QoS Control of Video Streams Using Quality Objects and the CORBA Audio/Video Service

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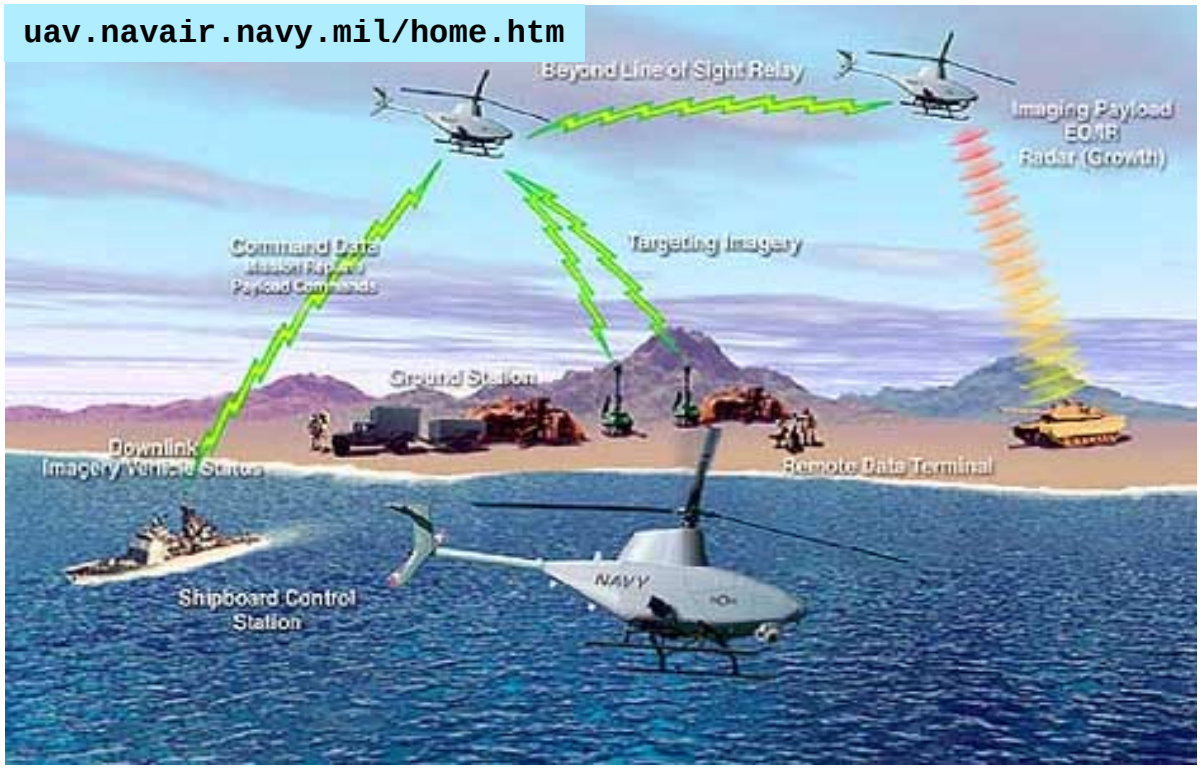
Unmanned Air Vehicle

uav.navair.navy.mil/home.htm



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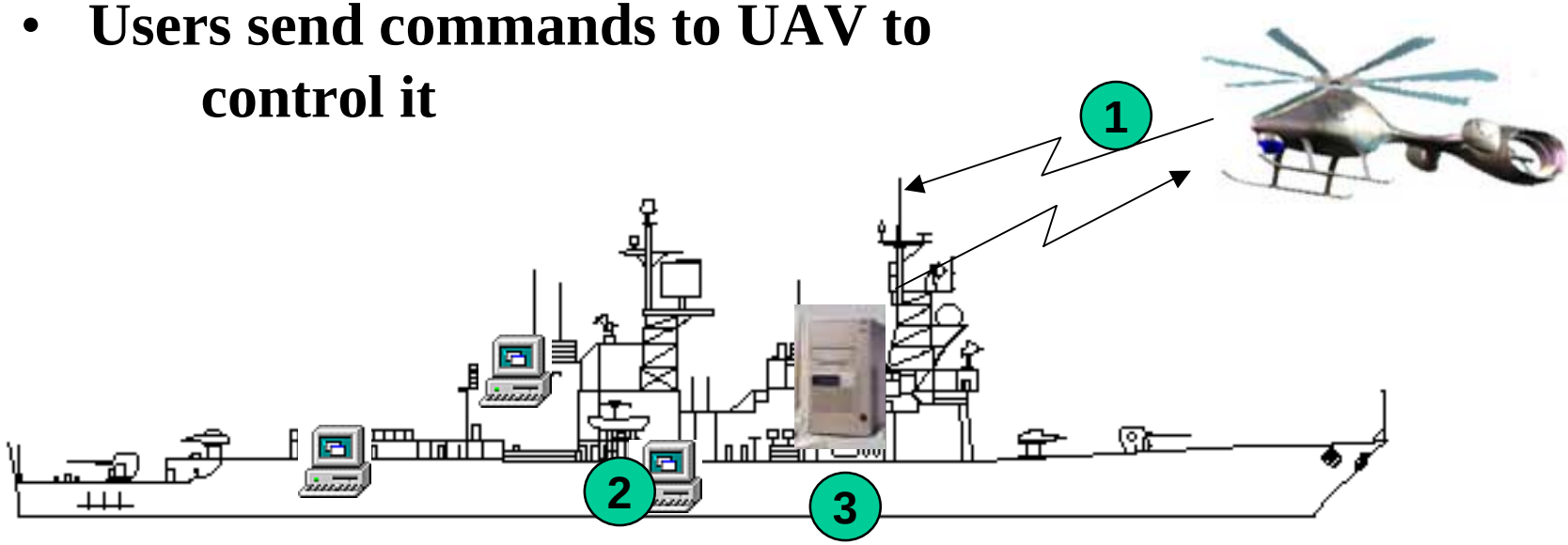
Prototype Architecture

- **Video feed from off-board source (UAV)**
- **Distributor sends video to hosts on ship's network**
- **Users' hosts receive video and display it**
- **Users send commands to UAV to control it**



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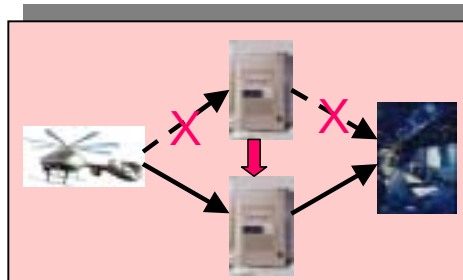
Why is Adaptation Necessary?

- Limited resources
  - CPU and network bandwidth are shared by many applications, not just video
  - Some applications are of higher priority than others, so it becomes necessary to adapt in response to scheduling and resource management decisions

UAV adaptive tactics

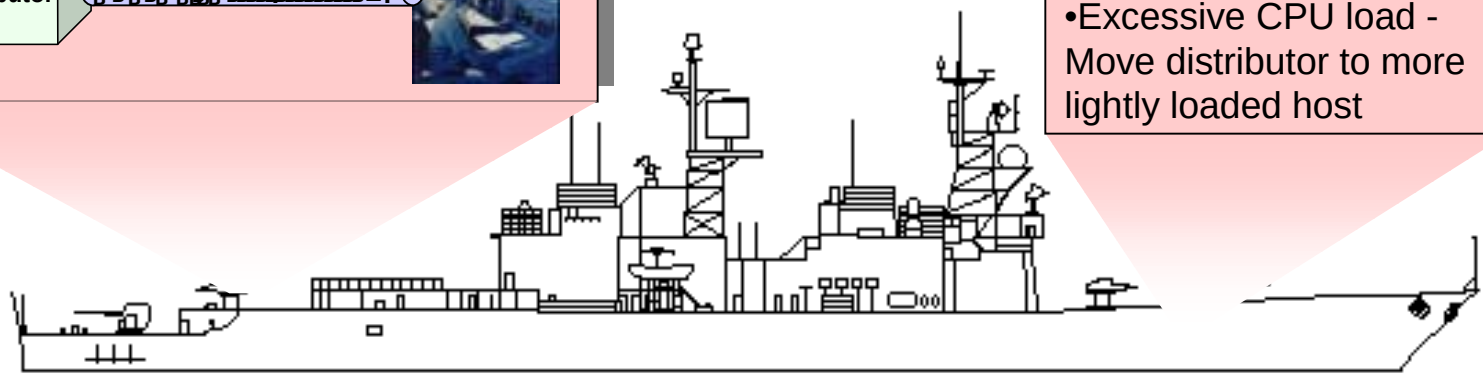
NETWORK RESERVATION

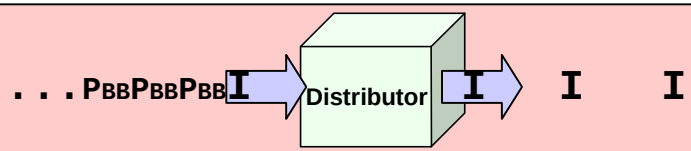
•Under excessive Network load - Use IntServ/DiffServ to reserve bandwidth



LOAD BALANCING

•Excessive CPU load - Move distributor to more lightly loaded host





DATA FILTERING

•Excessive network or CPU load - Drop frames

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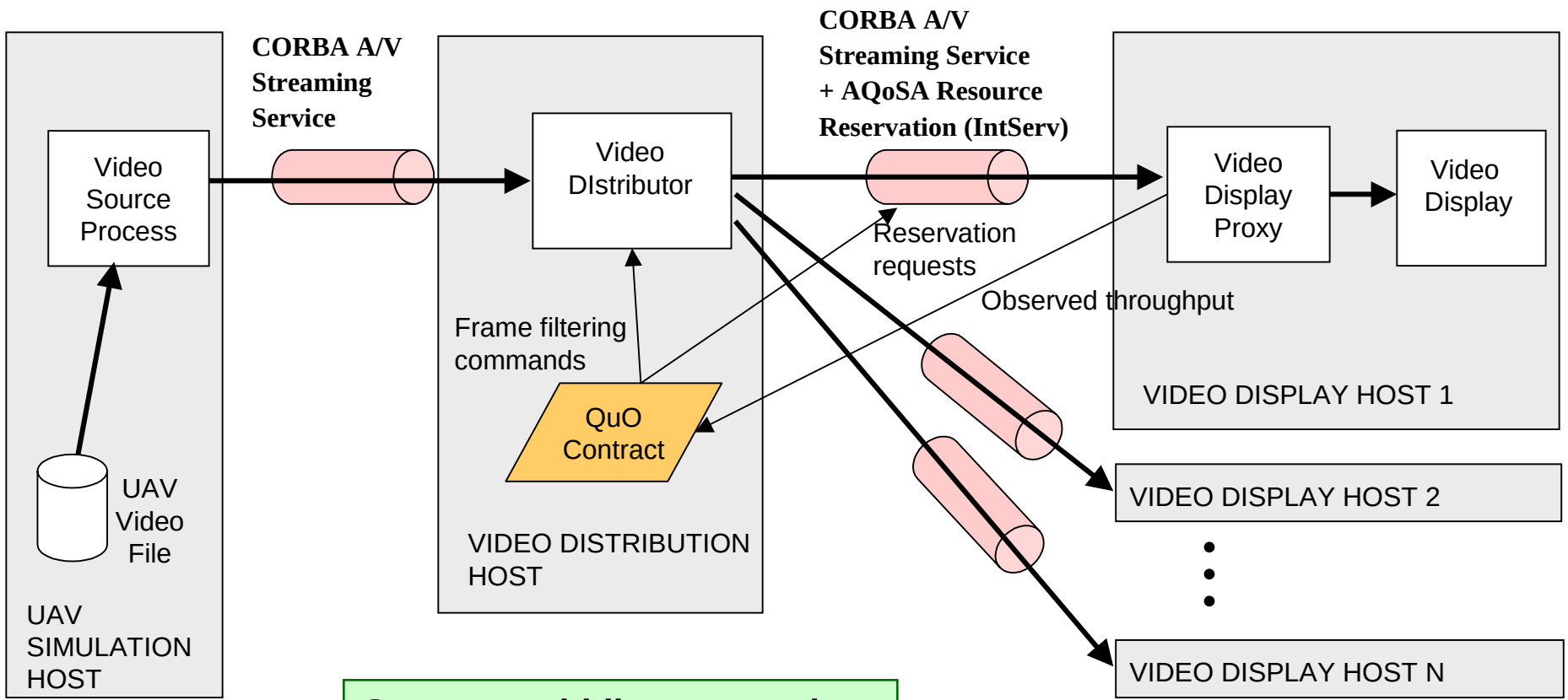
Why use a Framework?

- Quality Objects (QuO)
  - provides higher level programming model for specifying application-level QoS
- CORBA Audio/Video Service
  - abstracts away network programming concerns such as connection management
- ACE QoS API (AQoSA)
  - uniform API for QoS (RSVP, GQoS)

UAV application design



Common middleware services

- TAO CORBA A/V Service
- QuO
- AQoSA
- TAO Naming Service

Reused Off the Shelf Software

- DVDView video player

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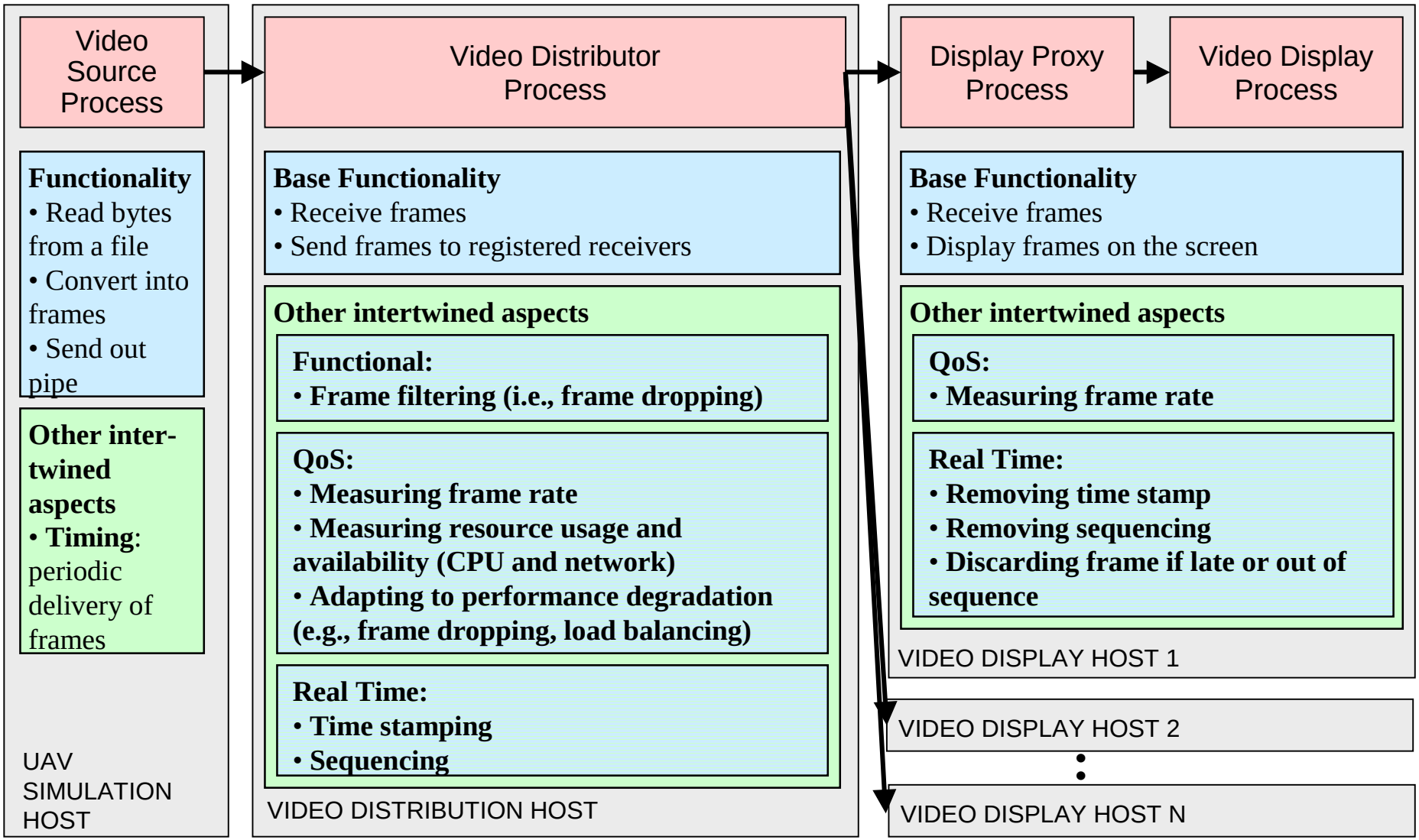
Functionality of the UAV architecture



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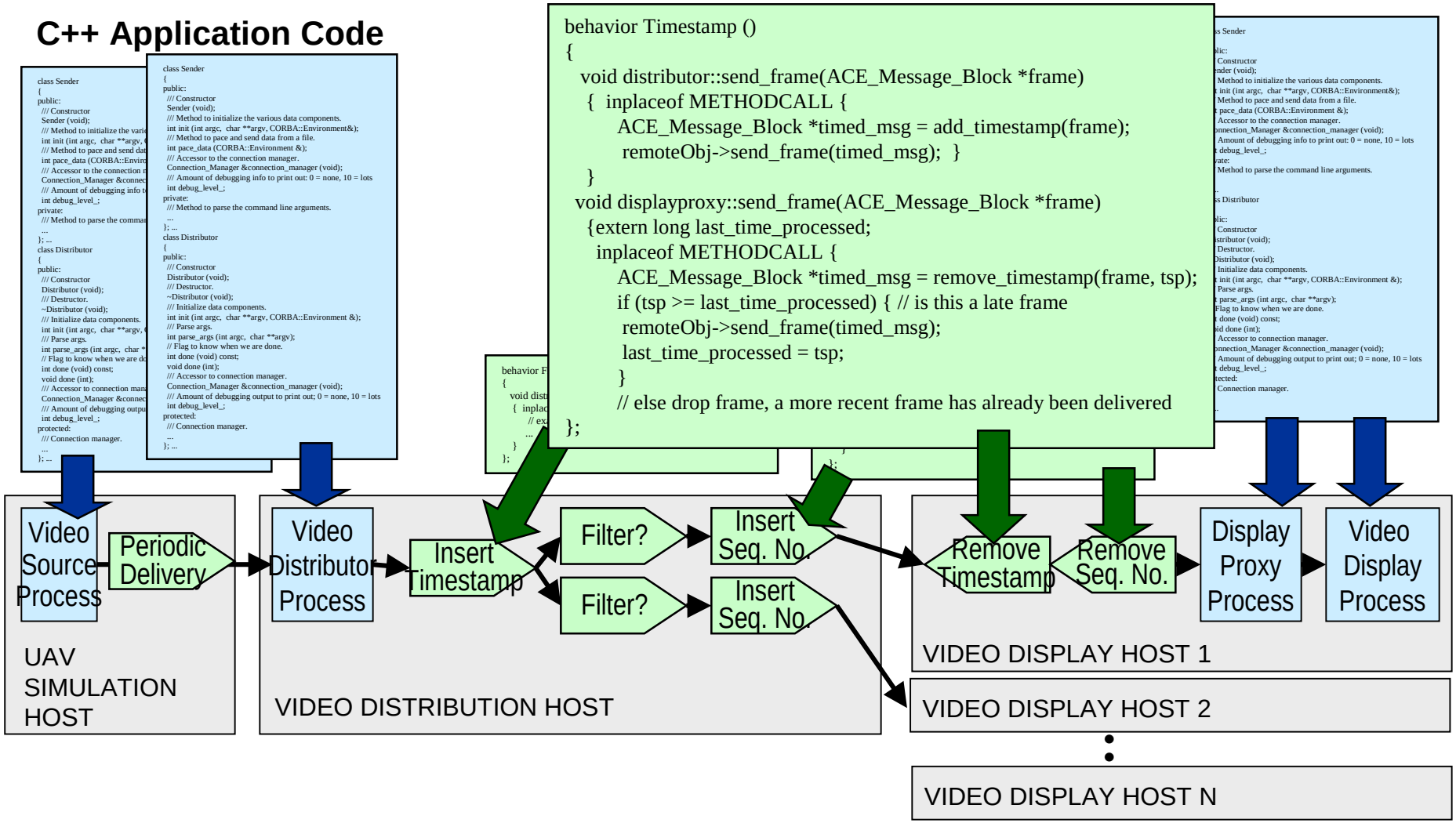
Quality Objects (QuO)

- **Provides a higher level programming model for specifying application QoS**
  - operating regions specified in QuO Contracts
  - transitions between regions trigger adaptive behaviors
- **Support for different middleware architectures**
  - CORBA (Java and C++)
  - Java RMI
  - local method call

Specifying QoS behaviors with QuO



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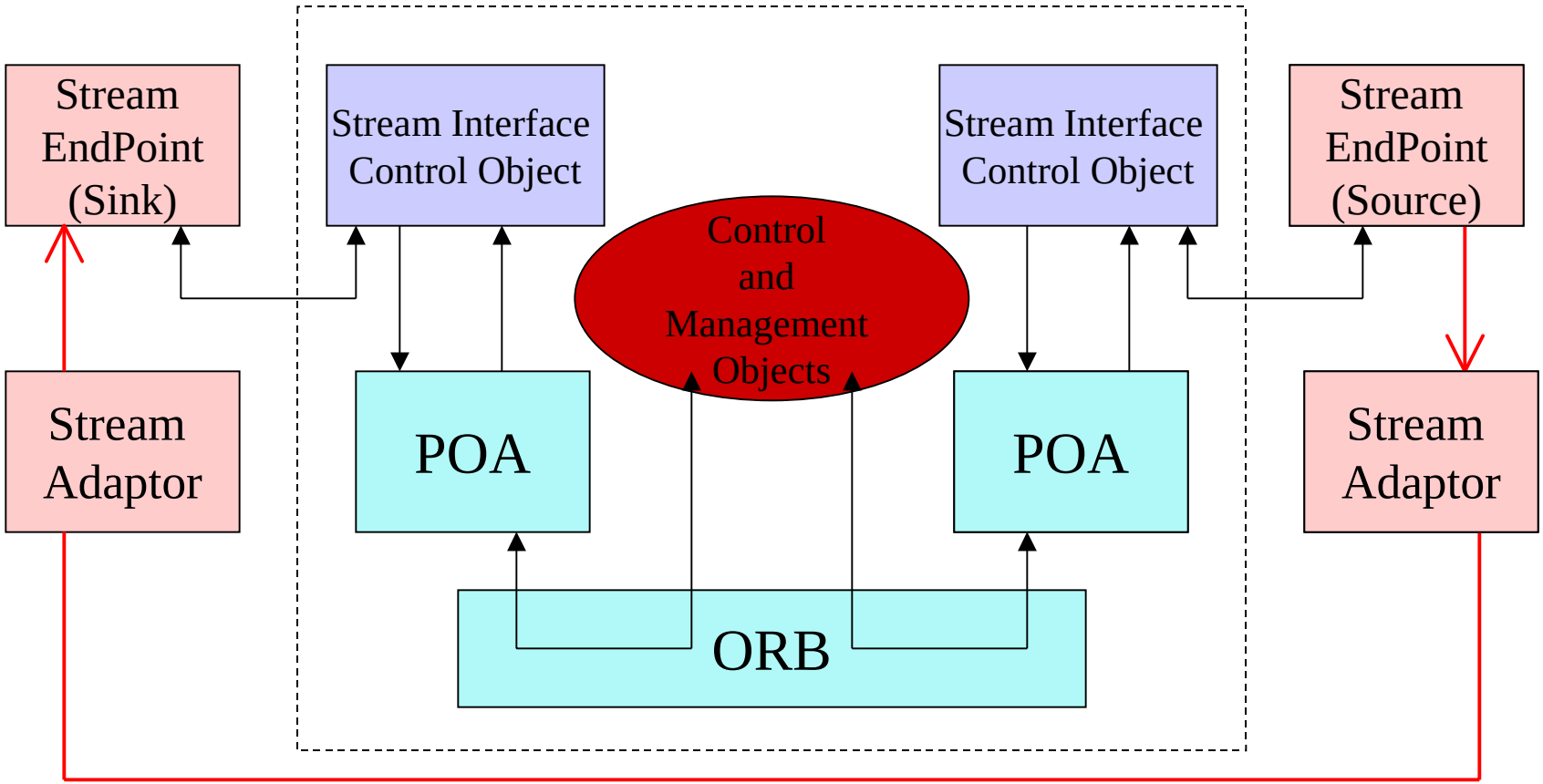
CORBA Audio/Video Streaming Service

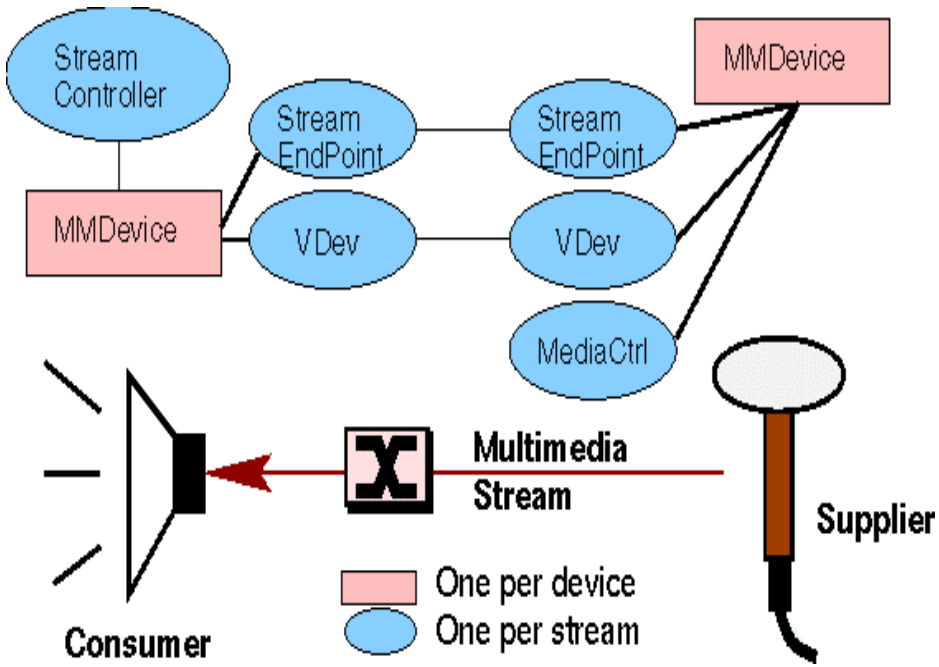
- **Goals of OMG CORBA A/V Service Specification**
  - Define standard mechanisms for:
    - Stream Establishment
    - Stream Control
    - Multiple Flows
    - Multiple Protocols
    - QoS

- **Goals of TAO A/V Streaming Service Project**
  - Implement OMG CORBA A/V Service Specification using TAO

CORBA A/V Service Overview

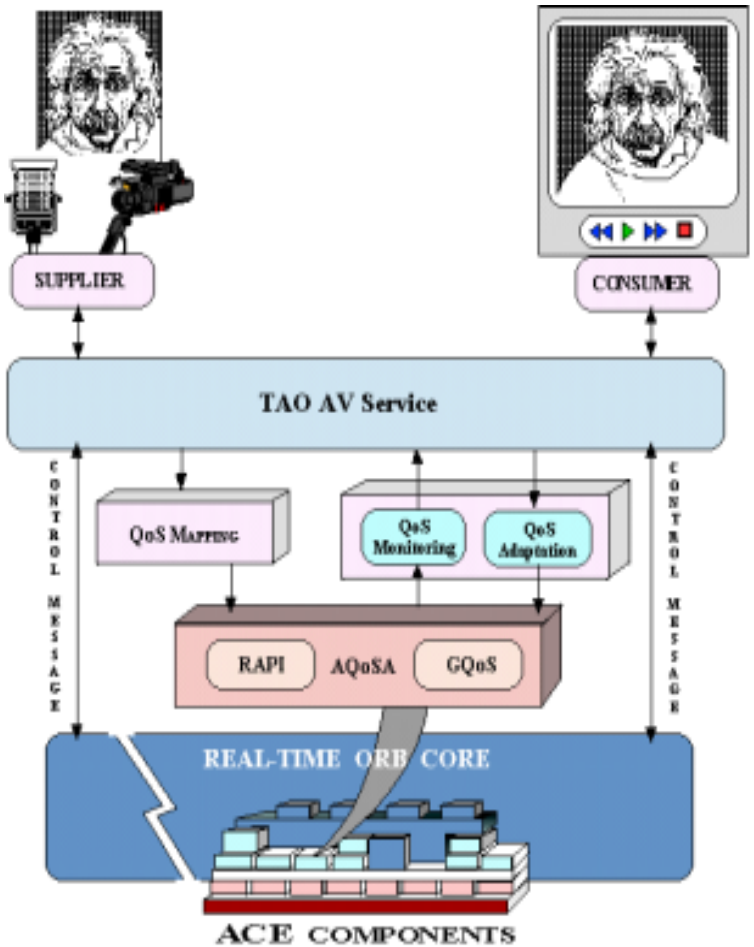


CORBA A/V Service Overview



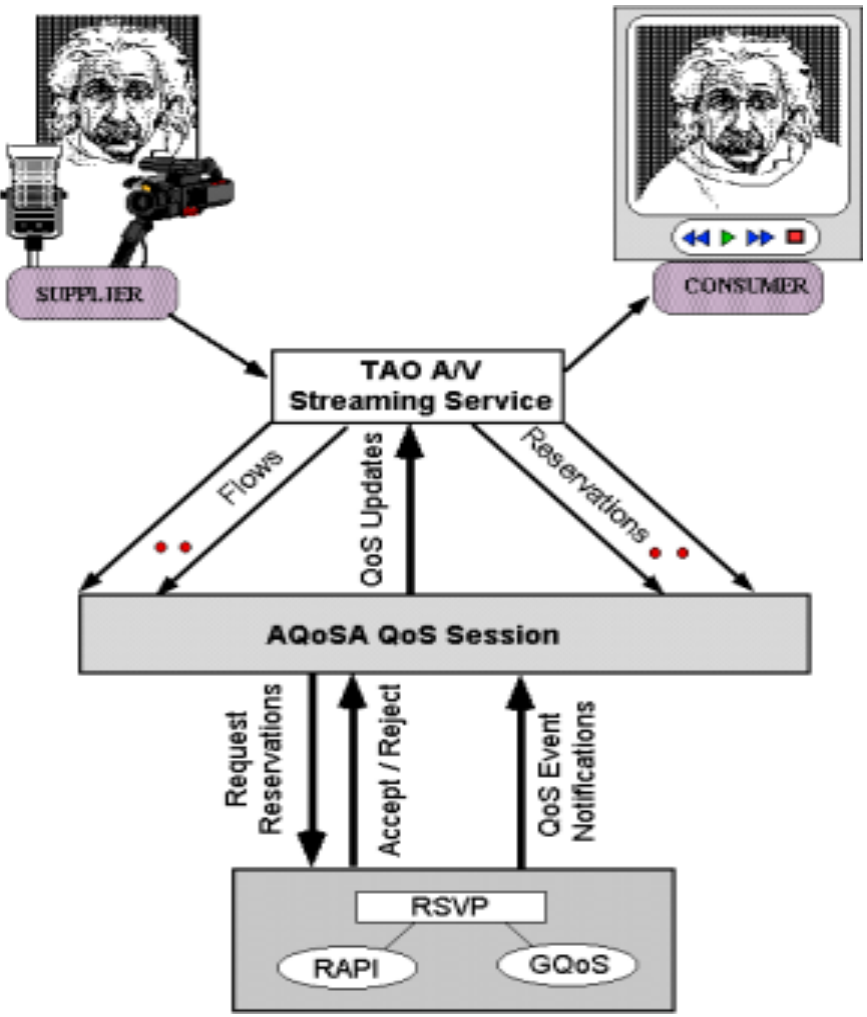
- *StreamCtrl*
  - controlling the stream
- *MMDevice*
  - interface for logical or physical device
- *StreamEndPoint*
  - network specific aspects of a stream
- *Vdev*
  - properties of the stream

QoS Enabled TAO A/V Service



- **TAO AV QoS Framework**
  - AQoSA
  - QoS Mapping
  - QoS Monitoring
  - QoS Adaptation
- **ACE QoS API (AQoSA)**
  - RAPI
  - GQoS

AQoSA API



- **Binds flows to reservations** in a uniform and portable way
- **Encapsulates** application's **notion of** the underlying network **QoS**
- **Separates QoS properties** of its sessions from **low-level socket data** transfer aspects
- Allows the application to **specify** and **request** QoS. Be notified if the QoS was not available
- **Updates** itself based on QoS notifications
- **Portably** wraps the QoS parameters
- **Implementation** targets (RSVP) Resource reSerVation Protocol
  - RAPI & GQoS

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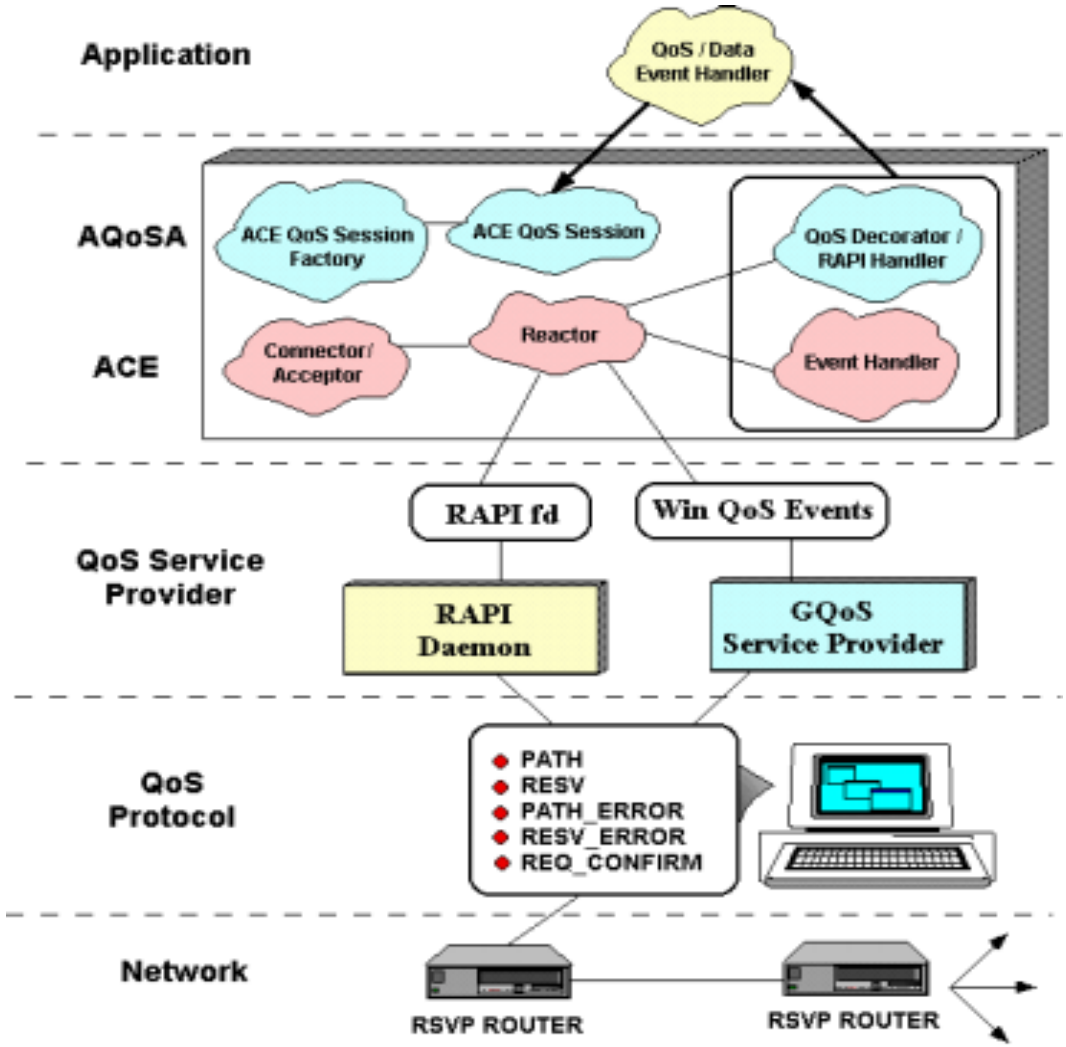
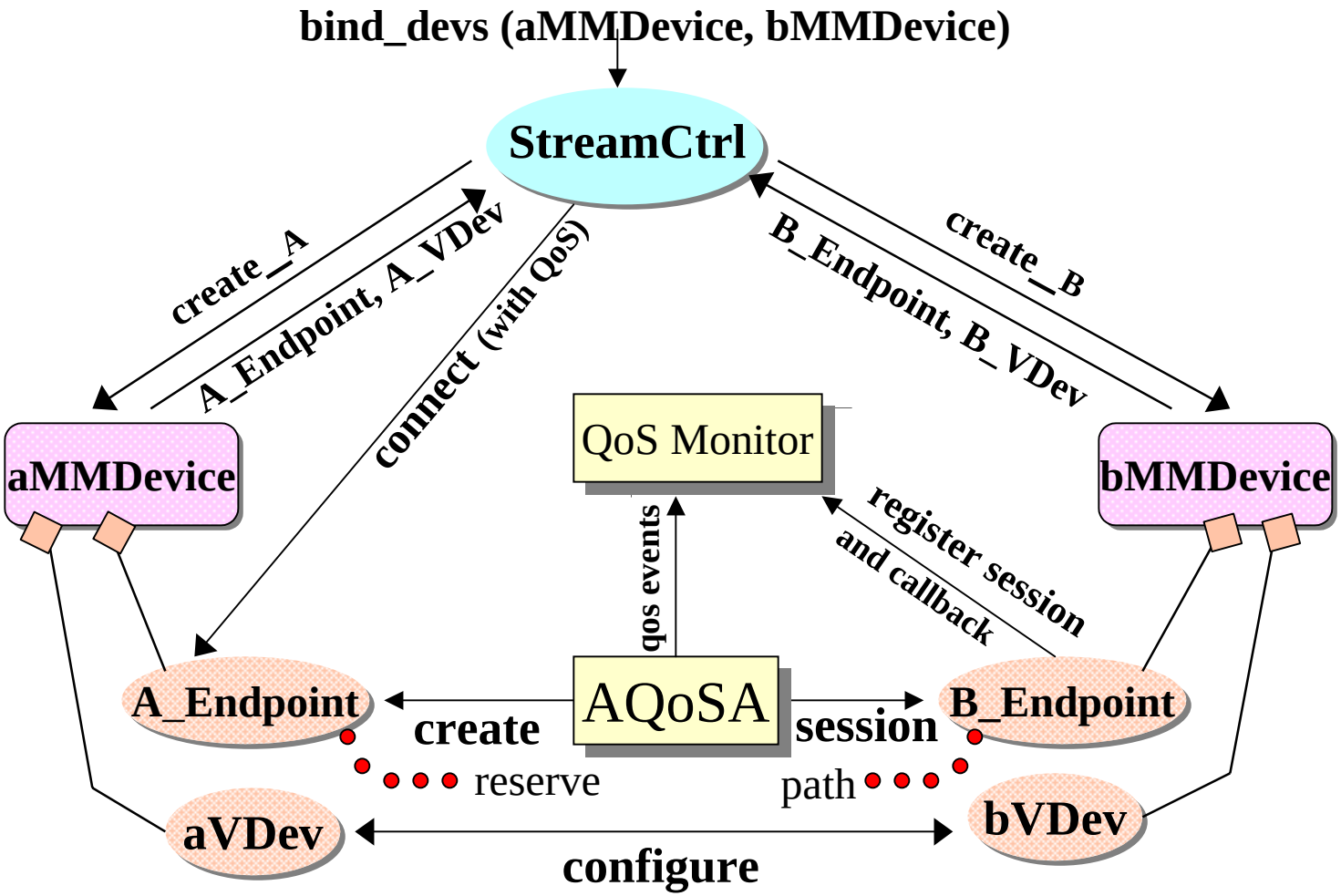
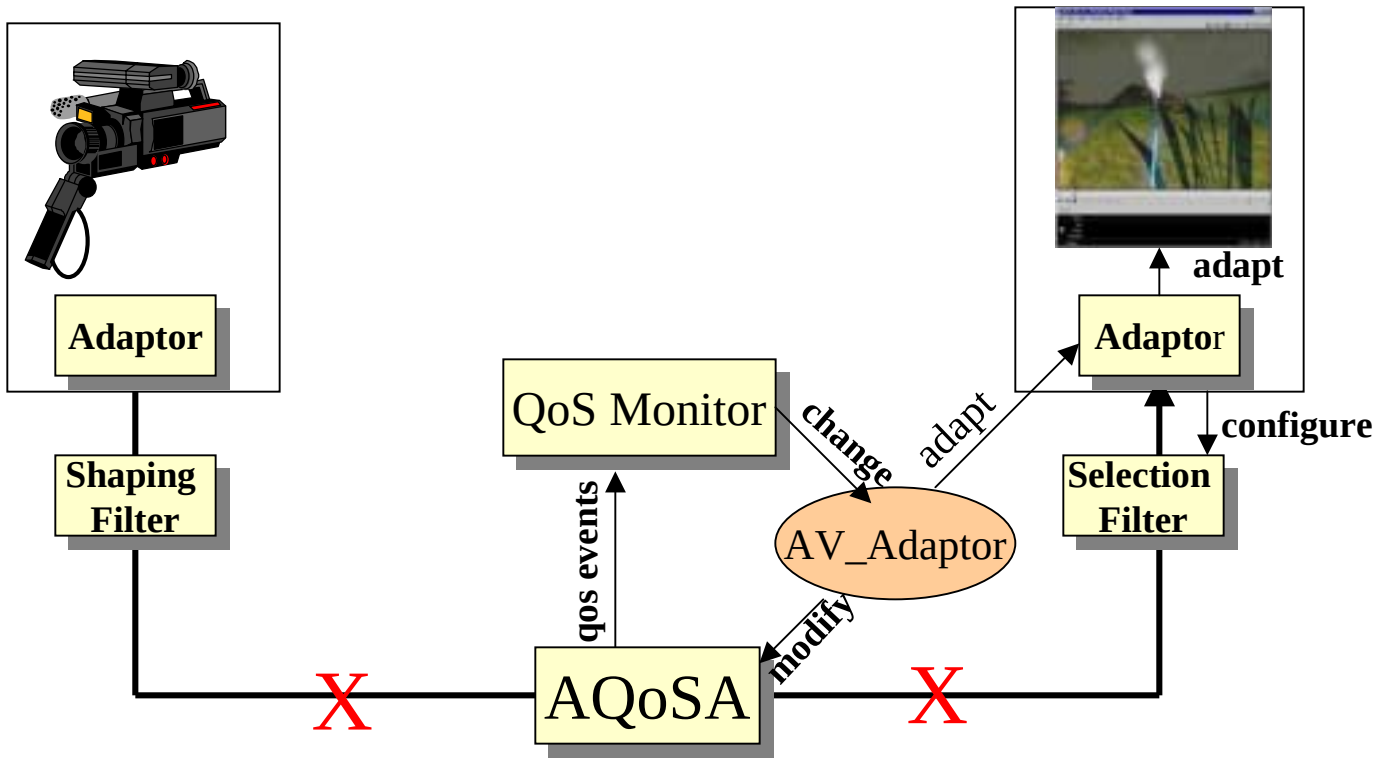
AQoSA Architecture



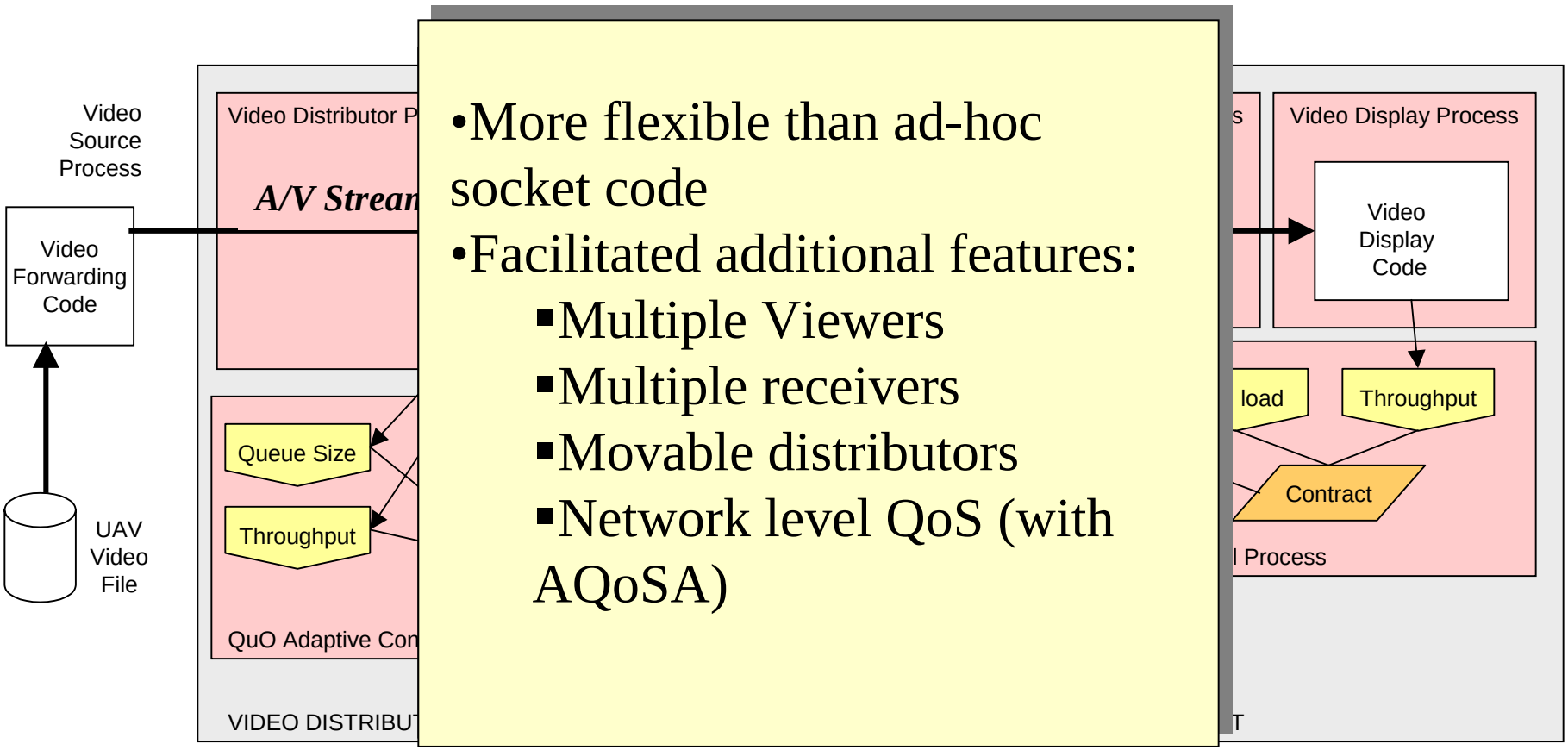
Connection Establishment



Change in QoS



Integrating TAO A/V in the UAV Application



- More flexible than ad-hoc socket code
- Facilitated additional features:
  - Multiple Viewers
  - Multiple receivers
  - Movable distributors
  - Network level QoS (with AQoSA)

Further References and Obtaining Software

- http://www.dist-systems.bbn.com/tech/QuO/
  - information about QuO framework
  - to obtain QuO, send e-mail to quo-help@bbn.com
- http://www.cs.wustl.edu/~schmidt/TAO.html
  - source code for TAO ORB, CORBA A/V service, and AQoSA
  - UAV application uses TAO 1.1.15 or higher (TAO 1.2 major release is imminent)
  - further information can be obtained via e-mail from av@oomworks.com
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