



IPv6 QoS based multicast services in DAIDALOS Project

Efficient mobile multicast with QoS support using context transfer

new technologies developed in DAIDALOS: CT, CARD (standardised by IETF Seamoby WG) interacting with QoS management

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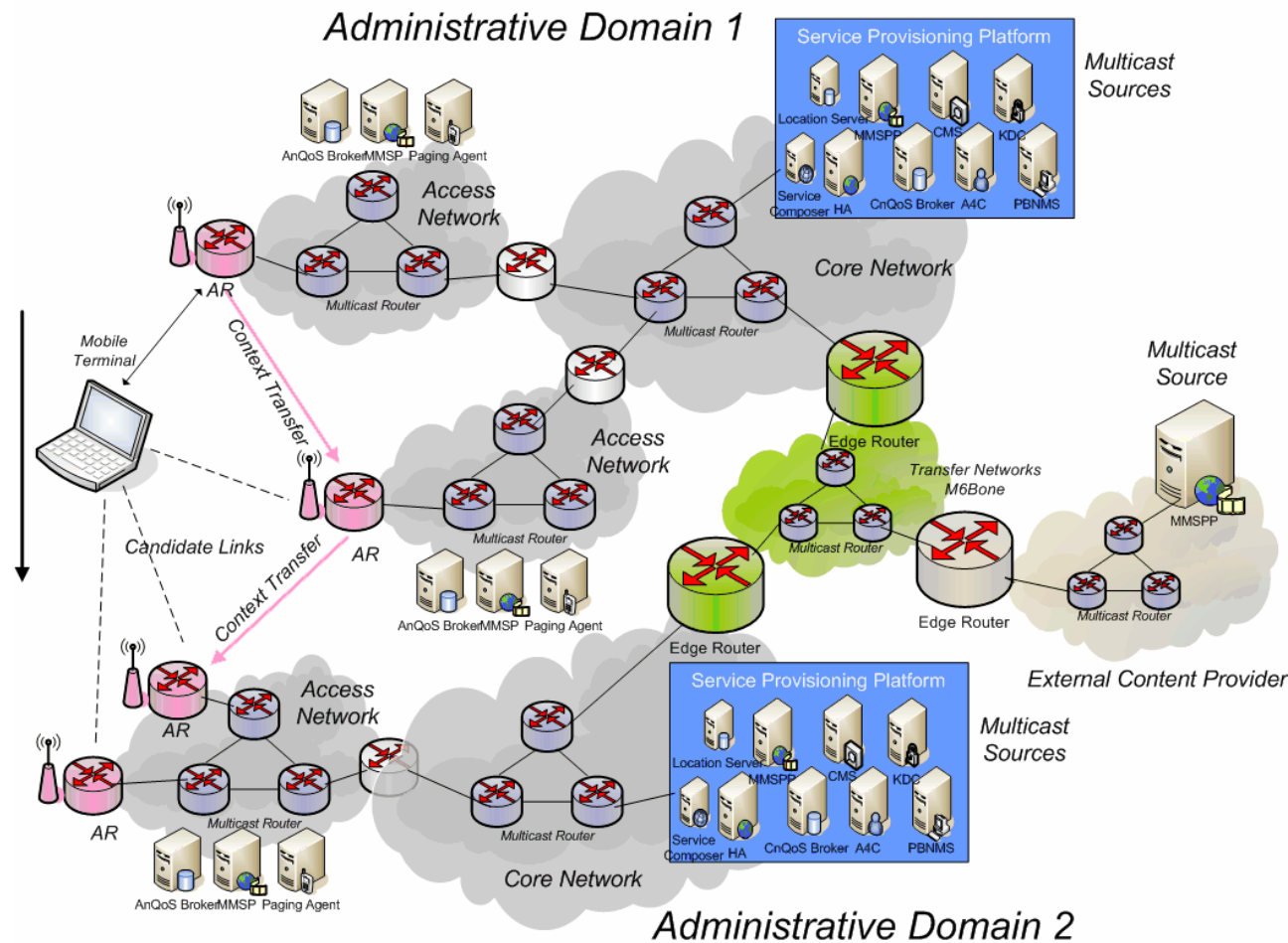
EU IST Integrated Project DAIDALOS



- ▶ **Designing Advanced Interfaces for the Delivery and Administration of Location independent Optimised personal Services, www.ist-daidalos.org**
 - Automated configuration, parameterisation and interaction of the interfaces for QoS support
 - Integration of **heterogeneous** wireless access networks, including **broadcast media**, based on mobile Ipv6 services
- ▶ **Issues in DAIDALOS architecture for supporting of QoS of mobile multicast communication**
 - Seamless handover based on IPv6 access networks
 - Management and planning of Internet resources of access networks using a service provisioning platform including distributed QoS manager agents (brokers) interacting with DiffServ and IntServ/RSVP QoS provisioning technologies.
 - Flexible performance management for resource usage optimisation and enhanced QoS provision considering access and wireless networks included in the mobile IPv6 network infrastructure.
 - Flexible interfaces of mobile applications for QoS parameters requests, negotiation and control.
 - Mapping of transport layer QoS parameters, such as end-to-end delay and packet loss, into QoS parameters of wireless networks.
 - Cross-network mapping of QoS parameters considering different wireless technologies (TD-CDMA, WLAN, WIMAX, DVB, GPRS, Bluetooth)



IPV6 mobile networking infrastructure for QoS support



Validation and Enhancement
of Current
Standards

Context transfer
→ Interoperability
→ Transfer of diverse contexts (QoS, security, multicast..)

Optimised QoS based on **Candidate Access Router Discovery**
→ Heterogeneous networks

Service Management based on **QoS brokers for access, core and inter-domain networks**



Multicast context transfer

Mobile Multicast Services in DAIDALOS



- ▶ **DAIDALOS automotive scenario with multicast services**
 - Multicast transfer from one source to many mobile clients over broadcast media (DVB-T)
 - Distribution of airport and free parking data from a dedicated sender to multiple mobile clients
 - Any Source Multicast for future services, such as mobile conferencing and teleworking
- ▶ **Source Specific Multicast (SSM) [RFC 3569] with mobile clients**
 - News distribution
 - Streaming and Multimedia multicast
 - DVB
- ▶ **Any Source Multicast (ASM) [RFC 1112] with mobile clients and sources**
 - Mobile Conferencing
- ▶ **Client and Source Mobility**
- ▶ **QoS based Multicast Models**
 - Source and Receiver driven QoS reservation
 - Receivers with Heterogeneous QoS



Context Transfer for Multicast Services



- ▶ Goal to re-establish the multicast services in case of handovers efficiently without requiring the mobile host to explicitly perform all protocol flows for those services from scratch [RFC3374]
- ▶ Context Transfer Protocol
 - Context Transfer protocol standardised by Seamoby IETF WG (M. Liebsch et al) → Messages to initiate and authorise context transfer as well as messages transferring contexts prior to, during and after handovers.
 - Supports integration of heterogeneous wireless networks in Internet infrastructure based on **interoperable services**
- ▶ Multicast Listening Context Transfer
 - Multicast Listener Discovery (MLDv2) [RFC3810]...
 - MLDv2 supports the join or leave a multicast group at any time and offers the SSM opportunity for receivers to filter specific multicast sources.
- ▶ Multicast Routing Context Transfer
 - PIM Sparse-Mode (PIM-SM) version 2 [RFC2117], [RFC2362]...
 - Protocol independent multicast routing
- ▶ Context transfer of QoS based resource reservations of mobile multicast connections
 - DiffServ [RFC3745]
 - IntServ/RSVP [RFC2490]



Multicast Listening Context Transfer for mobile clients



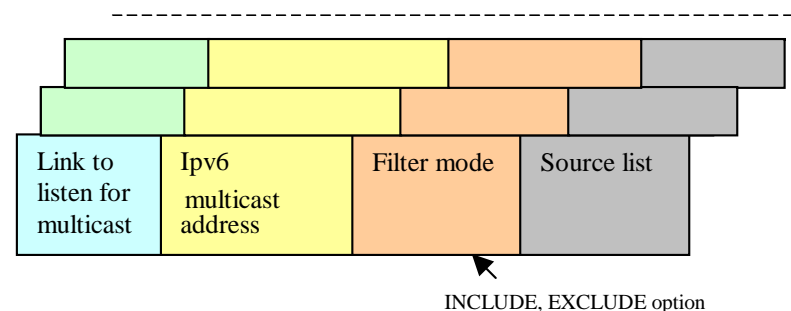
▶ MLDv2 context transfer

- Aggregated MLDv2 context per link at access router: (IPv6 multicast address, filter mode, source list)
-> needs state updates at previous and next access router before and after handover
- Socket multicast listening context: (interface, IPv6 multicast address, filter mode, source list)
→ not efficient to transfer because its location at mobile node

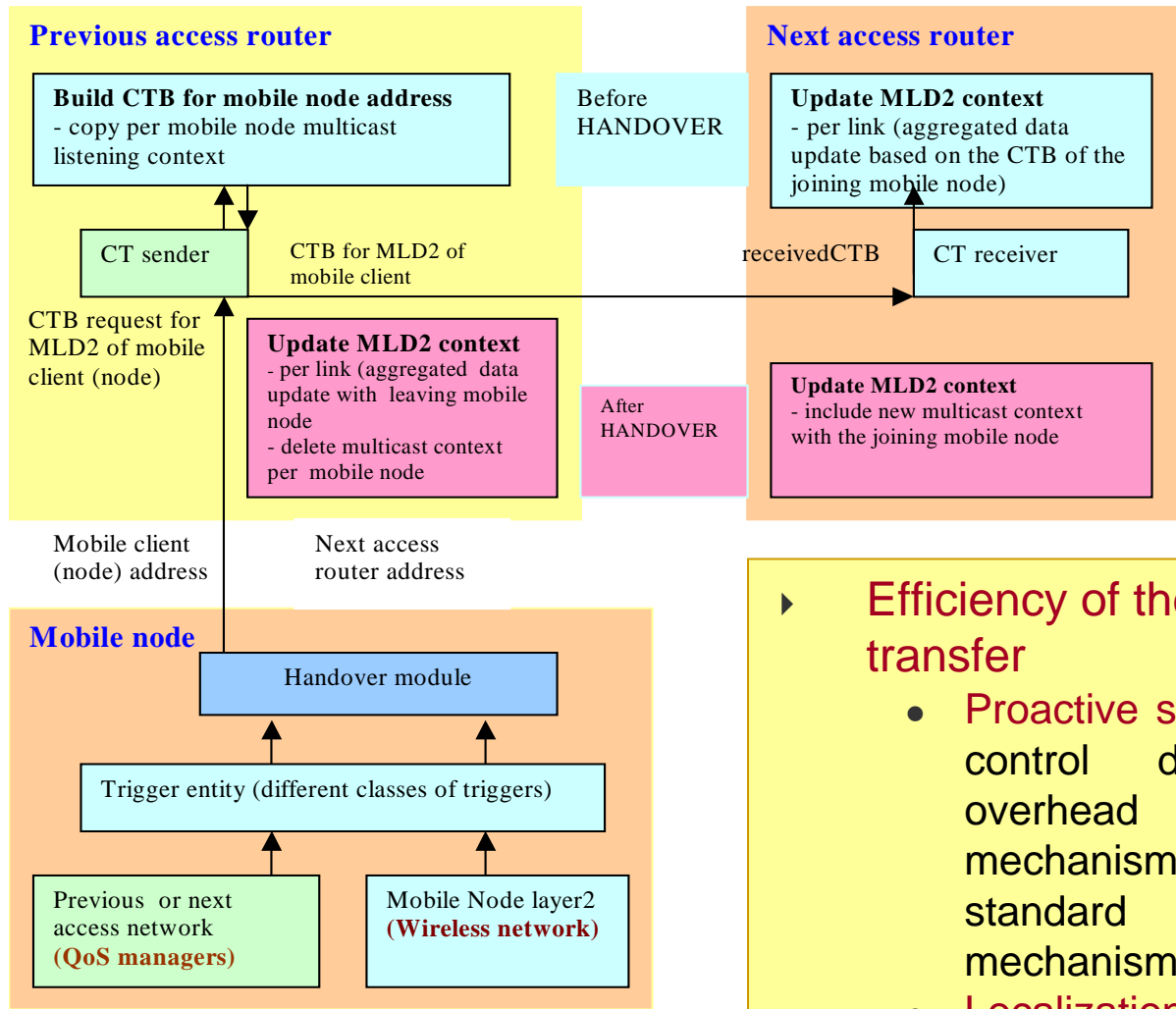
▶ MLDv2 Adaptation for Efficient Operation

- Per client multicast listening context at access router (MLDv2 Context Transfer Block) is proposed based on socket multicast listening context of the mobile multicast node

• MLDv2 Context Transfer Block



Scenario for multicast listening context transfer



- ▶ **Efficiency of the multicast context transfer**
 - **Proactive strategy** to transfer the control data reducing the overhead of communication mechanisms based on the standard MLDv2 listening mechanisms
 - **Localization of the communication operations**



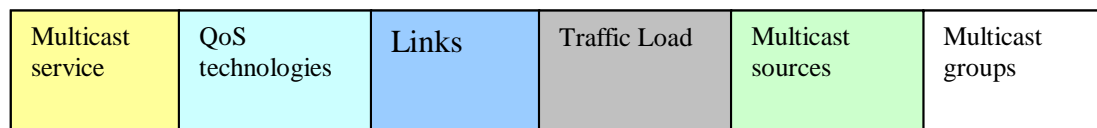
Multicast context transfer

QoS issues in Candidate Access Router Discovery



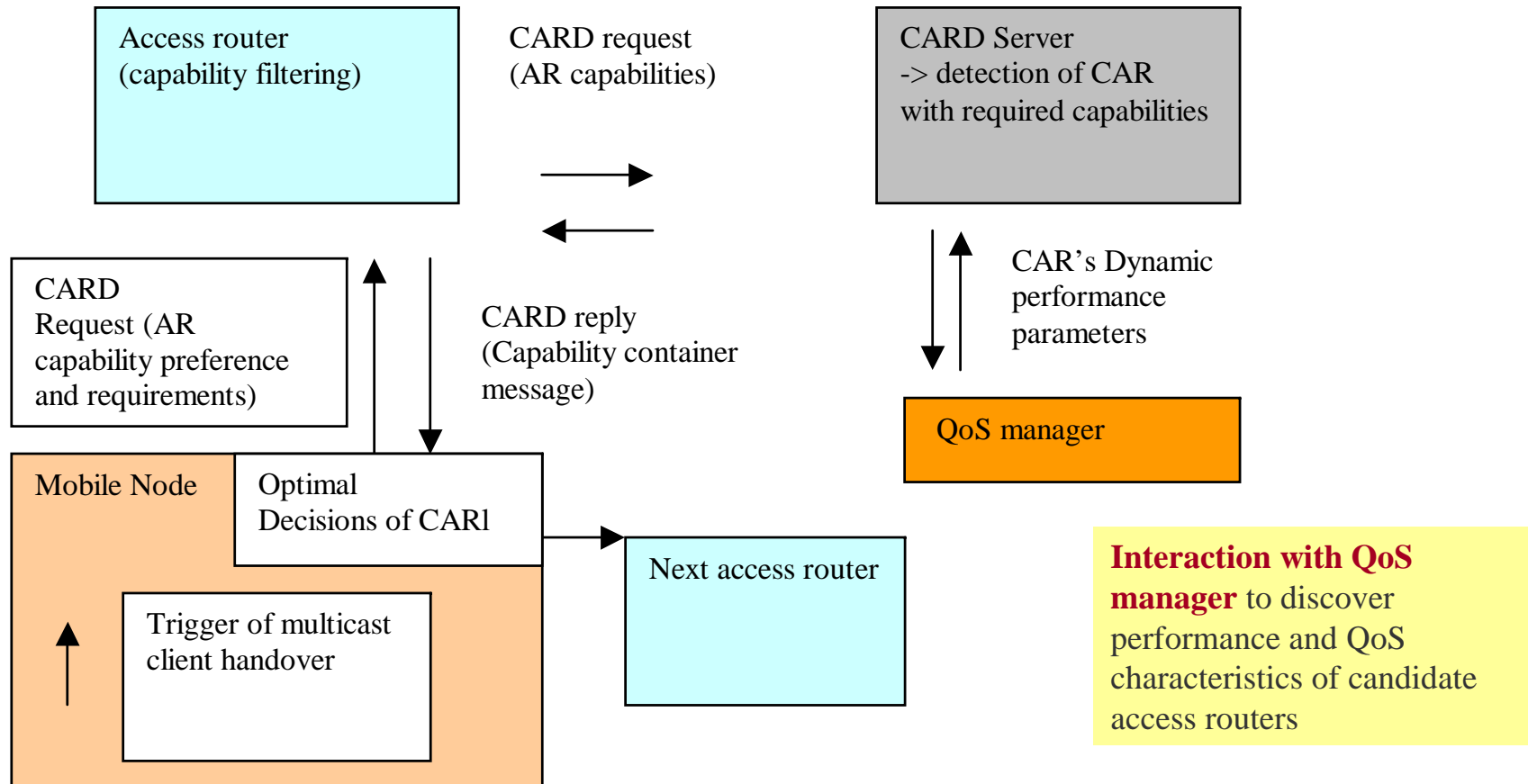
- ▶ The candidate access router discovery (CARD) protocol standardised by IETF Seamoby Working Group
 - designed to support the acquisition of information about the possible access routers that are candidates for the mobile node's next handover
- ▶ **CAR discovery**
 - Identify the IPv6 addresses of the CARs
 - Find the capabilities of those CARs to provide same services and protocols, as well as possibilities to reuse already established multicast services in another networks

- **Experiments with different CAR Attributes** for optimising decisions for a seamless handover of multicast services : static and dynamic





Centralized Server for CARD





Multicast routing context transfer for mobile clients

- ▶ Issues of PIM-SM context transfer
 - Tree data base at the router as context
 - Context transfer block – tree structure to the multicast group
 - Trees to the multicast groups required for the mobile clients should be re-built (over RP) at the next access router before the handover and deleted at the previous access router after the handover.
 - Mobile clients joining explicit sources, the new access router can build the SPT's at once without first receiving packets from the RP
- ▶ Optimisation focus
 - Interaction with QoS brokers (managers) at the access network for **resource reservation during the tree context transfer** for mobile multicast clients
 - Keeping context entries in the tree data base for future reuse in order to **avoid context transfer**





QoS management architecture for efficient handover

- ▶ **Different kinds of QoS managers** for inter-domain, core and access networks with specific responsibilities are interacting in this architecture
- ▶ **QoS brokers (managers) at the access network.**
 - Manage the QoS of the access routers and provide information on their capabilities
 - Uses signalling protocols and databases for management of QoS based mobile communication in an heterogeneous mobile IPv6 infrastructure
- ▶ **Features of QoS managers of access networks** for efficient handover and context transfer for multicast services
 - Keeping knowledge of access routers with multicast services in the network, as well as multicast groups, for which MLDv2 context is established at the access routers.
 - Measurement or prediction information for traffic flows of multicast access routers based on the collection of traffic measurements per routers and their evaluation.
 - **Management of resource reservation in advance for access routers considering predictions of mobile behaviour patterns**
- ▶ **Learning to reduce context transfer overhead based on performance management at the access routers, as for instance:**
 - **Detection of frequently used listening contexts to specific multicast group at the access routers**
 - **Optimising the life time of context structures for multicast listening and routing at the access routers.**





Further DAIDALOS topics on efficient mobile multicast handover

- ▶ **Enhancement of MLDv2** standardisation for mobile multicast clients context transfer
- ▶ Extension of CAR technology with **attribute descriptions for different kinds of handovers and applications** (contribution to standardisation based on experimental results)
- ▶ **Further specification of QoS management architecture for QoS negotiation and resource reservation in advance at CARs**
 - based on mobile patterns for the mobile multicast client and advance resource reservation requests
- ▶ **Optimisation of multicast tree context transfer**
 - considering techniques such as Context RP relocation, anycast RP routing mechanisms, tree migration and evolution techniques for QoS multicasting
- ▶ **Mobile source context transfer**
 - Design, development, standardisation

