Poseidon House
Castle Park
Cambridge CB3 0RD
United Kingdom

TELEPHONE: **Cambridge (01223) 515010**
INTERNATIONAL: **+44 1223 515010**
FAX: **+44 1223 359779**
E-MAIL: **apm@ansa.co.uk**

ANSA Phase III

ANSAworks: Multi-Media Streams and CORBA

Andre Kramer

Abstract

ANSAworks ‘96 presentation of DIMMA streams and AMBER multi-media work.

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Distribution:
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The AMBER Project:

Multi-Media Streams and CORBA

Andre Kramer

ak@ansa.co.uk

Communications Applications

- Telecommunications market is huge
  - EDI, CSCW, WWW, DAVIC
- *but:* Applications generally lack Architecture
  - Low level of abstraction
  - => can benefit from CORBA Technology
- Distributed multi - media
  - Many formats and protocols
  - Must support application level processing
  - Need concurrent multi-media support
- Standardization efforts
  - OMG TelSIG: CORBA and Streams
  - => can apply APM experience (ODP, TINA, DIMMA)

An aside on CORBA

- *Aim:* Portable distributed applications
- Object - oriented: Objects distributed over ORB
- Interfaces: IDL and RPC, operations and object references
- Language mappings: C, C++, SmallTalk etc.

OMG - Architecture and Interfaces

- CORBA 2: Interoperability between ORBs
- Object Services: Life-cycle, Transactions, Security, Events etc.

ORB Application Domains

- ORBs usually engineered for scalability
- No support for real-time, multi-media in current ORBs
- Risk of ad hoc extensions

Risks

- Unique opportunity
  - to apply CORBA to comms-oriented applications
- Monolithic solutions
  - Plug and Play
  - Multi - Media: CBR v.s. Adaptive
- Complex, conflicting standards:
  - need incremental approaches
- Must demonstrate that our approach works:
  - in face of high heterogeneity
  - has general applicability

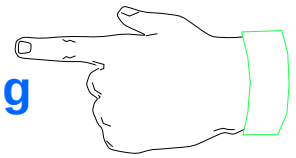
How to extend CORBA for Telcomms?

Extensions

- Streams - directional flows of typed frames
- Explicit binding - stream interfaces & communication end-points

Options

- 1) Build as Services on existing ORBs
  - c.f. IMA MSS proposal
- 2) Add connection management
  - Plugs and sockets
- 3) Both connection and interaction support:
  - Application level sources and sinks: s/w stream processing



Recommendation

- Identify set of CORBA extensions
- Demonstrate in ORB and for MM domain:

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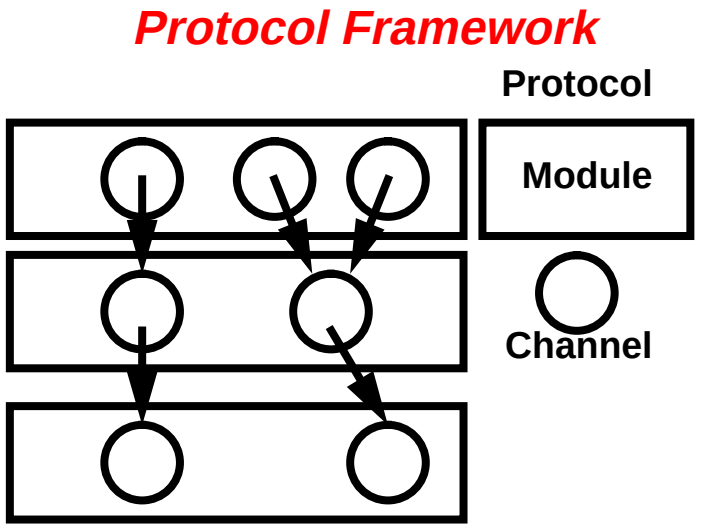
- Integrate with:
  - DIMMA Protocol Framework
  - ReTINA Real-time Telcomms DPE
  - Synchronous programming

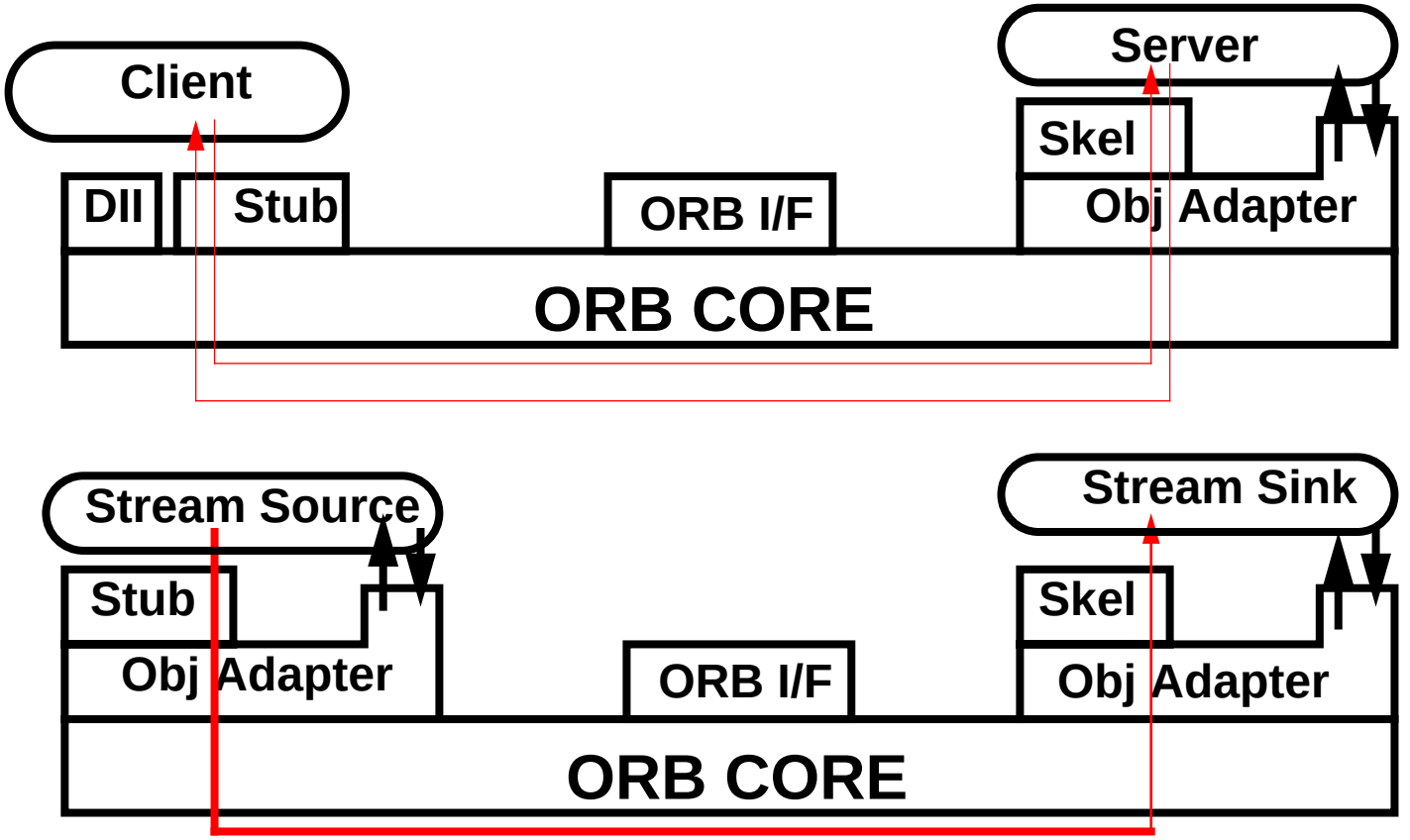


CORBA Implications

- Minimal IDL extensions
  - Interfaces with typed data “frames”
- Overload Object Adapter Concept
  - Object Adapters <-> Stream Adapters
  - Object Interfaces <-> Stream Interfaces
  - Object References <-> Stream References
- Add explicit resource management
  - Resources: threads, buffers, connections
  - Resource Pools
  - QoS

=> Extendable ORB

Adapters


Client
Server
Skel
DII
Stub
ORB I/F
Obj Adapter
ORB CORE
Stream Source
Stream Sink
Stub
Skel
Obj Adapter
ORB I/F
Obj Adapter
ORB CORE

Benefits

- Comms Apps and DPE convergence
- Comms services enabled CORBA: used as “Integration Glue”
- Demonstrators:
  - AMBER VIC MBone Tool
  - (CORBA IOE Extensions)
  - DIMMA DPE
- Leads into real-time
  - Concurrent stream processing, synch. programming
  - QoS Arch.

Multi-media <=> CORBA <=> Telecommunications

Existing CORBA Connection Model

- **Implicit, late - binding**
  - **Engineered for efficiency and scaling**
  - **Pervasive resource multiplexing**
- **Client / server RPC model**
  - **Asymmetric**
  - **Best - effort, focus is on inter-operability**
- **Need to exercise control:**
  - **Multi - party or third - party connections**
  - **Prioritize and synchronize communications**
  - **Provide QoS guarantees**
  - **Manage connection life-times, re-configuration**

Application Layer Framing

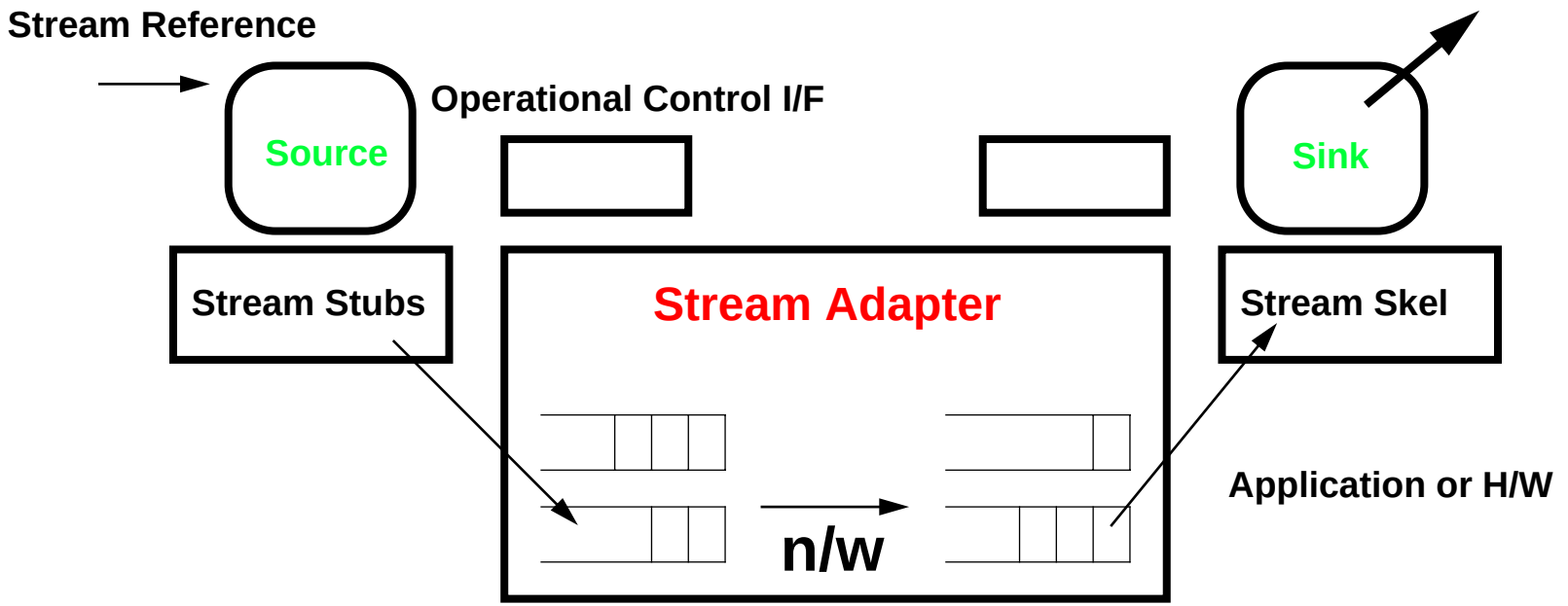
- **Frames:**
  - Sequence of messages from source to a sink
  - Multiple frame types
  - e.g. video & audio, base / delta coding, in-band cntrl
  - Marshalled by stream “stubs”

Frames as unidirectional non-blocking operations

- **Streams:**
  - Bunches of frames - *Flows*
  - Explicit connection set-up
  - Stream references

Streams as extended IDL interfaces

Streams and Adapters



Stream IDL

- **Frames and Streams: CORBA IDL Interfaces**

```
stream Conference {
       video (Participant, VideoFrame);
       voice (Sound_bite,  sequence of Speakers);
       whiteboardDraw (Item);
};
```

- **Frame grouping: unidirectional Flows**
  - **Basis for conformance based type checking**
  - **Binder generation -- for sets of interfaces, binding language**
- **JETSTREAM C++ mapping**

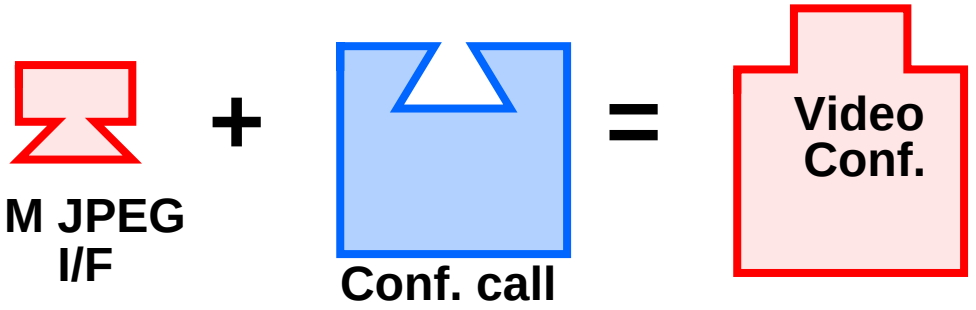
Flexible Binding

- **Stream Interfaces plug into Stream Adapters**
- **Stream Adapters Types:**
  - **Primitive Adapters: for std. multi - media formats**
  - **Composable Adapters: for application - level stream processing**
  - **Templated Adapters: for generic connection models**

Overload Object Adapter Concept!

- **Forms basis for standardization, vendor differenciation**
- ***Examples:* Multicast groups, HTTP-ng, MM data-flow**

Templated Adapters



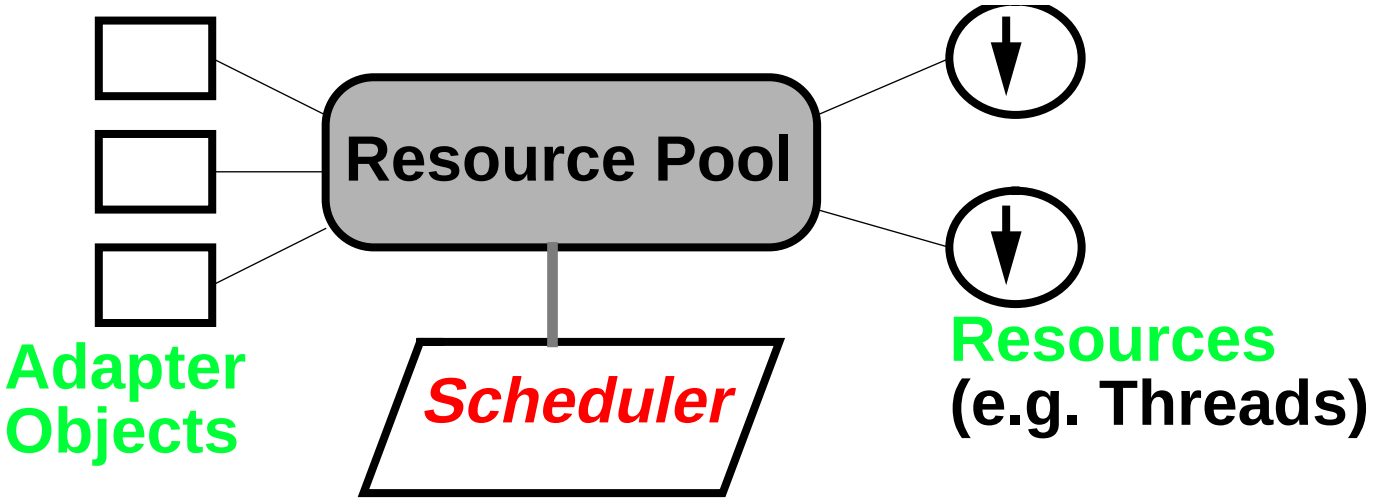
- Generic adapters (based on CORBA type ANY)
- Adapters encapsulate communication protocols
- Template generation for complex binders; specialized marshallers

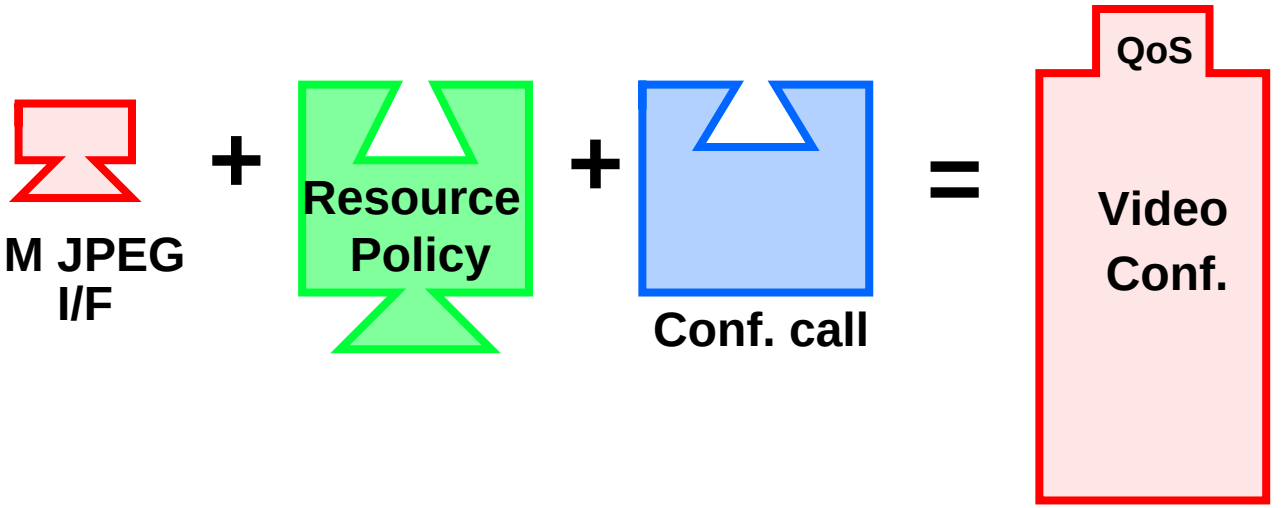
Adapters and Resource Pools

- Control muxing of all resources
  - Threads, buffers, protocol endpoints
  - Low-level and system level abstractions: memory, sockets
- Avoid application cross-talk => separate at low level
- Need abstractions for resource control: pools
- Adapters parameterized by policy

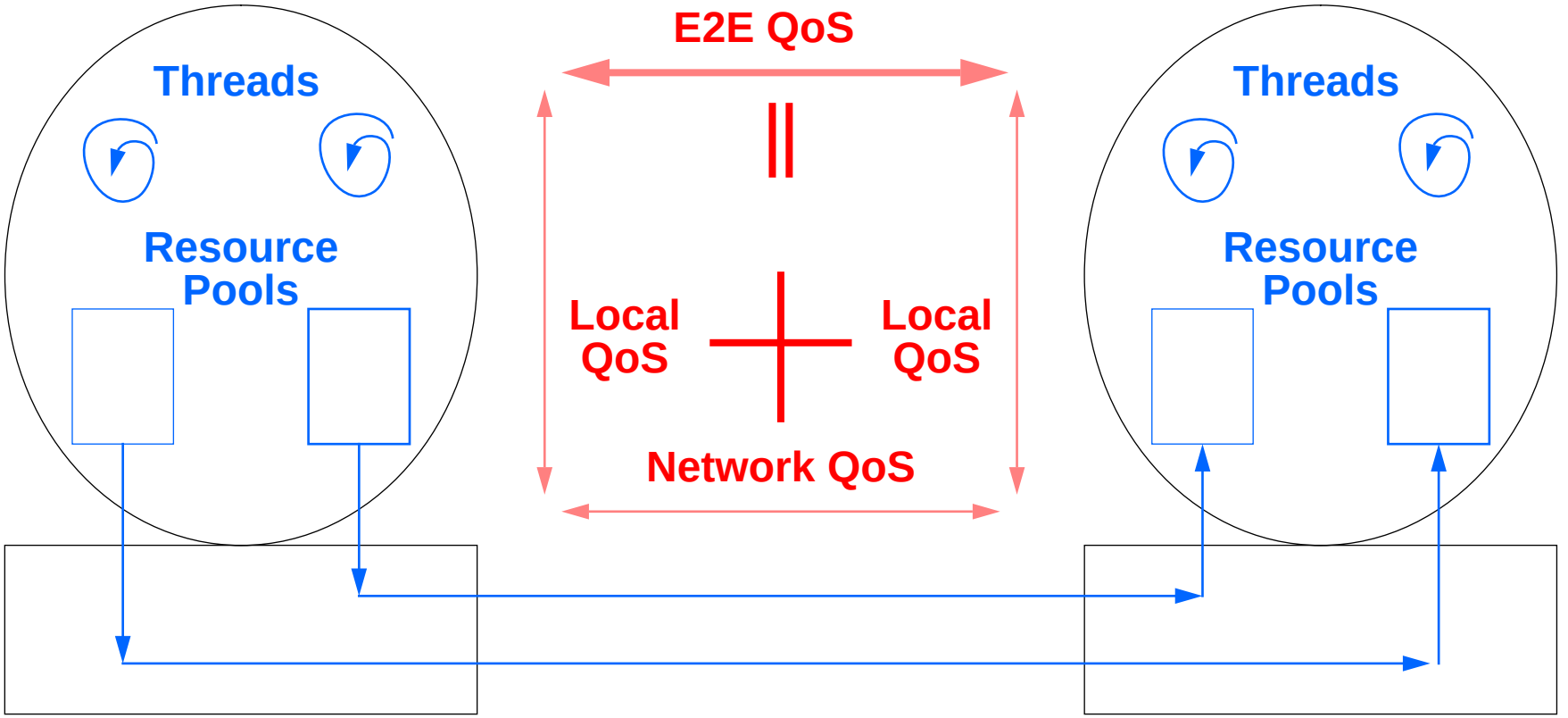
- Upcall based frame delivery at receivers
  - Thread shepherds message
  - Policy: one upcall at a time per interface

Resourced Stream Adapters





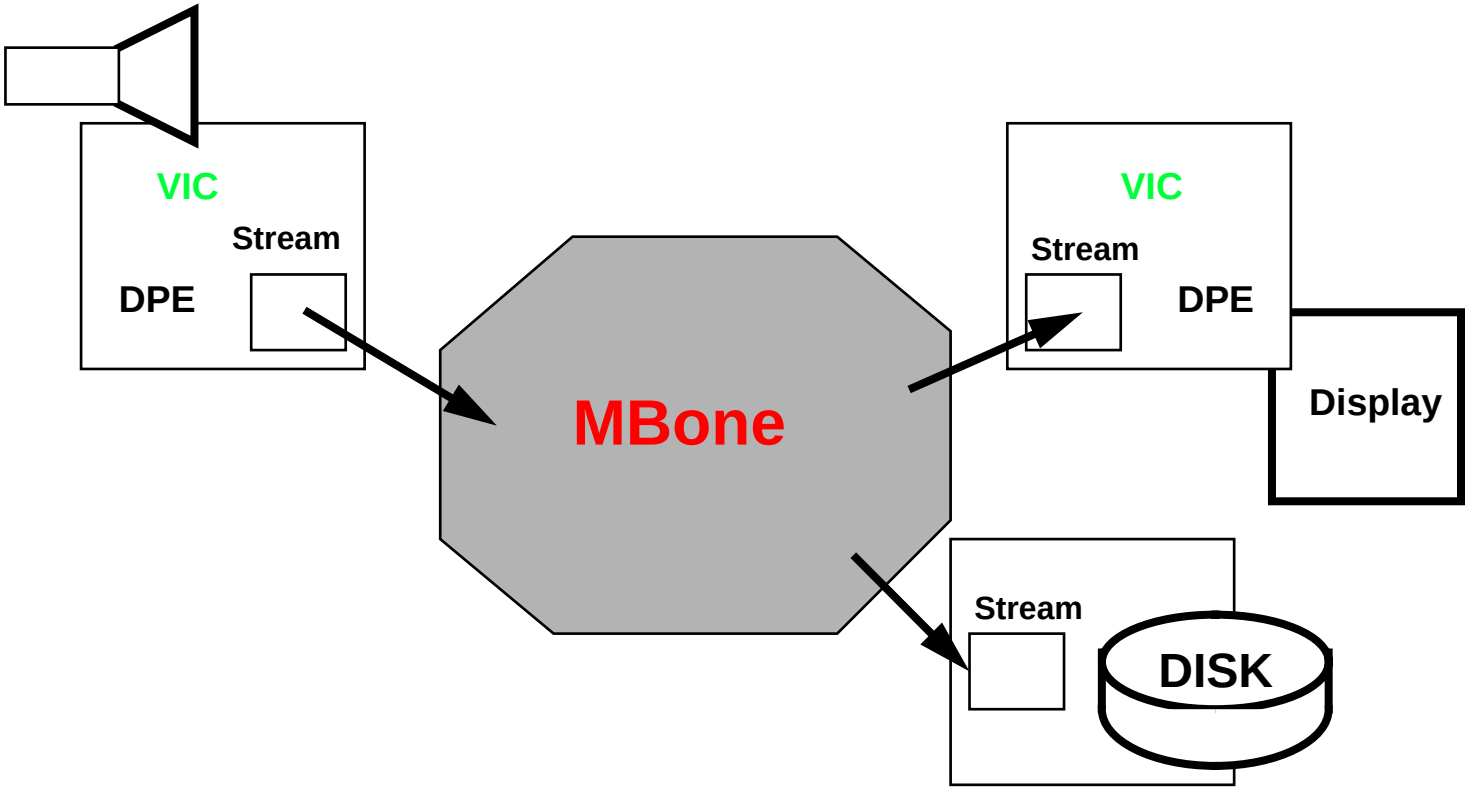
Concurrent Multimedia Streams



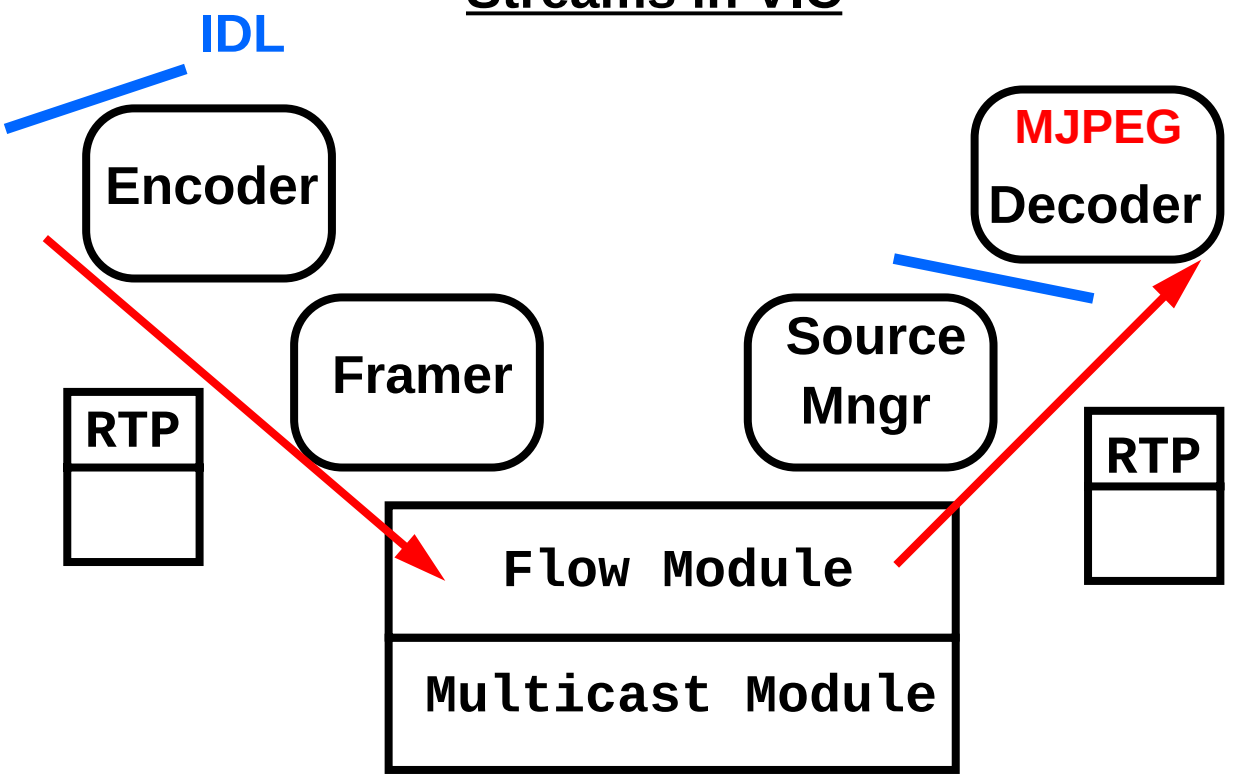
AMBER VIC (1)

- Demonstrate approach applied to Internet MBone
  - Streams: contrast CBR with adaptive MM approaches and ALF
  - Binding: investigate loose, multi-party conference models
- MBone (Deering Multicast)
  - Multicast IP
  - Virtual backbone of multicast routers
- VIC video tool
  - Sessions with multiple sources
  - Framework for multiple encodings
  - RTP - transport for multiple encapsulations with time

AMBER VIC



Streams in VIC



AMBER VIC (2)

- **Results:**
  - MBone multi-media testbed
  - VIC over DIMMA protocols, RTP support
  - General DPE integrated with MBone video tool

Combines CORBA and Internet

- **Future:**
  - Predictability via real-time support
  - Investigate ABR ATM n/ws, reservation protocols (RSVP)

Wrap Up

- Comms - oriented applications need CORBA
- New concepts: streams, explicit connections, pools, QoS
- Identified CORBA extensions: stream IDL, adapters, pools, SII
- AMBER MBone demonstrator
- Firm foundations: ODP, DIMMA, TINA-C / ReTINA

Multi-media <=> CORBA <=> Telecommunications