The logo for AQUILA, featuring a stylized red eagle above the word "AQUILA" in a black serif font.

AQUILA (IST-1999-10077)

**Adaptive Resource Control for QoS
Using an IP-based Layered Architecture**



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Agenda

- Project facts and objectives
- Network services
- Architecture
- Further regions of study
- Outlook

Project partners

Siemens (Co-ordinator), Germany

Bertelsmann mediaSystems, Germany

T-Nova Deutsche Telekom, Germany

Telekom Austria, Austria

Elisa Communications, Finland

Polish Telecom, Poland

**National Technical University of Athens,
Greece**

Warsaw University of Technology, Poland

CoRiTel, Italy

Dresden University of Technology, Germany

Salzburg Research, Austria

Q-Systems, Greece

**I&C
manufacturer**

**Internet Service Providers
and
Network Operators**

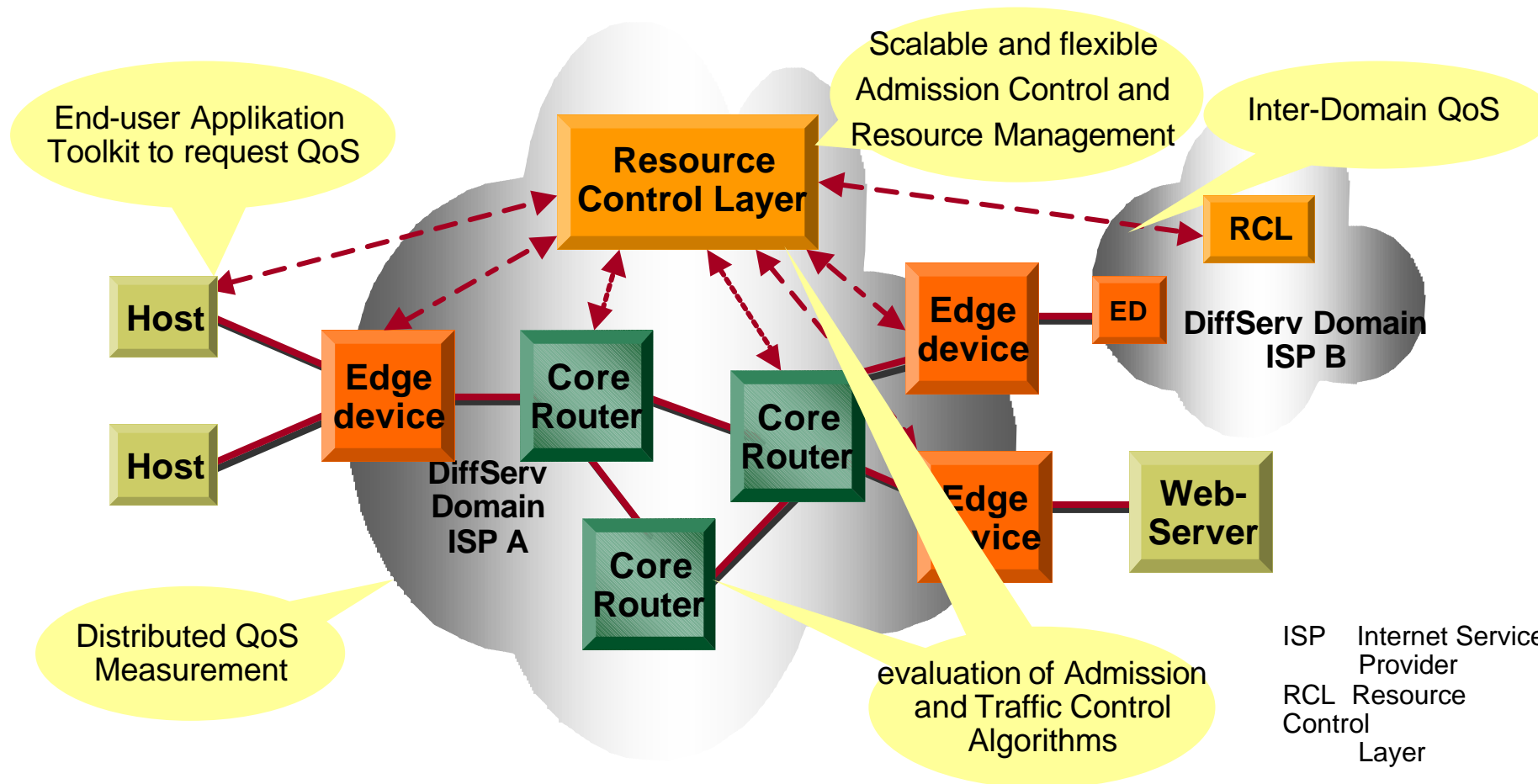
**Universities
and
Research Institutes**

**Web application
provider**

Main Objectives of the AQUILA project

- Investigate dynamic end to end QoS provisioning in IP networks
- Implement prototypes of a QoS architecture for a carrier grade DiffServ Core network
- Continuously analyse market situations and technological trends
- Contribute to standardisation bodies like IETF, ITU, ETSI, etc
- Time frame: 01/2000 - 12/2002
- Trials
 - lab trial: 1st quarter of 2001
 - field trial: 2nd half of 2002

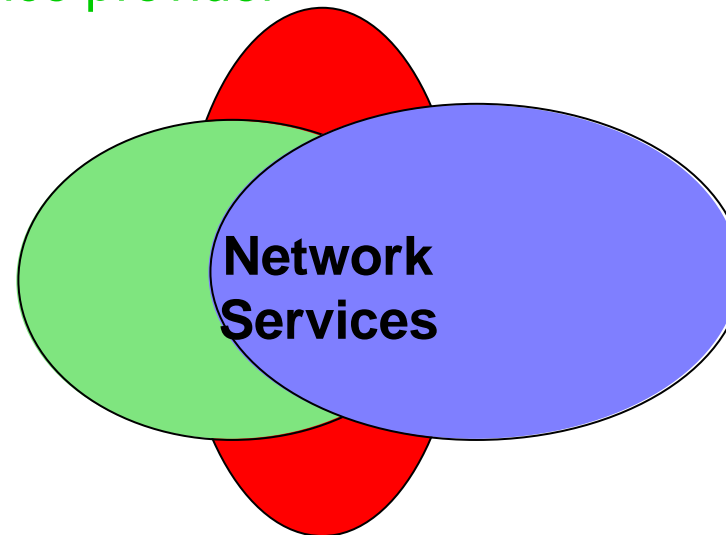
Main Objectives of the AQUILA project



Network Services

Constraints set by

- requirements from end-user and applications
- requirements from service provider
- technical feasibility



Goal:

only a few network services to allow clear service differentiation

Network Services

Premium CBR for IP Telephony and Voice Trunking

- low delay and jitter, very low loss, hard bandwidth guarantee, small packets

Premium VBR for Video Streaming and Teleconferencing

- low delay and jitter, low loss, bandwidth guarantee

Premium Multimedia for adaptive applications (TCP), e.g. ftp

- bandwidth guarantee, moderate delay

Premium Mission Critical for SAP, interactive games, online banking, ...

- very low delay and loss, non-greedy flows and rather small packets

Standard

- classical best effort traffic

Resource Control Layer

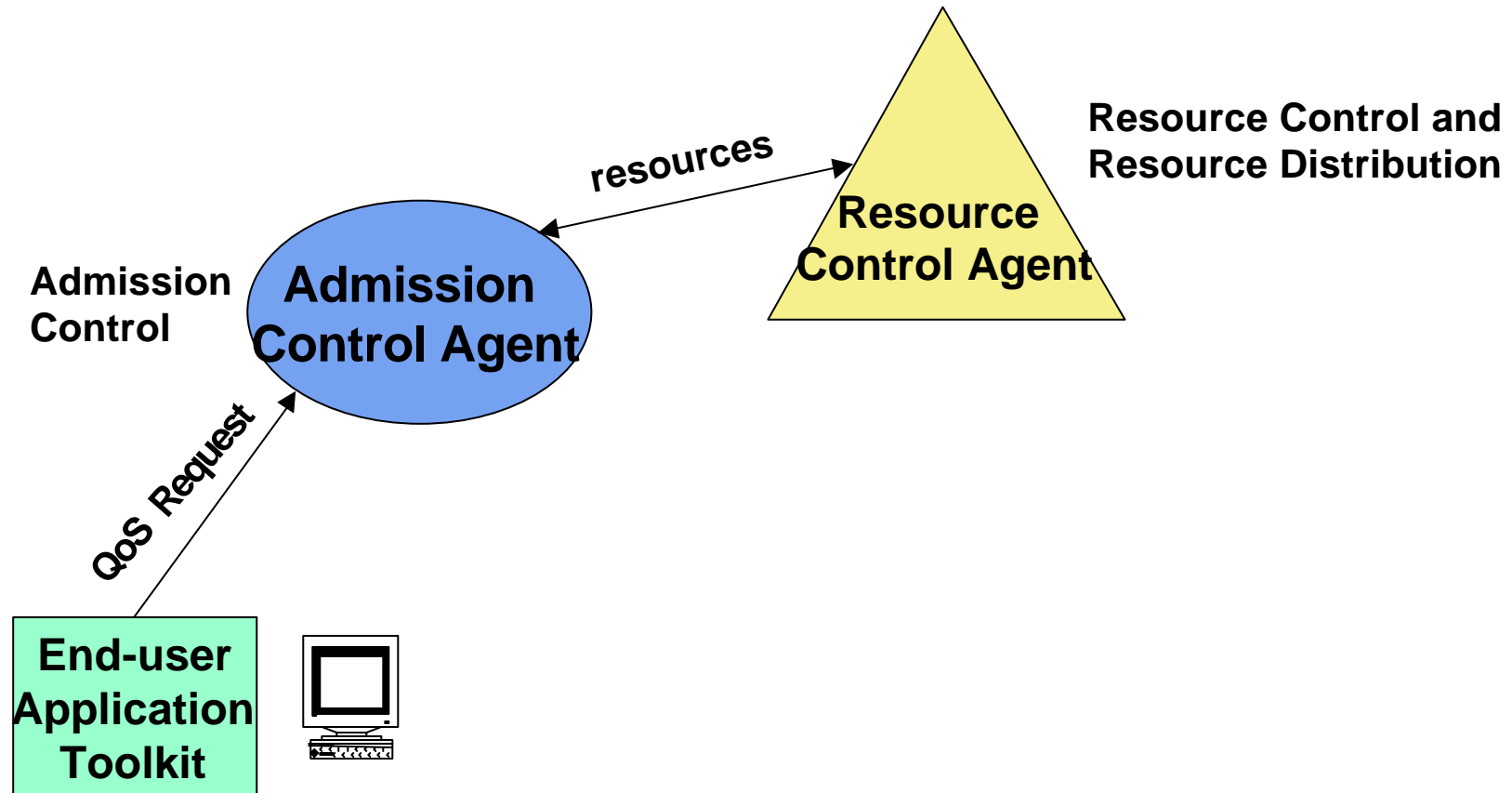
Tasks of the Resource Control Layer:

- Admission Control to limit the amount of prioritised traffic
- Resource Management
- QoS interface

Design Goals:

- simpler than ATM (no explicit reservation along the data path)
- carrier grade:
 - scalable approach
 - robust

Resource Control Layer: 3 functional entities



Assignments of the End-user Application Toolkit (EAT)

Middleware between QoS network and application:

- front end for network
- QoS portal for application (legacy and QoS aware)
- alternative, flexible approach for evaluating QoS reservations

Distinguish different roles:

- sender
- receiver
- requester
 - the requester initiates the reservation
 - the requester is charged for the service
 - the requester may be the sender, receiver or a third party

Assignments of the Admission Control Agent (ACA)

Admission control

- handle QoS requests
- check available resources
- admit/reject service requests autonomously
- require additional resources from Resource Control Agent (RCA) (not per flow!)
- release no longer required resources

ACA and Edge Router

- 1:1 relationship
- ACA provides policies to edge router

Assignments of the Resource Control Agent (RCA)

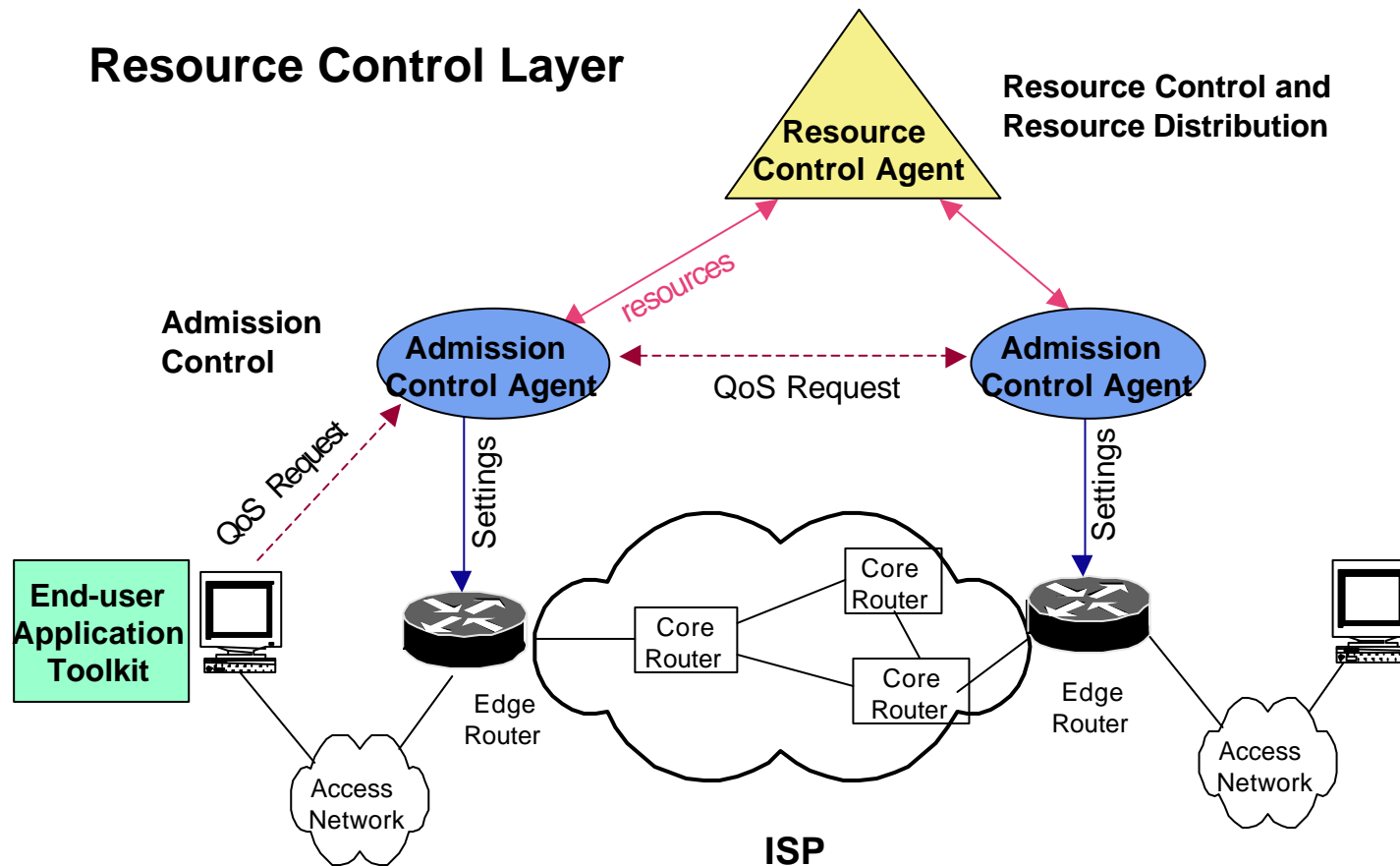
Edge bandwidth management

- distribute available bandwidth among ACAs

Optimisation strategy

- aim: distribute bandwidth so that requests are admitted by the ACA
 - with high probability
 - without interaction with the RCA
- RCA may use simple or complex algorithms for resource management

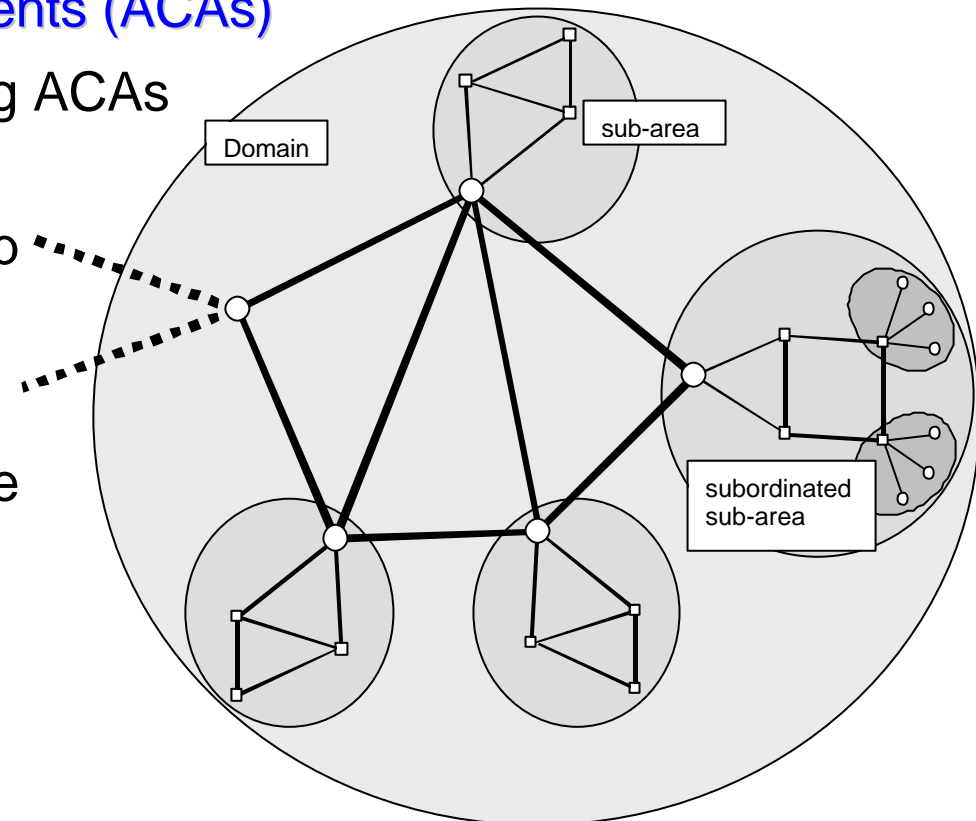
Resource Control Layer: A Two Layered Architecture



Resource Management

Grouping of Admission Control Agents (ACAs)

- group together neighbouring ACAs
- manage a common **resource pool** for the group
- distribute resources among group members
- multiple hierarchies possible



Avoiding Signalling within the Domain

Keep it simple

- do not look at individual links in most parts of the domain

But: add coarse topology information

Further enhancements

- RCA uses the network load information to adjust the max. bandwidth values that it may assign to an ACA
- RCA influences the routing in core routers (QoS routing, MPLS)

Principles

Strict separation of assignments

- the ACA is solely responsible for admission control
- the ACA never asks the RCA to fulfil a single QoS signalling request
- the RCA assigns bandwidth to the ACAs (on request of the ACAs), in a way that QoS requests received by an ACA from the users can be honoured with high probability

Local operation

- each component (ACA, RCA) can act independently of other components
- failure of a RCA only degrades network performance, but does not affect operation of other components

➔ No single point of failure, scalable QoS architecture

Further regions of study

- QoS Traffic Studies and Engineering
 - admission control algorithms
 - provisioning of initial configuration
 - network dimensioning
 - simulations
- Distributed QoS Measurement infrastructure
 - passive (monitoring) and active (probing)
 - results used for
 - evaluating concepts
 - influencing resource management of RCA
- End-user and Business Customer Survey

Outlook

2nd project phase addresses

- Interdomain QoS
 - Internet2
 - Simple Interdomain Bandwidth Broker Signalling (SIBBS)

- QoS support for multicast: point-to-many

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