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# **HOW IT EMPOWERS THE PROACTIVE ENTERPRISE**

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*October 2007*

## **Foreword**

IT is no longer a mere support activity inside the enterprise; it is one of the main success factors for companies across the world. There are endless examples of how IT, when aligned with business, has enabled business to adjust to market forces in real time, resulting in huge successes: Dell's on-demand computers, Air France's lean management system, DHL's real-time customer package tracking system, BSH's intelligent ATM system, etc,

Today's economies are increasingly driven by innovation. Companies must be able to adapt to customer demand and market changes in real-time; they have to be proactive, beat time, exceed their customer expectations, and keep-up with the ever-increasing complexity levels of their environment. In order to become proactive, companies need IT more than ever. SOA (Service Oriented Architectures) has been used to resolve some of those issues. However, today's technologies are too limited to achieve most of these goals. Or so we thought, until we (re)discovered agent technology.

Business systems based on agent technology are based on a cutting edge concept: agents are totally distributed, hugely agile, and naturally aligned with the business.

Those agent based systems are capable of managing complexity levels that other systems cannot, dynamically correlating events, intelligently automating tasks, and providing business with the adaptability and the insight they need to respond to changing business conditions in real-time. To empower your business with agility and align your IT with your requirements, you need to go beyond SOA. With agents, proactive companies have found their enabling technology.

This white paper will explain how agent technology can help you create value for your company. To allow you to fully understand the concept of agent technology and grasp the extent of proactive enterprises, we have partnered with the only software vendor providing commercially implemented, enterprise grade agent technology: Oslo Software.

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## 1 THE ENVIRONMENT OF PROACTIVE COMPANIES

### 1.1 A flattening and changing world

Technology and ambition have permitted humans to seize the world and shrink it down to their dimension. Our world is now evolving at an accelerating pace; all its parts are more interdependent, but also changing at different rhythms, thus creating an incredibly complex environment.

Enterprises face the same complexity challenges as the economy continues to change at a fast pace. Companies have to increase their ability to adapt in order to remain cost-efficient and customer focused. Their time paradigm has also changed with companies that work increasingly in real time and that need to be more and more capable to project themselves into the future. They also have to manage globalization and localization, productivity and innovation, and operational excellence with strategic insight. As a result, the enterprise environment is becoming more and more complex, changing and interconnected.

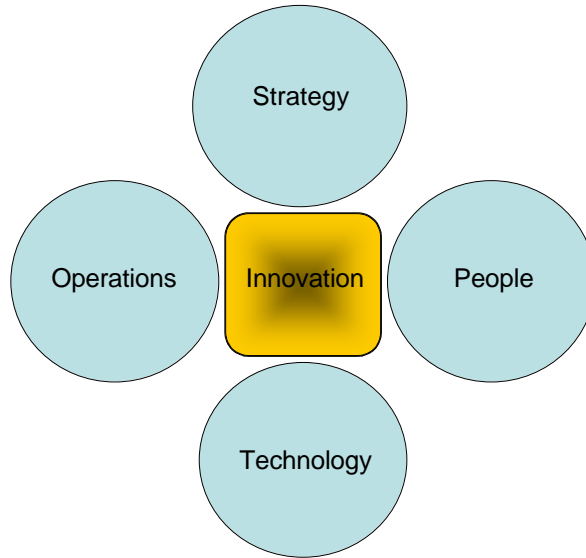
There is an abundance of examples demonstrating how disruptive this mutation of our shared environment can be: US car makers not forecasting the impact of the surge in oil prices, European shipyards crushed by Korean competition, silver photography replaced in a decade by digital photography, etc.

Mastering complexity is one of the keys toward success, the other key being innovation.

### 1.2 Innovation-driven economy

Innovation has always been the way humanity progresses ,from the discovery of tools to the taming of nuclear power. The success of economic power, enterprises, and humans has heavily relied on innovation. In our “flat” and interconnected world, this is more the case now than ever before, and modern economies have to be innovation-driven.

Innovation is based on the company’s strategy, operations, people, and technology, and on the quality of the interactions among those four factors along with their adaptation to the company’s environment (business, social, local, political, legal, etc.). Successful businesses have realized this alignment and are constantly improving it.



Market leaders will increasingly be those companies that not only innovate themselves but know also how to find and use innovations made by others in today's networked business systems. To innovate you have to know how to mash-up relevant innovations and add your value on top of it: strategy, people, technology, operations, etc. This approach allows companies to concentrate on its processes and the innovations it perceives as most critical. Aircraft manufacturers for their supply chain use this model. They design planes and manufacture some crucial parts, but they increasingly outsource the conception and the manufacturing of many of the aircraft's components. This is valid for the automotive, hi-tech industry and also for in financial or telecom services.

Innovation can then balance out the effect of our flattening world: in a previous business example, European shipyards were put out of business, but a decade later, some of them repositioned themselves for specialty ships, such as cruise ships or natural gas carriers. Not only did they change their strategy (going to a fast-growing market), they also optimized their operation and focused on their key points: people and technology.

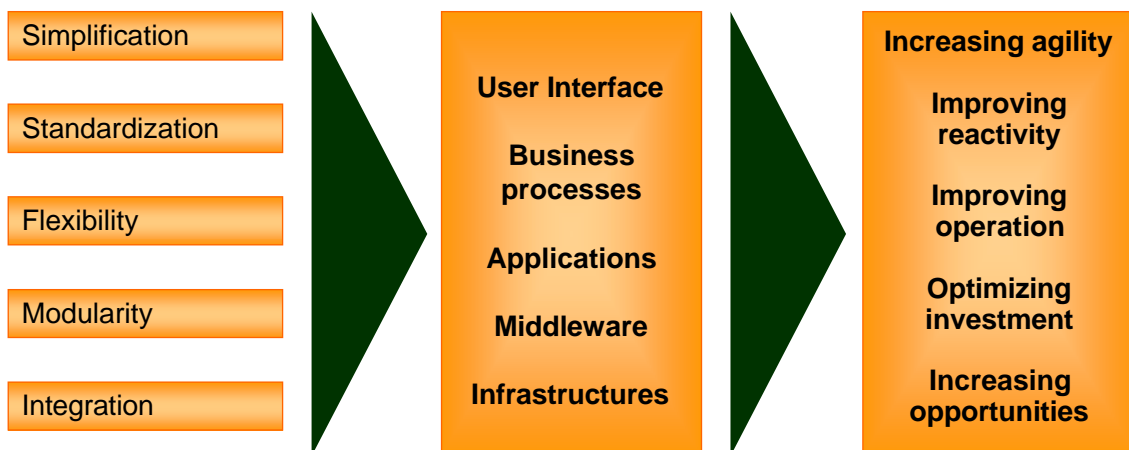
These business models are increasingly complex, and humans cannot cope with that kind of complexity as well as the adaptability levels needed and the velocity with which business has to be done; therefore, IT has become more and more important to enhance and optimize human decisions and business processes. It is the main tool to align strategy, technology, people and operations, and as such information technologies are the main catalyst to create proactive companies and, in so doing, to create innovations that leads to more added value.

### **1.3 The central role of IT**

IT is often compared to coal and petrol as an “energy” behind today economies, and this assertion is true. Our economies are increasingly dependant on IT, as they are on energy. But IT also empowers our economies and our companies with the means to master complexity and to foster innovation. IT is crucial in value creation, not only in that it can boost a company, but also because it can be the source of significant problems.

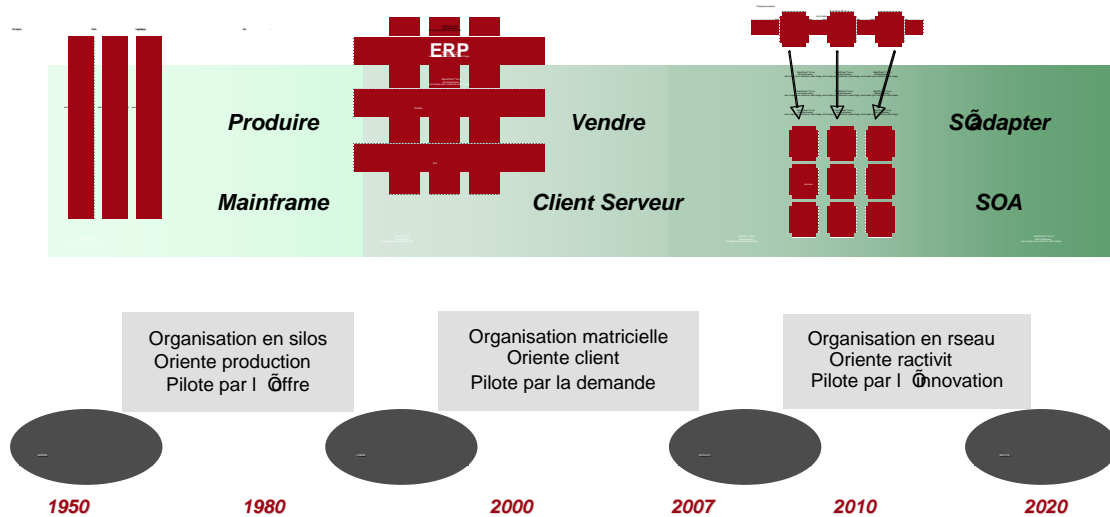
In our example about Aircraft makers, we describe their distributed value chain, a supply chain that is totally dependant on IT: Airbus in Germany was using an updated CAD/CAM system that was unable to plan the complexity of the electrical wiring in the plane. As a result the plane planning was delayed and billions were lost.

To be able to create value, IT systems have to be seen not as a cost center but as an innovation catalyst. They need to be as optimized and managed as any other business line inside the company. To become real innovation boosters and complexity handlers, companies' IT systems have to respect the 5 pillars of a modern IT system:



These pillars are the ways to make a modern IT system, a system that will focus on innovation and value creation. But this kind of cutting edge system needs enabling technology concepts. The foundations of these pillars are two crucial concepts in modern IT infrastructure: distributed network and intermediation. The technologies behind those concepts are the Internet and the Services Oriented Architectures (SOA).

This path towards an innovation-centric enterprise, towards the Internet and the SOA, has been a progressive evolution of both the business and the IT it relies on. This IT/Business alignment is even more crucial today, in an innovation-driven economy with distributed organizations and where adaptability and reactivity are the keys to success.



We will see how IT and business alignment is crucial to achieving these results, as well as what the key enablers of those proactive systems are, along with the major drawback of this evolution: complexity. Being proactive, companies will let innovation boost them, by aligning their strategy, people, operations, and technologies.

### 1.4 IT alignment

Since the beginning, IT has tried to adapt itself to the needs of the company it serves, but the results have been far from perfect. From its beginnings as an obscure support activity and cost center, IT has evolved to become a major factor in the creation of added value for businesses. This is the case now more than ever as business is currently totally reliant on IT to perform and to beat competition.

After the mainframe and client server eras, the advent of SOA has permitted better alignment as IT was going more and more towards the processes of the company, trying to unleash their potential.

But this is a never-ending quest, as new needs always appear, along with new demand for agility, new interactions between machines, between man and machines... Information systems need to adapt, to keep up with these changes and fluctuating business requirements. Thus, IT has evolved in parallel with companies' organization and business models, but as time seems to accelerate, so does the need of business/IT alignment, a main creator of added value and a key factor in proactivity.

As we have seen, innovation is key in value-creation, and we have realized that business and IT must be aligned and linked - but not bound - to allow for and foster innovation. The alignment of IT and business is the major factor that enables companies to be proactive and achieve success. To reach this goal, IT has to experience its "industrial revolution", as manufacturing has done in the past, when it evolved from craftsmanship to industry.

## **1.5 The "IT industrial revolution"**

This industrial shift is critical for advanced economies because they have to replace more and more workforce with capital (tooling) to stay competitive in the global market, and also because high end skills are scarcer.

The IT "industrial revolution" involves all of the innovation cycle: strategy, operations, people, and technology. As previously seen, Internet and SOA are crucial in this revolution as enablers, with the Internet as the transport protocol, and SOA as the target architectures

As IT is one of the key differentiators of today's businesses, Internet and SOA make possible the mutation of the economy in an increasingly connected, reactive, and flattening world. So the "IT industrial revolution" is also a big evolution for most companies, with the prospects it opens and the threats it generates for their businesses.

### **1.5.1 Internet**

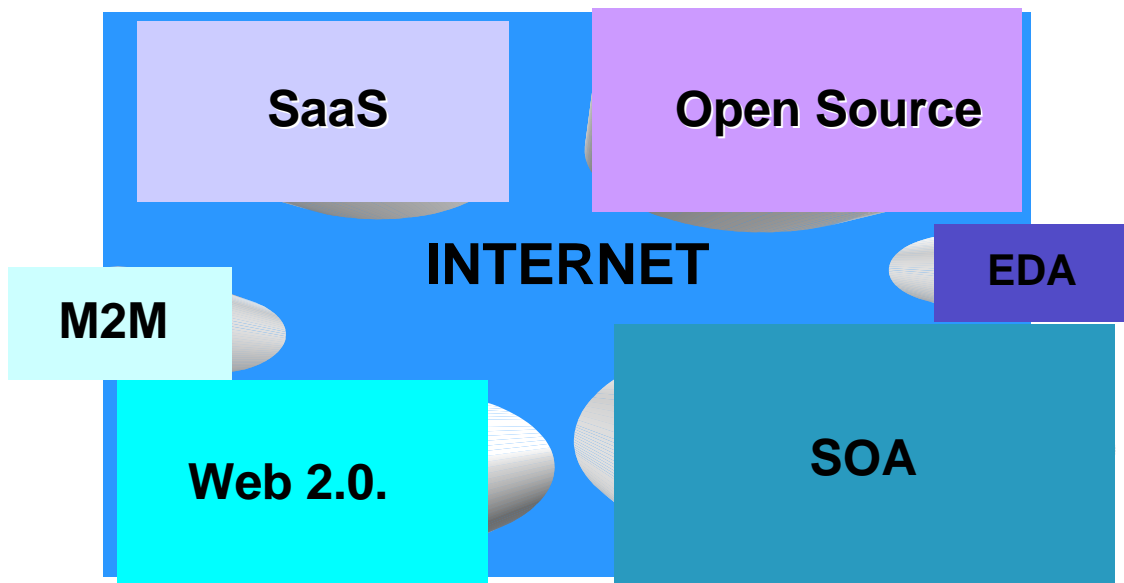
Just as the Industrial Revolution began with a major form of energy, Internet is this "energy" for the IT industrial revolution. The Internet network has revolutionized the way IT is done by allowing easy and standardized access to communications. New business models have been allowed and were created out of this revolution: e-commerce, of course, but also distributed supply chains and global sourcing, virtual factories...

The Internet is also the breeding ground for most of today's IT technologies, concepts and delivery models, which are changing the way business is done. The Internet's effects are the

embodiment of Schumpeter's disruption theory, as this technology strongly changes the way business is done and destroys business models, but it also enables the creation of other business models through the innovations it permits.

Examples abound around the world with companies such as Google (Software as a Service or SaaS), and Red Hat (Open Source), and more traditional industries with companies such as Ibertex (Zara) and DHL (Deutsche Post) being able to streamline their design, conception and supply chain processes. Offshore, global sourcing has been possible thanks to the Internet. It has happened in global industries such as the automotive, where major car manufacturers concentrate on the greatest added value part and use global sourcing for the other parts.

The worldwide collaborative open source software factory, the social Web 2.0, or Software as a Service, which help companies to optimize costs, would not be possible without the Internet. With the Internet, IT is becoming pervasive through M2M (Machine to Machine) and EDA (Event Driven Architectures) networks. Last but not least, the IT architecture of the future, Services Oriented Architectures (SOA), relies on the Internet.



### 1.5.2 SOA

Enabled by the Internet, SOA, the next wave of IT architecture, has gotten IT and business closer, as it intermediates technology and business processes. This architecture will rule IT for many years, as we can guess from main software editors' product road maps.

SOA relies on standard or customized but interoperable business and IT services. These services are aligned, integrated, and orchestrated, according to the company's processes to create composite applications. SOA derives a lot of its added value from the reusability either of existing applications that are encapsulated into services, or of brand-new services. These processes, composite applications, and services are developed, carried out, and monitored within middleware platforms.

The SOA concept can be compared to a 'clutch' between business requirements and IT resources, linking the two together. With SOA, companies can focus more on their business processes, knowing that IT will be more aligned to their needs. SOA is the business and IT concept that has made e-business possible seven years after the concept was introduced. It is also SOA-based architectures that are pushing SaaS (Software as a Service) in the market.

SOA helps business and IT to get aligned around the company processes. This link is one of SOA's fundamental strengths, but also the source of its complexity, and the reason why a new approach is required where business has to be a more important consideration in the conception of the information system.

## **1.6 The major drawback: complexity**

This IT alignment with business has generated more interactions and constraints on IT systems to support global, interactive, and distributed processes. Complexity has increased the tension on IT systems to such levels that IT cannot respond to business needs. There are two different aspects that increase complexity and tension on the IT system: the one that are business related and the one that are IT related.

### **1.6.1 *Business-related***

We have described the fast-growing complexity of our environment, but with the exponential flow of information and business events, the increasing velocity with which business has to be done, and the decision support systems required for business, humans cannot cope this kind of complexity, velocity, and reactivity. Agile and flexible IT systems are required.

Another business concern regarding complexity is that businesses often abandon innovations because they think they are not feasible due to complexity, and/or because of the cost this complexity will generate. This has been the case for most of the first wave of e-business

companies, unable to grasp the complexity of their new businesses. Then technology (among other factors) helped some of them to overcome complexity so they could become real success stories, such as e-Bay or Amazon.

This kind of business needs put enormous pressure on IT systems.

### **1.6.2 *IT-related***

Managing these levels of complexity is terribly difficult, and IT systems are often unable to handle it at affordable prices. So, often, cutting edge innovations are dumped. IT has to evolve to meet these requirements.

Information systems' size and complexity are also on the rise (volumes of information to manage, legal requirements, company interdependencies, integration of distinct technology layers and IT systems, etc.). The implementation of each technology and business requirement as a new layer on top of existing systems creates an ever-increasing amount of complexity. Making this behemoth agile and managing it has become a real problem, where IT will impede the business instead of helping it to create value.

## 2 THE PROACTIVE ENTERPRISE

### 2.1 Why will you be a proactive company?

According to Darwin's law of evolution, *in the midst of* environmental changes, if you don't adapt, you disappear.

We have already described the changing and moving environment of modern companies and with a flattening world comes exponential competition and an increasing need for business velocity and agility. To win they must anticipate, they must be proactive, they must to adapt or face the possibility of bankruptcy.

### 2.2 The needs of proactive companies

Proactive companies base their value proposition on innovation, velocity, and agility. These companies can dynamically allocate their resources to the ever-changing business requirements as they evolve in complex and moving environments. This implies that they:

- React immediately and anticipate the needs of their clients, suppliers, etc... i.e. their environment in general to create opportunities and avoid potential problems,
- Manage levels of complexity that technology and/or humans could not master previously,
- Develop an adaptable information system, increasingly automated and capable of delivering superior added value,
- Have open, intelligent, and collaborative systems to enable the agility now needed by most enterprises,
- Intermediate between business and technology so that IT systems remain aligned with business objectives.

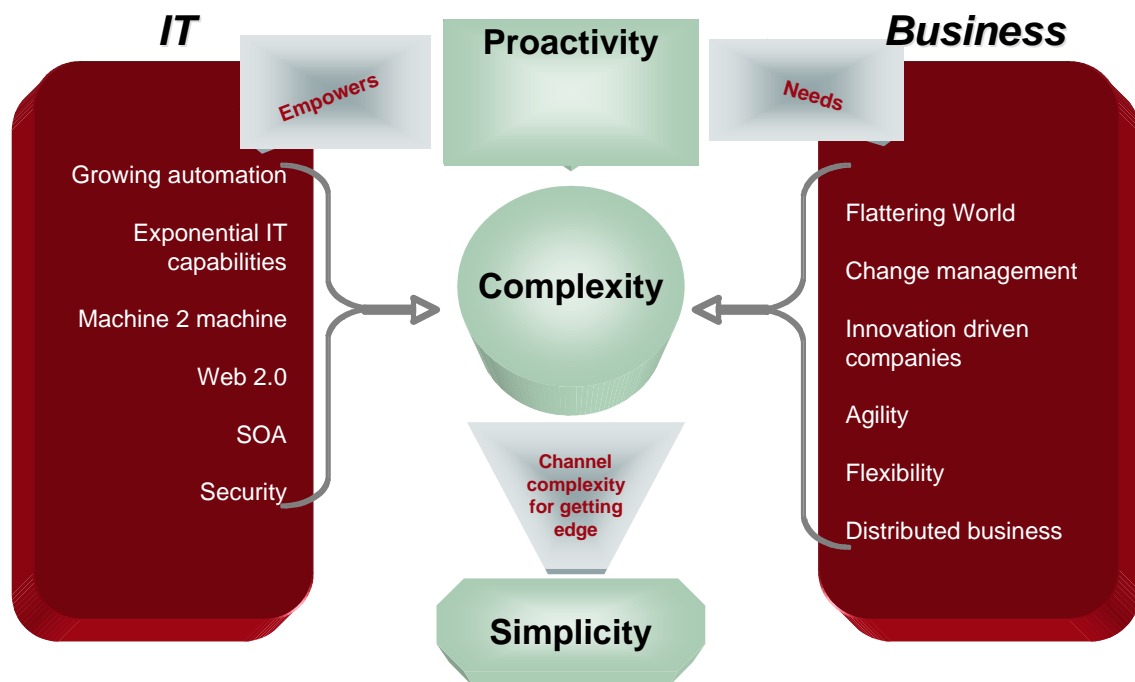
Platforms that are capable of delivering this concept combine several different tools from among today's existing technologies, including: Business Rules Engines, BPM, SOA platforms, complex event management tools, Business Intelligence tools, artificial intelligence, expert systems, etc... When these technologies are combined, company business events and objectives can be correlated to enable pro-activity

Doing so in accordance with company's business rules, the information system can trigger automatic and/or human reactions in such a way that companies can anticipate threats and weaknesses and react quickly.

To be proactive, these systems must be able to:

- Simplify the inherent complexity of today's businesses,
- Dynamically allocate resources,
- Empower IT systems.

The surge of complexity due to the evolution of the business environment, along with the increased velocity and agility needed coupled with the growing IT and business interactions put today's IT systems to their limits. SOA, even if it is far more agile than previous architectures, remains too rigid to deal with this kind of complexity. As for the Internet, we have to evolve to a more collaborative approach of the SOA, as the Internet has evolved toward a more collaborative approach with Web 2.0.



### 2.3 The IT enablers of a proactive company

These new tools will need to go a step further toward intermediation and distribution than SOA; they could be viewed as collaborative SOA tools. The main advantage of this collaborative SOA approach is the capacity to manage the increasing complexity coming from both business and IT. This complexity will continue to grow with the advent of the proactive enterprise, capable of dynamically allocating its resources, as more and more systems, technologies, business flow, and entities will collaborate.

These systems combine the majority of today's most advanced technologies. Some businesses are already combining them with the association of BRMS with BPM, Business Intelligence with ESB, or Complex Event processing with BPM... Examples of solutions delivered range from Insurance policy generators to adaptive CRM systems and Machine to Machine networks.

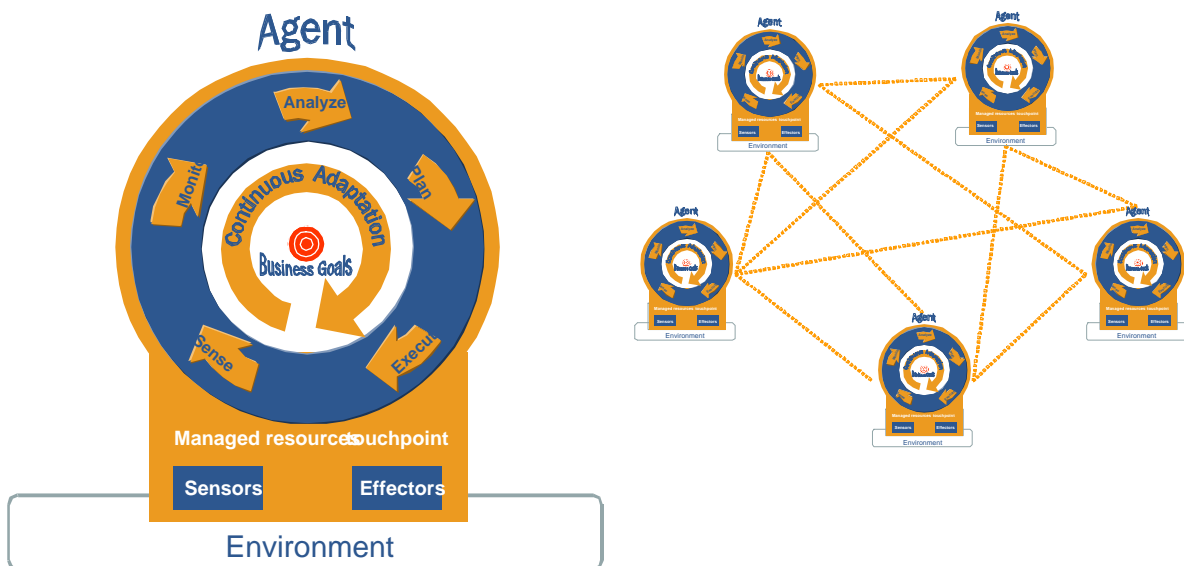
But these systems are usually custom-developed or poorly integrated, and thus remain limited and often difficult to handle, manage, or integrate. With this traditional approach, complexity is difficult to tackle and often increases. Companies have difficulties anticipating, as it is almost impossible to predict all business eventualities. Autonomous, dynamic, and intelligent systems are needed to solve this complexity and to remain in line with business objectives.

### 3 AGENT TECHNOLOGIES, THE COLLABORATIVE SOA

The most effective technology in terms of the proactive company approach is the concept of multi-agent systems inherited from artificial intelligence and complex event processing. Multi agents systems are based on collaboration between independent agents.

#### 3.1 The concept

The agent concept is the current optimum in distributed technologies and software intermediation. It is based on business goals-oriented development, and therefore naturally falls in line with business requirements. Each agent assigns one or more objectives according to company processes and rules. They carry out their objectives in conjunction with the other agents they interacts with, creating a sort of collective intelligence, similar to the collective intelligence of social insects. Agents allocate their resources according to company needs, and given that the agents and the system are goal-oriented, they are capable of dealing with unplanned exceptions and events. Therefore they are capable of leveraging the traditional limitations of BPM and BRMS systems. Flexibility and reactivity are hugely improved.



##### 3.1.1 From a business point of view

An agent is the “virtual clone” of a business element either physical element (truck, stock, operator, equipment, product, patient, etc...) or virtual element (client order, online booking, financial transaction, etc...). Those agents are the constituents of the multiple agent systems.

Representing these elements by an agent provides:

- Real-time management of all the events to which they are subject,
- Optimization of the activities in which they are involved,
- Simulation of multiple “what-if” scenarios

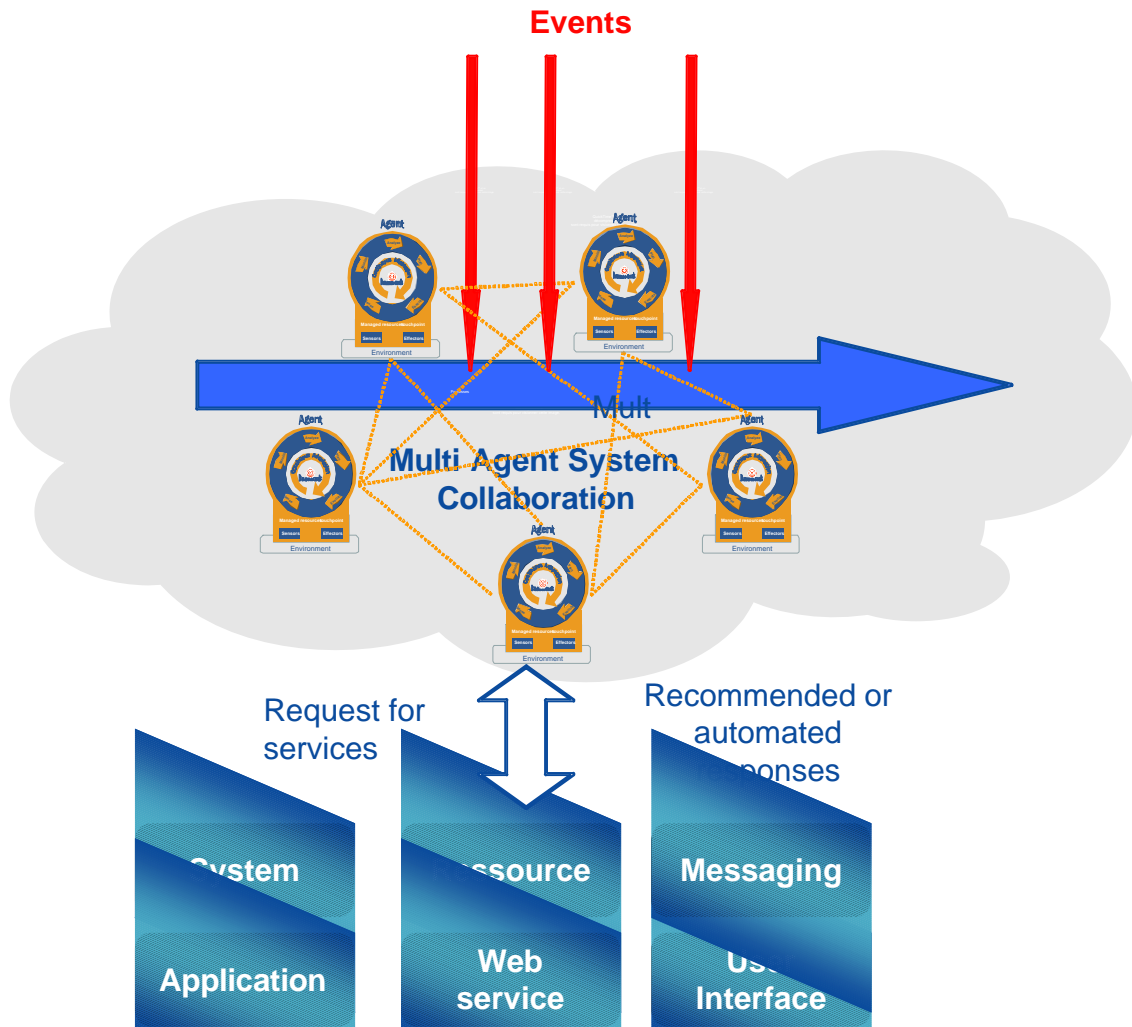
A Proactive Agent is an entity that can adapt to and interact with its environment as it can receive external stimuli (queries, events, services, etc.), to which it can react by requesting internal or external services. The agent will respond to the stimuli, by providing automated actions, recommendations, accessible from user interfaces, messaging and web services.

### **3.1.2 From an IT point of view**

Agents are distributed software components running on a server, that communicate with each other in an asynchronous manner.

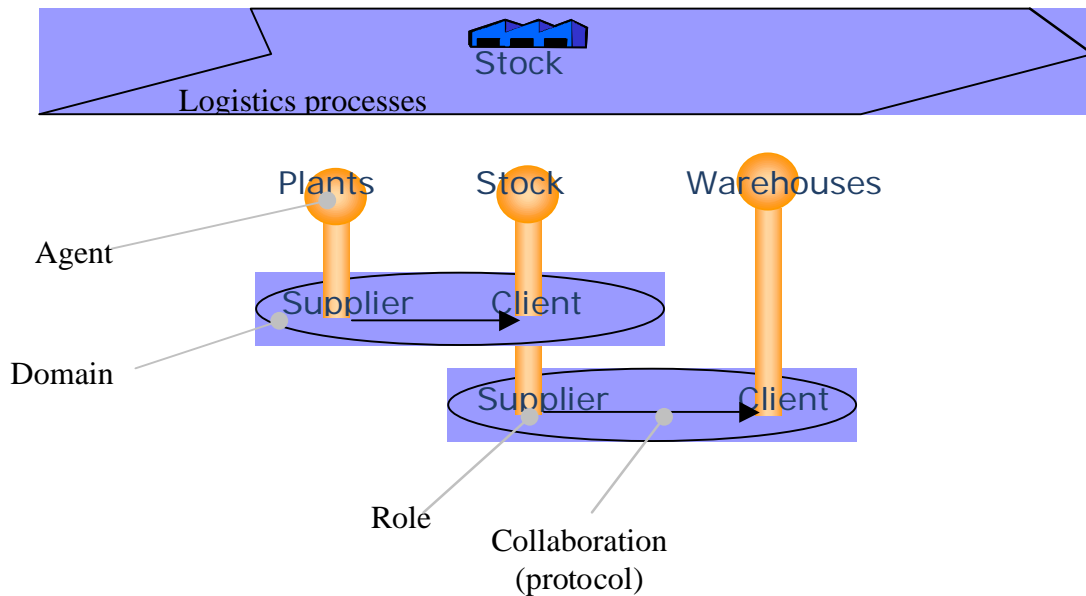
They are fully integrated into the information system as part of the Service Oriented Architecture. Agents consume and provide business services. Agents can connect to a wide range of applications: data bases, ERPs, web services, data flows, captors, devices, RFID, etc.

Agent monitor the information system in real time as they sense business events, context modifications, user requests,



### 3.1.3 Collaboration and distributed intelligence?

Agents constantly sense, monitor and analyze changes in their environment and interact with other agents to execute actions according to their assigned roles. The multiple agent systems are organized in domains that define a business area in which the agents act and/or to which they provide solutions.



### 3.1.4 What those systems deliver?

These are systems capable, in real time, of managing complex events that could not be managed by humans or other IT systems. With its innovative approach, the multi-agent system replaces the current limitations of the classic SOA approach, which is still too rigid for adaptive processes, dynamic resource allocation, unplanned business rules, or the complexity of unexpected and random events.

Agent technology is the platform for proactive companies, i.e., for those innovation-driven, network-structured enterprises that know that adaptability and dynamism are the keys to their success.

## 3.2 Examples of business scenarios for proactive companies

The agent concept can be applied in numerous ways: fraud detection in finance and telecom, security and anti-terrorism, real-time management of military units on the ground, dynamic management of investment portfolios, management of errors for SCM, e-business, etc.

Before, agent technologies were only used in very specific, mission critical systems such as defense systems for military aircrafts, autonomous robots for hazardous environments, hugely complex logistical chains, etc. Those systems were almost always custom-developed, costly, and difficult to manage. Now, the multi-agents approach is available, as a packaged software platform for any company willing to embrace this technological leapfrog.

We will quickly explain a handful of the many business scenarios you can realize with agent technologies before moving on to a detailed customer case with STMicroelectronics

### **Customer Relationship Management**

Goal-based agent systems can help service companies to optimize their customer revenues. These systems can help to streamline hotline services due to their dynamic resource allocation capacities, and they can also boost the revenues a company earns from a client by tailoring the company's response to its' clients' immediate needs.

### **Green IT**

Energy is becoming scarce and pollution costs are rising, so companies need to optimize these two points. Agent technologies empower companies with dynamic resources allocation, which helps them use the least expensive and/or the most efficient energy supplier. This technology can also monitor and manage the use of the energy inside the company, making it more energy-efficient and resulting in cost reductions.

### **Supply Chain Management**

In case of unplanned events, multi-agents systems can significantly reduce the time needed to solve SCM problems by dynamically allocating resources to where they are most needed. These systems can also be used to monitor the SCM and predict when problems will occur, thanks to their correlation capacities.

### **Manufacturing Execution Systems**

With their automation and resource allocation capacities, multi-agent systems are uniquely tailored to pilot and solve problems on a production line or factory. Their unique distributed technology also allows for the presence of an agent on most of the machines inside a plant, thus becoming truly pervasive.

### **Maintenance**

Agents can help companies improve the way they do their after-sales service by optimizing with intelligent and real-time automation, maintenance, and problem detection.

## 4 DETAILED CUSTOMER CASE: STMICROELECTRONICS

STMicroelectronics was created in 1987, following the merger of SGS Microelettronica (Italy) with Thomson Semiconductors (France) with a vision to become a world leader in microelectronics. The new company, which took the name STMicroelectronics in 1998, launched an aggressive growth strategy, based on a huge R&D effort, creating alliances with major clients and universities, establishing an integrated presence in the main economic regions, and developing of one of the most efficient manufacturing businesses in the world. ST is currently the world's fifth largest semiconductor manufacturer, and the European leader.

In total, the group currently employs over 51,000 people, holds 16 advanced R&D units, 39 design centers, 17 production sites, and 78 sales offices in 36 countries. In 2006, net turnover was \$9.85 billion.

ST manufactures integrated circuits and discrete components with silicon for companies that create electronic systems in communications fields (38% of the market), computer accessories (17%), retail (16%), automotive (15%), and industrial applications (14%).

### **A business need**

STMicroelectronics was on the lookout for an innovative, flexible, and upgradeable solution to manage both known and outstanding processes.

STMicroelectronics met with two representatives from the Oslo Software company during the market research stage of the project. The "agile staffing" project concept was then conceived during a preparatory meeting for the Christmas holiday period. The factory had to continue full-time operation during this period; it was necessary to ensure that all expertise would be available, especially on the critical machines.

This meeting didn't even come close to producing the desired efficiency – too many managers and engineers devoted too much time to analyzing detailed and more or less up-to-date Excel files. The problem stemmed from the multiple sources of data and the complex restrictions (rules for taking and recording paid leave, load plan by machine

type, availability of operators with the required training, planned leave for each one, planned qualification upgrade, necessary movement across teams, etc.).

By the time all this data was gathered locally and centrally for each of the 1,100 operators in five or six different applications, the file was already obsolete, without even taking into account that most of these “rules” (restrictions) had to be evaluated manually.

The “agile staffing” project’s main objective was simple: creating in a few clicks what we weren’t able to do in several hours with a group of engineers. One sentence summed up our initial specifications: “when an operator requests absence, their manager is immediately aware of the impact on the running of the department and can respond with almost definite elements.”

It actually meant identifying each party involved in the process, modelling the functioning, each person’s objectives, and their interaction with everyone.

To summarize, we had to model and then rationalize our processes of managing direct operational resources in order to provide the organization with visibility and flexibility.

### **A critical and enterprise wide project**

The project was launched conjointly among Operations, Industrial Engineering, Production Management, HR Management, and IT Management.

The project team was made up of an Industrial engineering-savvy project manager and an IT project manager from the partner company.

### **Oslo Suite was the only solution capable of meeting STMicroelectronics requirements.**

Oslo’s solution was able to handle the complexity of various data sources, complex interactions, and the requirement for flexibility plus IT and business alignment. As most of the rules were changing, over time the solution would have to be upgradeable and agile, and could under no circumstances be based on a “big integrated system”.

The largest part of the project was devoted to internal discussions: identifying the main players, modelling their own objectives (an operator wants to take leave and improve their qualifications), and finally, identifying the top source systems.

Oslo's business and goal-oriented approach helped STMicroelectronics to understand the modelling of their processes in a natural way. The managers and IT modelled the application in a manner similar to their natural language, due Oslo Suite model-oriented approach

**What was the ROI?**

The main difference between this "agile staff" project and the others was definitely the speed of implementation: the approach adopted by using Oslo Suite allowed us to remove barriers between the professional staff and people in the IT department.

Oslo Suite dramatically increased the agility of the systems. The dynamic staff allocation due to Oslo Suite resulted in a 3% increase in staff efficiency.

## 5 AUTHORS

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PAC is a leading marketing consulting company for IT users and their technology and service providers.

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Oslo is a leading software vendor providing dynamic resource allocation, collaboration, and orchestration.

Oslo is a private company founded in 2001 with worldwide operations in Europe and the United States of America. Oslo developed its agent technology expertise working with the international research community.

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