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PROPRIETARY WIRELESS PROTOCOLS

N-Streme and Nv2

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Soumil Gupta Bhaya
MTCNA , MTCRE, MTCWE, MTCTCE

Binknet Solutions Pvt. Ltd.
Kolkata, India.

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Nstreme and NV2 are Wireless Protocols created by

Mikrotik to improve Point to Point and Point to Multi

Point Wireless links.

Objective: To make an understanding of n-streme, and Nv2 protocol, How it is an improvement over Standard 802.11x, and application of Nv2 in our classroom so as to replicate an outdoor point-to-multipoint scenario.

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Class Setup:

Please Set your Routers to Default Configuration using "system reset-configuration" in terminal window.

Set your Radio name to "your name_xx" starting from the Left Serially, starting with xx=11. So first person on the left will be name_11.

Setup your LAN ip to be 192.168.xx.1/24 in your laptop and . 254 in your router.

Please Set your routers to connect with Class Router by connecting to ssid "wclass" (802.11b/g mode)

Put IP 10.1.1.xx/24 on your wireless interface and add static gateway in ip>route : 10.1.1.254

Add masquerade rue in ip>firewall>NAT, (chain=src-nat, out int=wan1, action=masquerade)

Check Ping to the Gateway.

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Requirements and Compatibility

➢ Nv2 Requires Router OS version 5x

➢Supported by Atheros AR 5413 and newer Chipsets

➢Not Compatible with non Nv2 protocols such as 802.11 or other Proprietary protocols

Why N-Streme / NV2 ???

802.11x	Nstreme	Nv2

CSMA/CA

CSMA with POLLING

TDMA

Problem:

Problem:

A Very Good
Solution

Hidden Node
Problem

Increased
Overhead due
to polling

WHY ??????

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T D M A ==>> Time Division Multiple Access

In TDMA mechanism, a specific node such as AP has responsibility to coordinate the nodes of the network.
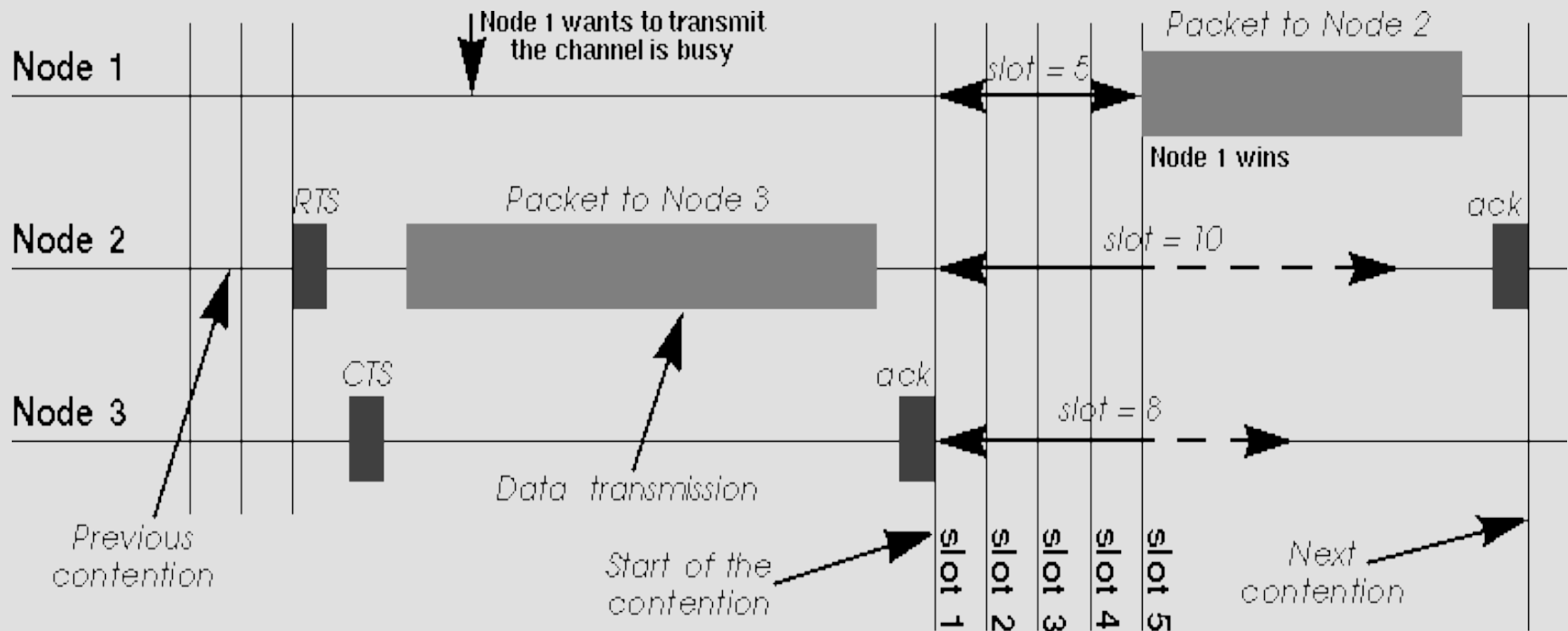
The time on the channel is divided into time slots which are generally of fixed size.

It reduces a lot of overhead in wireless networks and has benefits such as :

1> More Throughput

2> Lower Latency

3> Good for Point to Multipoint Networks

4> Solves Hidden Node Problem

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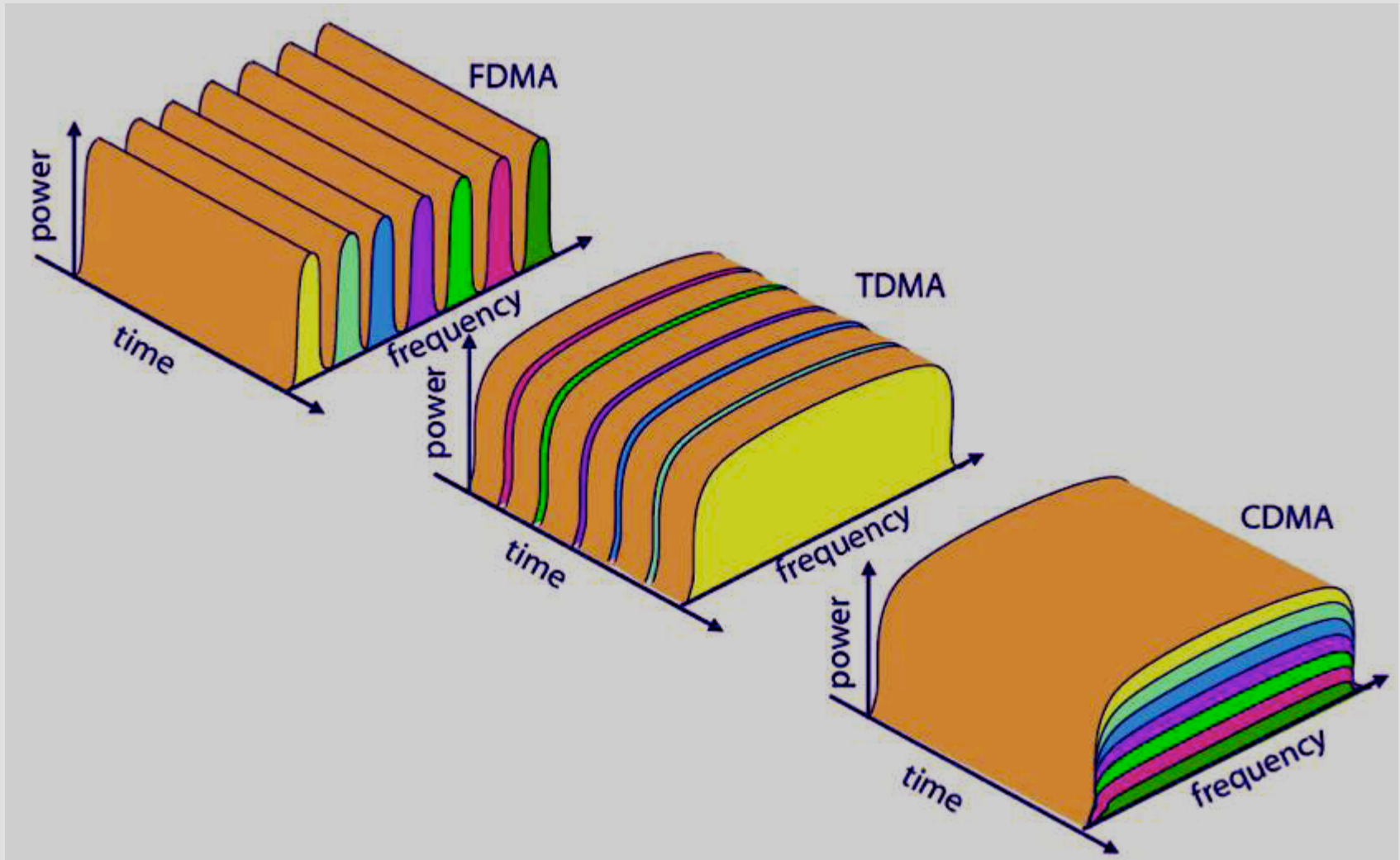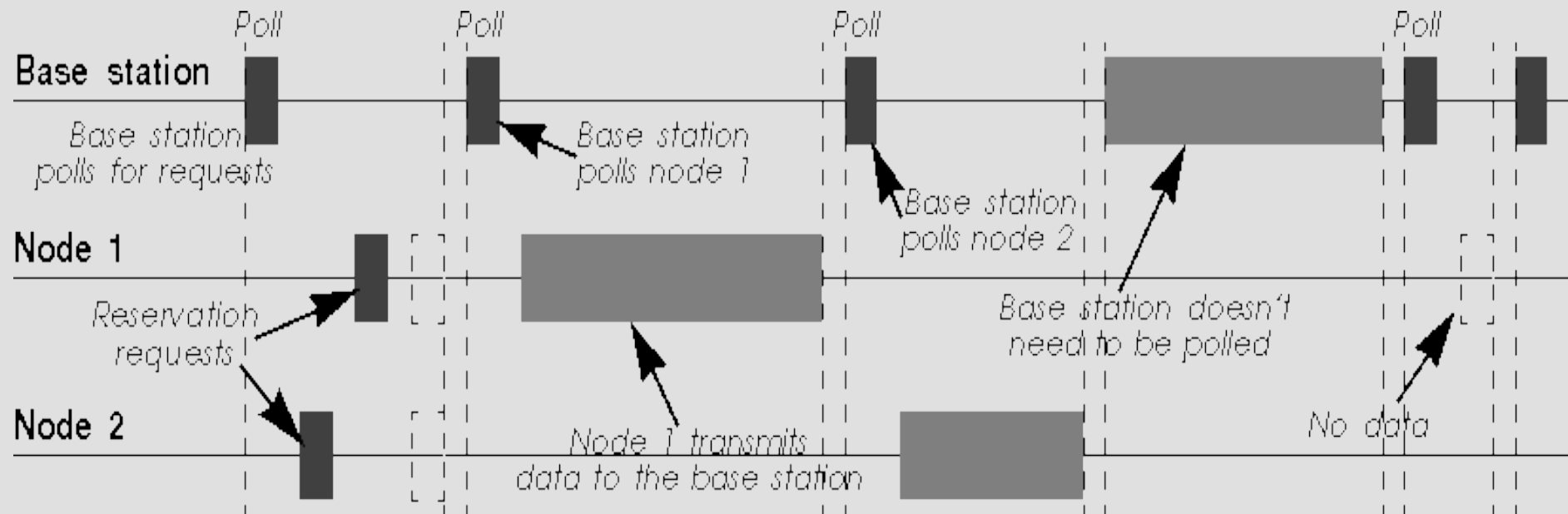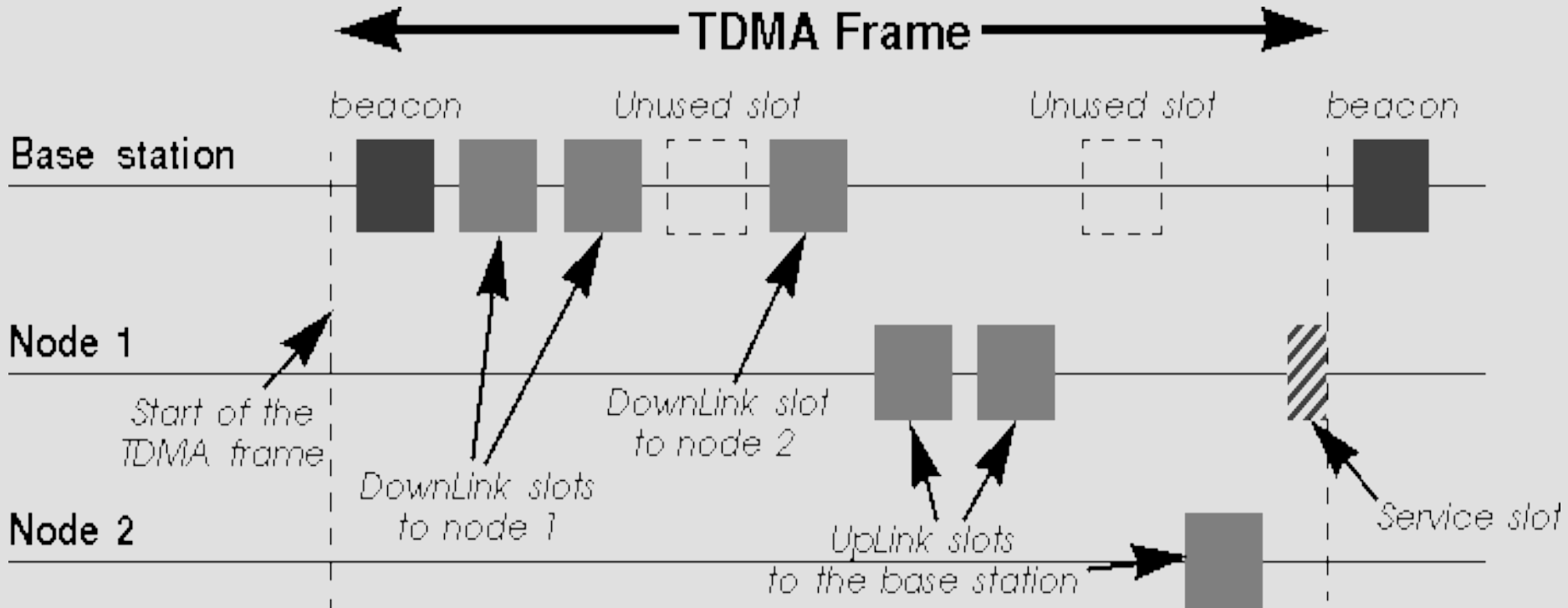
CSMA/CA MECHANISM

❖ Used by 802.11 Standard

POLLING MAC MECHANISM

❖ Used by Mikrotik Nstreme Protocol
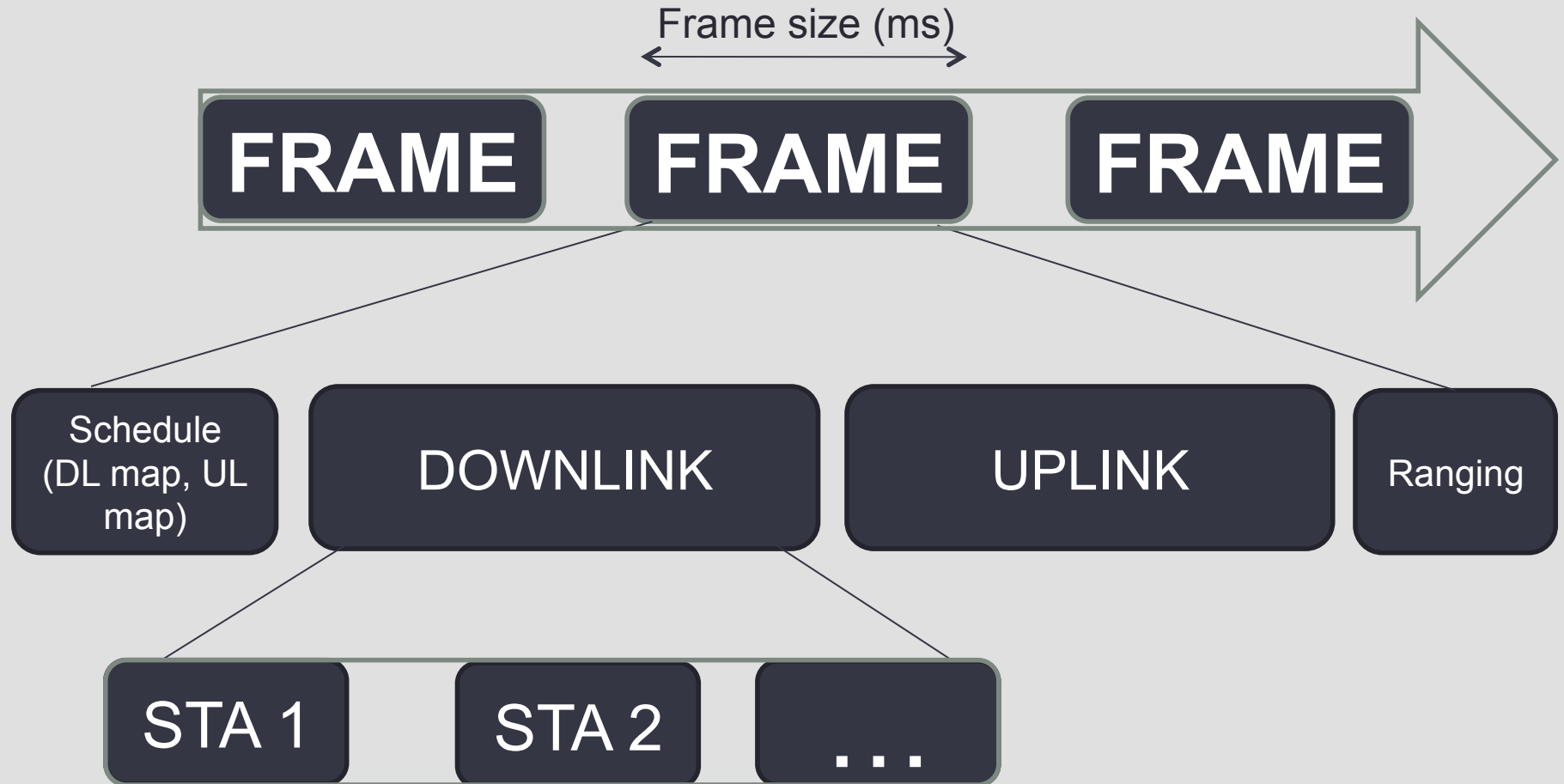
TDMA MECHANISM

❖ Used by Mikrotik Nv2 Protocol

Nv2 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.

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NV2 Frames

Frame size (ms)

FRAME   FRAME   FRAME

Schedule (DL map, UL map)

DOWNLINK

UPLINK

Ranging

STA 1   STA 2   …

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Registration of New Client

➢ Nv2 AP periodically assigns uplink time for new client.

➢ This time interval is used by new client to initiate registration to AP

➢ The 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 new client.

Nv2 Special Features

➢ Reliable communications across Nv2 links

➢Dynamic rate selection on per-client basis.

➢ 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.

Nv2 Settings

STATION STATION

Cell Radius

AP
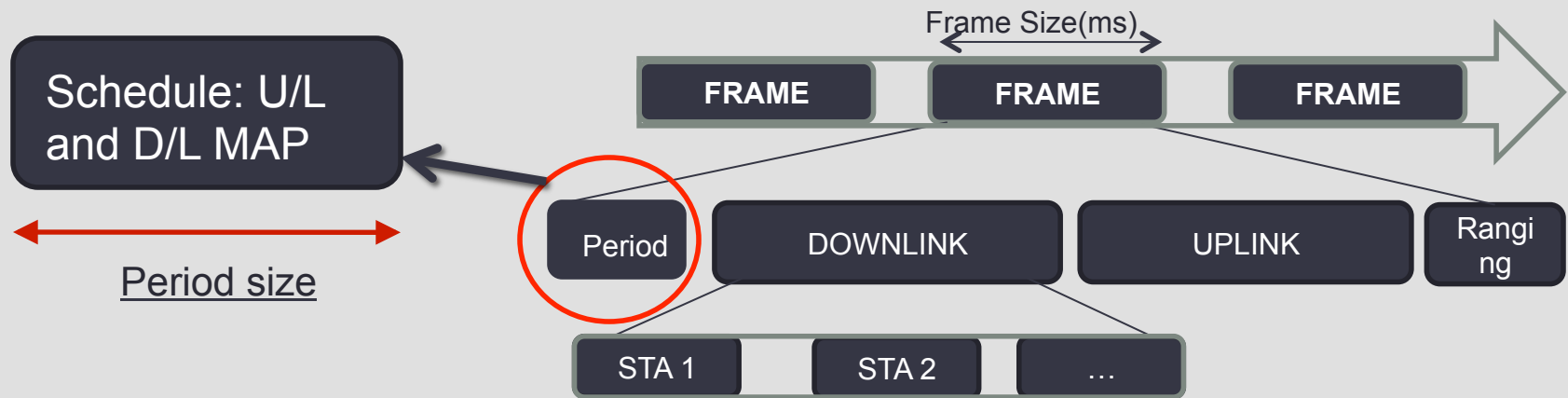
STATION STATION STATION

> ➤ **Nv2-cell-radius**
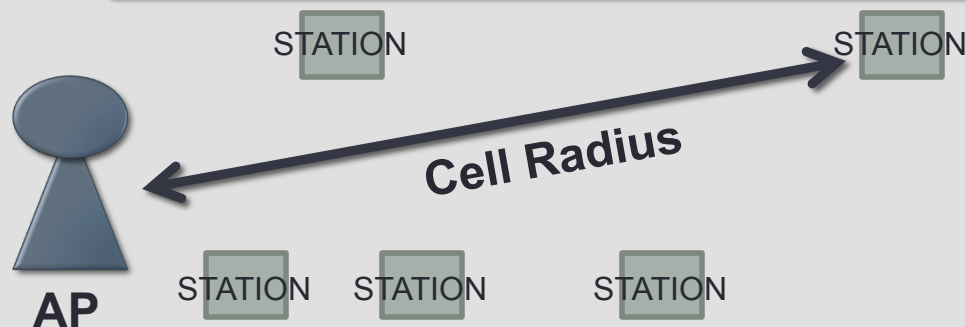
> Specifies distance to farthest client in Nv2 network in km.

> 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.

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Frame Size(ms)

| FRAME | FRAME | FRAME |

Schedule: U/L and D/L MAP

Period size

| Period | DOWNLINK | UPLINK | Ranging |

| STA 1 | STA 2 | ... |

➢ tdma-period-size

> It is the 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.

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Nv2 Setting

Nv2 QoS

Quality of Service

➢ 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

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QoS

➢ 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

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Frame Priority Mapping

➢If number of queues is 2 (default), mapping is as follows:
>   priority 0,1,2,3 -> queue 0
>   priority 4,5,6,7 -> queue 1

➢If number of queues is 4, mapping is as follows:
>   priority 0,3 -> queue 0
>   priority 1,2 -> queue 1
>   priority 4,5 -> queue 2
>   priority 6,7 -> queue 3

➢ If number of queues is 8 (maximum possible), mapping is as follows:
>   priority 0 -> queue 2
>   priority 1 -> queue 0
>   priority 2 -> queue 1
>   priority 3 -> queue 3
>   priority 4 -> queue 4
>   priority 5 -> queue 5
>   priority 6 -> queue 6
>   priority 7 -> queue 7

Security In NV2

➢ Nv2 does not support Standard WPA Encryption.

➢ The Encryption is done by Pre-Shared Key between AP and Clients.

➢ Security can be activated from the NV2 menu in Wireless Configuration.
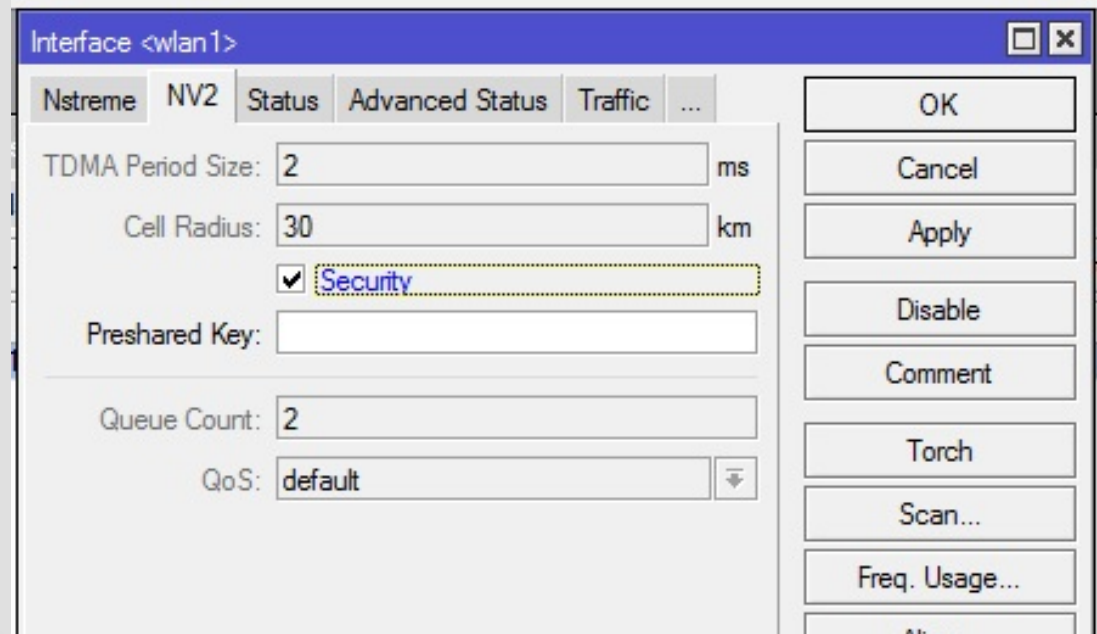
Advantage of NV2 over 802.11x

> # 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 frame propagation delay
> 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 (inter-frame spaces, preambles)

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Advantage of NV2 over N-streme

➢ 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 frame propagation delay

> 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

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Disadvantages of NV2

➢ Only RouterOS devices will be able to participate in Nv2 network and only RouterOS devices will see Nv2 AP when scanning.

➢ Nv2 network will disturb other networks in the same channel and 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.

➢ Does not Support 802.11x standard WPA/WPA 2 Security Protocols

Lab : Performance of NV2

➢ We shall change different Qos Features on your Nv2 link.

➢ What is the best possible setting ????

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SUMMARY

✓ Nv2 is Stable.

✓ Nv2 has More Control.

✓ Nv2 uses TDMA which is excellent in any kind of wireless scenario.

✓ Nv2 has additional QoS features.

✓ Nv2 is Mikrotik !

THANKING YOU

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Soon To Be a Mikrotik Certified Trainer