Flavio Cirillo

Tutor: Prof. Simon Pietro Romano

XXXIII Cycle - I year presentation

De-centralization of IoT Platforms:

Federation, Scalability,

Security, Privacy

Background

❖ Master degree in Computer Engineering from University of Naples „Federico II", May 2014

❖ PhD cycle within the COMICS group of DIETI with no granted research fellowship

❖ Collaborations:
  ❖ University of Naples „Federico II", DIETI
    ❖ Prof. Simon Pietro Romano
  ❖ NEC Laboratories Europe:
    ❖ Dr. Gurkan Solmaz, Dr. Ernoe Kovacs, Dr. Vincenzo Sciancalepore, Dr. Martin Bauer, Dr. Everton Berz Luiz
  ❖ Technical University of Dortmund
    ❖ Dr. Fang-Jing Wu
  ❖ University of Cantabria
    ❖ Prof. Luis Sanchez, Dr. Jorge Lanza, Dr. Ignacio Elicegui Maestro, Dr. Luis Diez
  ❖ Atos Research & Innovation (ARI) Internet of Everything Lab
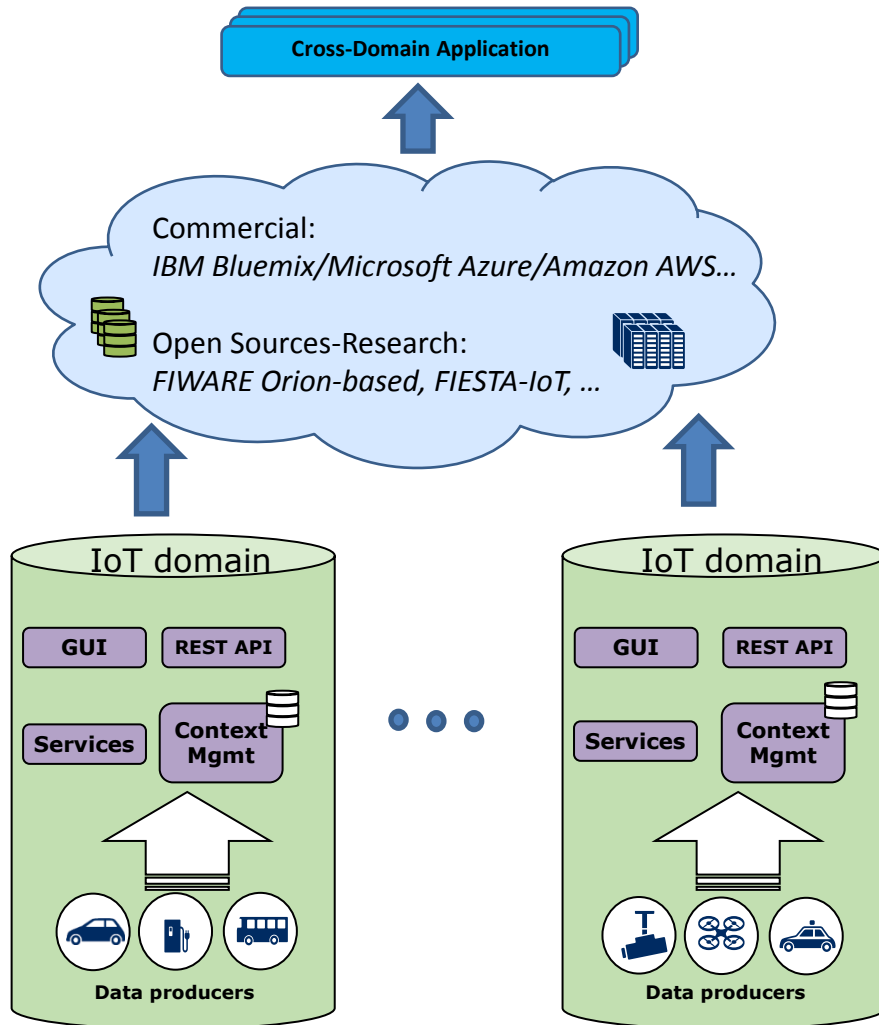   ❖ Jose Gato, Dr. David Fernandez Gomez

Research background: Evolution of Internet of Things
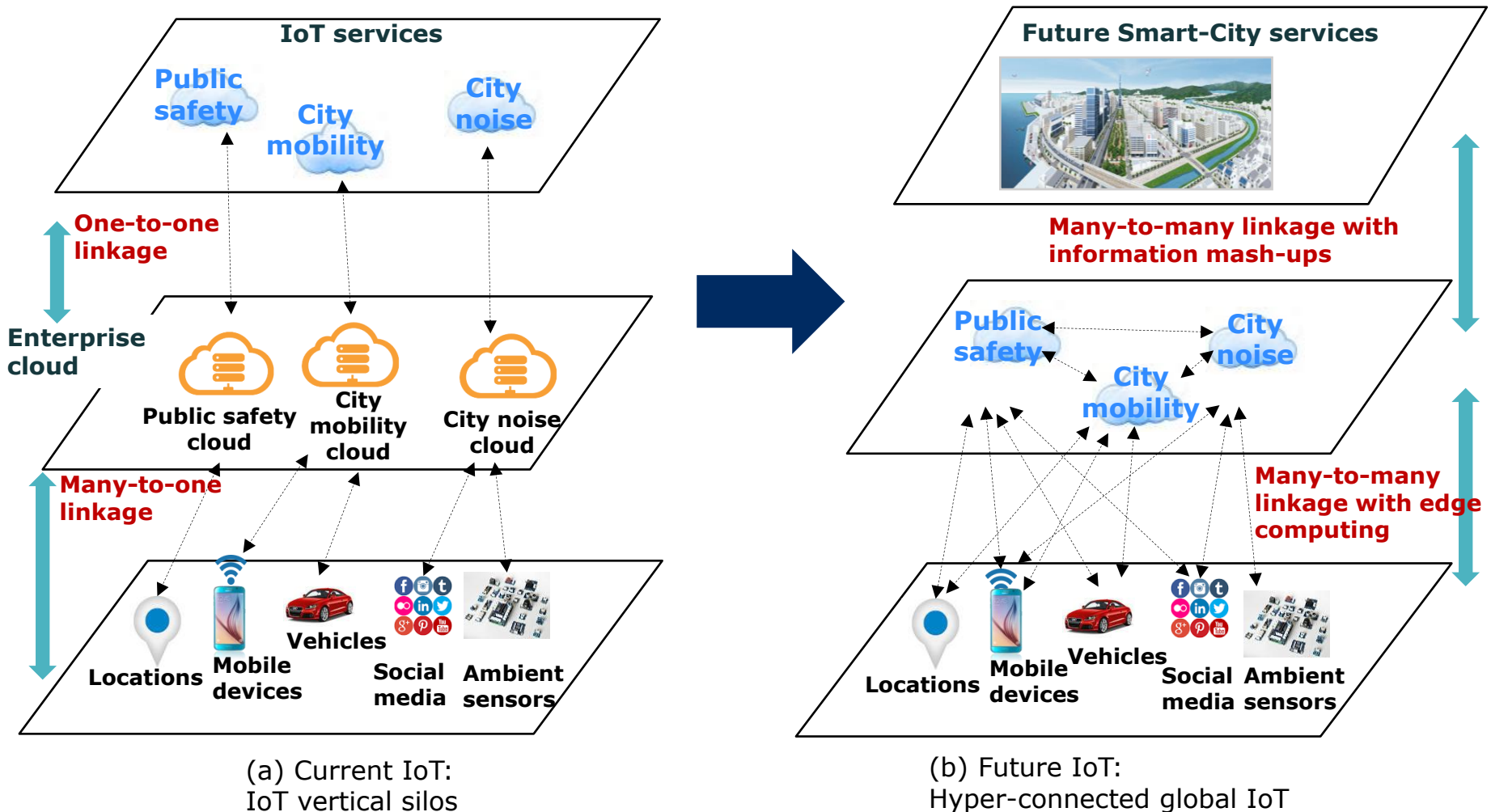
(a) Current IoT: IoT vertical silos

(b) Future IoT: Hyper-connected global IoT

Hyper-connecting IoT with centralized approach

Cross-Domain Application

Commercial:
IBM Bluemix/Microsoft Azure/Amazon AWS…

Open Sources-Research:
FIWARE Orion-based, FIESTA-IoT, …

IoT domain

GUI REST API

Services Context Mgmt

IoT domain

GUI REST API

Services Context Mgmt

Data producers

- ■ **Pro:**
  - Easy to implement
  - Store data into a cloud
  - Single contact point
  - Inherited cloud advantages:
    - Scalability on demand
   - Reliability
    - Marketplace readiness
   - …

- ■ **Cons**:
  - Creation of bigger IoT vertical silos
  - Vendor-lockin
  - Privacy: IoT providers lose control over the data
    - Companies are reluctant to give away their data (considered as a valuable asset)
    - Regulation issues (e.g. GDPR). Smart city projects typically deal only with not sensitive data (e.g. parking, lights, waste)

Hyper-connecting IoT with de-centralized approach
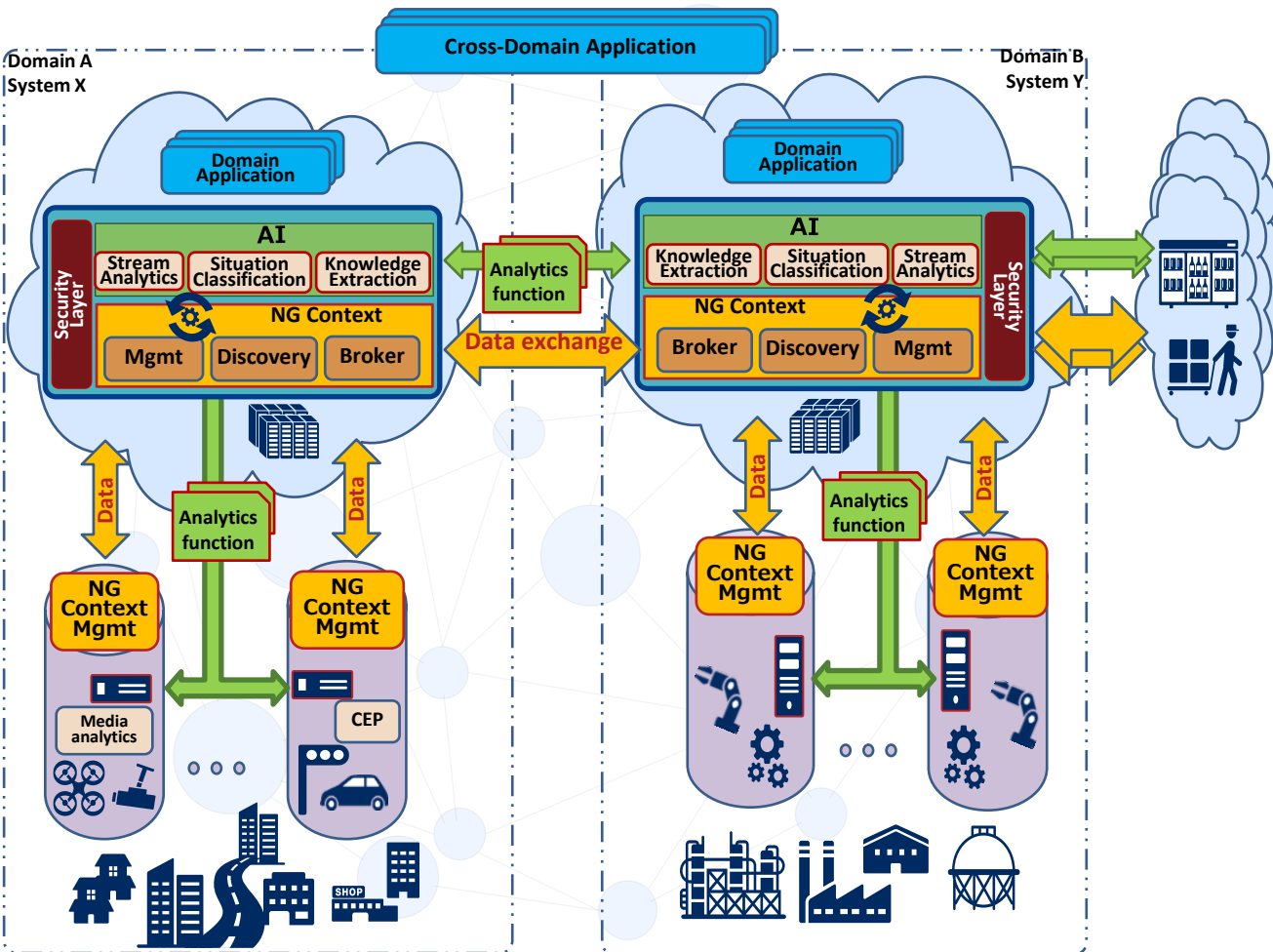
- **Federation**
 - Built on top of already existing platforms

- **Data Sovereignty**
  - Leaving data control into the hands of the data owner
  - E.g. Hospitals, Police dpt.
  - E.g. Industrial companies

- **Distributed knowledge**
  - Linked data graph distributed among domains

- **Dynamic data analytics allocation**
  - Data can be analyzed at the data owner premises

Results: Minimal overhead
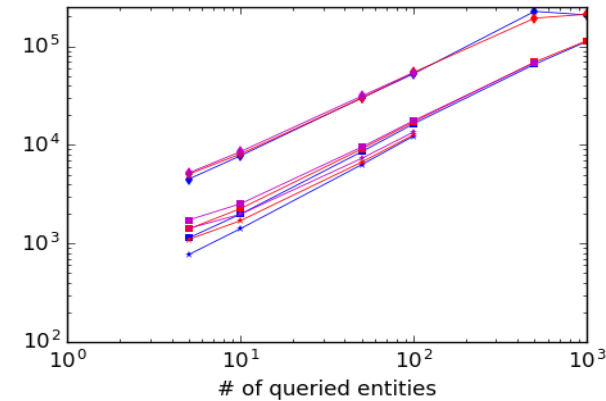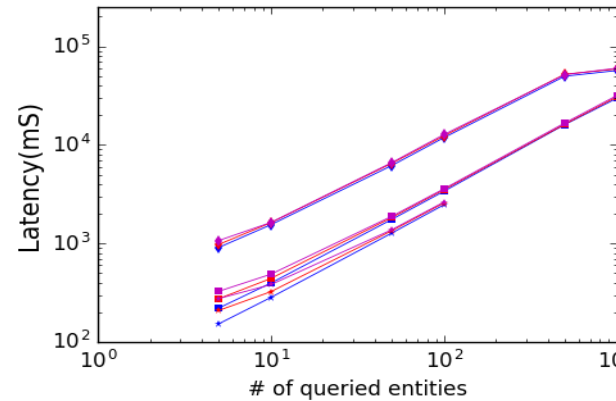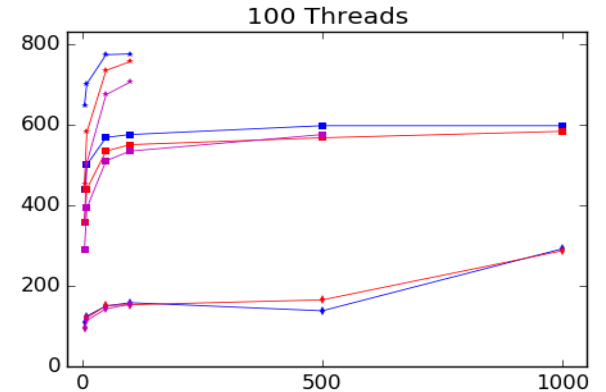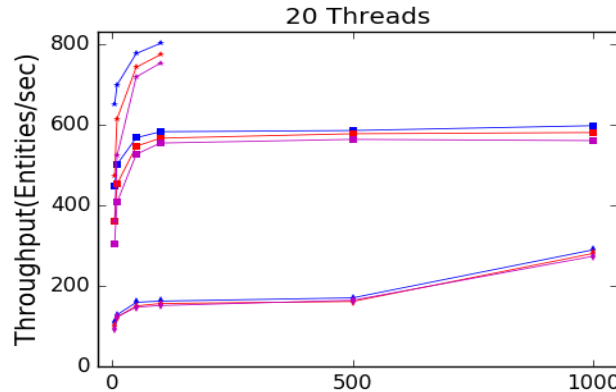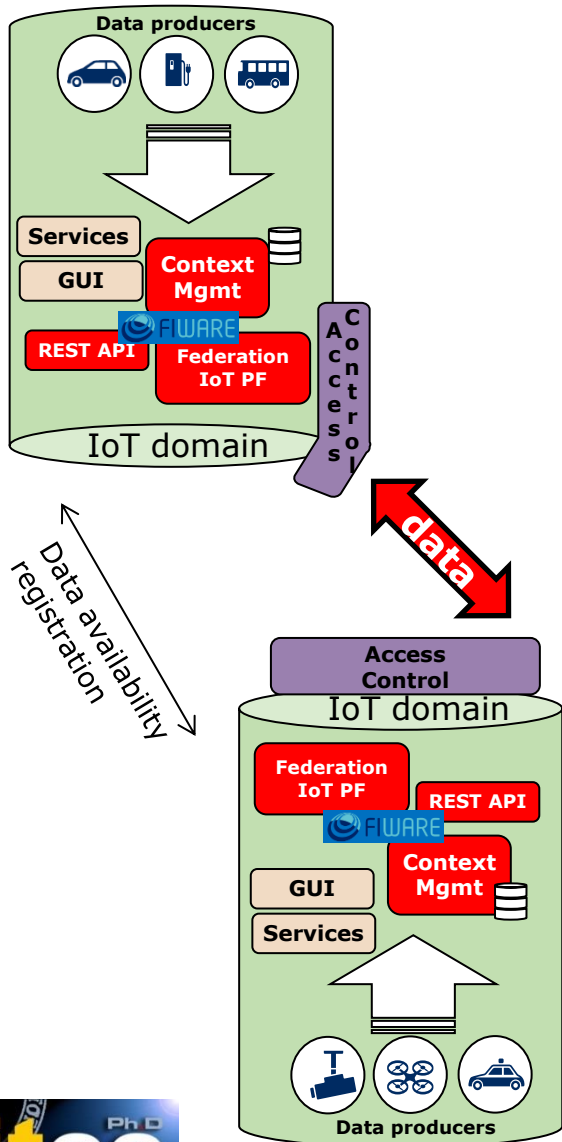
Results: Improved scalability

Throughput Plot / Latency Plot
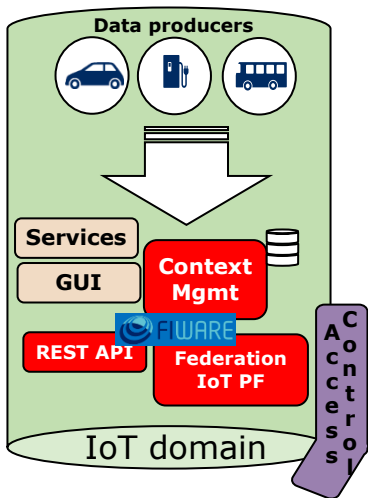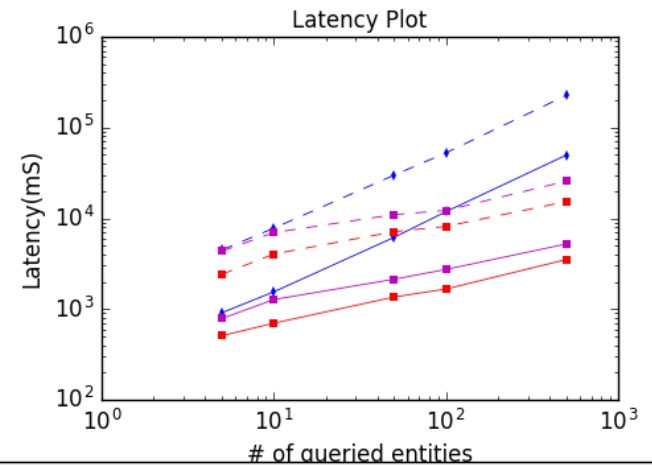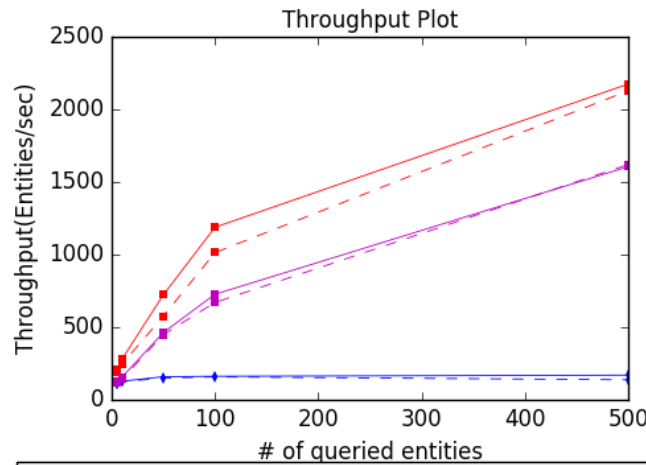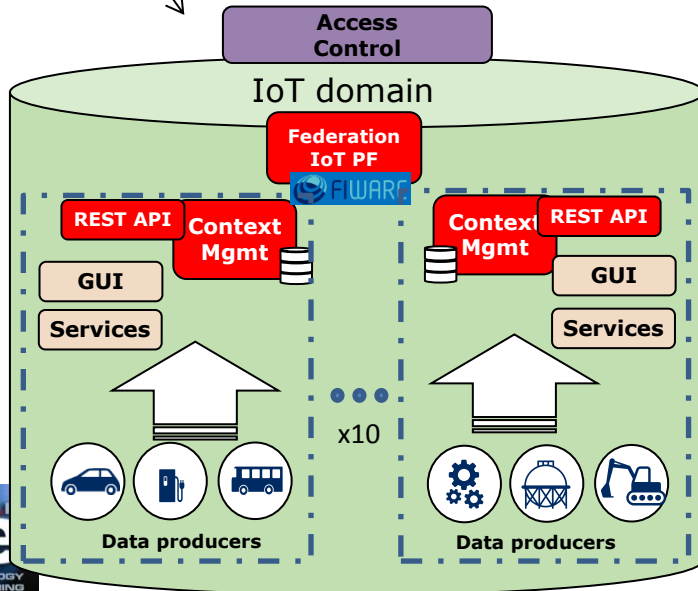
Legend:
- Orion,10k Entities,20 Threads
- Orion,10k Entities,100 Threads
- FedNoSec,10 Orion, 1k EntitiesEach, 20 Threads
- FedNoSec,10 Orion, 1k EntitiesEach,100 Threads
- FedSec,10 Orion,1k EntitiesEach,20 Threads
- FedSec,10 Orion,1k EntitiesEach,100 Threads

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7

Products:
Publications

- Published
  - [Journal] J. Lanza, L. Sánchez, J. R. Santana, R. Agarwal, N. Kefalakis, P. Grace, T. Elsaleh, M. Zhao, E. Tragos, H. Nguyen, **F. Cirillo**, R. Steinke and J. Soldatos , "*Experimentation as a Service Over Semantically Interoperable Internet of Things Testbeds*," in *IEEE Access*

- Final Proofreading
  - [Journal] G. Solmaz, F-J. Wu, **F. Cirillo**, E. Kovacs, J.R. Santana, L. Sánchez, P. Sotres and L. Munoz. "*Towards Understanding Crowd Mobility in Smart Cities through Internet of Things*". IEEE Communications Magazine.

- Under minor revision
  - [Journal] L. Zanzi, **F. Cirillo**, S. Mangiante, V. Sciancalepore, F. Giust, X Costa-Perez and G. Klas, "*Evolving Multi-Access Edge Computing to support enhanced IoT deployments*", IEEE Communications Standards Magazine
  - [Journal] **F. Cirillo**, F-J. Wu, G. Solmaz and E. Kovacs, *"Embracing the Future Internet of Things"*, MDPI Sensors Journal

- Submitted (under review)
  - [Journal] **F. Cirillo**, E. L. Berz, G. Solmaz, M. Bauer and E. Kovacs. "*A Standard-based Open Source IoT Platform: FIWARE*", IEEE Internet of Things Magazine (IoTM)
  - [Conference] **F. Cirillo**, N. Capuano, E. Kovacs and S.P. Romano, "*Standard-based Transparent Privacy-safe Federation of Secured IoT Platforms: a Scalable approach*", IEEE International Conference on Communications (ICC) 2019

Products: Planned

Publications

- Under preparation
  - [Conference] **F. Cirillo,** D. Straeten, D. Gomez Fernandez, J. Gato, I. Elicegui Maestro, L. Diez, R. Akhavan, "Atomic Services: co-creating smart city services" (tentative), IEEE Global IoT Summit (GIoTS) 2019
  - [Conference] **F. Cirillo**, N. Capuano, E. Kovacs and S.P. Romano, "IoT Registrar: Privacy-preserving system for IoT discovery" (tentative). (venue to be decided)

Next years

	Credits year 1								Credits year 2								Credits year 3									
	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Total	Check
Modules	15					6	6	12	18							0	0							0	12	30-70
Seminars	3	0,6	0,3	0,2	1,6			2,7	5							0	5							0	2,7	10-30
Research	42	4	4	10	7	13	8	46	37							0	55							0	53	80-140
	60	4,6	4,3	10,2	8,6	19	14	60,7	60	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	68	180

- Objectives
  - Data usage control in federation of IoT platforms
  - Federation of IoT stream analytics framework
    - horizontally across domains
    - vertically across edge and cloud

Thank you