

Unique Mesh Wireless Design on Motion Ship

Muhti Subiyantoro



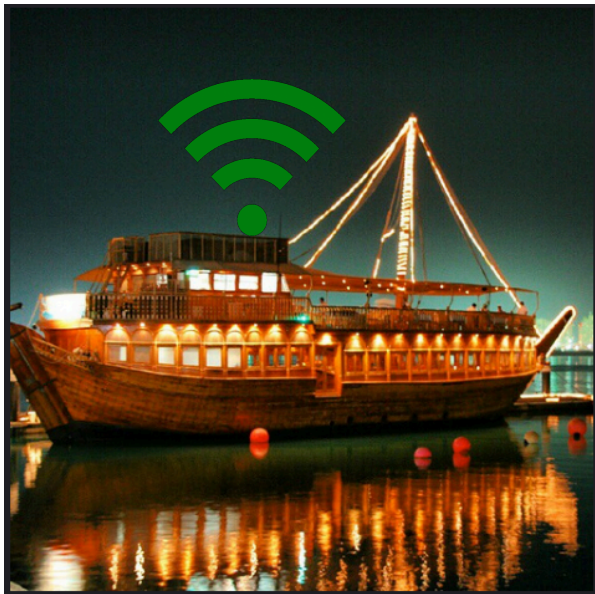
About Me

- 1974 - Born in Trenggalek
- 1999 – Graduated Electronic Eng. Universitas Muhammadiyah Malang
- 1999 – Start Working in Internet Service Provider
- 2004 – Using MikroTik
- 2006 - PT. Spectrum Indowibawa, Surabaya
 - Technical & Training Manager
 - MikroTik Certified Trainer
 - Academy Coordinator

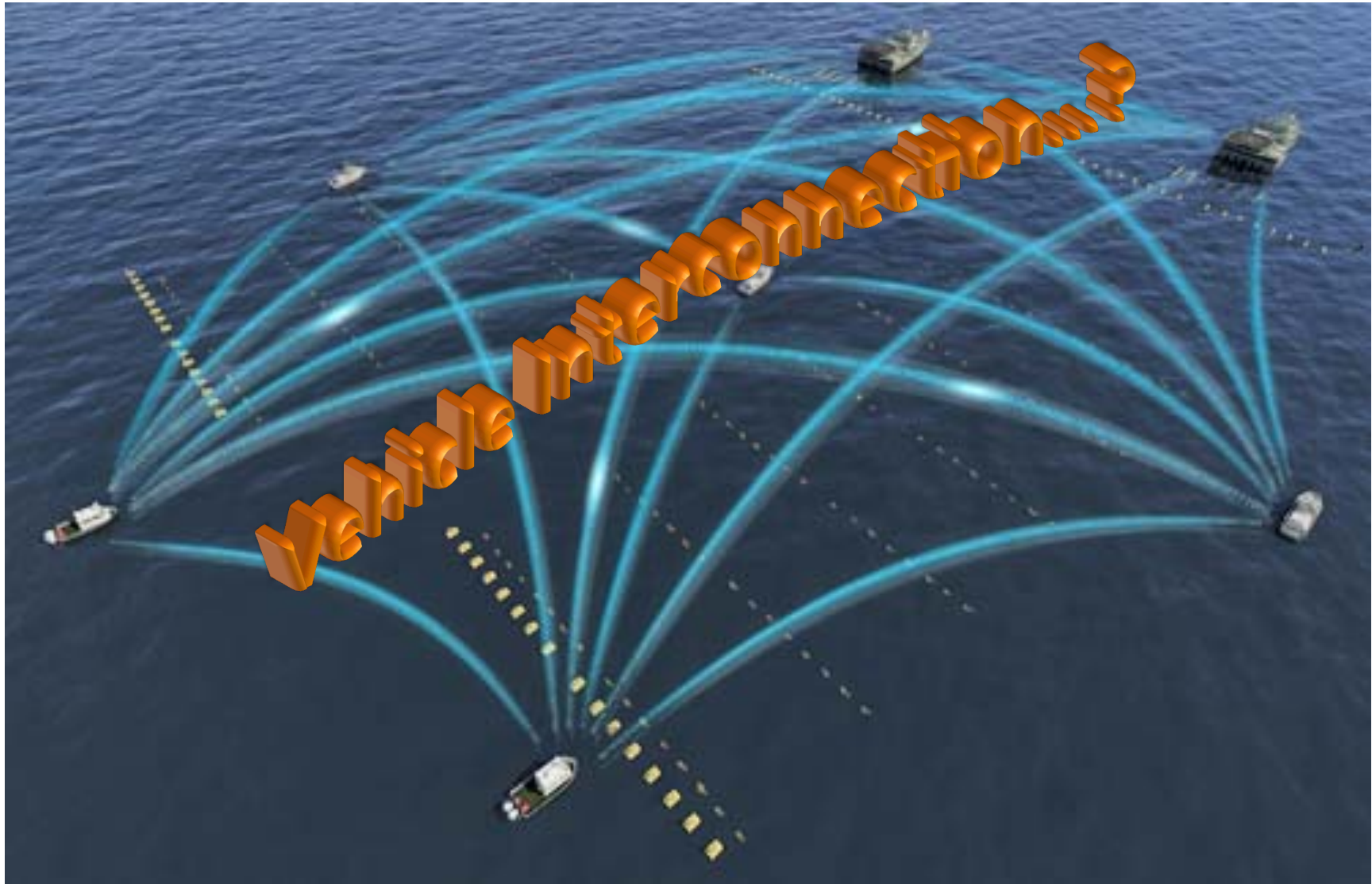


- Reseller Wireless & Router Equipment
- MikroTik
 - Consultant
 - Certified Training Partner
 - Network System Integrator

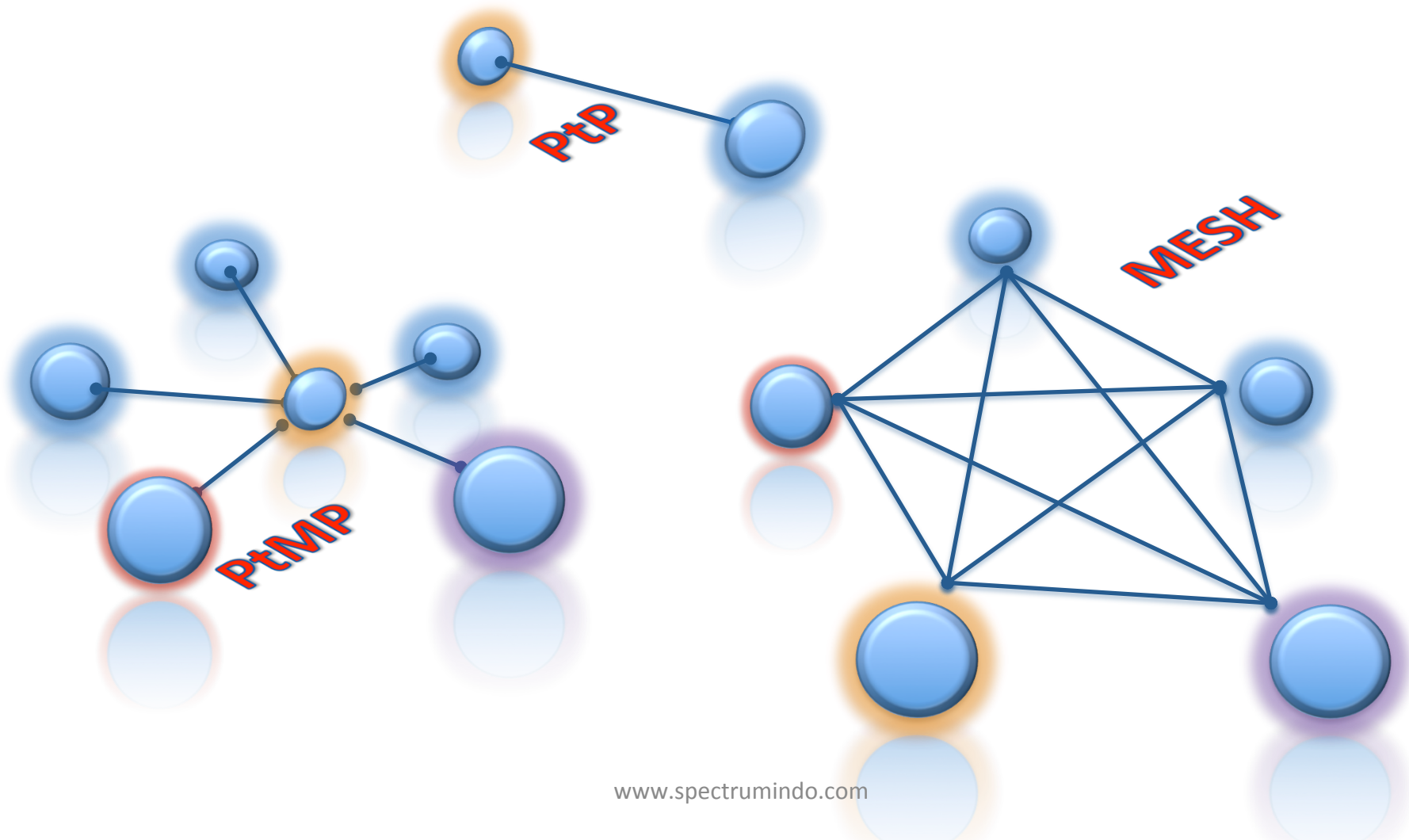
IDEA...?







Wireless Connection Topology

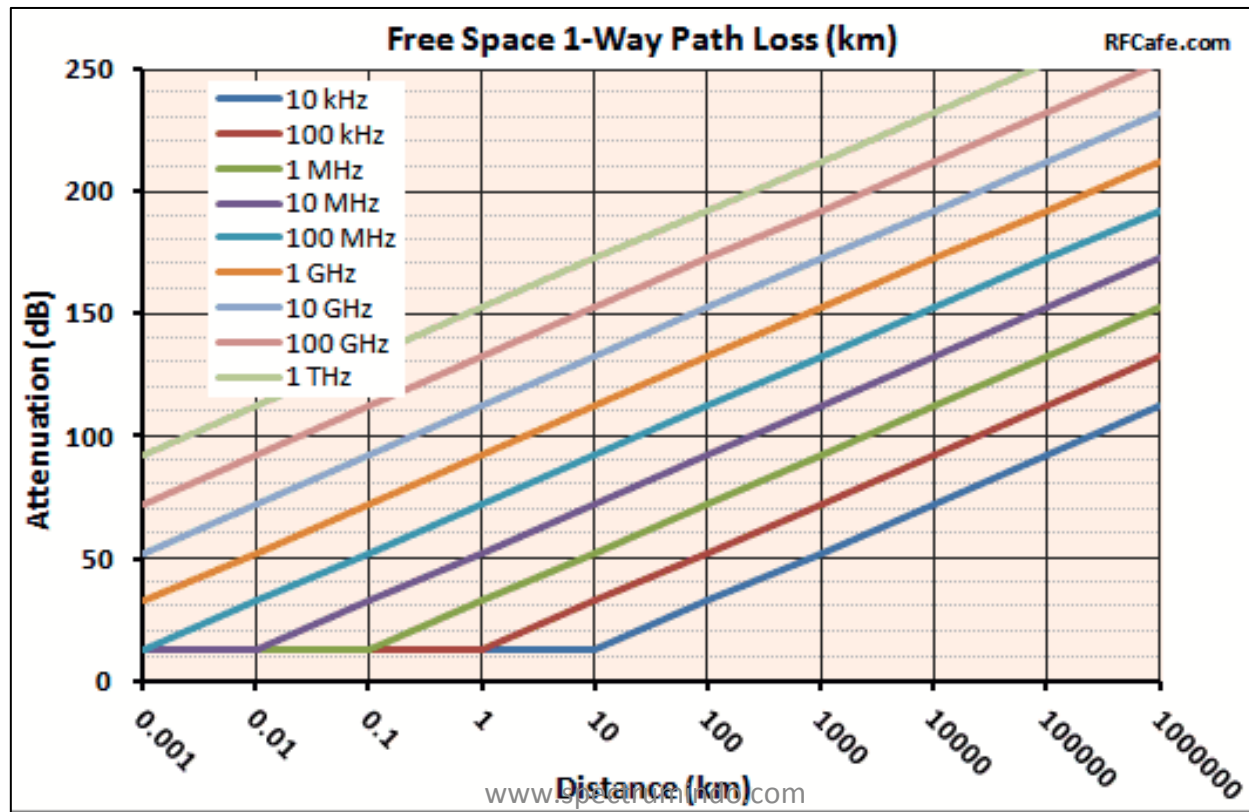


Wireless Variable

- Frequency
- Distance
- Coverage
- Tx Power
- Throughput
- Height of Antenna
- Interference
- Topology

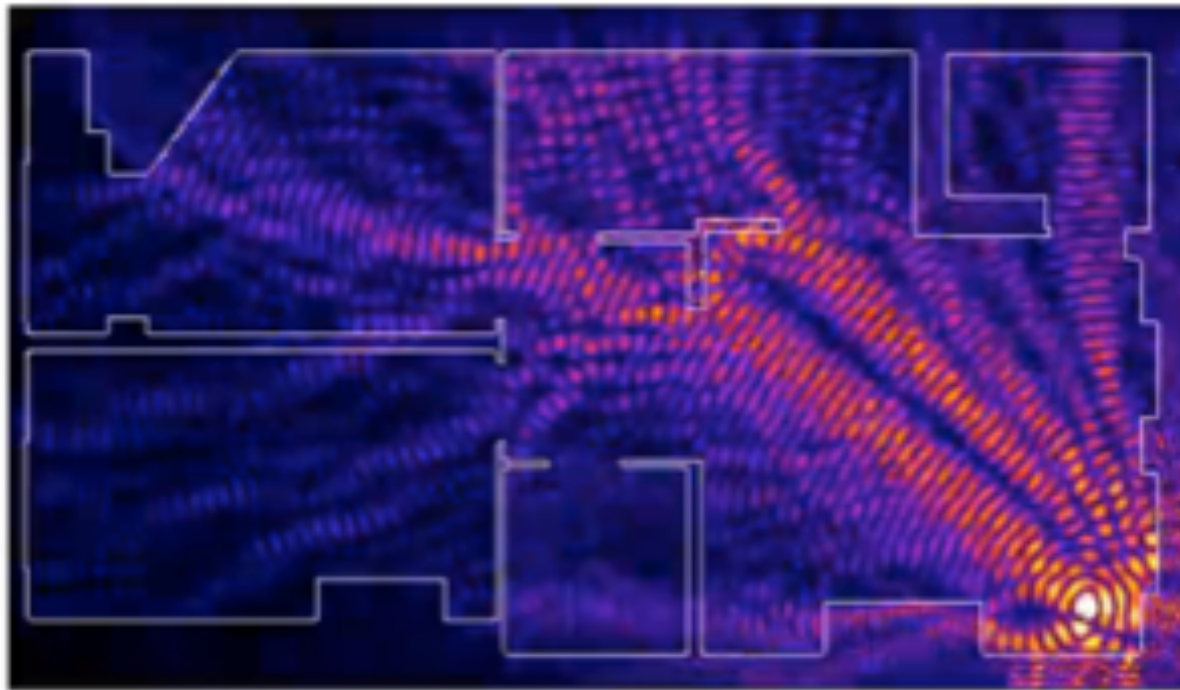
Frequency

- Lower Frequency, less Path Loss
- Less Path Loss, more distance



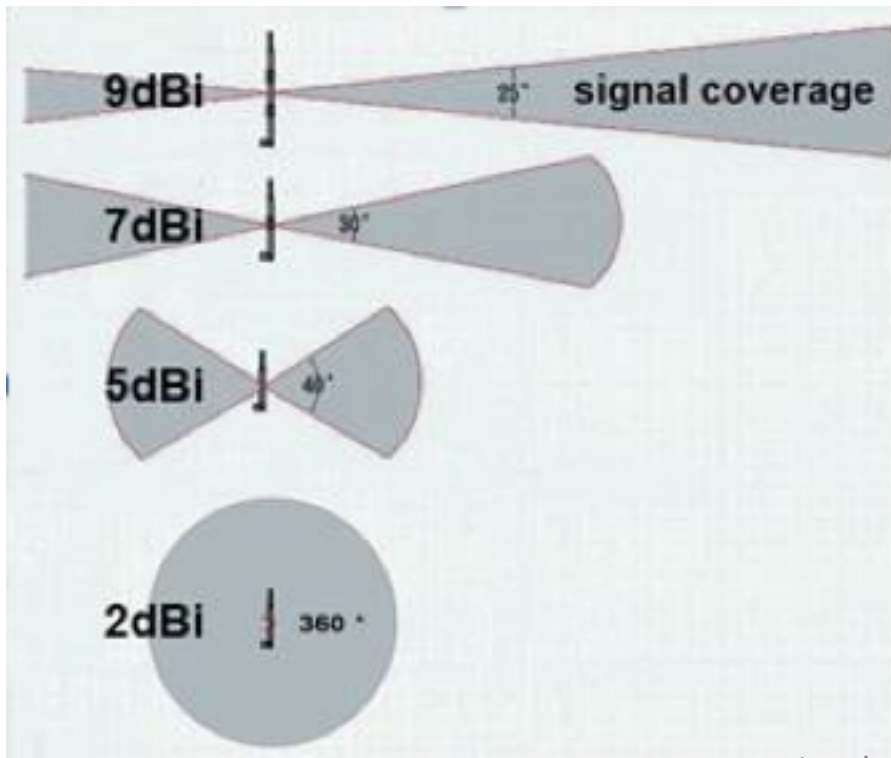
Distance

- More Distance, Less Signal
- Less Signal, Less Throughput

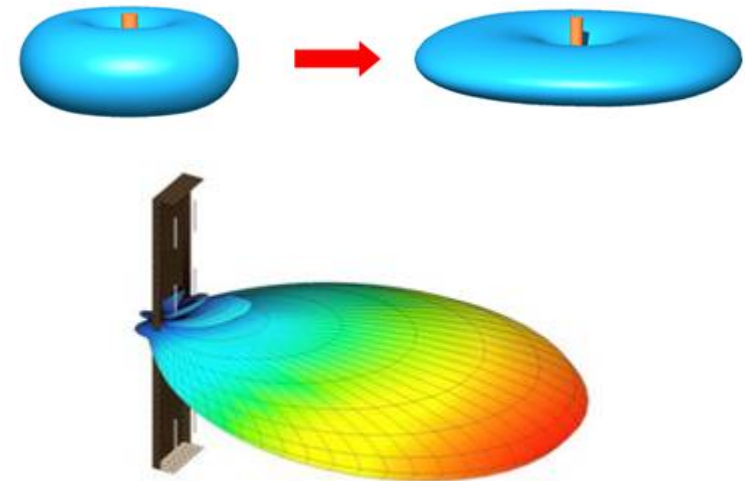


Coverage

- Higher Antenna Gain, Less Coverage Beam
- Less Coverage Beam, More Distance



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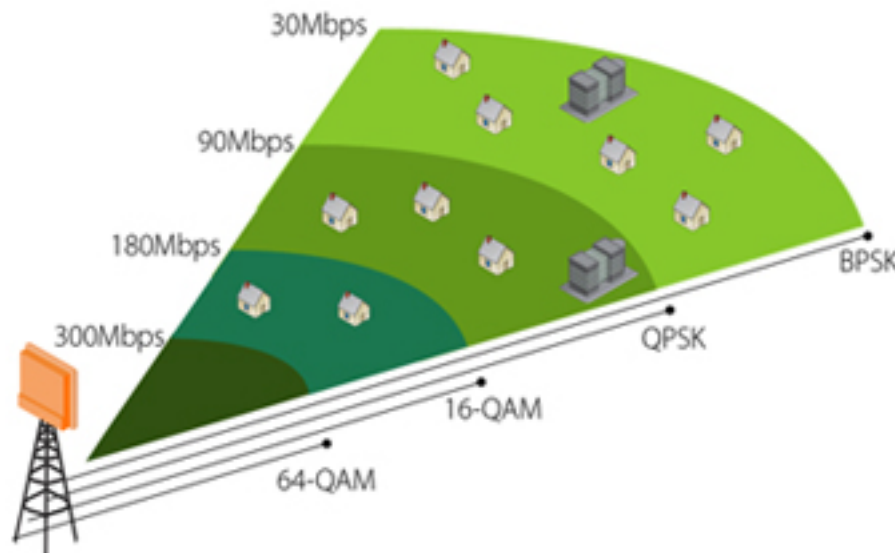
Tx Power

- Higher Tx, More Distance
- Higher Tx, More Throughput in Distance



Throughput

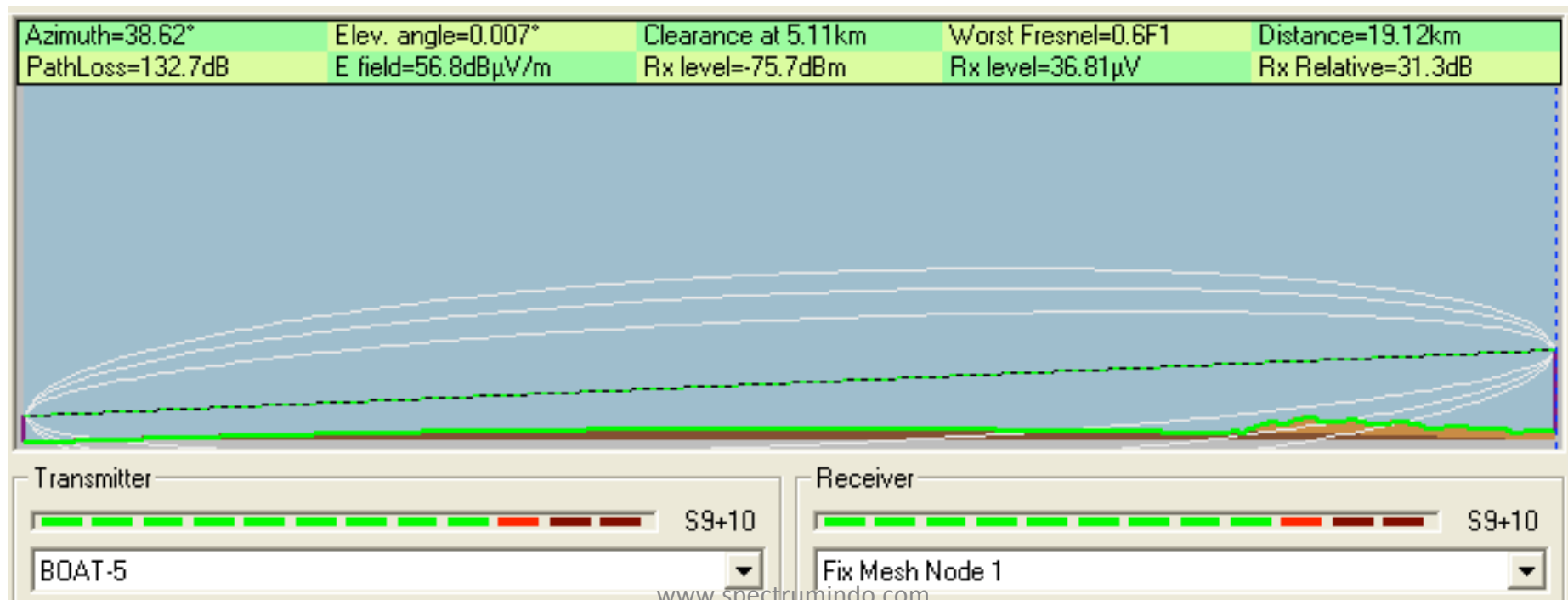
- More Tx Power, More Throughput in Distance
- Higher Antenna Gain, More Throughput in Distance



MCS Index	Modulation	Spatial Streams	802.11n Data Rate			
			20 MHz		40 MHz	
			L-GI	S-GI	L-GI	S-GI
0	BPSK	1	6.5	7.2	13.5	15
1	QPSK	1	13	14.4	27	30
2	QPSK	1	19.5	21.7	40.5	45
3	16-QAM	1	26	28.9	54	60
4	16-QAM	1	39	43.3	81	90
5	64-QAM	1	52	57.8	108	120
6	64-QAM	1	58.5	65	121.5	135
7	64-QAM	1	65	72.2	135	150
8	BPSK	2	13	14.4	27	30
9	QPSK	2	26	28.9	54	60
10	QPSK	2	39	43.3	81	90
11	16-QAM	2	52	57.8	108	120
12	16-QAM	2	78	86.7	162	180
13	64-QAM	2	104	115.6	216	240
14	64-QAM	2	117	130	243	270
15	64-QAM	2	130	144.4	270	300

Heigh of Antenna

- Enough Heigh of Antenna, good Fresnel Zone
- Good Fresnel Zone, no signal reflected by obstacle

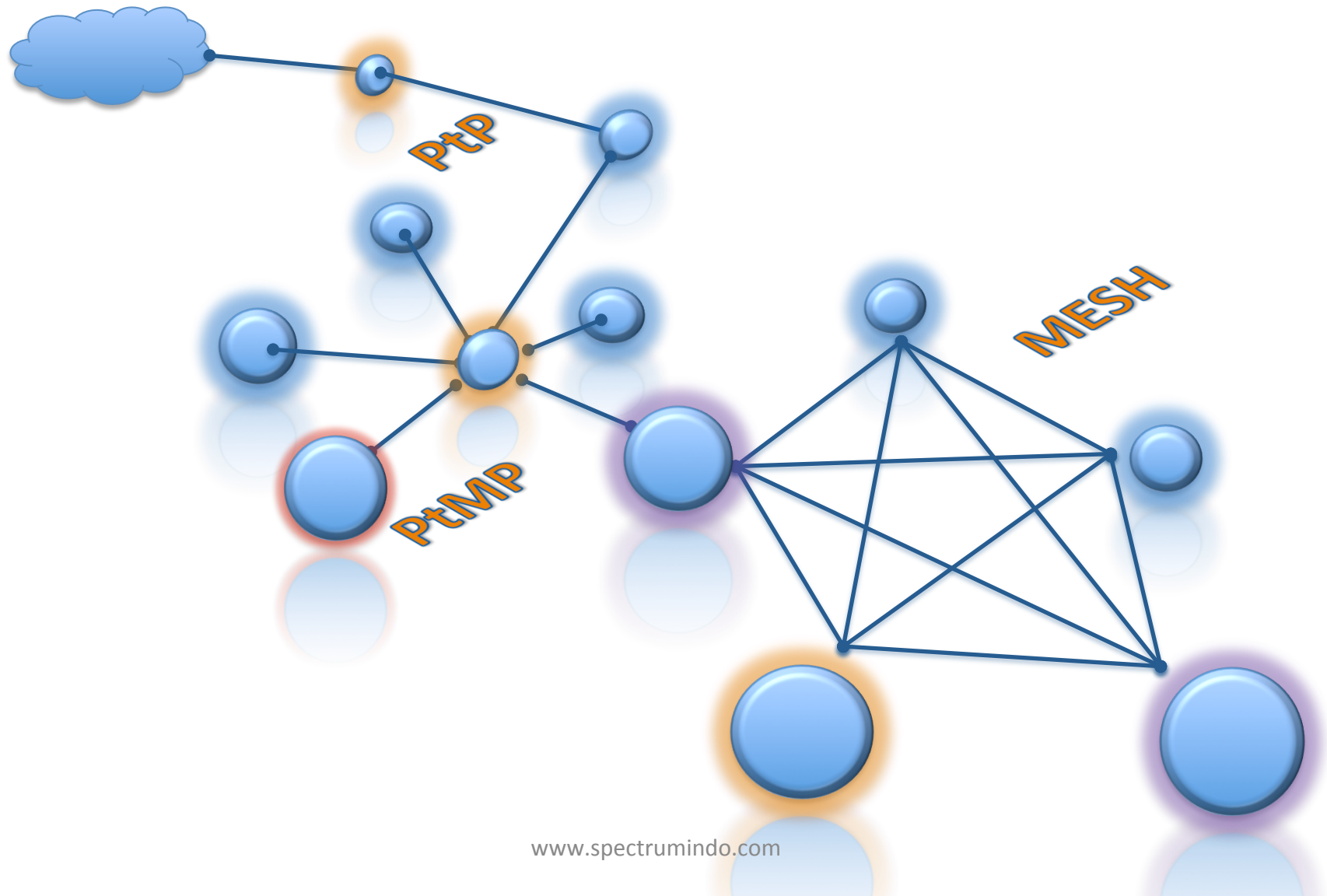


Interference

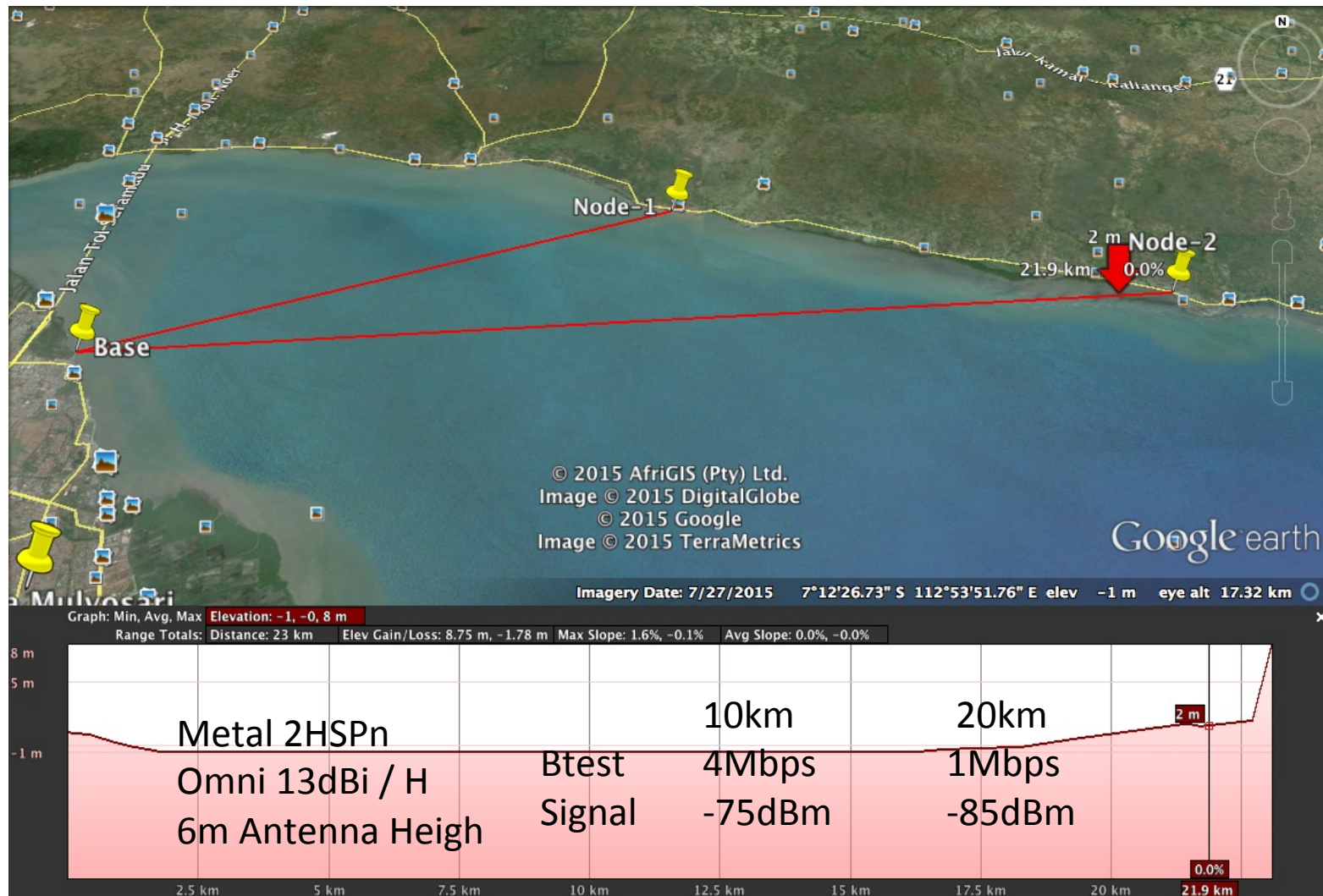
- High interference, low link quality



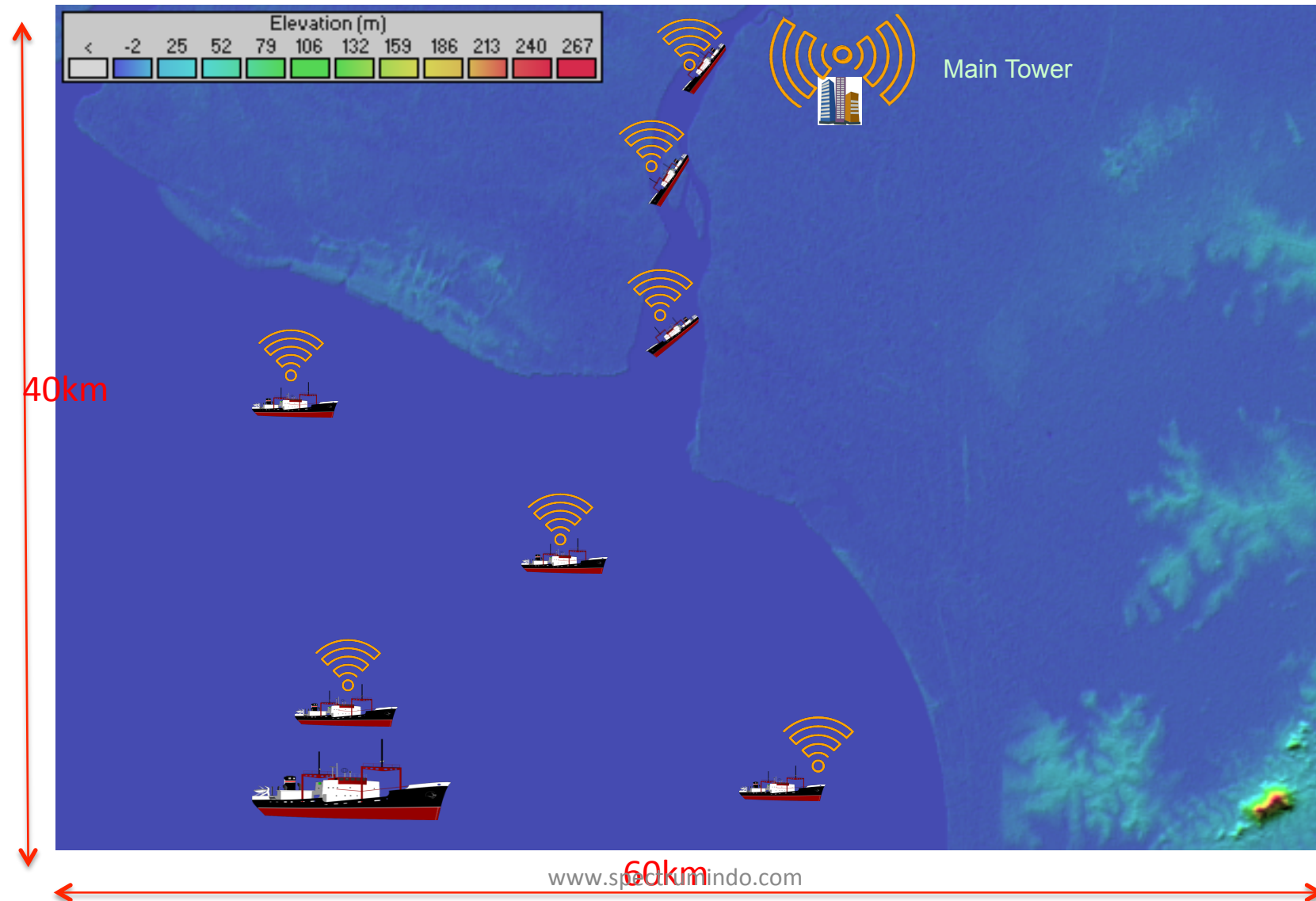
Combining Topology



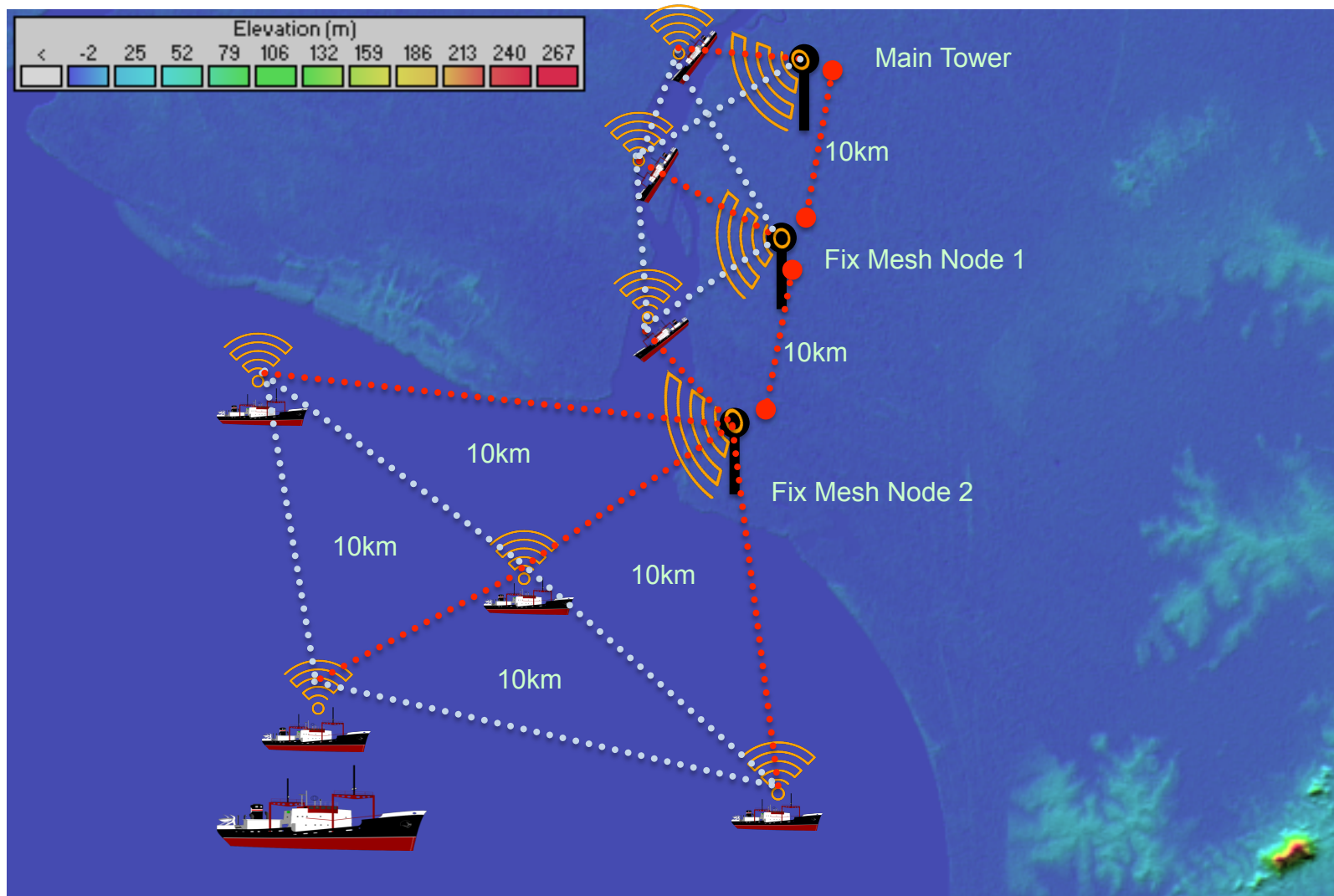
Test on Field



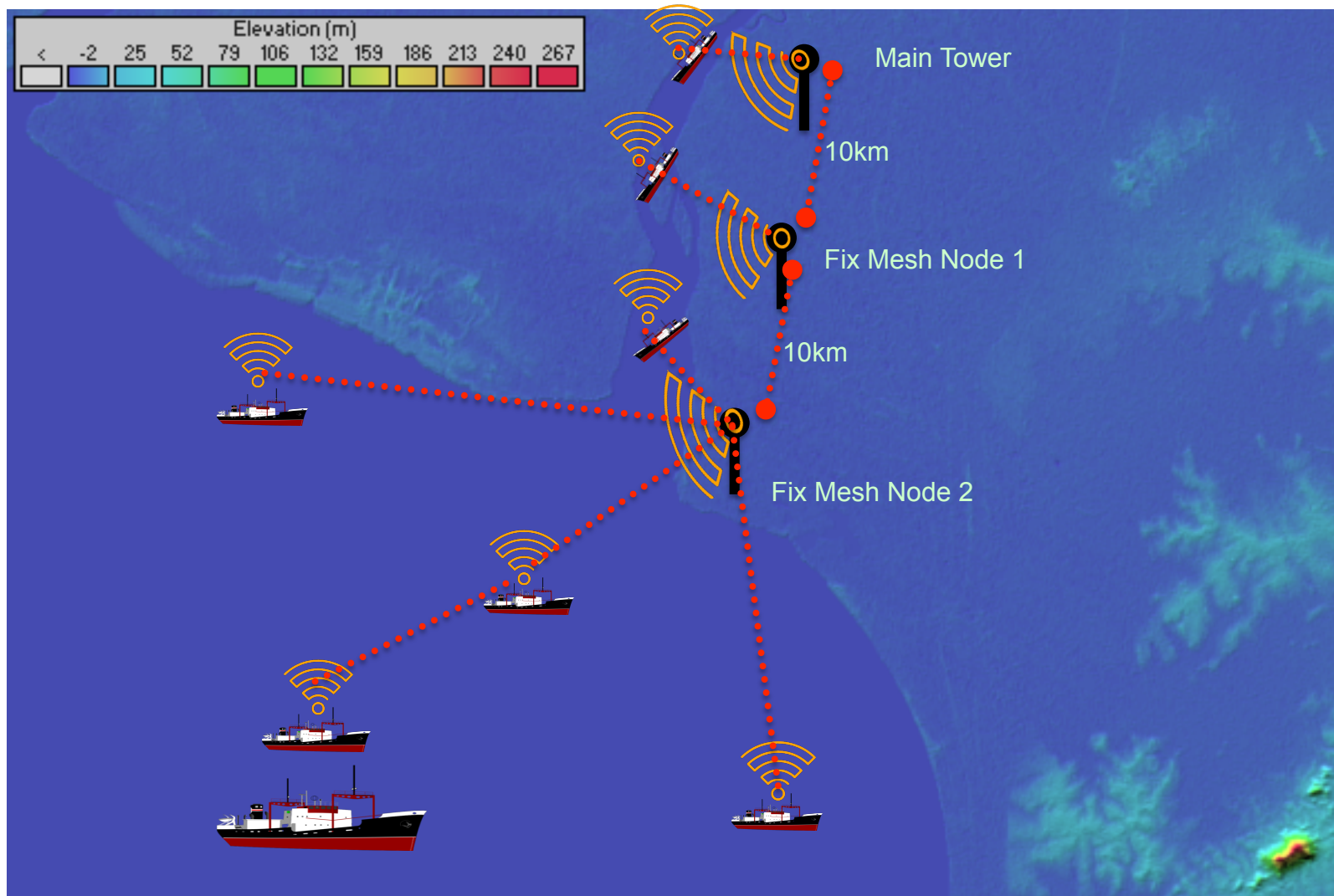
Moving Vehicle Network Plan



Infrastructure Link Design



Connection Tree



Mesh with MikroTik

- Wireless WDS Mesh with Mesh Interface
 - Mode : Ap-Bridge
 - Band : 2 Ghz – Only-N
 - Channel Width : 20 Mhz
 - SSID : Deep_Sea
 - Frequency : 2427
 - Security Profile : Default
 - WDS Mode : Static
 - WDS Default Bridge : none
 - Mesh : Mesh_1
 - Mesh Port : Ether1, All WDS Interface

Main Tower Node

Interface <wlan1>

General Wireless WDS Nstreme NV2 Status Traffic

Mode: ap bridge

Band: 5GHz-A

Channel Width: 20MHz

Frequency: 5180 MHz

SSID: Link_1

Scan List: default

Wireless Protocol: any

Security Profile: default

Interface <wlan2>

General Wireless Data Rates Advanced HT ...

Mode: ap bridge

Band: 2GHz-only-N

Channel Width: 20MHz

Frequency: 2427 MHz

SSID: Deep_Sea

Radio Name: Main_Tower

Scan List: default

Interface <wlan1>

General Wireless WDS Nstreme NV2 Status Traffic

WDS Mode: static

WDS Default Bridge: none

☐ WDS Ignore SSID

Interface <wlan2>

HT MCS WDS Nstreme NV2 Tx Power ...

WDS Mode: static

WDS Default Bridge: none

WDS Default Cost: 100

WDS Cost Range: 50-150

☐ WDS Ignore SSID

NODE - 1

Interface <wlan1>

General Wireless WDS Nstreme NV2 Status Traffic

Mode: ap bridge

Band: 5GHz-A

Channel Width: 20MHz

Frequency: 5180 MHz

SSID: Link_1

Scan List: default

Interface <wlan1>

General Wireless WDS Nstreme NV2 Status Traffic

WDS Mode: static

WDS Default Bridge: none

☐ WDS Ignore SSID

Interface <wlan2>

General Wireless HT HT MCS WDS Nstreme ...

Mode: ap bridge

Band: 2GHz-only-N

Channel Width: 20MHz

Frequency: 2427 MHz

SSID: Deep_Sea

Scan List: default

Wireless Protocol: any

Security Profile: default

Interface <wlan2>

HT HT MCS WDS Nstreme NV2 Status Traffic ...

WDS Mode: static

WDS Default Bridge: none

☐ WDS Ignore SSID

Wireless Tables

Interfaces

Nstreme Dual

Access List

Registration

Connect List

Security Profiles

Channels

Reset

Radio Name	MAC Address	Interface	Uptime	AP	...	Last Activi...	Tx/Rx Signal
BOAT_1	00:0C:42:61:6A:77	wlan2	00:00:35	yes	yes	0.260	-29/-25
Link_Node_2	00:0C:42:31:38:39	wlan1	00:03:03	yes	yes	0.260	-17/-17
Main_Tower	00:0C:42:31:38:AF	wlan1	00:03:03	yes	yes	0.000	-14/-15

Wireless Tables		
Interfaces		Nstreme Dual
Access List		Registration
Connect		
CAP		Scanner
Name	Type	
;;; Link_Main_Tower+Node_2		
R wlan1	Wireless (Atheros AR...	
RSA wds_Main_Tower	WDS	
RSA wds_Node_2	WDS	
;;; AP_to_BOAT		
R wlan2	Wireless (Atheros AR...	
RSA wds_BOAT_1	WDS	
wds_BOAT_2	WDS	
wds_BOAT_3	WDS	
wds_BOAT_4	WDS	
wds_BOAT_5	WDS	
wds_BOAT_6	WDS	
wds_BOAT_7	WDS	

Mesh		
Mesh		Ports
FDB		
Interface	Mesh	
I ether1	Mesh-1	
wds_BOAT_1	Mesh-1	
I wds_BOAT_2	Mesh-1	
I wds_BOAT_3	Mesh-1	
I wds_BOAT_4	Mesh-1	
I wds_BOAT_5	Mesh-1	
I wds_BOAT_6	Mesh-1	
I wds_BOAT_7	Mesh-1	
wds_Main_Tower	Mesh-1	
wds_Node_2	Mesh-1	

Mesh				
Mesh Ports FDB				
	Mesh	Type	MAC Address	On Interface
A	Mesh-1	local	00:0C:42:45:A3:FB	
A	Mesh-1	mesh	7C:C3:A1:88:0B:F1	wds_Main_Tower
	Mesh-1	larval	00:1C:42:96:FC:93	
A	Mesh-1	local	00:0C:42:61:6A:5E	
RA	Mesh-1	mesh	00:0C:42:46:86:2F	wds_Main_Tower
A	Mesh-1	mesh	00:0C:42:46:86:35	wds_Node_2
A	Mesh-1	mesh	00:0C:42:46:86:41	wds_BOAT_1
A	Mesh-1	local	00:0C:42:31:38:A8	

NODE - 2

Interface <wlan1>

General Wireless WDS Nstreme NV2 Status Traffic

Mode: ap bridge

Band: 5GHz-A

Channel Width: 20MHz

Frequency: 5180 MHz

SSID: Link_1

Scan List: default

Interface <wlan2>

General Wireless HT HT MCS WDS Nstreme ...

Mode: ap bridge

Band: 2GHz-only-N

Channel Width: 20MHz

Frequency: 2427 MHz

SSID: Deep_Sea

Scan List: default

Wireless Protocol: any

Security Profile: default

Interface <wlan1>

General Wireless WDS Nstreme NV2 Status Traffic

WDS Mode: static

WDS Default Bridge: none

☐ WDS Ignore SSID

Interface <wlan2>

HT HT MCS WDS Nstreme NV2 Status Traffic ...

WDS Mode: static

WDS Default Bridge: none

☐ WDS Ignore SSID

Wireless Tables							
Interfaces		Nstreme Dual	Access List	Registration	Connect List	Security Profiles	Channels
Reset							
Radio Name	MAC Address	Interface	Uptime	AP	...	Last Activi...	Tx/Rx Signal ...
BOAT_1	00:0C:42:61:6A:77	wlan2	00:00:28	yes	yes	0.630	-47/-44
Link_Node_1	00:0C:42:31:38:A8	wlan1	00:06:51	yes	yes	0.000	-17/-18

Wireless Tables		
Interfaces Nstreme Dual Access List Registration		
+ - ✓ ✗ 📄 🔍 CAP Scan		
Name	Type	
;;; Link_Between_BT5		
RS wlan1	Wireless (Atheros AR...	
RSA wds_Node_1	WDS	
;;; Mesh_to_BOAT		
R wlan2	Wireless (Atheros AR...	
RSA wds_BOAT_1	WDS	
wds_BOAT_2	WDS	
wds_BOAT_3	WDS	
wds_BOAT_4	WDS	
wds_BOAT_5	WDS	
wds_BOAT_6	WDS	
wds_BOAT_7	WDS	

Mesh		
Mesh Ports FDB		
+ - ✓ ✗ 📄 🔍		
Interface	Mesh	
I ether1	Mesh_1	
wds_BOAT_1	Mesh_1	
I wds_BOAT_2	Mesh_1	
I wds_BOAT_3	Mesh_1	
I wds_BOAT_4	Mesh_1	
I wds_BOAT_5	Mesh_1	
I wds_BOAT_6	Mesh_1	
I wds_BOAT_7	Mesh_1	
wds_Node_1	Mesh_1	

Mesh				
Mesh Ports FDB				
	Mesh ▲	Type	MAC Address	On Interface
A	Mesh_1	local	00:0C:42:46:86:35	
A	Mesh_1	local	00:0C:42:31:38:39	
	Mesh_1	larval	7C:C3:A1:88:0B:F1	
	Mesh_1	larval	00:1C:42:96:FC:93	
A	Mesh_1	mesh	00:0C:42:45:A3:FB	wds_Node_1
RA	Mesh_1	mesh	00:0C:42:46:86:2F	wds_Node_1
A	Mesh_1	local	00:0C:42:61:6D:41	
A	Mesh_1	mesh	00:0C:42:46:86:41	wds_BOAT_1

BOAT - 1

Interface <wlan2>

General Wireless HT HT MCS WDS Nstreme ...

Mode: ap bridge

Band: 2GHz-only-N

Channel Width: 20MHz

Frequency: 2427 MHz

SSID: Deep_Sea

Scan List: default

Wireless Protocol: any

Security Profile: default

Interface <wlan2>

HT HT MCS WDS Nstreme NV2 Status Traffic ...

WDS Mode: static

WDS Default Bridge: none

☐ WDS Ignore SSID

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List

+ - ✓ ✗ [Icon] [Icon] CAP Scanner Freq

	Name	Type	L2 MTU	Tx
X	wlan1	Wireless (Atheros AR...	1600	
R	wlan2	Wireless (Atheros AR...	1600	
	wds_BOAT_2	WDS		
	wds_BOAT_3	WDS		
	wds_BOAT_4	WDS		
	wds_BOAT_5	WDS		
	wds_BOAT_6	WDS		
	wds_BOAT_7	WDS		
RSA	wds_Main_Tower	WDS	1600	
RSA	wds_Node_1	WDS	1600	
RSA	wds_Node_2	WDS	1600	

Wireless Tables

InterfacesNstreme DualAccess ListRegistrationConnect ListSecurity ProfilesChannels

Reset

Radio Name	MAC Address	Interface	Uptime	AP	...	Last Activi...	Tx/Rx Signal ...
MESH_NODE_1	00:0C:42:61:6A:5E	wlan2	00:13:17	yes	yes	0.740	-26/-28
MESH_NODE_2	00:0C:42:61:6D:41	wlan2	00:13:20	yes	yes	0.450	-44/-47
Main_Tower	00:0C:42:61:6A:46	wlan2	00:07:33	yes	yes	0.000	-30/-36

Mesh		
Mesh Ports FDB		
	Interface	Mesh
I	ether1	Mesh_1
I	wds_BOAT_2	Mesh_1
I	wds_BOAT_3	Mesh_1
I	wds_BOAT_4	Mesh_1
I	wds_BOAT_5	Mesh_1
I	wds_BOAT_6	Mesh_1
I	wds_BOAT_7	Mesh_1
	wds_Main_Tower	Mesh_1
	wds_Node_1	Mesh_1
	wds_Node_2	Mesh_1

Mesh					
Mesh Ports FDB					
	Mesh	Type	MAC Address	On Interface	L
A	Mesh_1	local	00:0C:42:46:86:41		
A	Mesh_1	local	00:0C:42:61:6A:77		
	Mesh_1	larval	00:1C:42:96:FC:93		
RA	Mesh_1	mesh	00:0C:42:46:86:2F	wds_Main_Tower	
	Mesh_1	larval	7C:C3:A1:88:0B:F1		
	Mesh_1	larval	00:0C:42:45:A3:FB		
A	Mesh_1	mesh	00:0C:42:46:86:35	wds_Node_2	

MikroTik WinBox Loader v2.2.18

Connect To: 00:0C:42:46:86:41 ... Connect

MAC Address	IP Address	Identity	Version	Board ...
00:0C:42:45:A3:FB	192.168.10.2	NODE_1	6.32.2	RB433AH
00:0C:42:46:86:2F	192.168.10.1	Main_Tower	6.32.2	RB433AH
00:0C:42:46:86:35	192.168.10.3	NODE_2	6.32.2	RB433AH
00:0C:42:46:86:41	192.168.10.11	BOAT_1	6.32.2	RB433AH

Login:

Password:

Note:

```
OS-X:~ muhti$ ping -c 3 192.168.10.1
PING 192.168.10.1 (192.168.10.1): 56 data bytes
64 bytes from 192.168.10.1: icmp_seq=0 ttl=64 time=0.378 ms
64 bytes from 192.168.10.1: icmp_seq=1 ttl=64 time=0.359 ms
64 bytes from 192.168.10.1: icmp_seq=2 ttl=64 time=0.437 ms

--- 192.168.10.1 ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 0.359/0.391/0.437/0.033 ms
OS-X:~ muhti$ ping -c 3 192.168.10.2
PING 192.168.10.2 (192.168.10.2): 56 data bytes
64 bytes from 192.168.10.2: icmp_seq=0 ttl=64 time=2.179 ms
64 bytes from 192.168.10.2: icmp_seq=1 ttl=64 time=0.629 ms
64 bytes from 192.168.10.2: icmp_seq=2 ttl=64 time=0.875 ms

--- 192.168.10.2 ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 0.629/1.228/2.179/0.680 ms
OS-X:~ muhti$ ping -c 3 192.168.10.3
PING 192.168.10.3 (192.168.10.3): 56 data bytes
64 bytes from 192.168.10.3: icmp_seq=0 ttl=64 time=0.914 ms
64 bytes from 192.168.10.3: icmp_seq=1 ttl=64 time=0.851 ms
64 bytes from 192.168.10.3: icmp_seq=2 ttl=64 time=1.006 ms

--- 192.168.10.3 ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 0.851/0.924/1.006/0.064 ms
OS-X:~ muhti$ ping -c 3 192.168.10.11
PING 192.168.10.11 (192.168.10.11): 56 data bytes
64 bytes from 192.168.10.11: icmp_seq=0 ttl=64 time=0.611 ms
64 bytes from 192.168.10.11: icmp_seq=1 ttl=64 time=0.871 ms
64 bytes from 192.168.10.11: icmp_seq=2 ttl=64 time=0.638 ms

--- 192.168.10.11 ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 0.611/0.707/0.871/0.117 ms
```


Advantage

- Loop free Topology
- Route selection base on path cost
- The cost is automatically calculated base on actual link BW
- On demand route selection / tree base Topology



Thank You...

muhti@spectrumindo.com