WINLAB

API Specification For Virtualized WiMAX Basestation

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Product/Process:

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API specification for virtualized WiMAX BS
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1   API DOCUMENT PURPOSE

The API specification is a document that is used by project managers and system engineers as a means for formalizing the agreed upon API. The API exposed herein will be used in the implementation of the GENI scheduler (possibly running on a remote machine) for slice control.
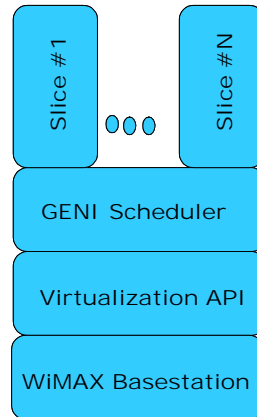

Figure 1: Software layering for slice control

As shown in Fig.1, the API will be responsible for collecting and exposing information from different components of the WiMAX system, such as the ASN-GW and the basestation. The API will also provide hooks for the GENI scheduler to achieve appropriate slice/flow control.

2   API SPECIFICATION

The API specification is classified based on functionality. Each category of APIs has both getters – responsible for reporting based on specified control information, and setters – responsible for setting the specified control information. The API provides both radio and flow level resource control to allow for flexibility during the design of the GENI scheduler. All of the API listed below may not be used for final implementation of the scheduler.

2.1 Network Entry Control

These set of functions are responsible for controlling and showing the status of network entry for mobile stations (MS).

2.1.1   append_mac_acl (MS_MAC_Addr, IPaddress/mask)
-         Add the given MAC address to the ACL (access control list)
-         IP address for the corresponding MAC address is specified along with the mask.
-         Done before a connection / flow can be setup.

2.1.2   remove_mac_acl(MS_MAC_Addr, IPaddress/mask)
-         Remove the given MAC address from the ACL
-         IP address for the corresponding MAC address is specified along with the mask.
-         Done before a connection / flow can be setup.

2.2   Flow Level Service Differentiation

These functions are responsible for controlling and monitoring flow – level traffic allocation. The GENI scheduler may use any or all of these for achieving traffic differentiation among flows based on current radio utilization. Monitoring radio utilization proves to be useful since even with a static traffic load at the base station, node mobility would change the amount of radio utilization. Adaptively using a more robust modulation and coding scheme (mcs), would result in higher radio resource utilization for supporting the same traffic level.

2.2.1   create_serviceclass(direction, priority, classifier-ips, classifier-ports, service_type)
-         Direction – Uplink or downlink for the class.
-         Priority – priority of the service class
-         Classifier-ips TLV - Source/Destination IP classifiers for flow classification
-         Classifier-ports TLV – Source/Destination port classifiers for flow classification.
-         Service_type - One of the five types – BE/UGS/rtPS/nrtPS/ertPS

2.2.2   delete_serviceclass(direction, priority, classifier-ips, classifier-ports, service_type)
-         Deletes the service class corresponding to the specification in the request.
-         Returns success if the service class could be successfully deleted (none of the flows are actively using these service classifiers).

2.2.3   set_minimal_mcs(Service class tlv, mcs)
-         Used to set the minimal modulation and coding scheme (MCS) to be used for that service class. An auto rate provision will select a better MCS based on the observed CINR conditions.
-         The user can chose one among available MCSs as an option for that class.
-         We are still exploring the possibility of setting this per class per MSID. As per our current understanding, this is difficult.

2.2.4   set_fixed_mcs(Service class tlv, mcs)
-         Used to set a fixed MCS for a particular service class.
-         This disables the automatic MCS adjustment using measured CINR.
-         If possible we wish to set this mcs value per MSID.

2.2.5   create_serviceflow(DL/UL, CID, MSID, Class TLV)

- Used to create a service flow in the uplink/downlink direction for a particular connection ID based on a specified service class classifier.
- Currently all SF initialization is from the ASN-GW, and they are pre-provisioned.
- Success returns an SFID

2.2.6   delete_serviceflow(SFID)

- Terminates the service flow allocated to a particular user.
- Success returns true.

2.3   Radio Level Service Differentiation

2.3.1   set_radio_resource(MSID, RR)

- Information provided by this function should be consulted during initial ranging and connection setup.
- RR – Radio resource uplink + downlink (set in % - 0 to 100)

set_bandwith_ul_dl_ratio(bandwidth, UL_DL_ratio) - Set supported bandwidth: 10M, 7.5M, 5M Hz
- Based on RR allocation in set_radio_resource(), this routine allows the user to set the uplink-downlink ratio as a fraction of the RR.
- UL_DL_ratio is used as a key to select one among standard UL_DL ratio supported by the BS. All MS has to use the same ul_dl_ratio

2.3.3   set_qos_priority(MS_MAC_Addr, QOS_priority)

- Information provided by this function should be consulted during initial ranging and connection setup.
- Default QOS priority TLV

2.4   Radio Level Monitoring

2.4.1   Get_Available_Resources ()

- Returns the Available DL and UL resources in the BS currently.

2.4.2   Get_MCS(SFID)

- Returns the current Modulation and coding scheme for the given service flow

2.4.3   Get_Throughput(SFID)

- Returns the current MAC throughput (Mbps) for the given service flow

2.4.4 Get_Packet_Loss(SFID)

- Returns the current packet loss rate and retries for the given service flow

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3 Abbreviations

- BS - Base station
- MS – Mobile station
- TLV – Type Length Value
- MAC_Addr – MAC address
- UL – Uplink
- DL – Downlink
- QOS – Quality Of Service
- MCS – Modulation and Coding Scheme