

**IEEE 802.21 MEDIA INDEPENDENT HANDOVER**

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Title: Practical experiences with media-independent link control

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Abstract: A description of practical experiences in creating a common interface for multi-technology radio interface management software

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## Content

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- Introduction
- EU-Mesh works in correspondence to requirements identified within 802.21
- How we try to realize the requirements identified for this SG
- Interfaces for cross layer interface management used in EU-Mesh
  - XIAN
  - DDL
- Lessons learned
- Some comments to the API primitives identified



## Background

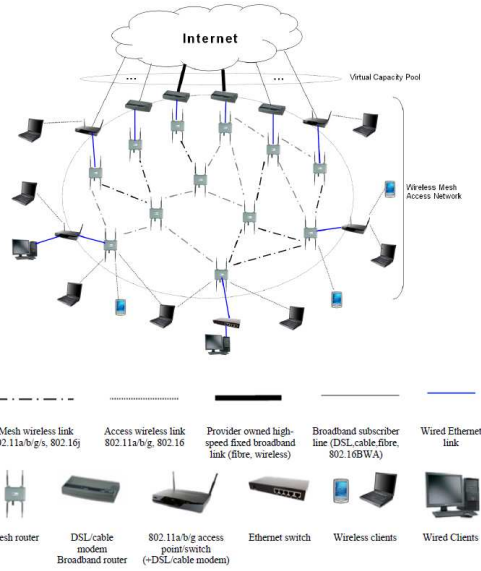
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- EU-Mesh project
  - a 30 month collaborative project which started January 2008, and is funded by the European Commission under Call 1 of ICT (Information and Communication Technologies) in FP7 (7th Framework Programme), targeting the objective “The Network of the Future” of Challenge 1: Pervasive and trusted network and service infrastructures.
  - EU-MESH's goal is to develop, evaluate, and trial a system of software modules for building dependable multi-radio multi-channel mesh networks with QoS support that provide ubiquitous and ultra-high speed broadband access.
  - Multiple radio technologies can be used to form a mesh network
    - Links using WIFI and WiMAX
    - Layer 3 routing highly preferred



# EU-MESH Data Plane Architecture

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# Network Management in EU-Mesh

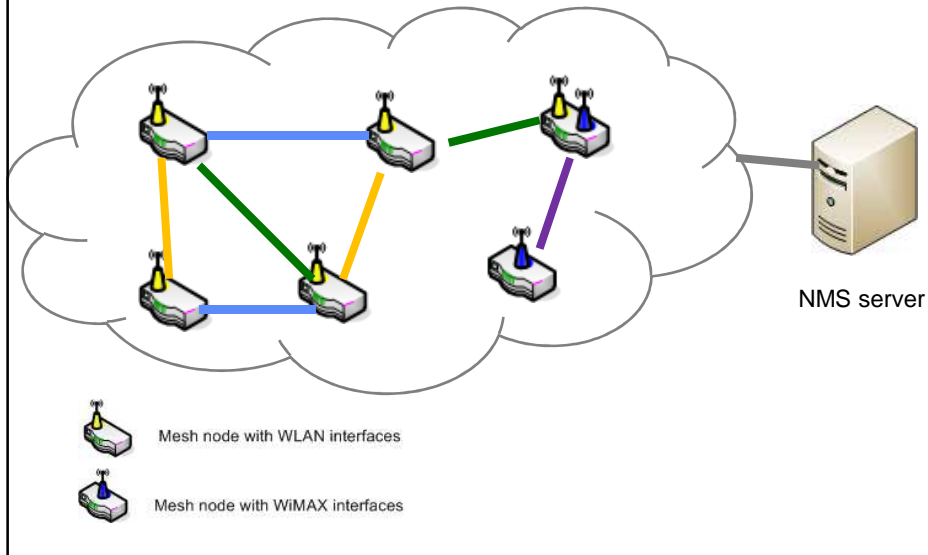
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- Proximity
  - NMS system for WiFi / WiMAX network (including mesh)
  - 802.16d BS



## Req 1: Topology Formation/Radio Config

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## Topology Formation/Radio Config cont.

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- Common interface for network management of 802.11 and 802.16 interfaces
- DHCP used for autoconfiguration, CAPWAP used for management of the nodes
- NMS server providing autoconfiguration for both WiMAX and WIFI devices
- Topology optimization / channel assignment algorithms for multi-radio WiFi mesh networks, centralized optimization algorithms executed on server
- Support for topology optimization in heterogeneous networks still seen as a future work



## Req. #2: LSP Setup/Resource Reservation

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- Mesh resource management functions provided by the NMS server and GUI
- Common interface for QoS parameters for WiFi and WiMAX
  - Defining the parameters by bandwidth and latency limits
  - Mapped to WiMAX classes of service
  - Mapped to IP HFSC queues on WiFi
- No automatic path reservation for multihop networks
- No interaction with routing



## Req. #3: Link State Info Propagation

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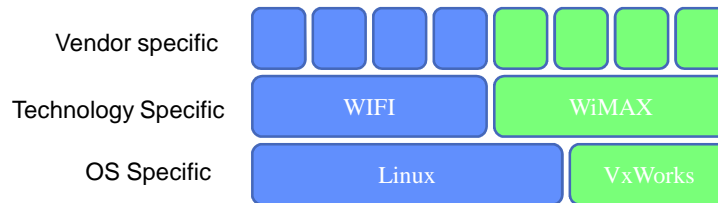
- Link state information propagated to the NMS server using CAPWAP messages
- The NMS server monitors the network topology, provides its visualization for the user
- Single point of gathering the knowledge provides easier implementation of topology management algorithm



## How we do so far

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- The agent on each of the devices gathers the information and provides it to the NMS server
- The code is specific for each type of interface and specific for some vendors
  - The code needs to be ported between different hardware providers, even for the same technology



## How would we utilize the media independent interface

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- Single code for multiple vendors and interfaces



## Interfaces used for link management

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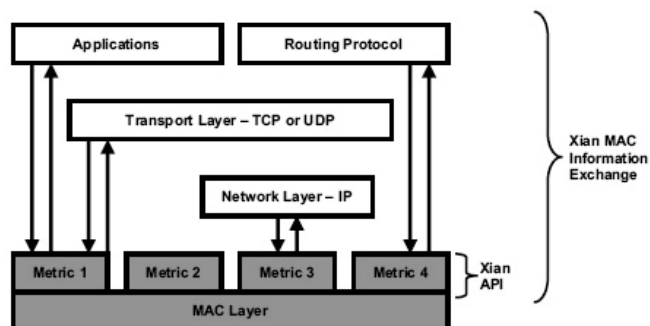
- DDL
  - Proximetry Propietarry
  - Supports WiFi and WiMAX
- XIAN
  - Developped by Thales
  - WiFi only



## XIAN

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- Library for accessing WIFI metrics from 802.11 MAC layer
- Communication is implemented on a Request/Response model
- Microprotocol to provide metrics from neighbor nodes





## Function provided by XIAN

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- Configuration states
  - configuration parameters of the 802.11 network device
- Aggregated metrics
  - counters providing statuses of the 802.11 interface
- Per neighbor/link metrics
  - Statistics of specific connections

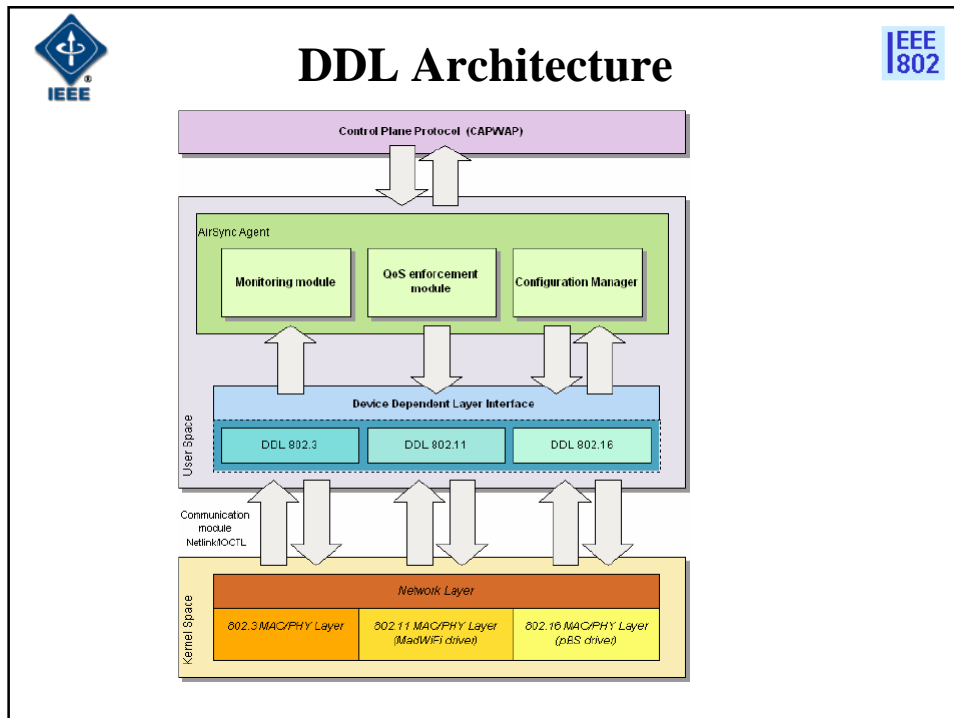


## DDL

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- Proprietary library for monitoring and managing the interfaces and devices
- Support for WIFI and WiMAX
- Function provided:
  - Configuration management
  - Statistics collection and link state monitoring
  - QoS management
- Reading the parameters by multiple interfaces
  - /proc filesystem
  - ioctl
  - interprocess communication

## DDL Architecture



## Parameters generalization

- To easily manage multiple parameters on different devices we introduced a concept of capability files
  - parameters identified by ID
  - capability files defines what device/interface supports what parameters and provides the user-readable description
  - the agent has hardcoded mapping between parameter ID and implementation of its application on specific platform
- This may be implemented by providing a space for vendor-specific parameters IDs
  - Application by MIH\_Radio\_Set\_Parameters



## Comments to information primitives

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- MIH\_Radio\_Get\_Parameters / MIH\_Radio\_Set\_Parameters
  - The list of parameters should include multiple parameters, starting from IP address ending on some technology specific parameters like e.g. beacon interval for WiFi
  - Easy way of adding a vendor-specific parameter would be a plus
- The flow may be identified not only by layer 3 5-tuple, but also by layer 2 fields, e.g. by VLAN ID