

Quality of Service Management Issues in Electronic Commerce

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Abstract

- **Quality of service issues have first been discussed in relation with the performance of communication networks. However, for understanding end-to-end performance of a distributed system, it is important to also consider the performance at the application level, of the different components of the distributed application, as well as the quality of service view of the user. Most work on quality of service management at the application level has been done for applications involving access to distributed multimedia databases, such as video-on-demand. The same QoS issues apply also to electronic commerce when users access a catalog which may include multimedia information in addition to the hard-core data elements, such as name and price of the product.**
- **In this paper, we identify various issues related to quality of service management for electronic commerce applications, and concentrate on one of these, namely the selection of a server from a pool of servers in order to optimize the overall cost-performance of the system and the user satisfaction.**

Typical EC application scenario

We consider the electronic mall paradigm:

- **Find suitable EC server**
- **Access server and browse through catalogue to find suitable items to buy**
- **Items to be bought are put into a shopping cart**
- **at the end of the session, the collected items are purchased through transactions including electronic payment transactions**

Notes:

The electronic catalogue may include multimedia sales promotions or product information (e.g. video of hotel facilities, 3D model of cars, video clip on advantages of a given micro-wave oven)

The client may interact with a real person, e.g. sales representative, using electronic conferencing facilities (only voice, or with video, possibly with facility for joint viewing of 3D models)

QoS issues

QoS issues involve all system components

Example: QoS in video-on-demand systems:

- **End-user wishes and requirements:** sound quality, video quality, color rendering, and ***cost***
- **Client system:** limitations due to screen size and precision, audio equipment, operating system's real-time response, available decoding software, etc.
- **Continuous media server:** number of users, overall throughput limitations, access delay and jitter
- **Stored MM document:** encoded information structure, possibly scalable encodings (or several versions)
- **Network:** throughput, delay, jitter

Overview of presentation

- **Introduction**
- **What are the QoS parameters relevant for EC**
- **What are the trade-offs concerning QoS issues in EC**
- **Looking at one question: How to provide service to millions of users ? -- Scalability of the brokerage function providing load balancing between servers**

QoS categories

Categories and Attributes of QoS (Koistinen and Frolund, HP):

- **Performance**
 - Attributes: response time
- **Reliability**
 - Attributes: down-time percentage, time-to-failure
- **Security**
 - Attributes: anonymity (yes-no), encryption, etc.

Other categories (see below):

- **Presentation quality**
- **Quality of search results**
- **Cost**
- **Quality of products**

Presentation quality

- **Applies to**
 - multimedia documents / presentations / video on demand
 - teleconferencing facilities
- **Attributes**
 - for images/video: spatial resolution, color resolution, frame rate
 - for audio: audio quality (e.g. telephone grade, CD-quality)
 - for teleconferencing: transmission delay
- **Relevance for EC:**
 - applies to multimedia presentations or 3D models which are part of the catalogue or sales promotions
 - quality of dialogue between user and sales representative
 - "product quality" in case that multimedia documents are sold

Quality of search results

- **Applies to**
 - information retrieval from data bases
- **Attributes**
 - power of query formulation framework (e.g. boolean queries, weighting strategies, etc.)
 - relevance of search results
 - call back percentage
 - accuracy
 - » accuracy of result data provided
 - » up-to-date nature of results
- **Relevance for EC:**
 - catalogue search
 - Web search to find interesting EC servers (brokerage function)

Cost

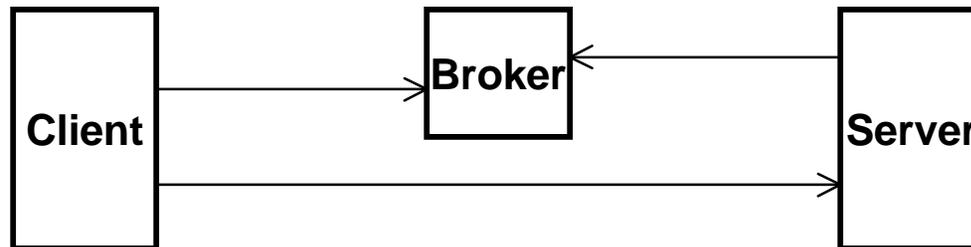
- **Applies to all aspects**
- **Attributes:**
 - **The meaning of cost is: how difficult is it to provide a given QoS ?**
 - **Usually measured in \$ (or possibly some fictitious cost units)**
 - **Note: Since the consideration of costs usually implies a trade-off between different aspects of the overall system, a common "cost" measure is required. In certain cases, it also relates to \$-costs which are transferred between the parties involved in the application**
- **Relevance for EC:**
 - **cost of articles sold**
 - **cost incurred by merchants to provide the EC infrastructure**
 - » **catalogue searching**
 - » **shopping cart and transaction services**
 - » **electronic payment services**
 - » **cost of infrastructure and salary for communication with sales representatives**

Comments on trade-offs and benefits

- **The parties involved:**
 - merchant, client (the user), whole-sales company, product manufacturer
- **Each party wants to optimize its benefit ("profit")**
- **Profit = Income - Expenses**
- **Strategies for the merchant:**
 - **Increase income**
 - » increase sales price (as long as remaining competitive)
 - » encourage more clients (implies some additional expenses)
 - better "service", e.g. quality of catalogue search, good sales representatives
 - more promotion
 - **Lower expenses, e.g. by automation (this is in the nature of EC)**
 - **Classify users by categories, with differential "services", e.g.**
 - » normal client (basic service)
 - » registered client (access to special offers, etc.)
 - » preferred client (also access to sales representatives and special search facilities)

Load balancing between servers

General architecture:



- **Broker needs info on QoS (typical response) of servers**
- **Should the broker take the distribution of new clients into account ?**
- **In case of very large systems, should the broker be replicated ? -- Do they need consistent information ?**
- **Scalability of QoS management protocol ?**

Conclusions

- **There are a variety of categories of QoS which apply to electronic commerce applications:**
 - response time, reliability, security, presentation quality, search result quality
- **For some of these qualities, user preferences should be considered (e.g. security, presentation quality (*see work on distributed multimedia databases*))**
- **There are various cost implications (for the merchant)**
 - also a relation with the profit and the price of the products sold
- **Managing response time for very large user populations: load balancing among multiple servers through brokers; how scalable are such management protocols ?**