



# MikroTik Industrial environment network

HELLO!  
I'm Aldo Frashëri



- 2012 – Informatic Engineering Diploma
- 2004 – Founded my own ISP
- 2019 – MTCNA, MTCRE, MTCWE
- Experience in small to mid size wired and wireless networks, FTTH installations (GPON, EPON etc.

15 ottobre 2004

**Locomotore senza guida per 100 Km. Due inchieste.**

Sembrava la scena di un film, ma era tutto reale. Un locomotore senza guida, ad una velocità media di 70 chilometri orari ma con punte di circa 100 km/h in alcuni punti in leggera pendenza) ha percorso oltre cento chilometri prima di finire la sua corsa in un binario morto nella piccola stazione di Rutino, in provincia di Salerno...

Tutto ha inizio dopo le 7 di stamattina, quando Franco Siciliano, 48 anni, di Paola (Cosenza), macchinista dipendente di una ditta campana che si occupa della manutenzione di convogli ferroviari, la "ventura", in servizio alla stazione di Longobardi (Cs), probabilmente in seguito ad un malore cade dalla motrice, forse azione la leva di partenza, tenta di risalire a bordo del mezzo ma non ci riesce. Il locomotore comincia lentamente la sua corsa, mentre Siciliano viene soccorso e trasportato in ospedale a Paola, dove viene ricoverato, con una prognosi di 15 giorni, per trauma cranico, contusioni ed escorizzazioni in diverse parti del corpo.

Scattato l'allarme, la società Rfi ha azionato il sistema di emergenza, bloccando o deviando i treni percorrenza di Marina di Maratea, in Basilicata, viene effettuato un primo tentativo di fermare la corsa del mezzo, ma fallisce. Tutto, quindi, si sposta a Rutino, dove, dove si prevede di sfruttare il binario morto in salita, per rallentare il locomotore, Cosi' avviene, con il deragliamento del mezzo e di quello che per alcune ore e' stato un vero e proprio incubo.

Il C...nteva diventare una strage, ma sul fatto sono state gia' aperte due inchieste. La p... della societa' Rfi e l'altra della procura della Repubblica di Paola.

Fonte: ...line)



# Projects VPN



OmniTIK5  
3G TIM Usb Key  
SIEMENS PLC





4



- ▶ 2015 - Container Terminal Installation

“

*Industrial environments have specific requirements for the equipment to be used and its reliability.*

”

6

1.

# Customer needs

What was requested

## Specific needs

The client is a company that has:

- ▶ Field container storage and movement
- ▶ A covered warehouse
- ▶ Chrome field storage







## Specific needs

- ▶ Surveillance System for all areas
- ▶ Wireless Coverage for Employees
- ▶ Phone Communication between different points (work undergoing)
- ▶ Fire Alarm system for the covered warehouse

108,000 m<sup>2</sup>

Area to be covered

## Specific needs

- ▶ Containers, 35000 m<sup>2</sup>
- ▶ A covered warehouse, 3000 m<sup>2</sup>
- ▶ Chrome storage fields, 47000 and 23000 m<sup>2</sup>

“

*All of this without WIRES!!*

”



# 2. Equipment

Wireless APs, Switches, Routers, etc

## Equipment

### Wireless

MikroTik equipment:

- ▶ SXTsq Lite5
- ▶ mANTBox 15s
- ▶ mANTBox 15s for handheld terminals
- ▶ 60GHZ Link
- ▶ CRS112-8P-4S-IN
- ▶ CRS328-24P-4S+RM
- ▶ RB4011iGS+RM

### Cables and Power

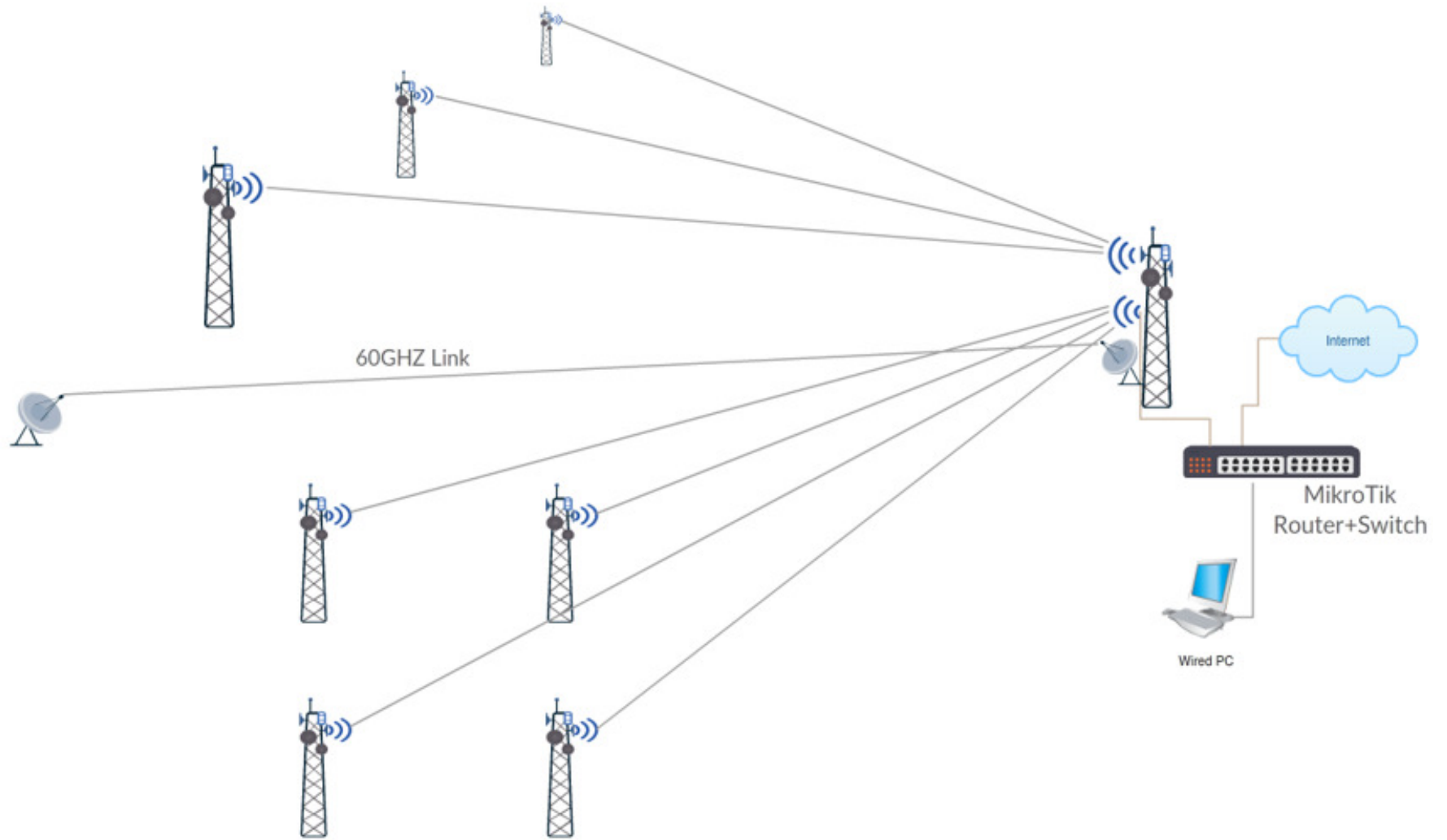
- ▶ Industrial Outdoor CAT5e
- ▶ Industrial UPS

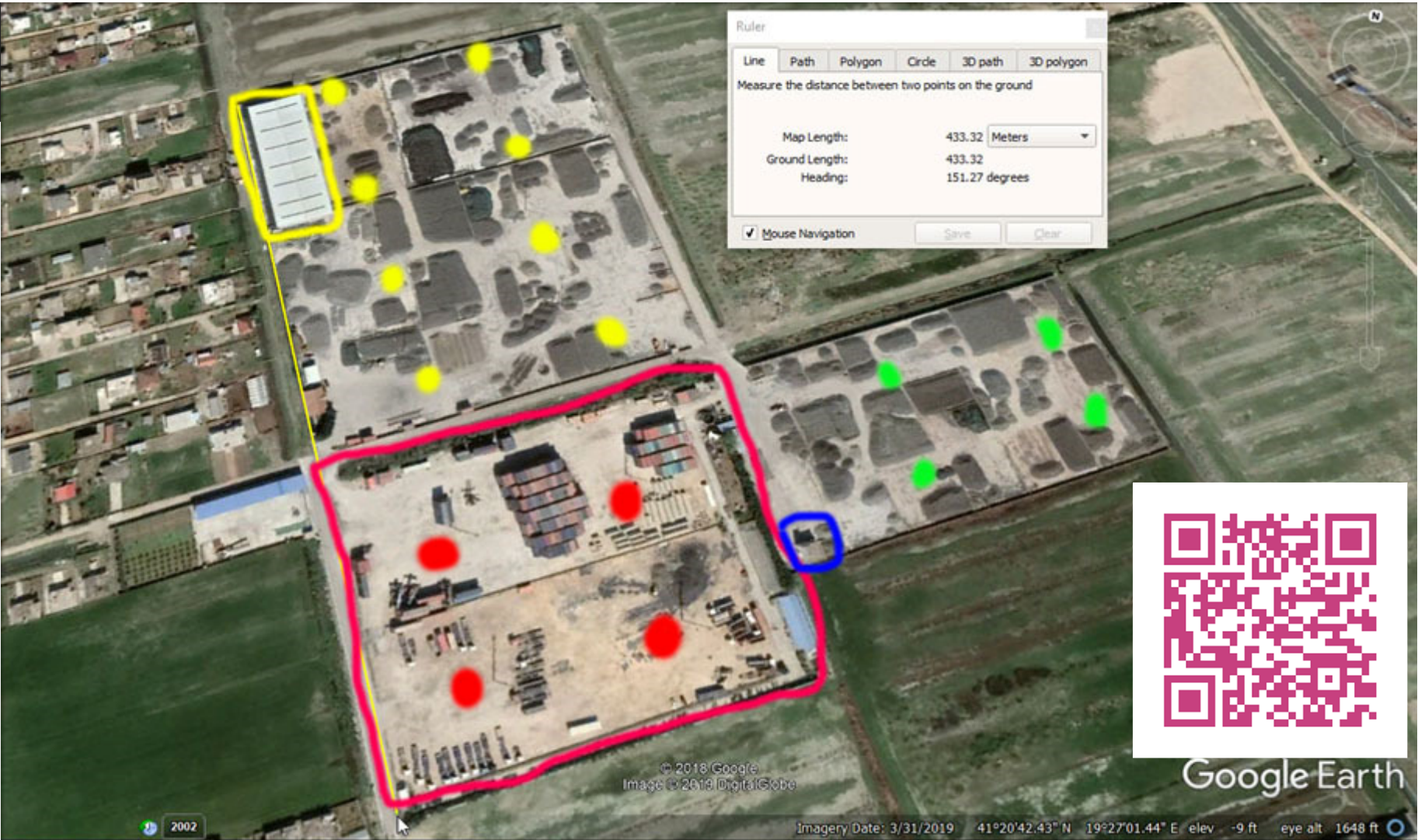
### Surveillance

- ▶ HikVision 5MP IP Cameras
- ▶ Network NVR

### Fire Alarm

- ▶ Siemens Fire Alarm





Ruler

Line Path Polygon Circle 3D path 3D polygon

Measure the distance between two points on the ground

Map Length: 433.32 Meters

Ground Length: 433.32

Heading: 151.27 degrees

Mouse Navigation Save Clear



Google Earth





## Equipment, Main Rack

### Main Rack

- ▶ CRS328-24P-4S+RM
- ▶ RB4011iGS+RM
- ▶ UPS



24PoE Gigabit, 4SFP+



ARM 32bit, 1.4GHZ 4 Core, 1GB Ram, 512MB NAND,  
10 Gigabit Ethernet, 1 SFP+

## Equipment, Main Rack



## Equipment, Main Tower

### Main Tower

- ▶ Wireless Wire Dish 60GHZ
- ▶ mANTBox 15s = Total 3



5GHz 120 degree 15dBi dual polarization sector  
Integrated antenna with 720Mhz CPU, 128MB RAM, SFP



2 Gb/s aggregate link up to 1500m+

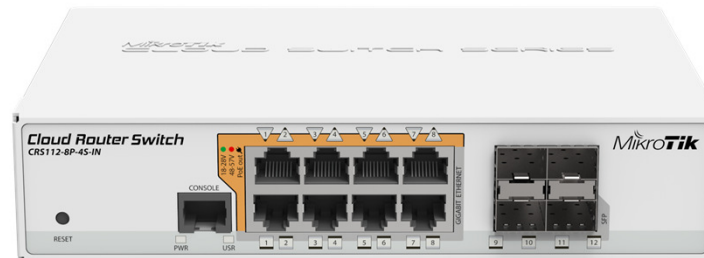


## Equipment, towers

### Towers, in total 17

- ▶ SXTsq Lite5, **17pcs**
- ▶ mANTBox 15s, **17pcs**
- ▶ CRS112-8P-4S-IN, **17pcs**
- ▶ 2-4 IP Cameras for each tower

Low-cost small-size 16dBi 5GHz dual chain integrated CPE/Backbone



8PoE Gigabit, 4SFP

## Equipment, Warehouse

### Warehouse

- ▶ Wireless Wire Dish 60GHZ, 1pc
- ▶ mANTBox 15s 4pcs
- ▶ CRS328-24P-4S+RM, 1pc
- ▶ 8 IP Cameras



# 3. Configuration

Putting all together

## Configuration

- ▶ The network was configured in Bridge mode so all the cameras could connect to the NVR in the main offices
- ▶ Sector Antennas for Staff connectivity were added to a CAPsMAN configured in the RB4011

## Configuration, Very important first steps



- ▶ Upgrade all devices to latest RouterOS version
- ▶ Input Identity to them
- ▶ Create another user with admin rights and delete the default admin user
- ▶ Disable all un-needed services in IP -> Services



## Configuration, APs in main Offices

- ▶ A bridge will be created that will have as ports wlan1 and ether1
- ▶ AP configuration in wireless with SSID and security profile

```
/interface bridge add name=bridgeMAIN
/interface ip address add address=192.168.1.101/24 interface=bridgeMAIN
/interface bridge port add interface=ether1 bridge=bridgeMAIN
/interface bridge port add interface=wlan1 bridge=bridgeMAIN
/interface wireless set ssid=AP_Zone01 wlan1 mode=ap-bridge
/interface wireless enable wlan1
/interface wireless security-profiles set default authentication-types=wpa2-psk
wpa2-pre-shared-key=xxxxxxxx mode=dynamic-keys
```

## Configuration, PtMP clients in the towers

- ▶ The only differences are in red color

```
/interface bridge add name=bridgeMAIN
/interface ip address add address=192.168.1.xx/24 interface=bridgeMAIN
/interface bridge port add interface=ether1 bridge=bridgeMAIN
/interface bridge port add interface=wlan1 bridge=bridgeMAIN
/interface wireless set ssid=AP_Zone01 wlan1 mode=station-bridge
/interface wireless set wlan1 radio-name=xxxxxxx
/interface wireless enable wlan1
/interface wireless security-profiles set default authentication-types=wpa2-psk
wpa2-pre-shared-key=xxxxxxxxx mode=dynamic-keys
```

# Configuration, PtMP clients in the towers

admin@B8:69:F4:D8:AC:33 (CLTower01) - WinBox v6.42.7 on SXTsq 5 (mipsbe)

Session Settings Dashboard

Safe Mode Session: B8:69:F4:D8:AC:33

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme NV2 ...

Mode: station bridge

Band: 5GHz-A/N

Channel Width: 20/40MHz Ce

Frequency: 5180 MHz

SSID: AP\_Zone01

Scan List: default

Wireless Protocol: any

Security Profile: default

Default Authenticate

OK  
Cancel  
Apply  
Disable  
Comment  
Advanced Mode  
Torch  
WPS Accept  
WPS Client  
Setup Repeater  
Scan...

## Configuration, APs in main Offices

- ▶ Clients connected to the first AP

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles Channels

Reset

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activit...	Tx/Rx Signal ...	Tx Rate	Rx Rate
↕ CLTower01	B8:69:F4: [REDACTED]	wlan1	00:00:05	no	no	0.980	-50/-29	6Mbps	6Mbps
↕ CLTower02	B8:69:F4: [REDACTED]	wlan1	00:00:05	no	no	0.990	-50/-27	6Mbps	6Mbps
↕ CLTower03	B8:69:F4: [REDACTED]	wlan1	00:00:05	no	no	0.980	-51/-35	6Mbps	6Mbps
↕ CLTower04	B8:69:F4: [REDACTED]	wlan1	00:00:05	no	no	0.980	-54/-26	6Mbps	6Mbps

## Configuration, APs in main Offices

- ▶ Clients connected to the second AP, etc

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles Channels

00 Reset

Radio Name	MAC Address	Interface	AP	W...	Last Activit...	Tx/Rx Signal ...	Tx Rate	Rx Rate
CLTower04	B8:69:F4	wlan1	no	no	0.450	-50/-27	300Mbps-...	6Mbps
CLTower05	B8:69:F4	wlan1	no	no	0.450	-47/-23	108Mbps-...	60Mbps-4...
CLTower06	B8:69:F4	wlan1	no	no	0.450	-51/-27	54Mbps	27Mbps-4...
CLTower07	B8:69:F4	wlan1	no	no	0.450	-45/-21	48Mbps	6Mbps
CLTower08	B8:69:F4	wlan1	no	no	0.450	-49/-25	48Mbps	6Mbps
CLTower09	B8:69:F4	wlan1	no	no	0.450	-43/-22	48Mbps	6Mbps
CLTower10	B8:69:F4	wlan1	no	no	0.440	-39/-19	48Mbps	6Mbps
CLTower11	B8:69:F4	wlan1	no	no	0.430	-40/-16	36Mbps	30Mbps-4...
CLTower12	B8:69:F4	wlan1	no	no	0.430	-34/-9	24Mbps	6Mbps
CLTower13	B8:69:F4	wlan1	no	no	0.430	-34/-8	12Mbps	6Mbps



## Configuration, APs in the towers

- ▶ The access points in the towers are connected via the switches with the SXT connecting to the main offices AP so we need to just enable CAP configuration on them

```
/interface wireless cap set discovery-interfaces=ether1  
/interface wireless cap set interfaces=wlan1  
/interface wireless cap set enabled=yes
```

## Configuration, RB4011 main router

On the main core router we create:

- ▶ One bridge for ethernet connected network
- ▶ One bridge called bridgeWirelessClients for CAPsMAN wireless clients
- ▶ Add IP for both bridges
- ▶ (optional) Add dhcp-server for both bridges
- ▶ Configure CAPsMAN in it (***next slide***)

## Configuration, RB4011 main router

- ▶ CAPsMAN config

```
/caps-man datapath
add bridge=bridgeWirelessClients client-to-client-forwarding=no name=datapath1
/caps-man security
add authentication-types=wpa-psk,wpa2-psk encryption=aes-ccm name=security1
passphrase=xxxxxxxx
/caps-man configuration
add datapath=datapath1 mode=ap name=cfg1 security=security1 ssid=ContainerField
/caps-man manager
set enabled=yes
/caps-man provisioning
add action=create-enabled master-configuration=cfg1 name-format=identity
```

## CAPsMAN

CAPsMAN

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

CAPs Scanner Find

Interface	SSID	MAC Address	EAP Identity	Tx Rate	Rx Rate	Tx Signal	Rx Sig...	Uptime	Tx/Rx Packets	Tx/Rx Bytes
		48:2C:A0:B6:FE:7F		36Mbps	6Mbps	0	-60	00:20:38.38	201/191	117.5 KiB/47.9 KiB
		7C:01:91:3F:B1:C8		263.2Mb...	390Mbps...	0	-54	00:04:21.30	17 044/11 525	22.3 MiB/1765.2 ...
		00:EC:0A:45:E1:18		150Mbps...	150Mbps...	0	-53	01:31:47.48	91 080/58 863	120.0 MiB/13.3 MiB
		B4:9C:DF:CA:EA:E1		433.3Mb...	351Mbps...	0	-52	01:45:19.29	575 658/233 447	820.3 MiB/16.0 MiB
		48:4B:AA:98:F0:B7		9Mbps	130Mbps...	0	-59	00:01:07.01	37/62	16.5 KiB/7.4 KiB
		90:E1:7B:62:00:4A		72.2Mbp...	72.2Mbp...	0	-46	00:00:53.32	7 446/3 317	9.7 MiB/393.1 KiB
		00:AE:FA:6D:D1:81		6Mbps	6.5Mbps...	0	-90	00:01:17.02	2/22	384 B/3814 B
		20:A6:0C:2A:58:16		72.2Mbp...	72.2Mbp...	0	-50	00:30:41.93	12 200/99 007	1417.5 KiB/128.5...
		48:2C:A0:93:B1:68		433.3Mb...	6Mbps	0	-45	00:19:29.92	5 010/5 115	2037.7 KiB/955.6...
		BC:A5:8B:EA:89:1A		195Mbps...	12Mbps	0	-66	00:38:08.60	32 214/13 319	42.1 MiB/3253.6 ...
		04:D6:AA:9E:36:22		433.3Mb...	433.3Mb...	0	-32	00:36:59.82	22 332/12 086	29.3 MiB/2147.2 ...
		70:28:8B:E2:6D:75		72.2Mbp...	72.2Mbp...	0	-48	00:43:59.21	11 473/8 087	10.3 MiB/1478.1 ...
		20:47:DA:25:08:65		72.2Mbp...	72.2Mbp...	0	-37	00:43:19.59	29 553/107 431	24.5 MiB/127.3 MiB
		CC:3A:61:8E:49:D3		292.5Mb...	433.3Mb...	0	-48	00:04:41.59	4 041/2 136	4468.0 KiB/394.2...
		40:D3:AE:96:BF:A4		72.2Mbp...	72.2Mbp...	0	-38	00:16:38.98	17 496/12 443	18.6 MiB/2121.3 ...
		58:40:4E:3E:F9:39		39Mbps...	14.4Mbp...	0	-82	00:37:08.28	100 153/26 534	123.5 MiB/3244.5...
		80:58:F8:1B:E0:D4		43.3Mbp...	19.5Mbp...	0	-78	00:49:19.09	65 959/60 751	12.5 MiB/5.6 MiB
		68:E7:C2:BD:1B:7B		6Mbps	6.5Mbps...	0	-81	00:00:24.39	90/148	23.7 KiB/20.9 KiB
		F8:38:80:AF:D7:AC		115.5Mb...	130Mbps...	0	-59	00:10:10.10	22 463/14 105	26.3 MiB/4082.9 ...

46 items

## Configuration, other equipment

- ▶ Wireless Wire Dish 60GHZ comes by default with bridge configuration, so we don't have really anything to do there, except creating username/pass for secure login, upgrade, etc
- ▶ All IP cameras and NVR are vendor specific operations to put them in the same subnet so the NVR can get video signal from the cameras
- ▶ Fire Alarm equipment also gets configured to connect via the network for remote notification alarms

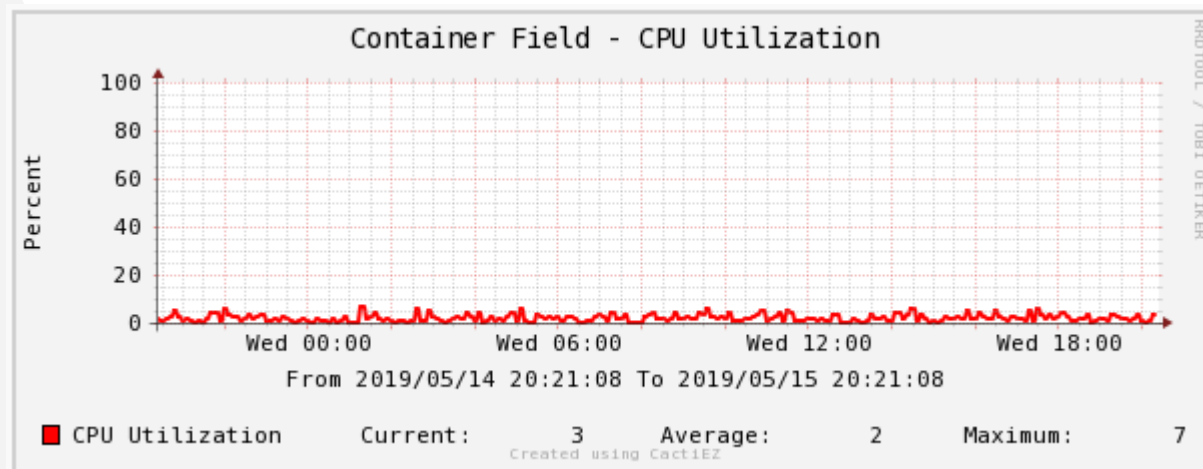


## Equipment

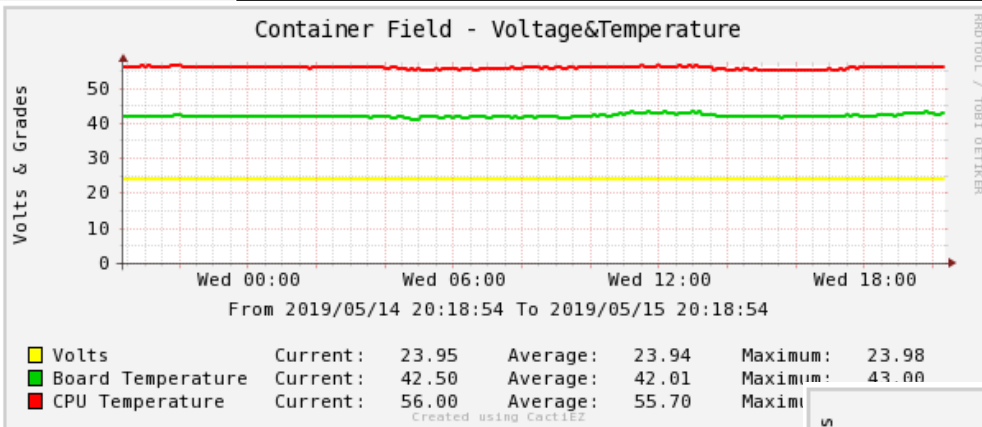
- ▶ Other equipment, that includes: **cables, UPS, boxes** to mount equipment in the towers, and even **bolts** and screws, should be industrial grade and as much resistant to the harsh environments as possible.

## Monitoring

- ▶ Because of the production critical nature of the setup, it is always advised to put up a monitoring server for the equipment

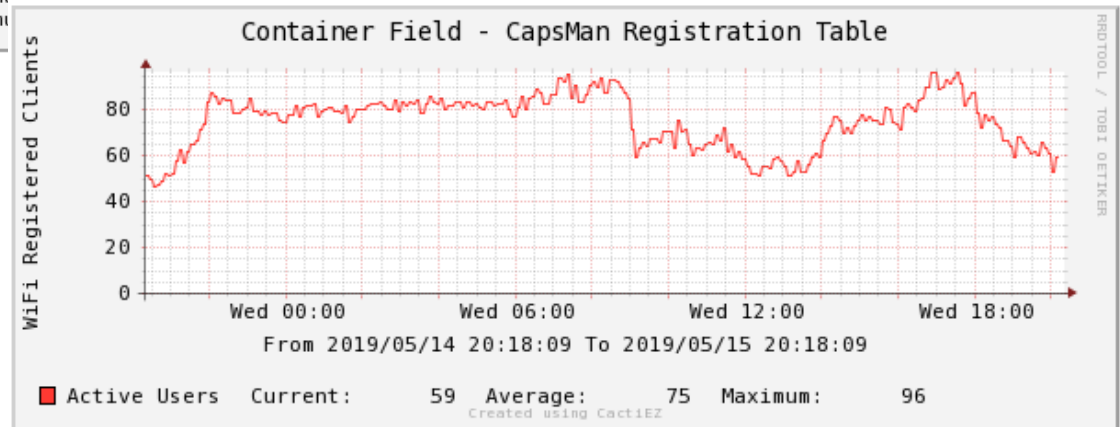


# Monitoring



- ▶ Voltage, Board and CPU Temperature

- ▶ Wireless Registered Clients



# 4. Conclusion

## Conclusion

- ▶ MikroTik equipment has proven itself as the right choice for industrial installations
- ▶ When in production critical and harsh environment, careful selection of equipment must be done
- ▶ Monitoring is a must



That is all.  
Thanks for your attention!

**Any question?**

**[aldo.frasheri@gmail.com](mailto:aldo.frasheri@gmail.com)**

