M2M Communications via XMPP

Near real time messaging in a federated world

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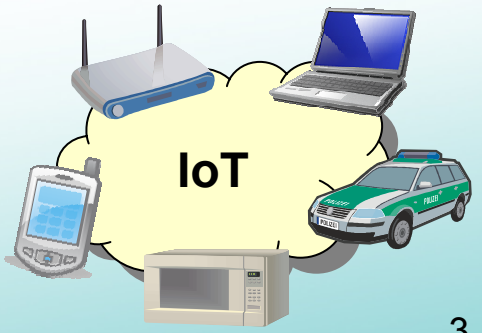
M2M Workshop

Outline

- Introduction
  - M2M: problem definition
  - Overlay networks
- XMPP
  - XMPP as overlay network
  - Virtual Identities
  - XMPP Standardization process
  - Software status, adopters
  - Web services over XMPP
- Mobile / Wireless support
  - Connection managers
  - Gateways
- Advanced Messaging Patterns
  - Pubsub
- Future research / standardization area

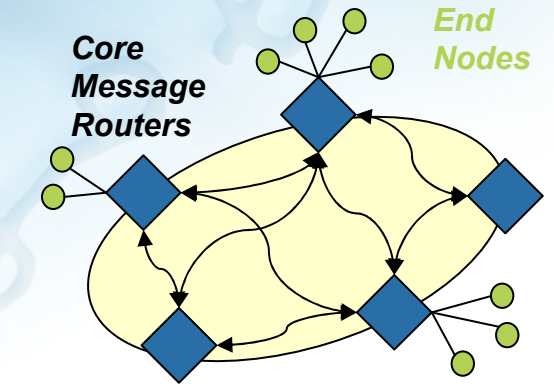
Machine to Machine: problem definition

- **M2M often related to the "Internet of Things"**
  - An attempt of definition*: the networking of everyday life objects*
- **Need of abstractions over technology fragmentation**
  - Growth of the Internet fostered by simple abstractions
    - END-to-END interoperability
    - Examples: IP (networking), DNS (naming, discovery), Sockets (API), HTTP (application level protocols), REST (programming paradigms)
- **Allow innovation at the edges**
  - Net neutrality is the real added value of the Internet
  - Bottom up approach
    - Make available the basic build blocks
    - Allow developers to concentrate on the application



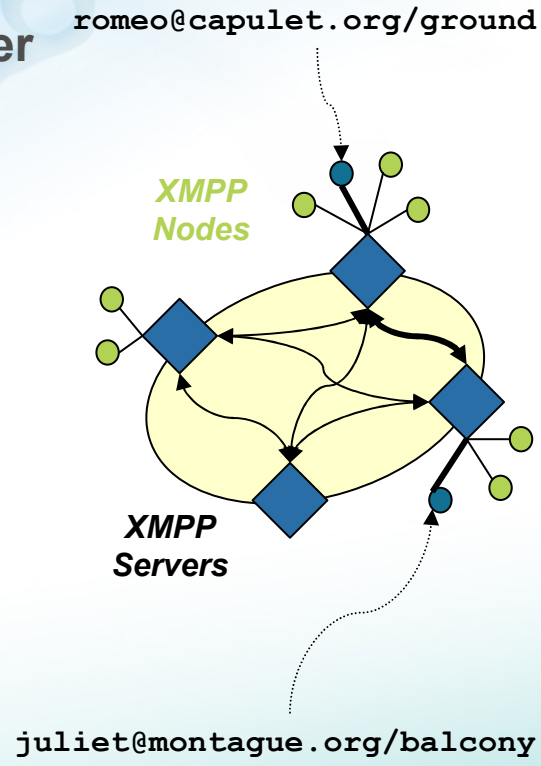
Overlay Networks

- **Logical networks abstracting the complexities of un underlying physical networks**
- **M2M requirements**
  - **Message based end to end communication**
  - **Virtual identities hiding physical addresses**
  - **Message morphing**
  - **Message buffering**
- **Basic layer over which building…**
  - **asynchronous messaging API**
  - **advanced messaging (e.g. pubsub)**
  - **discovery services**
  - **…**



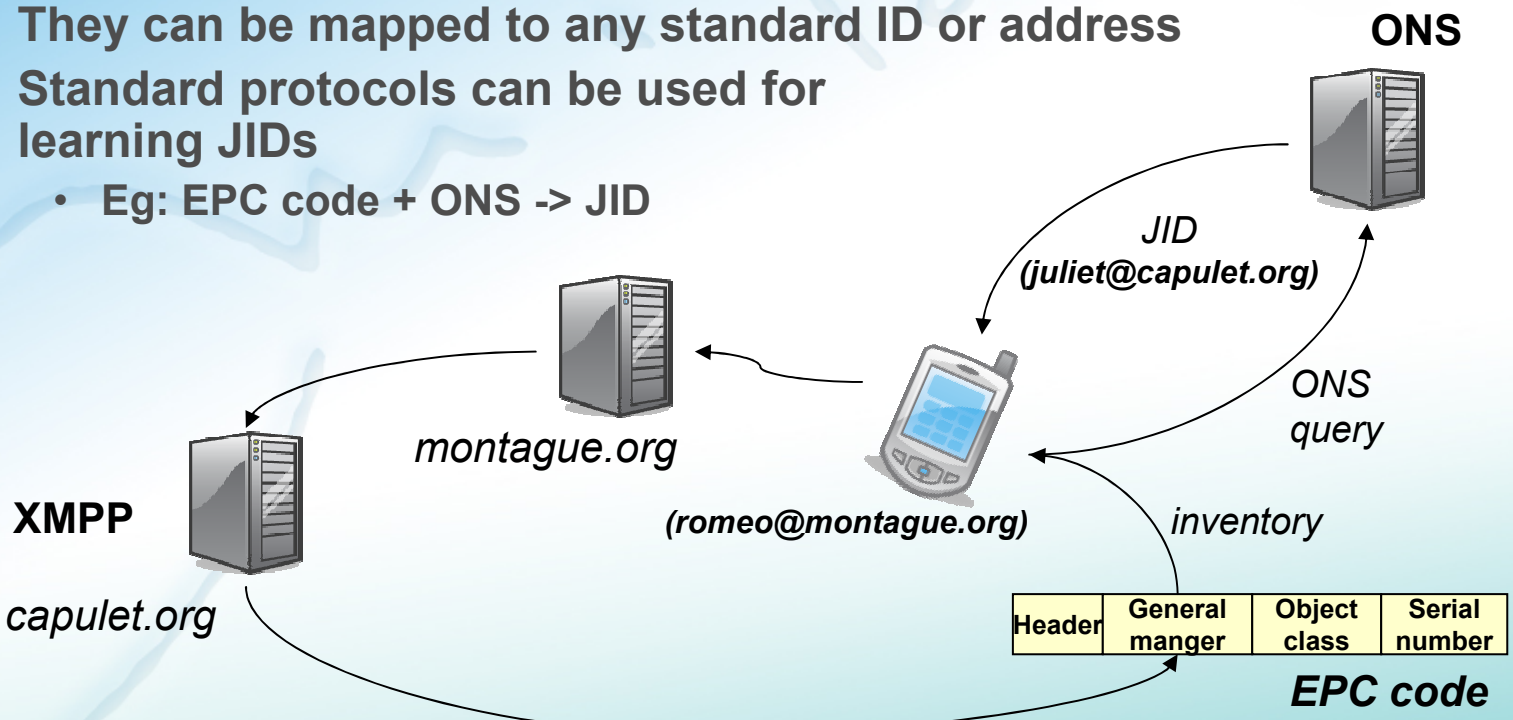
eXtensible Messaging and Presence Protocol (XMPP)

- **Open Instant Messaging protocol**
  - End to end communication between any peer
    - Servers have public IP addresses and FQDN
    - Transport with end nodes can be of any type (IP, ZigBee, Bluetooth…)
  - XML based
    - Easily extensible with arbitrary payloads
    - Distributed network of “web services”
  - Federation
    - XMPP services are instantly connected at Internet scale
- **Ideal as overlay network for M2M**
  - Simple messaging API hiding underlying complexities
  - Support for very limited end nodes



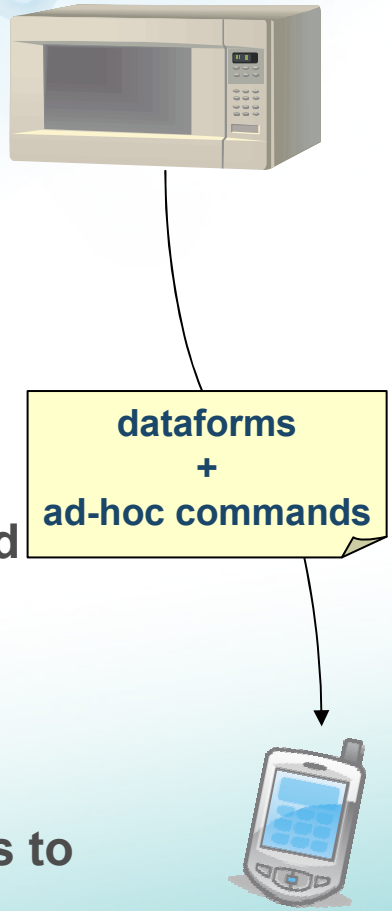
XMPP Virtual Identities

- **XMPP ids are named Jabber IDentifiers (JID)**
  - **user@server/resource**
  - **Domain owners can manage identities of their assets ("objects" or devices)**
  - **They can be mapped to any standard ID or address**
  - **Standard protocols can be used for learning JIDs**
    - **Eg: EPC code + ONS -> JID**



XMPP Standards Foundation

- ***Lightweight*** **standardization body for XMPP**
  - **IETF Interfacing: XMPP Core Protocol RFCs**
    - **Transport and basic IM features**
  - **XMPP Enhancement Proposals (XEPs)**
  - **Trusted federation initiative**
- **Relevant XEPs**
  - **Web services transport: XML-RPC, SOAP, IO-Data**
  - **Service discovery (DISCO)**
  - **Publish/Subscribe and Personal Eventing (simplified pub/sub)**
  - **Binary Streams Over HTTP (BOSH)**
  - **Jingle: stream initiation and session handling**
  - **Stream compression and binary streams**
  - **Ad-hoc commands, dataforms: export of UI snippets to any end node**

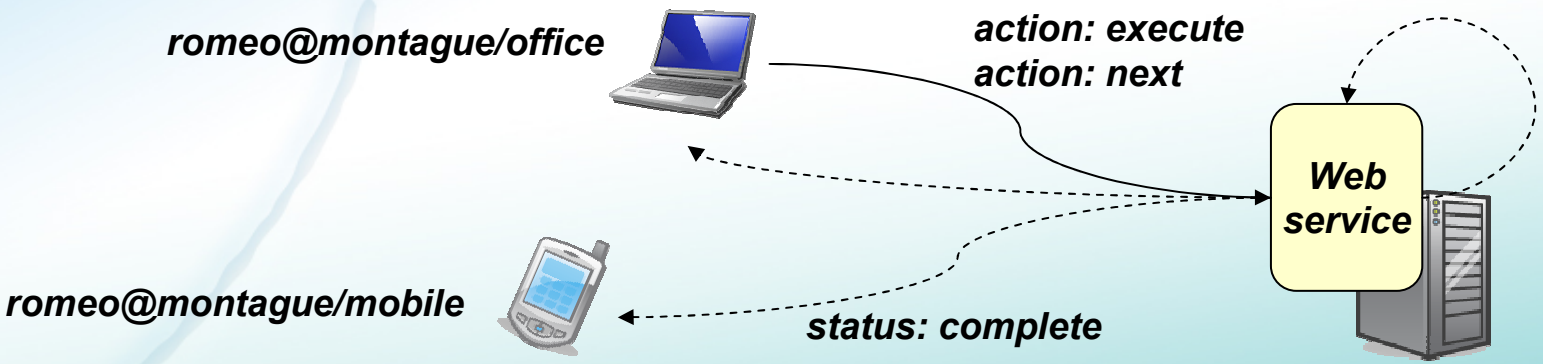


Real World Applications

- **Huge existing software base**
  - **Servers: open source and commercial scalable up to millions of nodes**
  - **Server components: write extensions in any language**
  - **Client libraries: available for any platform, (full support also in J2ME)**
  - **Clients: seamless desktop and web integration**
- **Adopters**
  - **IM: Google (GTalk, P2P in Android), Apple (iChat), AOL**
  - **M2M: TiVo, Isode, NOAA, Bioeclipse, BBC, Joost, …**
  - **ISMB/Bluendo experience**
    - **RFID middleware**
    - **Sensor networks realtime backbone**
    - **Enterprise service bus**
    - **Connector for roaming devices / devices**

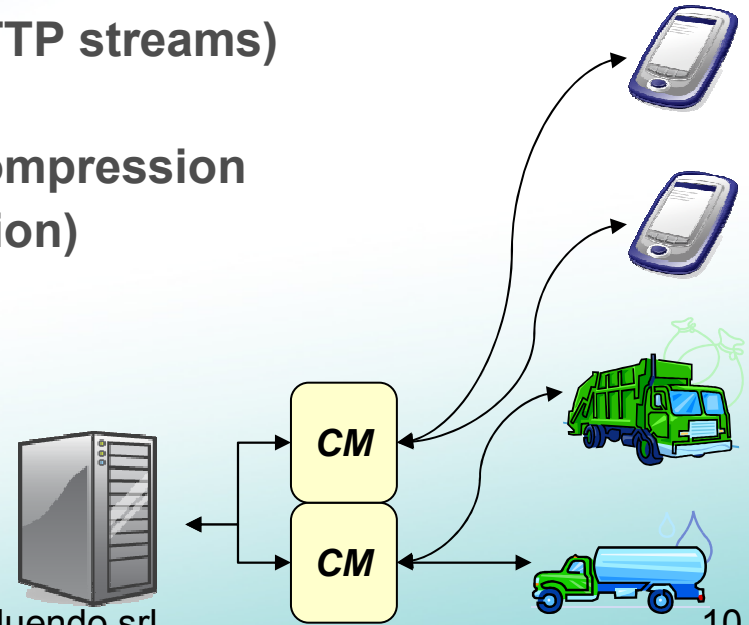
Asynchronous Web Services

- Traditional “synchronous” web services
  - SOAP (XEP-072), XML-RPC (XEP-009) over XMPP
- Asynchronous web services
  - IO-Data (first draft under revision)
  - REST approach: users specify “actions” on “remote resources”
  - Asynchronous execution
    - data may be returned later within a session
    - The requester may login on other machines o change address



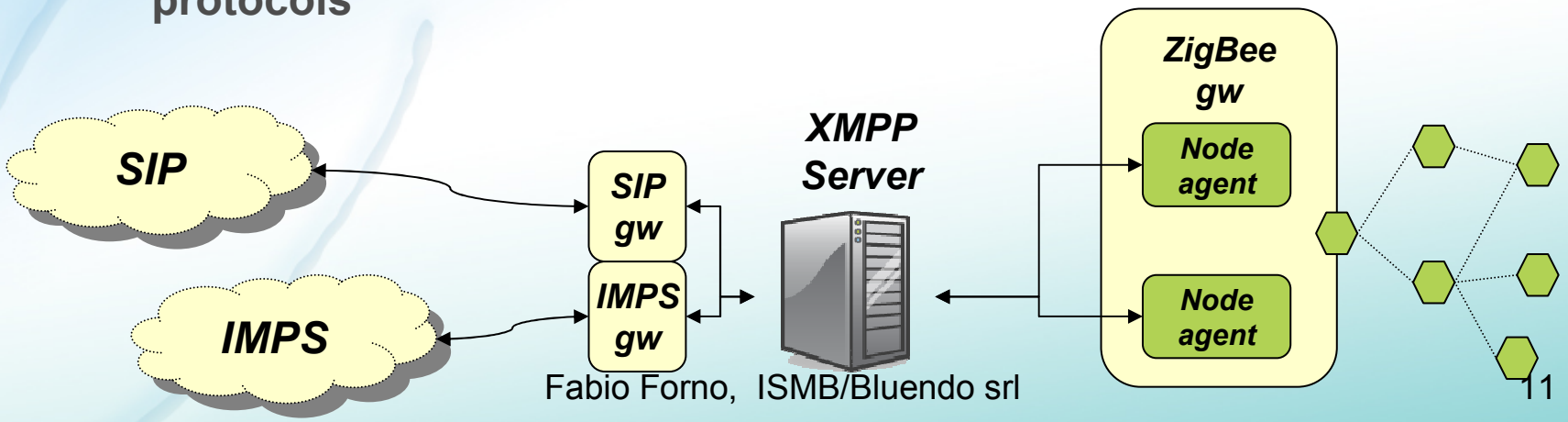
Connection Managers

- Used for clients fully supporting the XMPP stack
- Improved scalability / security
  - Allow handling millions of concurrent low traffic connections
  - Isolation of core routers and services from direct traffic
- They adapt sessions for mobile connections over IP
  - Reliable transport using BOSH (HTTP streams)
  - Session suspend / resume
  - Binary encoding, content aware compression
  - Message pruning (traffic optimization)



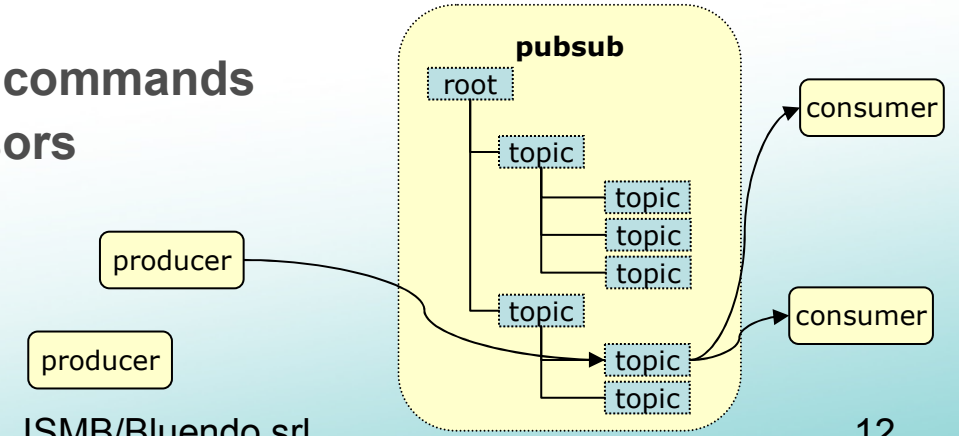
Gateways

- **Network gateways**
  - Connecting other messaging systems, e.g. SIP, IMPS, etc
  - Packet translation, identity mapping
- **End nodes gateways**
  - Mapping XMPP identities to sensor nodes
  - Keeping sessions alive and handling XMPP packets for end nodes
  - Communicating with end nodes using optimized ad hoc protocols



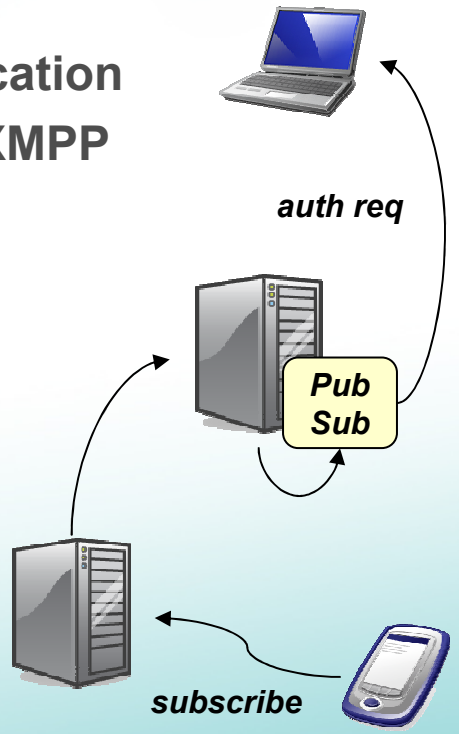
Advanced Event Distribution: Publish / Subscribe

- **Messages sent to “topics” and delivered when subscribers become available**
  - Loose coupling between event producers and consumers
  - Application level multicast, with hierarchical addressing
  - Easy reconfiguration of processing chains
  - High scalability
  - Simple APIs for client and service developers
- **Example applications**
  - Broadcasting configuration commands
  - Collecting events from sensors



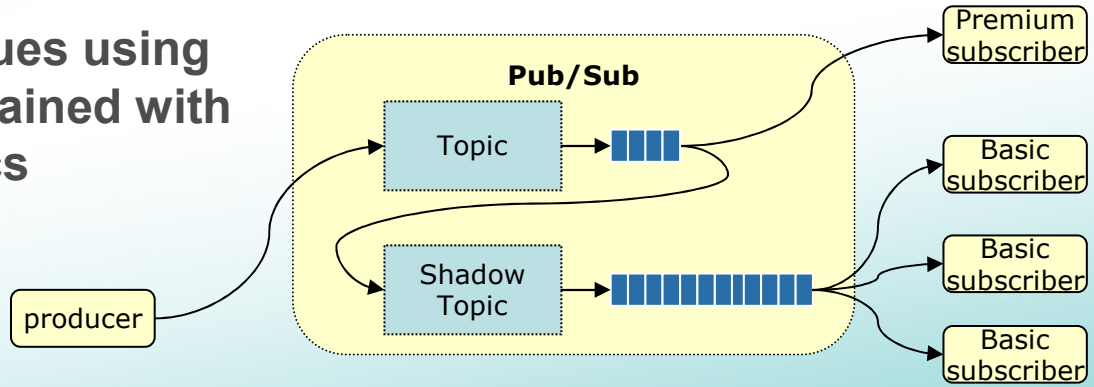
Federated Publish/Subscribe in XMPP

- **XEP 60 – PubSub**
  - Largest XEP, comprising detailed Pub/Sub use cases and implementation notes
  - Support in all servers as a dedicated component
  - Standalone implementations for pervasive application
  - No special support needed at client side (basic XMPP messaging allows using PubSub)
- **Features**
  - Sophisticated affiliation handling
    - Cross domain support
    - Access control for publishers and subscribers
  - Hierarchical topics (collection and leaf nodes)
  - Presence based delivery



Scaling PubSub

- **Horizontal scaling**
  - Any XMPP node can host a PubSub service
  - Any XMPP entity can subscribe to other domains pub/sub services
  - Discovery problem: e.g. given a RFID tag, how to identify related topis in foreign domains?
- **Vertical scaling**
  - Grant delivery times in nodes with high numbers of subscribers
  - Prioritize out queues using shadow topics chained with high priority topics



Further research / standardization areas

- API
  - Simple cross platform client messaging API
- Gateway functionalities
  - Mapping WSN identities to XMPP identities
  - Bridging of structured messages between other IM networks
- Discovery mechanism integration
  - Built-in XMPP disco only allows discovery features of known nodes
  - Discovery of nodes by features, location, other properties
- Pubsub taxonomies
  - Discovery of relevant topics (events) for a given items
  - Classification of event hierarchies
- Local Link Messaging
  - Direct communication with local objects, without passing through home servers

Questions?

Thanks for your attention

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Mobile XMPP related blog
http://blog.bluendo.com/ff

More info about XMPP
XMPP Standards Foundation
http://www.xmpp.org