
Home of Redis

# Redis Labs Introduction

# Who We Are

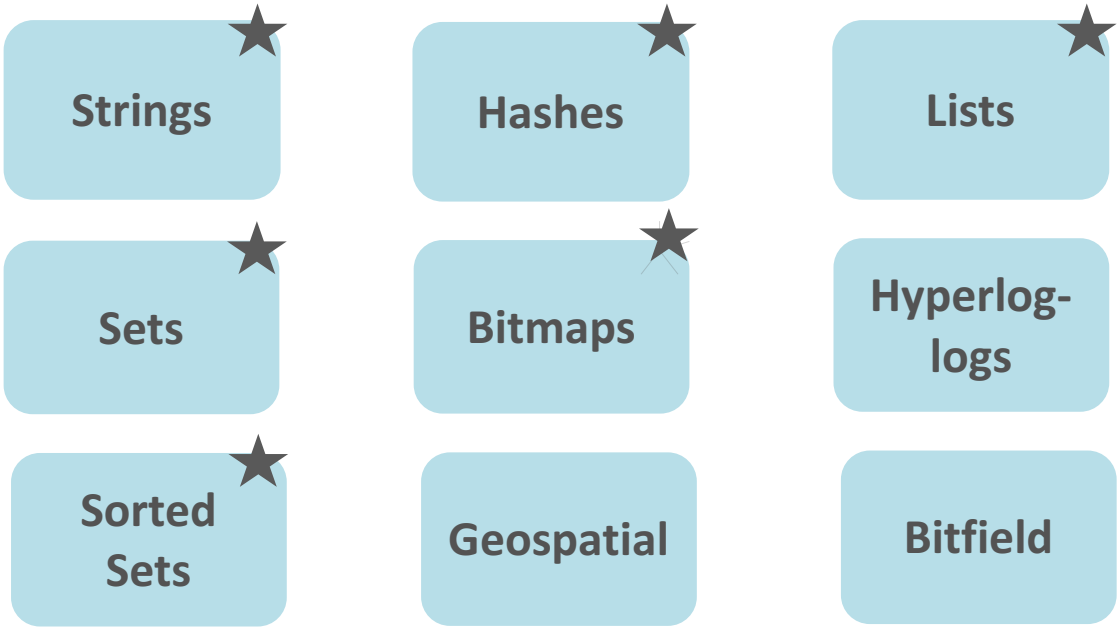

Open source. The leading **in-memory database platform**, supporting any high performance operational, analytics or hybrid use case.


The open source home and commercial provider of **Redis Enterprise (Redis$^{e}$)** technology, platform, products & services.

# What is Redis?

- Redis – (**RE**mote **DI**ctionary **S**erver)
- Open source.
- The leading **in-memory database platform**
- Created in 2009 by Salvatore Sanfilippo (a.k.a @antirez)
- Source: https://github.com/antirez/redis
- Website: http://redis.io

# REmote DIctionary Server



# Redis Tops Database Popularity Rankings

sumologic® .....#1 database technology on AWS

node.js .....#1 database used by Node.js developers

G2 CROWD .....#1 NoSQL in User Satisfaction

stackshare .....#1 NoSQL among Top 10 Data Stores

DATADOG .....#1 database on Docker

ClusterHQ DevOps.com #1 NoSQL database deployed in containers

DB-ENGINES .....#1 in growth among top 3 NoSQL databases

UpScored .....#1 database in skill demand

stackoverflow .....# 1 database in Top Paying Technologies

# The Redis Community

**162**

CLIENTS IN 48 LANGUAGES

**100+**

HIGHER LEVEL LIBRARIES AND TOOLS

**219**

CONTRIBUTORS

**6K+**

GITHUB COMMITS

**21.5K**

REDIS GITHUB STARS (#75)

**39K+**

STACK OVERFLOW QUESTIONS

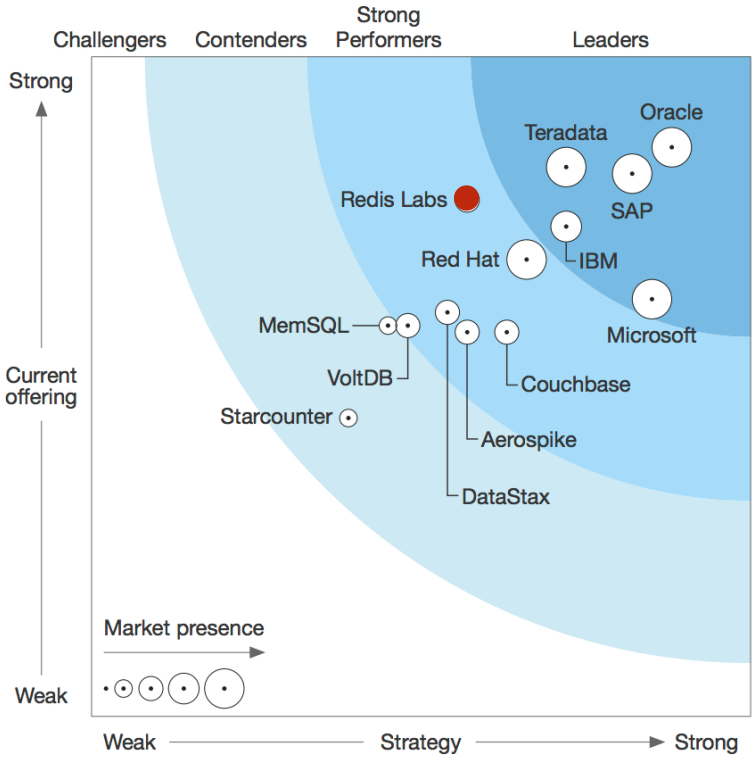
# Industry Recognition

Gartner®

Figure 1. Magic Quadrant for Operational Database Management Systems


Source: Gartner (October 2016)

FORRESTER®



# Customers From All Verticals

| Banks | Financial Services | Retail/E-commerce | Social | Media | Advertising |
|---|---|---|---|---|---|
| American Express | VISA | jet | twitter | msn | HAVAS |
| Wells Fargo | intuit | Starbucks | Atlassian | The Motley Fool | REVMOB |
| Crédit Agricole | fiserv. | GROUPON | twitch | bleacher report | Outbrain |

| Technology | Communications | Business Services | Travel | Gaming | Education |
|---|---|---|---|---|---|
| Apple | NOKIA | ARIBA | Expedia | EA Electronic Arts | its learning |
| Cisco | vodafone | PROSPERWORKS | Hotel Tonight | Playtika | HealthStream |
| DELL | verizon | RingCentral | tripadvisor | ROBLOX | Edgenuity |

# Redis is Extensively & Diversely Used

| Company | Use Case | Scope |
|---|---|---|
| Twitter | Timeline, follower, following | 0.5-1PB, 30 MM ops/sec |
| Weibo (Chinese Twitter) | Entire database | + 100 TB, 10MM ops/sec |
| Samsung US | Fast data store for mobile apps | 50MM users, <100 msec (E2E) |
| HTC | Fast data store for mobile apps | 40TB |
| Pinterest | Graph database | 10+TB |
| Stack overflow | Local/site/global caching | |

# Redis is Extensively & Diversely Used (2)

| Company | Use Case | Scope |
|---|---|---|
| Booking.com | Online bookings/fast transactions | 10-20 TB |
| Github | Repository router | 10+ TB |
| Tinder | Geo search, user profiles | 10-20TB |
| Snapchat | All messages | 40TB |
| Pinterest | Graph database | 500 MM messages/day, >100TB |

# Redis Labs Products

SERVICES — redis^e — SOFTWARE

## Redis^e Cloud

Fully managed Redis^e service on hosted servers within AWS, MS Azure, GCP, IBM Softlayer, Heroku, CF & OpenShift

RAM

## Redis^e Cloud Private

Fully managed Redis^e service in VPCs within AWS, MS Azure, GCP & IBM Softlayer

RAM or Flash

## Redis^e Pack

Downloadable Redis^e software for any enterprise datacenter or cloud environment

RAM or Flash

## Redis^e Pack Managed

Fully managed Redis^e Pack in private data centers

RAM or Flash

# Redis[e] Cloud - Offered Over IaaS and PaaS

## 4 Clouds, 45 data centers across the world

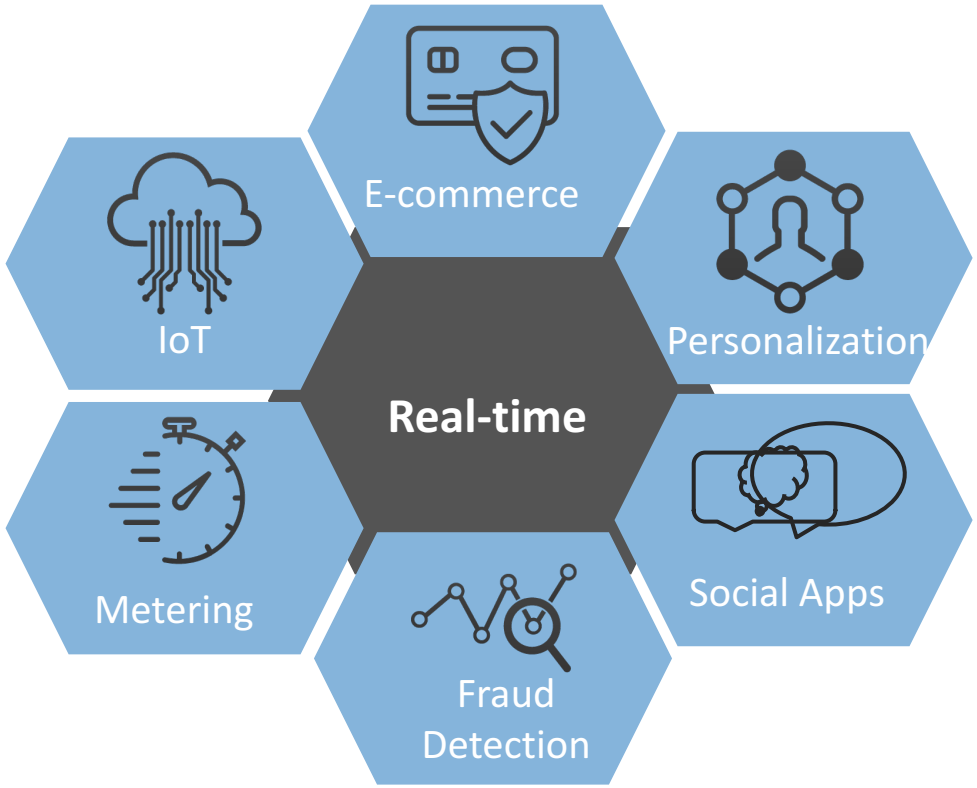

## 10 partner channels

heroku
Azure Marketplace
BlueMix
Pivotal Web Services
OPENSHIFT
IBM Cloud / marketplace
awsmarketplace
appfog
AppHarbor


Home of Redis

# Why Redis

# Redis Powers a Range of Solutions




…AND MANY MORE

# Redis Uniquely Suited To Modern Apps

A full range of capabilities that simplify and accelerate next generation applications

# Redis Uses Span Many Verticals

**Telco**

Billing (CDRs, SDRs)

**Finance**

High speed delivery of prices / transactions

**Business Services**

CRM, ERP

**Retail / E-Commerce**

Items Viewed, Similar Purchases, Top trends

**Technology**

High-Speed Operations

**Advertising**

Real-time ad placements, personalization

**Travel**

Recommendations, Ordering

**Media**

Notifications, Recommendations, Caching

**Education**

Subjects, Classes Classification

**Social**

Timeline, social graph, top followers, following

**Gaming**

Real time analytics for leaderboards, dashboards, messaging

# Real-Time Transactions are Needed in….

## Retail


Payment processing

Inventory management

Supply chain management

## Finance


Real-Time trading

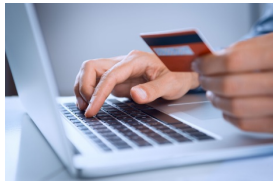
Money transfer
and disbursement

Loan management

## E-Commerce

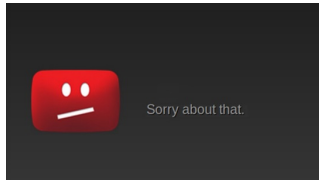

Order processing

Order fulfillment



Online Payments

## Entertainment




Digital rights management

Digital asset management

Ticketing

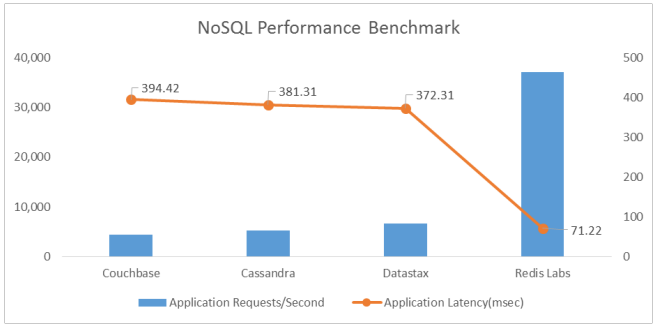
## Travel and Leisure


Reservations

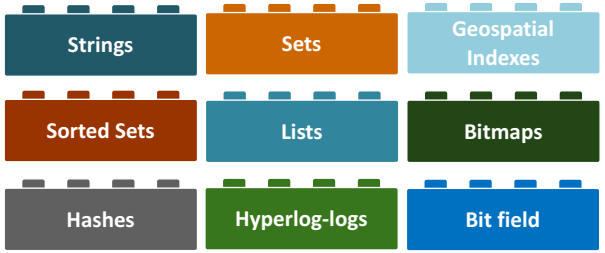

Inventory management

Real-time dispatching

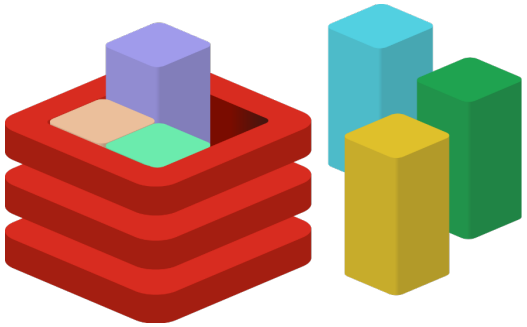
# Redis is a Game Changer




## Performance




## Simplicity
(through Data Structures)



## Extensibility
(through Redis Modules)

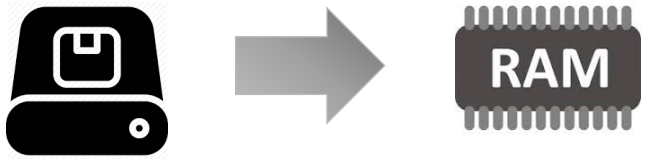
# Redis is Effective in OLTP and OLAP

## OLTP


The 100 msec de-facto standard for end-to-end app response time requires <1msec DB response time.

Redis is the only database that can support this under heavy load.

## OLAP



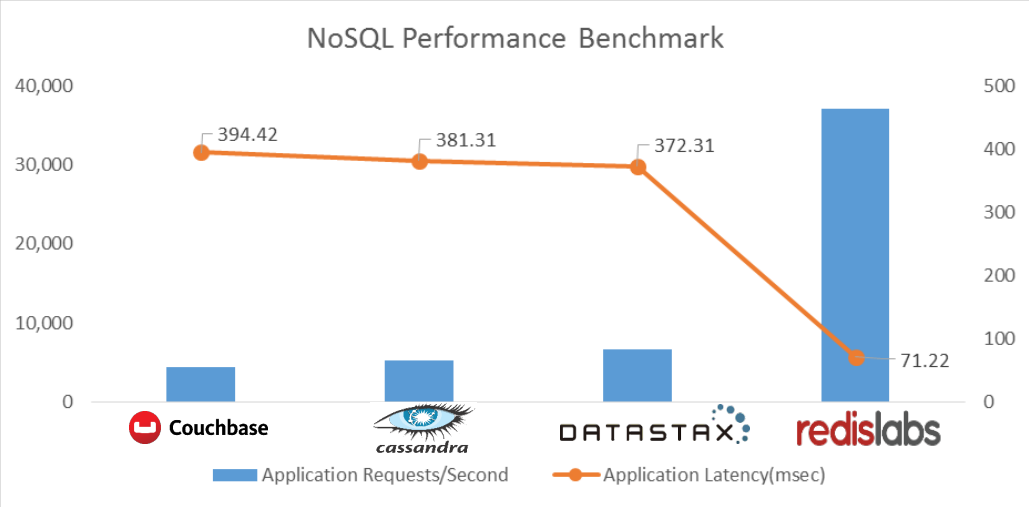

Disk-based

Query time: Days/Hours

RAM-based

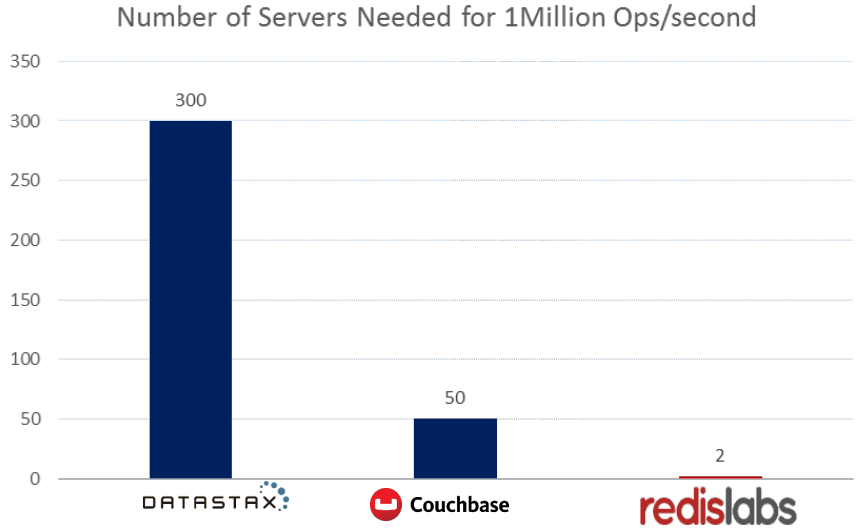
Query time: Minutes/Seconds

# Performance: The Most Powerful Database




Highest Throughput at Lowest Latency in High Volume of Writes Scenario

*Benchmarks performed by Avalon Consulting Group*




Lowest number of servers needed to deliver 1 Million writes/second

*Benchmarks published in the Google blog*

# Redis – Purpose Built For Performance

**Optimized Architecture**

Written in C

Served entirely from memory

Single threaded lock free

**Advanced Processing**

Most commands are executed with O(1) complexity

Access to discrete elements within objects

Reduced bandwidth/overhead requirements

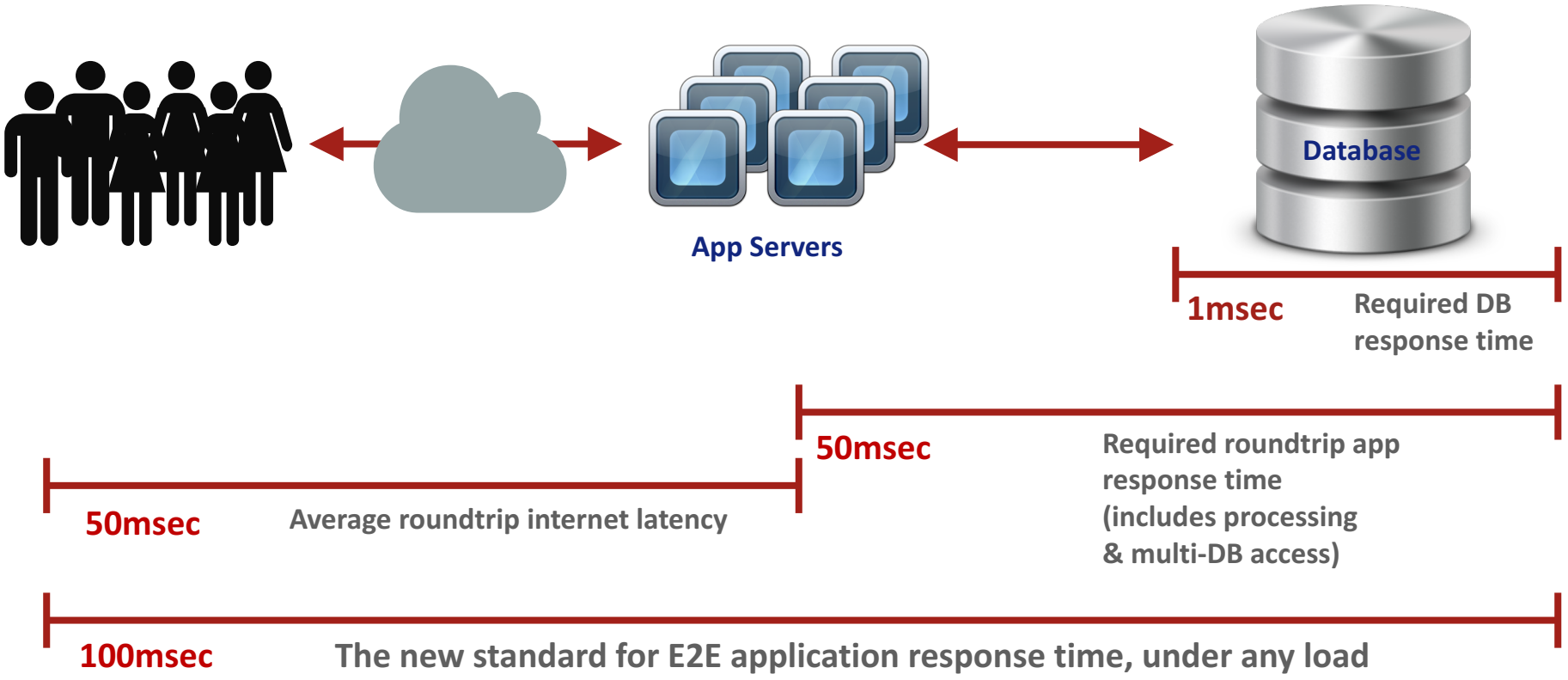
**Efficient Operation**

Easy to parse networking protocol

Pipelining for reduced network overhead

Connection pooling

# Why Use Redis as an Operational DBMS ?

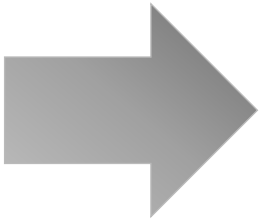


# Why Use Redis as an Analytics DBMS ?

**Query time:**

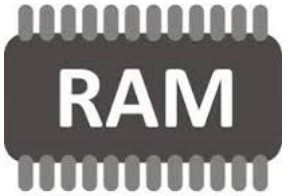
**Days/Hours**

**Disk-based**



**Query time:**

**Minutes/Seconds**



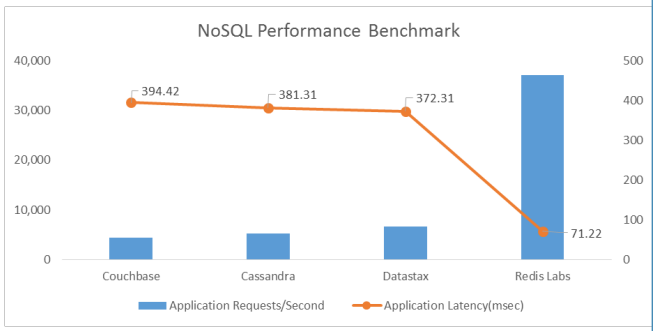

**RAM-based**

More on Redis in Analytics

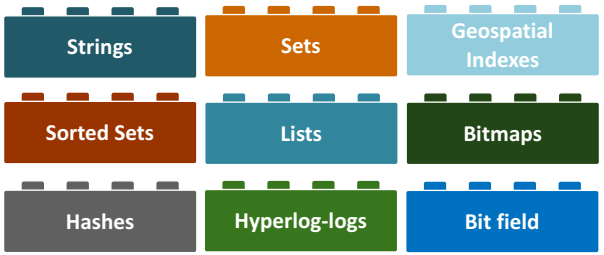

Home of Redis

# Redis Key/Value Data Structures

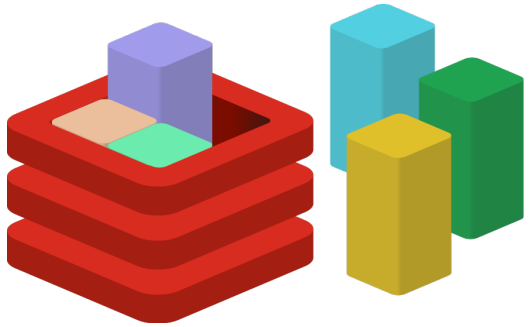
# Redis is a Game Changer




## Performance

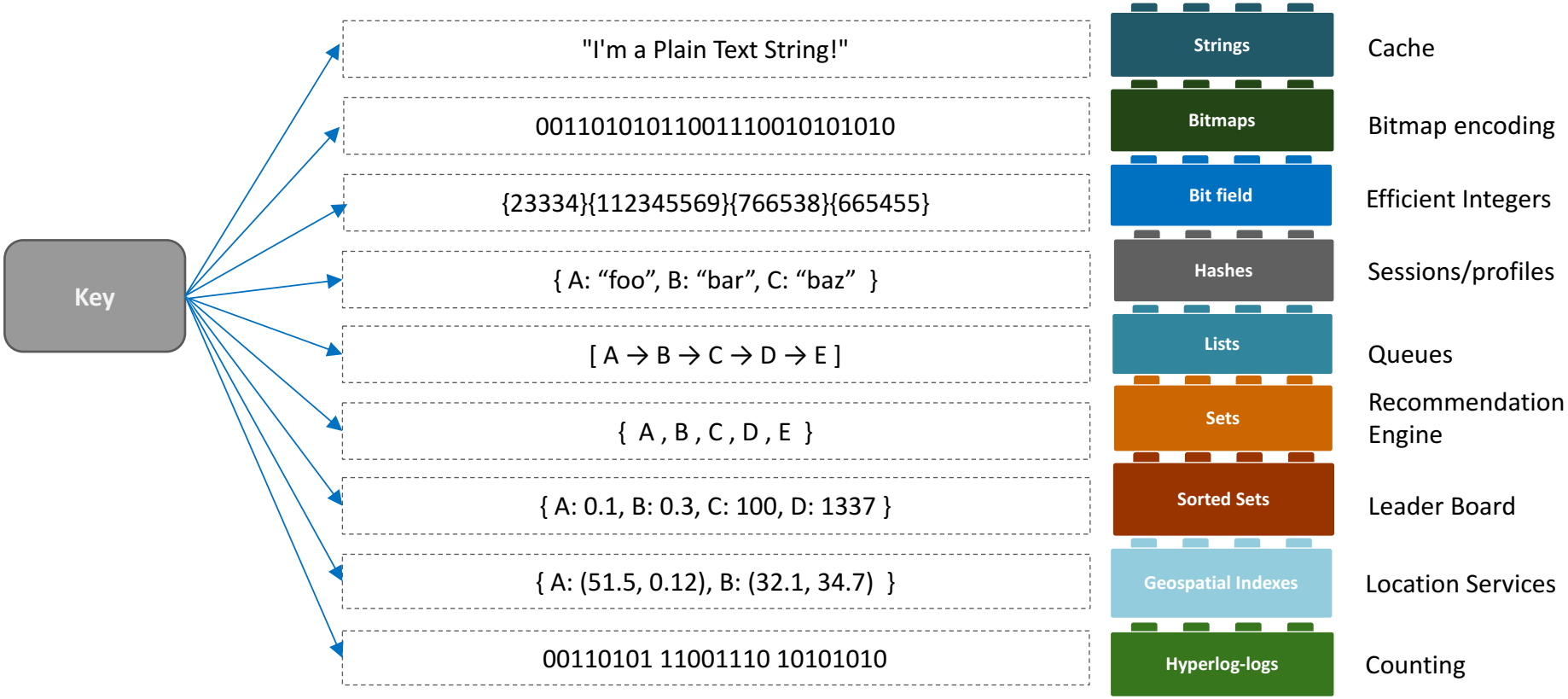



## Simplicity
(through Data Structures)



## Extensibility
(through Redis Modules)

# Data Structure Store: Lego For Your App



# What Can You Do With Redis?

Use as in-memory database, cache or message broker

## Common Uses

- Cache
- Message Brokers/Queues
- User Sessions
- Real-time Recommendation Engine
- Leaderboards
- …More…..much, MUCH more!!!

# Simple Cache

**The Problem**

- Multiple database calls create impossibly slow web page response times

**Why Redis Rocks**

- **Strings** are perfect for this!
- SET lets you save session variables as key/value pairs
- GET to retrieve values

# Redis Strings for Simple Cache

- Strings store text, which might be made from the results of multiple database queries and HTML
- Can have expiry
- You can register to listen for changes on keys and operations
- Multiple eviction policies supported

```
$ SET userid:1 “8754”
$ GET userid:1
$ EXPIRE userid:1 60
$ DEL userid:1
```

```
jedis.set("userid:1", "8754");
jedis.get("userid:1");
jedis.expire("userid:1", 60);
jedis.del("userid:1");
```

# User Sessions

## The Problem

- Maintain session state across multiple servers
- Multiple session variables
- High speed/low latency required

## Why Redis Rocks

- **Hashes** are perfect for this!
- HMSET lets you save session variables as key/value pairs
- HMGET to retrieve values
- HINCRBY to increment any field within the hash structure
- HDEL to delete one field/value

# Redis Hashes for User Sessions

hash key: usersession:1

| | |
|---|---|
| userid | 8754 |
| name | dave |
| ip | 10:20:104:31 |
| hits | 1 |
| lastpage | home |
| | |
| | |
| | |

```
$ HMSET usersession:1 userid 8754 name dave ip 10:20:104:31 hits 1
$ HMGET usersession:1 userid name ip hits
$ HINCRBY usersession:1 hits 1
```

```
$ HSET usersession:1 lastpage “home”
$ HGET usersession:1 lastpage
$ HDEL usersession:1 lastpage
```

```
$ DEL usersession:1
```

Hashes store a mapping of keys to values – like a dictionary or associative array – but faster

# Redis Hashes for User Sessions

```
Map<String, String> userSession = new HashMap<>();
userSession.put("userid", "8754");
userSession.put("name", "dave");
userSession.put("ip", "10:20:104:31");
userSession.put("hits", "1")
jedis.hmset("usersession:1", userSession);

jedis.hmget("usersession:1", "userid", "name","ip" ,"hits");
jedis.hincrBy("usersession:1", "hits", 1);
jedis.hset("usersession:1", "lastpage", "home");
jedis.hget("usersession:1", "lastpage");
jedis.hdel("usersession:1", "lastpage");
```

# Managing Queues of Work

## The Problem

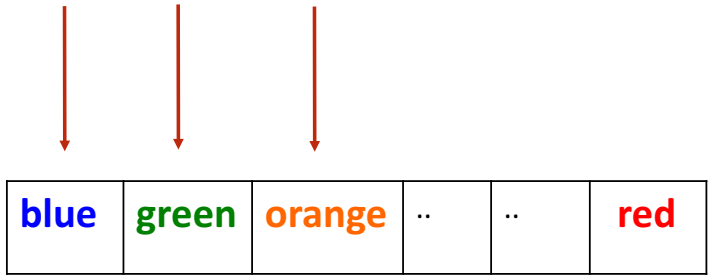
- Tasks need to be worked on asynch to reduce block/wait times
- Lots of items to be worked on
- Assign items to worker process and remove from queue at the same time
- Similar to buffering high speed data-ingestion

## Why Redis Rocks

- **Lists** are perfect for this!
- LPUSH, RPUSH add values at beginning or end of queue
- RPOPLPUSH – pops an item from one queue and pushes it to another queue

# Redis Lists for Managing Queues

LPUSH adds values to head of list




RPUSH adds value to tail of list

```
$ LPUSH queue1 orange
$ LPUSH queue1 green
$ LPUSH queue1 blue
$ RPUSH queue1 red
```

# Redis Lists for Managing Queues

```
$ LPUSH queue1 orange
$ LPUSH queue1 green
$ LPUSH queue1 blue
$ RPUSH queue1 red
```


```
$ RPOPLPUSH queue1 queue2
```

RPOPLPUSH pops a value from one list and pushes it to another list

# Redis Lists for Managing Queues

```
jedis.lpush("queue1", "orange");
jedis.lpush("queue1", "green");
jedis.lpush("queue1", "blue");
jedis.rpush("queue1", "red")

jedis.rpoplpush("queue1", "queue2");
```

# Real-time Recommendation Engine

**The Problem**

- People who read this article also read these other articles
- Want real time not data mining

Also used for:

- Recommending Similar Purchases
- Identifying Fraud

**Why Redis Rocks**

- **SETS** are unique collections of strings
- SADD to add tags to each article
- SISMEMBER to check if an article has a given tag
- SMEMBERS to get all the tags for an article
- use SINTER to find similar articles tagged with the same tags

# Redis Sets for Recommendations

Set: tag:1

| | | | | |
|---|---|---|---|---|
| article 1 | **article 3** | …. | | |

Set: tag:2

| | | | | |
|---|---|---|---|---|
| **article 3** | article 14 | Article 22 | .. | |

Set: tag:3

| | | | | |
|---|---|---|---|---|
| article 2 | **article 3** | article 9 | .. | |

Add values (articles) to Sets (tags)

```
$ SADD tag:1 article:3 article:1
$ SADD tag:2 article:22 article:14 article:3
$ SADD tag:3 article:9 article:3 article:2
```

Confirm the values have been added

```
$ SMEMBERS tag:3      (also tag:1 & tag:2)
```

```
1) "article:3"
2) "article:2"
3) "article:9"
```

Find values that exist in all three Sets

```
$ SINTER tag:1 tag:2 tag:3
```

```
1) "article:3"
```

# Redis Sets for Recommendations

```
jedis.sadd("tag:1", "article:3" ,"article:1");
jedis.sadd("tag:2", "article:22","article:14", "article:3");
jedis.sadd("tag:3", "article:9", "article:3", "article:2");

jedis.smembers("tag:1")
jedis.sinter("tag:1", "tag:2", "tag:3");
```

# Example : Redis For Bid Management

## The Application Problem

- Many users bidding on items
- Need to instantly show who's leading, in what order and by how much
- May also need to display analytics like how many users are bidding in what range
- Disk-based DBMS-es are too slow for real-time, high scale calculations

## Why Redis Rocks This

- Sorted sets automatically keep list of users and scores updated and in order (ZADD)
- ZRANGE, ZREVRANGE will get your top users
- ZRANK will get any users rank instantaneously
- ZCOUNT will return a count of users in a range
- ZRANGEBYSCORE will return all the users in a range by their bids

# Redis Sorted Sets

| Item: 1 | |
|---|---|
| id:3 | 44000 |
| id:4 | 35000 |
| | |
| id:1 | 21000 |
| id:2 | 10000 |
| | |

```
ZADD item:1 10000 id:2 21000 id: 1
ZADD item:1 34000 id:3 35000 id 4
ZINCRBY item:1 10000 id:3
```

```
ZREVRANGE item:1 0 0
id:3
```

```
jedis.zadd("item:1" , 10000 ,"id:2" );
jedis.zadd("item:1" , 21000 ,"id:1" );
jedis.zadd("item:1" , 34000 ,"id:3" );
jedis.zadd("item:1" , 35000 ,"id:4" );
jedis.zincrby("item:1",10000, "id:3");

jedis.zrevrange("item:1", 0,0);
```

# Sorted Sets for Leaderboards

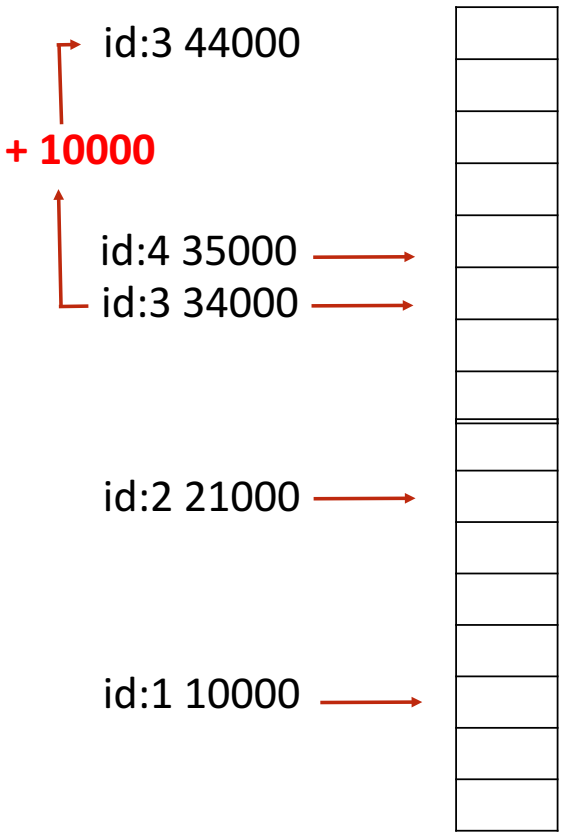
## The Problem

- MANY users playing a game or collecting points
- Display real-time leaderboard.
- Who is your nearest competition
- Disk-based DB is too slow

## Why Redis Rocks

- **Sorted Sets** are perfect!
- Automatically keeps list of users sorted by score
- ZADD to add/update
- ZRANGE, ZREVRANGE to get user
- ZRANK will get any users rank instantaneously

# Redis Sorted Sets




```
$ ZADD game:1 10000 id:1
$ ZADD game:1 21000 id:2
$ ZADD game:1 34000 id:3
$ ZADD game:1 35000 id:4
$ ZINCRBY game:1 10000 id:3
```

Get the Leader Board

```
$ ZREVRANGE game:1 0 0
$ ZREVRANGE game:1 0 1 WITHSCORES
```

# Redis Sorted Sets

```
jedis.zadd("game:1", 10000, "id:1" );
jedis.zadd("game:1", 21000, "id:2");
jedis.zadd("game:1", 34000, "id:3" );
jedis.zadd("game:1", 35000, "id:4");

jedis.zincrby("game:1", 10000,"id:3");

jedis.zrevrange("game:1", 0,0);
jedis.zrevrangeWithScores("game:1", 0,1);
```

# Search by Location

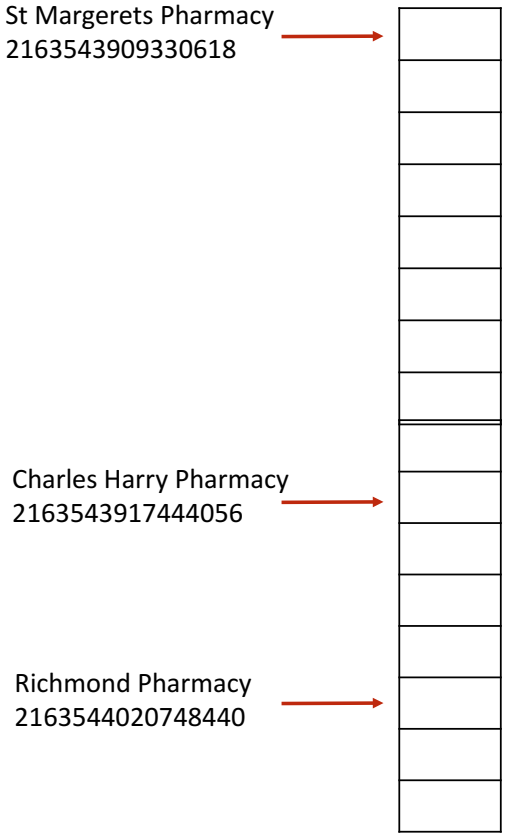
**The Problem**

- Give me all the pharmacies in 2 km radius
- How far am I from the hospital

**Why Redis Rocks**

- **GeoSet** is perfect!
- Stores location as Geohash
- GEOADD to add a location
- GEODIST to get distance
- GEORADIUS to get locations in radius

# Search By Location




```
GEOADD pharmacies -0.310392 51.456454  "Charles Harry
Pharmacy”
GEOADD pharmacies -0.296402 51.462069 "Richmond Pharmacy”
GEOADD pharmacies -0.318604 51.455338 "St Margerets Pharmacy”
```

```
GEORADIUS pharmacies -0.30566239999996014 51.452921 600  m
WITHDIST WITHCOORD ASC
1) 1) "Charles Harry Pharmacy"
   2) "511.6979"
   3) 1) "-0.3103932738304138 2"
   2) "51.4564528845986330 9"
```

# Search By Location

```
jedis.geoadd("pharmacies", -0.310392, 51.456454, "Charles Harry
Pharmacy");
jedis.geoadd("pharmacies",-0.296402, 51.462069, "Richmond
Pharmacy");
jedis.geoadd("pharmacies", -0.318604, 51.455338, "St Margerets
Pharmacy");

jedis.georadius("pharmacies", -0.30566239999996014, 51.452921,
600 , GeoUnit.M ,
GeoRadiusParam.geoRadiusParam().withCoord().withCoord().withDist
());
```

# Count Unique Visitors

**The Problem**

- Count unique daily visitors to the site
- How many unique users have clicked on an ad

**Why Redis Rocks**

- **HyperLogLog** is perfect!
- Keeps Count of each unique element
- PFADD to add an element
- PFCOUNT to get count

# HyperLogLog to Count Unique Visitors

- Stored as String

"HYLL\x01\x00\x00\x00\x04\x00\x00\x00\x00\x00\x00\x00E\xa0\x80S1\x84E
2\x88\\\x17\x80E\xdd”

- Maximum 12 KB size
- Standard error of 0.81%.

```
PFADD visitors:20160921 86.163.34.208
PFADD visitors:20160921 52.203.210.236
PFADD visitors:20160921 54.87.203.132
PFADD visitors:20160921 54.87.201.121
PFADD visitors:20160921 52.203.210.236
```

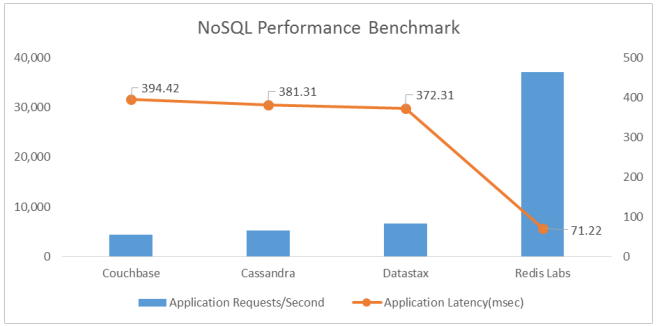
```
PFCOUNT visitors:20160921
(integer) 4
```

# HyperLogLog to Count Unique Visitors

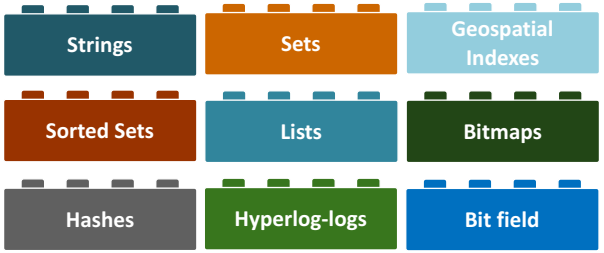
```
jedis.pfadd("visitors:20160921", "86.163.34.208");
jedis.pfadd("visitors:20160921", "52.203.210.236");
jedis.pfadd("visitors:20160921", "54.87.203.132");
jedis.pfadd("visitors:20160921", "54.87.201.121");
jedis.pfadd("visitors:20160921", "52.203.210.236");

jedis.pfadd("visitors:20160921");
```

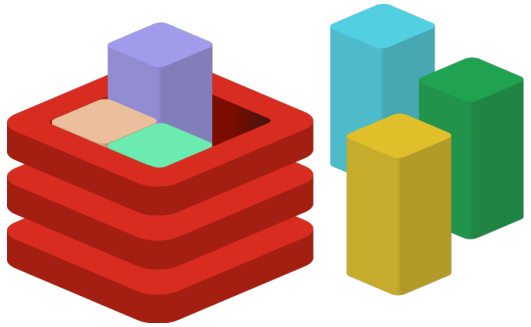
# Redis is a Game Changer




## Performance




## Simplicity
(through Data Structures)



## Extensibility
(through Redis Modules)

Full Text Search?

Secondary Index?

SQL?

Machine Learning?

# But Can Redis Do X?

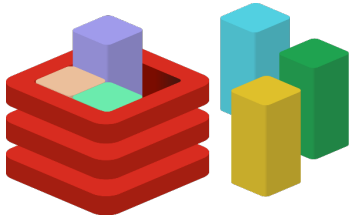
AutoComplete?

Graph?

Time Series?

# Redis Modules

- C extensions to Redis
- Work at native speed
- Add commands
- Can implement their own native data types
- Can extend redis or just use it as a “Server Framework”
  - Isolated API
  - ABI Backwards Compatibility



# Adapt your database to your data

| Neural Redis | Redis-ML | RediSearch |
| --- | --- | --- |
| Simple Neural Network Native to Redis | Machine Learning Model Serving | Full Text Search Engine in Redis |
| **ReJSON** | **Time Series** | **Graph** |
| JSON Engine on Redis. Pre-released | Time series values aggregation in Redis | Graph database on Redis based on Cypher language |
| **Rate Limiter** | **Crypto Engine Wrpper** | **Secondary Index/RQL** |
| Based on Generic Cell Rate Algorithm (GCRA) | Secure way to store data in Redis via encrypt/decrypt with various Themis primitives | Indexing + SQL -like syntax for querying indexes. Pre-released |