Class Announcements

- Database assignment 2 out
  - Due February 23
- Business Paper Draft Due 2/28
Example 3: Network Infrastructure Expanded

HHC Server Application

Passenger Information

message

HHC Client Application

Windows OS

TCP transport layer

Packets

Palm OS

TCP transport layer

Packets

WiFi Link Layer

WiFi Physical Layer

Networking Infrastructure

Passenger Information

message

Networking Infrastructure

Computer & Comm. Industry Structure

Two ways to design a system

Available components

System requirements

Decomposition from system requirements

Requirements

Assembly from available components

Components

Component: A subsystem purchased "as is" from an outside vendor

(Alternative – building your own subsystem)

A component implementation is encapsulated (although often configurable)

HHC Architecture

HHC Application

Coordination With HHC Server

User Interface

Palm OS

Networking Infrastructure

Data Management

The Palm OS we are buying “off the shelf” and integrating into our architecture. The Palm OS is a component.

Other Examples of components

Computer

Disk drive

Network

Network router

Operating system

Integrated circuit

Database management system

Why is a component implementation encapsulated?

Slide adapted from slides for Understanding Networked Applications
By David G. Messerschmitt. Copyright 2000. See copyright notice
Interoperability

- Components are interoperable when they interact properly to achieve some desired functionality.
- Increasingly component interoperability cannot be dependent on end-user integration:
  - PC and peripherals
  - Enterprise, inter-enterprise, consumer applications
  - Role for standardization

Outsourcing

- A subsystem design is contracted to an outside vendor.
- Responsibility is delegated.

HHC Architecture

- Suppose we choose to pay another firm to develop the user interface.
- This is called Outsourcing.
- Why would we do this?

System Integration

- Suppose we:
  - Bring together all these subsystems
  - And test them...
- This is called System Integration.

System integration

- Bring together subsystems;
- Make them work together;
- To achieve a goal.

- Requires
  - Testing
  - Making modifications to subsystem implementation.
Supplier Types

- Three types of suppliers:
  - Component Suppliers
  - Custom Subsystem Developers
  - System Integrators
  (Some suppliers are 2 or even 3 of above.)

Two ways to sell Software

<table>
<thead>
<tr>
<th>Product</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer installed and operated</td>
<td>Functionality provided over a wide-area network</td>
</tr>
<tr>
<td>Often (but not necessarily) sold or licensed at a fixed price</td>
<td>Often (but not necessarily) sold by subscription</td>
</tr>
</tbody>
</table>

Recall: Infrastructure and Applications

Infrastructure
- Equipment and/or software used by many applications

Applications
- Provide specific capabilities and features serving individual users.

Four possibilities

<table>
<thead>
<tr>
<th>Product</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Office</td>
<td>Hotmail</td>
</tr>
<tr>
<td>Application</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Personal computer</td>
<td>Internet DNS</td>
</tr>
</tbody>
</table>

Application Service Provider

- Two types
  - Bundled
    - An infrastructure provider bundles applications with their infrastructure
      - Example: Comcast, telephony service providers
  - Unbundled
    - A provider of an application service without providing an infrastructure service
      - Examples?

Examples of unbundled ASP model

- Yahoo: Web-based calendar
- gmail: Web-based email
- Schwab: Web-based stock trading
Unbundled ASP model

Advantageous to user
- Proven way to reduce installation, integration, and maintenance costs
- Contractual obligation for availability and quality
- Location independence

Advantages to supplier
- Ongoing revenue stream supporting upgrade and maintenance
- Usage-based revenue better aligned with user’s value proposition
- Opportunity for price discrimination, advertising revenue, etc.

Some pricing alternatives

Price discrimination?
Usage dependent?
Terms and conditions
- fixed, leasing, per-use, subscription
- warranty, service level agreements

Bundles
- maintenance, support, releases, provisioning and operations

Who pays?
- sometimes not the end user

Infrastructure acquisition

Application acquisition