

ILNAS



Digital Trust in Cloud Computing Breakfast

January 26th, 2017

ILNAS / ANEC

PROGRAM

09h30	Introduction & Welcome words <i>Dr. Jean-Philippe HUMBERT, Deputy Director - ILNAS</i>
09h40	Presentation of the National Standards Body <i>Dr. Jean-Philippe HUMBERT</i>
09h50	White Paper presentation - Digital Trust for Smart ICT & Cloud Computing <i>Dr. Johnatan PECERO SANCHEZ, Responsible of the Standardization department - ANEC GIE</i>
10h05	ICT Technical Standardization in Luxembourg <i>Mr. Nicolas DOMENJOUR, Project Officer "Standardization & ICT" - ANEC GIE</i>
10h15	Cloud Computing from national delegates perspective <i>Mr. Shyam WAGLE, PhD student - University of Luxembourg</i>
10h30	Round Table Discussion <i>Moderator: Dr. Johnatan PECERO SANCHEZ</i>

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Introduction

Dr. Jean-Philippe HUMBERT - ILNAS

ILNAS, Institut Luxembourgeois de la Normalisation, de l'Accréditation, de la Sécurité et qualité des produits et services

- ▶ **Creation:** Law dated July 14, 2014 (repealing the amended Law of May 20, 2008)
- ▶ **Status:** Public administration under the authority of the Minister of the Economy
- ▶ **Total staff:** 38 civil servants (January 2017)



Luxembourg's Standardization Strategy 2014-2020

PILLAR 1 Information and communication technologies (ICT)

- ▶ Support and constant **development of the standardization field dedicated to ICT**
- ▶ Implementation of the **Luxembourg's Policy on ICT standardization (2015-2020)**
 - Developing the interest and the involvement of the market
 - Promoting and reinforcing the participation of the market
 - Supporting and strengthening the education about standardization and related research activities
- ▶ Detection of **niche opportunities for economic developments**

PILLAR 2 National influence and compliance with legal attributions

PILLAR 3 Products and services

ANEC, Agence pour la Normalisation et l'Économie de la Connaissance (Agency for Standardization and knowledge-based Economy)

- ▶ **Creation:** October 4, 2010
- ▶ **Status:** Economic Interest Grouping (EIG)
- ▶ **Object:**
 - Promotion, awareness raising and training, applied research in the field of standardization and metrology in order to support companies' competitiveness in Luxembourg
- ▶ **Total staff:** 10 employees (Jan. 2017)
- ▶ **Partners:**

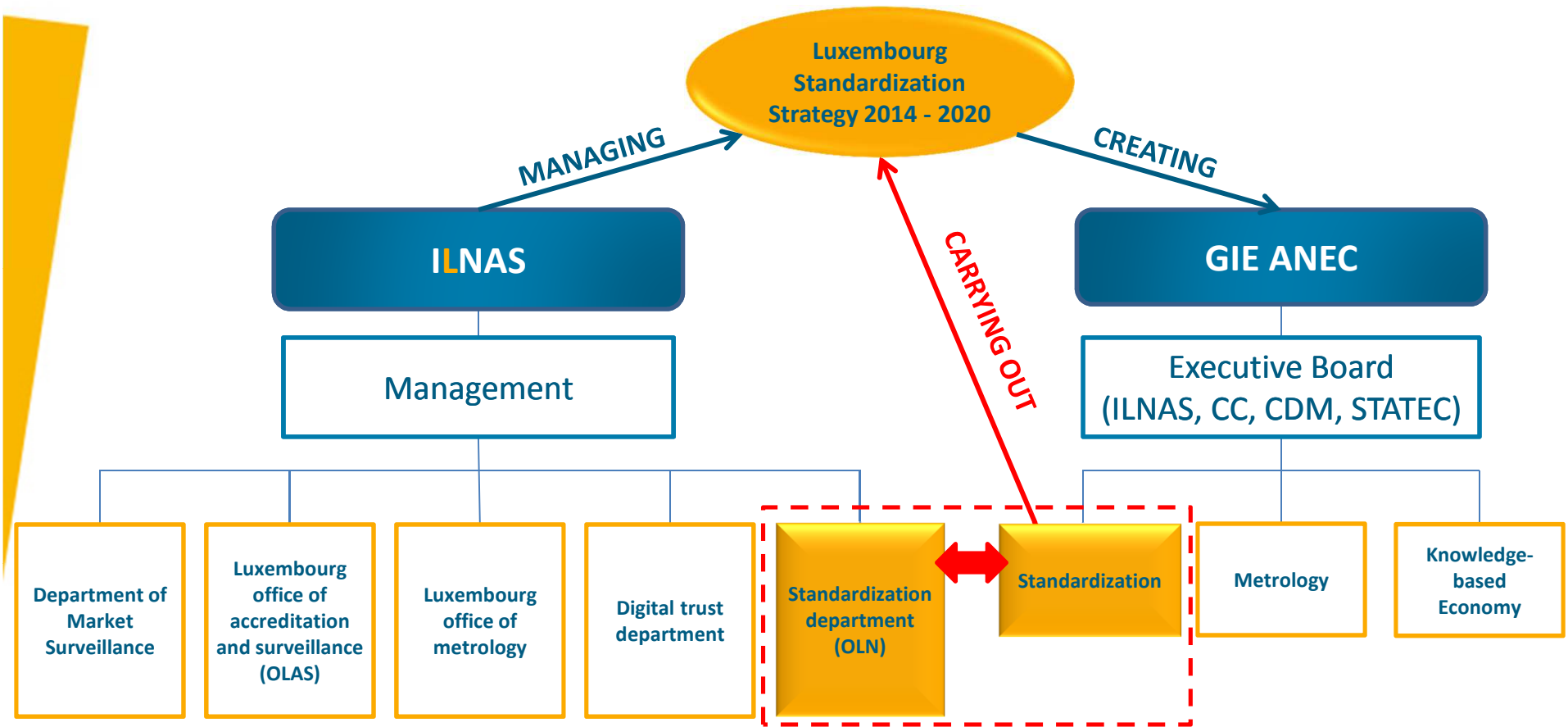


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 CHAMBRE
DES METIERS
Luxembourg CHAMBRE DE
COMMERCE
LUXEMBOURG

statec

Position



MAIN ACTIVITIES – FIRST SEMESTER 2016



**White Paper
Green Computing**



**Training Catalog
2016**



**Moovijob Tour DeLux
2016**



IS Days 2016



**White Paper
Big Data V1.0**



ICT Spring 2016



**ANS TIC
V6.0**

JANUARY

FEBRUARY

MARCH

APRIL

MAY

JUNE

**Article White Paper
Green Computing
(Soluxions
Magazine)**



**Workshop
« Normalisation &
Green
Computing »**



**Article ITone.lu
(ISO/IEC JTC 1/SC 27
national Mirror
Committee)**



**After work
« Smart ICT »
Girls In Tech**



**Article
ITnation.lu
(White Paper
Big Data)**



**Breakfast
White Paper
« Big Data »**



**Training in the
Technical High
School
Josy Barthel**



MAIN ACTIVITIES – SECOND SEMESTER 2016



Analysis of the University Certificate pilot project 2015/2016



White Paper "Digital Trust for Smart ICT"



Breakfast "Digital Trust for Smart ICT"



White Paper Big Data V1.2

JULY

AUGUST

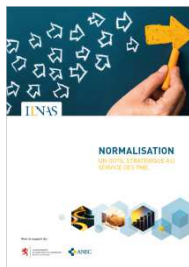
SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER

Development of a new brochure "Standardization & SMEs"



White Paper Big Data V1.1



Standards Analysis Aerospace sector-Luxembourg



Luxembourg Internet Days



Breakfast "Digital Trust for Big Data"



ILNAS positioning : Framework – Education about Standardization

FIRST STEP - University certificate “Smart ICT for Business Innovation” with University of Luxembourg

- Outcome of more than six years of work by ILNAS
 - ▶ Luxembourg Standardization Strategy 2014-2020
 - ▶ Policy on ICT technical standardization (2015-2020)
 - ▶ ILNAS: ETSI full member - Luxembourg Head of Delegation ISO/IEC JTC1
 - ▶ Pilot project conducted in the 2015-2016 academic year
 - ▶ **Next promotion:** in the 2017-2018 academic year

STRENGTHS

- Topics at the **cutting edge** and reflecting **current issues** in the field of ICT
- **No equivalent training in this area in Europe**
- An instrument to **strengthen the competitiveness** of national companies

OUTCOMES FOR THE NATIONAL ECONOMY

- Allow a **better understanding of the high level Smart ICT concepts**
- Definition of **new products** and/or **services**
- Identification of **niche markets**
- To improve **commercial approach**
- **Basis of new economic developments**
- Added value to **facilitate the communication with the client**



ILNAS positioning



- ▶ Strengthens its relation with academic partners in order to structure standards-related education and research in Luxembourg
 - Pilot project conducted between September 2015 and September 2016: University certificate “Smart ICT for Business Innovation” in partnership with the University of Luxembourg
 - Next promotion: September 2017 to September 2018
 - **Objective: Master degree related to technical standardization**
 - **Would address Smart ICT topics in line with national priorities, providing a smart way of linking technology, standards, and business and creating an additional means of innovation at national level**

White Paper “Digital Trust for Smart ICT” – 14th October 2016

The baseline



It surveys current advances in Digital Trust from three complementary points of view:

- A technical analysis
- A business and economic prospective analysis
- A technical standardization perspective

▶ From the technical analysis

- It reviews the basic concepts of the technology and the existing work supporting the development of Digital Trust
- It presents some technical challenges related to Digital Trust

▶ From business and economic prospective

- It highlights the interest for Digital Trust
- It stress the need of Digital Trust for each Smart ICT concepts

▶ From standards point of view technical standardization

- It considers both as an important tool to support Digital Trust for Smart ICT

▶ <https://portail-qualite.public.lu/fr/publications/confiance-numerique/etudes-nationales/white-paper-digital-trust-october-2016/White-Paper-Digital-Trust-October-2016.pdf>

LONG-TERM RESEARCH ACTIVITIES AND OBJECTIVES

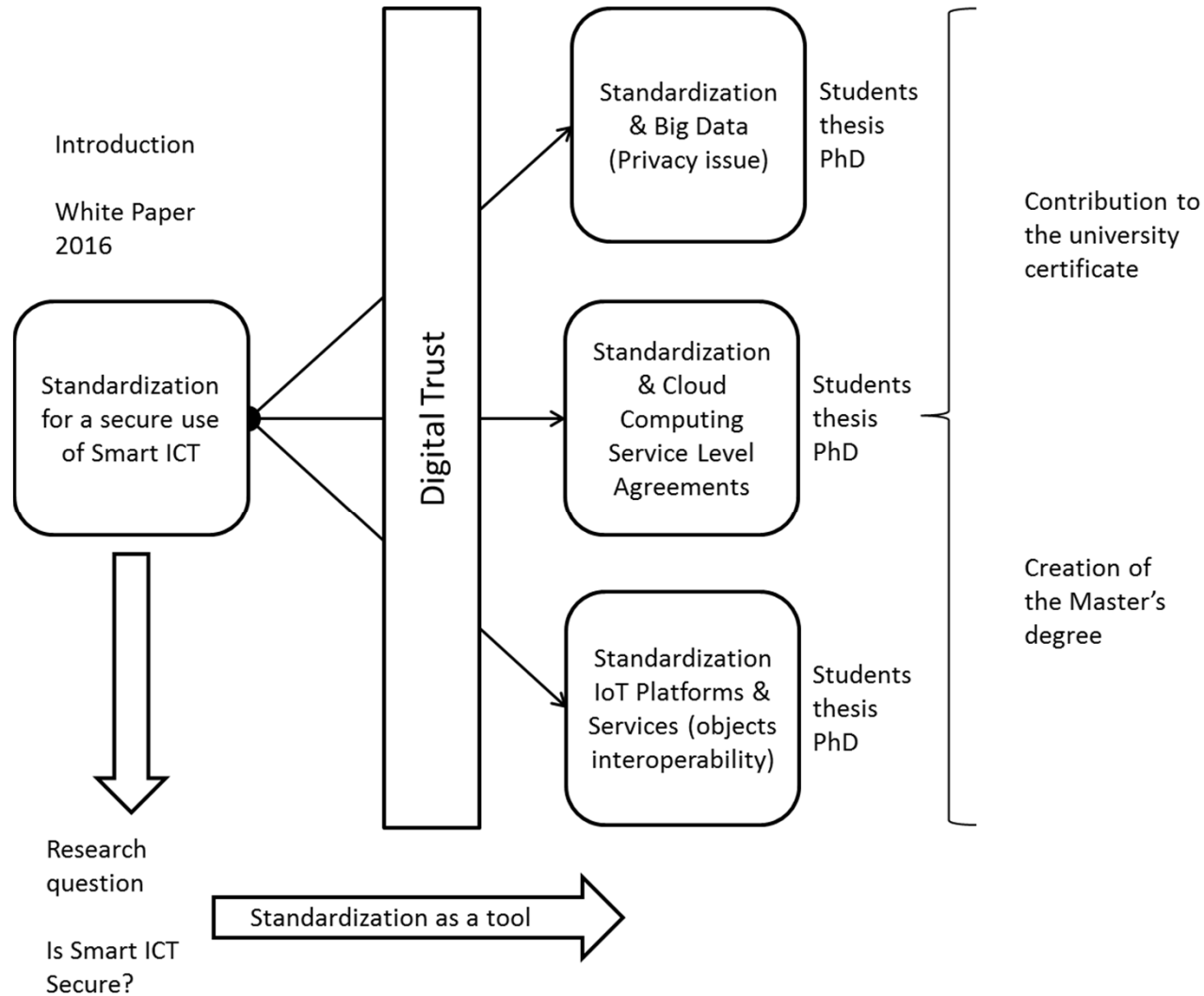
RESEARCH PROGRAM (2017-2020) ON DIGITAL TRUST FOR SMART ICT



securityandtrust.lu

- Joint collaboration between ILNAS & SnT-UL to reinforce the collaboration in the domain of Smart ICT for Business Innovation through Technical Standardization
- **Partnership and contract between ILNAS and SnT will be signed in January 2017**
- Possibility to involve some students from the university certificate during their internship
- 3 PhD students will be involved : **Digital Trust for Smart ICT**
 - ▶ **Cloud Computing**
 - ▶ **Big Data and Analytics**
 - ▶ **Internet of Things**
- Other main targets of the research program
 - ▶ To support the evolution of the academic program through the results of the research
 - ▶ **To serve as a basis for a future Master Program Smart Secure ICT for Business Innovation (expected 2019)**

LONG-TERM RESEARCH ACTIVITIES AND OBJECTIVES



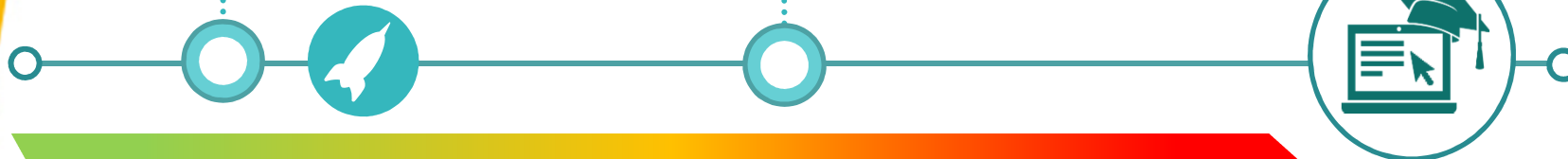
UNIVERSITY CERTIFICATE SMART ICT FOR BUSINESS INNOVATION
MID AND LONG-TERM OBJECTIVES

Prospective evolution

2015:
UNIVERSITY
CERTIFICATE
20 PARTICIPANTS

2017:
UNIVERSITY
CERTIFICATE
xx PARTICIPANTS

2019:
MASTER



MARKET

MARKET

MARKET

ILNAS



Presentation of the National Standards Body

Dr. Jean-Philippe HUMBERT - ILNAS

ILNAS, Institut Luxembourgeois de la Normalisation, de l'Accréditation, de la Sécurité et qualité des produits et services

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ILNAS Standardization activities in Luxembourg

▶ **Creation of national standards**



- National Annexes of the Eurocodes
- National Annex concerning the Winter Diesel
- National standard about the living surface
- Creation of a national standards office in the field of construction

▶ **Create a normative culture in Luxembourg**

- University Certificate "Smart ICT for Business Innovation" at the University of Luxembourg
- Promotion in the field of standardization (Newsletter, portail-qualite.lu, LinkedIn, events, ...)
- Trainings and research in the field of standardization
- Awareness raising sessions in high schools
- Communication plan for SMEs

I - Availability of standards

Standardization catalogue

- 61 national standards
- 48.000 European standards from CEN and CENELEC
- 58.000 international standards from ISO and IEC
- 7.100 ETSI standards (free) 
- 45.200 DIN standards 

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Institut luxembourgeois de la normalisation,
de l'accréditation, de la sécurité et qualité
des produits et services

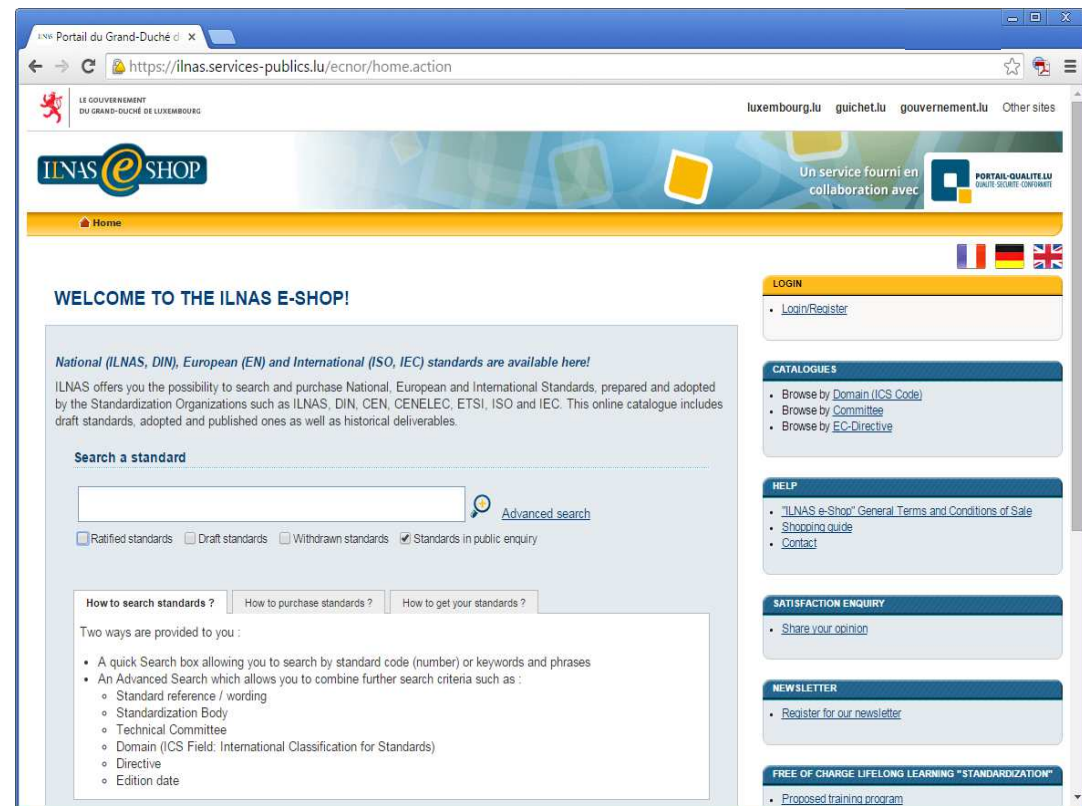


▶ More than **150.000 normative documents** at your disposal

I - Availability of standards

ILNAS e-shop

- ▶ Format: electronic
- ▶ Language: French, German and English
- ▶ Competitive prices
- ▶ Free access to documents in public enquiry

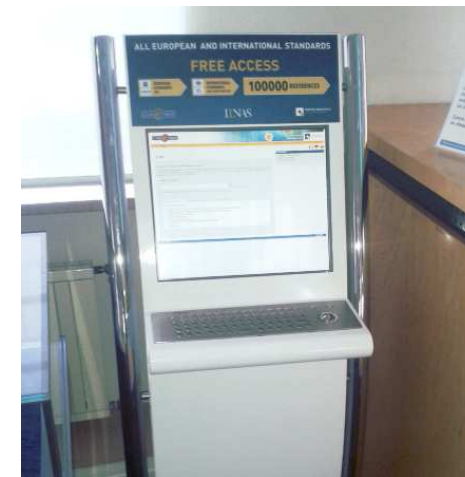


I - Availability of standards

Free access on lecture stations

- ▶ Availability of all EN (CEN,CENELEC et ETSI), ISO, IEC and ILNAS standards (despite DIN)

- ▶ Location of the reading stations:
 1. **Université du Luxembourg**
 - Campus Kirchberg
 2. **House of Entrepreneurship**
 - Kirchberg
 3. **Bibliothèque nationale de Luxembourg**
 - Luxembourg centre-ville
 4. **ILNAS**
 - Esch-Belval
 5. **LIST**
 - Esch-Belval (Maison de l'innovation)
 - Belvaux



II - Participation in standardization

Different possibilities

- ▶ **How to participate in the development of national, European and international standards ?**
 1. Comment of draft standards in public enquiry
 2. Active participation in a technical committee



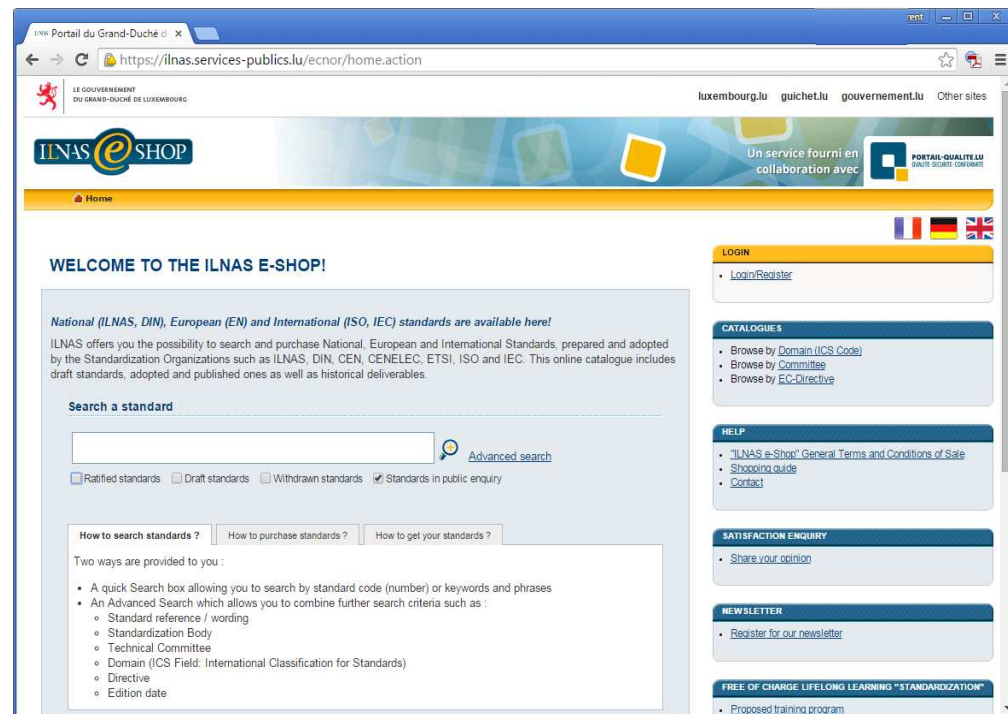
II - Participation in standardization

1. Public enquiry

- ▶ Navigate in the ILNAS e-shop in order to comment a draft standard which is in the stage of public enquiry



- ▶ <https://ilnas.services-publics.lu>



ILNAS Portail du Grand-Duché de Luxembourg

https://ilnas.services-publics.lu/ecnor/home.action

LE GOUVERNEMENT DU GRAND-DUCHÉ DE LUXEMBOURG

luxembourg.lu guichet.lu gouvernement.lu Other sites

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Un service fourni en collaboration avec PORTAIL-QUALITE.LU QUALITE-SECURITE-CONFORT

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FR DE GB

WELCOME TO THE ILNAS E-SHOP!

National (ILNAS, DIN), European (EN) and International (ISO, IEC) standards are available here!

ILNAS offers you the possibility to search and purchase National, European and International Standards, prepared and adopted by the Standardization Organizations such as ILNAS, DIN, CEN, CENELEC, ETSI, ISO and IEC. This online catalogue includes draft standards, adopted and published ones as well as historical deliverables.

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[Advanced search](#)

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How to search standards? How to purchase standards? How to get your standards?

Two ways are provided to you :

- A quick Search box allowing you to search by standard code (number) or keywords and phrases
- An Advanced Search which allows you to combine further search criteria such as :
 - Standard reference / wording
 - Standardization Body
 - Technical Committee
 - Domain (ICS Field: International Classification for Standards)
 - Directive
 - Edition date

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RÉSULTATS DE LA RECHERCHE

TRIÉ PAR [dropdown] RÉSULTATS PAR PAGE 10 RÉSULTAT(S) 1 - DES 173 1 2 3 4 5 ... 18

APERÇU PARTIEL GRATUIT PRIX LANGUE

<p>prEN ISO 20863 Edition 02/2017 </p> <p>Chaussures - Méthodes d'essai pour contreforts et renforts - Aptitude au collage (ISO/DIS 20863:2015) TC/SC : CEN/TC 309 Statut : Draft - Actif</p> <p><i>A l'heure actuelle pas de version électronique de cette norme en ligne pour l'édition linguistique: EN, FR.</i> <i>N'hésitez pas à contacter normalisation@ilnas.etat.lu</i></p>	<p>DE Commenter</p>	<p>€ 0.00</p>	<p>DE </p>	<p></p>
<p>prEN ISO 4885 Edition 03/2017 </p> <p>Produits ferreux - Traitements thermiques - Vocabulaire (ISO/DIS 4885:2015) TC/SC : ECISS/TC 100 Statut : Draft - Actif</p> <p><i>A l'heure actuelle pas de version électronique de cette norme en ligne pour l'édition linguistique: EN, FR.</i> <i>N'hésitez pas à contacter normalisation@ilnas.etat.lu</i></p>	<p>DE Commenter</p>	<p>€ 0.00</p>	<p>DE </p>	<p></p>
<p>prEN ISO 17708 Edition 03/2017 </p> <p>Chaussures - Méthodes d'essai applicables à la</p>				

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Recherche avancée

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- Conditions générales de Vente
- Guide d'achat
- Contact

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OFFRE DE FORMATION CONTINUE GRATUITE "NORMALISATION"

- Programme des cours proposés
- Prochaines sessions de formation
- Formulaire d'inscription

II - Participation in standardization

2. National delegate in standardization

▶ **Who can participate ?**

- Every socio-economic actor with a certain expertise

▶ **Cost of participation ?**

- Free participation in Luxembourg


▶ **National experts register (January 2017)**

- 231 persons registered
- 621 registrations in technical committees

Registre national des délégués en normalisation - Décembre 2016

Nombre d'inscriptions aux comités techniques :	
ILNAS/OLN	24
CEN	188
CENELEC	16
CEN/CENELEC	2
CEN/CENELEC/ETSI	2
ECISS	20
ISO/IEC	135
ISO	225
IEC	9
Total	621

Nombre de personnes inscrites : 231



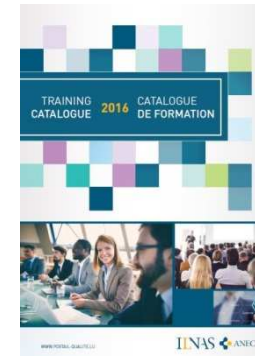
1, av du Swing - L-4367 Belvaux - Tél. : (+352) 24 77 43 40 - Fax : (+352) 24 79 43 40 - Email : normalisation@lnas.etat.lu - www.portail-qualite.lu

mars 13 janvier 2017
Approuvée par l'ordonnance HGER006
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Products and services

- ▶ ILNAS, in collaboration with G.I.E. ANEC, offers the following products and services to the national market :
 - Diffusion of normative information
 - Training and awareness sessions
 - Standards watch
 - Standards analysis (ICT)

- ▶ These products and services are provided for free on simple demand



Stay informed about ILNAS activities

Portail qualité:
www.portail-qualite.lu

ILNAS e-shop:
ilnas.services-publics.lu



PORTAIL-QUALITE.LU
QUALITE · SECURITE · CONFORMITE

Sécurité & Santé Métrologie Accréditation & Notification Confiance numérique Normes & Normalisation Propriété intellectuelle Evaluation de la conformité & Récompenses

07-04-2015

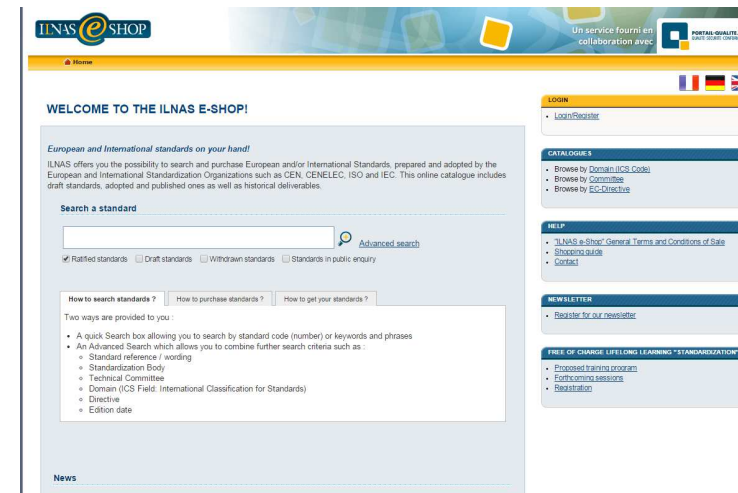
Résultats de l'enquête de satisfaction auprès des délégués nationaux en normalisation

Dans le cadre de sa démarche qualité, ILNAS a récemment mené une enquête d'évaluation de la satisfaction auprès de la communauté nationale des délégués, afin d'identifier ses attentes et connaître son appréciation des services actuellement proposés. Un questionnaire a ainsi été communiqué aux 180 experts inscrits au registre national des délégués en normalisation en février 2015.

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Accédez aux principaux services



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WELCOME TO THE ILNAS E-SHOP!

European and International standards on your hand!
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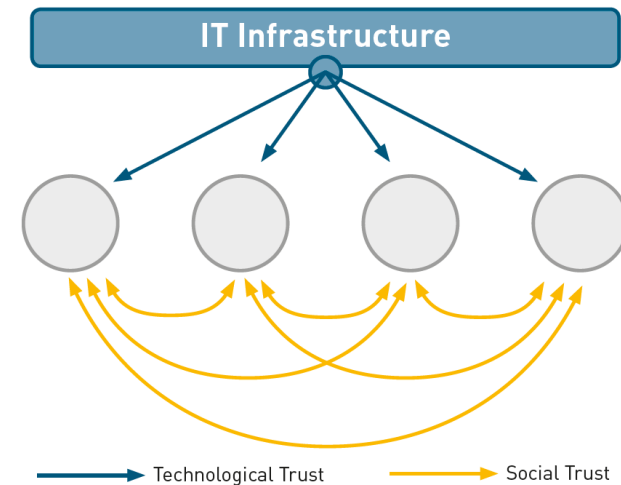


White Paper ***Digital Trust for Smart ICT – Cloud Computing***

Dr. Johnatan PECERO SANCHEZ - ANEC GIE

Trust Introduction

- ▶ Fundamental elements of trust
 - **Expectancy**
 - trustor anticipates a specific behavior from the trustee;
 - **Belief**
 - trustor has confidence that the expected behavior occurs
 - based on the evidence of the trustee's competence, goodwill, and integrity;
 - **Risk willingness**
 - trustor is prepared to take a risk for that belief.
 - trustee behavior is beyond the control of the trustor.
- ▶ **Expectancy, belief, and risk willingness** are both *social* and *technological* trust components at the same time.





White Paper
**DIGITAL TRUST
FOR SMART ICT**

Version 3.0 - October 2016



ILNAS logo

1

SMART ICT, A DEFINITION AND INTRODUCTION TO THE CONCEPTS

4

STANDARDIZATION TO LEVERAGE DIGITAL TRUST

2

DIGITAL TRUST FOR SMART ICT: ECONOMIC CHALLENGES AND PROSPECTS

5

CONCLUSIONS AND OUTLOOK

3

DIGITAL TRUST FOR SMART ICT: TECHNICAL APPROACHES

Introduce each of the 3 smart technologies, place them into context, provide technology characteristics and introduce Digital Trust requirements

- Smart Technology Landscape
- Internet of Things (IoT)
- **Cloud Computing**
- Big Data & Analytics
- Leads for Leveraging Digital Trust

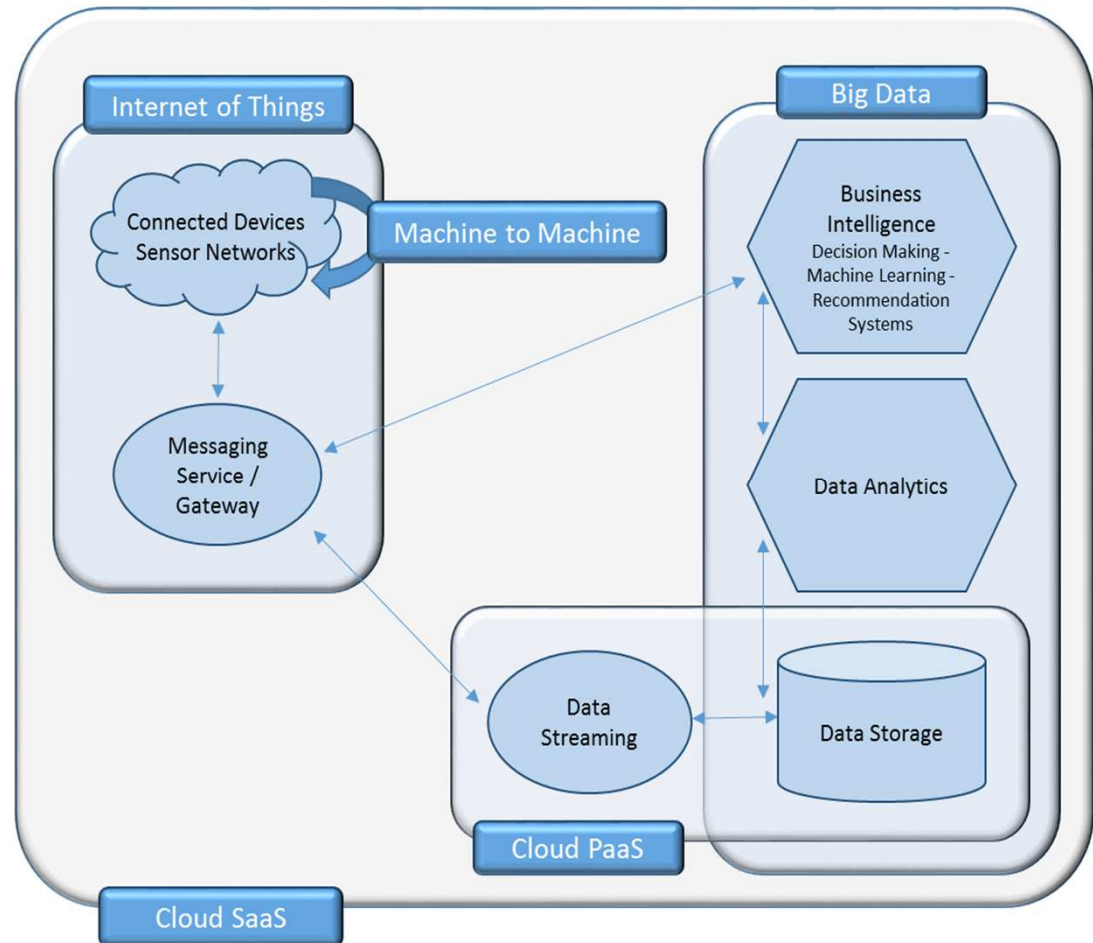
Overview

▶ Smart ICT

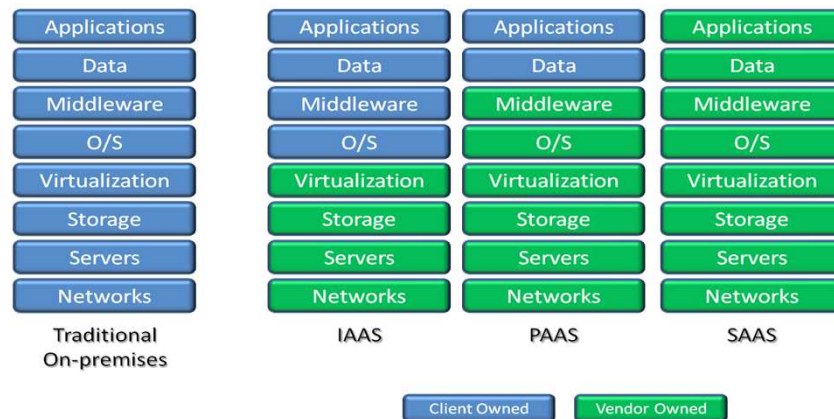
- Internet of Things
- **Cloud Computing**
- Big Data & Analytics

Key Characteristics of Cloud Computing

- On-demand self-service;
- Broad network access;
- Resource pooling;
- Rapid elasticity;
- Measured services;



Service Models



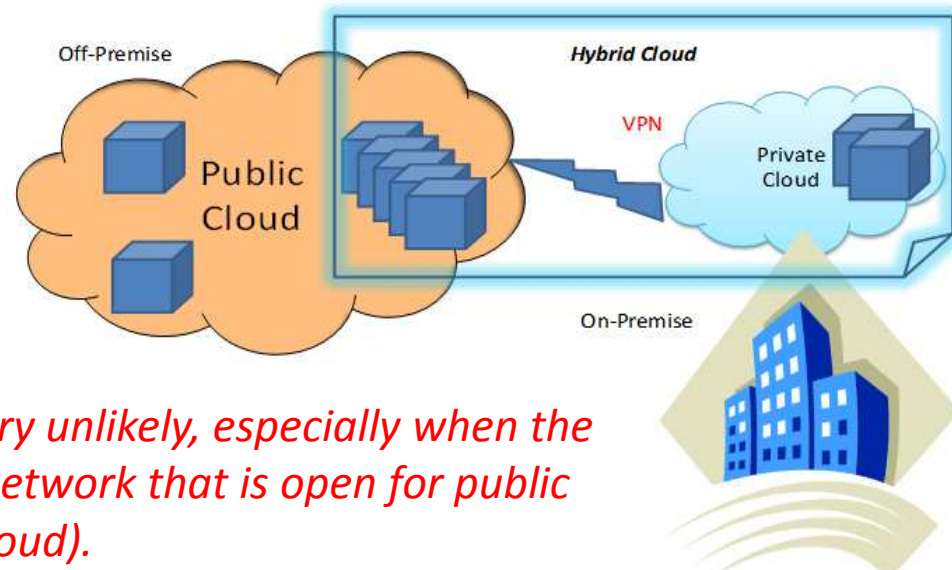
Three main service model

- Infrastructure-as-a-Service (**IaaS**) : usage of processing, storage, networks and other fundamental computing resources;
- Platform-as-a-Service (**Paas**) : Customers deploy onto the Cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider;
- Software-as-a-Service (**SaaS**) : Clients use the provider’s applications running on a cloud infrastructure;
- **Allocation of responsibilities are different.**

Deployment Models

Four deployment models

- **Private** : operated solely for an organization;
- **Public** : is provisioned for open use by the general public (shared resources);
- **Community** : shared by several organizations with common interests;
- **Hybrid** : is a composition of two or more clouds (private, public, or community).

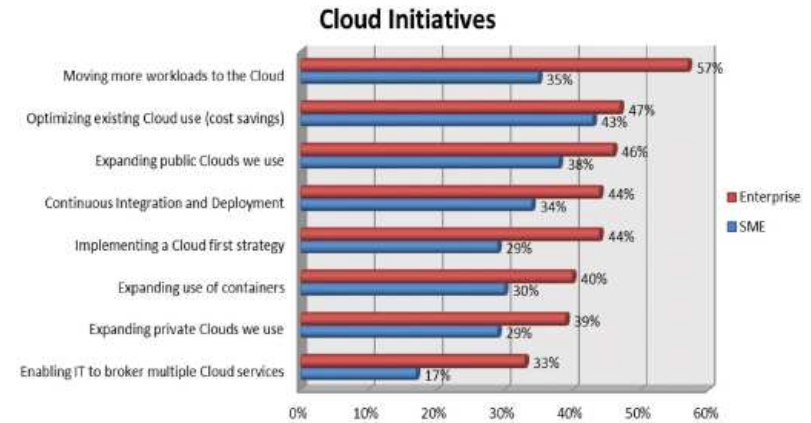
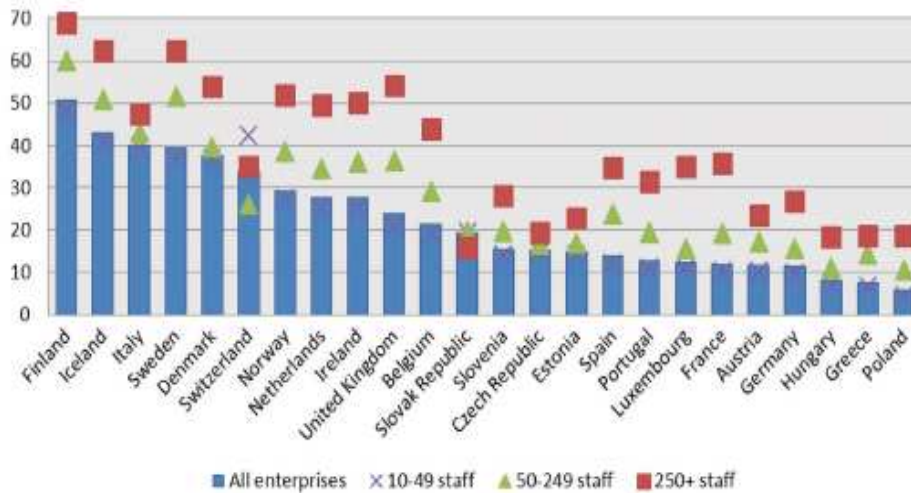


Cloud computing without digital trust is very unlikely, especially when the computing services are delivered over a network that is open for public use (i.e. public cloud).

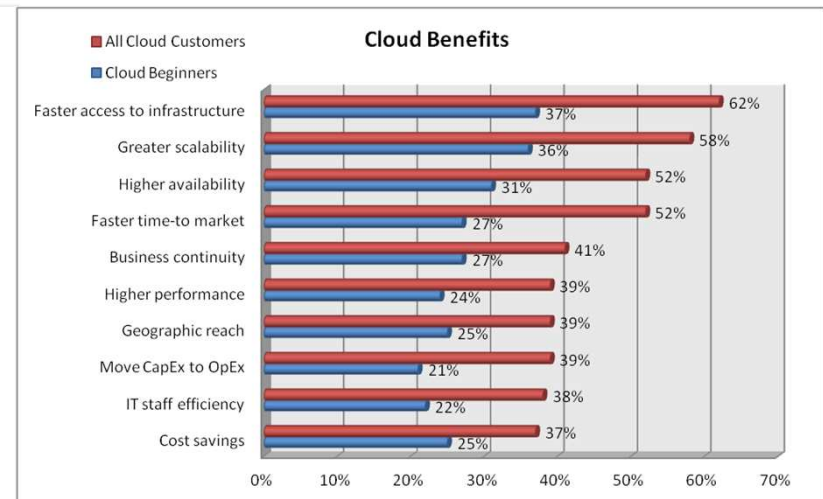


1	SMART ICT, A DEFINITION AND INTRODUCTION TO THE CONCEPTS	4	STANDARDIZATION TO LEVERAGE DIGITAL TRUST
2	DIGITAL TRUST FOR SMART ICT: ECONOMIC CHALLENGES AND PROSPECTS	5	CONCLUSIONS AND OUTLOOK
3	DIGITAL TRUST FOR SMART ICT: TECHNICAL APPROACHES		

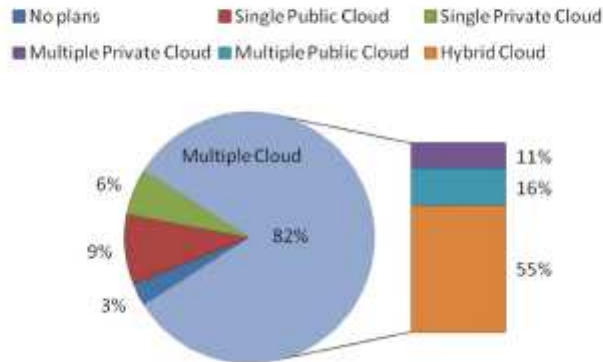
- **Economic Analysis and Prospects**
 - IoT
 - **Cloud Computing**
 - Big Data & Analytics
- **Economic Challenges of Trust**
 - IoT
 - Cloud Computing
 - Big Data & Analytics



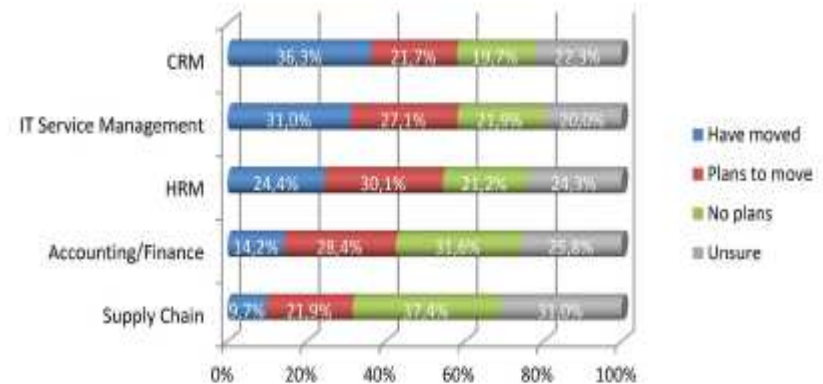
- Disrupting traditional hardware and software vendors business models
- Becoming a back-end for many forms of computing (e.g., IoT, Big Data)
- More and more companies are implementing a cloud-based services for their organization
- More perceived Cloud benefits (faster access, scalability, availability)



Enterprise Cloud Strategy (1000+ staff)



% of organizations at each stage of migrating to the Cloud



- Companies are looking to extend Cloud benefits to their systems of records
- Business investing more frequently in Cloud services with a higher level of sophistication such as CRM, IT service management, HRM
- Hybrid Cloud adoption is increasing significantly
- More enterprises are planning for adopting multiple public Clouds than those planning for multiple private Clouds



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- Economic Analysis and Prospects
 - IoT
 - Cloud Computing
 - Big Data & Analytics
- **Economic Challenges of Trust**
 - IoT
 - **Cloud Computing**
 - Big Data & Analytics

Digital Trust related concerns depending on the deployment model

- In a **private cloud**, trust management does not represent a main concern if the organization does not rely on a third-party service provider.
- In a **public cloud** many potential risks exist regarding security, privacy and loss of control over data.
- In a **community cloud**, if there is a third party involved, the same issues may occur as in the private cloud model, otherwise it is limited to community subjects.
- In **hybrid cloud**, trust management issues related to the public model relate to the hybrid one as well.

From the perspective of the Cloud Consumer:

1. Data security concerns
2. Reliability of service and business continuity
3. Integration and interoperability with on-premise systems
4. Weak contracts, SLAs and consequences for non-performance
5. Limited transparency
6. Loss of control
7. Immaturity of vendors
8. Vendor lock-in and data portability
9. Long-term costs and TCO uncertainties
10. Legal and regulatory compliance

From the perspective of the Cloud Provider :

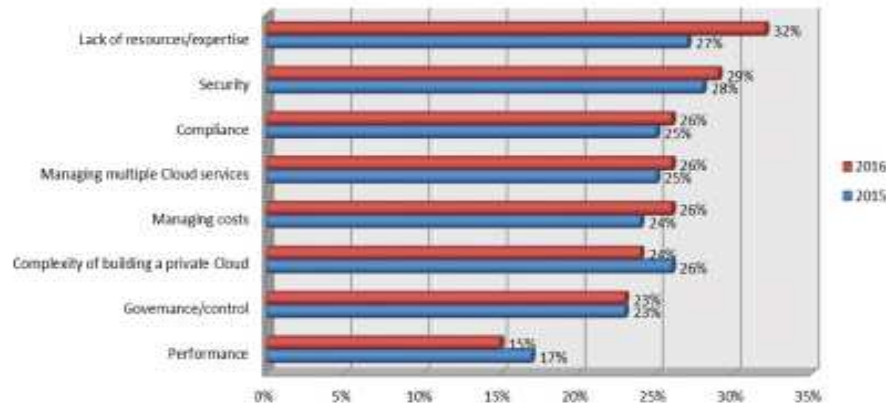
1. Joining the Cloud by users/resources dynamically
2. Different security policies
3. Continuity and provider dependency
4. Compliance with applicable regulations and good practices
5. Trust enhancement through assurance mechanisms

The resulting lack of trust could be an inhibitor for further adoption of Cloud in areas where sensitive to critical information is involved.

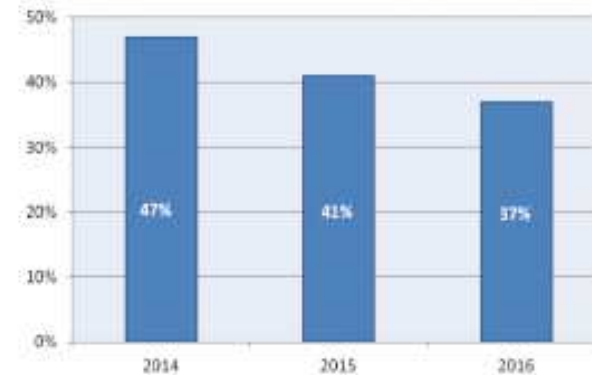
[25] R. K. Kalluri and C. G. Rao, "Addressing the Security, Privacy and Trust Challenges of Cloud Computing," *Int. J. Comput. Sci. Inf. Technol.*, vol. 5, no. 5, pp. 6094–6097, 2014.

[27] J. Mooney, *Essential Practices for Embracing the Inevitability of the Cloud*. MIT Sloan School of Management, Center for Information Systems Research, Boston, {MA}, 2012.

Cloud Challenges

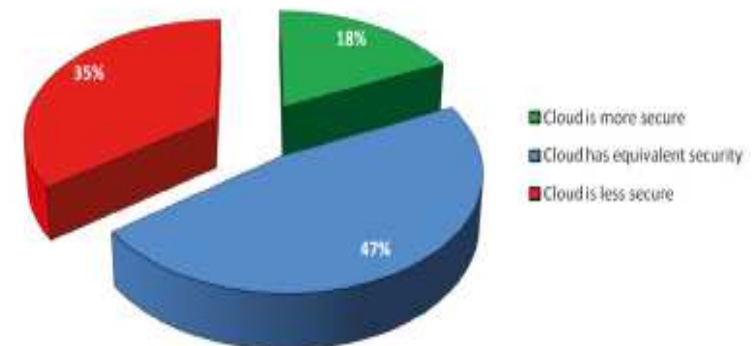


% of IT departments rating cloud security as a significant challenge



- **Lack of resources/expertise** has replaced security as the No 1 Cloud challenge
- **Security challenges decrease** as customers gain further cloud experience
- For IT departments, **security is decreasing gradually** in recent years
- **Compliance** with regulations and good practices
- **Managing costs** is an important challenge

Cloud Security vs. On-premises Security
Perception of IT leadership





White Paper
DIGITAL TRUST FOR SMART ICT

Version 3.0 - Oktober 2016



ILNAS logo

1

SMART ICT, A DEFINITION AND INTRODUCTION TO THE CONCEPTS

4

STANDARDIZATION TO LEVERAGE DIGITAL TRUST

2

DIGITAL TRUST FOR SMART ICT: ECONOMIC CHALLENGES AND PROSPECTS

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CONCLUSIONS AND OUTLOOK

3

DIGITAL TRUST FOR SMART ICT: TECHNICAL APPROACHES

- **Trust in Smart ICT**
 - Privacy
 - Data and Information Security
 - Interoperability
- **Trust in Cloud Computing**
 - **Trust as a Human Concern**
 - **Trust Models**
 - **Trust as a Technical Challenge**
 - **Trust as a Legal Puzzle**
- **Trust in Big Data**
 - Data Accessibility
 - Data Provenance and Reproducibility
 - Privacy Concerns in Big Data
 - Information and Data Security
 - Access and Policy Management Techniques
- **Trust in Internet of Things**
 - Privacy, Anonymity and Consent
 - Attack Surfaces and Threats
 - Smart Home Security
 - Security in Embedded Devices and Real-Time Processing
 - Transmission Encryption and Security
 - Security in IoT Friendly Messaging Protocols
 - Authentication / Secure Pairing

- ▶ Not only about **Security**
- ▶ Fundamentals
 - **Privacy**
 - Issues
 - Uncertainty, context-dependence, malleability
 - Linking through deep learning
 - Measures:
 - Anonymization / de-identification of PII
 - Regulations: ex. right to be forgotten
 - Privacy by Design
 - **Data and Information Security**
 - Confidentiality, Integrity, and Availability (CIA)
 - Availability, reliability, safety, integrity, maintainability
 - **Interoperability**
 - Between devices, systems and sub-systems
 - Compatibility: 2 systems communicate and work for a common purpose
 - Interchangeability: systems' purpose, functionalities and services are the same

Trust in the Cloud

- ▶ A trust management system ensures agreed trust relationships between entities using trust models.
 - Instrumental to improve digital trust between consumers and providers.

The most common trust mechanisms are:

1. Reputation / feedback based
2. Service Level Agreement (SLA) based
3. Trust as a service based
4. Accreditation, audit, and standards based
5. Certificate keys-based

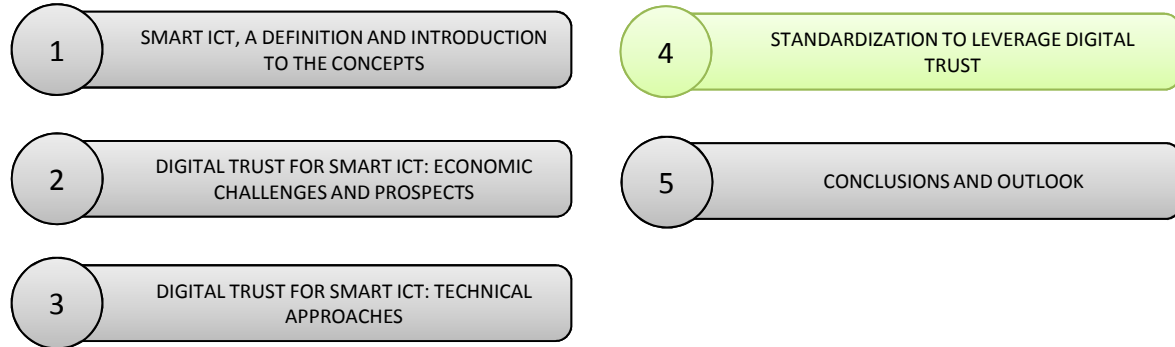
The management of trust relationships represents a key challenge



White Paper
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Partnership logo



- **Cloud Computing Standardization Technical Committees & Standards**
 - ISO & ISO/IEC
 - ETSI
 - ITU-T
- **Big Data Standardization Technical Committees & Standards**
 - ISO & ISO/IEC
 - ITU-T Study Group 13
 - NIST Public Working Group for Big Data
- **IoT Standardization Technical Committees & Standards**
 - ISO & ISO/IEC
 - ETSI
 - oneM2M
- **Common Standardization Technical Committees & Standards**
 - ITU-T
 - NIST Cyber-Physical Systems Public Working Group
 - The Alliance for IoT
 - Open Connectivity Foundation
 - IoT-A's reference model
 - ISO/IEC JTC 1/SC 27 – IT Security techniques
 - ISO/IEC JTC 1/SC 32 – Data management and interchange
 - ISO/IEC JTC 1/SC 40 – IT Service Management and IT Governance
 - ETSI/TC CYBER – Cyber Security
 - ETSI/ISG ISI – Information Security Indicators
 - CEN-CENELEC technical committees

Standards and technical standardization

- ▶ Standards and technical standardization can help establish and maintain Digital Trust in relation to current and future Smart ICT technologies

Examples for Cloud Computing

1. The international standard ISO/IEC 27018:2014 that focuses on protection of privacy of personal data in the Cloud
2. The ISO/IEC 27017:2015 that will strengthen the relationship between customers and service providers



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DIGITAL TRUST FOR SMART ICT: TECHNICAL APPROACHES

- **Review of each Smart Technology development prospective**
- **Stress out Digital Trust importance and impact**
- **Highlight standardization value for technological evolution**
- **Outlook Cloud Computing**
 - **The benefits of Cloud Computing are interesting**
 - **Because of the increasing maturity of both Cloud Providers and Customers a reduction in concerns about Cloud security emerges**
 - **Security is no longer the top Cloud challenge**
 - **The adoption of open and international standards will play a crucial role**

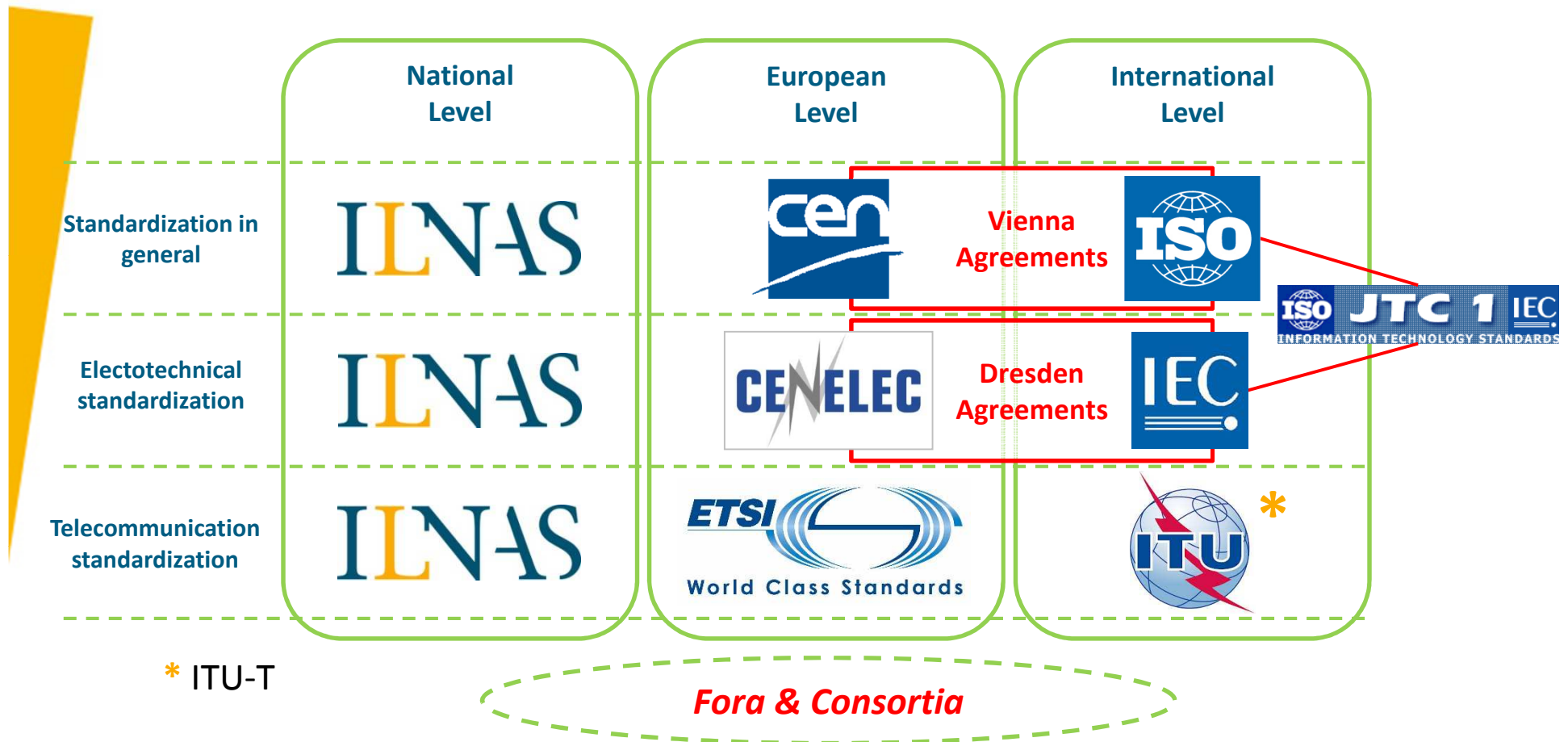
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ICT Technical Standardization in Luxembourg

Mr. Nicolas DOMENJOURD - ANEC GIE

Recognized standardization organizations



ICT Standardization in Luxembourg : ILNAS positioning

- ▶ Luxembourg Standardization Strategy 2014-2020
 - **ICT technical standardization is the Pillar I**

- ▶ Luxembourg's Policy on ICT technical standardization for 2015-2020
 - To foster and strengthen the national ICT sector involvement in standardization work through **three leading projects**:
 1. Developing market interest and involvement
 2. Promoting and reinforcing market participation
 3. Supporting and strengthening the Education about Standardization (EaS) and related research activities



Luxembourg's policy on ICT technical standardization 2015-2020

1 Developing the interest and the involvement of the market

- ▶ Drawing up a yearly **national standards analysis for the ICT sector**
 - Standards watch of the related sector
 - Identification of relevant technical committees and *Fora/Consortia*
 - Preparation of the final report of analysis and opportunities



STANDARDS ANALYSIS ICT SECTOR LUXEMBOURG (7th version under development)

Download: <https://gd.lu/HmfhJ>

- ▶ Defining a **national implementation plan for ICT technical standardization**
 - To involve targeted stakeholders of the Grand Duchy of Luxembourg in a global approach to standardization
 - Enhancing the international recognition of the Grand Duchy of Luxembourg

Luxembourg's policy on ICT technical standardization 2015-2020

2 Promoting and reinforcing the participation of the market

▶ Participating in relevant technical committees

■ Closely follow relevant ICT standardization committees

- ISO/IEC JTC1 - Information technology
 - ISO/IEC JTC 1/WG 9 - Big Data
 - ISO/IEC JTC 1/WG 10 - Internet of Things
 - **ISO/IEC JTC 1/SC 38 - Cloud Computing and Distributed Platforms**
- And more...
 - Various ETSI technical committees



▶ Provide information to the national community

- Share ICT standardization knowledge, with related community in Luxembourg
- Organization of related workshops at national level
 - ICT prospective developments
 - Smart ICT domain

Luxembourg's policy on ICT technical standardization 2015-2020

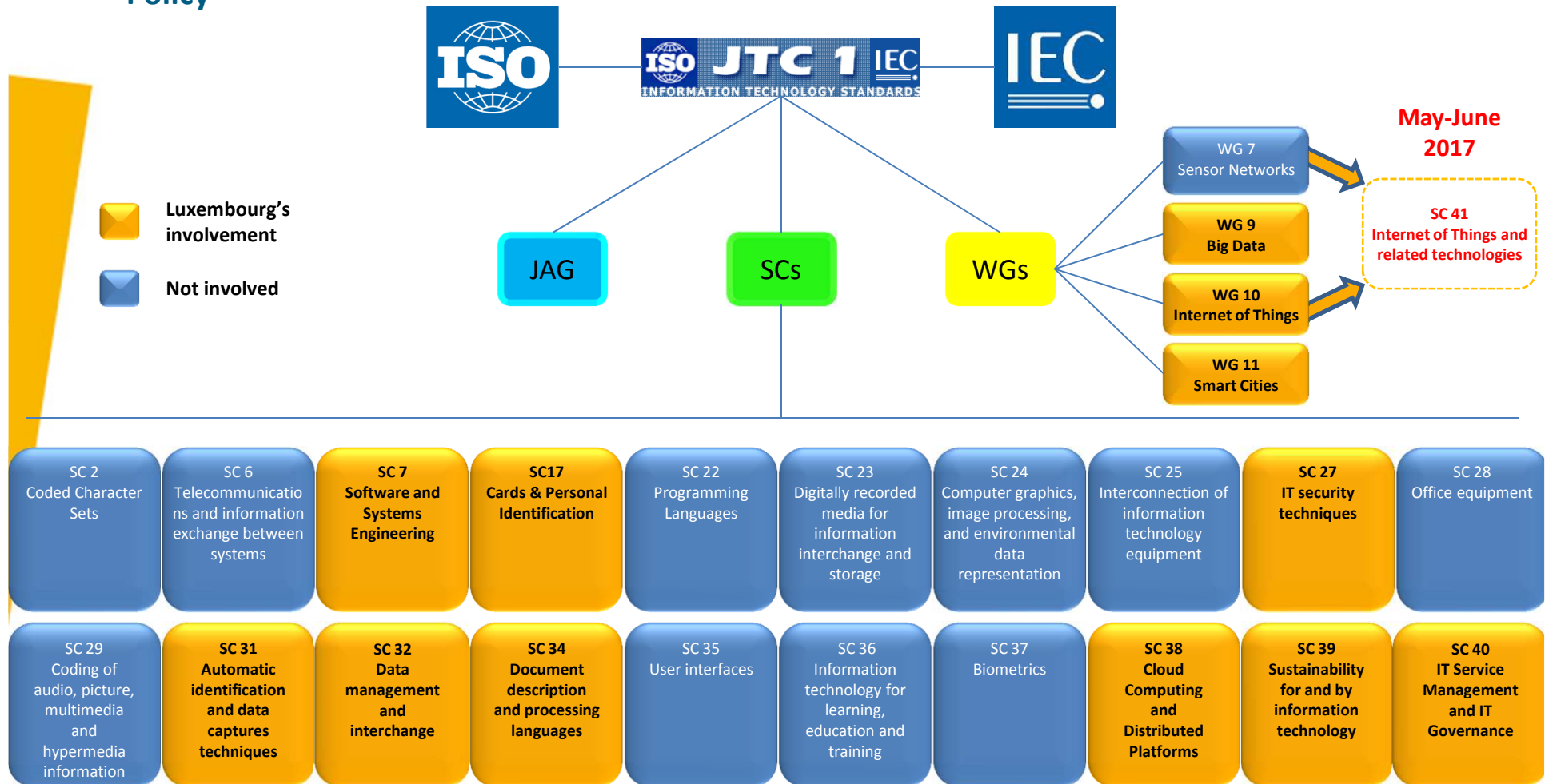
3

Supporting and strengthening the education about standardization and related research activities

- ▶ Managing the university certificate “Smart ICT for Business Innovation”
- ▶ **Developing research activities** (potential developments)
 - Future PhDs on “Smart ICT” topics
 - White Papers on “ Digital Trust & Smart ICT ” (Regularly updated)
 - Development of a research program dedicated to the domains of “ICT Technical Standardization”
- ▶ **Prospective of new diplomas** (potential developments)
 - Proposal concerning a dedicated ICT standardization Master’s Degree

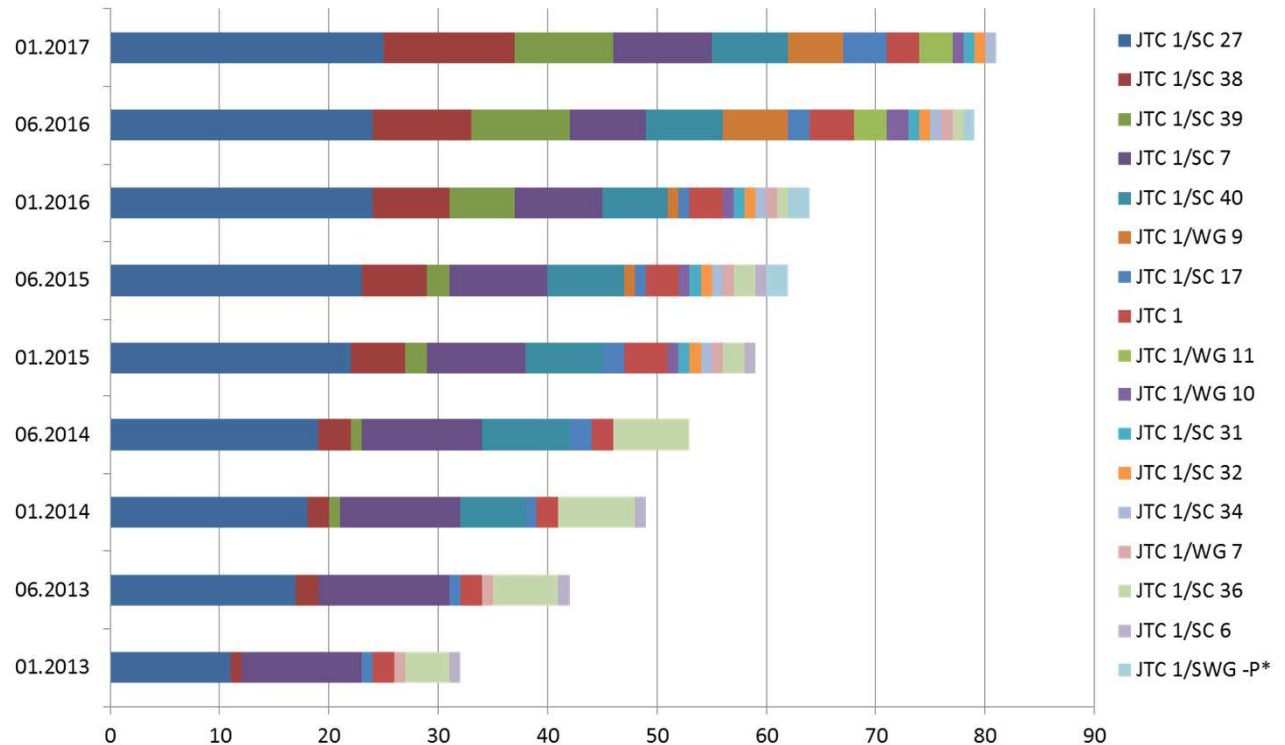


ISO/IEC JTC 1 representation at the national level : Direct outcomes from the ICT Standardization Policy



National mirror committees

- ▶ Definition: committee at the national level of an European or international committee (or subcommittee)
- ▶ ISO/IEC JTC 1: **9 SC** and **3 WG** are currently active at the national level
- ▶ **58 delegates** from Luxembourg are involved in ISO/IEC JTC 1 (a delegate can be registered in several committees)



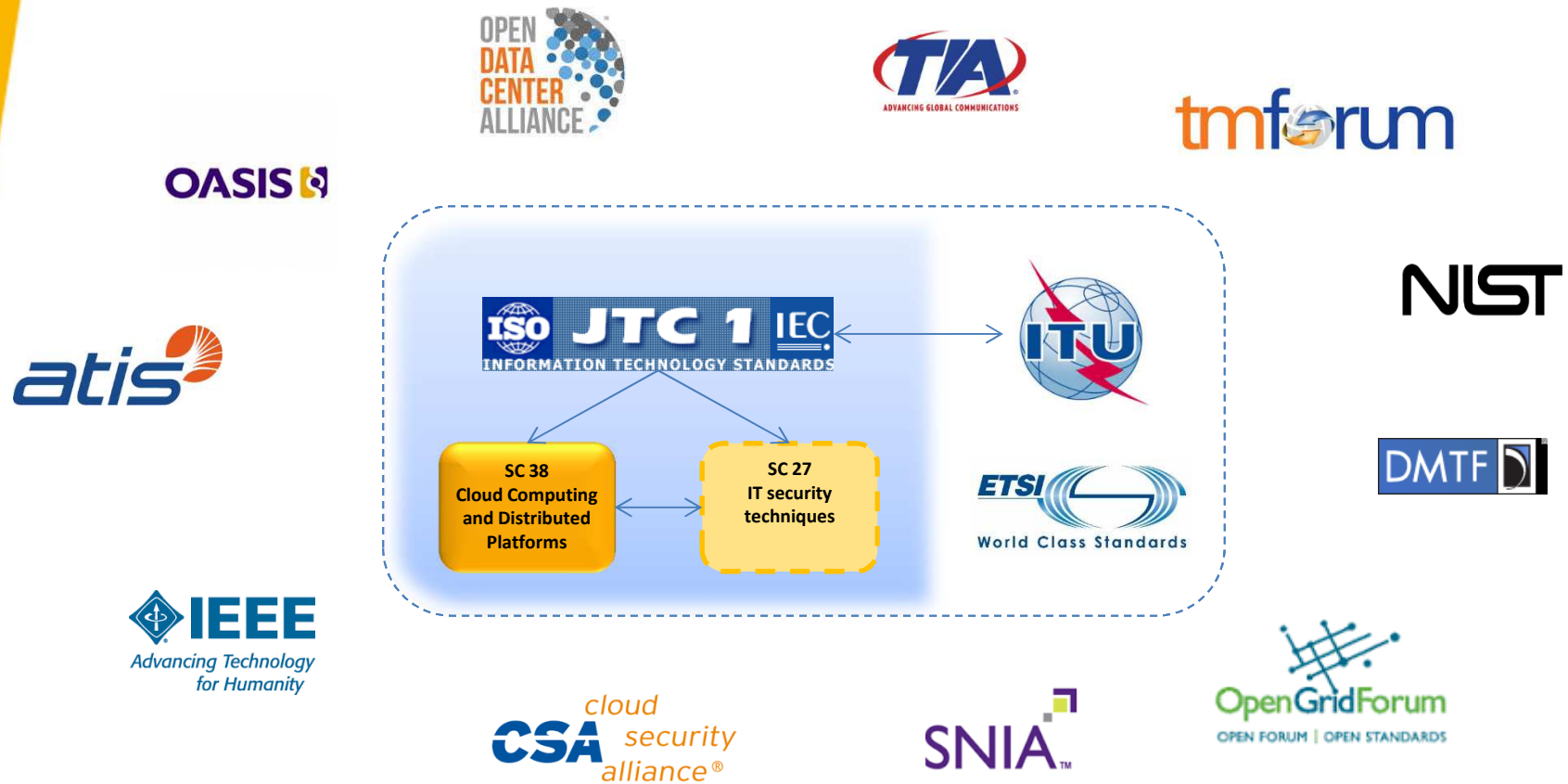
National ICT standardization delegates

- ▶ At the national level, the ICT sector is already an active standardization sector with currently **66 national delegates**

22 New delegates in 2016



Focus on Cloud Computing standardization



ISO/IEC JTC 1/SC 38 - Cloud Computing and Distributed Platforms

- ▶ **Created: 2009**
- ▶ **Main focus areas:**
 - Standardization in the area of Cloud Computing and Distributed Platforms
- ▶ **Structure:**
 - ISO/IEC JTC 1/SC 38/WG 3 - Cloud Computing Service Level Agreements (CCSLA)
 - ISO/IEC JTC 1/SC 38/WG 4 - Cloud Computing Interoperability and Portability (CCIP)
 - ISO/IEC JTC 1/SC 38/WG 5 - Cloud Computing Data and its Flow (CCDF)
- ▶ **Published projects: 9 International Standards and 1 Technical Report**
- ▶ **Projects under development: 4 International Standards**
- ▶ **Chairperson: Mr. Donald Deutsch (United States)**
- ▶ **Members: 40 countries (**Luxembourg**)**
- ▶ **Luxembourg's involvement (12):**
 - Mr. Michel AYME (ATOS)
 - Mr. Christophe DELOGNE (KPMG)
 - Mr. Joost PISTERS (Luxcloud)
 - Mrs. Myriam DJEROUNI (Banque de Luxembourg)
 - Mrs. Shenglan HU, Mr. Jean-Michel REMICHE (POST)
 - Mr. Qiang TANG, Mr. Shyam WAGLE, Mrs. Ana-Maria SIMIONOVICI (University of Luxembourg)
 - Mrs. Digambal NAYAGUM (AS Avocats)
 - Mr. Jean RAPP (Actimage)
 - Mr. Johnatan PECERO (ANEC GIE)

Some Cloud standards and projects related to Digital Trust (1/2)



Standard and/or project	Responsible SC	Stage	Trust issue
ISO/IEC 17788:2014 Information technology -- Cloud computing -- Overview and vocabulary	SC 38	Published	/ (foundation)
ISO/IEC 17789:2014 Information technology -- Cloud computing -- Reference architecture	SC 38	Published	/ (foundation)
ISO/IEC 19086-1:2016 Information technology -- Cloud computing -- Service level agreement (SLA) framework -- Part 1: Overview and concepts	SC 38	Published	Transparency, Contracts, ...
ISO/IEC 19086-2 Information technology -- Cloud computing -- Service level agreement (SLA) framework -- Part 2: Metric Model	SC 38	Under development	Transparency, Contracts, ...
ISO/IEC 19086-3 Information technology -- Cloud computing -- Service level agreement (SLA) framework -- Part 3: Core conformance requirements	SC 38	Under development	Transparency, Contracts, ...
ISO/IEC 19086-4 Information technology -- Cloud computing -- Service level agreement (SLA) framework -- Part 4: Security and privacy	SC 27	Under development	Privacy, Security

Some Cloud standards and projects related to Digital Trust (1/2)



Standard and/or project	Responsible SC	Stage	Trust issue
ISO/IEC 27017:2015 Information technology -- Security techniques -- Code of practice for information security controls based on ISO/IEC 27002 for cloud services	SC 27	Published	Security
ISO/IEC 27018:2014 Information technology -- Security techniques -- Code of practice for protection of personally identifiable information (PII) in public clouds acting as PII processors	SC 27	Published	Privacy
ISO/IEC 27036-4:2016 Information technology -- Security techniques -- Information security for supplier relationships -- Part 4: Guidelines for security of cloud services	SC 27	Published	Security
ISO/IEC 19941 Information technology -- Cloud computing -- Interoperability and portability	SC 38	Under development	Interoperability, Portability
ISO/IEC DIS 19944 Information technology -- Cloud computing -- Cloud services and devices: data flow, data categories and data use	SC 38	Under development	Interoperability, Portability

ICT Standardization in Luxembourg : New services supporting delegate's involvement - **Coaching for national standardization delegates**



- ▶ First step (available now)
 - Personalized support for the handling of collaborative work platforms and voting system
 - On demand for the national standardization delegates of the ICT sector
 - Complement the Training session “New delegate in standardization”

- ▶ Second step (development during 2017)
 - New tools & services based on the needs and barriers identified in step 1

- ▶ Objectives
 - Set up good practices common to all national delegates of the ICT sector
 - Facilitate the standardization work of national delegates
 - Understanding of the standardization environment
 - Organization of the national mirror committees
 - Encourage a stronger involvement of the national standardization community

Contact: anec@ilnas.etat.lu

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Cloud Computing from national delegates perspective *“SLA Monitoring in Cloud Computing”*

Dr. Shyam Wagle – University of Luxembourg

SLA Monitoring in Cloud Computing

Shyam S. Wagle

Interdisciplinary Centre for Security, Reliability and Trust (SnT)
University of Luxembourg

ILNAS, January 2017

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- Service Level Agreement in Cloud Computing

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- Regulatory Compliance Analysis of CSPs
- SLA Attributes used in Decision Recommendation Tool

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Service Level Agreement

- Definition:
“Service level agreement (SLA) is a formal, negotiated document that defines (or attempts to define) in quantitative and qualitative terms the service being offered to the users.”
- To bring users, providers, and regulators together in the chain of accountability, there is a need of service monitoring delivered by providers.
- Quality of Service (QoS) in Telecom Services¹:
 - EG 202 009-1: "Methodology for identification of parameters relevant to the Users" [i.1]
 - EG 202 009-2: "User related parameters on a service specific basis" [i.2]
 - EG 202 009-3: "Template for Service Level Agreements (SLA)" [i.3]

¹<http://www.etsi.org>

User Related Parameters in Telecom Services

- PSTN/Landline (TDM, IP), GSM (2G, 3G, 4G), Email, Internet services (ADSL, FTTH), SMS/MMS, and so on
 - QoS parameters for the
 - Technical quality for the service utilization
 - All service life cycle steps other than utilization
 - Charging and Billing- Based on CDR (Call detail record)
 - Call Duration
 - Call Destination
 -
 - Focused on:
 - QoS (Quality of Service)
 - MOS (Mean Opinion Score)
 -

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Initiation to Standardize SLA Metrics in Cloud Computing

- Metrics provide knowledge about characteristics of a cloud property through both its definition (e.g. expression, unit, rules) and the values resulting from the observation of the property.
- Contributions provided by different bodies to standardize the SLA metrics in Cloud Computing.
 - Cloud Service Level Agreement Standardization Guidelines²
 - Guide to Cloud SLA [CSCC, 2015],
 - Service Measurement Index (SMI) defined by CSMIC [Garg et al., 2011],
 - TM Forum [TMForum, 2015],
 - NIST Cloud Computing Standards Roadmap [NIST, 2011],
 - European Commission- Cloud Computing Service Level Agreements: Exploitation fo Research Results,
 - OCCI working group [OCCI, 2015,],
 - CLOUD: SLAs for Cloud service, ETSI TR 103 125 V1.1.1 (2012-11)

²<https://ec.europa.eu/digital-single-market/en/news/cloud-service-level->

SLA Metrics in Cloud Computing I

- Performance Service Level
 - Availability of the services (uptime, percentage of successful requests, percentage of timely service provisioning requests)
 - Response time of the service,
 - Capacity parameters (Number of simultaneous connections, Number of simultaneous cloud service users, Maximum resource capacity, Service Throughput) and support
- Security Service Level
 - Service Reliability, Authentication and Authorization,
 - Cryptography, Security Incident management and
 - Reporting, Logging and Monitoring,
 - Auditing and security verification,
 - Vulnerability Management and security control governance.
- Data Management Service Level
 - User's data,
 - Provider's data,

SLA Metrics in Cloud Computing II

- Cloud service derived data and so on
- Personal Data Protection Service Level
 - Data Controller/Processor
 - Applicable data protection codes of conduct, standards, certifications

SLA Metrics in Cloud Computing I

Criteria	Sub-criteria	Short Name
Liabilities	Liabilities	<i>Li</i>
Performance Service Level	Availability Response Time Capacity	<i>Av</i> <i>Res</i> <i>Cap</i>
Security Service Level	Service Reliability Authentication and Authorization Security incident mgmt Reporting Logging Monitoring	<i>Rel</i> <i>Au</i> <i>inc</i> <i>Rep</i> <i>Log</i> <i>Mon</i>
Data Management Service Level	Data Classification Data Backup, Mirroring and Restore Data Lifecycle and Portability	<i>Dcls</i> <i>BMR</i> <i>DLP</i>
Personal Data Protection Service Level	Code of Conduct Purpose of Specification Openness, transparency and notice Accountability Geographical Location of user data	<i>Ccon</i> <i>Pspec</i> <i>OTN</i> <i>Acc</i> <i>DL</i>
Provider Lock-in and Exit	Lock-in Exit	<i>In</i> <i>Ex</i>
Terms and conditions	Terms and conditions	<i>TC</i>
Changing Service Features	Changing Service Features	<i>CS</i>
Intellectual Property Rights(IPR)	IPR	<i>IPR</i>

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Evaluation Using Heat Map Technique

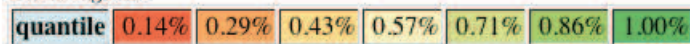
We assign 0 to 3 ordinary levels according to detail specification provided in the SLA document and Terms of service. If there is not any information provided, we assign 'NA' in that particular parameter.

1. 3 - "Available, complete and included all the points",
2. 2 - "Available, sufficient and missing some points",
3. 1- "Available, insufficient and missing some points",
4. 0- "Available, insufficient but not clear points"
5. 'NA' - "Not Available"

Pictorial Analysis of Compliance Status of CSPs

criteria	Acc	BMR	Mon	Log	Rep	OTN	inc	Au	Rel	DL	Li	IPR	Ex	In	Res	TC	Pspec	Ccon	DLP	Dels	Cap	Av	CS
weights	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
tau ^(*)	0.52	0.52	0.52	0.52	0.52	0.50	0.49	0.49	0.49	0.34	0.26	0.09	0.04	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	-0.34
Amazon Cloud	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1	3	3	3	NA	NA	NA	3	0
Google Cloud Storage	3	3	3	3	3	3	3	3	3	3	2	3	0	0	1	3	3	3	NA	NA	NA	3	2
Microsoft Azure	3	3	3	3	3	3	2	2	2	2	2	2	1	1	1	3	3	3	NA	NA	NA	3	1
Aruba Cloud	3	3	3	3	3	3	3	3	3	3	0	2	0	0	1	3	3	3	NA	NA	NA	3	0
IBM Cloud	2	2	2	2	2	2	3	3	3	3	2	2	0	0	1	3	3	3	NA	NA	NA	2	0
City Cloud	3	3	3	3	3	3	1	1	1	3	2	2	0	0	1	3	3	3	NA	NA	NA	3	2
Rackspace Cloud	0	0	0	0	0	0	3	3	3	0	3	3	1	1	1	3	3	3	NA	NA	NA	3	1
CenturyLinkCloud	1	1	1	1	1	1	1	1	1	3	3	1	0	0	1	3	3	3	NA	NA	NA	3	2
Gogrid Cloud	0	0	0	0	0	0	2	2	2	3	0	3	1	1	2	3	3	3	NA	NA	NA	3	3
ExoCloud	0	0	0	0	0	0	3	3	3	3	0	3	0	0	1	3	3	3	NA	NA	NA	3	3
BareMetal Cloud	0	0	0	0	0	0	3	3	3	0	1	2	0	0	1	3	3	3	NA	NA	NA	3	2
SoftLayer Cloud	0	0	0	0	0	0	2	2	2	3	1	1	1	1	1	3	3	3	NA	NA	NA	3	NA
UpCloud	0	0	0	0	0	0	1	1	1	3	2	2	1	1	1	3	3	3	NA	NA	NA	3	2
Elastic Host	0	0	0	0	0	0	2	2	2	0	1	3	0	0	1	3	3	3	NA	NA	NA	3	2
DigitalOcean Cloud	0	0	0	0	0	0	2	2	2	2	1	2	0	0	1	3	3	3	NA	NA	NA	3	2
Cloudcentral Cloud	0	0	0	0	0	0	1	1	1	0	1	3	1	1	1	3	3	3	NA	NA	NA	3	NA
Cloud Sigma	0	0	0	0	0	0	1	1	1	3	1	2	0	0	1	3	3	3	NA	NA	NA	3	2
HP Cloud	0	0	0	0	0	0	1	1	1	0	1	2	1	1	1	3	3	3	NA	NA	NA	3	2
VaultNetwork Cloud	0	0	0	0	0	0	1	1	1	0	2	1	0	0	1	3	3	3	NA	NA	NA	3	2
GMOCLOUD-US	0	0	0	0	0	0	0	0	0	0	0	3	1	1	1	3	3	3	NA	NA	NA	3	2

Color legend:



(*) tau: Ordinal (Kendall) correlation between marginal criterion and global ranking relation.

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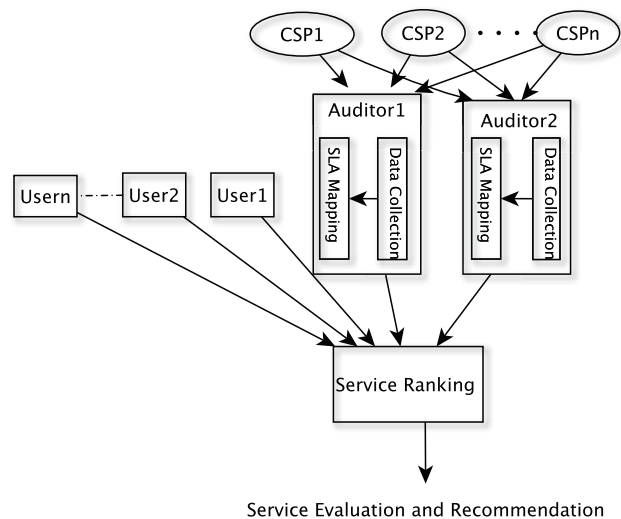
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CSP Evaluation Framework



Criteria and Sub-criteria for evaluating cloud services

Criteria	Sub-criteria	Short Name
Availability (C1)	Uptime(c11) Downtime(c12) Outage Frequency(c13)	<i>upT</i> <i>dwT</i> <i>ouT</i>
Reliability (C2)	Load Balancing(c21) MTBF(c22) Recoverable(c23)	<i>LB</i> <i>MTBF</i> <i>Rcv</i>
Performance (C3)	Latency(c31) Response time(c32) Throughput (c33)	<i>Lat</i> <i>rsT</i> <i>tpT</i>
Cost (C4)	Storage Cost (c41) VM instance cost(c42)	<i>stC</i> <i>snC</i>
Security (C5)	Authentication(c51) Encryption(c52) Audit-ability(c53)	<i>auT</i> <i>enC</i> <i>auD</i>

Service Performance Evaluation

criteria	tpT	MTBF	Lat	stC	stC	upT	upT	dwT	MTBF	Rev	rsT	ouT	Rcv	ouT	dwT	auD	enC	auT	snC	tpT	Lat	LB	auD	enC	auT	snC	rsT	LB
weights	2.00	2.00	2.00	3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00	2.00
tau(*)	0.50	0.48	0.38	0.36	0.36	0.33	0.32	0.31	0.29	0.23	0.20	0.18	0.16	0.15	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
MS	4	3	3	4	4	4	4	3	4	3	4	4	4	3	4	4	4	4	NA	NA	NA	4	4	4	4	NA	NA	4
Amz	4	3	4	4	4	4	2	3	3	3	3	2	3	3	2	4	4	4	NA	NA	NA	4	4	4	4	NA	NA	4
Cent	2	3	3	3	3	2	4	1	4	2	4	4	4	0	4	4	4	4	NA	NA	NA	4	4	4	4	NA	NA	4
HP	4	4	4	3	3	4	3	4	4	4	4	3	3	4	3	4	4	4	4	NA	NA	4	4	4	4	4	NA	4
Ggl	4	3	4	4	4	4	4	3	2	3	2	1	3	3	1	4	4	4	4	NA	NA	4	4	4	4	4	NA	4
Rsp	4	4	3	3	3	4	NA	4	NA	4	NA	NA	3	4	NA	4	4	4	4	NA	NA	4	4	4	4	4	NA	4
Sig	2	3	3	3	3	4	4	2	4	3	3	4	4	3	4	4	4	4	4	NA	NA	4	4	4	4	4	NA	4
Ela	2	2	3	3	3	2	4	2	4	1	4	4	4	1	4	4	4	4	4	NA	NA	4	4	4	4	4	NA	4
Cit	2	2	3	3	3	1	3	0	3	1	2	3	4	2	4	4	4	4	4	NA	NA	4	4	4	4	4	NA	4
Dig	2	2	3	3	3	4	2	0	2	2	2	1	3	2	1	4	4	4	NA	NA	NA	4	4	4	4	NA	NA	4
GMO	1	1	2	3	3	0	1	3	3	3	4	3	2	3	3	4	4	4	NA	NA	NA	4	4	4	4	NA	NA	4

Color legend:

quantile	0.14%	0.29%	0.43%	0.57%	0.71%	0.86%	1.00%
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(*) tau: Ordinal (Kendall) correlation of marginal criterion and global outranking relation.

Heatmap table by All Auditors

Conclusions

- SLA in Telecom Services
- SLA in Cloud Computing
- Use of SLA vocabulary in SLA monitoring

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Thank you for your attention!

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March 9, 2017

Breakfast **“Digital Trust for Internet of Things”**

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