

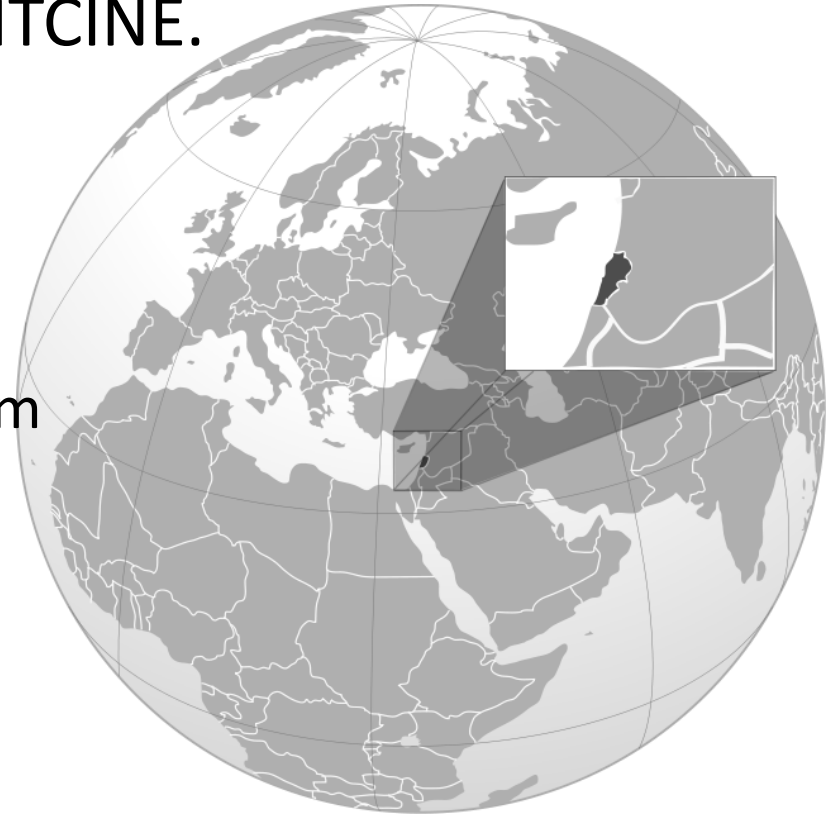
MikroTik for K-12 Schools in Lebanon Wi-Fi, CAPsMAN, Web Proxy

MikroTik User Meeting – MUM – 14-June-2016
Beirut - Lebanon

MikroTik Certified Trainer: Khalil Chamseddine
<http://ConnectionGT.com>

About me, the MikroTik Certified Trainer

- Name: Khalil Chamseddine
- Experience: Software, Hardware and Networking
- Places: Lebanon, Canada, Afghanistan...
- MikroTik Trainer in Lebanon and Region: MTCNA, MTCWE, MTCTCE, MTCUME, MTCRE and MTCINE.
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 - <http://ConnectionGT.com>
 - E-Mail: MikroTik@ConnectionGT.com
 - Phone: +961-3-892792

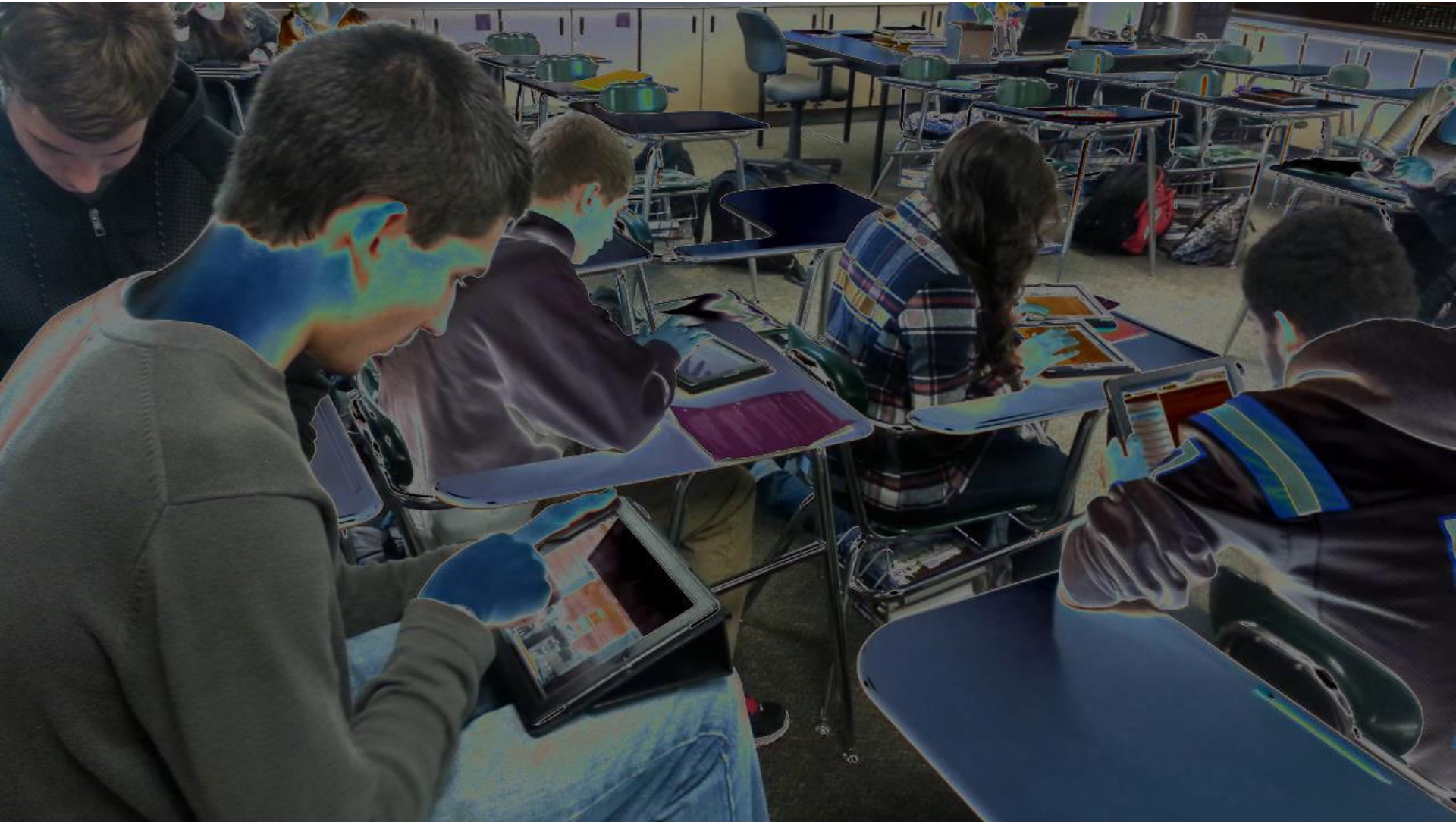


Outline

- School Requirements
- Design Considerations
- CAPsMAN
- CAPs: RouterBOARDS
- Web Proxy

School Requirements

- Provide Wireless Internet to Students in their classrooms



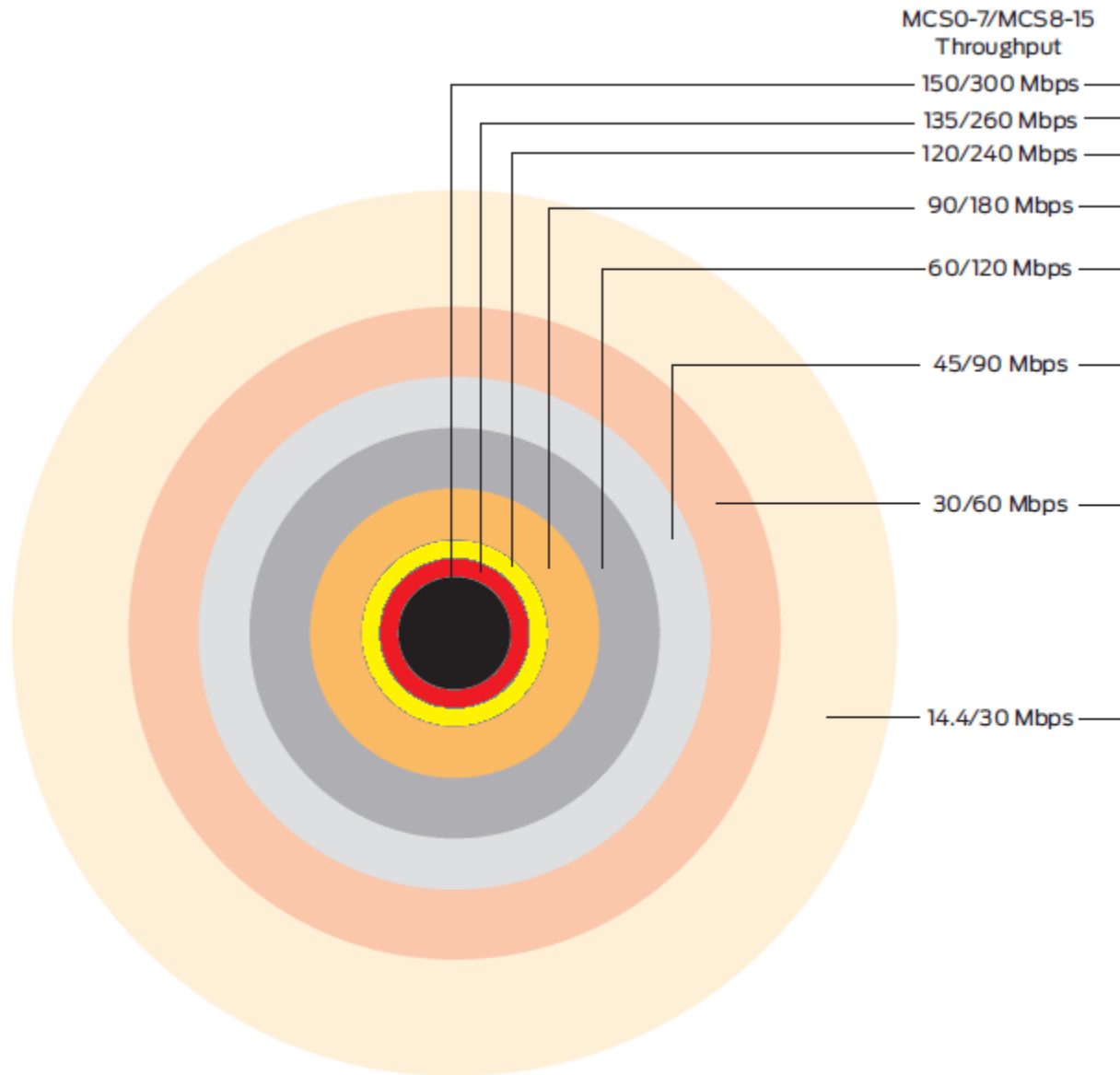
School Requirements

- Provide Wireless Internet to Students in their classes
 - Typical, 2~3Mbps per student
- Devices used: Laptops, Tablets, iPads
 - Educational Sites, Email, Some YouTube...
- Frequency Bands: Currently: 2.4GHz, Future, maybe 5Ghz
- Have the option to filter some internet traffic and some caching
- **Solution should be easy to manage**
- Our Typical School has “L” shape Building
 - 5 floors, 50 class rooms, 20~30 devices per class

Design Considerations

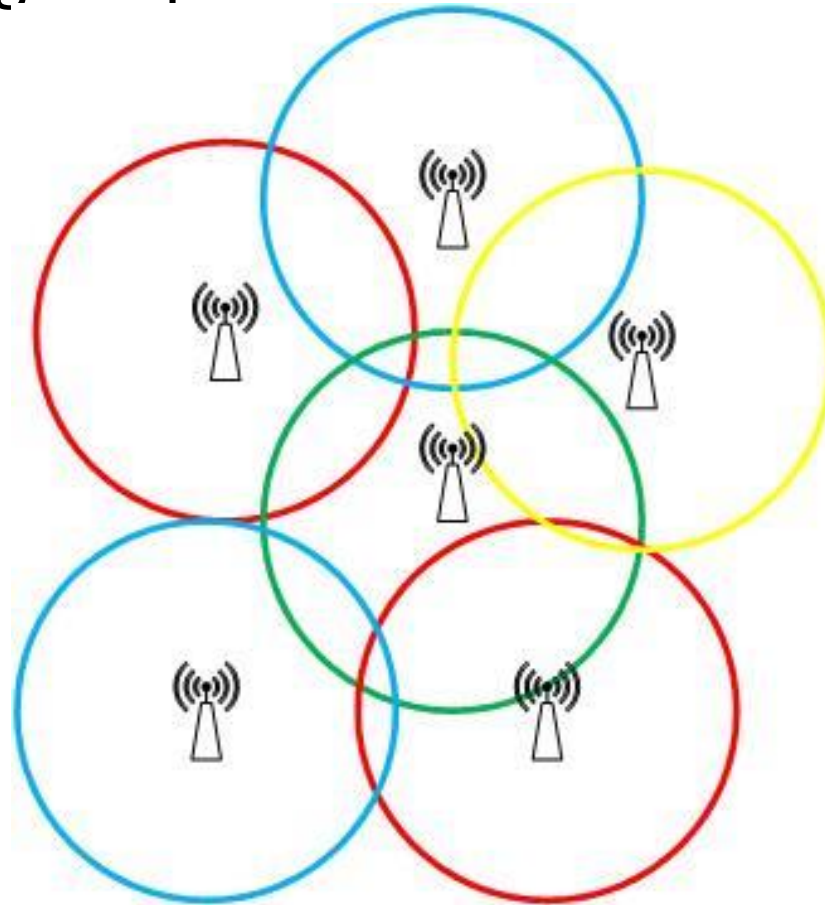
- Capacity versus Coverage
- Coverage Overlapping
- Frequency Overlapping
- Simple, centralized management

Capacity versus Coverage



Overlapping

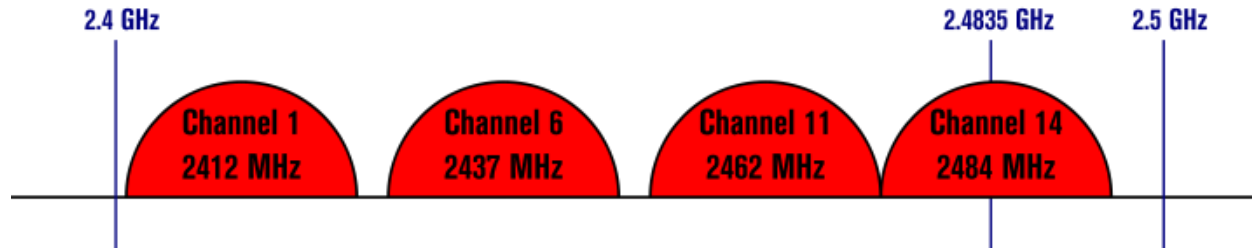
- Overlapping Coverage for good roaming
- Overlapping Channels
- Not Overlapping Frequencies



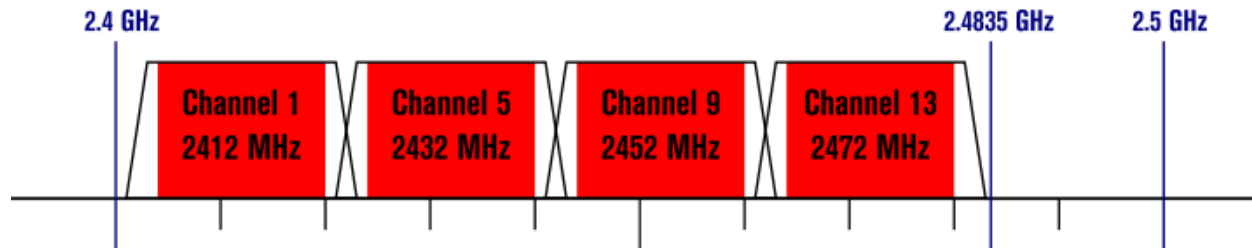
Channel Planning 2.4GHz

Non-Overlapping Channels for 2.4 GHz WLAN

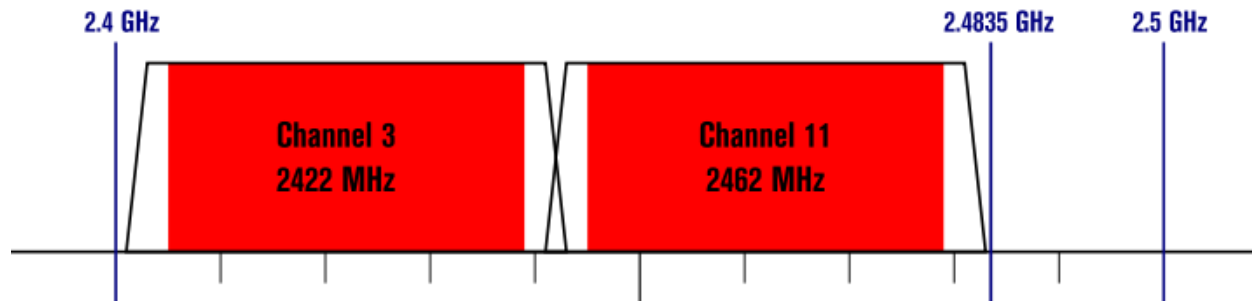
802.11b (DSSS) channel width 22 MHz



802.11g/n (OFDM) 20 MHz ch. width – 16.25 MHz used by sub-carriers



802.11n (OFDM) 40 MHz ch. width – 33.75 MHz used by sub-carriers



802.11n MCS

MCS index	Spatial streams	Modulation type	Coding rate	Data rate (Mbit/s)			
				20 MHz channel		40 MHz channel	
				800 ns GI	400 ns GI	800 ns GI	400 ns GI
0	1	BPSK	1/2	6.50	7.20	13.50	15.00
1	1	QPSK	1/2	13.00	14.40	27.00	30.00
2	1	QPSK	3/4	19.50	21.70	40.50	45.00
3	1	16-QAM	1/2	26.00	28.90	54.00	60.00
4	1	16-QAM	3/4	39.00	43.30	81.00	90.00
5	1	64-QAM	2/3	52.00	57.80	108.00	120.00
6	1	64-QAM	3/4	58.50	65.00	121.50	135.00
7	1	64-QAM	5/6	65.00	72.20	135.00	150.00
8	2	BPSK	1/2	13.00	14.40	27.00	30.00
9	2	QPSK	1/2	26.00	28.90	54.00	60.00
10	2	QPSK	3/4	39.00	43.30	81.00	90.00
11	2	16-QAM	1/2	52.00	57.80	108.00	120.00
12	2	16-QAM	3/4	78.00	86.70	162.00	180.00

MCS Details

- MCS INDEX VALUE
 - reference for “# of spatial streams + modulation + coding rate”.
- SPATIAL STREAMS
 - 4 spatial streams (802.11n)
 - 8 spatial streams (802.11ac)
- MODULATION TYPE
 - The more complex the modulation, the higher the data rate.
- CODING RATE
 - how much of the data stream is actually used to transmit usable data.
- GUARD INTERVAL
 - pause between packet transmission to ignore false information
- CHANNEL WIDTH
 - This is how much of the channel is being used.

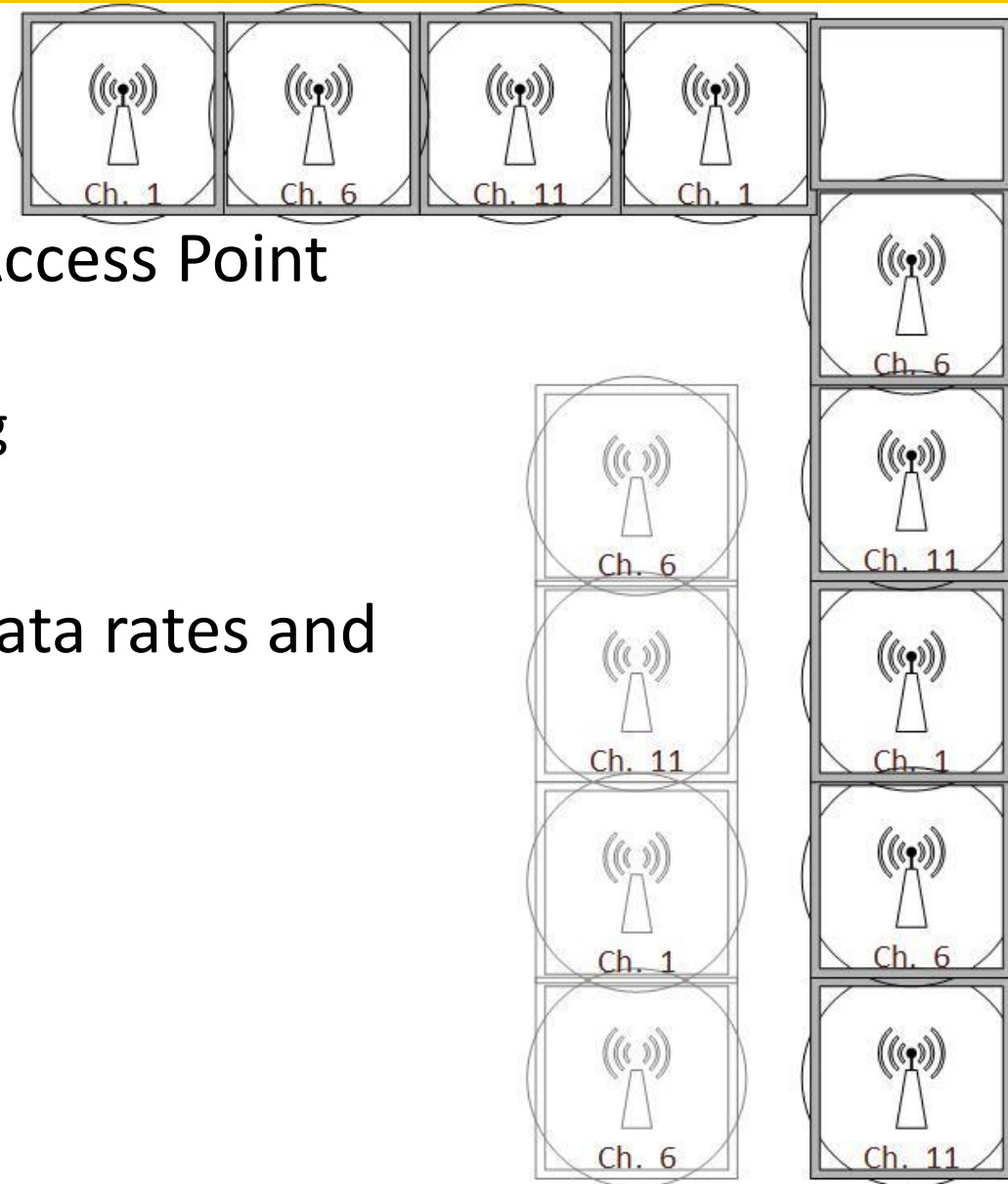
Solution Layout

- Each class shall have one Access Point
- Use only 802.11n (2.4Ghz) and some 802.11g
- Use CAPsMAN to manage the Access Points
- Tweak the TX power, the data rates

Data Rates, Channels, TX Power, AP-Tx Limit

- Use g/n for compatibility
 - 802.11n Data Rates: Select MCS-05 to MCS-14
 - 802.11g Data Rates: 24MHz, 48MHz
 - Channel Width 20MHz
 - Long Guarded Interval
- Channels: Use only Channels 1, 5, 9, and 13 or
 - Channels 1, 6, 11, if necessary
- TX Power: Start with 10dBm (for example).
 - Decrease to 7dBm if necessary
 - Increase to 17 dBm if necessary
- AP-TX Limit: Limit it to 3MB per client using the Access List.
 - Reminder: Limit rate of data transmission to this client. Value 0 means no limit. Value is in bits per second.

Solution Layout



- Each class shall have one Access Point
 - Capacity vs Coverage
 - Best in the middle of ceiling
- Tweak the TX power, the data rates and
 - Coverage overlapping: Yes
 - Frequency overlapping: No

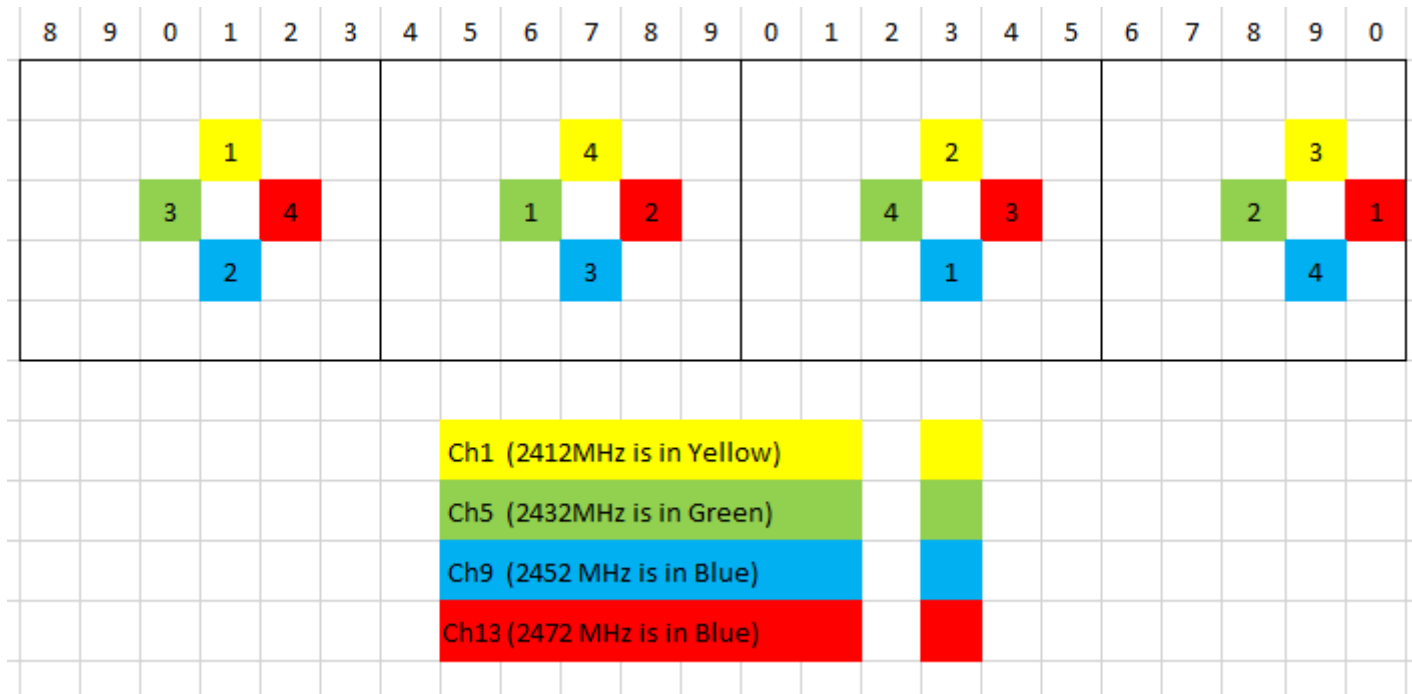
Plot channels for all floors

- Plan the coverage overlapping and frequency non-overlapping; using excel sheet for example.
- If using 3 channels: Risk of some frequency overlapping

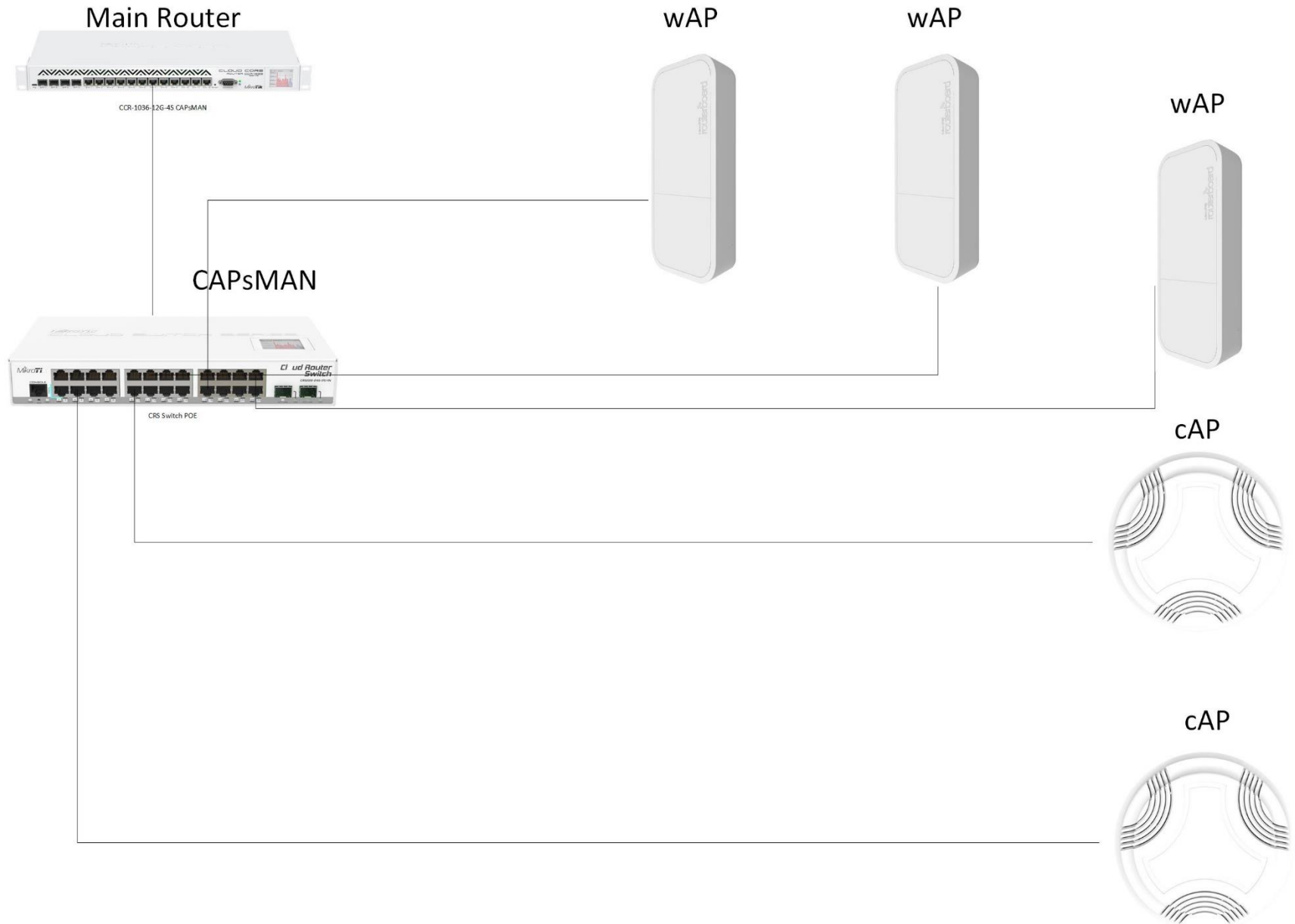
8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0					
			3											3						3			1				
								3														2					
		2	4				2	4					2	4					2	4		3					
			1					1						1						1		4					
																					5						
3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1		1	2	3	
																						1					
														Ch1	(2412MHz is in Yellow)								2				
														Ch6	(2437MHz is in Green)								3		3		
														Ch11	(2462MHz is in Blue)								4	2	4		
																						5			1		

Plot channels for all floors

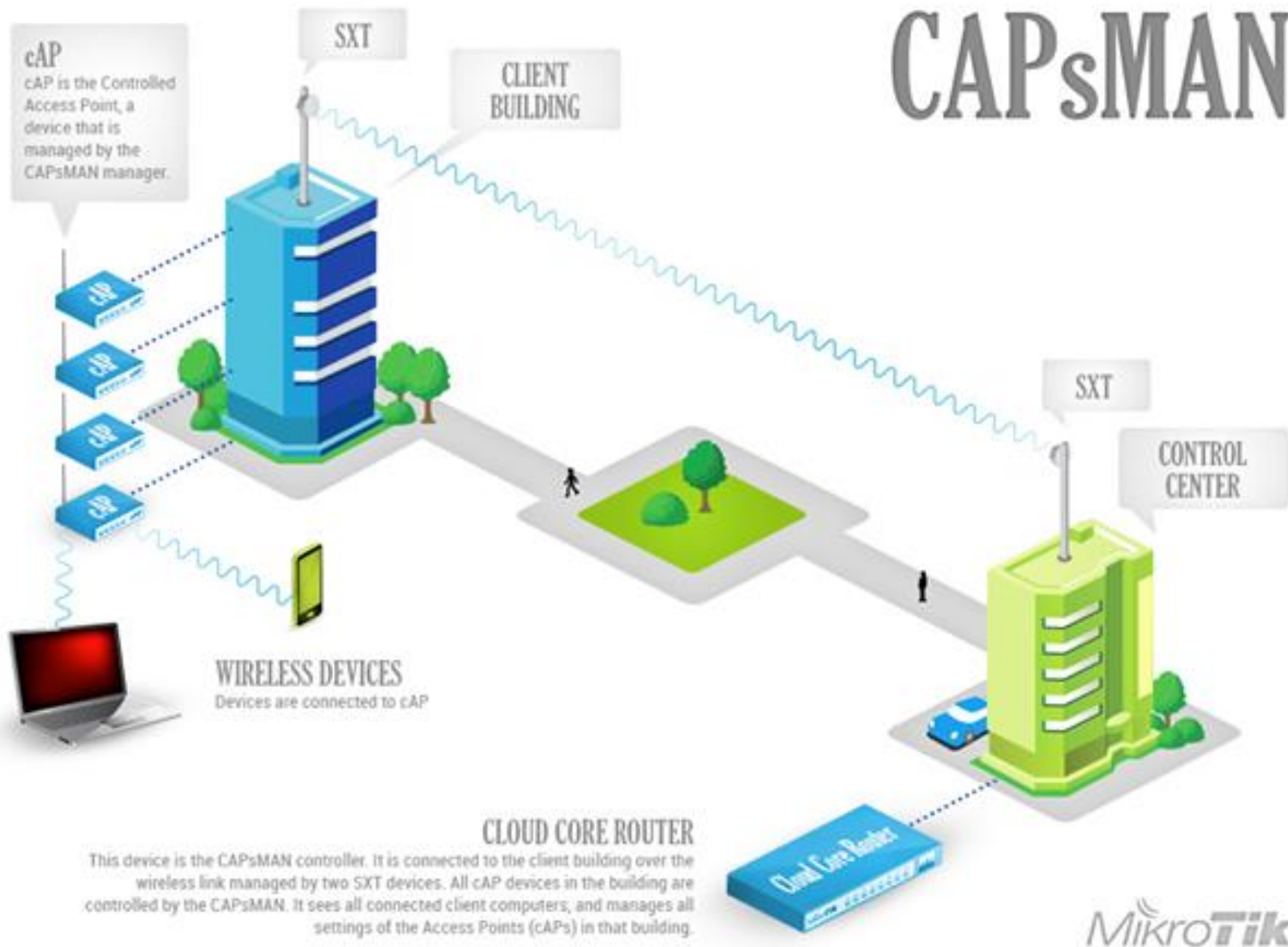
- Plan the coverage overlapping and frequency non-overlapping; using excel sheet for example.
- Using 4 channel scenario: better.



CAPs, RouterBOARDs, POE, CAPsMAN



CAPsMAN



CAPsMAN for centralized management

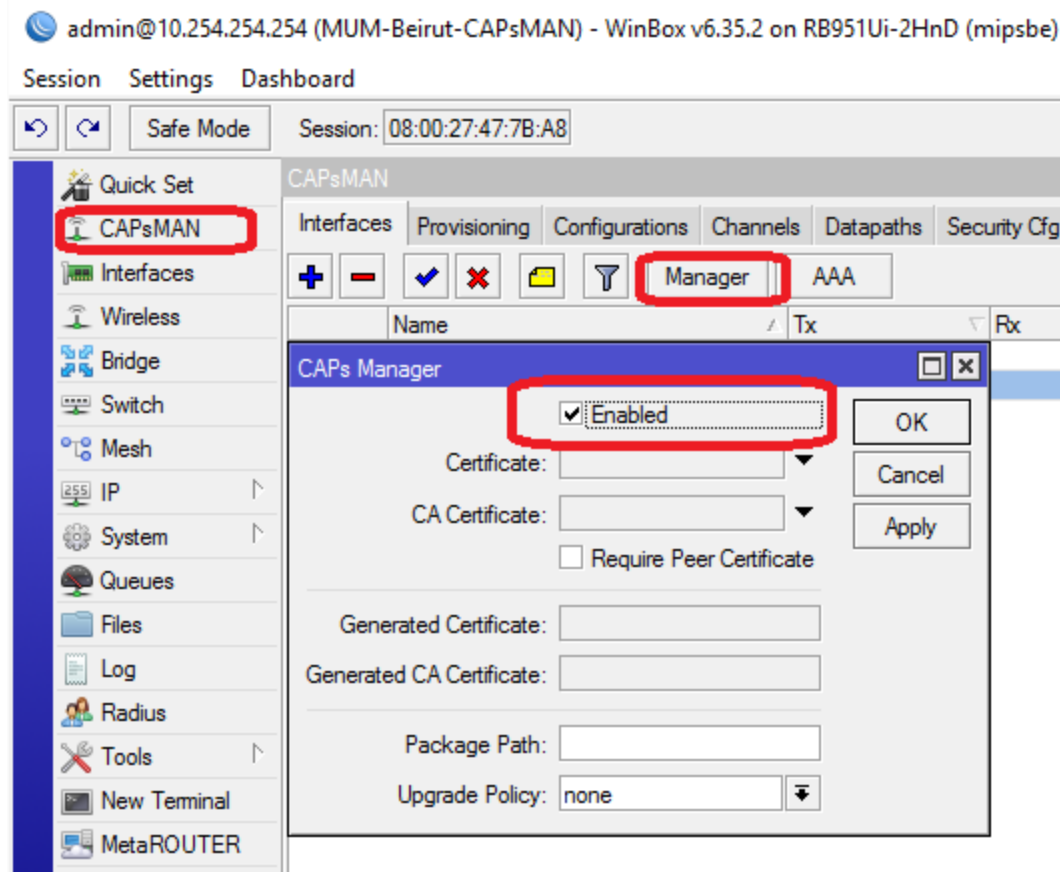
- CAP: Controlled Access Point
- CAPsMAN: Controlled Access Point system MANager
 - Centralized management of RouterOS APs
 - Provisioning of Aps
 - Custom configuration support
- CAPsMAN version 2:
 - Improved version
 - Available with latest RouterOS releases
 - wireless-cm2 package on all CAPs and CAPsMAN RouterBOARDS
- Since release 6.35.2: **wireless-rep package**
 - **CAPsMAN additional settings enabled**
 - **CAPsMAN Rates support**

Steps

- Enable CAPsMAN service
- Create Bridge interface and Add IP configuration
- Create CAPsMAN Configuration (rates, security...)
- Create Provisioning rule
- Enable CAP mode on the Aps
- Add entries to Access List

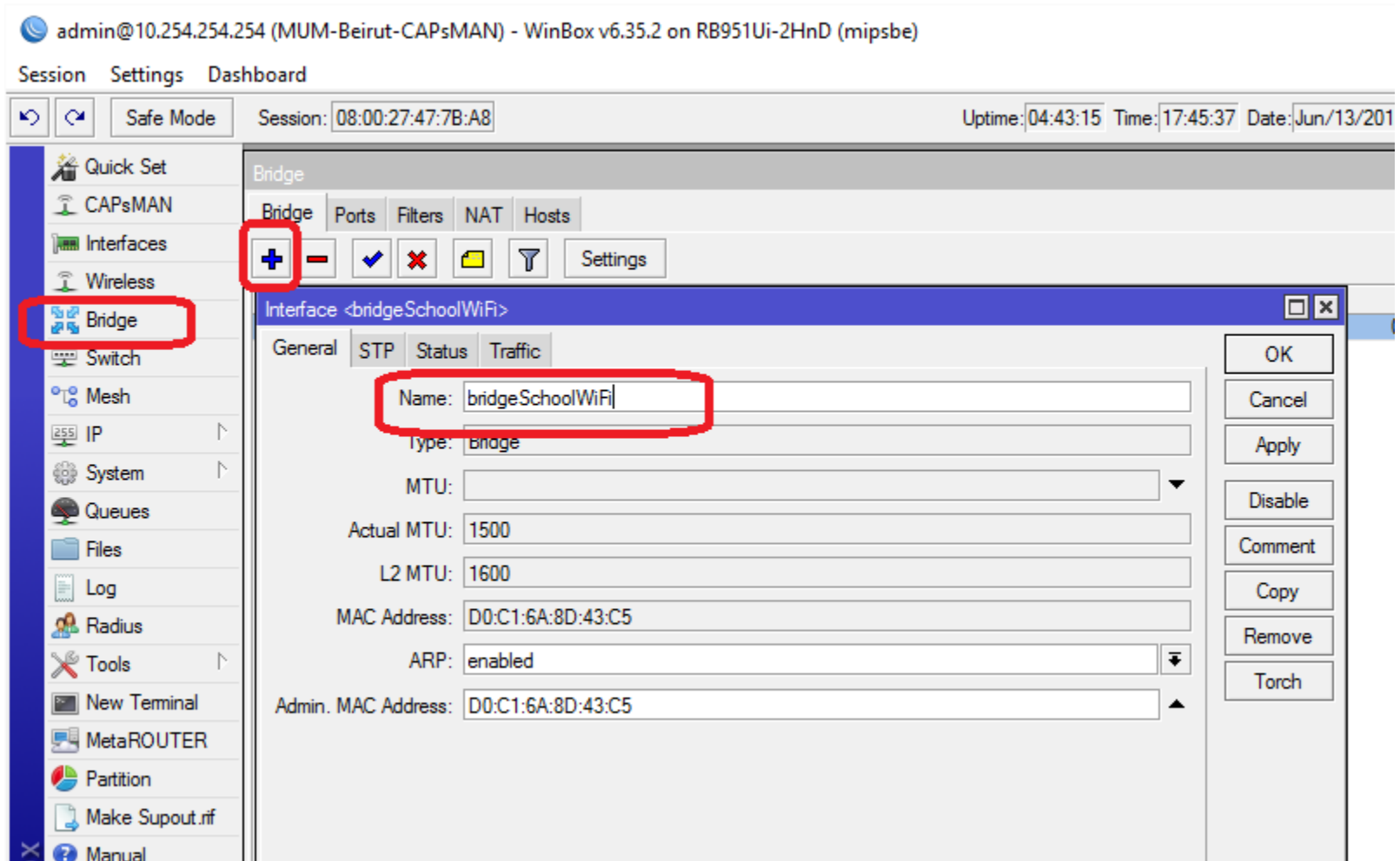
CAPsMAN Configuration: Step 1

- Enable CAPsMAN service
 - /caps-man manager set enabled=yes



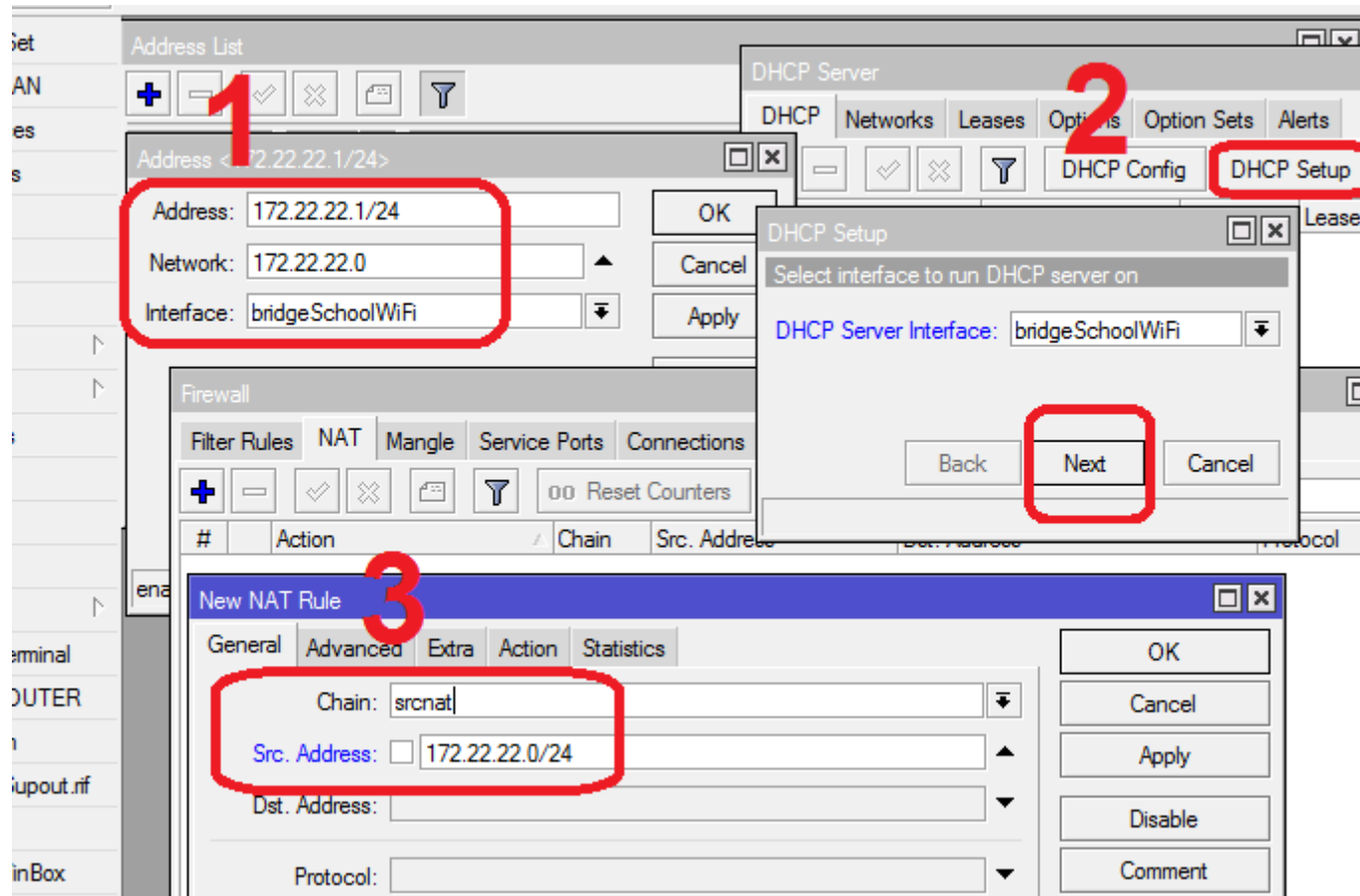
CAPsMAN Configuration: Step 2

- Create Bridge interface
 - /interface bridge add name=bridgeSchoolWiFi



CAPsMAN Configuration: Step 3

- Add IP configuration to Bridge interface
 - IP Address, DHCP Server, NAT Masquerade



CAPsMAN Configuration: Step 4-Rates

- Rates tab available in “wireless-rep” package

The screenshot shows the Mikrotik WinBox interface for CAPsMAN configuration. The left sidebar contains a tree view with 'CAPsMAN' highlighted. The main window displays the 'Rates' tab for the 'ratesCapacity' profile. The 'Basic Rates' section shows '24Mbps' and '36Mbps' selected. The 'Supported Rates' section shows '24Mbps' and '36Mbps' selected. The 'HT Basic MCS' section shows '4' and '5' selected. The 'HT Supported MCS' section shows '4' through '11' selected. The 'VHT Basic MCS' and 'VHT Supported MCS' sections are currently empty.

Session: 08:00:27:47:7B:A8 Uptime: 00:06:46 Time: 18:58:01 Date: Jun/13/2016 Memory:

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal MetaROUTER Partition Make Supout.nf Manual New WinBox Exit

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table

Name	Basic Rates	Supported Rates	HT Basic MCS	HT Supported MCS	VHT Basic MCS
ratesCapacity	24Mbps 36Mbps	24Mbps 36Mbps	4 5	4 5 6 7 8 9 10 11 12 1...	

CAPs Rate <ratesCapacity>

Name: ratesCapacity

Basic Rates

Basic Rates: ☐ 1Mbps ☐ 2Mbps ☐ 5.5Mbps ☐ 11Mbps ☐ 6Mbps ☐ 9Mbps
☐ 12Mbps ☐ 18Mbps ☒ 24Mbps ☒ 36Mbps ☐ 48Mbps ☐ 54Mbps

Supported Rates

Supported Rates: ☐ 1Mbps ☐ 2Mbps ☐ 5.5Mbps ☐ 11Mbps ☐ 6Mbps ☐ 9Mbps
☐ 12Mbps ☐ 18Mbps ☒ 24Mbps ☒ 36Mbps ☐ 48Mbps ☐ 54Mbps

HT Basic MCS

HT Basic MCS: ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☒ 4 ☒ 5
☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11
☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17
☐ 18 ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23

HT Supported MCS

HT Supported MCS: ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☒ 4 ☒ 5
☒ 6 ☒ 7 ☒ 8 ☒ 9 ☒ 10 ☒ 11
☒ 12 ☒ 13 ☒ 14 ☒ 15 ☐ 16 ☐ 17
☐ 18 ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23

VHT Basic MCS

VHT Supported MCS

OK Cancel Apply Comment Copy Remove

CAPsMAN Configuration: Step 4

- Wireless, Channel and Data path settings

The screenshot displays the Mikrotik WinBox interface for configuring CAPsMAN. The left sidebar shows the navigation tree with 'CAPsMAN' selected. The main window has tabs for 'Interfaces', 'Provisioning', 'Configurations', 'Channels', 'Datapaths', 'Security Cfg.', 'Access List', 'Rates', 'Remote CAP', 'Radio', and 'Registration Table'. The 'Configurations' tab is active, showing a table with one entry: 'School2016' with SSID 'SchoolWiFi', Country 'lebanon', and Rate 'ratesCapacity'. Below this, three configuration windows are open for 'School2016':

- Wireless Configuration:** Name: School2016, Mode: ap, SSID: SchoolWiFi, Distance: indoors, Country: lebanon, Max Station Count: 35. HT Tx Chains and HT Rx Chains are both set to 0 and 1.
- Channel Configuration:** Frequency: 2437 MHz, Width: 20 MHz, Band: 2ghz-g/n, Extension Channel: disabled, Tx. Power: 7.
- Rates Configuration:** Rate: ratesCapacity.
- Datapath Configuration:** Bridge: bridgeSchoolWiFi.

Red boxes highlight the specific settings being configured in each window.

CAPsMAN Configuration: Step 5

- Create Provisioning rule

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8 Uptime: 00:40:31 Time: 18:40:10 Date: Jun/13/2016 Memory: 102.5 MiB CPU

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal MetaROUTER Partition Make Supout.rtf Manual

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table

#	Radio MAC	Identity Regexp	Common Nam...	Action	Master Configurati...	Slave Configuration
0	00:00:00:00:00:00			create enabled	School2016	

CAPs Provisioning <00:00:00:00:00:00>

Radio MAC: 00:00:00:00:00:00

Hw. Supported Modes:

Identity Regexp:

Common Name Regexp:

IP Address Ranges:

Action: create enabled

Master Configuration: School2016

Slave Configuration:

Name Format: prefix identity

Name Prefix: cap

OK Cancel Apply Disable Comment Copy Remove

CAPsMAN Configuration: Step 6

- Enable CAP mode on the Aps
 - Effective settings from CAPsMAN shown in red

admin@10.242.242.254 (mumSXTYellow) - WinBox v6.35.2 on SXT Lite2 (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8 Uptime: 00:28:03 Time: 18:28:11 Date: Jun/13/2016 Memory: 45.0 MiB CP

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal MetaROUTER Partition Make Supout.tif Manual New WinBox

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles Channels

+ - ✓ ✗ 📁 🔍 CAP WPS Client Setup Repeater Scanner Freq. Usage Alignment Wireless Sniffer Wireless S

Name	Type	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx	FP Tx P
--- managed by CAPsMAN								
--- channel: 2462/20/gn(10dBm), SSID: SchoolWiFi, CAPsMAN forwarding								
X wlan1	Wireless (Atheros AR93...	0 bps	0 bps	0	0	0 bps	0 bps	0 bps

CAP

☒ Enabled

Interfaces: wlan1

Certificate: none

Discovery Interfaces: ether1

☐ Lock To CAPsMAN

CAPsMAN Addresses:

CAPsMAN Names: MUM-Beirut-CAPsMAN

CAPsMAN Certificate Common Names:

Bridge: none

Requested Certificate:

OK Cancel Apply

CAPsMAN Configuration: Step 7

- Add entries to Access List

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:B:A8 Uptime: 00:21:48 Time: 18:21:27 Date: Jun/13/2016 Memory: 102.8 MiB CP

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal MetaROUTER Partition Make Supout.rif Manual New WinBox Exit

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table

MAC Address in

#	MAC Address	Interface	Signal ...	Action	AP Tx Limit	Client To Client For...	VLAN M
...	Khalil Laptop X220						
1	68:A3:C4:ED:2A:91	all	-75..-30	accept	3M	no	
...	Khalil iPhone						
0							
...	iPad Hu						
3							
...	iPad Fa						
2							
...	Reject a						
4							

CAPs Access Rule <68:A3:C4:ED:2A:91>

MAC Address: 68:A3:C4:ED:2A:91

MAC Mask:

Interface: all

SSID Regexp:

Signal Range: -75..-30

Time

Action: accept

AP Tx Limit: 3M

Client Tx Limit:

Private Passphrase:

Client To Client Forwarding: ☐

OK Cancel Apply Disable Comment Copy Remove

CAPsMAN Interfaces

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Session: 08:00:27:47:7B:A8 Uptime: 00:15:12 Time: 18:14:51 Date: Jun/13/2016 Memory: 102.8 MiB CP

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table

+ - ✓ ✗ [Icon] [Icon] Manager AAA

	Name	Tx	Rx	SSID	HT Tx Chains	HT Rx Chains	Frequency	Band	Tx
R SMB	cap-mumSXTBlue-1	1772.3 kbps	133.1 kbps	SchoolWiFi	0 1	0 1	2437MHz	2ghz-onlyn	
R SMB	cap-mumSXTYellow-1	0 bps	0 bps	SchoolWiFi	0 1	0 1	2462MHz	2ghz-onlyn	

CAPsMAN Registration Table

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Session: 08:00:27:47:7B:A8 Uptime: 00:06:30 Time: 18:06:09 Date: Jun/13/2016 Memory: 103.0 MiB CP

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table

Interface	SSID	Tx Rate	Rx Rate	Tx Rate Set	Rx Signal	Uptime	Tx/Rx
... Khalil iPhone							
cap-mumSXTBlue-1	SchoolWiFi	52Mbps-20MHz/1S	65Mbps-20MHz/1S	OFDM:24-36 BW:1x HT:4-7	-58	00:04:16....	3 486
... iPad Fatima							
cap-mumSXTYellow-1	SchoolWiFi	36Mbps	130Mbps-20MHz/2S	OFDM:24-36 BW:1x HT:4-15	-43	00:05:53....	44/84

CAPsMAN: Coverage overlapping

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8 Uptime: 03:56:02 Time: 16:58:23 Date: Jun/13/2016 Memory:

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal MetaROUTER Partition Make Supout.tif

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table

Interface / SSID MAC Address Tx Rate Rx Rate Tx Signal Rx Signal Uptime Tx/Rx Packets

cap-mumSXTBlue-1 SchoolWiFi 34:C0:59:D5:4F:59 65Mbps-... 65Mbps-... 0 -58 00:01:25.... 649/859

Log

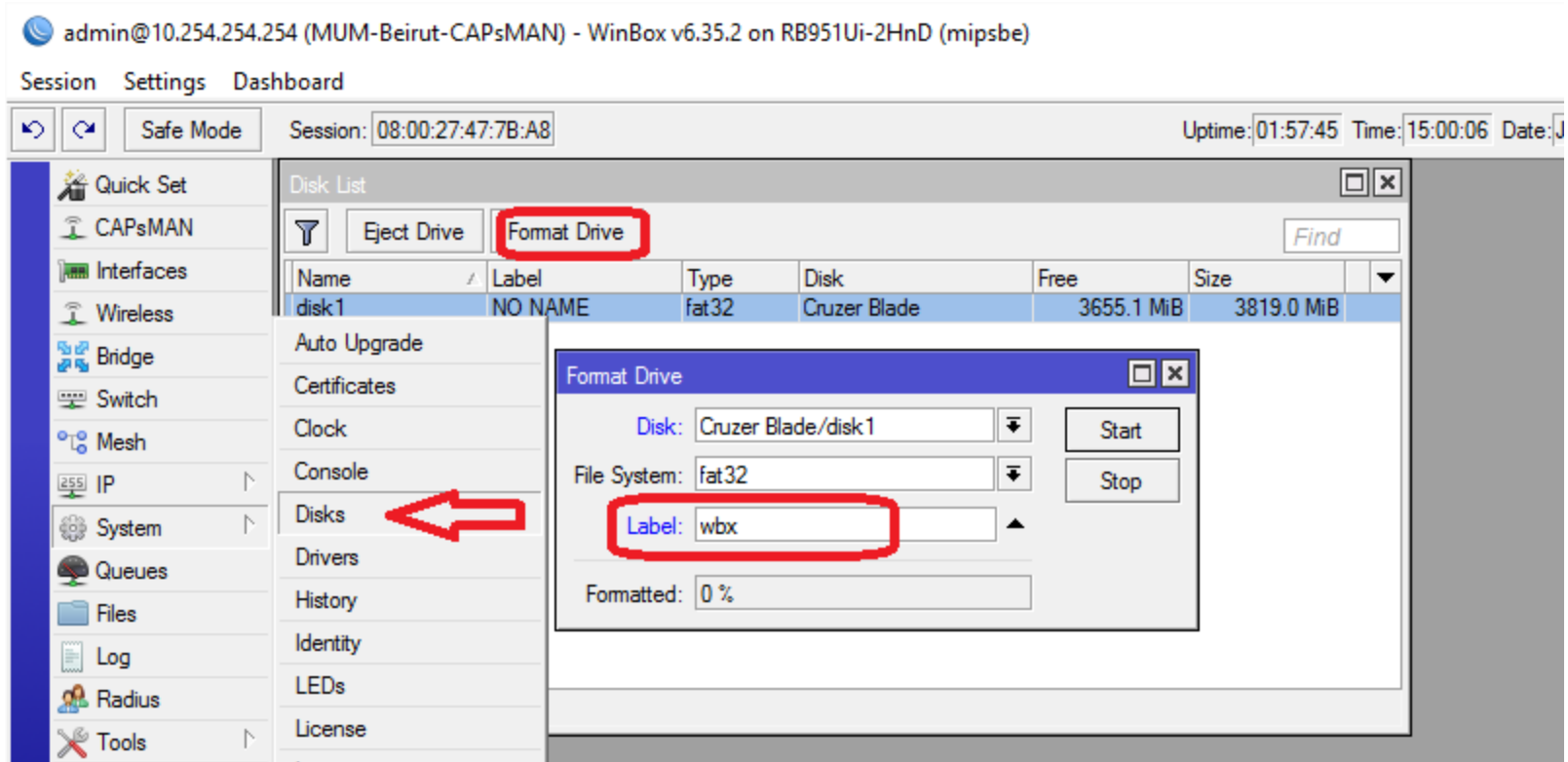
Freeze

Jun/13/2016 16:55:37	memory	caps, info	34:C0:59:D5:4F:59@cap-mumSXTBlue-1 connected
Jun/13/2016 16:56:23	memory	caps, info	34:C0:59:D5:4F:59@cap-mumSXTYellow-1 connected
Jun/13/2016 16:56:23	memory	caps, info	34:C0:59:D5:4F:59@cap-mumSXTBlue-1 disconnected, registered to other interface
Jun/13/2016 16:56:55	memory	caps, info	34:C0:59:D5:4F:59@cap-mumSXTBlue-1 connected
Jun/13/2016 16:56:55	memory	caps, info	34:C0:59:D5:4F:59@cap-mumSXTYellow-1 disconnected, registered to other interface

Web Proxy Simple Config

Web Proxy, Prepare Disk

- Prepare Hard Disk, USB



Web Proxy, Enable

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8 Uptime: 02:03:05 Time: 15:05:26 Date: J

Web Proxy Settings

General Status Lookups Inserts Refreshes

☒ Enabled

Src. Address: ::

Port: 8080

☐ Anonymous

Parent Proxy:

Parent Proxy Port:

Cache Administrator: webmaster

Max. Cache Size: unlimited KiB

Max Cache Object Size: 2048 KiB

☒ Cache On Disk

Max. Client Connections: 600

Max. Server Connections: 600

Max Fresh Time: 3d 00:00:00

☐ Serialize Connections

☐ Always From Cache

Cache Hit DSCP (TOS): 4

Cache Path: disk1

OK Cancel Apply Clear Cache Reset HTML Access Cache Direct Connections Cache Contents

Web Proxy, Transparent Redirect

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Session: 08:00:27:47:7B:A8 Uptime: 02:10:15 Time: 15:12:36 Date: Ju

Quick Set CAPsMAN Interfaces Wireless Bridge Switch Mesh IP System Queues Files Log Radius Tools New Terminal MetaROUTER Partition Make Supout.rif Manual New WinBox

NAT Rule <80>

General Advanced Extra Action Statistics

Chain: dstnat

Src. Address: Dst. Address:

Protocol: ☐ 6 (tcp)

Src. Port: Dst. Port: ☐ 80

Any. Port: In. Interface: Out. Interface:

Packet Mark: Connection Mark: Routing Mark: Routing Table: Connection Type:

NAT Rule <80>

General Advanced Extra Action Statistics

Action: redirect

☐ Log

Log Prefix:

To Ports: 8080

OK

Reset

Web Proxy, Check Connections

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8 Uptime: 02:21:57 Time: 15:24:18 Date: Jun/13/201

Web Proxy Settings

Web Proxy Connections

	Src. Address	Dst. Address	Last Prot...	State	Tx Bytes	Rx Bytes	
S	23.23.150.67	0.0.0.0	HTTP/1.1	idle	593 B	397 B	
S	52.1.89.113	172.22.22.254	HTTP/1.1	idle	493 B	634 B	
S	52.18.40.183	0.0.0.0	HTTP/1.1	idle	451 B	384 B	
S	52.19.228.209	0.0.0.0	HTTP/1.1	idle	456 B	305 B	
S	54.165.129.193	0.0.0.0	HTTP/1.1	idle	875 B	1307 B	
S	54.243.255.139	0.0.0.0	HTTP/1.1	idle	543 B	498 B	
S	64.233.166.95	0.0.0.0	HTTP/1.1	idle	980 B	1629 B	
S	66.117.29.37	172.22.22.254	HTTP/1.1	idle	1722 B	1765 B	
S	79.140.94.195	0.0.0.0	HTTP/1.1	idle	971 B	34.5 KB	
S	79.140.94.202	0.0.0.0	HTTP/1.1	idle	924 B	38.7 KB	
S	79.140.95.160	172.22.22.254	HTTP/1.1	idle	521 B	4376 B	
S	88.221.117.64	0.0.0.0	HTTP/1.1	idle	870 B	871 B	
S	88.221.117.81	0.0.0.0	HTTP/1.1	idle	871 B	248 B	
S	104.86.246.74	172.22.22.254	HTTP/1.1	idle	15.7 KB	82.2 KB	
S	104.86.246.74	172.22.22.254	HTTP/1.1	idle	14.1 KB	67.1 KB	
S	104.86.246.74	172.22.22.254	HTTP/1.1	idle	15.8 KB	55.8 KB	
S	104.86.246.74	172.22.22.254	HTTP/1.1	idle	7.0 KB	680.8 KB	
S	104.86.246.74	172.22.22.254	HTTP/1.1	idle	12.2 KB	103.5 KB	
S	104.86.246.74	172.22.22.254	HTTP/1.1	idle	7.1 KB	14.8 KB	
S	104.107.153.18	0.0.0.0	HTTP/1.1	idle	1067 B	23.5 KB	
S	104.107.153.18	0.0.0.0	HTTP/1.1	idle	724 B	1009 B	
S	104.107.153.18	0.0.0.0	HTTP/1.1	idle	511 B	19.2 KB	
C	172.22.22.254	0.0.0.0	unknown	idle	118.5 KB	19.4 KB	
C	172.22.22.254	0.0.0.0	unknown	idle	46.3 KB	4315 B	

OK Cancel Apply Clear Cache Reset HTML Access Cache Direct **Connections** Cache Contents

Web Proxy, Check Caching

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8

Uptime: 02:23:06 Time: 15:25:27 Date: Jun/13/201

Quick Set

CAPsMAN

Interfaces

Wireless

Bridge

Switch

Mesh

IP

System

Queues

Files

Log

Radius

Tools

New Terminal

MetaROUTER

Partition

Make Supout.rif

Manual

New WinBox

Exit

Web Proxy Settings

Web Proxy Cache Contents

Find

URI	File Size
http://aka.spotifycdn.com/media/thumbs/pixel/pixel.gif	0 KiB
http://apps.identrust.com/roots/dstrootcax3.p7c	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/s-code-contents-716...	19 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/s-code-contents-8ab...	14 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/s-code-contents-bd7...	15 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/satelliteLib-0e2519e7...	34 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/satelliteLib-332ee2d3...	22 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/satelliteLib-bd89012f...	19 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-53e5...	0 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-54c6...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-5513...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-551a...	0 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-55d7...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-55e0...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-5655...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-56d8...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-56d8...	1 KiB
http://assets.adobedtm.com/5d599bba477bad3ce4973aeb5c0a8c11709abbb4/scripts/satellite-570fd...	1 KiB
http://c.amazon-adsystem.com/aax2/amzn_ads.js	4 KiB
http://c.betrad.com/geo/c.js	0 KiB
http://code.jquery.com/jquery-latest.min.js	94 KiB
http://code.jquery.com/ui/1.11.4/jquery-ui.js	460 KiB
http://configusa.veinteractive.com/scripts/3.0/capture-apps-3.0.3.js	54 KiB
http://configusa.veinteractive.com/tags/9587A8E9/26B1/4DD7/A92C/4502E057FE31/tag.js	4 KiB
http://connectiongt.com/	0 KiB
http://connectiongt.com/e/179-cart_default/all-inclusive-course-mikrotik-senior-engineer-may-2016.jpg	2 KiB
http://connectiongt.com/e/179-cart_default/all-inclusive-course-mikrotik-senior-engineer-may-2016.jpg	2 KiB

OK

Cancel

Apply

Clear Cache

Reset HTML

Access

Cache

Direct

Connections

Cache Contents

Web Proxy, Check Status

admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)
admin@10.254.254.254 (MUM-Beirut-CAPsMAN) - WinBox v6.35.2 on RB951Ui-2HnD (mipsbe)

Session Settings Dashboard

Safe Mode Session: 08:00:27:47:7B:A8 Uptime: 02:24:20 Time: 15:26:42 Date: Ju

Web Proxy Settings

General **Status** Lookups Inserts Refreshes

Uptime:	00:19:10
Client Connections:	0
Server Connections:	25
Requests:	759
Hits:	110
Cache Used:	6 847 KiB
Total RAM Used:	1 138 KiB
Received From Servers:	9 023 KiB
Sent To Clients:	9 504 KiB
Hits Sent To Clients:	172 KiB

OK
Cancel
Apply
Clear Cache
Reset HTML
Access
Cache
Direct
Connections
Cache Contents

Summary: Solution Layout

- Each class shall have one Access Point
- Use only 802.11n (2.4Ghz) and some 802.11g
- Use CAPsMAN to manage the Access Points
- Tweak the TX power, the data rates
 - Increase Capacity, Decrease Coverage
- Uses CAPsMAN Access List to set conditions for connected devices
- Use Web Proxy near the gateway to cache selected websites.

Thank you

Questions?