MEASURING AVAILABILITY
The Player Focused Way

SRE CON_ AMERICAS

AKA Creating Accountability to Availability

Maxfield Stewart
Technical Director:
Live Operations
Riot Games

Who is this guy?

WHO IS RIOT GAMES

Developer & Publisher of
League of Legends
Valorant
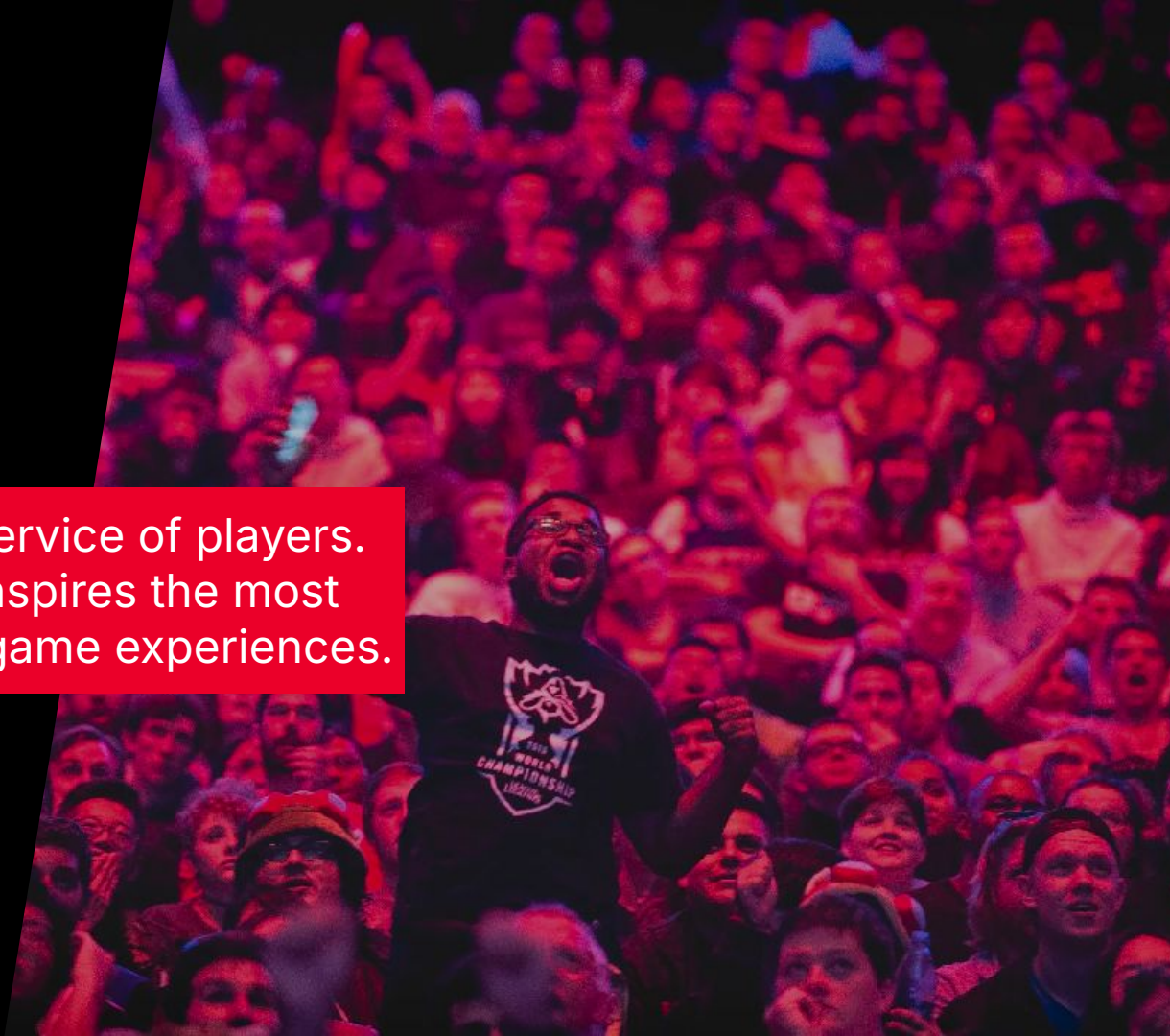*Legends of Runeterra*
2XKO
…and More!

We aspire to be the most beloved and trusted game company for the world's most passionate players.

PLAYER FIRST

Everything we do is in service of players. This continuous focus inspires the most meaningful and lasting game experiences.

Our Players

MORE THAN
100 MILLION

MONTHLY ACTIVE PLAYERS

MORE THAN
30 MILLION

DAILY ACTIVE PLAYERS

MORE THAN
2 MILLION

PEAK CONCURRENT PLAYERS

2,000+ RIOTERS
16 OFFICES

SANTA MONICA	SANTIAGO	MOSCOW	TAIPEI
ST. LOUIS	MEXICO CITY	COLOGNE	SYDNEY
NEW YORK	DUBLIN	SEOUL	ISTANBUL
SAO PAULO	BRIGHTON	HONG KONG	TOKYO

Our Infrastructure

More Than 800 'Services'

Mostly Golang & Java Micro-Services with C++ Game Servers

Sharded Game Deployments

Over 50 Game "Shards"

AWS / K8S Deployments

50k+ Containers 10's of Thousands of Cores

The Problem

01 The year is 2021.. the pandemic has started, we've gone multi game, and we're burning out

02 There was no standard to track how well we were maintaining service

03 Game Leadership & C-Suite Had no idea how well we were doing

04 Player Focused culture meant everything was a crisis

"**Plausible Deniability** in leadership meant despite a "total ownership" culture, there is no actual accountability to availability." -- Maxfield Stewart

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Evolution

01

Live Ops Must Own Availability & Response *(or it gets decentralized)*

02

Studio (Game) Leadership Must be Accountable for Availability

You have **12 months** to achieve this or we'll try something else. -- Derek Defields (Riot CTO)
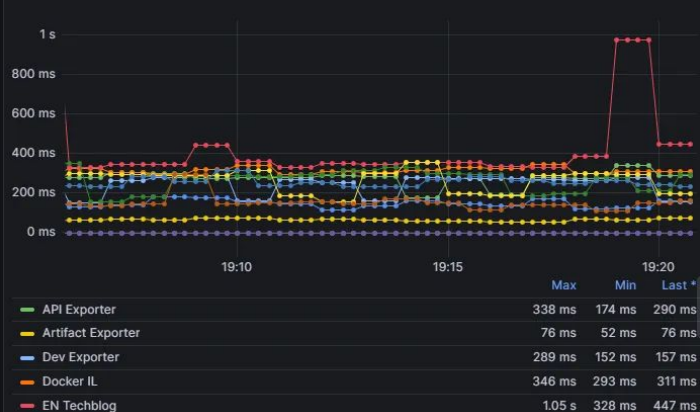
We Needed a Unified SLO

Site Status

API Exporter	Artifact Exporter	Dev Exporter	Docker IL	EN Techblog	Grafana
UP	UP	UP	UP	UP	UP

Local Portainer	Ma-Nish API	PDF Utils	Services Exporter	Techblog	Techblog Exporter
UP	DOWN	UP	UP	UP	UP

TLS Certificate Status

API Exporter	Artifact Exporter	Dev Exporter	Docker IL	EN Techblog
VALID	VALID	VALID	VALID	VALID

Grafana	PDF Utils	Services Exporter	Techblog	Techblog Exporter
VALID	VALID	VALID	VALID	VALID

TLS Certificate Remaining Days

API Exporter	Artifact Exporter	Dev Exporter	Docker IL	EN Techblog
72	72	72	42	62

Grafana	PDF Utils	Services Exporter	Techblog	Techblog Exporter
72	62	72	62	62

Response Times

	Max	Min	Last *
API Exporter	338 ms	174 ms	290 ms
Artifact Exporter	76 ms	52 ms	76 ms
Dev Exporter	289 ms	152 ms	157 ms
Docker IL	346 ms	293 ms	311 ms
EN Techblog	1.05 s	328 ms	447 ms

Estimated time to achieve 70-80% adoption of a new technical standard across all services at Riot is over 2 years.

The **players don't care if a single service is down**

They care if **they cannot engage the way they want (or need) to**

What Did We Have?

01 Sense of Ownership that led to responsive Alerting and Reporting

02 Player Support Organization Constantly monitoring trends

03 Responsive Incident Management Process

04 Pretty Good Real-time Metrics

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What to Focus On?

01 Incident Prioritization

02 Common Language

03 Rigorous Review

04 Communication

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Prioritization

Old 'Severity'

Sev 1 — Critical Service "outage"

Sev 2 — Critical Service "impaired"

Sev 3 — Non-critical Service "outage"

Sev 4 — Non-critical Service "impaired"

New Priority

P1 — Impacts > 50% of the player base on single shard/multiple shards

P2 — Impacts 15-50% of the player base on single or multiple shard

P3 — Impacts 1-15% of the player base on a single shard

P4 — Impacts < 1% of the player base on a single shard

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Our Solution Must be Something Players Would Agree With

The Player Journey

Connecting

Login

Patching

Purchasing (Store)

Purchasing Content

Purchasing Currency

Play

Retrieve Inventory

Form a Party

Match Making

Playing the Game

Chat & Voice

End of Game Rewards

Describing an Incident

We can now combine incident Priority and our Common Language to rapidly describe an incident.

|			
Game(s) & Shard(s)	League of Legends | North America	Valorant | Korea-Oceania-Europe	League of Legends | All Regions Valorant | All Regions Runeterra | All Regions
Priority	**P3** (1-15% of Players)	**P1** (More than 50% of Players)	**P2** (Between 15 and 50%)
Categories	Login	Match Making	Purchase Content
		Retrieve Inventory	End of Game
Duration	**10 Minutes**	**60 Minutes**	**240 Minutes**

None of this is an SLO!

Correct. It does however establish the basic building blocks.

(Don't worry, we're not going to do incident duration as the SLO... at least not directly)

Creating an SLO

SLO?
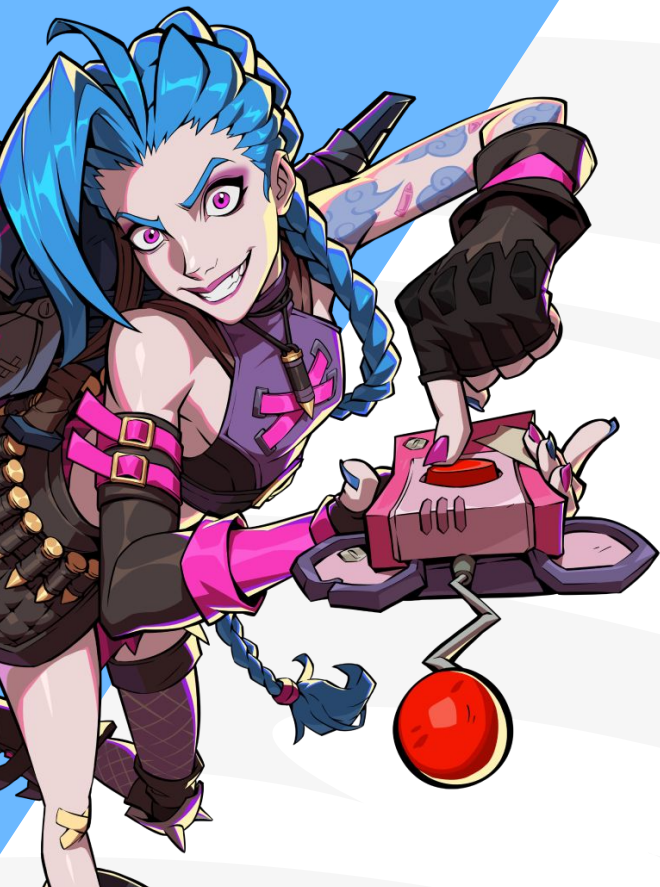
AI Overview

In the context of Site Reliability Engineering (SRE) at Google, a Service Level Objective (SLO) is **a measurable, quantifiable target for a service's performance or reliability that an organization aims to achieve and maintain**. 🔗

Here's a more detailed breakdown:

What it is:

An SLO defines a specific performance goal for a service, such as availability, latency, or error rate. 🔗

Why it's important:

SLOs help teams understand what level of reliability and performance is expected from a service and guide decisions about engineering trade-offs and resource allocation. 🔗

An SLO MUST Be Something Leadership Cares About!

01 A Missed Result MUST Feel Bad And Not be Debatable

02 It must go to the people who make decisions about feature vs fix!

03 It must go to the people who can actually impact the result!

Inspired by Power!

Think about serving power to households....

= 43800 min/month

2 hours (120 minutes) of failed delivery =
100 - (120 / 43800) = **99.997% *Available*** (0.003% outage)

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Inspired by Power!

Think about serving power to households....

= 43,800,000 min/month

100k Households

2 hours (120 minutes) of failed delivery =
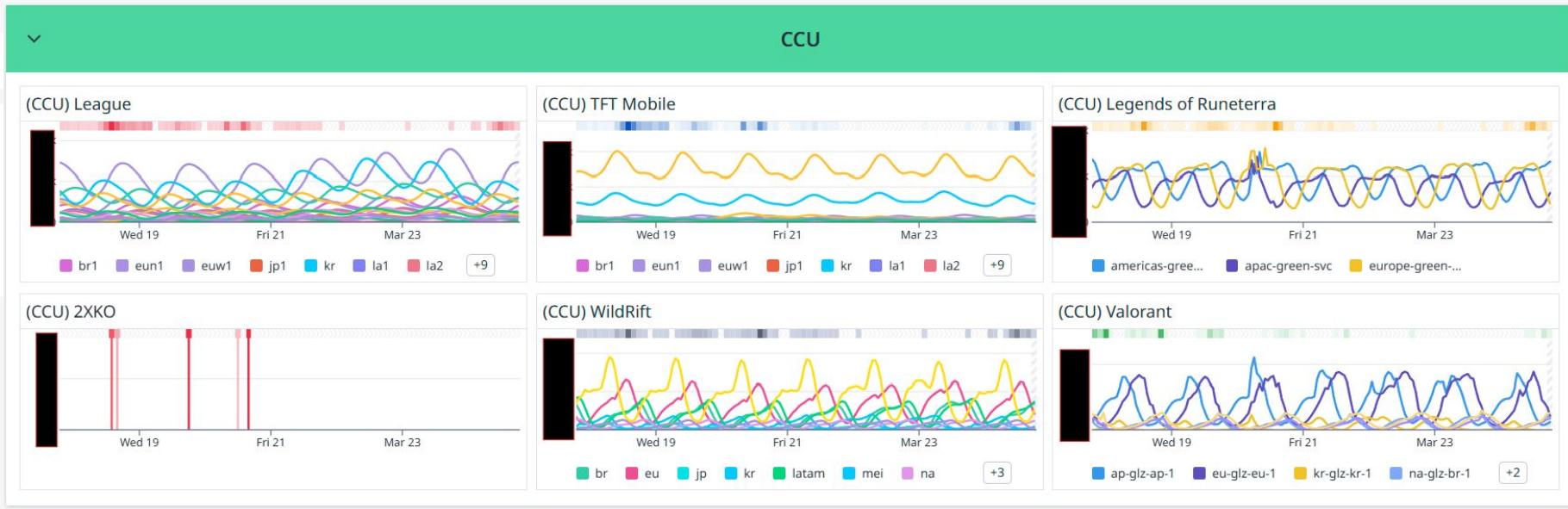100 - (120 / 43,800,00) = **99.999997% Available**

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We Measure Players Connected to our Platform Extensively

Player Minutes

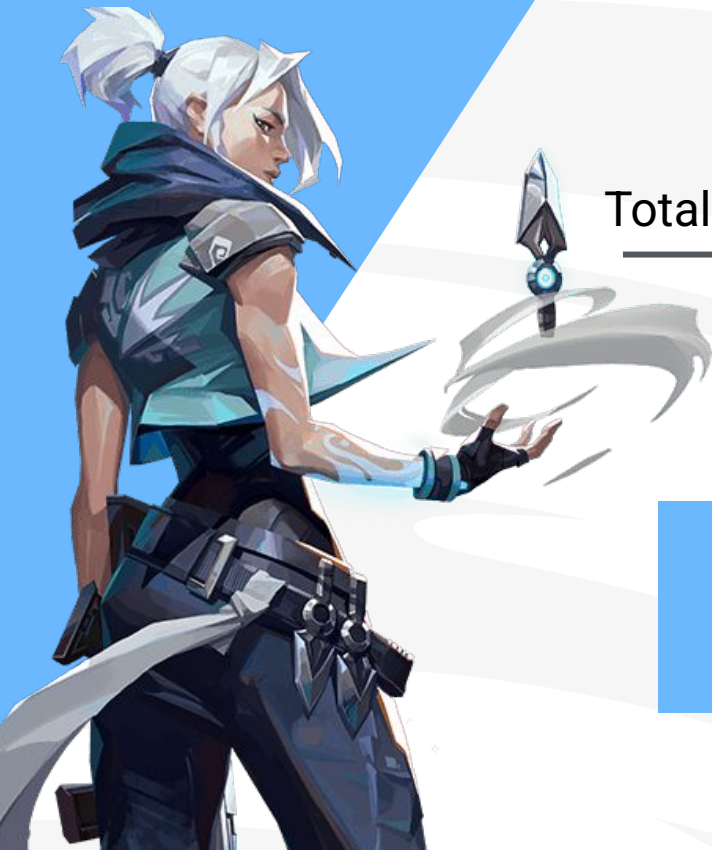Formula -> SUM(Concurrent players per Minute)

What if we measure availability by the percentage of served player minutes that were not impacted?

What if we measure availability by the percentage of served player minutes that were not impacted?

And we combine it with our previous Categorization and Priority?

Basic Formula

$$\frac{\text{Total Player Minutes a Month - Player Minutes Impacted*}}{\text{Total Player Minutes in a Month}}$$

...Per Game, Per Game Shard

*To come up with total *player minutes impacted* in an incident we take the incident time window and sum the player minutes served (Concurrent Players per minute) for that incident time window

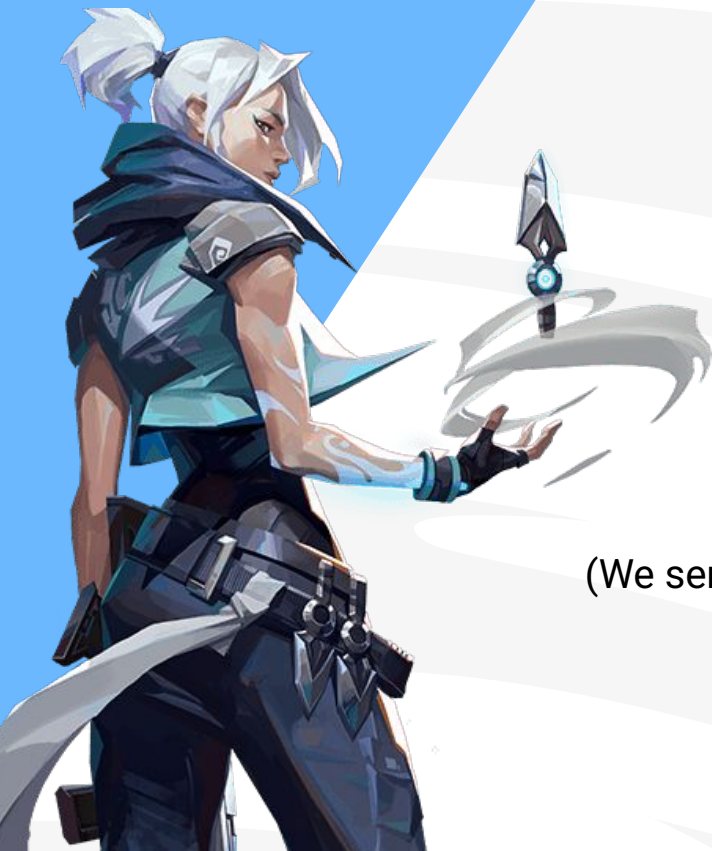# Benefits

01 Results are weighted!

P2 Results are Relative!

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The Target

99% Availability as Measured by the Player Journey

(We serve over 200 billion player minutes a month across all games)

The Final Report

Player Minutes Impact — *Of the total "served" player minutes in a month (based on CCU), what percentage were considered without incident. Derived from Incident Impact.*

		BR1	EUN1	EUW1	JP1	KR1	LA1	LA2	NA1	OC1	PH2	RU1	SG2	TH2	TR1	TW2	VN2	Passed Shards
Connect	Login	99.55%	✓	99.76%	✓	99.22%	99.59%	99.65%	99.66%	99.95%	✓	✓	✓	✓	✓	✓	✓	16 of 16
	Patching	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	16 of 16
Purchase	Purchase Currency	99.67%	✓	✓	✓	99.00%	99.70%	99.76%	99.75%	99.95%	✓	✓	✓	✓	✓	99.98%	✓	15 of 16
	Purchase Game Con..	✓	✓	99.64%	✓	98.97%	99.96%	✓	✓	✓	✓	✓	✓	✓	✓	99.98%	✓	15 of 16
Play	Form a Party	99.92%	100.00%	99.98%	✓	100.00%	99.94%	99.93%	99.95%	✓	✓	✓	✓	✓	✓	✓	✓	16 of 16
	Retrieve Player Data	99.86%	99.78%	99.48%	99.93%	99.18%	99.89%	99.87%	99.91%	99.97%	99.95%	99.81%	99.92%	100.00%	99.78%	99.91%	99.94%	16 of 16
	Matchmaking	99.83%	99.97%	99.58%	✓	99.22%	99.86%	99.88%	99.85%	✓	✓	✓	✓	✓	✓	✓	98.98%	15 of 16
	Play Game Mode	99.95%	99.85%	99.17%	99.11%	99.69%	99.96%	99.95%	99.88%	99.19%	99.48%	99.78%	99.70%	99.76%	99.93%	99.67%	99.53%	16 of 16
	Chat or Voice Chat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	16 of 16
	End of Game	✓	99.98%	98.96%	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	15 of 16
Other	Other Player Journe..	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	16 of 16
Grand Total		99.27%	99.58%	98.19%	99.04%	98.61%	99.31%	99.42%	99.36%	99.11%	99.43%	99.59%	99.62%	99.75%	99.71%	99.54%	98.45%	13 of 16
Monthly Total Player Minutes						100's of Millions to 10's of Billions of Player Minutes served (Redacted)												

Legend: > 99% | >= 97%

Percentages are calculated based on CCU per minute calculations and best guess player impacted (backed by metric data) at time of incident.

Grand Totals are larger than individuals because they include all incidents that impact the shard (ex: 2 20 minute incidents = 40 minutes)

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DEC'23

LEAGUE OF LEGENDS

98.97%
13/16

In December, League players experienced a total **[REDACTED] million minutes** of disruption.

(This percentage is the grand total of quality time available for the month)

All data is pulled from the Player Journey Quality Time report.

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How hard was it to make?

01   A Few Weeks to Design

02   4 weeks to implement v0.5, 12 to implement v1.0 (2 Data Analysts, 1 Soft Engineer)

03   2-3 Months of training, education, information sharing

04   By mid Q2 2021 all games were getting reports. By end of Q3 we stabilized the process

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Culture Change

How We Sold It

01 C-Suite Sponsor (CTO)

02 Studio Lead (Exec. Production Training)

03 Technical Lead Grass Roots

04 Company Level OKR (CEO Enforced)

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How it Works

01 Reports are finalized Monthly 5 days after EOM

02 Incident impact data is available Daily (can see how the month is trending) in Tableau

03 Data analysts built an automated pipeline between our Incident tracking and our CCU data

04 Each report includes full breakdowns of impacting incidents, links to RCA's and recurring problems

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What Changed?

01 Games averaged 97-98% availability in 2021. Games now average ~99% (2024 EOY)

02 We overhauled our RCA reporting

03 We funded an SRE program to have engineers available to work on specific observability or reliability projects

04 The focus on RCA's and availability reporting identified major gaps in observability and we migrated Obs. Platforms

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Cont'd

05 Our internal Morale survey scores for Live Ops went from ~1.5 to 4.3 (out of 5) in about 18 months.

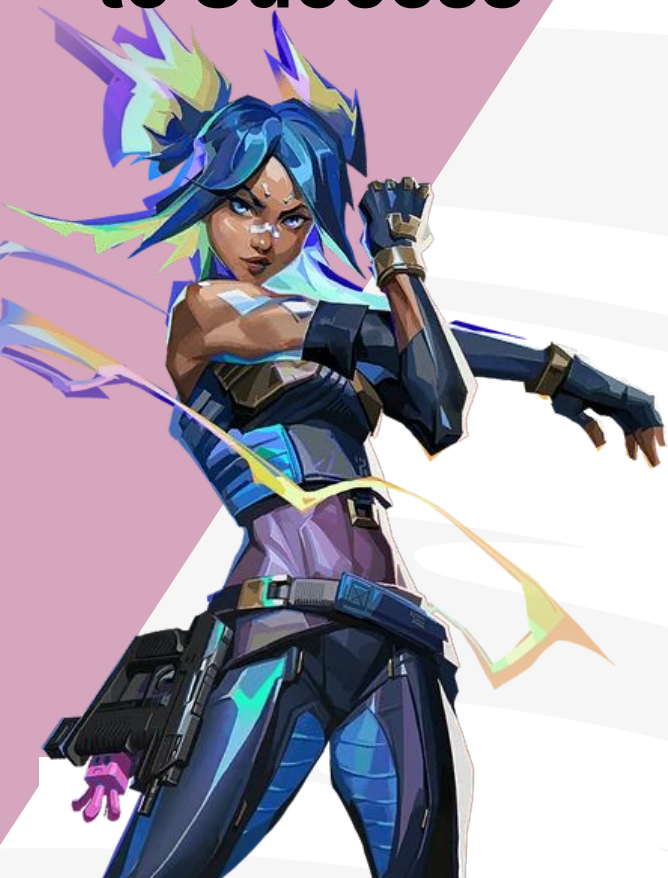**06** Live Ops as an org grew from ~30-35 people to about 80 in 3 years

06 The Riot Org started changing to match the reporting in 2023 (Conways Law)

07 In 2024 we evolved the Player Journey Categories based on Feedback (now over a dozen)

Real Keys to Success

01 Top Down Mandate (OKR/SLO) C-Suite Aligned & Enforced

02 A Reliable Data Source & Analysts that can make it "Plain Speak"

03 A Willingness to Fail & Iterate

04 A Passionate, Credible Owner with a Passionate Team.

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Thank you &
Questions?

RIOT GAMES —

Story Time

"Uptime" Tech Story Time

Appendix / Slides graveyard