

Peer to peer Internet telephony

challenges, status and trend

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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

- Self management
- Free resource sharing
- No central co-ordination
- ...

- Self management
- Utility computing
- Central co-ordination
- ...

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?

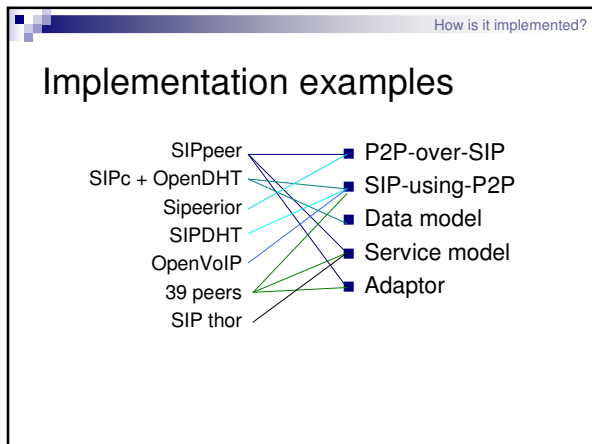
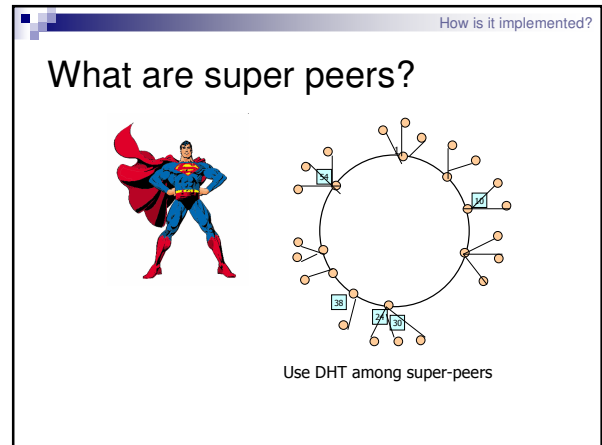
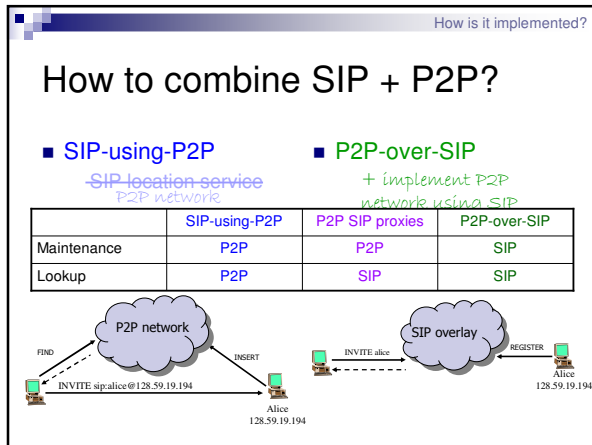
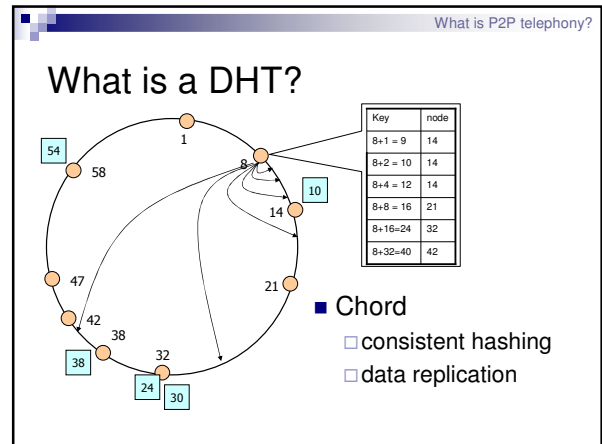
PBX, H.320, H.324, RTMP, Asterix/IAX, B2BUA, SBC, ...

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 \approx {server-count}	user count \nearrow K-degree \Rightarrow no limit	user count \nearrow $\approx 2^{(\text{node-capacity})^*}$ 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; boolean	connect to trusted nodes only	trust (most) super nodes; probabilistic
Availability	server redundancy $(1-(1-R)^K)$; catastrophic failure possible; bulk load	no guarantee	upper bound; 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

```



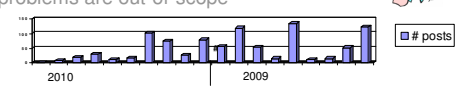
graph TD
    SIP[SIP usage] --- MT[Message transport]
    XMPP[XMPP usage] --- S[Storage]
    MT --- TP[Topology plugin]
    S --- TP
    TP --- FLM[Forwarding and link management]
    FLM --- TLS[TLS]
    FLM --- DTLS[DTLS]
  
```

- 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

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, ...

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