CORBA for Telecom Systems
Fact or Fiction?

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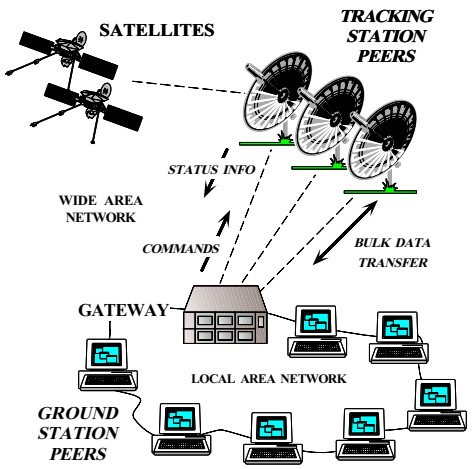
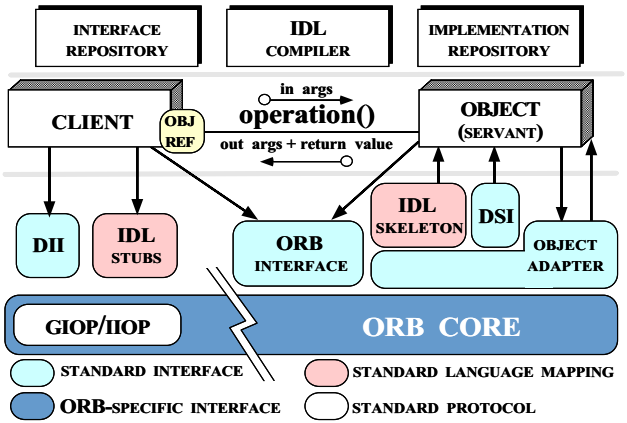
Problem: Lack of Real-time Middleware for Telecom



- Many telecom applications require QoS guarantees
  - *e.g.*, call-processing, network management, wireless systems
- Building these applications manually is hard
- Existing middleware doesn't support QoS effectively
  - *e.g.*, CORBA, DCOM, DCE
- Solutions must be *integrated*

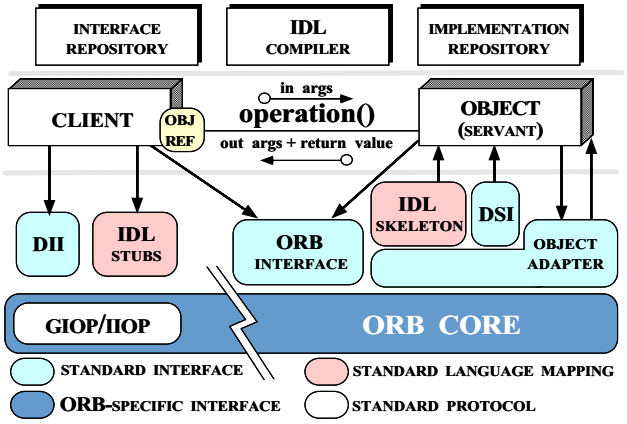
Candidate Solution: CORBA



www.cs.wustl.edu/∼schmidt/corba.html

- **Goals of CORBA**
  - Simplify distribution by automating
    - Object location & activation
    - Parameter marshaling
    - Demultiplexing
    - Error handling
  - Provide foundation for higher-level services

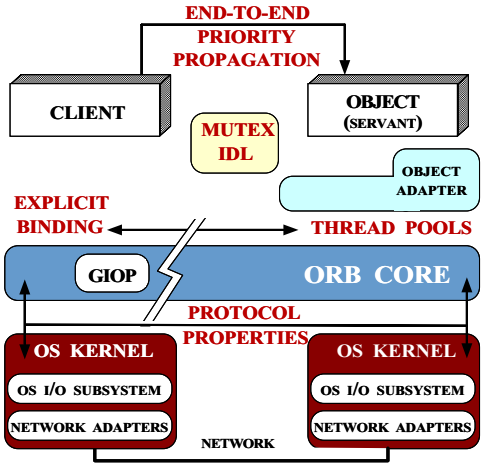
Caveat: Limitations of CORBA for Telecom Systems



www.cs.wustl.edu/∼schmidt/ORB-endsystem.ps.gz

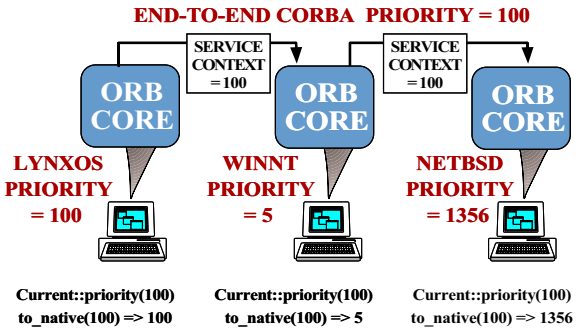
- **Limitations**
  - Lack of QoS specifications
  - Lack of QoS enforcement
  - Lack of real-time programming features
  - Lack of performance optimizations

Overview of the Joint Real-time CORBA Submission



- **Features**
  - End-to-end priority propagation
  - Protocol properties
  - Thread pools
  - Explicit binding
  - Mutex IDL

End-to-End Priority Propagation



- **Features**
  - Priorities can propogate end-to-end
    - Supports heterogeneous RTOS priority mappings
    - Supports priority inheritance
  - Servers can also dictate priority

Protocol Properties

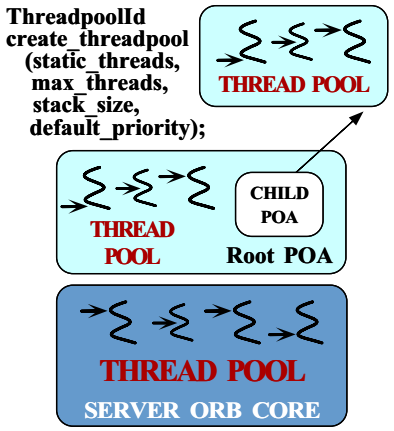
```
interface ProtocolProperties {};

typedef struct {
  IOP::ProfileId protocol_type;
  ProtocolProperties
    orb_protocol_properties;
  ProtocolProperties
    transport_protocol_properties;
} Protocol;
typedef sequence <Protocol> ProtocolList;

interface TCPProtocolProperties
  : ProtocolProperties
{
  attribute long send_buffer_size;
  attribute long recv_buffer_size;
  attribute boolean keep_alive;
  attribute boolean dont_route;
  attribute boolean no_delay;
};
```

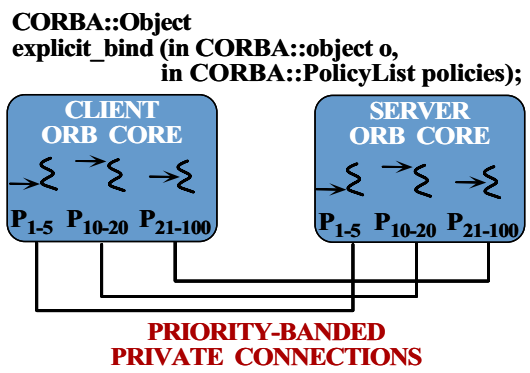
- **Features**
  - Select and configure communication protocols
    - *e.g.*, TCP socket options
  - Supports *ORB protocol* and *transport protocol* configuration
  - Ordering in `ProtocolList` indicates preferences

Thread Pools



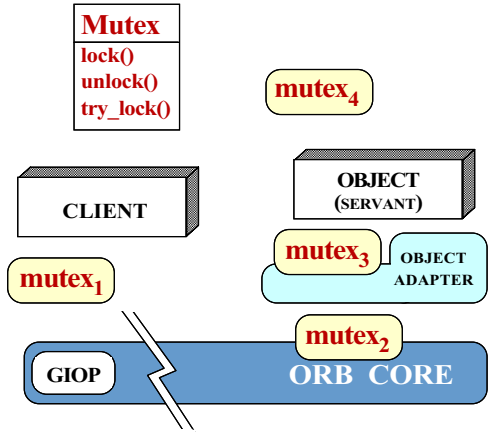
- **Features**
  - Pre-allocate threads and thread attributes
    - Stacksize
    - Static threads
    - Maximum threads
    - Default priority
  - Applicable at both the ORB and POA level

Explicit Binding



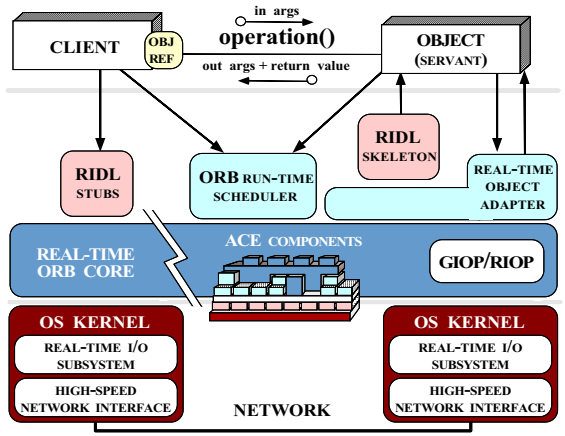
- **Features**
  - Enables pre-establishment of connections
    - Priority-banded connections
    - Private connections
    - Protocol policies

Mutex IDL



- **Features**
  - A portable Mutex API
    - *e.g.*, `lock`, `unlock`, `try_lock`
  - Necessary to ensure consistency between ORB and application synchronizers
  - Locality constrained

The ACE ORB (TAO)



www.cs.wustl.edu/∼schmidt/TAO.html

- **TAO Overview**
  - A real-time, high-performance ORB
  - Leverages ACE
    - Runs on POSIX, Win32, RTOSs
- **Related work**
  - U. RI, Mitre
  - QuO at BBN
  - ARMADA at U. Mich.

Concluding Remarks

- Developers of distributed, real-time telecom applications confront common challenges
  - *e.g.*, service initialization and distribution, error handling, flow control, scheduling, event demultiplexing, concurrency control, persistence, fault tolerance
- Successful developers apply *design patterns*, *frameworks*, and *components* to resolve these challenges
- ORBs are an effective way to achieve reuse of distributed telecom software components
- The next generation of ORBs will provide much better support for real-time QoS

Web URLs for Additional Information

- Real-time CORBA: `www.cs.wustl.edu/~schmidt/RT-ORB.ps.gz`
- Integrated ORB and OS I/O subsystem architecture:
  `www.cs.wustl.edu/~schmidt/RT-middleware.ps.gz`
- More information on TAO: `www.cs.wustl.edu/~schmidt/TAO.html`
- TAO Event Channel: `www.cs.wustl.edu/~schmidt/JSAC-98.ps.gz`
- TAO static scheduling: `www.cs.wustl.edu/~schmidt/TAO.ps.gz`
- TAO dynamic scheduling:
  `www.cs.wustl.edu/~schmidt/dynamic.ps.gz`