Semantic Software Technologies

WHITE PAPER

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TRANSINSIGHT®

Executive Summary – Understanding 100 Million Documents

Since the invention of written script, humans have been able to store knowledge. For more than 5000 years mankind's knowledge has continued to be amassed at an infinite rate. But in more recent times, the concentration of information has increased to such an extent that the human brain is continuously saturated. The enormous amount of data available today makes one thing necessary: a new paradigm for computers to gather as much information as possible from data. This is essential for acquiring the relevant information needed to make ground breaking new advances.

Working people across all sectors of the economy search at least two hours a day for information in company databases, on the Internet or on their own computers, emails, documents and tables. Transinsight has developed a tool that is capable of cutting down this time from hours to just a few minutes. Our new semantic technology guarantees that the answers you are searching for will be found, and found completely.

This sounds like an incredible promise. The Enterprise Semantic Intelligence® (ESI) platform of Transinsight operates according to principles which go far beyond common search strategies. ESI combines knowledge-based semantic technologies with exceptionally intuitive navigation. Semantic ranking procedures offer new interactive possibilities to look at complex and networked information from a completely different perspective. This allows us to gather insights which could not be detected using conventional methods. ESI has the ability which only humans have possessed for ages, namely recognising a semantic interrelationship.

Our company has been developing this method for the last ten years. Our model of emulation is based on biology, because living organisms are the prime examples of the highest complexity and networking. Renowned international enterprises use our products for their semantic searches to work more creatively and efficiently than their competitors. Among them are BASF, Unilever, RWE and Statoil.

This *White Paper* shows how the dissemination of information has developed over time and how it will do so in the future. It will show how our intelligent semantic technologies help companies manage their tasks to work more creatively to develop better products faster. We are confident that the increase of efficiency will attract more customers and help you better understand your customers needs.

The Vision – Intelligent Software Made in Germany

Despite the many incredible advances of the 21st century, we continue to be faced with enormous challenges in so many areas. Problems in the fields of environment, health, food and energy would be more easily solved if we had solutions for one fundamental challenge: Humans must be able to communicate with each other at all levels without hindrance. We must be able to transform individual knowledge into shared knowledge. Like the Latin expressions *communicare* or *communis,* we must be able to simply share and communicate together.

Today's methods of computer technology are insufficient to prevent the individual from being continuously overwhelmed by the enormous amount of information available. To illustrate the amount of data we are talking about here let us consider this interesting intellectual game. According to a study done by the US market research group and consulting company IDC,

the amount of information collected by the human brain in 2010 was roughly equivalent to one zettabyte. This is equivalent to a billion hard disks with one terabyte of storage. Placed in a continuous row they would encircle the globe twice. In 2020, the IDC predicts the volume of data to increase to roughly 35 zettabytes. This converted into one terabyte hard discs would result in a row of hard disks which is ten times the distance between the earth and the moon.

A core task of informatics research in the coming years will be to derive meaningful informational interrelationships from this sea of data. In February 2011, during the popular US TV quiz show *Jeopardy*, IBM's Watson was introduced with two gigabytes of stored data to respond to the shows questions. The average person could hardly retain this amount of information. Thus, using simple statistical methods, Watson's designers and programmers showed us which way the development is heading and which direction we should be going.

Transinsight's software solutions for knowledge-based informational analysis extend statistical methods using semantics and they significantly simplify how we work with computers. They were developed in an area which belongs to the most complex one in the science molecular biology. The highly networked communication structures and gigantic amounts of data in biological systems encouraged us to develop highly efficient algorithms and solutions. Using these, we will take on the challenges of intelligent information processing for the future – starting today.

The Problem – The Brain not Designed for the Knowledge of the World

Transferring knowledge by language and storing knowledge through writing humans have attained a unique position in nature. Although animals, too, have certain possibilities for reasonable communication, only humans have developed systems which allow for formulation of thought processes and sharing of these thought processes with others.

Using words and symbols, humans have developed an invention that is at least as revolutionary as the invention of the wheel or the control of fire, namely the fact that knowledge can be stored. Alphabets and writing, printing, newspapers, telephone, radio, television and the Internet dramatically revolutionised the dissemination of knowledge several times over. This highly efficient form of transferring information has become the intellectual-cultural and economic basis for mankind.

It is worthwhile to think about certain facts from time to time to help us get the complete picture. One important fact is that we live in a world where most information is available electronically. This implies that the duplication and circulation of information is almost effortless. But it also implies that the possibility of automatic analysis of information using computers is significantly easier.

Nonetheless, there is one problem. The flood of new information grows exponentially each day. This applies to individuals as well as to companies and organisations.

There is yet a bigger problem – in the course of evolution, the human brain has not developed the skills it needs to process huge amounts of information. The human brain is geared to allow us an orientation in a three-dimensional world. It enables us to talk with a manageable number of other humans and to listen to them. It allows us to read texts.

But this is not nearly enough for an orientation in a world filled with digitally saved information. Therefore, technical tools must first make it possible for humans to deal with data and information.

Understanding information – to link data and recognise patterns

Computers should help us find answers quickly. A computer system should work like a smart wizard. The wizard should know where the required information is located. He also knows whether information is relevant in context to the question. He knows what to do and in what order to answer questions and solve problems.

Operating systems that we know today - *Windows, Linux, iOS, Android* or *MacOS* are based on technologies originating in the 1960s. Their basic architecture and even the philosophy of organizing documents remain the same today. Data systems are recreated based on the logic of the paper world. A filing cabinet can be compared with a hard disc. The user creates a more or less useful system of order. Electronic documents, in the form of files, are saved in folders just like in the world of paper.

This logic became obvious a few decades ago when we attempted to recreate the physical world on computers via the virtual desktop. Computers were expected to facilitate work for the users back when computers were awkward calculating machines. The concept of a virtual desktop, which emerged at the beginning of the 1980s, brought the desk surface to the screen and was modelled on real objects. Still today, the user can playfully create virtual folders with a few clicks of the mouse and sort documents into the folders.

The physical world as an advisor – an intermediate step

There is no doubt that it was brilliant to imitate office reality in order to simplify working with computers, but there is a big catch here. All of the fundamental problems we faced in the traditional office world were also now imposed on the computer as well.

In itself, a filing cabinet offers no help to the user for structuring a convenient filing system. It also offers no support regarding where and in which folder documents should be filed so that they may be found again quickly. This three-dimensional office world follows a principle that hasn't changed since the time of medieval libraries. Even then, only the clever librarian could find, order, and form complete registries. Therefore, the system of organization is only as good as the person behind it.

Just like a wooden filing cabinet with manila folders, today's computers are passive vehicles for storing documents, emails, tables, photos and drawings. It is not a coincidence that folders, such as those in Windows Explorer, look like cardboard folders. But this leads to a considerable problem. With computers also, the intelligence behind the management of data lies almost entirely with the user. The computer itself offers no help in structuring its contents and information.

There is yet another problem. A paper document usually exists as a single copy in the traditional office world. Therefore, the question always arises where exactly, for instance, should a letter be filed most sensibly? If an insurance invoice arrives, according to what criterion should I file it? Under "Insurance" or "Invoices"? According to "Due Date" or "Vendor's Name"?

To aggravate the problem further, the larger a document is the greater the problem when it comes to filing it. The annual report of a listed company

can certainly be filed into the category “Financial Reports”. And yet the extensive content of the report is not accounted for. Included are names of competitors, partners, personnel, sales figures, data and products etc. All this information should also be possible criteria under which to file the report as well.

Now, one may argue that these documents can be copied as many times as categories exist to file them in. In the case of extensive printed documents, however, this method is inconceivable for one reason alone – simply too much paper and therefore office space would need to be utilised.

Another problem – an administrative assistant may be well-versed with his or her own filing system but its organisation and its table of contents are stored in the assistant’s head. Others have no idea what the assistant had in mind when the system was created. What happens if the assistant becomes unavailable and another person – not familiar with the system – takes over the data management?

This problem is twofold. What about incoming documents and documents that have been removed, even if temporarily. No records have been maintained but when the assistant returns, how do they know where new documents were filled and which documents were removed? It’s no wonder that many companies grapple with this problem. Even sophisticated ISO-certified filing systems and rigorous company regulations are unable to conclusively solve this problem.

An index of the content – a good step towards structuring

There is often a rough ordering structure in the traditional office world. Extensive texts are normally created by their authors according to a certain organizational method. Filing systems also have a general ordering pattern and yet, an indexed list of contents for filing systems does not exist in practice. At this juncture, one of the strong points of the computer becomes evident: within it a keyword search index can easily be constructed automatically. This has become an established procedure used by today’s search engines. But one thing must be absolutely clear; a classic index–like those found in printed books–represents only an alphabetical list of words or word groups in a document. All that can be obtained from this list is where a word has been mentioned in the document and nothing more.

So, this is the first step to create a keyword index that goes beyond the paper world. People who do so, however, still face certain limitations. The traditional index represents a list of keywords for *one* document. The computer however creates an index referring to several different documents all at once. Thus, this limitation can be better managed by computers.

But an index search has more limitations. The user must not only know exactly what they are looking for, they must use the same vocabulary used in the index. For instance, if a synonym is used which is not directly mentioned in the text and, hence, does not occur in the index, the search will be unsuccessful. Anyone looking for “opening hours noon” will not find information also pertaining to “opening hours midday” so therefore, we need an index capable of recognizing synonyms.

The index search is prone to yet another limitation. Related concepts that are relevant only in context will not be correlated in the search. Let us assume the user enters the search “heart disease” but he does not know that a document on “infarction” exists. If the words “heart disease” are not included within this document, the user will not find them even if pertinent to the topic. We need, then, an index that also takes the context into consid-

eration. Finally, we arrive at an index that reflects the semantic environment of a concept.
But problems may occur in the opposite direction as well–such as when a concept is reproduced by an ambiguous term. Anyone searching for information pertaining to the animal species “jaguar” will soon realize that search results will also offer extensive information about the vehicle make by the same name. This occurs because the index does not know which documents make sense given the context of the query. Here too, the index can only display what is included in the text. Ideally, we need an intelligent index which can differentiate words with similar spelling, homonyms, from each other within the context of the search.

In other words, we need an index which *understands* the search. This can be achieved when the index links the search to the relevant topic to find information which is not included in the text as a search word. The index should be able to record any changes *or* movement of documents in real-time. It should improve through a process of self-learning.

A system comprising this intelligent index as a basis of knowledge may also better comprehend the documents and information contained in them. It could provide more focused answers to the user’s questions since this system uses interrelationships that exist between documents and the question. It also uses interrelationships between the individual units of information and the level of meanings – which is the semantic level. Now, the question arises: where does such an intelligent index come from? Where does this highly expanded networked table of contents of knowledge come from?

The semantic index – ontologies structure contents

For decades, experts in many fields have strived to create “networked intelligent indices”. The first areas to do so were biology and medicine. One reason for this is that biological systems can be described hierarchically. At the same time, they are highly networked. Such indices are known as semantic networks of concepts or ontologies.

Transinsight’s semantic systems use ontology to classify a text in a variety of ways. Words or word groups of the text are intelligently linked to the concepts of the ontology. Also humans – and probably many other creatures – link new experiences to knowledge already known. In this way, new facts are tested and, if necessary, filed into the system of experiences and knowledge. Thus, they are available for processing new information and future thought processes. This is what we call learning. Learning processes can also be introduced into the virtual world. Any new document, which is filed by a system, should expand or correct the ontology of this system as automatically as possible. Thus, the system becomes more intelligent day by day.

The aim is as simple as it is ambitious. It is all about getting answers from a computer system, even to complex questions, which humans ask each other every day. Questions like: “w*hich documents between 2009 and 2011 belong to the customer Phantasy AG and are within the context of the problem we had with the component’s special wheel and led to an agreement”*? Or, “*which employee has the necessary know-how for this order and is available?”* Or, “*which of Joe Blogg’s emails contains the link to a website about the A380?”* This is how you would talk to a colleague or a friend. This kind of communication, however, is not yet possible with a computer.

Or is it?

Semantic Technologies – Computers become intelligent

The key to the new paradigm is semantics – which the dictionary defines as "the study of the meaning of characters and their relation to each other". Semantics is the tool which allows software to understand contents beyond keywords. This *understanding* is the prerequisite for people to be able to communicate more and more with a computer in a manner which is only possible between people. Therefore, a decisive step is necessary here. The semantic knowledge networks of concepts, the so-called ontologies, must be used as background knowledge in such a way that they work like a "virtual brain". Anyone arranging the contents according to a static filing system would invariably fall short.

Transinsight's technologies enable a computer to record meanings automatically and to analyse them in the next step. This makes a quick and complete search of all possible answers.

The ontology – the brain of semantic technologies

The use of structured background knowledge in the form of knowledge networks and ontologies is therefore the step into the next generation of computer systems. Ontologies allow us to structure documents, texts and information according to their content. They expand the system beyond the mere filing of documents in traditional locations. In doing so, ontology maps all concepts and contexts which are important to the user – or could possibly be in future. This gives rise to some important questions:

Where do such ontologies come from?
How large or broad-based do ontologies have to be in order to fulfil the needs of a customer?
Could various ontologies overlap?
Shouldn't there be a "world ontology" which maps all known knowledge and then made available to everyone – at least in parts?
How can one keep an ontology up-to-date and consistent?
Can ontologies developed on parallel lines be brought together?
How can one handle the several different languages?
How are access rights to the ontology handled?

Not all of these questions can be answered fully in one go. But there are answers, which are absolutely sufficient for practical use, to several of these questions. It is apparent that the creation of an ontology for a certain field or a certain company is first of all an investment. This investment, however, is manageable and pays off quickly – it is recovered within just a few months.

In addition, no individual must work into an empty space. Even today, there are hundreds, if not thousands, of specific ontologies available and generally for free. This means that a certain basic framework can almost always be used to build on. MeSH (Medical Subject Headings) and GO (Gene Ontology) are examples from within the biological domain. But other ontology's from fields such as education, finance, aviation, tax law and many more are available—also without cost and of good quality.

If no groundwork has been done in a particular field, this problem can be solved quite easily. Our software for creating ontologies semi-automatically is well-engineered. Thus, the creation of a specific ontology has become much simpler than a few years ago. Transinsight is the leader in the field of semi-automatic ontology generation. Our tools have been used to create a multitude of special ontologies. In this, Transinsight's system offers a major

advantage: It allows team work on an ontology following the Wikipedia model.

There is one aspect here that should not be underestimated. Experience has shown us that employees find it particularly motivating when they can participate in shaping the “brain of the system”. Here, different rights can be assigned so that it is possible to give its editors finely-tuned access rights.

The annotators – intelligent networking of information

One core task is the linking of texts with the respective ontology. For this purpose, Transinsight’s intelligent annotators are used. They sift through texts for relevant concepts and associate them – semantically correctly – with those of the ontology. Blurs, which inevitably occur in scanned documents using OCR (optical character recognition) or due to typing errors, are recognised with the highest possible accuracy. Therefore, we use an algorithm borrowed from biology for comparing the DNA strands. The result is maximum precision (F-measure 98%).

When it comes to properly resolving ambiguous concepts (e.g. “jaguar”, see above) our solutions clearly outperform human intelligence. A highly specialised classifier, the *maximum entropy classifier*, can be trained to identify any concept included in the ontology. Afterwards, it can decide independently with which concept a word or word group must be associated (F-measure 85%).

In order to achieve such a precise annotation, the respective context and relevant metadata are taken into account. The annotator will inform the system if a concept that is very distantly unknown appears in the (new) text. Then, the system tries to semi-automatically fit the new concept into the already existing ontology in a logical and semantically correct manner. In this regard, we follow a principle, which also applies to ontology generation as well as ontology upgrading. The expert can make the final decision whether to implement a suggestion in the productive system or not.

The annotator here uses different methods – *NLP (natural language processing*) combined with highly optimised statistical analyses in addition to using methods of reasoning. Furthermore, methods are used to automatically make a statement based on the probability of whether a word or word group is ambiguous or not.

Using these methods, Transinsight’s software achieves an accuracy of 90% or higher in automatic annotation. This makes our software clearly better than a human expert who, depending on the topic, can only achieve between 50% and 85% accuracy.

The search engine – transparency in complex data

How is the knowledge contained in an ontology used? A semantic search engine does this: Using the annotators described above, it creates links between the query, the ontology and the search results.

To ensure that the user really benefits from the advantages of this semantic technology, we must overcome one obstacle. The user needs an intuitive control concept in order to cope with the complexity of the information found. Semantic searches do not confront the user with a list of results like other conventional search engines. Rather, they provide the contextual meaning of the information linked by the knowledge base, i.e. the ontology.

Ontologies are often very extensive. From the screen graphics point of view, it is relatively difficult to show the user a clear depiction of the segment of the ontology that is most relevant to his query, along with the networking and search results. Transinsight's award winning navigation concept has found a solution for this by making it possible to explore the search engine's ontologies. Thus, the user always has an overview across the search *space*. He can simultaneously add what is important and easily hide the unimportant.

The search results are customized to navigation in real-time. Thus, an extremely fast and streamlined inspection of the search space becomes possible. There is an elementary difference compared to working with simple lists of results. In the case of our solutions, the user works interactively. The user acquires a new level of transparency, which enables him to include networking from all the relevant concepts in context to his query as a whole.

It is obvious that such concepts may provide some challenges to hardware and software. The effort of computing is much higher for a semantic search than for a keyword search. Therefore, algorithms must be highly optimised. Only in this way can we achieve better results at consistent computing power and at the same power consumption. It calls for an effective software system which can also work efficiently with heterogeneous hardware landscapes without problems.

Transinsight offers a system which is based on a distributed architecture and can use computing capacities in Cloud Computing without difficulty. Today, our system guarantees 99.99% availability making it the fastest and most flexible semantic search system available on today's market worldwide.

One example of the applied technology from Transinsight is our search engine www.GoPubMed.com which may be accessed without a fee. For more than ten years now, it has been continuously improved. This search engine is specialised in the demanding field of biomedicine and it provides access to approximately 20 million specialist articles. With background knowledge from approximately 200,000 concepts, it demonstrates every aspect of the semantic search remarkably well. Every day, GoPubMed is used by up to 20,000 biologists and physicians from all over the world.

Visions for Products – Enterprise Semantic Intelligence®

Every product developed by Transinsight is based on ESI or the Enterprise Semantic Intelligence® platform. This framework offers all the essential technologies and tools necessary for solving business processing problems ranging from the search for answers, document management, and even context-sensitive advertising.

Data and ESI – getting integrated, just more quickly

As described earlier, Enterprise Semantic Intelligence® uses background knowledge to make the search for information more intelligent. ESI achieves a new level of quality when it comes to computers which recognise the meanings hidden in data. ESI was awarded first prize at the 2007 International Competition for Textmining BioCreative in the most demanding category "Gen and protein identification in free texts". In a competition where 50 teams took part, ESI achieved the highest results worldwide with an accuracy of 81%. Today, the accuracy of annotation is on average considerably higher at more than 90%.

The individual solutions available from the software platform ESI are not limited to the area of semantic searches. The modular structure offers a high degree of flexibility. It also enables the use of its components in other environments. Thus, the platform can be used to make online shops intelligent and can support companies in Opinion Mining. It delivers semantically correct market analyses and competitor assessments in the field of Business Intelligence. The system is also used successfully in the area of drug development.

ESI Server – fast, flexible and precise

The Enterprise Semantic Intelligence® *Server* is the heart of the system. This component is responsible for the integration of data sources, the text analysis and the semantic indexing.

The ESI server can use different sources such as email, data systems, databases, *MS Share-Point*, websites and internal company documents. In addition to this, several data formats can be searched. The system is flexible in terms of scale and can therefore handle the requests of several thousand customers at the same time. With minimum delay, additional resources can be made available since all algorithms are designed for high scalability. The solutions can be installed in-house but they can also be used as a solution in Cloud Computing.

One globally unique feature is Transinsight's semantic learning algorithm. This method processes user feedback in such a manner that the system constantly updates itself and learns new facts. Improvements beyond 95% can be achieved by simple clicks of the mouse.

ESI Studio – extend the knowledge

The Enterprise Semantic Intelligence® *Studio* represents a platform which makes it possible to equip the brain of the system – the ontology – with more knowledge. By fully accessing the background knowledge, it helps to semi-automatically create new ontologies or extend those that already exist. It significantly simplifies and accelerates the process of manual creation of ontologies. Thus, an individual domain expert is able to create a knowledge network for a specialized area, for instance, Alternative Methods to Animal Testing, containing 20,000 concepts and 50,000 synonyms within two months. Without our tool, this task could take approximately six to eight months to complete.

ESI Explorer – discover the hidden

The Enterprise Semantic Intelligence® *Explorer* is the international award-winning user interface for your data. It allows comprehensive access to networked information and it provides unique semantic navigation through the search results at the same time. The ESI Explorer offers a high degree of flexibility. The graphical interface can very quickly be adapted to optimize specific customer requests.

ESI – rapid ROI

The success of a company lies not only in its products and technologies but more importantly in each of its processes. What is important is that each process, vital for product development, is improved continuously. The ESI platform provides access to all relevant facts, including competitor information but also knowledge collected from within the company. Using gen-

eralisation as well as specialisation and expansion, ESI covers the entire request completely. Nothing is missed in the search required by a company seeking to improve its effectiveness.

Of course, the individual always plays a key role in handling knowledge. Employees gain insights and obtain new knowledge for the company. With the use of ESI and the semantic networking of information, new knowledge is both reserved for company use and at the same time is made available to all its employees.

Solutions based on ESI can equal a savings of up to 90% of daily work time dealing with information. That means more time for employees to engage in real work. That in turn leads to measurably higher revenue and higher satisfaction among staff.

The ESI platform represents a solution for self-employed small entrepreneurs as well as for large global corporations. The flexible technical structure allows us to customize the system to your needs. All that is necessary are a few clicks in the configuration tool.

Semantic Solutions – ESI Makes it Possible

Knowledge networks – the heart of knowledge

There is one basic element that provides improved intelligence to a company–Transinsight's knowledge based networks. They set up a system-wide interface between the individual components including Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Content Management System (CMS)–with their own vocabulary. Transinsight offers comprehensive services for the creation of knowledge networks which are updated according to given standardised processes. Created ontologies can be provided to the customer both as a web service and used internally within a company.

Knowledge management – win efficiency by knowledge

Many companies today are facing the same problem: they want to merge documents from different processes, mostly related to completely different topics. The number of documents generated goes up with the number of processes. This, in turn, leads to increased volume of relevant information. Transinsight offers a comprehensive platform solution for the area of knowledge management. With its approach to semantic integration, it performs tasks better than conventional solutions.

To illustrate an example, integrating form processes such as IUCLID (International Uniform Chemical Information Database) and Harmonized Templates for chemical companies and government agencies is an integral part of our knowledge management solutions.

Opinion mining – understand what customers want

In order to reach customers, every company needs explicit knowledge about their customer's requirements and practices. In order to recognise what customers need and incorporate this knowledge into decisions about positioning products, we need intelligent technologies. A good place to understand what customers want is the Internet with all its discussion forums and social networking web pages.

ESI is able to collect and analyse both objective information and subjective opinions on specific issues. Thus, ESI supports companies when it comes to positioning products better and faster, and by developing more customer-oriented products. ESI offers efficient tools to automatically create targeted sentiment and opinion analyses (i.e. automatic opinion mining) as well as analyses of critiques and forum entries. Transinsight's opinion mining allows one to collect information and to differentially conclude general acceptance from the statements of a target group.

Automated evaluation is capable of shaving half the time off of manual analysis. With the right training, the mechanised solution is more reliable than a person in this field. We offer ESI opinion mining for the fields of politics, corporate communication, eGovernment, the stock exchange and the securities trading sector.

Semantic advertising – find your customers

Our online search engine www.GoPubMed.com shows how semantic technologies identify substantially correct relationships between information from external sources and research results. Then the results are systematically presented. An example of semantic advertising depicting exactly the same articles for sale – for instance, antibodies for genes and proteins – based on search results is presented all the way up to the level of individual documents. Such a system offers enormous advantages to advertisers. Their products are presented to a potential customer in a tailor-made manner and within the correct context.

Semantic web shop – customers find their products

With the semantic webshop, we have developed a product which helps your customers to efficiently and quickly find the product suitable for them within a broad portfolio of products.

This comprehensive online shop system helps to manage products easily and to present them to customers with precision. With integrated semantic search engine optimisation, your customers will find their products much faster. They will even find the products even if they haven't entered the correct product names. In the sophisticated biomedical field, for instance, our system is used for locating ELISA kits (containing reaction chemicals and antibodies). Our solutions could push up your sales by more than 15%.

What's next? – The Semantic Operating System!

We have broadly outlined all that is possible with our knowledge-based software. The step towards a semantic operating system that deals with contents and its meaning will extend or replace conventional systems such as *Windows, Linux or MacOS*. These systems will become less important, because more and more analysis and computing power is moving over to Cloud Computing, that is to say, to the Internet. This development is made possible by ever increasing transfer speed and volume. The future lies in a system that provides applications in Cloud Computing and makes them executable on all devices with screens.

In this regard, applications should be able to context-sensitively and semantically exchange information with each other. Thus, they always offer the most relevant applications and information to the user for the given situation. In addition, applications should be able to process the terminal's data including orientation in space, speed of movement, position and images from a camera.

Is it a vision in the distant future? No, we call it *Kaimbo*. Kaimbo allows the development of applications for all platforms and operating systems. And, thanks to ESI, it allows for semantic exchange of applications between each other. The prototype is ready. Would you like to learn more about it? Then, don't hesitate to contact us.

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