Composite Dev.
Research at SAP

Anne Hardy

SAP Research, Palo Alto
In current research projects, we cooperate with >200 partners

- 50 Universities
- 30 research organizations
- 80 technology partners
- 30 industrial users
- 10 public sector users

Innovations emerge from ecosystems, not from single players

We want to better leverage North American Universities. Such as Stanford, ...
Practical Research Methodology

Criteria
- Potential market
- Customer input
- Innovation
- Impact to SAP

Research
- Research Demo
- Research Pilot
- Product Transfer
- Product Enhancement
Real World Awareness, Miniaturization, and the Internet of Things

Recent advances in miniaturization, sensor & communication technology, and new materials drive for a new computing paradigm and an explosion of information
The Information Explosion

Exabytes Created, Captured, Copied in a Year


- Chevron – 2 Terabytes per day
- London Traffic Surveillance – 64 Trillion Bits/day
The Information Explosion

- ~ 65% Consumer Generated
- ~ 85% Incurring Enterprise Responsibility
- ~ 90% Unstructured Data

Key Questions

- How do we make sense of this data?
- Is there unlocked business value in this data?
Green Technology Momentum

Key Questions

- Where can customers and SAP provide value?
- What are the new business models?
- What new processes and technologies will be required?
The Rise of the Mobile Individual Business User (MIBU)

Corporate purchasing driving use of individual-owned mobile devices for Mobile Enterprise Applications

Worldwide Converged Mobile Device Market: Who Buys the Phone

Key Questions

- What mobile platforms and technologies are required to support mobile Enterprise apps?
The New Generation of Worker

- Comfortable with the “Web 2.0” world
  * For communication, collaboration, information gathering…

- Blurred line between work and “lifestyle”

- Low tolerance for lagging business IT

Key Questions

- What are their expectations of the SAP’s of the world?
- How will they define business processes?
SAP Research: Trend-driven Innovation

Information Explosion

Green Tech

Rise of the MIBU

The New Generation of Worker

Real World Awareness / Internet of Things

The SAP Research Vision and Research Areas

“Towards Business in Networked Economies”
- Rapidly changing business designs and business models
- Next generation of Web-related services and technologies
- Architectures of participation and collective intelligence
- IT-structures removing technology barriers to evolutionary business process transformation

Global Research Areas

<table>
<thead>
<tr>
<th>Business Aspects</th>
<th>Technology Platforms</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Ecosystems</td>
<td>Service Delivery Platforms</td>
<td>Future Manufacturing</td>
</tr>
<tr>
<td>Industrialization of Software Development</td>
<td>Internet of Things &amp; Real-World Awareness</td>
<td>Web 2.0 Applications</td>
</tr>
<tr>
<td></td>
<td>End-to-End Simplicity</td>
<td>Service Industry</td>
</tr>
<tr>
<td></td>
<td>Advanced Web Technologies</td>
<td>Public Sector</td>
</tr>
<tr>
<td></td>
<td>Sweeney Cross-Organizational Interoperability</td>
<td>Energy Distribution, Agri, and Conservation</td>
</tr>
<tr>
<td></td>
<td>Open Source &amp; Security</td>
<td>Composite Applications</td>
</tr>
<tr>
<td></td>
<td>Other Databases</td>
<td>Product Lifecycle Management</td>
</tr>
<tr>
<td></td>
<td>Mobility Platform</td>
<td>Service Applications</td>
</tr>
<tr>
<td></td>
<td>Virtualized Parallelism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Composite Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semantics and Ontologies</td>
<td></td>
</tr>
</tbody>
</table>

Global Research Ecosystem

Universities, Strategic Industrial Partners, Lighthouse Customers, Consortia
- Rapidly changing business designs and business models
- Next generation of Web-related services and technologies
- Architectures of participation and collective intelligence
- IT-structures removing technology barriers to evolutionary business process transformation

### Global Research Areas

<table>
<thead>
<tr>
<th>Business Aspects</th>
<th>Technology/Platforms</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Service Ecosystems</td>
<td>• Service Delivery Platform</td>
<td>• Future Manufacturing</td>
</tr>
<tr>
<td>• Industrialization of Software Development</td>
<td>• Internet of Things &amp; Real-World Awareness</td>
<td>• Web 2.0 Applications</td>
</tr>
<tr>
<td></td>
<td>• End-to-End Simplicity</td>
<td>• Service Industry</td>
</tr>
<tr>
<td></td>
<td>• Advanced Web Technologies</td>
<td>• Public Sector</td>
</tr>
<tr>
<td></td>
<td>• Seamless Cross-Organizational Interoperability</td>
<td>• Energy Distribution, Mgmt. And Conservation</td>
</tr>
<tr>
<td></td>
<td>• Open Source &amp; Security</td>
<td>• Composite Applications</td>
</tr>
<tr>
<td></td>
<td>• Active Databases</td>
<td>• Product Lifecycle Management</td>
</tr>
<tr>
<td></td>
<td>• Mobility Platform</td>
<td>• Service Applications</td>
</tr>
<tr>
<td></td>
<td>• Virtualization/Parallelism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Composite Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Semantics and Ontologies</td>
<td></td>
</tr>
</tbody>
</table>

### Global Research Ecosystem

- Universities, Strategic Industrial Partners, Lighthouse Customers, Consortia
SAP Research North Americas Research Fields

- Mobility Platform
- Internet of Things and Real World Awareness
- Advanced Web Technologies and Web 2.0 Applications
- Model driven Composite Dev.
- Risk Mitigation: Open Source
- Continuous Information Sensemaking
- Virtualization/Parallelism
Composite Dev. - Motivation

The globalization trend and dynamics of today's business operations impose many new requirements on software application development.

One of them is how to composite or extend an application by leveraging existing software components and enabling the quick development of new/missing functions.
## Typical Composite Dev. cycle

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator (IT)</td>
<td></td>
<td>Map application landscape to designated IT landscape also complete technical configuration (property settings)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developer (IT)</td>
<td></td>
<td>Implement new services or UI components and bring them into modeling environment as &quot;black box&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Analyst (IT)</td>
<td>Prototype Business Process, UI for each step and role as well as Information modeling. Select services for process and UI where possible</td>
<td>Business Configure of BP/App using modeling interface</td>
<td>Identify gaps to complete application (i.e. services needed, missing UI elements)</td>
<td></td>
</tr>
<tr>
<td>End User (LOB)</td>
<td>Validate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Owner (LOB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© SAP AG 2006, Novartis EBC / Wesley Mukai / 14
Composite Dev. - Vision

- More **concise** - fewer lines of code.
- More **expressive** - each line does more.
- More **understandable** - closer to business domain.
- More **productive** - less programming effort required

One-stop shop for composite applications

**A Development Platform**

That provides all the needed design and implementation facilities under one coherently integrated environment.

**And an Execution Platform**

That enables the efficient execution and effective monitoring and management of the composite applications.
Value proposition

Target user = developer with SSP

Quick application implementation and extension

One coherent integrated model

On-demand and on the fly enhancement

Design-time + run-time

Incremental development: start with the domain that you prefer
Features

DSL + Scripting = Unification
- Declarative + Imperative = Goodness
- Declarative only goes so far – we need a programming language
- DSL + Ruby = Ruby DSL

Clean separation of UI, business logic and data models.

Three Kinds of Composition
- Process flow-based composition
- Event-driven composition
- Data integration/aggregation
Challenges

What programming model is needed? Coarse grained or fine grained?

What is the right level of abstraction? What should be the associated models? For UI, Security, Event Management?

From high level modeling to workflow execution and monitoring?
Technologies

Model-Based Development Environment: Integrated Development & Execution Environment; Composite Application Development; Flexible and Expressive Scripting Language to support Modeling all Functional and Operational Aspects; Separation of UI, Business Logic, and Data Management; Modeling Real Time Input; Automatic Code Generation;

Agile Execution Platform: Data Mapping and Mediation; Persistent Data Management; Complex Business object support; Business Process Automation; Business Process Monitoring; Business Process Enforcement; Event Management & Correlations; Security Policy Enforcement

Service Binding

New Service Creation