

# TRACKING MMs OF GANKS IN NEAR REAL TIME

GARRETT EARDLEY

SEPTEMBER 2013



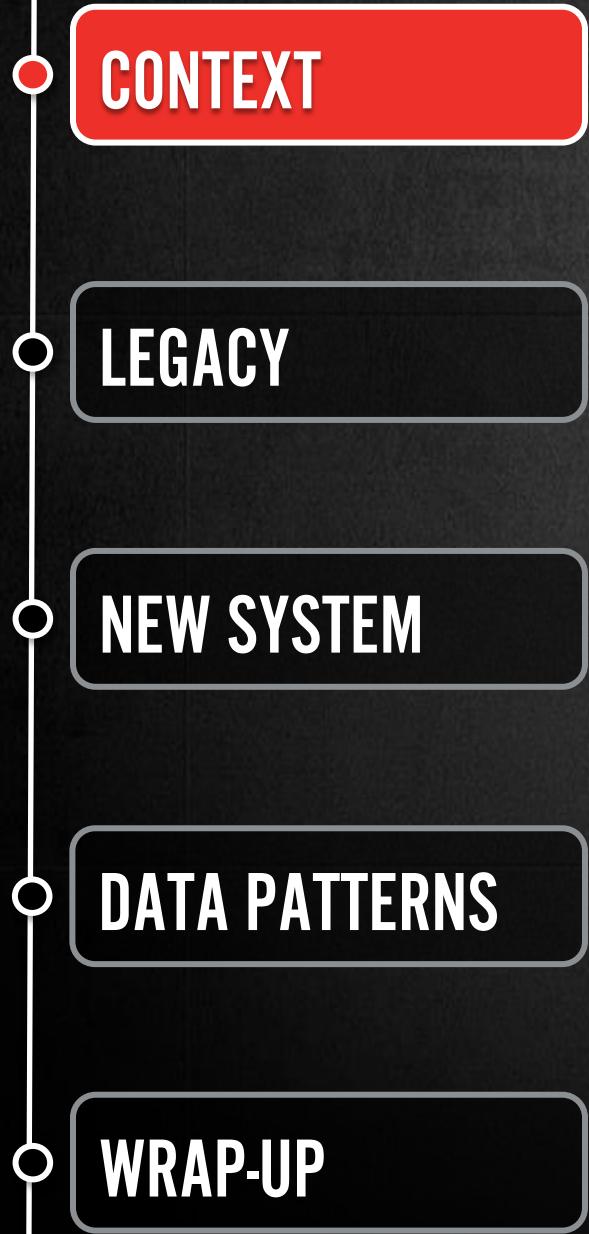
CONTEXT

LEGACY

NEW SYSTEM

DATA PATTERNS

WRAP-UP



OUR MISSION

---

**WE ASPIRE**  
TO BE THE MOST  
**PLAYER**  
  
**FOCUSED**  
GAME COMPANY IN THE  
**WORLD**

---

# LEAGUE OF LEGENDS®

2009  
LAUNCH

TEAM  
ORIENTED  
ONLINE PC  
GAME

100+  
CHAMPS

LIVE  
PLAYERS  
VS. LIVE  
PLAYERS

# LEAGUE OF LEGENDS®

## MATCHMAKING

League of Legends 3.11.13\_09\_11\_18\_32

LEAGUE OF LEGENDS

Play Bede 154078 x 414521

PvP Game Mode Game Map Game Type

Co-op vs. AI	Classic Dominion ARAM	Summoner's Rift 5v5 Twisted Treeline 3v3	Normal Blind Pick Normal Draft Pick Ranked Solo/Duo Draft Pick Ranked Teams Draft Pick
--------------	-----------------------------	---	---

Classic Summoner's Rift

Work with your allies to siege the enemy base and destroy their Nexus.  
Average game length is 30-45 minutes.

Last Step

Solo Party

Match me with teammates I will invite my own teammates

Home

7 !



# LEAGUE OF LEGENDS®

## CHAMP SELECT

Mac Beta League of Legends 3.8.13\_06\_14\_16\_46

Your Team

- Picking LordByronus
- Picking wiggerpower
- Picking Chopsteeks
- Picking sExYbArrY
- Picking SpectrumSoldier

52 LOCK IN your choice.

Champions Skins Search

Runes & Masteries

Miss Fortune	✓
miss fortune	✓

Spells

Choose Both Lock In

Blind Pick Tip

Your Champion has been Summoned! Now press the LOCK IN button to confirm your choice.

Don't show these tips again:

Match Details

Map: Summoner's Rift  
Team Size: 5x5  
Game Mode: Classic  
Pick Type: Blind Pick  
Game Type: Normal Game

Team Chat

okayyy  
calm downn  
bot supp  
aaaaaaaa  
top top top  
lol  
or does lord want to supp

Send

Summoner's Rift

3 !

# LEAGUE OF LEGENDS®

EARN GOLD



# LEAGUE OF LEGENDS®

## PURCHASE ITEMS

The screenshot shows the in-game item shop interface from League of Legends. The player has 225 gold available. The 'All Items' tab is selected, showing a grid of items categorized by type: Defense, Attack, Magic, Movement, and Consumables. The Defense section includes items like Health, Armor, and Magic Resist. The Attack section includes Damage, Critical Strike, Attack Speed, and Life Steal. The Magic section includes Ability Power, Cooldown Reduction, Spell Vamp, Mana, and Mana Regen. The Movement section includes Boots. The Consumables section includes items like Elixir and Potions. To the right of the item grid, there's a 'Builds:' section showing item dependencies and a 'Requires:' section for the 'Zeal' item, which costs 1175 gold and provides +18% Attack Speed, +10% Critical Strike Chance, +5% Movement Speed. The bottom of the screen shows the player's character stats (level 1, 51 gold, 0.58 CS, 335 damage), mini-map, and skill icons.

0 vs 0 0 0 0 0 0 0 0:46

FPS: 60

225

Recommended All Items

All Items

Defense

- Health
- Armor
- Magic Resist
- Health Regen
- Tenacity

Attack

- Damage
- Critical Strike
- Attack Speed
- Life Steal

Magic

- Ability Power
- Cooldown Reduction
- Spell Vamp
- Mana
- Mana Regen

Movement

- Boots
- Other Movement Items

Consumables

Builds:

Requires:

Zeal 1175

+18% Attack Speed +10% Critical Strike Chance +5% Movement Speed

BUY

SELL

225

51  
0.58  
335  
13  
30

1 1 2 1 3

335  
13  
30

225

460 / 460  
300 / 300

Q W E R D F B

Map

# LEAGUE OF LEGENDS®

## KILL DUDES



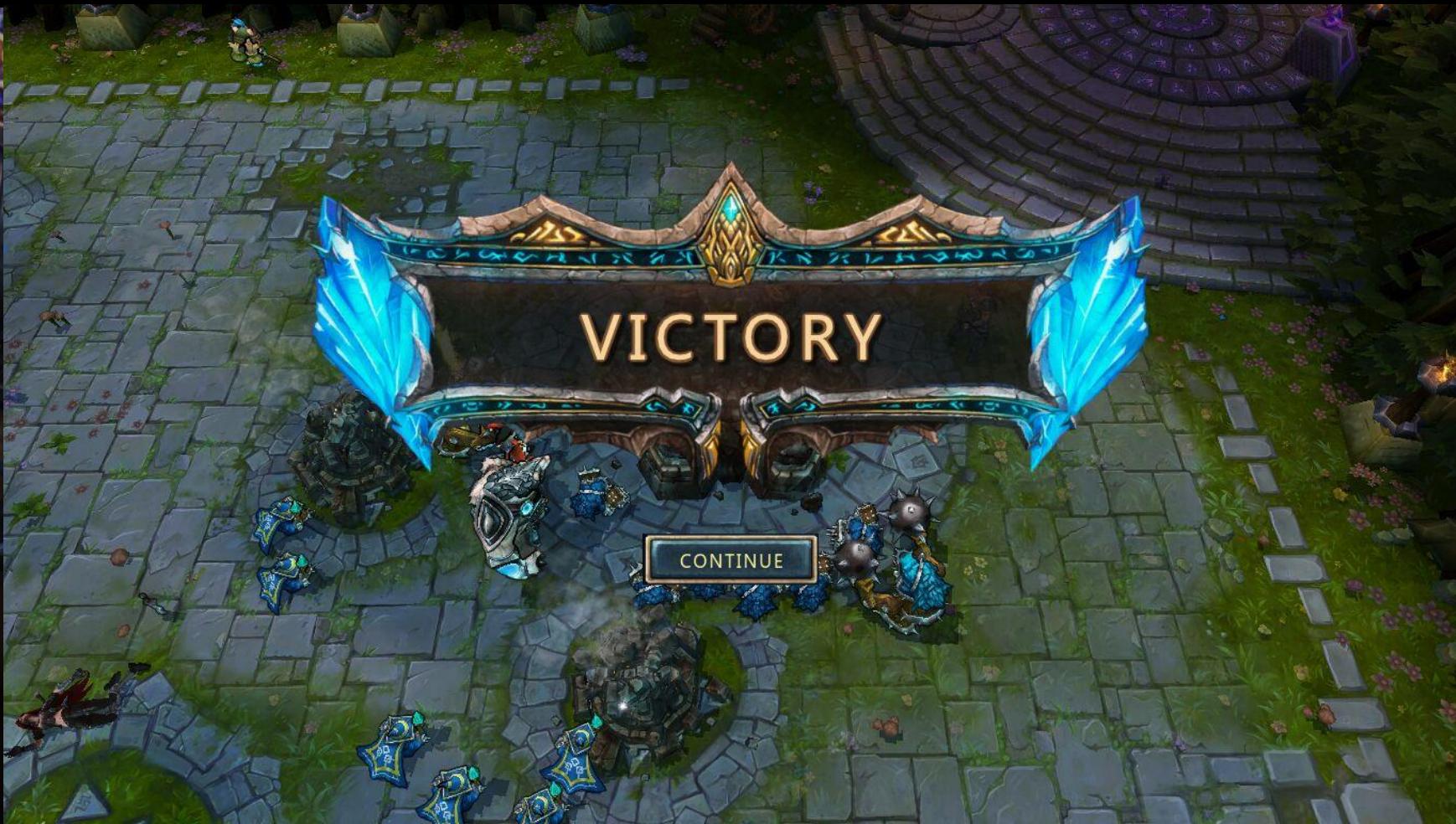
# LEAGUE OF LEGENDS®

## BLOW UP NEXUS



# LEAGUE OF LEGENDS®

VICTORY



# LEAGUE OF LEGENDS®

## END OF GAME SCOREBOARD

Overview   Grid   Graph

Summoner's Rift  
Classic  
Normal  
36:21

**BLUE TEAM WINS**

		3.6	24/15/52	X	15/24/35	
16	TSMTheOddOne Nocturne	3/5/9			10.9k	138
18	TSM Chaox Graves	10/1/8			15.7k	290
18	TSM Regnald Karthus	4/4/12			14.2k	324
18	TSM Dyrus Kayle	6/2/10			13k	237
15	TSM Xpecial Janna	1/3/13			10.6k	27
13	Snoopeh Maokai	1/6/6			7.8k	114
12	CLG Krepo Leona	1/6/10			6.7k	17
17	Wickd Shen	2/3/7			7.8k	166
18	CLG yellowpete Corki	7/5/5			10.6k	228
18	CLG Froggen Kog/Maw	4/4/7			10.8k	270

Your Team

TSMTheOddOne			
TSM Chaox			
TSM Regnald			
TSM Dyrus			
TSM Xpecial			

Enemy Team

Snoopeh			
CLG Krepo			
Wickd			
CLG yellowpete			
CLG Froggen			

Send

Home   Play Again!



CONTEXT



LEGACY



NEW SYSTEM



DATA PATTERNS



WRAP-UP

# LEGACY

---

**SHORT DEV WINDOW**

# LEGACY

---

SHORT DEV WINDOW

MINIMUM VIABLE  
PRODUCT

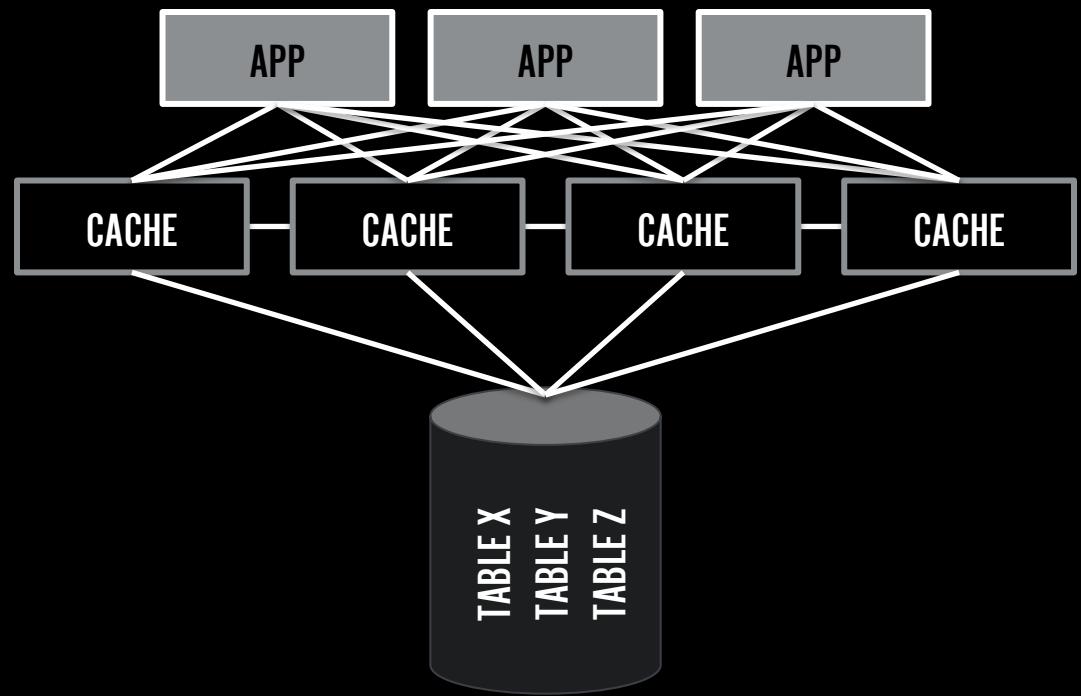
# LEGACY

SHORT DEV WINDOW

MINIMUM VIABLE  
PRODUCT

INCURED  
TECH DEBT

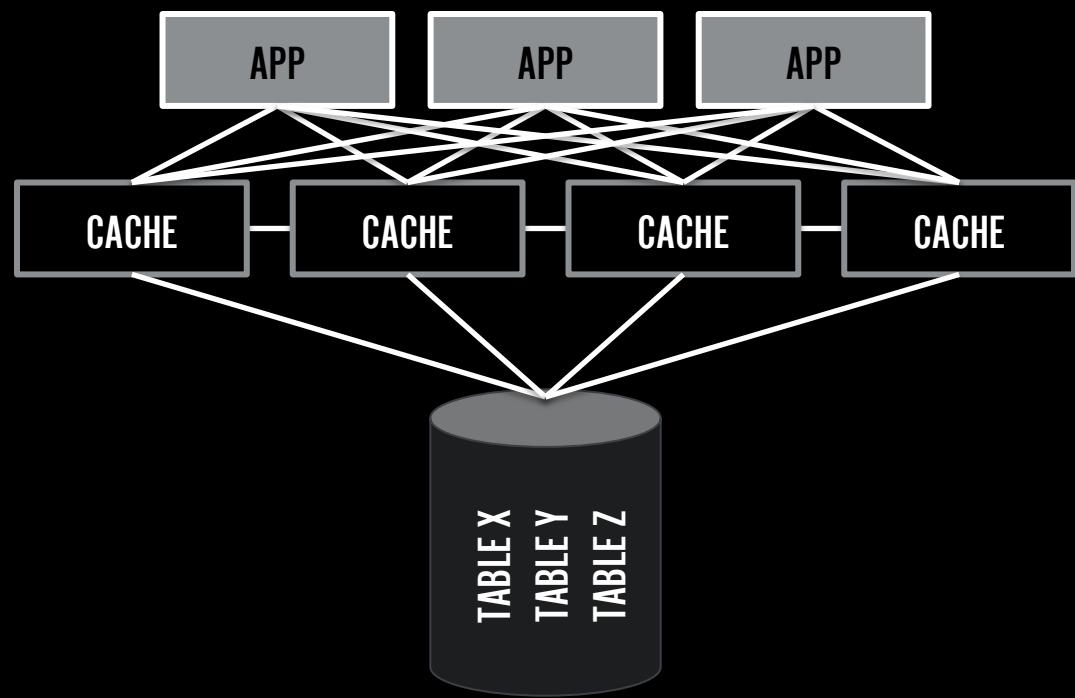
# IN THE BEGINNING (2009)



# IN THE BEGINNING

(2009)

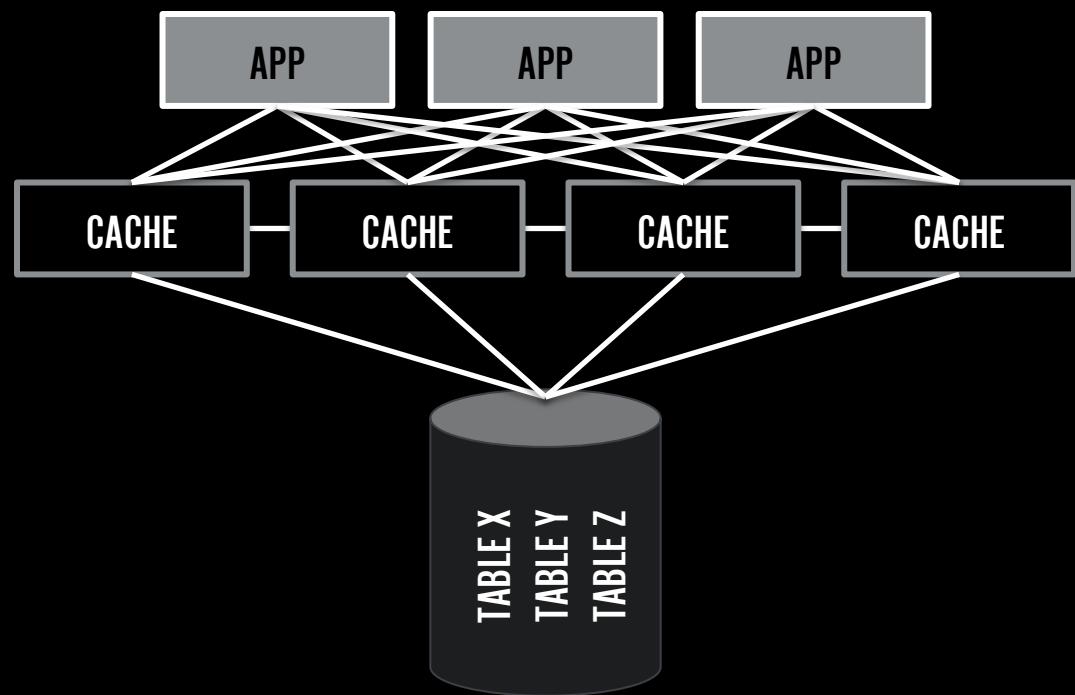
LOW CONCURRENCY TARGET



# IN THE BEGINNING (2009)

LOW CONCURRENCY TARGET

SINGLE ENVIRONMENT



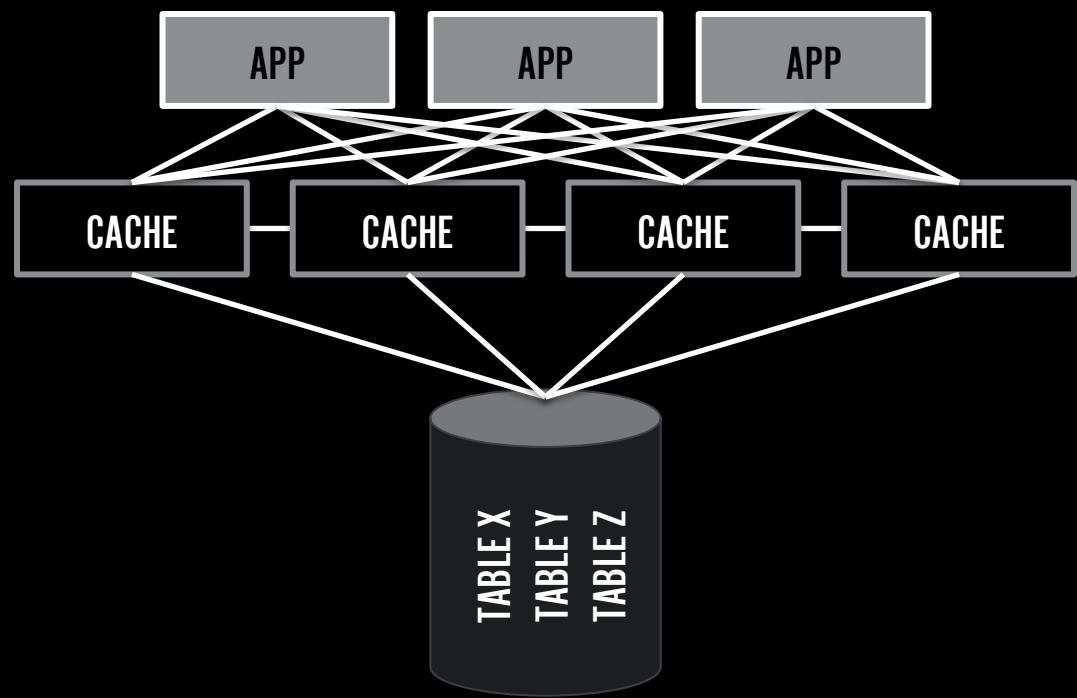
# IN THE BEGINNING

(2009)

LOW CONCURRENCY TARGET

SINGLE ENVIRONMENT

DB SINGLE POINT OF FAILURE



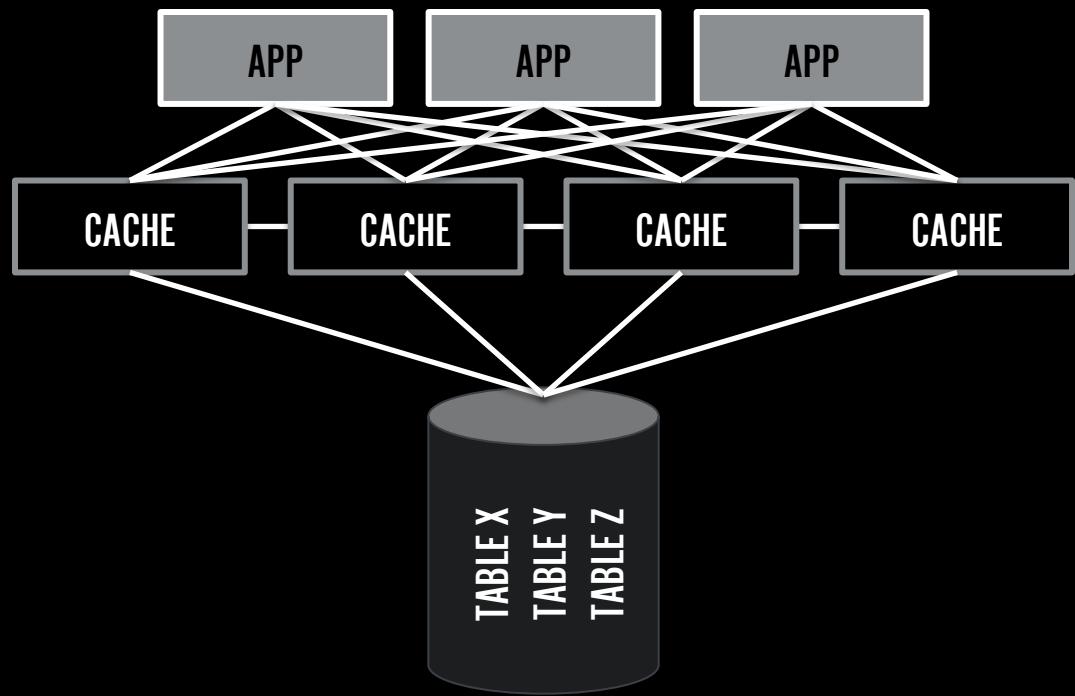
# IN THE BEGINNING (2009)

LOW CONCURRENCY TARGET

SINGLE ENVIRONMENT

DB SINGLE POINT OF FAILUR

DOWNTIME FOR UPGRADES



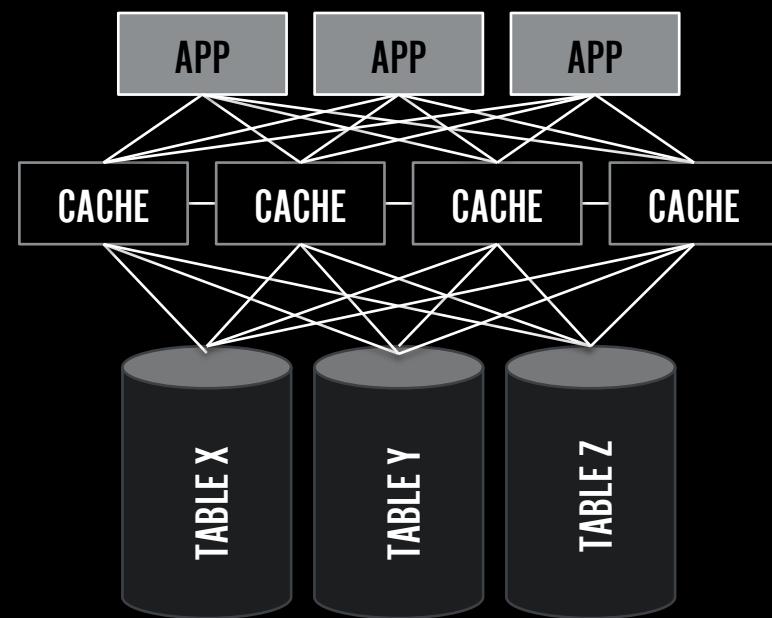
IN THE BEGINNING

(2009)

GROWING UP

(2012)

SHARDED DB



IN THE BEGINNING

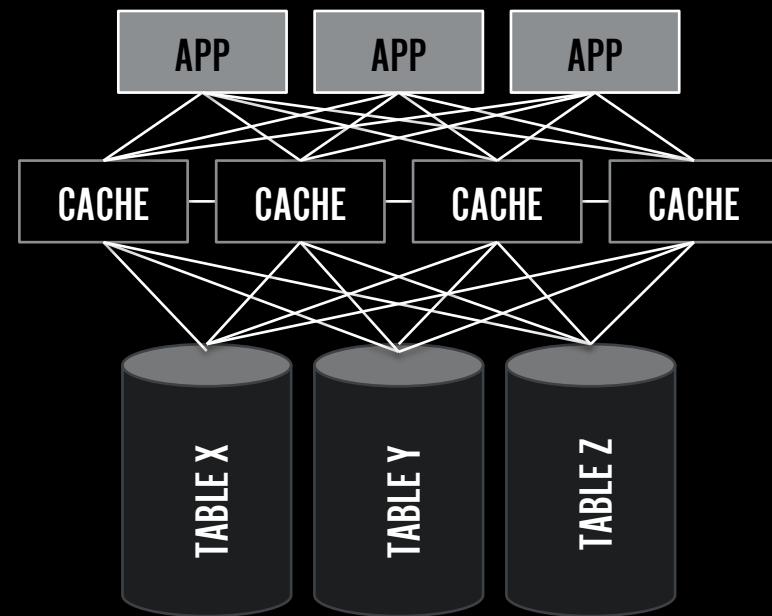
(2009)

GROWING UP

(2012)

SHARDED DB

MULTIPLE SPoF



IN THE BEGINNING

(2009)

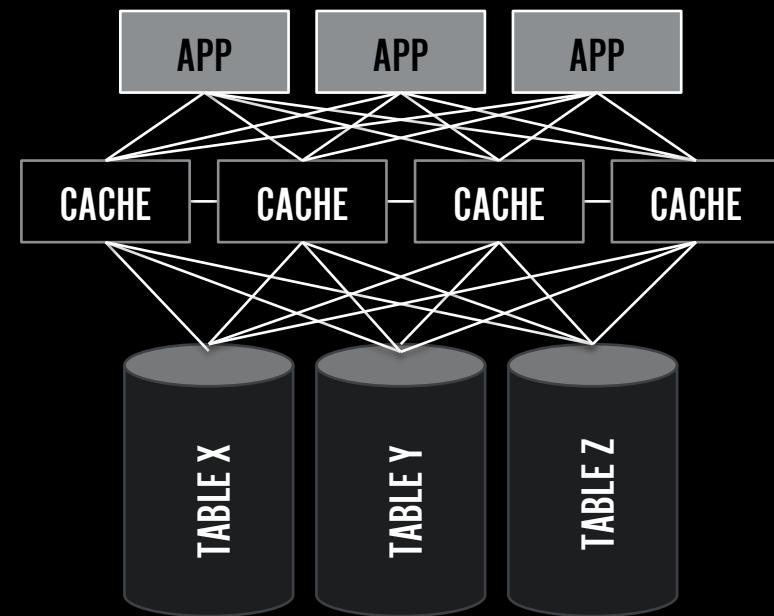
GROWING UP

(2012)

SHARDED DB

MULTIPLE SPOF

KEY/BLOB TABLES



IN THE BEGINNING  
(2009)

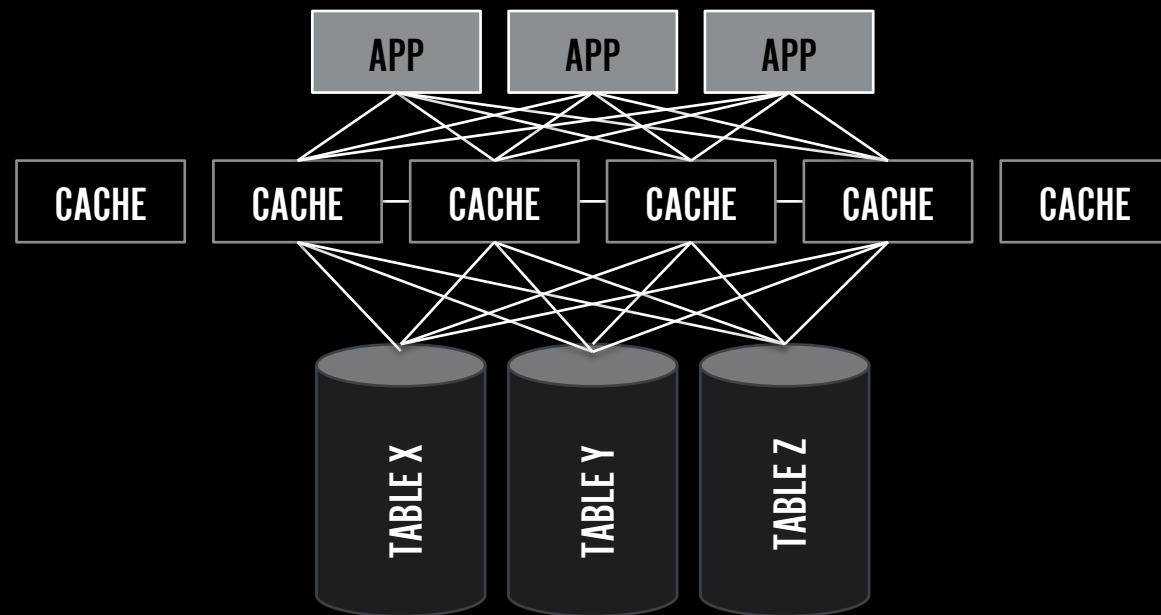
GROWING UP  
(2012)

SHARDED DB

MULTIPLE SPOF

KEY/BLOB TABLES

WIDER CACHE



IN THE BEGINNING  
(2009)

GROWING UP  
(2012)

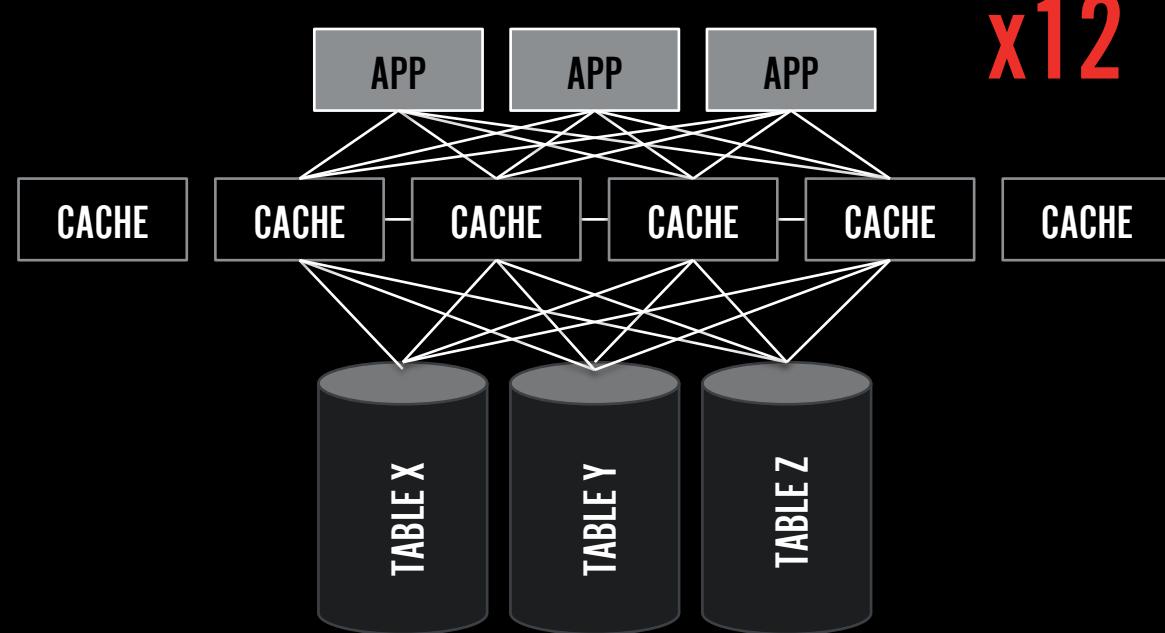
SHARDED DB

MULTIPLE SPOF

KEY/BLOB TABLES

WIDER CACHE

MORE REGIONS



IN THE BEGINNING

(2009)

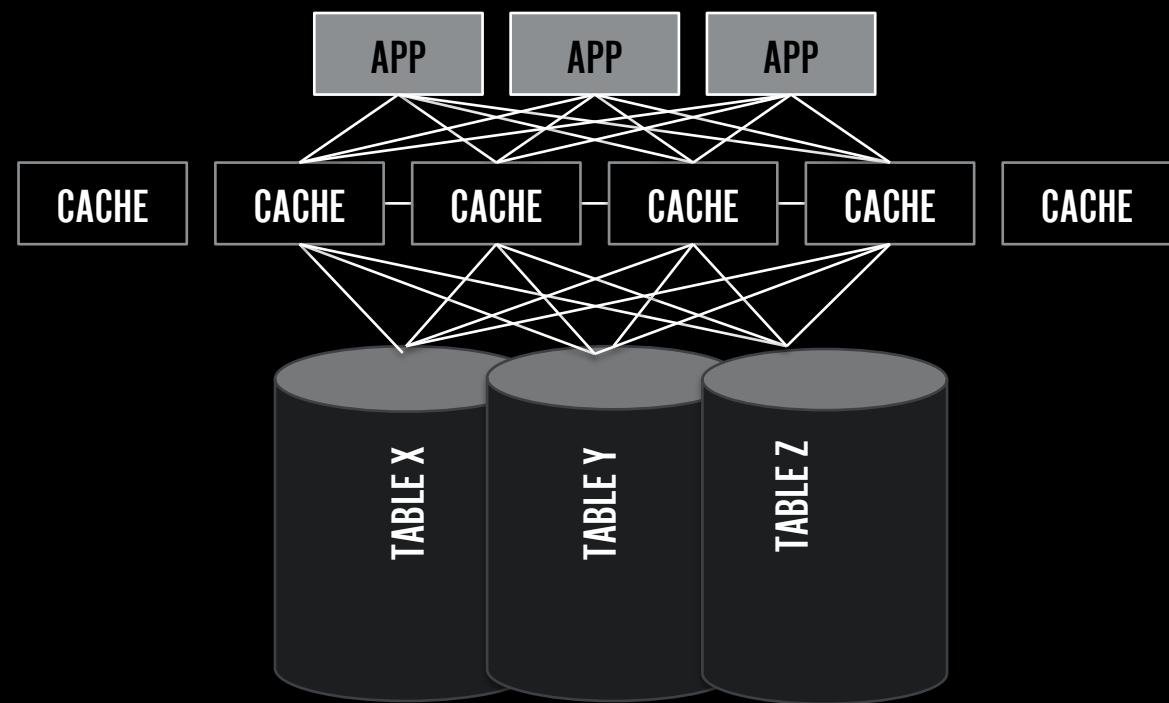
GROWING UP

(2012)

TODAY

(2013)

VERTICAL DB



IN THE BEGINNING

(2009)

GROWING UP

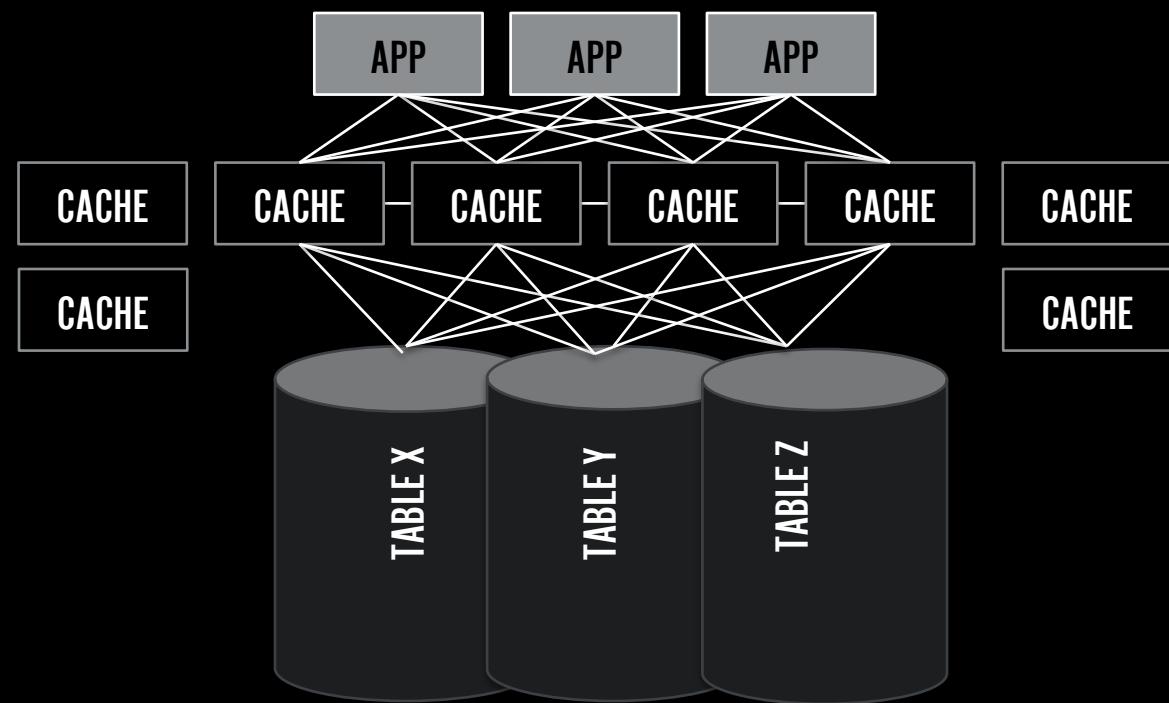
(2012)

TODAY

(2013)

VERTICAL DB

WIDER CACHE



IN THE BEGINNING  
(2009)

GROWING UP  
(2012)

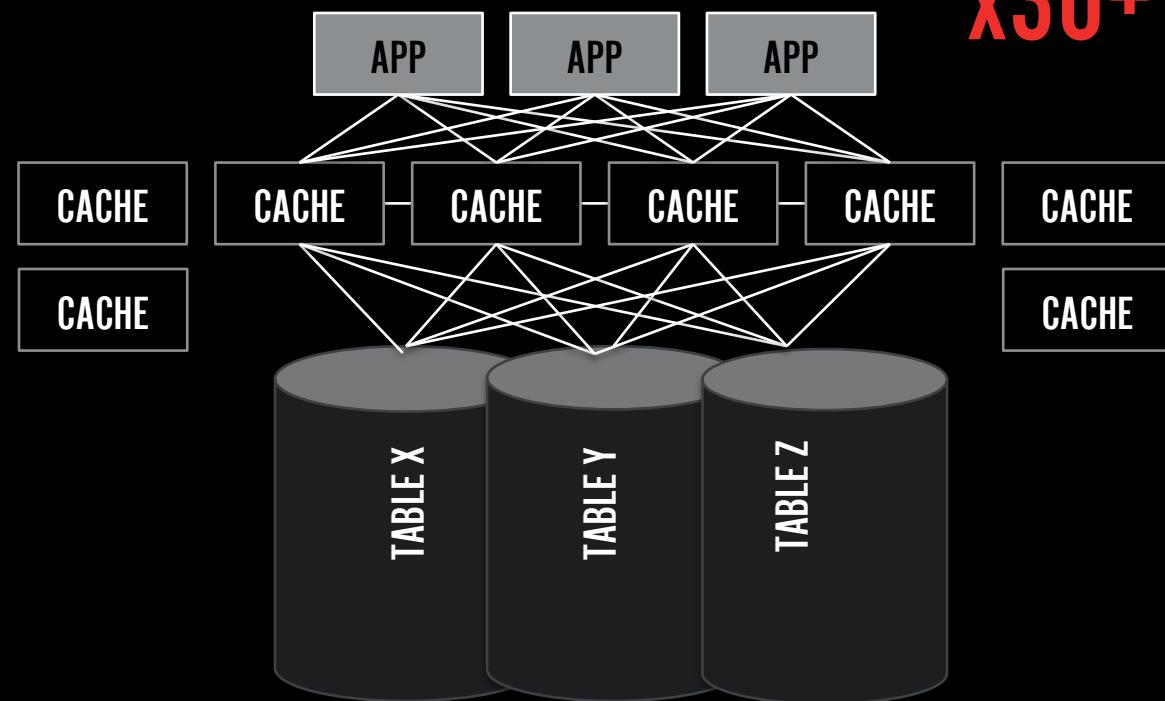
TODAY  
(2013)

VERTICAL DB

WIDER CACHE

MORE REGIONS

x30+



IN THE BEGINNING  
(2009)

GROWING UP  
(2012)

TODAY  
(2013)

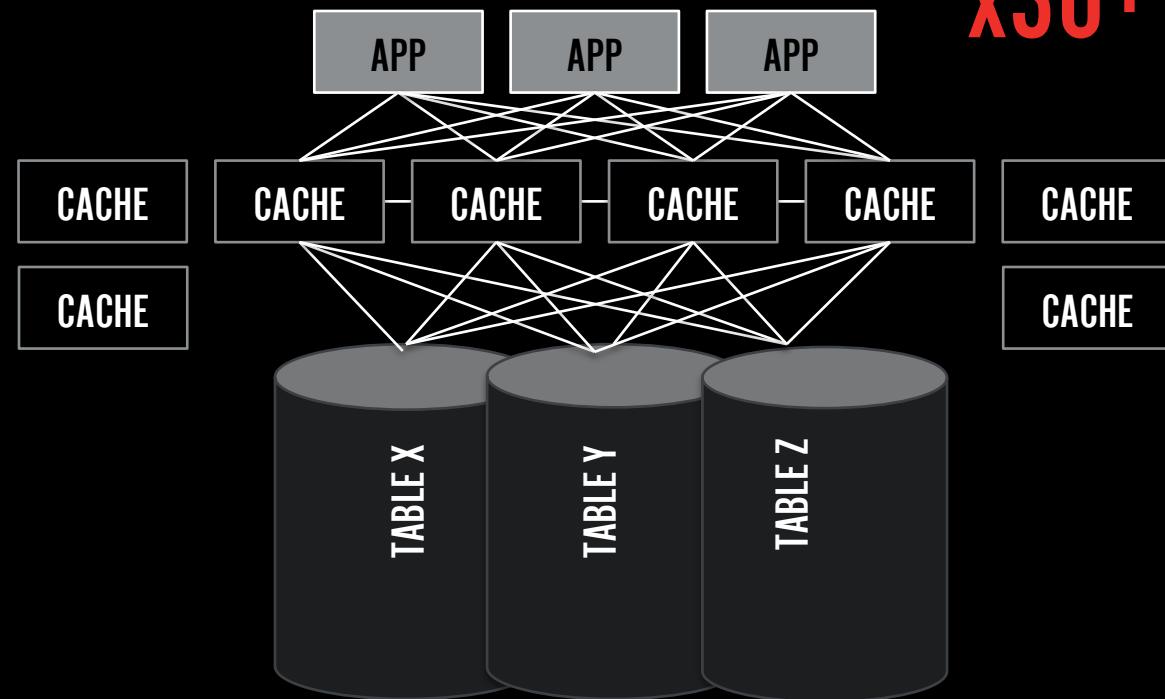
VERTICAL DB

WIDER CACHE

MORE REGIONS

PAIN NOT SOLVED

x30+



IN THE BEGINNING  
(2009)

GROWING UP  
(2012)

TODAY  
(2013)

VERTICAL DB

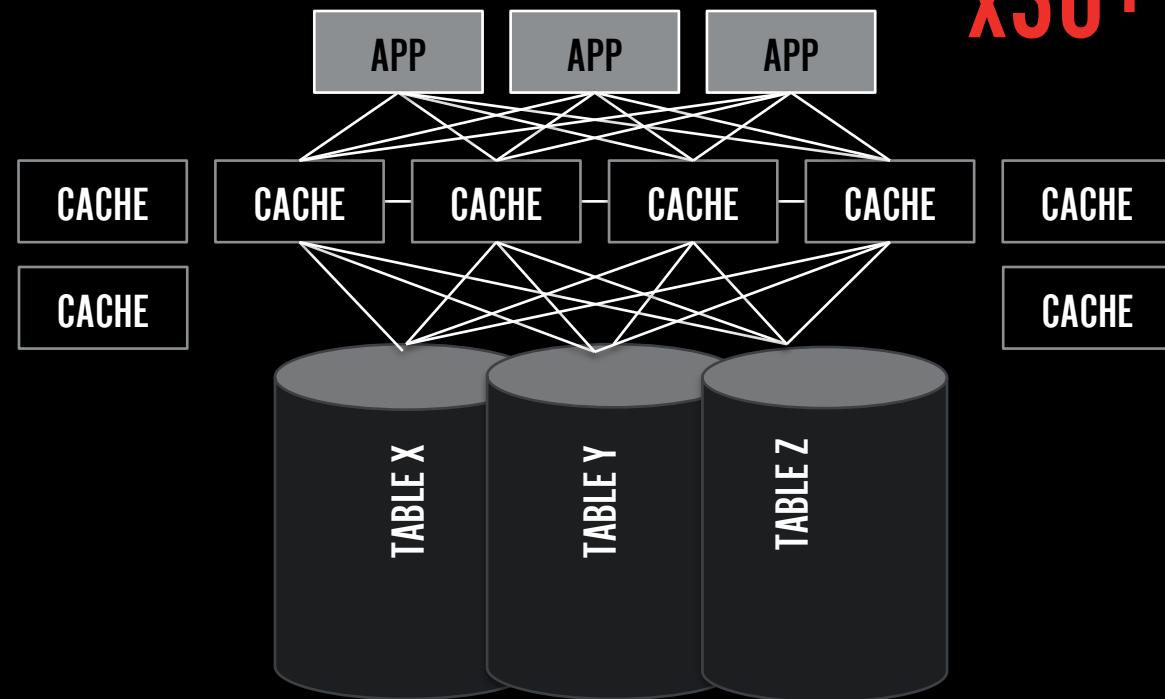
WIDER CACHE

MORE REGIONS

PAIN NOT SOLVED

NEW DATA HEAVY FEATURES DIFFICULT

x30+



# CHALLENGES TO SOLVE

---

SINGLE POINTS  
OF FAILURE

# CHALLENGES TO SOLVE

---

SINGLE POINTS  
OF FAILURE

DOWNTIME FOR  
HARDWARE/  
SOFTWARE  
UPGRADES

# CHALLENGES TO SOLVE

---

SINGLE POINTS  
OF FAILURE

DOWNTIME FOR  
HARDWARE/  
SOFTWARE  
UPGRADES

HORIZONTAL  
SCALING

# CHALLENGES TO SOLVE

SINGLE POINTS  
OF FAILURE

DOWNTIME FOR  
HARDWARE/  
SOFTWARE  
UPGRADES

HORIZONTAL  
SCALING

DATA HEAVY  
FEATURES



CONTEXT



LEGACY



NEW SYSTEM

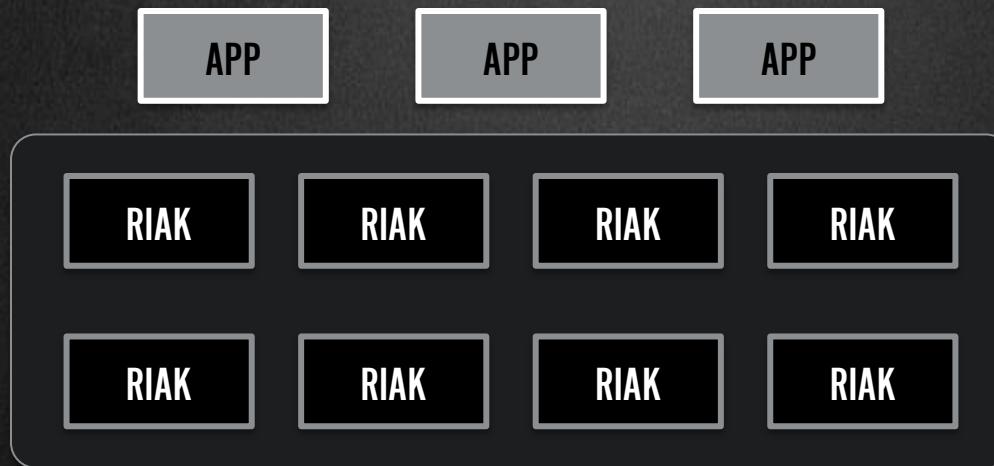


DATA PATTERNS



RECAP

# ARCHITECTURE



# WHY RIAK

---

NO SINGLE POINTS  
OF FAILURE

# WHY RIAK

---

NO SINGLE POINTS  
OF FAILURE

ROLLING UPGRADES

# WHY RIAK

---

NO SINGLE POINTS  
OF FAILURE

ROLLING UPGRADES

HOT REBALANCING

# WHY RIAK

NO SINGLE POINTS  
OF FAILURE

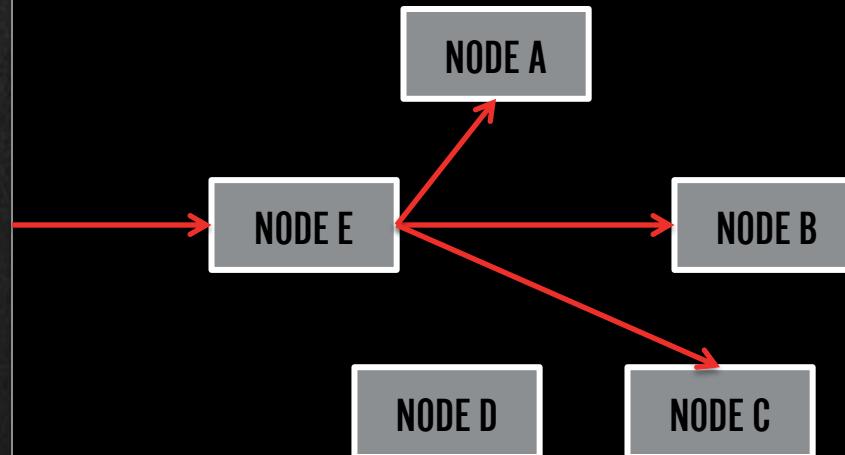
ROLLING UPGRADES

HOT REBALANCING

DATA HEAVY  
FEATURES

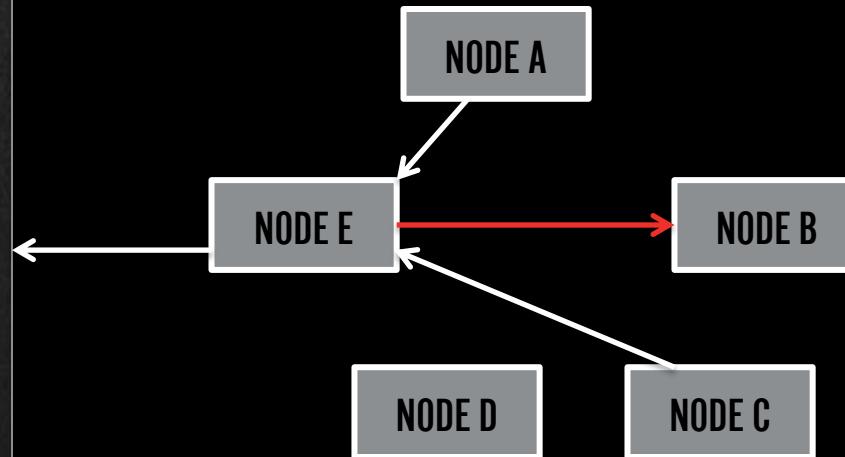
# HOW RIAK WORKS

## NORMAL CASE GET/PUT



# HOW RIAK WORKS

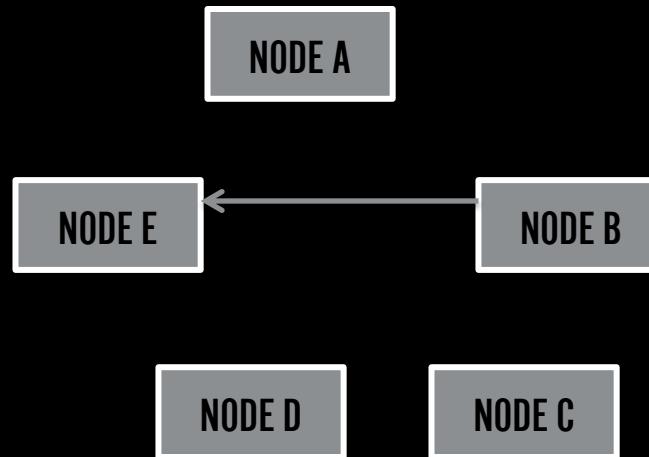
## NORMAL CASE GET/PUT



Only r/n or w/n records must be present/updated for operation to be successful

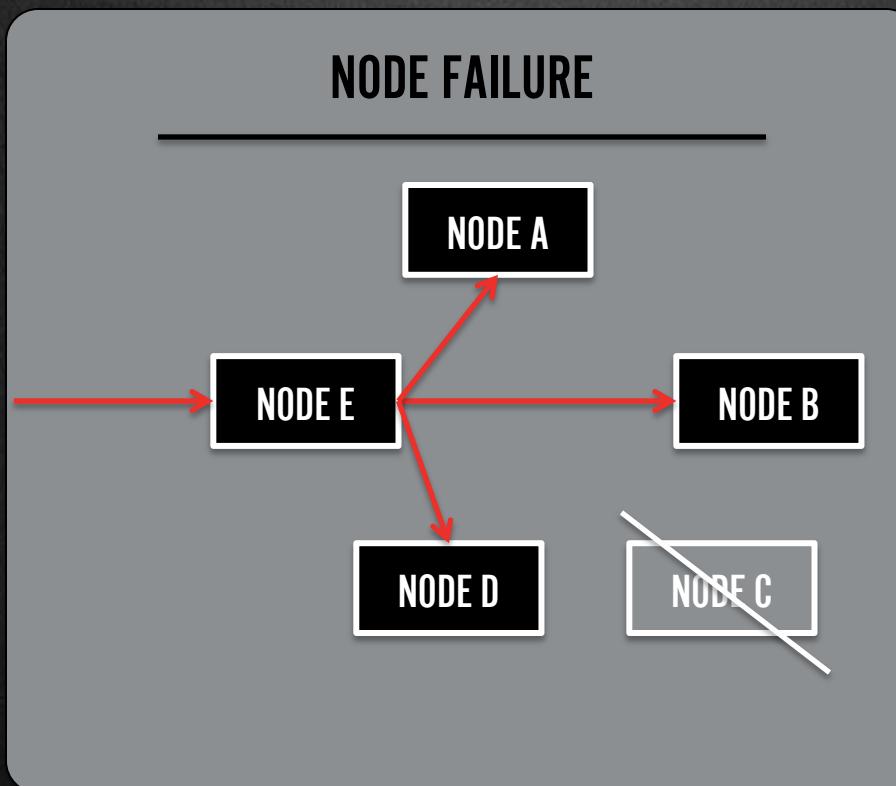
# HOW RIAK WORKS

## NORMAL CASE GET/PUT



Only r/n or w/n records must be present/updated for operation to be successful

# HOW RIAK WORKS



# APP CHALLENGES

---

CONFLICT  
RESOLUTION

# APP CHALLENGES

---

CONFLICT  
RESOLUTION

IDEMPOTENT  
OPERATIONS

# APP CHALLENGES

---

CONFLICT  
RESOLUTION

IDEMPOTENT  
OPERATIONS

BALANCING # GETS  
VS  
OBJECT SIZE



CONTEXT



LEGACY



NEW SYSTEM



DATA PATTERNS



WRAP-UP

# RAW DATA/STATEMENTS OF TRUTH

Overview Grid Graph

Summoner's Rift  
Classic  
Normal  
36:21

**BLUE TEAM WINS**

24/15/52 x 15/24/35

Player	K/D/L	Champions	Kills	Deaths	Assists	Items	Gold	CS
TSMTheOddOne Nocturne	16	3/5/9	10.9k	138				
TSM Chaox Graves	18	10/1/8	15.7k	290				
TSM Reginald Karthus	18	4/4/12	14.2k	324				
TSM Dyrus Kayle	18	6/2/10	13k	237				
TSM Xpecial Janna	15	1/3/13	10.6k	27				
Snoopeh Maokai	13	1/6/6	7.8k	114				
CLG Krepo Leona	12	1/6/10	6.7k	17				
Wickd Shen	17	2/3/7	7.8k	166				
CLG yellowpete Corki	18	7/5/5	10.6k	228				
CLG Froggen Kog'Maw	18	4/4/7	10.8k	270				

Your Team

- TSMTheOddOne
- TSM Chaox
- TSM Reginald
- TSM Dyrus
- TSM Xpecial

Enemy Team

- Snoopeh
- CLG Krepo
- Wickd
- CLG yellowpete
- CLG Froggen

Send

Home Play Again!

# RAW DATA/STATEMENTS OF TRUTH

## RAW DATA

Key: 1234

Value:

```
{  
  "gameId": "1234",  
  "participants": [  
    {  
      "summonerName":  
      "Bede",  
      "id": "3",  
      "champion": "Teemo",  
      "kills": 2,  
      "deaths": 3,  
      "assists": 5  
    },  
    ...  
  ]  
}
```

# RAW DATA/STATEMENTS OF TRUTH

## RAW DATA

```
Key: 1234
Value:
{
  "gameId": "1234",
  "participants": [
    {
      "summonerName": "Bede",
      "id": "3",
      "champion": "Teemo",
      "kills": 2,
      "deaths": 3,
      "assists": 5
    },
    ...
  ]
}
```

TRIVIAL

# RAW DATA/STATEMENTS OF TRUTH

## RAW DATA

```
Key: 1234
Value:
{
  "gameId": "1234",
  "participants": [
    {
      "summonerName": "Bede",
      "id": "3",
      "champion": "Teemo",
      "kills": 2,
      "deaths": 3,
      "assists": 5
    },
    ...
  ]
}
```

TRIVIAL

LAST WRITE WINS

# RAW DATA/STATEMENTS OF TRUTH

## RAW DATA

```
Key: 1234
Value:
{
  "gameId": "1234",
  "participants": [
    {
      "summonerName": "Bede",
      "id": "3",
      "champion": "Teemo",
      "kills": 2,
      "deaths": 3,
      "assists": 5
    },
    ...
  ]
}
```

TRIVIAL

LAST WRITE WINS

JUST STORE IT (NO NEED TO READ MODIFY WRITE)

# MATCH HISTORY/1:N INDEX

League of Legends 3.11.13\_09\_11\_18\_32

LEAGUE OF LEGENDS Play Bede 154078 414383

Bede Snuggle Monkeys Create a Ranked Team

Profile Leagues Match History Champions Runes Masteries Spells Item Sets Find Summoner

Stat Details

Stat	Value
Champion Kills	9
Deaths	9
Assists	34
Largest Killing Spree	3
Largest Multi Kill	3
Damage Dealt	70,458
Healing Done	464
Damage Taken	19,631
Gold Earned	11,000
Minions Slain	31

Victory (normal game) ARAM Howling Abyss September 12, 2013

Defeat (normal game) ARAM Howling Abyss September 12, 2013

Defeat (normal game) Classic Summoner's Rift September 12, 2013

Defeat (normal game) ARAM Howling Abyss September 11, 2013

Victory (normal game) ARAM Howling Abyss September 11, 2013

Defeat (normal game) Classic Summoner's Rift September 11, 2013

Defeat (normal game)

# MATCH HISTORY/1:N INDEX

PLAYER 3 JUST FINISHED GAME 1234

```
Key: 3
dV:
{ "matchList": [
    {"gameId": 1234}
]}
```

CURRENT VALUE IN RIAK

```
Key: 3
Value:
{ "matchList": [
    {"gameId":3},
    {"gameId":23},
    {"gameId":1003}
]}
```

# MATCH HISTORY/1:N INDEX

PLAYER 3 JUST FINISHED GAME 1234

```
Key: 3
dV:
{ "matchList": [
    {"gameId": 1234}
]}
```

CURRENT VALUE IN RIAK

```
Key: 3
Value:
{ "matchList": [
    {"gameId":3},
    {"gameId":23},
    {"gameId":1003}
]}
```

# MATCH HISTORY/1:N INDEX

PLAYER 3 JUST FINISHED GAME 1234

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 1234}  
]}
```

CURRENT VALUE IN RIAK

```
Key: 3  
Value:  
{ "matchList": [  
    {"gameId":3},  
    {"gameId":23},  
    {"gameId":1003}  
]}
```

**READ MODIFY WRITE**

```
Key: 3  
Value:  
{ "matchList": [  
    {"gameId":3},  
    {"gameId":23},  
    {"gameId":1003},  
    {"gameId":1234}  
]}
```

# WHAT ABOUT CONCURRENT UPDATES?

# MATCH HISTORY/1:N INDEX

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 1234}  
]}
```

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 2222 }  
]}
```

```
Key: 3  
Value:  
Sibling 1:  
→ { "matchList": [  
    {"gameId": 3},  
    {"gameId": 23},  
    {"gameId": 1003},  
    {"gameId": 1234}  
]}  
Sibling 2:  
→ { "matchList": [  
    {"gameId": 3},  
    {"gameId": 23},  
    {"gameId": 1003},  
    {"gameId": 2222}  
]}
```

# MATCH HISTORY/1:N INDEX

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 1234}  
]}
```

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 2222 }  
]}
```

```
Key: 3  
Value:  
Sibling 1:  
    { "matchList": [  
        {"gameId":3},  
        {"gameId":23},  
        {"gameId":1003},  
        {"gameId": 1234}  
    ]}  
Sibling 2:  
    { "matchList": [  
        {"gameId":3},  
        {"gameId":23},  
        {"gameId":1003},  
        {"gameId":2222}  
    ]}
```

**RESOLVE CONFLICT ON NEXT READ**

```
[  
{"gameId":3},  
 {"gameId":23},  
 {"gameId":1003},  
 {"gameId": 1234}  
]
```

```
[  
{"gameId":3},  
 {"gameId":23},  
 {"gameId":1003},  
 {"gameId":2222}  
]
```

# MATCH HISTORY/1:N INDEX

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 1234}  
]}
```

```
Key: 3  
dV:  
{ "matchList": [  
    {"gameId": 2222 }  
]}
```

**RESOLVE CONFLICT ON NEXT READ**

```
[  
{"gameId":3},  
 {"gameId":23},  
 {"gameId":1003},  
 {"gameId": 1234}  
]
```



```
[  
 {"gameId":3},  
 {"gameId":23},  
 {"gameId":1003},  
 {"gameId":2222}  
]
```



```
Key: 3  
Value:  
Sibling 1:  
 { "matchList": [  
     {"gameId":3},  
     {"gameId":23},  
     {"gameId":1003},  
     {"gameId": 1234}  
 ]}  
Sibling 2:  
 { "matchList": [  
     {"gameId":3},  
     {"gameId":23},  
     {"gameId":1003},  
     {"gameId":2222}  
 ]}
```

```
Key: 3  
Value:  
{ "matchList": [  
    {"gameId":3},  
    {"gameId":23},  
    {"gameId":1003},  
    {"gameId": 1234},  
    {"gameId": 2222}  
]}
```

# WHAT IF I JUST WANT TEEMO GAMES?



# MATCH HISTORY/1:N INDEX

Keep non-primary indexes in the record

Key: 3

Value:

```
{ "matchList": [  
    {"gameId":3, "champ": "Teemo", "win": false, "queue":"NORMAL"},  
    {"gameId":23, "champ": "Sejuani" , "win": false, "queue":"ARAM"},  
    {"gameId":1003, "champ": "Trundle" , "win": false, "queue":"NORMAL"},  
    {"gameId":1234, "champ": "Teemo" , "win": false, "queue":"RANKED_SOLO"}  
]}
```

# AGGREGATE STATS/SETS OF COUNTERS

League of Legends 3.11.13\_09\_11\_18\_32

LEAGUE OF LEGENDS

Play

Bede 154078 414383

30

Snuggle Monkeys

Create a Ranked Team

Profile Leagues Match History Champions Runes Masteries Spells Item Sets Find Summoner

Stats Graphs Season 3

Won: 5 Lost: 4 Win Ratio: 55.6%

Volibear the Thunder's Roar

Lifetime Totals

X 41	43	78
Max Kills 12	Max Deaths 10	
Total Turrets Destroyed 6	Damage Dealt 774,438	
Minions Killed 537	Physical Damage Dealt 390,323	
Double Kills 2	Magic Damage Dealt 327,736	
Triple Kills 0	Gold Earned 79,573	
Quadra Kills 0		
Penta Kills 0		

Per Game Averages

X 4.6	4.8	8.7
Total Turrets Destroyed 0.66	Damage Dealt 86,048	
Minions Killed 59.66	Physical Damage Dealt 43,369	
Double Kills 0.22	Magic Damage Dealt 36,415	
Triple Kills 0.00	Gold Earned 8841.4	
Quadra Kills 0.00		
Penta Kills 0.00		

Wins with 15/115 Champions.

Filter By Champion

Clear Filter

Volibear Rumble Sejuani Malphite Hecarim Zed Brand Leona Draven Trundle Singed Karma Kayle W...

4

!

# AGGREGATE STATS/SETS OF COUNTERS

```
Key: 3  
dV:  
{“kills”: 3,  
“deaths”: 2,  
...  
}
```

```
Key: 3  
Value:  
Original:  
{ “kills”: 100,  
“deaths”: 200  
...  
}
```

**READ MODIFY WRITE**

```
Key: 3  
Value:  
New Value:  
{ “kills”: 103,  
“deaths”: 202  
...  
}
```

# WHAT ABOUT CONCURRENT UPDATES?

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3

dV:

```
{“kills”: 3,  
“deaths”: 2,  
...  
}
```

Key: 3

dV:

```
{“kills”: 20,  
“deaths”: 0,  
...  
}
```



Key: 3

Value:

Original:

```
{ “kills”: 100,  
“deaths”: 200
```

...

}

Sibling 1:

```
{ “kills”: 103,  
“deaths”: 202
```

...

}

Sibling 2:

```
{ “kills”: 120,  
“deaths”: 200
```

...

}

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3

dV:

```
{“kills”: 3,  
“deaths”: 2,  
...  
}
```

Key: 3

dV:

```
{“kills”: 20,  
“deaths”: 0,  
...  
}
```



Key: 3

Value:

Original:

```
{ “kills”: 100,  
“deaths”: 200  
...  
}
```

Sibling 1:

```
{ “kills”: 103,  
“deaths”: 202  
...  
}
```

Sibling 2:

```
{ “kills”: 120,  
“deaths”: 200  
...  
}
```

Not resolvable without additional info

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3

dV:

```
{“kills”: 3,  
“deaths”: 2,  
...  
}
```

Key: 3

dV:

```
{“kills”: 20,  
“deaths”: 0,  
...  
}
```



Key: 3

Value:

Original:

```
{ “kills”: 100,  
“deaths”: 200  
...  
}
```

Sibling 1:

```
{ “kills”: 103,  
“deaths”: 202  
...  
}
```

Sibling 2:

```
{ “kills”: 120,  
“deaths”: 200  
...  
}
```

Not resolvable without additional info

Keep a list of deltas?

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3  
dV:  
{“gamelId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
}

Key: 3  
dV:  
{“gamelId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}

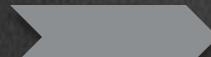


Key: 3  
Value:  
Original:  
“[{“gamelId”: 1  
“kills”: 1,  
“deaths”: 2  
...  
},  
... ,  
{“gamelId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
},  
{“gamelId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}]

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3  
dV:  
{“gamelId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
}

Key: 3  
dV:  
{“gamelId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}



Key: 3  
Value:  
Original:  
“[{“gamelId”: 1  
“kills”: 1,  
“deaths”: 2  
...  
},  
... ,  
{“gamelId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
},  
{“gamelId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}]

Resolvable when conflicts occur

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3  
dV:  
{“gameId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
}

Key: 3  
dV:  
{“gameId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}



Key: 3  
Value:  
Original:  
“[{“gameId”: 1  
“kills”: 1,  
“deaths”: 2  
...  
},  
... ,  
{“gameId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
},  
{“gameId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}]

Resolvable when conflicts occur

Expensive for 1000s of games and large # of metrics....

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3  
dV:  
{“gameId”:1234,  
“kills”: 3,  
“deaths”: 2,  
...  
}

Key: 3  
dV:  
{“gameId”: 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}



Key: 3  
Value:  
Original:  
[{"gameId": 1  
“kills”: 1,  
“deaths”: 2  
...  
},  
... ,  
{"gameId": 1234,  
“kills”: 3,  
“deaths”: 2,  
...  
},  
{"gameId": 2222,  
“kills”: 20,  
“deaths”: 0,  
...  
}]

Resolvable when conflicts occur

Expensive for 1000s of games and large # of metrics....

Combine keeping an aggregate with a list of deltas

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3

dV:

```
{"gamelid": 2222,  
 "ts":10,  
 "kills": 20,  
 "deaths": 0,  
 ...  
 }
```

Key: 3

Value:

```
{"truncationTime": 1,  
 "truncatedStats": {  
     "kills": 100,  
     "deaths": 200  
     ...  
 },  
 "recentGames": [  
     {"gamelid":1234,  
      "ts":4,  
      "kills": 3,  
      "deaths": 2,  
      ...  
 }  
 ]  
 }
```

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3

dV:

```
{"gamelid": 2222,  
 "ts":10,  
 "kills": 20,  
 "deaths": 0,  
 ...  
 }
```

Key: 3

Value:

```
{"truncationTime": 1,  
 "truncatedStats": {  
 "kills": 100,  
 "deaths": 200  
 ...  
 },  
 "recentGames": [  
 {"gamelid":1234,  
 "ts":4,  
 "kills": 3,  
 "deaths": 2,  
 ...  
 }  
 ]  
 }
```

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3

dV:

```
{"gamelid": 2222,  
 "ts":10,  
 "kills": 20,  
 "deaths": 0,  
 ...  
 }
```

Key: 3

Value:

```
{"truncationTime": 1,  
 "truncatedStats": {  
     "kills": 100,  
     "deaths": 200  
     ...  
 },  
 "recentGames": [  
     {"gamelid":1234,  
      "ts":4,  
      "kills": 3,  
      "deaths": 2,  
      ...  
 }  
 ]  
 }
```

# AGGREGATE STATS/SETS OF COUNTERS

Key: 3  
dV:  
{“gamelid”: 2222,  
“ts”:10,  
“kills”: 20,  
“deaths”: 0,  
...  
}

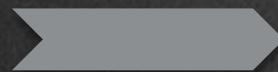
Key: 3  
Value:  
{“truncationTime”: 1,  
“truncatedStats”: {  
“kills”: 100,  
“deaths”: 200  
...  
},  
“recentGames”:[  
{“gamelid”:1234,  
“ts”:4,  
“kills”: 3,  
“deaths”: 2,  
...  
}  
]  
}

# AGGREGATE STATS/SETS OF COUNTERS

## READ + MODIFY

```
{“truncationTime”: 1,  
“truncatedStats”: {  
    “kills”: 100,  
    “deaths”: 200  
    ...  
},  
“recentGames”:[  
    {“gameId”:1234,  
     “ts”:4,  
     “kills”: 3,  
     “deaths”: 2,  
     ...  
},  
    {“gameId”: 2222,  
     “ts”:10,  
     “kills”: 20,  
     “deaths”: 0,  
     ...  
}  
]
```

Now = 10  
Max age = 4  
Truncate if  
ts < now - max age



## TRUNCATE + WRITE

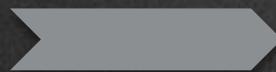
```
{“truncationTime”: 4,  
“truncatedStats”: {  
    “kills”: 103,  
    “deaths”: 202  
    ...  
},  
“recentGames”:[  
    {“gameId”: 2222,  
     “ts”:10,  
     “kills”: 20,  
     “deaths”: 0,  
     ...  
} ]  
}
```

# AGGREGATE STATS/SETS OF COUNTERS

## READ + MODIFY

```
{“truncationTime”: 1,  
“truncatedStats”: {  
    “kills”: 100,  
    “deaths”: 200  
    ...  
},  
“recentGames”:[  
    {“gameId”:1234,  
     “ts”:4,  
     “kills”: 3,  
     “deaths”: 2,  
     ...  
},  
    {“gameId”: 2222,  
     “ts”:10,  
     “kills”: 20,  
     “deaths”: 0,  
     ...  
}  
]
```

Now = 10  
Max age = 4  
Truncate if  
ts < now - max age



## TRUNCATE + WRITE

```
{“truncationTime”: 4,  
“truncatedStats”: {  
    “kills”: 103,  
    “deaths”: 202  
    ...  
},  
“recentGames”:[  
    {“gameId”: 2222,  
     “ts”:10,  
     “kills”: 20,  
     “deaths”: 0,  
     ...  
    }  
]
```

Still susceptible to network partitions longer than max age

Rebuild from match history + raw data when this occurs

**WHAT IF I JUST WANT TO KNOW HOW  
MANY TIMES TEEMO DIES?**

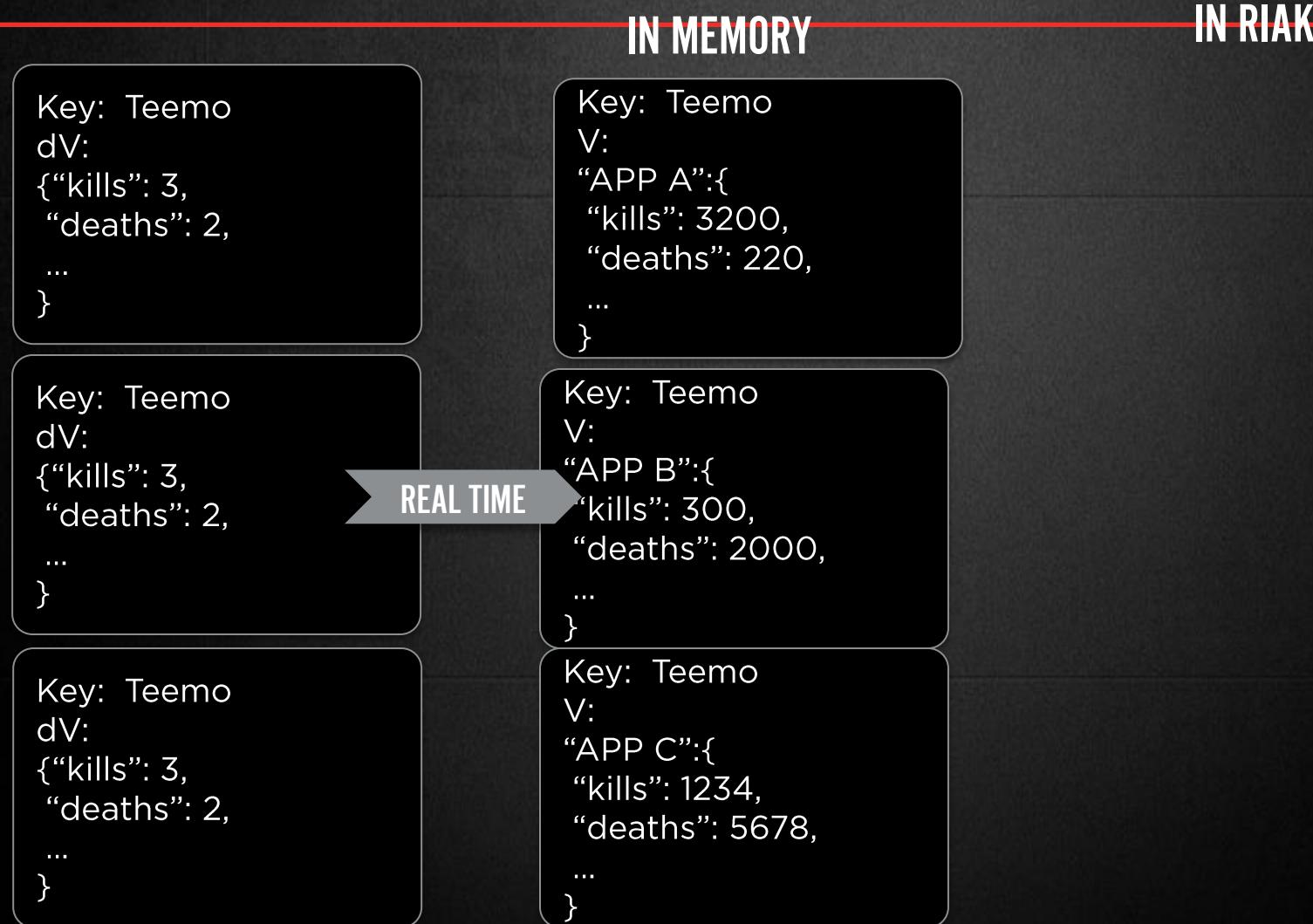


# GLOBAL AGGREGATES/HIGH FREQUENCY SETS OF COUNTERS

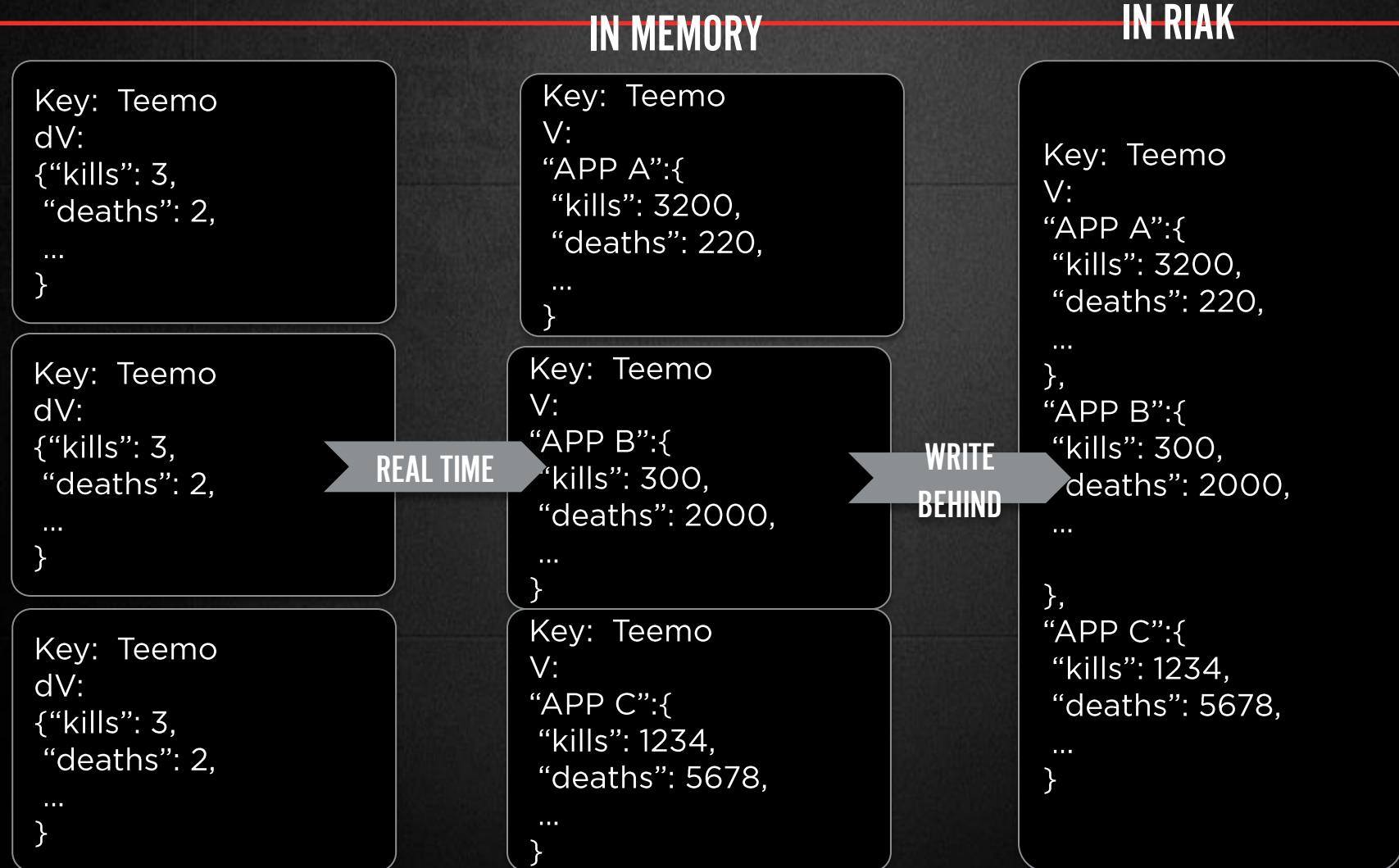
```
Key: Teemo  
dV:  
{“kills”: 3,  
“deaths”: 2,  
...  
}
```

**x100s per second per app node**

# GLOBAL AGGREGATES/HIGH FREQUENCY SETS OF COUNTERS



# GLOBAL AGGREGATES/HIGH FREQUENCY SETS OF COUNTERS



CONTEXT

LEGACY

NEW SYSTEM

DATA PATTERNS

WRAP-UP

# WHERE WE'RE AT

---

LIVE BUT DARK

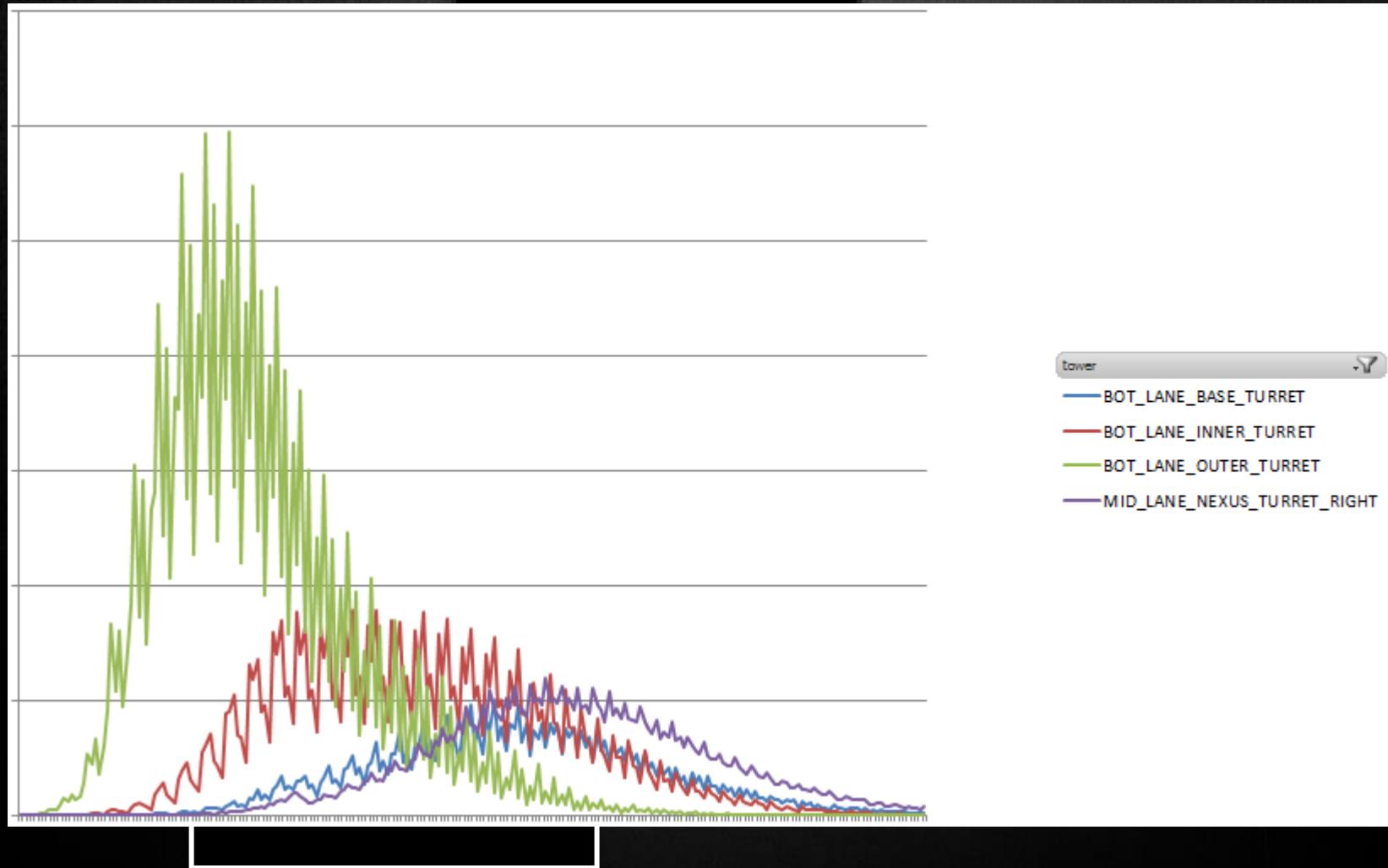
# WHERE WE'RE AT

---

LIVE BUT DARK

GAMEPLAY  
ANALYSIS

# WHERE WE'RE AT



# WHERE WE'RE AT

LIVE BUT DARK

GAMEPLAY  
ANALYSIS

THUNDERDOME



# THANK YOU! QUESTIONS?

GARRETT EARDLEY  
[geardley@riotgames.com](mailto:geardley@riotgames.com)

