AQUILA

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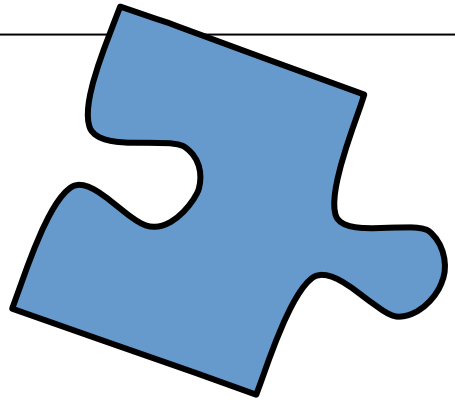
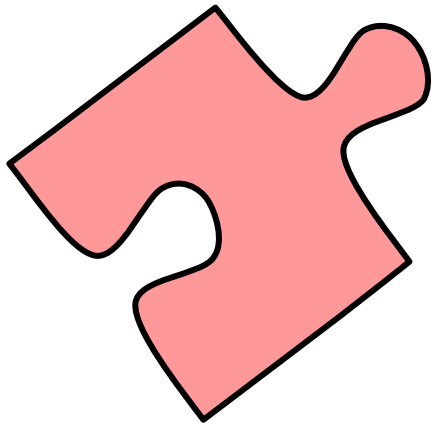
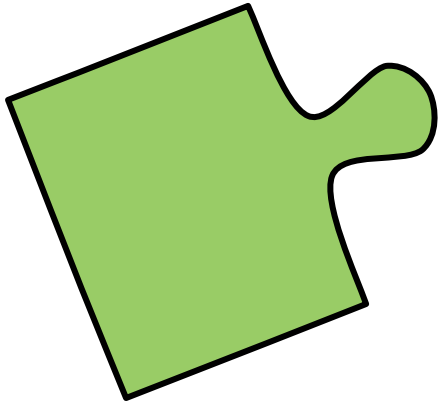


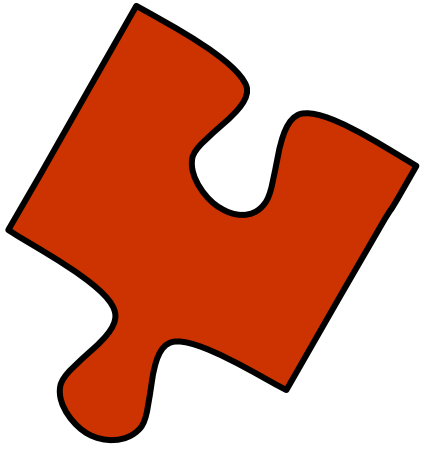


Putting the pieces together - Components for end-to-end quality of service

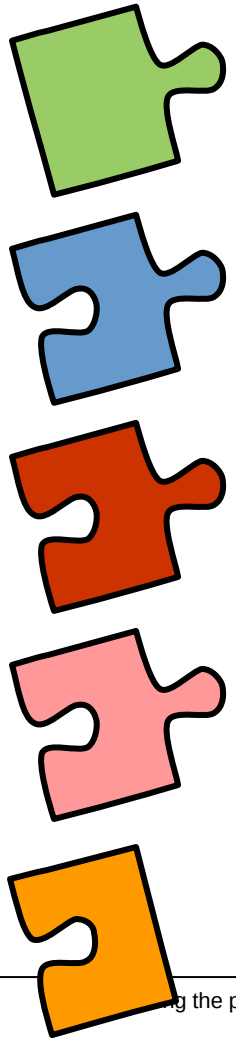
Martin Winter - AQUILA

SIEMENS





Outline



What the user wants

- User's perspective and expectations

What the application needs

- Link between user perception and network performance: application profiles

What the network offers

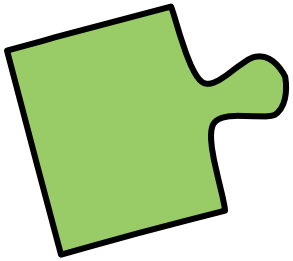
- Network services

How to reach the network

- Crossing the access network

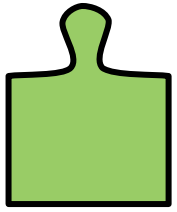
How multiple domains interact

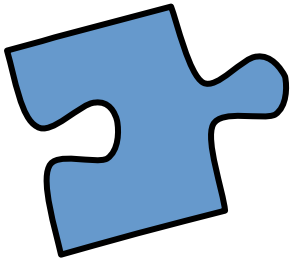
- Scalable inter-domain resource control



What the user wants

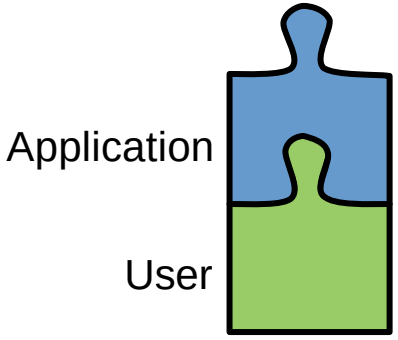
- **Basically, user demands are perceptive**
  - “I want to see that full-screen video sharp and smooth!”
  - “I want to hear my dialog partner clearly!”
  - “I want to have that information available in time!”
  - “I want to have that file transferred within a guaranteed time!”
- **Today’s situation**
  - The Internet Best Effort service answers these questions with a non-ambiguous “perhaps”.
- **The promise of QoS**
  - Tell the customer: “Yes, you will!”

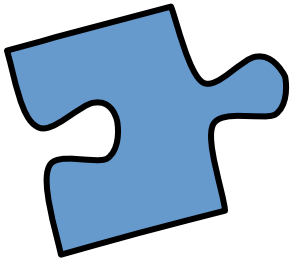




Applications: front-end to the user

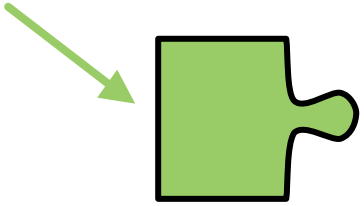
- **Users communicate over the network using applications**
  - The term “application” here means the software and/or hardware entities at the two ends of the communication line.
    - Videoconferencing tool
    - IP phone
    - File transfer utility
  - Applications provide the perception to the user.
  - Applications need the network to fulfil their task.

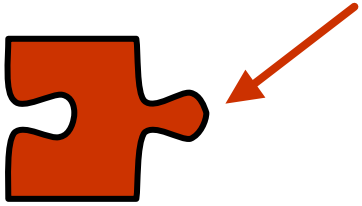


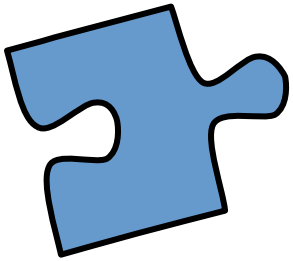


Mapping perception to network services

- **User requests quality**
  - in terms of perceptual grades and metaphors
- **Network provides quality**
  - in terms of transfer characteristics







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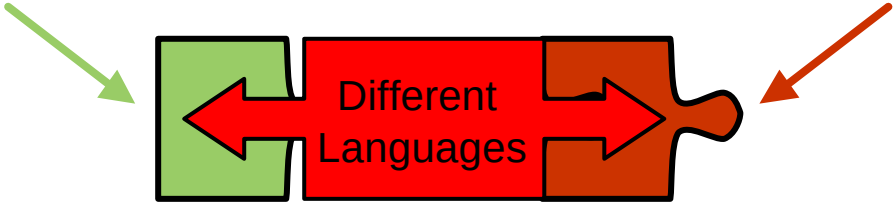

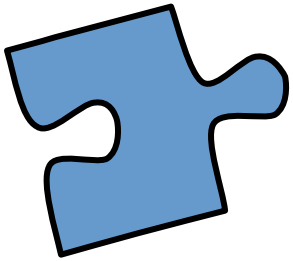

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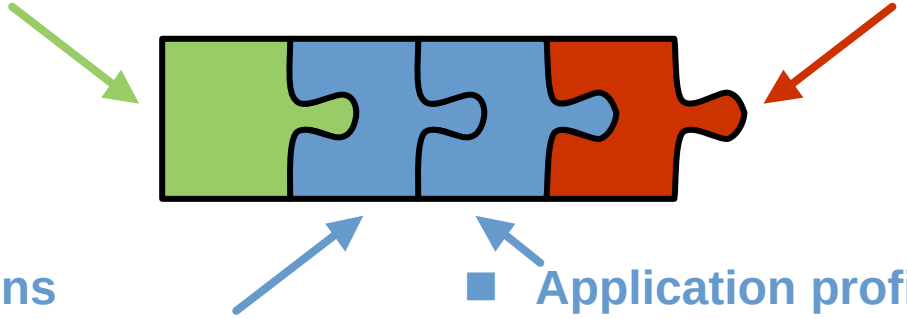
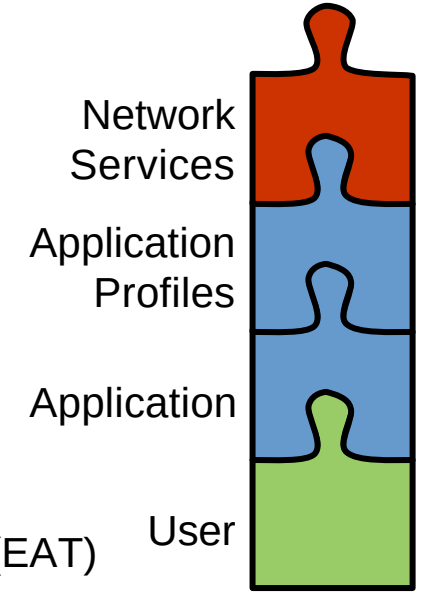
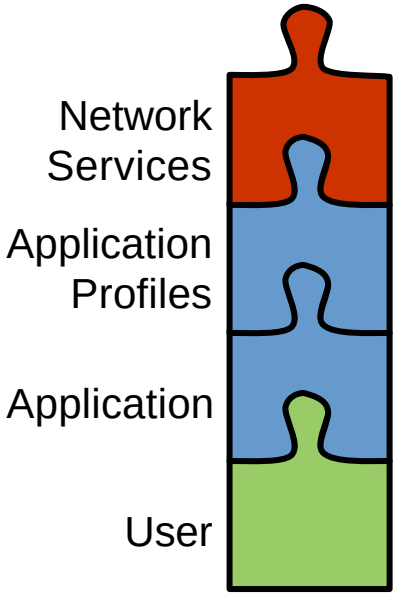


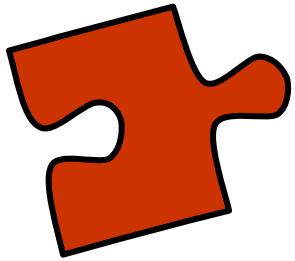
- **Applications**
  - use the network services
  - depend on the network transfer characteristics
  - **require** a minimum network performance in order to yield satisfying results for the user
- **Application profiles**
  - map the user's terminology to the network services
  - are provided as some kind of toolkit to applications to help them to request the proper network services
  - End-user application toolkit (EAT)



Applications' need from the network

- **Network service**
  - The offer to transport a flow in such a way, that a transfer characteristic is met, regarding
    - delay, jitter, loss
    - TCP fairness
- **QoS Parameters**
  - This set of parameters is used to describe the offered service

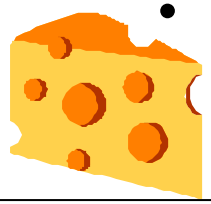




Network service vs. goods at the grocery store

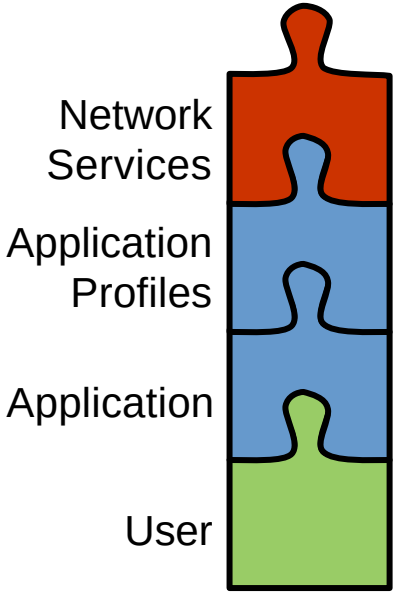
Grocery goods

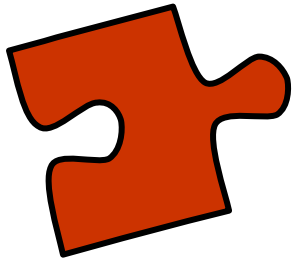
- Shopkeeper selects a list of items
- Items are identifiable by name, e.g. “Edam cheese”
- Each item has a list of ingredients
- A typical order consists of three parts:
  - Item identification
  - Who is requesting
  - Requested quantity
- “Give me 500gr of Edam cheese”



Network service

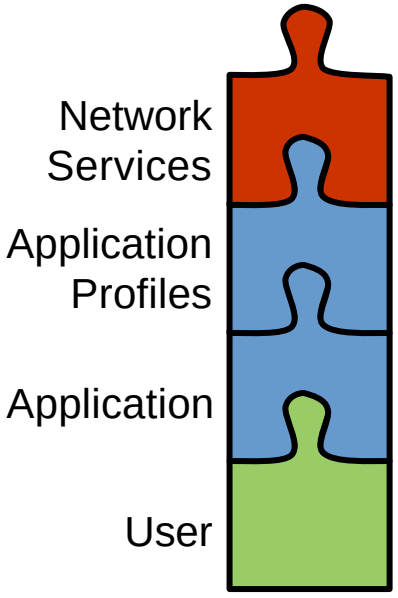
- Network operator predefines a set of services
- For convenience, a service is identified by a name
- Parameters of a service are known to the customer
- An application’s request consists of three parts:
  - Service identification
  - Flow identification
  - Requested bandwidth
- “Give my flow a premium handling for 200 kbit/s”

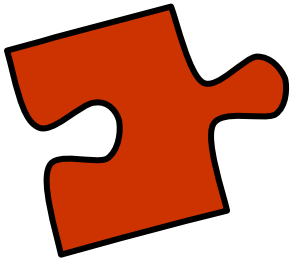




Network services

- **AQUILA chooses a limited fixed set of services**
  - Management
    - Resources can be managed per service
  - Negotiation
    - Scenario is a simple request/response sequence without parameter negotiation
    - Q: “Can I have x bit/s of service y for a flow from a to b?”
    - A: “yes” or “no”
  - Scalability
    - Scalability requires aggregated handling of reservations
    - Aggregation means uniform handling of a set of flows
    - Uniform handling means uniform transfer characteristics

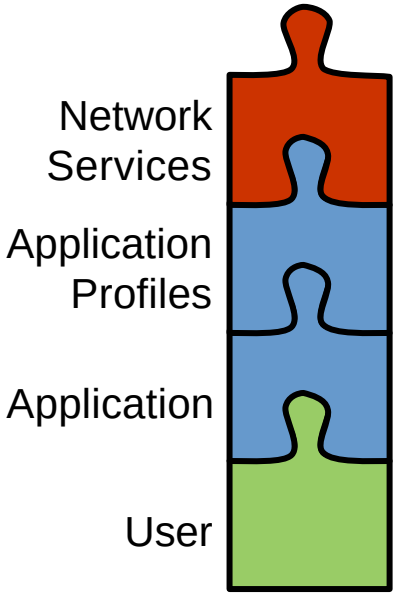


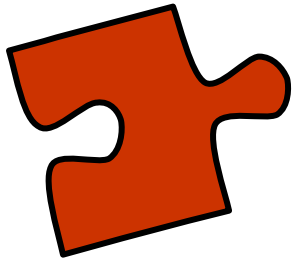


AQUILA set of network services

Network service	Traffic type	Characteristic examples	Application example
• Premium CBR	constant	small packets low loss	SIP VoIP
• Premium VBR	variable	large packets low loss	SIP Video
• Premium MM	adaptive	moderate delay	Streaming Video
• Premium MC	bursty	very low delay & loss	online Game
• Standard	best effort	classical	the rest

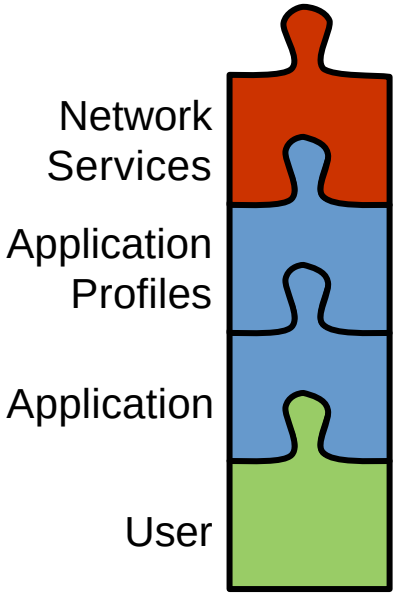
Goal: only a *few* network services to allow clear service differentiation



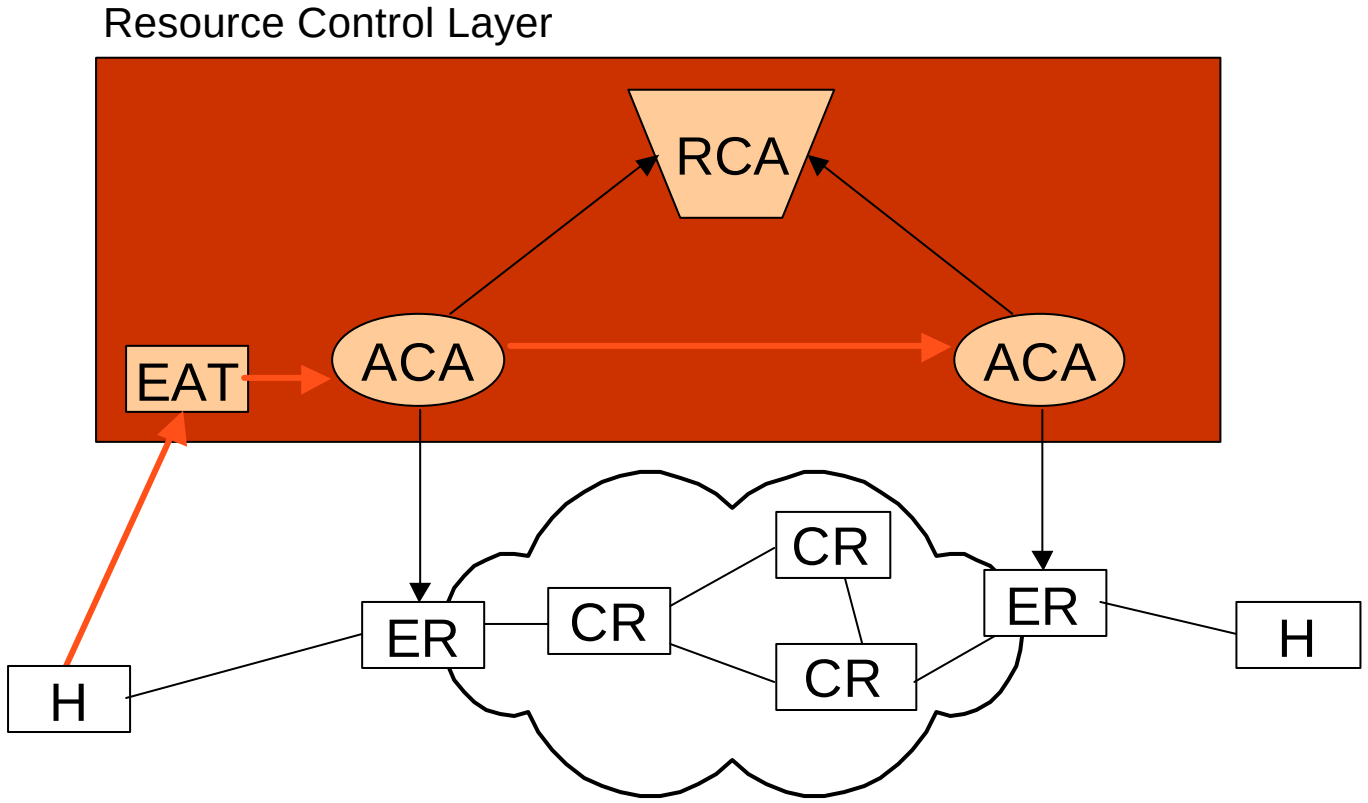


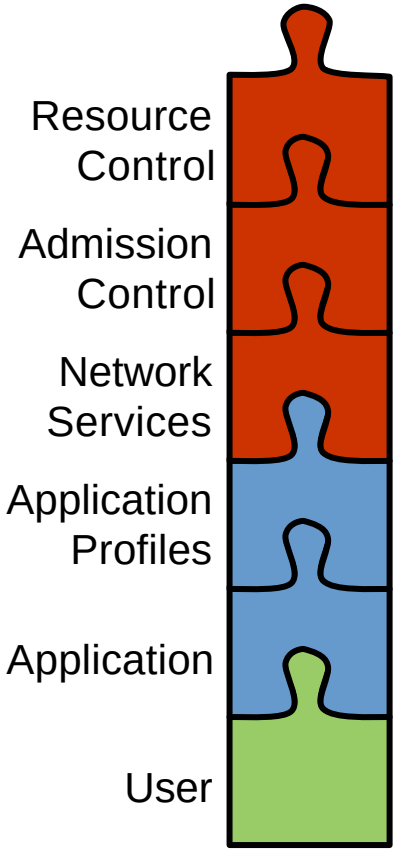
Network services implementation

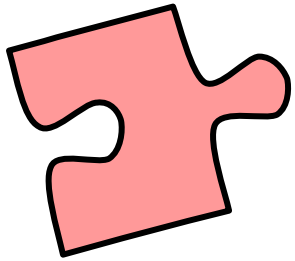
- **DiffServ based approach**
  - Map network services to DiffServ traffic classes
  - Perform admission control at the edges
- **Scalable traffic handling**
  - Individual flows visible at the edges only
  - Use aggregated handling in the core network
- **Scalable resource management**
  - Distributed network of
    - admission control agents (ACA) and
    - resource control agents (RCA)



The AQUILA resource control architecture

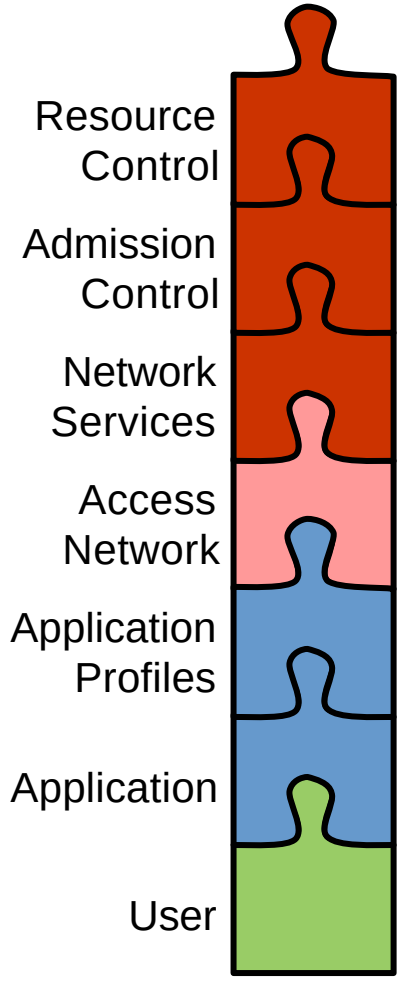






Access network QoS

- **Edge-to-edge Quality of Service**
  - Guaranteed packet delivery across the network
- **Access network QoS is missing**
  - Example: a SOHO using an ISDN or ADSL router
  - Not under network operator's control
  - No guarantees
- **Requirements**
  - It must be possible for the customer to manage QoS also in his access network
  - Enable the use of access network QoS protocols like RSVP



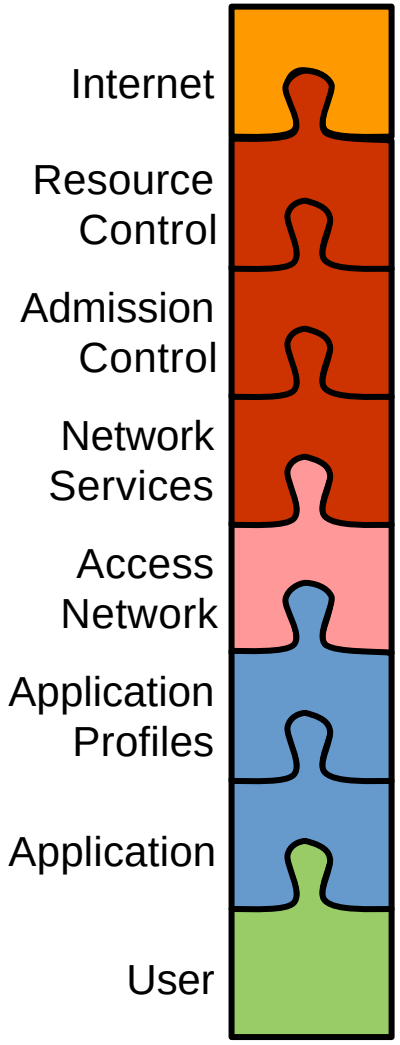
Inter-domain QoS: what's different?

Within a domain

- AC based on policies and internal resource availability
- AC per flow
- AC at ingress and egress
- Central resource control, "oracle"

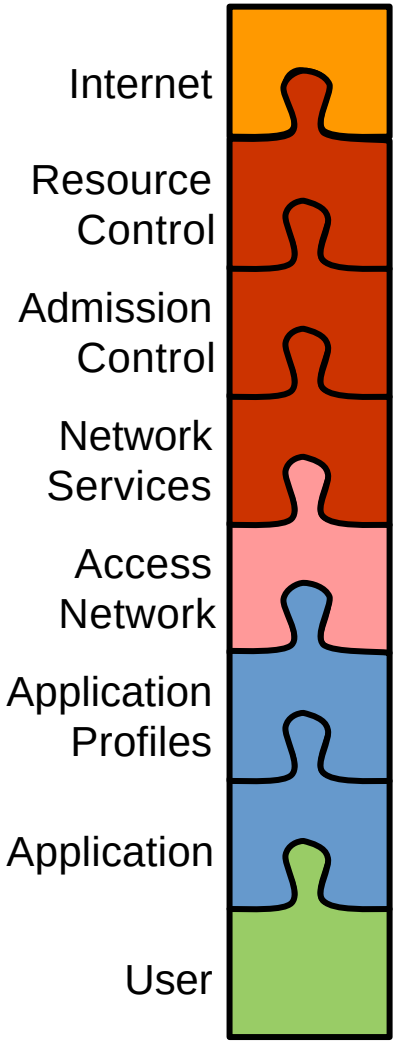
Between domains

- AC based on SLAs
- AC per network service
- AC at each domain
- Follow BGP route



Inter-domain QoS approach

- **Follow BGP routing**
  - Signalling follows BGP route
  - SLA-based admission control at border routers
- **Aggregation**
  - BGP routing forms “sink trees”, routed at the destination domain
  - Sink tree based aggregation of reservations, BGRP
- **Services**
  - SLAs are based on a set of globally well known services



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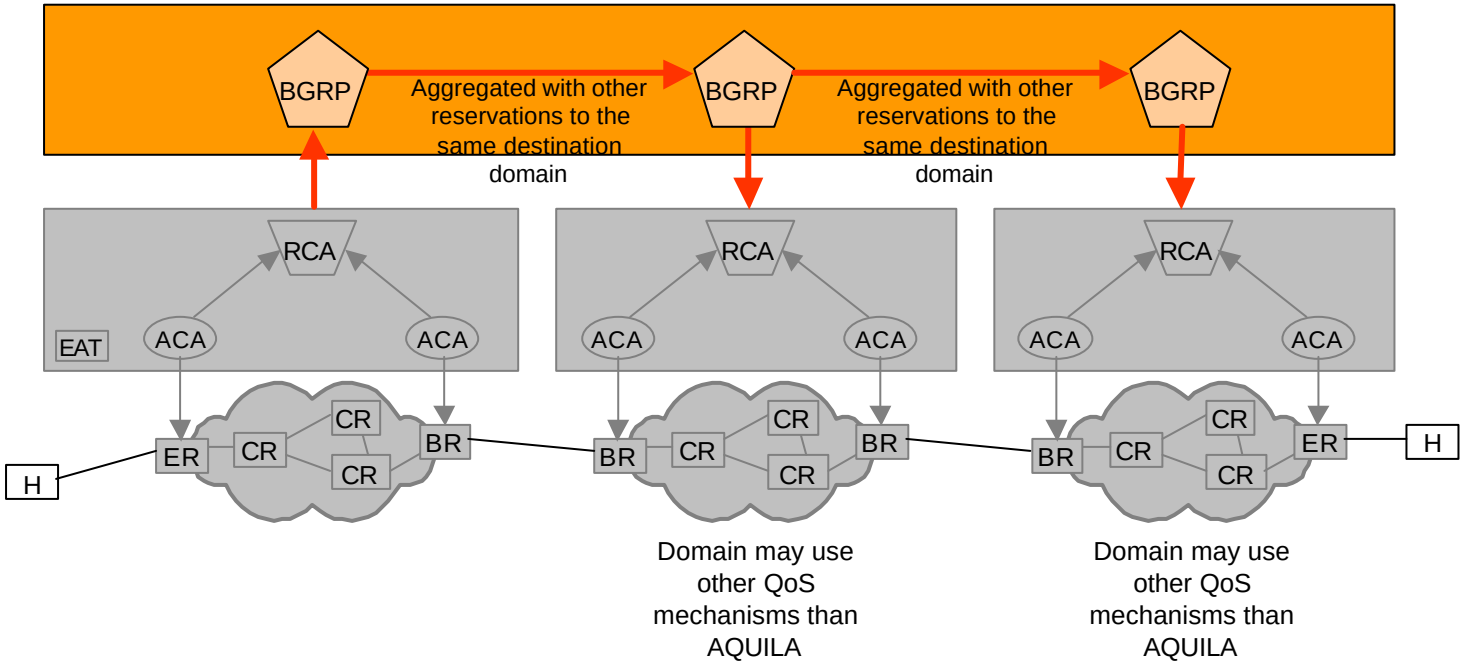
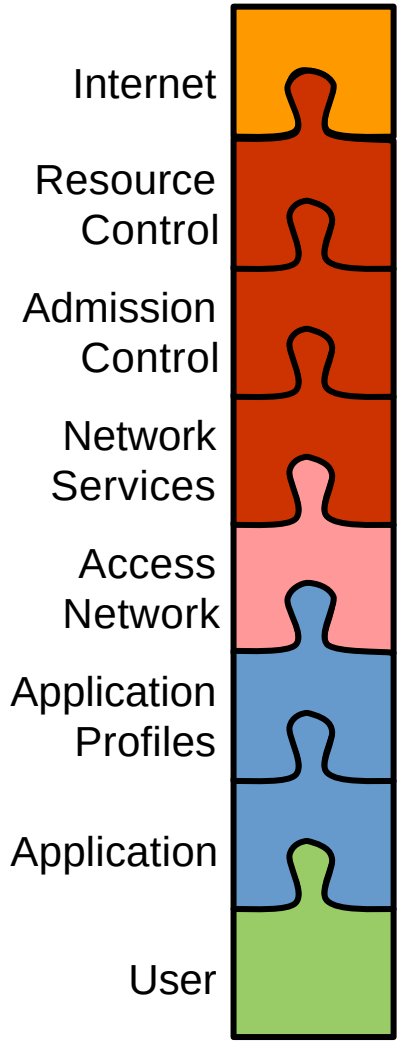
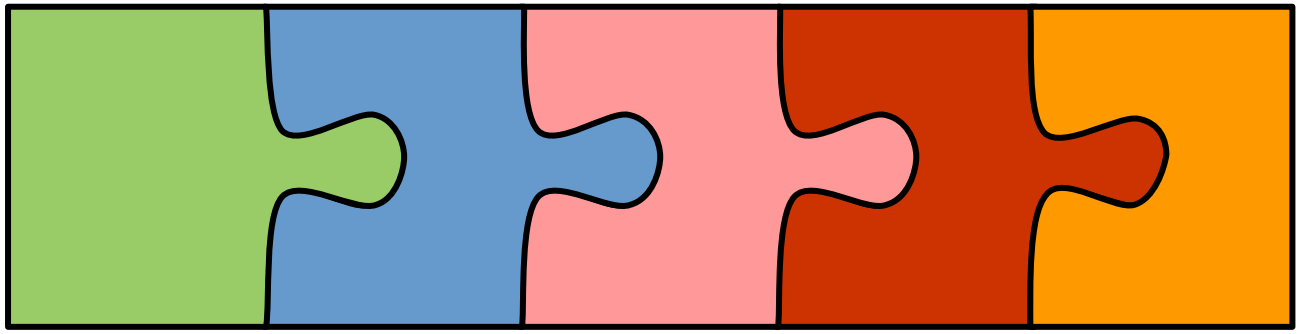
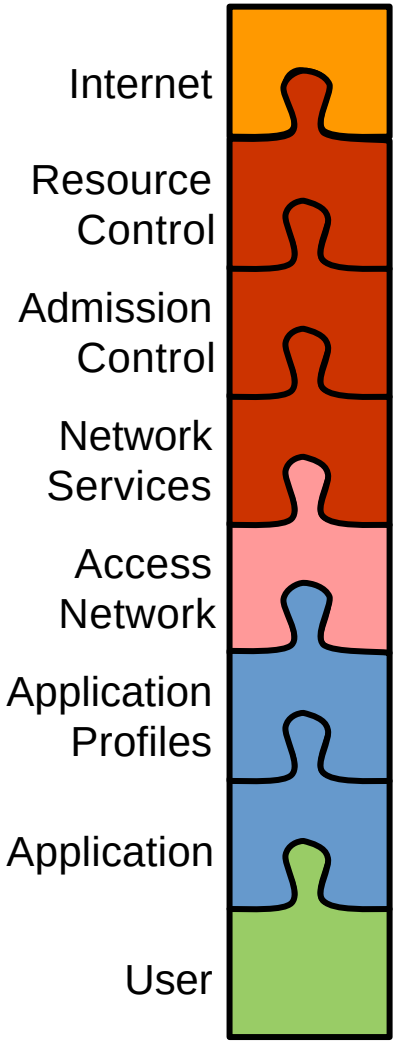




Putting the pieces together





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