Architecture of Information Systems (232011):

First Exam 2007/2008

June 25 2008 13:30-15:30 Spiegel 4

Please pay attention to the following:
- **This exam has to be completed in 2 hours**
- It is **NOT** allowed to use the book or any other material
- You can answer in either Dutch or English

Distribution of points:
- 10 points for showing up;
- Other questions as indicated.

1. Question 1 (10 points)

Describe the three distributed architecture patterns for middleware that the book presents. Give characteristics, advantages and disadvantages of each pattern.

2. Question 2 (20 points)

    a) It is said that it is important for distributed transactions to be conforming to the ACID properties. Explain what the ACID properties are; give a short explanation for each of them.

    b) Message Queuing is one of the communication concepts often used by middleware. Explain the concept of message queuing.

A simple debit/credit transaction is the one in which a person wants to move money from Account A to account B. Figure 1 illustrates a solution to this problem using distributed transaction processing. In this solution, the debit on account A and the credit on account B are both done in one distributed transaction.
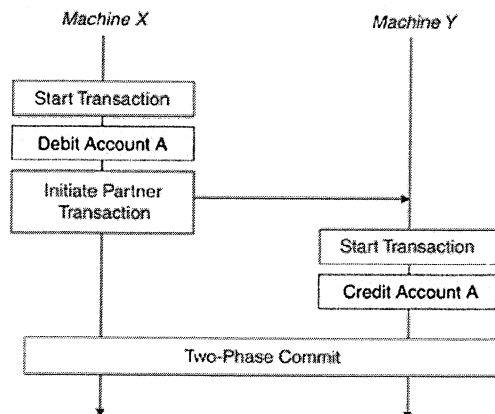

Figure 1: Debit/credit transaction using distributed transaction processing (Fig. 2-8 from the book).

Figure 2 gives an alternative solution: Debit/credit transaction using message queuing.
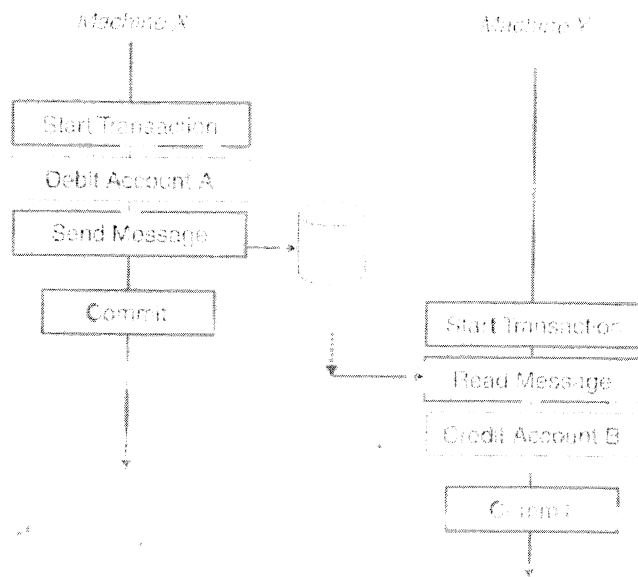

Figure 2: Debit/credit transaction using message queuing (Fig. 2-9 from the book).

c) Are the solutions of Figure 1 and Figure 2 conforming to the ACID properties?
d) What disadvantages of the solution of Figure 1 are solved by the solution in Figure 2?
e) Discuss why it $^{is}/_{is\ not}$ a good choice for an organization to use message queuing for real time processing of distributed transactions.

3. Question 3 (10 points)

a) Describe what resiliency of distributed systems is.
b) Give 3 important aspects/parts of resiliency analysis
c) Give some benefits of a resiliency analysis.

4. Question 4 (10 points)

a) Describe the relation between performance and scalability of middleware.
b) How is the use of Two Phase commit protocol related to performance?

5. Question 5 (20 points)

For the migration of a current information system to a new information system two approaches are **chicken little** and **cold turkey**.
a) Describe both approaches.
b) What is the role of gateways in both approaches?
c) Compare the two approaches according to: risk, failure, benefits and outlook.

6. Question 6 (20 points)

Consider the architecture diagram in Figure 3. This diagram depicts the infrastructure used by a large organization (which we will call 'Organisation A') for their web applications. The 'maintenance environment' in the bottom denotes the IT infrastructure (networks, workstations, servers, etc.) used by members of the IT department to maintain the systems depicted in Figure 3. In other words, the workstations used by programmers and system administrators to do their work are in the 'maintenance environment'. The 'perimeter protection' components consist of firewalls and intrusion detection systems. The compo-nent labeled 'IBM Edge Server' has no other security role than to handle HTTPS. The HTTP server serves static pages (e.g., the public homepage of Organisation A) and forwards HTTP requests for applications to the Websphere application server. Websphere consults the component labeled 'IBM Directory Service' to look up valid username/password combinations.
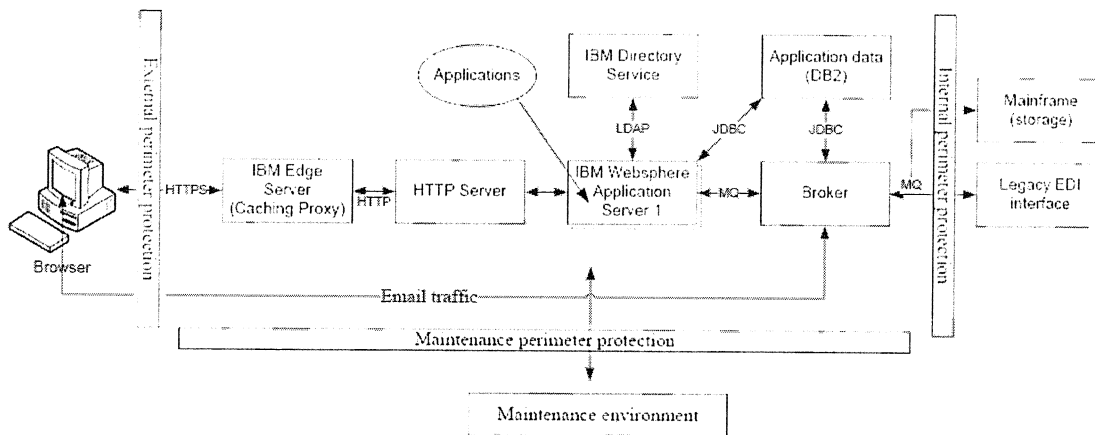

Figure 3: Architecture diagram.

a) Which component(s) in Figure 3 handle(s) authentication? Of what?

The Websphere application server itself has a token that it can use to identify itself to the directory server, the DB2 database that holds application data, and the message broker. The message broker has a security token to identify itself to the mainframes.
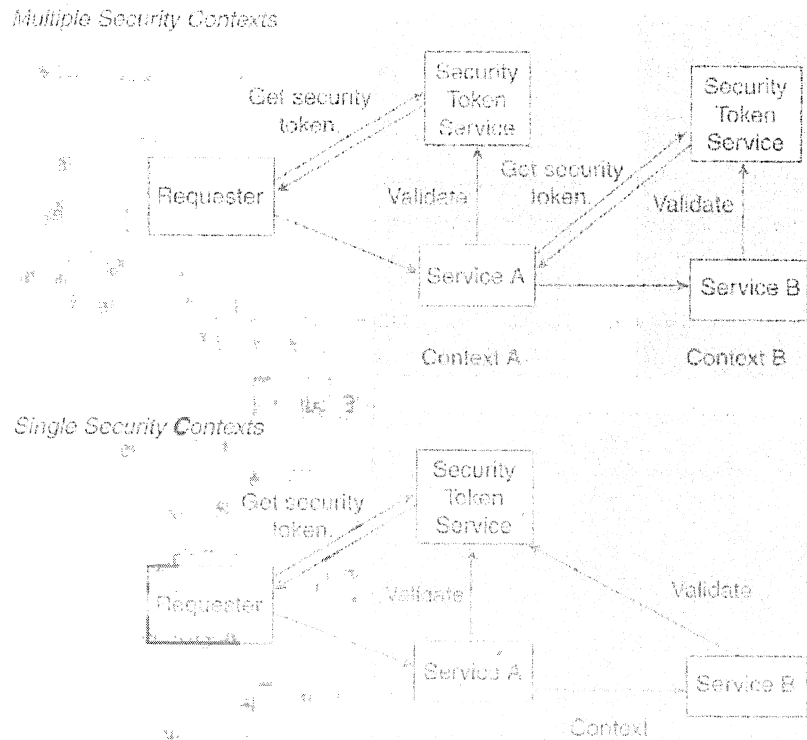
Consider Figure 4:

Figure 4: Multiple and single security contexts (Fig. 10-4 from the book).

  b) Redraw Figure 3 using the concepts from Figure 4. Which assumptions do you
     have to make?
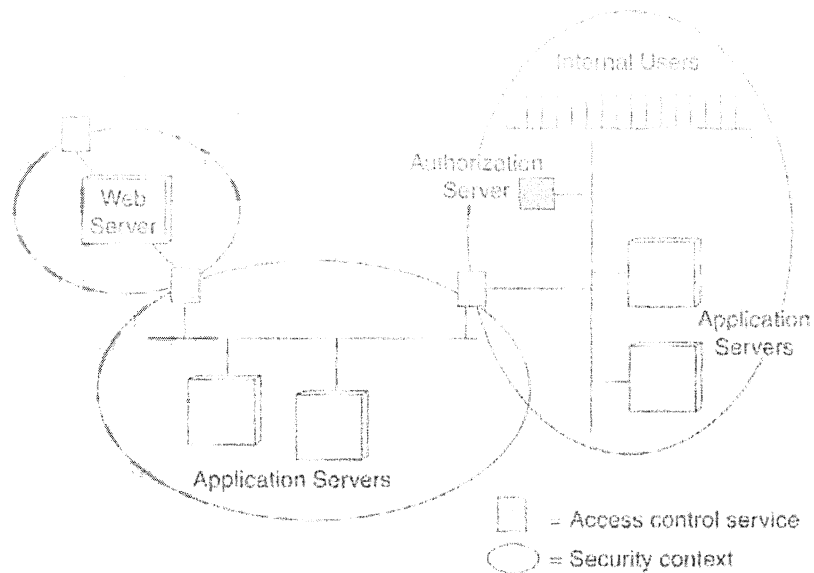
Consider Figure 5:

Figure 5: Security overview diagrams (Fig. 10-5 from the book).

  c) Redraw Figure 3 using the concepts from Figure 5. Which assumptions do you
     have to make?

(end)