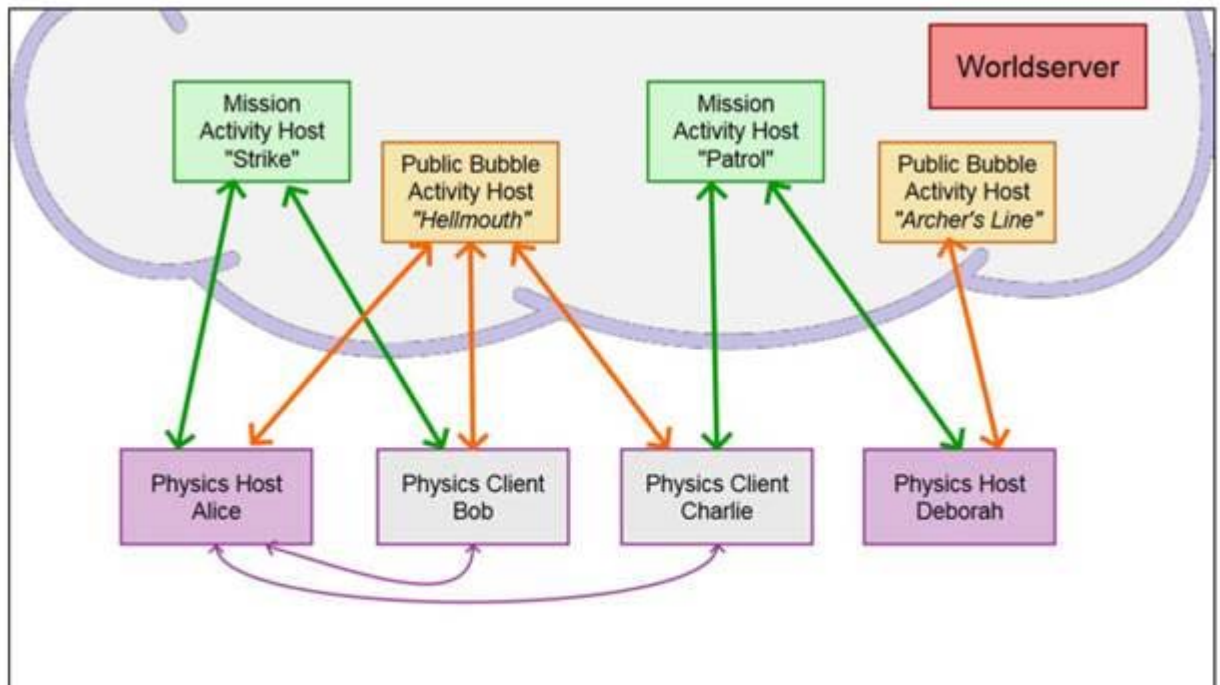


6,732,147	Sony PlayStation Product
“Sony PlayStation Product” refers to the PlayStation 3, PlayStation 4 running, for example, the PlayStation game Destiny.	
Claim 6	
<p>claim 6(a): A method for healing a disconnection of a first computer from a second computer, the computers being connected to a broadcast channel, said broadcast channel being an m-regular graph where m is at least 3, the method comprising:</p>	<p>The Sony PlayStation Product meets the recited claim language because it includes functionality to for healing a disconnection of a first computer from a second computer, the computers being connected to a broadcast channel, said broadcast channel being an m-regular graph where m is at least 3.</p> <p>The Sony PlayStation Product includes functionality for healing a disconnection of a first computer from a second computer, the computers being connected to a broadcast channel, said broadcast channel being an m-regular graph where m is at least 3. This functionality controls players disconnecting from a game session, and attempts to heal a game session by making new connections. The match server, host server or peer will communicate with another player that had an established communication channel with the disconnecting play and that can be connected to the game session to maintain an optimized game session or match and to create an optimized connectivity mesh of players. The functionality will initiate an attempt by the match server, host server, or peer to find a connection port to another player that can be used to maintain an m-regular graph in the game session or match and to create an optimized connectivity mesh of players. The functionality creates m-regular topologies of players when setting up logical and physical network topologies in order to do the following:</p> <ul style="list-style-type: none"> • manage states when different players leave, are kicked, or are disconnected. • manage the game during gameplay and to relay content through different NAT configurations; • route game data using optimal paths and relays; • distribute VoIP chat data among the players; and • determine which game a player should be matched to; • ensure no players are overloaded for optimal gameplay in a connectivity mesh; • create a game session with logical and physical network topologies • connect players to other players for matchmaking; <p>As shown below, utilizes a “hybrid” peer-to-peer network topology, where additional game player’s consoles as participants can forward data from one neighbor participant to another neighbor participant and non-client servers called “activity hosts” and can also communicate with each other as additional participants in the network, including PlayStation 3 (PS3) and PlayStation 4 (PS4) consoles (e.g. Physics Hosts and Physics Clients) and Activity Hosts (e.g. Mission Activity Hosts and Public Bubble Activity Hosts)</p>



... and uniquely complicated networking topology

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 7.
 Exhibit 2029 http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf at 78.(Physics Host (PS4))

As shown below, the product allows multiple participants to play the game online concurrently, allowing for reduced latency and frequent updates for a better online experience:

Host Migration!

- Dedicated Servers!
- Need to be cost-feasible
- Need to preserve peer-to-peer responsiveness
- Can we instead “fix” our Host Migration problems?

DESTINY 

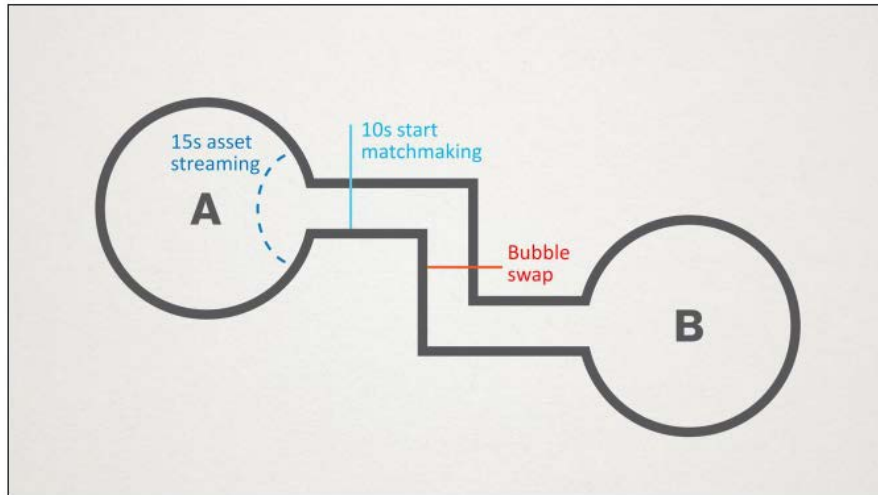
At this point, I'm sure some of you are thinking – just use dedicated servers! If we just never Host Migrate, because we put all our Physics Hosts in the cloud, we never have to solve all these pesky problems.

There's a couple strong reasons we didn't simply run dedicated servers that were traditional Physics Hosts.

For one thing, they need to be cost-feasible. To support our launch, we'd have needed hundreds of thousands of headless PS3-Parity executables in the cloud, and that becomes a significant continuous cost to maintain, especially if our player-retention continues to stay as strong as it has.

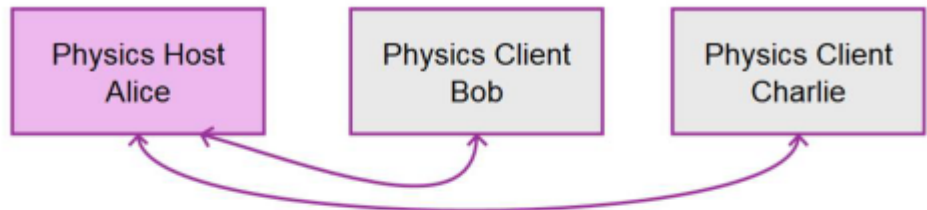
Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 53.

The product will retry to connect until a connection is successfully established by seamlessly swap players to the new game during matchmaking transitions to a networked game to heal a disconnection of a first computer from a second computer, the computers being connected to a broadcast channel, said broadcast channel being an m-regular graph where m is at least 3:



The neat thing we also do during these transitions is matchmake you to a new networked game. In order to meet new strangers in bubble B, we start matchmaking for a new host at the 10s mark, and are ready to seamlessly swap you to the new game when we perform our bubble swap.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 36.



So, let's suppose we've got 3 players in this public bubble – Alice, Bob, and Charlie.

They're Peer-to-peer connected to each other using traditional Reach networking, and Alice is the Physics Host.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 96.

Activity Host Separation

- This cool upside is also a downside
- Have to separate Public and Private scripts
- Very limited communication between Activity Hosts
- We've only scratched the surface here!

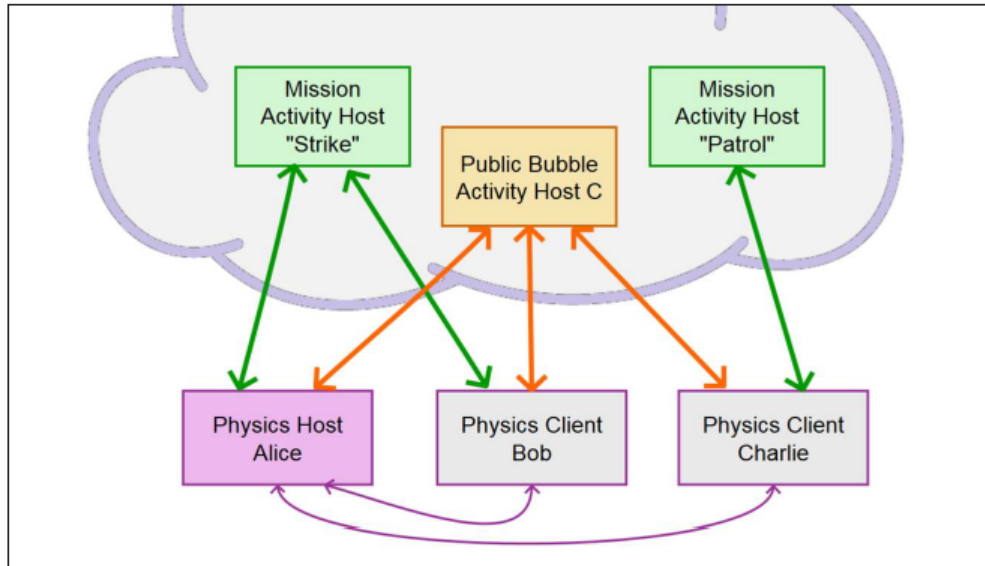
DESTINY 

This cool upside carries with it additional complexity – in order to do something like this, you have to split up your activity into Public and Private portions.

The Public Portions live on their respective Public Bubble Hosts, the private portions live on the Mission Host.

And for reasonably complex interactions between the two, you have to pass Global Flags back and forth between them, because there's very limited communication between Activity Hosts

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 111.



Finally, they're also simultaneously all connected to the same "Bubble Activity Host".

The Bubble Host is responsible for all the ambient scripting in the public bubble
 it spawns and scripts all the ambient AI that you fight
 It handles the respawn timing and placement of all the resource nodes and treasure chests
 and it runs all the logic for all the public events.

Those are the main things that we do in our Destiny public bubbles – but
 technologically a Bubble Host is almost identical to a Mission Host. So you could
 write an arbitrarily complex script in there for a crazy public boss encounter.

I said "Almost Identical," because there is one key difference between Mission Hosts
 and Bubble Hosts worth mentioning

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 99.

As shown below, the Sony PlayStation Product includes functionality to allow each participant to have connections to at least three neighbor participants, including PS4 consoles and allows players to "Invite Friends" to join his/her network:

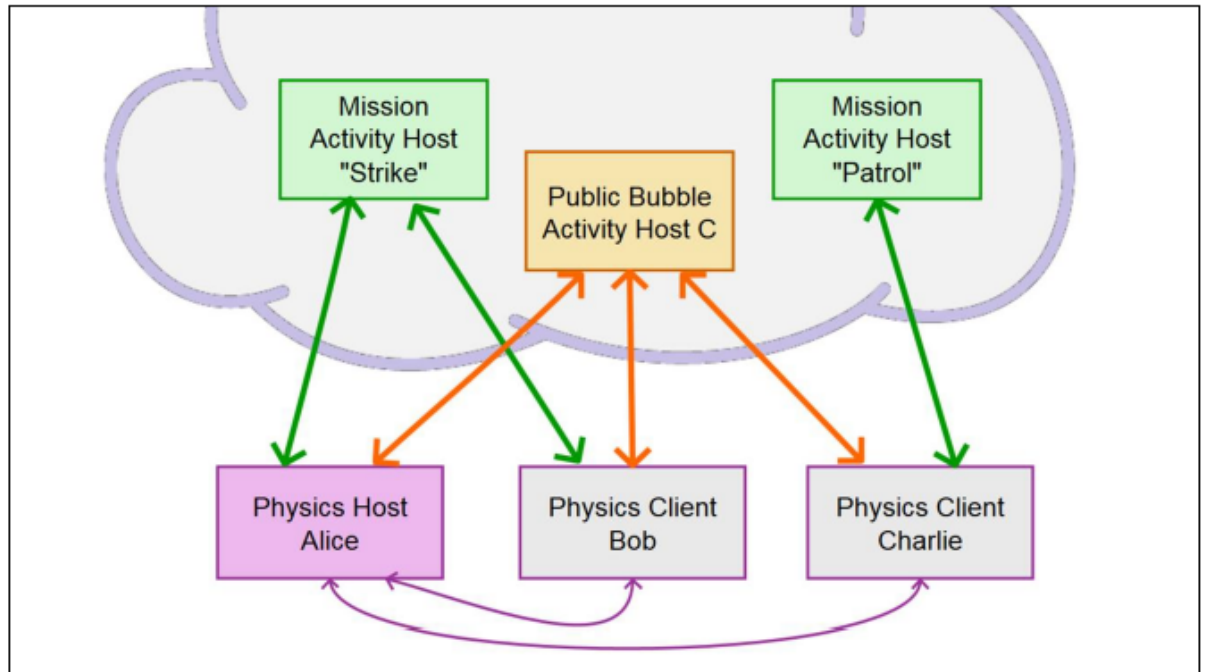


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 99.

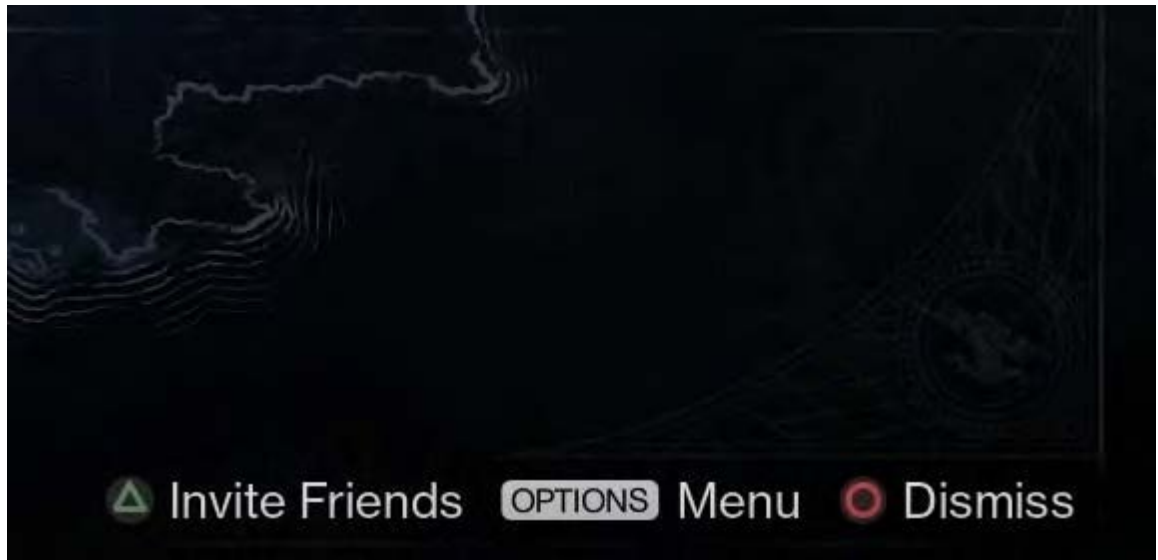
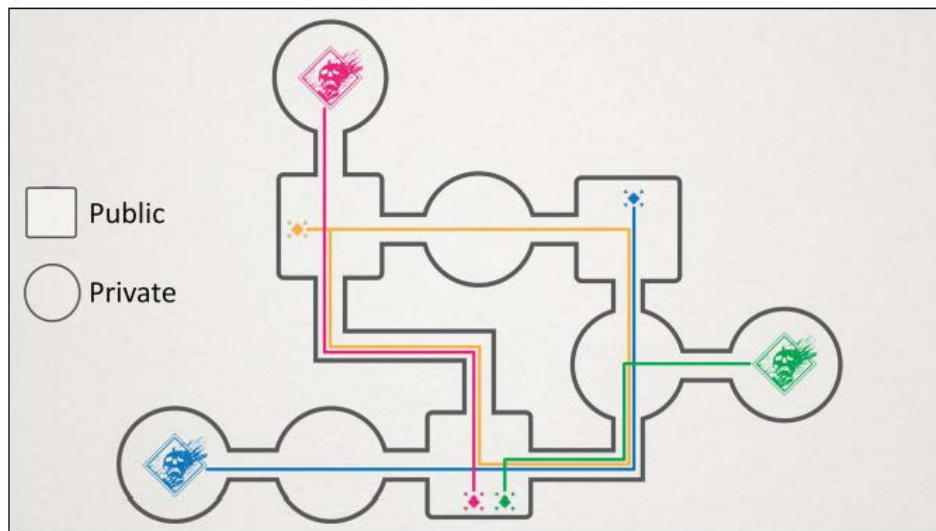


Exhibit 2037
 (https://www.youtube.com/watch?v=nIDyPPxKotM&feature=iv&src_vid=XKQfiwPzjmc&annotation_id=annotation_2453463955)

1 Friend Online | Invite Friends | OPTIONS Menu | Dismiss

Exhibit 2037 (<https://www.youtube.com/watch?v=mfzIDQQLCqk>).

The Sony PlayStation Product includes functionality to create m-regular topologies of players when setting up logical and physical network topologies using the PlayStation Network SDKs and Activity Hosts, which are used to handle activity and failover states when players are no longer connected or leave via Host Migration to a new physics host to heal a disconnection of a first computer from a second computer, the computers being connected to a broadcast channel, said broadcast channel being an m-regular graph where m is at least 3:



But Destiny is a world of intersecting, not parallel lines. Most of the time, players are just passing through public bubbles. Any one of these players could be the current Physics Host, and as soon as she leaves and deinstantiates the bubble, we need to Host Migrate to a new physics host.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 51; *see also* Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 40.

claim 6(b):
attempting to
send a message
from the first
computer to the
second
computer; and

The Sony PlayStation Product meets the recited claim language because it attempts to send messages from a first computer to second computer within m-regular connectivity meshes of players during different network game sessions and for different game session data and makes sure that each of the players is optimally connected to other players to ensure that all nodes are connected to the same number of nodes to ensure that no node is overloaded.

The Sony PlayStation Product includes functionality that attempts to send messages from a first computer to second computer within m-regular connectivity meshes of players during different network game sessions and for different game session data and makes sure that each of the players is optimally connected to other players to ensure that all nodes are connected to the same number of nodes to ensure that no node is overloaded, as shown in the screenshots below:



Exhibit 2030 (<http://vgboxart.com/viewfullsize/66658/Destiny/>);
Exhibit 2031.

The following screen captures show that the Sony PlayStation Product includes functionality that utilizes a “mesh-based” network that supports “millions of players online at once” attempting to send messages from a first computer to second computer:

Multiplayer in Destiny is set to be unlike anything that's come before. We spoke with Bungie technical director Chris Butcher about how it works under the hood and what displays to the player in the game. Find out the nuts and bolts of how Destiny differs from both MMOs and multiplayer shooters to carve its own path.

How did the big idea for Destiny's multiplayer philosophy start?

You have all of these examples of people who are doing big server cluster things like World of Warcraft or something like that. But we didn't really want to do that, because if you think about those kinds of games, you've got a centralized server that's simulating everything in the world, but that can only scale up to some number of players. Maybe it's 1,000. Maybe it's 5,000. Maybe it's 20,000. You compare that to the population of a console game and it's tiny.

So what that means is that you have to have dozens or hundreds of these separate servers. So we started out by thinking, "We want to have a single world that everybody can be in."

We took this mesh-based networking that we've been developing for years and years with Halo and adapted that networking to work in a seamless interconnected world full of other players and AIs. So when you're playing a destination you're moving from area to area and every one of those areas has got this mesh networking with a group of players that are in it at this one time. And then it has its own servers for that particular area so you're continuously moving around between these groups of both consoles and also dedicated servers that are hosting it.

That's the thing that I'm really excited that we've been able to do because I think it's been really hard for us. And I don't really think anybody else is going to be able to pull it off in the timeframe we're talking about on consoles.

Exhibit2028 <http://www.gameinformer.com/b/features/archive/2013/12/06/the-matchmaking-technology-of-destiny.aspx?PostPageIndex=1>

How does this mesh-based network play out in the game?

What happens is everybody in the world can play together. There aren't these barriers that are in place. You're all playing in one connected online world. When you're moving from location to location you're always going to have people to play with because there's this huge population. You never have to go to an area of the world that's deserted because there happens to be no one here on the server at this time.

There are these artifacts that you get when you have, when you do a simulation that runs on a single server on a big mainframe type thing, there are two problems that you get. One problem is all of the 5,000 people on your server nobody is playing in Old Russia at the moment so it's just empty when you go there. Or the other problem is all 5,000 people logged in and tried to go to the same place at the same time and the server crashes or it gets so full up that it's totally lagged out. And if it does get full then there are some of those games that will start having different instances, but typically they don't handle that very well because it's not a core part of the game design.

For us we've kind of said we want this game world to be able to work with millions of players online at once. And that means playing to the strengths of the consoles. Being able to use these very powerful machines to run a lot of the simulation. Being able to use the servers in a seamless fashion so that as you're moving from place to place you're switching networks with all of the different people that are around you. You've got a very high quality fast action gameplay experience. If you have all of these calculations taking place in a central server that's one place in the world you can't really have a fast action experience.

What if you're playing from Brazil or the West Coast of America? When we have this big pool of global players to matchmake with we're able to use all of our technology to make sure you're playing with people who are physically located near you so you have good ping to everybody else. So you're able to have this great action experience that you're used to in these action games. But at the same time you can do it in this global fashion.

Exhibit 2028 <http://www.gameinformer.com/b/features/archive/2013/12/06/the-matchmaking-technology-of-destiny.aspx?PostPageIndex=1>

As a further example, the following screen capture shows eight participants interacting with each other attempting to send messages from a first computer to second computer:



Exhibit 2033 <https://www.youtube.com/watch?v=dPcrmT0of5g>

When a user plays the product, connections to other players happens on the fly using “on the fly matchmaking” technology, “invisibly matching players with each other as they play.” This occurs by using a “dynamic network architecture” that allows game players’ consoles and/or game servers as participants to attempt to send messages from a first computer to second computer, as shown below:

wolfking2010 If a Fireteam member has to leave can another player seamlessly join my game?

Certainly, your Highness. How and why and under what circumstances will be better experienced than explained. The social connections that you'll enjoy on your travels are just one of the ways that Destiny will surprise you.

Exhibit 2033 [Bungie Weekly Update Archive] <http://destiny.bungie.org/bwu/26>





Exhibit 2034 <https://www.youtube.com/watch?v=MOY5zJcH0fI>

How to Join an Open Fireteam:

- Launch the in-game menu by pressing Start or Select
- Navigate to the Roster tab
- Select the leader or a participant of your target Fireteam
- Select "Join Fireteam"

How to Create a Fireteam:

- Launch the in-game menu by pressing Start or Select
- Navigate to the Roster tab
- Select the player you wish to join your Fireteam
- Select "Invite to Fireteam"

Exhibit 2024 https://www.bungie.net/7_How-to-Join-or-Create-a-Fireteam/en/Help/Article/13978

As shown above, the Sony PlayStation product contains functionality to allow a player to join a particular multiplayer game of interest, with each player attempting to send messages from a first computer to second computer, such as providing a "Fireteam" mode where up to six participants can form a team to play the game simultaneously online and that this "Fireteam" can be joined by identifying another participant of the targeted Fireteam:

The next step on that front begins with this Iron Banner.

Lord Saladin's battle for the Spark will feature new matchmaking settings that will assign more emphasis to connection quality. These changes will be made in an effort to reduce lag. There will still be some consideration given to matching you with worthy adversaries, but that's a thing we've done since Destiny first shipped.

Exhibit 2025 <https://www.bungie.net/en/News/News?aid=14278>



Iron Banner	
11:26	
zbone96	460
PattyBarrett	150
pNasTy24	110
spencer7brother	100
Bindrr	50
PetrolNinja	0
Alpha	870
FpsJoey	110
deadlord89	0
GameOfJobs	0
GrEaTnInJaPiG	0
KyleF329	0
Omegasombra	0
Bravo	110

Exhibit 2035 <https://www.youtube.com/watch?v=YG7lhxdsciA>

As shown below, the Sony PlayStation Product includes functionality to allow each participant to have connections to at least three neighbor participants, with each player attempting to send messages from a first computer to second computer, including PS4 consoles and allows players to “Invite Friends” to join his/her network:

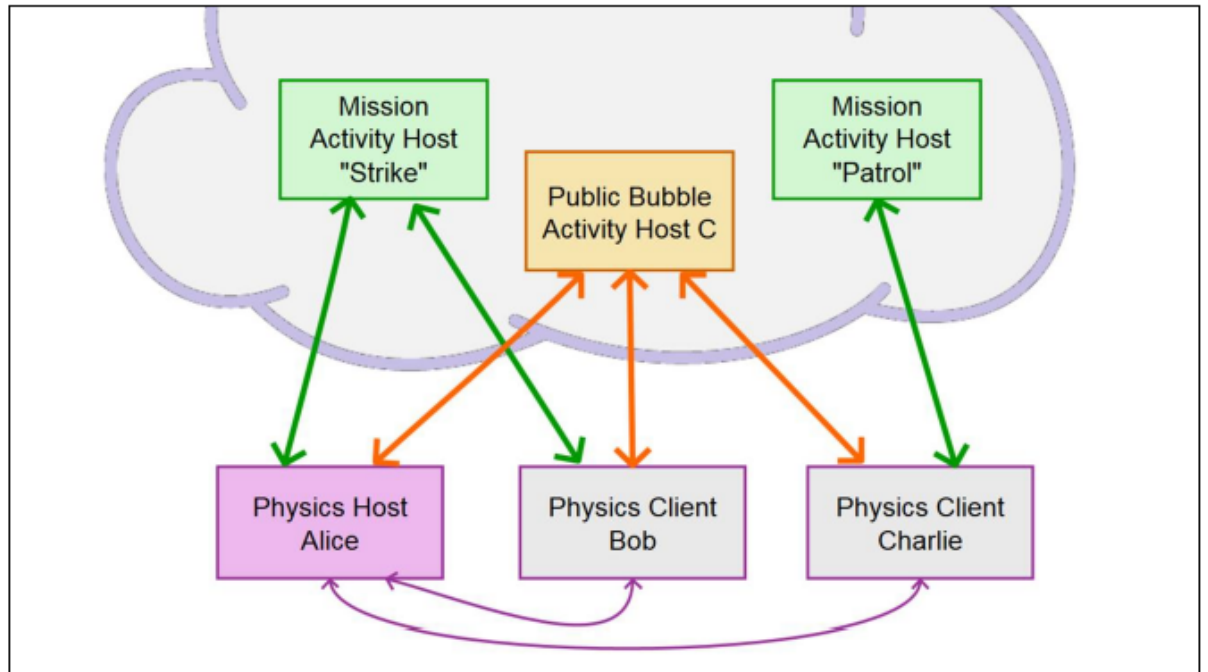


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 99

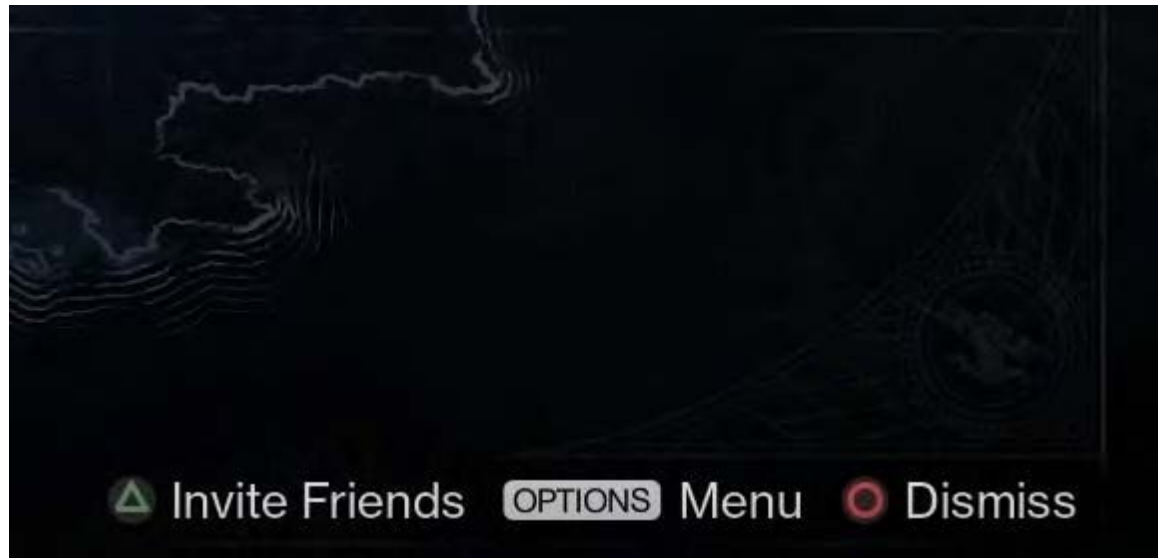


Exhibit 2037
https://www.youtube.com/watch?v=nIDyPPxKotM&feature=iv&src_vid=XKQfiwPzjmc&annotation_id=annotation_2453463955

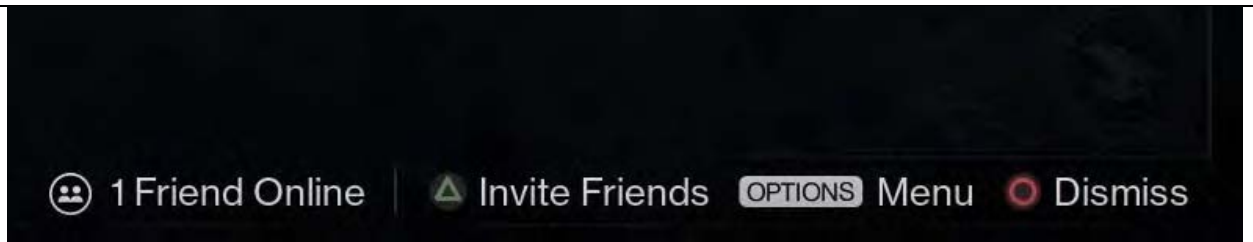


Exhibit 2036 <https://www.youtube.com/watch?v=mfzIDQQLCqk>

The Sony PlayStation Product includes functionality to attempt to send messages from a first computer to second computer in providing chat data to players of corresponding activity channels in a networked environment where m-regular can indicate that each of the players is optimally connected to other players to ensure that all nodes are connected to the same number of nodes to ensure that no node is overloaded:

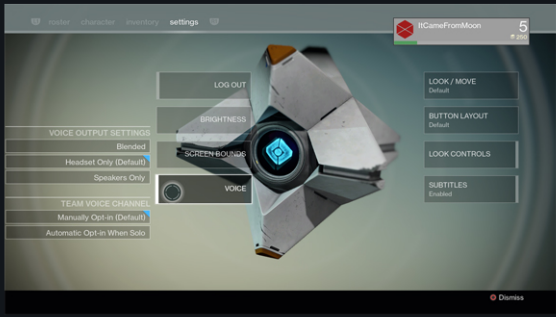
Joining Team Chat

If Team Chat is available, it can be accessed at any point in time by going into **Navigation Mode** in Destiny. As always, you activate that menu by deploying your Ghost.

[click to enlarge - see lower right]

Once in **Navigation Mode**, you will see the user interface for channel selection. The lower right of your screen will contain the following:

- Directional button icons
- Highlights for available chat options
- Text for current channel
- Icons for current channel

	<div><h3>Voice Chat Settings</h3><p>As with everything in Destiny, your Settings menu will enable you to establish your preferences. You will have two options under VOICE. Choose the one that best suits your style of play.</p><p>[click to enlarge - see lower left]</p><p>Manually Opt-in (Default) This is the default option. When playing a game, you will need to deliberately enter Navigation Mode to select Team Chat. Each member of a pre-formed party must select this option on their own.</p><p>Automatic Opt-in When Solo With this option, you'll be automatically added to the Team Chat channel when you're alone. The automated toggle will not happen if you're keeping the company of a friend in your Fireteam. That would separate you from them, and no one likes to be separated from their friends.</p><p>Exhibit 2032 https://www.bungie.net/en/News/Article/12376/7_voice-chat-beta-in-destiny</p></div>
<p>claim 6(c): when the attempt to send the message is unsuccessful, broadcasting from the first computer a connection port search message indicating that the first computer needs a connection; and</p>	<p>The Sony PlayStation Product meets the recited claim language because when the attempt to send the message is unsuccessful, it includes functionality to broadcast from the first computer a connection port search message indicating that the first computer needs a connection port.</p> <p>The Sony PlayStation Product includes functionality to broadcast from the first computer a connection port search message indicating that the first computer needs a connection when the attempt to send the message is unsuccessful by initiating an attempt by the match server, host server, or peer to find a connection port to another player that can be used to maintain an m-regular graph in the game session or match and to create an optimized connectivity mesh of players, and keeping games running whenever PlayStation consoles (aka Physics Hosts) disconnect from the game (aka Host Migration occurs) by electing a new Physics Host from one of the remaining players then to get a new authoritative simulation state from the new host, as described in the screenshots below:</p>

Host Migration!

- Elect a new host
- Handoff of simulation authority
- Reconciliation of inconsistent state
- This was a rare occurrence in Halo

DESTINY 

A Host Migration occurs whenever the Physics Hosting console disconnects from the game. In order to keep the game running, we need to elect a new Physics Host from one of the remaining players.

We pick a new host, and then need to get a new authoritative simulation state from the new host.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 49;

Bubbles

- A bubble is an autonomous unit of simulation
- Bubbles are our unit of asset loading
- Gold standard on PS3 was 6 vs 25

DESTINY 

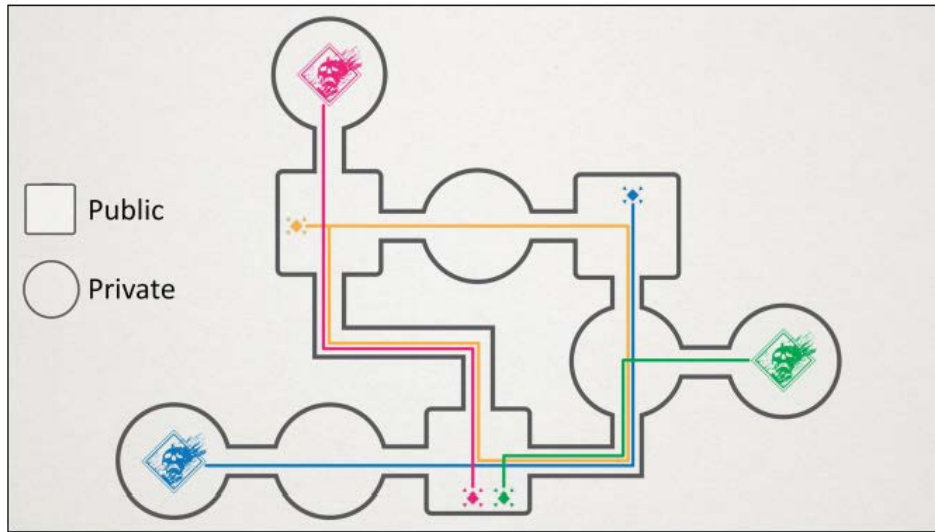
A bubble is our unit of simulation – a player is only ever simulating a single bubble's worth of combat and physics at any time.

A bubble is also our unit of asset streaming – you have at most 2 bubble's asset memory loaded at any time – the one you're currently simulating, and the one you're precaching.

For Simulation perf, we had a bunch of different perf rules depending on max player count, vehicles, etc., but our standard bubble was 6 vs 25 – that meant 6 players, and 25 AI in a single bubble active at any one time.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 32.

The Sony PlayStation Product includes functionality to create m-regular topologies of players when setting up logical and physical network topologies to keep games running whenever PlayStation consoles (aka Physics Hosts) disconnect from the game (aka Host Migration occurs) by electing a new Physics Host from one of the remaining players then to get a new authoritative simulation state from the new host:



But Destiny is a world of intersecting, not parallel lines. Most of the time, players are just passing through public bubbles. Any one of these players could be the current Physics Host, and as soon as she leaves and deinstantiates the bubble, we need to Host Migrate to a new physics host.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 51; *see also* Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 40.

Activity Hosts

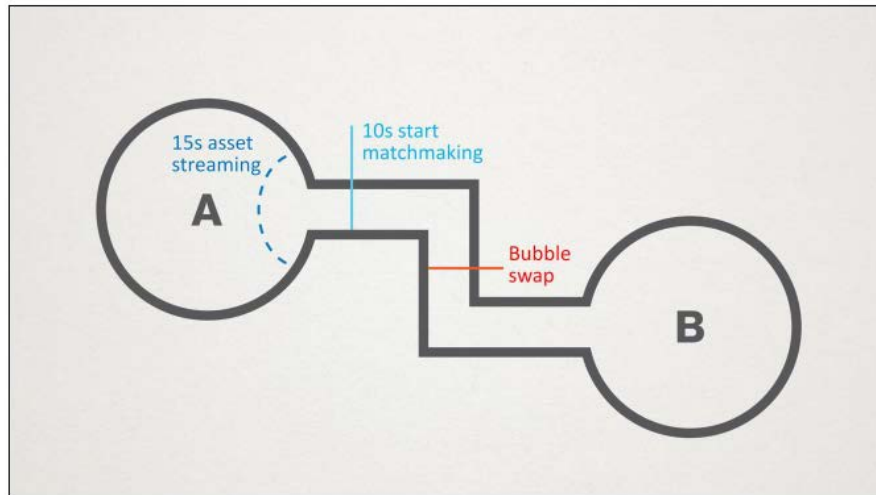
- No queues or downtime during launch
- 10,000 players per server
- Low Latency, Seamless Matchmaking

By combining our Activity Hosts with traditional Peer-to-peer networking, we get the low latency action gameplay of a Call of Duty or Halo, while constantly seamlessly matchmaking you to new strangers.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 11; *see also* Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 17 (“We force you to matchmaking with other players, even if all you want to do is play a solo campaign. Therefore we need to make sure that our matchmaking and networking goals never hurt that solo

campaign experience.”)

The Sony PlayStation Product includes functionality to create m-regular topologies of players when setting up logical and physical network topologies to handle activity and failover states when players are no longer connected or leave via Host Migration to a new physics host:



The neat thing we also do during these transitions is matchmake you to a new networked game. In order to meet new strangers in bubble B, we start matchmaking for a new host at the 10s mark, and are ready to seamlessly swap you to the new game when we perform our bubble swap.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 36.

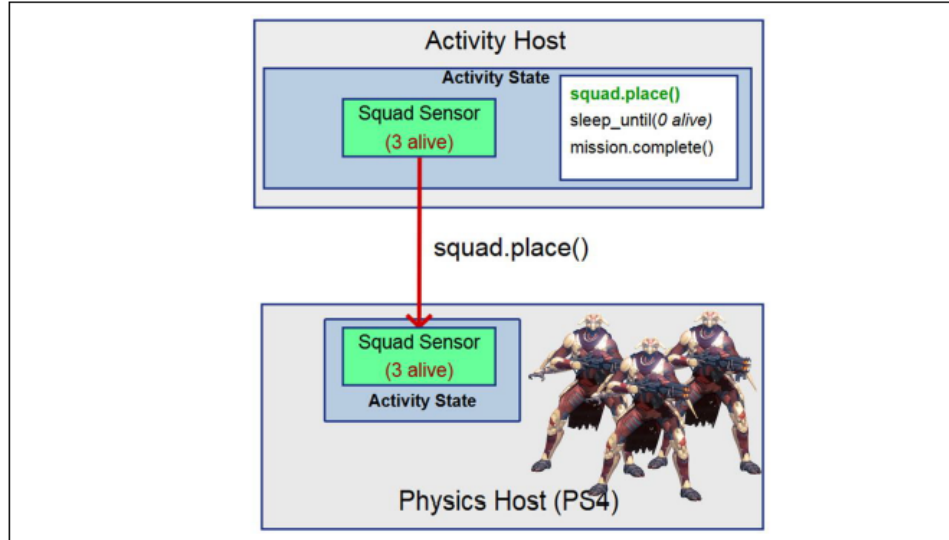


And we were able to support that load with just a few hundred servers in our datacenter, because we can handle loads of 10,000 players per server.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 10.

The Sony PlayStation Product includes functionality to create m-regular topologies of players when setting up logical and physical network topologies to seamlessly swap players to the new

game during matchmaking transitions to a networked game:



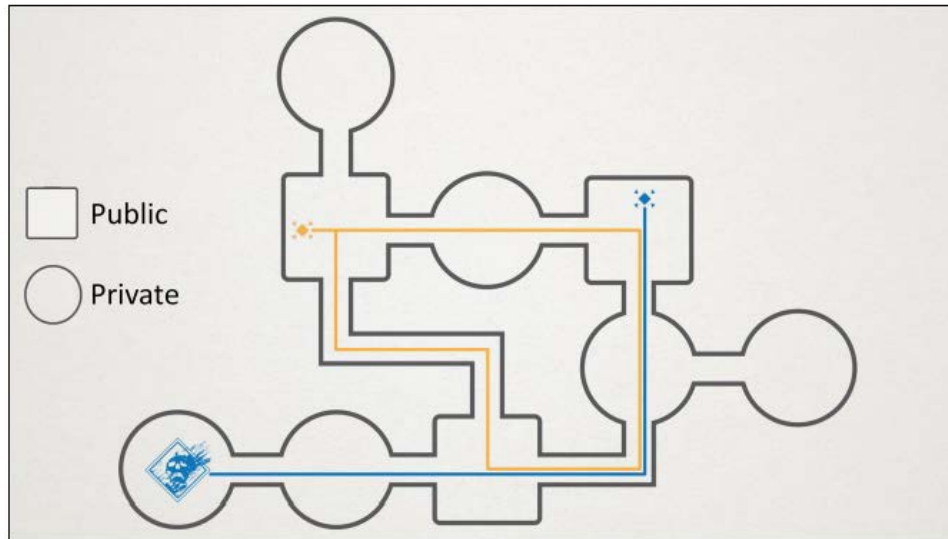
At this point the 3 AI are simulated on the Physics Host, and P2P networked to other clients.

Now there's already a couple interesting things to note here.

First, the Activity Script itself is running in the cloud – none of our Lua logic for Activity Scripts are executing on the PS4 client.

Second, it's worth pointing out that these 3 AI are not in "Activity State". There's a Squad Sensor inside activity state, but it's tracking very minimal state (there are 3 AI alive, and they're using this specific firing area).

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 80.



Now if I add some other activity lines – most of our activities start in a public bubble, and they all take you on a deliberate path through many bubbles. You typically get some exposure to 1-2 public bubbles during an activity line, and then dive into a private-bubble chain where we can have a hand-authored mission climax.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 45; see also Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 41 (“bubbles are our unit of autonomous simulation and matchmaking”).

Activity Hosts

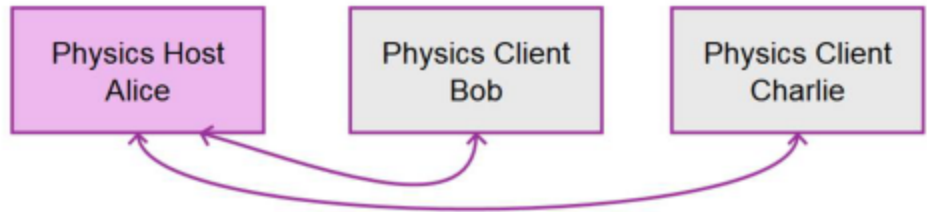
- No queues or downtime during launch
- 10,000 players per server
- Low Latency, Seamless Matchmaking
- PS4 Host Migrations every 160 seconds

DESTINY

A typical Destiny player is Host Migrating between different PS4's once every 160 seconds, without noticing any discontinuity in their simulation.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 12.

As shown in the screenshots below, where not every player in the game session is directly connected, either logically or physically to every other PS4 console (aka Physics Host of Physics Client) in the game, the Sony PlayStation Product includes functionality that broadcasts from the first computer a connection port search message indicating that the first computer needs a connection when the attempt to send the message is unsuccessful by creating a graph of players when setting up a logical and physical network topology via Public Bubbles Activity Hosts:



So, let's suppose we've got 3 players in this public bubble – Alice, Bob, and Charlie.

They're Peer-to-peer connected to each other using traditional Reach networking, and Alice is the Physics Host.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 96.

As shown in the following screenshots, using Bubble Activity Host for each of the public bubbles to handle the respawn timing and placement of all the resource nodes and runs all the logic for all the public events and Mission Activity Hosts for constant connection of all participants of the team mission:

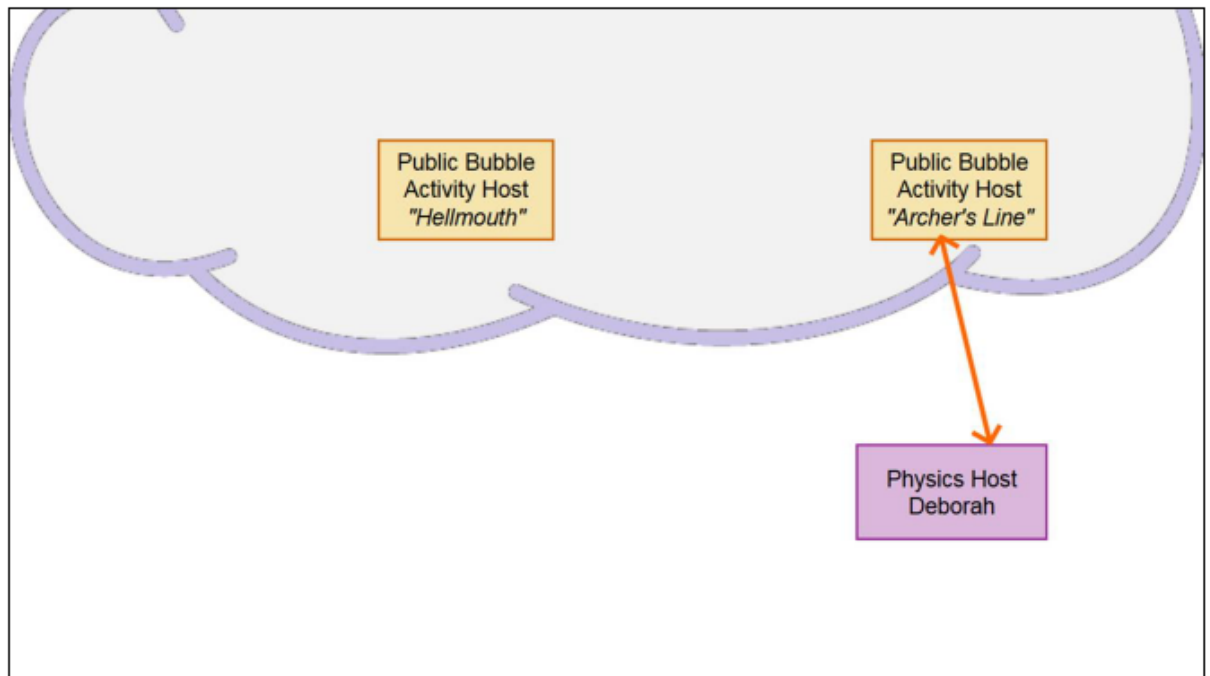


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 125.

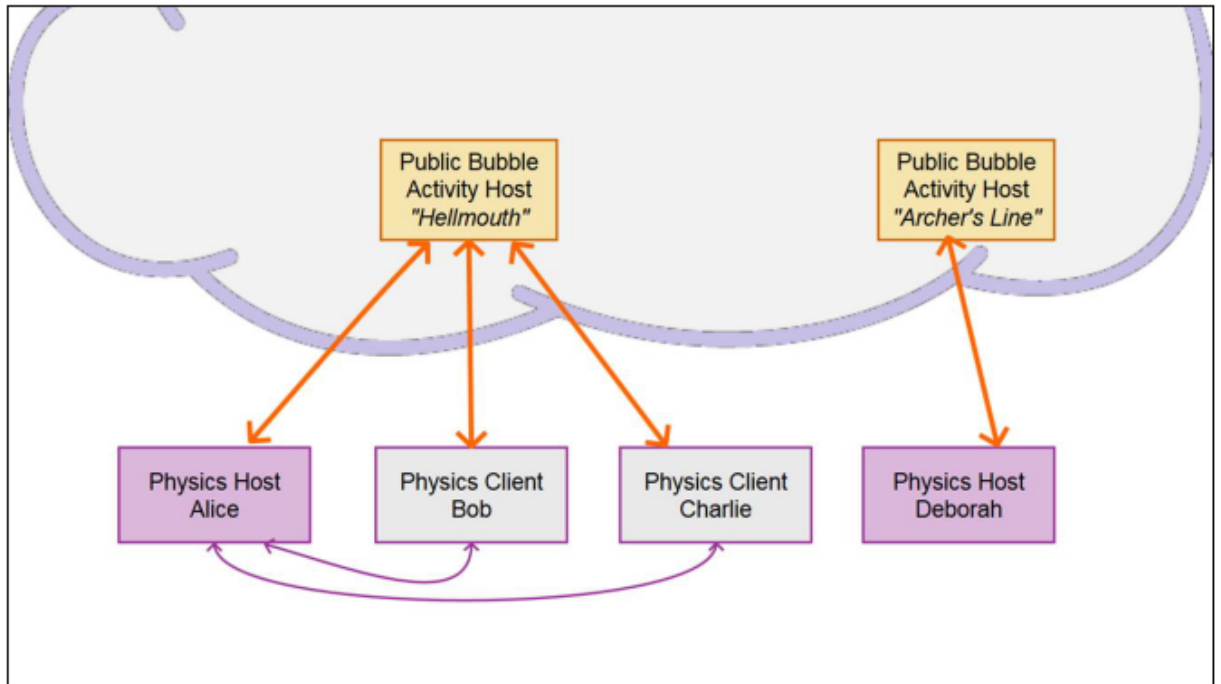


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 126.

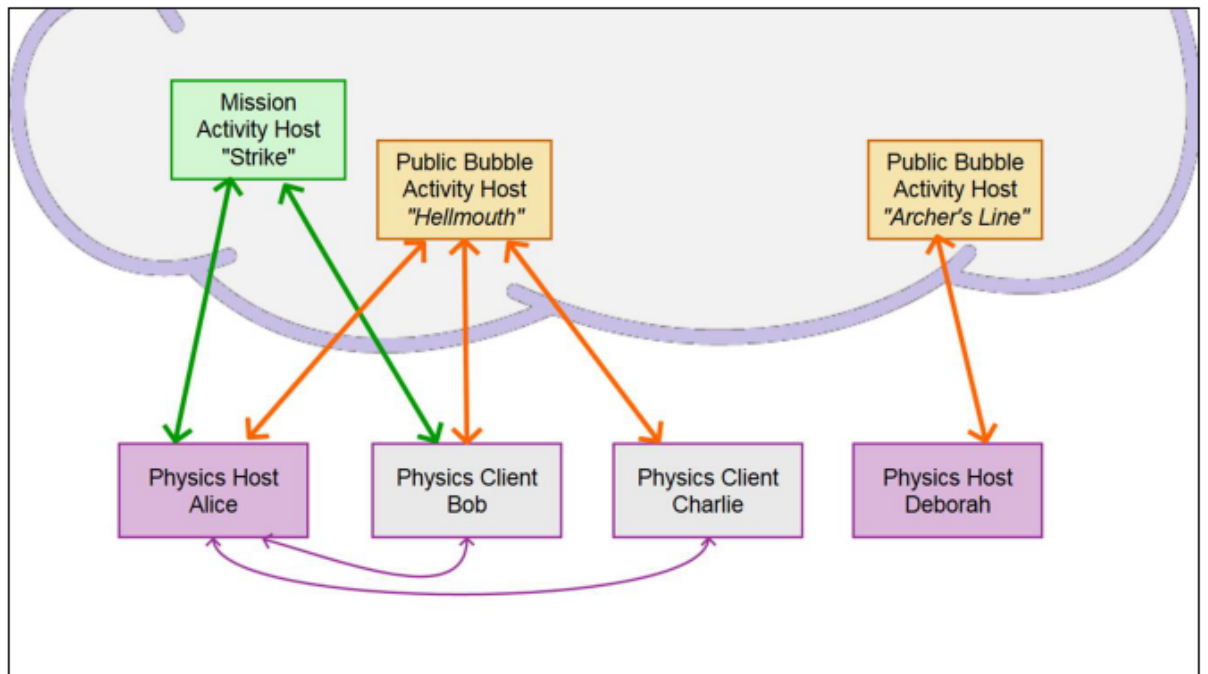


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 127.

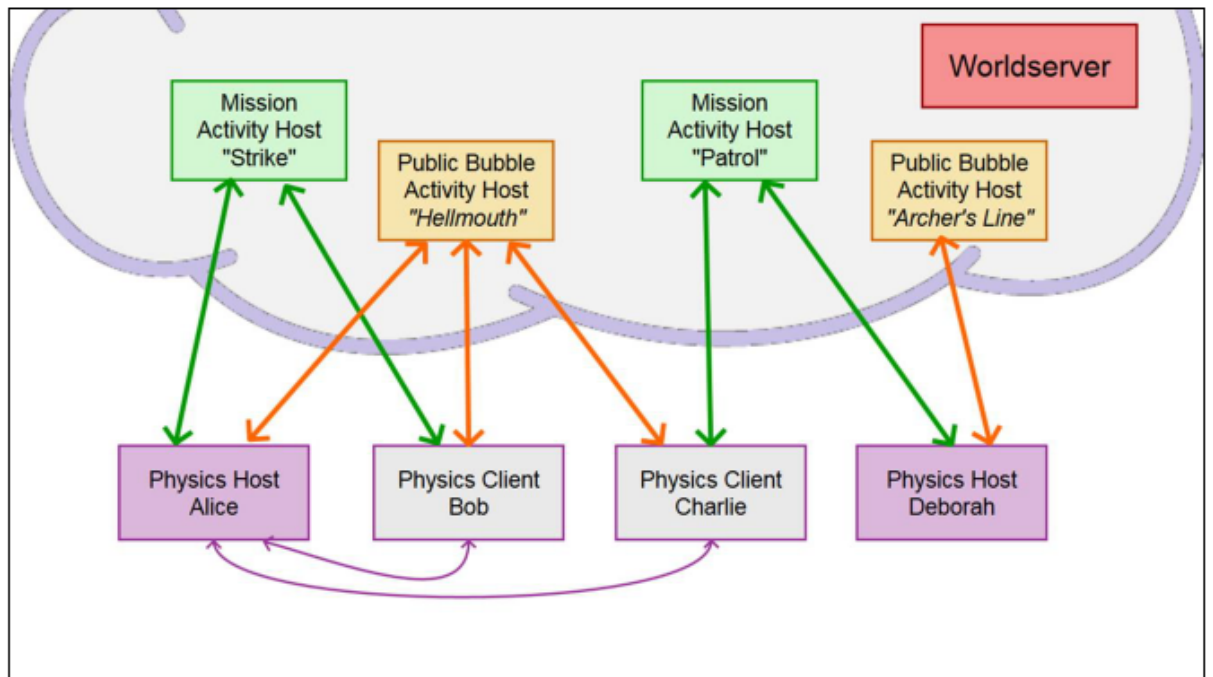


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 132

“Mission” Activity Host

- One Mission Host per Fireteam
- Runs the Script for your current Activity
- Owns all private bubbles in the destination

DESTINY 

So, to reiterate:

Each Fireteam gets their own Mission Host. All fireteammates are always connected to the same mission host (and this may be the only connection they share, if they're not in the same bubbles)

The Mission Host runs the Activity Script specific to the activity you're on – like a given Story Mission Script.

The Mission Host also owns all the Private Bubbles in the destination – that way your fireteam can meet up in any of these private bubbles, but no strangers will ever show up there.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 101.

claim 6(d):
having a third
computer not
already
connected to
said first
computer
respond to said

The Sony PlayStation Product meets the recited claim language because it includes functionality to have a third computer not already connected to said first computer respond to said connection port search message in a manner as to maintain an m-regular graph.

As shown below, the Sony PlayStation Product includes functionality for maintaining an m-regular graph by having a third computer not already connected to said first computer respond to said connection port search message in a manner that controls players disconnecting from a game session, and includes code for a match server, host server, or peers for receiving a

<p>connection port search message in a manner as to maintain an m-regular graph.</p>	<p>disconnect notice from a player attempting to leave a game session. This functionality will initiate an attempt by the match server, host server, or peer to find a connection port to another player that can be used to maintain an m-regular graph in the game session or match and to create an optimized connectivity mesh of players and attempts to evenly distributed players on the logical and physical networks so that in an evenly-distributed multiplayer game, the network of players is m-regular by electing a new Physics Host from one of the remaining players then to get a new authoritative simulation state from the new host to keep games running whenever PlayStation consoles (aka Physics Hosts) disconnect from the game (aka Host Migration occurs) and by initiating an attempt by the match server, host server, or peer to find a connection port to another player that can be used to maintain an m-regular graph in the game session or match and to create an optimized connectivity mesh of players. The Sony PlayStation product describes the example where we've got 3 players in this public bubble – Alice, Bob, and Charlie. They're Peer-to-peer connected to each other using traditional Reach networking, and Alice is the Physics Host.</p> <div data-bbox="500 749 1421 959" data-label="Diagram"> <pre> graph LR Alice[Physics Host Alice] <--> Bob[Physics Client Bob] Alice <--> Charlie[Physics Client Charlie] Bob <--> Charlie </pre> </div> <hr/> <p>So, let's supposed we've got 3 players in this public bubble – Alice, Bob, and Charlie.</p> <p>They're Peer-to-peer connected to each other using traditional Reach networking, and Alice is the Physics Host.</p> <p>Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 96.</p> <p>Then when 2 of them, Alice and Bob, do a Strike together that means they're connected to a "Mission Activity Host" for their mission. The Mission Activity Host is where all the script logic for their chosen Activity lives (firing off objectives, spawning bosses in their private bubbles:</p>
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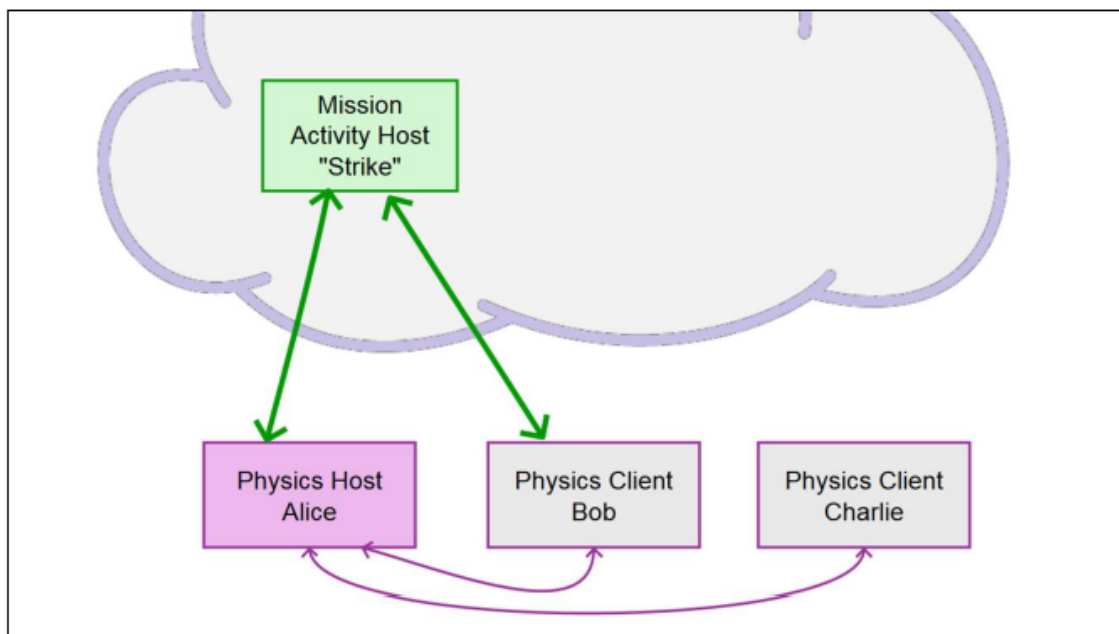


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 97.

Charlie is playing a Patrol, so while he's in the same bubble, he has a separate "Mission Activity Host," giving him local Patrol objectives:

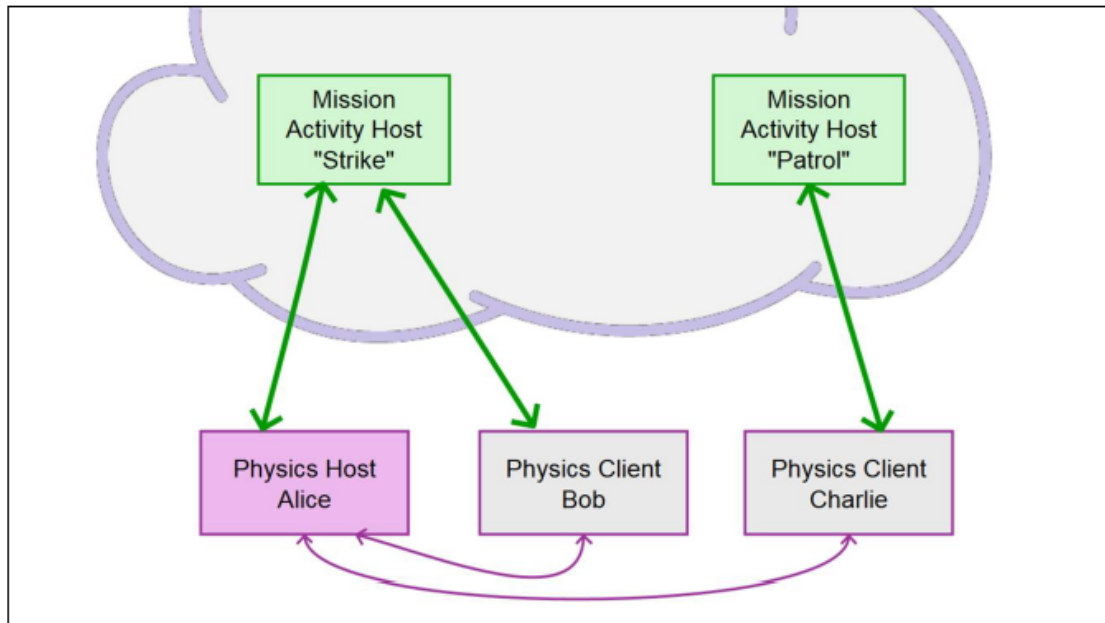


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 98.

As a result, the product makes sure they're also simultaneously all connected to the same "Bubble Activity Host" allowing constant and seamless matchmaking to new participants, without any discontinuity to maintain m-regular connectivity meshes of players during different network game sessions and for different game session data where m-regular can indicate that each of the players is optimally connected to other players to ensure that all nodes are connected to the same number of nodes to ensure that no node is overloaded:

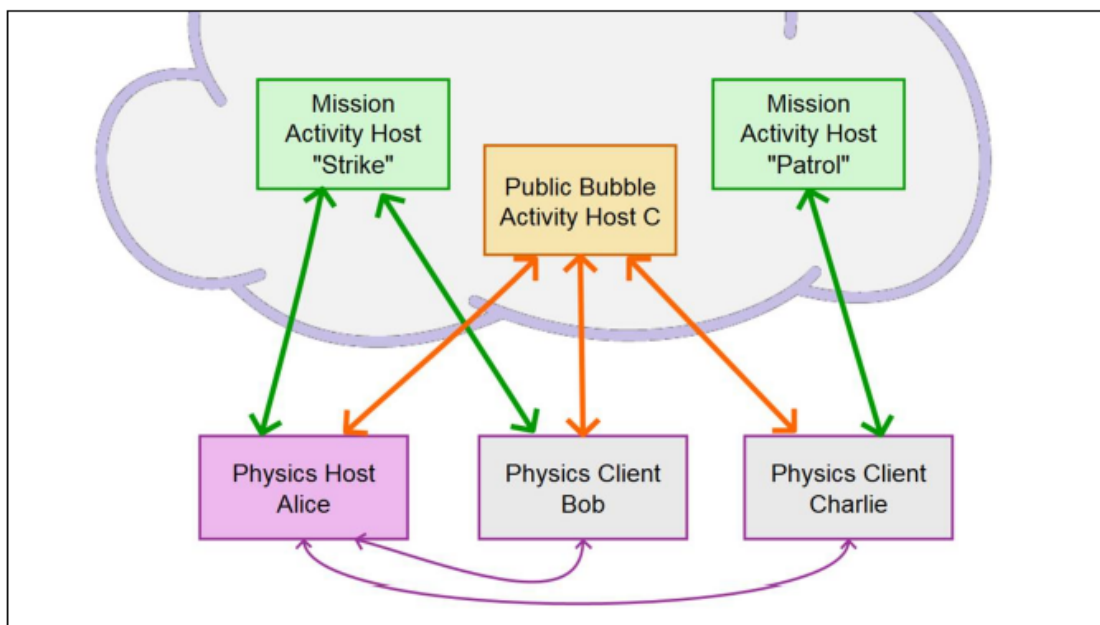


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 99

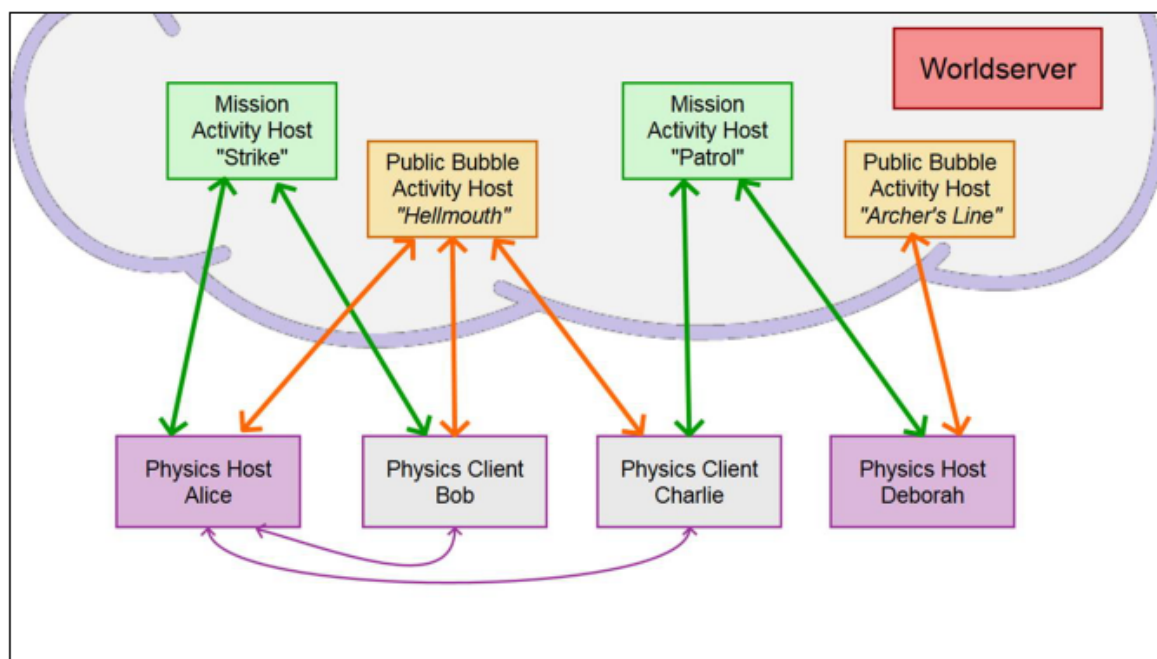
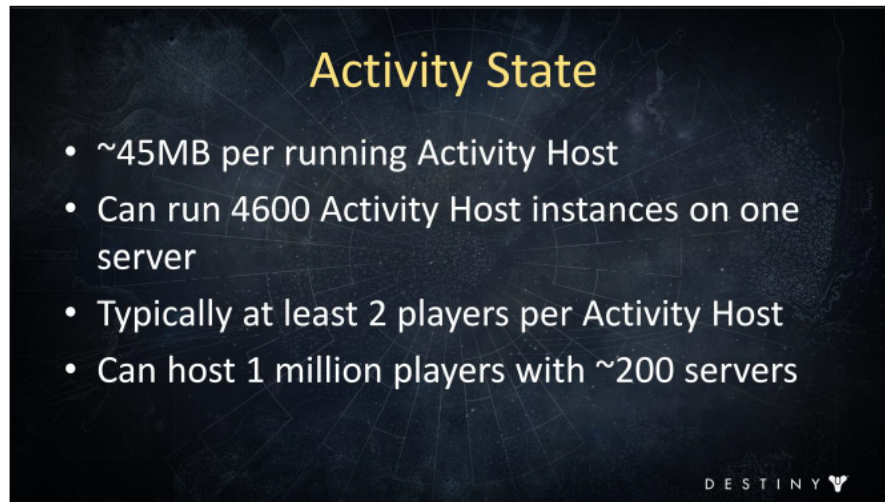


Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 99

us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 100

The product has a third computer not already connected to said first computer respond to said connection port search message in a manner that attempts to maintain a m-regular graph in the way the product manages activity states when different players leave, are kicked, or are disconnected allow it to handle a hypothetical 1 million concurrent users with only a couple hundred servers:



We tick our Activity Hosts at 10Hz, which allows us to run almost 5000 per server [40 core, 256GB]

Given that we typically have a bit over 2 players per Activity Host in real-world conditions, that means our datacenter can handle a hypothetical 1 million concurrent users with only a couple hundred servers, and that's with plenty of safety headroom on each machine.

That's dramatically better scale than trying to use a full dedicated server. With full dedicated servers, that same hypothetical 1 million players would require half a million headless PS3 processes, each running our full game simulation.

Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 88.

The product responds to said connection port search message in a manner that attempts to maintain a m-regular graph in forming network connections through TCP ports and relays to direct content through different NAT configurations during gameplay:

PlayStation™Network Sign-In	The status of your PlayStation™Network sign-in.
NAT Type	<p>How your PS4™ system is connected to the Internet This information can be used to judge the ease or difficulty of connecting to other PS4™ systems, such as when using communication features of games.</p> <p>Type 1: The system is connected directly to the Internet. Type 2: The system is connected to the Internet with a router. Type 3: The system is connected to the Internet with a router.</p>

Exhibit 2027 Test Internet Connection _ PlayStation®4 User's Guide.pdf at 1.

Use PlayStation™Network to connect your PS4™ system to a PlayStation™Network server or to another PS4™ system. When you're using PlayStation™Network at an office or other location with a shared network, a firewall or other security measures might prevent your PS4™ system from connecting to PlayStation™Network. If this occurs, refer to the port numbers listed below, which are used when you connect your PS4™ system to a PlayStation™Network server.

TCP: 80, 443, 3478, 3479, 3480
UDP: 3478, 3479

Exhibit 2027 Test Internet Connection _ PlayStation®4 User's Guide.pdf at 1

These are the port number that all games published by SCEE, may use for communicating with the game server:

TCP Ports:
80, 443, 5223, and what we call the 'port range' which is 10070 - 10080

UDP Ports:
3478, 3479, 3658, and 10070

These are the port numbers that the PlayStation Network will require to be open.

TCP Ports:
80, 443, and 5223

UDP Ports:
3478, 3479, and 3658

(Notice these port numbers are the same port numbers required for connecting to SCEE game servers)

Exhibit 2026 <http://community.eu.playstation.com/t5/PSN-Support/Port-Numbers-which-do-I-need-to-open-for-the-PlayStation-and-how/td-p/13390392> (Solved_ Port Numbers, which do I need to open for the Play... - PlayStation .pdf);

see also Exhibit 2029 (http://twvideo01.ubm-us.net/o1/vault/gdc2015/presentations/Truman_Justin_Shared_World_Shooter.pdf) at 5 (describing how the Sony PlayStation Product can run "a console shooter that requires an always-online internet connection.");

see also Exhibit 2027 http://manuals.playstation.net/document/en/ps4/settings/nw_test.html ("Use PlayStation™Network to connect your PS4™ system to a PlayStation™Network server or to another PS4™ system.... refer to the port numbers listed below, which are used when you connect your PS4™ system to a PlayStation™Network server...TCP: 80, 443, 3478, 3479, 3480")