CLOUD
SOFTWARE FINLAND 2012

Software cloud from Finland

CLOUD SOFTWARE FINLAND

www.cloudsoftwareprogram.org

Tekes

www.tekes.fi

TiViT

www.tivit.fi

Feet firmly on the ground, heads high in the clouds

The Internet is becoming ubiquitous. The web is now accessible from more capable hand held devices and home electronics than ever before. The killer app of the future is the one which accesses web provided data from anywhere in the world.

The software industry is currently experiencing a paradigm shift from traditional installable applications to web-based software, where applications consisting of data, code and other resources live on the Web as services and can be located anywhere in the world.

In the future, cloud technology will represent a major part of daily life. Active use of Internet applications will become common practice when, for example, consumers store, use, and distribute material they have created themselves.

The Finnish Cloud Software program is a research co-operation initiative by Finnish ICT leaders and pioneers focusing on establishing software engineering principles to web development, creating superior user experience, and empowering innovative green software technology

Cloud Software is open

Cloud Software is a project by Tivit plc., one of the Finnish Strategic Centres for Science, Technology and Innovation (SHOK), and is funded by the Finnish Funding Agency for Technology and Innovation (Tekes). Tivit was founded in February 2008 for the purpose of predicting the products and services of the future and is owned by 46 companies and public research communities.

The four-year Cloud Software Program was initiated in 2010 and now forms a partner network of 22 Finnish enterprises and 8 research organizations in Finland.

The project aims to generate breakthroughs in the field of cloud technologies, Lean enterprises and business models, integrating user experience and security as value-adding elements.

The preparation stage of Tivit's projects is open to all interested parties, and information concerning preparation stages already underway can be found on Tivit's website.

http://www.tivit.fi/en/contacts

Cloud technologies

Main goals of the technology in the cloud work package:
• Collect a compilation of best practices for cloud computing
• Develop toolbox for cloud computing application development
• Define & build an open cloud demonstration environment
• Define guidelines for openness in the cloud
• Develop sample applications that benefit from cloud computing and content mashupping

Lean software enterprise

Key tasks of the work package:
• Developing a framework for applying the Lean principles towards an enterprise transformation

• Conducting Lean Enterprise Transformation. Making Lean applicable in cloud software organizations

• Scaling Agile Software Development. Perfecting & automating the cloud software R&D engine

• Developing Integrated Software R&D Approaches. Seeking for competitive edge.

Cloud business

Principles for the cloud business model development:
• The cloud business models make use of open networks as the means to market and deliver software-based services on demand to the members of the internal and/or external value network.

• The business models make use of open interfaces, web technology, cloud platforms distributing processing and storage to the Internet, and also often open source software.

Safe, sustainable and open cloud ecosystem with superior user experience

In the software field, the most important competitive edges are operational efficiency, superior user experience, web-based software, open systems, data security, and sustainable software development.

The Cloud Software studies include research into what makes a product or service stand out and delight the user. Integrating user experience into software development throughout its life cycle is a basis for successful market development.

The cloud business models make use of open interfaces, open source software, web technology and cloud platforms.

Finland has pioneered research in Security Metrics, Vulnerability, Managing Complexity, Security as a Quality Aspect and Software Robustness areas. There is a desire to improve software and system development life-cycle efficiency so those efforts can drive security and security can support them.

Sustainable development is an emerging strong trend that is driven by the increase in price of energy and natural resources, consumer awareness and legislation.

Finland has always had a strong foothold in producing low-energy solutions and offers a good environment for the realization of green information technology: a cool climate, abundant water resources, good level of education, safety and inexpensive green energy.

The project involves investigation into how environmental friendliness can be improved with the help of software programs and algorithms.

Cloud-enabled business ecosystems and open source create success in Finland

As 2012 is closing, the four-year Cloud Software Program is about to complete its third year. This Tekes-sponsored, industry-driven research program includes 22 industrial and eight research participants, with F Secure as the driver company. Program volume for 2012 was 127 person-years, and with a budget of €15 million it is the biggest ongoing activity of Tivit Ltd, one of the Finnish Strategic Centres for Science, Technology and Innovation.

Some say that the cloud is already mainstream and not much is new. We strongly disagree. For example, Nomura Securities estimates that currently only 13 percent of enterprises outsource their data centers to cloud service providers. Furthermore, European privacy rules, multi-country business processes, a deep euro crisis and a lingering recession will conspire to delay the adoption of cloud computing in Europe by at least two years when compared with the USA, according to Gartner.

"A specific prerequisite for success is to become an expert in exploiting and contributing to cloud-enabled business ecosystems."

What does this then mean in practise? Firstly, there are great opportunities for those who want them. Secondly, Europe is playing catch-up and needs to invest to be globally competitive. Finally, we have learned that technology alone is not enough to make a successful transition to cloud computing. Numerous other aspects of a business need to be adapted in order to thrive among the increasingly fast-paced competition.

A specific prerequisite for success is to become an expert in exploiting and contributing to cloud-enabled business ecosystems. Together with Tivit and Tekes, the Cloud Software Program has initiated a new business ecosystem project called FinnCloud to advance collaboration-based new-business creation. Better yet, Tivit is investing in FORGE, a permanent infrastructure for innovation within cloud-enabled business ecosystems. The key results of the Cloud Software Program will be donated as FORGE core assets to facilitate reuse and ensure continuity after the Cloud Software Program ends. So be sure to check what FORGE has to offer, even in the coming years.

A number of other results were also achieved by the Cloud software Program recently. Here are some examples:

- F-Secure Content Anywhere synchronizes a user's content in the cloud, making it accessible on any device – including PCs, smartphones, tablets and connected digital TVs – anywhere and at any time of the day. Consumers' ease of use is paramount when accessing their content from more than one device, therefore the user interface will be uniform across all connected devices. Operators will be able to offer a safe personal cloud to their customers, on which to save, sync and share their digital content.

- Tieto has created an open source platform, Tieto Open Application Suite (TOAS): TOAS is a standards-compliant, robust and lightweight, infrastructure-agnostic, and cloud-enabled platform including best-of-breed open source de-facto components for creating innovative business solutions with a standardized leading-edge software development kit (SDK).

- One of the central aims of the Cloud Software Program is to develop open source code software and technologies. With the right amount of creativity, it is possible to conduct cloud research and study cloud-related technology with only a small budget. Students at JAMK University of Applied Sciences have developed JAMK's own test cloud, the "Junk Cloud", from recycled computers.

"The Junk Cloud is a demo platform which enables simulation of a small data center. It is used to test more effective ways to publish cloud services and develop cloud software," explains **Ilkka Turunen**, project expert at JAMK, who built the first version of the Junk Cloud.

In summary, the Cloud Software Program has continued strongly in 2012, with great results and a significant business impact. See the results in more detail on the Cloud Software website (**www.cloudsoftwareprogram.org**) and tune in to the related RSS channels to be the first to know about new results.

Sincerely yours,

Janne Järvinen

Director
External R&D Collaboration
F-Secure
Focus Area Director
Cloud Software Program

Photo Antti Ahtiluoto

Cloud as a bridge towards open data

"It is especially irritating that most taxpayers likely cannot access and make use of many of these systems at all, although their personal data has been gathered for decades."

There are many possible perspectives to the cloud as a change provoking ICT phenomenon. The two dominating views have been cloud as a platform for software-intensive applications and cloud as a service in itself. Rather often one of these views is associated with the "internet of things" alias ubiquitous computing alias the smart environment – however one wants to call the intelligent future, where physical and virtual artifacts and people meet each other.

Recently a third perspective that is seemingly related to cloud developments has also become more visible, namely open data. The reason is partly because of the sheer amount of digital data revolving around the Internet and its users. Indeed, what we have witnessed as individuals rather than as ICT professionals in social media have shaped our thinking and behavior in this regard. I would perhaps even like to argue that as system designers, integrators and providers, we are not yet living in the open data and digital services era, but still struggling with closed data, applications and interfaces.

Needless to say, many "open" social media environments are also rather strictly governed when it comes to their key infrastructure, core applications and ways to manage the system as a whole. Still, socially constructed and open data has been left loose, and there is neither a way nor a need to stop it. By this I do not mean Wikileaks, but information systems and software that people and businesses use on an everyday basis. When problems related to closed legacy architectures and data are so obvious that one can read about them in a newspaper, louder voices can be heard about re-thinking investments that seem to lead to cumbersome, isolated and very expensive "services". It is especially irritating that most taxpayers likely cannot access and make use of many of these systems at all, although their personal data has been gathered for decades.

More precisely, the creation of Internet data has already become open to nearly everyone, everywhere and at any time. The delivery and modification of data is at least in principle a somewhat different issue, although we know that copying is nowadays a layman's term for IPR and that training more lawyers is not a good solution to this issue.

Openness of data creation and *de facto* open and "free" data use will have some fundamental consequences for how we think about the cloud. This involves both the cloud as a platform for new digital services and the services themselves, as well as in the longer term the smart environments where the services and data are created and consumed. First of all, data in the cloud becomes a valuable property to be possessed, but it might not be that useful as a business asset if it is produced by a closed network of parties for the need of dedicated customers. To accept this will be a dramatic requirement and a radical change for many businesses, especially for the already existing and profitable ones: when certain data is made accessible by anyone for any use and any kind of modifications, its unique value for a particular business and customers in the cloud must be considered from a fresh angle.

Seen from the Finnish angle and from the viewpoint of the Cloud Software Program, it seems that that open and closed clouds and data are still quite separate from each other especially in business-to-business settings. However, we believe that there are means to bring them closer together in order to create a bridge between them, if not to close the gap entirely. One important means is the cloud itself as a shared platform. However, it is also necessary to offer processes, tools and development sites for creating and playing with open cloud data, applications and services. The playground should therefore cover not only the data itself, but also the essential support solutions, as well as initial applications and persuasive enough usage and business cases.

In the Cloud Software Program many of the business cases represent steps taken towards this direction, for example Tivit's Forge certainly paves a road to the same goal in more general terms. However, in the future we need even bigger clouds with heavier data to be opened. I would especially welcome one kind of secret weapon to be used in this. I am not thinking of the public sector as a forerunner in opening big amounts of formerly closed data, nor standards to unleash the full potential of storing, accessing and deploying data. These are needed, no doubt, but I would also like to see us, the people, being intensively involved in creating, copying, updating, deleting, cleaning, administering and following up data in the cloud. By this we will not only stimulate growth in new software and service vendors, but more importantly it will make us all jump into the cloud. The strategic cloud software research agenda is, after all, nothing else than managing this jump.

Veikko Seppänen
Academic coordinator
Professor
University of Oulu

Photo Juha Sarkkinen

Cloud plays a vital role in the future growth of the Finnish ICT sector and economy

The state of the global economy and especially sectors such as Information and Communications Technologies (ICT) has been turbulent during the last several years. Governments and enterprises continue to struggle to inject positive momentum and effectuate growth. No different from other countries around the world, the Finnish ICT sector continues to face major challenges as we prepare for 2013. One particular and significant trend to note is the increasing impact of Cloud on the Finnish economy as a whole. Cloud has become far more pervasive with its transformational effects spreading into several sectors of the economy and society via new innovations, services and the emergence of new companies.

"The Finnish economy and especially the ICT sector has experienced the increased positive impact of Cloud."

Overall, the speed of change in Cloud technologies and services continues to be impressive. Cloud has significantly changed the way we utilise software and at a rapid rate, continues to provide new opportunities for software and software-intensive companies. Although the ICT sector may experience some reduction in growth as it adapts to the turbulence of the global economic downturn – the sector will return again to normal or higher levels of growth. In this change, Cloud will and is playing a vital role in the future growth of the Finnish economy.

"Cloud Software Program is committed to a long-term action plan to enable and support new, innovative businesses through the sharing of the Program's expertise, experience and assets which will bring positive overall benefits to the Finnish economy in the future."

The Cloud Software Program's primary goal is to solve research challenges around Cloud business cases as defined by the Program's commercial partner organisations. The cases are strategically important research areas and the resulting business impact is critical for the future success. Over the past three years, the Cloud Software Program has completed important and critical work assisting in the launch of many creative and successful Cloud businesses and services. The new solutions and approaches employed by the companies extend the reach and impact of Cloud technology by driving better practices, productivity, security, user experience and efficiencies.

The critical capabilities and valuable assets developed by the Cloud Software Program are not only restricted for use with partner organisations. The Cloud Software Program is also committed to a long-term action plan to enable and support new, innovative businesses through the sharing of the Program's expertise, experience and assets which will bring positive overall benefits to the Finnish economy in the future.

"Tivit's Forge program aims to build a competence, capability and technology base to support Finnish digital service businesses."

One of many concrete tools for dissemination and implementation will be the Tivit program called Forge, which aims to build a competence, capability and technology base to support Finnish digital service businesses. In 2013, the Cloud Software Program will enjoy its final year in the Tivit program. During the final year we will finalise dissemination plans as well as select the best assets and other enablers which will be utilised later through Forge and other potential channels in order to maximise the positive impacts the Cloud Software Program brings to the Finnish ICT sector and economy. We will ensure that the Tivit's program results extend far beyond the program completion date.

Tua Huomo
Program Coordinator
VTT

Photo Tuija Sorsanen/VTT

On the road to a consumer's cloud software world

Are cloud services the next generation in the online world for all of us? Veikko Seppänen, academic coordinator of the Cloud Software Program, believes that it is, and says that we cannot yet even picture all its content and services.

Photo: Liisa Laurikainen, Vehrä

Banking, booking tickets and having discussions on social media sites are all handled online. In the future, cloud services will also be used in many other fields, and users and consumers will actively participate in them.

"We see a second wave of social media, in other words citizens will take part in many ways online alongside businesses and public administration," says **Veikko Seppänen**, academic coordinator of the Cloud Software Program.

He says there are many possibilities for use of cloud services. "To grasp hold of them, various uses for applications must be identified and necessary infrastructures built for the services." Strengths for Finns are first class, flexible and efficient work methods and tools as well as a high level of ability and educational possibilities.

Seppänen believes that for Finns, competitive benefits can be created in, for example, education and the wellness sector, which has top notch expertise and a highly functional public healthcare system. "New possibilities in the wellness and healthcare sectors include personalised monitoring of wellness, maintenance and development. In these fields physical activities like staying fit or eating healthily can be combined with services; this has already even been done, but development is just beginning. In teaching, cloud services can include various materials and solutions to support learning. Work is done in a cloud, using and creating materials, sharing experiences and at the same time learning."

"Strengths for Finns are first class, flexible and efficient work methods and tools as well as a high level of ability and educational possibilities.

Seppänen believes that for Finns, competitive benefits can be created in, for example, education and the wellness sector, which has top notch expertise and a highly functional public healthcare system."

A technology encompassing many fields

According to Seppänen, a cloud is much like microprocessors, personal computers and mobile technologies were in their time: a horizontal technology encompassing many different fields and uses. "Development toward adaptation of different applications into services which are accessed online has been clear as day for at least ten years." Seppänen sees three phases in information technology development: digital services, the Internet and a "smart" environment.

"Cloud technologies are part of the landscape in the development of digital services, which bring together different technologies and applications. At the same time, network infrastructure management, efficiency and quality need to be developed. A smart environment, in other words applications and digital content becoming part of the physical world, is likely, with the next development phase taking place in the next couple of decades."

Value of information is based on how it can be used

Cloud services bring new effectiveness to IT investments and better possibilities for managing the use of information system in collaborative networks. Cloud services purchased by small to medium-sized businesses include data security, accounting, billing and customer management systems, conveniently providing them with an integrated information technology environment. Services are paid for according to usage, and can be increased or decreased flexibly depending on needs. "This is an interesting and significant factor from the standpoint of large business use, as well. The content and development, offerings and user environments of services are realised through information technology. Services can still be linked to physical benefits, for example maintenance service for a machine or device can be located in a cloud.

The benefit can also be intangible, perhaps digitised information in an advisory service which is provided automatically without human participation in offering the service," says Seppänen.

Combining, modernising and further developing cloud solutions from previous and ongoing phases can be seen in the provision of cloud services.

"Applications are adapted and solutions are commodified as services," Seppänen explains. He feels that modernisation is significant in the beginning phase of cloud development, and possibly further along, as well.

"It is often a question of adapting a product or application into a service, but on a broader scale making use of information specifically as a commodity, and the ability to maintain users' interest in the information and service offered. Information is an increasingly valuable commodity in and of itself, and does not need to be packaged with devices or software. The value of information is created by the need to make use of it, be it related to one's own well-being, tomorrow's airline flight or a vendor's information about the purchasing habits of customers."

Use and development hand in hand

According to Seppänen, challenges for cloud services include management of large masses of data and large numbers of customers, along with content which stands out and reliability and quality of use. "In a way, there are two significant competitive factors, as there were before, for example devices and applications versus network performance during the mobile era."

He feels that in providing cloud services, use and development are more and more closely related. The implementation sites and needs in information technology solutions must be understood from the viewpoint of the users. "A good example is the mobile era, which Finns established and which enabled them to influence development of smart technology along with other leading vendors. At that time, active research and development of next generation information technology solutions took place in Finland as technology and its uses became interlaced."
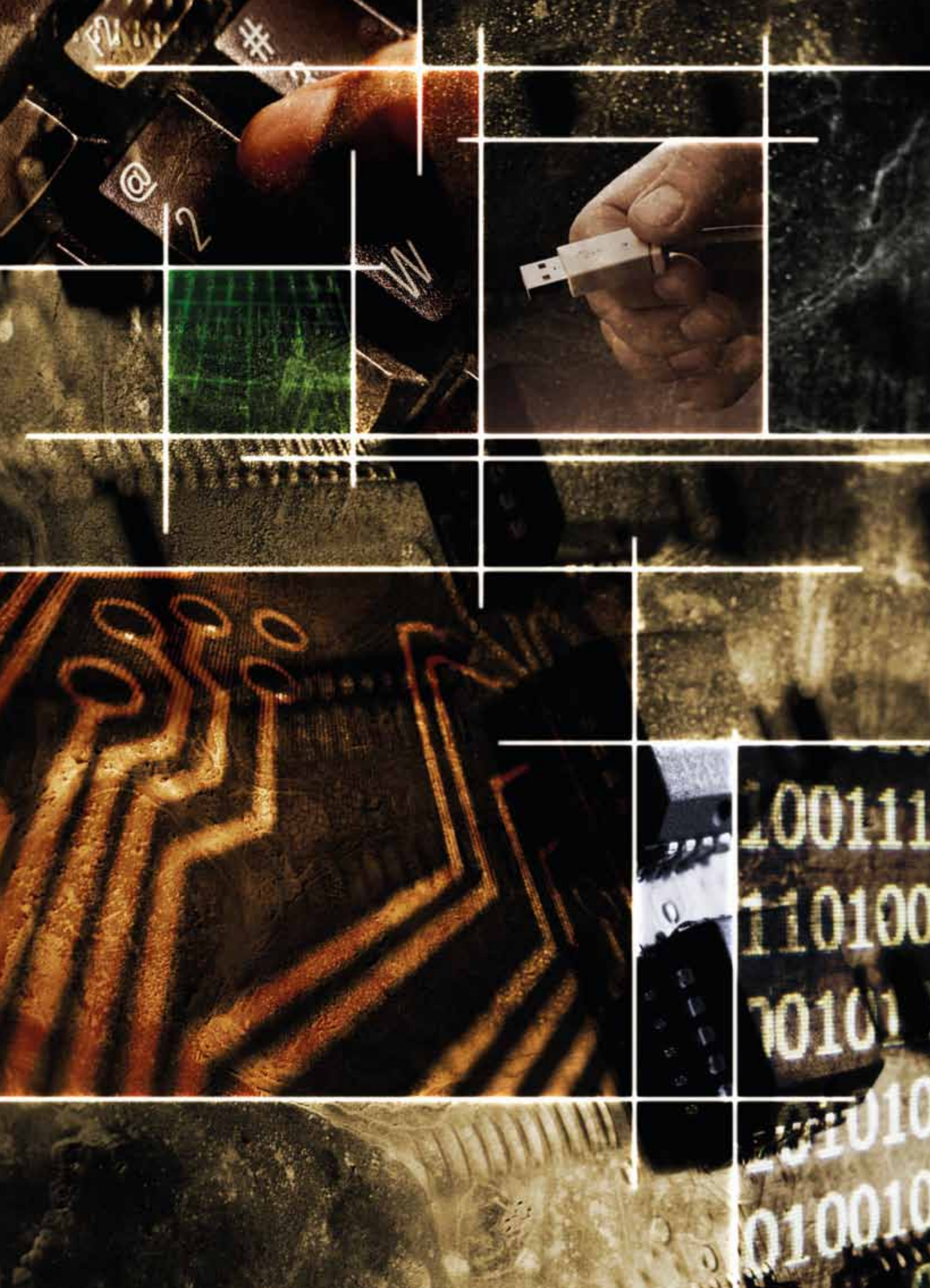
According to Seppänen, in the future more business and social innovations in cloud services can also be anticipated, along with a whole realm of possibilities. "In the cloud world there will probably not be two or three comparable cloud technology software giants. Still, monitoring and understanding international strategies and business operations from the standpoint of the largest players is also absolutely necessary."

Veikko Seppänen brings up the complicated question of ownership in cloud services. "How can rights and responsibilities be managed now that everything is becoming intangible and digital, consumption and provision are entangled, and services are interlaced on the Internet with data moving back and forth between them, merging them?"

Photo: Meeri Niilola, Tekes

Searching for a global research instrument

Usually, business activity and research are joined together in the projects of the Cloud Software Program.

For its part, Cloud Software Factory seeks to develop an international research instrument, which can be used on global empirically-based projects utilising cloud technology and research projects.

Cloud Software Factory focuses on the empirical examination of software development while also supporting its corporate partners in testing business operation-level problems.

Software Factory, located on the Kumpula campus of the Helsinki University Department of Computer Science, is a software development laboratory unique in Finland, where Professor **Jürgen Münch** and his students get to test and develop empirical interdisciplinary projects with companies operating in the field.

The laboratory replicates the conditions of the business world as closely as possible to offer students the opportunity to get acquainted with the needs of companies in the field even during the course of their studies. The laboratory was founded in 2010 as an initiative by Professor **Pekka Abrahamsson**, who was directing the Cloud Software Program.

Münch has presided over the laboratory since April 2011 and is also responsible for its pedagogical offering. His voice is filled with pride as he leads a guest on a tour around the facilities of Software Factory. The laboratory is in fact a cosily furnished classroom full of computers, displays and video equipment.

Münch has previously worked, amongst other positions, in the leading German software development institute IESE. In addition to teaching and research he has extensive experience of working with specialists in both the business field and research institutes. Indeed, he sees his own role first and foremost as a linking element between business activity and academic research.

One of Münch's most notable achievements was the establishment of long-term co-operation with Asian organisations (including the Japanese Aerospace Agency). He was also one of the initiators in the launching of wide-ranging co-operation with respected Asian software development evaluation experts.

For Münch, with his work funded by a grant from the University of Helsinki, taking over the directorship of Software Factory was a completely natural next step. The objectives of Software Factory

"The aim is to work out the various challenges that face the software development of companies and create systematic methods, the effect of which on the end result can be predicted."

are well in line with Münch's earlier career: the aim is to understand the established practices of software development better under laboratory conditions and clarify the applicability of certain technologies, methods and devices in relation to the requirements of the software development of businesses.

"Software Factory also seeks to ascertain why particular methods suit certain situations and what their effect is on the end result. The aim is to work out the various challenges that face the software development of companies and create systematic methods, the effect of which on the end result can be predicted," says Professor Münch.

Rapid changes in the operational environment of companies and constantly evolving software technologies have in part led to it becoming economically expedient to disperse software development across teams around the world. Software Factory is also divided into international teams. There are already thirteen teams across Europe and all the teams on the network work towards creating a global research infrastructure.

The goal is then for the infrastructure to create a global research instrument, which in turn would make it possible to study software development practices and technologies in a research laboratory environment that replicates real-world conditions as closely as possible.

Empirical problems are refined into universally applicable theories

Software Factory's projects are of great interest to the software industry as they offer companies an excellent test environment for trialling and piloting new products and technologies. Research and educational establishments also help businesses to identify the type of challenges in business activity that may be solved through academic research.

Professor **Jürgen Münch**

In defining the subject to be researched it's often difficult to distinguish business operation challenges related to innovation and research from other limiting factors, such as a shortage of suitable software developers, for example.

Professor Münch's team uses an empirical approach in their work.

"Our work typically begins with a practical problem, and we take technologies, methods and working tools applied to problems into account. We try to pin down information which can be used in solving the problem through systematic dry runs and testing. The end result is usually a theory which explains the observations made about the real world," Münch explains.

Software factory makes use of kanban and cloud computing

The next focus of Software Factory is on cloud technology software development, and the name of the laboratory will change accordingly to Cloud Software Factory. While technologies based on various cloud services are proliferating rapidly, their effect on software design is still unclear. Demand for products and services utilising cloud technology is high at the moment and will probably continue to grow. Despite this, information on cloud technology software development is centred on technological knowledge, whereas there's insufficient information about the effects of technologies in different development environments.

It's also still not possible to work out which practices, technologies and methods are best adapted for cloud-based software development and upkeep, or how to choose a technology, method, model or tool that best fits the objective or development environment in question. Cloud Software Factory is also looking for answers to these issues.

Software development is confronted with challenges not only by business activity restrictions and the spectrum of technologies, but also by the adoption of cloud technology. The software designer is no longer at the mercy of limited resources and this set-up fundamentally changes the nature of software development. The software developer of the future will be required to possess a better and better understanding of business operations and earnings logic. We have striven to take new requirements into account in the projects of the development laboratory, for example by creating workable products and services with the bare minimum of effort, and their survival prospects have been studied in the ecosystem of software development. At the same time, companies are supported in product development and innovation and they are helped to advance their understanding of the value of innovations to the end user.

Kirsi Gimishanov

Elektrobit Special Device Platform

The Elektrobit business project started at Software Factory at the beginning of 2012 and is centred on the Special Device Platform and the development initiatives related to the platform.
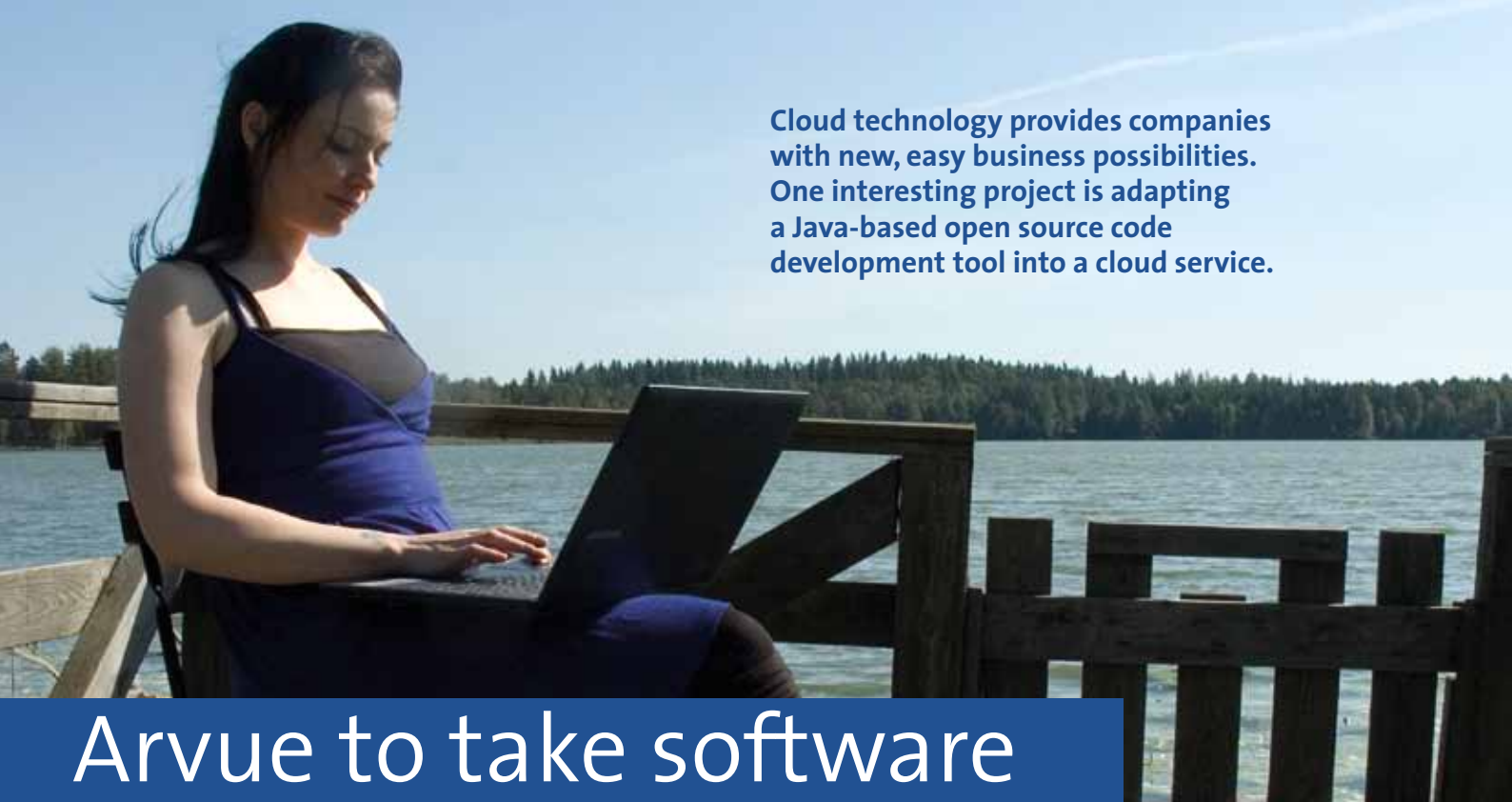
The goal is to develop action models which improve the development work of the teams spread across the world and the transparency of software and hardware development, as well as improving the means used to measure that development.

The transparency of development is essential in agile and Lean operating models, in order to avoid unnecessary design costs or work, amongst other considerations. Cultural differences and operating models are typical barriers to transparency. Within the project, an attempt is made to define which issues are important from a transparency point of view, and what transparency demands of the people who work in the development teams.

Tieto Open Application Suite

Tieto Finland Ltd has made use of co-operation with Software Factory to develop an entire product line assembled from open-source components during 2011: Tieto Open Application Suite. A community of developers has also been planned and set up around the product line, working together with Software Factory.

Tieto Open Application Suite contains various platforms which offer companies all-encompassing lifespan services cost-effectively. Software Factory has provided a diverse testing ground where it has been possible to try out things that could not be carried out in a normal critical business environment.

Cloud technology provides companies with new, easy business possibilities. One interesting project is adapting a Java-based open source code development tool into a cloud service.

Arvue to take software development to a cloud

The technology is best suited for building web-based solutions for administrative and operational management systems.

Vaadin Ltd's Arvue is a multifaceted application. Arvue is a tool designed for software developers working on small applications, or for small companies and associations doing development work. The applications can be accessed with a click of a button and can be embedded in any website. Adapting software development tools to a cloud enables community software development, in which several users can work conveniently on the same application from different locations. Software development is done using a browser-based visual editor.

Software development online

Compared to working in a traditional way which requires managing one's own computer, cloud services accessed through the Internet reorganise and facilitate work in a number of ways. Cloud services can eliminate the need for individual users to install and maintain software and development tools. This allows users to focus on their actual work much more easily and quickly than before. The Internet also enables community collaboration and social software development. For example, a developer's partner can work at a computer physically located on the other side of the globe just as easily as in the same office.

The Arvue application includes the cloud-based tool Arvue.com. At the moment Arvue.com is still a research project, but releasing a beta version for Cloud Software Program participants is being considered. "At the moment we are focusing on development and validation of technologies," says senior expert **Marc Englund**. However, numerous Arvue-related tools and software portions are already available, and can be used as part of the Vaadin environment.

Participants in research and development on how to exploit cloud possibilities and design models for community software development include the Tampere University of Technology, Åbo Akademi University and the Jyväskylä University of Applied Sciences. Universities have reviewed earlier and ongoing studies, and at the moment it appears that community software

development provides the best results for solving limited problems. "For example, when two different developers run into a conflict in centralised version management," says Professor **Tommi Mikkonen** from the Tampere University of Technology.
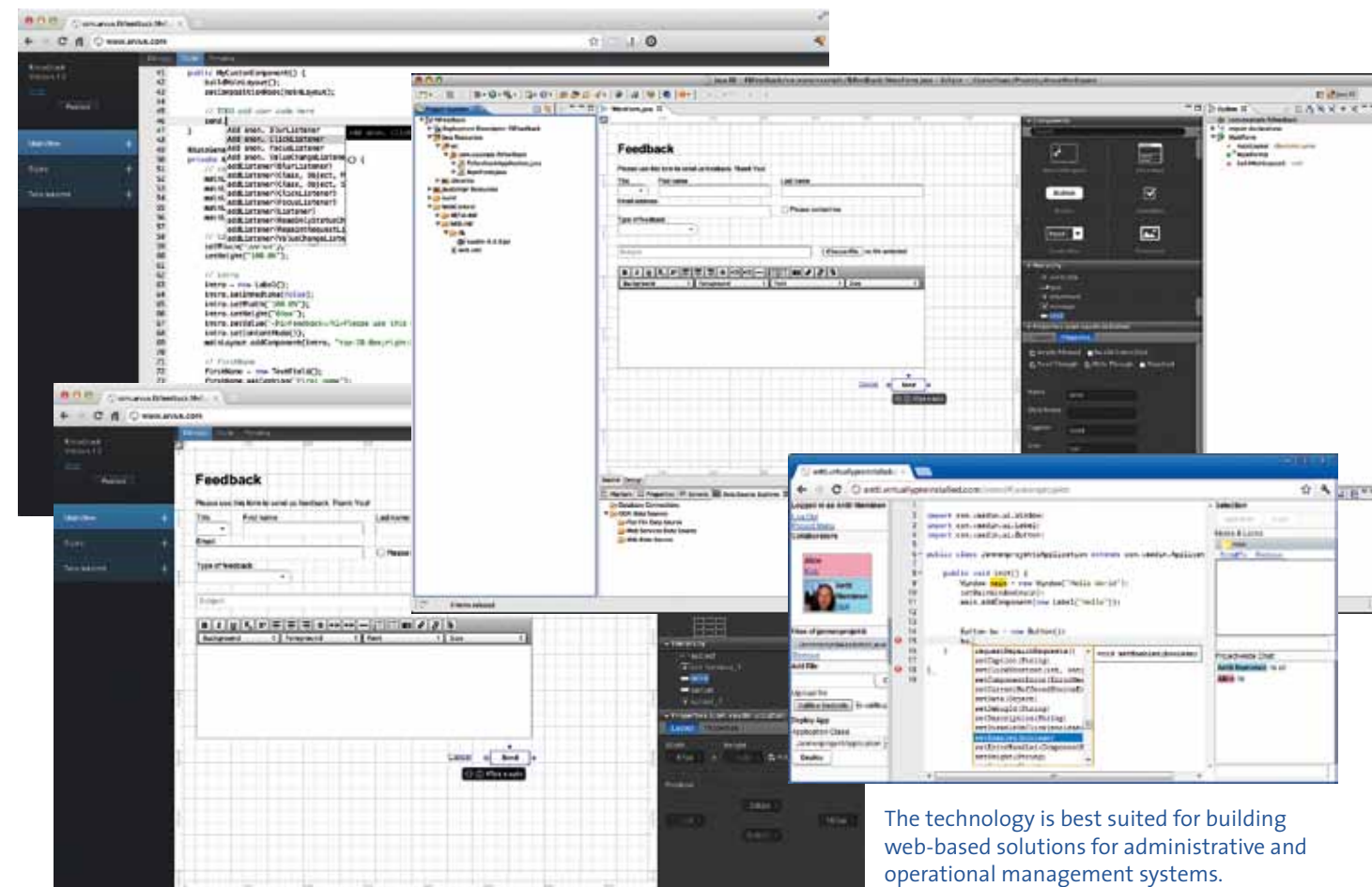
From offline to online with universities

The Vaadin Framework is an open source code tool and Java library for development of online applications. Work is facilitated by existing templates, themes and editors. The technology is best suited for building web-based solutions for administrative and operational management systems. Vaadin offers certain packaged development tools which enable software developers to design multifaceted and functional online applications more efficiently.

In the future, cloud services will provide more benefits for software development. Arvue tools and technologies which are already linked to the Vaadin environment are progressing toward realisation of the Arvue.com cloud service, but development work is a long-term task with many different parts. Universities participating the Cloud Software Program are driving realisation of the service through research, testing and development.

A source code editor called Cored, which enables support for multiple users, is being developed at the Tampere University of Technology and problems related to simultaneous use of the same Java Virtual Machine (JVM) are being studied. At the moment, a single Java Virtual Machine is generally used for a service's applications, making it possible to ensure that the applications do not conflict. Decreasing the number of virtual machines can save on resources, for example memory. In practice, a single virtual machine running applications which share libraries also improves start-up time for software platforms.

The current Cored programming editor is an integrated part of the Vaadin environment and makes use of Java's development package, which can be used to check for possible errors in code.

"The energy-efficient Linux schedule we are developing could dramatically reduce the energy consumption of data centres"

Enabling multiple users to collaborate in real time has been accomplished using the "differential synchronization" algorithm. To introduce the software the university has also designed a development tool (IDE) which supports adding comments to code, a chat forum for developers and integration with Facebook. Components for using Cored can be found in the Vaadin add-on directory (Vaadin Directory).

The Jyväskylä University of Applied Sciences is working on version management for Arvue. A group of students at JAMK have developed GIT integration, i.e. integrating the GIT version management application with Arvue. In practice, version management applications are necessary in developing all software projects. The applications enable results of the project and the work of different programmers to be managed and monitored throughout the development process. GIT version management, originally developed by Linus Torvald, is favoured and used in Linux kernel development, as well.

Community programming requires security solutions

Use of a single virtual machine for development of applications for several different projects requires verification to ensure that use of resources is evenly distributed and optimised. Problems can arise if, for example, two applications are being developed simultaneously and one is using too much memory or processor time, interfering with resources needed by another application or development group. "A monitoring application is available which enable the system administrator to examine applications in use and the amount of resources they require," says senior assistant **Johannes Koskinen** from the Tampere University of Technology.

A shared virtual machine may also compromise data security. "In the end, it is really a compromise between data security and memory usage. Solutions at the far ends of the spectrum, in other words all in the same instance in the virtual machine or all applications in their own instances, are easy to realise, but finding a suitable compromise is more difficult," explains Tommi Mikkonen.

"Security is critical for Arvue.com because an application which malfunctions due to intentional interference or an error may cause other applications running in the service to crash, or even cause the entire service to go down," notes Johannes Koskinen.

In addition to research and planning, practical development has been done to find a suitable security system for Arvue. There are already solutions to various problems. "Applications have only limited access to the surrounding environment. For example, reading and writing to files is limited to the application's own files. The solution is also used to scale the number of cloud service machines up or back down," says Johannes Koskinen. Maintenance services for Arvue.com are being developed in more detail at Åbo Akademi University.

Suvi Alanko

Additional information:
Cored editor information: http://cored.cs.tut.fi/

Programming editor with Java error checking and multi-user support: http://vaadin.com/addon/javaaceeditor

Goods Spotter: Exciting and ethical purchases

Photo: Niko Nurmi, Tekes

The product supports numerous data formats, making it possible to offer photos, videos, augmented reality text and normal text displays.

A strength of VTT's augmented reality research group is bringing augmented reality technology to light mobile devices.

Photo © Ari Turunen

Augmented reality helps in making purchasing choices. Tieto Ltd's Goods Spotter enables consumers to make carefully thought out purchases in an easy and exciting way.

Starting in July 2012, consumers in Finnish and Swedish stores have been able to use smart phones to browse for products best suited to their shopping habits from among a large volume of stock, or even compare the carbon footprints of various products. Tieto Ltd's Goods Spotter is an application which enables consumers to find a surprising amount of information about a product using bar codes or photos tailored for the purpose, to view directions for product use in a video format or to express their own opinions to others interested in the product.

More reality from a cloud

When a product on a convenience store shelf is scanned with a smart phone, the system retrieves information about the specific product from a cloud-based database. For example, the display can show suitability of a product organised in the order of one's own values, or provide other added information. This so-called added "Augmented Reality", i.e. digital information as part of the real world, has been studied at length at the VTT Technical Research Centre of Finland. In the Cloud Software Finland Program, VTT's augmented reality technology has been exploited in Tieto Ltd's product development.

Augmented reality has been studied around the world, and its creative uses have been developed through endeavours including MIT's SixthSense project, presented at the TED Conference in 2009, and Google's virtual reality glasses. Still, there are fewer consumer product technologies. Goods Spotter, developed in Finland, is already in use by consumers. It enables offering multifaceted additional information to consumers in an easy, user-friendly way. Goods Spotter has been designed to be exciting, for example through social dimensions and 3D graphics. The product is designed for the Finnish and Swedish markets, but there are no limitations even on global use.

VTT's strengths are bringing augmented reality technology to light mobile devices like mobile phones with cameras, which have limited system resources and Internet connectivity speeds. According to Tieto's Program Manager **Ville Puntanen**, the Cloud Software Program and collaboration with other parties has strongly affected development of the entire product concept, from effectiveness of the development team's assessment of business models to hands-on experience. Tieto has considered collaboration with researchers and businesses important, since the Cloud Software Program has facilitated product development. "Through Cloud Software we have been able to develop the concept together with top experts from many different research fields," says Puntanen.

Photo © Ari Turunen

Personalised information

"Goods Spotter is an unbelievably fine tool for giving consumers added information about products they are considering buying,"

In the future, users will be able to create a personal profile for themselves, which the application will use to offer personalised information based on the user's interests, perhaps about a product's country of origin, carbon footprint size or calories in foods. Low-carb dieters could create a profile to quickly find low-carb products on a store's shelves, or a shopper who favours Finnish products could receive product recommendations without reading the small print on packaging. Product recommendations can also make shopping much easier for allergy sufferers. Product information based on locations can be used to compare prices at various stores without having to go from one store to another.

Added information and features linked to a product by Goods Spotter can include product photos, videos with directions for use or viewing a map. Goods Spotter supports numerous data formats, making it possible to offer photos, videos, augmented reality text and normal text displays, animation or maps. Goods Spotter also supports 3D graphics. "By using 3D, items can be visualised within a space, and their features can be presented contextually or offered as social applications," says Ville Puntanen.

Multifaceted development outlook

Tieto is currently developing a game engine which can be used to reward users for adding reviews or finding various products. The game engine already enables rewarding users with rankings and reward points, and its functionalities and concepts are still being developed.

Goods Spotter is a diverse application, which in the future will be used more broadly than for simple convenience store shopping, for example to offer maps for events and timetables. A pilot project for Goods Spotter has been realised with S Group businesses, and the result have been promising. In Tampere, Trust Creative Society Ltd is offering Goods Spotter to their customers as a tool for communication between manufacturers and consumers.

"Goods Spotter is an unbelievably fine tool for giving consumers added information about products they are considering buying," says **Harri Helén**. Helén says the application provides a whole new way of communicating between the manufacturer, vendor and consumer, which is in demand. "Goods Spotter's ease of use is a significant benefit compared to other similar mobile phone applications," she adds.

Suvi Alanko

The consumer's say on cloud services

Developing innovative services necessitates new ways of talking to consumers. F-Secure carried out a study in which it collected user experiences of cloud services through web discussions.

Mika Kokkonen logs into VTT's web-based discussion service, Owela. It's already evening, but Kokkonen is actively discussing cloud services with sixty other volunteers. During the six weeks of the study, he has carried out various tasks and recounted his everyday needs relating to content storage, usage and sharing. Now he's sharing his opinions regarding F-Secure's cloud services. In one sense they can be seen as a backup service. The user has a real-world copy of their computer's contents stored within the cloud. As the user changes data on their computer, it also changes in the cloud. In the event of the computer breaking down, they can retrieve all the data from the cloud. Another aspect of the service is, for Kokkonen, directed at active users. It's like an external hard disk within the cloud. The data within it can be accessed through many different devices: the cloud diagram on the laptop can be viewed with a phone, for example. With this service the consumer shares, customises and uses information actively. Kokkonen considers F-Secure's services and the topics of the discussions to be of interest. Cloud services are a new experience for him.

"We are continually developing our services. With this study, we wanted to get long-term information about how consumers use cloud services. We at F-Secure believe that content is more important than equipment, and that use of content is not tied down to one location," says the project leader of the study, usability specialist **Ville Nore**. "The key survey question was how consumers see the differences in F-Secure's cloud services. Thinking about our product portfolio, will these services always be separate or should we develop entirely new services?"

Nore says that, from the product development point of view, it is a huge challenge to make customised cloud services for consumers. "It's easy to be satisfied with offering whole-product packages, making them as close as possible to the user's requirements." According to Nore, the service and software should be designed in such a way that the consumers have an avenue to everyday innovations. "The ideal perspective is that the user is able to adapt the service to their own needs. During the virtual discussions that took place during the study, it became clear that people cannot identify all their needs when using different services from home. The needs emerge gradually during use of the service. Identifying them requires learning and insight on the part of the user as well. Our opportunity is to generalise needs: if the consumer says that they want a specific service right now, we won't necessarily develop the service in question but rather a service that is multifaceted and thus adaptable to other uses as well."

The data security of services is important

"No outside party should be able to access the user's own data. Data security issues are important."

Study participant Mika Kokkonen had not heard about cloud services before. Indeed, it became apparent during the virtual discussions carried out by F-Secure that consumers often reach cloud services without realising it. Services are not necessarily recognised as cloud services, and it's of little concern to the consumers whether the technology is cloud computing or something else, as long as it meets their own needs. New cloud services are used experimentally, and their usage increases with experience. According to Nore, people do not input their data into the cloud straight away, but first make sure that the service works and is reliable. "No outside party should be able to access the user's own data. Data security issues are important," says Nore. He claims that no negative experiences came up in the discussions. "We're moving forward on a trial-and-error basis. When errors occur, the significance of data protection grows and trust in new services builds up slowly. Despite this, services are used if the benefits are greater than the risks and if there is no substitute service available." Nore believes that users' individual requirements bring challenges for the production of cloud services: there is a desire to control the services and modify them to suit personal needs. The reputation of the service provider is also significant: people choose the products of a supplier that is trusted and seen as responsible.

Mika Kokkonen's experiences of cloud services are mainly to do with the image bank. He is also interested in other services, but does not want to spend time getting acquainted with them or comparing them. The same applies to the individualisation of services: in order for him to start modifying the services to fit his own needs, they should already be well customised in a tick-box manner.
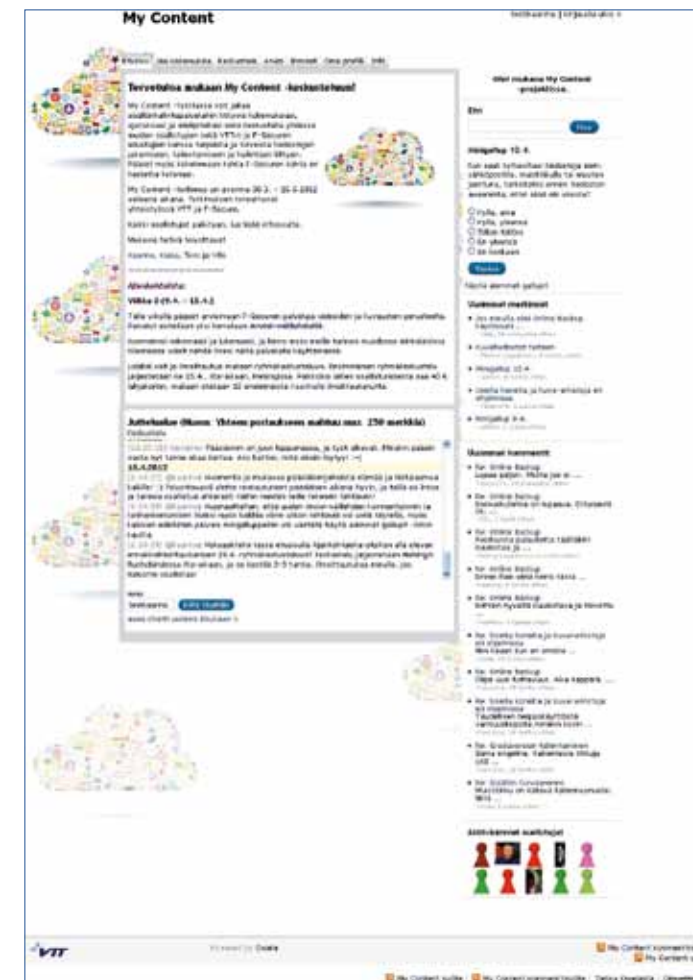
Tiina Autio

The front page of the Owela workspace. Participating in discussions in the Owela forum has been made fun and easy. The services of the future can be influenced through the internet, whenever and from anywhere. © VTT.

Photo © Tiina Autio

Ville Nore (F-Secure) and **Kaisa Koskela-Huotari** (VTT). "Although consumer research is a big part of what we do, we also have to be innovative in our research methods. This study brought up responses with many underlying reasons," says Nore.

The front page of the Owela workspace in the F Secure study. Both the users and developers of products and services meet in Owela. The aim is a dialogue that is active and mutually beneficial. © VTT.

Case: F-Secure's My Content study was carried out in the Owela discussion forum

F-Secure carried out its My Content study in cooperation with VTT in the spring of 2012. VTT's objective was to lay down preconditions for the sustainable development of society, employment and well-being by producing research and innovation services that would increase international competitiveness. One example of VTT's services is the Owela web platform, developed in 2006, which gives consumers the means to make themselves heard. It encourages positive generation of ideas and problem-solving, and directs users towards active cooperative development. F-Secure's study was also conducted within Owela, which has an established community of users consisting of hundreds of consumers around Finland. Owela is particularly suitable for the development of innovations and collecting user experience information regarding existing services.

"In addition to the Owela tool, VTT brings into the research project its expertise in conducting studies and discussions, motivating volunteers and designing tasks to obtain the desired data. The discussions are monitored and participated in. This takes time but achieves the best results," says researcher **Kaisa Koskela-Huotari** at VTT. Alongside virtual discussions and tasks, it's also possible to use other research methods. In this study, there were six weeks of discussion in the VTT web forum, and two focus group meetings at the premises of F-Secure.

According to **Ville Nore**, consumer information is used to produce more intelligent services. "The objective is to understand the end-user's mindset and get as near as possible to the end-user's wishes in designing the services. The study brought facts to decision-making and product management. When we followed consumers using our services, we obtained data that we can use to affect the logic of our services and, if required, alter their operating principles, before the product comes on the market. All information to do with how interaction should work within the service is useful to us."

Further information: http://owela.vtt.fi/

Product development through open source

The skills of Finnish software development firms are at their strongest in a flat organisational structure, in which teams have at their disposal server resources that work on a self-service principle in a project-specific independent working environment. Teams have to be able to differentiate their own activity within the organisation, when required, to ensure a better level of customer satisfaction.

These product development teams work like cells within the organisation, at their best forming the basis of a learning organisation. To facilitate the creation of agile product development infrastructures, specialised product development cloud services are also required, in the opinion of the designers of the FreeNest product development platform at the Jyväskylä University of Applied Sciences (JAMK).

"Collating all the open source tools into one service package is sure to be an attractive alternative to the cumbersome and pricy project management tools of commercial enterprises"

"Underlying everything is a desire to push the Finnish software development industry forward. With open development tools and highly skilled teams, good results can be achieved," says project specialist **Marko Rintamäki** at the Jyväskylä University of Applied Sciences. He explains that the FreeNest concept was originally developed alongside ongoing work on industrial projects. Based on experiences acquired, Rintamäki began using it as a training environment, which came to incorporate many pieces of open source utility software over the years. The overall package began to seem comprehensive, and it was found to be useful for other types of companies as well.

"The platform was named FreeNest and is aimed at product development, software, hardware and service development teams. It incorporates tools to support planning, requirements management, execution and testing, amongst other needs. Collating all the open source tools into one service package is sure to be an attractive alternative to the cumbersome and pricy project management tools of commercial enterprises. The FreeNest environment is the open source-based ALM (Application Lifecycle Management) solution," says Rintamäki.

"The idea is that the customer relationship, the producer and the product live as close as possible to each other throughout the whole lifecycle. All data can be presented to the customer easily, so that it's possible to react in a timely manner to any necessary situations, such as faults. Co-operation leads to a better end result," explains Rintamäki. He says that the opportunity for efficient communication may be radical when compared to the traditional billing for alteration requests after the completion of the project. "Agile development requires an efficient feedback channel: it's only then that it can fulfil the objectives set out for it."

For teams, a right to their own working environment

A fundamental principle in FreeNest-based working is that, by using the project platform, teams can work at their own pace, independently from the company. "The company's information systems services are usually shared out to all teams from centralised servers, and permission for changes must be sought from the principal user. In the alternative we are offering, a server is set aside for each team. The team gets full rights to its own working environment and, in the best case, can even make the customer part of its environment. This model only relates to tangible tools, not to the email system, for example. Data management still has a role to play, but increased independence can reduce the workload of management," says Rintamäki.

Because all FreeNest software components are open source, a customer-specific version can be adapted on demand, after which copying an instance won't necessarily cost more for the customer than the price of the computational resource. "Many commercial product-development software packages can't yet accommodate this too easily, given their licence models. In the internal network, it's possible to integrate commercial solutions as well, as part of the FreeNest concept."

The FreeNest product development platform in use in the school environment

Students at the Jyväskylä University of Applied Sciences (JAMK) used the FreeNest platform in their project in the summer of 2012. The aim of the project was to further develop the existing FreeNest service. Thirty students formed teams specialising in different areas. The user experience team designed a new look for the user interface. Development teams designed and implemented new functionalities. A separate cloud team studied the OpenStack cloud infrastructure and installed it into a server network that they had constructed themselves. The maintenance team supported the product development chain. The summer factory worked as a flat LEAN organisation. The summer factory was led by the Core steering group, which was also supported behind the scenes by the LivingLab team, which observed, analysed and interviewed the various teams.

"The important idea here is to facilitate high-level learning through the right working environment. The working method developed can be copied directly into one's own business. The students can apply what they have learnt and develop the FreeNest concept freely, as required for their own purposes. This is a win–win situation for both the company and the students," says **Ilkka Turunen**, who is a founding member of Nestronite and who directed the students at JAMK.

He explains that the FreeNest platform is extremely easy to use after initial guidance. It can also be used by students who only have experience of a few practice tasks. The students worked and developed an operating process at the same time, which was used to develop the software in the same way as in companies. The FreeNest reference environment was, at the outset, a virtual machine-based instance, but through the aggressive development work of the students, a considerably more refined release version was attained, in the form of the Ubuntu/Debian packaging model. The pre-alpha version of FreeNest 1.4 will be released for distribution during the course of this autumn.

"Openness makes very interesting things possible from the point of view of the students. The students worked as part of the FreeNest development team, and at the same time built an operating environment in line with their own preferences. With regard to development, it's essential to get feedback from the young producer vanguard of Generation Y. In an ideal scenario, FreeNest could form an ecosystem around itself, for new thoughts and ideas to move in. It would be interesting if software developers around the world started to develop software for this platform, and thus got a community involved. The target is to make FreeNest one of the best-known open source ALM solutions," says Turunen.

The summer factory's skynest blog:
http://blogit.jamk.fi/skynest

Rintamäki says that the objective of the concept developers, right from the start, has been to develop the operating environment as well as the process. "Through the development of the open team-working platform, ideas have also arisen as to how, for example, the subcontractors of a larger company could deliver their development work via an open development platform of an equivalent type, provided by the company. Facebook, for example, uses this type of solution. Process training can be arranged on a wider and more personalised basis than previously. In the best possible scenario, the company's product development environment could be transported on a memory stick and brought into use in just 15 minutes."

Increasing Finnish intellectual capital

Rintamäki makes the assumption that most Finnish businesses use open source solutions and tools at work, whether consciously or unconsciously. In his opinion, more widespread usage of open development tools will improve Finnish intellectual capital and competitiveness.

"If companies have software at their disposal, and the personnel learn to use them, expertise isn't restricted to just one workplace, but moves with the worker to the next company. From the point of view of competitiveness, challenges also arise from India and China, which are already using comparable software. In more rigid organisations it's fairly common that workers may install open source software to make their own work within a weighty process more efficient. An example of this is the version control tool Git. By elevating open tool chains into a more unified service, a clearer message is conveyed to companies about their possibilities."

Teams develop

An advantage of programs collated on the FreeNest platform is their general familiarity. By combining components appropriately, they form a working 'sandbox', which can be customised to fit the intended purpose. A working process model has also been created to support the components, which enables, for example, easy combination of the waterfall and agile models. "Different types of product development projects need different areas of concentration, and using just one process model is not necessarily the best choice. I've worked with large systems projects myself and have come to the conclusion that a quick response from the customer is the best way to do things right. Common sense gets you pretty far."

According to Rintamäki, it's an undeniable fact that teams learn and continually search for better solutions as they work. "Practices found in the FreeNest concept can easily be copied into the next work environment and thus be shared with new groups. Putting new processes into practice is much easier with small teams than with entire organisations. Information systems services have thus far not invested in customisation, which is important with an eye to the future, particularly in the case of product development. One strong indicator is DevOps thinking, which has gained prominence internationally, in which creators have very strong rights regarding their development environment. Although the FreeNest environment may, on first impression, even seem to be a rather cumbersome whole from the point of view of a small company, there are reasons behind this."

FreeNest programs as a working chain

As the product takes off, scaling the process is of primary importance. "Often, in a small company, fault reports are collected in the fault database and all development work relies on this database. A need for a wider selection of tools and processes is only noticed when the product grows," says Rintamäki.

Students at the JAMK summer factory

According to Marko Rintamäki, an equivalent problem often also arises on the configuration management side. "The company's version control is carried out in a very straightforward manner, until it becomes apparent that different versions of the software have to be delivered to the customers. Soon, the company has dozens of versions existing side by side. It's necessary to change version control and test that the version going to the customer is of a high quality. New components and processes are needed once more. You can go some of the way with separate tools, but a new software program may not necessarily fit into the chain. For this reason, we've developed a ready-made chain in which scaling will not be a problem as far as the components are concerned."

Cloud-enabled expansion

The FreeNest project platform is supposed to be used, for example, in the form of a cloud service purchased by the company. A whole server installation can also be set up within the company, which facilitates equivalent functionality when required. "Making use of cloud technology more widely alongside FreeNest is also an interesting area. An example of this is the strong integration with automated testing. At Nestronite Ltd, which we set up as a spin-off from the research work, we're interested in realising systems which match the wishes of the customers, to support product development. The concept can also be put together from other components when necessary. Expertise is always needed, though

it isn't free even in the case of open software. This is the basis of our business activity. Solutions are created as required for private, public and hybrid cloud environments," says Rintamäki, one of Nestronite's founders.

He explains that the FreeNest development platform is primarily intended for product development projects that need a longer product development cycle. "There's nothing to prevent use of the system in smaller projects too, but there are already competing solutions for that kind of work. Our aim is the process development of commercial software development, using open solutions within the company to help in this work."

Tiina Autio

More information about the FreeNest product:
http://freenest.org

More information about the Nestronite company:
http://nestronite.com

Designing energy management techniques for cloud infrastructures

Ericsson and Åbo Akademi University are involved with the project, which aims to bring innovation into the next generation cloud infrastructure by using globally competitive new technologies.

The project focuses on designing an energy manager prototype for multi-core processors, which is an extension of the Linux scheduler. The next goal is to extend these energy management techniques to cloud infrastructure.

The energy efficiency and power dissipation of data centres have become key issues for data centres. In 2007 the energy consumption of data centres in Western Europe was 56TWh. It is projected to increase to over 100TWh per year by 2020; this represents about seven times the capacity of the new Olkiluoto 3 reactor. Any reduction in the energy consumption of data centres will have an important impact on their power and cooling infrastructures and will reduce their operational costs and ecological footprint. Reducing energy consumption and improving resource exploitation can also enable expansion of data centre capacity and construction of new data centres to reduce pressure on the needed space and power supply.
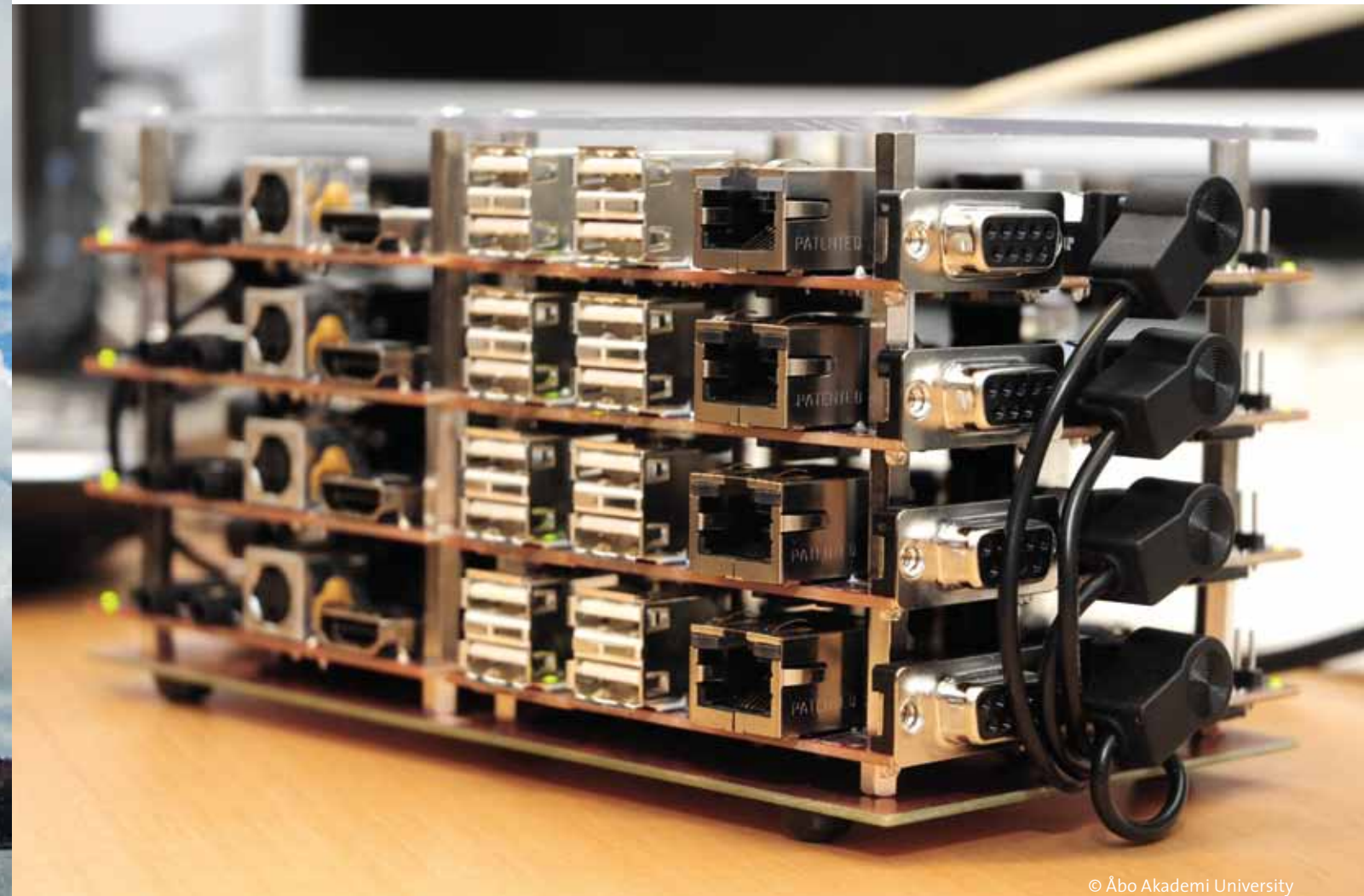
A team at Ericsson Cloud Program and Åbo Akademi University started a project in 2010 in which they carried out comparative studies of the energy consumption between ARM-based and conventional cloud infrastructure. The team evaluated the ARM Cortex processor architecture for the Erlang runtime system based on established benchmarks. Erlang is a general-purpose, open-source programming language and runtime system designed by Ericsson to support distributed and fault-tolerant applications.

"The finding was that ARM-based infrastructure could be between three and 11 times more energy efficient than conventional infrastructure, enabling a total cost saving for a data centre of 10 to 12.7 per cent," says **Sébastien Lafond**, a Senior Researcher at Åbo Akademi University.

© Åbo Akademi University

Sébastien Lafond says that the results that have been collected so far are very promising. 'I am very confident that we will reach the goal of contributing to the development of a new energy-efficient scheduler for Linux and a better understanding of the achievable cost reductions of ARM-based servers.

Photo: Ari Turunen

© Åbo Akademi University

A cluster of low-cost low-power single-board computers, which the project group built to demonstrate their work on energy management techniques for cloud infrastructures.

Photo: Heikki Sonninen

CSC – IT Center for Science Ltd. is to establish one of the world's most eco-efficient data centres in the Renforsin Ranta business park in Kajaani, on the site of the former paper mill of UPM in northern Finland. The data center will be built jointly by CSC and UPM, and it will provide a state-of-the-art environment for supercomputers, data storage, and other demanding IT systems. CSC is a member of the Cloud Software program.

"In the project we evaluated the obtainable costs and energy consumption reduction if energy efficient CPUs, such as ARMv7 based processors, were used in cloud infrastructure. The architecture of these processors, originally targeting smartphones and embedded systems, has been designed with energy efficiency in mind from the beginning. This makes these processors interesting candidates when looking for replacements to regular x86 architecture based server processors," Lafond says.

 Currently cloud infrastructures are over-dominated by x86 architectures.

"However, we can now see some new trends and future directions in cloud architectures with the use of non-x86 processors."

Energy-proportional computing as a goal

Energy consumption in cloud infrastructure is a current topic because the growing market for large distributed computing platforms has placed increasing demand on servers and data centres. There is currently a mismatch between the energy-efficiency characteristics and the behavior of cloud infrastructures as their most common operating mode corresponds to the lowest energy-efficiency region. The goal is to obtain energy-proportional computing. One of the main challenges is to dynamically adapt the capacity of the cloud infrastructure to the load fluctuation without introducing noticeable latency into the system.

Design of an energy-efficient Linux scheduler

"The energy-efficient Linux schedule we are developing could dramatically reduce the energy consumption of data centres"

In the project the team designed an energy-efficient Linux scheduler using the idle time per core as a load index to distribute tasks in a manner which will allow a dynamic scaling of system resources to match the current workload. This energy manager prototype for multi-core processors is an extension of the Linux scheduler, allocating tasks to the busiest non-overloaded core and leaving as many cores as possible unloaded in order to save energy with no, or minimal performance degradation.

"Because the workload on data centres is often variable and the typical CPU utilisation in servers is below 50% of its capacity, the energy-efficient Linux schedule we are developing could dramatically reduce the energy consumption of data centres," Lafond says.

There are few ongoing research activities to reduce the energy consumption of cloud systems on the level of the virtual machines.

"Our mechanism operates on the level of the operating system and is therefore complementary to energy efficient managers operating on the virtual machine level. Previous research has been done into the area of minimizing CPU utilisation and reducing the energy consumption of multi- and many-core processors. However, to our knowledge, using directly the scheduling and load balancing mechanisms of the operating system to allocate tasks to the busiest non-overloaded core is a new approach," Lafond says.

Knowledge for Finland

"Thanks to the Cloud Software program, this work could position Finland as the world leader in the technology foundation of cost-optimized data centres. It improves Finland's competitive position by enabling the establishment and expansion of data centres' capacity that would otherwise not be possible," Lafond says.

He believes that collaboration between universities and the industry based on new cloud business models and open cloud software infrastructures can lead to innovative solutions and technologies.

"I believe you need to think big, as the cloud will allow you to quickly scale up your services."

Tiina Autio

Photo: Jakke Nikkarinen

Other excellent examples of modern and eco-efficient data centers are Academica Uspenski Data Centre and the data centre of Cloud Software program member Tieto Ltd. in Espoo. Roughly half of the year the Academica data cetre can be cooled with cold sea water and the heat produced by the data centre is connected to the district heating network by Helsingin Energia. The thermal energy produced by the data centre will suffice to heat about 500 Finnish houses. In May 2010, the Uspenski data centre was granted the international Green Enterprise award.

Tieto's data centre uses a solution developed by Fortum. It is cooled by heat pumps and the heat are recycled for district heating in city of Espoo. The data centre produces thermal energy corresponding to the amount needed to heat approximately 1500 Finnish houses. Wired-magazine ranked Tieto's data centre among the nine most energy efficient data centers in the world in December 2011.

Interior decoration service moves to cloud service platform

VividWorks examined the functionality of their 3-D interior decoration service on the Windows Azure cloud service platform. Business function and technical changes were mapped out in the Cloud Software program. The company operates globally, investing in the US market in addition to Europe.

© VividWorks.

© VividWorks.

The VividPlatform interior design tool can also be used on an iPad. The program connects the real space and virtual furniture, by which means the furnisher can visualise their own room. The space is scaled to the right size by means of the marker used in the program. A camera within the system targets the marker, meaning that the pieces of furniture put down remain in the right proportions.

The InteriorPlanner tool can be used to place pieces of furniture virtually in the space desired. The floorplan can be constructed by the user on the basis of their home's dimensions. The location and dimensions of windows and the materials used for wall surfaces can also be defined. Furnishing can also be done on ready-made floorplans. The room is easy and quick to furnish.

VividWorks offers a focused interior design planning service for furniture manufacturers, distributors and consumers. With the aid of the company's VividPlatform tool, any customer can furnish their home virtually with a furniture store's products. The design is made on a floorplan or a photo taken of the room, in a 3-D environment. The furnisher gets to experiment with the products of Asko, Vepsäläinen, Isku and others in relation to the colours and dimensions of their home, on their own PC.

"The web-based service is always available and the interface can be grasped by anyone. The service makes the purchase decision of the end user easier", says **Miska Visuri** from VividWorks. The need and benefit are obvious. "People invest in decorating their home and purchase decisions are made more and more by means of the home PC. When so desired, planning the space and ordering the products can be done with the seller in furniture stores."

Cloud platform helps balance the load

The VividPlatform interior design tool is currently supported from Finland. The connections to Europe work but they get slower on crossing the Atlantic. Visuri says that the demand for cloud services comes from the nature of the application. The company has customers in nine and distributors in six countries.

"VividPlatform is a web-based service, so the cloud platform helps us in balancing the load. A situation like this might arise during one of our client's Facebook campaigns, for example. It's also an advantage to be able to define in the cloud platform in which countries the application is to be supported.

Just by ticking a box, our distributor starting up in Japan, or our furniture manufacturer seeking to break into the US market, gets connected without having to install separate servers", explains Visuri.

The company uses Microsoft technology at the moment and is therefore planning to move onto the Windows Azure cloud platform. "In functionality planning it was established that our tool suits this platform and that it can be used through different terminals. In practice, we are buying web capacity", Visuri says.

He says that with the Azure upgrades taking place, the company's own platform will only need small modifications. "The upgrades of Azure, such as the ones made to session sharing, are of benefit to us. The customer's session remains on one server for the whole period, and it's distributed to other servers when other customers use our service. A session with our product requires a lot of server capacity, including memory. The whole visual package is in there", Visuri explains.
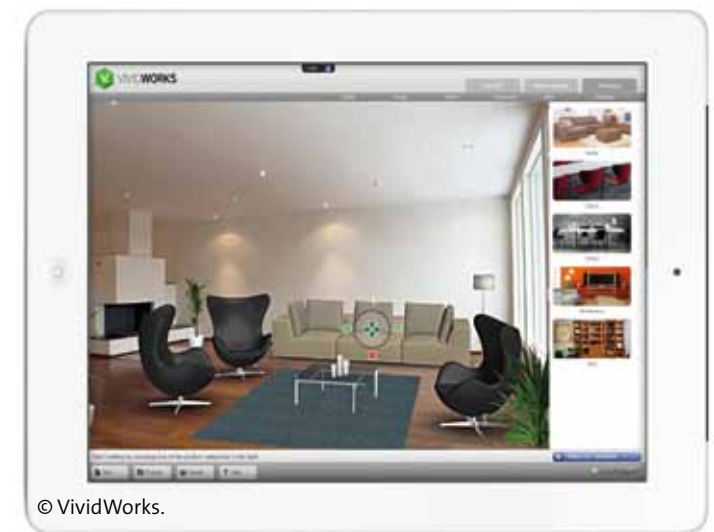
VividWorks is seeking to move to the cloud platform at the end of the year. One and a half years of research work, and of the project, still remain. During planning, the company will establish how its customer-specific software can be transferred into the cloud service: will each customer get their own cloud environment or will there be one large environment, from which a user-specifically customised solution is split off within the same single service?

Tiina Autio

© VividWorks.

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ProductComposer is the most important tool in the software. It enables the selection and configuration of almost any product. It can be used to build a modular sofa consisting of many parts, for example. Trying out additional sofa pieces is easy, with the program showing how the sofa can be expanded. Design is done in a virtual environment.

It's easy to furnish a room with the tools of VividWorks. Pieces of furniture can be turned around and moved freely inside the room.

VIVIDWORKS

Further information on VividWorks products:
www.vividworks.com.

Dissertation on Lean Thinking in Software Development

The aim of Marko Ikonen's (University of Helsinki) doctoral thesis is to improve the understanding of how Kanban impacts on software projects. The research is carried out in the area of Lean thinking, which contains a variety of concepts including Kanban.

Photo: Tekes, Helena Kalland

The history of software development in a somewhat systematical way has been performed for half a century. Despite this time period, serious failures in software development projects still occur. The pertinent mission of software project management is to continuously achieve more and more successful projects. The application of agile software methods and more recently the integration of Lean practices contribute to this trend of continuous improvement in the software industry. One such area warranting proper empirical evidence is the operational efficiency of projects. In the field of software development, Kanban as a process management method has gained momentum recently, mostly due to its linkages to Lean thinking. However, only a few empirical studies investigate the impacts of Kanban on projects in that particular area.

This article-type thesis conducts a set of case studies expanded with the research strategy of quasi-controlled experiment. The data-gathering techniques of interviews, questionnaires, and different types of observations are used to study the case projects, and thereby to understand the impacts of Kanban on software development projects. The research papers of the thesis are refereed, international journal and conference publications.

The results highlight new findings regarding the application of Kanban in the software context. The key findings of the thesis suggest that Kanban is applicable to software development. Despite its several benefits reported in this thesis, the empirical evidence implies that Kanban is not all-encompassing but requires additional practices to keep development projects performing appropriately. Implications for research are given, as well. In addition to these findings, the thesis contributes in the area of plan-driven software development by suggesting implications both for research and practitioners.

As a conclusion, Kanban can benefit software development projects but additional practices would increase its potential for the projects.

Marko Ikonen (University of Helsinki): **Lean Thinking in Software Develoment: Impacts on Kanban on Projects**

Thesis on Coaching Agile Software Development Teams

The master thesis by **Tatu Kairi** (University of Helsinki) explores the roles of the agile coach, defining it as mentoring which aims at intervening the normal work in a software project.

Agile software development can be described as philosophy of how software development is conducted. Short, timeboxed iterations with adaptive, evolutionary refinement of plans and goals form the central core of the agile software development. This loose family of methodologies is usually taught via coaching. It is not, however, currently clear in the literature what are the facets of coaching or even what are its goals.

Tatu Kairi explores the roles of the agile coach, defining it as mentoring which aims at intervening the normal work in a software project concerning either by the software development team, the organization of the team or the customers. The purpose of these interventions is to first teach how the agile software development is executed and later fine tune the performance of the team. This thesis continues with an examination on what principles should the coach employ with the software development team while coaching. Framework of this interaction is developed utilising constructivist learning theory as well as using relevant computer science literature.

To be able to evaluate, if the subjects of coaching are learning and how the learning is occurring, two metrics are presented as tools for the coach to employ critical self reflection. Sidky Agile Measurement Index (SAMI) is used to measure the level of adoption, while similar KMSmodel was created for the purpose of this thesis to profile on a more finegrained level, what the level of agility is composed of.

This framework is empirically tested in two case studies conducted in the Software Factory course at the Department of Computer Science, University of Helsinki. The course provides a realistic, industry- like setting where students form a team and complete a software development project for a real customer. As a participatory action research, the researcher acted as a coach to two new software teams, employing the theoretical framework and recording the events of the projects to a research diary and collecting metrics for the two models. The empirical results show that the proposed theoretical framework was successfully employed on the two case studies as well as initially asserting the expressiveness of it. This thesis concludes with a discussion of these results and the conclusions drawn of them.

Tatu Kairi (University of Helsinki): **Coaching agile software development teams: A case study from mentoring viewpoint**

Master thesis on creating a platform for user-generated content from mobile devices

Subhamoy Ghosh (Aalto University) studies in his thesis a mechanism by which content created by the users in mobile devices can be seamlessly to put in the cloud in a secure way.

The last two decades have experienced a surge in connectivity, and migration from stand-alone devices to a more connected environment. The internet has allowed all personal and professional devices to become more ubiquitous for every user. Consequently there is a change in the type of applications deployed on these devices. Ubiquitous operations are becoming more prevalent; technologies that utilize the Internet connectivity are replacing the older ones, which does not consider network connectivity in their operation. For example, communication, presence, location-based operations, seamless access to data over internet, are becoming more common and user-friendly.

The Cloud Software Program and Cloud Technologies in particular, intend to compile some best-practices and guidelines on cloud-based applications and efficient sharing of content and information for several users. One of the key intents of this thesis is to extend the definition of Cloud towards a concept of mobile cloud, such that several devices connected to the Internet including smartphones, and tablets can become active members of this system.

Current users own and use many network-connected devices. The user creates content using the default applications in these devices. One approach is to share and ubiquitously access the contents through a social media or content community. Such an approach will however make the users dependent on these communities or social media; moreover the user may also lose privacy of her content and even ownership of her data depending on the licensing policy of each community. In this thesis Subhamoy Ghosh argues that the contents residing in mobile devices should be available from anywhere, without any explicit user activity. That is, a user's content should get cloudified, while still remaining operable with the existing applications.

Ghosh presents as a proof of concept, a middleware that allows a user to use the existing applications uniformly, on local as well as remote content, and to also share the contents in a controlled way. The middleware hides all network activity from the user; it also makes the applications almost unaware while operating on a content residing in a remote location.

The middleware platform presented here might as well be used by other applications developed based on this middleware, to intelligently compose cloud-based mobile services.

Subhamoy Ghosh (Aalto University): **An Approach to seamlessy cloudify user-generated content from mobile devices**

Thesis on freemium pricing strategy published

The breakthrough of the SaaS (Software as a service) has led to the withdrawal of the traditional software pricing strategies and forced software vendors to change their established business practices.This literature review introduces the main features of the freemium pricing strategy and handles the opportunities and challenges of this strategy from the point of view of the SaaS vendor.

The results of the **Tanja Turunen's** study show that the freemium pricing strategy is a very powerful marketing tool. It can be used to attract attention of the audience and achieve a considerable market share. In addition to that, the freemium pricing strategy effectively improves diffusion to the markets and it is proven that company can benefit from the network effects of the software markets by using freemium.

The main challenges of the freemium pricing strategy are the suspicious attitude towards free products, the decrease of the appreciation of the product and the difficulty of achieving a considerable market share. Further, the success in versioning of the product and the conversion rate from users to customers are emphasized. Study shows that at the moment there is considerably little research about the challenges of freemium model.

Tanja Turunen (University of Jyväskylä): Freemium pricing strategy: **Opportunities and challenges from the point of view of SaaS vendors**

Report on initial design that threats mobile and embedded devices as cloud members published

The report presents an initial design that treats mobile and embedded devices as cloud members. The vision for the complete system is to enable availability of both content and services, regardless of location, as if the data were on the actual device.

The approach applied here for the system is based on a specific VisualREST server and a number of client devices, which share data in the cloud in a manner that is transparent to the applications running on the device. This is accomplished by using Filesystem in Userspace (FUSE) on the client devices, which is used to mount sets of remote files to local directories based on metadata stored on the VisualREST server. Furthermore, these directories, called "contexts", enable cloudification of files and sharing them. The software suite of the client device also contains applications that enable one-click availability of new multimedia content in the cloud as well as accessing these files thru contexts.

D1.3.4 Initial Desgin that Treats Mobile and Embedded Devices as Cloud Members

Report on user interfaces and interaction solutions published

The report introduces the user interfaces and interaction solutions that Cloud Software Program designed for cloud technologies. For each case the challenges faced in the interaction design and the solutions that came up with are described.

The optimal interaction solution is not about adding a nice user interface on top of the system like icing on the cake. In order to implement optimal interaction, the functionality and technical architecture of the system needs to be designed from the beginning to support easy and delighting interaction.

The report includes for cases: Universally Reachable Contact Book, EB Propsim F8, Flowd, and Cloud of Things.

Universally Reachable Contact Book describes a case where person's contact book information resides in the cloud. Through a participatory design and co-creation process, a user interface was ideated, prototyped, and tested.

EB Propsim F8 – User experience in a professional product describes the initial phases of user-centred design process, where the researchers aim to understand how the current solution is used by professional users, and what are the current interaction challenges. The data collection methods included contextual inquiry and expert evaluation methods, and the results were analysed against well-known usability heuristics by Nielsen.

Flowd, the music lovers' social network is a concept where fans can follow their favourite artist through cloud services. The main interaction challenges rise from integration of several existing services to the concept.

Cloud of Things describes two different solutions for enhancing people's shopping experience. The first one is an rfid tag -based prototype running on Android mobile device, allowing users to view and compare detailed product information e.g. related to sustainability of a grocery shop product. The other one is a "peek inside the box" concept, and augmented reality and context awareness system to view a 3D model of a product that is still inside a package.

D2.1.1 UX Challenges and Initial Interaction Solutions with Technologies in the Cloud

CoRED: Browser-based Collaborative Real-time Editor for Java applications

In the research article the CoRED editor and its extensions to other applications are presented. One of the main trends of software engineering is that the applications are moving from desktop to the web browser.

The trend has multiple benefits: Web applications are available globally and can be accessed using any up-to-date web browser. They are also easy and inexpensive to maintain. Updates are distributed automatically just by updating the application on the server. The web, and especially the usage of the cloud, makes it

possible for anybody with modest software development skills to create applications and then with small effort and relatively low costs to offer it to the global market.

An integrated development environment (IDE) is a software application that provides comprehensive facilities to computer programmers for software development. While the users of completed applications are heavily moving from desktop to the web browser, the majority of developers are still working with desktop IDEs such as Eclipse or Visual Studio. In contrast to professional installable IDEs, current web-based code editors are simple text editors with extra features. They usually understand lexical syntax and can do highlighting and indenting, but lack many of the features seen in modern desktop editors.

In the research article, CoRED, a browser-based collaborative real-time code editor for Java applications is presented. CoRED is a complete Java editor with error checking and automatic code generation capabilities, extended with some features commonly associated with social media. As a proof of the concept, researchers have extended CoRED to support Java based Vaadin framework for web applications. Moreover, CoRED can be used either as a stand-alone version or as a component of any other software. It is already used as a part of browser based Arvue IDE.

Janne Lautamäki, Antti Nieminen, Johannes Koskinen, Timo Aho, and Tommi Mikkonen (Tampere University of Technology), Marc Englund (Vaadin Ltd.): **CoRED – Browser-based Collaborative Real-Time Editor for Java Web Applications**

All-Encompassing Agility for Organisation

In his doctoral dissertation **Jarno Vähäniitty** bridges the gap between agile teamwork and comprehensive business management.

In his doctoral dissertation **Towards Agile Product and Portfolio Management**, Jarno Vähäniitty from the Software Process Research Group at the Department of Computer Science and Engineering in Aalto University bridges the gap between agile teamwork and comprehensive business management. Both practitioners and the academic research of agile development face a shared problem: how to combine even the most minute work items to the product visions and the overall strategic objectives of the company.

"There really is no link from agility to traditional management and product development models, so companies may find it difficult to embrace agile methods. It is a common fear that the operation may turn chaotic", believes Vähäniitty.

The heart of project management in agile methods is the backlog, a finely broken down and prioritised list of work, or 'user stories', which can be quickly completed. Problems occur, according to Vähäniitty, when this grass root level agility cannot find a connection to sales, product management or the long-term goals of the company.

"All the bits and bobs in the backlog must be tied to the decision-making and objectives in product management, but the connection has to go both ways – from overall business planning to everyday projects", emphasises Vähäniitty.

Together with his research group and students, Vähäniitty has developed Agilefant software tool which allows companies to get hold of and plan their operation on a single platform.

"Agilefant helps manage everything from a single project by one team to multi-project environments and all the way to strategic planning. Users are able to see for what goals and for whom their projects and user stories are carried out. It helps people from different organisational levels to speak a shared language", sums up Vähäniitty.

Vähäniitty can see agile methods suiting any kind of complex expert work where it is not feasible to plan everything from start to finish right away. Agility, however, sets a challenge to organisation and work cultures: the contents and progress of all projects should be open for everyone in the company to see.

"Adopting agile methods takes courage from companies and employees. The transparency required may at first be seen as intrusive control", admits Vähäniitty. In the future Vähäniitty expects to find a way to combine the further development of Agilefant with research.

"Agilefant is in use in dozens of organisations all over the world. If we can steal the time to write from all the funding applications for our research, with the data we have access to, there is no forum in our field on which we could not publish".

Jarmo Vähäniitty (Aalto University): **Towards Agile Product Portfolio Management**

http://lib.tkk.fi/Diss/2012/isbn9789526045061/isbn9789526045061.pdf

Take a tour and download Agilefant http://www.agilefant.org/

Report into Future of the Software Industry Underlines Importance of Business Ecosystems

In the future we will see business practice in the IT sector grouped into renewable ecosystems or value networks – the creation of which is not always straightforward. These insights can be found from the Strategic Research Agenda.

In the future we will see business practice in the IT sector grouped into renewable ecosystems or value networks – the creation of which is not always straightforward. Soon we will see the browser as a universal application platform, the cloud replacing the PC as the digital environment for users and mobile payment becoming commonplace. It follows that both the data reserves of cloud services and technology that processes and adds value to data are incredibly important areas of know-how. This is a fact underlined in the recent Cloud Software programme's Strategic Research Agenda, which succinctly outlined the future of the Finnish programming.

"In the future we are going to see an unlimited number of users and devices. Rather than having to pay for the programmes – which will be free – the user will have to pay for the services. Consumers are interested in educational programmes, information about how to stay happy and healthy, as well as travel services", says Professor **Veikko Seppänen** – the Academic Coordinator of the Cloud Software program.

According to the report, one of the strengths of Finnish firms and workers is their flexible and effective working methods, their excellent aids, coupled with the high level of know-how and training opportunities available. However, the development processes in cloud computing must become even quicker and even more flexible. In addition, the challenges posed by security, availability and usability of cloud infrastructure must also be met head on.

Internet and wireless technology link various sources of information to one another creating ubiquitous intelligence devices and smart environment solutions – the number of which is to increase exponentially. Billions of sensors and mobile devices – all being used in daily applications – require the cloud services offered over the internet.

There are many ecosystems already underway in the Cloud Software programme, with some at an advanced stage – and Tivit seeks to lower the threshold to participation in those ecosystems created in its research projects. By lowering this threshold, new ways of thinking and of testing projects and services are created, which in turn ensures that these projects and services have the maximum chance of reaching the market. With this in mind, Tivit recently launched a development laboratory for digital services – called Tivit Forge. The Forge development community is a unique setting – a place where full advantage can be taken of the very latest technology, and one which benefits from strong Finnish principles of free source code.

"Large companies also face the need to renew their ways of working as solutions move to the cloud, with their supply and uptake being a service – and not a product", says Seppänen. Although outsourcing has not marked the end of the IT market for Finnish players, the main problem remains the fact that there are few IT firms that serve the client directly. A range of cloud services – working in different sectors – is needed for users in small and medium-sized businesses. Indeed, products should not have to go through maintenance services or special training sessions in order to reach the service stage.

It is for this very reason that the ecosystem projects derived from Cloud Software programmes present a unique opportunity to add further life to the IT-sector market – with small and medium-sized businesses standing to gain the most from cloud computing solutions.

The Strategic Research Agenda (SRA) for the Finnish Software Industry (edited by Veikko Seppänen, Tommi Mikkonen and Pasi Tyrväinen):

Managing Innovation in the Cloud: Why a Product Variability Strategy is Critical?

Rapid delivery of products with appealing new features and technical complexity of products requires continuous improvement by companies to be successful, notes VTT's research summary.

There is increasing market pressure to augment the variability of software products. The success of a product's variability lies in its ability to adapt to changing user and market needs through change or customisation. More and more the enhancement of a product's adaptability (dependent on variations) is required for both forecasted and unforecasted needs to better serve multiple market segments, end-user groups and individual end-users. Product variability is not a new concept in Information and Communication Technologies (ICT) however its significance is changing in today's extreme customer-oriented markets.

This highly competitive marketplace has caused the focus in software development to shift from developing various technologies in products to the development of numerous variations and increased customisation in products. The new laser focus on the customer combined with cloud business has led to an environment where companies are compelled to search for new ways to differentiate themselves from their competition. This lean thinking has offered new opportunities in software product development that seek to avoid waste in development and deliver a product that meets unique customer requirements. At the same time, the introduction and management of different variations within multi-disciplinary products has increased the level of complexity of product development.

A software company seeking solutions to improve product variability management must look at product variability as a whole. This effort requires a comprehensive understanding of the company's strategic and operational environment including customer and market segmentation, current market conditions, future business prospects and the product development processes. Determining the product variability drivers and what product variability means in the each phase of the product life cycle, creates the comprehensive understanding on which a successful product variability strategy can be built.

Tuomas Ihme, Susanna Teppola, Minna Pikkarainen, Jukka Kääriäinen (VTT): **Managing Innovation in the Cloud: Why a Product Variability Strategy is Critical**

Master's thesis on open source and embedded systems published

The study aims to increase the theoretical and empirical understanding of open source business strategies in the domain of embedded systems by investigating open source business models, challenges, resources, and operational and dynamic capabilities.

It is increasingly understood across the domain of embedded systems that engagement with open source software development can provide various benefits. Open source can boost the formulation of new partnerships, provide new communication and recruitment channels, introduce efficient software development methodologies and formulate valuable resources and capabilities for companies. The growing global mobile phone market with over one billion units sold annually represents a particularly prominent domain for open source software, constituting opportunities for new entrants and new technologies. Linux, an open-source-based operating system, has been enabling well provisioned smartphones since 2002, and is currently being deployed by such companies as Nokia, Google and Samsung. Linux offers a lower software bill of materials (BOM) and faster time to market than many proprietary alternatives.

Ronnie Wong's Univeristy of Oulu) study aims to increase the theoretical and empirical understanding of open source business strategies in the domain of embedded systems by investigating open source business models, challenges, resources, and operational and dynamic capabilities. The empirical data were collected by an applied Delphi technique involving four case companies and a Delphi panel of 29 experts. This study proves the usefulness of an applied Delphi technique in the research area of the competitive dynamics of open source.

Several challenges, resources, and operational and dynamic capabilities of importance to business strategies in the domain of embedded systems could be identified. The results indicate that although the idea of exploiting free open source software is extremely attractive, open source on its own is not a business case.

In order to succeed with their open source business strategies, companies need to assess, i.e., recognise and comprehend the various challenges and risks of open source software development. It is also fundamentally important to have the means to generate appropriate dynamic capabilities to benefit from the open source phenomenon.

Ronnie Wong (University of Oulu): **Assessment of Open Source Business Strategies in the Domain of Embedded Systems**

Making use of calendars on mobile devices: a convenient way to schedule meetings

Aalto University's Software Business and Production Laboratory is developing a solution for utilising calendars on mobile devices to arrange meeting times.

Finding a time which is suitable for all participants is often difficult. The Preago software architecture and standards research group's project at Aalto University's Software Business and Production Laboratory is developing a solution for utilising calendars on mobile devices to arrange meeting times.

"We all use calendars on different devices and platforms. Therefore, a calendar system for automating meeting times must support many different devices and be integratable with existing calendars," says **Olli Korjus** of the Aalto University Software Business and Production Laboratory.

The scheduling system being developed in the project will enable users to agree upon meeting times using their own calendar software. When a user selects the time and the participants, the system will query participants' calendars in real time and find available times most suitable for each of them. The user can select the desired time from those options, after which the system will send the participants a confirmation of the meeting time.

The system also enables limiting available times as well as agreeing on a meeting time with a particular user group only during individually defined times. The same user can be queried for different times depending upon the type of meeting, for example an appointment with a customer, an internal company meeting or setting a time for sports with friends.

Photo: Ari Turunen

"Central factors in the system being developed are automation and ease of use, as well as privacy. The users do not need to share their own calendars with all participants, but rather can decide themselves which times the system reports as available," says Korjus.

The project first defined possible architecture solutions for the calendar system. After software architecture design, the next phase is development and implementation of a prototype.The project is in part related to software previously developed by the Software Business and Production Laboratory's Preago research group, which enables materials for meetings to be distributed through the cloud to participants' mobile devices.

The research project, part of the Cloud Software programme, is being realised collaboratively by Aalto University's Software Business and Production Laboratory's Preago research group and IPSS - Intelligent Precision Solutions and Services Oy.

The Software Business and Production (SoberIT), part of the Aalto University Department of Computer Science and Engineering, is improving the capability of the Finnish software industry to compete internationally by offering world-class education and research. Preago (Product requirements and architecture research group) is a research group which falls under SoberIT and focuses on software architecture and standards.

www.soberit.hut.fi http://cse.aalto.fi/research/groups/preago/

Master thesis on power efficient scheduling for a cloud system

Server centres consume more power than they have to. The aim of the thesis is to evaluate the available power-saving functionality.

A rapidly growing population, both online and offline, is creating an ever increasing demand for electricity. At the same time, an increasing climate awareness has caused a demand for higher and higher power efficiency in, among other things, computers. A lower power consumption is also more economical. The aim of **Joachim Sjöblom**'s (Åbo Akademi) thesis is to investigate the Linux Kernel and evaluate the available power-saving functionality.

With the Internet and networking slowly becoming ubiquitous server clusters receive more and more requests, which means they have to be expanded in order to handle the increase. The expansion again will lead to more power being consumed, both due to there being more electronics to be powered and because said electronics require cooling and ventilation. Solving this problem simply by increasing the amount of servers in the farms is not sustainable in the long run, as said farms dissipate a sizeable amount of power even when not under heavy loads. Currently these server centres, generally speaking, consume more power than they have to. This is partly because the power consumption scaling is not proportional to the current load over all the boards and processors in the system. That is to say, they have no way of turning parts of the system off if the part in question, based on the systemwide load, is not currently needed. This is where this thesis comes in.

In this thesis the Sjöblom proposes changes to the current scheduler. Sjöblom simulates scheduling for a number of different topologies and workloads using LinSched. LinSched is a user-space Linux scheduler simulator. Scheduling is one of the most complex aspects of the Linux kernel. Developing schedulers or changing policies and thereafter verifying their behaviour can be very challenging without the necessary experience. Fortunately there have been some recent advances in this area with the development of LinSched. This thesis presents results gathered for both the proposed scheduler and the current Linux scheduler and doing a comparison. The results indicate that the proposed scheduler has potential, but needs further work.

Joachim Sjöblom (Åbo Akademi): **Power efficient scheduling for a cloud system**

Master thesis on scalable distributed video transcoding architecture

Ixonos In **Tewodros Teneke**'s thesis a possible scalable distributed transcoder architecture is designed with the cloud in mind and its implementation performance for on-demand video transcoding is evaluated.

Nowadays video is being produced and consumed in more component representation formats, more device types and over variety of networks than ever. Meanwhile a seamless interaction between video content producing, transporting and consuming devices is required. The difference in device, network and video representation types results in the necessary requirements for a unified mechanism for video content adoption.

Transcoding is a process of translating or converting one coded signal representation to another. However most of the time transcoding becomes computationally intensive process. Due to this, one might need to utilize some sort of distributed computing approach to efficiently exploit the extra computational resources available among multiple machines, multicore CPUs, and distributed computing resources in a given facility, home or a dedicated cloud computing infrastructure. This distributed transcoding approach will then reduce rendering and start-up time of a video for on demand transcoding. Towards this goal, this thesis presents a distributed transcoding approach on how a set of heterogeneous processing and network capabilities can be utilized in an effective manner for the purpose of video transcoding.

Tewodros Teneke (Åbo Akademi): **Scalable Distributed Video Transcoding Architecture,**

Master thesis on simulating non-uniform memory access architecture for cloud server applications

Joakim Nylund's thesis evaluates and defines architectural candidates for cloud based servers. The research focuses on the interconnect and memory topology of multi-core systems.

As the core count in many architectures is constantly growing, the rest of the system also has to be updated to meet the higher demands the processing units set. One of these demands is the interconnect. As more processing power is available, the interconnect has to be able to move significantly more data then before. Another demand is the memory. With a traditional setup, there is only one memory available via one interconnect. When several processing elements are continuously asking for data, they are going to spend most of their time waiting, unless memory is not available in several places through several paths.

One specific memory design is investigated and the Linux support for the architecture is tested and analyzed with the help of a full-system simulator with modified memory architecture. The results demonstrates how available tools in Linux can be used to efficiently run tasks on separate CPU's on large systems with many processing elements.

Joakim Nylund (Åbo Akademi) investigates the Non-Uniform Memory Access (NUMA) design, a memory architecture tailored for many-core systems, and presents a method to simulate this architecture, for evaluation of cloud based server applications. The work also introduces and uses the NUMA capabilities found in the Linux kernel, and results from tests running on a simulated NUMA interconnect topology are presented and analyzed.

Joakim Nylund (Åbo Akademi): **Simulating Non-Uniform Memory Access Architecture for Cloud Server Applications**

Article on how Ericsson Finland adapted lean and agile thinking in software development

The article describes how Ericsson Finland changed a traditional functional silo-based telecom R&D center towards a Lean and Agile software development center.

The article describes how Ericsson Finland changed a traditional functional silo-based telecom R&D center towards a Lean and Agile software development center. It describes the major steps and methods utilized. Insights and lessons learned of the challenging transformation are also included.

Traditionally the telecom business has been standardization-driven and regulated on a national level. The development lead times have been long. The business landscape has changed leaving the major slow-moving vendors to struggle with the pace of the newcomers. Only recently the Lean principles and the Agile development philosophy has been recognized as the source for solutions to these challenges.

In 2008, Ericsson Finland started adopting Lean and Agile in software development at Ericsson R&D Center Finland, Mobile Media Gateway. The first concrete step was taken in autumn 2009; starting with one isolated cross-functional team performing as pure Scrum as possible. In 2010, Ericsson extended the change to involve the whole organization. It was realized early that this is a profound transformation of the way of working, the organization, the physical seating arrangements, the organisation culture and the competence profile.

With the help of Finnish IT coaching company Reaktor Ericsson utilised method called Scrum. Scrum is an iterative and incremental agile software development method for managing software projects and product or application development. In addition the Japanese Kanban-thinking was integrated to the software development. It is a method for eliminating unnecessary work.

Ericsson Finland has now cross-functional Scrum teams at Feature Development. Customer Service Request Handling, Fault Handling, Feature Integration and System Integration activities are performed by Kanban teams. The first release project with the new way of working was established in 2010.

First-hand experience from the Scrum teams, how the inter team cooperation works and how the Scrum framework scales, is the real source of learning. Only through large scale experience it is possible to form an understanding of how well the new way of

working is tuned into our situation. Kanban and Scrum are good methods if supported by the right thinking and understanding of the unique context.

Kirsi Mikkonen, Marko Seikola, Ari Jouppila, Christian Engblom (Ericsson Finland): **How we learn to stop worrying and live with the uncertainties**

From intelligent spaces to social machines

The In a joint project between Nokia, Aalto-University and Tampere University of Technology, the social behaviour of intelligent machines is researched.

What if machines would communicate as humans? Greet each other, learn from experience and in certain situations be able to provide situation suitable user valued services? In a joint project between Nokia, Aalto-University and Tampere University of Technology, the social behaviour of intelligent machines is researched.

The modern day human has an impressive amount of intelligent machines. Intelligent machines and so called intelligent spaces make it possible to provide the user in certain locations functionalities and services. In the corporate project of Nokia, the boundaries of intelligent spaces are stretched even further.

"The idea of intelligent spaces is based on that own machines in a certain location is connecting to an intelligent space", says Nokia Researcher **Tapani Leppänen**.

"We study a situation where machines in close physically proximity could create a community together, with same type of intelligence. Then we can talk about a mobile, location independent intelligent space which is able to adapt to its environment", continues Leppänen.

Particularly how the users react to machine produced speech is tested in the research. In its simplest form, the speech might be a machine greeting when it comes across another machine. The greeting will always change according to who is greeted and in what situation. The machine develops its own personality when the user adjusts the machine settings and the machine learns from experiences.

The focus of the research is to create an experience rich, entertaining and pleasant user experience. Intelligent machines

can create for example a home environment which offers learned services to certain situations. For example a TV which is programmed to function as a monitor, could suggest to always switch on the monitor when a photo-screen is enabled on another machine.

One possible application could be sponsored advertising where for a short time period, live "slogans" would be utilized in the communication between the machines.

Technically this is a case where cloud calculation is brought to terminals and their configuration and optimization. All the information which the system needs is in the cloud.
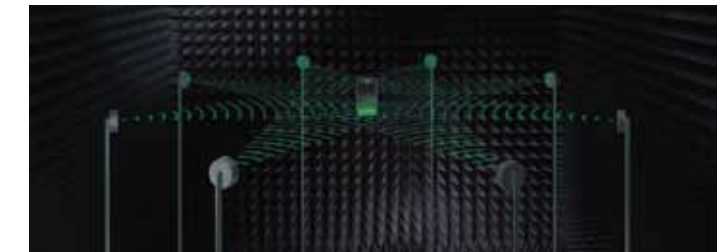
"In the single consumer's view, the data and applications are already in the cloud, but in this project, the aim is to outline how several machine applications can be transferred to the cloud, their interaction and behaviour, particularly in the mobile context", clarifies Leppänen.

Linking cars to cloud services

Elektrobit has the goal of developing new business models which make use of cloud computing technologies. In particular, new possibilities for linking cars to cloud services are being investigated.

Elektrobit Wireless is taking part in a number of collaborative projects with Cloud Software Finland. Cloud technology facilitates many new business possibilities from the standpoint of both technology and earnings logistics.

"The value of open architecture products has traditionally been in their electronics and open software," says **Hannu Hakalahti**, Managing Director of Elektrobit Wireless. Subsequently the focus has moved to services and applications. "In practice, this means that new business and earnings models must take this value change into consideration even more," he continues.

Elektrobit is collaborating on a project with the Oulu Business School to develop new ways to make cloud-based Internet and mobile services available for cars. According to Hakalahti, the most popular services used in cars at the moment are real-time traffic information, navigation and Internet radios. "As telematics technology for cars develops, cloud services offered for them will also develop rapidly," says Hakalahti. "Cloud services will include applications for driving assistance and increased safety, entertainment applications, applications related to car maintenance and social applications related to driving," he says.

In addition to technical issues, development of cloud services for cars requires clarification of business issues and earning models. These questions are being investigated in collaboration with the Oulu Business School. Jenni Myllykoski, a researcher at the Department of International Business at the University of Oulu, and the department director, Petri Ahokangas, are working together with Elektrobit on scenarios for business environments, alternative business models and analyses of customer needs.

The collaboration takes place in monthly workshops, where business models are further developed. The Oulu Business School has created an entire process and tools for the workshops which can be used to develop and assess new models. A preliminary version of a business model can be built quite quickly, even during one workshop, so the results can be continuously utilised and worked on further as part of business development.

Video formats brought to the screen using video converter service

Making thousands of different video formats compatible is a knotty task for which Packetvideo and Åbo Akademi University are searching for a flexible solution.

Difficulties with the compatibility of various video formats are a good example of a problem which is particularly noticeable and irritating to users if it is not working properly. Making thousands

of different video formats compatible is a knotty task for which Packetvideo and Åbo Akademi University are searching for a flexible solution.

As different kinds of smart phones and multimedia messaging devices become more common, how well the devices are able to communicate with each other is becoming more and more important to the user experience. For example, a significant part of a good user experience with videos includes the capability to view them on different receivers; television, tablets or smart phones.

In a joint project as part of the Cloud Software Finland programme, Packetvideo and Åbo Akademi University are working on a cloud technology based video conversion service, in other words software which automatically recognises incompatibility of a device and video format and converts it instantly into a compatible format.

"The software makes use of all devices in the local network or in the background which are part of the video conversion service," says **Jarno Kallio**.

"At the same time it makes an intelligent decision about whether to upload the video to the cloud for conversion or just to a local server."

Creative integration of new cloud services

Utilising and integrating Internet or mobile services based on public information sources and commercial cloud technology enables creating services which are useful for both service providers and Finnish consumers, who have access to localised applications both through the Internet and by mobile. Utilising and integrating Internet or mobile services based on public information sources and commercial cloud technology enables creating services which are useful for both service providers and Finnish consumers, who have access to localised applications both through the Internet and by mobile.

The Cloud Software Finland programme is developing various areas of cloud services, an important part of which is mapping out new business possibilities. Sometimes creative integration and localisation of existing services is more fruitful than challenging established market leaders.

VTT's Senior Scientist **Jukka Ahola**'s idea was to build mashup applications, in which individual components are independent of each other but when stitched together through software interfaces become more than the sum of their parts.

"In practice, we have tested product concepts with various commercial cloud services, which have been linked to public information sources and stitched together with web connectivity and mobile software using their own code. For example, we linked almost real-time car park and weather information to Google Maps street views using the City of Oulu's interfaces," says Ahola.

The idea of combining and utilising mashups and software

interfaces was born when Ahola researched trends and up-and-coming technologies on discussion sites popular among programmers. His idea was to pick out existing, generic building blocks and localise them for the Finnish market. The integration benefited everyone: Service providers gained more users, and Finnish consumers received better services localised for Finland.

Applicatios were part of the research which supports EB:s projects (EB Vehicle and EB Propsim).

An open service ecosystem supports networked business operating models

Businesses' information systems do not meet the demands of networking and service ecosystems. A new project is looking for partners in development of tools as well as end users to pilot-test tools in their own business networks.

Business is based more and more on networked operating models, which allow companies to better focus on their core business. However, businesses' information systems do not meet the demands of networking and service ecosystems.

"Current tools and processes are not sufficient in open and continuously changing value networks. Instead of individual service ecosystems developed for specific cases, we need standardised, industrialised platforms which can be configured and managed," says docent **Lea Kutvonen** of the Department of Computer Science at the University of Helsinki.

The research group led by Lea Kutvonen is developing infrastructure services and programming tools for an environment in which the use and management of service networks, integrated services and agreements regarding use of services are central. The goal is to offer a reference framework for defining a sustainable and open service ecosystem.

"Important factors in service ecosystems also include building trust, protecting privacy and managing risk," Kutvonen says.

Methods and tools being developed in the project support and speed up making business decisions in open service ecosystems. In addition, they facilitate inclusion of small and medium-sized businesses in service ecosystems as well as collaboration between cloud platforms.

The project is developing methods to support automated verification of semantic and pragmatic compatibility. The research group is also producing prototype tools for effective service development. In addition, the goal is to realise a service ecosystem infrastructure which enables integration of services, collaboratively realised service development and innovation as well as a service development methodology which can be utilised worldwide.

The project, which is part of the Cloud Software programme, is currently looking for partners in development of tools as well as end users to pilot-test methods and tools in their own business networks.

Cored – Communal Software Development

Tampere University of Technology has developed a communal programming platform called Cored.

Tampere University of Technology has developed a communal programming platform called Cored, which makes browser based software development possible over the Internet, without installing development tools to your own computers. With the help of Cloud services, programming can be done in a communal way and without unnecessary preliminary work phases.

Cloud services over the Internet, change and make working easier in comparison to the traditional way of managing your own computers in several ways. The Internet environment can remove the need to install and manage software and development tools for a single user. In this way, the actual work can be accessed easier and faster. The Internet makes also the communal way of working and social software development possible. These possibilities are currently not utilized in software development to their full potential.

The Cored programming editor is connected as a Vaadin component. The software utilizes the Java development package, and with this the possible coding errors can be verified. The possibility to have several real time users has been realized with a purpose built algorithm. To present the software, the University has also created a development tool (IDE), which makes code commenting possible by using the developer aimed chat and Facebook integration.

Cored is linked to the Arvue development platform (IDE), created by Vaadin Oy, and it has been developed in cooperation with Åbo Akademi and JAMK University of Applied Sciences. Working is made possible by using the Cloud Software Finland's program which is one of TIVIT Oy's top projects to promote the Finnish information technology development. The program combines the know-how of Universities and corporations in the research and development of cloud technologies. The program focuses for example on user experience, data security and system openness.

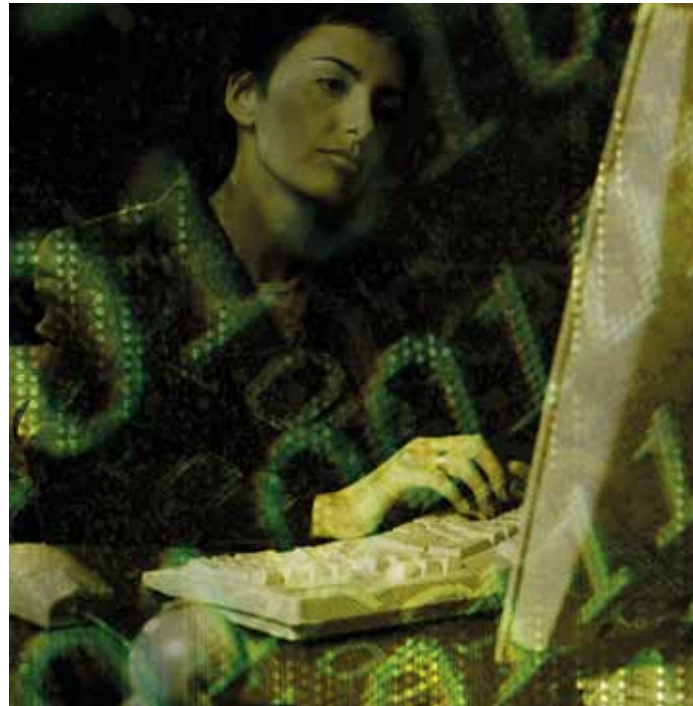## Expansion of the decentralized software development research network

The Universities of Oulu and Helsinki, together with Tieto Ltd, have combined their strengths in the Software Factory.

The Universities of Oulu and Helsinki, together with Tieto Ltd, have combined their strengths in the Software Factory, to support decentralized software development. There are international universities also involved in the start-up, whose contribution might be important in the future.

In the Cloud Software Program, the objective is to develop among others, the agile models and operational preconditions of software development. In of the related operational models is the decentralized software development, which is developed and tested among others in the University of Oulu by using the Software Factory concept. These software factories are

cooperation environments for researchers, students and corporations, who serve both the software production research and training, between both the Universities and corporate life.

The decentralized software development aims to achieve more efficient and better results by decentralizing the software development between groups which are geographically located in different locations, where each is focused on their own core competence area. By distributing a complex project to smaller parts and decentralizing its production between several teams, the best possible know-how of different sectors is ensured between groups. Decentralized software development can also be needed in subcontracting situations and in projects where cooperation is done between different institutions and partners.

The decentralized software development looks promising, but its realization is still challenging and examples of failure also exist. So there is still a lot of work in the research and tool development. Kari Liukkunen from the University of Oulu tells about the research and test work done in the software factory to find functional software development models.

"The objective is to develop decentralized software development models, which could in the future after the pilot phase, be transferred to corporate use. "

To help the local decentralization, also other than Finnish Universities are attracted as cooperation partners. Among others, the Ostrava University and Ostrava Technical University are joining the cooperation network and their operations can be brought to a concrete level already in the autumn of 2012. Also the project partner Tieto Ltd. has operations in Ostrava.

Tieto invests in open source code solutions - partnership with Vaadin

Tieto will adopt Vaadin's open source code technology

Tieto and Vaadin have signed a solution partnership agreement. Tieto will adopt Vaadin's open source code technology. The technology helps to build user interfaces for systems and facilitates their long-term maintenance. The technology is most suitable for building Web-based administration and ERP systems with long system life cycles.

"We want to continue investing in open source code solutions, because there is demand for internal and external portal implementations based on open source code technologies in several industries. Vaadin is a growing technology platform that allows us to provide more options in regard to technological solutions and consequently create savings for our customers. Our customers can also modernize their existing systems to better meet the needs of the end users," says **Vesa Rantala**, Vice President, Business Platforms and Solutions, Tieto

"Tieto is our largest partner in Finland. Through this cooperation Tieto can provide expertise in Vaadin for large system project deliveries. It is important for us that Vaadin's expertise is now also available for building user interfaces for large systems," says **Sami Ekblad**, Partnership manager, Vaadin.

Vaadin is a widely used and ascending technology platform for building rich Internet user interfaces. The partnership strengthens Tieto's expertise in portal applications, for example, in the Liferay open source environment. Ready-made component libraries and solution models also improve Tieto's efficiency and competitiveness.

VTT and F-Secure develop new data security solutions together with the users

F-Secure's Home solution product was examined by Owela, Internet services developed by VTT.

In the cooperation between F-Secure and VTT, the objective is to create even more user based data security solutions. The purpose on new data security solutions is to create added value to the customer. In these developments, the research information which is collected directly from existing and potential users is used.

One of the interesting product development possibilities is visible in the new possibilities of cloud services. According to F-Secure, one way of modifying the services to be even more user friendly is to change the delivery methods of the data security solutions. The "Safe Home" product of F-Secure makes possible the data security services to be offered through the network service provider and user control (Parental control) for the entire home network. There might not be a need for separate equipment or tools, but the data security solutions can be purchased as a part of a safe network environment.

To be able to better understand the added value for the user, the F-Secure's Home solution product was examined by Owela, Internet services developed by VTT. Owela is an innovation room where users, developers and researchers can meet and share their opinions and experiences to support the product development.

The research work of VTT was realized flexibly in parallel with product development. The sample size of the five week long research was a group of 70 users on the Owela platform. The Internet discussion form material was completed with information generated from questionnaires. The result was several remarks which have a direct effect in the product development before actual publication.

In the Cloud Software Finland program, the know-how of the universities and corporations in the different sectors of the centralized cloud services are combined. The cloud technology can create new types of operational possibilities for corporations and in this way make the users life easier.

Further information: http://owela.vtt.fi/owela/introduction/

Goods Spotter: Consumer values as the basis for developing cloud services

The value importance related to shopping experience in everyday life was studied by 60 individual values.

VTT strives to forecast the development of the cloud services by using user profiling. The now developed profiling method is value based, and the value importance related to shopping experience in everyday life was studied by 60 individual values. The value based personality method was used in developing the "Goods Spotter" application from Tieto.

The development requirement of cloud services is studied based on user values, so that future services and applications would correspond with the real needs of everyday life. At the same time support is received to the product development of companies. The cloud is a web based infrastructure which offers software and services through the Internet in a user friendly way, in real time, affordably and safely. The user does not have to install any software or acquire any servers or manage these. The cloud services can physically be used wherever and through different equipment.

In the study done by VTT, the importance of 60 single values was studied in connection with the shopping experience. Additionally the shopping behavior and sustainability related attitudes were studied. In a fast changing environment, also the needs of the people change fast, so through understanding the value world of people, the aim is to base the software service development on a more solid foundation.

As the research material, questionnaire answers from 1,000 consumers were gathered from Finland and Sweden in September 2011. The researchers profiled seven different personality descriptions based on the answers related on the values, which can be used as the foundation for service development. The personality descriptions can also be used in addition to product development in planning marketing communications to different groups and in supporting companies in their strategic decision making.

The Cloud Software Finland project which aims on developing the cloud services is a program made the Technology and Innovation in the Field of ICT (TIVIT) is a program which centralizes top know-how and combines the know-how of researchers and business life in researching cloud technologies and developing business pilots. The objective of the program is to raise Finland to the top of software development and focus on for example on user experience, data security and system openness.

http://www.tieto.com/what-we-offer/it-services/business-intelligence/sustainability-intelligence/goods-spotter

Freenest: Jyväskylä University of Applied Sciences developing open source code skills in a cloud

Using a lifecycle management tool called FreeNEST, open cloud technologies are being developed at the Jyväskylä University of Applied Sciences (JAMK).

One of the central development aims of the Cloud Program is open source code software and technologies. With the right amount of creativity, cloud research and studying cloud-related technology can also be done on a small budget. JAMK has developed its own test cloud, the "Junk Cloud", from recycled computers using students' efforts. "The Junk Cloud is a demo platform, which enables simulation of a small data centre. It is used to test more effective ways to publish cloud services and develop cloud software," explains Ilkka Turunen, project expert at JAMK, who built the first version of the Junk Cloud.

In order to develop cloud services, a functional cloud infrastructure is needed. A so-called Cloud Stack refers to an infrastructure encompassing the entire cloud solution, from the physical server level (infrastructure) through technical platforms to the software level (Software as a Service). Users generally see only the top level, the so-called Software as a Service (SAAS). Servers and connectivity tools (Infrastructure as a Service, IAAS, and Platform as a Service, PAAS) can be physically located anywhere.

Finnish Cloud Stack architecture has been assessed and developed in collaboration with various universities and businesses. **Ilkka Turunen** from JAMK says that particularly researchers from Aalto University and the University of Helsinki have worked diligently on infrastructure evaluation. Development work on an open Cloud Stack has led to extensive expertise in the field in Finland. At the moment, the Cloud Stack is using an open source code cloud system, OpenStack, developed by NASA in collaboration with Rackspace.

FreeNEST is a project management tool which enables management of the product development process throughout its lifecycle, from designing the service to maintaining it. FreeNEST

is well suited to management of the lifecycle of cloud services. The original developer of the FreeNEST concept, **Marko Rintamäki**, contributed this open source code tool to support teaching at JAMK about five years ago. FreeNEST is currently being used together with the OpenStack based Junk Cloud for various product development solutions by partners in the Cloud Software Finland Program.

JAMK's summer project includes development of protocols and technologies related to Linux Debian packages to better meet the needs of cloud services. Among other things, development of packages is related to Vaadin Oy's Arvue.com service, which is currently under development. "At this time 26 students working with the Junk Cloud are further developing FreeNEST through various business cases which have come to light during the Cloud Software Program."

In addition to open source code software and operating system development, students are gaining valuable experience with different types of practical product development projects. Ilkka Turunen emphasises that nimbly adaptable product development methods are an important area of study and learning made possible by the cloud.

Researching genomic data material by using cloud computing

Aalto University and CSC - IT Center for Science have developed as a part of the Cloud Software project solutions based on cloud computing to utilize genomic data material efficiently.

To research genomic data material, like databases which describe peoples genetic, require a powerful research infrastructure. The new measuring equipment technology has challenged the performance of the information technology infrastructure and requires a new kind of cloud computing tool to be developed.

Aalto University and CSC - IT Center for Science have developed as a part of the Cloud Software project solutions based on cloud computing to utilize genomic data material efficiently. In cooperation developed Hadoop-BAM and SeqPig software help the researchers to analyze enormous amounts of data material and thereby accelerate the working and makes completely new types of data analysis possible.

As the Molecular biology and medical research develop continuously, also the research environment has to be up-to-date. The next generation sequencing equipment produce an enormous amount of measuring data which traditional software can no longer process. Therefore the cloud computing methods have been raised to an important position which makes data distribution possible to a large number of calculation servers. Especially the map-reduce computing model and the Hadoop-technology source code realizing it are essential in the modern massive distributed computing.

The Hadoop-BAM and SeqPig software are developed in the project which makes it possible to process the data produced from

the sequencer equipment efficiently in the Hadoop environment. In the test the programs scale well to tens of calculation servers and up to 180 processor cores. The article reporting of the Hadoop-BAM program has been published in the esteemed Bioinformatics magazine (http://sourceforge.net/projects/hadoop-bam/). Also visualization tools have been developed in the project as a part of the CSC developed Chipster software, so that the large amounts of computing results can be easily illustrated and reviewed.

The developed methods and software have already attracted international attention. The Hadoop-BAM has been taken into use in the known Institute of Systems Biology, where it has been used to process extensive Cancer Genome Atlas material. The SeqPig software has been developed in cooperation with the Italian CRS4 calculation centre.

The Cloud Software Finland of Technology and Innovation in the Field of ICT (TIVIT) is a program which centralizes top know-how and combines the know-how of Universities and companies in researching and developing cloud technologies.

Additional information:
Hadoop-bam program: http://sourceforge.net/projects/hadoop-bam/
Chipster software: http://chipster.csc.fi/

User Experience Design Goes Agile in Lean Transformation - A Case Study

The article describes the results of a single-case case study, exploring the role of user experience (UX) work in agile software development. It was nominated for Best Paper Award in Agile 2012-conference.

The case study company is a large multinational telecommunication company undergoing a lean transformation process. In this case, lean transformation includes the adoption of agile software development practices. Transformation to agile practices had taken place one year prior to the analysis. The analysis is based on documentation analysis and semi-structured interviews of seven software development professionals. The results show that there were difficulties integrating UX design and software engineering work in an agile and iterative manner. The transition process succeeded in shifting UX and related documentation to a central planning role. The roles of the UX designers in the teams were still under re-definition. There was also a clear need to establish new ways of collaboration between UX professionals and software designers.

Minna Isomursu, Andrey Sirotkin (VTT Technical Research Centre of Finland, Oulu) and Petri Voltti, Markku Halonen (Nokia Corporation, Oulu): **User Experience Design Goes Agile in Lean Transformation - A Case Study**

The paper was presented and nominated for Best Paper Award in Agile 2012 conference: http://agile2012.agilealliance.org/ and is available for electronic downloading through IEEE Xplorer service.

Dissertation: Measurement-based value alignment and reasoning about organizational goals and strategies : Studies with the ICT industry

Mashups, Vladimir Mandic's dissertation focusses on failures of software projects. Software and ICT companies fail due less to technological factors than socioorganizational factors, among which the most common is unrealistic goals and objectives. The socioorganizational factors are present in companies and organizations of all sizes. Organizations need to know whether their goals and strategies are working and whether the strategies are effectively providing a reasonable return on investment for the effort that is being applied, i.e. to understand how valuable they are for the organization. In addition, organizations need to recognize what the risks are in achieving those goals and evaluate their probability. And, when goals are set properly then they have directive and energizing functions, they tend to utilize available resources better and serve as activators of cognitive processes and knowledge sharing cycles.

In this dissertation the GQM+Strategies approach was used. The approach was designed to help organizations to align goal-driven measurement schemes, i.e. GQM, with organizational goal hierarchy. The extensions developed in this dissertation (i.e., the solution proposed here) evolve the GQM+Strategies approach by providing an organization with capabilities to: (1) apply the work of value-based software engineering to directly address the return on investment (ROI) of their goals and strategies via evaluation of the costs and benefits of the goals and strategies chosen, (2) calculate a set of earned value metrics that allows organizations to effectively monitor the implementation of the organizational goals and strategies, (3) identify the risks associated with not achieving various sub-goals in a grid by analyzing goal risk exposures and acceptable risk levels, and (4) assess the threats of risky goals on other goals in the grid via evaluation of goal dependencies using the formal goal-strategies-goals models.

The GQM+Strategies approach was piloted in four different organizations involving more than 60 participants. The feedback from the participants was used to identify the research questions posed in this dissertation. The research approach (solution development process) adopted the design science framework and utilized analytical and empirical paradigms in different phases of the solution development. The analytical paradigms were used for solution development and evaluation, while empirical paradigms where used for evaluating certain aspects of the solution.
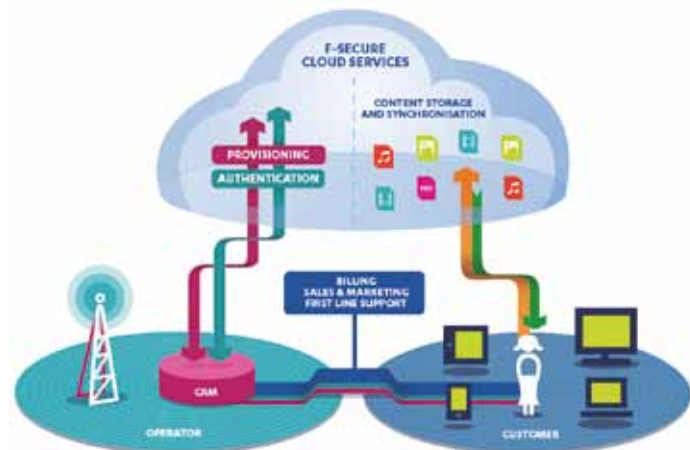
Vladimir Mandic (University of Oulu): Measurement-based value alignment and reasoning about organizational goals and strategies : Studies with the ICT industry

http://herkules.oulu.fi/isbn9789514299087/isbn9789514299087.pdf

Cloud news

Content Anywhere - a new cloud service

F-Secure's Content Anywhere is a simple and secure cloud service that backs up the content from user's devices and allows the user to access the content from any device, any time.

F-Secure's Content Anywhere synchronizes a user's content in the cloud, making it accessible on any device – including PCs, smartphones, tablets and connected digital TVs – anywhere and at any time of the day. Consumers' ease of use is paramount when accessing their content from more than one device, therefore F-Secure has been following similar design conventions and visual language across all connected devices. Operators will be able to offer a safe personal cloud to their customers, on which to save, sync and share their digital content.

F-Secure has been developing cloud-based security software for several years. From protecting devices against malware F-Secure is currently expanding to protecting the irreplaceable content of people. In the course of developing Content Anywhere, F-Secure organized a long-term user study with a group of friendly users, who used the new cloud service with their devices.

The new service was benchmarked against earlier Online Backup service, to validate the new value proposition, users' mental model, and user experience design conventions, and to identify areas for further improvement. The long-term user study was supported by an online focus group setting that allowed the development team to carry out an intimate dialog with the test users, to learn from their expectations, to gather their feedback, and to probe specific topics that were identified during the research project.

Cloud Software Program has contributed in the R&D of F-Secure's Content Anywhere.

http://www.f-secure.com/en/web/operators_global/content-anywhere

http://www.f-secure.com/en/web/operators_global/content-anywhere-information

http://herkules.oulu.fi/isbn9789514299087/isbn9789514299087.pdf

Ixonos takes the user experience of production-oriented cloud services to a new level

The online self-service tool allows Ixonos' cloud service customers to plan, purchase and independently deploy complex server and infrastructure environments within minutes, a world first.

Ixonos developed Ixonos Elastic Cloud especially for demanding production of online business.

The service is based on Ixonos' experience in maintenance and development of global digital services, and it is certified by Red Hat. Several leading European online service providers already benefit from the reliability and user experience of Ixonos Elastic Cloud. Ixonos' secure data centres are located in Finland and they serve more than 500 million Internet users monthly.

"This new self-service tool will further speed up online service development", notes **Jari Kekkonen**, Director, Business Development at Ixonos. The tool enables customers to ensure that the right amount of resources is available throughout the lifecycle of each application, and it additionally allows costs to be tracked in real time. "Our customers will also be able to expedite their production processes and, above all, to save on infrastructure management costs", Mr Kekkonen continues.

"Ixonos Elastic Cloud is priced on a usage basis, and it uses VPN or MPLS private network technology to securely integrate with the customer's on-premise data centre", mentions **Janne Luntta**, VP, Cloud & Hosting Services at Ixonos. "The benefits of the service are available to all customers, regardless of their present data centre situation", Mr Luntta adds.

http://www.ixonos.com/online-solutions/ixonos-elastic-cloud-services/

Cloud Software Program has contributed in the research and development of Ixonos Elastic Cloud.

The Communications of the Cloud Software is a new journal by the Cloud Software Finland team. It is aiming at advancing and communicating the scientific and industrial advancement in cloud computing technology, methodologies for developing cloud services, and in business of cloud computing. Compared to traditional journals with exhausting review cycles, this journal facilitates disseminating your original contributions on the topic within days. And it empowers to discuss on the viewpoints, findings, best practices, details and opinions.

Communications of the Cloud Software is available at http://cloudsw.org

The on-line journal will be published quarterly by the Cloud Software Finland team and the University of Jyväskylä. It is an open access publication, enabling high impact among those interested in the developments of Cloud Computing.

For scholars, the Communication of the Cloud Software offers two types of publishing opportunities for research articles:

1. Discussion Papers; After passing the editor's access-review, the contribution is published as a discussion paper. This type of publication enables disseminating your novel ideas fast. Discussion papers will be commented publicly on this CCS website.

2. Peer-Reviewed Articles; Discussion papers shall be appointed referees, which provide insightful comments and critique about relevance and rigor of the article. The comments from the general public received through the website should also be considered. Once the improved paper is of expected quality, it will be published in the issue of CCS.

For industry experts and practitioners, CCS offers a medium to bring into spotlight your excellence for example in business performance, technological advancements, superior user experience, and use of agile methods.

Proudly part of the Finnish Cloud Software Program

Aalto University

Established in 2010, the Aalto University is a new university with centuries of experience. The Aalto University was created from the merger of three Finnish universities: The Helsinki School of Economics, Helsinki University of Technology and The University of Art and Design Helsinki. The Aalto University is strongly future-oriented while, at the same time, building on the combined 300-year-history of three highly regarded universities. Only the best students and researchers are admitted to study and conduct research at the Aalto University.

CSC – It Center For Science

CSC — IT Center for Science Ltd is administered by the Ministry of Education and Culture. CSC provides IT support and resources for academia, research institutes and companies.

Digia

Digia's driver is the desire to succeed. It offers its customers success, through inventive solutions that enhance operational efficiency, improve user experiences and increase sales. Digia helps its customers become forerunners. With almost 1,600 top experts, Digia enables its customers to benefit from changes in the market, making the future a mutual success.

EB

Elektrobit develops advanced technology and transforms it into enriching end user experiences. EB specializes in demanding embedded software and hardware solutions for the automotive industry and wireless technologies.

ECE

ECE Ltd is a technical leader in the field of cellular planning and optimisation. We provide services and software products along with global solutions.

EXFO NetHawk

EXFO NetHawk provides its customers with powerful, scalable and easy-to-use tools and applications for telecommunications network testing.

Ericsson

Ericsson is the world's leading provider of technology and services to telecom operators. Ericsson is the leader in 2G, 3G and 4G mobile technologies, and provides support for networks with over 2 billion subscribers and has the leading position in managed services. The company's portfolio comprises mobile and fixed network infrastructure, telecom services, software, broadband and multimedia solutions for operators, enterprises and the media industry.

F-Secure

F-Secure is the global leader in providing security as a service through operators. A proven partner for revenue generation with an expanding portfolio of value-added services.
While you concentrate on what is important to you, we make sure you are protected and safe online whether you are using a computer or a smartphone. We also backup and enable you to share your important files. Our services are available through over 200 operators around the world and trusted in millions of homes and businesses.

Gearshift Group

We are a management consulting and M&A advisory firm serving technology companies. We have unmatched experience and know-how from technology business and our partners have seen the ups and downs of the segment for over 20 years.

IPSS

Intelligent Precision Solutions and Services helps clients develop their business by utilizing customer data.

IPSS is a partner which compiles an efficient and productive customer work environment for its clients – complete with customer data, equipment, tools and operating models.

Ixonos

Ixonos creates wireless technologies, software and solutions for mobile devices and services.

JAMK University of Applied Sciences

JAMK is an attractive, internationally oriented higher education institution with a strong role among the developers of the Jyväskylä region and Central Finland. The number of students is 8,000. We offer first- and second-cycle degree education, open studies, continuing education, and vocational teacher education.

Nokia

Nokia is committed to connecting people to what matters to them by combining advanced mobile technology with personalized services. More than 1.3 billion people connect to one another with a Nokia, from our most affordable voice-optimized mobile phones to advanced Internet-connected smartphones sold in virtually every market in the world.

Nokia Siemens Networks

Nokia Siemens Networks is a leading global enabler of telecommunications services. With its focus on innovation and sustainability, the company provides a complete portfolio of mobile, fixed and converged network technology, as well as professional services including consultancy and systems integration, deployment, maintenance and managed services. It is one of the largest telecommunications hardware, software and professional services companies in the world.

Movial

Movial inspires rich, intuitive Internet experiences for companies embracing transformational technologies. Leveraging its deep expertise in Internet, Linux and mobile devices, Movial seamlessly enables its customers to deliver richer user experiences to millions of people on PCs, and on mobile devices.

PV

Founded in 1998, PacketVideo is the software pioneer powering the world's leading multimedia services on millions of home and mobile devices. PacketVideo is a subsidiary NTT DoCoMo.

Reaktor

Our goal at Reaktor is to help our clients run demanding software projects successfully.

We work closely with several major corporations and large public sector organizations, helping them to build better information systems. We believe in long-term partnerships, and we use our knowledge and expertise to deliver the ideal technology solution for each individual client and project. We earn our clients' trust by delivering successful projects and high quality software.

Proudly part of the Finnish Cloud Software Program

RM5 Software

RM5 Software is a software company specialising in Entitlement Management. Our entitlement management technology manages 175 000 user identities by 1800 administrators in 700 different organisations and powers 200 different web services – both in on-premises and on-demand environments.

Tampere University of Technology

Tampere University of Technology (TUT) conducts scientific research in technology and architecture and provides higher education within these fields. The University operates in close collaboration with business life and other facets of society and produces high-standard services within its range of tasks. TUT is Finland's most international university of technology in researcher and student exchange. Leading-edge fields of research at TUT are signal processing, nanophotonics and intelligent machines.

Techila

Techila develops and sells Middleware solutions to produce HPC from the cloud. Techila enables applications to harness and utilize the infinite capacity of the Cloud quickly and easily. Unlike any other HPC Middleware solutions, Techila can be integrated easily and used securely, without the complexity.

Techila's typical customers are large organizations doing business critical optimization, modeling, simulations or data-analysis, and who need faster access to results in their business critical computing.

Tekes

Tekes is the most important publicly funded expert organisation for financing research, development and innovation in Finland. We boost wide-ranging innovation activities in research communities, industry and service sectors.

TeliaSonera

TeliaSonera provides network access and telecommunication services that help people and companies communicate in an easy, efficient and environmentally friendly way.

Tieto

Tieto is the leading IT service company in Northern Europe providing IT and product engineering services. Our highly specialized IT solutions and services complemented by a strong technology platform create tangible business benefits for our local and global customers. As a trusted transformation partner, we are close to our customers and understand their unique needs. With about 18 000 experts, we aim to become a leading service integrator creating the best service experience in IT

Tivit

Tivit is committed to ensuring even more rapid development of Finnish ICT know-how. As with other Finnish Strategic Centres for Science, Technology and Innovation (SHOKs), Tivit seeks to implement innovation policy, combine and systematise research and at the same time ensure that the results flow on to be used in the business world more rapidly than has previously been possible.

University of Helsinki

University of Helsinki is one of the best multidisciplinary research universities in the world. The high-quality research carried out by the university creates new knowledge for educating diverse specialists in various fields, and for utilisation in social decision-making and the business sector.

University of Jyväskylä

Drawing on the rich experience of 75 years of educational heritage, while at the same time embracing rapid modernisation, the University of Jyväskylä continues to set its sights firmly and confidently on the future.

Our core fields in research and education are basic natural phenomena and the structure of matter; education, learning, and teaching in the future; languages, culture, and social change processes; physical activity and wellbeing; and human technology.

University of Oulu

The University of Oulu is an international research and innovation university engaged in multidisciplinary basic research and academic education. The University of Oulu is one of the largest universities in Finland with an exceptionally wide academic base. Internationally pioneering research is conducted as a collaboration of different disciplines.

Vaadin

Vaadin is a Java framework for building modern web applications that look great, perform well and make you and your users happy.

VividWorks

VividWorks Ltd. offers innovative user-friendly visual solutions to the global market. We provide tools which are instantly accessible, enabling visual customization of products as a part of the purchase experience.

Vincit

Vincit provides solutions for challenging software projects

VTT

VTT Technical Research Centre of Finland is the biggest multitechnological applied research organisation in Northern Europe. VTT provides high-end technology solutions and innovation services. From its wide knowledge base, VTT can combine different technologies, create new innovations and a substantial range of world class technologies and applied research services thus improving its clients' competitiveness and competence.

Åbo Akademi

Åbo Akademi University has an acknowledged position at the forefront of research in such areas as biosciences, computer science, democracy, human rights, material sciences, process chemistry and psychology.

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