User Guide

Laguna1.0

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Apache License

Version 2.0, January 2004

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Chapter 1

1 OVERVIEW

Laguna is a transparent caching control plane providing IP/MPLS traffic monitoring & analysis, cache definition management & traffic matching. It is part of a larger solution consisting of control systems and edge caches.

The solution helps service providers and network operators manage network utilization better by transparently caching popular Internet content within the provider's network. Once content is cached, consumer requests can be fulfilled using local server resources (i.e. edge caches) rather than accessing data through the Internet peering point. For the service provider, this reduces congestion on the IP network and access network, lowers peering and network costs, and provides improved control over network utilization during peak usage periods. From a consumer perspective, transparent caching improves the quality and performance of OTT streaming services.

The overall solution consists of the following open source projects:

1. Laguna
   - An open source transparent caching control plane providing traffic monitoring and analysis, policy management and profile matching, and a content caching decision engine
   - Sponsored by Concurrent, released under the Apache License Version 2.0
   - Available on GitHub at https://github.com/concurrentlabs/laguna
2. Traffic Control
   - An open source implementation of a content delivery network providing HTTP request routing, performance monitoring, and a web-based management console
   - Sponsored by Comcast, released under the Apache License Version 2.0
   - Available on GitHub at https://github.com/Comcast/traffic_control
3. Traffic Server
   - An open source implementation of an edge caching server providing edge caching, request fulfillment, and content streaming
   - Sponsored by the Apache Foundation, released under the Apache License Version 2.0
   - Available on GitHub at https://github.com/apache/trafficserver

The transparent caching solution addresses the following operator challenges by providing the following benefits:

Challenge	Benefits of the Solution
Costs are rising as over-the-top (OTT) internet traffic increases	Reduce Costs • Better manage OTT traffic • Reduce peering costs • Reduce network expenses (core, metro, access)

Challenge	Benefits of the Solution
Consumer's quality of experience (QoE) of internet content is inconsistent	Provide a consistent, high quality IP data service • Increase value of IP data services • Give users a consistent experience, even at peak loads • Reduce video buffering and increase bitrates
Internet traffic flows are unpredictable	Create ability to manage internet OTT traffic • Reduce traffic peaks • Provide caching capability to reduce load on the network infrastructure • Decrease the impact of OTT demand peaks by smoothing the effects of increased traffic

1.1 SYSTEM ARCHITECTURE

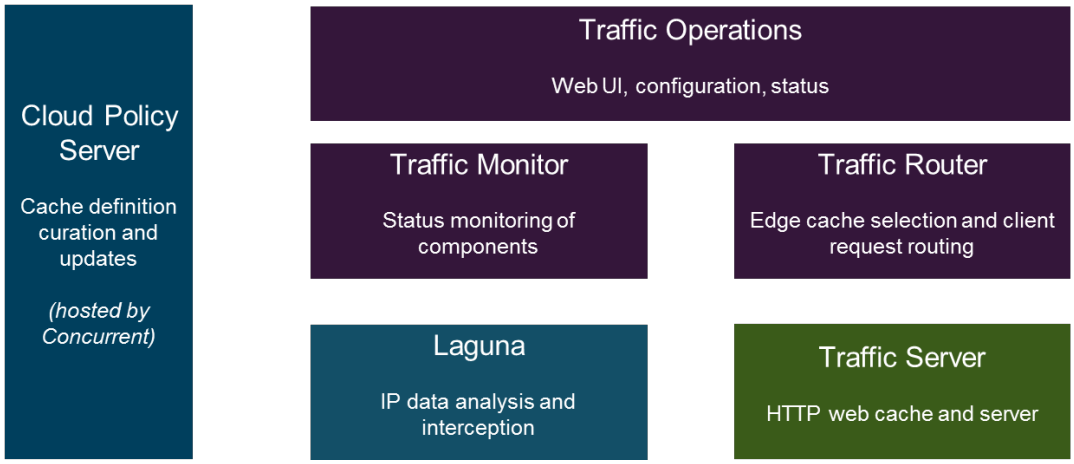
The transparent caching solution is targeted with transparently caching Internet video content that is hosted on web sites external to an operator's network. There need be no business agreement between the operator and the web site in order to cache the content on the caches within the operator's network. The caching happens transparently, without requiring changes on the web site or subscriber's equipment.

The overall solution is composed of the following components:

1. Laguna
    a. Integrates with the data network via optical tap or mirrored switch port provided by the operator. Supports IP networks and MPLS networks.
    b. Monitors and analyses data traffic
    c. Intercepts traffic based upon configurable algorithms and cache definition policies
2. Traffic Control: Consists of three main components
    a. Traffic Operations
        i. Provides web-based UI and configuration capabilities for the system
        ii. Centralized operational platform, providing graphs and dashboards of system activity
    b. Traffic Monitor
        i. Monitors edge caches and overall health of the system
    c. Traffic Router
        i. Receives client requests for content
        ii. Redirects to an available edge cache in the client's area
3. Traffic Server
    a. Apache Traffic Server (ATS) instance
    b. Services client HTTP requests
    c. Caches internet-sourced content

4. Cloud Policy Server
    a. Non-open source server hosted by Concurrent
    b. Provides curated cache definition profiles/policies to deployed transparent cache systems

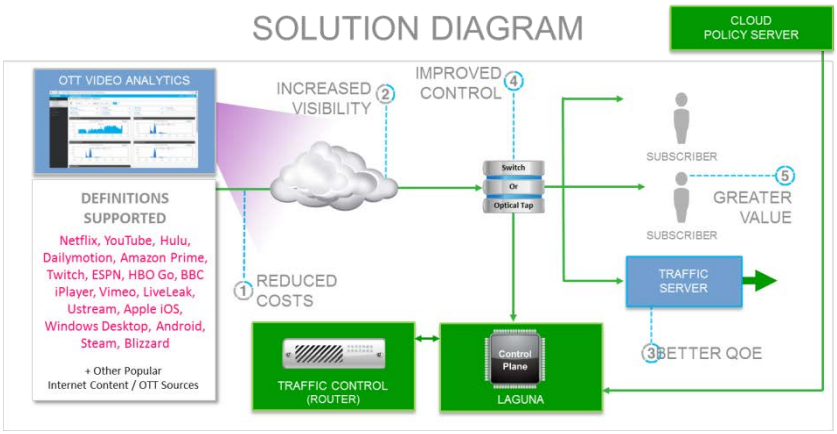
The following diagram illustrates the components described above:



In addition to the transparent caching components, there are also external components involved in the system:

1. Internet Websites
    - These are internet sites which host video content or software files which will be cached by the transparent caching system within the operator's network.
2. Client devices:
    - These are devices that end-users utilize to request content from the internet. These devices include PCs, HTTP TV devices, tablets, and mobile devices.
3. IP Network infrastructure:
    - This is the IP network deployed by the operator to route traffic from clients using their IP data services to the internet.

The following logical diagram illustrates the solution's interaction with client requests and internet-based content:



1.1.1 Typical Network Integration

The Laguna control plane component of the transparent caching system receives IP and/or MPLS traffic via a tap in the network. This tap is an interface on a network switch, and the "tapping" can be done anywhere in the network where Internet traffic from an operator's subscribers can be accessed. The tap can be either an optical tap or port mirroring from a switch.

The purpose of the tap is to relay this Internet traffic to Laguna. This relay occurs in parallel to the outbound transfer of the traffic out to the Internet. Thus, a subscriber's Internet traffic travels simultaneously both to the Control Plane as well as to the Internet site requested by the subscriber.

The Laguna server typically integrates with the operator's network via an operator-supplied optical network tap to the Laguna server's 10 GigE port(s). The edge cache integrates into a switch via a 10 GigE port(s), and Traffic Router integrates into a switch via a 1 GigE port(s). The Traffic Ops and Traffic Monitor processes must have network access to all components in the system for purposes of monitoring and log collection.

1.1.2 Functionality

The Laguna system operates off the concept of "services." A "service" is an internet site for which the Laguna system will monitor client requests and then direct client requests to cache. The following are the currently supported services:

- Youtube
- Netflix
- Hulu (mobile devices and appliances supported; desktop video is not supported as it is RTMP and not HTTP)
- Amazon Prime video
- Twitch
- ESPN
- HBO Go
- BBC iPlayer (on iOS devices)
- Daily Motion
- Vimeo

- LiveLeak
- Ustream
- Blizzard
- Steam
- Apple iOS updates
- Windows desktop updates (note that Windows mobile updates are not yet supported)
- Android updates

Note: The transparent caching system supports the caching of configured HTTP services on port 80; i.e. HTTPS and RTMP are not supported.

1.2 LAGUNA SUB-SYSTEMS

The Laguna transparent caching control plane is composed of the following sub-system components:

1.2.1 PACKET PROCESSOR

- Performs packet capture, network transport layer filtering, Layer2-Layer4 packet decoding for IPv4 and IPv6, HTTP GET packet filtering and processing, raw packet construction/injection for IPv4 and IPv6, and logging of messages to the Background Processor.

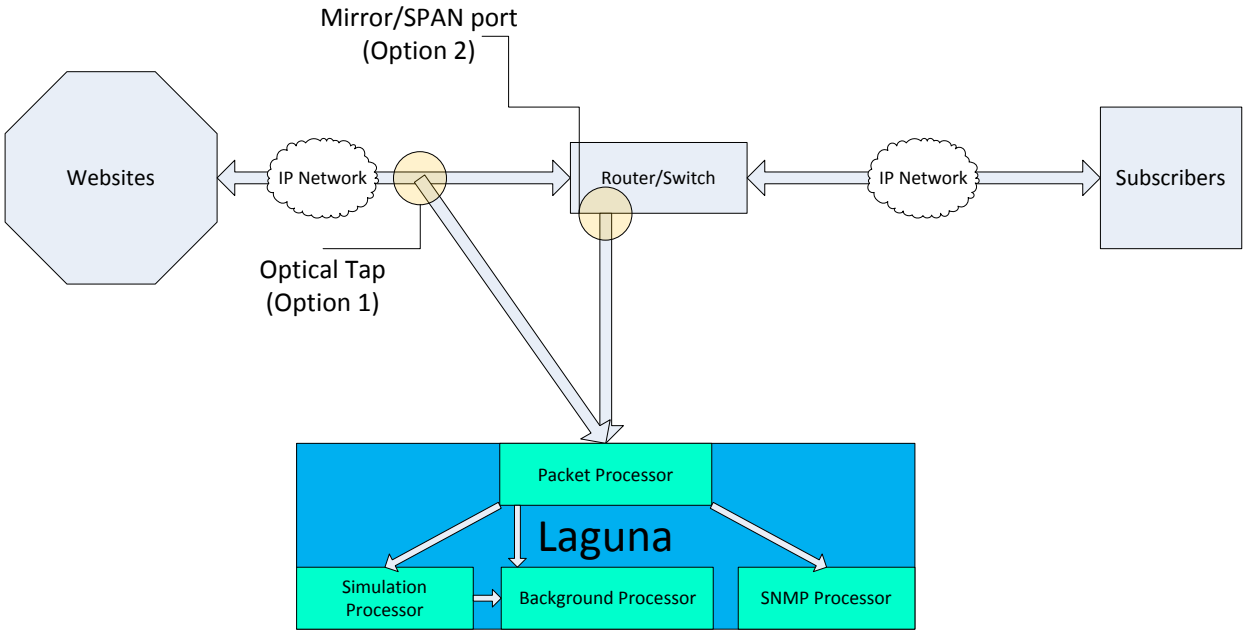
1.2.2 BACKGROUND PROCESSOR

- Reads log messages from the Packet Processor and simulation worker threads and writes them to persistent storage.
- Periodically checks to see if Laguna's configuration needs to be reloaded. If so, it sends the new configuration to the Packet Processor.

1.2.3 SIMULATION PROCESSOR

- When configured for simulation mode, Simulation Processor handles routing of requests to the simulation worker threads for extended processing that determines content size and cache key information to log simulation messages to the Background Processor.

The following logical diagram illustrates these components in connection with the network:



Chapter 2

2 LAGUNA FEATURES

The Laguna system supports the following general features.

2.1 CONFIGURABLE TRANSPARENT CACHING POLICIES

2.1.1 FLEXIBLE CACHING DEFINITION PROFILES

Laguna can be provisioned with multiple cache definition profiles (“services”) for which traffic will be transparently cached. These service types include live video, video, software downloads, and OS updates. These services correspond to internet websites or content sources, such as YouTube, Netflix, Hulu, HBO, ESPN, Apple iOS updates, and Microsoft Windows updates. Each service has a corresponding caching definition and algorithm associated with it. Note that currently the caching of HTTP traffic on port 80 is supported.

2.1.2 UPDATES VIA API

As the various internet websites make changes to the way they serve content, it may become necessary to update the caching definition for each of the corresponding services. Laguna allows for these definitions to be updated in real-time via a Web Services API; this allows changes to be made during run-time. Alternatively, changes can be made in the configuration files and the Laguna processes restarted.

2.2 TRAFFIC MONITORING AND ANALYSIS

2.2.1 IPV4 AND IPV6

Laguna can monitor and analyze both IPv4 and IPv6 traffic.

2.2.2 PACKET FILTERING AND DECODING

Laguna performs network transport layer packet filtering, Layer 2 through Layer 4 packet decoding, HTTP GET packet filtering and processing, reassembly of TCP HTTP protocol fragments, and raw packet construction and injection. This includes the ability to filter from within an MPLS network, based on MPLS labels.

2.2.3 SESSION CORRELATION

Laguna correlates IP packets together to identify a “session” and the content being served by that session. This is useful for reporting purposes as well as cache purging use cases.

2.2.4 LOGGING

Information concerning the decisions performed by Laguna are logged at the following selectable logging levels: debug, info, notice ,warn, error, fatal.

2.2.5 SIMULATION MODE

Provides enhanced simulation logging that is used by the management system to determine the theoretical bandwidth savings if the transparent caching system were placed in the active mode.

2.3 INTERNAL OPERATIONAL MODE MONITORING

Laguna internally monitors the other key components within the transparent cache system and will automatically switch from the active (redirecting) mode to a monitor mode if it detects any of the following conditions:

- Injection node (request router or edge cache) is down
- Incorrect Gateway MAC address is configured (router or other)
- The maximum redirection rate has been exceeded. (req/sec)

When any of these conditions occur, an error message is logged to the “tr_comp” logging component.

Example:

[ERROR] 2014-12-03 15:12:05. 3 “Error! transc is changing the operation mode from active to monitor”

Chapter 3

3 DOWNLOADING AND INSTALLING LAGUNA

These notes provide instructions on howto download and install the Laguna Transparent Caching Server Control Plane on 64-bit Linux CentOS 7 systems. Ensure at least the *Compatibility libraries* and *Development Tools*group of packages are available on the build server, in addition others may be required—use *yum* to resolve these package dependencies.

Refer to CentOS 7-scripts/SCRIPTS directory for scripts to help setup build and deployment systems.

3.1.1 PREREQUISITES

Create a working sandbox into which you will download and build the libraries and/or packages specified in steps 1-8 before attempting to build the Laguna application outlined in step 9 below.

1. C YAML File Parser Library
   Home http://pyyaml.org/wiki/LibYAML
   Download http://pyyaml.org/download/libyaml/yaml-0.1.5.tar.gz
   tar -zxvf yaml-0.1.5.tar.gz
   ./configure
   make
   sudo make install && ldconfig

2. C Logging Library
   Home https://github.com/HardySimpson/zlog
   Download zlog https://github.com/HardySimpson/zlog/archive/latest-stable.tar.gz
   tar -zxvf zlog-latest-stable.tar.gz
   cd zlog-latest-stable/
   make
   sudo make install && ldconfig

3. C JSON library
   Home http://www.digip.org/jansson
   Download jansson http://www.digip.org/jansson/releases/jansson-2.7.tar.gz
   tar –zxvf jansson-2.7.tar.gz
   ./configure
   make
   make check
   sudo make install && ldconfig

4. *C ZeroMQ Distrubuted Messaging Library*
   Home http://zeromq.org
   Dowload zeromq http://download.zeromq.org/zeromq-4.1.3.tar.gz
   Make sure that libsodium, libtool, pkg-config, build-essential, autoconf, and automake are installed.
   Check whether uuid-dev package, uuid/e2fsprogs RPM or equivalent on your system is installed
   ./configure
   make
   make check
   sudo make install && ldconfig

5. C Binding for ZeroMQ Library
   Home https://github.com/zeromq/czmq/releases
   Download czmq https://github.com/zeromq/czmq/archive/v3.0.2.tar.gz
   ./autogen.sh
   ./configure
   make
   make check
   sudo make install && ldconfig

6. PF_RING™ Linux kernel module and user-space packet processing framework
   Home https://github.com/ntop
   git clone https://github.com/ntop/PF_RING.git
   cd PF_RING/kernel
   make
   sudo make install
   cd ../userland/lib
   sudo make install
   sudo insmod ./pf_ring.ko

7. C Lock-free Data Structure Library
   Home http://www.liblfds.org
   git clone https://github.com/liblfds/liblfds6.1.1
   cd liblfds6.1.1/liblfds611
   mkdir bin; mkdir obj
   make –f makefile.linux ardbg
   sudo cp inc/liblfds611.h usr/local/include
   sudo cp bin/liblfds611.a /usr/local/lib

8. C Prototyping Library provides cp_mempool
   home http://cprops.sourceforge.net
   download http://sourceforge.net/projects/cprops/files/cprops/cprops-0.1.12/libcprops-0.1.12.tar.gz
   tar –xvf libcprops-0.1.12.tar.bz2
   cd libcprops-0.1.12
   ./configure
   make
   sudo make install && ldconfig

9. C Transparent Caching Server Control Plane
   Home https://github.com/concurrentlabs/laguna
   git clone https://github.com/concurrentlabs/laguna
   ensure soft link /usr/lib64/libpcap.so -> libpcap.so.1.5.3 exists
   cd 1.0
   make release
   make package

10. Install TCS Package
    rpm -ivh install/rpm/x86_64/release/RPMS/x86_64/transparent_caching-1.4.1-1.x86_64.rpm

3.1.2 NOTES

1) Building RPMs

make PFRING=1 package or make package will an create RPM with pfring the as packet capture option

RPM location: /install/rpm/x86_64/release/RPMS/x86_64/transparent_caching-x.x.x-x.x86_64.rpm

2) Configuration

Modify /etc/sysconfig/transparent_caching/config.yaml to specify redirect location, monitoring interface and outgoing interface

(optional) modify /etc/sysconfig/transparent_caching/trlog.conf to direct "INFO" output results to console or file.

3) Running

service [re]start transc

Play any youtube, netflix, etc site clip and check output log (/var/log/trservice.log and /var/log/trcomp.log).

libpcap support

Add PFRING=0 option to make, in order to build a libpcap version of control plane. EX: "make PFRING=0 package"

Chapter 4

4 LAGUNA OPERATION

4.1 NETWORK CONFIGURATION PROCEDURES

All instructions below assume network connectivity has been established first. Ensure that the DNS for the system is setup for (not on) the server (modify `resolv.conf` to set the `nameserver` to the correct DNS server for the network).

For example:

```
/etc/resolv.conf
nameserver 4.2.2.2
```

Note: Edge caches must also be configured to point to the correct DNS Server so that they can resolve host names from the HTTP requests in order to source content from the internet origin in the case of a cache miss.

The server may be set up to support either IPv4 or IPv6 or both. If iptables or ip6tables are in use, these must allow access to port 80, snmp port 161, 162 and agentx port 705.

Below is an example of an iptables script which opens the correct ports.

```
# Generated by iptables-save v1.4.7 on Thu May  8 15:18:46 2014
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [144:9792]
-A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 22 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A INPUT -i eth0 -p tcp -m tcp --dport 80 -m state --state NEW,ESTABLISHED -j
ACCEPT
-A INPUT -p tcp -m tcp --dport 80 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 161 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 162 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 705 -j ACCEPT
-A FORWARD -j REJECT --reject-with icmp-host-prohibited
-A OUTPUT -o eth0 -p tcp -m tcp --sport 80 -m state --state ESTABLISHED -j
ACCEPT
-A OUTPUT -o eth0 -p tcp -m tcp --sport 161 -m state --state ESTABLISHED -j
ACCEPT
-A OUTPUT -o eth0 -p tcp -m tcp --sport 162 -m state --state ESTABLISHED -j
ACCEPT
```

```
-A OUTPUT -o eth0 -p tcp -m tcp --sport 705 -m state --state ESTABLISHED -j
ACCEPT
-A OUTPUT -o eth0 -p tcp -m tcp --sport 80 -m state --state ESTABLISHED -j
DROP
-A OUTPUT -o eth0 -p tcp -m tcp --sport 161 -m state --state ESTABLISHED -j
DROP
-A OUTPUT -o eth0 -p tcp -m tcp --sport 162 -m state --state ESTABLISHED -j
DROP
-A OUTPUT -o eth0 -p tcp -m tcp --sport 705 -m state --state ESTABLISHED -j
DROP
COMMIT
# Completed on Thu May  8 15:18:46 2014
```

Below is an example of the equivalent ip6tables script.

```
: # Generated by ip6tables-save v1.4.7 on Thu May  8 15:30:55 2014
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
-A INPUT -p ipv6-icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 22 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp6-adm-prohibited
-A INPUT -p tcp -m tcp --dport 80 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 161 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 162 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 705 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 80 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 161 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 162 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 705 -j ACCEPT
-A FORWARD -j REJECT --reject-with icmp6-adm-prohibited
COMMIT
# Completed on Thu May  8 15:30:55 2014
```

4.2 CONFIGURATION FILES

The configuration files for Laguna are described below for reference:

- /etc/sysconfig/transparent_caching/config.yaml

  This is the main configuration file for Laguna. It is used to define general system configuration variables and also to define the services that are to be cached.

- /etc/sysconfig/transparent_caching/trlog.conf

  The trlog.conf file defines logging levels and logging format for Laguna. By default, logs will be rotated when they reach 10 MB in size, and up to 12 log files are retained.

- Management API: /usr/local/bin/api_server/config.yaml

  This configuration file defines the configuration values used by the Management API.

- Management API: /usr/local/bin/api_server/servers.yaml

  This configuration file defines additional configuration values used by the Management API.

Laguna's main configuration is stored in the `config.yaml` file on the Control Plane. The following are the fields in the configuration file:

Tag Name	Description	Unit	Limits	Optional	Relationships
/version	Config version	String	32 bytes	No	None
/modeofoperation	Mode of operation: "active" or "monitor"	String	32 Bytes	No	None
/monitoringinterface	Multiple monitoring interface options separated by ";". Format: <intf-name>:<intf-direction>;…. <intf-direction>: • rx • tx example: "eth0:rx";"eth1:tx" common usage: "eth0:rx"	String	256 bytes	No	/pcap-filter
/redirectaddress	Redirect packets from specified monitoring interface to specified Request Router (RR) or caching server address. Address for each monitoring interface also serves as black list address. Interface name followed by redirection address format: '"<intf>:<rediraddr>";…' or old format '<rediraddr>' Example: '"eth0:192.168.100.100"; "eth1:192.168.100.101"' **Note**: backward compatibility. If only one	String	512 bytes	No	/monitoringinterface

Tag Name	Description	Unit	Limits	Optional	Relationships
	interface'<redir addr>' is specified and mapping of interface name is not specified, all monitoring interface(s) will go to the same address.				
/outgoinginterface	Outgoing interface(s) packet injection point (Tx line). Interface name followed by target node type format: '"<intf>:<router/other>",…' or old format '<router/other>' Example: '"eth1:other";"eth0:router" **Note**: Backward compatibility. If only one interface is specified and mapping of interface name is not specified, all monitoring interface(s) will map/link to the same outgoing interface. **Note**: IP address MUST be specified on linux interface (ifconfig) if outgoing interface is to be connected to "router".	String	256 bytes	No	None
/outgoinginterfacedestmac	Outgoing interface injection packet destinamation MAC address. When set, the value will overwrite the value determined by the gwdisc service (gateway discovery service). Interface followed by MAC address. Format: '"<intf>:<MAC address>",…' Automatically set by gwdisc service.	String	256 bytes	Yes	/outgoinginterface
/outgoinginterfacesrcmac	Outgoing interface injection packet source MAC address. When set, the value will overwrite content gwdisc service (dataeway discovery service).	String	256 bytes	Yes	/outgoinginterface

Tag Name	Description	Unit	Limits	Optional	Relationships
	Format: '"<intf>:<MAC address>",…' Automatically set by gwdisc service.				
/outgoinginterfaceignorecors	Filter to ignore all CORS (Cross Origin Resource Sharing) requests with value can be set to 'true' or 'false. Default value is false	String	16 bytes	Yes	/outgoinginterface
/outgoinginterfacemplslabel	Inject packet with mpls label within Layer 2.5 with value can be set to 'true' or 'false'. Default value is false.	String	16 bytes	Yes	/outgoinginterface
/outgoingredirreqratemax	The maximum redirection request rate that Laguna will send to the redirection IP. If not specified will default to 5000 req/sec. Example: "2500"	String	32 bytes	Yes	/outgoinginterface
/mapinterface	Map or link monitoring Rx interface to outgoing interface Tx. Format: '"<mon-intf>:<out-intf>",...' Example '"eth0:eth0";"eth1:eth1"'	String	256 bytes	Yes	/outgoinginterface,/monitorinnginterface
/processproxyrequest	Process proxied request 'true' or 'false'. Default value is false.	String	16 bytes	No	None
/bwsimulationmode	Bandwidth simulation mode. "true" for active or "false" for passive simulation mode.	String	16 bytes	No	/bws imulationworkers
/bwsimulationworkers	Number of simulation worker threads. By default 15 workers will be created if on active mode and only 1 on non-active simulation mode. This value is static and not a reloadable configuration.	String	16 bytes	Yes	/bwsimulationmode
/bwsimulationoutgoinginterface	Bandwidth simulation mode outgoing interface. It will try to pick the interface through routing table	String	64 bytes	Yes	None

Tag Name	Description	Unit	Limits	Optional	Relationships
	if not specified.				
/pcap-filter	Apply filter(s) on specified monitoring interface in Berkeley Packet Filter (BPF) format.Interface name followed by BPFfilter format: '"<intf>:<BPF>";...' Example: '"eth0:tcp dst port 80"; "eth1:mpls 29 and tcp dst port 80"' Note: An interface can have multiple BPF filters. common usage: “eth0:tcp dst port 80”	String	1024 bytes	No	/monitoringinterface
/ipblacklist	Black list of ip address separated by a comma (“,”).	String	1024 bytes	Yes	None
/services	List of interested monitored target content services	List	64 objects	No	
/services/type	Content type	String	64 bytes	No	None
/services/target	Content target name	String	256 bytes	No	None
/services/options	Cache server site content options comma separated, “cache” or “nocache”. (TBD)	String	32 bytes	No	None
/services/httphdrmatchsignature	Generic HTTP field-value header filter signature pattern separated by “;” in ‘”<fieldname>:<value>”;…’ format. Request will be processed if field-value match is found, otherwise ignored. Can be set to overload /services/hostsignature value.	String	256 bytes	Yes	None
/services/hostsignature	Content HTTP header hostname signature pattern separated by “;”	String	256 bytes	Yes	None
/services/referersignature	Content HTTP header referrer signature pattern separated by “;”. Overloads content cache key Id value.	String	256 bytes	Yes	/services/url/cachekeyid

Tag Name	Description	Unit	Limits	Optional	Relationships
/services/httprangefield	Content HTTP header range field name. Overloads content cachekey range value.	String	256 bytes	Yes	/services/url/cachekeyrange
/services/httpsessionfield	Content HTTP header session field name. Media stream contexts are grouped by session id if specified.	String	256 bytes	Yes	/services/url/contextid
/services/url	List of content GET request URL signature	List	64 objects	No	None
/services/url/signature	Content GET request URL signature	String	1024 bytes	No	None
/services/url/maxmatchsize	Maximum URL GET request signature match size length.	Unsigned int	128 bytes	No	None
/services/url/contextid	Multiple content context Id URL relationships to none of list of session signature patterns for HTTP GET separated by ";". Context is grouped by session id if specified.	String	1024 bytes	No	/services/session/contextid
/services/url/cachekeyid	Multiple content cache key Id URL signature patterns for HTTP GET separated by ";". Being Overloaded by HTTP header referrer field value.	String	1024 bytes	No	/services/referersignature
/services/url/cachekeyrange	Content cache key range URL signature pattern for HTTP GET. Being Overloaded by HTTP header range field value.	String	1024 bytes	Yes	/services/httprangefield
/services/url/cachekeymisc	Multiple content cache key miscellaneous URL signature patterns for HTTP GET separated by ";"	String	1024 bytes	Yes	None
/services/session	List of session GET request signature	List	64 objects	Yes	None
/services/session/signature	Session GET request signature	String	1024 bytes	No	None
/services/session/maxmatchsize	Maximum session GET request signature match size length	Unsigned int	128 bytes	No	None
/services/session/cachekeyid	Multiple session cache key Id signature patterns for HTTP GET separated by ";".	String	1024 bytes	No	None

Tag Name	Description	Unit	Limits	Optional	Relationships
/services/session/contextid	Multiple session context Id relationships to list of urls signature patterns for HTTP GET separated by “;”	String	1024 bytes	No	/services/url/contextid
/services/session /cachekeyrange	Content cache key range session signature pattern for HTTP GET. Being Overloaded by HTTP header range field value.	String	1024 bytes	Yes	/services/httprangefield
/services/session /cachekeymisc	Multiple content cache key miscellaneous session signature patterns for HTTP GET separated by “;”	String	1024 bytes	Yes	None

```
Control plane runtime and pattern matching reloadable configuration structures
Tag Name                        Description                           Unit
Limits        Optional     Relationships
*****************************************************************************
**************************************************

/version                        Config version                        String
32 bytes       No            None

/modeofoperation                Mode of operation:
                                "active" or "monitor"                 String
32 bytes       No            None

/monitoringinterface            Monitoring interface(s).
                                Interface name followed by traffic
                                direction format:
                                '"<intf>:<rx/tx>";...'
                                example:
                                '"eth0:rx";"eth1:rx"'                 String
256 bytes      No            None

/pcap-filter                    Apply filter(s) on specified
                                monitoring interface in Berkeley
                                Packet Filter (BPF) format.
                                Interface name followed by BPF
                                filter format:
                                '"<intf>:<BPF>";...'
                                Example:
                                '"eth0:tcp dst port 80";
                                "eth1:mpls 29 and tcp dst port 80"'
                                Note: An interface can have
                                multiple BPF filters.                 String
1024 bytes     No            /monitoringinterface

/redirectaddress                Redirect packets from specified
                                monitoring interface to specified
                                Request Router (RR) or caching server
                                address. Address for each monitoring
                                interface also serves as black list
                                address. Interface name followed
                                by redirection address format:
                                '"<intf>:<redir addr>";...'
```

		or old format '<redir addr>' Example: '"eth0:192.168.100.100"; "eth1:192.168.100.101"' Note: backward compatibility. if only one interface '<redir addr>' is specified and mapping of interface name is not specified, all monitoring interface(s) will go to the same address.	String	
512 bytes	No	/monitoringinterface		
/outgoinginterface		Outgoing interface(s) packet injection point (Tx line). Interface name followed by target node type format: '"<intf>:<router/other>",...' or old format '<router/other>' example: '"eth1:other";"eth0:router"' Note: backward compatibility. if only one interface is specified and mapping of interface name is not specified, all monitoring interface(s) will map/link to the same outgoing interface. note: IP address MUST be specified on linux interface (ifconfig) if outgoing interface is to be connected to "router".	String	
256 bytes	No	None		
/outgoinginterfacedestmac		Outgoing interface injection packet destination MAC address. When set, the value will overwrite content gwdisc service value. Interface name followed by MAC address format: '"<intf>:<MAC address>",...'		

		Automatically set by gwdisc service.		String
256 bytes	yes	/outgoinginterface		
/outgoinginterfacesrcmac		Outgoing interface injection packet source MAC address. When set, the value will overwrite content gwdisc service value. Interface name followed by MAC address format: '"<intf>:<MAC address>",...'		
		Automatically set by gwdisc service.		String
256 bytes	yes	/outgoinginterface		
/outgoinginterfaceignorecors		Filter to ignore all CORS (Cross Origin Resource Sharing) requests with value can be set to 'true' or 'false'.		
		False by default.		String
16 bytes	yes	/outgoinginterface		
/outgoinginterfacemplslabel		Inject packet with mpls label within Layer 2.5 with value can be set to 'true' or 'false'.		
		False by default.		String
16 bytes	yes	/outgoinginterface		
/outgoingredirreqratemax		Maximum Inject redirect rate (pkts/sec) . 5k pkts/sec by dafault.		String
32 bytes	yes	/outgoinginterface		
/mapinterface		Map or link monitoring Rx interface to outgoing interface Tx. Format: '"<mon-intf>:<out-intf>",...' Example: '"eth0:eth0";"eth1:eth1"'		String
256 bytes	yes	/outgoinginterface,/monitoringinterface		
/ipblacklist		Black list of ip address separated by “,”.		String
1024 bytes	yes	None		
/processproxyrequest		Process proxied request 'true' or 'false'.		
		False by default.		String
16 bytes	No	None		

```
/bwsimulationmode               Bandwidth simulation mode
                                'true' or 'false'. False
                                by default.                          String
16 bytes        No            None
/bwsimulationoutgoinginterface  Bandwidth simulation mode
                                outgoing interface for
                                GET and HEAD request.
                                Routing table based by default.
                                example: eth0                        String
64 bytes        No            None
/bwsimulationworkers            Bandwidth simulation mode
                                worker threads to perform
                                GET and HEAD request.                String
16 bytes        No            None.
                                1 woker by default.
/services                       List of interested monitored
                                target content services              List
64 objects      No            None
/services/type                  Content type                         String
64 bytes        No            None
/services/target                Content target name                  String
256 bytes       No            None
/services/options               Cache server site content
                                options comma separated,
                                “cache”, “no-cache” or
                                "cache key cksum map format"
                                (<svcname>-ckeymap-
                                <container>-<cksumsize>)             String
32 bytes        No            None
/services/httphdrmatchsignature Generic Http field-value header
                                filter signature pattern separated
                                by “;” in '"<fieldname>:<value>";...'
                                format. Request will be processed if
                                field-value match is found
                                otherwise ignored. Can be set to
                                overload /services/hostsignature
                                value.                               String
256 bytes       Yes           None
/services/hostsignature         Hostname filter signature pattern
```

			separated by “;”. Request will be processed if hostname match is found otherwise ignored.	String	256 bytes	Yes	None
/services/referersignature			Content HTTP header referrer signature pattern separated by “;”. Overloads content cache key Id value.	String	256 bytes	Yes	/services/url/cachekeyid
/services/httprangefield			Content HTTP header range field name. Overloads content cachekey range value	String	256 bytes	Yes	/services/url/cachekeyrange
/services/url			List of content GET request URL signature	List	16 objects	No	None
/services/url/signature			Content GET request URL signature	String	1024 bytes	No	None
/services/url/maxmatchsize			Maximum URL GET request signature match size length	Unsigned int 128 bytes	No	None
/services/url/contextid			Multiple content context Id URL relationships to none or list of sessions signature patterns for HTTP GET separated by “;”. Context is grouped by session id if specified.	String	1024 bytes	No	/services/session/contextid,
/services/url/cachekeyid			Multiple content cache key Id URL signature patterns for HTTP GET separated by “;”. Being Overloaded by HTTP header referrer field value.	String	1024 bytes	No	/services/referersignature
/services/url/cachekeyrange			Content cache key range URL signature pattern for HTTP GET. Being Overloaded by HTTP header range field value.	String	1024 bytes	Yes	/services/httprangefield

```
/services/url/cachekeymisc      Multiple content cache key
                                miscellaneous URL signature
                                patterns for HTTP GET separated
                                by “;”                                  String
1024 bytes      Yes           None
/services/session               List of session GET request
                                signature                               List
4  objects      Yes           None
/services/session/signature     Session GET request signature           String
1024 bytes      No            None
/services/session/maxmatchsize  Maximum session GET request
                                signature match size length             Unsigned
int 128 bytes    No            None
/services/session/cachekeyid     Multiple session cache key Id
                                signature patterns for HTTP GET
                                separated by “;”.                       String
1024 bytes      No            None
/services/session/contextid     Multiple session context Id
                                relationships to list of urls
                                signature patterns for HTTP GET
                                separated by “;”                        String
1024 bytes      No            /services/url/contextid
/services/session/cachekeyrange Content cache key range
                                session signature pattern for
                                HTTP GET. Being Overloaded by
                                HTTP header range field value.          String
1024 bytes      Yes           /services/httprangefield
/services/session/cachekeymisc  Multiple content cache key
                                miscellaneous session signature
                                patterns for HTTP GET separated
                                by “;”                                  String
1024 bytes      Yes           None
```

Below is an example of the /etc/sysconfig/transparent_caching/config.yaml file:

```
version: '1.3.1'
modeofoperation: 'active'
#example: monitoringinterface: '"eth0:rx";"eth1:tx"'
#monitoringinterface: '"eth1:rx"'
monitoringinterface: '"eth9:rx";"eth2:rx"'
```

```
#example: pcap-filter: '"eth0:tcp dst port 80 ";"eth1:tcp src port 80"'
#pcap-filter: '"eth1:tcp dst port 80";"eth1:tcp dst port 8080";"eth3:tcp dst
port 80"'
#pcap-filter: '"eth1:tcp dst port 8080";"eth1:tcp dst port 80"'
#pcap-filter: '"eth9:mpls 299841";"eth9:mpls 299840"'
#pcap-filter: 'eth9:mpls'
#pcap-filter: '"eth9:mpls";"eth2:mpls"'
pcap-filter: '"eth9:tcp dst port 80";"eth2:tcp dst port 80"'
#example: outgoinginterface: 'eth0:router' or 'eth0:other'
#outgoinginterface: 'eth6:router'
outgoinginterface: '"eth6:router";"eth2:router"'
#mapinterface: '"eth9:eth6";"eth2:eth2"'
mapinterface: 'eth9:eth6'
outgoinginterfaceaddmplstag: 'false'
processproxyrequest: 'true'
outgoingredirreqratemax: ''
outgoinginterfacedestmac: ''
outgoinginterfacesrcmac: ''
redirectaddress: '"eth9:10.16.103.40";"eth2:10.16.103.30"'
ipblacklist: '10.16.101.30,10.16.103.30'
bwsimulationmode: 'false'
bwsimulationoutgoinginterface: 'eth2'
bwsimulationworkers: '10'
services:
    #Notice! Please change below to cache when not in simulation mode
    - type: 'video'
      target: 'bbci'
      options: 'cache'
      hostsignature: '"akamaihd.net";"bbc.co.uk"'
      url:
            - signature: '^/[a-z]/iplayerstream/secure_auth/\,.*?(.ts)'
              maxmatchsize: 440
              cachekeyid: 'kbps/modav/([^\_]+).*?([^_]+)'
              cachekeymisc: '.*/(.*\.ts)'
    #Notice! Please change below to cache when not in simulation mode
    - type: 'video'
      target: 'dmotion'
```

```
      options: 'cache'
      hostsignature: 'dailymotion.com'
      url:
            - signature:
'^/sec\([^/]+/frag\([^/]+/video/[^/]+/[^/]+/.*?\.(flv|ts)'
              maxmatchsize: 110
              cachekeyid: '/([^/]+)/'
              cachekeymisc: '[^/]+/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
    # signature matches Android phone
    - type: 'video'
      target: 'dmotion'
      options: 'cache'
      hostsignature: 'dailymotion.com'
      url:
            - signature: '^\/video\/[0-9]+\/[0-9]+\/.*?\.mp4'
              maxmatchsize: 100
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/(.*?\.mp4)\?'
    #new amazon prime video - android devices
    - type: 'video'
      target: 'amazon'
      options: 'mss-cache'
      hostsignature: '(akamaihd.net|level3.net)'
      url:
            - signature: '^/prod/.*?.+\.ism/manifest'
              maxmatchsize: 110
              cachekeyid: '/([^/]+)/'
    #new amazon prime video - android devices
    - type: 'video'
      target: 'amazon'
      options: 'cache'
      hostsignature: '(akamaihd.net|level3.net)'
      url:
            - signature: '^/prod/.*?.+\.ism/QualityLevels\([0-9]'
              maxmatchsize: 110
              cachekeyid: '/([^/]+)/([^/]+)/'
              cachekeymisc: '/[^/]+/[^/]+/(.*)'
```

```
    #new amazon prime video - mobile and desktop only
    - type: 'video'
      target: 'amazon'
      options: 'mss-cache'
      hostsignature: '(akamaihd.net|level3.net)'
      url:
            - signature: '^/d/[^/]+/ondemand/[^/]+/prod/.*?.+\.ism/manifest'
              maxmatchsize: 150
              cachekeyid: '/([^/]+)/'
    #new amazon prime video - mobile and desktop only
    - type: 'video'
      target: 'amazon'
      options: 'cache'
      hostsignature: '(akamaihd.net|level3.net)'
      url:
            - signature:
'^/d/[^/]+/ondemand/[^/]+/prod/.*?(\.ism)/QualityLevels\('
              maxmatchsize: 150
              cachekeyid: '([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/(.*)'
    #signature matches Android phone, Desktop Browser (IE,Chrome,Firefox),
iPad
    - type: 'livevideo'
      target: 'twitch'
      options: 'cache'
      hostsignature: '(twitch.tv|hls.ttvnw.net)'
      url:
            - signature: '^/hls[0-9]([^/]+)/([^/]+)/([^/]+)/(.*?\.ts)'
              maxmatchsize: 80
              cachekeyid: '/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/([^/]+)/(.*?\.ts)'
    #signature matches Android phone - live streaming
    - type: 'livevideo'
      target: 'espn'
      options: 'cache'
      hostsignature: '"espn.go.com";"edgecastdns.net"'
      httphdrmatchsignature: '"User-Agent:!Roku'
```

```
      url:
            - signature: '^/hls/live/[0-9]+/[a-z]+/espn\w+-\w+-[0-9]+/.*?\.ts'
              maxmatchsize: 100
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc:
'/[^/]+/[^/]+/[^/]+/[^/]+/([^/]+)/([^/]+)/(.*?\.ts)'
            - signature: '^/slices/([^/]+)/([^/]+)/([^/]+)/(.*?\.ts\?)'
              maxmatchsize: 120
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/[^/]+/(.*?\.ts)'
            - signature: '^/ls[0-9]*/espn/[0-9]+/[0-9]+/[0-9]+/\w+/\w+/[0-
9]+/[0-9]+/.*?\.ts'
              maxmatchsize: 100
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc:
'/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/([^/]+)/([^/]+)/([^/]+)/(.*?\.ts)'
    #signature matches Android phone - non live streaming
    - type: 'video'
      target: 'espn'
      options: 'cache'
      hostsignature: 'espn.com'
      url:
            - signature: '^/motion/[0-9]+/[0-9]+/[^/]+/hls/.*?\.ts'
              maxmatchsize: 100
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/(.*?\.ts)'
    #signature matches Android, iPad
    - type: 'livevideo'
      target: 'nbcsports'
      options: 'cache'
      hostsignature: '"akamaihd.net";"nbcolympics.com"'
      url:
             # matches android
            - signature: '^/hls/live/[0-9]+/\w+/\w+/\w+/[0-9]+/segment_[0-
9]+\.ts'
              maxmatchsize: 100
              cachekeyid:
'/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)'
```

```
              cachekeymisc:
'/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/(.*?\.ts)'
            - signature: '^/nbc[0-9]+/[^/]+/\S+/QualityLevels\([0-
9]+\)/Fragments\('
              maxmatchsize: 200
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/([^/]+)/([^\?]+)'
    #signature matches iPad
    - type: 'video'
      target: 'nbcsports'
      options: 'mss-cache'
      httphdrmatchsignature: '"User-Agent:!(Mozilla|Chrome)'
      hostsignature: '"akamaihd.net";"nbcolympics.com"'
      url:
            - signature: '^/vod+/\S+\.ism/manifest'
              maxmatchsize: 200
              cachekeyid: '/([^/]+)/'
#    #Notice! Please change below to cache when not in simulation mode
#    #NBC Sports non live on android, iPad
    - type: 'video'
      target: 'nbcsports'
      options: 'cache'
      hostsignature: '"akamaihd.net";"nbcolympics.com"'
      url:
            - signature: '^/vod/[^/]+/\S+/QualityLevels\([0-9]+\)/Keyframes\('
              maxmatchsize: 220
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/([^/]+)/([^\?]+)'
            # matches iPad Event Replays
            - signature: '^/vod/[^/]+/\S+/QualityLevels\([0-9]+\)/Fragments\('
              maxmatchsize: 220
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/([^/]+)/([^\?]+)'
            # matches Android phone - Hightligts (non-live)
            - signature: '^/[a-z]*/HD/video_sports/NBC.*nbcsports/[0-9]+/[0-
9]+/.*\.mp4\.csmil/segment.*\.ts'
              maxmatchsize: 220
```

```
              cachekeyid:
'/([^/])/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)/(\w+.*\.mp4\.csmil)'
              cachekeymisc:
'/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/(.*?\.ts)'
            # matches Android phone - Event Replays (non-live)
            - signature: '^/vod/[^/]+/nbc-sports-live\S+/QualityLevels\([0-
9]+\)/Fragments\('
              maxmatchsize: 200
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/([^/]+)/([^\?]+)'
    - type: 'video'
      target: 'ytb'
      options: 'ytb-ckeymap-mp2ts-0_512'
      hostsignature: '"(googlevideo.com)+";"(youtube.com)+"'
      url:
            - signature: '^/videoplayback/id/o-.*\,'
              maxmatchsize: 145
              cachekeyid: '/videoplayback/id/([^/]+)'
              cachekeyrange: '\,([^/]+)/begin/'
              cachekeymisc:
'/itag/([^/]+)/.*?/go[a|v]p/(.*)/begin/.*?/file/([^\?]+)'
            - signature: '^/videoplayback/id/o-'
              maxmatchsize: 20
              cachekeyid: '/videoplayback/id/([^/]+)'
              cachekeyrange: '/slices\%3D([^/]+)/begin/'
              cachekeymisc:
'/itag/([^/]+)/.*?/go[a|v]p/(.*)/begin/.*?/file/([^\?]+)'
    #old signatures - might not exists anymore
    - type: 'video'
      target: 'ytb'
      options: 'cache'
      hostsignature: '"(googlevideo.com)+";"(youtube.com)+"'
      url:
            - signature: '^/videoplayback/id/[0-9a-
z]{2}.*go[a|v]p/slices[^/]+/go[a|v]p/'
              maxmatchsize: 120
              cachekeyid: '/videoplayback/id/([^/]+)'
              cachekeyrange:
'/go[a|v]p/.*\,([^/]+)/go[a|v]p/.*\,([^/]+)/begin/'
```

```
              cachekeymisc:
'/itag/([^/]+)/.*?/go[a|v]p/(.*)/begin/.*?/file/([^\?]+)'
            - signature: '^/videoplayback/id/[0-9a-
z]{2}.*go[a|v]p/slices.*\,[^/]+/begin'
              maxmatchsize: 120
              cachekeyid: '/videoplayback/id/([^/]+)'
              cachekeyrange: '/go[a|v]p/slices.*\,([^/]+)/begin'
              cachekeymisc:
'/itag/([^/]+)/.*?/go[a|v]p/(.*)/begin/.*?/file/([^\?]+)'
            - signature: '^/videoplayback/id/[0-9a-
z]{2}.*go[a|v]p/slices[^/]+/begin'
              maxmatchsize: 120
              cachekeyid: '/videoplayback/id/([^/]+)'
              cachekeyrange: '/go[a|v]p/slices\%3D([^/]+)/begin'
              cachekeymisc:
'/itag/([^/]+)/.*?/go[a|v]p/(.*)/begin/.*?/file/([^\?]+)'
            - signature: '^/videoplayback.*?[\?\&]id=[a-z0-9]{2}'
              maxmatchsize: 700
              cachekeyid: '[\&\?]id=([^\&]+)'
              cachekeyrange: '[\&\?]range=([^\&]+)'
              cachekeymisc: '[\&\?]itag=([^\&]+)'
    #desktop web browser
    - type: 'video'
      target: 'ytb'
      options: 'cache'
      hostsignature: '"(googlevideo.com)+";"(youtube.com)+"'
      referersignature: '"/watch\?v=([^\&]+)";"/embed/([^\&]+)"'
      session:
            - signature: '(^/stream_204\?)'
              maxmatchsize: 16
              contextid: '[\&\?]cpn=([^\&]+)'
              cachekeyid: '[\&\?]docid=([^\&]+)'
            - signature: '(^/ptracking\?)'
              maxmatchsize: 16
              contextid: '[\&\?]cpn=([^\&]+)'
              cachekeyid: '[\&\?]video_id=([^\&]+)'
      url:
            - signature: '(^/videoplayback\?).*?(c=[Ww][Ee][Bb])'
```

```
              maxmatchsize: 950
              contextid: '[\&\?]cpn=([^\&]+)'
              cachekeyrange: '[\&\?]range=([^\&]+)'
              cachekeymisc: '[\&\?]itag=([^\&]+)'
    #generic
    - type: 'video'
      target: 'ytb'
      options: 'ytb-ckeymap-mp4-0_736'
      hostsignature: '"(googlevideo.com)+";"(youtube.com)+"'
      url:
            - signature: '(^/videoplayback\?)'
              maxmatchsize: 20
              cachekeyid: '[\&\?]id=o-([^\&]+)'
              cachekeyrange: '[\&\?]range=([^\&]+)'
              cachekeymisc: '[\&\?]itag=([^\&]+)'
    - type: 'video'
      target: 'hulu'
      options: 'cache'
      hostsignature: '"akamaihd.net";"hulu.com";"huluedgecast.com"'
      url:
            - signature: '^/hulu[0-9]+/[^/]+/[^/]+/agave[a-zA-Z0-
9].*(?<!\.enc)/.*?\?.*?autowidevine='
              maxmatchsize: 100
              cachekeyid: '([^/]+)/[^/]+/([^/]+)/'
              cachekeymisc: '[^/]+/([^/]+)/[^/]+/([^/]+)/([^\?]+)'
            - signature: '^/hulu[0-9]+/[^/]+/[^/]+/agave[a-zA-Z0-
9].*(?<!\.enc)\?.*?autowidevine='
              maxmatchsize: 100
              cachekeyid: '([^/]+)/[^/]+/([^/]+)'
              cachekeymisc: '[^/]+/([^/]+)/[^/]+/([^\?]+)'
    - type: 'video'
      target: 'hulu'
      options: 'cache'
      hostsignature: '"akamaihd.net";"hulu.com";"huluedgecast.com"'
      url:
            - signature: '^/httpls/[0-9]+/[^/]+/agave[a-zA-Z0-
9].*?[^/]+/[^\?]+\?'
```

```
            maxmatchsize: 90
            cachekeyid: '([^/]+)/[^/]+/([^/]+)/'
            cachekeymisc: '[^/]+/([^/]+)/[^/]+/([^/]+)/([^\?]+)'
          - signature: '^/httpls/[0-9]+/[^/]+/agave[a-zA-Z0-9].*?\?'
            maxmatchsize: 90
            cachekeyid: '([^/]+)/[^/]+/([^/]+)/'
            cachekeymisc: '[^/]+/([^/]+)/[^/]+/([^\?]+)'
          - signature: '^/[0-9]+/[^/]+/agave[a-zA-Z0-9].*?[^/]+/[^\?]+\?'
            maxmatchsize: 90
            cachekeyid: '[^/]+/([^/]+)'
            cachekeymisc: '([^/]+)/[^/]+/([^/]+)/([^\?]+)'
          - signature: '^/[0-9]+/[^/]+/agave[a-zA-Z0-9].*?\?'
            maxmatchsize: 90
            cachekeyid: '[^/]+/([^/]+)'
            cachekeymisc: '([^/]+)/[^/]+/([^\?]+)'
    - type: 'video'
      target: 'ntflx'
      options: 'ntflx-ckeymap-mp4-0_256'
      url:
          - signature: '^/range/.*?([\?]o=AQ).*?v=.*?t='
            maxmatchsize: 250
            cachekeyid: '[\&\?]o=([^\&]+)'
            cachekeyrange: '^/range/([^\&\?]+)'
          - signature: '^//range/.*?([\?]o=AQ).*?v=.*?t='
            maxmatchsize: 250
            cachekeyid: '[\&\?]o=([^\&]+)'
            cachekeyrange: '^//range/([^\&\?]+)'
          - signature: '^/\?o=AQ.*?v=.*?t='
            maxmatchsize: 250
            cachekeyid: '[\&\?]o=([^\&]+)'
    - type: 'osupdate'
      target: 'ios'
      options: 'cache'
      hostsignature: 'apple.com'
      url:
          - signature: '^/iOS[0-9].*?.+\.(zip|ipsw)'
```

```
              maxmatchsize: 250
              cachekeyid: '([^/]+)/([^/]+)/'
              cachekeymisc: '[^/]+/[^/]+/.*?(.+\.(zip|ipsw))'
    - type: 'osupdate'
      target: 'windows'
      options: 'cache'
      hostsignature:
'"windowsupdate.com";"download.microsoft.com";"dlservice.microsoft.com"'
      url:
            - signature: '^/[a-zA-Z0-9]+/msdownload/update/(?!(others/))'
              maxmatchsize: 35
              cachekeyid: '([^/]+)/([^/]+)/'
              cachekeymisc: '[^/]+/[^/]+/([^/]+)/(.*)'
            - signature: '^/download/[a-zA-Z0-9]+/[a-zA-Z0-9]+/[a-zA-Z0-9]+/'
              maxmatchsize: 20
              cachekeyid: '([^/]+)/([^/]+)/'
              cachekeymisc: '[^/]+/[^/]+/([^/]+)/([^/]+)/(.*)'
            - signature:
'^/msdownload/update/software/(?!(dflt/|updt/2011/05/|svpk/2011/0[2-
3]/|secu/2011/06/|crup/2010/02/))'
              maxmatchsize: 45
              cachekeyid: '/([^/]+)/([^/]+)/'
              cachekeymisc: '/[^/]+/[^/]+/(.*)'
    - type: 'osupdate'
      target: 'android'
      options: 'cache'
      hostsignature: 'android.clients.google.com'
      url:
            - signature: '^/packages/(data|ota)'
              maxmatchsize: 15
              cachekeyid: '/([^/]+)/([^/]+)/'
              cachekeymisc: '/[^/]+/[^/]+/.*?(.+\.zip)'


    # signatures match hbogo on desktop, ipad and droid
    - type: 'video'
      target: 'hbogo'
      options: 'cache'
```

```
      hostsignature: 'hbogo.com'
      url:
            # match series, movies, comedies on desktop
            - signature: '^\/videos\/PRO12\/e2\/hbo\/feature\/\d+\/\d+\/'
              maxmatchsize: 300
              cachekeyid:
'/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)/(\d+)/(\d+)/'
              cachekeymisc:
'/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/\d+/\d+/(\S+)/(\S+)'
              # cachekeyid:
'^/(videos)/(PRO12)/(e2)/(hbo)/(feature)/(\d+)/(\d+)/'
              # cachekeymisc:
'^/videos/PRO12/e2/hbo/feature/\d+/\d+/(\S+)/(\S+)'
            # match sports on desktop
            - signature: '^\/videos\/PRO12\/e2\/hbo\/feature\/\d+\/'
              maxmatchsize: 300
              cachekeyid: '/([^/]+)/([^/]+)/([^/]+)/([^/]+)/([^/]+)/(\d+)/'
              cachekeymisc: '/[^/]+/[^/]+/[^/]+/[^/]+/[^/]+/\d+/(\S+)/(\S+)'
              # cachekeyid: '^/(videos)/(PRO12)/(e2)/(hbo)/(feature)/(\d+)/'
              # cachekeymisc: '^/videos/PRO12/e2/hbo/feature/\d+/(\S+)/(\S+)'
            # match movies, comedies on droid
            - signature:
'^\/hlsvideos\/.+\/hbo\/feature\/.+\/.+\/.+\/.+\/\w+\.ts'
              maxmatchsize: 300
              cachekeyid: '/(.+)/(.+)/(.+)/(.+)/(.+)/(.+)/(.+)/.+$'
              cachekeymisc: '.+/(.+)/(.+$)'
            # match sports on droid
            - signature: '^\/hlsvideos\/.+\/hbo\/feature\/.+\/.+\/.+\/\w+\.ts'
              maxmatchsize: 300
              cachekeyid: '/(.+)/(.+)/(.+)/(.+)/(.+)/(.+)/.+$'
              cachekeymisc: '.+/(.+)/(.+$)'
            # match movies, comedies on ipad
            - signature:
'^\/videos\/.+\/.+\/hbo\/feature\/.+\/.+\/.+\/.+\/\w+\.ts'
              maxmatchsize: 300
              cachekeyid: '/(.+)/(.+)/(.+)/(hbo)/(feature)/(.+)/(.+)/(.+)/.+$'
              cachekeymisc: '.+/(.+)/(.+$)'
            - signature:
'^\/videos\/.+\/.+\/hbo\/feature\/.+\/.+\/.+\/.+/\w+\.aac'
```

```
              maxmatchsize: 300
              cachekeyid: '/(.+)/(.+)/(.+)/(hbo)/(feature)/(.+)/(.+)/(.+)/.+$'
              cachekeymisc: '.+/(.+)/(.+$)'
            # match sports on ipad
            - signature:
'^\/videos\/.+\/.+\/hbo\/feature\/.+\/.+\/.+\/\w+\.ts'
              maxmatchsize: 300
              cachekeyid: '/(.+)/(.+)/(.+)/(hbo)/(feature)/(.+)/(.+)/.+$'
              cachekeymisc: '.+/(.+)/(.+$)'
            - signature:
'^\/videos\/.+\/.+\/hbo\/feature\/.+\/.+\/.+\/\w+\.aac'
              maxmatchsize: 300
              cachekeyid: '/(.+)/(.+)/(.+)/(hbo)/(feature)/(.+)/(.+)/.+$'
              cachekeymisc: '.+/(.+)/(.+$)'
    # hbogo  video - roku devices
    - type: 'video'
      target: 'hbogo'
      options: 'mss-cache'
      hostsignature: 'hbogo.com'
      url:
            - signature: '^\/videos\/.+\/hbo\/feature\/.+\/\w+.ism\/manifest'
              maxmatchsize: 110
              cachekeyid: '/([^/]+)/'


    - type: 'video'
      target: 'vimeo'
      options: 'cache'
      hostsignature: '(vimeocdn.com|vimeo.com|vimeo)'
      url:
            - signature:
'^/[^/]+/[^/]+/.*?\.(mp4|flv)\?.*?token[2|=](.*?\&aktimeoffset\=|.*?\&aksessio
nid\=|)'
              maxmatchsize: 140
              cachekeyid: '/([^/]+)/([^/]+)/(.*?\.(mp4|flv))\?'
            - signature:
'^/s3.vimeo.com/.*?\.(mp4|flv)\?.*?AWSAccessKeyId\=.*?\&aktimeoffset\='
              maxmatchsize: 140
              cachekeyid: '/(.*?\.(mp4|flv))\?'
```

```
            - signature: '^/video/[^/]+/.*?\.mp4Frag.*?\.ts'
              maxmatchsize: 50
              cachekeyid: '([^/]+)/([^/]+)/(.*?\.ts)'
    - type: 'video'
      target: 'liveleak'
      options: 'cache'
      hostsignature: 'liveleak'
      url:
            - signature: '^/80281E/.*?(/LiveLeak-dot-com-).*?(\.mp4|\.ogg)\?'
              maxmatchsize: 150
              cachekeyid: '/(.*?.+)\?'
    - type: 'livevideo'
      target: 'ustream'
      options: 'cache'
      hostsignature: 'ustream'
      url:
            - signature:
'^/sjc.*?(/ustreamVideo/[^/]+/streams/live).*?\.flv(\?|)'
              maxmatchsize: 120
              cachekeyid: '/(.*?.+)/'
              cachekeymisc: '/.*?.+/(.*?\.flv)(\?|)'
            - signature:
'^/sjc.*?(/ustreamVideo/[^/]+//streams/live).*?\.flv(\?|)'
              maxmatchsize: 120
              cachekeyid: '/(.*?.+)//([^/]+)/'
              cachekeymisc: '/.*?.+/(.*?\.flv)(\?|)'
            - signature: '^/sjc.*?(/live_[0-9]/chunk).*?\.ts(\?|)'
              maxmatchsize: 120
              cachekeyid: '/(.*?.+)/'
              cachekeymisc: '/.*?.+/(.*?\.ts)(\?|)'
```

4.2.1 MULTIPLE INTERFACE MONITORING/REINJECTION

The control plane can monitor multiple interfaces and can use multiple reinjection interfaces. If multiple interfaces are monitored they must be mapped to the corresponding reinjection interface. See the

```
monitoringintface   - required
outgoinginterface   - required
mapinterface        - required if multiple outgoing interfaces are used
```

```
redirectaddress     - required
```

The **trlog.conf** file defines logging levels and logging format for Laguna. By default, most logs will be rotated when they reach 10 MB in size, and up to 12 log files are retained. It is described in detail below:

```
[global]
strict init = true
reload conf period = 10M

buffer min = 1024
buffer max = 2MB

#rotate lock file = /tmp/zlog.lock
rotate lock file = self
default format = "%d(%F %T.%l) %-6V (%c:%F:%L) - %m%n"

file perms = 600
fsync period = 1K

[levels]
TRACE = 10
CRIT = 130, LOG_CRIT

[formats]
simulation = "%m%n"
simple = "[%-5V] %m%n"
normal = "[%-5V] %d(%F %T.%l) %m%n"
detailed  = "%d(%m-%d %T) [%-5V] [%p:%F:%L] %m%n".

[rules]
#for Management System, DO NOT change this configuration
tr_svc_sim_.INFO  "/var/log/trsim.log", 20MB*60 ~ "/var/log/trsim-
%d(%Y%m%d).#3s.log";
#- zlog levels: "DEBUG" < "INFO" < "NOTICE" < "WARN" < "ERROR" < "FATAL".
#- mapping of logical log file name to physical log file name
#- log rotation of 12 log files total, 10 MB each
#logging option examples:
```

```
#output everything (all logical components and services) into one physical log
file
#tr_.WARN               "/var/log/troute.log",10MB*12; simple
#output logical component, system only into one physical log file
#tr_comp_sys.WARN       "/var/log/trcompsys.log",10MB*12; simple
#output logical component, pkt proc only into one physical log file
#tr_comp_pktprc.WARN    "/var/log/trcomppktprc.log",10MB*12; simple
#output both logical components, system and pkt proc into one physical log
file
tr_comp_.INFO            "/var/log/trcomp.log",10MB*12; normal
#output logical services in common w3c format into one physical log file
tr_svc_.WARN             "/var/log/trservice.log",10MB*12; simple
```

Note: Finer logging granularity for the tr_svc_ and tr_comp_ logging can be configured by modifying the /etc/sysconfig/transparent_caching/trlog.conf file.

The tr_svc_sim_ logging can be separated into manager and worker logs (the number after the worker is the thread number) as shown below. Normally in a production system a single simulation log is configured, if a Management System is used you should not change the tr_srvc_sim_.INFO configuration.

```
tr_svc_sim_main.INFO    "/var/log/trsim.log", 20MB*60 ~ "/var/log/trsim-
%d(%Y%m%d).#3s.log";
tr_svc_sim_worker_1.INFO      "/var/log/trsim_worker_1.log", 20MB*60 ~
"/var/log/trsim_worker_1-%d(%Y%m%d).#3s.log";
tr_svc_sim_worker_2.INFO      "/var/log/trsim_worker_2.log", 20MB*60 ~
"/var/log/trsim_worker_2-%d(%Y%m%d).#3s.log";
```

By default the component simulation statistics are written to the log file specified by the tr_comp_.INFO configuration parameter. If desired the simulation statistics can be written to a separate log file by adding a new logging parameter:

```
tr_comp_sim_.INFO            "/var/log/trcompsim.log",10MB*12; normal
```

The `/usr/local/bin/api_server/config.yaml` file defines the configuration values used by the Management API, as described below:

```
# ALL values MUST NOT BE EMPTY! If the value needs to be empty then use a 0
for a numeric value or '' for a string.


debug:
    False


port:
    8088
```

```
msg_code:
    - 10

http_response_codes:
    redirect: 302
    found: 200
    forbidden: 403
    not_found: 404
    general_error: 500

logging:
    True

log_file:
    '../logs/api_server.log'

errors_log_file:
    '../logs/api_server_errors.log'

log_format:
    '%(asctime)s %(levelname)-8s %(message)s'

log_date_format:
    '%m-%d %H:%M'

log_utc:
    False

log_when:
    'midnight'

log_rotation: # 24
    0

log_backups:
```

```
    7

cookie_expires:
    hls: 1
    hds: 3600
    mss: 1

alert_email:
    from_email: '@ccur.com'
    to_email: '@ccur.com'
    interval: 10
    smtp_server: ''
    subject: 'API Server Issue'

keys:
    secret: 'could_be_any_secret_key_value'

api_ip_allow_range:
    - 10.76.101.0/24
```

The `api_ip_allow_range` (highlighted above) should include a range, which includes the IP address of the Management System.

The `/usr/local/bin/api_server/servers.yaml` file defines additional configuration values used by the Management API, as described below:

```
# ALL values MUST NOT BE EMPTY! If the value needs to be empty then use a 0
for a numeric value or '' for a string.


servers:
    - 10.76.101.10

server_defaults:
    port: 5555

server_ports:
    10.76.101.10: 5555

servers_interface_ip:
```

```
    - 10.76.101.10


server_config:
    file: 'config.yaml'
    path: '/etc/sysconfig/transparent_caching/'
```

The highlighted IP addresses above should be replaced by the IP address of the system hosting the Laguna software. No other changes are necessary.

4.3 Bandwidth Simulation Mode Configuration

Laguna can be configured to run in a simulation mode where it will process http requests that match the configured service signatures and create additional simulation log files that can be processed by an external system in order to calculate the estimated bandwidth savings as if the system were in active mode.

To enable simulation mode set the *bwsimulationmod*e parameter in the */etc/sysconfig/transparent_caching/config.yaml* file to *'true'*.

The *bwsimulationoutgoinginterface* parameter is optional and if not configured Laguna will use the default routing table for sending out origin request for calculating cache keys and content sizes. The *bwsimulationworkers* is optional too, and defaults to 15 when not configured.

4.4 Redirection Throttle Configuration

Laguna can be configured to limit the number of HTTP requests that it will redirect. Depending upon network traffic and the number of available edge caches configured in the system it may desired to limit the HTTP requests that are sent to the edges.

The *outgoingredirreqratemax* parameter in the /etc/sysconfig/transparent_caching/config.yaml file controls the redirection rate, the default value is 5000 (req/sec) when not specified.

Example:

```
outgoingredirreqratemax: '5000'
```

4.5 Reinjection Destination/Source MAC Address Configuration

The Laguna system can be deployed in different network topologies. When Laguna redirects HTTP requests it must send reinjection requests to the client and origin. To have those requests reach the client and origins, the correct destination MAC address must be used in the request to ensure the request makes it to its intended destination.

Laguna would typically be deployed where its reinjection interface is to a router. Laguna can dynamically determine the MAC addresses for sending out the reinjection requests to the origin and clients. The *outgoinginterface* in the /etc/sysconfig/transparent_caching/config.yaml file must be configured to indicate what type of re-injection interface Laguna is configured in.

There are two possible interface types: *router* or *other.*

*"router" (layer 3 switch) – **The IP address must be statically assigned in the ifcfg-ethX file**.*

"other" (layer 2 switch) – The IP address assignment is optional.

The parameter is specified similar to below <injection interface>:<type>.

```
outgoinginterface: 'eth0:router' or 'eth0:other'
```

A new gateway discovery service runs in the background to detect if the outgoing interface changes and will automatically notify Laguna of the new MAC address that was found. The gateway discovery service automatically starts when the server boots and can be started/stopped manually via *service gwdisc start/stop.*

Laguna also supports manually configuring the MAC addresses too. If the parameters below are specified, they will override the dynamic MAC address discovery process Laguna uses.

Manual MAC address setting:

Laguna's re-injection destination and source MAC addresses can be specified in the /etc/sysconfig/transparent_caching/config.yaml file.

outgoinginterfacedestmac

outgoinginterfacesrcmac

If specified manually *the outgoinginterfacedestmac* address should be specified with the MAC address of the port on the router where the Laguna server's reinjection interface is connected to.

4.6 MULTI INTERFACE MONITORING/REINJECTION CONFIGURATION

Laguna supports monitoring and reinjection on multiple interfaces and redirect addresses. Each of the reinjection/redirect addresses correspond to one of the specified monitoring interfaces. Reinjection interfaces and redirect addresses can be configured several ways, examples of each way is shown below.

There are four configuration parameters related to the monitoring and reinjection interfaces:

```
monitoringintface   - always required
outgoinginterface   - always required
mapinterface        - required if multiple outgoing interfaces are used
redirectaddress     - always required
```

Single Monitoring Interface, single Reinjection interface and redirect address:

Note: In this mode, the redirect address is specified for each monitor interface.

```
monitoringinterface: 'eth9:rx'
outgoinginterface: 'eth6:router'
redirectaddress: '10.76.103.40'
```

Multiple Monitoring Interfaces with a single Re-injection interface and multiple redirect address:

Note: In this mode, the redirect address is specified for each monitor interface.

```
monitoringinterface: '"eth9:rx";"eth2:rx"'
outgoinginterface: 'eth6:router'
redirectaddress: '"eth9:10.76.103.40";"eth2:10.76.103.30"'
```

Multiple Monitoring Interfaces with multiple Re-injection interfaces and multiple redirect addresses:

Note: In this mode, the redirect address is specified for each monitor interface

```
monitoringinterface: '"eth9:rx";"eth2:rx"'
mapinterface: '"eth9:eth6";"eth2:eth3"'
outgoinginterface: '"eth6:router";"eth3:router"'
redirectaddress: '"eth9:10.76.103.40";"eth2:10.76.103.30"'
```

Multiple Monitoring Interfaces with a single Re-injection interfaces and single redirect addresses:

Note: In this mode, the redirect address is specified for each monitor interface

```
monitoringinterface: '"eth9:rx";"eth2:rx"'
outgoinginterface: 'eth6:router'
redirectaddress: '10.76.103.40'
```

4.7 MONITORING INTERFACE CONFIGURATION ON A MPLS NETWORK

Laguna supports monitoring traffic from within an MPLS network. Laguna does not currently support adding re-injection with labels, the re-injection points must be outside the MPLS network (the outgoinginterfaceaddmplstag should be set to false).

The two configuration parameters that would change if monitoring within a MPLS network:

```
pcap-filter   - defines PF-RING filter parameter
outgoinginterfaceaddmplstag  - adds the MPLS tag(s) on re-injection (NOT
SUPPORTED)
```

Sample normal non MPLS network configuration:

```
pcap-filter: 'eth2:tcp dst port 80'
outgoinginterfaceaddmplstag: 'false'
```

Sample MPLS network configuration:

```
pcap-filter: '"eth9:mpls";"eth2:mpls"'
outgoinginterfaceaddmplstag: 'false'
```

Sample MPLS network configuration filtering a specified label:

```
pcap-filter: '"eth9:mpls 299841";"eth2:mpls 299840"'
outgoinginterfaceaddmplstag: 'false'
```

4.8 STARTING THE TRANSPARENT CACHING SERVICES

The Laguna transparent caching services are started automatically when the system is restarted. To start the services manually, use the following commands:

Use the following commands to start the Laguna transparent caching services.

```
service transc start
```

```
service tcache_agentx start
service supervisord start
service gwdisc start
```

Chapter 5

5 LAGUNA LOGGING

Laguna has two log files for system operation:

- Component log (i.e. status about the Laguna processes themselves)
- Services log (i.e. information about the packet analysis as it relates to traffic matched to a defined "service" or site)

Laguna also has a simulation log file that is used when in the simulation mode. The simulation log file configuration in trlog.config must not be changed. The configured format is specific to allow the Management System to process the trsim.log files.

All logs are stored in `/var/log` on the Laguna server.

In addition, the logging system uses "simple," "normal," or "detailed" templates to format the log entries as follows:

- simulation ("%m%n")
- *Example: Initializing Outgoing Interface:eth0*
- simple ("[%-5V] %m%n")
- *Example: [INFO] Initializing Outgoing Interface:eth0*
- normal ("[%-5V] %d(%F %T.%l) %m%n")
- *Example: [INFO] 2014-04-16 16:45:47. 4 Initializing Outgoing Interface:eth0*
- detailed ("%d(%m-%d %T) %-5V [%p:%F:%L] %m%n")
- *04-16 16:46:42 INFO [8372:evlog.c:163] Initializing Outgoing Interface:eth0*

Within the component and service logging, further granularity is available to log the sub components in separate log files.

Those available for component logging include:

system	(ie. tr_comp_sys.WARN)
packet processing	(ie. tr_comp_pktprc.WARN)
simulation	(ie. tr_comp_sim_.INFO)

Those available for service logging include:

packet processing	(ie. tr_svc_pktprc.INFO)
simulation	(ie. tr_svc_sim_.INFO)

service simulation logging can be segregated further into main and worker logs

simulation main	(ie tr_svc_sim_main.INFO)

simulation workers	(ie. tr_svc_sim_worker”n”.INFO - where n is the worker thread number)

The default trlog.conf file is normally sufficient for production configurations.

Each log (service, component, and simulation) is described further below.

In addition to the Laguna log files, the system also contains the following log files:

- `tcache-agentx.log` (i.e. status about the SNMP agentx process)

To enable logging for transparent cache agentx update the /etc/rsyslog.conf file and include the following line:

- *local0.* */var/log/tcache-agentx.log*
- `supervisord.log` (i.e. information about the supervisord process, which monitors the other Laguna processes).

5.1 COMPONENT LOGGING

Component status information and messages are logged in the following component log file:

`trcomp.log`

The log format consists of an information string formatted according to “simple,” “normal,” or “detailed” templates, with increasing amounts of information contained in the log entry.

The logs support the following log levels: DEBUG, INFO, NOTICE, WARN, ERROR, FATAL.

The following is an example of the `trcomp.log` file:

```
2014-07-25 10:52:24.10 ****Site Info****
ntflx:
    HTTP GET Video File requests:21
    HTTP Injected:21
    HTTP Inject Err:0

2014-07-25 10:59:56.10 ****Packets Info****
    HTTP Pkts Total:443464
       HTTP Pkts Processed:28
           HTTP GET processed:28
               HTTP Active Video Sess:0
       HTTP Pkts Ignored:443436
           HTTP GET Req From Cache Server:20
           HTTP GET Parse Service unknown:0
       HTTP Pkts Errors:0
           HTTP GET process Err:0
       Pcap Pkts-parse Error:0
```

```
       Pcap Pkts-parse Ignore:0
    Injections:
       TCP RST injections:28
       TCP Fin injections:0
       TCP 302 injections:28
       TCP 302 Pop:79
    Pkt Capture stats:
       Tx Dropped:0
       Rx Dropped:0
       Rx Recv:443464
    Memory Pool Info:
       BlockSize:0
       ResizeCount:0
       UsedBlocksCount:0


2014-07-25 10:59:56.10 ****Site Info****
ntflx:
    HTTP GET Video File requests:21
    HTTP Injected:21
    HTTP Inject Err:0

2014-07-25 10:59:56.10 ****Site Info****
windows:
    HTTP GET Video File requests:7
    HTTP Injected:7
    HTTP Inject Err:0
```

5.2 SERVICE LOGGING

Information regarding monitored services are logged into the following log file:

```
trservice.log
```

The log format consists of w3c (common logfile format) files, formatted according to the specified template.

The logs support the following log levels: DEBUG, INFO.

The following is an example of the `trservice.log` file:

```
download.windowsupdate.com - - [25/Jul/2014:10:54:26 -0400]
"/msdownload/update/software/dflt/2011/08/4750242_3ef417aac455280b17cacefb0ec5
c78426eca5ca.cab" - -
```

```
Pkt Injections:51
Length payload: 409
src MAC/Ip/Port: 64:9e:f3:a9:bd:7f/184.51.150.187/80
dest MAC/Ip/Port: 00:0c:29:95:28:11/10.76.101.116/49293
Http Payload:
HTTP/1.1 302 Found
Location:
http://10.76.112.53/ccur/osupdate/windows/tcshost/download.windowsupdate.com/t
cskey/msdownload-update-software-dflt-2011-12-
4888157_690ed4eb7062bcd59ad7a5c6270c33d89f52fd5b.cab/0_0/tcsopt/cache/tcsosig/
msdownload/update/software/dflt/2011/12/4888157_690ed4eb7062bcd59ad7a5c6270c33
d89f52fd5b.cab
Accept-Ranges: bytes
Content-Type: text/html; charset=UTF-8
Content-Length: 0



Pkt Injections:52
Length payload: 0
src MAC/Ip/Port: 00:0c:29:95:28:11/10.76.101.116/49293
dest MAC/Ip/Port: 64:9e:f3:a9:bd:7f/184.51.150.187/80
Http Payload:
None(TCP RST)



download.windowsupdate.com - - [25/Jul/2014:10:55:02 -0400]
"/msdownload/update/software/dflt/2011/12/4888157_690ed4eb7062bcd59ad7a5c6270c
33d89f52fd5b.cab" - -


Pkt Injections:53
Length payload: 409
src MAC/Ip/Port: 64:9e:f3:a9:bd:7f/184.51.150.202/80
dest MAC/Ip/Port: 00:0c:29:95:28:11/10.76.101.116/49295
Http Payload:
HTTP/1.1 302 Found
Location:
http://10.76.112.53/ccur/osupdate/windows/tcshost/download.windowsupdate.com/t
cskey/msdownload-update-software-dflt-2011-04-
4169469_7f9c140f433074c1f696c88d0f069fff7c26ed02.cab/0_0/tcsopt/cache/tcsosig/
```

```
msdownload/update/software/dflt/2011/04/4169469_7f9c140f433074c1f696c88d0f069f
ff7c26ed02.cab

Accept-Ranges: bytes

Content-Type: text/html; charset=UTF-8

Content-Length: 0



Pkt Injections:54

Length payload: 0

src MAC/Ip/Port: 00:0c:29:95:28:11/10.76.101.116/49295

dest MAC/Ip/Port: 64:9e:f3:a9:bd:7f/184.51.150.202/80

Http Payload:

None(TCP RST)



download.windowsupdate.com - - [25/Jul/2014:10:55:26 -0400]
"/msdownload/update/software/dflt/2011/04/4169469_7f9c140f433074c1f696c88d0f06
9fff7c26ed02.cab" - -


Pkt Injections:55

Length payload: 409

src MAC/Ip/Port: 64:9e:f3:a9:bd:7f/184.51.150.187/80

dest MAC/Ip/Port: 00:0c:29:95:28:11/10.76.101.116/49297

Http Payload:

HTTP/1.1 302 Found

Location:
http://10.76.112.53/ccur/osupdate/windows/tcshost/download.windowsupdate.com/t
cskey/msdownload-update-software-dflt-2011-06-
4421239_25d449fbd3326aaa80bd372f0d2563d9995c1c52.cab/0_0/tcsopt/cache/tcsosig/
msdownload/update/software/dflt/2011/06/4421239_25d449fbd3326aaa80bd372f0d2563
d9995c1c52.cab

Accept-Ranges: bytes

Content-Type: text/html; charset=UTF-8

Content-Length: 0



Pkt Injections:56

Length payload: 0

src MAC/Ip/Port: 00:0c:29:95:28:11/10.76.101.116/49297
```

```
dest MAC/Ip/Port: 64:9e:f3:a9:bd:7f/184.51.150.187/80
Http Payload:
None(TCP RST)



download.windowsupdate.com - - [25/Jul/2014:10:55:31 -0400]
"/msdownload/update/software/dflt/2011/06/4421239_25d449fbd3326aaa80bd372f0d25
63d9995c1c52.cab" - -
```

5.3 SIMULATION MODE LOGGING

The simulation mode logging entries are logged into the following log file:

```
trsim.log
```

The configuration for the simulation mode log file should not be modified as the Management System expects default configuration format. When the trsim.log file rolls over they are renamed as trsim-YYYYMMDD.<seqId>.log.

The following is an example of entries in the `trsim.log` file:

```
TID:140410993239808 10.76.103.141 r20---sn-5uaeznes.googlevideo.com -
[03/Dec/2014:14:56:03 -0500] "GET
http://10.76.103.31/ccur/video/ytb/tcshost/r20---sn-
5uaeznes.googlevideo.com/tcskey/d4920668989f034975e73ae6ae53b9e07ed58167/23944
9549-282842714_18/tcsopt/ytb-ckeymap-mp4-
0_736/tcsosig/videoplayback?sparams=id%2Cip%2Cipbits%2Citag%2Cmm%2Cms%2Cmv%2Cn
h%2Cratebypass%2Csource%2Cupn%2Cexpire&key=yt5&nh=IgpwcjAxLmF0bDAxKgkxMjcuMC4w
LjE&fexp=900245%2C907259%2C916615%2C924219%2C927622%2C932404%2C942702%2C943917
%2C945323%2C947209%2C948124%2C952302%2C952605%2C952901%2C953912%2C957103%2C957
105%2C957201%2C958612&expire=1417653516&id=o-
AFACaZbMovPlvWg8L3OPwuJS83o0sdwIBT4ISoL9QID9&mm=31&ip=173.221.58.2&signature=5
488C049A0E47B5BF8F8D39FBA3EA127936EAC3C.A97DF7A6CAD2494E7A3D41D54A708FBEB2ACF6
8E&source=youtube&ms=au&mt=1417631713&mv=u&yms=nTjYOaYp_EE&el=watch&ipbits=0&u
pn=TqzWIJjyx4k&sver=3&dnc=1&itag=18&app=youtube_mobile&ratebypass=yes&cpn=cbJM
0rONnYu2q4n2&ptk=youtube_multi&oid=LtuniTgT0PFayH9n3PW4_A.ZP6trPnP707Uw7I8kjT4
Eg.qi9mMm7Ja2j4z_N_4fSiZA&pltype=contentugc&c=MWEB&cver=html5 HTTP/1.1" 206
43393165 "-" "AppleCoreMedia/1.0.0.9A405 (iPad; U; CPU OS 5_0_1 like Mac OS X;
en_us)"


TID:140410993239808 10.76.103.141 r20---sn-5uaeznes.googlevideo.com -
[03/Dec/2014:14:56:05 -0500] "GET
http://10.76.103.31/ccur/video/ytb/tcshost/r20---sn-
5uaeznes.googlevideo.com/tcskey/d4920668989f034975e73ae6ae53b9e07ed58167/23958
0621-282842714_18/tcsopt/ytb-ckeymap-mp4-
0_736/tcsosig/videoplayback?sparams=id%2Cip%2Cipbits%2Citag%2Cmm%2Cms%2Cmv%2Cn
h%2Cratebypass%2Csource%2Cupn%2Cexpire&key=yt5&nh=IgpwcjAxLmF0bDAxKgkxMjcuMC4w
LjE&fexp=900245%2C907259%2C916615%2C924219%2C927622%2C932404%2C942702%2C943917
%2C945323%2C947209%2C948124%2C952302%2C952605%2C952901%2C953912%2C957103%2C957
105%2C957201%2C958612&expire=1417653516&id=o-
```

```
AFACaZbMovPlvWg8L3OPwuJS83o0sdwIBT4ISoL9QID9&mm=31&ip=173.221.58.2&signature=5
488C049A0E47B5BF8F8D39FBA3EA127936EAC3C.A97DF7A6CAD2494E7A3D41D54A708FBEB2ACF6
8E&source=youtube&ms=au&mt=1417631713&mv=u&yms=nTjYOaYp_EE&el=watch&ipbits=0&u
pn=TqzWIJjyx4k&sver=3&dnc=1&itag=18&app=youtube_mobile&ratebypass=yes&cpn=cbJM
0rONnYu2q4n2&ptk=youtube_multi&oid=LtuniTgT0PFayH9n3PW4_A.ZP6trPnP707Uw7I8kjT4
Eg.qi9mMm7Ja2j4z_N_4fSiZA&pltype=contentugc&c=MWEB&cver=html5 HTTP/1.1" 206
43262093 "-" "AppleCoreMedia/1.0.0.9A405 (iPad; U; CPU OS 5_0_1 like Mac OS X;
en_us)"


TID:140410993239808 10.76.103.141 r20---sn-5uaeznes.googlevideo.com -
[03/Dec/2014:14:56:08 -0500] "GET
http://10.76.103.31/ccur/video/ytb/tcshost/r20---sn-
5uaeznes.googlevideo.com/tcskey/d4920668989f034975e73ae6ae53b9e07ed58167/23964
6157-282842714_18/tcsopt/ytb-ckeymap-mp4-
0_736/tcsosig/videoplayback?sparams=id%2Cip%2Cipbits%2Citag%2Cmm%2Cms%2Cmv%2Cn
h%2Cratebypass%2Csource%2Cupn%2Cexpire&key=yt5&nh=IgpwcjAxLmF0bDAxKgkxMjcuMC4w
LjE&fexp=900245%2C907259%2C916615%2C924219%2C927622%2C932404%2C942702%2C943917
%2C945323%2C947209%2C948124%2C952302%2C952605%2C952901%2C953912%2C957103%2C957
105%2C957201%2C958612&expire=1417653516&id=o-
AFACaZbMovPlvWg8L3OPwuJS83o0sdwIBT4ISoL9QID9&mm=31&ip=173.221.58.2&signature=5
488C049A0E47B5BF8F8D39FBA3EA127936EAC3C.A97DF7A6CAD2494E7A3D41D54A708FBEB2ACF6
8E&source=youtube&ms=au&mt=1417631713&mv=u&yms=nTjYOaYp_EE&el=watch&ipbits=0&u
pn=TqzWIJjyx4k&sver=3&dnc=1&itag=18&app=youtube_mobile&ratebypass=yes&cpn=cbJM
0rONnYu2q4n2&ptk=youtube_multi&oid=LtuniTgT0PFayH9n3PW4_A.ZP6trPnP707Uw7I8kjT4
Eg.qi9mMm7Ja2j4z_N_4fSiZA&pltype=contentugc&c=MWEB&cver=html5 HTTP/1.1" 206
43196557 "-" "AppleCoreMedia/1.0.0.9A405 (iPad; U; CPU OS 5_0_1 like Mac OS X;
en_us)"


TID:140410993239808 10.76.103.141 r20---sn-5uaeznes.googlevideo.com -
[03/Dec/2014:14:56:11 -0500] "GET
http://10.76.103.31/ccur/video/ytb/tcshost/r20---sn-
5uaeznes.googlevideo.com/tcskey/d4920668989f034975e73ae6ae53b9e07ed58167/23977
7229-282842714_18/tcsopt/ytb-ckeymap-mp4-
0_736/tcsosig/videoplayback?sparams=id%2Cip%2Cipbits%2Citag%2Cmm%2Cms%2Cmv%2Cn
h%2Cratebypass%2Csource%2Cupn%2Cexpire&key=yt5&nh=IgpwcjAxLmF0bDAxKgkxMjcuMC4w
LjE&fexp=900245%2C907259%2C916615%2C924219%2C927622%2C932404%2C942702%2C943917
%2C945323%2C947209%2C948124%2C952302%2C952605%2C952901%2C953912%2C957103%2C957
105%2C957201%2C958612&expire=1417653516&id=o-
AFACaZbMovPlvWg8L3OPwuJS83o0sdwIBT4ISoL9QID9&mm=31&ip=173.221.58.2&signature=5
488C049A0E47B5BF8F8D39FBA3EA127936EAC3C.A97DF7A6CAD2494E7A3D41D54A708FBEB2ACF6
8E&source=youtube&ms=au&mt=1417631713&mv=u&yms=nTjYOaYp_EE&el=watch&ipbits=0&u
pn=TqzWIJjyx4k&sver=3&dnc=1&itag=18&app=youtube_mobile&ratebypass=yes&cpn=cbJM
0rONnYu2q4n2&ptk=youtube_multi&oid=LtuniTgT0PFayH9n3PW4_A.ZP6trPnP707Uw7I8kjT4
Eg.qi9mMm7Ja2j4z_N_4fSiZA&pltype=contentugc&c=MWEB&cver=html5 HTTP/1.1" 206
43065485 "-" "AppleCoreMedia/1.0.0.9A405 (iPad; U; CPU OS 5_0_1 like Mac OS X;
en_us)"

TID:140410993239808 10.76.103.141 r15---sn-5uaeznel.googlevideo.com -
[03/Dec/2014:18:09:13 -0500] "GET
http://10.76.103.31/ccur/video/ytb/tcshost/r15---sn-
5uaeznel.googlevideo.com/tcskey/a9180630885109f7fbc342e82537ca64d3ddb89c/91750
4-127345803_18/tcsopt/ytb-ckeymap-mp4-
0_736/tcsosig/videoplayback?mt=1417648125&itag=18&id=o-
```

```
AAN07r6fJ_ViO9dTPzSQSMm2xXjB_mYzbNv3NUI_yHo8&app=youtube_mobile&key=yt5&ip=173
.221.58.2&sver=3&expire=1417669835&mv=u&el=watch&ms=au&mm=31&ipbits=0&nh=Igpwc
jAxLmF0bDAxKgkxMjcuMC4wLjE&source=youtube&ratebypass=yes&fexp=900245%2C907259%
2C916615%2C924219%2C927622%2C932404%2C942702%2C943917%2C945323%2C947209%2C9481
24%2C952302%2C952605%2C952901%2C953912%2C957103%2C957105%2C957201%2C958612&dnc
=1&yms=nTjYOaYp_EE&sparams=id%2Cip%2Cipbits%2Citag%2Cmm%2Cms%2Cmv%2Cnh%2Crateb
ypass%2Csource%2Cupn%2Cexpire&signature=053A3390625316BA34FDAF2DA35D3DE5A56A29
5A.9FDF7AEE880A510C427371B9B4A2AE32A6F03D7D&upn=HfhUWhKNhnk&cpn=DVJ-
stYdYQHXBOUU&ptk=mnet&oid=v9mY2iDO2L2wSVW4oaizUA&ptchn=U9w3qcecaD5qSpd4rEDZjg&
pltype=content&c=MWEB&cver=html5 HTTP/1.1" 206 126428299 "-"
"AppleCoreMedia/1.0.0.9A405 (iPad; U; CPU OS 5_0_1 like Mac OS X; en_us)"
```

Chapter 6

6 LAGUNA MONITORING

The Laguna transparent caching MIB can be used by monitoring systems to monitor the behavior of the Laguna system.

The MIB definition is installed in the `/usr/share/snmp/mibs/TCACHE-MIB.txt` file.

An example of the `/usr/share/snmp/mibs/TCACHE-MIB.txt` file is shown below:

```
TCACHE-MIB DEFINITIONS ::= BEGIN
IMPORTS
    enterprises, Counter32
        FROM SNMPv2-SMI
    OBJECT-TYPE
        FROM RFC-1212
        MODULE-IDENTITY, Integer32, Unsigned32
        FROM SNMPv2-SMI
        --
        OBJECT-GROUP
        FROM SNMPv2-CONF;

tcacheMIB MODULE-IDENTITY
    LAST-UPDATED    "201503110000Z"
    ORGANIZATION    "Concurrent Computer Corporation"
    CONTACT-INFO    " "
    DESCRIPTION     "MIB support Concurrent's Transparent Caching Solution."
    REVISION        "201503110000Z"
    DESCRIPTION     " "
    ::= { concurrentComputerCorporation 4 }

concurrentComputerCorporation OBJECT IDENTIFIER ::= { enterprises 1457 }
transCache                    OBJECT IDENTIFIER ::= { tcacheMIB 1 }
transCacheControlPlane        OBJECT IDENTIFIER ::= { transCache 1 }

tcacheGroup OBJECT-GROUP
    OBJECTS {   status,
                trafficCount,
                redirectCount,
```

```
                --
                domain,
                domainCount,
                --
                domainRedirect,
                domainRedirectCount,
                --
                video,
                videoCount,
                --
                videoRedirect,
                videoRedirectCount,
                --
                client,
                clientCount,
                --
                clientRedirect,
                clientRedirectCount,
                --
                clientTopDevice,
                clientTopDeviceCount,
                --
                redirectedService,
                redirectedServiceCount,
                --
                maxTableXmit,
                edgeProbeDuration,
                tablePurgeDuration,
                --
                tcsStartTime,
                tcsVersion,
                --
                mode }
    STATUS  current
    DESCRIPTION " "
    ::= { transCacheControlPlane 1 }
```

```
--
*********************************************************************************
****
-- cache control plane - up/down
--
*********************************************************************************
****
status OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Ping Transparent Cache Control Plane."
    ::= { transCacheControlPlane 2 }


--
*********************************************************************************
****
-- Overall Activity Counters
--
*********************************************************************************
****
trafficCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Traffic Counter for Transparent Cache Control Plane."
    ::= { transCacheControlPlane 3 }

redirectCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Redirect Counter for Transparent Cache Control Plane."
    ::= { transCacheControlPlane 4 }


--
*********************************************************************************
****
-- Domain Table - tally of top domains.
```

```
--
*******************************************************************************
****
domainTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF DomainEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { transCacheControlPlane 5 }

domainEntry OBJECT-TYPE
    SYNTAX      DomainEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    INDEX { domainIdx }
    ::= { domainTable 1 }

DomainEntry ::= SEQUENCE {
    domainIdx   Integer32,
    domain      OCTET STRING,
    domainCount Counter32
}

domainIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { domainEntry 1 }

domain OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Domains from all requests TCS sees."
    ::= { domainEntry 2 }
```

```
domainCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Count of how many requests are from the domain."
    ::= { domainEntry 3 }

--
*********************************************************************
****
-- Domain Redirect Table - tally of domain redirects.
--
*********************************************************************
****
domainRedirectTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF DomainRedirectEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { transCacheControlPlane 6 }

domainRedirectEntry OBJECT-TYPE
    SYNTAX      DomainRedirectEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    INDEX { domainRedirectIdx }
    ::= { domainRedirectTable 1 }

DomainRedirectEntry ::= SEQUENCE {
    domainRedirectIdx   Integer32,
    domainRedirect      OCTET STRING,
    domainRedirectCount Counter32
}

domainRedirectIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
```

```
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { domainRedirectEntry 1 }

domainRedirect OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Domains from all requests TCS redirects."
    ::= { domainRedirectEntry 2 }

domainRedirectCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Count of how many requests are from the domain."
    ::= { domainRedirectEntry 3 }


--
****************************************************************************
****
-- Video Table - tally of video formats.
--
****************************************************************************
****
videoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF VideoEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { transCacheControlPlane 7 }

videoEntry OBJECT-TYPE
    SYNTAX      VideoEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
```

```
    INDEX { videoIdx }
    ::= {videoTable 1 }

VideoEntry ::= SEQUENCE {
    videoIdx    Integer32,
    video       OCTET STRING,
    videoCount  Counter32
}

videoIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { videoEntry 1 }

video OBJECT-TYPE
    SYNTAX    OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { videoEntry 2 }

videoCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { videoEntry 3 }


--
****************************************************************************
****
-- Video Redirect Table
--
****************************************************************************
****
videoRedirectTable OBJECT-TYPE
```

```
    SYNTAX      SEQUENCE OF VideoRedirectEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { transCacheControlPlane 8 }

videoRedirectEntry OBJECT-TYPE
    SYNTAX      VideoRedirectEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    INDEX { videoRedirectIdx }
    ::= { videoRedirectTable 1 }

VideoRedirectEntry ::= SEQUENCE {
    videoRedirectIdx    Integer32,
    videoRedirect       OCTET STRING,
    videoRedirectCount  Counter32
}

videoRedirectIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { videoRedirectEntry 1 }

videoRedirect OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { videoRedirectEntry 2 }

videoRedirectCount OBJECT-TYPE
    SYNTAX      Counter32
```

```
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { videoRedirectEntry 3 }


--
*******************************************************************************
****
-- Client Table - tally of client devices.
--
*******************************************************************************
****
clientTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF ClientEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { transCacheControlPlane 9 }

clientEntry OBJECT-TYPE
    SYNTAX      ClientEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    INDEX { clientIdx }
    ::= { clientTable 1 }

ClientEntry ::= SEQUENCE {
    clientIdx   Integer32,
    client      OCTET STRING,
    clientCount Counter32
}

clientIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
```

```
    ::= { clientEntry 1 }

client OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Client identifier for all requests TCS sees."
    ::= { clientEntry 2 }

clientCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Count of how many requests are from the client."
    ::= { clientEntry 3 }


--
**************************************************************************
****
-- Client Redirect Table - tally client device redirects.
--
**************************************************************************
****
clientRedirectTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF ClientRedirectEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { transCacheControlPlane 10 }

clientRedirectEntry OBJECT-TYPE
    SYNTAX      ClientRedirectEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    INDEX { clientRedirectIdx }
    ::= { clientRedirectTable 1 }
```

```
ClientRedirectEntry ::= SEQUENCE {
    clientRedirectIdx   Integer32,
    clientRedirect      OCTET STRING,
    clientRedirectCount Counter32
}

clientRedirectIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { clientRedirectEntry 1 }

clientRedirect OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Client identifier from all redirected requests."
    ::= { clientRedirectEntry 2 }

clientRedirectCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Count of the redirected requests for each client."
    ::= { clientRedirectEntry 3 }


--
****************************************************************************
****
-- Client Top Device Table - tally of top client devices.
--
****************************************************************************
****
clientTopDeviceTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF ClientTopDeviceEntry
    MAX-ACCESS  not-accessible
    STATUS      current
```

```
    DESCRIPTION " Not Currently Supported."
    ::= { transCacheControlPlane 11 }

clientTopDeviceEntry OBJECT-TYPE
    SYNTAX      ClientTopDeviceEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    INDEX { clientTopDeviceIdx }
    ::= { clientTopDeviceTable 1 }

ClientTopDeviceEntry ::= SEQUENCE {
    clientTopDeviceIdx    Integer32,
    clientTopDevice       OCTET STRING,
    clientTopDeviceCount  Counter32
}

clientTopDeviceIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { clientTopDeviceEntry 1 }

clientTopDevice OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Not Currently Supported."
    ::= { clientTopDeviceEntry 2 }

clientTopDeviceCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Not Currently Supported."
```

```
    ::= { clientTopDeviceEntry 3 }


--
*******************************************************************************
****
-- Redirected Service Table - tally of redirected services.
--
*******************************************************************************
****
redirectedServiceTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RedirectedServiceEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { transCacheControlPlane 12 }

redirectedServiceEntry OBJECT-TYPE
    SYNTAX      RedirectedServiceEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    INDEX { redirectedServiceIdx }
    ::= { redirectedServiceTable 1 }

RedirectedServiceEntry ::= SEQUENCE {
    redirectedServiceIdx    Integer32,
    redirectedService       OCTET STRING,
    redirectedServiceCount  Counter32
}

redirectedServiceIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { redirectedServiceEntry 1 }

redirectedService OBJECT-TYPE
```

```
    SYNTAX      OCTET STRING (SIZE (256))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " List of redirected services and types."
    ::= { redirectedServiceEntry 2 }

redirectedServiceCount OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Count of redirected requests for each service."
    ::= { redirectedServiceEntry 3 }


--
****************************************************************************
****
-- Max Table Transmission.
--
****************************************************************************
****
maxTableXmit OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION "Max Table Transmission rows."
    ::= { transCacheControlPlane 13 }


--
****************************************************************************
****
-- Edge Probe Duration in seconds.
--
****************************************************************************
****
edgeProbeDuration OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION "Edge Probe Duration in seconds."
```

```
    ::= { transCacheControlPlane 14 }


--
*******************************************************************************
****
-- Table Purge Duration in seconds.
--
*******************************************************************************
****
tablePurgeDuration OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION "Table Purge Duration in seconds."
    ::= { transCacheControlPlane 15 }


--
*******************************************************************************
****
-- TCS ControlPlane Start Time as string, (UTC format) i.e.  2015-03-
17T13:42:17Z
--
*******************************************************************************
****
tcsStartTime OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (32))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " TCS ControlPlane Start Time as string, (UTC format) i.e.
2015-03-17T13:42:17Z"
    ::= { transCacheControlPlane 16 }


--
*******************************************************************************
****
-- TCS ControlPlane Version.
--
*******************************************************************************
****
tcsVersion OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (32))
```

```
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " TCS Version."
    ::= { transCacheControlPlane 17 }


--
*******************************************************************************
****
-- TCS Mode Table - Modes of TCS interfaces.
--
*******************************************************************************
****
modeTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF ModeEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { transCacheControlPlane 18 }

modeEntry OBJECT-TYPE
    SYNTAX      ModeEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    INDEX { modeIdx }
    ::= { modeTable 1 }

ModeEntry ::= SEQUENCE {
    modeIdx  Integer32,
    mode     OCTET STRING
}

modeIdx OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION " "
    ::= { modeEntry 1 }
```

```
mode OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (64))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION " Mode of TCS interface."
    ::= { modeEntry 2 }

END
```

Chapter 7

7 LAGUNA API

The Laguna system provides REST APIs, which can be used to retrieve and set configuration values and to perform other management commands. These REST APIs can be used by external systems to manage the Laguna transparent caching control plane.

Data sent to the components is encoded in JSON data structures.

7.1 RETRIEVING CONFIGURATION INFORMATION

To retrieve the configuration of Laguna, send an HTTP GET to the following:

```
http://[IP_of_Application_Server]:8088/v1/components/configurations/transparentcache/config/
```

7.2 SAVING CONFIGURATION INFORMATION

To save the configuration of Laguna, send an HTTP POST to the following:

```
http://[IP_of_Application_Server]:8088/v1/components/configurations/transparentcache/config/
```

7.3 PURGING EDGE CACHE

To purge cache information from Edge caches, send an HTTP POST with additional Header, Content/Type:application/json to the following:

```
http://[IP_of_Application_Server]:8088/v1/components/commands/transparentcache/config
```

with an HTTP body containing JSON data in the following format:

```
'{ "command":"purge" , "hosts" : [ "IP of Edge1", "IP of EdgeN" ], "targets": [ "target1/*", "targetN/*" ] }'
```

Target examples include the following

- To purge all YouTube videos from cache: `video/ytb/*`
- To purge all videos from all services from cache: `video/*`
- To purge all windows osupdates from cache: `osupdate/windows/*`
- To purge a single YouTube video from cache: `video/ytb/xxx` (where xxx represents the cacheId of the object in the Edge cache)

It is recommended that only a single Edge and target be specified, as the attempted purges will end if a purge is unsuccessful.

Note: *The cache purge feature is currently only supported by the Concurrent Edge Caching Server.*