# MikroTik RouterOS

## Lab with Virtualization Technologies



### Yangon, Myanmar

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B. C. Tech (hons)
MikroTik Consultant
**October 27, 2016**

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CCIE # 47682
MikroTik Certified Trainer

# INSTRUCTOR

- **Phyo Phyo Hein**
  - B. C. Tech (hons)
  - MikroTik Consultant
  - Experiences:
    - Cisco instructor since 2005
    - SingTel Mobile Support Network Engineer at NCS Co., Ltd (2008-2010)
    - Nera Telecommunications (Singapore) (2011-2012)
    - System Integration Manager at Yatanarpon Teleport (2012-2014)
    - Enterprise/ISP Manager at Kinetic Myanmar Technology (2014-2016)
  - Certifications:
    - **Cisco** CCNA R&S, CCNP R&S, CCIP, CCIE R&S Written
    - **Juniper** JNCIA-Junos, JNCDA
    - MikroTik MTCNA, MTCRE, MTCWE, MTCTCE, MTCUME, MTCINE

# INSTRUCTOR

- **Lay Minh (Makito)**
  - CCIE # 47682
  - MikroTik Certified Trainer & Consultant
  - Experiences:
    - 10 years in ISP industry since 2005
    - Billing solutions for service providers
    - ISP core network design and operation
  - Certifications:
    - **Juniper** JNCIA-Junos, JNCIS-SP, JNCDA
    - **VMware** VCA6-NV
    - MTCNA, MTCRE, MTCWE, MTCTCE, MTCUME, MTCINE
  - Areas of interest: BGP, MPLS, IPv6

# INTRODUCE YOURSELF

- Please introduce yourself to the class.
  - Your name
  - Your company
  - Your previous knowledge about networking
  - Your previous knowledge about virtualization
  - What do you expect from this course?

# CLASS PREREQUISITES

- Participants of this class are expected to:
  - Have general knowledge on basic networking and TCP/IP

  - Understand how MikroTik RouterOS works
  - Know how to configure MikroTik RouterOS for general purposes

  - Understand how VMware WorkStation works
  - Know how to configure VMware WorkStation for general purposes

# CLASS SCHEDULE

- **Class Topics**
  - **LECTURE:** Introduction to MikroTik
  - **LECTURE:** Introduction to VMware
  - **LAB:** VMware Installation & Basic Configuration
  - **LAB:** RouterOS + Virtual Machine Basic Connectivity Lab
  - **LECTURE:** Introduction to MetaROUTER
  - **LAB:** Routing Lab with MetaROUTER

- **Class Time**
  - October 27, 2016 (14:00 to 20:00)
  - Dinner break 17:30 to 18:30
  - Section break time 10 – 15 minutes
  - Q&A after each break

# INTRODUCTION TO MIKROTIK

**About MikroTik**

**MikroTik RouterOS**

**MikroTik RouterBoard**

**MikroTik Certifications**

# ABOUT MIKROTIK

- Location:

  Riga, Latvia

  (Northern Europe)

- Produces router hardware and software.

- To make internet technology cheaper, faster, easier and reliable.

- MikroTik Slogan: Routing the World.

- Founder (1996): John Trully & Arnis Reikstins.

# MikroTik Products

- RouterOS
  - Router operating system.
  - Can be installed on PC or any supported hardware.
  - Built with Linux Kernel.

- RouterBoard
  - Hardware router
  - Runs RouterOS
  - Various series from low-end to high-end
    - RB750GL: For home user or small office.
    - RB1100AHx2: Rack mount device, for medium network.
    - CCR1036-12G-4S: For enterprise or service provider network.

# RouterOS Features

- Supports various types of device:
  - Ethernet, Wireless Card, V35, ISDN, USB Mass Storage, USB 3G Modem, E1/T1...etc.
  - We cannot install extra driver on RouterOS

- Has features more than a standard router:
  - Routing (RIP, OSPF, BGP, PIM, RIPng, OSPFv3)
  - Firewall & NAT
  - Bandwidth Management
  - User Management (DHCP, Hotspot, Radius)
  - Tunnel (EoIP, PPTP, L2TP, SSTP, OpenVPN, PPPoE)
  - Real-time Tools (Torch, Watchdog, Ping, Traceroute, MRTG, Packet Sniffer)

# ROUTERBOARD TYPES

- RouterBoard model name, for example:

## RB951Ui-2HnD

Series    Ports    Wireless / Mini PCI
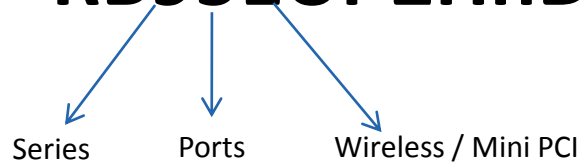
- **U** = USB port
- **i** = Power injector
- **2** = 2.4GHz wireless
- **n** = Support 802.11n wireless
- **D** = Dual chain antenna
- **G** = Gigabit Ethernet port
- **A** = Advanced, more memory or higher license
- **H** = High performance, more powerful CPU

- More info: http://wiki.mikrotik.com/wiki/Manual:Product_Naming

# ROUTERBOARD ARCHITECTURE

- RouterBoard architecture distinguished by type and performance of the processor.

- Software / OS is different for each architecture

  - mipsbe

  - x86

  - ppc

  - mipsle

  - tile

  - smips

**RouterOS**
Please choose your instruction set:

| | |
|---|---|
| *mipsbe* | CRS series, RB4xx series, RB7xx series, RB9xx series, RB2011 series, SXT, OmniTik, Groove, METAL, SEXTANT |
| *x86* | PC / X86, RB230 series |
| *ppc* | RB3xx series, RB600 series, RB800 series, RB1xxx series |
| *mipsle* | RB1xx series, RB5xx series, RB Crossroads |
| *tile* | CCR series |
| *smips* | hAP lite |

**SwitchOS**

| | |
|---|---|
| *switches* | RB250GS, RB260GS, RB260GSP |

- Complete information can be found at
  http://www.mikrotik.com/download

# MikroTik Certifications

- Certification levels
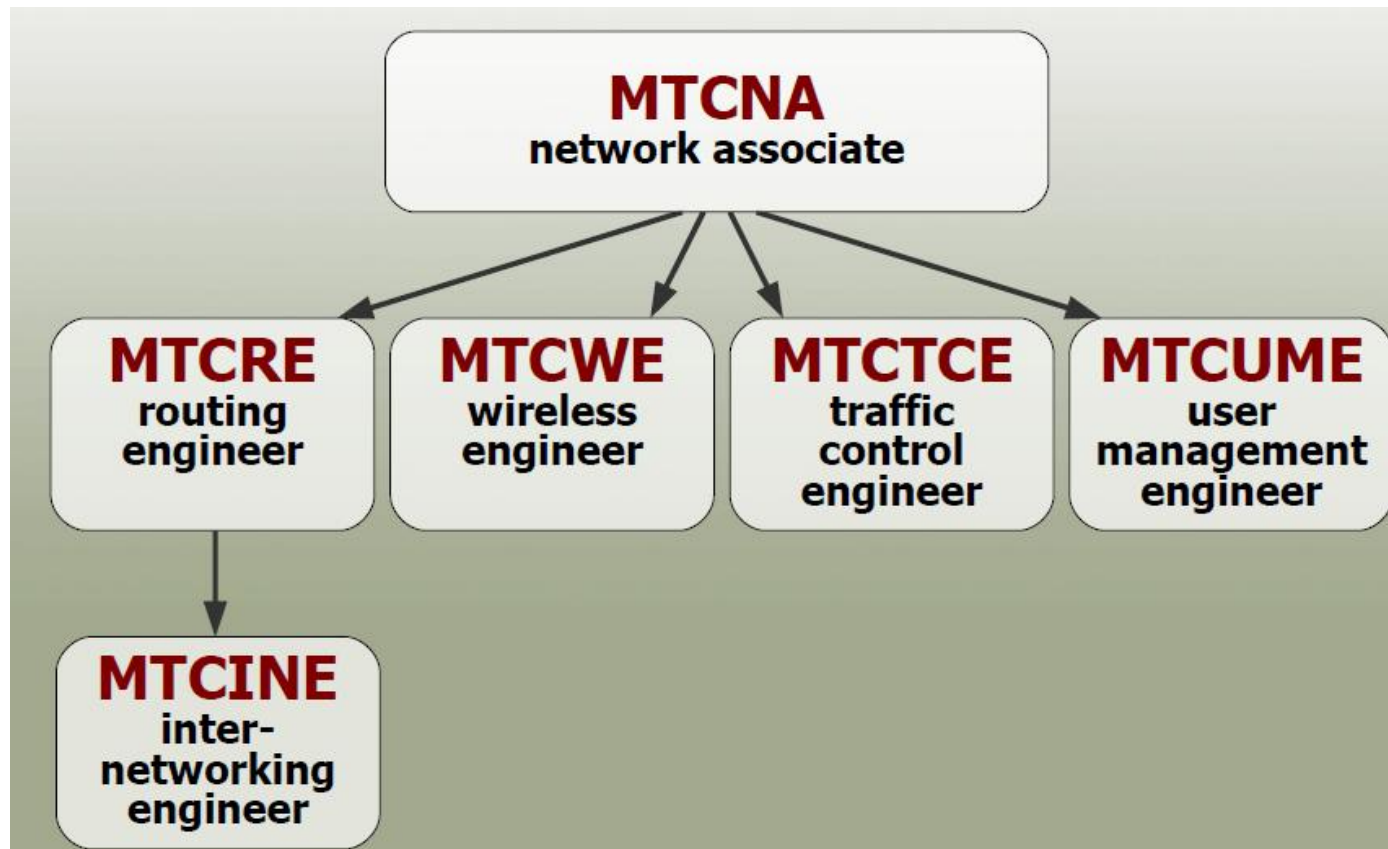
# MikroTik Certifications (Cont.)

- **MTCNA**
  - Fundamental and overall knowledge about RouterOS.
  - For beginner, similar to CCNA.

- **MTCRE**
  - Enterprise network technologies: ECMP, OSPF, VLAN, VPN...etc.

- **MTCINE**
  - Service provider network technologies, such as: BGP, MPLS, RSVP-TE, VPLS...etc.

# MikroTik Certifications (Cont.)

- **MTCWE**
  - Wireless concepts
  - Wi-Fi technologies: IEEE 802.11a/b/g/n/ac

- **MTCTCE**
  - Bandwidth management, Quality of Service (QoS)
  - Firewall, DNS, DHCP, Web Proxy…etc.

- **MTCUME**
  - Hotspot
  - IPSec
  - Authentication, Authorization, Accounting (AAA)

# INTRODUCTION TO VMWARE

**About VMware**

**VMware WorkStation**

**Benefits of Virtualization**

# ABOUT VMWARE



- Virtualization and cloud computing software provider for x86-compatible computers.

- Vmware started X86 Virtualization in 1999.

- A subsidiary of EMC Corporation and has its headquarters in Palo Alto, California.

- "VMware" is often used in reference to specific VMware Inc. products such as VMware Workstation, VMware View, VMware Horizon Application Manager and VMware vCloud Director.

- **Today our main focus is VMware WorkStation!**

# VMWare WorkStation

- A test-and-development environment that allows systems administrators to create and run virtual machines (VMs) directly on a desktop.

- Hypervisors
  - a virtual machine manager, is a program that allows multiple operating systems to share a single hardware host

- Integrates with other VMware tools,
  - vSphere, to increase collaboration between test-and-development labs and real-life production environment

- Today LAB will be running
  - RouterOS on VM over Microsoft Windows
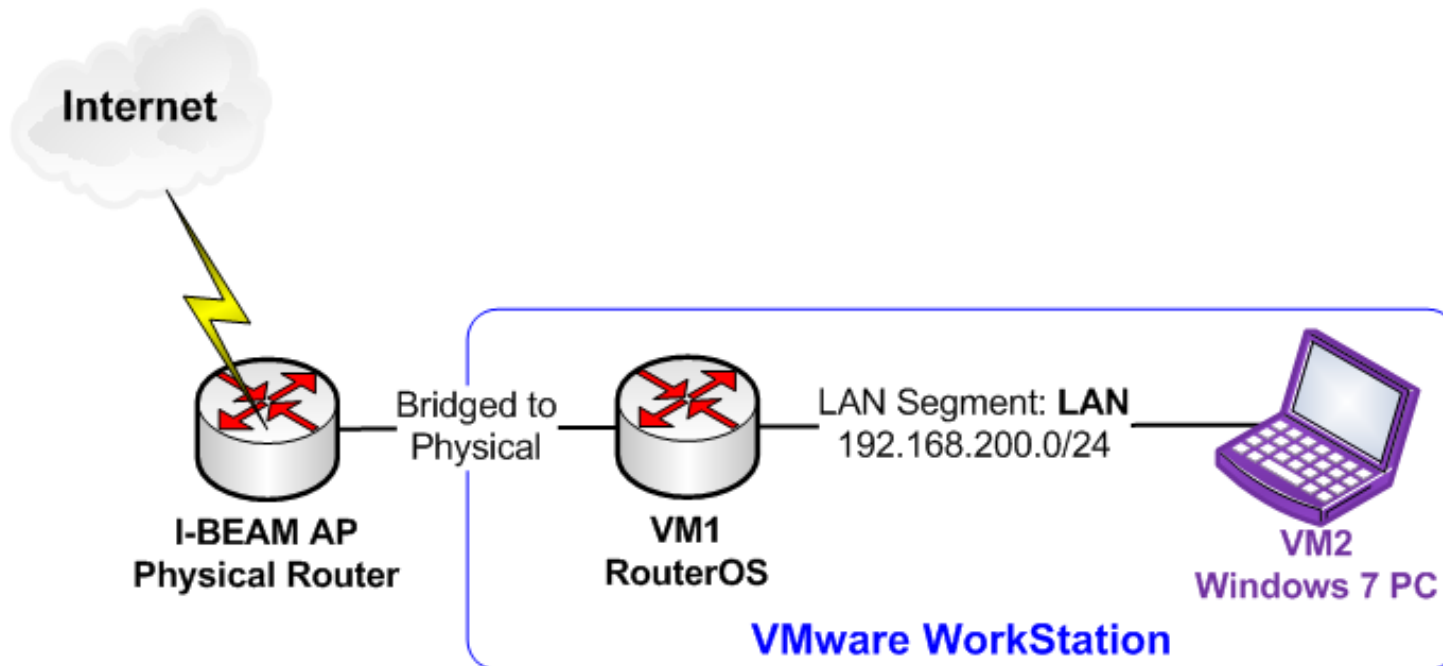
# BENEFITS OF VIRTUALIZATION

- Less heat buildup
- Reduced Cost
- Easier Backup
- Easier Migration to Cloud
- Save Energy, Go Green
- Increase Uptime

# LAB: ROUTEROS + VIRTUAL MACHINE BASIC CONNECTIVITY LAB

- Install 2 VMs
  - Microsoft Windows 7 PC
  - MikroTik RouterOS
- Configure basic connectivity as shown in diagram below:

# INTRODUCTION TO METAROUTER

**What is MetaROUTER?**

**Requirements & Limitations**

**MetaROUTER Applications**

# WHAT IS MetaROUTER?

- Router in Router

- A **Virtual Router** running on a physical **Host Router**

- Available since RouterOS 4.0 beta 1 and RouterOS v3.21.

- Currently MetaROUTER can be used on:

  - RB400, RB700 series except models with SPI flash, RB900 series except models with SPI flash, RB2011 boards

  - Listed PPC boards: RB1000, RB1100, RB1100AH and RB800

# REQUIREMENTS & LIMITATIONS

- Minimum 24MB RAM for each Virtual Router
- Host Router's minimum RAM requirement =

    Host Router's RAM + all Virtual Router's RAM

- Maximum 8 Virtual Routers per Host
- Up to 8 Virtual Ethernet interfaces
- Host Router CPU is bottleneck
    - In lower model RouterBOARDs, MetaROUTER usually causes high CPU, hence, increases latency
- Virutal Routers use same RouterOS image as Host Router
    - No effect on upgrade/downgrade/add/remove packages
- Cannot use external storage devices in the Virtual Routers

# METAROUTER APPLICATIONS

- Simple Lab Scenarios

- Dedicated Router for Customer
  - Useful for allowing clients or lower-privilege users access to their own "router" and to configure as they like, without the need for a complete second router
  - Customer can create own firewall filters and other policies

- Install third-party operating system
  - OpenWRT is popular option
    - More info: https://wiki.openwrt.org/inbox/doc/mikrotik_metarouter_openwrt
    - OpenWRT on RB450G: https://wiki.openwrt.org/toh/mikrotik/rb450g

# LAB: ROUTING LAB WITH METAROUTER

- Configure 2 MetaROUTER
  - Gateway Router
  - Client Router
- Configure basic connectivity as shown in diagram below:
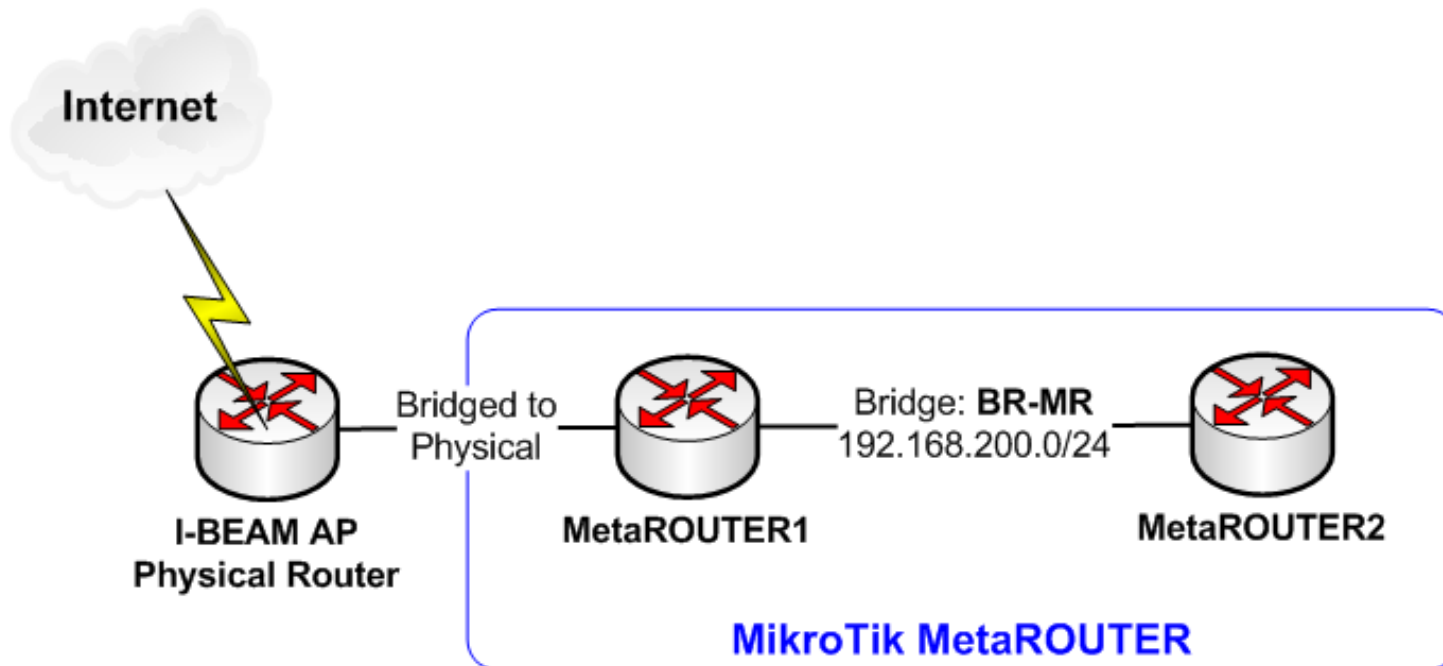
# QUESTIONS & ANSWERS

**If you have any questions, feel free to ask!**

**Or you would like to review a specific topic, please request.**

# The End

## Thanks for your attention!

**Contact Us**

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