Architecture of the CORBA Component Model

Event Service

Overview

- Event-oriented communication: an alternative for call-based client-server architecture
- Event Service: simple decoupled communication
- Notification Service: Extension of the Event Service
  - Offers greater flexibility

Events & Notifications

- Event: „something that happens“, „occurrence of some sort“, atomic
- Notification: Information about an event (message)
- Each message has a single distinct source, but potentially many recipients (1:n communications)
- Medium may support n:n communications
- Source of messages does not know consumers
  - Recipients are not explicitly addressed
- Emitting a message is typically non-blocking

Objectives and Applications

- Objectives are decoupling and autonomy
  - In space
  - In time
  - Syntactically
  - Semantically
- Distribution of messages (news ticker)
- Management of Telco networks
- Conferencing systems

Example Applications

- Example Scenario
  - Stock exchange
    - Stocks are traded at different exchanges
    - Decoupled scenario: notations are independent of individual trading decisions
    - Notations are distributed to all registered customers
  - Customers can subscribe to all/certain stocks
    - Provision of
      - Frequency of notification
      - Validity of data (e.g. do not communicate rates older than x minutes)
      - ...

First Approach

```
struct Time
{
    string current_date;
    string current_time;
};
interface StockExchange;
struct StockQuote
{
    string stock_id;
    StockExchange market_place;
    double current_quote;
    Time current_time;
};
```

First Approach

```
interface Subscriber
{
    void receive (in ::StockQuote current_quote);
};

interface StockExchange
{
    void subscribe (in ::Subscriber customer);
};
```

First Approach

- *StockExchange* Implementation:
  - Manages list of *Subscriber* objects
  - On each rate change, all *Subscriber* objects are notified
- Use communication patterns
  - subscribe/publish
    - Interested parties subscribe to news agency
    - News agency emits news messages
  - Push model
    - News messages are emitted <u>actively</u> by the agency

Approach using CORBA Event Service Interfaces

- CORBA Event Service
  - Interfaces standardized by OMG for event services
    - ftp.omg.org/pub/docs/formal/00-06-15.pdf
    - ftp.omg.org/pub/docs/formal/98-10-05.idl
    - ftp.omg.org/pub/docs/formal/98-10-06.idl
- Event consumers and supplier
  - Communication patterns push and pull
    - Push model: Producer is active
    - Pull model: Consumer is active
- Typed and untyped communication
  - Untyped: messages are communicated using the any type

Consumer and Supplier – Push Model

```
interface PushConsumer {
    void push (in any data) raises(Disconnected);
    void disconnect_push_consumer();
};

interface PushSupplier {
    void disconnect_push_supplier();
};
```

Consumer and Supplier – Pull Model

```
interface PullSupplier {
    any pull () raises(Disconnected);
    any try_pull (out boolean has_event)
            raises(Disconnected);
    void disconnect_pull_supplier();
};

interface PullConsumer {
    void disconnect_pull_consumer();
};
```

First Approach using CORBA Event Service (Push Model)

```
interface StockExchange2;
struct StockQuote2 {
    // ...
    StockExchange2 market_place;
    // ...
};

interface Subscriber2 : ::CosEventComm::PushConsumer
{};

interface StockExchange2 : ::CosEventComm::PushSupplier {
    void subscribe ( in ::Subscriber2 customer);
};
```

First Approach using CORBA Event Service (Push Model)

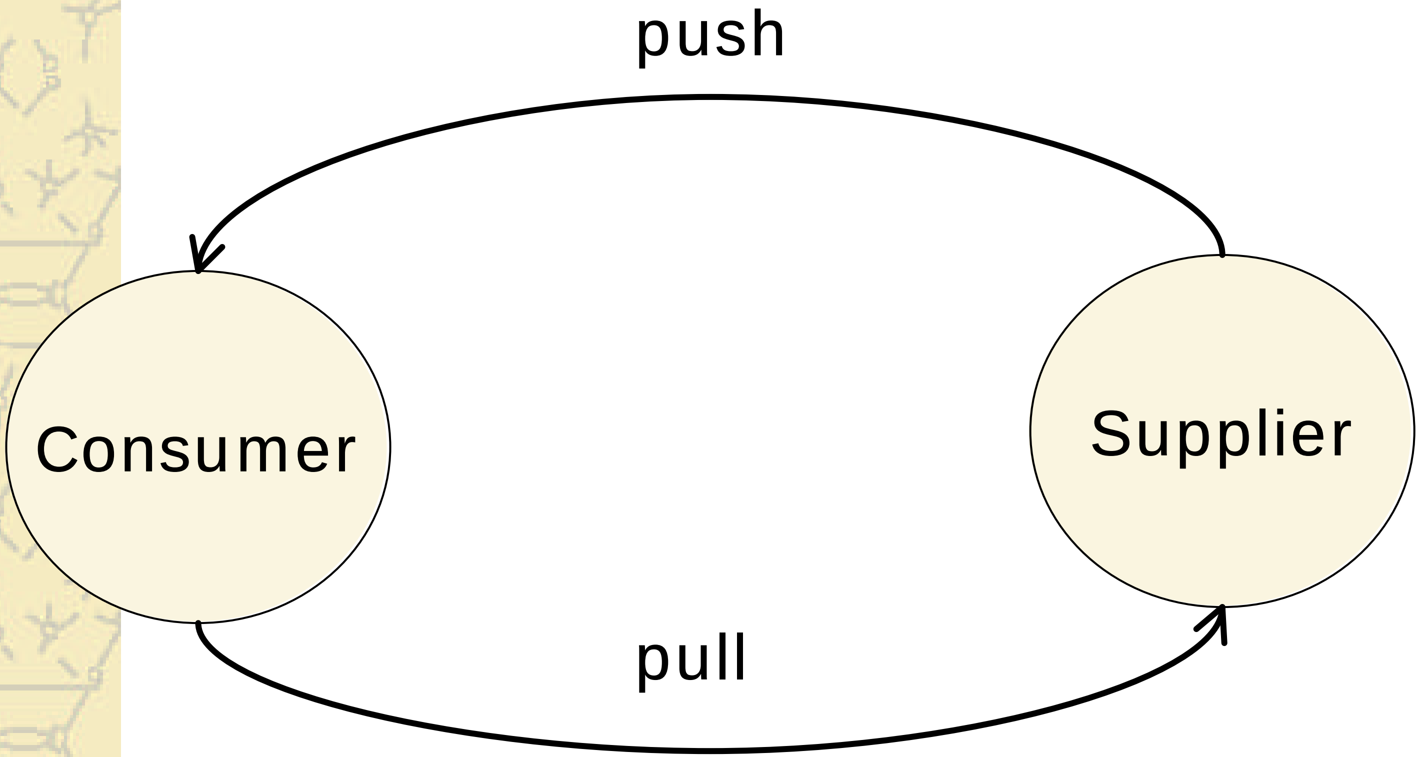
Usage of standard interface for *StockExchange* service

- Push model proves appropriate
- Explicit usage of inheritance from PushConsumer and PushSupplier

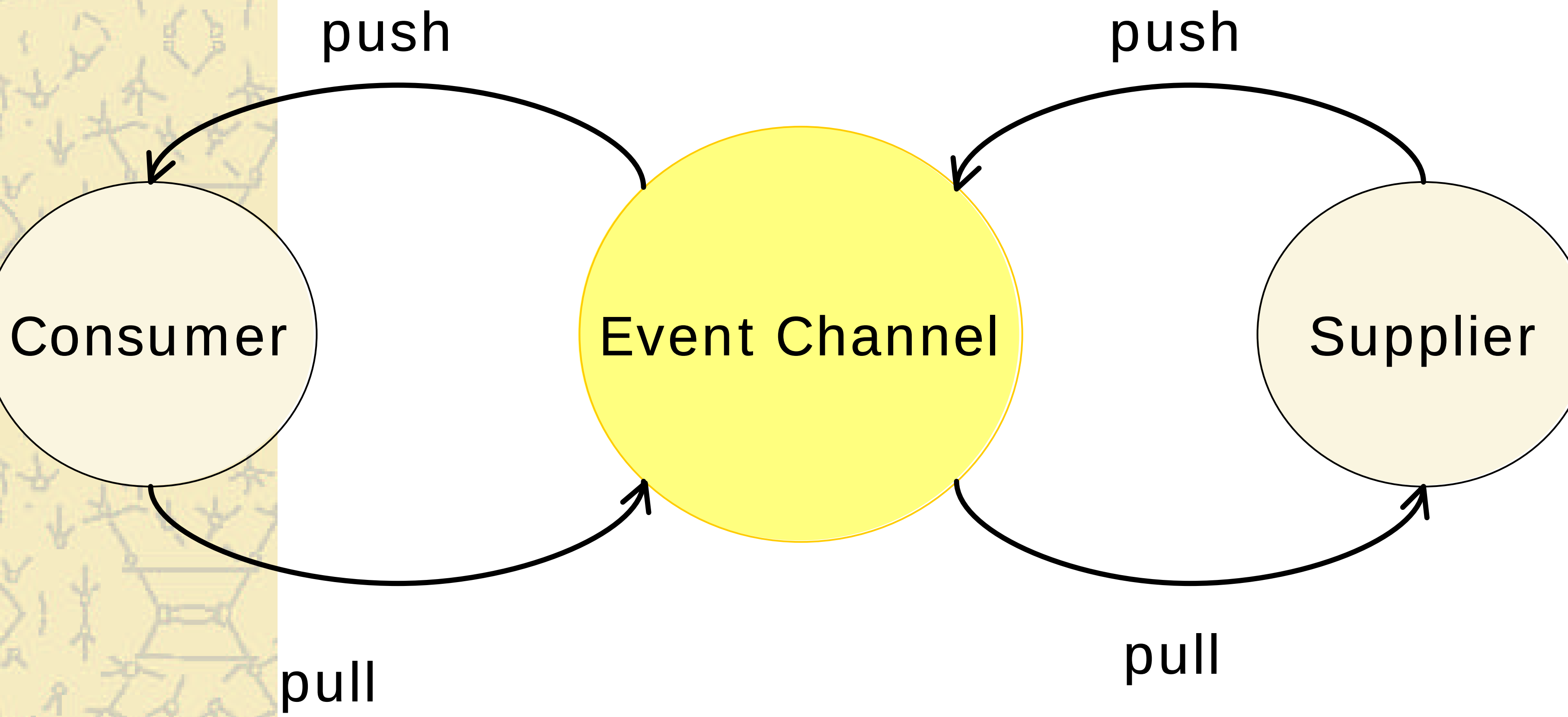
Problems?

- *StockExchange* objects are client-aware: all consumers must be known to supplier
- Solution: Use a middleman between consumer and producer
- Call the middleman „channel“ and consider the push model

Event Channels



Event Channels



A *Channel* Definition

```
interface Channel
    : ::CosEventComm::PushSupplier,
      ::CosEventComm::PushConsumer {
    void register_supplier (
            in ::CosEventComm::PushSupplier supplier);
    void register_consumer (
            in ::CosEventComm::PushConsumer consumer);
};

interface MyConsumer : ::CosEventComm::PushConsumer
{};

interface MySupplier : ::CosEventComm::PushSupplier
{};
```

A *Channel* Definition

- Advantages:
  - Decoupling of communications between *StockExchange* objects and *Subscriber* objects
  - *Subscriber* objects only know the channels they use
  - A single channel can transmit events of multiple suppliers, distributing them transparently to multiple consumers

CORBA Event Channel Interfaces

- Event channel interfaces standardized by OMG
  - Built on top of PushConsumer, PushSupplier, PullConsumer, PullSupplier
  - Usage interfaces (event channel)
  - Management interfaces

Event Channel – Usage Interfaces

```
module CosEventChannelAdmin
{
    exception AlreadyConnected {};
    interface ProxyPushConsumer
         : ::CosEventComm::PushConsumer
     {
           void connect_push_supplier (
              in ::CosEventComm::PushSupplier push_supplier) raises (
                       ::CosEventChannelAdmin::AlreadyConnected);
     };
};
```

Event Channel – Usage Interfaces

```
module CosEventChannelAdmin
{
     exception TypeError{};

     interface ProxyPushSupplier
               : ::CosEventComm::PushSupplier
     {
               void connect_push_consumer (
                    in ::CosEventComm::PushConsumer push_consumer) raises
                              (::CosEventChannelAdmin::AlreadyConnected,
                               ::CosEventChannelAdmin::TypeError);

     };
};
```

Event Channel – Management Interfaces

```
module CosEventChannelAdmin
{
    interface ConsumerAdmin;
    interface SupplierAdmin;
    interface EventChannel
    {
            ::CosEventChannelAdmin::ConsumerAdmin
    for_consumers ( );
            ::CosEventChannelAdmin::SupplierAdmin for_suppliers ( );
            void destroy ( );
    };
};
```

Event Channel – Management Interfaces

```
module CosEventChannelAdmin
{
    interface ConsumerAdmin
    {
            ::CosEventChannelAdmin::ProxyPushSupplier obtain_push_supplier ( );
            ::CosEventChannelAdmin::ProxyPullSupplier obtain_pull_supplier ( );
    };

    interface SupplierAdmin
    {
            ::CosEventChannelAdmin::ProxyPushConsumer obtain_push_consumer (
    );
            ::CosEventChannelAdmin::ProxyPullConsumer obtain_pull_consumer ( );
    };
};
```

StockExchange Event Service, Using *EventChannels*

- Specification of *Subscriber2* and *StockExchange2* can be reused
- Procedure
  - StockExchange2 object receive (magically yet) an object reference of a EventChannelAdmin object
  - Instantiate via

    ```
    EventChannelAdmin->for_suppliers()->
      obtain_push_consumer()
    ```

    ProxyPushConsumer object, which they use to supply events
  - Registration via **`connect_push_supplier()`**

StockExchange Event Service, Using *EventChannels*

- Procedure
  - *Subscriber2* object receive (magically yet) an object reference of an *EventChannelAdmin* object
  - Instantiate via

    ```
    EventChannelAdmin->for_consumers()
    ->obtain_push_supplier()
    ```

    a *ProxyPushSupplier* object, from which they will receive events
  - Register there using **`connect_push_consumer(...)`**

Results so far

- Usage of standardized interfaces for middleman objects of the StockExchange service
  - Simple administration and usage
  - Decoupled communication between supplier and consumer
- Open issues:
  - How to obtain object reference for an EventChannel?
  - Answer:

```
CORBA::Object_var obj = orb->resolve_initial_references("EventService");
CosEventChannelAdmin::EventChannel::_narrow(obj);
```

  - Problem: this only allows for a single channel shared by all producers and consumers

Further Concepts

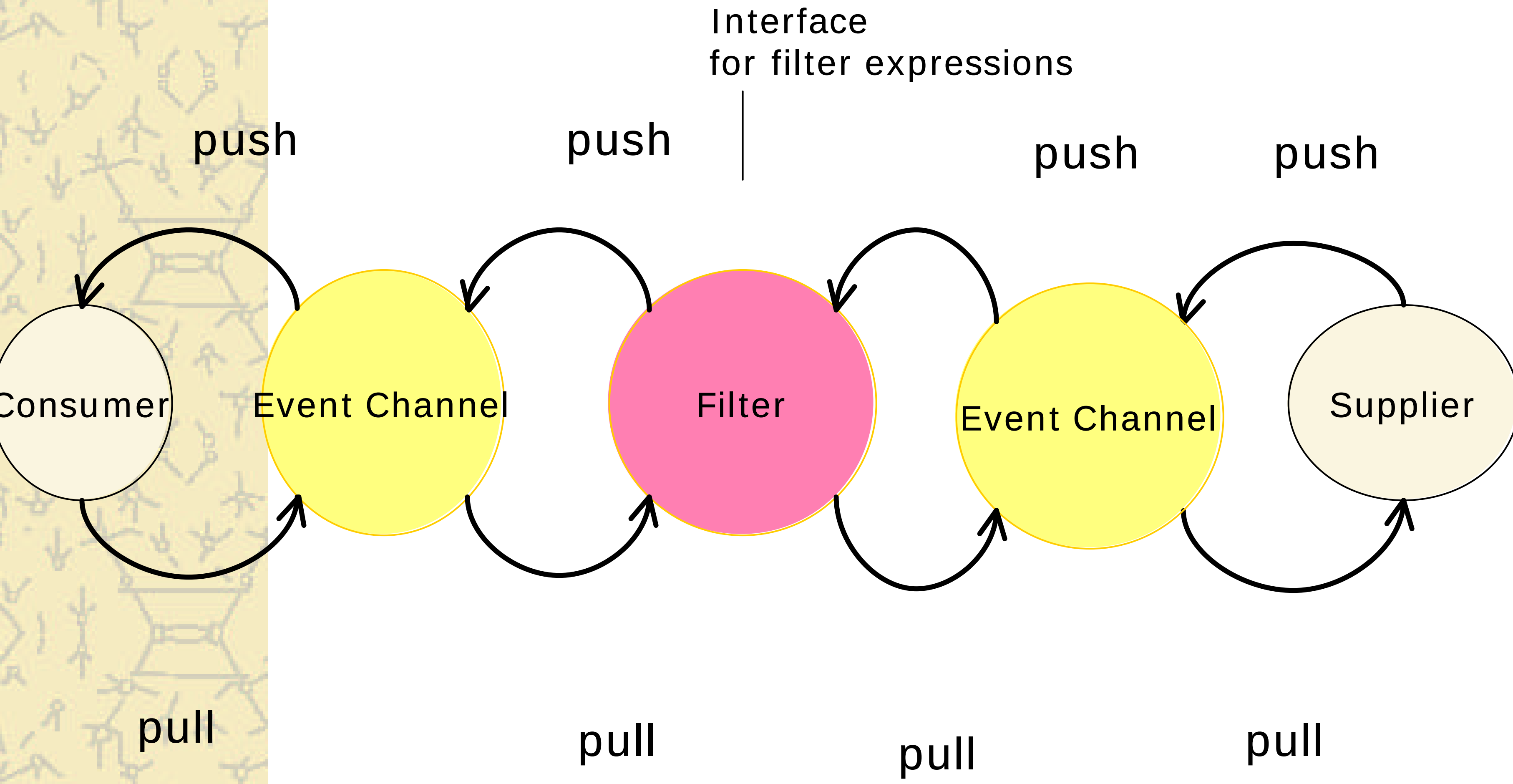
- EventChannel factories
  - Objects able to create EventChannel object
    - For EventChannels NOT standardized
    - Proprietary solutions (e.g. ORBacus)

```
interface EventChannelFactory {
   CosEventChannelAdmin::EventChannel
        create_channel(in ChannelId id);
   CosEventChannelAdmin::EventChannel
        get_channel_by_id(in ChannelId id);
   ChannelIdSeq get_channels();
   void shutdown();
};
```

Further Concepts

- Event filters
  - Usable in stock exchange service
    - Subscriber may only be be interested in specific stocks
    - Stop-loss: subscriber may be interested only if the rate is below a certain value
    - Stop-bye: subscriber is interested only in rates above a certain value
- Can be implemented as middleman between channels with additional interfaces to install filters

Further Concepts



Further Concepts

- Quality of service for event transmission
  - Event validity/timeout
  - Delay of events
  - Guarantee of delivery
- Canonical extension of the Event Service with these concepts is the Notification Service
  - OMG standard
  - Compatible with Event Service through inheritance