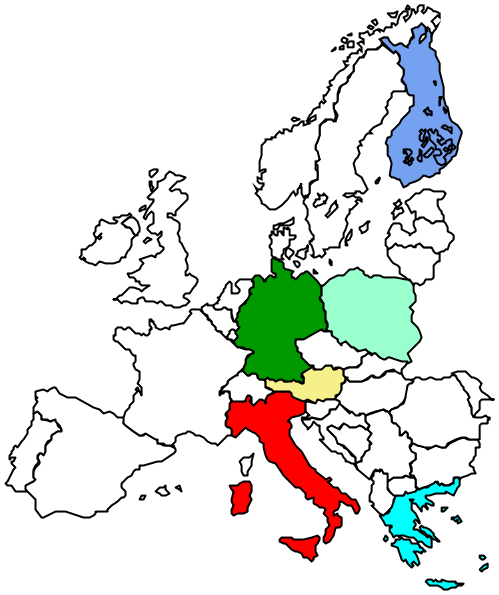
AQUILA (IST-1999-10077)

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



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The AQUILA Resource Control Layer Architecture

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Agenda

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

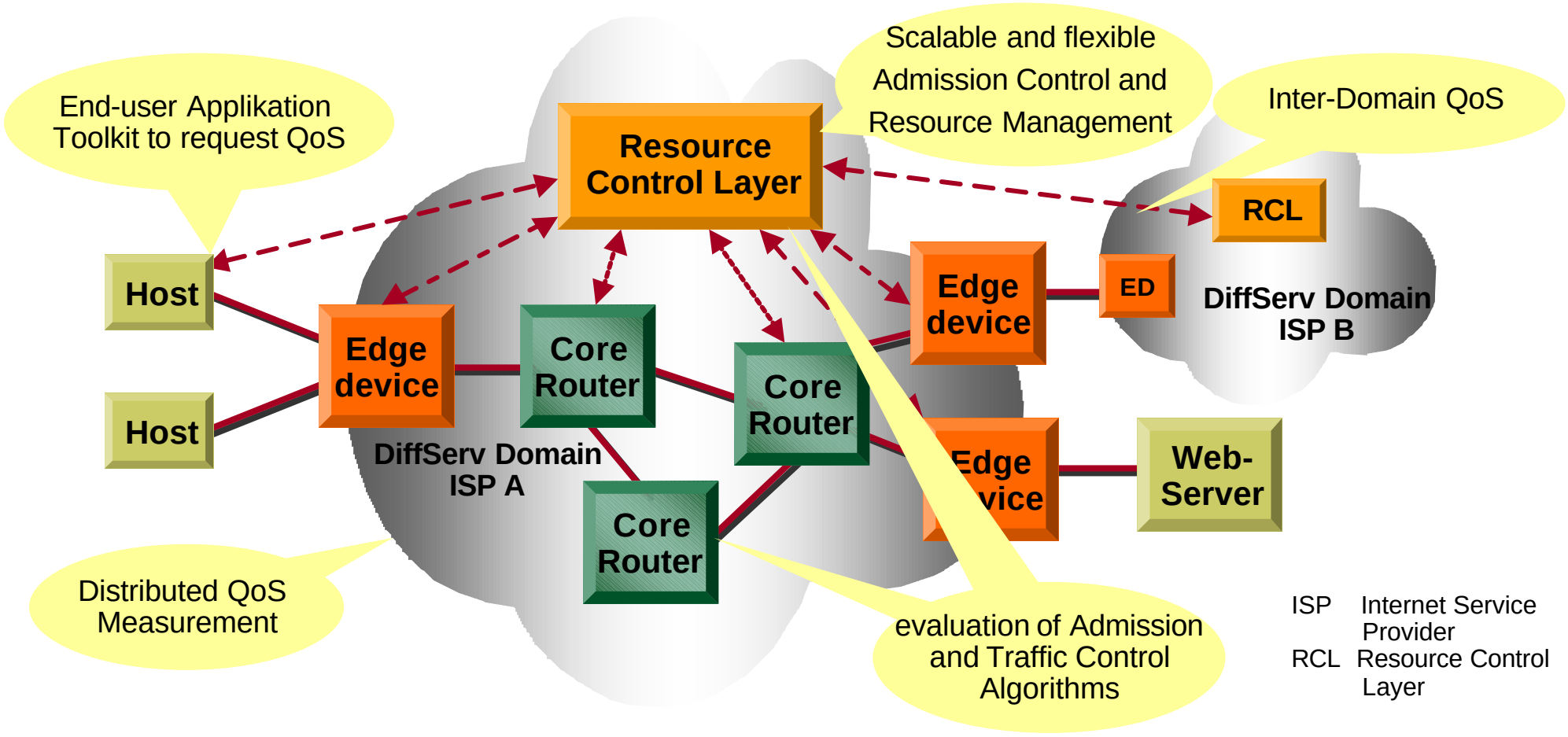
Project partners

Siemens (Co-ordinator), Germany	I&C manufacturer
Bertelsmann mediaSystems, Germany T-Nova Deutsche Telekom, Germany Telekom Austria, Austria Elisa Communications, Finland Polish Telecom, Poland	Internet Service Providers and Network Operators
National Technical University of Athens, Greece Warsaw University of Technology, Poland CoRiTel, Italy Dresden University of Technology, Germany Salzburg Research, Austria	Universities and Research Institutes
Q-Systems, Greece	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

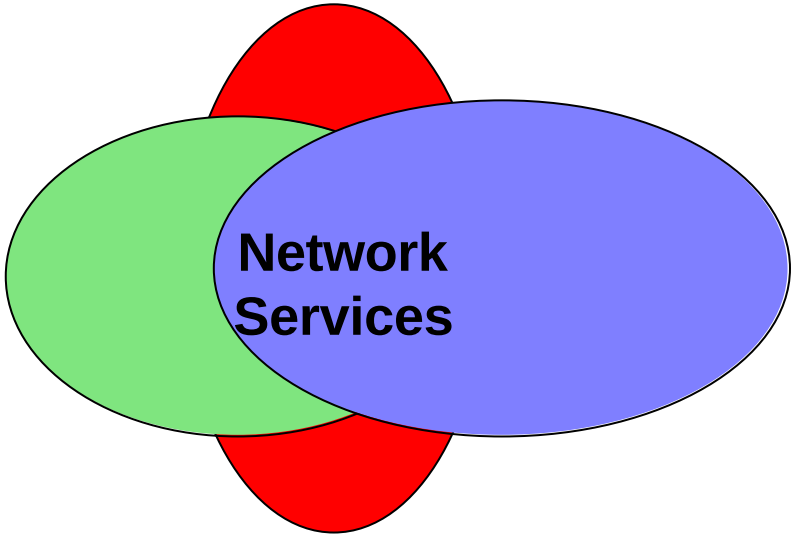
Main Objectives of the AQUILA project



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

Service Level Specification

- Network service
- Reservation style
  - point-to-point, point-to-any, any-to-point, point-to-many
- Traffic descriptor
  - single rate (PR)
  - single token bucket (SR, BS)
  - dual token bucket (PR, SR, BS)
- Reservation timing
  - immediate, advance, periodic

PR: Peak Rate
SR: Sustainable Rate
BS: Bucket Size for SR

Resource Control Layer

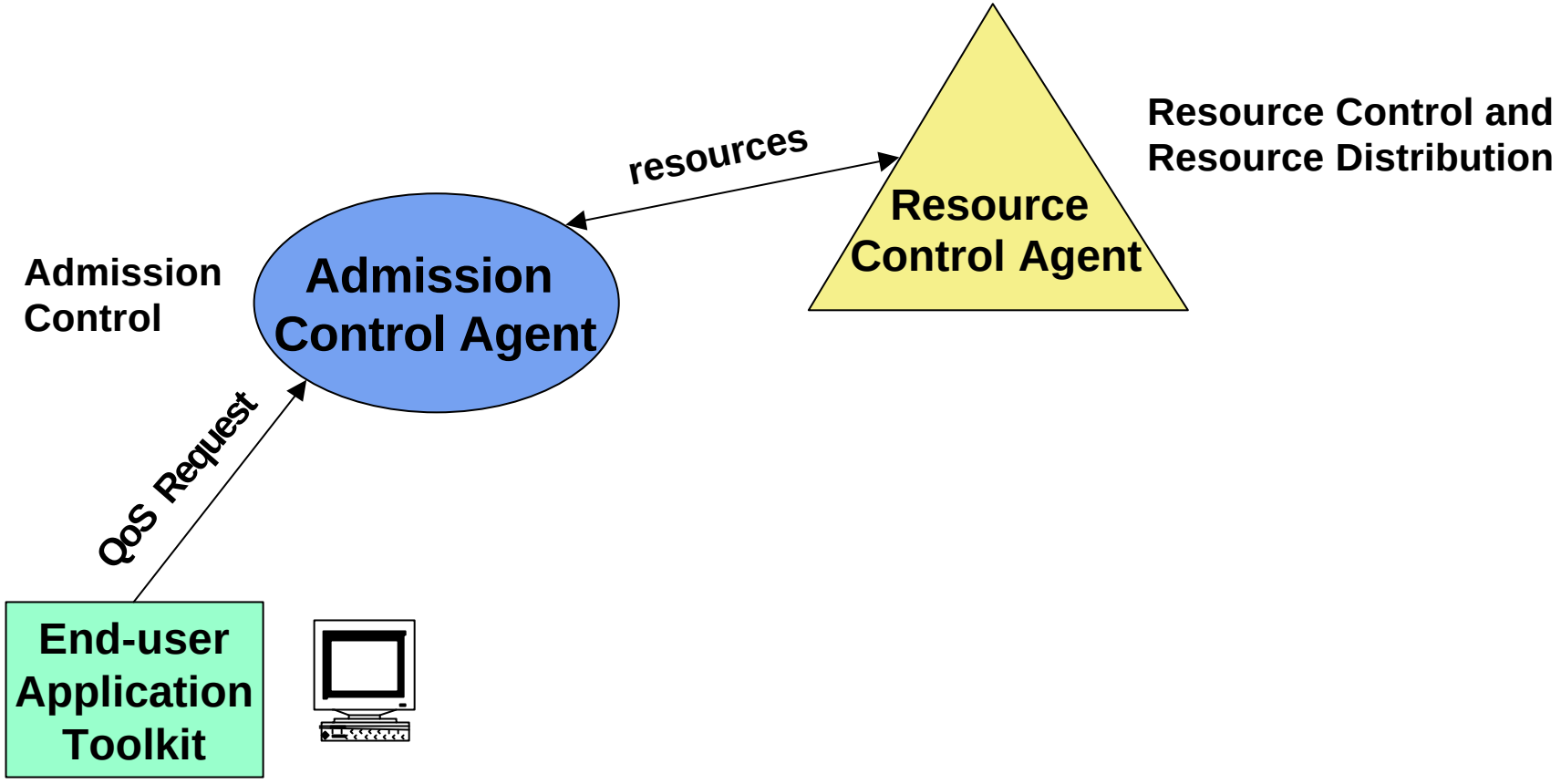
Tasks of the Resource Control Layer:

- 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)

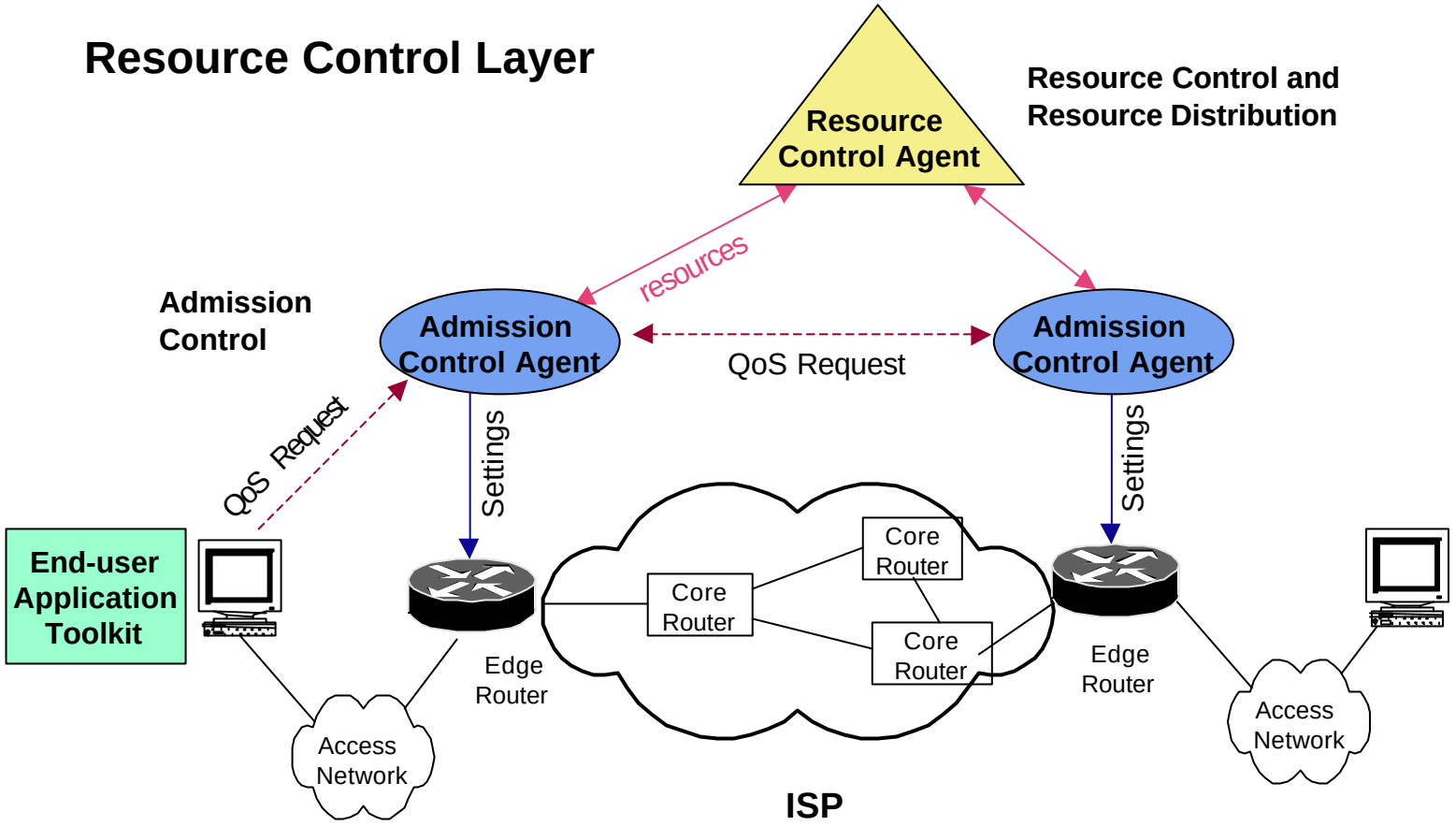
Edge bandwidth management

- 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

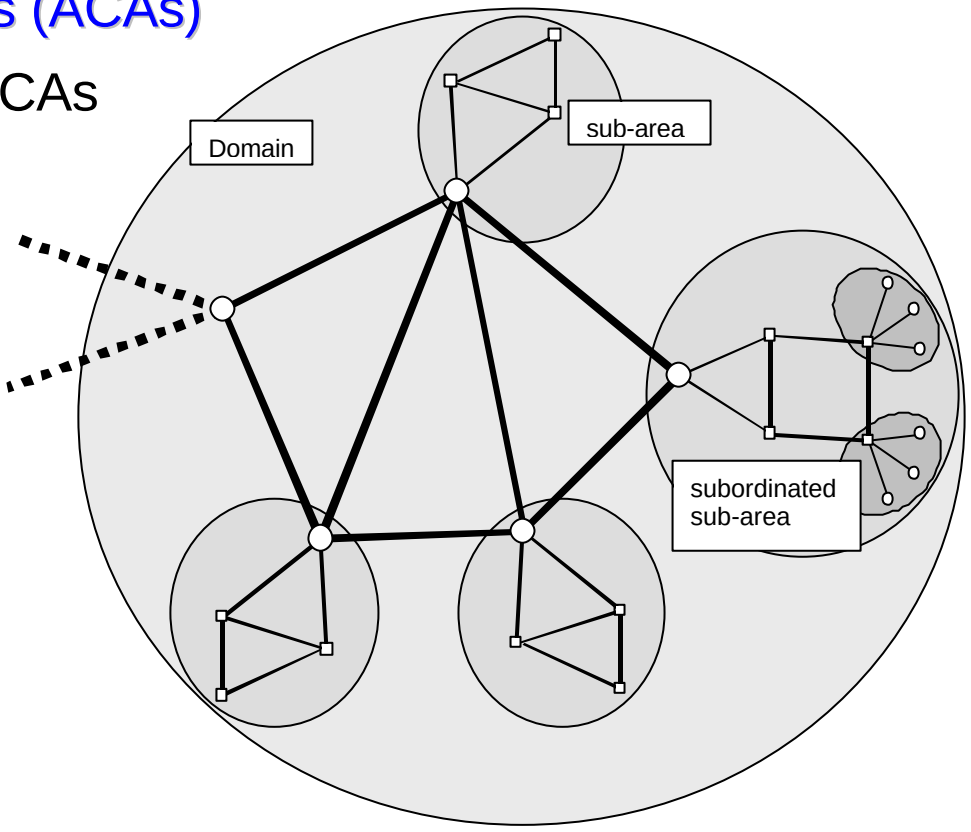
Resource Control Layer: A Two Layered Architecture



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)

Network Services deployment

Premium CBR for IP Telephony and Voice Trunking

- p2p flows with ingress and egress reservation
- single token bucket, drop-tail, PQ

Premium VBR for Video Streaming and Teleconferencing

- p2p flows with ingress and egress reservation
- dual token bucket , drop-tail, WFQ

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

- p2p flows with ingress and egress reservation
- single token bucket, WRED, WFQ

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

- p2a flows with ingress reservation only
- dual token bucket, WRED, WFQ

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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