BWCTL: Scheduling Tests Without Conflict

e2epi.internet2.edu/bwctl

What is BWCTL? It is the Bandwidth Control tool, a scheduler developed by Internet2's End-to-End Performance Initiative (E2Epi); more information can be found at: http://e2epi. internet2.edu/bwctl/.

What is Iperf? Iperf is a tool to measure TCP and UDP bandwidth, delay jitter, datagram loss; more information can be found at: http://dast.nlanr.net/Projects/ Iperf/.

What is Thrulay? Thrulay is a tool to measure TCP and UDP bandwidth. It differs from Iperf in that it keeps track of round-trip times during the transfer so the effects of queing can be more easily seen; more information can be found at: http://e2epi.internet2.edu/ thrulay/

What is Nuttcp? Nuttcp is another popular tool to measure TCP and UDP bandwidth similar to Iperf; more information can be found at: http://www.wcisd. hpc.mil/nuttcp/Nuttcp-HOWTO.html

The decentralized design of the Internet hampers the provision of services that are coordinated across operating domains, such as end-to-end path analysis. Users attempting to run bandwidth tests could not be certain they were scheduling tests when other tests were not running (to avoid skewed results) and found it difficult to get permission to run tests to certain locations (due to security restrictions at those sites).

Combining Monitoring and Diagnostics

Internet2 supports a number of tools on the Network Observatory with the goal of allowing the average user access to tools to locate problems and identify the administrative domain responsible for its solution. For example Internet2 performs a battery of regularly scheduled active tests to archive data on loss,

jitter, throughput, and one-way latency. If the necessary data is not included in the database, a test can be scheduled on demand.

When Internet2 first explored running throughput tests on regularly scheduled intervals to validate achievable throughput across the 11-node Abilene backbone; the developers realized that end users would want the ability to additionally run throughput tests from the edges of the network (i.e. campuses) into the middle of the network (i.e. the Abilene backbone). Therefore the measurement infrastructure needed to have a method to control when both regularly scheduled tests were performed and allow on-demand tests from users (without allowing those tests to interfere with the regular testing). These are requirements beyond the scope for which Iperf was designed.
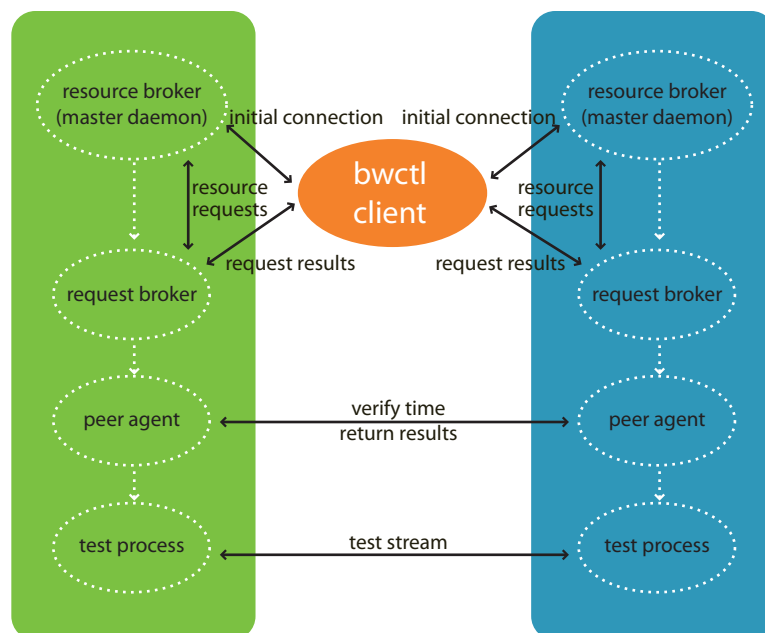

Figure 1: BWCTL Client Arranging a Test Between Two Servers

The Bandwidth Control Tool (BWCTL)

BWCTL was born of that need; it is a command line client application and a scheduling and policy daemon that currently wraps Iperf, Thrulay and Nuttcp. BWCTL executes the chosen throughput tester program on behalf of the user after doing authentication, authorization and scheduling. The BWCTL client application works by contacting a BWCTL daemon on each of the two test endpoints to request that they perform a specific throughput test between them. The daemon process manages and schedules the resources of the host on which it runs to ensure more than one throughput test does not happen at the same time on either host. Note: The client will manage the test directly if one of the endpoints is local, and no daemon is running (as in Figure 2).

BWCTL was designed to enable non-specific throughput tests to a host without having to give full user accounts on the given system. Many users want the ability to run throughput tests to determine the achievable bandwidth between a pair of hosts. It is often useful to test to multiple points along a network path to determine the network characteristics along that path. Typically, users who want to conduct path decomposition must directly contact the network or system administrators who control the hosts along the path. Each administrator must either run half of the test for the user or provide a user account on the host, which is untenable for all but well-known testers. Most network paths involve multiple administrators. These hurdles make path decomposition difficult in practice.
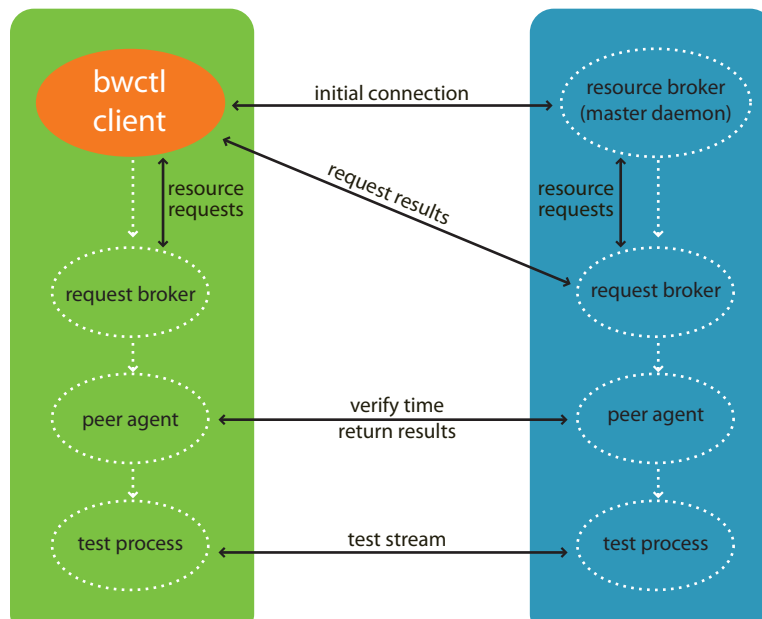
Administrator-Controlled Testing

BWCTL can help with this problem: it allows an administrator to configure a given host as available for running throughput tests, and then that host can be shared by multiple users without concern that those users will interfere with each other. Specific policy limits can be applied to specific users (or groups of users), and individual tests are scheduled so they will not interfere with each other.

BWCTL allows the administrator to classify incoming connections based upon a user name and AES key (generated by a passphrase) combination or, alternatively, based upon an IP/netmask. Once the connection is classified, the daemon process can determine the exact type and intensities and types of tests that will be allowed. (More details on policy controls can be found in the manual pages.)

A detailed description of BWCTL and full documentation is available at: e2epi.internet2.edu/bwctl/

Get Involved!

To join the group of adopters, please contact Jeff Boote (boote@internet2.edu) or subscribe to one of the two mailing lists that support this project:

• bwctl-users: A general discussion list for users to discuss problems. This list is monitored by the designer.

• bwctl-announce: This list is used to announce new versions or significant developments with regard to the software. Information about these lists, including links to subscribe, is at https://mail.internet2.edu/wws/lists/engineering

Figure 2: BWCTL Client Directly Testing with a Server

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