MOVING UP and MOVING DOWN

Ideas and opinions about the connection
between small scale specialized human networks
and large scale collaborative IT-technology.

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Contents

1. Introduction

For a long time people believed that, the world had entered a period of sustained growth (the long boom) that could eventually double the world's economy every dozen years. New waves of technology would lead to big productivity increases that would cause high economic growth.

The long boom assumed an evolutionary process where governments, companies and consumers could easily absorb new waves of technologies. In practice, new technologies act as a shockwave. Every time when companies become aware of the shockwave (a hype), they react quickly. The wave acts as a threat (the competition will beat us if we don't act) and at the same time as an attractor (it will generate high benefits for us if we win). Therefore, everybody starts to experiment, sometimes on a very large scale. After a long time best practices emerge and the new technology is absorbed. At that moment it becomes often clear that the technology has a completely different effect than everybody thought it would have. Most of the time there are many losers and a few winners.

Not many technologies keep their promise (e.g. Client/Server, E-Commerce). The frequency of shockwaves is much higher than the absorption time of the new technology. The effect is that companies are in many stages of adoption at the same time. More and more managers are very skeptic and hesitant to start a new absorption wave. They are left with many layers of software. Some of the software-layers are so old that almost nobody knows what is does or how to get rid of it. Most of the companies first want to clean the mess of all the waves that hit their company before they start with something new. The big problem is that the software-industry never stops to launch new shockwaves and nobody knows for sure if the new wave (perhaps for the first time) will keep its promise or his threat.

Behind the scene, something else is happening. Western culture is encountering a paradigm shift. Slowly the era of rationalism is ending. The rationalists were obsessed by objectivity and perfection. In their view, objectivity and perfection can only be accomplished by controlling the subjective parts, the emotions (detracting the brain) and the imagination (creating illusions) by the logical reasoning of the intelligent calculating machine, the brain. The rationalists created the big corporations (with the brain at the top), the general-purpose computer (with the brain in the operating system) and the standardized mass production systems that eliminated the craftsman and replaced him with the perfect objective human, the robot. The brain is not capable to understand the effects of his interventions in nature and society anymore. His aim to control has the opposite effect. Nature and society are complex systems with many unknown short-term and long-term feedback loops.

The new paradigm takes its metaphors out of biology. The world consists of numerous networks of cooperating and competing human agents. A network is uniquely determined by its human- and technology-patterns. These patterns act as an imaginary boundary. They shield the network from changes in the environment. New participants have to learn to use the technology and the internal procedures to survive in the network. The

behavior of the human participants in a network changes slowly. When they do not like the network, they move to another. Human members come and go but the technology-patterns of the network stay alive.

On a high level, we can see that the opening of a new space of possibilities causes the movement of all the networks. When one of the networks moves into the new space, others have to follow in due time. The movement of a network can be slowed down by physical boundaries (islands, mountains), physical space itself (traveling) and cultural boundaries (languages).

The invention of symbols opened up mental space. It caused a major change in human society by enabling the creation of writing, mathematics and the development of the automatic calculator, the Computer. The Internet is opening a vast new space (Cyberspace) of new opportunities on two levels. It makes new technology-patterns possible and it facilitates the bridging of human networks (communication). The last factor will speed up of the movement of networks heavily. New networks and new patterns of behavior (products, services, cultures) will arise (and fade away) that nobody has ever imagined.

The Internet is enabling a level of collaborative creativity that was not possible before. The corporations try to manage the collaborative creativity by giving the customer a choice (mass customization), speeding up the product development processes by introducing advanced systems of product life cycle management and involve the customer in de product-design (customer-innovation). Outside the corporations, consumers and small flexible specialized companies merge spontaneously into networks that produce unique products that carry the signature of the craftsman again. In the future big corporations, consumers and small-scale businesses will merge and create a completely new business-ecology.

The Internet and its new general purpose technology-patterns will make it possible to move down to the human scale of cooperation, the network. By connecting the networks, the world will move up to a level of collaboration that was never possible before in history.

2. Smart Customer Networks

When a customer connects his multimedia PC, using a broadband connection (e.g. ADSL), to the Internet an enormous amount of possibilities confront him. He can download and share software, music and movies, buy almost everything he wants for the lowest price (often for free), arrange his own holiday, learn more about a subject than a specialist, join a specialized community and communicate (without using the telephone-network) with his friends, colleagues and family everywhere in the world by means of text, voice or video.

To make use of all the possibilities of the Internet the customer has to learn new skills. He learns a lot by trial and error. When he is in trouble friends and relatives that are more advanced help him. After some time the customer becomes an experienced user of the Internet. He changes into a smart customer and becomes a trusted expert in his field of interest. Every time when he finds out a new possibility, he communicates it to his network. The people that trust his expertise join him to use the new feature in a very short time.

Smart customers become smart citizens when they want to use political pressure to accomplish something. They join or create pressure groups. When a smart customer gets sick he becomes a smart patient. He searches the Internet to find the cause of his problems, joins a community of people with the same illness, asks an expert for advice and gives all the information he has gathered to his general practitioner or his medical specialist. There he negotiates his treatment. If he does not get the medicine he wants he is able to buy it somewhere on the Internet.

Most of the companies and government agencies cannot capture the smart consumer. He is navigating from vendor to vendor, from one pressure group to another, always looking for the best fit. The needs of this kind of customer are constantly changing and expanding. Smart customers are not only buying services in the network, they are inventing, developing and selling their own products combining components from different vendors.

Smart customers can save a company and governments a lot of money. They take over the activities of high paid specialists. Vendors that understand this issue, cooperate with the customer in every stage of their processes. They let them sell the product (through their personal network), make it possible to assemble their own combinations, give them information about the state of the process, help them to enhance their network and skills and let them even participate in the development of new products.

Not everybody has the time, the money, the facilities, the network or the capabilities to make optimal use of all the opportunities of the Internet. The number of smart consumers and the amount of smart customer networks is growing very rapidly. They are leading a new revolution that will change the marketplace and eventually every aspect of our culture.

3. From Mass Production to Smart Customer Networks

The Industrial age is the age of mass production. The Taylor school of management dominated the organization of business. Taylor believed one should manage people (and customers) in the same way one manages inanimate assets and the machines on which people work. Mechanization and standardization of components and interfaces, careful supervision of quality standards, and minute division of labor characterize the mass production process itself. The division of labor was accomplished by breaking down work into simple, repetitive tasks eliminating unnecessary motion and limiting the handling of different tools and parts. The consequent reduction in production time and the ability to replace craftsmen with lower-paid, unskilled workers or even robots resulted in lower production costs and a less expensive final product.

After the phase of mass production, the industry is now in the phase of mass customization. By carefully standardizing it is possible to make a distinction between components that customers like to vary (mostly visible) and parts that are part of the essential (invisible) infrastructure. A good example is the production line of Dell computers where customers can choose their own configuration.

A next step is to involve the customer in the design-process of the product (Customer Innovation). Companies like BMW or Audi give customers already access to innovation platforms where average drivers are invited to create the next generation of cars.

The move from Mass Production to Smart Customer Networks is the move from one united production and sales model aimed at the customer, to a network-model involving the customer in all stages. The challenge is to combine large-scale mass-production with small-scale user-involvement. It will be impossible to coordinate all the processes from one single point of control. Many coordinators have to synchronize their activities.

Manufacturers, retailers and customers have to act together in a collaboration network. Retailers and suppliers have to maintain customer relationships by sharing customers, margins, and intangibles like brand, as well as jointly planning marketing, merchandising, and sales activities and becoming more like companions (in a good marriage) than master and servant.

Mass Customization and Customer Innovation puts a high strain on the customer. The amount of choices a customer has to make is constantly increasing. The number of possible combinations of components that relate to a product and to a combination of components of different products will soon surpass the complexity a human being can handle. People simply do not have the time and the cognitive capacity to make all the choices that are needed. This problem can only be resolved when product-developers take the capabilities of the complete human cognition system into account.

Mass Customization and Customer Innovation give the customer a small stake in the business cycle. The customer is treated as a consumer and not as a co-producer. All the major design-decisions are still made by the executives in the corporation. In the future customers want to be treated on an even footing.

If customers really get frustrated, they can generate an enormous collective power. With this power, they can change the policies of a corporation (e.g. the Brent Spar affair of Shell) or even take over the complete business cycle. An example is the Open Source Movement where a network of programmers wanted to destroy the monopoly of the big software corporations on operating systems. They developed a new free-ware operating system called Linux. The corporations are now trying to stop this fatal development by taking over the commercializing of the product (Red Hat) and by fighting the developers in court because they have infringed their patents.

A war between consumers united in Smart Customer Networks and the Big Corporations is not in the benefit of both the competitors. They have to cooperate and combine their expertise. The big problem is that organizations, supply chains and their supporting systems were never designed to be demand driven. The challenge is to find an evolutionary path where a new fully collaborative infrastructure cooperates with the existing legacy-systems and business-processes.

4. From General-Purpose Computers to General-Purpose Technology

4.1. Introduction

The IT-Industry has evolved in nearly 50 years. In that timeframe, it became the most influential business in the Industry. Everybody is completely dependent on the computer and its software. The IT-Industry has gone through various technology waves. The waves generated integration problems that were solved by the construction of abstraction layers. The layers not only solved problems. They also created new problems that were solved by other layers. The effect of all intertwining layers is an almost incomprehensible, not manageable, software-complex. The main reason behind this development is the architecture of the general-purpose computer. It was developed to control and not to collaborate. The Internet makes it possible to leave the prison of the general-purpose computer and to move to a new collaborative infrastructure that supports general-purpose IT-Technology.

4.2. The General Purpose Computer

Charles Babbage invented the first computer (the Difference Engine) in 1833. Babbage wanted to automate the calculation of mathematical tables. His engine consisted of four parts called the mill (the Central Processing Unit, the Operating System), the Store (the database), the Reader, and the Printer. The machine was steam-driven and run by one attendant. The Reader used punched cards. Babbage invented a programming-language and a compiler to translate symbols into numbers. He worked together with the first programmer, Lady Lovelace who invented the term bug (a defect in a program). The project of Babbage stopped because nobody wanted to finance him anymore.

It was not until 1954 that a real (business-) market for computers began to emerge by the creation of the IBM 650. The machines of the early 1950s were not much more capable than Charles Babbage's Analytical Engine of the 1830s. Around 1964 IBM gave birth to the general-purpose computer, the mainframe, in its 360-architecture (360 means all-round). The 360/370-architecture is one of the most durable artifacts of the computer age. It was so successful that it almost created a monopoly for IBM. Just one company, Microsoft, has succeeded to beat IBM by creating the general-purpose computer for the consumer (the PC).

IBM and Microsoft are both protecting their markets by developing technology that is difficult to connect. Both are moving to the same area, the connection-point between the PC and the Mainframe (the Server), creating tremendous integration problems.

4.3. Integration Problems

Programming a computer in machine code is very difficult. To hide the complexity a higher level of abstraction (a programming language) was created that shielded the complexity of the lower layer (the machine code). A compiler translated the program back to the machine code. Three languages (Fortran, Algol and COBOL) were

constructed. They covered the major problem-area's (Industry, Science and Banking) of that time.

When the problem-domains interfered, companies were confronted with integration problems. IBM tried to unify all the major programming-languages (COBOL, Algol and Fortran) by introducing a new standard language, PL1. This approach failed. Companies did not want to convert all their existing programs to the new standard and programmers got accustomed to a language. They did not want to loose the experience they had acquired. Integration by standardizing on one language has been tried many times (Java, C-Sharp). It will always fail for the same reasons. All the efforts to unify produce the opposite effect, an enormous diversity of languages.

To cope with this problem a new abstraction layer was invented. The processes and data-structures of a company were analyzed and stored in a repository (an abstraction of a database). The program-generator made it possible to generate programs in all the major languages. It was not possible to re-engineer all the legacy-systems to this abstraction-level. To solve this problem a compensating integration-layer, Enterprise Architecture Integration, was designed

The PC democratized IT. Millions of consumers bought their own PC and started to develop applications using the tools available. They were not capable to connect their PC's to the mainframe and to acquire the data they needed out of the central databases of the company. New integration layers (Client-Server Computing and Data-Warehouses) were added.

Employees connected their personal PC to the Internet and found out that they could communicate and share software with friends and colleagues all over the world. To prohibit the entrance of unwanted intruders, companies shielded their private environment by the implementation of firewalls. Employees were unable to connect their personal environment with their corporate environment. A new integration problem, security, became visible and has to be solved.

It looks like every solution of an integration problem creates a new integration problem in the future.

4.4. Competing Infrastructures

The process of creating bridges to connect disconnect layers of software is going on and on. The big problem is that the bridges were not created out of a long time perspective. They were created bottom up, to solve an urgent problem.

IT-technology shows all the stages of a growing child. At this moment, companies have to manage and to connect many highly intermingled layers related to almost every step in the maturing process of the computer and its software. Nobody understands the functionality of the whole and can predict the combined behavior of all the different parts. The effort to maintain and change a complex software-infrastructure is increasing exponentially.

The IT Industry has changed his tools and infrastructure so often that the software-developer had to become an inventor. He is constantly exploring new technical possibilities not able to stabilize his craft. When a developer is used to a tool he does not want to replace it with another. Most developers do not get the time to gain experience in the new tools and technologies. They have to work in high priority projects. Often the skills that are needed to make use of the new developments are hired outside. The effect is that the internal developers are focused on maintaining the installed base and get further behind. In the end, the only solution that is left is to outsource the IT-department creating communication problems.

After more than 40 years of software-development, the complexity of the current IT-environment has become overwhelming. The related management costs are beginning to consume any productivity gain that they may be achieving from new technologies. It is almost impossible to use new technology because 70 to 90% of the IT budget is spent on keeping existing systems running. If new functionality is developed, only 30% of the projects are successful. If the complexity to develop software is not reduced, it will take 200 million highly specialized workers to support the billion people and businesses that will be connected via the Internet.

4.5. General-Purpose Collaboration Technology

In the manufacturing industry, the principles of generalization and specialization are visible. Collaboration makes it possible to create flexible standards and a general-purpose infrastructure to support the standards. When the infrastructure is established, competition and specialization starts. Cars use a standardized essential infrastructure that makes it possible to use standardized components from different vendors. Car vendors are not competing on the level of the essential infrastructure. The big problem is that IT-Industry is still fighting on the level of the essential infrastructure, blocking specialization. To keep their market share the software has to stay in the abstraction framework (the general purpose architecture) they are selling and controlling.

A new collaborative IT-infrastructure is arising that is able to solve the current integration problems. The new infrastructure makes it possible to specialize and simplify programs (now called services). Specialized messages (comparable to the components in the car industry), transported over the Internet, connect the services. This approach makes it much easier to change the connections between the services.

The World Wide Web Consortium (W3C), founded in October 1994, is leading the development of this new collaborative infrastructure. W3C has a commitment to look after the interest of the community instead of business. The influence of W3C is remarkable. The big competitive IT-companies in the market were more or less forced to use the standards created by the consortium. They were unable to create their own interpretation because the standards are produced as open source software.

The basis of the new collaborative foundation is XML (eXtensible Markup Language). XML is a flexible way to create "self-describing data" and to share both the format (the syntax) and the data on the World Wide Web. XML describes the syntax of information.

XML has enabled a new general-purpose technology-concept, called Web-Services. The concept is comparable to the use of containers in intermodal shipping. A container enables the transport a diversity of goods (data, programs, content) from one point to another point. At the destination, the container can be opened. The receiver can rearrange the goods and send them to another place. He can also put the goods in his warehouse and add value by assembling a new product. When the product is ready it can be send with a container to other assembly lines or to retailers to sell the product to consumers.

Web-Services use the following standards:

- **SOAP**

SOAP is the container. It standardizes the exchange of envelopes containing data, programs and content.

- **WSDL**

WSDL (Web Services Definition Language) enables a flexible software-assembly-process. It does this by standardizing the Application Program Interface (API's). API's are used to connect software-components (now called Services).

- **UDDI**

UDDI (Universal Description, Discovery and Integration) identifies the appropriate warehouse, where Services are stored.

- **URI**

URI (Uniform Resource Locator) identifies the computer where a resource can be located. A resource can be a page of text, a video or sound clip, a still or animated image, or a program.

Web-Services facilitate the flow of complex data-structures (services, data, content) through the Internet. Services, can rearrange data-structures, ad value by combining them with other data-structures and can send the result to other services.

All kinds of specialized data-structures are defined that are meant to let specialized services act on them. An example is taxation (XML TC). XML TC (a part of the Oasis standards organization) focuses on the development of a common vocabulary that will allow participants to unambiguously identify the tax related information exchanged within a particular business context. The benefits envisioned will include dramatic reductions in development of jurisdictionally specific applications, interchange standards for software vendors, and tax agencies alike. In addition, tax-paying constituents will benefit from increased services from tax agencies. Service providers will benefit due to more flexible interchange formats and reduced development efforts. Lastly, CRM, payroll, financial and other system developers will enjoy reduced development costs and schedules when integrating their systems with tax reporting and compliance systems.

Web-Services are the next shockwave that is bringing the IT-community into a state of fear and attraction. Their promise is lower development cost, and a much simpler architecture. Their threat is that the competition will make a better use of all the new possibilities. The same pattern emerges. Their installed base of software slows most of the companies down. They will react by first creating an isolated software-environment and will have big problems in the future to connect the old part with the new part.

Web-Services will generate a worldwide marketplace for services. They are now a threat to all the current vendors of big software-packages. In essence, they have to rewrite all their legacy-software and make a split in generic components (most of them will be available for free) and essential services users really want to pay for. Big software-vendors will transform themselves into specialized market places (service-portals) where users can find and make use of high quality services. Other vendors will create advanced routing-centers where messages will be translated and send to the appropriate processor.

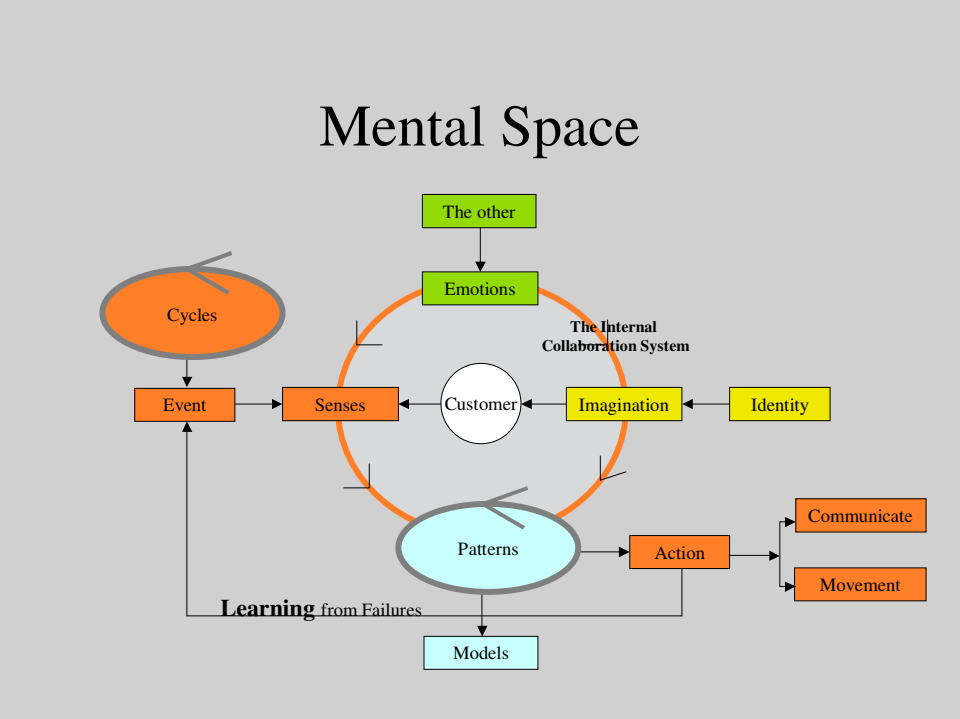
It will be difficult for small service-providers to get the attention and the trust of companies and consumers to make use of their services. They will join in collaborative networks that are able to promote and secure their business. It is impossible to see if they will survive in the still competitive environment where big giants still have an enormous power to influence and a lot of money to create new services. If the big giants succeed, history will repeat itself. The new emerging software-ecology will slowly loose its diversity.

Web-services are an example of the principles of mass-customization and customer innovation. All the software-vendors are restructuring their big chunks of software into components that can be assembled to create a system. Small competitors and even customers will also create components. In due time the number of possible combinations of components that are able to create the same functionality will surpass the complexity a human (or a collective of human beings) can handle. We are faced with the same problem we encountered in Chapter 3. To solve this problem we have to find out what differs humans from machines.

5. Understanding the Customer

5.1. Introduction

Until now, this paper was focused on new developments in IT-technology. The last decade the rational approach has dominated the human being. In the next chapters, we will show what can be done to create technology that considers the human scale. In the approach of Taylor and Ford, the employees and customers are treated as programmable machines. The focus was on a perfect coordination of the senses, the muscles and the production system (the assembly line). The emotions and the imagination were neglected. In mass customization, the emotions are involved. In customer innovation, the imagination is imperative. In a demand oriented system all the parts of the human cognitive system have to play a role in a coherent and balanced way. In this chapter a model of the individual human cognitive system (Mental Space) is presented that will be expanded to the group and the collective level in the next chapters.



5.2. Mental Space

The human body acts on its environment with messages and action-patterns. The incoming and outgoing messages are observed by the senses and transformed to an internal format. The internal communication system sends the messages to the appropriate place in the body. The emotions are always looking for danger. They want to control the priority of the actions to make it possible for the body to react immediately. The imagination creates an image of the outside world and helps the body to generate scenario's to improve its action-patterns.

- **The Senses**

The senses are the connection to the physical outside world. They shield the human being from the enormous amount of signals that are trying to enter the body. They filter incoming data and transform the data in a standard internal format. When the senses detect an event, it is evaluated by the emotions. If the event is not important, nothing happens. It the event is unusual it becomes aware in the conscious. Events that are highly repeating are not noticed after some time. An internal program (an action-pattern) automates the handling of the event.

- **The Action Patterns**

The muscles act in physical space. They acquire an enormous amount of reaction-patterns by repeated practicing. Humans learn from their failures. When the senses detect an event, many appropriate patterns are located and enabled.

When the patterns enter mental space, they change into models. Complicated patterns are compressed into models. Humans use all kinds of compression techniques to make the world compact and therefore more understandable. Static models (e.g. an organization contains employees) compress the world in wholes (nouns) and parts (attributes). They create identities. Dynamic models (the employee sells a product) compress causal chains (event, actor, result). They make it possible to reason.

Models behave the same way as sensors do in physical space. They shield the mental space of the human being from the enormous amount of ideas that the imagination is producing.

- **The Emotions**

The emotions act on hostile and friendly forces. They shield the body from physical injuries (avoiding pain) and take care of the self re-production process of the body (looking for food and a sexual partner).

The emotional system determines the amount of resources that is allocated to the evaluation and the search for adequate action patterns. If an event is dangerous, all resources in the body are used. The body reacts without thinking and uses a biological inherited and fast pattern (fight, flight, freeze, the primary emotions). If there is enough time to react, the emotional system evaluates its preferences and enables the preferred actions-patterns.

If the preferences are related to a long-term perspective, they enter mental space and the human has a choice to make. In the evaluation of long-term preferences, the other plays an important role. People want to take care of the other (family, friends, children), are afraid to get in to a conflict (dominance, status) and want to be praised by the other for what they are accomplishing.

- **The Imagination**

Humans imagine (by creating pictures connected with feelings) what events they like to happen (a wish). When they are pessimistic, they imagine what events they do not want to happen (a fear). The imagination is the innovative part of the human mental space that generates all kinds of new connections (ideas). The imagination is also the most free to play with new ideas. People can simulate and practice in their imagination without getting into trouble. The imagination produces the idea of the identity.

The imagination uses visual metaphors to create an understandable world. On the lowest level the metaphors are connect to the action patterns. The image of a cup is connected to picking up the cup, holding the cup and moving the cup. New structures are blended with old familiar structures. Many metaphors make use of the human understanding of technology. Freud based his theory of the unconsciousness on his understanding of the steam-machine ("I am steamed up with emotions"). Many theories of the mind are based on the metaphor of the computer. People always relate new phenomena to something they already understand. They sometimes do this (in the eyes of others) in very strange ways. A skilful teacher knows this and tries to find the bridge (the right metaphor, a story) between his world and the world of the student.

- **The Collaboration System**

They way the human collaboration system works is comparable to the way web-services are communicating using the SOAP-standard. In the human body, all the sub-systems (e.g. the services, the organs) are connected by shared communication-channels. There are fast (the nervous system) and slow reacting shared channels (the endocrine system). All the sub-systems use specific messenger-molecules to communicate their actions and act on incoming messengers. Messengers materialize with every thought we create and with every emotion we feel. When a messenger enters the boundary of a sub-system, (e.g. a cell) it triggers messengers that are specific for that sub-system.

- **The Output**

The action patterns make the muscles move according to a movements-plan that is stored in memory. The movement-plans of the muscles enable people to walk, to work (using tools) and to talk. In this last case, people communicate their intentions. The human communication contains a complicated mix of signals that are related to the emotions (e.g. visual expressions, gestures), the patterns (assertions) and the imagination (visual images, ideas).

5.3. Understanding the Mental Space of the Customer

People resist change. The patterns they have acquired control their behavior and determine their potential. People do not want to change their patterns dramatically. They want to acquire new patterns (by doing) without noticing the change. Only a major event (a critical moment), mostly with negative impact, can have a radical effect. If this event happens it takes a very long time to recover and get into harmony again. When people have to adjust their patterns too often, they experience stress and on the long run get sick.

If people cannot adjust their patterns, they have to involve the other parts of the cognitive system. When they involve the emotions, they have to set priorities and make a choice. People do not like making choices. They are incapable of evaluating all the possibilities. They can also make use of the senses and look at the real opportunities in the outside world. People are almost incapable of doing this because their imagination produces the images it wants to see. If the imagination really faces the facts, the identity is attacked. It feels powerless and unable to control his path of destiny. The last possibility a human has is to adjust the imagination. He has to realize that the possibilities he imagined were just illusions.

If everything stays the same, people get bored. They hope that an event will occur that relates to their wishes. People are the most satisfied if their environment produces just enough change (a challenge) they can cope with. They want a balance between the will (what they want, the imagination, variation) and their capabilities (what they are able to do, predictability, the patterns, their skills).

In a perfect demand oriented economy, a supplier has to provide a challenge to the customer. To provide this challenge the supplier has to understand the wishes and the fears (the imagination) of the customer, his behavior (the patterns) and the balance between the two parts. If the customer is out of balance the supplier has to help the customer to acquire new patterns (learning), help him to make a choice (advice) or show him the real opportunities (scenario's) taking care of the customers identity.

It is very difficult for a supplier to get accurate information. Most people are unable to make their behavioral patterns conscious. When people are asked about their opinion (an aspect of the emotions), they often do not want to offend the other and give proper answers. People only want to share their most secret wishes with people they trust (partner, family, friends). Correct information about the customer can only be acquired by carefully observing and analyzing the activities of the customer (what he is doing). It is completely impossible for a company to observe the activities of all their customers. The only one who can do this is the customer himself.

Customers can observe their activities if they were able to gather personal activity-patterns, get the opportunity to analyze their behavior, and share their activity-patterns with others to get an advice. Most of the needed data is somewhere already available (patient records, buying behavior, payments etc) or can be made available by making connections to the tools the consumer is using in his personal- and work-environment (Emails, Content). The only thing that has to happen is that companies and government agencies make these patterns, which are most of the time privately owned by the customer, available.

It can be envisioned that in the far future all personal data is kept in a private space. Only the customer (the owner) can make the data available to others. This approach would prevent many problems in the current situation (e.g. spam). The last step in a perfect rational demand oriented system is reached when the personal activity-patterns are

automatically transformed in standardized need-messages that are sent out to appropriate providers. It will be clear that the full realization of this concept will take a very long time.

Smart Customer Networks make it possible to use the group and not the individual as the level of communication and interaction. An open dialogue in a group gives the individual the opportunity to look in the mirror of the other and make his challenges more conscious. Others are able to observe every aspect of a person. Shared challenges give a group a common goal.

6. Specialized Cooperating Human Networks

6.1. Introduction

People have to cooperate to survive. Children need their parents to nurture and teach them. Parents need the help of their children when they are old. The basic principle behind cooperation is long-term reciprocity. People give something voluntary and sometimes for free to others or help the other trusting they get something of the same value back in the future. To survive people have to have a long-term perspective. They have to sustain their environment and the supporting infrastructures to make sure that there are enough people and tools to help them when they are old.

The need to survive created the basic level concept of cooperation (the tribe). The tribe transformed into higher and more complex levels of cooperation (town, guild, state, corporation) when human society evolved.

To coordinate the complex structures the mental concept of the many leveled hierarchy was formed. This concept fails when the environment of the organizational structure becomes turbulent. Hierarchies adapt too slowly to their environment. At this moment, hierarchies are falling apart in cooperating self-sustaining specialized network. The networks are gaining control over many activities that are now taking place at the level of the big corporation and the state.

This chapter contains a description of the basic roles in a specialized network. It describes the way networks can be connected and formulates the ways the members in the network have to cooperate to sustain the network.

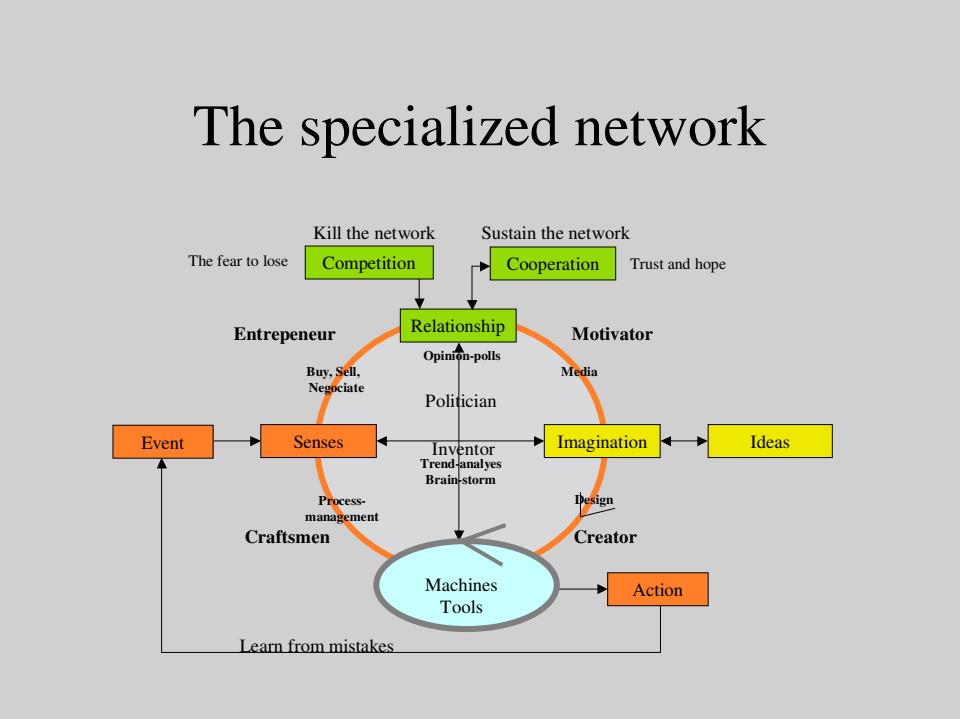
6.2. The Basic Roles in a Network

A specialized network produces activities and products that are consumed by other specialized networks. To realize the output people have to play complementary roles. The basic roles can be constructed by a combination of two of the components in the human mental space described in Chapter 5.

When we use the four components of the mental space, we can distinguish six basic roles:

- **Craftsmen (Senses, Patterns)**
  A craftsman has acquired experience by practicing. Craftsmen do not like too much change. Change requires new practicing and keeps him from producing. A craftsman loves to make what he sees. He learns by copying. Examples are carpenters, painters, musicians, technicians and programmers. The craftsmen are the producers in the network. In many cases, programmable machines can replace their activities. Craftsmen use specialized tools. If their processes are standardized a process-model can be used to coordinated their activities.

- **Entrepreneur (Senses, Emotions)**
  An entrepreneur feels what preferences people have. Examples are retailers and brokers. Entrepreneurs sell the products the network is producing and buy products the network needs. They also are the people that negotiate contracts and make connections to other specialized networks. Entrepreneurs use technologies like relationship-management-tools and procurement-systems.



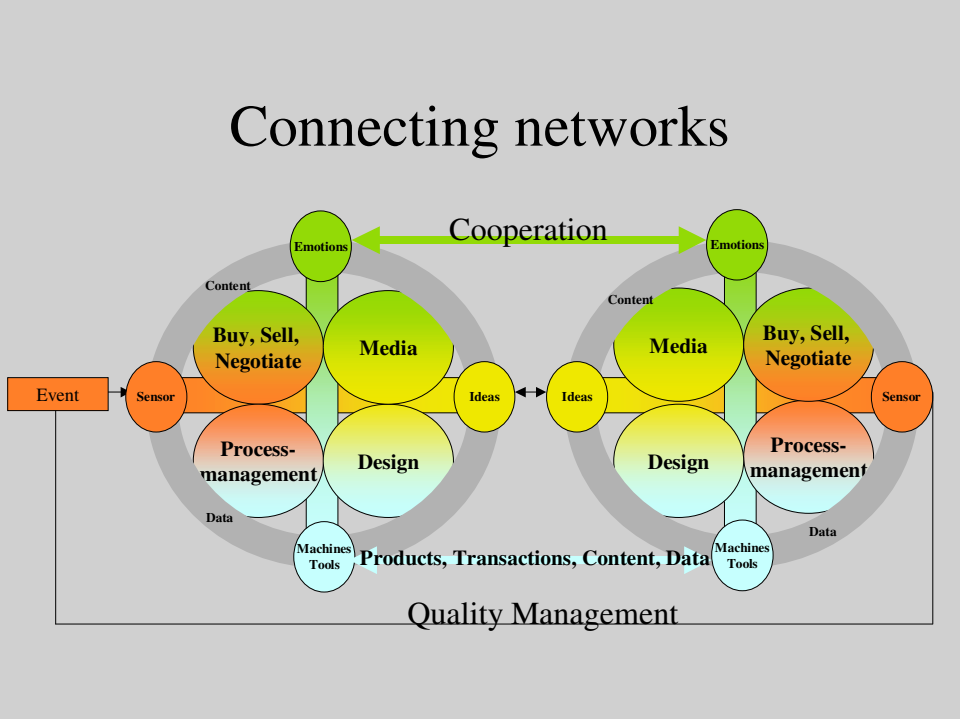
- **Politicians (Emotions, Patterns)**
  A politician structures collective emotions by creating consensus. He feels the opinions of the collective, has the gift to influence opinions, and gets people into collaborative action. A politician looks after the social cohesion in the network. He uses opinion polls and media.

- **Creators (Imagination, Patterns)**
  A creator visualizes the whole of a structure. A creator can balance variety (his imagination) and predictability (the patterns). Examples are composers, architects and designers. A creator designs the machines and the products the network is producing.

- **Motivator (Emotions, Imagination)**
  A motivator visualizes what makes people move forward. Motivators develop concepts. Many of them operate in the media (actors, writers, poets and movie-directors). Motivators cannot live without variety. Other examples are coaches and psychiatrist. A motivator looks after the long-term perspective of the network by creating and implementing a shared vision.

- **Inventors (Senses, Imagination)**
  An inventor makes sense of his imagination. Inventors generate ideas and create prototypes (R&D). They use brainstorming tools and analyze trends.

The roles are not evenly distributed in the network. The majority of the people play the role of the producer, the craftsman. In the current situation, the basic roles are concentrated in specialized corporations (e.g. media, retail, production-plants) or staff-department of big corporations. Many high talented people are already leaving the big corporations and take part of specialized networks. The amount of one-person-companies is increasing.



6.3. Cooperation

People can cooperate with persons that share with them one of their basic cognitive components. An entrepreneur can convince a craftsman what products people he has to sell. They are both practical people (the senses). A creator (e.g. an architect) can show a craftsman what to make. They share a focus on structure (patterns). When complementary roles are working in a cooperative environment, they join their forces in an open dialogue. This dialogue has many stages ranging from brainstorming (inventors take the lead) to realizing material structures (craftsman work together with creators).

Politicians, entrepreneurs and motivators can only perform if they are able to observe and express emotions (visual expressions, gestures). To ensure a successful cooperation they have to meet. New technologies like video-conferencing make it possible to cooperate anytime, any-place and anywhere.

6.4. Innovation, Sharing Ideas

To collaborate people have to communicate face to face. In a competition patents (legal actions) and secrecy (rules and walls) shield ideas to prevent the competitor to take the lead. In cooperation, ideas are shared to sustain the network.

The most used model in communication is the sender/receiver-model. People send and receive content (e.g. email, documents, pictures, plans, designs) Specialized networks need advanced content-management systems to support this model of communication.

The sender/receiver-model supposes that the brain converts ideas directly into words and that another person can easily draw out the meaning of the ideas from the words. It assumes little effort to understand or interpret what is being conveyed. The sender/receiver-model only works if there is a high level of common conceptual understanding (a shared model) between all the people involved in the communication process. In reality, this is mostly not the case especially when experts (inventors, craftsman and creators) are communicating with laymen (entrepreneurs, motivators and politicians). The dialogue between an expert and a layman is often a monologue. The expert confuses the layman with all his knowledge and the layman is not capable of asking the right questions. In the end, the layman stops asking questions and accepts the situation.

The sender/receiver-model reduces a specialized network to a production-process. The model lowers the social cohesion (politicians), reduces the external cooperation (entrepreneurs) and removes the long-term perspective of the network (motivators).

People have to invest time to understand (ask unsophisticated questions) and explain their ideas (inventions) in many ways. It also takes time to generate trust. Ideas of others have to be tried out (in the imagination or in the real world) to understand them. People have to have the opportunity to fail and learn from their mistakes. Sometimes they generate personal inventions that can be given back to the others to create reciprocity. Eventually ideas create new personal patterns that can be shown and praised by others. Collaboration does not take place instantly but evolves in a cycle where the pleasure of finding things out is the motivator.

6.5. Connecting Patterns

Specialized networks can connect their production- and design-process by exchanging content, products, data-structures and transactions using the Internet.

6.6. Quality Management

Specialized networks can share experience and improve their behavior.

6.7. Competition

When people are pessimistic and afraid the other becomes the enemy. They shield themselves from the outside world by creating fixed boundaries (walls). To make sure that they get something in return they use a threat (e.g. physical force, the legal system).

Before they start, they have to spend time to prevent a possible conflict (making contracts, detailed specifications). When people trust each other, they cannot wait to start.

The fear of losing something (possessions, status, existence) changes a collaborative relationship into a battle. In a competition, the focus is on winning and selfishness. Fear has a negative impact on the senses (tunnel view), the emotions (stress) and the imagination (creativity block). In a competition, priority is given to stay in front and to prohibited possible actions of the enemies. To win one has to predict and control by defining strict rules and make sure that people obey the rules. Internal and external competition finally kills a cooperative relationship. To prevent the move from cooperation to competition people have to sustain a free and open communicate-process.

7. Human Scale Technology

7.1. Introduction

Humans are the most advanced toolmakers in nature. The main reason is that they are the less specialized organisms. They need tools to survive. People are also the most complex organisms in nature. This complexity makes it possible to invent new possibilities and to work with specialized tools and animals (horse, cow, hammer, car, computer).

All the time people have tried to make a better living by inventing new tools. If the basic needs were met (food, housing, health, safety), people got the time to get their emotional system into balance (love, self-esteem) and satisfy their imagination (play, explore, self-actualization).

At this moment, the amount of leisure-time to enjoy family life, relax, play and explore is going down. The number of people with heavy levels of stress is growing. The pressure on the emotions is increased by the current state of technology. The tools have overlapping functionality, take too much of the attention, do not communicate with each other and dominate the human being.

Tools have to be integrated completely in the cognitive system of the human being. If a tool takes over a part of the sensory-motor system (glasses, hammer, car) the imagination has to learn a new way to create the outside world. In the end, after practicing, people become united with their hammer or their car. They are not aware that they are carrying their glasses. If people have to practice too long or the tool is constantly intervening in their workflow the emotions get involved. They get frustrated and angry.

7.2. The Basic Human Tools

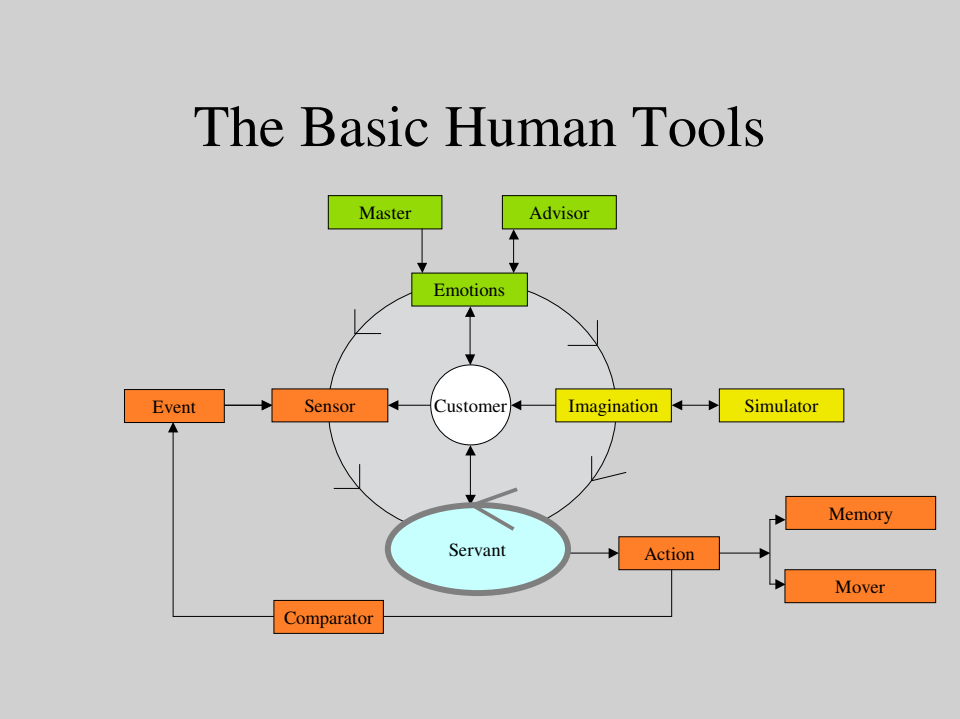
When we use cognitive model of chapter 5, we can distinguish the basic human tools. In this document, they are called mover, memory, sensor, comparator, advisor and simulator. The tools were first invented to support basic human activities like talking, moving, looking and hearing, remembering and learning. In a later stage of development, the use of the tools generated a new space of exploration. In this space, new tools emerged. The invention of symbols started the exploration of Mental Space. Program Languages, Telecommunication and especially the Internet has opened up a new space to explore, called Cyberspace.

- **Advisor or Master**

Advisors and masters involve the emotions. An advisor helps to make a choice or to set priorities. A master (e.g. a physician, teacher, manager) makes a choice for a person. The Cyberspace version of the master and the advisor is the Expert System. It uses advanced ways of pattern-recognition (e.g. Neural Networks).

- **Simulator**

Simulators stimulate the imagination. Theaters and movies are examples of passive simulators. Games are actively involving many people. The Cyberspace version of the active simulator is the Collaborative Computer Game. The passive form can be seen in the Movie and the Television-program.



- **Memory**

A memory archives the results of an internal or external dialogue. In the beginning, human communication was only verbal. Important issues to remember were incorporated in stories that were told from one generation to the other. When people specialized their activities, they needed a method (bookkeeping) to keep track of all the transfers. People invented symbols and the external memory to do this. The writing-symbols made it possible to share and exchange memories (letters, books) without talking. Writing enabled the movement of memories. The library was invented to store the external memories and protect them from fading away. Cyberspace is filled with the versions of static and moving memory called the Electronic Message (Email, Transaction) and the Database.

- **Mover**

Movers were the first tools used in human society. A mover is an extension of the muscles. The first generation was invented to help the human move in physical space. Examples are hammers, cows, horses, steam-machines, cars, bicycles and robots. The next generation supported the movement of symbols (e.g. moving numbers) in mental

space. The Difference Engine of Charles Babbage was invented to automate the calculation of mathematical tables. The most advance version of the mover, the telecommunication network, enables the movement of external memory's in cyberspace.

- **Sensor**

Sensors transform and filter data. Glasses and hearing aids were invented to support people when they get old. Humans looked at the stars and invented the telescope. In a later stage very advanced sensors were developed (Radio-telescope, MRI). They use complex statistical calculations to filter and transform the sampled data into pictures or sounds.

- **Comparator**

Human survival and learning is based on comparing data and acting on the result. A comparator acts on an exception. To compare data a measurement instrument is needed and a agreement about the object of measure.

Human beings started to measure time and space a long time ago. It was needed to navigate and to predict the movement of the stars. In the first phase, the human body was used as a measure-instrument of space and the cycle of the sun and the moon as a measurement for time. The big problem with this approach was that every person and every place on earth came up with a different measurement and a different time. When the human networks started to connect, standardization on a global level became necessary. The process of standardization of time and space took many ages. It needed numerous inventions in technology to support the process. The measure-instruments changed from mechanical devices (the clock) to software-devices.

7.3. The Invisible Servant

A servant coordinates the activities of sensors, comparators and movers. Servants take over repetitive patterns. Humans find these activities boring (not imaginative). A servant has to act invisible (a black box). When the use of a servant is prohibited, humans get frustrated. It has to be there all the time and do its job inconspicuous. With the help of the comparator and the sensor, the servant has to detect events and take appropriate action (coordinated movements, action patterns).

The big problem at this moment is the visibility and the interference of the servant in the human activity. People have to fill in the same form all the time. Processes stop in the middle of a company. The customer has to handover the data to the other processes.

Humans do not like to be emotional involved in boring activities. Therefore, the needs (their wishes) have to be defined in a very simple way. It must be possible to imagine the behavior of the complete system without knowing how the system is operating.

A good example of a perfect servant is the central heating system. People define their needs (a temperature) and everything works. The temperature is a control variable that represents the performance of the total heating system. People are able to imagine the effect of adjusting the thermostat (a comparator) on the environment they live in. They do

not need to know how the servant works. His behavior is hidden. The central heating system is a black box, loosely coupled with another invisible servant-system, the utility-system (gas, electricity).

7.4. From the General-Purpose Computer to the Appliance

The servant and its associates were in the first era of IT locked into the physical space of the general-purpose computer. They had to stay close together because of the speed of communication. The speed and the capacity of the telecommunication network is going up fast. This makes it possible to specialize and connect computers (called Appliances). In the next chapter we will show how all the parts of the basic human tools will work together in the new exploration space, Cyberspace.

8. The Collaboration System

8.1. Introduction

Collaboration of humans takes part at the level of the network. Participants create a network, share a common goal, exchange ideas, communicate intensively, specialize and create stable patterns of behavior. The specialization of the network takes place at the level of the creators and the craftsmen. They design and produce unique products.

The repetitive patterns of the craftsmen are automated and are transformed into invisible servants. The servants work together and exchange data. If the networks and the participants are not located on one physical place, they have to communicate using the Internet.

A network is uniquely determined by its human-and technology patterns. These patterns act as an imaginary boundary. They shield the network from changes in the environment. New participants have to learn to handle the machines, the tools and the internal procedures. The have to accustom themselves to the patterns to survive in the network.

The internal patterns (the behavior) of the human participants in a network change. They learn new behavior by cooperating with other people outside the network. If the technology of the network is not adaptable, the most innovative participants get bored. They need a new challenge, leave the network and move forwards to another network. When the technology is not adapted, the networks dies and the most conservative participants (mostly the craftsmen) are suddenly out of work. To keep the network alive the technology has to adapt itself to the learning process of the participants in the network.

This chapter contains an abstract general IT-technology framework that supports connected specialized human networks working in cyberspace.

8.2. Systems, Sensors, Servants and Appliances

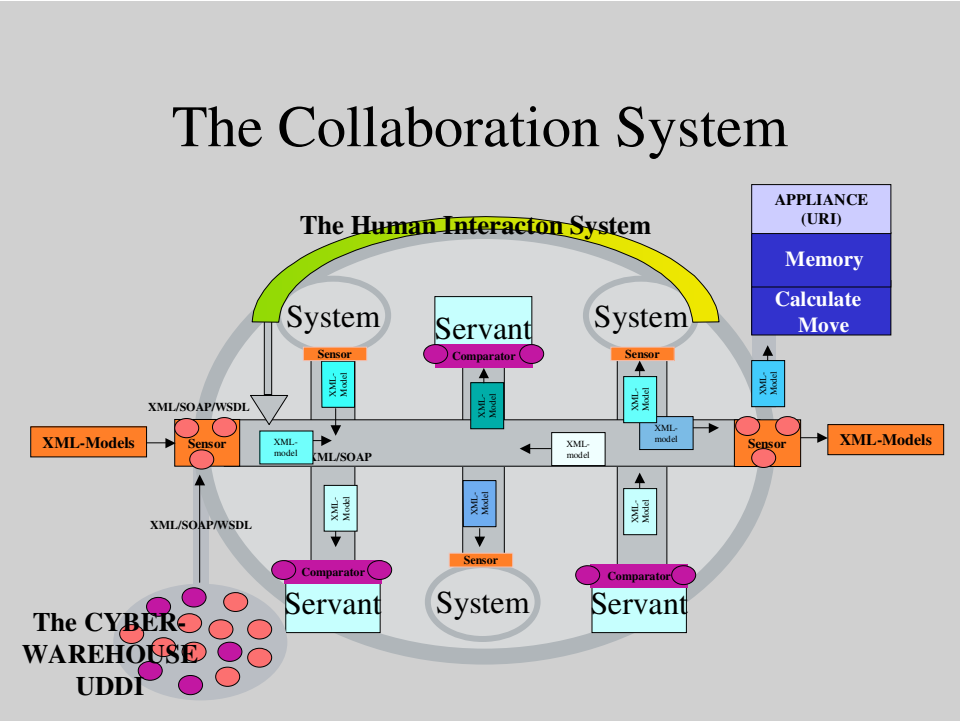
A system (a context, an ecology, a network, a collaboration system, a software-package, a legacy-system, a back-end, a client) is anything with a boundary. A system contains sub-systems and servants.

When the system is a software-system, it needs an appliance (a specialized computer resource identified by an URI) to perform its activities. The appliance uses an operating system (now called a virtual machine) to calculate and to move objects internally and externally. It uses an internal and external memory (a database) to store its objects.

The activities of a system can be distributed over the Internet. Sub-systems can make use of other appliances to work with. The appliances can be localized by their URI. The

objects that are needed to coordinate the activities of the appliances flow over the Internet from one appliance to another.

The boundary (A Sensor, an Interface) protects and sustains the identity of the system. It shields the system from unwanted intruders (filtering) and transforms input it wants to handle into an appropriate internal format.



A sensor can act in physical space (a wall, a door, eyes, ears), in mental space (a model) and in cyberspace (a program). A sensor mirrors the patterns of the servants and the sub-systems in the system. A sensor connects external data that flows through the system with the internal patterns of the servant. Such a connection is called an Application Program Interface (API). API's are defined with the XML/SOAP/WSDL-standard. The sensor has the same functionality inside out. It blocks output and transforms output into a format that the outside cyber-world can handle. Messages are send out to other systems.

A system consists of a dynamic assembly of many parts and relations. To manage the complexity of such a system the parts and their relations have to be bundled in independent servants (Services, Application Programs) that communicate with each other.

In a well-defined system, it must be possible to remove and replace a servant without destroying the complete system. On the contrary, it must be impossible to divide a servant into different parts without destroying the component. A servant has to be invisible, rigid (undividable) and highly predictable.

8.3. Designing for Change

The environment of a system generates major and minor changes. Changes (events) take the form of structured data-objects, unstructured objects (e.g. documents) and assignments (e.g. change A to B). To realize a stable system, the system has to be designed to process the majority of the changes by its servants. To accomplish this the famous 80-20 rule has to be applied (20% of the exceptions take 80% of the code). The exceptions are handled by comparators. Comparators make it possible for the system to be adaptive.

An adaptive system has to contain just enough servants and comparators to articulate the expected behavior. When a system contains not enough comparators, his behavior is rigid. A legacy-system is an example. When a system contains too much comparators its behavior is too flexible. The system has grown out of its essential functionality. Vendors create over-articulated systems when they add new functionality without a real need of their customers.

It is merely impossible to design a well-articulated system in one step. Well-articulated systems have a long history of internal transformation. The transformation process has to have no effect on the environment of the system.

8.4. The Communication System

The servants have to communicate freely within the boundaries of the system. This is done by exchanging specialized data-structures (based on XML/SOAP-messages). When the messages pass their boundary, they have to travel to the appropriate system. The servants must be able to recognize the messages. This is accomplished by incorporating a matching instrument in the servant.

8.5. Reusing Sensors and Comparators, The Cyber Warehouse

The sensors and comparators are shared by other systems. They are stored in a specialized Cyber-Warehouse (based on the UDDI-standard). The systems are filed with the sensors and comparators they need when their appliances are activated.

8.6. Incorporating Legacy Systems

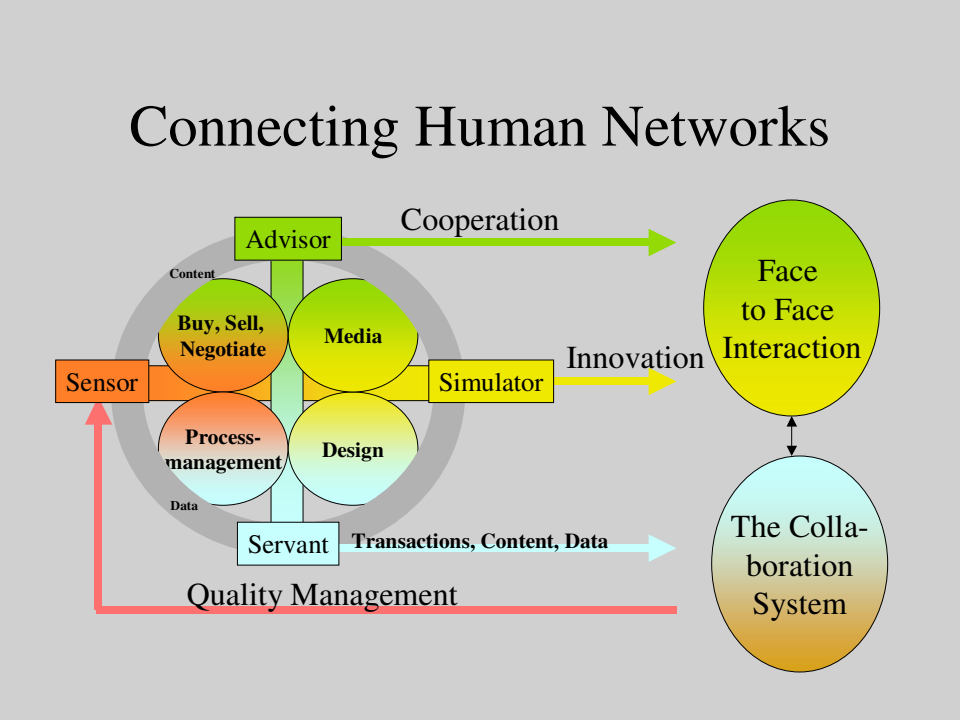
Most of the servants that have been developed are not well-articulated. In these legacy-systems, the data is fragmented. It travels around in the system in an obscure way. The system contains many entrances (Interfaces). Some of the interfaces give an entrance to a highway. Other interfaces lead to loops or dead-ends. It will be very difficult to connect such a system to the collaborative infrastructure.

To connect a legacy-system it has to be divided into sub-systems, servants and comparators. After this is done the sub-systems, have to be enclosed (wrapped) by a boundary that is capable of transforming the external events in appropriate messages. It will be easier to connect modern systems (e.g. packages like SAP). Most of them already have well-defined interfaces.

8.7. The Collaboration System

The collaboration system emerges out of the behavior of the sub-systems and the servants connected by the communication-system. The collaboration-system acts on changes (events, signals) outside its environment. When a change enters the collaboration system, the communication system propagates the changes to the appropriate sub-systems or servants. The servants do their job. They combine the inputs they receive and produce output they send out to the system. Human beings can observe the behavior of the collaborative system using the Human Interaction Level.

8.8. Supporting Specialized Human Networks



The specialized human networks can be connected by incorporating their Process-Managers, their Commercial Systems (Buy, Sell) and their Quality-Management Systems into the Collaboration System.

Cooperation and Innovation needs Face-to-Face-Interaction. The results of the Interaction (Content) can be handled by the Collaboration System. When the messages have to reach the Human Interaction Level (now called a Client), they have to be transformed and incorporated in the appropriate tools (e.g. the Advisor, the Simulator).