RediSearch Aggregations

Super fast data processing pipeline!

RediSearch 101

- High Performance Search Index
- Redis Module
- Written From Scratch in C
- Supports multiple index types
- Open Source / Commercial
  - Commercial is scalable and distributed
  - Several commercial customers
  - Largest cluster: 200 shards, ~2B documents, 8TB RAM

What Can RediSearch Do?

- Full-Text, Numeric, Geo and Tag indexes
- Real-time indexing and updates
- Distributed search on Billions of documents
- Complex query language
- Auto-Complete
- Highlighting

So, Aggregations...

> *"**Data** **aggregation** is the compiling of information from databases with intent to prepare combined datasets for data processing."*
>
> *(Whatever you say, Wikipedia)*

- Take a Search Query
- Process the results to produce some insights from them by:
  - Grouping
  - Reducing groups
  - Applying Transformations
  - Sorting
- Transform plain search results into statistical insights

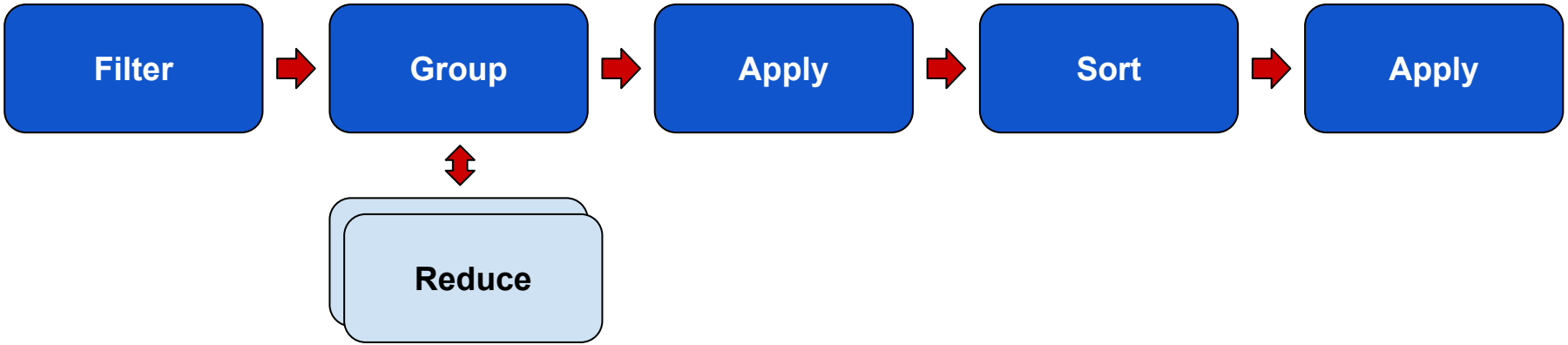
Aggregate Request vs Search Request

- Search request just fetches the top N most relevant results
- Processing is minimal if any
- Focus is on filtering and ranking

- Aggregate requests use the same query language
- But add a pipeline of processing steps
- Emphasis on processing and transforming

The Aggregation Pipeline

- Transform the results by combining multiple steps
- All steps are repeatable and work on the upstream data



What The API Looks Like

```
FT.AGGREGATE {index} {query}
  [LOAD {len} {property} ...]
  [GROUPBY {len} {property} ...
    [REDUCE {func} {len} {arg} … [AS {alias}] ]
  [SORTBY {len}{property} [ASC|DESC] …[MAX {n}]
  [APPLY {expr} AS {alias}]
  [LIMIT {offset} {num} ]
```

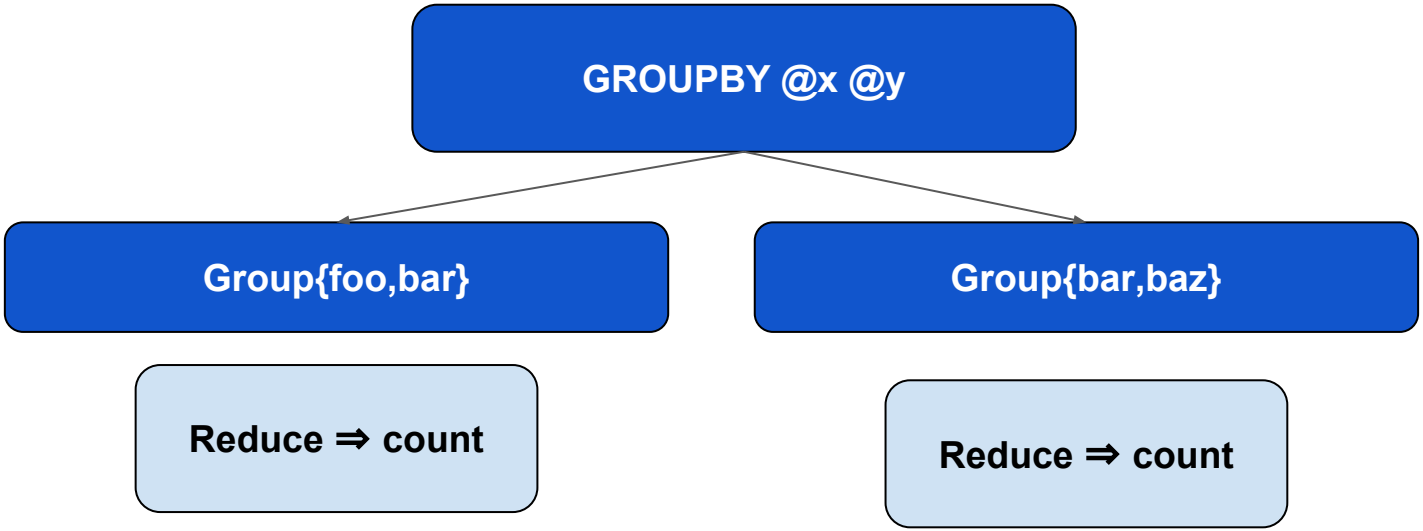
Aggregate Filters

- Determine what results we process
- Same query syntax as normal RediSearch queries
- Can be used to create complex selections

```
@country:{Israel | Italy}
@age:[25 52]
@profession:”1337 h4x0r”
-@languages:{perl | php}
```

GROUPBY and Reduce

- Grouping by any number of fields / upstream properties
- A GROUPBY is associated with many reducers
- Reducers process each matching result per group and “flatten” them



Available Reducers

- COUNT
- COUNT_DISTINCT
- COUNT_DISTINCT**ISH**
- MIN / MAX
- AVG
- SUM
- STDDEV
- QUANTILE
- FIRST_VALUE
- TOLIST

APPLY Transformations

- APPLY applies 1:1 transformations on results
- Evaluate a complex expression per result
- Can be numeric / text functions
- Numeric operators
- Runtime errors result in NULL

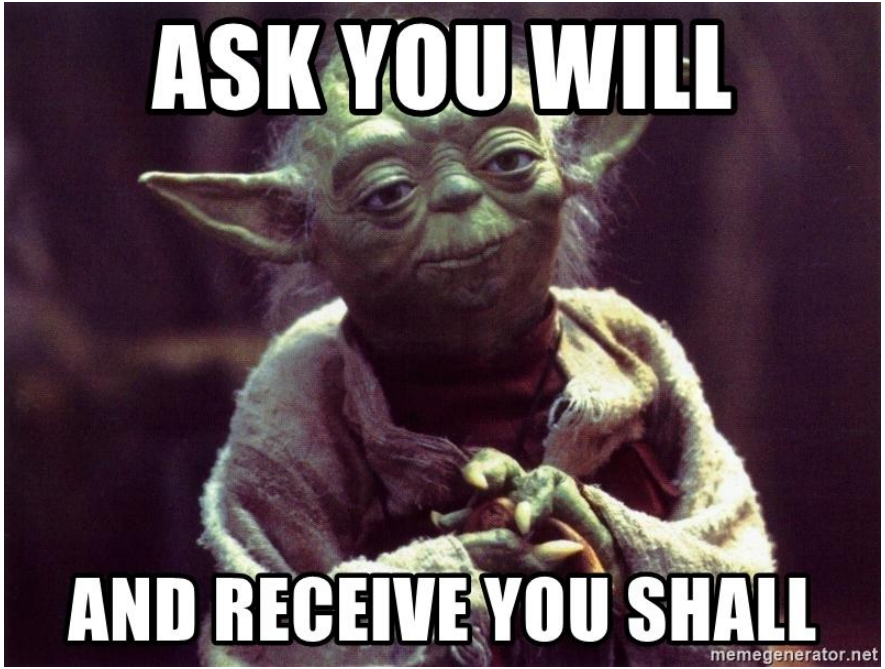
```
APPLY "sqrt((@a + @b)/2)" AS avg
APPLY "time(floor(@timestamp/86400)*86400)" AS date
APPLY "format('Hello, %s', @userName)" AS msg
```

Numeric Functions and Expressions

- Numeric operators:

  + - / * % ^

- log(x), log2(x)
- floor(x), ciel(x)
- abs(x)
- sqrt(x)
- exp(x)



String Functions and Expressions

- lower(s)
- upper(s)
- substr(s, offset, len)
- format(fmt, …)
- time(unix_timestamp, [fmt])
- parsetime(str, [fmt])

SORTBY

- Sort by one or more properties
- Each can be ASC/DESC
- MAX limits to top-N results
- Using MinMaxHeap

LIMIT vs. SORTBY MAX

- SORTBY … MAX {n}
- LIMIT {offset} {num}

- Limit can be applied even without sorting
- Max just speeds up sorts, but doesn't page through results
- Getting results 10-20 will work best as:

SORTBY … **MAX** 20 **LIMIT** 10 10

Aggregations In Practice

The Problem

- Github events (push, issue, pr, etc) stream
- For each event we have:
  - Repo
  - Actor (user)
  - Type
  - Time
  - Text
- Let’s extract the top committers on Github!

Step 1: Filter

We scan only pushes:

```
FT.AGGREGATE gh "@type:{PushEvent}"
```

Step 2: Group/Reduce

Let's group by **actor**, and count the number of commits and unique repos.

```
FT.AGGREGATE gh "@type:{PushEvent}"
GROUPBY 1 @actor
   REDUCE COUNT 0 AS commits
   REDUCE COUNT_DISTINCT 1 @repo AS repos
```

Step 3: Apply transformations if needed

Let's group by **actor**, and count the number of commits and unique repos.

```
FT.AGGREGATE gh "@type:{PushEvent}"
GROUPBY 1 @actor
   REDUCE COUNT 0 AS commits
   REDUCE COUNT_DISTINCT 1 @repo AS repos
APPLY "@commits/@repos" AS commits_per_repo
```

Step 4: Sort

Sort by commits per repo:

```
FT.AGGREGATE gh "@type:{PushEvent}"
GROUPBY 1 @actor
   REDUCE COUNT 0 AS commits
   REDUCE COUNT_DISTINCT 1 @repo AS repos
APPLY "@commits/@repos" AS commits_per_repo
SORTBY 2 @commits_per_repo DESC MAX 20
```

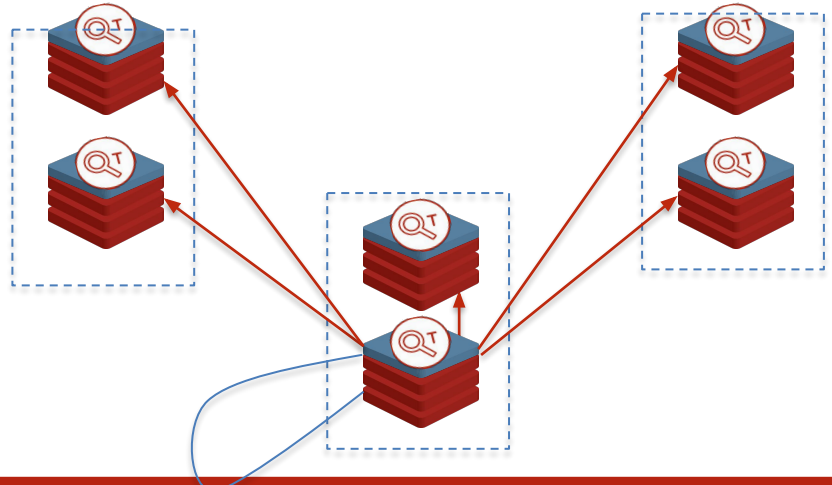
Another Example: Total/Unique Visitors Per Hour

```
FT.AGGREGATE visits
   APPLY "@time - (@time%3600)" AS hour
   GROUPBY 1 @hour
      REDUCE COUNT_DISTINCT 1 @userId AS unique
      REDUCE COUNT 0 AS total
   SORTBY 2 @hour ASC
   APPLY "time(@hour)" AS hour
```

(Near) Future Challenges

How Do You Scale Aggregations?

- All this works very well on a single node
- But what if your data is split across nodes?
- Simple searches run the query on each node and merge



How Do You Scale Aggregations?

- That cannot always be done for aggregations
  - How would you merge AVG?
  - How would you merge COUNT_DISTINCT?

Simple Approach - Filter Push-Down

- We push the filtering stage and the properties we want to all nodes
- We merge all results into one stream
- Perform aggregations on it as if it was a single node's results

- Pros: simple
- Cons: ALL matching records must be transferred over the network

Nicer Approach - Complex Push-Down

- We tale the original request
- For each step we can either:
  - Push it down to the nodes as is
  - Push down and create some special merge logic
  - Decide we cannot push down anything and quit

Nicer Approach - Complex Push-Down

- Merge logic:
  - COUNT ⇒ Pushed down as COUNT, merged as SUM
  - AVG ⇒ Pushed down as SUM + COUNT, merged as SUM/COUNT
  - COUNT_DISTINCT ⇒ Pushed as TOLIST, merged as COUNT_DISTINCT
  - Etc


Thank You!
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TLV 2018
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home of redis