Internet of Things: Concept Reply vision

An ecosystem of connected people, objects and services; enabled by pervasive and transparent technology built to improve our quality of life.
What’s driving the vision?

**Population**
- For the first time in 2008 the number of people living in urban areas equalled the rural figure. This number will reach 70% of the world's population by 2050 (Source Population Reference Bureau)

**Ageing**
- The average life expectancy in Europe increased by 5 years in the last 15 years (Source Eurofund)

**Congestion**
- Up to 10% of traffic in the large cities consists of cars looking for a place to park (ITN Forum)

**Energy**
- 60 percent of electrical energy is lost through inefficiencies in the grid. (Source Off-Grid)

**Cost**
- Changing economic conditions are forcing change in the way we manage and provide services

**Environment**
- Global warming, pollution, climate changes.
Web Evolution

- **Web 1.0**
  - Connecting Data
  - Information is somewhere else

- **Web 2.0**
  - Connecting People
  - Applications are somewhere else

- **Web 3.0**
  - Connecting Objects
  - Hardware is somewhere else

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Key elements of an IoT Platform

Applications
- End-to-End Vertical Applications
- Mashup portals
- Business Intelligence
- City Management Dashboards

Orchestration
- City or Regional level Interoperable Service Bus
- Flexible Process Platforms
- Smart Objects Platform

Services
- Service Aggregation & Adaptation
- Context Management and Location Awareness
- Real-time Service Brokering, Discovery and Publishing
- Semantic-based Distributed Reasoning

Data
- Sensors
- Locations
- Identifications
- Web
- Historical databases

Security
Privacy and Trust
Smart Objects

Sensing things

Tagging things

Saying things

Thinking things

Adaptive things

Illustration by Lisa Kruse Braiman for Forbes
Key Characteristics for Smart Objects

**Pervasiveness**
- Intelligent systems will be all **around** as well as **on** the person

**Seamlessness**
- The services will be **continuous** and **transparent** to the person

**Awareness**
- The machines will be aware of the **location** and of the personal **context** as it is happening

**Adaptiveness**
- Machines will interoperate with the network, service and content according to the person’s needs
Key Features Implementation

- UDDI-based WSDiscovery
- Caching Service for large user area
- Logical Model Dynamic Extensibility
- Event Notifications
- Adaptive UI
- Context Awareness as a Service
- Legacy Connectivity Adaptation
- DPWS WSDiscovery
Building Smarter Objects

Web Service Layer
- Public unified interface
- Single/Dual binding support

Logical Device Layer
- Translation of device specific data into common logical structure

Physical Device Layer
- Legacy network adaptation
- Device message parsing & formatting

<service>
  <temperature>20</temperature>
</service>

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**IoT Principles**

**SOA**
IoT Platform adheres to SOA principles and implements a Rootstock Architecture

**W3C Standards**
Interfaces are defined according to W3C Standards: HTTP, SOAP, WSDL

**Unified Data Modelling**
All nodes share the same common Web Service interface, the same data model and can be freely interconnected

**Data Caching**
Data changes provided by limited capability devices are cached and made persistent

**Event Driven Architecture**
Physical device changes are translated into Event Notifications

**Physical Things Abstraction**
Physical Entities are converted into Logical Entities to provide an abstract homogeneous view
Internet of Things Management Tool

The Project focus is to develop:

- **Application Framework** (Software Middleware) based on Concept’s **Internet of Thing (IoT)** platform, on **SOA** (Service Oriented Architecture) technologies and **Web Services Orchestra**.
- **Vertical Business Applications** to respond quickly to the market changes and business demand.

The Application Framework will include:

- **Common Web Services**: web services providing more complex services compatible with different kinds of Vertical Applications
- **Dedicated Web Services**: web services with appropriate functionality for specific areas:
  - Smart Building
  - Smart Transportation
  - Protection & Safety
  - Health&Care and Wellness
Context awareness

“Context is any information that can be used to characterise the situation of an entity“

“A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user’s task“

A.K. Dey

Key aspects of our solution

- Context recognition combining data from heterogeneous sources
- Decision making
- Adaptive interfaces
- Semantic web W3C languages
- Configurability and extensibility
- Distributed reasoning

Extensibility
Semantics: OWL ontology
Rules
Semantic reasoner

- **Context awareness** is a key enabler for ubiquitous computing systems or pervasive computing.
- “**Semantic reasoner**” is a building block that facilitates the development of context aware applications in different domains: health, vehicles, logistics, domotics, infomobility, ...
IoT Platform Management Layers

Vertical Business Applications
- Smart Transportation
- Smart Building
- Smart Wellness
- Protection & Safety

Business Process Layer
- Orchestra (Business Process Management Layer)

Internet of Services
- Enterprise Service Bus (ESB)

Web Services Layer
- Occupancy service
- Tracking Service
- Identification Module
- Access Service
- Alerting Service
- Climatic Service
- Lighting service
- Data Conversion

Internet of Things
- Message Queue
- XML
- XML Adapter
- TCP/IP
- TCP/IP Adapter
- Legacy

Sensor Communication Layer
Main Stakeholders

State
- Must provide the necessary funds for infrastructure
- Will need to foster partnership initiatives to develop services and applications

Industry
- Required to provide the technology and produce the objects
- Will need to develop and manage the services

Consumer
- Will have to adopt the services and use the Smart objects
Thanks

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