

MEASUREMENT OF AR COMMERCIAL PLATFORMS- INSTRUCTIONS

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STEPS FOLLOWED FOR EXPERIMENTS RELATED TO BACKGROUND SERVER:

Analysis of Background Servers

We performed 3 different experiments as mentioned below

In experiment 01 was a single user experiment

- Open JOIN XR Application
- User A joins the meeting and mutes themselves
- Stand still for 1 minute
- Move around without moving hands for 1 minute
- Move around by moving hands for 1 minute
- Stay still for 1 minute

In experiment 02 which was a two user experiment with User A moving and User B being steady

- Open JOIN XR Application
- User A joins the meeting and mutes themselves
- User B joins the meeting after 30 seconds and mutes themselves
- User A and B keep standing
- User A moves by keeping hand still whereas User B is still standing for 1 minute
- User A moves with hand movement whereas User B is still standing for 2 min
- User A stands User B stands

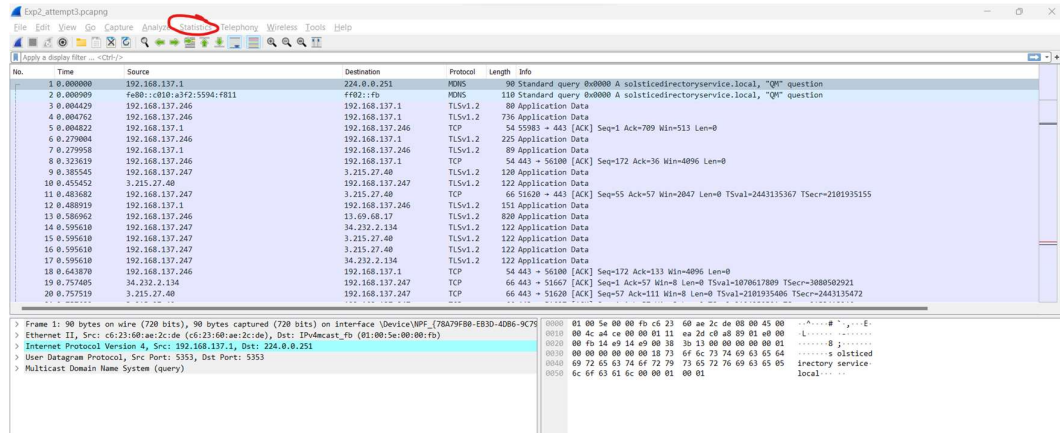
In experiment 03 which was a two user experiment where both User A and User B are moving

Open JOIN XR Application

- User A joins the meeting and mutes themselves
- User B joins the meeting after 30 seconds and mutes themselves
- User A and B keep standing
- User A and User B move by keeping hand still for 1 minute
- User A and User B move with hand movement for 2 min
- User A stands User B stands

WIRESHARK ANALYSIS FOR ABOVE EXPERIMENTS:

- Go to Statistics in the Menu bar



- Press on conversations from the drop down
- Navigate to every tab with conversation the protocol used can like TCP or IPV4 can be determined based on tab heading
- Sort duration in descending order, consider only those conversation
- Consider those background servers where AddressA is hololens ip then Address B would be the background servers
- As shown in below figure where hololens ip is 192.168.137.247 so the background server is 142.251.163.188

Address A	Address B	Packets	Bytes	Packets A -> B	Bytes A -> B	Packets B -> A	Bytes B -> A	Rel Start	Duration	Bits/s A -> B	Bits/s B -> A
192.168.137.246	192.168.137.1	13,584	10,881 MiB	9,751	10,639 MiB	3,833	247,776 KiB	0.0004429	572.1416	152,323 KiB	3,464 KiB
192.168.137.1	224.0.0.251	536	47,129 KiB	536	47,129 KiB	0	0 bytes	0.0000000	571.2409	675 bytes	0 bytes
192.168.137.247	136.68.17	702	316,616 KiB	449	186,878 KiB	253	131,740 KiB	0.569662	569.0887	2,627 KiB	1,852 KiB
192.168.137.1	224.0.0.252	236	19,359 KiB	236	19,359 KiB	0	0 bytes	9.264558	562.3979	281 bytes	0 bytes
192.168.137.1	192.168.137.255	19	3,266 KiB	19	3,266 KiB	0	0 bytes	0.866092	543.3367	49 bytes	0 bytes
192.168.137.246	142.251.163.188	48	11,400 KiB	20	2,102 KiB	28	9,299 KiB	18.653473	535.1732	32 bytes	142 bytes
192.168.137.247	192.168.137.1	73	9,390 KiB	37	3,052 KiB	36	6,338 KiB	13.603598	521.5929	47 bytes	99 bytes
192.168.137.1	136.68.17	1,000	759,399 KiB	1,144	481,179 KiB	656	278,221 KiB	66.433265	505.5823	7,613 KiB	4,402 KiB
192.168.137.1	91.199.81.186	14,255	3,295 MiB	5,604	2,174 MiB	8,651	1,121 MiB	72.305380	498.7814	35,709 KiB	18,413 KiB
192.168.137.247	224.0.0.251	16	4,604 KiB	16	4,604 KiB	0	0 bytes	40.211903	495.0738	76 bytes	0 bytes
192.168.137.1	91.199.81.203	2,350	183,781 KiB	1,112	85,887 KiB	1,238	97,895 KiB	82.636232	489.1928	1,404 KiB	1,601 KiB
192.168.137.246	91.199.81.186	15,305	3,343 MiB	5,023	970,963 KiB	10,282	2,395 MiB	88.150129	483.9747	16,050 KiB	40,539 KiB
192.168.137.1	239.255.255.250	20	4,219 KiB	20	4,219 KiB	0	0 bytes	88.631772	483.0444	71 bytes	0 bytes
192.168.137.1	192.168.137.1	64	12,311 KiB	32	2,864 KiB	32	9,446 KiB	49.985700	482.9465	48 bytes	160 bytes
192.168.137.246	91.199.81.203	2,303	180,345 KiB	1,092	84,429 KiB	1,211	95,916 KiB	93.315232	478.5206	1,411 KiB	1,604 KiB
192.168.137.247	175.17.144.11	22	1,807 KiB	9	776 bytes	13	1,049 KiB	150.602817	403.2239	15 bytes	21 bytes
192.168.137.1	255.255.255.255	2	352 bytes	2	352 bytes	0	0 bytes	112.253732	331.9368	8 bytes	0 bytes
192.168.137.247	3.220.159.105	142	83,582 KiB	45	12,993 KiB	97	70,589 KiB	198.940451	311.5698	341 bytes	1,812 KiB
192.168.137.246	34.111.82.212	28	7,487 KiB	16	2,874 KiB	12	4,613 KiB	102.409426	298.6162	78 bytes	126 bytes
192.168.137.247	3.215.27.40	152	17,460 KiB	94	8,393 KiB	58	9,067 KiB	0.385545	197.0680	348 bytes	376 bytes
192.168.137.247	34.232.134	154	18,063 KiB	92	8,105 KiB	62	9,957 KiB	0.595610	196.9062	337 bytes	414 bytes
192.168.137.247	18.154.230.229	65	12,577 KiB	34	3,712 KiB	31	8,865 KiB	13.795151	183.6416	165 bytes	395 bytes
192.168.137.247	52.114.133.166	45	14,303 KiB	26	6,375 KiB	19	7,928 KiB	23.545212	173.8743	300 bytes	373 bytes
192.168.137.247	54.163.175.227	13	810 bytes	7	390 bytes	6	420 bytes	29.388255	168.0487	18 bytes	19 bytes
192.168.137.1	44.233.137.115	39	12,288 KiB	20	4,870 KiB	19	7,418 KiB	68.816386	129.8590	307 bytes	467 bytes
192.168.137.246	44.233.137.115	38	10,841 KiB	19	3,807 KiB	19	7,034 KiB	87.419383	126.3378	246 bytes	456 bytes
192.168.137.247	239.255.255.250	8	1,695 KiB	8	1,695 KiB	0	0 bytes	2.041264	123.0251	112 bytes	0 bytes
192.168.137.1	51.132.193.105	254	215,879 KiB	177	201,323 KiB	77	14,556 KiB	110.157793	62.0724	25,946 KiB	1,875 KiB

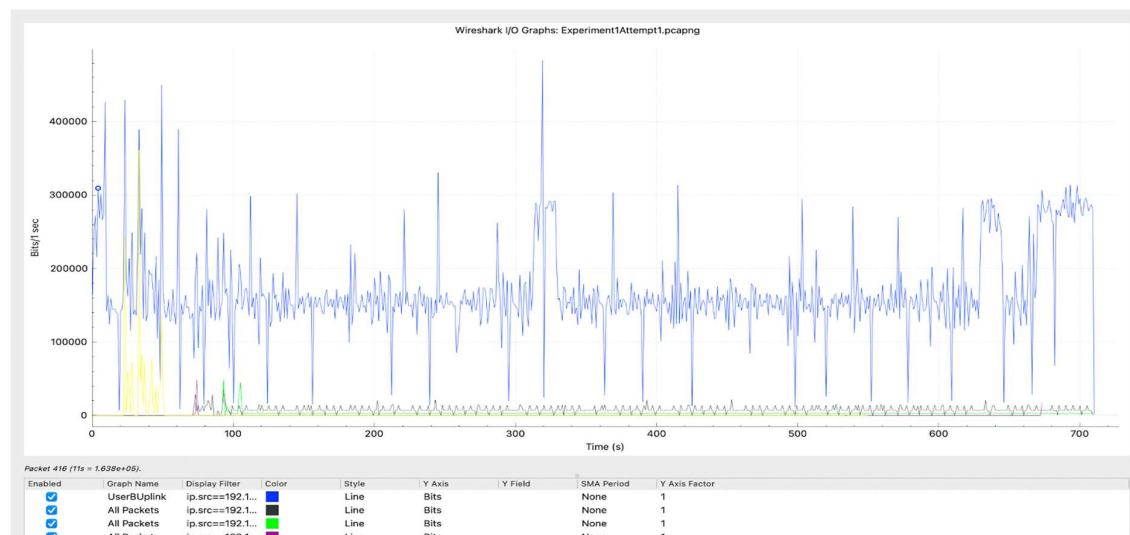
- Based on the conversation we built the table shown in below figure to fill the table we used below steps
 - To determine RTT used the ping command over the terminal using ping ip address
 - Data in bytes transferred in the conversation tab we used Bytes A -> B
 - Throughput is the value in the column Bytes in the conversation section
 - For duration we used the value from duration column in the conversation

Experiment 1 attempt 3 scenario Only user A is using JoinXR

Server (ip.dst==)	RTT	geoloca tion/serve r	Protoc ol	Anycast	Date time	Data(Byte s) WireShar k	Through put	Duration
91.199.81.186	20.404	Hamburg, Germany	HTTPS	yes	6th March	378.625 KiB	2.95KiB	473.1684
34.111.82.212	20.593	Kansas, united States	Https	Yes	6th March	7.349KiB	3.204KiB	18.3467
13.107.4.52	25.55	Redmond, Washington	Http	Yes	6th March	5.971KiB	34Bytes	465.14
13.69.68.17		Amsterdam, Europe	HTTPS	No	6th March	742.429 KiB	7.813KiB	465.1407

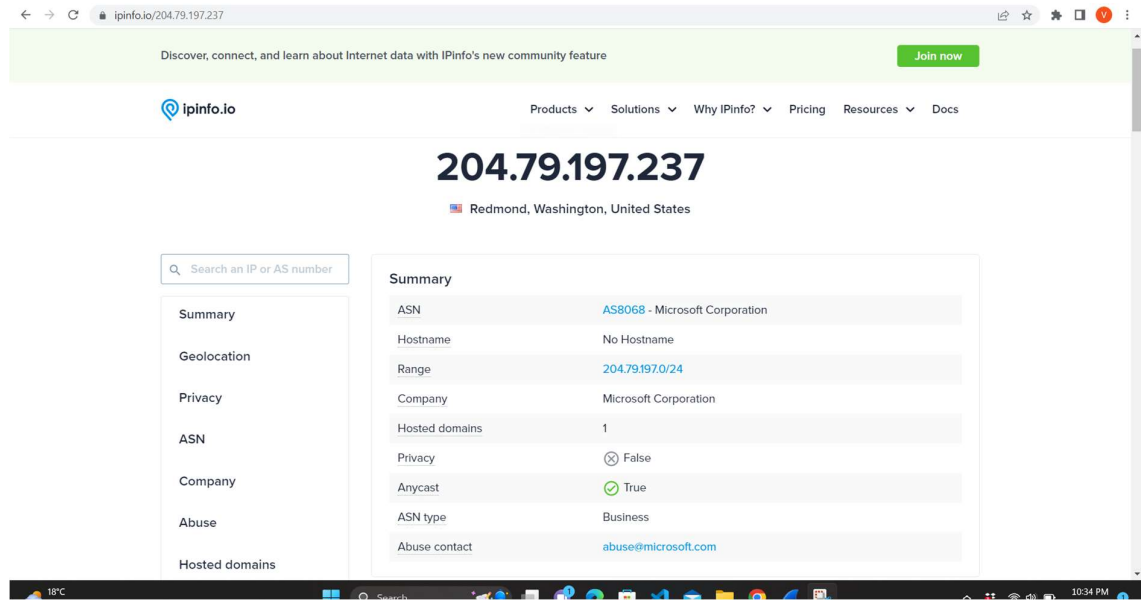
I/O Analysis

- Go to Statistics I/O Graphs
- You will get a new tab with many lines in graph format
- Now add filter in the display filter column
- Ip.src == hololens ip and ip.dst == background server ip got from previous steps
- After applying this filter you will have graph filtered based on above values
- Make sure Y-Axis column is Bits



IPINFO ANALYSIS OF BACKGROUND SERVERS:

- Next, we went to website <https://ipinfo.io/> to determine location, anycast details for the server
- Based on the background server we obtained from conversation you can just append to the above link for example if the background server is 204.79.197.237 the the link would be <https://ipinfo.io/204.79.197.237> on hitting the link you would find information like anycast details, location details as shown in below figure



Use of Device Portal for CPU GPU Utilisation

- For connecting to device portal on the hololens go to Security -> Developer Setting -> Enable device portal
- Hit the hololens ip provided once you hit enable device portal
- You will get the CPU and GPU values in graph format

Analysis of Latency with VPN

VPN Usage:

The VPN used is an application called VPN Shield available on Microsoft Store.

- Open VPN Shield
- Choose the country
- Click on connect
- Once VPN shows connected start experiment

Analysis of start and stop of a shared video over various countries with variations in Avatar

Steps:

- Run a millisecond clock (this is done for synchronization)
- Join a JOINXR Meeting
- Start recording the video, make sure the millisecond clock is part of your video
- Start the VPN on User B Hololens
- User A shares the video
- User A starts and pauses the video
- User B starts and pauses the Video

Below are screenshots of User A and User B at 06:37:18:598 with millisecond clock
USER A:



USER B:



Variations

- The first variation was to check the experiment results where both users were without any photo on avatar.
- The second variant was to check the experiment results with both users having a photo on avatar.
- Last variant was mixed scenario was where one user had avatar and other user did not have any avatar

Description of Variation 01: NO Avatar on both Users

- This is the default case provided by JoinXR
- In this case both users do not have images and are shown as 3D figures like below



Avatar without Photo

- Do the above mentioned steps with both Users having avatars like above

Description of Variation 02: Both UserHave photos on Avatar

- For this variant got to website <https://join.fracturereality.io/> go to Profile section
- Click the change button
- Upload a photo and you will update your avatar with photo as shown below
- For this variation you need to update photo for both users from both their accounts
- Do the steps mentioned for starting and pausing video mentioned steps with both Users having avatars like below that is with photo



Avatar with photo

Description of Variation 03: One User has photo on Avatar and other one does not

- For this variant got to website <https://join.fracturereality.io/> go to Profile section
- Click the change button
- Upload a photo and you will update your avatar with photo as shown below
- For this variation you need to update photo for one user only the other user will have the default avatar
- Do the steps mentioned for starting and pausing video mentioned steps with one user having avatar other not having avatar

Analysis of Latency for tool Dictation in JoinXR with meeting and drop-in

- Run a millisecond clock (this is done for synchronisation)
- Join a JOINXR Meeting
- Start recording the video, make sure the millisecond clock is part of your video
- Open dictation tool
- Make sure the dictation is visible for you and other users
- Start dictating
- Check which frame had first appearance for you and for the same for your partner to calculate latency

FFMPEG:

To convert video into frames we used FFMPEG Tool.

We used the command: `ffmpeg -i input.mp4 out%d.png` to generate the image frames.

Post this we checked which frame had first appearance for you and for the same for your partner to calculate latency