Amber Dolezal

**Methodology and Procedure:**

The testing methodology must be described. Any equipment to be used should be discussed, and the test setup should be described in sufficient detail such that another researcher could reproduce the setup. The testing procedure should also be sufficiently described (in report format) such that the procedure could be duplicated.

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**Methodology**

This AR remote rendering application will be tested utilizing the Hololens 1, Wi-Fi, a computer, and a bench-mark app (non-remote rendering).

**Procedure**

**Setting up HoloLens to use Windows Device Portal**

1. Power on your HoloLens and on the device.
2. Use the Bloom on HoloLens to launch the main menu.
3. Gaze at the Settings tile and do an air-tap gesture on HoloLens.
4. Select the Update menu item.
5. Select the For developers menu item.
6. Enable Developer Mode.
7. Scroll down and enable Device Portal.
8. Set up the Windows Device Portal so you can deploy apps to this HoloLens over Wi-Fi, select Pair to generate a pairing PIN. Leave the Settings app at the PIN popup until you enter the PIN into Visual Studio during your first deployment.

**Connecting over Wi-Fi**

1. Connect your HoloLens to Wi-Fi.
2. Look up your device’s IP address by either:
   1. Going to Settings > Network & Internet > Wi-Fi > Advanced Options.
   2. Going to Settings > Network & Internet and selecting Hardware properties.
   3. Using the “What’s my IP address?” voice command.
3. From a web browser on you PC, go to https://<YOUR\_HOLOLENS\_IP\_ADDRESS>
   1. The browser will display the following message: “There’s a problem with the website’s security certificate” because the certificate, which is issued to the Device Portal, is a test certificate. You can ignore this certificate error for now and continue.

**Installing a certificate**

1. In Windows Device Portal, navigate to the Apps manager page.
2. In the Deploy apps section, select Install Certificate.
3. Under Select certificate file (.cer) used to sign an app package, select Choose File and browse to the certificate associated with the app package that you want to sideload
4. Select Install to start the installation.

**Installing the benchmark/non-remote rendering application**

1. When you’ve created an app package from Visual Studio, you can remotely install it onto your device from the generated files.
2. In Windows Device Portal, navigate to the Apps manager page.
3. In the Deploy apps section, select Local Storage.
4. Under Select the application package, select Choose File and browse to the app package that you want to sideload.
5. Check the respective boxes if you want to install optional or framework packages along with the app installation and select Next.
6. Select Install to start the installation.
7. Once the installation is complete, go back to the All apps page on your HoloLens and launch your newly installed application.

**Instantaneous System Performance Readings**

1. From the Windows Device Portal home page on the Microsoft HoloLens, Select the Views from the menu on the left.
2. Then select Apps.
   1. Ensure that the only app that is currently running is the one being tested.
   2. End any unnecessary processes that are running.
3. From the Windows Device Portal home page on the Microsoft HoloLens, Select the Performance from the menu on the left.
4. To see the instantaneous system performance, select System Performance.
   1. Log the following metrics periodically during the test:
      1. **SoC power:** Instantaneous system-on-chip power usage, averaged over one minute
      2. **System power:** Instantaneous system power usage, averaged over one minute
      3. **Frame rate:** Frames per second, missed VBlanks per second, and consecutive missed VBlanks
      4. **GPU:** GPU engine usage, percent of total available
      5. **CPU:** percent of total available
      6. **Memory:** Total, in use, committed, paged, and non-paged

**Performing a trace**

1. On the left, navigate to Performance > Performance Tracing
2. Choose an available profile or select Custom profiles > Browse then use this profile to analyze CPU performance:

<https://aka.ms/CPUProfileforDevicePortal>

1. Click Start Trace.
2. The HoloLens is now recording a trace. Make sure to trigger the performance issues that you want to investigate, and then select Stop Trace.
3. The trace will be listed at the bottom of the webpage. Select the disk icon at the right-hand side to download the ETL file.

You now have an ETL file that you can either open directly in WPA or send to someone else.