Bridging the gap between Cellular and the Internet

IPv6 and Mobile cellular networks

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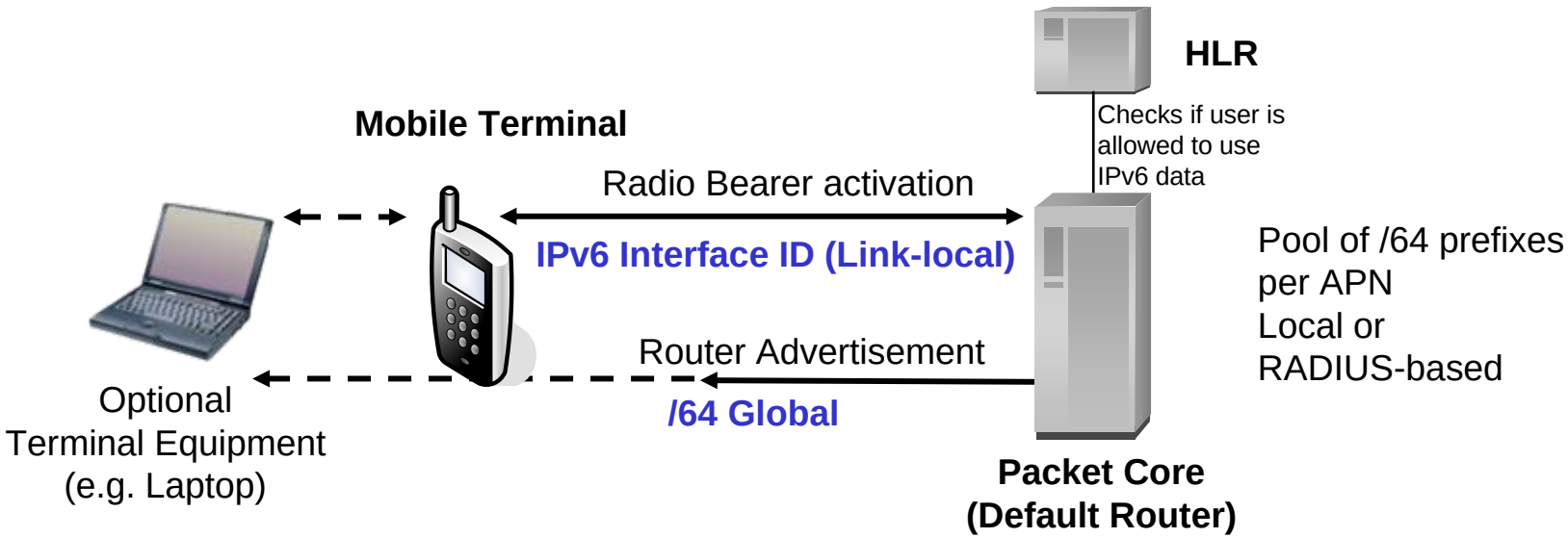
Broadband Cellular and IPv6?

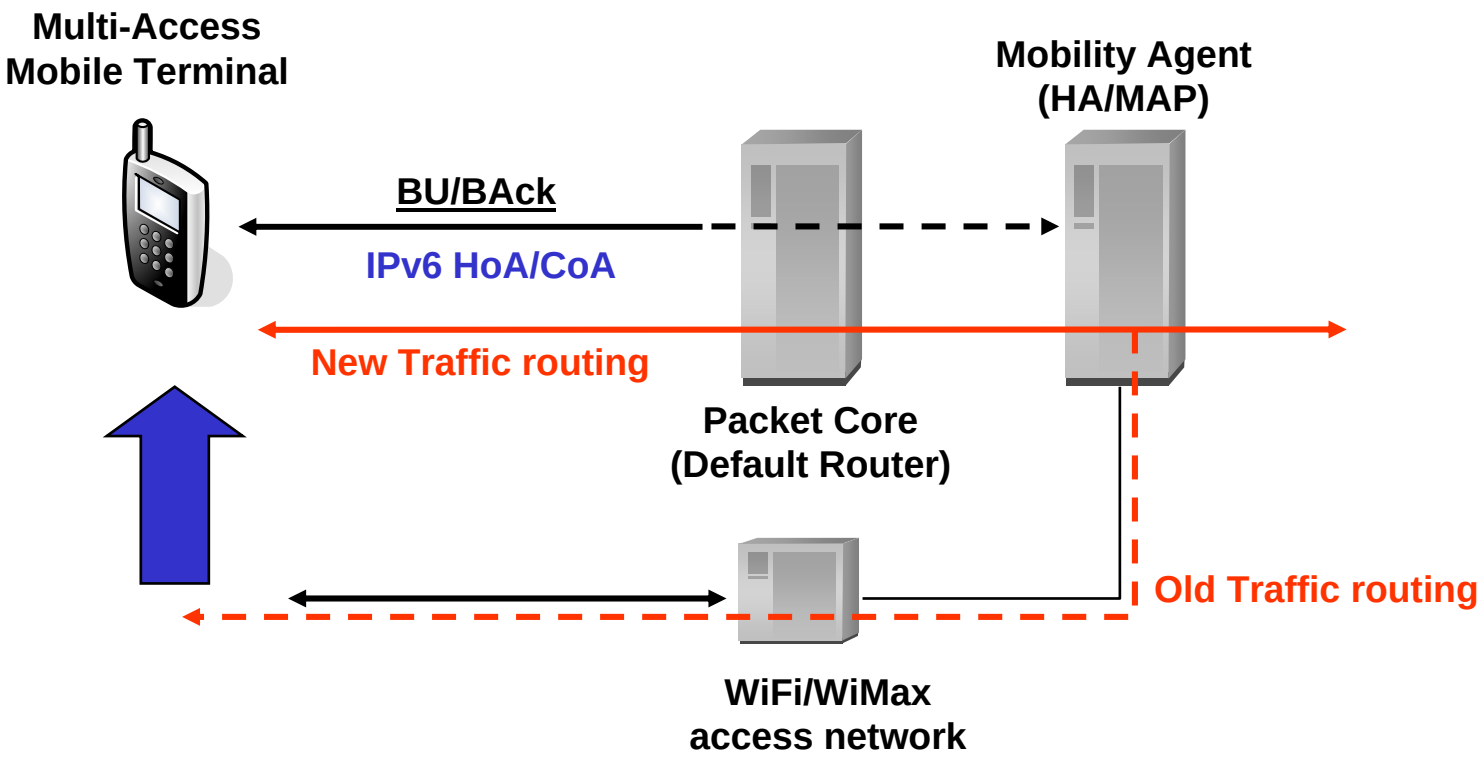
- Italy has one of the highest 3G (UMTS) penetration percentages in the world
- IPv6 is in UMTS and LTE/SAE (3GPP) standards
- Italian operators are early adopters of mobile broadband technology
  - High Speed HSDPA technology deployed for IP data access
- Over-investment or under-investment in infrastructure?
  - Packet Data usage has recently risen (i.e. USB dongle)
  - Deployed UMTS network infrastructure is not prepared for mass uptake of high bandwidth services (video, music etc.)
- Case for development of attractive services to increase packet data service usage while evolving the network infrastructure
  - Services and network infrastructure should converge

IPv6 in UMTS/LTE



- IETF/3GPP successful collaboration produced future-proof IPv6 standard for Mobile Networks
- Link-local (IID) address provided by default router to avoid duplication
- Each Mobile Terminal is assigned a unique /64 IPv6 prefix which can be used to create multiple addresses (privacy), Personal Area Networks etc.
- Unreliable DAD can be avoided (reduces messages over air)

Mobile IPv6 for multi-access

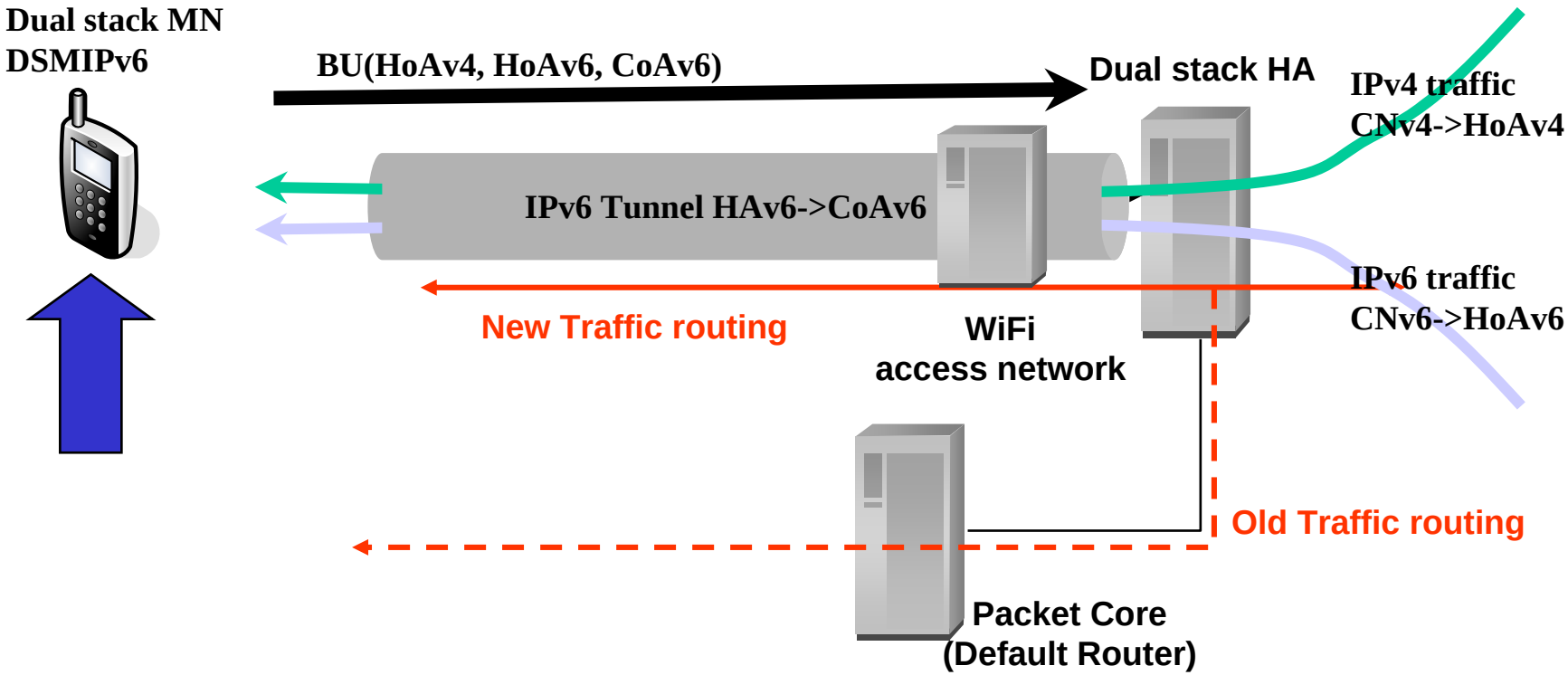


- MIPv6 for Multi-Access Mobility (maintaining session continuity)
- Multi-radio hosts may perform MIP handover before leaving previous link
- HMIPv6 for greater efficiency (lower handover delay)

IPv6 Transition

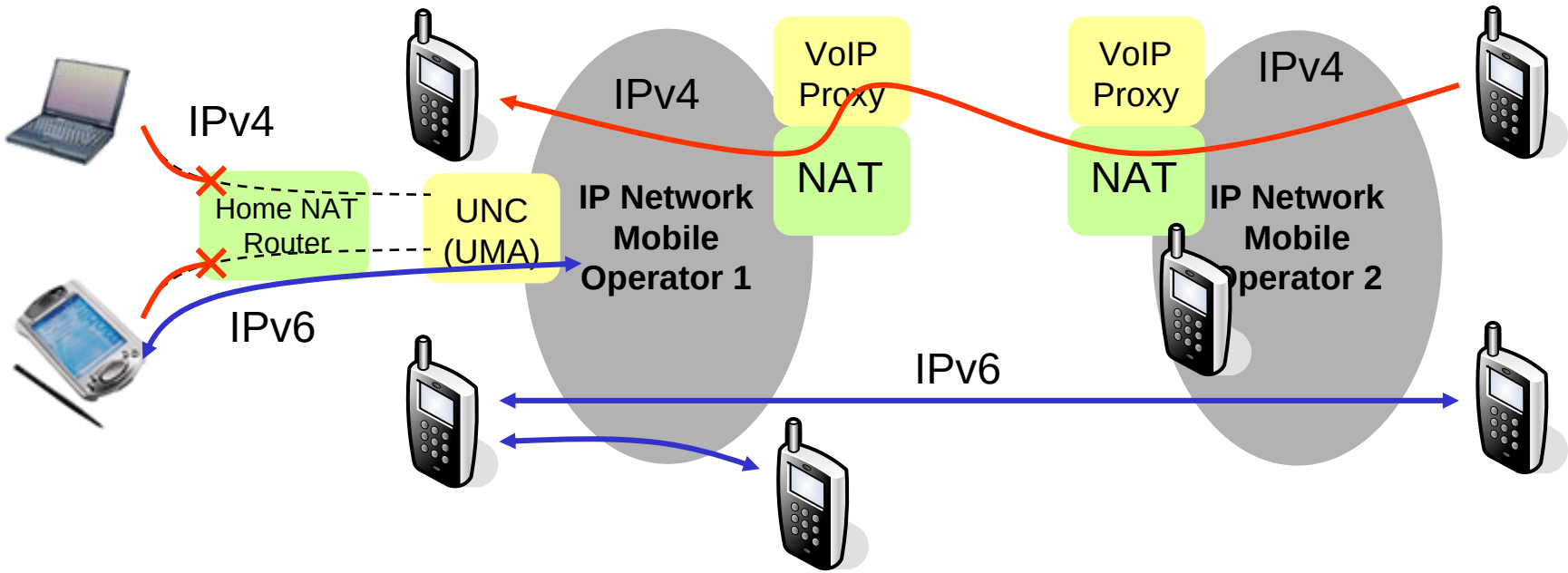
- Current 3GPP networks
  - Single IP version links (no mixing of v4/v6 on the same link)
  - Requires transition mechanisms e.g. ISATAP
- SAE/LTE
  - New PDNtype IPv4v6
  - A link can be associated with one IPv4 address only, with one IPv6 address/prefix only or with both one IPv4 and one IPv6 address/prefix
  - Dual-version operation is possible
  - Note: normal precautions needed to avoid failures and inefficiencies e.g. RFC4943
- Mobile IP transition
  - Possible IP version incompatibility between 3GPP and non-3GPP networks
  - DSMIPv6, extends MIP6 to work over IPv4 and IPv6 networks, and transport of both IPv4 and IPv6 in tunnel to HA

IPv6 Transition – DSMIPv6



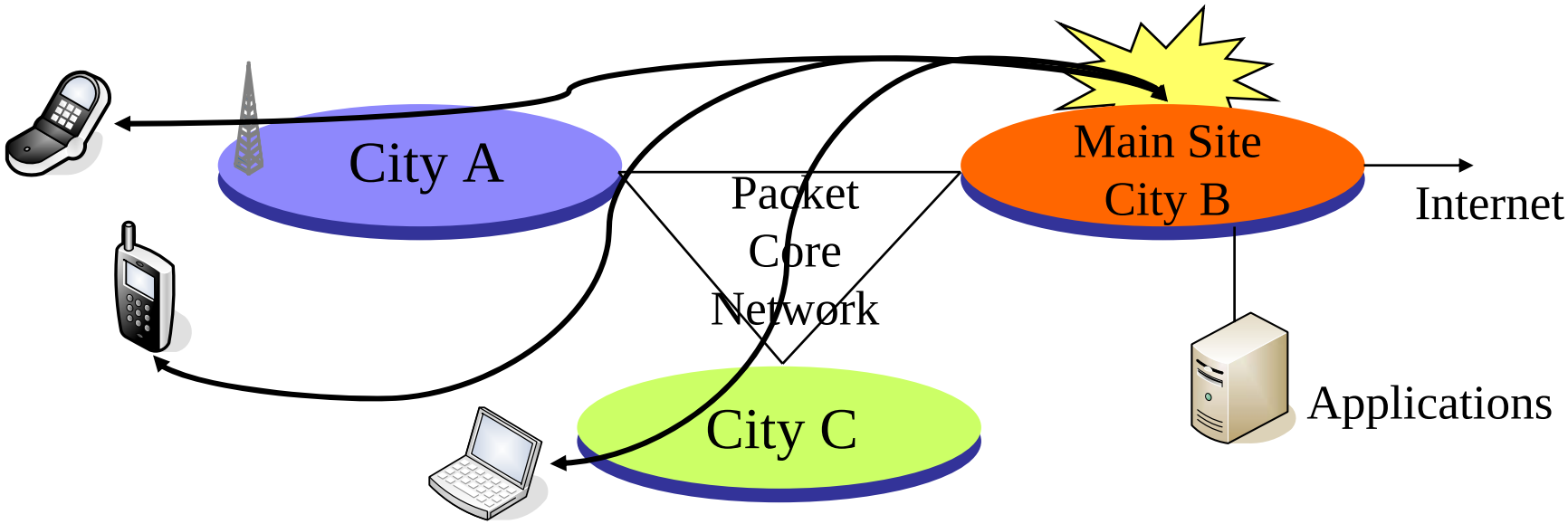
- HA Mobility binding HoAv4 HoAv6 -> CoAv6
- DSMIPv6 host uses IPv6 and mipv6 on 3GPP dual-version network
- Session continuity after movement to IPv4 only WiFi network

Peer2Peer VoIP – Inter-operator



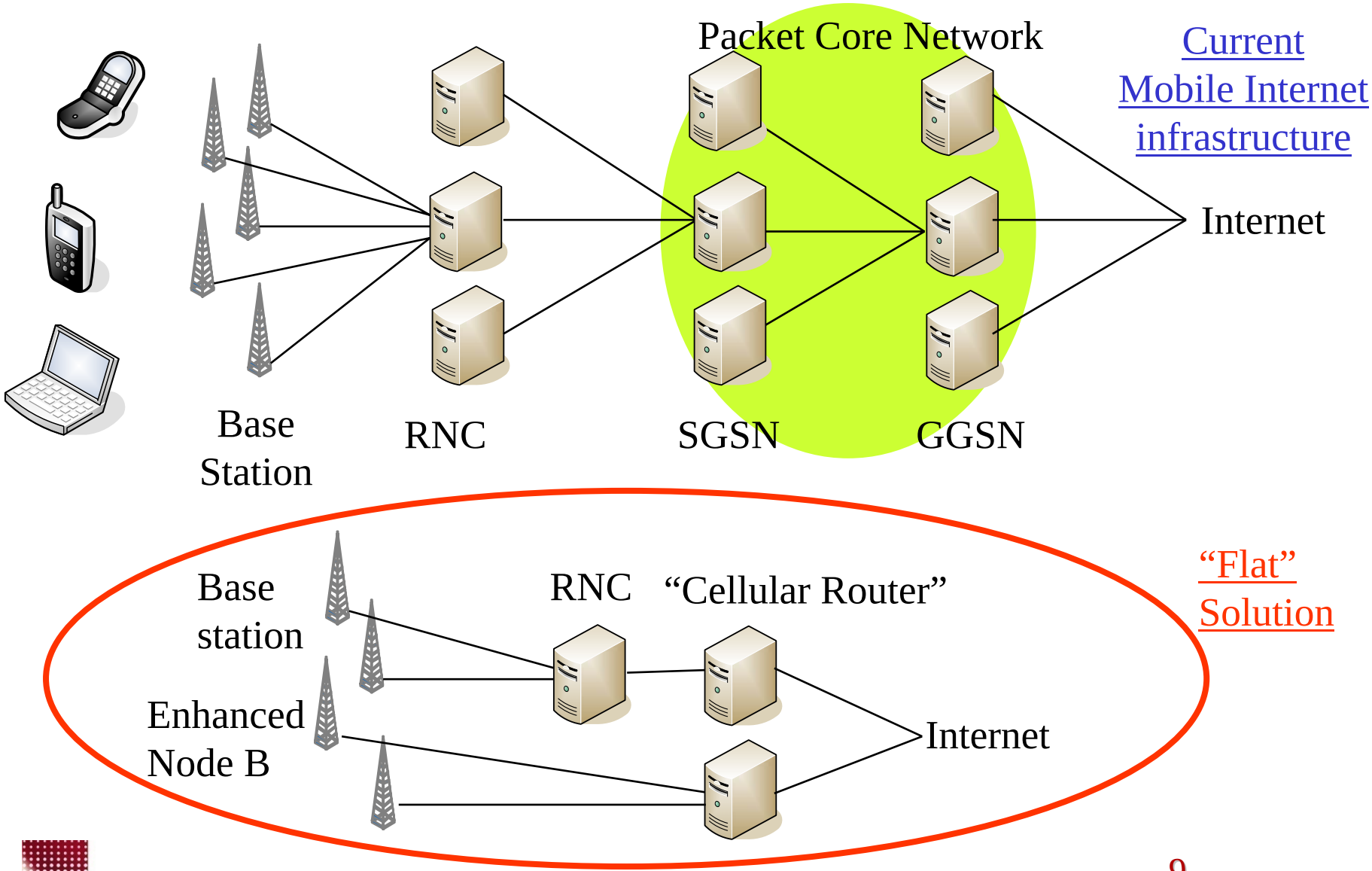
- Full Peer2Peer using IPv6 (P2P Presence and Voice)
- Peer2Peer on IPv4 requires some form of Proxy/STUN box with a public IPv4 address
  - Scalability issues, QoS issues
- UMA: Home NATs don't always support IPsec NAT traversal and even then often support only one IPsec tunnel
  - Simpler to go for IPsec on IPv6 (IPsec is mandated in IPv6 devices)

Why current options fall short



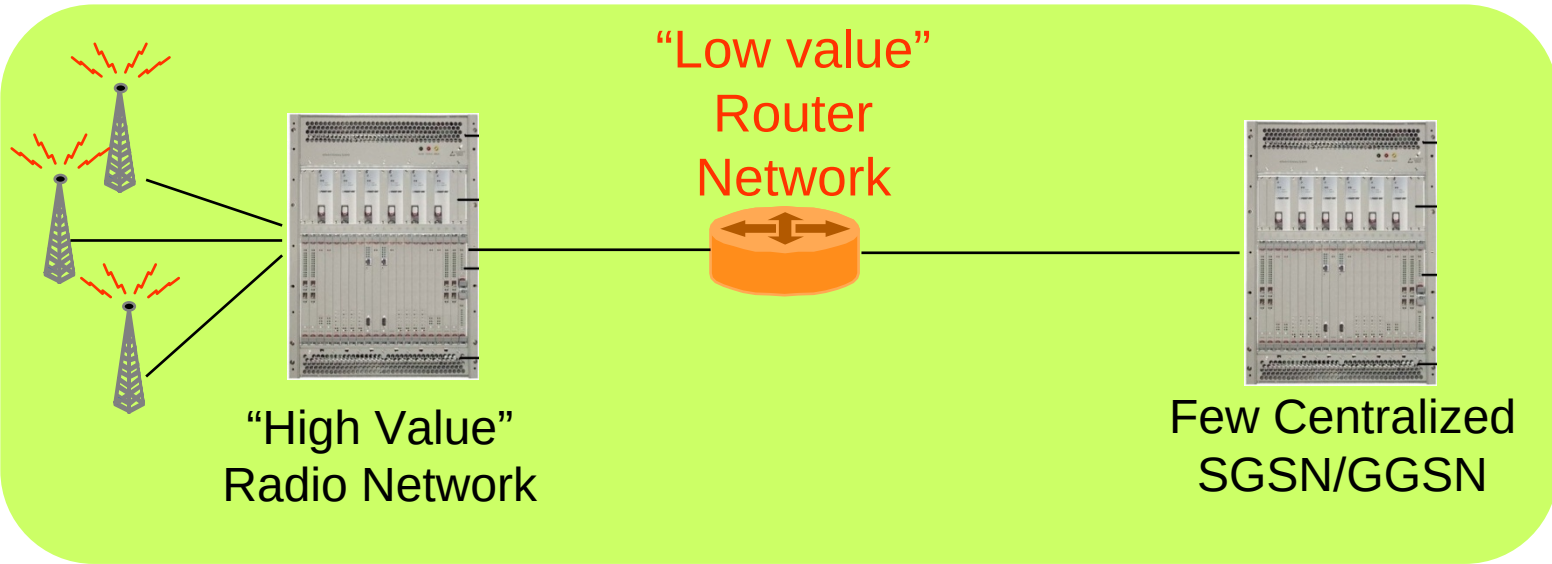
- Expensive and inefficient **centralized hierarchical data services architecture**
  - Main Sites where all traffic and application servers are concentrated
  - Inefficient traffic routing
  - Possible today due to low traffic usage and capacity overbooking
  - **Low quality, Limited bitrates, high latency**: not feasible for 3G HSPA and 4G
- Services are not integrated into the network architecture – does not create an environment for development of new services

Network Architecture evolution

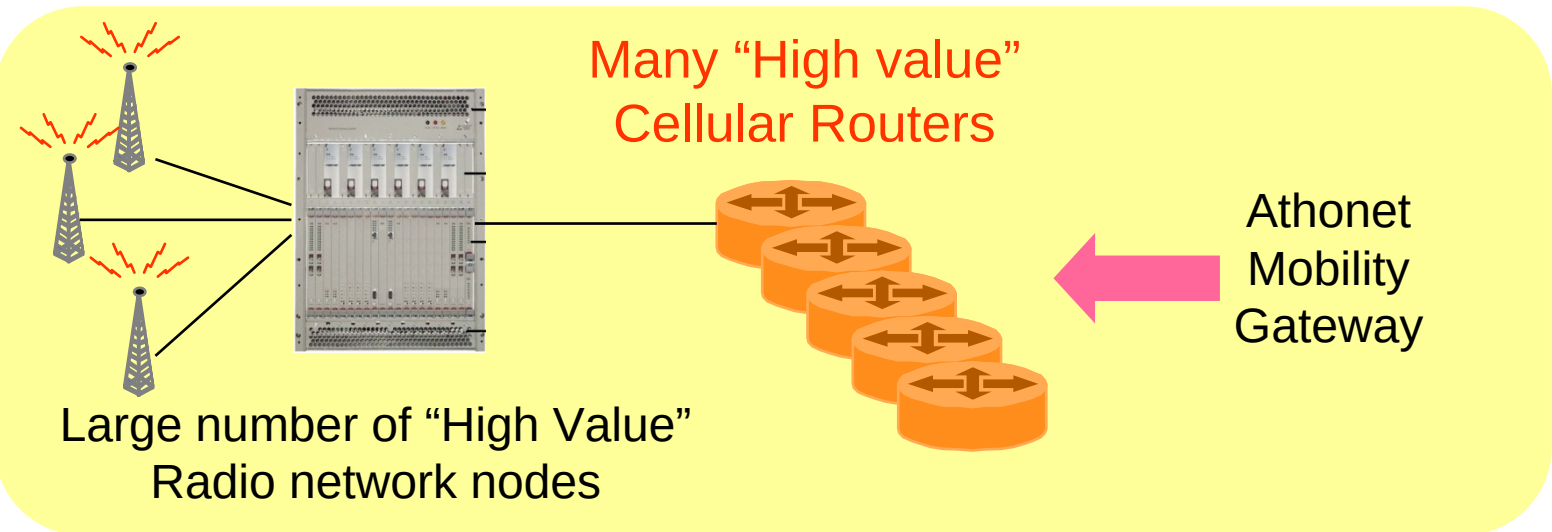


Mobility Gateway in flat network

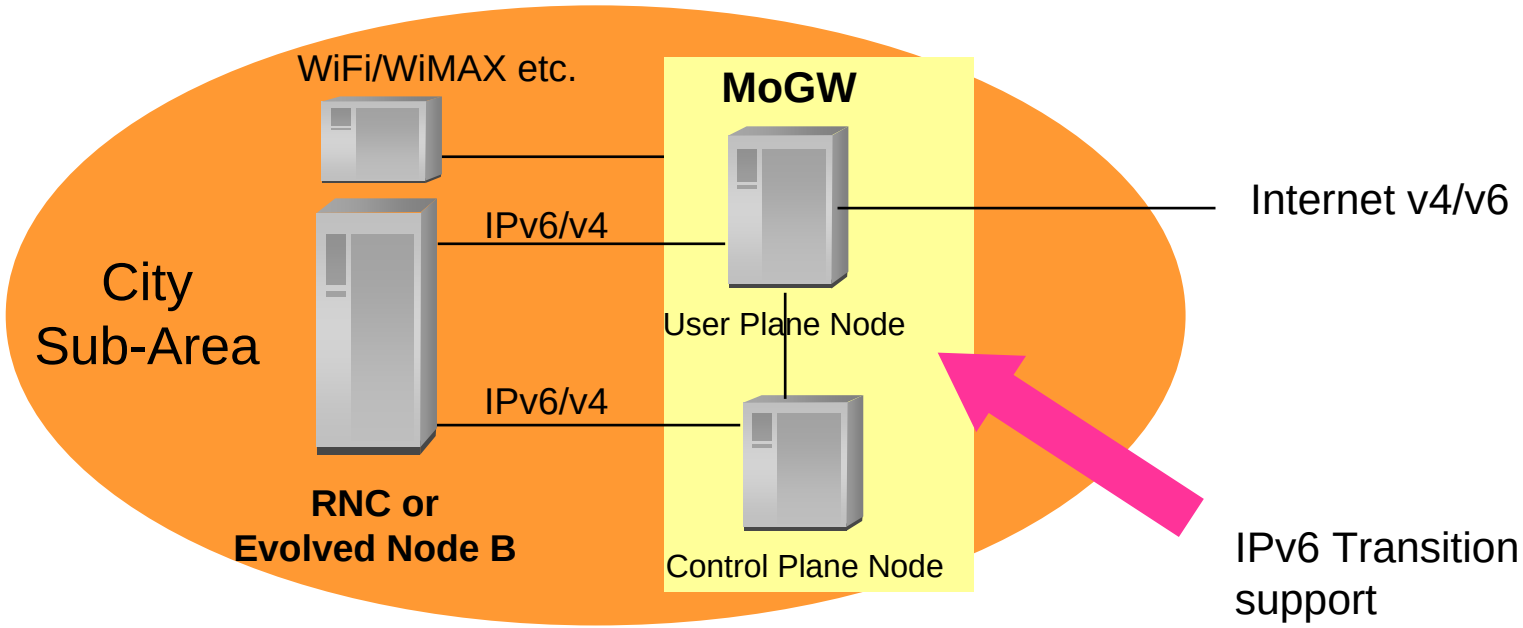
TODAY



Flat Distributed Network Evolution



An “IP view” on 3G Network evolution



- High bandwidth real-time applications are emerging (music, VoIP, video, peer2peer)
  - Require low latency and no bottlenecks
- Lessons from Internet: need to bring the content close to the users
- Flat & distributed network

IPv6 on a mobile phone?

- Available in the shops
  - E.g. Nokia Series 60
- Mobile OSs support IPv6: Symbian, Windows Mobile, Linux
- But as a user you need not know that
- What is the advantage?
  - Real Push & Pull (no longer only Pull): A global address on each mobile device means the device can be “reached” from anywhere
  - Networking: A whole subnet for a Personal Area Network
  - More to come from new developers…

Conclusions

- More applications needs to become wireless and connected
- LTE/SAE will only have PS connectivity (assigned at UE power on): every UE/module will need at least one IP address
- Broadband mobile networks strong push for IPv6 adoption
- The increase in traffic in mobile data networks lead to a de-centralized flat network architecture
- Considerable changes are needed on the CN including taking the CN closer to the edge access network
- IPv6 and transition mechanism needs to be in products for the operators to offer attractive services

Thank you!

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