ENABLING EFFICIENT AND OPERATIONAL MOBILITY IN LARGE HETEROGENEOUS IP NETWORKS

Views on Wireless Network Convergence

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Version 1.0

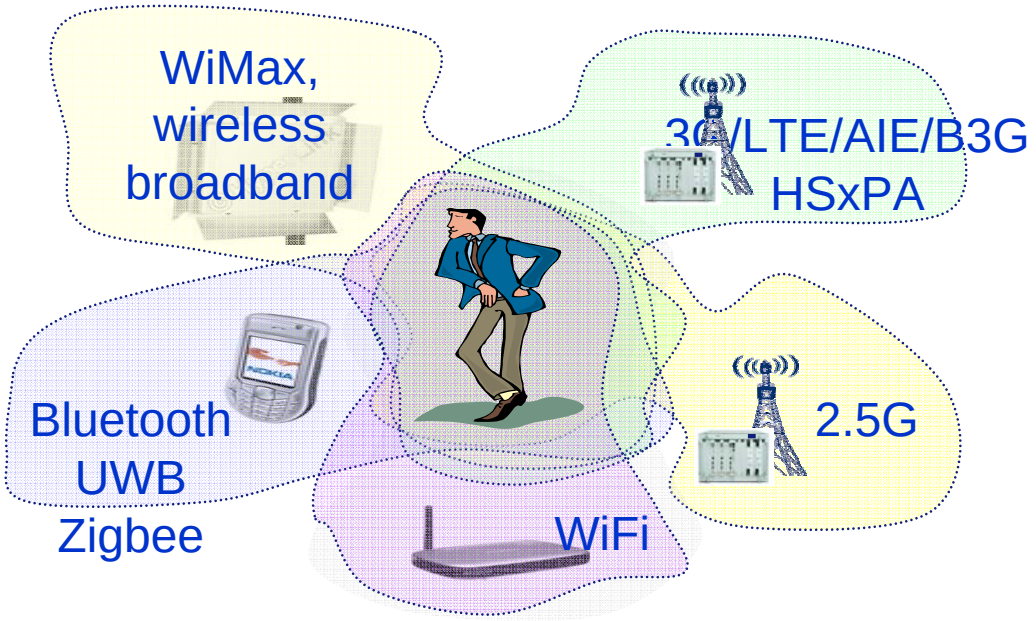
Information Society Technologies

Agenda

- Motivations for Wireless Network Convergence
- Convergence Categories
- Issues on IP based Convergence
- A Possible Evolution Strategy

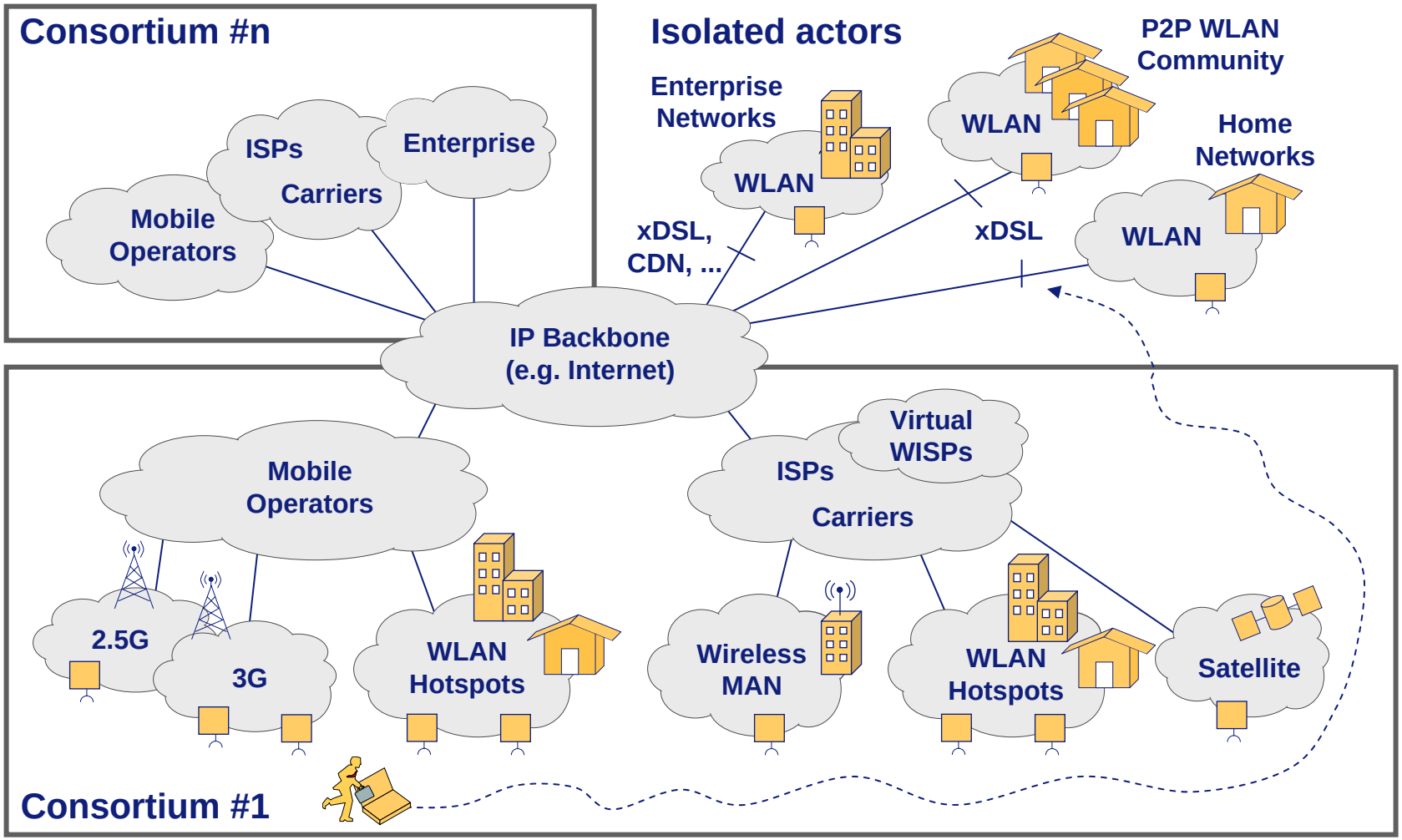
Future Wireless Communications

- User centric wireless world providing ubiquitous services
  - Anywhere
  - Whenever
  - Whoever
  - Whomever
  - Any means

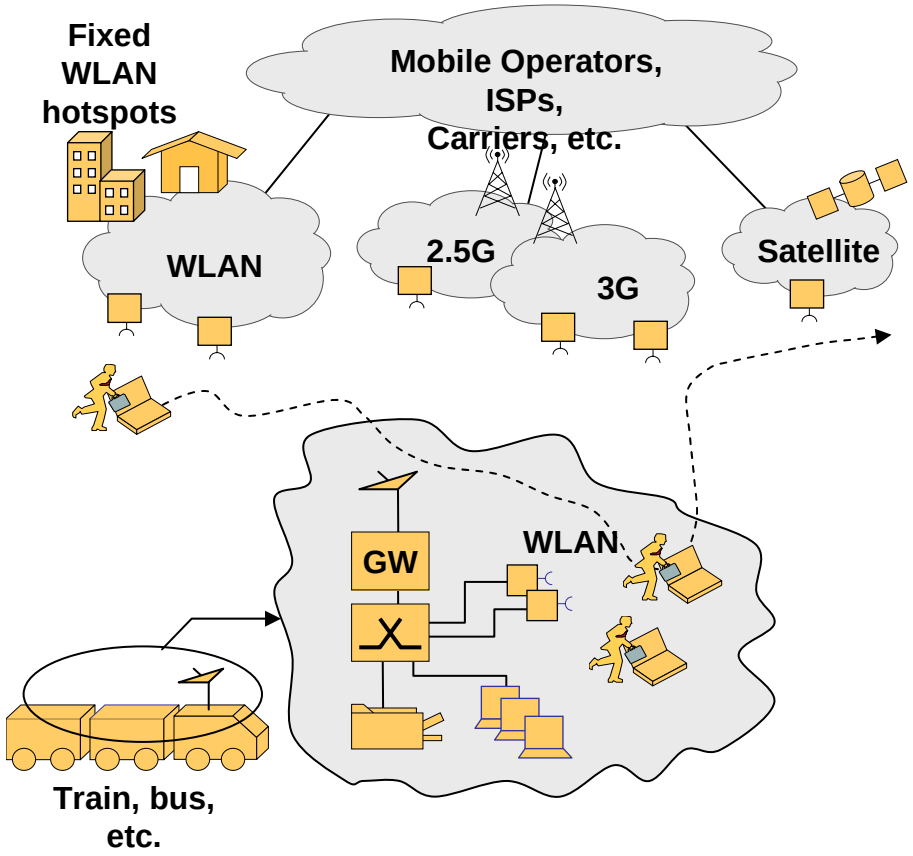


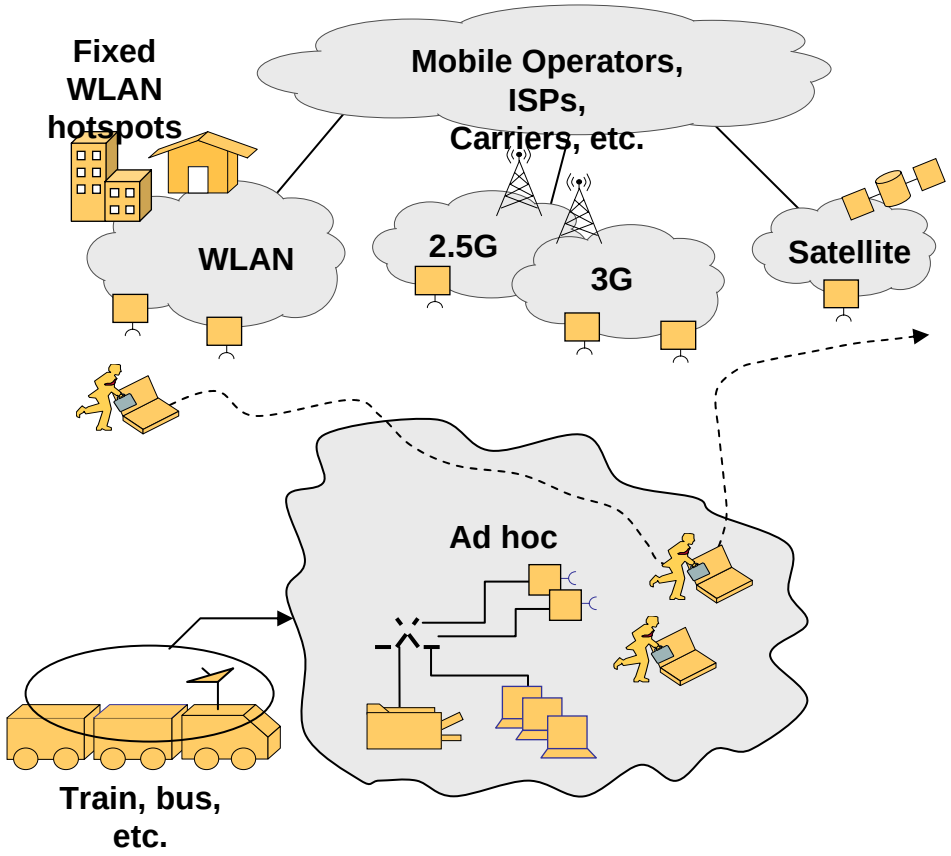
Source: 1Q 2005 Gartner

Application Scenario (I): User Moving in Wireless World



Application Scenario (II): Moving Networks

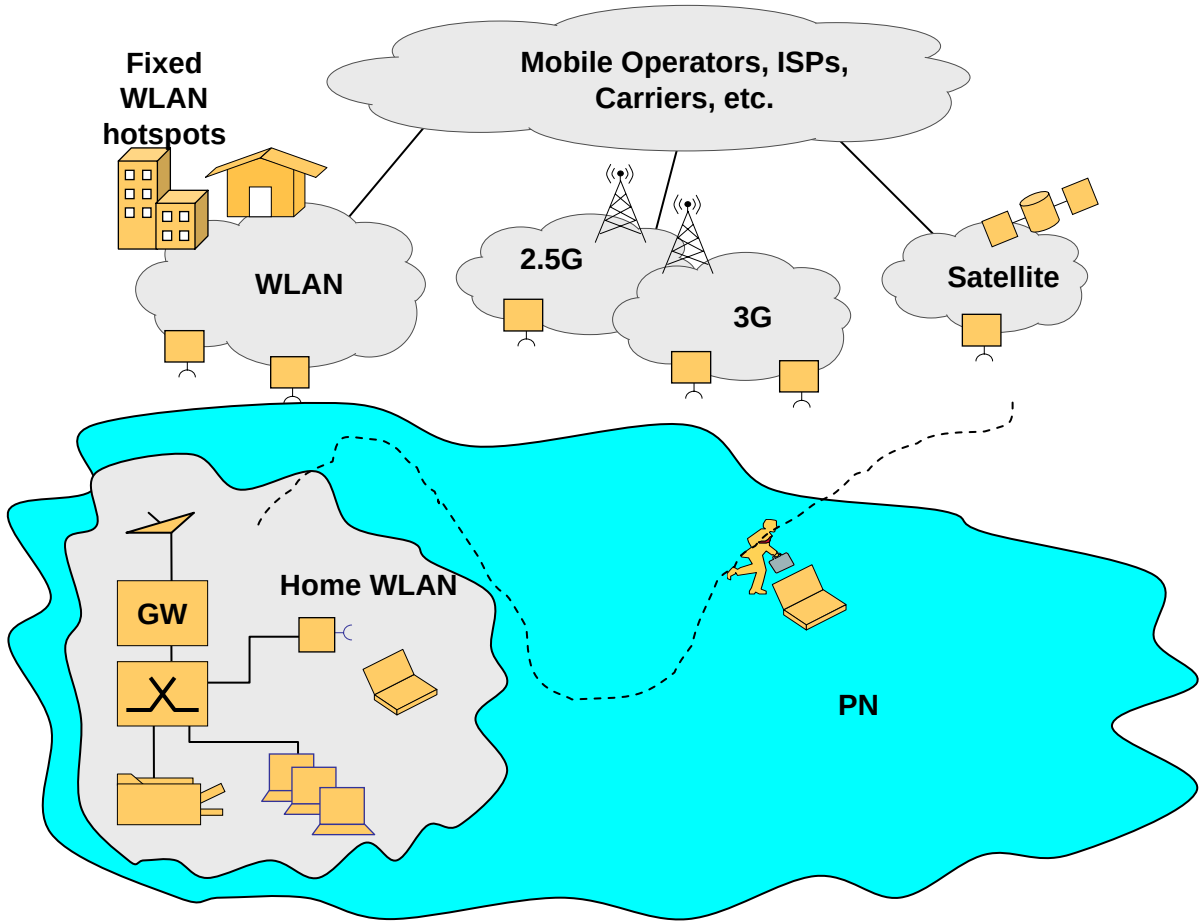




Network Access via single Equipment

Network Access via individual approach

Application Scenario (II): Virtue Moving Networks



Challenges to Future Wireless Communications (I)

- Various User Requirements:
  - Varieties of portable terminals
  - Always best connected
  - Demands for enjoying a wide variety of voice, data and multimedia services independently of their geographical location
  - Higher performance requirements than today (higher bit-rate, lower delays, etc.)

Challenges to Future Wireless Communications (II)

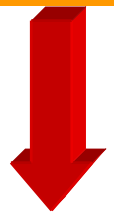
- Requirements for evolution of network infrastructure:
  - support for a huge number of connected terminals (phones, laptops, sensors on vehicles etc.)
  - capacity to deliver an increasing amount of data traffic
  - maximization of network coverage (ubiquitous service)
  - efficient usage of network resources (radio access, backbone)
  - support for always-on connectivity anywhere, in any mobility condition and with the best possible performance;
  - minimization of the delays experimented by users in order to enable interactive services
  - enable the offering of a wide variety of value added IP services, with a quality significantly better than today

Enabler against Challenges

Now, We are here

Diverse Wireless World

Converged Wireless World



Convergence of wireless/wired telecom world, informtainment, and information technology world

High Level Technique Issues for Wireless World Convergence

- How to support multiple access technologies, multiple administration domains
- How to support multiple kinds of services
- How to support seamless mobility
- How to implement efficient traffic delivery
- How to provide ubiquitous services

High Level Technique Requirements for Wireless World Convergence

- Convergence solutions rather than network innovation
- High reliability
- High scalability
- Optimized usage of network resources
- Minimization of e2e transfer delay for data packets
- Optimized support for always-on operation

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Multiple Dimensional Convergence Categories

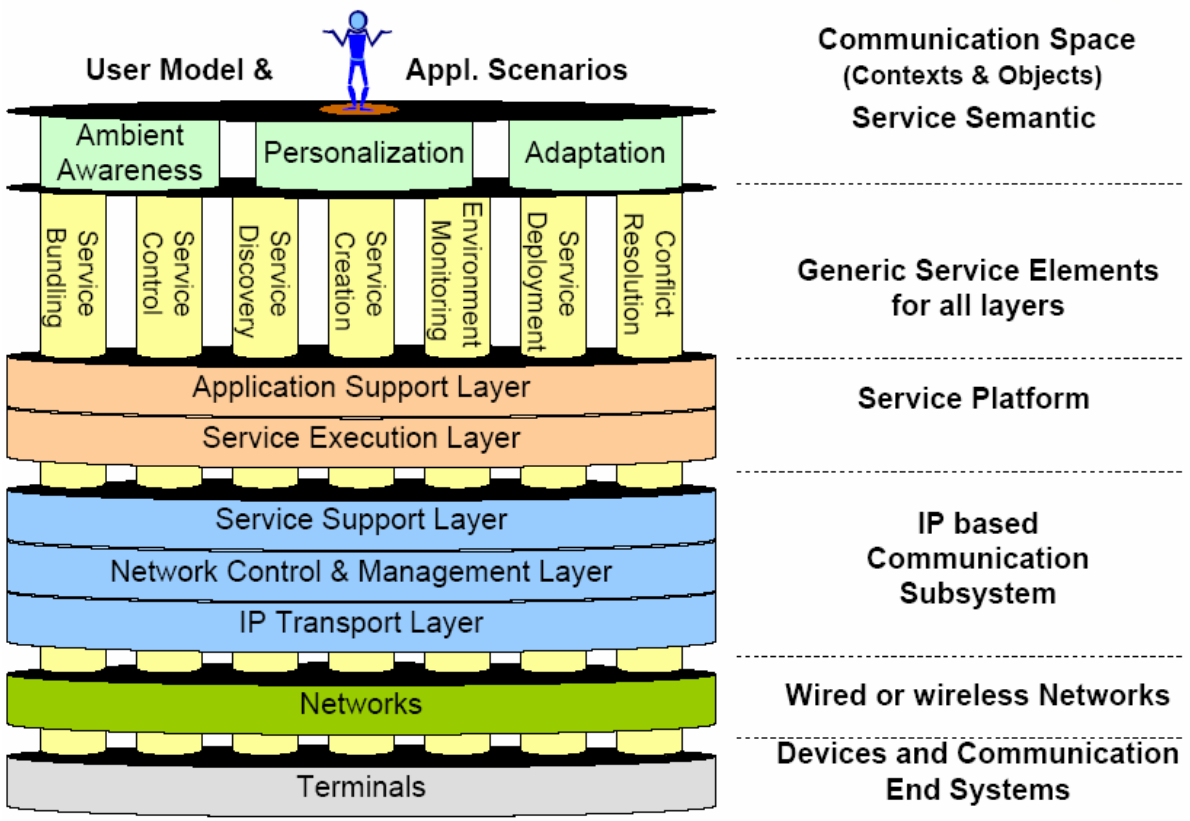
- Converged Architecture
  - Converged Applications
  - Converged Services
  - Converged API
  - Converged Networks
  - Converged Spectrum

or/and

  - Converged Devices
  - Converged Infrastructure

Layered Convergence Concept

- The lower layer where convergence occurs, the higher performance achieved.
- Different pairs of Networks may converged at different layer.



Source: WWRF White Paper, 2005

Convergence - Degree

- loose convergence-> tight convergence
  - Common billing and customer care among involved networks
  - Common access control and charging among involved networks
  - Services sharing among involved networks
  - Service continuity among involved networks
  - Seamless services among involved networks
- Factors to convergence degree
  - Operators agreements
  - Capability of infrastructure and terminals
  - etc.

- Any options are possible

- ENABLE's view: **converged networks** on **IP based transport and control layer** at first stage

  => Efficient and operational mobility in large heterogeneous IP networks

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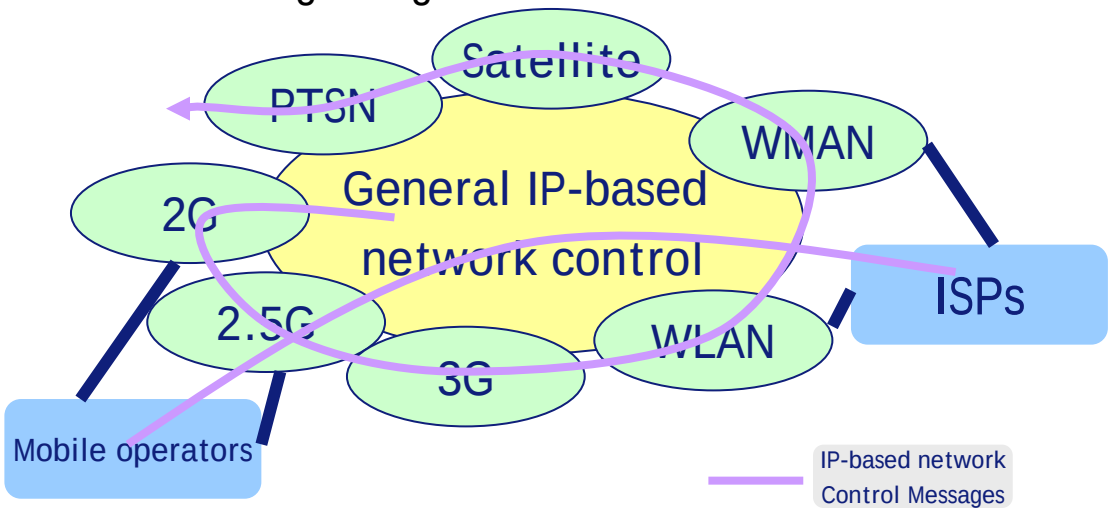
Issues on IP based Convergence

- IP-based network control
  - General network control policies of different domains
    - Intra-technology
    - Inter-technology
  - Efficient control messages
    - Minimization of signaling round trips
    - Minimization of signaling overhead

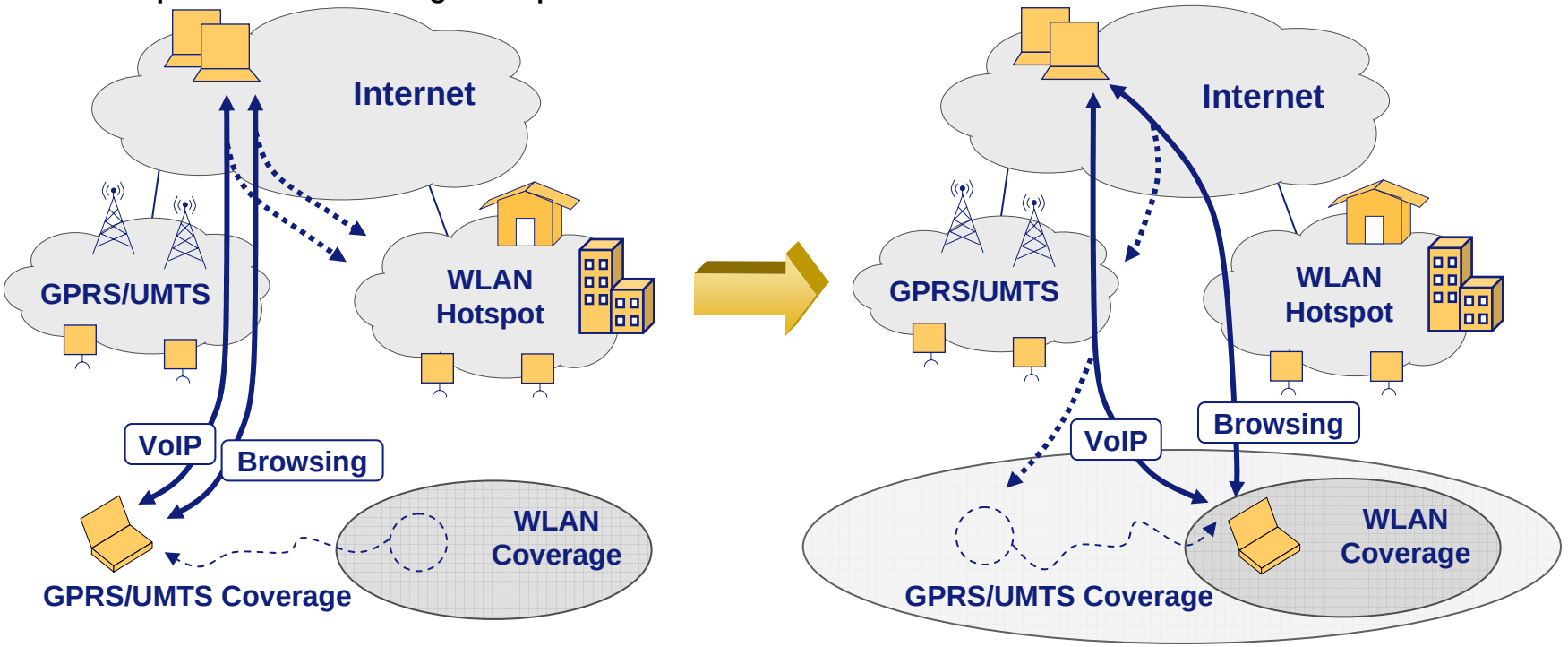


Issues on IP based Convergence

- IP-based transporting
  - Supporting efficiently transporting of traffic
  - Transparent transporting traffic
    - Across different IP version(IPv4/IPv6 IPv4 with NAT)
    - Across different access technologies
    - Without requiring users' intervention

Issues on IP based Convergence

- IP-based routing and addressing
  - Be enable to accommodate of **a vast (and fast growing)** number of users and terminals
  - Implement IP addressing over heterogeneous networks
  - Optimized Routing for specified service/network



Issues on IP based Convergence

- Communication Quality
  - Guaranteed QoS E2E Mobility
    - Fast handoff (e.g. for real-time non-reliable applications)
    - Lossless handoff (e.g. for non/near real-time applications)
    - Seamless handoff (e.g. for real-time reliable applications)
  - Flexibly offered specified QoS according to different condition
    - User profile
    - Network loading
    - Resource Usage
- Supporting of IP service
  - Ability to effectively handle a variety of different types of IP traffic
    - Real time/Non-real time/Mission critical/Reliable
    - End to End/End to Multicast/ Multicast to Multicast
  - Service based access system selection: efficient usage of RR

Issues on IP based Convergence

- Security and Privacy
  - Enhanced security and privacy
  - Coordination of different Security and Privacy Policies of different network and operators
- Deployment
  - Backwards compatible with legacy system
  - Flexibility of deployment
  - Smoothly convergence process

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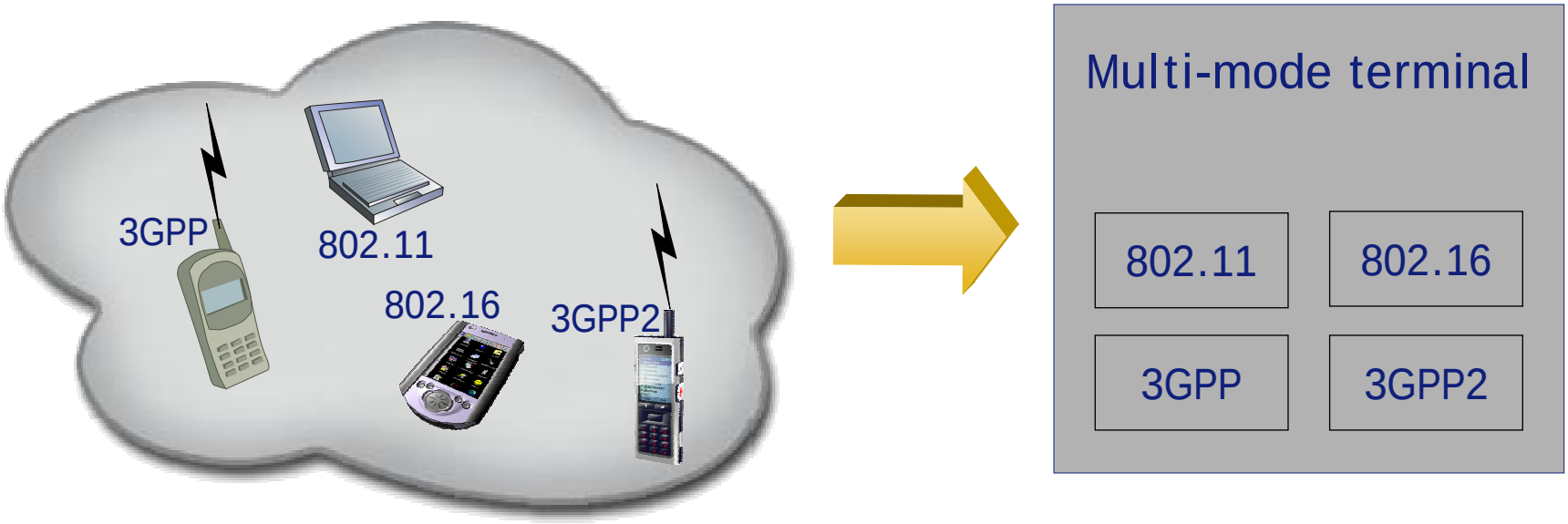
Evolution Strategy

- **0.** With Mobile terminal evolvement, more and more terminals with multiple network interfaces appear

- **1.** Implementation of an adaptation layer supporting part of transport layer convergence functions, such as seamless handover, without affecting existing legacy networks, .

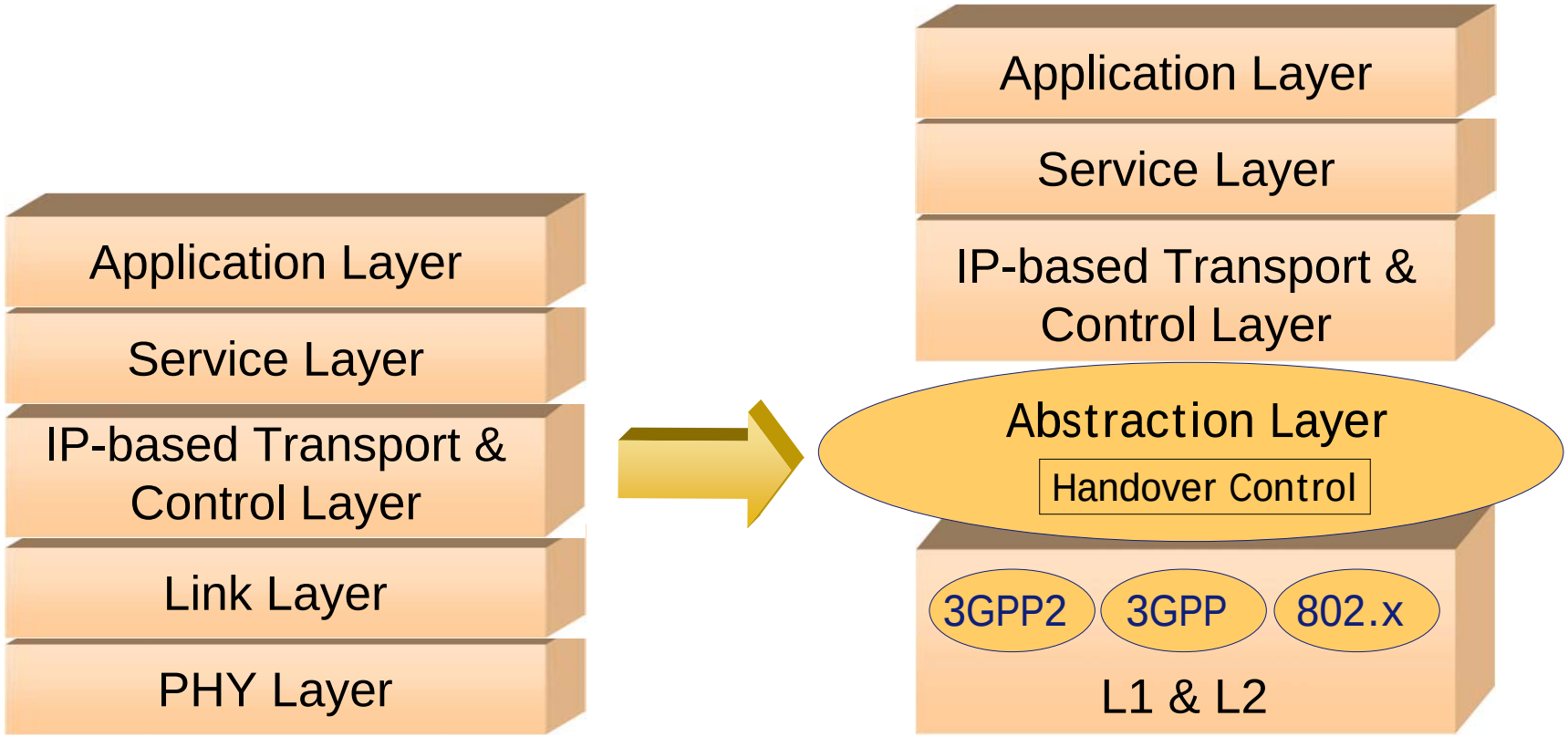
- **2.** Add convergence functionality to the adaptation layer, and make it mandatory to implement convergence on IP transport and control layer.

Step 0: Multi-mode Terminal



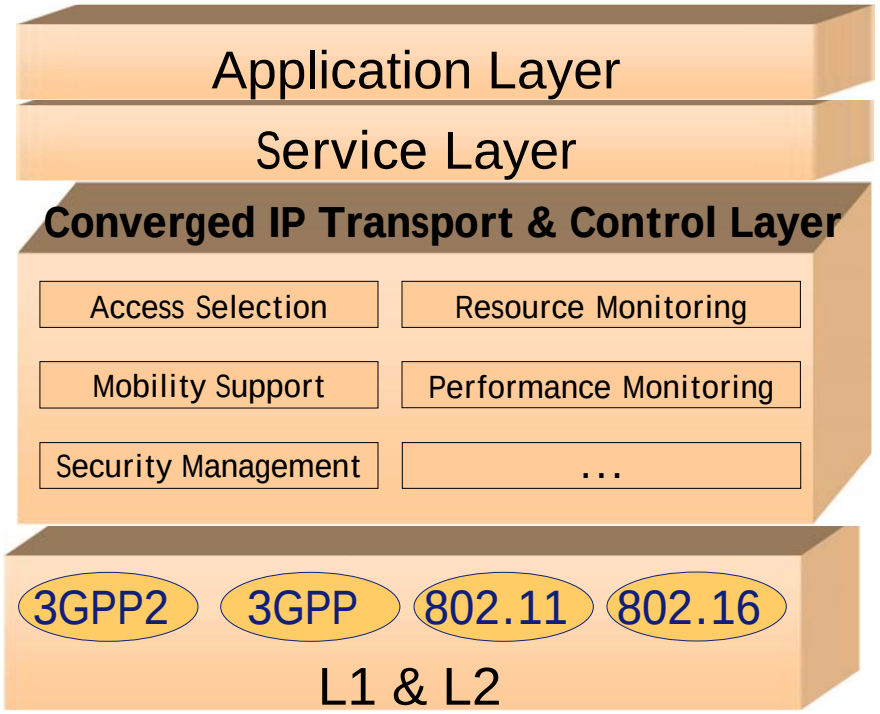
- For ubiquitous service, the mobile node is capable of supporting multiple interfaces at the same time.

Step 1: Adaptation Layer

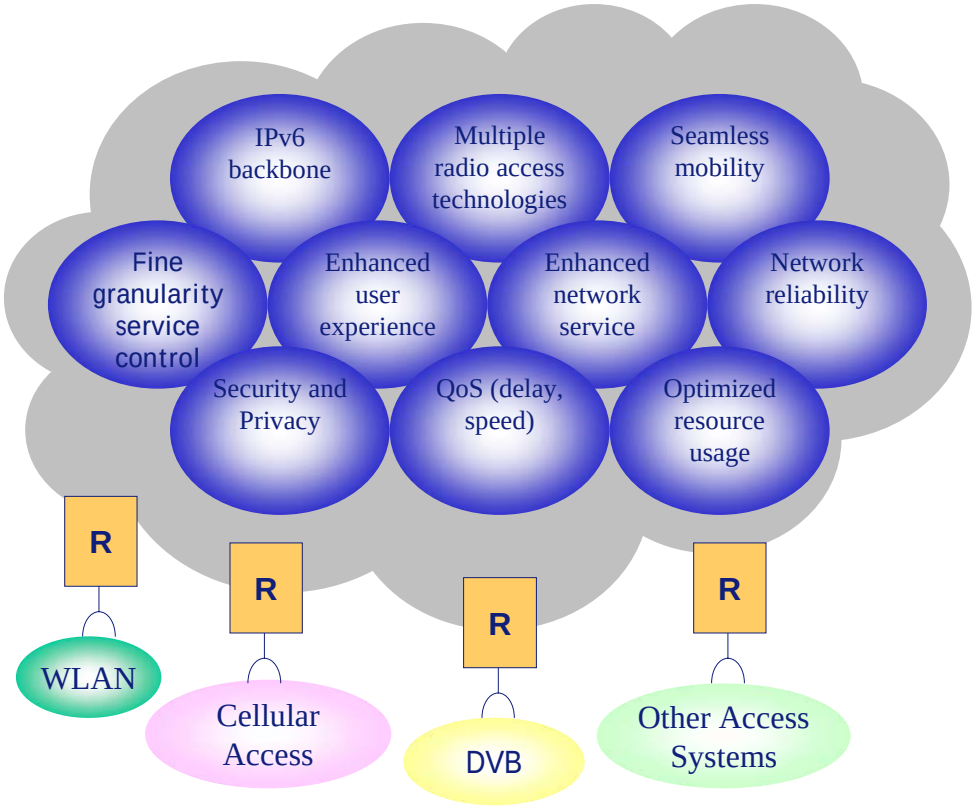


- An optional abstraction layer
- Perhaps Solve seamless handover problem only

Step 2: Extension of Abstraction Layer



Converged networks on IP-based communication subsystem Layer



A converged network example

Reference

- Enable Proposal Part B, V12.0, 2005
- Enable Requirements and Scenarios, V1.2, 2006
- S.R. Subramanya, Multiple Dimensions of Convergence – Outcomes and Issues, WWRF15#, 2005