New Wireless Features on RouterOS v5

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Nv2

- Proprietary wireless protocol developed by MikroTik
- Based on TDMA (Time Division Multiple Access) media access technology
- Works on Atheros chipset cards:
  - AR5413 and newer chipset cards (R52)
  - N chipset cards (R52n,R52Hn)
- Supported from RouterOS v5

TDMA benefits

- More throughput
- Lower latency
- Suited well for Point-to-MultiPoint networks
- Solves hidden node problems

Nv2 working mechanism

- Media access is controlled by Nv2 AP
- Time is divided dynamically by AP in “periods”:
  - Downlink (from AP to Clients)
  - Uplink (from Clients to AP)
    - Uplink time is divided between the connected clients based on their requirements for bandwidth
- At the beginning of each period AP broadcasts schedule that tells clients when they should transmit and the amount of time they can use

New Nv2 client connection

- Nv2 AP periodically assigns uplink time for "unspecified" client
- This time interval is used by fresh client to initiate registration to AP
- AP estimates propagation delay between AP and client and starts periodically scheduling uplink time for this client in order to complete registration and receive data from client

Nv2 features

- Reliable communications across Nv2 links
  - Dynamic rate selection on per-client basis
  - ARQ (Automatic Repeat reQuest) for data transmissions
- QoS with variable number of priority queues
  - built-in default QoS scheduler that can be accompanied with fine grained QoS policy based on firewall rules or priority information propagated across network using VLAN priority or MPLS EXP bits

Nv2 implementation status

- RouterOS v5.0rc1 supports following features:
  - TDMA media access
  - WDS support
  - QoS support with variable number or priority queues
- Features that Nv2 **does not have yet**:
  - data encryption
  - RADIUS authentication features
  - administrator controlled media access policy
  - synchronization between Nv2 APs
  - some other features...

Nv2 compatibility and coexistence with other wireless protocols

- Only RouterOS devices will be able to participate in Nv2 network
- Only RouterOS devices will see Nv2 AP when scanning
- Nv2 network will disturb other networks in the same channel
- Nv2 network may be affected by any (Nv2 or not) other networks in the same channel
- Nv2 enabled device will not connect to any other TDMA based network

Nv2 vs 802.11

- Media access is scheduled by AP
  - eliminates hidden node problem and allows to implement centralized media access policy - AP controls how much time is used by every client and can assign time to clients according to some policy instead of every device contending for media access
- Reduced propagation delay overhead
  - There are no per-frame ACKs in Nv2 - this significantly improves throughput, especially on long distance links where data frame and following ACK frame propagation delay significantly reduces the effectiveness of media usage
- Reduced per frame overhead
  - Nv2 implements frame aggregation and fragmentation to maximize assigned media usage and reduce per-frame overhead (interframe spaces, preambles)

Nv2 vs Nstreme

- Reduced polling overhead
  - instead of polling each client, Nv2 AP broadcasts uplink schedule that assigns time to multiple clients, this can be considered "group polling" - no time is wasted for polling each client individually, leaving more time for actual data transmission. This improves throughput, especially in PtMP configurations
- Reduced propagation delay overhead
  - Nv2 must not poll each client individually, this allows to create uplink schedule based on estimated distance (propagation delay) to clients such that media usage is most effective. This improves throughput, especially in PtMP configurations
- More control over latency
  - reduced overhead, adjustable period size and QoS features allows for more control over latency in the network

Wireless-protocol setting

Value	AP	Client
unspecified	establish nstreme or 802.11 network based on old **nstreme** setting	connect to nstreme or 802.11 network based on old **nstreme** setting
any	same as **unspecified**	scan for all matching networks, no matter what protocol, connect using protocol of chosen network
802.11	establish 802.11 network	connect to 802.11 networks only
nstreme	establish Nstreme network	connect to Nstreme networks only
nv2	establish Nv2 network	connect to Nv2 networks only
nv2-nstreme-802.11	establish Nv2 network	scan for Nv2 networks, if suitable network found - connect, otherwise scan for Nstreme networks, if suitable network found - connect, otherwise scan for 802.11 network and if suitable network found - connect
nv2-nstreme	establish Nv2 network	scan for Nv2 networks, if suitable network found - connect, otherwise scan for Nstreme networks and if suitable network found - connect

Nv2 settings

- **nv2-cell-radius**
  - specifies distance to farthest client in Nv2 network in km
  - affects the size of contention time slot that AP allocates for clients to initiate connection and also size of time slots used for estimating distance to client
  - If this setting is too small, clients that are further away may have trouble connecting and/or disconnect with "ranging timeout" error
  - in order to maintain maximum performance, it is advised not to increase this setting if not necessary, so AP is not reserving time that is actually never used, but instead allocates it for actual data transfer

Nv2 settings

- **tdma-period-size**
  - size in ms of time periods that Nv2 AP uses for media access scheduling. Smaller period can potentially decrease latency (because AP can assign time for client sooner), but will increase protocol overhead and therefore decrease throughput. Increasing period will increase throughput but also increase latency
  - It may be required to increase this value for especially long links to get acceptable throughput

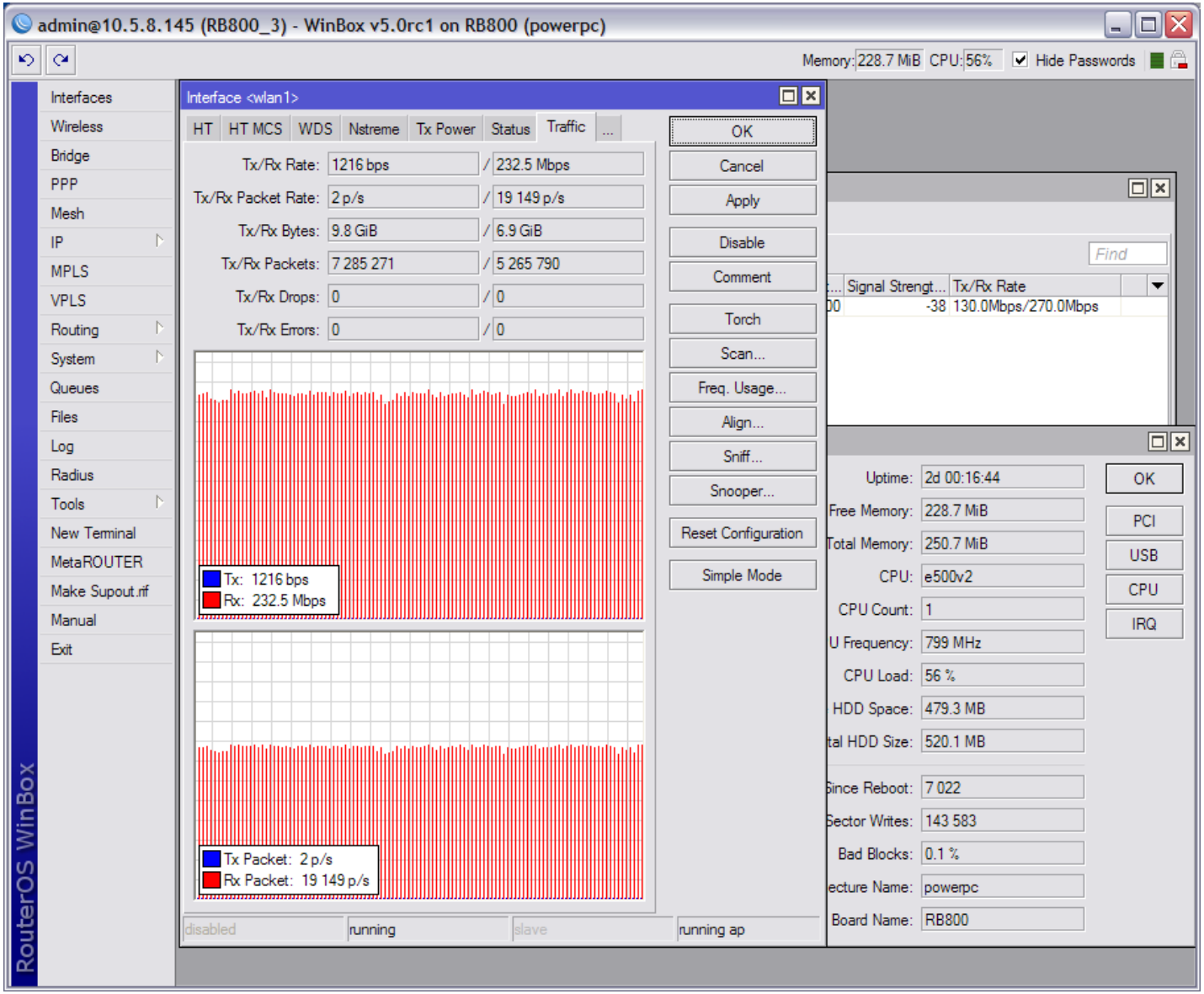
QoS in Nv2

- QoS in Nv2 is implemented by means of variable number of priority queues
- Queue is considered for transmission based on rule recommended by 802.1D-2004 - only if all higher priority queues are empty
  - at first all frames from queue with higher priority will be sent, and only then next queue is considered
- QoS policy must be designed with care so that higher priority queues do not make lower priority queues starve
- QoS policy in Nv2 network is controlled by AP, clients adapt policy from AP

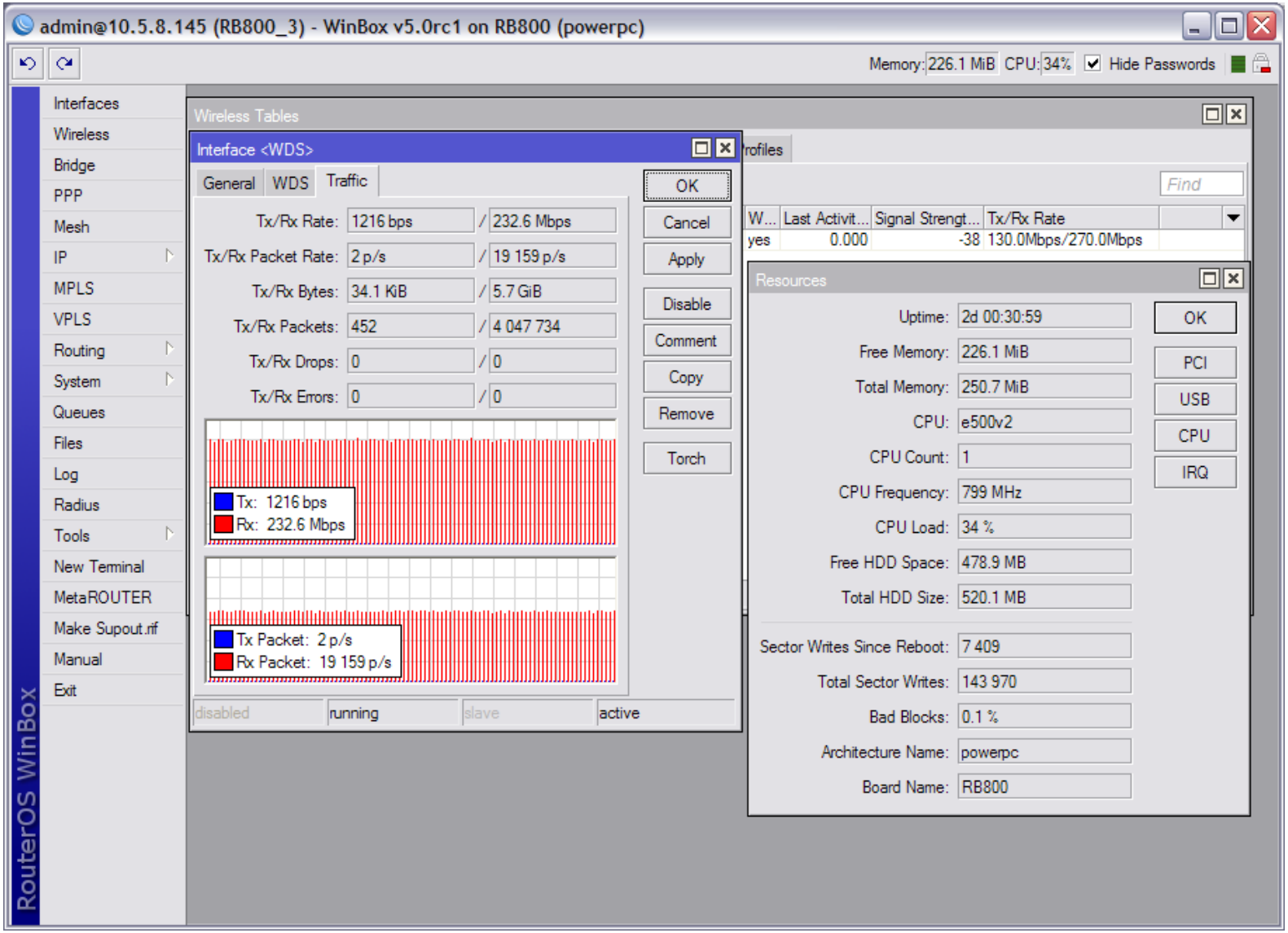
QoS in Nv2

- **nv2-queue-count**
  - specifies how many priority queues are used in Nv2 network
- **nv2-qos=default**
  - outgoing frame at first is inspected by built-in QoS policy algorithm that selects queue based on packet type and size
  - If built-in rules do not match, queue is selected based on frame priority field, as in **nv2-qos=frame-priority** mode
- **nv2-qos=frame-priority**
  - QoS queue is selected based on frame priority field
  - frame priority field is not some field in headers and therefore it is valid only while packet is processed by given device
  - frame priority field must be set either explicitly by firewall rules or implicitly from ingress priority by frame forwarding process, for example, from MPLS EXP bits

Nv2 routing on RB800



Nv2 bridging with WDS on RB800



Nv2 TCP routing on RB800