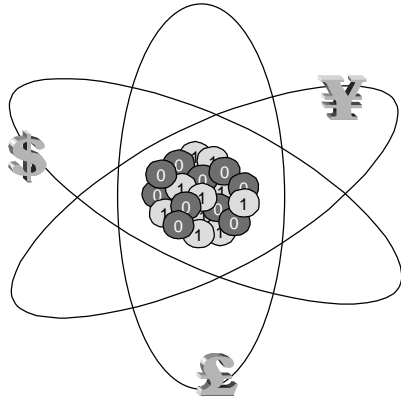


Database support for E-Commerce Applications

Manoj Kumar, mkumar@in.ibm.com
Anant Jhingran, anant@us.ibm.com



IBM Research Division
India Research Lab

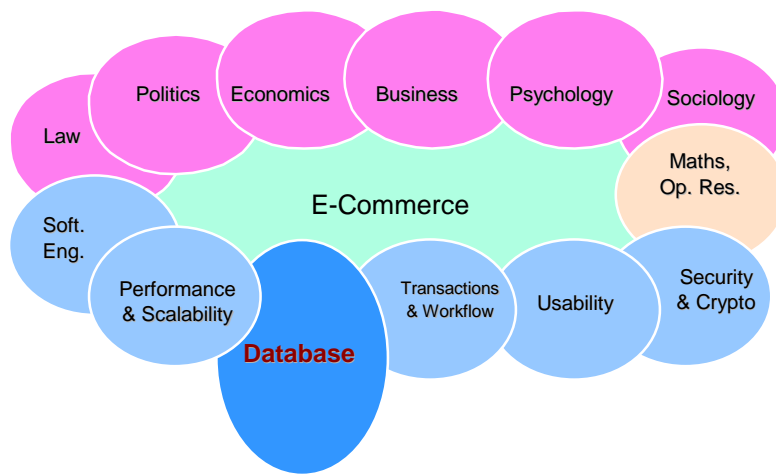
Role of Internet in Business

- Marketing
 - Advertising
 - Sales-Promotions
 - Information/Directory services, Catalogs
- Business Transactions
 - Buying/Selling things: Fixed Price model
Auctions, Brokerages, Procurement
 - Payments: Credit cards, e-cash and e-banking
- Customer Support & Service
 - Personalization

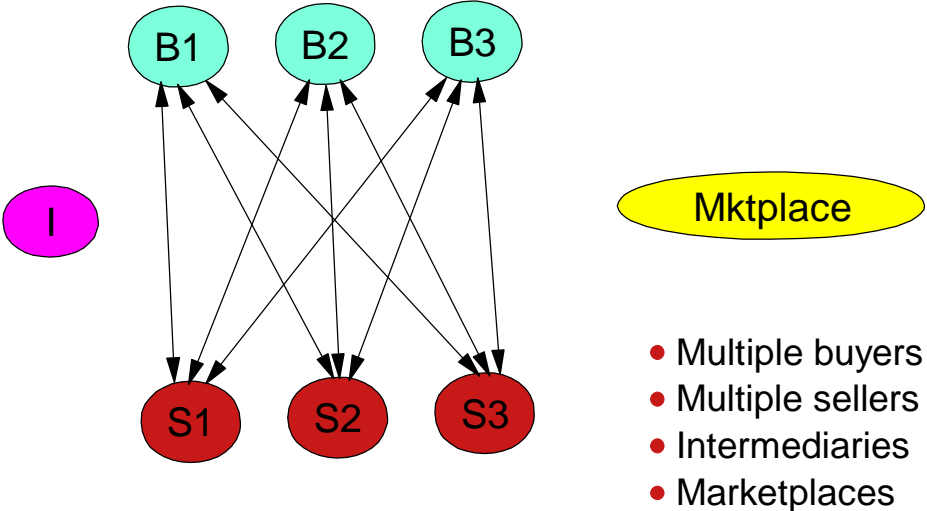
Overview

- Role of Internet and databases in eCommerce
- E-Catalogs
- E-Markets: Auctions, RFQ, Exchanges
- e-Coupons: Sales Promotions
- Personalization

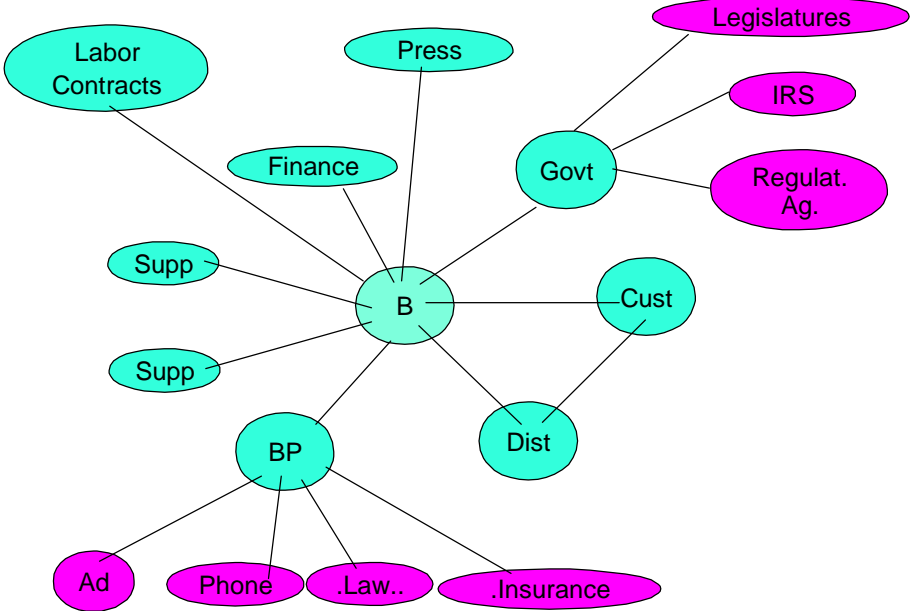
Building a good commerce system



eCommerce Eco System

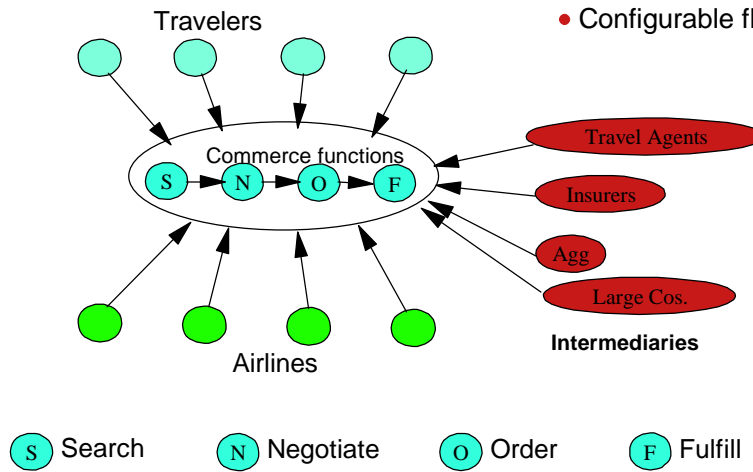


The Intermediaries

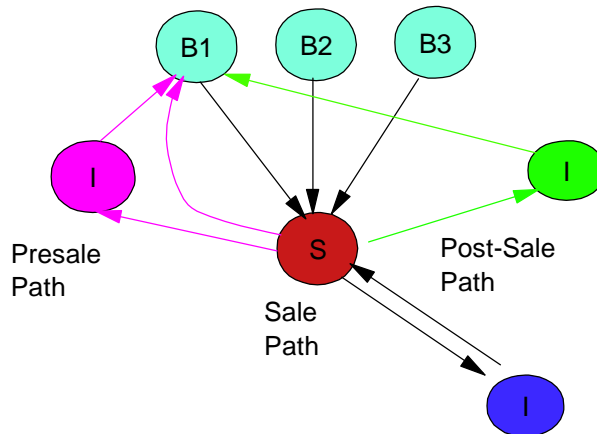


eCommerce Middleware

- Multiparty transactions
- Pluggable components
- Configurable flow

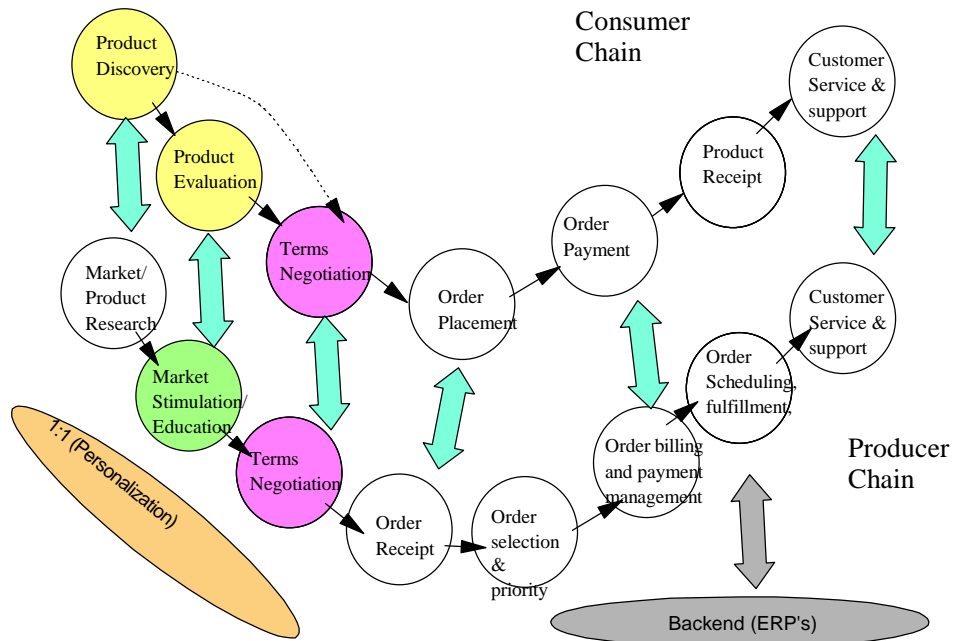


Example: Seller's Environment

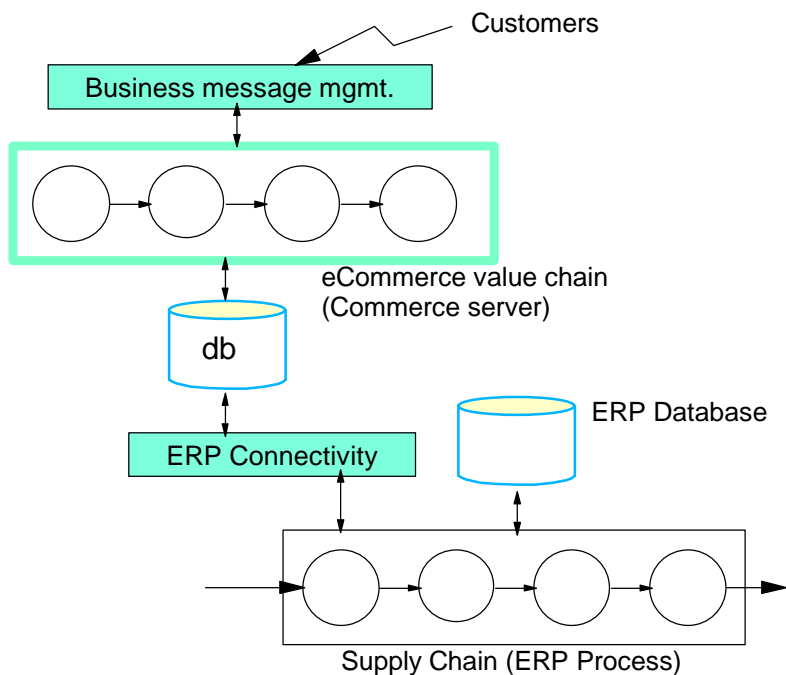


Presale, sale, and post-sale functions supported by intermediaries.

E-Commerce Value Chain



Role of E-Commerce systems



Overview

- Role of Internet and databases in eCommerce
- E-Catalogs
- E-Markets: Auctions, RFQ, Exchanges
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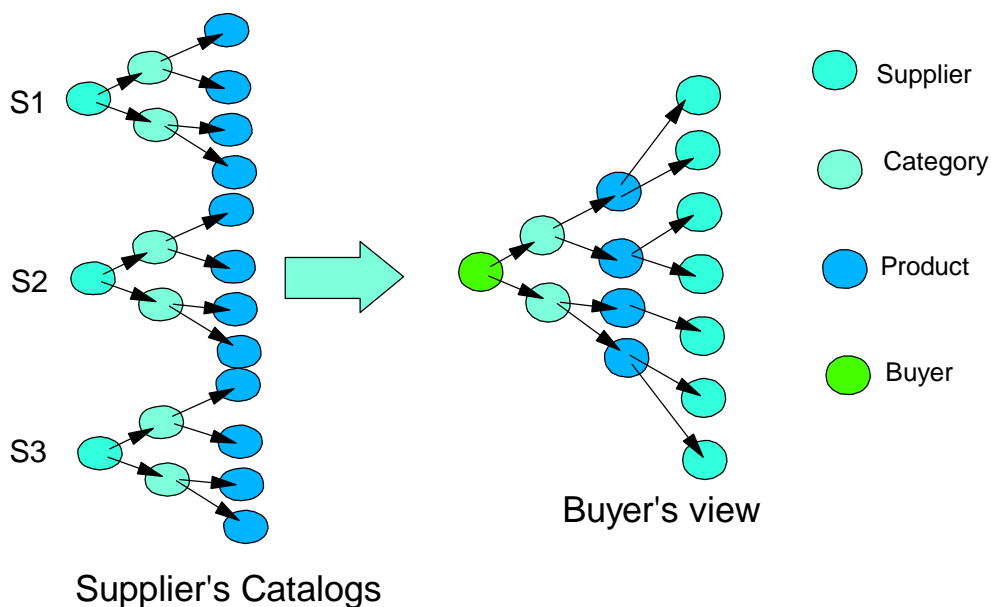
Business function provided by catalog

- Browsing
 - Organizing products by categories
 - Dynamic reorganization based on user profile,
 - Dynamic product customization and price quoting
- Search
 - Attribute based search
 - Product advisors
- Delivery vehicle for Coupons/Promotions
- Aggregation
 - Buyer/Distributor Centric Catalogs

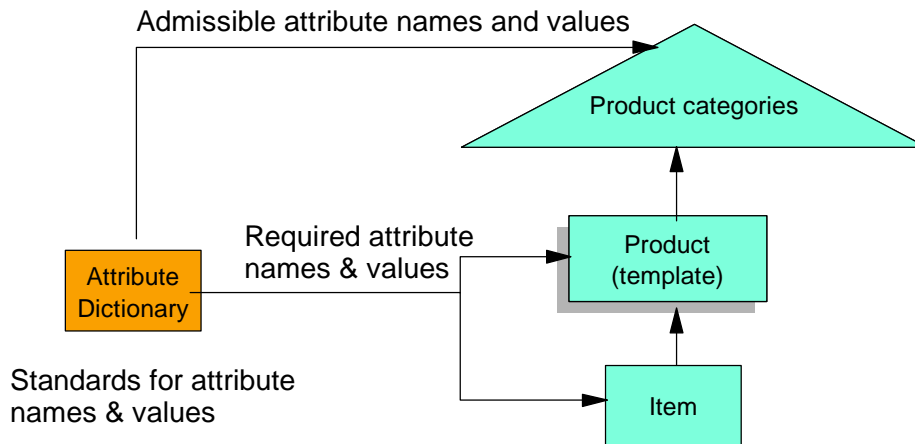
Steps in Building a Vibrant Catalog

- **Collecting, Cleansing Data**
 - Most companies have data spread in proprietary format such as Quark
 - Massive Warehousing Problem
 - * thinking of product attributes (such as color = pink, material = "silk") is a new process
- **Categorization (building the catalog hierarchy)**
 - Classification using 60,000 attributes! (most are empty)
 - a product may be in several categories
- **Aggregation**
 - Supplier 1 calls it "tyres", Supplier 2 calls it "tires"
 - Supplier 1 measures in cm, Supplier 2 in inches
 - Also, discriminate suppliers as the last step
- **Providing Different Search Metaphors**
 - simple efficient text search and category based browsing
 - more complex -- "salesman" like search
 - * today I am in a mood of surprising my wife -- what do you suggest?

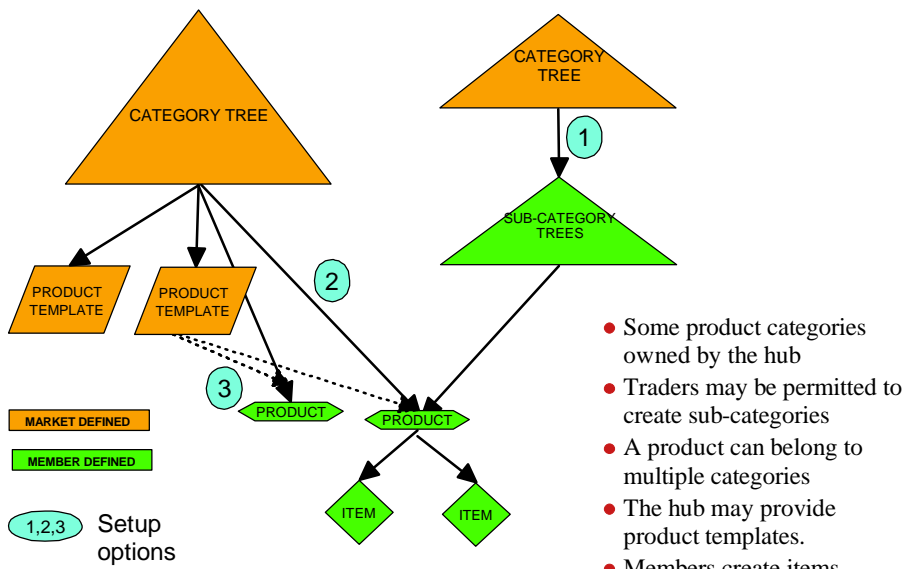
Catalog Aggregation Process



Consistent Categorization & Product definition



Defining Categories



Requirements for E-Catalogs

Summary of CommerceNet Catalog Working Group recommendations

- Scalable and support distributed search
- Provide up-to-date information
- Support variety of search techniques
- Cross-catalog search (e.g. for comparison)
- Open architecture
 - ▶ Connection of new info sources
 - ▶ Open standards

Database research issues in E-Catalogs

- Organization based views
 - Business buyers see products authorized by their organizations
 - Only products from authorized vendors shown
 - Prices negotiated by the buying organization shown
- Reporting and auditing
 - Reports generated of purchases from the catalog for each buying organization
- Efficient implementation of alert services
 - Query optimization for catalog shopping domain
 - Communication bottlenecks: IP multicast vs. efficient unicast
- Schema integration issues in Catalog aggregation
- Search Technology
 - Text extenders
 - Searching via images

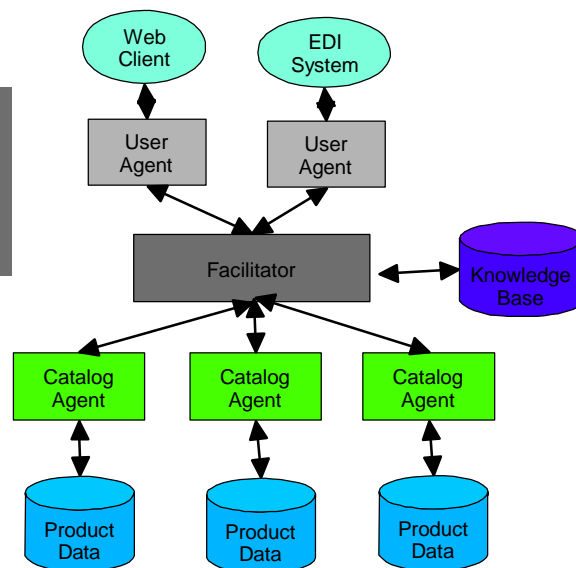
Virtual Catalogs

- Current distributor or retailer catalogs are based on:
 - ▶ Hyperlink approach - interaction details lost
 - ▶ Integrated approach - significant storage and maint cost
- Virtual Catalogs:
 - ▶ Dynamic retrieval of product data
 - ▶ Distributor maintains control over interactions
 - ▶ Built on top of a Smart Catalog infrastructure

Smart Catalog Architecture

Facilitator acts as an information broker
Stores agent provided advertisements of coverage
Decomposes requests requiring action by multiple agents

Catalog agent has 3 roles:
Advertise the coverage of the product database
Translate queries into the product db language
Package answers from product db into ACL

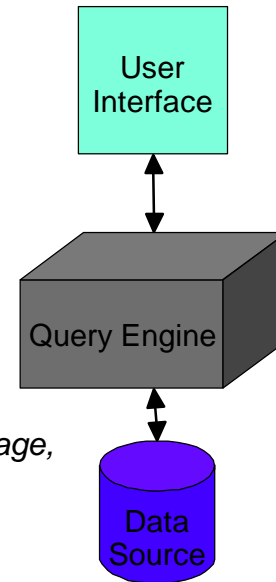


Query processing core separated from the data sources and user interfaces
Multiple user interfaces can access system Variety of data sources can be connected

Information Integration

Abstraction Hierarchy

- Interface relations
 - ▶ *cars* (*manufacturer, year, mileage, price, value*)
- Base relations
 - ▶ *classifieds*(*manufacturer, model, year, mileage, price*)
 - ▶ *bluebook*(*manufacturer, model, year, mileage, value*)
- Site relations:
 - ▶ *nytimes*(*manufacturer, model, year, mileage, price*)
 - ▶ *gm*(*model, year, mileage, value*)
 - ▶ *bmw*(*model, year, mileage, value*)



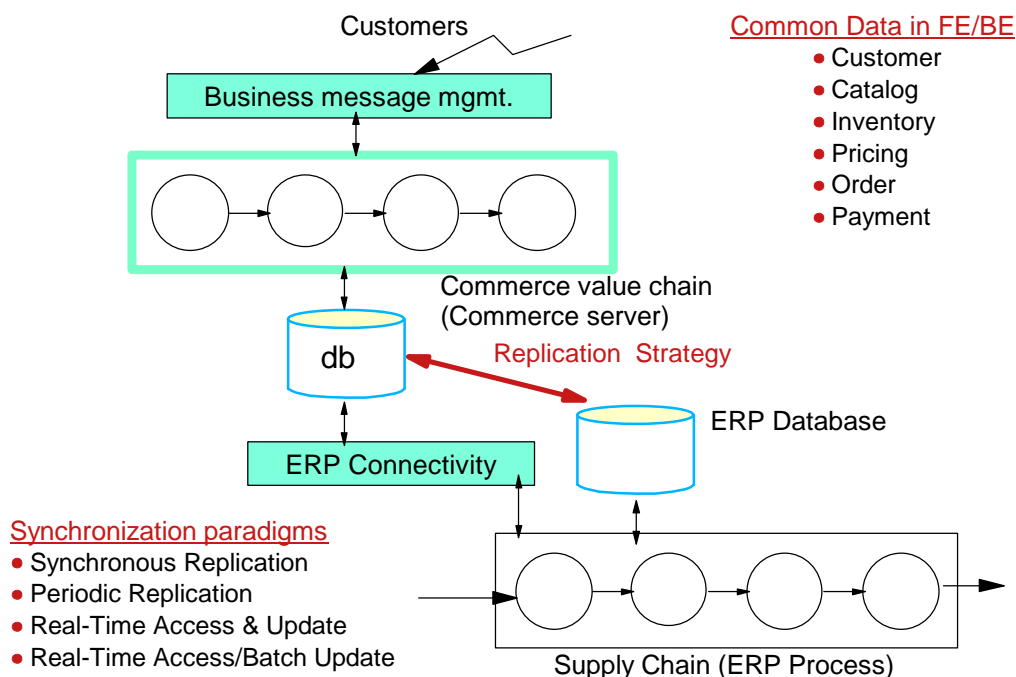
Abstraction Hierarchy

- Base relations in hierarchy provide flexibility
 - ▶ Can add new information sources easily
 - ▶ Serve as the basic building blocks of the app domain
- Interface relations and site relations are expressed in terms of the base relations
 - ▶ *cars* (*manufacturer, model, year, mileage, price, value*) *= *classifieds*(*manufacturer, model, year, mileage, price*) & *bluebook*(*manufacturer, model, year, mileage, value*)
 - ▶ *nytimes*(*manufacturer, model, year, mileage, price*) => *classifieds*(*manufacturer, model, year, mileage, price*)
 - ▶ *gm*(*model, year, mileage, value*) *= *bluebook*(*gm, model, year, mileage, value*)

Query Processing

- Three step process:
 - ▶ Reduction: Translate from interface to base relations
 - $\text{cars}(\text{gm}, \text{model}, 1996, \text{mileage}, \text{price}, \text{value}) \ \& \ \text{price} < \text{value}$
 - $\text{classifieds}(\text{gm}, \text{model}, 1996, \text{mileage}, \text{price}) \ \& \ \text{bluebook}(\text{gm}, \text{model}, 1996, \text{mileage}, \text{value}) \ \& \ \text{price} < \text{value}$
 - ▶ Abduction: Translate from base to site relations
 - $\text{nytimes}(\text{gm}, \text{model}, 1996, \text{mileage}, \text{price}) \ \& \ \text{gm}(\text{model}, 1996, \text{mileage}, \text{value}) \ \& \ \text{price} < \text{value}$
 - ▶ Optimization: Eliminate redundant source accesses, etc

Replication Overview

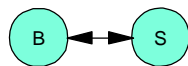


Overview

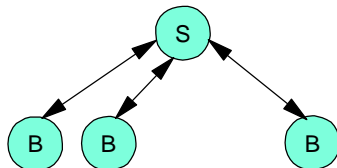
- Role of Internet and databases in eCommerce
- E-Catalogs
- **E-Markets: Auctions, RFQ, Exchanges**
- e-Coupons: Sales Promotions
- Personalization

Market Mechanisms

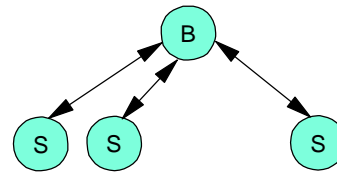
- Who trades with whom ?
- At what price ?
- E-Markets: Market mechanisms on the Internet



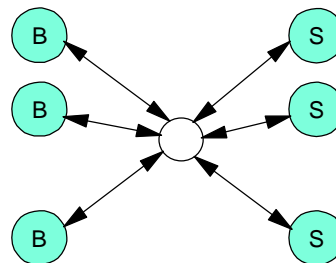
Two Party Negotiation
(Grocery, Cars)



Auctions (House)



Bids/Procurement
(Home improvement)



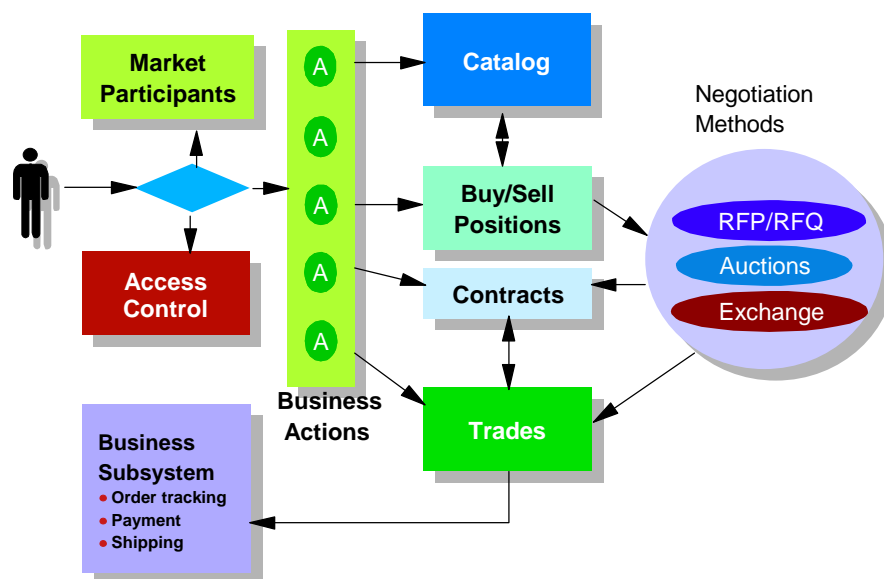
Brokerage/Exchange

IBM Confidential

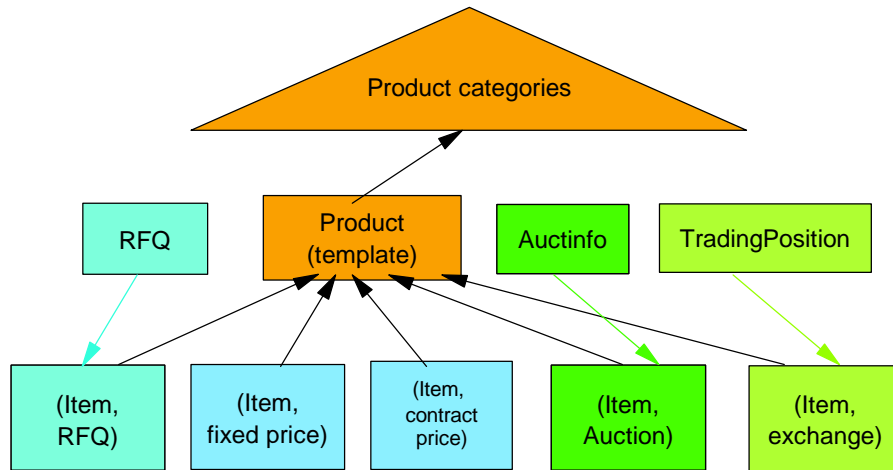
Internet promotes E-Markets

- Internet lowers the cost of market mechanisms
- Internet magnifies their advantages
- More markets will switch to auctions, competitive bidding for procurement, and exchange model

E-Marketplace Structure

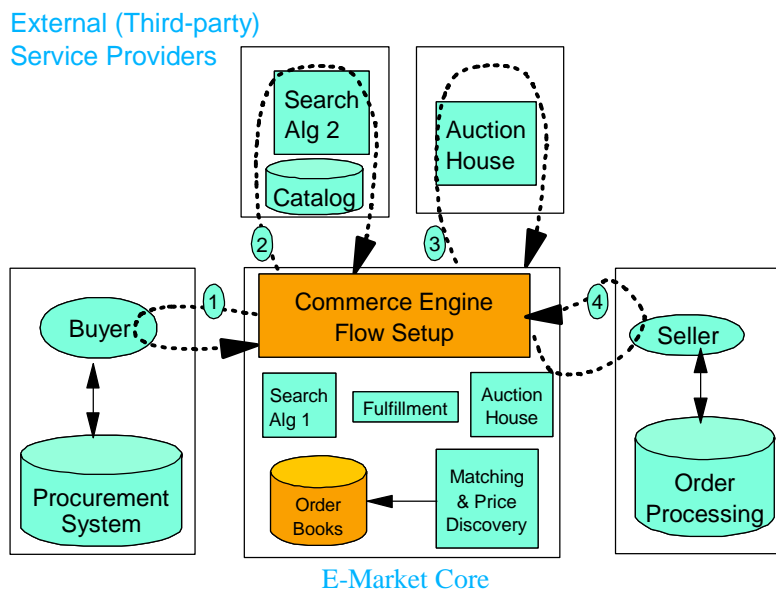


Products and trading positions

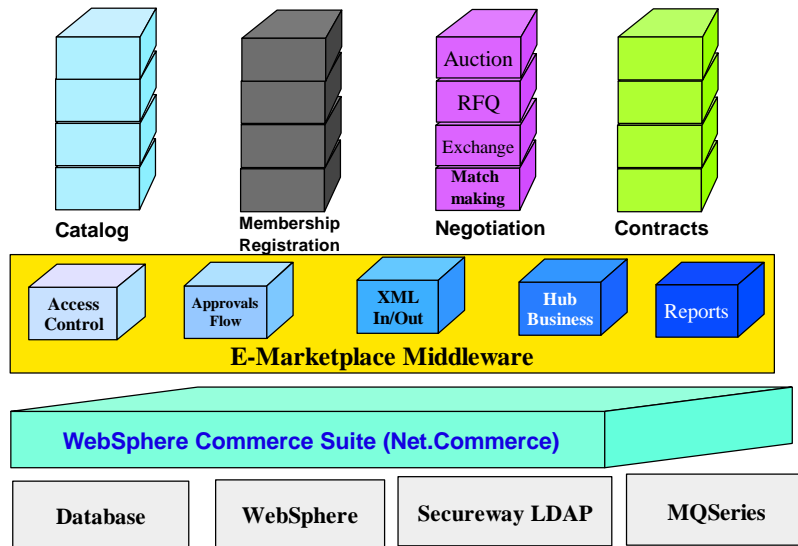


- Product: What is being traded
- Trading position: How it is traded

E-Market Implementation

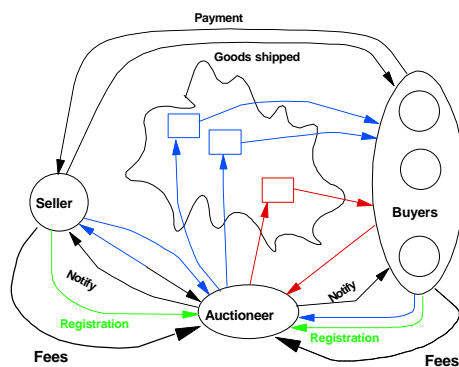


An E-Marketplace Offering



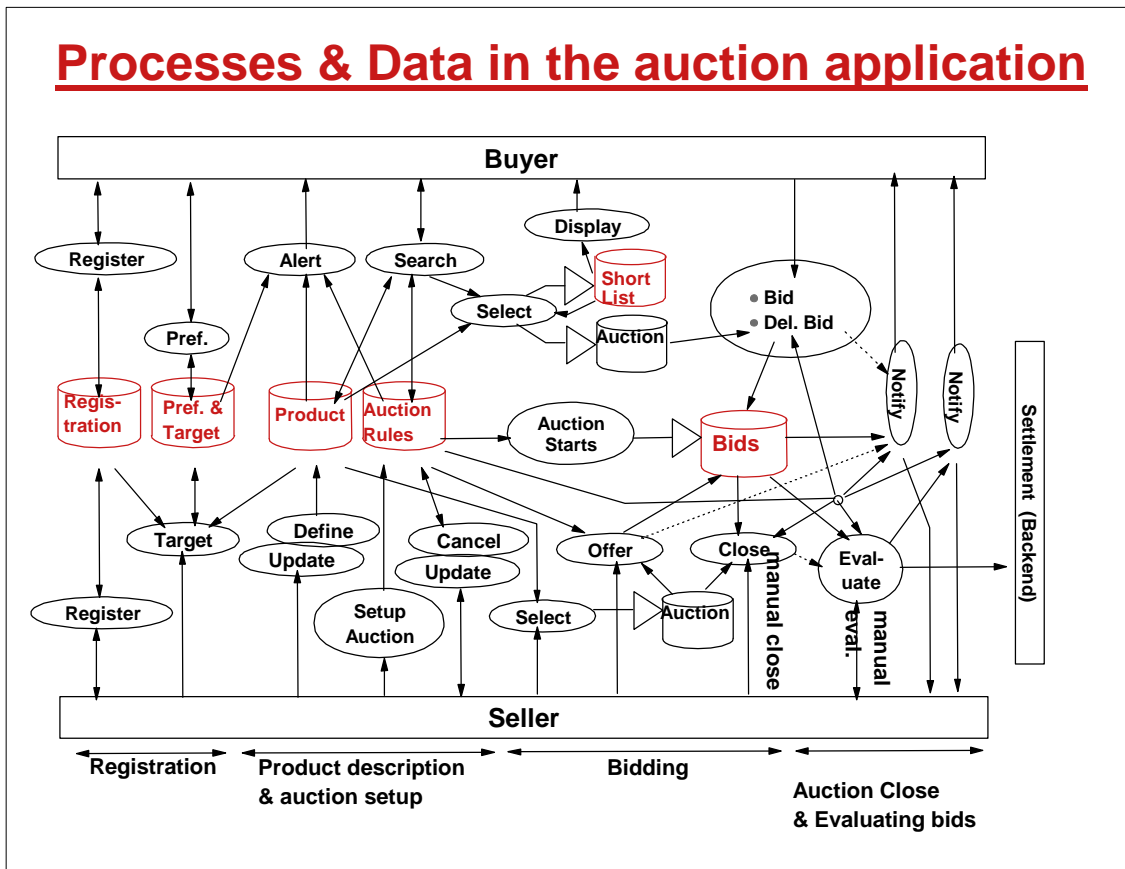
[WebSphere Commerce Suite - MarketPlace Edition WCS-MPE](#)

Auction Processes

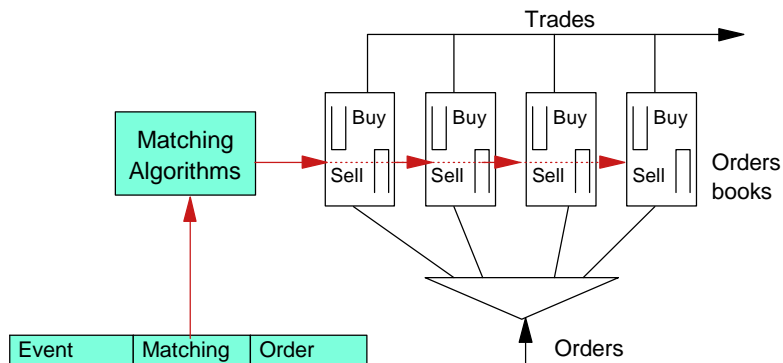


- Initial one time registration
- Product description
- Auction setup
 - ▶ Each product can have its own auction format/rules
- Bidding
 - ▶ manual & proxy
- Closing the auction
- Chat/Discussion forum
- Settlement

Processes & Data in the auction application



The e-Exchange order books



Event	Matching Alg.	Order book
Order in	CDA	O1
Mkt. Close	Call mkt.	O2
Timer evt.	WT	O1,O2

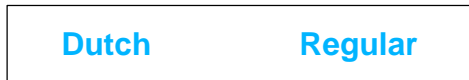
- Numerous types of instruments traded for each product
- There are several dozen types of orders
- Same inventory may be committed through multiple market mechanisms

Classifying Auctions

Interaction



Bid Control



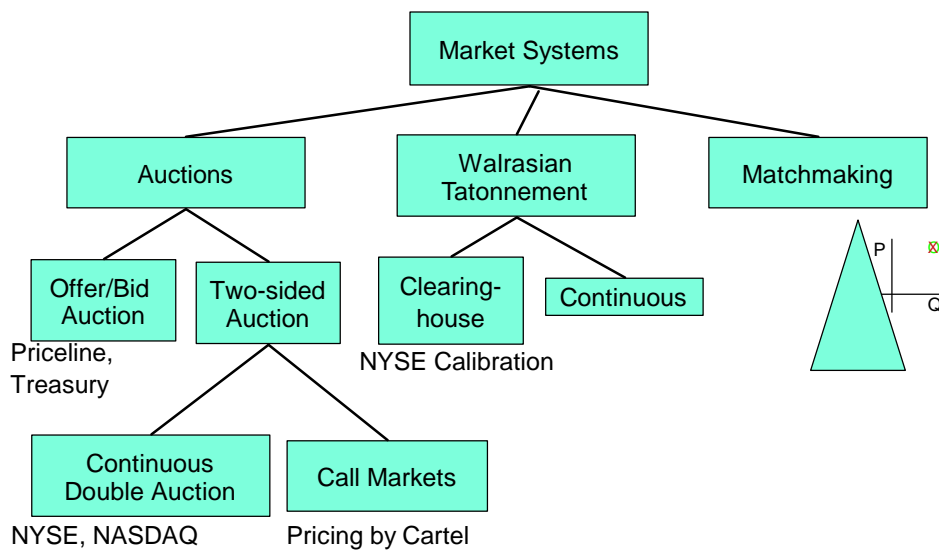
Pricing



Closing Rules



Double Auctions / Exchanges



Future Directions for Database research in E-Trading

- Standardized Business objects:
 - Bid/Offer, Product - Production Capacity, soft goods (insurance)
- Messaging
 - Integration with backend ERP systems
 - Automatic archiving of old records
 - Audit trails
- Efficient communication of Market information and notification of trading results
 - communicate best bid in an auction or ask/bid prices in a brokerage to relevant parties
 - IP multicast vs. efficient implementation of unicast to a group implemented as an OS service

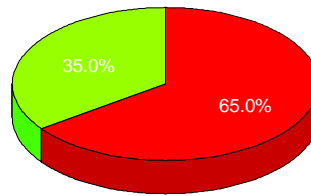
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- **e-Coupons: Sales Promotions**
- Personalization

Sales Promotions: Opportunity

Marketing Industry (1991)

Advertising
(Information)
7.6% CGR



Sales Promotions
(Incentive, usually monetary)
\$100 Billion, 12% CGR

Varieties

- Traditional coupons
- Cash Back Offers
- 2 for 1 (x for y) deals
- Free Trials/Samples
(in-pack/on-pack inserts)
- Cross sales, Upsales
- Contests
- Loyalty Awards

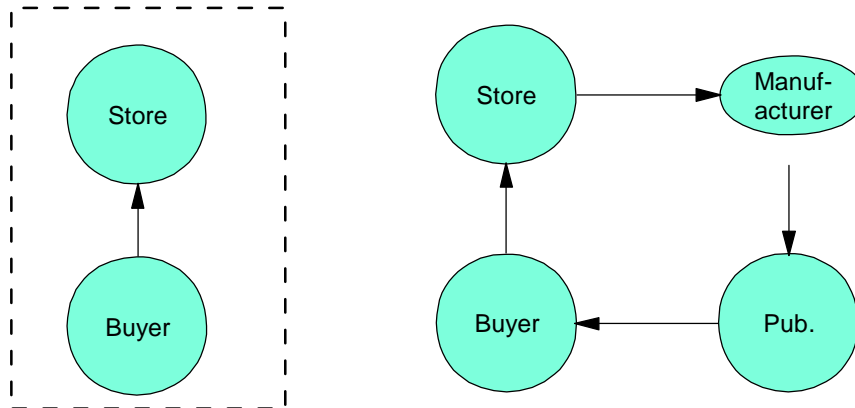
Purpose

- Promote new brand
- Switch brand loyalty
- Increase consumption
- Attract shopper into store
- Inventory reduction

Promotions

- Cross sales and upsales coupons: given when shopper buys some thing
- Best seller lists, store specials, and daily specials
- Loyalty awards: Given automatically after a basket of purchases in multiple shopping visits
- Frequent visit awards: Given for certain amount of online interaction

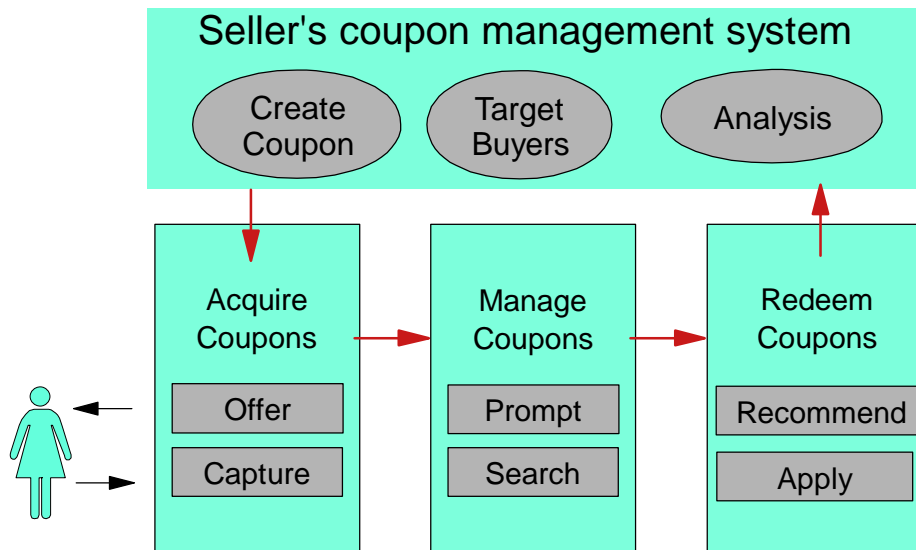
Manufacturer's vs. Store Coupons



- Known buyer
- Duplication/Trading preventable

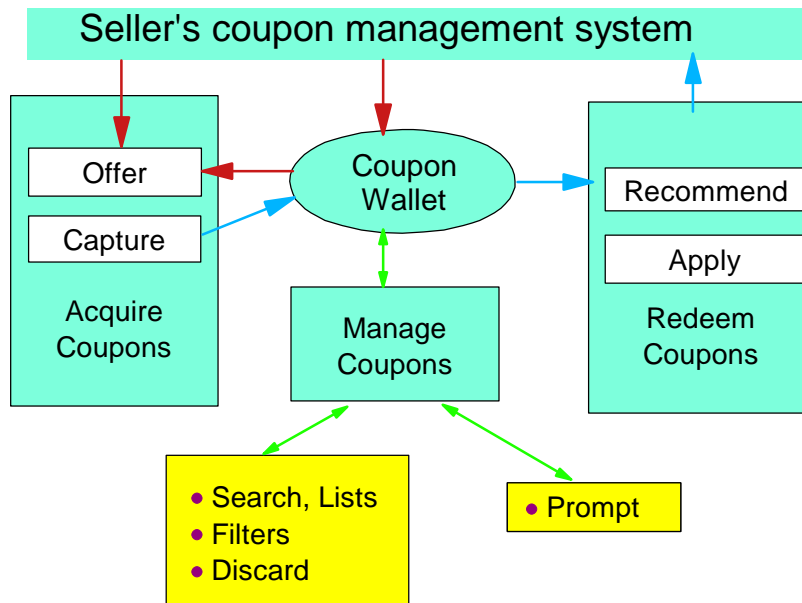
- To prevent trading/ duplication
 - Serial number
 - Buyers info
 - Online verification or store restriction

e-Coupons



**Offered in WCS 5.x
1Q-01**

e-Coupons



Coupon Object

- Package to which coupon applies
 - One item (Particular model of TV)
 - Multiple items of same kind, or of different kinds
 - Total purchase order value
- of the coupon
 - Fixed monetary value (Save \$1.00)
 - 10% of purchase price
 - Shirt free (or 50% off) with pants
 - Two for one sales
 - points (frequent flyer), buttons, tokens
- Validity window, Targeting restriction (geographic)
- Number of coupons distributed
- Display method
- Administrative tools: create, distribute, monitor, close

Coupon Wallet

- Maintained in store
- Shopper can specify products/categories
 - Coupons for specified products/categories only stored in wallet
- Shopper can search for coupons in his wallet
 - Various selection and ordering metaphors
- Coupons may require shopper action to be acquired
- Shopper can specify coupons he is willing to accept

Redemption

- Applicable coupons displayed when order created
- Shopper selects coupons for redemption
 - Coupon redemption should not be totally automatic
 - Users may have different plans for using their coupons
- However, tools provided to help selection
- When coupon redemption is automatic
 - shopper should be made aware of the redemption (to earn good will for the discount being given)

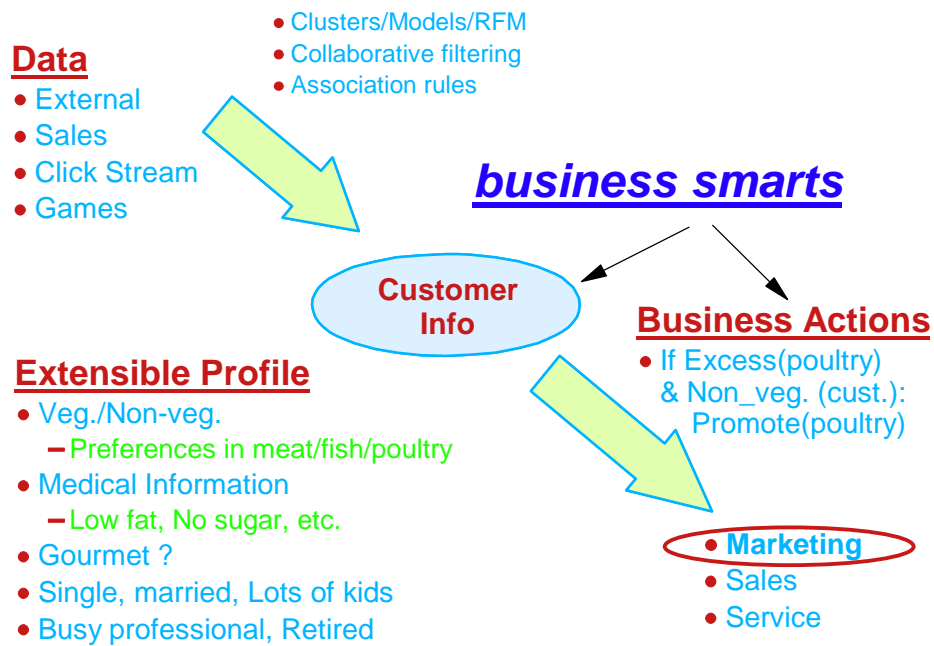
Database capabilities needed for coupons: Triggers / Alerts

- Ability to trigger stored procedure on access
 - For monitoring access behavior, for example, number of times a product is viewed
- Ability to trigger stored procedure based on access behavior
 - For example, offer discount if product viewed x times but not bought within a certain timeframe
- Ability to launch stored procedure based on condition holding true for a period of time
 - Close auction if no new bid received for 15 minutes
 - Send dunning letters (reminder if payment not received in 10 days)

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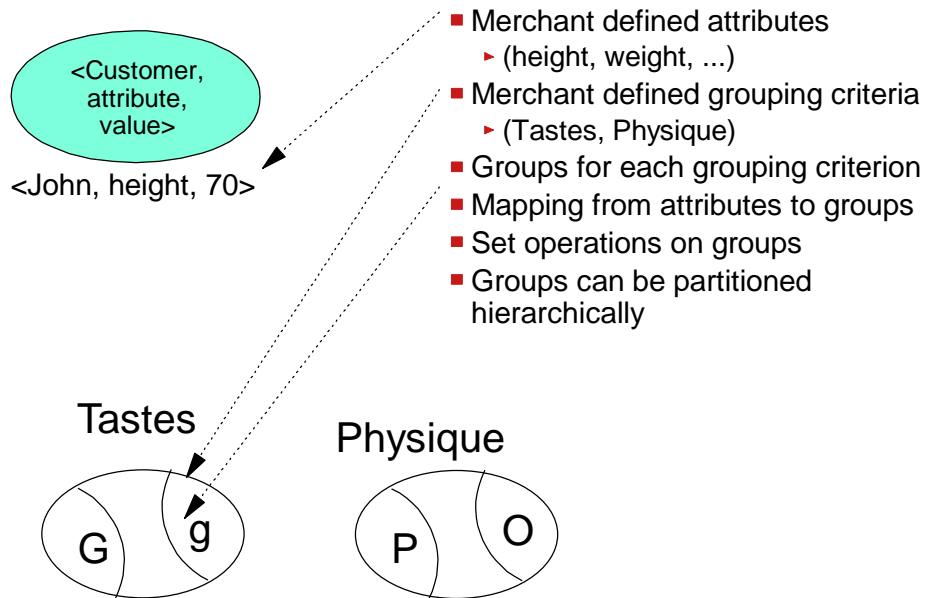
Personalization and sales promotions



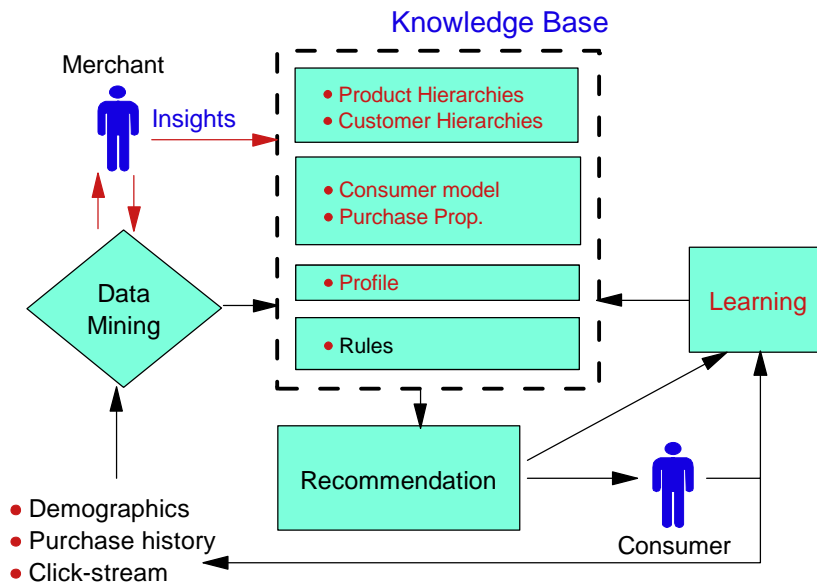
Customer Profiles

- Knowledge of the customer
- Standard part
 - ▶ Demographics
 - ▶ Customer valuation
- **Extensible part (for insurance industry)**
 - ▶ Risk aversion
 - ▶ Accident propensity
 - ▶ Automobile, property, and health descriptions

Tools for managing profiles



Personalized marketing on Internet



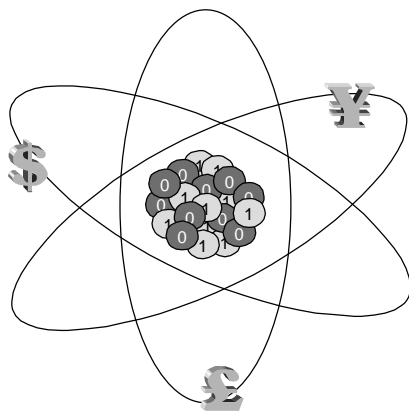
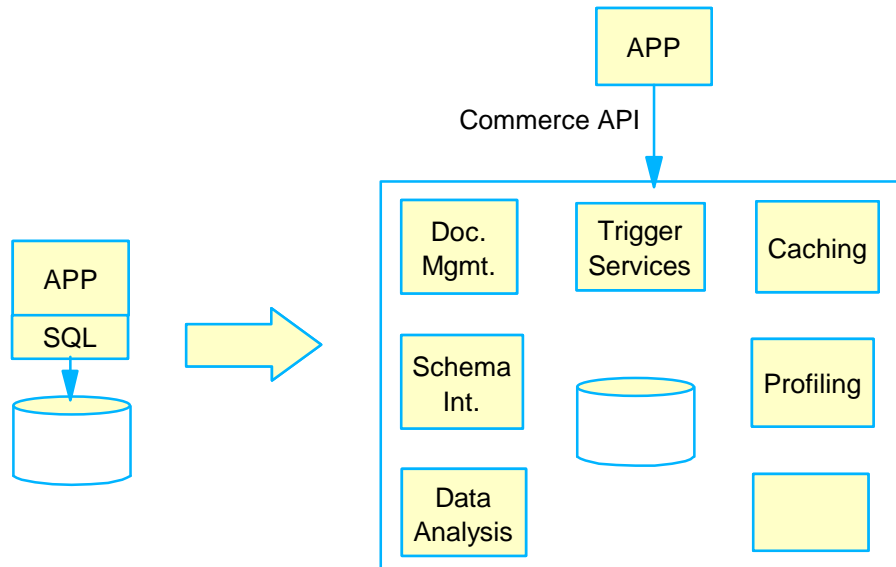
Using rule engines for business actions

- Give 15% discount to **loyal** customers
- If customer **likes humor**, promote Dilbert
- In Dec. promote calendars to shoppers **buying gifts**
- To promote product, show ad/incentive if customer has **seen product and not bought**, or customer **not likely to see product**, and product **not promoted before**

Issues in applying Datamining to E-Commerce

- Data like purchase history has too many dimensions
 - Straight forward application of clustering would fail
 - Preprocessing needed to retain relevant attributes
 - E.g., instead of shirts, slacks and suits, have apparel
 - Problem: How to find the right dimensions for analysis
- Building good predictor models: combining
 - Similarity of shopping basket content
 - Shopping for thanksgiving dinner vs. summer barbecue vs regular shopping.
 - Consumption models
 - Factoring changes in seasons and family head count
 - Profile data and business rules

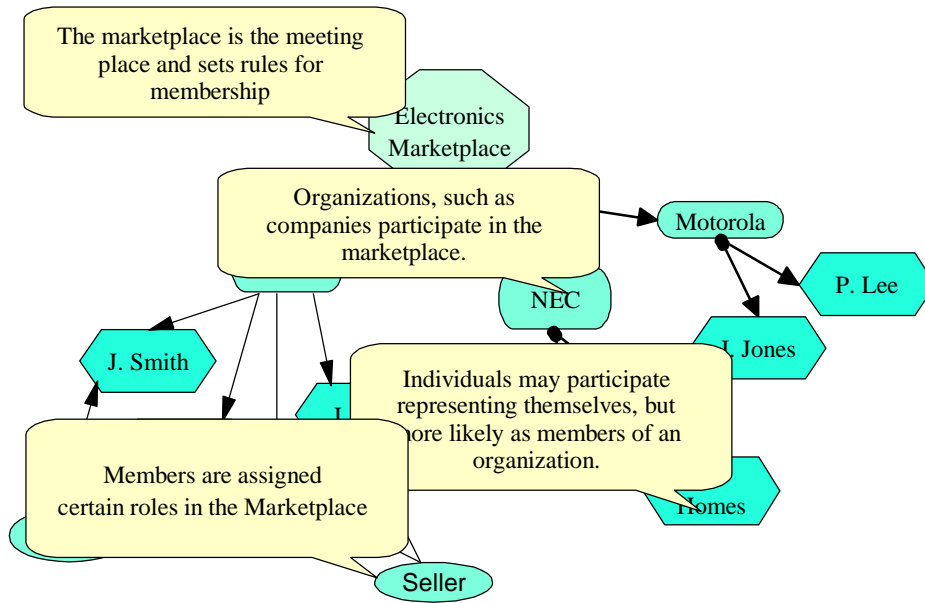
Evolution of Databases in E-Commerce Environment



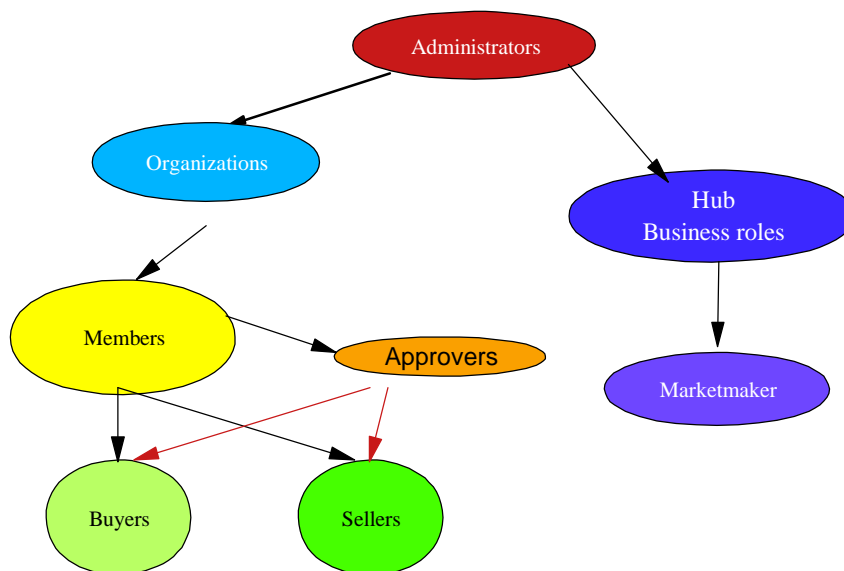
Backup

Papers on this subject can be found at
www.ibm.com/iac

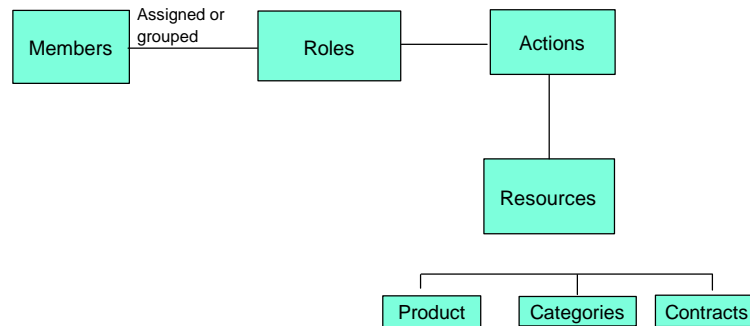
Membership



Approval

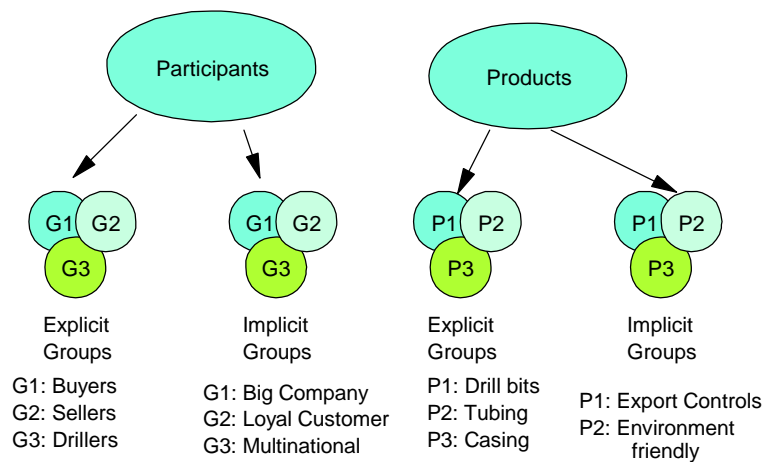


Access Policies



- Access policies specify which users can take what actions on which objects: i.e., the relation:
 - ▶ <UserGroup, Action, Resource Group, Resource Role>
- Actions include
 - ▶ basic functions such as [view, modify, create, delete]
 - ▶ market level functions such as [quote, buy, requestQuote, ...]
- Issue: efficient implementation

Member and Resource Groupings



Explicit means user navigable, Implicit requires search

Static vs. Dynamic Facts

- "loyal" and "likes humor" are static facts
 - ▶ Can be processed in batch mode, off line
 - ▶ Low processing requirements
 - ▶ Can be asserted by conventional Rules Engines **off-line**
- "buying gifts", "product not promoted before", are dynamic facts
 - ▶ Real time processing, high processing overhead
 - ▶ Session logs to feed **inline rules**

Simple Rules

- On Event
If Condition
Then action
- Events
 - ▶ Entering or Leaving Rack/Aisle/Category
 - ▶ Adding book to shopping cart
 - ▶ Placing order for selected books

Simple Conditions and Actions

- Conditions
 - ▶ Shopper a busy professional (retired person)
 - ▶ Shopper likes humor
 - ▶ Product has cross-sale or up-sale item

- Actions
 - ▶ Show audio version of a thick book or a less voluminous book on the same subject
 - ▶ Suggest other humor books
 - ▶ Advertise/Discount the cross-sale item

Performance Considerations

- Profiles store static facts
 - ▶ Efficient mechanisms to assert these facts needed

- Mechanisms other than rule engines to exercise few commonly used (and simple) rules
 - ▶ Custom solution (hard wired rules)

- Support for incremental processing