MLBN Data Cleaning, Publishing and Analysis Process

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Introduction

This document is intended to establish provenance of the measurements collected during the *Measuring Library Broadband Networks (MLBN)* program, funded by the Institute of Museum and Library Services (IMLS) National Leadership Grant for Libraries program (award #LG-71-18-0110-18).

Data Overview

Internet measurement test data collected by the measurement devices in the MLBN program was collected during the development of the Murakami software itself, which included changes to the output formats for supported tests and different NDT test client code used between program years. We generally refer to the data collected by program year 1 and 2, as we used two different software releases of Murakami in each year. Only data from the second program year between 2020-02-01 and 2021-01-31 were used for our analyses and final reporting. However, in this document we also outline the process used to prepare the data collected from the first program year as well.

Year 1 Data Collection Instruments

In year 1, Murakami used the following Internet measurement tests:

- NDT - Network Diagnostic Tool (using the ndt5 protocol) provided by Measurement Kit
- DASH - Dynamic Adaptive Streaming over HTTP, provided by Neubot
- speedtest-cli - Community developed command line interface for testing internet bandwidth using speedtest.net

NDT and DASH measurements were conducted to the nearest M-Lab server. Speedtest measurements were conducted to the nearest OOKLA server. Because NDT and speedtest-cli are both throughput measurements, that NDT uses a single TCP stream for measurement, and speedtest-cli supports both single and multiple TCP streams, in year 1 we ran speedtest-cli measurements using a single stream to make these two measurements more comparable.

The NDT client library used was provided by Measurement Kit, a C++ application that provided multiple open source Internet measurement instruments. During program year 1, this library was

slated for deprecation by its maintainer. During this time, M-Lab also released replacement client libraries written in Go for two NDT protocols, ndt5 and ndt7.

Year 2 Data Collection Instruments

In year 2, Murakami used the following Internet measurement tests:

- NDT (v5) - Network Diagnostic Tool provided by M-Lab
- NDT (v7) - Network Diagnostic Tool provided by M-Lab
- speedtest-cli (single stream) - Community developed command line interface for testing internet bandwidth using speedtest.net
- speedtest-cli (multi-stream) - Community developed command line interface for testing internet bandwidth using speedtest.net

In the second program year, the NDT client from Measurement Kit was replaced with two client libraries provided by M-Lab. ndt5-client-go ran the ndt5 protocol test, and ndt7-client-go ran the ndt7 protocol test, each to the nearest M-Lab server. In addition to a single stream test with speedtest-cli we also conducted a multi-stream test. And finally, we removed the DASH test in year 2 since its maintainer (also the maintainer of Measurement Kit) shared that it may also be deprecated in the future.

Changes to the Murakami Software Across Program Years

The Murakami software can be thought of as an orchestrator for running the data collection instruments described above. Because one goal of the program itself was to improve the software itself, changes to the format of saved test results were changed during development. In year 1 data from each test was saved in the native formats provided by each client library. In order to make Murakami a more useful software to support structured data collection for research, in year 2 a standard schema for each supported measurement instrument was introduced.

The output schema for each instrument includes four metadata fields that can be provided by the user deploying Murakami device(s):

- *MurakamiDeviceID*
    - A generated ID for each Murakami device when using Balena
    - Required by Murakami Viz to connect a device's data to a specific location
- *MurakamiLocation*
    - Identifier for the location of the Murakami device
    - Added as an environment variable
    - Used as a metadata value on each saved test result, and in the test result file name
- *MurakamiConnectionType*
    - Identifier for the type of connection the Murakami device is measuring (i.e. wifi, ethernet)
    - Added as an environment variable

    - Used as a metadata value on each saved test result, and in the test result file name
- *MurakamiNetworkType*
    - Identifier for the type of network the Murakami device is measuring (i.e. egress, public, staff)
    - Added as an environment variable
    - Used as a metadata value on each saved test result, and in the test result file name

As these schemas were rolled out, minor changes to other field names in the schema were made, and ultimately standardized.

The end result of the issues discussed above were:

- Inconsistent schema between tests in years 1 and 2
- Missing fields and contents in year 1 data that were added in year 2
- Minor field naming differences in some year 2 results

To address these issues, as part of the data preparation and cleaning for analyses, additional steps were made to ensure a consistent dataset covering both program years could be published and shared.

Data Preparation Methods

To clean and unify the data from each program year into a common schema, we used the standard output schema for Murakami's supported measurement instruments. Data collected in year 1 was first converted from JSONL to CSV format, using a utility script, *murakami-convert.* An updated version of *murakami-convert* is now included in the software itself. One CSV file was saved for each Murakami device. Each CSV was then opened using Libreoffice, and four metadata columns were added: *MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,* and *MurakamiNetworkType.* The values for these columns were primarily obtained from internal project documentation. All cleaned CSV files were then uploaded to Google Cloud Storage, and were loaded into the BigQuery tables: `Y1_dash_import`, `Y1_ndt_import`, and `Y1_speedtest_import`.

Schema fields for test data collected in year 2 had mostly consistent formats, except in cases where:

- Field was named as plural and later changed to singular, such as *DownloadUnits* changed to *DownloadUnit*
- Field was initially named and then altered to be more specific, such as *RTTValue* changed to *MinRTTValue*
- Field was added to the schema, such as the addition of *MurakamiDeviceID*

Year 2 data for each measurement instrument was loaded into the following BigQuery tables: `Y2_ndt5_import`, `Y2_ndt7_import`, and `Y2_speedtest_import`. The data in each of these

imported tables was then examined for rows missing the *MurakamiDeviceID* metadata field. Because this field was added to Murakami's output schemas late in the development process, many test rows did not contain this field. To preserve the data as imported, and to standardize names of fields across the archive, a query was written to re-format and add missing fields where needed, to filter for only test results that did not contain errors, and to save the results in a separate, final table to be used for analyses. The queries used and resulting table names are provided in **Appendix A.**

Datasets Used in Final Analyses

Limiting the scope of measurements in year 2 for final analysis

The MLBN team determined that our final analyses would focus on performance or "speed" measurements from different available tests. Since the DASH test is a measure of streaming, we decided to not run it in the second year. Additionally, we expanded the number of performance tests in the second year: NDT v5 and v7, and speedtest-cli single and multi-stream tests.

Deriving metadata tables from survey results, and source measurement tables

To enable richer analyses and visualizations of the data, we created three metadata tables/views:

- Device Metadata view
- Libraries Metadata table
- Libraries and Servers Coordinates view

To aid in the creation of the *Libraries and Servers Coordinates view,* an additional table (mlab_sites_20200707) was created from an export of M-Lab's site-info API to more easily join the exact locations of M-Lab's servers for NDT test results.

Creating a final joined database view for visualization and analysis

Once all performance tests were loaded into individual import tables, a "view" was created using a query that unified all performance measurements in a single dataset.

Please see **Appendix B** for details on the creation of metadata tables and views, as well as the final joined database view.

Data Aggregation and Visualization in DataStudio Report

With cleaned data stored in Google BigQuery tables and views, the MLBN research team were able to easily aggregate and visualize the final dataset in an interactive report using Google's DataStudio platform.

Additional Traceroute Data Collected from Library Devices

In order to explore various facets of latency and routing after the completion of the MLBN program, traceroutes were gathered from one measurement device at each library participating in the program:

- To each M-Lab server through which an NDT test was conducted
- To each Ookla server through which a speedtest-cli test was conducted

First, the unified performance tests view was queried and used to retrieve a list of all unique server URLs for each library and test combination. We decided to use IP address for conducting the traceroutes, and wrote a small utility script, *get-ips.sh*, to lookup the IPs for all servers' hostnames. The result was a CSV mapping each server and IP address for each test. The unique IP address for NDT and Ookla servers for each library and test were created as CSV files. Finally, the relevant IP address files for NDT and Ookla test servers were uploaded to each egress device at each library, and traceroutes were conducted to each server in each list using another utility script, *run-traces.sh*. Each individual traceroute to each server was saved as an individual file, named with associated metadata using this format: *Library-test-IPaddress*. For example: Andover-MA-ndt-128.177.119.203.

While these traceroutes were not part of our final program analyses, it is the intention of MLBN researchers to use these data in the future to examine latency over the hops in the end to end path between MLBN libraries and Ookla and M-Lab servers.

Appendix A - Data Prep Queries

Year 1 test data

Measurement test:	**speedtest-cli**	***# Rows***
Source import table:	**Y1_speedtest_import**	**109406**
Cleaned destination table:	**_Y1_speedtest**	**109406**

Query:

```
SELECT
  "speedtest-cli-single-stream" AS TestName,
  timestamp AS TestStartTime,
  NULL AS TestEndTime, MurakamiLocation, MurakamiConnectionType,
  # Use either egress or public, remove additional indicators of location in the network type
field. These will be added to the device metadata table.
  CASE
       WHEN MurakamiNetworkType = 'central-egress' THEN 'egress'
       WHEN MurakamiNetworkType = 'rondo-egress' THEN 'egress'
       WHEN MurakamiNetworkType = 'admin-egress' THEN 'egress'
       WHEN MurakamiNetworkType = 'ep-foster-egress' THEN 'egress'
       WHEN MurakamiNetworkType = 'datacenter-egress' THEN 'egress'
       WHEN MurakamiNetworkType = 'egress-datacenter' THEN 'egress'
       WHEN MurakamiNetworkType = 'ep-foster-public' THEN 'public'
       WHEN MurakamiNetworkType = 'hendrick-hudson-public' THEN 'public'
```

```
      WHEN (MurakamiNetworkType = 'egress' AND MurakamiLocation = 'hollis') THEN 'public'
      ELSE MurakamiNetworkType
      END AS MurakamiNetworkType,
  MurakamiDeviceID,
  download/1000000 AS DownloadValue,
  "Mbit/s" AS DownloadUnit,
  upload/1000000 AS UploadValue,
  "Mbit/s" AS UploadUnit,
  Ping, "ms" AS PingUnit, NULL AS BytesSent, NULL AS BytesReceived, NULL AS Share,
  Timestamp, url AS ServerURL,
  lat AS ServerLat, lon AS ServerLon,
  name AS ServerName, country AS ServerCountry, cc AS ServerCountryCode, sponsor AS
ServerSponsor, id AS ServerID,
  host AS ServerHost, NULL AS ServerDistance, latency AS ServerLatency, "ms" AS
ServerLatencyUnit,
  NULL AS ClientIP, NULL AS ClientLon, NULL AS Isp, NULL AS IspRating, NULL AS Rating, NULL AS
IspDownloadAvg, NULL AS IspUploadAvg,
  NULL AS LoggedIn
FROM `mlab-sandbox.mlbn_beacons.Y1_speedtest_import`
```

Measurement test:	**ndt5**	***# Rows***
Source import table:	**Y1_ndt5_import**	**118324**
Cleaned destination table:	**_Y1_ndt5**	**90149**

Query:

```
SELECT
"ndt5" AS TestName,
# Measurement Kit named the test start time differently.
measurement_start_time AS TestStartTime,
# Measurement Kit results did not include test end time.
NULL AS TestEndTime,
MurakamiLocation, MurakamiConnectionType,
# Use either egress or public, remove additional indicators of location in the network
type field. These will be added to the device metadata table.
CASE
  WHEN (MurakamiNetworkType IN
('central-egress','rondo-egress','admin-egress','ep-foster-egress','datacenter-egress'
,'egress-datacenter')) THEN 'egress'
  WHEN (MurakamiNetworkType IN ('ep-foster-public','hendrick-hudson-public')) THEN
'public'
  WHEN (MurakamiNetworkType = 'egress' AND MurakamiLocation = 'hollis') THEN 'public'
  ELSE MurakamiNetworkType
  END AS MurakamiNetworkType,
MurakamiDeviceID,
test_keys_server_address AS ServerName,
NULL AS ServerIP, NULL AS ClientIP,
NULL AS DownloadUUID,
test_keys_simple_download/1000 AS DownloadValue,
"Mbit/s" AS DownloadUnit,
test_keys_simple_upload/1000 AS UploadValue,
"Mbit/s" AS UploadUnit,
NULL AS DownloadRetransValue, NULL AS DownloadRetransUnit,
test_keys_advanced_min_rtt AS MinRTTValue, "ms" AS MinRTTUnit
FROM `mlab-sandbox.mlbn_beacons.Y1_ndt_import`
WHERE test_keys_failure IS NULL
```

```
AND (MurakamiLocation IS NOT NULL AND MurakamiNetworkType IS NOT NULL AND
MurakamiDeviceID IS NOT NULL)
```

Measurement test:	**dash**	***# Rows***
Source import table:	**Y1_dash_import**	**94612**
Cleaned destination table:	**_Y1_dash**	**94612**

Query:

```
SELECT
TestName, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
  # Use either egress or public, remove additional indicators of location in the network type
field. These will be added to the device metadata table.
  CASE
        WHEN MurakamiNetworkType = 'central-egress' THEN 'egress'
        WHEN MurakamiNetworkType = 'rondo-egress' THEN 'egress'
        WHEN MurakamiNetworkType = 'admin-egress' THEN 'egress'
        WHEN MurakamiNetworkType = 'ep-foster-egress' THEN 'egress'
        WHEN MurakamiNetworkType = 'datacenter-egress' THEN 'egress'
        WHEN MurakamiNetworkType = 'egress-datacenter' THEN 'egress'
        WHEN MurakamiNetworkType = 'ep-foster-public' THEN 'public'
        WHEN MurakamiNetworkType = 'hendrick-hudson-public' THEN 'public'
        WHEN (MurakamiNetworkType = 'egress' AND MurakamiLocation = 'hollis') THEN 'public'
        ELSE MurakamiNetworkType
        END AS MurakamiNetworkType,
TestRuntime, TestStartTime, ConnectLatency, MedianBitrate, MinPlayoutDelay, ProbeASN, ProbeCC
FROM `mlab-sandbox.mlbn_beacons.Y1_dash_import`
```

Year 2 test data

Measurement test:	**speedtest-cli**	***# Rows***
Source import table:	**Y2_speedtest_import**	**348108**
Cleaned destination table:	**_Y2_speedtest**	**348108**
# Tests between 2020-02-01 and 2021-01-31		**318662**

Query:

```
SELECT
TestName, TestStartTime, TestEndTime,
# Make MurakamiLocation field contents consistent
CASE
  WHEN (MurakamiLocation = 'bennington') THEN 'Bennington-VT'
  WHEN (MurakamiLocation = 'hollis') THEN 'Hollis-AK'
  WHEN (MurakamiLocation = 'pasco') THEN 'Pasco-County-FL'
  WHEN (MurakamiLocation = 'MultnomahCounty-OR') THEN 'Multnomah-County-OR'
  WHEN (MurakamiLocation = 'pryor') THEN 'Pryor-OK'
  WHEN (MurakamiLocation = 'SalineCO_AR') THEN 'Saline-County-AR'
  WHEN (MurakamiLocation IN ('StPaul-MN-central','StPaul-MN-rondo')) THEN 'St-Paul-MN'
  WHEN (MurakamiLocation = 'TraverseCityMI') THEN 'Traverse-City-MI'
  WHEN (MurakamiLocation = 'truro') THEN 'Truro-MA'
  WHEN (MurakamiLocation = 'twinfalls') THEN 'Twin-Falls-ID'
  WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA') THEN 'Union-County-PA'
  WHEN (MurakamiLocation = 'ventura') THEN 'Ventura-County-CA'
  WHEN (MurakamiLocation = 'Westchester-NY') THEN 'Westchester-County-NY'
  ELSE MurakamiLocation
  END AS MurakamiLocation,
```

```
# Use wifiAP for connection type, not network type
CASE
  WHEN (MurakamiNetworkType = 'wifiAP' AND MurakamiConnectionType = 'wired') THEN 'wifiAP'
  ELSE MurakamiConnectionType
  END AS MurakamiConnectionType,
# Use either egress or public, remove additional indicators of location for network type
CASE
  WHEN (MurakamiNetworkType IN ('central-egress','rondo-egress')) THEN 'egress'
  WHEN (MurakamiNetworkType IN ('ep-foster-public','hendrick-hudson-public')) THEN 'public'
  WHEN (MurakamiNetworkType IN
('admin-egress','ep-foster-egress','datacenter-egress','egress-datacenter')) THEN 'egress'
  WHEN (MurakamiNetworkType = 'egress' AND MurakamiLocation = 'hollis') THEN 'public'
  ELSE MurakamiNetworkType
  END AS MurakamiNetworkType,
# Add missing device ids for tests run before device id was added to test output
CASE
  WHEN (MurakamiDeviceID IS NULL OR MurakamiDeviceID = '' ) THEN
       CASE
       WHEN (MurakamiLocation = 'Andover-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '556c71ca1fc920a3bedd452e19f689629da83816969ed156f2e25daec41c81'
       WHEN (MurakamiLocation = 'Andover-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'f13dabdd65e625d8e434ba2e545275d6e1596b3dc74e7ebc9c94ec4e55eb83'
       WHEN (MurakamiLocation = 'Avery-Morrison-Newland-NC' AND MurakamiConnectionType =
'wired' AND MurakamiNetworkType = 'egress')
       THEN 'f0bad0813723616d140c56f23bdd1a815e9920354e7e0a5690500a7e6a47d7'
       WHEN (MurakamiLocation = 'Avery-Morrison-Newland-NC' AND MurakamiConnectionType =
'wired' AND MurakamiNetworkType = 'wifiAP')
       THEN 'd6b4cc941994f4f9589ccf590f93d57e88f78d58c562f920104c66b73d9be7'
       WHEN (MurakamiLocation = 'bennington' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '0ce3deb83d74a4f01fa44909b11cde455afc9c69937369a3dcdfd3bbdb5dd7'
       WHEN (MurakamiLocation = 'bennington' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'fa2555c5f06cdc15ea0dcbd93c4356275de6536b19721bd578cc6df6048542'
       WHEN (MurakamiLocation = 'Bennington-VT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '0ce3deb83d74a4f01fa44909b11cde455afc9c69937369a3dcdfd3bbdb5dd7'
       WHEN (MurakamiLocation = 'Bennington-VT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '5c57d216-2024-46a8-9a71-70d8f3e2a8a7'
       WHEN (MurakamiLocation = 'Caruthersville-MO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a79d8d9f9698dfcf20abcea31ac99da599ee27d416a3e3a22bc24d70667097'
       WHEN (MurakamiLocation = 'Caruthersville-MO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '537b0104e123a9eaa14e8461ecabb3ab5179ffcc5e16b7ddc8f18b70405830'
       WHEN (MurakamiLocation = 'Cherokee-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'bd7274cf0e0028efd3004b7097a50bb9ae14add26ebd0b2712611cba816f30'
       WHEN (MurakamiLocation = 'Cherokee-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '8d188301aecdc350a7f5cff0ce530aa1b7a03f68626dc18a4e28d866d9b2f9'
       WHEN (MurakamiLocation = 'Clarkston-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a8317f4387929c0046322db9cd93eabceb63852301dbef9ea21196b2b04b58'
       WHEN (MurakamiLocation = 'Clarkston-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'a1afb0dd6f22192fb92d4bf6f813a66f8fb572f0f9bade184b2173b8c865f7'
       WHEN (MurakamiLocation = 'Cochise-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
```

```
       THEN '604c3a35f30a2f00c2abc22a6aa9415262e488745adfac8a6c4c4053c0838a'
       WHEN (MurakamiLocation = 'Dardanelle-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a4d0f0b7ad843133ad6789c90a2e5e23d7e1fe45be14a61f52784e745c851a'
       WHEN (MurakamiLocation = 'Dardanelle-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'c31579ef54eb6d3b81239e552a35e356e69b4229ed2e328a2f0d8333a00d6b'
       WHEN (MurakamiLocation = 'Denver-CO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '73f78dfec7517e5d7587b7416f37cff7d983acee938d58e1650edcc40d26a8'
       WHEN (MurakamiLocation = 'Estherville-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '819d60ecaf26244134118bd6f13c1051a9ab29bdd3c0ac7874ab0da088b0a8'
       WHEN (MurakamiLocation = 'Estherville-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'de1a5dc8202c60ce8084bcdb06444d8030136cc70a9176ac9ced569c21c04c'
       WHEN (MurakamiLocation = 'Ferguson-CT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2ed68879fd9d4319968ac37d2f749e24066076a4e76d1d72a906d412e12ca3'
       WHEN (MurakamiLocation = 'Ferguson-CT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '69bfda0d0971b19ab951d519b5f4b8c4a6baf34784be7465622e15afc9530c'
       WHEN (MurakamiLocation = 'Graham-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'cc691dc7c1c475d4635027e30310b16a1f8eacc24657758d7cda5637202dc2'
       WHEN (MurakamiLocation = 'Graham-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '1d4db3602174938999e3a857d878ef2c75cf62b187cb3ca522a82ad27c2839'
       WHEN (MurakamiLocation = 'Gunn-Yanceyville-NC' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'e11a8d128919b1e4cab23256f43c0947fdf001fbc077eeaf11ee03ecc32a38'
       WHEN (MurakamiLocation = 'Gunn-Yanceyville-NC' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '1c1622d3a6be26f89428ad6c8c879cc225e3709bdfa594eb273e893185cb1e'
       WHEN (MurakamiLocation = 'Hall-County-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'c2338a3c36582e0f54482865fc718ea876c7300ae381811a03511415f60ef1'
       WHEN (MurakamiLocation = 'hollis' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '8889d7dc92d3bcf391ca17dfa1c14e8794ae2024e02a28b3d7b6e3c6fd4d24'
       WHEN (MurakamiLocation = 'Hollis-AK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '8889d7dc92d3bcf391ca17dfa1c14e8794ae2024e02a28b3d7b6e3c6fd4d24'
       WHEN (MurakamiLocation = 'Live-Oak-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'bd09d6ef24c87ca0e11c17c77919e12c0618fb4894003a0b96ba9fe766757b'
       WHEN (MurakamiLocation = 'Live-Oak-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '191952ac76b3f91a3562eaf57a495945779da872cd48ba222d9a3d1f3520f3'
       WHEN (MurakamiLocation = 'MonroeCO-Bedford-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2bcb7a8bcabdba8739fcec68b1fab56a1e5ba28c798424e8bde803164be946'
       WHEN (MurakamiLocation = 'MonroeCO-Bedford-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '12c1f0c973e7f11e41d48d7fa724b91e20e16efb1d069e07939e6874ad2c31'
       WHEN (MurakamiLocation IN ('Multnomah-County-OR','MultnomahCounty-OR'))
       THEN '556b24040bbe3cbcf07c0d69416b704cd1351ed172c6b18719c12bf07f8715'
       WHEN (MurakamiLocation = 'pasco' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '27e5ebd707c86f95402a3ce174a7678646108d1c0868aa7c8b6b5a9d68512d'
       WHEN (MurakamiLocation = 'pasco' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
```

```
       THEN 'e850fa6692ce0837732a6399bee7967ac924e956b6abd02266e8807f85cfe5'
       WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '1277315e-ca11-414d-8314-83ab6c2dea5b'
       WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '27e5ebd707c86f95402a3ce174a7678646108d1c0868aa7c8b6b5a9d68512d'
       WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'f9f0f24d-117a-49b7-b151-1771736f4796'
       WHEN (MurakamiLocation = 'pryor' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'fa54497783b9b6d17bfea99d433d78b3261b5d2d51a71e4cc761bf9c94b8ec'
       WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN 'ae873c02-7ce5-4ea8-989c-c8acaff7b4d4'
       WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'fa54497783b9b6d17bfea99d433d78b3261b5d2d51a71e4cc761bf9c94b8ec'
       WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'eb420ba1-7b5d-4abd-8ee5-f00443907fbe'
       WHEN (MurakamiLocation = 'SalineCO_AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '89ae0999c42e2069c1a916e9f7910044055e5f992d8275bb04639afbc42575'
       WHEN (MurakamiLocation = 'SalineCO_AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '7d4cd303608a093473b045555457135b25a4d3172a906e74bf33be78667469'
       WHEN (MurakamiLocation = 'Sheridan-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a61c40879e3453baaa8372ec7d13c6e28b48765111b23b655f07d21d080676'
       WHEN (MurakamiLocation = 'Sheridan-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'f96c6337f079211e0cc179cd0f658c574beb40e0f5c1054f4f534c76a74a12'
       WHEN (MurakamiLocation = 'St-Paul-MN' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'central-egress')
       THEN '2d05fb0fa1f8f3c49450090074eea94f13556b374e46f9ef27c9b52f0dd12a'
       WHEN (MurakamiLocation = 'St-Paul-MN' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'rondo-egress')
       THEN 'dbd895fd9efa6e7edb7d7cd1c2fe29a881fb41b6c5f52765696d1a1fb96f4f'
       WHEN (MurakamiLocation = 'StPaul-MN-central' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2d05fb0fa1f8f3c49450090074eea94f13556b374e46f9ef27c9b52f0dd12a'
       WHEN (MurakamiLocation = 'StPaul-MN-rondo' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'dbd895fd9efa6e7edb7d7cd1c2fe29a881fb41b6c5f52765696d1a1fb96f4f'
       WHEN (MurakamiLocation = 'TraverseCityMI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '147c04903a6473f5b786fe80ee8919296b3961352a89f8a1f97cba7e770cf9'
       WHEN (MurakamiLocation = 'TraverseCityMI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '7d42c3cbf9e327fee2000d80e2ba3214e056f1ee790668232bbab2fa9b8ed5'
       WHEN (MurakamiLocation = 'truro' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '88b504cb15b6dd5269b05feadab21fb8f52918cebc6b17c054cd8e2f6a8561'
       WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN 'fd2090df-2bec-4bf2-98f5-14feef381297'
       WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '88b504cb15b6dd5269b05feadab21fb8f52918cebc6b17c054cd8e2f6a8561'
```

```
       WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '9989e4bb892f6ad76aa64d226df2d4418cd7f592797e4c14ab2af211d092f5'
       WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '8c89b108-b4b9-4f5b-abdd-e2a9005f346f'
       WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '6ad8a3b4e1373e9453f891868d17c71552784ccf0de76d0be5c37e378324b7'
       WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'c0bf72bb-69c9-40e3-bae5-1b48f08b9250'
       WHEN (MurakamiLocation = 'twinfalls' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '6ad8a3b4e1373e9453f891868d17c71552784ccf0de76d0be5c37e378324b7'
       WHEN (MurakamiLocation = 'twinfalls' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '60a526f9337cc3596835bd7808bafb12a71f89e1d03e743fcdfc545c967ec5'
       WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'egress')
       THEN '35bb94d186ecd81c7e3bcd50a54d9ee6c0f2ecf447ad7aaac25723ac16e8f7'
       WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'wifiAP')
       THEN '2c147df644d27cd9397e730fa0a14955602378becb38fecd51a6d546471d2c'
       WHEN (MurakamiLocation = 'ventura' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'efb9e8d0aae1a3ef4a3933859d73af038eee67e9c3cd25feeb39252520fa6b'
       WHEN (MurakamiLocation = 'ventura' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '6a86203cb125b2e5e4c5a2b33ab4147214802cd28b7fa5174f5965a8bf5e7f'
       WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'ep-foster-public')
       THEN '824e16a8-3249-4deb-a6df-a58ebab1608d'
       WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'admin-egress')
       THEN 'f3dbf186-2464-40a2-b1f3-1df081da4924'
       WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'ep-foster-egress')
       THEN 'efb9e8d0aae1a3ef4a3933859d73af038eee67e9c3cd25feeb39252520fa6b'
       WHEN (MurakamiLocation = 'Waltham-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '1e3e78349a1d716735fcbe08602b7107884519b487984e13b26350c494dcd3'
       WHEN (MurakamiLocation = 'Waltham-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '56e4435afe914f8565f906ea6b3d031c9081a0966fa909d1c62c49884d3782'
       WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wifiAP'
AND MurakamiNetworkType = 'hendrick-hudson-public')
       THEN '6dcda18649ef7b32f8060c48975aad7b0a9338acb67e7df06d2b7aba6704e3'
       WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'datacenter-egress')
       THEN 'e6750030f4efc9ab79a90d854d075a6c2bef51e07ebca6cf0f7dd6b664a120'
       WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'hendrick-hudson-public')
       THEN '0c8865d9e30d21284ce7f22981007740e229d32671093cd164675a6a257b6b'
       WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '6dcda18649ef7b32f8060c48975aad7b0a9338acb67e7df06d2b7aba6704e3'
       WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress-datacenter')
       THEN 'e6750030f4efc9ab79a90d854d075a6c2bef51e07ebca6cf0f7dd6b664a120'
       WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
```

```
       THEN '0c8865d9e30d21284ce7f22981007740e229d32671093cd164675a6a257b6b'
       END
  ELSE MurakamiDeviceID
  END AS MurakamiDeviceID,
CASE
  WHEN DownloadValue IS NULL AND Download IS NOT NULL THEN Download
  WHEN DownloadValue IS NOT NULL AND Download IS NULL THEN DownloadValue END AS DownloadValue,
CASE
  WHEN DownloadUnit IS NULL AND DownloadUnits IS NOT NULL Then DownloadUnits
  WHEN DownloadUnit IS NOT NULL AND DownloadUnits IS NULL Then DownloadUnit END AS
DownloadUnit,
CASE
  WHEN UploadValue IS NULL AND Upload IS NOT NULL THEN Upload
  WHEN UploadValue IS NOT NULL AND Upload IS NULL THEN UploadValue END AS UploadValue,
CASE
  WHEN UploadUnit IS NULL AND UploadUnits IS NOT NULL THEN UploadUnits
  WHEN UploadUnit IS NOT NULL AND UploadUnits IS NULL THEN UploadUnit END AS UploadUnit,
Ping,
CASE
  WHEN PingUnit IS NULL AND PingUnits IS NOT NULL THEN PingUnits
  WHEN PingUnit IS NOT NULL AND PingUnits IS NULL THEN PingUnit END AS PingUnit,
BytesSent, BytesReceived, Share, Timestamp, ServerURL, ServerLat, ServerLon, ServerName,
ServerCountry, ServerCountryCode, ServerSponsor, ServerID, ServerHost, ServerDistance,
ServerLatency,
CASE
  WHEN ServerLatencyUnit IS NULL AND ServerLatencyUnits IS NOT NULL THEN ServerLatencyUnits
  WHEN ServerLatencyUnit IS NOT NULL AND ServerLatencyUnits IS NULL THEN ServerLatencyUnit END
AS ServerLatencyUnit,
ClientIP, ClientLat, ClientLon, Isp, IspRating, Rating, IspDownloadAvg, IspUploadAvg,
LoggedIn, Country
FROM `mlab-sandbox.mlbn_beacons_final.Y2_speedtest_import`
```

Measurement test:	**ndt5**	***# Rows***
Source import table:	**Y2_ndt5_import**	**165279**
Cleaned destination table:	**_Y2_ndt5**	**162906**
# Tests between 2020-02-01 and 2021-01-31		**148967**

Query:

```
SELECT
TestName, TestStartTime, TestEndTime,
# Make MurakamiLocation field contents consistent
CASE
  WHEN (MurakamiLocation = 'bennington') THEN 'Bennington-VT'
  WHEN (MurakamiLocation = 'hollis') THEN 'Hollis-AK'
  WHEN (MurakamiLocation = 'pasco') THEN 'Pasco-County-FL'
  WHEN (MurakamiLocation = 'MultnomahCounty-OR') THEN 'Multnomah-County-OR'
  WHEN (MurakamiLocation = 'pryor') THEN 'Pryor-OK'
  WHEN (MurakamiLocation = 'SalineCO_AR') THEN 'Saline-County-AR'
  WHEN (MurakamiLocation IN ('StPaul-MN-central','StPaul-MN-rondo')) THEN 'St-Paul-MN'
  WHEN (MurakamiLocation = 'TraverseCityMI') THEN 'Traverse-City-MI'
  WHEN (MurakamiLocation = 'truro') THEN 'Truro-MA'
  WHEN (MurakamiLocation = 'twinfalls') THEN 'Twin-Falls-ID'
  WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA') THEN 'Union-County-PA'
  WHEN (MurakamiLocation = 'ventura') THEN 'Ventura-County-CA'
  WHEN (MurakamiLocation = 'Westchester-NY') THEN 'Westchester-County-NY'
  ELSE MurakamiLocation
  END AS MurakamiLocation,
# Use wifiAP for connection type, not network type
```

```
CASE
  WHEN (MurakamiNetworkType = 'wifiAP' AND MurakamiConnectionType = 'wired') THEN 'wifiAP'
  ELSE MurakamiConnectionType
  END AS MurakamiConnectionType,
# Use either egress or public, remove additional indicators of location for network type
CASE
  WHEN (MurakamiNetworkType IN ('egress-datacenter')) THEN 'egress'
  WHEN (MurakamiNetworkType = 'egress' AND MurakamiLocation = 'hollis') THEN 'public'
  WHEN (MurakamiNetworkType = 'wifiAP') THEN 'public'
  ELSE MurakamiNetworkType
  END AS MurakamiNetworkType,
# Add missing device ids for tests run before device id was added to test output
CASE
  WHEN (MurakamiDeviceID IS NULL OR MurakamiDeviceID = '' ) THEN
       CASE
       WHEN (MurakamiLocation = 'Andover-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '556c71ca1fc920a3bedd452e19f689629da83816969ed156f2e25daec41c81'
       WHEN (MurakamiLocation = 'Andover-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'f13dabdd65e625d8e434ba2e545275d6e1596b3dc74e7ebc9c94ec4e55eb83'
       WHEN (MurakamiLocation = 'Avery-Morrison-Newland-NC' AND MurakamiConnectionType =
'wired' AND MurakamiNetworkType = 'egress')
       THEN 'f0bad0813723616d140c56f23bdd1a815e9920354e7e0a5690500a7e6a47d7'
       WHEN (MurakamiLocation = 'Avery-Morrison-Newland-NC' AND MurakamiConnectionType =
'wired' AND MurakamiNetworkType = 'wifiAP')
       THEN 'd6b4cc941994f4f9589ccf590f93d57e88f78d58c562f920104c66b73d9be7'
       WHEN (MurakamiLocation = 'bennington' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '0ce3deb83d74a4f01fa44909b11cde455afc9c69937369a3dcdfd3bbdb5dd7'
       WHEN (MurakamiLocation = 'bennington' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'fa2555c5f06cdc15ea0dcbd93c4356275de6536b19721bd578cc6df6048542'
       WHEN (MurakamiLocation = 'Bennington-VT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '0ce3deb83d74a4f01fa44909b11cde455afc9c69937369a3dcdfd3bbdb5dd7'
       WHEN (MurakamiLocation = 'Bennington-VT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '5c57d216-2024-46a8-9a71-70d8f3e2a8a7'
       WHEN (MurakamiLocation = 'Caruthersville-MO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a79d8d9f9698dfcf20abcea31ac99da599ee27d416a3e3a22bc24d70667097'
       WHEN (MurakamiLocation = 'Caruthersville-MO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '537b0104e123a9eaa14e8461ecabb3ab5179ffcc5e16b7ddc8f18b70405830'
       WHEN (MurakamiLocation = 'Cherokee-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'bd7274cf0e0028efd3004b7097a50bb9ae14add26ebd0b2712611cba816f30'
       WHEN (MurakamiLocation = 'Cherokee-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '8d188301aecdc350a7f5cff0ce530aa1b7a03f68626dc18a4e28d866d9b2f9'
       WHEN (MurakamiLocation = 'Clarkston-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a8317f4387929c0046322db9cd93eabceb63852301dbef9ea21196b2b04b58'
       WHEN (MurakamiLocation = 'Clarkston-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'a1afb0dd6f22192fb92d4bf6f813a66f8fb572f0f9bade184b2173b8c865f7'
       WHEN (MurakamiLocation = 'Cochise-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '604c3a35f30a2f00c2abc22a6aa9415262e488745adfac8a6c4c4053c0838a'
       WHEN (MurakamiLocation = 'Dardanelle-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
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       THEN 'a4d0f0b7ad843133ad6789c90a2e5e23d7e1fe45be14a61f52784e745c851a'
       WHEN (MurakamiLocation = 'Dardanelle-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'c31579ef54eb6d3b81239e552a35e356e69b4229ed2e328a2f0d8333a00d6b'
       WHEN (MurakamiLocation = 'Denver-CO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '73f78dfec7517e5d7587b7416f37cff7d983acee938d58e1650edcc40d26a8'
       WHEN (MurakamiLocation = 'Estherville-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '819d60ecaf26244134118bd6f13c1051a9ab29bdd3c0ac7874ab0da088b0a8'
       WHEN (MurakamiLocation = 'Estherville-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'de1a5dc8202c60ce8084bcdb06444d8030136cc70a9176ac9ced569c21c04c'
       WHEN (MurakamiLocation = 'Ferguson-CT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2ed68879fd9d4319968ac37d2f749e24066076a4e76d1d72a906d412e12ca3'
       WHEN (MurakamiLocation = 'Ferguson-CT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '69bfda0d0971b19ab951d519b5f4b8c4a6baf34784be7465622e15afc9530c'
       WHEN (MurakamiLocation = 'Graham-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'cc691dc7c1c475d4635027e30310b16a1f8eacc24657758d7cda5637202dc2'
       WHEN (MurakamiLocation = 'Graham-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '1d4db3602174938999e3a857d878ef2c75cf62b187cb3ca522a82ad27c2839'
       WHEN (MurakamiLocation = 'Gunn-Yanceyville-NC' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'e11a8d128919b1e4cab23256f43c0947fdf001fbc077eeaf11ee03ecc32a38'
       WHEN (MurakamiLocation = 'Gunn-Yanceyville-NC' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '1c1622d3a6be26f89428ad6c8c879cc225e3709bdfa594eb273e893185cb1e'
       WHEN (MurakamiLocation = 'Hall-County-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'c2338a3c36582e0f54482865fc718ea876c7300ae381811a03511415f60ef1'
       WHEN (MurakamiLocation = 'hollis' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '8889d7dc92d3bcf391ca17dfa1c14e8794ae2024e02a28b3d7b6e3c6fd4d24'
       WHEN (MurakamiLocation = 'Hollis-AK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '8889d7dc92d3bcf391ca17dfa1c14e8794ae2024e02a28b3d7b6e3c6fd4d24'
       WHEN (MurakamiLocation = 'Live-Oak-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'bd09d6ef24c87ca0e11c17c77919e12c0618fb4894003a0b96ba9fe766757b'
       WHEN (MurakamiLocation = 'Live-Oak-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '191952ac76b3f91a3562eaf57a495945779da872cd48ba222d9a3d1f3520f3'
       WHEN (MurakamiLocation = 'MonroeCO-Bedford-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2bcb7a8bcabdba8739fcec68b1fab56a1e5ba28c798424e8bde803164be946'
       WHEN (MurakamiLocation = 'MonroeCO-Bedford-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '12c1f0c973e7f11e41d48d7fa724b91e20e16efb1d069e07939e6874ad2c31'
       WHEN (MurakamiLocation IN ('Multnomah-County-OR','MultnomahCounty-OR'))
       THEN '556b24040bbe3cbcf07c0d69416b704cd1351ed172c6b18719c12bf07f8715'
       WHEN (MurakamiLocation = 'pasco' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '27e5ebd707c86f95402a3ce174a7678646108d1c0868aa7c8b6b5a9d68512d'
       WHEN (MurakamiLocation = 'pasco' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'e850fa6692ce0837732a6399bee7967ac924e956b6abd02266e8807f85cfe5'
       WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
```

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       THEN '1277315e-ca11-414d-8314-83ab6c2dea5b'
       WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '27e5ebd707c86f95402a3ce174a7678646108d1c0868aa7c8b6b5a9d68512d'
       WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'f9f0f24d-117a-49b7-b151-1771736f4796'
       WHEN (MurakamiLocation = 'pryor' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'fa54497783b9b6d17bfea99d433d78b3261b5d2d51a71e4cc761bf9c94b8ec'
       WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN 'ae873c02-7ce5-4ea8-989c-c8acaff7b4d4'
       WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'fa54497783b9b6d17bfea99d433d78b3261b5d2d51a71e4cc761bf9c94b8ec'
       WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'eb420ba1-7b5d-4abd-8ee5-f00443907fbe'
       WHEN (MurakamiLocation = 'SalineCO_AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '89ae0999c42e2069c1a916e9f7910044055e5f992d8275bb04639afbc42575'
       WHEN (MurakamiLocation = 'SalineCO_AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '7d4cd303608a093473b045555457135b25a4d3172a906e74bf33be78667469'
       WHEN (MurakamiLocation = 'Sheridan-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a61c40879e3453baaa8372ec7d13c6e28b48765111b23b655f07d21d080676'
       WHEN (MurakamiLocation = 'Sheridan-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'f96c6337f079211e0cc179cd0f658c574beb40e0f5c1054f4f534c76a74a12'
       WHEN (MurakamiLocation = 'St-Paul-MN' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'central-egress')
       THEN '2d05fb0fa1f8f3c49450090074eea94f13556b374e46f9ef27c9b52f0dd12a'
       WHEN (MurakamiLocation = 'St-Paul-MN' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'rondo-egress')
       THEN 'dbd895fd9efa6e7edb7d7cd1c2fe29a881fb41b6c5f52765696d1a1fb96f4f'
       WHEN (MurakamiLocation = 'StPaul-MN-central' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2d05fb0fa1f8f3c49450090074eea94f13556b374e46f9ef27c9b52f0dd12a'
       WHEN (MurakamiLocation = 'StPaul-MN-rondo' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'dbd895fd9efa6e7edb7d7cd1c2fe29a881fb41b6c5f52765696d1a1fb96f4f'
       WHEN (MurakamiLocation = 'TraverseCityMI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '147c04903a6473f5b786fe80ee8919296b3961352a89f8a1f97cba7e770cf9'
       WHEN (MurakamiLocation = 'TraverseCityMI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '7d42c3cbf9e327fee2000d80e2ba3214e056f1ee790668232bbab2fa9b8ed5'
       WHEN (MurakamiLocation = 'truro' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '88b504cb15b6dd5269b05feadab21fb8f52918cebc6b17c054cd8e2f6a8561'
       WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN 'fd2090df-2bec-4bf2-98f5-14feef381297'
       WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '88b504cb15b6dd5269b05feadab21fb8f52918cebc6b17c054cd8e2f6a8561'
       WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '9989e4bb892f6ad76aa64d226df2d4418cd7f592797e4c14ab2af211d092f5'
```

```
       WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '8c89b108-b4b9-4f5b-abdd-e2a9005f346f'
       WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '6ad8a3b4e1373e9453f891868d17c71552784ccf0de76d0be5c37e378324b7'
       WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'c0bf72bb-69c9-40e3-bae5-1b48f08b9250'
       WHEN (MurakamiLocation = 'twinfalls' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '6ad8a3b4e1373e9453f891868d17c71552784ccf0de76d0be5c37e378324b7'
       WHEN (MurakamiLocation = 'twinfalls' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '60a526f9337cc3596835bd7808bafb12a71f89e1d03e743fcdfc545c967ec5'
       WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'egress')
       THEN '35bb94d186ecd81c7e3bcd50a54d9ee6c0f2ecf447ad7aaac25723ac16e8f7'
       WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'wifiAP')
       THEN '2c147df644d27cd9397e730fa0a14955602378becb38fecd51a6d546471d2c'
       WHEN (MurakamiLocation = 'ventura' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'efb9e8d0aae1a3ef4a3933859d73af038eee67e9c3cd25feeb39252520fa6b'
       WHEN (MurakamiLocation = 'ventura' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '6a86203cb125b2e5e4c5a2b33ab4147214802cd28b7fa5174f5965a8bf5e7f'
       WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'ep-foster-public')
       THEN '824e16a8-3249-4deb-a6df-a58ebab1608d'
       WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'admin-egress')
       THEN 'f3dbf186-2464-40a2-b1f3-1df081da4924'
       WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'ep-foster-egress')
       THEN 'efb9e8d0aae1a3ef4a3933859d73af038eee67e9c3cd25feeb39252520fa6b'
       WHEN (MurakamiLocation = 'Waltham-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '1e3e78349a1d716735fcbe08602b7107884519b487984e13b26350c494dcd3'
       WHEN (MurakamiLocation = 'Waltham-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '56e4435afe914f8565f906ea6b3d031c9081a0966fa909d1c62c49884d3782'
       WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wifiAP'
AND MurakamiNetworkType = 'hendrick-hudson-public')
       THEN '6dcda18649ef7b32f8060c48975aad7b0a9338acb67e7df06d2b7aba6704e3'
       WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'datacenter-egress')
       THEN 'e6750030f4efc9ab79a90d854d075a6c2bef51e07ebca6cf0f7dd6b664a120'
       WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'hendrick-hudson-public')
       THEN '0c8865d9e30d21284ce7f22981007740e229d32671093cd164675a6a257b6b'
       WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '6dcda18649ef7b32f8060c48975aad7b0a9338acb67e7df06d2b7aba6704e3'
       WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress-datacenter')
       THEN 'e6750030f4efc9ab79a90d854d075a6c2bef51e07ebca6cf0f7dd6b664a120'
       WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '0c8865d9e30d21284ce7f22981007740e229d32671093cd164675a6a257b6b'
       END
  ELSE MurakamiDeviceID
```

```
  END AS MurakamiDeviceID,
ServerName, ServerIP, ClientIP, DownloadUUID, DownloadValue, DownloadUnit, UploadValue,
UploadUnit, DownloadRetransValue, DownloadRetransUnit, MinRTTValue, MinRTTUnit
FROM `mlab-sandbox.mlbn_beacons_final.Y2_ndt5_import`
WHERE
  TestError IS NULL
  AND DownloadValue IS NOT NULL
  AND UploadValue IS NOT NULL
  AND DownloadRetransValue IS NOT NULL
  AND MinRTTValue IS NOT NULL
```

Measurement test:	**ndt7**	***# Rows***
Source import table:	**Y2_ndt7_import**	**174436**
Cleaned destination table:	**_Y2_ndt7**	**172851**
# Tests between 2020-02-01 and 2021-01-31		**158264**

Query:

```
WITH
filtered AS (
SELECT
TestName, TestStartTime, TestEndTime,
# Make MurakamiLocation field contents consistent
CASE
  WHEN (MurakamiLocation = 'bennington') THEN 'Bennington-VT'
  WHEN (MurakamiLocation = 'hollis') THEN 'Hollis-AK'
  WHEN (MurakamiLocation = 'pasco') THEN 'Pasco-County-FL'
  WHEN (MurakamiLocation = 'MultnomahCounty-OR') THEN 'Multnomah-County-OR'
  WHEN (MurakamiLocation = 'pryor') THEN 'Pryor-OK'
  WHEN (MurakamiLocation = 'SalineCO_AR') THEN 'Saline-County-AR'
  WHEN (MurakamiLocation IN ('StPaul-MN-central','StPaul-MN-rondo')) THEN 'St-Paul-MN'
  WHEN (MurakamiLocation = 'TraverseCityMI') THEN 'Traverse-City-MI'
  WHEN (MurakamiLocation = 'truro') THEN 'Truro-MA'
  WHEN (MurakamiLocation = 'twinfalls') THEN 'Twin-Falls-ID'
  WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA') THEN 'Union-County-PA'
  WHEN (MurakamiLocation = 'ventura') THEN 'Ventura-County-CA'
  WHEN (MurakamiLocation = 'Westchester-NY') THEN 'Westchester-County-NY'
  ELSE MurakamiLocation
  END AS MurakamiLocation,
# Use wifiAP for connection type, not network type
CASE
  WHEN (MurakamiNetworkType = 'wifiAP' AND MurakamiConnectionType = 'wired') THEN 'wifiAP'
  ELSE MurakamiConnectionType
  END AS MurakamiConnectionType,
# Use either egress or public, remove additional indicators of location for network type
CASE
  WHEN (MurakamiNetworkType IN ('egress-datacenter')) THEN 'egress'
  WHEN (MurakamiNetworkType = 'egress' AND MurakamiLocation = 'hollis') THEN 'public'
  WHEN (MurakamiNetworkType = 'wifiAP') THEN 'public'
  ELSE MurakamiNetworkType
  END AS MurakamiNetworkType,
# Add missing device ids for tests run before device id was added to test output
CASE
  WHEN (MurakamiLocation = 'Andover-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '556c71ca1fc920a3bedd452e19f689629da83816969ed156f2e25daec41c81'
  WHEN (MurakamiLocation = 'Andover-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'f13dabdd65e625d8e434ba2e545275d6e1596b3dc74e7ebc9c94ec4e55eb83'
```

```
  WHEN (MurakamiLocation = 'Avery-Morrison-Newland-NC' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'egress')
       THEN 'f0bad0813723616d140c56f23bdd1a815e9920354e7e0a5690500a7e6a47d7'
  WHEN (MurakamiLocation = 'Avery-Morrison-Newland-NC' AND MurakamiConnectionType = 'wired'
AND MurakamiNetworkType = 'wifiAP')
       THEN 'd6b4cc941994f4f9589ccf590f93d57e88f78d58c562f920104c66b73d9be7'
  WHEN (MurakamiLocation = 'bennington' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '0ce3deb83d74a4f01fa44909b11cde455afc9c69937369a3dcdfd3bbdb5dd7'
  WHEN (MurakamiLocation = 'bennington' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'fa2555c5f06cdc15ea0dcbd93c4356275de6536b19721bd578cc6df6048542'
  WHEN (MurakamiLocation = 'Bennington-VT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '0ce3deb83d74a4f01fa44909b11cde455afc9c69937369a3dcdfd3bbdb5dd7'
  WHEN (MurakamiLocation = 'Bennington-VT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '5c57d216-2024-46a8-9a71-70d8f3e2a8a7'
  WHEN (MurakamiLocation = 'Caruthersville-MO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a79d8d9f9698dfcf20abcea31ac99da599ee27d416a3e3a22bc24d70667097'
  WHEN (MurakamiLocation = 'Caruthersville-MO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '537b0104e123a9eaa14e8461ecabb3ab5179ffcc5e16b7ddc8f18b70405830'
  WHEN (MurakamiLocation = 'Cherokee-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'bd7274cf0e0028efd3004b7097a50bb9ae14add26ebd0b2712611cba816f30'
  WHEN (MurakamiLocation = 'Cherokee-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '8d188301aecdc350a7f5cff0ce530aa1b7a03f68626dc18a4e28d866d9b2f9'
  WHEN (MurakamiLocation = 'Clarkston-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a8317f4387929c0046322db9cd93eabceb63852301dbef9ea21196b2b04b58'
  WHEN (MurakamiLocation = 'Clarkston-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'a1afb0dd6f22192fb92d4bf6f813a66f8fb572f0f9bade184b2173b8c865f7'
  WHEN (MurakamiLocation = 'Cochise-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '604c3a35f30a2f00c2abc22a6aa9415262e488745adfac8a6c4c4053c0838a'
  WHEN (MurakamiLocation = 'Dardanelle-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a4d0f0b7ad843133ad6789c90a2e5e23d7e1fe45be14a61f52784e745c851a'
  WHEN (MurakamiLocation = 'Dardanelle-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'c31579ef54eb6d3b81239e552a35e356e69b4229ed2e328a2f0d8333a00d6b'
  WHEN (MurakamiLocation = 'Denver-CO' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '73f78dfec7517e5d7587b7416f37cff7d983acee938d58e1650edcc40d26a8'
  WHEN (MurakamiLocation = 'Estherville-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '819d60ecaf26244134118bd6f13c1051a9ab29bdd3c0ac7874ab0da088b0a8'
  WHEN (MurakamiLocation = 'Estherville-IA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'de1a5dc8202c60ce8084bcdb06444d8030136cc70a9176ac9ced569c21c04c'
  WHEN (MurakamiLocation = 'Ferguson-CT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2ed68879fd9d4319968ac37d2f749e24066076a4e76d1d72a906d412e12ca3'
  WHEN (MurakamiLocation = 'Ferguson-CT' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '69bfda0d0971b19ab951d519b5f4b8c4a6baf34784be7465622e15afc9530c'
  WHEN (MurakamiLocation = 'Graham-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
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       THEN 'cc691dc7c1c475d4635027e30310b16a1f8eacc24657758d7cda5637202dc2'
  WHEN (MurakamiLocation = 'Graham-County-AZ' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '1d4db36021749389999e3a857d878ef2c75cf62b187cb3ca522a82ad27c2839'
  WHEN (MurakamiLocation = 'Gunn-Yanceyville-NC' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'e11a8d128919b1e4cab23256f43c0947fdf001fbc077eeaf11ee03ecc32a38'
  WHEN (MurakamiLocation = 'Gunn-Yanceyville-NC' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '1c1622d3a6be26f89428ad6c8c879cc225e3709bdfa594eb273e893185cb1e'
  WHEN (MurakamiLocation = 'Hall-County-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'c2338a3c36582e0f54482865fc718ea876c7300ae381811a03511415f60ef1'
  WHEN (MurakamiLocation = 'hollis' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '8889d7dc92d3bcf391ca17dfa1c14e8794ae2024e02a28b3d7b6e3c6fd4d24'
  WHEN (MurakamiLocation = 'Hollis-AK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '8889d7dc92d3bcf391ca17dfa1c14e8794ae2024e02a28b3d7b6e3c6fd4d24'
  WHEN (MurakamiLocation = 'Live-Oak-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'bd09d6ef24c87ca0e11c17c77919e12c0618fb4894003a0b96ba9fe766757b'
  WHEN (MurakamiLocation = 'Live-Oak-GA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '191952ac76b3f91a3562eaf57a495945779da872cd48ba222d9a3d1f3520f3'
  WHEN (MurakamiLocation = 'MonroeCO-Bedford-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2bcb7a8bcabdba8739fcec68b1fab56a1e5ba28c798424e8bde803164be946'
  WHEN (MurakamiLocation = 'MonroeCO-Bedford-MI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '12c1f0c973e7f11e41d48d7fa724b91e20e16efb1d069e07939e6874ad2c31'
  WHEN (MurakamiLocation IN ('Multnomah-County-OR','MultnomahCounty-OR'))
       THEN '556b24040bbe3cbcf07c0d69416b704cd1351ed172c6b18719c12bf07f8715'
  WHEN (MurakamiLocation = 'pasco' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '27e5ebd707c86f95402a3ce174a7678646108d1c0868aa7c8b6b5a9d68512d'
  WHEN (MurakamiLocation = 'pasco' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'e850fa6692ce0837732a6399bee7967ac924e956b6abd02266e8807f85cfe5'
  WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '1277315e-ca11-414d-8314-83ab6c2dea5b'
  WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '27e5ebd707c86f95402a3ce174a7678646108d1c0868aa7c8b6b5a9d68512d'
  WHEN (MurakamiLocation = 'Pasco-County-FL' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'f9f0f24d-117a-49b7-b151-1771736f4796'
  WHEN (MurakamiLocation = 'pryor' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'fa54497783b9b6d17bfea99d433d78b3261b5d2d51a71e4cc761bf9c94b8ec'
  WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN 'ae873c02-7ce5-4ea8-989c-c8acaff7b4d4'
  WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'fa54497783b9b6d17bfea99d433d78b3261b5d2d51a71e4cc761bf9c94b8ec'
  WHEN (MurakamiLocation = 'Pryor-OK' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'eb420ba1-7b5d-4abd-8ee5-f00443907fbe'
  WHEN (MurakamiLocation = 'SalineCO_AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
```

```
       THEN '89ae0999c42e2069c1a916e9f7910044055e5f992d8275bb04639afbc42575'
  WHEN (MurakamiLocation = 'SalineCO_AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '7d4cd303608a093473b045555457135b25a4d3172a906e74bf33be78667469'
  WHEN (MurakamiLocation = 'Sheridan-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'a61c40879e3453baaa8372ec7d13c6e28b48765111b23b655f07d21d080676'
  WHEN (MurakamiLocation = 'Sheridan-AR' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN 'f96c6337f079211e0cc179cd0f658c574beb40e0f5c1054f4f534c76a74a12'
  WHEN (MurakamiLocation = 'St-Paul-MN' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'central-egress')
       THEN '2d05fb0fa1f8f3c49450090074eea94f13556b374e46f9ef27c9b52f0dd12a'
  WHEN (MurakamiLocation = 'St-Paul-MN' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'rondo-egress')
       THEN 'dbd895fd9efa6e7edb7d7cd1c2fe29a881fb41b6c5f52765696d1a1fb96f4f'
  WHEN (MurakamiLocation = 'StPaul-MN-central' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '2d05fb0fa1f8f3c49450090074eea94f13556b374e46f9ef27c9b52f0dd12a'
  WHEN (MurakamiLocation = 'StPaul-MN-rondo' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'dbd895fd9efa6e7edb7d7cd1c2fe29a881fb41b6c5f52765696d1a1fb96f4f'
  WHEN (MurakamiLocation = 'TraverseCityMI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '147c04903a6473f5b786fe80ee8919296b3961352a89f8a1f97cba7e770cf9'
  WHEN (MurakamiLocation = 'TraverseCityMI' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '7d42c3cbf9e327fee2000d80e2ba3214e056f1ee790668232bbab2fa9b8ed5'
  WHEN (MurakamiLocation = 'truro' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '88b504cb15b6dd5269b05feadab21fb8f52918cebc6b17c054cd8e2f6a8561'
  WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN 'fd2090df-2bec-4bf2-98f5-14feef381297'
  WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '88b504cb15b6dd5269b05feadab21fb8f52918cebc6b17c054cd8e2f6a8561'
  WHEN (MurakamiLocation = 'Truro-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '9989e4bb892f6ad76aa64d226df2d4418cd7f592797e4c14ab2af211d092f5'
  WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '8c89b108-b4b9-4f5b-abdd-e2a9005f346f'
  WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '6ad8a3b4e1373e9453f891868d17c71552784ccf0de76d0be5c37e378324b7'
  WHEN (MurakamiLocation = 'Twin-Falls-ID' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN 'c0bf72bb-69c9-40e3-bae5-1b48f08b9250'
  WHEN (MurakamiLocation = 'twinfalls' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '6ad8a3b4e1373e9453f891868d17c71552784ccf0de76d0be5c37e378324b7'
  WHEN (MurakamiLocation = 'twinfalls' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '60a526f9337cc3596835bd7808bafb12a71f89e1d03e743fcdfc545c967ec5'
  WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '35bb94d186ecd81c7e3bcd50a54d9ee6c0f2ecf447ad7aaac25723ac16e8f7'
  WHEN (MurakamiLocation = 'UnionCounty-LewisburgPA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '2c147df644d27cd9397e730fa0a14955602378becb38fecd51a6d546471d2c'
```

```
  WHEN (MurakamiLocation = 'ventura' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN 'efb9e8d0aae1a3ef4a3933859d73af038eee67e9c3cd25feeb39252520fa6b'
  WHEN (MurakamiLocation = 'ventura' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '6a86203cb125b2e5e4c5a2b33ab4147214802cd28b7fa5174f5965a8bf5e7f'
  WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'ep-foster-public')
       THEN '824e16a8-3249-4deb-a6df-a58ebab1608d'
  WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'admin-egress')
       THEN 'f3dbf186-2464-40a2-b1f3-1df081da4924'
  WHEN (MurakamiLocation = 'Ventura-County-CA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'ep-foster-egress')
       THEN 'efb9e8d0aae1a3ef4a3933859d73af038eee67e9c3cd25feeb39252520fa6b'
  WHEN (MurakamiLocation = 'Waltham-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress')
       THEN '1e3e78349a1d716735fcbe08602b7107884519b487984e13b26350c494dcd3'
  WHEN (MurakamiLocation = 'Waltham-MA' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'wifiAP')
       THEN '56e4435afe914f8565f906ea6b3d031c9081a0966fa909d1c62c49884d3782'
  WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wifiAP' AND
MurakamiNetworkType = 'hendrick-hudson-public')
       THEN '6dcda18649ef7b32f8060c48975aad7b0a9338acb67e7df06d2b7aba6704e3'
  WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'datacenter-egress')
       THEN 'e6750030f4efc9ab79a90d854d075a6c2bef51e07ebca6cf0f7dd6b664a120'
  WHEN (MurakamiLocation = 'Westchester-County-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'hendrick-hudson-public')
       THEN '0c8865d9e30d21284ce7f22981007740e229d32671093cd164675a6a257b6b'
  WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wifi' AND
MurakamiNetworkType = 'public')
       THEN '6dcda18649ef7b32f8060c48975aad7b0a9338acb67e7df06d2b7aba6704e3'
  WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'egress-datacenter')
       THEN 'e6750030f4efc9ab79a90d854d075a6c2bef51e07ebca6cf0f7dd6b664a120'
  WHEN (MurakamiLocation = 'Westchester-NY' AND MurakamiConnectionType = 'wired' AND
MurakamiNetworkType = 'public')
       THEN '0c8865d9e30d21284ce7f22981007740e229d32671093cd164675a6a257b6b'
  ELSE MurakamiDeviceID
  END AS MurakamiDeviceID,
ServerName, ServerIP, ClientIP, DownloadUUID, DownloadValue, DownloadUnit, UploadValue,
UploadUnit, DownloadRetransValue, DownloadRetransUnit, MinRTTValue, MinRTTUnit, DownloadError,
UploadError, TestError
FROM `mlab-sandbox.mlbn_beacons_final.Y2_ndt7`
)
SELECT * EXCEPT(DownloadError, UploadError, TestError) FROM filtered
WHERE DownloadError IS NULL AND UploadError IS NULL
```

Appendix B - Creating Metadata Tables and Views, and Unified Performance View for Final Analysis

Device Metadata view

```
WITH
```

```
y1_ndt5_meta AS (
  SELECT 1 AS ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
  FROM `mlab-sandbox.mlbn_beacons._Y1_ndt5`
  GROUP BY MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType
),
y1_dash_meta AS (
  SELECT 1 AS ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
  FROM `mlab-sandbox.mlbn_beacons._Y1_dash`
  GROUP BY MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType
),
y1_speedtest_meta AS (
  SELECT 1 AS ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
  FROM `mlab-sandbox.mlbn_beacons._Y1_speedtest`
  GROUP BY MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType
),
y2_ndt5_meta AS (
  SELECT 2 AS ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
  FROM `mlab-sandbox.mlbn_beacons._Y2_ndt5`
  GROUP BY MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType
),
y2_ndt7_meta AS (
  SELECT 2 AS ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
  FROM `mlab-sandbox.mlbn_beacons._Y2_ndt7`
  GROUP BY MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType
),
y2_speedtest_meta AS (
  SELECT 2 AS ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
  FROM `mlab-sandbox.mlbn_beacons._Y2_speedtest`
  GROUP BY MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType
)
SELECT * FROM y1_ndt5_meta
GROUP BY ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
UNION DISTINCT (SELECT * FROM y1_dash_meta )
UNION DISTINCT (SELECT * FROM y1_speedtest_meta )
UNION DISTINCT (SELECT * FROM y2_ndt5_meta )
UNION DISTINCT (SELECT * FROM y2_ndt7_meta )
UNION DISTINCT (SELECT * FROM y2_speedtest_meta )
ORDER BY ProgramYear, MurakamiDeviceID, MurakamiLocation, MurakamiConnectionType,
MurakamiNetworkType
```

Libraries Metadata table

This table was derived from surveys of participating libraries, desk research examining the public websites of participating libraries, and additional information from public APIs or services. The fields in this table are:

- library_name
- branch_location
- state
- imls_code
- MurakamiLocation

- Timezone
- Zipcode
- Lat_Lon
- Isp1Name
- Isp1type
- Isp1AccessMedia
- Isp1ConnectionType
- Isp1NetworkType
- Isp2Name
- Isp2type
- Isp2AccessMedia
- Isp2ConnectionType
- Isp2NetworkType
- Isp1ASN
- Isp1ASName
- Isp2ASN
- Isp2ASName

Libraries and Servers Coordinates view

```
WITH
mlabsites AS (
  WITH split_coords AS (
       SELECT *, SPLIT(coordinates, ",") AS split FROM
`mlab-sandbox.critzo.mlab_sites_20200707`
  )
  SELECT asn, city, country, ipv4_prefix, ipv6_prefix, metro, name, provider, uplink, (SELECT
STRING_AGG(CAST(s AS STRING), ",") FROM UNNEST(ARRAY_REVERSE(split)) AS s) AS coordinates FROM
split_coords
),
mlbn_libraries AS (
  SELECT library_name, branch_location, state, imls_code, MurakamiLocation, Timezone, Zipcode,
  REPLACE(REPLACE(Lat_Lon,"(",""),")","") AS Lat_Lon FROM
`mlab-sandbox.mlbn_beacons.libraries_metadata`
),
ndt5_client_server_Y1 AS (
  SELECT "ndt5" AS TestName, "Y1" AS MLBNProgramYear, tests.MurakamiLocation,
mlbn_libraries.Lat_Lon AS library_lat_lon, #CAST(ClientIP AS STRING) AS ClientIP,
CAST(ServerIP AS STRING) AS ServerIP,
  ServerName,
  mlabsites.coordinates AS server_lat_lon,
  mlabsites.provider AS host,
  CONCAT(mlabsites.city, ", ", mlabsites.country) AS ServerLocation
  FROM `mlab-sandbox.mlbn_beacons._Y1_ndt5` tests, mlabsites, mlbn_libraries
  WHERE ServerName LIKE CONCAT("%",mlabsites.name,"%")
  AND tests.MurakamiLocation = mlbn_libraries.MurakamiLocation
  GROUP BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, # ClientIP, ServerIP,
  ServerName,
  server_lat_lon,
  host,
  ServerLocation
),
```

```
speedtest_client_server_Y1 AS (
  SELECT TestName, "Y1" AS MLBNProgramYear, tests.MurakamiLocation, mlbn_libraries.Lat_Lon AS
library_lat_lon, # CAST(ClientIP AS STRING), "" AS ServerIP,
  ServerURL AS ServerName,
  CONCAT(ServerLat, ",", ServerLon) AS server_lat_lon, ServerSponsor AS host, ServerName AS
ServerLocation
  FROM `mlab-sandbox.mlbn_beacons._Y1_speedtest` tests, mlbn_libraries
  WHERE tests.MurakamiLocation = mlbn_libraries.MurakamiLocation
  GROUP BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, # ClientIP, ServerIP,
  ServerName,
  server_lat_lon,
  host,
  ServerLocation
),
ndt5_client_server_Y2 AS (
  SELECT "ndt5" AS TestName, "Y2" AS MLBNProgramYear, tests.MurakamiLocation,
mlbn_libraries.Lat_Lon AS library_lat_lon, # ClientIP, ServerIP,
  ServerName,
  mlabsites.coordinates AS server_lat_lon,
  mlabsites.provider AS host,
  CONCAT(mlabsites.city, ", ", mlabsites.country) AS ServerLocation
  FROM `mlab-sandbox.mlbn_beacons._Y2_ndt5` tests, mlabsites, mlbn_libraries
  WHERE ServerName LIKE CONCAT("%",mlabsites.name,"%")
  AND tests.MurakamiLocation = mlbn_libraries.MurakamiLocation
  GROUP BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, #ClientIP, ServerIP,
  ServerName,
  server_lat_lon,
  host,
  ServerLocation
),
ndt7_client_server_Y2 AS (
  SELECT "ndt7" AS TestName, "Y2" AS MLBNProgramYear, tests.MurakamiLocation,
mlbn_libraries.Lat_Lon AS library_lat_lon, # ClientIP, ServerIP,
  ServerName,
  mlabsites.coordinates AS server_lat_lon,
  mlabsites.provider AS host,
  CONCAT(mlabsites.city, ", ", mlabsites.country) AS ServerLocation
  FROM `mlab-sandbox.mlbn_beacons._Y2_ndt7` tests, mlabsites, mlbn_libraries
  WHERE ServerName LIKE CONCAT("%",mlabsites.name,"%")
  AND tests.MurakamiLocation = mlbn_libraries.MurakamiLocation
  GROUP BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, # ClientIP, ServerIP,
  ServerName,
  server_lat_lon,
  host,
  ServerLocation
),
speedtest_client_server_Y2 AS (
  SELECT TestName, "Y2" AS MLBNProgramYear, tests.MurakamiLocation, mlbn_libraries.Lat_Lon AS
library_lat_lon, # ClientIP, "" AS ServerIP,
  ServerURL AS ServerName,
  CONCAT(ServerLat, ", ", ServerLon) AS server_lat_lon, ServerSponsor AS host, ServerName AS
ServerLocation
  FROM `mlab-sandbox.mlbn_beacons._Y2_speedtest` tests, mlbn_libraries
  GROUP BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, #ClientIP, ServerIP,
  ServerURL,
  server_lat_lon, host, ServerLocation
)
SELECT * FROM ndt5_client_server_Y1
GROUP BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, # ClientIP, ServerIP,
ServerName,
server_lat_lon,
host,
```

```
ServerLocation
UNION ALL (SELECT * FROM speedtest_client_server_Y1)
UNION ALL (SELECT * FROM ndt5_client_server_Y2)
UNION ALL (SELECT * FROM ndt7_client_server_Y2)
UNION ALL (SELECT * FROM speedtest_client_server_Y2)
ORDER BY TestName, MLBNProgramYear, MurakamiLocation, library_lat_lon, # ClientIP, ServerIP,
ServerName,
server_lat_lon,
host,
ServerLocation
```

Query to Create View of Unified Performance Tests

```
WITH
device_metadata AS (
  SELECT * FROM `mlab-sandbox.mlbn_beacons_final.device_metadata`
),
libraries_meta AS (
  SELECT MurakamiLocation, imls_code, Timezone, library_name, branch_location, state, Lat_Lon
FROM `mlab-sandbox.mlbn_beacons_final.libraries_metadata`
),
server_coords AS (
  SELECT TestName, MurakamiLocation, library_lat_lon, host, ServerLocation, ServerName,
server_lat_lon
  FROM `mlab-sandbox.mlbn_beacons_final.library_server_coords`
),
y2_ndt5 AS (
  SELECT 2 AS ProgramYear, TestName, DATETIME(TestStartTime, Timezone) AS TestStartTime,
tests.MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType, MurakamiDeviceID,
ServerName, DownloadValue, DownloadUnit, UploadValue, UploadUnit, MinRTTValue, MinRTTUnit,
library_name, branch_location, state, imls_code, Timezone, Lat_Lon, CAST(ClientIP AS STRING)
AS ClientIP, DownloadUUID
  FROM `mlab-sandbox.mlbn_beacons_final._Y2_ndt5` tests, libraries_meta meta
  WHERE tests.MurakamiLocation = meta.MurakamiLocation
),
y2_ndt7 AS (
  SELECT 2 AS ProgramYear, TestName, DATETIME(TestStartTime, Timezone) AS TestStartTime,
tests.MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType, MurakamiDeviceID,
ServerName, DownloadValue, DownloadUnit, UploadValue, UploadUnit, MinRTTValue, MinRTTUnit,
library_name, branch_location, state, imls_code, Timezone, Lat_Lon, CAST(ClientIP AS STRING)
AS ClientIP, DownloadUUID
  FROM `mlab-sandbox.mlbn_beacons_final._Y2_ndt7` tests, libraries_meta meta
  WHERE tests.MurakamiLocation = meta.MurakamiLocation
),
y2_speedtest AS (
  SELECT 2 AS ProgramYear, TestName, DATETIME(TestStartTime, Timezone) AS TestStartTime,
tests.MurakamiLocation, MurakamiConnectionType, MurakamiNetworkType, MurakamiDeviceID,
ServerURL AS ServerName, DownloadValue/1000000 AS DownloadValue, DownloadUnit,
UploadValue/1000000 AS UploadValue, UploadUnit, Ping AS MinRTTValue, PingUnit AS MinRTTUnit,
library_name, branch_location, state, imls_code, Timezone, Lat_Lon, CAST(ClientIP AS STRING)
AS ClientIP, "" AS DownloadUUID
  FROM `mlab-sandbox.mlbn_beacons_final._Y2_speedtest` tests, libraries_meta meta
  WHERE tests.MurakamiLocation = meta.MurakamiLocation
),
combined_results AS (
  SELECT * FROM y2_ndt5
  UNION ALL (SELECT * FROM y2_ndt7 )
  UNION ALL (SELECT * FROM y2_speedtest )
)
SELECT * FROM combined_results
```

```
WHERE ClientIP IS NOT NULL AND DownloadUUID IS NOT NULL
```