

Internet Technology & Web Engineering

Internet Relay Chat (IRC)

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Overview

- Distributed system for real-time text chat
- Users have **nicknames**
- One-to-one chat between users
- One-to-many group chat in **channels**
- Multiple independent networks co-exist
- Each network consists of 1..n IRC servers
- Started in 1988, first RFC 1459 appeared 1993
- Current RFCs 2810-2813 are outdated
 - RFCs describe version 2.10, reference implementation is 2.11
 - Other networks use adapted server software

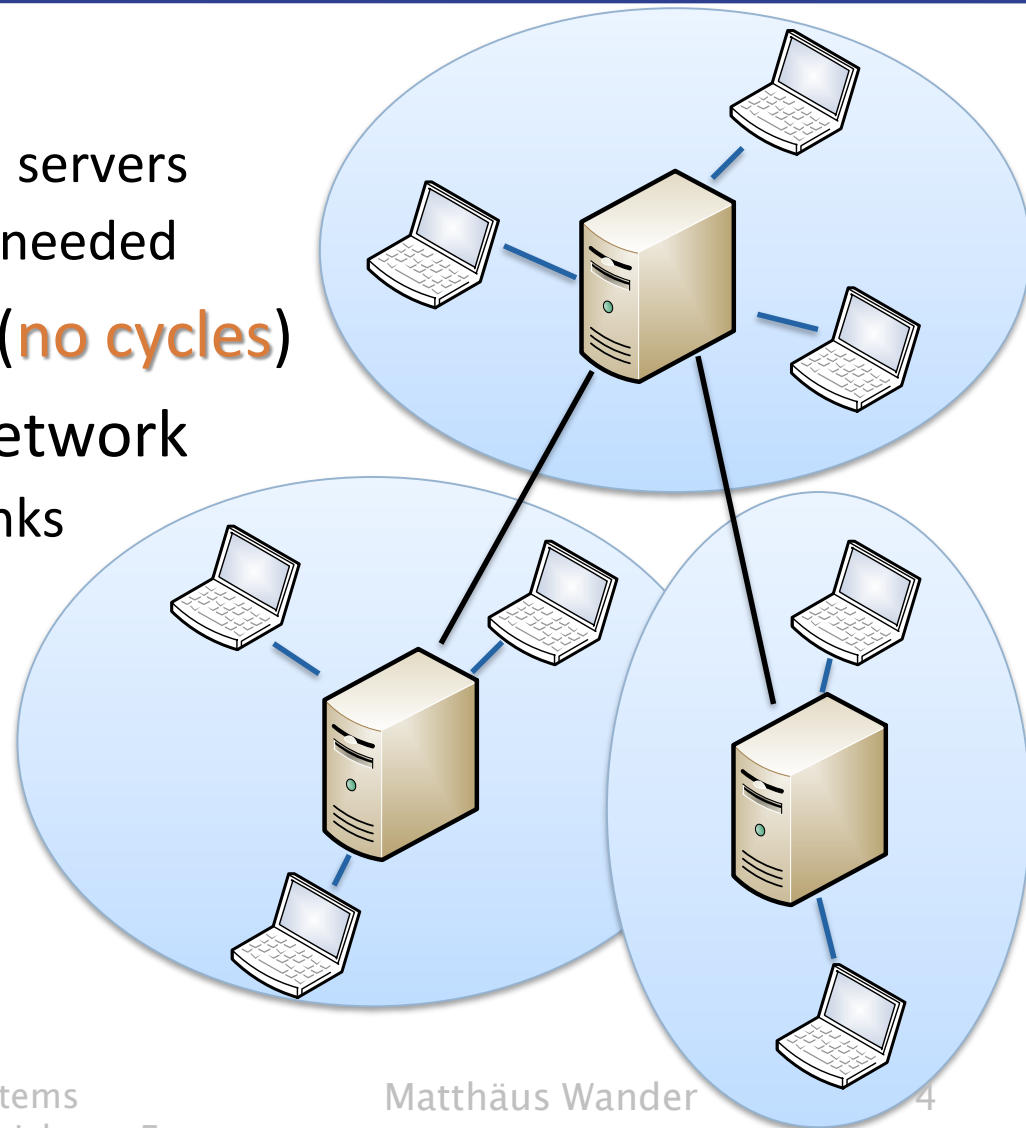
IRC Client

```
theo@whitespace: ~
Welcome to worldchat - be nice, keep it in English and take a look at www.worldch.at | xix> i'm proud to h
15:54:10 -!- miaragazzatroia [~Tiscali@ppp-218-205.28-151.libero.it] has left #worldchat []
15:54:34 <+mikeb> draw a line or not?
15:54:51 <+Zickzack> Mutually intellgible, yes, because I could explain that word to you
15:55:22 <+Zickzack> If you are from the Central States, chances are I would not understand you, but I do
not really count, because I am not a native speaker
15:55:27 -!- Jacob82 [~Jacob@c83-177-192-237.cust.tele2.se] has joined #worldchat
15:55:34 <_nyo> drink water.
15:55:38 <_nyo> water is good
15:55:39 <+mikeb> you mean there are some words from old germa
15:55:42 <_nyo> im out
15:55:44 -!- werner70 [c2697846@webchat.xs4all.nl] has joined
15:55:51 < Jacob82> i am back
15:55:54 <+Zickzack> I never met somebody who spoke Old German
15:56:04 < ThinkANew> bbl
15:56:06 <+Zickzack> And I doubt if there were, we could estab
15:56:06 <@Trancer> Otzi
15:56:11 <+Zickzack> I have been to Poland
15:56:12 <@Trancer> :D
15:56:27 <+Zickzack> We could converse in English
15:56:30 <+Zickzack> But that is a trick
15:56:48 < Jacob82> i have been in london
15:57:01 < zielu> london sucks
15:57:03 <+mikeb> i think we have to agree to disagree
15:57:16 <+Zickzack> mikeb, I am on the side of science with t
15:57:30 -!- ^Motylek^ [~b@ip-78-102-57-101.net.upcbroadband.c
[15:57:37] Theo (*i) | 3:IRCnet/#worldchat ( lnt) | Act: | 5
[#worldchat]
```

```
mIRC
File View Favorites Tools Commands Window Help
freenode SigMobile #wikia-runescape
freenode SigM
Channel: 1
#wikia
#wikia-runescape (freenode, SigMobile) [37] [+Cnt]: The RuneSc...
* @Ryan_PM wonders why he ever wanted to edit
wikipedia.
<SigMobile> Everyone smile again :D
<@Shanty_Claws> http://runescape.wikia.com/wiki/
User_talk:Matthew2602#I_tried_D:
<Matthew2602> CHEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
<SigMobile> :D
* SigMobile makes Shanty_Claws smile
<Matthew2602> [[Cheese]]
<bullbot> http://runescape.wikia.com/wiki/Cheese
* @Shanty_Claws smiles
<Matthew2602> ^true story
<@Ryan_PM> http://en.wikipedia.org/wiki/Special:
Log/Bluesonic43
<SigMobile> Ryan_PM: Perhaps, to help improve
it?
@afk|222
@Andorin
@ChanServ
@Ryan_PM
@Shanty_Cl
+RuneScrip
A_proofrea
Aeriana
APexil
arble
Ariac
bullbot
Clooth
Cook_Me_P1
Courts|LoL
Evil1888
```

Architecture

- Client/Server
 - Control data shared by all servers
 - Chat messages routed as needed
- Multicast tree structure (**no cycles**)
- All servers trusted in a network
 - Manual setup of server links
- Text-based data transfer
- TCP connections



IRC Protocol

- **Text**-based protocol
 - 8-bit messages except NUL (0x00), CR, LF
 - No character set specified (usually ISO 8859-1, recently UTF-8)
 - Nickname characters: A..Z, a..z, 0..9, {, |, }, ~, [, \,], ^, `, _ , -
- **Stateful** session
- **Asynchronous** message communication
 - No strict command/reply – reply may follow later
- Authentication optional
 - Plaintext login/password (rarely for users)
 - DNS Hostname Lookup
- SSL/TLS optional (rarely for users in popular networks)

Example Client Session

NICK Bob

USER Bob Bob random.ircd.de :Robert Example

:Uni-Erlangen.DE 020 * :Please wait while we process your connection.

:Uni-Erlangen.DE 433 * Bob :Nickname is already in use.

NICK MightyBob

**:Uni-Erlangen.DE 001 MightyBob :Welcome to the Internet Relay Network
MightyBob!~Bob@example.net**

**:Uni-Erlangen.DE 002 MightyBob :Your host is Uni-Erlangen.DE, running
version 2.11.1p1**

[...]

JOIN #example

:MightyBob!~Bob@example.net JOIN :#example

:Uni-Erlangen.DE 332 MightyBob #example :This is some topic

**:Uni-Erlangen.DE 333 MightyBob #example Alice!~alice@example.net
1331976347**

:Uni-Erlangen.DE 353 MightyBob = #example :@Alice @Bob MightyBob

:Uni-Erlangen.DE 366 MightyBob # example :End of NAMES list.

PRIVMSG #example :What's up, guys?

:Alice!~alice@example.net PRIVMSG #example :Nothing much

QUIT :booring

ERROR :Closing Link: MightyBob[~Bob@example.net] ("booring")

Message Format

```
JOIN #example  
:Uni-Erlangen.DE 433 * Bob :Nickname is already in use.  
:Alice!~alice@example.net PRIVMSG #example :Nothing much
```

- Prefix (optional)
 - Client: unused
 - Server: Indicates command originator
- Command
 - Literal or numeric
- Up to 15 command parameters separated by whitespace
 - Colon („:“) indicates last parameter
 - Last parameter may contain whitespaces
- Line length ≤ 512 characters (including CR LF)

Channels

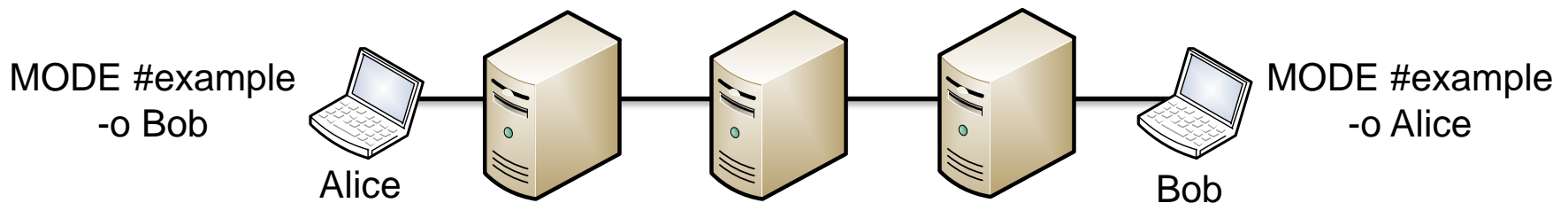
- Users can join and part channels
- First user joining becomes **channel operator**
 - Can give operator privilege to other users
 - Operator(s) can change channel modes, invite/kick users, ...
 - User loses privilege when leaving/disconnecting
- Operators set/unset **channel modes**
 - MODE #foo +o Bob: give operator privilege
 - MODE #foo +b *!*@*.de: ban hostmask (prohibit joining)
 - Other modes: moderated, invite only, channel password, etc.
- Channel prefix determines type, e.g. #example
 - # regular (mostly used)
 - + modeless (no operators)

Server-to-Server Connections

- All IRC servers in network must know all other servers, users, channels and modes
 - Scalability issues in large networks
- No redundant paths (acyclic network graph)
 - If server link breaks down, the network splits
- If servers connect to each, the network joins
 - Servers exchange known servers, users, channels and modes
- Nickname collision → drop both („KILL“ message)
 - Abuse netsplits to drop other users
- Channel collision → merge users with their privileges
 - Abuse netsplits to obtain chanop (**channel takeover**)

Handling Collisions

- Nickname/channel delay during netsplit
 - Known nicknames remain blocked
 - Known empty channels don't give chanop
- Timestamping creation time of nickname/channel
 - Nicknames/channels remain available during netsplit
 - When network joins, the older ones are privileged
- Assign unique user IDs
 - If nickname collides, rename both users to their IDs
- Still, propagation delay can desync a channel



Connection Timeout & Flood Control

- PING message to detect connection timeouts
 - PING must be replied with PONG
- Users can cause high traffic in network
 - Channel hopping, spamming users on other server
- Flood control with „penalty“ seconds
 - For every user message, process and add +2 penalty seconds
 - Penalty decrements when nothing is received (minimum: 0 sec)
 - Do not process messages if penalty ≥ 10
 - May add penalty seconds for resource-intensive messages
- Allows for small bursts of up to 5 messages
- Drop user („Excess Flood“) if input buffer overflows

Conclusion

- Distributed real-time chat system
- Name collisions (drop other users, obtain chanop)
 - DDoS attacks against IRC networks to cause netsplits
 - Technical measures to reduce exploitation of collisions
- Still, consistency is **not** enforced (channels can desync)
- Scalability is limited, but not a serious problem anymore
 - Ressources increased, number of users decreased
- RFC specification outdated
- No user privacy (see **SILC** for a secure system)