

Object Model

- Object References
 - Objects can be accessed via object references
- Interfaces
 - Definition of signatures of a set of methods
- Actions
 - The state of the receiver may be changed
 - Further invocations on methods in other objects may take place
- Exceptions
- Garbage Collection

Distributed Objects

- RMI

- Client Invocation is sent to the server managing the remote object.
- An object may be accessed concurrently.

Distributed Object Model 1/2

- Remote Method Invocation
 - Method invocations between Object in different processes
- Remote Object References
 - Objects can be accessed via remote object references, from different processes.
 - Identifier of a unique remote object.
 - Used to invocation of remote methods
 - Can be passed as arguments and results of remote methods invocations

Distributed Object Model 2/2

- Remote Interfaces
 - Definition of signatures of a set of methods
 - Some systems (CORBA) provides Interface Definition Languages (IDL) for defining remote interfaces.
 - Classes can be implemented using different languages.
 - In Java RMI, remote interfaces are defined as any other Java Interface, but they need to extend an interface named Remote.
- Actions
 - Nested remote invocations
- Exceptions (network)
- Garbage Collection
 - Using remote references

RMI Invocation semantics 1/2

- RMI based on request-reply protocol
- Techniques that provide different delivery guaranties are:
 - Retry request message
 - Duplicate filtering
 - Retransmission of results
- Definition of **Idempotent operations**
 - An operation is **idempotent** if it can be performed repeatedly with the same effect as if it had been performed exactly once.

RMI Invocation semantics 2/2

Fault tolerance measures			Definition of Invocation Semantics	
Retransmit request message	Duplicate filtering	Re-execute procedure or Retransmit reply		
No	Not applicable	Not applicable	MayBe	CORBA (optionally)
Yes	No	Re-execute procedure (*)	At-least once	Sun RPC
Yes	Yes	Retransmit reply	At-most once (**)	Java RMI, CORBA

(*) unacceptable if the procedures on server are not idempotent.

(**) it is the semantic of Java RMI.