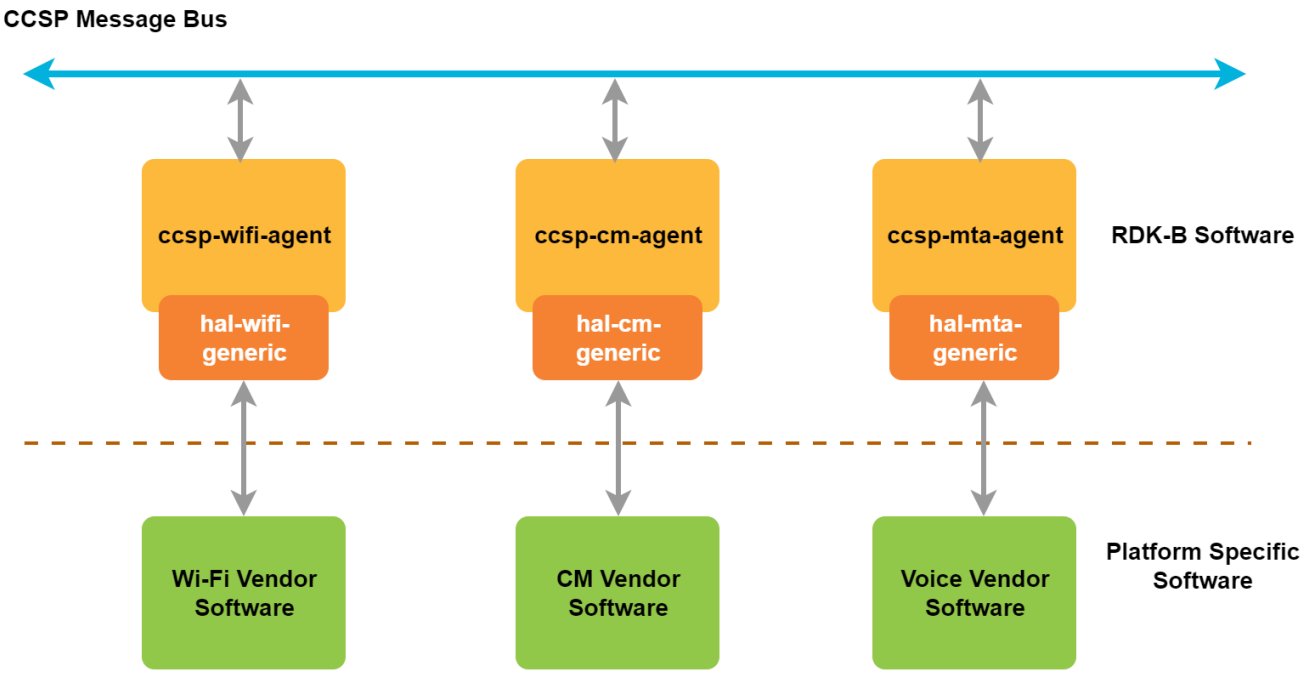
Hardware Abstraction Layer (HAL)

Introduction

RDK-B components are designed to avoid platform or silicon dependencies. Hardware Abstraction Layer (HAL) defines a standard interface for hardware vendors to implement. The HAL layer abstracts the underlying hardware like MOCA, Wi-Fi, etc. through a standard set of APIs defined as part of RDK-B HAL for the respective components. This HAL layer is implemented per platform and the rest of the components can be compiled to run on the new platform without major modifications.

The HAL in RDK-B Architecture section gives an overview of CCSP framework's Hardware Abstraction Layer.

HAL can be common-HAL or component-specific-HAL. Components may define a component specific HAL to hardware drivers, that are only used by that component



Component Specific HAL

- HAL APIs will be available in the CMF repo path: "../rdkb/components/opensource/ccsp/hal/source/"
- PandM HAL Integration (back-end) Layer is also known as component specific HAL.
- This layer makes call to underlying Linux system calls/commands, third party modules, open source modules and other CCSP components to execute the requests.
- This layer will be more component specific and will be providing APIs to CCSP so as to manage a particular hardware module of the system.
- Following are some of the component specific HALs available in "../rdkb/components/opensource/ccsp/hal/source/" path.
    - Wifi
    - MoCA
    - MTA Agent
    - CM
    - Ethernet Switch
    - DHCPv4C
    - Virtual LAN
    - Firewall
    - DPoE
    - Bluetooth
    - MSO_Management
    - Voice
    - WAN
    - TR69_TLV

Wi-Fi HAL

All HAL functions prototypes and structure definitions are available in wifi_hal.h file.

- WI-fI HAL is used for the RDK-Broadband Wifi radio hardware abstraction layer.
- Latest version of RDKB supports 300+ Wi-Fi HAL API's.
- Based on how Wi-Fi vendor exposes their driver capabilities in user space, the HAL API's can be implemented in wifi_hal.c
- Some of the APIs are :

1. wifi_getRadioChannelStats
2. wifi_getRadioChannelStats2
3. wifi_getApAssociatedDeviceRxStatsResult
4. wifi_getApAssociatedDeviceTxStatsResult
5. wifi_getApAssociatedDeviceTidStatsResult
6. wifi_getApAssociatedDeviceStats
7. wifi_getHalVersion
8. wifi_factoryReset
9. wifi_factoryResetRadios
10. wifi_factoryResetRadio
11. wifi_setLED
12. wifi_init
13. wifi_reset
14. wifi_down
15. wifi_createInitialConfigFiles
16. wifi_getRadioCountryCode
17. wifi_setRadioCountryCode
18. wifi_pushCountryCode
19. wifi_getATMCapable
20. wifi_setATMEnable

- To see the API specification of WI-fI HAL please refer - Wi-Fi HAL APIs

MOCA HAL

All HAL functions prototypes and structure definitions are available in moca_hal.h file.

- MoCA HAL is used for the RDK-Broadband MoCA hardware abstraction layer.
- An abstraction layer, mainly for interacting with MoCA driver.
- The APIs are :
    1. moca_GetIfConfig
    2. moca_SetIfConfig
    3. moca_IfGetDynamicInfo
    4. moca_IfGetStaticInfo
    5. moca_IfGetStats
    6. moca_GetNumAssociatedDevices
    7. moca_IfGetExtCounter
    8. moca_IfGetExtAggrCounter
    9. moca_GetMocaCPEs
    10. moca_GetAssociatedDevices
    11. moca_FreqMaskToValue
    12. moca_HardwareEquipped
    13. moca_GetFullMeshRates
    14. moca_GetFlowStatistics
    15. moca_GetResetCount
    16. moca_setIfAcaConfig
    17. moca_getIfAcaConfig
    18. moca_cancelIfAca
    19. moca_getIfAcaStatus
    20. moca_getIfScmod
- To see the API specification of MoCA HAL please refer - MoCA HAL APIs

MTA HAL

All HAL functions prototypes and structure definitions are available in mta_hal.h file. An MTA can deliver Home Phone service in addition to High Speed Internet.

- MTA HAL used for the RDK-Broadband hardware abstraction layer for Cable Modem.
- An abstraction layer, implemented to interact with MTA device.
- mta_hal.c file provides the function call prototypes and structure definitions used for the MTA hardware abstraction layer.
- Some of the APIs are :
    1. mta_hal_InitDB
    2. mta_hal_GetDHCPInfo
    3. mta_hal_LineTableGetNumberOfEntries
    4. mta_hal_LineTableGetEntry
    5. mta_hal_TriggerDiagnostics
    6. mta_hal_GetServiceFlow
    7. mta_hal_DectGetEnable
    8. mta_hal_DectSetEnable.
    9. mta_hal_DectGetRegistrationMode
    10. mta_hal_DectSetRegistrationMode
    11. mta_hal_DectDeregisterDectHandset
    12. mta_hal_GetCalls
    13. mta_hal_GetDect
    14. mta_hal_GetDectPIN
    15. mta_hal_SetDectPIN
    16. mta_hal_GetHandsets
    17. mta_hal_GetCALLP
    18. mta_hal_GetDSXLogs

19. mta_hal_GetDSXLogEnable
20. mta_hal_SetDSXLogEnable

- To see the API specification of MTA HAL please refer - MTA HAL APIs

CM HAL

All HAL functions prototypes and structure definitions are available in cm_hal.h file.

- CM HAL is used for the RDK-Broadband hardware abstraction layer for Cable Modem.
- It provides interface that cable modem software developers can use to interface to RDK-B.
- Some of the APIs are :
    1. cm_hal_InitDB
    2. docsis_InitDS
    3. docsis_InitUS
    4. docsis_getCMStatus
    5. docsis_GetDSChannel
    6. docsis_GetUsStatus
    7. docsis_GetUSChannel
    8. docsis_GetDOCSISInfo
    9. docsis_GetNumOfActiveTxChannels
    10. docsis_GetNumOfActiveRxChannels
    11. docsis_GetErrorCodewords
    12. docsis_SetMddIpModeOverride
    13. docsis_GetMddIpModeOverride
    14. docsis_GetUSChannelId
    15. docsis_SetUSChannelId
    16. docsis_GetDownFreq
    17. docsis_SetStartFreq
    18. docsis_GetDocsisEventLogItems
    19. cm_hal_GetDHCPInfo
    20. cm_hal_GetCPEList
- To see the API specification of CM HAL please refer - CM HAL APIs

Ethernet Switch HAL

All HAL functions prototypes and structure definitions are available in ccsp_hal_ethsw.h file.

- It provides implementation for Ethernet Switch Control.
- Based on how vendor exposes their driver capabilities in user space, the HAL API's can be implemented in hal-ethsw-generic/git/source/ethsw /ccsp_hal_ethsw.c
- The APIs are :
    1. CcspHalEthSwInit
    2. CcspHalEthSwGetPortStatus
    3. CcspHalEthSwGetPortCfg
    4. CcspHalEthSwSetPortCfg
    5. CcspHalEthSwGetPortAdminStatus
    6. CcspHalEthSwSetPortAdminStatus
    7. CcspHalEthSwSetAgingSpeed
    8. CcspHalEthSwLocatePortByMacAddress
    9. CcspHalExtSw_getAssociatedDevice
    10. CcspHalExtSw_ethAssociatedDevice_callback_register
    11. CcspHalExtSw_getEthWanEnable
    12. CcspHalExtSw_setEthWanEnable
    13. CcspHalExtSw_getEthWanPort
    14. CcspHalExtSw_setEthWanPort
    15. GWP_RegisterEthWan_Callback
    16. GWP_GetEthWanLinkStatus
    17. GWP_GetEthWanInterfaceName
- To see the API specification of Ethernet Switch HAL please refer - Ethernet Switch HAL APIs

DHCPv4C HAL

All HAL functions prototypes and structure definitions are available in dhcpv4c_api.h file.

- DHCPv4C HAL is used for the RDK-B DHCPv4 Client Status abstraction layer.
- DHCPv4C HAL API's functionality should be implemented by OEMs.
- dhcpv4c_api.c provides the function call prototypes and structure definitions used for the RDK-Broadband DHCPv4 Client Status abstraction layer.
- Some of the APIs are :
    1. dhcpv4c_get_ert_lease_time
    2. dhcpv4c_get_ert_remain_lease_time
    3. dhcpv4c_get_ert_remain_renew_time
    4. dhcpv4c_get_ert_remain_rebind_time
    5. dhcpv4c_get_ert_config_attempts
    6. dhcpv4c_get_ert_ifname
    7. dhcpv4c_get_ert_fsm_state
    8. dhcpv4c_get_ert_ip_addr

9. dhcpv4c_get_ert_mask
10. dhcpv4c_get_ert_gw
11. dhcpv4c_get_ert_dns_svrs
12. dhcpv4c_get_ert_dhcp_svr
13. dhcpv4c_get_ecm_lease_time
14. dhcpv4c_get_ecm_remain_lease_time
15. dhcpv4c_get_ecm_remain_renew_time
16. dhcpv4c_get_ecm_remain_rebind_time
17. dhcpv4c_get_ecm_config_attempts
18. dhcpv4c_get_ecm_ifname
19. dhcpv4c_get_ecm_fsm_state
20. dhcpv4c_get_ecm_ip_addr

- To see the API specification of DHCPv4C HAL please refer - DHCPv4C HAL APIs

VLAN HAL

All HAL functions prototypes and structure definitions are available in vlan_hal.h file.

- VLAN HAL is or the RDK-B Broadband VLAN abstraction layer.
- VLAN HAL layer is intended to support VLAN drivers through the System Calls.
- The APIs are :
    1. vlan_hal_addGroup
    2. vlan_hal_delGroup
    3. vlan_hal_addInterface
    4. vlan_hal_delInterface
    5. vlan_hal_printGroup
    6. vlan_hal_printAllGroup
    7. vlan_hal_delete_all_Interfaces
    8. _is_this_group_available_in_linux_bridge
    9. _is_this_interface_available_in_linux_bridge
    10. _is_this_interface_available_in_given_linux_bridge
    11. _get_shell_outputbuffer
    12. insert_VLAN_ConfigEntry
    13. delete_VLAN_ConfigEntry
    14. get_vlanId_for_GroupName
    15. print_all_vlanId_Configuration
- To see the API specification of VLAN HAL please refer - VLAN HAL APIs

Firewall HAL

All HAL functions prototypes and structure definitions are available in hal_firewall.h file.

- This module is responsible for setting firewall rules like port forwarding, port triggering Parental control etc.
- Some of the APIs are :
    1. firewall_service_init
    2. firewall_service_start
    3. firewall_service_restart
    4. firewall_service_stop
    5. firewall_service_close
    6. GetHttpPortValue
    7. Wan2lan_log_deletion_setup
    8. Wan2lan_log_insertion_setup
    9. GettingWanIP_remotemgmt_deletion_logsetup
    10. GettingWanIP_remotemgmt_insertion_logsetup
    11. DeleteRemoteManagementIptablesRules
    12. AddRemoteManagementIptablesRules
    13. DisablingHttps
    14. EnablingHttps
    15. DisablingHttp
    16. EnablingHttp
    17. SetHttpPort
    18. SetHttpsPort
    19. RemoteManagementiptableRulessetoperation
    20. BasicRouting_Wan2Lan_SetupConnection

- To see the API specification of Firewall HAL please refer - Firewall HAL APIs

DPOE HAL

All HAL functions prototypes and structure definitions are available in dpoe_hal.h file.

- DPOE HAL is used for the RDK-Broadband DPoE hardware abstraction layer as per the DPoE-SP-OAMv1.0-I08-140807 specification.
- Some of the APIs are :
    1. dpoe_getOnuId
    2. dpoe_getFirmwareInfo
    3. dpoe_getEponChipInfo
    4. dpoe_getManufacturerInfo

5. dpoe_getNumberOfNetworkPorts
6. dpoe_getNumberOfS1Interfaces
7. dpoe_getOnuPacketBufferCapabilities
8. dpoe_getOamFrameRate
9. dpoe_getLlidForwardingState
10. dpoe_getDeviceSysDescrInfo
11. dpoe_getMaxLogicalLinks
12. dpoe_setResetOnu
13. dpoe_getStaticMacTable
14. dpoe_getEponMode
15. dpoe_getDynamicMacAddressAgeLimit
16. dpoe_getDynamicMacLearningTableSize
17. dpoe_getDynamicMacTable
18. dpoe_getStaticMacTable
19. dpoe_getMacLearningAggregateLimit
20. dpoe_getOnuLinkStatistics

- To see the API specification of DPOE HAL please refer - DPOE HAL APIs

Bluetooth HAL

All HAL functions prototypes and structure definitions are available in bt_hal.h file.

- The APIs are :
    1. ble_Enable
    2. ble_GetStatus
- To see the API specification of Bluetooth HAL please refer - Bluetooth HAL APIs

MSO Management HAL

All HAL functions prototypes and structure definitions are available in mso_mgmt_hal.h file.

- MSO Management HAL is used for the RDK-Broadband hardware abstraction layer for MSO Management.
- The APIs are :
    1. mso_pwd_ret_status mso_validatepwd
    2. mso_set_pod_seed
    3. mso_get_pod_seed
- To see the API specification of MSO Management HAL please refer - MSO Management HAL APIs

Voice HAL

All HAL functions prototypes and structure definitions are available in voice_hal.h file.

- Voice HAL is used for the RDK-Broadband hardware abstraction layer for VoIP.
- Some of the APIs are :
    1. voice_hal_Init
    2. voice_hal_InitDB
    3. voice_hal_Deinit
    4. voice_hal_DeinitDB
    5. voice_hal_setVoiceProcessState
    6. voice_hal_getVoiceProcessState
    7. voice_hal_getVoiceProcessStatus
    8. voice_hal_getConfigSoftwareVersion
    9. voice_hal_getCountProfiles
    10. voice_hal_getServiceVersion
    11. voice_hal_getCountServices
    12. voice_hal_getCountLines
    13. voice_hal_getCountPhyInterfaces
    14. voice_hal_setIpAddressFamily
    15. voice_hal_getBoundIfName
    16. voice_hal_setBoundIfName
    17. voice_hal_setIpAddressFamily
    18. voice_hal_getIpAddressFamily
    19. voice_hal_setLinkState
    20. voice_hal_setIpWanAddress
- To see the API specification of Voice HAL please refer - Voice HAL APIs

WAN HAL

All HAL functions prototypes and structure definitions are available in wan_hal.h file.

- The APIs are :
    1. wan_hal_Init
    2. wan_hal_SetSelfHealConfig
    3. wan_hal_SetWanConnectionEnable
    4. wan_hal_SetSelfHealConfig
    5. wan_hal_GetWanOEUpstreamCurrRate

6. wan_hal_GetWanOEDownstreamCurrRate
7. wan_hal_SetQoSConfiguration
8. wan_hal_RestartWanService

- To see the API specification of WAN HAL please refer - WAN HAL APIs

TR69_TLV HAL

All HAL functions prototypes and structure definitions are available in Tr69_Tlv.h file.

- Telemetry Key fields and data fields are stored in the database as TLV (Tag, Length, Value)

1. Tag - uniquely identifies the field.
2. Length - gives the size (in number of bytes) of the data associated with the field.
3. Value - contains the actual data associated with the field stored in network byte ordering.

Common HAL

- A common HAL provides the necessary abstraction to all the CCSP components to interface with other common hardware components.
- Eg : Platform HAL

Platform HAL

- Platform HAL is an abstraction layer, implemented to interact with cable modem device for getting the hardware specific details such as Firmware Name, Boot loader Version, etc.
- This HAL layer is intended to support platform drivers
- platform_hal.c file provides the function call prototypes and structure definitions used for the platform hardware abstraction layer
- Some of the APIs are :

1. platform_hal_GetDeviceConfigStatus
2. platform_hal_GetTelnetEnable
3. platform_hal_GetSSHEnable
4. platform_hal_SetSSHEnable
5. platform_hal_GetSNMPEnable
6. platform_hal_SetSNMPEnable
7. platform_hal_GetSerialNumber
8. platform_hal_GetWebUITimeout
9. platform_hal_SetWebUITimeout
10. platform_hal_GetWebAccessLevel
11. platform_hal_SetWebAccessLevel
12. platform_hal_PandMDBInit
13. platform_hal_DocsisParamsDBInit
14. platform_hal_GetModelName
15. platform_hal_GetFirmwareName
16. platform_hal_GetHardwareVersion
17. platform_hal_GetSoftwareVersion
18. platform_hal_GetBootloaderVersion
19. platform_hal_GetBaseMacAddress
20. platform_hal_GetHardware

To see the API specification of Platform HAL please refer - Platform HAL APIs