Normative Text for QoS

Date: 2006-December-22

Author(s):

Name	Company	Address	Phone	email
Nada Golmie	NIST	100 Bureau Dr, Stop 8920 Gaithersburg, MD, 20899, USA	+1 301 975-4190	nada.golmie@nist.gov
Richard Rouil	NIST	100 Bureau Dr, Stop 8920 Gaithersburg, MD, 20899, USA	+1 301 975-3387	richard.rouil@nist.gov

Abstract

This document contains normative text changes related to the support of the Media Independent Handover Quality of Service model currently defined in IEEE 802.21 draft D3.0.

Content

5.1.3 Quality of Service *(page 13)*

The quality of the service (QoS) experienced by an application depends on the accuracy, speed and dependability of the information transfer of the communication channel. The IEEE 802.21 standard provides support for fulfilling application QoS requirements in the presence of a communication handover.

~~The MIH QoS model defines parameters that may be used in specifying and assessing characteristics of packet transfers between a source and its destinations. The communication channel is considered to be composed of several connected segments, each under a possibly different but cooperative administrative authority. Examples for such channels, such as for IP traffic have been detailed in [34].~~

There are two aspects of QoS to consider in the context of 802.21. Firstly, there is the QoS experienced by an application during a handover. Secondly, there is the QoS considered as part of a handover decision. The IEEE 802.21 specifications includes mechanisms that support both aspects of QoS towards enabling seamless mobility; however the MIHF alone cannot guarantee seamless mobility. Depending on the QoS requirements of the end-to-end application, seamless mobility implies minimizing the latency, and potential packet loss incurred during a handover so as to minimize the end-to-end delay and loss perceived by the application. Seamless mobility also implies the timely assessment of network conditions, such as the monitoring of packet loss on the link of current network and of signal strength on the link on both current and target networks in order to optimize the handover decision and its execution.

The MIH services defined by the IEEE 802.21, including event, command, and information service, need to consider network traffic performance objectives and how well they meet the application quality of service requirements.

The MIH QoS model defines parameters that are used to set the requirements and assess the performance of packet transfers between a source and its destinations. When used in threshold setting commands (such as MIH_Configure), these parameters describe the QoS requirements of the MIH user. On the other hand, when used in parameter reporting events (such as MIH_Link_Paramerters_Report) and parameter extraction commands (such as MIH_Get_Status), they characterize current network conditions. Therefore, depending on their usage these parameters can represent either static QoS requirements or dynamic network measurements.

~~The communication channel is considered to be composed of several connected segments, each under a possibly different but cooperative administrative authority. Examples for such channels, such as for IP traffic have been detailed in [34].~~

5.2.2 QoS Design Principles *(page 16)*

In the context of the 802.21 specifications it is assumed that applications communicate via a packetized communication channel ~~over which a transmitted packet can experience the following outcomes~~ that is considered to be composed of several connected segments, each under a possibly different but cooperative administrative authority. Examples of such channels, such as for IP traffic have been detailed in [34].

A transmitted packet over a communication channel can experience the following outcomes:

- Be received with no errors at its intended destination
- Be received with errors at its intended destination
- Not be received in which case it is said that the packet is lost.

The maximum attainable speed of information transfer over a given communication channel can be constant, as it is usually the case with network segments involving only wired links, or it can be time varying at different scales, at is the case for segments involving wireless links. This measure will be called channel ~~capacity~~ throughput, for the purposes of this document.

The ability of the channel to provide accurate information transfer can be described via a statistical model characterized by the following parameters:

1. Minimum Packet Transfer Delay: is defined as the minimum delay over a population of interest
2. Average Packet Transfer Delay: is defined as the arithmetic mean of the delay over a population of interest
3. Maximum Packet Transfer Delay: is defined as the maximum delay over a population of interest
4. Jitter: is defined as the standard deviation of the delay over a population of interest
5. Packet loss rate: is defined as the ratio between the number of frames that are transmitted but not received and the total number of frames transmitted over a population of interest.
6. Packet error rate: is defined as the ratio between the number of packets that have been received with errors and the total number of packets present in a population of interest.

It is generally accepted that based on the required accuracy of information transfer applications can be grouped into a small number of behavioral sets [Y.1541] called Classes of Service (CoS). Support for differentiation via Classes of Service is pervasive in many of the IEEE 802 based standards (802.11, 802.1q, 802.16, etc.).

For a link that supports CoS differentiation, per CoS traffic accuracy parameters need to be maintained in order to provide insights on how individual traffic classes are faring.

In summary, the following set of parameters characterize the speed and accuracy of the information transfer a multi-CoS traffic link supports:

1. Link ~~capacity~~ Throughput, representing the maximum information transfer rate achievable. This value is determined by the physical characteristics of the link. While for wired links ~~is~~ it is usually a constant, for wireless links it is time varying due to the sharing of the medium
2. Link Packet Error Rate: representing the ratio between the number of frames received in error and the total number of frames transmitted in a link population of interest
3. Supported classes of service: represents the maximum number of differentiable classes of service supported by this link.
4. Class of Service Parameters List. For each of the supported classes of service the following

parameters are defined:

a) Class Minimum Packet Transfer Delay: is defined as the minimum delay over a class population of interest

b) Class Average Packet Transfer Delay: is defined as the arithmetic mean of the delay over a class population of interest

c) Class Maximum Packet Transfer Delay: is defined as the maximum delay over a class population of interest

d) Class Packet Delay Jitter: is defined as the standard deviation of the delay over a class population of interest

e) Class Packet loss rate: is defined as the ratio between the number of frames that are transmitted but not received and the total number of frames transmitted over a class population of interest.

It is assumed that the classes of service definitions used within IEEE 802.21 conform to [Y.1541].

~~The performance implications to consider from the MIH perspective include both the transient network performance achieved during a handover as well as the continuous monitoring of current network conditions.~~

~~The 802.21 specifications provide mechanisms to support seamless mobility as an enabler; however the MIHF alone cannot guarantee seamless mobility. Depending on the QoS requirements of the end-to-end application, seamless mobility implies minimizing the latency, and potential loss incurred during a handover so as to minimize the end-to-end delay and loss perceived by the application. Seamless mobility also implies the timely assessment of network conditions, such as the monitoring of packet loss on the link on current network and of signal strength on the link on both current and target networks in order to optimize the handover decision and its execution.~~

~~The MIH services defined by the IEEE 802.21, including event, command, and information service, need to consider network traffic performance objectives and how well they meet the application quality of service requirements.~~

6.4.3 Information Service Elements *(page 50)*

Table 6 - Information Elements

No	Name of Information Element	Description	Representation in Section
General Information Elements			
1.1	TYPE_IE_NETWORK_TYPE	Link types of the networks that are available in a given geographical area	
1.2	TYPE_IE_OPERATOR_IDENTIFIER	The operator identifier of the access net work/core network .	
1.3	TYPE_IE_SERVICE_PROVIDER_I DENTIFIER	Identifier for the service provider.	
Access Network specific information For each (Link Type and Operator) combination following information may be provided			
2.1	TYPE_IE_ACCESS_NETWORK_I DENTIFIER	Identifier for the access network.	
2.2	TYPE_IE_ROAMING_PARTNERS	Roaming Partners. Access Network Operators with which the current access network operator has direct roaming agreements.	
2.3	TYPE_IE_COST	Cost. Indication of cost for service or network usage	
2.4	TYPE_IE_NETWORK_STANDAR DS	Access Network specific applicable revisions to the base access network standard	
2.5	TYPE_IE_NETWORK_SECURITY	Security characteristics of the link layer	
2.6	TYPE_IE_NETWORK_QOS	QoS characteristics of the link layer	
PoA specific information For each PoA of each (Link Type + Operator) following IEs may be provided			
3.1	TYPE_IE_POA_ ADDRESS	MAC Address of PoA	
3.2	TYPE_IE_POA_L OCATION	Location of PoA. Geographical location of a given PoA. Multiple location types are supported includ ing coordinate-based location information and civic address	
3.3	TYPE_IE_POA_DATA_RATE	Data Rate. The minimum and maximum value of data rate supported by the link layer of a given PoA	
3.4	TYPE_IE_POA_CHANNEL_RAN GE	Channel Range/Parameters. Spectrum range supported by the Channel for that PoA	
Higher layer services/information per PoA			
4.1	TYPE_IE_POA_SUBNET_INFOR MATION	Information about subnets supported by a typical PoA	
4.2	TYPE_IE_POA_IP_CONFIG_MET HODS	IP Configuration Methods supported by a typical PoA	
4.3	TYPE_IE_POA_ CAPABILITIES	Bitmap of PoA capabilities	
4.4	TYPE_IE_POA_IP_ADDRESS	IP Address of PoA.	
Other Information Elements			
5.1	Vendor Specific IEs	Vendor Specific Services	defined by individ ual vendors.

6.4.5.2.6 QoS in Network (for Access Network + Operator) *(page 58)*

Type	Description	Length	Value
TYPE_IE_NETWORK_QOS	Network QOS Characteristics	Variable	QoS classes and Traffic Specifications. The length, format and semantics of this field are defined in Table 12.

Table 12 - QoS Parameter Encoding

~~Syntax~~	~~Length (octets)~~	~~Notes~~
~~Throughput~~	~~4~~	~~The maximum information transfer rate achievable. It is measured in kbps~~
~~Link Packet Error Rate~~	~~2~~	~~A value equal to integer part of the result of multiplying -100 times the log10 of the ratio between the number of packets received in error and the total number of packets transmitted in a link popula tion of interest.~~
~~Supported number of COS~~	~~2~~	~~The maximum number of differentiable classes of service sup ported.~~
~~CoS Minimum Packet Transfer Delay~~	~~4~~	~~This is an encoded value which contains the class of service identi fier in the 2 most significant octets and the minimum packet transfer delay for the class in ms in the two least significant octets. Valid range for minimum packet transfer delay: [0..65535] ms~~
~~CoS Average Packet Transfer Delay~~	~~4~~	~~This is an encoded value which contains the class of service identi fier in the 2 most significant octets and the average packet transfer delay for the class in ms in the two least significant octets. Valid range for average packet transfer delay: [0..65535] ms~~
~~CoS Maximum Packet Transfer Delay~~	~~4~~	~~This is an encoded value which contains the class of service identi fier in the 2 most significant octets and the maximum packet trans fer delay for the class in ms in the two least significant octets. Valid range for maximum packet transfer delay: [0..65535] ms~~
~~CoS Packet Transfer Delay Jitter~~	~~4~~	~~This is an encoded value which contains the class of service identi fier in the 2 most significant octets and the packet transfer delay jit ter for the class in ms in the two least significant octets. Valid range for packet transfer delay jitter: [0..65535] ms~~
~~CoS Packet Loss rate~~	~~4~~	~~This is an encoded value which contains the class of service identi fier in the 2 most significant octets and a value equal to integer part of the result of multiplying -100 times the log10 of the ratio between the number of packets lost and the total number of packets transmitted in the class population of interest~~

Syntax	Length (octets)	Notes
QoS Parameter Type	2	The type of QoS parameter as defined in Table T0
QoS Parameter Value	Variable	The parameter value is dependent on the parameter type. For generic QoS parameters, the encoding is defined in Table T1

Table T0 – QoS Parameter Type Encoding

Syntax	Length (octets)	Notes
QoS Link Family	1	The type of link for the QoS Parameter. Values for these types are defined in Table 8. Type 0 indicates Generic link type.
QoS Parameter Subtype	1	The subtype of QoS parameter. The QoS parameters for the Generic link type: 0: Number of supported CoS 1: Throughput (kb/s) 2: Packet Error Rate 3: CoS Minimum Packet Transfer Delay (ms) 4: CoS Average Packet Transfer Delay (ms) 5: CoS Maximum Packet Transfer Delay (ms) 6: CoS Packet Transfer Delay Jitter (ms) 7: CoS Packet Loss Rate 8~255: Reserved [Editor's note: The QoS parameters for link specific types are TBD.]

Table T1 - QoS Parameter Value Encoding

Syntax	Length (octets)	Notes
Number of Supported CoS	1	The maximum number of differentiable classes of service supported. Valid range: [0..255]
Throughput	4	The maximum information transfer rate achievable. It is measured in kb/s.
Packet Error Rate	2	A value equal to the integer part of the result of multiplying -100 times the log10 of the ratio between the number of packets received in error and the total number of packets transmitted in a link population of interest.
CoS Minimum Packet Transfer Delay	4	This is an encoded value which contains the class of service identifier in the 2 most significant octets (valid range: [0..255]) and the minimum packet transfer delay for the class in ms in the two least significant octets. Valid range for minimum packet transfer delay: [0..65535] ms.
CoS Average Packet Transfer Delay	4	This is an encoded value which contains the class of service identifier in the 2 most significant octets (valid range: [0..255]) and the average packet transfer delay for the class in ms in the two least significant octets. Valid range for average packet transfer delay: [0..65535] ms
CoS Maximum Packet Transfer Delay	4	This is an encoded value which contains the class of service identifier in the 2 most significant octets (valid range: [0..255]) and the maximum packet transfer delay for the class in ms in the two least significant octets. Valid range for maximum packet transfer delay: [0..65535] ms.
CoS Packet Transfer	4	This is an encoded value which contains the class of service identifier

Delay Jitter		in the 2 most significant octets (valid range: [0..255]) and the packet transfer delay jitter for the class in ms in the two least significant octets. Valid range for packet transfer delay jitter: [0..65535] ms.
CoS Packet Loss rate	4	This is an encoded value which contains the class of service identifier in the 2 most significant octets (valid range: [0..255]) and the value equal to the integer part of the result of multiplying -100 times the log10 of the ratio between the number of packets lost and the total number of packets transmitted in the class population of interest in the two least significant octets.

7.5.4 Link_Configure_Thresholds *(page 84)*

7.5.4.1 Link_Configure_Thresholds.request *(page 84)*

7.5.4.1.1 Function

This primitive is used by MIHF to configure thresholds for Link_Parameters_Report indication.

7.5.4.1.2 Semantics of service primitive

The primitive parameter is as follows:

Link_Configure_Thresholds.request(
~~LinkParameterList~~
LinkConfigureParameterList
)

~~Name~~	~~Type~~	~~Valid Range~~	~~Description~~
~~LinkParameterList~~	~~List~~	~~N/A~~	~~A list of following set of parameters:~~ ~~LinkParameterType,~~ ~~InitiateActionThreshold,~~ ~~RollbackActionThreshold,~~ ~~ExecuteActionThreshold~~
~~LinkParameterType~~	~~A pair of {LinkType:ParamType}.~~ ~~Examples:~~ ~~{Generic:Link Speed},~~ ~~{Generic:Link Bit Error Rate},~~ ~~{Generic:Link Frame Loss Rate before retransmission},~~ ~~{Generic:Link Signal Strength},~~ ~~{Generic:Link SINR},~~ ~~{GPRS:BLER},~~ ~~{GPRS:RxLevNCell}~~	~~N/A~~	~~Parameters for which thresholds may be set~~
~~InitiateAction-Threshold~~	~~Threshold values are dependent on parameter for which they are being set.~~	~~N/A~~	~~Threshold value which may cause MIH Users to start "setup" type activities in response to actual parameter values crossing this threshold.~~
~~RollbackAction-Threshold~~	~~Threshold values are dependent on parameter for which they are being set.~~	~~N/A~~	~~Threshold value which may cause MIH Users to cancel or rollback the above setup type operation if the actual parameter values retreat to this threshold.~~
~~ExecuteAction-Threshold~~	~~Threshold values are dependent on parameter for which they are being set.~~	~~N/A~~	~~Threshold value which may cause MIH Users to execute taking appropriate action if the actual parameter values cross this threshold.~~

Name	Type	Valid Range	Description
LinkConfigureParameterList	List	N/A	A list of LinkConfigureParameter:

Elements of LinkConfigureParameter

Name	Type	Valid Range	Description
QoSParameterType	INTEGER	~~1-255~~N/A	Parameter for which thresholds may be set as defined in Table 12. Note~~: Type 0 is reserved~~Subtype 0 for Generic link type is reserved.
InitiateAction-Threshold	Threshold values are dependent on parameter for which they are being set.	N/A	Threshold value which may cause MIH Users to start “setup” type activities in response to actual parameter values crossing this threshold.
RollbackAction-Threshold	Threshold values are dependent on parameter for which they are being set.	N/A	Threshold value which may cause MIH Users to cancel or rollback the above setup type operation if the actual parameter values retreat to this threshold.
ExecuteAction-Threshold	Threshold values are dependent on parameter for which they are being set.	N/A	Threshold value which may cause MIH Users to execute taking appropriate action if the actual parameter values cross this threshold.

7.5.4.1.3 When generated

This primitive is generated by an MIHF that may need to set threshold values for different link parameters.

7.5.4.1.4 Effect on receipt

The recipient responds immediately with Link_Configure_Threshold.confirm primitive.

7.5.4.2 Link_Configure_Thresholds.confirm *(page 85)*

7.5.4.2.1 Function

This primitive is sent in response to the Link_Configure_Threshold.request primitive. This primitive specifies the status of threshold configuration operation.

7.5.4.2.2 Semantics of service primitive

The primitive parameters are as follows:

Link_Configure_Thresholds.confirm (
~~LinkParameterStatusList~~
LinkConfigureStatusList,
Status

)

Name	Type	Valid Range	Description
LinkParameter-StatusList	List	N/A	A list of following set of parameters: LinkParameterType Status
LinkParameter-Type	A pair of {LinkType:ParamType}. Examples: {Generic:Link Speed}, {Generic:Link Bit Error Rate}, {Generic:Link Frame Loss Rate before retransmission}, {Generic:Link Signal Strength}, {Generic:Link SINR}, {GPRS:BLER}, {GPRS:RxLevNCell}	N/A	Parameters for which thresholds may be set
Status	Enumerated	Success Error	Status of operation

Name	Type	Valid Range	Description
LinkConfigure-StatusList	List	N/A	A list of LinkConfigureStatus
Status	Enumerated	Success Error	Status of operation

Elements of LinkConfigureStatus

Name	Type	Valid Range	Description
QoSParameterType	INTEGER	N/A	Parameter for which thresholds configuration was requested. Table 12 for encoding. Note: Subtype 0 for Generic link type is reserved.
Status	Enumerated	Success Error	Status of operation

7.5.4.2.3 When generated

This primitive is generated in response to the Link_Configure_Thresholds.request operation

7.5.4.2.4 Effect on receipt

The recipient prepares to receive Link Parameter Change notifications on successful execution of this primitive. However, if Status indicates an error, the recipient shall ignore any other returned values and, instead,

shall perform appropriate error handling.

7.5.10 Link_Parameters_Report.indication *(page 91)*

7.5.10.1 Function

Link_Parameters_Report indicates changes in link parameters have crossed specified threshold levels. This may include link layer parameters such as throughput, delay, etc. The threshold level for each such parameter may have to be configured through a separate command to link layer.

Event Type: State Change

7.5.10.2 Semantics of service primitive

Link_Parameters_Report.indication(
LinkIdentifier,
LinkParametersReportList
)

Parameters

Name	Type	Valid Range	Description
LinkIdentifier	Link ID	N/A	Identifier of the link associated with the event
~~Num LinkParameters~~	~~INTEGER~~	~~0-65535~~	~~Number of parameters in LinkParameterList~~
~~LinkParameterList~~ LinkParametersReportList	List	N/A	~~A list of triplets of {LinkParameterType, oldValueofLinkParameter, newValueOf-LinkParameter)~~ A list of LinkParameterReport

Elements for LinkParameterReport

Name	Type	Valid Range	Description
QoSParameterType	INTEGER	N/A	Parameter for which threshold has been crossed Note: Subtype 0 for Generic link type is reserved.
oldValueofLinkParameter	Threshold values are dependent on parameter for which they are being set.	N/A	Old parameter value
newValueOf-LinkParameter	Threshold values are dependent on parameter for which they are being set.	N/A	New parameter value

7.5.10.~~2~~3 When generated

7.5.15.1 Link_Get_Parameters

7.5.15.1 Link_Get_Parameters.request

7.5.15.1.1 Function

This primitive is used by MIH Function to obtain Link Parameters.

7.5.15.1.2 Semantics of service primitive

The primitive parameter is as follows:

Link_Get_Parameters.request (
~~LinkParameterList~~

LinkParametersRequest
)

Name	Type	Valid Range	Description
~~LinkParamterList~~ LinkParametersRequest	~~List~~ BITMAP	~~NA~~ N/A	~~A list of link parameters.~~ BITMAP representing the list of QoS Parameters for which status is requested. The bit position represents the QoS Parameter Type. For example if bit 0 is set, the MIHF is requesting the maximum number of CoS supported by the link.

7.5.15.1.3 When generated

This primitive is generated by an upper layer entity that may need to immediately obtain present values of different link parameters.

7.5.15.1.4 Effect on receipt

The recipient responds immediately with Link_Get_Parameters.confirm primitive.

7.5.15.2 Link_Get_Parameters.confirm *(page 93)*

7.5.15.2.1 Function

This primitive is sent in response to the Link_Get_Parameters.request primitive. This primitive provides present value conditions of the link, which may reflect an on going average measurement.

7.5.15.2.2 Semantics of service primitive

The primitive parameters are as follows:

Link_Get_Parameters.confirm (
~~LinkParameterList,~~
LinkParametersStatusList,
Status

)

Name	Type	Valid Range	Description
~~LinkParamterList~~ LinkParametersStatusList	List	N/A	~~A list of link parameters.~~ A list of QoS Parameter as defined in Table 12
Status	Enumerated	Success Error	Status of operation

~~Table 29 - Valid Range of Link Parameters~~

~~Name~~	~~Valid Range~~
~~RSSI~~	~~0-90dB~~
~~SNR~~	~~-30-60dB~~
~~C/I~~	~~-20-50dB~~
~~BER~~	~~10e-1 to 10-e-6~~
~~Data Rate~~	~~In Mbps~~

7.6.11 MIH_Link_Parameters_Report

7.6.11.1 MIH_Link_Parameters_Report.indication *(page 106)*

7.6.11.1.1 Function

MIH_Link_Parameters_Report notification is sent by the MIHF to MIH Users to indicate various values of link parameters.

The event may be local or remote.

Parameters

Name	Type	Valid Range	Description
LinkIdentifer	Link ID	N/A	Identifier of the link associated with the event
~~LINK_QOS_PARAMETER_LIST~~ LinkParametersStatusList	List	N/A	A list of QoS Parameter for which threshold has been crossed ~~as specified in Table~~ Note: Subtype 0 for Generic link type is reserved.

7.6.15 MIH_Get_Status *(page 108)*

An MIH_Get_Status command is issued by upper layer entities to discover and monitor the status of the currently connected and potentially available links. An MIH_Get_Status command may be local or remote. For example, a local get status may help the policy function that resides out of MIH to make optimal handover decisions for different applications when multiple links are available in a mobile node. A remote initiated MIH_Get_Status from the network side may enable the network to collect the status information on multiple links in a mobile node through the currently connected link.

Upper layer entities may query the lower layers periodically in a specified interval or based on the preferences in a policy engine, which is out of the scope of the standard.

7.6.15.1 MIH_Get_Status.request

7.6.15.1.1 Function

This primitive is issued by MIH Users to discover the status of the currently connected and potentially available links.

7.6.15.1.2 Semantics of the service primitive

The parameters of the primitive are as follows:

MIH_Get_Status.request (
SourceIdentifier,
DestinationIdentifier,
LinkIdentifierList,
GetStatusRequestSet
)

Name	Type	Valid Range	Description
Source Identifier	Identifier	Any valid individual or group identifier	The identifier of entity where the request is initiated. This field may be optionally left empty if the command is local.
Destination Identifier	Identifier	Valid MIHF identifier	The destination identifier of request or response. This is the identifier of local or peer MIHF.
LinkIdentifierList	LIST	N/A	List of link identifiers for which status is requested. If the list of empty, return the status of all available links.
Get Status Request Set	~~Set of status requests~~ Integer	~~Set of status requests~~ N/A	~~Containing a set of interested status information.~~ List of StatusRequest. The encoding uses a bitmap as follows: Bit #0: DEVICE_INFO Bit# 1: OPERATION_MODE Bit# 2:CHANNEL_ID Bit# 3:BATTERY_LEVEL Bit# 4: LINK_QOS_PARAMETERS_TYPE_LIST Bit# 5-255: reserved

7.6.15.1.3 When generated

This primitive is generated when MIH Users request the status information from lower layer links.

7.6.15.1.4 Effect of receipt

An MIH_Get_Status command is issued by the local MIH Function to get information on the status of the links. A remote MIH_Get_Status command causes the peer MIH entity to issue the local MIH_Get_Status command.

7.6.15.2 MIH_Get_Status.confirm

7.6.15.2.1 Function

This primitive is issued by the MIHF entity to report the status of the links in response to the requests of MIH Users.

7.6.15.2.2 Semantics of the service primitive

The parameters of the primitive are as follows:

MIH_Get_Status.confirm (
SourceIdentifier,
DestinationIdentifier,
GetStatusResponse~~Set~~List,
Status
)

Name	Type	Valid Range	Description
Source Identifier	Identifier	Any valid individual or group identifier	The identifier of entity where the request is initiated. This field may be optionally left empty if the command is local.
Destination Identifier	Identifier	Valid MIHF identifier	The destination identifier of request or response. This is the identifier of local or peer MIHF.
GetStatusResponse~~Set~~List	~~Response for requests~~ LIST	~~Set of status response~~ N/A	~~Contains status response for set of requested items~~ List of StatusResponse
Status	Enumerated	Success Error	Status of operation

Elements of StatusResponse

Name	Type	Valid Range	Description
LinkIdentifier	INTEGER	N/A	The link identifier for which status has been requested
LinkStatusList	LIST	N/A	List of LinkStatusResponse

Elements of LinkStatusResponse

Name	Type	Valid Range	Description
StatusParameterType	INTEGER	0-255	Type of parameter to be configured: 0: DEVICE_INFO 1: OPERATION_MODE 2:CHANNEL_ID 3:BATTERY_LEVEL 4: LINK_QOS_PARAMETERS_LIST 5-255: reserved
ConfigurationParameterValue	Values are dependent on parameter for which they are being set.	N/A	Value of the parameter being set

LinkStatusType values

Name	Type	Valid Range	Description
DEVICE_INFO	STRING	N/A	Information on manufacturer, model number, revision number of the software/firmware and serial num ber in displayable text are returned.
OPERATION_MODE	INTEGER	0x00 Normal Mode 0x01 Power Saving Mode 0x02 Power Down	Returns the link's current power mode.
CHANNEL_ID	INTEGER	N/A	The ID of the channel currently in use
BATTERY_LEVEL	INTEGER	0-100; -1; unknown bat tery level	Battery level in percentage;
LINK_QOS_PARAMETERS_TYPE_LIST	LIST	N/A	List of QoSParameterType as defined in Table 12.

7.6.15.2.3 When generated

This primitive is generated when MIHF receive the status information and report to MIH Users.

7.6.15.2.4 Effect of receipt

Upon receipt of the link status information, the MIH Users make decisions and take actions.

~~Name (Get Status Requests)~~	~~Type~~	~~Valid Range~~	~~Description~~
~~DEVICE_INFO~~	~~STRING~~	~~N/A~~	~~Information on manufacturer, model number, revision number of the software/firmware and serial num ber in displayable text are returned.~~
~~OPERATION_MODE~~	~~INTEGER~~	~~0x00 Normal Mode 0x01 Power Saving Mode 0x02 Power Down~~	~~Returns the link's current power mode.~~
~~LINK_ID~~	~~Link ID~~	~~N/A~~	~~Return the ID of the link currently configured to communicate with.~~

~~CHANNEL_ID~~	~~INTEGER~~	~~N/A~~	~~The ID of the channel currently in use~~
~~BATTERY_LEVEL~~	~~INTEGER~~	~~0-100; -1; unknown bat tery level~~	~~Battery level in percentage;~~
~~LINK_QoS_PARAMETER_LIST~~	~~LIST~~	~~N/A~~	~~A list of QoS Parameters and their corresponding values as specified in Table .~~

7.6.17 MIH_Configure *(page 112)*

MIH_Configure may be issued by upper layer entities to control the behavior of lower layers, for example, to set some feature of the driver of a specific link. MIH_Configure may contain the configuration commands for multiple lower layer links. When MIH receives MIH_Configure, it issues the Link_Configure_Thresholds commands to corresponding links. The configuration parameter are passed on to Link_Configure_Thresholds commands.

7.6.17.1 MIH_Configure.request

7.6.17.1.1 Function

This primitive is issued by MIH Users to control the behavior of a lower layer link.

7.6.17.1.2 Semantics of the service primitive

The parameters of the primitive are as follows:

MIH_Configure.request (
SourceIdentifier,
DestinationIdentifier,
LinkIdentifier,
ConfigurationRequests~~Sets~~List
)

Name	Type	Valid Range	Description
SourceIdenti fier	Identifier	Any valid individual or group identifier	The identifier of entity where the request is initiated. This field may be optionally left empty if the com mand is local.
Destination Identifier	Identifier	Valid MIHF identifier	The destination identifier of request or response. This is the identifier of local or peer MIHF.
LinkIdentifier	Link ID	N/A	Identifier of the link to configure.
Configuration Requests~~Sets~~List	~~Set of configuration parameters for corre sponding interfaces~~ LIST	N/A	~~Containing a set of configuration parameters. See Table below.~~ List of ConfigurationRequest

7.6.17.1.3 When generated

This primitive is generated when MIH Users attempt to control the behaviors of lower layer links, for example, set some features in the drivers.

7.6.17.1.4 Effect of receipt

A local configure command causes the MIH to issue a Link Configure Threshold command to set the thresholds for lower layers according to the specified configuration parameters. A remote configure command causes the MIH in the peer entity to issue a Link Configure Threshold command. If multiple links need to be configured then Link Configure Threshold command should be sent to each of the links.

Elements of ConfigurationRequest

Name	Type	Valid Range	Description
ConfigurationParameterType	INTEGER	0-255	Type of parameter to be configured: 0: OPERATION_MODE 1: DISABLE_TRANSMITTER 2:LINK_ID 3:CURRENT_ADDRESS 4: SUSPEND_DRIVER 5:LINK_QOS_PARAMETERS_LIST 6-255: reserved
ConfigurationParameterValue	Values are dependent on parameter for which they are being set.	N/A	Value of the parameter being set as defined in Table 30.

Table 30 – Link Configuration Parameter Values

Name	Type	Valid Range	Description
OPERATION_MODE	INTEGER	0x00 Normal Mode 0x01 Power Saving Mode 0x02 Power Down	Change the device's power mode
DISABLE_TRANSMITTER	Boolean	N/A	Enable/disable the transmitter of the inter face.
LINK_ID	Link ID	N/A	Change to the specified link
CURRENT_ADDRESS	STRING	N/A	Change the current address to the value specified
SUSPEND_DRIVER	Boolean	N/A	Suspend or resume of the specified interface.
LINK_QOS_PARAMETERS_LIST	LIST	N/A	A list of QoSParameter and their corresponding values as specified in Table 12 .

~~**Table 31 - LinkQoSParameterType values**~~

Value	Name	Value Size (octets)	Valid Range	Description
0	Throughput	4	0-2^32	The maximum information transfer rate achievable. This value is determined by the physical characteristics of the link. It is measured in kbps
1	Link Packet Error Rate	2	0-65535	A value equal to integer part of the result of multiplying -100 times the log10 of the ratio between the number of packets received in error and the total number of packets transmitted in a link population of interest.
2	Supported number of COS	2	0-65535	The maximum number of differentiable classes of service supported by this link
3	CoS Minimum Packet Transfer Delay	2	0-65535	This is an encoded value which contains the class of service identifier in the 2 most signifi cant octets and the minimum packet transfer delay for the class in ms in the two least signifi cant octets. Valid range for minimum packet transfer delay: [0..65535] ms
4	CoS Average Packet Transfer Delay	2	0-65535	This is an encoded value which contains the class of service identifier in the 2 most signifi cant octets and the average packet transfer delay for the class in ms in the two least significant octets. Valid range for average packet transfer delay: [0..65535] ms
5	CoS Maximum Packet Transfer Delay	2	0-65535	This is an encoded value which contains the class of service identifier in the 2 most signifi cant octets and the maximum packet transfer delay for the class in ms in the two least signifi cant octets. Valid range for maximum packet transfer delay: [0..65535] ms
6	CoS Packet Transfer Delay Jitter	2	0-65535	This is an encoded value which contains the class of service identifier in the 2 most signifi cant octets and the packet transfer delay jitter for the class in ms in the two least significant octets. Valid range for packet transfer delay jitter: [0..65535] ms
7	CoS Packet Loss rate	4	0-2^32	This is an encoded value which contains the class of service identifier in the 2 most signifi cant octets and a value equal to integer part of the result of multiplying -100 times the log10 of the ratio between the number of packets lost and the total number of packets transmitted in the class population of interest
8-255	Reserved	N/A	N/A	Reserved for future use.

7.6.17.2 MIH_Configure.confirm *(page 115)*

7.6.17.2.1 Function

This primitive is issued by the MIH entity to report the result of the MIH_Configure command.

7.6.17.2.2 Semantics of the service primitive

The parameters of the primitive are as follows:

MIH_Configure.confirm (
SourceIdentifier,
DestinationIdentifier,
LinkIdentifier,
~~ConfigurationResponseSets~~
ConfigurationResponseList,
Status
)

Name	Type	Valid Range	Description
Source Identifier	Identifier	Any valid individual or group identifier	The identifier of entity where the request is initiated. This field may be optionally left empty if the command is local.
Destination Identifier	Identifier	Valid MIHF identifier	The destination identifier of request or response. This is the identifier of local or peer MIHF.
LinkIdentifer	Link ID	N/A	Identifier of the link configured.
~~Configuration ResponseSets~~ Configuration ResponseList	~~Set of configu ration parame ters and their configuration results~~ LIST	N/A	~~Containing a set of configuration parameters and their corresponding configuration results: ConfigurationParameter ResultCode~~ List of ConfigurationResponse
Status	Enumerated	Success Error	Status of operation

Elements of ConfigurationResponse

Name	Type	Valid Range	Description
ConfigurationParameterType	INTEGER	0-255	Parameter for which configuration has been requested.
Status	Enumerated	Success Error	Status of operation

7.6.17.2.3 When generated

This primitive is generated when MIH receive the results of the Link Commands.

7.6.17.2.4 Effect of receipt

Upon receipt of the result code, the MIH Users make evaluations and take actions.

8.4.1.23 Link Quality Parameter Type

This specifies the type of link parameter.

Type	Length	Value
23	~~2~~ 2	~~First Octet: Type of link.~~ ~~0: Generic~~ ~~Other valid values are defined in Table 8.~~ ~~Second Octet: Type of Parameter~~ ~~(definition is specific to the Type of Link)~~ ~~For Generic Link:~~ First Octet: Type of link. 0: Generic link type 1-255: Link specific types as defined in Table 8. Second Octet: Subtype of Parameter Generic Link Parameters: ~~0: Speed~~ ~~1: Signal Strength~~ ~~2: Bit Error Rate~~ ~~3: Frame Loss Rate before Retransmission~~ ~~4-255: Reserved~~ 0: Number of supported CoS 1: Throughput 2: Packet Error Rate 3: Minimum Packet Transfer Delay 4: Average Packet Transfer Delay 5: Maximum Packet Transfer Delay 6: Packet Transfer Delay Jitter 7: Packet Loss Rate 8-255: Reserved [Editor's note: specific link parameter types TBD]

8.4.1.26 Link Status Parameters Type

This parameter specifies the set of link layer parameters for which status may be requested or reported.

Type	Length	Value
26	4	Set of link parameters for which status is requested or the value is reported ~~Bit #0: Network Types~~ ~~Bit #1: Device Information~~ ~~Bit #2: Operation Mode~~ ~~Bit #3: Channel Identifier~~ ~~Bit #4: Channel Quality~~ ~~Bit #5: Link Speed~~ ~~Bit #6: Battery Level~~ ~~Bit #7~31: Reserved~~ Bit #0: Device Information Bit #1: Operation Mode

		Bit #2: Channel Identifier Bit #3: Link Speed Bit #4: Battery Level Bit #5: Link QoS Parameters Type List Bit #6~31: Reserved

8.4.1.29 Link Configure Parameters Type

This specifies the set of link parameters that may be configured for handover.

Type	Length	Value
29	1	Set of link parameters which may be used to configure the link ~~Bit #0: Operation Mode~~ ~~Bit #1: Transmitter Status~~ ~~Bit #2: Current Address~~ ~~Bit #3~31: *Reserved*~~ Bit #0: Operation Mode Bit #1: Transmitter Status Bit #2: Link ID Bit #3: Current Address Bit #4: Driver Status Bit #5: Link QoS Parameter List Bit #5~31: *Reserved*

8.4.1.31 Link Parameter Threshold

This specifies the threshold value of a link layer parameter.

Type	Length	Value
31	Variable	Specifies the threshold value of a link layer parameter. The value depends on the parameter under consideration.

8.4.1.36 Link Status Parameters Response

This parameter specifies the response to request to get the status of link layer parameters, see Section 7.6.15.2.4 for details of link status parameter definition.

Type	Length	Value
36	Variable	Status of different link layer parameters

8.4.1.37 Link Configure Parameter Value

This specifies the type of link parameter.

Type	Length	Value
37	Variable	Values for a set of link parameters that need to be configured

Annex A4 - QoS Examples

(informative)

Table 42 below gives an example mapping between the QOS parameters defined by the MIHF and the measurements available on the link. This mapping is media specific and implementation dependent.

Table 42 – An example of a QoS Parameter Mapping Table.

802.21	802.11	802.16	3GPP	3GPP2
Throughput	Peak Data Rate	Maximum Sustained Traffic Rate	Maximum Bitrate	Peak_Rate
~~Guaranteed (Min) Bitrate~~	~~Minimum Data Rate~~	~~Minimum Reserved Traffic Rate~~	~~Guaranteed Bitrate~~	
~~Peak Rate~~	~~Peak Data Rate~~	~~-~~	~~-~~	~~Peak_Rate~~
Packet Loss Rate ~~Before Retransm~~.				Max_IP_Packet_Loss_Rate
Packet Error Rate		Packet Error Rate	SDU Error Ratio	
~~Max Packet Size~~	~~Maximum MSDU Size~~	~~-~~	~~Maximum SDU Size~~	~~Packet_Size~~
CoS Minimum Packet Transfer Delay				
CoS Average Packet Transfer Delay			Transfer Delay	
CoS Maximum Packet Transfer Delay	Delay Bound	Maximum Latency		Max_Latency
CoS Packet Transfer Delay Jitter		Tolerated Jitter		Delay_Var_Sensitive

Figure 36 represents an example flow diagram for using the QoS framework defined by the MIHF. The MIH configure primitive is used to set the application quality of service requirements and make it available to the MIHF. These parameters are mapped into media specific measurements at the MIH layer and then used to configure the link parameter thresholds. While this mapping is not defined by these specifications, Table 42 provides an example of such mapping. The primitive MIH_Link_Parameter_Report is used to relay link specific measurements back to the MIH User.