Using the RB750UP as an Access Point Router

Mikrotik MUM
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Presenter

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  - Engineer (BSEE)
  - Advisory Board – Valley Vision
  - Member CPUC Working Group 2 – "Barriers to Broadband Deployment"
- Winters Broadband
  - Founded 2011 with one T1 (1.5Mbps) link
  - Today
    - Coverage area over 500 sq. miles
    - 43 Access Point sites
    - 100% rural customer base
  - Over 200 Mikrotik routers

Questions

- Who are WISP's?
- Who are using the RB750UP router?
- Who are writing scripts?
- What do you use as backup power for you Access Point sites?

Objectives

- Product
  - Provide an overview of the RB750UP router, its features and specifications
- Applications
  - Show how the RB750UP can be applied in WISP Access Point applications
- Scripting
  - Show how the use of scripting can enhance and add value

Typical Access Point Applications

- Access Point Site
  - Three Sector antennas
  - Two backhaul links
  - Router
  - Power consumption ~ 44W (1.83A @ 24V)

- Micro POP (AP)
  - Omni-directional antenna
  - One backhaul link
  - Router
  - Power consumption ~ 20W (0.83A @ 24V)

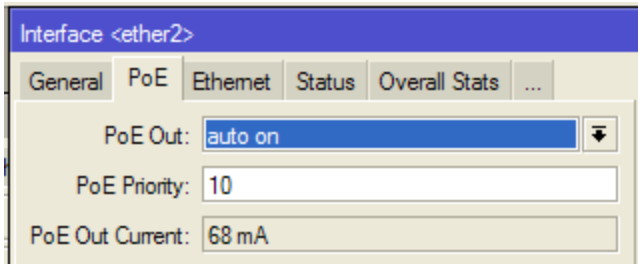
RB750UP Router Specifications & Limitations

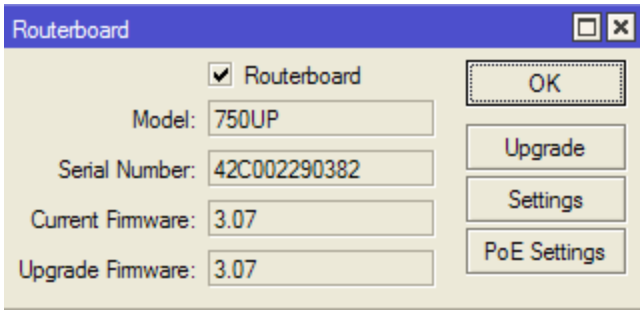
- Specifications
  - V_{IN} = 8 to 30 VDC
  - I_{OUT} = Max 1A on a port[1]
  - I_{OUTMax} = 2.2A[1]
    - PoE out on ports 2 to 5
  - Port Prioritization[1]
  - Port power monitoring[1]
  - Power consumption 2.4 W to 3.6 W

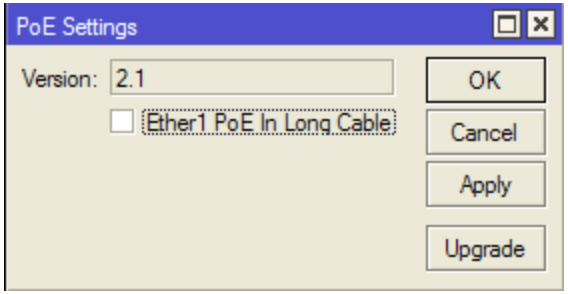
Note: 1. Requires version 2.x PoE-Out controller firmware

RB750 Router
PoE Configuration & Reporting

- Power Control
  - Off, Forced On, Auto On
  - PoE Priority
  - PoE Out Current
- Firmware
  - Upgrade to version 2.x







RB750UP Router CLI Report

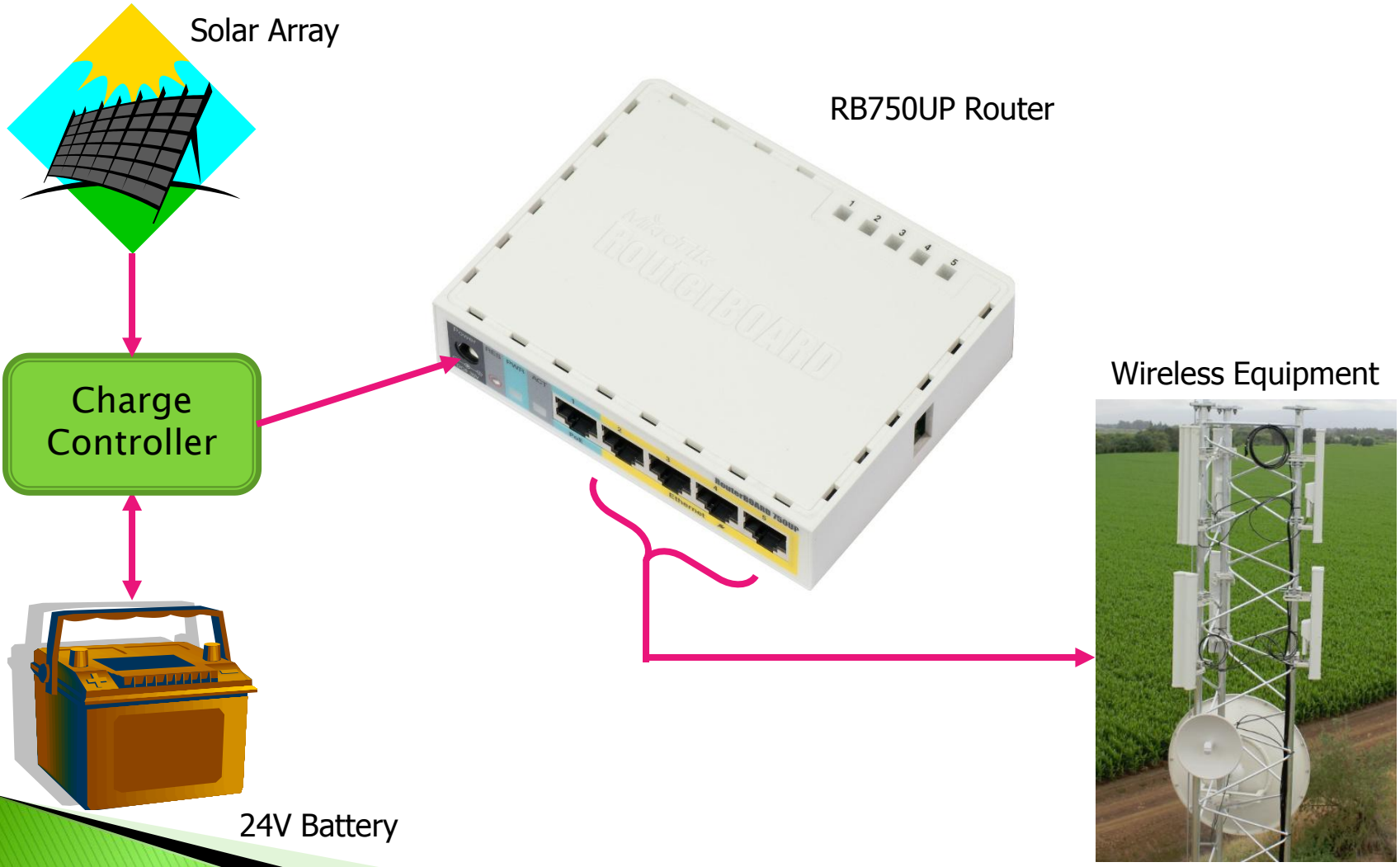
- PoE Parameters

```
[admin@MikroTik] > interface ethernet poe monitor [find]
                    name: ether2 ether3 ether4 ether5
     poe-out-voltage: 23.4V  23.4V  23.4V  23.4V
     poe-out-current: 172mA  164mA  124mA  492mA
       poe-out-power: 4W     3.8W   2.9W   11.5W
```

RB750UP Router Benefits

- Router
  - OSPF for backbone links
  - Increased network availability
- Power Control
  - Control of attached wireless devices
  - Power monitoring
  - Reduced maintenance costs – no truck roll required
- Bandwidth Control
  - Allows global upload speed to set optimizing backbone utilization
- Scripting
  - Allows features to be added
  - Enhanced router capability
  - Reduced operating and maintenance costs

Typical Solar Powered Solution



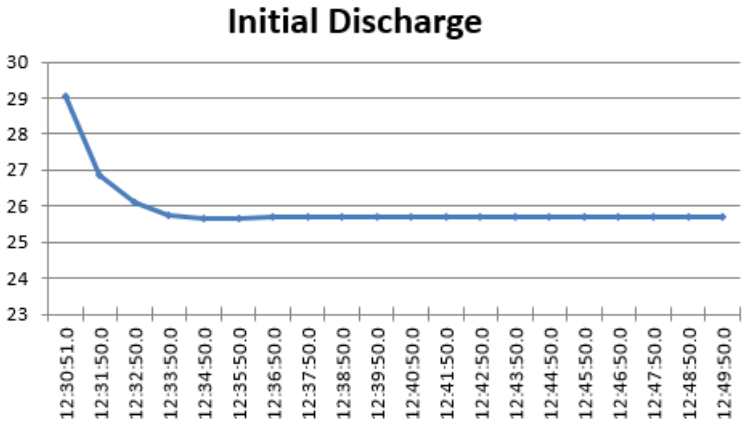
Access Point Power – Solar Solution

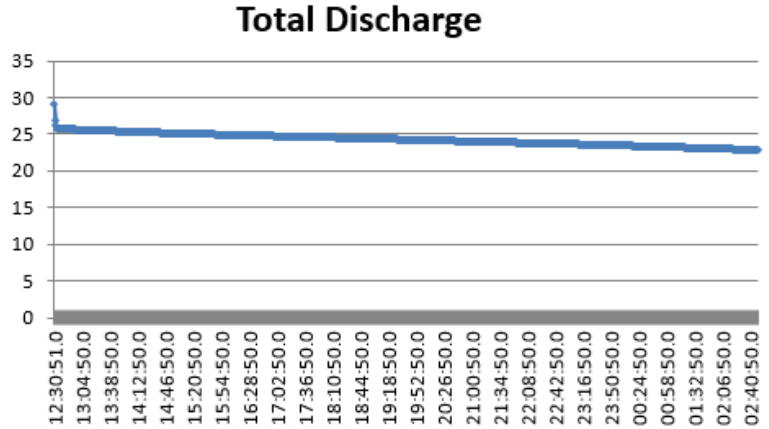
- Charge Controller – SunSaver SS-20L-24V
  - 24V 20A charge controller with LDV
    - Load Disconnect 23.0 V
      - 11.5 V per battery
    - Load Reconnect 25.2 V
      - 12.6 V per battery

  ? How long between disconnect and reconnect with battery being charged

Battery Discharge Characteristics

- 24V 26AH Battery Configuration
  - Two 12V 26AH batteries in connected in series
  - Fully charged
  - 2A load

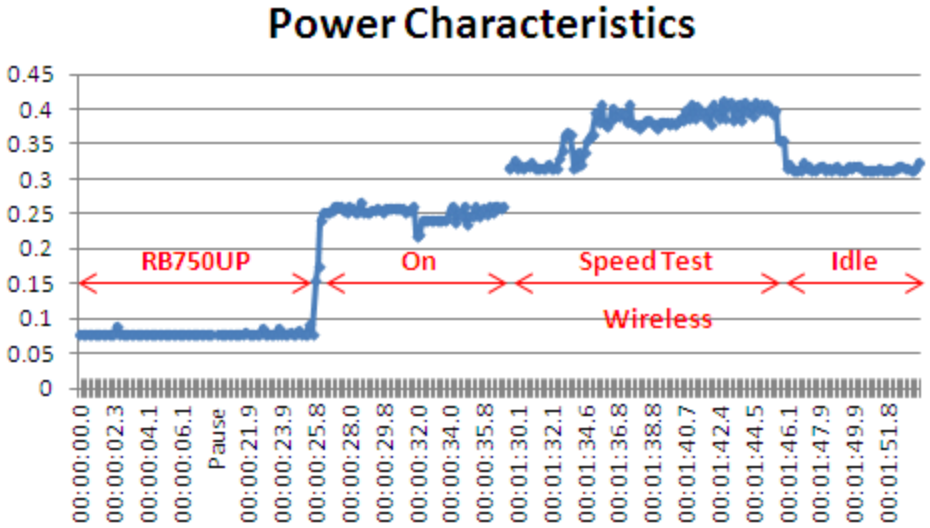




- Run time at 2A to 23V disconnect voltage = 13:43 hours
  - 23V is recommended disconnect voltage to avoid battery damage
  - Need longer run time – use larger capacity batteries

Power Usage Characteristics

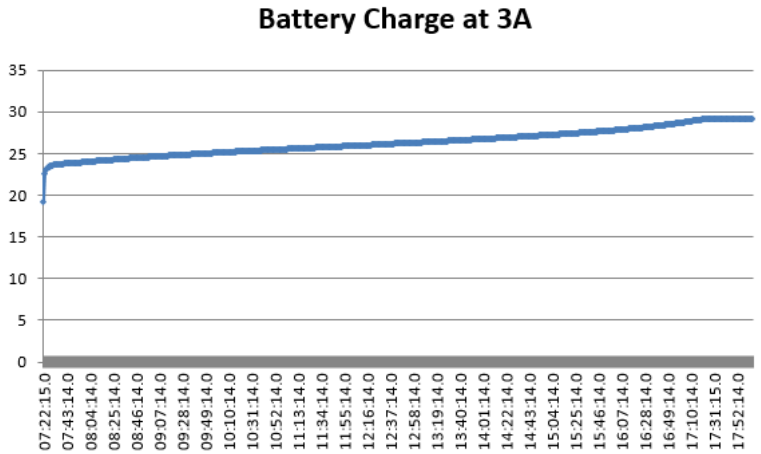
- Test with wireless unit



- Power consumption
  - RM750UP = 80mA
  - Wireless unit = 170 to 330mA

Battery Charge Characteristics

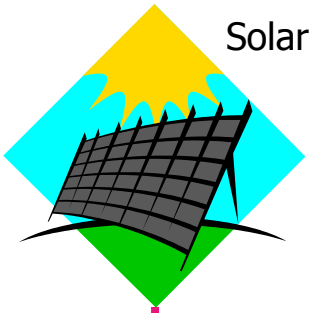
- 24V 26AH Battery configuration
  - Two 12V 26AH batteries connected in series
  - Discharged to 23V disconnect level
  - 3A battery charge rate



  - Charge time = 10:30 hours
  - Time to reconnect voltage of 25.2V = 2:48 hours
    - **No power = No service = Support Calls**

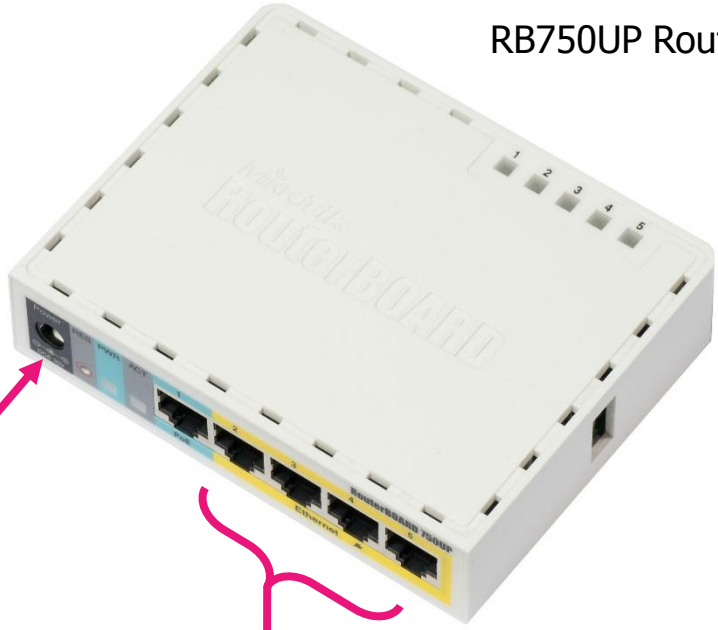
RB750UP Solution
Solar Powered

Solar Array



Charge Controller

RB750UP Router



Wireless Equipment

24V Battery

RB750UP Configuration
Low Voltage Disconnect (LDV)

- Connect the RB750UP directly to the battery array and configure it to provide the LDV
  - Monitor battery voltage
    - Provide alert when battery voltage is < 24V & > 23V
    - Disconnect load when battery voltage < 23V
      - Provide alert, keep router alive
  - PoE voltage readings report the port output voltage
    - For input voltages from 8V to 16V it is -0.5V < input voltage
    - For input voltages from 17V to 30V it is -0.6V < input voltage
      - E.g. 24V input provides a PoE output of 23.4V

```
[admin@MikroTik] > interface ethernet poe monitor [find]
                    name: ether2 ether3 ether4 ether5
     poe-out-voltage: 23.4V  23.4V  23.4V  23.4V
     poe-out-current: 172mA  164mA  124mA  492mA
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```

RB750UP Router
Low Voltage Disconnect (LDV)

- LDV Script
  - Get system voltage Vpoe
  - If (Vpoe>23.4V) log result
  - If (Vpoe<23.4V & Vpoe>22.4V) send warning message
  - If (Vpoe<22.4V) send alert message & take action
    - Turn PoE power off
  - If (Vpoe>22.4V) send alert message & take action
    - Turn PoE power on

- PoE Control Script
  - Script that is called by other scripts to control PoE outputs
  - Multi-function script, controlled by variables

RB750UP Router
PoE Control Script (part 1)

- Variables
  - :global PoePort
    - 2 ~ 5 selects specific port number, 0 selects all four ports
  - :global PoeMode
    - Action required “ON” or “OFF”
  - :global PoeDelay
    - Delay in seconds between port activation
  - :local ptr
    - Counter used by program

RB750UP Router
PoE Control Script (part 2)

- Turn power on selected PoE port/s ON
  - :if ($PoeMode = "ON") do={
  - if ($PoePort=0) do={
  - :for ptr from=2 to=5 step=1 do={
  - /interface ethernet poe set "ether$ptr" poe-out=auto-on
  - :log info "PoE on port $ptr switched $PoeMode"
  - :delay ($PoeDelay.s)
  - }
  - } else={
  - /interface ethernet poe set "ether$PoePort" poe-out=auto-on
  - :log info "PoE on port $PoePort switched $PoeMode"
  - }

RB750UP Router
PoE Control Script (part 3)

- Turn power on selected PoE port/s OFF

```
} else={
    if ($PoePort=0) do={
        :for ptr from=2 to=5 step=1 do={
            /interface ethernet poe set "ether$ptr" poe-out=off
            :log info "PoE on port $ptr switched $PoeMode"
        }
    } else={
        /interface ethernet poe set "ether$PoePort" poe-out=off
        :log info "PoE on port $PoePort switched $PoeMode"
    }
}
```

RB750UP Router
PoE Control Test Script (part 1)

- Script to allow testing of PoE Control script
  - Set test conditions by editing script values and then run script
  - Results will be logged
- Sample script 1
  - Turn power on all ports ON with 15s delay between ports
  - :global PoePort 0
  - :global PoeMode "ON"
  - :global PoeDelay 15
  - :execute PoeControl
- Log

00:38:33	system info	device changed by admin
00:38:33	script info	PoE on port 2 switched ON
00:38:48	script info	PoE on port 3 switched ON
00:38:48	system info	device changed by admin
00:39:03	system info	device changed by admin
00:39:03	script info	PoE on port 4 switched ON
00:39:18	system info	device changed by admin
00:39:18	script info	PoE on port 5 switched ON

RB750UP Router
PoE Control Test Script (part 2)

- Sample script 2
  - Turn OFF power on port 3
  - :global PoePort 3
  - :global PoeMode "OFF"
  - :global PoeDelay 0
  - :execute PoeControl
- Log

00:41:03	system info	changed script settings by admin
00:41:04	script info	PoE on port 3 switched OFF
00:41:04	system info	device changed by admin

RB750UP Router
Low Voltage Disconnect Script (part 1)

- Variables
  - :global PoePort
  - :global PoeMode
  - :global PoeDelay
  - :global Vbatlow 234 #Voltages are in 1/10 of a volt
  - :global Vbatoff 224
  - :global Vtest
  - :global TestMode
  - :global Vsystem [/system health get voltage]
  - :local SystemName [/system identity get name]
- Test mode? Use voltage from test program
  - :if ($TestMode=1) do={:set Vsystem $Vtest}

RB750UP Router
Low Voltage Disconnect Script (part 2)

- Battery voltage between 23V and 24V – alert message
  - :if (($Vsystem < $Vbatlow) && ($Vsystem > $Vbatoff)) do={
  - :local emessage ("Warning ".$SystemName. " voltage is ". [:pick $Vsystem 0 2] . "." . [:pick $Vsystem 2 3]."V")
  - # /tool e-mail send to="youremail@yourdomain.com" subject="Warning $SystemName – Low Voltage" body=$emessage
  - :log info $emessage}
- Battery voltage below cutoff voltage of 23V – activate LDV
  - :if ($Vsystem < $Vbatoff) do={
  - :local emessage ("Alert ".$SystemName. " voltage is ". [:pick $Vsystem 0 2] . "." . [:pick $Vsystem 2 3]."V")
  - # /tool e-mail send to="youremail@yourdomain.com" subject="Alert $SystemName – Powered Down" body=$emessage
  - :log info $emessage
  - :set PoePort 0
  - :set PoeMode "OFF"
  - :execute PoeControl}

RB750UP Router
Low Voltage Disconnect (part 3)

- Battery voltage above cutoff voltage – activate load
  - :if ($Vsystem > $Vbatoff) do={
  - :local emessage ("Alert ".$SystemName. " voltage is ". [:pick $Vsystem 0 2] . "." . [:pick $Vsystem 2 3]."V")
  - # /tool e-mail send to="youremail@yourdomain.com" subject="Alert $SystemName – Powered Up" body=$emessage
  - :log info $emessage
  - :set PoePort 0
  - :set PoeMode "ON"
  - :set PoeDelay 10s
  - :execute PoeControl}

RB750UP Router
LDV Test Script

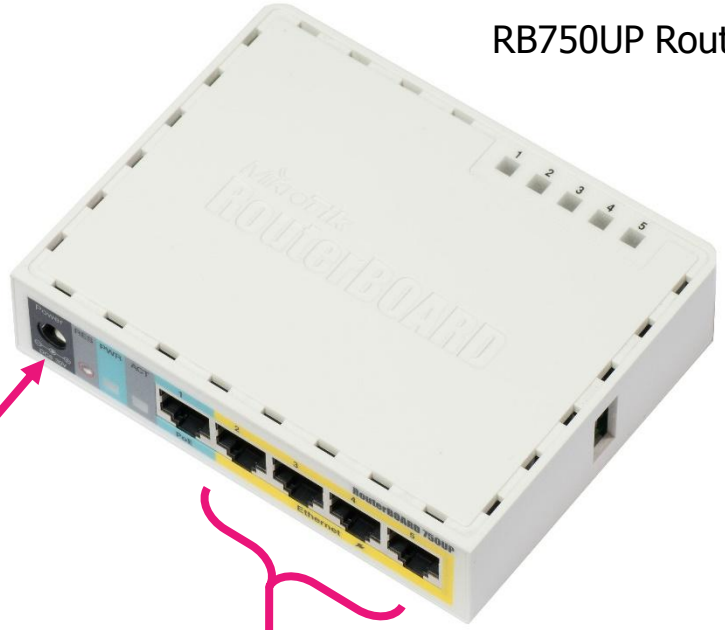
- Script to allow testing of LDV capability
  - :global Vtest 222
  - :global TestMode 1
  - :execute LDV
  - Set voltage and test mode and then execute script
- Log

00:47:07	script info	Alert RB750UP voltage is 22.2V
00:47:07	system info	device changed by admin
00:47:07	script info	PoE on port 2 switched OFF
00:47:07	system info	device changed by admin
00:47:07	script info	PoE on port 3 switched OFF
00:47:07	system info	device changed by admin
00:47:07	script info	PoE on port 4 switched OFF
00:47:07	script info	PoE on port 5 switched OFF
00:47:07	system info	device changed by admin

  - Note: Information on this emailing of messages can be found on the Mikrotik wiki and has therefore not been included in this presentation.

RB750UP Solution
Utility Powered

RB750UP Router



Utility Power
110V

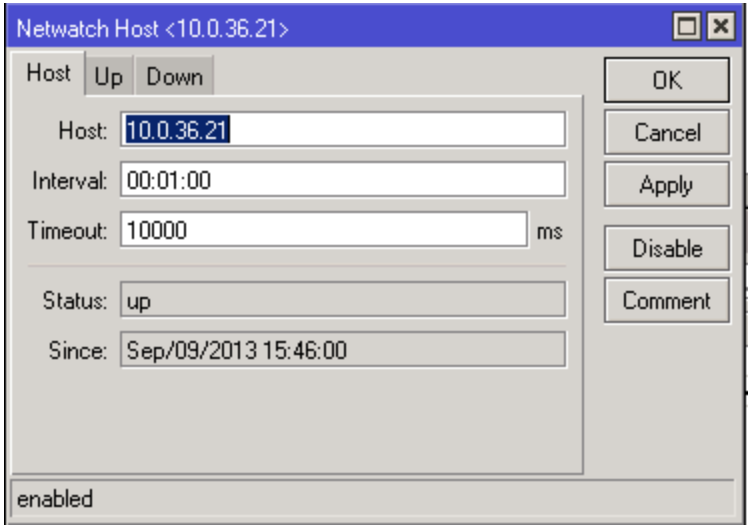
Battery
Charger

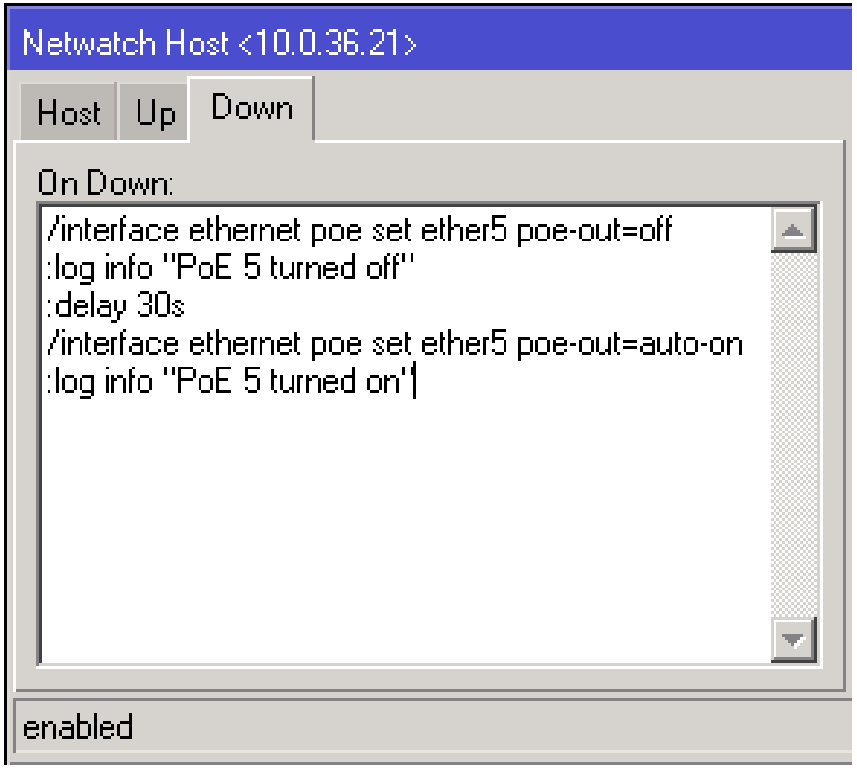
24V Battery

Wireless Equipment

RB750UP Configuration
Wireless Equipment Power Control

- Netwatch
  - Monitor device IP address and reboot if connectivity is lost
  - Log actions taken





RB750UP Configuration
Power Monitoring and Reporting

- Scheduler
  - Set schedule for script to run
- Script
  - Monitor PoE/System Health Voltage to determine status of DC power feed
- Reporting
  - Send an alert and report messages

  - Note: Information on this subject can be found on the Mikrotik wiki and has therefore not been included in this presentation.

RB750UP Configuration Sequenced Power Up

- Turning on all loads simultaneously can result in a power spike which can place router in overload condition
- Sequencing power turn up minimizes power spike
- Included in LDV script
- Scheduler
  - Run script after startup
- Script
  - Put 15s delay between starting each interface

RB750UP Configuration Load Shedding

- Reduce power consumption by powering down devices
  - If battery voltage is reaching critical level, run time can be extended
  - Power down backup link
  - Power down non critical sectors
  - Maximize uptime
  - Keep the router up it provides the control and reports

RB750UP Router Summary

- Ideally suited as an Access Point router
  - Routing
  - Bandwidth control
  - Control over powered devices
- Scripting enhances functionality
  - Cost effective redundant power solutions
  - Highly efficient Low Voltage Disconnect (LDV)
  - Powered equipment monitoring and reboot
  - Power monitoring and reporting
  - Load shedding

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