

## Application Note

## Router Features



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# Used symbols

 *Danger* – Information regarding user safety or potential damage to the router.

 *Attention* – Problems that can arise in specific situations.

 *Information* – Useful tips or information of special interest.

 *Example* – Example of function, command or script.

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# 1. Operating System

The Linux-based operating system tailored for Advantech cellular routers combines the simplicity of web-based configuration with the flexibility of an open platform. This enables the development of custom configuration scripts and Router Apps (User Modules). The functionality described in this chapter is supported by the latest firmware version of these routers.



Please note that certain functions or applications mentioned in this application note are supported only by specific router models.

## 1.1 LAN Features

Feature	Description
Ethernet	Supports speeds of 10 or 100 Mbps, in both half and full duplex modes. Offers IEEE 802.1X Authentication (client) with options for EAP-PEAP/MSCHAPv2 or EAP-TLS. Features bridged interfaces and the 802.1d Spanning Tree Protocol, which is configurable exclusively via a script.
IPv4/IPv6	Includes multicast support. Note: The v2 platform routers do not support IPv6.
DHCP Client	Features a configurable DHCP client for dynamic IP address assignment.
DHCP Server	Offers both dynamic and static DHCP leases with a customizable lease time. Supports IPv6 prefix delegation for network address distribution.
DNS Forwarder	Provides DNS forwarding capabilities, enhancing network efficiency.
DHCP Relay	Incorporates support for the DHCP Relay Agent, facilitating network management.
VLAN	VLAN configuration is achievable solely through scripting, providing network segmentation options.
LAN Features	Provides a comprehensive overview of LAN capabilities and configurations.

Table 1: LAN Features

## 1.2 Connectivity Features

Feature	Description
Mobile WAN	Supports GPRS, UMTS, or LTE with PAP and/or CHAP authentication. Accommodates up to 2 SIM cards with optional PIN protection. Features SIM switching based on connection failure, roaming status, data limit, or Binary Input activation. Includes dial number for GPRS or CSD connections and supports private APN usage. Monitors traffic limits with SMS warnings upon exceedance and provides a 60-day traffic history. Offers functionalities for SIM lock and unlock.
PPPoE Client	Enables connections to ADSL routers using PAP and/or CHAP authentication.
WiFi Access Point WiFi Station	Depending on the model, supports IEEE 802.11ax/ac/a/b/g/n standards across 2.4/5/6 GHz frequencies. Offers WPA/WPA2/WPA3 authentication with a Pre-Shared Key (PSK) or an external RADIUS server for enterprise setups. Provides encryption using WEP, TKIP, or AES and supports a 40 MHz channel width in 802.11n. Includes Wi-Fi Multimedia (WMM) for Quality of Service (QoS). Features Accept or Deny lists for MAC address filtering, along with SSID and client isolation. Capable of simultaneous operation in Wi-Fi Access Point and Station modes for specified hardware configurations, supporting two SSIDs in AP mode (multi SSID). The <i>Follow STA radio settings</i> option enables the Wi-Fi AP to dynamically align its radio settings with those of a foreign AP to which the Station (STA) is connected.

Table 2: Connectivity Features

## 1.3 Routing Features

Feature	Description
Static Routes	Directs traffic towards a specified destination through a designated gateway and interface.
Backup Routes	Automatically switches to backup connections in the event of connectivity loss. Supports backup via Mobile WAN, PPPoE, Wi-Fi Station, or Ethernet. Offers the capability to utilize multiple WAN connections simultaneously, with optional load balancing according to predefined weights.
VRRP	Supports versions 2 and 3 of the protocol for high availability. Facilitates automatic switching based on traffic monitoring and/or ping responses to ensure continuous connectivity.
Stateful Firewall	Enables detailed control over inbound traffic based on source. Regulates traffic forwarding between specified sources and destinations, including protection against common DoS attacks. Supports up to sixteen rules for both incoming and forwarded packets, enhancing network security.
NAT	Facilitates access from public WAN to designated services. Allows forwarding of incoming traffic to specific IP addresses and ports, including forwarding of all unspecified traffic to a default server. Supports Port Address Translation (PAT), masquerading of outgoing packets, and NAT64, offering versatile traffic management options.
QoS	Quality of Service settings can be tailored through scripting, enabling precise control over traffic prioritization and bandwidth allocation.

Table 3: Routing Features



## 1.4 VPN Features

Feature	Description
Cisco FlexVPN	A Cisco-specific implementation of the IKEv2 standard, configurable via the IPsec settings page for robust and flexible VPN solutions.
IPsec	Supports both policy-based and route-based VPNs with IKEv1/IKEv2 protocol compatibility. Offers certificate-chain validation and dynamic IP address and interface updates via IKEv2 MOBIKE. Authentication methods include pre-shared secret or RSA/ECDSA X.509 certificates, with a broad selection of ciphers for payload protection up to AES256/SHA512. Adheres to NIST cryptographic strength recommendations beyond 2030, incorporates Dead Peer Detection, and ensures Perfect Forward Secrecy.
OpenVPN	Flexible VPN solution supporting IPv4/IPv6, UDP/TCP, in client or server mode. Authentication can be performed via pre-shared secret or X.509 certificate for secure connections.
GRE Tunnels	Offers Multipoint tunnel support (complement with the Router Apps' Protocol NHRP for configuration). Features include keyed tunnels with a 32-bit pre-shared secret and multicast support for broad application.
L2TP client or server	Supports both managed L2TP v1 for controlled setups and unmanaged L2TP v3 for Pseudowire applications. Configurable MTU and RTU for tailored network performance.
PPTP client or server	Provides PPTP Passthrough capabilities with adjustable MTU and RTU for optimized tunneling performance.
WireGuard	Simplified VPN configuration allowing up to four tunnel setups for efficient and secure connectivity.

Table 4: VPN Features

## 1.5 Services Features

Feature	Description
DynDNS client	Utilizes the Dynamic DNS Update API from dyn.com to automatically register both IPv4 and/or IPv6 addresses for seamless domain name mapping.
NTP client NTP server	Supports synchronization with up to two remote NTP servers using the NTPv3 protocol for accurate timekeeping.
SSH server SFTP server	Secure shell and file transfer services available exclusively for Admin users, ensuring secure remote administration and file handling.
Telnet server	Provides remote console access, although its use is not recommended for security reasons due to unencrypted communication.
FTP server	Enables file transfers for authenticated users, but its usage is advised against for security reasons due to lack of secure communication.
Expansion ports	Facilitates access to RS232/485/422 interfaces via UDP or TCP client/server connections. Also supports USB to serial converters for extended connectivity options.
External data storage	Allows for the use of USB flash drives or SD cards for additional data storage solutions.

Table 5: Services Features

## 1.6 Administration Features

Feature	Description
User Authentication (PAM)	Integrates with a local database or remote RADIUS/TACACS+ servers. Supports Admin and User roles with configurable password complexity. Allows optional syncing of remote users to the local database for ease of management.
Web / HTTP(S)	Employs TLS 1.2 for secure connections. Implements brute-force attack mitigation by banning IP addresses for 1 minute after 3 unsuccessful login attempts.
SNMP Agent	Compatible with SNMP v1/v2c and v3, offering standard MIB for system and network interface info. Includes custom MIBs for mobile WAN, GPS, and extension boards, with the ability to remotely control Binary I/O and report via SNMP Traps.
SMTP(S) Client	Secures email sending with SSL/TLS or STARTTLS. Enables sending emails from startup scripts for automated notifications.
SMS	Supports notifications for critical events like reboots or WAN outages. Allows for remote commands and user-initiated SMS through AT commands or TCP/serial interfaces.
Custom Scripts	Executes scripts at startup or when interfaces change status, for flexible automation.
Status Displays	Provides real-time information on Network, Mobile WAN, Wi-Fi, DHCP, IPsec, and DynDNS status for comprehensive monitoring.
Logging	Offers limited local log storage and the ability to export logs to a syslog server in compliance with RFC 3164 for thorough analysis.
One-Click Report	Facilitates easy collection of configuration and status data for troubleshooting support.
Live Data in GUI	Updates status information in the GUI in real time, eliminating the need for manual refreshes.
Two-Factor Authentication	Enhances security by enabling two-factor authentication for access control.

Table 6: Administration Features

## 1.7 Configuration Features

Feature	Description
Passwordless Console Login	Allows SSH access without a password by utilizing SSH Public Keys, enhancing security and convenience.
Profiles	Supports up to four independent configuration profiles for flexible, dynamic router reconfiguration.
Online Firmware Update	Facilitates firmware updates directly from the router's GUI, connecting to the public Advantech server via the Internet.
Online Router App Installation	Enables the installation or updating of Router Apps directly from the router's GUI, using the public Advantech server over the Internet.
Backup and Restore	Offers the ability to back up and restore router configurations, including defined users, in a password-protected file for secure management.
Automatic Update	Scheduled firmware and/or router configuration updates, performed every 24 hours post-reboot or at a specified time, downloadable via Web HTTP/FTP or USB flash drive.
Upgrade Rollback	Automatically reverts an upgrade if the router fails to reboot post-upgrade, ensuring reliability (not available on v2 platform routers).

Table 7: Configuration Features

## 2. Router Apps

The core functionality can be extended using one or more User Modules. Beyond the large set of modules we offer a Software Development Kit (SDK) so users can easily create their own modules.

### 2.1 Connectivity Router Apps

RA Name	Description
802.1X Authenticator	Supports network access control via an external RADIUS server, with the ability to exempt specific MAC addresses.
Band Select	Customize the range of frequency bands the router can operate on.
Backup APN	Automatically switches to a secondary APN in case the primary APN connection fails.
Bluetooth	Incorporates Bluez 5 and D-Bus to provide comprehensive Bluetooth functionality for your router.
Ethernet Mirroring	Allows mirroring of data packets from one Ethernet interface to another for monitoring or analysis.
Layer 2 Firewall (L2FW)	Filters traffic based on MAC addresses to enhance network security.
NAT	Implements Source NAT (SNAT) and Destination NAT (DNAT) for flexible internet sharing and access control.
PPP Gateway	Enables internet access for legacy devices with only serial line connectivity.
Transparent Mode	Directly assigns the mobile WAN IP address to a connected Ethernet device.
URL Blocker	Restricts access to specific domain names (URLs) for content filtering and security.
WiFi SSID Switch	Dynamically switches between up to four predefined Wi-Fi Access Points based on signal strength or availability.
WiFi STA Relay	Bridges the WiFi station mode interface to an Ethernet port, enabling transparent mode over WiFi.

Table 8: Connectivity Router Apps

## 2.2 Routing Router Apps

RA Name	Description
FRR	Provides a comprehensive suite of Internet routing protocols specifically tailored for Advantech routers.
OpenVPN Custom Config	Enables text-based configuration of OpenVPN tunnels for flexible VPN setups tailored to specific network requirements.
Stunnel	Creates encrypted tunnels for network traffic, enhancing security for data in transit between servers and clients.

Table 9: Routing Router Apps

## 2.3 Services Router Apps

RA Name	Description
Captive Portal	Provides a customizable access page for Wi-Fi users, offering features such as password authentication, bandwidth limits, session timeouts, and data usage caps. Enables administrators to manage user access and gather usage statistics for analysis or external logging.
File Uploader	Automates the transfer of files to and from FTP/SFTP servers, including downloading, uploading, and cleanup of old files, facilitating seamless file management and distribution.
GPS	Enables the reporting of GPS positions via SNMP for location tracking and management. Allows for the forwarding of raw NMEA data for detailed location analysis and supports time synchronization based on GPS signals for accurate system timing.
MQTT Broker	Includes support for the MQTT Message Broker, leveraging the Mosquitto project.
MQTT Manager	Enables control and monitoring of Advantech routers via MQTT.
NetFlow/IPFIX	Supports NetFlow v5, v9, and IPFIX protocols for comprehensive network traffic analysis. Features include various sampling methods and the capability to export flow data to remote or local collectors, enhancing network visibility and management.
NTRIP Client	Enhances GPS accuracy by utilizing corrections from an RTK base station via the NTRIP protocol, ideal for applications requiring precise positioning.
NTP	Implements NTPv4 for accurate time synchronization across network devices, ensuring consistent timing for logging, scheduling, and operational tasks.
Samba	Provides a Samba server for shared access to the router's /var/data/samba directory, enabling easy file sharing and access within Windows networks.

Table 10: Services Router Apps

## 2.4 Administration Router Apps

RA Name	Description
Customer Logo	Allows branding of the web admin interface with a custom logo, enhancing corporate identity.
Daily Reboot	Schedules automated router reboots to ensure system freshness and reliability.
Ext4 Filesystem Utilities	Brings advanced filesystem management capabilities for efficient storage handling.
Firmware Over-The-Air (FOTA)	Allows for cellular module firmware updates remotely, ensuring up-to-date functionality and security.
Loopback	Facilitates router management and network routing strategies through a virtual interface.
Midnight Commander	Enhances file management through a user-friendly graphical interface, facilitating easier navigation and file operations.
NMAP	Delivers powerful network discovery and security auditing tools to identify and address vulnerabilities.
PDU SMS	Extends SMS capabilities beyond the standard limit, enabling longer message transmissions.
Pinger	Ensures network reliability by monitoring line connectivity, with automatic notifications or actions on line failure.
SCEP Client	Offers a secure and automated method for router certificate enrollment, simplifying device authentication processes.
Sleep Mode	Enables energy savings by configuring the router to enter low-power mode based on time or binary input signals.
TCP SYN Keep-Alive	Verifies the router's ability to establish TCP connections, enhancing network reliability.
Vim	Provides a rich text editing experience for complex configuration and scripting tasks.
Web Terminal	Offers convenient web-based access to the router's console, enabling command-line operations without direct physical access.

Table 11: Administration Router Apps

## 2.5 Protocol Conversion Router Apps

RA Name	Description
AT Modem Emulator	Facilitates conversion of AT commands to TCP/IP and vice versa, enabling legacy device connectivity.
DNP3 Outstation	Integrates DNP3 protocol support, enhancing data collection from industrial sensors and actuators.
Modbus Logger	Captures Modbus RTU traffic for analysis and troubleshooting, enhancing network diagnostics.
Modbus to LwM2M	Bridges Modbus devices with LwM2M networks, facilitating IoT device management.
Modbus to MQTT	Integrates Modbus devices with MQTT networks, enabling flexible IoT communication architectures.
Operating Hours Counter	Monitors device usage with resettable and non-resettable counters for maintenance scheduling.
Packet Splitter	Diversifies data flow across multiple targets, optimizing network traffic distribution.
Protocol ALPHA-MODBUS	Translates Mitsubishi ALPHA2 data for Modbus TCP networks, ensuring compatibility and integration.
Protocol DF1-Ethernet	Translates DF1 serial protocol to industrial Ethernet standards, supporting legacy industrial devices.
Protocol MODBUS-RTU2TCP	Converts Modbus RTU to TCP messages, enabling seamless integration of serial and IP networks.
Protocol MODBUS-RTUMAP	Aggregates multiple Modbus slaves into a single Modbus TCP connection, simplifying network architecture.
Protocol MODBUS-TCP2RTU	Transforms Modbus TCP messages for serial line communication, supporting a wide range of devices.
Serial over LAN	Provides TCP/IP server access to a serial port, enhancing device integration flexibility.
Serial to TCP	Acts as a TCP/IP client to access serial ports remotely, broadening communication capabilities.
Wake-on-LAN Gateway	Enables Wake-on-LAN functionality across networks, facilitating remote device management.

Table 12: Protocol Conversion Router Apps



## 2.6 Node-RED Router Apps

RA Name	Description
Node-RED	Dynamic programming tool designed for the efficient integration of hardware devices, APIs, and online services.
Node-RED / AWS	Enhances your Node-RED environment by integrating comprehensive support for Amazon Web Services (AWS).
Node-RED / Azure	Augments your Node-RED development environment by introducing specialized support for Microsoft's Azure IoT platform.
Node-RED / BACnet	Enhances Node-RED by offering tailored support for the BACnet protocol, a pivotal standard for Building Automation and Control Networks (BACnet).
Node-RED / Bluetooth	Extends the capabilities of Node-RED by incorporating specialized support for Bluetooth technology, focusing on Bluetooth Low Energy (BLE) devices.
Node-RED / Dashboard	Amplifies your Node-RED experience by enabling you to design and implement web user interfaces directly within your Node-RED flows.
Node-RED / DNP3	Serves as an invaluable extension for your Node-RED ecosystem, enabling seamless integration with DNP3 (Distributed Network Protocol 3) protocol-based systems.
Node-RED / Filesystem	Enhances your Node-RED environment by introducing a comprehensive set of filesystem operations.
Node-RED / FTP	Enriches your Node-RED environment by incorporating support for both FTP (File Transfer Protocol) and SFTP (Secure File Transfer Protocol).
Node-RED / GPS	Extends your Node-RED environment by adding support for GNSS (Global Navigation Satellite Systems) functionalities.
Node-RED / Gzip	Is valuable addition to your Node-RED setup, enabling gzip compression capabilities.
Node-RED / KNX	Significantly enhances your Node-RED environment by incorporating full-fledged support for the KNX protocol, a cornerstone in modern building automation systems.
Node-RED / LwM2M	Extends Node-RED's capabilities by providing full support for the OMA Lightweight M2M (LwM2M) protocol.
Node-RED / Modbus	Enriches Node-RED with comprehensive support for the Modbus protocol, accommodating both TCP and RTU variants.
Node-RED / OPC UA	Provides a fully-integrated solution for interacting with OPC UA protocol services, offering both client and server functionalities.
Node-RED / PLC EtherNet/IP	Serves as a specialized conduit for integrating Node-RED flows with Allen Bradley/Rockwell PLCs via the EtherNet/IP protocol.
Node-RED / PLC Melsec	Designed to seamlessly integrate Node-RED flows with Mitsubishi PLCs using the Melsec protocol.
Node-RED / Splunk	Offers a robust integration with Splunk, facilitating real-time data logging and analytics.

Table 13: Node-RED Router Apps

## 2.7 Integration Router Apps

RA Name	Description
Cumulocity Agent	Serves as an agent that enables seamless integration with the <a href="#">Cumulocity IoT Platform</a> .
Docker	Serves as an open platform that simplifies the development, shipping, and execution of applications by utilizing containerization technology; see <a href="#">Docker Official Site</a>
WebAccess/DMP	Utilize the WebAccess/DMP Client app to connect seamlessly with the WebAccess/DMP remote device management platform; see <a href="#">Advantech WebAccess/DMP</a> .
Zabbix Agent	Functions as an agent for the Zabbix network monitoring platform; see <a href="#">Zabbix Official Site</a> .

Table 14: Integration Router Apps

## 2.8 Development Router Apps

RA Name	Description
Advantech SDK	See <a href="#">Advanced usage and scripting</a> page for details.
Azure IoT SDK Python API Ver- sion 2	Enables Advantech routers to establish a secure connection to Microsoft's Azure IoT platform, facilitating seamless data exchange and device management; see <a href="https://github.com/Azure/azure-iot-sdk-python">github.com/Azure/azure-iot-sdk-python</a> .
Python3	Expands your router's capabilities by providing support for the Python3 programming language; see <a href="http://www.python.org">www.python.org</a> .
Node.js	Serves as a robust JavaScript runtime, built atop Chrome's V8 JavaScript engine; see <a href="http://nodejs.org/en/">nodejs.org/en/</a> .
LUA	provides support for the versatile LUA scripting language, which merges straightforward procedural syntax with robust data manipulation features, such as associative arrays; see <a href="http://www.lua.org">www.lua.org</a> .
GNU Debugger (GDB)	Provides project debugger, allows you to see what is going on 'inside' another program while it executes; see <a href="http://www.gnu.org/software/gdb">www.gnu.org/software/gdb</a> .

Table 15: Development Router Apps

## 3. Commands

The table below highlights a selection of notable commands available in the console environment of Advantech routers. For a full list and detailed descriptions of these commands, please refer to the [Commands and Scripts](#) application note.

Command	Description
arp	Displays and modifies the IP-to-MAC address translation tables.
brctl	Sets up, maintains, and inspects the Ethernet bridge configuration in the Linux kernel.
conntrack	Interfaces with the netfilter connection tracking system.
curl	Transfers data from or to a server.
dhcrelay	Relays DHCP and BOOTP requests to DHCP servers on other subnets.
dmesg	Displays kernel log messages.
doas	Executes commands as another user.
eatables	Administers firewall rules at the Ethernet frame level.
email	Sends an email.
ethtool	Displays or modifies Ethernet card settings.
fwupdate	Updates the router's firmware.
ifconfig	Configures a network interface.
ftpput	Uploads files to an FTP server.
io	Reads binary inputs and controls binary outputs of the router.
ip	Displays or configures network interfaces.
ipcalc	Calculates network settings based on an IP address and netmask.
iptables	Administers IP packet filtering and NAT.
iw	Manages wireless devices and their configuration.
klog	Prints kernel logs.
led	Controls the USB or PWR LED of the router.
lpm	Puts the router into low power mode based on specified events.
mount	Mounts a file system.
nc	Opens a network connection to a specified IP and port.
net-snmpinform	Sends SNMP INFORM messages to a management entity.
net-snmptrap	Sends SNMP trap messages to a management entity.
ntpdate	Sets the local date and time by polling an NTP server.
ping	Sends ICMP echo requests to a network host.
ping6	Sends ICMPv6 echo requests to a network host.
ps	Displays information about system processes.
reboot	Reboots the router.
report	Lists the router's report from the command line.
restore	Restores the router's configuration from a configuration file.
rlog	Displays router log messages.

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Command	Description
route	Shows or manipulates the IP routing table.
slog	Displays the system log.
scp	Securely transfers files between hosts on a network.
sipcalc	An advanced console-based IP subnet calculator.
snmpget	Queries information on a network entity using SNMP GET requests.
snmpset	Modifies information on a network entity using SNMP SET requests.
snmptrap	Sends SNMP traps.
sms	Sends an SMS message.
ssh	Securely logs into a remote machine and executes commands.
status	Writes out the status of the router's interfaces or system.
tc	Manages network bandwidth and Quality of Service (QoS).
tcpdump	Dumps network traffic.
traceroute	Traces the route to a network host.
traceroute6	Traces the route to a network host using IPv6.
umount	Unmounts file systems.
umupdate	Adds or deletes a user module from the command line.

Table 16: List of the Most Notable Commands

## 4. Related Documents

You can obtain product-related documents on *Engineering Portal* at [icr.advantech.com](http://icr.advantech.com) address.

To get your router's *Quick Start Guide*, *User Manual*, *Configuration Manual*, or *Firmware* go to the [Router Models](#) page, find the required model, and switch to the *Manuals* or *Firmware* tab, respectively.

The *Router Apps* installation packages and manuals are available on the [Router Apps](#) page.

For the *Development Documents*, go to the [DevZone](#) page.