

Cluster-Hub firmware

Release Notes

(09 Nov 2015)

The Cluster-Hub firmware was first released to run on the Afar “Classic” radio model AR-24027, which is no longer in production. That firmware version is identified as version 1.xx.

In 2010 we ported this firmware to the newer family of Afar radios, and tested it in two of those models (AR-09010E and AR-24027E). This firmware is identified as version 2.xx or higher.

Version 2.xx was then back-ported to the “Classic” radio model to provide a compatibility path between the Classic radio and the new model AR-24027E.

With release 2.20 and later the new radio model AR-24027E can be mixed with the Classic radio AR-24027 as long as both run versions 2.20 or later. Note however that even though they have the same version the firmware files for the “Classic” radio and the new model radios are different as they run on different processors. For version 2.20 the file names are:

CLH02_20.BZ Runs on the Classic radios

CLH02_20.BZE Runs on the newer models

Version: 1.29

Date: 15 Feb 2010

Last version released for the “Classic” radio models.

Version: 2.12

Date: 22 Dec 2010

Validated in the 900 MHz radio model AR-9010E. There are some deficiencies uncovered later which are described in the version 2.20 below

Version: 2.20

Date: 1 Mar 2011

Compatibility:

1. Validated in following models: AR-9010E, AR-24027, AR-24027E,
2. In the model AR-9010E this version is compatible with version 2.12.
3. The two 2.4 GHz models can inter-operate when running this version.

New Features:

1. At the master hub you can now use the “monitor-link” command to monitor all links at the same time by specifying the link number as zero.

Problems Fixed:

1. In a two hub system, if the hub with the higher serial number is rebooted, the resulting two-hub cluster does not synchronize properly and oscillates losing and regaining sync. This does not occur when there are three or more hubs.
2. With very high traffic on the hub ethernet, some heartbeat packets that were delayed on the LAN were not being rejected. This can result in a slave-hub adjusting its cycle improperly and possibly causing an RF collision.
3. With a TDD cycle set to 20 ms the slave hubs reject a high number of heartbeat packets unnecessarily, filling the event log quickly.
4. If the master-hub in a cluster was the only one needing to transmit over RF for that cycle, it did not send out the outbound schedule on the Ethernet. This resulted in the slave hubs logging a warning that could quickly fill their event logs.

Known problems:

1. The “monitor-link” issued at a remote radio is not working properly. It constantly clears the counts.
 2. The master hub may not wait for missing inbound packets resulting in discarding packets that arrive later out of order.
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Version: 3.00

Date: 4 May 2011

Compatibility:

1. Validated in following models: AR-9010E, AR-24027, AR-24027E,
2. All radios must have version 3.xx. Can not be mixed with version 2.xx

New Features:

1. Supports networks with up to 16 different clusters automatically selecting one of the cluster masters to act as the clock source for all radios in the multiple clusters. All radios in the multiple clusters then synchronize their cycles to the single clock.
2. Each hub dynamically measures the Ethernet transit time from the clock master. It then offsets its cycle to cancel the effects of this transit time.
3. Improved filtering of the cycle period errors, both for hub synchronization and the remote radio synchronization over RF, resulting in much tighter synchronization with less probability of RF collisions.

Problems Fixed:

1. Fixed the known problems listed for version 2.20

Version: 3.01

Date: 20 May 2011

New Features:

The highest value for the “max-response-bytes” in the UDP interface was limited to the maximum size of an Ethernet packet resulting in the radio responses to certain commands to get truncated. Now the highest value was increased to 65521 bytes. These “jumbo” UDP packets are fragmented into multiple Ethernet packets by the IP stack and reassembled on the host side.

Problems Fixed:

1. Hub radios check for consistency in their configuration (cycle period, split, priority) against other hub radios in the same LAN and report any conflicts in the event log and “show”command. The message text did not match the conflict type.
2. Issuing the “load-configuration”command on a hub radio with multiple remotes, could, on occasion, cause the radio to reboot.

Version: 3.02

Date: 10 Oct 2011

Problems Fixed:

1. The cluster synchronization over Ethernet did not work properly when the nominal Ethernet delay between the synchronization master and a slave hub exceeded ~55 us. Now it supports delays on the Ethernet of up to ~250 us.
2. When a radio restarts its resynchronization over the Ethernet it could lose a buffer. After many of those events the radio would reboot.
3. For the 900 MHz models the maximum allowed transmit power is now 26 dBm. With previous max of 27 dBm, the transmitter power amplifier could get damaged when transmitting into a reactive load.

Known Problems:

The network-id in the node command is erroneously being truncated to 8 bit wide (fixed in 3.04).

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.03

Date: 2 Aug 2012

New Features:

Increased the maximum transmit power in the 900 MHz model back to 27 dBm (it had been limited to 26 dBm in October 2011 to prevent damage to the Power Amplifier). All new shipments of the 900 MHz radios have a different last stage Power Amplifier (PA) which is not susceptible to break under reactive loads and provides a cleaner signal. You can issue the "version" command to find which model you have:

Hardware Type: 256x-00A4 (Original 900 MHz with weaker PA - power limited to 26 dBm)

Hardware Type: 256x-00A6 (Improved 900 MHz model with stronger PA)

Compatibility Issues: Version 3.03 runs on all radio models and identifies the different 900 MHz hardware types. It allows you to set a transmit power in the range of 0 to 27 dBm. However, if the hardware is the original 900 MHz model (with a weaker PA) it clips the maximum power to 26 dBm.

Earlier software versions do not recognize the new hardware type and do not run properly if back loaded into the new 900 MHz radio models.

Problems Fixed:

The switching power supply in all model radios (except the Classic) could create noise in VHF channels around 120 to 180 MHz. This could interfere with a "walkie-talkie" operating in close proximity to the Afar radio. With this version the power supply switching frequency is dithered randomly which eliminates the energy in the harmonics that were causing this problem.

Known Problems:

In a cluster with more than 2 hubs, the third and subsequent hubs has difficulty synchronizing to the existing heartbeat. Fixed in version 3.05

The network-id in the node command is erroneously being truncated to 8 bit wide (fixed in 3.04).

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.04

Date: 25 Oct 2012

Problems Fixed:

The network-id in the node command was erroneously being truncated to 8 bit wide. Now it accepts and stores full 32-bits.

Opening and closing Telnet or Econ sessions with the radio caused a slow memory leak. After many of those events, the radio might stop responding to pings and eventually reboot.

Known Problems:

In a cluster with more than 2 hubs, the third and subsequent hubs has difficulty synchronizing to the existing heartbeat. Fixed in version 3.05

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.05

Date: 3 Nov 2012

Problems Fixed:

In a cluster with more than 2 hubs, the third and subsequent hubs had difficulty synchronizing to the existing heartbeat. This was introduced in version 3.03, worked better in version 3.02. It is now fixed.

Known Problems:

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.10

Date: 13 Aug 2013

New Features:

1. The DHCP parameter in the IP command now accepts specifying the port (local-only or radio-only) where to look exclusively for a DHCP server. Previously, you could only turn DHCP "on", and the radio would look for a server on both ports. The value "on" is still allowed.
2. You can now specify the "min-cluster-size" in the node command. This allows to configure hubs such that, if they become disconnected from the LAN, they shut down the RF transmissions instead of creating a new cluster and collide with the other hubs. The value of 0 disables this feature and keeps compatibility with previous versions.

Problems Fixed:

1. The "load factory" command could induce an immediate reboot due to the single node timeout feature being turned on. Now it resets the reboot timeout first and no reboot happens.
2. In the command ">display-config factory", the dhcp-client field was incorrectly displaying the current value instead of the factory default (off).

Known Problems:

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.11

Date: 21 Aug 2013

Problems Fixed:

1. When a remote is getting out of range of the cluster, the master hub could queue a "link management packet" to that remote and later find that no hubs are covering it. That packet was not transmitted and was not being freed resulting in a slow buffer leak which, over time, would eventually cause the master hub to run out of memory and reboot.
2. On power up a remote radio seemed vulnerable to some Ethernet packets that were failing a consistency check and causing the radio reboot. This condition now logs an event but does not reboot the radio.
3. The ">download" command, if given a file that did not exist, could cause the radio to reboot.
4. If a hub with an incompatible software is present in the same cluster, the radios issue a warning (in the "show" command) and do not attempt to synchronize. If you then turned off the hub with the incorrect software the other hubs failed to recognize that the problem had been removed and would not synchronize until rebooted.

Known Problems:

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.12

Date: 27 Oct 2013

New Features:

1. Added a new parameter to "rf-receive-setup" command: "disconnect=boolean". When set to 1 a remote radio will disconnect from the current cluster and start looking for a new parent right away. When set to 0 (or not specified), a remote radio changes the channels or antennas but stays attached to the current cluster. This is useful if that one cluster has hubs set to transmit on two channels, in which case the radio stays attached. If there are no hubs in the same cluster transmitting on the new frequency, the remote radio times out after 1 second, only then tries to attach to a new cluster.

Problems Fixed:

1. The algorithm to compute the delays over the Ethernet (used in the synchronization of all the hubs), has a window of acceptable jitter for a new heartbeat packet to be accepted for averaging. That window was too narrow and after a few packets missing it, it could cause the clock to drift and then force the slave-hub to restart the synchronization. This would be seen as a "Dropped hub" event logged by the hub master followed a few seconds later by adding that hub back again.
2. There was a warning event being logged erroneously in the IP stack ("Bad free of MESS..."). This was being seen when the radio received and processed a PING or an ARP for example.

Known Problems:

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.14

Date: 29 Oct 2013

Changed the default of the "disconnect" parameter for "rf-receive-setup" (added in version 2.12). Now, if not specified and the channel or antenna changed, the remote radio automatically disconnects from the current cluster and starts looking for a new one right away. You can override this default with the parameter "disconnect=0", which prevents the automatic disconnect.

Problems Fixed:

When a new IP address was obtained through DHCP, the IP stack was not being initialized correctly and the radio might not respond to IP packets sent to that address right away.

Known Problems:

There is a potential for a memory leak if you use the UDP command interface and issue commands that result in replies that use jumbo UDP packets. See fix in version 3.16

Version: 3.15

Date: 10 Dec 2013

Known problems:

Memory leak (applies to previous version): When the radio is functioning as the cluster master, under some conditions, it may experience a memory leak (see fix in version 3.16). This can be tracked with the "memory" command which displays various parameters regarding the free memory pool status.

```
Memory information:
    1059 allocated buffers,      5 fragments
    1211552 total free bytes, largest fragment = 1202720
```

Over time the number of allocated buffers and fragments increases, while the size of the largest fragment decreases. Once the size of the largest free fragment is too low the software can not allocate memory and it reboots.

In this version we added the "monitor-memory" command which continuously displays the above values and adds tracking the number of the IP stack memory allocations and releases from/to the memory pool, as well as events with troubleshooting information to help track this incident.

Problems Fixed:

1. If a remote radio misses receiving an outbound data packet sent to the Ethernet broadcast address, a subsequent packet (received correctly) could stay stuck in the radio (waiting for the missing packet), either indefinitely or until a new broadcast packet arrived. Now the timeout of about 300 ms works and releases those packets.
2. When a remote radio is in range of more than 4 hubs, the "monitor-coverage" command at the master hub (which displays the signal strengths of up to 4 hubs) was displaying its information incorrectly.
3. If you turn on DHCP mode and the radio already had an IP address, the radio did not immediately request a new IP address from a server. It would instead wait until the address had to be renewed, only then would change the IP address. Now it requests a new IP address right away.
4. For the 900 MHz models using an older RF board version, the maximum transmit power is now capped at 24 dBm (even though the command accepts values up to 27). With higher power

levels the transmitter power amplifier could get damaged when transmitting into a reactive load. This does not apply to the newer RF board revision which can transmit the full 27 dBm. The software recognizes which board is installed and only caps the power for the older version. You can identify the board in your radio in the power up banner (or with the "version" command) as follows:

Hardware type: xxxx-00A4 (older RF Board version)

Hardware type: xxxx-00A6 (newer RF Board version)

Version: 3.16

Date: 20 Feb 2014

Problems Fixed:

1. Memory leak: when using the UDP command interface, if you set the max-response-bytes to a large number and issue a command that results in a reply that makes use of jumbo UDP packets (larger than 1500 bytes), the integrity of the free memory pool becomes compromised. This was reflected as a slow decrease of free available memory, or a sudden drop of available free bytes down to 0 (both shown with the "memory" command). This has been fixed.
2. With the Ethernet running at 10 Mbps long packets could be received with a frame error and discarded (with an entry in the event log). This was due to a clock tolerance setting which was now increased to correct the issue.
3. With the Ethernet running at half duplex a packet collision would result in an incorrect event being logged indicating an error in the packet Time of Arrival. This event is no longer logged.

Version: 3.17

Date: 24 Oct 2014

Problems Fixed:

When the number of hubs in the cluster matched its maximum allowed value (which is shown in the "show" command), and there were no remotes, then broadcast packets were not being transmitted over RF. This could result in the broadcast queue to fill up, and the master radio to log a warning event. Now, while there are no remotes, the master hub discards all broadcast packets so the broadcast queue remains empty until a remote is accepted into the cluster.

The cycle split computation (in auto mode) was not taking into account bytes that had been pulled out of the transmit queues but not yet transmitted over RF. When there is inbound traffic this could cause an unnecessary extra delay in the transmission of outbound packets.

The computation of slots to assign to a remote was slightly underestimated. Under some conditions it could result in assigning a single slot when the remote minimum number was 2. This would result in

the remote logging an error, and not transmitting in that cycle.

The engineering command to show the transmit queues (dtq) now only runs in the master hub, as it was intended. Also, it now shows the number of bytes that have moved out of the transmit queues but are waiting to be transmitted.

Version: 3.18

Date: 17 Sep 2015

New Features:

Added a parameter “block-remote-broadcast” to the ethernet command. If "on" then the master-hub will NOT re-transmit (to other remotes) broadcast packets received from a remote. If your system never requires remote to remote communications, this prevents the unnecessary broadcast of packets over RF to reach every remote.

Problems Fixed:

While a hub has no remotes, when it receives a broadcast packet it was incorrectly logging an error event (“215 Plan Ahead Error 13”). This causes no harm. It was a side effect from a fix in version 3.17 where we flush those broadcast packets while the unit has no remotes.

Improved the backoff timing when collisions occur due to many new nodes joining the network simultaneously.

In the process of joining a cluster a remote was not checking if the cycle schedule packet was coming from the selected cluster. If there were two clusters within range, on the same channel (which the design should avoid), this could slow down the attachment process.

Known Problems:

When performing a code download over a telnet connection in a fast LAN, you may see "S-rec length error" leading to an unusable file. The workaround is to configure your terminal emulator to insert a delay after each line of text pushed down to the radio. A delay of 1 ms per line makes the problem go away. This problem also appears in older versions.

Version: 3.19

Date: 6 Nov 2015

New Features:

When a remote attaches to a new cluster, it now transmits to the new hub ethernet packet(s) with the

source address set as each of the stations in its LAN. The hub broadcasts these packets on its LAN which triggers the network fabric to re-route packets to the remote stations in their new place in the network.

Problems Fixed:

Open and closing an Econ session on a radio, might, on occasion, result in a buffer leak. After many of those occurrences (more than 150) the radio could then run out of buffers at which time it would reboot.

The master hub would drop a slave-hub from its list if two consecutive status packets from the slave hub were dropped on the Ethernet. This should be very unusual but the timeout was increased and now the slave hub is only dropped after four consecutive packets are dropped.

An error in processing the response to an ARP request could cause an unexpected reboot of the radio. The error is now detected in time to allow the radio to place an entry in the event log and continue running.