LCOS 10.42
Addendum

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LANCOM
Systems

Contents

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1 Addendum to LCOS version 10.42

This document describes the changes and enhancements in LCOS version 10.42 since the previous version.

2 Routing and WAN connections

2.1 SD-WAN dynamic path selection

Used in an SD-WAN scenario where several lines are available, dynamic path selection (DPS) optimizes the performance of an application by directing data traffic over the line with the best quality as rated by metrics such as load, packet loss, latency or jitter.

In SD-WAN scenarios, MPLS lines should either be replaced or supplemented by cost-effective Internet connections such as DSL, cable Internet, fiber optic or 4G/5G. Load balancing helps to make use of the total bandwidth of all of the available lines. Dynamic path selection can be used to assure the performance of mission-critical applications. All lines are continuously, actively monitored with ICMP packets to calculate metrics for load, packet loss, latency and jitter. Policies are used to define the requirements of business applications: For example, the real-time data traffic on lines can be monitored for the allowed packet loss or the maximum latency of a possible path. The dynamic path selection algorithm selects the best quality line for sessions. If several lines meet the requirements, load balancing distributes the load across these lines by means of round-robin scheduling.
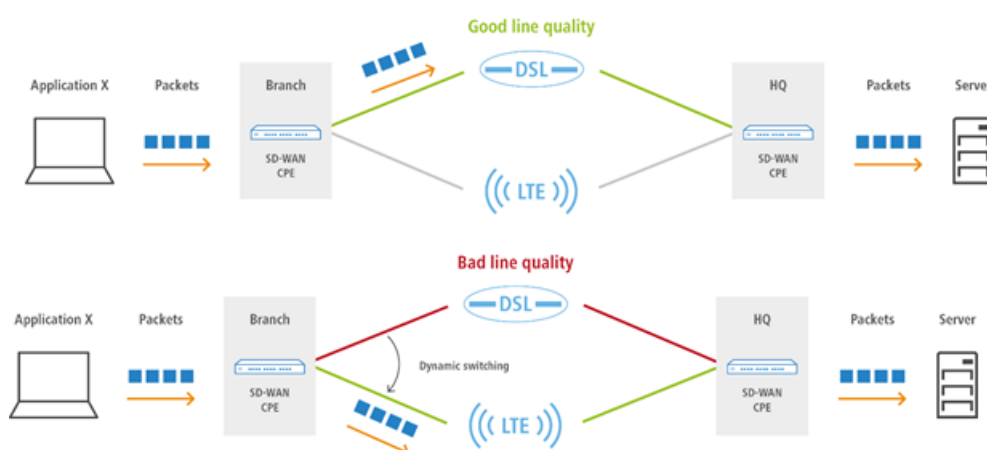
(!)   Policies can be defined as "critical". If none of the lines fulfill the policy, no data traffic is transported at all.

Dynamic path selection is activated on a load balancer. A load balancer can be defined either for Internet connections or for SD-WAN overlay tunnels (VPN). The end point for ICMP test packets can either be any IP address or the central-site SD-WAN gateway.

In the firewall, the defined (load balancer) policies for the applications are used in corresponding firewall rules. There, the traffic or applications to which the load balancer policy is to apply are defined.

2.1.1 Configuring Dynamic Path Selection

To configure dynamic path selection with LANconfig, navigate to the view **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection**.
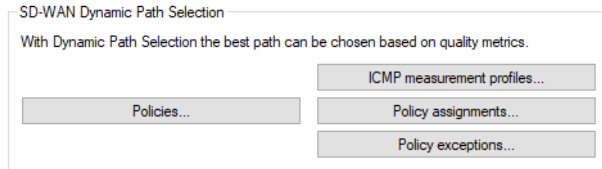
ICMP-Measurement-Profiles

ICMP measurement profiles specify a parameter set used by measurements that are based on ICMP pings. Interface metrics are derived from measurements to quantify the connection quality. These metrics are: Average round trip time (RTT, latency), jitter and packet loss rate.

To configure the ICMP measurement profiles, navigate to the view **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **ICMP measurement profiles**.
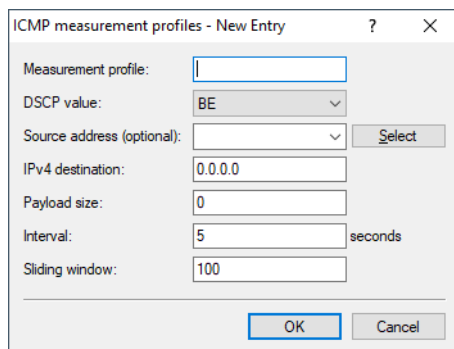
Measurement profile

> The name of the profile. This name is used to reference the profile in DPS policies.

DSCP value

> Sets the DSCP value in the IP header of measurement packets. DSCP (Differentiated Services Code Point) is used for QoS (Quality of Service).

Source address (optional)

> References a named loopback address that is used as the sender in the measurement packets. If the field is left empty, the router automatically selects an address that matches the sending interface.

IPv4 destination

> The measurement destination as a valid IPv4 unicast address. With 0.0.0.0 entered, the measurement destination is determined dynamically by the VPN. If the field is left empty, no measurements are made for this family of addresses.

Payload size

> Specifies the size of the data payload that follows the ICMP header (payload size) of the pings being sent.

Interval

> The interval in seconds between 2 measurements. The maximum round trip time is also specified. Packets not answered within a measurement interval are counted as packet loss.

Sliding window

> Maximum number of measurement values that are used to determine the interface metrics. If a measurement value is received after the number specified here has been reached, the oldest measurement is discarded.

Policies

To evaluate the connection quality of the interfaces used for Dynamic Path Selection, the metrics calculated from the measurement profiles are compared to threshold values, and points (as a score) are awarded. These points added up to determine which is the "best" interface. Certain thresholds can be specified as being "critical" (e.g. jitter <= 30 ms). Dynamic load balancer decisions are based on the points total in combination with the exceeded critical threshold values. A DPS policy collects the threshold values and criticality markings that are required to calculate the total points.

To configure the DPS policies, navigate to the view **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **Policies**.

Policy

> The name of the DPS policy. This name is used to reference the policy in firewall rules. All of the rows in this table with the same policy name are combined into one policy. This makes it possible, for instance, to use the same metric multiple times with different thresholds in the same policy. This allows a points-based grading (e.g. 10 points with a latency <= 100, another 10 points with a latency <= 50).

Measurement profile

> Either empty or the name of an ICMP measurement profile.

> (!) The field must be empty if and only if the **SLA metric** is set to "Load(%)". In all other cases, a measurement profile must be specified.

SLA metric

> This is the metric generated from the measurements of the set measurement profile. The value of metric is compared to the threshold value. Possible values:

> > Latency (ms)
> > Jitter (ms)
> > Packet loss (%)
> > Load (%)

> (!) The metric "Load(%)" denotes the utilization of the interface in percent of the maximum bandwidth. As this value is not determined using separate measurements, the entry **Threshold** must be left empty.

Threshold

> Where an interface is used by numerous load balancers, or where multiple policies are used to rate the load balancer that uses this interface, measurements need to be prevented by making an an exception for this interface in all of the affected policies.

Score

> If a metric undershoots the chosen threshold, the points are added to the overall result of the policy.

Critical
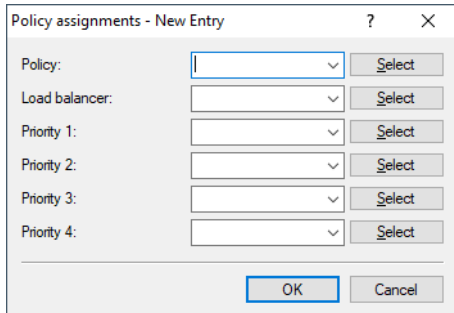
> Marks whether a threshold is critical. If a threshold value marked as "critical" is not undershot, the overall result is not defined.

(!)   An interface with an undefined overall result cannot be selected by a dynamic load balancer decision.

Policy-Assignments

Here you set which DPS policy should be used with which load balancer, and what the priorities are if the overall results are equal.

To configure the policy assignments, navigate to the view **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **Policy assignments**.

Policy

>   The name of an existing DPS policy from *Policies* on page 7.

Load balancer

>   Name of a load balancer to be rated by this policy. Measurements are automatically started on all interfaces of this load balancer according to the measurement profiles referenced in the policy.

>   (!)   Measurements can be suppressed for individual interfaces of this load balancer. See also *Policy exceptions* on page 8.
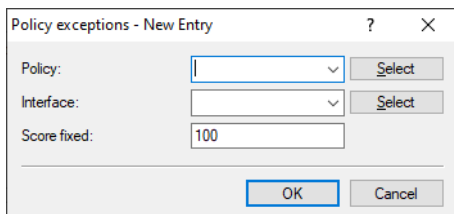
Priority

>   If several interfaces achieve the same overall policy result during dynamic path selection, the "Priority" values determine which interface is actually selected (1 – highest priority, 4 – lowest priority). If the fields are left empty, then load balancing follows the standard "round-robin" strategy.

Policy exceptions

One option is not to apply measurement profiles to certain interfaces, for example if they are charged by data volume.

To configure the policy exceptions, navigate to the view **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **Policy exceptions**.

Policy

>   The name of an existing DPS policy from *Policies* on page 7.

Interface

The name of an interface (e.g. WAN remote sites, VPN tunnels) belonging to a load balancer that is rated by the policy. The measurement profiles referenced in the policy are not used to start measurements on the interface.

ⓘ Where an interface is used by numerous load balancers, or where multiple policies are used to rate the load balancer that uses this interface, measurements must be prevented by making an an exception for this interface in all of the affected policies.

Score fixed

Since no dynamic overall result can be derived without making measurements, this score for the interface is used for all decisions relating to dynamic path selection.

2.1.2 Show commands
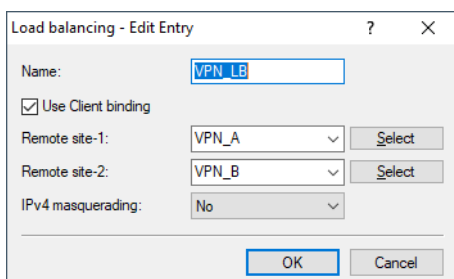
> `DPS-v4-Policies <policy> <peer>`: Displays information about the IPv4 policies used by dynamic path selection for the corresponding policy and remote site.

> `DPS-v4-Score <policy> <load-balancer>`: Shows information about the score for dynamic path selection over IPv4 for the corresponding policy and load balancer.

> `DPS-v4-Score-Details <policy> <peer>`: Shows detailed information about the IPv4 dynamic path selection score for the corresponding policy and remote site.

> Extension to the ping command:

`ping -l <policy>`: Uses the specified dynamic path selection load balancer policy to determine the outgoing interface.

2.1.3 Sample configurations

Scenario with two VPN tunnels over two different Internet connections from the branch office to the headquarters

In this example, dynamic path selection should be set up for all data traffic in a scenario with two VPN tunnels over two different Internet connections from the branch office to the headquarters. The IP address for testing the line quality with ICMP test packets is the private IP address of the central-site gateway, 10.8.0.3. The goal is that only the best line or VPN tunnel should be selected according to the latency.

Dynamic path selection is activated at the branch office only. We are assuming that both of the Internet connections are available and that the two VPN tunnels VPN_A and VPN_B are already configured as a load balancer with the name VPN_LB:

1. Add a new table row under **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **ICMP measurement profiles**.

The first step is to create a new measurement profile. The IPv4 destination is the private IP address of the central gateway, 10.8.0.3. Measurement packets used to evaluate the paths are sent over the VPN tunnels (SD-WAN overlays) every 5 seconds.

```
ICMP measurement profiles - Edit Entry        ?    ×

Measurement profile:        MESS-PROFIL
DSCP value:                 BE
Source address (optional):              ⌄    Select
IPv4 destination:           10.8.0.3
Payload size:               0
Interval:                   5            seconds
Sliding window:             100

                      OK          Cancel
```

2. Add a new table row under **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **Policies**.

The next step is to create a new policy with an SLA metric "Latency" set with a threshold of 50 ms. If the corresponding VPN tunnel has a latency of less than 50 ms, the path is given a score of 100 (points). A connection that does not meet this criterion receives a score of 0, i.e. it is rated as worse. The path with the highest score is the preferred path and is therefore used for the data traffic. If both paths have an identical score of 100, load balancing is performed with both of the VPN tunnels.

```
Policies - Edit Entry                    ?    ×

Policy:                 LB-RICHTLINIE
Measurement profile:    MESS-PROFIL    ⌄    Select
SLA metric:             latency(ms)    ⌄
Threshold:              50
Score:                  100
Critical:               No             ⌄

                      OK          Cancel
```

3. Add a new table row under **IP Router** > **Routing** > **SD-WAN Dynamic Path Selection** > **Policy assignments**.

In the following, the newly created policy is linked to the VPN load balancer cluster VPN_LB. The priority fields can be left blank.

```
Policy assignments - Edit Entry          ?    ×

Policy:          LB-RICHTLINIE    ⌄    Select
Load balancer:   VPN_LB           ⌄    Select
Priority 1:                       ⌄    Select
Priority 2:                       ⌄    Select
Priority 3:                       ⌄    Select
Priority 4:                       ⌄    Select

                      OK          Cancel
```

4. Add a new table row under **Firewall/QoS** > **IPv4 rules** > **Rules**.

Create a new firewall rule that accepts all traffic and that has the value "LB-RICHTLINIE" as the load balancer policy.
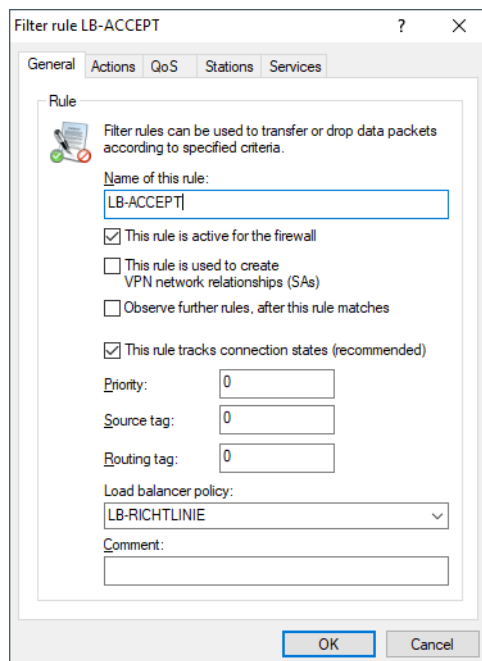
2.2 Additions to the Setup menu

2.2.1 Dynamic-Path-Selection

Used in an SD-WAN scenario where several lines are available, dynamic path selection optimizes the application performance by directing the data traffic over the line with the best quality according to metrics such as load, packet loss, latency or jitter.

Dynamic path selection is activated on a load balancer (see *2.8.10.2.16 LB-Policy* on page 20). A load balancer can be defined either for Internet connections or for SD-WAN overlay tunnels (VPN). The end point for ICMP test packets can either be any IP address or the central-site SD-WAN gateway.

SNMP ID:

2.110.4

Console path:

Setup > **Firewall**

ICMP-Measurement-Profiles

ICMP measurement profiles specify a parameter set used by measurements that are based on ICMP pings. Interface metrics are derived from measurements to quantify the connection quality. These metrics are: Average round trip time (RTT, latency), jitter and packet loss rate.

SNMP ID:

2.110.4.1

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection**

Measurement-Profile

The name of the profile. This name is used to reference the profile in DPS policies.

SNMP ID:

2.110.4.1.1

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

DSCP-value

Sets the DSCP value in the IP header of measurement packets. DSCP (Differentiated Services Code Point) is used for QoS (Quality of Service).

SNMP ID:

2.110.4.1.2

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Possible values:

> **BE**
> **CS0**
> **CS1**
> **CS2**
> **CS3**
> **CS4**
> **CS5**
> **CS6**
> **CS7**
> **AF11**
> **AF12**
> **AF13**
> **AF21**
> **AF22**
> **AF23**
> **AF31**
> **AF32**
> **AF33**
> **AF41**
> **AF42**
> **AF43**
> **EF**

Loopback-Addr.

Optionally references a named loopback address used as the sender in the measurement packets. If the field is left empty, the router automatically selects an address that matches the sending interface.

SNMP ID:

> 2.110.4.1.3

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Possible values:

> Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

IPv4-Destination

The measurement destination as a valid IPv4 unicast address. With "0.0.0.0" entered, the measurement destination is determined dynamically by the VPN. If the field is left empty, no measurements are made for this family of addresses.

SNMP ID:

> 2.110.4.1.4

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Payload-Size

Specifies the size of the data payload that follows the ICMP header (payload size) of the pings being sent.

SNMP ID:

2.110.4.1.6

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Possible values:

Max. 5 characters from `[0-9]`

Interval

The interval in seconds between 2 measurements. The maximum round trip time is also specified. Packets not answered within a measurement interval are counted as packet loss.

SNMP ID:

2.110.4.1.7

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Possible values:

Max. 5 characters from `[0-9]`

Sliding-Window

Maximum number of measurement values that are used to determine the interface metrics. If a measurement value is received after the number specified here has been reached, the oldest measurement is discarded.

SNMP ID:

2.110.4.1.8

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **ICMP-Measurement-Profiles**

Possible values:

Max. 5 characters from `[0-9]`

Policies

To evaluate the connection quality of the interfaces used for Dynamic Path Selection, the metrics calculated from the measurement profiles are compared to threshold values, and points (as a score) are awarded. These points added up to determine which is the "best" interface. Certain thresholds can be specified as being "critical" (e.g. jitter <= 30 ms).

Dynamic load balancer decisions are based on the points total in combination with the exceeded critical threshold values. A DPS policy collects the threshold values and criticality markings that are required to calculate the total points.

SNMP ID:

> 2.110.4.16

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection**

Policy

The name of the DPS policy. This name is used to reference the policy in firewall rules. All of the rows in this table with the same policy name are combined into one policy. This makes it possible, for instance, to use the same metric multiple times with different thresholds in the same policy. This allows a points-based grading (e.g. 10 points with a latency <= 100, another 10 points with a latency <= 50).

SNMP ID:

> 2.110.4.16.1

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policies**

Possible values:

> Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Measurement-Profile

Either empty or the name of an ICMP measurement profile.

> (!) The field must be empty if, and only if, the SLA metric "Load(%)" is selected. In all other cases, a measurement profile must be specified.

SNMP ID:

> 2.110.4.16.2

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policies**

Possible values:

> Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

SLA-Metric

This is the metric generated from the measurements of the set measurement profile. The value of metric is compared to the threshold value.

(!) The metric "Load(%)" denotes the utilization of the interface in percent of the maximum bandwidth. As this value is not determined using separate measurements, the entry *2.110.4.16.2 Measurement-Profile* on page 15 must be left empty.

SNMP ID:

2.110.4.16.3

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policies**

Possible values:

Latency (ms)
Jitter (ms)
Packet loss (%)
Load (%)

Threshold

Where an interface is used by numerous load balancers, or where multiple policies are used to rate the load balancer that uses this interface, measurements need to be prevented by making an an exception for this interface in all of the affected policies.

SNMP ID:

2.110.4.16.4

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policies**

Possible values:

Max. 10 characters from `[0-9]`

Value

If a metric undershoots the chosen threshold, the points are added to the overall result of the policy.

SNMP ID:

2.110.4.16.5

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policies**

Possible values:

Max. 5 characters from `[0-9]`

Critical

Marks whether a threshold is critical. If a threshold value marked as "critical" is not undershot, the overall result is not defined.

> (!) An interface with an undefined overall result cannot be selected by a dynamic load balancer decision.

SNMP ID:

2.110.4.16.6

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policies**

Possible values:

No
Threshold is not marked as critical.
Yes
Threshold is marked as critical.

Policy-Assignments

Here you set which DPS policy should be used with which load balancer, and what the priorities are if the overall results are equal.

SNMP ID:

2.110.4.17

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection**

Policy

The name of an existing DPS policy from *2.110.4.16.1 Policy* on page 15.

SNMP ID:

2.110.4.17.1

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignments**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Load-Balancer

Name of a load balancer to be rated by this policy. Measurements are automatically started on all interfaces of this load balancer according to the measurement profiles referenced in the policy.

> (!) Measurements can be suppressed for individual interfaces of this load balancer. See also
> *2.110.4.18 Policy-Assignment-Exceptions* on page 19.

SNMP ID:

>   2.110.4.17.2

Console path:

>   **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignments**

Possible values:

>   Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Priority-1

If several interfaces achieve the same overall policy result during dynamic path selection, the "Priority" values determine which interface is actually selected (1 – highest priority, 4 – lowest priority). If the fields are left empty, then load balancing follows the standard "round-robin" strategy.

SNMP ID:

>   2.110.4.17.3

Console path:

>   **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignments**

Possible values:

>   Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Priority-2

If several interfaces achieve the same overall policy result during dynamic path selection, the "Priority" values determine which interface is actually selected (1 – highest priority, 4 – lowest priority). If the fields are left empty, then load balancing follows the standard "round-robin" strategy.

SNMP ID:

>   2.110.4.17.4

Console path:

>   **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignments**

Possible values:

>   Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Priority-3

If several interfaces achieve the same overall policy result during dynamic path selection, the "Priority" values determine which interface is actually selected (1 – highest priority, 4 – lowest priority). If the fields are left empty, then load balancing follows the standard "round-robin" strategy.

SNMP ID:

2.110.4.17.5

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignments**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Priority-4

If several interfaces achieve the same overall policy result during dynamic path selection, the "Priority" values determine which interface is actually selected (1 – highest priority, 4 – lowest priority). If the fields are left empty, then load balancing follows the standard "round-robin" strategy.

SNMP ID:

2.110.4.17.6

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignments**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Policy-Assignment-Exceptions

One option is not to apply measurement profiles to certain interfaces, for example if they are charged by data volume.

SNMP ID:

2.110.4.18

Console path:

Setup > **Firewall** > **Dynamic-Path-Selection**

Policy

The name of an existing DPS policy from .

SNMP ID:

2.110.4.18.1

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignment-Exceptions**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Interface

The name of an interface (e.g. WAN remote sites, VPN tunnels) belonging to a load balancer that is rated by the policy. The measurement profiles referenced in the policy are not used to start measurements on the interface.

(!) Where an interface is used by numerous load balancers, or where multiple policies are used to rate the load balancer that uses this interface, measurements must be prevented by making an an exception for this interface in all of the affected policies.

SNMP ID:

2.110.4.18.2

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignment-Exceptions**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Score-Fixed

Since no dynamic overall result can be derived without making measurements, this score for the interface is used for all decisions relating to dynamic path selection.

SNMP ID:

2.110.4.18.3

Console path:

> **Setup** > **Firewall** > **Dynamic-Path-Selection** > **Policy-Assignment-Exceptions**

Possible values:

Max. 10 characters from `[0-9]`

2.2.2 LB-Policy

Specifies the dynamic path selection policy used for this firewall rule.

SNMP ID:

2.8.10.2.16

Console path:

> **Setup** > **IP-Router** > **Firewall** > **Rules**

Possible values:

> Max. 16 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_. ``

Default:

> *empty*

3 Wireless LAN – WLAN

3.1 WPA default passphrase deprecated

Until now, the default WPA passphrase for LCOS was preset to "L" and the LAN MAC address. As of LCOS 10.42 this preset WLAN passphrase is deprecated. It is now essential for the user to configure an individual secure passphrase. If no passphrase is configured despite the fact that a passphrase is required for the selected encryption mode (WEP, WPA2/3-PSK), the WLAN will simply not operate. The syslog indicates that no passphrase is set, although one is required.