

# Peer to peer Internet telephony

challenges, status and trend

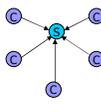
Kundan Singh  
Oct 2010

## What will you learn?

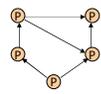
- What is P2P telephony?
- How is it implemented?
- What are the benefits and limitations?
- What is IETF doing about it?

What is P2P telephony?

## Problem with servers



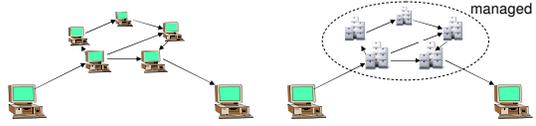
- Server-based
  - Operations cost: maintenance, configuration
  - Central points of catastrophic failures
  - Controlled infrastructure (e.g., DNS)
- Peer-to-peer
  - Robust: no central dependency
  - Self organizing, no configuration
  - Inherently scalable



What is P2P telephony?

## Peer-to-peer ≠ cloud computing

|   |  |
|---|--|
| <ul style="list-style-type: none"> <li>■ Self management</li> <li>■ Free resource sharing</li> <li>■ No central co-ordination</li> <li>■ ...</li> </ul> | <ul style="list-style-type: none"> <li>■ Self management</li> <li>■ Utility computing</li> <li>■ Central co-ordination</li> <li>■ ...</li> </ul> |
|---|--|



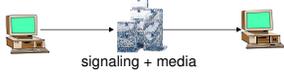
What is P2P telephony?

## A brief history



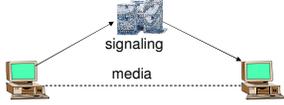
- 1999 ■ Napster initiated P2P file sharing
  - "for every one of you that falls, two shall arise."
- 2001 ■ Distributed hash tables
  - Chord, CAN, Pastry, Tapestry, Kademlia, ...
- 2003 ■ Skype (re-)invented P2P-VoIP
  - Now: 13% international calls, 54 billion minutes
- 2004 ■ Demonstrated P2P-SIP at Columbia University
  - IETF WG formed; several more implementations
- 2008 ■ Adobe added P2P to Flash Player
  - Proprietary, E2E but not quite P2P

What is P2P telephony?



signaling + media

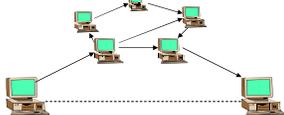
PBX, H.320, H.324, RTMP, Asterix/IAX, B2BUA, SBC, ...



signaling

media

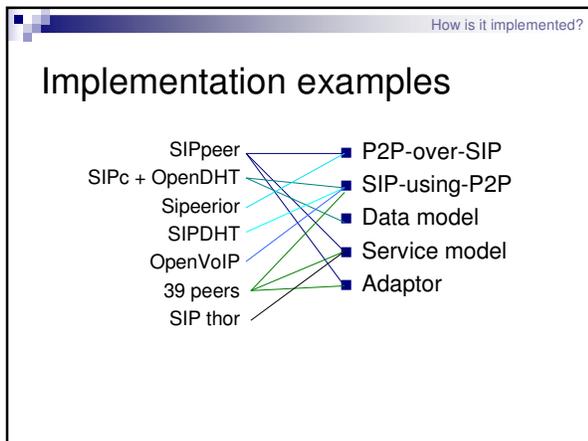
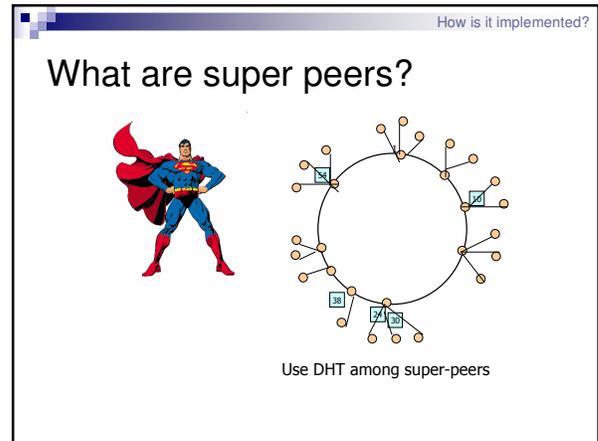
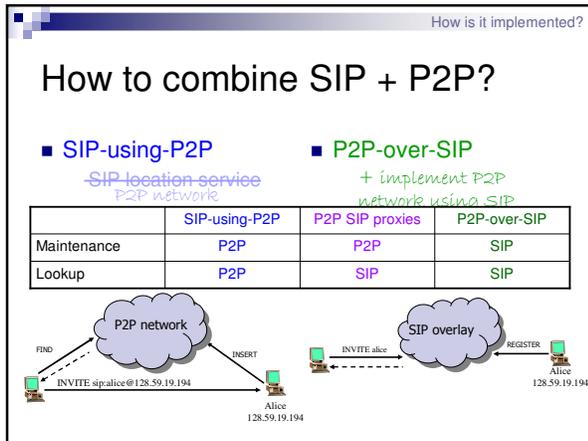
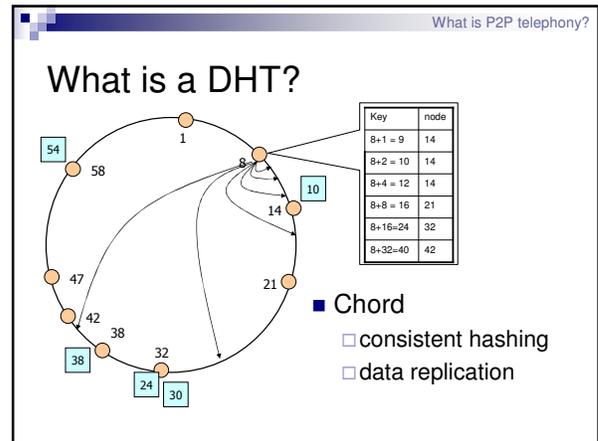
SIP, H.323, XMPP/Jingle, Gtalk, RTSP, RTMFP, ...



Skype, P2P-SIP, ...

What is P2P telephony?

|                   | File sharing                            | Skype                           | P2P-SIP                               |
|-------------------|---|---------------------------------|---------------------------------------|
| topology          | (mostly) unstructured                   | Kazaa based ⇔ unstructured      | structured DHT ⇔ efficiency guarantee |
| inter-operability | implementation driven                   | proprietary/close needs gateway | open protocols + algorithms           |
| efficiency        | caching, delay storage, split-and-store | overloaded super-nodes          | caching useless; bounded load         |
| centralized       | varies                                  | login server                    | enrollment service                    |
| malicious nodes   | incentive driven                        | proprietary software            | open problem                          |



- What are the benefits and limitations?
- ### What are the challenges?
- Bootstrap a network
  - Security of stored data and keys
  - Data vs service model
  - NAT and firewall traversal
  - Working with free loaders
  - Getting around malicious peers

What are the benefits and limitations?

## When to do P2P?

if

- most of the peers **do not trust** each other, AND
- There is **no incentive** to help peers

then

- P2P does not** evolve naturally to work

See <http://p2p-sip.blogspot.com/2009/10/security-in-p2p-sip.html>

What are the benefits and limitations?

|                    | server-based   | Unstructured P2P (blind-search)                          | Structured P2P (Chord)  |
|--------------------|--|--|---|
| Scaling            | server count $\nearrow$<br>$\approx$ {server-count}                              | user count $\nearrow$<br>K-degree $\Rightarrow$ no limit | user count $\nearrow$<br>$\approx 2^{(\text{node-capacity})^*}$<br>uptime, churn, ... |
| Efficiency         | most efficient   | #connections $\searrow$                                  | maintain = $O((\log N)^2)$  |
| Call setup latency | one or two steps   | #connections $\searrow$                                  | lookup = $O(\log N)$  |
| Security           | trust provider;<br>boolean   | connect to trusted nodes only                            | trust (most) super nodes; probabilistic   |
| Availability       | server redundancy<br>$(1-(1-R)^K)$ ;<br>catastrophic failure possible; bulk load | no guarantee   | upper bound;<br>catastrophic failure unlikely   |

\* Node capacity of 10 register/s and refresh/call rates of 1/min  $\Rightarrow$  more than 16 million peers (super-nodes) in the network

What is IETF doing about it?

## IETF P2P-SIP working group

- Includes
  - peer protocol, client protocol, SIP usage, locating resources.
- Excludes
  - modification to SIP, unique identities, "research"-type, search, multicast, dynamic DNS, ...
- Must
  - use existing tools from other WGs

What is IETF doing about it?

## Proposed architecture

SIP usage    XMPP usage

- MUST
  - Chord DHT
  - 128-bit keys
  - DTLS and TLS

What is IETF doing about it?

## REsource LOcation And Discovery

- Creating pages of specifications
  - draft-ietf-p2psip-base-10 (154p), plus ICE+STUN +TURN+DTLS (260p), and: draft-ietf-p2psip-sip-05, -diagnostics-04, -self-tuning-02, service-discovery-01
- Creating unnecessary complexity
  - No compliant implementation; discourages developers/start ups; real problems are out-of-scope

# posts

## Summary

- What is P2P telephony?
  - Versus client-server, end-to-end, and cloud
- How is it implemented?
  - P2P-over-SIP, SIP-using-P2P, data vs service, adaptor & proxy,
- What are the benefits and limitations?
  - Scalability, availability, maintenance, lookup
- What is IETF doing about it?
  - RELOAD, SIP usage, ...

Visit <http://39peers.net> for more