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Title	**Network Architecture Considerations in Support of the MBWA Design**
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Re:	MBWA Call for Contributions
Abstract	This presentation addresses some fundamental network architecture considerations in support of the MBWA design.
Purpose	Informational, to avoid pitfalls of restricting MBWA applicability to particular network architectures.
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Network Architecture Considerations in Support of the MBWA Design

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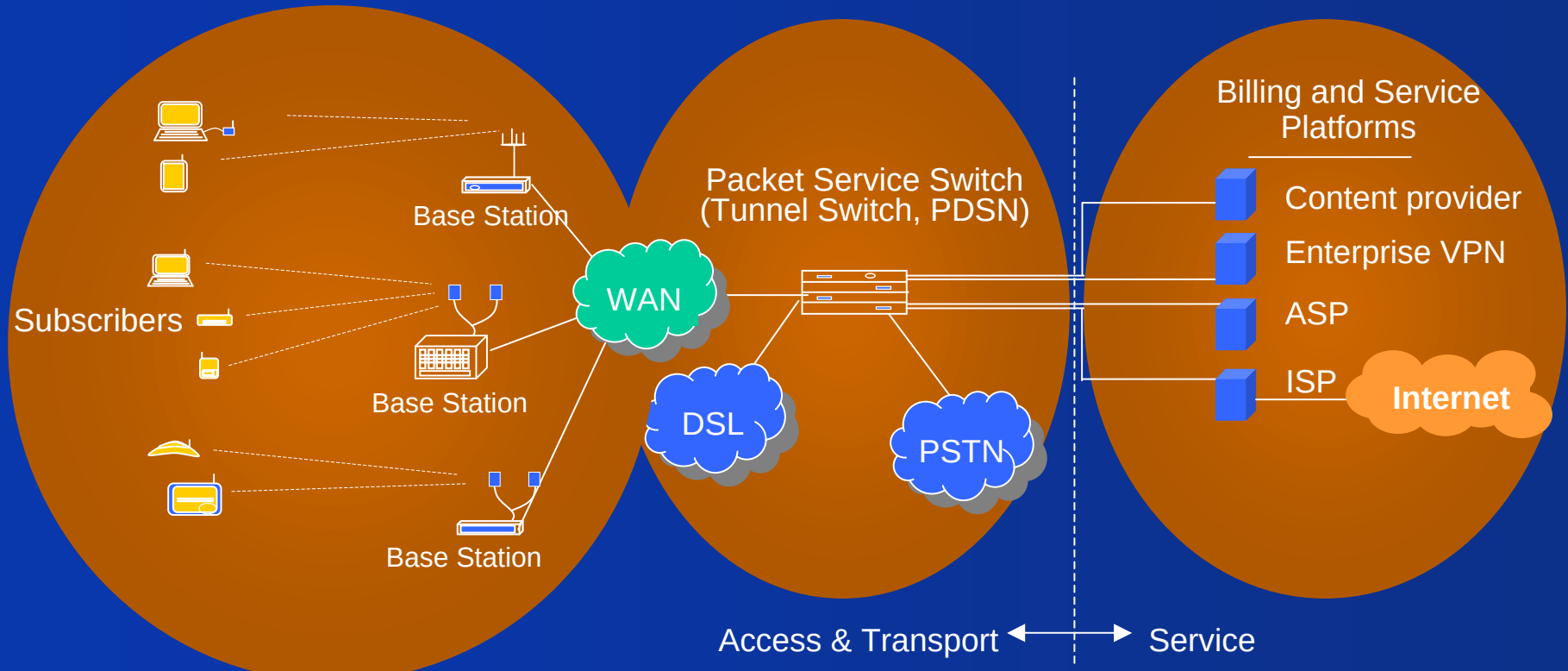
Proposed Network Objectives for MBWA

- Support existing Internet broadband and broadband wireless network and service models
  - Basic structure from existing Broadband Internet Access Networks
    - Internet broadband access networks and broadband wireless access networks share structure
    - Re-use of infrastructure e.g. DSL, 3GPP, 3GPP2, etc.
  - Simple IP/ Mobile IP
  - Internet QOS architecture

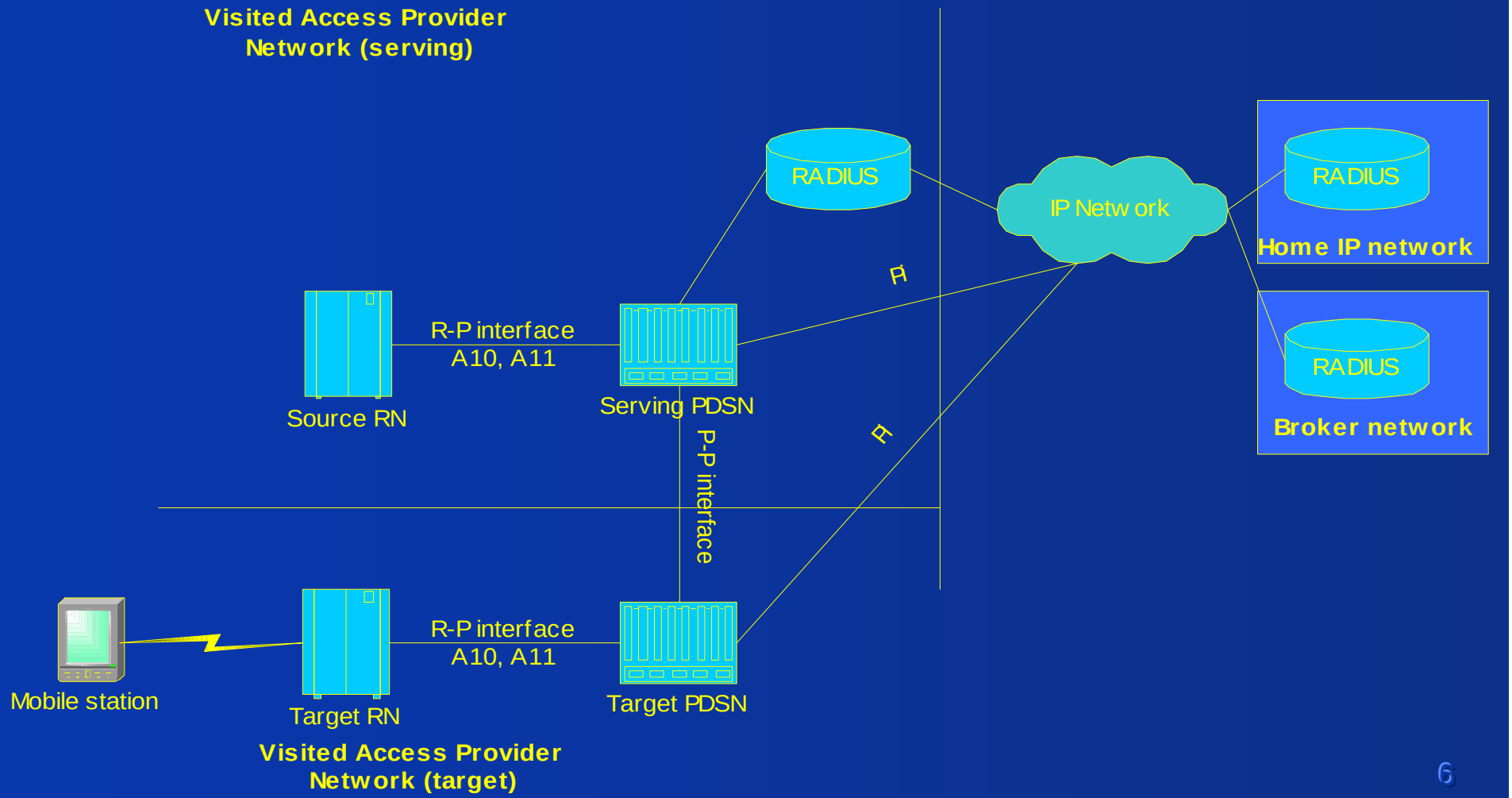
Proposed Network Objectives for MBWA (continued)

- Since different network solutions possible (we present here a few), avoid dependencies above MAC/PHY and/or North of the base station –
  - not within the charter of 802.20
  - increases the difficulty and cost of inter-working with other networks
  - reduces opportunity for network infrastructure sharing
  - potentially increases deployment costs

A Simple and Integrated Network/Service Model



Sample Scenario – 3GPP2 (CDMA 2000 Infrastructure)



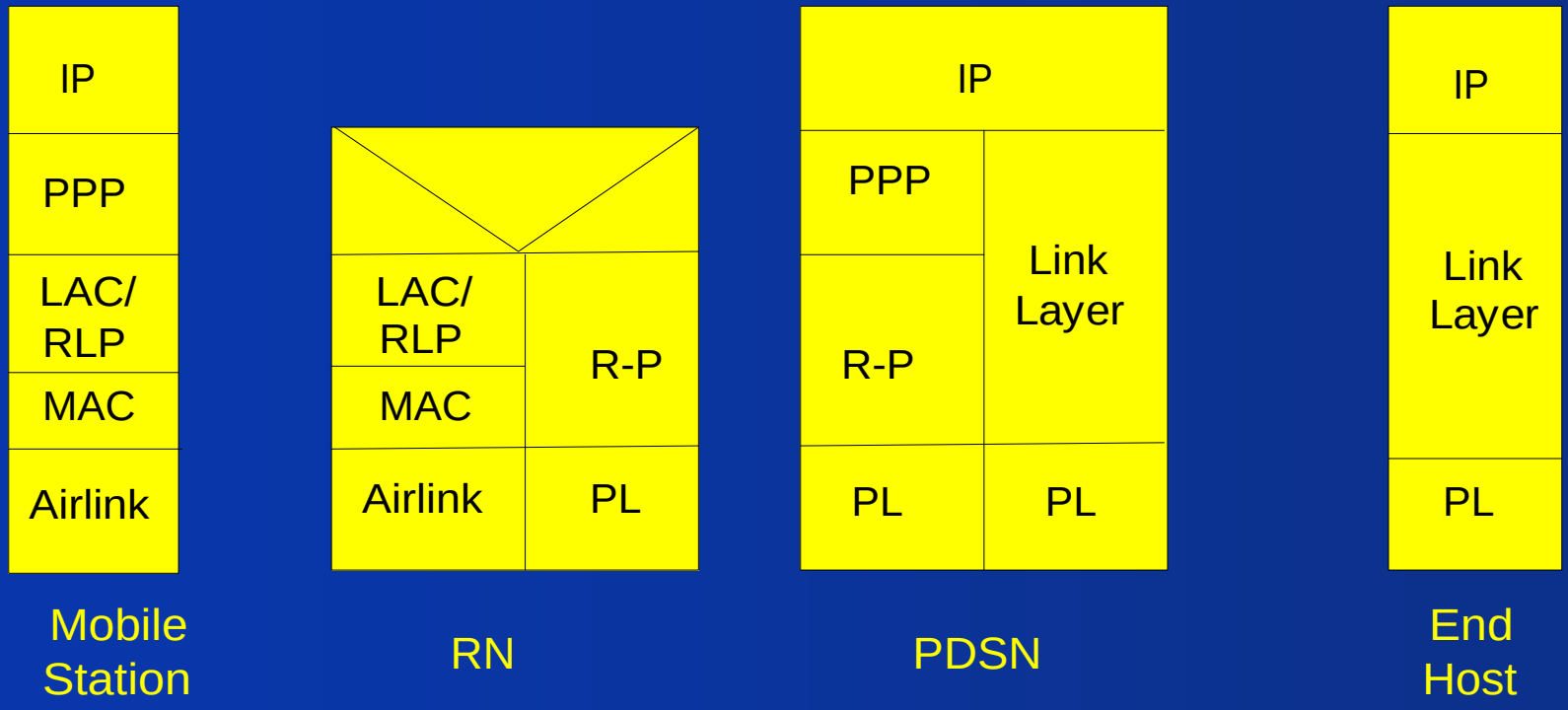
Benefits of a Simple and Integrated Network/Service Model

- Extends wired broadband access network
- Fits into existing infrastructure
- Uses existing OAM&P frameworks
- Greatly simplifies Access Points
- Un-tethers IP/PPP devices, applications
- Provides Mbps data rates
- Scales to multiple markets, providers

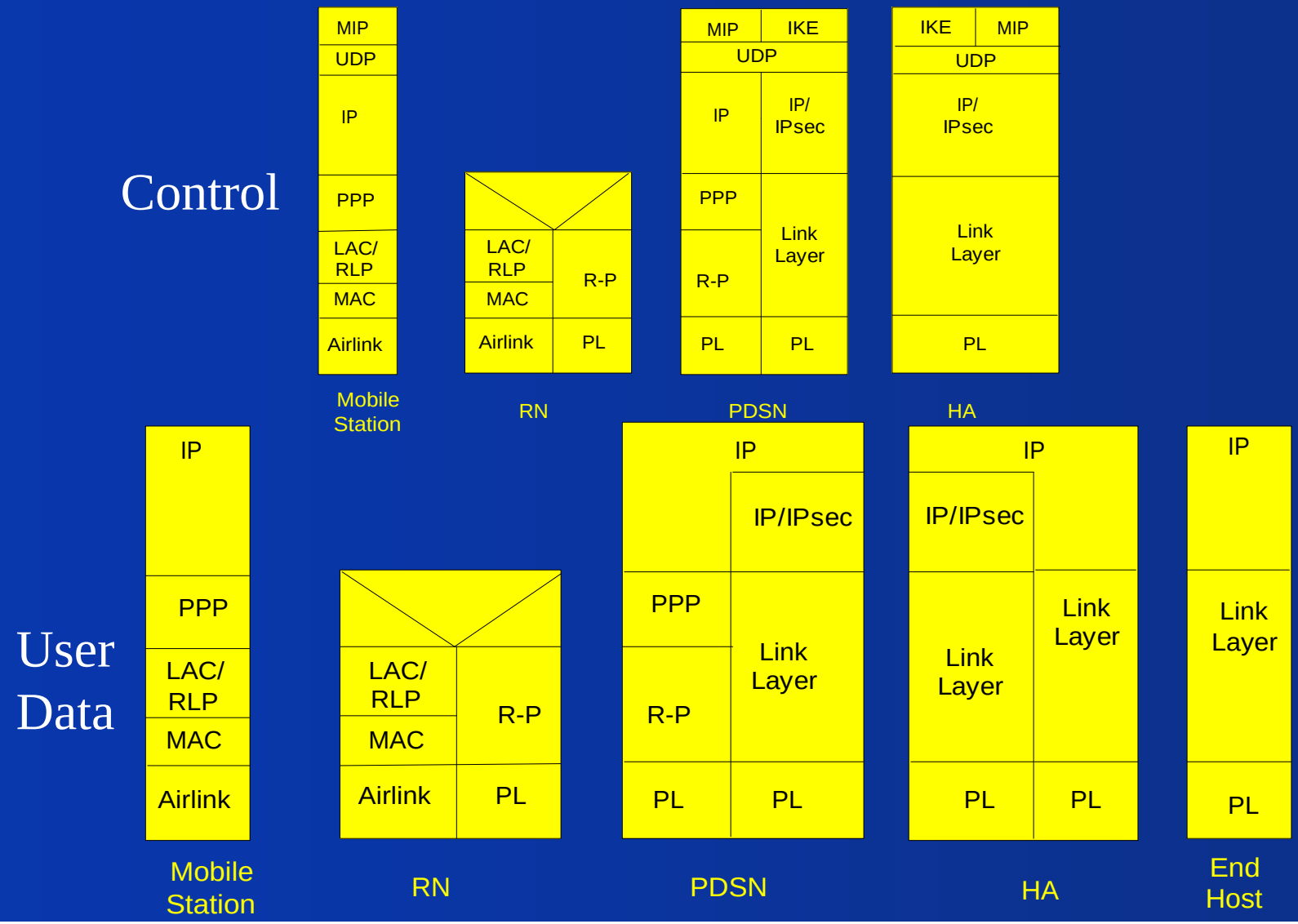
Simple IP

- Simple IP implies
  - mobile assigned IP address dynamically (DHCP or IPCP)
  - mobile provided routing service by service provider network
- Simple IP micro mobility through PSS/PDSN
- Avoids Mobile IP inefficiencies and problems
  - complexity
  - no triangle routing
    - » Route optimization in IPv4 but changes need to be implemented in host
  - handoff latency
  - security (firewall traversals, ingress filtering)
- Simple IP macro mobility
  - mobile IP proxies in access network
  - PSS/PSS communication

3GPP2 Simple IP



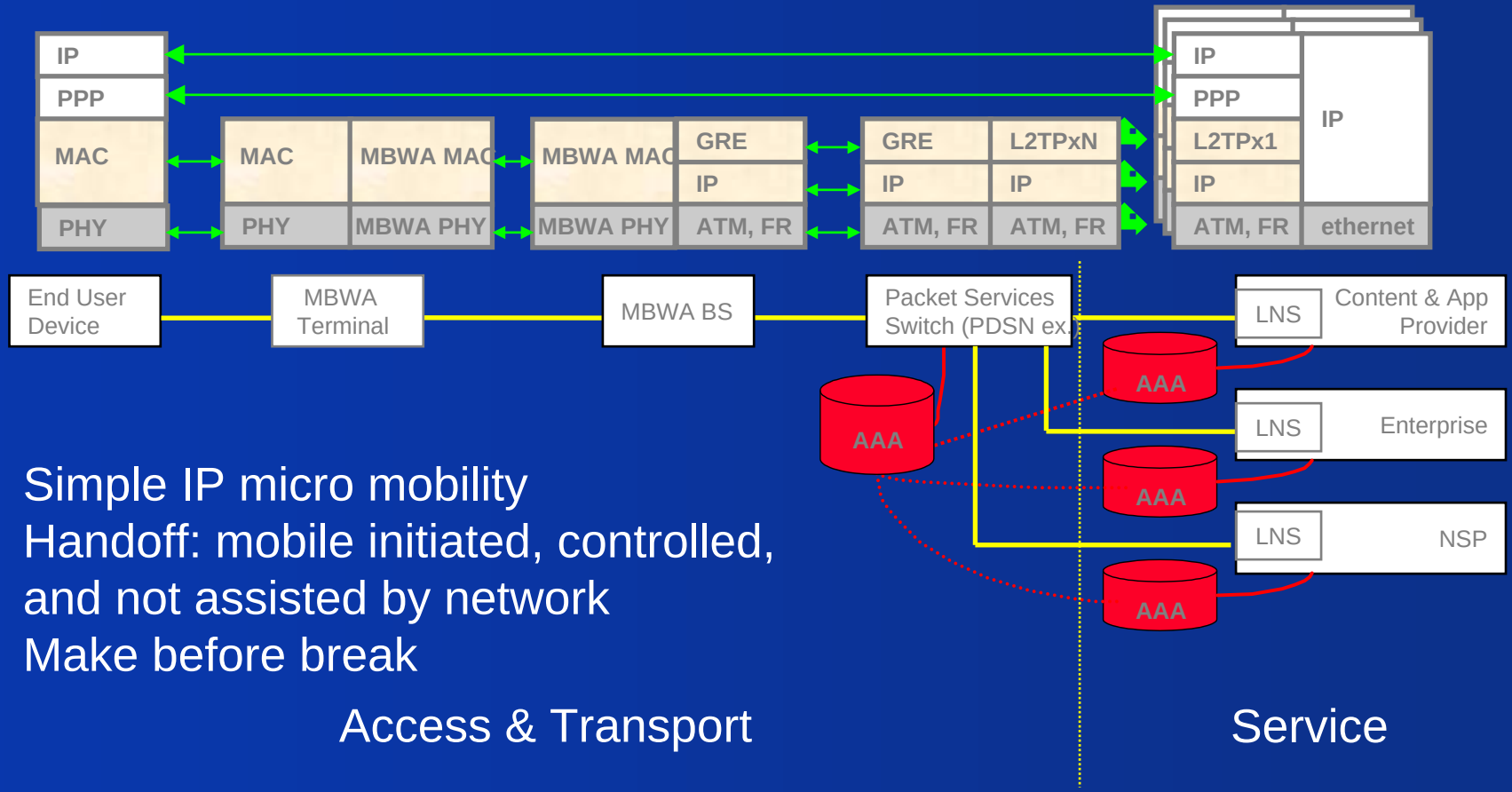
3GPP2 Mobile IP



Layer 2 Switching Access Network

- Layer 2 encapsulation between mobile and Network Access Server
  - PPP for end-user,
    - PPP already is the computer/user portability solution
  - L2TP/GRE/GTP for transport
  - Simple Access Point (i.e. BS, no routing, no MIP)
  - No need for Access Point to Access Point communication
  - Reuse of infrastructure for
    - switching, provisioning, billing, traffic engineering, QOS, etc.
- Support of wholesale/retail as well as vertical ISP business models

User Data Transport Scenario



Simple IP micro mobility
Handoff: mobile initiated, controlled, and not assisted by network
Make before break

Access & Transport

Service

*Tunnel Switch PSS uses L2TP on BS/PSS link

Packet Services Switch

- Allows sharing of access infrastructure
  - L2TP switch or
  - PDSN (3GPP2)
- Switches sessions to correct service provider
- Performs QOS functions on per-circuit basis
- Available from wide range of OEMs
- Participates in mobility
- Controlled by access provider

L2TP Network Server (LNS)

- Off-the-shelf device
- Terminates end-user PPP sessions
- Effects end-user authentication
- Performs per-user or per-app QOS
- Collects raw usage statistics (typ. RADIUS)
- Controlled by service provider
- Can be virtualized within PSS

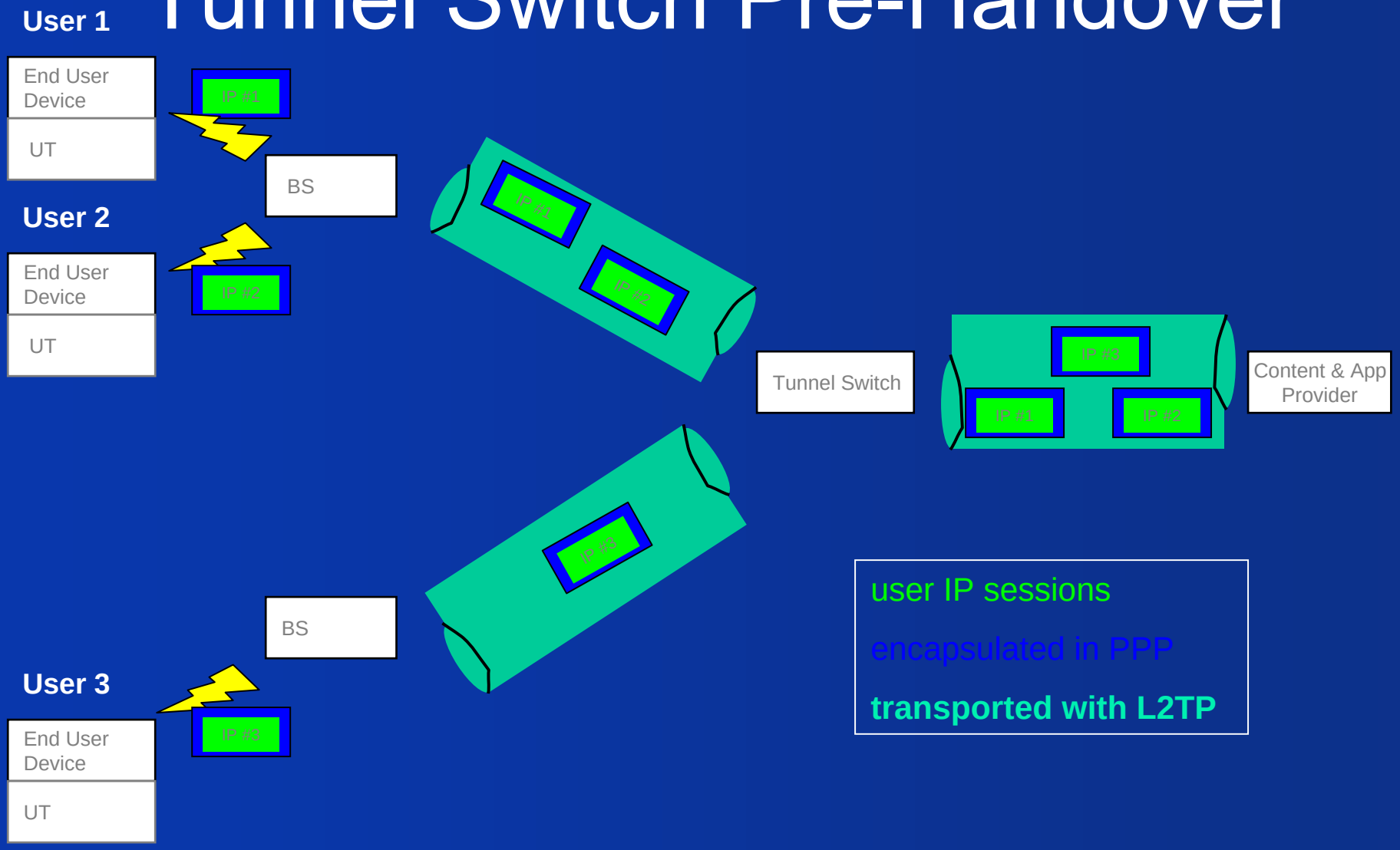
Mobility

- PPP transparent handover
  - comprises radio and network aspects
  - mobile-driven at radio layer
- Two network solutions supported
  - L2TP-based solution using tunnel switch
  - GRE-based solution using PDSN
- Mobile IP can be used across PSS domains
  - Mobile IP unattractive for micro mobility
  - latency and overhead concerns in access network
  - Simple IP across PSS domains supported by some vendors

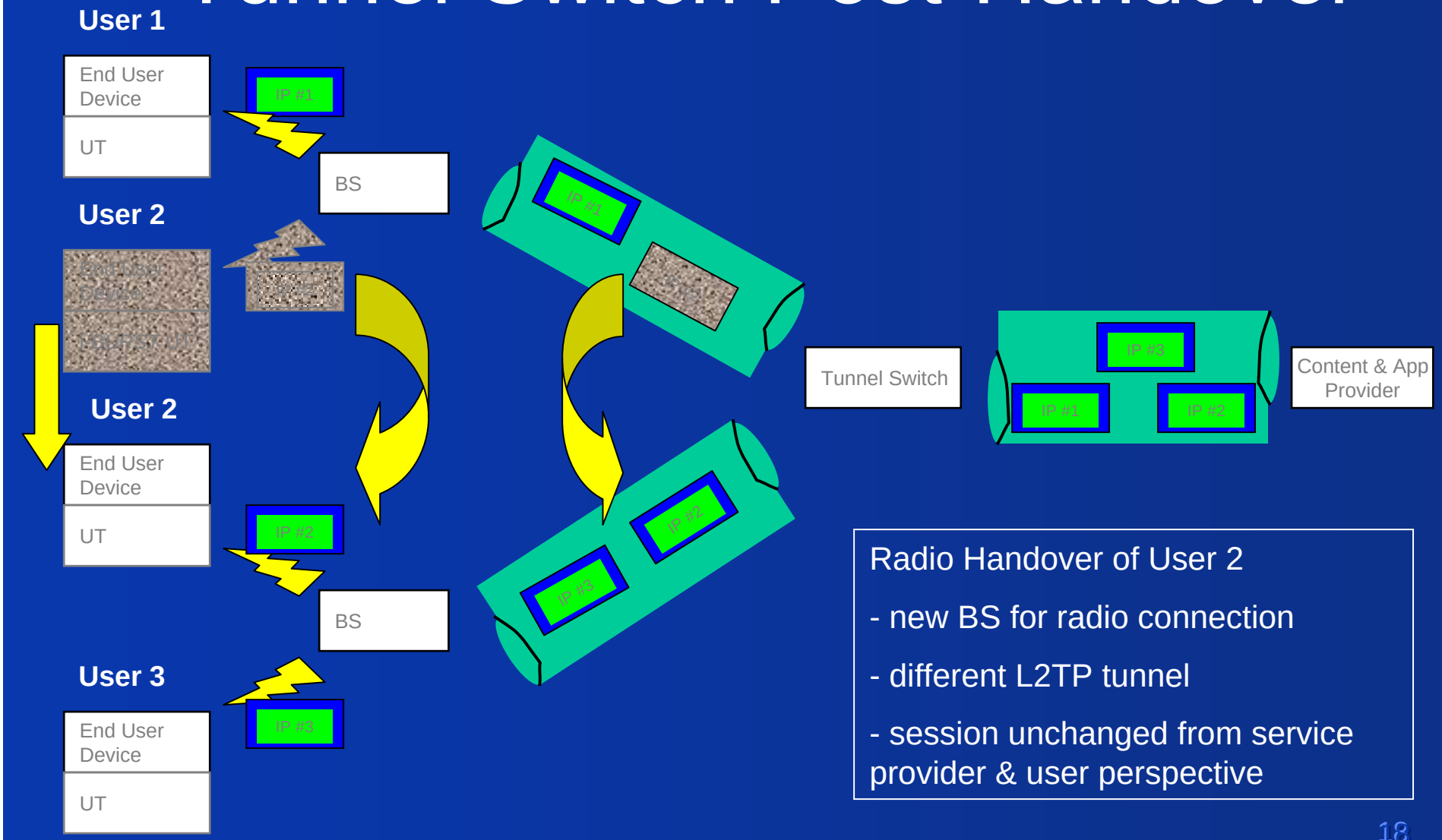
Mobility Variants

- Tunnel switch based handover
  - L2TP extension
  - negotiated by mobile and tunnel switch
- PDSN based handover
  - 3GPP2 standard solution
  - negotiated by PCF (base station) and PDSN
  - conceptually similar to tunnel switch solution

Tunnel Switch Pre-Handover



Tunnel Switch Post-Handover



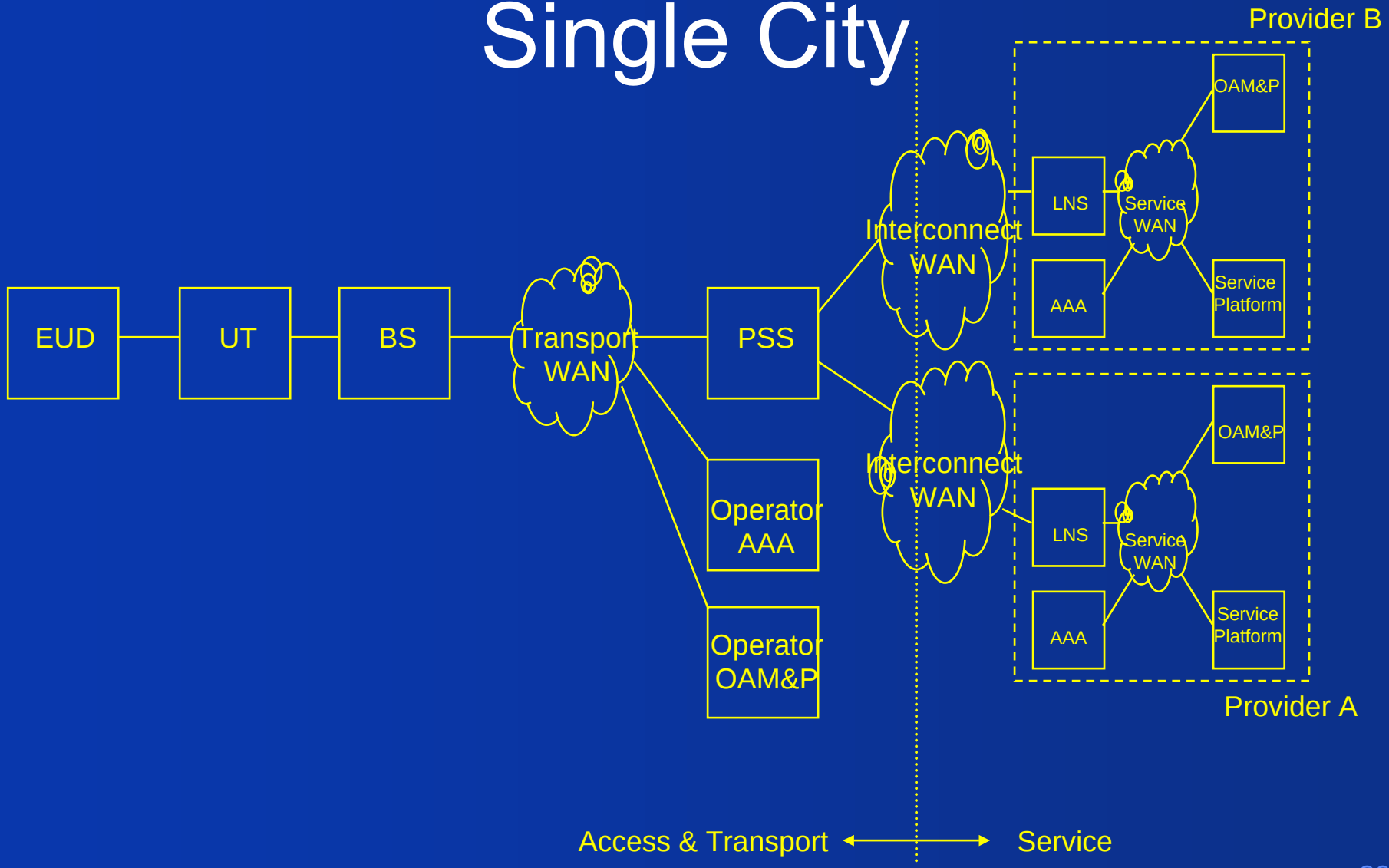
Radio Handover of User 2

- new BS for radio connection
- different L2TP tunnel
- session unchanged from service provider & user perspective

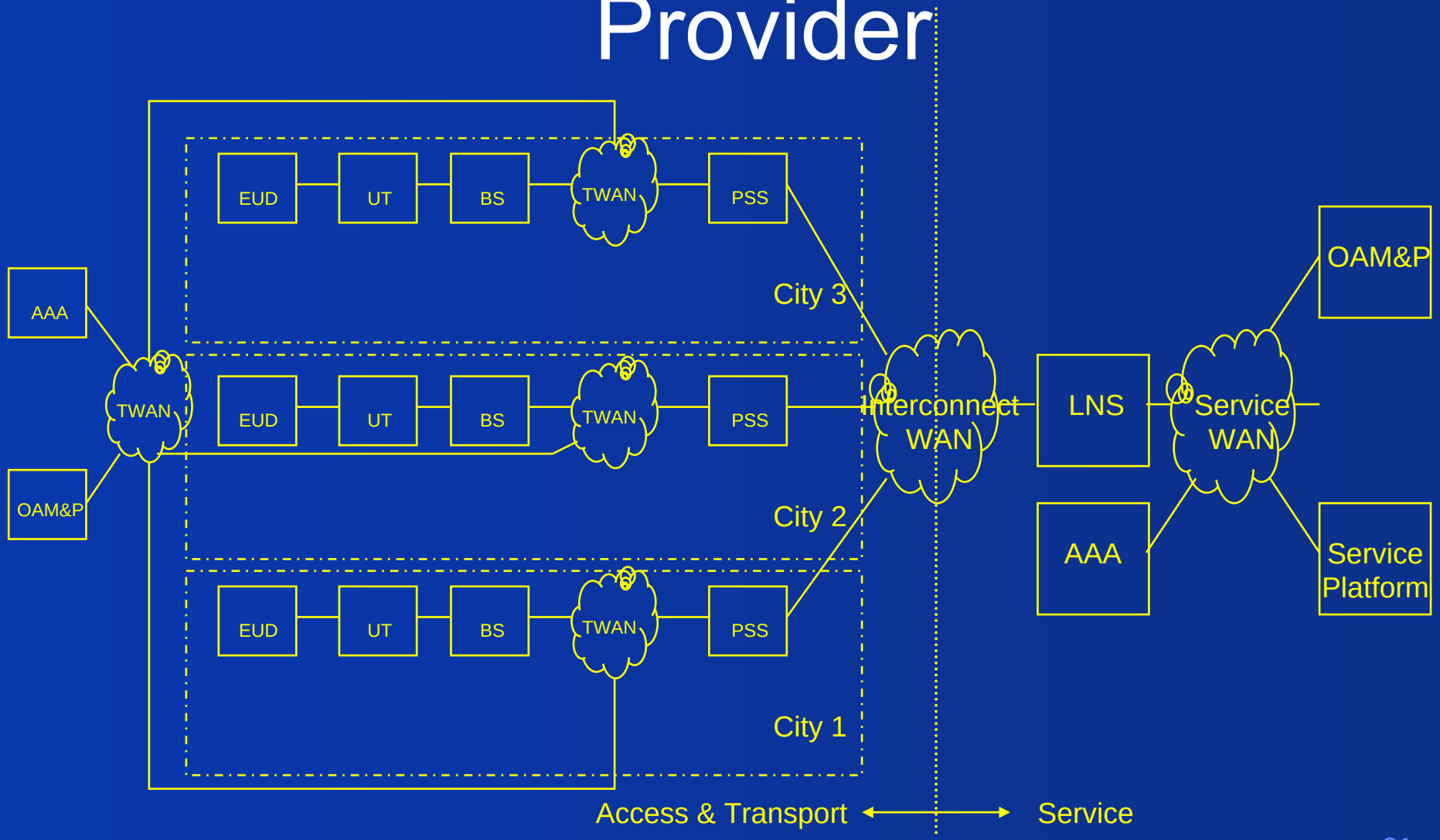
General Architectural Principles

- Single PSS per service area typical
- Large PSS's can support hundreds of thousands of concurrent PPP sessions
  - Example: 200,000 sessions * 10% penetration * 50% of the users logged on at any time = 4 M pops
- Multiple service providers/single access network
- Each SP has a small number of global sites
- Parallel ATN and service provider services

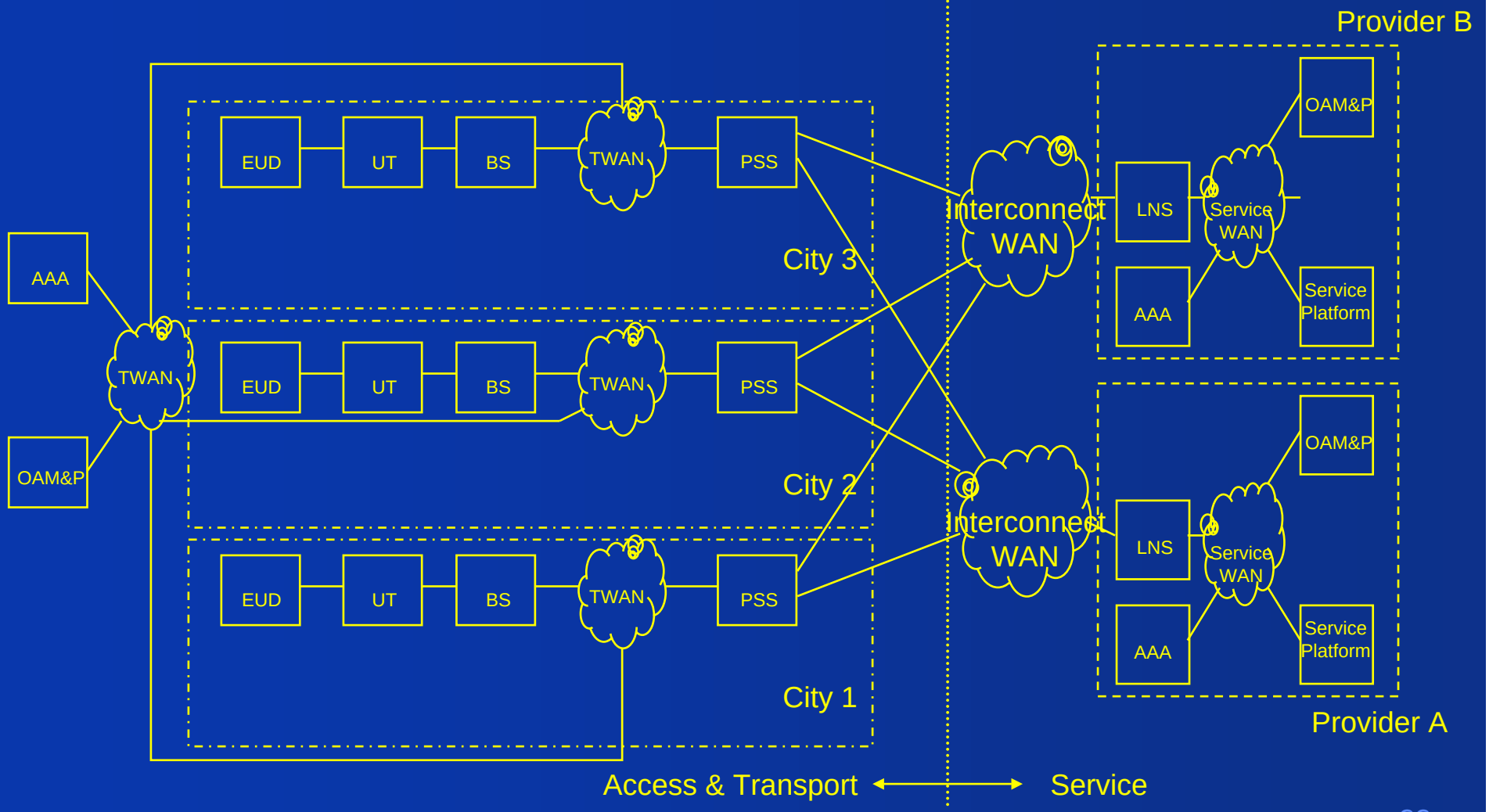
Multiple Service Providers, Single City



Multiple Cities, Single Service Provider



Multiple Cities, Multiple Service Providers



Summary

- MBWA should be network solution agnostic
- Layer 2 Switching Solution presented
  - leverages existing broadband access networks,
  - compatible with derivative networks such as 3GPP, 3GPP2
  - standards-based, fast micro-mobility (e.g. Simple IP)
  - standard provisioning, billing tools (benefit of PPP)
  - no special software on EUD (as with Mobile IP)

Summary (continued)

- Layer 2 Switching Solution presented
  - reduced complexity at base station, makes it a bridge rather than router/FA
  - eliminates HA bottleneck
  - PPP encapsulation hides IP addresses in transport network (in fact, PPP can be thought of as alternative tunneling technology to Mobile IP)
  - eliminates need for BS-BS communications
  - allows separate authentication of user and device
  - better suited to supporting multiple independent service provider model