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Jini and the Grid

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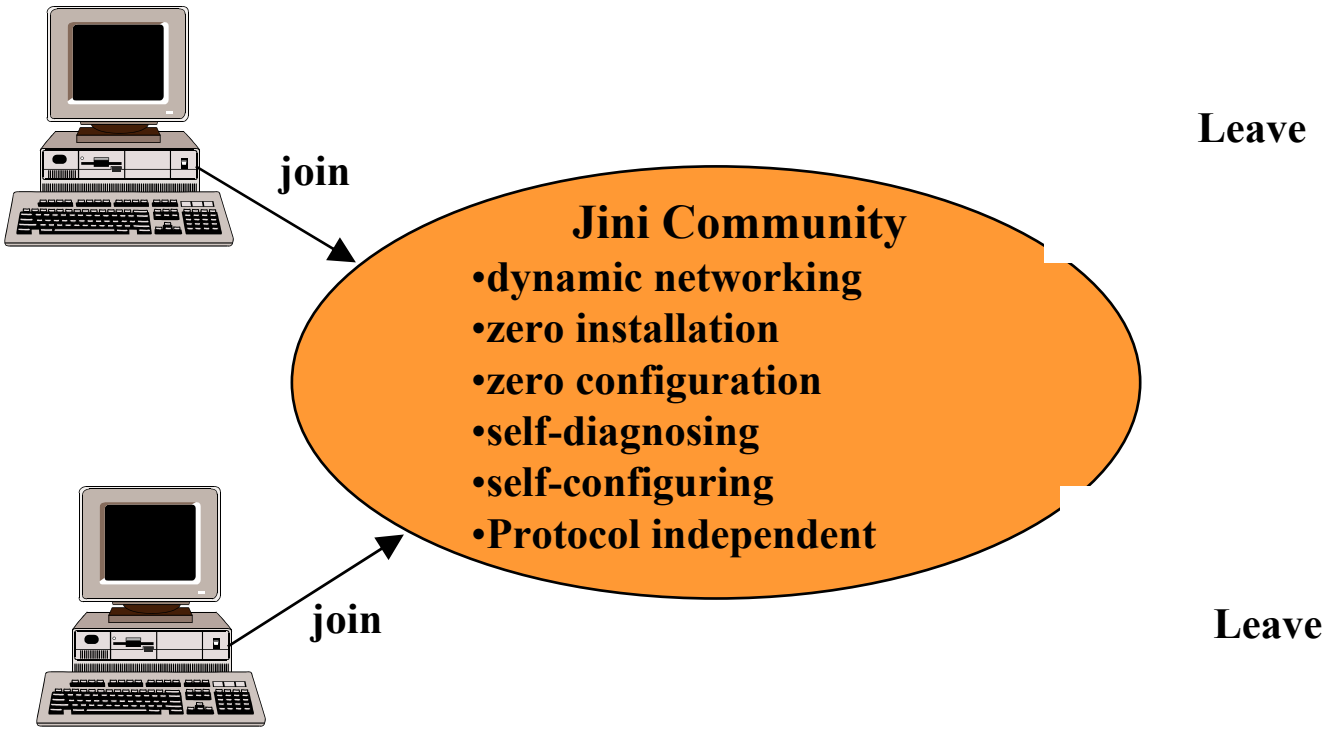
Jini: an overwiev

- Jini, in Arabic word meaning „magic”, is a dynamic distributed network computing architecture for providing networking of services
- Jini provides an infrastructure to enable this dynamic formation of services with
  - 0% installation
  - 0% configuration
  - 100% service interaction
- Self-diagnosing, self-configurable architecture
- Protocol-independent architecture, it can interact with any distr. Object using any protocol (RMI, CORBA, DCOM, etc.)

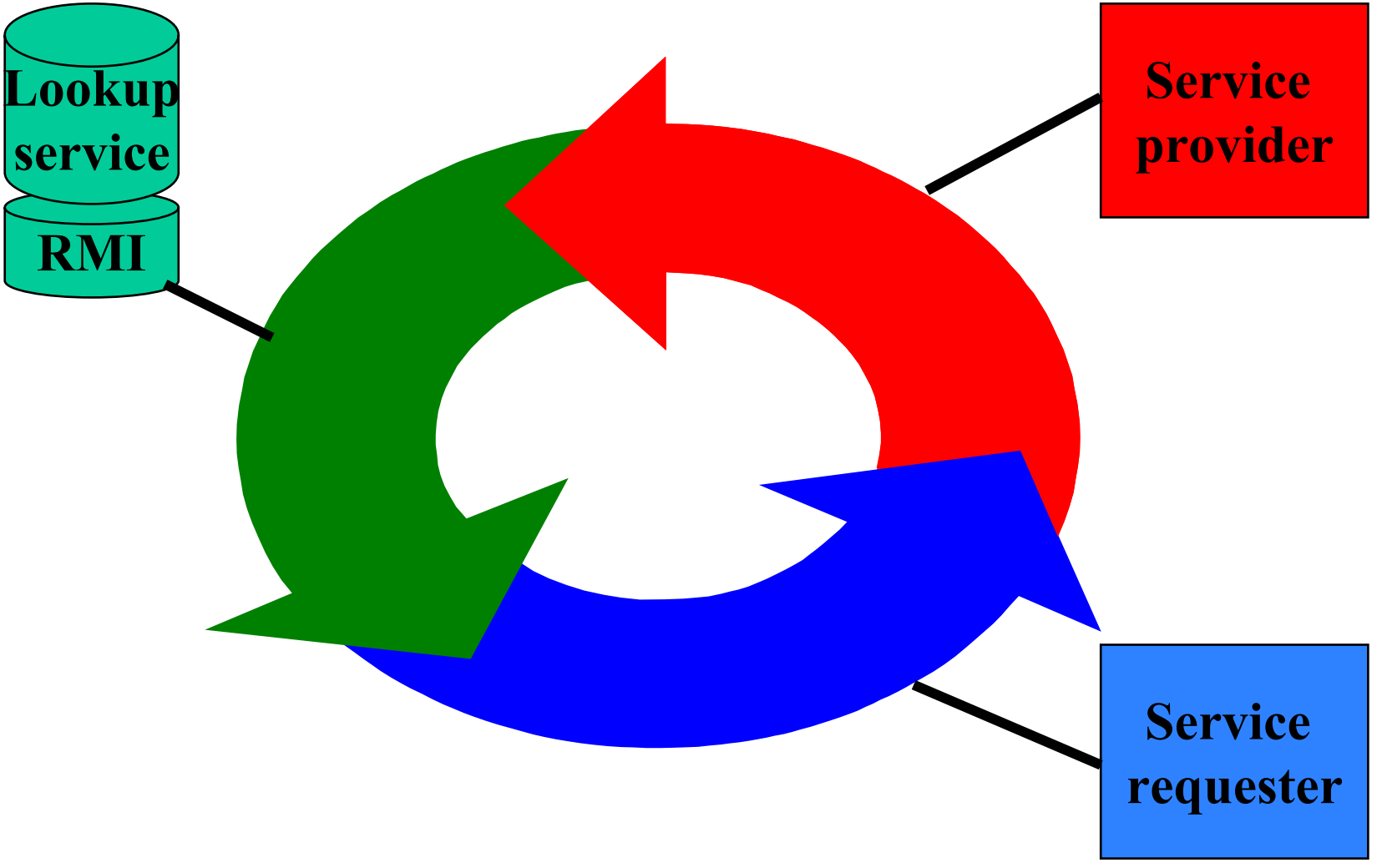
Jini: a dynamic network



Goals for Jini

- To provide an infrastructure to connect
  - anything
  - anytime
  - anywhere
- To provide an infrastructure to enable „network plug and play”
  - 0% installation
  - 0% configuration
- To support a service-based architecture by abstracting the hardware/software distinction
- To provide an architecture to handle partial failure

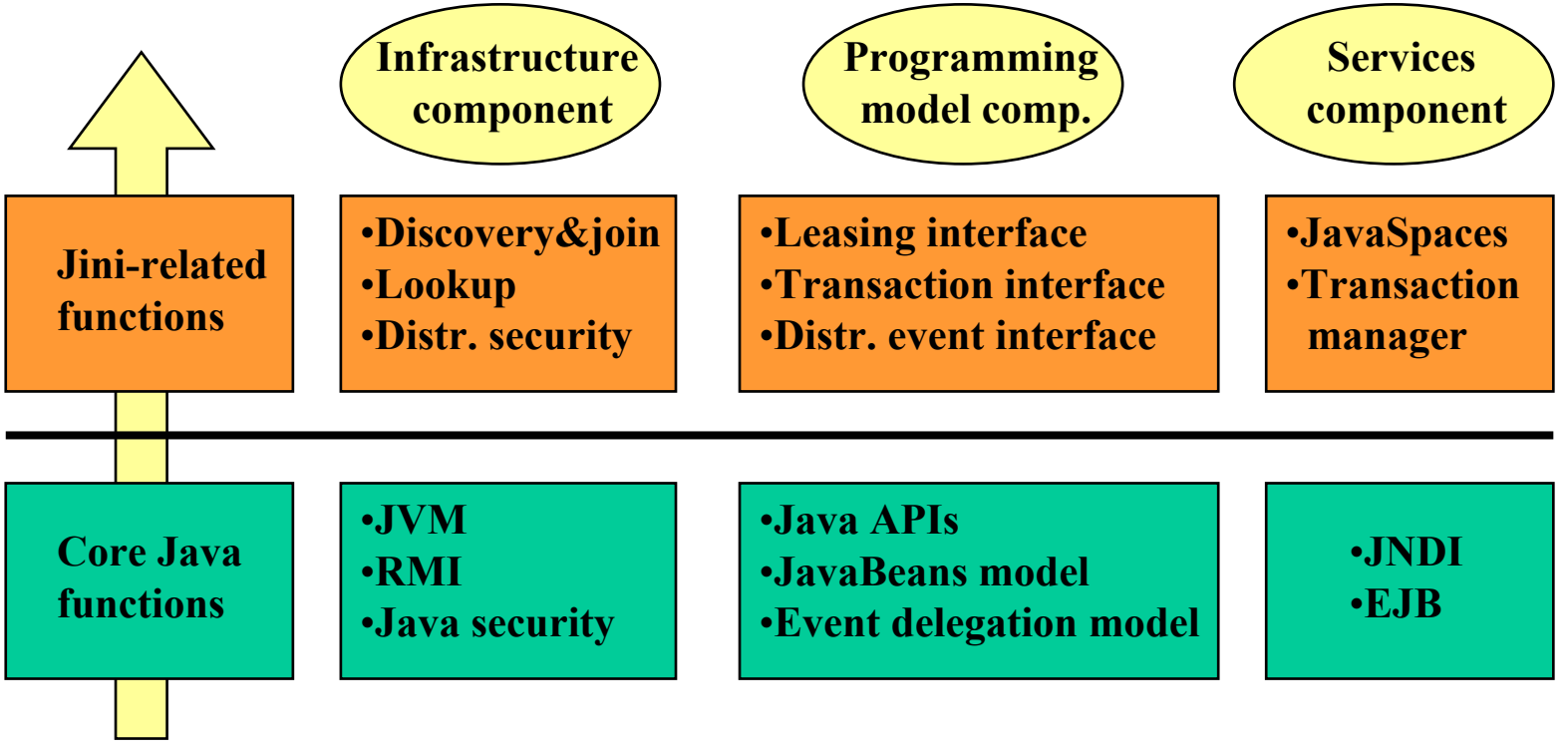
Three basic elements of Jini



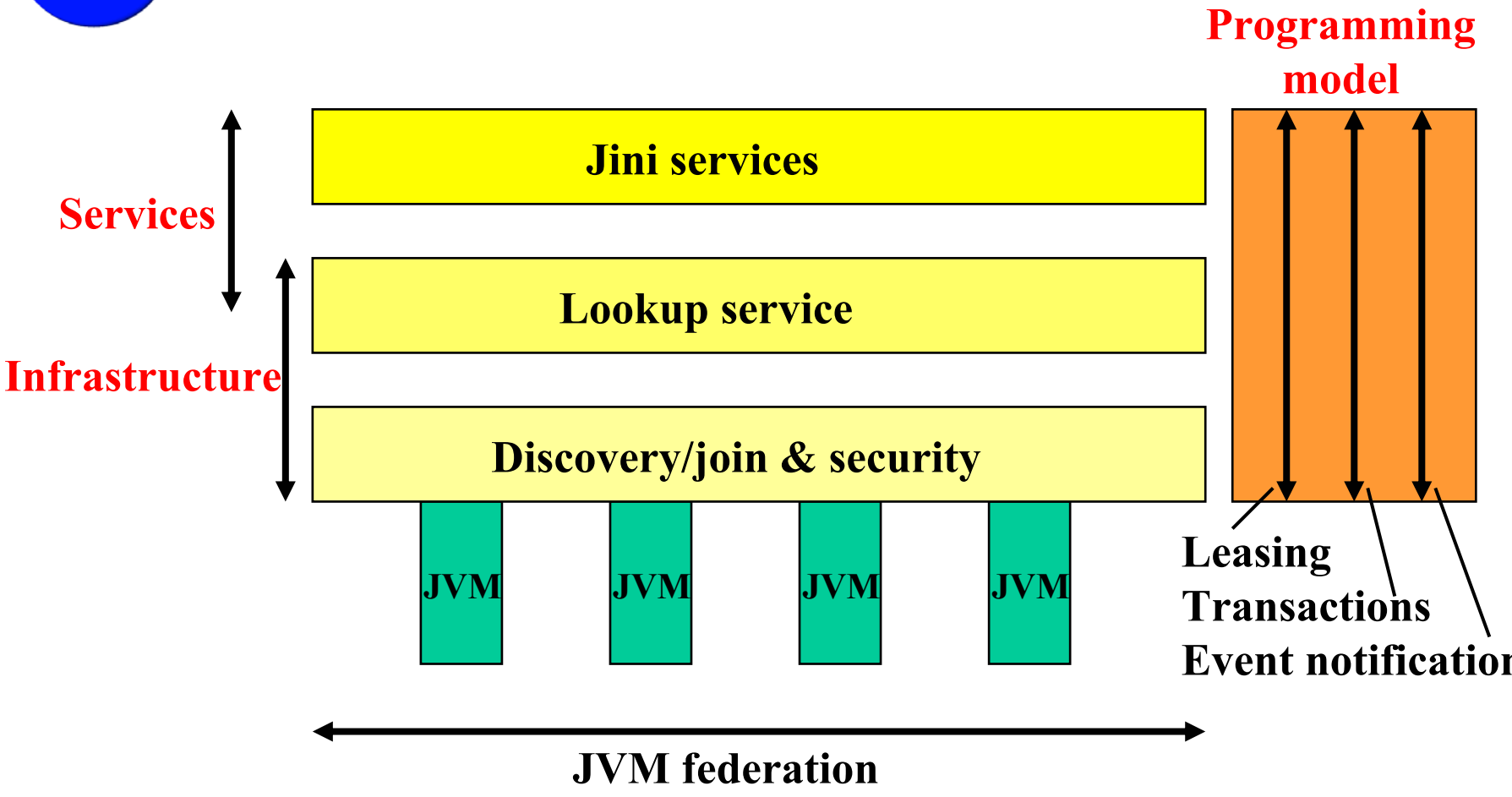
System Assumptions

- The existence of a network with reasonable latency
  - Jini relies havily on Java's mobile-code feature
- Each Jini-enabled device has some memory and processing power
- Each device should be equipped with a JVM (Java Virtual Machine)
- Service components are implemented using Java
  - All the service components should live as Java objects to facilitate the service requester to download and run code dynamically.
  - However, Java does not expect a Java service implementation, only a Java wrapper

Relationship between Java and Jini



Jini components



Infrastructure component

- Discovery and join protocol: defines the way how
  - services discover other services
  - services advertise themselves
  - services become part of the federation
- RMI: enables service proxies to be downloaded
- Distributed security model
- Lookup service
  - serves as a repository of services
  - helps members to find each other in the Jini federation
  - entries are Java-compliant byte-code objects, which can be written in Java or wrapped by Java

Services component

- Services component denotes the services that together form the Jini community
- The services are identified as Java objects
- Each service has an interface, which defines the operations that can be requested from the service
- The interface also reflects the service type
- Basic services of Jini:
  - Lookup service
  - JavaSpaces service: optional distr. Persistence mechanism
  - Transaction manager service

Programming model component

- The programming model supports the following interfaces:
  - **Lease** interface, which extends the Java programming model by adding time to the notion of holding a reference.

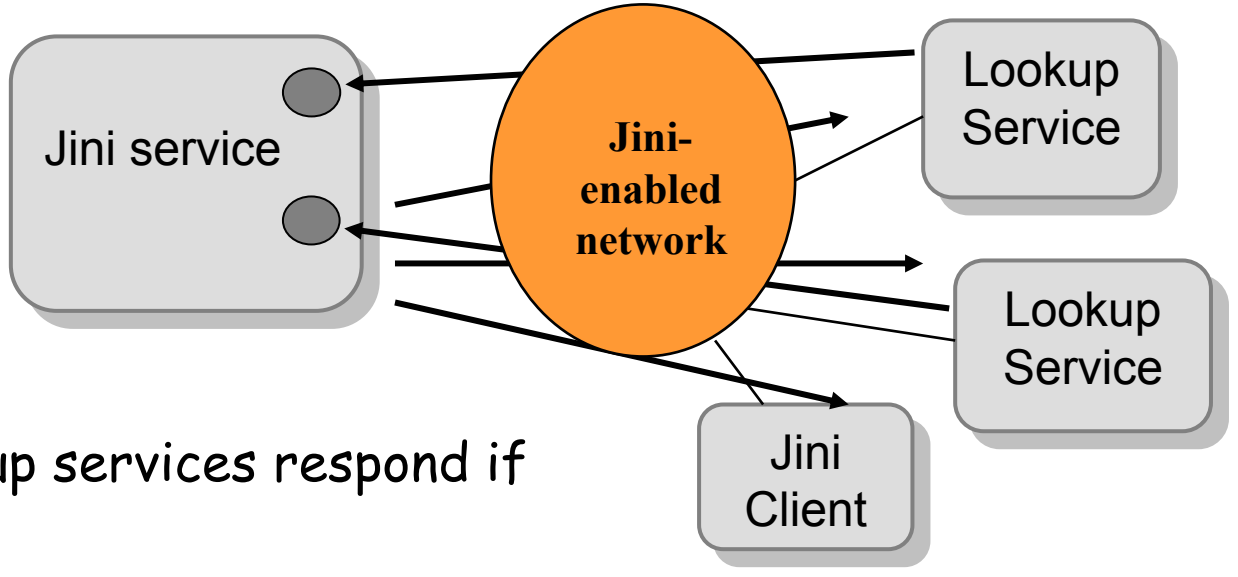
    Duration based model for allocating and freeing the resource references.
  - **Event notification** interface, which extends the JavaBeans event delegation.
  - **Transaction** interface, which allows OO transaction handling.

Operation in more detail

- The fundamental behaviour is defined by three protocols
  - **Discovery** – how to locate the Lookup Service
  - **Join** – how to register with the LS and export services
  - **Lookup** – how to find suitable services
- **Main operation steps**
  - Services export their services (in the form of Java objects)
  - Clients locate services and download objects or execution
  - Client-Service interaction (formation of a federation) is governed by need

Service provider registering (discovery protocol)

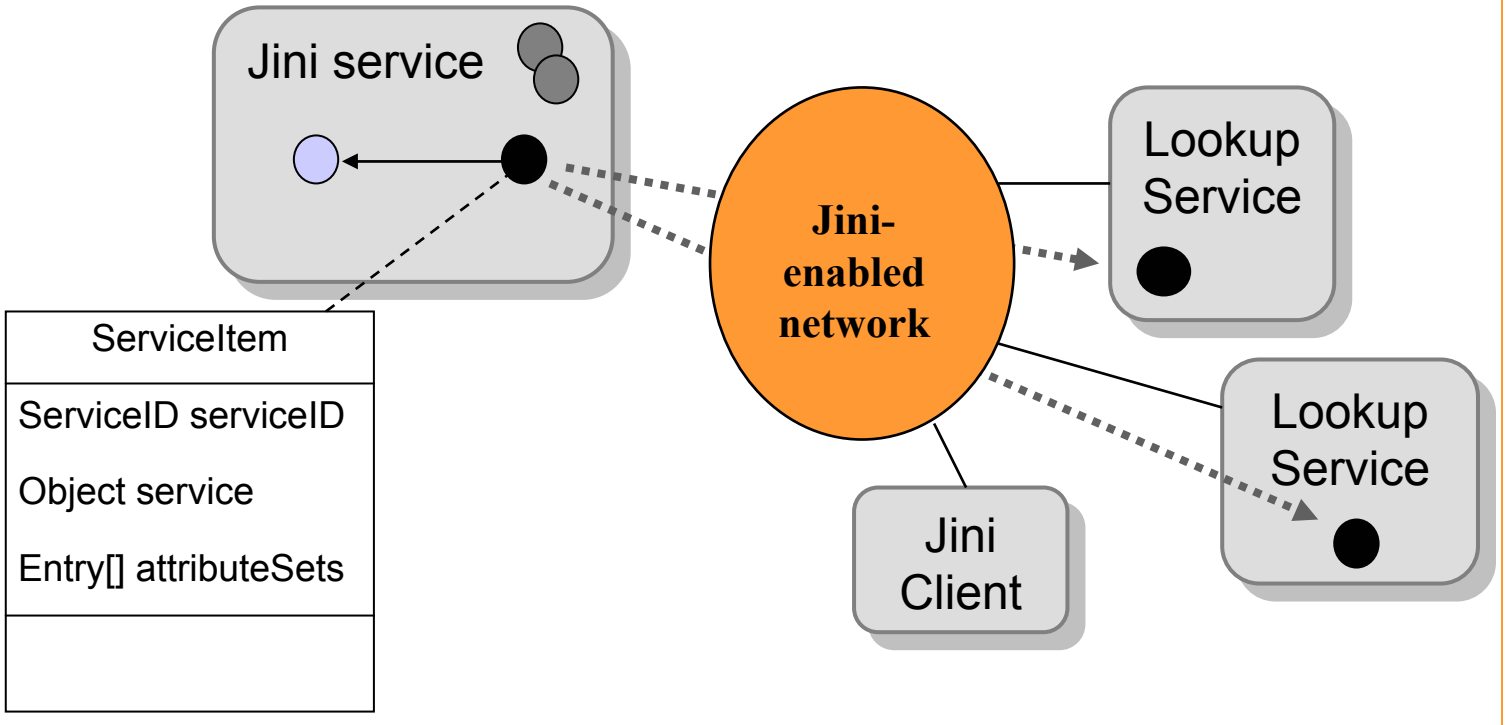
- The service performs a multicast discovery to find lookup services on the network.
- A multicast message is received by everyone on a network



  - Lookup services respond if alive
  - Service receives a proxy object of the LS

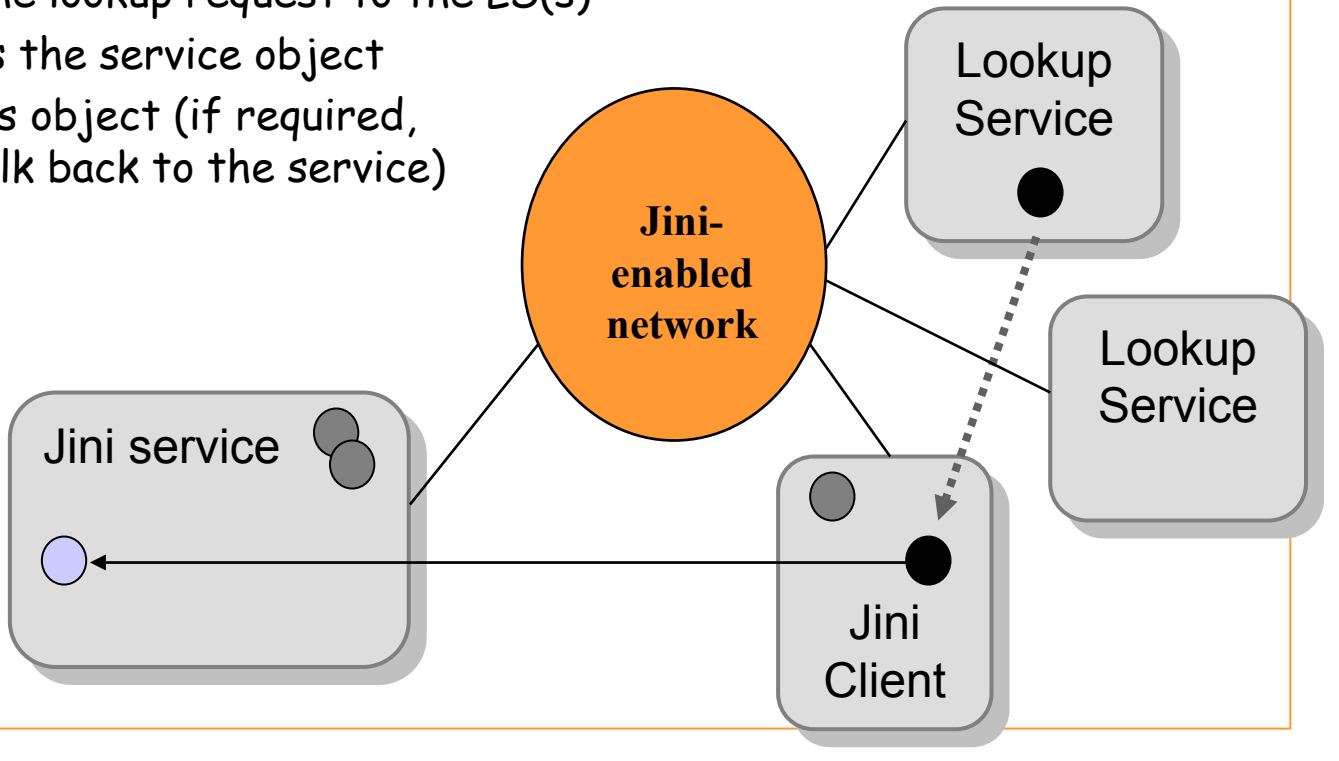
Service provider registering 2 (join protocol)

- Using the LS proxy, the service uploads its object and attributes to the lookup service

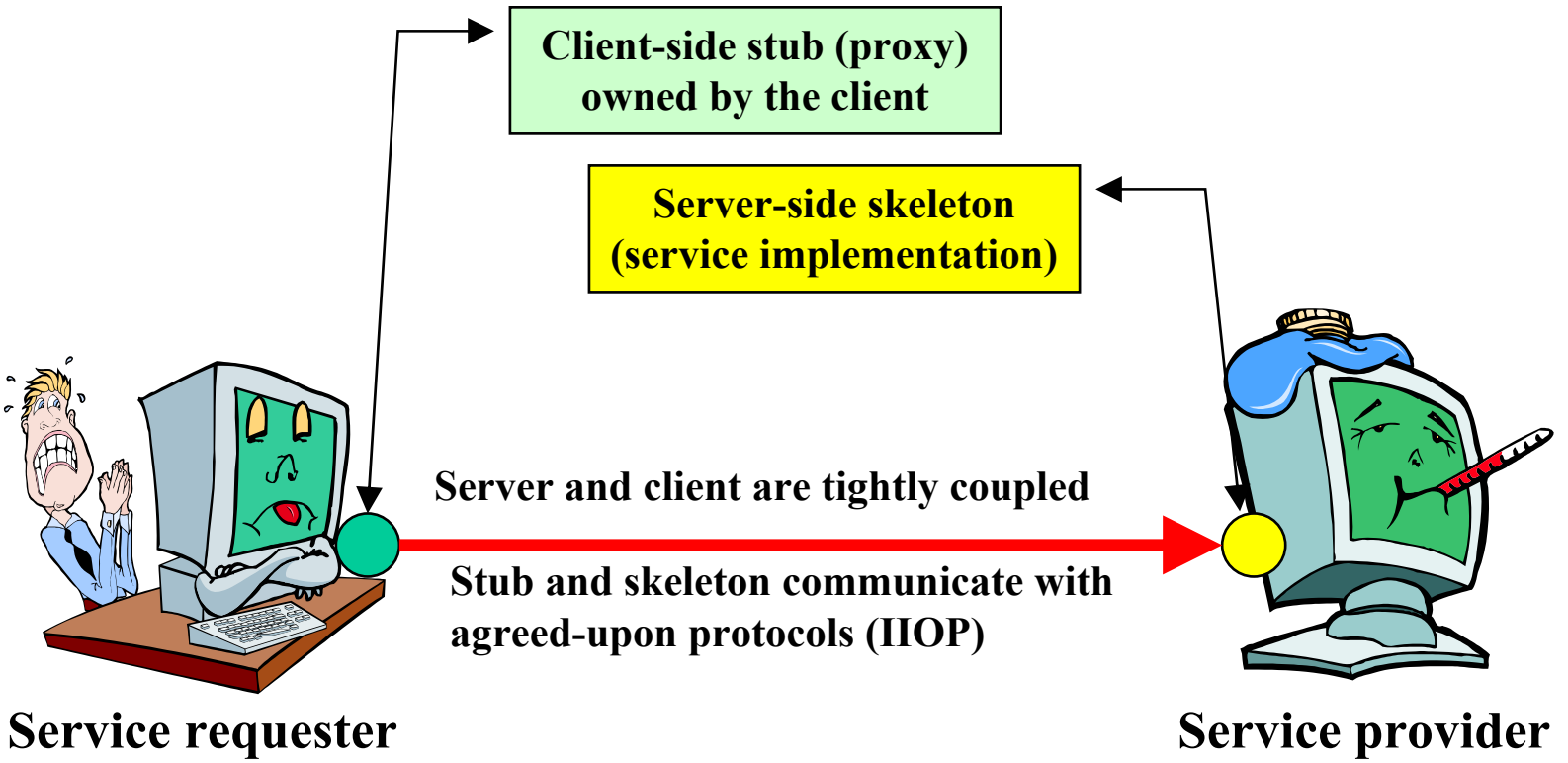


Client requesting service (lookup protocol)

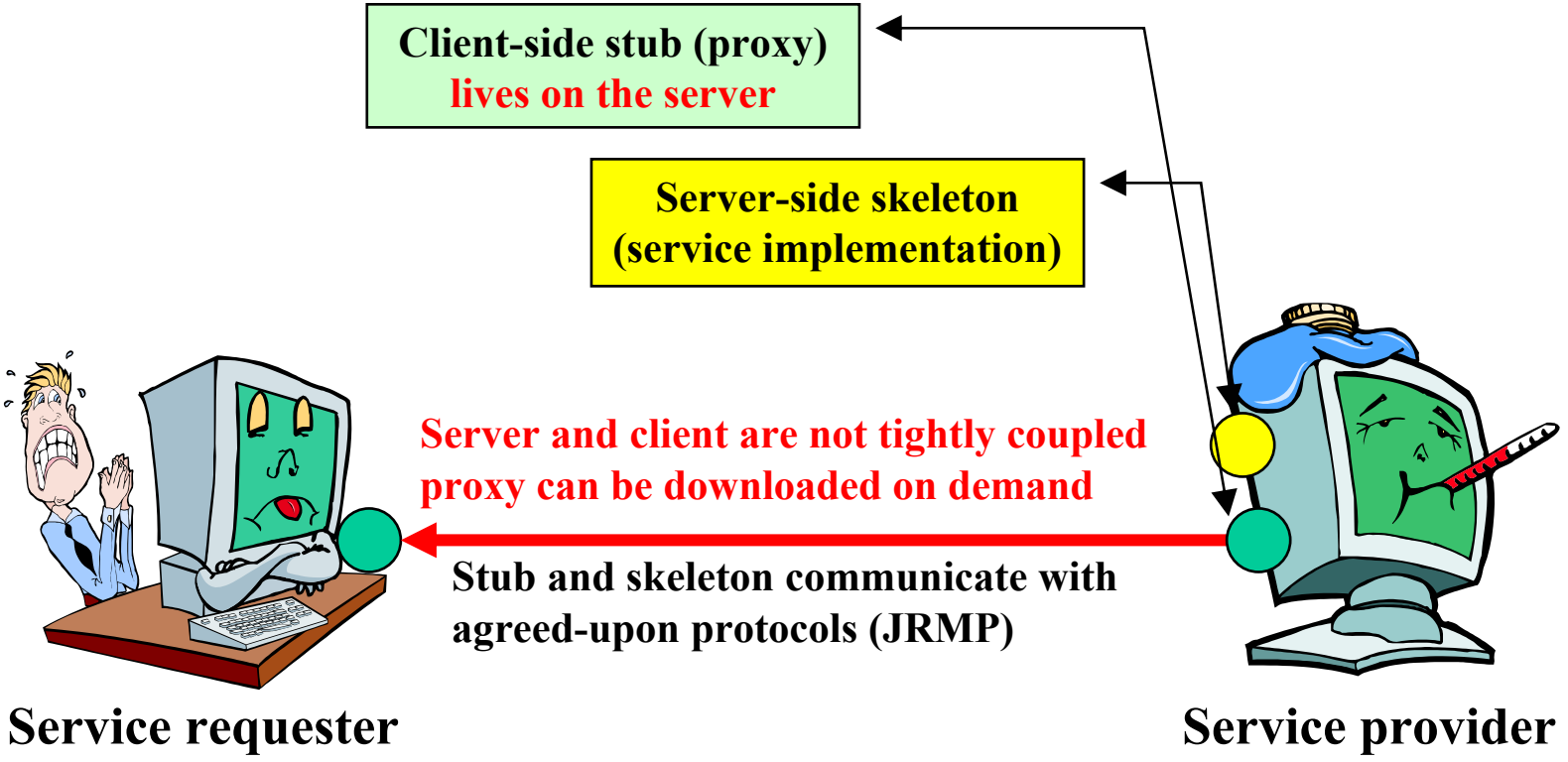
- Finding a service
  - The client (already discovered the LS(s)) specifies the interface of the required service
  - Sends the lookup request to the LS(s)
  - Receives the service object
  - Executes object (if required, it can talk back to the service)



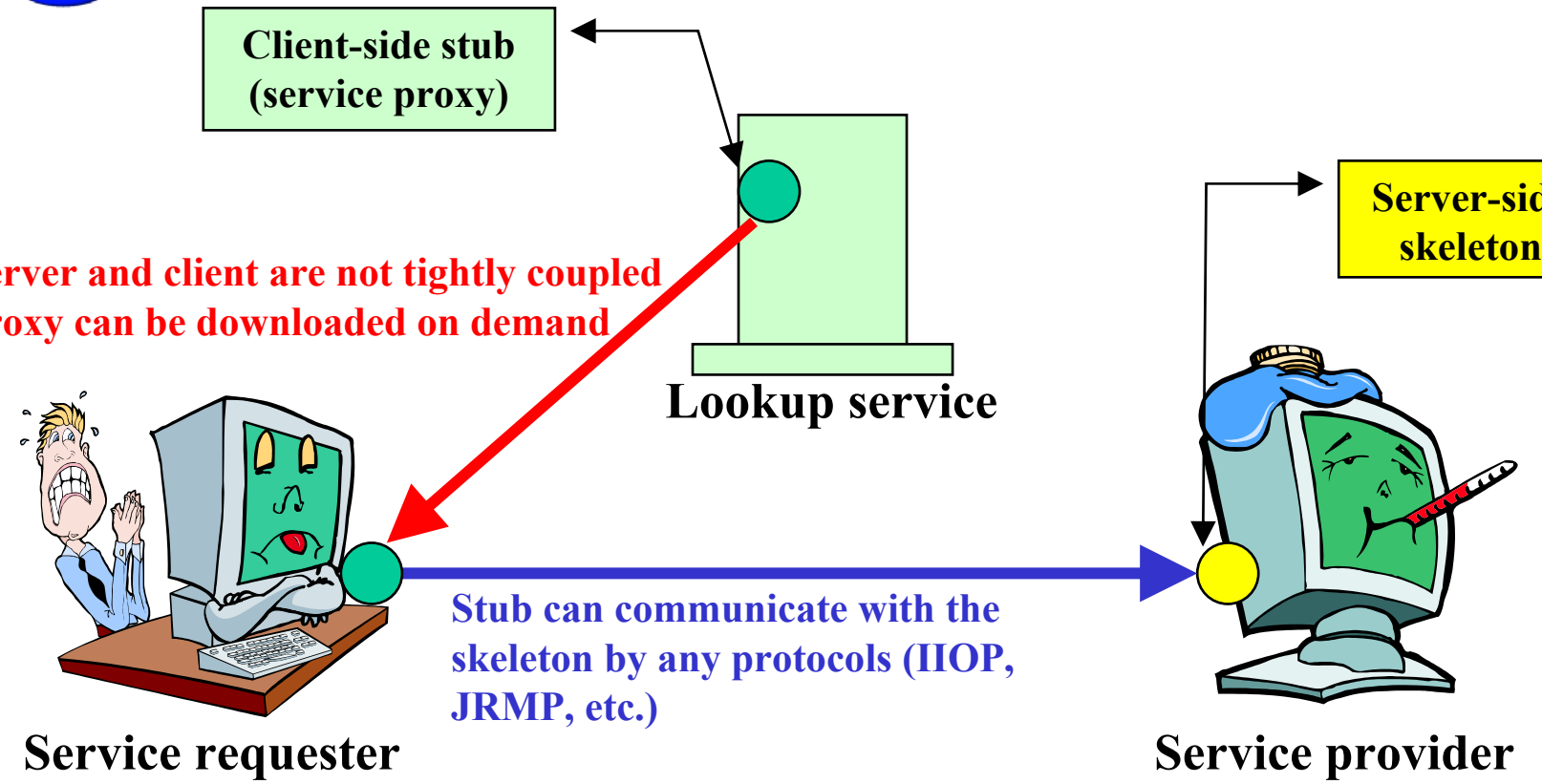
CORBA: Protocol-dependent system



RMI: Protocol-dependent system



Jini: Protocol-independent system



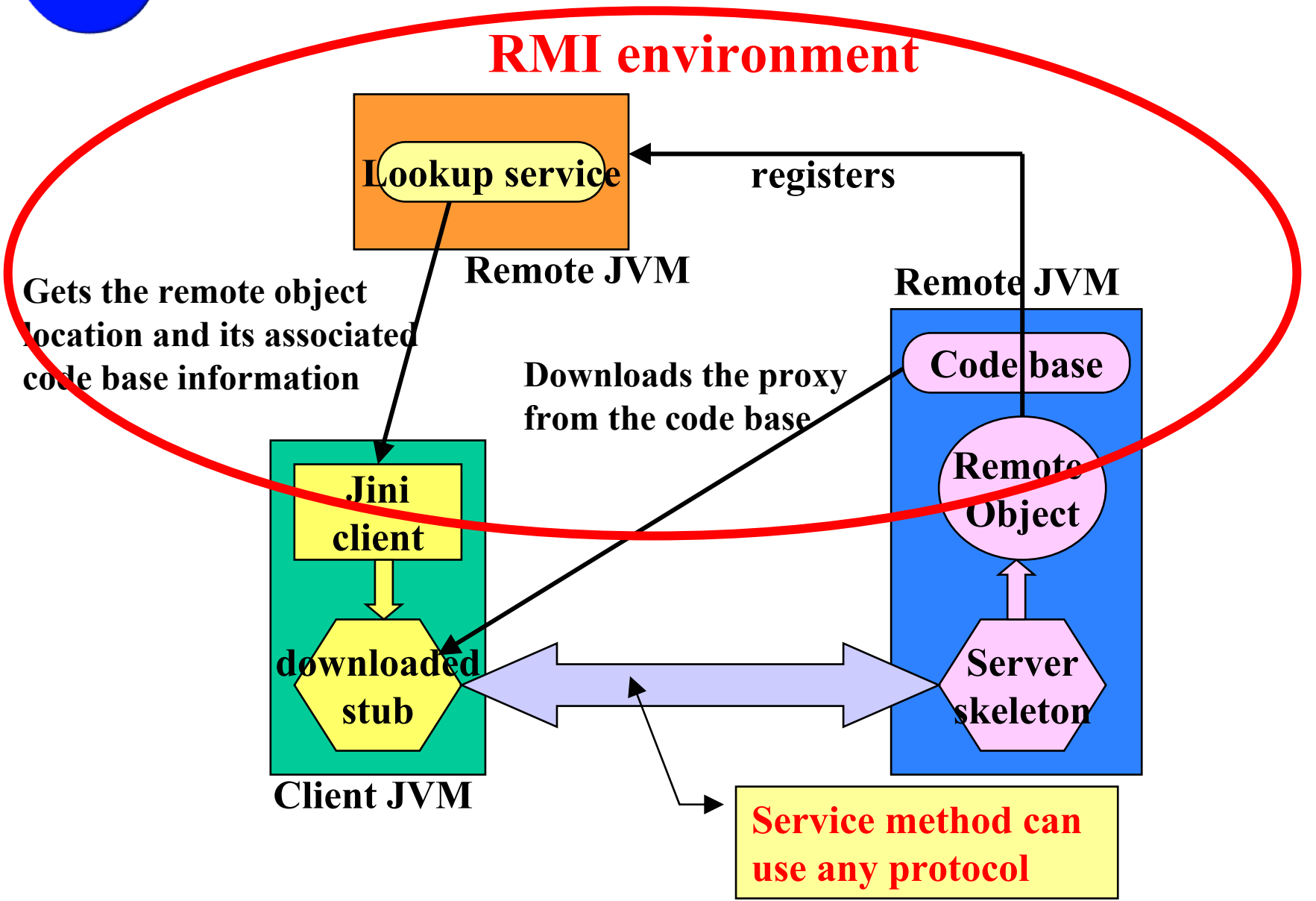
Comparison of Jini and RMI

- Similarity
  - Both provide a mechanism for Java objects and applications (services) to communicate across JVMs.
- Differences 1
  - RMI handles protocol level issues
    - method invocation
    - passing parameter values
  - Jini handles higher-level issues like service interaction
- Differences 2 (Fig. 3-29):
  - RMI protocol-dependent, uses the JRMP protocol
  - Jini is protocol-independent, acts with any distributed protocol (JRMP, IIOP, ORPC)

The role of RMI within Jini

- Jini is dependent on the RMI/Java environment and not the RMI protocol
  - Jini uses the RMI/Java environment to download the stub
  - but once the stub is downloaded it can use any protocol to communicate to its remote object

Jini on top of RMI



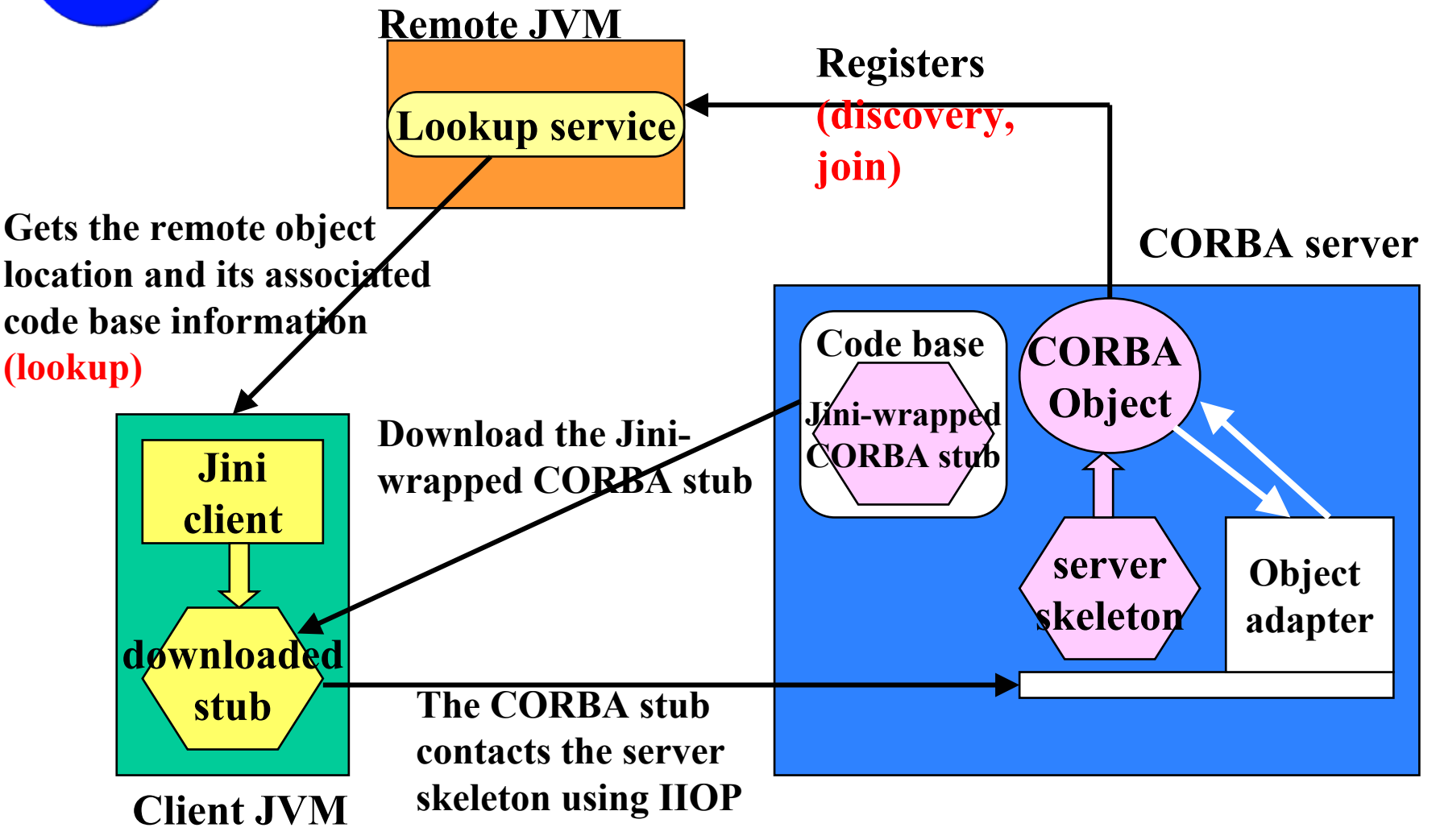
Differences between Jini and CORBA

- CORBA provides a location- and protocol-specific distr. Architecture (Fig. 3-29):
  - client must be prewired with the naming service
  - client must have relevant ORB libraries (client stubs)
  - client must use the IIOP protocol
- Jini is a location- and protocol-independent distr. Architecture (Fig. 3-29):
  - client need not know the location of a lookup service
  - client need not have stub libraries
  - stub can use any protocol
- CORBA can support many languages through IDL
- Jini requires Java Object wrapping

Co-operation between Jini and CORBA

- A Jini proxy can be written that can wrap the CORBA client proxy and can be registered in a Jini lookup server
- Discovery, registration, reregistration and leasing can be handled by a third-party Java component.
  - Any Jini client who would like to use the service can locate a lookup service and download the Java-wrapped CORBA client proxy
  - The client proxy can now communicate to its CORBA server working in the same way as in a CORBA environment
- This design is suitable if you have an ORB running on the client system.
- Otherwise use a bridge scheme.

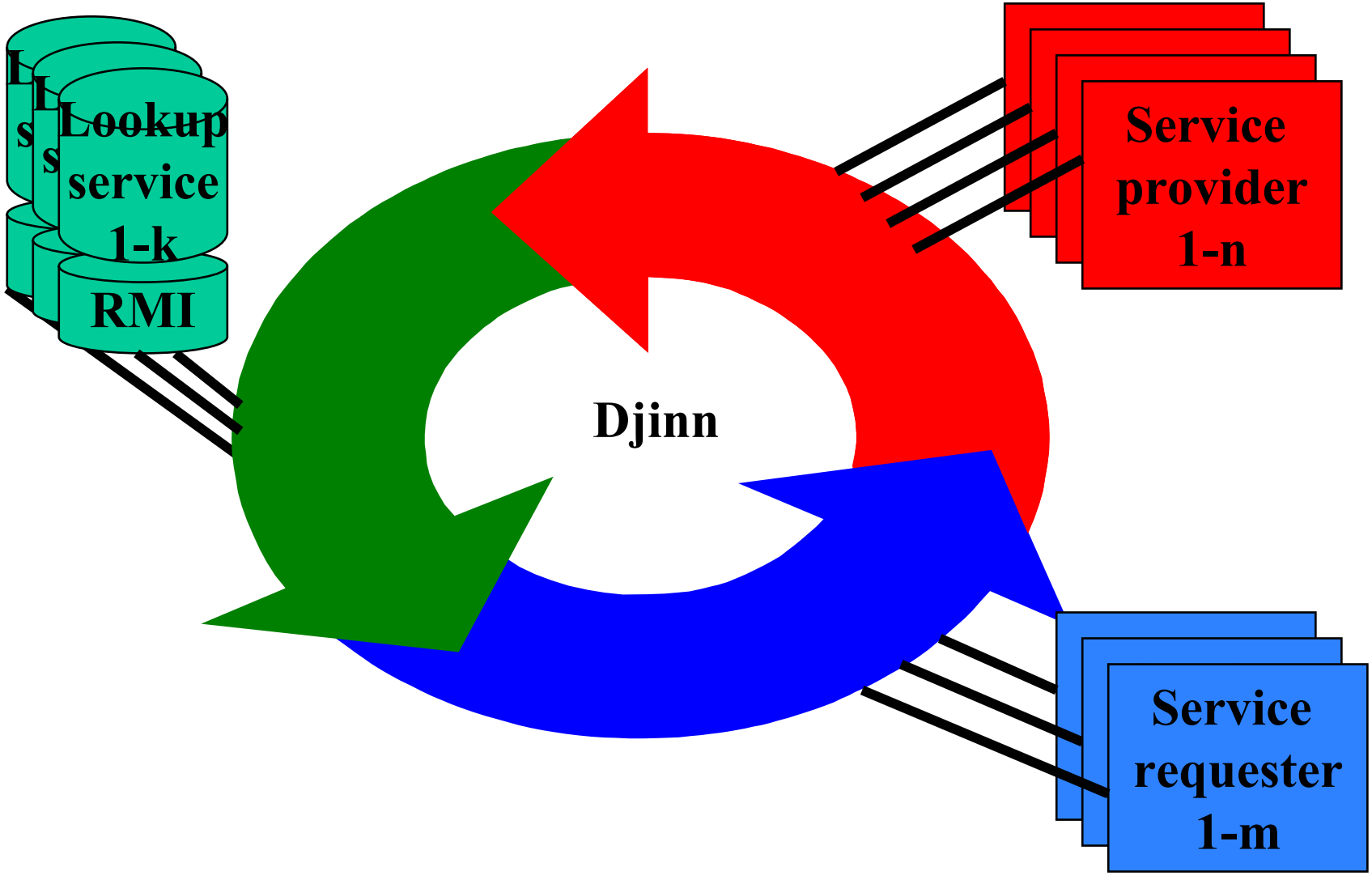
Co-operation between Jini and CORBA



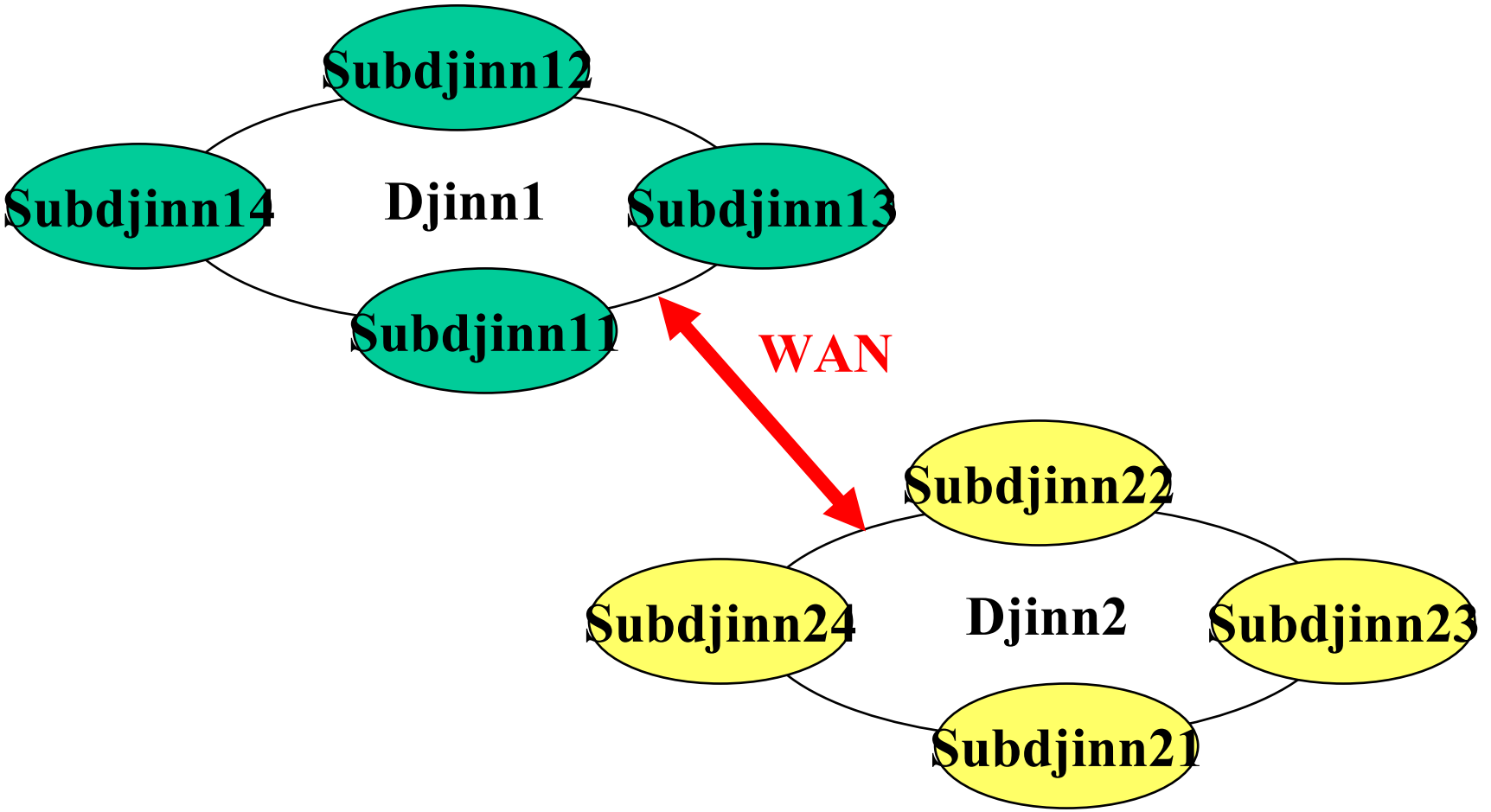
Three levels of scalability in Jini

- Jini community (or Djinn): is a group of
  - lookup services
  - service providers
  - service requesters
- A djinn can contain smaller subdjinns
- Djinns can be connected to form larger distributed Jini service networks

Structure of a djinn



Levels of scalability in Jini



Applications and literature of Jini

- Remote access to clinical data
- Large-scale wish fulfilment support for organizing holidays, wedding, etc.
- Jini on wheels – the car as a mobile infrastructure
- Using Jini to enable a framework for agent-based systems

- Sing Li: Professional Jini, Wrox Press, 2000
- S. I. Kumaran: Jini Technology, Prentice Hall, 2002

Thank you