System Enhancements for Accessing Broadcast Services in All-IP Networks

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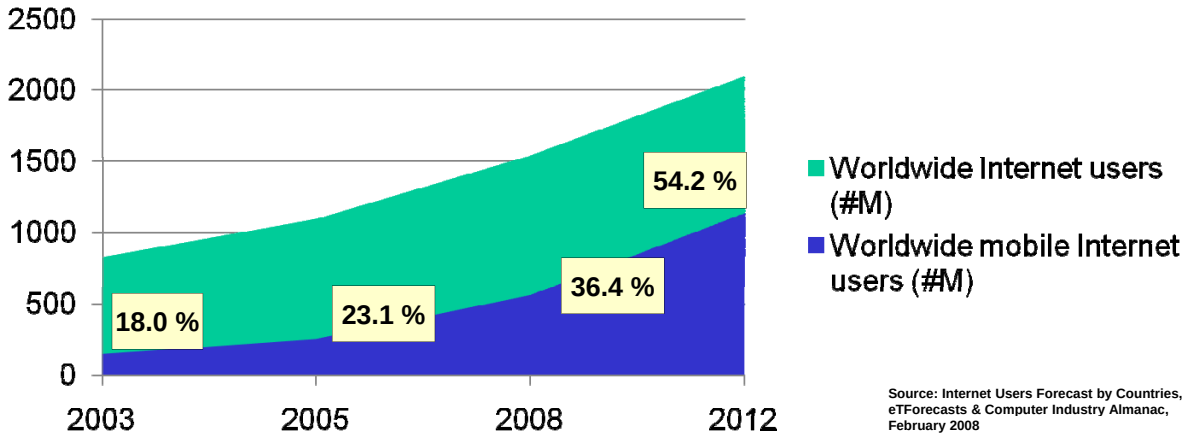
Motivation

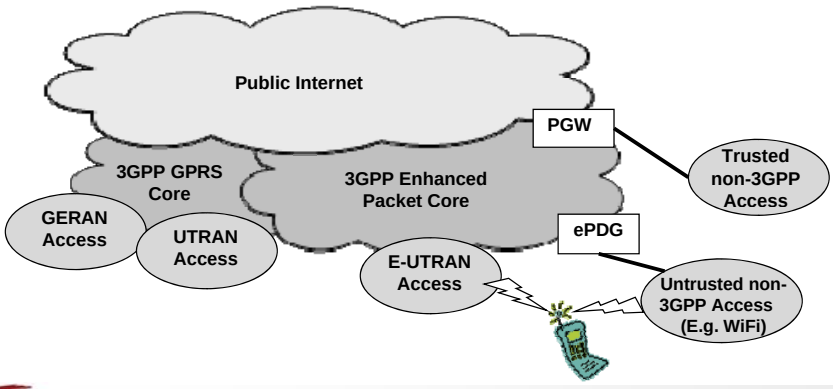


Source: Internet Users Forecast by Countries, eTForecasts & Computer Industry Almanac, February 2008

- Over 4 billion cellular subscriptions
  - Over 3 billion of these based on 3GPP standardized technology
- Increase of IP based services accessed by users through 3GPP device
- 3GPP solution: definition of all-IP network

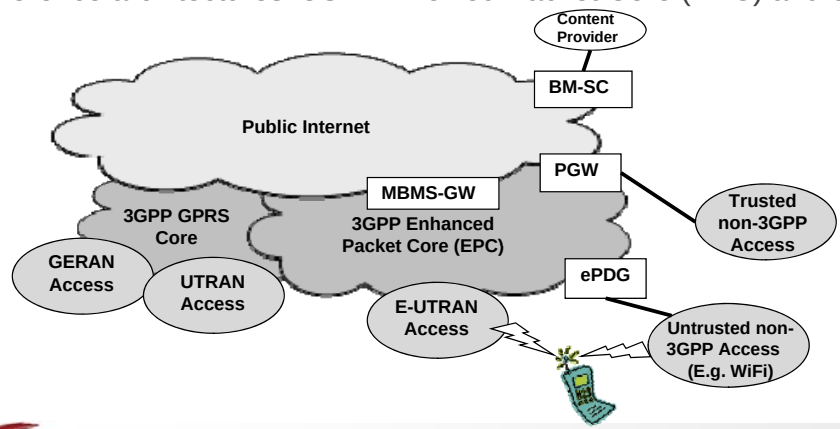
All IP Network definition

- "All IP Network" (AIPN) paradigm
  - The deployment relies on the usage of Internet Protocol (IP) on all the network nodes
  - Every base station implements IP functionalities (acts as an IP access router)
  - Interworking between different mobile systems is based on IP
  - Enables new technologies deployment with minimal extensions to the core network reducing CAPEX

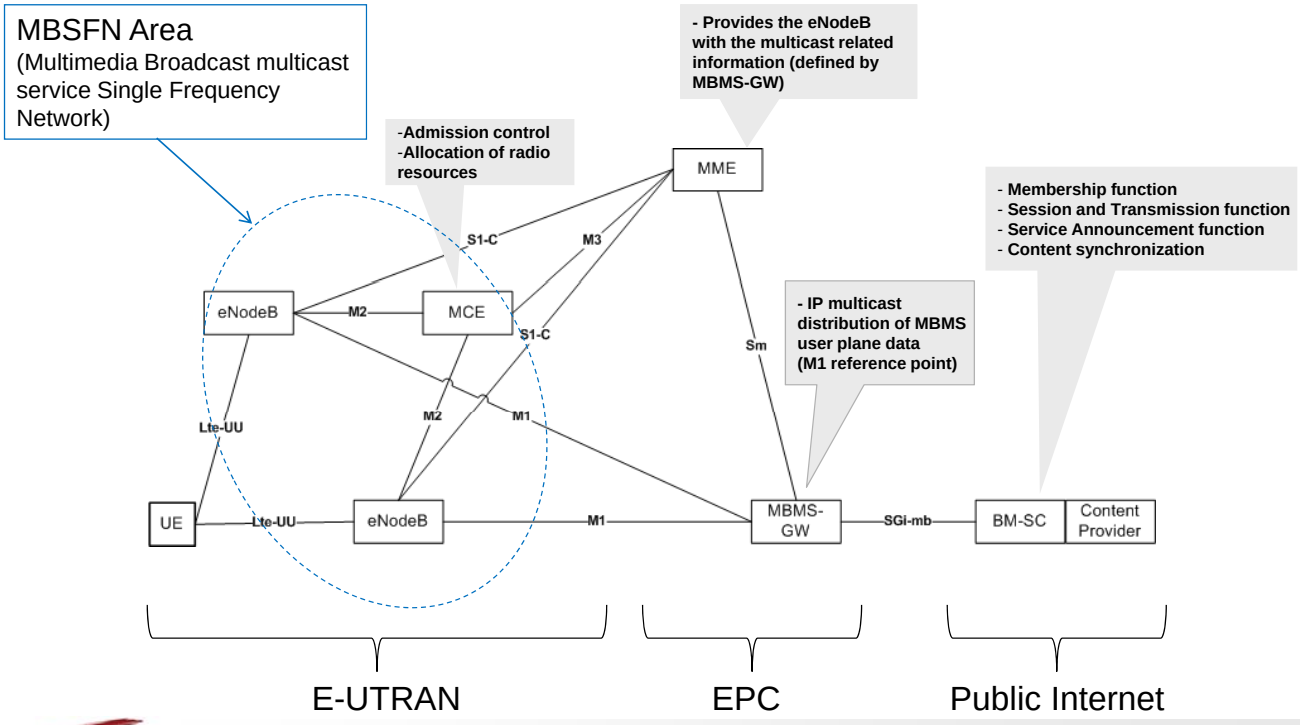


Broadcast technology integration in an AIPN

- Challenges for integration of broadcast technology/services in an AIPN
  - The broadcast services rely on a central entity acting as content provider
  - Solutions may require synchronized data packets delivery (see e.g. evolved Multimedia Broadcast Multicast Service - eMBMS)
- Adopted approach: interworking between broadcast system and AIPN
  - Provisioning of broadcast services to the user over different access systems
  - Depending e.g. on the user scenario, network load conditions, and radio conditions, the access system can be dynamically changed
- Reference architectures: 3GPP Evolved Packet Core (EPC) and eMBMS



EMBMS reference architecture model



Interworking scenarios and problem statement

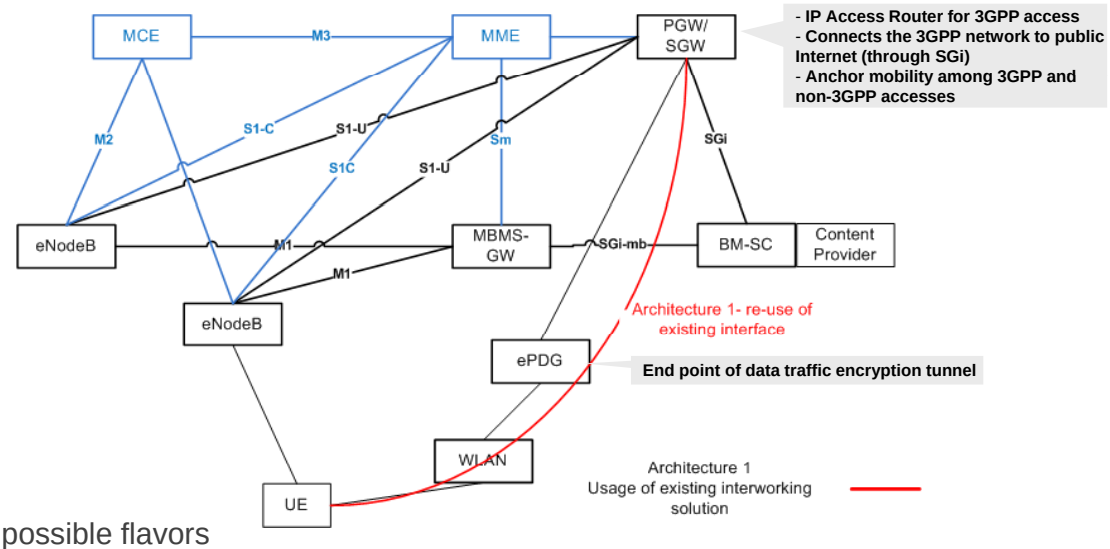
- Interworking scenarios
  - Resources optimization - counting
    - Number of users in a MBSFN area is low
    - Unicast channel can be used to deliver the broadcast service
  - Retention priority
    - Network can not deliver through broadcast channel all the broadcast services
    - Broadcast services not delivered through broadcast channel are unicasted
- Problem statement
  - In the above scenarios the service may stop being available over the broadcast channel
  - Interrupting the service would mean a bad user experience and is unacceptable for operators
  - WLAN interworking is one option to enable service continuity
  - An architecture and protocols to enable WLAN interworking with the MBMS bearer service need to be designed

Possible architectural approaches

- Architecture 1
  - Re-usage of existing interfaces for EPC-WLAN interworking
- Architecture 2
  - Definition of an interface between ePDG/WLAN and MBMS-GW

- For each considered architectures there are 2 possible solutions based on the IP transmission mode
  - Unicast vs. multicast

Architecture 1 – Re-use non-3GPP access architecture

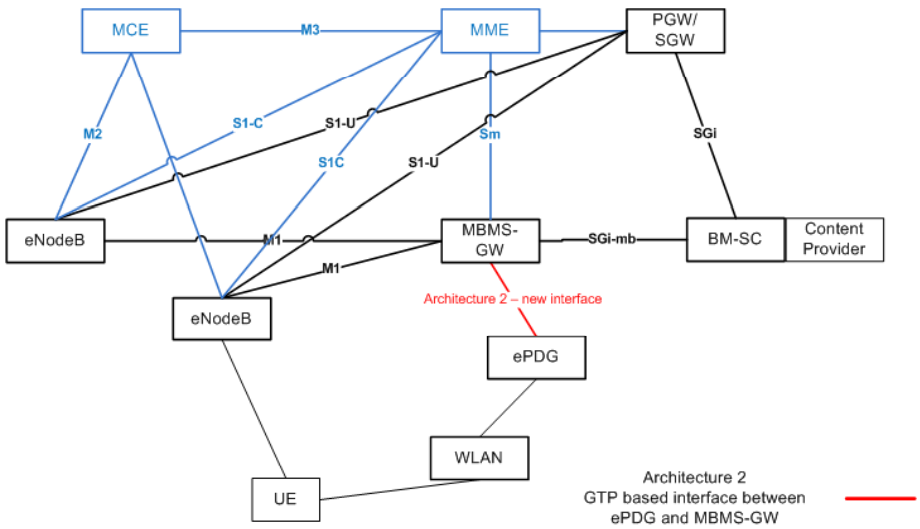


- Two possible flavors
  - Multicast routing in the network between PGW and ePDG/WLAN
  - Unicast tunneling between PGW and UE

Architecture 1 – Considerations

- IP Multicast based approach
  - The service packets are transmitted on IP multicast through the SGi interface
  - The PDN-GW forward the IP multicast packets to the UE
  - Impact on the existing architecture
    - Multicast routing protocol capability is required in
      - PDN-GW
      - Network implementing the SGi interface
      - Network between the ePDG and the PDN-GW
    - Multicast routing protocols usage must not taken as granted
      - Several networks do not implement it
- IP Unicast based approach
  - The BM-SC transmits the packets in IP unicast using as IP destination the UE address
  - Impact on the existing architecture
    - The PDN-GW needs to be informed whether the packets need to be sent over WLAN or EPC

Architecture 2 – New interface WLAN and MBMS-GW



- ePDG interface can be based on GTP
  - M1 interface between MBMS-GW and eNodeB is GTP based

Architecture 2 – Considerations

- IP Multicast based approach
  - The service packets are transmitted on IP multicast through the M1 interface as when sent to the eNodeB
  - Impact on the existing architecture
    - M1 interface between MBMS-GW and ePDG
    - Control plane interface between ePDG and MME
    - If the usage of WLAN needs to be selective (e.g. streaming service requires E-UTRAN only) BM-SC needs to be “technology” aware
- IP Unicast based approach
  - IP unicast based M1 for E-UTRAN is not specified
    - No point-to-point bearer is created by the MBMS-GW in case of E-UTRAN
  - If M1 interface can be unicast for E-UTRAN, impact on the existing architecture are:
    - Control plane interface between ePDG and MME
    - If the usage of WLAN needs to be selective (e.g. streaming service requires E-UTRAN only) BM-SC needs to be WLAN aware

Comparison of 2 architectures

	PROS	CONS
Re-use non-3GPP access - multicast	Requires no new interfaces	Require multicast routing protocol deployment
Re-use non-3GPP access - unicast	•Requires no new interfaces •Minimal impact to existing architecture	Non-optimal delivery of traffic
Interface WLAN and MBMS-GW - multicast	Optimized integration (traffic not routed through the internet)	Extensions to existing architecture (control plane MME-ePDG and user plane ePDG-MBMS-GW)
Interface WLAN and MBMS-GW - unicast	Same as multicast based solution (M2 interface can implement unicast or multicast)	Same as multicast based solution (M2 interface can implement unicast or multicast)

Conclusions

- Study and analysis of interworking between an AIPN and a broadcast service system
  - Reference: 3GPP eMBMS and EPC architecture
- Identification of scenarios for interworking between AIPN and a broadcast service system
- Proposal of 2 possible approaches suitable for the identified scenarios
  - Architecture 1 – re-usage of existing interfaces
  - Architecture 2 – definition of a new interface
- Comparison of solutions
  - Architecture 1
    - Limited impact on existing architecture
    - Requires transmission of broadcast service through the public Internet (i.e. not controlled by the mobile network operator)
  - Architecture 2
    - Higher impact on existing architecture
    - Keeps transmission of broadcast service within mobile operator network

THANK YOU!