Mashups, SaaS, and Cloud Computing: Evolutions and Revolutions in the Integration Landscape

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Based on tutorial at ICDE'09 with:

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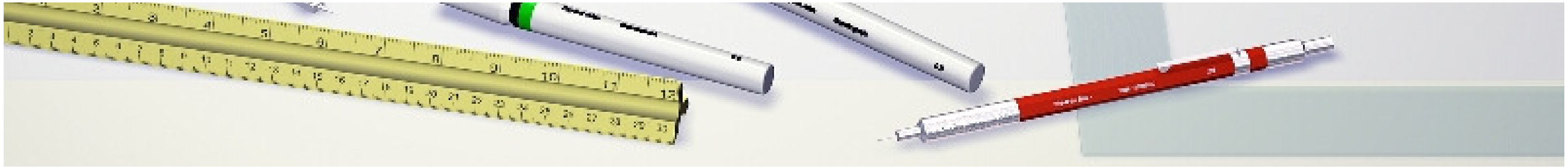
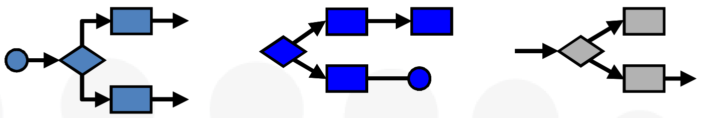


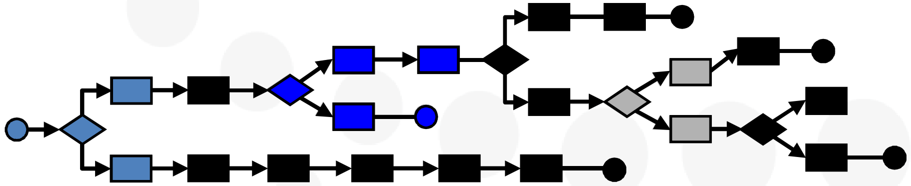
Agenda

- Issues and Solutions in Data and Application Integration
- SOA and Service Composition
- Mashups
- Integration, Mashups, and Cloud Computing

Integration/composition is key to operations improvement and monitoring

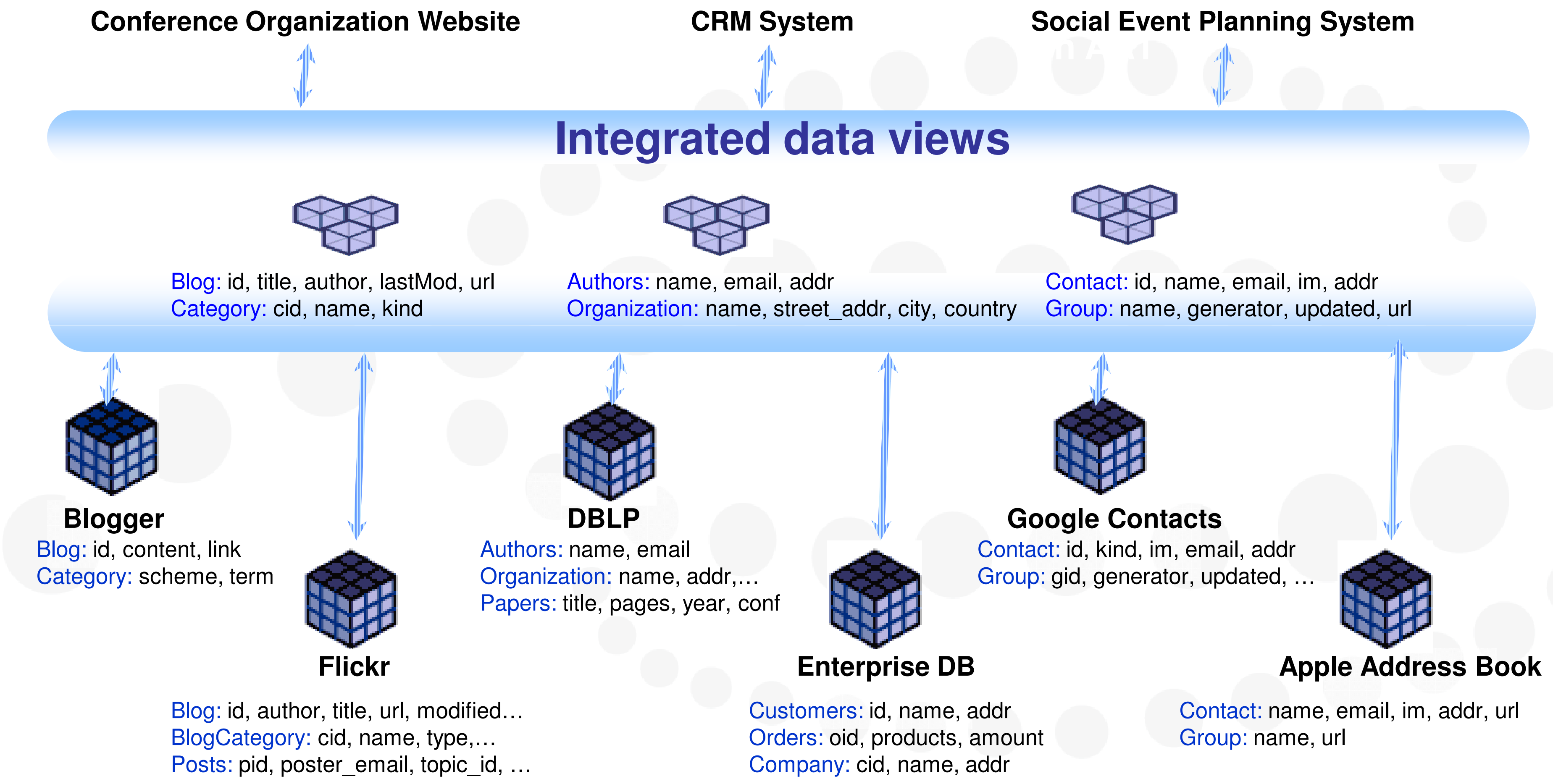
Silos of data sources and applications (before integration, no global view)





Integrated systems: global view (important for cost reduction, global visibility, and increased productivity)

Example 1: Enterprise Information Integration (EII)



Conference Organization Website

CRM System

Social Event Planning System

Integrated data views

Blog: id, title, author, lastMod, url
Category: cid, name, kind

Authors: name, email, addr
Organization: name, street_addr, city, country

Contact: id, name, email, im, addr
Group: name, generator, updated, url

Blogger
Blog: id, content, link
Category: scheme, term

Flickr
Blog: id, author, title, url, modified…
BlogCategory: cid, name, type,…
Posts: pid, poster_email, topic_id, …

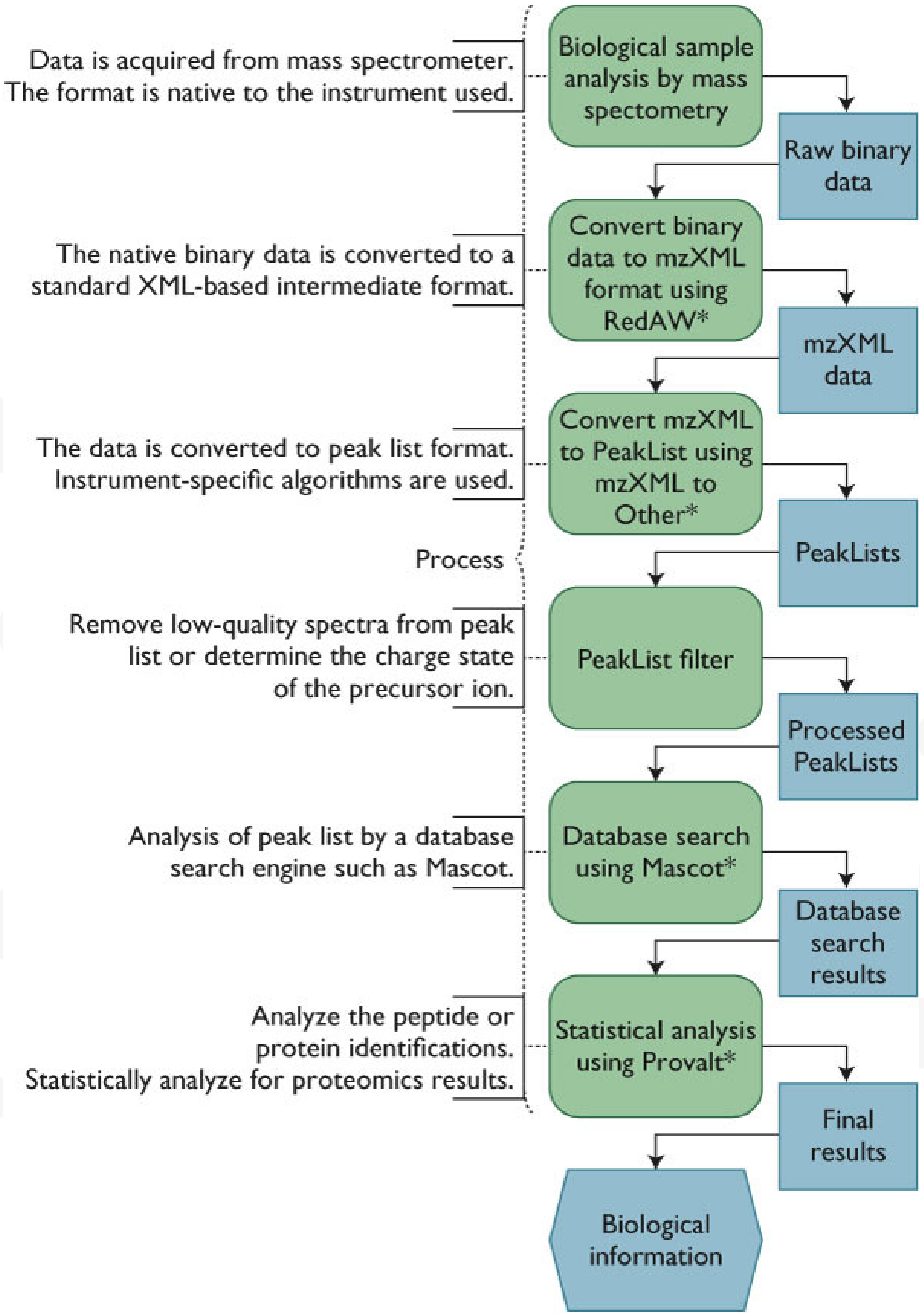
DBLP
Authors: name, email
Organization: name, addr,…
Papers: title, pages, year, conf

Enterprise DB
Customers: id, name, addr
Orders: oid, products, amount
Company: cid, name, addr

Google Contacts
Contact: id, kind, im, email, addr
Group: gid, generator, updated, …

Apple Address Book
Contact: name, email, im, addr, url
Group: name, url

Example 2: Scientific processes



Data is acquired from mass spectrometer. The format is native to the instrument used.

The native binary data is converted to a standard XML-based intermediate format.

The data is converted to peak list format. Instrument-specific algorithms are used.

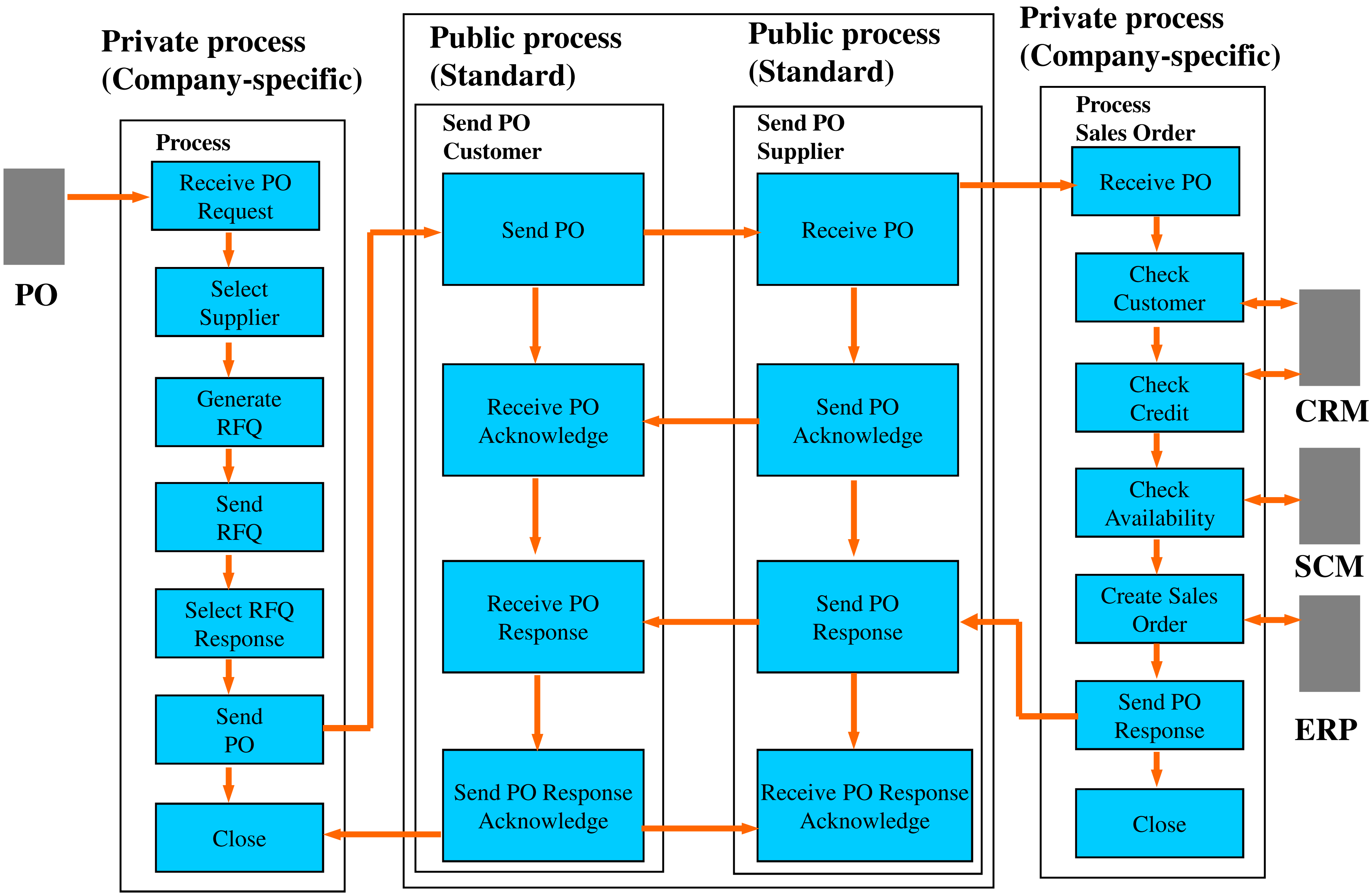
Remove low-quality spectra from peak list or determine the charge state of the precursor ion.

Analysis of peak list by a database search engine such as Mascot.

Analyze the peptide or protein identifications. Statistically analyze for proteomics results.

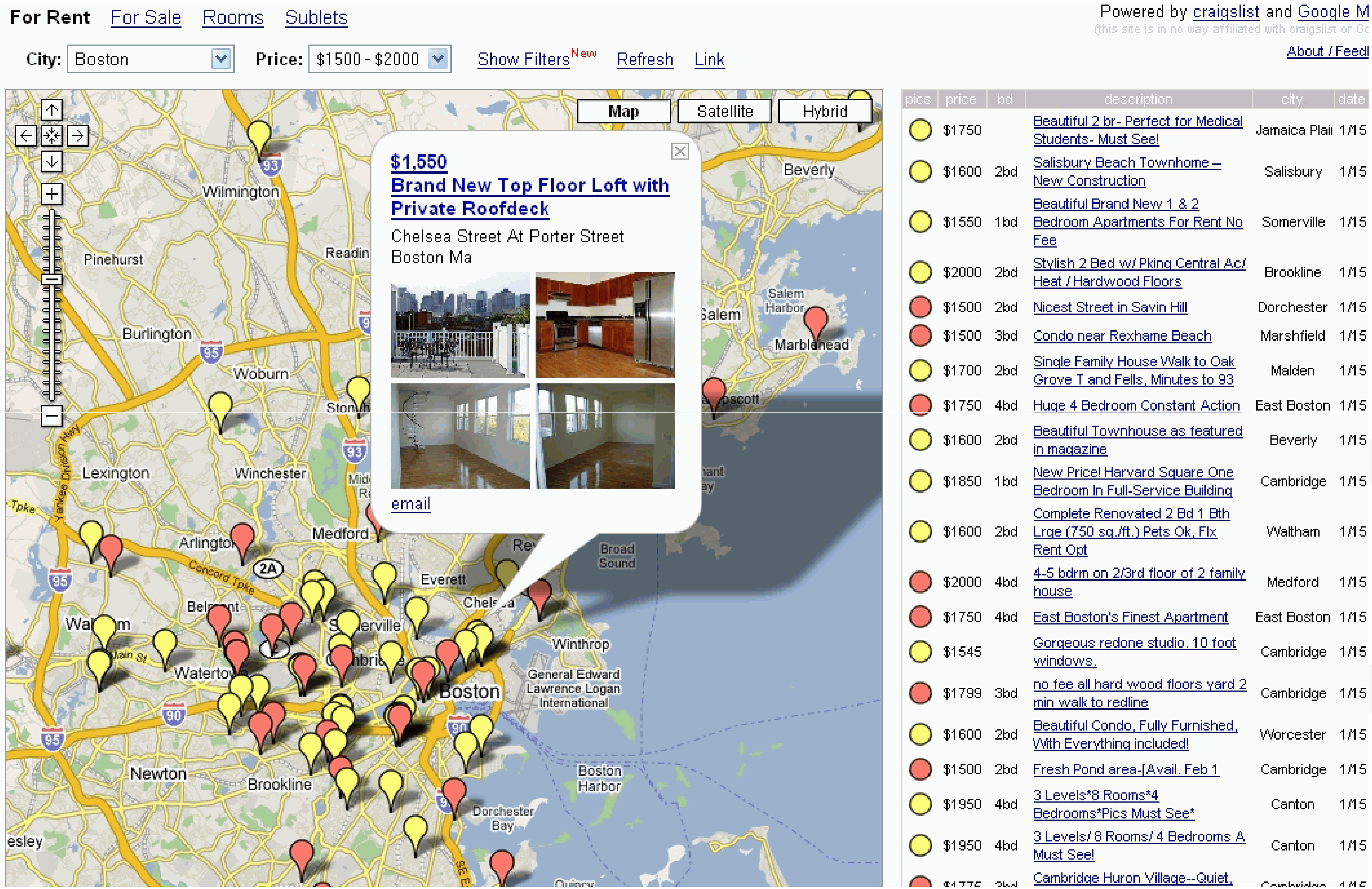
Process
Biological sample analysis by mass spectometry
Raw binary data
Convert binary data to mzXML format using RedAW*
mzXML data
Convert mzXML to PeakList using mzXML to Other*
PeakLists
PeakList filter
Processed PeakLists
Database search using Mascot*
Database search results
Statistical analysis using Provalt*
Final results
Biological information

Example 3: B2B Integration



(Source: e-business Architectures and Standards, Anil L. Nori, Tutorial, VLDB'2002, HongKong, China)

Example 4: Mashup (more on mashup later)



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City: Boston Price: $1500 - $2000 Show Filters New Refresh Link

About / Feedl

$1,550
Brand New Top Floor Loft with Private Roofdeck
Chelsea Street At Porter Street
Boston Ma
email

pics	price	bd	description	city	date
🟡	$1750		Beautiful 2 br- Perfect for Medical Students- Must See!	Jamaica Plai	1/15
🟡	$1600	2bd	Salisbury Beach Townhome – New Construction	Salisbury	1/15
🟡	$1550	1bd	Beautiful Brand New 1 & 2 Bedroom Apartments For Rent No Fee	Somerville	1/15
🟡	$2000	2bd	Stylish 2 Bed w/ Pking Central Ac/ Heat / Hardwood Floors	Brookline	1/15
🔴	$1500	2bd	Nicest Street in Savin Hill	Dorchester	1/15
🔴	$1500	3bd	Condo near Rexhame Beach	Marshfield	1/15
🟡	$1700	2bd	Single Family House Walk to Oak Grove T and Fells, Minutes to 93	Malden	1/15
🔴	$1750	4bd	Huge 4 Bedroom Constant Action	East Boston	1/15
🟡	$1600	2bd	Beautiful Townhouse as featured in magazine	Beverly	1/15
🟡	$1850	1bd	New Price! Harvard Square One Bedroom In Full-Service Building	Cambridge	1/15
🟡	$1600	2bd	Complete Renovated 2 Bd 1 Bth Lrge (750 sq./ft.) Pets Ok, Flx Rent Opt	Waltham	1/15
🔴	$2000	4bd	4-5 bdrm on 2/3rd floor of 2 family house	Medford	1/15
🔴	$1750	4bd	East Boston's Finest Apartment	East Boston	1/15
🟡	$1545		Gorgeous redone studio. 10 foot windows.	Cambridge	1/15
🔴	$1799	3bd	no fee all hard wood floors yard 2 min walk to redline	Cambridge	1/15
🟡	$1600	2bd	Beautiful Condo, Fully Furnished, With Everything included!	Worcester	1/15
🔴	$1500	2bd	Fresh Pond area-[Avail. Feb 1	Cambridge	1/15
🟡	$1950	4bd	3 Levels*8 Rooms*4 Bedrooms*Pics Must See*	Canton	1/15
🟡	$1950	4bd	3 Levels/ 8 Rooms/ 4 Bedrooms A Must See!	Canton	1/15
🔴	$1775	3bd	Cambridge Huron Village--Quiet,	Cambridge	1/15

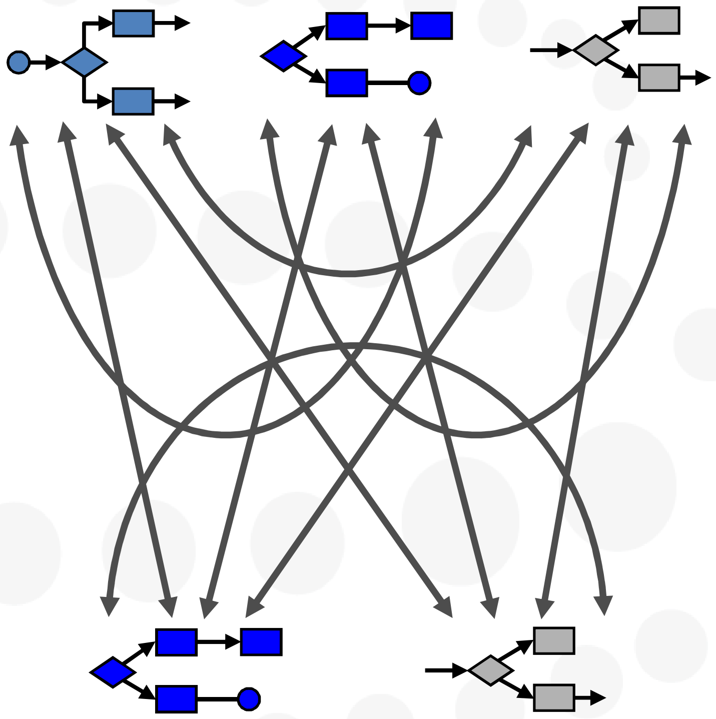
Development of Composite Applications

(In practice)

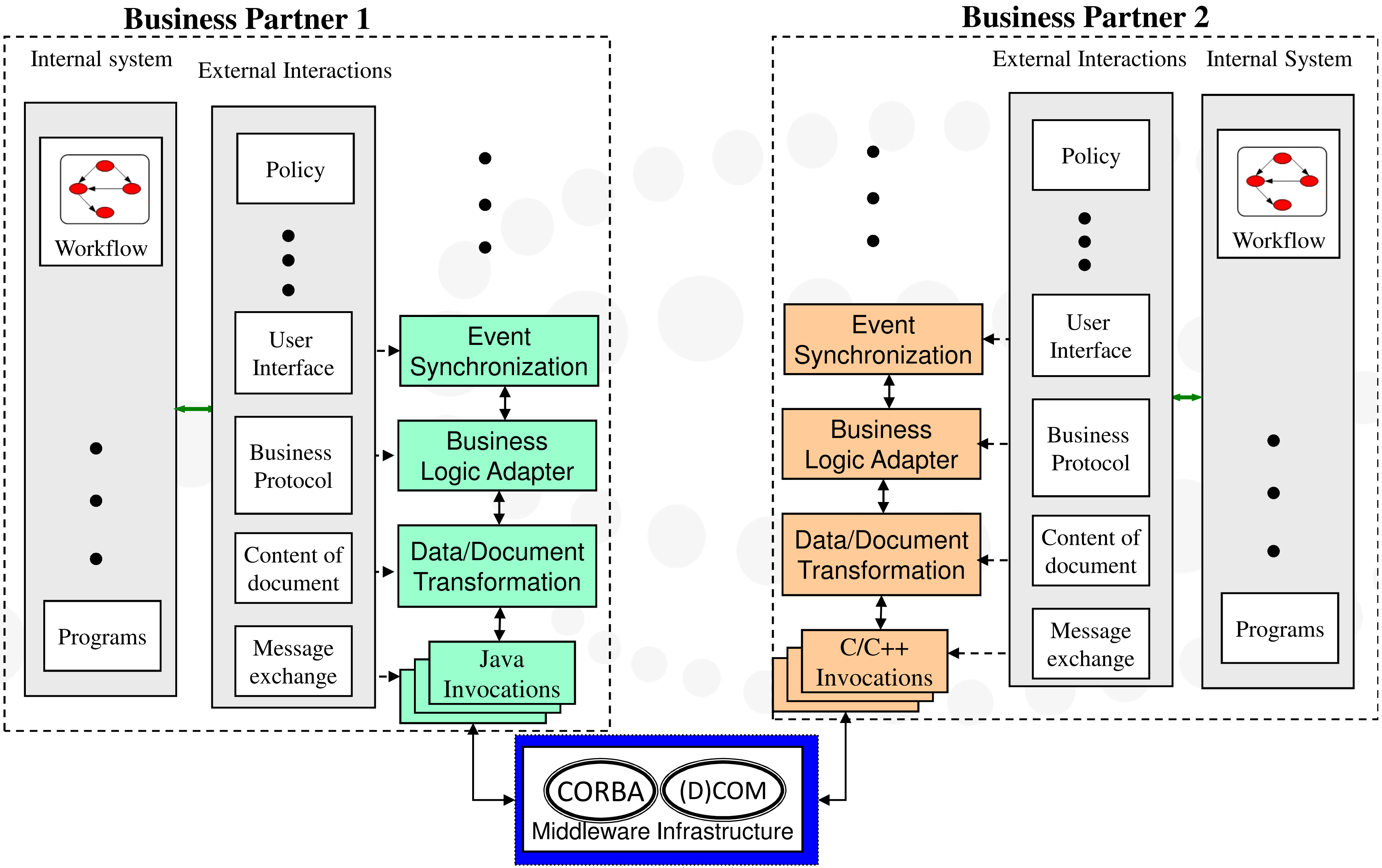
- Applications and data sources are autonomously developed and deployed

- Proprietary technologies (communication protocols, data formats, business and presentation logic)

- Costly development and maintenance of integrated systems **especially in large and dynamic environments**



Interoperability Layers



Communication Layer

- Exchange of messages among partners
  - Transport binding, communication modes such as asynchronous/ synchronous
  - Partners must understand messages (agree on the formats)
  - Message exchanges must be done in a secure way
  - Message exchanges must be done in a reliable manner
- Partners use different protocols (or even proprietary protocols)
  - Internet messaging (e.g., HTTP, SOAP), messaging middleware (e.g., IBM's MQSeries), EDI VANs, remote application services (Java RMI, CORBA IIOP), ...
- Interoperability objective
  - independence from transport protocols
- Interoperability solutions
  - Translate messages between heterogeneous protocols
- Examples of solutions
  - Message broker/server, message transformer

Enterprise Application Integration

- Typically rely on distributed object frameworks such as CORBA, DCOM, EJB and other state of the art technologies such as database gateways and transaction monitors
- Separation between applications and infrastructure services (e.g., persistence management, security management, transaction management, trading, event, naming services)
- EAI suites provide pre-built data and application integration facilities (e.g., application adapters, data transformations, and messaging services)

EAI (Enterprise Application Integration)

- Typically rely on distributed object frameworks such as CORBA, DCOM, EJB and other state of the art technologies such as database gateways and transaction monitors
- Developers focus on component specification and logic (e.g., using CORBA IDL, programs), they do not need to know where remote objects are located, in which languages they are implemented, how they communicate, etc.
- Emphasis more on platforms integration: wrapping heterogeneous systems, routing requests, remote operation invocation
- Common API layer: business objects are wrapped with explicit interfaces, they communicate by making remote calls directly to their peers
- Data, process, presentation level heterogeneities are worked out offline/mostly manual (some tool support exist)

Content Layer: Message structure and semantics

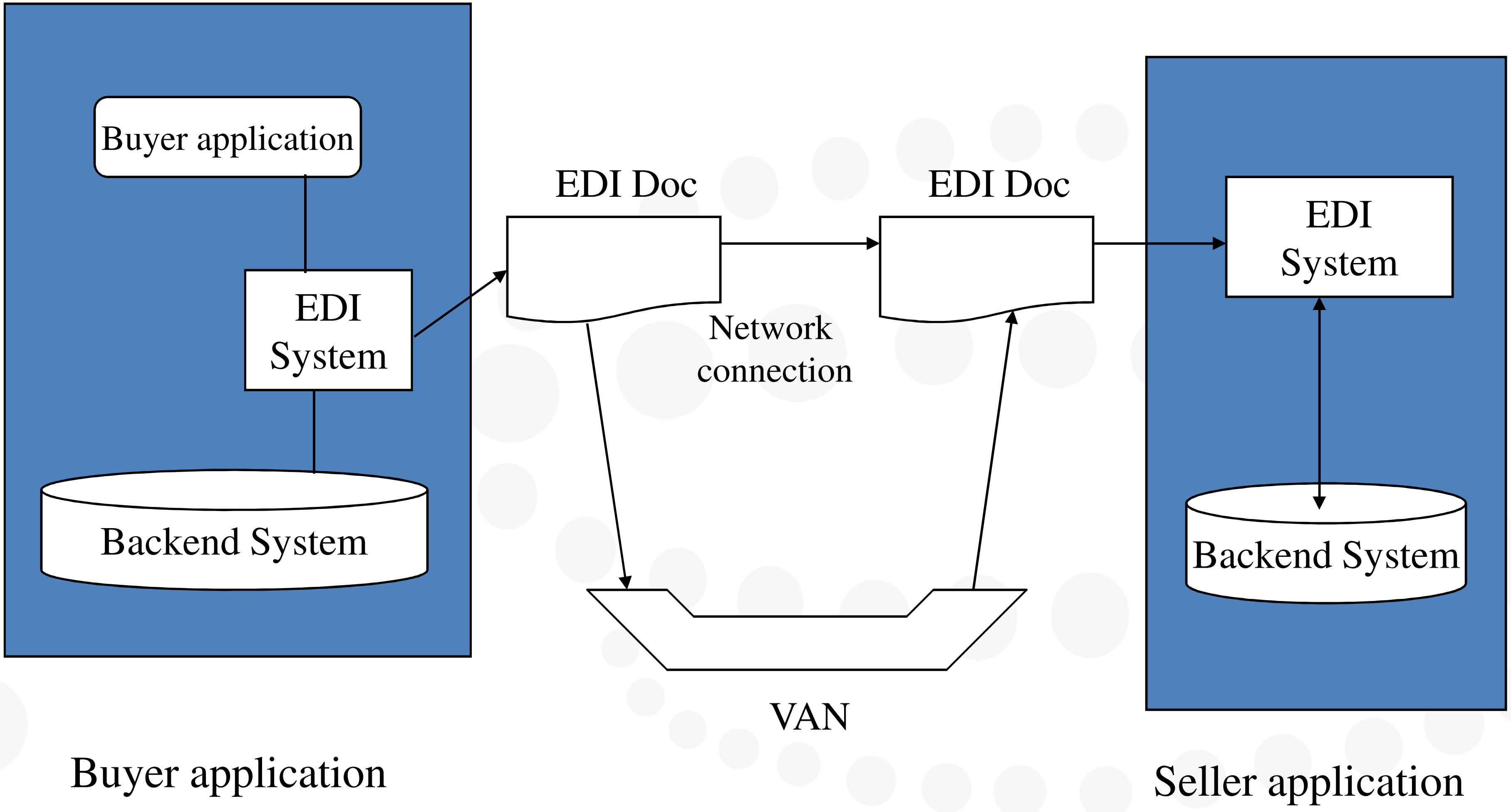
- Partners must understand the structure and semantics of messages

- E.g., does a document represents a purchase order? A request for quote? A production description?

- Structures (e.g., different structures for a purchase order), services may provide same functionality but with different operation structures (e.g., different names, different signatures)

- Semantics: Does a service provides a required functionality? does *Price* means *Price* including *tax*?

Electronic Data Interchange

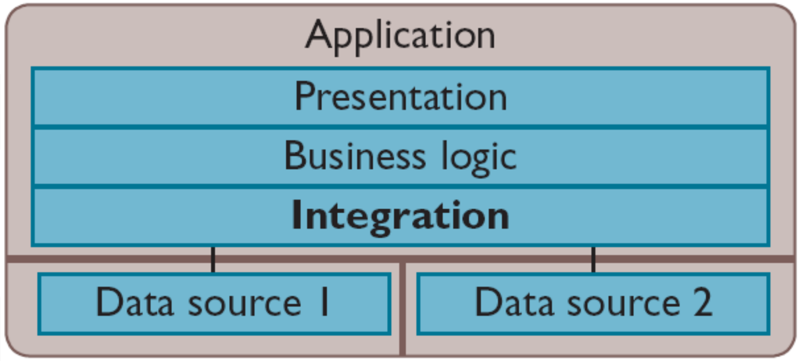


Data integration solutions

Integrated access to:

Multiple data sources/

data flow



- Data integration approaches: EII (virtual data views), ETL/data flows (e.g., scientific processes/process data warehouse)

- Presentation logic is ad-hoc, and in hybrid applications, the application logic is ad-doc

Data Integration (state of the art)

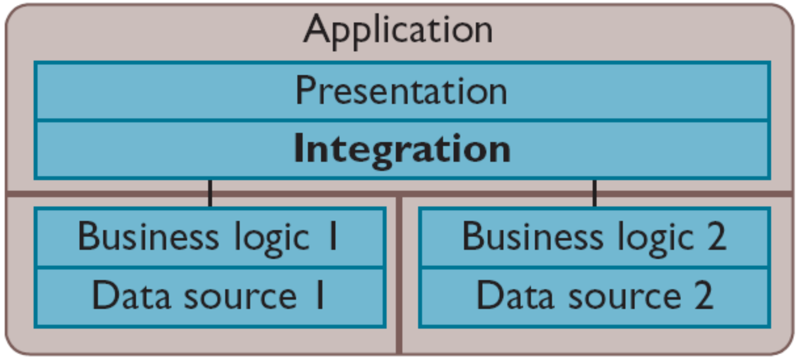
- Wrappers (uniform access to heterogeneous sources)
- Schema matching (e.g., linguistic / structural / ontology analysis to identify elements similarity)
- Data Transformation languages (e.g., XSLT, XQuery)
- Models Management (recent work in the DB community)
- Data flow languages (ETL, scientific workflows)
- Good progress, but more work is needed on usability and consolidation

Business process Layer

- Semantics of interactions (joint business process)
- Partners must agree on the choreography of interactions and meaning of messages
- E.g, steps (send order, process order, deliver product), deals (a purchase is refundable after 2 days)
- Semantics of interactions must be well defined, such that there is no ambiguity as to:
  - What a message may mean? What actions are allowed? What responses are expected?
- For example, if a company A requires an acknowledgement of purchase orders from its partners, then partner processes must have a corresponding activity

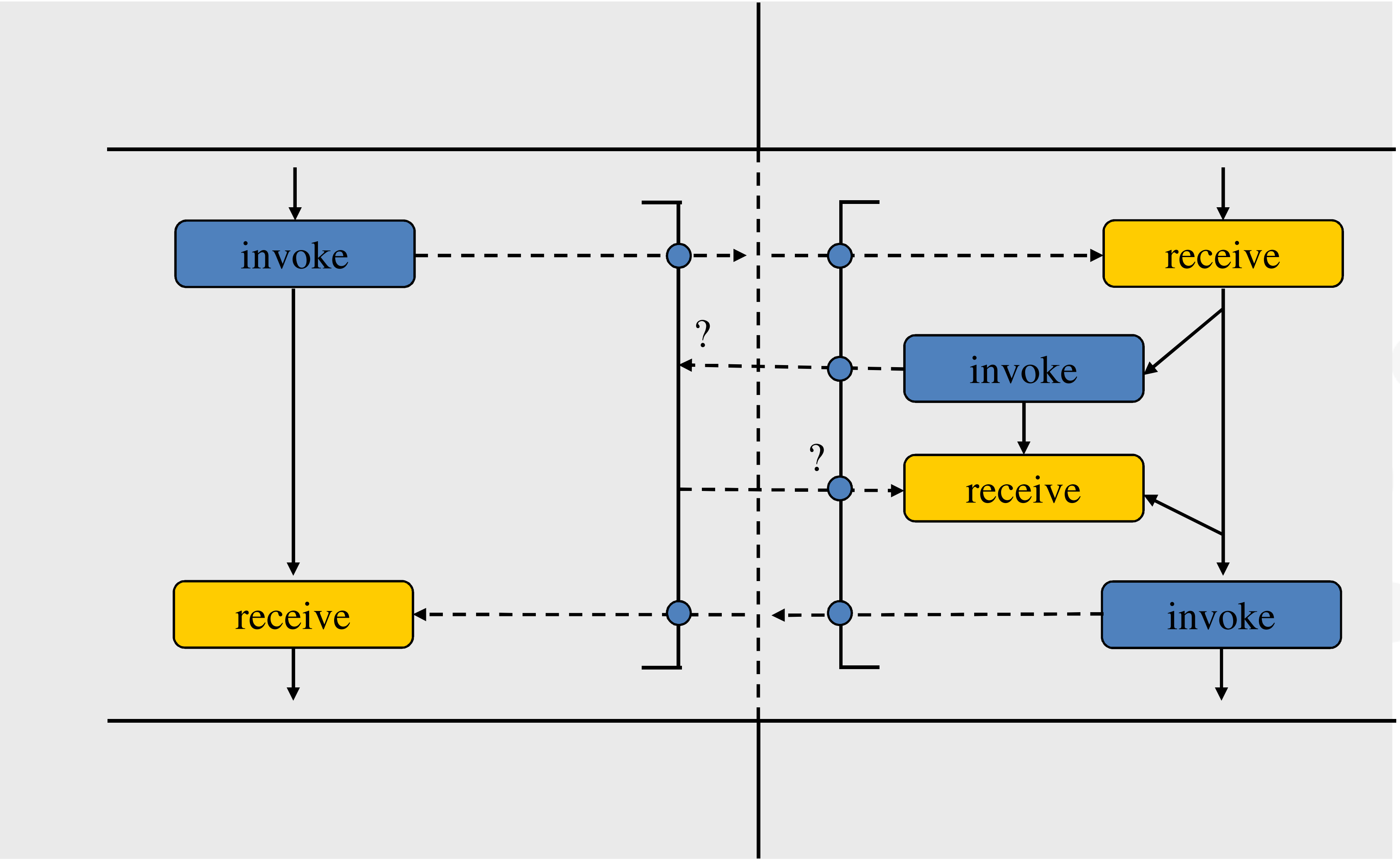
Process/application integration

Composition/coordination



- **Integration approaches:** EAI/Workflow, SOA/BPEL
- Presentation logic is ad-hoc

Business Process Layer (Cont.)



Business Process Layer (cont.)

- Interoperability at this layer requires the understanding of the behavior of partner public processes (called external conversations, business protocols)
- Traditional EAI middleware
  - component interface describes *very little semantics* (e.g., message formats)
  - *business process is usually agreed upon off-line*.
- *Automation requires rich interface description models but a balance between expression power and simplicity is important for the success of the technology (expressive: useful and usable)*

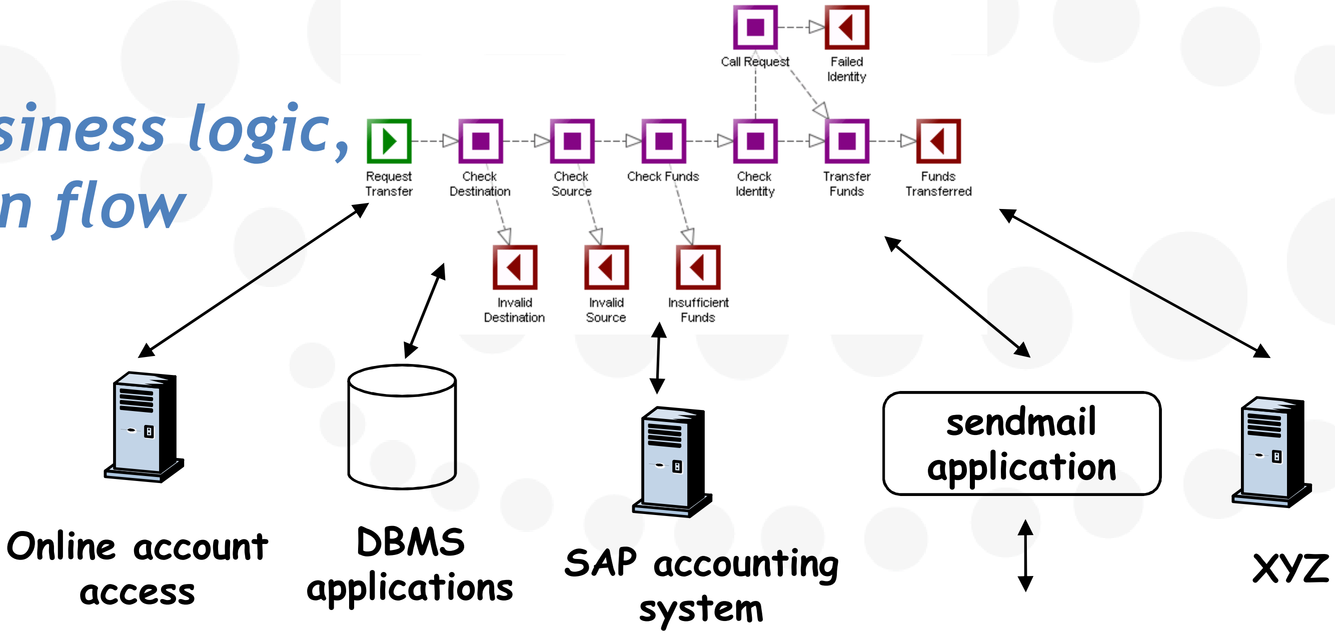
Effective interface description should cater for:

- Making *implicit information* (as in closed environments) *explicit* (essential in autonomous environments)
- *Messages order* (e.g., buy after login)
- Transactional implications (e.g., can I cancel a purchase?, if yes at what cost)
- *Temporal aspects* (e.g, can I cancel a purchase any time? After a fixed time period?)
- *Security* (will the results be digitally signed?)
- *Privacy* (How do you know if partners have compatible policies?)
- *Quality of service* (e.g., performance/reliability)
- *Exception Handling* (e.g., support for transaction protocols)

Workflow Management Systems

- Information
- Flow
- Resources
- Organization

Automate business logic, information flow



Online account access

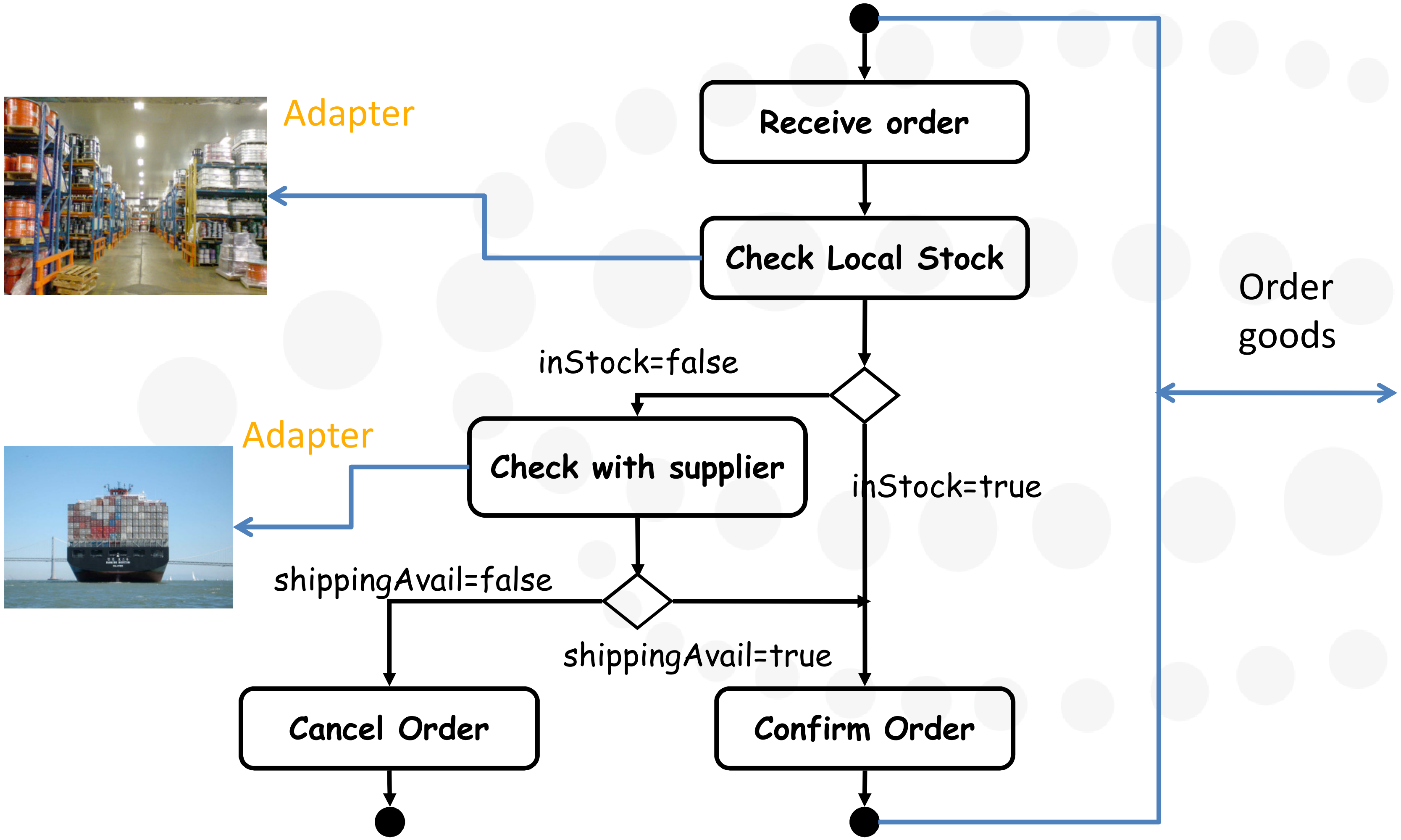
DBMS applications

SAP accounting system

sendmail application

XYZ

Control flow



Adapter

Receive order

Check Local Stock

Order goods

inStock=false

inStock=true

Adapter

Check with supplier

shippingAvail=false

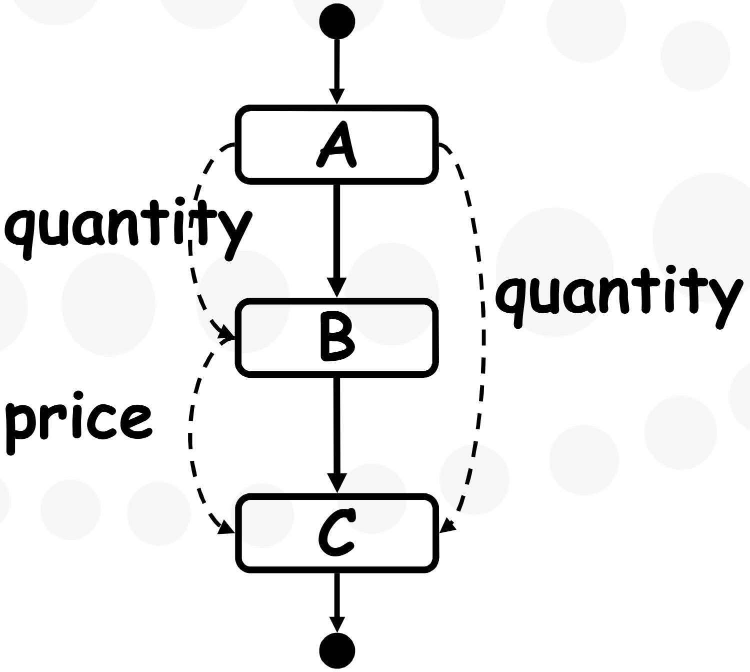
shippingAvail=true

Cancel Order

Confirm Order

Data Transfer among Components

- Blackboard vs data flow

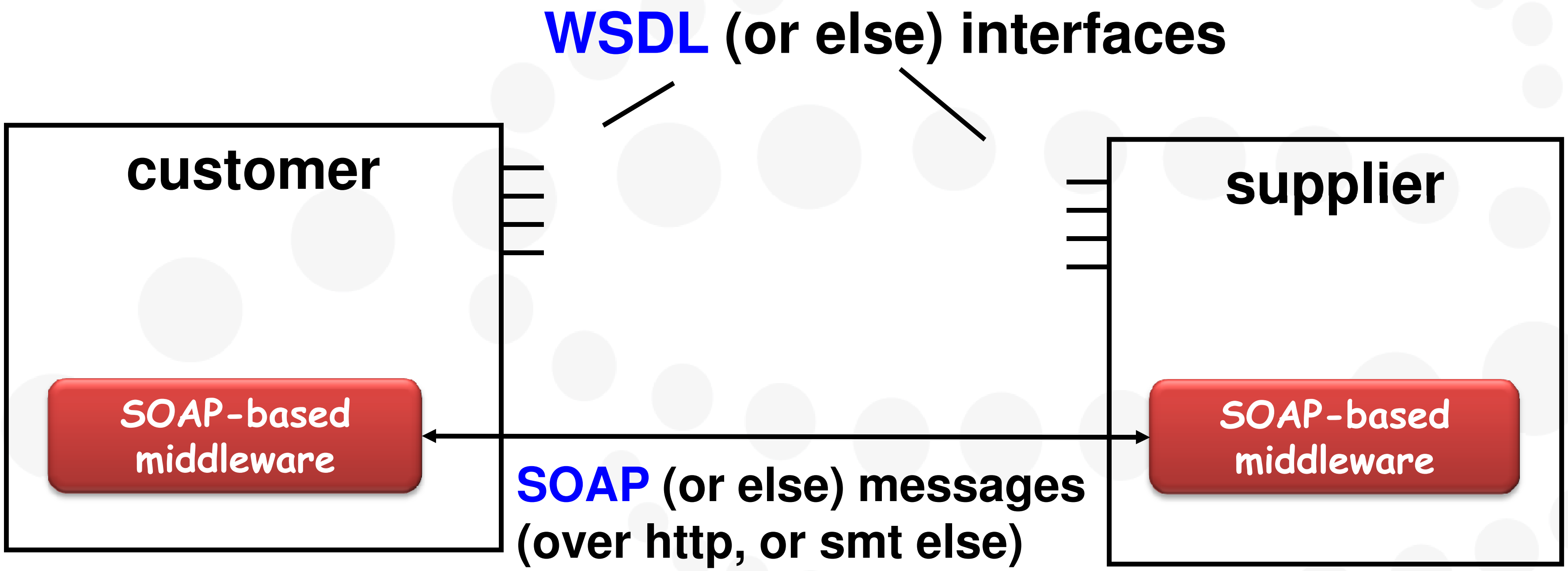


Services and Service composition

Web service

- A service available on the Web and **designed** to be accessible **by another application**
- A web service is NOT the same thing as a service on the Web

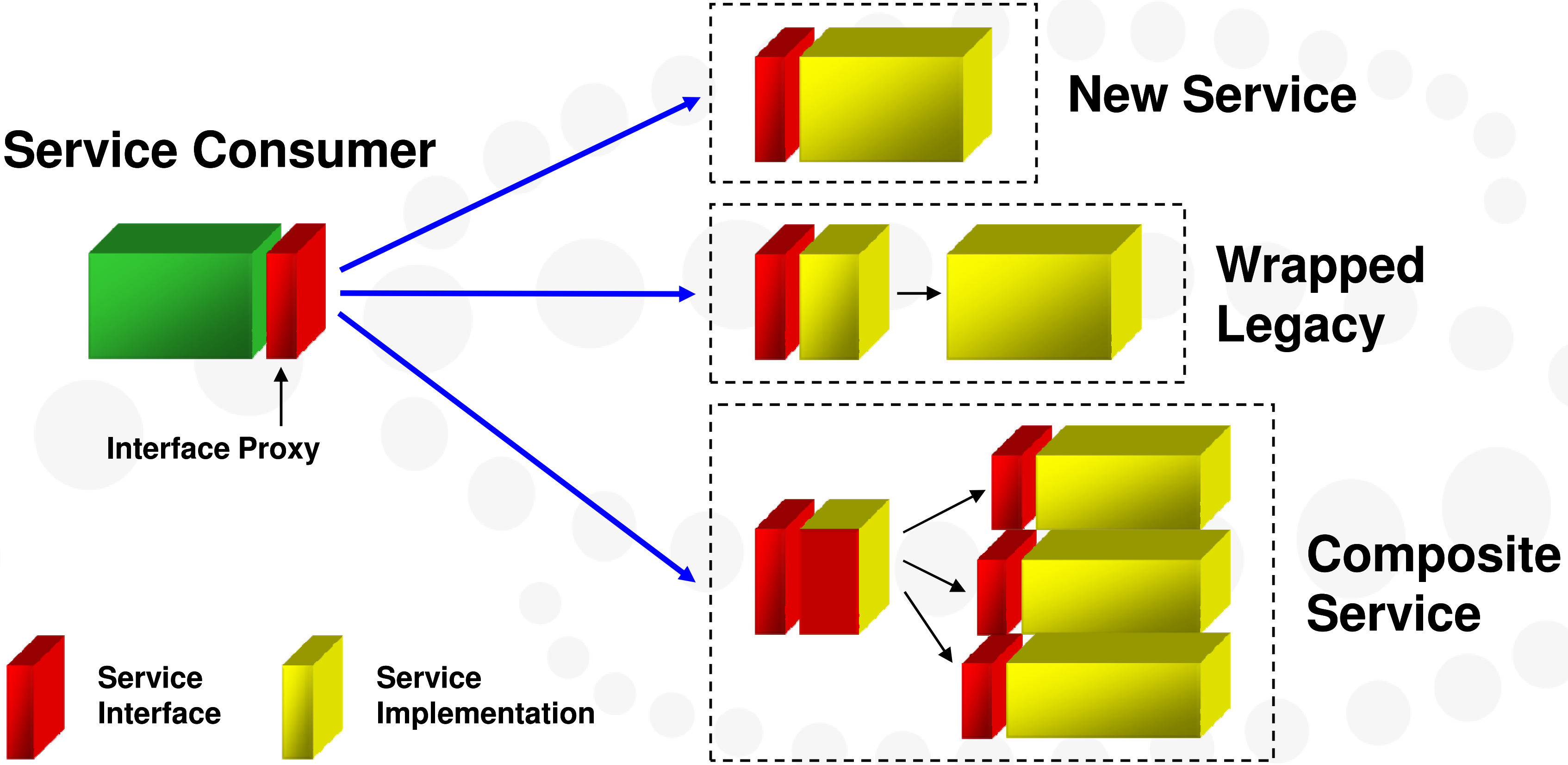
Historic standards



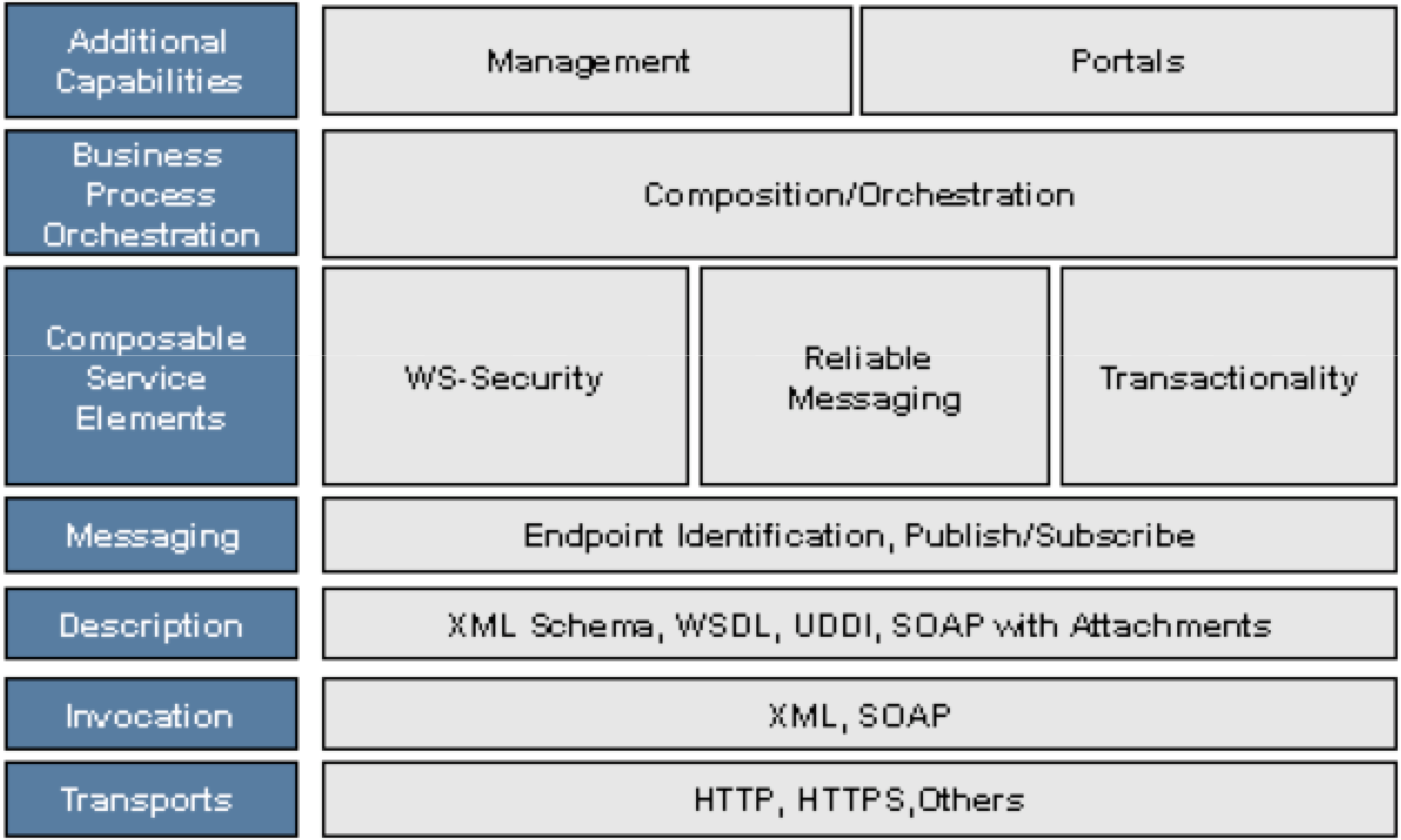
WSDL (or else) interfaces

SOAP (or else) messages
(over http, or smt else)

Services as components

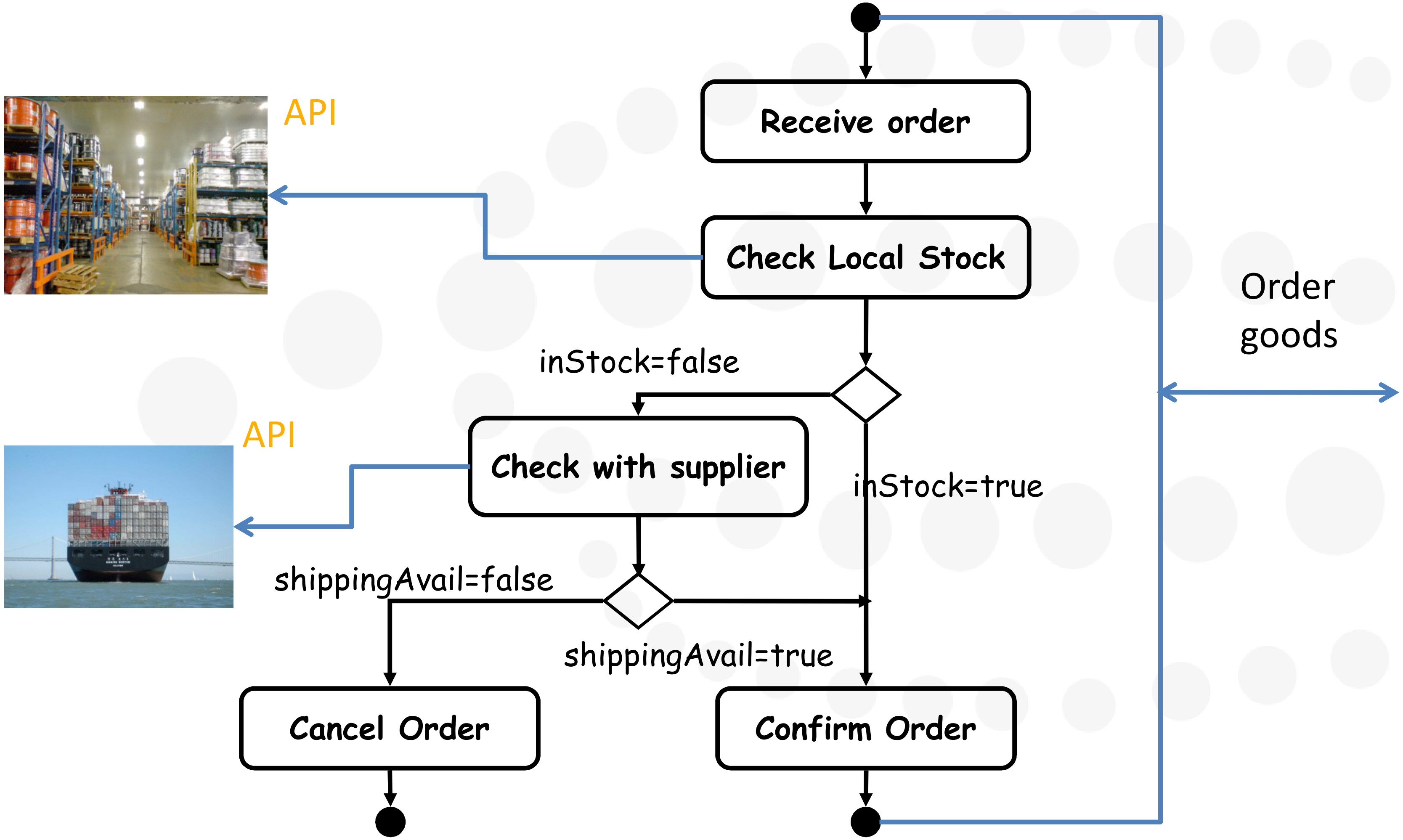


WS-I SOA stack



Additional Capabilities	Management	Portals	
Business Process Orchestration	Composition/Orchestration		
Composable Service Elements	WS-Security	Reliable Messaging	Transactionality
Messaging	Endpoint Identification, Publish/Subscribe		
Description	XML Schema, WSDL, UDDI, SOAP with Attachments		
Invocation	XML, SOAP		
Transports	HTTP, HTTPS,Others		

Service composition



API

Receive order

Check Local Stock

Order goods

inStock=false

API

Check with supplier

inStock=true

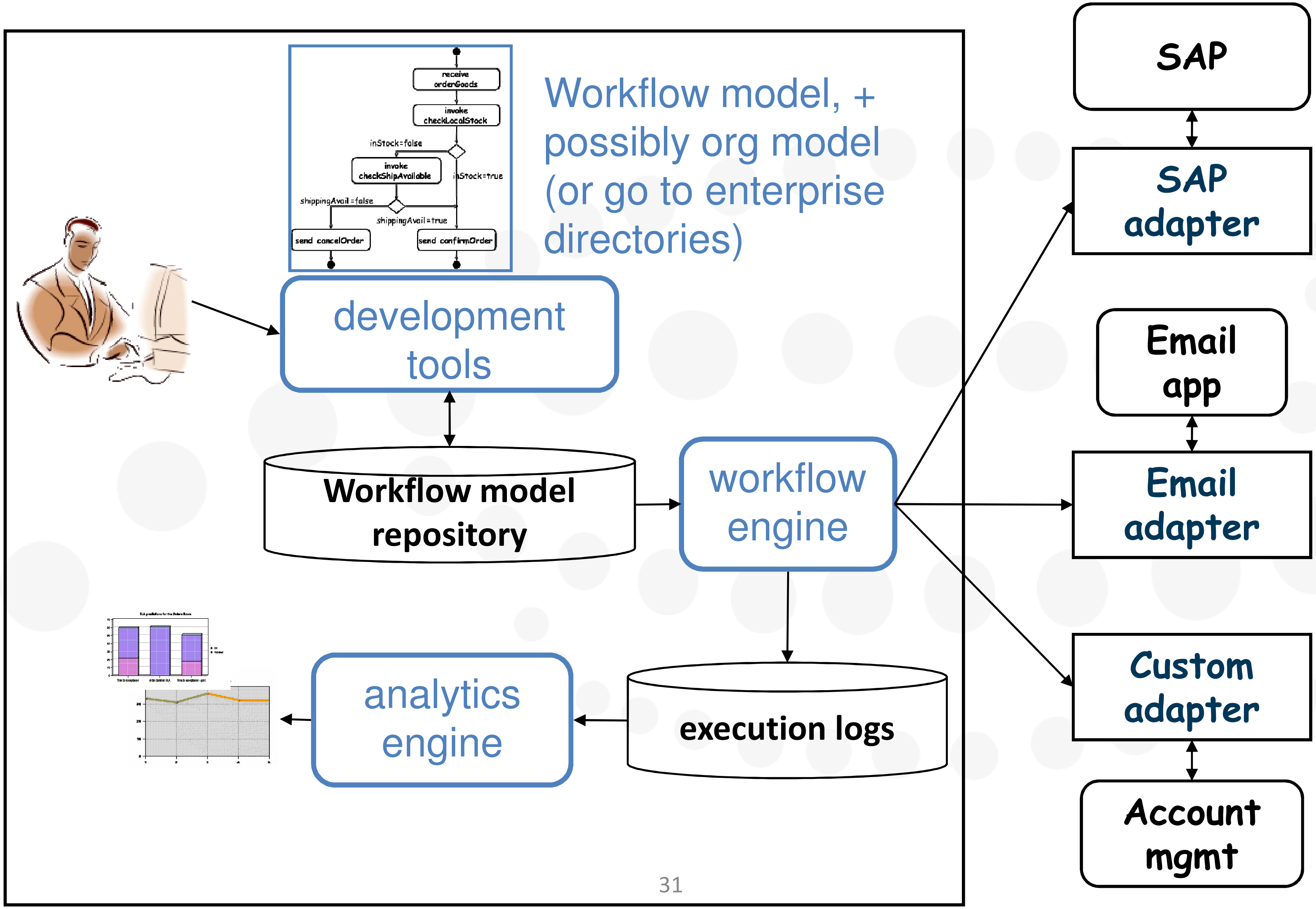
shippingAvail=false

shippingAvail=true

Cancel Order

Confirm Order

Workflow system architecture



Workflow model, + possibly org model (or go to enterprise directories)

development tools

Workflow model repository

workflow engine

execution logs

analytics engine

SAP

SAP adapter

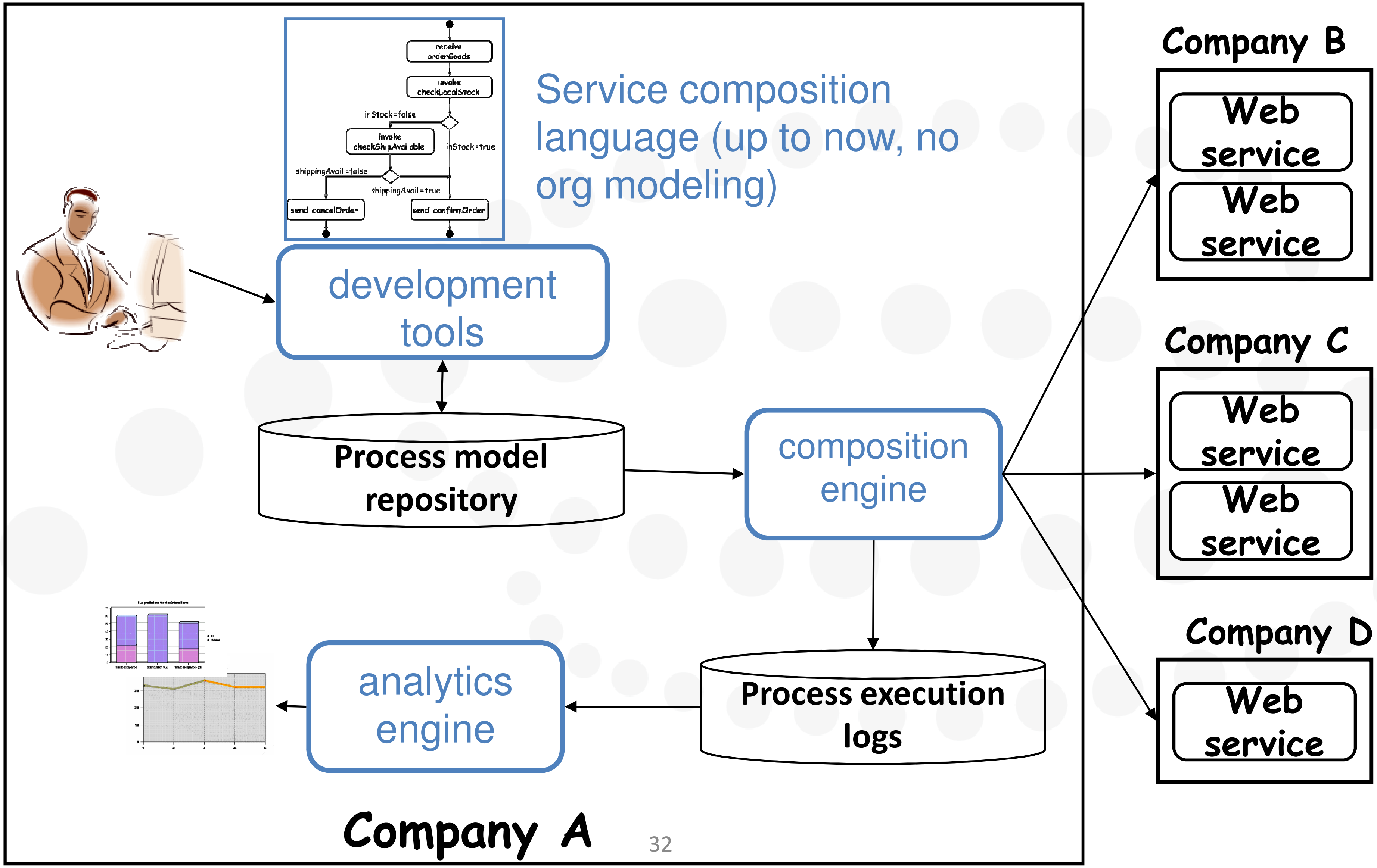
Email app

Email adapter

Custom adapter

Account mgmt

Elements of WS composition middleware



Service composition language (up to now, no org modeling)

development tools

Process model repository

composition engine

Process execution logs

analytics engine

Company A

Company B

Web service

Web service

Company C

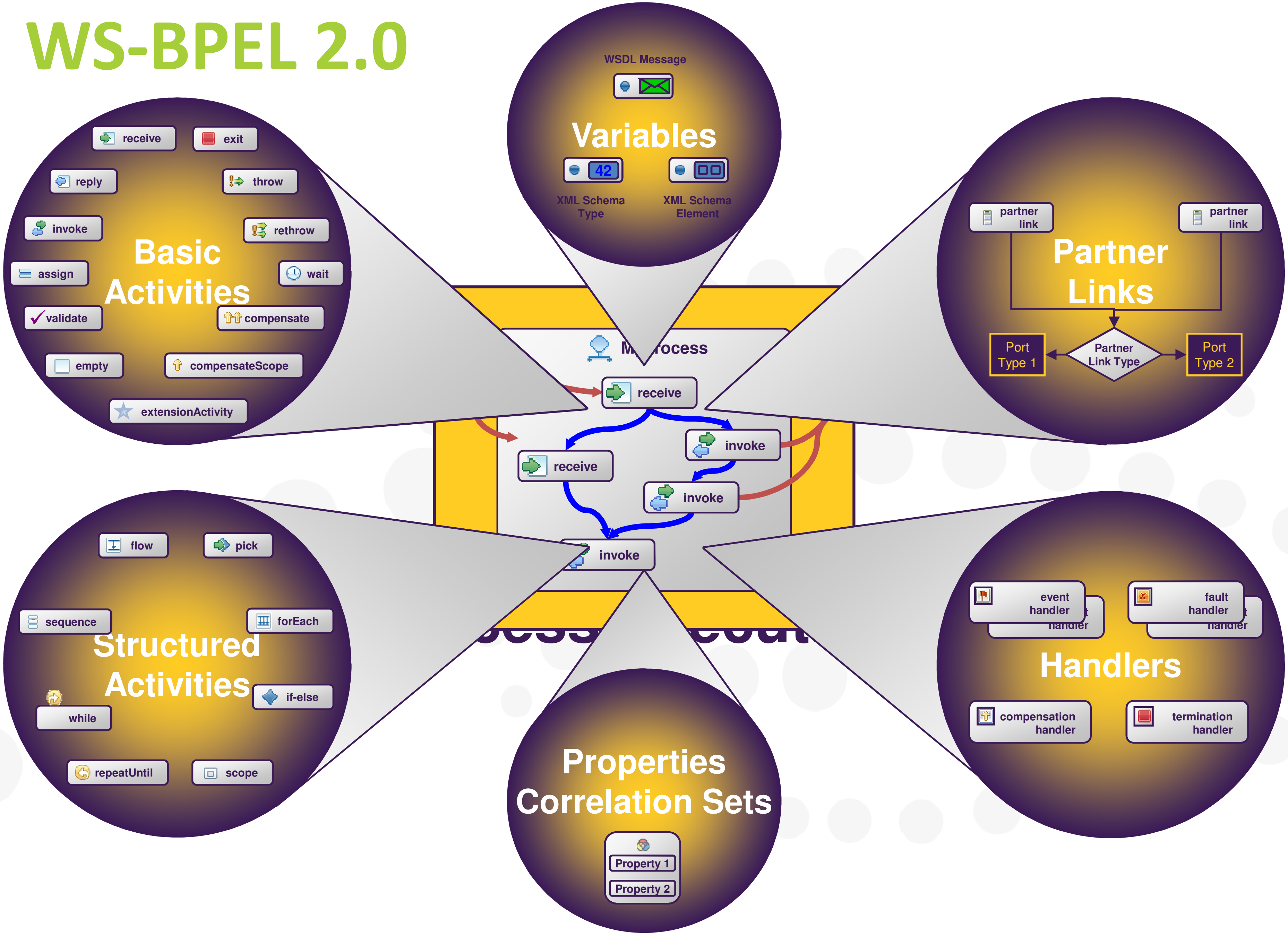
Web service

Web service

Company D

Web service

WS-BPEL 2.0



WSDL Message
Variables
42
XML Schema Type
XML Schema Element
Basic Activities
receive
exit
reply
throw
invoke
rethrow
assign
wait
validate
compensate
empty
compensateScope
extensionActivity
Partner Links
partner link
partner link
Port Type 1
Partner Link Type
Port Type 2
M rocess
receive
invoke
receive
invoke
invoke
Structured Activities
flow
pick
sequence
forEach
while
if-else
repeatUntil
scope
Handlers
event handler
fault handler
compensation handler
termination handler
Properties Correlation Sets
Property 1
Property 2

BPEL and its richness

- Complex synchronization constructs
- Events
- Exceptions
- Compensation

No KISS in Web Services

- WSDL and SOAP not that easy as well, not to mention the other specs….
- Even if Web services were meant to be simple, born to be simple..

MASHUPS

What are we talking about?

- **Mashup** – possible defintions
  - "...a mashup is a web application that combines **data** from more than one source into a single integrated tool..." [wikipedia.com – March 24, 2009]
  - "...you can integrate two or more [...] **Web APIs** to create something new and unique, known as a mashup..." [*]
- A mashup is a web application that is developed by composing **data**, **application logic**, and/or **user interfaces** originating from disparate web sources.
- Similar terms: service mashups, data mashups

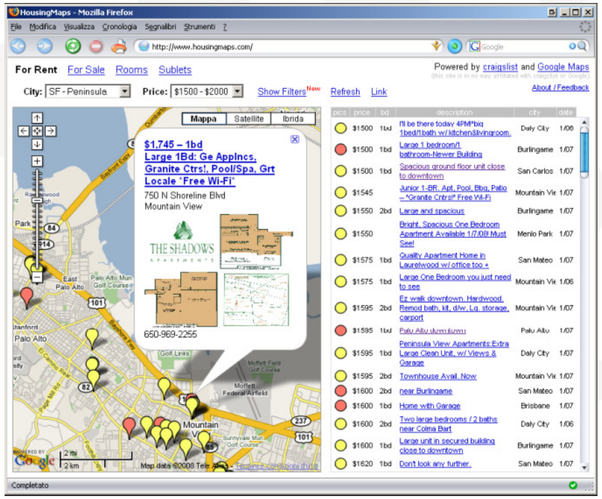
* http://www.ibm.com/developerworks/webservices/library/ws-soa-mashups/index.html?S_TACT=105AGX04&S_CMP=EDU

Mashup = integration the Web 2.0 way

- Young **integration** practice using the Web as platform
- Highly **user-driven**
  - Oftentimes the actual providers of content/functionality are not even aware of being “wrapped”
  - Google Maps example: initially skilled users hacked the AJAX code of the application
- Strong **evolution**: from hacking to first systematic development approaches in a few years

Let’s see an example

- The HousingMaps application (http://www.housingmaps.com) composed of:
  - Google Maps (http://maps.google.com)
  - Craigslist (http://www.craigslist.com)


HousingMaps - Mozilla Firefox
File Modifica Visualizza Cronologia Segnalibri Strumenti ?
http://www.housingmaps.com/
Google
Mappa
Satellite
Ibrida
Redwood
Park
84
114
East Palo Alto
Palo Alto Mun Golf Course
101
Stanford
Palo Alto
El Camino Real
Page Mill Rd
82
Bayfront Expy
Bayshore Fwy
Golf Links
Moffett Field Golf Course
Moffett Federal Airfield
Mountain View
237
101
Sunnyvale Mun Golf Course
85
Foothill Expy
POWERED BY Google
2 mi
2 km
Map data ©2008 Tele Atlas - Termini e condizioni d'uso
Completato

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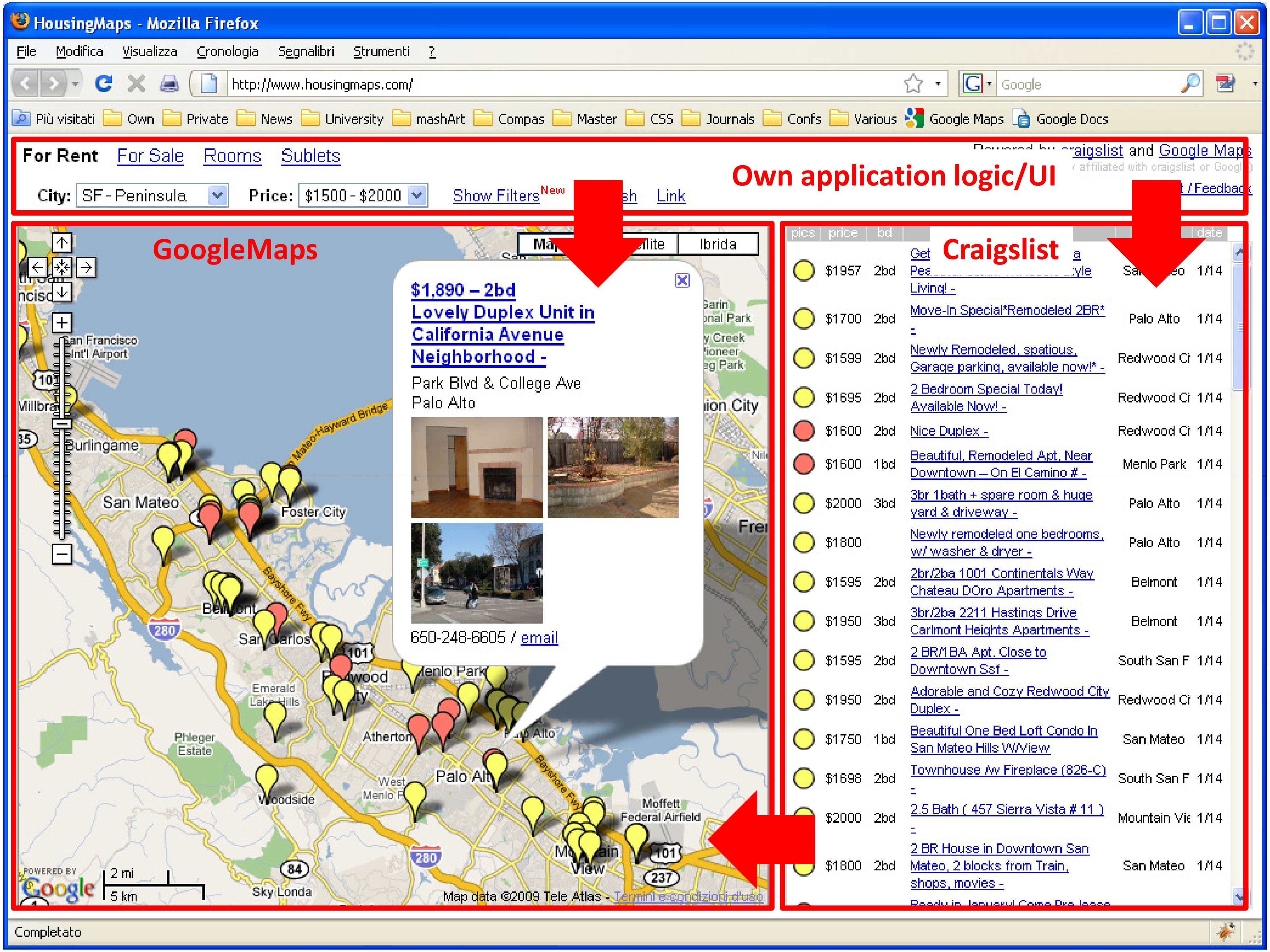
About / Feedback

City: SF - Peninsula Price: $1500 - $2000 Show Filters New Refresh Link

$1,745 – 1bd
Large 1Bd: Ge Applncs, Granite Ctrs!, Pool/Spa, Grt Locale *Free Wi-Fi*
750 N Shoreline Blvd
Mountain View
THE SHADOWS APARTMENTS
650-969-2255

pics	price	bd	description	city	date
●	$1500	1bd	I'll be there today 4PM*big 1bed/1bath w/ kitchen&livingroom.	Daly City	1/06
●	$1500	1bd	Large 1 bedroom/1 bathroom-Newer Building	Burlingame	1/07
●	$1500	1bd	Spacious ground floor unit close to downtown	San Carlos	1/07
●	$1545		Junior 1-BR. Apt, Pool, Bbq, Patio – *Granite Cntrs!* Free Wi-Fi	Mountain Vie	1/07
●	$1550	2bd	Large and spacious	Burlingame	1/07
●	$1550		Bright, Spacious One Bedroom Apartment Available 1/7/08! Must See!	Menlo Park	1/07
●	$1575	1bd	Quality Apartment Home in Laurelwood w/ office too +	San Mateo	1/07
●	$1575	1bd	Large One Bedroom you just need to see	Mountain Vie	1/06
●	$1595	2bd	Ez walk downtown, Hardwood, Remod bath, kit, d/w, Lg. storage, carport	Mountain Vie	1/07
●	$1595	1bd	Palo Alto downtown	Palo Alto	1/07
●	$1595	1bd	Peninsula View Apartments:Extra Large Clean Unit, w/ Views & Garage	Daly City	1/07
●	$1595	2bd	Townhouse Avail. Now	Mountain Vie	1/07
●	$1600	2bd	near Burlingame	San Mateo	1/07
●	$1600	1bd	Home with Garage	Brisbane	1/07
●	$1600	2bd	Two large bedrooms / 2 baths near Colma Bart	Daly City	1/06
●	$1600	1bd	Large unit in secured building close to downtown	Burlingame	1/07
●	$1620	1bd	Don't look any further.	San Mateo	1/07

Demo


HousingMaps - Mozilla Firefox
File Modifica Visualizza Cronologia Segnalibri Strumenti ?
http://www.housingmaps.com/
Google
Più visitati Own Private News University mashArt Compas Master CSS Journals Confs Various Google Maps Google Docs
Completato

Own application logic/UI

GoogleMaps

Craigslist

For Rent For Sale Rooms Sublets

City: SF - Peninsula Price: $1500 - $2000 Show Filters New ...sh Link

...aigslist and Google Maps
...affiliated with craigslist or Googl...
...t / Feedback

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San Francisco Int'l Airport
Millbra...
Burlingame
San Mateo
Foster City
Belmont
San Carlos
Redwood City
Emerald Lake Hills
Phleger Estate
Atherton
Menlo Park
Palo Alto
West Menlo P...
Woodside
Moffett Federal Airfield
Mountain View
Sky Londa
San Mateo-Hayward Bridge
Bayshore Fwy
101
280
84
237
POWERED BY Google
2 mi
5 km
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$1,890 – 2bd
Lovely Duplex Unit in California Avenue Neighborhood -

Park Blvd & College Ave
Palo Alto

650-248-6605 / email

pics	price	bd			date
●	$1957	2bd	Get ... a Pe... ...yle Living! -	Sa... ...eo	1/14
●	$1700	2bd	Move-In Special*Remodeled 2BR* -	Palo Alto	1/14
●	$1599	2bd	Newly Remodeled, spatious, Garage parking, available now!* -	Redwood Ci	1/14
●	$1695	2bd	2 Bedroom Special Today! Available Now! -	Redwood Ci	1/14
●	$1600	2bd	Nice Duplex -	Redwood Ci	1/14
●	$1600	1bd	Beautiful, Remodeled Apt, Near Downtown – On El Camino # -	Menlo Park	1/14
●	$2000	3bd	3br 1bath + spare room & huge yard & driveway -	Palo Alto	1/14
●	$1800		Newly remodeled one bedrooms, w/ washer & dryer -	Palo Alto	1/14
●	$1595	2bd	2br/2ba 1001 Continentals Way Chateau DOro Apartments -	Belmont	1/14
●	$1950	3bd	3br/2ba 2211 Hastings Drive Carlmont Heights Apartments -	Belmont	1/14
●	$1595	2bd	2 BR/1BA Apt. Close to Downtown Ssf -	South San F	1/14
●	$1950	2bd	Adorable and Cozy Redwood City Duplex -	Redwood Ci	1/14
●	$1750	1bd	Beautiful One Bed Loft Condo In San Mateo Hills W/View	San Mateo	1/14
●	$1698	2bd	Townhouse /w Fireplace (826-C) -	South San F	1/14
●	$2000	2bd	2.5 Bath (457 Sierra Vista # 11) -	Mountain Vie	1/14
●	$1800	2bd	2 BR House in Downtown San Mateo, 2 blocks from Train, shops, movies -	San Mateo	1/14
●			Ready in January! Come Pre-lease		

Web 2.0

- **Web 2.0**? Again, there are lots of different (and sometimes diverging) definitions:
    - “Web 2.0 is a term describing the trend in use of World Wide Web technology and web design that aims to enhance creativity, information sharing, and, most notably, collaboration among users...” [wikipedia.com]
    - “Web 2.0 is best described as a core set of patterns that are observable in applications that share the Web 2.0 label. These patterns are services, simplicity, and community…” [*]

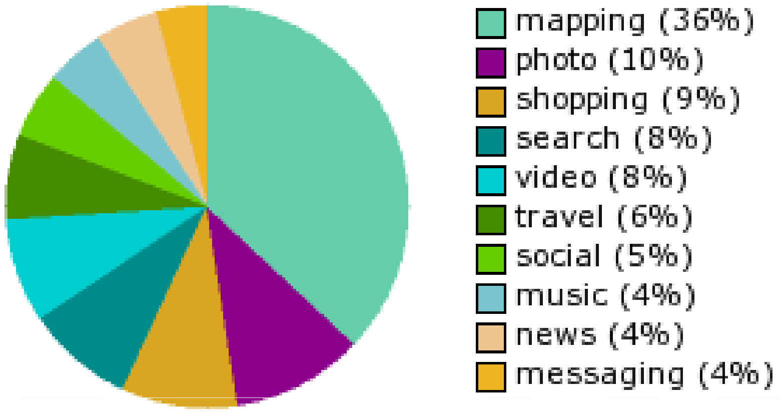
* http://www.ibm.com/developerworks/webservices/library/ws-soa-mashups/index.html?S_TACT=105AGX04&S_CMP=EDU

The enabling factor of Web 2.0

- Over the last years we have been witnessing **two main trends** on the Web:
  - User participation in the **content creation** process (e.g., communities, social networks, blogs...)
  - User participation in the **development** process (e.g., mashups)
- Which are enabled or fostered by:
  - **Simplicity of usage**: intuitive, interactive applications
  - **Simplicity of development**: novel and standardized web technologies

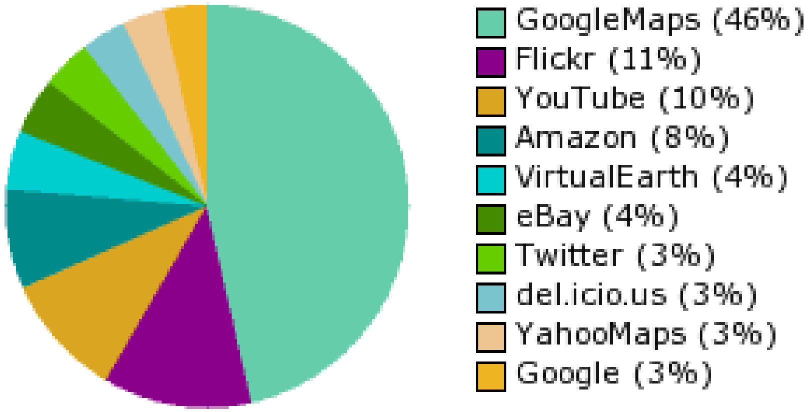
Some figures (programmableweb.com)

- Most popular categories of **mashups**



ProgrammableWeb.com 03/19/09

- Most popular web **APIs**

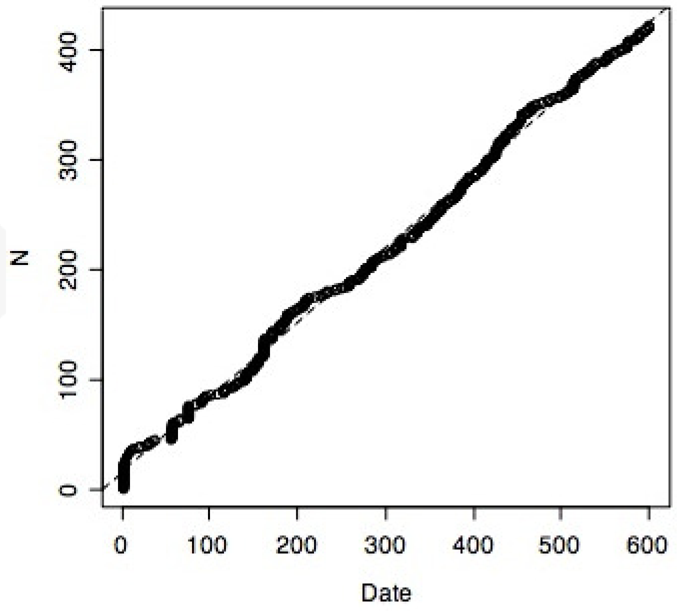


ProgrammableWeb.com 03/19/09

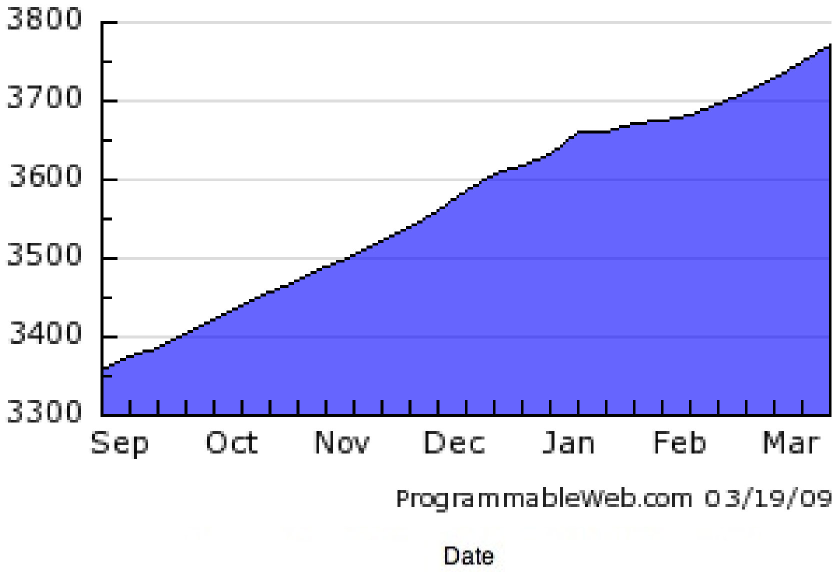
Dynamics of the ecosystem

- Constant growth since programmableweb.com went online (over 600 days) [by Michael Weiss, Carleton University]

Number of APIs

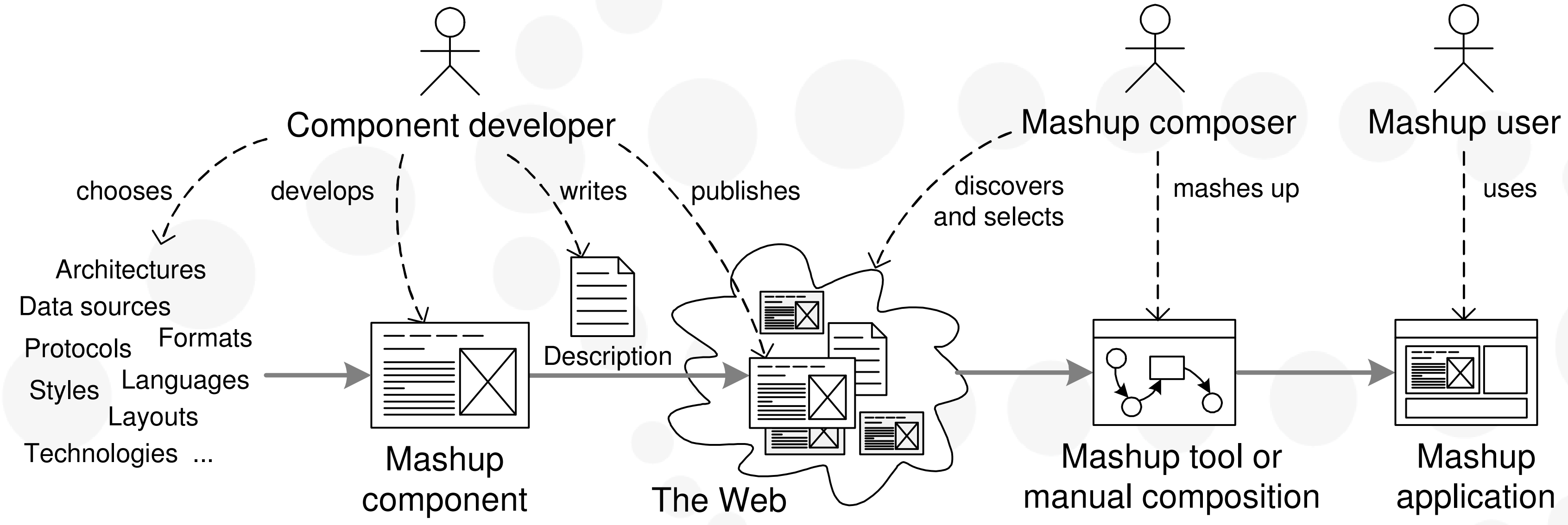


Number of mashups

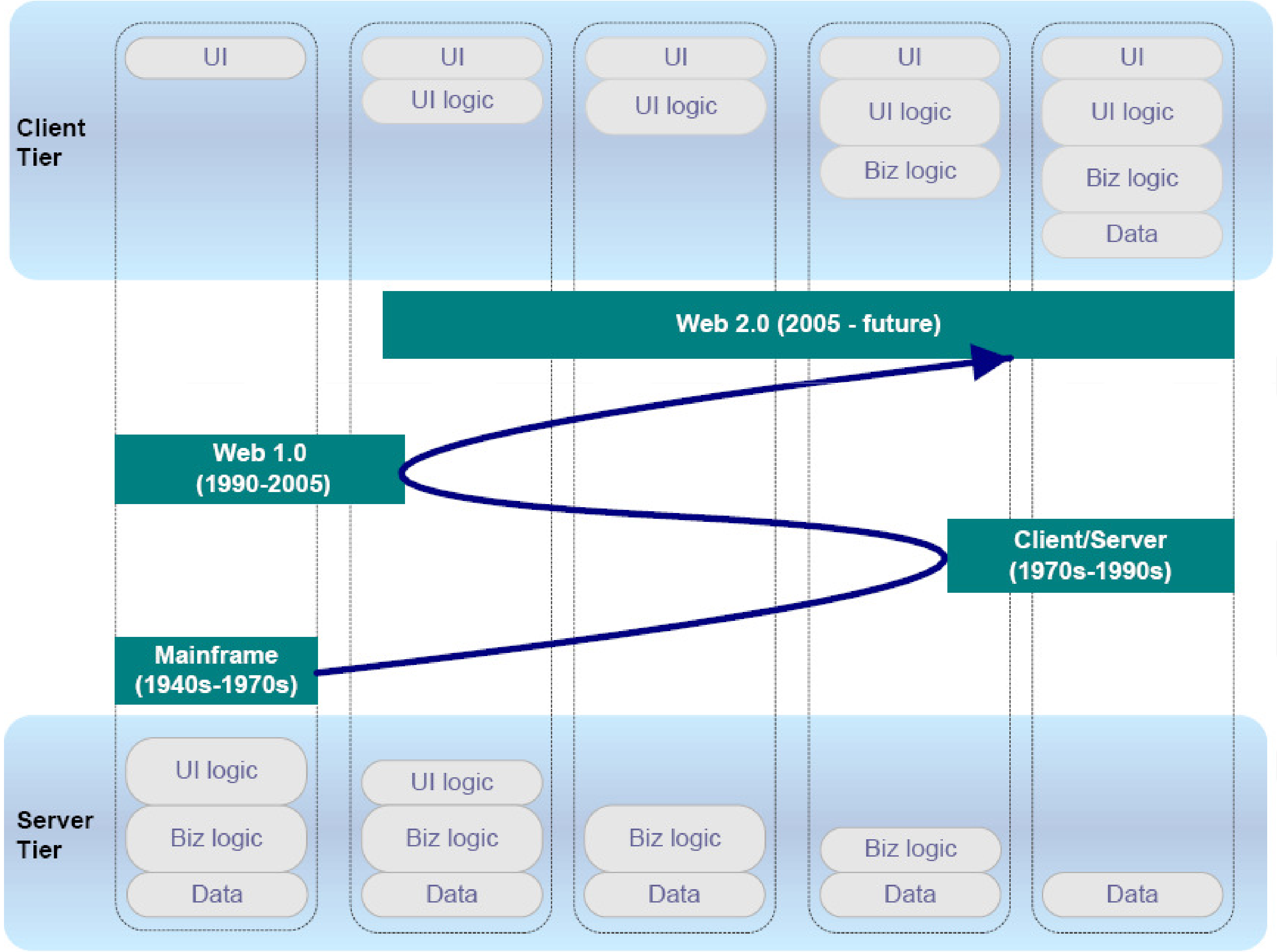


Developing a mashup: what does it mean?

- The mashup development scenario

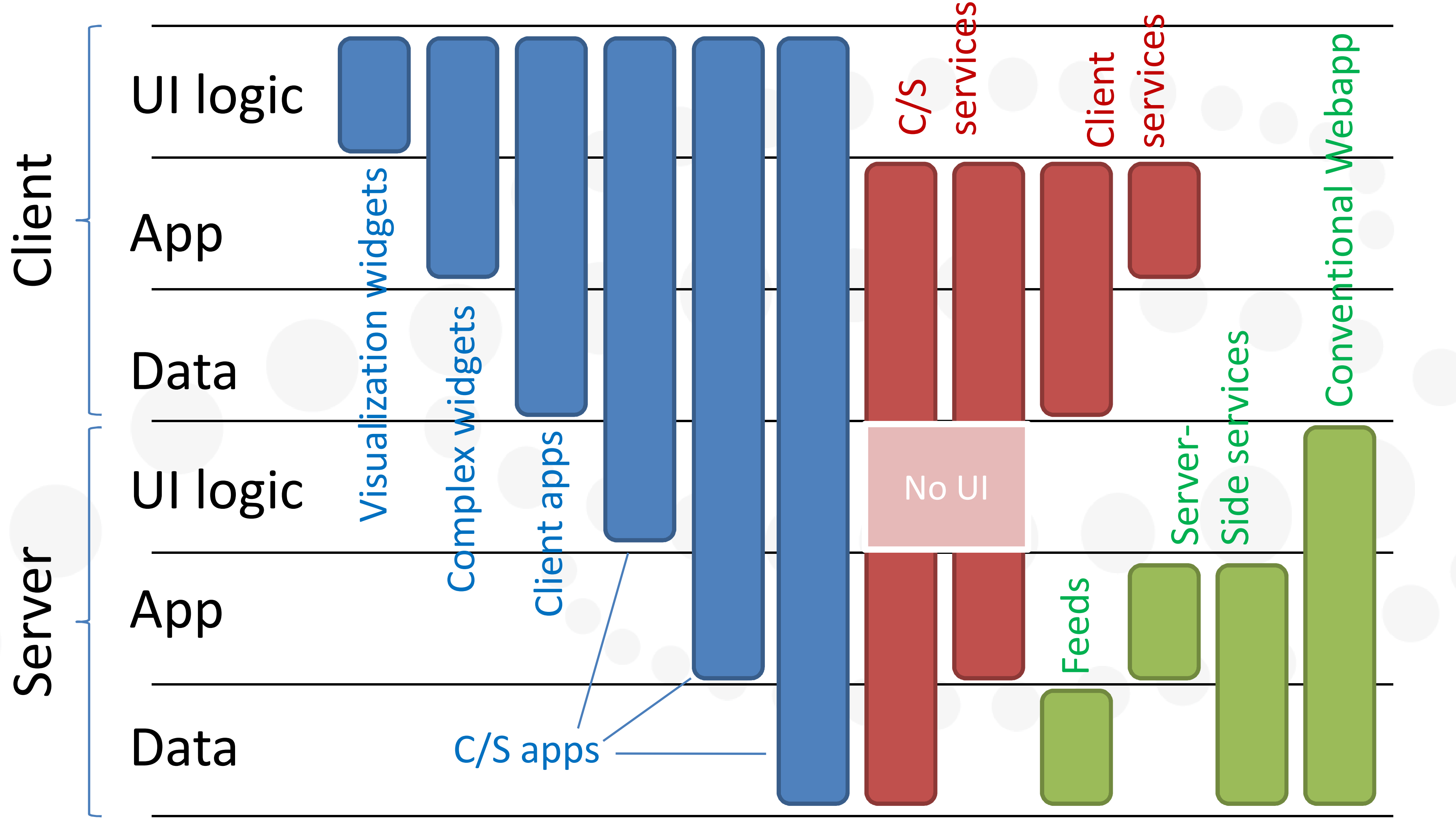


Distribution of apps over C and S

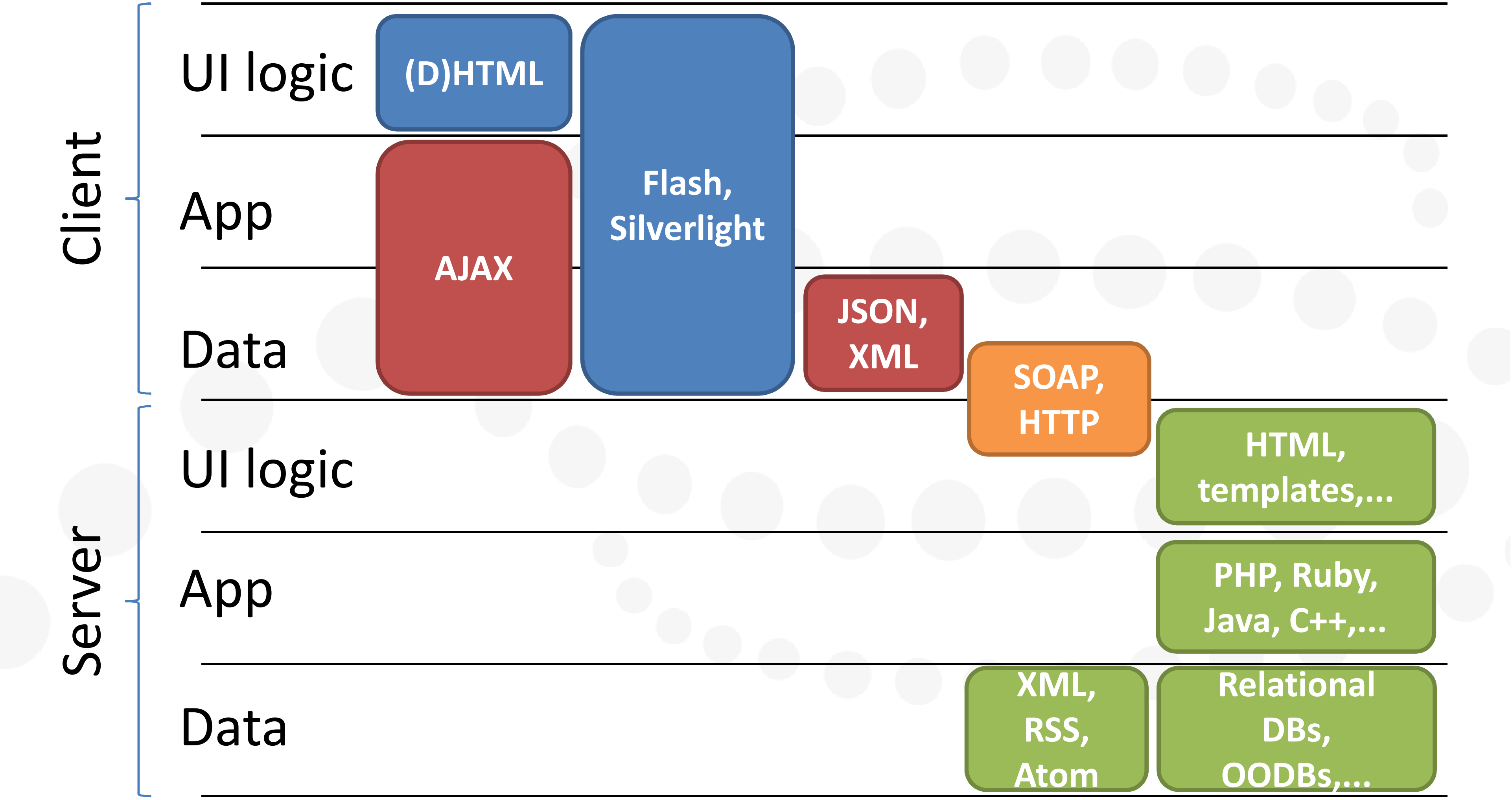


Source: www.coachwei.com

Mashup component/API types



The technological landscape



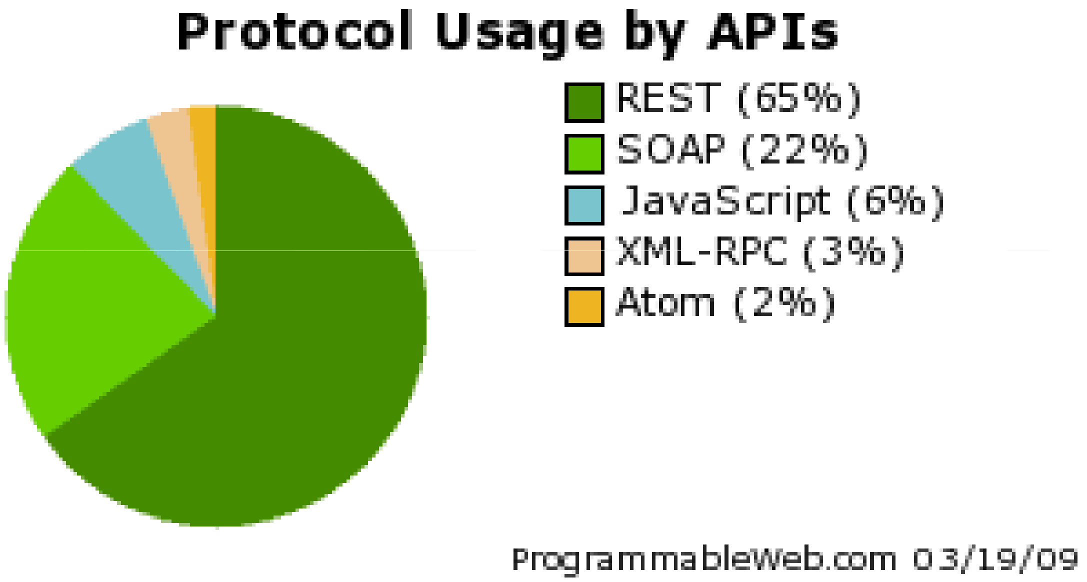
SOAP/WSDL web services

- **Programming interfaces** accessible over the Web
  - **WSDL** = Web Service Description Language
    - Abstract service description language (tech-agnostic)
  - **SOAP** = Simple Object Access Protocol
    - XML message exchange protocol
- **SOA** = Service-Oriented Architecture
  - Producer, comsumer, registry (virtual marketplaces)
- Complex advanced features: security, reliability, transactions, addressing,...
- Orechestration and choreography

RESTful web services

- A new **architectural style** of developing web services
- Principles
  - Operations based on **HTTP methods** (Get, Post, Put, Delete)
  - Services are **stateless** (no session data at the server side)
  - Access via hierarchically structured **URIs**
  - XML or JSON over **HTTP**
- Benefits
  - Simplicity and immediacy
  - No big overhead for composing and parsing messages
  - More efficient service implementations

“Protocol” usage by APIs



Mashup development manually (1/2)

- **Sceanrio 1** (at the beginning): No APIs available
- Developent tasks
  - **Read** and interpret AJAX code of GMaps
  - **Hack** into GMaps code to implement marker support
  - **Extract data** from Craigslist with regular expressions (write a wrapper)
  - **Format** extracted data and forward data to GMaps
- Problems
  - No stabel interfaces
  - Highlyl error-prone and time-consuming

Mashup development manually (2/2)

- **Scenario 2** (today): GMaps comes with AJAX API and Craigslist provides an RSS feed
- Development tasks
  - **Instantiate** GMaps component
  - **Layout** RSS feed
  - Set **markers** through GMaps API
- Problems
  - Manual development for skilled programmers
  - Manual parsing of RSS feed
  - No common Web API format

Partially assisted development

- There are many (online) tools for
  - Data extraction from Web pages
  - Web content clipping

  >> Aid the development of mashup components or APIs

dapper

openkapow beta

lixto THE WEB INTELLIGENCE COMPANY

RoadRunner

Demo

Fully assisted development

- Mashup tools/platforms
  - **Simplify** the overall development process
  - Provide easy-to-use **development** instruments
  - Provide dedicated **execution** environments
  - Support the whole **lifecycle** of mashup applications
  - Enable even the **less experienced** user to mash up own applications
- Let’s see some **representative** examples
  - Yahoo Pipes, Intel Mash Maker, Microsoft Popfly, JackBe Presto (yet, there are many others)

beta pipes™

- Powerful, hosted **data mashup** tool for the processing of
  - RSS/Atom feeds
  - XML/JSON data resources/services
- Targets skilled users and **programmers**
- **Data flow** approach (pipes)
- No support for **user interface** design

Demo

Intel® Mash Maker BETA

- Client-side **browser extension** for interactive mashup development
  - Data extracted from annotated web pages
  - Widgets (UI components) for data visualization
  - Copy/paste of Web contents into other Web pages
- Targets **average Web users** and programmers
- Data passing through **environment variables**
- No support for **service components**

Demo

Microsoft Popfly

- Highly interactive, hosted **mashup platform** for consumer mashups
  - Mashup “blocks” for data, application logic, and UIs
  - Mainly JavaScript blocks
  - Comes with own block builder
- Targets **advanced Web users** and programmers
- Data passing by **coupling** components and mapping outputs to inputs
- Still weak support for UI components

Demo

JACKBE™

- Full-fledged **enterprise mashup platform** with desktop integration
  - Main focus on data mashups
  - Support for web services and (local) spreadsheet files
  - Separate layout support for UIs (mashlets and portals)
- Targets advanced users and programmers
- Data flow logic
- Still limited layout capabilities

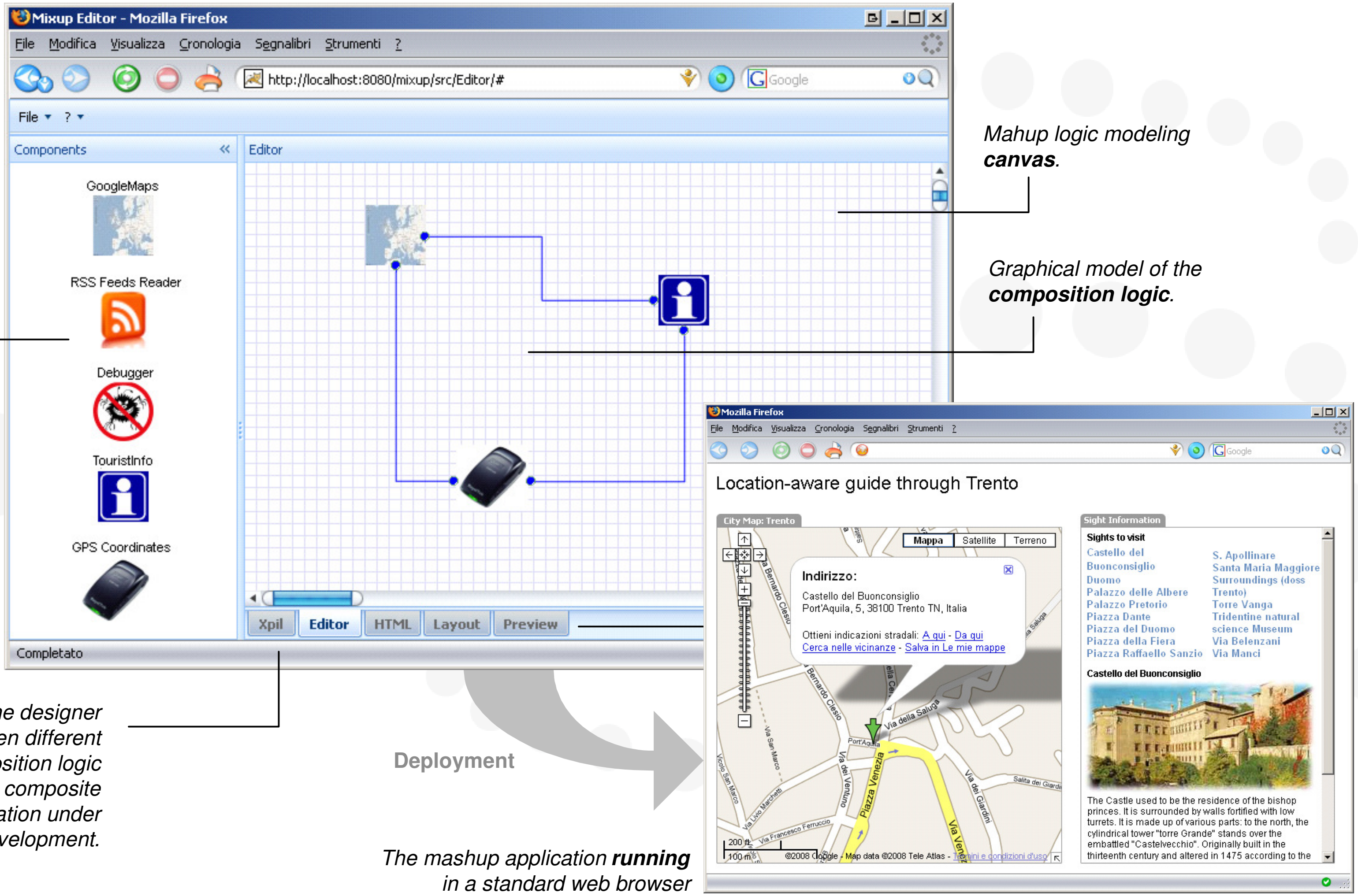
Demo

Our own research on mashups

- **UI integration**
  - Stand-alone web apps as **UI components**
  - **Synchronization** among components
- **Universal integration**
  - UI, application logic, and data components
  - One **component model**: abstract components, highlight similarities
  - One **composition model**: one formalism for synchronization and orchestration
  - **Hosted** development and execution

UI integration: visual editor

List of *application* ***components*** *available for the mashup. Additional components may easily be* ***loaded*** *into the editor by referencing the respective online resource.*



Location-aware guide through Trento

Indirizzo:

Castello del Buonconsiglio
Port'Aquila, 5, 38100 Trento TN, Italia

Ottieni indicazioni stradali: A qui - Da qui
Cerca nelle vicinanze - Salva in Le mie mappe

©2008 Google - Map data ©2008 Tele Atlas - Termini e condizioni d'uso

Sights to visit

Castello del Buonconsiglio	S. Apollinare
Duomo	Santa Maria Maggiore
Palazzo delle Albere	Surroundings (doss Trento)
Palazzo Pretorio	Torre Vanga
Piazza Dante	Tridentine natural science Museum
Piazza del Duomo	Via Belenzani
Piazza della Fiera	Via Manci
Piazza Raffaello Sanzio	

Castello del Buonconsiglio

The Castle used to be the residence of the bishop princes. It is surrounded by walls fortified with low turrets. It is made up of various parts: to the north, the cylindrical tower "torre Grande" stands over the embattled "Castelvecchio". Originally built in the thirteenth century and altered in 1475 according to the

Mahup logic modeling ***canvas****.*

Graphical model of the ***composition logic****.*

Tabs that allow the designer to switch between different ***views*** *(e.g. composition logic vs. layout) on the composite application under development.*

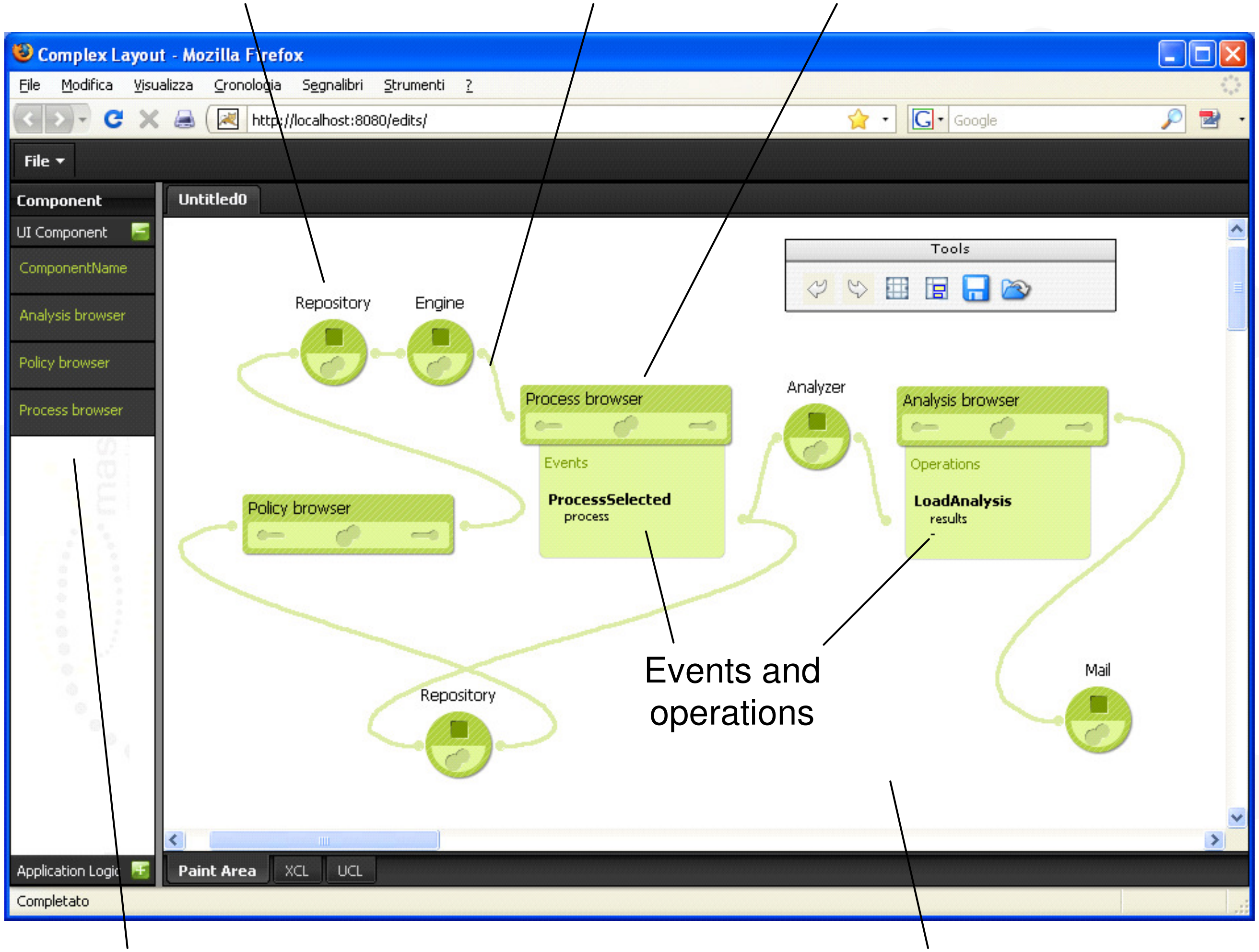
The mashup application ***running*** *in a standard web browser*

Universal integration

Service component

Data flow connector

UI component



Complex Layout - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti ?

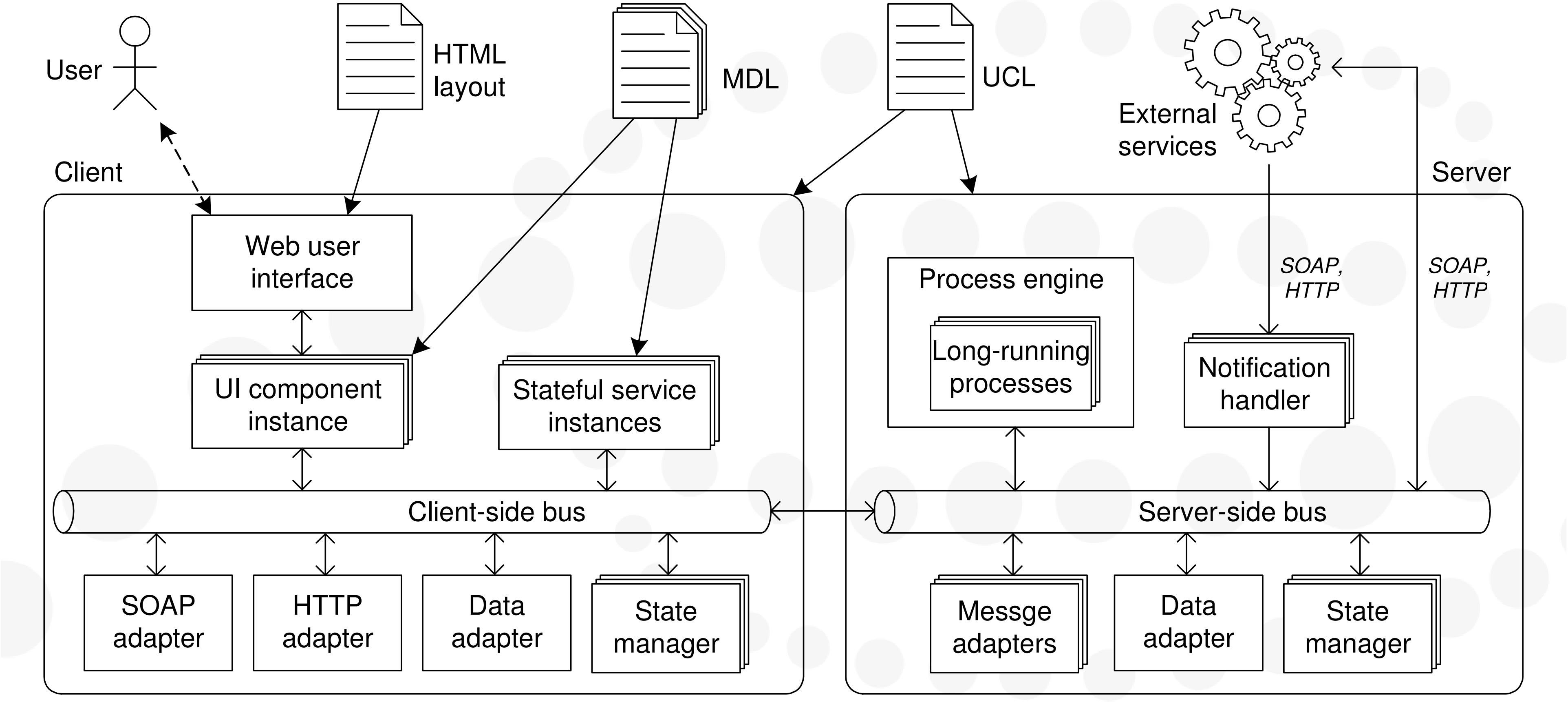
http://localhost:8080/edits/

Events and operations

Component browser

Composition canvas

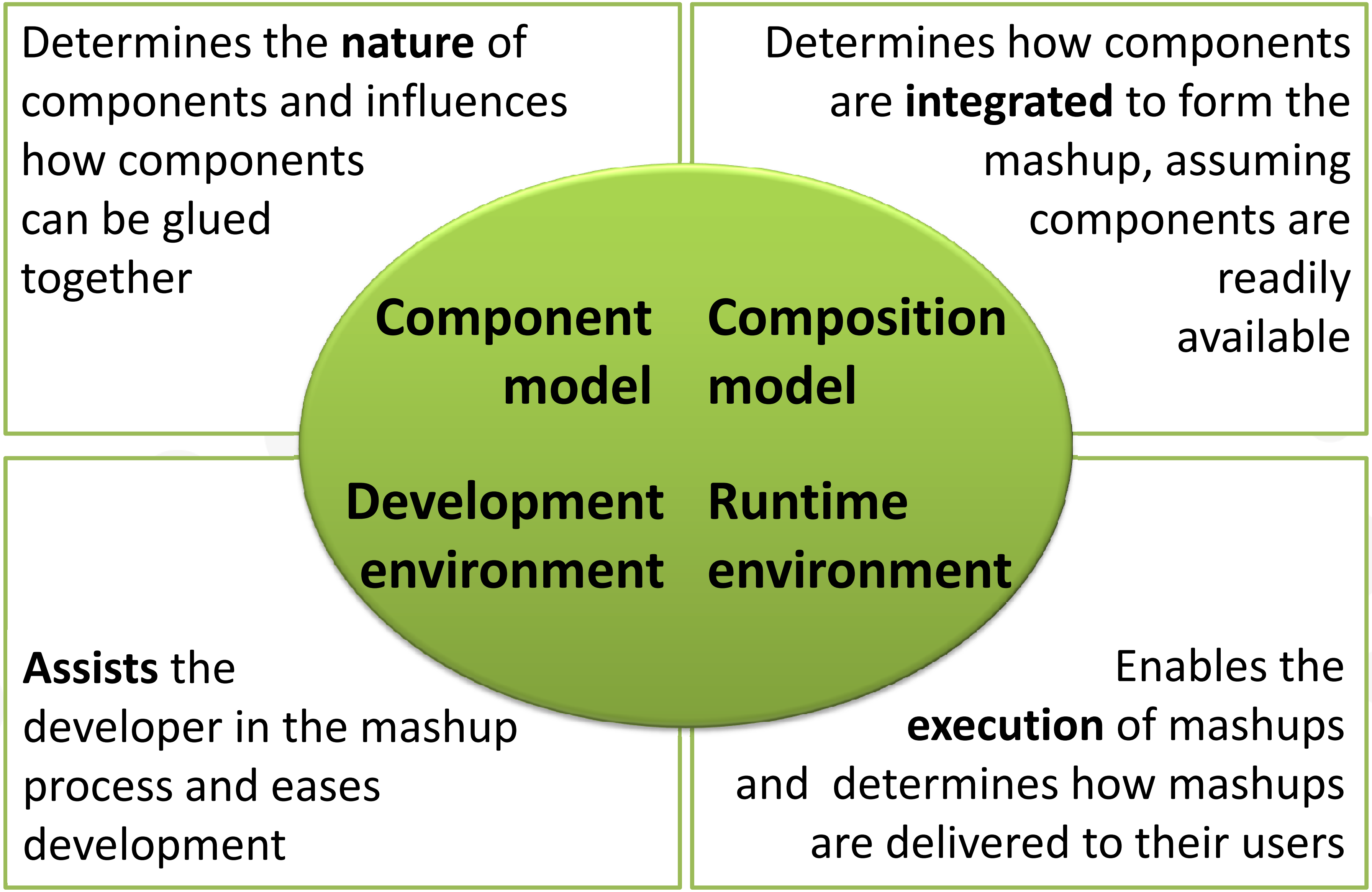
Hosted execution environment



Hosted execution environment

- Development challenges:
  - Seamless integration of **stateful** and **stateless** components and of **UI** and **service** components
  - **Short-living** and **long-running** process logics in the same environment
  - **Distribution** of execution taks over client and server
  - Transparent handling of multiple **communication protocols**

Analyzing mashup tools



Component model

Determines the **nature** of components and influences how components can be glued together

Composition model

Determines how components are **integrated** to form the mashup, assuming components are readily available

Development environment

Assists the developer in the mashup process and eases development

Runtime environment

Enables the **execution** of mashups and determines how mashups are delivered to their users

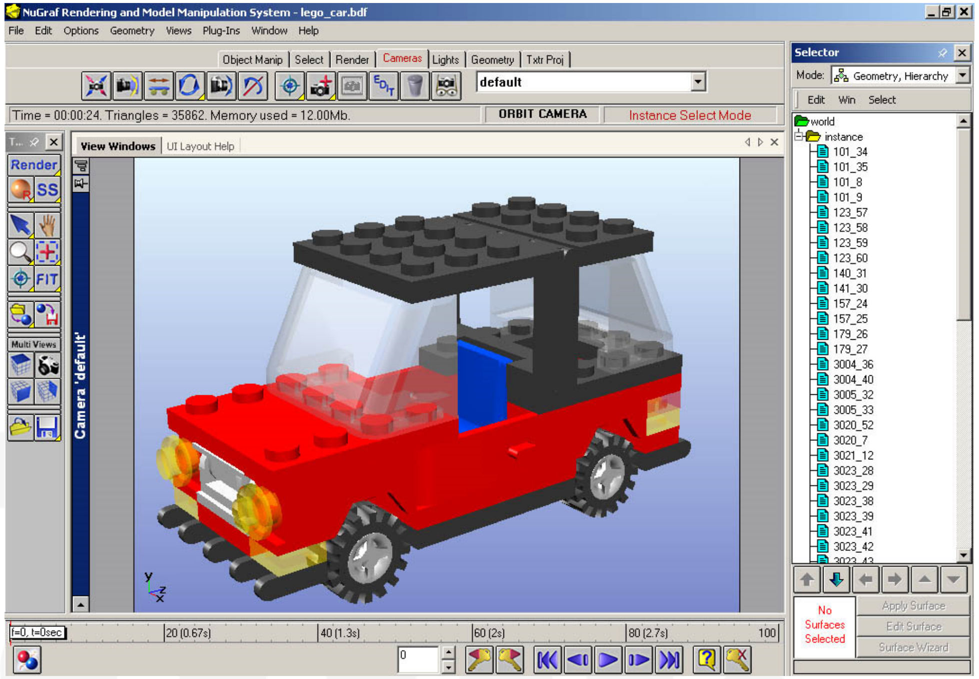
Component model

- **Type**
  - Data (DA) vs. application logic (AL) vs. user interface (UI)
- **Location**
  - Local vs. remote
- **Direction of interaction**
  - One-way vs. two-way
- **State**
  - Stateful vs. stateless
- **Behavior**
  - Active vs. reactive

Composition model

- **Type**
  - Data (DA) vs. application logic (AL) vs. user interface (UI)
- **Orchestration style**
  - Flow-based vs. event-based vs. layout-based
- **Data passing style**
  - Data flow vs. blackboard
    (without vs. with shared memory)
- **State**
  - Stateful vs. stateless
- **Instance model**
  - Instance-based or continuous

Development environment



Time = 00:00:24. Triangles = 35862. Memory used = 12.00Mb.

- **Target users**
  - Web users vs. tech-savvy users vs. programmers
- **Interface paradigm**
  - Visual drag-and-drop vs. textual editors vs. combinations
- **Type of support**
  - Composition only vs. composition + components vs. component only
- **System requirements**
  - Hosted, web-based vs. standalone
  - Additional modules, plug-ins, or browser features

Runtime environment

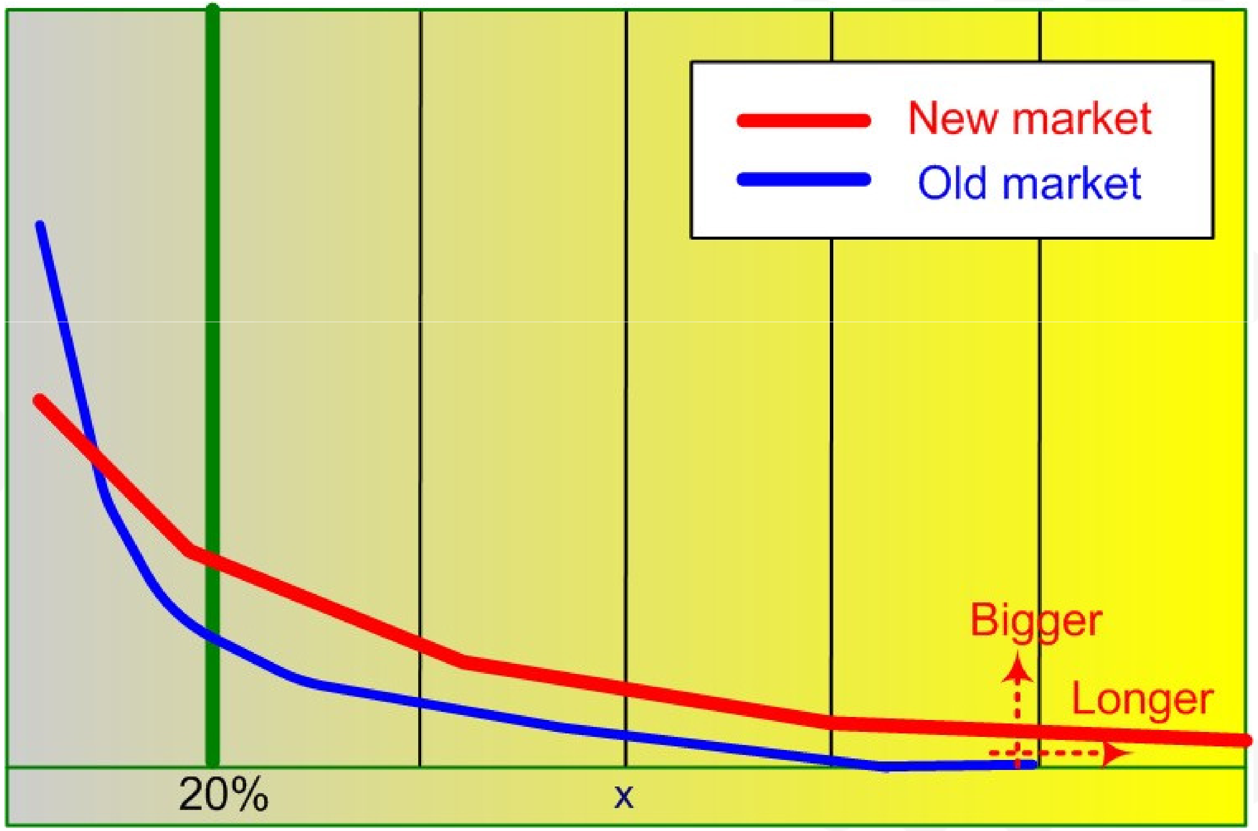
- **Deployment model**
  - Complied (web app based) vs. interpreted (engine-based)
- **Execution location**
  - Local vs. remote vs. hybrid
- **System requirements**
  - Browser plug-ins or extensions?
- **Scalability**
  - Number of data sources, in the number of models (compositions), or in the number of users

Applicability of mashups

- But what about the **utility** of mashup applications?
  - Mashups are still mostly 1-page apps...
- Only very few innovations are really **breakthroughs**, most innovations only create little value
- Perfectly **understanding customer needs**, in order to customize software and satisfy as much users as possible, is costly – if not impossible
- Mashups may leverage “**user innovation**”:
  - Users themselves know best what they want
  - Mashups enable them to build their own applications

The long tail of the SW market

Number of users



Applications

[wikipedia.com]

A new development paradigm?

- Characteristics of **modern** web applications
  - **Fast** development cycles (Internet time)
  - **Incremental** development (prototype-based)
  - Continuous online **evolution**
- The software life cycle of modern web applications is **no longer** captured by traditional life cycle models (e.g., the spiral or the waterfall model)
- And what about user-driven composition of web applications and **mashups**?

Crowd Programming in the Clouds

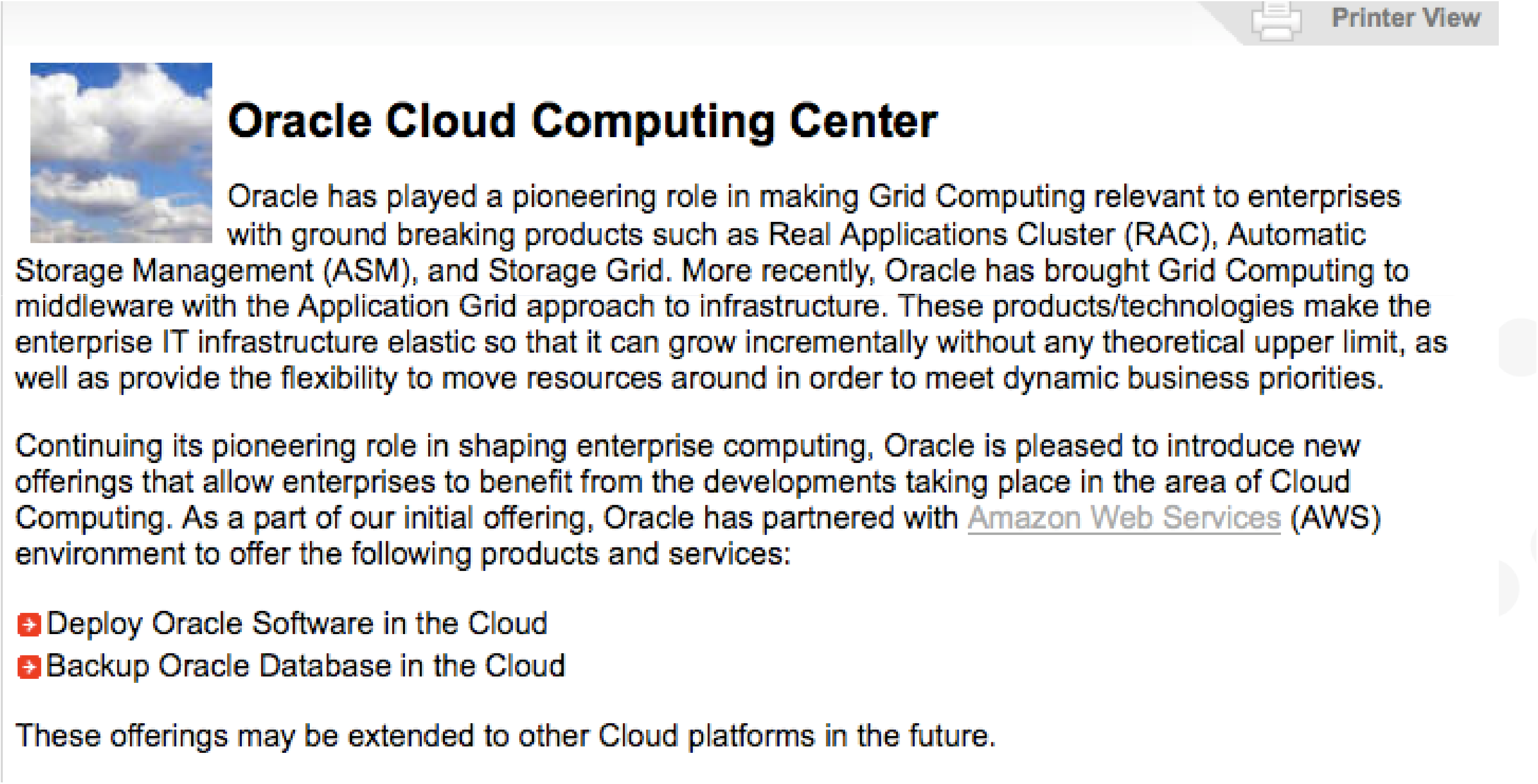
Focus of this last section

- Saas and cloud not the focus, would need a seminar on their own
    - VMs, cooling and energy mgmt, utility computing…
- Goal here is to say what they are and why they are relevant / how they are related to mashups and integration

Just l ke th
Web ervi

Aaron V eiss: '
it's bein calle
IBM to G oogle
Microso t, is su
thing. Bu like t
“cloud computing” can take on different shapes depending on the viewer, and often seems a little fuzzy at the edges.

Larry Ellison’s view on the cloud



Oracle Cloud Computing Center

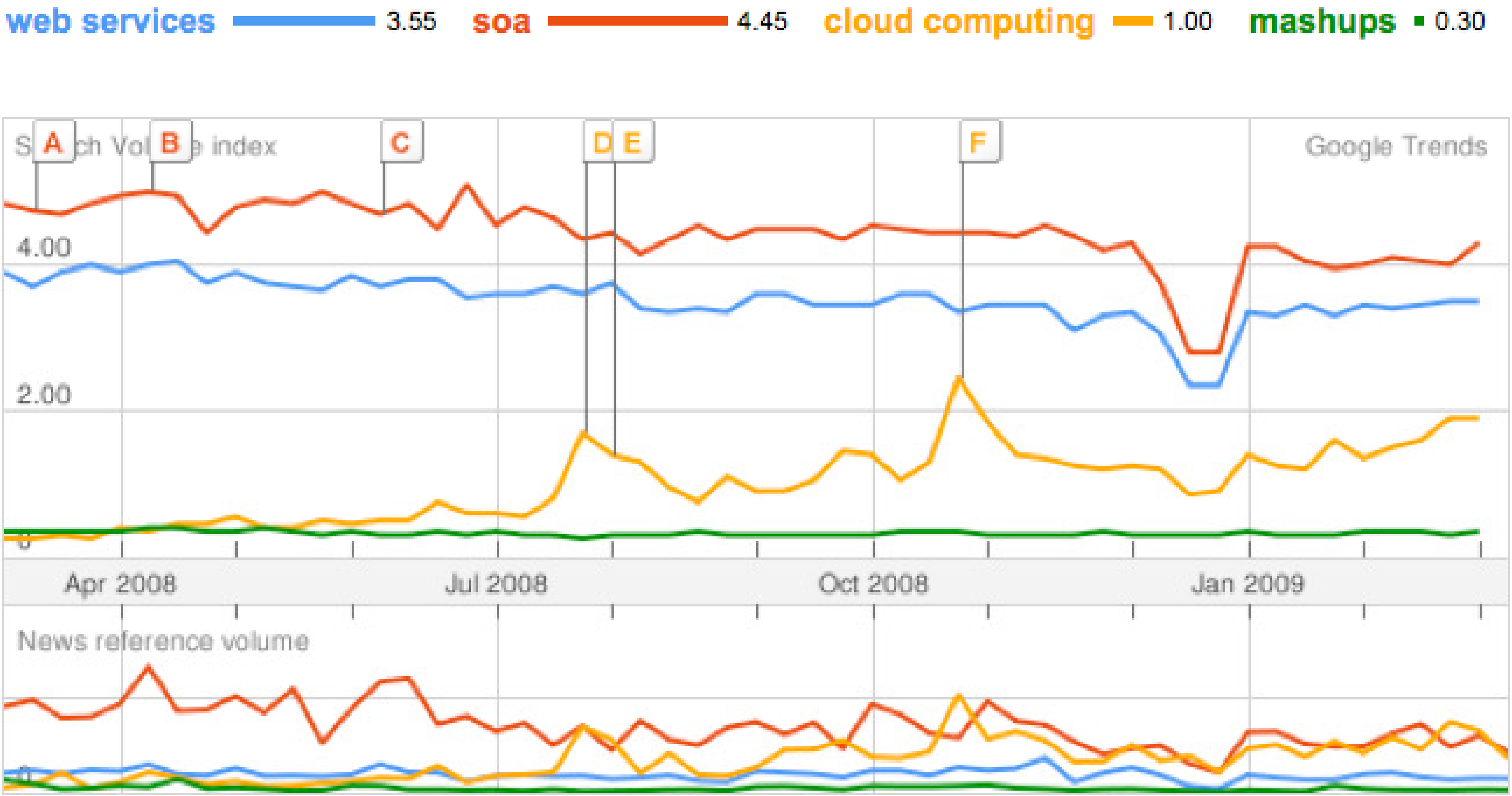
Oracle has played a pioneering role in making Grid Computing relevant to enterprises with ground breaking products such as Real Applications Cluster (RAC), Automatic Storage Management (ASM), and Storage Grid. More recently, Oracle has brought Grid Computing to middleware with the Application Grid approach to infrastructure. These products/technologies make the enterprise IT infrastructure elastic so that it can grow incrementally without any theoretical upper limit, as well as provide the flexibility to move resources around in order to meet dynamic business priorities.

Continuing its pioneering role in shaping enterprise computing, Oracle is pleased to introduce new offerings that allow enterprises to benefit from the developments taking place in the area of Cloud Computing. As a part of our initial offering, Oracle has partnered with Amazon Web Services (AWS) environment to offer the following products and services:

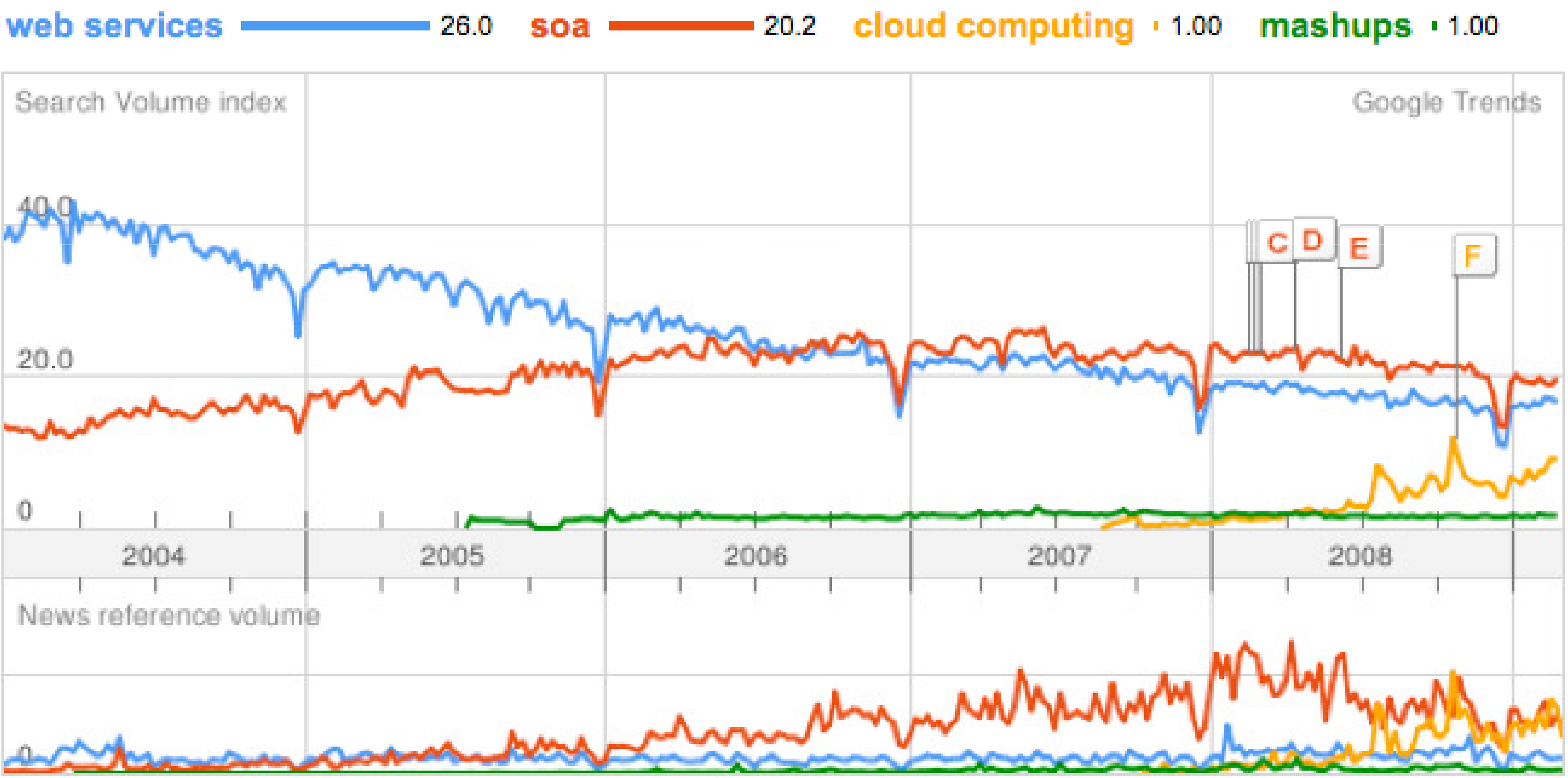
- Deploy Oracle Software in the Cloud
- Backup Oracle Database in the Cloud

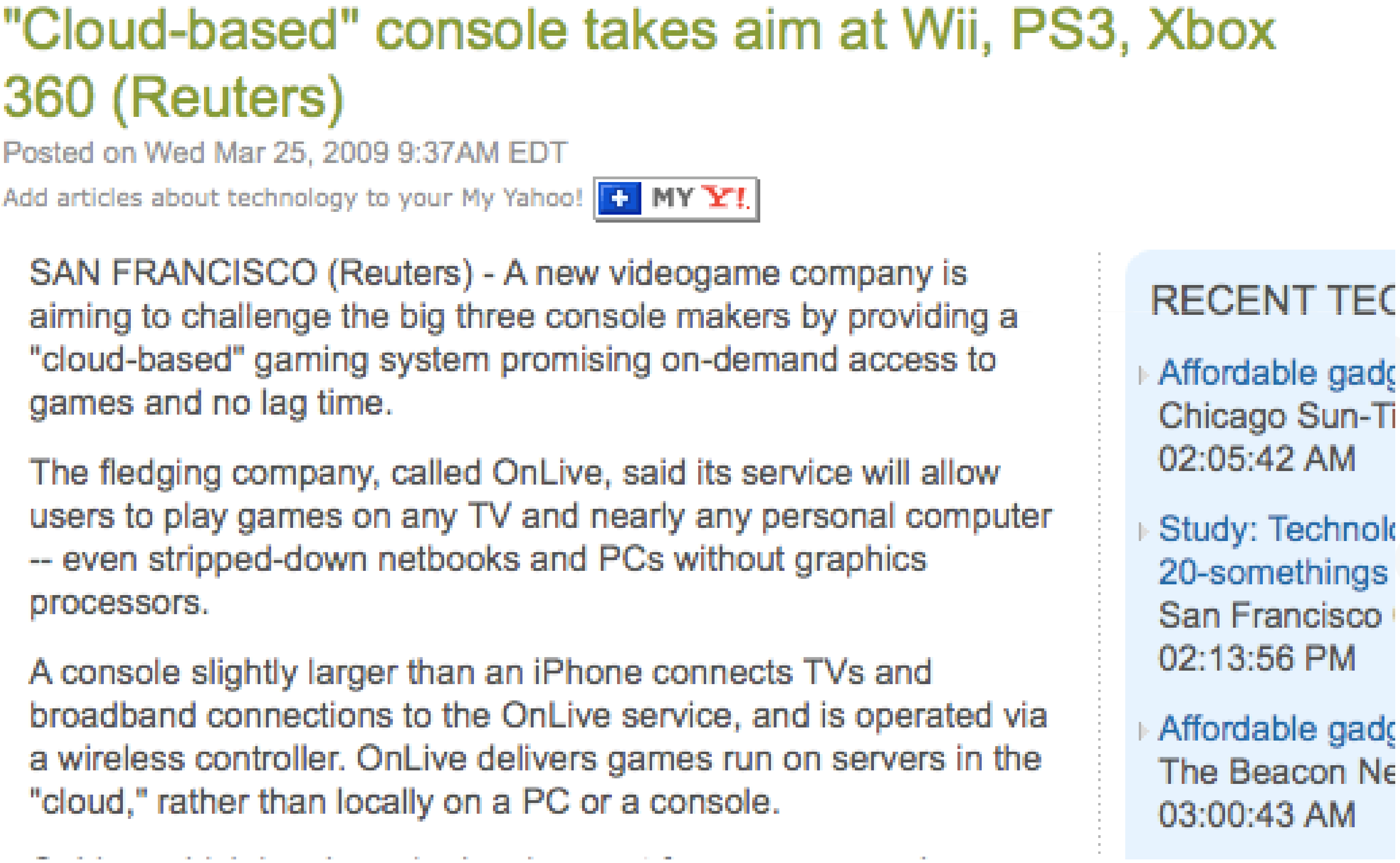
These offerings may be extended to other Cloud platforms in the future.

BuzzTracker



BuzzTracker – larger scale





"Cloud-based" console takes aim at Wii, PS3, Xbox 360 (Reuters)

Posted on Wed Mar 25, 2009 9:37AM EDT

Add articles about technology to your My Yahoo!

SAN FRANCISCO (Reuters) - A new videogame company is aiming to challenge the big three console makers by providing a "cloud-based" gaming system promising on-demand access to games and no lag time.

The fledging company, called OnLive, said its service will allow users to play games on any TV and nearly any personal computer -- even stripped-down netbooks and PCs without graphics processors.

A console slightly larger than an iPhone connects TVs and broadband connections to the OnLive service, and is operated via a wireless controller. OnLive delivers games run on servers in the "cloud," rather than locally on a PC or a console.

RECENT TEC

- Affordable gadg
Chicago Sun-Ti
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- Study: Technolo
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San Francisco
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- Affordable gadg
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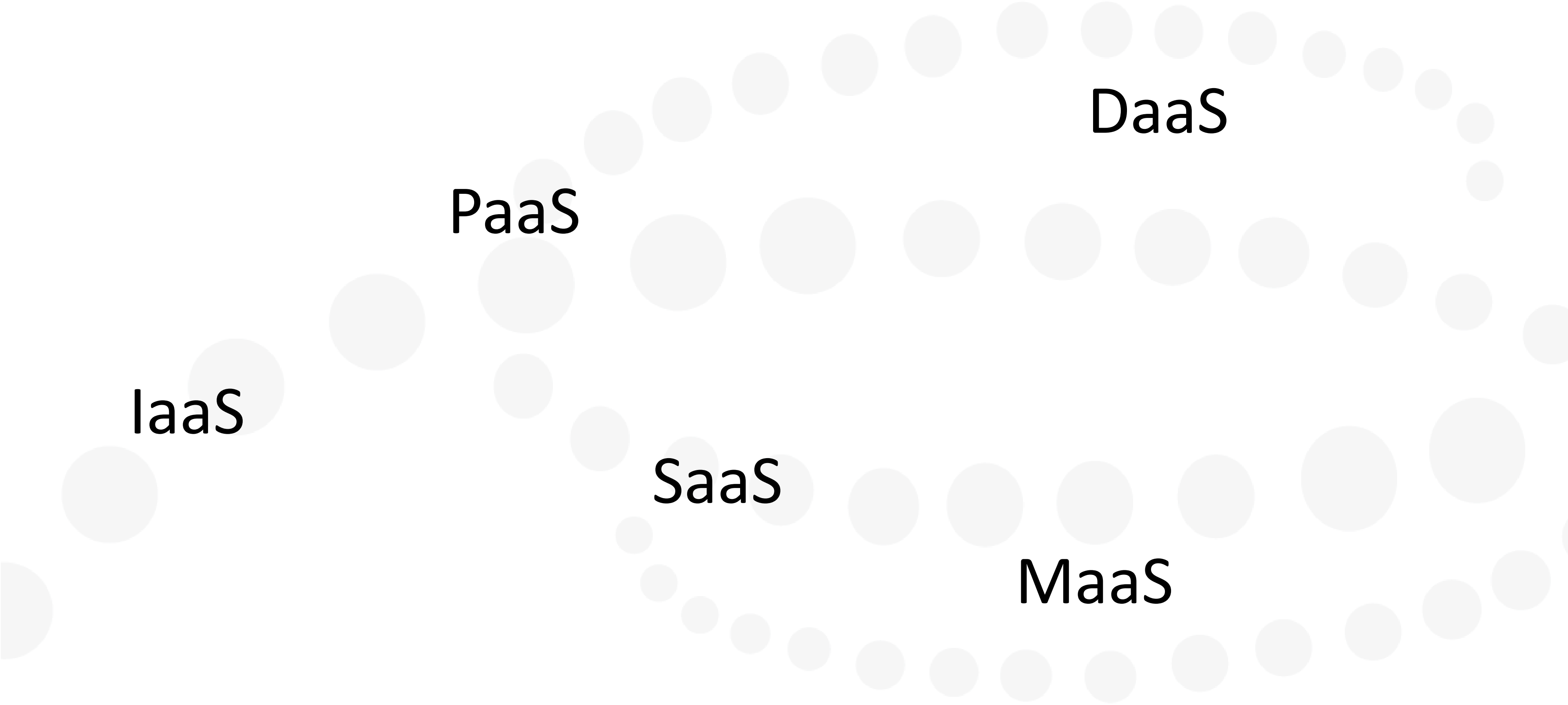
Cloud computing and cloud services

- IT as a service
  - Utility model
  - Hosted… managed…
  - Ideally, scalable, available, secure, efficient
  - Pay per use, no upfront cost
  - Handle peak loads
  - Share information
- Enabled by connectivity, VM technology, online/offline technology

WaaS – Whatever as a Service



DaaS

PaaS

IaaS

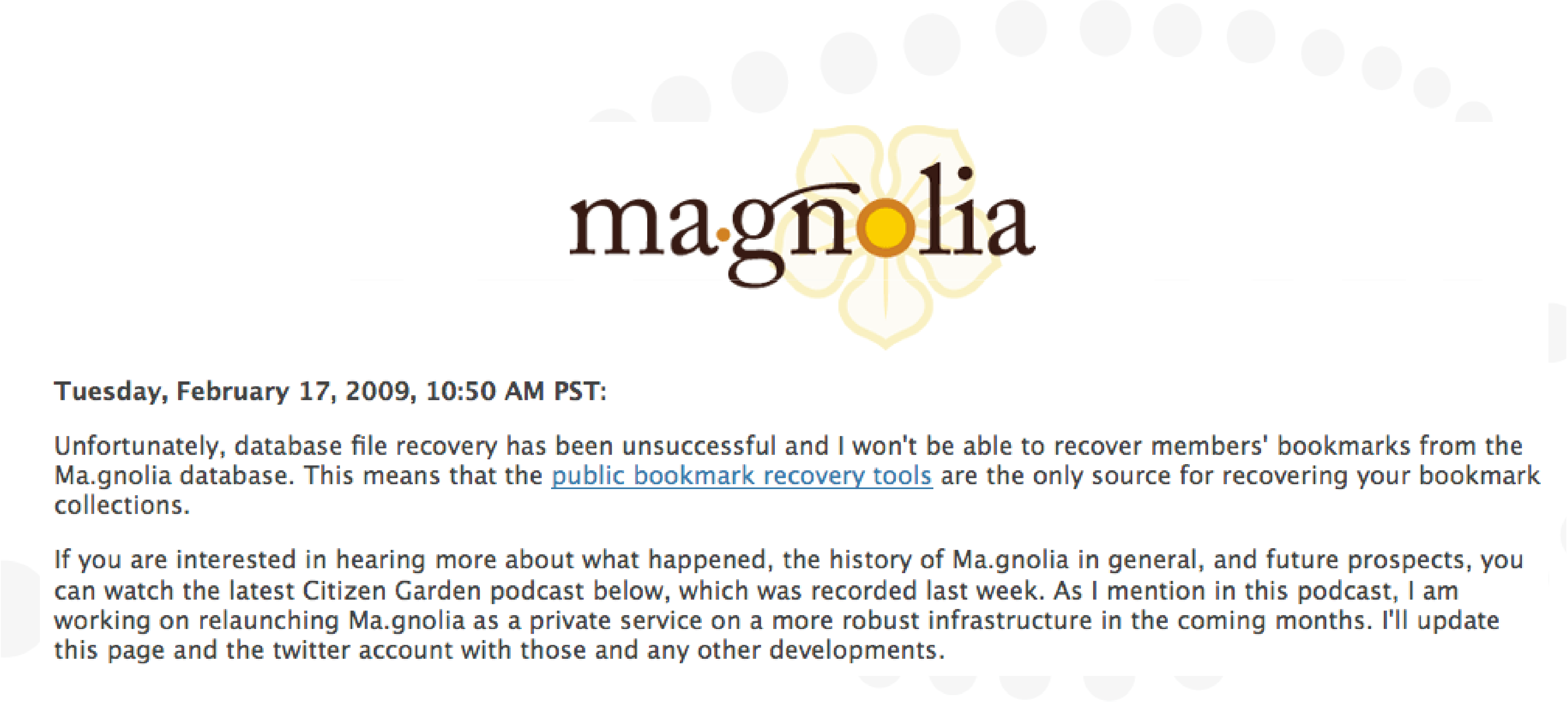
SaaS

MaaS

Challenges for cloud providers

- Scalable/available Multi-tenant infrastructure
- Privacy/security
- Business models, SLAs (and offering different ones to different customers)
- Auditing
- Efficient resource utilization
- Usability
- Offline use
- New design patterns/models (application-driven)

Handle with care…



Tuesday, February 17, 2009, 10:50 AM PST:

Unfortunately, database file recovery has been unsuccessful and I won't be able to recover members' bookmarks from the Ma.gnolia database. This means that the public bookmark recovery tools are the only source for recovering your bookmark collections.

If you are interested in hearing more about what happened, the history of Ma.gnolia in general, and future prospects, you can watch the latest Citizen Garden podcast below, which was recorded last week. As I mention in this podcast, I am working on relaunching Ma.gnolia as a private service on a more robust infrastructure in the coming months. I'll update this page and the twitter account with those and any other developments.

Five is enough...

- "I think there is a world market for maybe five computers...” (1943)
  - Thomas Watson (1874-1956), president and chairman of IBM

SaaS and SOA, Mashups…

- Originally meant for humans, use via browser
- Lately, saas apps provide api… distinction between saas and soa is blurring
    - Even if saas NOT born or dev with the idea of being components, not designed for this, sometimes they evolve into them
    - Examples of gmap and gdoc
- A lot more interesting services available
- Mashuppable

aaS mindset…

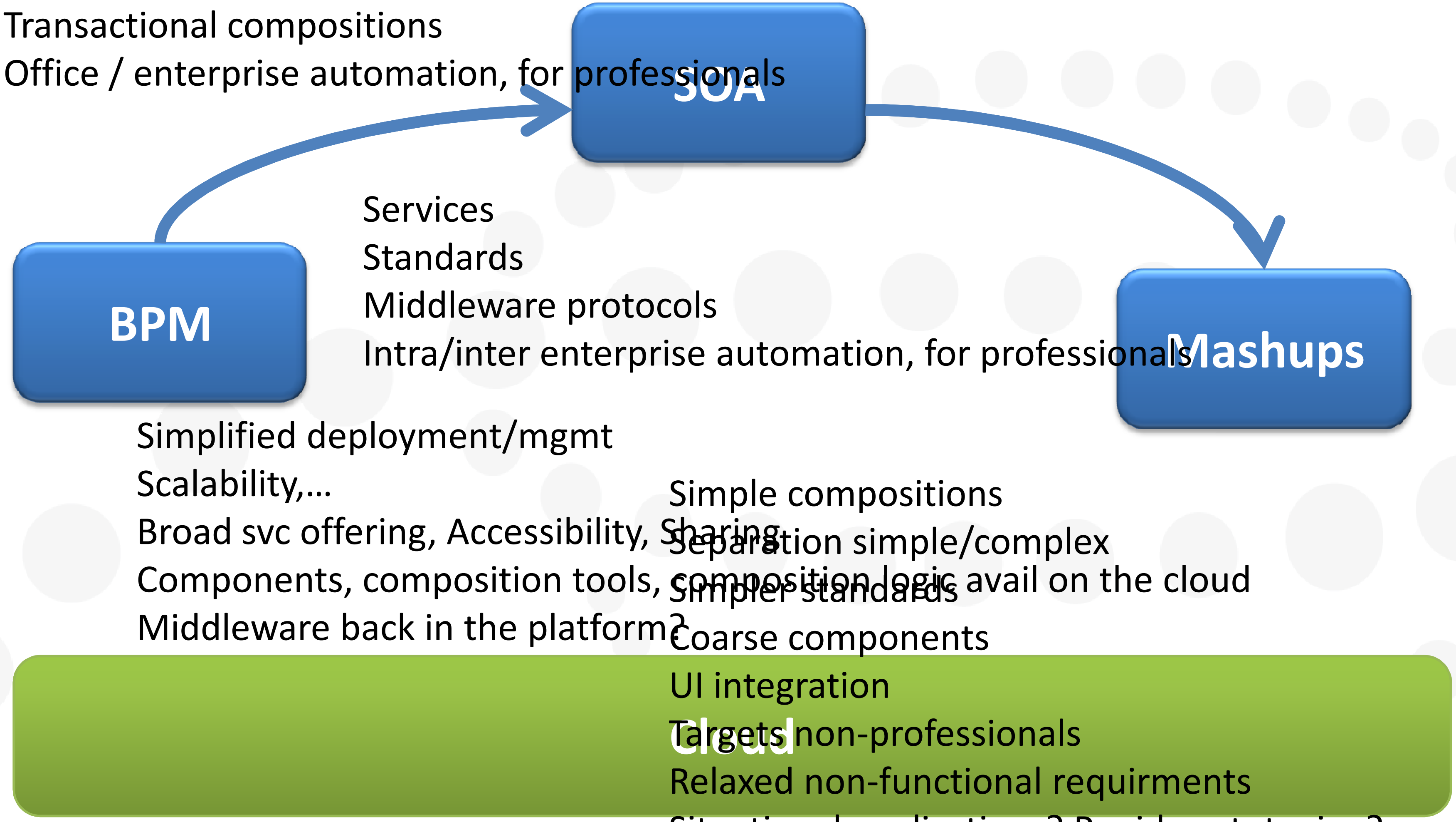
- Naturally leads to thinking API and thinking ***aaS***
- Maybe it’s the fashion,…
- Think SME
- Everything is more “accessible”, even *our own components*

Ease of deployment/management

- Analogous to simplicity in mashup models
- I still have to develop my service/ service composition / mashup, but
  - No need to involve our IT dept or to purchase machines
  - No need to wait 3 weeks because you found out that your blade server consumes more energy than your wiring can support
  - No need to install/manage the dev platform
  - Deploy with a click (and all the other goodies)

Share the integration logic

- PaaS can do for integration logic what SaaS / SOA do for services
  - Share, reuse
- Possible/easier to share programming knowledge, and specifically mashup and composition knowledge

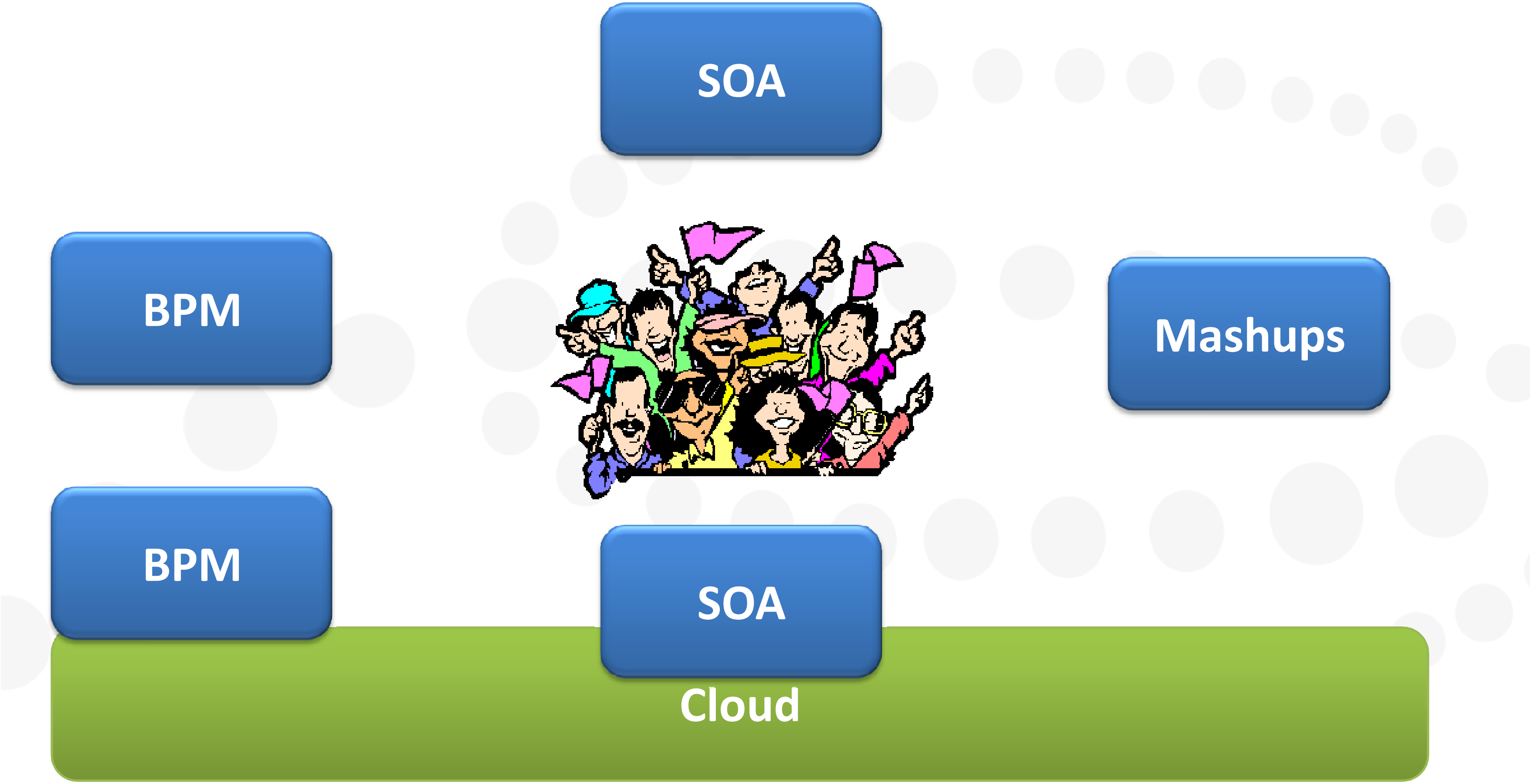


Composition languages
Composition platforms
Transactional compositions
Office / enterprise automation, for professionals

Services
Standards
Middleware protocols
Intra/inter enterprise automation, for professionals

Simplified deployment/mgmt
Scalability,...
Broad svc offering, Accessibility, Sharing
Components, composition tools, composition logic avail on the cloud
Middleware back in the platform?

Simple compositions
Separation simple/complex
Simpler standards
Coarse components
UI integration
Targets non-professionals
Relaxed non-functional requirments
Situational applications? Rapid prototyping?



SOA

BPM

Mashups

BPM

SOA

Cloud

Domain Expert Programming

- Between flexible processes and quasi-situational application
  - “Process automation” at large
- Only way out: let domain expert do the “coding” (and the prototyping, and the testing)

What do we need

- Programming languages not really for domain experts, or not for automation of enterprise processes
  - Either target problem or target users do not match or fit
- Offset complexity with knowledge reuse
  - Odds are, people (maybe experts) have done the same thing before
- Reuse
  - Insights on which components to use
  - mashup/composition knowledge
- (Not talking about semantic web, goal-driven automated composition,….)

Directions (?)

- IT becomes commodity
- Mashups for the People
- Some key challenges:
  - How to make composition models/tools that are simple enough and useful enough?
  - How to build reusable components? What are the characteristic of a “good” reusable component?
  - Can only domain-specific models succeed?

Thanks

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