

Users Equal Distribution on Multi-PPPoE Servers

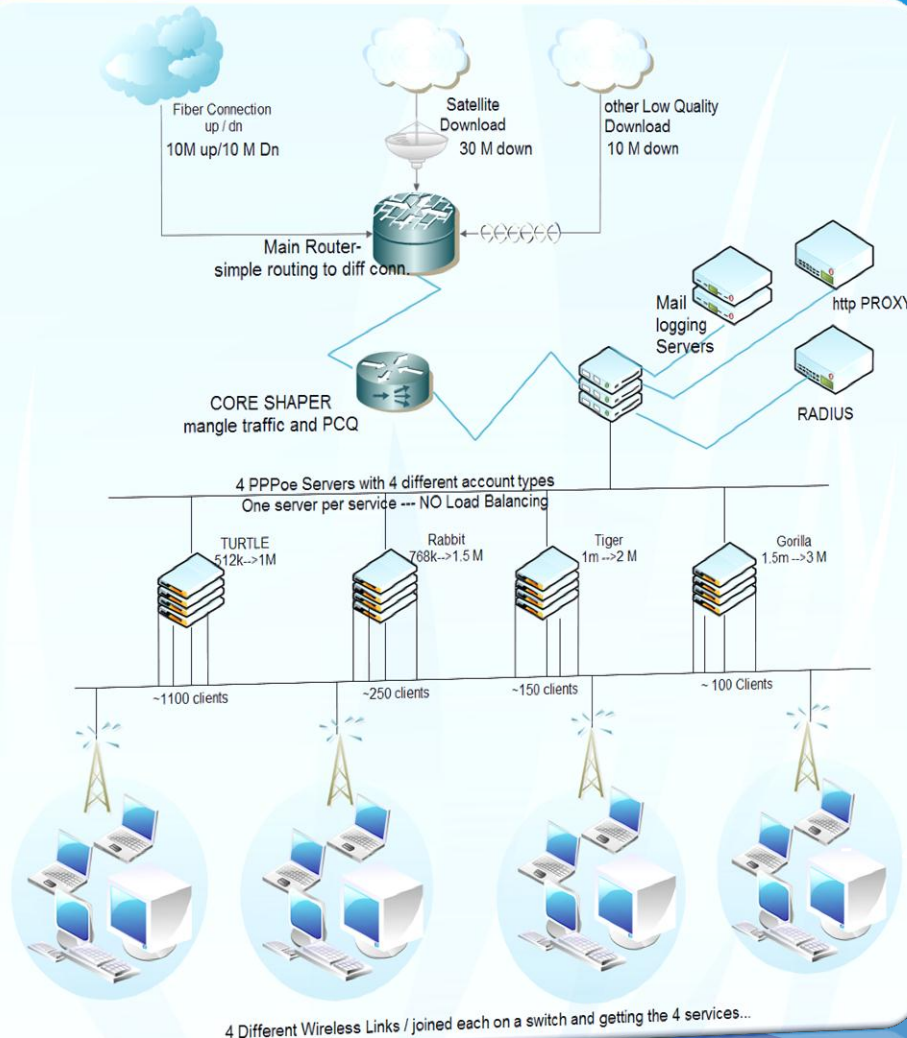
Using RouterBoard and RouterOS

Charbel Matta – Fast2serv , Lebanon.

MuM Dubai – Aug 2012 .

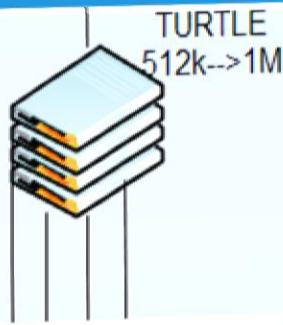


Current Scenario – Case Study:

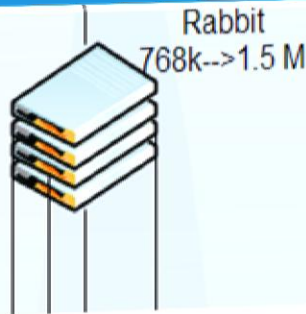


- Wisp had the following:
- Approx ~1500+ users (10% monthly growth)
- 4 Different wireless Links
- 4 PPPoe servers
- 4 account types and Service

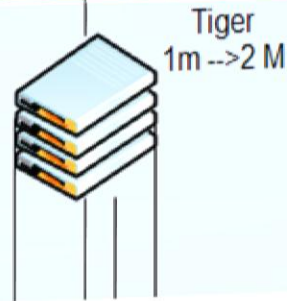
Case Study : ppp distribution



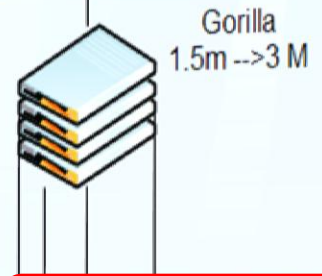
850 Turtle



540 Rabbit



200 Tiger



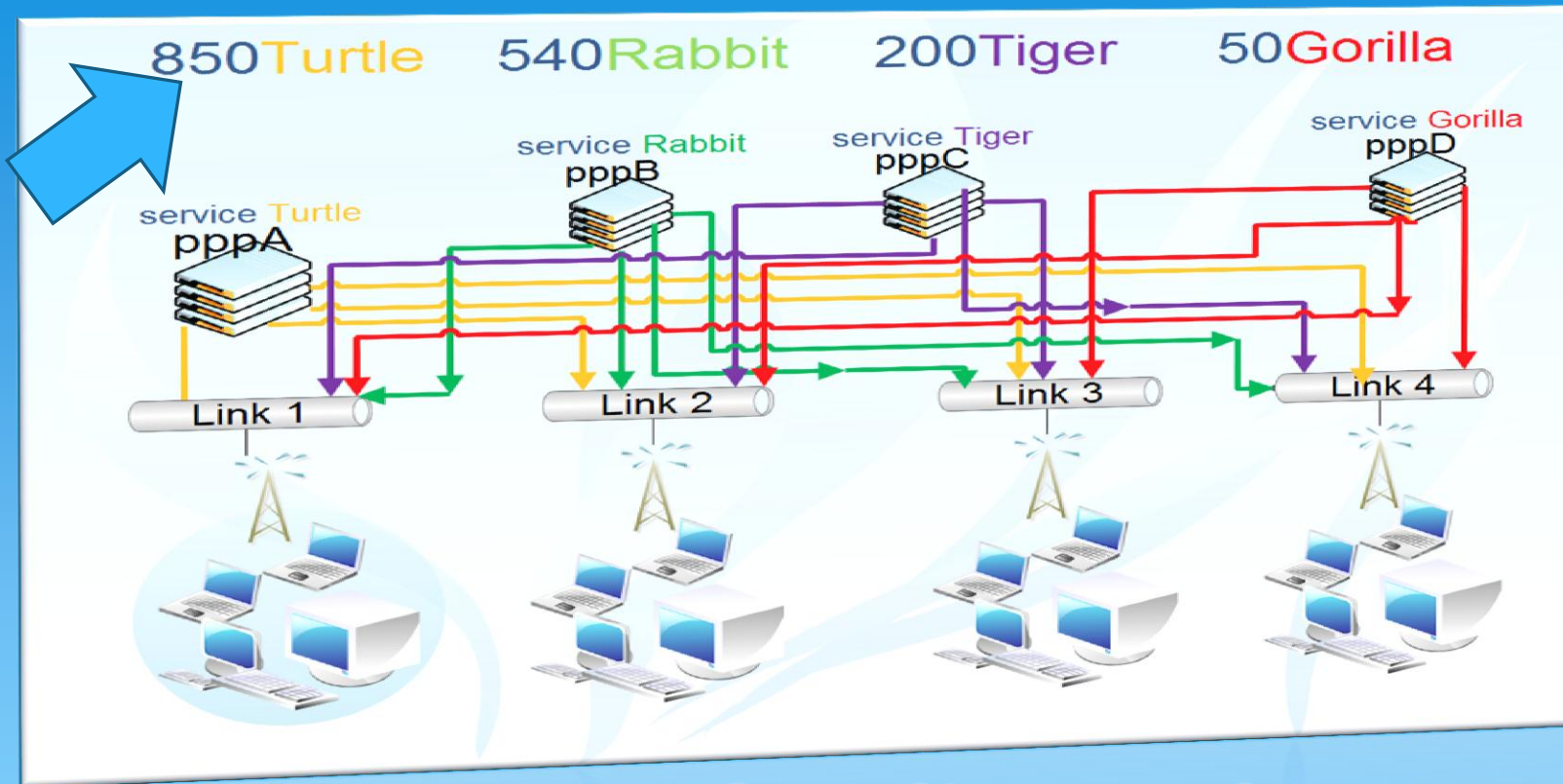
50 Gorilla

- 4 Services are offered with different prices

- This is giving unbalanced distribution as pppoe clients per one concentrator

- ex: gorilla have ~50 clients turtle have ~850

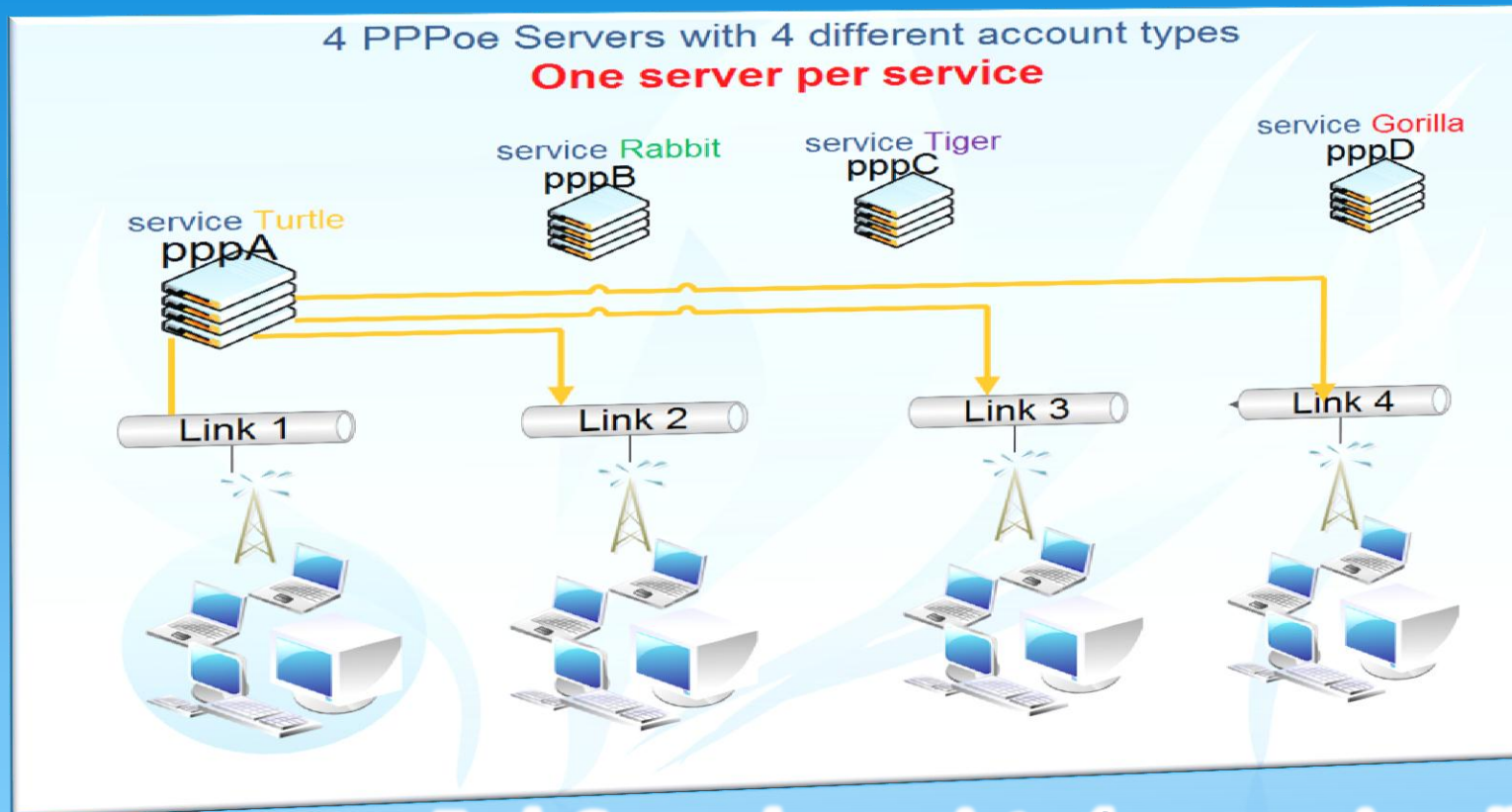
Current Scenario – Closer Look:



as demand is more on low cost Account
Normally pppA(turtle) is congested ~ 900Users

NO Load Balancing

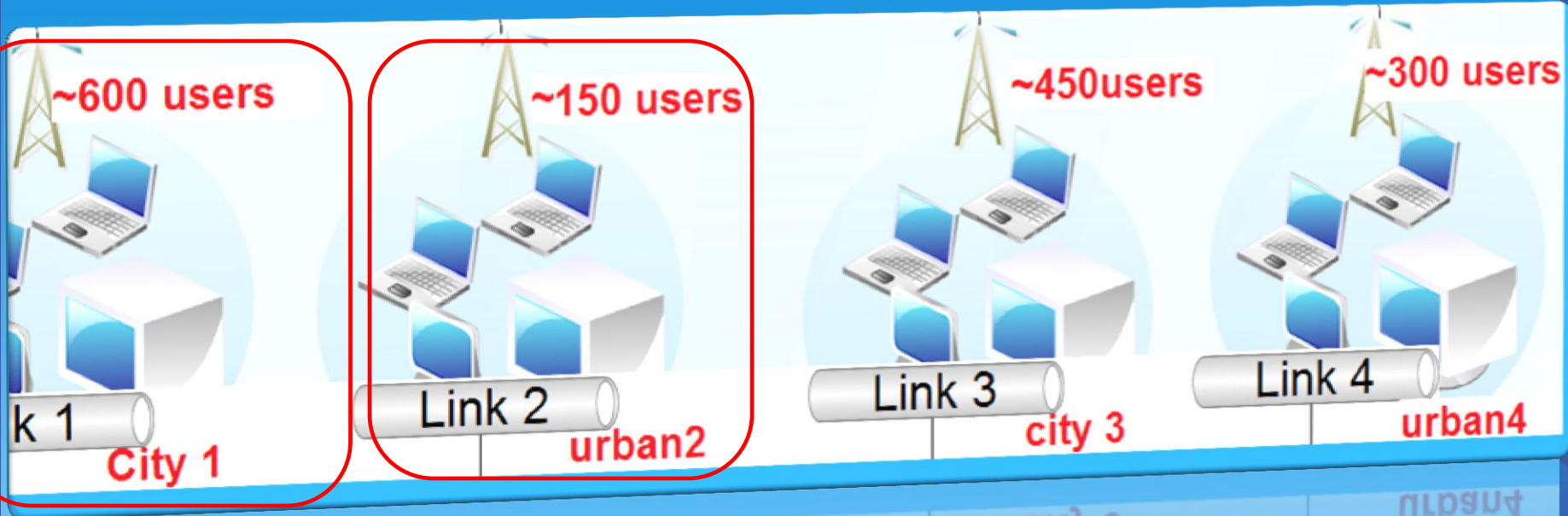
Current Scenario – Closer Look:



Each Server have 4 interfaces serving all 4 Links
one interface for every link

One Server per Service

Case Study: wireless Links

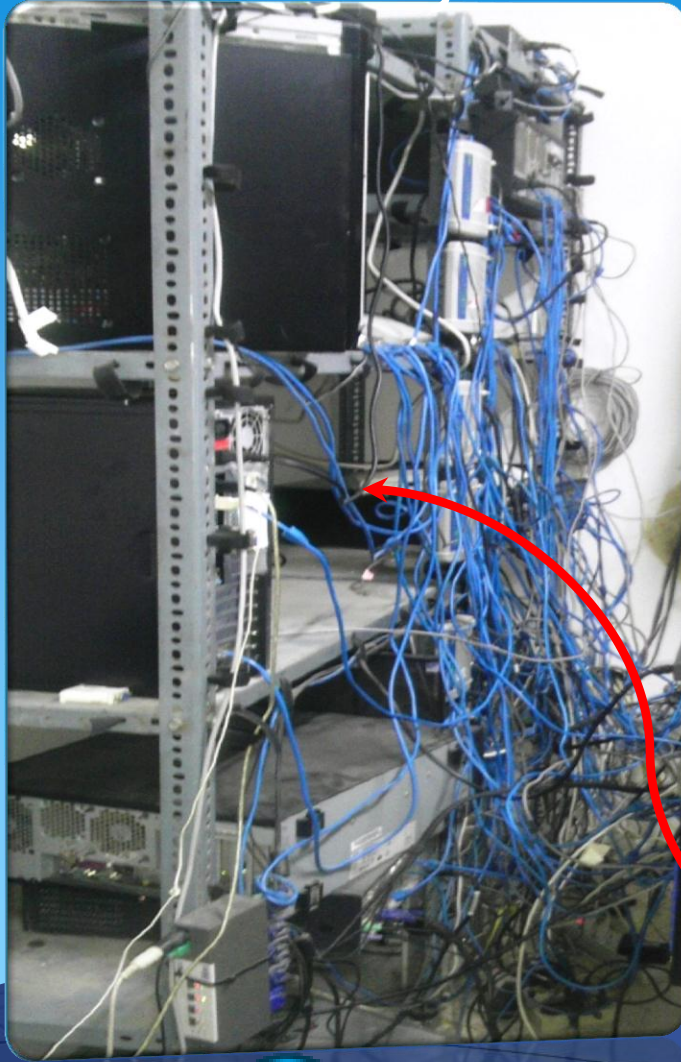


-All 4 links serves different areas (city and suburbs)

thus it is not possible to have one server per link

ex: link 1 have total of ~600 clients and link2 d have only ~150

Case Study: old servers



Old Servers are all x86 running routerOS with low resources .

No Organisation –Chaos

the clients are divided into 4 different wireless links then joined with basic switches along with one interface from each concentrator.

Where is pppA ????
True Cable Jungle

Case Study: Requirements

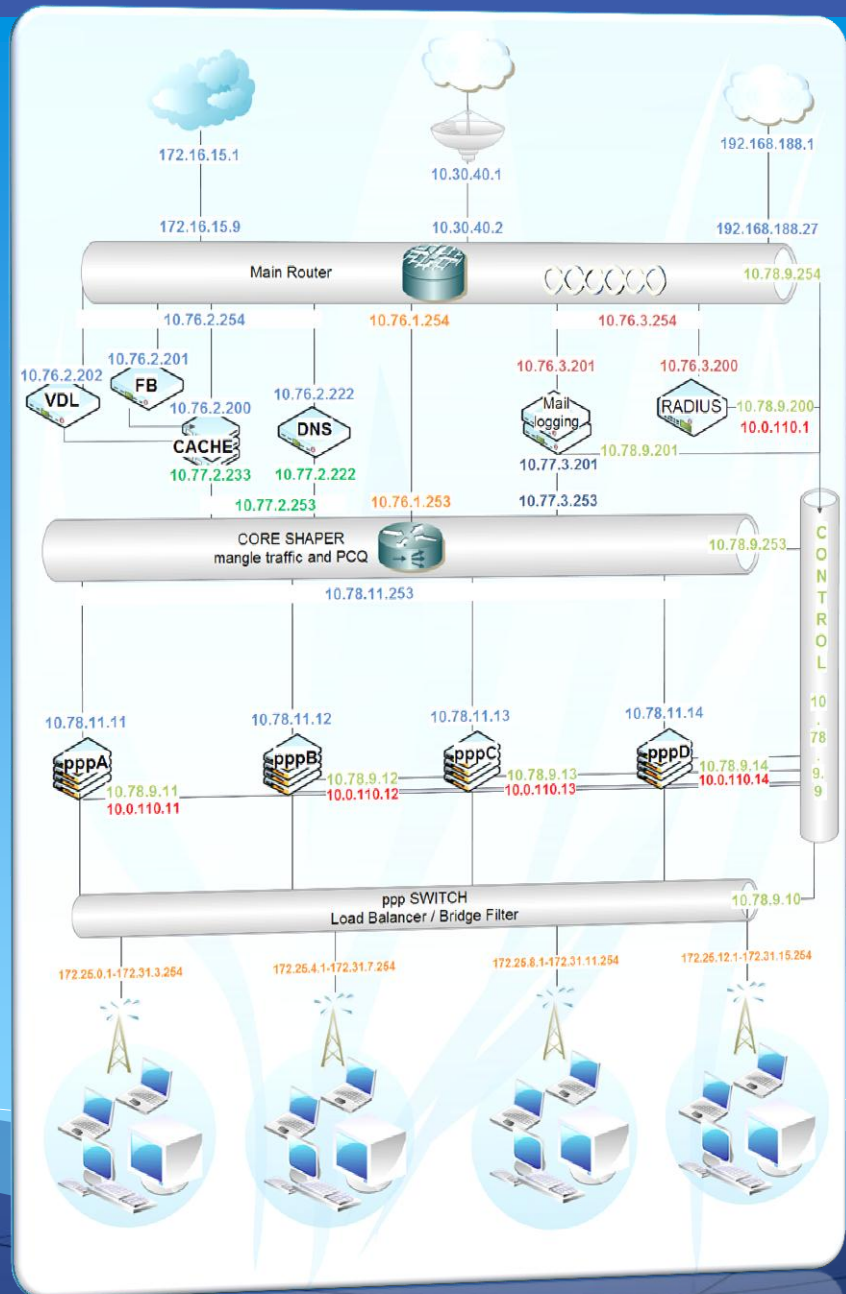
- Chaos needs reorganization and New Topology...
- Old Servers Systems Needs to be replaced...
- All 4 links must be joined in one network somehow...
- Need load balance pppoe on all 4 servers.
- Need System scalability
(as growth is ~150+ users/month)



Solution: topology

Chaos needs
reorganization and
New Topology, how?

Design New Topology



Solution: Hardware

- **Old Servers Needs to be replaced**

What To Choose ???



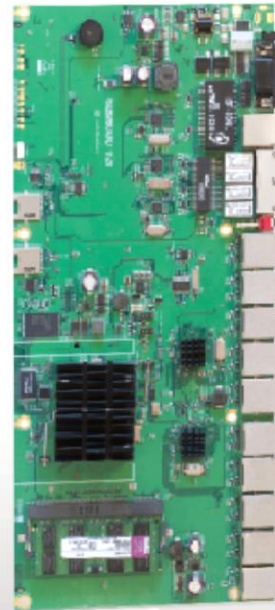
RB1100AHx2



Dual
Core

2GB

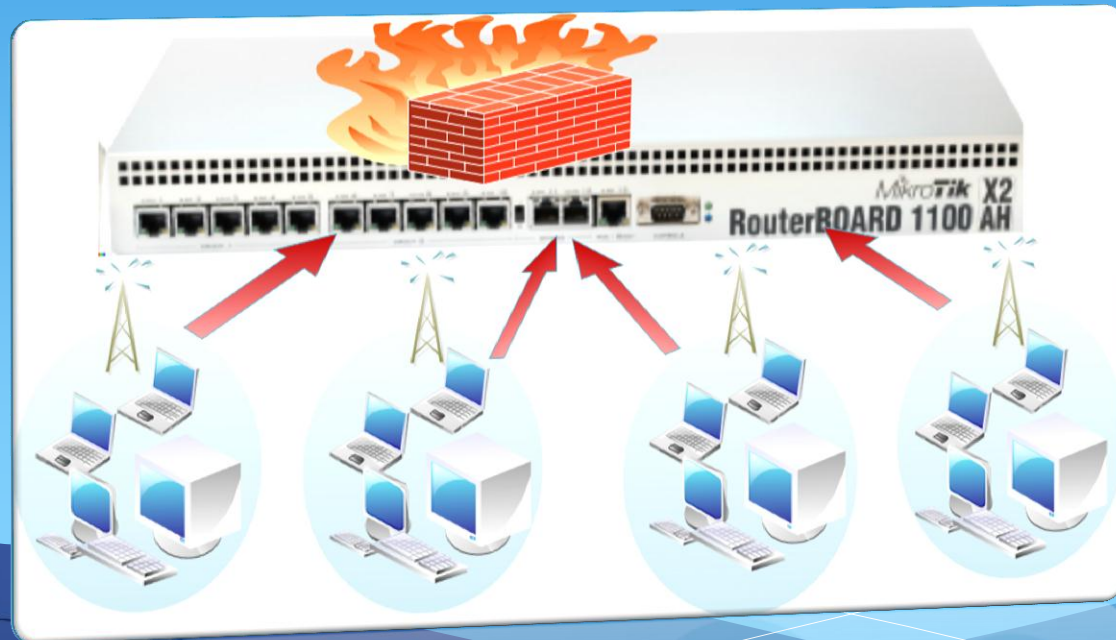
13 Gbits ports



Solution: Bridge

- **Wireless Links Needs
to Be Joined together, How?**

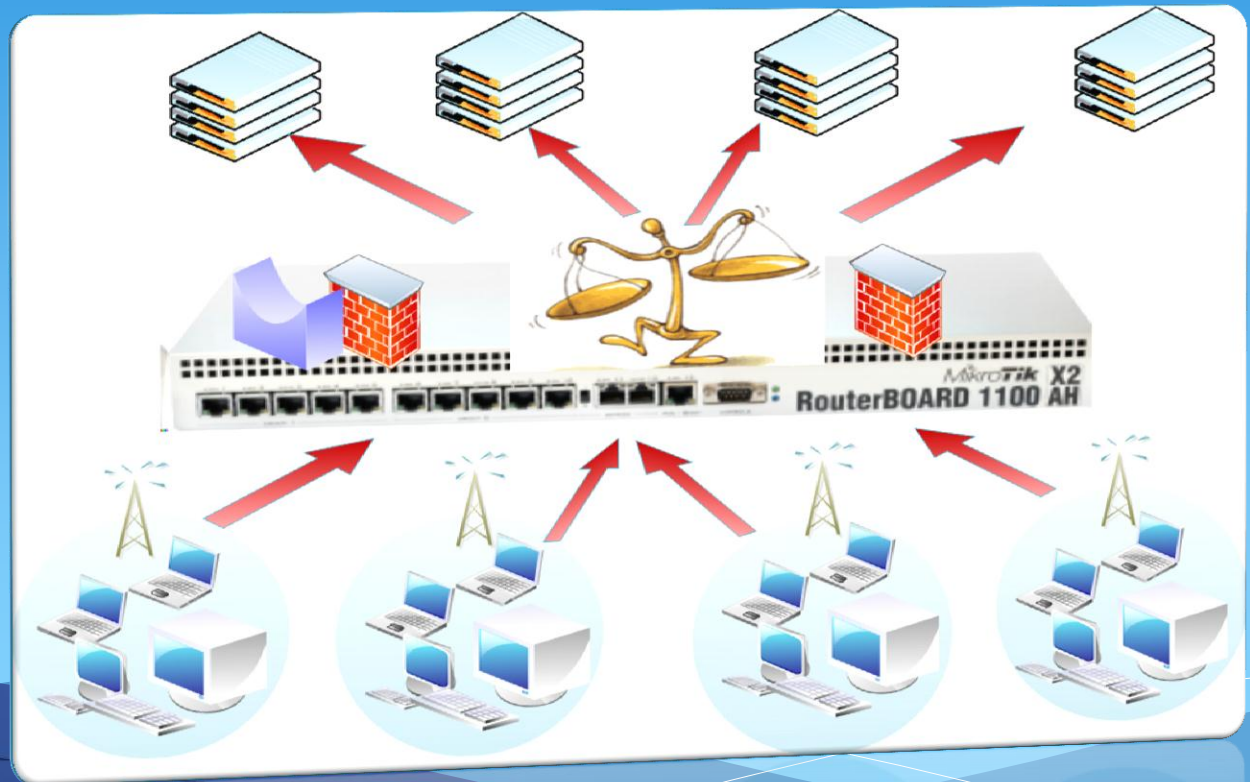
Bridge ALL Links and use routerOS Firewall Bridge



Solution: Load Balance

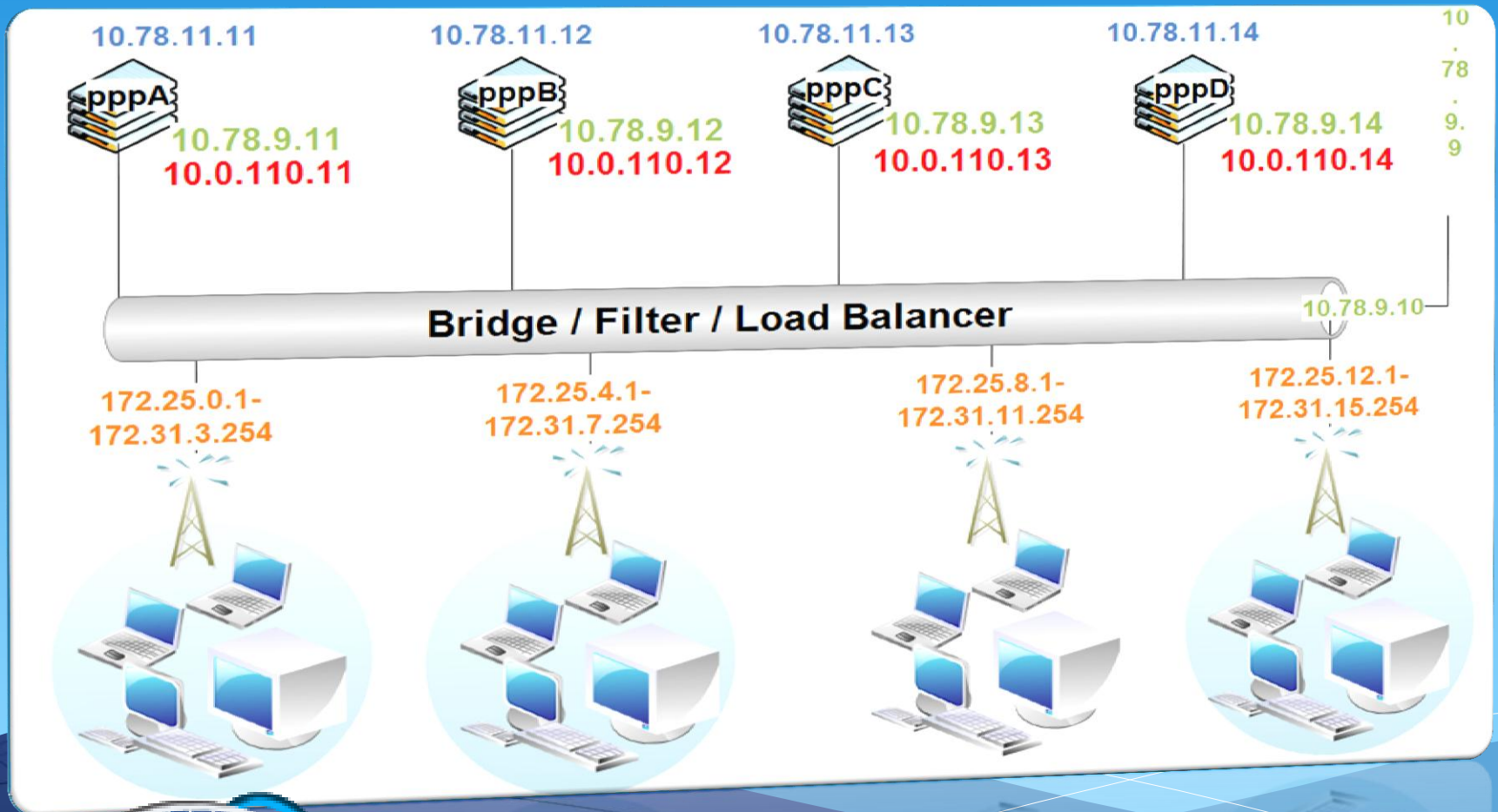
- **Load Balance pppoe Connections**

Tune the previous bridge to act as load balancer



Solution: Load Balancer

Closer look to configuration:

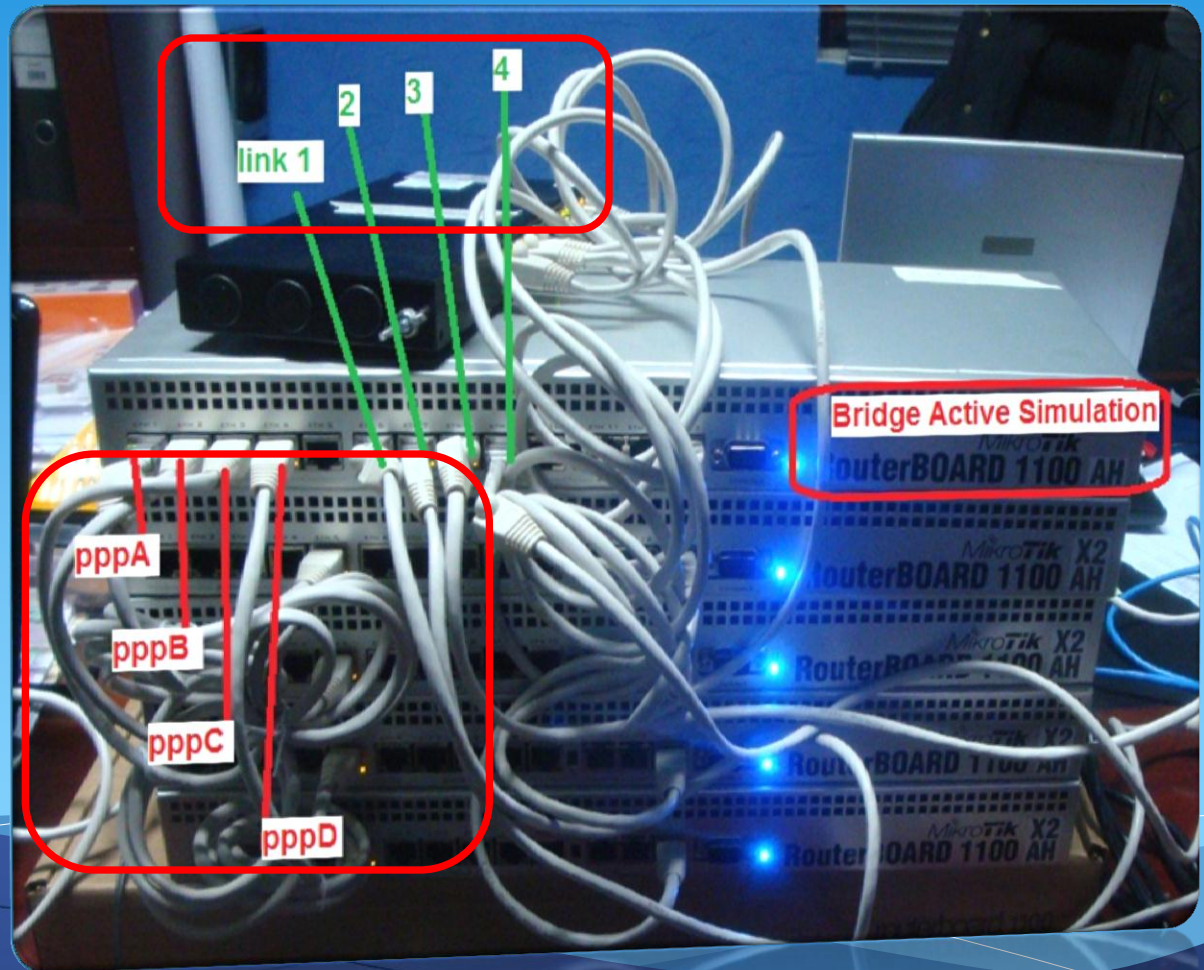


Solution: Load Balancer

load balance LAB:

4* 1100AHx2 as
pppoe servers

1 * 1100AH as
Bridge/firewall



Solution: Bridge

Bridge ALL Links and pppoes

- Create Bridge with ALL links and pppoe servers as ports

The screenshot displays two windows from the Mikrotik WinBox interface. The 'Interface List' window on the left shows a table of network interfaces. The 'Bridge' window on the right shows the configuration for a bridge named 'Main Switch'.

	Name	Type
	Laptoptest	Ethernet
R	Link1	Ethernet
R	Link2	Ethernet
R	Link3	Ethernet
R	Link4	Ethernet
R	Main Switch	Bridge
R	PPPA	Ethernet
R	PPPB	Ethernet
R	PPPC	Ethernet
R	PPPD	Ethernet
	PcTest	Ethernet
R	control	Ethernet
	ether11	Ethernet
	ether12	Ethernet

Interface	Bridge	Prio
Laptoptest	Main Switch	
Link1	Main Switch	
Link2	Main Switch	
Link3	Main Switch	
Link4	Main Switch	
PPPA	Main Switch	
PPPB	Main Switch	
PPPC	Main Switch	
PPPD	Main Switch	
PcTest	Main Switch	

Solution: Bridge Firewall

After bridge we will use routerOS Firewall Facility

- Bridge Filter Drop ALL except:
pppoe –discovery (8863)
pppoe Sessions (8864)

Terminal

```
[admin@Switch] /interface bridge filter> print
Flags: X - disabled, I - invalid, D - dynamic
0 chain=forward action=accept mac-protocol=pppoe-discovery
1 chain=forward action=accept mac-protocol=pppoe-session
2 X chain=forward action=drop
```


Solution: pppoe servers

after firewall we
create all PPPoe
servers

4 pppoe servers

4 Service names

4 ip pools

PPPC - WinBox v5.14 on RB1100AHx2 (powerpc)

ALL PPPoe Servers Has same config

IP Pool

Name	Addresses	Next Pool
TurtlePool	172.26.8.2-172.26.11.254	none
RabbitPool	172.27.8.2-172.27.11.254	none
TigerPool	172.28.8.2-172.28.11.254	none
GorillaPool	172.29.8.2-172.29.11.254	none

PPP

Interface PPPoE Servers Secrets Profiles Active Connections

Service	Interface	Max MTU	Max MRU	MRRU	Default Profile	Authenti
Turtle	ppp-out	1480	1480		Turtle	pap
Tiger	ppp-out	1480	1480		Tiger	pap
Rabbit	ppp-out	1480	1480		Rabbit	pap
Gorilla	ppp-out	1480	1480		Gorilla	pap

Interface List

Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel
Name	Type	L2 M		
R control	Ethernet			
R ether1	Ethernet			
R ether2	Ethernet			
R ether3	Ethernet			
R ether4	Ethernet			
R ether6	Ethernet			
R ether7	Ethernet			
R ether8	Ethernet			
R ether9	Ethernet			
R ether10	Ethernet			
R ether11	Ethernet			
R ether12	Ethernet			
R ppp-out	Ethernet			
DR <<pppoe-gorilla3-1>	PPPoE Server			
DR <<pppoe-gorilla3-2>	PPPoE Server			
DR <<pppoe-gorilla3-3>	PPPoE Server			

Terminal

```
[admin@PPPC] > ppp secret print
Flags: X - disabled
# NAME SERVICE CALLER-ID PASSWORD
0 turtle4 pppoe turtle4
1 rabbit1 pppoe rabbit1
2 tiger1 pppoe tiger1
3 gorilla1 pppoe gorilla1
```

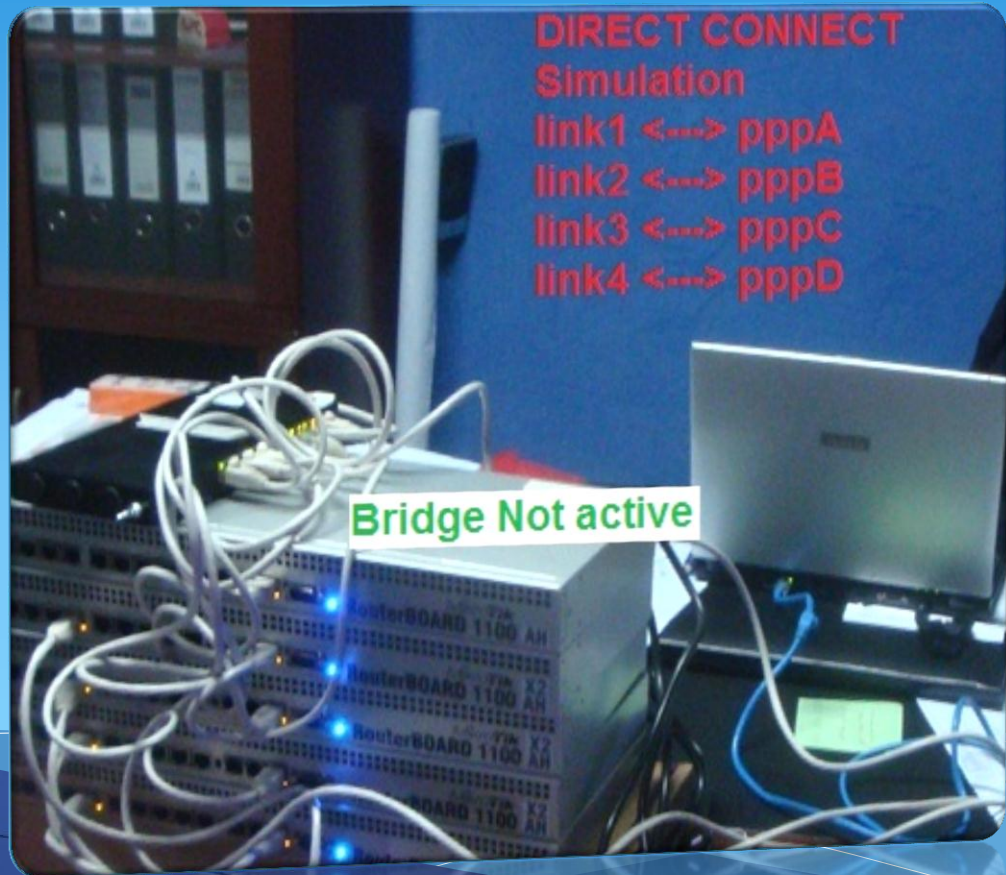
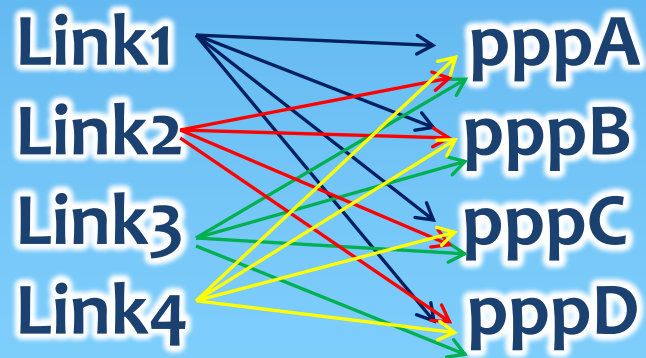
Terminal

```
1 name="Turtle" local-address=172.26.8.1 remote-address=172.26.8.254
  use-mpis=default use-compression=default use-vj-compression=default
  use-encryption=default only-one=default change-tcp-keep-alive=0
2 name="Rabbit" local-address=172.27.8.1 remote-address=172.27.8.254
  use-mpis=default use-compression=default use-vj-compression=default
  use-encryption=default only-one=default change-tcp-keep-alive=0
```

Solution: Simulator

- Using RB433 connected to all 4 link ports we created script to simulate ~500 real clients connections .

Direct connect
Simulation



Solution: Simulator result

The screenshot displays the RouterOS WinBox interface with four separate PPPoE user lists, each highlighted with a red box and labeled with red text:

- pppA 154 users**: 154 items (1 selected)
- pppB 150 users**: 150 items
- pppC 113 users**: 113 items
- pppD 143 users**: 143 items

Each list shows a table of users with columns for ID, profile, MAC address, and IP address. The users are distributed across four servers (turtle1, turtle2, turtle3, turtle4) in a non-equal manner.

NoN equal Distribution between the pppoes

pppoe sessions are distributed arbitrary on all 4 servers....

Pppoe Discovery have 16 service

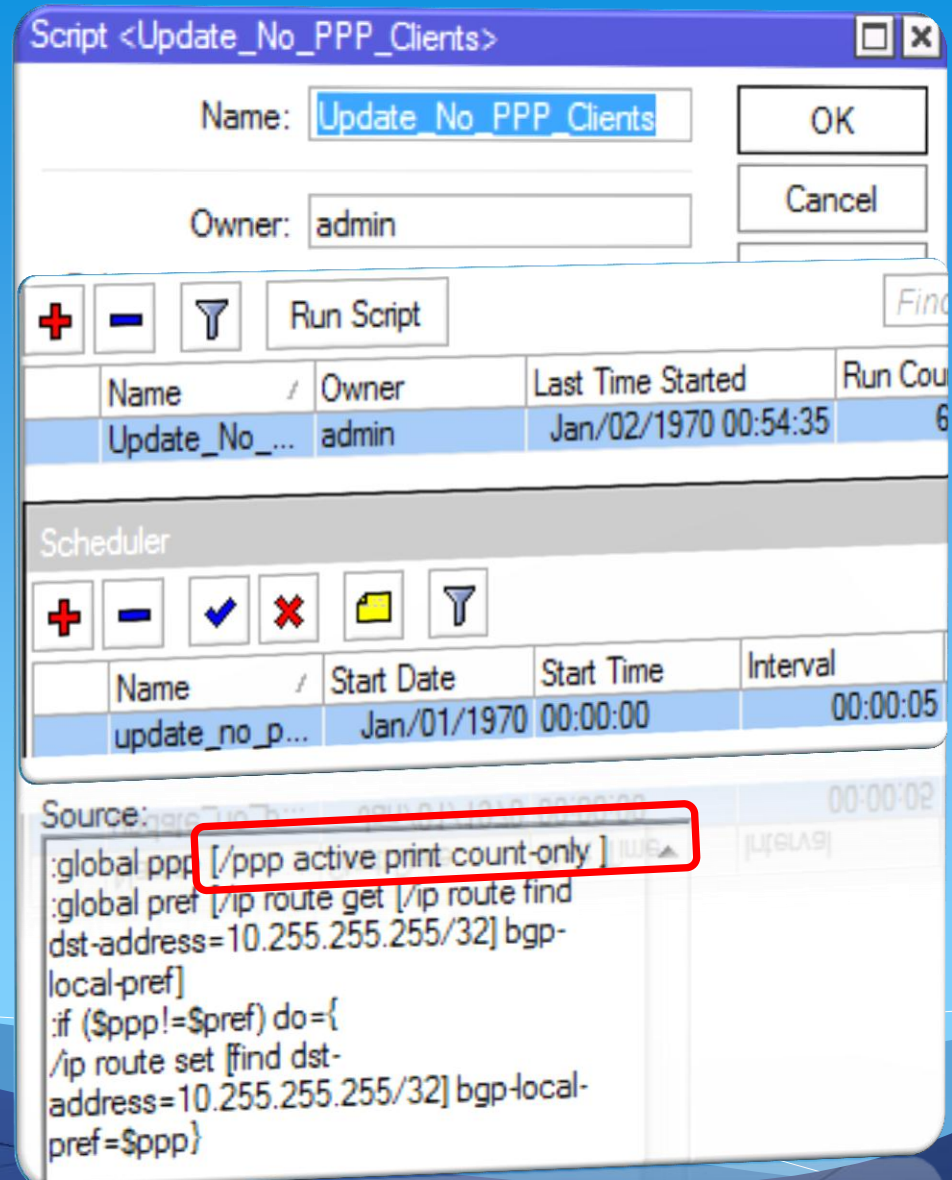
(4 Gorilla 4tiger 4Rabbit 4Turtle)

Solution: #connected

- In Order to load balance we need to know at anytime how many users are connected to each pppoe server

create and Schedule every 5s script to update the NO' of connected users

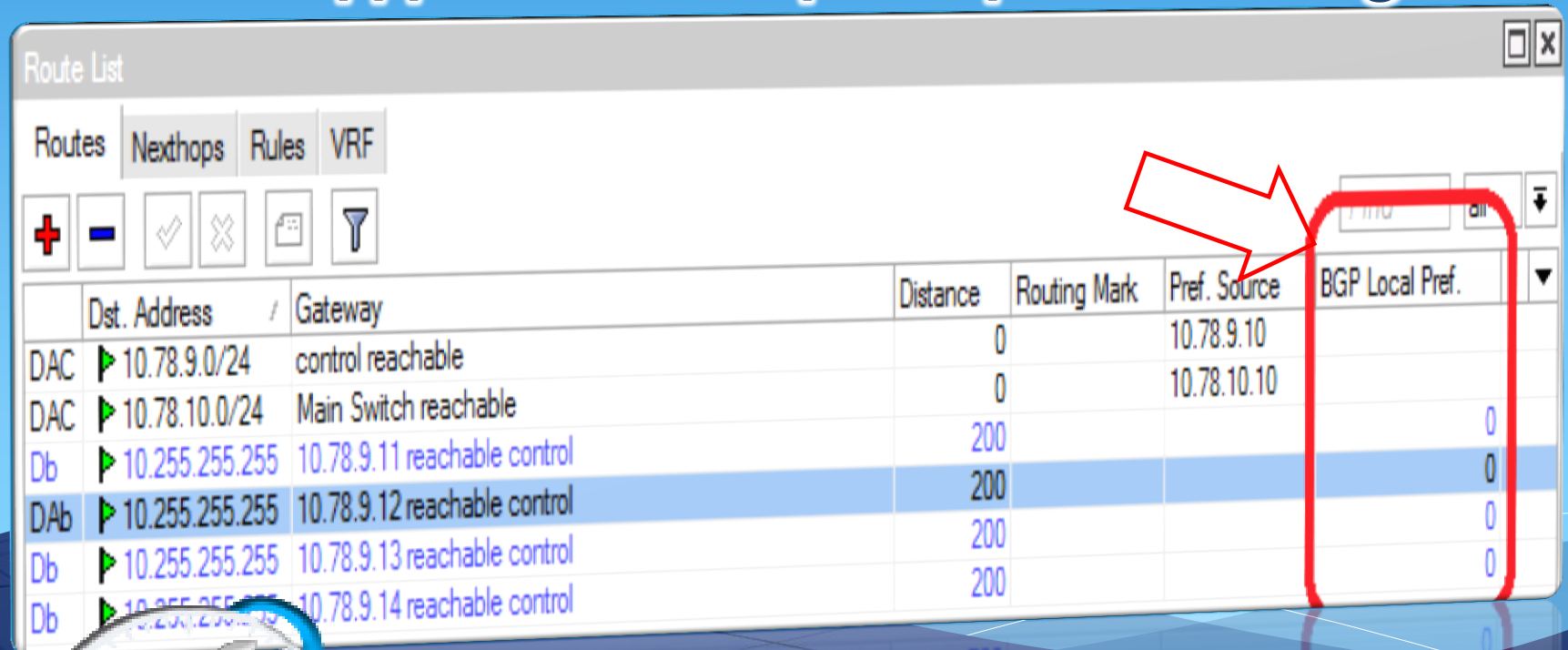
/ppp active print count-only



Solution: Load Balancer

-Now that the Number of active ppp is know on each server,How to pass it to Bridge ????

Create local BGP between ALL pppls and bridge, where we Store the # of ppp in BGP Local pref & pass it to bridge...



Route List

Routes | Nexthops | Rules | VRF

+ - ✓ ✗ [icon] [icon]

	Dst. Address / Gateway	Distance	Routing Mark	Pref. Source	BGP Local Pref.
DAC	▶ 10.78.9.0/24 control reachable	0		10.78.9.10	
DAC	▶ 10.78.10.0/24 Main Switch reachable	0		10.78.10.10	
Db	▶ 10.255.255.255 10.78.9.11 reachable control	200			0
DAb	▶ 10.255.255.255 10.78.9.12 reachable control	200			0
Db	▶ 10.255.255.255 10.78.9.13 reachable control	200			0
Db	▶ 10.255.255.255 10.78.9.14 reachable control	200			0

Solution: Load Balancer

- Create a local BGP peers and set instance:

```
Terminal
[admin@PPPB] > routing bgp peer
[admin@PPPB] /routing bgp peer> print
Flags: X - disabled, E - established
#  INSTANCE      REMOTE-ADDRESS      REMOTE-AS
0 E default      10.78.9.10           65535
[admin@PPPB] /routing bgp peer> ..
[admin@PPPB] /routing bgp> instance print
Flags: X - disabled
0  name="default" as=65535 router-id=0.0.0.0 redistribute-connected=no
   redistribute-static=yes redistribute-rip=no redistribute-ospf=no
   redistribute-other-bgp=no out-filter="" client-to-client-reflection=yes
   ignore-as-path-len=no routing-table=""
```

Solution: Load Balancer

- Create a Route on all ppps with gateway to the main bridge to pass all the route info

Route <10.255.255.255>

General Attributes

Dst. Address: 10.255.255.255

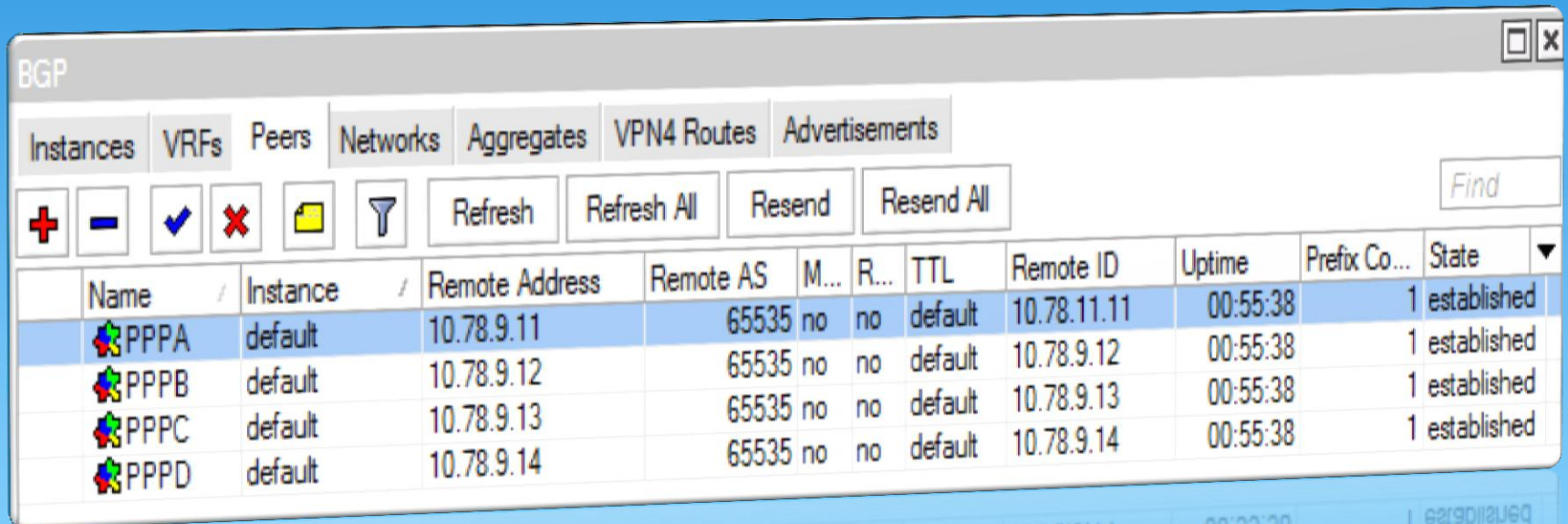
Gateway: 10.78.9.10 reachable ether13

Check Gateway:

Type: unicast

Solution: Load Balancer

- **After BGP creation**
- **BGP peer list in main bridge will look as follows:**



BGP

Instances VRFs Peers Networks Aggregates VPN4 Routes Advertisements

Find

Refresh Refresh All Resend Resend All

Name	Instance	Remote Address	Remote AS	M...	R...	TTL	Remote ID	Uptime	Prefix Co...	State
PPPA	default	10.78.9.11	65535	no	no	default	10.78.11.11	00:55:38	1	established
PPPB	default	10.78.9.12	65535	no	no	default	10.78.9.12	00:55:38	1	established
PPPC	default	10.78.9.13	65535	no	no	default	10.78.9.13	00:55:38	1	established
PPPD	default	10.78.9.14	65535	no	no	default	10.78.9.14	00:55:38	1	established

Solution: Load Balancer

**Script is running on all
ppps every 5 seconds &
returning the number
of active connections**

**Modify script to store
The # of ppp in BGP pref**

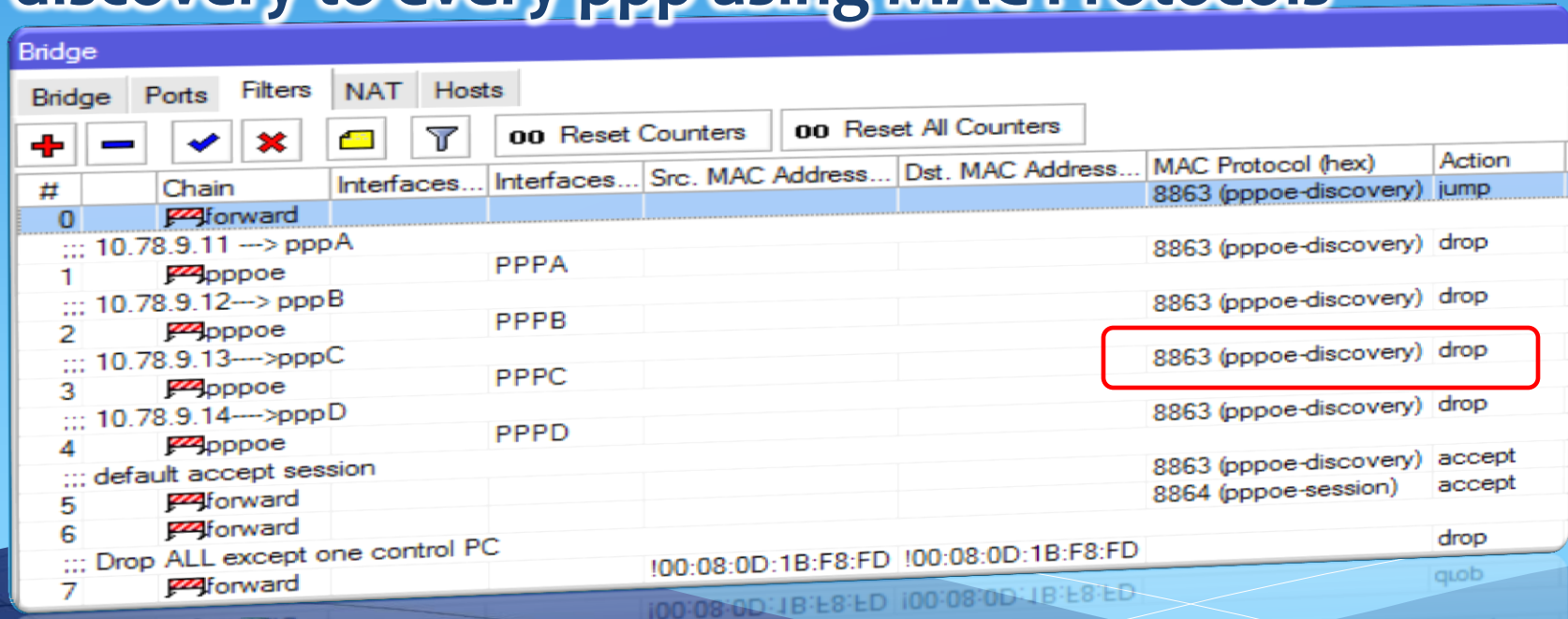
Source:

```
:global ppp [/ppp active print count-only ]
:global pref [/ip route get [/ip route find
dst-address=10.255.255.255/32] bgp-
local-pref]
if ($ppp!=$pref) do={
/ip route set [find dst-
address=10.255.255.255/32] bgp-local-
pref=$ppp}
```

Solution: Load Balancer

Now after active user # on each ppp is in bgp local pref how to priotirize one ppp over other?

Configure the firewall to be ready to enable/disable discovery to every ppp using MAC Protocols



The screenshot shows the Mikrotik WinBox interface, specifically the Bridge tab. It displays a list of firewall rules for PPP sessions. The rules are numbered 0 through 7. Rule 0 is the default rule. Rules 1 through 4 are for specific PPP sessions (pppA, pppB, pppC, pppD) and are set to drop traffic with protocol 8863 (pppoe-discovery). Rule 5 is for the default accept session and is set to accept traffic with protocol 8863 (pppoe-discovery). Rule 6 is for the default accept session and is set to accept traffic with protocol 8864 (pppoe-session). Rule 7 is for the default accept session and is set to drop traffic with protocol 8863 (pppoe-discovery). The rule for pppC (rule 2) is highlighted with a red box.

#	Chain	Interfaces...	Interfaces...	Src. MAC Address...	Dst. MAC Address...	MAC Protocol (hex)	Action
0	forward					8863 (pppoe-discovery)	jump
1	pppoe		PPPA			8863 (pppoe-discovery)	drop
2	pppoe		PPPB			8863 (pppoe-discovery)	drop
3	pppoe		PPPC			8863 (pppoe-discovery)	drop
4	pppoe		PPPD			8863 (pppoe-discovery)	drop
5	forward					8863 (pppoe-discovery)	accept
6	forward					8864 (pppoe-session)	accept
7	forward			!00:08:0D:1B:F8:FD	!00:08:0D:1B:F8:FD	8863 (pppoe-discovery)	drop

Solution: Load Balancer

How to give advantage to the lowest occupied PPP and pass connections to it ??

create a Scheduled script that discover the lowest occupied ppp & Enable its discovery in firewall, wich make it discoverable to pass sessions to it

```
:global min 100000000
:global clients
:global newActive
:global concentrator
:foreach c=server in=[/ip route find dst-address=10.255.255.255/32] do={
    :set clients [/ip route get $server bgp-local-pref]
    :set concentrator [/ip route get $server gateway]

    if ($clients<$min) do={
        :set min $clients
        :set newActive $concentrator
    }
}

:foreach c=rules in=[/interface bridge filter find] do={
    :if ([/interface bridge filter get $rules comment]=$newActive) do={
        /int br filter disable $rules;
    } else={
        /int bridge filter enable $rules;
    }
}
```

Solution: Load Balancer TEST

Balancer in Action

Bridge

Bridge Ports Filters NAT Hosts

00 Reset Counters 00 Reset All Counters Find all

#	Chain	Interfaces...	Interfaces...	Src. MAC Address...	Dst. MAC Address...	MAC Protocol (hex)	Action	Bytes	Packets
0	forward					8863 (pppoe-discovery)	jump	91 448	1 988
1	pppoe		PPPA			8863 (pppoe-discovery)	drop	9 108	198
2	pppoe		PPPB			8863 (pppoe-discovery)	drop	9 430	205
3	pppoe		PPPC			8863 (pppoe-discovery)	drop	9 154	199
4 X	pppoe		PPPD			8863 (pppoe-discovery)	drop	9 154	199
5	forward					8863 (pppoe-discovery)	accept	95 992	1 888
6	forward					8864 (pppoe-session)	accept	4 771 672	103 121
7	forward			!00:08:0D:1B:F8:FD	!00:08:0D:1B:F8:FD		drop	1 084 062	11 872

disabled

Discoverable & will get session

Route List

Routes Nextops Rules VRF

8 items (1 selected)

Name	Dst. Address	Gateway	Distance	Routing Mark	Pref. Source	BGP Local Pref.
R Link1	DAC 10.78.9.0/24	control reachable	0		10.78.9.10	
R Link2	DAC 10.78.10.0/24	Main Switch reachable	0		10.78.10.10	
R Link3	DAb 10.255.255.255	10.78.9.12 reachable control	200			72
R Link4	Db 10.255.255.255	10.78.9.13 reachable control	200			71
R Main Switch	Db 10.255.255.255	10.78.9.11 reachable control	200			71
R PPPA	Db 10.255.255.255	10.78.9.14 reachable control	200			70

pppD less occupied

Solution: Load Balancer TEST

Test with
simulator:

35
Clients
on each

The screenshot displays four RouterOS WinBox windows, each showing a different PPP profile (A, B, C, and D) with 35 clients connected. The windows are titled "admin@10.78.9.13 (PPPA) - WinBox v5.14 on RB1100AHx2 (powerpc)", "admin@10.78.9.14 (PPPD) - WinBox v5.14 on RB1100AHx2 (powerpc)", "admin@10.78.9.11 (PPPA) - WinBox v5.14 on RB1100AHx2 (powerpc)", and "admin@10.78.9.12 (PPPB) - WinBox v5.14 on RB1100AHx2 (powerpc)".

Each window shows a table of active connections with columns: Name, Service, Caller ID, En..., Address, and Uptime. The clients are categorized into four types: turtle, rabbit, tiger, and gorilla. Red boxes highlight specific client types and their connections.

ppp A - 35 clients directly connected

ppp B - 35 clients directly connected

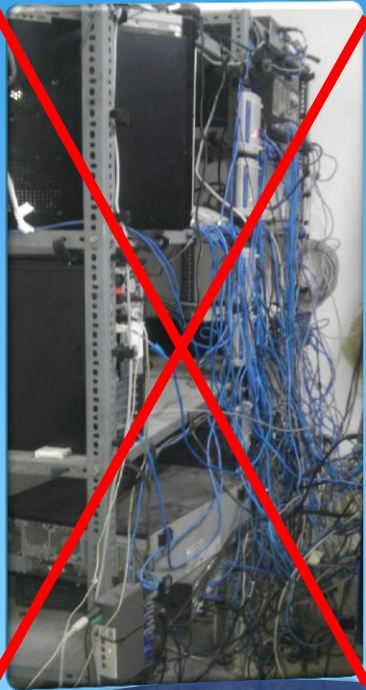
ppp C - 35 clients directly connected

ppp D - 35 clients directly connected

4 client types from 4 different links
ex: tiger3 is from link3 on third pppoe "pppC"

Solution: Reorganize

















- Bridge / Firewall / Load balancer OK
- Time to Reorganize, lets Implement



Solution: Load Balancer TEST

Test on real
network
After
implement

303
Clients
on each

Problem loading page										NAS Management	
		10.78.11.11	pppA	polaris	Telnet	polaris	Yes	polaris	pppA	Auto-detect 	302 
										<ul style="list-style-type: none">• Turtle• Rabbit• Tiger• Gorilla• Cheetah• Snail	
		10.78.11.12	pppB	polaris	Telnet	polaris	Yes	polaris	pppB	Auto-detect 	303 
										<ul style="list-style-type: none">• Turtle• Rabbit• Tiger• Gorilla• Cheetah• Snail	
		10.78.11.13	pppC	polaris	Telnet	polaris	Yes	polaris	pppC	Auto-detect 	302 
										<ul style="list-style-type: none">• Turtle• Rabbit• Tiger• Gorilla• Snail• Cheetah	
		10.78.11.14	pppD	polaris	Telnet	polaris	Yes	polaris	pppD	Auto-detect 	303 
										<ul style="list-style-type: none">• Turtle• Rabbit• Tiger• Gorilla• Cheetah• Snail	

Equal Distribution

Thank You for your Attention

Questions ????

Charbel Matta – Fast2serv , Lebanon.

MuM Dubai – Aug 2012 .



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