greenWAVE REALITY™

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GreenWave Reality
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Document Revision History

Document	Author	Revision	Date	Notes
TR-143 Implementation Design	Ng Kok Kee, Zhou Bin, Li Geng, Lau Chia Chee	0.1	09/10/2014	Modues, Interfaces
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TR-143 Implementation Design

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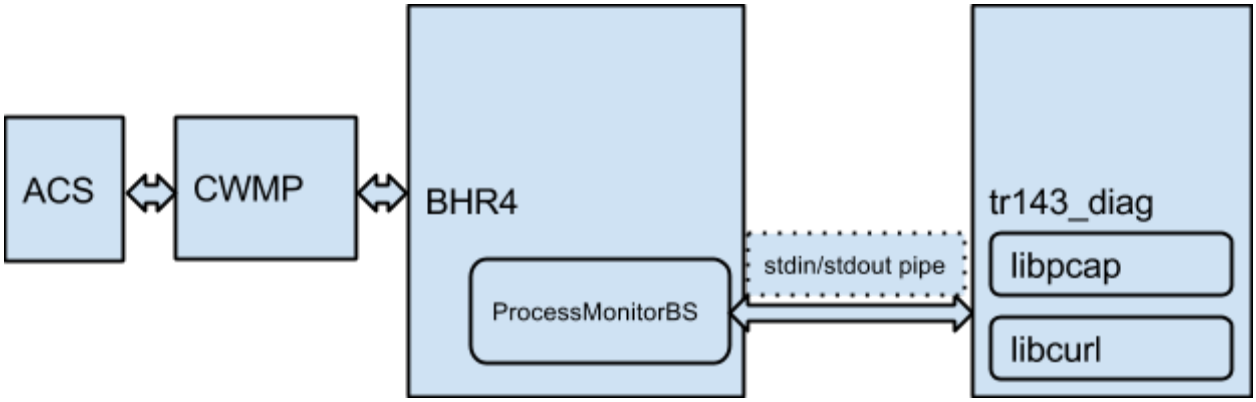
Overview

An individual application (tr143_diag) is used to handle TR-143 diagnostics operations such as Network Throughput Test and UDP Echo Plus Test, and output all necessary results of TR-143 parameters. When a TR-143 diagnostics operation is triggered (e.g., from ACS), this application is executed by BHR4 main process, and its output is captured by BHR4 through the stdin/stdout pipe between them.

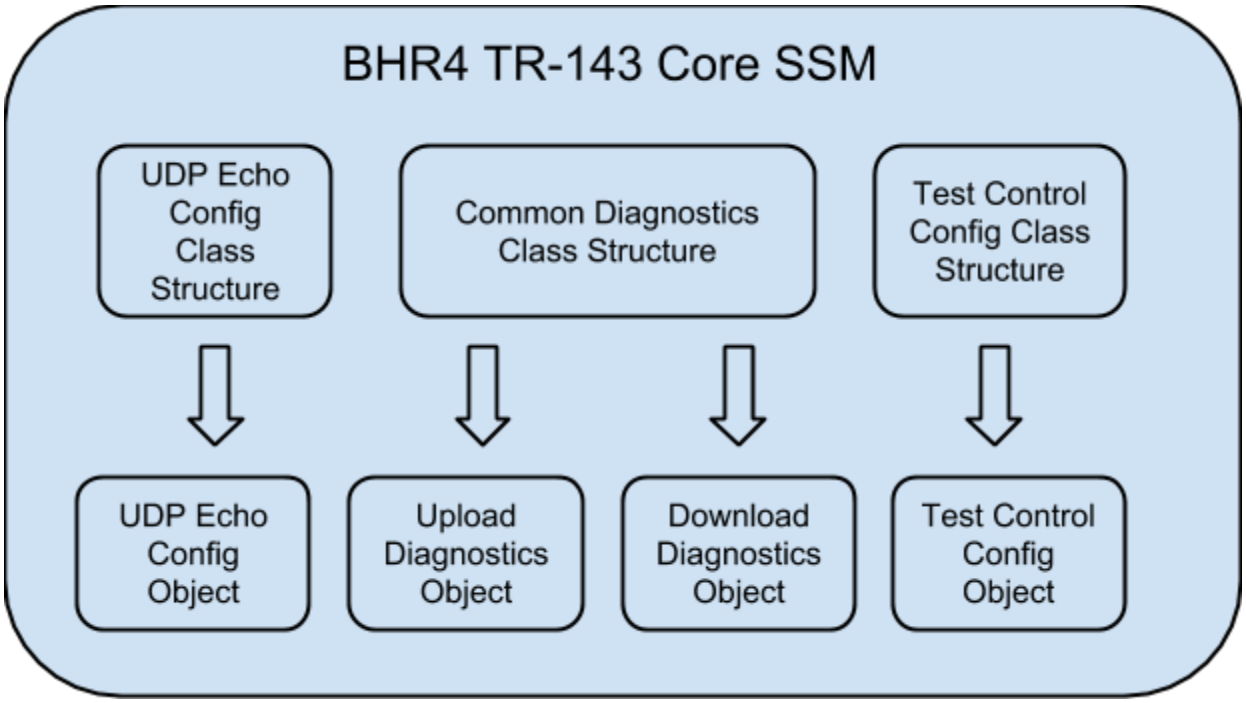


Modules

TR-143 related modules inside BHR4

TR-143 SSM

TR-143 core SSM is a set of class structures, initializer and serializer to hold and manage the set of objects and parameters with 1-to-1 mapping relationship to parameters in TR-143 data models.



In addition to the TR-143 standard parameters, core SSM holds a set of internal parameters to manage scheduled test controller operations.

TR-143 Data model

Based on standard data model specified in DSL Forum 2008 TR-143 standard. In addition, Verizon specific objects, parameters and modification are implemented as requested in conformance with "TR-143 on Verizon FiOS Router (BHR) ECR Oct 2014".

Name	Type	Write	Description	Object Default
.Capabilities. .Capabilities.-PerformanceDiagnostic	object	-	The capabilities of the device. This is a constant read-only object, meaning that only a firmware upgrade will cause these values to be altered. The capabilities of the Performance Diagnostics (DownloadDiagnostics and UploadDiagnostics) for the device.	-
DownloadTransports	string	-	Comma-separated list of supported DownloadDiagnostics transport protocols for a CPE device. Each item in the list is an enumeration of: "HTTP" "FTP" (OPTIONAL)	-
UploadTransports	string	-	Comma-separated list of supported UploadDiagnostics transport protocols for a CPE device. Each item in the list is an enumeration of: "HTTP" "FTP" (OPTIONAL)	-
.DownloadDiagnostics.	object	-	This object defines the diagnostics configuration for a HTTP and FTP DownloadDiagnostics Test. Files received in the DownloadDiagnostics do not require file storage on the CPE device.	-
DiagnosticsState	string	W	Indicate the availability of diagnostic data. One of: "None" "Requested" "Completed" "Error_InitConnectionFailed" "Error_NoResponse " "Error_TransferFailed" "Error_PasswordRequestFailed" "Error_LoginFailed" "Error_NoTransferMode" "Error_NoPASV" "Error_IncorrectSize"	-

Name	Type	Write	Description	Object Default
			"Error_Timeout" If the ACS sets the value of this parameter to Requested, the CPE MUST initiate the corresponding diagnostic test. When writing, the only allowed value is Requested. To ensure the use of the proper test parameters (the writable parameters in this object), the test parameters MUST be set either prior to or at the same time as (in the same SetParameterValues) setting the DiagnosticsState to Requested. When requested, the CPE SHOULD wait until after completion of the communication session with the ACS before starting the diagnostic. When the test is completed, the value of this parameter MUST be either Completed (if the test completed successfully), or one of the Error values listed above. If the value of this parameter is anything other than Completed, the values of the results parameters for this test are indeterminate. When the diagnostic initiated by the ACS is completed (successfully or not), the CPE MUST establish a new connection to the ACS to allow the ACS to view the results, indicating the Event code "8 DIAGNOSTICS COMPLETE" in the Inform message. After the diagnostic is complete, the value of all result parameters (all read-only parameters in this object) MUST be retained by the CPE until either this diagnostic is run again, or the CPE reboots. After a reboot, if the CPE has not retained the result parameters from the most recent test, it MUST set the value of this parameter to "None". Modifying any of the writable parameters in this object except for this one MUST result in the value of this parameter being set to "None". While the test is in progress, modifying any of the writable parameters in this object except for this one MUST result in the test being terminated and the value of this parameter being set to "None". While the test is in progress, setting this parameter to Requested (and possibly modifying other writable parameters in this object) MUST result in the test being terminated and then restarted using the current values of the test parameters.	
Interface	string(256)	W	Specifies the IP-layer interface over which the test is to be performed. The content is the full hierarchical parameter name of the interface. The value of this parameter MUST be either a valid interface or an empty string. An attempt to set this parameter to a different value MUST be rejected as an invalid parameter value.	-
Name	Type	Write	Description	Object

				Default
			If an empty string is specified, the CPE MUST use the default routing interface	
DownloadURL	string(256)	W	The URL as defined in [3], for the CPE to perform the download on. This parameter MUST be in the form of a valid HTTP [2] or FTP [6] URL. When using FTP transport, FTP binary transfer MUST be used. When using HTTP transport, persistent connections MUST be used and pipelining MUST NOT be used. When using HTTP transport the HTTP Authentication MUST NOT be used.	-
DSCP	unsignedInt [0:63]	W	The DiffServ code point for marking packets transmitted in the test. The default value SHOULD be zero.	-
EthernetPriority	unsignedInt [0:7]	W	Ethernet priority code for marking packets transmitted in the test (if applicable). The default value SHOULD be zero.	-
ROMTime	dateTime	-	Request time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the client sends the GET command. For FTP this is the time at which the client sends the RTRV command.	-
BOMTime	dateTime	-	Begin of transmission time in UTC, which MUST be specified to microsecond precision For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the first data packet is received. For FTP this is the time at which the client receives the first data packet on the data connection.	-
EOMTime	dateTime	-	End of transmission in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the last data packet is received. For FTP this is the time at which the client receives the last packet on the data connection.	-
TestBytesReceived	unsignedInt	-	The test traffic received in bytes during the FTP/HTTP transaction including FTP/HTTP headers, between BOMTime and EOMTime,	-
TestBytesReceived	unsignedInt	-	The total number of bytes received on the Interface between BOMTime and EOMTime.	-
TCPOpenRequestTime	dateTime	-	Request time in UTC, which MUST be specified to	-

Name	Type	Write	Description	Object Default
			microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the TCP socket open (SYN) was sent for the HTTP connection. For FTP this is the time at which the TCP socket open (SYN) was sent for the data connection. Note: Interval of 1 microsecond SHOULD be supported.	
TCPOpenResponseTime	dateTime	-	Response time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the TCP ACK to the socket opening the HTTP connection was received. For FTP this is the time at which the TCP ACK to the socket opening the data connection was received. Note: Interval of 1 microsecond SHOULD be supported.	-
X_D4A928_ConcurrentSessions	unsignedInt	W	The number of concurrent connections to use in a multi-threaded test	-
X_D4A928_TestBytesReceivedUnderFullLoading	unsignedInt	-	Test traffic received by the CPE between the last BOMTime and first EOMTime across all connections in a multi-threaded test.	-
X_D4A928_TotalBytesReceivedUnderFullLoading	unsignedInt	-	The total traffic received in bytes between the last BOMTime and first EOMTime across all connections in a multi-threaded test.	-
.UploadDiagnostics.	object	-	This object defines the diagnostics configuration for a HTTP or FTP UploadDiagnostics test. Files sent by the UploadDiagnostics do not require file storage on the CPE device, and MAY be an arbitrary stream of bytes	-
DiagnosticsState	string	W	Indicate the availability of diagnostic data. One of: “None” “Requested” “Completed” “Error_InitConnectionFailed” “Error_NoResponse” “Error_PasswordRequestFailed” “Error_LoginFailed” “Error_NoTransferMode” “Error_NoPASV” “Error_NoCWD” “Error_NoSTOR” “Error_NoTransferComplete” If the ACS sets the value of this parameter to Requested, the CPE MUST initiate the corresponding diagnostic test. When writing, the only	-

Name	Type	Write	Description	Object Default
			allowed value is Requested. To ensure the use of the proper test parameters (the writable parameters in this object), the test parameters MUST be set either prior to or at the same time as (in the same SetParameterValues) setting the DiagnosticsState to Requested. When requested, the CPE SHOULD wait until after completion of the communication session with the ACS before starting the diagnostic. When the test is completed, the value of this parameter MUST be either Completed (if the test completed successfully), or one of the Error values listed above. If the value of this parameter is anything other than Completed, the values of the results parameters for this test are indeterminate. When the diagnostic initiated by the ACS is completed (successfully or not), the CPE MUST establish a new connection to the ACS to allow the ACS to view the results, indicating the Event code "8 DIAGNOSTICS COMPLETE" in the Inform message. After the diagnostic is complete, the value of all result parameters (all read-only parameters in this object) MUST be retained by the CPE until either this diagnostic is run again, or the CPE reboots. After a reboot, if the CPE has not retained the result parameters from the most recent test, it MUST set the value of this parameter to “None”. Modifying any of the writable parameters in this object except for this one MUST result in the value of this parameter being set to “None”. While the test is in progress, modifying any of the writable parameters in this object except for this one MUST result in the test being terminated and the value of this parameter being set to “None”. While the test is in progress, setting this parameter to Requested (and possibly modifying other writable parameters in this object) MUST result in the test being terminated and then restarted using the current values of the test parameters.	
Interface	string(256)	W	IP-layer interface over which the test is to be performed. The content is the full hierarchical parameter name of the interface. The value of this parameter MUST be either a valid interface or an empty string. An attempt to set this parameter to a different value MUST be rejected as an invalid parameter value. If an empty string is specified, the CPE MUST use the default routing interface.	-
UploadURL	string(256)	W	The URL as defined in [3], for the CPE to Upload to.	-

Name	Type	Write	Description	Object Default
			This parameter MUST be in the form of a valid HTTP [2] or FTP [6] URL. When using FTP transport, FTP binary transfer MUST be used. When using HTTP transport, persistent connections MUST be used and pipelining MUST NOT be used. When using HTTP transport the HTTP Authentication MUST NOT be used.	
DSCP	unsignedInt [0:63]	W	DiffServ code point for marking packets transmitted in the test. The default value SHOULD be zero.	-
EthernetPriority	unsignedInt [0:7]	W	Ethernet priority code for marking packets transmitted in the test (if applicable). The default value SHOULD be zero.	-
TestFileLength	unsignedInt	W	The size of the file (in bytes) to be uploaded to the server. The CPE MUST insure the appropriate number of bytes are sent.	-
ROMTime	dateTime	-	Request time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the client sends the PUT command For FTP this is the time at which the STOR command is sent.	-
BOMTime	dateTime	-	Begin of transmission time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the first data packet is sent. For FTP this is the time at which the client receives the ready for transfer notification.	-
EOMTime	dateTime	-	End of transmission in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time when the HTTP successful response code is received. For FTP this is the time when the client receives a transfer complete.	-
TotalBytesSent	unsignedInt	-	The total number of bytes sent on the Interface between BOMTime and EOMTime.	-
TCPOpenRequestTime	dateTime	-	Request time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the time at which the TCP socket	-

Name	Type	Write	Description	Object Default
			open (SYN) was sent for the HTTP connection. For FTP this is the time at which the TCP socket open (SYN) was sent for the data connection Note: Interval of 1 microsecond SHOULD be supported.	
TCPOpenResponseTime	dateTime	-	Response time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 For HTTP this is the Time at which the TCP ACK to the socket opening the HTTP connection was received. For FTP this is the Time at which the TCP ACK to the socket opening the Data connection was received. Note: Interval of 1 microsecond SHOULD be supported.	-
X_D4A928_ConcurrentSessions	unsignedInt	W	The number of concurrent connections to use in a multi-threaded test	-
X_D4A928_TestBytesSentUnderFullLoading	unsignedInt	-	Test traffic sent by the CPE between the last BOMTime and first EOMTime across all connections in a multi-threaded test.	-
X_D4A928_TotalBytesSentUnderFullLoading	unsignedInt	-	The total traffic sent in bytes between the last BOMTime and first EOMTime across all connections in a multi-threaded test.	-
.UDPEchoConfig.	object	-	This object allows the CPE to be configured to perform the UDP Echo Service defined in [4] and UDP Echo Plus Service defined in Appendix A.1.	-
Enable	boolean	W	MUST be enabled to receive UDP echo. When enabled from a disabled state all related timestamps, statistics and UDP Echo Plus counters are cleared.	-
Interface	string(256)	w	IP-layer interface over which the CPE MUST listen and receive UDP echo requests on. The content is the full hierarchical parameter name of the interface. The value of this parameter MUST be either a valid interface or an empty string. An attempt to set this parameter to a different value MUST be rejected as an invalid parameter value. If an empty string is specified, the CPE MUST listen and receive UDP echo requests on all interfaces. Note: Interfaces behind a NAT MAY require port forwarding rules configured in the Gateway to enable receiving the UDP packets.	-
SourceIPAddress	string	W	The Source IP address of the UDP echo packet. The CPE MUST only respond to a UDP echo from this source IP address	-

Name	Type	Write	Description	Object Default
UDPPort	unsignedInt	W	The UDP port on which the UDP server MUST listen and respond to UDP echo requests.	-
EchoPlusEnabled	boolean	W	If True the CPE will perform necessary packet processing for UDP Echo Plus packets.	-
EchoPlusSupported	boolean	-	True if UDP Echo Plus is supported.	-
PacketsReceived	unsignedInt	-	Incremented upon each valid UDP echo packet received.	-
PacketsResponded	unsignedInt	-	Incremented for each UDP echo response sent.	-
BytesReceived	unsignedInt	-	The number of UDP received bytes including payload and UDP header after the UDPEchoConfig is enabled.	-
BytesResponded	unsignedInt	-	The number of UDP responded bytes, including payload and UDP header sent after the UDPEchoConfig is enabled.	-
TimeFirstPacketReceived	dateTime	-	Time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456, The time that the server receives the first UDP echo packet after the UDPEchoConfig is enabled.	-
TimeLastPacketReceived	dateTime	-	Time in UTC, which MUST be specified to microsecond precision. For example: 2008-04-09T15:01:05.123456 The time that the server receives the most recent UDP echo packet.	-
.X_D4A928_Performance Diagnostics.	object	-	This object allows the CPE to be configured to perform the TR-143 test control protocol	-
DownloadTransports	string	-	Comma-separated list of supported DownloadDiagnostics transport protocols for a CPE device. Each item in the list is an enumeration of: “HTTP” “FTP” “NDT” “DNS” “WebPage” “ReverseUDPEchoPlus” “TWAMP” “PathPing” “PassiveUsageMonitoring”	-
UploadTransports	string	-	Comma-separated list of supported UploadDiagnostics transport protocols for a CPE device. Each item in the list is an enumeration of: “HTTP”	-

Name	Type	Write	Description	Object Default
			"FTP"	
ThroughputTestingEnabled	boolean	W	True if Throughput testing is enabled	-
PerformDownloadThroughputTest	boolean	W	True if Download Throughput testing is enabled	-
PerformUploadThroughputTest	boolean	W	True if Upload Throughput testing is enabled	-
TestServerIPAddress	string	W	IP address to test server (to send TestRequest messages and TestResult messages to)	-
TestRequestInterval	unsignedInt	W	A recurring fixed time interval within which a TestRequest is made to the test server. The TestRequestInterval repeats until ThroughputTestingEnabled is set to false	-
TestRequestLimit	unsignedInt	W	The number of periodic tests to request before automatically setting ThroughputTestingEnabled to FALSE and no longer running periodic tests (until ThroughputTestingEnabled is re-enabled). This parameter allows the CPE to perform a fixed number of requested tests before no longer sending TestRequest packets. When this parameter is unassigned, or set to zero, then it does not take affect and periodic tests run indefinitely.	-
TestRequestUDPPort	unsignedInt	W	UDP port on which each TestRequest is made (i.e. UDP port value of TestRequest packets)	-
TestRequestTimeout	unsignedInt	W	The amount of time a BHR waits for receiving a TestResponse packet in response to a TestRequest packet is has sent to the test server	-
TestResultsTCPPort	unsignedInt	W	TCP port on which a TestResult packets are sent (i.e. TCP port value of the TCP connection used to send TestResult packet)	-
ClientVersionNumber	unsignedInt [0:7]	W	This version number placed on the Version field bits in the TestRequest packets. E.g. when ClientVersionNumber = 0 then Ver2 = 0, Ver1 = 0, Ver0 = 0, or when ClientVersionNumber = 1 then Ver2 = 0, Ver1 = 0, Ver0 = 1, etc …	-
RequestedTestProtocol	string	W	A string value denoting the test protocol type to be set in the Protocol Type (PT) bits in each test request message. Note the actual test that is run is defined by the value of the PT bits returned from the test server. However, the parameter indicates which test protocol is requested. It can be set to one of the following string values: "HTTP" or "FTP" or "NDT" or	-

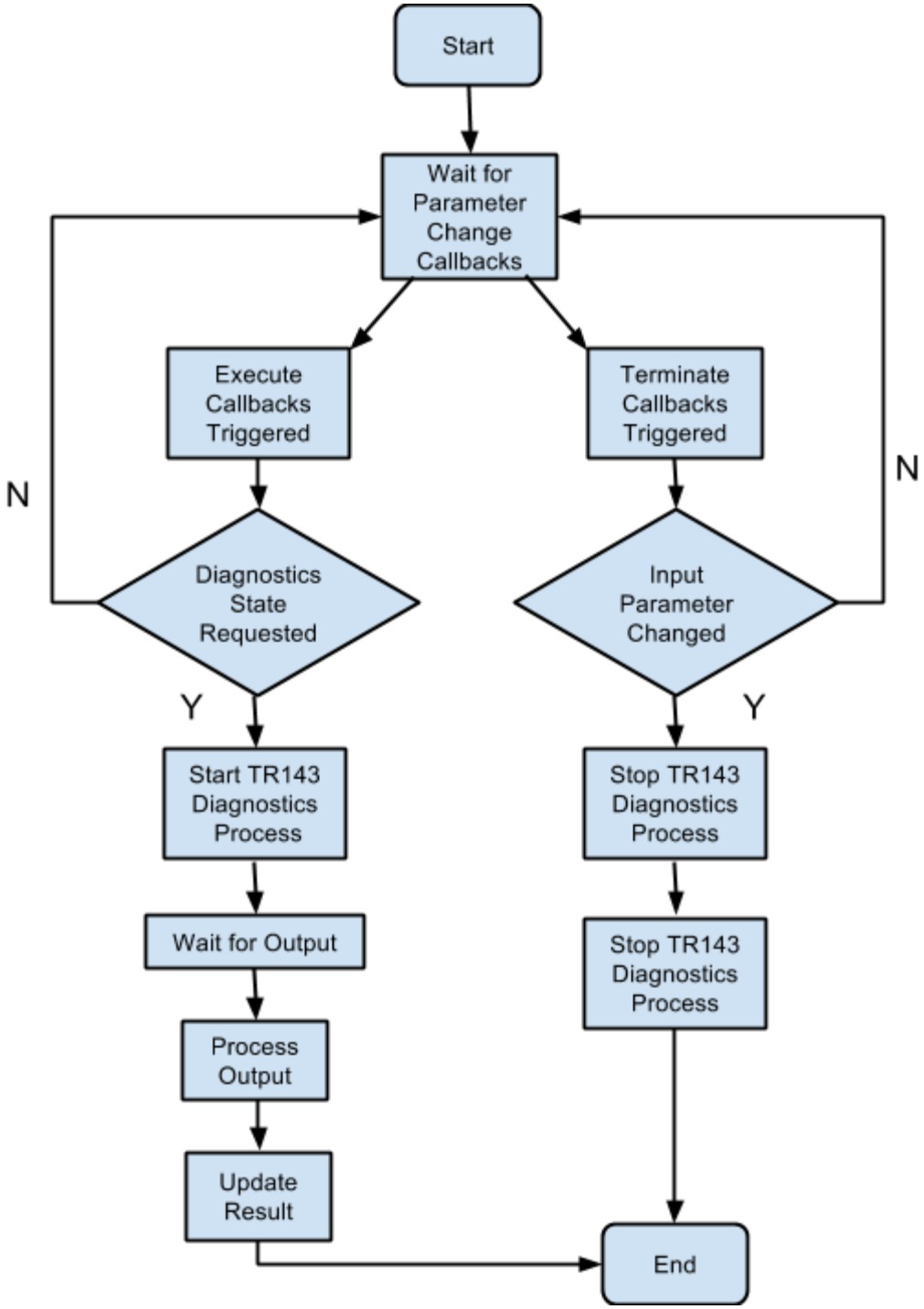
Name	Type	Write	Description	Object Default
			"DNS" or "WebPage" or "ReverseUDPEchoPlus or TWAMP" or "PathPing" or "PassiveUsageMonitoring"	
DownstreamSpeedTier	string{16]	W	A string denoting the downstream speed tier in Kbps (e.g. 25000 denotes a 25Mbps downstream tier)	-
UpstreamSpeedTier	string{16]	W	A string denoting the upstream speed tier in Kbps (e.g. 25000 denotes a 25Mbps upstream tier)	-
DeviceSerialNumber	string[64]	W	The serial number of the current device (e.g. the Home Gateway device serial number)	-
LATA_ID	string[64]	W	A string designation for the LATA the device is in	-
GWR_ID	string[64]	W	A string designation for the serving GWR for this device	-
OLT_ID	string[64]	W	A string designation for the serving OLT for this device	-
ONT_ID	string[64]	W	A string designation for the serving ONT (or ONT model type) for this device	-

Process Monitor for diagnostics app (tr143_diag)

Process monitors are implemented for each of the specific TR-143 diagnostics (Upload, Download and UDP Echo diagnostics). Process monitor from each diagnostics test monitor the internal and external changes (via TR69/ACS for example) in the writable input parameters. Changes to these input may trigger a series of actions (start/stop the diagnostics process, reset certain parameters for example), in accordance with the behaviour specified in TR-143 standard document or Verizon ECR extensions.

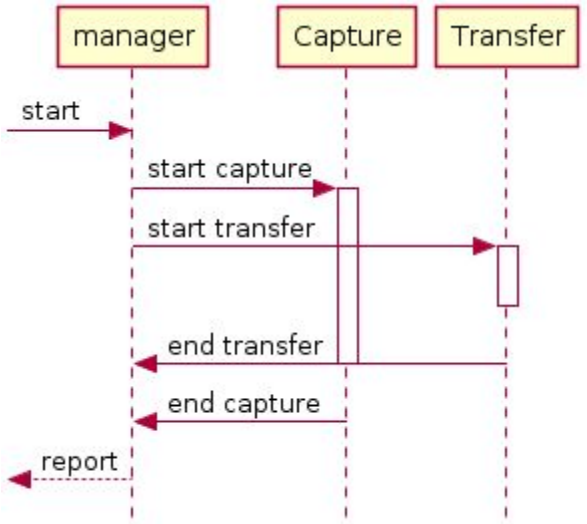
As the diagnostics process completes execution, process monitor will parse the output stream returned by the diagnostics application and update the result parameters such as states, time and byte count in core SSM.

Following flowchart provides a high level overview of the process.


Start
Wait for Parameter Change Callbacks
Execute Callbacks Triggered
Terminate Callbacks Triggered
N
Diagnostics State Requested
Input Parameter Changed
N
Y
Y
Start TR143 Diagnostics Process
Stop TR143 Diagnostics Process
Wait for Output
Stop TR143 Diagnostics Process
Process Output
Update Result
End

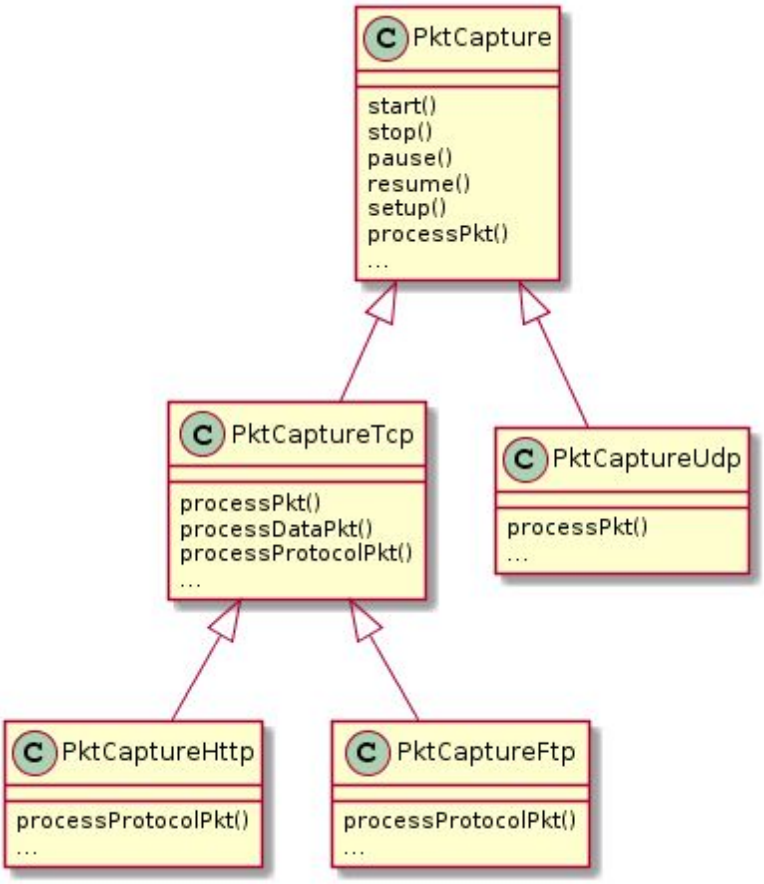
TR-143 diagnostics app (tr143_diag)

tr143_diag app supports two types of diagnostics: Network Throughput Test and UDP Echo Plus Test. For each type of diagnostics, there are two modules running in parallel: transfer module and capture module. Transfer module is used to do related network transfer during test, such as HTTP, FTP, or UDP, and capture module is used to collect corresponding packet's information such as timing, length, sequence number etc. Both modules are monitored and managed by a manager module which will generate final report of TR-143.

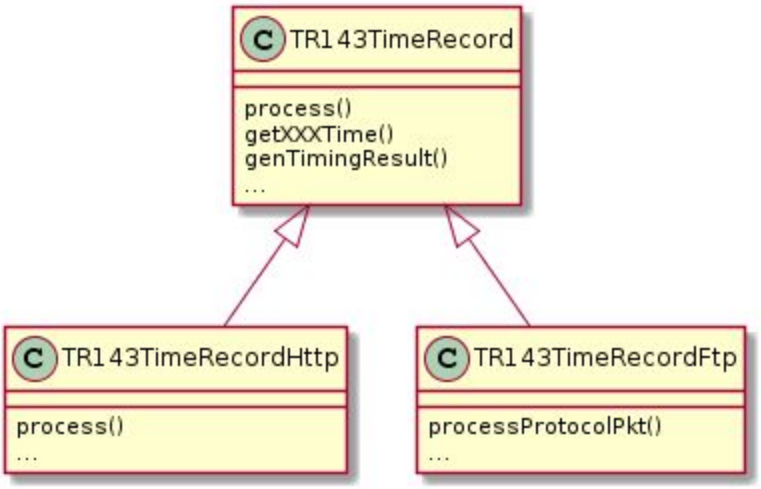


Capture Module

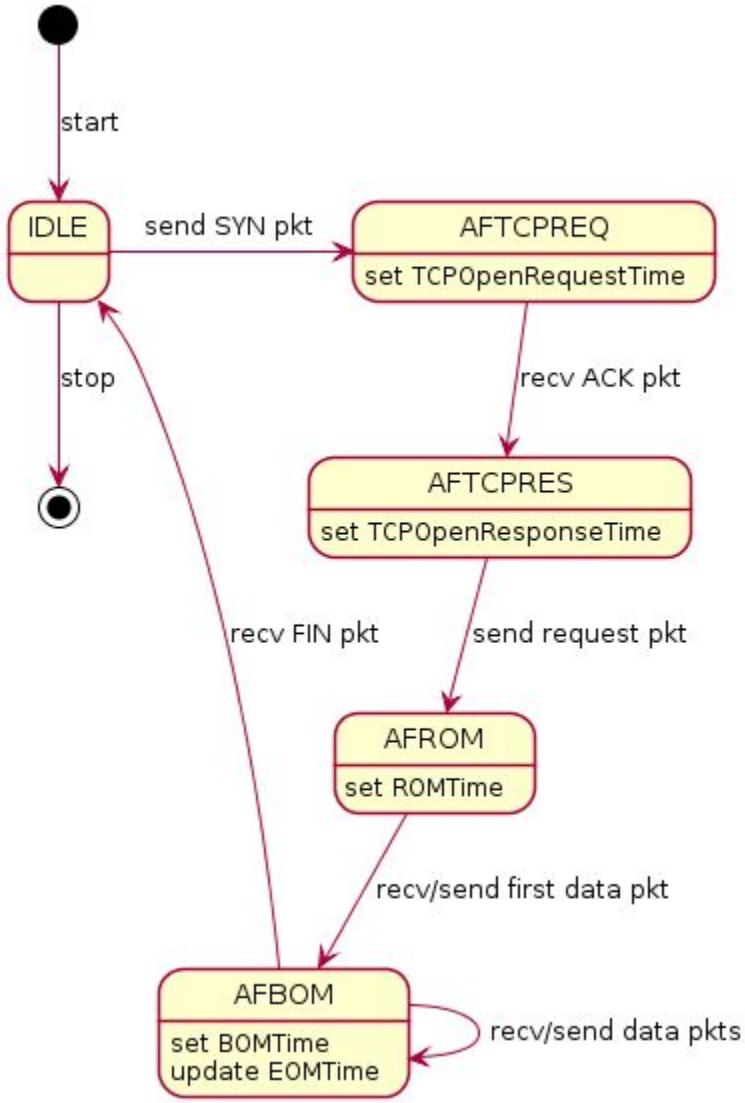
To archive high accuracy of timing and other information during network transmission, capture module uses libpcap to capture every IP packet and analyze necessary part of the packet. The fundamental class PktCapture is responsible for generic operation of libpcap, such as setup, start, stop, and rough process of captured packets. Its derived class PktCaptureUdp is used in UDP Echo Plus Test. PktCaptureHttp and PktCaptureFtp are used in Network Throughput Test for HTTP and FTP respectively.



In multi-session transfer scenario of Network Throughput Test, capture module creates a data structure (Class TR143TimeRecordHttp or TR143TimeRecordFtp) for each concurrent connection, which is differentiated by TCP port number. Such data structure is used to record necessary TR-143 information for corresponding connection. TR143TimeRecordHttp is for HTTP and TR143TimeRecordFtp is for FTP. Both are derived from a base class TR143TimeRecord.



TR143TimeRecordHttp and TR143TimeRecordFtp maintain a state machine to keep tracking time of packets during transfer:



Transfer Module

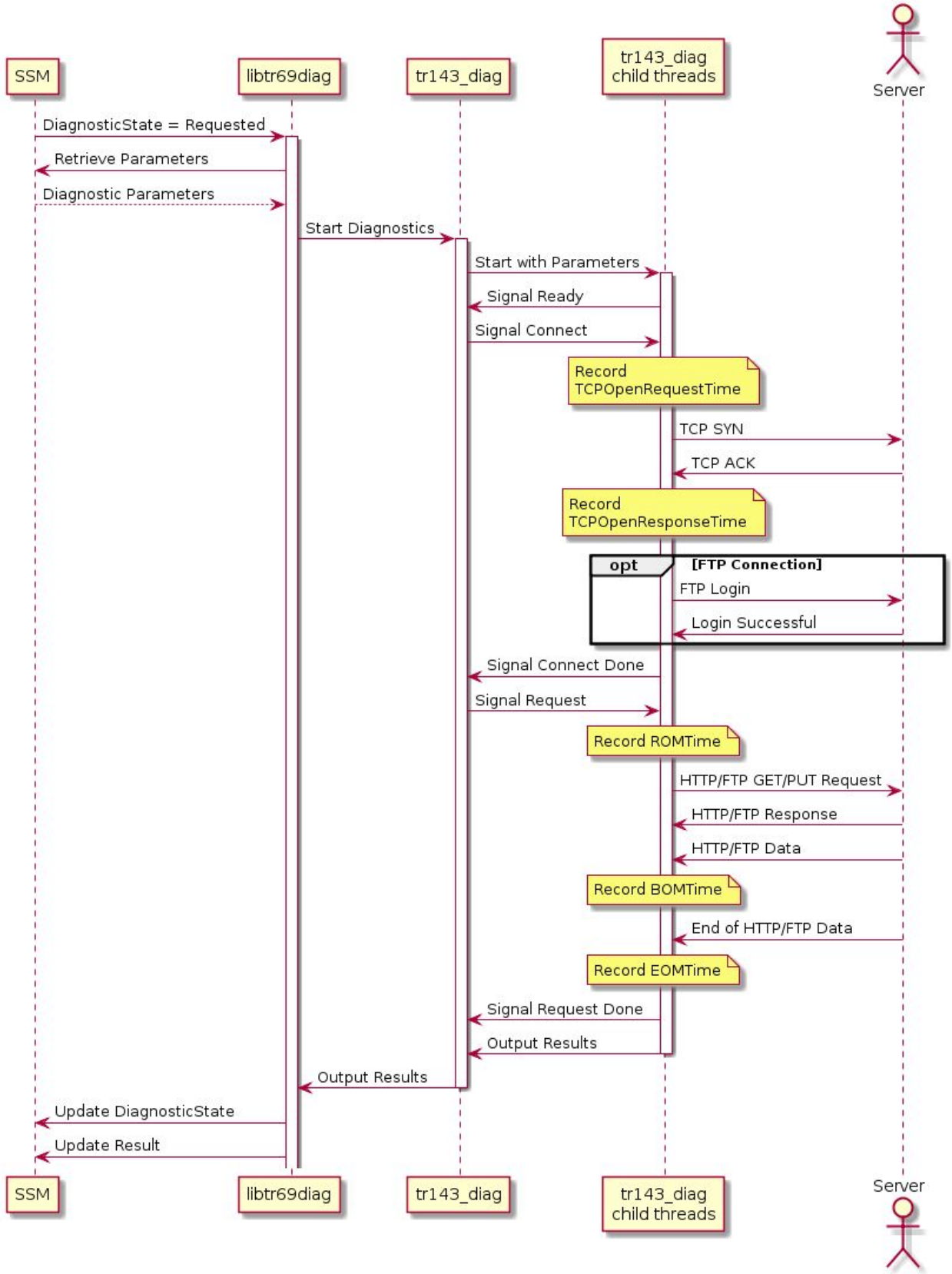
There are two sub modules CurlTransfer and UDPEchoPlusServer for Network Throughput test and UDP Echo Plus test respectively.

Network Throughput Test

CurlTransfer module is based on libcurl, and responsible for HTTP/FTP uploading/downloading. In order to support multiple session test, this module can be executed in multiple threads at the same time. To be thread-safe, two options must be set:

1. Signal must be disabled in libcurl using option CURLOPT_NOSIGNAL
2. Thread callback functions must be defined for libopenssl: pthreads_locking_callback() and pthreads_thread_id()

A full sequence of Network Throughput test is as follows:


SSM
libtr69diag
tr143_diag
tr143_diag child threads
Server
DiagnosticState = Requested
Retrieve Parameters
Diagnostic Parameters
Start Diagnostics
Start with Parameters
Signal Ready
Signal Connect
Record TCPOpenRequestTime
TCP SYN
TCP ACK
Record TCPOpenResponseTime
opt
[FTP Connection]
FTP Login
Login Successful
Signal Connect Done
Signal Request
Record ROMTime
HTTP/FTP GET/PUT Request
HTTP/FTP Response
HTTP/FTP Data
Record BOMTime
End of HTTP/FTP Data
Record EOMTime
Signal Request Done
Output Results
Output Results
Update DiagnosticState
Update Result
SSM
libtr69diag
tr143_diag
tr143_diag child threads
Server

UDP Echo Plus Test

UDPEchoPlusServer is based on boost socket libraries and responsible for UDP Echo Plus test. Besides echoing each request from outside, it communicates with PktCaptureUdp module to get corresponding timestamp information and puts them into the response. It also outputs such information to SSM for record purpose, referring to the following interfaces.

Interfaces

Input parameters of tr143_diag

All writable TR-143 parameters can be used as input parameters passed to tr143_diag to prepare diagnostics operations. Input parameters may have following format:

Usage: tr143_diag [options]

Options:

-t, --DiagType (UDPEchoPlus)	diagnostic type: dl (download), ul (upload), echo (UDPEcho), or echo+
-n, --ThreadNum	specify number of concurrent threads (valid in download/upload diagnostics)
-i, --Interface	specify interface to be used (valid in all diagnostics)
-D, --DSCP	specify DSCP in IP header (valid in download/upload diagnostics)
-l, --TestFileLength	specify file length (valid in upload diagnostics)
-o, --Timeout diagnostics)	specify timeout (ms) for transfer attempt (valid in download/upload
-u, --URL	specify URL (valid in download/upload diagnostics)
-p, --Port	specify listening port (valid UDPEchoPlus diagnostics)
-s, --SourceIPAddress	specify source IP to accept (valid in UDPEchoPlus diagnostics)

Output of tr143_diag

All readable TR-143 parameters (i.e., results) are included in the output of tr143_diag, as following format:

Output of upload/download diagnostics (overall followed by each thread's statistics):

DiagnosticsState=xxx,TCPOpenRequestTime=xxx,TCPOpenResponseTime=xxx,ROMTime=xxx,BOMTime=xxx,EOMTime=xxx,FullLoadTestBytes=xxx,FullLoadTotalBytes=xxx,TestBytes=xxx,TotalBytes=xxx

1:
DiagnosticsState=xxx,TCPOpenRequestTime=xxx,TCPOpenResponseTime=xxx,ROMTime=xxx,BOMTime=xxx,EOMTime=xxx

2:
DiagnosticsState=xxx,TCPOpenRequestTime=xxx,TCPOpenResponseTime=xxx,ROMTime=xxx,BOMTime=xxx,EOMTime=xxx

...

Output of UDP Echo (Plus) diagnostics (one output per pkt recv/sent):

EchoPlusSupported=xxx,PacketsReceived=xxx,PacketsResponded=xxx,BytesReceived=xxx,BytesResponded=xxx,TimeFirstPacketReceived=xxx,TimeLastPacketReceived=xxx

Issues

1. Download speed: HTTP/FTP download speed is capped at 300+ Mbps. Current investigation shows it's probably caused by driver issue.