Redis Modules TL;DR

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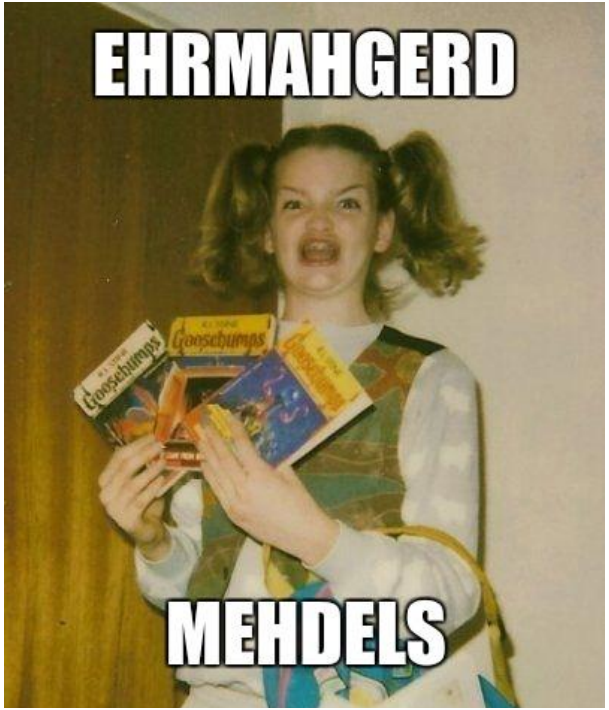
So… Modules, huh?

- I’ve been waiting 6 years
- Will change Redis forever IMO
- The key is the API concept



What Modules Actually Are

- Dynamically loaded libraries into redis
- Extend redis with new commands
- Written in C (C++ if you really insist)
- Using a C API designed to isolate redis internals

The Race For JS Modules is ON!

Atwood's Law

Any application that *can* be written in JavaScript, *will* eventually be written in JavaScript.

What Modules Can't Do (YET)

- Register new data structures *
- Override existing commands *
- Block
- Not the entire API of redis is accessible directly
- All Coming Soon

** Not completely true!*

Modules in Action

```
127.0.0.1:9875> MODULE LOAD example.so
OK
127.0.0.1:9875> HSET foo bar baz
(integer) 1
127.0.0.1:9875> HGETSET foo bar w00t!
"baz"
127.0.0.1:9875> HGETSET foo bar wat?
"w00t!"
```

The Main API Layers

High Level API	• Generic RedisCall • Basically Lua on steroids
Operational API	• Compose responses, examine call replies • Memory Management
Low Level API	• Selected parts of redis commands (L*, Z*) • String DMA

Main Building Blocks

RedisModuleString*	RedisModuleCallReply*	RedisModuleKey*
Memory managed strings for the module Opaque to the developer Args and replies	Returned from most calls Like the protocol can be: ● Strings ● Arrays ● Integers ● Errors ● Null	References to keys we are working with, mainly for the lower level API Acquired with Open Released automatically or with Close

RedisModuleCtx *

- Redis' execution context for a command
- Opaque to the module developer
- Passed to most functions
- Behind the scenes manages resources
  - Allocated Objects
  - Opened Keys
  - Automatic free at exit

High Level API

```
RedisModuleCallReply *rep =
RedisModule_Call(ctx,
                 "HGET",
                 "cl",
                 "foo",
                 1337);
```

High Level API

- More or less like LUA's API
- Generic **RedisModule_Call**
- Examine replies with **RedisModule_CallReplyType**
- Reply to the client with **RedisModule_ReplyWith***
- Slower than lower level API, but flexible

Low Level API

- MUCH faster

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- List push/pop
- Expire
- More to come!

String DMA

- Use Redis strings as raw memory
- Zero Copy Overhead
- Resize strings with **RedisModule_Truncate**
- BYODS - Bring Your Own Data Structure

Shameless Plug: RedisModulesSDK

- Basic Module Template
- Complete Documentation
- Automating Boring Stuff
  - Argument Parsing
  - String Manipulation
  - Response Validation
  - Testing

https://github.com/RedisLabs/RedisModulesSDK

Let's Make a Module!

```
HGETSET <key> <element> <newval>
```

Step 1: Command Handler

```
#include "redismodule.h"

/* HGETSET <key> <element> <value> */
int HGetSetCmd(RedisModuleCtx *ctx,
               RedisModuleString **argv, int argc) {

    return REDISMODULE_OK;
}
```

Step 2: validate args

```
/* HGETSET <key> <element> <value> */
int HGetSetCmd(RedisModuleCtx *ctx, RedisModuleString
**argv, int argc) {
    if (argc != 4) {
        return RedisModule_WrongArity(ctx);
    }

    return REDISMODULE_OK;
}
```

Step 3: Auto Memory

```
/* HGETSET <key> <element> <value> */
int HGetSetCmd(RedisModuleCtx *ctx, RedisModuleString
**argv, int argc) {
    if (argc != 4) {
        return RedisModule_WrongArity(ctx);
    }

    RedisModule_AutoMemory(ctx);
    return REDISMODULE_OK;
}
```

Step 4: Making Calls!

```
/* HGETSET <key> <element> <value> */
int HGetSetCmd(RedisModuleCtx *ctx, RedisModuleString
**argv, int argc) {
    ...
    RedisModuleCallReply *rep = RedisModule_Call(ctx,
        "HGET", "ss", argv[1], argv[2]);

    RMUTIL_ASSERT_NOERROR(rep)
    ...
}
```

Step 4: MOAR CALLZ PLZ

```
/* HGETSET <key> <element> <value> */
int HGetSetCmd(RedisModuleCtx *ctx, RedisModuleString
**argv, int argc) {
    ...
    RedisModuleCallReply *srep = RedisModule_Call(ctx,
        "HSET", "sss", argv[1], argv[2], argv[3]);
    REDIS_ASSERT_NOERROR(srep)

    return REDISMODULE_OK;
}
```

Step 5: Returning a reply

```
/* HGETSET <key> <element> <value> */
int HGetSetCmd(RedisModuleCtx *ctx, RedisModuleString
**argv, int argc) {
    …

    RedisModule_ReplyWithCallReply(ctx, rep);

    return REDISMODULE_OK;
}
```

Step 6: Initializing

```
int RedisModule_OnLoad(RedisModuleCtx *ctx) {

    if (RedisModule_Init(ctx,"EXAMPLE",1,REDISMODULE_APIVER_1)
        == REDISMODULE_ERR) return REDISMODULE_ERR;

    if (RedisModule_CreateCmd(ctx,"HGETSET",
        HGetSetCommand, "write", 1, 1, 1) == REDISMODULE_ERR)
        return REDISMODULE_ERR;

    return REDISMODULE_OK;
}
```

Step 6: Initializing

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        HGetSetCommand, "write", 1, 1, 1) == REDISMODULE_ERR)
        return REDISMODULE_ERR;

    return REDISMODULE_OK;
}
```

Building and Makefile

- No special Linking required
- Just **#include “redismodule.h”**

```
CFLAGS =  -Wall -fPIC
LDFLAGS = -shared -Bsymbolic -lc

module.so: module.o
    $(LD) -o $@ module.o $(LDFLAGS)
```

IT WORKS!

```
127.0.0.1:9875> MODULE LOAD example.so
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"w00t!"
```

ENDLESS POSSIBILITIES

The Low Level API

Low Level API: Example

```
/* ZSUMRANGE <key> <startscore> <endscore> */
int ZsumRange_RedisCommand(RedisModuleCtx *ctx,
RedisModuleString **argv, int argc) {

    return REDISMODULE_OK;

}
```

Low Level API: Read Arguments

```
int ZsumRange_RedisCommand(...) {
    double min, max;
    double sum = 0;

    if (MUtil_ParseArgs(argv, argc, 2, "dd", &min, &max)
        != REDISMODULE_OK) {
        RedisModule_WrongArity(ctx);
    }
    ...
}
```

Low Level API: Open The Key

```
int ZsumRange_RedisCommand(...) {
    ...
    RedisModuleKey *k =
        RedisModule_OpenKey(ctx, argv[1], REDISMODULE_READ);

    if (RedisModule_KeyType(k) != REDISMODULE_KEYTYPE_ZSET){
        return RedisModule_ReplyWithError(...);
    }

}
```

Low Level API: Iterate ZSET

```
int ZsumRange_RedisCommand(...) {
    ...
    // Open The iterator
    RedisModule_ZsetFirstInScoreRange(k, min, max, 0, 0);

    while(!RedisModule_ZsetRangeEndReached(k)) {
        ...
        RedisModule_ZsetRangeNext(k);
    }
    RedisModule_ZsetRangeStop(k);
```

Low Level API: Read Iterator Values

```
while(!RedisModule_ZsetRangeEndReached(k)) {

    double score;
    RedisModuleString *ele =
        RedisModule_ZsetRangeCurrentElement(k, &score);

    RedisModule_FreeString(ctx, ele);
    sum += score;
    RedisModule_ZsetRangeNext(k);

}
```

Low Level API: Return the value

```
/* ZSUMRANGE key startscore endscore */
int ZsumRange_RedisCommand(RedisModuleCtx *ctx,
    RedisModuleString **argv, int argc) {
    ...

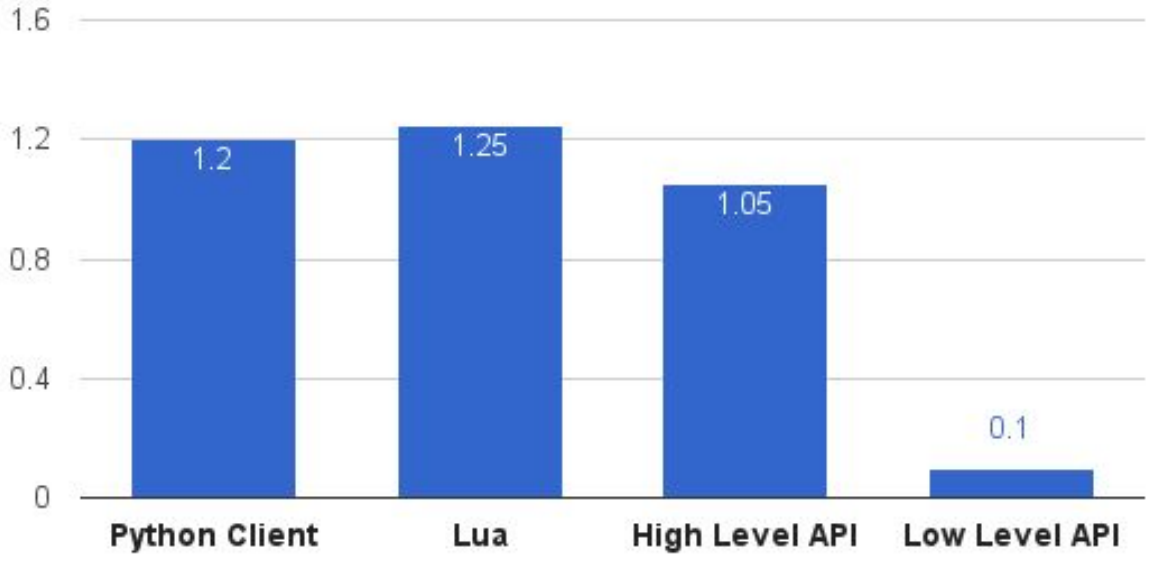
    RedisModule_CloseKey(key);
    RedisModule_ReplyWithDouble(ctx, sum);

    return REDISMODULE_OK;
}
```

A Little Benchmark

- Sum the scores of 1,000,000 ZSET Elements
- Python client, Lua script, High/Low Level Modules
- Low Level API uses iterators
- The rest use ZRANGEBYSCORE

Benchmark: Results (seconds)



KTHXBAI!

redisconf
2016