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E-Business and Research Institutes: When Technologies, Platforms and Methods Converge to Meet Users' Needs

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1. Introduction

Research and educational institutes as well as business entities make massive use of the Internet and the web as the ideal platform to make their work and to promote their products. The main mission of a generic research or educational environment is to look at specific topics with studies and research, but one of the goals is disseminating and promoting such research, projects and activities. Even if not for-profit, such organizations need funds for their activities obtained as state funds or European contributions, or any other financing methods. The amount of financing is in some way related to the quality of the work done, the results in terms of scientific knowledge and technological transfer, but also is strictly related to the capacity of the institute to disseminate and promote researches, projects and activities. Studies, research and projects are the products and services of such organizations that still have a target market and therefore require the actions and methods of a typical business environment. In this perspective, we could apply to organizations such as research or education institutes some of the models and techniques of the business world to obtain successful results especially in today's hyper-connected environment. In general, models are defined by a combination of policies, operations, technologies and ideology. And a business model (Chesbrough, 2007) describes how an organization creates, delivers and captures value through a process known as a business strategy. Core aspects of the model include purpose, offering, infrastructure, trading practices and operational processes. An e-business (Smith, 2001) refers to a dynamic interdisciplinary topic, utilizing models, techniques and concepts that combine business and technology especially based on the Internet and the web. Generally, an e-business has an online presence that is exploited in different forms (i.e., selling, publicizing, trading, transacting over the web, etc.), but strategies that lead to a successful e-business such as customer relation management (CRM) (Greenberg, 2009) and supply chain management (SCM) (Hugos, 2011) are the same used by a general enterprise even if it takes advantage of Information and Communication technology (ICT) (Dutta & Mia, 2009) to boost efficiency and responsiveness. In addition other organization types must take account of the needs of their target audience, create a marketing plan geared to such needs and re-think their architecture from the point of view of the manager as well as that of the customer. The social revolution in how we communicate point outs the technological aspect as an added value factor for all types of

organizations. The web platform and service-based activities guide the transformation of the key business processes through Internet technologies, its main applications and its evolving platform. Focusing on the products/services of a research institute (i.e., the research activities, projects, etc.), we apply models and practices from the e-business world since they share in some ways a common goal, which is the success of the organization. The main aspect is related to customers' expectations, and thus, a CRM strategy must be built in order to promote and advertise scientific culture as a way to have a return investment. Communication is an important mission of every organization selling products or services. The creation, development and suggestion to users of whatever product, go through a business process. The lifecycle of a product requires several activities that in a global market take advantage of the web world and its tools.

The chapter will describe the goal of providing an innovative cultural/scientific e-product related to astrophysical knowledge from an e-business point of view in order to take advantage of this perspective to obtain a successful result. Our aim is to develop and test a model to propose research and products results in order to reach many stakeholders and generate leads for the organization through several channels. Our research project starts from the need to provide a prototype product of a research institute designed from a business perspective and followed by a business plan, offered and "sold" with marketing techniques and thus with a specific marketing and strategic plan and developed with innovative ICT technologies. Starting from the contact point between the two organization types by considering a specific use case in testing the model, we will discuss platforms (i.e., newer Internet distributed infrastructures) and web technologies (i.e., languages, standards, etc.) that should be adopted to realize a good product. From a strategic perspective, technology is heading towards mobility in terms of hardware, software and network and a strong emphasis on information and its architecture (Spencer, 2010), which will be conveyed through a diversified set of rich multimedia web applications or services adhering to standards to satisfy the common goals of usability, accessibility, internationalization and multilingualism, interoperability, etc. An e-product for communication purposes implies a specific user interface for applications and/or services, platforms to deploy and execute such products and languages used for the development are the same regardless off the organization's type.

The organization of the chapter is as follows: Section 1 presents the Institute use case (the Italian national institute for astrophysics), describing its products from an e-business perspective. Section 2 emphasizes the common points of the two organizations types, describing some practical evidences such as social network tools and so-called tagging or data collection technologies. Section 3 highlights technological solutions that are divided into two main technical topics: the platform where the e-business and its tools work (i.e., distributed infrastructures) and the applications/services needed (i.e., web applications).

1.1 Research/educational institute products: the INAF case

The National Institute for Astrophysics (INAF) is an Italian research institute whose mission is to execute, promote and conduct scientific and technological research in astronomy and astrophysics. Moreover, the institute has the duty to disseminate and popularize its results in the school and society and to promote and to encourage technological transfer toward industries. The INAF is composed of 19 institutes spread all over Italy, most hosted in

historical buildings such as medieval castles later converted into astronomical observatories located in tourist cities (i.e., Padua, Rome, Florence, Naples, etc.). In particular, astronomical observatories have a great history and hold a great cultural heritage as historical and modern scientific instrumentations and libraries. Due to the different aspects of this kind of institute, we could consider several products and services as outcomes of these organizations. We focus on products since they help us to model the organization as a business and apply a strategy coming from a business environment especially in terms of marketing and fundraising. We think that a research institute should provide outcomes analyzed through indicators that define the success or failure of a study and project and have implications for the survival and competitiveness of an institution. Outreach and public activities increase public visibility and enhance fund raising opportunities. In our opinion, research and educational institutes even if not for profit may be considered businesses since specific processes for retrieving funds for their survival, a marketing plan to promote the entity to citizens and the different categories of stakeholders especially in an epoch of economic crisis can be applied. Research, projects and their results especially in scientific disciplines contribute to new knowledge, discoveries, but could also produce outcomes in everyday life in different contexts even in an interdisciplinary contest. Many intersections and synergy are driven by technologies and the exploration of the universe. Disseminating and promoting such work help to finance the research and thus could be viewed with a marketing approach. Moreover, specific customer relationships processes and supply chain management especially in projects related to scientific instrumentations are becoming an integral part of researchers' work. Astrophysics is in fact a discipline that embraces several topics that are theoretical and practical: studies about the universe and its components require complex instrumentations that involve technological aspects. We focus however on specific products related to the communication and dissemination goal even if the field of application of such a topic involves every aspect of researchers and projects in this science. These products are actually realized with software tools that in a global networked environment are web applications executed through distributed architectures (Schewick van, 2010) and with client and server software on several kinds of devices in an online or offline mode using various communication networks.

1.2 Dissemination of projects' results and knowledge

Our experience in the outreach and dissemination of Astronomy has grown in the last few years (Boccato et al., 2005) thanks to several projects with different targets (Pastore, 2005), developed in a variety of contexts and heterogeneous content. Moreover, all these projects conducted over several years have had the same characteristics: the use of emerging technology regarding information and communication technology. Many branches of communication as well as everyday life are shifting on the Internet infrastructure and on the web platform. Especially now, we are approaching a new way of work that requires an always-on network connection. The new frontiers are user mobility and ubiquity, and these are aspects on which new dissemination should be based. The technological aspect is shared among organizations since citizens and thus customers' lives go through the Internet. In astrophysics, for example, outreach could be enhanced only through future Internet technologies and the evolution of the web as a platform. The first tool for disseminating and marketing outcomes is a website, but this facility is not sufficient and should be integrated with other applications and methods taken from the so-called web 2.0 environment (Oreilly,

2007). Social network facilities and all digital communication forms (i.e., blogs, SMS, etc.) are examples of relative new methods of implementing Internet or web marketing (Cox, 2003). And in this optics, science communication remains the main aspect of every research activity and project and needs methodologies and a detailed plan in order to guarantee a successful result. Finally, science produces a knowledge-based economy based on discovery and innovations that cannot be achieved without increasing and enhancing all the aspects related to the diffusion of scientific culture. This could be reached by establishing interdisciplinary activities, and a good approach is to combine newer developments in the ICT and e-business area.

1.3 The INAF case

With the idea of dissemination and outreach of astrophysics, its projects, and its heritage, we propose a method to design and implement new methods for doing research and projects. Most of the experiences done in the past by our institute related to this field (Pastore et al., 2008), took advantage of new technologies to disseminate information, but in our opinion were lacking in terms of marketing and in a return on investment. Focusing on the threads related to an e-business approach, the new trend in ICT technologies for wireless or contactless communication protocols, mobile devices and mobile apps (Anthes, 2011), we propose a model for a typical scientific product to be used in a ubiquitous environment and seen from a sales perspective.

We consider our institute business-like with products and services to be provided in a target market with a certain degree of concurrency and thus with the need to customize and propose a brand. We approach scientific products as a way to gain visibility for our Institute, its activities and its heritage. From this point of view, a business and a research institute even if they have different aims or goals could converge on some common objectives, and using methodologies, tools or processes that traditionally belong to the e-business world in the research institute environment could contribute to enhancing the visibility of an institution and provide an opportunity for growth. The newer products that we are going to plan should take advantage of different tools, facilities and methods seen from a technological point of view but in the optics of a business perspective in order to promote this science, its outputs and its outcomes. We are starting from the assumption that our institute is an organization that needs to promote its image as means of the scientific culture and astrophysical science. In this optics, we apply a business plan approach to the activities related to promoting sciences followed by specific market analysis and with the added value of using the Internet and the web as a platform and as tools to make this work. Analyzing the trend, we focus on a product developed for communication purposes that should be the way by which we promote our Institute such as:

- It is executed in the different categories of mobile devices regarding hardware or software capabilities;
- It takes advantages of different wireless and contactless communication protocols that are added on to mobile devices;
- It uses a web marketing approach for advertising;
- It is subject to a business plan analysis in order to test the need for investment and the capacity to become a successful product.

The mobile environment is taken as the platform due to its spread and fast diffusion thanks to the advance of devices regarding compute and storage capabilities with the richness of software. However the web platform remains the main way to distribute and execute software due the advances in communication technologies and the availability of bandwidth. The following paragraphs give an idea of this approach, which is relatively new for our institute. An example is the realization of a framework, as shown in Fig. 1, to provide the vast amount of information related to astrophysics with the activities at the different institutes' sites in terms of software executed on mobile devices.

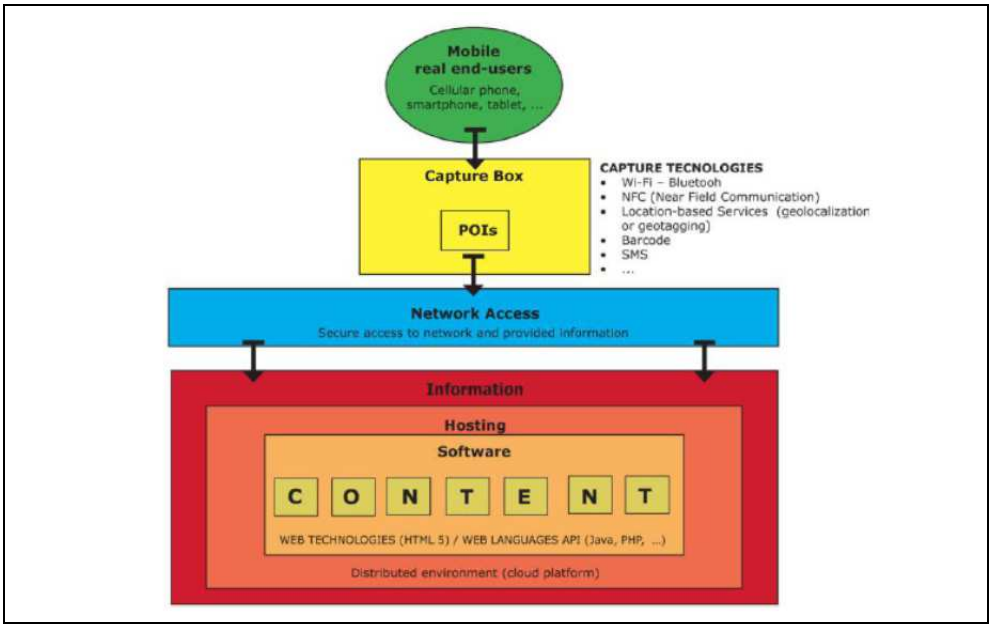


Fig. 1. Example of the e-product prototype framework.

Users with mobile devices are captured by using different communication technologies and could convey different kinds of information via a network application hosted on distributed platforms. Specifically, the information module will propose well-structured content (content module) in terms of web applications, tools or services using standard web technologies or languages (software module); these are hosted in a distributed environment (hosting module). This example could be applied even in a business context since platforms, applications and languages are the same regardless of the environment in which they are applied. The focus is on users and the satisfaction of their needs as a means for obtaining information regardless of the features of the users' devices. Among the techniques used to capture users, the use of a barcode is relatively new in such an environment. Extended two-dimensional barcodes, called 2D barcodes, act as tagging systems (Leder et al., 2010) and a marketing tool in a business environment. The 2D codes can store more complex information (alphanumeric characters, binary, URLs, SMS, e-mail, etc.) as an identification number to track a specific product. The approach, whose implementation is described later, could be easily implemented and allows many people to be reached. The main characteristic

is the facility of realization and reading thanks to the standardization of the codes and the presence of free software able to produce and read such codes. This method successfully and in a relatively economic way disseminates content in order to promote an institution and to give visibility to its activities.

2. Where e-business and research/educational institutes converge

The business model describes how a company functions, how it provides a product or services and revenue and indicates how the business will create and adapt to markets and technologies. The business model has four components: the e-business concept, the value proposition, sources of revenue and business activities, resources and capabilities. A business model could describe how an organizations is funded on hierarchical principle and, interacts with other actors in a competitive market in order to produce an economic value. Adopting digital platforms allows a business to reduce costs (administrative and controls, internal management, etc.). It is the method of doing business by which a company can sustain itself, that is, generate revenue. Business models have been defined, categorized and implemented in many different ways (brokerage, advertising, community, etc.). Moreover, an organization may combine several different models as part of its overall Internet business strategy. A research institute, like any other e-business organization, exchanges products and services with other institutions or organizations, groups and individuals even if the mission diverges and in the case of the research and educational environment the goal is not making profit. An interesting reference model in the literature (Osterwalder & Pigneur, 2010) proposes the Business Model Canvas as a way to develop a business model with building blocks to be used as the model design template. This model distinguishes the four main areas of a business: infrastructure, offer, customers and financial viability. The infrastructure aspect helps to highlight key activities necessary to execute a business model and the resources needed to create value for customers and to define the pattern network. With offering, the area is defined as products and services and their value, and the customer aspect defines customer segments as the target audience, the distribution channels and customer relationships. Finally, in the finances definition we find the cost structure (outcomes) and the revenue streams (incomes). The applications of these nine basic building blocks to both organizations show the logic how a company and a research institute intends to have successful results. It should result in a strategy to be implemented through structures, processes and systems. However, all these areas have in some way interactions with the improvement of ICT and in specifically with newer Internet technologies to support activities' implementation. In this perspective, distributed platforms that need to support applications and services by guaranteeing some of the important features such as availability, fault tolerance, applications and services needed could be considered a further convergent point between the two organizations. Distributed architectures evolved from grid to cloud computing (Myerson, 2009) that makes on-demand resource provisioning a reality.

Moreover, when talking about applications, we refer to web applications for a decreased developing time and maintenance and for the usability and spread of the applications. Web applications are executed through a browser, a tool that is present in every device. Web apps are more successful than normal applications because the former are more user-friendly and thus are candidates to be successful products. With the newer specifications about web languages, the constraints related to always on connectivity are released due to

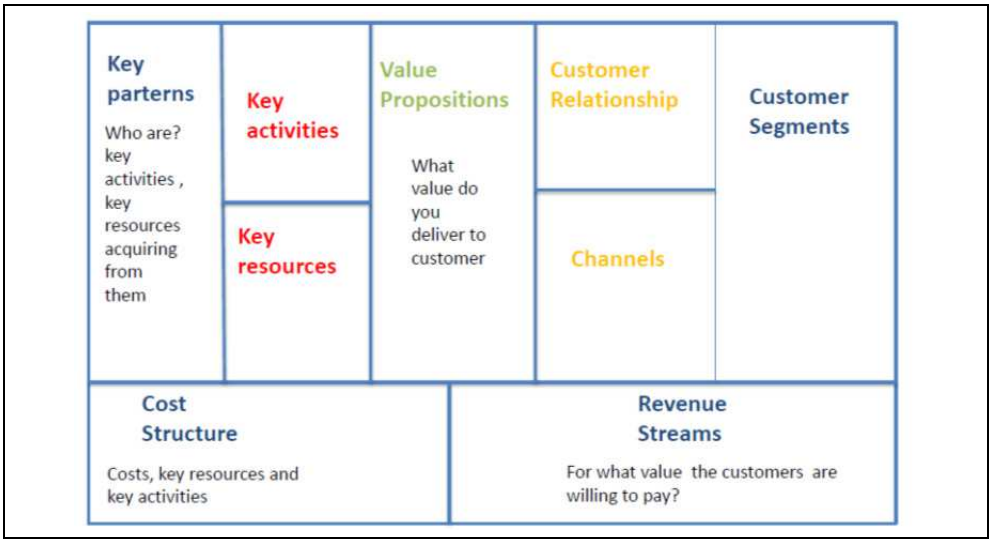


Fig. 2. Main building blocks of a business model according the business model canvas.

the capacity of offline web applications. Web languages (Cederholm, 2009) show new markup languages and different ways of using scripting languages to enhance user interaction and experience. Bringing a business to the web provides many benefits by offering personalized service, high-quality customer service and improved supply chain management. Moreover, operating on the web, requires specific technologies to build and run the service/product. Finally, the capabilities of web 2.0 such as collective intelligence, network effects, user generated content and self-improving systems that have a great impact on networking in terms of wireless communication protocols should be considered.

Focusing on a product as a core business that needs to be provided to heterogeneous stakeholders, there are platforms where single products made of applications or services are deployed to be hosted and/or distributed and languages used to develop the products. E-products are strictly related to hardware devices where the products are executed and/or provided and in this optics standards are the main requirement to provide important features for a successful product: usability, accessibility, interoperability and internationalization.

2.1 Points of convergence

We have highlighted two practical cases in the convergence of the methods and techniques of e-business and research organizations approaches. Both aim to gain results in terms of visibility or the successful of a product by using the Internet architecture and web platform. Many activities are made through web applications specifically developed for use in a collaboration mode and executed in specific frameworks according to the requirements of the distributed environment. We refer to the introduction of social media as a way to apply a web advertising model and the use of tagging technologies, even if with different aspects, to both organizations. Web advertising or web marketing is a method that offers content

mixed with advertising messages different from banner ads. This tool takes advantage of technology to enhance the promotion of a specific product, service or the organization itself. There is a shift towards a new form known as contextual advertising/behavioural marketing and content-targeted advertising: the concept is to focus on the actual behaviour of potential customers that is going toward the use of mobile devices, mobile Internet and specific web applications to create a community model based on user loyalty.

2.2 Exploitations of social media platform

Social media technologies facilitate broad participation and enlarge the stakeholders of an organization. These technologies are seen as a means for economic revitalization through business innovation; however, they are not markets or hierarchies, but ecosystems: the reference business models are not limited to traditional economical exchanges, but require complex transactions. Their members are not only clients, but also stakeholders and thus have some interest in the organizations. The technologies could have different functions such as a reduction in design or production or marketing costs of products and services. Social networks from Facebook to Foursquare are not only seen as entertainment or free-time activities but have also become important tools in citizens everyday lives. This aspect of diffusion brings attention to the method of making money with these tools or at least taking advantage of the potential customers that the tools can reach. Each type of social network according to its spread, use or potentiality in different country could help to reach specific goals related to user attractions, needs and expectation. Specifically, each platform could give an added value in terms of helping customer communication, brand exposure, site traffic boost and search engine customization (SEO). As Table 1 shows, each platform could provide different marketing outcomes. Facebook is an excellent tool for customer communication by creating a central hub that companies can use to drive interactions even if the best tool remains Twitter.

Social media	SEO	Customer communication	Brand exposure	Boost site traffic
Facebook		X (excellent)	X	Little effect
Twitter		X (best)		
Flickr	X (great)			
Linkedin	X		X (very useful)	
YouTube				
Digg				X

Table 1. Social media and expected results.

Studies (O'Dell, 2011) have provided charts showing which social networks are best for organizations, CRM and marketing goals. Facebook and Twitter refer users to the content, and Flickr and YouTube allow to enhanced SEO.

2.3 Contactless and other technologies' communication protocol

With the widespread use of mobile devices, wireless-like communication technologies able to transfer few data are becoming more and more important as a business strategy.

Reaching customers through their own devices can guarantee direct and fast contact. Among the technologies, we distinguish the ancestor technology that is the barcode, evolved in 2D (bi-dimensional) code and short and medium wireless technologies ranging from Radio Frequency Identification (RFID) to Near Field Communication (NFC) and Wi-Fi. All these technologies contribute to providing ubiquitous and mobile information. RFID has been successfully used in the supply chain (Meyerson, 2006), 2D code technologies were developed in the marketing area since the ease of implementation and contactless technologies such as NFC are gaining importance as related to micro-payments made through mobile devices allowing evolution of the e-commerce topic (Reynolds, 2011). As an approach to test a marketing tool in a research environment, we implemented 2D barcodes as a way to disseminate information about our institute and its sites.

2.3.1 The INAF use case of 2D code

Two-dimensional codes, which show different standard implementations, are the square usually black-and-white images present in stores, magazines, and journals as a way to store an URL through which a business can promote itself or its products. However, the information coded in the matrix even if limited could be different and of various formats. 2D code technology helps to store information as squared images since the data are saved in both directions, forming a matrix rather then staked bars. Coded with software mostly available freely online (generators) and, normally printed in some support, a 2D code is read with specific client software by every device equipped with a camera. Born as ancillary technologies, now with the spread of mobile devices, 2D codes have begun to have an impact as the kind of functionality that commercial customers are starting to ask of mobile developers. Consumers owning a mobile device equipped with a camera and software reading such codes can scan the image and usually obtain information that could be easily remembered since the consumers could save it on their own devices.

Among the different standards developed, the QR (quick response) code specification allows up to about 4000 alphanumeric characters together with several other data types to be encoded in the matrix barcode (Denso Wave, 2009).

Fig. 3. QR codes experiment outside our institute buildings.

In our experiment, as Fig. 3 shows, we tested this technology by printing QR codes that we posted outside the main entrances of our institute buildings. QR codes have been easily implemented by using online software such as QR-code generators and are read by freely available client software, i-nigma for example. This is certainly a good method to exploit the

potential of such technology and to contribute to creating curiosity about an organization, enhancing a visibility approach. Two-dimensional code give the first impact and information about an organization without the need to connect to the Internet and with the opportunity to store some information about the location directly on users' devices. Unfortunately, this technology does not have broader knowledge and needs to be promoted.

3. Software architecture and platforms: grid paradigms vs. Cloud paradigms

Regarding key resources needed for an e-business, software infrastructure plays a big role. Virtually all large computer-based systems are now distributed systems. Information processing, storing and publishing are distributed over several computers and systems rather than confined to single machines even if in a cluster structure. Distributed software engineering is therefore very important for an enterprise computing system. All systems share resources, openness, concurrency, scalability and fault-tolerance. The disadvantages are complexity, security, manageability and unpredictability. Distributed computing architectures and platforms have evolved recently from a cluster, to a grid and cloud system (Keahey et al., 2009) due to the increased requests made of computer resources in a broader meaning, not only in terms of computing and storage resources, but also any kind of service. Enhanced distributed platforms such as cloud and web standards play an important role since they are the main technologies that seem to provide a value-added and a medium-term life under guarantee. Moreover, they are necessary infrastructure needed by each organization. Table 2 reports a comparison of the three main architectures by considering the main features.

Category	*Cluster*	*Grid*	*Cloud*
Size	Small	Great	Small→great
Initial cost	Very high	High	Low
Resources type	Homogeneous	Heterogeneous	heterogeneous
Typical ROI	Very High	Medium	High
Hardware	Very expensive	Expensive	VM use upon hardware
Network type	Private /Proprietary	Private based on Ethernet	Public Internet on Ethernet
Security requirement	Low→ High	High	High
SUMMARY	Supercomputer	workstation	Groups of VM

Table 2. Differences in distributed paradigms.

Each platform has a specific action context that should be carefully analyzed in order to choose the best solution by making trade-off between costs and benefits.

3.1 The grid paradigm experience

The first experience of a distributed paradigm extending clustering computing in some way is the grid paradigm born with the idea of sharing distributed computing resources between

trusted organizations called Virtual Organizations (VOs). The sharing is however regulated by a specific security model based on the Public Key Infrastructure (PKI), and thus, resources are released only to authenticated users in a trusted environment. The INAF, similar to most Italian research institutes, experimented on grid platforms (Pastore, 2004) thanks to European grid projects that were initially born as a platform for the Large Hydron Collider (LHC) project at CERN that has now become the European grid infrastructure (now known as EGI) grouping national grid projects and acting as underlying infrastructure for many scientific applications. However, different experiences in using this paradigm have demonstrated that an extension toward web applications and web services shared in a grid environment is complicated at least in the European infrastructure using gLite as the software framework (Pastore, 2008).

Moreover, the security infrastructure that guarantees the distribution of resources, could act as a limit in an environment such as the web. The main application seems to be in grouping computing and storage resources to be distributed among VO' users. Web applications that are executed through web servers seem to be better hosted in cluster environments, since they represent a closed structure, reliable and robust, but have some problems of scalability. In this optic, the application of the cloud paradigm, which declares the release of resources on demand, could be a solution that fits with services and applications with different traffic peaks. The main issues underlying such technologies are, for example, threshold policy, interoperability issues, hidden costs and unexpected behaviour that even if necessitating the adoption of such infrastructures have a great impact on cost structure in terms of the building blocks of the model. In the European grid, a difficult specific use case could be linked to the experimental characteristic of the European grid infrastructure that has shown the unexpected behavior of an application launched in the environment.

The vision that grid computing has and in part has realized in Europe, for example, with the EGEE infrastructure, even if started to solve the data management and the computing needs related to the LHC project that is devoted to a specific science project has been and actually is used for many applications in different science fields. Different researchers in different countries have been able to use shared resources and advantages from all the benefits that this infrastructure has brought. Choosing this platform compared to commercial grid solutions was inevitable in research institutes that in many cases embraces the open-source or the community philosophy. However, the EGI.eu objectives aim at providing a convergence between different paradigms and enhanced middleware software able to provide each type of resources' demanded.

3.2 The promises of the cloud paradigm

Some limitations and constraints of the grid paradigm have led to an extension of this vision in order to provide every kind of resource even if in a broader meaning (from computing resources to entire virtual machines). Cloud computing is the latest effort at delivering resources as a service. According the US National Institute of Standards and technologies (NIST), cloud computing is "a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort on service provider interaction. "

Cloud represents a shift away from computing as a product that is owned to computing as a service that is delivered over the Internet from large-scale data centers or clouds. However, at present much ambiguity and uncertainty exist regarding the realization of these promised benefits, as there is currently much hype. Clouds (Linthicum, 2009) are categorized in term of type, distinguishing private, public, hybrid and community clouds and by the type of service offered. The first distinction is in terms of SaaS (Software as a Service) or AaaS (application as a service), PaaS (Platform as a Service) and IaaS (infrastructure as a Service). Next to the main three patterns, others, as Fig. 4 shows, are now considered a cloud category such as Storage as a Service (or disk space on demand that is related to the concept of grid computing), DaaS (database as a Service), or Information as a Service meaning the ability to consume any type of content available through a well-defined interface, and other models.

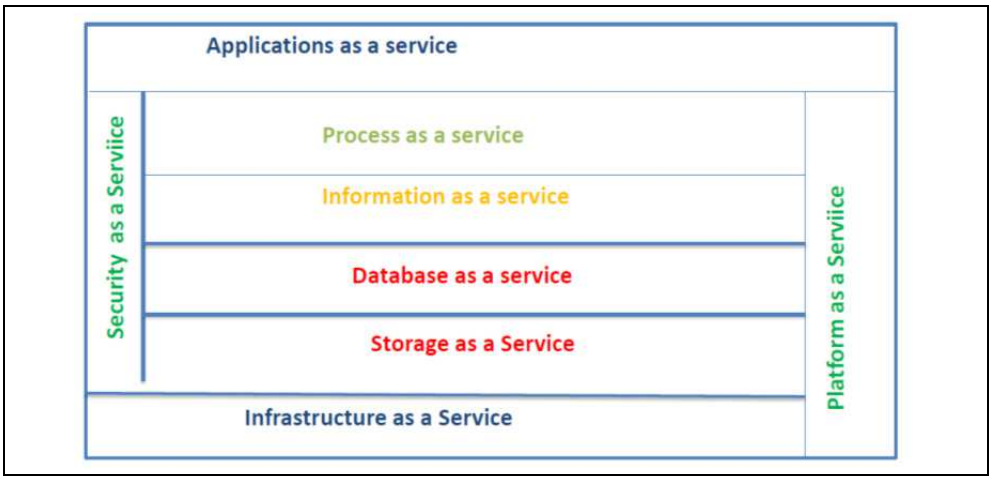


Fig. 4. Categories of cloud computing and environment representation.

Each implementation implies a complex software architecture essentially taking advantage of virtualization technologies based on the Service oriented Architecture (SOA). A SOA (Erl, 2008) is a technology framework that allows interconnected systems to expose and access services and information bound to those services. Such services could then be orchestrated to realize composite applications thanks to the addition of abstraction layers. This concept, which was referred to as inside an organization even if geographically distributed, is extended with a cloud, which means taking the SOA outside an enterprise. The diffusion of this technology in recent years has been an important factor in the evolution of the distributed paradigm allowing the sharing of a complex resource such an entire operating system and all the layered software that is executed over the system.

The cloud model comprises the following characteristics: on-demand provision of computing capabilities given as needed without requiring human interaction; ubiquitous network access by heterogeneous client platforms; location-independent and elastically resource pooling that is dynamically assigned and provisioned to scale up or scale down (Marshall, 2009).

The cost-based aspect, which is a pay-per-use view, allows the following consideration: capabilities are charged using billing models based, for example, on storage, bandwidth or

computing resources consumed. Because adhering to open philosophy solutions should be taken by open source offerings, but academic and open source implementation is limited, and efforts related to its adoption should be carefully evaluated with the real cost of a commercial solution.

Both commercial and open source solutions follow cloud categorization. An example of a PaaS cloud is the Microsoft and Google solution that offer the entire platform (Microsoft Azure vs. Google Apps Engine) to develop and deploy web applications. IaaS solutions are those provided by a main commercial brand such as Amazon, VMware, Oracle and so on. The academic solutions Nimbus developed by researchers at the University of Chicago and Open Nebula designed by researchers at Madrid University aim at transforming a cluster in an IaaS and a data center in a cloud infrastructure that could adapt dynamically to the load request, respectively. These products seem to be oriented in sharing standard resources (storage and computer), but this concept should be inevitably expanded since applications are ported in a web environment. In this perspective development framework, different according the programming language used for the applications (i.e., PHP, Python, .NET framework, and so on) should be provided together with entire virtual machines hosting the software stack necessary for computer execution. Among the platforms providing this broader resource in the open-source field seem to emerge Eucalyptus and Xen Cloud Platform.

Eucalyptus is commercial, open-source software that implements a cloud framework based on different open-source virtualization techniques such as Xen and KVM. The open-source version allows private and public clouds to be created, and in this last field, a community cloud has been created in order to support the distributed cloud and spread the adoption of this framework. Moreover, this software is also used in the Ubuntu project as the cloud platform, and since this Linux distribution has been widely diffused, this software probably will be successfully adopted. On the other hand, Xen with VMware approssimally dividing the virtualization market has integrated its software with XCP, a complete infrastructure (Fig. 5) that realizes an IaaS.

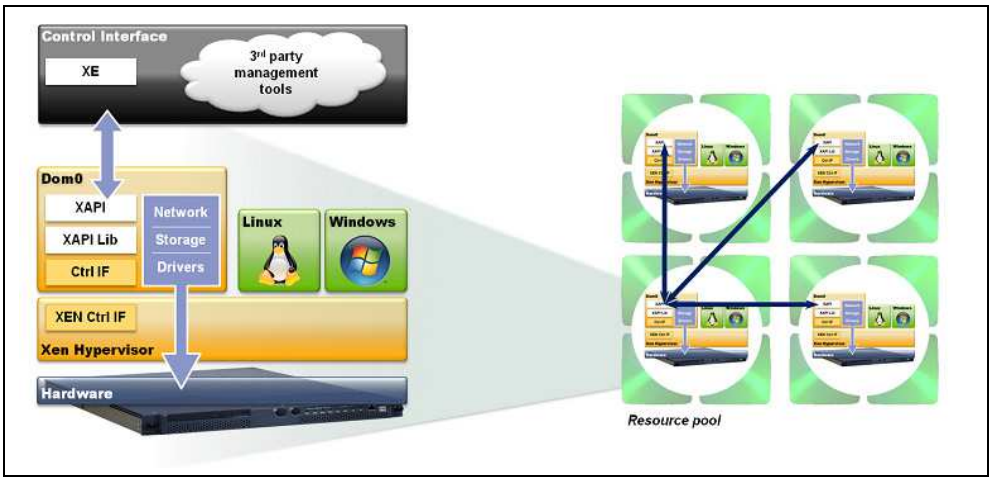


Fig. 5. Details of the Xen Cloud Platform (provided by xen.org).

Due to the offers and the problem that surround cloud computing related to security and network demand, for example, there is some confusion about what different solutions offer regarding needs. Cloud is strictly related to a commercial brand that at this moment provides the effective implementations, and analysis of the costs-benefits should be done before choosing a solution. Specifically considering the availability of budget and workforce in many cases in a research environment, adopting the Google or Amazon platform seems to match the needs. From this point of view, the two organizations as regards in terms of choosing IT platforms seem to converge since e-business is going to the cloud to reduce the costs related to a hardware and software infrastructure management.

4. Web applications and services development: Standards and languages for making good products

The convergence present for software infrastructure remains in the category of applications used in both organizations. Due to the web platform, we are considering web applications (Desoza, 2011). A web application (or web app) is an application that runs on web platforms usually designed with web standards. Web standards describe the actual specifications of how a language or technology works on the web. They are specified by an industry standards body such as the World Wide Web Consortium (or W3C) that refers to techniques of applying the language or technology taken in most cases as best practices. Usually standards included in this definition refer to the model of application development that divides the content structure and semantics usually designed with the HTML markup language from its presentation realized through the style sheet languages (or CSS) and behavior implemented with a web programming language as Fig. 6 describes.

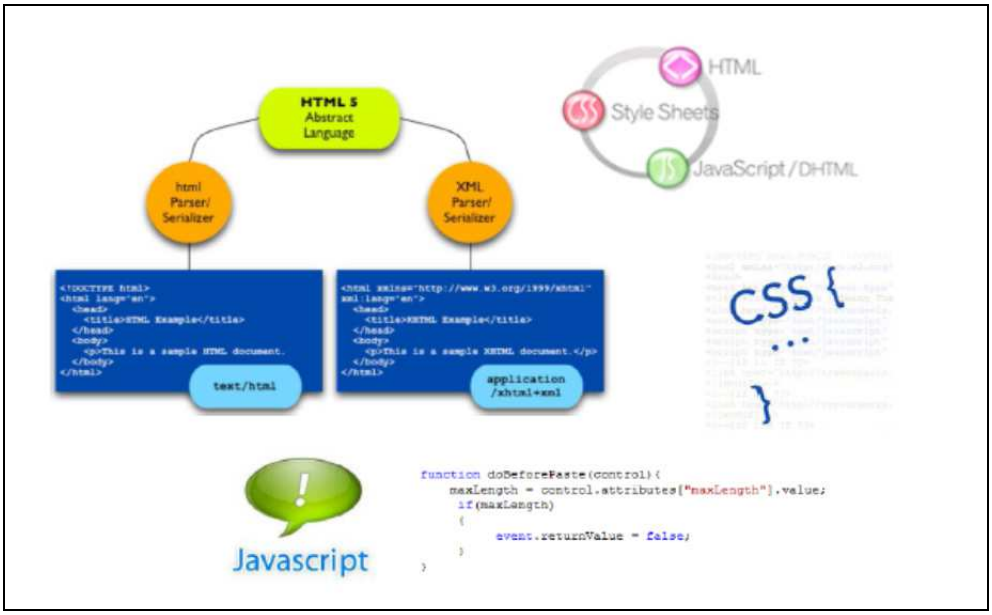


Fig. 6. Web apps standard languages.

A primary distinction about server-side and client-side programming language that characterizes the way the application is executed (on the server or on the browser) has always distinguished the different web applications. Many applications rely on a PHP platform even if in recent years languages such as Python, Ruby, etc. have taken the lead. Since every web application is executed through a web browser and there are a plethora of existent web client (i.e., Firefox, Internet Explorer, Safari, Opera, Chrome, etc.) besides the different versions found on mobile devices, each client software has different capabilities in executing and rendering an application. The main aspect is using languages that tend to be standard to support interoperability, which is becoming the main issue. However, standards help to create applications that allow other important goals such as accessibility, usability and multilingual to be reached. Two main visions when developing for applications are: one web ensuring that working within the architecture of the web and user intentions, meaning the difference in needs between users of desktop and mobile devices. Such objectives should be reached regardless of the type of organization considered. The solution is using markup and programming languages that comply with the standards.

4.1 The role of open web standards

With the advent of dynamic web and rich web applications (Preciado, 2005) introducing interactivity and multimedia features, languages for the web have proliferated requiring client browsers to have so-called external plug-ins to execute the website or application. Famous ones are Adobe Flash and Apple QuickTime, which are available freely but relate to commercial software to create such applications. This could generate an issue in execution on all browsers. The lack of interoperability is solved by trying to develop applications that follow standards, but the evolution of languages toward integrating of multimedia was slow compared to users' requests. This has contributed to the proliferation of Flash-based applications. Among the different versions of the languages, now we are approaching the HTML 5 specification, which combines the different efforts of the W3C and the Web Hypertext Application technology (WHATWG) Working group associations to create a language that could offer significant audio and video functionality including the advantages of the Document Object Model (DOM), ECMAScript language, the standard version of the Javascript client programming languages that evolved to include server-like requests. A web application developed with open standards makes effective use of an ecosystem of markup languages composed, as Fig. 7 shows, of different markup languages based on XML (such as SVG), style sheets and specific libraries (i.e., jQuery) allowing applications with different features to be developed.

This overcomes the need to develop different applications for different target devices, or operating systems. The new features of the HTML5 specification are that these applications can be packaged as standalone pieces of software, can run online or offline and include natively audio, video and graphics contexts. Equally, a web app can simply be a part of a website as an interactive functional web page where much of the processing is done on the client side using cross-platform standard web Application Programmig Interfaces (APIs) to access device features as necessary. Web applications are in some ways the opposite of so-called native applications that are applications that can also be downloaded through a website. Usually, applications are software designed to run directly on a specific platform and sometimes to work in vendor-specific environments, and thus with direct access to the

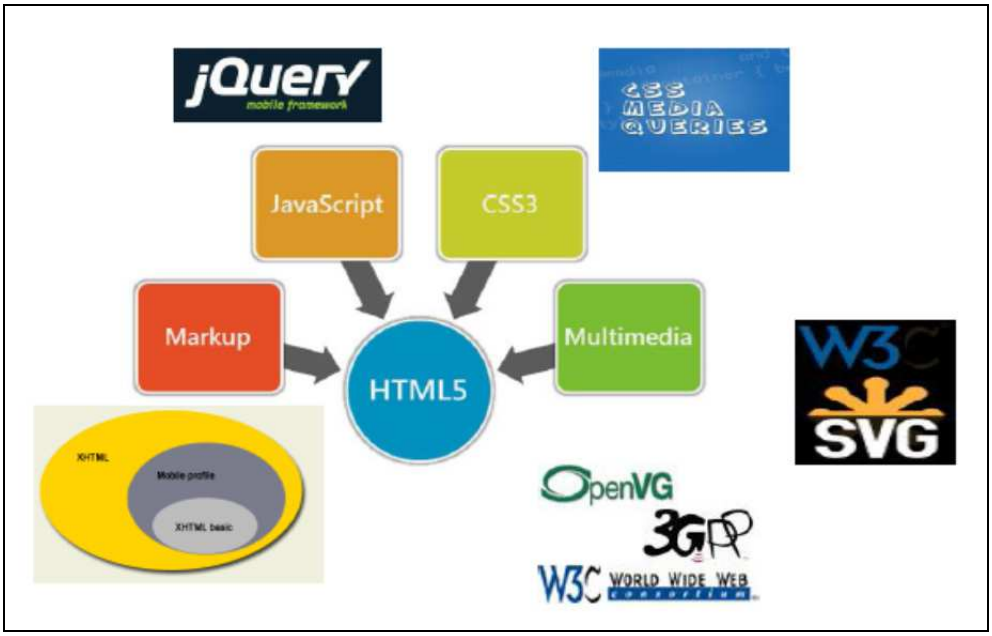


Fig. 7. HTML 5 and standard specifications ecosystem.

features of the underlying system. Open web applications indeed become installable websites that being built using standard web technologies with additional metadata that allow the user agent to discover, install, launch and grant additional privileges. Access to hardware features is made with APIs. Moreover, a web app can be downloaded as a standalone piece of software known as widget. A widget is standardized and operates entirely separately from any browser in a way like a native application. The most readily available widget engine is Opera. In this way, web standard technologies are opening the way for web-based applications including widgets with a target both the desktop and the mobile environment as targets.

4.2 Mobile web apps

An important field of work is the mobile environment, due the diffusion of such devices with increasing capabilities. Web applications developed specifically for mobile devices (Mahamoud et al., 2010) are transforming the software world with implications for the methods for developing, marketing and distributing software. The example of the mobile apps store is emblematic. As web apps, they are developed with reduced development cycles and distributed directly on the web without the need for installation, or, distribution and thus the need for a traditional marketing approach. Related to the different kinds of mobile devices, there are the Apple Store, the Google Android market, the OVI store and so on. The backdraw is that developing on mobile devices is a difficult due to the different types and features of mobile devices. There are many differences in hardware and software features, outlining the differences between old and newer devices. There are many variables to consider in such an environment that is rapidly changing and is fragmentary: diverse

hardware and software, thin or fat client, carrier network or wireless, intermittent connectivity. There are so many challenges in supporting multiple devices on multiple networks for a highly variable business environment. There are many device platform choices, but looking at operating systems with enterprise capabilities, the only candidates are Apple iOS and Google's Android. However, limiting to one or two platforms is not the right solution even if it depends on the application given and specific market trends. Developing different applications according to different types of hardware is an expensive solution. A possible solution is the HTML5 browser delivery application for most products and native installed applications with a wrapper such as PhoneGap, but depends on the devices targeted and use cases (Stark, 2010a, 2010b).

A mobile web app differs from a mobile version of a website because the app is tailor-made for the mobile platform. The User Interface is generally more customized and includes more mobile device-centric user interfaces. And they differ from native apps for mobile devices since web apps make browsing a pleasurable experience but suffer from performance concerns. The choice of standards for developing mobile web applications could successfully reduce the time and cost of development aiming at reaching all kind of users. In addition, e-business and research institutes should look at enhancing their number of customers as a means to reach customer satisfaction in diversified market.

5. Ideas for future research

Future research should focus ton a research institute's aim to promote research and project outcomes as a core business and thus must follow the normal phases of selling a product with the added-value of ICT technologies, and distributed platforms, web applications and the wireless communication protocol. In this context, the research has to focus on the specific aspect related to market strategies and customer relationships. The market context is an important topic for e-business, but studies considering the typology of the market and the potential customers for different organizations such as research institutes could contribute to the vision of promoting, disseminating and transferring scientific and technological activities to the public and companies in order to realize a technological transfer. Identifying a market allows customers to be defined as in the perspective of a non-profit organization and a strategy for customer relationships, focusing on customer segments as the heart of the organization, grouping into distinct segments with common behaviors and requirements. The ideas should start from the assumption that adopting a business model is necessary regardless of the type of organization since a model helps to identify the key point of the business's activities and the resources needed. Especially for a business on the web, the points of convergence could push researchers into working on the same objective. Moreover, a research institute needs to model its organization on e-business optics to diversify the institute' activities in the perspective to reach the best result that also funds for the work of the employers.

6. Conclusion and further development

Research institutes and e-businesses even if they have different missions have some convergence points that make it possible to apply the same business model. We proposed a methodology that looks at the e-business environment, techniques and activities devoted to reach a specific value that could also be applied also in a not-profit organization and thus

does not always see the economic aspect. The practical effect of our project in such an aim is the application to a marketing strategy, for example, using social media or tagging technologies to our products that are the results of researchers and projects. Working on products and services while taking into account the e-business perspective could contribute to an enhancement of the provided products and more attention to reach all kinds of potential users. In this perspective, great importance is placed on technologies and applications that play an essential role because the advances in ICT are dynamic and continue at an ever increasing rate. Further development will be the practical applications of such ideas in the context of disseminating information about the institute and its work as they are were a brand to promote, and real products to sell, highlighting the customer segments, enhancing the relationships and putting a value generator as the center of the work.

7. References

Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. Strategy and Leadership, Vol. 35 no. 6, 2007, pp.12-17. Emerald Group Publishing Limited, ISSN 1087-8572.

Smith, D.M. (2001). The E-Business Book: A Step-byStep Guide to E-Commerce and Beyond. ISBN 978-157-6600-90-0, Bloomerang Press, U.S.A.

Greenberg, P. (2009). CRM at the Speed of Light, Fourth Edition: Social CRM 2.0 Strategies, Tools and Techniques for Engaging your Customers. ISBN 978-007-1590-45-7. McGraw-Hill Osborne Media.

Hugos, M. H. (2011). Essentials of Supply Chain Management. 3rd edition. ISBN 978-047-0942-18-5. Wiley

Dutta, S., Mia, I. (2009). The Global Information Technology Report 2008-2009, Mobility in a Networked World. World Economic Forum, URL: https://members.weforum.org/pdf/gitr/2009/gitr09fullreport.pdf

Spencer, D. (2010). A Practical Guide to Information Architecture. Five Simple Steps LPP. ISBN: 978-0-9561740-6-2

Schewick van, B. (2010). Internet Architecture and Innovation. The MIT Press, New edition June 2010. ISBN 978-0-262-01397-0

Boccato, C., Benacchio, L., Nobili, L., Pastore S. (2005). "Cath the Stars in the Net!? Eight years of experiences in communicating astronomy via new technologies" Proceedings of In "Communicating Astronomy with the Public 2005": Proceedings from the ESO/ESA/IAU Conference ESO HQ, Garching, Munich, Germany , June 2005, eds. I. Robson & L.L. Christensed, pp. 242-250, ESA/Hubble.

Pastore, S., Benacchio, L., Boccato, C., Lazzaretto, E., Nobili, L. (2005). "The Learning from Starlight" project: experiencing mobile technologies to improve education and outreach of Astrophysics", Recent Research Developments in Learning technologies, Vol. 3, 2005, FORMATEX, Badojoz, Spain pp. 1138-1143.

Oreilly, T. (2007). What is Web 2.0: Design Patterns and Business Models for the Next Generation of Software. Communications & Strategies, No. 1, p. 17, First Quarter 2007. Available at SSRN: http://ssrn.com/abstract=1008839

Cox, B. (2003). Internet Marketing (NetEffect Series). Prentice Hall, 1 edition 2003. ISBN 978-010336286

Pastore, S., Boccato, C., Galliani, M., Nobili, L., Lazzaretto, E. (2008). "Implementations of the Web 2.0 Phenomenon and Its Technologies for Science Outreach and Communication in the Research Network". Proceedings of 3rd Int. Conference on Internet and Web Applications and Services, 2008. ICIW '08 (8-13 June 2008), IEEE Computer Society, pp. 547 - 551

Anthes, G. (2011). Invasion of the Mobile Apps. *Communication of the ACM,* Vol.54, No.9, (September 2011), pp. 16-18, DOI:10.1145/1995376.1995383

Leder K, Macdonald J. and Chris Speed (2010) Tagging technology: is future bright, A public workshop. ISBN 978-1-90443-43-8

Osterwalder, A. and Pigneur, Y. (2010). Business Model Generation. Self Published. ISBN 978-2-8399-0580-0

Myerson, J. (2009) Cloud computing versus grid computing. Service types, similarities and differences, and things to consider.IBM developerWorks technical library. IBM comporation 2009.

Cederholm, D. (2009). Web Standards Solutions, Second Edition. Apress. ISBN 978-1-4302-1920-0

O'Dell J. (2011). Which social sites are best for which marketing outcomes? Mashable business. Mashable.com. Retrieved 20 September 2011.

Meyerson, J.M. (2006). RFID in the Supply Chain: A Guide to Selection and Implementation (Resource Management) Auerbach Publications; 1 edition (November 20, 2006), ISBN-13: 978-0849330186

Reynolds, J. (2004). The complete e-commerce book, 2nd edition: design, build and maintain a successfull web-based business. CMP 2004. ISBN: 978-1578203123

Denso Wave, (2009). QR Code Standardization. QR Code.com. Denso-wave.com. Retrieved 23 April 2009.

Keahey, K., Tsugawa, M., Matsunugana, A., Fortes., J. (2009). Sky Computing, Internet Computing IEEE, vol. 13, no. 5, pp.43-51

Pastore, S. (2004). Using web services in a grid infrastructure: an early implementation of web services actors programming a grid application to access astronomical databases', LNCS –3270 Springer-Verlag Volumes, on "Grid Services Engineering and Management (GSEM'04)", 2004 pp.1-14

Pastore, S. (2008). The necessity of Semantic Tecnologies in Grid Discovery, *Journal of Networks (JNW)*, Volume 3, Issue 4, April 2008, Academy Publisher, pp. 1-9.

Linthicum, D. S. (2009). Cloud Computing and SOA convergence in your enterprise: A step-by-step guide. Addison-Wesley Professional. ISBN: 978-0-321-65939-2

Erl, T. (2008). Service-Oriented Architecture: Concepts, Technology & Design. Prentice Hall/Pearson PTR. ISBN: 0131858580

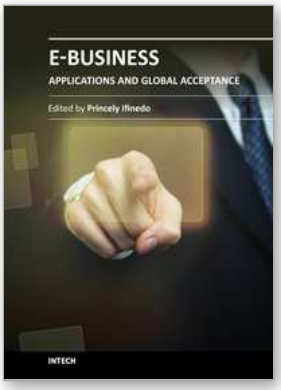
Marshall, P., Keahey, K., Freeman, T. (2009). Elastic Site: Using Clouds to elastically Extend Site Resources.

Desoza, S. (2001). Web Application Development for Emerging Businesses. Technorati.

Preciado, J.C., Linaje, M., Sanchez, F., Comai, S. (2005). Necessity of methodologies to model Rich Internet Applications, Proceedings of the 2005 seventh IEEE International Symposium on Web Site Evolution, 2005

Mahamoud, Q.H. and Popowicz, P. (2010). Toward a framework for the discovery and acquisition of mobile applications, *Proceedings of 2010 9th International Conference on Mobile Business*, Athens, Greece, June 27-29, 2010

Stark, J. (2010a). Building iPhone Apps with HTML, CSS and Javascript. O'Reilly Media, Sebastopol, CA.
Stark, J. (2010b). Building Android Apps with HTML, CSS and Javascript. O'Reilly Media, Sebastopol, CA.



E-Business - Applications and Global Acceptance

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E-Business - Applications and Global Acceptance is a collection of well-written papers that employ empirical and theoretical/conceptual approaches to highlight insights on the global acceptance of electronic business (e-business) and other useful applications and conceptualizations in the area. As our knowledge of the e-business phenomenon continues to mature and evolve, it is pertinent that new insights and information be made available. This edited book is published against such a backdrop. In essence, this book seeks to provide value to both e-business researchers and practitioners, with information sourced from differing regions of the world. The diversity in the sources of insights is welcome and this edited book covers a wide range of interesting, topical, and timely issues dealing with the acceptance of e-business applications or systems, business processes integration and management, the extension of e-business concepts to not-for-profit (nonprofit) organizations, and the construction of a service innovation model. Without a doubt, this book will be a comprehensive reference point for knowledge seekers who want to understand emerging conceptualizations, processes, and behaviors in the e-business domain.

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