

# Flexible Relay Wireless OFDM-based networks

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**FlexIble RElay Wireless OFDM-based network RKS  
**FIREWORKS IST-27675 STP****

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# Outline

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- Consortium Presentation
- FIREWORKS environment
- Problem statement and drivers
- FIREWORKS target system
- Objectives
- Deployment scenarios

# FIREWORKS Environment

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- FIREWORKS is
  - A [European Commission](#) (EC) Project in terms of 6<sup>th</sup> Framework Programme – Priority 2 “Information Society Technologies”
  - 50% budget is funded by EC
  - Submitted in March 2005
  - Approved in July 2005
  - Potential kick-off date → Dec. 2005
  
- **Duration 27 months**

# **FIREWORKS Consortium**

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<b>INTRACOM S.A. (Principal Contractor)</b>	<b>INT</b>	<b>Greece</b>
<b>MOTOROLA Labs</b>	<b>MOT</b>	<b>France</b>
<b>Commissariat A L'Energie Atomique – LETI (CEA/LETI)</b>	<b>CEA</b>	<b>France</b>
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<b>University of Surrey</b>	<b>UniS</b>	<b>United Kingdom</b>
<b>Technical University of Catalonia</b>	<b>UPC</b>	<b>Spain</b>
<b>Czech Technical University</b>	<b>CTU</b>	<b>Czech Republic</b>
<b>Hellenic Telecommunication Organization</b>	<b>OTE</b>	<b>Greece</b>

# Problem Statement

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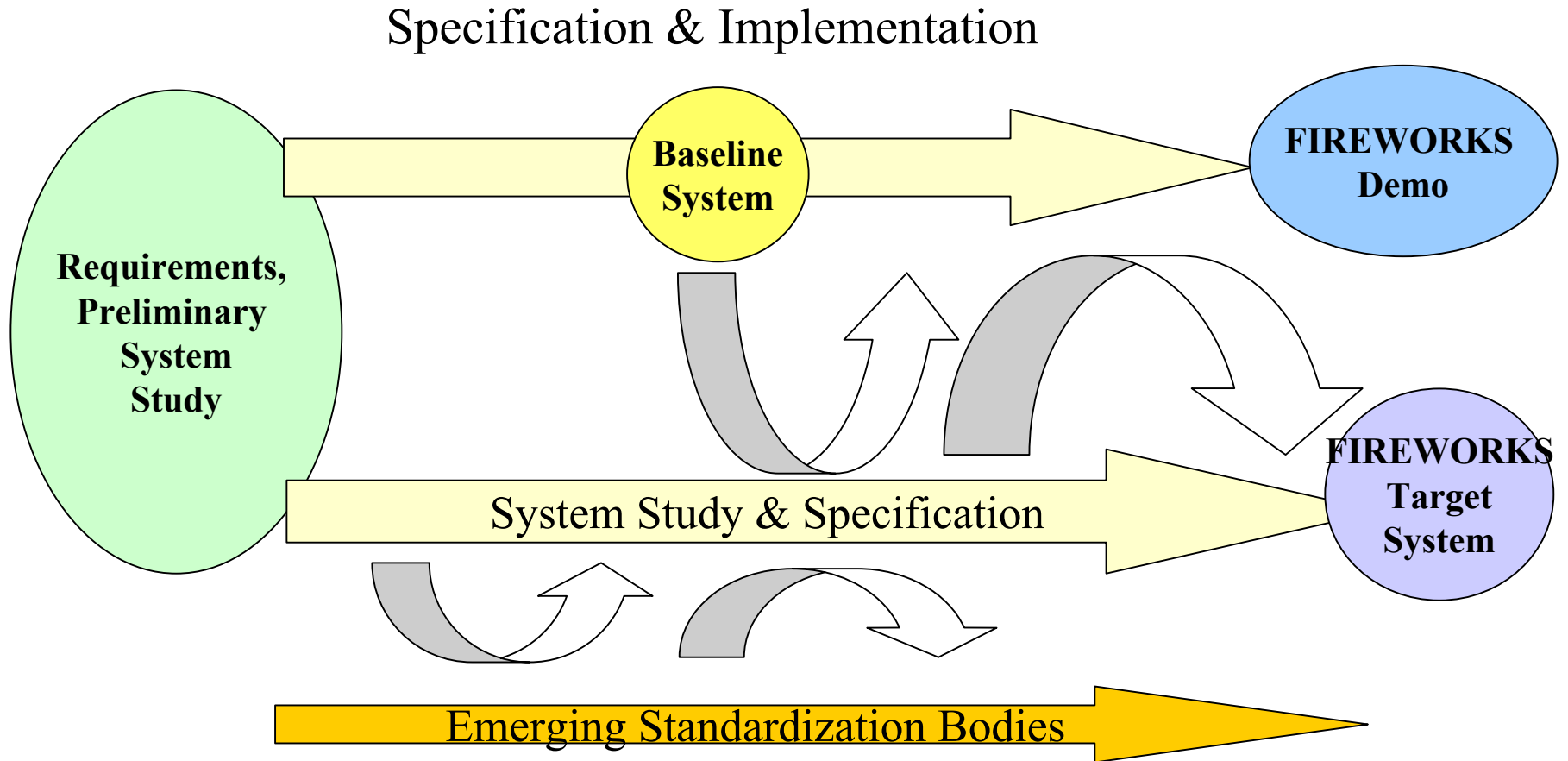
- Problem Statement
  - Emerging and future BWA systems require:
    - ◆ **Ubiquitous** provision of **Broadband** services
    - ◆ Even in hostile environment and propagation conditions:
      - ❖ **NLOs** reception
      - ❖ Areas with **terrain** and **cost** difficulties(e.g., in underdeveloped areas)
      - ❖ supporting **mobility**
    - ◆ Fulfilling specific **QoS** requirements

# FIREWORKS drivers

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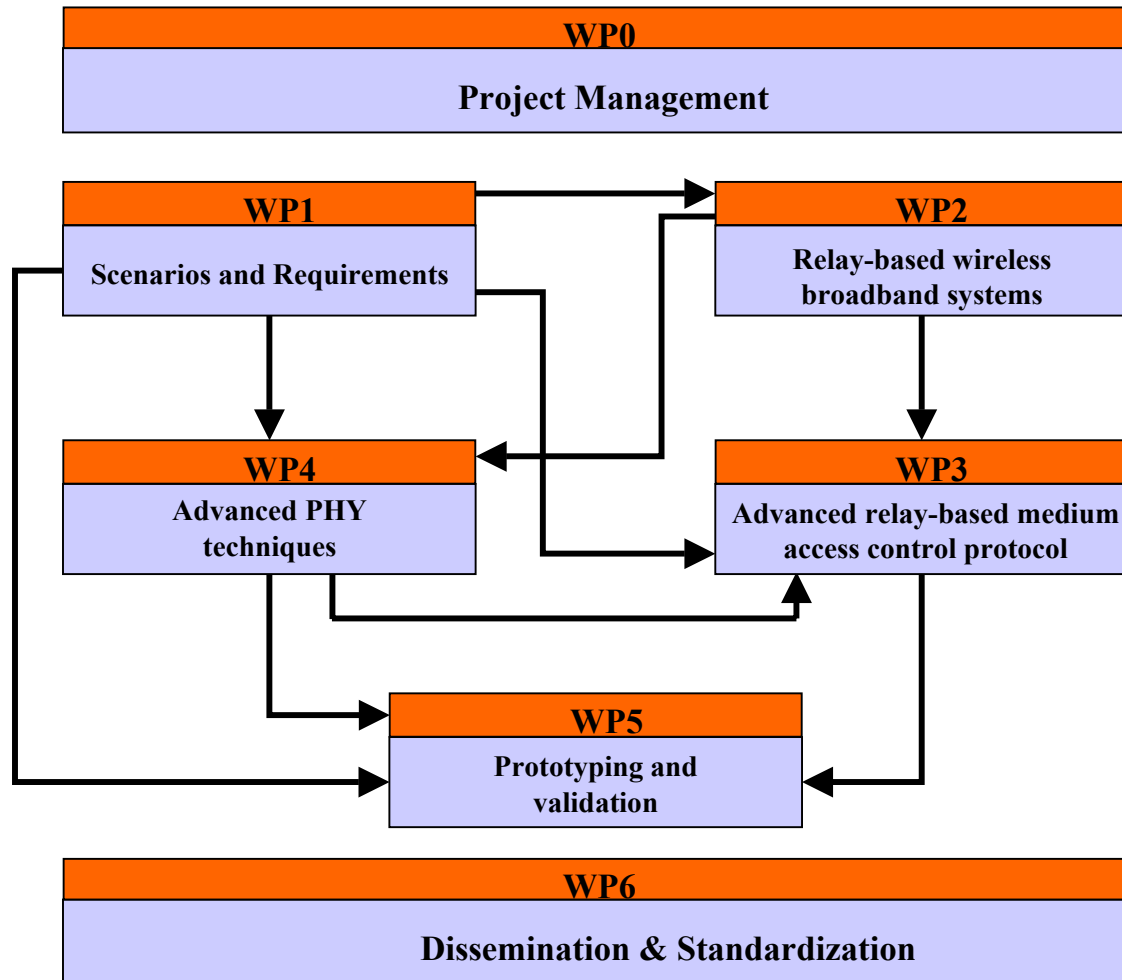
- Lack of BWA solutions to cover the high throughput and coverage requirements in costly efficient manner
- Need of flexible nodes adapting to the changing characteristics of the surroundings, power restrictions & services required at a specific moment
- Non existence of WMANs and WLANs standards specifying a sufficient **set of functionalities** to operate a **Flexible Mesh network**
  - Need of functions that efficiently manage the signaling or feedback information between nodes

# FIREWORKS Evolution paths





# Project Organization



# FIREWORKS Target System

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- Mesh OFDM-based Broadband Wireless Access (BWA) system based on flexible Relay Stations that provides solution for
  - Extended and ubiquitous coverage with QoS, in adverse environments
  - Scalable deployment that can easily adapt to terrain changes (i.e. in under-development areas).
  - Overcoming limited capacity at the cell edges, NLOS, heavy shadowing from obstacles, penetration loss in an outdoor-to-indoor link, mobility and their combination
  - Joint capacity optimization between FIREWORKS and existing or emerging WMANs and WLANs architectures

# Objectives (1/2)

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- To design innovative flexible Advanced Antenna System (AAS) concept
  - Efficient trade-off performance improvement vs. data rate
  - Increase in the number of simultaneous transmitting and receiving users
- Flexible Relays in PHY and MAC
  - **PHY** layer:
    - ◆ MIMO, Spatial Diversity Coding, Spatial Multiplexing, Beam-Forming and Cooperative MTMR
  - **MAC** layer
    - ◆ Advanced Radio Resource Management schemes and distributed MAC protocols for Mesh

## Objectives (2/2)

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- To optimize the network capacity as a result of relaying functionality
- To design innovative cross-layer optimization techniques for cooperative relays
- To specify operational deployment scenarios, service provisioning and system requirements as well as techno-economics assessments
- To establish a liaison and contribute to the emerging standards in
  - IEEE 802.16 SG “Mobile Multi-hop Relay Study Group”
  - IEEE 802.11s

# Deployment Scenarios (1/2)

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## ➤ **Outdoor, Wide Area, Cellular Deployment**

- Involves *Outdoor-to-Outdoor* Transmission and *Fixed, Mobile* or *Portable* Radio Equipment. Based on WMAN technologies, enhanced for *Mesh Operation* and *Relay-based* Deployment.
- Provides Access to *Residential, Industrial, Corporate* and *Individual* Users.

## ➤ **Outdoor-to-Indoor, Microcell Deployment**

- *Outdoor-to-Indoor* Transmission and vice versa
- Considers *Indoor, Plug&Play Desktop* WMAN Equipment

## ➤ **Indoor Deployment**

- *Indoor* Wireless Connectivity based on Enhanced WLAN Technology
  - Interconnects *Home Appliances, Entertainment* and *Communication* Devices and provides *Bridge* to the external WMAN 'Backhaul' Network
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# Deployment Scenarios (2/2)

