

## 02 Basic Router Configuration

### ↳ Network Protocol

↳ កំណត់រាស្ត្រ message

### ↳ Port Address

↳ 0-1023 → well known port (destination)

1024-49151 → reg port

49152-65535 → random port (source)

### ↳ IP address

			private ip
↳ class A	0	/8	10.0.0.0/8
↳ class B	10	/16	172.16.0.0/12
↳ class C	110	/24	192.168.0.0/16
↳ class D	1110		

### ↳ Physical address

↳ 48 bit

↳ លើវឌ្ឍនភាពបានសម្រេចក្នុងកម្មវិធានរបស់រួម

### ↳ Message Delivery

↳ រួមបានផ្តល់ជូន → frame



### ↳ Unicast

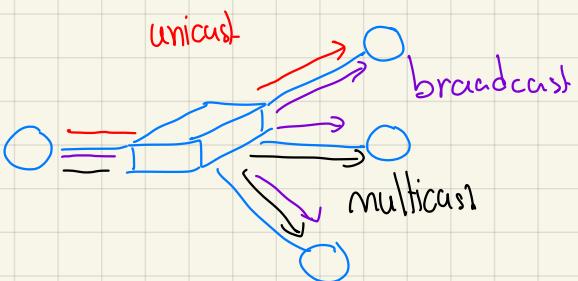
↳ ផ្តល់ទៅតីម្គាល់មិនមានបញ្ហា

### ↳ Broadcast

↳ ផ្តល់ទៅអគ្គន៍ 9ឬ mac F, ip broadcast address

### ↳ Multicast

↳ ផ្តល់ទៅពិនិត្យ



### ↳ Cisco IOS

#### ↳ Mode operation

↳ User → អ្នក → >

privileged → ពិនិត្យ = #

global configuration → ពិនិត្យដែឡិក → (config) #

## 03 Static Routing & Dynamic Routing Protocol

### ↳ Function of Router

#### ↳ Why routing?

↳ route เส้นทางที่ไปยัง network

↳ router = computer {cpu, os, memory}

↳ router ต้องมีเครื่องมือในการติดต่อ network ทาง interface ที่จะ

↳ กำหนดเส้นทางที่ต้องการให้กับที่ต้องการ

↳ จึง route 2 ที่ static, dynamic

↳ แล้ว ↳ จึงมี routing table

### ↳ Default Gateway

↳ กำหนดเป็นอย่างเดียวของทุกๆ host ใน network

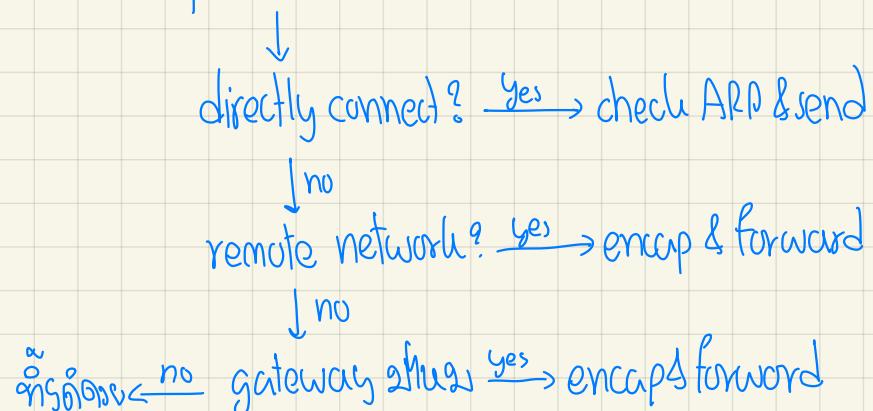
### ↳ Connect Device

↳ Document Network Address → mgmt doc

↳ กรณีกำหนด ip ให้ host → static, dynamic (dhcp)

### ↳ Path Determination

packet หลังจาก → router ดูใน routing table → des ip match subnet ...



↳ เชิงหมายเหตุ ? → รีดิคัม metric → ต่ำ = ดี → แล้วแต่ protocol

↳ administrative distance (AD) = ความน่าเชื่อถือ

connect	0	rip	120
static	1	en eigrp	170
eigrp sum	5		
inter-eigrp	90		
ospf	110		

## L Routing Table

### ↳ Remote Network Routing

D 10.0.0.7/24 [90111112] via 192.168.1.1, 0:00:05, serial0/0  
network ที่รับ  
protocol  
AdminMetric  
ip int ต่อไป  
update time

### ↳ Type of Static Route

↳ standard = สมการทั่วไป route 60s

default = ไม่match ทุกอัปเดตทุกครั้ง

summary = สรุป network

floating = เส้นทางอ่อนiable

### ↳ CIDR (classless interdomain routing)

### ↳ VLSM (Variable length subnet mask) → แบ่งช่วง → แบ่งได้ตามที่ต้อง

## 04 RIP-1BW

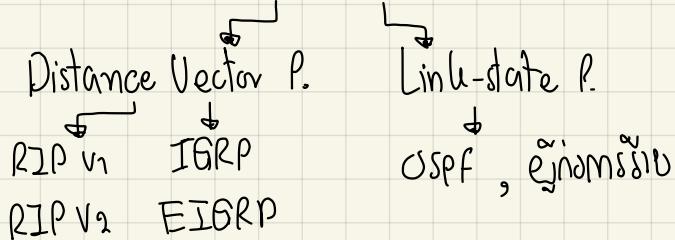
ឧបត្ថម្ភ

### ↳ Dynamic Routing Protocol { algorithm, routing protocol message }

↳ ផ្តល់ពេលវេលានៅក្នុង router ទាំងអស់ , នូវ update routing ដោយ topology ថ្មីថ្មី , និង best path

↳ នៅ network រាយក្រឹង , មានចំណាំនិងគេងគេង

### Interior Gateway Protocol



### ↳ Distance Vector

to destination

### ↳ Link-state

↳ route ជាដីលីវិកសារ vector { distance, direction }

↳ មានរឿងរាល់ topology

↳ មានរឿងរាល់ topology

of  
direction to go

↳ update with new

↳ update with T

### ↳ Classful (មាន subnet) , Classless (គឺជាសំណើ)

↳ Convergence → សម្រេចការការពារ down នៅក្នុងគម្រោង

### ↳ Routing Protocol Metric

↳ ការត្រួតពិនិត្យមិនមែន , នៅលើ load balance  $\Rightarrow$  តាមរយៈការការពារ 2 នៃរឿងរាល់

### ↳ Routing Protocol AD

↳ numeric value that specific the preference of a particular route

### ↳ Distance Vector Routing Protocol

↳ ចាប់ផ្តើម  $\rightarrow$  update ដោយរូបា ឬធំ broadcast

$\rightarrow$  មិនស្រួលបាន

$\rightarrow$  ស្រួលបាន

↳ ពេលវេលា  $\rightarrow$  time to convergence  $\rightarrow$  នូវការដោះស្រាយចំណាំ

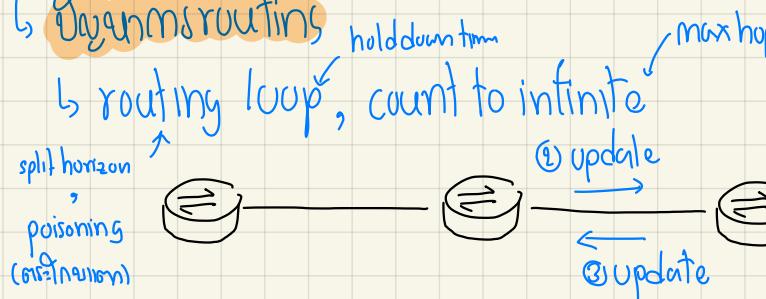
$\rightarrow$  Scalability  $\rightarrow$  នៅលើ

$\rightarrow$  resource usage  $\rightarrow$  ការប្រើប្រាស់បន្ទាន់

$\rightarrow$  នូវតម្លៃក្រុង , ភាពក្រុង

- ↳ ពន្លាកេរណ៍ 3 state ផ្សែងៗ
  - ① cold start = basic config
  - ② initial exchange = ចេញបុណ្យ ពារី
  - ③ លេកសៀវភៅ

## ↳ ចិត្តការក្រុងផ្ទាល់

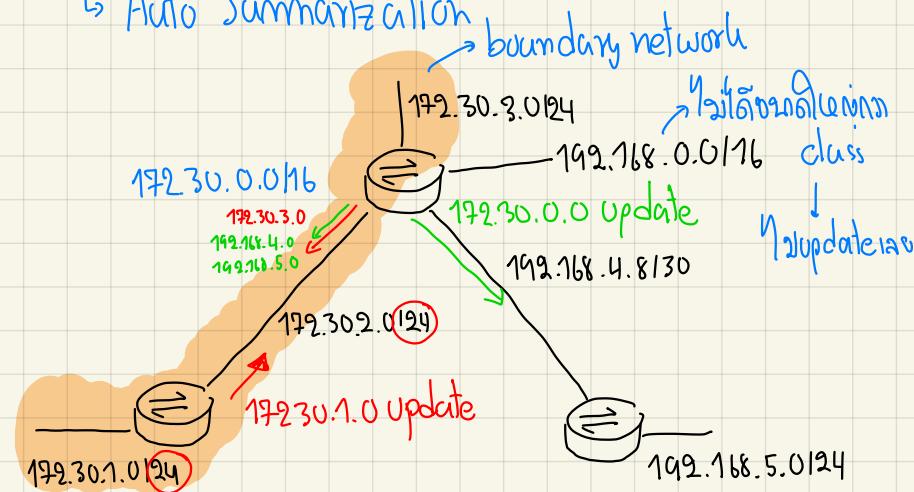


; split horizontal → ក្រុងផ្ទាល់ មិនអាច  
ពារីទៅក្នុងផ្ទាល់ទេ  
; មិនមែនទៅក្នុងផ្ទាល់ទេ, hop ចំនាំ

## ↳ RIPv1

- ↳ routing maintenance
- ↳ update timer 30s
- ↳ invalid, hold down 180s
- ↳ flush 240s
- ↳ គិតសំណង់ (AD=120)
  - ↳ classful → មិនសំណង់ subnet
  - ↳ metric & hop count > 15 នឹង
  - ↳ distance vector
- ↳ operation messages
  - ↳ request message
  - ↳ response message

## ↳ Auto Summarization



- ① ពួកគេ update នៅក្នុង boundary តែងតាំង → update នៅ subnet ដែលមិនការពារ
- ② ពួកគេកំណត់ update នៅ classful

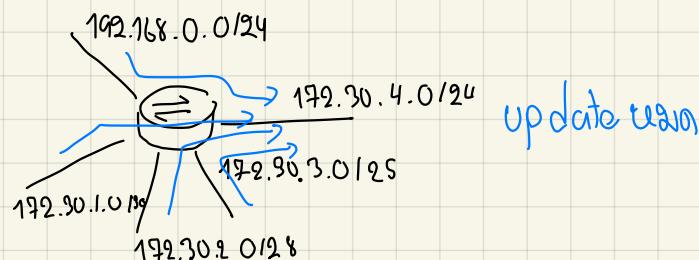
## ↳ ចិត្តការក្រុង discontinuous network

- ↳ ក្នុង boundary ip តែងតាំងបានក្នុង នៅក្នុង?
- ↳ update នៅ classful

## 05 RIP V2 & ACL

### ↳ RIP V2

- ↳ VLSM, discontinuous network, ပေါ်တဲ့ rip 1, ခုက္ခလာဆုတ်, classless, support မျှနှိမ်  
↳ မျှနှိမ်ခြောက်ခြုံရွက်, timer မေတ္တာ၏။
- ↳ no-autosummary (မြှောက်ခြားမှု)



## Access List Control

↳ အသေဆုံးပုံစံ :: protocol :: int :: direction

↳ ACL operation

↳ implicit deny ?

↳ work as if-else

↳ wildcard mask

↳ missing subnet mask => 255-subnet

↳ 0 or, 1 ignore

↳ Standard Access List

↳ ဖော်ပေါ် source access-list [1-99] [perm] [deny] [ip] [wc]

↳ ဘက်ဆို destination, မီဒော်entire protocol

↳ Extended Access List

↳ ဖော်ပေါ် source access-list [100-199] [perm] [deny] [protocol] [s ip] [s wc] [d ip] [d wc] eq [protocol]

↳ ဘက်ဆို source, စွမ်းဆေး protocol

## 06 OSPF & DHCP

### ↳ Link-State Routing Protocol (OSPF, ផ្លូវការនៃរាយ)

↳ មុនពីរក្នុង network

↳ ការចាប់តាំង → network មានការស្វែងរក

→ fast convergence → កិច្ចប្រឈមលើក្នុងការស្វែងរក

→ ទាក់ទង

↳ Dijkstra's algorithm, shortest path first (SPF)

↳ កំណត់ cost របស់វា

↳ Link-State Update

↳ Link-State Routing Process

↳ ① basic config → នឹងនិរតាមរបាយការ

② say "hello" → នឹងរួមរាយ

③ build LSP (លើក្នុងការស្វែងរក) → នឹងបញ្ជាផាណ  $r_1 \rightarrow r_2$  នៃ network [ip], cost [cost]

④ flood នាំ, ឈានដែលត្រួតពីរបស់ខ្លួន → ចិត្ត

⑤ ការការពិនិត្យ best path → ចិត្ត

↳ ចិត្តនេះ → រួម resource ឱ្យបានការ, គឺមានរាយដោយប្រើ SPF, ឬ bandwidth នៃភាពធនាន់

### ↳ OSPF

↳ data structure

Database	Table	អង្គភាព
Adjacency Database	Neighbor Table	shu ip ospf neighbor
LSDB	Topology Table	shu ip ospf database
Forwarding Database	Routing Table	shu ip route

↳ ospf message

↳ ① hello → ផ្ទេរព័ត៌មានអ្នកជុំបាន

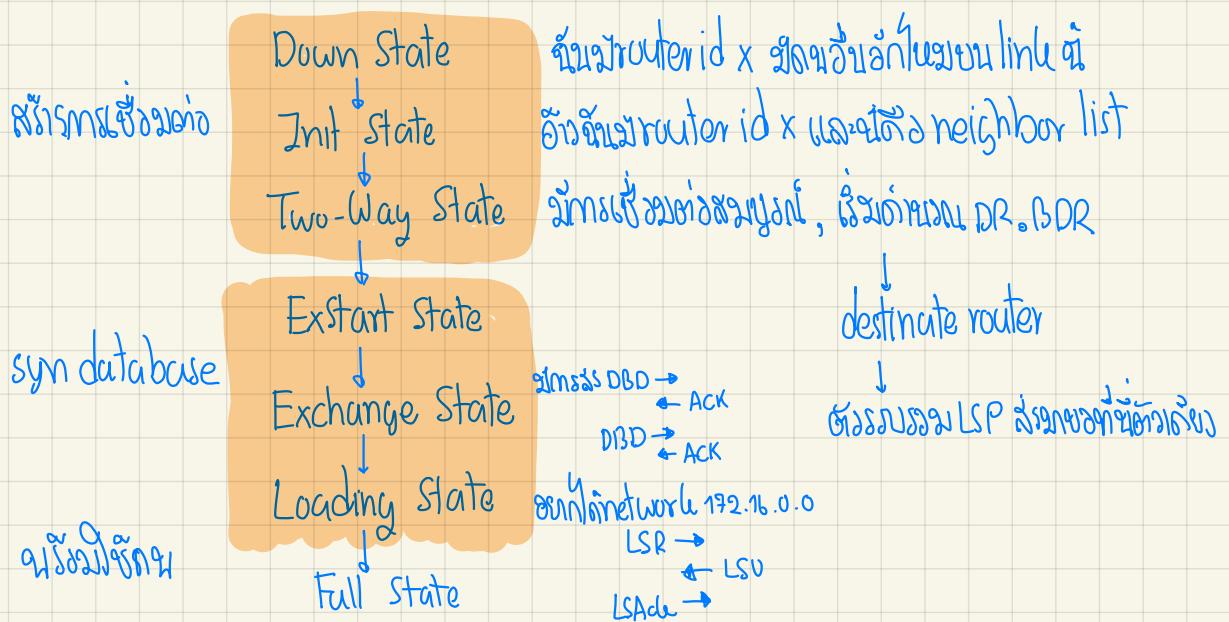
② Database Description (DBD) → សមតារមិនស្វែងរកទៅលើ router

③ Link-State Request (LSR) → ទទួលទៅស្វែងរកតាមអ្នកដែលស្ថិតនៅលើ

④ Link-State Update (LSU) → ផ្តល់

⑤ Link-State Acknowledgement (LSA ack) → ack

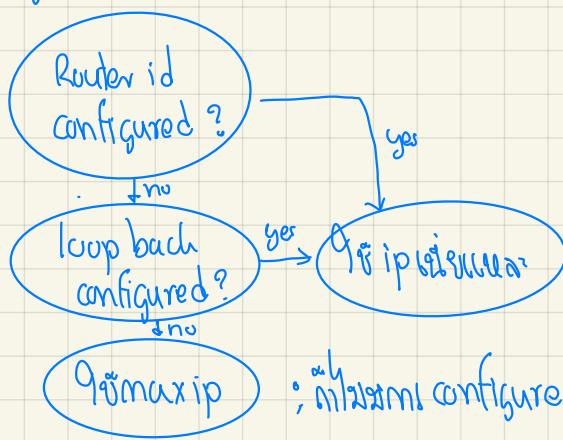
## ↳ ospf operation →



## ↳ Configuration

↳ process id ⇒ local significant

↳ router id



; ក្នុងក្នុង config → link id → router id ដែលត្រូវ

↳ cost =  $\frac{\text{ref bw} (10^8)}{\text{int bw}}$

10G	$10^{10}$
G	$10^9$
F	$10^8$
E	$10^7$

ក្នុង setting ទៅនឹងលើលើលើលើលើ (Mbps)

## DHCP

↳ llanip → manually =

→ automatic =

→ dynamic = ប្រព័ន្ធដែល

↳ router នឹងប្រើប្រាស់ broadcast

↳ operation → ① dhcp discover(broad cast)

“ទូរសព្ទ ip លោកស្រី”

② dhcp offer

“តើ ip ឲ្យបាន”

③ dhcp request (broad cast)

“ឯកសារ ip ទីនា”

④ dhcp ack

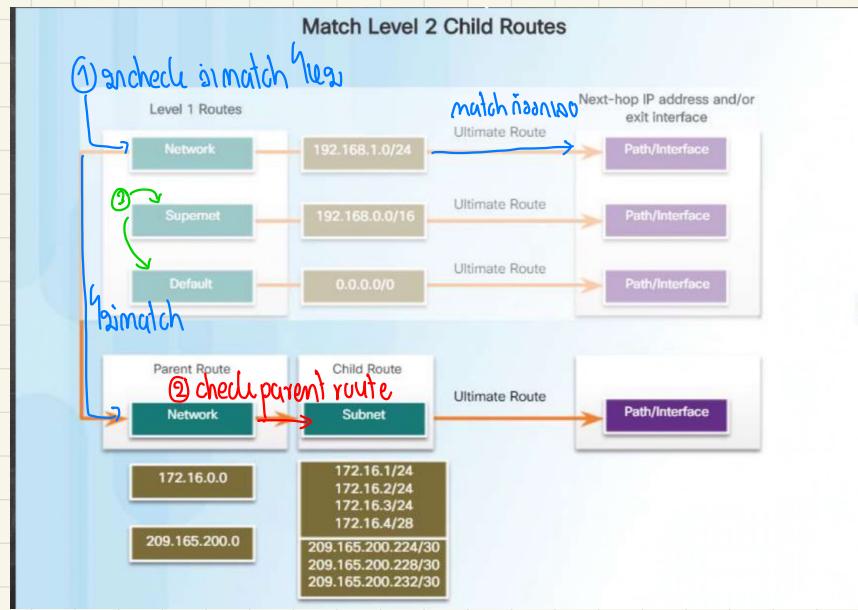
“គឺជាបាន”

# Routing Table Term

- ↳ Level 1 route
- ↳ Network route → quan classful
- Supernet route → mark 2 classful mark
- Default route

↳ ultimate route = route ~~quán~~ ~~quán~~ ~~quán~~

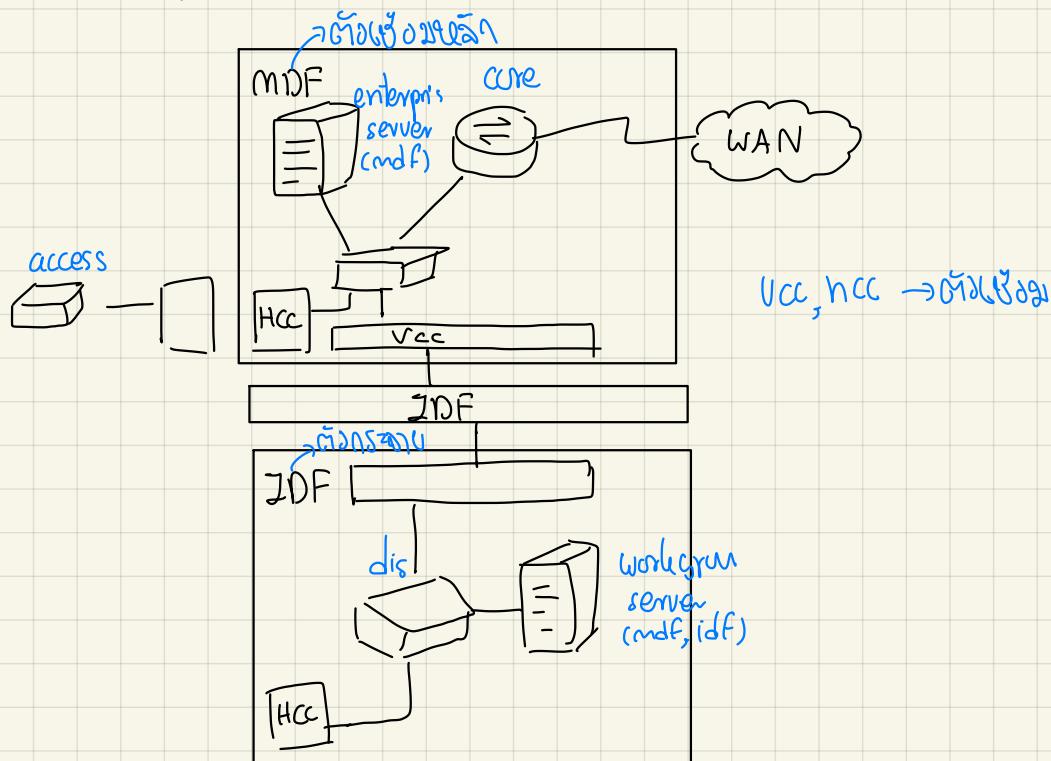
## ↳ Route Lookups Process



## 07 Basis Switch & Address Resolution Protocol

### ↳ LAN Design

↳ ព្រឹមនៃចំណែកអាជីវកម្ម → <core , distribution>, access



### ↳ Collision Domain

↳ ជាការងារដែលបានរាយឡើង និងបានរាយឡើង → នូវ bus

### ↳ Broadcast Domain

↳ ជាការងារដែលបានប្រាប់ប្រាប់ broadcast → layer 2

### ↳ The Switched Environment

#### ↳ Switch Operation

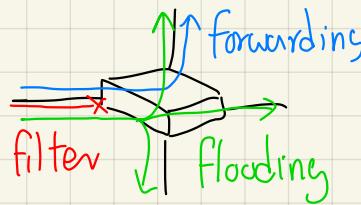
① Learning (រាយការណ៍ថា frame នីមួយៗមែនពីរ)

② Aging → ស្ថិតិ ①

③ Flooding

④ Forwarding

⑤ Filter



↳ នៅផ្លូវ

Receive frame

↓  
Learn & aging

↓  
Is it broadcast, multicast or unicast?

no

↓  
source, dest នៅទីនេះក៏?

yes

↓  
forwarding

↓  
filtering

## ↳ Frame Forwarding

- ↳ 2 នៅ → ① store and forward → ត្រូវ  
② cut-through → ត្រូវបានស្វែងរកដោយចេញទៅថ្មី

## ↳ Switch Port Security

- ↳ mode នៃសង្កាត់ → ① static → ត្រូវមាន <sup>info</sup> MAC address  
② sticky → <sup>ត្រូវពាក្យ</sup> ត្រូវលើក្រុង <sup>ត្រូវពាក្យ</sup> <sup>ត្រូវលើក្រុង</sup>  
③ dynamic → ត្រូវពាក្យ <sup>ត្រូវលើក្រុង</sup> <sup>ត្រូវពាក្យ</sup>

## ↳ violation mode

	forward	send sys log	display err msg	increase violation c	shutdown p
protect					
restrict		✓		✓	
shutdown				✓	✓

## ↳ Address Resolution Protocol

- ↳ mapping ip to mac address រាយការណាស់ ip xxxx ត្រូវត្រួតពិនិត្យ

## ↳ Subnet Planning

Network	RegHost	MacHost	Subnetwork	Subnetmask	រាយការណាស់
៩០		២,៦,១៤,៣០ ៦៤,១២២	x.x.x.y	២៥៥.៧.៧.៧	.....

## 08 STP

### ↳ Redundancy

↳ សម្រាប់ផ្លូវចុះទៅ → បិន្ទាន → broadcast stream, ពិនិត្យមានចំណាំ > 1 frame, mac address មានចំណាំរបៀប

### ↳ Spanning Tree Protocol

↳ សម្រាប់ផ្លូវចុះទៅលើ loop → ក្រឡាសម្រាប់ផ្លូវចុះទៅលើ loop ដឹងបាន

↳ មែន → one root bridge per network

one root-port per non root-bridge

one designate port per segment

↳ ក្រឡាសម្រាប់  
① ជាន root bridge

② ជាន root port

③ ជាន designate port

④ ជាន non-designate port

↳ stp operation

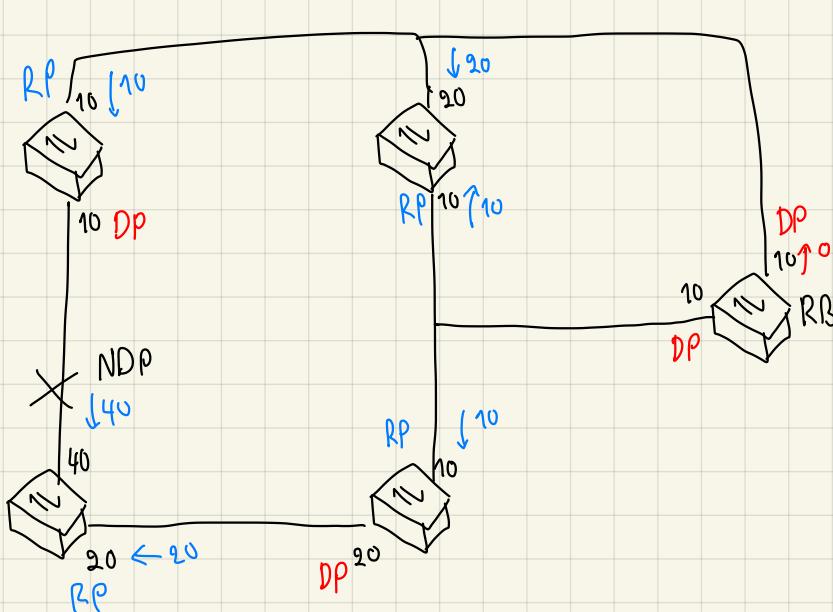
priority + extended (ulam)

↳ ① root bridge → bridge id = priority + mac → min (bridge id) = root bridge

② path cost

↳ BPDU      Root ID : មួយទីនាម  
Bridge ID : មួយទីនាម  
cost : តាម

; នឹងរាយនៃលទ្ធផលីតិ៍នេះ → ស្ថាល់នៅក្នុងប្រព័ន្ធ



① ជាន ID

② ជាន RP

③ ជាន PP

; min cost ត្រូវក្នុង → តាមលោក

## 09 VLAN & Inter VLAN

### ↳ VLAN (1-1005)

- ↳ ရှိခိုက်သူ၏ switch တွင်
- ↳ nonbroadcast domain
- ↳ ပေါ်လုပ်နည်းလမ်း

### ↳ VLAN in a Multi-Switched Environment

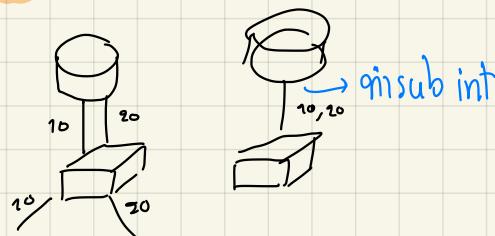
- ↳ ပို့ဆောင်ရေးလုပ်ဆောင်ရေးနယ်မြေ၏ interface (ဆိုလျော့မြန်မာရှိနှင့်)
- ↳ မိုးရှုံး 1 interface များအတွက် 1 VLAN

### ↳ Tagging Ethernet Frames for VLAN Identification

- ↳ မြန်မာရှိနှင့် လုပ်ဆောင်ရေးနယ်မြေ မှာ → miss tag
- ↳ မြန်မာရှိနှင့် trunk မြော်လောက်သူ၏ လုပ်ဆောင်ရေးနယ်မြေ
- ↳ native VLAN → VLAN မှာမူများ၏ tagging

### ↳ Inter VLAN Routing

- ↳ ပို့ဆောင်ရေးနယ်မြေ



## 10 UTP & NAT

### ↳ Utp (vlan trunking protocol)

↳ ក្នុងការពារនៅលើ trunk

↳ ការចូលរួម domain

↳ ចំណាំការ VLAN វិត → ឱ្យកែក្រុង NVRAM

↳ វិធានលេងការកែក្រុងការផ្តល់ឯកសារ (configuration revision)

	Server	Client	Trunk
source utp message	/	/	
listen to utp msg	/	/	
create vlan	/		/
remember vlan	/		/

### ↳ Adding a switch to an existing UTP domain

↳ ឈរលើសទៅក្នុង → ការកែក្រុងការពារនៅលើ server, configuration revision នឹង → VLAN នៃខ្លួន  
↳ VLAN នៅលើសបានរួមឲ្យបានដោយ

### ↳ Pruning

↳ ការលើសនៅលើ VLAN នៃខ្លួនទៅលើ broadcast

## NAT (network address translation)

↳ ផលកការតែងតាំង ip private តែងតាំង → ip global តែងតាំងបាន

### ↳ Type of NAT

↳ static nat → m private : n public ; only m can travel

↳ dynamic nat → m private : n public ; only n can travel

↳ pat → m private : n public ; more than n can travel

### ↳ Pros & Cons

↳ ip ងារ  
security ↑

↳ អ៊ីន  
trackless

## 11 EIGRP & IPV6

### ↳ EIGRP

↳ เป็น distance vector routing protocol

↳ features → DUAL algorithm → 有多個 backup path , 有 backup path

→ establishing neighbor adjacencies

→ Reliable Transport Protocol | ใช้ transport layer

→ update 通知更新

→ กรณี load balance กรณี cost ไม่ต่างกัน

↳ ภายใน protocol { neighbour, topology, routing table }

↳ packet type : → hello ผู้รับทราบข้อมูล (multicast)  
update ผู้อัปเดตข้อมูล , สร้าง route table

ack

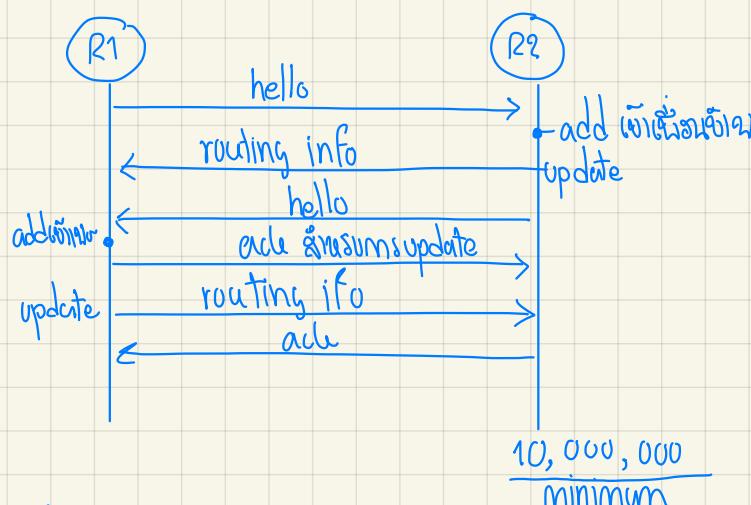
query request specific information

reply response to query

↳ AS จัดการส่วนตัวภายใน domain ของเราย

↳ router-id เดียวกันกับ OSPF

↳ operation →



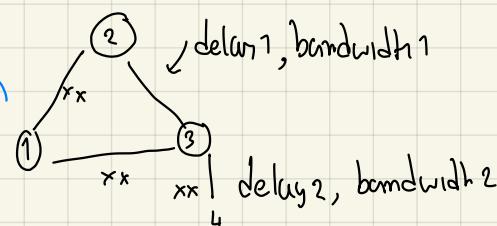
ซึ่งมี DUAL 9 ขั้นตอน  
best path

↳ eigrp metric

↳ default → bandwidth , delay → cost = [bandwidth + delay] \* 256

↳ delay = sum of delay

↳ ต้องการ interface ที่จะมาต่อสู่ภายนอก



จาก ② → ④)

## ↳ DUAL and Topology Table

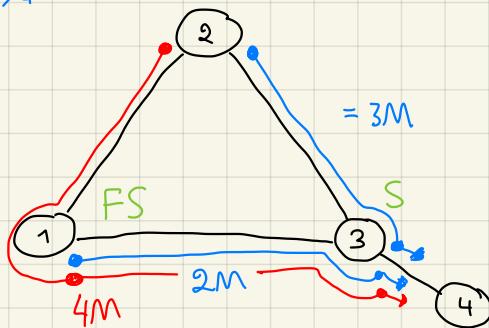
↳ គិតលក្ខណៈផែនក្នុង  $\rightarrow$  ① Successor (S) = ម៉ោងទាំងចាត់ទីនៃប៉ុណ្ណោះ

② Feasible Successor (FS) = ពីរណឹង distance (RD) ដូចខាងក្រោម FD

③ Reported Distance (RD) = មាតាការដែលបានបញ្ជាក់ថ្មីជាបន្ទាល់

④ Feasible Distance (FD) = cost សំរាប់ទំនួលទីនៃប៉ុណ្ណោះ

ក្នុង  $\rightarrow$  ៤



ផែនក្នុងក្នុង  $\rightarrow$  ៤

$\hookrightarrow$  FD ទៅលើលើលើលើ = 3M

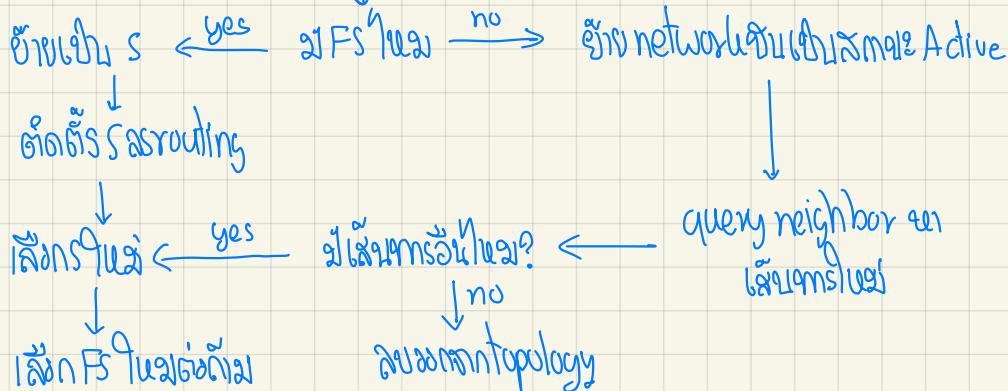
វាគ័យបានបញ្ជាក់ = 4M

$\hookrightarrow$  នៅពេល RD តាក់រុកលើក្នុង ៤ < FD

$\hookrightarrow$  ១ ម៉ោង FS

## ↳ DUAL and Convergence

successor នៅក្នុង



↳ IPv6 (128 bit)

↳ မြန်မားသူ၏ V<sub>4</sub> → V<sub>6</sub> → hw , tunneling , translation

↳ မြန်မားသူ၏ V<sub>6</sub> → ① ပို့ဆောင်ရွက် → CO2 → ၃

② ဘို့ဆောင်ရွက်သူ၏ လုပ်ချက်၏ ၁ :: ၀ :: A → ၁ :: A