Wake on LAN, Power consumption \ saving and shutdown

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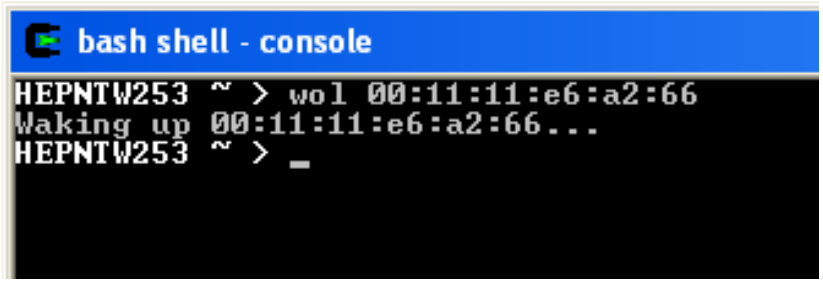
What is Wake on LAN? (magic packet)

The ability to switch on remote computers that are apart of the local network



Magic packet - FF FF FF FF FF FF
Example mac address – 00:11:11:E6:A2:66 * 16

HEX:
FF FF FF FF FF FF 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66 00 11 11 E6 A2 66

Decimal:
255 255 255 255 255 255 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102 0 17 17 230 162 102

Binary:
11111111 11111111 11111111 11111111 11111111 11111111 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110 00000000 00010001 00010001 11100110 10100010 01100110

Requirements – Target machine

- Power supply on at the wall socket
- Requires a BIOS with APM (Advanced Power Management)
  Enable Wake on LAN

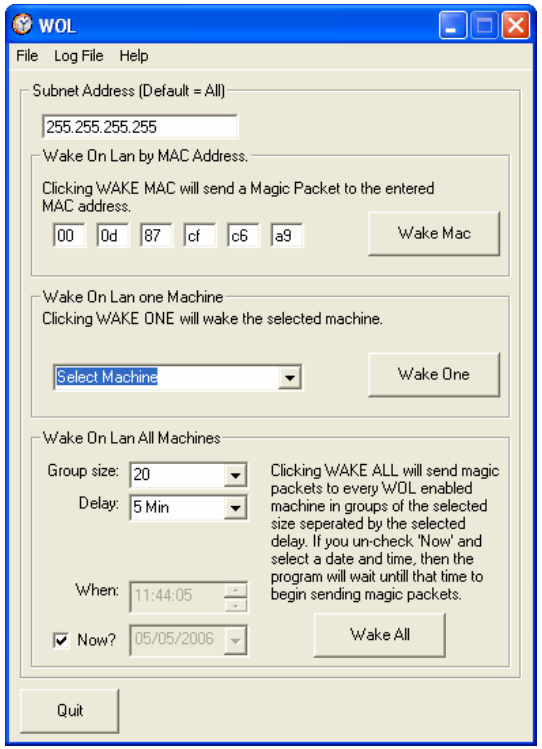
Level	Power state
S0	On and fully operational.
S1	System is in low power mode (a.k.a. sleep mode). The CPU clock is stopped, but RAM is powered on and being refreshed.
S2	Similar to S1, but power is removed from the CPU.
S3	Suspend to RAM (a.k.a. standby mode). Basically, most components are shutdown except RAM.
S4	Suspend to disk (a.k.a. hibernate mode). The memory contents are swapped to the disk drive, and then reloaded into RAM when the system is awakened.
S5	Power off.

- Nic would get its power from the standby power supply
- When a network card has been configured to be turned on via WOL it will …
  When computer is off its WOL status is enabled
  When computer is on its WOL status is disabled
- Hardware - Works on all PPD's Intel P4 workstations and some P 3 866Mhz
- Operating system - (Advanced Configuration Power Interface (ACPI))
  Windows 98, 2000 and XP (Will not run on Windows NT or Windows 95)

Requirements - Software

A program has been created via Microsoft Visual Basics 6 containing

- MAC address database (Media Access control)
- Single \ multiple machine boot
- Scheduling WOL
- Staggered WOL



IP Address	PC name	Formatted MAC address
130.246.41.66	HEPNTW247	00-11-11-33-e2-09
130.246.41.67	HEPNTW248	00-11-11-33-e3-82
130.246.41.68	HEPNTW249	00-11-11-33-e7-22

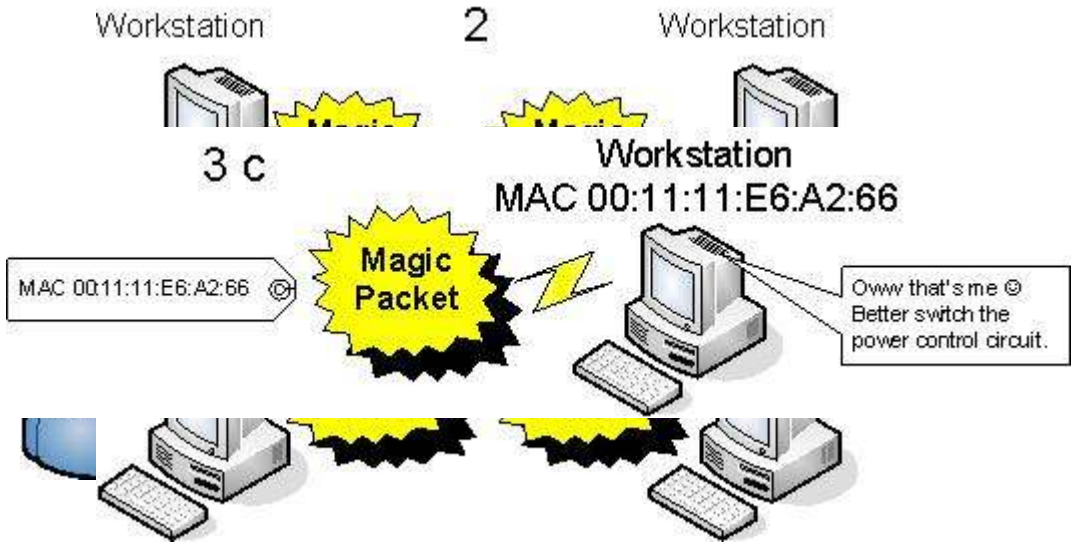
```
If itmWOL.Checked = True Then

    With Winsock1
        .RemoteHost = SubnetAd      ' ('broadcast' address of 255.255.255.255)
        .Protocol = sckUDPProtocol  ' (UDP - User Datagram Protocol)
        .SendData WOLPac            ' (Contents of the magic packet)
        .Close
    End With

End If
```

How does it work step by step example

1. Software broadcast 255.255.255.255 + Wake on LAN command (MAC * 16 = ‘Magic packet’)
2. All networked devices receive the ‘magic packet’
3. The NIC adapter will react to a "Magic Packet" containing its own MAC address by toggling a signal connected to the computer power control circuitry.
4. The power control circuitry, in response, would activate power to the computer resulting in the computer booting the OS.



Remote shutdown & Power consumption \ saving

Power Consumption of desktop equipment in PPD (watts)

Device name	Off (Plugged In)	Standby	Idle	Busy
3 GHz Viglen Desktop	2	2	75	130
2.5 GHz Viglen Desktop	2	2	60	110
Flat screen Monitor (Belinea 101720)	0	2	30	-
Modern 19” CRT Monitor (Samsung SyncMaster 900SL)	0	66	100	-
Much Older 21” CRT (Digital 21” VRC21)	0	26	100	-

Scheduled shutdown command to run on Friday nights at 10pm
shutdown -s -f -m \\ (machine name)

So workstations are off from 10pm Friday ~ 8:00am Monday = 58 hours

100 3 GHz machines at idle: 7,500 watts * 58 = 435,000 / 1000 = 435 KwH
100 3 GHz machines at standby: 200 watts * 58 = 11,600 / 1000 = 11.6 KwH

Thank you to Alex Tinsley for his work on Wake On LAN and power measurements

The End