

# JXTA Overview



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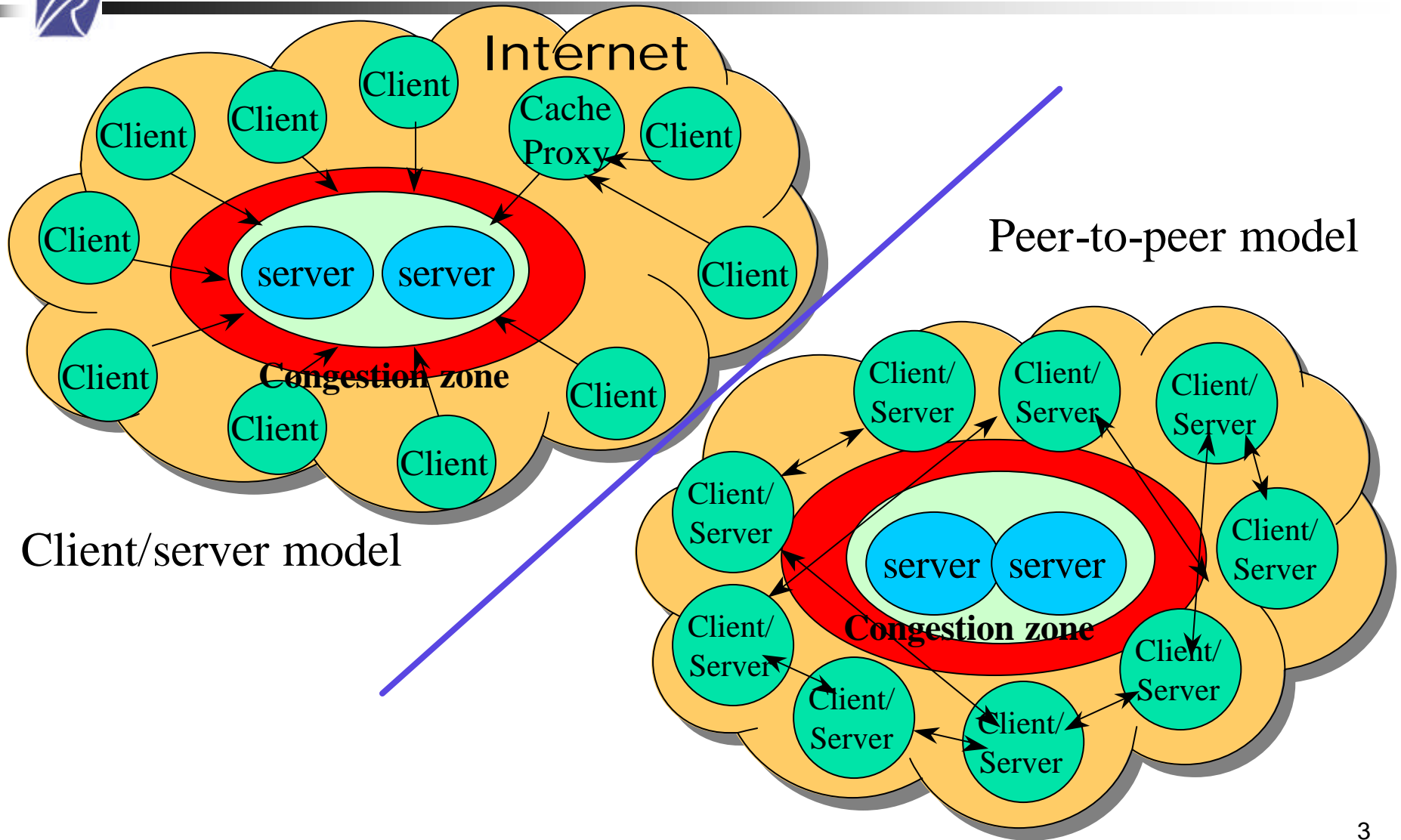
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# Plan



- Why peer-to-peer (P2P) ?
- Introduction to JXTA
  - Goals
  - Basic concepts
  - Protocols
- JXTA 2.0
  - Loosely-Consistent DHT
- Conclusion

# Why peer-to-peer (P2P) ?



# P2P: a definition



- **Goal:** take advantage of resources available at the edges of Internet
  - Computing power, storage, content
- **Definition**
  - Larged distributed system
  - **Variable connectivity** and **temporary IP addresses**
  - Parity: each node can be client **and** server

# P2P: features



- **Dynamicity** of the network
  - Composition and topology
- **Dynamic discovery** of peers and resources
- **Scalability**
  - More peers => more performance
- **High availability**
  - Interchangeable peers (replication)

# JXTA: a Generic Framework for P2P Computing



- Open platform for P2P programming
- Common functionalities
- Language, OS, network agnostic
- Set of interoperable protocols (XML)
- Open source project:

<http://www.jxta.org>

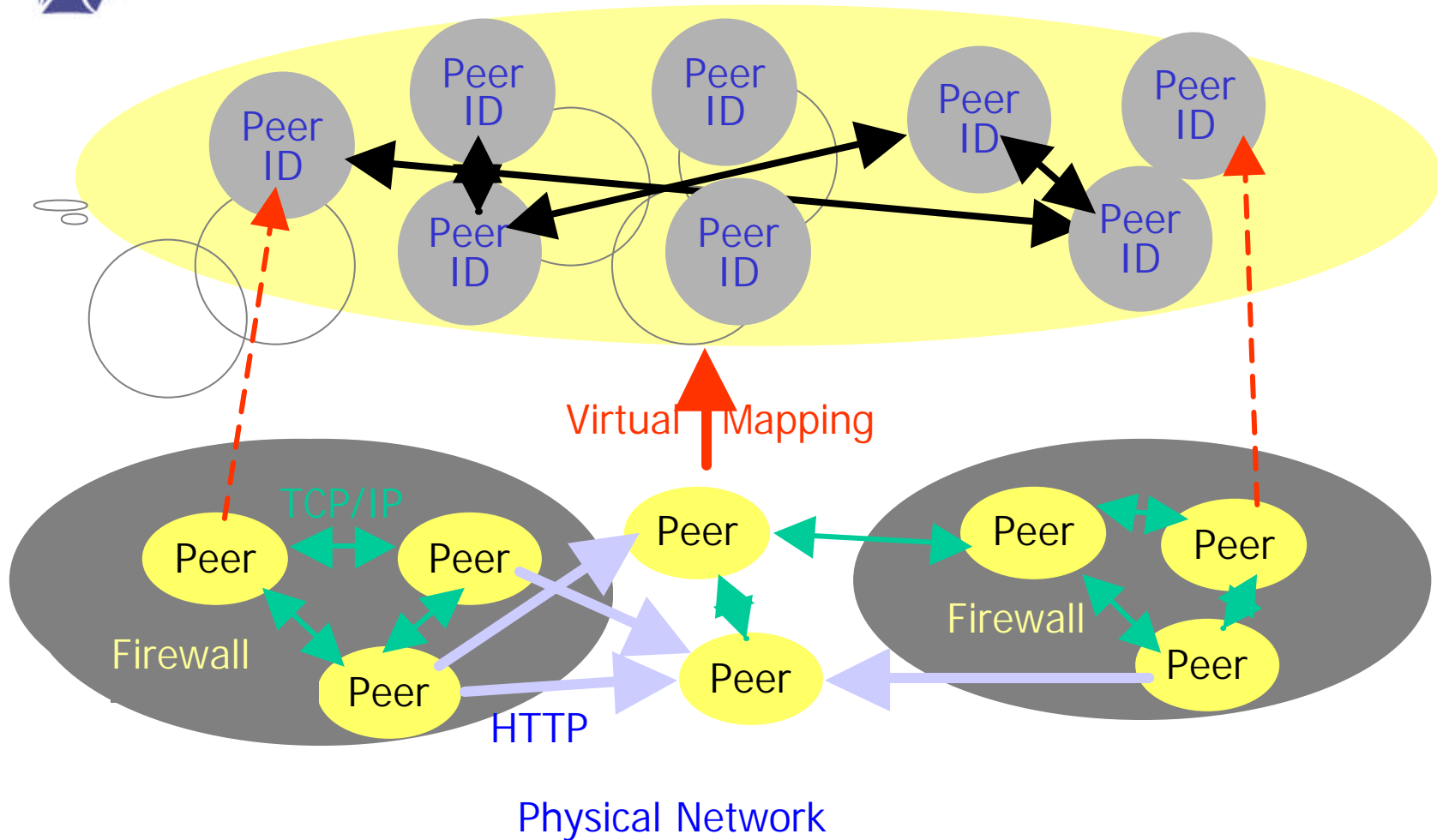


# JXTA Services and Applications



- Distributed storage and data sharing
  - Search, indexing and file sharing
- Large scale distributed computing
- P2P messaging and collaboration tools

# JXTA Virtual Network





# Peers

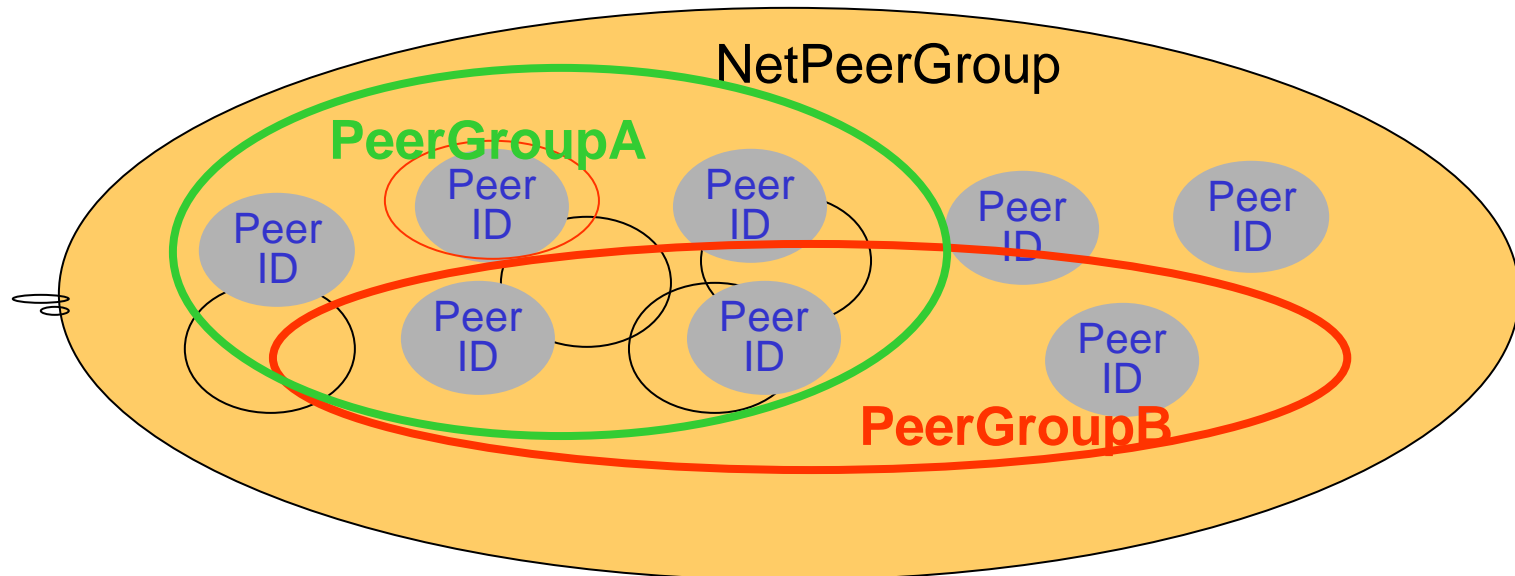


- A peer
  - Unique identifier (UUID)
  - Addressable independently of its location (firewalls, NAT)
  - Multiple Peer “endpoint” address (TCP, HTTP, etc.)
- Peer types
  - Minimal edge : send/receive
  - Full edge : + cache
  - Rendezvous : + fwd requests
  - Relay : +routing cache +firewall support

# Peer Groups



- Why Peer Groups?
  - Provide a “group” identity (common interest)
  - Create secure & protected domains
  - Scope peer operations (discovery, search, communications)
  - Enable monitoring



# Advertisements



- Every resource is represented by an advertisement
  - Peer
  - Peer group
  - Pipe
  - Service
  - Content
  - Peer status

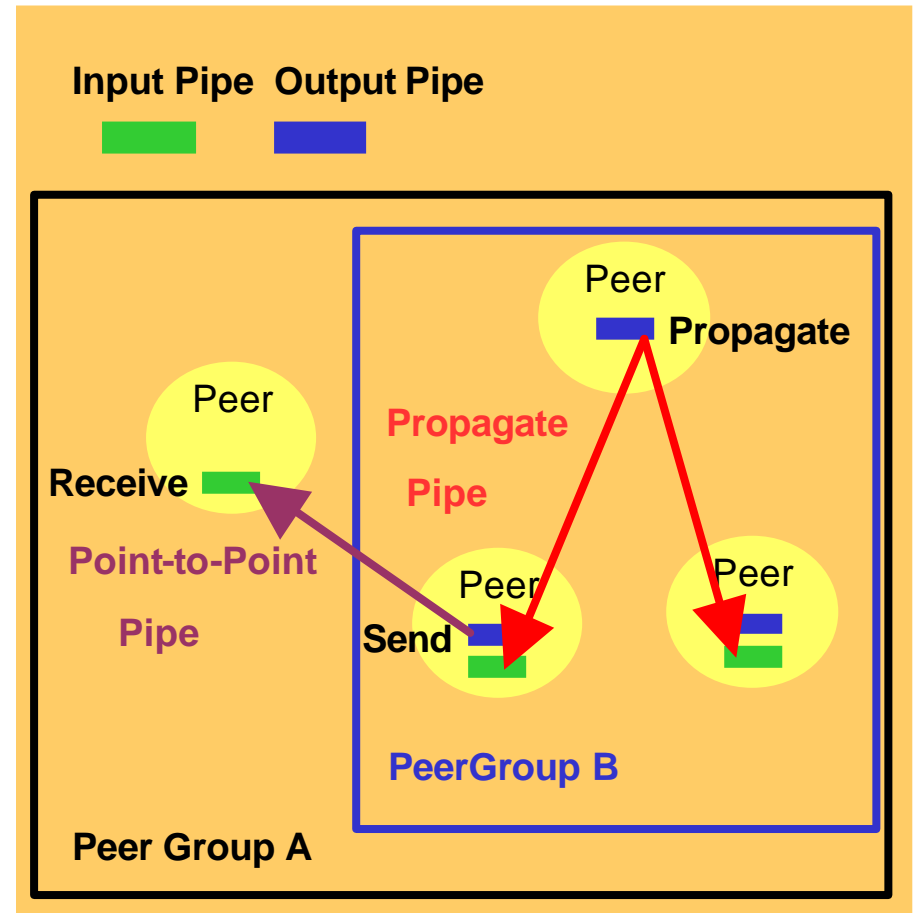
PeerGroup Advertisement:

```
<?xml version="1.0"?>
<!DOCTYPE jxta:PGA>
<jxta:PGA>
  <GID>
    urn:jxta: uuid-
    BCBCDEABDBBBABEABBBABA000000
  </GID>
  <MSID>
    urn:jxta:uuid-
    BFEDDFBABA FRUDBACE00000001
  </MSID>
  <Name>
    My Group
  </Name>
  <Desc>
    This group is to be used for my own
    testing
  </Desc>
</jxta:PGA>
```

# Pipe: Virtual Communication Channel



- Non-localized communication channel between two or more peers
  - Uni-directional
  - Asynchronous
  - Unreliable



# Pipe Communication Model



- Connect to services independently of their peer locations
- Dynamic binding
  - At pipe creation or for every message sent
- Build highly-available services
  - Transparent fail-over by reconnecting pipe endpoints
- Pipeline multiple services to form complex service

# Network Services



- Peer Services
- PeerGroup Services
- Can be dynamically loaded

# JXTA Protocol Stack



Peer Discovery  
Protocol

Pipe Binding  
Protocol

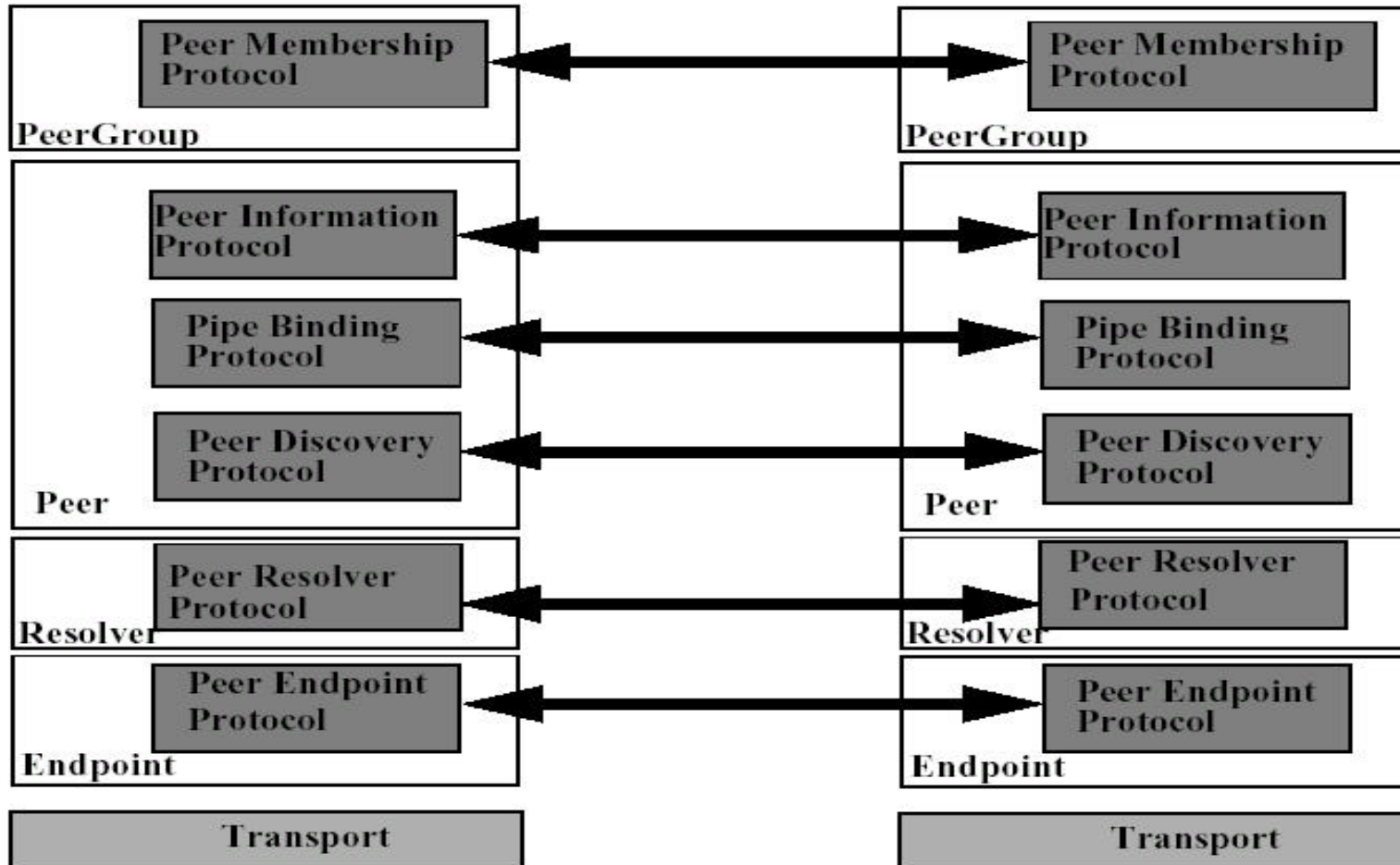
Peer Info  
Protocol

Peer Resolver Protocol

Peer Endpoint  
Protocol

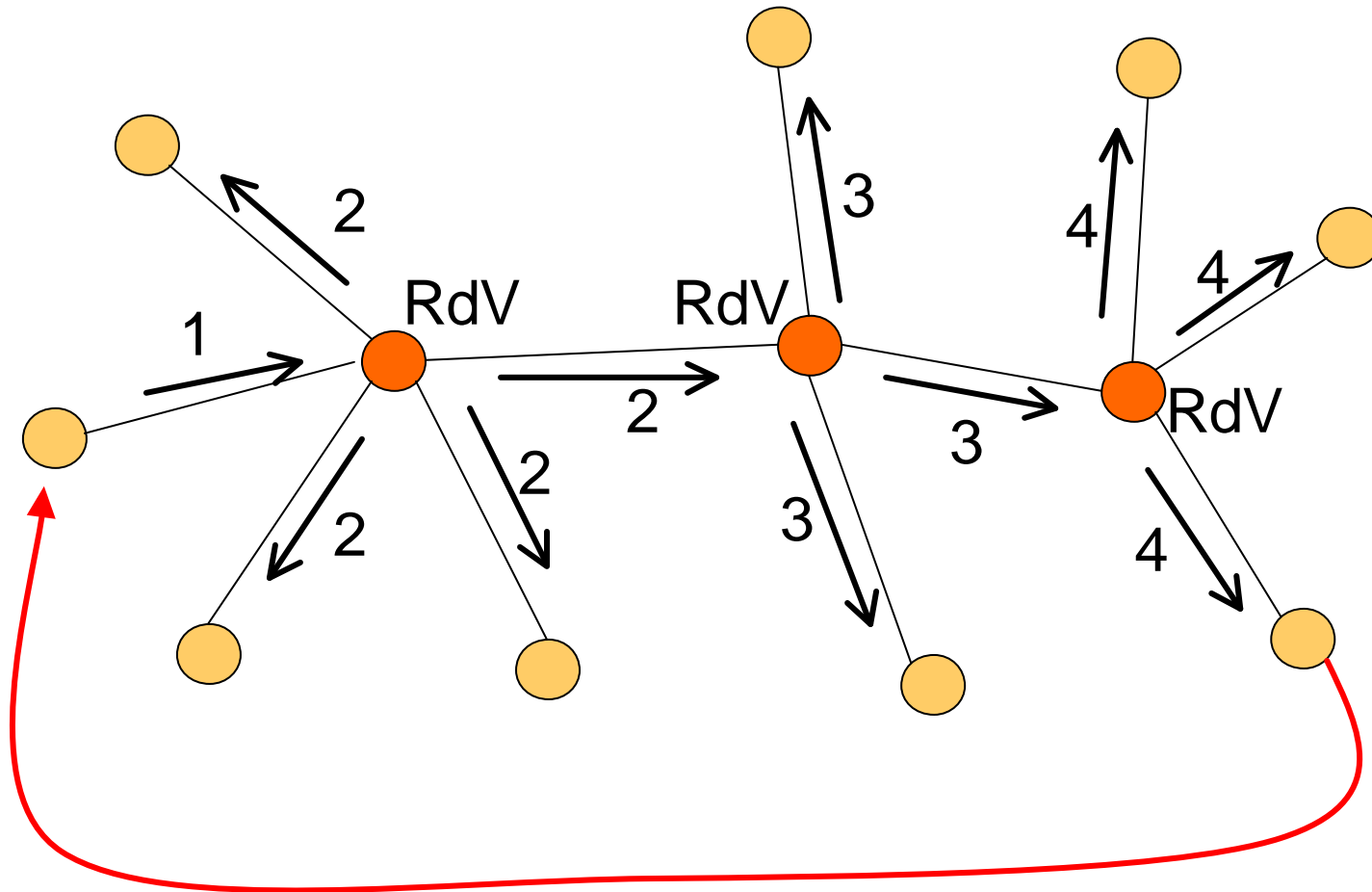
Peer Rendezvous  
Protocol

# JXTA Protocol Stack

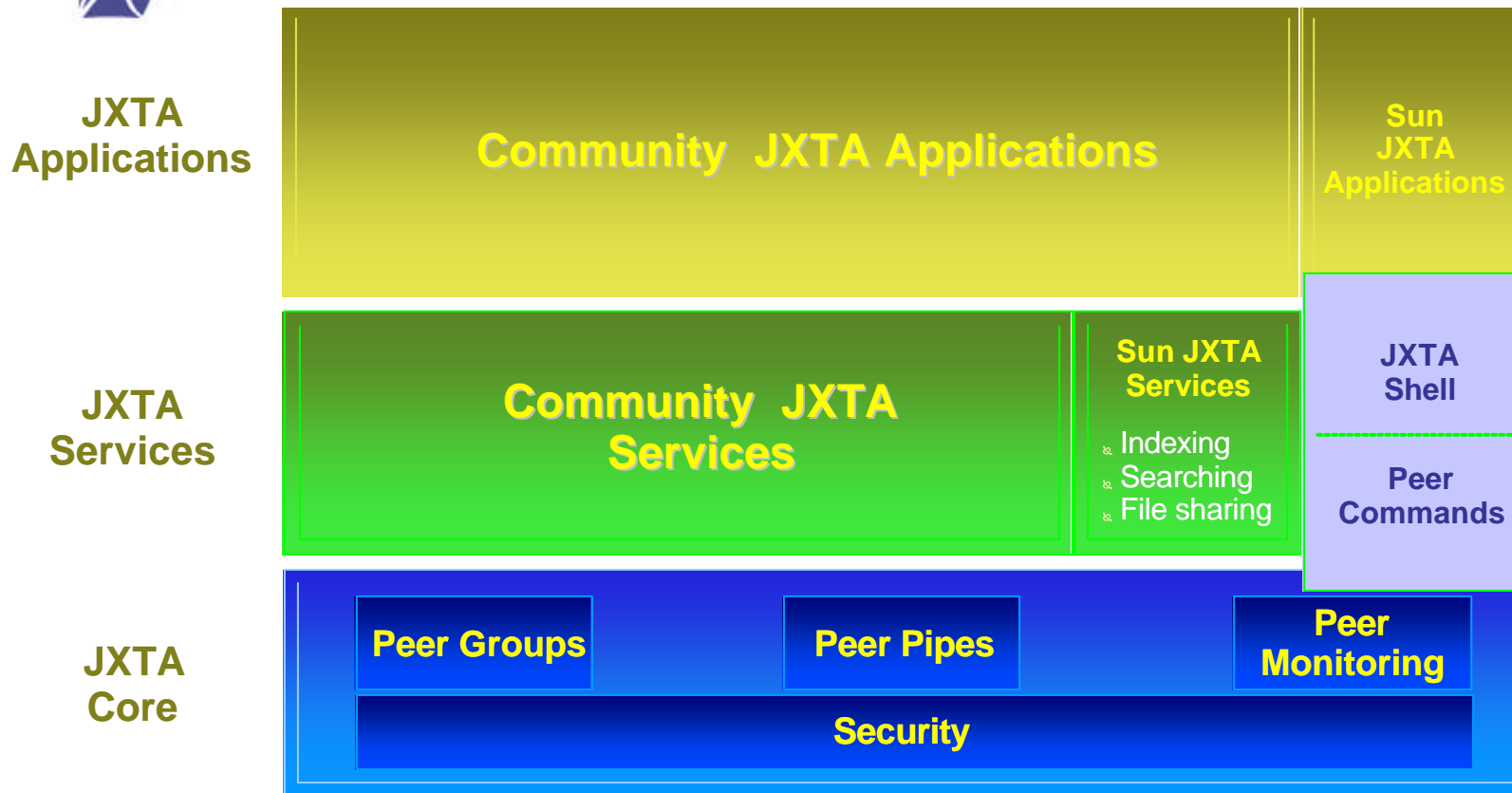




# Peer Discovery Protocol (JXTA 1.0)



# JXTA: Architecture



Any Peer on the Expanded Web



# JXTA: Core Services



- Discovery Service
- PeerInfo Service
- Pipe Service
- Resolver Service
  
- Membership Service
- Access Service

# JXTA 2.0 J2SE Released



- Better performance
- Greater scalability
- More stable
- Wire protocol incompatible
- Mostly API compatible

# New Rendezvous Network



- In JXTA 1.0, all peers were involved in the propagation of resolver, discovery, and propagate pipe messages within the PeerGroup
- In JXTA 2.0, resolution and propagation are done via two new concepts:
  - Rendezvous super-peer network and Rendezvous Walker Service
  - Shared Resource Distributed Index (SRDI) Service to distribute advertisement indexes through the rendezvous network

# New Propagation



- Queries only propagated among rendezvous peers
- Edge peers only receive direct queries for their own advertisements
- Rendezvous peers self organize
- Pluggable frameworks used to walk the Rendezvous web

# Shared Resource Distributed Index



- Edge peers publish indices of advertisements across Rdv network using Distributed Hash Tables (DHT)
- DHTs are maintained by Rendezvous peers
- Queries are directed to appropriate Rdv
- If not found, a walk of the Rdv web is performed
- Hash functions are pluggable

# Loosely-Consistent DHT



- Peers have high churn rate
- Maintaining a consistent distributed index outweigh the advantages of having one
- Network crawling is expensive but does not have any maintenance cost

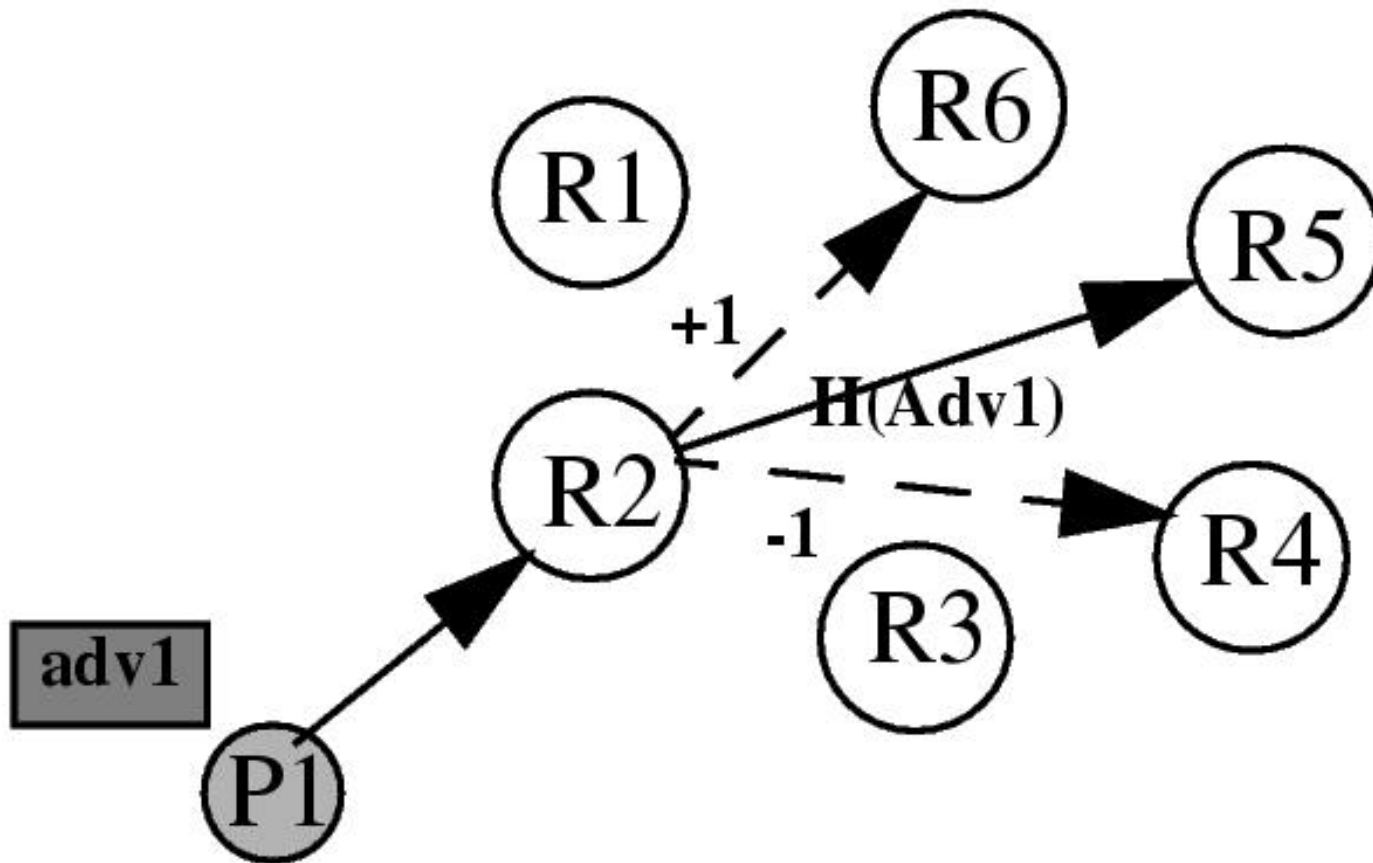


# Rendezvous Peer View (RPV)

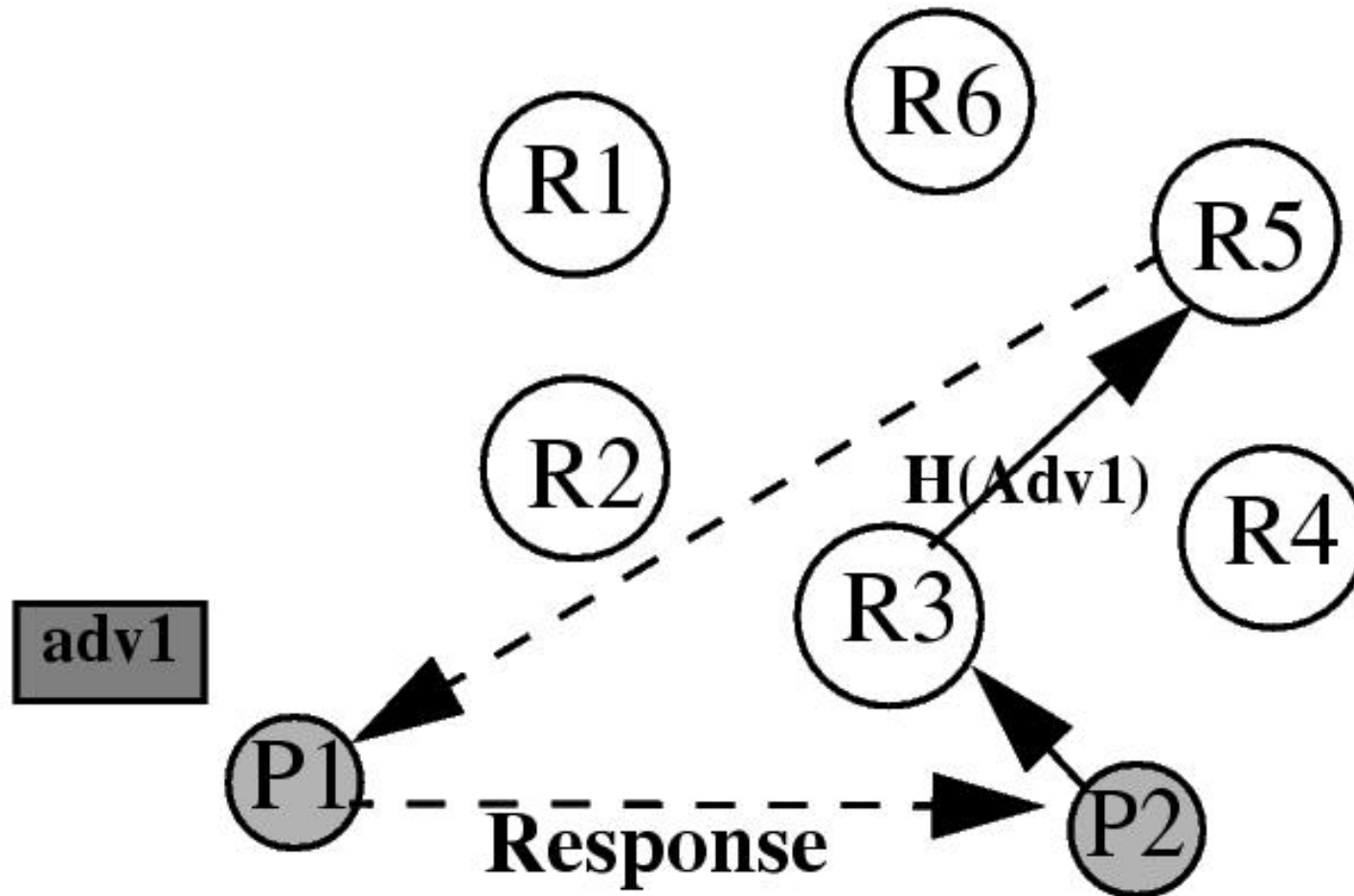


- Each rendezvous peer maintains an ordered list of known rendezvous peer in the peer group by their peer IDs
- No strong consistency mechanism is used to enforce the consistency of the RPV across all rendezvous
- Rendezvous periodically select random number of rendezvous from their RPV, and send them a random list of their known rendezvous

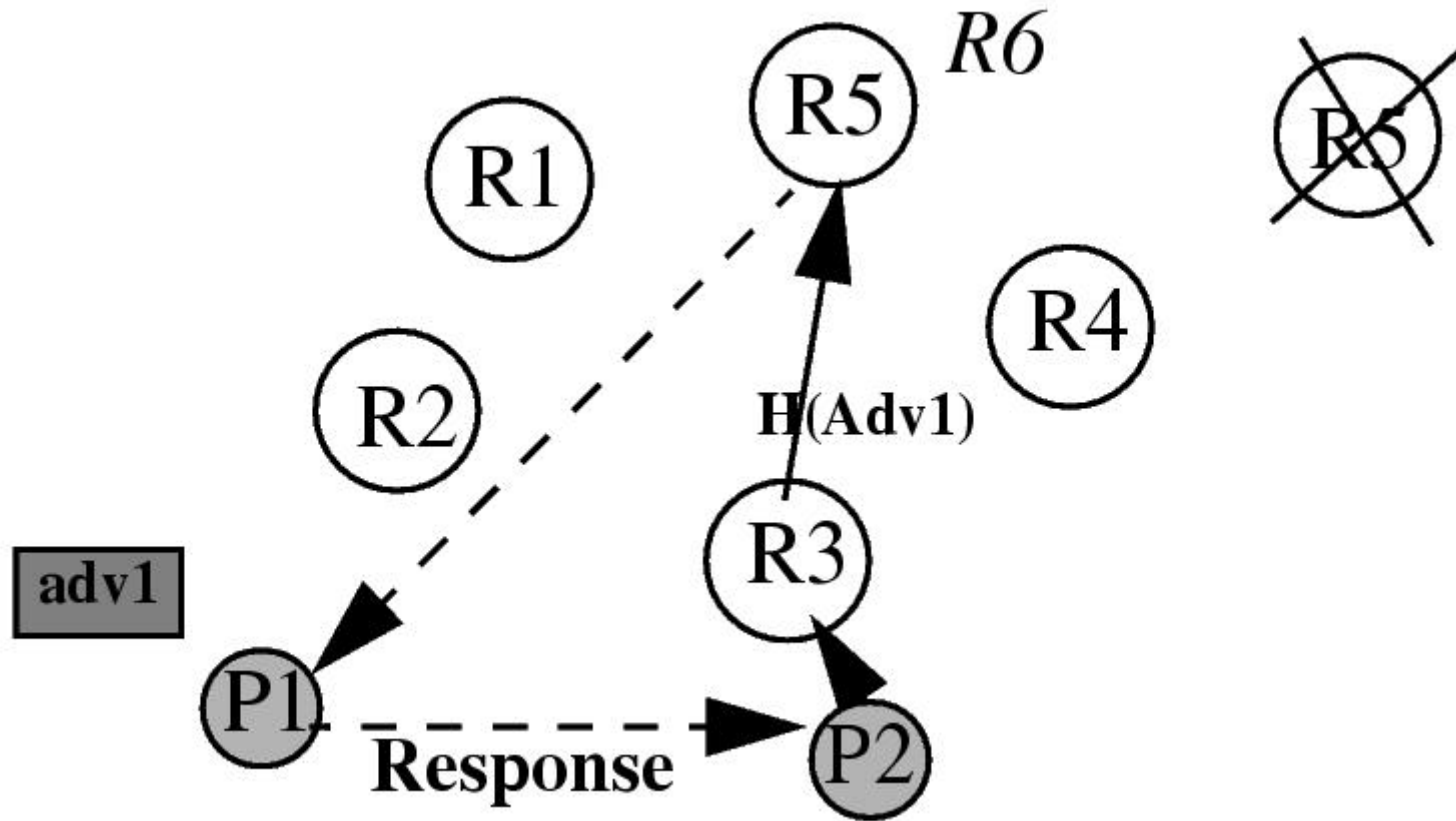
# Publish advertisement



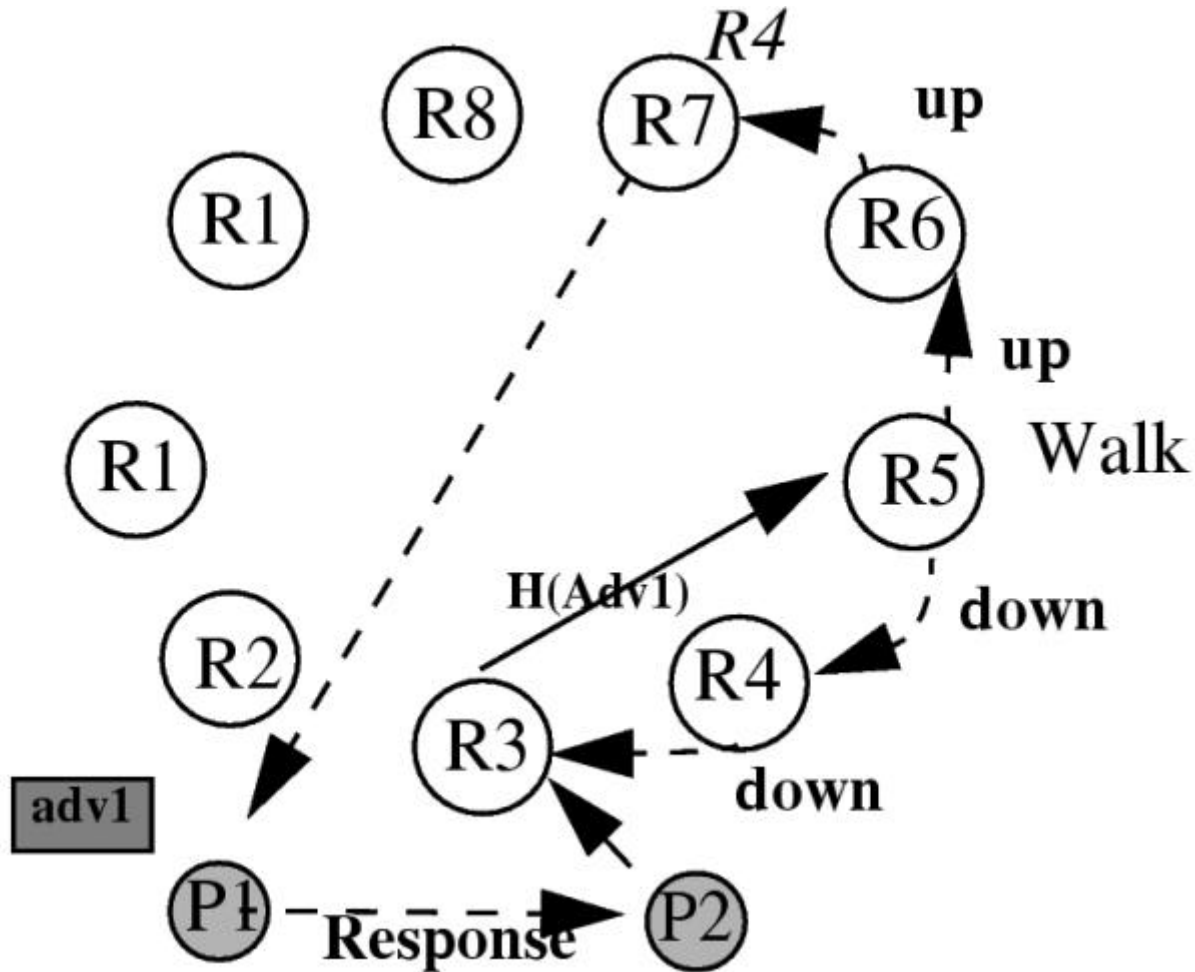
# Search advertisement



# Inconsistent view



# Limited-range walker



# Finding Rendezvous Peers



- Edge peers maintain lists of rendezvous peers
- Dynamic fail-over when connection fails
- Edge peers discover and cache Rdv advertisements
- Seeding Rdvs are used to bootstrap
- Auto-promotion to Rdv if none can be found in PeerGroup

# JXTA Implementation Platforms



- JXTA-J2SE Implementation (J2SE 1.3.1)
  - Full Implementation of JXTA Protocols
  - Tutorials and Programmer Guide
- JXTA-C
  - JXTA 1.0
  - Edge peer only
- Others: Objective-C, Perl, Ruby, .Net

# Conclusion



- JXTA: open platform for P2P services and applications
- JXTA Concepts
  - Peers
  - PeerGroups
  - Advertisements
  - Pipe
  - JXTA protocol stack
- Loosely-Consistent DHT