E-Business Challenges and Directions:
Important Themes from the First ICE-B Workshop

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Abstract. A three-day asynchronous, interactive workshop was held at ICE-B'10 in Piraeus, Greece in July of 2010. This event captured conference themes for e-Business challenges and directions across four subject areas: a) e-Business applications and models, b) enterprise engineering, c) mobility, d) business collaboration and e-Services, and e) technology platforms. Quality Function Deployment (QFD) methods were used to gather, organize and evaluate themes and their ratings. This paper summarizes the most important themes rated by participants: a) Since technology is becoming more economic and social in nature, more agile and context-based application develop methods are needed. b) Enterprise engineering approaches are needed to support the design of systems that can evolve with changing stakeholder needs. c) The digital native groundswell requires changes to business models, operations, and systems to support Prosumers. d) Intelligence and interoperability are needed to address Prosumer activity and their highly customized product purchases. e) Technology platforms must rapidly and correctly adapt, provide widespread offerings and scale appropriately, in the context of changing situational contexts.

Keywords. Adaptability, agile methods, autonomic computing, business value, business-IT alignment, change management, cloud computing, collaboration, composability, context-aware computing, CRM, customer relationship management, digital native, e-Business, applications, models, enterprise ontology, enterprise engineering, e-Services, integration, intelligent user interfaces, interoperability, interoperability, mobility, physical organization, platforms, product customization, prosumer, SDLC, semantic Web, service orientation, service scalability, social CRM, social networks, societal IT, system development life cycle, ubiquity, virtual organization, virtual worlds.

1 Workshop Overview and Important Challenges

1.1 Workshop Objectives and Methodology

The International e-Business Conference (ICE-B) is one track within the International Joint Conference on e-Business and Telecommunications (ICETE). In 2010, a unique three-day interactive workshop was held for ICE-B'10. The workshop was conducted

as an asynchronous collaborative consortium. The goal was to create a jointly authored paper on e-Business challenges and directions in the following subject areas: a) e-Business applications and models, b) enterprise engineering, c) mobility, d) business collaboration and e-Services, and e) technology platforms. The workshop had two venues: a) a traditional position paper presentation session, and b) an interactive forum which lasted all three days of ICE-B'10. Regarding the former, position paper authors became subject area leads for the joint paper. Regarding the latter, a very large physical display was maintained for recording: a) all themes generated by ICE-B'10 papers and presentation sessions, b) participants' research, and c) importance ratings. The method for information posting, organization and rating was directly from Quality Function Deployment [158]. On the last day of the workshop, ICETE'10 participants voted on the relative importance of posted themes. This paper reports on the most important themes, tying them back to ICE-B'10 conference papers and posters.

1.2   e-Business Applications Challenges

Economic, Technological, Societal, IT. Changes in business are usually related to the way that it must adapt to the Five Forces [131]. Nowadays, business is increasingly moving towards e-Business to stay competitive, but introducing new applications into a business may lead to a variety of problems, especially if that business is not accustomed to being supported by that technology [145]. This is particularly pronounced when a business moves from a static Web presence (i.e. a Web site or a transaction portal [30] to a dynamic Web presence (i.e. social network blog, online customer chat forum, "try before you buy" virtual experience [35] Many businesses now struggle to make Web 2.0 profitable [83].

New Technology Creates Strategic Challenges. Web 2.0 has opened up businesses to customers [66]. As a result, laggard firms are struggling to decide: how much operational transparency to provide users during an end-to-end transaction, how much investment is need to comply with new standards, how to formulate a business case that all customers can understand, and how much operation control to give up. Coupled with these decisions are dilemmas such as how much information to share, getting off the proprietary network legacy, breaking or keeping the mindset/trade-off of value versus cost, and how much product ownership to give away. In addition, traditional challenges (i.e. suppliers, new entrants, demand, etc) still exist [14].

More Agile e-Business is Needed. Application development practices from the mid-1950s to the mid-1980s concentrated on the computer. Human resistance to these applications is primarily due to bad design [21]. The practices of the mid-1980s to the mid-2000s concentrated on users, but often limited themselves to a fixed set of contexts. Resistance to using this software was due primarily to computer illiteracy or usability errors. Since the mid-2000s, user contexts are noted for being dynamic, complex, and possibly unpredictable [94]. So, e-Business applications need to have more than just interfaces and workflows that match pre-defined usage contexts [71]. Users must have the ability to design e-Business applications as they are being used.

1.3 Enterprise Engineering Challenges

Understanding and Managing the Enterprise. Enterprise engineering focuses on the technology aspects of the design, analysis, implementation and operation of all elements associated with an enterprise. Such technology aspects are closely related to the analysis and design phases of the software development process [63]. During these phases, designers aim at establishing an explicit representation of the organizational and technical system processes and infrastructures in order to increase their understanding of the enterprise and make development of automated support possible. Important notions here are Enterprise Architecture (EA) and enterprise ontology. EA is a description of the information, behavior and structure aspects of an enterprise at a business, application and infrastructure level [97]. There is no common agreement on the precise model and languages to be used for accomplishing this coverage, but the importance of EA for strategic decisions across individual projects is widely recognized. A major challenge is to maintain the integrity of EA and its consistency with the continuously changing organization [63]. More formal and prescriptive approaches may be necessary to address this challenge [76]. Also new aspects may need to be considered, such as value [60] and culture [105] in order to make EA more effective for business innovation.

Enterprise ontology is a description of the concepts and relationships that can exist for a community of people of an enterprise [44]. The description is a conceptualization of knowledge in an enterprise domain, such that knowledge can be shared among stakeholders, and, using a formal knowledge representation, automated reasoning by software agents and interoperability in distributed software applications can be supported [62]. A recognized problem in this field is the agreement of a single or intermediate ontology in B2B collaboration and the alignment of top-down and bottom-up derived ontologies [67]. Also, there is a lack of frameworks to compare the strengths and weaknesses of candidate ontologies [60].

Integration and Interoperability. A related view on enterprise engineering is the modeling and integration of various organizational and technical parts of business processes [171]. The integration problem applied to the collaboration or network aspect of enterprises leads to the identification of interoperability issues. Enterprise interoperability is necessary to achieve seamless collaboration between enterprises, and to allow new business models characterized by flexible partnerships [147]. Enterprises in several domains move from highly data-driven to more cooperative information-driven, knowledge-driven environments [122] based on standards [13].

Despite the strategic importance of interoperability, and the availability of standards and architectures, several technical, semantic and organizational issues still exist [30], [171]. Ontology-based and service-oriented approaches have been proposed here as possible solution directions [66]. Business-IT alignment contributes to the effectiveness of integrated solutions, and concerns itself with how IT can help achieve business objectives and improve business performance. Alignment implies that IT and business functions should adapt their strategies together, which is a dynamic and evolutionary endeavor [107].

1.4   Mobility Challenges

Coping With Digital Natives. e-Business needs to cope with the behavior and requirements of "digital natives." The generation of the digital natives grew up with the Internet and has a great degree of competence concerning the usage of Internet services. Digital natives are well informed and assertive regarding products they want to buy [121]. They are continuously in contact with their community in social networks, where they express their positive as well as negative experiences with products, services and companies. These statements have a fundamental meaning for the purchase decision of the other members of the social network community. Bloggers write about the product or company in their blogs, videos are published via YouTube or similar sites, and the product is the subject of online discussions. Because of the wide-spread use of Smart phones, the digital natives are "always on". This means that a bad experience of one customer can develop a huge impact on a company's reputation in a larger community. This phenomenon is similar to a chain reaction. Charlene Li and Josh Bernoff coined the term "groundswell" for this phenomenon [101]. This means companies have to: a) place their products in social networks additionally to their regular marketing activities, b) promptly respond to negative feedback, and c) create a marketing strategy that uses mobile ads to influence digital natives in a positive way.

Totally Personalized Products. According to [133], a key factor of sustainable competitive advantage for businesses in the future is the ability to focus on the importance of individual customer experiences and tailor products accordingly to his or her individual needs. So, the customers are able to co-create the products they want to buy. This paradigm of the customer relationship where the customer feels like they are they only one, or the most important customer of a company, is called "N = 1" [133]. To adopt this aspect to m-Business, and to create value for the customer, m-Services should be context aware and rapidly change to address user needs and environment [11]. One important context would be the current location of a user. To provide such context aware services the challenges are to: a) equip mobiles with several different and robust sensors to capture changing context (e.g., surrounding noise [23] and b) analyze, assemble and offer the right product to the user for the current situation).

Mass Adoption of m-Services. Before the introduction of the iPhone, the adoption of m-Services had been modest and focused on SMS and location based services [50]. Now, there are over 42 million iPhones [98], and so its concept has been copied and AppStores (e.g., Andriod Market, Ovi Store) offer their services to the user. Today, forecasts predict the number of mobile users accessing the Internet will surpass the number of users accessing the Internet using PCs, and some also predict a significant shift from Web use to mobile application use [7]. Beside these changes, will there be barriers from the perspective of physical, cognitive, security, economic and entertainment value of m-Services for mass adoption and user acceptance? According to Ervasti and Helaakoski, the utility of m-Services has a strong impact on user attitude towards mobile services [138], and this means the added value of m-Services has yet to fully to meet user needs. Another finding is that context information for personal m-Services is an important influencing factor towards user intent to buy m-Services [50]. These findings should be incorporated into the future development of m-Services.

1.5 Collaboration and e-Services Challenges

Proper Inclusion of the Digital Native Population. "Digital natives" were born after 1980, after the first social digital technologies were invented. They live much of their lives online via social mediated interaction. Their notions of making friends, creating/working, experiencing music, and sharing their lives differ from those born before 1980 [121]. Sometimes called "The Net Generation," they relate to technology differently, with reflexes tuned for speed and innovation. They want freedom, choice, and customization in everything they do and buy. They enjoy conversation, not lecture, and insist on integrity underneath communications. They want to have fun at school and work, and want to learn to think for themselves. They are very willing to electronically engage, and search online about products before buying [160]. Regardless of name, this group is global in its force, scope and nature, and operates more like a population rather than a generation [121]. Thus, e-Business needs to cope with the behavior and needs of digital natives. This means managing the groundswell and the impact of the participation of this population in the context of their social network communities [133]. Specifically: a) knowledge-intensive firms must create shared interest, b) service-oriented firms must create complementary online spaces for people to discuss shared practices, and thus discover the tacit knowledge that impacts purchases, and c) honest and open dialog between customers and the sales force [93].

Offering Fully Customized Products to Consumers. Given how digital natives think, e-Business must offer totally personalized products and adjust its customer relationships in ways so customers feel like they are the only, and most important, customer [134]. The business challenge is typically called "value co-creation" [5]. Value co-creation, is an emerging innovation, marketing and business paradigm describing how customers and users are seen as active participants in the design of personalized products, services and experiences [133], [127]. Often this participation is organized via the Internet to enable the opportunity for customers to integrate their knowledge, experience and skills into existing, modified or entirely new market offerings reflecting their personal preferences, needs and contexts [142]. For example, in the case of global software development, the platforms of electronic engagement are: a) individual connection, b) electronic Community, c) resource sharing, and thus product personalization or co-production can happen via any of these forms of engagement [159]. Therefore, e-Business must have a multi-pronged approach to digital natives and customized products. In short, it must have: a) a global strategy, b) integration of product-system-business processes, c) rapid response, d) reconfigurable manufacturing systems, e) innovative products, f) products able to be highly personalized, g) data driven operations, and h) flexible strategic alliances [176].

Matching Pragmatic Interoperability to Semantic Interoperability
Interoperability at the service level is characterized by three aspects: syntactic, semantic and pragmatic [170]. Semantic Interoperability is the ability of communicating entities (not only computers) to share unambiguous meaning [130]. Syntactic Interoperability, provided by languages such as XML, involves a common data format and protocol to organize data so that: a) information can be correctly interpreted from its structure, and b) syntactic errors can be detected [8]. However, data represented using

one syntax may not be accurately translated into a different syntax [65]. Interoperability is a multifaceted problem caused by issues such as: a) organizational incompatibilities buried deep within collaborating enterprises, b) architectural mismatches, c) defective assumptions about application behavior, and d) mismatched properties within business collaboration models. Thus, pragmatic interoperability (i.e. the implementation) is hard to match to semantic interoperability (i.e. what was intended). One approach: build taxonomies of independent aspects, each being a different view of enterprise computing. A clean separation makes easier the identification interoperability requirements [140]. Ontology can aid in the construction of this taxonomy. In general, a single ontology containing every term used in every computer application is thought to be impossible, because of the speed and dynamics of how people construct business vocabulary. However, it seems possible to define a set of very primitive terms that can then be used to create concepts for applications or ontologies [43].

1.6   Technology Platforms Challenges

Technology platforms play the crucial role of enabling e-business developments, by providing the possibility for flexible service invocations. Enabling the construction of flexible and loosely coupled business applications, spanning over different networked enterprises capable of interconnecting their applications and share data by combining a set of services, service-oriented technology platforms represent an essential foundation for e-business interactions [20]. Such kind of platforms are also expected to bridge technology and real life, with regard to how technology is incorporated by real-life systems which are human-centered, taking into account that e-Business means now much more than electronic data interchange. Three key issues in this regard are Autonomy, Adaptability, and Context Awareness:

- Autonomy: how modules can maintain, in some cases, their own autonomic functioning, "deciding" on their own what to do next.
- Adaptability: how automated systems can adapt to a changing environment.
- Context-Awareness: how systems can deliver services in line with the user's situational context, plus the concerns of mobility, security, and collaboration.

One consideration of technology platforms relates to two desired features essentially important: service orientation and service scalability.

Service Orientation. Service orientation is required for achieving a wide spread of offered technical IT facilitations through advanced ICT platforms, unrestricted by the way the service delivering components are implemented and also by other low-level issues. Service-oriented platforms should hence allow for an easy way of pushing forward business goals through formulated requests at high level, abstracting from the underlying technical details. This can only be accomplished through "wrapping" technology and accessing it through standardized interfaces through which a platform utilizes service invocations. Although this has already been well-established as a research vision [3] it is still missing a wide practical accomplishment.

Service Scalability. Scalability is significant because of the open nature of most technology platforms [177], which appear as facilities often supporting interactions and/or

collaboration. This means that scaling up to hundreds or thousands of users and involved organizations may be needed. In supply-chain, for instance, which much relies on e-Business facilitation [154] is often necessary to serve hundreds of suppliers and thousands of users, allowing them to adequately profile their requests as well as to establish and maintain dynamic collaborations, relying on diverse services provided by different service-providers. To solve this, platforms are often "tempted" to enforce standards, which makes their support of limited use to many customers or they allow for dynamic, autonomic support which nevertheless handles a limited number of "scenarios." We hence need a wider degree of customization through which users would be left to shape the platform support according to their preferences, while being flexibly led in establishing this, for guaranteeing that they would only go for requests that are adequate with regard to what the platform is providing.

2 e-Business Applications Directions

Area	Themes Across Area 1	Score	Rank
1	e-Business must support the convergence of producer and consumer.	26	5
1	e-Business requires needs analysis, including human "connections."	25	6
1	Business is experiencing economic, technological, societal, and IT challenges.	24	7
1	e-Business solutions have adaptive user interfaces + workflows that match user's context.	10	17
1	e-Business applications have transformed companies into global, and more trusted, providers.	10	18
1	e-Money flexibility and usability is designed into the "money" and the machines that process it.	3	30
1	Business faces strategic tensions + drivers that e-Business applications must address.	0	37
1	Validating e-Marketing agreement and its effectiveness.	0	38
1	Executives are asking engineers to build more agility into their e-Business applications.	0	39

Table 1. Conference Themes and Relative Importance for e-Business Applications
(Scores are *relative* importance ratings. The ranking was done across all subject areas.)

2.1   Eliciting Context-Based Usage and Operational Requirements

Business applications are becoming easier to use, and are now being used by consumers with different technical knowledge and skills [50]. Part of this trend is due to application developers, who are improving their abilities to: a) understand how to help consumers carry out their everyday work, and b) serve the business and operational needs of producers [145].

Consumers are more and more often actively involved in the product design and development process in order to get the application that will cover all or most of their business or working needs and will be usable and understandable to them [143]. Producers as well need consumers to contextually specify the exact situations in which they will use the application, and to specify those requirements in non-technical language [71] including operational constraints. Since consumers with less technical experience usually describe their needs by giving concrete examples, involving them can provide producers with more concrete and straightforward information about the expected product [185]. The framework and the goals of existing and future application usage can be better determined if explained with concrete examples using simple language [11]. Application designers will then be able to transform those requirements into technical language, and thus implement e-Business applications with fewer errors.

The current direction of merging the producer and consumer into the so-called "prosumer" [164] brings new value to application development, especially to require-

ments elicitation [23]. In the end, consumers will be more satisfied with the result, such as the utility of the product or service [186] and simpler and more rational procedures for installation and use [2]. Having the prosumer actively involved in the process of e-Business development is a direction which can improve the quality of life of life for the consumer [58] and give friendlier face to the provider [84].

2.2   Positive Changes to the System Development Life Cycle (SDLC)

Improved requirements elicitation is part of a larger trend of improved practices throughout the System Development Life Cycle (SDLC) [169]. These practices start when the need for a system is recognized [105] and carry through to actual delivery and deployment of the system [186]. Here are the improved practices discussed during paper presentations at the conference:

- Project Scope and Planning: a) ontology for consistent understanding of the problem [67], b) buy versus build decisions that best meet business needs [1].
- Requirements Elicitation: a) in-depth understanding of the user's context [105] and [180] b) accurate transactional requirements [116] and [26].
- Solution Design: a) designing flexible business processes into applications [166] b) software versions of rules and standards from business models [13].
- Solution Implementation: a) implementation for interoperability [123] and [52] b) thorough and dependable testing [55] and [76].

Together, these practices address some key decision-making that occurs during the SDLC, and provide a three-way benefit to project stakeholders. First, executives are more assured that the way they designed the business and intend it to operate will actually be realized in the e-Business [14]. Second, the users will experience technology that has a higher likelihood of matching: a) the different work/leisure contexts in which they find themselves [180] b) their changing mental perspectives as their context changes [72] and c) specifics of their activities in any given work/leisure context [129]. Third, system developers spend less time in each SDLC phase on standards, rules, and agreements already decided upon by both the business and the users [59]. This win-win-win situation is the direct result of the business making an investment in better practices and tools [126] and the willingness of developers and users to collaborate during application development [145].

2.3   Widening Scope of e-Business Applications

Business Scope. While some markets continue to grow, business is attempting to resolve the sometimes conflicting requirements and constraints of the economic, technological, societal and IT perspectives [126]. In response, business models are being developed to address customer needs while also addressing industry and government standards and regulations [145]. In addition, the Internet has become part of everyday life, and in the case of "digital natives," life is lived on technology [121] The outcome of a whole population geared to electronic (versus brick and mortar) commerce means the scope of its applications must move beyond ground stores and supply chains and to the Internet. In other words, nowadays a business without an Internet presence is

risking market penetration in significant ways [162]. For future success e-Business applications must be facile in social networks and with multimedia [74].

Consumer Scope. Business scope and consumer scope are intertwined. From the consumer perspective, digital natives expect anything–anywhere–anytime [118]. So, e-Business is trying to spread into every corner of the Internet, such as: blogs, wikis, portals, and social networks – in other words, e-Business must now be managed, or business will find the well-known phenomenon of "scope creep" to severely impact profitability [135]. If managed properly, consumers stand to gain many benefits; for example: a) personalized products [15], [181], b) better and simpler services [11], c) more intuitive and natural user interfaces [16], d) novel ways to transact [116] and e) application behavior sensitive to the user's current context [104].

Functional Scope. Some e-Business applications are attempting to tackle business strategy in an attempt to satisfy widening business and user scopes [53] (e.g. e-Voting, e-Health, e-Delivery, e-Careers, e-Procurement, e-Complaints, e-Banking, and e-Billing. Managing the functional scope of such applications can partially be addressed via standard: a) Web services that communicate with consumers through a generic Web-based interface using standardized information [61], b) business models [52], c) business ontology [67], and d) interoperability [123]. Clearly, growth and maturity of all these standards are a major e-Business direction.

2.4 "How Much Technology" is a User Decision

Ultimately, the main purpose of any e-Business application is to help consumers carry out their desired activities as simply, quickly and reliably as possible [173]. As e-Business applications become more functionally rich, more adaptable, and more inter-active, the user needs be put in control of just how much technology should be used in any given life context [156]. This choice is not just a simple matter of better speed, easier use, simpler process, or any other similar benefit of current e-Business applications [161]. Instead, it is a matter of user comfort with the decision-making process in whatever life context they are now experiencing [87].

While these ideas are not new, we see the next immediate generation of e-Business applications being on the tipping point of providing functions and information in ways that allows users to selectively choose, or ignore entirely, assistance and/or data at any given moment in time to at any breadth or depth. Both research and literature are not mature in this area, and we see much growth in this direction. This direction must answer the question "How much technology is really needed to make an optimal decision?" [109] A related question might be "Should e-Business applications have embedded AI technology so that they learn over time and then infer [54] to not offer assistance and/or information [49] when the user has re-entered a known life context and has previously chosen to ignore similar assistance and/or data?

We acknowledge the research and hard work of the many hundreds of scholars in the areas of participatory design [48] user-centered design [120] collaborative design [164] and many similar concepts, methods and techniques for allowing users to partic-ipate in the design of computer artifacts. Up to now, user participation has been li-

mited to the development stage of a technology. But, with the advent of cloud computing [9], composable Web services [75], ontologies [60], and maturing of artificial intelligence technology [54], we see a potential for the e-Business application development path that allows users to design technology while it is being used. This is an interesting and an exciting direction, and we expect much growth in this area.

3 Enterprise Engineering Directions

Area	Themes Across Area 2	Score	Rank
2	Design systems that can evolve with changing business needs.	38	1
2	Value modeling / analysis is needed in enterprise application development.	33	3
2	e-Commerce (physical to digital to virtual) is altering business economics.	14	12
2	Web 2.0 is focused on entrepreneurship as part of Enterprise 2.0.	10	19
2	Business transaction standards enable B2B interoperability.	7	21
2	Analytical CRM: discover trends + opportunities corresponding to "digital native" reqts + the social network.	7	22
2	Companies want their e-Business solutions to grow into global solutions.	6	26
2	The e-Business model must address the explicit design of culture into the solution.	4	27
2	e-Business solutions are becoming a heterogeneous collection of well-integrated components.	4	28
2	Companies are building proprietary ontologies to describe their business + how it operates.	0	40
2	Holistic business transformation framework enables physical --> digital --> virtual path.	0	41
2	Adopt a meta-design paradigm to design systems that can evolve.	0	42

Table 2. Conference Themes and Relative Importance for Enterprise Engineering
(Scores are *relative* importance ratings. The ranking was done across all subject areas.)

3.1   Coping with Societal, Business and Technology Change

A major theme in enterprise engineering is dealing with change: business environments are continuously changing, due market or technology developments. If business organizations and their supporting IT systems do not evolve in sync, businesses would experience increasingly less effective systems. Therefore, the ability to adapt while keeping alignment between business and IT has emerged as an important factor for successful business operation. Initially, research focused on frameworks that help to understand, analyze and construct business-IT alignment. With proper alignment, the potential of IT systems is fully exploited to achieve business goals and objectives. Such frameworks have been discussed by [183], [107], Enterprise Architecture (EA) subsequently emerged as an important discipline to deal with alignment issues, next to issues of integration and complexity [188], [189].

The evolution of the Internet towards a business enabler [190] has important implications for business organizations: not only will advance IT, reduce costs, and increase productivity, it will also enable novel business models with corresponding organizational transformations. In other words, Internet developments such as electronic marketplaces, business service ecosystems and market-oriented clouds [191], [192] push business organizations to make corresponding organizational changes. These changes are not merely optional, but may be necessary to exploit these opportunities and to remain competitive or excel in their line of business.

Consequently, business-IT alignment becomes even more challenging. Organizational changes may occur more frequent, following the pace of technology development, and they will extend across organizational boundaries, due to the collaborative nature of modern ICT-based business. The role of EA remains prominent, however it is important to consider alignment as a continuous process that is addressed with an

evolving EA [169]. The EA lifecycle consists of multiple improvement cycles, going through definition-implementation-execution-refinement phases, in which market and technology trends can be taken into account [193]. In order to ensure the integrity of EA across business, application and infrastructure levels, the application of model-driven approaches may be useful and should be further investigated [194], [191]. Furthermore, in order to guarantee consistency with the implemented enterprise information system, architecture reconstruction approaches [195] may be applied, acknowledging that EA cannot always enforce conforming implementations but may itself be made conformant to reality by using bottom-up knowledge.

3.2   Addressing Stakeholder Values

Many promising IT applications and services are not commercially successful due to being too much technology-biased. In order to be successful, business aspects should be carefully considered during design and implementation, leading to a clear business plan [196] with a sound value proposition [59].

Each intended partner or stakeholder will only enter a proposed collaboration for a new business service if the benefits of participation are considered to outweigh the costs. Moreover, a participant (or participant role) can be essential for the collaboration, in the sense that without this participant (role) the service cannot be introduced or provided, e.g. because of lack of budget, expertise or infrastructure. In this setting, benefits and costs are not necessarily only or directly related to monetary aspects. For example, benefits may be the increase of recognition, friendship, publicity, knowledge or ownership. Costs may be the decrease of any of these properties or assets. In any case, benefits and costs may be valued differently by different partners and stakeholders. For a business service to be successful, each participant should perceive the collaboration as being profitable, i.e. having net benefits for its particular situation and preferences. Even if a new service has clear overall benefits over an existing situation, successful introduction or operation may not occur because the distribution of benefits and costs is unbalanced: some participants benefit more than other, or some participants pay the costs while other participants enjoy the benefits. Since situations and preferences may change in time, for each individual participant, it is important to maintain value propositions in order to keep essential participants onboard.

Although this all seems obvious, in practice many technology-oriented projects still start off without considering the business case. Or, they make important design decisions without taking business aspects into account. Fortunately, the maturing of e-business technology also led to an increased interest in market exploitation opportunities, which in turn shifted attention to business models. Several frameworks for understanding and analyzing e-business models have been proposed [197], [198]. These are complemented with various accepted business modeling techniques, such as Resource-Event-Agent (REA), Business Model Ontology (BMO) and e3value. The latter focuses on value models that capture the economic value exchange in a business network, and therefore best fits the concern expressed above.

E3value has originally been proposed by [60] and since then has been extended and applied for various purposes. Since value modeling must be considered in the broader scope of enterprise engineering, value-based business-IT alignment must be addressed [199]. This puts forward issues of consistency and transformations between the value model and various other models in the context of enterprise architecture. For example, the relationship between a value model and a goal model is studied in [200] and between a value model and a process model in [201], [199]. A systematic approach for transforming a value model into a coordination process model is proposed in [202]. Also, attention has been paid to the creating value models for business collaborations [203] and adapting B2B processes in case of changing requirements [204]. Because of the increasingly important role of service-oriented architectures for enterprise systems, value-based service analysis has been considered in [205].

3.3   Migration from Physical to Digital to Virtual

With the development of the Internet as a unified and global infrastructure for communication and access to information, commerce entered the digital era. This era is characterized by a new form of commerce – e-commerce – empowered by the Internet and associated technologies, which complement traditional, physical commerce. E-commerce facilitates the transaction of "old-fashioned" goods and services. However, it also allows new value-added services as well as fundamentally different products, namely digital products [176]. Currently, another development can be observed, which can be seen as a shift to the virtual. This shift, already foreseen more than a decade ago [206], will bring new ways of service interactions based on computer representations of people, products, processes and places. Examples are digital negotiation agents, e-stores, virtual processes for supply chains, and avatars [207].

The move to virtual is reinforced by the current phase of evolution that the Internet is undergoing, which will lead to what is being called the Future Internet [208]. The Future Internet embraces two important concepts: the Internet of Things (IoT) and the Internet of Services (IoS). The former is based on advances in pervasive computing and ambient intelligence, which allows embedded computation and communication capabilities in daily objects, making them identifiable, traceable and controllable from remote locations. This allows new monitoring and control applications, such as tracing and tracking, plus interaction between the physical world and the digital world [209]. It also enables new context-aware services [210]. These services adapt the interaction with their user environment dependent on the context –state or state changes in the physical world– that is inferred from data obtained from context sensors.

IoS entails the emergence of a global and dynamic services marketplace [211]. In the IoS vision, business services are dynamically created and adapted to match demand, supply and available partnerships [213]. Further, new deployment and delivery models can be used, enabling on-demand rapid provisioning of virtual machines, platforms and services with pay-per-use [213], [192]. E-commerce and virtual markets based on the Future Internet cause challenges for enterprise engineering. Current research provides directions to address these challenges, including: serious gaming [23], business transformation processes [84], [169], and business process flexibility [166].

4 Mobility Directions

Area	Themes Across Area 3	Score	Rank
3	e-Business needs to cope with the behavior and requirements of "digital natives."	15	8
3	e-Business must offer personalized products and adjust its customer relationships.	14	13
3	Mass adoption of m-Services requires attitude (i.e. it is useful) and intention (i.e. I will use it).	7	23
3	m-Services can adapt its solution to match changing context + location.	7	24
3	m-Business solutions provide more adaptive user interfaces + workflows to match the user's context.	4	29
3	m-Services are striving to be effortless, accessible and appealing.	3	31
3	No standard business model for solutions over wireless.	0	43
3	m-Business solutions need to recognize and acquire information in changing contexts.	0	44
3	m-Business solutions must improve their ability to locate users in "harsh environments."	0	45
3	m-Services are striving to span geography, organization and user competence.	0	46
3	Mobile e-Business is incorporating more contextual, dynamic content in support of user-to-user interaction.	0	47

Table 3. Conference Themes and Relative Importance for Mobility
(Scores are *relative* importance ratings. The ranking was done across all subject areas.)

4.1   Mobility and m-Services

The topic "mobility" in ICE-B focused more on the side of m-Services and mobile technology than on the side of hardware or provider networks. The term "m-Services" stands for mobile services which are services where the clients are mobile terminals (MT) and at least the access network is a wireless one. Examples for MT include cellular phones, personal digital assistants or smart phones. The ubiquitous character of MT is essential: people can carry them around with themselves most of the day in turned on state. When we use the term "mobile service" we actually mean mobile and wireless data services with added value by providing additional information for a user [38]. A thematic analysis based on ICE-B 2010 papers, ICETE 2010 keynotes and some important e-business publications has been conducted. An overview of the results of this analysis for mobility is shown in Table 3.

4.2   Context Awareness of m-Services

The term "context," with regard to mobile applications, was introduced by [144] and is a set of information that describes the current situation of a user. A context sensitive application makes use of this information to adapt itself to the needs of the user. For mobile applications this is especially important, since the terminals have a limited interface for interaction with the user, e.g., small displays or no full keyboard. Context information can be differentiated by two distinctions [22]: 1) the privacy level (public and private) and 2) the degrees of variability (static, semi-static or dynamic). One special context is the location of a user. It would be classified as "private" and "dynamic". A service that evaluates the location of at least one mobile device during execution is called "Location Based Service" (LBS) [36]. Until 2009, LBS has been one of the most popular and used services for mobile devices [50]. Since the availability of the iPhone, which has a wide variety of application services, the so-called "apps," caused other services to become more attractive [98]. An application or service is context-aware when it adapts itself according to context information, so that it offers appropriate services corresponding to the user's situation. This aspect of context awareness is very important for the private use of application services and

even more for business use (e.g., for mobile sales and service representatives or mobile workers). Thus, the quality of the context information plus the analytical combination to come to the right conclusion about the user's current situation can be seen as one determining factor in the adoption process of application services [11]. Summing up, one direction in mobility will be that application services are using and combining several context services so that they can exactly adapt their services to the current context and situation of a user and offer appropriate service.

4.3   m-Services and Social Networks

It is important to note that there have been recent and significant changes in the use of media plus the overall behavior of consumers. This is affecting m-Services and their design. In short, the mobile device is not only for direct communication, but is also for real-time feedback. According to the Interone study, digital natives are using laptops and smart phones while also watching TV, in order to search for additional information or as a feedback channel to respond to quiz games or opinion surveys [78]. For companies, this means addressing this behavior when placing information and advertisements in TV shows and when offering games or surveys. Since the great success of the iPhone and the versatile offer of applications in different application stores [98], new possibilities in many ways have arrived. Here are just a few examples:

Always On: Because of being "always on" users have more flexibility and independence in planning activities with friends [41] when shopping or enjoying entertainment. This will have an impact on business models, range of coverage and types of communication [78]. Nowadays, people have new ways to interact with their environment (e.g., respond to an advertisement when passing by a shop). Virtual services enrich the user's reality with additional information. One instance of this is a new kind of navigation enriched with additional information (e.g., a city tour on a Smartphone with historical information to important buildings and nice places to have a coffee, and another option might be to get a city tour as an audio guided tour). So, because of being "always on" there are increased opportunities for mobile learning. The offer for new applications for mobile and also social learning is growing [89]. Therefore, "apps" which use context information like the location, a camera, a microphone or a motion device can realize great potential of mobile terminals [78].

"I like it" button. Because digital natives want to be where their friends are, they primarily maintain their social contracts to friends in social networks, where they can reach them always and everywhere. In social networks they can share their preference for things with their friends or spontaneous express themselves by pressing the button "I like it". Instead of the ranking of the links the amount of clicked likes of a product now is important. Respective buying decisions these personal customer experiences are getting more and more important. Through social and mobile media the consumption of media, the communication and the shopping will come closer together [78]. This will impact product placement and advertisements. Consequently some firms already offer products in a social network.

Increase of Online Buying. Due to the personalized "reach out" to potential customers with mobile advertisement plus the improved usability of mobile devices, ads can not only be used to inform and lead to a buying decision but also lead to an online purchase. This will be positively influenced because the potential customer has the possibility to compare prices and to confirm his decision by recommendations of his friends. This can also be named as "social mobile commerce" [45], [78].

Customer Managed Relations. Due to the versatile information in social networks plus context information such as user location, completely new interconnections are possible for optimally building relationships to potential customers. A new dimension of Customer Relationship Management (CRM) is emerging due to social network users being able to converse directly with companies regarding new products and customization possibilities. Thus, Customer Managed Relations [100] is a new trend.

Online and Offline are Merging. Applying special m-Services views of real world can be expanded with information in computer generated imagery. The physical and virtual reality is merging; this is also called "augmented reality" [103]. Gartner Research identified augmented reality as one of the top ten most disruptive new technologies from 2008 to 2012 [57]. Using such an m-Service, for example using www.wikitude.org, people can track – using their smart phones – objects at a special location, called point-of-interest, thereby enriching themselves with digital information and/or reading the digital graffiti messages of other users. Digital information can be open to all or limited to the contracts of the social network of one user.

4.4   m-Service Security Gaps

Mobile-Specific Security Gaps. Mobile devices are used by a majority of people as a personal assistant, and are taken everywhere. Thus, the possibility that these devices get lost or are stolen is real. This can result in unauthorized individuals gaining large amounts of confidential data (e.g. telephone numbers, addresses, or financial data) or even access to mission-critical systems if the device contains business data. In another scenario, if an unauthorized person "borrows" an unattended mobile computer, he or she may gain access to confidential systems. Additionally, wireless data communications are much more vulnerable to attacks than conventional "wired" communication, because they use "air," thus can be more easily accessed. Since the encryption of data to ensure privacy and integrity can be cracked [39], new technologies and concepts for preventing unauthorized data access and bolstering security will be necessary.

Location Privacy Gaps. Apart from the disclosure of user location by that user – such as publishing a rectangle that contains the user's actual whereabouts – mobile devices must protect user's location and context information from unauthorized others. According to one study [37], many people do not want to be tracked by others without their knowing about it. Also, there are various ways to abuse user information. For example, one might be able to resolve a user's name based on just location information. To ensure the privacy of actual user locations, the development of approaches to prevent such location information misuse is an important direction.

5 Collaboration and e-Services Directions

Area	Themes Across Area 4	Score	Rank
4	An AI-based 3D friendly visual user interface.	37	2
4	Multi-media social networks.	30	4
4	e-Business needs to cope with the behavior and requirements of "digital natives."	15	9
4	e-Business must offer personalized products and adjust its customer relationships.	14	14
4	Pragmatic (i.e. implemented) interoperability must match semantic (i.e. intended) interoperability.	13	16
4	Virtual Worlds are prime candidates to become arenas for "try before you buy."	7	25
4	The semantic Web, and its applications, enable e-business solutions to grow in scope and depth.	1	33
4	Quality of Service (QoS) for e-Services is multi-dimensional, and has many specific areas of concern.	0	48
4	Ensure privacy for all queries of any individual.	0	49
4	Pragmatic (i.e. implemented) interoperability must match semantic (i.e. intended) interoperability.	0	50
4	Cloud maturity now allows for cloud-based Web services to be created.	0	51
4	Computer-mediated networks are expanding people's ability to connect and converse.	0	52
4	Business terminology model standardizes e-Services operability + its corresponding SLAs.	0	53
4	Web 2.0 --> Social Networks --> Untapped Dynamic Niche Markets.	0	54

Table 4.Conference Themes and Relative Importance for Collaboration and e-Services
(Scores are *relative* importance ratings. The ranking was done across all subject areas.)

5.1 Evolving Ubiquity and Ability of Intelligent User Interfaces

Intelligent user interfaces apply artificial intelligence to the problem of human-machine interaction [46]. As user interfaces become more aware [175], they offer people more assistance with their tasks. One kind of user interface agent is called a "wizard" [10]. These agents provide task assistance by breaking the human endeavor into an often linear series of steps and presenting the steps to a person, one at a time. Another kind of user interface agent is called a "guide" [10]. Typically, guides provide assistance by monitoring a person's interaction with their immediate environment, and then presenting appropriate information, such as: highlighted important things to now consider, a set of choices, or the next best possible steps.

Over the last ten years, wizards and guides have appeared on an increasing number of diverse of computerized devices [119]: hand-held personal digital assistants, cell phones, pagers, pens, notepads, desk and wall-size computers, and also in everyday objects. The increasing connectivity of computers, started by the World Wide Web and continuing with ubiquitous computing, bolstered this proliferation. Also, recognition-based interfaces, especially speech [132], and vision systems are now becoming available to the general public, as well the need for 3D [102], customization [148] and scripting [82].

In 2010, we see the fusion of artificial intelligence, visualization, and Web 2.0 creating interfaces not thought of ten years ago: a) recommender systems based on user preferences [106] or by the history and genealogy of the user's information [81], b) high adaptability using software ontologies [16], c) personalization governed by the user's social networks [15] or by the social tagging implied by the user's searches or Web navigation [56], d) unexpected and highly useful data generated by context-aware mashups [115] and spatial hypertext [90], and e) machine learning based on the user's evolving vocabulary [79] or the user's prior personalization choices [181]. The availability and low cost cloud computing now provides storage and processing to implement far more sophisticated approaches than the ones mentioned above.

5.2 Multimedia Social Networks Are Better Understood and Utilized

The growth of multimedia social networks on the Internet is revolutionizing content distribution and social interaction, and has led to a new research area, called social multimedia computing. Included in this area are: contextualized media understanding, cooperative multimedia networking, multimedia interaction dynamics, and social multi-media community analysis [162]. This research area is crucial to e-Business, because companies can be more successful if they know such things as: a) how social multimedia is used to discover relationships and connections, b) how identity can be reliably verified, and c) how to properly cascade authorization to view data [91]. e-Business is also in a new domain of knowledge acquisition, because traditional marketing studies do not uncover key facts about customers and buying patterns. For example, knowledge discovery in blogs is different than knowledge discovery in databases or documents: clustering, decomposition and ranking are key techniques [96].

Even simple questions do not yet have good answers. For example: Why do people connect in social networks? Is it common interest? Is it friendships? Homophily (like-mindedness) is not yet well understood [99]. We do know that connection patterns in multimedia social networks evolve. For example, communities grow quickly at the beginning of an episode. The resulting connection patterns often create "small worlds" which can affect consumer patterns. In addition, strong cultural influences can bias the final purchase. For example, in some countries, face-to-face dialog must take place after online dialog before a purchase is made [174]. However, we do have some important answers that can immediately impact e-Business design. For example, current methods for analyzing the behavior of users who share multimedia in peer-to-peer live-streaming social networks have shed light on human dynamics such as cheating, malicious activity, and attacking. As a result, strategies now exist to: a) stimulate user cooperation, b) achieve cheat free interaction, c) provide attack resistance, and d) help provide reliable services [106].

Technical directions are also promising. For example, new-generation smart phones enable learning, visualizing, and sharing data about peoples' daily activities. Through smart phones, users exchange multimedia data (e.g. video, audio, images), and wireless users in physical proximity can share these data via spontaneous social interactions triggered by user profile exchanges. Recent algorithms now exist to create fast and efficient connections and data transfers using a topology overlay [25]. Such multimedia file sharing has exploded in large-scale multimedia social network communities such as Napster, flickr and YouTube, and consumes 43% of the overall bandwidth, which is about three times of all WWW traffic. This consumption is driving innovation in efficient, scalable and robust data sharing strategies. For example, signal processing is being used to model, analyze and perform behavior forensics on multimedia social networks (i.e. fingerprinting use), for the purpose of designing more secure and personalized devices [186]. Other examples include: annotating images using personal and social network contexts [150] and event annotation [187].

5.3 Virtual Worlds for Consumer-related Populations, Expertise and Things

Virtual worlds have become very popular, and there is a very strong trend towards larger worlds and more user generated content, including 3D content [74]. Research has shown that "try before you buy" is part of the digital native's mentality [121], and virtual worlds already provide interactive forums where potential buyers can try products or speak with product critics or evangelists, such as in Second Life [17]. Based on these experiences, there is no reason why virtual worlds in general cannot move out the gaming arena and into the e-Business arena: the connecting, interacting, and entertaining nature of Virtual Worlds makes them prime candidates to become arenas for "try before you buy" [108]. And research, such as using P2P content delivery for making real-time, multimedia content streaming more efficient [74] continues to make virtual worlds faster, and hence more life-like, for its user populations.

From a social perspective, one can envision that, as virtual worlds become interactive forums for consumerism, there could be an explosion of virtual population births. Such populations could be comprised of digital natives who would get paid for providing product/service experience/advice. A rise of "micro-nationals" around a core idea, core belief, common work task, product use, and so, may soon occur. And such populations would be just as aligned to their commonly held agreements as they are with their current nationality [149]. Understanding user behaviors in virtual worlds is also valuable for e-Business. For example, participatory sensing – the process whereby individuals and communities use ever-more-capable mobile phones and cloud computing to collect and analyze data for use in discovery [51] – can shed light on buying intent [179]. As these micro-populations are born, they become new markets, and to exploit such markets, as mentioned earlier in this Section, e-Business activities associated with the virtual community must not merely coincide with its social interactions, but be embedded within them [12].

From a technical perspective, the door is now open for virtual worlds to unite with The Internet of Things [118]. This technology merger holds great promise for e-Business. To explain: The concept of embedded interaction is very present in virtual worlds, even though "things" are not physical. No reason why virtual worlds cannot connect into the real world. Then, the current issues surrounding the Internet of Things apply [92]. And the virtual (as opposed to real) nature of the virtual world has advantages. For example: a) invisibility, interactivity, and multimodality for virtual things can be altered in real-time, b) context-aware things change their shape and/or behavior depending on user location and activity, and c) embedded computing for work or play be used in simulated contexts not suitable in the real world [118]. Many technical directions need exploration, such as the tradeoffs between embedded devices versus interaction devices, and between implicit versus explicit interaction [94].

5.4   Semantic Web Drives Standards for Smarter/Faster e-Commerce

Today, the top four technical directions for the Semantic Web are: 1) semantic-driven computation for identifying all solution possibilities and the best one, 2) automatic service composition via an orchestration model, 3) ontology-driven profiling using correct semantics for better access to solutions, and 4) semantic-driven decomposability to detect matching patterns in needs and solutions [183]. Here is a summary:

Semantic-Driven Computation. e-Commerce based on Web services allows any entity to trade with any other entity. Two frameworks are needed: a Web Services Modeling Framework (WSMF) [83] and Semantic Web Enabled Web Services (SWWS) [24]. WSMF is described below. The SWWS comprises five standards: coordination, semantics, discovery, trading, and negotiation. Future directions include: a) architecture for coordinated trading, b) semantics to mine social networks for commerce potential, c) product catalogues that suggest personalization possibilities, and d) intelligent agents for purchase negotiations [111].

Automatic Service Composition. Currently, the static Web has three key technologies: HTML, HTTP and URI for documents, and the dynamic Web three key technologies: WSDL, UDDI, and SOAP for services [83]. Today's Web Services Modeling Framework (WSMF) has four key technologies: a) ontologies, b) goal repositories, c) service descriptions, and d) mediators [83]. Future directions include: a) ontologies to define social network dynamics, b) repositories of prior successful commerce, c) an open orchestration model comprising product catalogs for personalization, and d) architecture for supporting purchases via intelligent agents [111].

Ontology-Driven Profiling. One possible future is to use "buying intention" as a new HTML anchor for tagging products to social network conversations. This tagging provides disambiguation semantics that enables more relevant ads, and simpler product discovery [125]. In this way, the strict publish-and-subscribe model of the semantic Web is augmented with buying intent history, and thus operates more along the lines of a query-for-content model [179]. Therefore, as soon as a prior buying intent is recognized, then previously used online ads can be invoked [111].

Semantic-Driven Composability. Composing Web services is a complex endeavor, and requires syntactic and semantic rules for success. Semantic composability rules include a) message, b) operation, c) qualities, and d) composition [113]. e-Business marketing exploits these rules to improve online ads: a) message = intent, b) operation = intent to buy, c) qualities = product personalization needs, and d) composition = intent plus needs matched to an offering. Such composability provides strong disambiguation semantics, and enables faster recognition of consumer buying intent [111].

6 Technology Platform Directions

Area	Themes Across Area 5	Score	Rank
5	Exploitation of information fusion concepts and technologies.	15	10
5	SOA-based enterprises will evolve in service-oriented enterprises.	15	11
5	Technology platform recognizes service request patterns; manages composition + reuse.	14	15
5	Service-oriented architecture enables dynamic composition of managed and basic services.	10	20
5	Pervasive, ubiquitous computing that is intelligent + aware.	3	32
5	Adequate mechanisms for interoperability, privacy, trust, control, and self-management.	1	34
5	Data protection, encryption, integrity, corrections, publication, utility, provenance, availability + accessibility.	1	35
5	On-demand e-Service composition --> dynamic applications.	1	36
5	Grid-based applications require ways to dynamically add + remove services.	0	55
5	Wiki technology requires robust authentication, authorization, and auditing of user generated content.	0	56
5	Electronic auction applications must be designed for a variety of usage situations and rules.	0	57
5	Wiki technology provides high information availability and immediacy.	0	58
5	SENSEI Framework for middleware integration platform for horizontal B2B integration.	0	59
5	Quality of Service (QoS) attributes that drive the design of SOA components --> compliance + usability.	0	60

Table 5.Conference Themes and Importance for Technology Platforms
(Scores are *relative* importance ratings. The ranking was done across all subject areas.)

A technology platform (TP) ensures optimum performance, availability, reliability, security, and intuitive data access across heterogeneous environments [20]. As such, a TP needs to adequately address the essential, desired features of current IT facilities: service orientation, support of autonomic behavior of entities, and context sensitivity [152]. We argue moreover that the actual "Cloud" direction [32] needs to be reflected as well in the current technology platform features. In the remaining of the section, we briefly outline and discuss each of these technology platform-related directions.

6.1 Service-Oriented Computing

Accommodating service orientation would require being consistent with the principles of the Service-Oriented Computing (SOC) Paradigm [146], considering the notion of "service" as a fundamental concept being nevertheless differently interpreted depending on the perspective; there are two main perspectives in this regard, namely the business perspective and the IT perspective. In a business context, a service involves the exchange of some action, performance or promise for value between a client and the provider [157]. In an IT context, a service refers to the external behavior of an IT system which behavior can be observed and experienced by the user of that system [155]. It is argued hence that considering these perspectives in combination allows SOC to bring together business and IT, by repeated aggregation of IT services into composite applications supporting business services that in turn are aggregated into business processes [168]. Thus, a SOC-inspired development of ICT applications would mean the ability to create new applications from existing services, independently of who provides these services, where they are provided, and how they are implemented [153]. Using the aforementioned, we derive the following requirements:

- Allow users to "play" with services at a high level;
- Maintain a sound link with the underlying technology;
- Reliably and flexibly establish and close connections, as needed;
- Support interoperability of full value;
- Properly handle all semantics;
- Align with advanced search facilities to enable service discovery.

6.2 Autonomic Computing

In contrast to visions for human-centered information systems [33], sometimes there are many contexts where information systems can take autonomous action [19]. Technology platforms thus need to facilitate such "autonomic" behavior, which in turn requires the need for consistency within the principles of the Autonomic Computing Paradigm [151]. From this perspective, systems should be capable of adapting to dynamic, open environments on their own, with little or no human intervention.

The Autonomic Computing Paradigm [88] has been proposed as a way to reduce the cost of maintaining complex systems, and to increase the human ability to manage these systems properly. Autonomic Computing introduces a number of autonomic properties, such as self-configuring, self-healing, self-optimizing and self-protecting. Extending and enhancing a system with these properties is an important step towards a self-management system.

At least some fundamental concepts and architectural building blocks need to be considered for constructing self-managed systems with autonomic properties. The two main building blocks of an automatic computing architecture are autonomic managers and managed resources [77]. Managed resources are hardware or software components, for example a business application, a router or a database. A managed resource is managed by an autonomic manager. This autonomic manager forms the central part of the autonomic architecture. It collects data from managed resources, which is used for diagnosing failures and other unwanted behavior. The autonomic manager formalizes and executes remedy plans for the managed resource which are intended to correct the unwanted behavior. These arguments suggest requirements:

- Properly support technical IT systems acting on their own;
- Consider autonomous action (i.e. without triggers from "outside");
- Act autonomously if the user interests would require such action;
- Yet protect users from inadequate or improper autonomic actions.

6.3 Context-Aware Computing

A key feature concerning any technology in service to human needs is its ability to adapt its behavior based on the user situation [178]. Technology platforms thus need to facilitate context-awareness, and do so consistent with the principles of the Context-Aware Computing Paradigm [152]. Their underlying logic must acknowledge that end-user needs are not static, and are partially dependent on the particular context in which the end-user is situated. Context-aware systems are thus primarily motivated by their potential to increase user-perceived effectiveness (i.e. to provide services that better suit the needs of the end-user) by taking account changing conditions. We refer to the collection of conditions which characterize an end-user's immediate surroundings, which are relevant for the system in pursuit of user-perceived effectiveness, to be "end-user context," or "context" for short, in accordance to definitions found in today's literature [40].

Context-aware systems can be somewhat effective if the end-user is mobile and uses a personal handheld device for the delivery of services. Mobility implies dynamic context, including most notably changing location. Regarding locations, different ones

may have different social environments and different network access options, which offer opportunities for the provision of adaptive or value-added services based on these contexts. Especially in the mobile case, context changes are continuous, and a context-aware system may exploit this by providing near real-time adaptation during a service delivery session with its end-user. Taking the aforementioned into account, we derive the following requirements:

- Applications should be sensitive to user's entire situation;
- Applications must adapt their behavior when the situation changes;
- Platforms must guarantee adequate Quality-of-Context levels;
- Platforms support security for the end user;
- Platforms must enforce privacy of context information.

6.4   Cloud Computing

Emerging Enterprise Technologies are profoundly changing the way we think of IT. From economics and efficiency, to process and usage models, all these dimensions comprise the Cloud Computing Paradigm. Many organizations look to "externalize" IT systems and services as a potential cost-savings advantage, primarily by moving internally hosted IT services to external providers. Other organizations view "external" IT as potential disaster recovery systems, or as on-demand capacity to boost business continuity and customer service levels [80].

With regard to these issues, and considering the e-Business technology platforms directions, we need to take a closer look Cloud Computing. Most notably, we need to identify current emerging enterprise technologies, and how they might facilitate e-Business and might produce a competitive advantage. There is hence a new wave of interest in the "Externalization of IT;" for example, anything-as-a-service (e.g. Software as a Service, Infrastructure as a Service, Platform as a Service, On Demand delivery, outsourcing, and so on). Taking the above background information into account, we derive the following requirements:

- Properly mediate between Cloud services and externalized services;
- Support the utilization of externalized services;
- Enforce Quality-of-Service standards with regard to externalized services.

7 Summary and Conclusions

e-Business Applications. Today's businesses are pressured by economic, technological, societal, and IT forces. In addition, Web 2.0 creates new strategic challenges never before considered by executives. Compounding these matters are the and digital native population who are demanding highly agile e-Business and personalized products. In response to these challenges, e-Business application development methods have appeared to better elicit context-based usage and operational requirements. There have also been many improvements in the System Development Life Cycle to ensure context-awareness is properly implemented. In addition, business sees that widening the scope of e-Business applications to every corner of the Internet can prove profita-

ble. The big direction yet to be considered is giving the user real-time decision-making on adapting e-Business application to suit his or her current context.

Enterprise Engineering. In the area of enterprise engineering, two major challenges were identified. One challenge relates to understanding and managing the enterprise, and requires further work on Enterprise Architecture and enterprise ontologies. The other challenge follows from the necessity to connect applications and the trend to collaborate in business networks and form extended enterprises. Several issues exist here, at technical, semantic and organizational level, in order to achieve seamless integration and open interoperability. We also discussed three interesting enterprise engineering directions: cope with change, address value aspects, and move to virtual. Cope with change is concerned with developments that can help to address the problem of continuous change in business environments. Addressing value aspects relates to advances in business modeling that can capture economic value exchanges between participants in a business network. Finally, move to virtual is an evolutionary development of e-commerce towards the availability of more advanced business services for virtual market places, enabled by the Future Internet and associated technologies.

Mobility. m-Services and social networks offer new possibilities in many ways. For users, they can offer more flexibility and independence in planning activities, in shopping, in communication and getting entertainment. For companies, they will need to adapt business models, advertisements, product placements, communication channels, customer relationships and business processes to address new consumer behaviors. They will need to pay special attention to, and focus on, digital natives because this population is using mobile technology in new ways. Along with the many positive effects of new mobility come the concerns of privacy. An adequate reliable protection of information is therefore necessary to ensure user privacy and data integrity.

Collaboration & e-Services. e-Business needs to recognize the groundswell of people now joining the digital native population. Part of that recognition means to reengineer the business to provide a fully customized product to each customer. In parallel, e-Business needs to be concerned with its electronic products, services and operations to ensure they all interoperate with other products, services and companies. Directionally, e-Business appears to be on a path to better understand and utilize multimedia social networks – a haven for digital natives. Thus, e-Businesses should start to see the value of virtual worlds, not only for the connection to digital natives, but also for the opportunity to offer product trials (i.e. via try before you buy demos) and advice (i.e. via product maven avatars). For products, there is growing recognition for intelligent user interfaces offering products that are highly attuned to the user's ever-changing context. Operationally, the Semantic Web is becoming more commonplace in e-Business strategies, and R&D is attempting to solve its issues and provide standards to commercial firms to enable better simplicity, reliability and speed.

Technology Platforms. In the area of technology platforms, two major challenges were rated as most important. One challenge relates to the necessity for delivering services through technology platforms in a way that hides the underlying technical

complexity from the user, while at the same time keeping the vital link to the underlying technology. The second challenge relates to the need for most technology platforms to scale up when faced with the dynamic requirement of supporting a multitude of concurrent users, allowing all of them to adequately profile their requests as well as to establish and maintain dynamic collaborations. To meet these challenges, it is of essential importance to consider four relevant computing paradigms that complement each other: a) Service-Oriented Computing, b) Autonomic Computing, c) Context-Aware Computing and d) Cloud Computing. Service-Oriented Computing concerns itself with service delivery, regardless of who is providing the service. Autonomic Computing focuses on the operation of the technical system itself, which must constantly consider is autonomous action is desired, required and/or appropriate. Context-Aware Computing is simultaneously monitoring the user's ongoing changing situations, and subsequently altering the behavior of IT systems to match each situation. Cloud Computing concerns itself with the externalization of services and/or facilities through "The Cloud." To meet the aforementioned challenges, incorporating features related to each of these paradigms, in combination, is required.

8 Acknowledgements

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