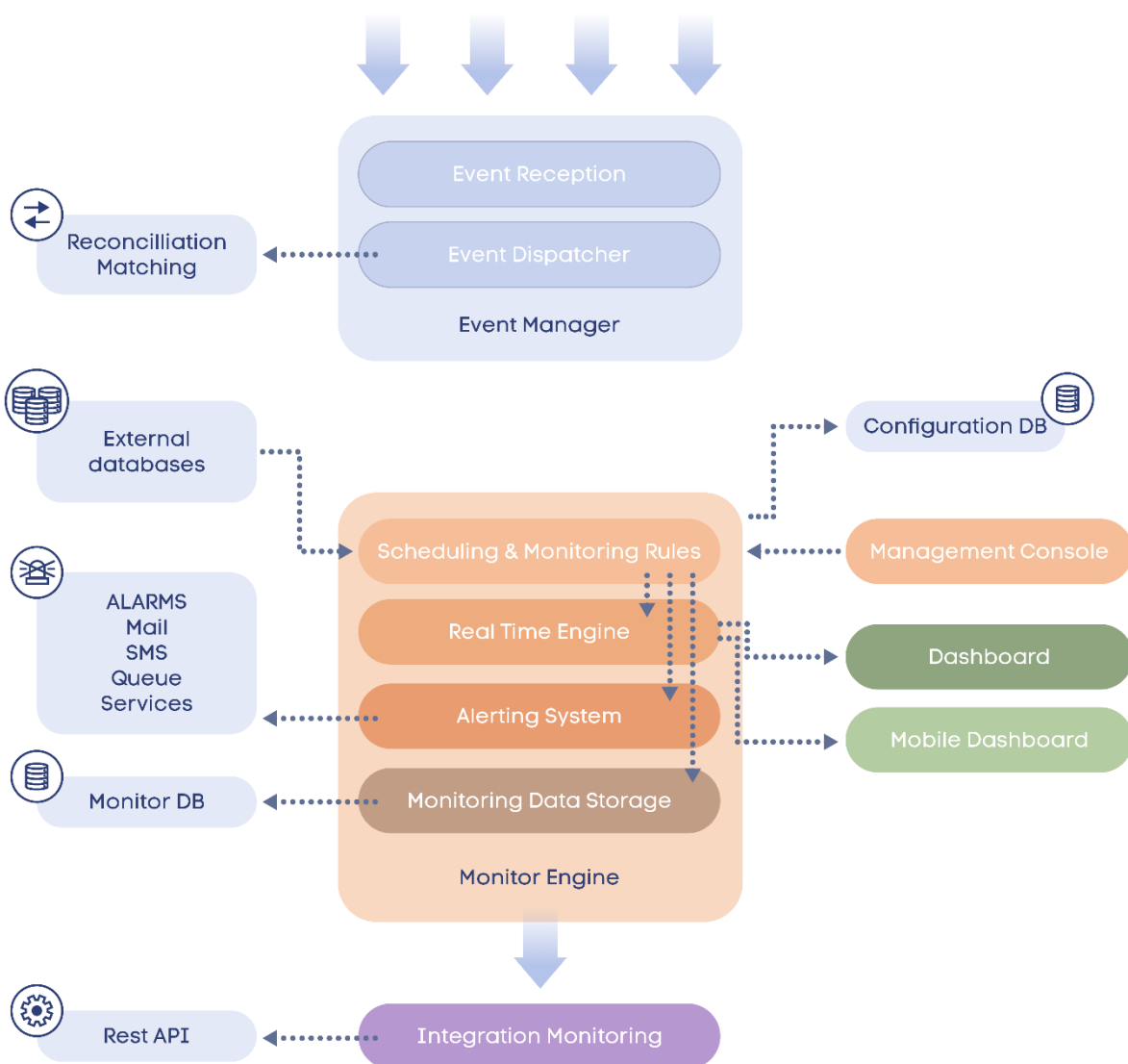
High level architecture diagram

The figure below introduces the different components of the engine:

- **Event Reception:** processes the information received from applications through events (MQ\JMS and information received from applications in various formats) or sequential files; normalizes and enriches the information received and saves it to event databases making it available to all modules of the suite.

- **Event Dispatcher:** forwards normalized events to the various modules in the suite based on configuration rules. Communicates in synchronous mode with engine monitoring and in asynchronous mode with the other optional modules (Reconciliation, Matching etc.).

- **Scheduling and Monitoring Rules**: performs surveys of information on the product database or by linking to external databases, applies controls based on user-defined thresholds or retrieved from the historical database. It updates data in real time to the Real-Time Engine and activates the Alerting System to send alerts.

- **Alerting System:** the system manages the configured alerts and notifications that will be forwarded to the recipients via email, sms, queues, push notifications, based on an alarm distribution list.

- **Real-Time Engine:** each time the information in the product database changes, it updates all the contents of the dashboards and the pages involved on all the registered devices.

- **Monitoring Data Storage:** collects recovered data through the Event Reception and Scheduling and Monitoring Rules components and stores it on the product database. The component is also able to identify events useful for statistical purposes, can aggregate information and contribute with these functions to the creation of a historical analytical database.

- **Integration Monitoring:** is the module that monitors the entire RIQUADRO suite in order to ensure system reliability through proactive metrics checks and sensitive indicators. It can interface with professional network and application monitoring systems (e.g. Zabbix) allowing complete monitoring coverage and easier integration with existing monitoring systems.

4.2   Presentation Layer

In the RiQuadro suite, the presentation layer part is represented by an interactive and multi-platform visualization tool that allows you to create, explore, and share dashboards. This provides a rich set of components (widgets) for the management and configuration of graphics, monitoring systems with custom alarms, user profiling, and customizations.

Its main components are:

- **Dynamic Dashboard**: web pages dedicated to the end user and allow activity monitoring.
- **Management Console**: **Console** for product configuration and *runtime* aspects.

Dynamic Dashboard

The dashboard is a web page where all its elements communicate and are strategically placed to perfectly interpret the monitoring needs of the end user.

The Dynamic Dashboard is a page consisting of a set of widgets organized and displayed in a grid. Through dynamic dashboards, RiQuadro allows you to monitor business information in order to get a clear picture of the status and performance of all the services you want to monitor. In addition to being able to view the information, the user has the ability to interact with the dashboard:

- customize the layout working on the change of the theme and then the style of the entire page
- position the various widgets, through "drag&drop" functionality, in a way congenial to your use
- each graph can define thresholds in order to customize and maximize the benefits of the alarm management mechanism
- use search filters created specifically for a single widget

Below is an example of a Dynamic dashboard of the product.
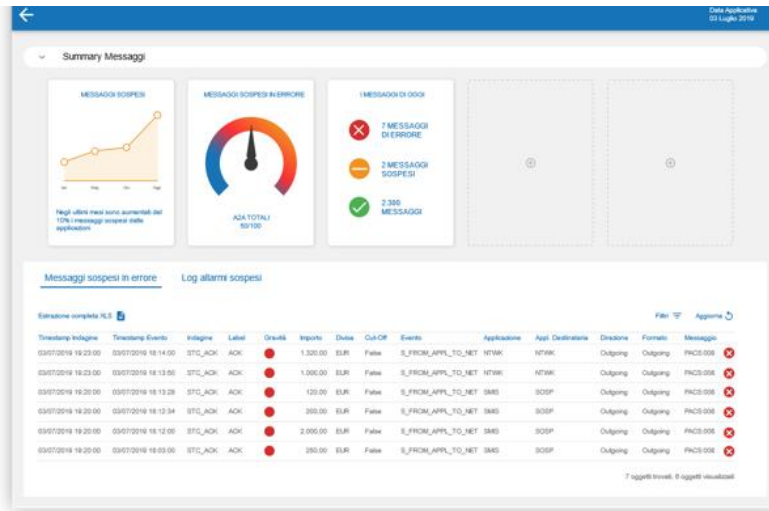
Graphical widgets to highlight anomalies, thresholds and service levels. Clicking you access to drill down to new dashboards

Personalized management of widgets

List of anomalies detected with the possibility of viewing detailed information

Possibility to tick the notification of anomalies taken in charge and / or resolved.

Management Console

Management Console represents the product configuration console composed of:

- **monitoring rules/actions designer**: aimed at creating and configuring surveys, defining actions for sending alarms, defining distribution lists to identify a set of recipients,
- **page composer:** creating pages/dashboards
- **user profile management**: authentication/authorization management, creation of groups, role management, creation of enablement sets, and feature census.

Monitoring rules

The configuration of the monitoring rules defines the data survey logic, aimed at controlling business processes and the exchange of information between systems in real time.

At a logical level, a survey can be schematically illustrated by the following figure:
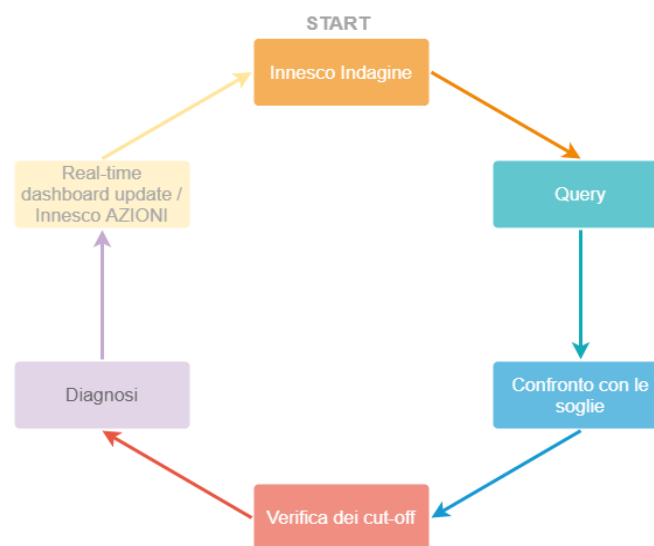
The surveys are activated on the basis of a time schedule using a *"cron"* type expression. Each survey may have more than one schedule and be associated with a specific calendar.

You can also associate the "Automatic Recovery" feature to each survey. The recovery investigation checks whether the conditions that generated the alarm still exist, if not, an alert is automatically sent to all the recipients of the alarm to close it.

Below is an example of configuring the *cron* expression via the application's web page:

Every investigation must be associated:
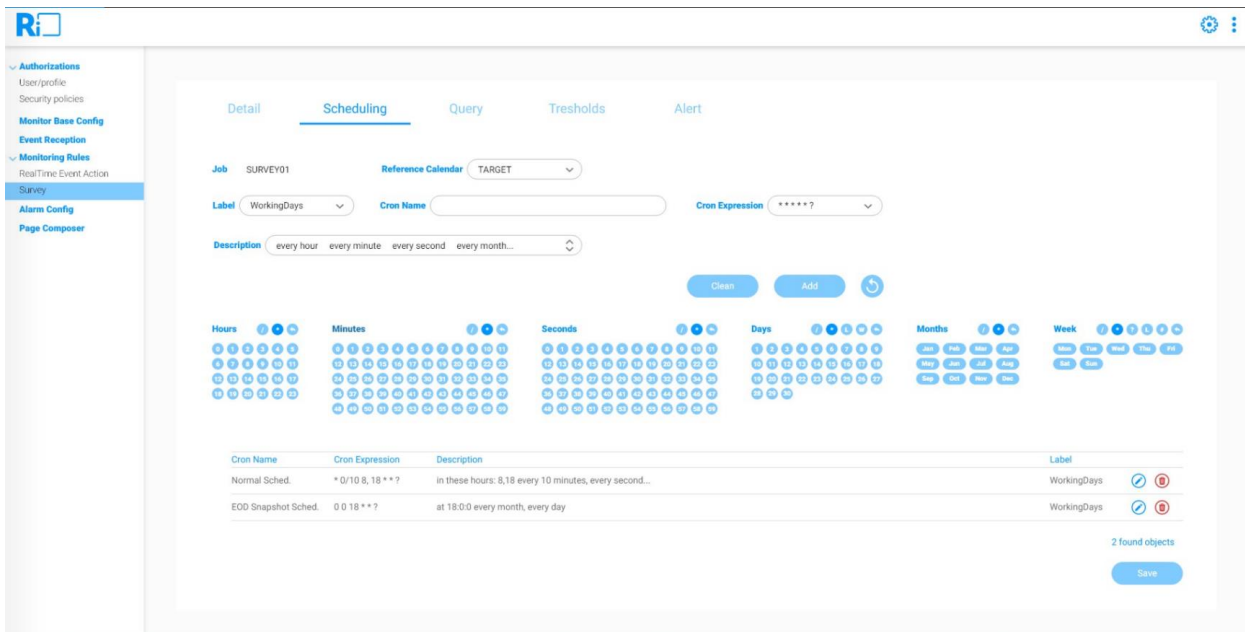- to a Monitor Engine: the system automatically creates the query leaving the user the possibility to define further filter criteria concatenated to the "*where condition*" generated;
- to a Free Query: the user has full freedom to define the data extraction query.

Surveys based on Monitor Engine can be classified into 3 distinct types:
- SuspensionEngine: detection of processes, automatic or manual, waiting for an excessive period of time;
- TimeStatsEngine: amount of operations, time range or amounts that deviate from expected values;
- ExtractEventStoreEngine: extraction from external database and saving the information extracted as events via Monitoring Data Storage.

Various elements can be configured within the surveys:
- Define whether the investigation extracts events related to messages or files;
- Define whether the survey should filter the result according to the cut-off;
- Define whether the investigation should activate automatic recovery;
- Establish the scheduling frequency of the investigation and recovery;
- Define the type of investigation (Free Query or Monitor Engine);
- Depending on the type of investigation define query and where condition of extraction;
- Associate one or more threshold levels (Threshold) among those surveyed;
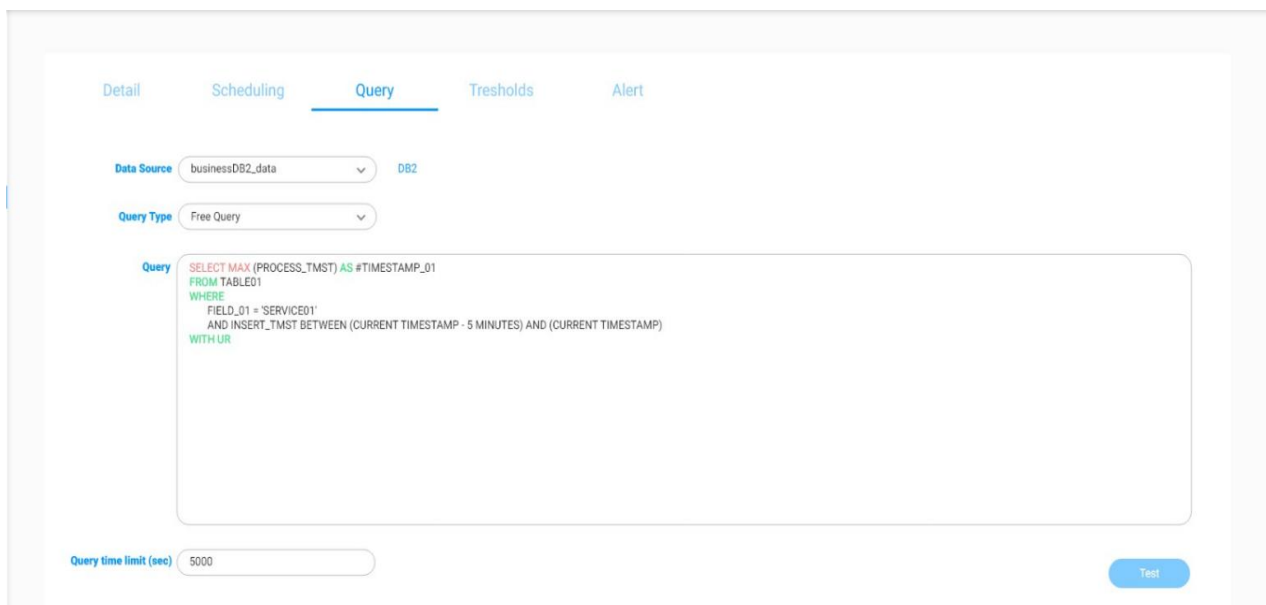- Associate one or more actions to be performed at each threshold.

Within the thresholds you can configure:
- Timetable range (from\To)
- Days (WorkingDays\Holidays etc.)
- Calendar (ex: Target)

You can also associate to each Alarm/Notification:
- Distribution list
- error/gravity code
- description (with placeholders that are resolved at run-time with the extracted values the query)
- maxRetry (maximum number of items)
- waitingTime (time interval between mailings)
- maxElements (maximum number of out-of-threshold elements to be sent in the alarm detail)

Below is an example of Free Query:

Actions Designer

After entering the threshold values, you can configure the actions to be performed in case of "out of threshold":
- INSERT: inserts evidence of suspension on the suspended management table;
- DELETE: deletes evidence of suspension from the suspended management table.
- MATCH: The match action involves matching the event being processed with a previously processed event to retrieve information from the latter and set it to the event being processed if it is not present.
- ALARM: The ALARM action is performed upon receipt of the event and allows an alarm to be sent to a distribution list.
- REPORT: you can associate distribution lists to reports as for notifications and alarms.

The alarm management is in charge of the Alerting System module which takes care of forwarding the alarms to the configured distribution lists and sending the alarm information to be historicized on the database to the Monitoring Data Storage module.

The Alarm module provides the configuration of distribution lists, each distribution list can contain the following types of addresses:
- o Email addresses
- o Sms addresses
- o Address groups
- o Groups of Addresses based on data hierarchy
- o External Resources

Address groups may contain:
- o Email addresses
- o Sms addresses

The groups of addresses based on the hierarchy of belonging of the data allow to define email or sms addresses linked for example to a banking group in a multi-bank or service center configuration; the levels of belonging are 3
- o Level 1 (ex: Holding)
- o Level 2 (ex: Bank)
- o Level 3 (ex: Branch)

Page Composer

The Page Composer is the tool that allows the creation of pages (dashboard) for rendering information, composing and configuring different widgets (tables, different types of graphs, etc. ...), taking care of both display and functional aspects.

The tool provides a pre-packaged page (template) or a grid to use as a drawing board to compose the page. In addition to being able to position elements (widgets) typical of a dashboard such as graphs and tables, there are also widgets belonging to a normal web page such as an accordion or tabs, allowing you to enrich the page by inserting navigation and communication logic between the different elements.
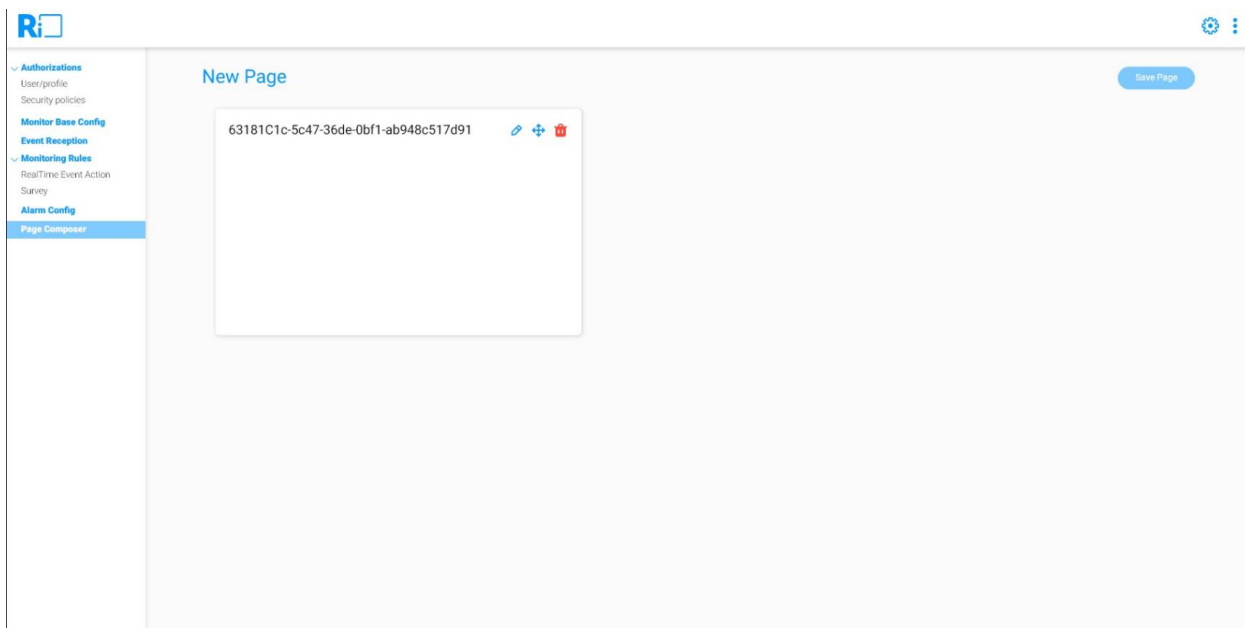
In the settings panel there are grouped configurations available as follows:

General: allows you to set the general scope information of the widget (e.g. the title)

Variables: where you can define a list of variables. Depending on the type, a variable can be used for example as a search filter, in a query, as a mapping with other variables of other widgets, used in the interaction of events, etc.

Data: in the data section you have to indicate which is the data source, first of all identifying the type as a query or a service. In the case of a query you have a Query Editor that allows, after selecting the data-source, the definition of one or more queries

Advanced: in advanced there are the specific configurations by widget type. If the widget provides for this, first select the subcategory (e.g. graph type) so that its possible configurations, including styling and data formatting options, are dynamically loaded.

Events: this section is dedicated to the management of events between components. Summarizing a widget, you can listen to an event triggered by another widget, so that you can launch your own action whenever the event you listen to is triggered. This Event-Engine is a powerful tool that allows multiple widgets to dialogue with each other.

Below is a screenshot of the composer with all his elements.
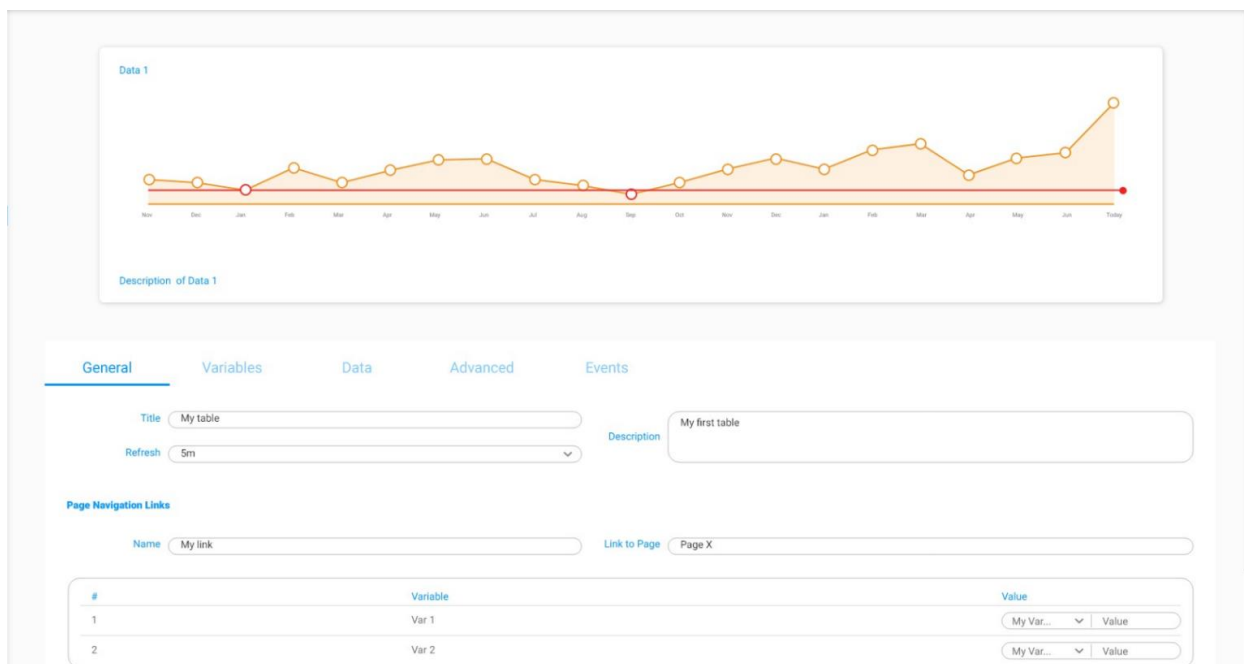
User Profile Management

Through User Profile Management, it is possible to manage users and profiling, adapting to extremely complex organizational structures, allowing to assign roles and privileges with high granularity.

The configuration of the profiles in RIQUADRO is extremely widespread and allows you to enable every single element of the pages implemented through the Page Composer.

Security Policy

To meet the different security policy needs of organizations RiQuadro provides a section dedicated to the definition of policies, allowing a high degree of configurability and following the guidelines provided by international security standards.

5 FORMS

5.1 Monitoring

The Monitoring module is able to control in **real time** the business processes in charge of processing operations and the exchange of information between systems.

Its main features are to:

- o Proactively **anticipate possible causes of disruption by** increasing the speed of problem identification and in many cases avoiding impacts on end users;
- o **Verify that** automatic or manual **tasks are executed** correctly and on time;
- o **Control data sending and receiving** processes, inside and outside the information system
- o **Automatically detect deviations** from reference models or normal system operation;
- o In case of anomalies, **alert the persons in charge**;

The Monitoring module **dynamically investigates the collected data in** order to identify and prevent abnormal situations and then report them to the relevant offices.

There is a **sophisticated scheduling system** that makes it possible to plan the execution of investigations at set intervals.

The possible investigations, as already highlighted, are classified into the following three types:

- SuspensionEngine: detection of processes, automatic or manual, waiting for an excessive period of time;
- TimeStatsEngine: amount of operations, time range or amounts that deviate from expected values;
- ExtractEventStoreEngine: extraction from external database and saving the information extracted as events via Monitoring Data StorageData Storage

Below are examples of configurable surveys:

Survey Example	Scheduling
Verify that the messages processed are between 70% and 150% of the average of the previous day.	From Monday to Friday at 20:30
Verify that all the provisions sent get an outcome	From Monday to Friday from 21:20 to 24:00 every 15 minutes
Check that the are no suspended operations between one application and another.	On working days European calendar Hourly
Check for negative validations (reject) .	On working days European calendar Hourly
Check that a device performs at least one operation every 10 minutes.	Everyday Every 10 minutes
Checks the correspondence, for quantity and amount, between the messages sent by the back-end and that received by the telematic channels.	From Monday to Friday at 22:00 to 22:30

5.2   Reconciliation

The Reconciliation Module consists of a mix of BAM, SQL queries, mathematical formulas and graphical widgets designed to **facilitate the balancing of** quantities and amounts.

Its main functions are to:

- **Reconcile the numerical data** of heterogeneous applications by centralizing it in a single point;
- **Apply the quadrature** with extreme simplicity to any application park thanks to a generic power supply interface;
- **Graphically represent** both the applications and the individual tasks at the base of the operating processes, thanks to its **high configurability**
- **Allow to send an alert** by email or text message in case of no reconciliation;

RiQuadro is fully configurable and congruent with the enabling profile of each connected user.

Dedicated buttons allow direct access to the total and suspended pages of each application area.

The Initial Framework provides immediate evidence of the quadrature status of internal applications and/or towards counterparties and/or service centers.

For each user it is possible to create a custom view by freely grouping the squares by application service, telematic channel or other grouping.
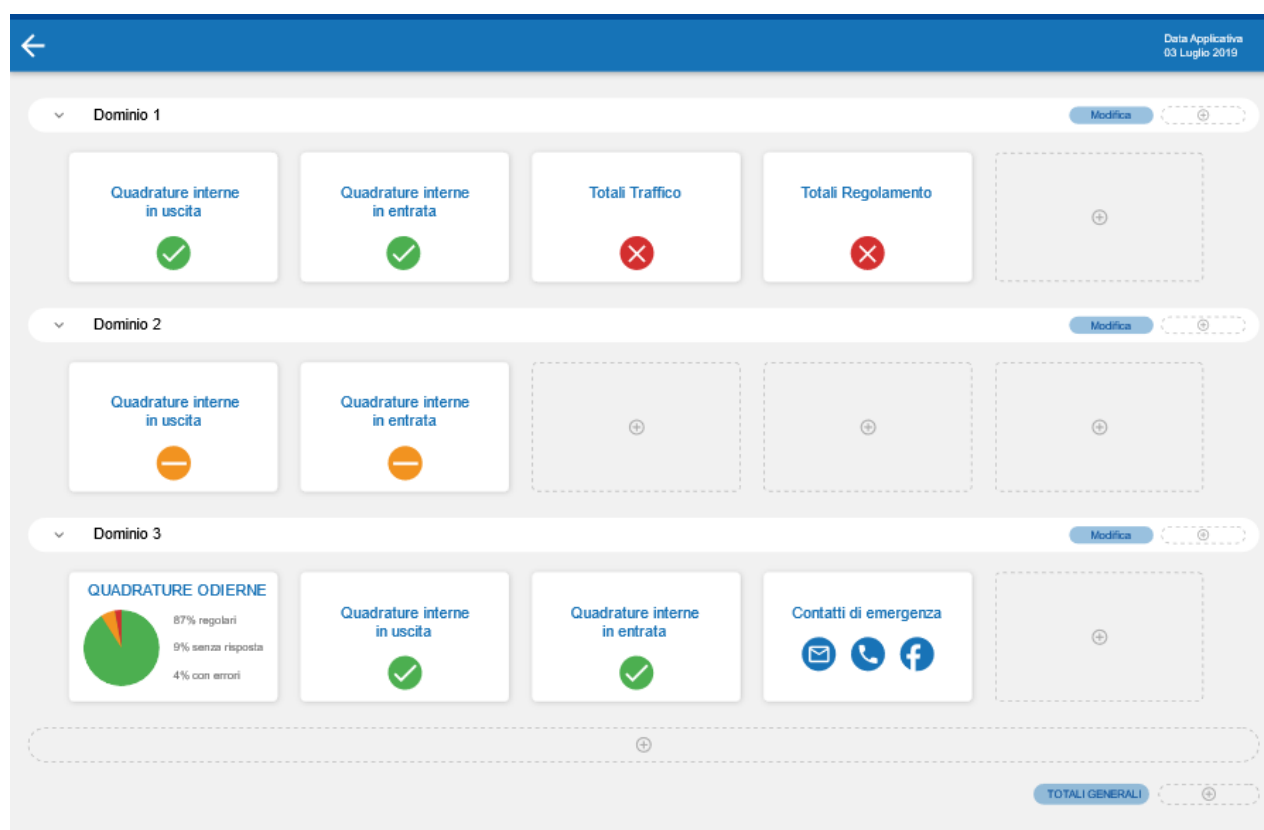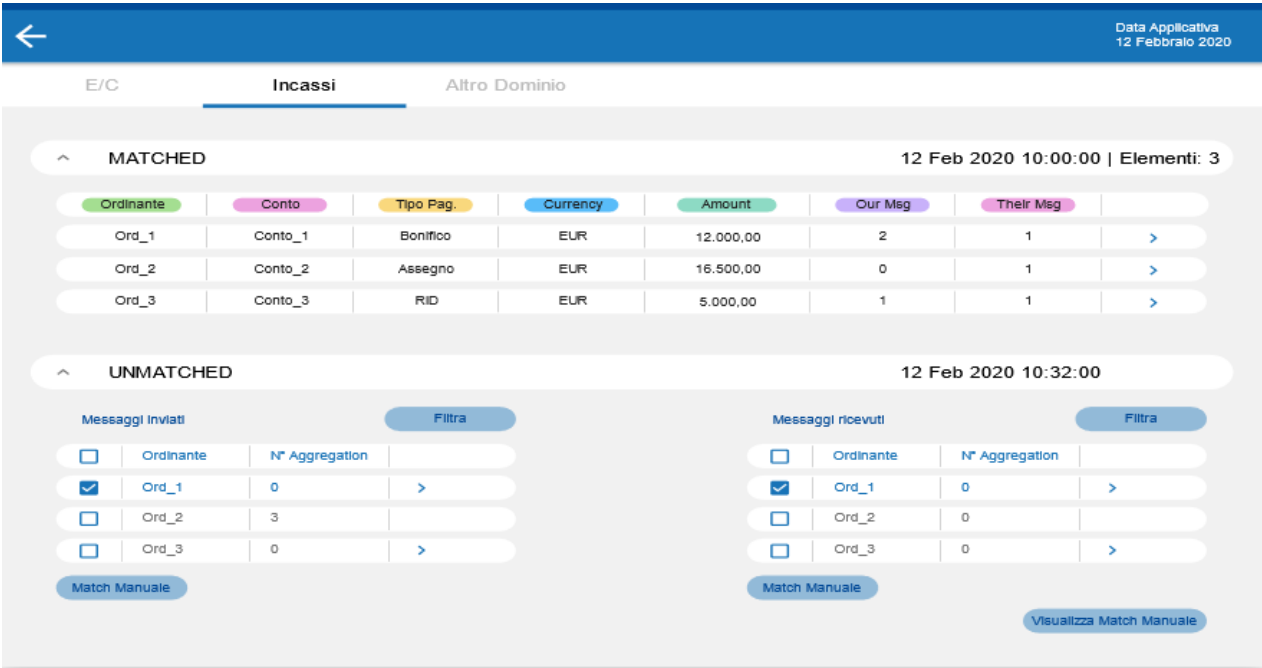

5.3   Matching

The Matching module is designed to perform **the analysis** and **matching of** complex information.

Its main features are the following:

- **Facilitate reconciliation** and data **matching** operations by trying to minimize manual intervention.
- Allow, thanks to its **high level of configurability,** to reconcile the most varied information flows with other flows;
- **Provide intelligent matching algorithms** that suggest data flows that have common characteristics;
- Allow **customization of user interfaces** based on the most relevant information for the user or a specific context
- Produce **grinding movements** for the balancing of any open batches or for the opening of new batches
- Thanks to the rules set by the users, over time the **matching percentages** tend to **increase**;

Below is an example of a **"many to many" survey monitor** with "single-view" **surveys**, for reconciled messages, and "comparison-view" surveys, for messages that the system has failed to reconcile. The user can intervene on the latter by entering manual matching rules that will be assimilated by the system and used for subsequent reconciliations.
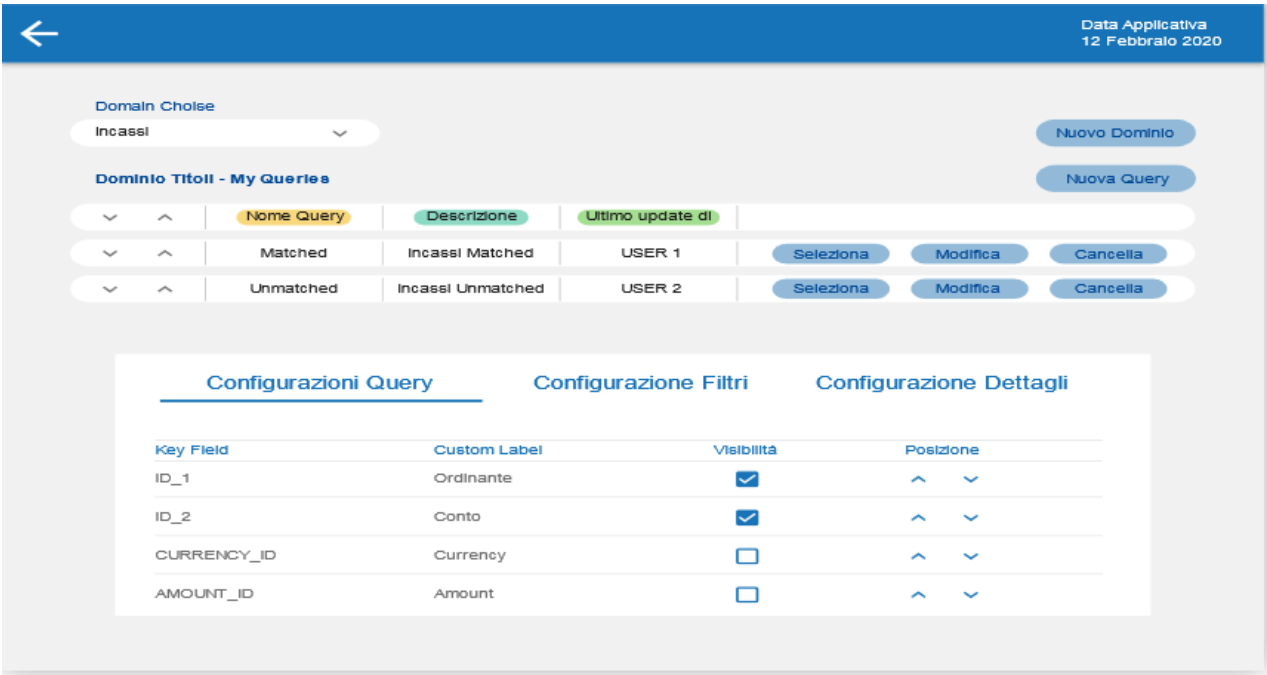

The interface makes the visualization of information flows easy and immediate:

- Configure the domain and its dashboard
- Make it easy to configure the fields to be displayed in detail for each individual match and the header sections of the detail for each survey
- Make filter screens for "comparison-views" easily configurable for each survey
- Configure each survey by defining an inquiry from the simplest to the most complex aspects.
- Make result lists easily configurable, including labels, columns and visibility of results for each survey.

6 STABILITY, SCALABILITY, TRACEABILITY, SAFETY

6.1 Stability

The solution is developed on a mature and robust Java framework at the base of many applications, including mission-critical, currently installed and in use in production in various banks.

The event reception module guarantees the full operation of the listener ports associated with the reception queues even in case of "poison message".

"Poison message" means messages sent on a queue (jms\mq) that cannot be processed by the receiving application and that exceed the maximum "retry" limit defined on the listener port listening on the queue. Usually this happens in case of errors found by the receiving application on the message being processed, causing the listener port to stop processing any correct messages in the queue.

6.2 Scalability

The solution guarantees load scalability both in terms of vertical scalability (increasing the processing capacity of the individual machine) and horizontal scalability (adding other machines in load distribution).

6.3 Traceability

All operations carried out by the user on web configurations are logged in and made available for consultation via web pages.

The run-time component uses log4j as the logging mechanism.

6.4   Security

RiQuadro is equipped with a sophisticated User Profile Management facility to manage profile authentication/authorization, group creation, role management, creation of enablement sets and feature census.

RiQuadro has its own SSO (Single-Sign-On) system but can be integrated with the SSO and profiling system used by the customer.

Further details can be found in the User Profile Management description section.

7   SOFTWARE REQUIREMENTS

Operating Systems
AIX
Red Hat Enterprise Linux - Server Architecture
Microsoft Windows Server

Application Server
IBM WebSphere Application Server
Oracle WebLogic Server
JBoss Enterprise Application Platform

Database Management System
Oracle Database Server
IBM DB2
MySql

Message Oriented Middleware Services
IBM WebSphere MQ

8   COMPANY OVERVIEW

Quad Solutions Ltd is a Payments specialist IT Services and Solutions company based in Malta. It is a distributor of the RiQuadro solution from Payotik. Payotik is a company of the Corvallis Group, a leading IT services company on the Italian market, with a high added value offer aimed at the banking, insurance, industrial and service sectors and public administrations.

Payotik is a company specialized in the management of complex projects in interbank networks, payment systems and technical and application monitoring of enterprise architectures.

Founded and represented by experts who have played primary roles in the management of Italian payment systems for over twenty years, Payotik in recent years has gained significant experience in System Integration activities on projects where it was necessary to integrate different components of the information system, often distributed on heterogeneous platforms.

The many years of experience gained in the Finance sector have enabled the creation of innovative solutions for the control and reconciliation of data flows in complex information systems.