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Facebook Tao

Distributed Data Store for the Social Graph

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Introduction

What is TAO?

Tao

is a geographically distribute store

- deployed at Facebook
- with efficient and timely access to social graph
- using a fixed set of query
- replacing memcache
- running on thousands of machines
- provide access to many PB of data
- process a billion reads ad millions of writes each second!

The social graph

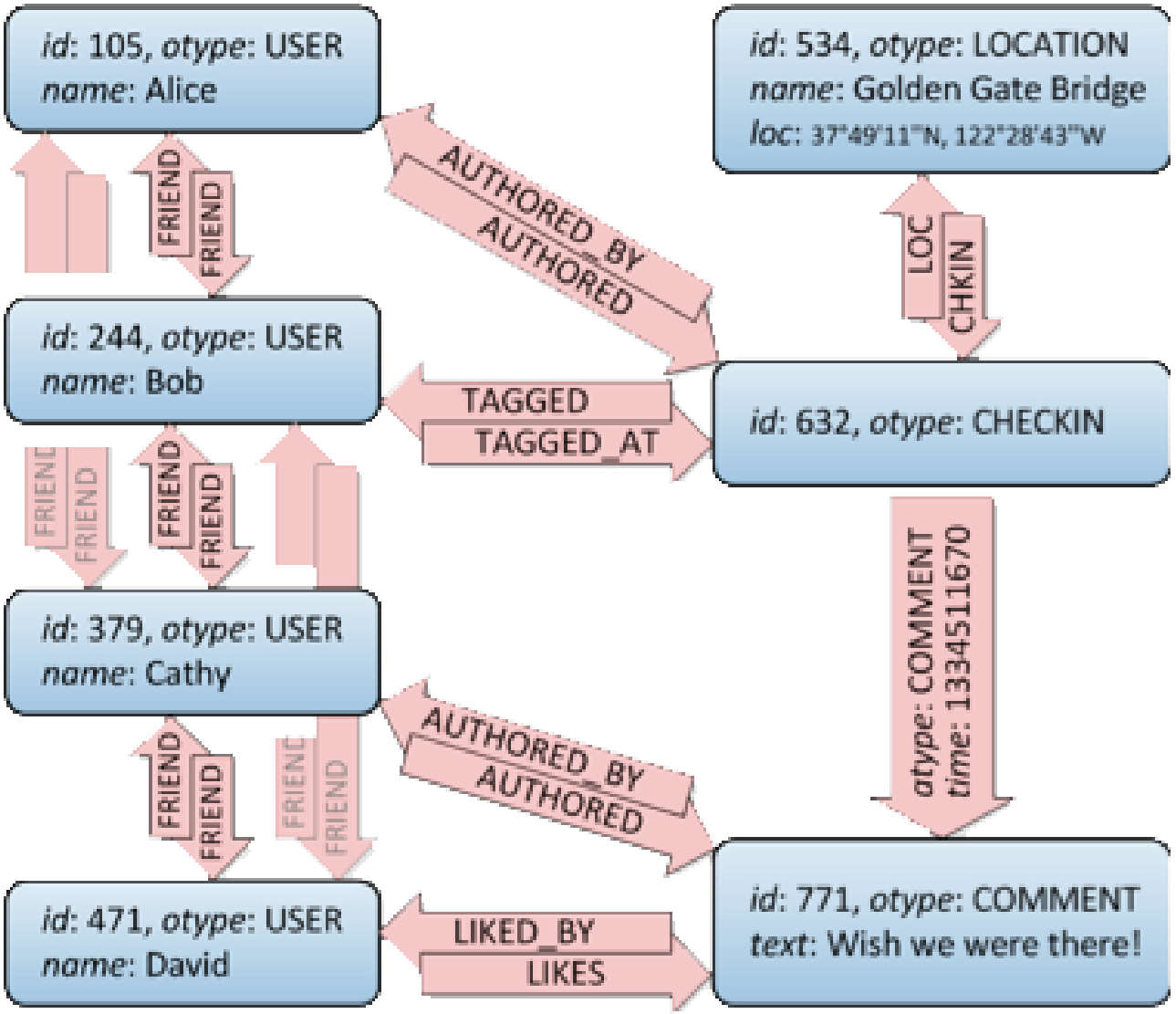
Facebook has more than 1 billion active user

- recording relationships,
- sharing interests,
- uploading pictures and …

The user experience of Fb comes from rapid, efficient and scalable access to the *social graph*

What's behind an entry in yours Fb page?

A single Fb page aggregate and filter hundreds of items from the social graph.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name: Alice
id: 534, otype: LOCATION
name: Golden Gate Bridge
loc: 37°49'11"N, 122°28'43"W
AUTHORED_BY
AUTHORED
FRIEND
FRIEND
LOC
CHKIN
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name: Bob
TAGGED
TAGGED_AT
id: 632, otype: CHECKIN
FRIEND
FRIEND
FRIEND
FRIEND
atype: COMMENT
time: 1334511670
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name: Cathy
AUTHORED_BY
AUTHORED
FRIEND
FRIEND
FRIEND
FRIEND
id: 471, otype: USER
name: David
LIKED_BY
LIKES
id: 771, otype: COMMENT
text: Wish we were there!

Before Tao

- Facebook was storing the social graph to MySql
  - Quering it from PHP
  - Storing result in memcache

Over time Fb deprecated direct access to MySQL in favor of a graph (associations, nodes) abstraction

Limits

- Operations on lists are inefficient in memcache (update whole list)
- Complexity on clients managing cache
- Hard to offer read-after-write consistency

Also they want to access social graph from non-PHP services

TAO's Goals

- Efficiency at Scale
- Low read latency
- Timeliness of writes
- High read availability

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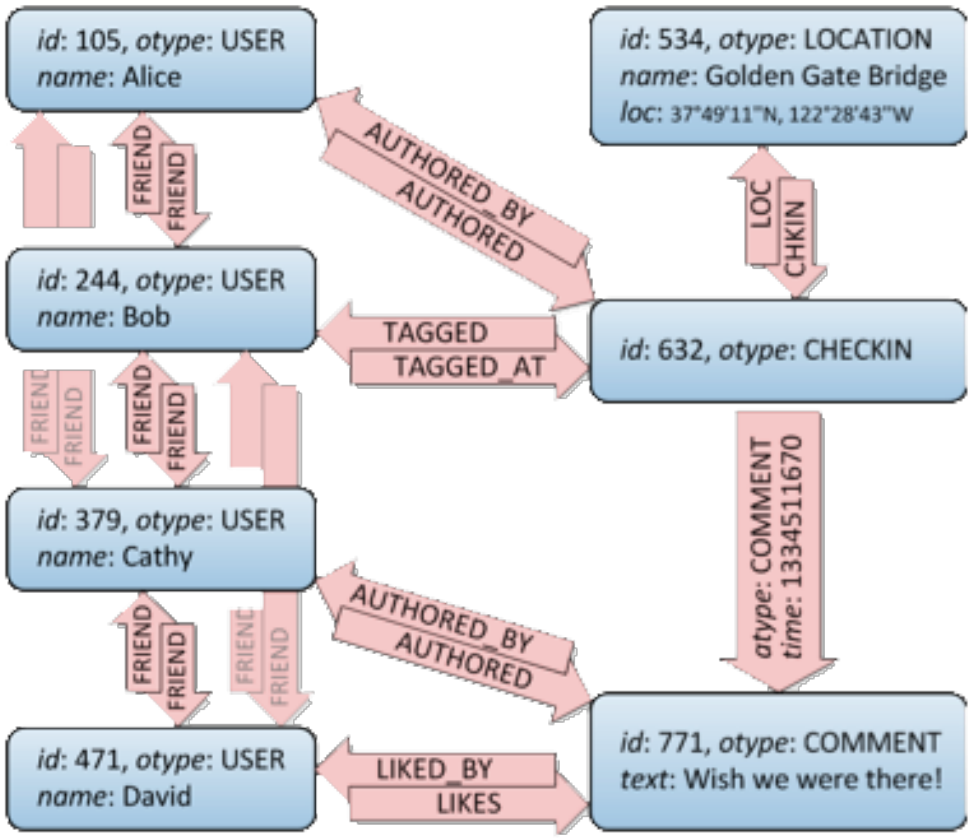
Tao Data Model

T.A.O. stands for “The Associations and Objects”



Objects

- Typed nodes (type is denoted by `otype`)
- Identified by 64-bit integers (unique)
- Contains data in the form of key-value pairs
- Models users and repeatable actions (e.g. comments)

API for objects:

- Allocate new object
- retrieve
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Associations

- Typed directed edges between objects (type is denoted by `atype`)
- Identified by source object `id1`, `atype` and destination object `id2`
- Contains data in the form of key-value pairs.
- Contains a 32-bit `time` field.
- Models actions that happen at most once or records state transition (e.g. like)
- Often inverse association is also meaningful (eg like and liked by).

Associations API

- Add new
- Delete
- Change type

Also inverse association is created or modified automatically

Querying TAO

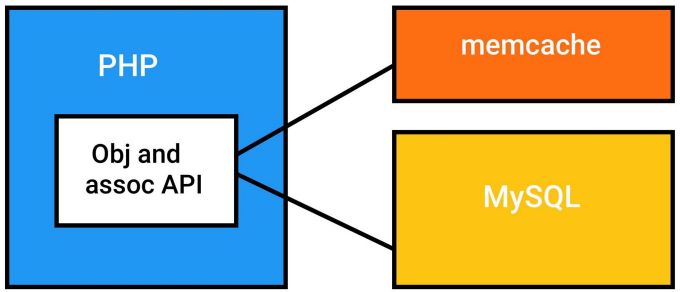
TAO's associations queries are organized around *associations list*

- `assoc_get(id1,atype, id2set, high?, low?)`
- `assoc_count(id1,atype)`
- `assoc_range(id1, atype, pos, limit)`
- `assoc_time_range(id1,atype, high, low, limit)`

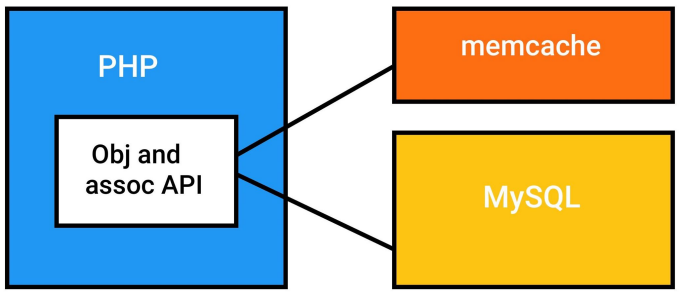
Query results are bounded to 6000 results

Architecture

Before Tao



After Tao



Architecture

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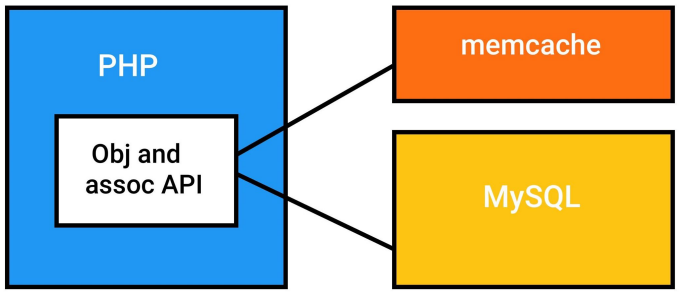
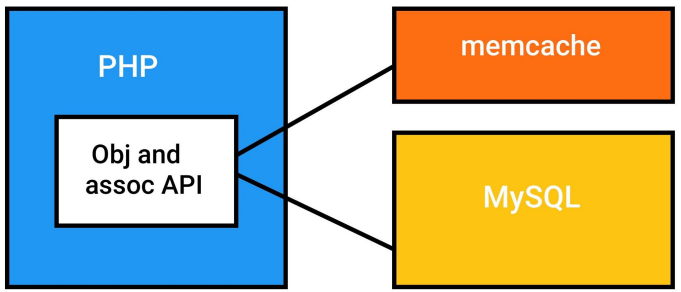


After Tao



Storage Layer

- Object and Associations are stored in MySql (before & with TAO)
- TAO API is mapped to a small set of SQL queries
- A single MySql server can't handle TAO volumes of data
  - We divide data into logical *shards*
  - *shards* are mapped to db
  - different servers are responsible for multiple shards
  - mapping is adjusted for load balancing
- Object are bounded to a *shard* for their entire lifetime
- Associations are stored in the *shard* of its `id1`

Implementation

title