Class Announcements

- Assignment 4
  - Due Thursday 2/19
- Business paper draft
  - Due Tuesday 2/24
- Database Assignment 2 posted
  - Due Thursday 2/26
System integration

- Bring together subsystems;
- make them work together;
- to achieve a goal.

- Requires
  - Testing
  - Making modifications to
    - architecture and/or
    - subsystem implementation

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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

**Product**
- Customer installed and operated
- Often (but not necessarily) sold or licensed at a fixed price

**Service**
- Functionality provided over a wide-area network
- Often (but not necessarily) sold by subscription

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Recall: Infrastructure and Applications

Infrastructure
- Equipment and/or software used by many applications

Applications
- Provide specific capabilities and features serving individual users.
Four possibilities

Product          Service

Microsoft Office  Hotmail

Application      Infrastructure

Personal computer  Internet DNS

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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

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Unbundled ASP model (con’t)

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
  - warrantee, service level agreements
Bundles
  - maintenance, support, releases, provisioning and operations
Who pays?
  - sometimes not the end user
Infrastructure acquisition

Infrastructure

Build and operate
Build but do not operate
Do not build but operate
Neither

Trend

Outsourced operations
System integrator
Service provider

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Application acquisition

Application

- Develop internally
- Buy as product
- Contract development
- Product w/ customization

Trend

Software supplier
Outsource developer
Supplier, consultants
Stovepipe vs. Integrated Infrastructure

**Stovepipe architecture**

---or---

**Turnkey Solution**

- Single supplier provides all encompassing solution
- (complete with infrastructure)

**Integrated Infrastructure**

- Separate infrastructure that can support many applications

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From stovepipe to layering

Data  Voice  Video

Many applications

Application-dependent infrastructure

Integrated Infrastructure (Maybe broken into Additional layers.)

Application-independent
Stovepipe vs. Integrated Infrastructure

- What are some examples of each?

- What are the advantages of each approach?
Vertical Integration vs. Diversification

- A company is **vertically integrated** when it makes rather than buys the subsystems in its products.

- A **diversified** company produces products across different industry segments.
Vertical Integration vs. Diversification

Why do customers favor less vertical integration?
- Prefer competition amongst component suppliers
- Mix and match components
- Reduced lock in

Disadvantages??
- Customer needs to integrate components from different suppliers.

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Vertical Integration vs. Diversification

- Why do customers favor diversification?
  - Reduce coordination costs by having to deal with fewer suppliers.

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General Trend

- Less Vertical Integration

- More Diversification

- Of course there are exceptions...
Today’s supplier structure

- Applications
- Frameworks and components
- Middleware
- Infrastructure (network, OS) software
- Equipment (network, computers)
- Semiconductors, components

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Standardization
Purpose of a standard?

- Allow products or services from different suppliers or providers to be interoperable
Scope of a standard

Included:
- interfaces (physical, electrical, information)
- architecture (reference model)
- formats and protocols (FAP)
- compliance tests (or process)

Excluded:
- implementation
- (possibly) extensions
Reference model

Decide decomposition of system

- where interfaces fall

Defines the boundaries of competition and ultimately industrial organization

- competition on the same side of an interface
- complementary suppliers on different sides
- hierarchical decomposition at the option of suppliers
- (possibly) optional extensions at option of suppliers
Some issues

Once a standard is set

- becomes possible source of industry lock-in; overcoming that standard requires a major (~10x?) advance
- may lock out some innovation

In recognition, some standards evolve

- IETF, CCITT (modems), MPEG
- backward compatibility
Types of standards

de jure
- Sanctioned and actively promoted by some organization with jurisdiction, or by government

de facto
- Dominant solution arising out of the market
- Voluntary industry standards body

Industry consortium
Common or best practice

Examples?
Examples

**de jure**
- GSM, ISDN Telephone interface

**de facto**
- Microsoft Windows API (Application Programming Interface)
- Intel Pentium instruction set

**Voluntary industry standards body**
- IEEE (Institute of Electrical and Electronic Engineers)
- IETF (Internet Engineering Task Force)

**Industry consortium**
- bluray

**Best practice**
- Windowed GUI

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The changing process

- As technology and industry move more quickly, the global consensus standards activity has proven too unwieldy
  - e.g. ISO
- “New age” standards activities are more informal, less consensus driven, a little less political, more strategic, smaller groups
  - e.g. IETF

Programmable/extensible approaches for flexibility
- e.g. XML, Java

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Reasons for change

- From government sanction/ownership to market forces
  - Increasing fragmentation
  - Importance of time to market

Greater complexity

- Less physical/performance constraint for either hardware or software
Lock-in

(Particularly open) standards reduce consumer lock-in

- Consumers can mix and match complementary products

Increase supplier lock-in

- Innovation limited by backward compatibility
- e.g. IP/TCP, x86, Hayes command set

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Aside: Network Effects

- The value of owning some products goes up if lots of other people have it too.
  - Examples?

- This phenomenon is called “network effects”

- How do standards influence network effects?
Network effects

Standards can harness network effects to the industry advantage

- Revenue = (market size) × (market share)

Increases value to customer

Increases competition

- Only within confines of the standard
- But forces customer integration or services of a system integrator
Why standards?

de jure are customer driven to reduce confusion and cost
de facto standards are sometimes the result of positive feedback in network effects

Customers and suppliers like them because they
- increase value
- reduce lockin

Governments like them because they
- promote competition in some circumstances
- May believe they can be used to national advantage
Approaches

Consensus
- ISO

Collaborative design
- MPEG

Competitive “bake off”
- IETF
Open vs. Proprietary Standards

- Open standard - a standard that is well documented, unencumbered by intellectual property rights and restrictions, and available to any vendor.

- What are the advantages?

- What are the disadvantages?
Why companies participate

Pool expertise in collaborative design
  - e.g. MPEG

Have influence on the standard

Get technology into the standard
  - Proprietary, with expectation of royalties
  - Non-proprietary

Reduced time to market
Standards applied to Business Processes?

Can you standardize business processes?

Yes!:

- **ISO 9000**
  - A set of standardized business processes for Quality Management.
  - Supports TQM (Total Quality Management)

- **RosettaNet**
  - A set of standardized business processes, and accompanying standardized data interfaces/formats for conducting e-business.