BUILDING INTEROPERABILITY INTO SMART CITY SOLUTIONS: FUTURE SHOCK AND INFORMATION MANAGEMENT

Dr. Lindsay Frost (NEC Labs Europe) as ETSI ISG CIM Chairman, to ITU-T FG DPM Workshop

YOUR BACKGROUND

- Digitalization is infiltrating all city /municipal /citizen interactions
- Governments are expected to
  - **Integrate older data** into Cloud services
  - **Monitor and optimize** mobility, waste management, energy, air pollution, social services and eHealth solutions
  - **Cope with babel** of different data storage assumptions, different protocols, different definitions for the same things
  - **Forge collaboration** between different departments/stakeholders
  - **Do more with less**

My background

Dr. Lindsay Frost

NEC Chief Standardisation Engineer

Chairman of ETSI ISG CIM (Industry Specification Group for cross-cutting Context Information Management)

Board Member ETSI

CEN/CENELEC/ETSI SF-SSCC delegate (Sector Forum on Smart and Sustainable Cities and Communities)

Previously: research manager in physics facilities in Germany, Italy and Australia; manager NEC R&D teams for 3GPP, WiMAX, fixed-mobile convergence, WLAN; group chairman in Wi-Fi Alliance; Board Member of Home Gateway Initiative; co-chair of the HGI Smart Home group

NEC Laboratories Europe GmbH (Heidelberg)

- **Data Science, 5G networking, Security, Blockchain, IoT, Smart Transport**
- **NLE ~ 100 international staff**

Collaborations with top European universities in ~10 European Projects:

- **Wise-IoT**
- **VirtuWind**
- **SSICLOPS**
- **FIESTA**
- **CleanSky**
- **SUPERFLUIDITY**
- **SynchroniCity**
- **SCOUT (Safe and COnnected aUtomation in road Transport)**
- **REPLICATE (REnaissance in PLaces with Innovative Citizenship And TEchnology)**
- **CPaaS.io – City Platform as a Service.Integrated and Open**

ETSI ISG CIM: MISSION

... to make it easier

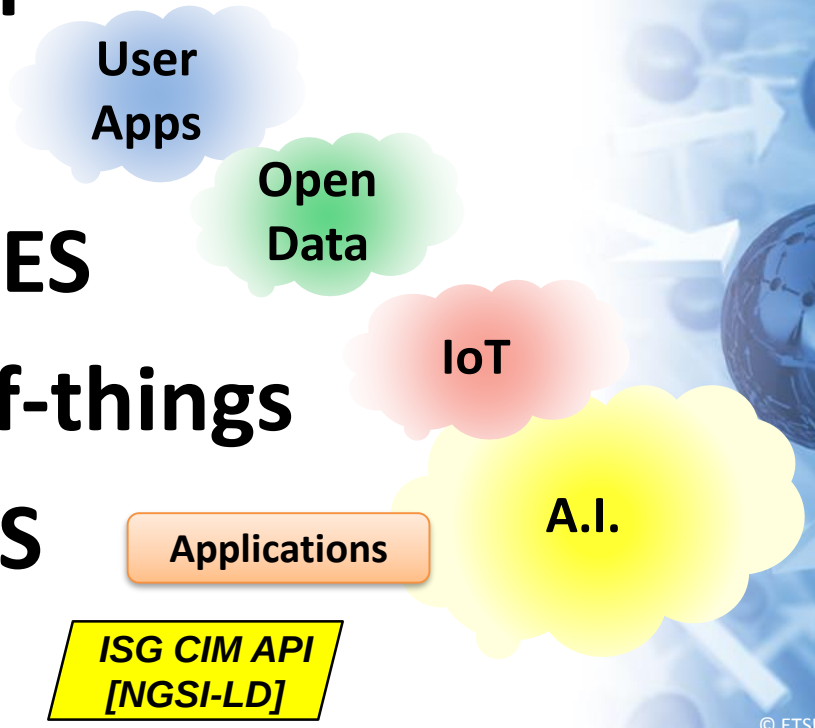
for END-USERS

and CITY DATABASES

and IoT internet-of-things

and 3rd-party APPS

to exchange INFO



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CONTEXT INFORMATION MANAGEMENT: EXCHANGE DATA AND DEFINITIONS (ONTOLOGY)

User Apps

A.I.

APPs

APPs

APPs

Open Data

Context Information Management

ISG CIM API [NGSI-LD]

ISG CIM API [NGSI-LD]

IoT

Context Information Ontologies

ntext mation ologies

Proprietary Data

Exchanging data and ontology allows Users and A.I. to see ***MEANING***

CONTEXT INFORMATION MANAGEMENT: EXCHANGE DATA AND DEFINITIONS (ONTOLOGY)

User Apps

A.I.

APPs

Open Data

Provenance

Context Information Management

Usage

IoT

Context Information Ontologies

Context Information Ontologies

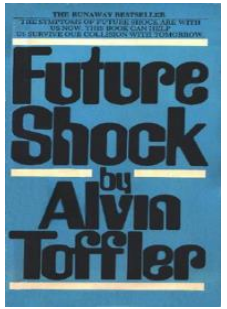
Proprietary Data

More: PROVENANCE, licensing, privacy ? USAGE, Billing, FoF info, errors?

HOW CAN ALL THAT INFORMATION BE HANDLED ?

FUTURE SHOCK

- "Future Shock" by Alvin Toffler (1970): "information overload„
  → too much information in too short a time
  → too much uncertainty for making decisions
  → stress, poor responses, neurosis ... for people and societies

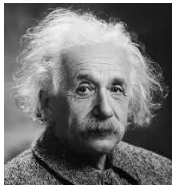


- **Coping with information overload, high risk & uncertainty ?**

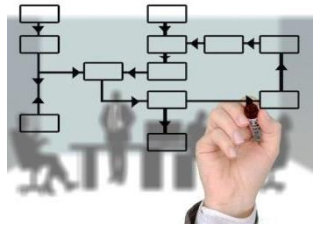
Hide & Hope

Panic & (Re)act

Filter by Role Model



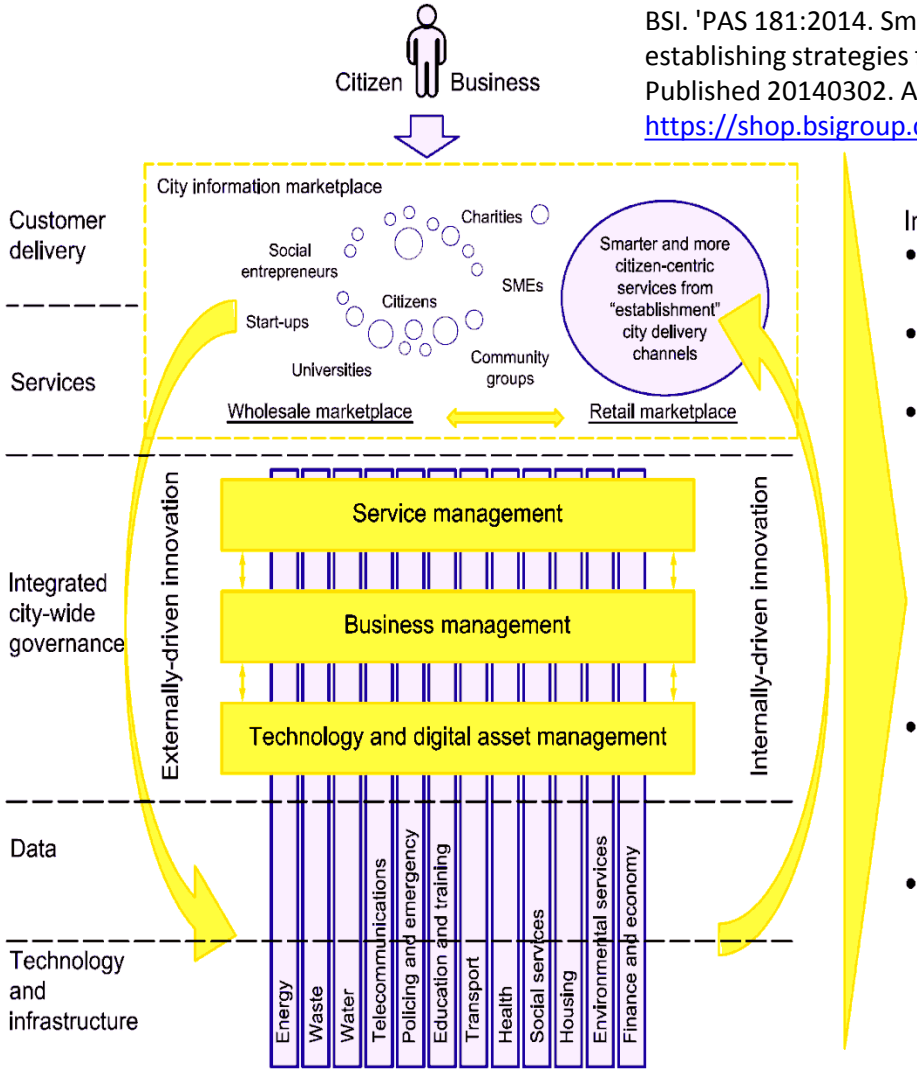
Rationate



REDUCE RISKS→

RATIONATE

- Identify silos
- Modularize
- Interop layers
- Service centric
- Info centric
- No lock-in
- No single points of failure
- Monitor it ...



BSI. 'PAS 181:2014. Smart city Framework. Guide to establishing strategies for smart cities and communities.' Published 20140302. Accessed 20180105 at https://shop.bsigroup.com/forms/PASs/PAS181-2014/

Impact:

- City data unlocked from individual silos
- Logical separation of data, service and customer delivery layers
- Externally-driven innovation:
  - Enablement of new marketplace for city information and services
  - Citizens, SMEs and social entrepreneurs enabled to co-create public services and create new value with city data
- Internally-driven innovation:
  - Improved and integrated service delivery
  - Resource optimization
- Ability to drive city-wide change at speed

REDUCE RISKS WITH STANDARDS

- Standards help enable interoperability, avoid "vendor lock-in"
  - improve economies of scale and cost savings
  - create a common market, improve global market access
  - disseminate awareness and knowledge
  - foster progress, cross-education and innovation
- Standardization is voluntary/dynamic, not from regulators
  - „Self regulation" by the market and best practice benchmark

... and creates an ecosystem of experts

- Governments/Citizens need to reference them for
  - Protection of health and the environment, ensuring safety
  - Compatibility and interoperability of public services
- Standards help all stakeholders, including:
  - industry at large, small and medium-size enterprises
  - public authorities and regulators academia and the research comm
  - consumers, etc etc

REDUCE RISKS WITH STANDARDS

- St… …ability, avoid "vendor lock-in"
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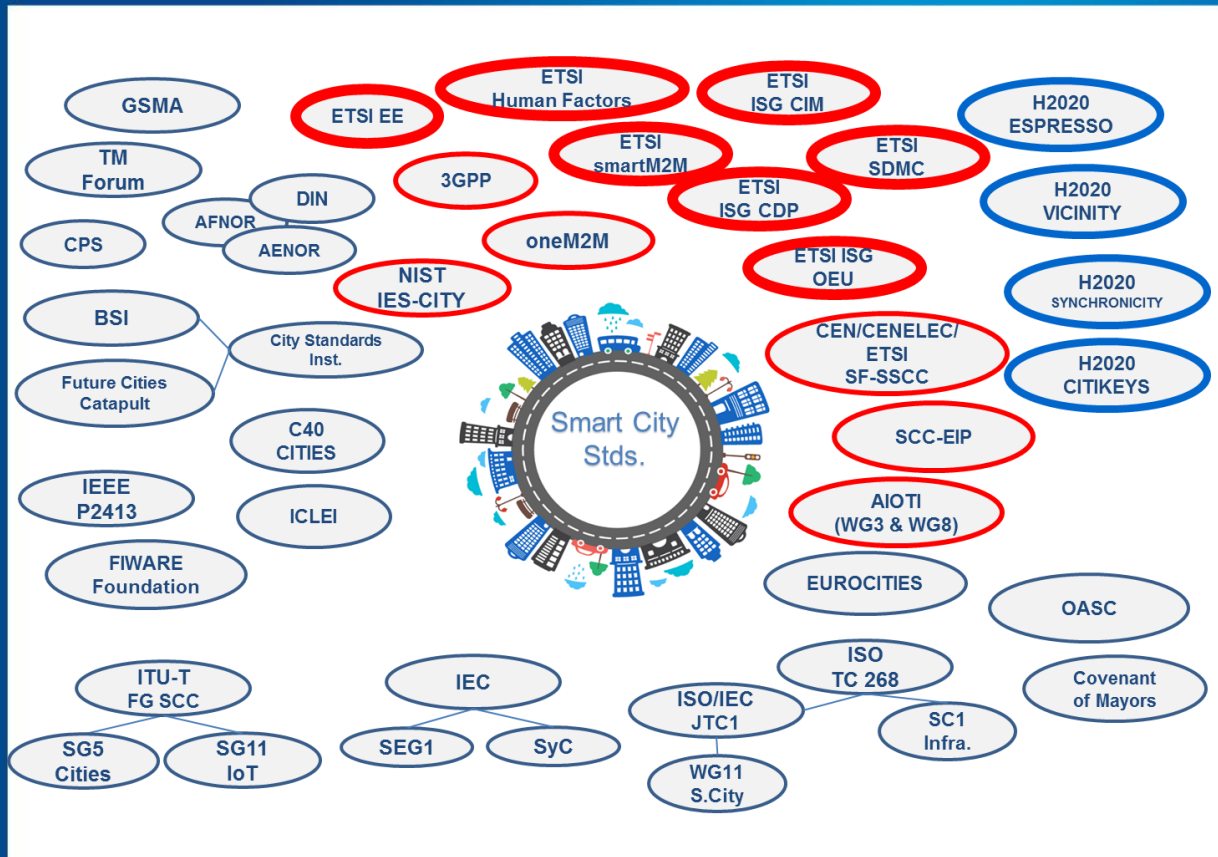
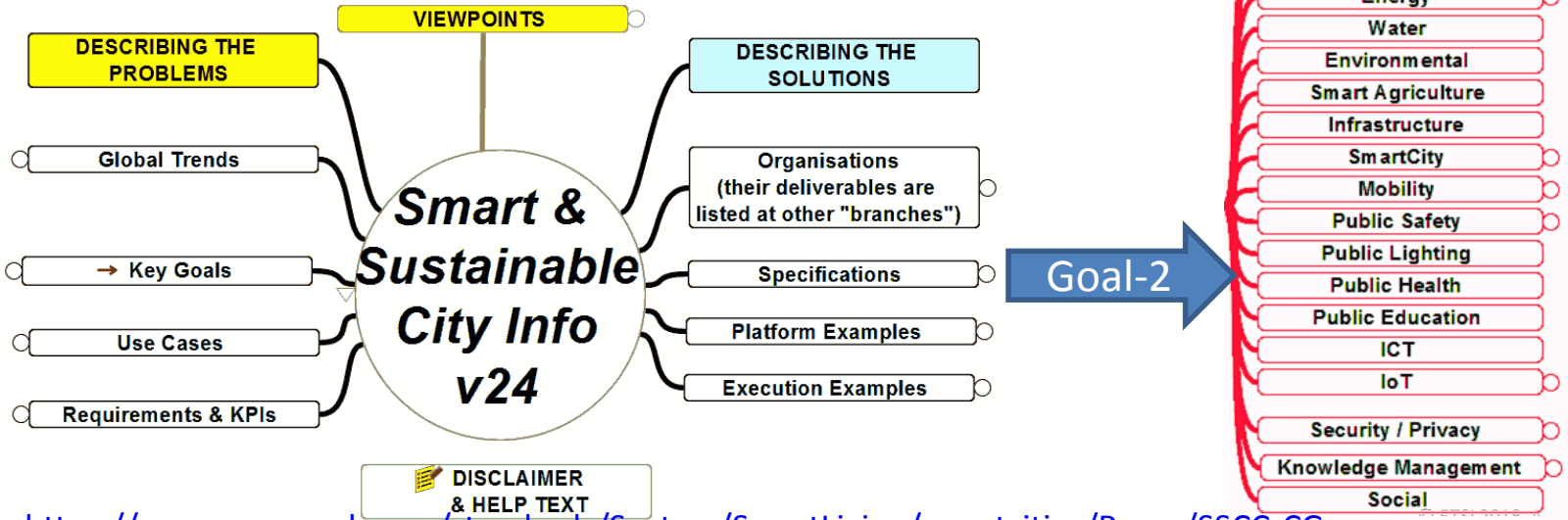
SDO MAP : IS THERE A GUIDE OR SIGNPOST ?



A SIGNPOST: SF-SSCC MINDMAP (IN DRAFT)

- Goal-1: organize links to the **relevant organisations**
- Goal-2: collect links to most **relevant specifications** and guidelines impacting Smart Cities, grouped in clear topic areas



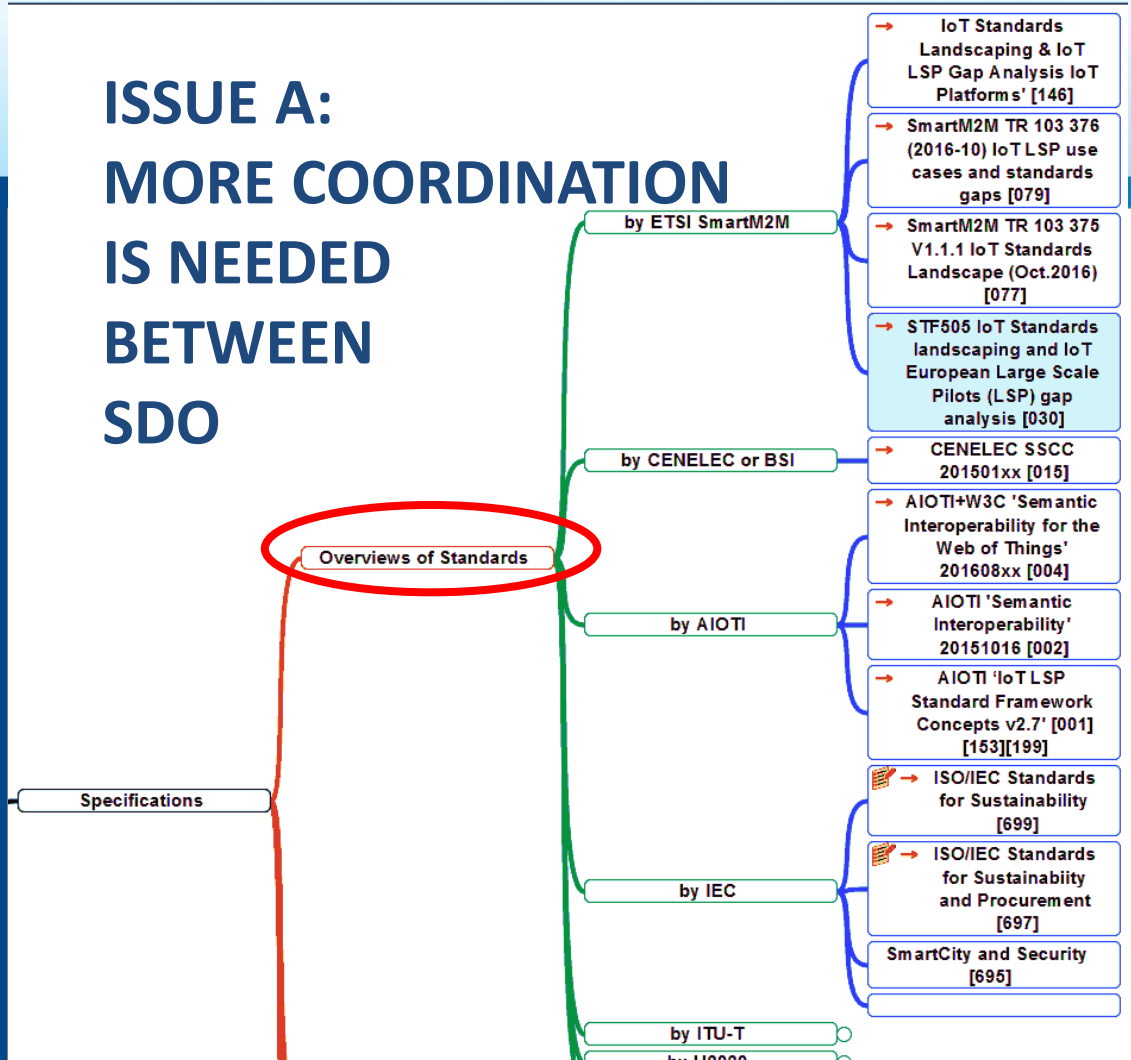
https://www.cencenelec.eu/standards/Sectors/SmartLiving/smartcities/Pages/SSCC-CG.aspx

A SIGNPOST: SF-SSCC MINDMAP (IN DRAFT)

We already see a number of obvious problems / issues:

- A: More coordination is needed between SDOs
- B: Need alignment for IoT
- C: Need to talk about same things
- D: Lack of Domain Consensus
- E: „Keep it simple“ info exchange?

ISSUE A: MORE COORDINATION IS NEEDED BETWEEN SDO



- e.g. each group does its own overview, which are related but not identical
  (yes, like this one ...)
- e.g. Topics and domains which were once separate are now overlapping (e.g. street lighting with hotspots)

ISSUE B: WE NEED ALIGNMENT FOR IOT

- **Dozens of IoT Architectures ...**
  - AIOTI WG3 IoT High Level Architecture - Release_2_0 [125]
  - ETSI SmartM2M TS 103 527 Virtualized IoT Architectures
  - IEEE P2413 [112]
  - IIC Industrial Internet Reference Architecture v1.8 [104]
  - IIoT Connectivity Framework [162][194]
  - W3C Semantic Sensors [207]
  - oneM2M TR-0036 Adaptation for Smart-city [070]
  - NIST CyberPhysical Systems Framework [074] [352]
  - ITU-T SG20 ITU-T Y.4000 Overview IoT [507]
  - ITU-T SG20 Y.4111/Y.2076 IoT Semantics [410]

ISSUE C: NEED TO TALK ABOUT SAME THINGS

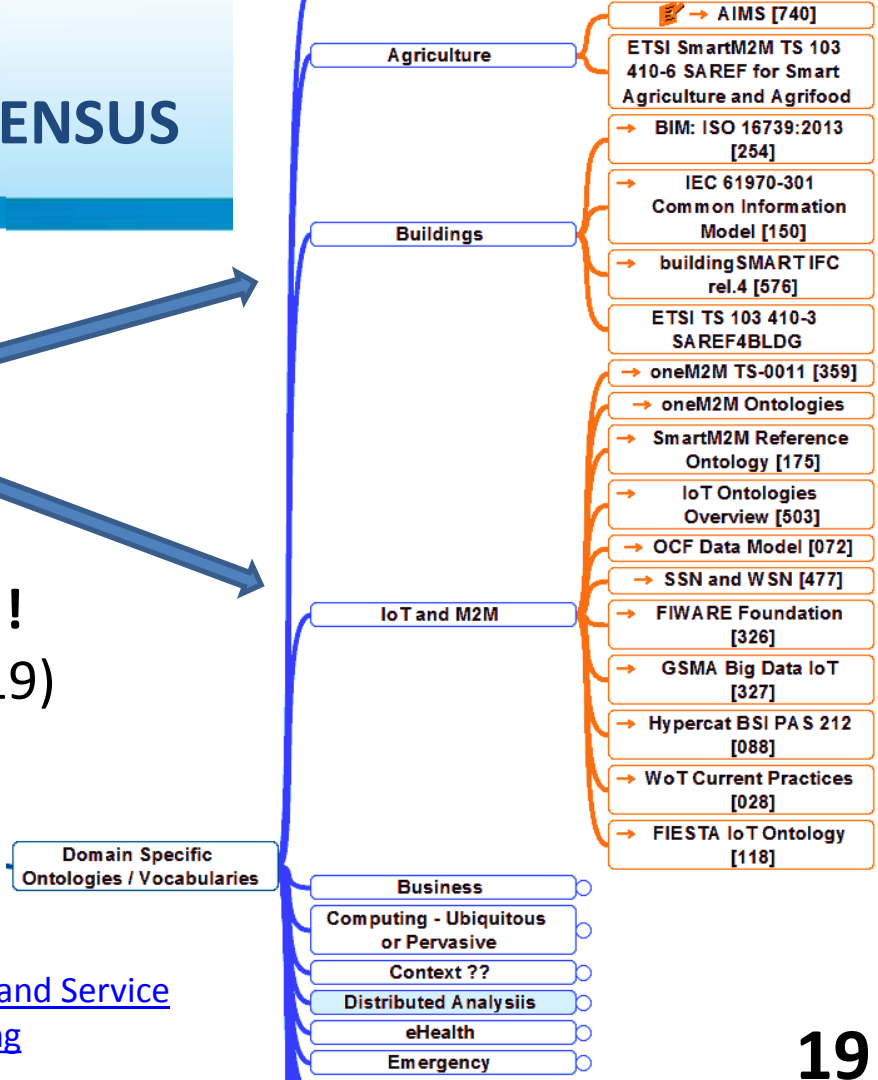
- Libraries of thousands of vocabularies/ontologies, overlapping
  - ISO/IEC 11179 Metadata Registries [257]
  - FAIRsharing.org
  - Project Open Data [279][280]
  - Open Metadata Registry [268]
  - BARTOC [737] Basel Register of Ontologies
  - Biomedical Ontologies [742]
  - …
- Matching up ontologies is MUCH harder than (re)using same ones !

ISSUE D: LACK OF DOMAIN CONSENSUS

- **Need consensus in each domain**
  e.g. Here we see 4 in Buildings
  e.g. Here we see dozen in IoT ??
- **EC has begun regulating to reduce these barriers to trade / efficiency !**
  e.g. INSPIRE Directive (deadline 2019)

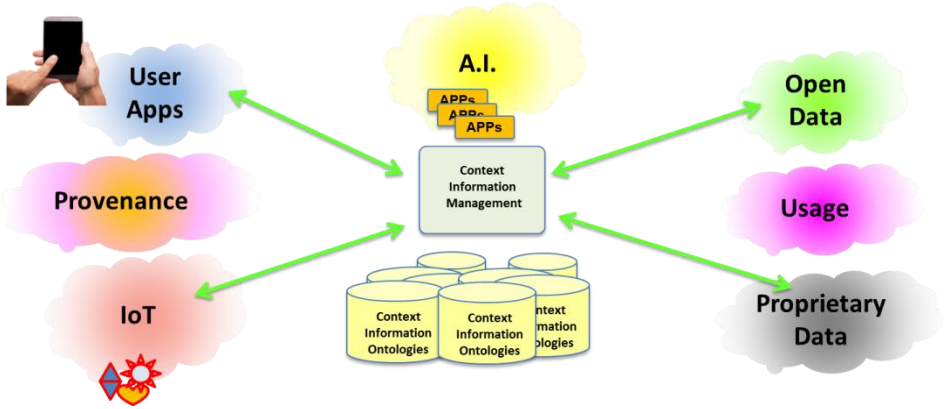
„To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the INSPIRE Directive requires that common implementing Rules (IR) are adopted …"

Metadata, Data Specifications, Network Services, Data and Service Sharing, Spatial Data Services, Monitoring and Reporting



ISSUE E: „KEEP IT SIMPLE“ INFO EXCHANGE?

- Goals (not all achievable?)
  - Transport info between any two systems
  - Keep context information and relationships with data
  - Minimal complexity (but as much as really needed)
  - Attractive to programmers
  - Adapt to security / privacy (GDPR, ENISA, ...)



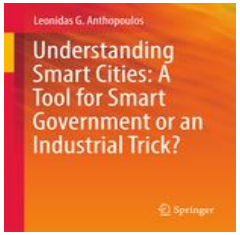
- Assumptions to use?
  - Federated architecture
  - Linked Data compatible
  - Query & Notify in same API

CAN WE (OR YOU) „KEEP IT SIMPLE“ ?

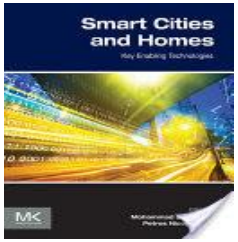
ETSI ISG CIM NGSI-LD API FEATURES (+LIMITS)

- **Information Model is Graph-based & information-centric**
  - Core concepts include Entities and Relationships
  - Entities can have Properties and Relationships
  - Relationships/Properties can also have Properties, Relationships
- **Referencing of defined/hierarchical vocabularies/ontologies**
  - All terms are unambiguously defined
  - **Allows users to reference their familiar information definitions**
- **Model and Query language (is constrained so more predictable)**
  - Federation of (independent) information sources, anywhere
  - Queries: based on entity type or ID, can filter results, can constrain scope (time, geography), constrained not to traverse

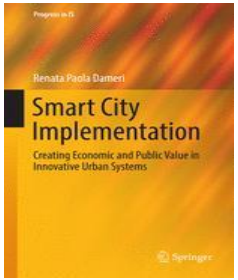
FYI: SOME BOOKS ON SMART CITY STANDARDS



- Anthopoulos, Leonidas G., "Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick?", 2017, ISBN 978-3-319-57015-0, Contents



- Mohammad S Obaidat, Petros Nicopolitidis, "Smart Cities and Homes: Key Enabling Technologies", 2016, ISBN 9780128034637, Contents



- Renata Paola Dameri, "Smart City Implementation: Creating Economic and Public Value in Innovative Urban Systems", 2017, ISBN 978-3-319-45765-9, Contents

FYI: OVER 100 SMART CITY EVENTS IN 2018 ...

- **Type https://goo.gl/5GfmzV or go to**
  https://docs.google.com/docu/mentd/1l3b_FXIdukTkRGCEdL4bi9gNVvEDx9anVQlMcHrye68/edit?usp=sharing

G	20181204-20181206	ICT 2018, Vienna
S	20181203-20181207	oneM2M TP 38, Japan
S	20181129-20181129	ETSI BOARD#120
C	20181128-20181130	EUROCITIES 2018, Edinburgh
S	20181127-20181128	ETSI General Assembly #72, Sop Antipolis
S	20181115-20181115	World Smart City Forum, Barcelc
C	20181113-20181115	Smart City Expo World, Barcelon
S	20181112-20181113	ETSI ISG CDP, Barcelona
C	20181106-20181107	Smart City + Smart Grid, Paris
S	20181026-20181027	ETSI BOARD#119
S	20180925-20180927	SmartM2M#47, S. Antipolis
C	20180925-20180927	Future Smart Cities, Cairo
C	20181024-20181028	Local Renewables Conference 2018, Freiburg (Germany) and Basel (Switzerland)
C	20180923-20180925	Industry of Things World, Berlin
C	20181022-20181026	ETSI IoT Week, S. Antipolis
S	20180917-20180921	oneM2M TP 37, Europe
C	20180917-20180921	ITS World Congress, Copenhager
C	20180912-20180914	IoT Week Korea, Seoul

C	20180910-20180913	ITU Telecom World, Durban
S	20180910-20180914	OGC TC/PC, Stuttgar
S	20180905-20180907	ETSI ISG CDP, Jersey
S	20180716-20180720	oneM2M TP 36, USA
C	20180708-20180712	World Cities Summit
S	20180703-20180705	SmartM2M#46 Plen
S	20180627-20180628	Innovation for Bette Business, Nice
S	20180620-20180621	ETSI BOARD#118
C	20180619-20180623	ICLEI World Congres
C	20180618-20180623	SEMIC 2018, Sozopo
C	20180618-20180620	SMARTCOMP 2018,
	20180613-20180615	Foro de Ciudades Ife Madrid
C	20180611-20180615	ETSI Security Week,
C	20180607-20180608	Unleashing Innovati & IoT, Amsterdam
W	20180604-20180608	EU Sustainable Ener Brussels

C	20180604-20180607	IoT & Smart City Platform Convergence, Bilbao
C	20180604-20180607	ICF Global Summit 2018, Greenwich
C	20180604-20180607	IoT Week, Bilbao
C	20180604-20180606	ICF Intelligent Community Forum, London
S	20180528-20180601	ISO/TC211 Meeting, Copenhagen
C	20180523-20180525	4th Smart Cities India Expo, 2018, New Delhi
S	20180523-20180525	oneM2M TP 35, Europe
C	20180523-20180525	4th Smart Cities India 2018 Expo, New Delhi (India)
C	20180522-20180524	Smart City Africa, Abidjan (Ivory Coast)
G	20180521-20180525	Green cities for a greener future, Brussels
A	20180517-20180518	EUROCITIES cooperation platform

… PLEASE JOIN THE EFFORT TO ALIGN SMART CITY STANDARDS AND INFORMATION

- **Contact for ETSI ISG CIM:**
  Chairman: Lindsay Frost
  ISGSupport@etsi.org
- Open pages for consensus material:
  https://docbox.etsi.org/ISG/CIM/Open
- + visit at: https://portal.etsi.org/CIM

- **Contact for SF-SSCC:**
  Chairman: Bernard Gindroz
  https://www.cencenelec.eu/standards/Sectors/SmartLiving/smartcities/Pages/SSCC-CG.aspx