CrossTalk: Scalably Interconnecting IM Networks

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Problem

- Growth of social sites relying on“network effect”

- Consequences of the “network effect”:
  - Quality does not necessarily drive adoption
  - Popularity within social circles matters most

Mechanisms to mitigate vendor lock-in for social apps?

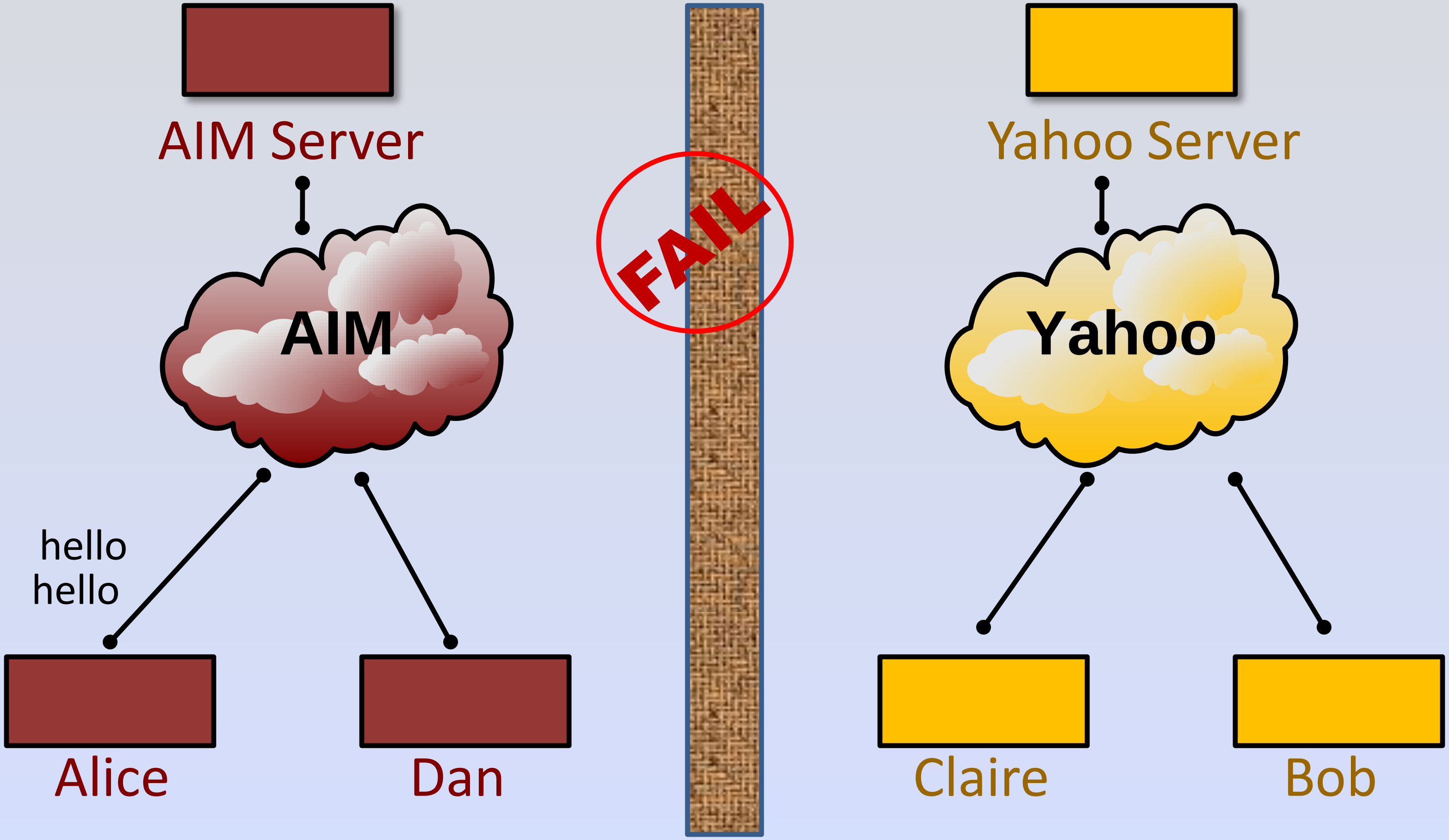
Introduction/Motivation

- Case Study: IM Networks
  - Simple social application, provides insight
- CrossTalk
  - Scalably interconnects IM networks while allowing users to continue utilizing the client of their choice
- Benefits:
  - Allows users to switch to new innovative clients
  - Permits smaller IM networks to interoperate with larger IM services
  - May rekindle interest in **3rd party applications** by allowing inter-IM network message exchanges
    - Examples include Chat Translator, Twitter Synch, etc

Outline

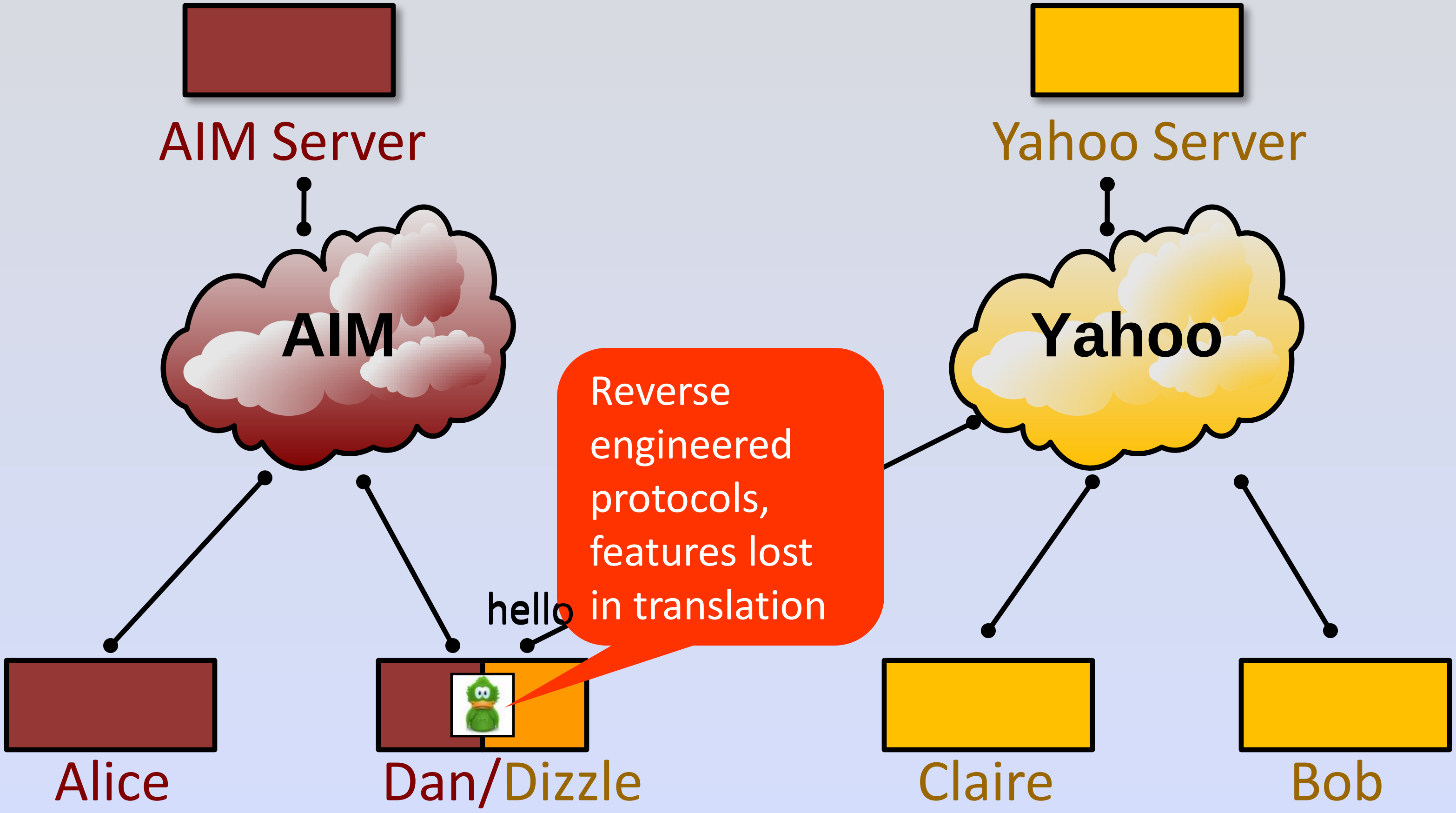
- Existing Approaches
- New Idea: Bypass Gateways
- Implementation
- Evaluation
- Future Work:
  - Encryption
  - General Architecture

Approach 1: Ignore Problem



- Cannot communicate across boundaries

Approach 2: Client Consolidation



Reverse engineered protocols, features lost in translation

- ○ **Main problem: Feature Subtraction**
- ○ **Multiple identities**

Client Consolidation Limitations

- Feature subtraction

ahoney
n Ubuntu
: Mar 2005
: Portland, Oregon

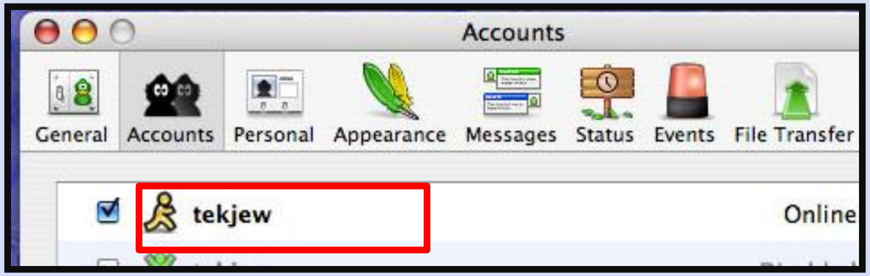
“Never worked for me either”

File transf
Asked by

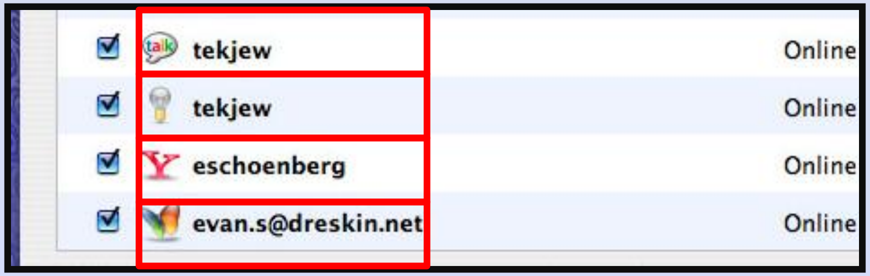
I am un
The only
firmware
I would appreciate some
es is that my rou

“..unable to use transfer files using Trillian”

- Multiple Identities



☑	tekjew	Online



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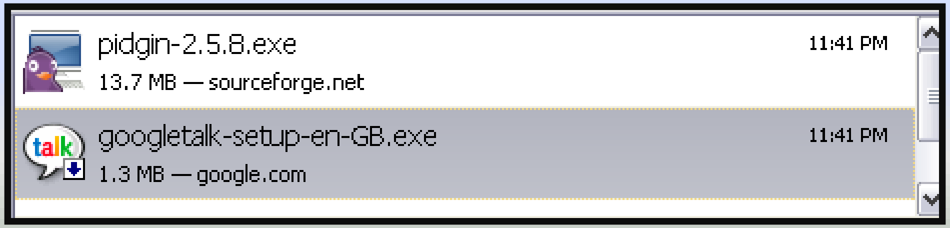
☑	tekjew	Online
☑	eschoenberg	Online
☑	evan.s@dreskin.net	Online

- Software/Network Overhead



pidgin-2.5.8.exe 11:41 PM
13.7 MB — sourceforge.net

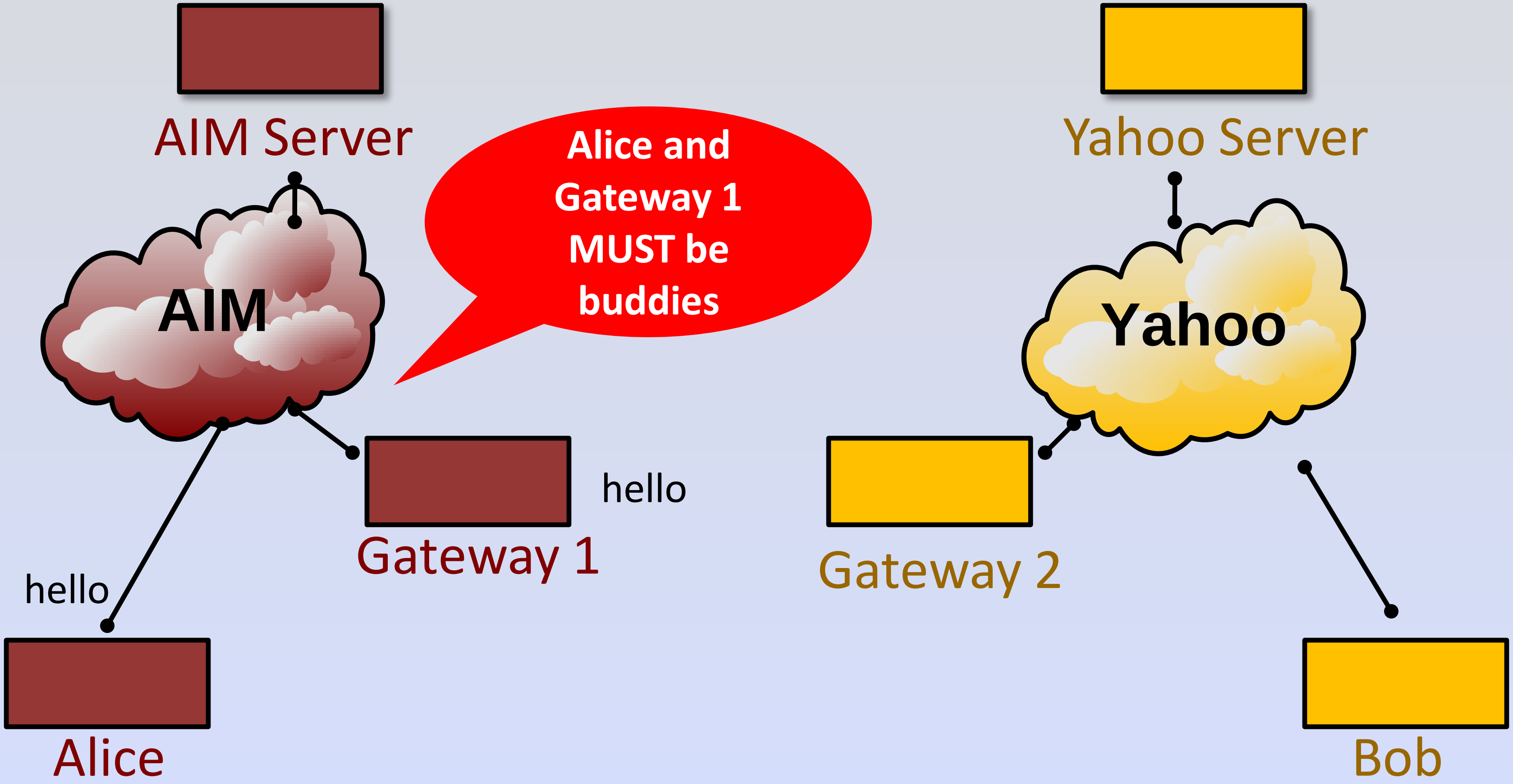
googletalk-setup-en-GB.exe 11:41 PM
1.3 MB — google.com

13.7 MB

vs

1.3 MB

Approach 3: Standard Gateway



Alice and Gateway 1 MUST be buddies

○ **Main problem: Scalability**

○ **Server can easily detect/disable**

Standard Gateway Limitations

- Gateways subject to user restrictions:
  - Limits on buddy list size (e.g. < 512)
  - Limits on concurrent sessions (e.g. 1 for Skype)
- Suppose IM network with 50 million users:
  - If maximum size of buddy list 500:
    - 100k Gateways to cover all users
- Need **massive** gateway replication to interconnect millions of users
- Thus, standard gateways do not scale
- Gateways employ awkward semantics:
  - Ex: IM gtalk:user@domain.com hello

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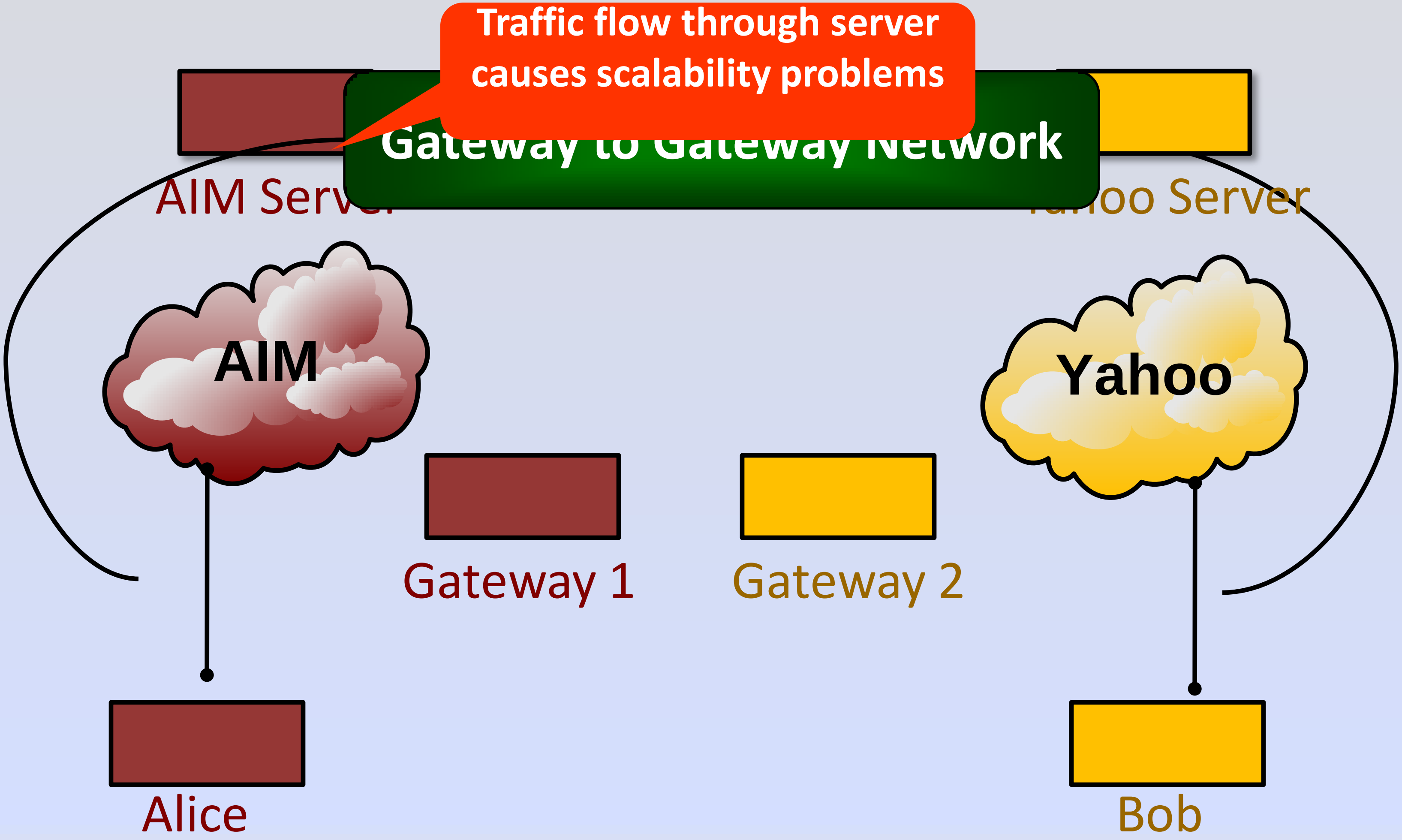
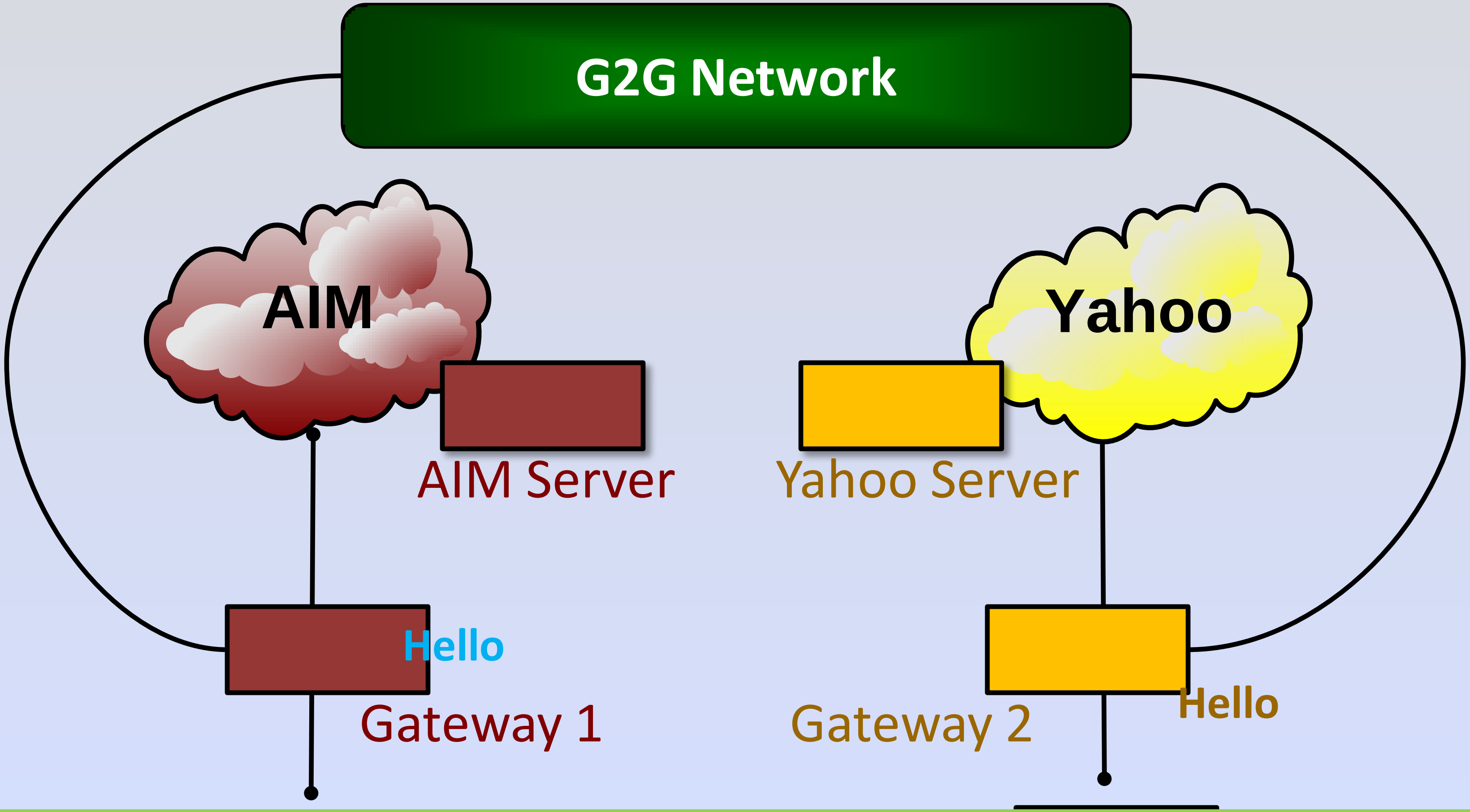
Bypass Gateways


Traffic flow through server causes scalability problems
Gateway to Gateway Network
AIM Server
Yahoo Server
AIM
Yahoo
Gateway 1
Gateway 2
Alice
Bob

Bypass Gateways



✓ Scalable and no feature subtraction (in base network)

○But, *both* ends must be behind gateway

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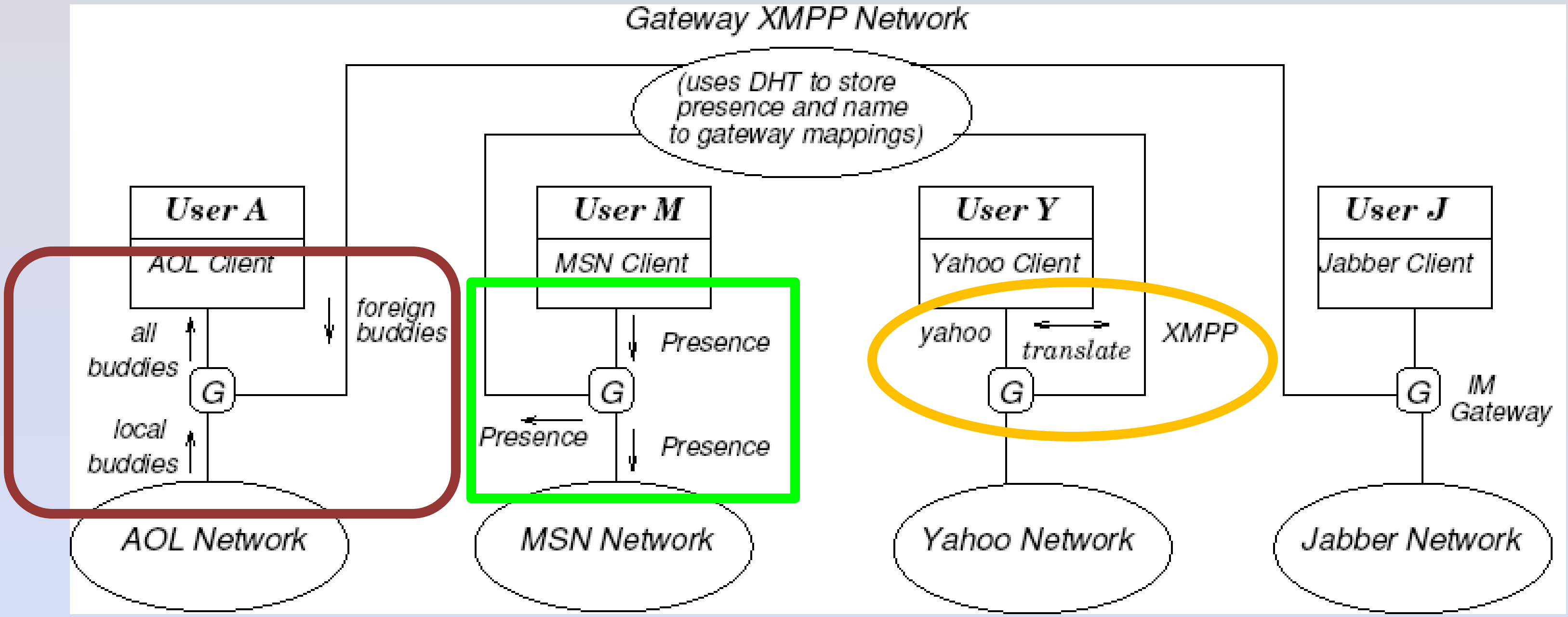
Crosstalk Components

- Unmodified clients
  - Each user must have the ability to specify a proxy
  - Simple naming convention
    - ex: AOL user ***alice*** identified as ***alice@aol***
- Bypass gateways
  - Interpose between clients and servers
- Gateway-to-Gateway network
  - Logical network
  - Gateways connected via DHT

CrossTalk Architecture



- **3 major functions:**
  - Translation between AIM, MSN, Yahoo, Jabber
  - Bifurcating Presence Information
  - Merging Buddy Information

Gateway Processing Steps

For each user:

1. Identify protocol, wait for user to authenticate to base server
2. Update user’s state in DHT
3. Retrieve foreign buddy list from DHT
4. Repeatedly : pass-through *or* intercept & translate

Lessons Learned

- Can use protocol version numbers to allow time for reverse engineering
- Must merge protocol packets carefully
  - Ex: AOL embeds sequence numbers in messages that must be modified to merge information
- Must scale to many TCP connections per user
  - Ex: MSN creates per conversation TCP connection

Applications Built on CrossTalk

- Built 2 example applications:
  - IP geolocation
  - Last.fm information
- Suppose AOL user A wants to know Yahoo user Y’s location or listening habits:
  - User A types “/music” or “/location” as an IM
  - User Y’s client responds with “Shakira” or “San Diego”
- Works because bypass gateways allows IMs to reach other networks

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Evaluation Questions

- Two metrics
  1. Latency: How much delay for translation?
     - Baseline delays vary from 5msec – 230msec
  2. Throughput:
     - What size enterprise can a single Bypass Gateway support?

Latency: < 25 msec
Throughput: 1 desktop PC, greater than 4000 person workload

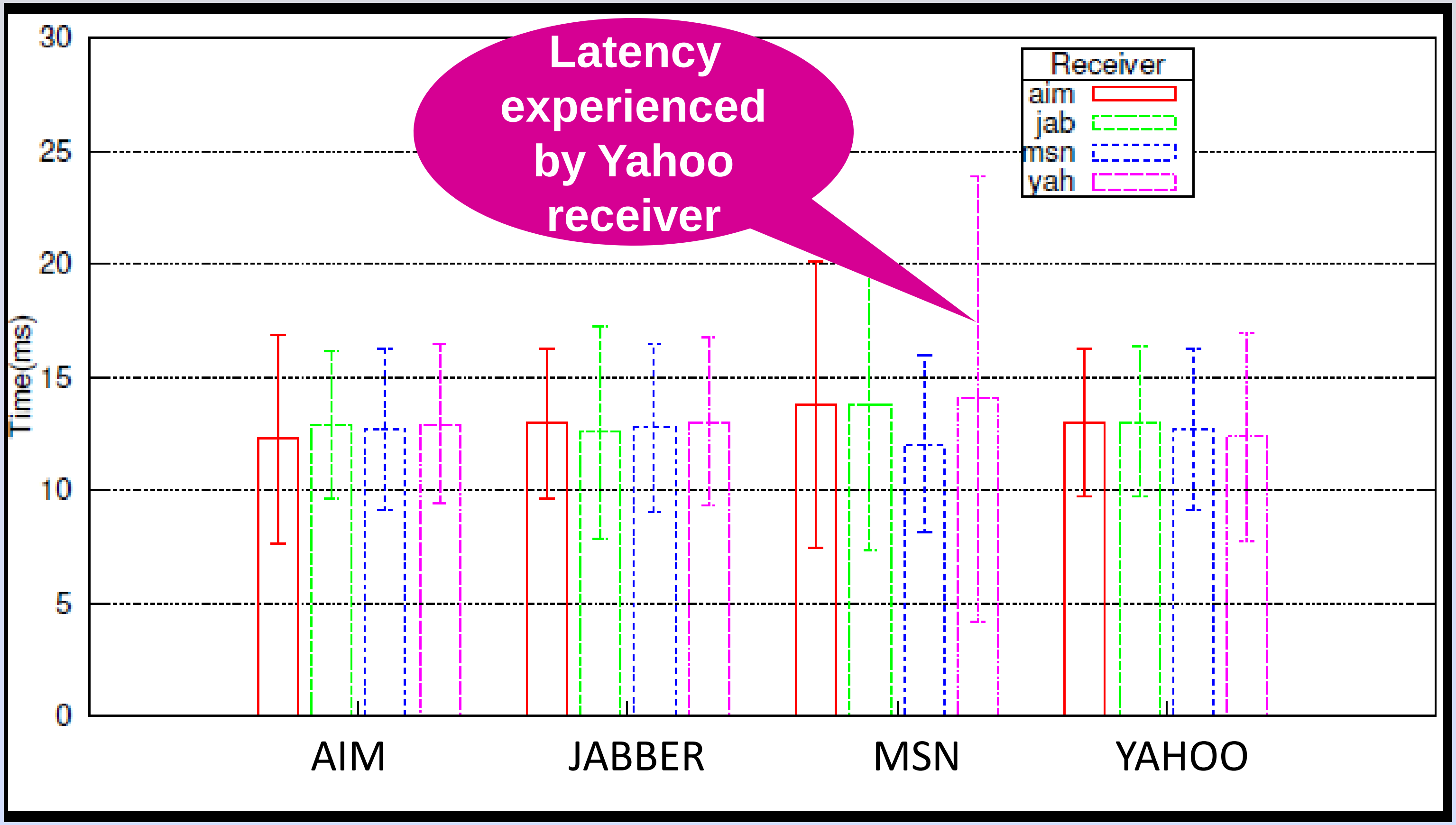
IM Traffic Model

- Guo et. al monitored MSN, AIM traffic in an enterprise network with > 4000 employees
- **Heaviest load** usage characteristics:
  - ~130 online users per protocol
  - ~20 concurrent conversations per user
  - Message length of ~150 characters
  - ~1 second interval between successive chat messages

Evaluation Methodology

- Modeled cross/same-to-same IM traffic using market shares
- Implemented mock IM servers to handle same-to-same traffic
- Spread clients/servers across local VMs
- Gateway run on P4 3.2 Ghz, 1Gb

Translation Latency Results



Latency experienced by Yahoo receiver

SENDER PROTOCOL

Max cross traffic latency < 25 msec

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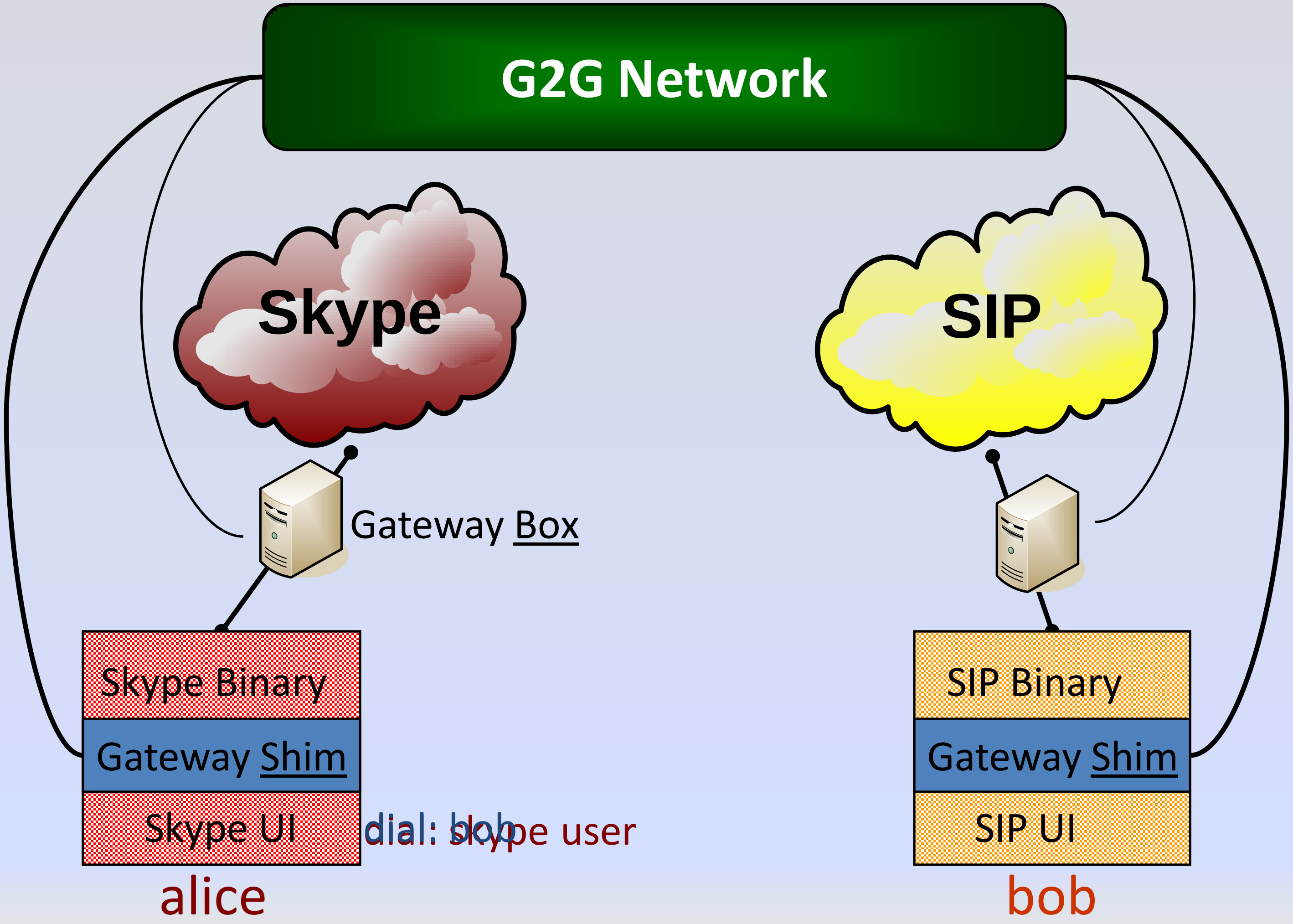
Future Work: Handling Encryption



G2G Network

Skype

SIP

Gateway Box

Skype Binary

Gateway Shim

Skype UI

dial: bob

skype user

alice

SIP Binary

Gateway Shim

SIP UI

bob

Future Work: General Architecture

- Migrate to a **new abstract client layer**
  - Ask for services using abstract calls
    - Send IM, Dial Call, Get File
- Insulate users from changes in technology
  - Protocol intelligence in the cloud
- Make use of bypass gateways or shim layers to achieve interconnectivity for unmodified clients
- Use a DHT to store mappings on behalf of all applications
- Enable service composition by modeling services as nodes in graph

Conclusion

- Introduced new technique (bypass gateways) that overcomes vendor lock-in and avoids scaling limits of standard gateways
  - May foster third-party innovation
  - Larger providers cannot easily hinder and smaller providers have incentives to join
  - IM gateway prototype can support throughput for enterprise IM benchmark