COMPUTER SCIENCE & ENGINEERING
Göteborg
SAA

EXAMINATION
2010-12-14

HT-10
CTH-TDA596
GU-DIT240

DISTRIBUTED SYSTEMS examination

DAY: 14/12 - 10 TIME: 14-18 ROOMS: VV

Responsible:	Sven-Arne Andreasson 1043
Results ready:	see course homepage for information
Grades:	GU: G 24p, VG 42p CTH: 3:a 24p, 4:a 36p, 5:a 48p of maximum 60 points.
Allowed aids:	Nothing except paper, pencil and English - xx dictionary.

NOTE:

- All questions **MUST** be answered in English only!
- Write clearly and use the pages in a clever way so it is easy to read.
- Each task should be started on a new sheet. Use only one side of each paper.
- When describing an algorithm (protocol) use numbered paragraphs in order to make it easier to read (and get right).
- All answers should be motivated!

Question 1) Describe briefly what CORBA stands for. How is it supposed to be used? What are its benefits? What are its disadvantages?

(10 points)

Answer: CORBA — Common Object request Broker Architecture
A standardized way how objects can cooperate in a distributed environment.

answer according to lecture notes

.....

Question 2) Describe what is meant by Peer-to-Peer Architecture. Give example of different types.

(10 points)

Answer:

Peer-to-Peer Architectures

+ Any process can communicate with any other process,
  but according to an overlay network

+ Structured

  - The overlay network is constructed according to a deterministic procedure.

    - e.g. through a distributed hash table (DHT).

  - membership management:

    - a node can join and leave the network.
      for many applications it is important to know when a node belongs to the network or not.

+ Unstructured

  - The overlay network is constructed using randomized algorithms.

  - Hard to scale.
    To find data super-peers might be used

Question 3) Code Migration:

a) What is meant by Code Migration?

b) What is it used for?

c) Give examples of different types of Code Migration.

(10 points)

Answer:

Code Migration

+ To move processes to other computers.
+ Can be decided
  - before starting a process
  - while a process is running
+ Mainly used for performance issues: Load Balancing
+ Can also be used for enhancing availability:
  - If a computer is breaking down, or if it has to be upgraded or given service
    - move its ongoing processes to another computer.
    - *Tandem* systems since 1970ies

Different types of Code Migration

+ Weak Mobility
  move before starting a process. Only transfer the code segment.
  - Sender-initiated mobility
    e.g. load balancing
    - Execute at target process
    - Execute in separate process
  - Receiver-initiated mobility
    - Execute at target process
      e.g. java applets
    - Execute in separate process
+ Strong Mobility
  move running process. Must transfer the programs environment (resource segment and execution segment as well as the code segment.
  - Sender-initiated mobility
    - Migrate process
    - Clone process
  - Receiver-initiated mobility
    - Migrate process
    - Clone process

Question 4) A system consists of a number of processes which are cooperating using messages in a computer network.

a) Give the definition for a partial order, $\rightarrow$, between the events in the system.

b) Assume that P and Q are two processes sending messages to each other. The events $p_1, p_2, p_3, ..$ with $p_1 \rightarrow p_2 \rightarrow p_3 ...$ happens in process P and the events q_1, $q_2, q_3, ...$ with $q_1 \rightarrow q_2 \rightarrow q_3 ...$ happens in process Q. Draw a diagram showing an example of message passing for which it holds that $p_1 \rightarrow q_5, q_1 \rightarrow p_5, p_1$ "concurrent" with q_2 and p_3 "concurrent" with q_5.

(10 points)

Answer:

Partial Ordering of Events

"$\rightarrow$" (happens) before

Definition: "$\rightarrow$" on the set of events in a distributed system is the least relation that fulfills: (6 points)

(*i*) If a and b are two events in the same process and a happens before b, $a \rightarrow b$ holds.

(*ii*) If a is the sending of a message in one process and b is the receiving of the same message in another process, then $a \rightarrow b$ holds.

(*iii*) If both $a \rightarrow b$ and $b \rightarrow c$ holds, then $a \rightarrow c$ holds.

(*iv*) If an event a "not happens before" an event b it is denoted as $a \not\rightarrow b$.

(*v*) If $a \not\rightarrow b$ and $b \not\rightarrow a$ holds, then a and b in a way are "concurrent", this is denoted as $a \,//\, b$:

+ example (4 points)

Question 5) Describe the *ABCAST* algorithm.

a) What is it used for?

b) What are the prerequisites?

c) Describe the algorithm.

d) Give a small example.

(10 points)

Answer: a) Atomic broadcast (multicast) (1 point)
b) according to lecture notes (1 points)
c) according to lecture notes (6 points)
d) .. (2 points)

Question 6) Authentication in distributed systems.

a) Why is there authentication in a distributed system?

b) What are the main classes of authentication in a distributed system?

c) For which combinations is there need for authentication?

d) Give the name for one authentication protocol!

(10 points)

Answer:

+ Authentication - to verify an Identity. for security in a distributed system (2 points)

+ Main classes of Authentication in a distributed system: (3 points)

  - Authentication of the contents of a message, i.e. verifying that the content is the same at receiving as at sending.

  - Authentication of the origins i of a message, i.e. verifying that the real sender of the message is the indicated sender.

  - Authentication of identities, i.e. verifying that an entity has the identity it claims.

+ Authentication exists in the following combinations: (3 points)

  - Host – Host.

  - User – Host.

  - Process – process.

+ *Kerberos* . (2 points)
