Launching and Supporting Killzone Shadow Fall
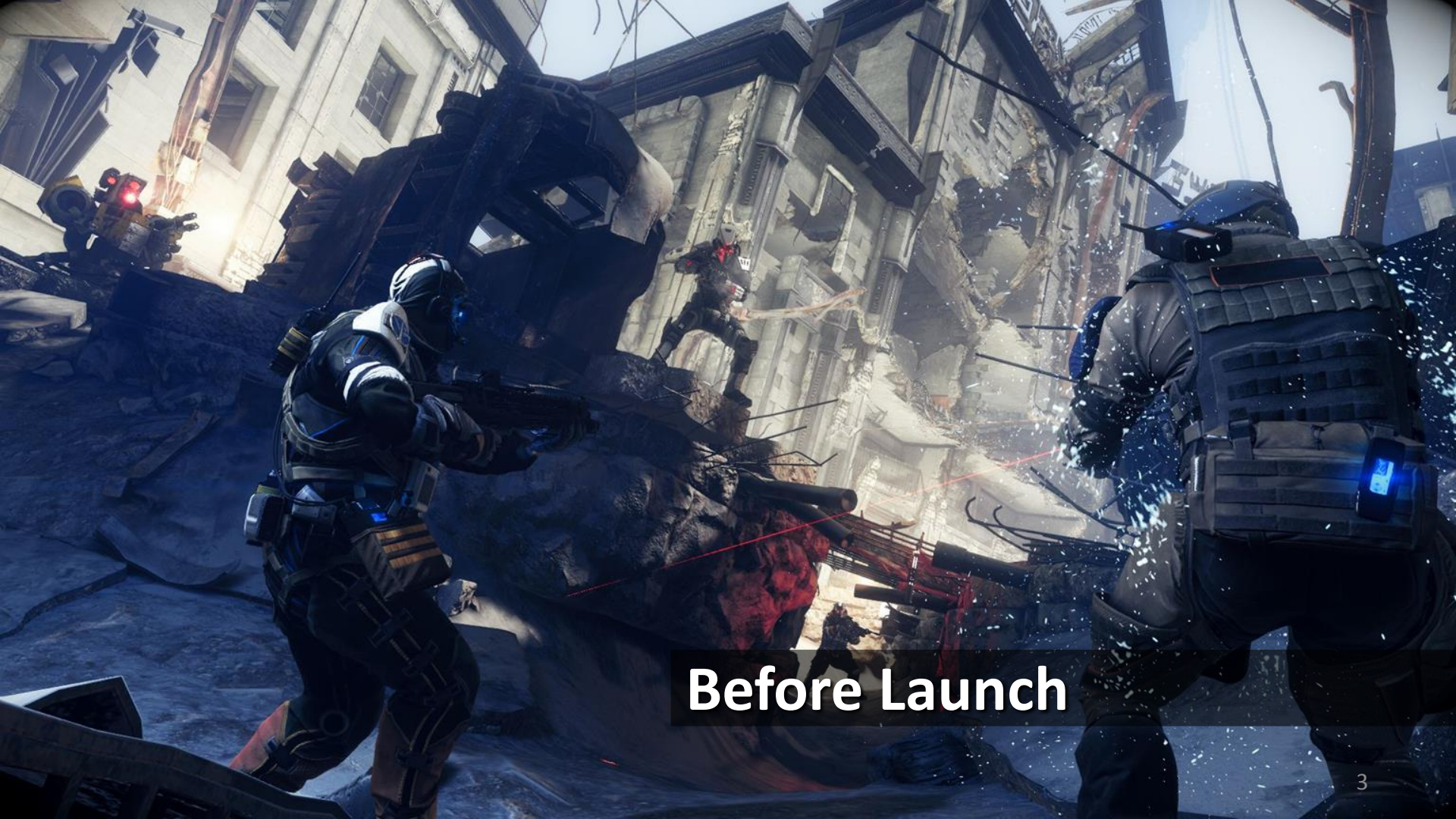
Jorrit Rouwé
jorrit@guerrilla-games.com
Lead Game Tech, Guerrilla Games

Introduction

- Killzone Shadow Fall is a First Person Shooter
- 24 player team based gameplay
- Users can create game modes
- PS4 launch title

Before Launch

Road to Launch

- Previous Title: Killzone 3
  - Closed beta (~100 players within Sony)
  - Semi public beta (~15K players invited)
  - Public beta (~25K players concurrent)

- PS4 launch
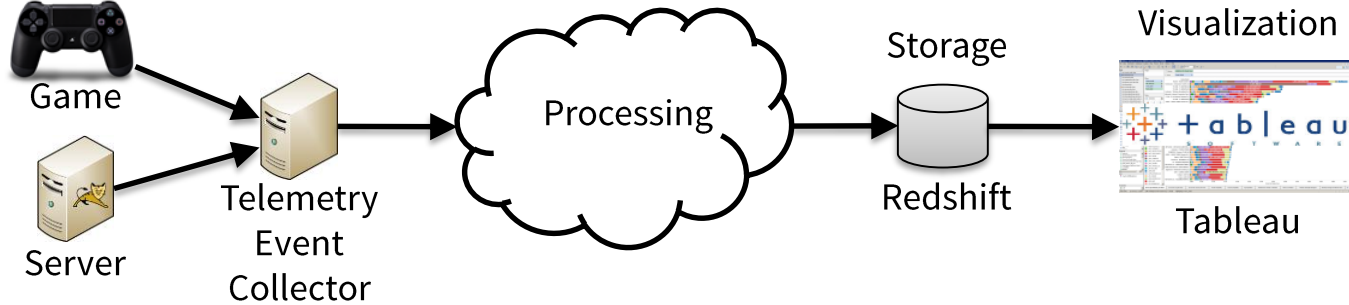 - Limited hardware
  - Max ~100 player test

Development Focus
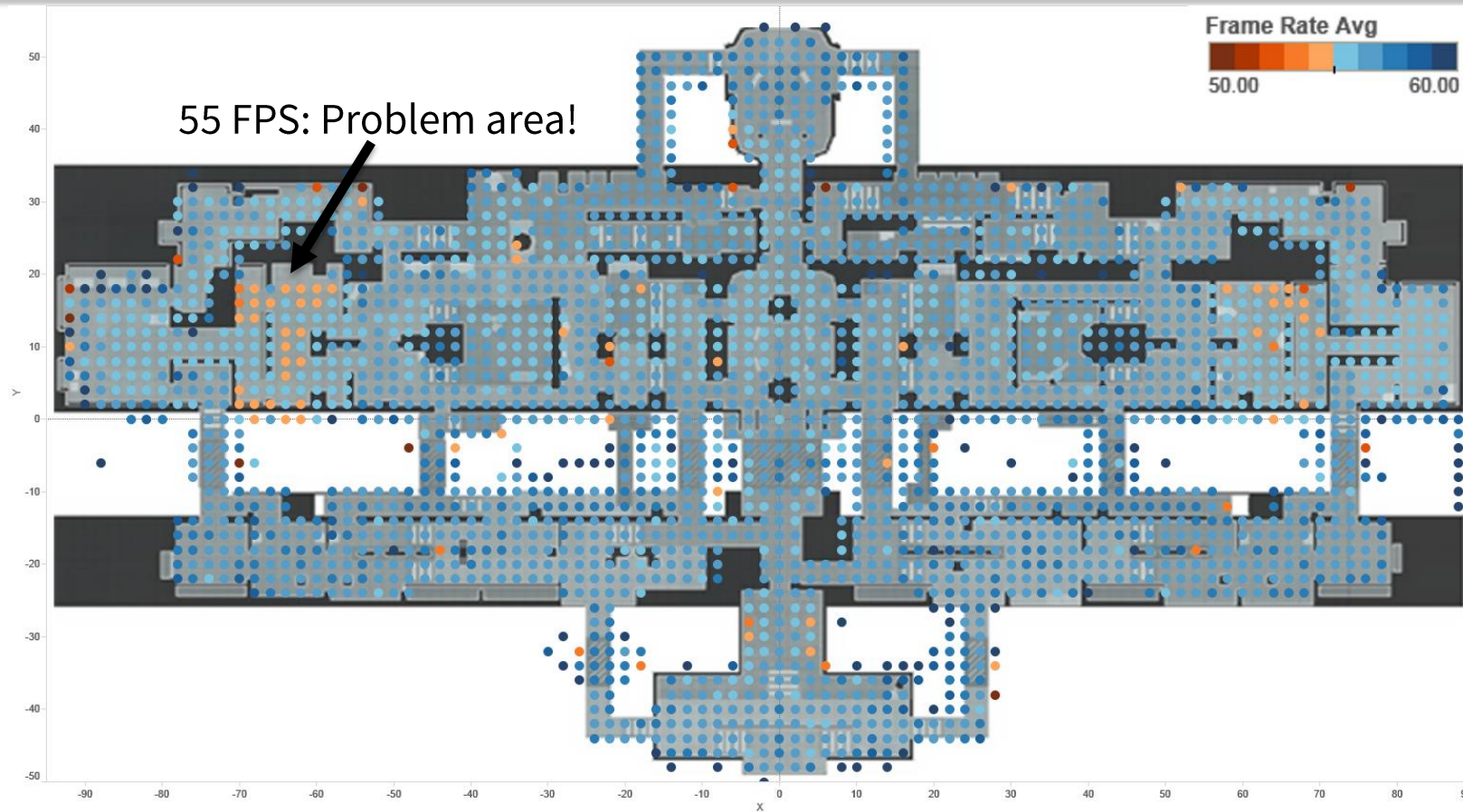
- Telemetry
- Load testing
- Monitoring
- Kill Switches

Telemetry – Collecting Game Metrics

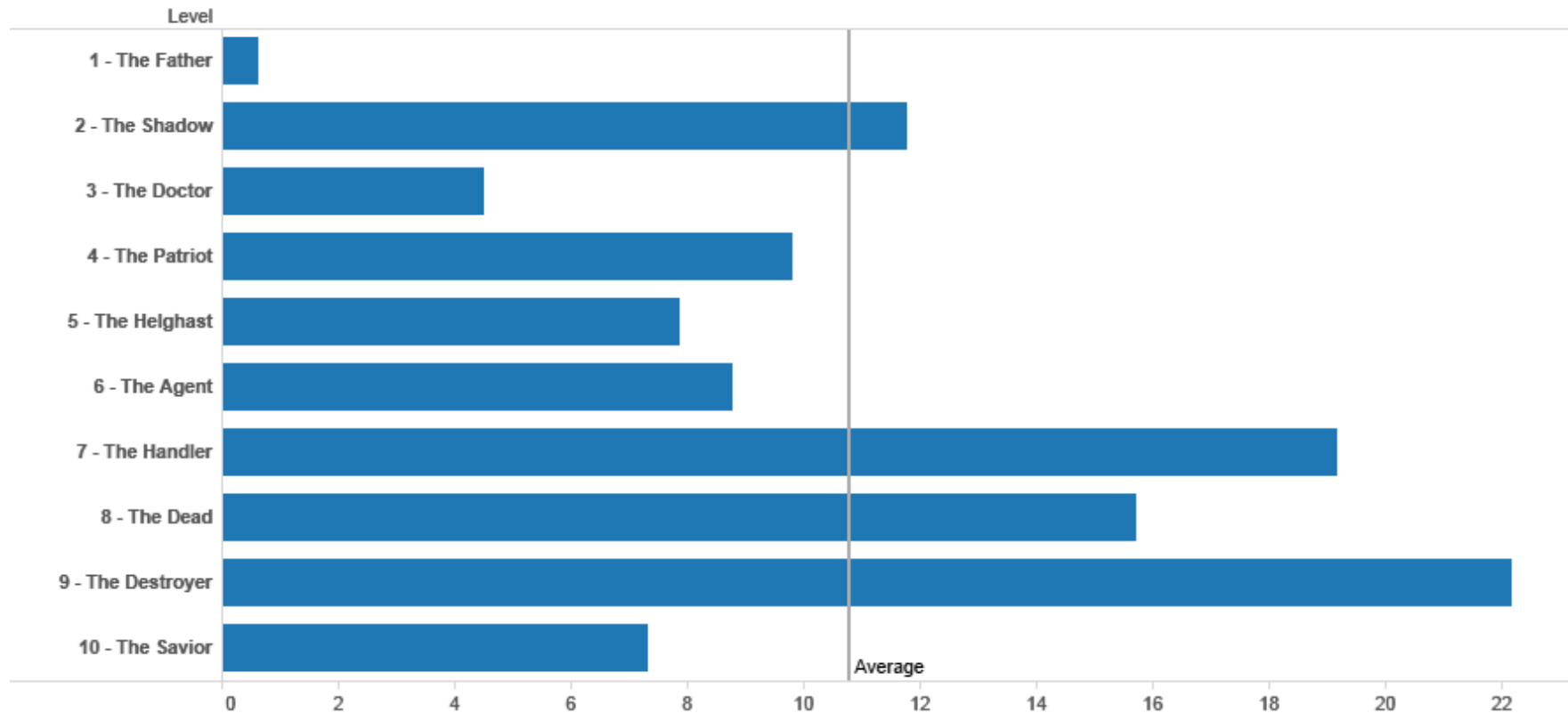# Frame Rate Heat Map – The Terminal

55 FPS: Problem area!

SP - Average Deaths Per Player Per Level

MP - Death Balance – The Forest

VSA failing to spawn camp

Objective A

HGH Spawn

HGH being spawn camped

Objective C

Objective B

100% HGH

100% VSA

HGH failing to spawn camp

VSA Spawn

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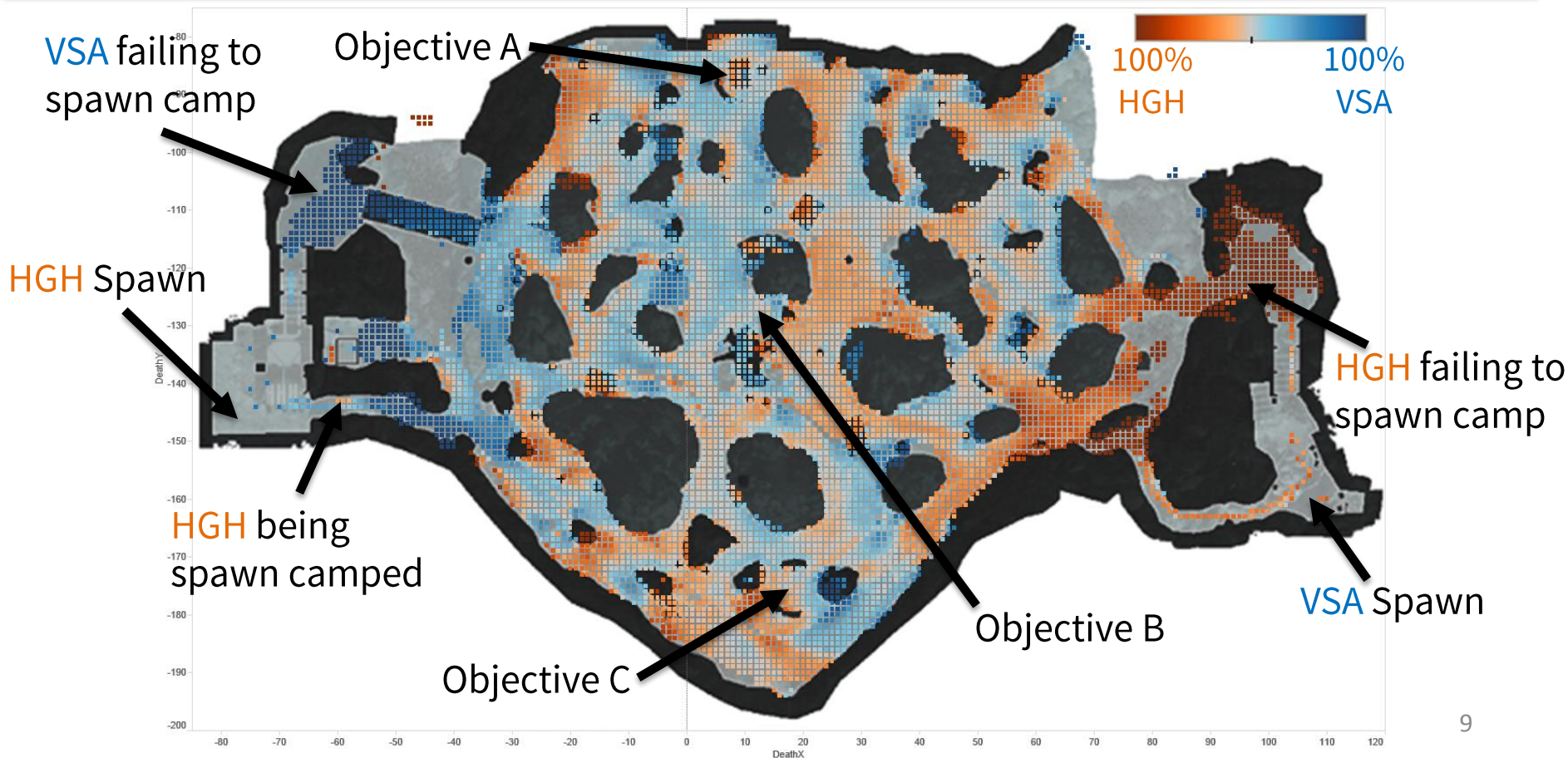
Development Focus

- Telemetry
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- Monitoring
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Load Testing – What to Test

- Functionality
  - Match making (e.g. day night cycle, featuring game mode)
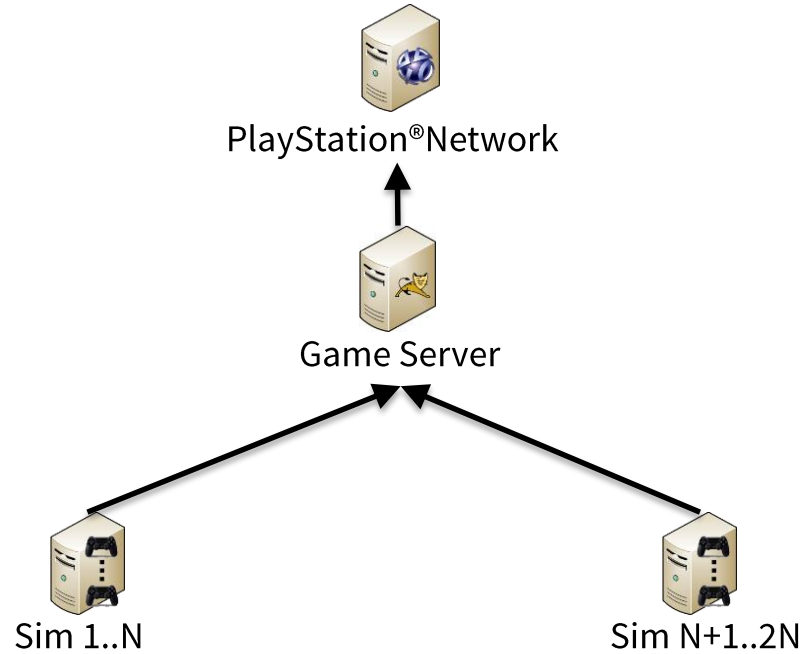 - Score posting
  - Leaderboards
  - …
- Failures
  - Loss of server
  - Temporary loss of connectivity
  - PlayStation®Network outage / slow response
  - Server update

Load Testing – Framework
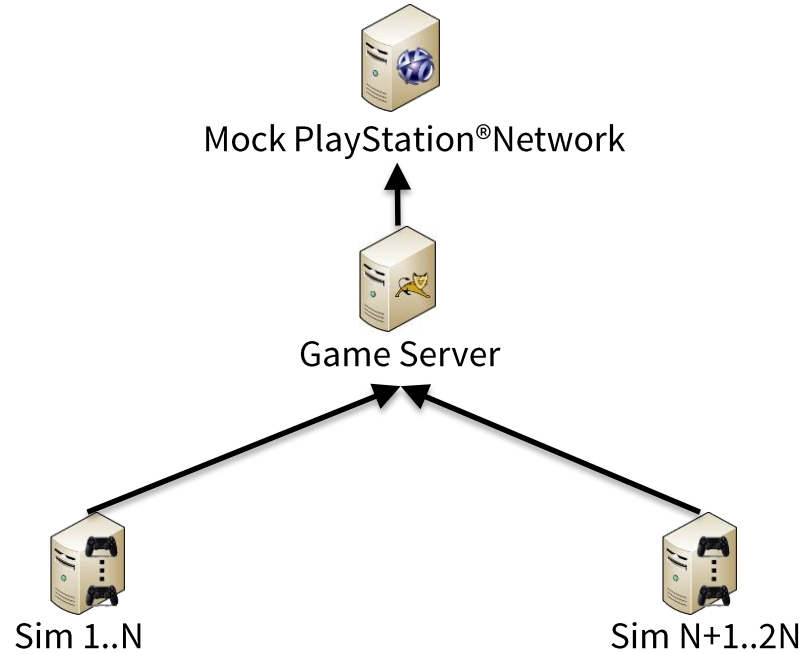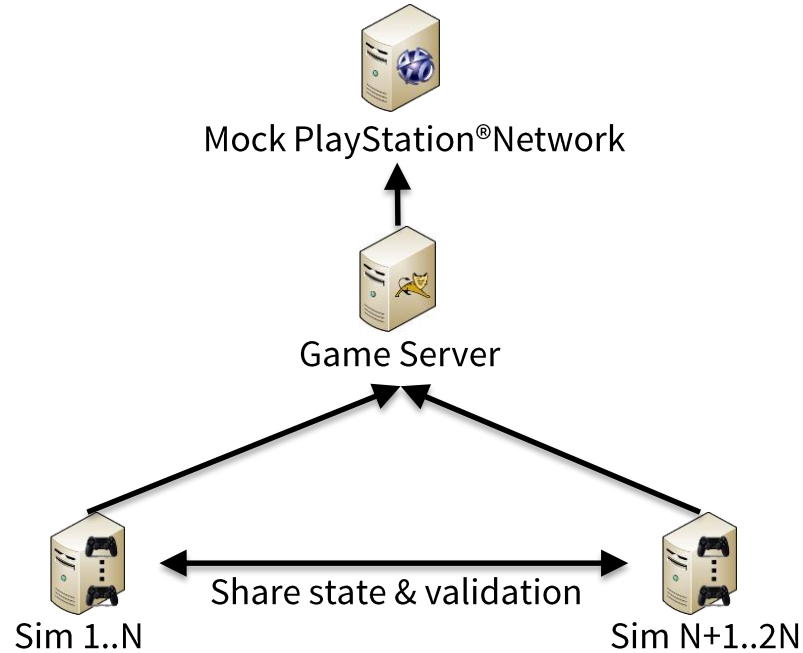
PlayStation®Network

Game Server

Sim 1..N   Sim N+1..2N

Load Testing – Framework

Mock PlayStation®Network

Game Server

Sim 1..N

Sim N+1..2N

Load Testing – Framework

Mock PlayStation®Network

Game Server

Sim 1..N — Share state & validation — Sim N+1..2N

Load Testing – Framework

Mock PlayStation®Network

Game Server

Telemetry & Monitoring

Behavioral Verification

Sim 1..N

Share state & validation

Sim N+1..2N
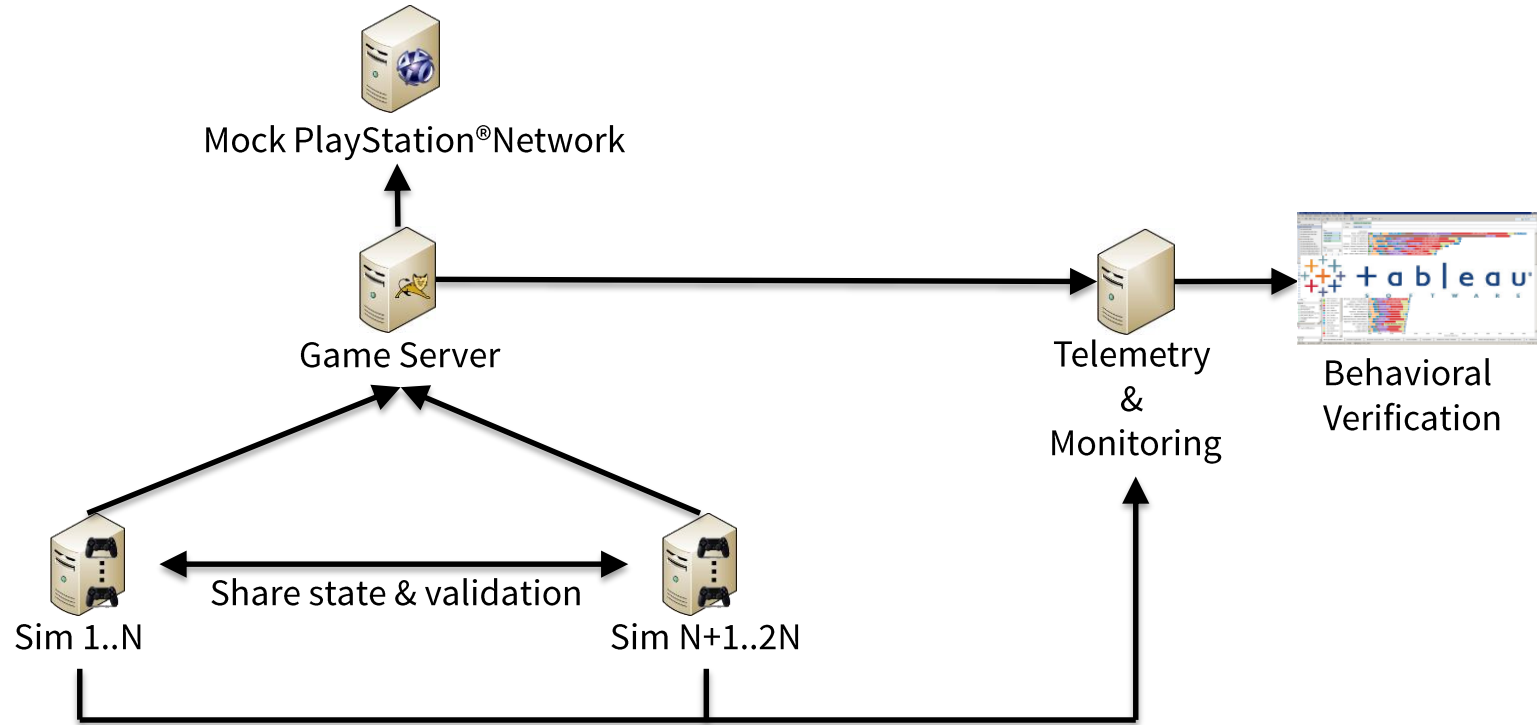
Development Focus

- Telemetry
- Load testing
- Monitoring
- Kill Switches

Monitoring

- What to monitor
  - Player count
  - REST API timings / errors
  - Database throughput / errors
  - Connectivity between servers (game servers / PSN)
  - Low level OS (disc / CPU / memory / network)
  - Backups
- 24/7 on call support for failures

Development Focus
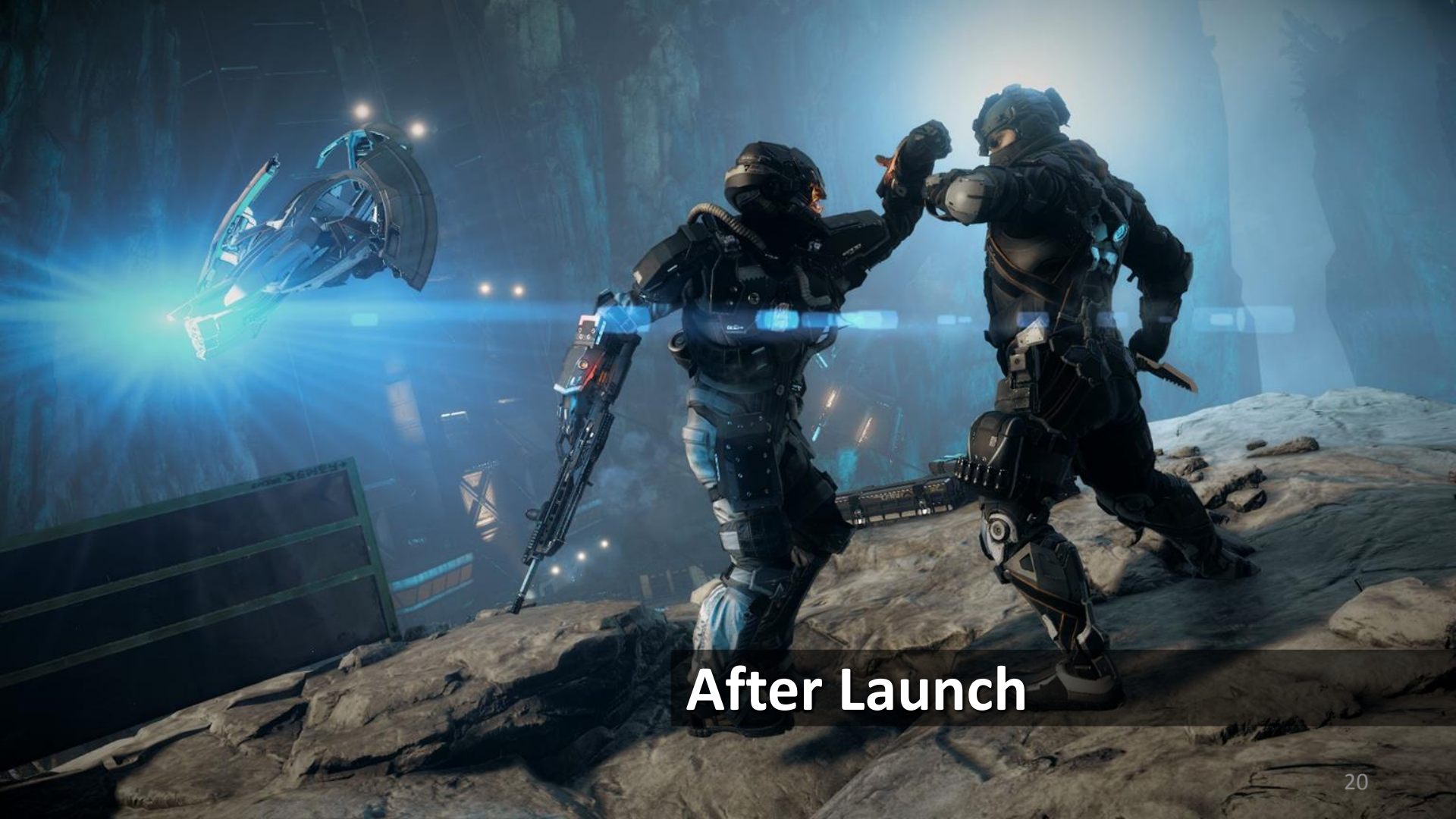
- Telemetry
- Load testing
- Monitoring
- Kill Switches

Kill Switches

- Block apps (killzone.com, public API, live tiles)
- Block individual REST APIs (e.g. post score)
- Block hard to test things (e.g. game merging)
- Block misc. components (e.g. telemetry)

After Launch

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Match Making - What Players Expect

- Low ping
- Full games
- Team balanced
  - Player count
  - Skill level
- A choice of game modes
- No dropped connections

Average Ping Between Regions

Player Region	Server Region										
	Tokyo	London	US-East (Ashburn)	Frankfurt	US-West (San Diego)	Sydney	US-Central (Dallas)	Sao Paulo	Milan	Istanbul	Singapore
Tokyo	59	355	228	304	172	174	230	394	342	355	120
London	331	80	160	88	220	400	213	304	102	134	312
US-East (Ashburn)	240	158	82	181	125	280	122	215	192	222	293
Frankfurt	347	124	171	87	233	409		315			
US-West (San Diego)	212	211	142	243	97	248	151	264	282	285	264
Sydney	261	418	320	396	251	100	305	449	436	453	241
US-Central (Dallas)	242	219	132		136	283	103	249	227		
Sao Paulo	380	309	234	305	263	437	255	111	332	376	439
Milan	372	141	208		270	444	248	355	125		
Istanbul	382	180	223		276	452		353		135	360
Singapore	245	376	332		302	297		475		398	154

Average Ping Between Regions - Conclusion

- Matchmaking tries to avoid cross region!
  - Smaller regions / game modes don't have enough players
  - Friends may want to play cross region
  - 98%+ success in large, 80% in smallest region
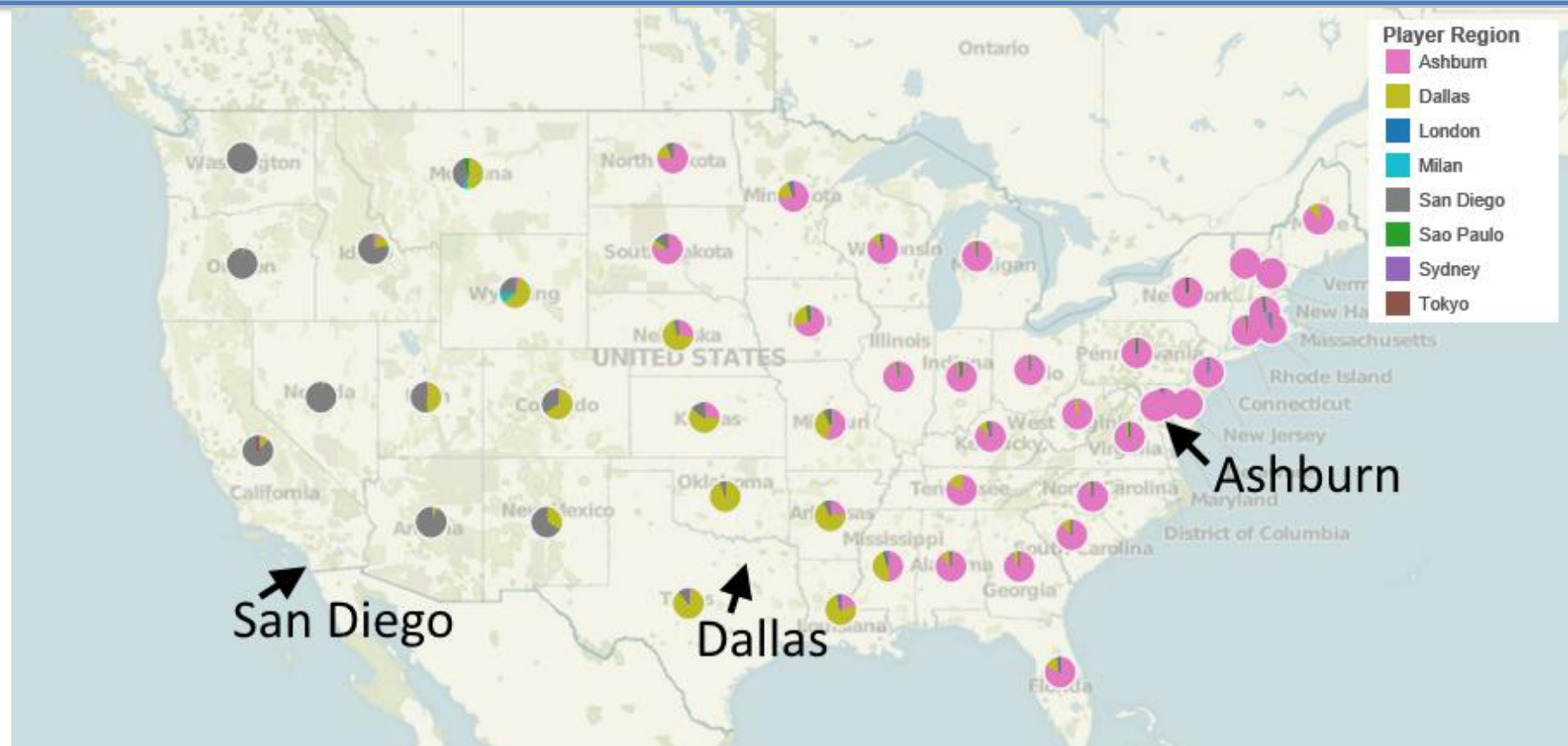
Ping – Cable vs Wireless
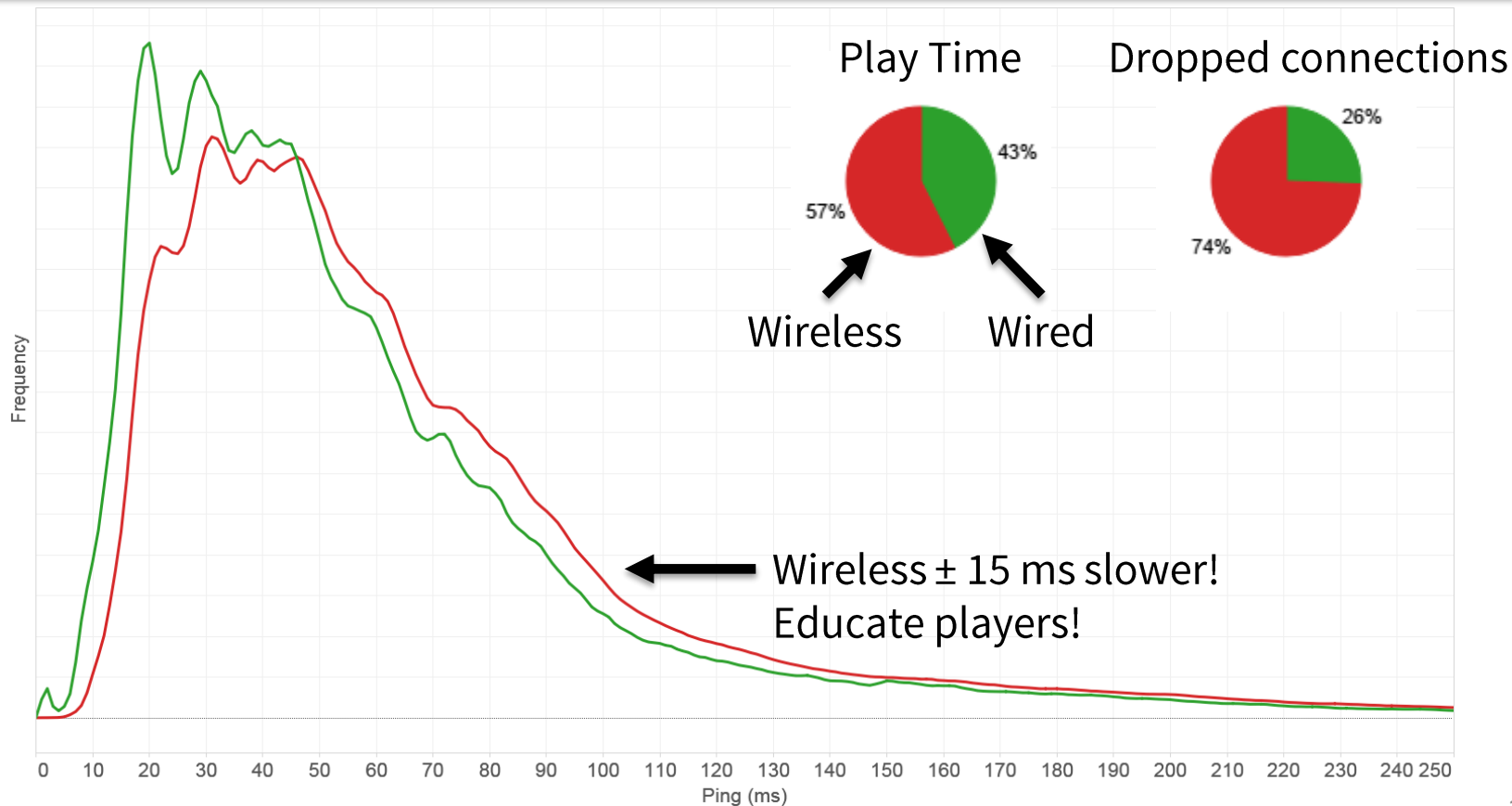
The Hunt for Server Locations (Sao Paulo)

The Hunt for Server Locations (Dallas)

The Hunt for Server Locations (Istanbul)

# The Hunt For Server Locations – Conclusion

- Geographically close does not mean low ping
  - Possible packet: US East → US West → US East
  - Very hard for players to understand
  - We don't offer region selection

- Too many regions = too few players per region

Match Making - What Players Expect

- Low ping
- Full games
- Team balanced
  - Player count
  - Skill level
- A choice of game modes
- No dropped connections

Joining Full Games
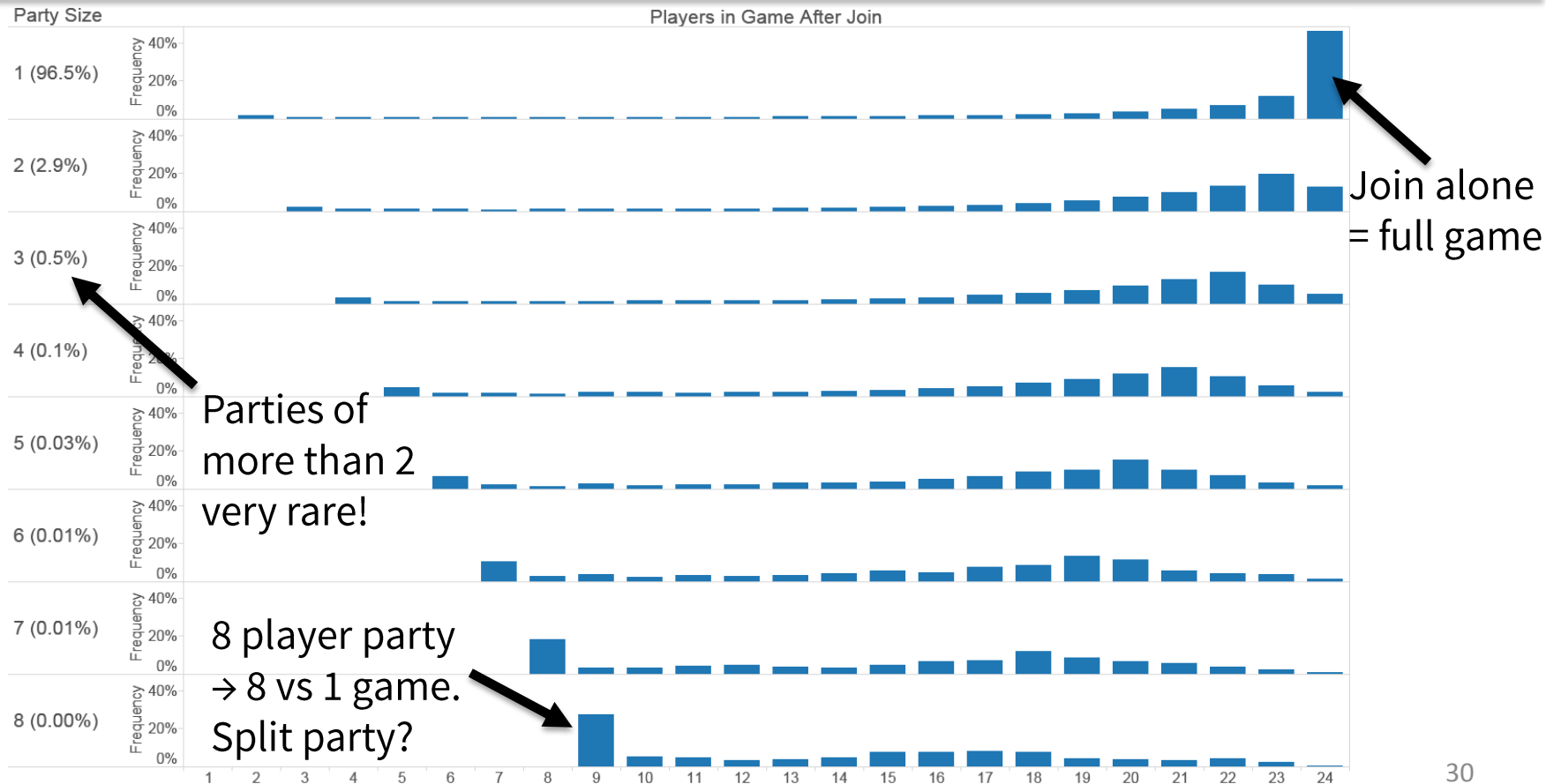
Match Making - What Players Expect

- Low ping
- Full games
- Team balanced
  – Player count
  – Skill level
- A choice of game modes
- No dropped connections

Team Balance - ELO Glicko

	VSA 12 PLAYERS		🏆	💀	⚰️
1	Galandrias1		650	2	2
2	FjHIPHOP		575	3	1
3	MariusBuZz		525	1	
4	meanmikey		525	1	
5	GG | sjorrit	📶	350	1	3
6	Tommsen4		325	1	1
7	amjad382		250	0	3
8	Stalkrider		225	0	1
9	kaunas2015		225	0	
10	muzmus_		0	0	
11	fahd50232		0	0	
12	nicoleto-92		0	0	

	HGH 12 PLAYERS		🏆	💀	⚰️
1	Onnibus		1325	4	1
2	BenasMarius		1200	5	0
3	Roprout		850	3	1
4	Vyacheslav990		625	3	1
5	KiLLerBoY522000		350	1	0
6	EvilFurry23		200	1	1
7	alex1982066		75	0	2
8	Mobster025		0	0	0
9	herbie4luvbug		0	0	0
	maxys1977		0	0	0
	fewagainstmany8		0	0	1
	kidark69		0	0	2

Divide by time played

Discard not played long enough

Team Balance - ELO Glicko

Team Balance - ELO Glicko

Team Balance

- Skill based separation = too many groups
- Player count balance most important
- Use ELO skill rating to
  - Determine team when sizes equal
  - Shuffle teams at end of round

Match Making - What Players Expect

- Low ping

- Full games

- Team balanced
  - Player count
  - Skill level

- A choice of game modes
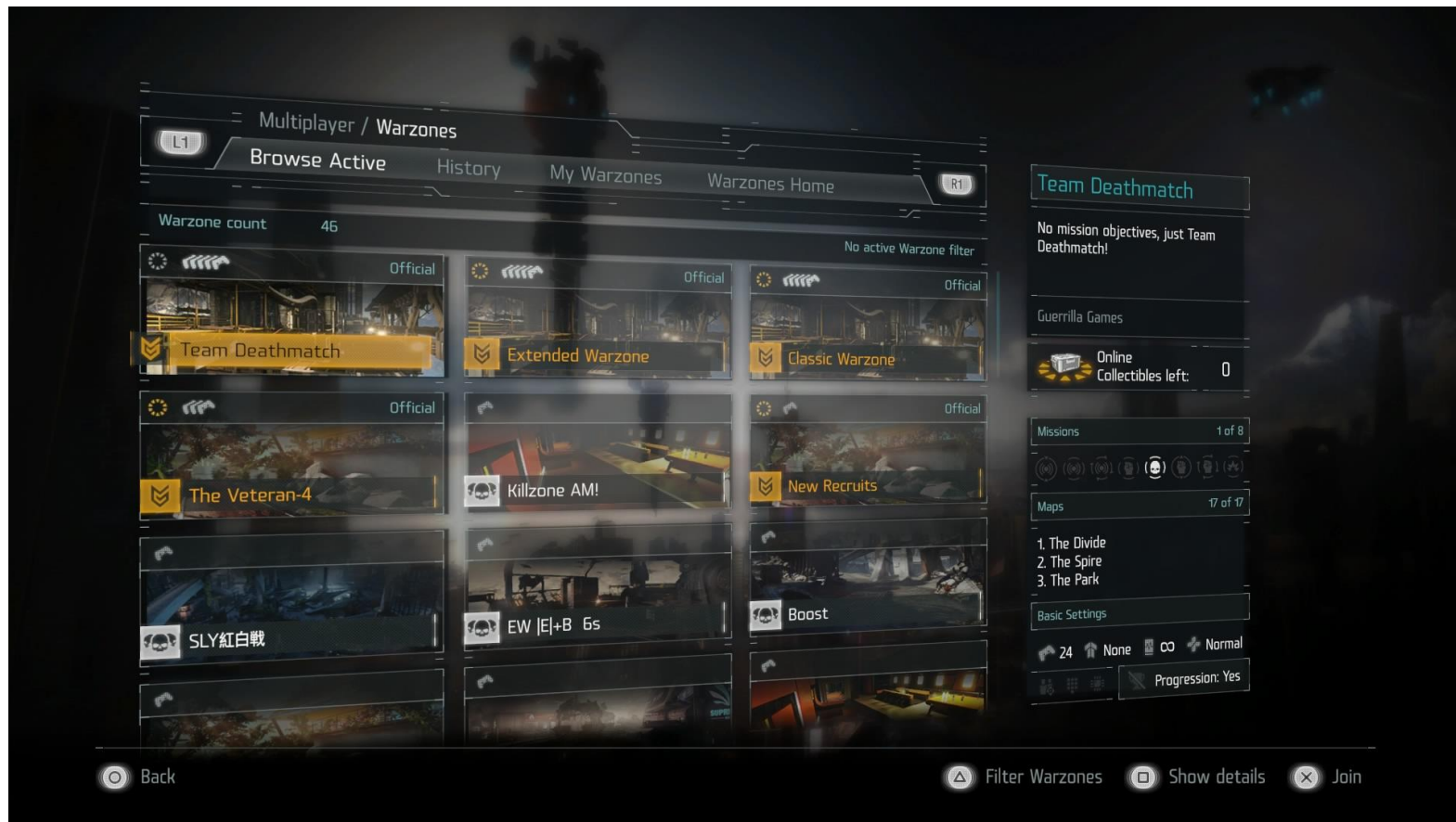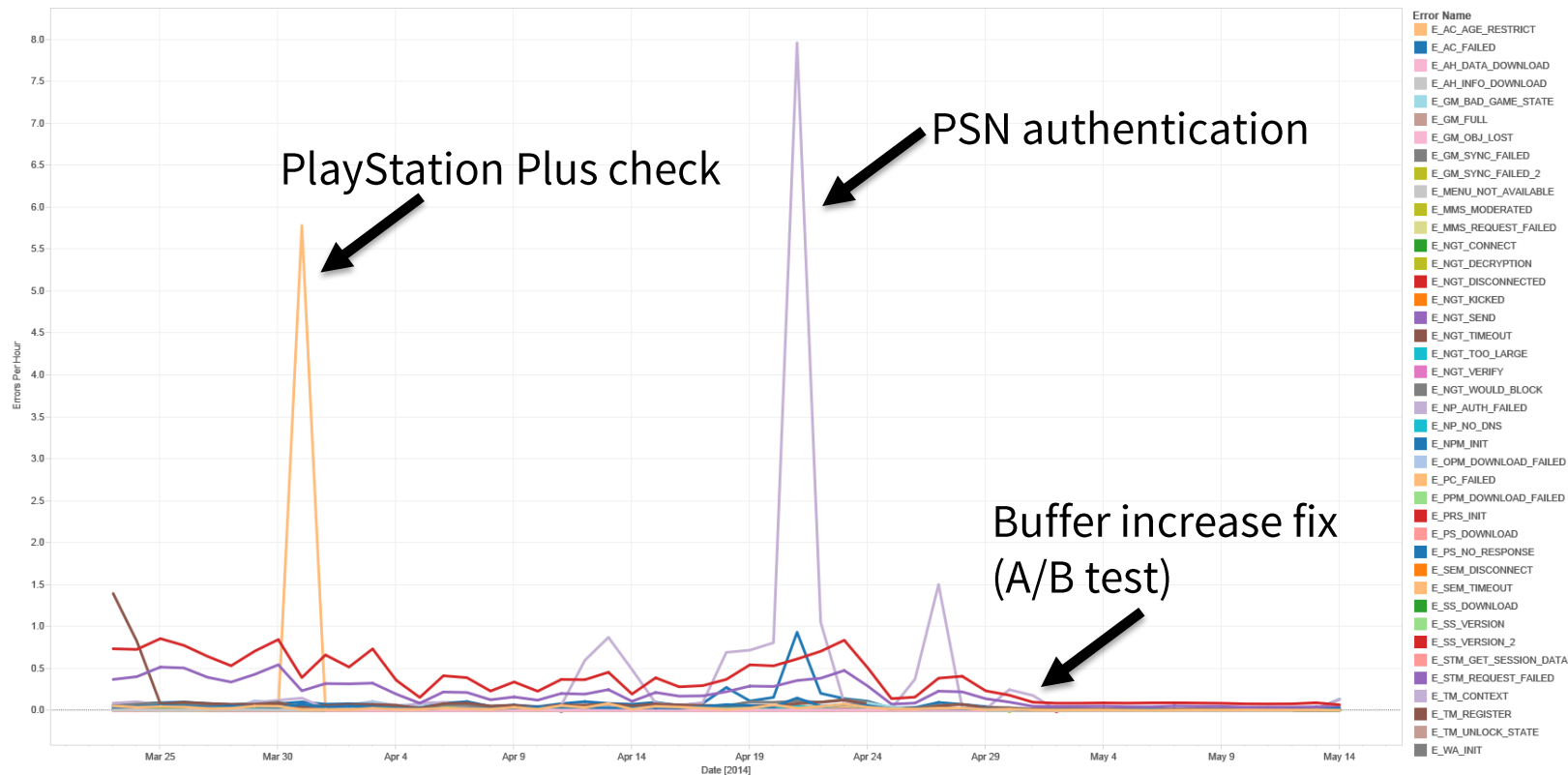
- No dropped connections

A Choice of Game Modes

Match Making - What Players Expect
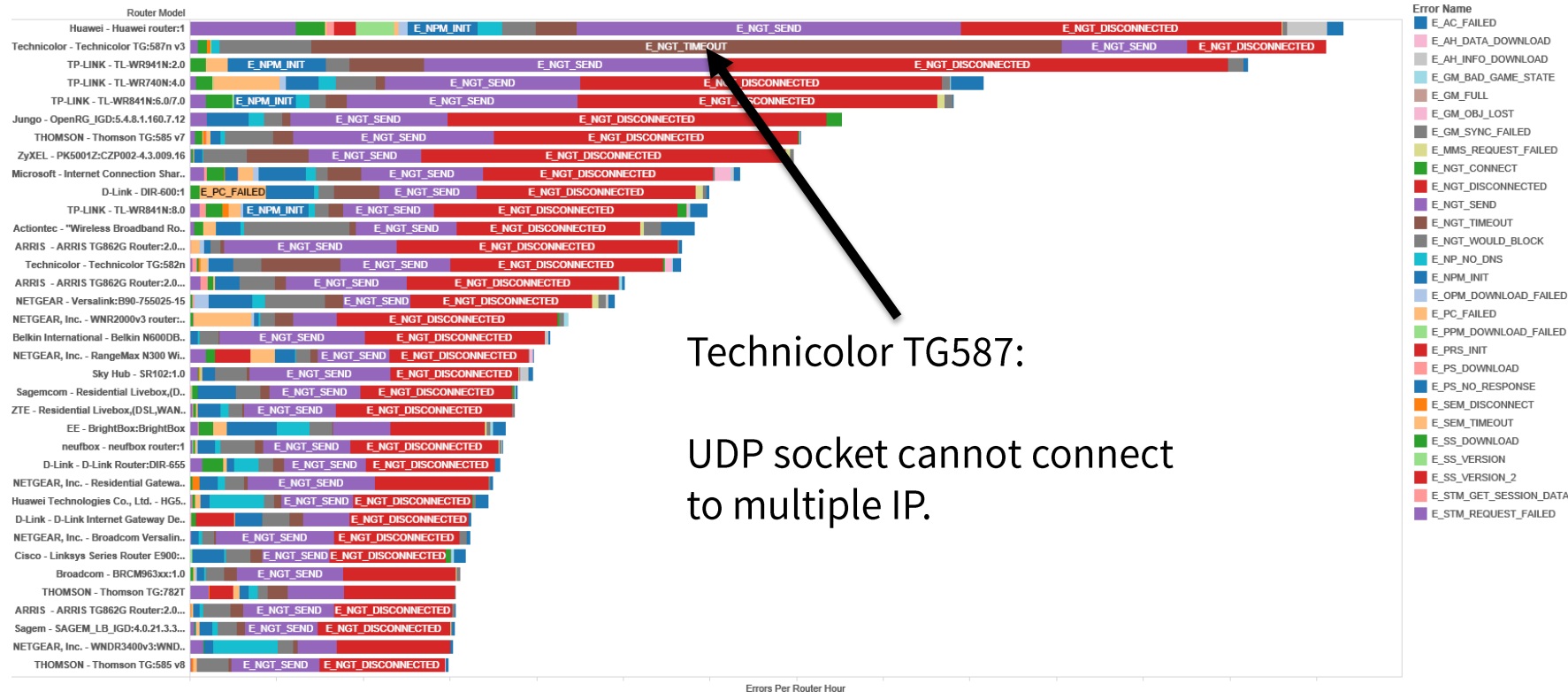
- Low ping
- Full games
- Team balanced
  - Player count
  - Skill level
- A choice of game modes
- No dropped connections

Errors Per Hour Over Time

PlayStation Plus check

PSN authentication

Buffer increase fix (A/B test)

Error Name
- E_AC_AGE_RESTRICT
- E_AC_FAILED
- E_AH_DATA_DOWNLOAD
- E_AH_INFO_DOWNLOAD
- E_GM_BAD_GAME_STATE
- E_GM_FULL
- E_GM_OBJ_LOST
- E_GM_SYNC_FAILED
- E_GM_SYNC_FAILED_2
- E_MENU_NOT_AVAILABLE
- E_MMS_MODERATED
- E_MMS_REQUEST_FAILED
- E_NGT_CONNECT
- E_NGT_DECRYPTION
- E_NGT_DISCONNECTED
- E_NGT_KICKED
- E_NGT_SEND
- E_NGT_TIMEOUT
- E_NGT_TOO_LARGE
- E_NGT_VERIFY
- E_NGT_WOULD_BLOCK
- E_NP_AUTH_FAILED
- E_NP_NO_DNS
- E_NPM_INIT
- E_OPM_DOWNLOAD_FAILED
- E_PC_FAILED
- E_PPM_DOWNLOAD_FAILED
- E_PRS_INIT
- E_PS_DOWNLOAD
- E_PS_NO_RESPONSE
- E_SEM_DISCONNECT
- E_SEM_TIMEOUT
- E_SS_DOWNLOAD
- E_SS_VERSION
- E_SS_VERSION_2
- E_STM_GET_SESSION_DATA
- E_STM_REQUEST_FAILED
- E_TM_CONTEXT
- E_TM_REGISTER
- E_TM_UNLOCK_STATE
- E_WA_INIT

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Errors Per Hour Per Router

Technicolor TG587:

UDP socket cannot connect to multiple IP.

Conclusion

- Had very little downtime
- Kill switches used on few occasions
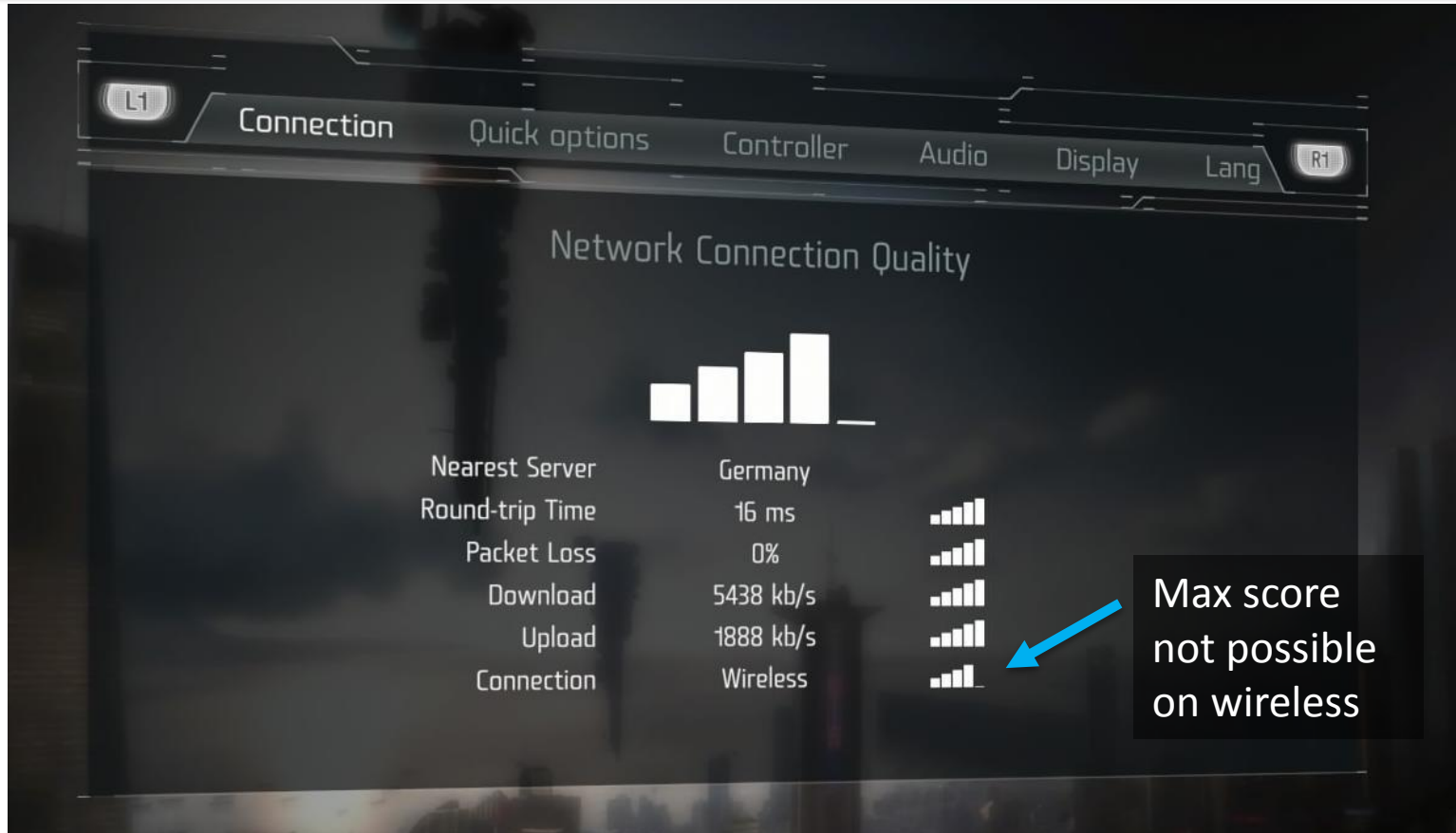- Match making is a hard problem
- Telemetry helped a lot

Questions?

Also see: 'The Server Architecture Behind Killzone Shadow Fall'
http://jrouwe.nl/serverarchkzsf/

Bonus Slides

Ping – Educate Players!

The Hunt for Server Locations (Milan)

The Hunt for Server Locations (Frankfurt)