Wed June 7th – Room#2011 @ SparkSummit2017

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Home of Redis

Real-time Machine Learning

and surviving Titanic…

Cihan Biyikoglu
VP of Product Management

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Agenda

- Intro to Redis and Redis Labs
- Real-time Analytics with Redis
- Deep Dive into Machine Learning with Redis
- QA

Intro to Redis Labs

Redis Labs – Home of Redis

The commercial company behind Open Source Redis

Provider of the **Redis Enterprise (Redis^{e})** technology, platform and products

Founded in 2011

HQ in Mountain View CA, R&D center in Tel-Aviv IL

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Redis Labs Products

SERVICES

SOFTWARE

redis^e

Redis^e Cloud

Fully managed Redis^e service on hosted servers within public clouds: Amazon (AWS), Microsoft Azure, Google Cloud, IBM Softlayer, Heroku, Cloud Foundry & RedHat OpenShift

RAM

Redis^e Cloud Private

Fully managed Redis^e service in Virtual Private Clouds (VPC) within Amazon (AWS), Microsoft Azure, Google Cloud, IBM Softlayer

RAM & Flash

Redis^e Pack

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

RAM & Flash

Redis^e Pack Managed

Fully managed Redis^e software in any private data center

RAM & Flash

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Mature and Stable Technology & Products

250K+

DATABASES RUN
OVER 3 YEARS

600+

NEW DATABASES
CREATED EVERY DAY

1,000+

CLOUD NODE FAILURE AND
OUTAGES EVENTS
SURVIVED WITH NO DATA
LOSS

100 +

MAN-YEARS OF ENTERPRISE
REDIS TECHNOLOGY
DEVELOPMENT

50+

DEDICATED REDIS
ENGINEERS

13

GRANTED AND PENDING
PATENTS

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Intro to Redis

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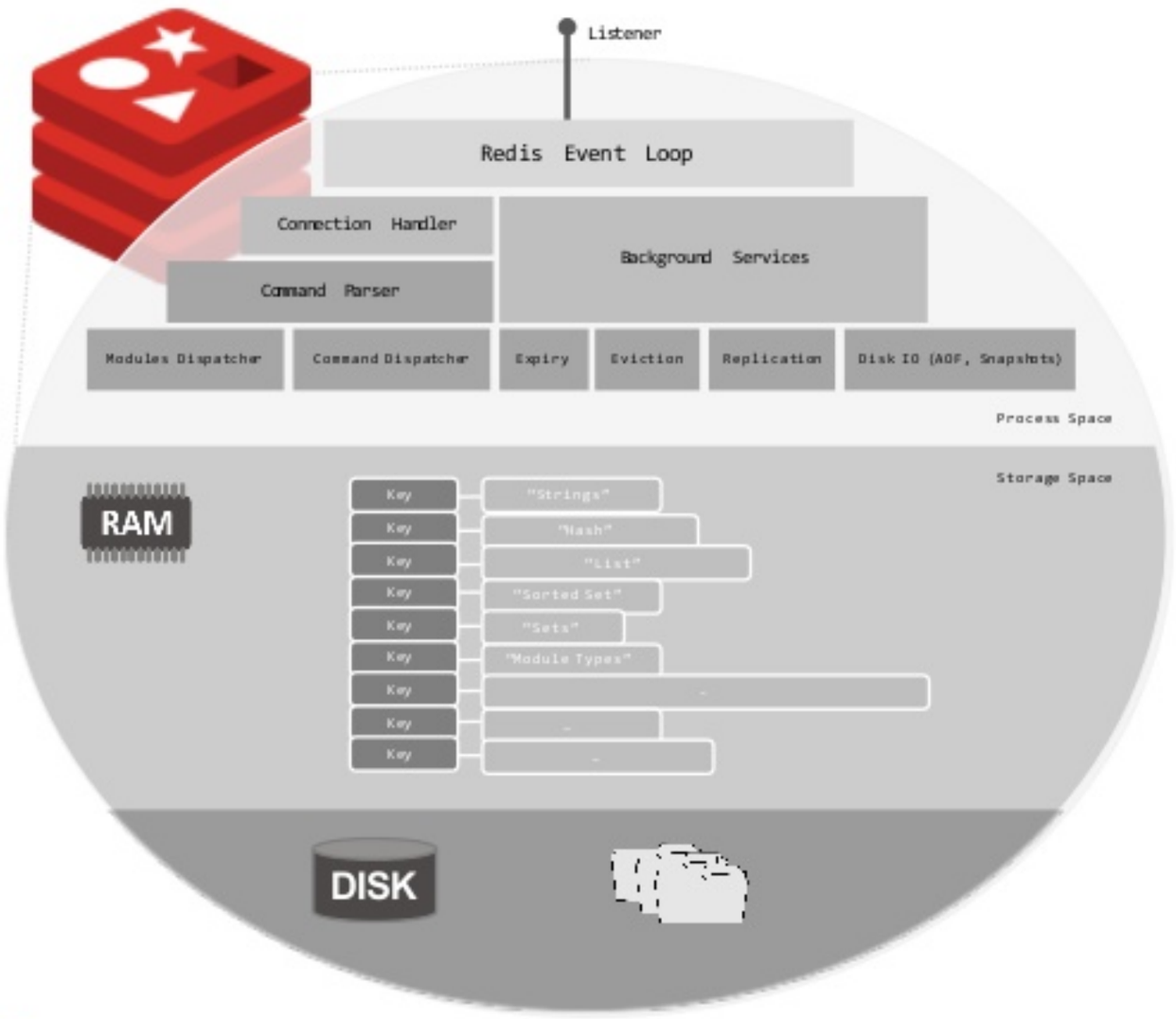
Redis Architecture



- Single Threaded, In-memory Engine with Persistence
  - "Lock Free" architecture for fast execution
  - In-memory, optimized for high speed access
  - Persistence with AOF or Snapshot disk durability

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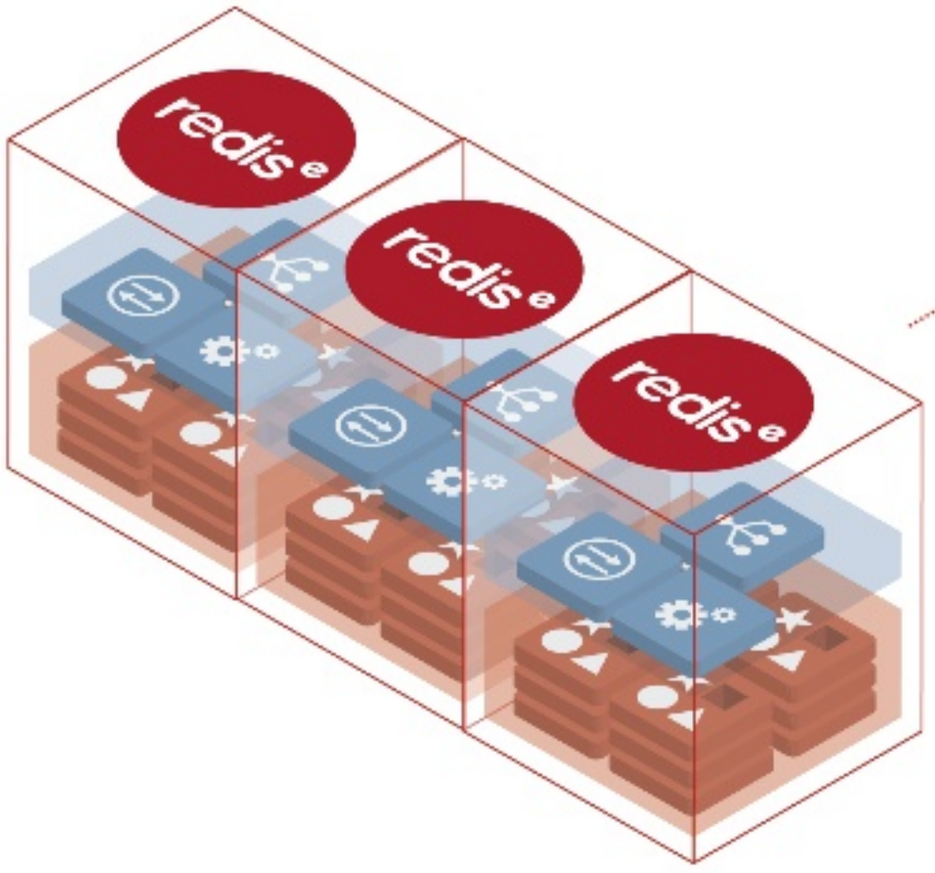
Redis^{e} Technology :: Cluster Architecture

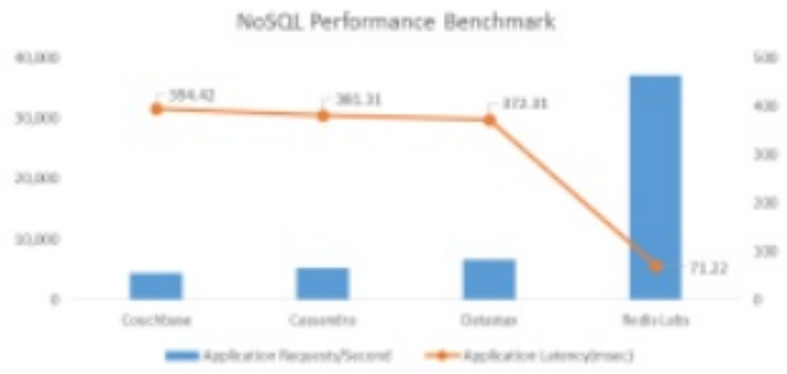


Redis^{e}

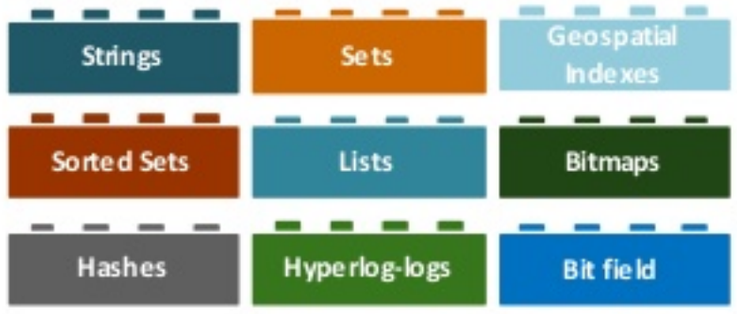
Cluster Architecture

- Shared nothing cluster architecture
  - Single node type for simple scalability
- Fully compatible with open source commands & data structures
  - Simply change your Redis application connection endpoint to Redis^{e}

Why Redis?



Performance



Simplicity
(through Data Structures)

Extensibility
(through Redis Modules)

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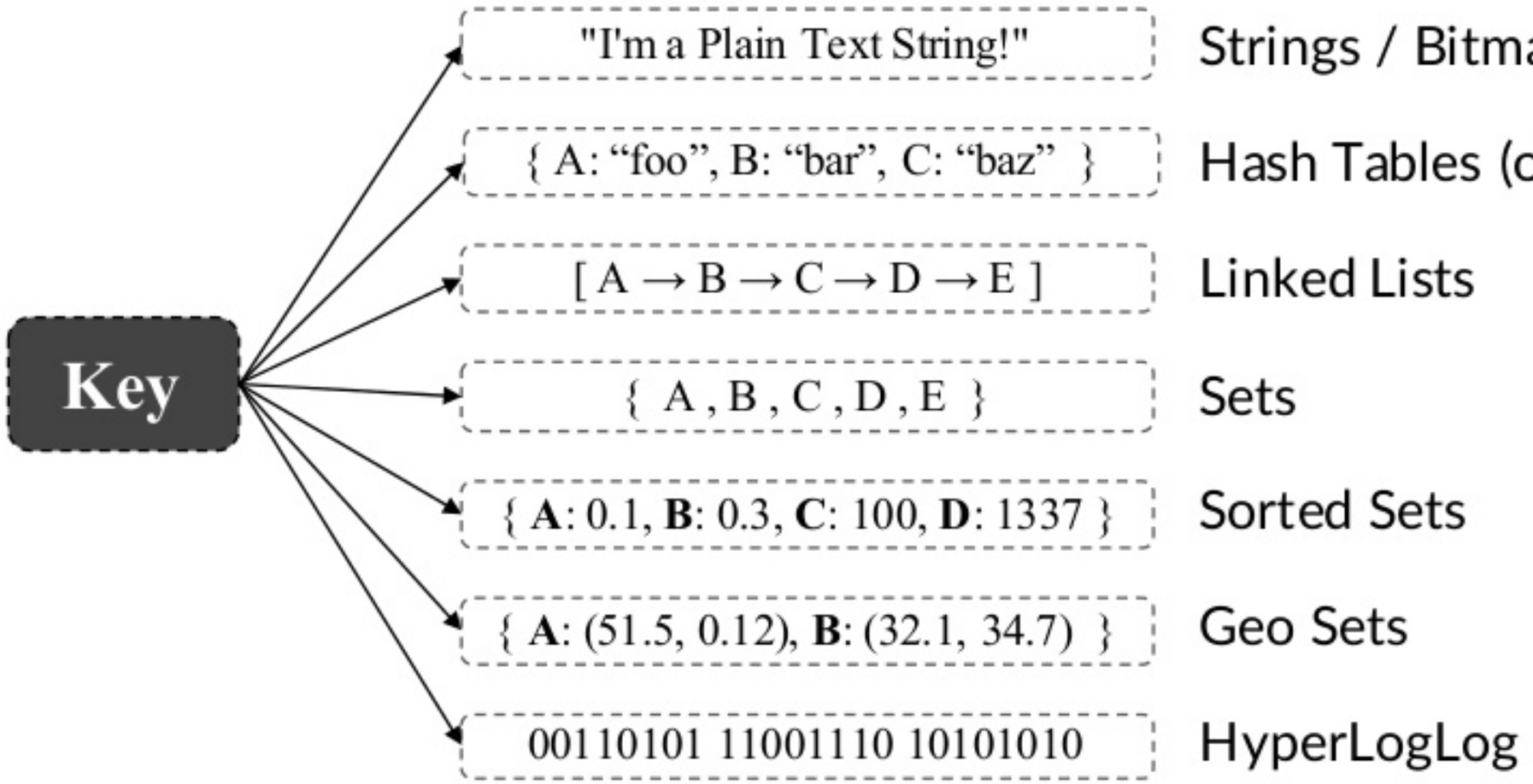
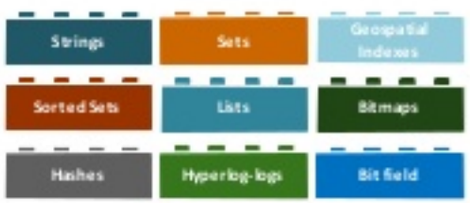
A Quick Lap Around Redis





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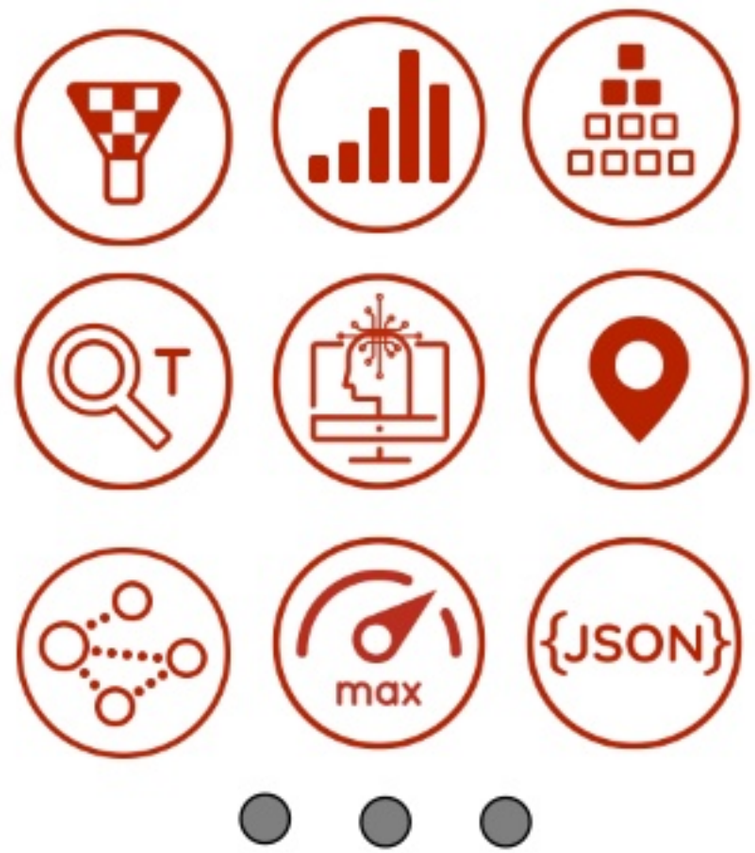
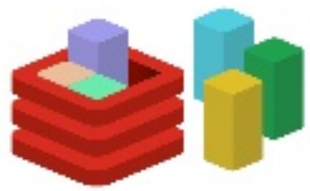
Modules : A Revolutionary Approach

- Native Extensibility in C, C++, Go, Python
  - Add your own structures & methods
- 50+ created so far
  - More on Next Slide...





Modules : A Revolutionary Approach

Adapt your database to your data, not the other way around

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 Wrapper	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

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Machine Learning with Redis

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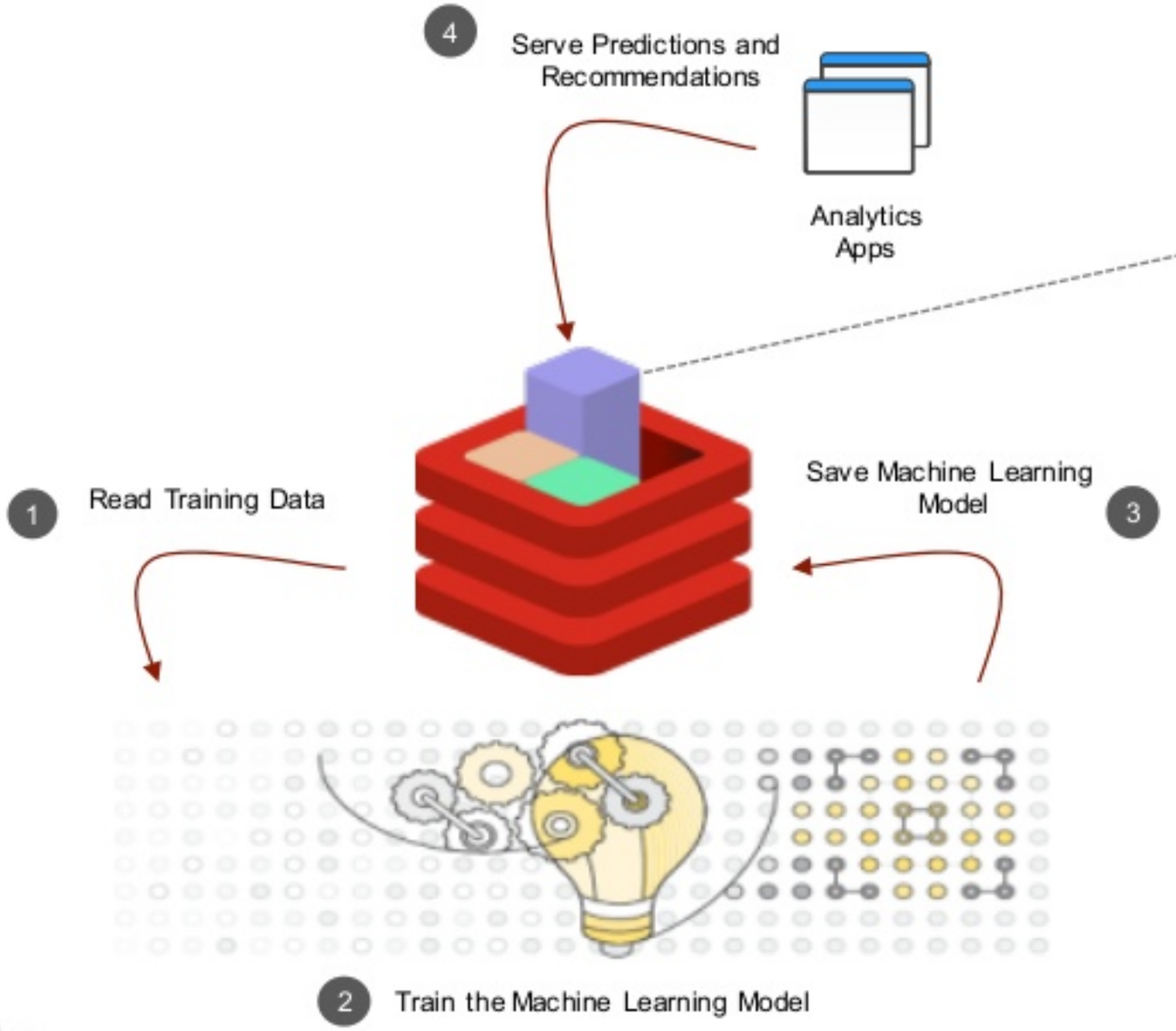
#1

Redis in Machine Learning



REDIS-ML

- Models can be stored, retrieved and updated natively with Redis-ML
- Accelerates predictions serving for complex ML model by x100
- Unified and simplified ML serving operation – HA, Scale, Perf and more

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Redis ML

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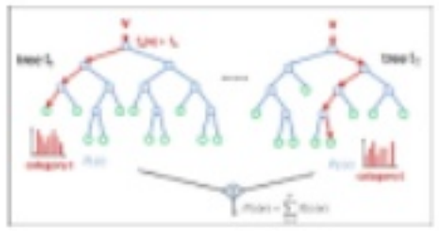
The Machine / Deep Learning (ML/DL) World

(2) Generate ML Model



(3) Serving the model

(1) Training

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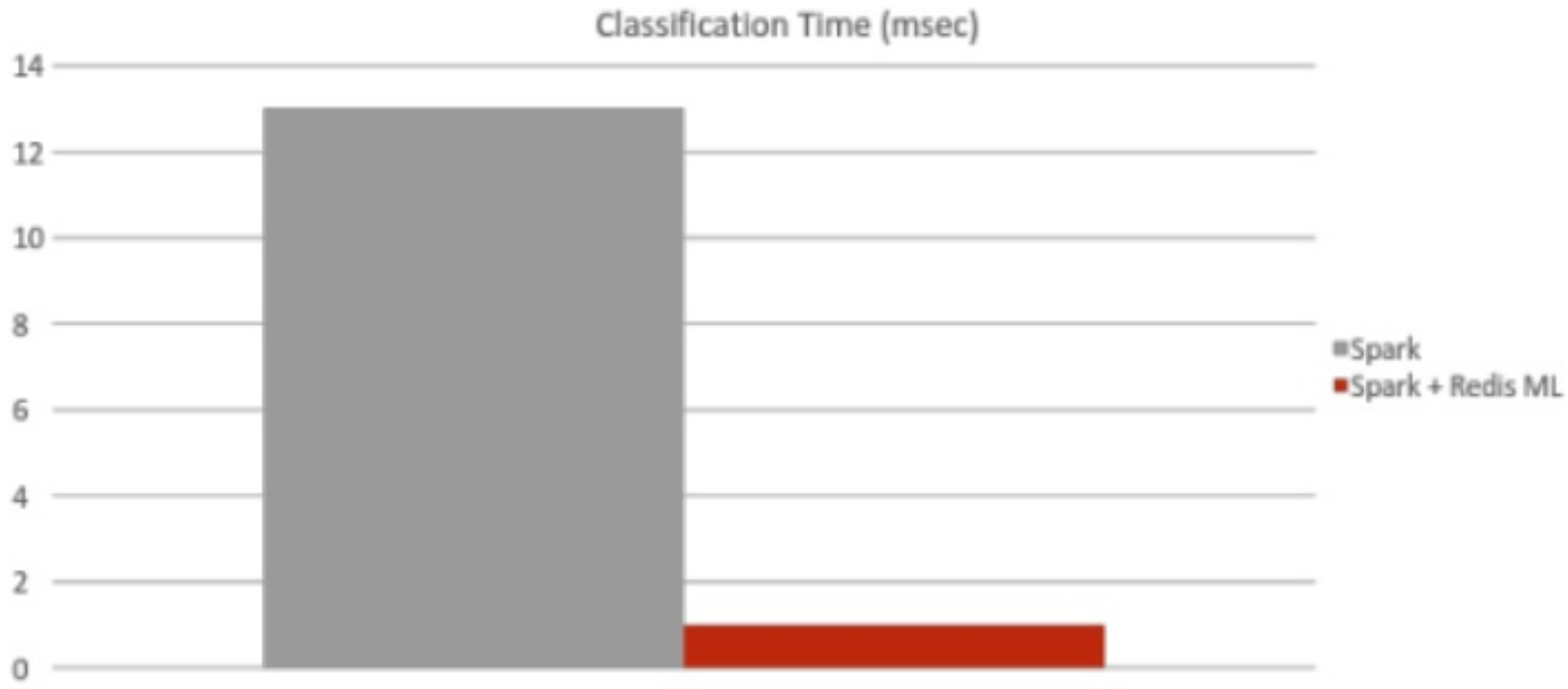
Redis ML with Spark ML

13x Faster

Classification Time Over Spark



Random Forest; 1,000 forests @ 15,000 trees

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Try it Yourself!

databricks Notebook:

http://bit.ly/sparkredisml

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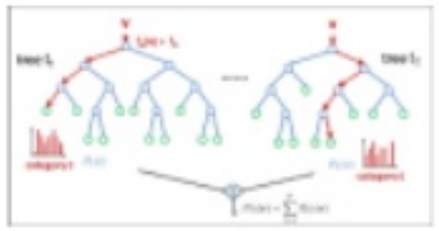
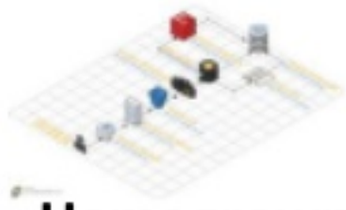
The Machine / Deep Learning (ML/DL) World

(2) Generate ML Model



(3) Serving the model

(1) Training



Homegrown

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ML Models Serving Challenges

- But then…
  1. ML Models are becoming bigger in size as they get more precise and complex!
  2. Serving recommendations in mission critical apps - Scaling, Performance, HA & DR…
  3. How do you manage multiple model types (Random Forest, Gradient Boosted Trees, Logistic Regression, etc.)
  4. How do you manage multiple versions of each model
  5. How do you upgrade a model across so many machines
  6. What if the training and serving apps are written in different languages
  7. And so on….

Homegrown

Real World Challenge

Ad Serving

- Need to serve 20,000 ads/sec @ 50msec data-center latency
- Runs 1k campaigns → 1K random forest
- Each forest has 15K trees
- On average each tree has 7 levels (depth)

Homegrown

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Large/Accurate Models are Expensive to Serve !

Item	Calculation	Total
Random Forest ops/sec	20K (ads/sec) x 1K (forests) x 15K(trees) x 7 x 0.5 (levels)	1.05 trillion ops/sec
Max ops/sec on the strongest AWS instance vcore	2.6Ghz x 0.9 (OS overhead) x 0.1 (10 lines of code per ops) x 0.1 (Java overhead)	23.4 million ops/sec
# of vcores needed	1.1 trillion / 23.4 million	44,872 vCores
# of c4.8xlarge instances needed	44,872 / 36	1,247 Instances
Total Cost in Reserved Instances	**1,247 x 9213**	**~$11.5M/year**

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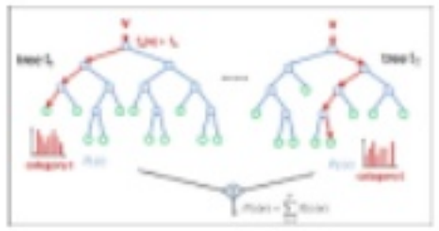
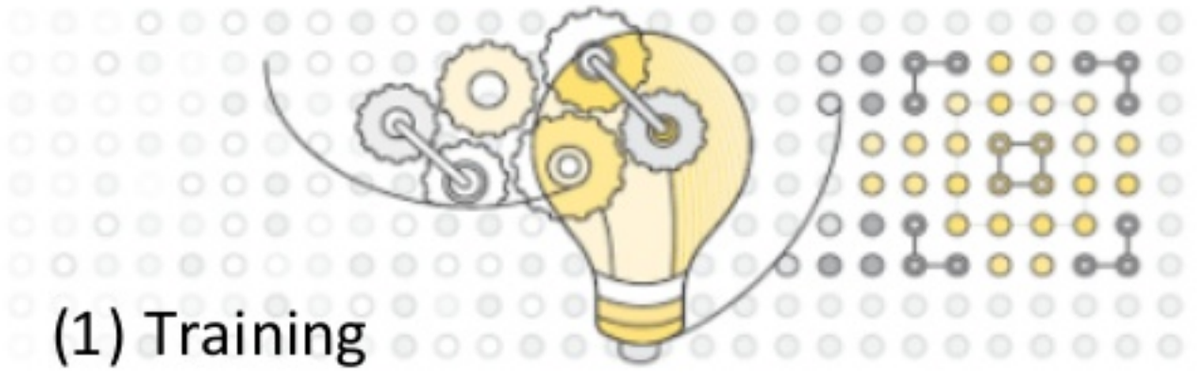
The Machine / Deep Learning (ML/DL) World

(2) Generate ML Model



(3) Serving the model

redis



(1) Training

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Ads Model Serving: Homegrown vs. Redis^{e} + ML

Cut computing infrastructure

by 97%

Homegrown

1,247 x c4.8xlarge

redis^{e}

35 x c4.8xlarge

More Details

- Catch the Video from Spark Summit 2017!

Building a Large Scale Recommendation Engine with Spark and Redis-ML

Shay Native – Redis Labs

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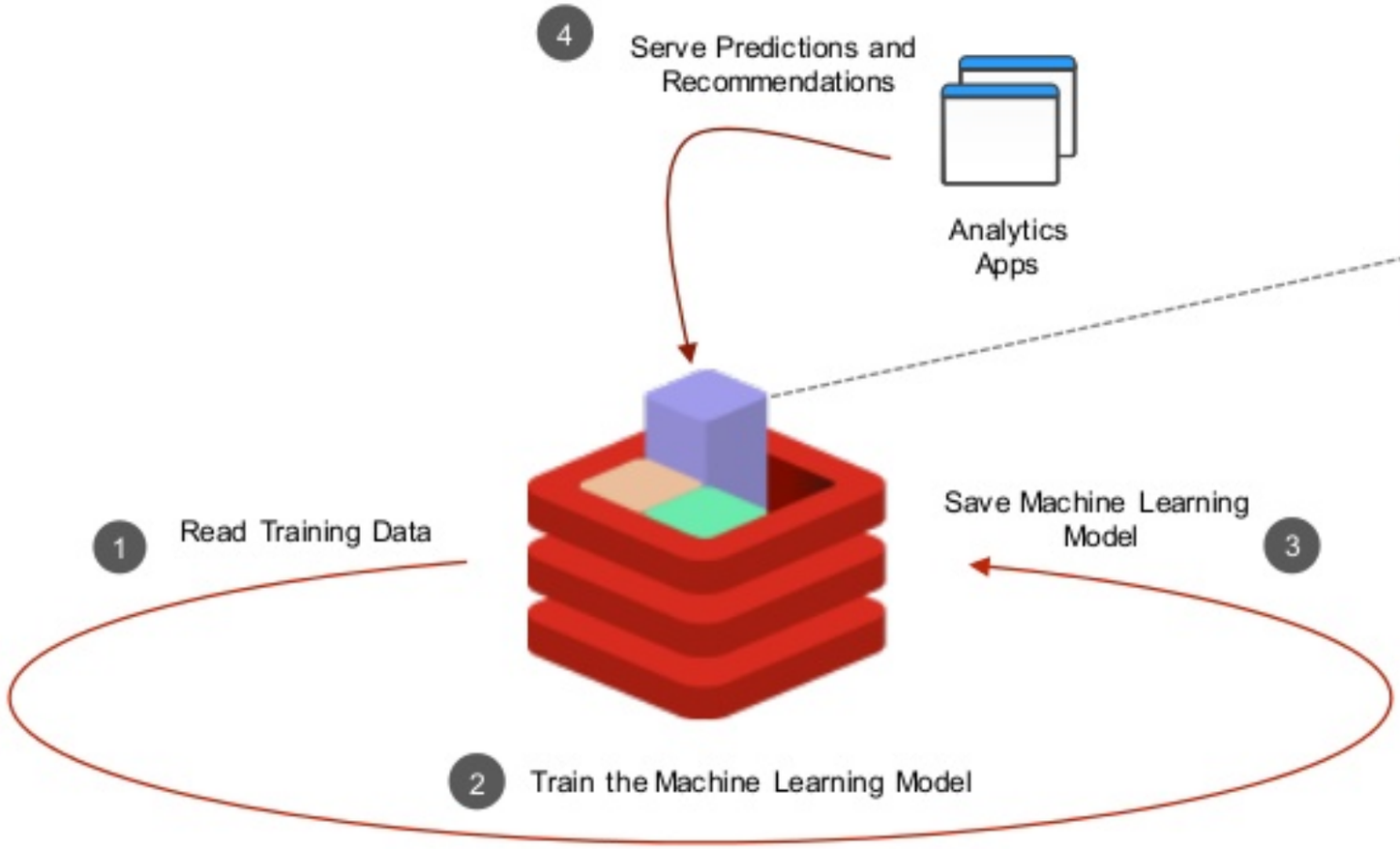
#2

Redis in Machine Learning



NEURAL REDIS

- Simple neural network as a native data type for Redis
- Training and classification in Redis with simple, intuitive APIs in real-time

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Neural Redis

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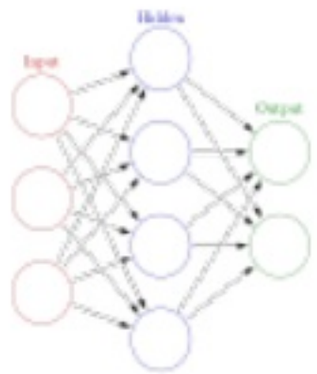
Neural Redis

- A very simple to use API.
- Automatic data normalization.
- Online training of neural networks in different threads.
- Ability to use the neural network while the system is training it (we train a copy and only later merge the weights).
- Fully connected neural networks using the RPROP (Resilient back propagation) learning algorithm.

Get Started!

```
> redis-server --loadmodule /path/to/neuralredis.so
```



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https://github.com/antirez/neural-redis


Surviving Titanic…
DEMO

Steps

- #1 Load "Titanic Survival" stats
  - Passenger Attributes

    [Class, Sex, Age, Travel companions – siblings, spouses, parents, children and Fare price]

```
NR.CREATE mynet CLASSIFIER 9 15 -> 2 DATASET 1000 TEST 500 NORMALIZE
NR.OBSERVE mynet …
```

- #2 Train

  Training done in memory, in real-time…

```
NR.TRAIN mynet AUTOSTOP
```

- #3 Predict Survival on Titanic

  First Class Passenger [1 0 0], Female [0 1], Age [30], No Companion [0 0], Fare Price [200]

```
NR.RUN mynet 1 0 0 0 1 30 0 0 200
> % Chance of Death
> % Chance of Survival
```

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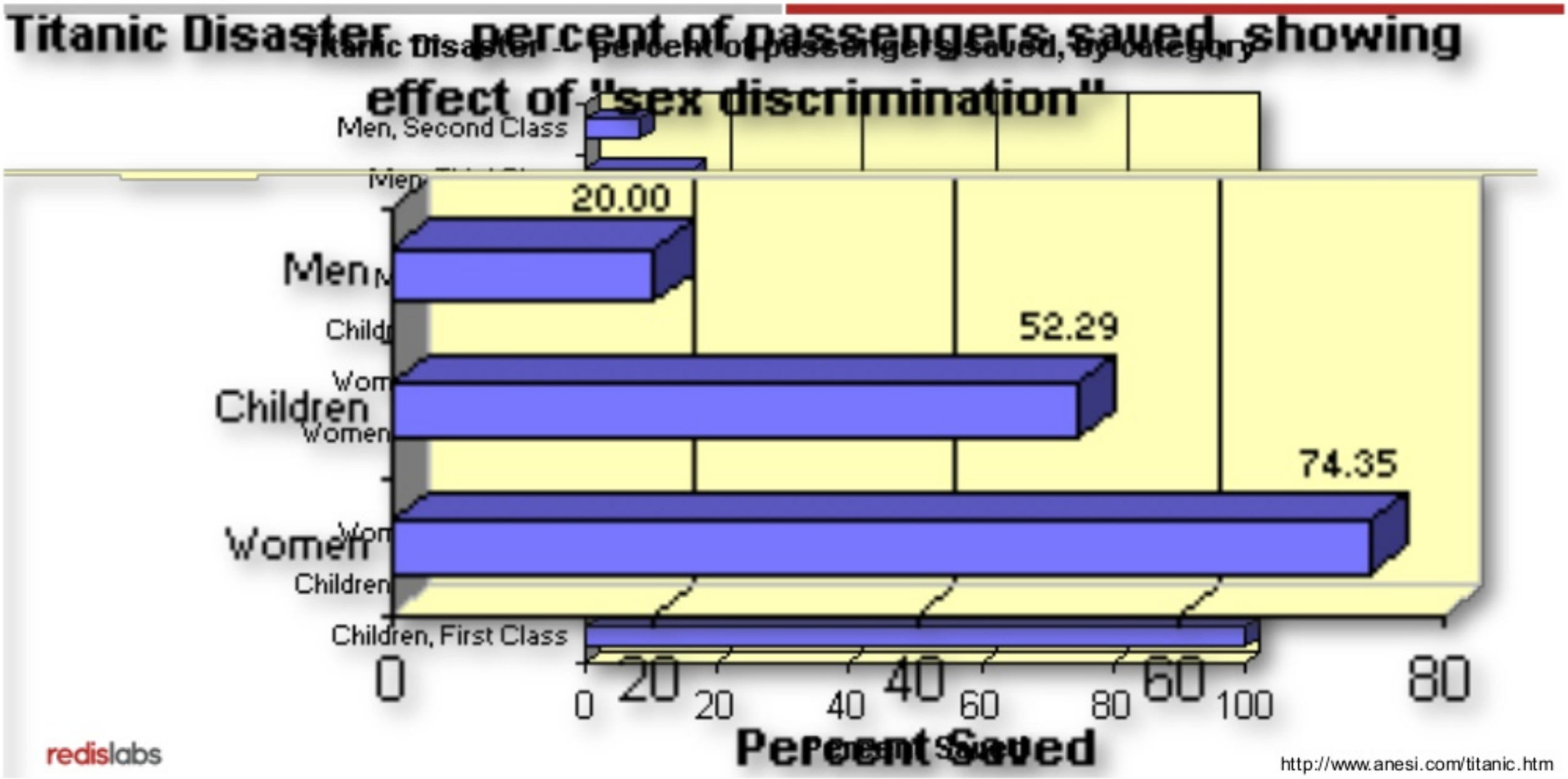
Real Survival Rates on Titanic!



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http://www.anesi.com/titanic.htm


Surviving Titanic…
DEMO

Agenda

- Intro to Redis and Redis Labs
- Real-time Analytics with Redis
- Deep Dive into Real-time Machine Learning with Redis
- QA

Thank You!

Resources

- **Getting Started with Redis and Redis^{e}**
  - https://hub.docker.com/r/redislabs/redis/

- **Getting Started with Redis and Machine Learning**
  - https://redislabs.com/modules/machine-learning/

- **Other Resources**
  - Redis-ML : https://github.com/RedisLabsModules/redis-ml
  - Spark-Redis-ML : https://github.com/RedisLabs/spark-redis-ml
  - Neural Redis : https://github.com/antirez/neural-redis
  - Databricks Notebook – Spark & Redis : http://bit.ly/sparkredisml

Q&A