



Hello

- IP multicast
- JGroups multicast
- JGroups API
- Example
- Demonstration
- How JGroups works
- Conclusions
- Questions
- References

JGroups: a Java system for communicating with a group of machines

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MSc in Computer Engineering

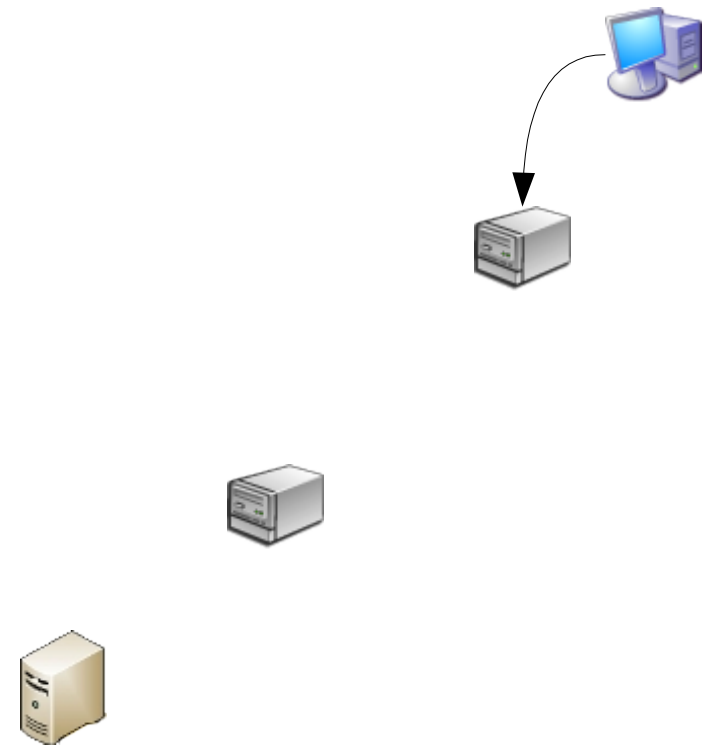
UFR IMA, Grenoble, FRANCE



IP multicast

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- Aim: resource-efficient data transmission to multiple targets
- IGMP protocol

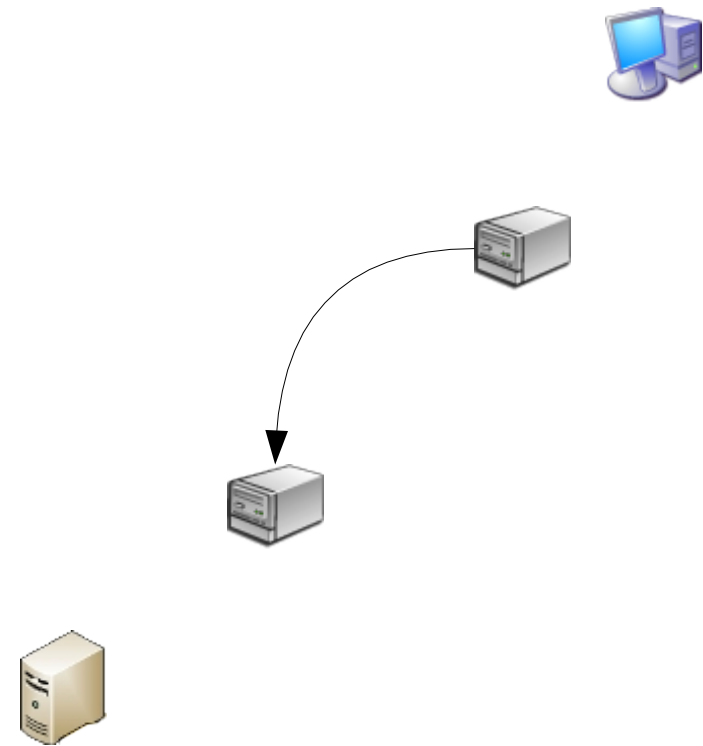




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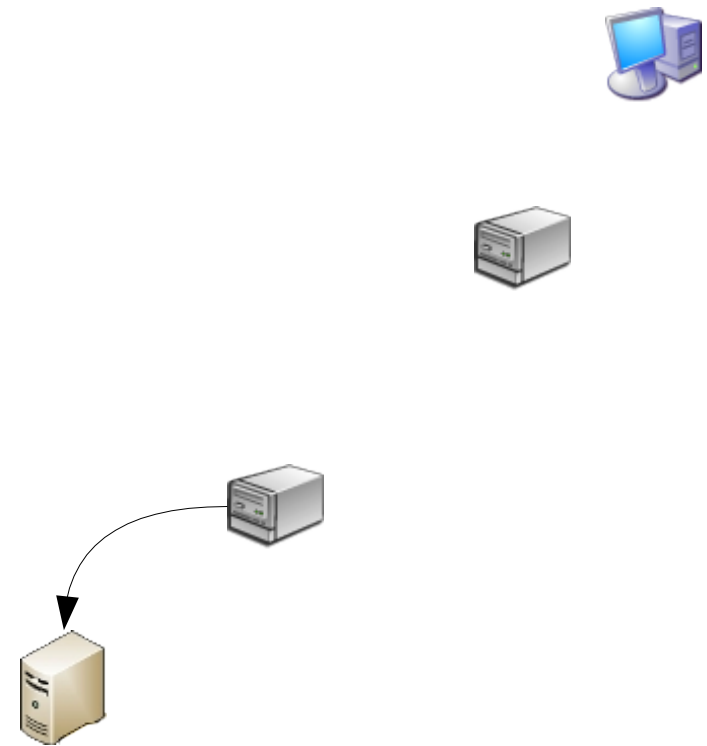




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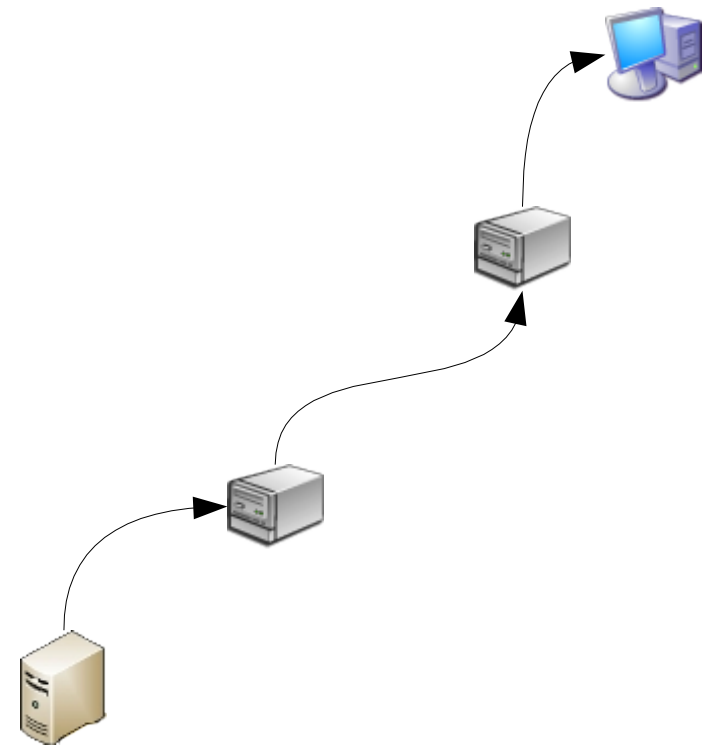




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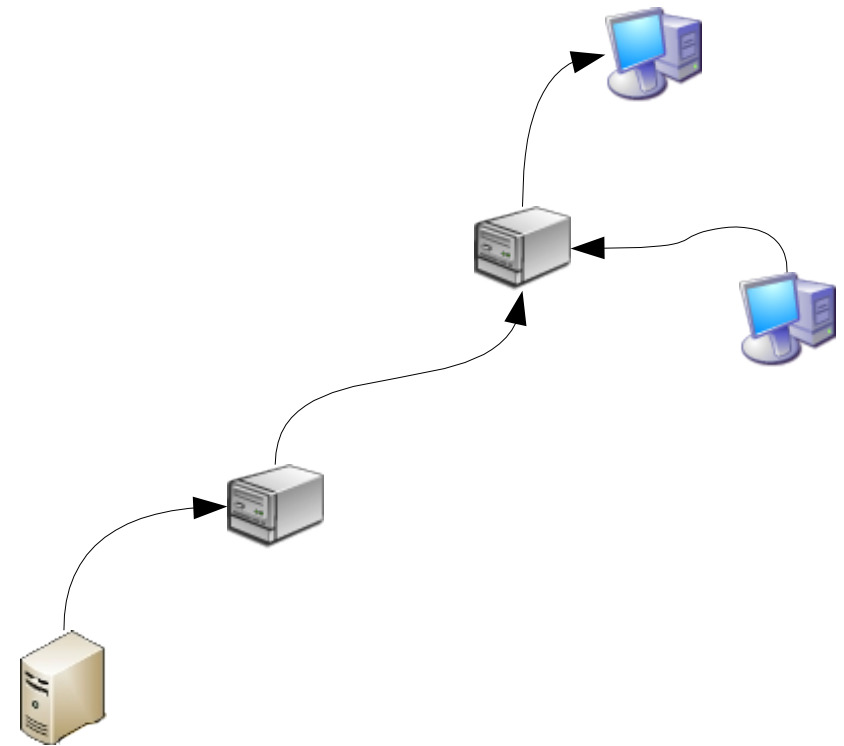




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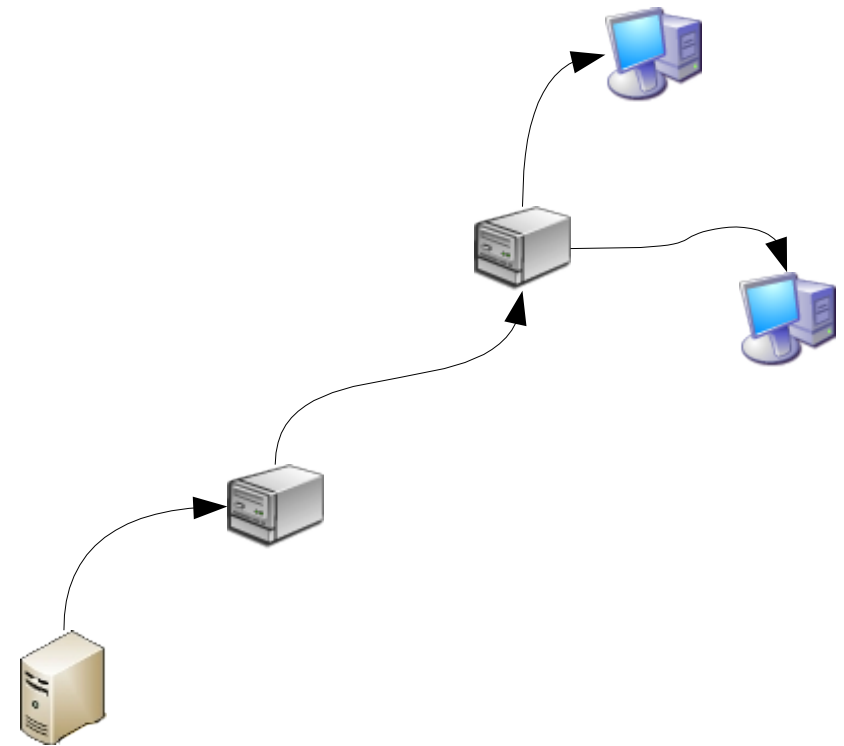




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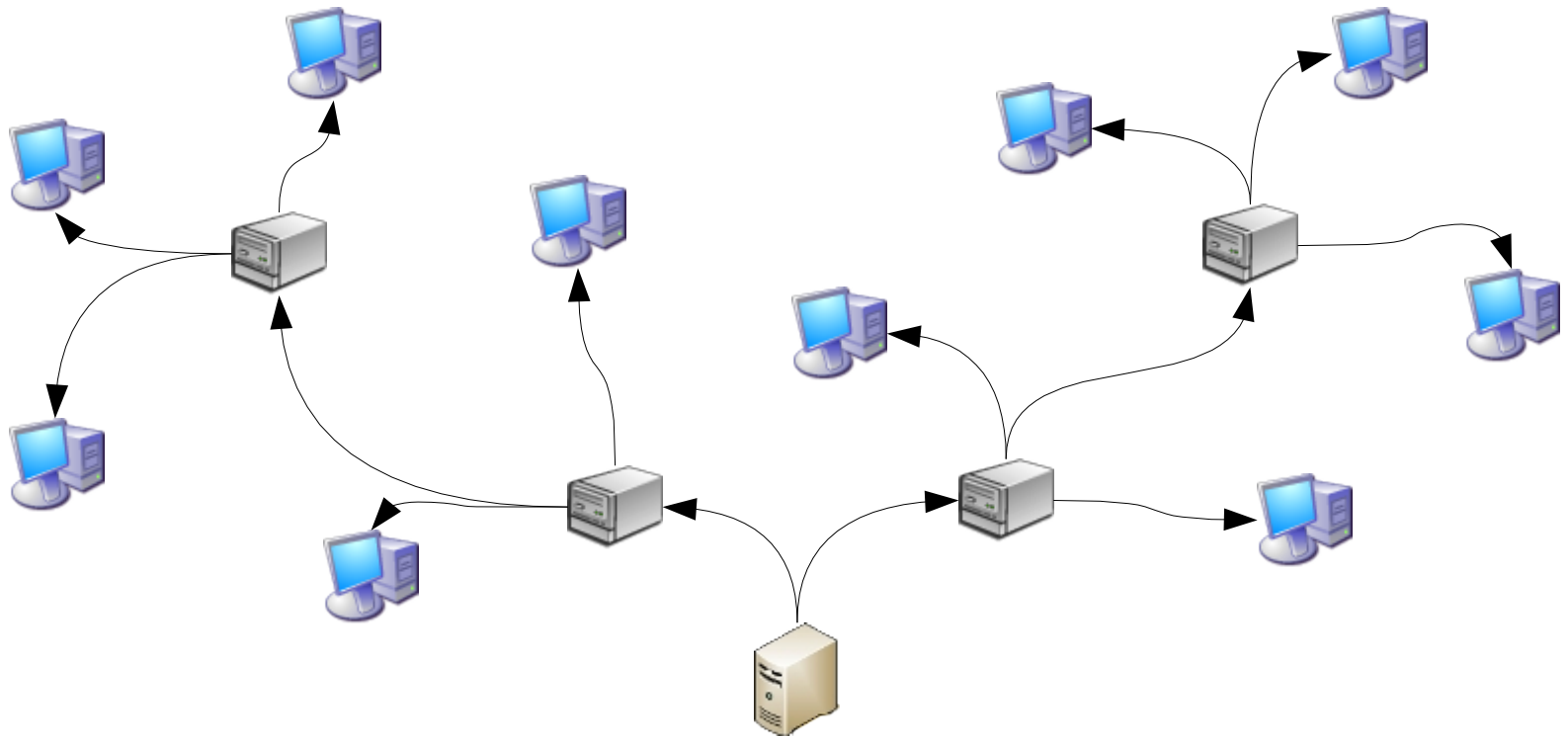




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- Radio / Video transmission, OSPF



JGroups multicast

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- Initial aim: to provide a Java class for IP multicast
- Extensions:
 - Choice between protocols: UDP, TCP, JMX
 - Subscription and unsubscription notification
 - Crashed member detection
 - Reliable and ordered transmissions
 - Point-to-point messaging
 - Fragmentation of big messages
 - Scheduling policies: atomic (all or none), FIFO, total order
 - Encryption



JGroups API

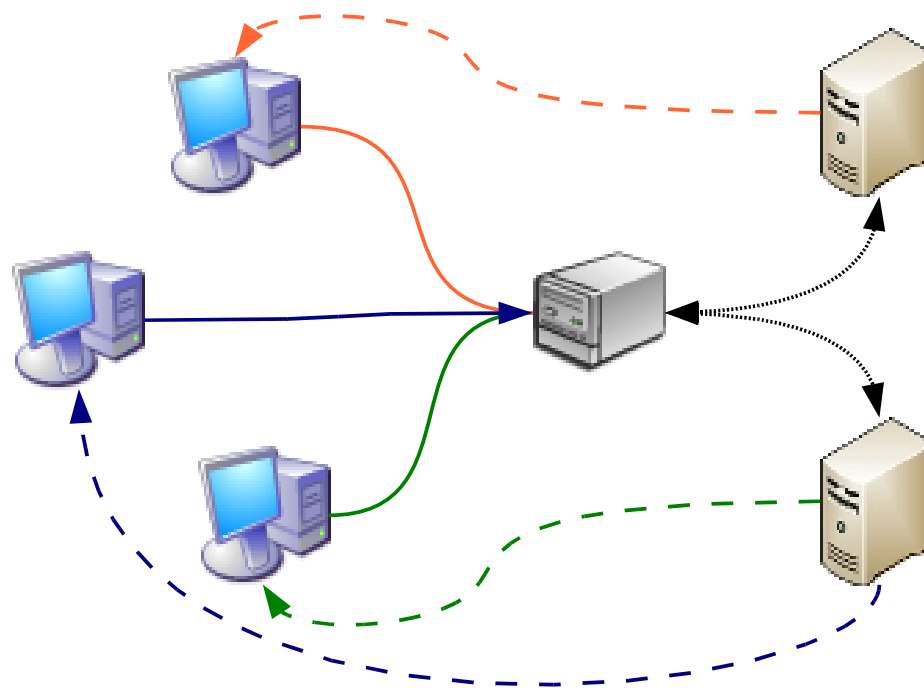
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- Channel creation: `new JChannel(props);` with properties such as:
 - Transport protocol
 - Reliable or non-reliable transmissions
 - Scheduling policies
- `connect` method to join the group
- `send` method for multicast or unicast sending
- `receive` method (blocking) or `publish / subscribe` alerts for receiving
- `disconnect` method to quit group



Example

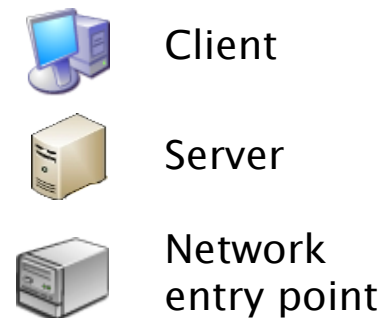
- Request distribution system



Communication types:



Machine types:





Demonstration

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• Distributor's code

```
public void onRequest( HttpServletRequest request ) {
    // Get the list of available servers
    Vector<Address> servers = channel.getView().getMembers();
    if( servers.size() <= 1 ){
        // In this case, there are no servers!
        onError( 501 );
    } else {
        int gatewayPosition = servers.indexOf(channel.getLocalAddress());
        int targetServer = gatewayPosition;
        // Pick a server to process request, make sure it really
        // is a server and not the distributor
        while ( targetServer == gatewayPosition ) {
            targetServer = random.nextInt(servers.size());
        }
        // Redirect request to server. Server will respond to client directly.
        channel.send(new Message( servers.get(targetServer), null, request ));
    }
}
```

• Servers' code

```
while( true ) {
    // wait for a request
    Object o = channel.receive(0);
    // Only process normal messages
    if( o instanceof Message ) {
        o = ((Message) o).getObject();
        // verify that it's an HTTP request
        if( o instanceof HttpServletRequest ) {
            // Call the standard HTTP server program with request
            ProcessRequest( (HttpServletRequest) o );
        }
    }
}
```



How JGroups works

- **Ethereal**

No. -	Time	Source	Destination	Protocol	Info
1	0.000000	192.168.25.131	228.8.8.8	IGMP	V2 Membership Report
2	0.007931	192.168.25.131	224.0.0.75	IGMP	V2 Membership Report
3	0.084068	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
4	1.150895	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
5	2.443899	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
6	9.965719	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
7	11.028988	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
8	11.146212	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
10	21.598201	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
11	22.212492	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
12	27.688201	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
13	28.136554	192.168.25.131	228.8.8.8	UDP	Source port: 1033 Destination port: 45566
14	29.132816	192.168.25.131	228.8.8.8	UDP	Source port: 1033 Destination port: 45566
15	30.118251	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
16	30.207289	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
17	30.400785	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
18	30.407729	192.168.25.131	228.8.8.8	UDP	Source port: 1033 Destination port: 45566
20	45.593701	192.168.25.131	228.8.8.8	UDP	Source port: 1033 Destination port: 45566
21	45.612956	192.168.25.131	228.8.8.8	UDP	Source port: 1033 Destination port: 45566
22	48.458657	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
23	48.734481	192.168.25.131	228.8.8.8	UDP	Source port: 1029 Destination port: 45566
24	51.434913	192.168.25.131	228.8.8.8	UDP	Source port: 1033 Destination port: 45566
25	51.554688	192.168.25.131	224.0.0.2	IGMP	V2 Leave Group
26	51.582727	192.168.25.131	224.0.0.2	IGMP	V2 Leave Group

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Pros and perspectives

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- **Pros:**
 - Stable system for dynamic groups
 - Very modular architecture (OSI)
 - Ships with 19 examples and 117 tests
- **Open projects**
 - Ethereal plugin
 - Bluetooth support
 - Compatibility with Java standards: JavaSpaces, ...
 - HTTP load balancer
 - ...



Cons

- Functionnalités not offered by JGroups but offered by rivals such as .NET:
 - Packet coalescing
 - Priorities
 - Per-message transmission options
 - Subgroups
 - Stream exchanging
 - State exchange
- JGroups doesn't have a logo!
- User's manual partially empty

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Questions ?

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- **References**

- JGroups web site and links in it (mostly JBoss presentations)
- Web sites such as Wikipedia or Cisco for information about grouping and load balancing protocols in TCP/IP
- Ethereal
- Didier Donsez' lecture notes on Jini
- Microsoft's MSDN library



Thank you

Thank you

Documents available on

<http://scholar.alishomepage.com/Master/JGroups/>

