



UNIVERSITY OF BRESCIA – HEALTH & WEALTH

Università degli Studi di Brescia

Department of Information Engineering



The Internet of Things as a platform for Health and Care applications

PhD Candidate Paolo Bellagente - Tutor Prof. Alessandra Flammini
PhD program in Technology for Health - XXX cycle





The EU way to Smart Cities



MARKET PLACE OF THE
EUROPEAN INNOVATION
PARTNERSHIP
ON **SMART CITIES**
AND **COMMUNITIES**

“Smart cities should be regarded as systems of people interacting with and using flows of energy, materials, services and financing to catalyse sustainable economic development, resilience, and high quality of life; these flows and interactions become smart through making strategic use of information and communication infrastructure and services in a process of transparent urban planning and management that is responsive to the social and economic needs of society. ”

Active and Healthy Ageing in the EU

STRATEGIC IMPLEMENTATION PLAN FOR THE EUROPEAN INNOVATION PARTNERSHIP ON ACTIVE AND HEALTHY AGEING

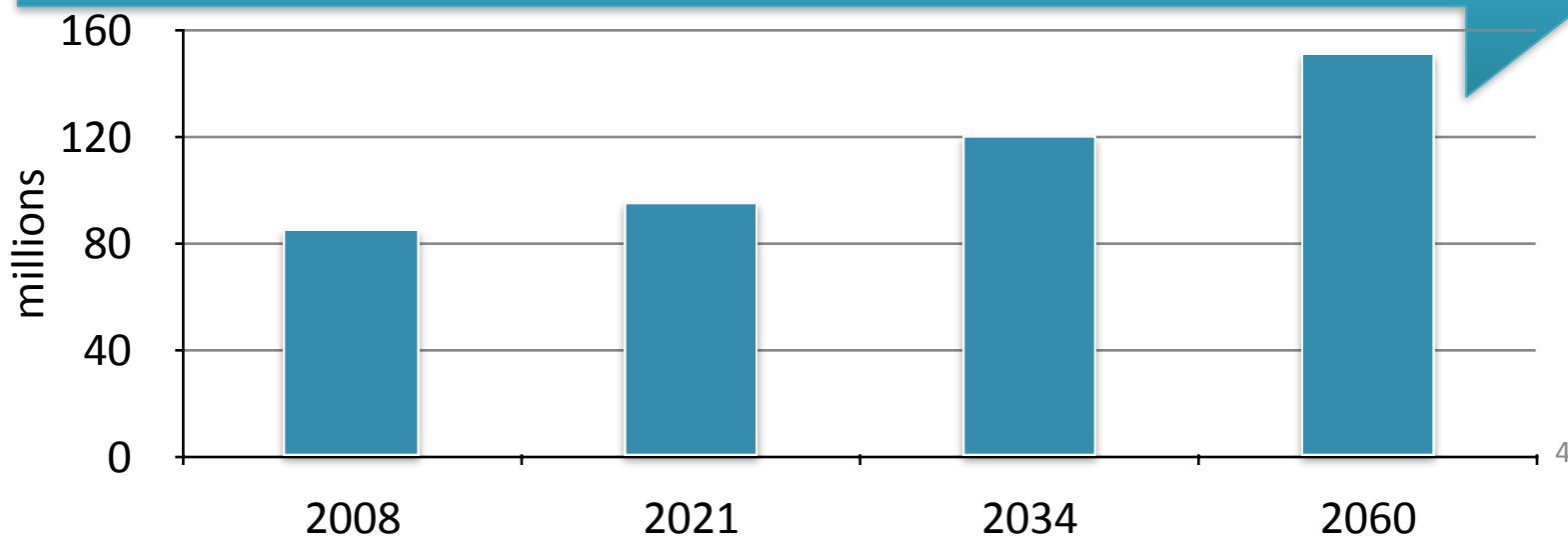
- Prevention, screening & early diagnosis
- Care & Cure
- Active Ageing & Independent Living



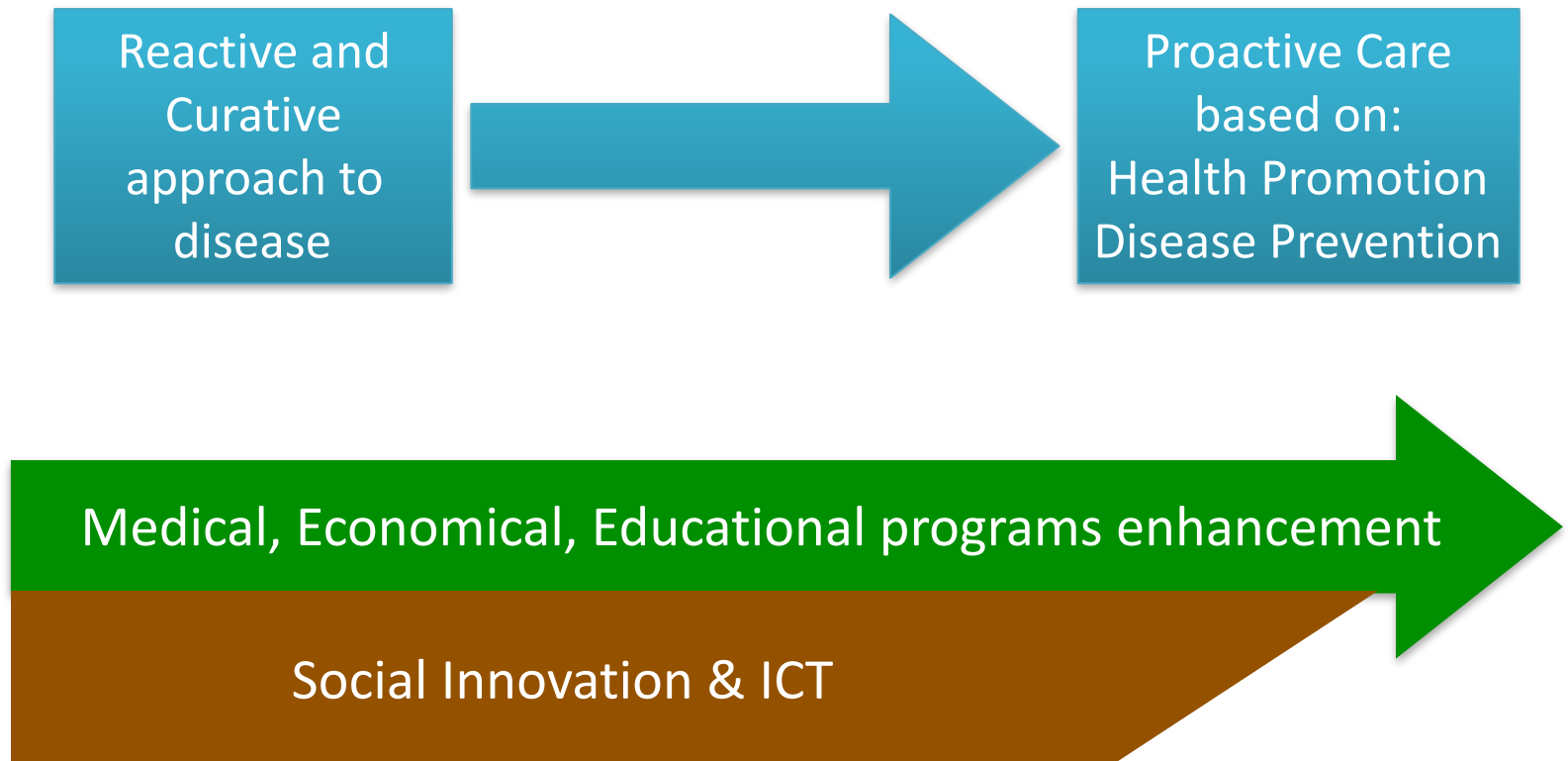
65+

2008 2011

2060



Strategic Implementation Plan



State of the art:



MARKET PLACE OF THE
EUROPEAN INNOVATION
PARTNERSHIP
ON **SMART CITIES**
AND **COMMUNITIES**

TELE-HEALTH E-HEALTH ASSISTIVE TECHNOLOGY GERONTECHNOLOGY TELEMEDICINE



@Home

@Outdoor

• Early Warning

• Vital Signs monitoring

• R2C Communications

APPLICATIONS:

- Safety & Security
- Vital signs monitoring
- Early warning on emergency
- Mobility monitoring
- Relatives-to-caregivers communications
- ...

Interoperability,
Process Integration,
Widely and inexpensive
deployment





The Internet of Things



IEEE

Internet of Things

Towards a definition of Internet of Things (IoT)

(Revision 1 - 27 May 2015)

“Things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental and user contexts. [...] ‘Internet of Things’ means ‘a worldwide network of interconnected objects uniquely addressable, based on standard communication protocols.’”

(ETP EPoSS, “Internet of Things in 2020”, 2008).

...is the combination of distributed information processing, pervasive wireless networking and automatic identification, deployed inexpensively and widely. [...] In other words, the Internet of Things turns physical actions into knowledge in the cloud and knowledge in the cloud into physical action in a way that's never existed before.

(The Internet of People: Integrating IoT technologies is not a technical problem - Mike Kuniavsky)





IoT-A
Internet of Things - Architecture



“the interoperability of solutions at the communication level, as well as at the service level, has to be ensured across various platforms.”

INTRANet of Things



INTERNet of Things

Reference Model

Domain
Model

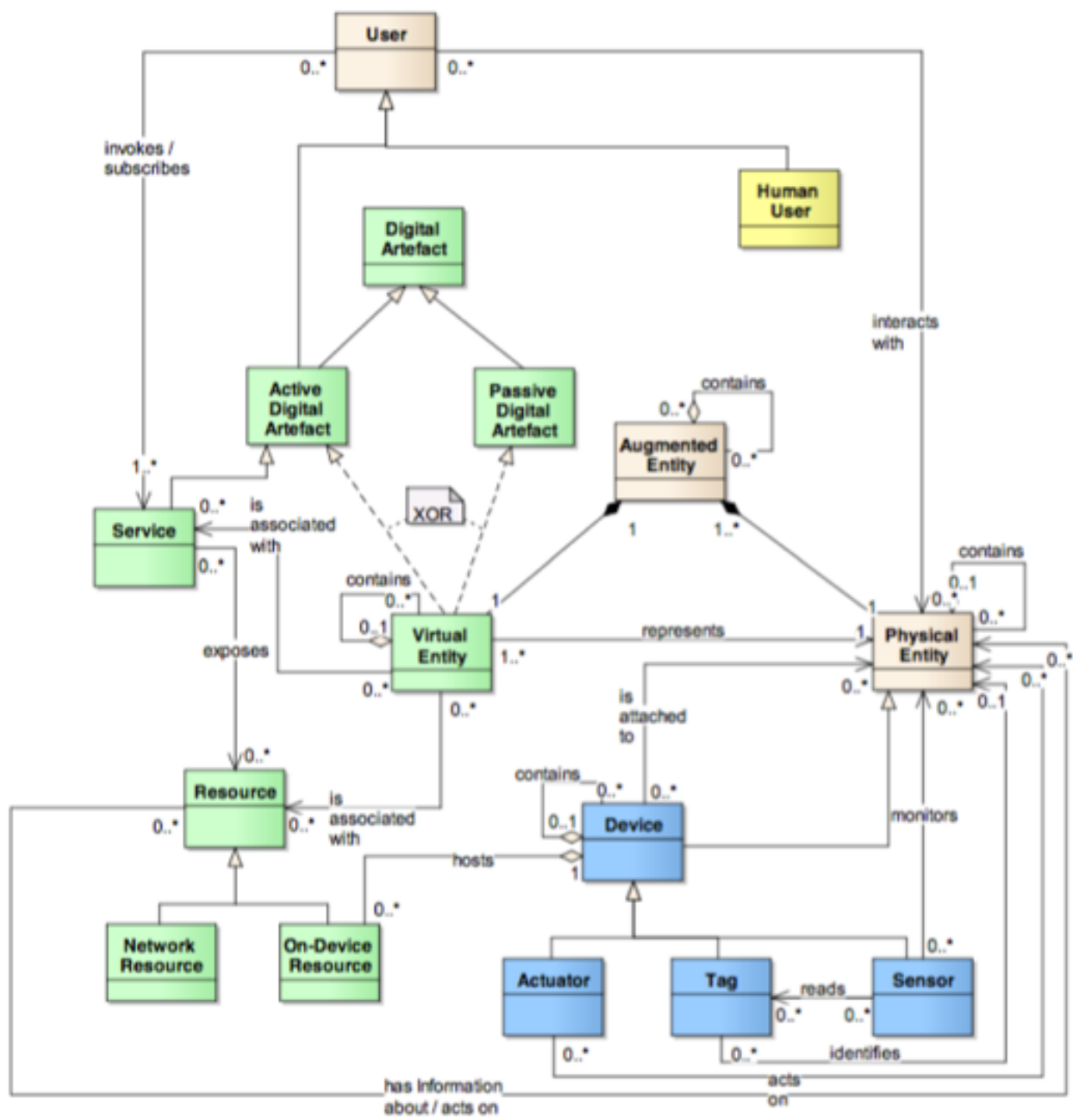
Functional
model

Reference
Architecture



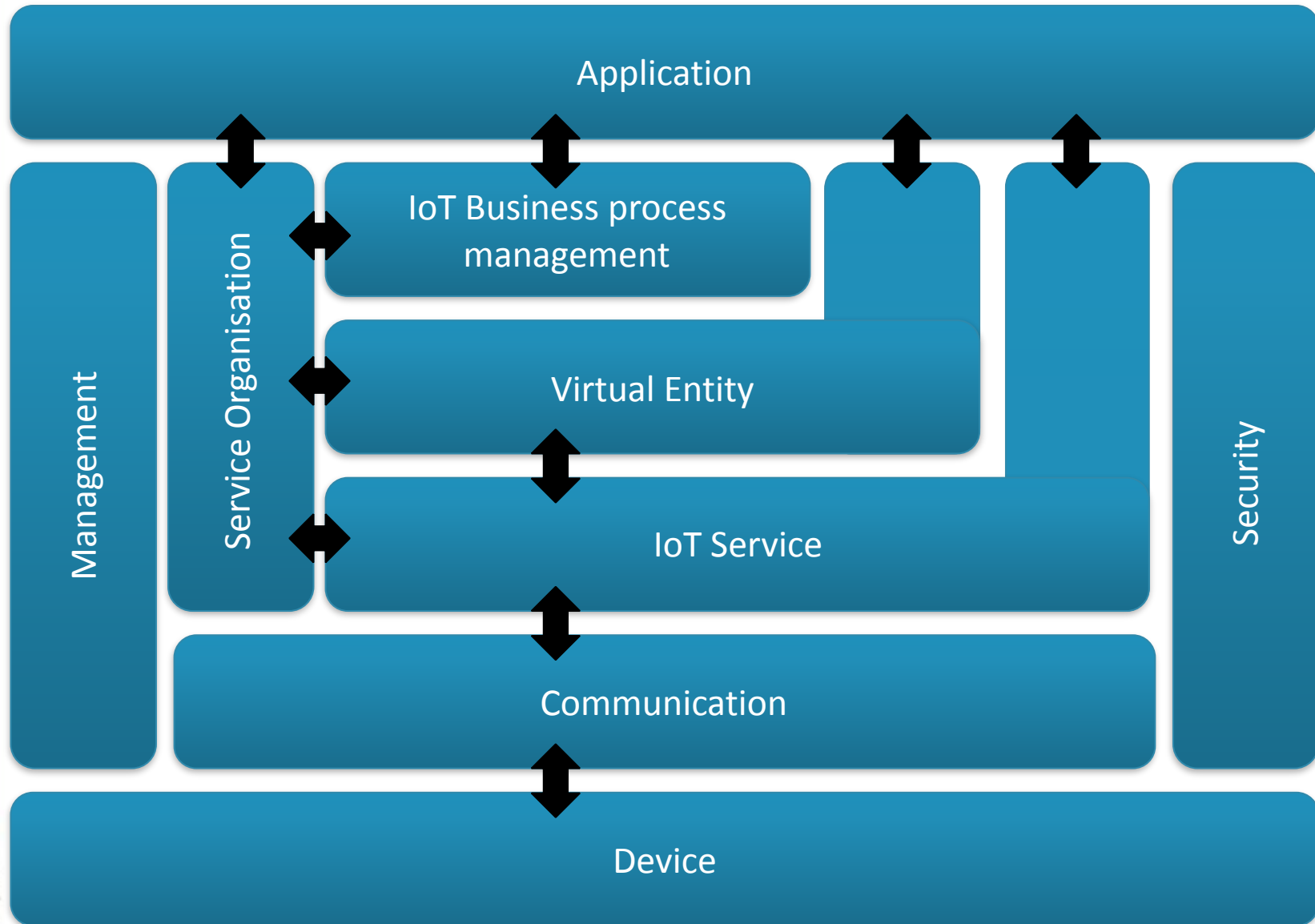


IoT-A Domain Model





IoT-A: Functional Model

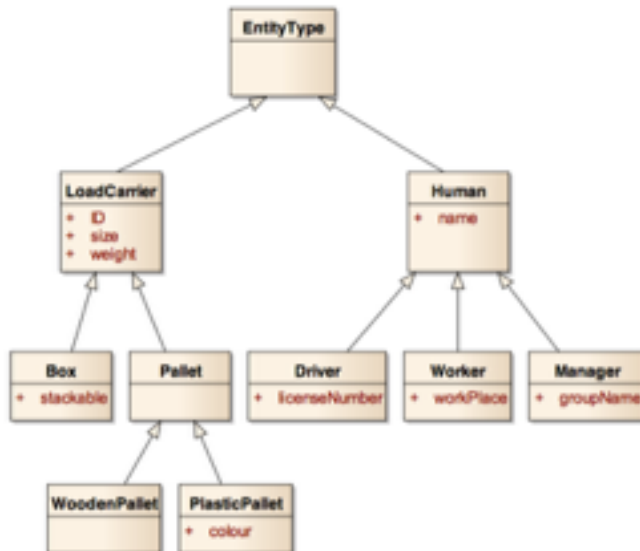


Reference Architecture

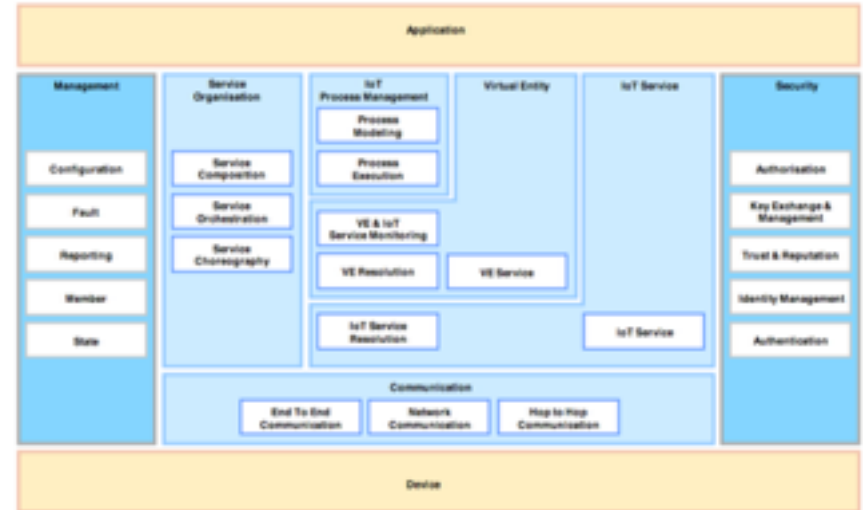
DEFINE:

- Functional elements;
- Interactions of said elements;
- Information management;
- Operational features;
- Deployment of the system;

Information View-Point



Functional View-Point



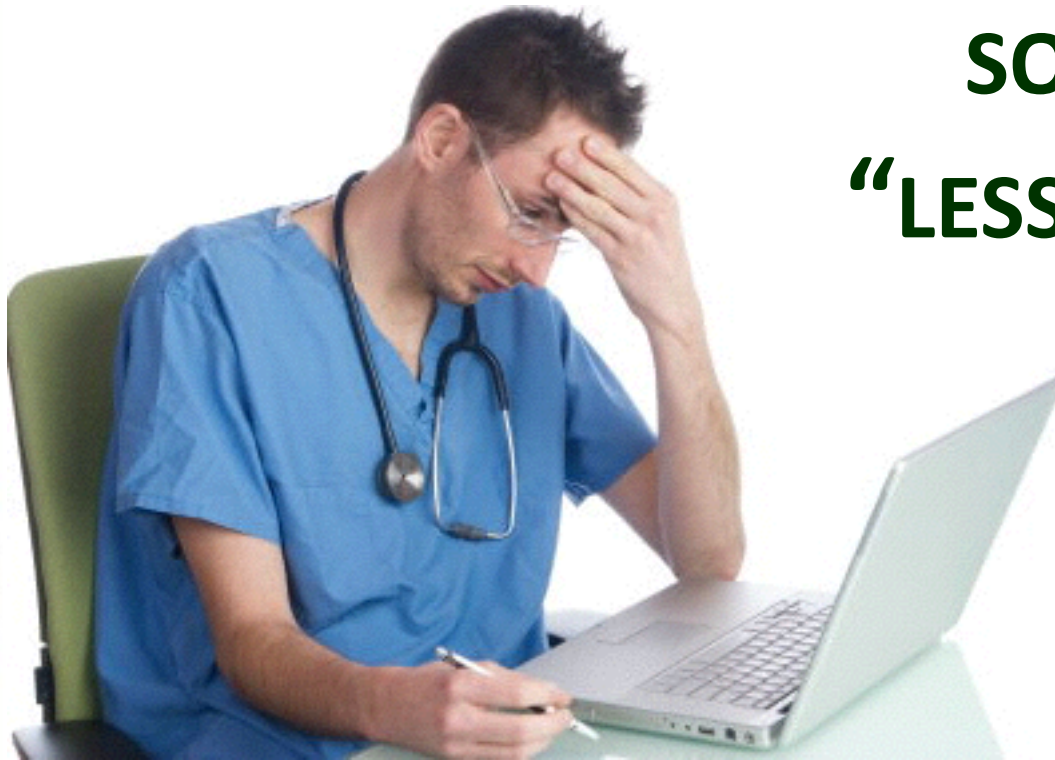
Deployment View-Point



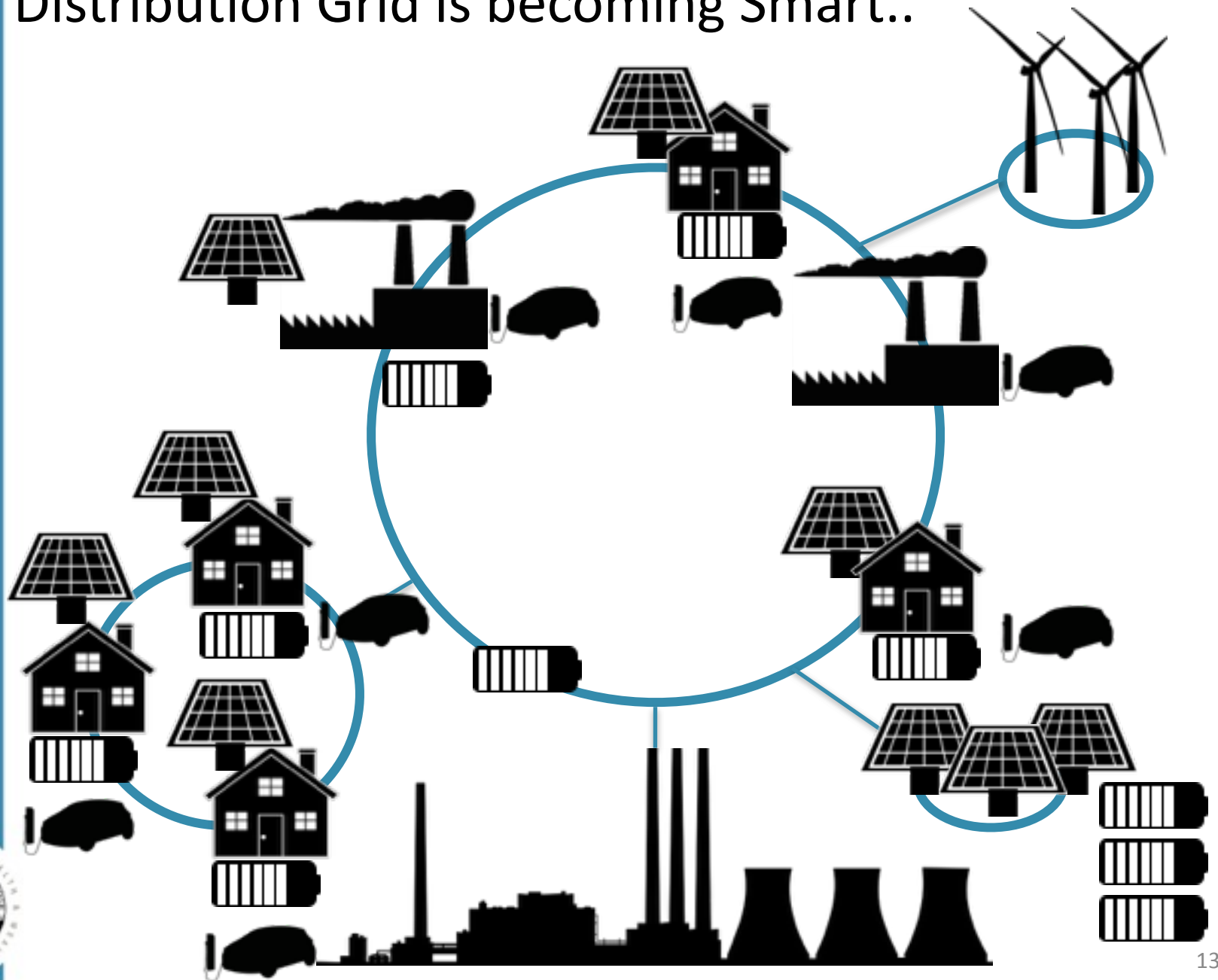
DOES THIS STUFF WORK?

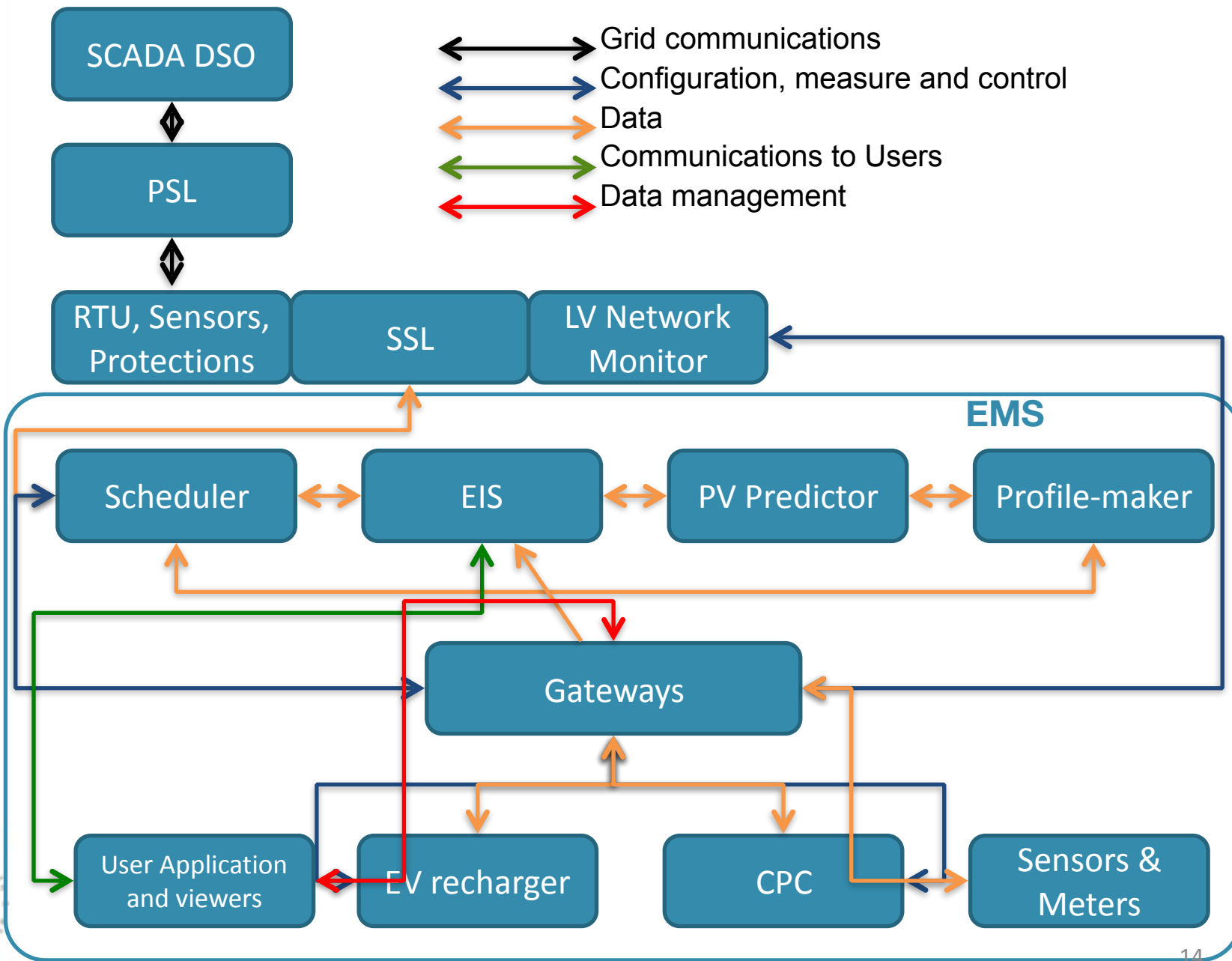
Before we try to kill someone in
hospitals...

LET US TRY ON
SOMETHING
“LESS” CRITICAL...

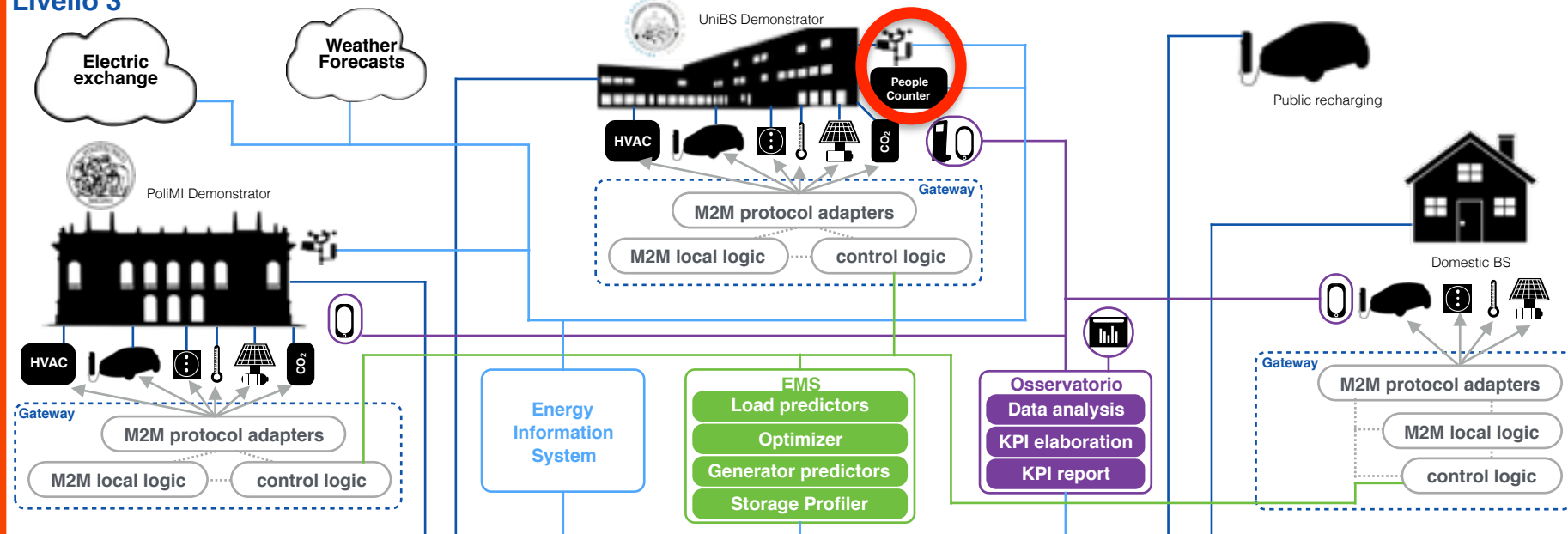


Distribution Grid is becoming Smart..





Livello 3



Livello 2



Livello 1

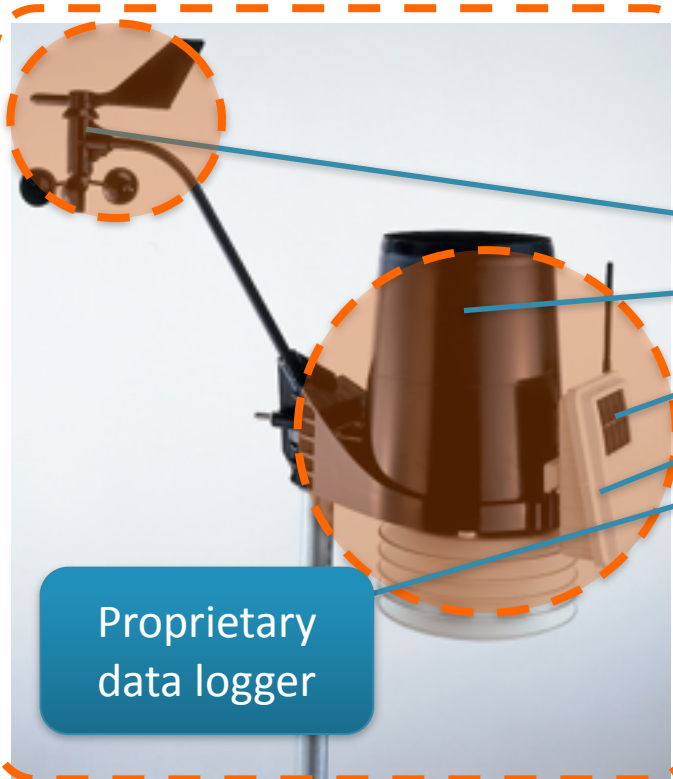


Livello 0





Weather station



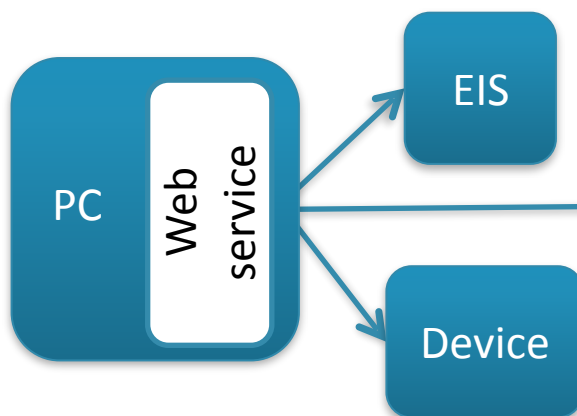
Physical Entity

Devices

- Wind
- Rain
- Solar radiation
- Temperature
- Proprietary data logger

Resources

measure of every sensor



Virtual Entity

- station location
- Sensors id, type

Digital Artefact

Human



1st International Forum on Research and Technologies for Society and Industry

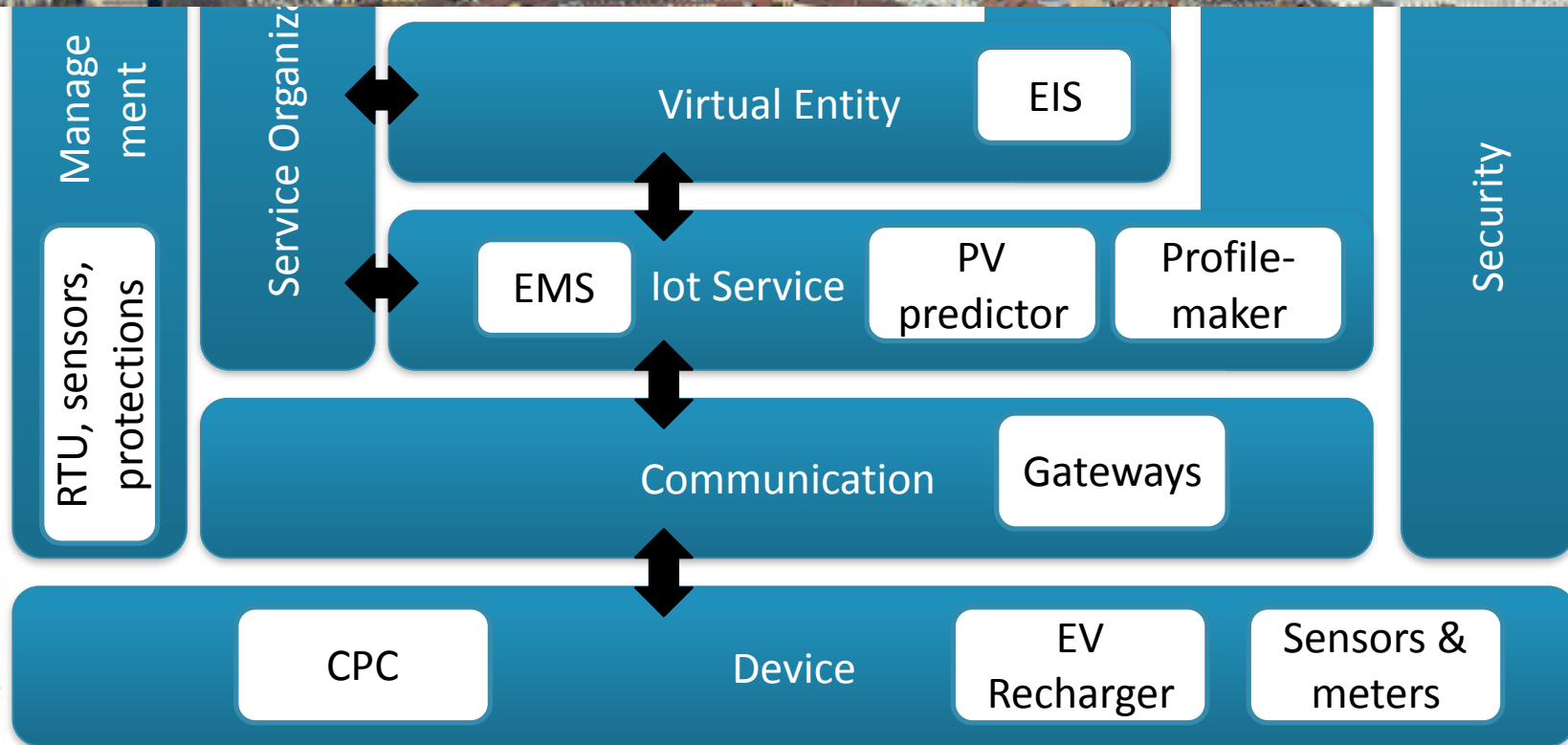
Leveraging a better tomorrow

Torino, Italy, 16-18 Sep. 2015

Organized by the IEEE Italy Section and Politecnico di Torino, Italy

Adopting IoT Framework for Energy Management of Smart Building: A Real Test- Case

Paolo Bellagente, Paolo Ferrari, Alessandra Flammini, Stefano Rinaldi





eLUX
energy
Laboratory
as University
eXpo

COMING SOON... STAY TUNED...

<http://lux.unibs.it>

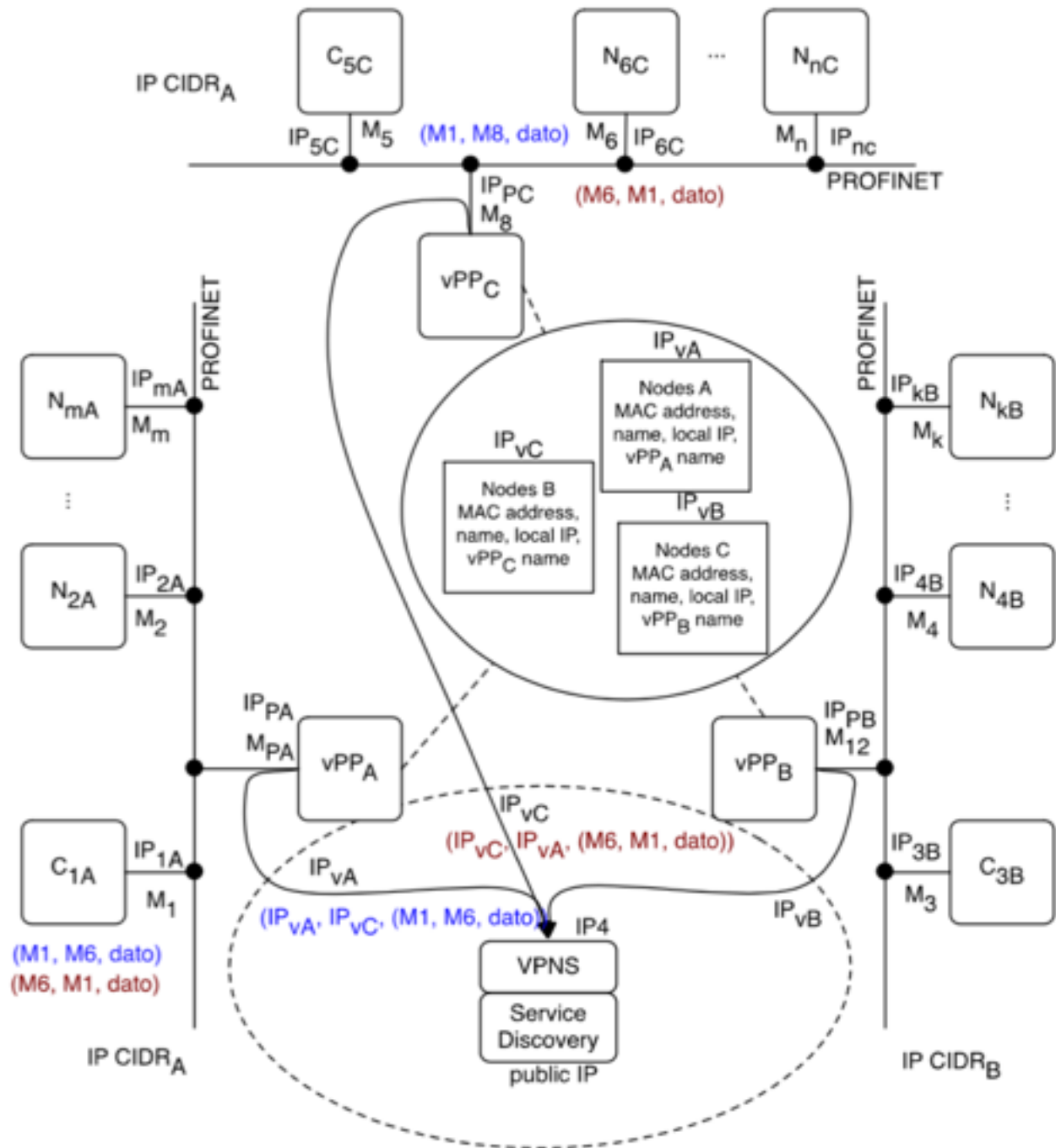


GOOD, BUT YOU SPEAK ABOUT 15MIN TIMESLOT... HOW IS IT FAST?

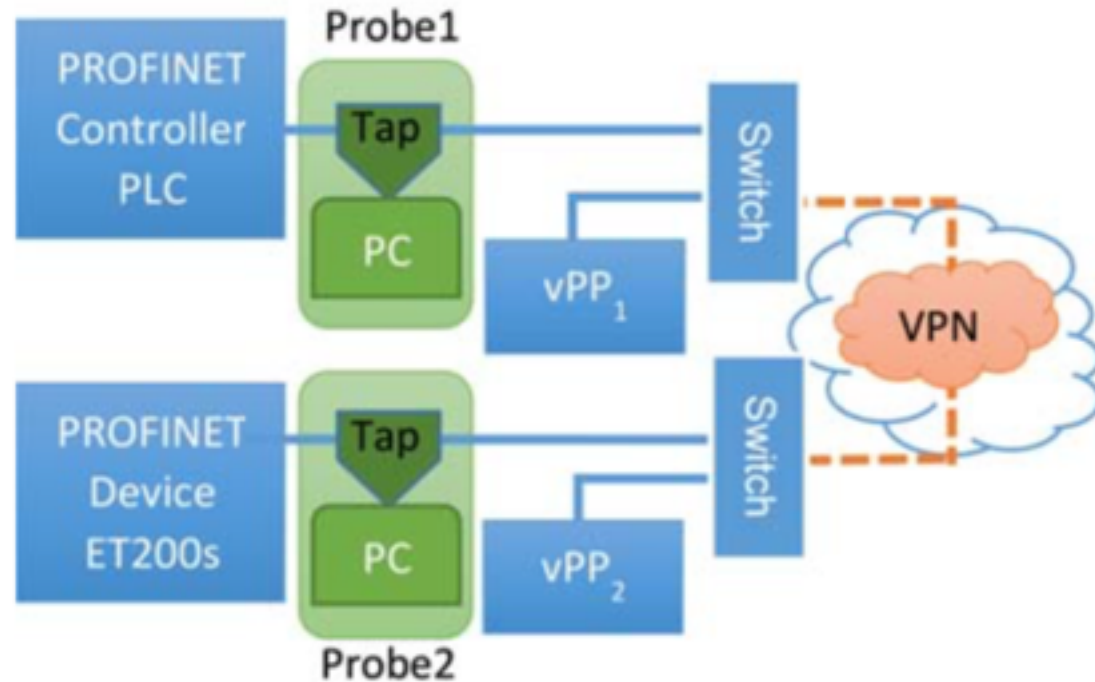
You know time is somehow "vital" in
hospitals...

LET US TRY ON
SOMETHING
INDUSTRIAL...
THEY USE
TO GO FAST!





vProfinet Test transfer time



Cycle time (ms)	Dir.	Transfer time (ms)					
		<i>Mean</i>	<i>Std.Dev</i>	<i>Mode</i>	<i>Min</i>	<i>99 percentile</i>	<i>Max</i>
128	PLC →	44.7	16	41	9	81	466
256		42.1	14	38	10	78	618
512		41.8	12	33	9	74	478
128	PLC ←	45.8	10	42	10	79	315
256		43.8	14	42	10	72	722
512		44.0	12	38	10	72	514





Enabling PROFINET devices to work in IoT: characterization and requirements

Paolo Bellagente, Paolo Ferrari, Alessandra Flammini, Stefano Rinaldi, Emiliano Sisinni
University of Brescia



Message-oriented Middleware for M-health IoT

Simulato su
Raspberry pi

ISO/IEEE 11073

Simulato su
Raspberry pi

**M³IoT - Message-oriented Middleware for M-health
Internet of Things: design and validation**

Paolo Bellagente, Alessandra Flammini, Emiliano Sisinni
Dept. of Information Engineering
University of Brescia
Brescia, Italy
{p.bellagente, alessandra.flammini, emiliano.sisinni}@unibs.it

Cal

HTTP

Manager

msc
RabbitMQ



GREAT!! LET'S PLAY NOW!

Even though it seems it will cost us
millions of euros in managing,
networking, new had-hoc digital stuff...





Project SAndroidE (Sensors for Android Embedded)

Using external devices as they were embedded



[Project](#) [Targets](#) [Progress](#) [Tutorial](#) [Applications](#) [News](#) [Downloads](#)

Quick access

- SAndroidE presentation and roadmap
- Download framework (alpha version)
- Video tutorial on the framework use



SAndroidE

(Sensors for Android Embedded)

A free framework allowing external devices to be managed in Android

Contacts

Prof.ssa Alessandra Flammini
University of Brescia
Dept. of Information Engineering
Via Branze 38
25123, Brescia, ITALY
☎ +39-030-371-5627
✉ +39-030-380014
✉ alessandra.flammini@unibs.it
🌐 es3.unibs.it

Last update

31/05/2016, see News



HW&FW Developers

Let the Developers easily share their creations to App Developers, just by a well-defined description file.



App Developers

Let the Developers easily handle in their projects external resources without worrying about the communication level or the HW composition.



End Users

Let the users purchase SAndroidE-compliant remote nodes, install appropriate Apps and easily set up a sensor/actuator system, without using a PC.

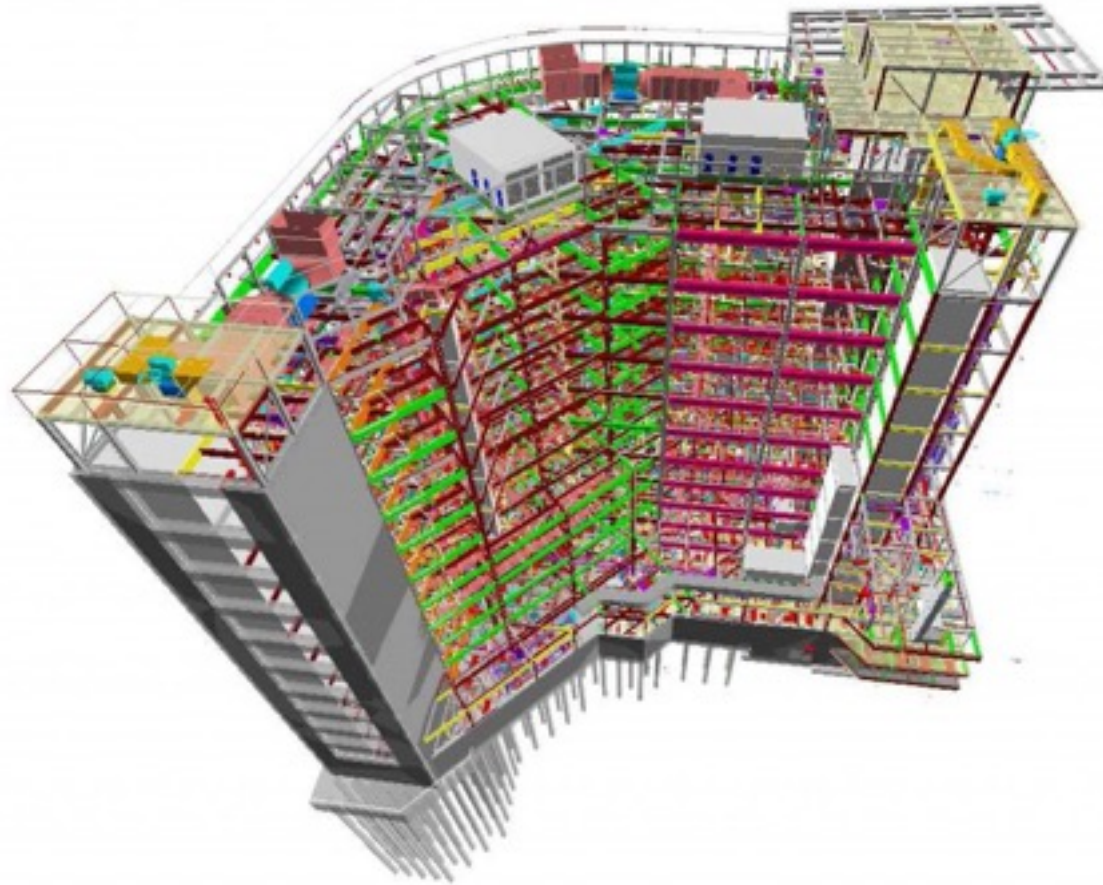


<http://es3.unibs.it/SAndroidE>



Next step: the cognitive building

Move the BIM from design to management



Enhance the performances of hospitals through
simulation and Building Automation

Let me say many thanks to:



Prof. Alessandra Flammini



Prof. Paolo Ferrari, PhD



Prof. Emiliano Sisinni, PhD



Eng. Stefano Rinaldi, PhD



Eng. Angelo Vezzoli, PhD

DII ES³





Thanks for your attention, any questions?

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p.bellagente@unibs.it

