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Beyond the SAS® Credit Risk Management Solution: The Gruppo Banca Carige Credit Monitoring Model and the Keinavo Advanced Web 2.0 Reporting Framework

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ABSTRACT

CARIGE Group implemented a new model for credit monitoring that allows for the automatic survey, control, and operational management of the customer base. A structured and industrialized management delivers more effectiveness and efficiency in the credit monitoring practice, enabling CARIGE to improve their portfolio quality and the operational efficiency across the entire credit-allowance chain:

- By integrating the internal rating, the model provides the network with the elements for managing the potential deterioration of credit rating in a precise ("daily") and anticipatory way.

- By providing the executive board with a real-time, drilled-down reporting on the status of the loan portfolio, the model allows for a decrease in the incidence of unpaid loans and absorbed capital.

Keinavo has exploited the full potential of SAS® 9 through a framework that is integrated to SAS® Credit Risk Management through the SAS Java APIs. The framework is used to quickly and easily create rich Web 2.0 user interfaces, which are distributed through CARIGE's intranet. Today, CARIGE's credit monitoring stands out because of its immediacy, accuracy, and effectiveness.

INTRODUCTION

The credit monitoring process is a key process in the finance business. The process can be split into two main parts, or phases: detection and management. The former refers to the activities that find, or detect, anomalies in the credit behavior of the customer base, while the latter refers to the activities to collect the debt of anomalies and their costs.

Among the success factors in the financial services industry we should consider:

- Accuracy of anomaly detection

- Frequency of anomaly detection

- Efficient, fast and accurate anomaly management and treatment

CARIGE's old approach to anomaly detection and management was not very efficient. It relied on a centralized office to detect and communicate the anomalies to the organizational units. Detection was based on a system that was not well integrated; the system also had too many indicators, some of which had marginal relevancy. The lack not only of a consistent set of rules, but also of a structured information system, also made the process difficult and not fluid. Communication was done via email, phone calls and letters, making information management cumbersome.

In order to gain efficiency, CARIGE decided to reengineer their credit monitoring processes. The new process is supported by a reporting-dashboard platform integrated with the SAS Credit Risk Solution and the SAS Enterprise BI Platform and a reporting framework implemented by Keinavo.

A NEW CREDIT MONITORING PROCESS

The new reengineered monitoring process is built upon 2 macros steps:

- Anomaly identification and publication (detection)

- Anomaly processing (management and monitoring)

The global strategy is to automate the identification of anomalies and then swiftly publish them to the organization to assure prompt processing. By doing this, the complete organization is empowered to achieve an optimal processing of the anomalies.
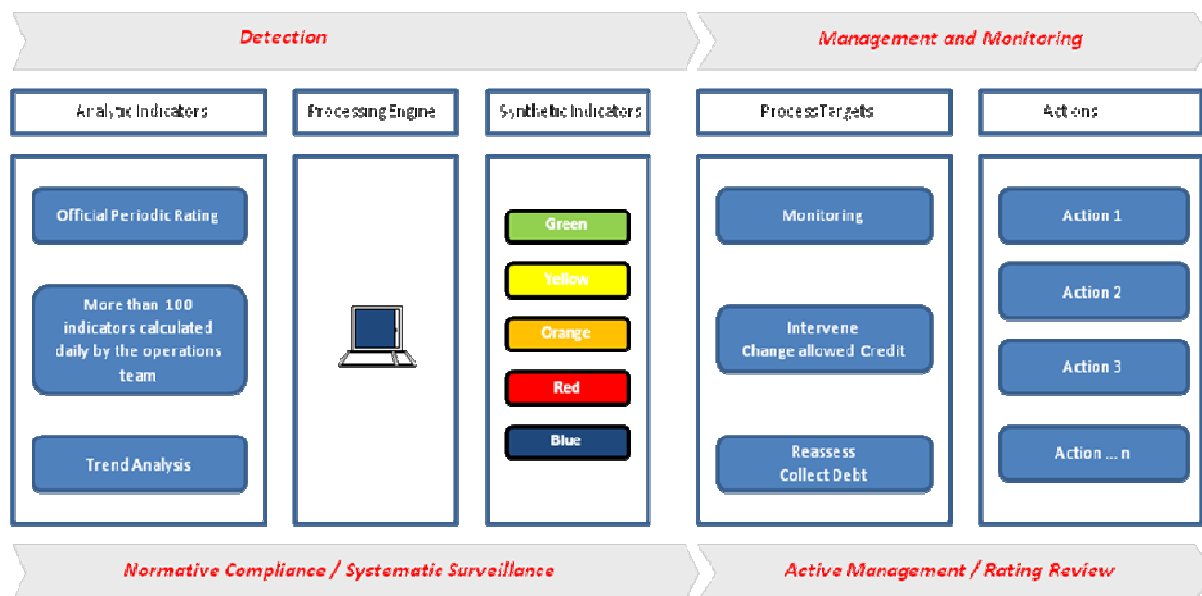

Figure 1 – CARIGE's New Monitoring Process

A set of rules known and shared by the whole organization has been defined. The rating and publication of the credit risks are performed on a daily basis. Based on this set of rules, a colour rating scheme of the credit risk has been defined. Clients are categorized into 5 different risk categories, identified by the five colors shown in the "Synthetic Indicators" box in figure 1.

The new process is efficient and empowers the organization in the identification and processing of the anomalies.

From a management point of view, an accurate reporting-dashboard system of the new process was required. This platform is detailed in the section "Credit Risk Monitoring Reporting".

CREDIT RISK MONITORING PROCESS REPORTING ARCHITECTURE

Keinavo and CARIGE decided to implement a solution based on SAS Data Integration Server, SAS Enterprise Business Intelligence Server and the Keinavo Business Intelligence Framework.

There are 2 main streams of data manipulation jobs. The first stream is the classic Extraction, Transformation and Loading (ETL) of the data, from the Detail Data Store (DDS) to the generation of the OLAP cubes. The second stream loads and maintains users in the SAS Metadata; in addition it maintains the user access rules to each of the cubes.

- The "data stream" reads tables from the corporate DB2 database into a SAS staging area. The data is further transformed and manipulated into a mart area where the dimensional model is loaded. The models implement dimensions of type S.C.D. 2 (Slowly Changing Dimension Level 2), a job made easy by the handy transformations available in SAS DI Studio. Once the mart area is populated, the final OLAP cubes are built. The cubes are used as the input source to OLAP Infomaps which are then consumed by the frontend.

- The "users stream" reads information from a centralized, corporate-wide organizational unit table. This table contains the full structure of the organization; for consistency and accuracy it is also used as the organizational dimension for all the OLAP cubes. The process creates and maintains the users base both on the SAS Metadata server and on the physical IBM AIX server where the system is implemented. More details on the implementation can be found in the section "Metadata security model" below.
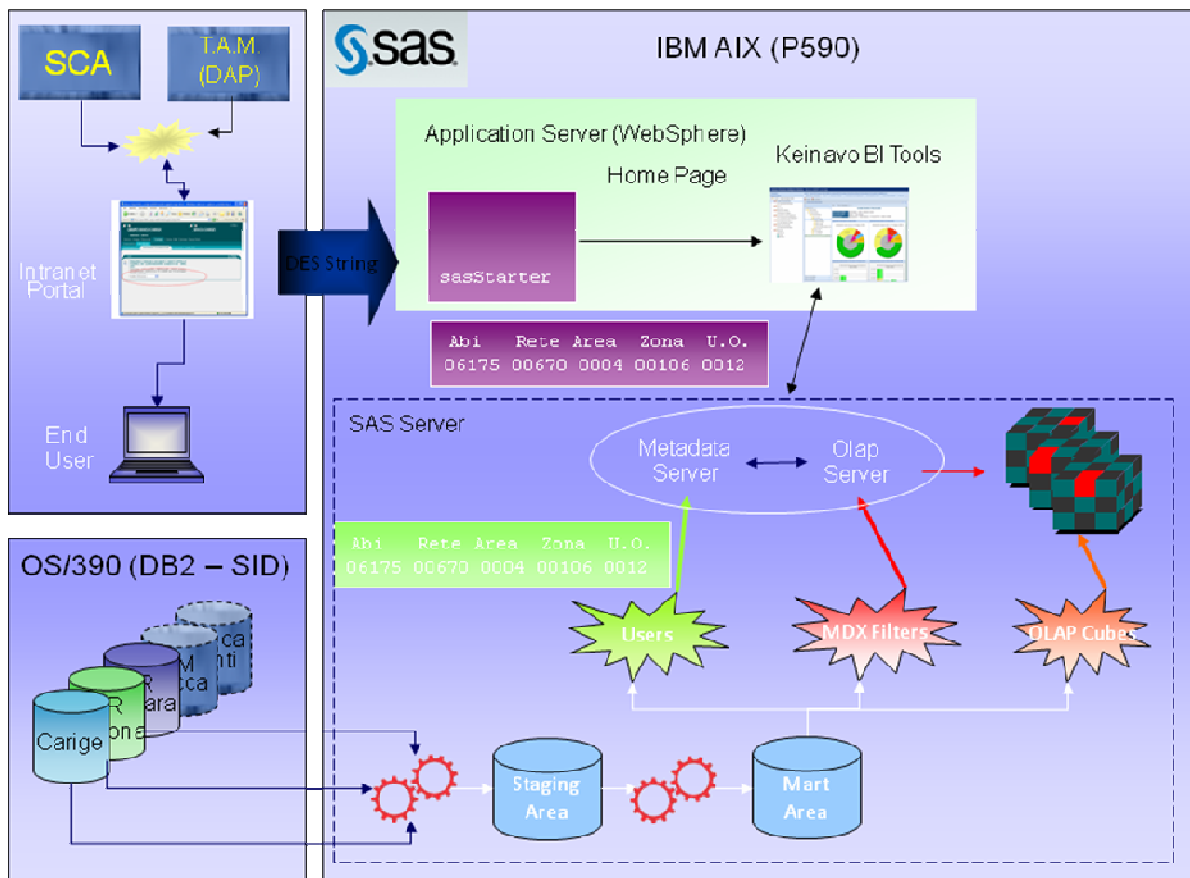

Figure 2 - CARIGE Credit Monitoring Architecture

DATA MODEL

The information to report for the credit monitoring is organized in a dimensional model. The time evolution of the statistics is fundamental for the business users.

Main dimensions are:

-Time

-Internal Geographical Organization

-Market Businesses

-Internal Business Units

-Client Classifications

-Client Risk Rating

METADATA SECURITY MODEL

The CARIGE Group delivers its credit monitoring system to the five banks in its organization. Each bank's structure is shown in the image below.
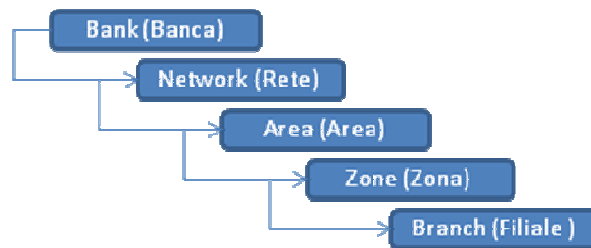

Figure 3 - The CARIGE Organizational Units Structure

The requirements for profiling the users on the system are simple and straightforward: "The job position of the user accessing the reporting is the key driver for the selection of the information to be presented to the user. The user should get the information he is responsible for!" This means, for example, that if a user is an Area Director, he should see only his Area's data and be able to drill down and see the details for the Zones and Branches reporting to him. In other words, we had to create and maintain one user for each Bank, Network, Area, Zone and Branch, adding up to **a total of about 3,500 distinct user profiles**. CARIGE also required that the users should access the reporting system through the group's intranet portal via Single Sign On.

This situation poses 4 significant problems:

1. How do we map physical users to "Role" users?

2. How do we implement the required Single Sign On functionality?

3. How do we easily maintain such a big number of users?

4. How do we show only the data pertaining to a user given his role?

It turns out the 4 problems were strictly interconnected and one main idea laid the foundation to solve them all.

Mapping physical users to role users

CARIGE maps its organization with unique numeric codes, or identifiers. For example one bank would be mapped to code 06175, another to code 06110 and so on; the same goes for all the other organizational units (O.U.). Following this logic, our Area Director would belong to Banca Carige (06175), Rete Liguria (00670) and his own Area Terr.le Genova Centro (0002). We then can safely identify our Area Director with this identifier: 06175_00670_0002. Strings like this are used to uniquely identify each O.U. and are hence the ideal candidates to become our "role-based user IDs".
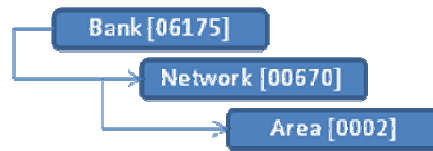
Figure 4 - An Example of O.U code based id (06175_00670_0002)

These derived role-based user IDs (e.g. 06175_00670_0002) become the user IDs in the SAS Metadata Server and through the mechanism described above they are mapped to the physical user IDs already available internally to the CARIGE Group. The role-based user IDs also become "physical" IDs on the machine hosting the SAS BI Platform to allow authentication to the SAS Metadata.

Implementing Single Sign On (sasStarter)

The sasStarter module effectively maps a CARIGE Group "physical" user ID (such as psmith) to a "role based" SAS ID (such as 06175_00670_0002) and transparently logs the user to the SAS BI Platform. When a user logs in to the intranet portal, the portal passes the O.U. codes associated to the physical user to the "sasStarter" J2EE module, implemented by Keinavo; sasStarter builds and validates the required unique identifier, logs the user onto the SAS Metadata Server and passes a user context to the required SAS web application or to Keinavo BI Tools.

This abstraction mechanism from physical to role-based user also solves another key requirement from CARIGE. When our Area Director is not in the office, for any reason, his second-in-charge temporarily takes his role as director. CARIGE have implemented a system that understands this temporary change and, through their intranet portal, will pass the newly assigned codes to the sasStarter module which will correctly "interpret" the temporary role of Area Director "of the day".

Maintaining a huge base of users

From what we have said so far, it is obvious that we needed an automated way to create and maintain the huge base of users, both on the SAS Metadata Server and on the physical machine hosting it. The system has a constantly updated and centralized table containing the organizational structure mapping roles and codes; this table is also used as the O.U. dimension table in all the OLAP cubes in the reporting system. We decided to use this table as the main driver to create and maintain the SAS BI Platform role user IDs and the physical host user IDs, too.

SAS Data Integration processes were developed to take advantage of this dynamic and corporately managed O.U. table; these processes created SAS canonical tables which we then passed on to the %mdu family of SAS macros. These macros allow for automatic users maintenance in the SAS Metadata. Beyond that, we used the delta canonical tables to generate AIX shell scripts which maintain the physical IDs on the host machine. The system administrators are alerted if there are any changes to the O.U. structure and they simply have to run the scripts that were just generated to synchronize the host users and the SAS Metadata users.

Showing profiled data

Last, but certainly not least in the metadata security tasks, was to show the users "profiled" data. All the information shown in the reports come from OLAP cubes which have a O.U. dimension, created from the O.U. dimension table, which contains both the codes and the descriptions of the 5 levels used in the drillable dimension. We found a way to automatically create and apply the MDX security expressions to the O.U. dimension of the OLAP cubes; as described below. The cubes contain the levels' descriptions and codes. We use the codes to automatically generate the user IDs (see paragraph above); we then manipulated and mapped the codes through SAS formats to create an MDX expression.

Our example user id

06175_00670_0002

is transformed into the MDX expression

"descendants([Organizzazione].[Tutte Le Banche].[Banca Carige].[Rete Liguria].[Area Terr.le Genova Centro])"

which is then applied to the metadata of the OLAP cube; the SAS Batchaci tool allows for automated massive security maintenance of cubes security, given an input dataset with the required information, such as user IDs and MDX expressions to apply for them.

GRAPHICAL USER INTERFACE

CARIGE's reporting requirements for the system reporting interface were very precise from both the functionality and the GUI point of view.. Functional requirements, such as "horizontal data security" and their resolution, have already been discussed in previous sections of this paper. This section focuses on the Graphical User Interface implemented by Keinavo and on how it completely satisfies CARIGE's requirements.

Four macro requirements were identified by CARIGE:

1. Complete and full integration with the SAS9 Business Intelligence Platform

2. Complete adherence to report layout. CARIGE had already defined "on paper" a set of reports that had to look exactly the same on the users' screen.

3. A very fast development and test cycle, with daily updates.

4. Continuous involvement of the business team to minimize the "go-live" timescale.

Keinavo developed a set of tools, called Keinavo BI Tools, that perfectly fit these requirements.

KEINAVO BUSINESS INTELLIGENCE TOOLS

Keinavo BI Tools is a framework for dashboard and reporting, completely integrated with the SAS9 BI Platform. Entirely written in the Java language, both for the client and server side, it allows writing web 2.0 rich internet applications and provides the user with a desktop like experience. The interface to the SAS9 Platform is implemented with the SAS Java API provided by SAS AppDev Studio.

Keinavo BI Tools provides out of the box functionality such as Single Sign On, Data Query and Filter, Tables, and Charts (implemented with Flash technology). It fully leverages the SAS9 (9.1.3 and 9.2) platform by fully supporting the SAS Foundation Services (Authentication and Session, Metadata, Query and Reporting, Stored Process and Logging). The Keinavo BI Desktop reports are saved as SAS metadata objects by means of a custom metadata Transformation, called KBIReport.

The GUI created with Keinavo BI Tools give the users a desktop like experience with advanced and customizable functionality, such as drag and drop and contextual menus support. WYSIWYG export and print capabilities and cross-browser support (browsers supported are Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, Apple Safari and Opera, on any operating system).
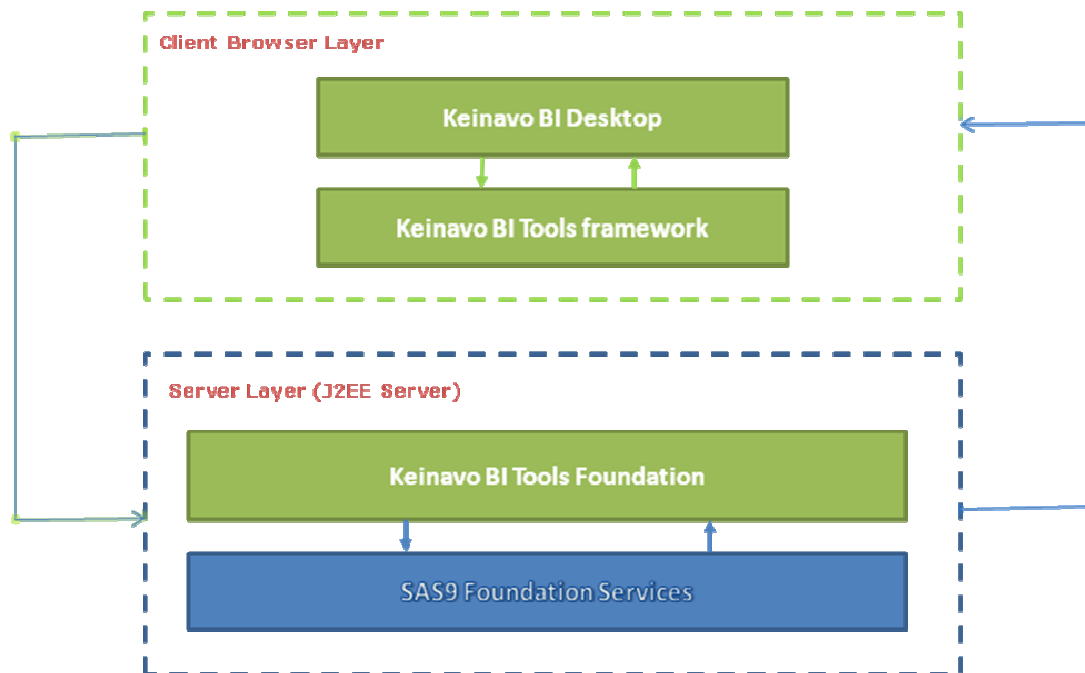

Figure 5 - Keinavo BI Tools Architecture

Figure 5 shows the high level architecture of Keinavo BI Tools. Keinavo BI Tools Foundation is the software interface to the SAS9 Platform, implemented with the Java SAS APIs provided by SAS AppDev Studio. Keinavo BI Tools framework is a set of visual classes enabled to communicate with the foundation layer. Keinavo BI Desktop is a "ready-made" application built with the classes available in the framework.

Both the client and the server layer are written in the Java language. Although this is the obvious choice for the server side, it is unusual for the client side. Web applications are usually built using a combination of a pure JavaScript framework and other techniques. This approach has proved cumbersome and difficult to maintain, especially for enterprise applications. Keinavo BI Tools has been written using the Google Web Toolkit framework, which allows writing web applications in pure Java, as if they were standard Java desktop applications; after being tested, the applications are "compiled" into very efficient JavaScript by the GWT compiler and are then ready to be packaged and deployed. The approach of using GWT has several benefits from a technical perspective (one code base, only one language: Java, no cross-browser problems, debugging within Eclipse, Unit Testing, SVN integration through Eclipse for better team management and so on).

CARIGE REPORTS WITH KEINAVO BI TOOLS

CARIGE and Keinavo have developed together a set of reports that satisfy and exceed the expectations set out by the business team. Consisting of ad-hoc information profiled for each organization unit, the reports allow a much better, more efficient and responsive way of working, while leveraging the full potential of the SAS9 Business Intelligence Platform.

The images below show just a few of the reports and are used as examples to describe the reporting structure and functionalities.
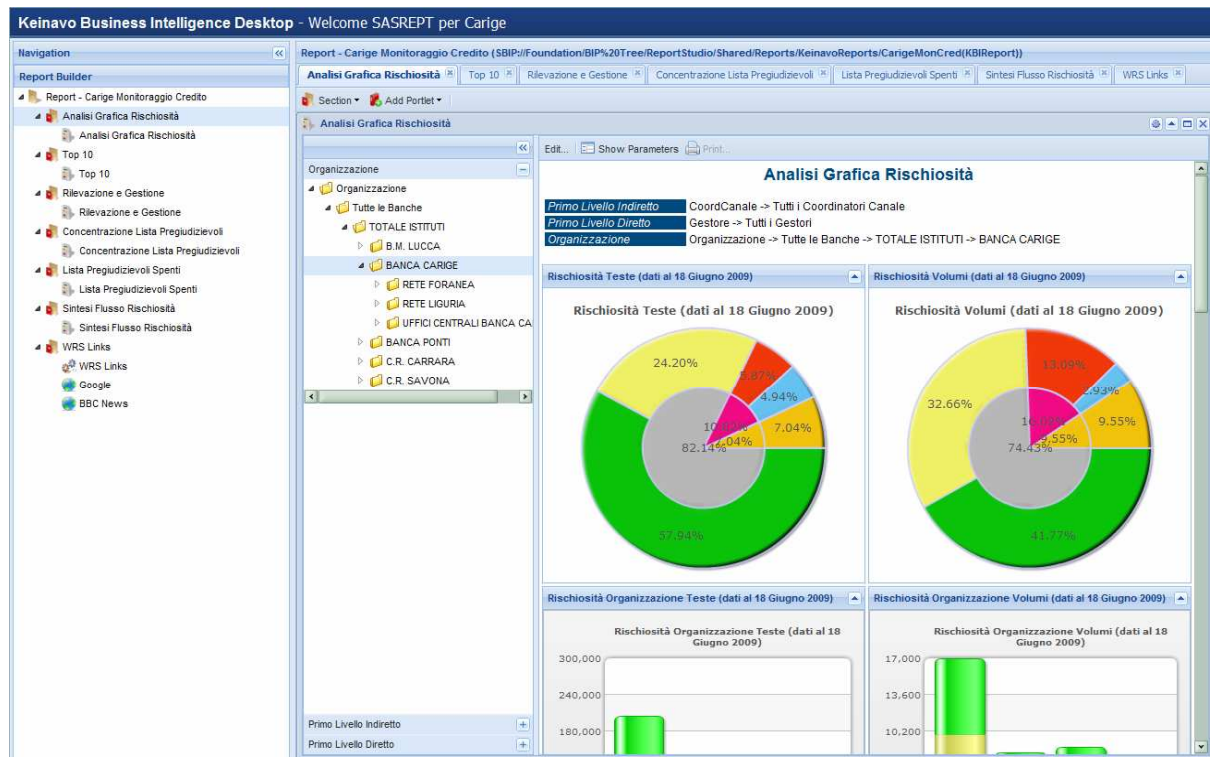

Figure 6 - Risk Graphical Analysis (Simulated data)

Figure 6 shows a dashboard that graphically represents the most current "risk snapshot". Of relevance is the "Multilevel pie" chart that shows hierarchical data (in this case on two levels) within a pie chart. The outermost layer shows the percentage of assets and clients relative to each risk category, identified by their colors; the innermost layer shows the same data, aggregated at another level (for example the grey area is the sum of the yellow and green categories).

The users can subset the data by selecting a node in the organizational unit dimension tree (for example the "Banca Carige" node in the "Organizzazione" tree highlighted in the image) and dragging it in the charts area on its right. This operation can be performed on all the dimensions defined in the portlet (see the additional items "Primo Livello Indiretto" and "Primo Livello Diretto" below the tree that can be clicked to show their corresponding dimension trees).

The reports in the CARIGE reporting system were implemented using the Keinavo BI Tools "Stored Process Linked Portlet", which links an OLAP SAS Infomap to a SAS Stored Process. The input parameters of the Stored Process are populated by dropping values coming from dimensions defined on a SAS OLAP cube upon which the Infomap is defined.

Also in figure 6 we can see the Keinavo BI Desktop structure and layout. A report builder is available on the left, which can be used to build and/or navigate the report. A report is based on sections (represented by tabs in the central area), each of which can contain one or more portlets. In the case of figure 2 the section "Analisi Grafica Rischiosità" contains only one portlet (STP Linked Portlet) of the same name.

Depending on the users' grants, Keinavo BI Desktop can be accessed in Read/Write mode (as shown in figure 2) or in read-only mode. The desktop is highly configurable and editing capabilities as well as many other details can be configured.
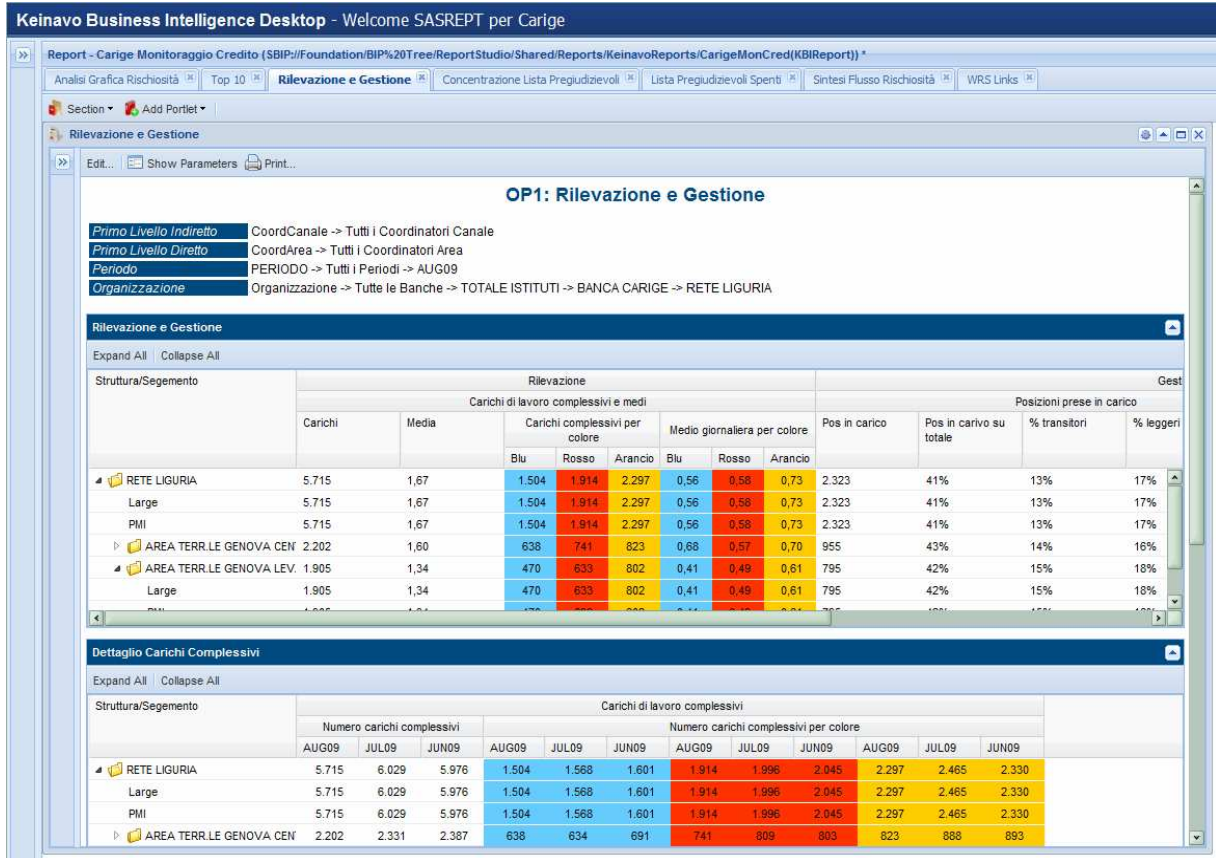
Figure 7 - A Tabular Report (Simulated data)

Figure 7 shows a report with tables with complex, resizable and sortable headers. The leftmost column contains a fixed hierarchical tree view of the data, as requested by CARIGE. The nodes of the report represent values of an organizational unit level ("Rete" in this case) that can be expanded to show the detail by market segment. The usual colors are used to indicate the risk category they pertain to. The second table also shows am additional detail of the data by month. The users can select a month, as usual via drag and drop, the table will show data for the selected month and two previous months.

The sections on the left (report builder and hierarchy navigator) have been collapsed by the user to guarantee maximum readability.
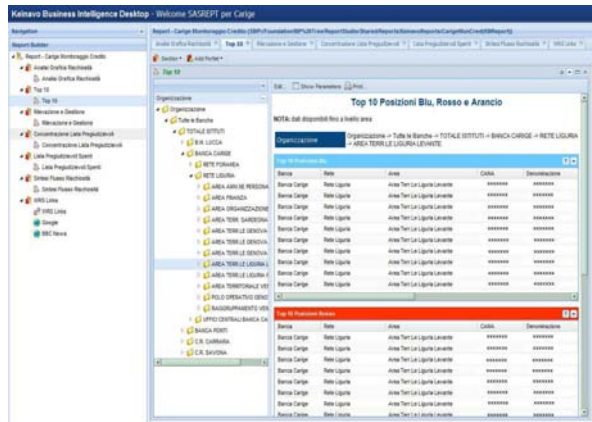

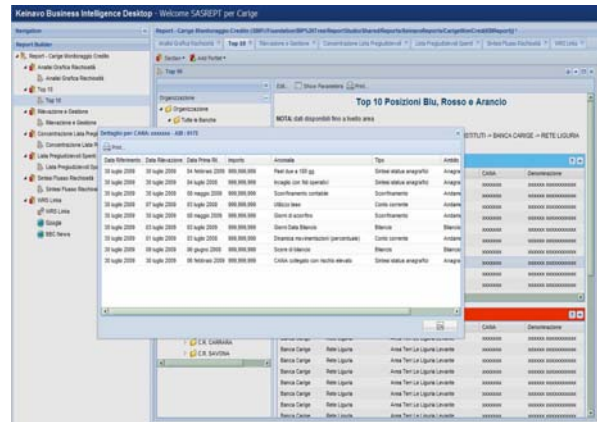**Figure 8 - Top 10 Report (Simulated data)**

Figure 9 - Top 10 Report (Detail) (Simulated data)

Figure 8 shows the "Top 10" report per color (i.e. risk category). The most problematic clients per category are shown in each table. The colors of the header of the tables identify the risk category. By double clicking on a row of the table, a window containing the last transactions by the selected client becomes visible (figure 9).

CONCLUSION

Gruppo Carige's new monitoring process allows the bank to quickly detect, manage and monitor anomalies.

Gruppo Carige and Keinavo have worked together to exploit the full potential of the SAS9 BI Platform, from data Extraction, Transformation and Loading processes to the very last detail implementation of the Graphical User Interface. Through continuous research and utilization of the most advanced software development techniques Keinavo has created a reusable framework that is ready to satisfy most requirements.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the authors at:

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