Banking Intelligence Accelerator – Decision Support

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Along with the development of information technology, Business Intelligence plays an important role in banking operation process. Business Intelligence in banking sector is a method of storing and presenting key bank business data so that any key user can quickly and easily ask questions of accurate and timely data. The growing competition and increased speed of business changes has dramatically shown the need for business intelligence in banking sector. In this paper, we analyze the business intelligence components, how they fit the banking sector and how they can be secured to match the framework of the whole banking information system. Having the decision process analyzed in the banking field, we propose an architectural model to sustain the decision and integrate easily in the complex banking environment.

Keywords: *Business Intelligence, Decision, Data Warehouse, Architecture, Banking Accelerator*

1 Introduction

The world wide emergence of information revolution impacts every type of business and industry, and particularly, the banking industry. The value of needed piece of information increases with the square root of the number of users who can access that information, multiplied by the number of business areas in which users act. Inspite the huge amount of information stored inside banking information systems about customers and their transactions, the banks can rarely exploit its full potential in leveraging of tactical and strategic decision making [6]. Striving for a success, banks are trying to find means for efficient analysis of these data. Implementation of BI systems in banking begins with collection, enhancement, and purification of the daily legacy data from internal and external sources, including third party organizations. Availability of "enhanced" data in real time helps banks recognize and take benefit from new possibilities to strengthen customer relations, attract new prospects, and adapt to growth. BI effectively couples business strategies with information technologies leveraging on the existing IT infrastructure and skills [5].

2 Banking Intelligence Overview

Industry experts are in agreement that today's banking industry enjoys a highly dynamic environment – with mergers, acquisitions, divestitures, outsourcing initiatives, and branches closing and reopening – characterized by a fast-changing set of business, regulatory, and IT requirements. It is imperative for banks to gain market share while increasing operational efficiency. An interesting view from Forrester Research is that on the IT side, existing banking platforms can be compared with baroque castles. These ancient constructs are not up to the quality, cost and time-to-delivery requirements of modern banks.

The definition we agreed for the Banking Intelligence was the ability of a banking organization to comprehend and use information in order to increase its key performance indicators. Banking Intelligence comprises of a number of activities, procedures and applications, some of mostly used are: Data Warehousing, Data Marts, OLAP tools, tools for Extraction, Transformation, and Loading (ETL) of data, Information Portals, Data Mining, Business Modeling, etc. In this paper, we briefly describe three,

most commonly adopted technologies: Data Warehousing, Analytical processing, and Data Mining [9]. The banking sector has constantly been pushed by demands for new and innovative products and by regulatory requirements. Undergoing processes of a bank influenced by economy actions happening around the globe have inevitable made bank's information systems highly heterogeneous, with disintegrated applications, overlapping sets of data, and disperse points (in location and time) of data collection and processing. The idea to collect and unify the data form disparate sources has led to the concept of Data Warehousing. Data Warehouse filled with complete and purified (cleansed and enhanced) data is a prerequisite for the task of transforming information into knowledge. On-Line Analytical Processing and Data Mining are common methods for retrieving hidden knowledge from the data stored in a Data Warehouse. To picture the aforementioned Banking Intelligence components and emphasis how they fit into the whole banking system architecture, we illustrate **figure 1**, below, briefly resuming the main BI components and how the data flows between them, providing desidered output.

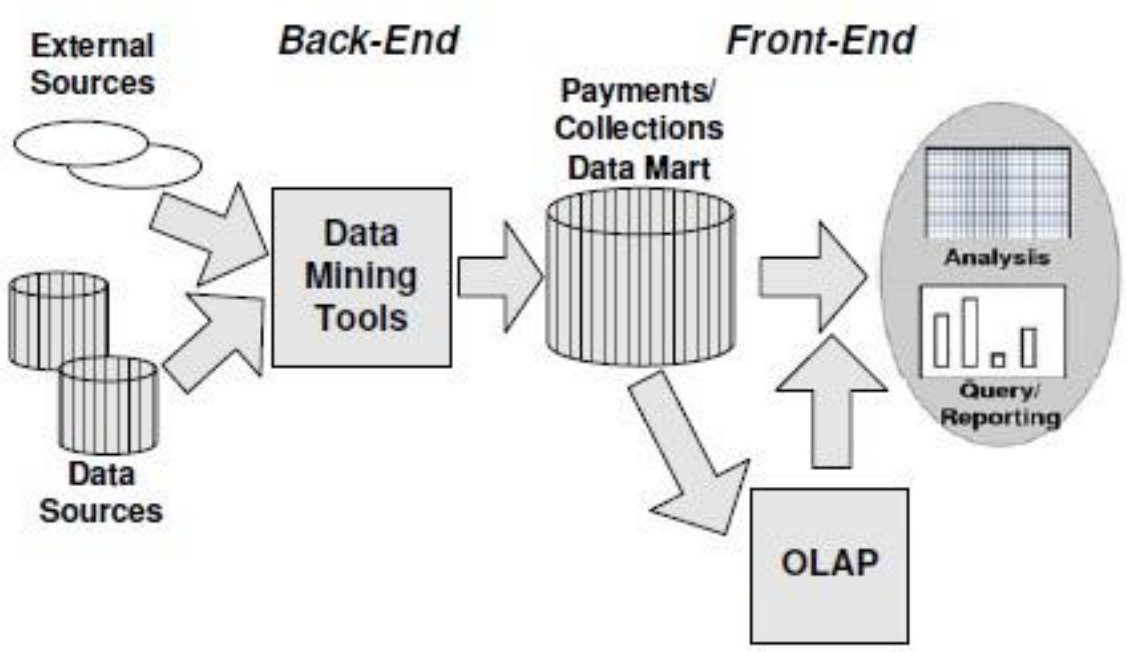

Fig. 1. Banking Intelligence architecture [3].

The picture depicts the core of the system comprised as a centralized data warehouse, allowing the end user to perform predictive, multidimensional analysis, over millions of transactions from customers of a bank agency. Also we have identified two innovative preprocessing methodologies, based on data mining techniques, which are exploited in the banking sector to populate the warehouse. These are highly effective at dealing with schema reconciliation and duplicate detection issues and, hence, assure a reliable integration and consolidation of heterogeneous bank data into a unique archive.

On-line Analytical Processing (OLAP) enables manipulation and analysis of large amount of data, comparison of different types of data, complex computations and, most importantly, an intuitive graphical user interface (GUI) for presentation of results in various perspectives including drill-up and drill-down capabilities. OLAP tools are essential component of today's BI systems [5]. Data Mining is founded on algorithms for detection of unknown and unexpected patterns in large sets of data,

clustering and segmenting of data and finding dependencies between multidimensional variables. The results of Data Mining analysis are presented graphically with the dominant and unexpected behavioral patterns enhanced. Applications for Data Warehousing, On-line Analytical Processing, and Data Mining are being widely adopted in modern banks to provide timely answers to many questions which previously required costly and lengthy programming and batch processing [7].

Systems of a Banking Intelligence standard, combine data from internal information systems of a bank and they integrate data coming from the environment e.g. statistics, financial and investment portals and miscellaneous databases. They are meant to provide adequate and reliable up-to-date information on different aspects of enterprise activities, having as final goal supporting decision in real time. The structure of such system consists of the following modules:

• tools to extract and transfer data – they are mainly responsible for data transfer from transactional systems and Internet to data warehouses;

• data warehouses – they provide room for thematic storing of aggregated and already analyzed data;

• analytic tools (OLAP) – they let users access, analyze and model business problems and share information stored in data warehouses;

• tools for reporting and ad hoc inquiring – they enable creation and usage of different synthetic reports;

• presentation layer – applications including graphic and multimedia interfaces whose task is to provide users with information in a comfortable and accessible form

3 Banking Intelligence key role in decision process

Business Intelligence is currently one of the fastest developing directions in information technology. Nowadays BI systems are connected with CRM systems (Customer Relationships Management) and ERP (Enterprise Resource Planning) to provide an enterprise with a huge competitive advantage[2]. Banking executives are focused on results. They need to know the bank's customers in great depth so as to sell the right product to the right customer for the right reasons and also manage risk and comply with changing requirements. All these challenges lead to the introduction of banking intelligence, which refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information and also sometimes to the information itself. Banking intelligence can provide historical, current, and predictive views of banking operations, most often using data that has been gathered into a data warehouse or a data mart. Main tasks that are to be faced by the Banking Intelligence systems include intelligent exploration, integration, aggregation and a multidimensional analysis of data originating from various information resources [8].

Based on our experience we could analyze and summarize main characteristics that a business intelligence application should meet in order to serve the decision support, its ultimate goal:

- To have a clear architecture. The BI solution employs the prevalent data warehouse concept. Data are collected into the data warehouse first, and then transferred into a specially designed data mart. Many banks have their own data warehouse. Aside of those, various data marts can be built for various purposes. The Banking Intelligence solution aims to adapting the existed warehouse and can be quickly deployed using this architecture.
- To be subject oriented. Based on our experience of banking industry, especially on the domestic market, we summarize an overall subject library. Those subjects are organized as main topic,

sub-topic, etc. The bank decidents, as their need, can select any subject they are interested in. The subject oriented manner makes the banking intelligence implementation unambiguous and cost effective.

- Prove timely response. This benefit inherits from the OLAP technology. Other than the off-line analysis and report, banking intelligence can trace the ongoing changes and provide valuable information by timely response.

The design of the data mart plays a key role in the process of decision making. In particular, the identification of its dimensions actually determines the capability of the overall decision support system to answer meaningful business queries [4]. However, many difficulties arise while constructing the foresaid warehouse. More specifically, these divide into syntactic and semantic issues. We could distinguish this involves two major problems, namely schema reconciliation and data reconciliation. In our banking intelligence scenario, the requirement for schema reconciliation mainly follows from the textual format of the personal information concerning both debtors and creditors. This information may not be uniformly formatted and, hence, its constituting records may apparently conform to different schemas. Indeed, the order of appearance of personal information attributes across the individual lines of text may not be fixed. In addition, their recognition is further complicated by the absence of both a canonical encoding format and of suitable field separators, which is mainly due to erroneous dataentry, misspelled terms, transposition oversights, inconsistent data collection and so forth. Also, distinct records may lack different attribute values, which makes them appear with a variable structure. Yet, the collection of personal information may be fragmented over disparate data sources, which further exacerbates the aforementioned difficulties.

4 Banking Intelligence Accelerator Model

Industry trends indicate that increasing competition in the financial industry is driving financial institutions to seek a customer - centric view of their business, in order to better understand their customers, deepen the business relationship with them, up-sell more products, and reduce turnover. In addition, consolidation and acquisitions within the financial industry are placing increased pressure on the ability of financial institutions to achieve that single view of the client, maintain consistent and reliable data quality, and control their exposure to regulatory and compliance risk.

What we propose in this paper is an accelerator that enables financial institutions to adopt a customer-centric view of performance by consolidating customer information across all lines of business. This accelerator solution incorporates each component of the transformation process to a customer-centric view. At its core, the accelerator is based on a time-tested Banking Data Model coupled with tools that help populate the model with the institution’s data. With this foundation in place, financial institutions would be able to leverage advanced analytics, predictive modeling, pre-built dashboards, and custom reports, to allow management at the branch, line of business, call center and enterprise levels to visualize performance and monitor customer behavior, thereby helping to improve and expand customer relationships.

To illustrate the Banking accelerator proposed solution we have put together **figure 2**, which shows a high components overview of proposed model.

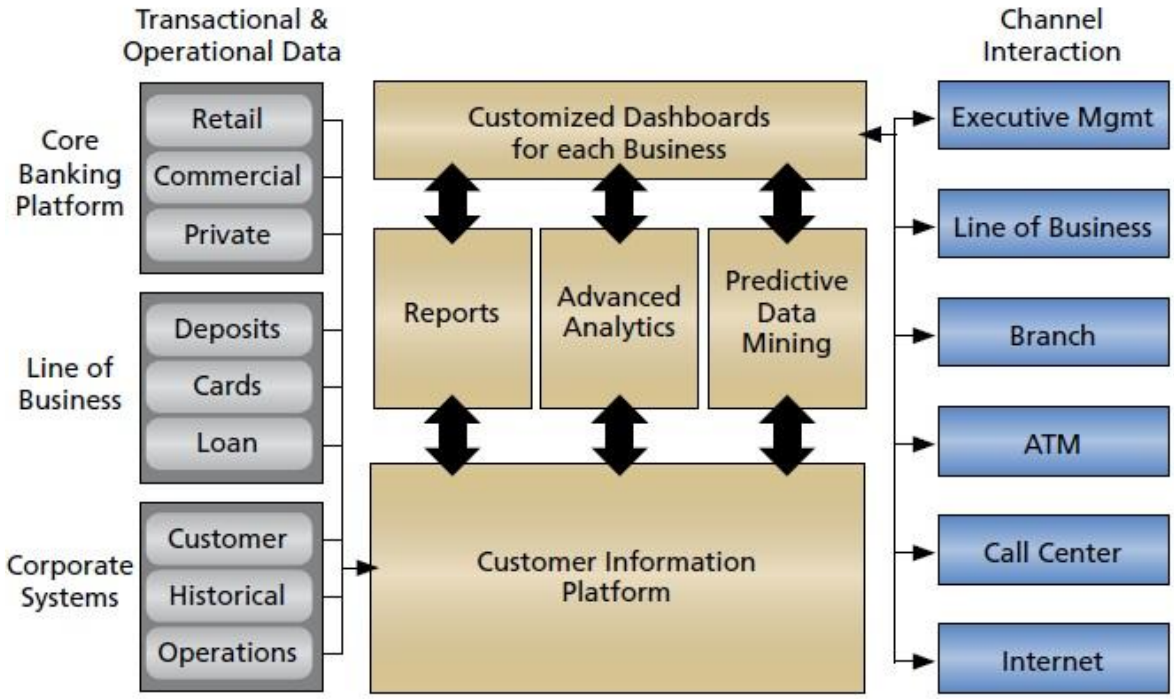

Fig. 2. Banking Intelligence Accelerator Model.

Implementing Banking accelerator solution, will transform the way Bank organizations run their business by providing them with pre-configured business products and ready-to-use transaction sets. With model proposed, banks can get a head start in core Banking deployment and based on a parameterization capability, banks can launch products quickly, and gain edge over competition and thereby significantly reduce the deployment risks, efforts and timeframe. The enterprise integration accelerators allow banks to easily migrate from their legacy core banking applications and in turn support them in their transformation initiatives. With reduction in deployment time, banks can focus on their growth objectives and deliver innovative products and services to customers.

Banks can leverage the proposed accelerator model to quickly expand into new customer segments and/or geographies. Using an open architecture, the model, could offer the option of implementing modules based on business relevance and should also allow the banks to leverage their current IT investments with its ability to co-exist with any third party application.

Such model can be built on new-generation technology platforms and should be capable of addressing multi-entity, multi-currency, multi-lingual, requirements. The Banking Intelligence Accelerator model can provide complete scalability and adaptability to rapidly growing and changing businesses like the banking one. It can be presented with a complete range of independent business modules, which operate within an integrated framework. This would allow the bank or financial institution to choose the module set that is relevant to their business paradigm and also allow the institution to decide on the sequencing the roll out of specific business areas during implementation.

5 Example of Banking Intelligence Accelerator Architecture

With the above model specification in mind we can propose an example of architecture that is based on the n-tier principles. High performance is ensured by basing the product on an N-tier

architecture, using messaging, by developing the middleware (glue binding the various tiers) as highly optimized & tuned in-memory processes. Each of the tiers performs a well defined function, thus allowing for a clear separation on processing. Each tier is independently scalable and designed to utilize the underlying multi-threading design and multi-processor hardware capability.

Having its architecture based on open-source components, it can be implemented and integrated in any banking environment regardless the hosting platforms. This advantage provides the banks with the ability to undertake major growth initiatives without being restricted by the application's inability to support those initiatives due to compatibility restrictions.

An illustrated example of such architecture that can consist in an implemented solution which should match the N-tier architecture and the model we propose, is shown in **figure 3**.

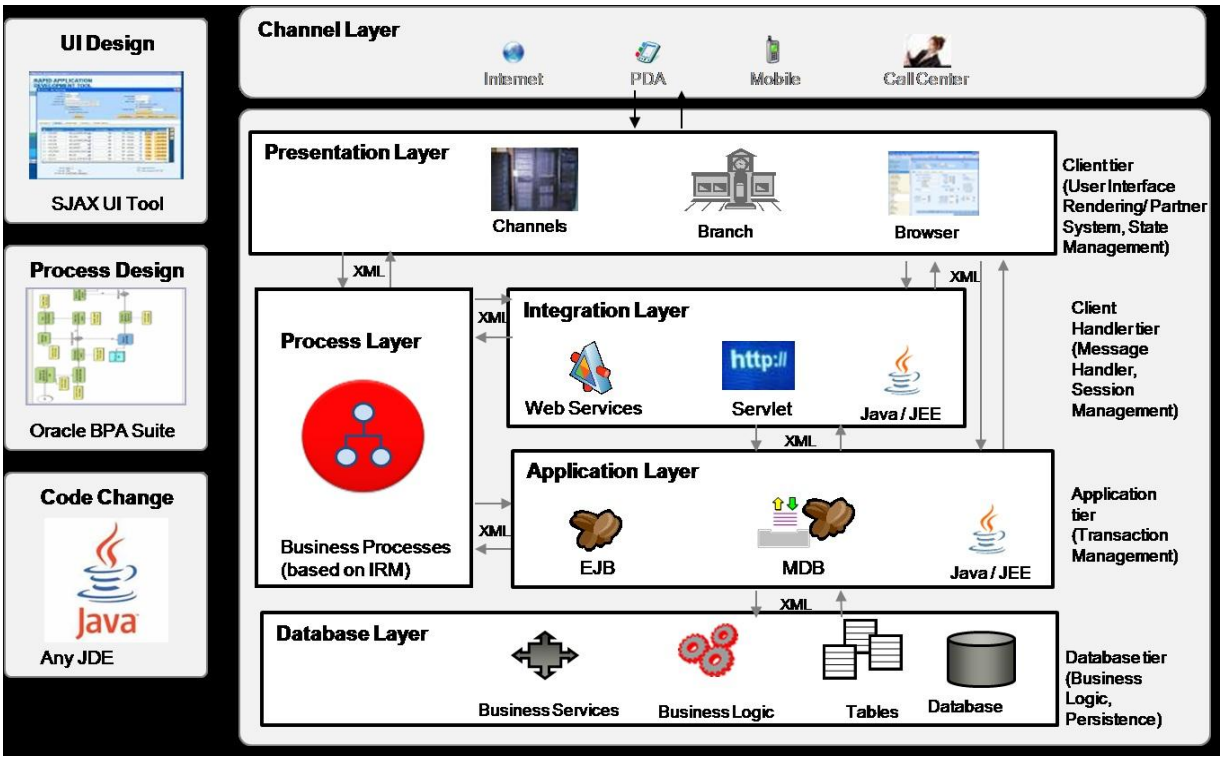

Fig. 3 Example of Banking Intelligence Accelerator architecture [10].

Reviewing this architecture, the system can consist of an *user interface*, preferably light-weight in nature (available on the web) and based on JavaScript and XML technologies. The communication between the browser and the web server can be using XML. The rendering is done on the client using XSLT for rendering as HTML. This allows for reduced infrastructure requirements due to following two most encountered restrictions: the bandwidth between the client and server is low and usually security policies might restrict a dedicated session with the database. The user interface should be configurable, while the screen can be easily adapted to different languages. Last, but not least, having in mind the Banking Intelligence Accelerator architecture is proposed for the banking sector, the user interface should meet the accessibility requirements for the teller (retail banking) screens and mobile devices.

The lower tier, we envisioned for the purpose of this paper, is the *process tier*, which should provide the ability for processes to be developed around the natively provided application. For example, can be defined processes using Oracle BPEL Process Manager and

integrate the same into the application‘s user interface framework. When deployed in a process centric model, the Banking Intelligence Accelerator provides a task-based user interface. By default, task based user interface is offered for the branch platform. The banking Intelligence accelerator interfaces with the Process Manager API‘s for viewing and managing tasks in the application. The process framework offers a facility to do the following: message content to control the data flow between different tiers, data transformation as needed, routines to match the banking business rules, flow control to monitor how the data is routed between different steps in the process and security to control who is eligible to perform a particular task.

At this level, the proposed architecture would not differentiate partner channels from its own native user interface when it comes to data processing. The *application and integration tier* provides the message handling, session management (for the native user interface) and transaction management in the application. The application and integration tier is based on open-source protocols like the ones offered by Java and JEE 5 technologies and is designed to be vendor independent, which makes the solution supported on any J2SE 1.4/JEE 5 compliant application server.

The back-end is a relational database management system i.e. Oracle 11g. The database tier ensures integrity of data and also provides business logic that can be PL/SQL stored procedures loaded into the database. At this tier, a clusterization solution i.e. Oracle RAC (Real Application Clusters) can be implemented to build redundancy and support failover & recovery, scalability and high availability.

We also envisioned the ability of extensibility framework for the Banking Intelligence Accelerator, which implies existence of additional handlers in the front-end units as well as back-end units. Typically, whenever any customization is done, the changes are typically done in the base units and if there are no additional handlers for site specific customizations like defaulting of specific values, inclusion of additional validations etc. the underlying base units need to be modified for any type of customization and this also makes identification of customization changes difficult.

Therefore, to minimize modification of base units, the architecture proposes at application tier level a provision to support extensibility in the following areas: maintenance of user defined fields at each screen level and capture of data, usage of user defined fields in advice formats, generation of notifications for operations done in the system.

It is a well recognized fact that any bank‘s data centre is bound to be heterogeneous in nature. Many systems, disparate technologies, various modes of usage, a multitude of mechanisms by which to integrate with, the Banking Intelligence accelerator needs to be fit into such an environment. The integration needs therefore, will also be varied in nature. Hence one of the design goals of proposed architecture has been that it should integrate easily with external systems for which it provides an *integration gateway*. *Integration gateway* uses a service and notifications based approach to integration under the principles of Service Oriented Architecture. The architecture provides for interfaces supporting open standards that can be used to easily integrate with other applications. The gateway provides for various deployment patterns, all of which can co-exist, to enable these various integrations.

6 Banking Intelligence accelerator – Implementation aspects

In the way our system’s architecture has been exposed in this paper, the implementation should meet out-of-the-box paradigm. This is because of its open-source and heterogeneous protocols and technology, the propose components connectors and handlers and the ability to

fit in banking and financial services business models.

System of the Banking Intelligence standard should be analyzed taking into consideration all the benefits of their implementation in a bank, likely to be generated [1]. Case studies we came through, proved and emphasised our belive that a Banking Intelligence solution, like the one presented hereby, may be utilized mainly for:

1. Strategic planning including first of all:
   - modeling different methods in the development of an organization;
   - informing about the realization of an bank's strategy, mission, goals and tasks;
   - identifying problems and "bottlenecks" to be tackled;
   - providing information on the enterprise's environment and market trends.
2. Improving relations with customers and in particular:
   - providing sales representatives with adequate knowledge on customers so that the reps could rapidly meet their customers' needs;
   - following the level of customer satisfaction, together with efficiency of business practices and identifying market trends.
3. Analyzing profitability of products and services manifested inter alia in:
   - providing analyses of "the best" and "the worst" products, employees, regions (as far as sales, costs or results are concerned).
4. Analyzing internal processes and operational efficiency of a banking system by means of:
   - providing analyses of deviations from the realization of plans;
   - providing knowledge and experience emerged while developing and launching new products onto the market;
   - exchange of knowledge among research teams and banking departments.
5. Controlling and management accounting and in particular:
   - analysis of actual costs and financial flows.

Due to solutions that fulfill all the functions mentioned above, management of a banking system gains new quality and, what is more an organization like banks is bound to become intelligent.

7 Conclusions

Scope of this paper was to identify the role of banking intelligence in decision processes, proposed a model to accelerate banking business processes, assisted decision, integrate easily in the multitude of banking environment applications and depict some of the most important aspects of implementation. The experience and researches in business intelligence and banking area, were a great help, understanding the technological and business processes running in the industry backend and build a model which should answer with ease the most recent requirements for decision process in financial services field.

Conclusion we came to, after conducted research for building this paper is that disconnected information systems can be integrated in order to achieve a complete and coherent decision support solution, so using business intelligence application standards is a primary rule for effective and documented decisions. In the banking sector, there is a spent of resources of annual IT budgets on business intelligence software products and they need to prove reliable and secure. Therefore, as we described across this paper, players in this area need a reliable infrastructure to link the explosion of new software applications and data sources, keeping a good pace with the volume of enterprise data, business partners, suppliers and customers.

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