Operational Management using Wake-on-LAN

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Yeongkwun Kim received his B.S. and M.S. degrees in Computer Science from Kwang-Woon University, Seoul, Korea. He received his Ph.D. in Computer Science from Illinois Institute of Technology, Chicago. His research interests include Network management, Agent technologies in Telecommunication, Internet QOS management, human-computer interaction and mobile communications. He was a senior member of technical staff to Wireless Communications Lab in Korea Telecom R&D Group and 5ESS Customer Technical Support Group in Lucent Technologies.

Theoretical Background

- WOL allows administrators to perform system maintenance even if the user has turned off the computer ← enables clients to wake up all computer systems remotely

- WOL was used to save time on business processes by turning on and having computers ready for employees when they arrive*.

* M. Stefanovie et al, “Mutual Impact of High Computer Network Utilization and Business Processes”, International Scientific Conference on Industrial Systems, 2017.

Network management can be defined as **O**AMP of network and services

Operations is concerned with daily operations in providing network services

Wake on LAN (WoL) ?

- A computer networking standard that allows a computer to be turned on or awakened by a network message

- allows the administrator to remotely power up all sleeping machines so that they can receive updates

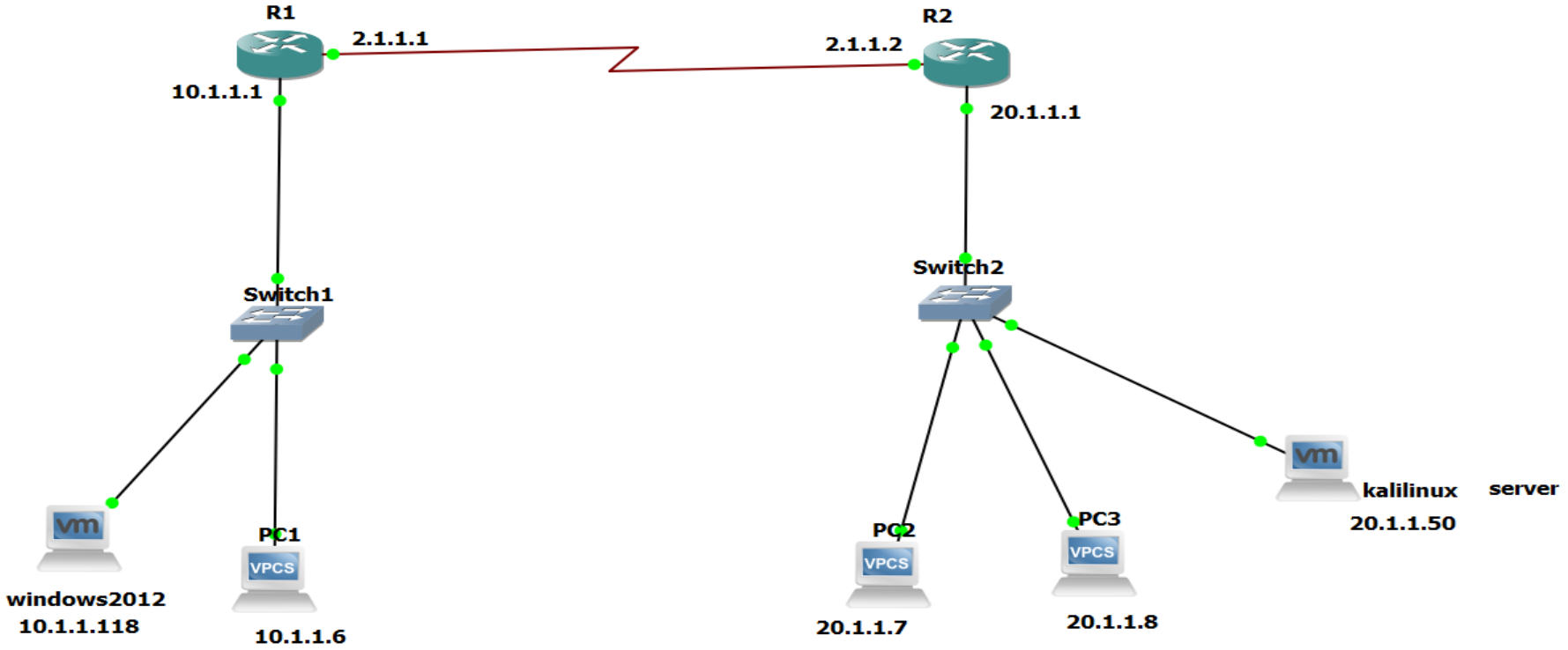
Magic Packets

- contains the destination MAC address, 255 (FF-FF-FF-FF-FF-FF) to broadcast the packets to the destination computers.
- could be sent as any network- and transport-layer protocol, although it is typically sent as a UDP datagram to port 0,[6] 7 or 9, or directly over Ethernet.
- does not provide a delivery confirmation.

Network Setup (Tools)

- **GNS3 Network Simulator:** uses Dynamips emulation software to simulate Cisco IOS
- **VMware workstation pro:** enables users to set up virtual machines on a single physical machine, and use them simultaneously along with the actual machine
- **Wireshark Network Adapter:** a network protocol analyzer to capture and interactively browse the traffic running on a computer network

Model Network Configuration



Subnet Mask and IP Configuration

	Router1	Router2	PC1	PC 2	PC 3	Windows server	Kali linux server
Interface 0	10.1.1.1	20.1.1.1	10.0.0.6	20.0.0.7	20.0.0.8	10.1.1.118	20.1.1.50
Interface1	2.1.1.1	2.1.1.2	N/A	N/A	N/A	N/A	N/A

Communication from PC1 to PC2 in the WoL

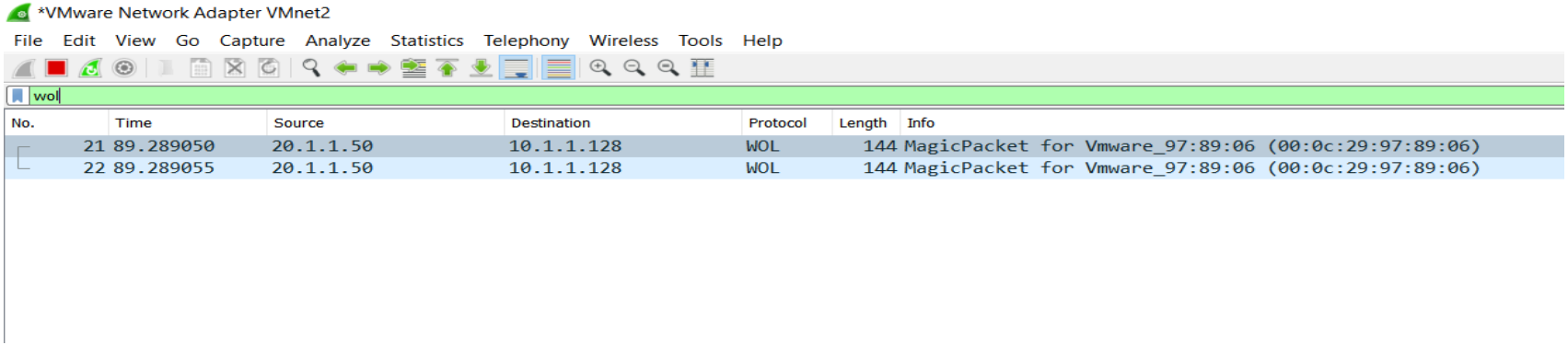
1. Switch1 holds the MAC address of the PC1 and Switch 2 holds the MAC address of PC2 & PC3.
2. When it pings 20.1.1.7(PC2) from PC1(10.1.1.6), the ip goes to the network gateway 10.1.1.1 which is the IP address of router 1
3. Router 2 advertises its own network (20.1.1.2/24) and broadcast it to other Routers
4. When Router 1 receives 20.1.1.0/24 network information, it checks for the shortest path and the advertising routes it has.
5. Since Router 1 has the network path of the destination ones, Router 1 sends the network (20.1.1.0/24) to Router 2.
6. Router 2 receives the IP address of 20.1.1.7/24 from PC 1 of Router 1 and sends it to the Switch 2 port of PC2.
7. Switch 2 receives IP address 20.1.1.7. Switch 2 holds the MAC address of PC2. Now the switch 2 sends the received packet to the PC2 based on the MAC address

Sending magic packets from kali server to windows machine

Using WOL application written in C to send magic packets from server to the end client

Syntax to send magic packets: wol -v --host=10.1.1.128 --port=9 00:0c:29:97:89:06

--v : verbose output
--host=HOST broadcast to this IP address or hostname
--port=9 selecting the port which you want to use
00:0c:29:97:89:06: Destination MAC address



Pros and Cons of using WoL

Pros:

- Flexibility
- Usefulness – network administrator/IT people who are working remotely

Cons:

- Security - don’t distinguish between which PC is sending the magic bundle.
  - anyone on a network with a good and compatible IP address can possibly remotely access the computer

Conclusion

- Although WoL is a generally matured technology, numerous organizations do not implement it due to confinement.

- The WOL allows the administrator to remotely power up all sleeping machines so that they can receive updates.

- Needs to increase robustness