Swift on Server: Are we There Yet?

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try! Swift NYC 2018

Motivation

- Decide on framework/language for new project
- Focus on product - not tools
- Investigate Swift

So, Is Swift on Server There Yet?

It Depends.

Goals of This Talk

- Things to consider when building a server app
- What Swift is good at
- Help you decide whether you want to use Swift on the server
- Constructive criticism
- Lots of non technical reasons - not the focus

Things to consider when building a server app

Storage

- Relational database?
  - What level of abstraction will I be using?
  - How will I handle schema migrations?
- Document store?
- Columnar store?

Load Profile

- Large number of quick requests? (Web APIs)
- Large number of open connections with low activity? (IMAP)
- Lower number of slow requests (reporting)
- SLAs?
  - Requests per second
  - 90th percentile response time

Deployment

- How messy is it to deploy?
- Docker is not a panacea
- More components => more things that can fail

Logging / Monitoring

- How am I going to debug in production?
- How can I tell if something is wrong?
- What metrics am I going to monitor?

Swift Frameworks

Kitura

Vapor

What Swift Excels At

No Garbage Collection

- Garbage collection on a server is usually not a problem
- … Until it is
- For GC to be effective you need “free” memory
- Pause the world is still a problem
- ARC is low overhead, predictable

Value Types

- Concurrency is required on server
- Shared mutable state 😭
- Shared immutable state 🙂
- Value types 😁

Performance - JSON

Language	Framework	Average Latency (ms)
Swift	Vapor	1.4
Swift	Kitura	2
Java	Play	6.2
Python	Django	9.3

Source: https://www.techempower.com/benchmarks/

Performance - JSON

Language	Framework	Responses/ Second	% Drop-off
Java	Play	24,906	0%
Swift	Vapor	23,190	7%
Swift	Kitura	20,637	17%
Python	Django	13,924	44%

Source: https://www.techempower.com/benchmarks/

Performance - DB Query

Language	Framework	Average Latency (ms)
Swift	Kitura	6.7
Java	Play	9.9
Python	Django	17.6

Source: https://www.techempower.com/benchmarks/

Performance - DB Query

Language	Framework	Responses/ Second	% Drop-off
Java	Play 2	12,929	0%
Swift	Kitura	9,487	27%
Python	Django	4,039	69%

Source: https://www.techempower.com/benchmarks/

Memory Footprint

Language	Framework	Memory (GB)
Swift	Kitura	0.8
Python	Django	1
Java	Play	1.8

CPU Usage

Language	Framework	CPU Usage (%)
Java	Play	65%
Swift	Kitura	67%
Python	Django	83%

Problems With Swift

Errors

- In Java/Python/Ruby, say you have a NullPointerException
- Kills that request, returns a 500
- Other in-flight requests are not impacted
- Not the case in Swift - have to be extremely careful

Crashes

```
vapor: Server starting on http://0.0.0.0:8080
vapor: Illegal instruction (core dumped)
```

Concurrency

Problems With Swift Frameworks

Logging / Monitoring

- No standard logging API (i.e. SLF4J, structlog/logging, etc.)
- Framework specific logging is not versatile
  - No MDC/TLC
  - Only stdout
- Missing monitoring similar to CodaHale's Metrics

MDC

- Mapped Diagnostic Context
- Build up a context as you go

```
protocol MDC {
    static func put(key: String, value: String)
    static func get(key: String) -> String?
    static func remove(key: String)
    static func clear()
}
```

MDC

```
func handleRequest(_ request: Request) {
    if let userAgent = request.headers["UserAgent"] {
        MDC.put(key: "userAgent", value: userAgent)
    }
    // ...
}
```

MDC

```
func handleRequest(_ request: Request) {
    if let userAgent = request.headers["UserAgent"] {
        MDC.put(key: "userAgent", value: userAgent)
    }
    // ...
}

func authenticateRequest(_ request : Request) {
    if let authHeader = request.headers["Authentication"] {
        let userId = getUserId(authHeader: authHeader)
        MDC.put(key: "userId", value: userId)
    }
    // ...
}
```

MDC

```
func handleRequest(_ request: Request) {
    if let userAgent = request.headers["UserAgent"] {
        MDC.put(key: "userAgent", value: userAgent)
    }
    // ...
}

func authenticateRequest(_ request : Request) {
    if let authHeader = request.headers["Authentication"] {
        let userId = getUserId(authHeader: authHeader)
        MDC.put(key: "userId", value: userId)
    }
    // ...
}

func sendEmail(_ email: Email) {
    // ...
    logger.info("Sent email")
    // ..
}
```

MDC

```
[start event]
timestamp=2018-03-06T16:02:08,253+05:30
thread=ratpack-compute-1-2
level=INFO
logger=com.surya.timetrackerws.logging.TTWSRequestLogger
mdc={clientIP=Unknown, method=POST, msDB=28, msRequest=2358, numDB=2,
path=v1/requestPasswordReset, queryParams=,
requestId=0b745755-dfee-4ba1-b5b6-9c96a085c0d5,
statusCode=200, userAgent=python-requests/2.18.4}
message=Response sent
[end event]
```

Code Sharing

- Not able to share much code between iOS and server
- DB libraries are different
- Networking libraries are different
- Business logic often intricately tied to both

Missing Libraries

- Reading/writing Microsoft Office files
- Image manipulation

Tooling

- Xcode 👍
- Swift PM 👍
- Xcode + Swift PM 👎
- Need to debug on Linux
- Xcode has no good way of doing this
- Official Swift binaries only available for Ubuntu

Summary

- Things to consider when building a server app
- What Swift is good at
  - No garbage collection
  - Value types
  - Performance
  - Resource usage
- Areas where Swift could be better

Thank You!