PLATFORM for Service Engineering and Service Software

Software as a Service

Strategic Research Agenda

ICT Innovation Platform Software as a Service

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PLATFORM for Service Engineering and Service Software

Software as a Service

Software as a Service is like a watersource, where underneath the surface waterstreams are finding their way through tunnels, coming together, flow into each other and appear above the surface as a great bubbling never ending waterstream. A **service** for anybody who wants to use it!

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SRA IIP-SAAS

This is the Strategic Research Agenda (SRA) of the ICT Innovation Platform Software as a Service (IIP-SaaS). The SRA was created in close cooperation with the board of IIP-SaaS and Advisory Board.

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1.

Summary

Services constitute the larger part of the modern economy. Sectors such as health care, finance, government, and entertainment are largely based on services. But even in agriculture, manufacturing, retail and distribution, services are an important component of the added value.

The productivity growth in service industries has lagged behind the productivity growth in agriculture and manufacturing in past decades. However, due to new developments in ICT it can be expected that innovation in services will increase dramatically in the nearby future. The concept of Software as a Service (SaaS) allows business services to be re-engineered in such a way that componentised, autonomous services can be developed anywhere in the world. These services can be assembled and packaged into new service concepts for mature markets. This will lead to a growth in productivity in services because these services can be delivered electronically at very low variable costs.

This report provides a number of examples of new services that cross the boundaries of individual sectors of the economy.

For the Netherlands, this future development is both a challenge and an opportunity. It is an opportunity, because it will allow the Netherlands to improve its competitive position in several services sectors such as finance, distribution and creative industries. Moreover, this development will lead to an increase in productivity in sectors where labour shortages are to be expected and costs need to be reduced – such as health care and government. The knowledge gained in these sectors can be reused elsewhere, especially via ICT service providers.

However, these developments also constitute a challenge. In order to seize this opportunity, the knowledge infrastructure in the Netherlands has to be turned towards ICT-related service innovation. Innovative services need to be developed, tested, brought to the market and reused. Education institutions and research programmes have to change their focus and become aware of the need for the development of in-depth knowledge in this field.

This report describes the direction in which research and knowledge development should proceed. It is the result of work performed by the SaaS ICT Innovation Platform, initiated by ICT Regie in the field of SaaS. This platform mobilises the community of practice in the Netherlands, and aims to create a larger movement for knowledge development. The report concludes that especially facilities for R&D and experiments are needed, such as testing environments and living labs. Such facilities can speed up the creation and valorisation of knowledge. Such investments do not require new institutions or buildings, but rather they require distributed facilities all over the country in joint collaborative settings, with much visibility for students at various levels of education as well as for companies in open innovation.

2.

Introduction

New ICT networks and services are changing our lives and society. We can connect with old and new friends and use their collective intelligence with just a few clicks. Google can see the development of a new flu epidemic two weeks earlier than the Centre for Disease Control, even with their vast network of doctors around the USA. Individuals can earn money by offering services online and large and small companies can develop and operate new channels for cooperation. All this is made possible by a new way of combining and using pieces of different software systems. This is what we call Software as a Service, abbreviated as SaaS.

SaaS has a lot of potential for the future. The goal of this Strategic Research Agenda is to state which research questions and themes need to be addressed in order to take advantages of the (economic) potential SaaS offers to society with a focus on the Netherlands. This is the main reason the Software as a Service (IIP-SaaS) ICT Innovation Platform was established.

Our definition of SaaS is:

SaaS refers to a service delivery model in which remote componentised (business) services are accessible through a software interface and can be combined to create new (business) services delivered via flexible networks.

In this definition, several aspects are important:

- The components of the digital services can easily be combined in networks of nodes delivering services to each other.
- By combining service components in novel ways, it is possible to create new value-added services and new business models.
- The ICT infrastructure needed for these digital services also enables the delivery of business services.

By definition, SaaS is neither focused exclusively on software nor exclusively on business services, but rather on the intertwining of services and software. Figuratively, this can be envisioned by imagining the software and service entwined like the structure of the double helix of DNA. The strands are held together by the main views on SaaS: business, technology, migration and operation. As shown in the diagram.

ECONOMIC IMPORTANCE

70% of our economy consists of services. For a long time, in services we have seen the productivity paradox of ICT. Even though we can clearly see the positive effects of the use of ICT in services

companies, the effect is much harder to see on a macro-economic level (Van Ark et al., 2006)[1]. Much of the evidence of these positive effects is exemplary and not consistent throughout sectors.

The reason for this discrepancy between the micro-economic and macro-economic level is that the use of ICT is often a disruptive innovation that requires the development of new business models, changes in products and services, changes in the delivery processes and in the value networks that produce the services. ICT in itself leads to little productivity gain; ICT in combination with the re-engineering of all aspects leads to a potentially huge gain in productivity.

Successful examples of this type of innovation like Amazon.com have turned industries upside down and forced everyone in the business to redesign their processes and services (Weeda et al., 2006)[2]. These changes do not just affect the company but rather they affect the entire sector, from producers to delivery to the final customers. As such, SaaS is a potential disruptive technology where the interaction between technology, business models and the skills of people is paramount.

It is therefore important to focus the stimulation of SaaS not just on the development and implementation of the technology but on the combination with new business models within a sector and even between different sectors. The challenge here is to create innovation in the whole ecosystem of companies that are dependent on each other and have to move together in order to capitalise the potential productivity gains (Pilat, 2006)[3].

SOCIETAL IMPORTANCE

Not only is it important for businesses to take advantage of SaaS, government and non-profit organizations can also profit from using SaaS. Communicating with and informing citizens can get easier and more personalised information and services can be deployed. Hospitals are already actively involved in creating and testing services for people that are receiving care in their own home, for example. Electronic patient files are being developed in several countries in Europe. How can we use these files in the best possible way?

THE NETHERLANDS

The Netherlands has a strong tradition in trade, an excellent software sector and is one of the leading countries when it comes to developing services. Moreover, it has an excellent digital infrastructure and the vast majority of people and businesses is online. SaaS thus offers many opportunities for the Netherlands in the coming years. In order to take full advantage of this developing economic field of networked services the Netherlands needs to:

- Develop open testbeds or living labs that make the development of new services easier, especially the building and testing of these services in cooperation between different companies. In these testbeds or living labs, newly combined services can be tested in environments that simulate the real world.
- Create an infrastructure or community of people that knows how to build new business services on top of existing services and knows how to cooperate, thereby leveraging what exists. Especially in the Netherlands where services constitute more than 70% of our economy this will lead to a leap in productivity.

The Netherlands, an innovation and services-oriented country, should become a leader in this development, in order to maintain a leading position in services and trade. Therefore, investments are required for new, mainly digital services. This is not only desirable from an economic perspective, but the development of improved digital services is also necessary to cope with bottlenecks in social fields, including health care. Due to the networked complexity of SaaS, a stimulating role of government is needed to bring the parties together.

RESEARCH NEEDED

The examples above give an idea of what SaaS can do. Actually, some of the examples, in a different context or form, are already on the web. Technically a lot can be done, while on the other hand, many of the potential advantages are not being used because of current organizational structures

and market positions. We will focus in this SRA on four major themes that bring together technological and organizational aspects:

- Business Services Innovation: analysis and design of services from a business perspective.
- Software Services Evolution: the software technology needed to execute these services.
- Services Transition: the transition from classical software applications to service-based applications.
- Services Governance and Operations: the operational aspects of keeping services available.

SaaS is very much multidisciplinary in nature: aspects like software quality, business modelling, security, architecture, legal issues and many other areas have to be looked at to make innovation in real life possible. Research is needed into these various aspects and how they influence each other.

A NEW DISCIPLINE: SERVICE ENGINEERING

Advancement in information technology allows (business) services to be produced and delivered in completely new ways. This movement leads to a whole new playing field worldwide in the delivery of services in digital form. Since the digital delivery of services is no longer dependent on time and place, it will lead to a further restructuring of services, which may be called Services Engineering. Services Engineering will bring together people from technological, organizational and human behavioural fields in the same way as has happened with logistics in the past. This field will consist of professional networks (guilds) as well as academic networks in close cooperation.

OUR GOAL(S)

IIP-SaaS[i] is determined to create projects together with businesses, science and government to advance capabilities in this field in the Netherlands. These efforts will lead to a business ecosystem, a testbed and a network of professionals that will help us improve productivity in services and make us more competitive as a country.

ICTregie[ii] iniated the Software as a Service (IIP-SaaS) ICT Innovation Platform as a way of organizing the community around SaaS. This SRA is the result of the combined effort of this IIP-SaaS community.

CONTENT OF THIS DOCUMENT

This document is structured as follows:

- Chapter 2 provides an analysis of the current situation with respect to services and SaaS. Moreover, it gives an optimistic and pessimistic scenario for how the role of SaaS will develop and influence society. Based on this analysis, implications are given on the course of research.
- Chapter 3 describes the roadmap for the knowledge discovery and development of SaaS. This roadmap does not only cover research topics but also plans for technology transfer, education and community building. All these areas are needed for the development of the new profession of service engineering.
- Chapter 4 gives an overview of the main activities to be developed to achieve the full potential of SaaS and an 8 years timeframe. Chapter 5 deals with the SaaS research questions. The focus is on the areas most important for The Netherlands.
- Chapter 6 describes the relationship between this SRA to the other ICT Innovation Platforms of ICTregie and how to coordinate the efforts.
- Chapter 7 discusses the valorisation of the research through innovation projects and the dissemination of results.
- Chapter 8 describes the starting point for the scientific and professional organization that is needed to take the field of SaaS further.
- Chapter 9 describes the relationship to European programmes.

i *www.iipsaas.nl*
ii *www.ictregie.nl*


3.

Analyses and scenarios

3.1. Introduction

The potential impact of SaaS on our society and economy is enormous. More and more services will be offered to us in a digital form. SaaS will be the driving force behind digital services in the near future. Not only will SaaS provide tools for the rapid development and maintenance of new services it promises to make it possible for digital services to be easily and swiftly linked together (like Lego blocks) and form new services, without the writing of time consuming and error-sensitive handmade software.

Although SaaS is important for our whole services-based society, IIP-SaaS will focus on 3 sectors of Dutch society where the impact of SaaS will be the greatest: government, finance and health care. In the following 3 paragraphs, an overview will be given of the opportunities SaaS offers to take up the main challenges for these 3 priority sectors. Examples of new services made possible by SaaS will be given.

An overview of the contribution of SaaS to the strategic ICT agenda 2008-2011 (Dutch Ministry of Economic Affairs, 2008)[5] of the Balkenende IV Cabinet will then be given.

The last 2 paragraphs will describe the business implications of SaaS and contain scenarios for the growth and importance of SaaS in the future.

3.2. Government

The working methods of our governmental bodies and their relationship to citizens will change significantly in the years ahead. The reason for this change is ICT. Government services will become mainly digital, the relationship between citizens and governments will grow more and more interactive and new services like eVoting and eConsultation will emerge.

Two trends in the role of the government in Dutch society have been identified:

- Withdrawing government. The prosperity and care of current society has led to educated and mature citizens who want to make individual choices. As a consequence, the role of government is being shifted towards the role of a (meta) controller and enables partial freedom of execution and regulation to the market.
- Serving government. The government is increasingly only one of the players on the market. The performance of government is evaluated by citizens more seriously and compared to market performance. This leads to higher pressure to perform in a more customer-oriented manner and more efficiently.

Software as a Service enables broad service provision by the government to citizens and companies. The following Software as a Service realizations serve as examples for a future in which government is increasingly withdrawing and service-oriented:

- Public registries. Public announcements can be registered and citizens and companies can subscribe to relevant publications in order to remain up-to-date with relevant requests, development and decisions.
- Overall dossier. This service offers functionality to providers and their customers to develop personal dossiers with the goal of providing overall service provision. Possible applications are electronic records of dossiers for the construction of a house. Public and private partners can be provided access to the information in the dossiers.

3.3. Health care

The demand for health care is rising and will continue to rise in coming years. The costs of health care will mount, while productivity will barely grow. Added to the changing demography (more care-dependent elderly people) this leads to the conclusion that innovation and new ways of working are inevitable.

The following trends can be identified in the health care sector in the Netherlands:

- Decentralisation of health care and self-care. Large-scale treatment in hospitals is being replaced by polyclinics and home care.
- Prevention of diseases and increasing wellness. A shift is occurring from intervention (cure) to prevention, with an increasing desire to live as healthily as possible for as long as possible.
- Improvement of therapies and improvement of the human being. Not only the treatment of diseases is improving, but also the improvement of the functioning of humans is being pursued, so-called human enhancement.

In the health care sector, new and improved services are a major challenge. SaaS can facilitate here. SaaS can contribute to more efficient processes, streamlining administrative processes and a centralised position of the care applicant instead of the care provider.

Examples of network health care services, made possible by Software as a Service:

- Tele-monitoring. A service that assembles and provides the medical information of a patient.
- Health care broker. A service that brings health care needs and providers together.
- Patient dossier. A service that manages and maintains the medical files of a patient,
- Wellness services. Indirect health care services that improve quality of live, like audio-/video-communication and alarm systems.

3.4. Finance

More than 50% of Dutch citizens use internet banking. The number of service channels and outlets for financial products and services increases year after year. Financial products are increasingly composed of all kinds of intermediate products. New, robust and trustworthy financial services and new ways of cooperation require new business models and new digital services.

The following trends have been identified in the Dutch financial sector:

- Cost reduction. Work activities are increasingly geographically spread and assigned to parties that are specialised in these activities.
- Complexity and diversity of products. Financial products are more often assembled from several other products. Banks are offering an increasing number of complementary services.
- New market channels. An increasing number of outlets are being used for the sale of financial products, including supermarkets and retailers.
- Compliance and regulation. New regulations (Basel II, among others) and standards (SEPA) make it a requirement to enable greater transparency and more data and information exchange.

Examples of SaaS enabled digital services:

- Financial service broker. The broker offers a broad spectrum of financial services of different providers, and offers personalised and integrated service provision for life-planning and significant life events.
- Trusted service provider. Thanks to their role as trusted third party, banks extend their service provision with backup services and a "digital safe".

3.5. Link to the 2008-2011 ICT Agenda

In the 2008-2011 ICT Agenda, the Balkenende IV cabinet presents its vision regarding future developments in society and the economy, to the extent that these are supported by ICT. The central theme of the ICT agenda is digital services. The Netherlands, as an innovation and services-oriented country, should increase its efforts in order to maintain a leading position in service and trade. Therefore, investments are required for new, mainly digital services.

In this ICT agenda, a number of ICT priorities are set for the next few years:

- Electronic services provided by the government; basic electronic services and the provision of online information should become available for all citizens and businesses in the next few years.
- Interoperability and standards: to warrant interoperability of applications and services, (open) standards are required.
- Societal domains and ICT; In order to eliminate bottlenecks in social areas like health care, education and security, ICT innovations are essential.

As discussed above, SaaS will be the driving force behind digital services, whether these are services in societal domains like health care or education or services for the financial sector or government. SaaS will provide new tools to develop, maintain and implement services much more easily and less expensively than is possible today with handmade, tailored software. Moreover, with SaaS location is no longer an issue. Via the internet, services can be composed and used in practically every home or office. Therefore, SaaS is the main technology to take up the challenges described in the 2008-2001 ICT Agenda.

3.6. Demands from businesses

CORE VERSUS NON-CORE ACTIVITIES

Companies are increasingly focusing on their core business while outsourcing non-core activities to specialised companies. The main reasons for outsourcing are cost savings and a lack of the necessary expertise. Software management is a clear example of an activity that for many organizations is not considered to be part of their core business. This has led to the emergence of application hosting, Application Service Providing (ASP) and the modern successor thereof, Software as a Service (SaaS).

FLEXIBLE COMPOSITION OF SERVICES

Another noticeable trend is the unbundling and flexible composition of services (e.g. software modules for ERP, HRM and inventory). As a result of intense competition, increasing complexity of business processes and changing customer expectations and demands, organizations are demanding flexible support of their business processes by means of ICT. As a result, ICT demands are increasingly shifting towards the fulfilment of the specific needs of the customer instead of generic solutions. Until recently, services or functions were combined into a fully integrated solution for the customer. Currently, an opposite trend can be identified in the development of generally applicable services which can be composed into new services that are specially tailored to the needs of the customer.

REDUCTION OF COSTS

The modern trend towards focusing on cost efficiency is supported by SaaS by offering specific functionality of software applications as service to the customer. The infrastructure developed to

facilitate SaaS may enable various service providers to offer competing services to customers, resulting in an increased availability of different services as well as reduced costs (due to competition and economies of scale). Furthermore, development investments and maintenance expenses are reduced from the customer point of view. However, as is often the case in ICT, these technologies may also lead to monopolies of certain service providers. Such possibilities can be a reason for deeper research, driven by the needs of customers, government, or business.

THE CUSTOMER IS KING

In addition, the shift towards a more central role of the customer is supported by SaaS, due to the possibility of composing more complex services from several smaller services. In this way, tailored services can be provided according to the specific requirements of the customer. Demand-driven service provision is, therefore, supported by SaaS.

3.7. Technological development of SaaS

The ICT market is currently experiencing a transition in which software is no longer provided as a product, but as a service. This transition was already deployed in the nineties by Application Service Provision (ASP), in which software packages were offered online. This development has arrived at the next phase, in which the service offered is no longer a fully integrated application, but rather a small software component that can be invoked in run time. Using these software components as building blocks, new software services can be configured in a simple and fast way.

The key difference with current practices in ICT is that in SaaS only the functionality of software components is delivered to the customer. Traditionally, software applications were installed on the machine of the customer. With SaaS, such components are deployed remotely. It is precisely this feature that offers unprecedented opportunities for organizations, such as increased flexibility by preventing vendor lock-in and/or legacy. This service orientation includes the feature that the functionality of several components can be composed to obtain more complex functionality to create new business services.

3.8. Scenarios

OPTIMISTIC AND PESSIMISTIC SCENARIOS FOR THE GROWTH AND IMPORTANCE OF SAAS IN THE FUTURE

There are many dimensions in which future scenarios can be developed each with their optimistic and pessimistic variants. Out of the multitude of dimensions, the following dimensions are explicitly mentioned in this analysis:

- International legal framework and trade liberalisation
- Technological innovation and adoption by society
- Challenges to research
- Service engineering as a discipline
- Business services innovation (incl. cross-sector cooperation)
- Labour productivity and effects on safety, health and the environment

Optimistic and pessimist scenarios for the Netherlands can now be sketched along these dimensions inspired by NESSI SRA (NESSI, 2008)[6].

INTERNATIONAL LEGAL FRAMEWORK AND TRADE LIBERALISATION

In an optimistic scenario, new EU legislation (SEPA, Service Directive) as well as by the WTO favours international trade in services. An open economy such as that of the Netherlands, benefits from

this legal framework, because entrepreneurs from the Netherlands are successful in increasing exports. In a pessimistic scenario, the open economy is vulnerable to new entrants providing services from developing countries which increase imports without increasing exports.

This dimension calls for economic and business research into the field of digital services in relation to the legal framework. Moreover, the knowledge acquired in such research should be available for government negotiators within the context of the EU and WTO.

TECHNOLOGICAL INNOVATION AND ADOPTION IN SOCIETY

In an optimistic scenario, the application of innovative technologies makes the worldwide trade in services would make it more easy for the Dutch services economy to grow internationally. The societal characteristics of the Dutch market push this market to become an early adopter of new ICT-empowered service concepts. In a pessimistic scenario, the complexity of our networked society grows beyond imagination. Companies can no longer rely on traditional instruments to find and serve customers.

This dimension calls for research into the software engineering principles of SaaS. In addition, research is needed into the effect of innovative technologies on society and into technology adoption models. Factors influencing the adoption of technology, such as ease of use and the social acceptance of technology should be taken into account by innovative private and public organizations when moving to SaaS.

CHALLENGES TO RESEARCH

In an optimistic scenario, the academic community in the Netherlands manages to bridge the gap between software engineering, information systems, and related academic fields such as business management, economics and law. Moreover, the research is sponsored by public and private organizations that are actively involved and need the results. In a pessimistic scenario, there is no academic community that shares a common mission to understand the core issues of the services economy, or how to press forward. There are no effective knowledge transfer mechanisms from research to service companies. This will seriously harm the innovative capabilities of Dutch society.

This dimension calls for joint research between software engineering and information systems, including participants from the sectors of business, economics and law. Empirical research should be combined with theoretical work in service and software engineering.

SERVICE ENGINEERING AS A DISCIPLINE

In an optimistic scenario, the process of service development and innovation is further professionalised. The professionals are known in the field because they can bridge the gap between business and ICT. In a pessimistic scenario, business services engineering is delinked from service engineering in ICT and there is no acknowledgement of the need to bridge the gap. This would mean that SaaS remains in the technological domain and would not lead to strong business innovation.

This dimension calls for the establishment of a strong community of practitioners and the development of curricula at research universities and universities of applied sciences.

BUSINESS SERVICES INNOVATION (INCL. CROSS-SECTOR COLLABORATION)

An optimistic scenario will show a real focus on the people-centred design of services leading to the opportunity for differentiated and radically new service concepts. ICT acts as enabler for disruptive change in business models and creates new market space for new value chains. Moreover, service innovation crosses the traditional boundaries between sectors. A pessimistic scenario will show that the process of services development and innovation needs to be further professionalised. ICT developments introduce common challenges, e.g., the trustworthiness of identity, data and partners. Moreover, cross-sector innovation turns out to be very difficult in the pessimistic scenario.

This dimension calls for research and education into business services engineering. The cross-sector issues also require that demonstration projects are not confined to the classical sectors (such as e-health and e-government), but cross the boundaries related to the sectors.

LABOUR PRODUCTIVITY AND EFFECTS ON SAFETY, HEALTH, AND ENVIRONMENT

In an optimistic scenario, SaaS will allow for an increase in labour productivity because fewer services have to be delivered in face-to-face meetings. Therefore, these services can be automated or will be delivered in a delinked way (e-mail, teleconference, etc.). Some of these modes are currently being investigated in new forms of telecare and telebanking. These modes allow productivity to grow and reduce the burden caused by labour on issues like safety, health and environment.

In a pessimistic scenario, new forms of service delivery, as in telecare, are merely new channels of communication that do not lead to real change. The possibility that the pessimistic scenario becomes true requires experiments, prototypes, and a professional community interacting with academia.

4.

Phasing for 2008 - 2016

4.1. Introduction

The IIP-SaaS partners conclude that 4 distinct activities have to be developed to achieve the full potential of SaaS in the Netherlands. These activities are research, education, valorisation and guilds. For each of these activities, ambitions were determined in a timeframe of 8 years (cf. Table 1). The ambitions and deliverables of the individual activities are described in the following paragraphs.

	2 years	4 years	6 years	8 years
Research	Large FP7 projects Dutch research projects on the way	First results to be used in education and business	Results of KP7, new projects with Dutch universities in the lead	Hotspot of SaaS research
Education	Short courses for professionals and influence on current curricula	Start curricula development service architect	Start education based on curricula	Internationally known
Valorisation	Demonstration projects with business and technological inst.	Established and sustainable test-bed for new pilots	Established testing facility for new applications	Hotspot for the implementation and testing of real life SaaS applications
Guilds	Start with organizing the professional and academic community	Known and used as communication platform and steering priorities in the field	Most users are members. Strong involvement from the professional and academic fields	

Table 1: Activities of IIP-SaaS in 8 years timeframe

4.2. Research

The long-term goal is to become a leader in research into the SaaS services application domains of finance, health and government and to be recognised as such internationally. This leads to the following milestones:

2 years

- Service Innovation and SaaS is an important topic in EU projects. Goal of IIP-SaaS is to facilitate academia and the business community to play a leading role in EU projects. This is done by working together with NESSI with the focus on filling in the application domains. After two years this will lead to participation in several EU projects.

4 years

- SaaS is a field where developments are initiated from academia as well as from the business community. After four years, several joint research projects between academia and the business community will have led to the implementation of new concepts and technologies in practice and the business community will have become an important source for setting the priorities of new developments.

6 years

- After six years, Dutch consortia will be increasingly recognised as leaders in the field of SaaS. They will lead several EU projects founded by Dutch consortia from academia and the business community.

8 years

- After eight years, the Netherlands will be a hotspot of research into SaaS in Europe. Several universities will have programmes focused on SaaS in a variety of technical, legal, social and business-oriented subjects. The focus is on multidisciplinary cooperation between universities and the business community.

4.3. Education and Training

The long term goal is to create a strong education programme for SaaS and related issues, focused on academic as well as practical advancement in business services. Since SaaS is a field that is focused on what works in practice, this interaction between the academic and practical field is important

2 years

- Education starts with a focus on courses for professionals in the field. Through these courses, new knowledge can be used by businesses and cooperation on what research is important can be established at an early stage.

4 years

- After some time, the focus of the education changes to the regular education provided by research universities and universities of applied sciences. More and more, SaaS issues will be part of the curricula and the outline of a separate curriculum of Service Architect will evolve

6 years

- The first service architect curricula are established as a multidisciplinary field.

8 years

- Internationally known.

4.4. Valorisation

SaaS is a multidisciplinary field in which the focus is on what will work in practice. Therefore, strong cooperation between the different sectors of academia and business is important. Through technology transfer, new possibilities for business are created but it will also lead to new knowledge about the application of these technologies. Therefore, valorisation (technology transfer from research A To practitioner B) is an important field in SaaS. This cooperation between different academic disciplines and with business must have an organizational component to facilitate the complex partnerships required.

A platform will be created to coordinate and structure the cooperation. The goal is to work together in a multidisciplinary environment and create joint testbeds to be able to profit from each other's work.

The valorisation goals are:

2 years

- The organizational structure of the valorisation platform is established and most parties working on SaaS research are involved to varying degrees. The first testbeds based on research projects from the partners are established.

4 years

- Several testbeds are continuously available to the partners to test new developments and create a platform for cooperation in research projects from different academic fields as well as from the business community. Businesses will start to use the testbeds as an infrastructure to test new solutions and models before going to the market. There will be a formal structure in which the parties involved from academia and the business community will be the stakeholders.

6 years

- After six years, the focus will be increasingly on the real-life implementation of new developments. SaaS will have grown in importance in the business community and therefore in economic importance. Services will be closer to the market.

8 years

- With SaaS, the focus of testing will shift from testing in isolation to testing with integration. For the focus sectors of finance, health care and government, test environments will be established that currently have status in the ICT and Service infrastructure of the sector. Examples are payments, health records and the like. Based on this default infrastructure, it is possible to test new services in relation to how they will function within the current infrastructure.

4.5. — *Guilds*

A strong professional community is important for SaaS. The interaction between academic research, the practical use of new developments and a focused education programme is key for the economic spin-off. The Guilds are an important area to create this interaction.

2 years

- An entity is created in which people from business as well as from academia come together to discuss SaaS topics and exchange knowledge.

4 years

- The guilds have become a stable platform to exchange information between academia and businesses. The guilds start to function as the main platform for setting priorities and for cooperation between academia and businesses.

6 years

- The majority of SaaS professionals are members of a guild and there is an active group of people driving the community.

5.

Research themes and questions

As we have shown in the previous chapters, we can say that SaaS is a multidisciplinary area. The essence of successful implementation lies in the combined approach of businesses, people and technical issues. However, a distinction between broad research areas can be made clear in the following table:

	Architecture	**Transition**	**Governance**
Business	***5.1.*** Business Services Innovation	***5.3.*** Service Transition	***5.4.*** Services Governance and Operations
Technology	***5.2.*** Software Service Evolution		

On the one hand a distinction can be made at the business and technological level, even though there is a broad area in which both must be aligned for successful implementation. On the other hand, there is the distinction between the design of the new situation, the transformation to the new situation and the operation and governance of the final situation. This leads to the following research themes:

- **Business Services Innovation:** analysis and design of services from a business perspective.
- **Software Services Evolution:** the software technology needed to execute these services.
- **Services Transition:** the transition from classical software applications to service-based applications.
- **Services Governance and Operations:** the operational aspects of keeping services available.

These four themes are discussed below and the research questions will be posed. These research questions give the direction of the research that will be set up by IIP-SaaS.

Misdaadkaart.nl (Crimemap)

An interesting example of creating new business value through combination of existing services is Misdaadkaart.nl. This is a combination of press releases that the police are obliged to publish after a crime and they match this, based on the postal code, with Google Maps. This way they show in which neighbourhoods there is the most crime. This site is used by people searching for a new home (how dangerous is the neighbourhood I am going to live!). Money is made through adds delivered by Google. This website is an excellent example of adding value by just combining existing services, a Mashup.
www.misdaadkaart.nl

5.1. *Business Services Innovation*

5.1.1. INTRODUCTION

The Netherlands has a long-standing reputation as an open, externally oriented economy that acts as a hub in a network of international distribution and trading relationships with many other countries across the world. In today's global economy, services have become increasingly prominent. At the same time, ICT has become a key enabler in the creation and innovation of services. Business Services Innovation is a research area where the focus is on the business opportunities of SaaS developments. The technology makes entirely new business structures possible and creates new opportunities that can only be seized by aligning the structure and operation of business with new technology options.

In this context, we define the term 'business service' as follows (and in accordance with Chapter 2 of the SRA):

A business service is a componentised, independent piece of business functionality that is remotely accessible through a software interface and can be combined to create new business services delivered via flexible networks.

Business Services Innovation therefore deals with the analysis, decomposition and synthesis of services from a business point of view, based on the new possibilities that new technologies offer. In this respect, two factors are driving this change:

- The independence of time and place that SaaS creates in delivering services; and
- The new possibilities to create business processes by combining 'industry standard' services in a transparent and automated way.

Below, in section 5.1.2. the different areas are outlined that need to be addressed in business services innovation, taking the business-oriented perspectives on these issues as our organizing structure. A simple framework for business innovation forms the basis for this.

From an academic perspective, Business Services Innovation necessitates a fruitful combination of organizational and management sciences on the one hand, and computer and information sciences on the other. The emerging discipline of 'Services Science, Management and Engineering' as advocated by Spohrer et al. (2007)[7] brings these fields together. This discipline applies the design-

oriented approach of engineering to the business issues of management. Moreover, this discipline uses established management models and practices for 'human' organizations in these newly arising automated service networks (cf. Section 5.1.3 below).

From an economic and management perspective, Business Services Innovation leads to the emergence of a new kind of industry: providers of online business services, and the associated intermediaries and advisers. Many new business opportunities arise, not only for providers and consumers of services themselves, but also in the associated areas of consultancy, governance and control[i]. This issue, the architecture of business services, is discussed in Section 5.1.4. below.

5.1.2. FRAMEWORK FOR BUSINESS SERVICES INNOVATION

The framework consists of two models: a Process Model and an Aspect Model. The Process Model for service innovation addresses the phases of the innovation process that lead to a new service. The Aspect Model for service innovation addresses the interaction between the different aspects that link business services to the appropriate IT services that realize these services, and the architecture and governance needed to implement and deliver these services.

Process model for business services innovation

Service innovation requires a series of steps which do not necessarily have to be performed in sequence; rather, these steps interact with each other. The first step is service exploration. The aim of service exploration is to discover the service characteristics of existing business functionality and to explore its potential for innovation.

The goal is to find promising directions, rather than to understand the service in full detail. The second step concerns service engineering. Service engineering leads to a shortlist of innovative services which are worthwhile understanding in more detail. Also, service engineering encompasses designing the service by involving multiple disciplines, such as economics, process engineering, and computer science. At a certain point in time, the service will be up and running. Service management then comes into play. Service management is concerned with the sustainability of the service, quality management, and if necessary, the reconfiguration of the service. These steps lead to research questions such as:

- Which disciplines need to be involved in business services innovation? (Examples include strategy, economics, business engineering and computer science.)
- What processes can facilitate the development of innovative business services, keeping in mind the various disciplines to be involved?
- How can the various steps be considered as continuous processes, rather than just sequential activities, reflecting the dynamic, changing nature of services?
- How can design trade-offs be made while developing a service (both within a single discipline, and while considering multiple disciplines)?

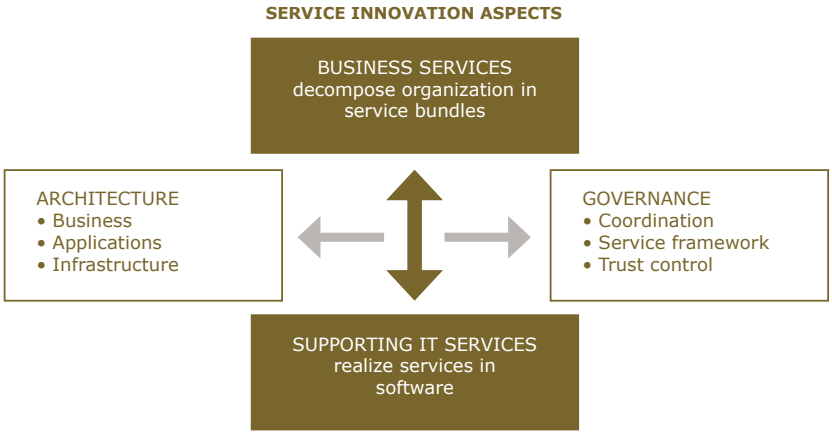
Aspect Model for business services innovation

Services innovation requires the interplay between the business aspect and the technology aspect. Within the business aspect, organizational offerings are analysed and decomposed into service bundles. Within the IT Technology aspect, services are implemented in so5tware components such as, for example, web services and service-oriented architectures (cf. Section 5.2). The challenge of services innovation is to create a new potential for the construction of business functionality and to discover the appropriate links between the business and technology layer; i.e. business services have to be mapped on software services and components such that they realize the business services in the proper way.

These links are established in two other aspects; Governance and Architecture. The Architecture aspect determines the mapping of the business services to the business functionality as well as to the technology components. This includes specification languages for business services as well as software components and technical infrastructure. The Governance aspect determines the coordination

i *As witnessed, for example, by the recent trend to outsource even the management and governance of outsourcing contracts to specialist outsourcing consultants.*

of services; i.e., control mechanisms that govern the correct execution and bundling of services (cf. Section 5.4.).



5.1.3. SERVICES SCIENCE, MANAGEMENT AND ENGINEERING

This section is concerned with the design aspects of business services and their related networks. This boils down to various questions related to value creation, and to the buying and selling of services. These questions can be grouped according to the perspective of the service client and the service provider.

Value network perspective (client focus)

The value network viewed from the client's perspective is focused on issues such as making the business case for using (external) business services, sourcing/vendor strategies, et cetera. Accordingly, questions like the following are raised while considering the value network perspective:

- What methodology should be followed for services re-engineering?
- How to find and contract suppliers of services?
- How to assess the organizational impact of services re-engineering?
- How to build a business case?
- How to manage risks (security, discontinuity, lock-in)?

Value network perspective (provider focus)

Looking at the value network from the provider's perspective leads to questions centred on the commercial viability of service offerings. This requires answering questions like:

- How to (semi-) automatically compose service-provision networks, given commercial software service catalogues, a stated customer need, and a type of business model?
- How to compose commercial software services into a complex, potentially multi-supplier, service bundle, which satisfies an articulated customer need?
- What are suitable pricing, payment and ownership schemes for software services, including licensing issues?
- How to align a software service business model with the actual software service provision?
- How can a commercial software service be decomposed into smaller commercial software services, in which each can still be provided by a single supplier?

5.1.4. ARCHITECTURE OF BUSINESS SERVICES

In our framework for business services innovation, we understand 'architecture' to encompass not only software and technology, but also (and in particular) business and organization architecture.

Designing a service (and the related service network) requires not only a clear perspective of business models and governance, but also of the realization of these services in terms of business processes, organizational structures, information models and flows, and many other aspects, parts of which are subsequently 'mapped down' into software architecture and technology. Vice versa, new technological possibilities arising from 'below' should be accommodated in a well-organized manner in the corresponding business services, again requiring an architectural approach to business services design.

Design perspective

Before we can start to design business services and networks, we must agree on the way in which we will describe these. Since the nature of these service networks implies that there are many stakeholders from different organizations involved who need to work with these designs, agreeing on a common set of concepts and descriptions is all the more important. Capturing and reusing pre-existing knowledge and best practices in the form of reference models, patterns, et cetera, is an important part of such methods. This results in the following research questions:

- What are the essential concepts needed to describe (model) business services and networks and what language do we need for this?
- How can these designs be mapped onto software implementations of these business services and what tools can be used to do this?
- Which best (and worst) practices are available in the design and configuration of business services?
- How can we design for change, i.e., how can we incorporate change as an integral element in the design of service networks?

Interoperability perspective

The complexity of service networks demands close attention to the interoperability of services and their providers and consumers, at multiple levels (syntactic, semantic and pragmatic). Questions like the following need to be answered:

- How can we assess the interoperability challenges in an SaaS environment?
- Which standards at the business level (not just technical interoperability) need to be agreed upon to make the easy switching of vendors possible for user organizations, and vice versa, to expand the reach of these service vendors?
- How can we ensure compatibility between service contracts, including those from different jurisdictions?
- Which IT standards can be used to minimise the interoperability challenge related to Saas?
- How can we assess the quality and viability of these standards?

Amazon Mechanical Turk

Some services are mindboggling in their concept the first time you see them. Amazon mechanical turk is one of them. It is meant for services that are impossible to perform by computer but are easy for humans. For exampling labelling the content of pictures. On the customer side it is a software interface where you can offer the work you want to offer, e.g. the labelling of pictures (like faces, nature, animals etc). On the other side the work is distributed over thousands of people worldwide that will do the job manually based on the script that you made.
www.mturk.com

5.2. Software Service Evolution

5.2.1. INTRODUCTION

The previous section elaborated the research needed into the business area. This section focuses on the research required into information systems and software engineering.

Modern service innovation differs in two respects from traditional software development.

First, organizations no longer know beforehand the quality and performance of software services, because they have become dependent on software services supplied by (external) service providers. Hence, to guarantee the quality and performance of the service delivery of these software services, organizations need much more advanced architecture and governance models of software services. This issue was addressed above in the framework for Business Services Innovation.

Second, software development is no longer primarily driven by technical specifications, but rather by business needs and requirements; i.e. software services are developed directly from business services. However, the reuse of third party services offered on the internet is becoming increasingly important, especially in the SaaS context. Moreover, the development towards SaaS not only requires the development of services, but also the development of run-time platforms in which services can be combined. Such platforms may take the form of portals, workflow engines, or integration suites, but usually the platforms are a combination of these.

The transition of enterprise applications to a services-based infrastructure can be approached in two ways, using a green field approach and using an evolutionary approach.

5.2.2. GREEN FIELD APPROACH

A green field approach uses the latest insights into business processes and service technologies and targets flexible and scalable solutions that can be easily adapted to new business processes and new technologies. These solutions start from high-level, usually rule-based, business descriptions and automate many parts of the actual software construction process by way of domain-specific languages, code generators, and model-driven techniques.

Flexibility is gained in two ways. At the level of business processes, change seems simple: it amounts to changing the business rules and regenerating the software. At the level of software implementation, flexibility is gained since all knowledge of hardware and software platforms is embedded in the generation process and changes to the infrastructure can be accommodated by changing the generation process and regenerating the software.

The green field approach is very appealing but it has several major limitations. First of all, the regeneration of software is a technique that is not scalable. For small services and small run-time environments in experimental settings, regeneration is straightforward. However, the regeneration of running software on a platform may become a nightmare, especially when data has to be migrated. An alternative might be to avoid regeneration and focus on interpretation as the main run-time technology, but interpreters are proprietary. This leads to research questions such as:

- How can we develop software generators for services and platforms that can be changed while running?
- How can we handle persistent data in such environments?
- How can we reap the benefits of interpretation without becoming proprietary?

Another drawback of green-field approaches deals with the question of how the connection can be made with existing ('legacy') applications. This question will be even more complex when the business process encompasses more business partners, each with their own ICT environment. This is where the evolutionary approach comes into the picture.

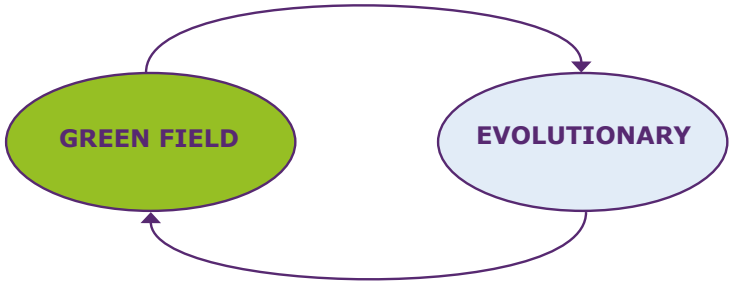
5.2.3. EVOLUTIONARY APPROACH

The evolutionary approach takes the software of an existing system into consideration and gradually adapts it to new requirements. This approach consists of two main phases:

- Software analysis applies sophisticated techniques to the actual source code and extracts facts from it. These facts are used to build models of the software that can help in understanding its architecture and in searching for specific properties such as database usage, concurrency, dependencies and specific information flows.
- The knowledge that is gathered in this way can be used for software transformation: the automatic transformation of the existing software into a new structure and form.

Typical examples of this evolutionary approach are the subdivision of an existing application into independent parts that can be connected to a service interface. Another approach is knowledge extraction from source code that can be used as the starting point for a new, rule-based, re-implementation.

Obviously, these two approaches should work in tandem: the green field approach fails in making a connection with existing systems and the evolutionary approach should not be applied blindly but rather it needs a target to steer the direction of the evolution. This tandem can be visualised as follows:



5.2.4. RESEARCH FOCUS FOR SOFTWARE SERVICE EVOLUTION

Given the above description and analysis of the field of software service evolution, we have identified the following research themes that will substantially advance the state of the art in this field and at the same time will create the fundamental knowledge that is necessary to maintain and increase the competitive edges of the Dutch services industry.

Focus I: High-level service descriptions

High-level service descriptions are needed to describe the "what" of software services:

- What is the functionality provided by a service? What is its performance?
- What is its reliability? What quality of service can it offer?
- In what ways can it be composed with other services?
- What are its legal constraints?

Typical research questions study how this can be achieved:

- How can different kinds of services be classified, i.e., business service, ICT service, security service, information service, computational service, etc.
- How can services be described at a high level? How can domain-specific languages be used to describe services in specific service domains as classified above?
- How can these descriptions be verified and tested?
- How can high-level service descriptions be used to generate service implementations?
- How can these descriptions anticipate the connection with legacy systems?

Focus II: Platform development

The run-time platforms in which services will be connected need additional research as well. Apart from questions similar to those formulated for services, the platforms should guarantee continuity, performance, security, user management and single-logon, scalability, smooth degradation, interoperability with other platforms, etc.

This leads to research questions such as:

- How can the interoperability of service descriptions (and of the derived services) be increased?
- How can the development of service descriptions be supported by tools for development, validation, simulation and execution?
- How to interoperate with legacy systems
- How can various platforms interoperate? For example, how should different workflow management systems or different portals interoperate?
- How to guarantee security under an SaaS paradigm (to be investigated together with IIP Veilig Verbonden)?
- How to guarantee continuity of operation under an SaaS paradigm?
- How to develop testbeds for platform development?

Focus III: Evolutionary methods and techniques

Evolutionary techniques are needed to enable existing software systems for service-based eco- systems. Typical questions to be answered are:

- What is the structure of the legacy system?
- What is the quality of its parts?
- Which parts can be migrated to a service-based infrastructure?
- What is the relationship between high-level service descriptions and software migration?
- What is the quality of the migrated system?

Typical research questions study how this can be achieved:

- How can legacy systems be analysed from the perspective of service enabling?
- How can software transformations be designed that ensure compatibility with high-level service descriptions?
- How can the quality properties of the migrated system be predicted?
- How can evolution scenarios be designed and described and how can their impact be determined?
- How can analysis and transformation be supported by tools for development, validation, simulation and execution of migrations?

Carglass

Carglass delivers services for reparation and replacement of car window shields. The company has invested heavily in the digital integration with their customers: they can look into the insurance company system to see what kind of insurance someone has and based on that can start and finish the whole process of service delivery. The only thing the insurance company has to do is pay the costs. The communication with the customer is done by Carglass, an excellent example of the mixing of services and software from different companies. However, this leads to all kind of questions like: who's customer is it, how do you deal with pricing, (the insurer saves money in the call centre but the bill is paid through the damage department).

www.carglass.nl

5.3. Service Transition

To advance to a service-based organization, many changes need to be accomplished. These changes can have significant organizational, technical and individual consequences. Infrastructure (incorporating legacy systems in an SaaS world), culture (from doing it yourself to partnerships), and hierarchies are all considerably affected when moving to SaaS-oriented delivery.

Managing this transition and change is an important and complex task. However, transition management is an issue that almost all implementations of SaaS will face, since few initiatives can start from a green field situation. Managing this transition may become one of the most important competitive factors. Due to the ever changing context, we must conclude that change and movement will become the constant factor: Panta Rhei.

Areas that are affected by these change processes are, among others: business models based on networks while in transition, new bases for risk analyses, managing service levels during transition, technological infrastructures that exist in hybrid configurations, etc.

The main scientific fields that are needed to contribute to research in this area are the fields of business and computer science, but significant contributions must also be expected from economics, law, and the social sciences. Since these fields influence each other during transition, the challenge for service transition is to take a holistic approach and also focus on the inter-relations between these areas.

5.3.1. FRAMEWORK FOR SERVICE TRANSITION

We use the following definition for service transition:

Service transition is the migration from a current, legacy situation to a service-based business and the management of the risks of changes at the organizational, technical and individual level.

Service transition at an organization therefore deals with all the aspects of a migration from a situation in which the organization does not make use of service-orientation to a situation where the organization is running based on services from a business and a technical point of view. This includes the various intermediate steps that are possible along the way. The end situation consists of an organization that uses services that are built using the view of the Business Services Innovation part of this SRA.

It is important to note that this transition touches upon all aspects of the business. It is therefore crucial that such a migration is performed well, because otherwise business criticality will be compromised. During migration, the organizational structure, the technical (IT) infrastructure and (groups of) individuals within the organization are affected. Therefore, all these elements need to change and this change has to be managed accordingly in order to avoid or deal with as many risks as possible.

In this field, we consider four main areas of interest where challenges and research questions for service transition can be identified:

- Change management of service transition:
  How to plan and execute a transition at the organizational and personal level?
- Technology management of service transition:
  How to perform an analysis of the technical transformation from legacy to SaaS?
- Risk management of service transition:
  How to manage the risks when migrating to a service-based organization?
- Business aspects of service transition:
  What business opportunities are enabled by a transition to a service-oriented organization?

5.3.2. CHANGE MANAGEMENT OF SERVICE TRANSITION

This area is concerned with the management of change in the organizational structure and the cultural elements of the organization. We therefore distinguish between these two perspectives. The harder elements of the transition at the technical level are part of technology management.

Organizational perspective

The organization in which a service transition is being executed will change in structure, governance models, control mechanisms, management practices and so on. In that sense, the following questions can be raised:

- What is a good organizational structure for the new service-based situation?
- Are new management principles, governance models and control mechanisms necessary and how can they be effected?
- How to change with an unclear present situation and a moving target in the future; how to manage change in this situation?
- How to plan for the necessary changes in organization involved in the transition?
- What kinds of reference solutions are suitable for what type of situations (service layers, partial rebuild, outsourcing, modularisation, etc.)?
- How to ensure continuity of service during the transition period?
- How to build the transition from small evolutionary steps?

Cultural perspective

The culture of the organization will also change and usually there will be resistance to such a change. The main challenge is to convince the employees of the added value of the new situation. In this sense, the following questions can be raised:

- How can employees be involved as much as possible in the migration path?
- How can expectations of the new situation be best managed?
- How can the improvement in the way of working and the added value of the service-based situation be sketched towards the employees in the organization?
- How can the management of the organization increase the level of trust in the migration path?
- How can the employees of the end-users of the service-based situation be empowered as much as possible?
- How can conflicts, as they appear, be dealt with and resolved as easily as possible?

5.3.3. TECHNOLOGY MANAGEMENT OF SERVICE TRANSITION

This area is concerned with the management of change in the technical structure and infrastructure of the organization. We distinguish between the perspective of technical analysis of the migration path and the perspective of evolution towards the new situation.

Analysis perspective

This perspective is focused on analysing the new situation and deciding on the timing and place of switching and visualisation of the new situation. In this sense, the following questions can be raised:

- Which technical analyses of existing (legacy) software are needed when making the decision to switch to SaaS or not?
- How can the results of these analyses be visualised in order to make them understandable for non-experts?

Evolution perspective

This perspective is entirely focused on the evolutionary steps that need to be taken during the migration path. It concerns the necessary transformations and their limitations, continuous evolutionary steps and interoperability between legacy and SaaS applications. In this sense, the following questions have to be answered:

- Which transformations are needed to transform legacy systems into SaaS applications?
- What are the limitations of this transformational approach?
- How can the continuous evolution of SaaS applications be supported?
- How can interoperability between legacy software and SaaS applications be enabled?

5.3.4. RISK MANAGEMENT OF SERVICE TRANSITION

This area is concerned with the management of risks during the technical migration path. We distinguish between the perspective of determining the risks of the migration path and the operational perspective of the migration in terms of quality and performance.

Risk perspective

This perspective is focused on the determination of risks during the technical transformation and possible measures that can be taken. In this sense, the following questions can be raised:

- What risks can be identified during the migration path?
- How do you determine risks that specifically relate to transition and hybrid situations?
- What measures can be taken to deal with these risks?
- Which control mechanisms are needed during transition in order to manage risks?
- What are the interdependencies between risks that might occur during transition?
- What are the risks with respect to privacy and the security of information and people?

Operational perspective

This perspective is focused on the operational aspects of the migration and how to deal with the quality and correct execution of the migration path. In this sense, the following questions can be raised:

- How is the quality of the migration being defined and which parts of the migration need to be measured?
- What quality and progress measurement mechanisms can be used during the migration path?
- What operational management processes and principles need to be applied?
- What does the project management of the migration path look like?
- How can we simulate and predict the relevant aspects and solutions before and during transition?
- What auditing mechanisms are possible during the transition?

5.3.5. BUSINESS ASPECTS OF SERVICE TRANSITION

This area is concerned with the economic aspects and the potential business opportunities that emerge during the transition. We distinguish between the business and financial perspective and the legal perspective of the transition.

Business and financial perspective

This perspective is focused on the business and financial aspects of the transition, such as business opportunities, business models, value drivers, business cases, transition costs, hybrid situations and service levels.

- What new business opportunities relate to the transition itself?
- How do you ensure a smooth transition from the "old world" to the new?
- What business models are most suited to hybrid situations?
- What value drivers and business cases can be defined and what transition costs apply?
- What are the service levels that can be achieved during transition and in hybrid situations?

Legal perspective

This perspective is focused on legal aspects such as the ownership of the services to be migrated to, the licensing of software and services and intellectual property rights.

- What is the role of legal issues and compliance relating to the transition period?
- Who is the owner of the new services and what is the impact of this ownership during the transition?

Google bank

While checking who in the Netherlands has a banking licence a journalist found out, to his surprise, that Google also has one. And come to think of it, Google has an excellent position to become one. For example through peer to peer lending based on their knowledge build up with communities (Addloans?). Or through their feeling for "what is happening" and apply that to risk management. They even "own" a mobile payment platform through Google phone and the Android operating system.

5.4. Services Governance and Operations

5.4.1. INTRODUCTION

The Netherlands has a long-standing reputation in ICT operation and maintenance services as well as having developed reference models for it such as ASL[i] and BiSL. These reference models have not only been introduced and implemented within the Netherlands but also internationally. National representatives were involved over the past years in harmonising ASL and BiSL with the international ITIL framework for the management of information services, as well as to eTOM as a framework for telecommunications and information networks. In this context, SaaS creates great opportunities from a business perspective, enabling the flexibility with which an open economy flourishes.

Service Operation and Maintainability therefore deals with the business models and processes to deliver, maintain and operate services from the point of view of business (tenants and users) and providers (service providers and aggregation providers), based on the new possibilities that new technologies offer. In this respect, the following factors are driving this change:

- The tenants of a service are no longer the owners of it.
- The providers do not know all the users of the service and they cannot predict the required performance and availability.
- Aggregators can help tenants to find and combine individual services with business services and to guarantee the required availability and performance.
- The changing ICT business chain models will have an impact on security (management), operation and management strategies.

i *BiSL: Business Information Services*
ASL: Application Services
eTOM: enhanced Telecom Operations Map
ITIL: Information Technology Infrastructure Library
ASP-model: Application Service Provider-Model.

Therefore, new knowledge has to be developed for service operation and maintainability areas like:

- How to deliver networks of (business) services? (Current design processes are much more focused on the design of single entities instead of networks.)
- How to ensure the operability and maintainability of these services and networks.
- How to create ICT business models that take the new way of usage into consideration?
- What external factors, like laws, practices and the like, influence operation and maintenance?

5.4.2. RESEARCH AGENDA FOR SERVICE OPERATION AND MAINTENANCE

Design perspective

The design methodology should specify which properties of business services networks need to be analysed (at design time and run time) and monitored (at run time). These include quality, costs and benefits, performance, stability, adaptability, propagation of faults/risks and usage patterns. A proper design requires that business services and service networks are analysed, simulated, validated and tested to assess such properties before deploying these services in practice. Knowledge to be developed covers the instruments needed for these analyses and predictions (e.g. mathematical analysis tools, simulation environments, service network prototype labs, business-level test harnesses, et cetera). Such knowledge should answer questions like:

Operation and Maintenance services (Architecture) for SaaS:

- What best and worst practices are available in the design of the operation and maintenance processes for the services, what kind of reference models are needed?
- What (domain-specific) languages do we need to describe the management of SaaS services and networks throughout the life cycle management?
- Which requirements can be defined to secure operation and maintain the services and networks?
- Which trial projects can be defined to test and simulate the operation and maintenance?

Business models for Operation and Maintenance:

- What business models are valid for the operation and management of SaaS services delivered in networks?
- How can we work with the replaceable services within the network to provide a better availability and performance?
- Which payment models will be relevant and how to deploy them?
- How will different payment models interwork?

Governance:

- What agreements are needed between parties to deliver and maintain and secure a network of SaaS services?
- Which operation and management is necessary for privacy, security, authentication and authorisation in a heterogeneous network of services?

Operations perspective

Business services networks are complex structures with many interdependencies between partners and their systems. Deployment without a thorough analysis entails considerable business risk, and running the service networks requires active monitoring and control. To be able to estimate the properties of these networks such as cost, performance, stability, quality, et cetera, various analysis techniques might be used. Both the design-time analysis of service architectures and run-time testing and monitoring of operational services come into play. This results in questions like:

- Which operational processes are needed from the customer perspective to manage the SaaS environments?
- Which skills, techniques and tools should be available from the user perspective to enable the successful use and combination of services? And which should be available from the provider perspective to enable the successful development and deployment of services?

- Which (scalable) infrastructure is needed to facilitate a substantial use of SaaS solutions?
- Which cost drivers are part of the operational side of SaaS? What strategies using SaaS can be used to lower the operational costs?

5.4.3. SERVICE GOVERNANCE

Within our framework for business services innovation, 'governance' is understood to address the managerial issues of business services networks. In particular, we focus on the coordination perspective, i.e., control mechanisms that govern the correct execution and bundling of services. To guarantee the quality and performance of service delivery of these software services, organizations need much more advanced governance and architecture models of software services. These models are becoming more and more analogous to the managerial models in organizations where tasks are delegated by one person to the other, and management has to monitor and control the executions of these tasks. Hence, in services innovation research, theories from economics and management science have to be extended with computer science. This includes issues such as how can service providers and consumers in a network make clear agreements; the risk management and security perspective, i.e., how to safely operate a service-based business; the change perspective, i.e., how to make the transition from the current situation to a desired state.

Coordination perspective

Service networks need to be based on clear agreements between the parties involved. Such agreements may take the form of SLAs or other types of contracts. The complexity of service networks and the often fine-grained nature of the business services involved, compared to 'traditional' product and service contracts, lead to many research questions:

- What governance models and control mechanisms can be developed for the correct and compliant execution and bundling of services?
- What is the role of trust in governance models for service delivery? How do SaaS contracts differ from current outsourcing contracts?
- Is it possible to standardise SaaS contracts? Is it possible to automatically negotiate contracts for standardised services?
- What agreements are needed between parties to cooperate in a network of SaaS services? (What kind of contracts and service levels)? What means of conflict resolution are possible between parties in a network?
- What are the legal issues that are relevant for service delivery using SaaS? How can we protect intellectual property regarding services?

Risk management and security perspective

Operating in a service network makes an organization highly dependent on the services of others, and vice versa, liable towards other parties that use its services. Legal issues may span multiple jurisdictions and secure operation require verifiable measures across an entire service network.
The resultant research questions include:

- Which possible risks can be identified for SaaS and what measures and control mechanisms can be taken to manage and mitigate these? What are the best strategies to manage liability?
- How can we deal with the higher interdependence of an organization on other organizations due to SaaS in terms of risk and profitability?
- How to determine the risk of failure of parties in the network and how to safeguard against these risks?
- How can we ensure privacy, security, authentication and authorisation in a heterogeneous network of services? Which security standards can be used in both SaaS and internal environment?
- How can we assess and audit compliance and security measures implemented by the SaaS provider? How to ensure compliance with applicable laws and regulations, even in multi-enterprise, cross-border service networks?

iDeal

For small web shops a simple but secure payment system is crucial. It should be easy to integrate into their website, low threshold to use it and make sure that payment is done when the goods are shipped. iDeal is a good example where this flexible approach is accomplished while maintaining all the security of the complex and heavy banking payment systems. The front end that can be integrated easily is in fact an entry to the internet payment services that banks deliver to their customers. Around this they created a service ensures the web shop that the payment is done. This service is a good example of the combination of the importance of hybrid solutions of current monolithic systems and flexible cloud services.

5.5. Further development and implementation SRA

This SRA is the starting point. Over the course of time, it will have to be further refined as well as put into action through joint projects between academia and the business community. Four lines of action are mentioned below:

A. BUILDING THE COMMUNITY

The creation of a community, linking academia to application, which serves to share and distribute knowledge regarding services innovation experiences and strategies across different sectors.

B. DEVELOPING JOINT KNOWLEDGE

The development of shared, generic, knowledge for the modelling, analysis and construction of ICT-enabled innovative services. This knowledge comprises not only a strong conceptual foundation, but also a framework for technologies and best practices. Key parts of the technologies are implemented in software (e.g. as analytical tools) supporting the development of services innovation. Key characteristics and requirements for the joint knowledge are:

- It provides service models and descriptions that are inherently component-based and can be flexibly configured and adapted.
- It takes business requirements and considerations regarding service innovation as its trigger and starting point, i.e. it considers services innovation from the value creation standpoint.
- It considers integrated analysis of the projected economic as well as ICT technological feasibility of proposed service innovation trajectories.
- The analysis of services takes into consideration known customer and social factors relating to patterns of adoption and the diffusion of service innovations.

C. TESTING THE JOINT KNOWLEDGE

Testing and validation of the joint knowledge by its application in several new services innovation projects in a specific Dutch industry and the public sector. (In particular: e.g. finance, e-health care and e-government.)

D. CLOSING THE KNOWLEDGE LOOP

The setting up of a fast-feedback management mechanism between service innovation research projects and industry/customer usage that decreases the lead times for knowledge sharing as well as for time to market.

One may consider the strategic agenda components to build the community and to close the knowledge loop (A+D) as the Dutch analogy of what in EU research strategy terms a Technology

Platform for Services Innovation. The components concerned with building and testing the joint knowledge (B+C) then cover the overarching strategic goals of the IIP-SaaS research project proper; they also should lead to direct opportunities for the taking up of results by participating parties or spin-off companies.

6.

Relationships to the other IIPs

The challenges and rewards of developments in SaaS can be found in different scientific areas and sectors. There are relationships with areas like software development and business alignment and relationships with sectors such as the creative industries, health care, finance and government. SaaS is the glue that holds many of these developments together. For many of these issues, ICTregie has stimulated and set up IIPs. Other ICT Innovation platforms are described below as well as how IIP-SaaS is cooperating with them.

6.1. *IIPs focused on separate sectored domains*

IIP-CREATE

IIP-CREATE is the IIP that focuses on the creative industries. This IIP brings together 3 disciplines: 1. creativity & design, 2. services & products (industry) and 3. ICT Research & Innovation. It covers topics like (serious) gaming, social software, artificial intelligence, new media, industrial design and ambient technology.

IIP-CREATE focuses on 5 research themes: Search and find your way (in the information overload), Connectivity (adapt the information to the individuals' need), Virtual and real worlds (for education, games and social interaction), Collaboration as a way of life (sharing content and digital tools for working and living together), Interactive and tangible environments (creating the right atmosphere and experience).

Innovation, design and creativity have increasingly become networked and distributed. Interaction technology is the bridge between people and creative products and services. New interactive ways are needed to keep pace with the abundance of data, functions and experience. To realize new creative services and products, a flexible software infrastructure is needed that is seamless and transparent. IIP-SaaS can deliver this software infrastructure.

IIP-SaaS can support the development of new creative products and services in a number of ways: flexible software infrastructures, Interoperability of services, Recreation and reuse of functions and data-sources, Building blocks to automatically create virtual worlds and games and New business models for content distribution and management.

IIP-HEALTHSUPPORT

IIP-HealthSupport is the IIP that focuses on the contribution that ICT can make to enhance the health sector through better solutions and higher productivity. A strong focal point for this IIP is "patient centric healthcare" that creates networks of health organizations focused on delivering care and cure in the best way to the person.

The health sector is one of the focal points of IIP-SaaS. By cooperating with IIP-HealthSupport we will combine the communities involved and elaborate projects together.

IIP-ICT IN DE BOUW (ICT FOR CONSTRUCTION)

In the construction sector newly developed methods such as vitual construction on the basis of building information models, have led to the demand for application software and related services. Web technology will increasingly be introduced for the storage and communication of object and building information models. This development offers interesting opportunities for the introduction of software as a service, in particular because there are many small companies in the sector, which are (financially) unable to set up the necessary ICT infrastructure and service within their organisations.

6.2. IIPs focused on technology issues

IIP-INTELLIGENTE COMMUNICATIE (INTELLIGENT COMMUNICATION)

People are using an ever increasing amount of communication means and are more and more surrounded by intelligent equipment. This environment is creating a large amount of data and knowledge that can be used to create "intelligent environments".

In these intelligent environments various end-user devices are connected seamlessly with one another. SaaS applications make it possible and manageable to access information from these various devices.

IIP-SENSOR NETWORKS

Sensor networks are becoming more ubiquitous everyday. The sensors are becoming smaller, more versatile and more robust. IIP-Sensor networks stimulates research into massive distributed sensor networks including aspects like robust communication and self correcting mechanism and the like.

The miniaturization of sensors and the increasing quantities of available data have also led to new scientific developments creating new algorithms which aim to analyze these data and regulate, control and simulate increasingly complex systems.The information that these networks deliver are input for many applications like health, mobility and others.Applications will increasingly be distributed systems with the capability of dynamically extending their functionality by incorporating other systems present in their environment. Such diverse systems should be capable of supplying various services on behalf of different users and hence offer excellent opportunities for SaaS applications.

IIP-VEILIG VERBONDEN (SECURITY AND PRIVACY)

IIP-Veilig verbonden is focused on research in relation to ICT security and privacy. The research subjects are identity management, data and policy management, infrastructure, economics and risk management, regulation and ethics, certification and international standardisation and methods and tools.

Security is an important issue in SaaS due to the digital and network centric focus. For these issues, a close cooperation will be set up with IIP-Veilig verbonden regarding the security and privacy issues in this SRA.

IIP-PRODUCTSOFTWARE (PRODUCT SOFTWARE)

IIP-Productsoftware has its focus on the development and marketing of standard software. The world of product software is clearly moving in the direction of flexible SaaS solutions. In addition, most of the SaaS implementations involve to a large extent standard product software solutions. As such, the IIP-product software is an important partner in relation to the subject of software and software development in the "Software Services Evolution" in this SRA.

7.
Valorisation

7.1. Intro

Services constitute an increasing percentage of our economy (even a company rooted in physical products like OCE has become largely dependent on services and even started a "services research centre"). More and more of these services are produced and delivered in a digital form. In addition, many of these services consist of combinations of other services. We have seen in the previous chapters that this leads to new paradigms of doing business.

This leads to the conclusion that building up capabilities in the development of compound services is important for the Dutch economy. For example, capitalising on our extensive knowledge on pensions by exporting it is dependent on our capabilities to deliver operational services alongside consultancy. For example, by creating back-office systems that integrate with systems in other countries. Or by creating health-care services around MRI scanners.

7.2. Research projects

In order to achieve the knowledge and results as described in the previous sections, business and educational institutions must participate together in research projects. The proof of the pudding is after all in the eating. The focus of these projects will be mainly driven by questions from the market sectors. SaaS is, as shown, is firmly rooted in business.

These projects will be developed in close cooperation with the three sectors – health care, finance and government – and potentially other sectors, which are potentially sufficiently interesting for the purposes of SaaS. Based on the scenarios, pre-competitive demonstrators will be developed on a project basis. These demonstrators will reveal the added value of the knowledge and research results of the SaaS programme. The main goals are to:

1. Draw up scenarios of future services within the sectors that are able to guide the SaaS research project.
2. Use the current research themes as described by the roadmap to develop the knowledge which is required to facilitate SaaS developments from a business as well as software perspective.
3. Establish a testbed in which knowledge and results can be applied, validated and demonstrated within the developed scenarios.
4. Transfer and warrant the knowledge and results for all SaaS partners and other stakeholders, both local and international.

7.3. Testbeds and infrastructures

For the Dutch economy, much value is to be gained by enhancing our capabilities in designing and implementing new (compound) services. Especially due to the nature of our economy that so strongly rests on services and trade. In order to take advantage of this development, we need to invest in two major areas: a) the infrastructure to build and test compound services and b) the training of people regarding the design and operation of compound services.

A. Due to the network centric nature of SaaS, it becomes increasingly difficult to design and test new services in isolation. For non-critical services like misdaadkaart.nl this is not a big problem but for mission critical software it is. Take, for example, an application that advises about the use of medication but is dependent on the Electronic Health Dossier, a database of medications and side effects and a database of known interactions between medications. These separate databases are not under the control of the organization that creates the compound service. However, testing can only be done by real interaction with these databases. But interacting with the official EPD with test data is not something anyone would approve of. The creation of a testbed infrastructure that would make testing these connections possible would very much help to improve the speed of development and the security of the end solutions. This is especially true of the basic services like health care records, payment infrastructures and the like.

B. A testbed infrastructure without enough people with extensive knowledge on how to use it will be worthless. Therefore we need to invest in the training and education of people about how to design, test and operate in a networked services world. To succeed, new skills are needed. First of all, the challenges are not just ICT related but to a large extent also legal, concerning business models, service levels and the like. Second, the mindset in respect of the design of new services is changing from new development to the reuse of already existing and available services.

These two areas cannot be examined separately. The interaction between building up the infrastructure, creating a community of people with knowledge and skills and the setting up of projects to create experience is intense. Moreover, a strong cooperation between businesses, academia and government is needed. The following steps need to be taken for this:

- Creation of a common vision of the direction we need to take and the goals we wish to achieve and the roadmap to accomplish it. This Strategic Research Agenda is a first step towards this roadmap.
- Setting up projects involving businesses, academia and government focused on building the knowledge community as well as making steps in building up the needed infrastructure.
- Establishment of a structure to stimulate cooperation between the parties involved. In this structure, all relevant parties are represented. IIP-SaaS can be the starting point for this.
- Funnelling the created knowledge about the design, testing and operation of SaaS services through education institutions and professional guilds.
    - Dissemination: this is the active provision of the results of projects to the rest of the world, for example, through a website with results, through articles at conferences, through periodical publications and/or through interviews in magazines.
    - Outreach: this is the transfer of knowledge that targets specific audiences. Policies will determine which results are offered, for example, to develop new initiatives with these audiences within or adjacent to the SaaS programme and the NSEL.
    - Valorisation: reasoning from the knowledge perspective, this concerns the determination of added value for the target group. Hence, the receiving target groups will determine the value of the results and knowledge in an interactive and practically applicable way.

8.

Education and Guilds

The introduction of SaaS requires new knowledge concerning architecture, structure and technology. The knowledge intensive society as is currently emerging in the Netherlands and the objectives stated at the European level require research and education institutions to fulfil the demand for knowledge and education in this field. Therefore, a clear and tight alignment of relevant educational curricula – which include short courses for professionals, education for services engineers and programmes regarding service software in ICT education – is a necessity. Knowledge concerning architecture, structure and technology should be part of the training for professionals and services engineers, professional education and research university education. However, the process of integrating services engineering knowledge within educational curricula requires careful planning, in order to facilitate a smooth and timely introduction of the indispensable expertise and skills with respect to SaaS.

The shift towards SaaS and its implementation in business requires at least sufficient knowledge on the part of professionals in the field. In that respect, professional training has a high priority, in order to ensure the swift availability of experts in the field. Next, a planned introduction and the management of educational adoption of the SaaS technology is necessary. In the past, both research university and vocational education have fallen short with respect to alignment with the requirements of the business community. A clear example of this mismatch can be found with SOA. Although there is a very clear trend towards SOA and the service-oriented redesign of legacy systems, research universities still do not provide sufficient knowledge and skills concerning this subject. In order to prevent this mismatch in the case of SaaS, a well-managed introduction of service engineering as an expertise is inevitable.

These curricula must be firmly embedded in professional practice as the field emerges. Just as an academic discipline grew out of logistics in part due to practical problems and solutions, so should disciplines grow from SaaS grow. Our first focus is on creating research projects together with businesses and academia. In the next phase, steps will be taken to strengthen professional guilds and academic curricula.

9.

European network

In the coming years, IIP-SaaS will also be active internationally. The activities are twofold: first, there are close ties with the European Technology Platform for software and services: NESSI. NESSI and IIP-SaaS both focus on software and services. The main difference is that NESSI is a European Technology Platform and IIP-SaaS is a national technology platform. Currently, IIP-SaaS is member of a network of platforms that is closely tied to NESSI. IIP-SaaS acts as the antenna of NESSI in the Netherlands.

The reason why IIP-SaaS is active within the network of NESSI antennas, is related to the practical need within Europe to know what is happening in the field of software and service in various countries. NESSI and the European Commission currently lack an overview of what is happening in that field. The national platforms are closer to the source of information and in that way they are better able to provide the information needed. The platforms can learn from each other: best and worst practices can be exchanged. Which government projects succeeded, which failed? What is the state of E-health, and E-government in the various countries, which countries are ahead and which countries need to improve ICT services? Working together will increase knowledge management in this field considerably.

Not only is knowledge management important, but the need for collaboration is evident. The following is taken from a communication from the European commission in March 2009: "Despite recent pioneering efforts, such as Joint Technology Initiatives, and Joint Research programmes under the seventh EU Framework Programme for Research and Development, Europe's ICT R&D landscape remains fragmented. Little interlinkage can be seen in the knowledge triangle, between innovation, R&D and education policies that are often drawn up in isolation by different ministries or at different levels. The consequences are: duplication of efforts, lack of critical mass, difficulties in addressing common challenges jointly and, in the end, sub-optimal returns on R&D investments. To reduce fragmentation Europe needs to better coordinate its policies and concentrate and specialise its resources. This entails stronger collaboration between the Community, the Member States, the regions, industry and academia, with the Community acting mostly as facilitator of multinational transnational collaborations". The NESSI antennas network will be one of the instruments that fights fragmentation and fosters transnational collaboration.

Another motive for cooperation with other national platforms is to open new ways for businesses to expand and to see what is happening in other countries. In the coming years, the tools of communication and the interaction between people from the different platforms can open up new opportunities. The platforms can serve as stepping stones. In short: supporting the European ICT and services sector is possible if the NESSI antennas network takes off and becomes mature.

The second main international activity has to do with the 7th EU Framework Programme for Research (FP7). IIP-SaaS will support and encourage more Dutch participation in research projects with-

in FP7, specifically in the area of software and services. This means that IIP-SaaS will inform members of the community about calls and tools for strengthening research in the field of software as a service.

In general: IIP SaaS will promote bilateral or multilateral cooperation. A large number of Dutch researchers and businesses within this field is already active in an international context but IIP-SaaS can and will provide additional information and opportunities for them. The Netherlands can only become a hotspot for software services research and development in Europe when Dutch academia and businesses are well known in Europe and working together with other strong research groups and businesses.

Appendix A
RELATIONS TO OTHER PROGRAMMES

RELATIONS TO NESSI, ROADMAP SAS AND JACQUARD

The areas from Roadmap SaS, JACQUARD and NESSI are given below in relation to the area Service Engineering:

From Roadmap SaS:

- Business-economic aspects
- Governmental and legal aspects
- Transparency, monitoring and enforcement
- Architecture and service engineering

From JACQUARD:

- Alignment
- Integration and exploration
- Architecture

From NESSI:

- Provide a flexible infrastructure to support the networked economy.
- Define open architectures for intranet- to internet-scale service delivery.
- Add coherence to the composition of uncoordinated services across all layers and all providers.
- Ensure social, economical, legal and cultural viability.
- Pave the way towards the collaborative executable enterprise.
- Provide the business context for services in hybrid service-based systems.

The areas from Roadmap SaS, JACQUARD and NESSI are given below in relation to the area Service Software:

From Roadmap SaS:

- Identification and security
- Interoperability

From JACQUARD:

- Configuration
- Integration and Exploration
- Componentisation

From NESSI:

- Add the dimensions of knowledge to the interaction between user and (business and societal) services.
- Provide end-to-end trustability in hybrid service-based systems.
- Realize the ubiquitous service availability.

The areas of Services Transition and Services Operations are not explicitly focused on in the above mentioned publications.

Appendix B
GLOSSARY

ASL	Application Services Library
ASP	Application Service Provider
BiSL	Business Information Services
eTOM	Enhanced Telecom Operations Map
ETP NESSI	European Technology Platform for Networked European Software & Services Initiative
IIP	ICT Innovation Platform
ITIL	Information Technology Infrastructure Library
JACQUARD	NWO Research Programme on Software Engineering and Software as a Service
NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (The Netherlands Organisation for Scientific Research)
R&D	Research & Development
SaaS	Software as a Service
SEPA	Single Euro Payments Area
SOA	Service-oriented Architecture
SOC	Service-oriented Communications
SRA	Strategic Research Agenda
WTO	World Trade Organisation

Endnotes

1. B. van Ark, R. Inklaar & G. de Jong: "ICT-gebruik, productiviteit, groei en waardecreatie", ESB 91, no. 4494 Sept. 2006, pp.16-21 (ESB Dossier ICT en Economische groei)
2. J.N.T. Weda, J.J.M. Theeuwes & M. de Nooij: "Maatschppelijke Baten van eVaardigheden – een verkenning" SEO Economish Onderzoek, Amsterdam, 2006
3. D. Pilat: "De economische effecten van ICT", ESB 91, no. 4494 Sept. 2006, pp. 9-13 (ESB Dossier ICT en Economische groei)
4. Roadmap Sofware als Service, ICTregie, 2007
5. ICT-Agenda 2008-2011, De gebruiker centraal in de digitale dienstenmaatschappij, 9 June 2008
6. NESSI Strategic Research Agenda, Vol. 3.FP7-2.exec, NESSI Roadmap, Work Programme 2009-2010, Public Version 29 February 2008 –Revision 1.0
7. J. Spohrer, P.P. Maglio, J. Bailey and D. Gruhl: "Steps Toward a Science of Service Systems", Computer, Jan. 2007, pp. 71-77

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