

Relation to other projects:

Parts of the MASA architecture implementation are already used in other NEC projects. For example, the MediaStorm streaming module is used for the development of several multimedia services. MASA is also used as the underlying QoS streaming technology in the MUSE Service Environment currently developed in the Internet Services Group of NEC Heidelberg. Other co-operations with the Universities of Braunschweig, Ulm and Mannheim are under discussion.

Future Work:

The MASA project will be continued by the MASA NETWORK project between Siemens AG, University of Ulm and NEC Heidelberg, officially starting October 1st 2001. MASA NETWORK is intended to complete the MASA QoS Framework architecture by adding access network brokers (ANB) and core network brokers (CNB) for network resource management. Transcoding QoS brokers will provide support for transcoding and filtering of multimedia streams.

Publications:

1. Hannes Hartenstein, Andreas Schrader, Andreas Kassler, Michael Krautgärtner and Christoph Niedermeier, *High Quality Mobile Communication*, Proceedings of the KIVS'2001 Conference, German Informatics Society (GI), February 2001, Hamburg, Germany.
2. Darren Carlson, Hannes Hartenstein and Andreas Schrader, *QoS Orchestration for Mobile Multimedia*, AWS'2001, The First Workshop on Applications and Services in the Wireless Networks. Evry, France, July 25-27, 2001.
3. Christian Kücherer, Andreas Kassler, Andreas Schrader and Oliver Haase, *End Device and Network Adaptation of WaveVideo Streams*, SSGRR'2001, International Conference on Advances in Infrastructure for Electronic Business, Science, and Education on the Internet, L'Aquila, Italy, August 6-12, 2001.
4. Andreas Kassler, Christian Kücherer and Andreas Schrader, *Efficient Wavelet Video Filtering*, QoS'2001, 2nd International Workshop on Quality of future Internet Services, Coimbra, Portugal, September 24-26th, 2001.

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MASA

Mobility and Service Adaptation in Heterogeneous Mobile Networks

Summary:

MASA is a comprehensive end-to-end QoS architecture supporting user policy-controlled media transmission and processing in heterogeneous environments. MASA offers easy-to-use interfaces to hide the complexity of underlying network QoS mechanisms and allows for seamless handoffs in wireless scenarios.

Motivation:

The Internet offers challenging new opportunities for the development of communication applications such as video conferencing, multimedia distance learning, virtual reality group chatting, and many more.

In order to enhance the Internet to be a multimedia communication medium allowing anywhere usage by

anybody anytime, many technical problems still have to be solved. One of the most well known problems is the missing support of reliable and predictable quality for real-time streaming of audio and video content. Therefore, effective methods for providing *Quality of Service* (QoS) are needed.

Since more and more devices will be mobile, most multimedia applications should also be able to run in mobile environments. Unfortunately, the growing number of different fixed line (e.g. Ethernet, ATM, xDSL, etc.) and wireless (e.g. GSM/GPRS, Wireless LAN, UMTS, etc.) access network technologies in combination with the growing variety of user devices (e.g. mobile phone, PDA, WebPad, Multimedia Workstation, etc.) will lead to a high level of heterogeneity with quickly changing terminal power and link qualities.

In recent years, a number of approaches have been proposed to enhance the Internet with different QoS mechanisms, but most of them concentrate only on certain aspects of the overall QoS problem (e.g. video filtering or resource reservation), certain entities of the transmission path (e.g. terminal) or certain layers of the communication model (e.g. DiffServ, IntServ). In almost all of them, key features are missing, like inter-session relationship, multiparty support, adaptation mechanisms, or load-balancing and fast handover.

Therefore, taking also the mobility-specific needs into account we develop MASA as a comprehensive *media-centric QoS architecture*.

The MASA Project

MASA is a joint project of NEC Europe Ltd. Heidelberg, Siemens AG and the University of Ulm. Phase I of the project (Oct. 1999 – Sep. 2000) focused on terminal aspects. The MASA QoS framework was designed to fulfill the requirements of a comprehensive integrated end-to-end QoS multimedia management system, allowing the usage of underlying network layer QoS technologies, and hiding the complexity of QoS and adaptive media management from the applications. By controlling the complete communication infrastructure MASA is able to support QoS in a way, which can neither be realized within

the application nor with the underlying network QoS technologies alone.

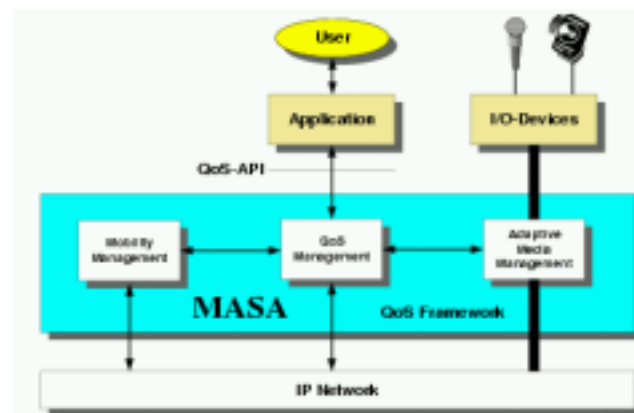


Figure 1: MASA on End-Systems

The MASA framework has the following main features:

- MASA represents a comprehensive management system for end-to-end QoS.
- MASA maps high-level (user) QoS policies into appropriate (network) QoS parameters for the underlying QoS technologies. These mapping functions can be easily modified and extended.
- A QoS-API for MASA end-systems is provided to relieve developers of QoS-enabled mobile applications from QoS/media/mobility-related concerns.

Because of the above properties, the MASA framework serves two purposes: on the one hand by providing a "middleware product" for rapid development of mobile applications and on the other hand as a research platform for testing of adaptation and handover strategies or QoS policies in general.

The MASA Architecture

The MASA QoS architecture consists of a distributed set of autonomous QoS Brokers, which can be placed on the (potentially mobile) end-system, on intermediate network nodes (e.g. router, switches) and on transcoding units (gateways). Each Broker delegates and coordinates

different Managers which in turn are responsible for specific tasks, like resource-, network-, media-, policy- and mobility- management.

The main task of the End-System QoS Broker is to coordinate, orchestrate and manage local and remote resources for adaptive multimedia streaming, to map the user's QoS wishes to appropriate QoS parameters and to support mobility between different access networks. Network QoS Brokers can be regarded as centralized QoS management units which support the End-System QoS Brokers and orchestrate all streams in the respective network domain according to a given network management policy.

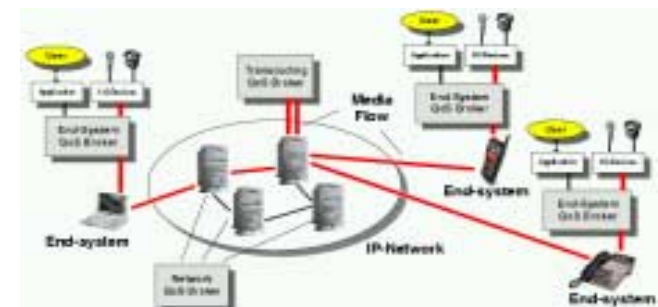


Figure 2: The MASA Architecture

Appropriate interfaces and protocols are used to realize communication between the distributed QoS Brokers and allow for capability exchange, admission and authorization requests, and the management of media channels.

MASA presents applications with mechanisms for the processing and transmission of 'high quality' multimedia streams, i.e. adapted to the user's QoS wishes and the available infrastructure and resource availability. Applications subscribe to the system and use the provided multimedia facilities to control the set-up of a complete chain of media processors, consisting of capture devices, codecs, effect processors, RTP packetizers, etc. Graphical user interfaces are provided to present media information.

MASA supports mobile devices by integrating mobility management into the framework, using fast QoS re-negotiation and adaptation mechanisms to allow seamless intra- and inter-technology handoff.