Go at scale

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WHAT DO WE DO?

SEA's #1 Consumer Internet Platform

Everyday services
Commute, Eat, Deliver & Pay
all in one app

Over **90 million**
mobile downloads

Over **5 million** micro-entrepreneurs

196 Cities in 8 Countries
for transport

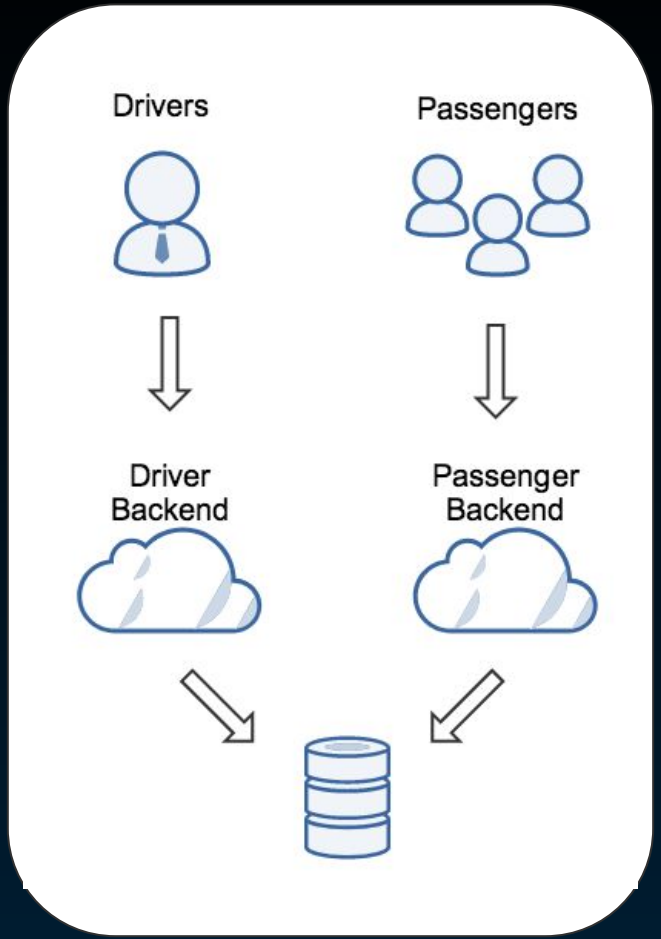
+500 cities
for payments

AGENDA

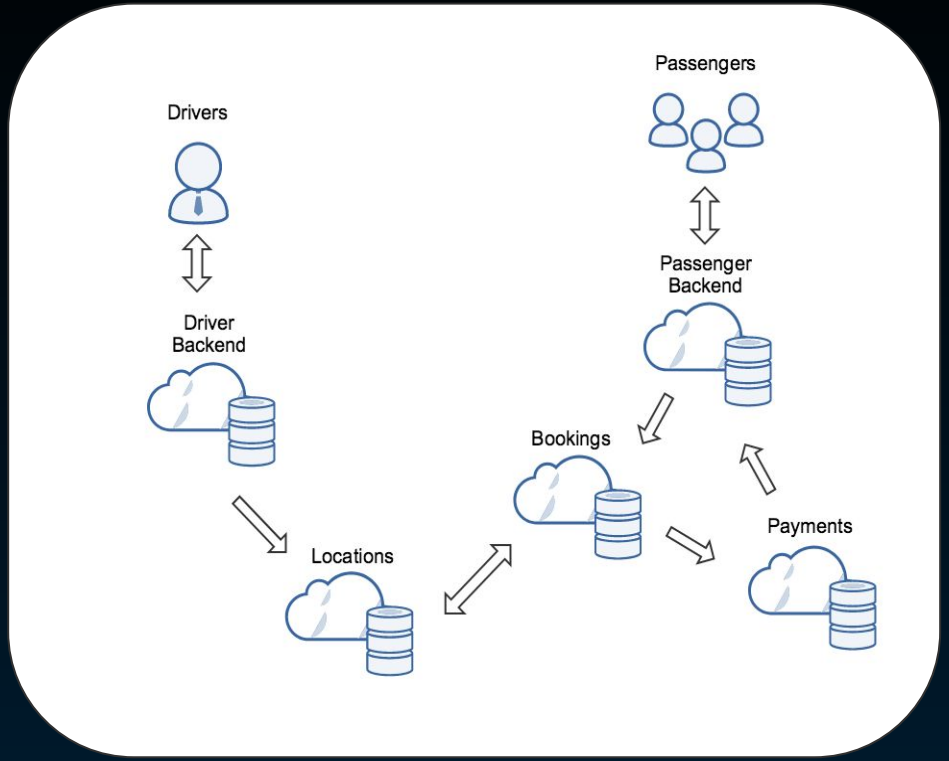
- Brief technical history of Grab
- Go at Grab
- From Monolith to Microservices
- Go projects at Grab
- What's next?

LEGACY

- First monolith: 2013
- Coded in Ruby on Rails (pax) and Node.js (dax)
- Single MySQL database
- Simple, but functional



- Enter 2014, distinct applications
  - Poi (locations) RoR
  - Dispatcher (dax) NodeJS
  - Gamma (pax,pricing, bs) RoR
- 1st Go services deployed



- Rails monolith business logic was migrated 1:1 to Go, endpoint by endpoint
- Multiple stages of testing: unit tests, load testing, shadow testing
- Requests were proxied to allow gradual rollout and side-by-side test
  - First from Ruby → Go
  - When Go was handling sufficient amount of traffic, switched the DNS
  - Final few endpoints were proxied from Go → Ruby
- After initial migration, further factorised the ‘Go monolith’ to new services
- https://engineering.grab.com/zero-downtime-migration

RND() STATS

- Migration off monolith completed in 2016
- Backend now comprises 37837 Go files
- 256 microservices
- Largest single Go file is 2416 lines (Rewards)
- 3024 source code commits in the last 30 days
- There are over 450 active contributors

Language	3 Years Ago	Now
Ruby	200K	200K
CSS, JS, HTML	25K	200K
Nodejs	50K	0
Obj C + Swift	17K	170K
Java	75K	360K
Infrastructure + Config	35K	300K
Go	0	2,000K
Total	**402K**	**3,230K**

GO SHOUT OUT

- Go has excellent readability and requires little to no context to read
  - great improvement vs Ruby when debugging unfamiliar services
- Go co-evolved with the "modern microservice world"
  - gRPC, tracing, service meshes,infrastructure-as-code
- Many of our 3rd party tools are written in Go
  - easier to customise or integrate with them
- Go encourages loose coupling and no “magic”
  - E.g. RubyOnRails was too opinionated on database use, Go gave us a lot more flexibility.

- Grab's developer ecosystem has evolved for microservices
  - Code ownership, coding standards, CI/CD, standard libraries
- Key decision was to use a 'monorepo'
- Simplified dependency management between services, one vendor directory (glide)
- Easy to write tools for Go sources, enforce standards, perform refactoring
- In-house framework (GrabKit) makes it trivial to write new microservices, enables rapid development
  - Includes standard libraries, best practices boilerplates in generated code

ENGINEERING CHANGE

2012

GrabTaxi first launched in June 2012

2013

Entered Philippines in July 2013

Entered Singapore and Thailand in Oct 2013

2014

Entered Vietnam in Feb 2014

Entered Indonesia in June 2014

GrabCar first launched in July 2014

GrabBike first launched in Nov 2014

2015

GrabExpress first launched in July 2015

GrabHitch first launched in Nov 2015

2016

GrabPay regional launched in Jan 2016

Grab for Business first launched in June 2016

GrabPay Credits first launched in Dec 2016

GrabShare first launched in Dec 2016

2017

GrabCoach first launched in Feb 2017

GrabShuttle first launched in Mar 2017

JustGrab first launched in Mar 2017

Entered Myanmar in Mar 2017

Kudo acquired to expand GrabPay platform in Apr 2017

GrabNow first launched in June 2017

P2P Fund Transfer first launched in Aug 2017

GrabRewards launched in Aug 2017

1 Billion Rides completed in Oct 2017

Merchant Payments first launched in Nov 2017

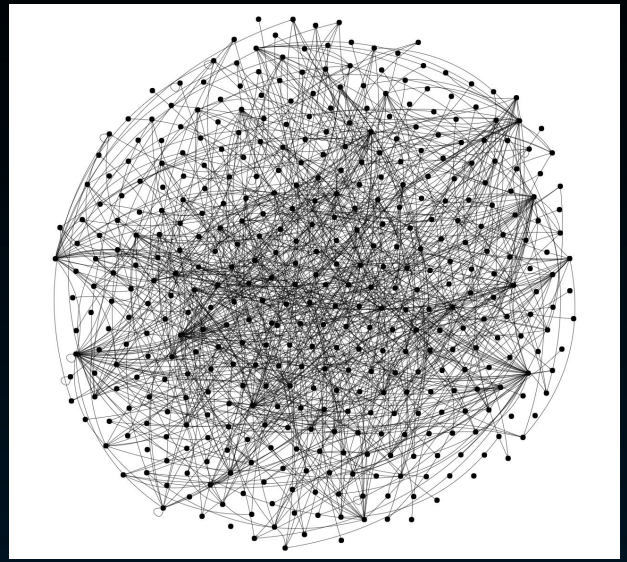
Entered Cambodia in Dec 2017

2018

Acquisition of Uber's business in SEA in Mar 2018

GrabCycle bike-sharing marketplace first launched in Mar 2018

OUR SUCCESS LEADS TO ENGINEERING CHALLENGES



RIDES

SCALABILITY

Platform handles Grab's growing number of users

REUSABILITY

Platform allows components to be reused by different products

EXTENSIBILITY

Platform can be extended to support new services we build for Grab

MAINTAINABILITY

Platform is not a set of messy pipes

AVAILABILITY

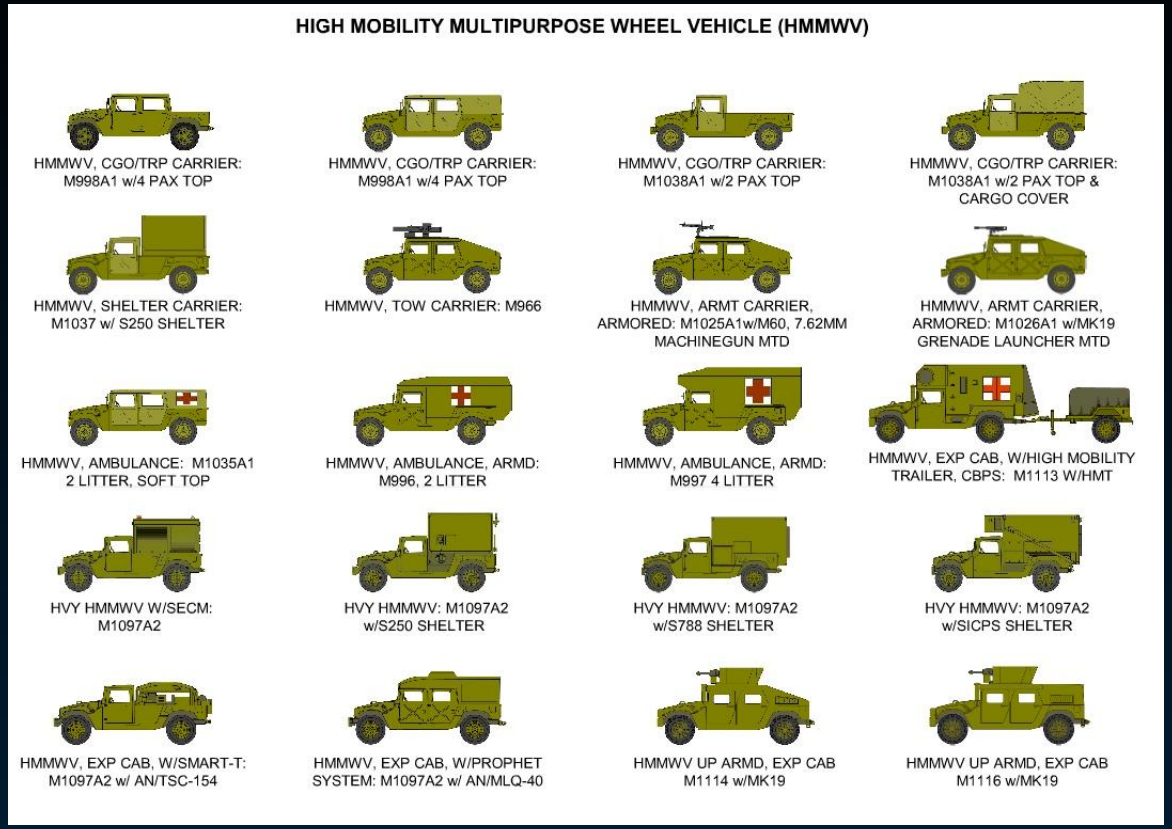
Platform does not go down

RELIABILITY

Platform does not fail or lose data

SECURITY

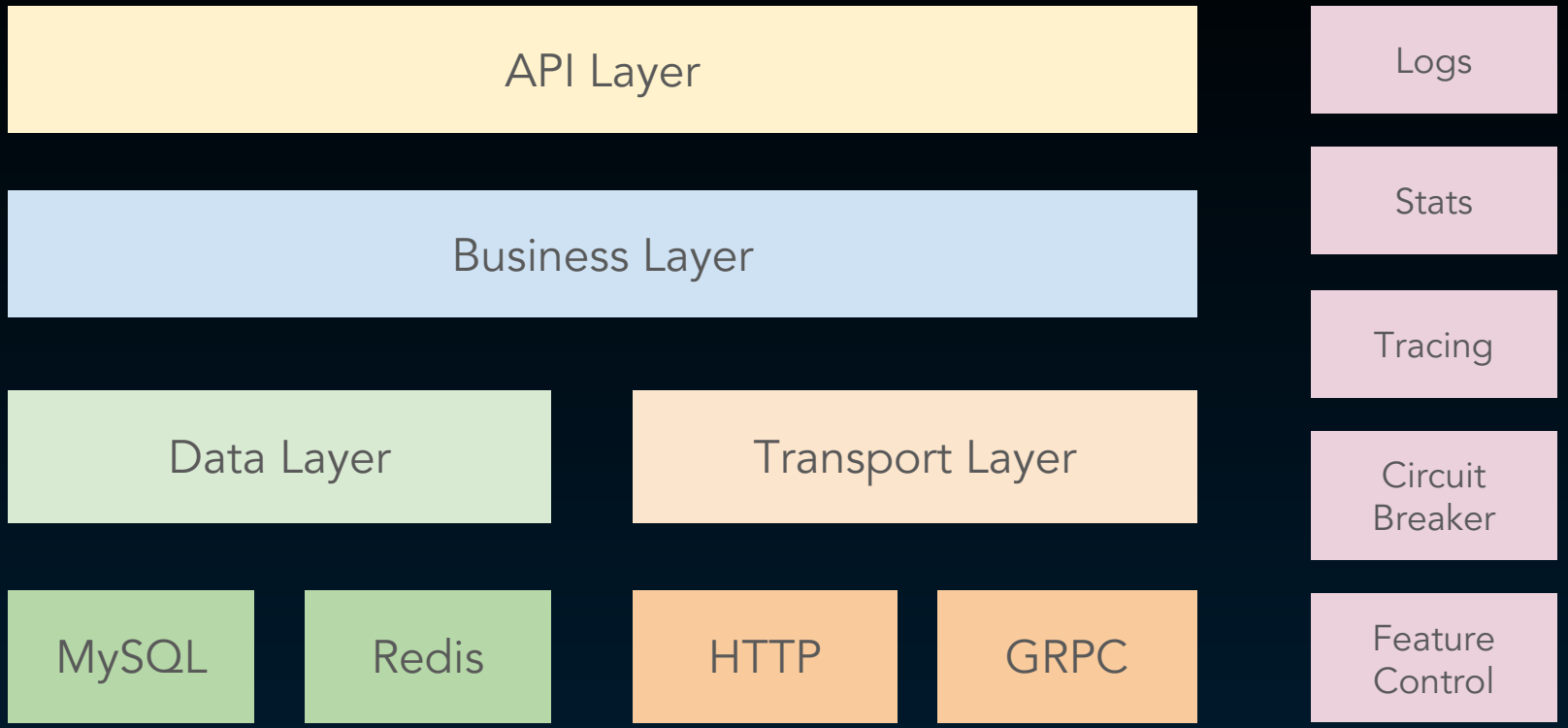
Platform safeguards data and access



Solution:

- Layered architecture
- Modular components

MICROSERVICE

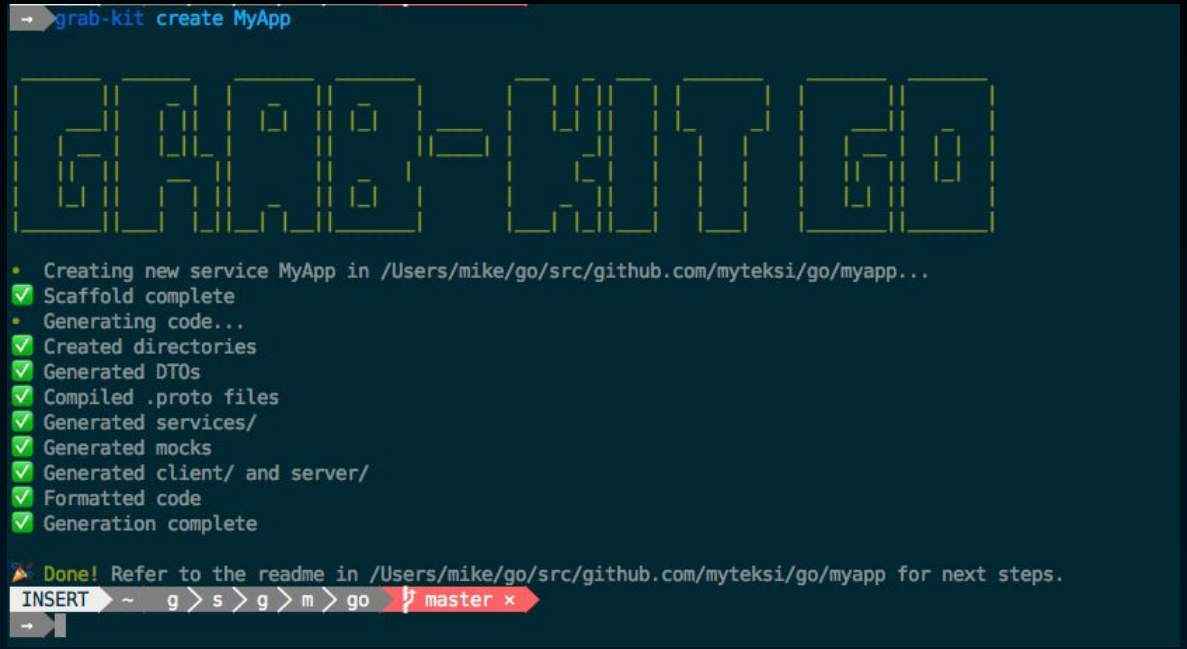


How to enforce this on all the new services?

GRABKIT

Auto-generating everything

Using Golang template package to render project specific settings with common project templates.



transport proto skeleton config persistence unit updateable ready2go

Isn't this like GoKit?

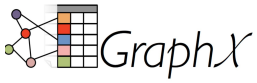
- Go-Kit contains libraries and patterns for building microservices.
- Go-Kit contains many microservice utilities that are implemented differently at Grab
- Whilst Go-Kit suggests techniques for microservices, there is still a lot of manual work to implement them.

- Grab-Kit is inspired by Go-Kit but does not depend on it.
- Grab-Kit takes the 'endpoint' abstraction from Go-Kit and re-implements it.
- Grab-Kit goes beyond the ideas proposed by Go-Kit, adding automatic code generation to save writing boilerplate code. Grab-Kit **actually** helps you focus on the business logic by doing this work for you.

LESSONS

- Microservices means frequent deployments
  - requires effective communication/coordination
- Debugging and root cause analysis is difficult
  - centralized logging is mandatory
  - good monitoring and alerting will save you
- Go makes distributed tracing easy
  - Make your functions accept context; you'll be glad you did!
- Have clear ownership of services and escalation process
  - who to call if things go wrong

OUR STACK



Machine Learning/ Deep Learning Layer

Compute Layer

Infra Layer

We are building SEA's largest consumer internet platform

One year ago

- GrabTaxi
- GrabShare
- GrabExpress
- GrabHitch
- GrabCar
- GrabBike
- GrabFood

Added over the last year

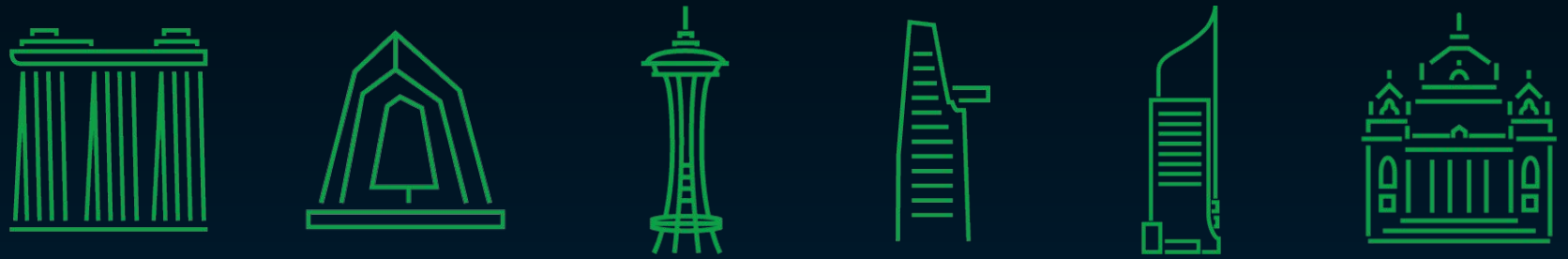
- GrabPay wallet
- JustGrab
- GrabShuttle
- GrabRewards
- GrabCoach
- GrabNow
- GrabCycle

What you build at Grab...

Is just as important as for whom.

THE TEAM

- Engineering Centers in Singapore, Beijing, Seattle, Ho Chi Minh City, Jakarta and Bengaluru
- > 500 engineers
- https://grab.careers/



Grab

Thank you