
Mobile Network Architecture & Protocols

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I. Seskar, D. Raychaudhuri

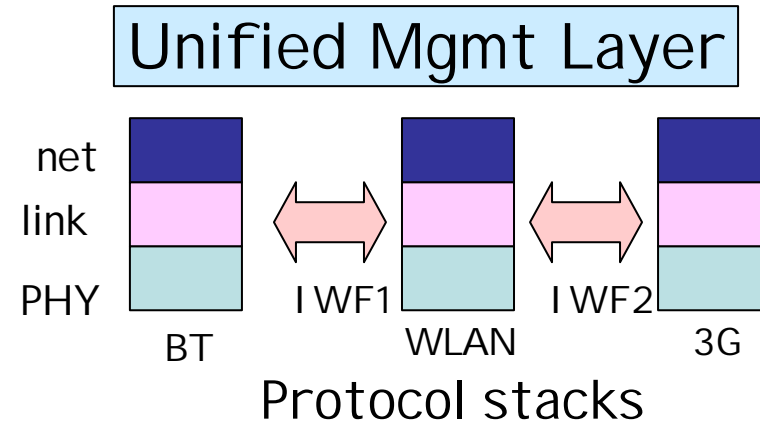
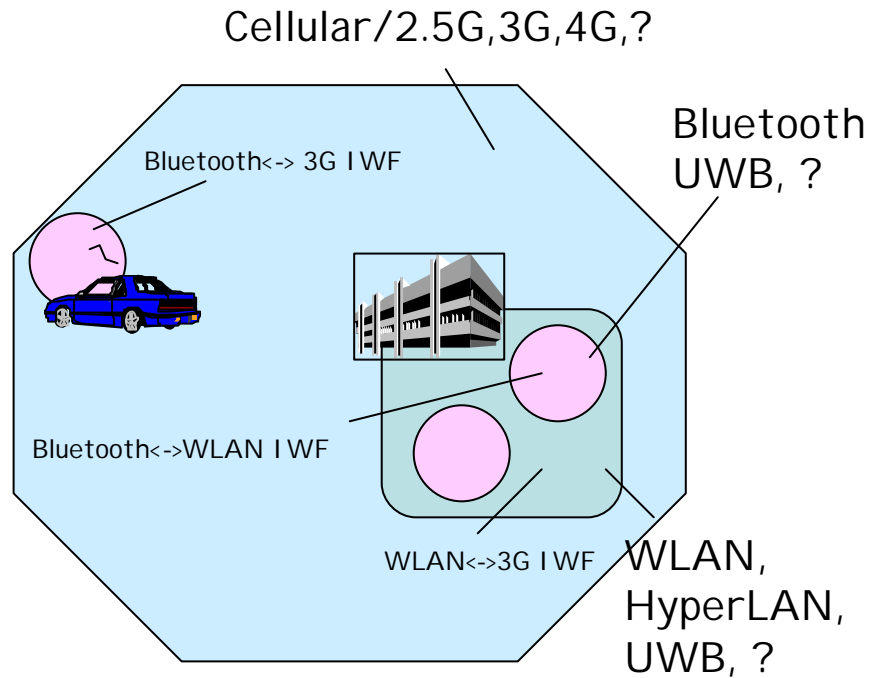
MobNets: Introduction

This project aims to explore the fundamentals of next-generation mobile network architectures and protocols, looking beyond the issues addressed by today's mobile IP, WLAN and 3G solutions.

Problem:

- Standardization process is too long for today's fast paced technological innovations
- Solution needs ability to evolve the protocol to meet future needs while minimizing standards complexity
- Need for customization

MobNets: Multimode Networks



Emerging Multimode Networks



Multiple devices with multitude of interfaces

Techniques for seamless service:

- Authentication, global roaming
- Security issues
- Dynamic handoff
- End-to-end QoS control
- Network management
- Service level agreements (SLA)

MobNets: Protocol Design Scenarios

1. Compatible upgrades to WLAN protocols for service features such as flow QoS and multicasting;
2. Interworking of multiple radio link technologies such as Bluetooth, 802.11, GPRS and 3G/WCDMA;
3. Data caching in the network in context of mobile Infostations type services;
4. Content delivery techniques for mobile users, including those based on variations of IP multicast and new semantic routing techniques. [This project involves collaboration with Semandex Networks, a NJ-based startup that has developed an XML content router product.]

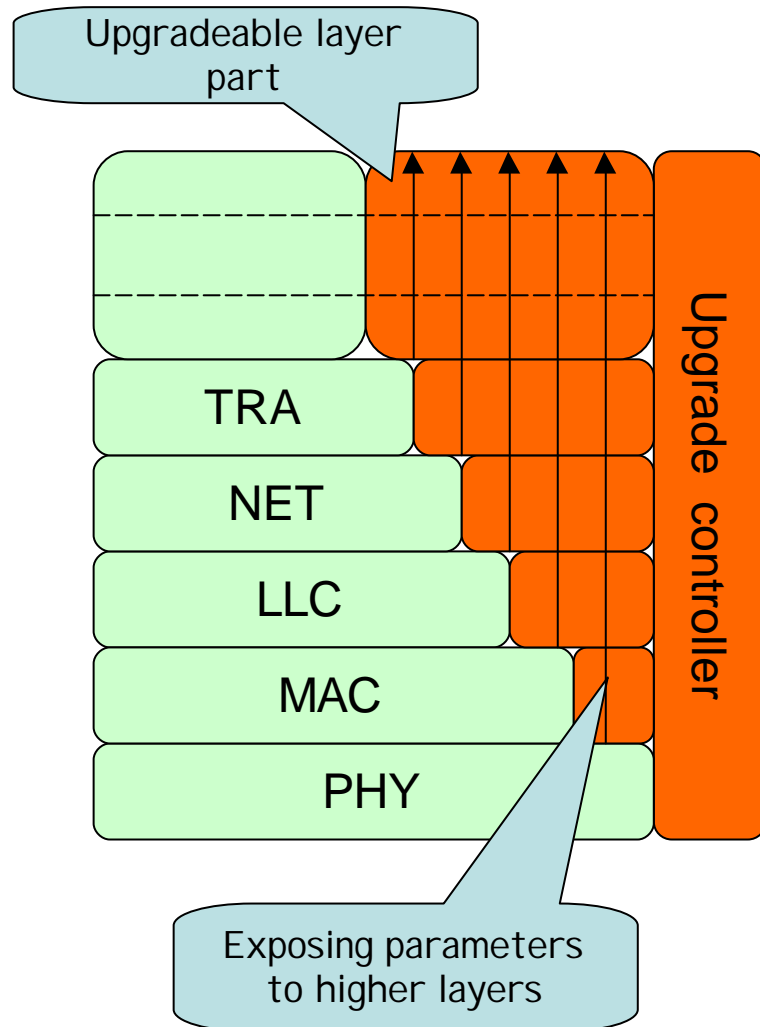
MobNets: **Dynamic Protocol Upgrades**

- Already exists in application layer protocols and middleware components as pluggable modules (WEB browser plug-ins, VoIP applications etc.) and is slowly moving into lower layers.
- What is needed is a framework that provides a uniform set of APIs and methods used to select, download, configure, and monitor each protocol layer.

In addition, successful solution has to:

- be applicable to endpoint devices as well as routers.
- provide security and fault-recovery
- deal with legacy devices
- be flexible

MobNets: Dynamic Protocol Upgrades (cont)

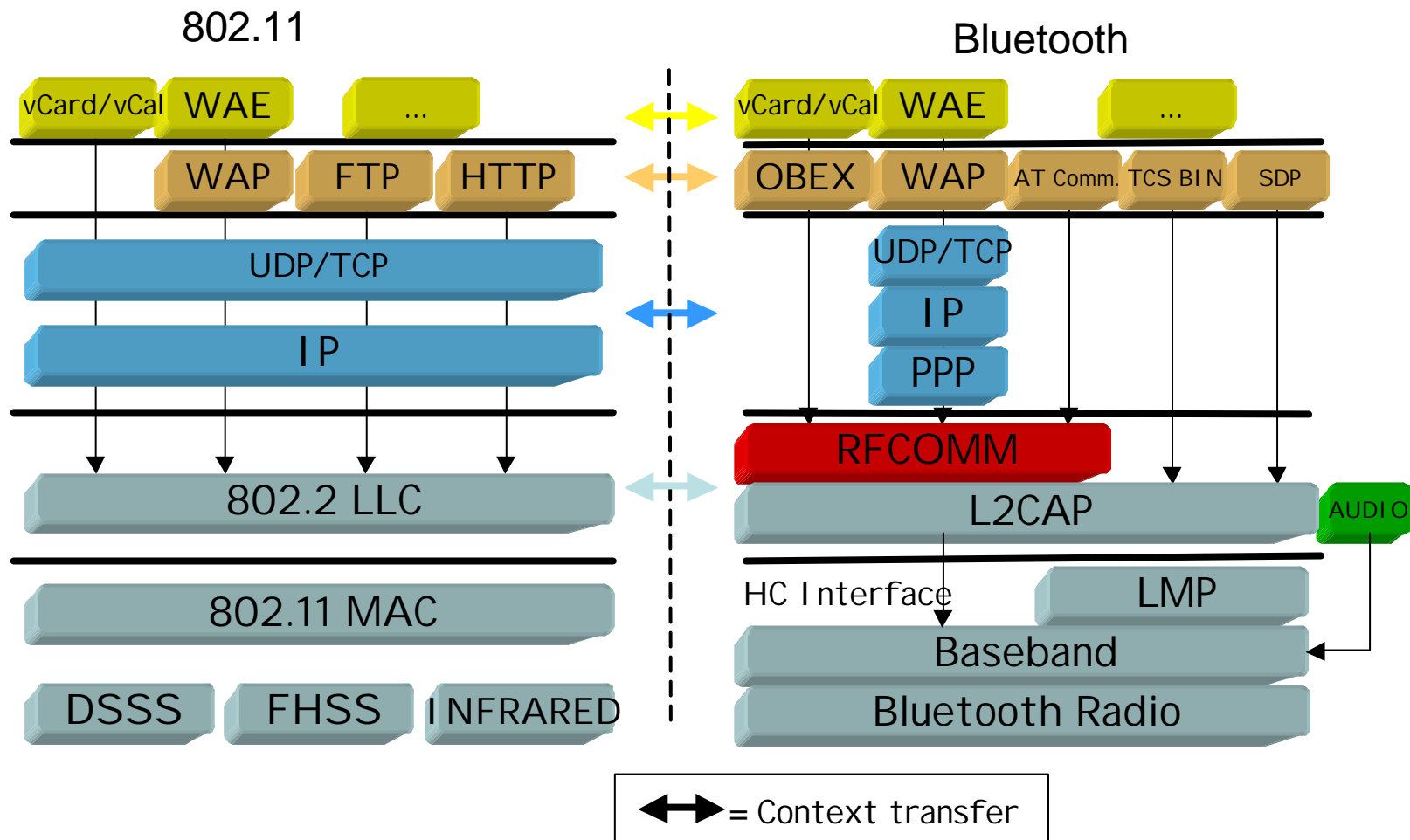


Assumptions:

- Well defined interfaces at every layer
- Exposed data structures and parameters supporting methods and algorithms
- Modular approach
- IP as a base for control connectivity
- Controller that ensures transfer, module correctness and integration into the stack

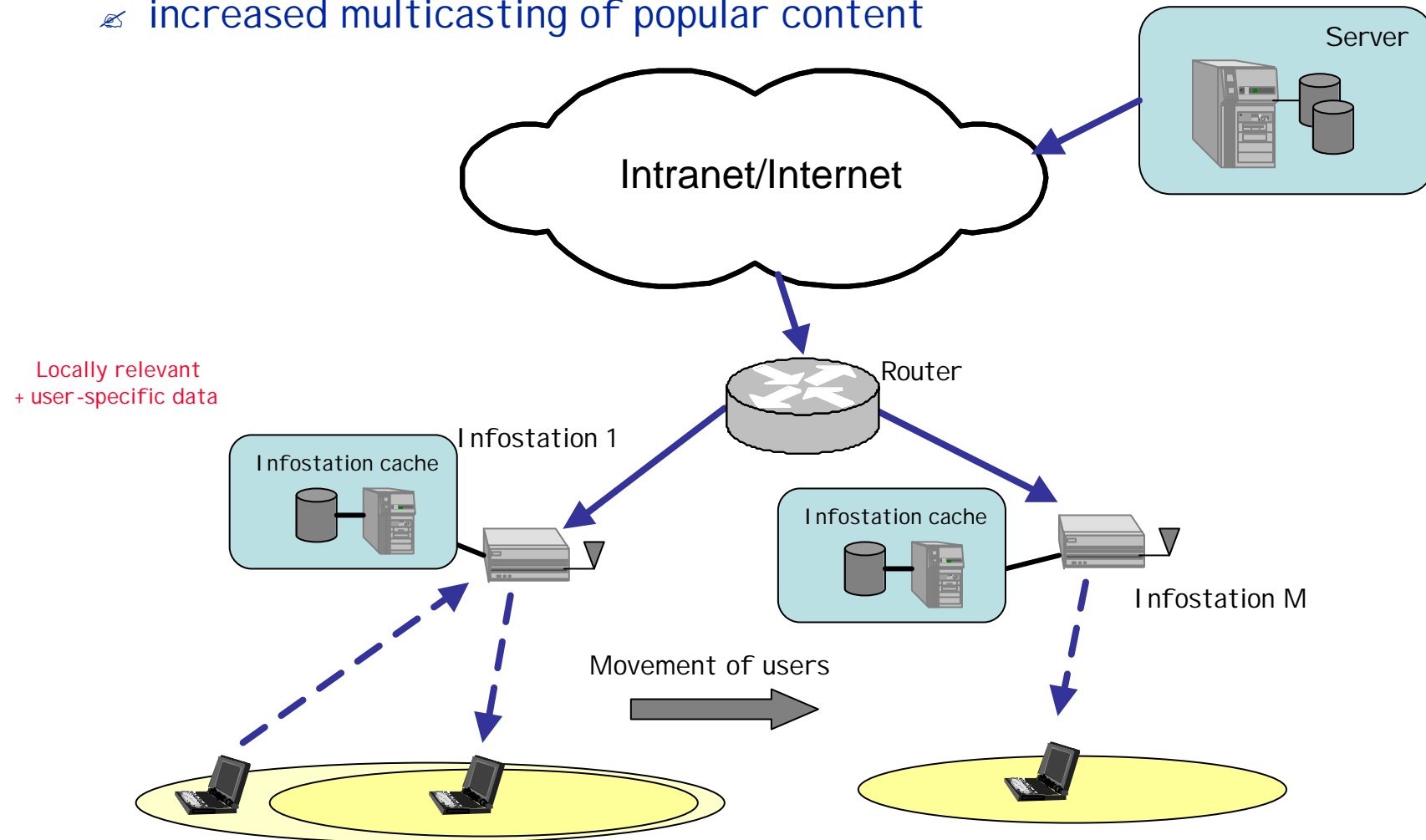
MobNets: Interworking

Peer-level collaboration of network entities supporting global roaming, handoff, etc



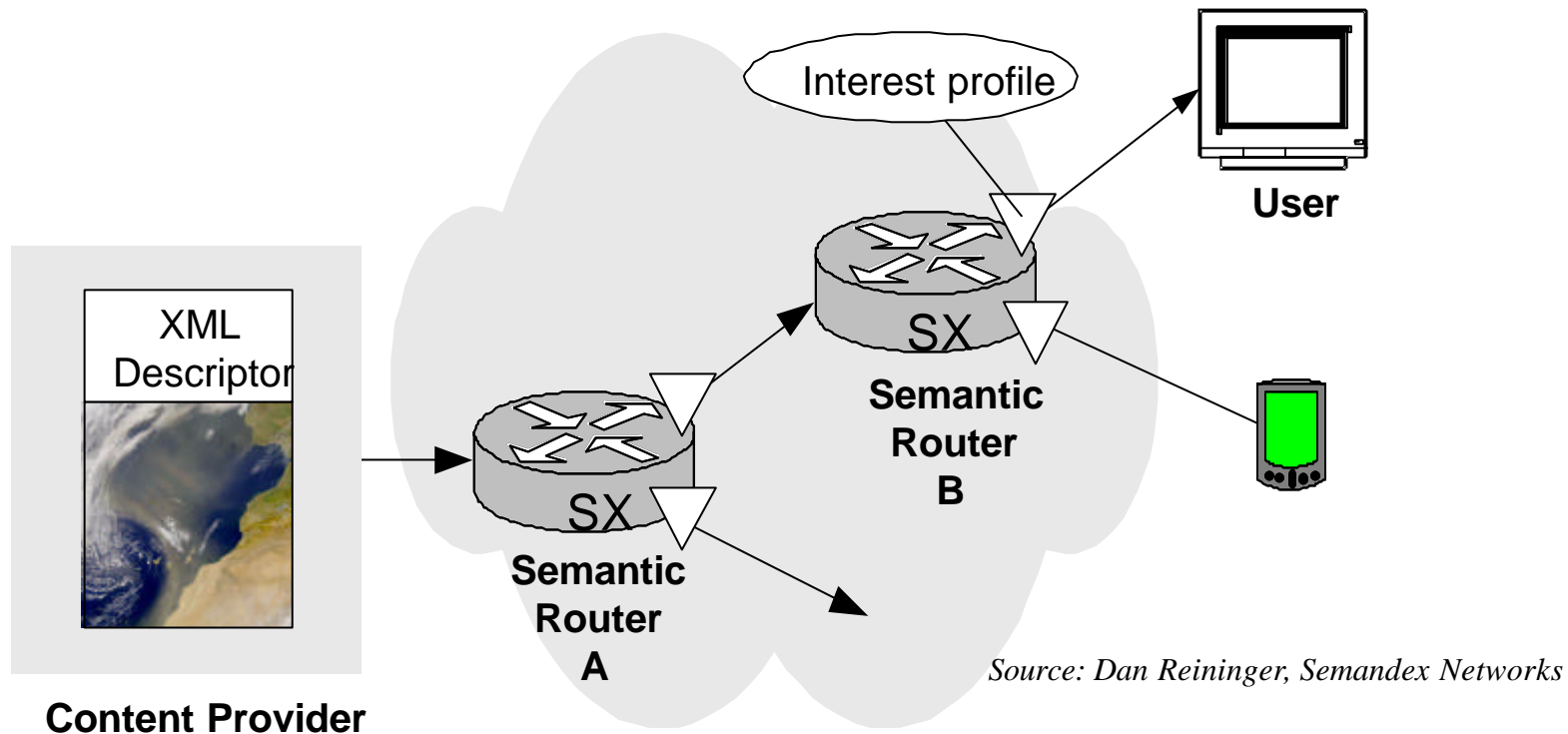
MobNets: Infostation Caching

- Opportunistic caching in Infostation environment:
 - ✍ content caches in the Infostations
 - ✍ increased multicasting of popular content



MobNets: Content Routing

- Emerging content-routing techniques will facilitate real-time, location-aware information delivery in a scalable way (collaboration with Semandex Networks) ...

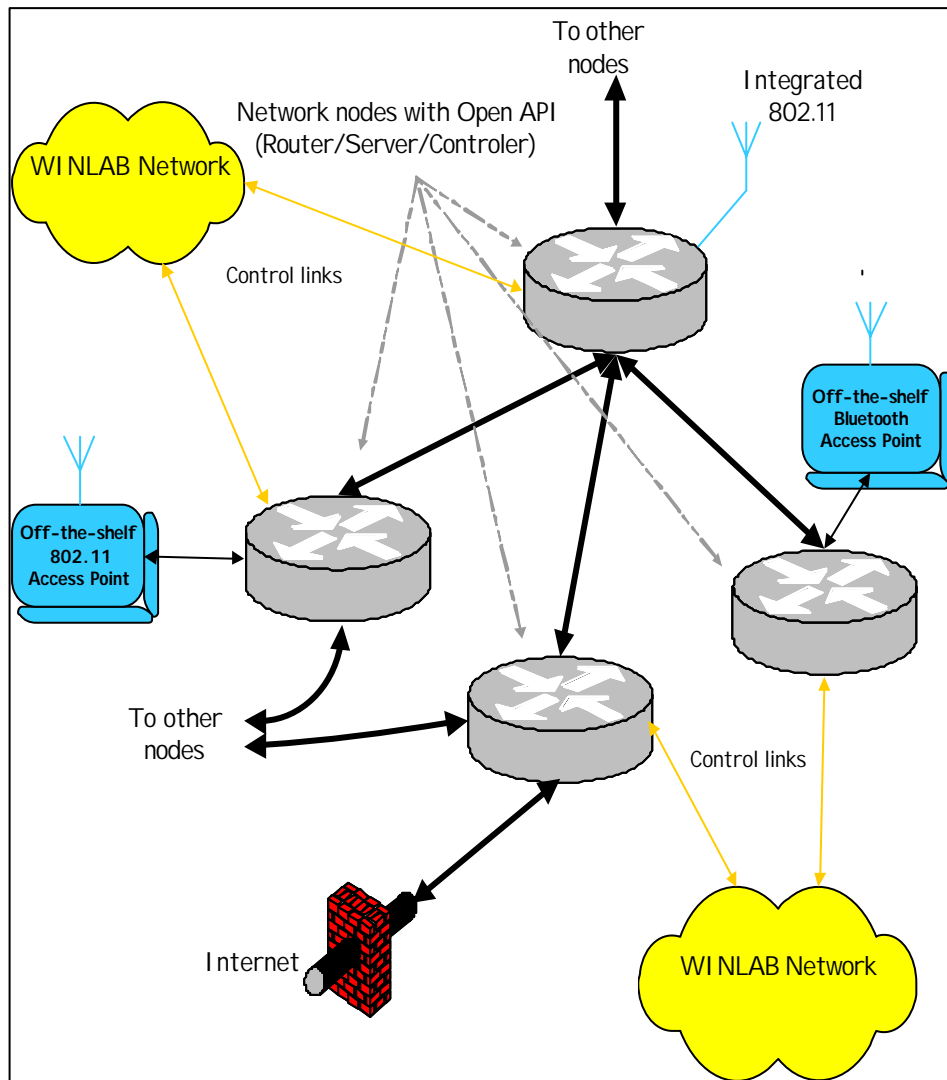


MobNets: Approach

Open architecture network in mobile context tasks:

- Identify radio and mobility related parameters
- Design open APIs
- Develop dynamic downloading of service module software for “all” network levels (assumption is that the system is TCP/IP based)
- Address legacy support issues
- Develop support for incremental service deployment
- Develop service description concept
- Develop conflict resolution mechanisms

MobNets: Experimental Testbed



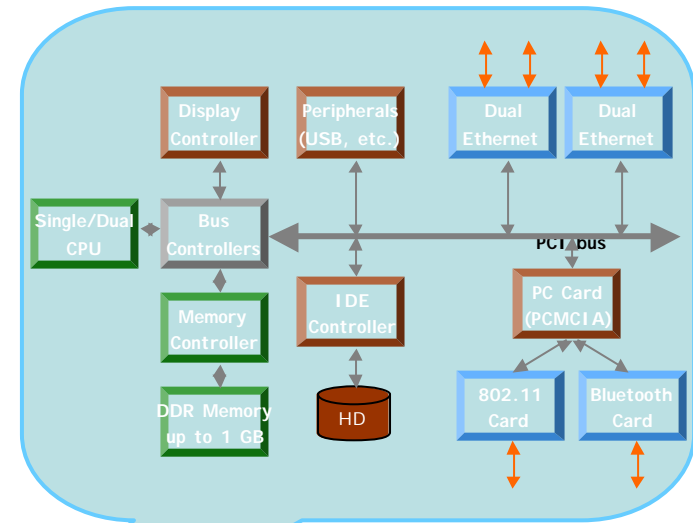
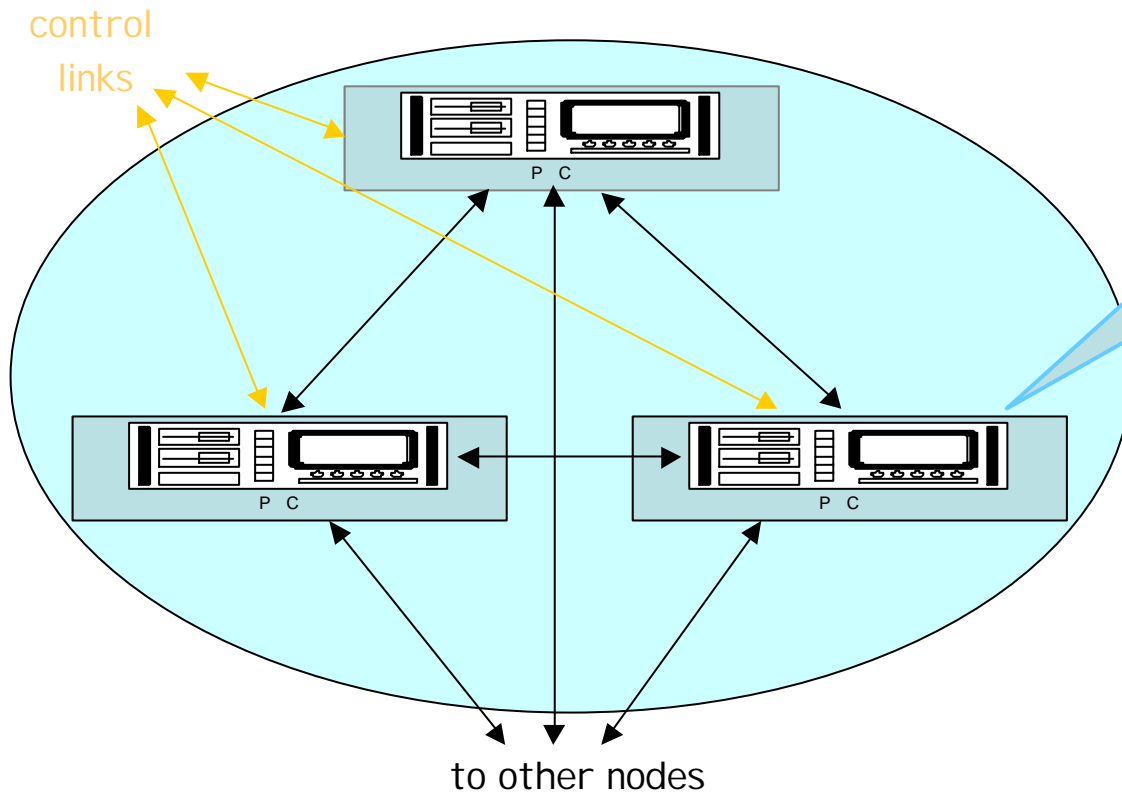
Purpose:

- Evaluate different approaches in terms of protocol functionality
- Evaluate software performance
- Enable rapid prototyping
- Implement open architecture network on a generic hardware platform
- Provide support for legacy device integration

MobNets: Testbed node

Each node has 3 general purpose PCs:

- 1U form factor
- Single or dual CPU configuration with up to 1 GB of memory
- Quad 100 Mb/s Ethernet



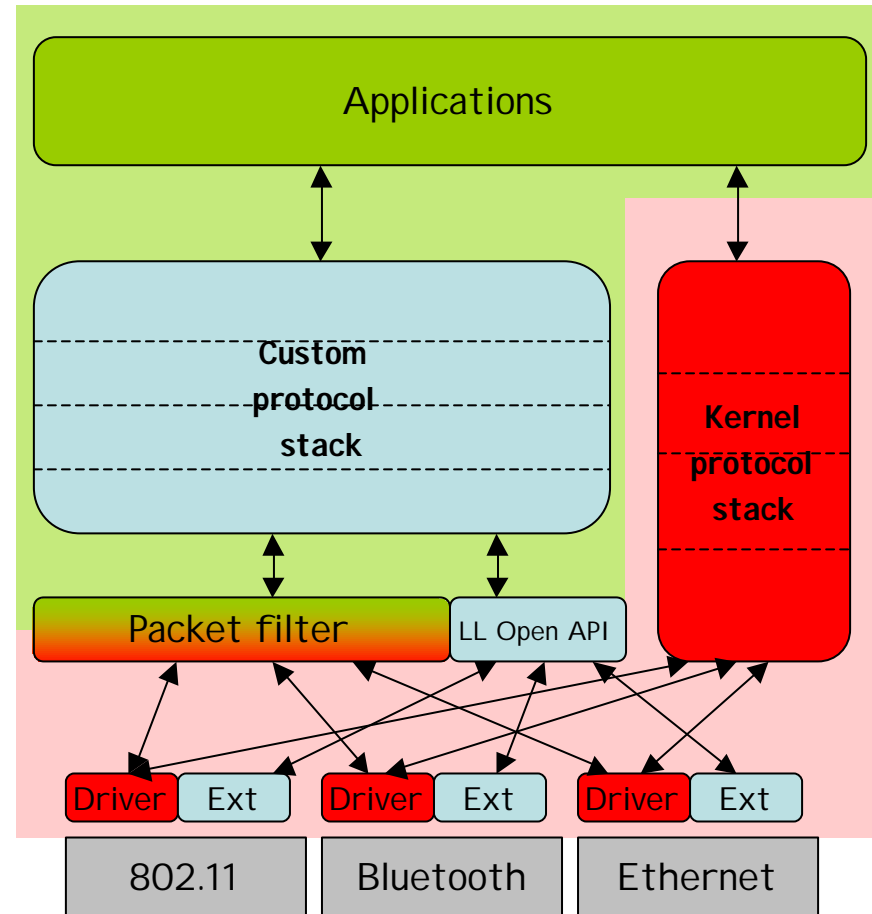
Node can be used as:

- Router
- Server/Cache
- Access point
- Or combination of the three

MobNets: Software platform

Main SW features:

- Open Linux OS
- By using packet filters minimizes driver development
- Multiple independent developers each with separate protocol stack
- Uses existing TCP/IP stack for control only
- Java based



MobNets: Software platform (cont)

Benefits of using Java:

- Code portability
- Huge existing code base
- Existing security/authentication model
- Support for pluggable entities
- Support for important concepts
(runtime loading, concurrency, CORBA, RMI etc.)
- Support for XML based protocols

Drawbacks:

- Performance hit
- Re-implementation of TCP/IP

MobNets: Status

- The project is in its initial phase with the following sub-projects currently underway:
 - Architectural design and network testbed establishment.
 - Generic API for 802.11b and Bluetooth access points development
 - 802.11/Bluetooth interworking development
 - User space TCP/IP protocol development