

AppEngine by Example

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How many **downloads** do we have?



More than **250** million!

How many **requests** per second?

Average for all games >> more than **1000**

SGL peak >> **1350**

How many **daily** players?

Around **400 000!**

Work smart not hard



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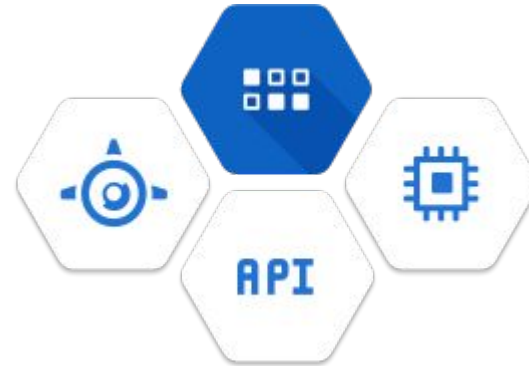
Google Cloud Platform



How many **developers** work on MFG backend?

4!

App Engine & Datastore



Advantages for MFG

- No infrastructure
- Fast deployment
- Microservices
- Monitoring
- Error Reporting
- Easy to maintain in a small team
- Newest trends

WE OFFER 3 KINDS OF SERVICES
GOOD-CHEAP-FAST
BUT YOU CAN PICK ONLY TWO

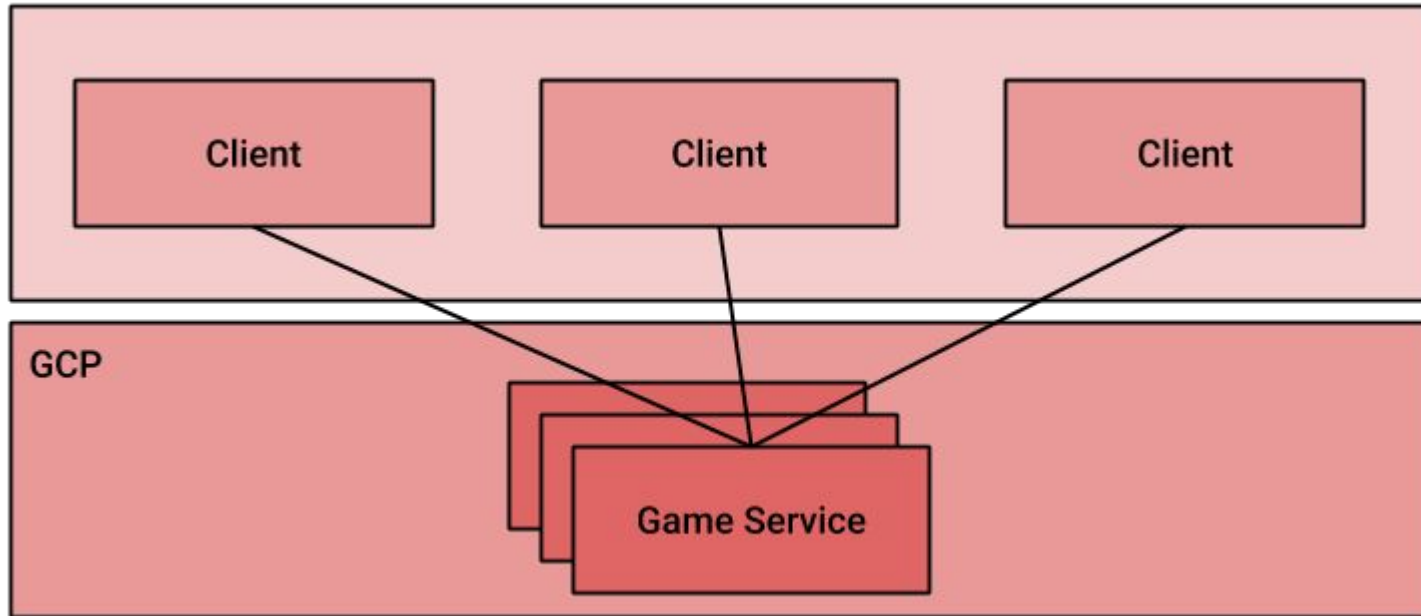
GOOD & CHEAP WON'T BE **FAST**

FAST & GOOD WON'T BE **CHEAP**

CHEAP & FAST WON'T BE **GOOD**

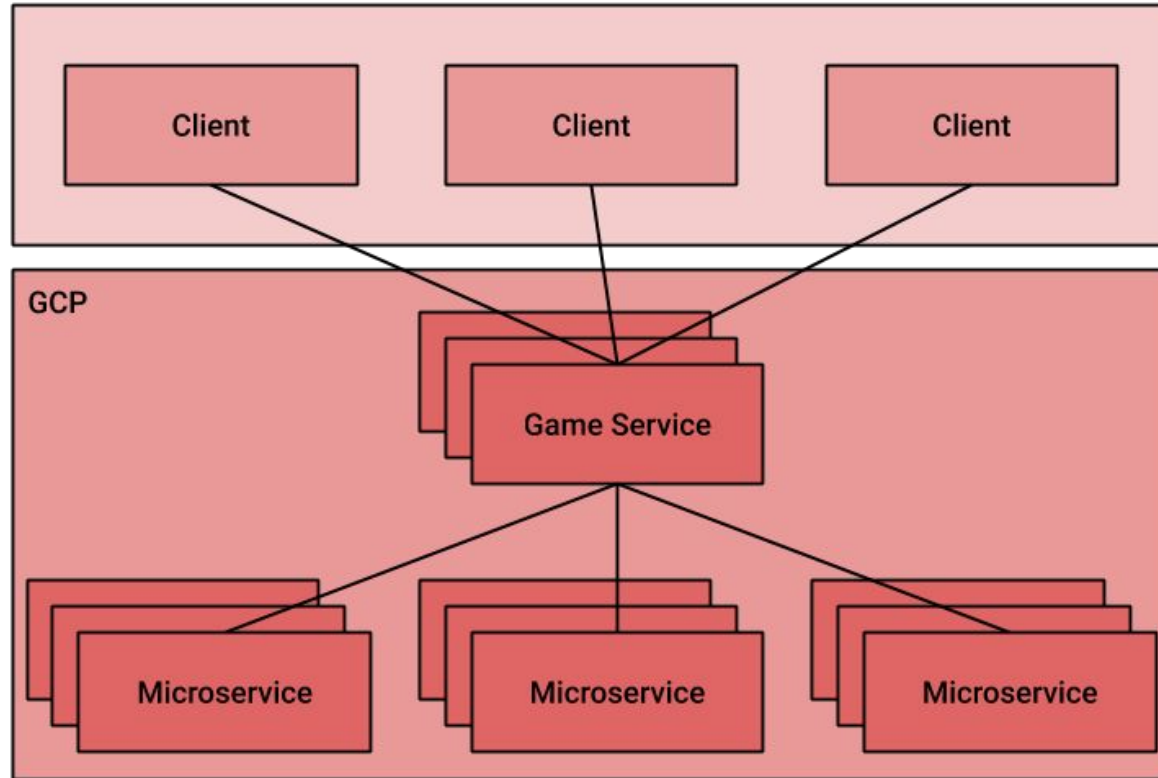
- Dead Trigger
- Monolithic Service
- Backup player progress

First steps

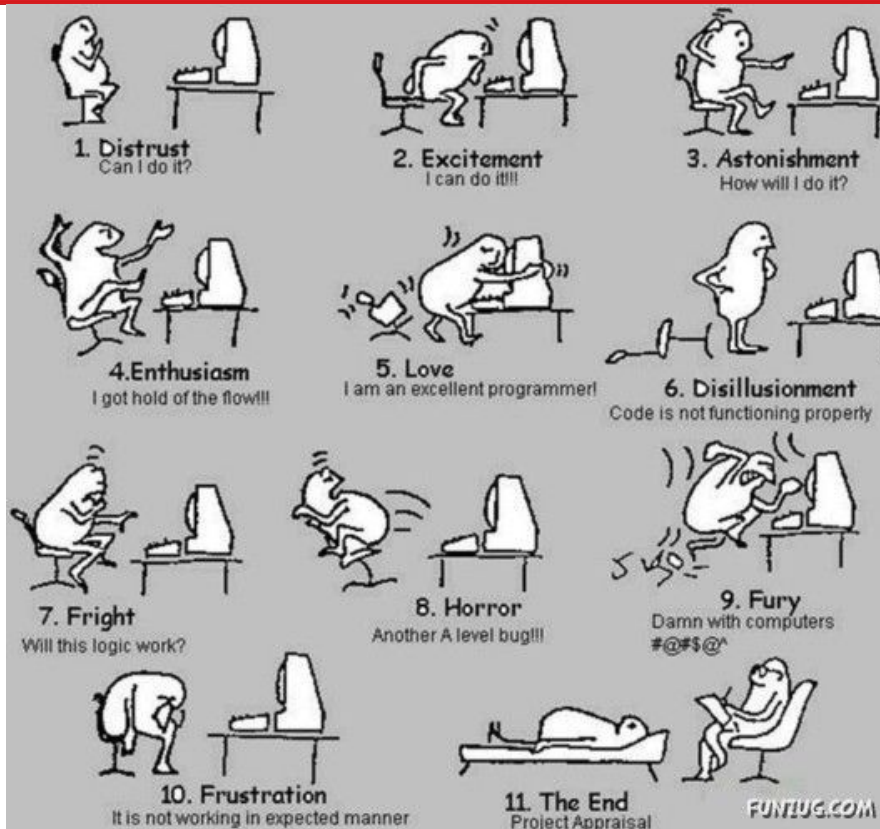


- Dead Trigger 2, Unkilled
- Latency
- Single point of attack
- Costs for traffic
- Firefighting

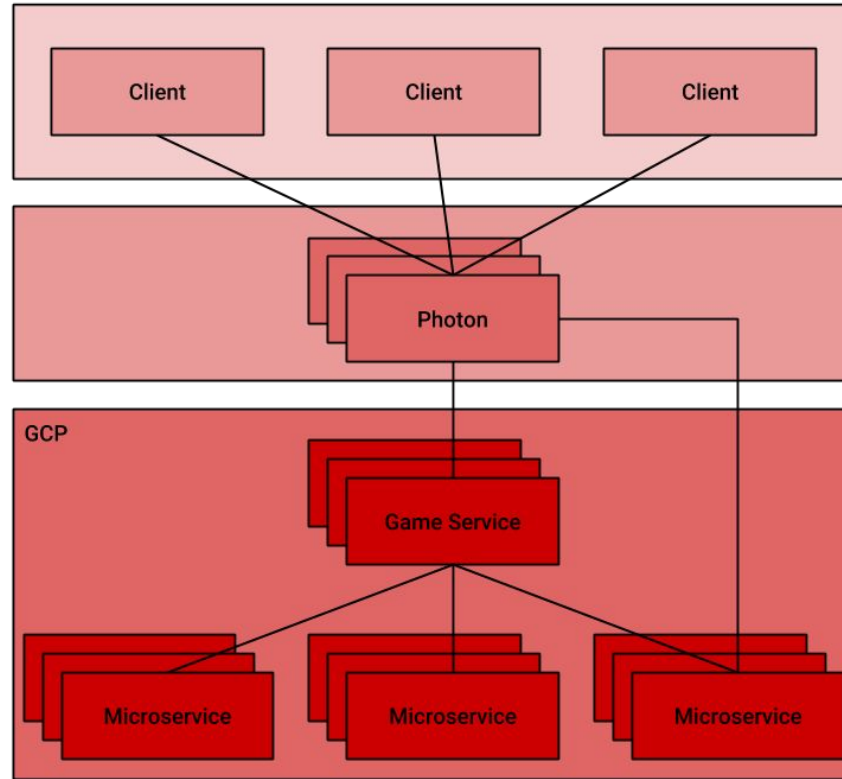
Refinements



AppEngine Lifecycle by MFG



Present



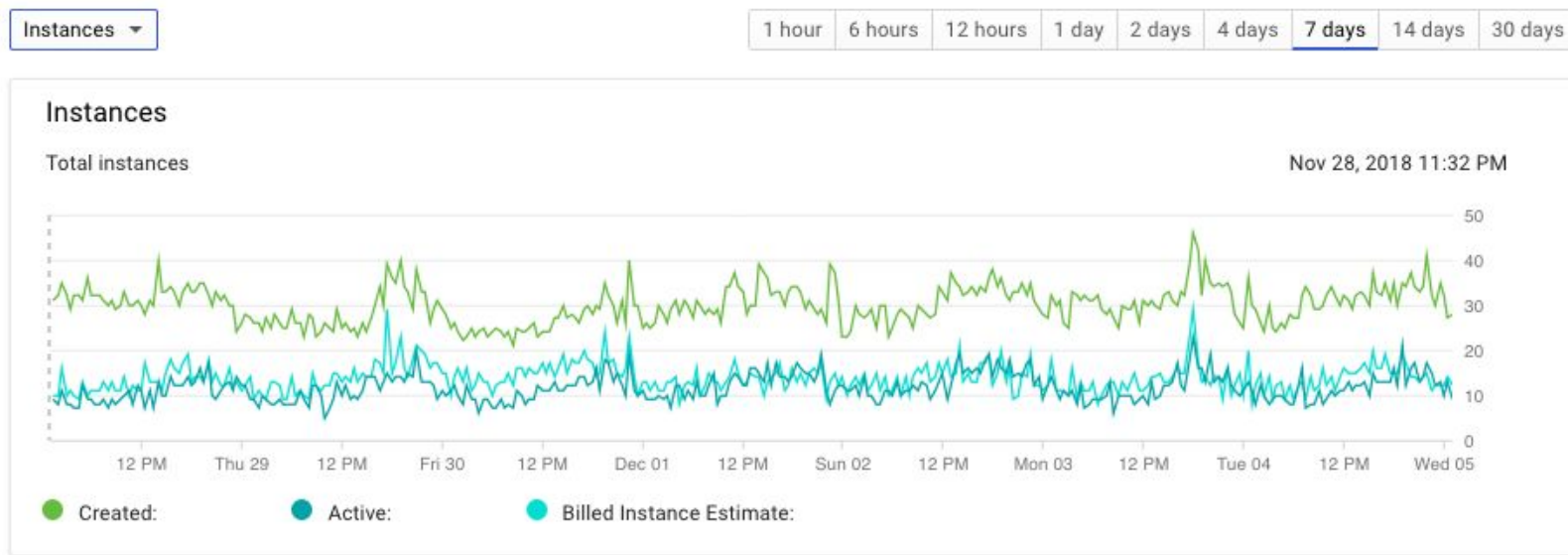
Multiple environments

- development vs production
- canary deployments
- multiple versions

- Stateless/Stateful
- Number of transactions
- Number of entity access in seconds
- Read from DB without key (Eventual consistency)

Managed instances

- **Autoscaling** (great during launch, peaks)



Serverless - keep it under control

Logging

GAE Application, sgl-075		request_log		Any log level		Jump to time		Dec 4, 2018, 1:03:17 PM CET	
+/- 1 hour									
Showing logs from Dec 4, 2018, 12:03:17 PM to Dec 4, 2018, 2:03:17 PM (CET)								Download logs	View Options
▶	2018-12-04 13:01:57.654 CET	POST	200	37 B	173 ms	AppEngine...	/_ah/queue/__deferred__	:	
▶	2018-12-04 13:01:59.159 CET	POST	200	37 B	135 ms	AppEngine...	/_ah/queue/__deferred__	:	
▶	2018-12-04 13:01:59.726 CET	POST	200	89 B	4.9 s	Unknown	/game/vendor/buy	:	
▶	2018-12-04 13:02:02.424 CET	POST	200	2.46 KB	1.6 s	Unknown	/game/server/users/store	:	
▶	2018-12-04 13:02:02.540 CET	POST	200	89 B	457 ms	Unknown	/game/server/users/store	:	
▶	2018-12-04 13:02:03.447 CET	POST	200	183 B	4.2 s	Unknown	/game/server/gameplay/start	:	
▶	2018-12-04 13:02:04.296 CET	POST	200	89 B	1.6 s	Unknown	/game/money/drop	:	
▶	2018-12-04 13:02:04.717 CET	POST	200	89 B	1.4 s	Unknown	/game/vendor/buy	:	
▶	2018-12-04 13:02:09.339 CET	POST	200	89 B	278 ms	Unknown	/game/storage/move	:	
▶	2018-12-04 13:02:14.828 CET	POST	200	109 B	706 ms	Unknown	/game/server/users/store	:	
▶	2018-12-04 13:02:16.094 CET	POST	200	321 B	3.3 s	AppEngine...	/game/validate/profile	:	
▶	2018-12-04 13:02:16.914 CET	POST	200	37 B	121 ms	AppEngine...	/_ah/queue/__deferred__	:	
▶	2018-12-04 13:02:17.650 CET	POST	200	37 B	22 ms	AppEngine...	/_ah/queue/__deferred__	:	
▶	2018-12-04 13:02:24.238 CET	POST	200	89 B	3.4 s	Unknown	/game/item/sell	:	
▶	2018-12-04 13:02:24.435 CET	POST	200	321 B	3.4 s	AppEngine...	/game/validate/profile	:	
▶	2018-12-04 13:02:25.352 CET	POST	200	37 B	40 ms	AppEngine...	/_ah/queue/__deferred__	:	
▶	2018-12-04 13:02:25.599 CET	POST	200	89 B	801 ms	Unknown	/game/money/drop	:	
▶	2018-12-04 13:02:27.127 CET	POST	200	327 B	1.3 s	AppEngine...	/game/validate/profile	:	
▶	2018-12-04 13:02:27.354 CET	POST	200	37 B	30 ms	AppEngine...	/_ah/queue/__deferred__	:	

Serverless - keep it under control



Error reporting

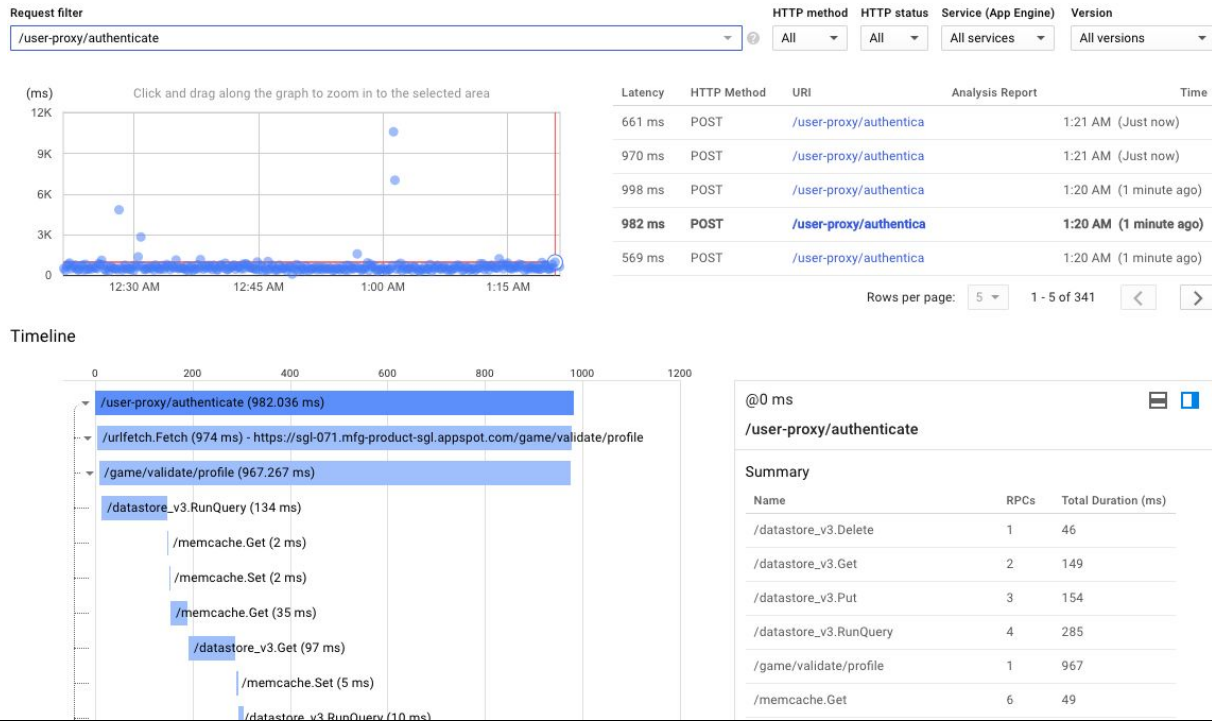
[1 hour](#)[6 hours](#)[1 day](#)[7 days](#)[30 days](#)

Errors in the last hour

Resolution Status		Occurrences		Error	Seen in	First seen
Open	▼		296	Throwable: Quest Grinds-FTUE.Grinds-FTUE-A_409 not changed (uid sgl:m4 gear.LogInternal.error (LogInternal.java)	sgl-071:223209-infusion-price-rank-tolerance	Oct 19, 2018
Open	▼		52	RuntimeException: Pointless request, nothing was changed. com.madfinger.server.ControllerServer.proceed (ControllerServer.java)	sgl-071:223209-infusion-price-rank-tolerance	Jul 25, 2018
Open	▼		7	RequestException: Expected amount Resource.Money : 68 Received : 59 com.madfinger.game.storage.Controller.validatePrice (Controller.java)	sgl-071:223209-infusion-price-rank-tolerance	Oct 24, 2018
Acknowledged	▼		24	RuntimeException: Move() : cannot move item Gear.Man2_Shoulders-001, t com.madfinger.game.storage.Validator.move (Validator.java)	sgl-071:223209-infusion-price-rank-tolerance	Oct 20, 2017

Serverless - keep it under control

Distributed tracing - know your bottlenecks



Costs

Reports

[PRINT](#)

March 1 – 19, 2019 (total cost) ?

€158.16

includes €0.00 in credits

↑ 20.92%

€27.36 over February 10 – 28, 2019

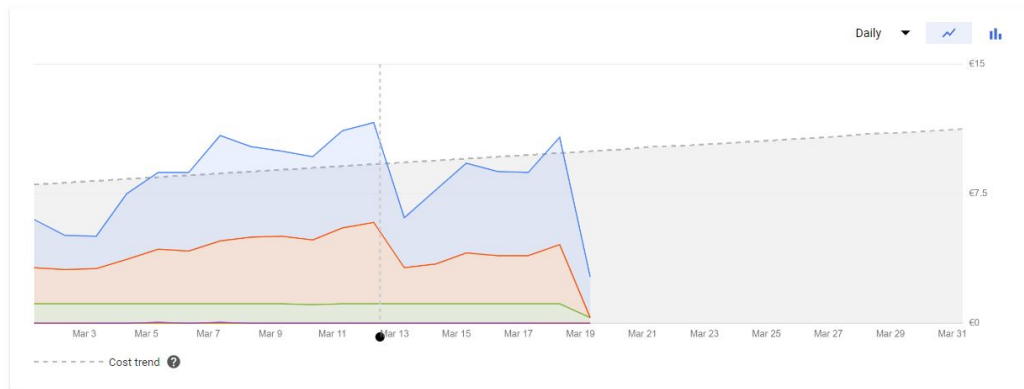
March 2019 (forecasted total cost) ?

€295.28

includes €0.00 in credits

↑ 60.78%

€111.62 over February 2019



SKU	Product	SKU ID	Usage	Cost before credits	Promotions	Discounts	↓ Cost after credits
Cloud Datastore Read Ops	App Engine	000A-BC9A-4DEE	157,218,598 count	€82.59	€0.00	—	€82.59
Frontend Instances	App Engine	E2EB-F679-D108	1,773.03 hour	€55.89	€0.00	—	€55.89
Redis Capacity Basic. M1 Belgium	Cloud Memorystore for Redis	ED04-130F-C092	437.42 gibibyte hour	€19.65	€0.00	—	€19.65
Cloud Datastore Entity Writes	App Engine	1982-2E8F-D0A3	130,082 count	€0.02	€0.00	—	€0.02
Multi-Regional Storage Europe	Cloud Storage	EC40-8747-D6FF	0.24 gibibyte month	€0.01	€0.00	—	€0.01

So far so good ...

- 35 microservices
- design tailored to App Engine & Datastore
- everything is automated
- aim is to make architecture simple

... but there are some exceptions

Matchmaking

YOUR FAME 225

YOUR TEAM 18

ENEMY TEAM 19

ENDS IN 08:57

24 / 285

0 8

121

20 Riazliskani

20 mondhero

Your Team				Enemy Team			
#	PLAYER	FAME	KILLS	#	PLAYER	FAME	KILLS
1	20 S1ayerGun12	225	2	1	20 Rayanben	300	3
2	20 Riazliskani	125	1	2	20 Sarwar	50	0
3	20 mondhero	0	0				

Provide match for players around the world

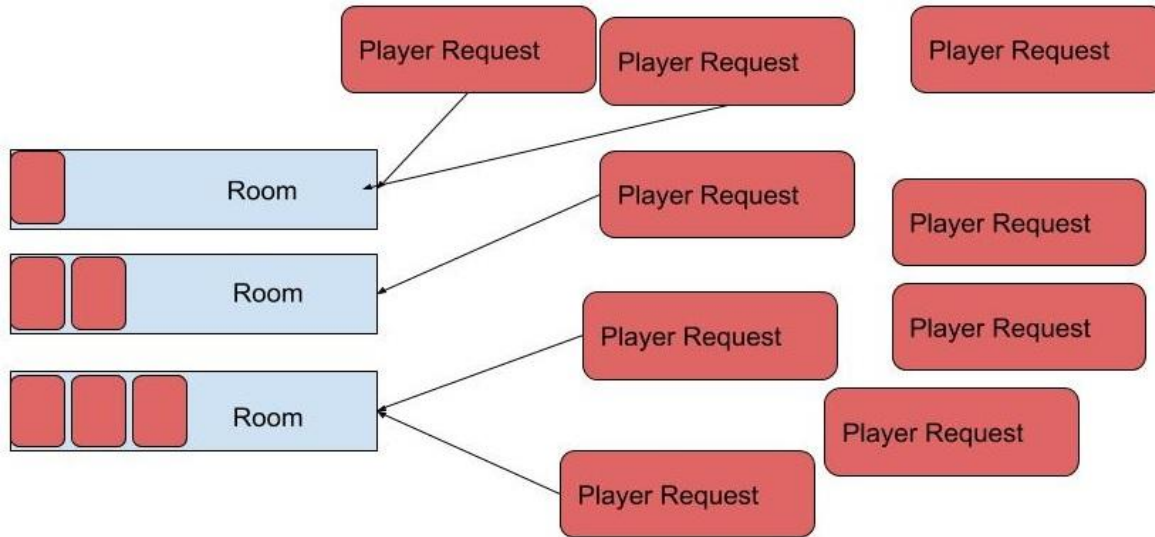
- Room based, Request based
- Filtering (PING, SQUADS)
- Invitation system
- Join of incomplete room

- Fast
- Universal
- Robust but simple (Microservice)
- Cheap
- Easy to deploy/Easy to change **“on the fly”**

- V1 -> Requests + Rooms
- V2 -> Invitations + Join Incomplete Rooms
- V3 -> Memcache / Redis implementation

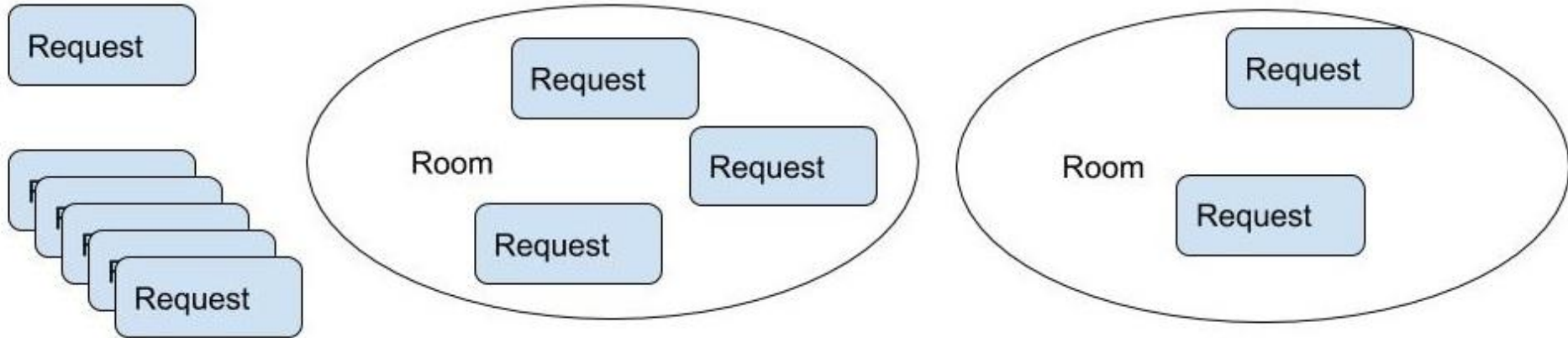
- AppEngine
- DataStore (+ Indexing)
- Memcache
- Crons
- Memorystore

- Request Based
- Creation of the room by request



Second Iteration

- Room Based
- Invitation system
- Join the room (ongoing match)



- Redis/Memorystore
- Pub/Sub mode
- Advanced filtering

DB Sample



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Kind

Request-tvt4x4

Cancellation

Config

Guide

Invitation

Request-pve3

Request-pvp2

Request-tvt4x4

Room

Assist

false

CTime

2019-03-19 (16:47:14.129) CET

Filter

AppID#818bfafd-9faf-4182-8981-
5c6d636004cb-:Region#ASIA-:Version#0.8.3-:MatchType#TvT4x4-:Gamepl
ayMode#Supremacy-:MissionID#-:Tier#Rank-6-:Probation#False

MTime

2019-03-19 (16:47:14.129) CET

Players

["sgl:3j4i-agto-7snq-set"]

Ratings

[1]

Clean API

Search in logs

API Versioning

```
"Body": {
  "Filters": {
    "AppID": "C263-6127-2B7E-6982-4FDD-568C",
    "Region": "",
    "Version": "0.9.0",
    "GameplayMode": "Supremacy",
    "MatchType": "PvP4",
    "MissionID": "",
    "Tier": "Rank--1",
    "Probation": "False"
  },
  "Players": {
    "sg1:r5y4-4zlm-ojbo-zmdf": 27.0
  },
  "Invitation": false
}
```

2019-03-19 16:46:05.404 CET lib.service.internal.Log log: Service response: 200 {{ (Log.java:29)
"Expiration": "2019-03-19 16:01:05"

▶	λ	2019-03-19 16:45:52.625 CET	POST	200	124 B	160 ms	Unknown	/v2/sg-legends/pvp4/match
▶	λ	2019-03-19 16:43:50.658 CET	POST	200	124 B	176 ms	Unknown	/v2/sg-legends/pve3/match
▶	λ	2019-03-19 16:43:45.540 CET	POST	200	124 B	327 ms	Unknown	/v2/sg-legends/pvp2/match
▶	λ	2019-03-19 16:43:35.263 CET	POST	200	124 B	362 ms	Unknown	/v2/sg-legends/pvp2/match
▶	λ	2019-03-19 16:41:56.083 CET	POST	200	124 B	233 ms	Unknown	/v2/sg-legends/pve3/match
▶	λ	2019-03-19 16:41:08.738 CET	POST	200	124 B	224 ms	Unknown	/v2/sg-legends/pvp2/match
▶	λ	2019-03-19 16:40:55.399 CET	POST	200	124 B	194 ms	Unknown	/v2/sg-legends/pvp2/match
▶	λ	2019-03-19 16:38:32.719 CET	POST	200	124 B	350 ms	Unknown	/v2/sg-legends/pve3/match
▶	λ	2019-03-19 16:34:49.788 CET	POST	200	124 B	288 ms	Unknown	/v2/sg-legends/pve3/match
▶	λ	2019-03-19 16:33:35.526 CET	POST	200	124 B	284 ms	Unknown	/v2/sg-legends/pvp4/match

Leaderboards

30 fps

24 Sha5fdmgdi88 211.1 87,601 0 173,282 357,507

INDUSTRIAL YUAN PERZER ROG PH H

MONTHLY

HALL OF FAME

POSITION	RANK	NICKNAME	FAME
1	27	Shadowgu268a	732,824
2	27	Ribbbon	593,618
3	27	GodModeON	508,999
4	27	NoGod	508,132
5	27	Cccccccccc	506,866
174	20	NoMorePerks	2,287
175	27	Shadowg7ke7f	2,280
176	24	Sha5fdmgdi88	2,266
177	27	Apple	2,229
178	27	Shadowgup	2,227

Leaderboard data is updated once per 12 hours.

hub_Main
ONLINE: MASTER
SERVER: dfe55794-3358-4647-89b2-1a729b5517d
BUILD: SGLDevelopment\unkg_308
ROOM: Room_sgl.mcur-2u7r-tb7U2m - Station 159534

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the content may change in the future

MADFINGER Games 2019

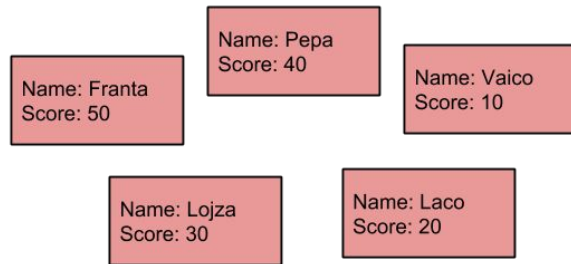
0.9.0.0

What do we need?

- What's my rank compared to other players?
 - in all games?, only in PvP?, ...
- What's the rank of players around me?
 - +-5, 10, 100?, ...
- What's the top 10?
 - ever?, in my country?, this week?, ...
- Sort players according to different criterions ... in real-time

What's the big deal?

- 100 000's -> 1 000 000's entries in leaderboard
- Many leaderboards per game
- 10 000 concurrent users reading/writing



- Sort players by score - easy
- Rank them - tough (at least at scale)
 - Typically implemented using some tree-like structure to achieve $O(\log(N))$

Rank	Name	Score
1	Franta	50
2	Pepa	40
3	Lojza	30
4	Laco	20
5	Vaico	10

(1) App Engine Standard

- Tree structure in Datastore
- Atomic updates? - contention
- Serialize score updates to avoid contention - no realtime leaderboards
- Works but complicated and expensive

(2) Custom C++ application

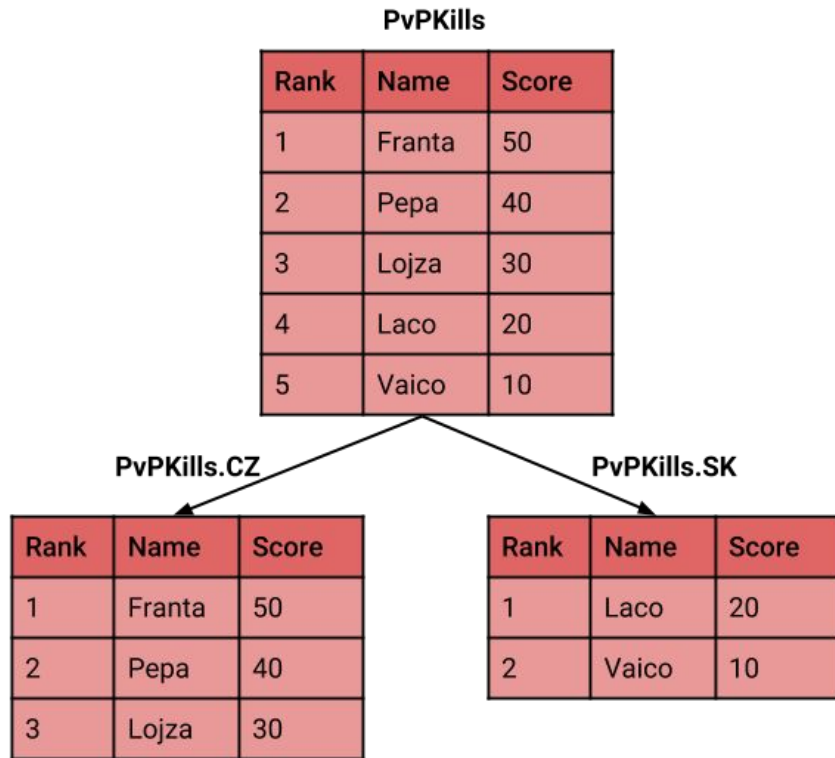
- Based on custom 3D engine code from our GFX guru
- Single instance but fast and cheap enough
- Temporary solution
- Works but hard to maintain and extend

(3) Redis



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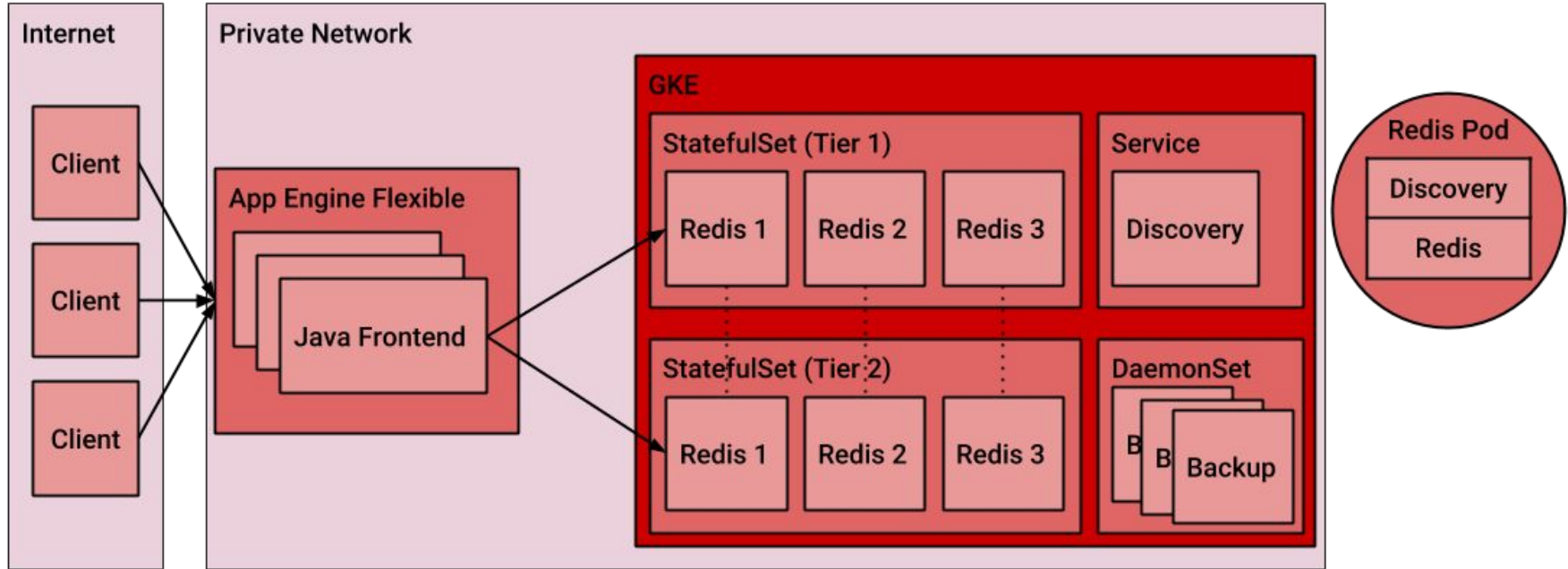
- Native sorted set structure (ZSET), very fast
- LUA scripts + thin Java frontend
- One Redis per game
- Runs on GCE
- Everything good but
 - Managing VM is not for free
 - everything is manual
 - No horizontal scalability



(4) App Engine + Redis + Kubernetes



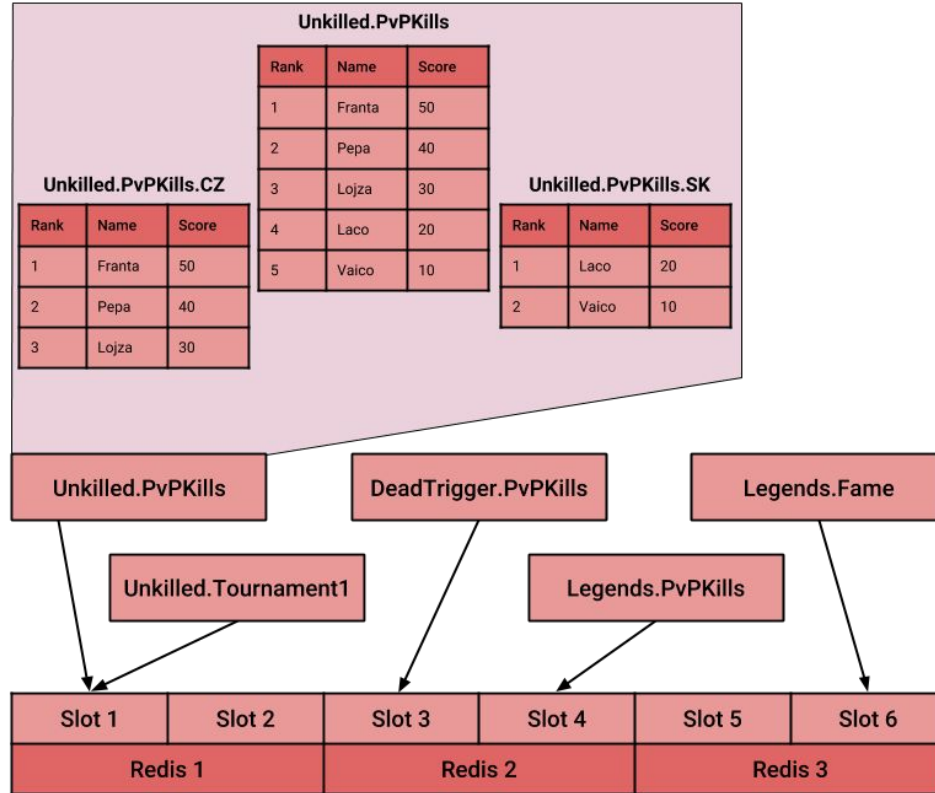
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(4) App Engine + Redis + Kubernetes



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Key takeaways

- Write games - don't manage infrastructure
- Your serverless solution can't handle it? - simplify your features
- Keep it under control - log, trace, get notified



Questions & Answers

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