Insights on innovation management practices at T-Systems

Analysis of a new business model for identity services on public computer network systems

February 18th, 2011

Alejandro E. Berrizbeitia

“Por eso quiero, hijo mío,

que te des a tus hermanos,

que para su bien pelees

y nunca te estés aislado;

bruto y amado del mundo

te prefiero a solo y sabio.”

Andrés Eloy Blanco, *Coloquio bajo la palma*

To my father

Abstract

This monographic identifies innovation management elements at a major German IT services firm (T-Systems International GmbH) and subjects them to critical analysis through the study of a corporate business initiative known as Project CifraH (Citizen Interoperability Folder for Relationships based on Avatar Hosting) undertaken at an international subsidiary of the company.

After an overview of the current state of the art in the field of Identity and Authentication in public computer network systems (such as the Internet) and describing the main initiatives undertaken by the firm in order to manage its innovation activities, the Project CifraH is analyzed in order to highlight "best practices" in adequately aligning the company's innovation efforts with its business goals.

These qualitative insights serve as the basis for recommending an increment on the degree of flexibility for deal-making at the international business units of the firm, as well as improvement on the flow of information between certain corporate areas, in order to contribute to the improvement of T-Systems'—and the Deutsche Telekom Group's—performance at innovating.

Sinopsis

Esta monografía identifica elementos de gestión de la innovación en una conocida compañía alemana del sector TIC (T-Systems International GmbH) y los somete a un análisis crítico a partir del estudio de una iniciativa de negocio denominada Proyecto CifraH (*Citizen Interoperability Folder for Relationships based on Avatar Hosting* por sus siglas en inglés) llevada a cabo en T-Systems ITC Iberia SAU, una unidad internacional de la compañía.

Después de hacer una revisión del estado del arte en el campo de la identidad y autenticación en redes informáticas públicas (como lo es Internet) y de describir las principales iniciativas que lleva a cabo la compañía para gestionar su actividad de innovación, se analiza el proyecto CifraH con el fin de identificar "prácticas modelo" en alinear los esfuerzos de innovación de la empresa con sus objetivos de negocio.

Estas perspectivas cualitativas sirven de base para recomendar un incremento en el nivel de flexibilidad permitido a las unidades internacionales de la compañía de cara a cerrar acuerdos de negocio, así como para recomendar una mejora en el flujo de la comunicación entre ciertas áreas corporativas, con miras a contribuir a la mejora en el desempeño del ejercicio de la innovación en T-Systems y el Grupo Deutsche Telekom.

Acknowledgements

This work represents the culmination of my efforts towards obtaining an engineering degree in telecommunications—ending a winding road that spun three universities and many times of uncertainty.

Besides my family—who have backed me up all along my studies—I'd like to extend my warmest thanks to the institutions and the people that provided me with the necessary stability and support.

To that extent, I'd like to praise the Universidad Católica Andrés Bello's teachers and staff for providing us, the alumni, with a stable environment in which we could grow and develop even amidst the increasingly degrading state of our Nation. I'm proud to be part of that force for good that is sowing the seeds of the future.

I also want to express my deep appreciation to the Universitat Politècnica de Catalunya and its people for having nurtured me within their culture of excellence and having welcomed me so warmly into the Catalan society. As well as acknowledge the unwavering support I have received from the staff of the Innova-TICs program and Pere Losantos—tutor of this final project—in my academic endeavors.

I'd also like to extend my thanks to Carlos Cosials, T-Systems Iberia's Innovation Manager, and to Joan Alfonso, Business Development manager with whom I worked with for over three years, for providing me with the opportunity to work with them in this and many other interesting, and innovative, projects.

Index

Introduction

To conceive "innovation" as an inescapable requisite for a company' survival, not to mention its profitable growth, is an almost standard belief in the corporate culture of today's most successful business ventures.

During the last decade this axiom has progressively spread to organizations in all kinds of areas—such as the public sector and charities—to the point of becoming a sort of universal mantra whose claimants put forward in their mission statements in order to express their capacity to be true players in current—and future—ultra-dynamic markets.

The meaning of innovation, though, remains "an elusive notion" [The Economist, 2007] for which there is no widely-accepted definition among management academics and whose implications, measurement parameters and other 'basic' features are still subject of much debate.

In part, this is due to the fact that some characteristics pertaining to innovation—such as creativity, paradigm disruption, ingenuity, novelty and imagination—seem to inherently reject being delimited within closed reference frameworks—so as to avoid disrupting their true essence.

Bearing these considerations in mind, an exhaustive definition for innovation will not be sought in the scope of this work. Instead, the straightforward concept stated in 2005 by Richard Lyons—then the Chief Learning Officer of Goldman Sachs, a renowned investment bank, and currently the Dean of Haas Business School—will be considered sufficient: "Fresh thinking that creates value".

That phrase highlights what is perhaps innovation's most distinct aspect in order to distinguish it from "invention" or otherwise similar terms that might prompt confusion: An innovation must be successful in a given market—it must **create value**—in order to be called as such.

What matters gets measured

In spite difficulties to define innovation, its exercise is increasingly becoming part of a practical science which seeks to measure it and teach its principles—and hence make its related processes and activities **manageable**. Clayton Christensen—a Harvard Business School professor and renowned expert on the subject—insist that "simply, innovation is not as unpredictable as many people think. There's no recipe for it yet, but we're getting to it."

On the same note, Peter Drucker (1909-2005)—perhaps the most celebrated business academic of all time—remarked that "purposeful tasks that can be organized—and in need of being organized" and should be treated as a part of an executive's job. [The Economist, 2007]

Certainly there are a number of distinguishable elements that are common to all forms of innovation and from which is possible to extract innovation management models and tools. This is fundamental in order to comply with one of the most basic tenets of corporate strategy taught at business schools "**what matters gets measured**".

Xavier Anyeto and Marta Albertí, innovation directors at IDOM Group—a renowned Hispanic engineering and architecture consulting firm—express this idea in a government-sponsored innovation report: "to visualize innovation as a strategic business process is a necessary condition in order to be able to manage it in a systematic way... It is, thus, fundamental to identify such process, systematize it and subject it to a continuous measurement and improvement system." [Anyeto and Albertí, 2008]

Regarding the Information Technology (IT) industry (sometimes also: Information and Communication Technology (ICT) industry), it can be said that "innovation" bears a two-pronged significance. On one side ITs are subject to innovations in themselves—such as the many times when new discoveries make older IT infrastructure obsolete—but on the other hand ITs are potent innovation-enablers in a very wide range of applications and industries—given their huge potential for disrupting established paradigms in the handling of valuable information between humans and/or machines.

A subject for the study of innovation management

This monographic seeks to contribute to the field of innovation management by leveraging the inside knowledge of the innovation process at a T-Systems Iberia, a major IT services firm for corporate customers headquartered in Barcelona and a fully-owned subsidiary that belongs to the Deutsche Telekom Group, one of the world's biggest telecommunications providers.

Drivers and scope

An "innovative" project at T-Systems that seeks to monetize a cloud-based Identity Management Services platform dubbed "CifraH" (Citizen Interoperability Folder for Relations based on Avatar Hosting), conceived conceptually in 2009, is the compelling event that drove the interest for this analysis—performed within the framework of the Polytechnic University of Catalonia's (UPC) "Innova-TICs" program for the study of innovation management in technology ventures.

CifraH emerged as a concept when T-Systems Iberia's department in charge of scouting for innovative business opportunities identified a hindrance in the company's internal process for securely identifying remotely with is main governmental clients for sensitive business transactions.

This fitted nicely with a company product that the had been struggling for sometime to enter the local market: "My Access Key[1]"—a pay-per-use (i.e. "dynamic" in T-Systems' terminology) service that provides customers with access to a secure, cloud-based, work environment by leveraging identification technology hosted on a portable USB flash drive).

[1] See: http://www.t-systems.be/tsi/servlet/contentblob/t-systems.be/en/540160/blobBinary/My-Access-Key-ps.pdf

Structure and method of analysis

This monographic is structured in three parts. First, a high-level overview of the current state of the art in the Identity and Authentication field for public computer network systems (such as the Internet) is given. Starting with a description of the historical context of cryptographic technology and followed by a review of the most recent futuristic concepts conceived by the experts in the field.

In the second chapter, Deutsche Telekom's current innovation management process and various initiatives are described at the three levels of the organization relevant to project CifraH: Deutsche Telekom AG, T-Systems International and T-Systems Iberia.

Lastly, the third part of this work focuses on the main aspects of project CifraH, which are first described and then subjected to a critical analysis that seeks to judge the viability of the business model and the adequacy of the corporate sponsorship given to the initiative.

1. Identity and telecommunications: Engineering for trust

As society leverages the possibilities enabled by the Internet to conduct its activities, the protection of information assets has become a vital component of on-line data exchange.

1.1. The high cost of security in the transmission of digital assets

In trying to keep pace with the rapid advancement of communication technologies in a wide range of applications, the last decades saw a series of techniques built on top of the nascent network communication protocols with the goal of providing some degree of security in the face of numerous threats to the sensitive information handled within the 'digital' boundaries of organizations. These developments enabled further advancements in Information and Communication Technologies (ICT) as increasingly more parties trusted the new information systems and decided to make use of them.

Already by the end of the XX Century, most of the basic principles that constitute the current technical framework for securely handling digital information on-line where largely put in place—as agreed upon by the major global institutions—based essentially around the possibilities enabled by **public-key cryptography**.

Regarding economic activity, looking beyond the "trust" barrier that still hinders the deployment of fully-digitalized business processes, companies in most sectors of the economy have always foreseen very significant cost-saving opportunities in what is known as "paperwork elimination" initiatives. Making use of advanced digital security techniques, such as "e-Signatures", these initiatives would provide the means to further streamline operations and shorten business cycles by providing workflow automation and document life-cycle management functions. Making it more convenient, quick and secure to execute legally-binding agreements on-line (Forrester, a market research firm, estimates a 75% of potential savings in organizations that implement a complete digitalization of their business

processes [Nagel. Forrester Research, 2009.]) All this makes for highly attractive possibilities that drive the marketplace for solutions able to provide levels of trust in digital environments and communications.

On the other hand, the increasingly complex and rapidly-changing scenario regarding on-line information security systems greatly elevates ICT costs within organizations, both in the form of capital expenditures in digital infrastructure as well as of specialized know-how necessary to prevent potential catastrophes caused by lack of best-in-class security procedures. The cost and complexity of the necessary investment thus remains one of the main obstacles towards the adoption of fully digitized business processes. Famously, such was the case with the Public-Key Infrastructure (PKI) security framework at the beginning of the decade [Stamp. Forrester Research, 2005.]

As will be explained below, a possible source of savings may be found elsewhere in the industry under the form of "Cloud computing" business models.

1.2. Cloud computing business models for information security services

In order to improve the costs/benefits ratio of ICT adoption for organizations, new business models have risen as providers of these technologies attempt to reduce their client's burdens regarding the implementation, maintenance, renewal and management of these solutions; including for example the "outsourcing" of in-house ICT management and the "renting" of hardware components. Particularly, the last decade saw a surge in computer processing power and digital communications capacity that has allowed organizations to **acquire computing capacity on usage-based quotas** and other similar schemes **-collectively labeled as "cloud computing" offerings**. Essentially, cloud computing aims to allow organizations to regard their whole ICT environment as "services" provided much like a utility—such as the electric company—would. Based on such hired ICT

service, the organization is able to execute its automated digital-based activities disregarding the underlying information technology layer.

Forrester defines cloud computing as: "A standardized IT capability (services, software, or infrastructure) delivered via the Internet in a pay-per-use, self-service way." [Staten. Forrester Research, 2009]

It is also relevant to note that current market terminology tends to refer to three broad types of cloud computing offerings, namely "Infrastructure as a service" (IaaS), Platform as a service (PaaS) and "Software as a Service" (SaaS.) These categories make reference to the computing 'abstraction layer' up to which the customer is provided with service and are relevant to the level-of-control/implementation-complexity trade-off the customer requires (i.e. while an IaaS scheme provides customers with tools to control the low-level computer processes 'hosted in the cloud' that govern the execution of their applications, SaaS offerings simply provide the customers with remote access to fully-running applications under a service-level agreement (SLA) contract.)

The "PaaS" scheme will be relevant to the topic of this dissertation, so it requires some further clarification. While in a IaaS scheme the service provider only guarantees the permanent dynamic availability of 'virtual server' capacity and basic functions (such as creating a new instance of the virtual machine), and in a SaaS scheme the provider has to ensure the functioning of end-customer business processes as such, the **PaaS offering constitutes an in-between step where the customer is given high-level tools to develop its own business applications on top of a common developing framework (the platform) 'serviced' by the provider to all its customers** (such 'usage-based quotas' schemes tend to be profitable only in the presence of significant economies of scale.)

The same rationale that drives cloud services can be applied to digital information security. Since the technical prowess needed to properly implement proper ICT

security is increasingly sophisticated and ever-changing, there is a relevant market for the provision of digital information security as much "as a service" as it is possible. **Cloud computing schemes could constitute a major leap forward in the protection of information assets towards universal paperwork elimination and on-line execution of legally binding contracts**; bearing an enormous potential for ICT cost-reduction for consumers of digital security services and creating a profitable market for the providers with the best service offerings. Such is the rationale behind T-Systems' CifraH project which this dissertation sets about to analyze.

In order to outline the current state of the art regarding digital information security, the major innovations in recent history regarding the security of digital communications, ranging from technical to regulatory, will be briefly commented on the next few pages. Further on in this chapter, a brief overview will be given of the latest ideas and current challenges for the ICT community in this field.

1.3. Technical developments in digital information security: Innovation overview

The need to protect information being conveyed through any communication channel from its potential interception by any party other than the intended recipient is probably as old as the human use of common language systems. Evidence on developments in "cryptology" (as the body of knowledge that deals with the concealment of information is known today) are found throughout history—mainly, though not solely—in the contexts of war and diplomacy. Notorious examples range from the famed 'letter by letter' substitution technique used by Julius Caesar at military campaigns, now known as Caesar's cipher (a cipher is a set of instructions, or algorithm, that transforms a given set of data) all the way to current state-of-the-art cryptographic systems that leverage on the latest developments in mathematics thinking and computing technology.

Efforts in this field are aimed at providing a degree of trust in the communication channel used as well as in the content of the information being dealt with. There are

different regards in which this trust can be sought, with varying degrees of importance depending on the application. Namely these are: information "privacy", information "integrity", "authentication" of the interlocutor and "non-repudiation" of the conveyed information. Designing a system able to provide "absolute trust" to communications constitutes the holy grail of the current information security landscape, but such an absolute degree of trust is considered a practical impossibility by current means at the time of this writing.

Besides a progressive improvement of the tools of the trade that allowed for increasingly faster and more accurate data processing tasks, it can be argued—from an innovation perspective—that there were no major breakthroughs in the history of cryptography and cryptanalysis (the sciences of devising and breaking ciphers, respectively) until the second half of the XX century. Some of the most notable contributions to the development of cryptology from that period are mentioned below:

The development of computational logic and computing power

Although the cryptographic ciphers initially remained based on the same principles as in its inception (i.e. 'substitution' and 'transposition,') and thus not really representing a breakthrough in cryptographic thinking, the advent of computing allowed for an exponential increase in the speed, accuracy and cost-effectiveness of the so-called "crypto systems"—as well as in the desired complexity of the ciphers.

Innovation-wise, it is perhaps debatable whether this would constitute an innovation as such or rather an incremental step on the state of the art by leveraging computational tools in the cryptographic field. In any case, the impact of this practice is highly relevant.

The development of information theory

The principles of information theory fathered by Claude Shannon allowed for a 'globalization' of cryptology in academic and research circles within a universal framework of understanding. Characteristically, it enabled the development of cryptology in the context of the increasingly important computing environment. The principles and ideas, such as "work factor" and "one-time-pads", stated by Shannon (most famously in his 1949 paper "Communication Theory of Secrecy Systems") remain to this day the basis of modern thinking in cryptology.

Other ideas and techniques

In the same line of the "incremental innovations" commented above, several important developments by many specialists have contributed to the advancements of cryptology. Particularly in order to overcome obstacles that prevented the application of many cryptographic principles in practice. A notable example is "Kerckhoff's principle," which argues on the benefits of making the cipher being used in the cryptographic process publicly known while the "key"[2] remains the secret piece of the scheme.

Other notable examples are the application of techniques such as "redundancy" and "freshness," in order to provide protection in case of sophisticated cryptanalytic or other types of attacks on the communication system, and the use of "hash functions" (such as MD5 or SHA-1) in order to allow for the technical feasibility of the cryptographic computing systems by reducing the volume of data to be processed [Tanenbaum, 2010.]

---

[2] In current cryptographic thinking "ciphers" are considered mathematical functions of several parameters, one of them being the "plaintext" of the information to be transmitted and another one being the "key".
This key is an essential piece of data in the process since it permits the original plaintext to be recovered from its 'scrambled' form. This parameter remained the only 'secret' piece of information in the system (this allows for the cipher's strength to be put under the scrutiny of the worldwide community, thus better assessing its infallibility.)

The invention of Public-Key Cryptography

Arguably the most innovative breakthrough in cryptographic thinking since ancient history, "public-key cryptography" enabled effective deployments of complex security solutions in the digital communications arena more than any other idea conceived until this day. In that regard it may only be comparable—in the foreseeable future—to the potential advent of feasible quantum cryptography; a field which still belongs solely (although less-so every day) to the realm of R&D laboratories.

Ralph Merkle is considered the father of public-key cryptography, while the first practical implementation is attributed to W. Diffie and M. Hellman who published their work in 1976. Although it was later revealed that British intelligence organizations had developed a similar scheme some time earlier.[3]

Public-key cryptography paved the way for finally overcoming the age-old obstacle of establishing a secure communication channel between parties that haven't had any previous communication (since until the time a mutual agreement on a secret key to be used in the communications had to take place prior to the communication, making the distribution of such secret key between the involved parties the weakest link in the security system). This eventually drove the massive usage of cryptographic solutions that is a reality today for a wide range of applications—including on-line banking and public sector services for instance.

The idea essentially consists of using a set of two secret keys (in contrast to the single secret key used in what is now-called a "symmetric-key" cryptographic scheme) for each party involved in the communication –a "**public key**" known to the general public, and a mathematically-related (but not feasibly obtainable from the knowledge of the former) "**private key**" that is only known by its owner (such that a

[3] The UK's Government Communications Headquarters (GCHQ) comments on this fact: http://www.gchq.gov.uk/history/pke.html

message ‘encrypted’ with the public key could only be ‘decrypted’ by a cipher using the private key). The inverse process is usually true as well, which is especially important for further applications of public-key cryptography, such as digital certificates) [Tanenbaum, 2010.]

The most widely-used public-key cryptography cipher is “RSA” (an acronym formed by the initials of its creators: Rivest, Shamir and Adleman), although many other schemes exist. These ciphers base their strength against potential cryptanalytic attacks on computing-intensive operations of well-known mathematical difficulty (such as the factoring of large numbers or the computation of discrete logarithms modulo a large prime.)

Note that symmetric-key cryptography is still widely used in a wide array of applications where it is as much or even more suitable than Public-key cryptography. Two of the most commonly used ciphers at the time are “AES” (aka. Rijndael) and “Triple-DES”. Both of which have repeatedly proven their robustness when under cryptanalytic attacks of the highest computing power.

Public-key cryptography principles allowed the implementation a kind of electronic signature known as “digital signature” (digital analogous to traditional hand-written signatures, which are meant to irrefutably provide a statement of validation associated to a given entity) which in turn have given way to “digital certificates” (written certificates that are ‘digitally signed’ by a “trusted third party” (TTP) known as certificate authorities (CAs) in order validate the authenticity of given public keys as belonging to the certified entities.)

In turn, digital certification has enabled the development of different schemes (such as Public Key Infrastructure (PKI) and web-of-trust schemes) that attempt to implement frameworks able to provide trust (privacy, authentication, integrity and non-repudiation) in digital communications. This has been accomplished with varying degrees of success. Probably the best-known PKIs currently are those

implemented following the Internet Engineering Taskforce's (IETF) Transport Layer Security (TLS) standard used in most web-browsers for the establishment of Secure Socket Layer (SSL) connections over the web. The digital certificates used by this scheme are those under the current X.509 standard of the International Telecommunications Union Standardization Sector (ITU-T.)

It is necessary to remark, though, that currently there is no known implementation of a cipher that can be theoretically proven to be completely secure. Theoretically, this can only be accomplished by the used of one-time pads, which are not feasible to implement by current means [Tanenbaum, 2010.]

1.4. Trust frameworks for public computer networks

The convergence between computer science and its cryptology-enabling applications that was briefly commented above has provided tools that can help circumvent many obstacles on the path towards the "digitization of society" —meaning the currently prevalent trend that looks to enhance the interactions of individuals by use of information and communication technologies in many areas of human activity. Most of these obstacles refer to the difficulty of providing such interactions with a degree of trust comparable to, or better than, that provided by traditional means (such as the way people identify themselves by looking, talking and otherwise sensing each other while being present at the same locality.)

Since trust is paramount to human activity—as it allows for agreements that enable the collaborations on which society is based—a proper framework for it has to be put in place in order to fully exploit the potentials such digitization of society. In order to visualize the current challenge in this field, a useful analogy could be made with the well-known frameworks for providing identity, and the means to authenticate it, to individuals and institutions around the world:

Currently, sovereign governments around the globe usually provide their constituents with a formal system of identification. By this scheme, an individual is supposed to have a unique identifier (be it just a name or combinations of different information such as "I.D." numbers) which is used as the linchpin of all the information and services of –and available to–said individual. The same happens for other kinds of entities such as companies or other organizations.

With the development of transportation enabling global routes and marketplaces, in order to facilitate the **flow of people and goods across the globe**, standards were agreed upon for the worldwide identification of people and entities. Perhaps the most notable example is the current "passport" international system, in which each individual in the world is identified by a unique passport number issued by a recognized sovereign government. This universally unique identifier allows a given entity to access a range of services within an established framework of trust and accountability under the rule of law.

The **flow of information across the globe**, though, is a matter of a different sort; given the inherently abstract and reproducible nature of information. Although information has always flown freely—first in an oral fashion and later in paper-based image schemes—it hasn't been until the advent of the digitization of society that it became an imperative to have a worldwide scheme to identify information; precisely because information can now, in many aspects, even completely substitute for the presence of an individual.

Finding universal consensus in order to create a similar framework for the provision of identity in a digitized society, by leveraging ICT systems and the adequate cultural paradigms, is still a challenge presented on the ICT community by the time of this writing.

Many advances have been made towards answering this challenge, up to the point that a universally agreed scheme for dealing with identity and authentication in digital environments—which give way to privacy, non-repudiation and integrity and thus providing a degree of trust—could be said to already be in sight. There are several causes for this optimism, as all relevant players in this arena (i.e. governments, the services industry, consumers, academia as well as many voluntary enthusiasts) are bent on tackling the matter; frequently engaging in collaboration for this end and can be said to have yielded some notable results.

As is common regarding ICTs, in the identity and authentication field they not only provide a cheaper and more practical substitute for existing models, but they also make possible the emergence of new ways of conceiving these activities which were unfeasible with traditional methods. The latest developments in the field include proposals to, for example, allow for the possibility of having different "personas" (or sets of identity attributes) in digital communications. This would give an individual a greater level of control over the depth of detail that is being given away at any given time.

Another paradigm shift comes by providing authentication between entities without necessarily revealing any information whatsoever regarding the identities of either party (providing verification and anonymity at the same time.)

Solutions in this area are unevenly classified in various market denominations (such as Identity Management (IdM), Identity and Access Management (IAM), Single-sing-on (SSO), "Strong" and "Multi-factor" authentication and the more recent Authentication as a service (AaaS) and Identity management as a Service (IDaaS), etc.) which are many times used interchangeably and/or in conjunction hence leading to much confusion. Throughout this article each case will be indicated as belonging to a certain market segment when it is relevant to the discussion, instead of favoring any single nomenclature in such a still nascent field.

In order to provide a glimpse on the state of the art of current identification and authentication solutions, a selection of examples—not intended to be comprehensive—is loosely listed and commented in the next pages. This will shed some perspective into the elements that constitute the CifraH solution in order to consider it in its proper context. For further information on each idea refer to the listed bibliography.

1.5. Highlights in current Identity and Authentication thinking

1.5.1. Overview

A lack of consensus and a mix of different interests, cultural traits and legacy systems have so far stymied the conception of a truly universal framework for identity and authentication in open communication networks. On the other hand, the immense competition in the field has given way to accelerated rates of new inventions and proposals.

At present, any approach to implement a universal trust framework in digital environments must be taken with a grain of salt, since in many respects the market must still be considered as immature –even if some of the ideas have existed for several years by now. While the current state of the art is comprised of an ecosystem of ideas, working groups, more or less developed standards as well as right-on incompatible approaches (and some losers still clinging-on to existence as well,) making the overall picture blurry and the future hard to discern, some highlights and promising success cases can be made out from the latest developments in the field. Namely:

- Theoretical proposals
    - Multi-factor authentication
    - User-centric identity
    - Token- (claims-) based approach vs. Relationship-based identity systems
    - Identity Federation

- IdaaS and AaaS
- Single-sign-on (“enterprise” E-SSO or Web-SSO)
- The laws of identity
- Bill of rights for users of the social web
- The identity metasystem
- Personal data ecosystem
- Verified identity claims
    - Blind signature and Zero-knowledge prove (U-Prove)
- Personal Data Services (PDS)
- Vendor Relationship Management (VRM)
- Active Identity Client (AIC)

- Established technologies and techniques
    - Active Directory (Microsoft)
    - Public-Key Infrastructure (PKI)
    - Lightweight Directory Access Protocol (LADP)
    - Kerberos protocol
    - Smart cards (ICC cards)
    - Biometric analysis hardware
- Open standards
    - OpenID
    - Oauth
    - WebID specification (email as end-points)
    - Open Social
    - Portable Contacts
    - Information Cards
    - OASIS XRD (eXtensible Resource Descriptor)
    - OASIS XRI (eXtensible Resource Identifier)
    - OASIS XDI (XRI Data Interchange)
    - SAML
    - Liberty Alliance ID-WSF

- WS-Trust (WS-*) (Microsoft)
- DiSo Distributed Social Networking Project
- Webfinger
- Salmon protocol
- Activity Streams
- PubSubHubbub

- Standards interoperability efforts
  - OSIS (Open Source Identity Systems)
  - Concordia
- Multi-Protocol Open Source Projects
  - Higgins Project (supports Information Cards, OpenID, SAML, XRI, XDI)
  - simpleSAMLphp
  - Shibboleth
  - CAS (Central Authentication Service) project (supports OpenID, SAML, prototype Information Card support)
  - Bandit (Novell)
  - OpenSSO (supports SAML, Liberty ID-FF/ID-WSF, WS-Federation, Information Cards, OpenID)
- Industry Consortia
  - Identity Commons
  - Kantara Initiative (former Liberty Alliance)
  - Open Identity Exchange (including the OpenID and InfoCard foundations)
  - OASIS ID Trust
  - ITU-T Focus Group on IdM
  - Data Portability Project
- Major "Information Card" Projects
  - The Pamela Project "Relying Party" Code
  - Higgins Project
  - CardSpace (Microsoft)

    - Bandit
    - XMLDAP (Java Information Card library) Relying Party Code and Security Token Server code
- Browser Based Card Selectors
    - Higgins Project (offers both browser-based and native card selectors)
    - "openinfocard"
- Recent governmental initiatives
    - White house National Strategy for Trusted Identities in Cyberspace
    - European eIDs (such as Spain's DNIe)
    - European STORK initiative
- Industry's IAM offerings
    - Microsoft's Forefront, Active Directory Federation Services
    - Oracle's Access Manager and Identity Federation
    - IBM's Tivoli Federated Identity Manager (TFIM)
    - Verisign/Symantec personal Identity Portal (PIP)
    - Other companies with similar solutions:
        - RSA
        - Ping Identity
        - Novell
        - Sun Microsystems

A selection of the most notable among the listed ideas will be commented below, insofar as they are relevant to the object of this paper. Industry offerings and many ideas will not be considered while those initiatives directly relevant to the provision of identity and authentication on open networks will be taken into account. Additionally some brief comment will be offered on the role that governments in Europe and the United States have taken in this regard so far.

Web environments are distinguished from the corporate networks mainly in that they are open (transparent and available to the general public) and decentralized (not governed from a sole node). In all aspects related to the web, thriving communities of innovators are constantly at work with the goal of improving existing solutions; sometimes driven by mere enthusiastic interests, which many times ends up congregating around a myriad of 'community' and 'open' projects, and some other times driven by special groups of interests (such as industry consortia.)

In order to cross boundaries and domains on the web people need the power to manage their own identity information. At the time of this writing, the information technology community is a very interesting stage regarding identity and authentication in which all relevant players are converging in the same arena with a common goal: to provide a universally-accepted trust framework for interactions in digital environments. There is an increasingly widespread common view among society, industry, academia and government alike that this framework will be achieved along the lines of openness and decentralization that have characterized the Web and its breathtaking success and global preeminence. "Federation" has traditionally been the trumpet call for a framework for allowing the flow of identity information across organizations and it has been achieved with different degrees of success. But this analysis is more concerned with a truly global framework with the potential of transcending all boundaries.

The increasing popularity and potential uses of the so-called "social networks" has only exacerbated the convergence of the different actors of the ICT community, up to the point that currently there is evidence of the emergence of what is being dubbed as an "open stack" for the enabling "the social web"[4]. This layered scheme is incrementally gaining on popularity and could be a very prevalent conceptual framework in the near future.

[4] See: http://www.slideshare.net/Kaliya/online-identity-for-community-managers-openid-oauth-information-cards

Many of these efforts are bent on eliminating the current "username/password" scheme that is currently so prevalent in the networked world and is considered rather insecure –especially for its vulnerability and potential consequences in the face of 'phishing' attacks. Although the "multi-factor authentication" and otherwise "strong authentication" schemes (hardware tokens, usage of PIN codes sent via SMS text to cell phone service subscribers, dynamic questions aimed at filtering impostors, etc.) that rose to tackle this issue are already fairly widespread, a need for a truly innovative solution (including strong authentication as well) is still evident.

Among the most noteworthy of the protocols included in this stack are OpenID[5] and Oauth.[6] OpenID is mainly known as a solution for providing "Web Single-sign-on" (allowing for the use of only one user/password combination for signing-in to on-line services and permitting the user to control which personal information the service can access to). OAuth provides a way for users to allow the exchange of data between different web services without the users having to give away their personal login information to all on-line service providers. OAuth has gained popularity especially for its use in the wildly popular social networks that have emerged in the last years, which serve as platforms for specialized customized applications (usually developed by third parties) that many times need to make use of the users' personal data.

The latest developments of these two standards (namely OpenID 2.0 and OAuth 2.0) endeavor to overcome their predecessors shortcomings and their advances are backed up by major leaders in the field (such as Google Inc., Yahoo Inc., Microsoft corp., Verisign inc., and many others.)

[5] See "WebID 1.0 specification" at http://openid.net/

[6] See: http://oauth.net/

It is important to note that a very relevant initiative has emerged by design of the authoritative World-Wide-Web Consortium (W3C), dubbed WebID which seeks to simplify current approaches to trust provision by leveraging on existing standards[7] (namely the X.509 Certificates and the Transport Security Layer (TLS) protocol). This specification constitutes an important change in the approach so far taken by OpenID, although these are not mutually exclusive. The WebID is intended to address the Web-SSO problematic but it adds to it in that it seeks to "provide a universal and extensible mechanism to express public and private information about yourself."[8] This is especially relevant in the context of the "semantic web", a concept for a future vision of the Internet mainly driven by the W3C as well. Another notable difference with OpenID is that it favors non-URI (Uniform Resource Identifiers) 'endpoints' such as e-mail addresses (which are more intuitive) for use as user identifiers.

Another notorious initiative is the "Information Card Ecosystem"[9]. "Information Card" is a metaphor greatly endorsed, funded and pushed-ahead by Microsoft corp. as a solution to the Web-SSO since the demise of their previous (and proprietary) "Microsoft Passport" approach, currently very prominent and driven by the open source "Higgins" project as well (both Microsoft and the Higgins Project fund the Information Card Foundation). Under this approach, "active client" programs on the users' side of the communication provide the entities that need proof of your identity—widely known as "Relying Parties" (RP)—with tokens (strings of bits) containing "claims" that are "asserted" by an Identity Provider (note the difference between the aforementioned "identifiers" with latter "claims." While Identifiers are a single string (such as a URI or an e-mail address) that link to things together and enable correlation, claims come in pairs and are a reference by one

[7] See: http://esw.w3.org/WebID#How_does_the_WebID_Protocol_compare_with_OpenID.3F

[8] See: http://payswarm.com/webid/

[9] See: http://informationcard.net/

party about another (or itself) but it does not need to be linked to an identifier.[10] This could allow an individual, for example, to assert its age but not its real name to a relying party. These claims allow the user to obtain on-line services, such as access to a portal in the case of single-sign-on, from the relying party.

The "card" analogy comes from the fact that users can relate the active client's "identity selector" (the best known solutions are the Higgins Project's selector and Microsoft's Windows CardSpace solution, based on the open WS-Trust protocols[11]) with commonly used wallets which hold real cards such as national identification documents, driver's licenses, etc. Note that this scheme, as well as the OpenID and WebID mentioned before, allow for the configuration of different 'personas' for each occasion, each of which asserts a different set of claims as needed.

The latest developments in relation to information cards are "verified identity claims" and "minimal disclosure" a scheme which leverages the principles of "zero-knowledge proof" and "blind signature", in order to be able to provide verification of asserted claims while maintaining the anonymity of the interlocutor[12] (a solution dubbed "U-Prove" recently acquired by Microsoft,[13]) and Personal Data Stores[14] (which would constitute a central point of information about a person's identity). Potentially, using a Personal Data Store a user would be able to control the flows of data between services that provide data about the user and services that wish to consume it; as it provides management functions over the identity information

[10] See: http://www.slideshare.net/Kaliya/iiweast-introduction-to-identity-community?from=ss_embed

[11] See: http://msdn.microsoft.com/en-us/library/aa480189.aspx

[12] See: http://www.readwriteweb.com/archives/bending_the_identity_spectrum_verifiable_anonymity_rsa_security_conference.php

[13] See: http://channel9.msdn.com/shows/Identity/Deep-Dive-into-U-Prove-Cryptographic-protocols/

[14] See: http://wiki.eclipse.org/Personal_Data_Store_Overview

distributed across the Internet (a proposal similar to some of WebID's functionalities in this regard.)

In order to establish a common terminology and framework that enables a faster collaboration in these topics several attempts have been made by different groups to standardize the vocabulary and provide a schematic of all involved parties in the provision of identity and authentication to users across networks. Two of the most widely accepted are the Kantara Initiative's "Identity Assurance Framework"[15] and Open Identity Exchange's (OIX) "Open Identity Trust Framework" (OTIF[16].) A recent announcement has been made by these two organizations in which they state that there's a collaboration project between them that seeks to "develop a joint approach to federation services and trust framework certification"[17].

[15] See: http://kantarainitiative.org/confluence/display/GI/Identity+Assurance+Framework+v2.0

[16] See: http://openidentityexchange.org/what-is-a-trust-framework

[17] See: http://kantarainitiative.org/wordpress/tag/oix-trust-framework-platform/

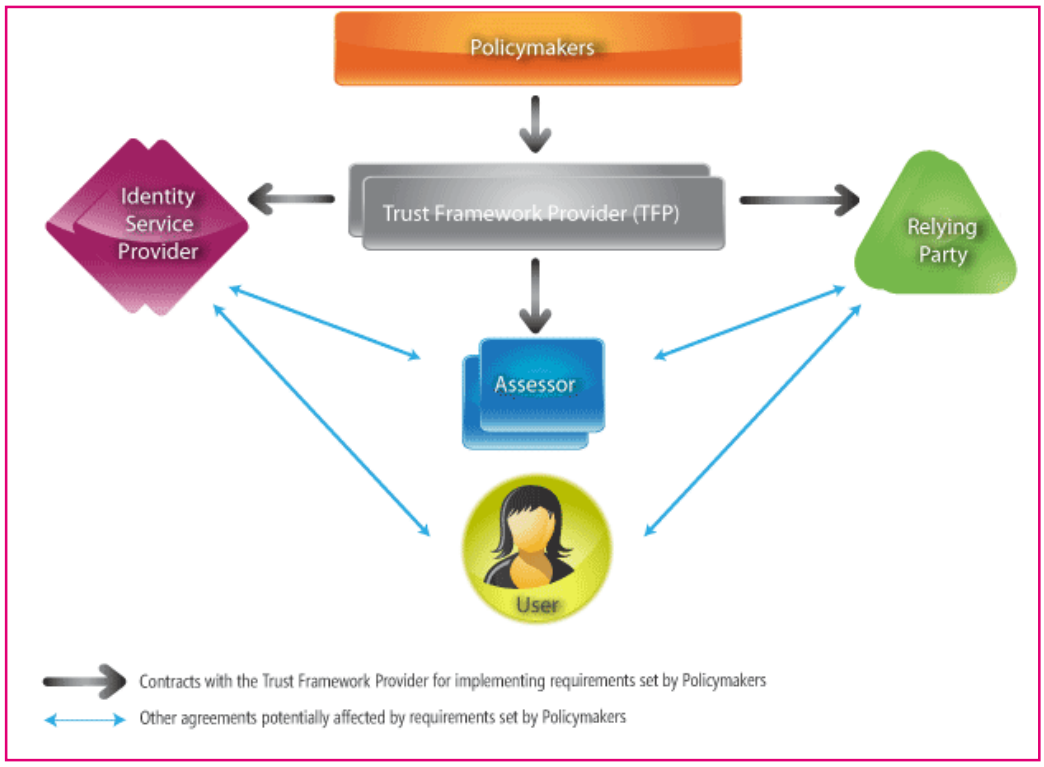


Figure 1. OIX's Open Identity Trust Framework (OTIF)

This Frameworks coincide in the well-established "trust triangle" of User-Identity-Provider and Relying Party and add to it other "Identity Stakeholders", coinciding pretty much in every respect. The OIX's OTIF is shown in the figure above. Notice that in respect of the technology that supports all the interactions, there is a central player generically denominated the "Trust Framework Provider". This role is fundamental for the topic of this article, since it means to analyze the business case for this specific role under certain market conditions.

1.5.2. Government initiatives

European Union countries provide a rich base of experimentations and experiences to draw from for studies on the provision of public services via digital environments. More than in any other area of the world, governments have been pursuing trust schemes to enable truly digital societies in order to build competitive edges in their respective countries.

Besides the Public-Key Infrastructure of Certificate and Regional Authorities (RA) (both public and private) put in place as in most of the rest of the world, European Governments have promoted the their national identification numbering systems (be it a citizen's registry, drivers license, health and social security numbers, bank's login information as in Sweden or the optional availability of different systems such as in Austria) for application in this field. Such efforts have resulted in the deployment of significant IT infrastructure across the continent, including in the form of smart cards (Integrated Circuit Cards or ICC) increasingly for all citizens (sometimes denominated eID for generalization purposes), such as in the Spanish case.

This ICCs are provided with several sets of digital signatures and digital certificates which are used by government systems to securely identify its citizens and provide public services remotely, securely and automatically, presumably at a lesser cost. As is common in pan-European initiatives, widely different legal frameworks, legislation, local cultural traits and historical contexts made up for a very heterogeneous environment of approaches and solutions.

Currently, the European Commission sponsored (through its Competitiveness and Innovation Program) "STORK" consortium[18] (of which T-Systems is part of) aims to "establish a European eID Interoperability Platform that will allow citizens to establish new e-relations across borders, just by presenting their national eID." The first pilot projects were deployed in the second half of 2010 (aimed at, for example, allowing EU citizens change their address remotely as they move across borders) and currently the project it is still expected to announce its further plans. In order to be compliant to all legislations across the member countries, the STORK project does not "store" as such any personal data at all.

[18] See: https://www.eid-stork.eu/

At the other side of the Atlantic, much talk has been done regarding the incumbent Federal Administration of the USA's "National Strategy for Trusted Identities in Cyberspace" draft[19] a consequence of the Cyberspace Policy Review issued by the incoming president during his first days of office[20]. Among the main results expected of the draft are the guidelines for the establishment of a new federal legal framework to enable innovation in this field, a voluntary scheme for numbering all citizens and a call to the private sector to take the lead in these efforts.[21]

1.6. T-Systems' approach to identity and authentication

The above overview of current thinking in the Identity and Authentication in open networks field, together with the comments on cloud computing offerings and the technical principles underlying communication security, make possible to properly contextualize the CifraH solution in order to give way to the development of the idea in further chapters.

Project CifraH at T-Systems intends to develop a software platform in line with what the *Trust Framework Provider (TFP)* constitutes in the context of the *OIX's Open Identity Trust Framework (OTIF)* as seen above. This solution will be provided in a "PaaS" scheme to the different "identity stakeholders" in the market –electronic notaries (like the T-Systems' participated joint venture called "Logalty,") Identity Service Providers or governmental agencies that intend to offer their constituents with specialized identity and access management solutions (such as STORK-enabled portals)–who must, in turn, provide specialized applications (possibly in a "SaaS" scheme) to other end users in the market (citizens, companies, organizations, etc.)

[19] See: http://www.dhs.gov/xlibrary/assets/ns_tic.pdf

[20] See: http://www.whitehouse.gov/assets/documents/Cyberspace_Policy_Review_final.pdf&pli=1

[21] See: http://fcw.com/articles/2010/11/04/trusted-identities-strategy.aspx

Some of the functionalities that must be enabled in the CifraH platform are the possibility of managing digital identities and 'personas' (or avatars) through Active Clients, provide claims as asserted by Spanish Certificate Authorities (CAs) and support web-portals and the ability to syndicate services to relevant users.

It is important to note that project CifraH relies on the perceived market momentum of the Spanish market as identified by the organization. This means that speed is an important factor to consider along the project, since waiting 'too long' might render the solution outdated or irrelevant. These ideas will be developed in the third and final chapter of this monographic.

2. Innovation management at T-Systems

This section provides a brief overview on the activities carried out at T-Systems Iberia's corporate environment. Since T-Systems is part of an important multinational corporate group (the Deutsche Telekom Group) this implies the need to consider innovation from a group-wide perspective in order to fully understand what permeates into the Iberian business unit of the company.

The information displayed in this section is a compilation of non-classified material gathered from the internal documentation available to T-Systems International's employees and, unless otherwise indicated, it states the official view of the company regarding the topic at hand. However, in those cases where analytic judgment is implied it represents the sole view of the present work's authorship.

The following overview will begin by describing the main structures put in place with the goal of innovating at the parent company: Deutsche Telekom AG—which is the biggest German telecommunications operator and one of the most relevant companies in this field worldwide. These structures reflect on the nature of the company's understanding and regard of innovation as a business activity.

Secondly, another description and brief analysis will ensue with a focus on the Group's business arm for corporate customers called T-Systems; a subsidiary that has developed structures of its own to generate innovations both within the company and as a value-added service for its clients. Finally, an explanation on the status of innovation at T-Systems Iberia will be given, which will serve as the basis for the analysis of the CifraH innovation project in further chapters.

2.1. Innovation at the Deutsche Telekom Group

2.1.1. Company overview: Deutsche Telekom AG

Deutsche Telekom AG (DTAG) is one of the world's leading telecommunications and information technology service companies. With a presence in 50 countries and 260.000 employed professionals, it serves a customer base of nearly 200 million. On 2009 the company generated €64.6 billion in revenues, over half of it from outside of Germany, the company's home country [DTAG company profile. September 2010.]

As the heir of the former German state-owned monopoly, the company boasts several decades' know-how in the telecommunications industry; as well as considerable infrastructure assets. Currently, in addition to its core businesses (classic fixed-network and mobile access) the company is specifically tapping new growth areas through investments in **intelligent networks** and its portfolio of **IT, Internet and Network Services.**

Alongside many of the world leading companies, DTAG envisions a near future of ubiquitous, mobile, live, broadband communications that enable the delivery of value-added services via the global telecommunication network. Hence the company's vision statement is to be "the international market leader for connected life and work" [Deutsche Telekom, 2010.]

The idea of connectivity—at home, on the move and at work—provides the central basis for the future design of Deutsche Telekom's various product categories. The three core product categories are **voice/messaging, high-speed Internet and IPTV**, constituting the essential topics that largely determine the Company's business operations in both fixed and mobile networks.

2.1.2. Innovation initiatives at DTAG

At Deutsche Telekom innovation is given a tall priority as one of the activities vital for the realization of the organization's goals. This is evident considering the resources invested on innovation-related programs.

It can be said that DTAG has an 'institutionalized' approach to innovation –meaning that the responsibility for innovation is assigned to specific units of the company. After taking into account an extensive experience gained after years of managing different initiatives regarding innovation, as can be shown by internal documentation spanning several years, the current framework for innovation management within the company is established around four structures: Telekom Laboratories, the Innovation radar, the T-Gallery and T-City. Each of these will be briefly described below.

Telekom Laboratories (T-Labs)

A private scientific research institute affiliated to Technische Universität Berlin (Technical University of Berlin), T-Labs was established on April 2005 with the goal of consolidating DTAG's research and development (R&D) activities, all of which are currently conducted from T-Labs.

Deutsche Telekom Laboratories
An-Institut der Technischen Universität Berlin

Figure 2. T-Labs

Organizationally, Telekom Laboratories belongs to the central Product and Innovation division of Deutsche Telekom, but its singular nature as a joint "academic-private sector" collaboration makes it unique within the company's organizational framework. Characteristically, it also maintains close collaboration with 16 universities worldwide and has ongoing operations in Berlin, Darmstadt (Germany), Beer Sheva (Israel), and Los Altos (California, United States.)

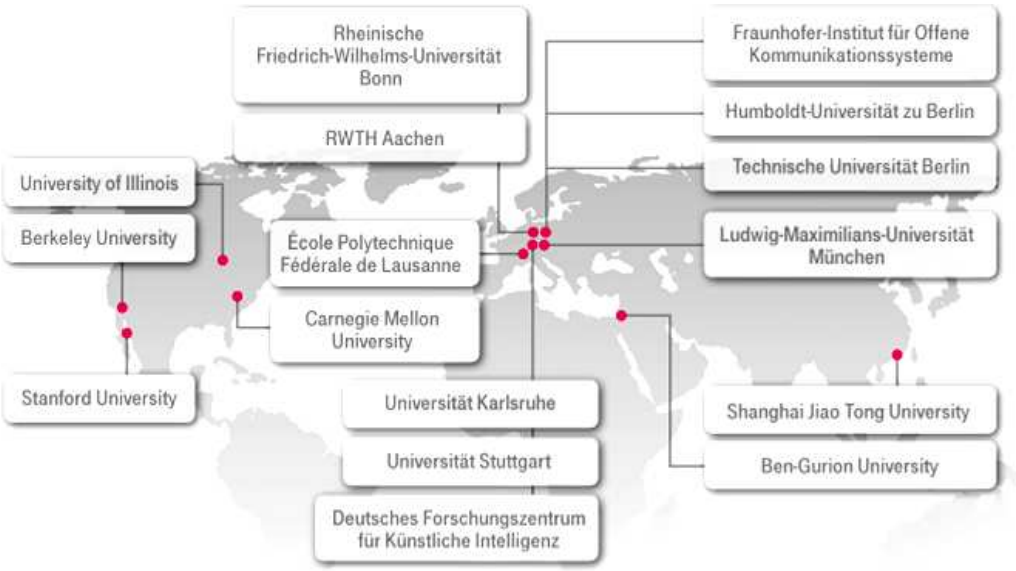


Figure 3. T-Labs partner research institutes

Staffed with over 300 specialists (among them 125 DTAG employees, 65 postdoctoral staff and around 80 postgraduates, plus research students from all

over the world) T-Labs is bent on developing new technologies for innovative products and services that are expected to be rolled out or market-ready **within 18 months to five years** (medium to long-term innovation projects). Shorter term product developments and product innovations are undertaken by the different divisions of Deutsche Telekom's organization.

Notably, the fact that the T-Labs are intended to reinforce the long-term innovative strength of the organization seems to indicate that this kind of structure was considered inadequate for carrying out shorter-term innovation initiatives. Being instead the corresponding business unit within the company the most adequate place from which to pilot the latter. This is a characteristic that can be considered as an industry "best practice", which makes it worth to consider (as well as revise) as time goes by in order to judge its merits.

The core of the R&D done at T-Labs is project work. All projects support the objective of developing innovative products and services for DTAG's customers. The results are primarily transferred to the Group's different strategic business units or are used to establish spin-off organizations. This fact points towards another of DTAG's innovation management practices to take into account: The funding mechanisms put in place by the company in order to foster spin-offs to further develop on those innovation outputs that turn out to be outside DTAG's main course of interest at the given time. This is achieved through an entrepreneurship program piloted from the Group's venture capital arm: T-Venture.

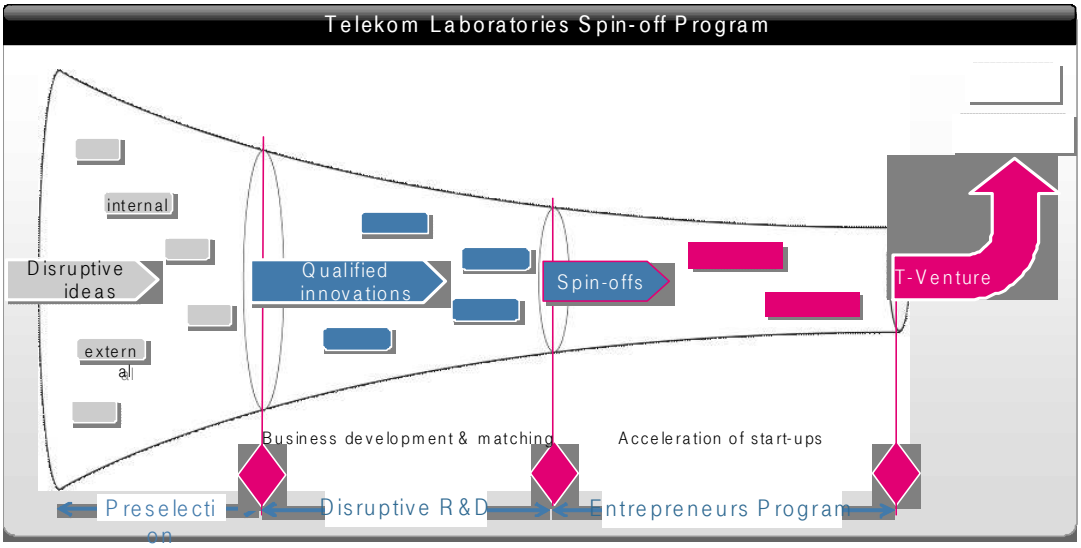


Figure 4. T-Labs spin-off program

It is also relevant to notice the "open" nature of the T-Labs structure. This follows the pattern of similar initiatives in other companies of the IT industry (such as the Bell Labs, HP Labs and IBM Labs) where openness is embraced in order to enable the collaboration with high-class research institutes. In fact, the T-Labs complete around 50% of its innovative solutions jointly with its network of international partners.

Möckel and Arnold [2009] (high-rank scientists at the T-Labs) state that "... the university and industry research collaboration at Telekom Laboratories is mutually attractive: On the one hand, it offers the results of pure academic research the real chance of becoming applied research and, even more, a real market product. It also bears a relation between university- driven questions and the practical relevance of problems of everyday life... This might sometimes prevent the often bemoaned sitting in the ivory tower, even though academic freedom is one of the cornerstones of research at Telekom Laboratories. On the other hand, industry has the opportunity to take an active part in state-of-the-art research and to put this "advantage of knowledge" to work developing innovative products with the best available technology. International partnerships complete the open-minded atmosphere."

Within the DTAG, the Telekom Laboratories are considered a widely successful initiative that establishes a trend and a role model for innovation within the industry.

Innovation radar

The innovation radar is an internal journal published three times a year containing the results of a market and trend analysis based on a "global scouting network" of company experts. The results provide information on innovation technologies and current market requirements.

Said scout network—consolidated by the T-Labs—is tightly-knit across the globe and includes renowned universities and institutes such as Berkeley, Stanford and MIT, as well as such distinguished IT companies as Microsoft, Siemens and IBM.

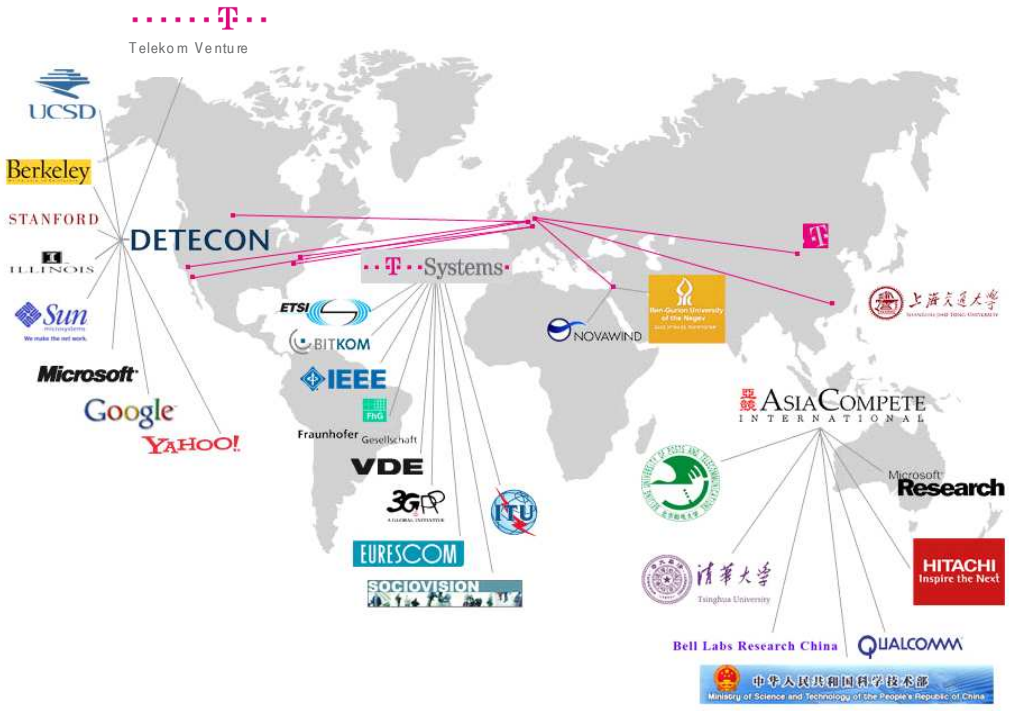


Figure 5. DTAG's Global scouting network of partners

These scouting activities result in around 100 suggestions for innovative technologies and services every year. Relevant topics are selected from proposals by joint expert network from Deutsche Telekom Laboratories and T-Systems (which is a fully-owned subsidiary of DTAG). Depending on relevance and time, horizon topics are positioned on a "radar" diagram and described in profiles.

The Innovation Radar provides information on new technologies as well as on new and announced market offerings of start-ups, suppliers or competitors (This radar is not confined to B2B innovations, but also encompasses consumer or market technologies). All this information supplies hints and proofs of the industry's adoption of new paradigms or solutions across the world.

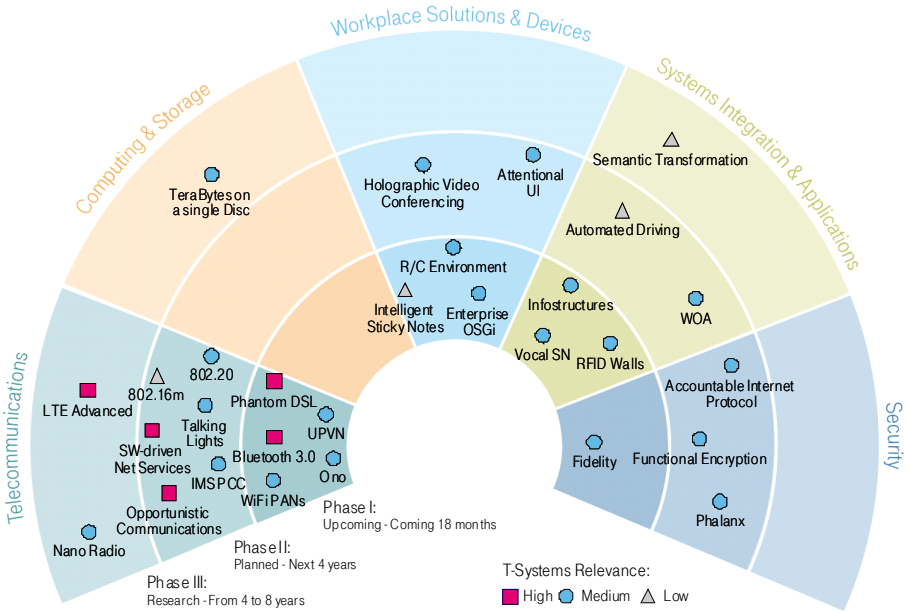


Figure 6. T-Radar 2009

The innovation's significance can be directly determined from the innovation's position within the Innovation Radar. Those topics that are to be found at the centre of the screen are expected to be of particular relevance within a short period of time.

The radar provides information on what is technically feasible. It then breaks this information down into the segments: Telecommunications, Computing and storage, Workplace Solutions and Devices, Systems Integration and Applications and Security. It uses profiles to illustrate the business model, potential, degree of innovation and market readiness of the particular technology. Interested parties

can thus access a general technical description as well as the current research status.

According to a T-Systems director in the Telecommunications division the Radar is, admittedly, a costly initiative whose outcome is hard to asses directly in terms of monetary value, but it is considered within the group as highly important nevertheless. The availability across the whole organization, and at every level, of structured information about the latest world-wide advancements in the topics most relevant to the company's business is another practice to consider as worthy of attention at DTAG.

T-Gallery

DTAG has established a series of showrooms for the public presentation of its innovation results, the most notorious of which is the T-Gallery, a 1.600m2 facility at the Bonn headquarters of the company. These showrooms serve as test beds where the company gets feedback on its latest innovations from users interacting in a real-life environment.

2.2. Innovation at T-Systems International

In the following pages a description of the innovation environment at the multinational "T-Systems" is given. First an overview of the company will be made, followed by a review of the company's innovation areas, activities, processes and offering to its customers; also, some notorious examples of successful innovation will be mentioned.

2.2.1. Company overview: T-Systems International GmbH

T-Systems International GmbH constitutes the "corporate customer arm" of Deutsche Telekom AG. It operates information and communication technology systems for multinational corporations and public sector institutions.

The company is a fully-owned subsidiary of DTAG. It operates in 20 countries and employs over 45.000 people and its customers include practically every industrial sector: automotive, telecommunications, the financial sector, retail, services, media, energy and the manufacturing industry as well as government agencies and the healthcare sector. It generated revenues of €8.8 billion on 2009.

This organization was founded on the year 2000 when DTAG acquired the information systems division of the former DaimlerChrisler AG. In the year 2005 T-Systems also acquired Gedas, the IT subsidiary of Volkswagen AG. The sheer magnitude of these mergers and acquisitions certainly speak of the strengths of T-Systems as an IT powerhouse, as it bears a legacy of the know-how of several of Germany's most important companies in the industry.

T-Systems' brand is based on the synergies that emerge from the combination of Information Technology (IT) and the Telecommunications (Telco) capabilities that constitute the core strength of its parent company; as the company can boast of significant assets in data centers around the world as well as the global communications network of Deutsche Telekom. Hence T-Systems is considered to belong in the "Information and Communication Technologies" (ICT) industry. As a "one-stop" provider of IT and telecommunications technology, T-Systems offers high quality of service for complex projects, and in particular for major outsourcing deals.

2.2.2. Innovation at T-Systems

As with its parent company, T-Systems values innovation highly so as to invest considerable resources in innovation-related activities. This is reflected in the company's motto as well:

"We shape the networked future of business and society and create value for customers, employees and investors thanks to innovative ICT solutions."

Innovation management at T-Systems is closely meshed with the DTAG's innovation initiatives. T-Systems' own innovation activities focus on a time horizon under 2 years, which is quite close to market. As explained before, for research and development activities with a longer time horizon T-Systems cooperates with T-Labs (as well as other 3rd party universities and institutes.)

In T-Systems' understanding, "there are two major goals driving innovation: [T-Systems, 2010]

To maximize commercial benefits through innovation without having the burden of pushing the innovation process itself,

To minimize commercial uncertainty by ensuring predictable cost for the services provided within the described bundles; and to avoid surprises caused by unforeseen additionally charged items or services."

These "goals that drive innovation" provide some insights into how the company conceives innovation. A first insight is that the company understands innovation as a pathway towards "commercial benefits" (as is naturally expected), in contrast to as an end in itself; a realization that makes the organization seek the benefits from innovation without this representing a burden, but rather a natural belief somehow embedded in every day's regular functioning.

Another insight could be made into what T-Systems accepts as an unavoidable consequence of innovation, one which has to be managed rather than feared:

uncertainty. Although it seeks to minimize uncertainty, the company accepts that it is an integral part of the nature of the business; a philosophy that allows the company to 'plan' for uncertainty and hence "avoid surprises."

There is evidence all over T-Systems' corporate literature that stresses innovation as not only a technical breakthrough, but also and uttermost a business success reality:

"For T-Systems, innovation management means the controlled transfer of innovations from concept to market where competitive advantage can be realized...

...T Systems' ambition is not only to invent new leading edge technology, but also to focus on innovations that will be ready for deployment to real business environments within a period of 12 to 24 months...

... Technology innovations are constantly analyzed to see how they can be transformed into solutions." *[T-Systems, 2010]*

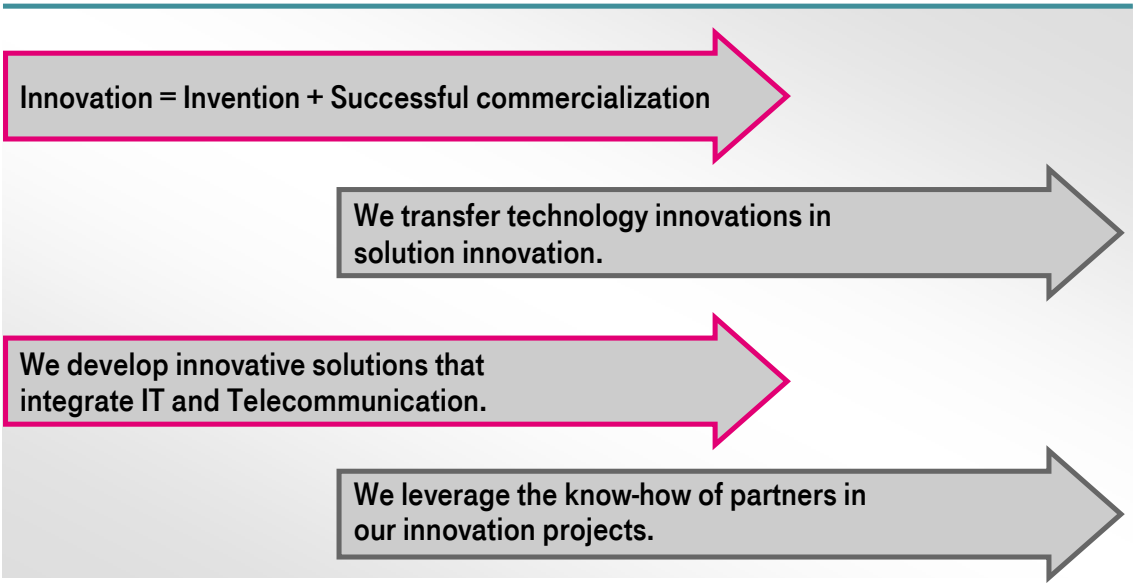


Figure 6. The nature of innovation at T-Systems

When referring to "solutions" T-Systems implies that the customer's best interest drives the innovation efforts –as commercial success ultimately means satisfying customer's needs. As it will become more evident further in this analysis, the customer plays a very significant part in T-Systems innovation management process.

According to the company's statement [T-Systems corporate profile, 2010] and in alignment with DTAG' strategy, T-Systems focuses its innovation efforts on the area of "intelligent networks"; as it sees high growth potential in that market. Until now the applications were more activity has taken place are in the "connected cars", the health sector and efficient energy management categories (e.g. satellite-based toll systems, convenient in-car Internet access for navigation, automatic emergency calls and voice-controlled e-mail; what is known as "integrated healthcare", where patients benefit from cross-sector care and treatment from hospital doctors, GPs, specialized therapists and rehabilitation clinics). There are also other areas where T-Systems invests in innovation, which will be briefly described below.

2.2.3. Innovation areas

The fields in which T-Systems seeks to innovate are the following: [T-Systems, 2010]

- Mobile Solutions ("Anywhere, anytime ICT"):
  - ✓ Mobilizing enterprise applications on modern smartphones (mobile CRM, mobile field services, mobile workflow processes),
  - ✓ Developing advanced mobile device & application management services,
  - ✓ The usage of mobile devices in unified communication & collaboration & fixed mobile convergence scenarios (one number, one message box, reachability management, switch calls, integrated in Outlook etc.),
  - ✓ Developing high security mobile solutions for politics or top management
- Machine2Machine (Increase transparency & automation):
  - ✓ Automatic communication between sensors, machines and backend systems to monitor or control will take centre stage in the future. T-Systems provides sample solutions for
  - ✓ Smart metering of energy utilization and

- ✓ Ad-hoc mesh networks for load carriers aiming at just-in-time/just-in-sequence logistics

- Advanced Collaboration (Facilitate interaction):

  - ✓ New ICT based tools and processes improve communication and collaboration within enterprises. Examples are unified collaboration as well as enterprise X.0 collaboration, joint engineering platforms or highly secure document exchange

- Industry Solutions (industry-specific):

  - ✓ This comprises all kinds of solutions that are relevant for T-Systems' customers in the industrial sectors Telco, automotive, public, finance, travel & transport

- Modular Service Oriented ICT (Enable structural flexibility by recombination of processes & applications):

  - ✓ Not only flexibility in capacity or the speed of provisioning a greenfield system is relevant to customers. Many customers still operate heterogeneous legacy systems which are vital to their business, but are approaching the end of their lifecycle. T-Systems focuses research activities on achieving the utmost structural flexibility of ICT to support customers in migrations, changes and organizational restructuring

- Dynamic Services from the network (Functionalities and ICT infrastructure resources available online (easy provisioning, flexible capabilities, highly automated)):

  - ✓ The keywords here are Cloud Computing, Software-as-a-Service, Platform-as-a-Service and Infrastructure-as-a-Service. ICT resources are provided and managed by a central service provider, ensuring highly

automated, flexible computing capacities and automated billing as well as easy and fast provisioning (often with user self service)

- Security & Governance (secure and compliant End-to-End solutions for access, collaboration & applications):

This comprises all kinds of ICT components implemented for securing network, data and communication.

2.2.4. Innovation alliances

T-Systems collaborates with other companies in innovation activities through different "innovation alliances". This signals an effort to benefit from the "open innovation" paradigm that has become increasingly popular during the last decade. Nevertheless the open innovation paradigm, as such, within T-Systems is considered fairly limited in contrast to the bigger efforts in open innovation—especially the T-Labs initiative described previously—carried out in the rest of the Group.

Regarding this subject, the management of the T-Labs unit state that "Right now, the opening of the innovation system is highest in the area where it can be expected to matter the most: corporate R&D. The R&D in the business units (T-Mobile, mobile services, T-Home, fixed telephony and broadband access and T-Systems, business customers and ICT services) has traditionally focused on applied research and development, mostly based on innovations brought in from suppliers. Therefore, the competitiveness of innovations on the business-unit level is based on procurement rather than on the internal innovation capacity. Here, the open innovation ecosystem needs to be enlarged in order to include these decentralized business units." [Rohrbeck, Hölzle and Georg, 2009.]

The major alliances that T-Systems has in place for innovation activities are mentioned below [T-Systems, 2010.]

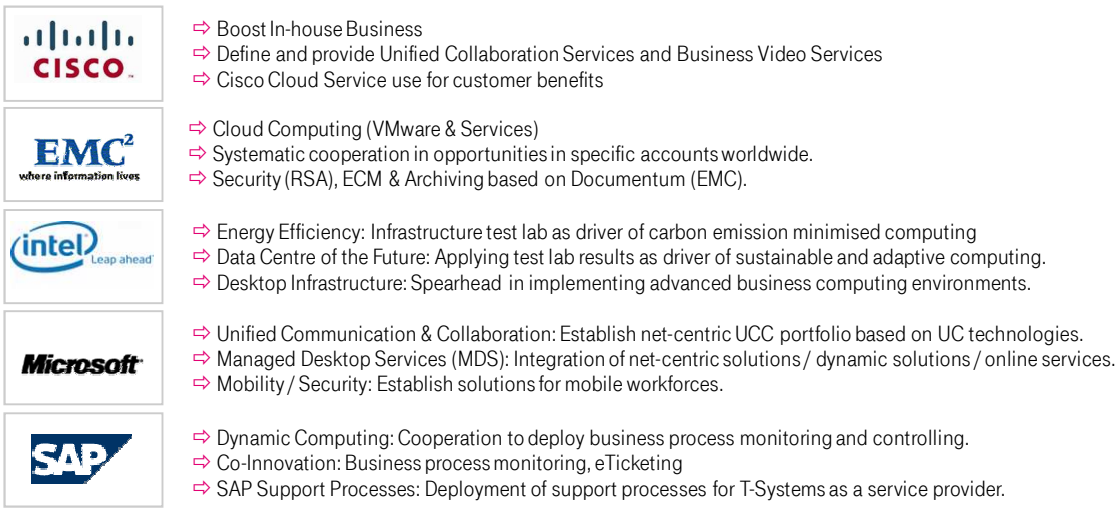


Figure 8. T-Systems' innovation partners

2.2.5. The innovation center

In order to manage all this innovation 'ecosystem' T-Systems has set-up a specialized unit to manage all its innovation-related activities. The "Innovation Center" is the equivalent to the T-Labs at Deutsche Telekom. Its role is to manage innovation initiatives at T-Systems around three main tasks: [T-Systems, 2010]

- To transfer the results of innovation achieved at DTAG to its client base in a manner such that it tackles the latter's needs;
- To execute Special ICT projects, which can mean to "take over" project management in certain cases; and
- To run the ICT Lab, a test laboratory and showroom in the city of Munich located at the facilities of one of the company's most advanced data centers, were live demonstrations and workshops for customers take place.

In the line of these tasks, the Innovation Center carries out its activities according to the sequence described below. [T-Systems, 2010]

1. Inspiration from the outside and identification of prospects: A systematic scouting published regularly in the "Innovation Radar" (commented in the previous section) provides insight on new technologies and market offerings from start-ups, suppliers or competitors; all of which supplies hints and

proofs of adoption of new paradigms or solutions. After reviewing the Radar's information, the Innovation Center initiates and moderates topic-based innovation circles and communities (e.g. the mobile enterprise application community, the security community etc.), initiates internal and external idea competitions (e.g. Call for Proposals, European Satellite Navigation Competition with T-Systems Special Topic Price etc.) and also exchanges information and views with strategic partners and small innovative companies on a regular basis.

2. Identification of trends: The Innovation Center brings together all the inputs gathered from the previous steps and identifies and prioritizes the major issues and trends that are important for T Systems' customers and the ICT industry.
3. Focus activities: Management attention is organized for the best ideas and the innovators "are coached" (which means that guidelines are given to the employees that will take responsibility on specific innovation projects.)
4. Show, Explain, Discuss, Convince and Get Feedback: Finally, the Innovation Center organizes innovation workshops with the company's customers, as well as live demonstrations and showcases that are presented at the ICT Lab. These initiatives are supported by conference speeches and articles in different magazines.

The "Innovation Center" set-up at T-Systems as the responsible unit for driving innovation within the company is an innovation management practice to be considered within the present work. It is particularly remarkable the way in which this unit operates—that is, fostering innovation instead of seeking to exert absolute control over it—since, as previously noted, it is generally considered counterproductive to endeavor to 'confine' the sources of innovation in predetermined and inflexible structures.

2.2.6. Innovation management process

There is a general framework in place for the management of innovation activities within T-Systems. The investigation that preceded the current work evidences that this wasn't so over a year ago, or at least not in its current depiction available for all employees. Nevertheless, it is also evident by a simple inspection that the current model incorporates and fine-tunes into a more 'whole' structure the innovation paradigms previously established in the company's business activities.

T-Systems performs a "continuous innovation process (CIP) which regularly reviews technologies, tools, processes and methodologies for optimization or renewal to the benefit of T-Systems and its customers... hence technology innovations are constantly analyzed to see how they can be transformed into solutions" [T-Systems, 2010]. This process leverages on the capabilities of the whole Deutsche Telekom Group, of which T-Systems takes pride on being "the leader in service innovation within this group."

As it will become evident below, the innovation management process strongly highlights an inherent direction towards customer service in every step of the way; as every phase of the process is driven by what's most in line with the customer's interests. This is also evident from the fact that the customer is encouraged to take an active part in the innovation process.

The importance given to customer service reflects on the "orientation towards results" that innovation is given within the company, as previously noted, but it also indicates that there is a degree of "openness" in the nature of innovation at T-Systems (in the line of the "open innovation" paradigm made popular by Haas Business School professor H. Chesbrough at the beginning of the decade) since one of the main features that characterizes open innovation is the carrying out of innovation activities co-jointly with customers, suppliers and even the competition – roles that are often strongly intermingled in the IT industry.

The following diagram illustrates the process: [T-Systems, 2010]

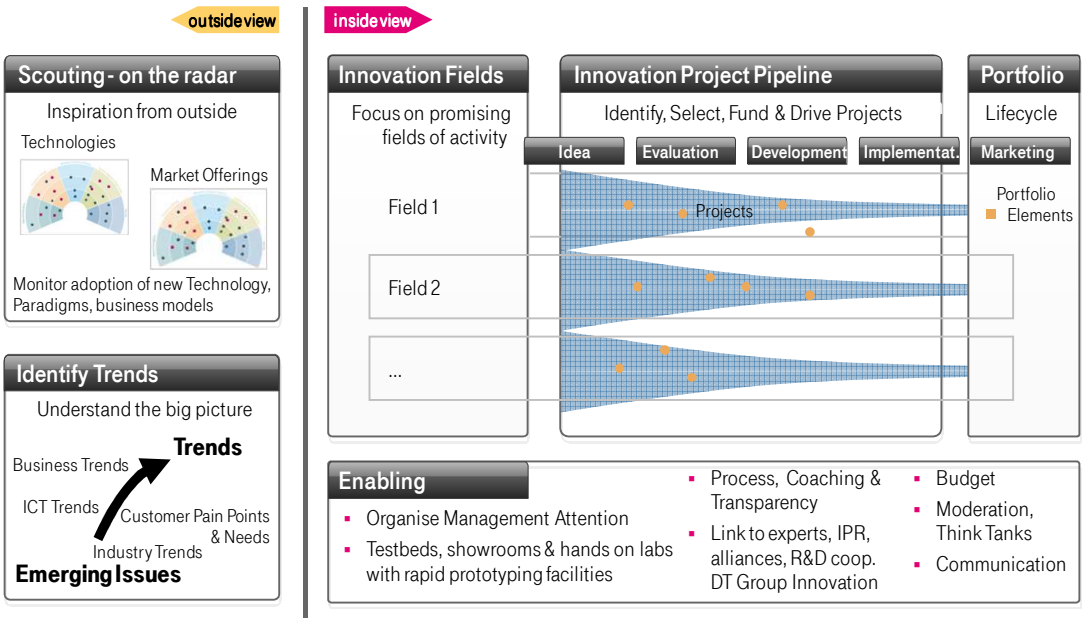


Figure 9. The innovation management process "give creativity the right framework"

As shown in the diagram, there are two major "views"—outside and inside views—that divide the process. The outside view deals with the company's external environment which is relevant to innovation, whereas the inside view refers to the internal framework for business decision making about innovation.

The outside view contemplates the previously mentioned "Innovation Radar" initiative, in which a global network of experts gathers information and renders a report that ranks into a series of easy-to-read metrics a selection of 'novelty' technologies and industry phenomena relevant to DTAG/T-Systems business. T-Systems is very deeply involved in the making the Innovation radar, as it is one of its main sources of input in the continuous innovation cycle; along with customer analysis and industry-specific market studies.

As shown in the figure below, the two main sources for the innovation radar are: a selection of "technology topics" assessed co-jointly by T-Labs and T-Systems' innovation center experts and "market offerings, adoption and opinion topics" assessed by T-Systems innovation center.

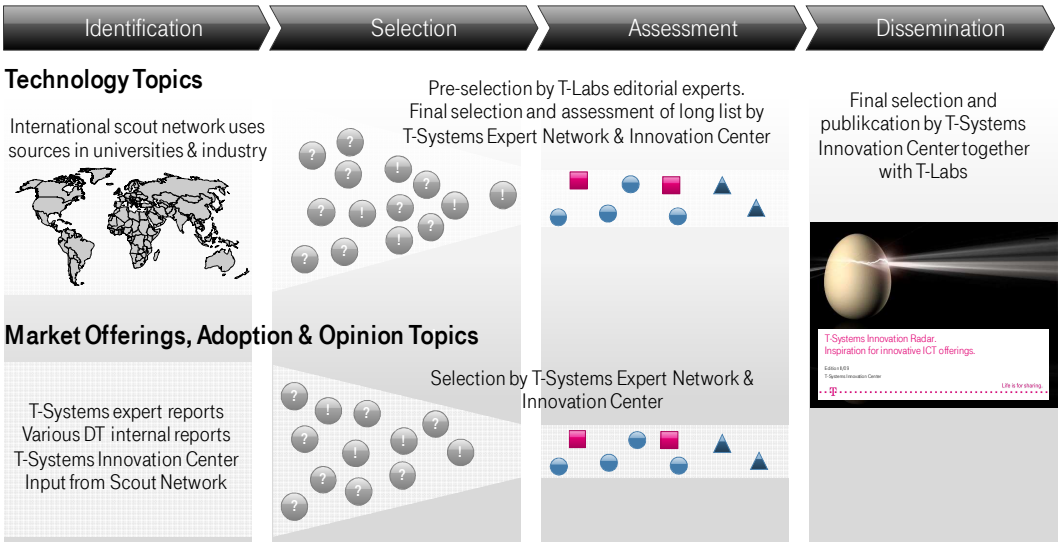


Figure 10. The Innovation Radar's making process

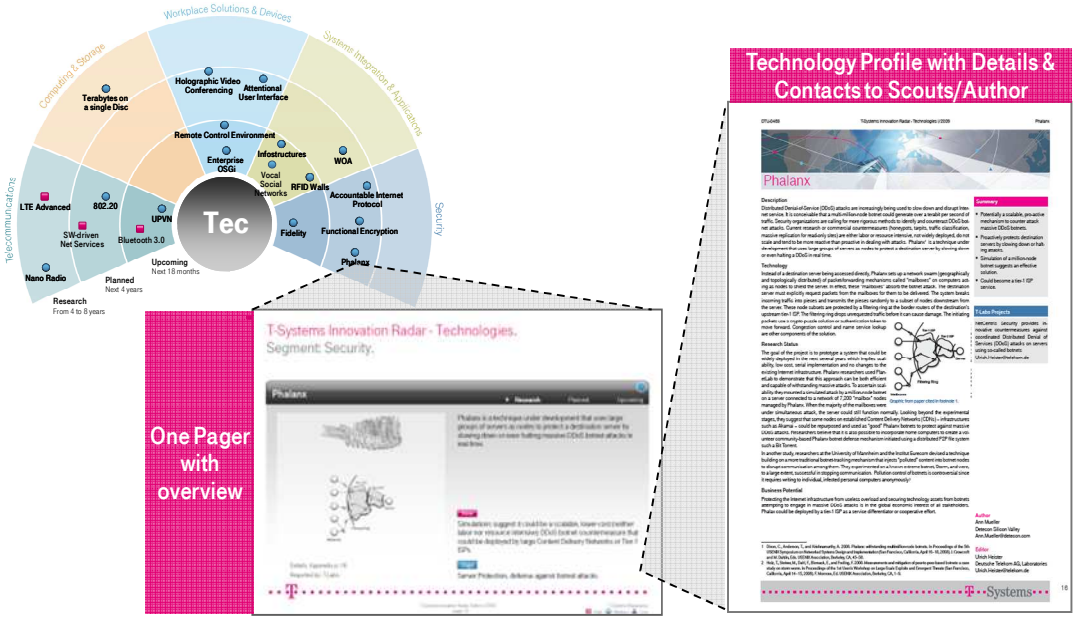


Figure 11. Innovation Radar - Detail

It was previously indicated that customer's involvement in the innovation process reflected on 'open innovation' elements in T-Systems' innovation paradigm. Other elements of open innovation can be evidenced in the "outside view" phase of the innovation process, since the scouting network that generates the input for the rest of the process is a collaborative network of private, public and academic entities.

The Innovation Pipeline

Considering the seven innovation areas of T-Systems (Mobile Solutions, Machine2Machine, Advanced Collaboration, Industry solutions, Modular Service Oriented ICT, Dynamic services from the network and Security & Governance) the inputs from the "outside view" phase are sorted into their corresponding area and then put through an "Innovation pipeline"; a funnel approach to the different potential innovation initiatives—much in the line of the well-known commercial opportunities or "sales" funnel—that filters out those ideas deemed inadequate for investment by the company.

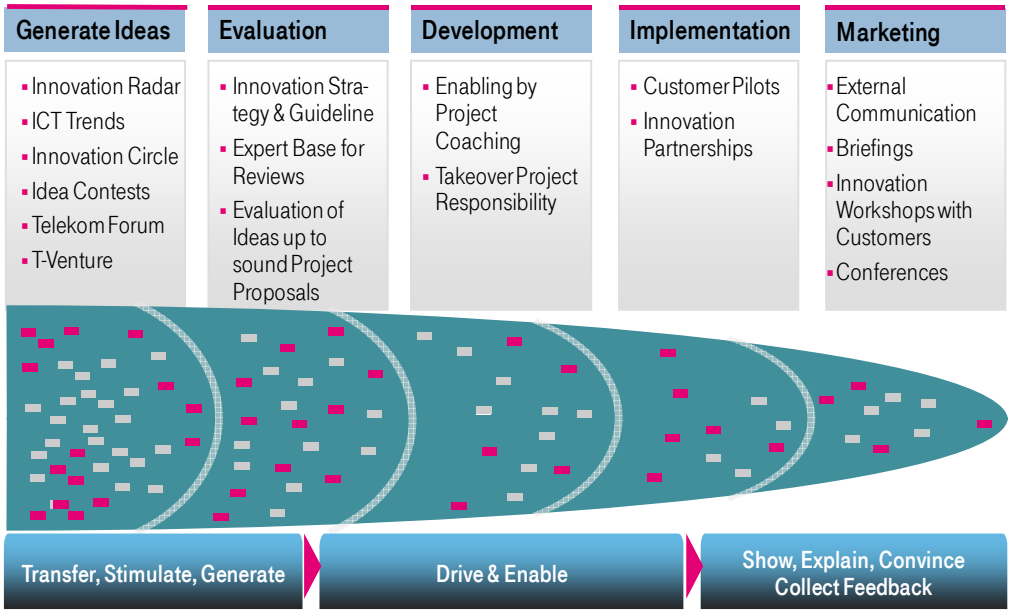


Figure 12. Innovation pipeline - Detail. Tools for enabling innovation at each stage.

The pipeline's sequence of filtering the best ideas is a task performed by T-Systems innovation center: [T-Systems, 2010]

"T-Systems' innovation management puts the radar's contents to the test, searches out the profiles and technologies that are relevant to the company's own areas and creates concise summaries of the information. **These summaries are then discussed with Product Management, Operations and Sales.**

Within T-Systems' Innovation Center department, the findings of the Innovation Radar are

examined in the "Innovation Pipeline" where, **after several stages of close inspection and evaluation, new services or products are assessed and selected for adding to T-Systems' portfolio.**"

These "stages of close inspection and evaluation" refer to the activities within the "enabling" group of the inside view phase of the innovation process (both technologic and managerial tasks. Namely: Test beds, showrooms & hands-on labs with rapid prototyping facilities; Moderation think tanks, Organization of activities to get the attention of the management on the pipelined ideas, link to experts within DTAG as well as outside of the company through alliances and R&D cooperation, Intellectual Property Rights (IPR), Budgeting exercises and communication activities.)

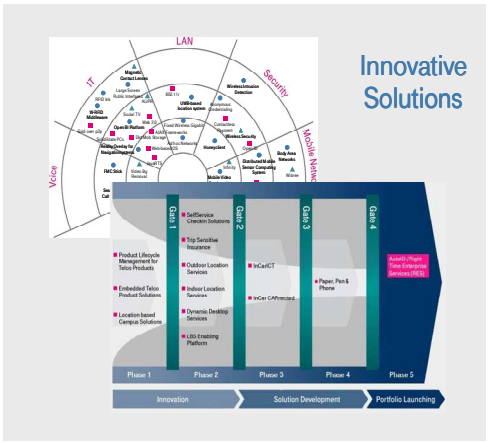
Also note how in these stages the business units of the rest of the company are actively involved in the innovation management process. This is—naturally—absolutely necessary since it would be completely senseless to place an innovative product on the market without having it had properly analyzed by, for example, the sales department; where the people that knows most about what the customers expect from the company are located.

One characteristic that becomes noticeable during this part of the process is that in spite of the stated "closed door" approach for this part of the process (evident since it is within the so-called the "inside view" phase) the activities include the sharing of information with certain agents that are external to the company; highlighting once again the level of embracement of the open innovation paradigm inside T-Systems.

It is worth considering this fact as a potential industry best practice since —arguably—the selection of ideas that must go through the pipeline, obtaining funding and hence **becoming part of the company's portfolio** is a task that requires the application of business criteria sensible of disclose to outside parties. Nevertheless, the company apparently considered that the potential benefits that ensue from a more "undisclosed" process of pipelining are worth the openness.

Evidently, it is necessary to establish proper mechanisms for safeguarding the company's business interests.

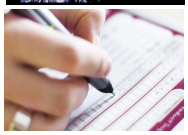
At the end of the pipeline stage, those ideas that "made it through to the end" are integrated into T-Systems portfolio of solutions and services. Some of the most remarkable cases –as judged by their praise in the market—are shown below:



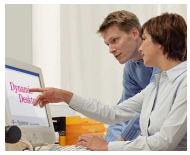
Internet on Rail
- Real-time internet access in all high-speed trains and waiting rooms of Deutsche Bahn AG

Instore Communication
- Innovative communication in Points of Sales: Digital Advertising on huge screens and added value services at multimedia terminals

eCargo
- Automatic tracking&tracing of international transport via GPS
- Real-time fleets localisation, efficient route planning



Paper, Pen and Phone
- Union between digital and paper world through electronic data registration and digital signing via combination of a special pen, special paper and a mobile telephone



Dynamic Desktop Services
- Virtualisation of PCs and their applications which are running on a central platform
- No more desktop maintenance, always up-to date applications

Toll Collect
- First Toll Management Solution for vehicles in movement via
- Special software, OBU, in combination with position control via GPS, data transmission and centralized data management

Figure13. Innovative solutions incorporated to the portfolio

In the final stages of the innovation management process is where the customers start playing a vital part on the innovation that is being pursued. Activities in this stage are collectively dubbed "Communication". T-Systems encourages its customers to integrate into the innovation process in order to achieve mutual benefits from the resulting innovations, and this includes actively communicating with the customer. This offering to customers will be expanded on in the following section.

2.2.7. Customer involvement

In its sales offerings, besides the comprehensive capability to integrate technological know-how of IT and telecommunications into concrete, seamless ICT

solutions, T-Systems offers its customers the benefits of the continuous innovation process carried out at the company.

Regarding innovation, the company states:

"Innovation and improvement will derive from different origins, such as T-Systems' general innovation management process, Optimization within the services provided and Innovation in the business model." *[T-Systems, 2010]*

Note that the above quote cites "innovation in the business model" as a factor. Business model innovation is a practice that took on a significant relevance in the industry at the end of 2008 [Townsend. Forrester Research, 2009], who correctly predicted that business model innovation—which was "all the rage" at the time—would be commoditized as the market offering for it stabilized. Although more akin to companies in the strategic consulting industry, T-Systems can play an important role by innovating in its customers' business models.

"... Being a vendor-independent provider, T-Systems does not need to push a specific technology innovation, but puts the customers' benefits first." *[T-Systems, 2010]*

That last statement is significant in that it points towards an important consideration regarding innovation involving the customer (an element often associated, at mentioned before, as belonging to the paradigm of open innovation) in that: When the interests of the provider and customer are not fully aligned, the conjoint innovation effort needs to take the necessary precautions so it does not perverts itself into a biased cycle of short-term profitability (e.g. a different IT services provider that is an equipment-vendor as well might be tempted to recommend more purchases of their own wares than would probably be really in the customer's best interest.)

Communicating Trends, new Technologies and Solutions to the customer

There are three mechanisms set by T-Systems with the goal of managing innovation in conjunction with different customers. These activities are performed by T-Systems service delivery and account management units (the units responsible for the adequate delivery of the contracted services and for customer interaction at high level respectively):

- **Innovation Board** consisting of representatives of the customer and T-Systems,
- Dedicated special meetings (such as workshops) to discuss ideas, innovations and solutions,
- Innovation proposals by T-Systems
- Innovation awards, for selected partners

The two last activities are ad-hoc and dependent on causality (if, for example, a new industry-specific solution that is relevant to the customer arises from the innovation process), whereas the first two are premeditated statements of intention to innovate from both parties.

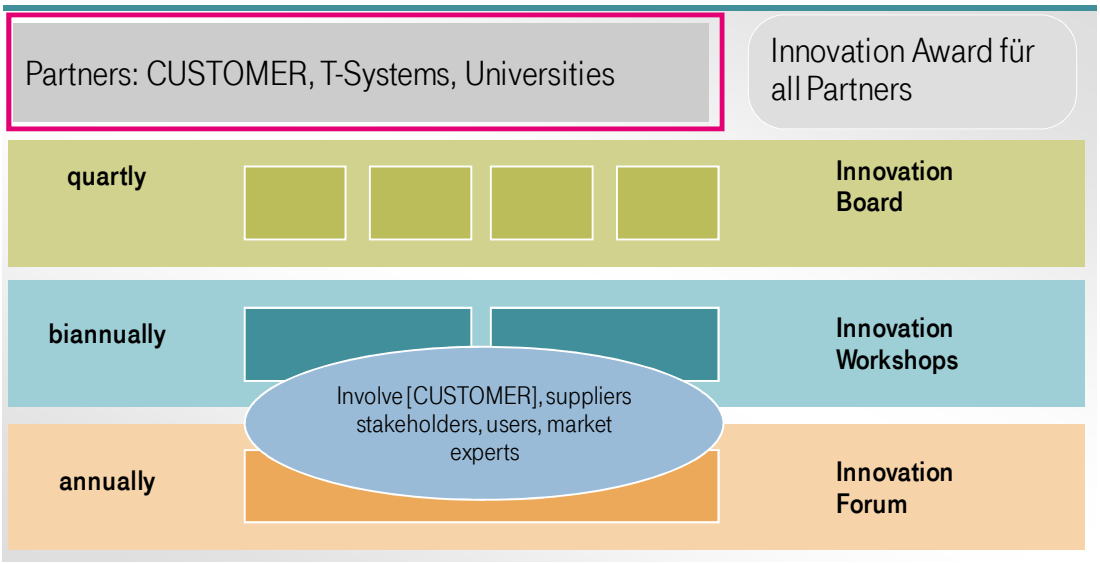


Figure14. Interaction with customers and partners for innovation.

The purpose of the innovation forum is "to connect its brightest business entrepreneurs with T-Systems' technical expertise at T-Labs, increasing social networks and developing future concepts and ideas to be taken to the Innovation Board. The Innovation Forum will be planned by the Innovation Board and will have a focus on special topics which have been identified as critical to the future development of the customer."

The innovation workshops, on the other hand, are less sumptuous and more regular: "T-Systems will offer regular Innovation workshops and showcases that will allow the customer to understand the innovations which are emerging within the industry e.g. Cloud Computing. T Systems is keen to obtain the customer's feedback on targeted innovations and how these could potentially be used within the customer within its current and emerging markets."

The innovation board, in turn, has the following purposes: [T-Systems, 2010]

- Evaluating and reviewing current technology used to deliver its services and communicating potential future enhancements that will result in improved service levels or commercial performance.
- Review technical aspects of its day to day delivery (e.g. interdependencies between technologies and service elements) and develop technology roadmaps to be applied within its technical architecture and service

solutions.

- Discuss the customer's strategy in current or emerging markets and the main business drivers and identify opportunities which may be enabled by innovative ICT technology.
- Discuss innovations that could potentially be developed further together with the customer, based on work undertaken by Deutsche Telekom Labs (DT Labs) that is part of the T Systems Innovation Radar.
- Manage all activities to identify innovation projects and steer them (evaluate, execute and implement).

Innovation Board meetings take place "at least" twice a year –although initially T-Systems suggests a quarterly basis "to get the team established and initiatives underway". To generate and evaluate innovation projects, T-Labs and the customer are invited to present ideas and projects developed in response to specific business needs. **It will be the role of the Innovation Board to decide which projects should be pursued and funded. A strict gateway approval model will be implemented to ensure that projects remain focused on deliverables, time and cost elements.**

If an idea is endorsed by the client, and the innovation board decides to go through with it, T-Systems' account manager takes on the responsibility for submitting the related innovation proposals (including a cost/benefit analysis and project proposal) into T-Systems innovation process in order to consider it for new business development. The customer can negotiate different advantages by being the pioneer and serving as a test bed for the potential innovation.

In its sales offering T-Systems states the following rationale for the innovation board as an adequate innovation management mechanism:

"T-Systems recommends to establish an innovation board consisting of representatives of the customer and T Systems. This will support a shared awareness of relevant upcoming innovations and facilitate efficient decision taking and reliable coordination of innovations that are to be introduced. T-Systems already has extensive experience of establishing such

innovation boards, for example with Airbus, Daimler and British American Tobacco (BAT).

The client benefits from this process as innovations are transformed to industrialized service offers which can be ordered "off the shelf". The Business Development Unit will pay special attention to finding relevant solutions for said customer's industry. These solutions are tested regarding technology, having proven commercial benefits and a tried and tested implementation method to reduce risks at roll-out."

Regarding the actual implementation of innovations with its customers, T-Systems defines three "types" of innovation: 1) That which is driven by driven by keeping a service "state-of-the-art", the innovation that leads to improvements in existing services and has evolved from T-Systems' proactive research and development and the innovation that is possible due to the supplier's ability to develop and offer completely new or enhanced products and services.

"Each type of innovation is handled with its respective processes, personnel and tools. These processes are integrated by the innovation governance model characterized by the innovation board, the meetings of experts on the particular subject matter and the innovation proposals submitted to the customer."

For further information referring to these types of innovation, including a brief mention of specific examples of application, please refer to Appendix A.

According to Forrester research [Andrews, Forrester research. 2010] there are several considerations to take into account when contracting for innovation with technology services providers. The research revealed that one of the most important obstacles in joint innovation between customers and their technology providers was the lack of understanding when measuring the output innovation; as in many occasions, for example, the provider was bent on cost-reduction while the customers had a different priority of business goals in mind.

"Our survey respondents noted that since innovation programs still vary widely in target audience, scale, and scope, no innovation metric can be universal. Their message: If their

clients want them to create more innovation, the client needs to be able to define its unique business goals and desired outcomes —and link these objectives in its services contracts."

The analysis concludes by recommending to customers, among several other things, to "Work with your provider to hone in on the right metrics", understanding that there is no universal metrics for innovation, since success in this case will depend completely on the particular goals the client wants to achieve.

T-Systems' approach to innovation as a service offered to its customers and achieved though a conjoint management effort embodied in these "innovation boards" constitutes a fine example of such business practices as recommended by Andrews:

*"... **the customer has a role to play here in supporting T Systems to understand their business model, future strategy and how they view the threats, challenges and opportunities within their market**. T Systems develops innovative solutions that integrate IT and telecommunications and leverage the know-how of partners by incorporating them from the early stages of development activity. This cooperation is extended within pilot projects that will allow our clients' business to evaluate the potential value of new technology and also to suggest enhancements before technology is finally released to market."*

2.3. Innovation at T-Systems Iberia

2.3.1. Company overview: T-Systems ITC Iberia SAU

T-Systems entered the Spanish market in the year 2000 with the acquisition of "Debis Systemhaus", the former IT division of the then Daimler Chrysler AG, since nearly two years earlier Debis had been awarded the privatization of the Catalan's Government IT department under a 6-year contract. T-Systems settled thus in the Spanish market with the strong footprint given by a strong, stable customer that provided a steady flow of income.

After a 2006 fusion with Gedas—the IT subsidiary of Volks Wagen AG and with a significant presence in Catalonia as well—T-Systems Iberia has become the biggest unit of the company outside Germany with over 4.000 employees and a presence in over 50 cities on the Iberian peninsula. Although the Catalan Government still represents about a third of the company's revenues—the other major client being the Volks Wagen Group Spanish subsidiary SEAT—the company has progressively diversified its client base and independence from its biggest customer.

The Iberian branch of T-Systems is constituted mainly by an executive C-suite—which reports to the executive committee at T-Systems' headquarters in Frankfurt, but is granted a certain autonomy regarding both business and internal structural decisions nevertheless—as well as by its own Sales and Delivery units.

DTAG's innovation management structure is also present at T-Systems Iberia in regards to its portfolio offering, since the responsibility for the "Scouting-on the radar", "Identifying trends" and "Enabling" activities is assigned to the Iberian Portfolio & Offering Management department –which reports directly to the local CEO. This fact points towards several relevant observations.

First, the fact that innovation management at T-Systems Iberia is located directly below the top executive level of the company indicates an effort to ensure that the output of the scouting stage of the process will be heard by the company's management, as well as guaranteeing that the innovation activities with customers will get proper funding and support 'from the top.'

It is also relevant to note that the responsible unit for innovation is the same one responsible for managing the company's portfolio of products and solutions. This parallels T-Systems' main branch in Germany (since the Innovation Center is under the same Portfolio & Offering Management—or "POM"—department) but it is notable in that the company considered important to mimic the German structure in

the Iberian branch in order to properly execute its innovation tasks in accordance to the relevant issues of the local marketplace.

Perhaps another consideration is in order regarding the phases of the innovation process in which T-Systems Iberia doesn't participate –notably in the "innovation pipeline" phases. The lack of local representation in the pipelining process might result in the filtering-out of some solutions relevant to the Iberian market that may not have been adequate for Germany, which could result in lost business opportunities (since the only way to offer the result of an innovation is if the solution is present at the company's offering portfolio.)

2.3.2. A case study for innovation management practices

In the following chapter T-Systems Iberia's innovation management practices will be considered by studying the execution of a specific project that is part of a local innovation initiative: Project CifraH.

The present status of this project is "Evaluating" –the second stage of the innovation process performed by the innovation centre described in the previous sections (see "figure 11"). T-Systems Iberia does not have a direct representation in this evaluation board and thus depends on sponsors and ad-hoc presentations to members of the board in order to get the funding needed to carry on with the opportunity.

The idea was conceived by the POM department at T-Systems Iberia as part of a scouting process of ideas for the potential application of a company's product. When the need for a more flexible process for securely signing legally-binding electronic documents within T-Systems Iberia became evident, a task team was formed in order to develop a solution to the problematic ultimately conceiving the CifraH project and the characteristics of a platform for secure transactions that could be used internally as well as a market offering.

During a quarterly review of business ideas in which the POM department engages with the company's headquarters, the idea for CifraH was signaled to be presented to the innovation center by the end of 2009. Feedback from the evaluation board was received two months later suggesting modifications to the project such as the inclusion of local partners as well as external sources that could, partially, provide funding for CifraH. Both recommendations were followed and by the end of summer 2010 Cifrah was reintroduced to the innovation center's pipeline for evaluation, where it is still pending for an answer.

Further description of the idea, as well as an account of the partnerships, financial aspects and other 'internal-politics' factors involved, will be presented in the following sections. This analysis will focus on judging the adequacy and effectiveness of the company's mechanisms for enabling innovation, as exemplified by the CifraH project.

3. The CifraH project at T-Systems: An innovation perspective

3.1. Project overview

3.1.1. The goal

The goal of the CifraH project is to develop a "cloud-based" platform for the implementation and delivery of advanced digital identity solutions that is profitable to implement and run.

These solutions must be understood not only as "secure communication" services but, higher up in the value chain, as full-fledged solutions for the management of identity attributes—including capabilities of complete legal action and representation—in open communication networks.

3.1.2. The business model

The developed platform will be commercialized in a "platform as a service" (PaaS) scheme.

As mentioned before, in a PaaS offering the customer is given—often in a pay-per-use scheme—high-level tools for making use of a software developing framework (the platform) that provides "basic" functions (identity management functions, in this case) for developing the customer's own business applications in order to provide high value-added services to the final client.

According to Forrester research [Heffner, Forrester Research. 2009] "PaaS is one of the multiple categories of offerings that fly under the vague and often ill-used banner of cloud computing." hence providing the following definition:

"PaaS is an externally hosted service providing a complete platform to create, run, and operate applications, including development tools, administration and management tools, runtime engine(s), data management engine(s), security facilities, and user-management services. PaaS is based on Internet protocols and patterns."

Given a sufficiently-big market demand, the PaaS model allows for benefitting from economies of scale as the same platform is exploited for by serving several customers at once.

John R. Rymer [Forrester Research, April 2009] summarizes the benefits that PaaS models bring to customers with the following phrase:

"The basic reward of PaaS is that it allows IT groups to defray capital costs and some operations costs (configuration, management, reliability, and scalability) to a vendor. PaaS shares these potential advantages with other forms of "cloud computing." If the economics work out, application development groups should be able to use these cost savings to improve their responsiveness to the business' needs for new and changed applications."

3.1.3. The platform

As the CifraH project is still in its inception phases (pending for funding for Research and Development (R&D) activities) it is still too early to draw a complete picture of the proposed functionality of the platform. Nevertheless, the platform is conceived, as of now, of having the following functionalities:

- Capacity to storage of identity information (attributes). Such as X.509 digital certificates for the authentication of user's identities
- Tools for managing identity information as avatars (also known as 'personas')
- Tools for managing identity information stored on a user's active clients (supports TSL (SSL), SAML, eID schemes, InfoCards (WS-trust, Higgins) and other open standards such as OpenID+OAuth and WebID)
- Support of strong authentication mechanisms for accessing the platform and validating interactions with other parties
- Is Kantara+OIX identity frameworks compliant

- Supports zero-knowledge proof mechanisms

For the purpose of illustrating how the platform can be used, the following examples would constitute potential customers for this solution:

- A SaaS provider that develops a white-label web service for Notary publics to mass-manage legally-binding electronic interactions between organizations as part of paperwork elimination and workflow automation initiatives
- A SaaS provider that develops a white-label web service for public sector agencies to provide digital certificate management and "syndication" of custom-fitted public services to citizens and organizations.
- A SaaS provider that develops a white-label web service for companies that implement web services to improve their offerings and want to provide their users with control over their personal information (e.g. web-based retail portals that permit its users to install third-party developed "apps" in order to provide them with an enhanced shopping experience)

In order to clarify what **doesn't belong** to the scope of the project, the following examples wouldn't count as potential customers of the platform:

- Identity Services provider that develops and offers web-based identity management solutions for users to access different commercial services (e.g. Web-SSO providers). For business reasons; free offerings such as OpenID (federated) and WebID (web of trust) are more likely to conquer that terrain.
- Identity Services provider that develops and offers domain-specific federated identity management solutions for users to access different

commercial services (e.g. Enterprise SSO providers). For business reasons; these functionalities are covered by a myriad of solutions from a range of IAM providers (IBM's Tivoli, Microsoft Identity Foundation, etc.)

Please refer to Appendix B for further detail on the CifraH project's planning, including a detailed description of the working groups and their activities.

3.1.4. Partnerships

The CifraH project will be carried about by T-Systems in consortium with other organizations, including specialist software developers and potential customers of the service. Although the initial idea for the project was born within T-Systems, the decision to seek collaboration with other companies responds to the following factors:

1. Minimizing the risk of investment
2. Complementing in-house capabilities with specialist know-how found in the market
3. Ensuring commitment for initial consumption of the service by including potential clients interested in the initiative
4. Increasing the probabilities of a smooth market introduction of the product by collaborating with territorial companies and actors.

T-Systems' partners for this project are the following: [T-Systems Iberia, 2010]

- Barcelona Digital Centre Tecnològic (BDigital): A private foundation and serves as a connection hub for many relevant players in the local industry segment. It has experience in security within cloud computing environments.
- Deister Software: A local SME specialized in quality methodologies for software development
- Wolters Kluwer España: A provider of legal services, mainly safe storage of

sensitive, legally-binding, documents. It is a potential customer for this platform. It has an important presence in Spanish town halls and local administrative bodies, as well as in many law firms.

- Logalty: A joint venture between T-Systems and the well-known local "Garrigues" law firm, it offers "third party of trust" services by, among other things, providing "electronic proof" in digital business transactions. This company also constitutes a potential customer for the CifraH PaaS offering.

These actions can be said to take the CifraH project into the realm of what is known as "open innovation –a term that has grown very much in popularity since its conception and is now widely used in the industrial world. Although it is a subject appropriate for a much wider discussion, a few insights will be made regarding the collaboration between T-Systems and its partners in the CifraH project regarding open innovation principles. One of the most common definitions of Open Innovation is the following:

"A paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" [Chesbrough, H.W. (2003)]

3.1.5. Responsibilities

T-Systems will bear the overall responsibility for general management and coordination of the project, but it will coordinate the tasks co-jointly with the rest of its partners. The functions for the development of the project are structured in a set of working groups, each composed of professionals from the different participants of CifraH. A work plan has been agreed upon in order to carry about all the necessary tasks.

In order to co-jointly manage the project, the following structures will be put in place: [T-Systems Iberia, 2010]

1. Coordination committee: Responsible for the technical and administrative management of the project. It is headed by T-Systems.
2. R&D committee: Responsible for the coordination of R&D activities. Headed by BDigital.
3. Business committee: Responsible for guaranteeing a business-oriented approach of the result, headed by Logalty. It will be composed mainly of business and legal consultants that are external to the rest of the project's activities.
4. Working groups: There will be seven working groups, according to the following job distribution and participants.

- WG1. Project management (T-Systems and BDigital)
- WG2. R&D Requirements (T-Systems, BDigital, Deister Software, Wolters Kluwer, Logalty)
- WG3. identity and Authentication in a cloud environment (T-Systems, BDigital, Deister Software, Wolters Kluwer, Logalty)
- WG4. Cryptography in a cloud environment (T-Systems, BDigital, Deister Software, Wolters Kluwer, Logalty)
- WG5. Platform development (T-Systems, BDigital, Logalty)
- WG6. Platform integration and validation (T-Systems, BDigital, Deister Software, Wolters Kluwer, Logalty)
- WG7. Promotion of the results (T-Systems, BDigital, Wolters Kluwer, Logalty).

3.1.6. Financial aspects

The project will be mainly financed by T-Systems and the estimated cost totals nearly 1M€. The biggest share of the cost will be borne by T-Systems and a governmental subvention has been solicited from the Spanish Central Government.

After negotiations with the different partners, the following budget has been agreed upon: [T-Systems Iberia, 2010]

T-Systems

Concept	Cost Year 1 (€)	Cost Year 2 (€)	Cost Year 3 (€)
Investment in hardware	0	0	0
Personnel direct costs	157.255	414.781	457.240
External services	35.000	70.000	70.000
Other	36.451	87.956	96.448
TOTAL	228.706	572.737	623.688
SUBVENTION	82.852	207.481	225.941
CREDIT	100.101	250.700	273.005

Deister Software

Concept	Cost Year 1 (€)	Cost Year 2 (€)	Cost Year 3 (€)
Investment in hardware	0	0	0
Personnel direct costs	69.123	314.978	73.305
External services	15.000	30.000	30.000
Other	13.825	62.996	14.661
TOTAL	97.948	407.974	17.966
SUBVENTION	50.175	208.992	60.430
CREDIT	28.182	117.387	33.942

Logalty

Concept	Cost Year 1 (€)	Cost Year 2 (€)	Cost Year 3 (€)
Investment in hardware	0	0	0
Personnel direct costs	26.355	43.925	43.925
External services	25.000	25.000	25.000
Other	5.271	8.785	8.785
TOTAL	56.626	77.710	77.710
SUBVENTION	20.514	28.152	28.152
CREDIT	24.787	34.016	34.016

Wolters Kluwer

Concept	Cost Year 1 (€)	Cost Year 2 (€)	Cost Year 3 (€)
Investment in hardware	0	0	0
Personnel direct costs	42.115	85.796	55.436
External services	0	0	0
Other	8.423	17.159	11.087
TOTAL	50.538	102.955	66.523
SUBVENTION	18.675	35.873	24.887
CREDIT	22.565	43.345	30.071

The following is a results projection made as an initial estimation for the amortization of the investment: [T-Systems Iberia, 2010]

Mean annual fee	2013	2014	2015	2016
Services consumption	25% of SaaS	25% of SaaS	25% of SaaS	25% of SaaS
Disk storage	50,00 €	50,50 €	51,01 €	51,52 €
Transaction	900,00 €	909,00 €	918,09 €	927,27 €
Number XaaS providers	2	10	20	32
Number “A” clients	200	1500	4500	10800
Number “B” clients	100	750	2250	5400
EXPLOITATION INCOME	100.000,00 €	757.500,00 €	2.295.225,00 €	5.563.625,40€
Basic services	10.000,00 €	75.750,00 €	229.522,50 €	556.362,54 €
Value-added services	90.000,00 €	681.750,00 €	2.065.702,50 €	5.007262,86 €
OPERATING COSTS	55.000,00 €	416.625,00 €	1.262.373,75 €	3.059.993,97€
CifraH service (PaaS)	25.000,00 €	189.375,00 €	573.806,25 €	1.390.906,35€
XaaS service	30.000,00 €	227.250,00 €	688.567,50 €	1.669.087,62€
PARTNER INCOME				
CifraH service (PaaS) provider	25.000,00 €	189.375,00 €	573.806,25 €	1.390.906,35€
XaaS provider	100.000,00 €	151.500,00 €	229.522,50 €	278.181,27 €

AMORTIZATION OF INVESTMENT				
CifraH service (PaaS) provider	2.050.000,00 €	2.025.000,00 €	1.835.625,00 €	1.261.818,75€
XaaS provider	450.000,00 €	350.000,00 €	198.500,00 €	-31.022,50 €
NET RESULT	-2.375.000,00€	-2.034.125,00 €	-1.230.796,25 €	438.291,37 €
CifraH service (PaaS) provider	-2.025.000,00 €	-1.835.625,00 €	-1.261.818,75 €	**129.087,60 €**
XaaS provider	-350.000,00 €	-198.500,00 €	**31.022,50 €**	309.203,77 €

These estimates were made according to the following hypothesis:

- Exploitation of the platform begins in 2013
- T-Systems and Deister Software are the PaaS providers, their investment totals 2M€
- Logalty and Wolters Kluwer are potential "XaaS" ("x" meaning something to be determined) providers. Their investment totals 450k€
- In 2013 there are 2 XaaS providers (Logalty and Wolters Kluwer); while by 2016 this number has grown to 32.
- There are two types of final clients. "A" clients are estimated to consume a mean annual sum of 50€ for document storage services (e.g. a Wolters Kluwer client) and "B" clients are assumed to be typical Logalty clients. The estimates are made according to the current and predicted client base of the two partner XaaS providers
- It is assumed that the XaaS providers use the CifraH PaaS platform at a cost of 25% of their revenues.

3.2. Analysis of innovation elements in CifraH

3.2.1. Innovative potential: A business model conceived for driving widespread demand

The 'business model' (i.e. the rationale for the generation of value, which in this in this case translates to high revenues) for the exploitation of the technical platform is the key innovation element of the CifraH project.

Since the technology involved already exists and standardization efforts in this field are well-under way worldwide, the innovative 'bet' of the project lies in the idea that **a PaaS offering of just the basic functions for managing and authenticating identity attributes and claims** in open communication networks can—rightly priced of course—spawn a myriad of value-adding, high-end identity services that will drive the growth of this market segment and provide an attractive source of revenue for market leaders.

It is very relevant to stress this point, since it is in the business model where the added-value proposition of the company lies (the necessary technical, commercial and financial resources as well as the risk resilience needed in order to generate the necessary economies of scale for the scheme to be profitable and sustainable are not within the reach of just "any" other player in the industry). According to a renowned Catalan business executive and innovation expert "... there is no radical innovation without a new business model."[22] Also "... strategic innovation with a focus on the generation of new business models is a new professional practice" which requires "teamwork of experts from multiple backgrounds and experience levels" working under an "application of knowledge" mentality[23].

A report by IBM's (International Business Machines Corporation, a renowned information technology (IT) company) Institute for Business Value comments on the

[22] See: http://www.antoniflores.com/innovar-no-es-limpiar-el-polvo-de-la-mesa/

[23] See: http://www.antoniflores.com/tocar-en-playback-una-reflexion-del-entorno/

difficulties in defining "business model innovation" and, based on extensive research, opts for providing a framework for understanding around three different kinds of business model innovation.[24] These are: [IBM Institute for Business Value, 2009]

- "Industry" business model innovation: Innovating the industry value chain by moving into new industries, redefining existing industries or creating entirely new ones, also by identifying/leveraging unique assets.
- "Revenue" business model innovation: Innovating how we generate revenue through offering re-configuration (product/service/value mix) and pricing models.
- "Enterprise" business model innovation: Innovating the role we play in the value chain by changing our extended enterprise and networks with employees, suppliers, customers, and others, including capability/asset configuration.

If this conceptual framework is taken into account, the CifraH project would fall under the "Revenue" business model innovation category. Since T-Systems' role as a provider of services for corporate clients in the ICT industry is maintained, it is in the pricing model and the service value mix where the potential innovation must take place.

3.2.2. Opportunity cost: The right market at the right moment

The technical elements involved in the project are not innovative per se, but if applied in the proper form and the adequate market conditions are given, the idea might succeed. This principle that holds true for most innovations leads to the obvious questions: "When is the right time for introducing this potential innovation into the market?" Or in this particular case: "By the time the development of the

[24] "Paths to success: Three ways to innovate your business model". IBM Institute for Business Value study, March 2009.

CifraH platform is finished will the Spanish market ready for the massive demand that is necessary to support the profitability of the investment?"

Given the state of the art of the technology and standards, the legislative advances regulating transactions through digital means in some parts of the world and in Spain, the recent introduction of eID solutions across Europe and the accelerated mass-consumerization of technology, it is project CifraH's bet that by the time the development of the platform is completed the target market will be mature enough to make the commercialization of this product—and potentially other services that might surge from the know-how obtained along the development of CifraH—highly profitable for the company.

3.2.3. From inception to investment

T-Systems Iberia has put in place some mechanisms to enable the mobilization of resources to tackle this sort of highly uncertain innovation goals. As the CifraH project has proved, the organization is able to commit both human resources to manage and lead innovative projects and the financial capital to fund them.

Nevertheless, this capacity to commit has its limits. First of all the fact that much of the funding needed for the project is dependent on the approval of a subsidy by the Spanish Government. This makes the project dependant on a very uncertain source of funding that fiercely sought after by many competing initiatives. Which leads to ponder if it wouldn't be better for T-Systems to finance the project on its own, contracting the know-how that it might lack for the development of the platform to external companies.

A second factor at play is T-Systems participation in Logalty, a potential customer of the CifraH platform. Partially owning this firm would constitute a strategic advantage for CifraH's goals if it weren't for the current danger of falling-out with the other partner of the Logalty joint venture. T-Systems and Garrigues are considering ceasing their current partnership; particularly T-Systems might

abandon the project. In which case T-Systems is contractually bound to renounce to seek market share from services that might compete with Logalty's offering for the two years immediate to the cessation of the venture.

On the other hand, to fund the entire project is an option that would result in an increasingly uphill effort. This is due to two reasons. First, at T-Systems Iberia, since it is fully-owned by its German counterpart, all investment projects of a certain size must pass through a series of quality gates and likewise approval processes and stages ultimately governed by the Deutsche Telekom's business review executive board. This highly-centralized approach allows flexibility for local country management to decide on relatively small projects, such as the current CifraH project's less than 05,M€ committed to the initiative, but it does not permit higher risk-taking for larger sums of money and risks. Such a case would require a big effort from CifraH's leadership in order to mobilize inner procedures of the organization. The innovation board described in the previous chapters has actually been informed of the CifraH initiative, and it recommended seeking the subsidies of the Spanish Government before attempting to move the CifraH project into the next phase of T-Systems innovation pipeline.

3.2.4. Leveraging open innovation: The partners complete the picture

The second reason is more related to territorial market factors. By working with local organizations and companies (such as BDigital and Deister Software) a company in a foreign country (as T-Systems is in the Iberian market) increases its chances of locating its products in the local marketplace, especially when the Public Sector is an important target customer, as is the case of CifraH. In Iberia T-Systems does not have the clout it enjoys in other countries (specially in Germany, of course, but also in much of eastern Europe as well as in the United States where T-Mobile is the third biggest Telco operator) so it must seek to work with partners in order to get a foothold of the market.

Openly collaborating with other companies increases the complexity of the initiatives, as risks, responsibilities and investments are shared by different actors. Once again, this is an obstacle for the approval of the initiative in the different phases of T-Systems' innovation pipeline.

4. Conclusion and recommendations

The CifraH project constitutes a fine example of initiative and commitment to innovation within a complex and considerably-sized corporate structure. Several innovation management practices that are being carried about in order to achieve the benefits that are expected from this kind of investments are notable. Namely:

- Local country management is encouraged to embark on innovative business initiatives, within certain risk parameters.
- The corporate culture is aware of the importance of the "open" aspects of innovation; and as such is ready to undertake projects that require the involvement of several external industry players and different levels of commitment.
- Specific human resources are assigned with the task of facilitating the advance of innovation initiatives through the company's complex system of approvals and financing. As well, these employees are provided with mechanisms—such as the innovation pipeline—to help prioritize and conduct efforts along the process.
- Incentives are put in place in order to reward successful innovation projects.

On the other hand, several factors threat to undermine the outcome of the CifraH project, which in turn sheds light on the weak spots of the company's innovation systems:

- The fact that T-Systems is a "foreign-owned" as perceived in the Iberian market might hinder some innovation initiatives when political factors are not properly handled.
- While recurring to governmental subsidies is a good way for obtaining funding for innovation projects and sharing the risks, if the project fundamentally depends on this source of financing—as in this case with CifraH—there is a high probability that the initiative might not be able to

move ahead.

- It is difficult for the local Iberian unit of the company to bet on innovative projects when the sums involved exceed a certain amount, since the organization as a whole becomes more risk-adverse at such levels of investment.

Understandably enough, since consortia and business collaborations imply responsibilities for the outcome of investments, getting involved in this sort of practices carries an inherent risk. And although the CifraH project at T-Systems demonstrated that the organization is ready to assume these necessary risks up to some extent, demonstrating flexibility and openness. But if T-Systems is really bent on growing in the Iberian market by leveraging its innovation potential it must allow for more agile procedures for locally managing innovation decisions. Especially when dealing with business model innovation goals.

Therefore, it is highly recommended that the company performs a review of the local executive management's granted level of flexibility in order to close sizable business deals that are properly aligned to the needs and business style of the local market in a more constraint-free manner.

Another recommendation is to promote a higher level of collaboration between Headquarters' Innovation Center and the international units of T-Systems. Although several mechanisms for market evaluation and prediction exist within the company, the fact that innovation initiatives in the international units of the company depend so heavily on portfolio-related goals, in contrast to generation of new innovation pipeline inputs for example, risks making the innovation activity too portfolio-based and not in enough alignment with the market needs.

The fact that the development of the CifraH project has been less smooth than initially predicted cannot be blamed on a single factor. It is rather due to several business, economic and political factors. Nevertheless, this observation of the

efforts that were carried by T-Systems Iberia around the CifraH initiative definitely indicate that there is still some way to go towards the goal of enabling the capacity for innovation that the company needs to flourish in the Iberian market.

5. Bibliography

- "A special report on innovation". The Economist. October 13, 2007
- "Un marco global para el desarrollo de la I+D y la innovación en la empresa". Xavier Ayneto y Marta Albertí, Innovación en la empresa (monográfico de la Comissió d'Indústria i Tecnologia - Foment del Treball). 2008.
- "E-Signatures Q&A: Legalize It". Bill Nagel. Forrester Research. December 2, 2009.
- "PKI: Alice And Bob Have Still Got A Job". Paul Stamp. Forrester Research. January 14, 2005.
- "Best Practices: Infrastructure-As-A-Service (IaaS)". James Staten. Forrester Research. September 9, 2009.
- Computer Networks (5th edition). Andrew S. Tanenbaum, David J. Wetherall. Prentice Hall. 27 September, 2010.
- Deutsche Telekom company profile. As of September 4th 2010. http://www.telekom.com/dtag/cms/content/dt/en/13588
- "Deutsche Telekom Laboratories as a Testbed for Modern Technology and Innovation Management". Peter Möckel and Dr. Heinrich M. Arnold. 2009.
- Documentation for the Sales Department.T-Systems, 2010.
- T-Systems Corporate profile. As of September 4th 2010. http://www.t-systems.com/tsi/servlet/contentblob/t-systems.de/en/626900/blobBinary/Corporate-Profile-T-Systems.pdf
- "Opening up for competitive advantage – How Deutsche Telekom creates an open innovation ecosystem". René Rohrbeck, Katharina Hölzle and Hans Georg Gemünden. 2009
- Forrester Research. "Contracting For Innovation With Technology Service Providers". Chris Andrews. April 23, 2010.
- Predictions 2009: Innovation management. Chris Townsend et al. January 22, 2009.
- Taking The Fog Out Of Cloud Computing: Platform-As-A-Service. Randy Heffner et al. February 10, 2009.
- Platform-As-A-Service Is Here: How To Sift Through The Options. by John R. Rymer. April 21, 2009.
- T-Systems Iberia CifraH project report. 2010.
- Chesbrough, H.W. (2003). Open Innovation: The new imperative for creating and profiting from technology. Boston: Harvard Business School Press, p. xxiv
- "Paths to success: Three ways to innovate your business model". IBM Institute for Business Value study, March 2009. http://www-935.ibm.com/services/us/gbs/bus/pdf/g510-6630-01-paths2success.pdf

Appendix A. Conjoint provider-customer innovations at T-Systems

The following content describes the three types of innovation that T-Systems considers when working together with their customers.

This information is given to T-Systems' customers in commercial approximations in order to illustrate the possible roles and benefits from an "Innovation board" initiative. It is available to the Sales Unit employees to serve as a template for customer interaction. [T-Systems, 2010]

Innovation in an Outsourcing Contract

T-Systems is dedicated to driving a continual process of innovation throughout its own business and in its customer relationships. Experience has shown, however, that to optimise the benefit of such an approach, it is important to differentiate between various types of innovation in order to get a clear and consistent view both of innovation leadership and the predictability of any related costs.

Therefore T-Systems' approach to implementing new technologies and solutions depends on the type of the innovation. Each type of innovation is handled with its respective processes, personnel and tools. These processes are integrated by the innovation governance model characterised by the innovation board, the meetings of experts on the particular subject matter and the innovation proposals submitted to the customer.

a) Changes or innovation that is driven by keeping a service "state-of-the-art".

The customer participates in these innovations, which are triggered either by market demands or proactively discovered and made available by T-Systems. Changes of this type are e.g. performance increase (CPU) and cost reduction due to technology progress, or the upgrading of operating systems to more recent versions.

Solutions of that kind are often suggested by T-Systems' suppliers as technology innovations or by technology scouts scanning the market on behalf of T-Systems. These are then tested to see whether they fit into the T-Systems environment with regards to security, operating and monitoring. This process is performed by the respective delivery unit which aims to implement the innovation. The success in improving the service is ensured by methods such as DMAIC and the relevant Six Sigma activities.

The customer has the advantage of obtaining already tested state-of-the-art services without having to bother about technological details.

This approach has provided Debitel, a T-Systems' customer, with a stable level of performance and service although the software utilised has become more complex.

b) Innovation that leads to improvements in existing services and has evolved from T-Systems' proactive research and development.

Often this type of innovation allows technical and/or commercial benefits for both T-Systems and its customers which would then be shared between the parties involved. This would also apply to potentially required investments.

These solutions are usually developed on the basis of innovative technology components and tested extensively at T-Systems. After approval a pilot installation is implemented on the premises of a customer who may obtain considerable benefit from this solution. Based on this feedback, the solution is finely-tuned to addressing the customer's needs and assessed commercially. T-Systems then includes the service in its standard Solution Offering Portfolio (SOP).

These solutions will be presented to the customer by the account team on the Innovation Board. The customer may also be selected as a pilot customer for new solutions. If the customer and T-Systems decide to implement the solution, the project will be handled by T-Systems' Project Management according to the principles of PMI methodology.

The customer benefits by being offered new solution enhancements ready for implementation that have been proven in a business case study using implementation methodology.

An example for an innovation of this nature is T-Systems' move to offer various dynamic services (such as T-Systems' "Dynamic Infrastructure Services" or "Dynamic Services for SAP® Applications"), which allow its customers to respond rapidly and appropriately to the needs arising from their business.

For instance, the international paper group SAPPI Ltd. (South African Paper and Pulp Industries) outsourced responsibility for its global standard SAP applications operations to T-Systems and its dynamic SAP solution. T-Systems consolidated the 30 complex SAP systems serving more than 6,500 users worldwide. The paper group benefited from the highly secure infrastructure at the T-Systems data centre in Vienna and the transparency of its global load capacity increased.

SAPPI can now determine the capacity utilisation of each individual location at a glance, flexibly and agilely, and thus has better cost variability and cost transparency. In addition, T-Systems set up competence centres divided according to region. The employees at these centres are responsible for country-specific needs, meaning that SAPPI receives individual care across the globe.

c) Innovation that is possible due to the supplier's ability to develop and offer completely new or enhanced products and services.

T-Systems also develops completely new services and products. These have the potential to transform the customer's business processes. They therefore have to be implemented in joint projects between T-Systems and the customer.

In principle the development of these services follows the same rules as service innovations. There is also a strong emphasis on market assessment as well as on technical feasibility, testing and piloting.

These new services and products will be presented to the customer by the account team on the Innovation Board. They are also often presented in T-Systems' customer communication media such as the "Best Practice" magazine. If the customer and T-Systems decide to evaluate and implement the solution, the project will be handled by T-Systems' Project Management according to the principles of PMI methodology.

The customer profits from being able to choose and add those innovations to the scope of consumed services from which its business benefits most.

An example of such an innovation is the RFID-based solution "Real Time Enterprise Services" (RES) that enables companies to manage all the elements of their supply chains efficiently and transparently. RES allows companies to identify every object unambiguously and from a distance whilst monitoring via central communications platforms is done automatically.

RES was successfully implemented at Railion Deutschland AG, for example. Railion Deutschland AG is the largest transport company in the European Union. T-Systems developed the "eCargoService" based on an intelligent Tracking Management. The GPS-supported system assists in locating and monitoring the Railion freight cars all over Europe. By means of this highly integrated service Railion receives rapid, real-time and extensive information on the location and the transport circulation of the goods throughout Europe. Railion Deutschland AG can thus react more quickly to business-related occurrences and is finally more flexible in adapting to these occurrences.

Appendix B. Schematics on the CifraH project

5.1. Operations plan

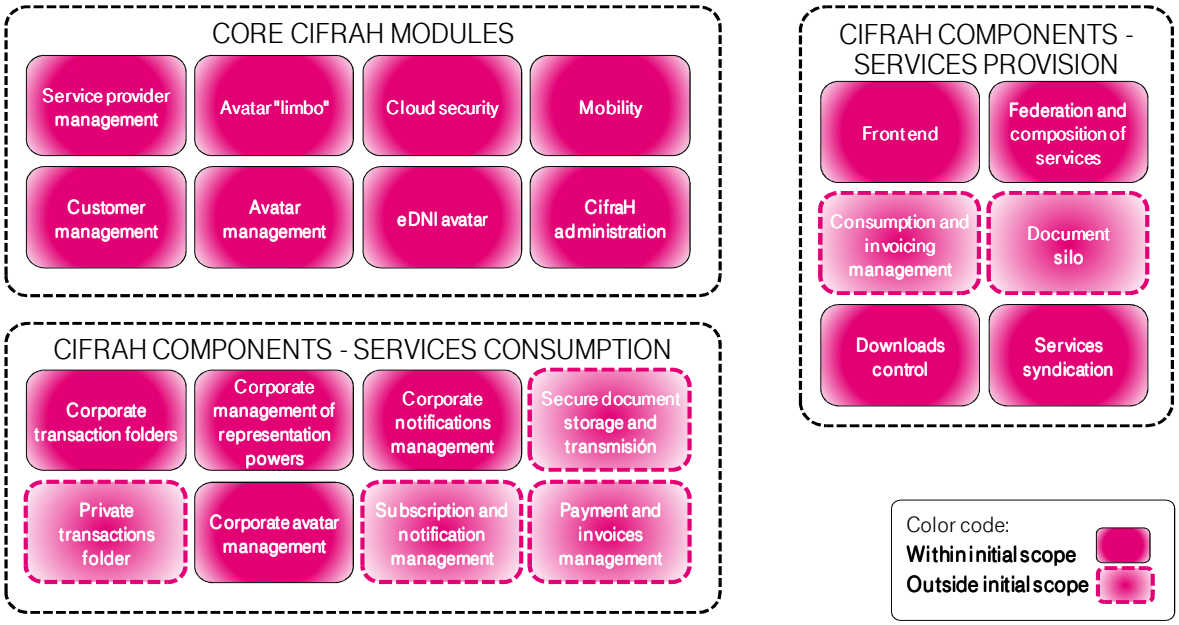


Figure 15. Operational modules

5.2. Functional task-groups

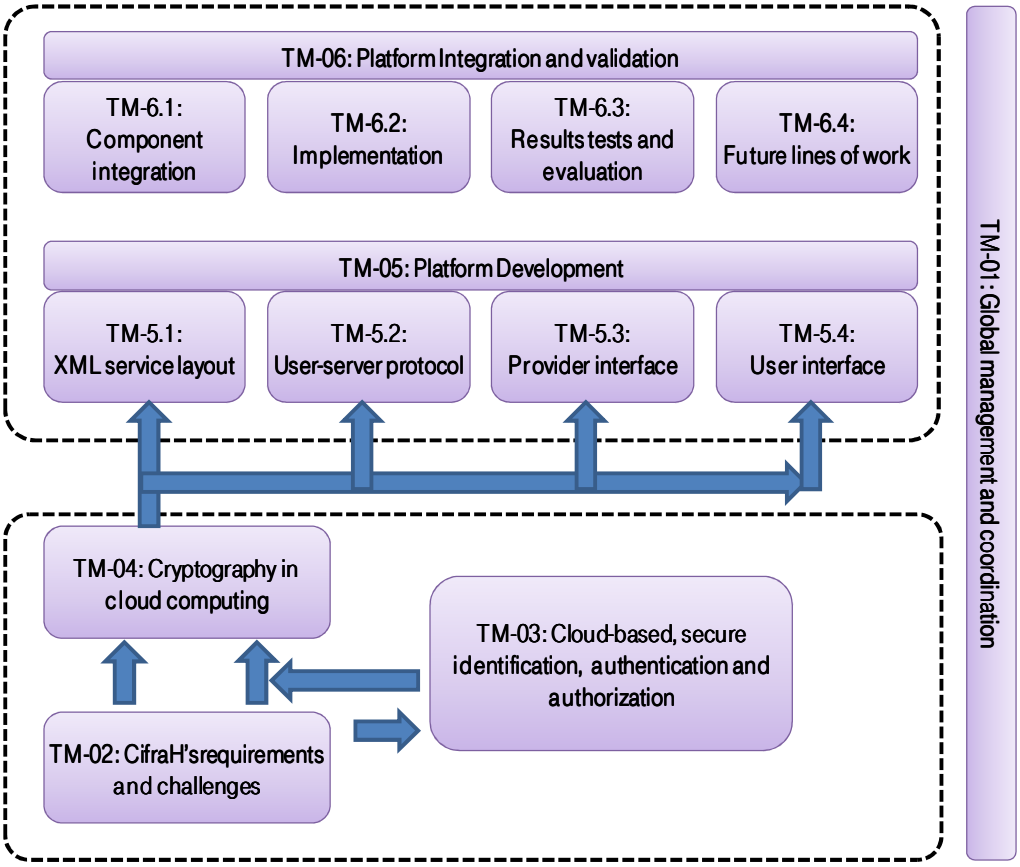


Figure 16. Project task-groups