Report for: Wifi Capacity Test

Tue Aug 02 09:08:53 PDT 2022



Objective

The Candela WiFi Capacity test is designed to measure performance of an Access Point when handling different amounts of WiFi Stations. The test allows the user to increase the number of stations in user defined steps for each test iteration and measure the per station and the overall throughput for each trial. Along with throughput other measurements made are client connection times, Fairness, % packet loss, DHCP times and more. The expected behavior is for the AP to be able to handle several stations (within the limitations of the AP specs) and make sure all stations get a fair amount of airtime both in the upstream and downstream. An AP that scales well will not show a significant over-all throughput decrease as more stations are added.

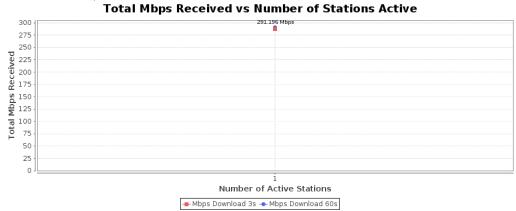
Realtime Graph shows summary download and upload RX Goodput rate of connections created by this test. Goodput does not include Ethernet, IP, UDP/TCP header overhead.

CSV Data for Realtime Throughput



Total Megabits-per-second transferred. This only counts the protocol payload, so it will not count the Ethernet, IP, UDP, TCP or other header overhead. A well behaving system will show about the same rate as stations increase. If the rate decreases significantly as stations increase, then it is not scaling we

CSV Data for Total Mbps Received vs Number of Stations Active

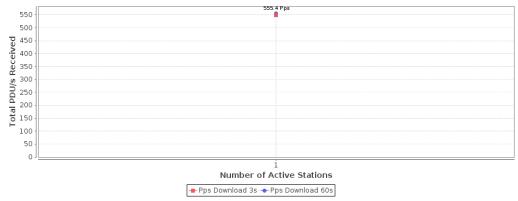


Protocol-Data-Units received. For TCP, this does not mean much, but for UDP connections, this correlates to packet size. If the PDU size is larger than what fits into a single frame, then the network stack will

segment it accordingly. A well behaving system will show about the same rate as stations increase. If the rate decreases significantly as stations increase, then it is not scaling well.

CSV Data for Total PDU/s Received vs Number of Stations Active

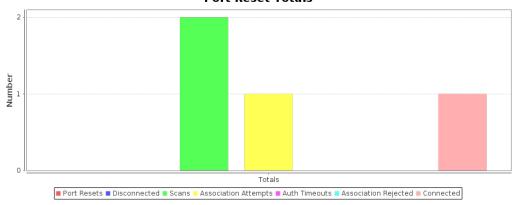




Station disconnect stats. These will be only for the last iteration. If the 'Clear Reset Counters' option is selected, the stats are cleared after the initial association. Any re-connects reported indicate a potential stability issue. Can be used for long-term stability testing in cases where you bring up all stations in one iteration and then run the test for a longer duration.

CSV Data for Port Reset Totals

Port Reset Totals



Station connect time is calculated from the initial Authenticate message through the completion of Open or RSN association/authentication.

CSV Data for Station Connect Times

Station Connect Times



Wifi-Capacity Test requested values

Station Increment:	1	

Loop Iterations:	Single (1)					
Duration:	1 min (1 m)					
Protocol:	TCP-IPv4					
Layer 4-7 Endpoint:	NONE					
Payload Size:	AUTO					
MSS	AUTO					
Total Download Rate:	1G (1 Gbps)					
Total Upload Rate:	Zero (0 bps)					
Percentage TCP Rate:	10% (10%)					
Set Bursty Minimum Speed:	Burst Mode Disabled (-1)					
Randomize Rates	true					
Leave Ports Up	false					
Socket buffer size:	OS Default					
Settle Time:	5 sec (5 s)					
Rpt Timer:	fast (1 s)					
IP ToS:	Best Effort (0)					
Multi-Conn:	AUTO					
Show-Per-Iteration-Charts	true					
Show-Per-Loop-Totals	true					
Hunt-Lower-Rates	false					
Show Events	true					
Clear Reset Counters	false					
CSV Reporting Dir	/home/lanforge/report-data/wifi-cap-csv-data-2022-08-02_09.07					
Build Date	Fri 17 Jun 2022 05:02:03 PM PDT					
Build Version	5.4.5					
Git Version	e4afc0739ee746116945e553e48705b0b0eeb7a5					
Ports	1.1.eth1 1.1.wlan1					
Firmware	0. 6-1					
Machines	ct523c-0b31					

Requested Parameters:

Download Rate:	Per station:	1000000000 (1 Gbps		1000000000 (1 Gbps)			
Upload Rate:	Per station:	0 (0 bps	s) All:	0 (0 bps)			
Total:		•	1000000000 (1 Gbps)				
Station count:				1			
Connections per stat	ion:	1					
Payload (PDU) sizes:			AUTO (AUTO)			

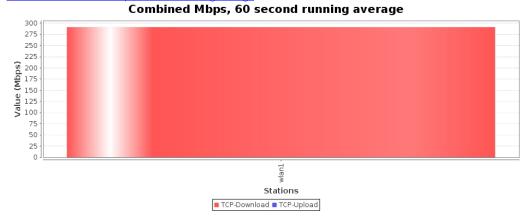
Observed Rate:

Download	Сх	291.196 Cx	291.196 Cx	291.196	All	291.196

Rate:	Min:	Mbps	Ave:	Mbps	Max:	Mbps	Cx:	Mbps
Upload Rate:	Cx Min:	0 bps	Cx Ave:	0 bps	Cx Max:	0 bps	All Cx:	0 bps
Total:								291.196 Mbps
Aggregated Min: 291.196 Avg: 291.196 Max:						291.196 Mbps		

This graph shows fairness. On a fair system, each station should get about the same throughput. In the download direction, it is mostly the device-under-test that is responsible for this behavior, but in the upload direction, LANforge itself would be the source of most fairness issues unless the device-under-test takes specific actions to ensure fairness.

CSV Data for Combined Mbps, 60 second running average



Requested Parameters:

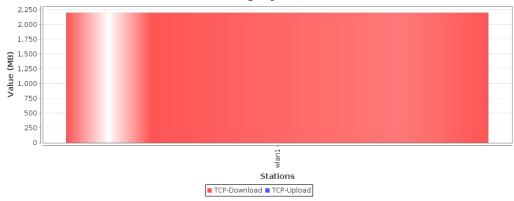
Download Rate:	Per station:	n: 1000000000 (1 Gbps)		1000000000 (1 Gbps)		
Upload Rate:	Per station:	0 (0 bps	s) All:	0 (0 bps)		
Total:			1000000000 (1 Gbps)			
Station count:			1			
Connections per stat	ion:					
Payload (PDU) sizes:		AUTO (AUTO)				

Observed Amount:

Download Amount:	Cx Min:	2.051 GB	Cx Ave:	2.051 GB	Cx Max:	2.051 GB	All Cx:	2.051 GB
Upload Amount:	Cx Min:	ОВ	Cx Ave:	ОВ	Cx Max:	ОВ	All Cx:	ОВ
Total:								2.051 GB

This graph shows fairness. On a fair system, each station should get about the same throughput. In the download direction, it is mostly the device-under-test that is responsible for this behavior, but in the upload direction, LANforge itself would be the source of most fairness issues unless the device-under-test takes specific actions to ensure fairness.

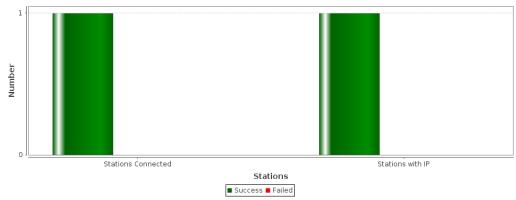
Combined Received Megabytes, for entire 1 m run



Maximum Stations Connected: 1 Stations NOT connected at this time: θ Maximum Stations with IP Address: 1 Stations without IP at this time: θ

CSV Data for Station Maximums

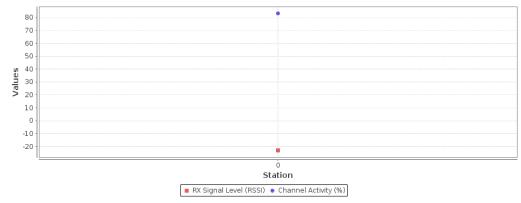
Station Maximums



RF stats give an indication of how well how congested is the RF environment. Channel activity is what the wifi radio reports as the busy-time for the RF environment. It is expected that this be near 100% when LANforge is running at max speed, but at lower speeds, this should be a lower percentage unless the RF environment is busy with other systems.

CSV Data for RF Stats for Stations

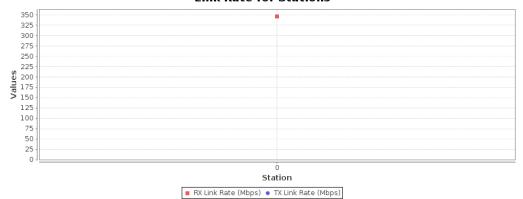
RF Stats for Stations



Link rate stats give an indication of how well the rate-control is working. For rate-control, the 'RX' link rate corresponds to what the device-under-test is transmitting. If all of the stations are on the same radio, then the TX and RX encoding rates should be similar for all stations. If there is a definite pattern where some stations do not get good RX rate, then probably the device-under-test has rate-control problems. The TX rate is what LANforge is transmitting at.

CSV Data for Link Rate for Stations

Link Rate for Stations



Key Performance Indicators CSV

```
Scan Results for SSIDs used in this test.
BSS cc:19:a8:e6:cd:81(on wlan1) -- associated
             last seen: 178943.390s [boottime]
TSF: 154900263 usec (0d, 00:02:34)
             frea: 5180
             Heg: 5100
beacon interval: 100 TUs
capability: ESS Privacy RadioMeasure (0x1011)
signal: -13.00 dBm
last seen: 252 ms ago
             Last seen: 252 ms ago
Information elements from Probe Response frame:
SSID: client_connectivity_al
Supported rates: 6.0* 9.0 12.0 18.0 24.0* 36.0 48.0 54.0
TPC report: TX power: 23 dBm
RSN: * Version: 1

* Group cipher: CCMP

* Position in the CCMP
                            * Pairwise ciphers: CCMP

* Authentication suites: PSK

* Capabilities: 16-PTKSA-RC 1-GTKSA-RC MFP-capable (0x008c)
             BSS Load:
                             * station count: 1
                             * channel utilisation: 247/255
* available admission capacity: 0 [*32us]
             RM enabled capabilities:
Capabilities: 0x32 0x00 0x00 0x00 0x00
                                       Neighbor Report
Beacon Passive Measurement
                          Beacon Active Measurement Nonoperating Channel Max Measurement Duration: 0 Measurement Pilot Capability: 0
             HT capabilities:
                          Capabilities: 0x1ad
                                        RX LDPC
HT20
                                        SM Power Save disabled RX HT20 SGI
                                        TX STBC
                                        RX STBC 1-stream
                          Max AMSDU length: 3839 bytes
No DSSS/CCK HT40
Maximum RX AMPDU length 65535 bytes (exponent: 0x003)
                          Minimum RX AMPDU time spacing: 4 usec (0x05) HT RX MCS rate indexes supported: 0-31
             HT TX MCS rate indexes are undefined HT operation:
                            * primary channel: 36

* secondary channel offset: no secondary

* STA channel width: 20 MHz
                             * HT protection: no
* non-GF present: 1
* OBSS non-GF present: 0
                             * dual beacon: 0
* dual CTS protection: 0
                             * STBC beacon: 0
* L-SIG TXOP Prot: 0
             * PCO active: 0
* PCO phase: 0
Extended capabilities:
                             * Extended Channel Switching
                             * BSS Transition
                             * Interworking
                               QoS Map
                             * Operating Mode Notification
* Channel Schedule Management
                             * Channel Schedule Management
                             * Max Number Of MSDUs In A-MSDU is
             VHT capabilities:
VHT Capabilities (0x0f8b69b1):
                                        Max MPDU length: 7991
Supported Channel Width: neither 160 nor 80+80
                                        RX LDPC
short GI (80 MHz)
                                        TX STBC
SU Beamformer
                                        MU Beamformer
```

```
VHT RX MCS set:
                            1 streams: MCS 0-9
                            2 streams: MCS 0-9
3 streams: MCS 0-9
4 streams: MCS 0-9
                            5 streams: not supported
                            6 streams: not supported
7 streams: not supported
8 streams: not supported
              VHT RX highest supported: 0 Mbps
              VHT TX MCS set:
                            1 streams: MCS 0-9
2 streams: MCS 0-9
                            3 streams: MCS 0-9
4 streams: MCS 0-9
                            5 streams: not supported
6 streams: not supported
                            7 streams: not supported
8 streams: not supported
              VHT TX highest supported: 0 Mbps
                * channel width: 0 (20 or 40 MHz)

* center freq segment 1: 36

* center freq segment 2: 0
* VHT basic MCS set: 0x0000

Transmit Power Envelope:

* Local Maximum Transmit Power For 20 MHz: 25 dBm
HE capabilities:
             HE MAC Capabilities (0x000512081000):
+HTC HE Supported
TWT Responder
                            BSR
OM Control
                            Maximum A-MPDU Length Exponent: 2
OM Control UL MU Data Disable RX
             HE PHY Capabilities: (0x442002c00f438518000c00):
HE40/HE80/5GHz
242 tone RUs/5GHz
LDPC Coding in Payload
NDP with 4x HE-LTF and 3.2us GI
RX HE MU PPDU from Non-AP STA
                            SU Beamformer
                            SU Beamformee
                            MU Beamformer
                            Beamformee STS <= 80Mhz: 3
Sounding Dimensions <= 80Mhz: 3
                            Ng = 16 SU Feedback
Codebook Size SU Feedback
                            Triggered SU Beamforming Feedback
PPE Threshold Present
                            Max NC: 3
TX 1024-QAM
                            RX 1024-0AM
             HE RX MCS and NSS set <= 80 MHz
1 streams: MCS 0-11
                           1 streams: MCS 0-11
2 streams: MCS 0-11
3 streams: MCS 0-11
4 streams: MCS 0-11
5 streams: not supported
6 streams: not supported
                             7 streams: not supported
              8 streams: not supported HE TX MCS and NSS set <= 80 MHz
                            1 streams: MCS 0-11
2 streams: MCS 0-11
3 streams: MCS 0-11
                            4 streams: MCS 0-11
                            5 streams: not supported
                            6 streams: not supported
7 streams: not supported
              8 streams: not supported
PPE Threshold 0x7b 0x1c 0xc7 0x71 0x1c 0xc7 0x71 0x1c 0xc7 0x71 0x1c 0xc7 0x71
WPS:
                 * Version: 1.0
                * Wi-Fi Protected Setup State: 2 (Configured)
                * Response Type: 3 (AP)
* UUID: adf4e098-1169-2efb-52cd-30431a11b6fd
* Manufacturer: AlticeLabs
                * Model: AlticeLabs GR140DG

* Model Number: GR140DG

* Serial Number: 5054494EA8E6CD7F

* Primary Device Type: 6-0050f204-1
                  Device name: FiberGateway
Config methods: Display
                * RF Bands: 0x3
* Version2: 2.0
WMM:
                * Parameter version 1
                * u-APSD
* BE: CW 15-1023, AIFSN 3
* BK: CW 15-1023, AIFSN 7

* VI: CW 7-15, AIFSN 2, TXOP 3008 usec

* VO: CW 3-7, AIFSN 2, TXOP 1504 usec

802.11u Advertisement:
              ANOP
```

Auxiliary files: wifi-cap-csv-data

Generated by Candela Technologies LANforge network testing tool. $\underline{www.candelatech.com}$

