

LanPro VULCAN PtmP SERIES Application Note B01.

LPVULCAN400_AN_ENB01W

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Subjects treated:	
1	Considerations on using LanPro VULCAN Radios instead of Wi-Fi Radios.
2	A surveillance application.
3	A deployment case study.

1 Considerations on using LanPro VULCAN Radios instead of Wi-Fi Radios

● Why do we need LanPro VULCAN instead of the standard WiFi?

ANS:

Wi-Fi has potential limitation of CSMA/CA in remote application.

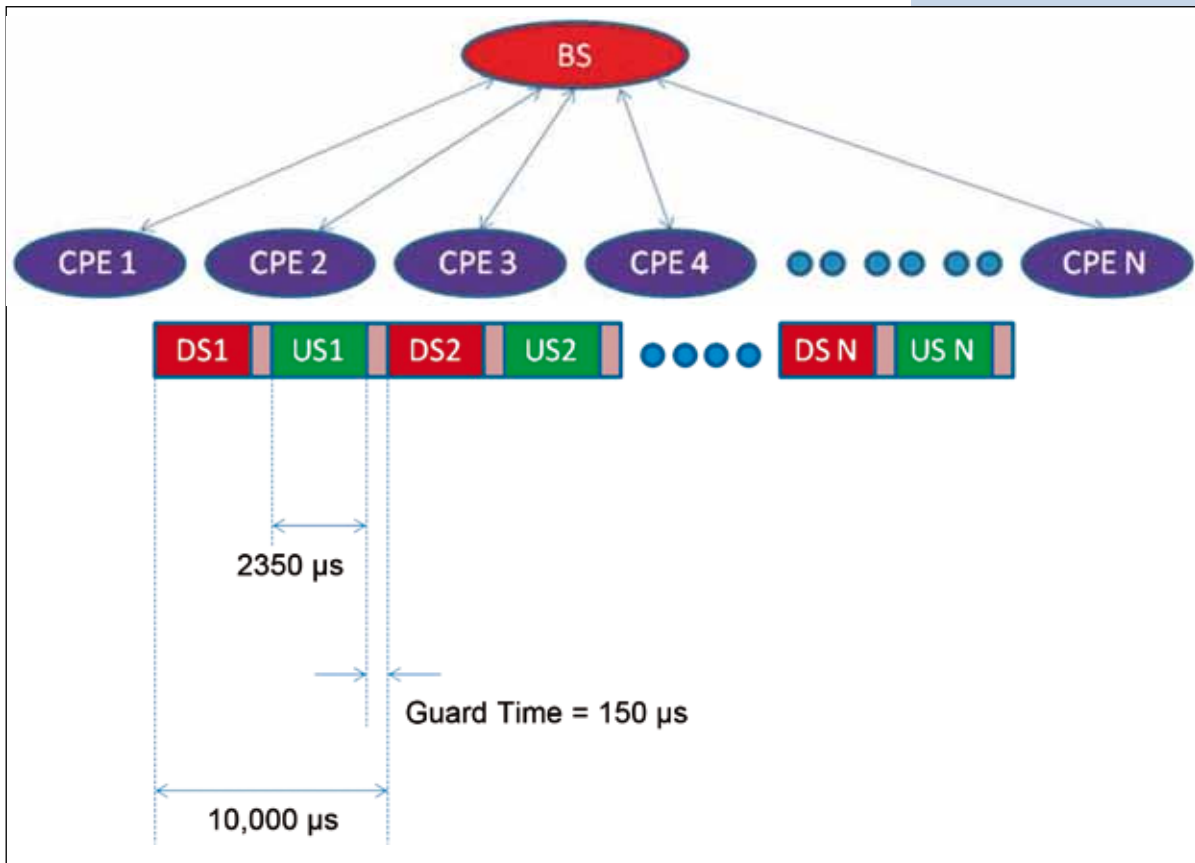
•	As a wireless network card cannot receive data while in transmission. Collision detection becomes a key issue.
•	Within the wireless domain, a packet transmitted from one node cannot be received by all other nodes (hidden node problem).
•	Algorithm is not suitable for long-distance transmission.
•	If the channel is detected busy before being transmitted, a random interval is delayed. If the channel is idle for a certain period, then transmission can proceed=>Random backoff.
•	The existence of remote equipment is determined by ACK.

LanPro VULCAN is a technology of TDMA, suitable for outdoor, long-distance and one-to-many device transfer protocol.

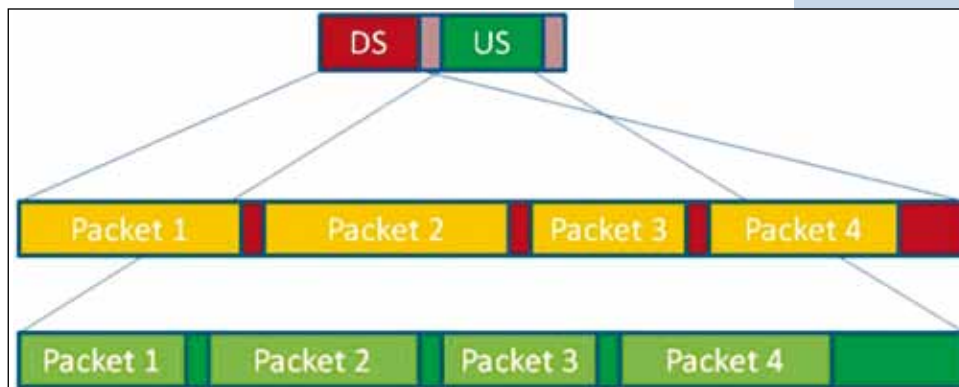
•	Different from CSMA/CA.
•	The maximum transfer efficiency can be 1.5 times that of CSMA/CA.
•	In the outdoor environment, LanPro VULCAN doesn't have the hidden node problem, which occurs so often under 802.11. Total bandwidth won't be reduced considerably due to hidden node problem.
•	Within 802.11 network, the remote transmission device will take up more time resources because of bad transmission quality, seriously affecting other devices. NEAR-FAR issue will not happen under LanPro VULCAN.

● Revolutionized Network and Protocol Structure.

•	The communication transmission of Base Station (BS) to each CPE is divided into two directions: Upstream (US) and Downstream (DS).
•	Each unit is 10 ms. Within the time slot of 10 ms, it is divided into Upstream, Downstream and Guard Time.
•	Under condition of long distance, Guard time ensures the communications between the parties won't collide with each other as a result of transmission delay.

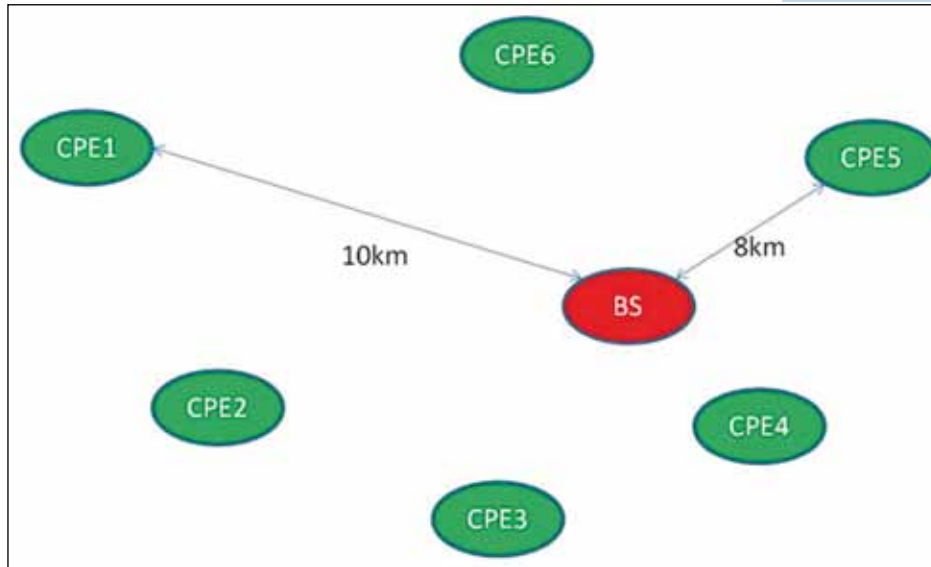


● **Raising Throughput Effectively.**



<ul style="list-style-type: none"> • Within a time slot, bursting is the method for LanPro VULCAN. The gap between each packet is only 9~10 μs, needing to neither wait for ACK of other party, nor to do random backoff. Hence, the transmission efficiency of LanPro VULCAN is much higher than that of Wi-Fi 802.11, whose gap time for each packet is 200~300 μs.
<ul style="list-style-type: none"> • Though under LanPro VULCAN there is no need to wait for ACK or ARQ (Automatic Repeat Request), its design still exists in LanPro VULCAN. That is, if the receiving end has lost a packet, the transmitting end, based on the request, will re-transmit the packet not received by receiving end. Information exchange of ARQ is mixed in the data packet and doesn't occupy too much bandwidth.
<ul style="list-style-type: none"> • Auto-Rate Control for remote transmission is also designed in LanPro VULCAN, determining the best OFDM modulation according to the distance and environment of transmitting and receiving ends. After test, the actual data transmission of LanPro VULCAN, including the overhead mentioned above, is a lot higher than that of 802.11 by 50%.

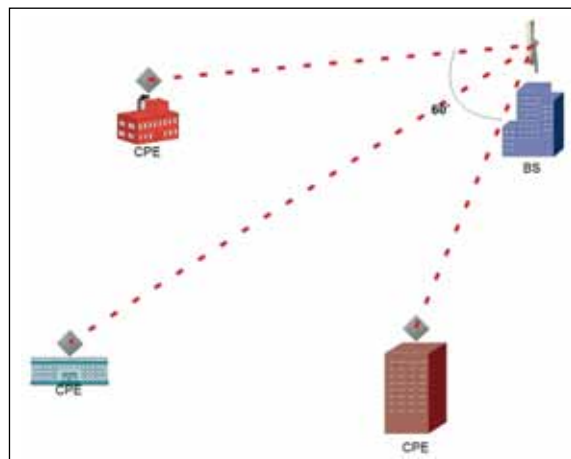
● **Solving Hidden Node Problem.**



●	Under IEEE 802.11, based on CSMA/CA, collision is avoided by using random backoff.
	<ul style="list-style-type: none"> - In outdoor, CPE1 and CPE5 are not aware of the transmission of each other, causing collisions when transmitting data to BS. Then, both CPE1 and CPE5 have to transmit data again. - According to the actual experience, when there are over eight devices in the network, the hidden node problem will decrease overall network bandwidth by at least 50%.
●	When LanPro VULCAN is in use, thanks to the pre-arrangement of transmission time of each CPE, it won't occur that two CPEs transmit data at the same time. And when several devices are in the network, the overall network bandwidth won't decline due to hidden node, fully and efficiently exploiting wireless network resource.

LanPro VULCAN Coordination

●	The IEEE 802.11 standard is based on CSMA/CA, that is, each device competes freely for network resources. Theoretically, the right for each device to get available data is equal.
	<ul style="list-style-type: none"> - However, the environment and OFDM on transmission of each device are different, suggesting that when transmitting a packet with the same length, remote devices will use much more network resources because of using low-speed modulation and even higher probability of re-transmitting. That will cause that the performance of the remote device to be seriously affected by long distance.
●	Under LanPro VULCAN, the transmitting time of each device is evenly distributed. Thus, when transmitting data, remote device will not occupy the transmitting time of other device, which means each device will have allocated transmitting time and not have Near-Far problem as 802.11.



● **What's the difference between WiFi and Lanpro VULCAN?**

By comparing the two figures on the right, we can see that the long distance transmission with CSMA travels twice the distance (data sending and data acknowledgement), which means more time and less efficiency

However, with the same EIRP, the VULCAN data rate can stay at 40 Mb/second in 40 Km distance transmission with TDMA technology

Standard Wi-Fi Radio (Total EIRP = 46 dBm)

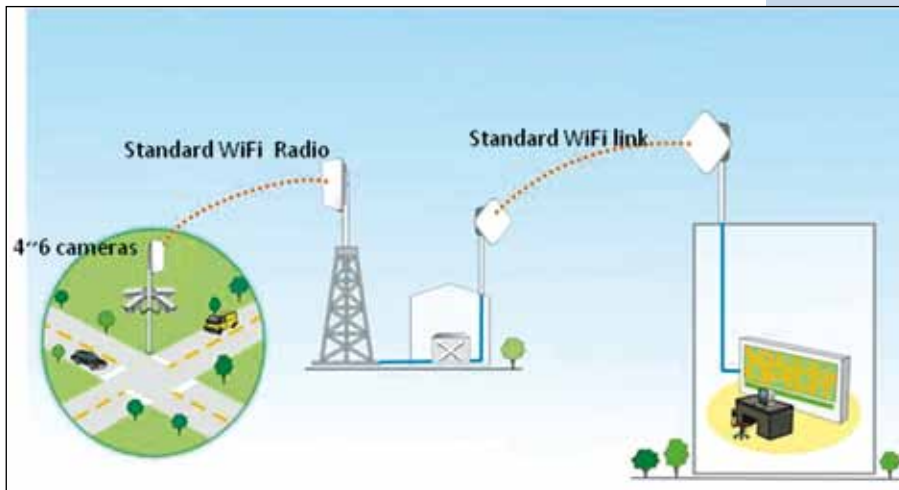
VULCAN Series (Total EIRP = 46 dBm)

Specifications				
Radio				
Operating frequency	450-510 MHz (Vulcan 400 standard), customized: 300MHz~Sub-6 GHz			
Channel bandwidth	5 & 10 MHz software selectable			
Output power and Rx sensitivity (Packet Error Rate: 10%)				
	Data Rate	Modulation	Tx Output pwr	Rx Sensitivity
	54 Mbps	64QAM 3/4	33 (± 1.5) dBm	-90 dBm
	36 Mbps	16QAM 3/4	33 (± 1.5) dBm	-98 dBm
	18 Mbps	QPSK 3/4	36 (± 1.5) dBm	-101 dBm
	6 Mbps	BPSK 1/2	37 (± 1.5) dBm	-103 dBm
Frequency stability	± 10 ppm			
Modulation	OFDM			
Range	up to 40 km			
Effective throughput (TP):				
		Single Stream TP	Streams TP aggregated	
	5 MHz channel BW	6 Mbps	8 Mbps	
	10 MHz channel BW	11 Mbps	18 Mbps	
Upload Stream/Time Ratio setting	20-80%			
Interfaces				
RF (antenna) connector	N-type (Jack)			
Ethernet	IEEE 802.3 (10Base-T) / IEEE 802.3u (100Base-Tx)			
Manageability				
Management and setup	Web-based configuration			
Operating model	Base Station / CPE (PtMP)			
SNMP agents	MIB II			
Protocol	TCP/IP, IPX/SPX, NetBEUI			
QoS	Data flow control			
DHCP	DHCP client			
Other features	VLAN (IEEE 802.1Q); spanning tree protocol (802.1d)			

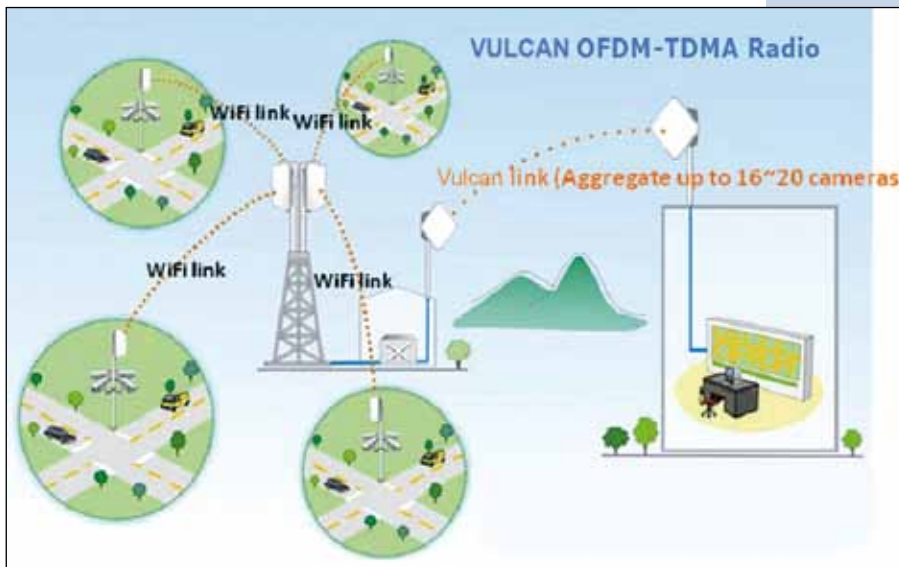
Security	
Data encryption	64/128/152 bits encryption WPA-PSK, WPA-TKIP, WPA2-AES 128 bits
Authorization	MAC Address Access Filter
Environment	
Operating temperature	-30 ~ 55 °C
Storage temperature	-30 ~ 70 °C
Humidity	95% non-condensing
Power supply solutions	
AC 100-264 V, 50-60 Hz, DC 24 V	
DC 48 V	
DC 10 ~ 30 V	

2 Surveillance Application

● *What's the difference between Standard Wi-Fi and VULCAN?*



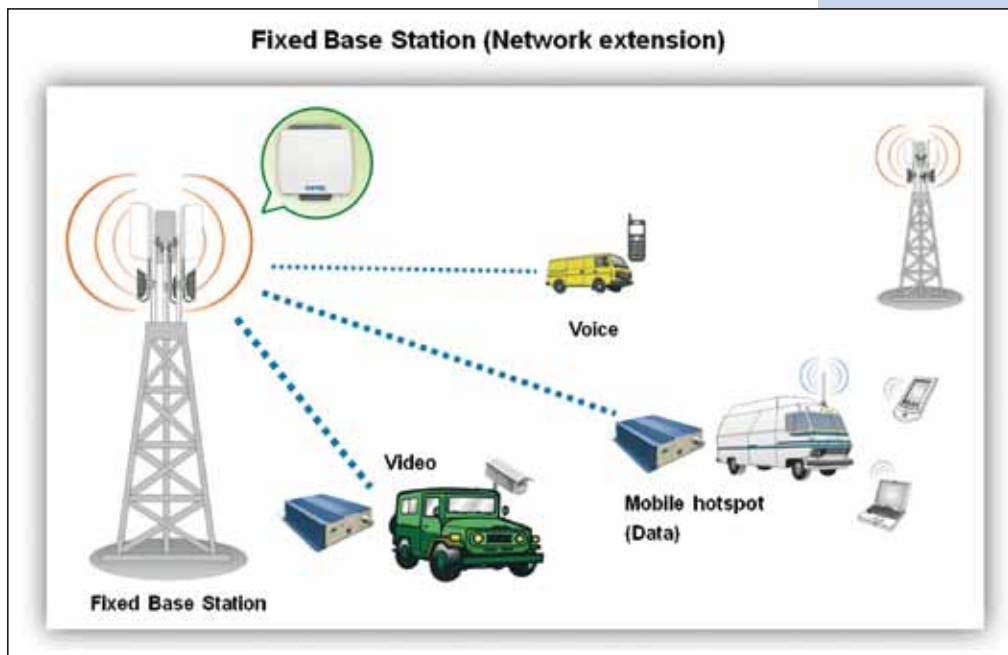
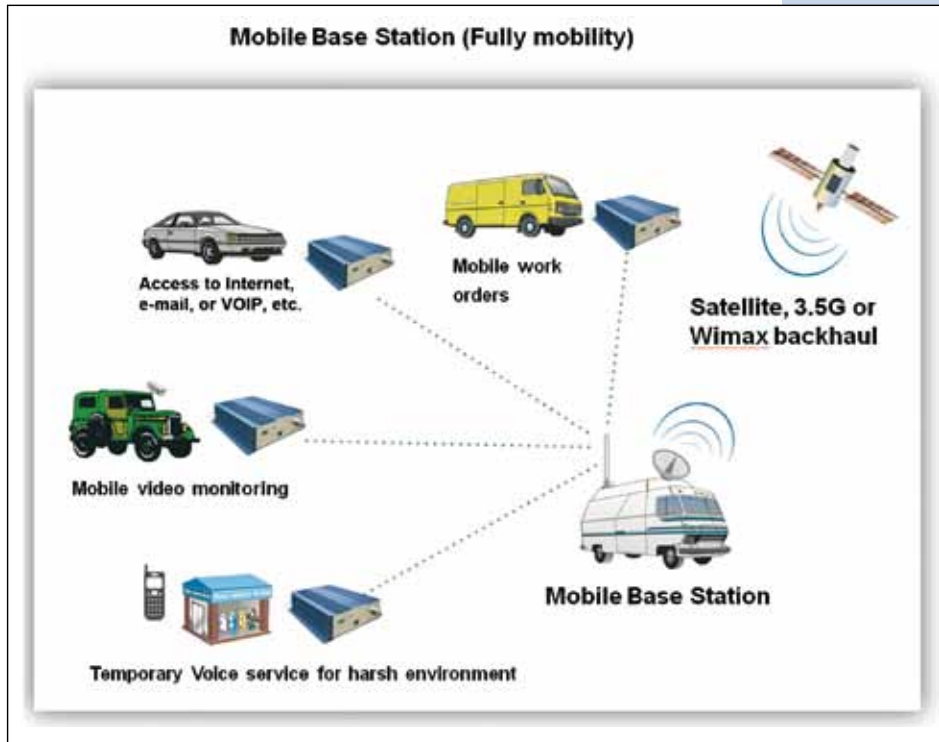
Usually a standard 802.11 Wi-Fi radio supports 4~6 cameras as the maximum, even though it has 23 Mbps effective data rate. The video quality performance is H.264 & MPEG4 without lag @ 30 fps and no mosaic.



The LanPro VULCAN link easily aggregates the cameras up to 16 ~ 20 cameras. And the video quality supports the standard H.264 & MPEG4 without lag @ 30 fps and no mosaic.

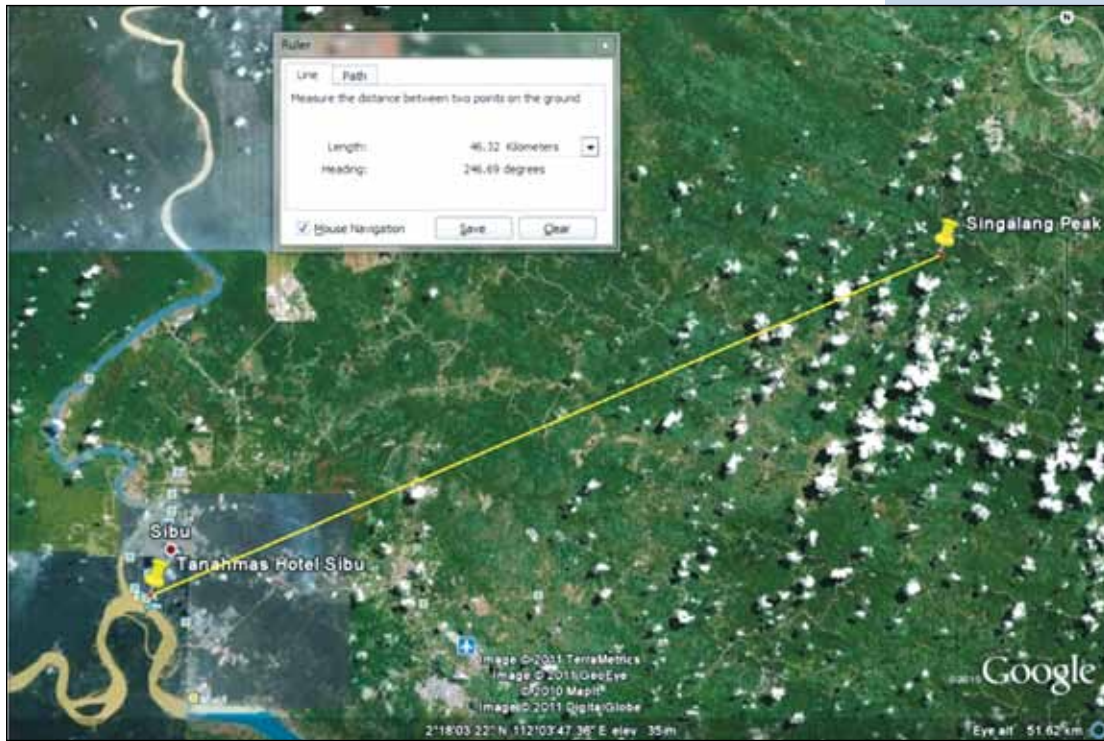
LanPro VULCAN, supports a great feature: "UPLOAD STREAMS TIME RATIO" letting the user to easily allocate the effective data rate between upload and download bandwidth. A surveillance application usually needs a higher throughput from the remote to the central site. The maximum 80% of the total throughput can be allocated for the upload streams used.

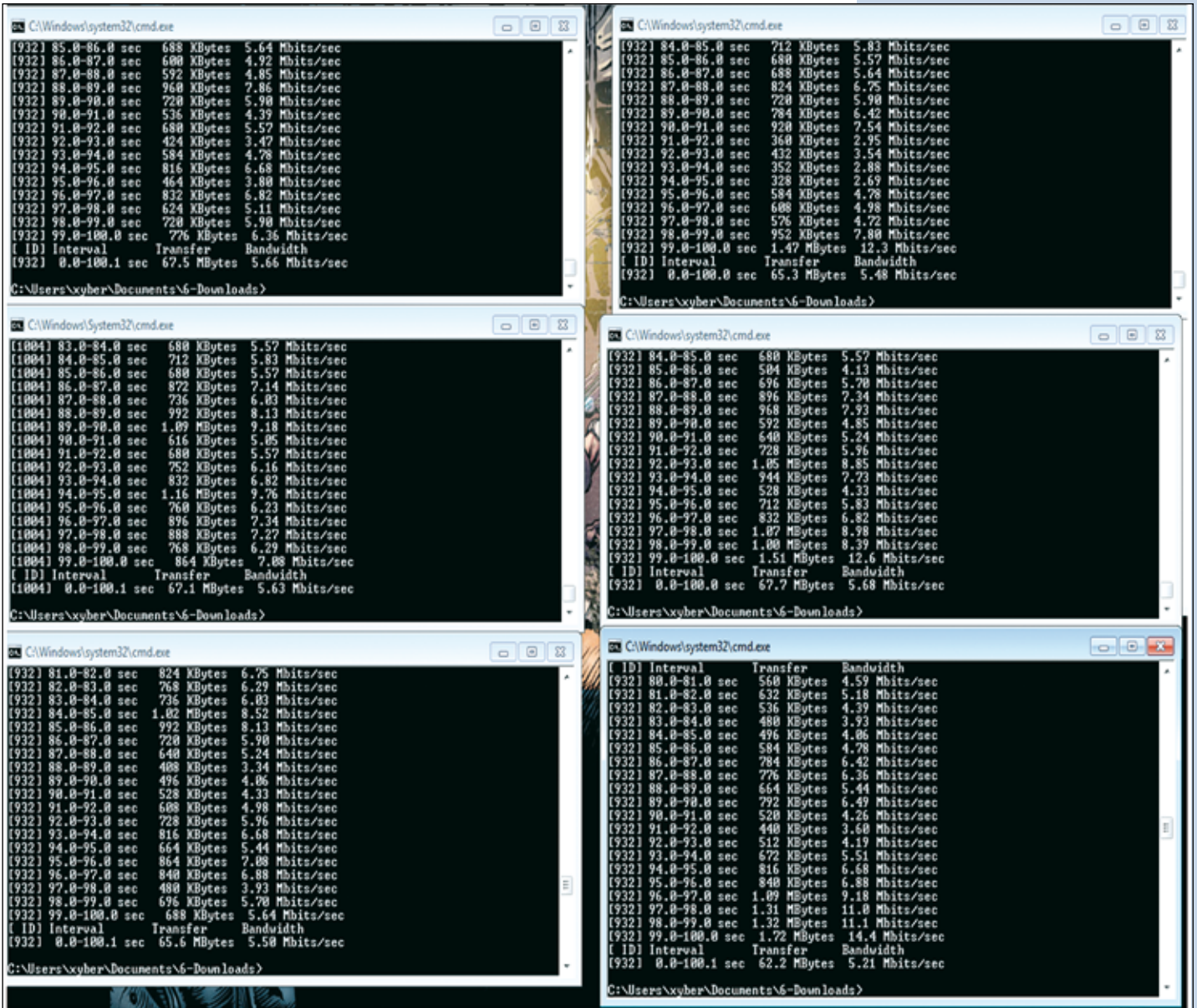
More Applications:



3 Study case

Long distance backhaul wireless link	
Location:	Sarawak, Malaysia
Customer:	Local ISP
Application:	Company system, intercom and internet access
Equipment:	Vulcan Series outdoor TDMA subscriber with external antenna power 23 dBm
Antenna:	32 dBi Disc
Distance:	46km





Link performance:	
•	6 concurrent sessions
•	Average throughput per session: 5.53Mbps
•	Total throughput achieved: 33.16Mbps