An investment content delivery secure e-service

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Abstract: - This paper presents a web-based content delivery service named RISE that intends to cover the needs of a wide-range business entities wishing to take trustworthy and confidential business actions or invest in an industry sector, by effectively and efficiently *collecting*, *managing*, *combining* and *analyzing* untapped and value-added economic related public content from a number of sources such as Statistical Offices (SOs), regional Chambers of Commerce (CoCs) and successful private content providers. Users that would be interested in using the RISE service include investment companies, venture capital enterprises, banks, business consultants as well as isolated SMEs and individual users who seek investment opportunities.

Key-Words: Web Services, Content Management, Security, XML Cryptography, Value-added Public Content

1 Introduction

Nowadays many enterprises wish to engage in investment activities in various regions, in many different countries. While each country is at a different stage of development, there is a common need to enhance trade and cross-border cooperation, to develop infrastructure and to strengthen the financial sector. One key factor that may increase investment in an area is access to economic related content about the specific region. Foreign investors are reluctant to take initiatives in developing countries due to the lack or poor existence of trustworthy and qualified information channels. Even in cases where adequate information is provided, this relies on a single content provider, and it is not further validated or analysed.

Therefore the combined establishment of such information channels and the provision of supportive electronic services to assist and encourage single users, SMEs, venture capitalists or foreign organizations to be informed on the special business characteristics of a geographical region, are identified as a promising open market opportunity.

Local public administrations as well as private organizations hold useful and untapped electronic content that can form the basis of a successful electronic service. On-line and multilingual access to value added public content in a consistent and business effective manner should be at a national, European and international level, and should be accompanied by simplified procedures. The type of users that would be interested in using such a service includes investment companies, venture capital enterprises, banks, business consultants as well as isolated SMEs and individual users who want to expand their market horizons.

From a technological aspect, there are technologies and tools that can satisfy this demand. The adoption of the *eXtended Markup Language (XML)* and *Web Services* technologies as the means to achieve *security*, *interoperability*, *user friendliness* and adequately *performance* is a well promising approach [3][4]. *World Wide Web Consortium (W3C)* XML is a flexible, standard based data format that represents a significant improvement over the current Internet technologies in describing and exchanging data, providing additionally seamless access to very large complex distributed information databases. Web Services, based on XML, provide efficient, low cost, scalable and interoperable means for communication between enterprises and organizations or even for the propagation of information to simple users. This functionality is delivered over Internet protocols combined with security technologies such as *Public Key Infrastructure (PKI)* and *XML Cryptography* [4][8][25].

Furthermore, business information processing tools exist, which can be fed with aggregated cross-market business data, add value to these data and produce comprehensive and concise business reports that can guide organizations on how to draw a business course or make a profit out of giving

directions to others to develop their investment plans.

This paper presents a Web Services based content delivery service, named *"RISE"* that facilitates multilingual access to an integrated portfolio of business-related reports and studies. These are produced by adding value on public content business data. Such business-related reports cover a wide spectrum of identified business information needs of the industries and markets, of countries in many regions.

The value chain of the required content management system includes the following:

- Content sources, i.e., public and private organizations, which hold digitized business-related (raw and processed) data.
- Content Collection, i.e., tools, procedures and staff that cooperate in order to collect, validate, and harmonize the raw data
- Content Management, i.e., tools, procedures and staff that cooperate in order to securely aggregate, store and manage the content
- Content Publishing, i.e., tools, procedures and staff that cooperate in order to reach the targeted audience in a secure, effective and efficient, web-based manner.

The rest of the paper is structured as follows: Section 2 provides a state-of-the-art on existing approaches on investment content delivery e-services; Section 3 presents the architecture of the RISE service, its benefits and characteristics; Section 4 presents the content management procedure adopted within RISE and finally Section 5 draws conclusions.

2 Prior work on investment content delivery e-services

The RISE service satisfies all the prerequisites for a widespread access to information and knowledge to all investors who seek business investment opportunities in a specific region or country, through an informative and regional economical analysis. Similar services are offered by companies in the US covering US related business information and content or related to specific regions such as the *Newly Independent States* [1].

In Europe continent similar approaches include the effort conducted in the *SEED* and *CB-Business* IST projects [2][3]. In these cases, the services are structured around the entire life cycle of business events and they offer information on business opportunities in *South Eastern Europe (SEE)* countries. This information concerns market,

economy and regulatory issues. Specifically, a user can obtain useful information on a specific market/business sector (such as banking, telecoms etc.), statistics on the general economy, information on the economic/business environment or on the legislation in force regarding foreign investments, trade and other related aspects. Furthermore, the user can obtain information on all registered companies and products and gives all the required content in order to specify the appropriate way on how to set up a company in foreign country or even to set up a foreign branch of an existing company. The Chambers of Commerce, of the corresponding countries provide the required electronic content. Other similar services are offered by *EIPCOT Consortium in the Eurotransbiz* project, which is a European Internet portal prototype, focusing on the companies' transmission process [4]. Eurotransbiz establishes a European Economic Lookout Observatory producing harmonized statistical data across major industrial sectors and countries. It covers three wide regions (France, Spain and Italy), and offers information on business opportunities in the countries that participated in the corresponding project. The provided information, among others, concerns information for the set-up and management of an enterprise, help about legal, financial and logistics matters, market, economy and regulatory issues. Although a stakeholder can obtain useful information on a specific sector, statistics on the general economy, information on the legislation in force regarding foreign investments, trade and other related aspects, the EIPCOT services are focused on buying or selling an enterprise and not on investment opportunities.

In addition the RISE service provides more specific information in every industry sector, coming from the appropriate combination of the electronic content provided. It provides validation and harmonization procedures on the collected content and through the use of an economic analysis tool called FINAN (a commercial economic and market analysis tool), offers professional analysis and responsible predictions on business related aspects to all its users. An additional advantage of RISE is that it offers both country and region specific business information, as opposed to SEED and CB-Business which offer only country specific information. This is a major requirement when wishing to invest in a specific industry sector in a specific area and therefore more fine-grained and intrinsic information is needed, so that possible risks are mitigated.

3 The RISE architecture

The RISE service provides economic analysis of all industries and companies for a market, comparisons among them, as well as forecasts of future analysis of particular industry sectors. Important business aspects are clearly and responsibly identified, in order for individual investors, larger companies, venture capital etc. to invest appropriately in a specific industry sector. The information related to these business aspects is provided by the appropriate combination of content offered mainly from *Content Providers (CPs)*, such as Statistical Offices (SOs), the corresponding to the region Chambers of Commerce (CoCs) and through a team of economic journalists and specialized financial analysts. The required information is collected from heterogeneous data sources through inherently different data collection procedures. Therefore consistent validation procedures are a vital stage within the Information Life Cycle ensuring homogenisation.

The secure Web Services platform, depicted in the following figure *(Figure 1)* and based on new and existing technologies, represents a generic architecture consisting of several application areas, each one customisable according to the actual service providers' and users' needs and requirements.
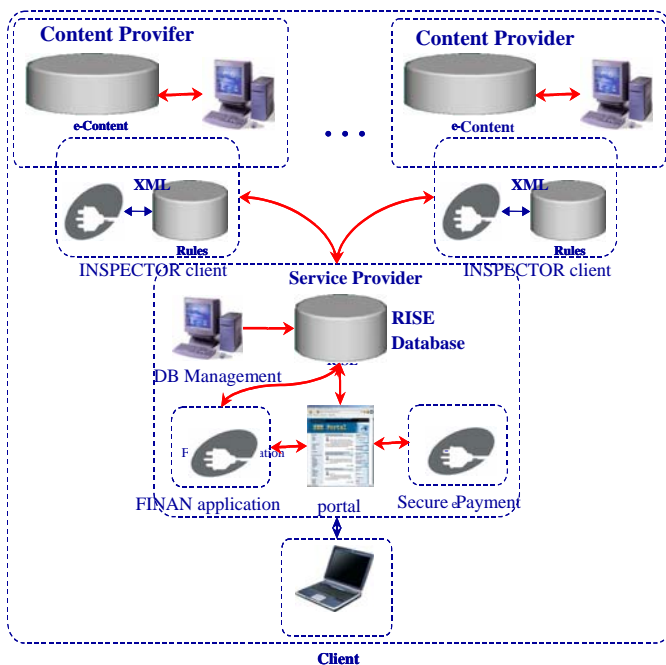

Figure 1: *The RISE architecture*

It mainly consists of three different entities, the various CPs that own untapped electronic content, the *Service Provider (SP)* who aggregates and enhances the content in order to be offered as an added value, web based service to the user, and the final users who are seeking business investment opportunities in a specific region.

The CPs own public information covering a broad spectrum of business related information, offering a macroeconomic picture of the economic sector at the country or at a number of countries, or even at specific regions within the country. Such information could be the following:

- Primary data, related to production, consumption, imports, exports, number of enterprises in the sector, total sales of it and total employment,
- Processed data, related to mean values of sales per enterprise, mean values for employment per enterprise and predictions of production, consumption, imports, exports, sales etc. using time series analysis.

The above data assists the user to decide the initiation or not of an economic activity for any given sector and in any given country or countries. Public content from public channels could be gathered from important organizations as the OECD, Stability Pact, UNECE and regional Statistical Offices.

In order to make the analysis more specific (e.g. pinpointing to a single enterprise or a specific company), content providers could also offer:

- *Primary data* related to balance sheets and results such as sales, cost of sales, gross profit, selling expenses, long and short term liabilities, provisions, fixed asset, stocks, debtors and securities, and
- *Derived data* (from processing results by sector) related to structure (economic data as a percentage of assets, evolution of economic data (Investments, capital, loans, etc), financial results statement analysis, sources and uses of capital, cash flow statement, working capital and financial Indicators.

The results of the data processing provide an analysis of the existing situation of the specific industry sector, and standardised indicators for this sector. Based on the above primary and processed data, the user is able to formulate an in depth opinion on the existing economic situation, in the desirable sector and come to a conclusion on whether the entrance to that sector would be promising or not. Additionally to the specific data provided, the SP provides analysed business related content through its large team of economic journalists, the specialised financial analysts and mainly from the use of specific economic analysis tools. Its extensible database contains detailed and analytical financial data and news information in the desirable region, country and internationally.

Specifically, the data that is retrieved among others for the described service is related to stock exchange financial market, mutual funds, real time news, economic indicators, company profiles, financial analysis, announcements of initial public offerings, world market and financial press analysis on a monthly basis.

4 The RISE content management methodology

The content management methodology that is adopted in the RISE platform and is depicted in the following figure *(Figure 2),* organises the content management in four distinct and interconnected phases, including integrated security characteristics:

- *Content Collection*, which employs the appropriate tools, procedures and staff in order to gather, validate and harmonise electronic public content from the various Content Providers
- *Content Management,* which focuses on the management of the aggregated content that resides in the main database of the RISE service, as well as processes and tools employed to access, update and administer the collected content.
- *Content Publishing,* which employs the tools, procedures and staff required to draw content out of the main database, creates reports using the FINAN application and publishes them on the corresponding section of the Service Provider information service.
- *Workflow Management*, which is actually a horizontal activity and involves the appropriate tools, procedures and staff that assure the entire process of collection, storage and publication, in order to run effectively and efficiently, according to predefined timelines and actions.
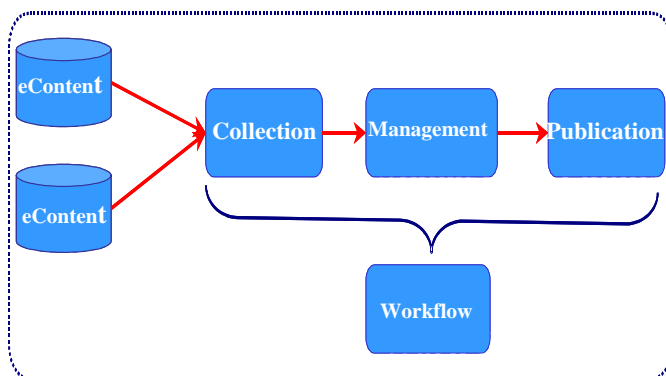

Figure 2: *RISE content management approach*

4.1 Content Collection

The Content Collection procedure is generally based on a system of meta-information, e.g., a system of information about the information that has been collected. This provides the 'handles' on the collected content needed to find it, evaluate its appropriateness, and assemble it into useful business-related reports during the subsequent tasks of content management and publishing. The RISE content is qualified according to the following general types of meta-information:

- *Divisional meta-information* that segments continuous content into discrete (content) components in consistent and useful way in order to be accessed independently
- *Access meta-information* that determines how content can be located according to four major categories:
  - o Hierarchies, which are outlines that list the content in the context of higher and lower order concepts
  - o Indexes that are sets of terms that categorize content using word and phrases
  - o Associations that links between one piece of content with another
  - o Browse orders, which specify which piece of content should be seen before and after a given piece of content
- *Management meta-information* that adds parameters to content such as unique Ids, author name, status, statistics and content version.
- *Inclusion meta-information* that allows one piece of content to be embedded in other content.

In this procedure all the CPs and the SP are involved, using appropriate tools. One of them is the INSPECTOR tool, used in order to enforce validation and harmonization rules specific to the RISE context. These include correctness rules that assure that the content is prepared in accordance with validation and harmonization standards (e.g. use of accepted nomenclatures), communication rules in order for the content to project the needs of the target audience (e.g. correct formats and formalisms to use), and consistency rules that assure that all the other rules are applied evenly over the entire content base.

All the involved partners use a data transfer module, developed with Web Services, and a customized parser, in order to convert the received data to XML [5][6]. Finally, standard web servers and application servers are also used in order to securely transfer the data over the Internet.
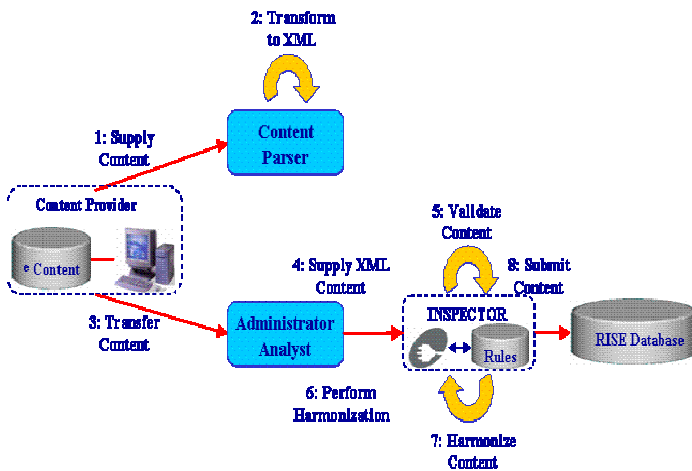
Figure 3: RISE Content Collection procedure

The Content Collection procedure, as depicted in the previous figure *(Figure 3),* is conducted in two stages. In the first stage, the parser converts the extracted from the CPs' database content into the XML format. This XML input in the second stage, feeds the INSPECTOR tool so that validation of the content can take place against specific validation rules under the control of the local network of financial analysts and editors of the publication service which resides at the Service Provider. The above-described process is iterated until a valid and harmonized form of the data is reached. The secure Web Services data transfer module is then used to dispatch the XML data to the RISE database where it is stored [7]. This process is repeated each time the Content Providers update the offered content.

4.2 Content Management

The main activity during the Content Management procedure is the aggregation, administration and update of the provided content. The outcome of this phase is a RISE database that is used to support the RISE service in terms of content provision. Any further database administration takes place during the Content Management procedure.

Specifically, the RISE database performs the following functions:

- Storage of content, which can be simple text, a component, a binary file or meta-information,
- Selection of content through fielded querying to find components with particular meta-information associated with them,
- Management of content that includes security, user maintenance, status identification of content for workflow triggers and maintenance operations, transaction logging, bulk automated processes that run periodically against subsets of the database, and

input/output processes that load in and push out the content
- Connection to other systems over the network with a variety of clients, including the FINAN application and the publication service.

The Content Management procedure involves only the SP using the RISE database, the web server and the application server for loading content into it, and all possible related database management components.

4.3 Content Publishing

The main actor that participates in the Content Publishing phase is the SP that uses the RISE database, the FINAN application and the business information portal in order for the user to access the described service.

During the Content Publishing phase the FINAN application produces business reports that are published through the portal that resides at the Service Provider. The portal is customised to support the service and provide potential users with the expected options, according to standard investment and business oriented templates, rules and terminology.
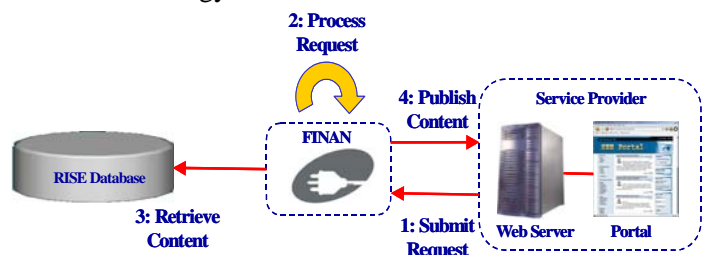

Figure 4: Content Publishing

The sequence of steps for Content Publishing, as depicted in the above collaboration diagram (*Figure 4*), is the following:

- A request for the RISE service is submitted through the portal that resides at the Service Provider
- The FINAN application receives the request information in order to be processed
- During processing, the FINAN application accesses the accumulated and aggregated content on the RISE database in order to formulate the requested report
- The report is published through the publication portal.

The outcome of the whole procedure is the RISE report, which is presented to the end user.

4.4 Workflow Management

The Workflow Management procedure involves all the CPs and the SP, and runs as a "background" activity during the above-described Content Collection, Management and Publishing phases. It ensures that the workflow procedures, which are defined to support the RISE service, are being carried out with the most appropriate and efficient way by the responsible personnel, using standard workflow management tools for monitoring and reporting (e.g. sheets, e-mail, etc.).

The service design incorporates takes into account secure access requirements and incorporates the appropriate security technologies including authentication, confidentiality and authorization mechanisms to provide secure communication channels and procedures in the RISE service. The security of the service is the result of a multi-level approach. Primarily the process itself has been designed with security being the highest priority. The customer does not provide any sensitive data to the merchant, which would allow the identification of the customer, misuse of the data, or improper, unsafe storage of the data. As a result the customer may stay anonymous during the transaction (lawful interception is provided for).

RISE facilitates multilingual access to an integrated portfolio of business-related reports and studies, establishing an added value service by the provision of specific information per industry sector. This in-depth specialization per industry sector, is realized by the combination of the appropriate electronic content, which covers a wide spectrum of identified business information needs of the industries and markets, of countries in various regions. The service covers the whole value chain of the required content management system, including enhanced and adequately correlated mechanisms for content collection, content management, content publishing and workflow management, having security as a primary concern.

4.5 Security Infrastructure

In order to support the secure infrastructure RISE platform implements the basic security services of *authentication*, *integrity*, *confidentiality* and *non-repudiation* utilizing cryptographic operations on data, including digital signatures, encryption and time stamping. More specifically, it uses the *W3C XML Signature Recommendation (XML-DSIG)* and *W3C XML Encryption* draft standard to digitally sign and encrypt the XML content.

XML-DSIG defines a means of rendering a digital signature in XML and brings several benefits of XML to digital signatures, making them human-readable, easily parsed, platform independent, and generally more advantageous for workflow environments than preceding standards like *Public Key Cryptography Standard - PKCS#7* [10][5][8].

XML Encryption allows the selective encryption of arbitrary portions of XML documents, thus allowing seamless integration into workflow processes [10][5][8]. Furthermore, OASIS *WS Security (WS-S)* adds encryption, digital signatures and authorization token support to SOAP messages for Web Services [5][13].

The need for every user to own a public/private key pair, which should form the basis for the users' or organizations' digital identity in wireless environments, is fulfilled in the proposed platform through the communication with a PKI *(Figure 5)*.
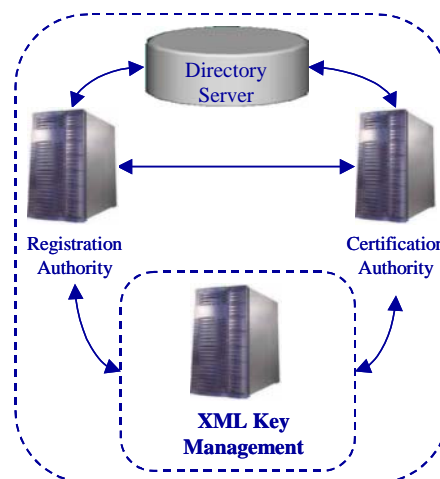

Figure 4: *Content Publishing*

The key interaction with the PKI in order to perform validity verification for the web services of the designed platform will be provided by XKMS technology. XKMS integrated with SOAP will simplify the deployment of enterprise-strength PKI services by transferring complex key verification processing tasks from the PC to a Trust Service.

Digital signature verification experiments with different XML-based document sizes of 495, 12800 and 540000 bytes, resulted in mean processing time of 1856, 2008, 11758 ms [25]. The main conclusion of the above work is that the mean processing time for signature verification of XML-based documents is directly proportional to the size of the document. Therefore, in order to provide sufficient system performance, file sizes for exchanged documents, and SOAP messages have to be kept as small as possible.

5 Conclusions

RISE facilitates multilingual access to an integrated portfolio of business-related reports and studies, establishing an added value service by the provision of specific information per industry sector. This in-depth specialization per industry sector is realized by the combination of the appropriate electronic content, which covers a wide spectrum of identified business information needs of the industries and markets, of countries in various regions. The service covers the whole value chain of the required content management system, including enhanced and adequately correlated mechanisms for content collection, content management, content publishing and workflow management, having security as a primary concern.

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