DirectExchange Motivation

Who? Visa (US)
- 14,000 financial institutions (6,000 of them banks)
- 330 million credit cards
- 35 billion transactions for a total of $720 billion a year

What? A private IP network between merchants and banks
- Reliable: zero downtime, zero mistakes
- Scalable: 10,000 messages/second, $60 million per hour
- Flexible: ‘plug and play’ new functionality

Why? Support more banking services
- More payment options: mobile phones, PDAs, smart cards
- Web access to account information
- In general, allow for easy implementation of new services
## DirectExchange Laundry List

<table>
<thead>
<tr>
<th>First Tier: Presentation</th>
<th>Middle Tier: Business Logic</th>
<th>Third Tier: Database</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td>Sun Enterprise Servers</td>
<td>85TB EMC Symmetrix storage array: McLean, VA, San Mateo, CA</td>
</tr>
<tr>
<td>Anything</td>
<td>J2EE (Solaris), BEA Systems’ Tuxedo transaction server</td>
<td>Oracle</td>
</tr>
<tr>
<td><strong>Middleware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anything that runs TCP/IP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In-between: IP network, CICSO routers, Fibre
Sequoia 2000 Motivation

Who? A typical PSE (Problem Solving Environments) band
  • Computer scientists: UC Berkeley, UC San Diego
  • Global change researchers: Los Angeles, Santa Barbara
  • Industry: Digital Equipment Corporation, Hewlett-Packard

What? Computing environment for global change researchers
  • Predict and understand changes in the Earth system
    – Earth radiation balance
    – Ocean circulation
    – Atmospheric chemistry
    – ...

Why? Global change researchers have too much data
  • Data acquisition: 6 satellites, 2 TB per day
  • Data management: 0.1 TB per year per user
  • Visualization: space-time data, 300 MB per ‘picture’
Sequoia 2000 Visualization Workflow

**Visualization Recipe**

1. User submits a **visualization recipe** to the database. A recipe consists of database operations, custom filters, and **eyes**.

2. An **intelligent subsystem** rewrites the recipe using user hints and database contents.

3. The database executes the recipe and returns **renderable objects** (hierarchical space decomposition) output by the eyes.

4. The display subsystem animates the renderable objects.

5. Renderable objects can submit new recipes to the database.
Sequoia 2000 Visualization Architecture

Presentation Tier

- Display Subsystem

‘Business’ Logic Tier

- Intelligent Subsystem
- Object Handler

Database Tier

- Recipe Manager
- RDBMS
Sequoia 2000 Components

1. Presentation Tier
   Display Subsystem  Renders objects on the screen and delivers events to them (dumb client).

2. ‘Business’ Logic Tier
   Object Handler  Routes/translates messages (middleware).
   Intelligent Subsystem  Transforms recipes using domain-specific knowledge (rewrite rules).

3. Database Tier
   Recipe Manager  Executes visualization recipes. Each recipe is a dataflow graph where the nodes are either data transformations or ‘eyes’.
   RDBMS  Guess what? It stores and queries data!
3-Tier Architecture on the Grid

Presentation Tier (user interface)
- Experiment/Simulation Catalog
- Visualization of Results
- Data Acquisition

‘Business’ Logic Tier (processing logic)
- Data Conversion (Mediators)
- Data Analysis
- Optimization
- Recommendation

Database Tier (high performance)
- Database
- Simulations