# Adopting gRPC at Spotify


@mattgruter

2019-02-06

# “Developers don’t care about new RPC technologies”

*-- someone at KubeCon 2018*

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# Why?

Why are we doing this?

# What?

What do we get out of this?

# How?

How do we get there?

# Spotify's Infrastructure

~2500 services

~1000 developers

~250 teams

Java, Python, ...

# Hermes

Not this Hermes!

# Hermes

But this

# Hermes

Written in 2012

Based on ZeroMQ

JSON or protobuf payload

Not a RPC framework

# Hermes works!

# Why Change?

# Hermes Ecosystem

# 404 Not Found

# From NIH to OSS

# Why gRPC?


CLOUD NATIVE
imgflip.com

https://www.cncf.io

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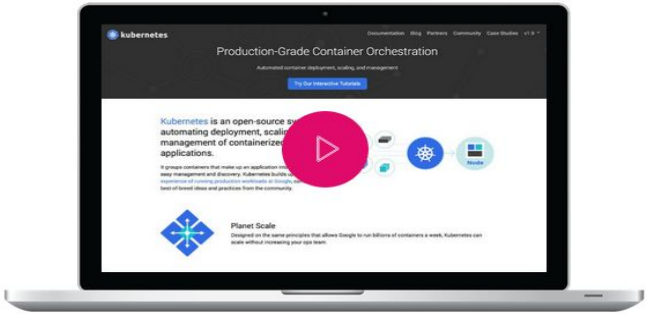
# Projects

We host and nurture components of cloud native software stacks, including Kubernetes, Prometheus and Envoy. Kubernetes and other CNCF projects are some of the **highest velocity projects** in the history of open source. We are regularly adding new projects to better support a full stack cloud native environment.

kubernetes Prometheus OPENTRACING fluentd GRPC rkt CNI envoy JAEGER NATS LINKERD HELM




## kubernetes

Kubernetes is the world's most popular container-orchestration platform and the first CNCF project. Kubernetes helps users build, scale and manage modern applications and their dynamic lifecycles. First developed at Google, Kubernetes now counts more than 2,300 contributors and is used by some of the world's most-innovative companies, across a wide range of industries. The cluster scheduler capability lets developers build cloud native applications, while focusing on code rather than ops. Kubernetes future-proofs application development and infrastructure management on-premises or in the cloud, without vendor or cloud-provider lock-in.

VISIT PROJECT WEBSITE

# gRPC

1. HTTP/2 based
2. Binary protocol
3. Strongly typed service and message definition (Protobuf)
4. Encryption

# The gRPC Advantage

# The Proto

# Code Generation

Java, Golang, Python, Ruby,
Dart, PHP, Node.js,
Objective-C, C#, C++

# Protobuf

```
syntax = "proto3";

package spotify.metadata.v1;

option java_package = "com.spotify.metadata.v1"
option java_multiple_files = true;
option java_outer_classname = "MetadataProto";

// Interface exported by the server.
service Metadata {
 rpc GetMetadata(SongId) returns (SongMetadata) {}
}

message SongId {
 int32 id = 1;
}

message SongMetadata {
 int32 id = 1;
 string name = 2;
 string artist = 3;
 string album = 4;
}
```

# Server Logic (Java)

```java
public class MetadataService extends MetadataGrpc.MetadataImplBase {

   // [...]

   @Override
   public void getMetadata(SongId songId,
                           StreamObserver<SongMetadata> response) {
       LOG.info("Received getMetadata request");
       response.onNext(store.searchMetadata(songId)
               .orElse(EMPTY_METADATA));
       response.onCompleted();
   }

}
```

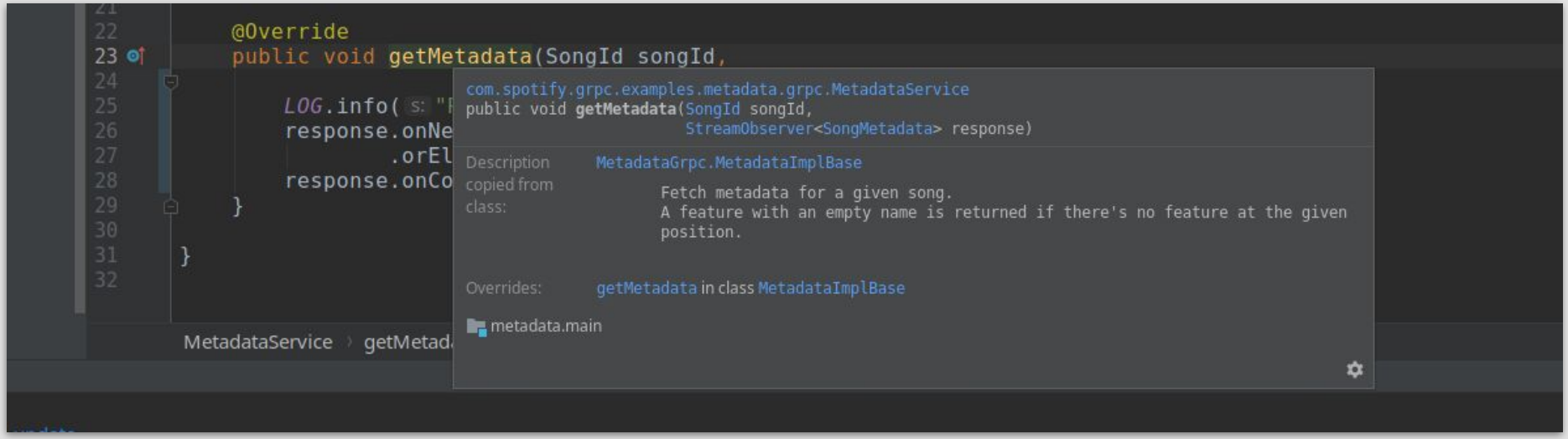
# Polyglot client impl.

```go
func main() {
    ctx, cancel := context.WithTimeout(
        context.Background(), time.Second)
    defer cancel()
     )

     conn, err := grpc.Dial("nls://metadata")
     if err != nil {
         log.Fatalf("couldn't connect to grpc server: %v", err)

     }
     defer conn.Close()

     client := pb.NewMetadataServiceClient(conn)
     r, err := client.Metdata(ctx,
         &pb.SongId{
             Id: "42"
         },
     )
     if err != nil {
         log.Printf("metadata request failed: %v\n", err)
         return
     }
     fmt.Println(r.Response)
}
```


@Override
public void getMetadata(SongId songId,
LOG.info( s: "
response.onNe
.orEl
response.onCo
}
}
MetadataService
getMetad
com.spotify.grpc.examples.metadata.grpc.MetadataService
public void getMetadata(SongId songId,
StreamObserver<SongMetadata> response)
Description copied from class:
MetadataGrpc.MetadataImplBase
Fetch metadata for a given song.
A feature with an empty name is returned if there's no feature at the given position.
Overrides:
getMetadata in class MetadataImplBase
metadata.main

# Schema Management

1. Embrace the **proto**

2. Shared repo for all **protos**

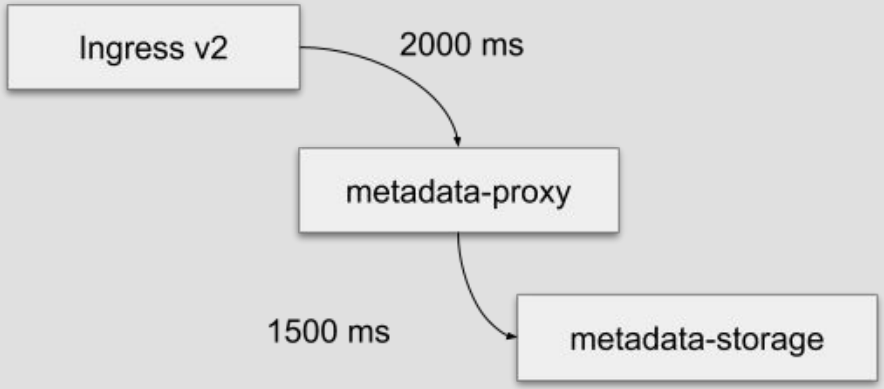
3. Version on the **proto** level

# Schema Management

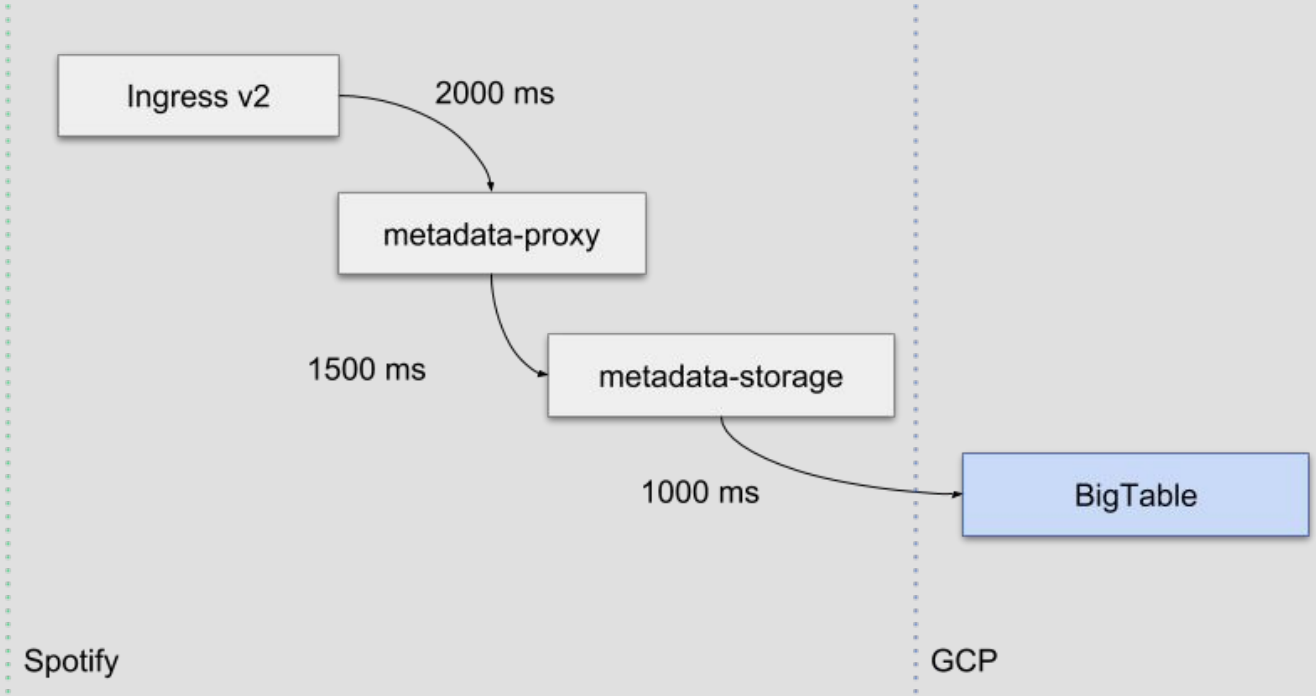
`github.com/uber/prototool`

# Resiliency

# Deadlines



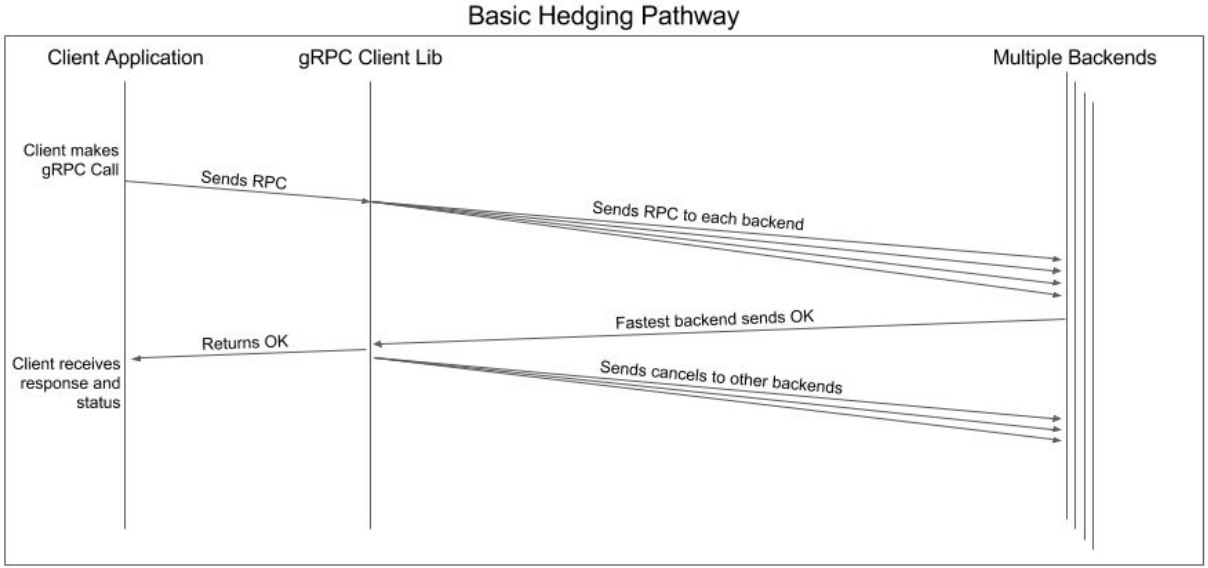
# A common RPC


Ingress v2
2000 ms
metadata-proxy
1500 ms
metadata-storage
1000 ms
BigTable
Spotify
GCP

# Retries

- Transparent
- Configurable

# Hedging


Basic Hedging Pathway
Client Application
gRPC Client Lib
Multiple Backends
Client makes gRPC Call
Sends RPC
Sends RPC to each backend
Fastest backend sends OK
Returns OK
Client receives response and status
Sends cancels to other backends

# Thundering Herd

# Retry throttling

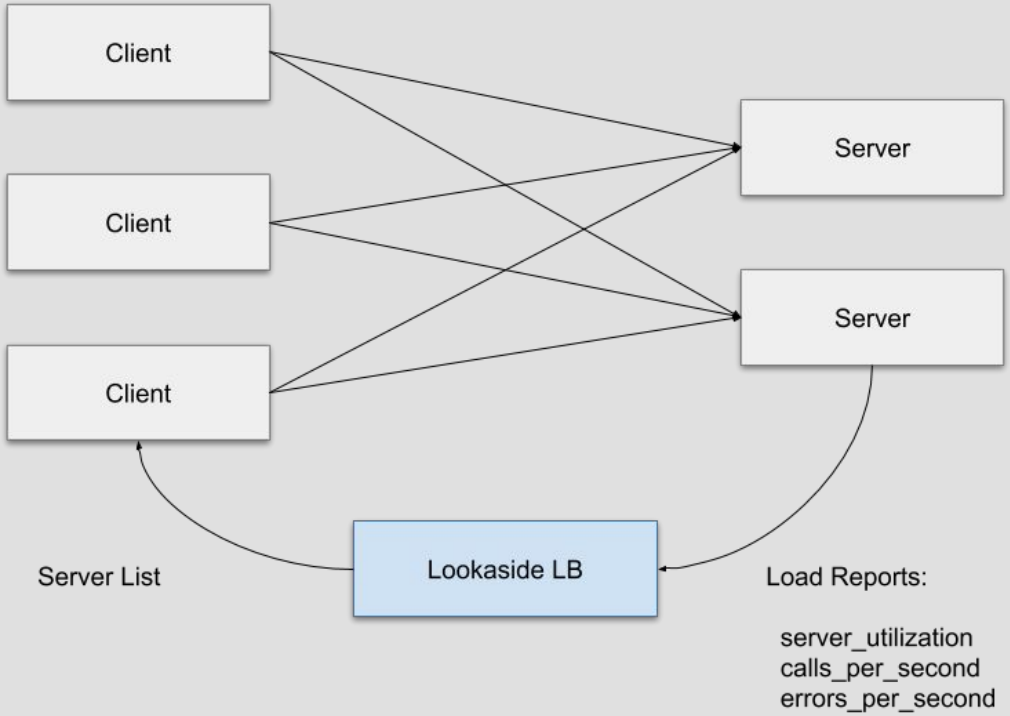
# Load Balancing & Routing

# Load Balancing

- Client-side
- Proxy
- Lookaside

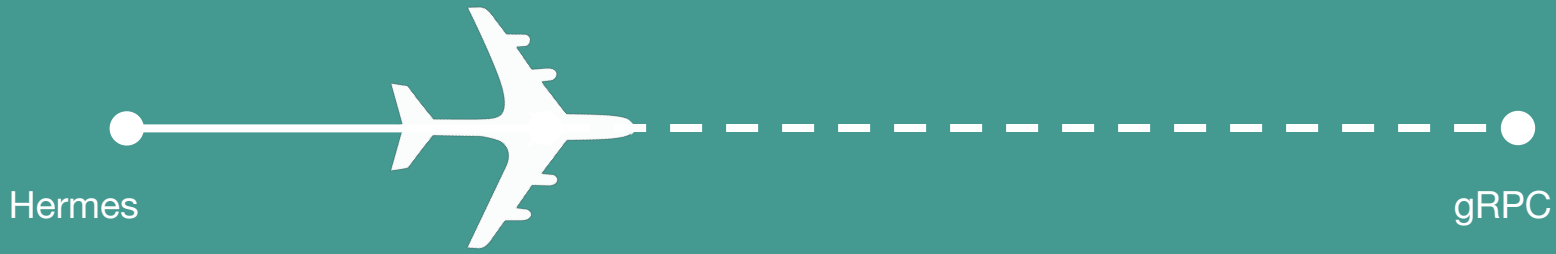
# Load Balancing

## lookaside



# How to Migrate?

# Our Journey



# Stats

2874 Services

1341 HTTP

983 Hermes

76 gRPC

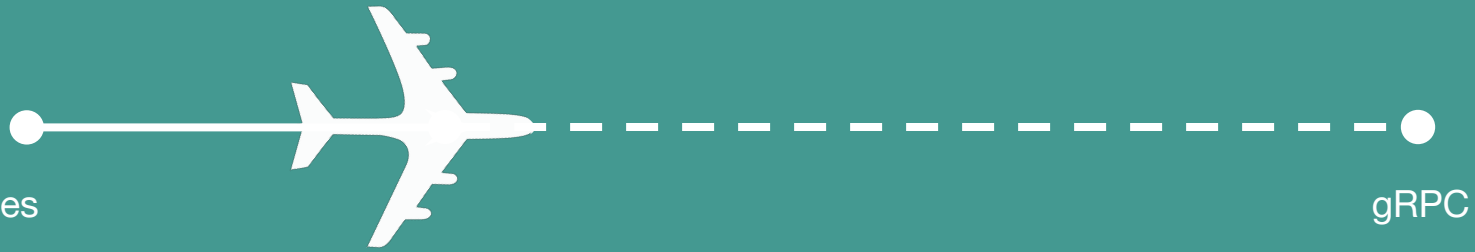
# Our Journey

80 services

Distance Travelled

900 services

Remaining Distance to Destination



Hermes

gRPC

# Challenge #1

# Change is hard

# 1. Don’t force it!

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`code generation`

# 1. Don’t force it!

Resiliency patterns

code generation

# 1. Don’t force it!

Tracing

Resiliency patterns

code generation

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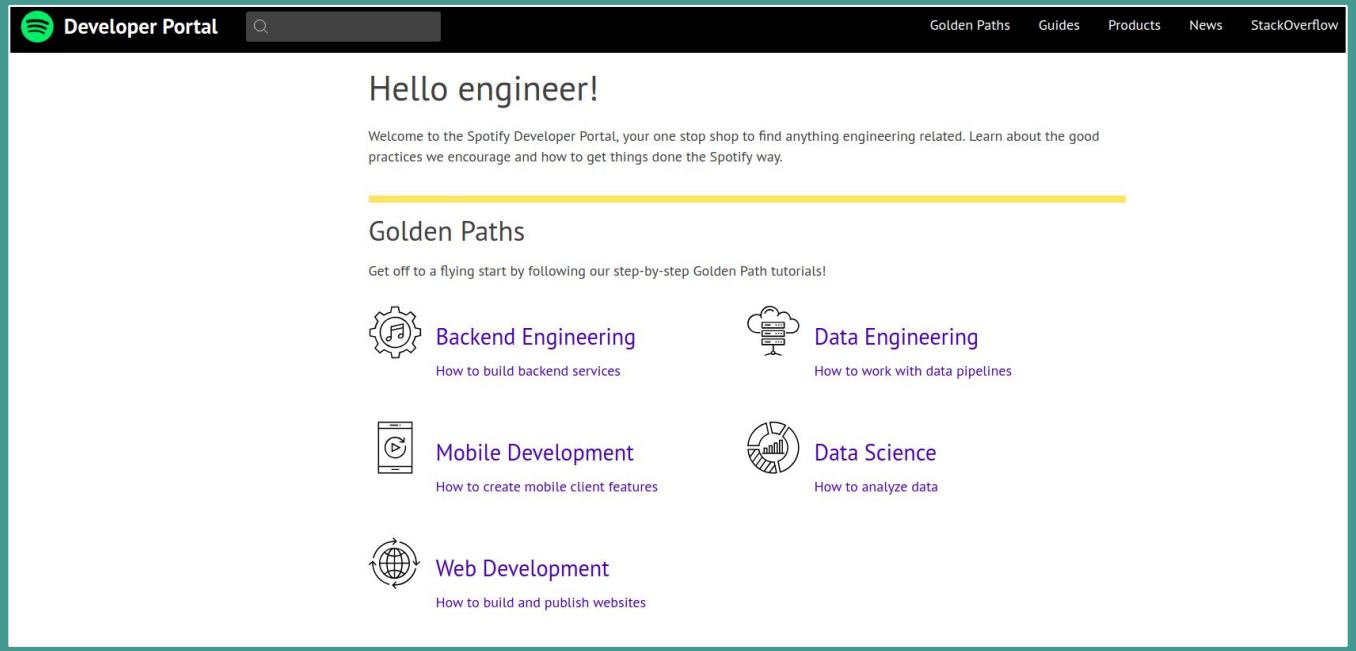
Tracing

Resiliency patterns

Istio

code generation

# 2. Make the Right Choice the Easy Choice



# 3. Unblock & Decouple

9:06 AM **dzolo** check it out, metadata-proxy on a VM in "production":

```
$ grpcurl -max-time 1 -plaintext -d '{"requests": {"kind": 1, "gid":"[redacted]"}}' [redacted]
metadataproxy[redacted] spotify.metadata.service.Metadata/GetEntities
{
  "responses": [
    {
      "entity": {
        "track": {
          "gid": [redacted]
          "name": "Never Gonna Give You Up",
          "album": {
            "gid": [redacted]
            "name": "The Best Of",
            "artist": [
              {
                "gid": [redacted]
                "name": "Rick Astley",
                "localized_name": [
...
```

🎉 3

9:16 AM **villes** 🥳

# Challenge #2

# Yet another protocol

# Never-ending migration


gRPC

# Step by step

1. Add a new gRPC API
2. Move clients to new API
3. Remove old API

# Step by step

1. Add a new gRPC API
2. Move clients to new API
3. Remove old API

# Challenge #3

# Developer experience

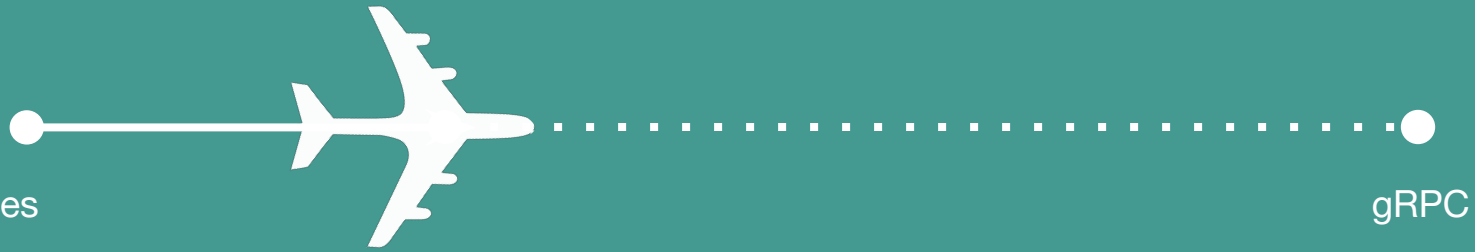
# Our Journey

80 services

Distance Travelled

900 services

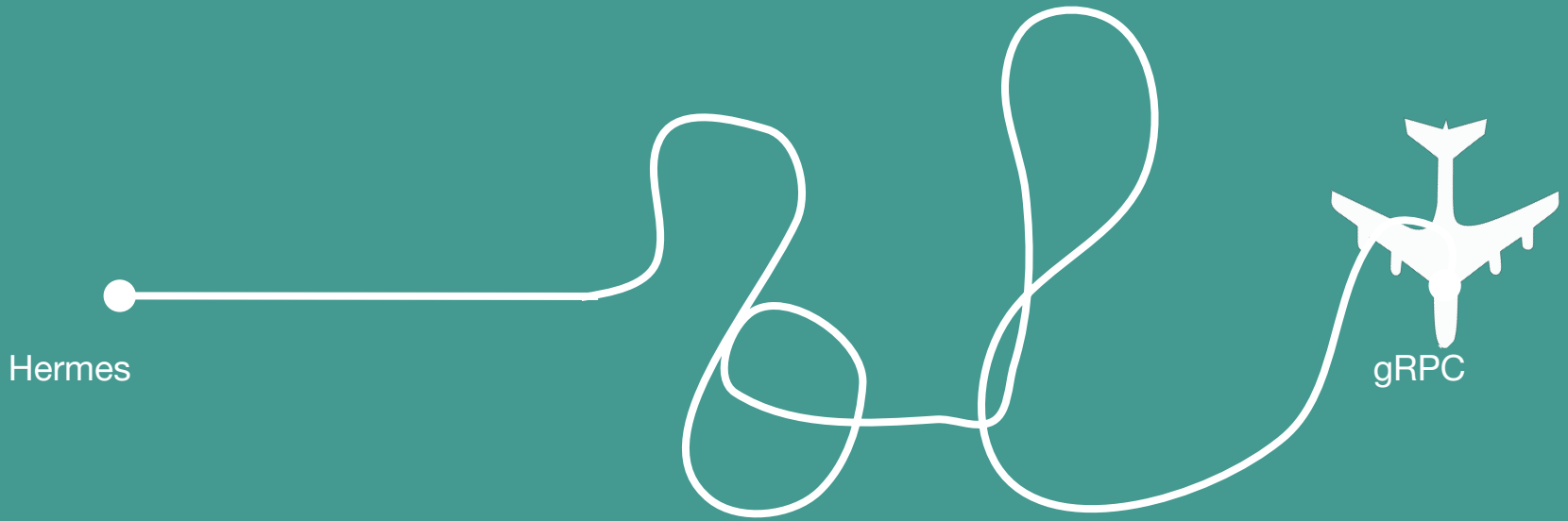
Remaining Distance to Destination



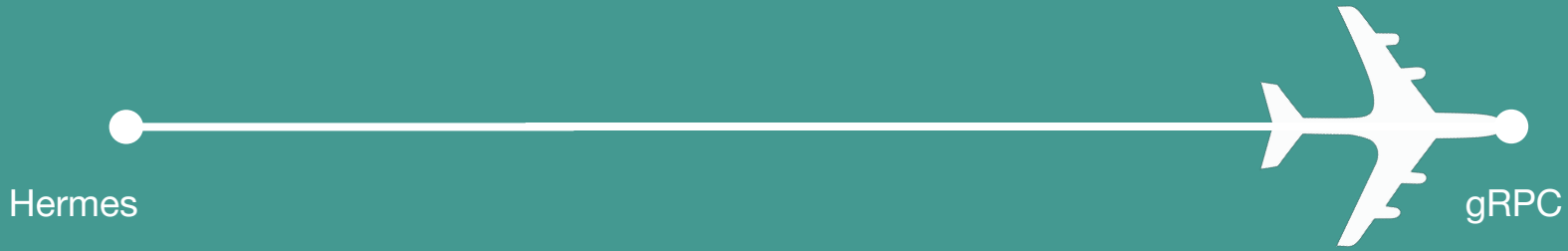
Hermes

gRPC

# Our Journey



# Our Journey



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**Developers don’t have care about new RPC technologies**

# Thank You