

IP Networking Untethered

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Link Layer Wish List

■ Reliable link

- Far fewer end-to-end retransmissions

■ Low delay

- Efficient transport layer (TCP/IP)
- Interactive applications supported (VoIP)

■ Enhanced IP hand-off

- True make-before-break
- Reliable seamless Mobile IP handoffs

■ Just another IP access link

- IP to the Basestation
- Efficient IP Multicast
- Optimal IP QoS control
- Re-use IP Policy and management systems

**Better
User Experience**



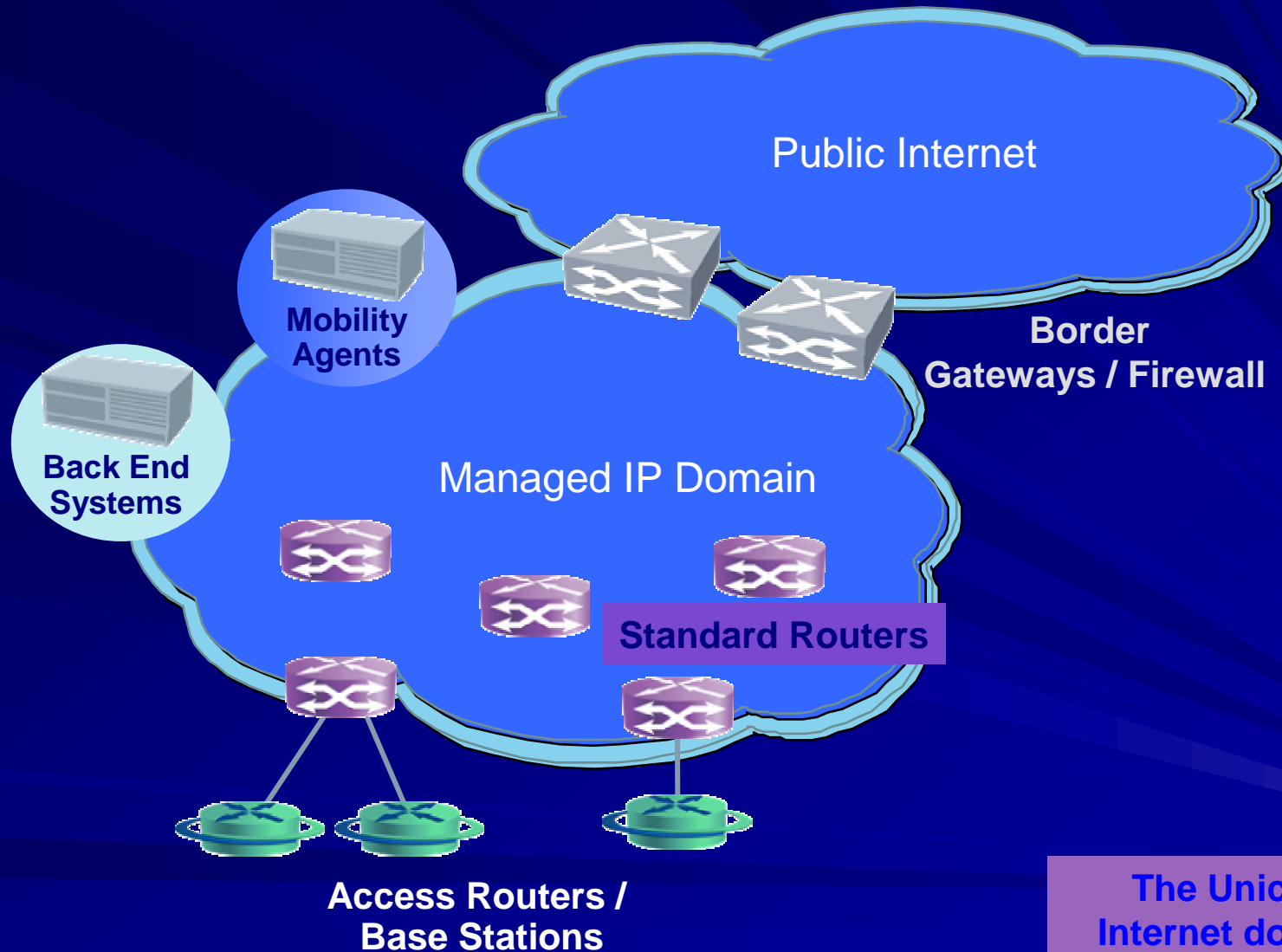
flash-OFDM™ Access Router



■ Combined Router and Base Station Functionality

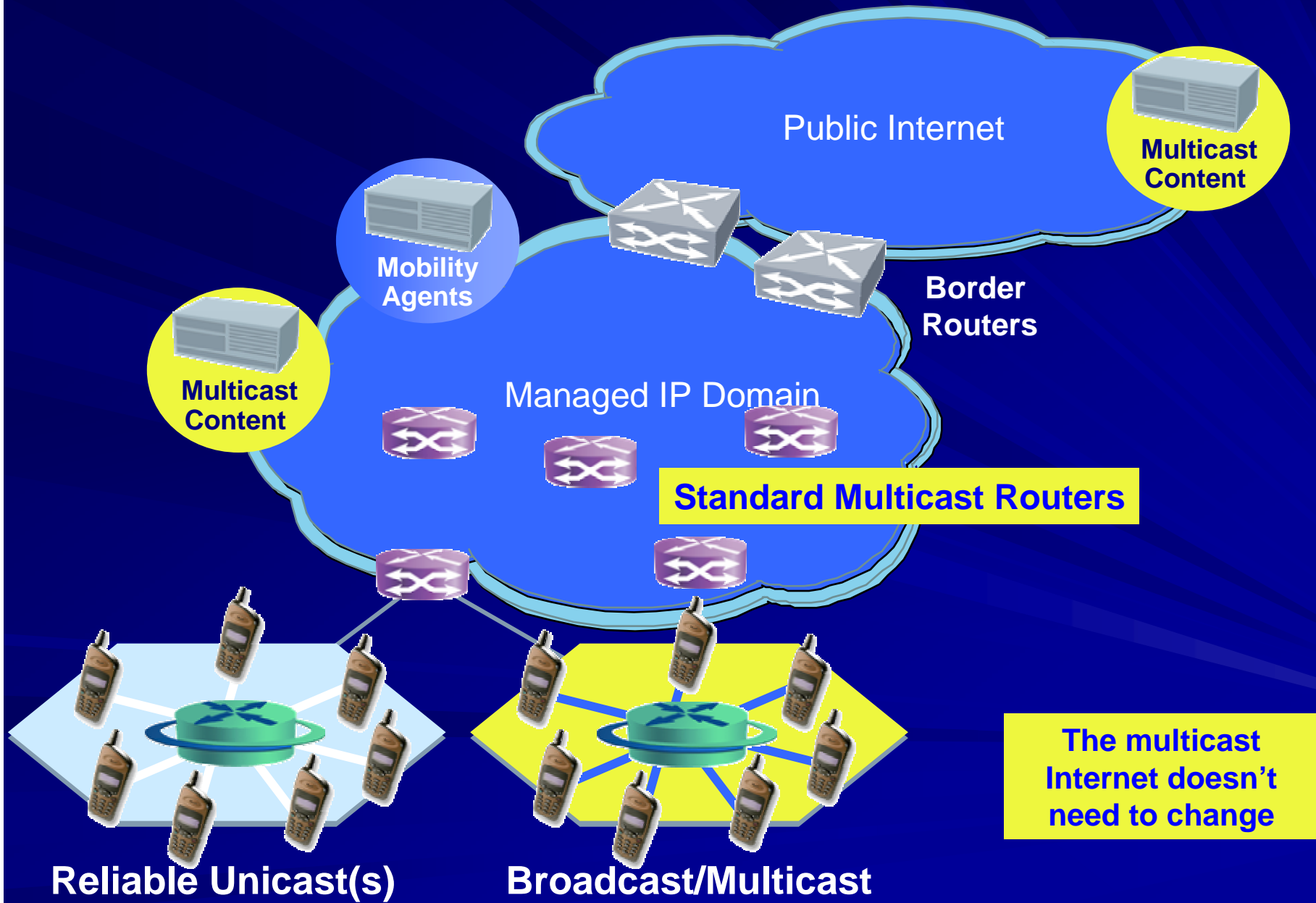
- Extends Wired Internet Experience to Mobile User
- Adapts Wireless to the Internet and not vice-versa
- IP unicast and multicast routing with hand-off
- Enables Ideal TCP behavior over wireless
- Enables IP-based cellular multimedia services
- Maximizes Revenue/Hertz, not just bits/Hertz

High Level Architecture

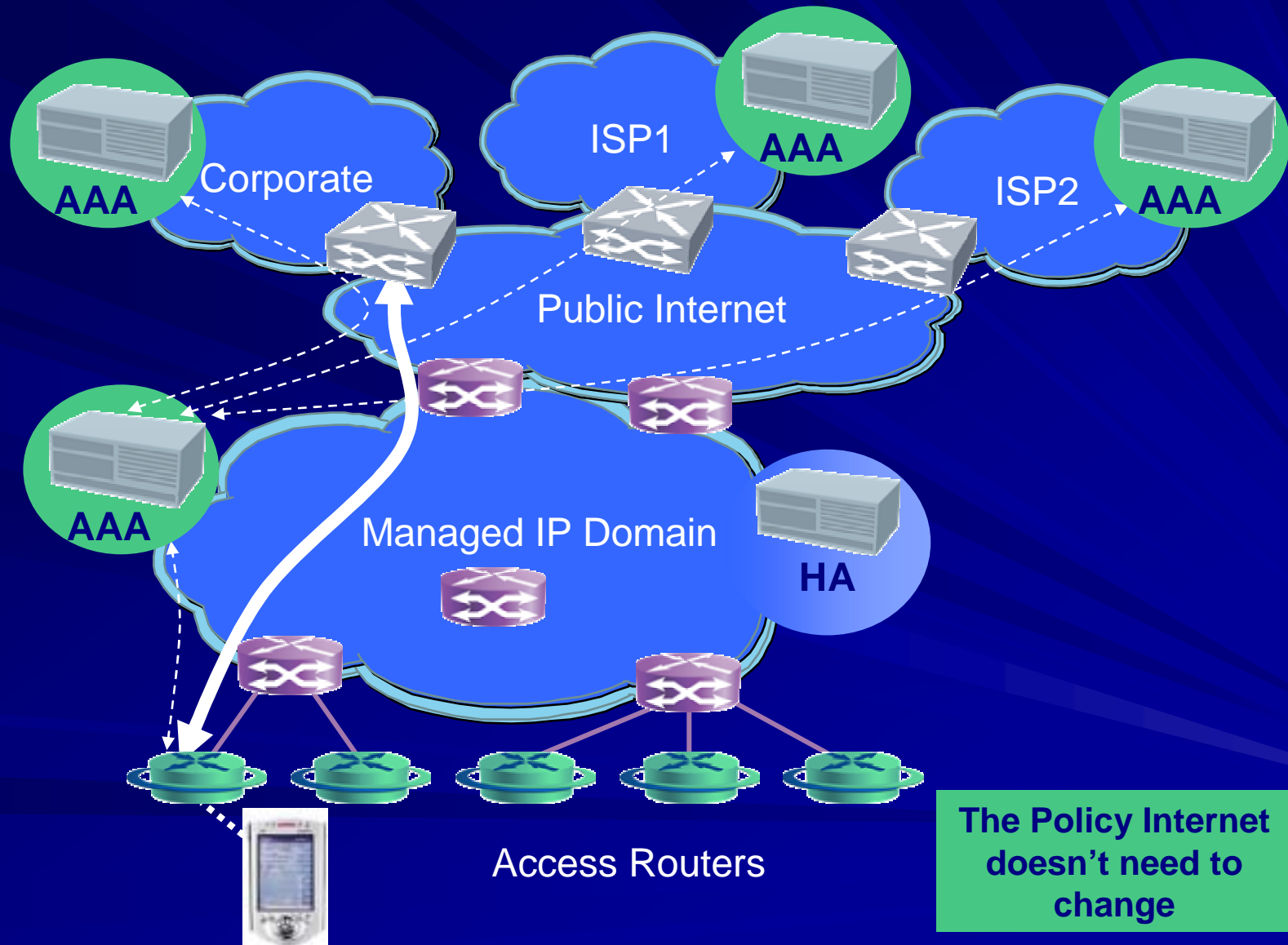


**The Unicast
Internet doesn't
need to change**

IP Multicast Architecture



Roaming/Mobility Models



IP Handoff Features

■ Interoperable

- Home Agent (HA) uses vanilla Mobile IP
- Foreign Agent (FA) uses vanilla Mobile IP + hand-off extensions
- facilitates inter-technology hand-offs

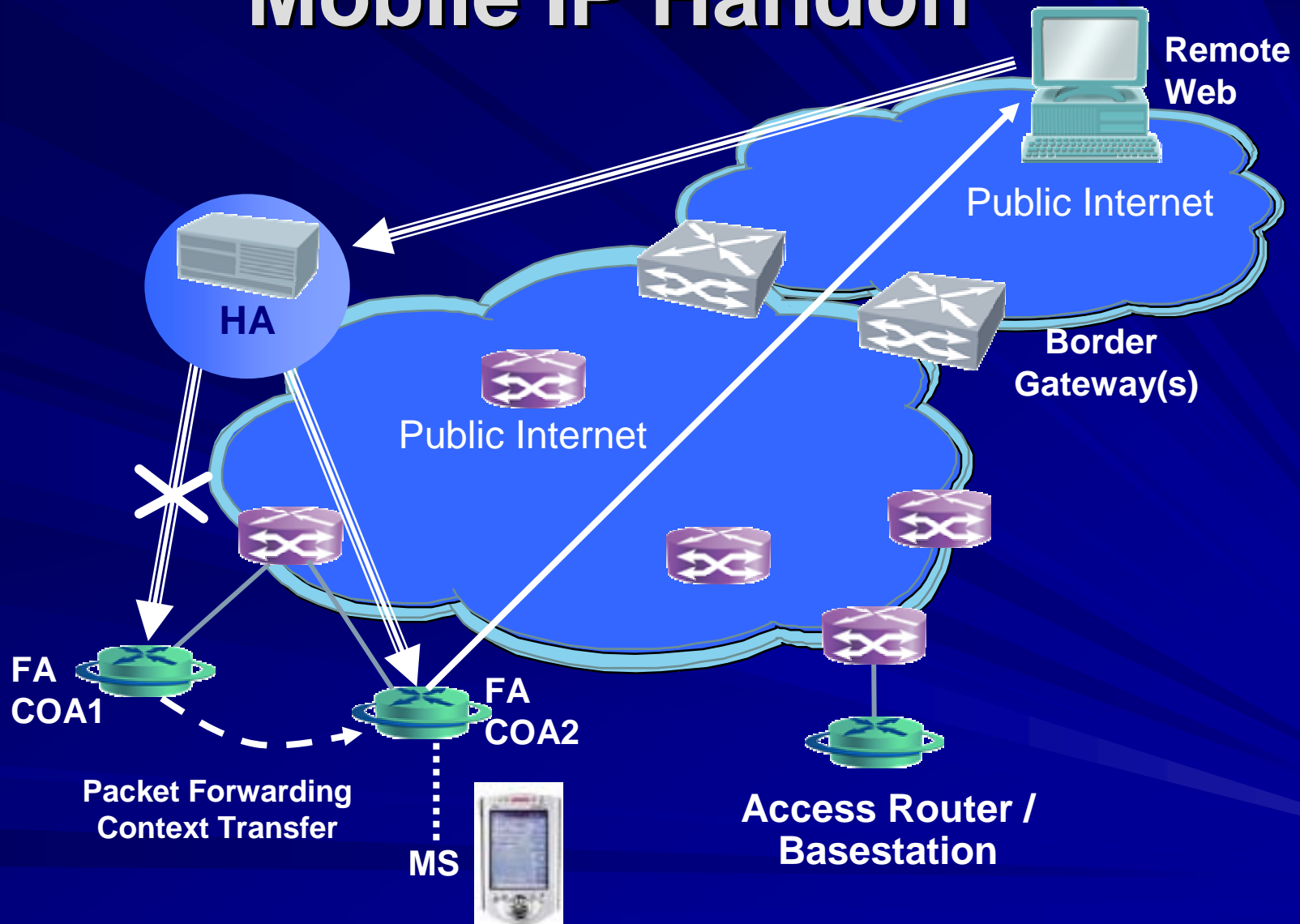
■ Seamless to the user

- Minimum packet loss and latency

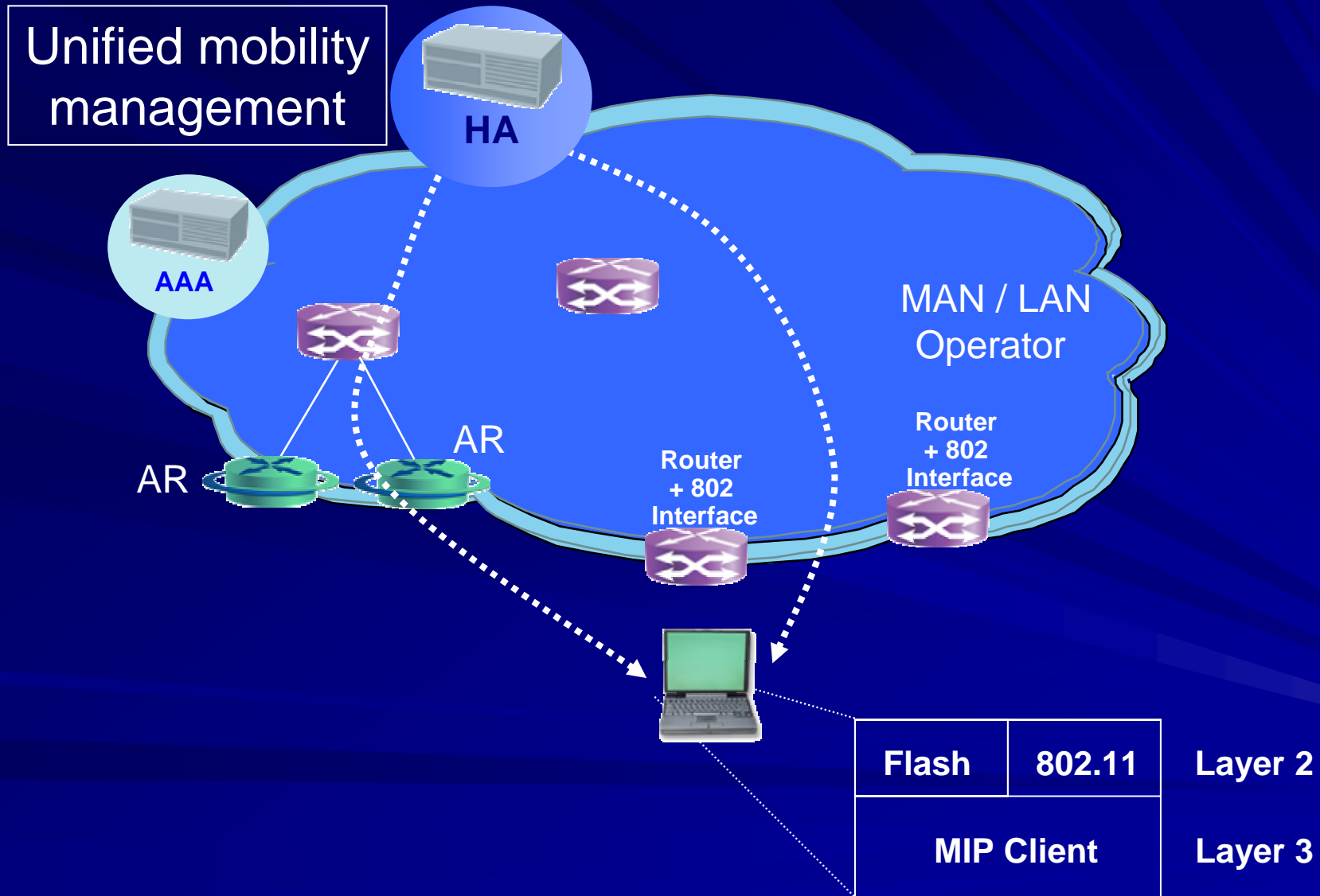
■ Robust

- Proactive and reactive flavors

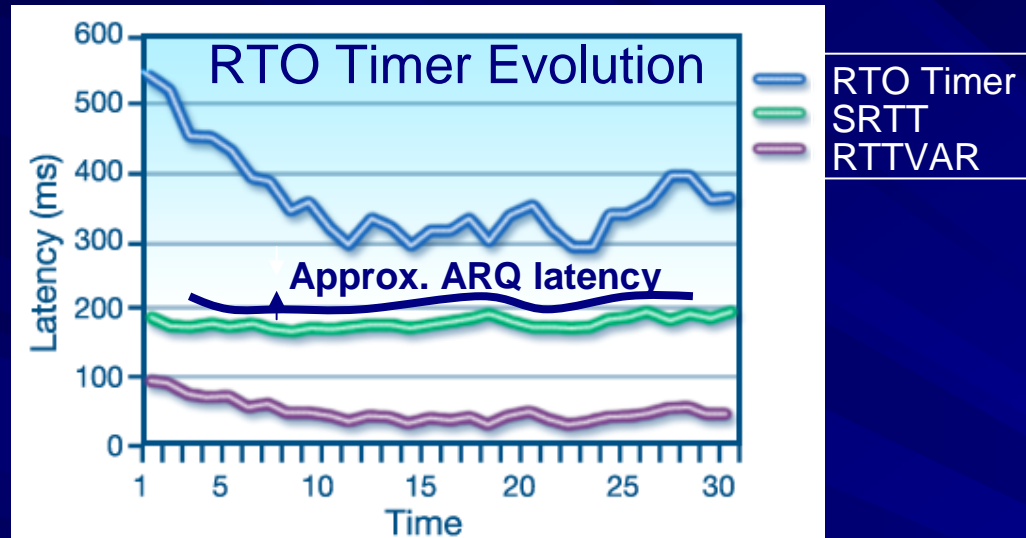
Mobile IP Handoff



Inter-Technology Handoff



flash-OFDM™ TCP Advantage



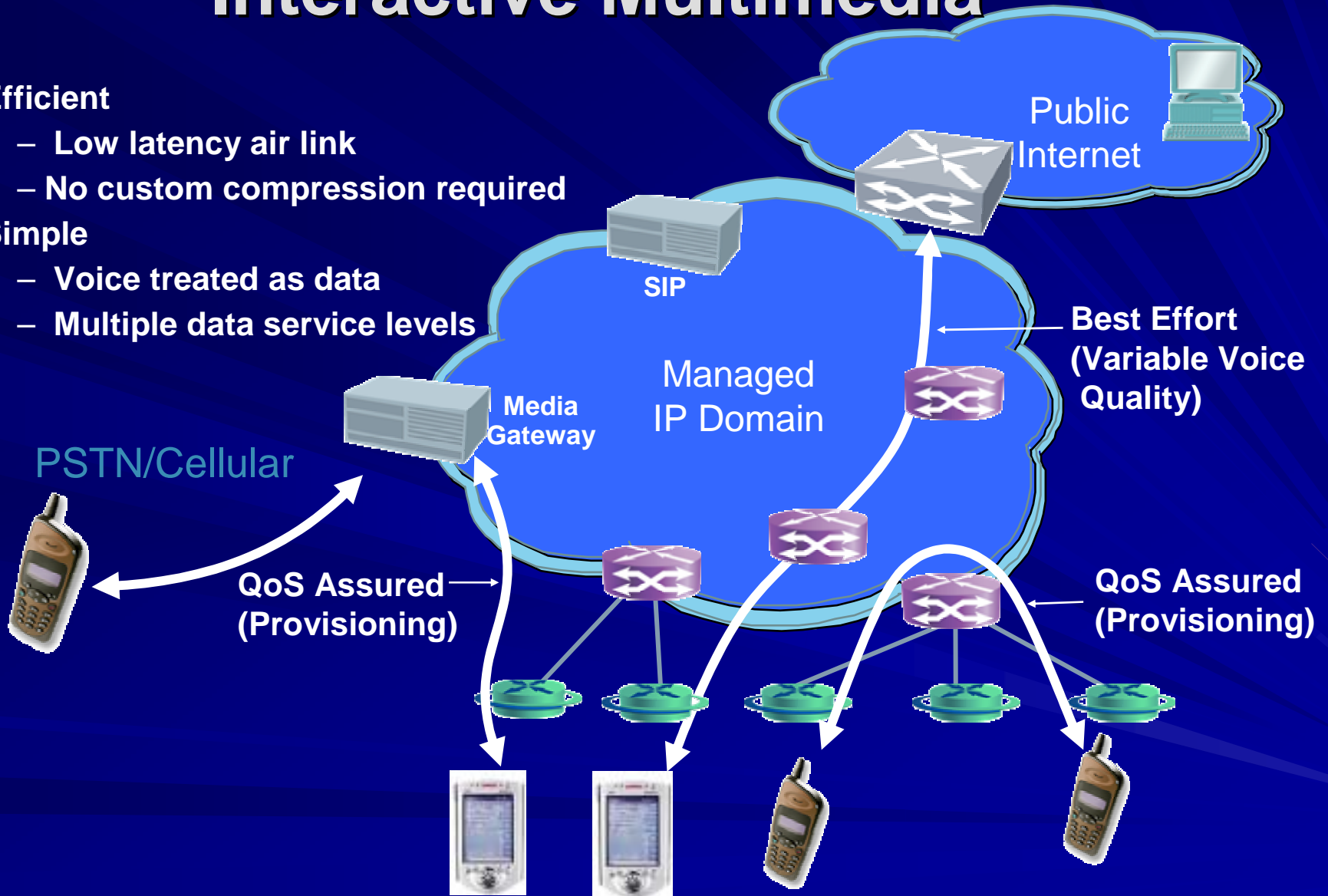
- Reliable link
- Adaptive TCP bandwidth discovery as per wired Internet

TCP BACK-OFF FAR LESS LIKELY

- flash-OFDM™ ARQ latency below TCP Retransmission Time-Out (RTO)
- No need for wireless-specific modification
- Round Trip Times short
 - Interactivity and short-lived TCP transactions (web “mice”) for a large user set
- TCP over 2.5/3G similar to TCP over Geo-synchronous satellites
 - “Long delays cause TCP to react slowly”
 - “Transient congestions may take 10’s of seconds to be resolved”
 - *TCP Options for Satellite Paths (RFC 2488) from Cisco IPJ, vol.3, no.2., Sept.2000*
 - *“TCP Over 2.5G and 3G Wireless Networks,” Draft-ietf-pilc-2.5g3g-00.txt, Feb.2001*

Interactive Multimedia

- Efficient
 - Low latency air link
 - No custom compression required
- Simple
 - Voice treated as data
 - Multiple data service levels



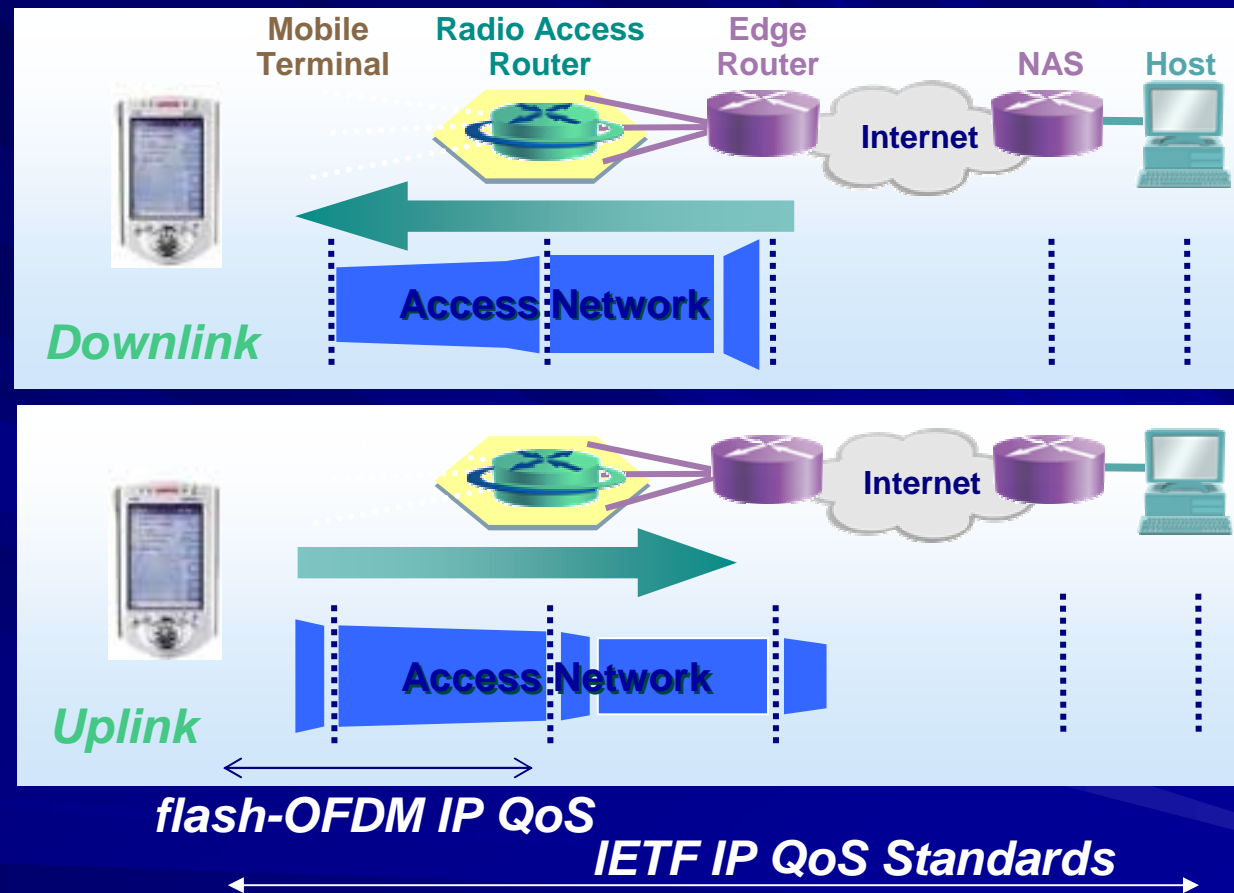
Maximizing Revenue/Hertz

Focus on Access Network and Not Just Air Link

Maximized
Mobile role in
IP Resource
Management

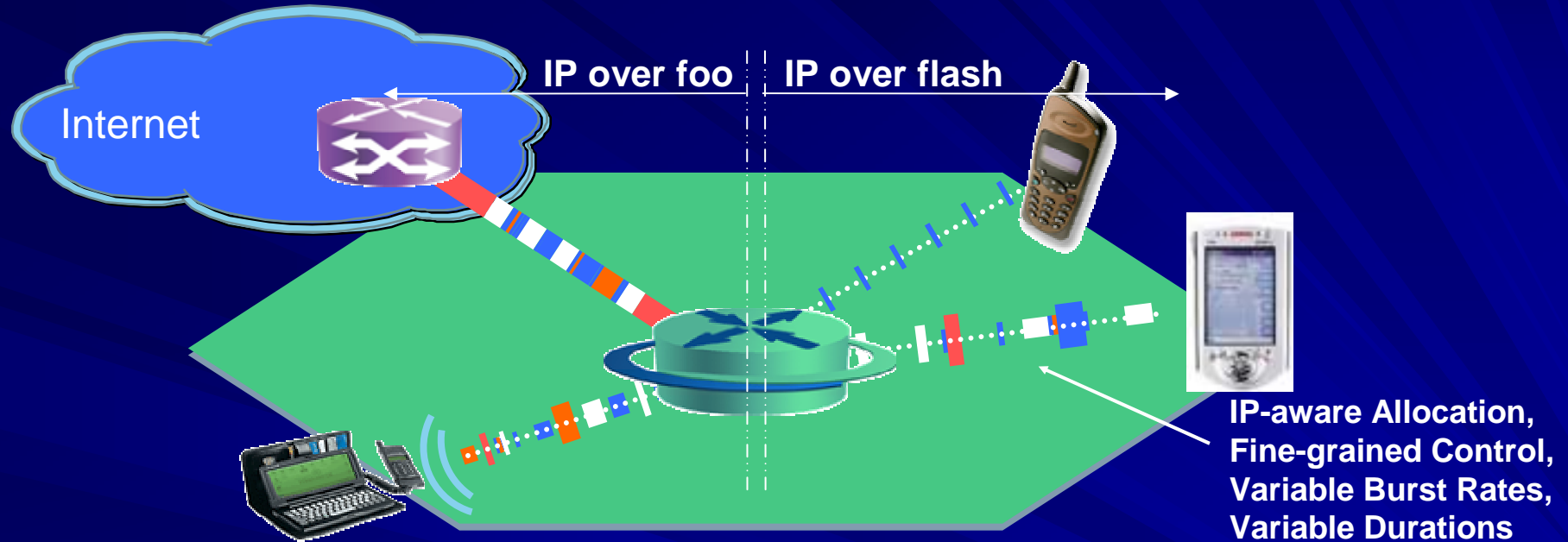
Mobile Servers
supported
(e.g. 100 kbps cameras)

'Impedance Matched'
Access Components



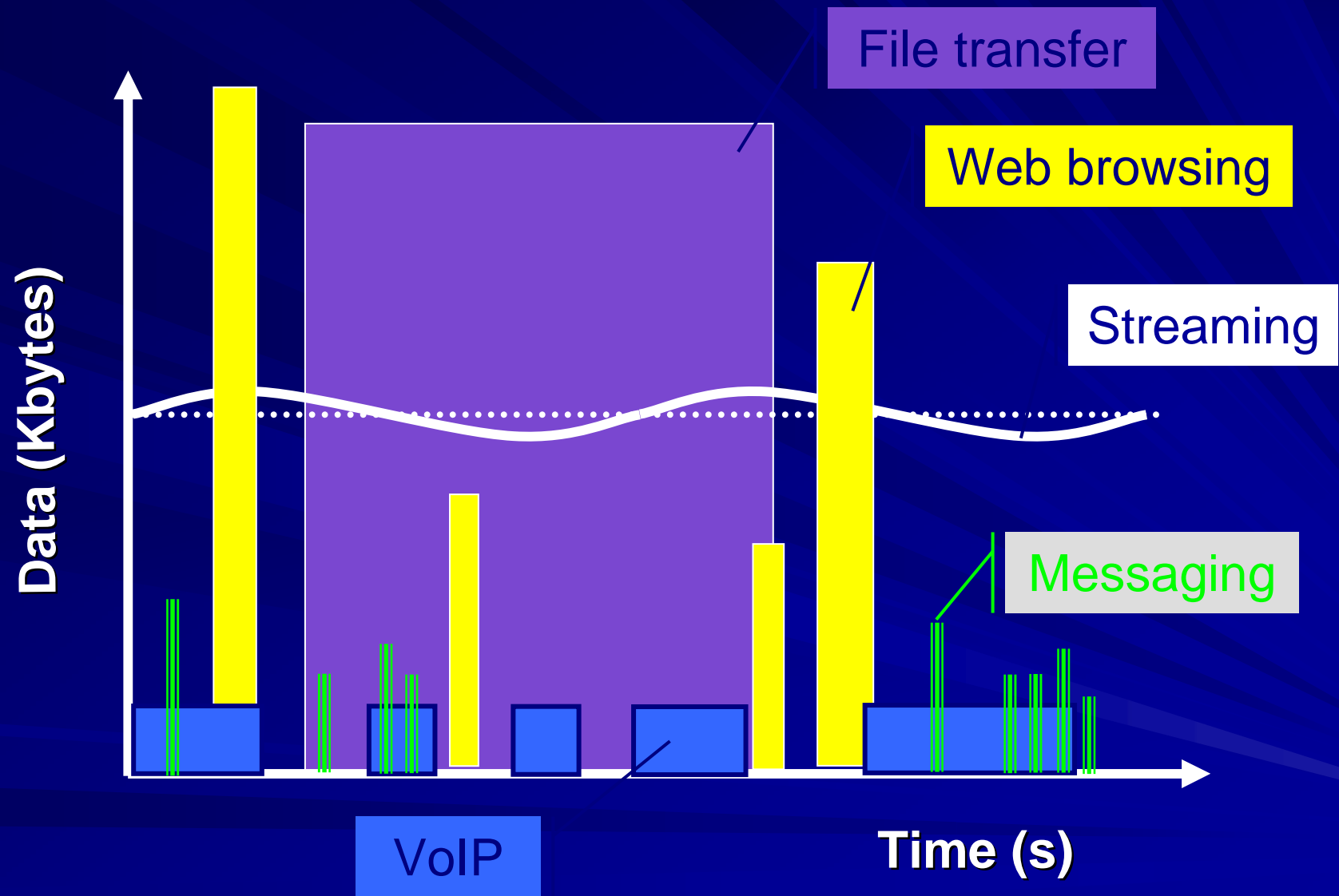
- IETF standard 'tools' utilized at / between pinch points (Diff-serv, RSVP, etc.)
- Joint MAC / IP Layer optimization over air link
- **Rich flexible QoS toolkit (unicast + multicast)**

Enablers for IP QoS 'Over the Air'

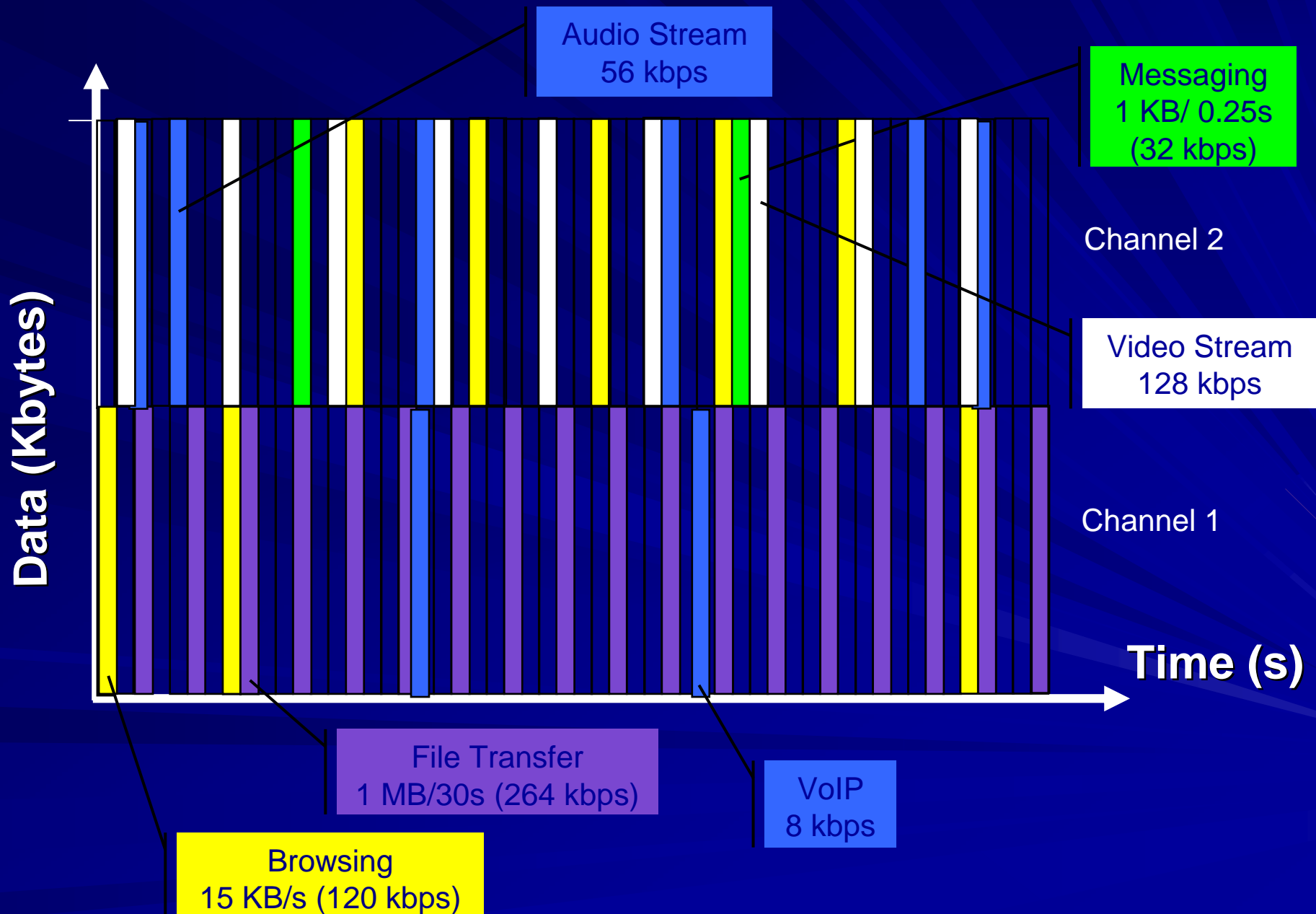


- **One wired backhaul, multiple 'wire-like' links**
 - Reliable, low latency air links with **minimal** mac layer QoS features
 - Operator-defined and customized IP QoS services
 - Fully integrated with AAA and user profiles
- **Link layer Unicast / Broadcast / Multicast**
 - Mobile can **simultaneously** receive unicast and multicast
- **Fully-scheduled, flash-OFDM air resource**
 - **Downlink:** IP aware scheduler in Access Router
 - **Uplink:** add generic, lightweight assignment requests

Applications and Data Flow



Application Scheduling over flash-OFDM



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