The MINSTREL Push System

Manfred Hauswirth
Distributed Systems Group
Technical University of Vienna

© Manfred Hauswirth, 2001

Overview

+ The OpeNlix EU project
+ Introduction to push systems
  - Main concepts
  - Push systems vs. other DS paradigms
+ Minstrel in detail
  - Architecture
  - Hybrid broadcasting
  - Implementation

© Manfred Hauswirth, 2001 Slide 2/41

The OpeNlix Project

+ Open Personalized Electronic Information Commerce System
+ Funded by the European Union in the Information Society Technologies Program

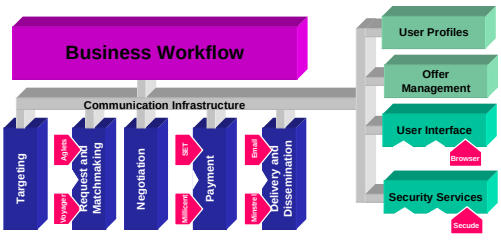
© Manfred Hauswirth, 2001 Slide 3/41

OpeNlix - The Goal

+ Enable enterprises to produce, sell, deliver, and manage highly personalized contents and services over the Internet
  - Describe information offers and requests (BOL)
  - Find matches between offers and requests (+ profiles)
  - Timely delivery (push system)
  - Flexible and secure (micro-/macro-) payments
  - Authentication, non-repudiation, copyright
  - Mediation (super-distribution) and brokering
  - Flexible business models

© Manfred Hauswirth, 2001 Slide 4/41

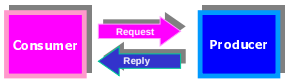
The OpeNlix Architecture



© Manfred Hauswirth, 2001 Slide 5/41

Meanwhile on the Internet ...

+ Unskilled users: Internet = WWW + Email
+ Quality of information found/retrieved proportional to knowledge/skills
+ On-demand, user-initiated interaction
+ Information passively waits for users
+ Portals + E-Shops



© Manfred Hauswirth, 2001 Slide 6/41

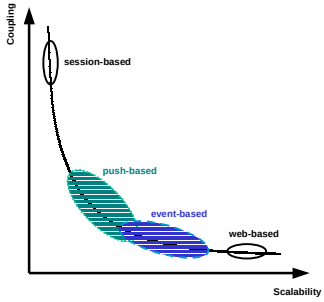
A push towards the Future

+ Users
  – select among information channels
  – subscribe to some channels
+ Pull ⇨ push
+ New interaction pattern: push/pull mix

Communication Models

	Client-Server		Peer-to-Peer	
	Session-based	Web-based	Event-based	Push-based
Coupling	tight	loose	very loose	medium
Number of Clients	moderate (1000)	high (1,000,000)	many (100,000)	many (100,000)
Number of Servers	few (10)	many (100,000)	many (100,000)	few (100)

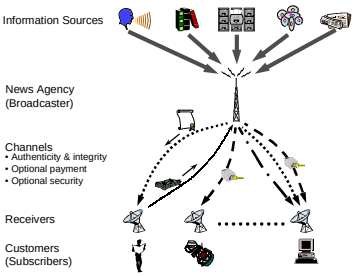
Coupling vs. Scalability



Push Systems vs. Event-based Systems

	Push Systems	Event-based Systems
Purpose	timely data distribution	event notification
Participant roles	asymmetric	symmetric
Advertisement policy	simple advertisement (channel)	expressive advertisement language
Subscription policy	simple subscription (channel)	expressive subscription language
Frequency of events	low to medium	high
Number of events	low to medium	high
Payload size	large	small
P/C interconnection	static channels & static producers	dynamic binding to producers
Event grouping	channel	event patterns
Filtering	reduce data transmission req.	reduce number of events

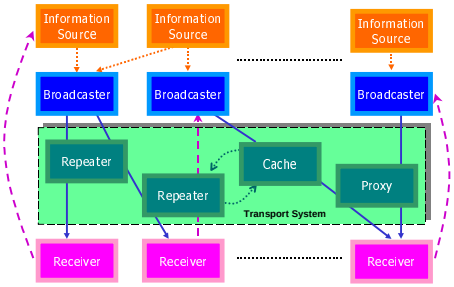
A sample Scenario: News Agency



Some more sample Applications

+ Intra-company employee information system
+ Electronic maintenance manual
+ Stock ticker system
+ News agency information system
+ Software distribution
+ Electronic classroom

Push System Component Model



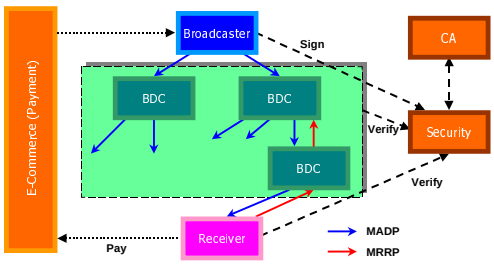
© Manfred Hauswirth, 2001 Slide 13/41 MINSTREL TU

Minstrel's Challenges

+ Actively disseminate information to a large number of users
  - Active push distribution
  - Scalability (users, network bandwidth)
    - Off-line receivers
    - Distribution algorithm (network/server load)
    - Caching Infrastructure
    - Publication of available Channels
  - Authenticity and integrity of information
  - Payment methods and business models
  - Static and executable content (security !)

© Manfred Hauswirth, 2001 Slide 14/41 MINSTREL TU

Minstrel Architecture



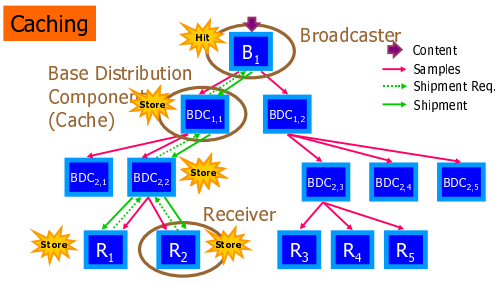
© Manfred Hauswirth, 2001 Slide 15/41 MINSTREL TU

Broadcasting Strategies

+ Multicast
  - limited access
+ Client pull
  - scales well
  - frequency vs. coherence
+ Server push
  - directory of subscribers
  - scalability?
+ Hybrid approaches
  - push/pull mix

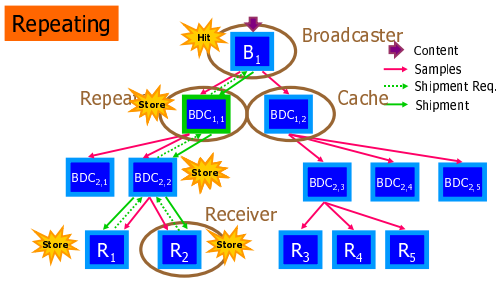
© Manfred Hauswirth, 2001 Slide 16/41 MINSTREL TU

Minstrel Hybrid Broadcasting (1)



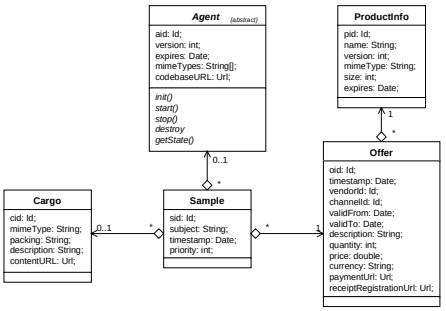
© Manfred Hauswirth, 2001 Slide 17/41 MINSTREL TU

Minstrel Hybrid Broadcasting (2)

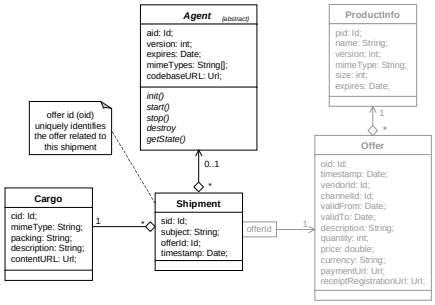


© Manfred Hauswirth, 2001 Slide 18/41 MINSTREL TU

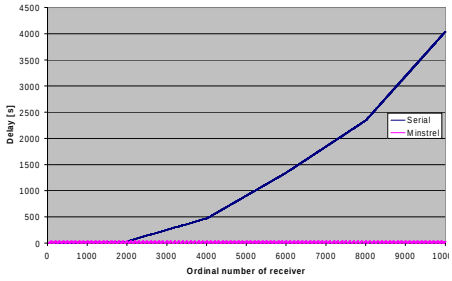
What's in a Sample?



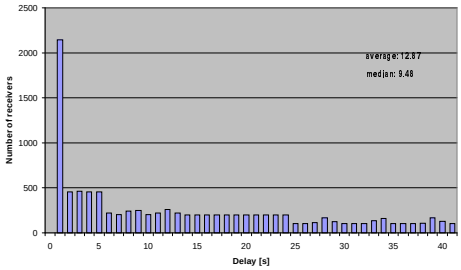
What's in a Shipment?



Delay: Minstrel vs. Serial



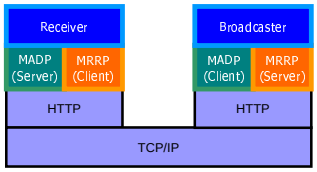
Distribution of Delays



Broadcasting: Key Technologies

+ XML messages over HTTP
  - Off-the-shelf web server
  - Java servlets (light-weight servlet engine for clients)
  - Off-the-shelf XML Parser
+ Intelligent message scheduling
+ Persistent Document Object Model (PDOM) database (XML documents)

Protocol Stack



Communication Security

+ Samples & shipments are digitally signed
  - no message tampering
  - no masquerading
  - no replaying (timestamps)
+ All communication can be encrypted (SSL)
  - no wiretapping
  - confidentiality

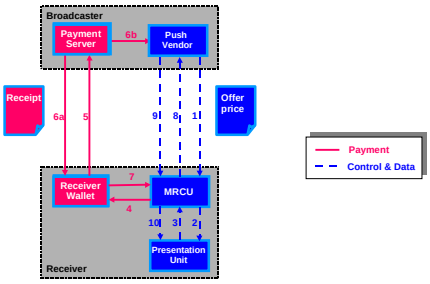
Executable Content

+ Java Secure Execution Framework (JSEF)
  - Beyond Java's security model
  - Additive and subtractive permissions
  - Hierarchical user groups
  - Global and local policy
  - Interactive security negotiation
  - XML-based configuration

Payment

+ Micro-/Macro-Payment
+ Payment methods are defined by the offers
+ Payment business models are defined by the offers
  - pay-per-view, flat fee, time-based, etc.
  - before/after delivery
+ Must rely on existing payment systems

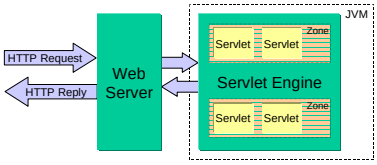
Minstrel's Payment Model



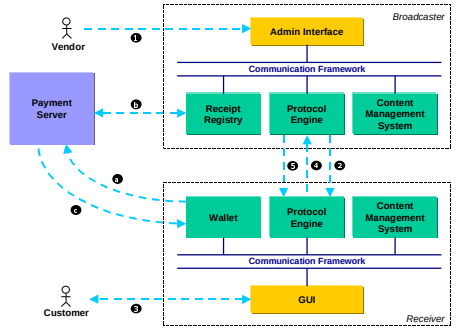
Implementation

+ Alpha version of Minstrel v2
  - Client- and server-side protocol engines
  - MADP/MRRP: XML via HTTP
  - Servlet-based (light-weight servlet engine for clients)
  - Client GUI (Swing) + light-weight component framework
  - Pay-per-view business model + Millicent payment

Servlets

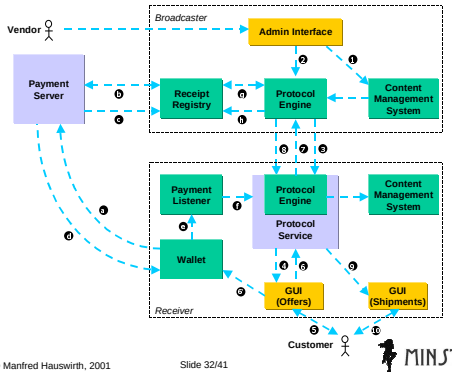


Minstrel Architecture revisited



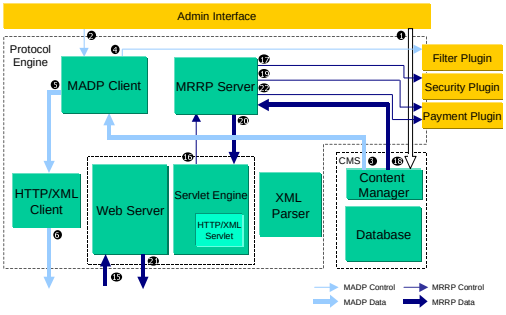
© Manfred Hauswirth, 2001 Slide 31/41 MINSTREL TU

A detailed Interaction



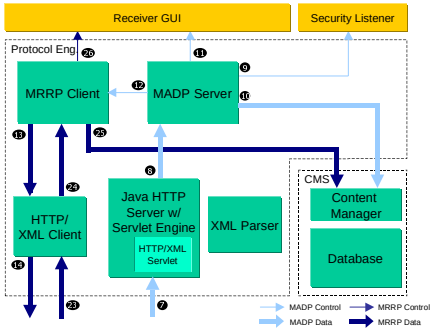
© Manfred Hauswirth, 2001 Slide 32/41 MINSTREL TU

Broadcaster: Control/Data Flow



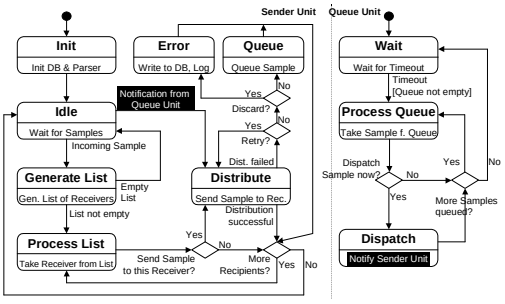
© Manfred Hauswirth, 2001 Slide 33/41 MINSTREL TU

Receiver : Control/Data Flow



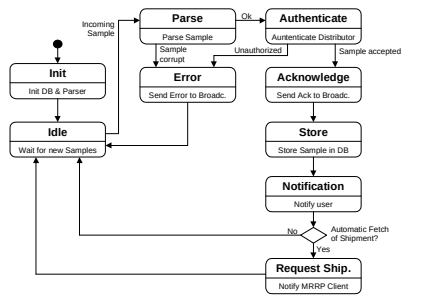
© Manfred Hauswirth, 2001 Slide 34/41 MINSTREL TU

MADP Client Activity Diagram



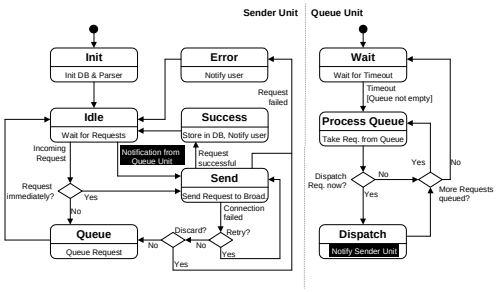
© Manfred Hauswirth, 2001 Slide 35/41 MINSTREL TU

MADP Server Activity Diagram

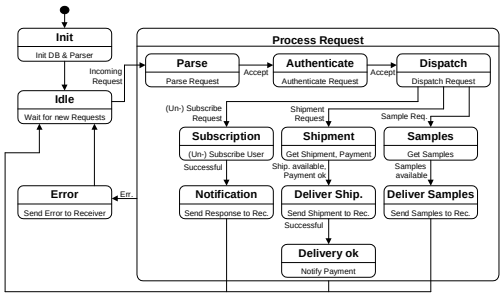


© Manfred Hauswirth, 2001 Slide 36/41 MINSTREL TU

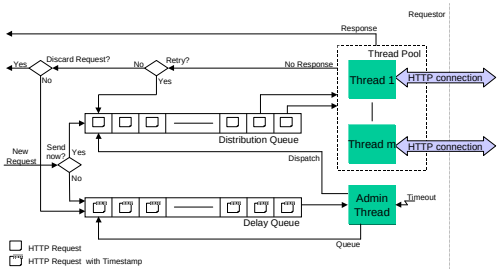
MRRP Client Activity Diagram



MRRP Server Activity Diagram



Multithreaded HTTP Client



Ongoing Work

- Port servlets to servlet specification v2.2 (currently v2.0) - v2.3 already on the way (Tomcat)
- Minstrel CMS
- Unified (web-based) administration and configuration
- Base Distribution Component
- Papers on Minstrel

Questions ?