

Electric  
Mobility



# “eMotion in Smart Cities”

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## Technology overview in M2M application scenarios: from satellite to domotics

Rosalba Suffritti, Matteo Collina,  
Alessandro Vanelli Coralli, Giovanni Emanuele Corazza  
University of Bologna, Italy



A woman in silhouette stands on a train platform, reading a newspaper. The background is a blurred train with horizontal streaks of light, suggesting motion. The scene is lit with warm, golden light, possibly from the setting or rising sun. The woman is wearing a dark coat and has a bag slung over her shoulder. The overall mood is contemplative and busy.

How can we improve  
our quality of life?

A woman in silhouette is standing on a train platform, reading a newspaper. The background shows a blurred train with horizontal streaks of light, suggesting motion. The scene is lit with warm, golden light, possibly from the setting or rising sun.

## We need to take on...

- Societal Challenges
- Daily Challenges

# Societal Challenges

## ■ Pollution



# Societal Challenges

## ■ Energy consumption



# Societal Challenges

- Energy supply



# Societal Challenges

## ■ Natural disasters



# Daily Challenges

■ Will it rain?

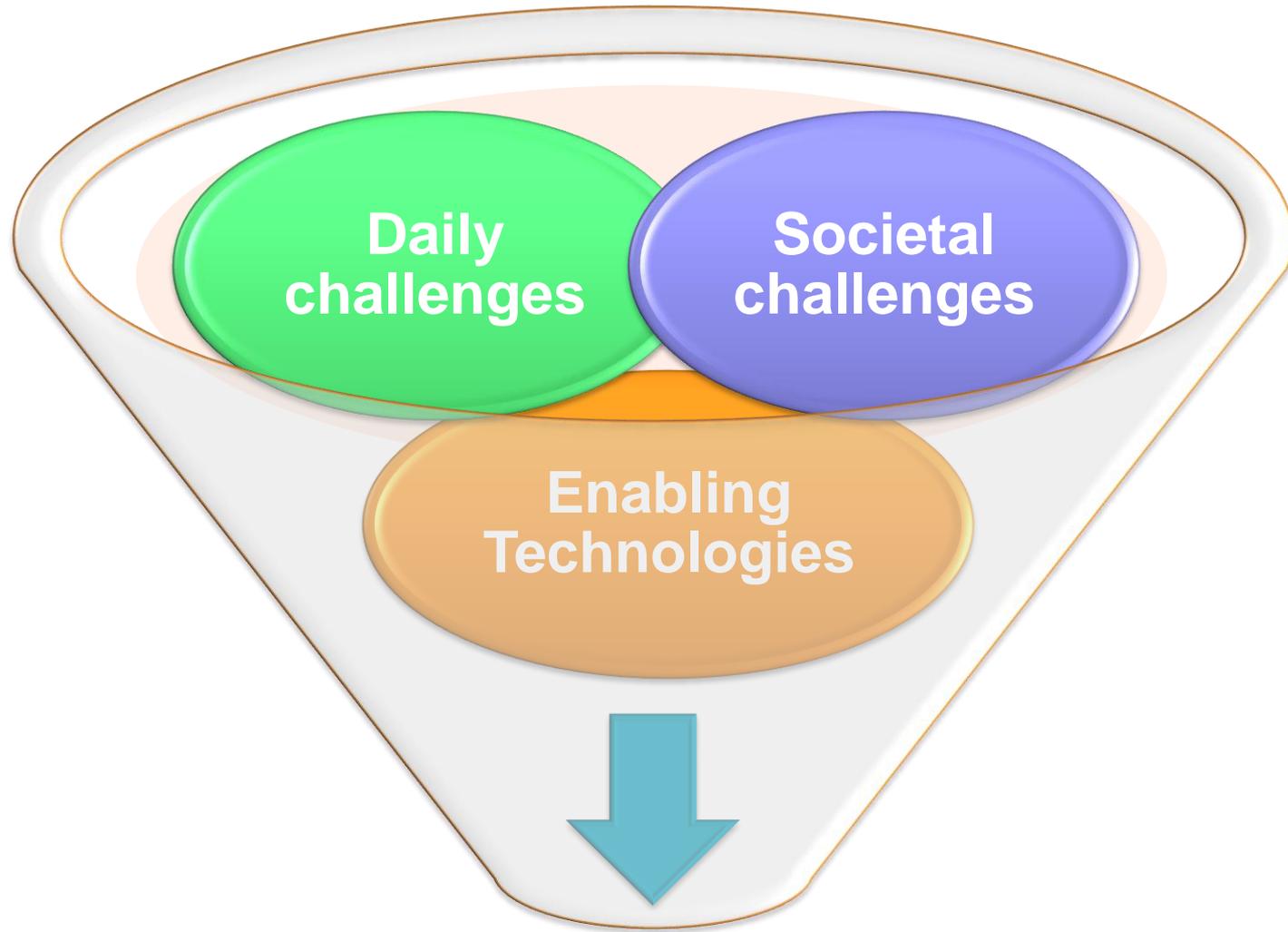


# Daily Challenges

- Can I save some money?



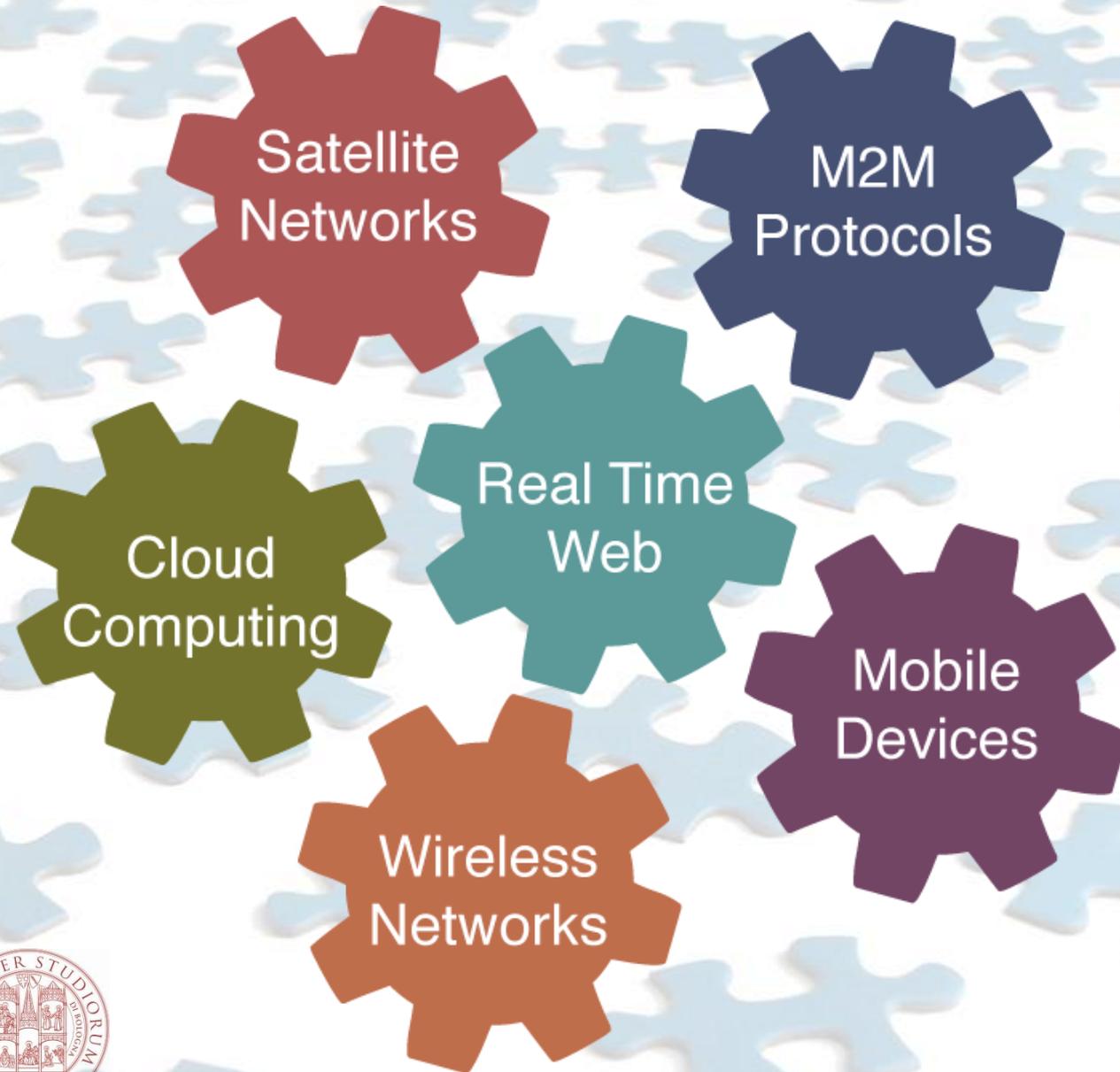
# Things need to talk each other...



**Global Smart Network**



# A wide range of smart technologies...



# Mobile devices

- Smartphones, tablets, e-readers are everywhere, still they cannot:
  - Locate themselves inside a building
    - without the usage of expensive setups (radio fingerprinting)
    - without telling everyone they are there (broadcast)
  - Interact with our environment (i.e. houses, public transportation, malls)
    - forward the sensors data in a privacy-safe manner (i.e. crowdsourced weather monitoring)
- Multi-sensors wearable devices:
  - to help elderly people
  - to boost athletes performance
  - to support workers in an emergency



# Real time Web...beyond Web 2.0

- The Web is built around syndication and HTTP is based on the request/response pattern.
- In order to blend the Web and the M2M world, the first must become real-time.
- An ongoing effort is done by the industrial and research communities to overcome this constraint:
  - WebSockets
  - Server-Sent Events
  - SPDY
  - HTTP 2.0



# Cloud computing for M2M

- **Centralized device management**
  - Billions of devices must be remotely organized to expose a comprehensive vision to the users.
  - In order to guarantee security and privacy, the provisioning of the devices should be done in the cloud.
- **Big data storage and analysis**
  - The huge amount of data coming from sensor networks must be stored and subsequently analyzed.
- **Real-Time data Analysis**
  - There are several softwares focused on real-time processing (e.g., Storm) but consolidated solutions are still missing.



# Wireless networks

- M2M communications market is largely dominated by terrestrial wireless and mobile networks.
  - Cellular Networks (2G/3G/4G networks)
    - Long range
    - High speed
    - Low latency
    - Access and backhaul capabilities
  - Wi-Fi, ZigBee, Femto-cells, etc.
    - Short range
    - Low power
    - Low throughput
  - A combination of both technologies is required.
    - Real-time tracking
    - Remote monitoring
    - Smart metering



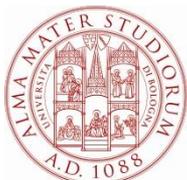
# Satellite networks

- Satellite networks represent the ideal complement to 2G/3G/4G wireless terrestrial networks.
  - Satellite M2M represents 2% in volume (6% in revenues) of the overall M2M market and it is developing faster.
- Satellite networks can offer:
  - truly worldwide coverage even in very remote areas
  - high scalability to expand the system as data traffic grows
  - high security in data communication
  - high resilience even in case of natural or man-made disasters
  - cost effectiveness even across national borders
- Satellite networks can be suitable for M2M services mostly based on the transmission of short messages from/to remote sensors or mobile devices.



# Candidate air interface for M2M

- S-MIM (S-Band Mobile Interactive Multimedia) air interface standardized within ETSI SES SCN as TS 102721 (12/2011).
- Integrated satellite/terrestrial mobile system operating in S Band with GEO satellite.
- Services/Applications:
  - Two-way real-time services to end-users
    - Public safety and emergency services (eCall)
  - Data acquisition
    - Environmental monitoring
    - Traffic monitoring
  - Interactive broadcast/multicast
    - Interactive streaming
    - Interactive data distribution



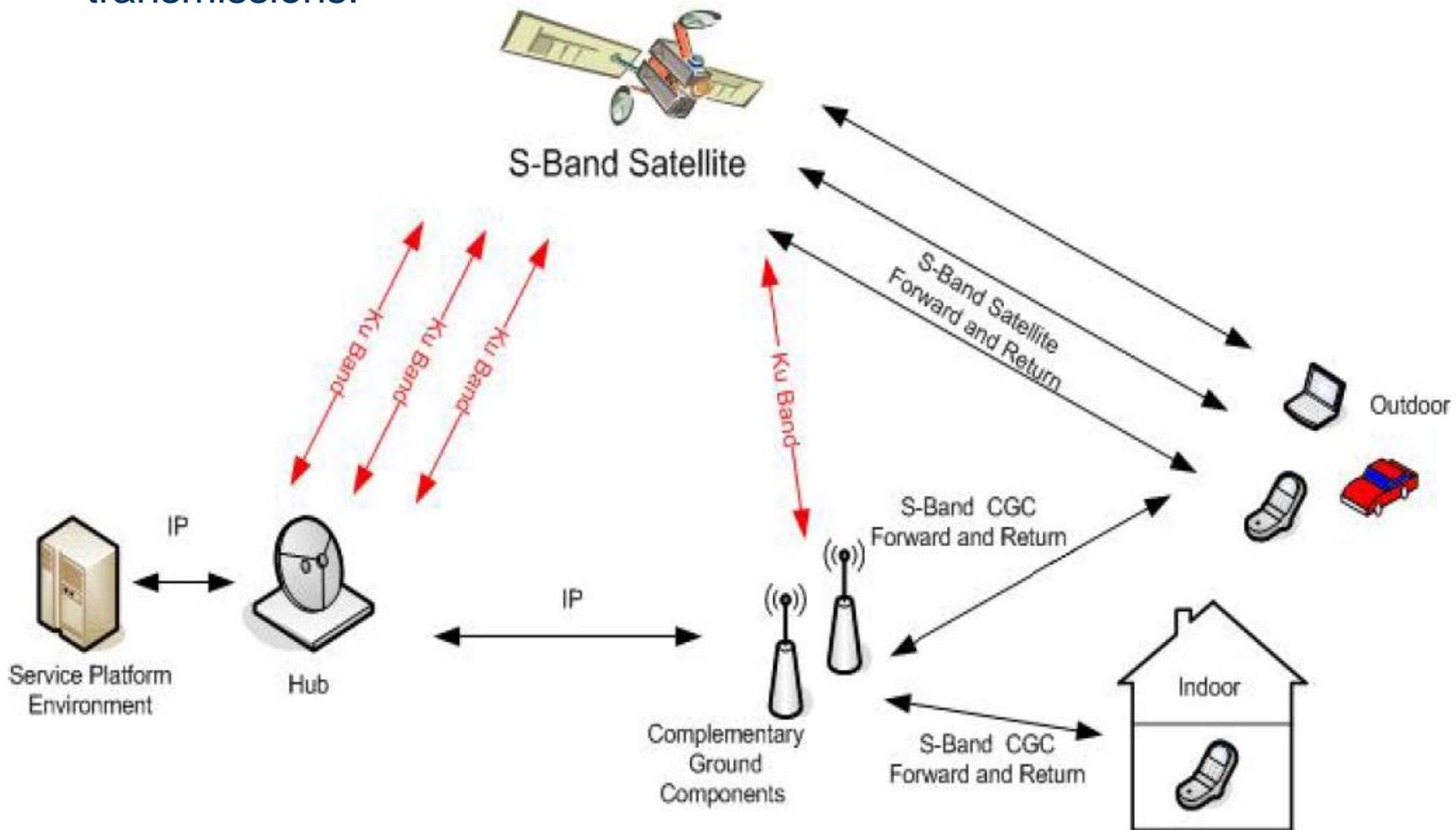
# Candidate air interface for M2M

- Low cost, bandwidth and power efficient solution to send short messages:
  - Modest power requirements on the terminal side (0 dBW EIRP)
  - Widely reuse of 3GPP Wideband Code Division Multiple Access (W-CDMA) technology properly adapted to the new requirements.
  - Optimised for S-band (2 GHz) MSS allocation.
  - Asynchronous access: Enhanced Spread Spectrum Aloha Random Access (E-SSA) scheme in the RTN link (ESA patent).
  - Encapsulation/Fragmentation to transport IP over the air interface based on Return Link Encapsulation.
- Adaptation to higher frequency bands (Ku/Ka bands)
  - Spectrum availability
  - Higher supported bit rate



# Candidate air interface for M2M

- Satellite component may be complemented by terrestrial Complementary Ground Components (CGCs) to provide enhanced terrestrial coverage and capacity.
  - The same air interface for the RL satellite as well as UL terrestrial transmissions.



# Next Steps

## ■ We need...

- stronger effort from academic and industrial communities
  - interdisciplinary actions
  - elaboration on a comprehensive vision
  - definition of best practices
- new flexible and secure communication protocols
- new high data volume management methods
- new regulations
  - Data and network access
  - Data privacy
  - Interference management



# Thank you!

## Contacts:

Rosalba Suffritti  
University of Bologna  
Email: [rosalba.suffritti@unibo.it](mailto:rosalba.suffritti@unibo.it)

Matteo Collina  
University of Bologna  
Email: [matteo.collina2@unibo.it](mailto:matteo.collina2@unibo.it)



# References

- ETSI TS 102 721-1: “Satellite Earth Stations and Systems; Air Interface for S-band Mobile Interactive Multimedia (S-MIM); Part 1: General System Architecture and Configurations”.
- ETSI TS 102 721-3: “Satellite Earth Stations and Systems; Air Interface for S-band Mobile Interactive Multimedia (S-MIM); Part 3: Physical Layer Specification, Return Link Asynchronous Access”.
- S. Scalise, “S-MIM: a Novel Radio Interface for Efficient Messaging Services over Satellite”, 6<sup>th</sup> ASMS Conference/12<sup>th</sup> SPSC Workshop, September 2012, Baiona, Spain.

