



# Multi Point Wireless AP on RouterOS

Citraweb Nusa Infomedia, Indonesia

[www.mikrotik.co.id](http://www.mikrotik.co.id)



# Introduction

## **Valens Riyadi**

Mikrotik Certified Engineer

Mikrotik Certified Trainer since 2004

Mikrotik Certified Consultant

Mikrotik Academy Coordinator

Citra.net.id WISP CEO

IT Expert on Disaster Relief

Proud Member of "Routed World" community



## **Pujo Dewobroto**

# Masalah Umum

- Banyak yang masih beranggapan bahwa kecepatan (speed / rate) yang tertera di sebuah interface wireless adalah kecepatan transfer yang bisa digunakan
- Permasalahan umum yang sering dihadapi pada jaringan Wireless Point to Multi Point :
  - Kecepatan transfer naik turun
  - Jumlah perangkat Station / CPE

**Wireless Network Connection Status**

General

Connection

IPv4 Connectivity: Internet

IPv6 Connectivity: No network access

Media State: Enabled

SSID: linksys

Duration: 11 days 11:22:41

Speed: 54.0 Mbps

Signal Quality:

Details...

Activity

Sent — — Received

Bytes: 1,200,647 | 5,9

Properties Disable Diagnose

???

Radio Name	Tx Rate
Client1	54Mbps
Client2	144.4Mbps-20MHz/2S/SGI
Client3	144.4Mbps-20MHz/2S/SGI
Client4	54Mbps
Client5	144.4Mbps-20MHz/2S/SGI

# 802.11 WLAN WIFI Family

- 802.11b - 2,4GHz, max 11Mbps
- 802.11a - 5GHz, max 54Mbps
- 802.11g - 2,4GHz, max 54Mbps
- 802.11n - 2,4 / 5 GHz, max 600Mbps
- 802.11ac - 5GHz, max 1,3Gbps

# Datarate

- Datarate adalah kecepatan maksimal secara teoritis berdasarkan kalkulasi dari Modulasi
- Pada WIFI, terdapat 2 datarate
  - Basic Rate : datarate yang harus disupport AP dan client. Digunakan untuk management
  - Supported : datarate yang bisa digunakan apabila kondisi memungkinkan.  
Jika signal bagus, akan menggunakan datarate diatasnya, begitu juga kebalikannya

# Datarate (2)

Interface <wlan1>

Wireless Data Rates Advanced HT WDS Nstreme Tx Power ...

- Rate

default  configured

Supported Rates B:  1Mbps  2Mbps  5.5Mbps  11Mbps

Supported Rates A/G:  6Mbps  9Mbps  12Mbps  18Mbps  
 24Mbps  36Mbps  48Mbps  54Mbps

Basic Rates B:  1Mbps  2Mbps  5.5Mbps  11Mbps

Basic Rates A/G:  6Mbps  9Mbps  12Mbps  18Mbps  
 24Mbps  36Mbps  48Mbps  54Mbps

Pada kondisi dilapangan, throughput yang bisa kita dapatkan biasanya berkisar 40-60% dari datarate yang digunakan

# RX Sensitivity - TX Power

## R2SHPN

802.11b	RX Sensitivity	TX Power
1Mbit	-93	32dBm
11Mbit	-77	30dBm
802.11g	RX Sensitivity	TX Power
6Mbit	-93	32dBm
54Mbit	-77	29dBm
802.11n		
MCS0 20MHz	-93	32dBm
MCS0 40MHz	-93	31dBm
MCS7 20MHz	-74	28dBm
MCS7 40MHz	-72	27dBm

Semakin besar data rate yang digunakan, kemampuan TX power-nya semakin kecil dan minimum signal strength yang harus diterima semakin besar

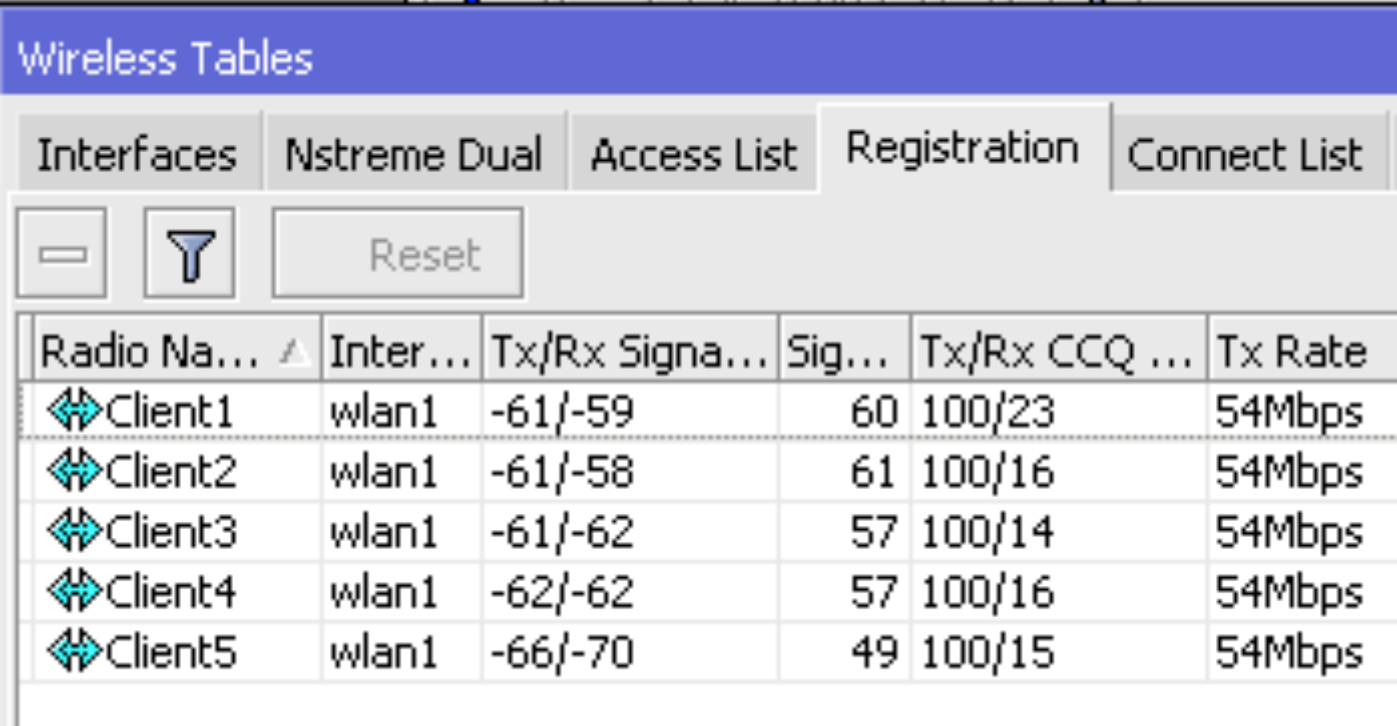


# SNR & CCQ

- SNR - Signal to Noise Ratio adalah selisih antara signal yang diterima dengan noise yang ada di sekitar
  - Semakin besar nilai SNR secara teoritis semakin bagus
- CCQ - adalah prosentase seberapa efektif throughput yang bisa digunakan pada sebuah link yang dihitung dari frame yang dikirim secara software dan hardware

# Perangkat testing

- AP dan CPE menggunakan HapLite



The screenshot shows the Mikrotik 'Wireless Tables' interface. It features a navigation bar with tabs for 'Interfaces', 'Nstreme Dual', 'Access List', 'Registration', and 'Connect List'. Below the tabs are control buttons: a minus sign, a funnel icon, and a 'Reset' button. The main area contains a table with the following columns: 'Radio Na...', 'Inter...', 'Tx/Rx Signa...', 'Sig...', 'Tx/Rx CCQ ...', and 'Tx Rate'. The table lists five clients connected to 'wlan1'.

Radio Na...	Inter...	Tx/Rx Signa...	Sig...	Tx/Rx CCQ ...	Tx Rate
↔ Client1	wlan1	-61/-59	60	100/23	54Mbps
↔ Client2	wlan1	-61/-58	61	100/16	54Mbps
↔ Client3	wlan1	-61/-62	57	100/14	54Mbps
↔ Client4	wlan1	-62/-62	57	100/16	54Mbps
↔ Client5	wlan1	-66/-70	49	100/15	54Mbps

# Test 802.11g datarate 6mbps

Eth. Pro...	Protocol	Src.	▲ Dst.	Tx Rate ▲	Tx Pack...
800 (ip)		10.10.10.1	0.0.0.0	5.4 Mbps	446
1 item		Total Tx: 5.4 Mbps	Total Rx: 0 bps	Total Tx Packet: 446	Tot
Name ▼	Type	Tx	Tx Packet...	Tx Drops	Tx Errors
R wlan1	Wireless (Atheros AR9300)	5.4 Mbps	446	0	0

**Hanya 5,4Mbps**

# Test 802.11g datarate 54mbps

Eth. Pro...	Protocol	Src.	△	Dst.	Tx Rate	△	Tx Pack...
800 (ip)		10.10.10.1		0.0.0.0	30.2 Mbps		2501
1 item		Total Tx: 30.2 Mbps		Total Rx: 0 bps		Total Tx Packet: 2 501	
R	↔ wlan1	Wireless (Atheros AR9300)		29.9 Mbps	2 476	0	0

**Hanya 30Mbps**

# Test 802.11g datarate 54mbps

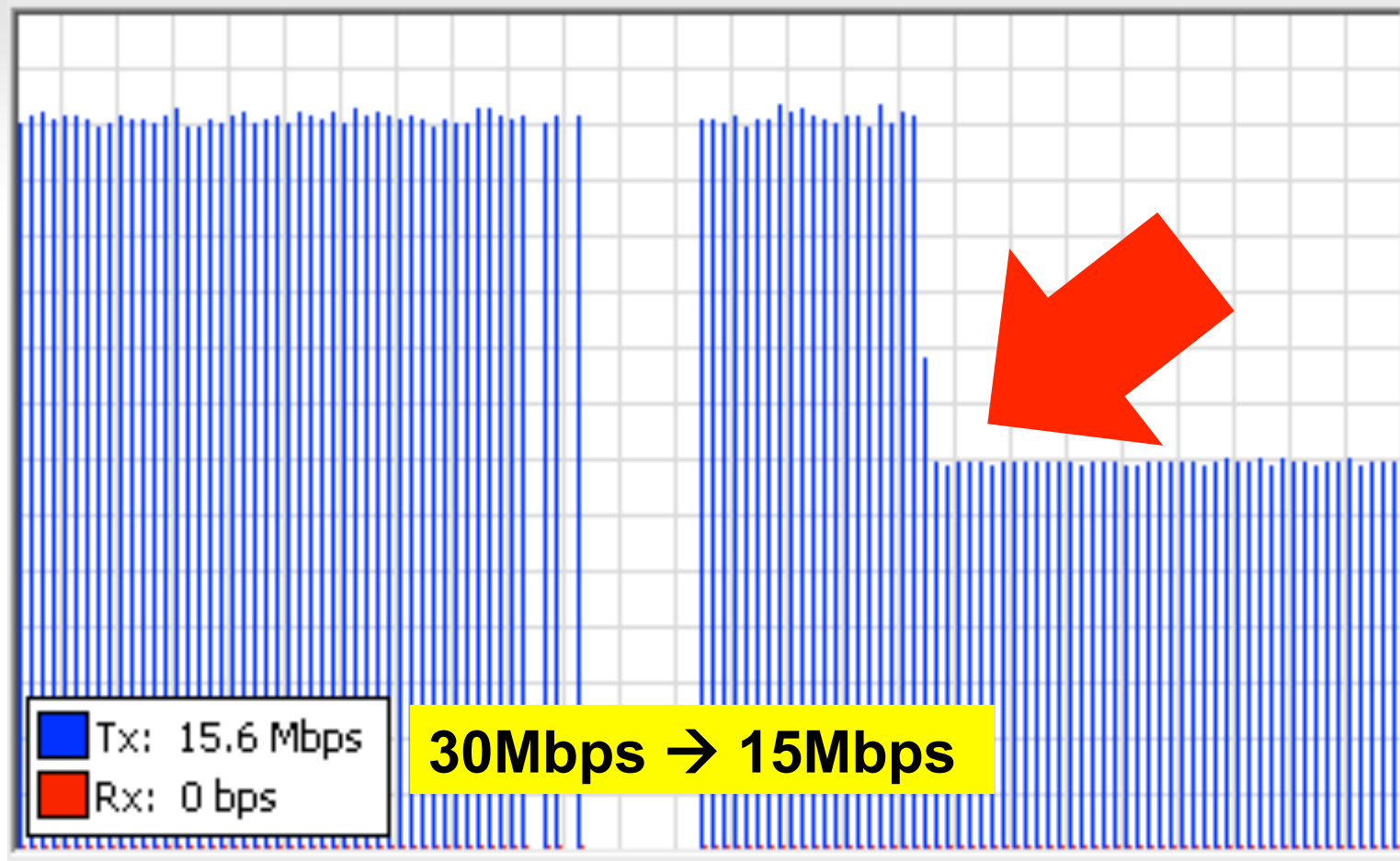
Eth. Pro...	Protocol	Src.	▲ Dst.	Tx Rate ▲	Tx Pack...			
800 (ip)		10.10.10.1	0.0.0.0	5.9 Mbps	495			
800 (ip)		10.10.10.2	0.0.0.0	6.0 Mbps	496			
800 (ip)		10.10.10.3	0.0.0.0	6.0 Mbps	496			
800 (ip)		10.10.10.4	0.0.0.0	6.0 Mbps	496			
800 (ip)		10.10.10.5	0.0.0.0	6.0 Mbps	496			
5 items		Total Tx: 6.0 Mbps		Total Rx: 0 bps		Total Tx Packet: 496		Tot
Name ▼	Type	Tx	Tx Packet...	Tx Drops	Tx Errors			
R wlan1	Wireless (Atheros AR9300)	30.0 Mbps	2 483	0	0			

**Total tetap 30Mbps**

# Test 802.11g datarate mixed

Eth. Pro...	Protocol	Src.	△ Dst.	Tx Rate	△		
800 (ip)		10.10.10.1	0.0.0.0	3.1 Mbps			
800 (ip)		10.10.10.2	0.0.0.0	3.1 Mbps			
800 (ip)		10.10.10.3	0.0.0.0	3.1 Mbps			
800 (ip)		10.10.10.4	0.0.0.0	3.1 Mbps			
800 (ip)		10.10.10.5	0.0.0.0	3.1 Mbps			
5 items		Total Tx: 3.1 Mbps		Total Rx: 0 bps		Total Tx Packet: 258	
Name	Type	Tx	Tx Packet...	Tx Drops	T		
R wlan1	Wireless (Atheros AR9300)	15.5 Mbps	1 286	0			

# Test 802.11g datarate mixed



# Test 802.11n 20Mhz

Eth. Pro...	Protocol	Src.	▲ Dst.	Tx Rate ▲	Tx Pack...
800 (ip)		10.10.10.1	0.0.0.0	68.6 Mbps	5664
800 (ip)		10.10.10.5	0.0.0.0	0 bps	0

2 items	Total Tx: 0 bps	Total Rx: 1152 bps	Total Tx Packet: 0	Tot
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	Name ▼	Type	Tx	Tx Packet...	Tx Drops	Tx Errors
R	↔ wlan1	Wireless (Atheros AR9300)	67.7 Mbps	5 592	0	0

**Hanya ~67Mbps**



# Test 802.11n 40Mhz

Eth. Pro...	Protocol	Src.	▲ Dst.	Tx Rate ▲	Tx Pack...
800 (ip)		10.10.10.1	0.0.0.0	78.4 Mbps	6479

1 item	Total Tx: 78.4 Mbps	Total Rx: 0 bps	Total Tx Packet: 6 479	Tot
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	Name ▼	Type	Tx	Tx Packet...	Tx Drops	Tx Errors
R	wlan1	Wireless (Atheros AR9300)	78.6 Mbps	6 494	0	0


**Hanya ~78Mbps**

# Test 802.11n 40Mhz

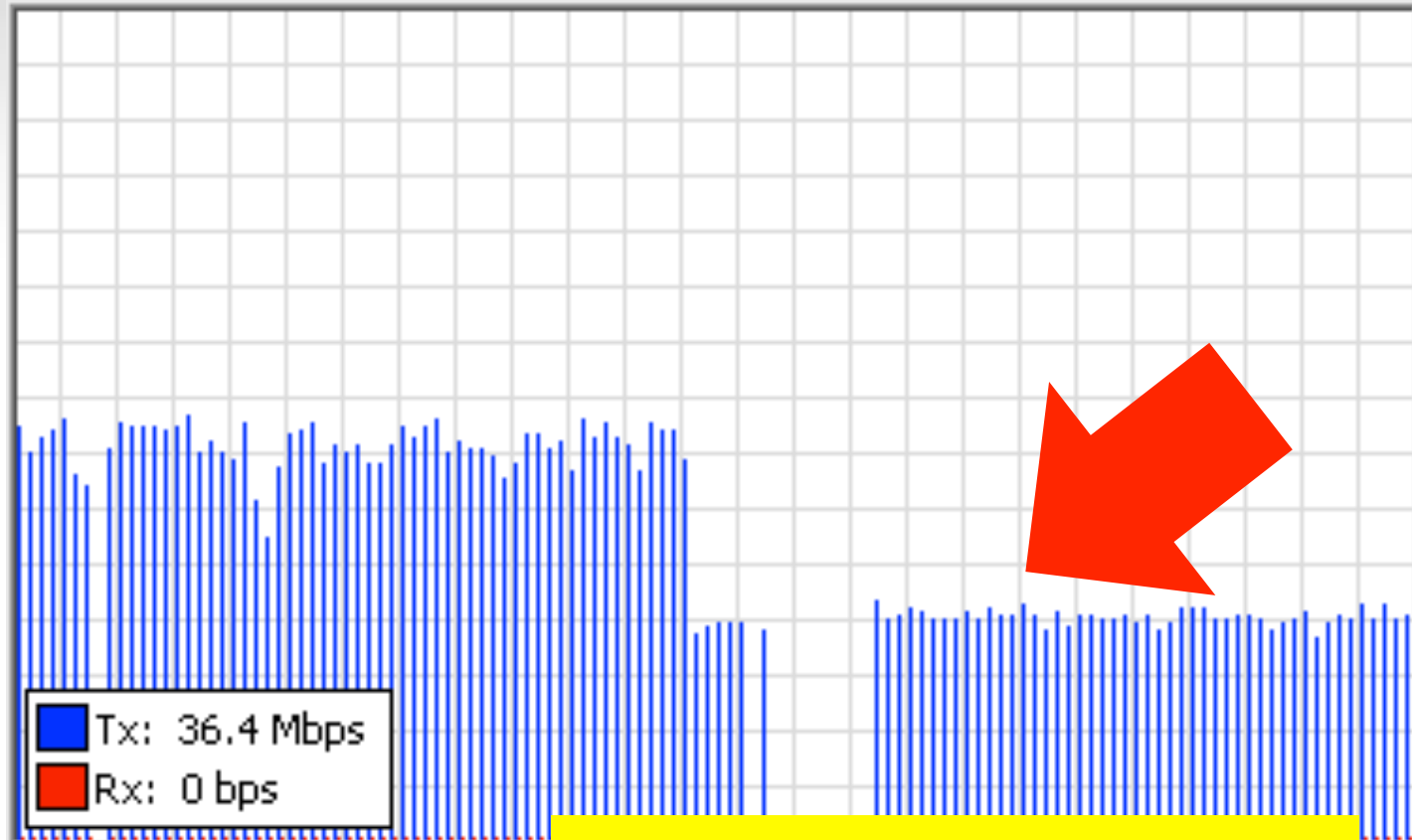
Eth. Pro...	Protocol	Src.	△	Dst.	Tx Rate	△	Tx Pack...
800 (ip)		10.10.10.1		0.0.0.0	14.2 Mbps		1176
800 (ip)		10.10.10.2		0.0.0.0	14.2 Mbps		1177
800 (ip)		10.10.10.3		0.0.0.0	14.2 Mbps		1177
800 (ip)		10.10.10.4		0.0.0.0	14.2 Mbps		1177
800 (ip)		10.10.10.5		0.0.0.0	14.2 Mbps		1177
5 items		Total Tx: 14.2 Mbps		Total Rx: 0 bps		Total Tx Packet: 1 177	
Name	Type	Tx	Tx Packet...	Tx Drops	Tx Errors		
R wlan1	Wireless (Atheros AR9300)	71.3 Mbps	5 887	0	0		

**Hanya ~70Mbps**

# 802.11n mix 802.11g

Eth. Pro...	Protocol	Src.	△	Dst.	Tx Rate	△	Tx Pack...	
800 (ip)		10.10.10.1		192.168.1.201	7.1 Mbps		591	
800 (ip)		10.10.10.2		192.168.1.201	7.1 Mbps		591	
800 (ip)		10.10.10.3		192.168.1.201	7.1 Mbps		591	
800 (ip)		10.10.10.4		192.168.1.201	7.1 Mbps		591	
800 (ip)		10.10.10.5		192.168.1.201	7.1 Mbps		591	
5 items (1 s...		Total Tx: 7.1 Mbps		Total Rx: 0 bps		Total Tx Packet: 591		To
	Name ▾	Type		Tx	Tx Packet...	Tx Drops	Tx Errors	
R	 wlan1	Wireless (Atheros AR9300)		36.2 Mbps	2 990	0	0	

# 802.11n mix 802.11g



**70Mbps → 36Mbps**

# 802.11 Queue

#	Name	Target	Download Ma...	Download Lim...	Download
0	Wireless	10.10.10.0/24	unlimited	unlimited	64.4 Mbps
1	WL...	10.10.10.1	5M	1M	3.9 Mbps
2	WL...	10.10.10.2, 10....	80M	50M	60.5 Mbps

Eth. Pro...	Protocol	Src.	Dst.	Tx Rate	Tx Pack...
800 (ip)		10.10.10.1	192.168.1.201	5.0 Mbps	418
800 (ip)		10.10.10.2	192.168.1.201	9.1 Mbps	757
800 (ip)		10.10.10.3	192.168.1.201	9.1 Mbps	757
800 (ip)		10.10.10.4	192.168.1.201	9.1 Mbps	756
800 (ip)		10.10.10.5	192.168.1.201	9.1 Mbps	757

5 items	Total Tx: 9.1 Mbps	Total Rx: 0 bps	Total Tx Packet: 757	Tot
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Name	Type	Tx	Tx Packet...	Tx Drops	Tx Error
R wlan1	Wireless (Atheros AR9300)	41.4 Mbps	3 422	0	



**36Mbps → 41Mbps**

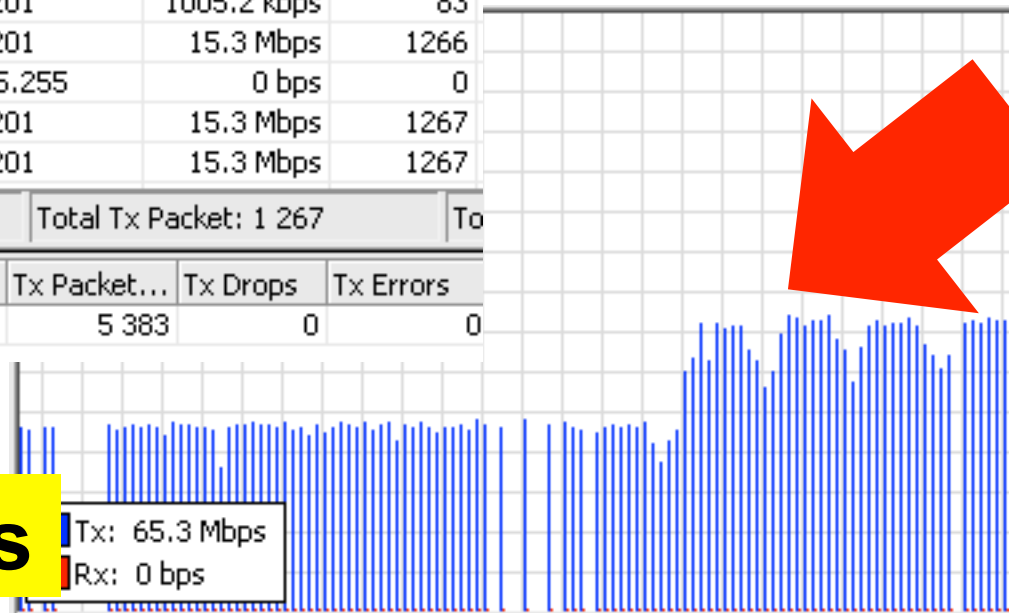
# 802.11 Queue

#	Name	Target	Download Ma...	Download Lim...	Download
0	Wireless	10.10.10.0/24	unlimited	unlimited	77.4 Mbps
1	WL...	10.10.10.1	1M	1M	986.2 kbps
2	WL...	10.10.10.2, 10....	80M	50M	76.4 Mbps

Eth. Pro...	Protocol	Src.	Dst.	Tx Rate	Tx Pack...
800 (ip)		10.10.10.1	192.168.1.201	1005.2 kbps	83
800 (ip)		10.10.10.2	192.168.1.201	15.3 Mbps	1266
800 (ip)		10.10.10.3	255.255.255.255	0 bps	0
800 (ip)		10.10.10.3	192.168.1.201	15.3 Mbps	1267
800 (ip)		10.10.10.4	192.168.1.201	15.3 Mbps	1267

6 items    Total Tx: 15.3 Mbps    Total Rx: 0 bps    Total Tx Packet: 1 267

Name	Type	Tx	Tx Packet...	Tx Drops	Tx Errors
wlan1	Wireless (Atheros AR9300)	65.1 Mbps	5 383	0	0



**41Mbps -> 65Mbps**

Wireless Tables

Interfaces Nstream Dual Access List Registration Connect List Security Profiles Channels

oo Reset

Interface wlan1

Radio Name	MAC Addr...	Tx/Rx ...	Signa...	Tx/Rx ...	P Throug...	Tx Rate	Rx Rate
client-5	D4:CA:6...	-50/-51	44	100/96		30502 54Mbps	54Mbps
client-13	D4:CA:6...	-58/-59	36	100/94		30502 54Mbps	54Mbps
client-16	D4:CA:6...	-53/-55	40	100/94		30502 54Mbps	54Mbps
client-17	D4:CA:6...	-51/-57	38	100/92		30502 54Mbps	54Mbps
client-18	D4:CA:6...	-60/-61	34	100/89		30502 54Mbps	54Mbps
client-19	D4:CA:6...	-57/-61	34	100/93		30502 54Mbps	54Mbps
client-20	D4:CA:6...	-52/-57	38	100/93		30502 54Mbps	54Mbps
client-21	D4:CA:6...	-53/-56	39	100/92		30502 54Mbps	54Mbps
clienthap-31	E4:8D:8C...	-57/-58	37	100/98		30502 54Mbps	54Mbps
clienthap-32	E4:8D:8C...	-51/-51	44	100/95		30502 54Mbps	54Mbps
clienthap-33	E4:8D:8C...	-54/-53	42	100/93		30502 54Mbps	54Mbps
clienthap-34	E4:8D:8C...	-54/-53	42	100/99		30502 54Mbps	54Mbps
clienthap-35	E4:8D:8C...	-54/-52	43	100/93		30502 54Mbps	54Mbps
clienthap-37	E4:8D:8C...	-48/-48	47	100/98		30502 54Mbps	54Mbps
clienthap-38	E4:8D:8C...	-45/-49	46	100/90		30502 54Mbps	54Mbps
clienthap-39	E4:8D:8C...	-49/-56	39	100/87		30502 54Mbps	54Mbps
clienthap-41	E4:8D:8C...	-49/-52	43	100/94		30502 54Mbps	54Mbps
clienthap-42	E4:8D:8C...	-49/-53	42	100/96		30502 54Mbps	54Mbps
clienthap-43	E4:8D:8C...	-53/-56	39	100/93		30502 54Mbps	54Mbps
clienthap-44	E4:8D:8C...	-50/-52	43	100/81		30502 54Mbps	54Mbps
clienthap-45	E4:8D:8C...	-53/-54	41	100/95		30502 54Mbps	54Mbps
clienthap-46	E4:8D:8C...	-56/-55	40	100/96		30502 54Mbps	54Mbps
clienthap-47	E4:8D:8C...	-56/-53	42	100/97		30502 54Mbps	54Mbps
clienthap-48	E4:8D:8C...	-54/-53	42	100/94		30502 54Mbps	54Mbps
clienthap-50	E4:8D:8C...	-63/-61	34	100/83		30502 54Mbps	54Mbps
clienthap-51	E4:8D:8C...	-55/-57	38	100/95		30502 54Mbps	54Mbps
clienthap-52	E4:8D:8C...	-63/-62	33	100/94		30502 54Mbps	54Mbps
clienthap-55	E4:8D:8C...	-55/-60	35	100/95		30502 54Mbps	54Mbps
clienthap-56	E4:8D:8C...	-56/-55	40	100/98		30502 54Mbps	54Mbps
clienthap-57	E4:8D:8C...	-59/-57	38	100/99		30502 54Mbps	54Mbps
clienthap-59	E4:8D:8C...	-61/-58	37	100/96		30502 54Mbps	54Mbps
clienthap-60	E4:8D:8C...	-64/-61	34	100/95		30502 54Mbps	54Mbps
clienthap-61	E4:8D:8C...	-64/-61	34	100/93		30502 54Mbps	54Mbps
clienthap-62	E4:8D:8C...	-65/-62	33	100/95		30502 54Mbps	54Mbps
clienthap-64	E4:8D:8C...	-63/-62	33	100/91		30502 54Mbps	54Mbps
clienthap-58	E4:8D:8C...	-66/-66	29	99/95		30472 54Mbps	54Mbps
clienthap-63	E4:8D:8C...	-57/-55	40	100/87		30502 54Mbps	54Mbps

60 items out of 81 (1 selected)

Torch (Running)

Interface: wlan1

Entry Timeout: 00:00:03 s

Filters

Src. Address: 10.0.0.0/8

Dst. Address: 10.0.0.0/8

Src. Address6: ::/0

Dst. Address6: ::/0

MAC Protocol: all

Protocol: udp

Port: any

VLAN Id: any

DSCP: any

Start Stop Close New Window

Eth...	Pro...	Src.	Dst.	Tx Rate	Rx Rate	Tx Packet ...	Rx Pack...
800 ...	17 ...	10.200.0.1	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.2	10.200.2.2	484.4 kbps	0 bps	40	0
800 ...	17 ...	10.200.0.5	10.200.2.2	472.3 kbps	0 bps	39	0
800 ...	17 ...	10.200.0.6	10.200.2.2	472.3 kbps	0 bps	39	0
800 ...	17 ...	10.200.0.7	10.200.2.2	472.3 kbps	0 bps	39	0
800 ...	17 ...	10.200.0.8	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.11	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.12	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.13	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.15	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.16	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.17	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.18	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.19	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.20	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.21	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.22	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.23	10.200.2.2	472.3 kbps	0 bps	39	0
800 ...	17 ...	10.200.0.24	10.200.2.2	314.9 kbps	0 bps	26	0
800 ...	17 ...	10.200.0.31	10.200.2.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.32	10.200.3.2	472.3 kbps	0 bps	39	0
800 ...	17 ...	10.200.0.33	10.200.3.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.34	10.200.3.2	387.5 kbps	0 bps	32	0
800 ...	17 ...	10.200.0.35	10.200.3.2	460.2 kbps	0 bps	38	0
800 ...	17 ...	10.200.0.36	10.200.3.2	484.4 kbps	0 bps	40	0

60 items Total Tx: 27.0 Mbps Total Rx: 0 bps Total Tx Packet: 2 234 Total Rx Packet: 0

**RB433+R52 (AP)  
60 Haplite (CPE)**





# NV2 (Mikrotik Only)

- Media Access diatur oleh AP, sehingga menghilangkan potensi permasalahan hidden node
- Tidak lagi menggunakan frame ACK, sehingga mengurangi delay per framenya.
  - Sangat cocok untuk CPE yang jauh
- Mendukung frame aggregation, sehingga overhead per frame bisa dikurangi

# Custom Datarate

- Untuk best effortnya, batasi minimum datarate yang diharapkan sesuai kondisi client

Interface <wlan1>

Wireless Data Rates Advanced HT WDS Nstreme NV2 Tx Power ...

— Rate

default  configured

Supported Rates B:  1Mbps  2Mbps  5.5Mbps  11Mbps

Supported Rates A/G:  6Mbps  9Mbps  12Mbps  18Mbps  
 24Mbps  36Mbps  48Mbps  54Mbps

Basic Rates B:  1Mbps  2Mbps  5.5Mbps  11Mbps

Basic Rates A/G:  6Mbps  9Mbps  12Mbps  18Mbps  
 24Mbps  36Mbps  48Mbps  54Mbps

# Access List

- Dengan menggunakan Access list, kita bisa mengunci signal dari client yang boleh terkoneksi ke interface wireless kita

AP Access Rule <00:00:00:00:00:00>

MAC Address:

Interface: all

Signal Strength Range: -70..-40

AP Tx Limit:

Client Tx Limit:

Authentication

Forwarding

Default Authenticate

Default Forward

Hide SSID

# Queue

- Selalu atur penggunaan bandwidth client anda 😊

# Thank You!

Dijinkan menggunakan sebagian atau seluruh materi pada modul ini, baik berupa ide, foto, tulisan, konfigurasi dan diagram selama untuk kepentingan pengajaran, dan memberikan kredit kepada penulis serta link ke [www.mikrotik.co.id](http://www.mikrotik.co.id)

