Web 3.0 Approach to Corporate Information Systems Evolution

Valentin Kisimov*

Summary:

The new "Web 3.0" technology has not well matured enough yet, but there are many efforts to implement it for the needs of Corporate Information Systems (CIS). The CIS generally serve to support corporate business and encompass modules dedicated to maintaining the core corporate activities, such as banking transactions (for banking CIS), the management of the production lines (for industrial CIS), supply-chain management (for Logistic CIS), etc. The CIS have evolved over the years and their components are based on non-Web technologies and Web 1.0 or Web 2.0 technologies. With the new era of Web 3.0 technology, the CIS have to be transformed (re-engineered) so as to work with Web 3.0 principles. This transformation can be made along a few lines: converting Web 3.0 to Web 1.0 or Web 2.0 technologies (with missing functionalities); separating the Web 3.0 elements from the other CIS and providing special integration features; converting the non-Web technologies, Web 1.0 or Web 2.0 technologies into Web 3.0 principles of operation and achieving an integrated CIS working with Web 3.0 principles. The purpose of the current paper is to present a new approach for the re-engineering of the existing (legacy) CIS, integrating Web 3.0 elements and working with the Web 3.0 principles.

Key words: Corporate Information Systems; Web 2.0; Web 3.0; ICT Architectural Bleuprint; Conceptual ICT Architecture

JEL: O31 - Innovation and Invention: Processes and Incentives; O32 - Management of Technological Innovation and R&D.

1. Appearance of Web 3.0 as evolution of Web 1.0 and Web 2.0

The Web terms creator – Sir Tim Berners-Lee, defined in 1999 in his work "Weaving the Web" [9], the term "Web", which in fact is the definition of Web 1.0. According to this definition, Web is a collaborative environment, where everybody is connected to everything via a unique information space and everybody has the ability to edit this space. Over the years such a functionality has not been achieved, but other functions have been developed - WWW (World Wide Web) and the Browser and HTML have been created as the core of real communication between people. In 2004 alone the idea of editing in Web was realized, and together with the functions of user's content incorporation

* Professor, DSc, University of National and World Economy, Sofia, Bulgaria, Vice-Rector; vkisimov@unwe.bg;

and editing, the new "Web 2.0" term was coined.

In fact, the "Web 2.0" term was coined by Dale Dougherty, vice-president of O'Reilly Media Inc. The term was officially rejected by Tim O'Reilly (O'Reily T. 2005). This time, the ICT industry, which was still suffering from "dot.com" problems, embraced the new term and accepted it as a new direction of evolution. In his definition Tim O'Reilly does not go into practical details and for this reason in 2006 offers a new comprehensive definition of Web 2.0 (Web 3.0 Concepts, 2011), which was further clarified in his next publications (What is Web 3.0, 2007; Maher V, 2007; Hoy, T, 2007). At the core of the newly defined Web 2.0 is not the attempt to create new types of Corporate Information Systems, but to support the people outside corporate life. Apart from this focus of Web 2.0, the architects of Corporate Information Systems started to look for approaches to incorporate the Web 2.0 technologies into the Corporate Information Systems.

The main building blocks of Web 2.0 technologies are:

- Wikis (networked set of web pages, where everybody can read and edit each page);
- Blogs (Web site consisting of discrete entries presenting opinions or event logs - "posts", typically displayed in reverse chronological order, so the most recent post appears first);
- Social networks (Web tool to communicate between independently created groups of individuals, where the individual is at once a user and content creator, and the tool serves to establish relationships between individuals, groups, organizations, or even entire societies);
- RIA (Rich Internet Applications), based only on user browser's interactivity functions, supported by the technologies Ajax, Flash, RSS, Mashup, etc.;
- Web based Content Management Systems;
- Web Services Applications, communicating between Web 1.0 and Web 2.0 services;

Table 1 offers a comparison of Web 1.0 and Web 2.0 based on their distinctive features.

Table 1. Comparison of Web 1.0 and Web 2.0

Web 1.0	Web 2.0
Connect computers	Connect people
For reading of information	For reading and writing of information
Content management capabilities	Wikis
Personal Websites	Blogs
Dialogs based on simple request-response	Dialogs based on Rich Internet Applications
Offer information to read	Collaborative creation of information for usage
Information classification	Information organized by its tagging
Individual or companies are participants	Participants are social groups of people or socially related people and companies
End user is an individual	End user is a member of a social group of people
…	…

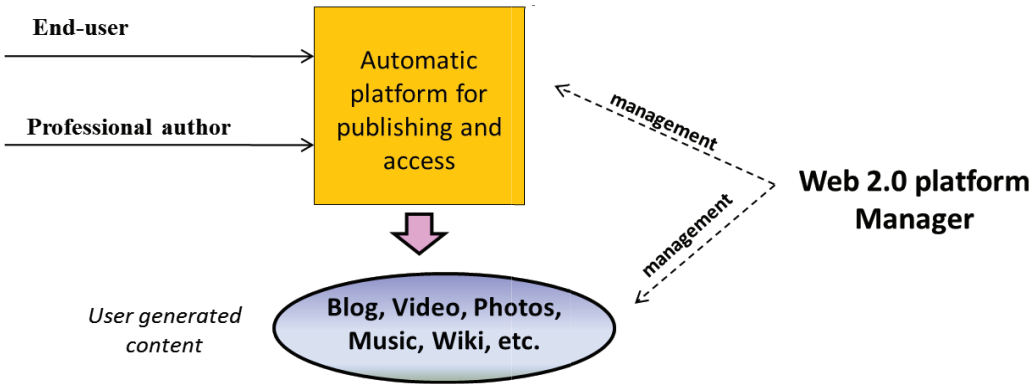

Fig.1. Actors in Web 2.0 from ICT architectural point of view

From ICT architecture point of view, Web 2.0 can be presented graphically trough figure 1.

The Web 2.0 ICT platform can be used for publishing of Blogs, for shared usage of Video and Audio data, for Social networking, or for Wiki. This platform has an Administrative Manager. Content can be created either by professional authors (defining integration between different Web services) or by an end-user (loading for example his photos and/or travel experiences).

The use of Web 2.0 in Corporate Information Systems raises the following issues that should be resolved:

- How to deal with the millions of corporate HTML pages;
- How to find the correct file;
- How to filter the unnecessary information;
- How to make a new information for the Corporate Information System, form HTML pages;
- How to increase the value of the published information;
- How to extract the meaning from the millions of corporate HTML pages;
- How to distinguish different HTML pages, which have the same content meaning.

One of the Web 2.0 technologies is Taxonomy, which operates with classified terms. The "term" in Taxonomy is not just a word, but also an object in the context of Object-oriented approach, with specific attributes and relations with other terms. The term is a building block of the Taxonomy and is also referred to as "taxon". The taxonomy schema is a classification of taxons. Normally between taxons there are relations, called "parent-child", "supper type – subtype" or "generalization-specialisation". The subtype has the same characteristics as the supper type. For example, the taxon "car" has a subtype "Chevrolet". The taxonomy is organized as a hierarchy of objects (taxons) belonging to the same class. The taxonomy can be used normally for the classification of economic activities, for example products-company-industry. Examples of such taxonomies are United States Standard Industrial Classification (SIC), the North American Industry Classification System (NAICS), Statistical classification of economic activities in the

European Community (NACE), the United Kingdom Standard Industrial Classification of Economic Activities, Industry Classification Benchmark, etc. Each taxonomy has an area of utilization, for example economics, medicine, management, etc. We can define this area of utilization as a "domain". The international and national taxonomies are as a rule used by Statistical institutes. The taxonomy starts its development from a set of terms – a dictionary. The ordered dictionary (for example alphabetically or logically related terms, according to the recent usage) represents the second level of taxonomy. The third level of taxonomy is the terms that are hierarchically linked by meaning. The fourth level of taxonomy is the structure, which contains a few hierarchies of terms.

A taxonomy hierarchy is built on a standard, defining the relationships between the terms, or on an expertise created by one or a few people. A taxonomy built by an expert could be further reordered (creating a new taxonomy) by another expert. For example, the "Web information system" taxonomy can be built either on the "Web page"-"Structured data" hierarchy or on the "Web page"-"Extracted knowledge"-"RDF data"-"Non-structured data" hierarchy. The process of creation of a taxonomy version on the basis of one or a few taxonomies, based on an expert's view, is called creation of a "Folksonomy". The Folksonomy is typical of the evolution from Web 2.0 to Web 3.0.

Web 2.0 has been in operation for more than 6 years, but the business effect and result of its implementation is very low, as is shown in figure 2.

Across the world there are about 1.5 billion Internet users. About 300 million people publish information and about 30 million publish regularly to meet the demands of Internet users. Only 0.01% of all Internet users earn money from the

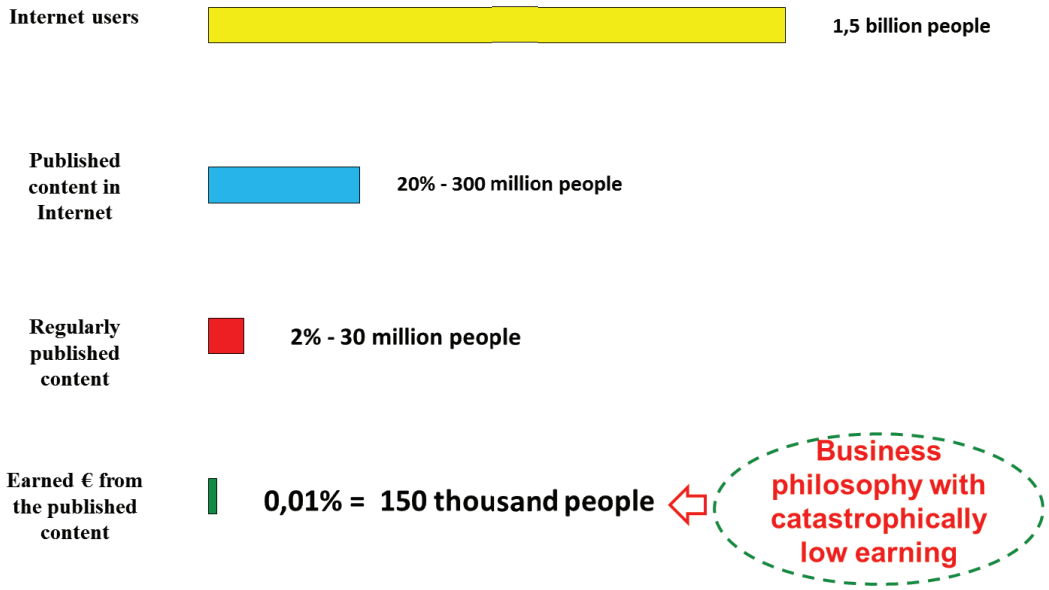

Fig. 2. Different types of users-publishers in Web 2.0

published content. Hence, Web 2.0 is a bad business philosophy because of the low level of earning – the profit is estimated to stand at about 1€/hour for the actively published information. In human evolution there is no business model with such a low level of earning. For this reason Web 2.0 is not seen as a technology of the future, but as an interim stage in the technological evolution. By comparison, the telephone was created for the purposes of maintaining social contacts, and though it initially had a zero or low profitability, it is a unique tool for communication (not like Web 2.0). Hence the telephone was not blocked in its evolution and now has a profitable business model. The Web 2.0 technologies have a great value for individuals, but a low business value for the corporations. If corporations implement Web 2.0 technologies, then how can they make a profit from those technologies? They earn some profit from advertising, but their profit from the Corporate Information Systems is not relevant.

Driven by such an analysis, the Web technologies further evolved and the Web 3.0 technologies were created, which ensured a profitable business model. The core of the Web 3.0 is that the user not only creates content, but also forms a profitable business model, which ensures revenues. Hence the major directions in the evolution of Web 3.0 can be defined as follows:

- Creation of conditions for generation of user made applications, bringing profit to the users;
- Conversion of the Web 2.0 formed information into meaningful information – knowledge, bringing profit to its creator.

This implies that Web 3.0 should incorporate features for the loading and execution of business applications, extracting knowledge from the content that has been loaded on the Web 1.0 and Web 2.0 instruments.

In brief, to identify the 3 types of Web X.0 technologies, the following distinction should be made (Nikolov R at al, 2008):

- Web 1.0 is for reading of documents;
- Web 2.0 is for evolution of the human creativity, via sharing information and providing collaborative actions;
- Web 3.0 is for mutual execution of business functions, loading and executing business applications on different computer systems, where the knowledge is a core element.
- The distinguishing between the 3 type Web X.0 technologies can lead to another summary:
- Web 1.0 is for "reading" only, Web 2.0 is for "reading - writing", while Web 3.0 is for
- "reading – writing – executing";
- Web 1.0 is "Network platform", Web 2.0 is "Network with distributed shared content repositories", while Web 3.0 is "Network with servers for loading and executing of business applications" and "Semantic webs for creation of knowledge".

The implementation of the Web 3.0 "reading – writing – executing" functionality requires that servers with Infrastructure services for the loading and execution of applications are established. These servers could be private corporate servers or Cloud Computing-based servers. In (Bolinder J, 2008) it is explicitly defined that Web 3.0 is well oriented to Cloud Computing

Environments, e.g. to the use of IaaS (Infrastructure as a Service) services.

The Ontology is a typical characteristic of the Web 3.0 technologies. It is a Web 3.0 building block dealing with knowledge. The Ontology in Information systems (in other sciences there are different contexts) – (Ontology, 2009) is a formal representation of knowledge via the network of concepts and relationships between them, where the concepts belong to a single domain, for example Computer Science. Gruber (Gruber T, 1993) is one of the first authors to define ontology as "formal specification of shared knowledge". Ontology works with vocabulary, part of the domain, where each concept shares attributes and forms relations with other concepts. Generally speaking, Ontology is developed through the Object-Oriented approach, where the concept is presented as a class with specific characteristics. The simple relation is parent-child, but there are other possible relations in ontology. There is a standard language for ontology description - OWL (Ontology Web Language), which uses the following elements: class (concept), object (instance of a class with particular attributes), class attributes, relations connecting classes, constraints (for example what kind input data can be accepted), rules (for example - the type *if-then*), and events (leading to change a content of an attribute).

The Ontology for a domain represents the knowledge for the domain. There may possibly be a hierarchy between ontologies, where the 'upper ontology" represents the objects that are common for the 'lower ontologies". In Informatics, Ontology represents the knowledge in the domain of Informatics. ***The goal is to use a single ontology from many applications, e.g. same knowledge to be reusable from different business applications, where each application could be used different parts of the ontology, or the ontology with different attributes for its classes.*** Using ontology, different reasons can be established.

A single ontology can be created by many experts. Other experts from the same or closed domain can modify the already created ontology, thus arriving at a new version of ontology, referred to as "Folksontology".

The Semantic Web is a term, totally related to Web 3.0. It is defined again by Tim Berners-Lee, who was then director of W3C Consortium (World Wide Web Consortium). It uses technologies, aiming to extract a meaning from web documents – Web pages, Wikies, etc., presenting them in a form suitable for computer treatment. For the moment, the computers still have limited participation in processing the data from the Internet. The main computer functions are reduced to the storage and retrieval of information, while the human functions are related to evaluating, classifying and interpreting the meaning of the information. Since computers do not understand the human functions (at this stage), it is necessary to create a language meaningful for the computers to facilitate the process of evaluation, classification and interpretation of meaning. For this reason the Semantic Webs have been developed, in which the meaning is presented in a form that is understandable for computers,

namely the RDF (Resource Description Framework) language – a language based on XML, using URI identifiers for resource identification. In fact, RDF is a language for the description of resources in a way understandable for computers. The RDF format works with metadata, which are data for the data. RDF is not a language for human reading. There are complementary languages, supporting the RDF work: RDFS (RDF Schema), being an extension of RDF, serving to make classes, properties and hierarchy; SPARQL (Protocol and RDF Query Language) — new language for quick access to data presented in RDF; and OWL – the language working with ontologies, created with RDF and RDFS.

The Semantic web is not a network of webpages. It encompasses the relationships between concepts (things) and their properties. With the introduction of the Semantic web as part of Web 3.0, the Web 1.0 and Web 2.0 can be defined as syntactic webs.

The main purpose of the Semantic webs is to form a new type of document – Web 3.0 document, presenting its knowledge via RDF constructs. So far there have been limited Web 3.0 documents posted on the Internet. This raises the question of whether we can convert the Web 1.0 and Web 2.0 documents into Web 3.0 ones, which could possibly be treated by Semantic webs. For this reason it is useful to make a comparison between the 3 types of Web technologies and provide a clear definition of the distinctive entities.

The comparison between Web 2.0 and Web 3.0, based on data-information-knowledge concepts, is presented in the form of a table – table 2 (Cho A, 2010).

Table 2. Comparison between data-information-knowledge features of Web 2.0 and Web 3.0

Web 2.0	Web 3.0
Web of documents	Web of data
Existence of lot of information	Information management process
Use Social networks	Use Intelligent Network
Knowledge created by the crowd	Knowledge created by experts
Search tools	Finding tools
Massively used PageRank algorithm for Google search	Use Ontology for search
Minimum rules, anarchy of information	Use standards, protocols, business rules

Table 3. General comparison between Web 1.0, Web 2.0 and Web 3.0

Web 1.0	Web 2.0	Web 3.0
Mainly reading from Web	Mainly reading and writing in the Web	Portable personal Web
450 million users	1+ billion users	Focus on individual users
Oriented to companies	Oriented to communities	Oriented to needs
Own content	Shared content	Semantic Web
HTML pages, Portals	XML, RSS	User defined content
Key words	Taxonomy, Folksonomy	Ontology

The comparison between Web 1.0, Web 2.0 and Web 3.0 can be presented in a table – table 3 (Web 3.0 Concepts, 2011).

The evolution of the social relationships resulted in the creation of Web 2.0, while the evolution of the information linkage resulted in the creation of Web 3.0.

The evolution of Web 3.0 offers a new way of searching information:

- Search based on tagging (creation of tags to Web 1.0 and Web 2.0 documents, as Web 3.0 has natural tags);
- Contextual search using Taxonomy, Folksonomy, Ontology and Folksontology;
- Conceptual search using Ontology and Folksontology;
- Search for deductive conclusions.

2. Essence of Web 3.0 related to corporate information systems

There is no publicly accepted definition of Web 3.0, still less of Web 3.0 related to Corporate Information Systems. In 2006 Tim Berbers-Lee, the creator of the Web term, coined the Web 3.0 term as an extension to Web 2.0, using Semantic webs and later on adding a special focus on the data. Rajnish Sharma defines Web 3.0 as one intended for "Reading-Writing-Execution" (Web 2.0, 2008), so Web 2.0 can be considered to be "Web for data", while Web 3.0 is "Web with computer servers for loading and execution of business applications". In literature, there is ongoing debate on the essence of Web 3.0. In this paper another aspect is added – what is Web 3.0 for the individual Internet user and what is Web 3.0 for the Corporate information systems and corporate users. Obviously there are differences and this paper will focus on the second of these aspects, which can be summarised as follows:

- In Corporate Information System the numbers of the websites is limited compared to the Internet;
- In Corporate Information System the size of Wikies is limited compared to those applied on the Internet;
- The Social networks in Corporate Information Systems are not well defined in terms of goals and functions;
- Most of the corporate data cannot be stored on publicly shared repositories for considerations of corporate confidentiality;
- Corporate Web documents are subject to less dynamics and changes than those on the Internet.

In our study we have identified 11 Web 3.0 functions that have a serious impact on the Corporate Information Systems:

i. Web for Reading-Writing-Execution of Business applications;
ii. Using of Semantic Webs for the introduction of Intelligence to the Corporate Information Systems;
iii. Creation of Hierarchical and Relational Ontologies;
iv. Creation of Corporate Folksonotologies by corporate experts;
v. Identifying Search systems based on Taxonomies / Folksonomies / Ontologies / Folksontologies;
vi. Using distributed Infrastructure platforms for running Business applications;
vii. Using Cloud Computing services for the loading and execution of business applications;
viii. Using Web based virtualisation;
ix. Re-engineering of Web 2.0 technologies to serve the model Reading-Writing-Ex-

ecution of Business applications, and using Semantic Webs with Hierarchical and Relational Taxonomies/Folksonomies and Ontologies/Folksonotologies;

x. Providing analyses of Corporate Social networks;

xi. Providing explicit personalization.

The specific features of Web 3.0 involve the use of standards, unlike Web 2.0. The aforementioned 11 functions define the "Web 3.0 for Corporate Information Systems" term. In our view, this paper presents the first attempt to define the "Web 3.0 for Corporate Information Systems" term.

In the literature there are many controversial definitions of Web 3.0, which have been grouped under the heading of *unacceptable understanding for "Web 3.0 for Corporate Information Systems"*. These are:

- Web 3.0 mainly are Semantic Webs using Ontologies;
- Web 3.0 is a Virtual database;
- Web 3.0 is a set of standards converting the Web into a Big database;
- Web 3.0 is an extension of Web 2.0;
- Web 3.0 is focusing mainly on data.
- Based on all this, the Web 3.0 for Corporate Information Systems has been defined as "***A set of technologies, tools and social processes, performing the specified above 11 functions, and providing business profitable model***".

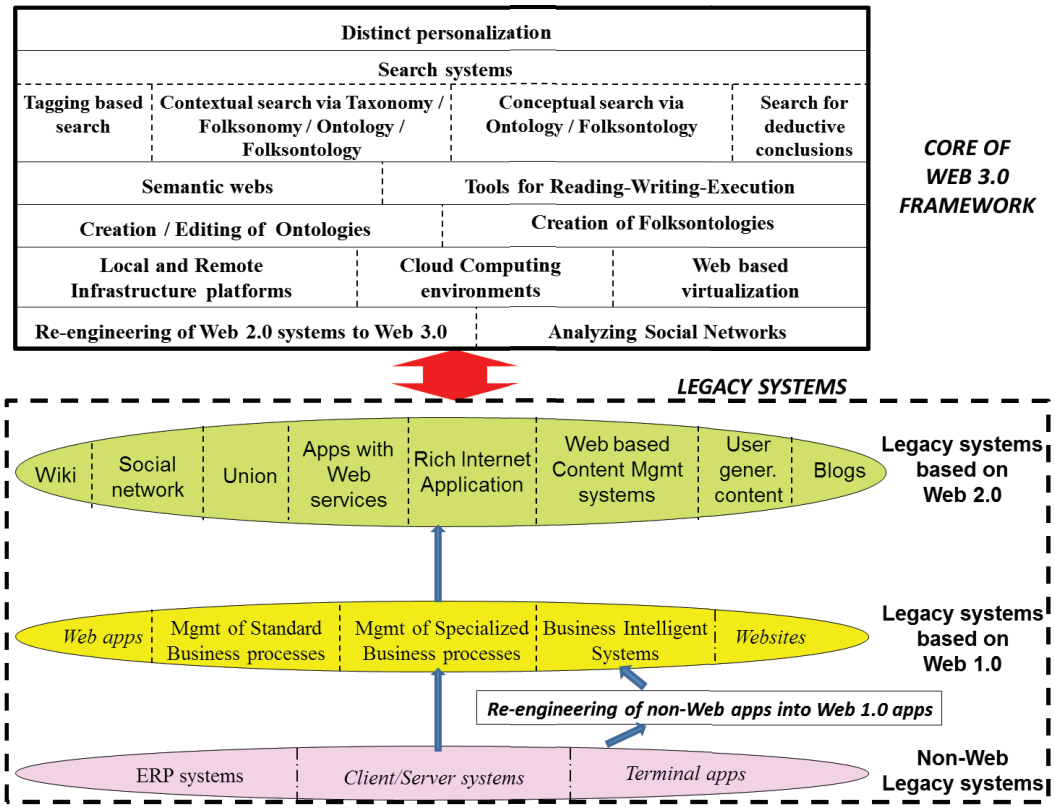

Fig. 3. Framework for Web 3.0 Corporate Information System

3. Architectural blueprint for Web 3.0 implementation in corporate information systems

The design of ICT architecture (in our case for Web 3.0 Corporate Information System) should be based on a Framework. The framework for Web 3.0 Corporate Information System has been developed and it is presented in figure 3.

The essence of the developed and proposed Framework for the Web 3.0 Corporate Information System is the application of Web 3.0 and non-Web 3.0 technologies, integrated into a Corporate Information System, wrapping all of them into "Web 3.0 forms and principles of work". For this reason, the Framework consists of:

- Core of Web 3.0 Framework, covering all Web 3.0 technologies;
- Legacy systems, covering Web 2.0 technologies (presented in the figure as "Legacy systems based on Web 2.0"), Web 1.0 technologies (presented in the figure as "Legacy systems based on Web 1.0") and non-Web technologies (presented in the figure as "Non-Web Legacy systems").

In fact the major legacy corporate systems are non-Web systems and Web 1.0 systems. The Web 2.0-based systems have been developed to meet individual rather than corporate needs, and this is why this technology is not very popular in the Corporate Information Systems. The proposed Framework has 3 levels for the Legacy systems – for not-Web technology based systems, for Web 1.0 technology based systems and for Web 2.0 technology based systems. For the first type of systems, the Framework proposes an appropriate re-engineering - "Re-engineering of non-Web applications into Web 1.0 applications". The main non-Web applications are Terminal applications, Client / Server systems and ERP systems (most of the new features of the ERP systems are already Web 1.0 based, but there are many non-Web ERP systems or components of them, for which reason the ERP systems are in the group of non-Web systems). The re-engineering of non-Web applications into Web 1.0 application uses technologies like Citrix (Citrix, 2010) and IBM Publishing system for AS/400 applications [20]. For the terminal applications, there are terminal emulation systems, which can be used also for the purpose of re-engineering. The Web 1.0 base Legacy systems, the non-Web systems converted into Web.1.0 based Legacy systems, and Web 2.0-based Legacy systems can be used in the development of the Web 3.0 Framework via the appropriate conversion, presented in the figure as "Re-engineering of Web 2.0 systems to Web 3.0" as part of the Core Web 3.0 Framework.

The Core Web 3.0 Framework for Corporate Information Systems is developed into 6 levels:

- *Communication level*, providing integration with Web 2.0 technologies, covering "Re-engineering of Web 2.0 systems to Web 3.0" and "Analysing Social networks";
- *Infrastructure components level*, including "Local and Remote Infrastructure platforms", "Cloud Computing environments", and "Web based virtualization";
- *Ontology management level*, including "Creation/Editing of Ontologies" and "Creation of Folksontologies";

- *Execution systems level*, consisting of 2 components – "Semantic webs" and "Tools for Reading-Writing-Execution";
- *Search systems level*, including "Tagging based search", "Contextual search via Taxonomy / Folksonomy / Ontology / Folksontology", "Conceptual search via Ontology / Folksontology", and "Search for deductive conclusions";
- *Level of Distinct personalization*.
- Most of the components of the Core Web 3.0 Framework for Corporate Information Systems are explained above as general Web 3.0 elements. For the sake of clarity their explanation will be further expanded. The purpose of the "Re-engineering of Web 2.0 systems to Web 3.0" component is to convert the pure Web 2.0-based systems and those converted to Web 2.0 systems into ICT components, which are accessible and manageable from Web 3.0 systems, just like the pure Web 3.0 systems. Example of such re-engineering is the creation of tags in Wiki or in Social Networks as well as enabling "Tagging based search" to access the Web 2.0 components. The essence of the "Re-engineering of Web 2.0 systems to Web 3.0" component is to enable the Web 2.0 systems to work with Taxonomies, Folksonomies, Ontologies and Folksontologies. The "Analysing Social Networks" component (Social Network Analysis, 2011) forms and measures the relationships between people, groups of people, computers, departments, URLs and URIs. The result of its functioning is the analysis of the following relationships in a corporation: man-man, man-computer, and computer-computer. While the Social Networks on the Internet connect only people, the Social Networks in a Corporation can connect people, computer, information entities (for example, a table in a database related to a particular business process). The "Local and Remote Infrastructure platforms" component represents servers, network devices and Information security appliances. Together with the "Cloud Computing environments" component, they support reading-writing-execution of business application, e.g. they ensure the selection and dedication of resources, needed for local and/or remote execution of business applications.

4. Conceptual ICT architecture for Web 3.0 corporate information system

Based on the Architectural Blueprint for Web 3.0 implementation in Corporate Information Systems, proposed above, a Conceptual ICT Architecture for Web 3.0 Corporate Information System has been developed. This ICT Architecture is presented in figure 4.

The Web 3.0 based Corporate Information system uses Web 2.0 technologies re-engineered to Web 3.0 accessibility, together with the pure Web 3.0 technologies. All Web 1.0 and non-Web technologies have to be made enabled and accessible equally as Web 2.0 technologies, to be used in the Web 3.0 Corporate Information systems, as was specified above. For this reason, the legacy corporate systems using the technology prior to Web 3.0 will be managed as Web 3.0 components.

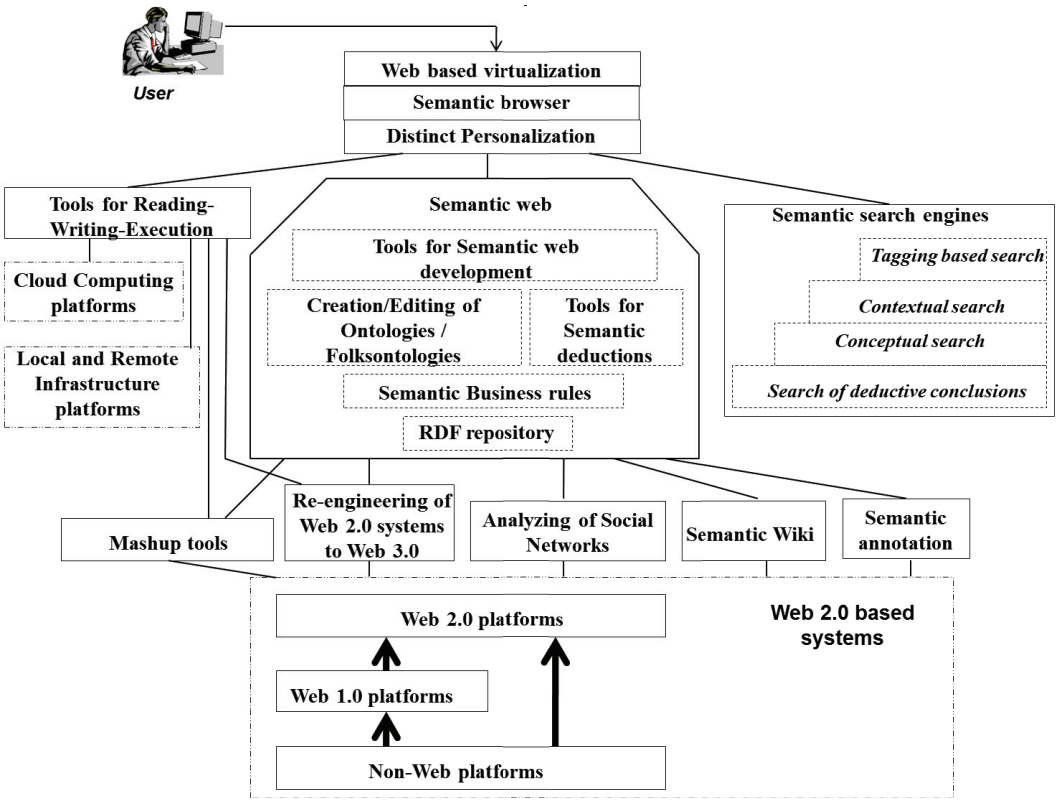

Fig. 4. Conceptual ICT Architecture for Web 3.0 Corporate Information System

There are some purely ICT components in the Conceptual architecture, which are not part of the Framework presented above, to which special attention should be paid.

The Semantic Wiki is like every wiki, but for the knowledge built into the content. Generally speaking, the content of the wiki consists of text and links. The Semantic wiki contains additional information about the content of the text and the links between the pages. This additional information can be used for indexing the wiki context and for adequate search. This additional information presents semantic data in a RDF form.

The Semantic annotation is a process for making tags to appropriate information sources. As a result of the extension of the semantic annotation the information sources are connected to the appropriate ontologies. This can be applied to the relationship between the natural languages and the information, stored in a computer, and can provide a formal approach to conducting searches in non-structured data.

The proposed Mashup tools provide the integration of the Web 2.0 environments with the Web 3.0 technologies. Generally, the Mashup technology is part of Web 2.0 technologies and ensures the quick creation of web content, using Web services (like RESR) and components (Wedges).

The Tools for Semantic web development offer a set of functions and algorithms, used in the development of Semantic webs. They create RDF files and work with them, and also operate with RDFS, OWL and SPARQL. They can be used to create different components of the Semantic webs, using the languages Java, C#, VB/Net. Some of those tools provide for the development of only particular Semantic web components, while other provide for the development of a full functional Semantic web.

The RDF Repository is called also RDF Store (Triple store) and is a system to keep and manage RDF data.

The tools for Creation/Editing of Ontologies/Folksontologies are web-based applications, having the following features: Create a new Ontology; Read and edit an Ontology; Merge ontologies into a single Ontology; Modify an Ontology into Folksontology; Modify a Folksontology into a new Folksontology; Merge ontologies and folksontologies into a new Folksontology.

The tools for Semantic Business rules work with rules stored in RIF (Rule Interchange Format) form, based on Horn rules and first-order semantics. These rules are treated as an extension of the OWL ontology description. At the same time, the RIF's rules use the characteristics of ISO Common Language and Conceptual Graphs.

The tools for Semantic deductions (conclusions created in the Semantic webs) serve to create deductions from existing axioms and facts in the RDF repositories. They work along the following principles: Creation of conclusions; Forst's sequence predictive logic; forward moving creation of conclusions; backward moving creation of conclusions; Probability conclusions.

The Semantic browser is an ICT component that should normally exist in the Client environment (computer). It is a tool for browsing semantic content. Such a tool extracts and visualizes objects and their relationships in RDF, RDFS and OWL repositories. Furthermore it focuses (filters) specific relationships. The Semantic browsers are normally created via JavaScripts or Rich Internet Applications.

The Semantic search engines look for information that is either tagged or identified by ontologies. There are four possible categories of engines for conducting the following types of search:

- Tagging-based search, where the tags are related to objects in a particular taxonomy or ontology, used as identifiers for the search;
- Contextual search using taxonomies/ folksonomies/ontologies/folksontotlogies. This search is conducted on webpages in different servers, much like the full-text search in a wiki page, providing a search mechanism at the level of link to the core page;
- Contextual search using ontologies/ folksontologies. This search looks for contextual similarity of information in non-structured data (archives, emails, logs, reports, etc.), e.g. the search looks for a similar concept of the request;
- Search for deductive conclusions, made by deductive logic, based on deductive arguments.

The tools for Reading-Writing-Execution in the Corporate Information systems have to be oriented towards business applications and used for installing applications. The Business application has to be located on a server (generally on a virtual server). This server can be located on a Local infrastructure platform, a Remote infrastructure platform or a Cloud Computing platform. "Local and Remote infrastructure platform" is defined as an ICT infrastructure, consisting not only of servers, but of all network and security appliances, needed for the operation of Web 3.0 technologies. To support the Corporate Information systems, the Cloud Computing platform should possess all security features - the "DMZ" and "Internal network" areas and all capabilities to install and manage adequate corporate security policy.

5. Conclusion

The paper presents a new approach to the design of the Corporate Information systems, using Web 3.0 technologies and orienting the entire Corporate Information systems to look like as Web 3.0 system, based on Web 3.0 technologies and working with Web 3.0 principles. A definition of Web 3.0, focused on Corporate Information systems is provided. Furthermore the paper proposes specially designed Architectural Blueprint for Web 3.0 implementation in Corporate Information Systems, on the basis of which Conceptual ICT architecture of Web 3.0 Corporate Information System has been developed with all components and relationships. At the Information Technologies and Communications Department at University of National and World Economy in Sofia, Bulgaria, different prototypes of this Architecture have been developed and tested.

References:

Bolinder J., The Return of Web 3.0 – Cloud computing, Browser extension or the Distributed Web, http://impl.emented.com/2008/08/04/the-return-of-web-30-cloud-computing-browser-extensions-or-the-distributed-web, 2008, [Accessed Sept,7th, 2012]

Cho Allan, The mashup matrix: linking the ideas of Web 2.0 to Web 3.0, http://www.slideshare.net/allancho/web-30-presentation-presentation, [Accessed Sept, 7th, 2012]

CITRIX XenApp, http://en.wikipedia.org/wiki/Citrix_XenApp, 2010 [Accessed Sept,7th, 2012]

Gitonga D., Define Web 3.0, http://www.ehow.com/facts_5787765_ define-3_0.html, [Accessed Sept,7th, 2012]

Gruber T., "A translation approach to portable ontology specifications". In: Knowledge Acquisition. 5: 199-199, 1993

IBM WebSphere Host Publisher, http://www-01.ibm.com/software/webservers/hostpublisher/library/publications/guide40/guide03.htm, [Accessed Sept,7th, 2012]

Hoy T., The next revolution: Clod computing and Web 3.0, Chief Marketer, http://chiefmarketer.com/technology/1109-cloud-computing, 2008, [Accessed Sept,7th, 2012]

Hoy T., Web 3.0: Converting Cloud computing and the Web, http://www.ebizq.net/topics/cloud_computing/features/12477.html, 2010, [Accessed Sept,7th, 2012]

Maher V., Web 3.0 is only partly semantics, Bizcommunity.com Media, http://www.bizcommunity.com/Article/196/16/27000.html, 2008, [Accessed Sept,7th, 2012]

Nikolov R., Kisimov V., Koychev I., Web 2.0/3.0: Borders and National Security, NATO BORDER SECURITY FORUM - ADVANCED RESEARCH WORKSHOP, Covilha, Portugal, 17 – 21 September 2008

O'Reilly T., 2005, What is Web 2.0: Design Patterns and Business Models for the next generation of software. O'Reilly website, 30th September 2005. O'Reilly Media Inc. , http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html, [Accessed Sept,7th, 2012]

Ontology (information science), http://en.wikipedia.org/wiki/ Ontology_(information_science), [Accessed Sept,7th, 2012]

Sir Tim Berners-Lee, T. 1999, Weaving the Web, Orion Business Books

Social Network Analysis, A Brief Introduction, http://www.orgnet.com/sna.html, 2011, [Accessed Sept,7th, 2012]

Taxonomy, http://en.wikipedia.org/wiki/Taxonomy, [Accessed Sept,7th, 2012]

Tim Berners-Lee, Wikipadia for Tim Berners-Lee, http://en.wikipedia.org/wiki/Tim_Berners-Lee, [Accessed Sept,7th, 2012]

Ventures C., Cloud 3.0 - Cloud linked data, Implementing the Semantic Web on Cloud, Cloud Computing Journal, http://cloudcomputing.sys-con.com/node/1491243, 2010, [Accessed Sept,7th, 2012]

Web 3.0 Concepts Explained in plain English, Digital Inspiration, http://www.labnol.org/internet/web-3-concepts-explained/8908/,2011, [Accessed Sept, 7th, 2012]

Web 2.0, Awesome Highlighter, http://awurl.com/C5Yp6w1B, 2008, [Accessed Sept,7th, 2012]

Web 3.0, Webopedia for Web 3.0, http://www.webopedia.com/TERM/W/ Web_3_point_0.html, [Accessed Sept,7th, 2012]

What is Web 3.0, What will Web 3.0 be Like?. About.com, http://webtrends.about.com/od/web20/a/what-is-web-30.htm, [Accessed Sept,7th, 2012]