



ITU-T Kaleidoscope 2010

Beyond the Internet? - Innovations for future networks and services

Context-Aware Smart Environments Enabling New Business Models and Services

Boris Moltchanov
Telecom Italia Labs

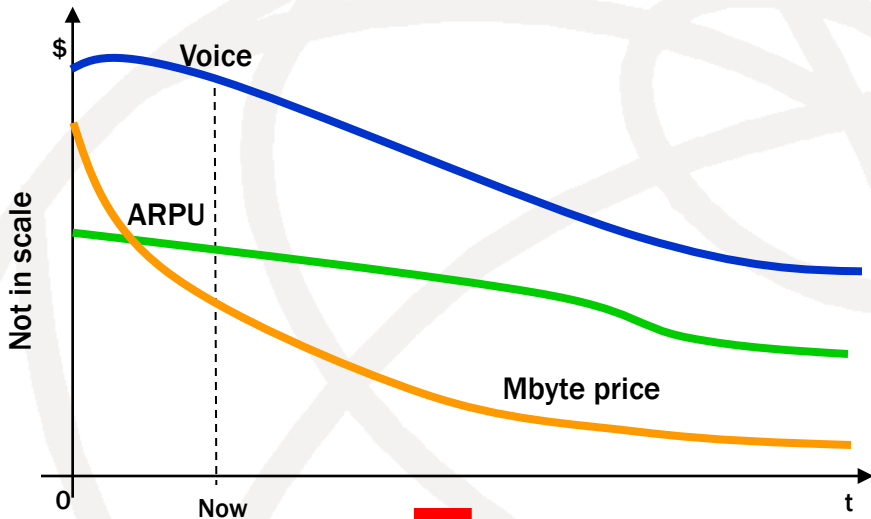
Christian Mannweiler
University of Kaiserslautern

Jose Simoes
Fraunhofer FOKUS

Index of Content

- 1. Introduction and Motivation – Why?
- 2. Definitions and Terminology – Context
- 3. Research Area:
 - Technology
 - Context Management – Architecture
 - Context Processing – Situation Provider
 - Business
- 4. Trials and demo – Results
- 5. Conclusion and Outlook – Q&A

Trends In The Telecom Market



Wireline voice revenues to decline 7%

<http://www.itfacts.biz/wireline-voice-revenues-to-decline-7/9278>

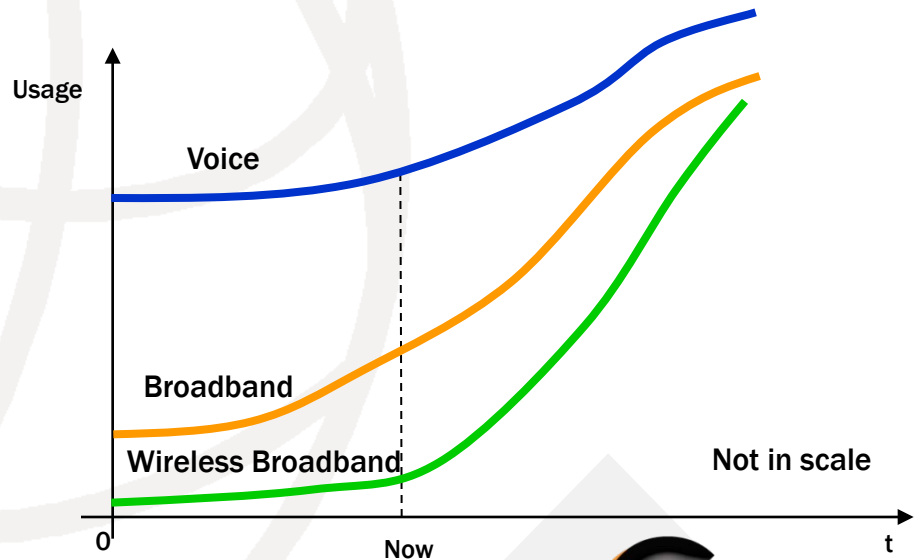
Declines in Mobile Voice ARPU Will Continue in 2010 in Western Europe

<http://www.3g.co.uk/PR/Sept2007/5122.htm>

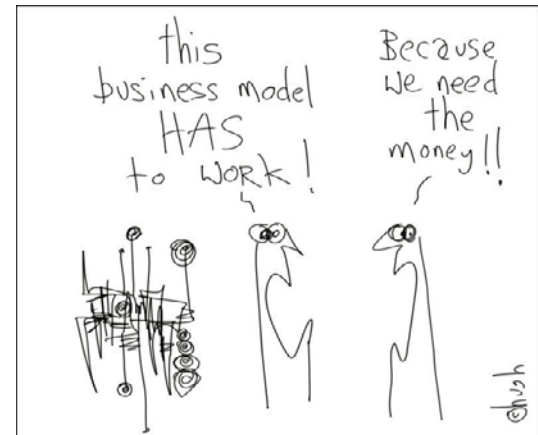
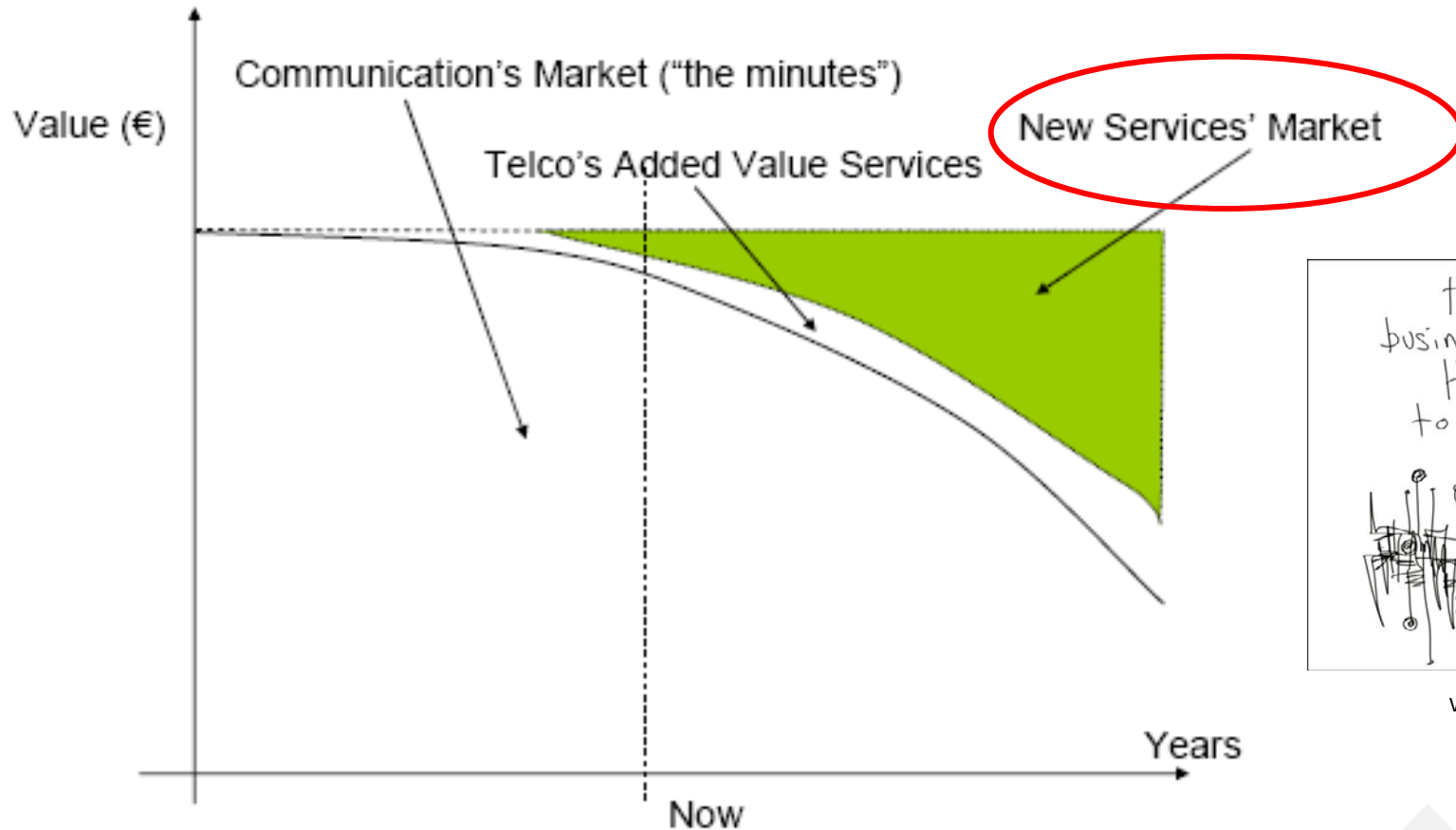
CTIA: Wireless Data Service Revenue Up 63 Percent

<http://www.xchangemag.com/hotnews/7ah2311452685346.html>

**A Network Paradox:
"more usage of networks
means less revenue"**



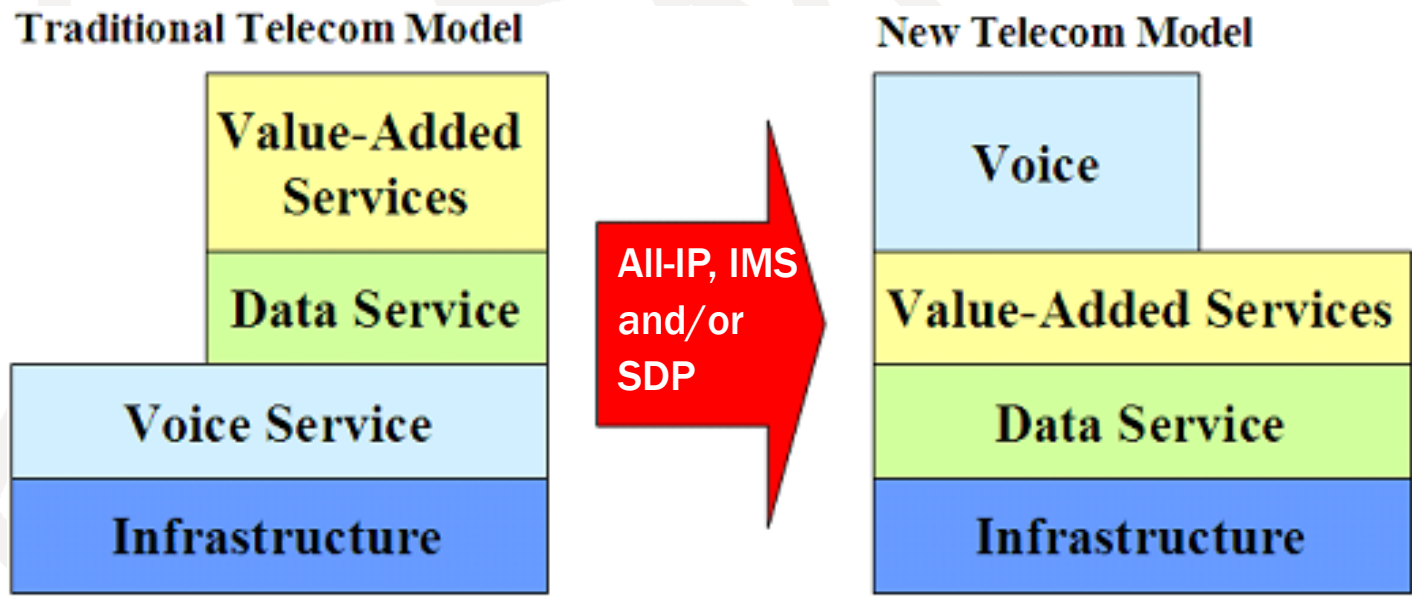
The Service Market and the Business Proposition



www.gapingvoid.com

Operators Are Trying To Move To A Different Business Model

http://james.seng.sg/archives/2006/02/08/net_neutrality.html



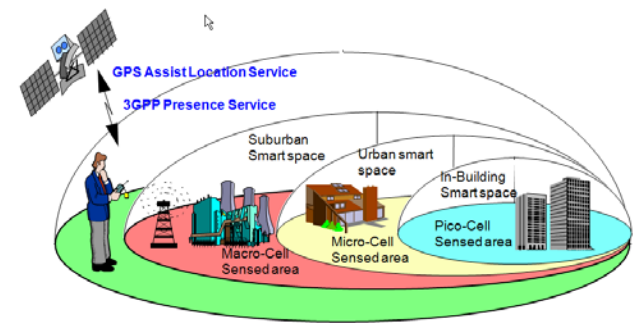
Recap of Motivation

- Mobile devices are constantly evolving
 - Processing power, Memory
 - Sensors, Network Connectivity (“always on”)
 - Everyday Companion and Private Gadget
- *Smart Services and Applications* adopting to any type of context
 - User assistance, Health Care
 - Entertainment, E-Tourism
 - Augmented Reality
 - Mobile Social Networking
 - Tailored Advertisements
 - Automotive
- Numerous service/industry/technology/... domains
→ Need for generic but very smart context provisioning



... and old-fashion
Telecoms are loosing
business opportunities

Definitions and Terminology



- **Smart-space:**

- any real or virtual location equipped with passive and active artifacts that have the processing and communication capabilities to interact with each other in a (mutually) beneficial way.

- **Context:**

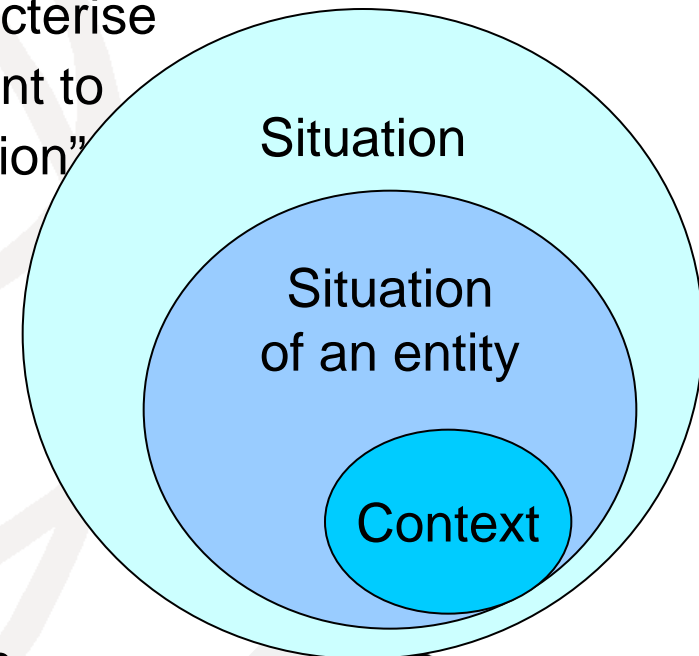
- “any information that can be used to characterise the situation of an entity considered relevant to the interaction between entity and application” (cp. Dey and Abowd 2001)

- **Situation:**

- is a particular condition or set of circumstances

- **Context Management:**

- context acquisition + context dissemination



Context Types

- *Context in Smart Spaces:*
 - Location
 - civil address
 - geo-coordinates
 - Infrastructure
 - devices
 - network
 - Physical conditions
 - temperature, light, humidity
 - noise, pressure
 - etc.
 - Logical conditions
 - activity, preferences
 - friend, parent
 - Raw or reasoned



Context Awareness

Person's or system's capability of knowing about a user's or object's context and acting accordingly

Create/acquire context data based on network, device, sensor & user information

Elaborate context information to define a high-level "service-usage context"

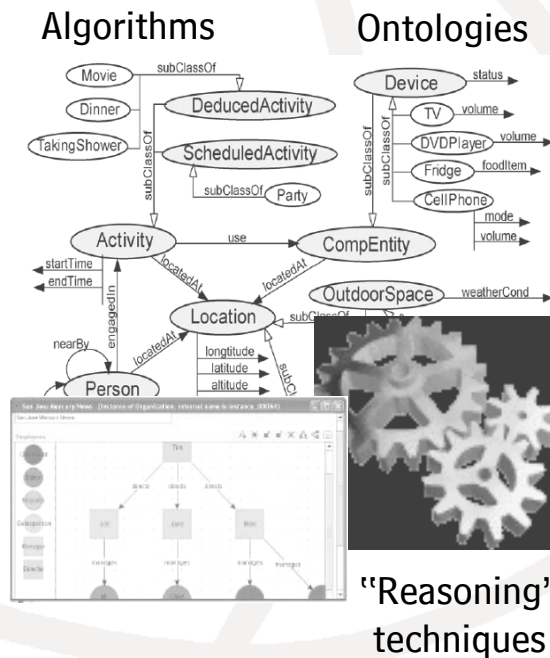
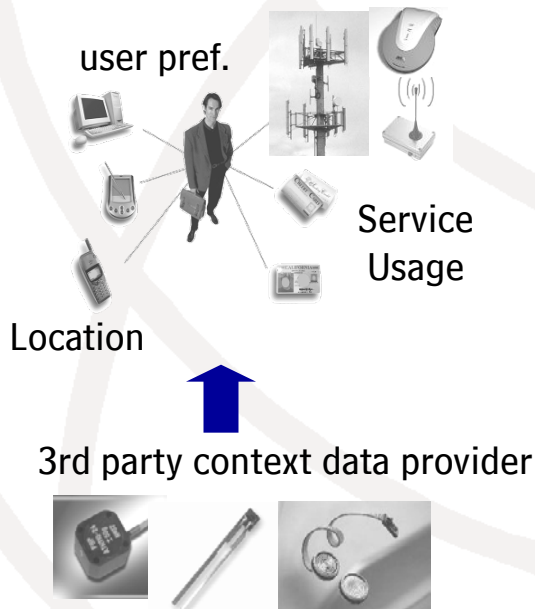
Provide "Context Data" & "service-usage context" to users and services

Context Data

Telco exclusive parameters

Context Analysis

Service integration



Service Advertising

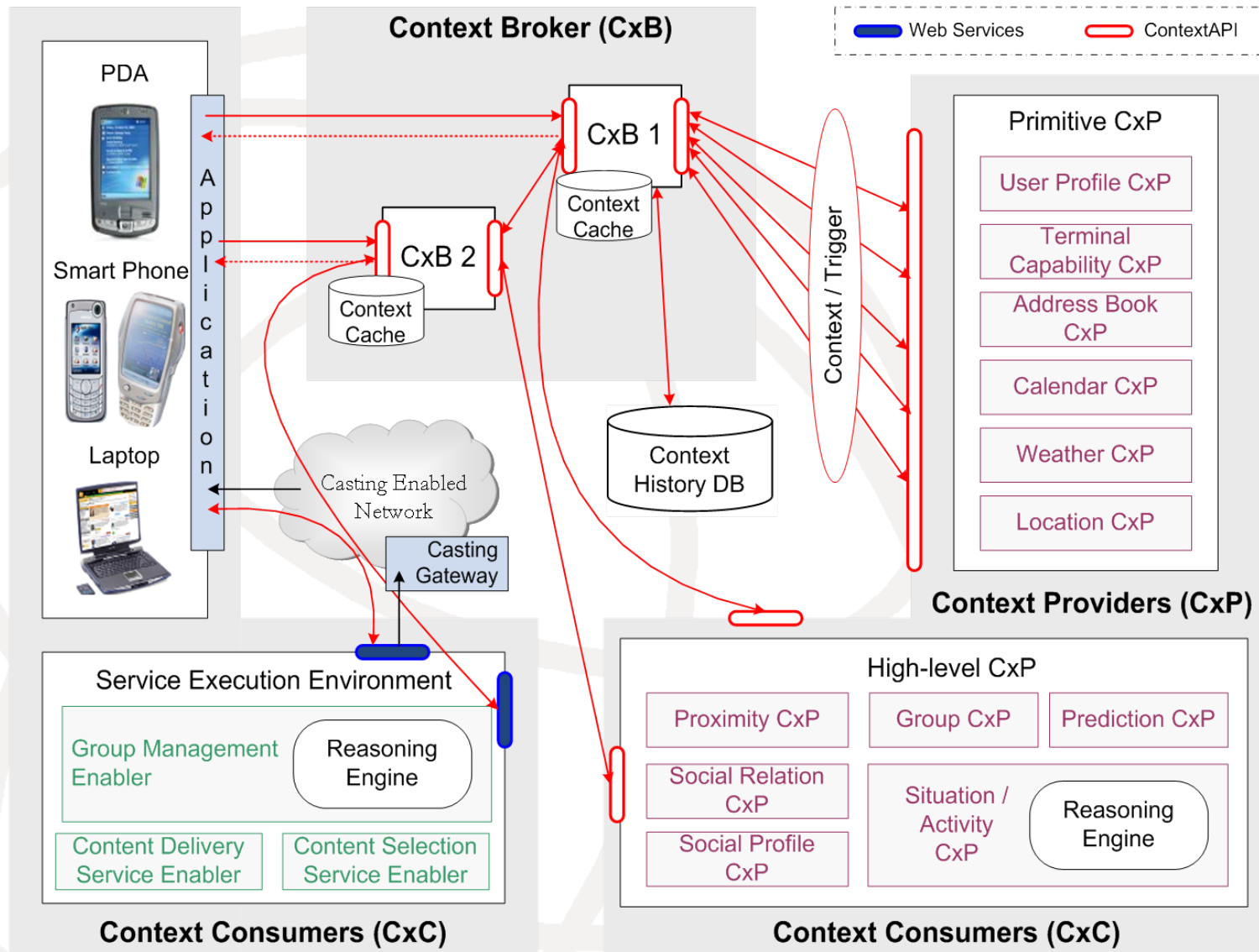


Group Awareness

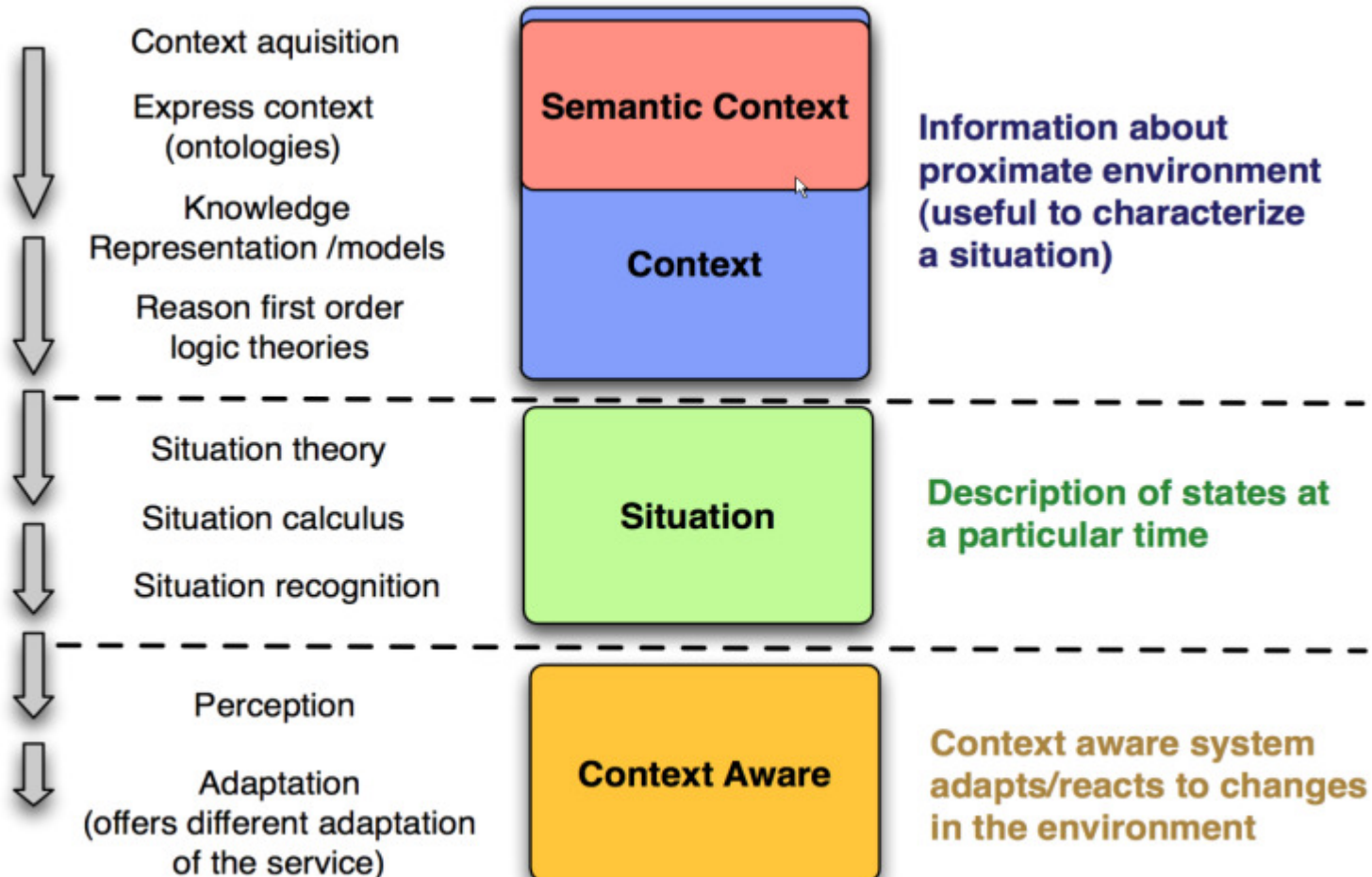
Mobility support



Context Management Architecture

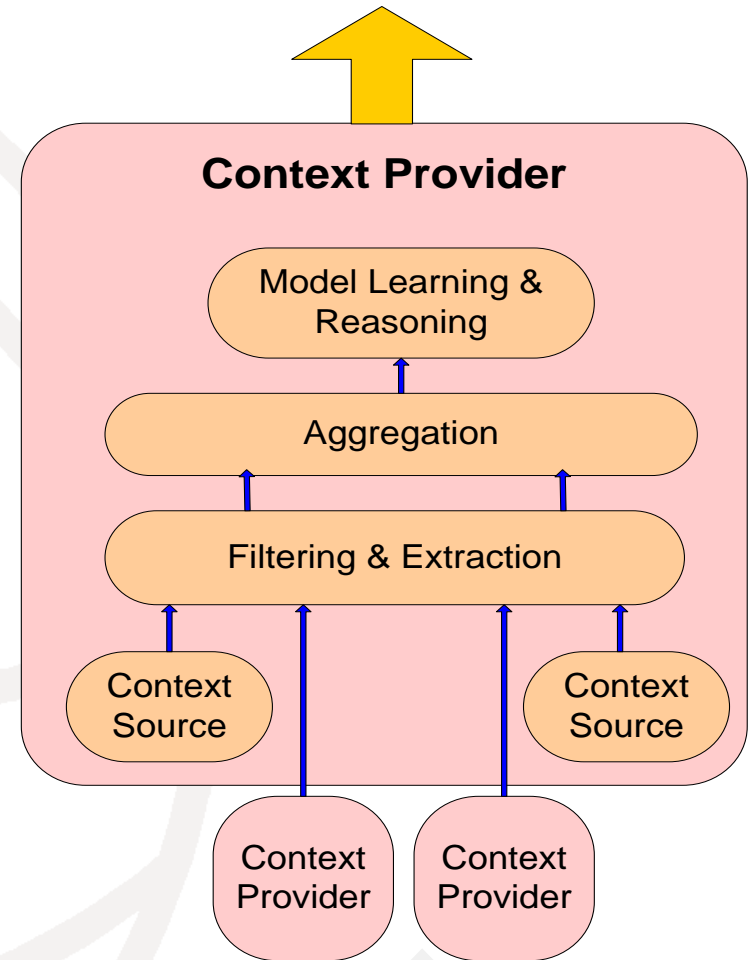
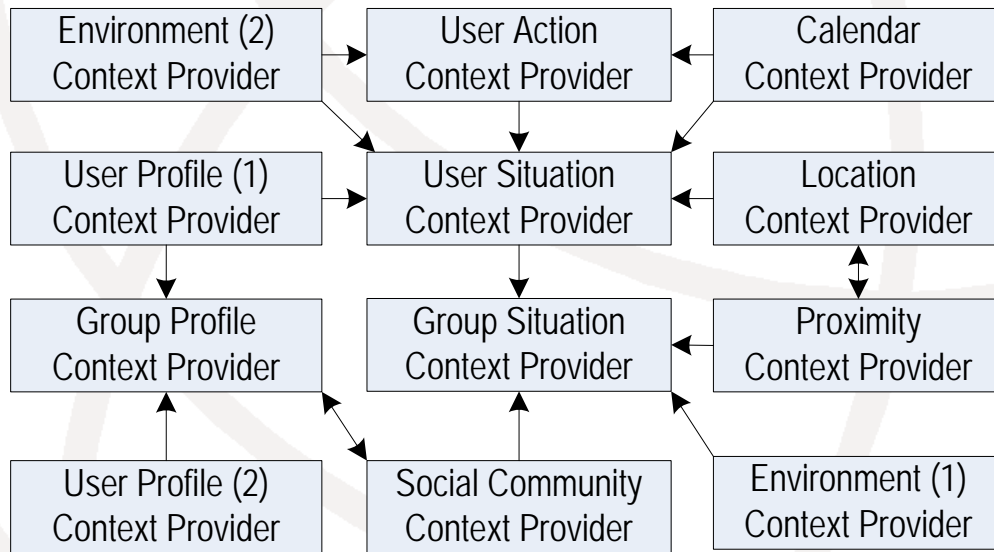


Context Representation: Layered Context Model



Context Reasoning

- Each CP is responsible for a certain *context scope*
- CPs may depend on each other



Research Area: Business

Application Areas

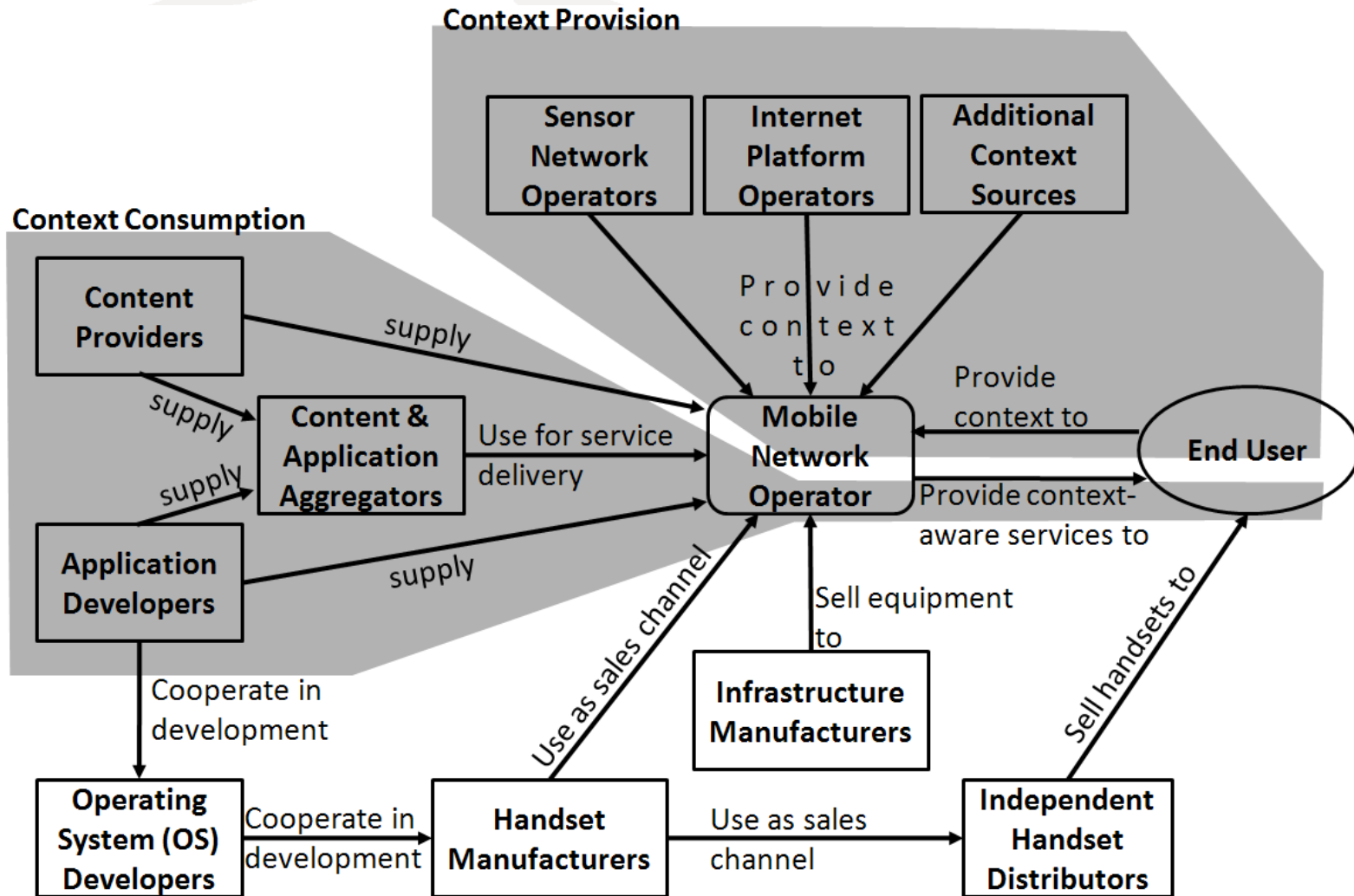


- **Sustainability** – assisted living (**e-Health**), smart cities, teleworking, elderly people support
- **Green-energy** – optimization of energy consumptions, green dash boards for energy consumption control, differentiated energy provisioning, green energy producing (generation), energy waste reducing
- **Machine-to-machine communications** – smart factories, logistics and vehicular communication (fleet management), traffic management
- **e-Health** – smart hospitals, personalized fitness programs, elderly support from remote, advanced national health and wellness program
- **Emergency management** – recovery and rescue teams support, fast recovery from catastrophes, remote monitoring, support for efficient material provisioning
- **Gaming** – distributed and remote entertainment, educational and tourism systems

Research Area: Business Models

- **In-House** – the context information is used by Telco or IT companies with no outsourcing from and not exposing to anywhere (sort of context-aware “walled garden”)
- **Advertising** – the context information is used to better target the customer accordingly to advertised product or service
- **Context Exposing** – Telco or IT company expose the context information regarding its customers to 3rd parties, for payment, also as part of a XaaS cloud or Context-aaS cloud
- **Self-Service** – the customers build their own context-aware services and application with usage of the context information provided by Telco or IT companies, which are only context providers and service orchestrators

Research Area: Business Relationships



Research Area: PayBack Modes

■ Indirect

- In-House (e.g. selling own services and applications embedding the context-awareness)
- Advertising (i.e. selling own goods and services advertised by context-aware advertisement)
- Self-Service (e.g. traffic and network and network features usage increase)

■ Direct

- Advertising (e.g. selling the context-aware advertisement as a service by subscription)
- Service Exposure (e.g. selling the context information as a service)

■ RevenueShare

- Advertising (e.g. cashflow is coming from advertised 3rd parties goods or services)
- Self-Service (e.g. cashflow is coming from sold 3rd parties goods, services and applications)
- Service Exposure (e.g. cashflow is coming from usage or 3rd parties goods, services and applications)

Research Area: Payments Schemas

■ Pay per use

- Payment is performed for each context information request or usage (e.g. targeting advertisement)

■ Flat time-limited payment

- Payment is performed for context information access based on access grant duration (e.g. flat payment for 1month access to the context management system)

■ Pay per functionality/context

- Payment is performed per specific context-aware functionality or context information provided

■ Pay per monitored entities amount

- Payment is performed per amount or type of monitored entities (objects or persons)

■ Premium payments

- Payment is performed on a mixed basis (e.g. frequent context information user, for long continuous usage or great amount of context information regarding huge number of monitored entities, etc.)

Research Area: Customer Management

■ Opt-In

- A customer explicitly expresses its willingness to be addressed by context-aware services
- No privacy issues once the customer agrees with the context-aware service usage and conditions
- Limited number of customers initially and difficulty in the customer acquisition due to start from empty customer base and not easy (not automatic) to convince to sign-in for the context-aware service

■ Opt-Out

- Customer receives the context-aware services automatically without explicit express of her/his willingness
- Privacy issue is very actual hence the privacy regulated by respective laws and customer decision shall be respected
- Initially great (maximum possible) number of customers, that nevertheless shall be provided with the means for sign-out from the context-aware service

Demo and Trials



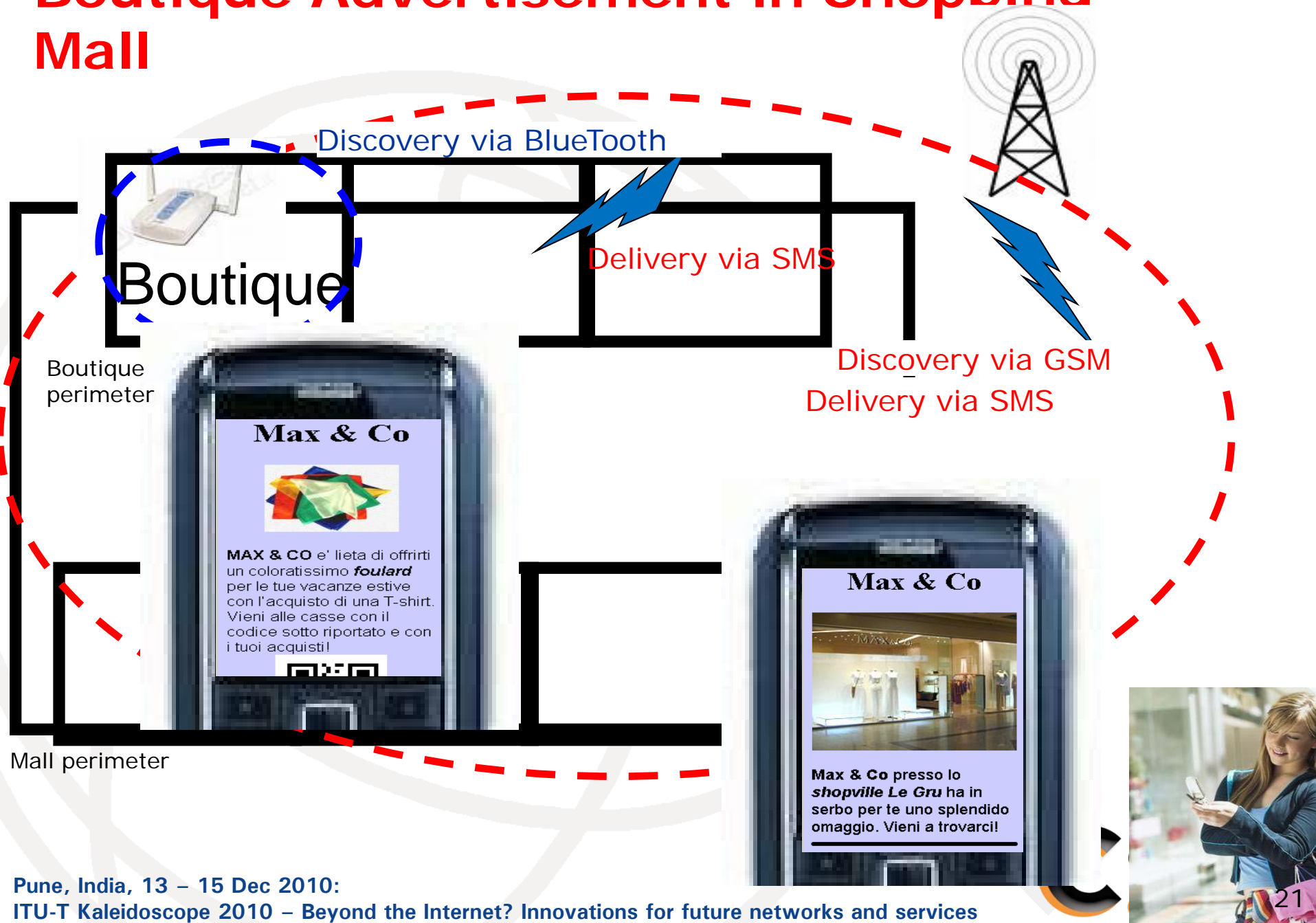
Telecom Italia's services for Public Administrations

TI is already providing some context-aware services tied to a certain location or a territory to its customers especially for mobile users in the eTourism field, where the B2B2C model is implemented with the following elements:

- the development of a model of integrated and aggregated offer on a local basis, or "under the patronage" of public administrations responsibility
- the involvement of the PAs (Public Administrations) for the sponsorship of the model and the involvement of the proper actors active on the business value chain
- the collection and delivery of content (e.g., information for the enhancement of heritage artists)
- a strong leverage on mobile devices for the end customer and on TI's infrastructure based on assets (connectivity, data centers, Telco Capabilities) solutions
- the hypothesis of conditional business to the establishment of a collaborative model based on a local public-private integration

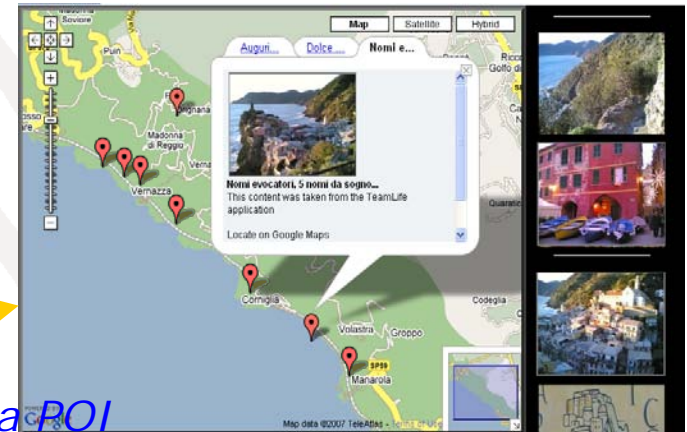
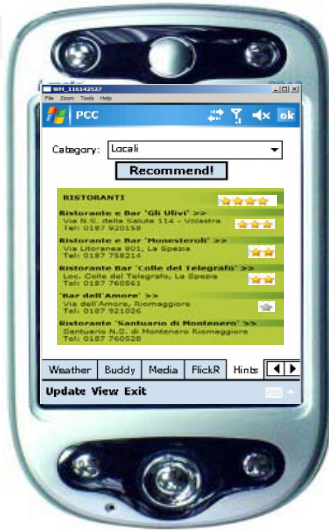


Boutique Advertisement in Shopping Mall



e-Tourism & POI & Recommendations

Points Of Interest & Graffiti



Attach photo (Graffito) to a POI
Receive recommendation

▶ Mobile users can:

- **share** multimedia UGC on the server with other users or service
- **search** for local POIs based on their context. Results are sorted based on votes from the user profile and Social Network (using collaborative filtering algorithms)
- **vote** and send quick reviews about visited POIs and user generated content
- **attach multimedia** content to a POI (Multimedia Graffiti). People can later see photos/listen to audio comments attached to a POI

Other trial

BICISTAFFETTA 2008 5 - 10 Settembre

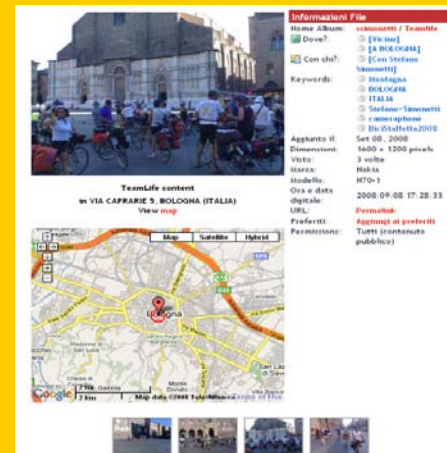
Evening Mosaico viewing in the Roma's Hotel

Push SMS of each race segment:
 - at the beginning it is information about the city of destination & weather forecast
 - in the city about visiting places
 - In the city on arrival it is information about accomodation facilities

Evening viewing in the Hostel at Mincio di Rodigo with local Assessors

Arrival at the Piazza della Signoria and Closing Ceremony in Villa Arrivabene with local Assessors: viewing of the overall event's content Mosaico viewing

Evening Mosaico viewing and slideshow of the photos in the premises of the Palazzo D'Accursio (Piazza Maggiore) with local Authorities



Other Trials



DTT Tourism in Valle d'Aosta



Interantion FOA Top Management Forum (Roma)



Wireless4Business Forum (Milano)



5. Conclusions and Future Work

• Conclusions

- Created a comprehensive context management platform
- Performed study of different business models and payment types
- Implemented first services, mainly in-house and premium usage

• ToDo

- Better management of privacy and security issues and trust management
- Federation of context
- New business models
- Complex Value Chains building capability
- Win-Win condition identification
- Revenue sharing schemes and pricing
- Mixed business models and respective payment schemas
- Interoperability on large scales in heterogeneous environment
- Building large smart-spaces is expensive
- Improvement of business models based on cloud organized services



Thank you very much for your attention

—

Questions?

boris.moltchanov@telecomitalia.it



Context-aware Systems for Smart Spaces

■ Context Management Requirements

Enhance and leverage context data through

- Consistent representation, filtering, aggregation, fusion, inference, quality evaluation, and prediction

Efficiently exchange data and provide context services

- context discovery, storage, and distribution
- common and open interfaces for communication within and across smart spaces
- management procedures for smart space entities owning context data (AAA)

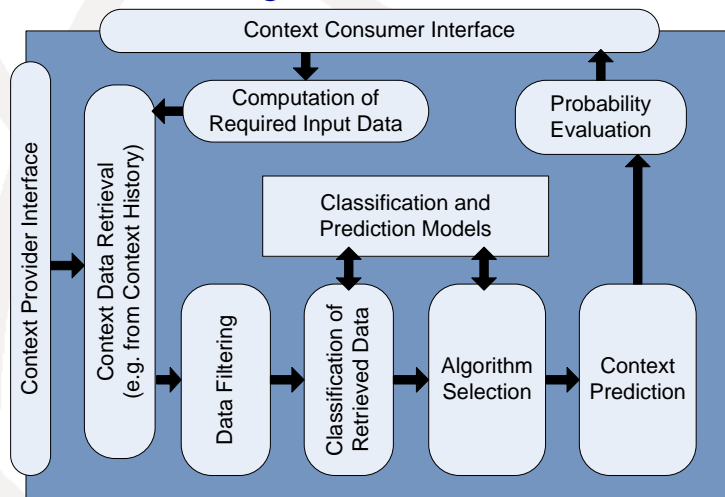
Ensure end-to-end data security by

- monitoring and assuring the non-violation of privacy, security and trust within and across smart spaces
- guaranteeing the enforcement of rules and policies.

Example:

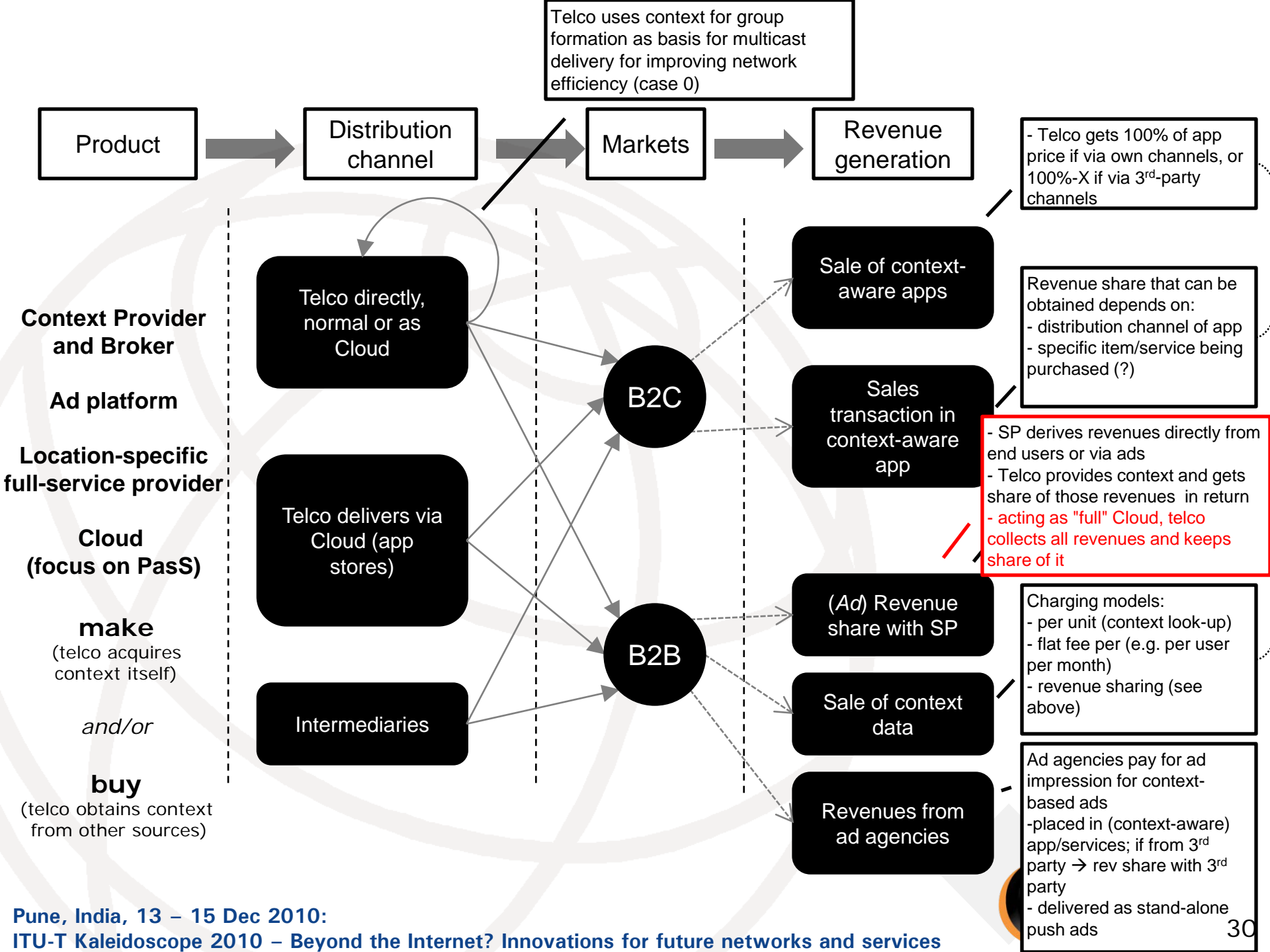
Context Prediction for Mobility Support

- Location is valuable context data for mobility support in wireless networks
 - Preparation of handover decision
 - Avoidance of “unnecessary” handovers
 - Increase of resource efficiency
- Prediction of user movement by exploiting data from
 - GPS
 - Signal strength indicators
 - Multi-sensor environments
- Analysis tools
 - Categorical time series prediction
 - Markov and hidden Markov networks
 - Bayesian networks
 - Higher-order Markov models
 - Kalman Filter
 - Particle filtering

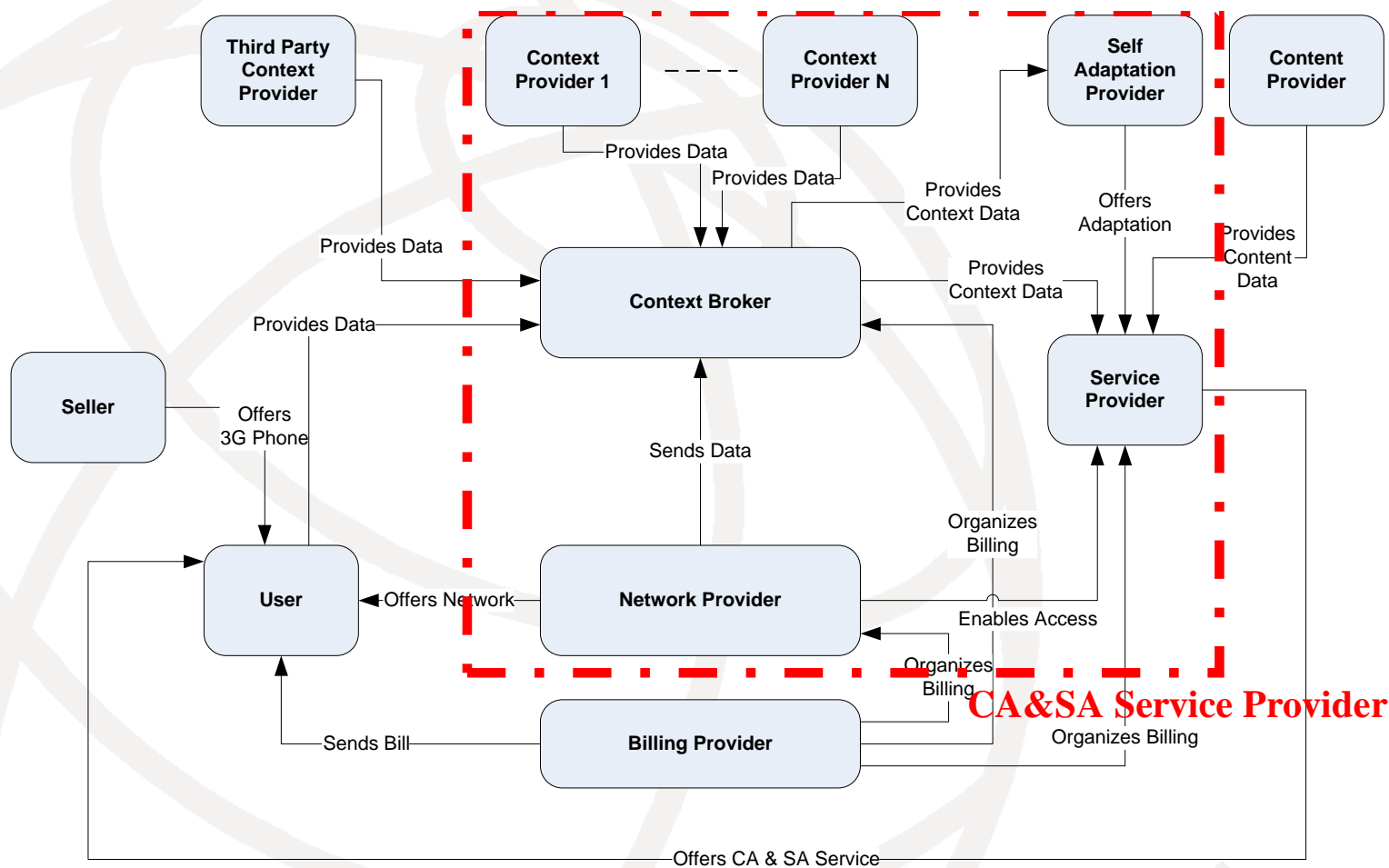


Proposed telco business models

1. Telco as context provider and broker,
 2. Telco as new context-based advertising platform,
 3. Telco offering location-specific context-aware multicast-based applications, and
 4. Telco as cloud-based service provider.
- Business models build up on each other
 - Required changes, investments, and risks as well as revenue potential increase



Roles and Interactions in an eTourism Service Scenario



CA & SA Service Provider

4.4 e-Tourism & POI & Recommendations (3)



User can take pictures and share them in the same context as combination of concepts from the previous two slides



4.5 Venice Carnival Trial

(Mosaic and Web-Portal)

CARNEVALE VENEZIA 2008
SENSATION
6 SENSI X 6 SESTIERI

al 4050 (TIM)

rialto boy

Home Login

Ultimi Uploads Ultimi commenti Più Visti Più Votati

Ultimi Arrivi

RSS

<p>TeamLife content in Piazza San Marco, Venezia (Italy) View map posted by: guest 1 viste Feb 01, 2008</p>	<p>...e per finire...maschere!! in Piazza San Marco, Venezia (Italy) View map posted by: guest 1 viste Gen 31, 2008</p>	<p>...e ancora maschere in Piazza San Marco, Venezia (Italy) View map posted by: guest 1 viste Gen 31, 2008</p>	<p>ancora maschere in Piazza San Marco, Venezia (Italy) View map posted by: guest 1 viste Gen 31, 2008</p>
---	---	---	--

TELECOM ITALIA
CARNEVALE VENEZIA 2008
SENSATION
6 SENSI X 6 SESTIERI

4.5 Venice Carnival Trial (2)



(Mobile experience – widget and .mobi)



4.6 Other Trials



Gallery Map

Lista Album [Public content tagged with: bicistaffetta2008] | [Permalink to map](#) | 44.5631075217,10.9835148025

Home > User galleries > guest > Teamlife

FILE 4/226

Informazioni File

Nome Album: guest / Teamlife
 Valutazione (39 voti): ★★★★★ (Dettagli)
 Keywords: fuochi d'artificio
 Aggiunto il: Lug 18, 2008
 Dimensioni: 1600 x 2390 pixels
 Visto: 84 volte
 Marca: NIKON CORPORATION
 Modello: NIKON D80
 Ora e data digitale: 2008-07-05 23:15:19
 URL: Permalink
 Preferiti: Aggiungi ai preferiti
 Permissions: Tutti (contenuto pubblico)

Mare rosa



La Notte Rosa – Rimini (Lug-Ago '08)

“Terre D’Adelaide & Odon
withSITAF – Italian Society
of Traforo Autostradale
Frejus



Terre d’Adelaide & Odon

Ultimi Arrivi

