# iPoll™- PTMP Protocol

Technical Paper

LigoWave's iPoll™ PTMP (Point to Multi-Point) proprietary protocol is an innovative solution to eliminate transmission congestion and close cluster interference created in PTMP wireless installations.

iPoll is a superior upgrade to the standard HCF (Hybrid Coordinate Function) technique. Without iPoll, any device will transmit data without timing and coordination. HCF will cause frequent collisions when CPEs are sending data to the same AP. Each collision will cause a random backoff timer before the CPEs can transmit data again. Multiple collisions will cause a major drop in throughput and performance for the entire network. iPoll overcomes these common problems and yields drastically better performance results in the same situation compared to standard HCF technology based networks.

## Figure 1. iPoll transmission scheme
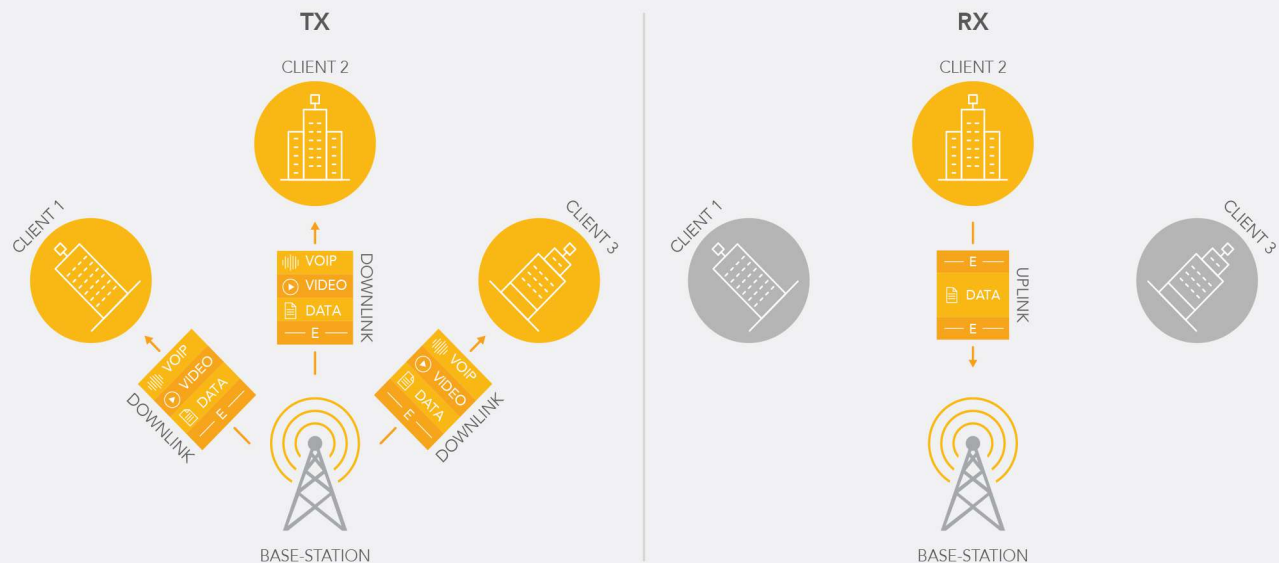


iPoll eliminates mediated access by polling every subscriber sequentially. The data transmission arbitration is accomplished by the access point. The AP sends a data frame and a poll frame to the CPE station and receives data from the polled station before starting to poll other CPE stations. Each station starts sending data once a poll frame is received. The proprietary iPoll protocol allows each wireless link to obtain maximum bandwidth with the lowest possible latency. This is accomplished by utilizing a smart polling feature which handles connected clients' activity. Stations, which require less airtime are moved to a low activity or idle list, while stations, which are generating more traffic are moved to an active list. By decreasing the number of polled stations we achieve lower latency figures as well as higher throughput per station. The uplink/downlink ratio is implemented to control the throughput from the access point to stations. This ratio is dynamic and adjusts based on the active number of stations. The dynamic uplink/downlink ratio together with QoS makes LigoDLB device based networks self-optimizing and able to achieve maximum performance in different conditions.
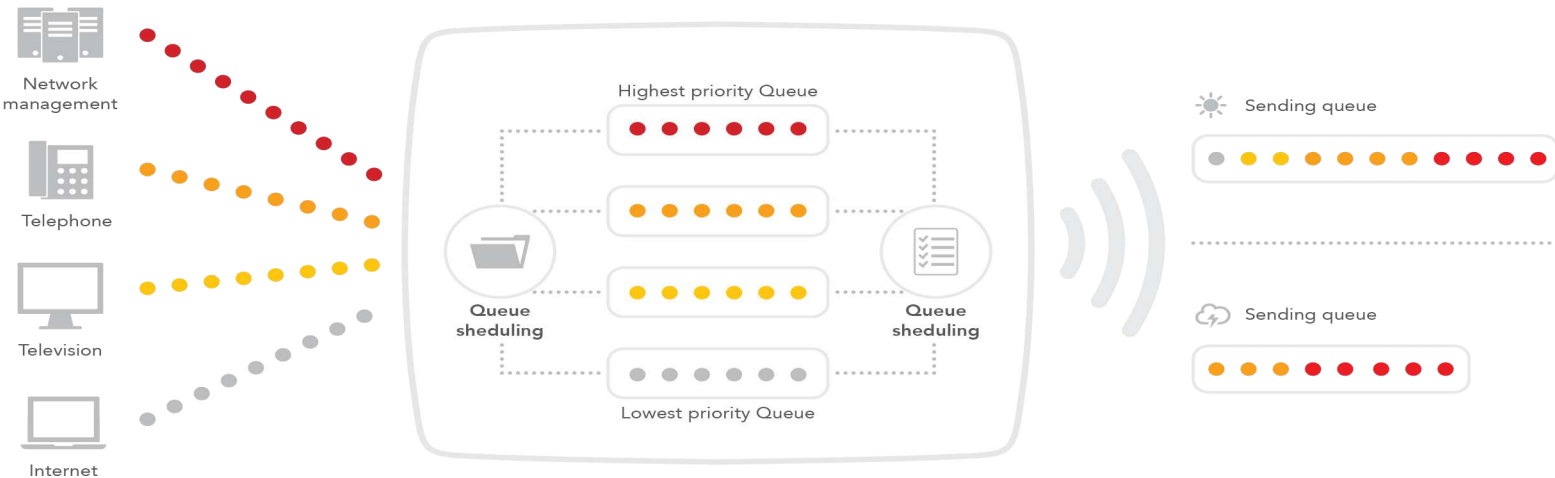
**Features**

- QoS (L2/L3 or DSCP/COS) – prioritization of different type of traffic
- Higher throughput (180 Mbps) and PPS (60,000)
- Automatic Transmit Power Control
- Higher number of clients per base-station
- Ensures reliable packet delivery
- Guarantees even throughput per CPE even in a congested environment
- Utilizes the radio channel efficiently despite the station activity difference
- Ensures low latency by controlling packet retransmission and acknowledgements
- Stabilizes jitter
- Checks and divides CPE's into different activity groups

# QoS in detail

iPoll is equipped with a traffic prioritization technique, which is mandatory in multiple services networks. QoS is implemented on four wireless transmit queues, where each queue has a different priority from lowest to highest. The prioritization policy uses the WRR (Weighted Round Robin) algorithm, which means that bigger capacity is given to high queues and smaller to lower queues. If the radio performance degrades the lowest priority traffic will be dropped first.

The base station performs traffic identification and mapping for the queues. The traffic has to be marked before passing the radio. The marking should be done on the equipment before the base station and after the CPE. The data can be marked according to VLAN 802.1p and IP ToS/DSCP fields. VLAN has precedence over IP (in a case when two marks mismatch). For more information refer to the user manual or contact customer support.

Network management

Telephone

Television

Internet

Highest priority Queue

Queue sheduling

Queue sheduling

Lowest priority Queue

Sending queue

Sending queue

# Triple Play support

The proprietary wireless protocol, QoS mechanism and advanced multicast handling supports Triple Play services in LigoDLB wireless networks. Standard Triple Play is Voice (VoIP), Video (IPTV) and regular data to the consumer. VoIP is transferred in both directions at the

higher priority queue. IPTV goes in multicast towards the customer from the network. The base station performs multicast switching and prioritizes the data. The balance of the radio capacity is assigned to the Internet data and arrives as best-efforts traffic.

DATA

IPTV Multicast

VOIP

CPE

CPE

Base station
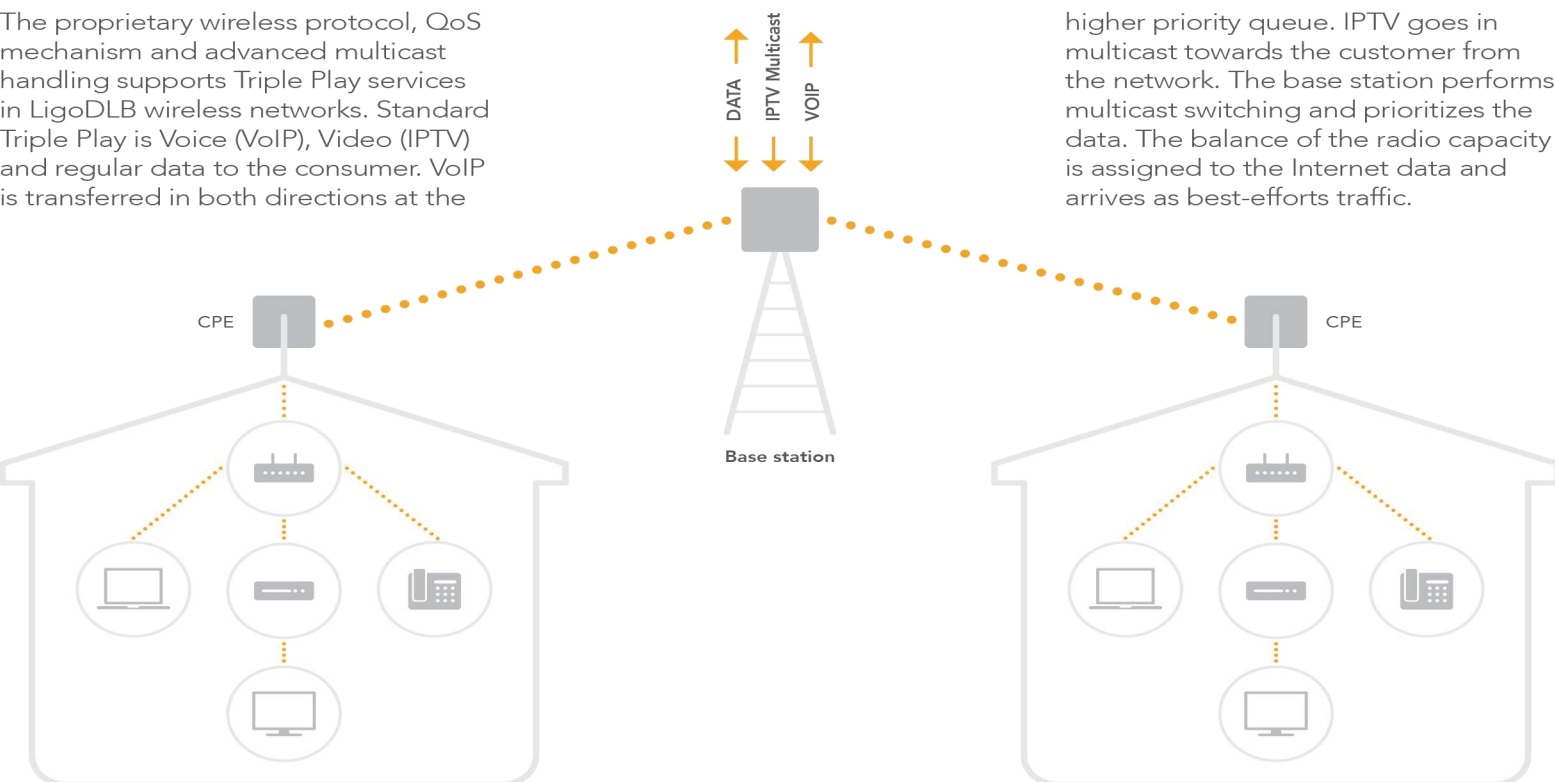
# iPoll 3 vs iPoll 2 improvements

The iPoll 2 protocol was made to simplify the coexistence and migration from LigoWave's APC series products that are based on the Ralink (Mediatek) chipset to the LigoDLB series products which are Qualcomm Atheros chipset based. Using iPoll 2 all APC series client devices can be replaced with LigoDLB series client devices without switching the network to 802.11N mode. Once the network consists of LigoDLB series devices, iPoll 3 mode is highly recommended.

There were several major improvements made when designing the iPoll 3 protocol; three are detailed below:

- Multiple client polling when the base-station is transmitting (decreases latency). The multi-polling feature is operating in hybrid mode, when different client groups are divided into categories based on the client activity. More active stations are put in the main scheduler window, which performs round-robin operation with every active CPE by allocating them a data slot as well as a time-slot for transmission which is limited by the downlink/uplink ratio.

- Hardware accelerated QoS (allows prioritizing mission critical data and delivery of different services). The hardware QoS is realized by re-using the available wireless multimedia extensions (WME) capability available in HCCA and EDCA standards. The lower priority queues, which are usually used for http, ftp, torrent etc. traffic are used only when a connected station receives the permit – token from the Access Point, otherwise the data is buffered until the token is received. The higher priority queues, like video or voice, which require low latency and jitter free performance are allowed to transmit data without receiving permission from the Access Point.

- The dynamic uplink/downlink ratio (improves throughput for high density client scenarios, where downlink is more critical then uplink). The uplink/downlink ratio is controlled by the AP, which decides based on the amount of active clients in the scheduler, what ratio is appropriate for the current situation.

# Easy migration to LigoDLB

iPoll is a proprietary protocol made exclusively for LigoWave products. LigoDLB devices can work with other manufacturer's equipment (using 802.11N mode) thereby permitting a gradual migration to LigoDLB equipment based networks without replacing all 3rd party devices on the network instantly. LigoDLB base stations support auto selection of wireless protocols (802.11N, iPoll 2, iPoll 3); there is no need to reconfigure the CPEs when changing the base station.

## Upgrade procedure

| Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|
| Switch all the wireless equipment to 802.11N mode | Start deploying LigoDLB client devices into the network until all of them are replaced | Start using LigoDLB base-station | Switch to iPoll mode |