Design and Performance of a Real-Time Notification Service

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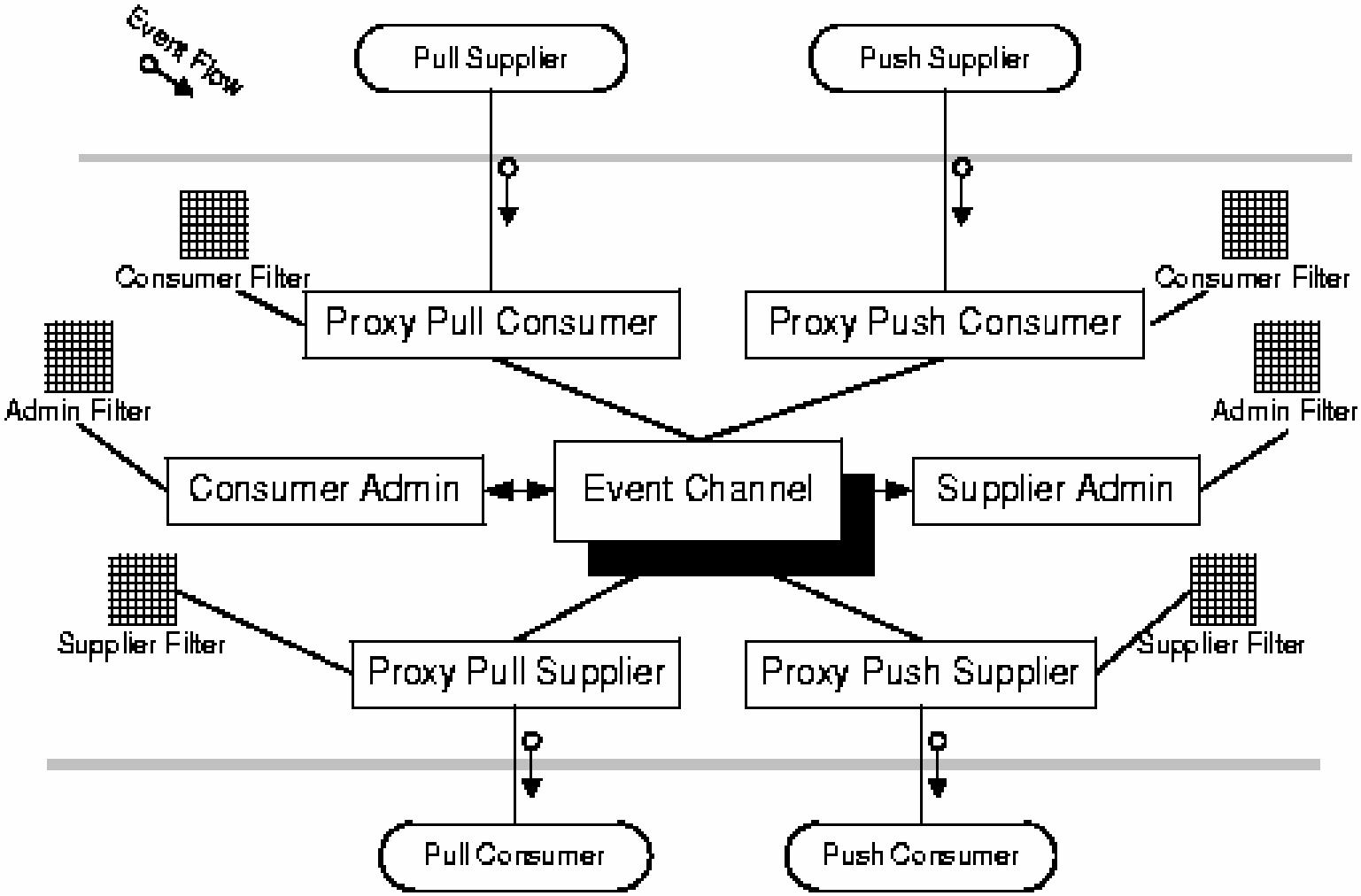
- IDL extensions and programming paradigm
- Performance Analysis

Notification Service Component Structure



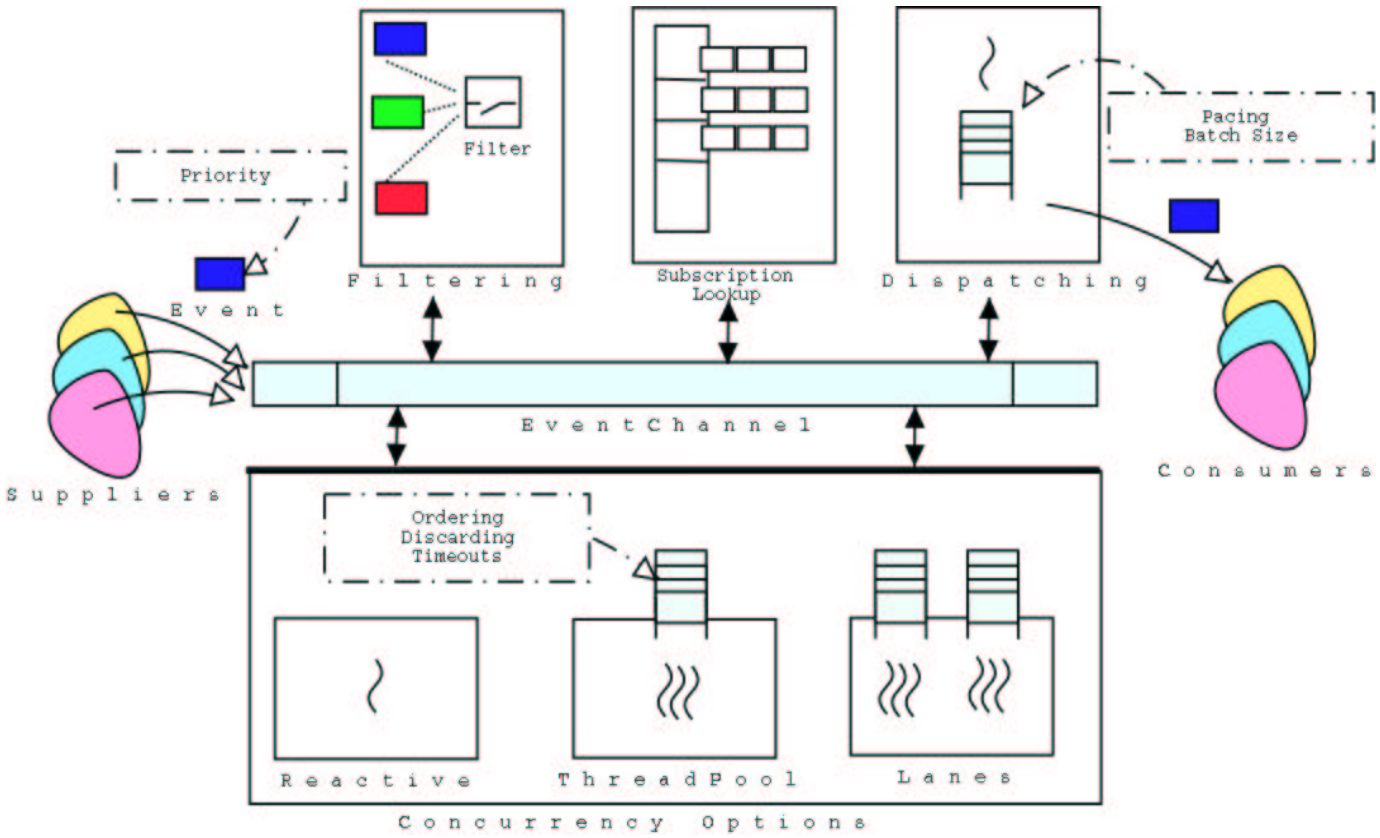
Real-Time Notification Service

- RT-CORBA 1.0 provides end-to-end QoS guarantees for ***direct*** client-server communication
- Standard Notification Service does not make use of the priority and scheduling capabilities defined in RT-CORBA 1.0
- RT-Notification provides end-to-end QoS guarantees for ***anonymous*** event communication
- Improved timeliness and predictability in the transmission and delivery of events to event consumers via Event Channels
- Integration with Real-Time CORBA, particularly in the areas of configuration of priorities and scheduling

Requirements of RT-Notification RFP

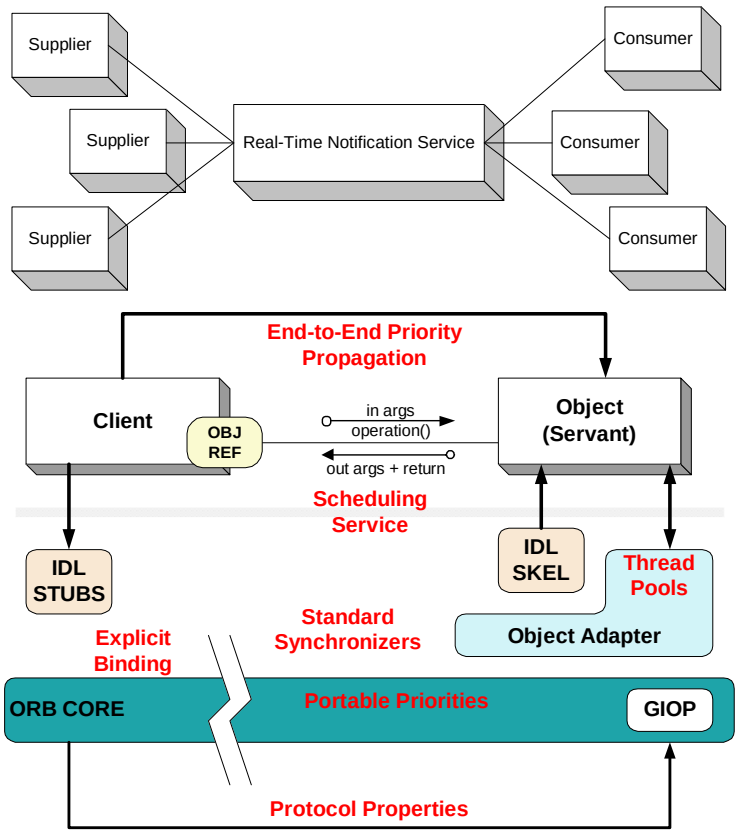
- Limit Complexity of Filters.
- Provide subset of filtering process.
- Subset functionality for Real-time behavior.
- Priority aware end- to-end event propagation.
- Provide means to set RT QoS parameters.
- Interface for resource management.
- Support Interaction with a scheduling service and describe schedulable entities.

RT-Notification Architecture



- Concurrency options
  - Reactive
  - ThreadPool
  - ThreadLane
- QoS support
  - Priority
  - Ordering
  - Discarding
  - Timeouts

Integration with RT-CORBA 1.0



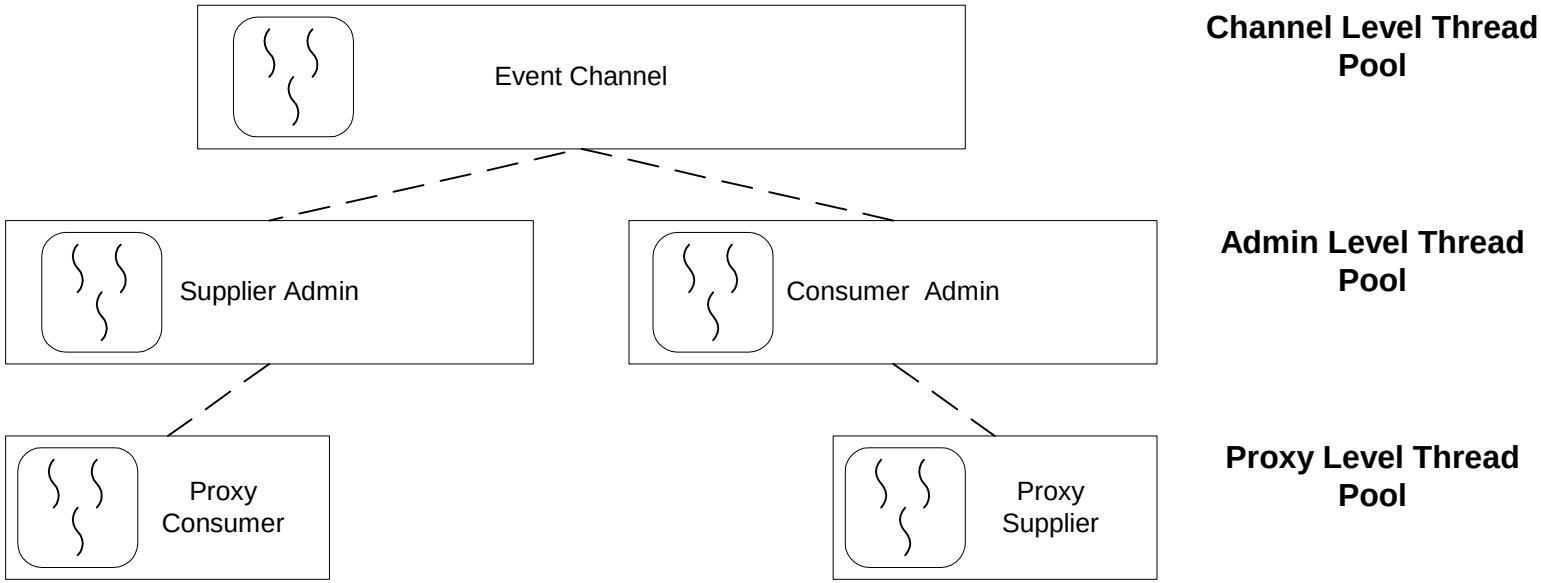
- Support RT-CORBA Thread Pools and Lanes
- Proxy's are activated in RT-POA
- Support Priority Models
- Extends TAO Notification Service.
- IDL extensions and new QoS properties.

IDL Extensions

- `set_qos` method sets QoS properties via name-value pairs
  - Specify thread-pools at Channel and Admin levels
  - Notify IDL Extension defines `ThreadPoolParams`, `LanesParams`
- `obtain_proxyconsumer` and `obtain_proxysupplier` modified to accept QoSProperties

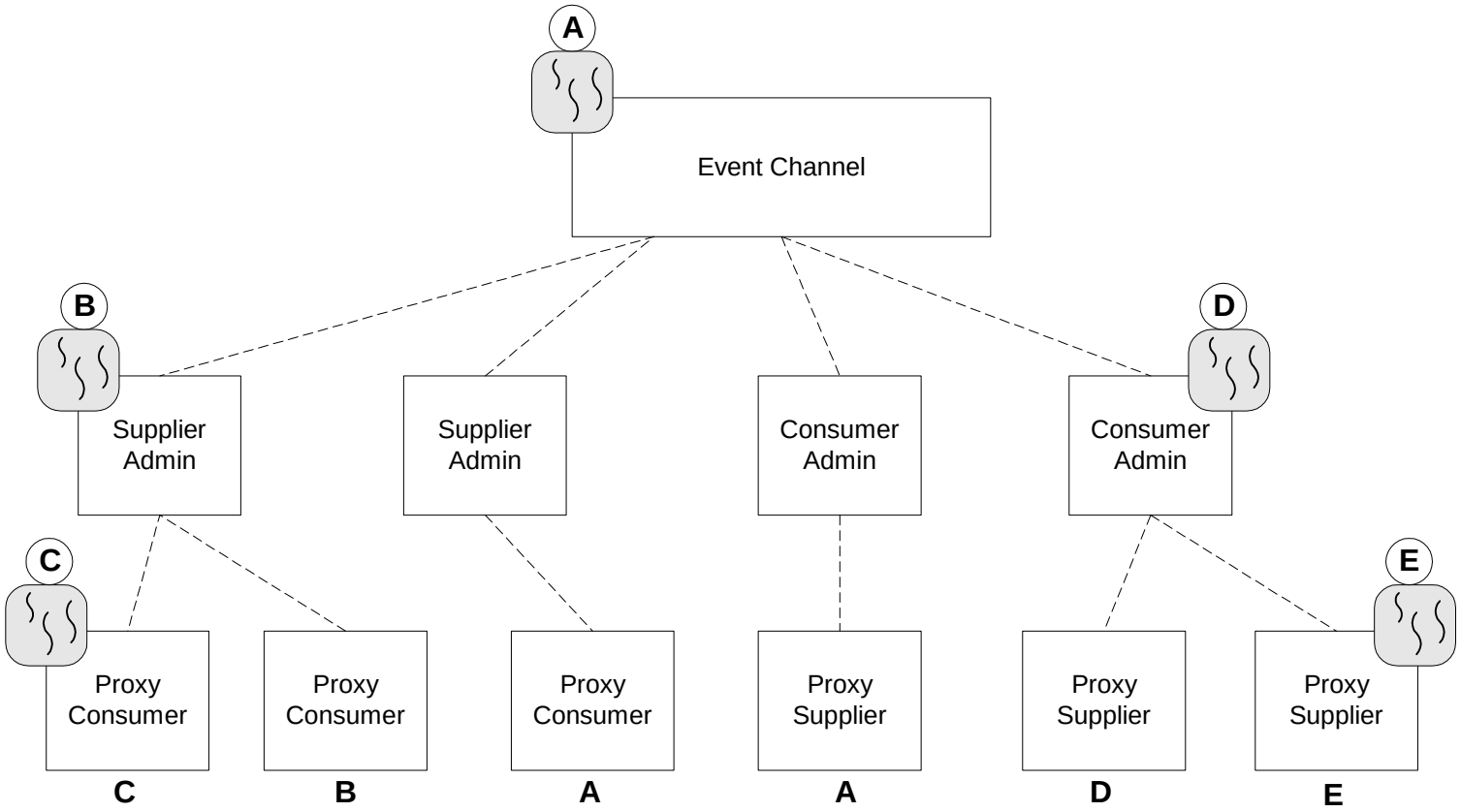
```
module NotifyExt
{
  const string ThreadPool = "ThreadPool";

  // ThreadPoolParams : same as
  // RTCORBA::create_threadpool
  struct ThreadPoolParams
  {
    unsigned long stacksize;
    unsigned long static_threads;
    unsigned long dynamic_threads;
    Priority default_priority;
    boolean allow_request_buffering;
    unsigned long max_buffered_requests;
    unsigned long max_request_buffer_size;
  };
};
```

Thread Pool Support in RT-Notification

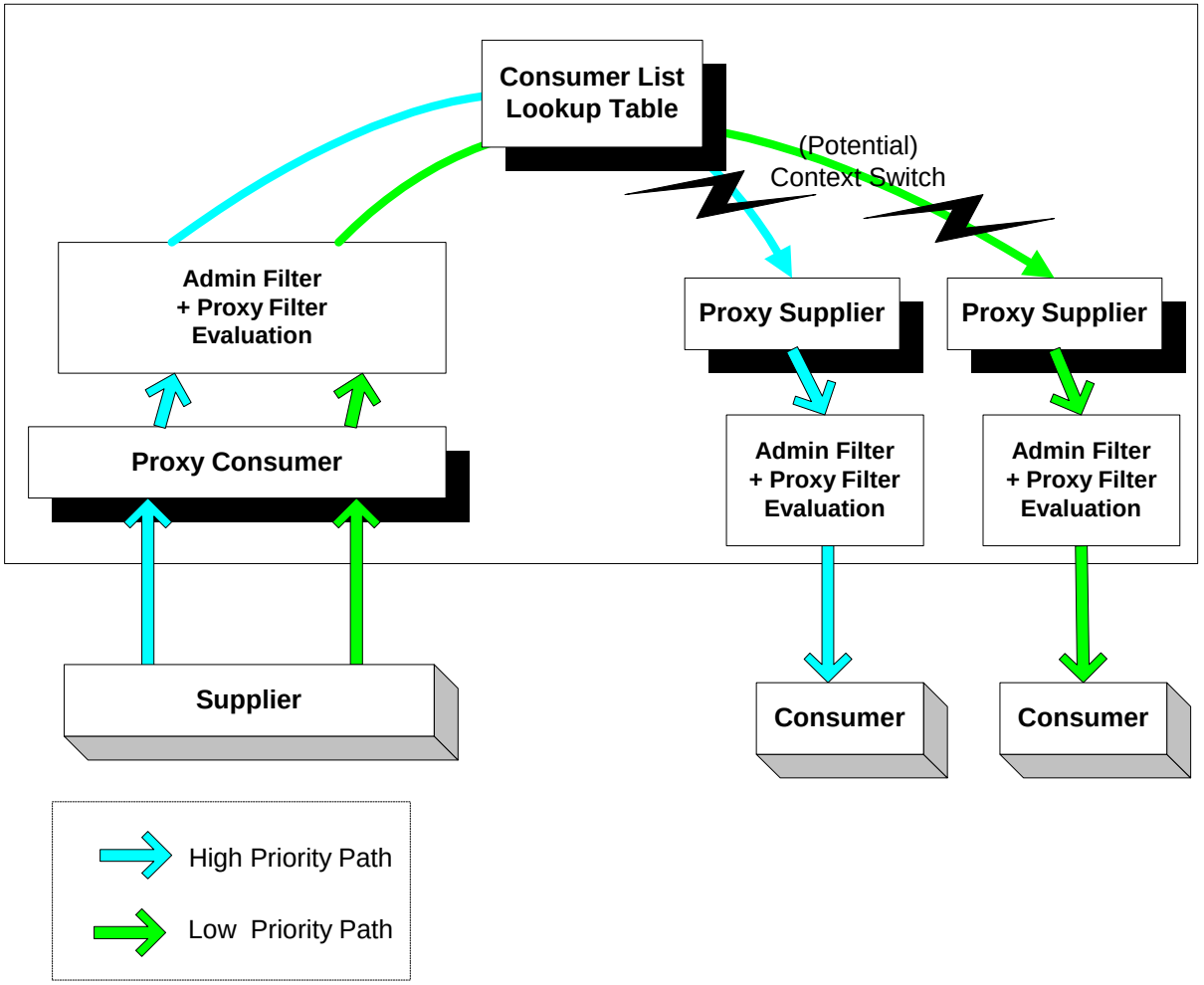


- Thread Pool can be set at 3 levels – Channel, Admin and Proxy
- Proxy Objects are activated in RT-POA at one of the 3 levels
- Levels allow sharing of thread pools; e.g., supplier admin thread pool allows multiple proxy consumers to share threads

Possible Thread Pool Configurations



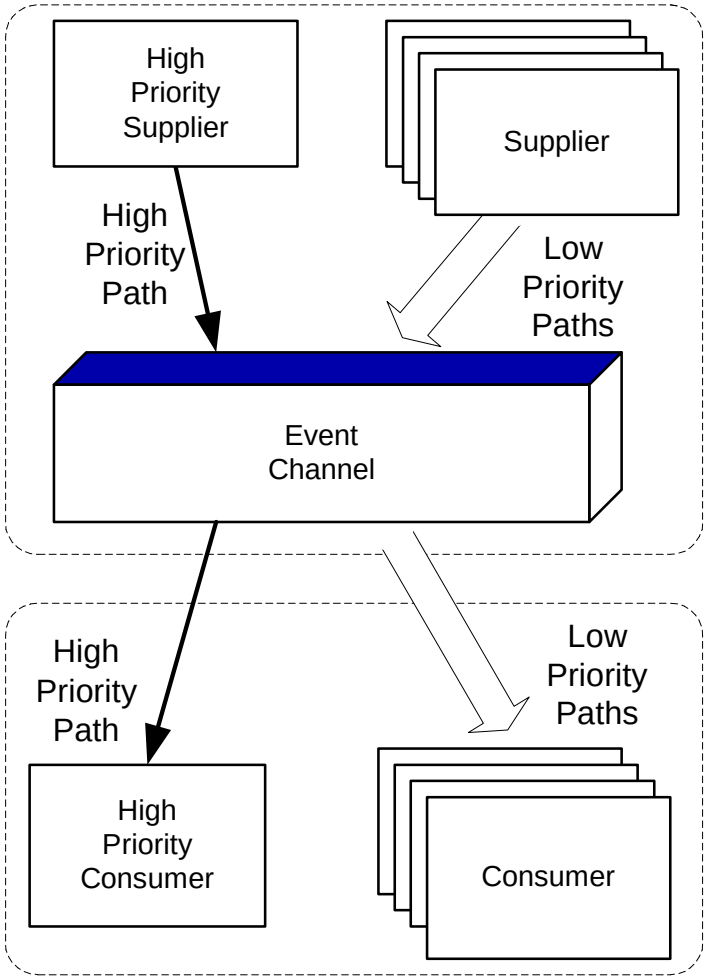
End-to-end priority preservation



Performance Results

- Experimental Setup
- Load vs Throughput
- Paths vs Throughput
- Max Throughput

Experimental Setup

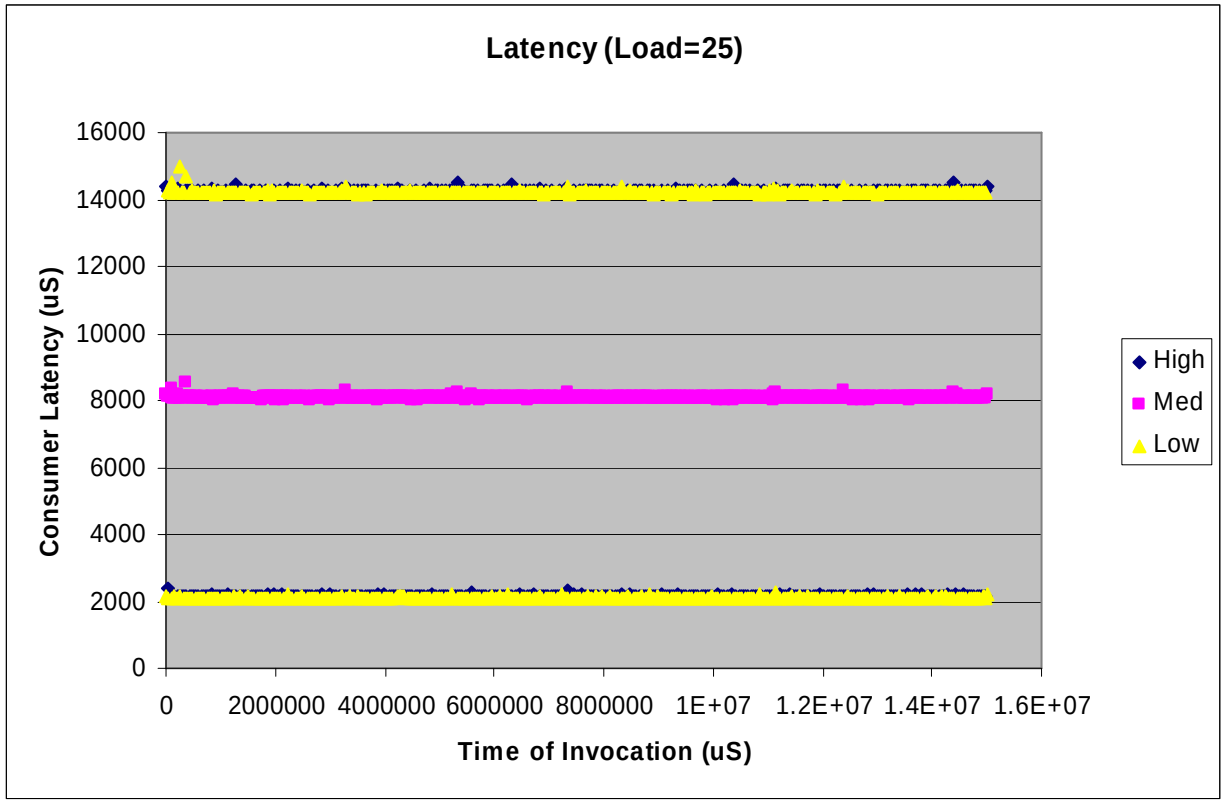


- Each Supplier runs in a separate thread.
- Each Supplier can be configured with a priority and period.
- Each ProxyConsumer is activated in a Lane that matches the supplier priority.
- "Path" refers to event path from 1 supplier to 1 consumer.
- Results from TAO 1.3.3 on Redhat Linux 7.1 , 800Mhz CPU (Emulab)

Load vs Throughput

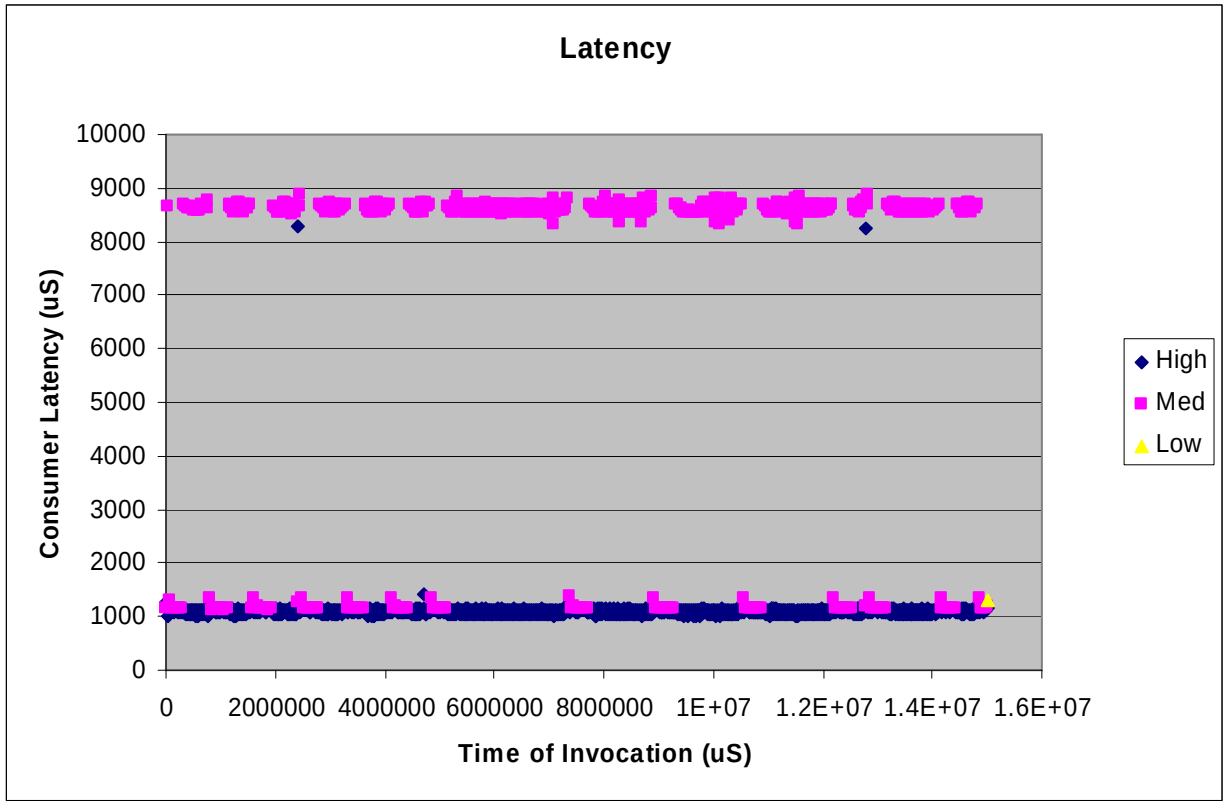
Latency (Cos Notification)

In previous setup at Load = 25



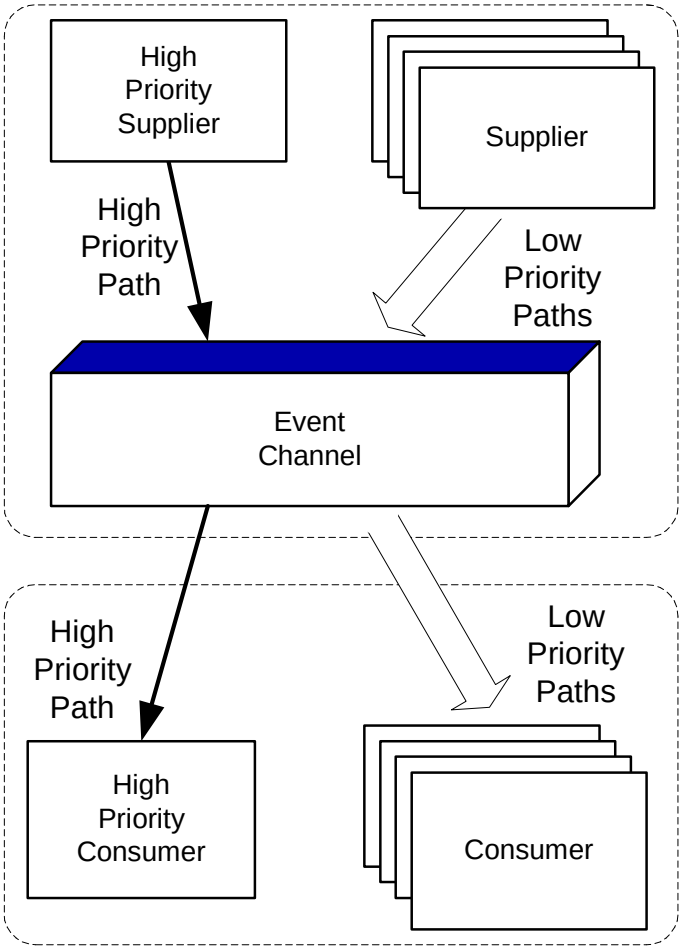
Latency (RT-Notification)

In previous setup at Load = 25



Paths vs Throughput

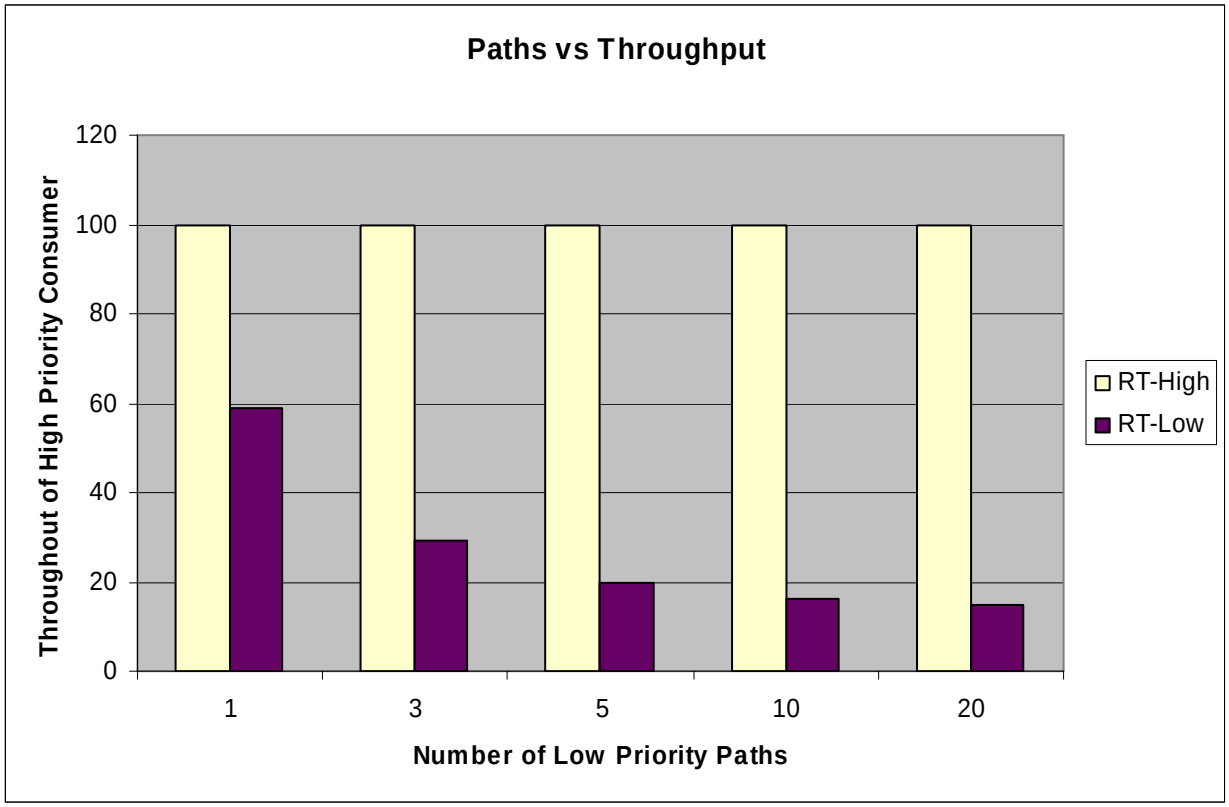
Paths vs Throughput



- 1 High Priority Path
- Several same Low priority paths
- Each at 100Hz
- 2 Lanes at EventChannel level.
- Increasing number of low priority paths: 1,3,5,10,20
- No Threads in CosNotification.
- $TAO_ROOT/orbsvcs/tests/Notify/performance-tests/scripts/Paths_vs_Throughput

Paths vs Throughput

Load = 30



- Throughput of High Priority Path is maintained.

Conclusion

- TAO's RT Notification extends the Notification service.

- Integrates with RT CORBA features
  - ThreadPools and Lanes
  - Priority Models

- Performance tests demonstrate
  - Priority Preservation
  - Low Jitter
  - Low Overhead