



Keith Adams on the Architecture of Slack, using MySQL, Edge Caching, & the backend Messaging Server

Podcast with [Keith Adams](#) by [Wesley Reisz](#) on Dec 16, 2016 | [Discuss](#)Share     [My Reading List](#)[Read later](#)

In this week's podcast, [QCon chair Wesley Reisz](#) talks to [Keith Adams](#), chief architect at Slack. Prior he was an engineer at Facebook where he worked on the search type live backend, and is well-known for the HipHop VM [hhvm.com]. Adams presented [How Slack Works](#) at [QCon San Francisco 2016](#).

Key Takeaways

- Group messaging succeeds when it feels like a place for members to gather, rather than just a tool
- Having opt-in group membership scales better than having to define a group on the fly, like a mailing list instead of individually adding people to a mail
- Choosing availability over consistency is sometimes the right choice for particular use cases
- Consistency can be recovered after the fact with custom conflict resolution tools
- Latency is important and can be solved by having proxies or edge applications closer to the user

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


Notes

Challenges at Slack?

Group Messaging

- **1m:30s** Many companies focus on messaging; but persistent group messaging is the key focus of Slack, supporting message search and archival as well as groups
- **2m:00s** Group chats in other messaging clients require you to individually add members, much like sending a group email works today

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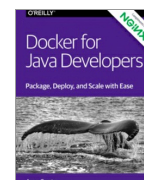
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- [2m:35s](#) Channels are used to allow optin membership of groups as well as seeing historic messages sent to that channel
- [3m:00s](#) A slack channel feels like a place you belong in

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Latency

- [3m:30s](#) Voice and video interactions are impacted by latency; the same is true of messaging clients
- [4m:00s](#) The user interface can provide indications of presence, through avatars indicating availability and typing indicators
- [4m:15s](#) Latency is important; sometimes the difference is between 100ms and 200ms so the message channel monitors ping timeout between server and client
- [4m:40s](#) 99th percentile is less than 100ms ping time
- [5m:15s](#) If the 99th percentile is more than 100ms then it may be server based, such as needing to tune the Java GC
- [5m:25s](#) Network conditions of the mobile clients are highly variable
- [6m:20s](#) Mobile clients can suffer intermittent connectivity

Architecture

- [7m:15s](#) Slack consists of a sharded LAMP stack; web servers, memcache, and a fleet of mysql instances
- [7m:30s](#) Teams are sharded across mysql instances
- [8m:20s](#) The realtime part of the clientserver communication is due to the messaging infrastructure
- [8m:35s](#) Slack is a message amplifier; it takes the message written by the individual and then delivers it to all the clients that are interested in receiving the message, with the lowest latency possible
- [9m:00s](#) The majority of desktop based connections are longlived WebSocket connections

Edge caching

- [11m:00s](#) Users who are far away from the east coast are terminated with an edge cache called flannel (formerly slackd)
- [11m:50s](#) The roundtrip time is much more tolerable if the edge cache serves content quicker
- [12m:15s](#) Local conversations can be optimised with the edge cache

Posting messages

- [13m:00s](#) Most clients use the websocket to post messages via JSON instead of using the API at api.slack.com
- [14m:00s](#) Write amplification happens inmemory in the Java process to deliver messages to currently connected clients, and then sends the message backend
- [15m:00s](#) There is a possibility of failure, in that the Java process may deliver the message to the network clients but then fail to persist it
- [15m:10s](#) The platform is being redesigned and will hopefully address in future
- [16m:00s](#) There's no evidence that this has hit people

Business and community

- [20m:00s](#) Commercial users of Slack need to be more tightly controlled and defined, or to selectively enable/disable features for individual users
- [20m:30s](#) Lots of users have their own logins for each service; there's interest in improving that while still allowing commercial companies to use single sign on solutions

MySQL and persistence

- [21m:30s](#) MySQL has replication and data protection built in; other companies have thousands of man years in operating without data loss
- [22m:15s](#) Users care that persistence works and they don't lose data, not what the storage system is
- [22m:40s](#) Lots of the data is relational but consistency is not absolute; master to master replication allows for eventual (in)consistency
- [23m:40s](#) The best order fit for the master to master is to selectively prefer which master is written to using the loworder bit of the team identifier; so even teams prefer to write to one master and odd teams will prefer to write to the other master
- [24m:30s](#) Availability is being preserved instead of consistency in the CAP triangle
- [24m:55s](#) Insert on **duplicate key** update semantics allows users to post messages, and if the message has been replicated previously then the subsequent insert will overwrite it

Consistency and conflicts

- [25m:15s](#) Consistency problems can occur when two rows are inserted in the two masters simultaneously; it is a querybyquery case that needs to resolve conflicts in an appropriate way

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- [26m:15s](#) Manual conflict resolution indicates an application error in not being able to resolve conflicts itself
- [26m:35s](#) Relaxing consistency helps availability for the system
- [27m:00s](#) Most mutations that happen in Slack are performed at human scale and pace
- [27m:10s](#) It's unlikely that a user will update the profile picture in a smaller number of microseconds to end up in an inconsistent state
- [27m:25s](#) It's extremely rare that it happens, and if it does, the user can always set their picture again
- [28m:10s](#) If there was no conflict resolution then the masters could diverge
- [28m:15s](#) There is a conflict resolution system recipe; masters live for a month and then new read replicas are attached and caught up; when they are, they become the new masters since they are in sync with each other

MySQL and the future

- [29m:00s](#) MySQL is used because Slack has operational experience and the fact that relational queries are used means that other solutions like Cassandra haven't been explored yet
- [30m:10s](#) Slack's architecture is still evolving and it may change in the future
- [31m:30s](#) As the growth continues and the orders of magnitude increase, there may be rewrites in the future as well

Origins of Slack

- [32m:20s](#) Slack started as a company called TinySpec which created a massively multiplayer game called Glitch, and weren't getting the growth in the game that they were looking for
- [33m:00s](#) The game server had a bot which indexed all messages that had been sent
- [33m:30s](#) Users were using the builtin IRC server for messages
- [33m:50s](#) The developers pivoted and came up with the idea of using the IRC server as a standalone product; SLACK, with a backronym of Searchable Linked Archive of Company Knowledge
- [34m:50s](#) Group messaging succeeds if the users feel like they are part of a shared space

Companies mentioned

- [Slack](#)
- [Facebook](#)

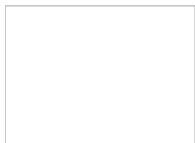
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