ESTUDIO SOBRE PRUEBAS DE ESTRÉS EN UNA RED WIRELESS 802.11G/N

PARTE I

En este **segundo estudio** se analizarán & compararán las estadísticas del consumo de CPU, utilización de memoria RAM, y tiempos de respuesta que influyen en el desempeño de una implementación Punto-MultiPunto en el estándar 802.11g/n

PREGUNTAS FRECUENTES EN IMPLEMENTACIÓN WIRELESS

AP, Estaciones, 802.11 a/b/g/n

- Cuál es la eficiencia de una red Wireless con Carga ?
- Cómo determinar cuántos clientes soporta un AP ?
- Es importante analizar los Paquetes Por Segundo ?
- Influye en la eficiencia el uso de los diferentes estándares?
- Es mejor N1x1 que N2x2 ? … por qué (si o no) ?

Qué sucede realmente en una red Wireless cuando se la somete a carga?

PRUEBAS EXHAUSTIVAS, ESCENARIOS, ESTADÍSTICAS, NUMEROSOS ANÁLISIS

AP, Estaciones, 802.11 b/g/n

	Ping Terminal PC (mseg)				CPU		Free	Traffic Out	Tx Packets	Rx Packets		
Carga	Min (mseg)	Prom (mseg)	Max (mseg)	Packet Loss	% Prom	(MiB)	(Kbps)	(Kbps)	(p/s)	(p/s)		
0 Kbps	6.25	61.09	523.28	0%	1%	9.70	2.00	10.00	3	6		
200 Kbps	6.25	61.09	523.28	0%	5%	9.50	3,707.00	3,815.00	21	23		
500 Kbps	1,830.34	3,323.86	5,123.13	0%	8%	9.00	9,640.00	7,134.00	57	58		
750 Kbps	6,011.42	14,274.35	19,060.00	14%	10%	8.30	13,600.00	2,900.00	119	121		
850 Kbps	19,542.13	22,167.29	24,507.36	17%	12%	8.00	13,600.00	2,900.00	160	1,111		WA Web
1 Mbps	30,166.95	37,069.34	45,471.90	24%	13%	8.00	13,600.00	2,900.00	200	980		NADA
0 Kbps					1%	9.70	50.00	2.40	4	8		
200 Kbps	6.41	19.54	197.05	0%	8%	8.70	3,500.00	3,500.00	333	335		2 equipos
500 Kbps	7.01	32.33	238.82	4%	11%	8.40	8,900.00	9,100.00	783	784		
750 Kbps	119.71	371.09	1,474.07	8%	11%	8.00	13,100.00	13,600.00	1,147	1,162		WA funciona
850 Kbps	126.54	461.57	2,208.90	24%	12%	8.00	14,700.00	15,700.00	1,213	1,257		WA funciona
1 Mbps	223.40	1,105.24	3,861.29	28%	13%	7.40	20,000.00	2,700.00	546	1,463		WA funciona
1.5 Mbps	546.70	3,472.79	9,274.21	69%	14%	7.40	24,900.00	489.00	20	2,129		WA no
2 Mbps	696.56	2,013.07	5,055.36	51%	16%	7.80	28,200.00	2,600.00	117	2,464		*** 3 equipos
0 Kbps					3%	9.70						
200 Kbps	6.05	18.28	344.42	4%	5%	9.70	3,500.00	3,500.00	343	347		
500 Kbps	6.26	26.30	137.87	2%	9%	9.40	8,900.00	8,900.00	822	855		
750 Kbps	6.12	49.41	260.82	6%	11%	9.20	13,500.00	13,600.00	1,179	1,175		
850 Kbps	61.02	124.12	257.96	19%	14%	9.00	15,300.00	15,300.00	1,304	1,306		WA funciona
1 Mbps	71.14	186.39	608.13	16%	16%	9.00	18,100.00	17,200.00	1,566	1,452		WA funciona
1.5 Mbps	58.47	688.85	2,010.54	26%	16%	8.80	26,800.00	11,200.00	1,059	2,116		WA funciona
2 Mbps	683.69	2,589.41	6,102.96	44%	18%	8.60	36,200.00	2,300.00	374	2,979		WA funciona
2.5 Mbps	827.24	4,230.34	8,620.56	33%	21%	8.60	45,100.00	2,200.00	327	3,357		WA no

UNA PEQUEÑA INTRODUCCIÓN

Academy Xperts

2006 - Network Xperts
2011 - MikroTik Xperts (solo MikroTik)
2013 - Evolución a **Academy Xperts**
(MikroTik, Ubiquiti, iBoss, Wild Packets, Wispro, Elastix)

Desde 2011: Centro de Certificación y Consultoría (MikroTik y Ubiquiti) más importante en toda América (norte, centro y sur)

Cursos en **15 países**: México, Puerto Rico, Rep. Dominicana, Guatemala, Honduras, Nicaragua, Costa Rica, Panamá, Venezuela, Colombia, Ecuador, Perú, Bolivia, Chile y Argentina

MÁS de **2,500** certificaciones MikroTik

UNA PEQUEÑA INTRODUCCIÓN

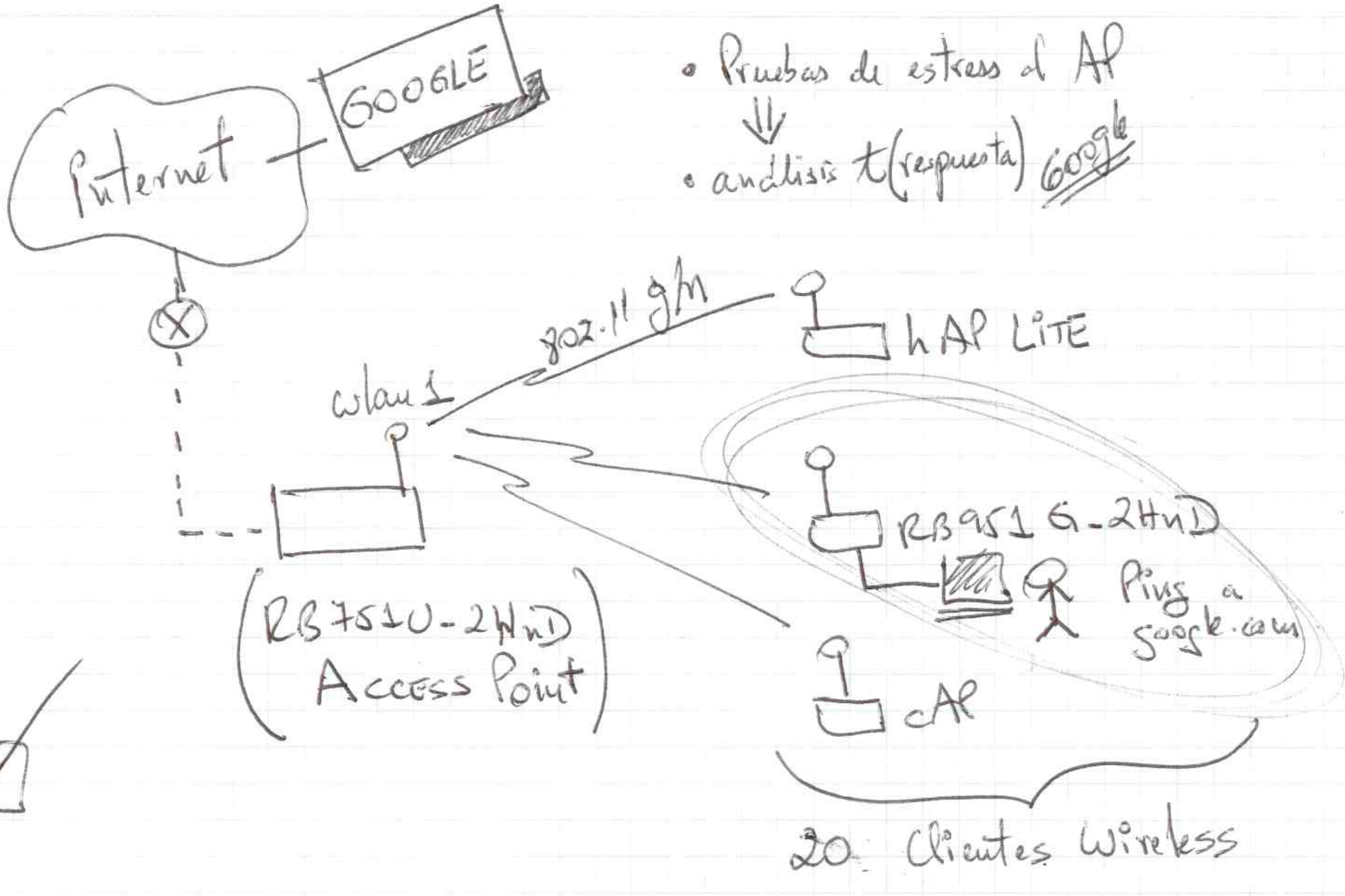
Mauro Escalante

1986-1990, Ingeniería en Ciencias de la Computación (ESPOL)
1989, DBA Informix 4GL
1991, DBA Oracle
1993, Ingeniero Especialista en Motorola (X.25, Frame Relay, routing, VoIP)
1995, Jefe de Redes e Internet Banco Tungurahua
1997, Gerente de Redes e Infraestructura Banco Tungurahua

2001, Especialización en **Análisis y Troubleshooting de Redes** usando Analizadores de Protocolo con sistemas expertos
2006, CEO Network Xperts
2009, MikroTik Trainer Partner
2011, CEO MikroTik Xperts
2013, CEO Academy Xperts

22 años de experiencia en Redes LAN-WAN-Wireless

IDEA Y ESCENARIO DEFINITIVO



RECORDAR QUE SON PRUEBAS IDEALES DE LABORATORIO EN UN AMBIENTE CONTROLADO

Ra...	MAC Address	Interface	Uptime	AP	Tx/Rx Si...	Signal To...	Tx/Rx CC...	Tx Rate	Rx Rate
R1	D4:CA:6D:E5:7F:E3	wlan1_AP1	00:51:48	no	-29/-30	73	65/61	180Mbps-40MH...	121.5Mbps-40M...
R2	00:0C:42:B7:C9:13	wlan1_AP1	00:48:21	no	-36/-42	61	73/48	300Mbps-40MH...	104Mbps-20MHz...
R3	D4:CA:6D:B4:31:1D	wlan1_AP1	00:48:36	no	-40/-40	63	75/64	300Mbps-40MH...	216Mbps-40MHz...
R4	D4:CA:6D:C2:7F:0E	wlan1_AP1	00:48:53	no	-38/-45	58	80/79	300Mbps-40MH...	240Mbps-40MHz...
R5	4C:5E:0C:0C:2D:A2	wlan1_AP1	00:49:14	no	-39/-48	55	94/66	270Mbps-40MH...	240Mbps-40MHz...
R6	4C:5E:0C:0C:2F:55	wlan1_AP1	00:47:51	no	-35/-46	57	89/54	300Mbps-40MH...	180Mbps-40MHz...
R7	4C:5E:0C:0C:2F:37	wlan1_AP1	00:47:15	no	-38/-40	63	83/75	300Mbps-40MH...	270Mbps-40MHz...
R8	4C:5E:0C:0C:2F:00	wlan1_AP1	00:46:32	no	-38/-47	56	83/68	243Mbps-40MH...	162Mbps-40MHz...
R9	D4:CA:6D:C2:7F:63	wlan1_AP1	00:46:22	no	-43/-46	57	78/70	270Mbps-40MH...	243Mbps-40MHz...
R10	4C:5E:0C:0C:2B:F4	wlan1_AP1	00:45:47	no	-43/-49	54	79/56	216Mbps-40MH...	162Mbps-40MHz...
R11	D4:CA:6D:C2:7F:E0	wlan1_AP1	00:45:26	no	-41/-43	60	78/73	216Mbps-40MH...	270Mbps-40MHz...
R12	4C:5E:0C:59:FA:25	wlan1_AP1	00:44:40	no	-44/-50	53	72/81	240Mbps-40MH...	240Mbps-40MHz...
R13	4C:5E:0C:0C:2F:5A	wlan1_AP1	00:43:22	no	-39/-47	56	83/77	270Mbps-40MH...	216Mbps-40MHz...
R14	D4:CA:6D:C2:7D:BA	wlan1_AP1	00:43:03	no	-39/-40	63	86/71	270Mbps-40MH...	216Mbps-40MHz...
R15	E4:8D:8C:87:06:3D	wlan1_AP1	00:42:41	no	-42/-46	57	87/53	300Mbps-40MH...	240Mbps-40MHz...
R16	4C:5E:0C:AF:D0:B7	wlan1_AP1	00:42:20	no	-43/-42	61	83/71	300Mbps-40MH...	243Mbps-40MHz...
R17	E4:8D:8C:83:3C:53	wlan1_AP1	00:41:58	no	-42/-41	62	81/45	270Mbps-40MH...	270Mbps-40MHz...
R20	4C:5E:0C:59:F9:BC	wlan1_AP1	00:41:37	no	-33/-36	67	83/59	243Mbps-40MH...	162Mbps-40MHz...

ESCENARIO BASE

- **Configuración del Access Point**
    - band = 2GHz-only-G
    - frequency = 2412
    - supported-rates-a/g = 36, 48, 54
    - basic-rates-a/g = 36, 48, 54
    - distance = indoors (ack timeout)
    - tx-power = 12

ESCENARIO INICIAL

AP + 1 estación

Station:

- hAP Lite (RB951Ui-2nD)
- Paquetes estándares
- SNMP habilitado
- Bridge = Wlan1 + Eth1

Cliente LAN:

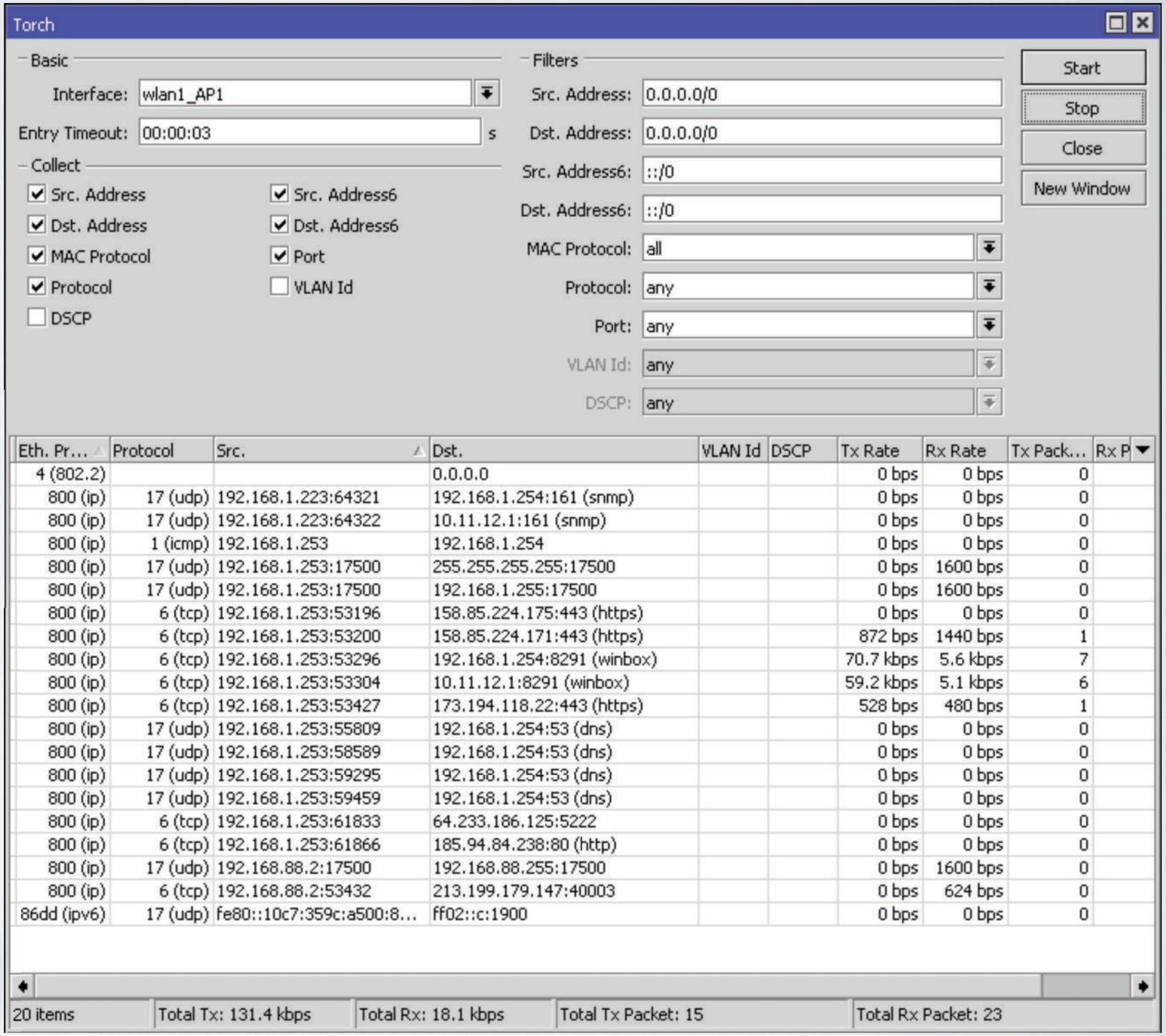
- MacBook Pro
- Google Chrome
- Safari
- Skype
- Mail (IMAP, 5 cuentas)
- Winbox (3 RBs)

Consumo aprox PC:

- **Tx = 131 Kbps**
- Rx = 18 Kbps

AP recibe aprox:

- **Rx = 131 Kbps**

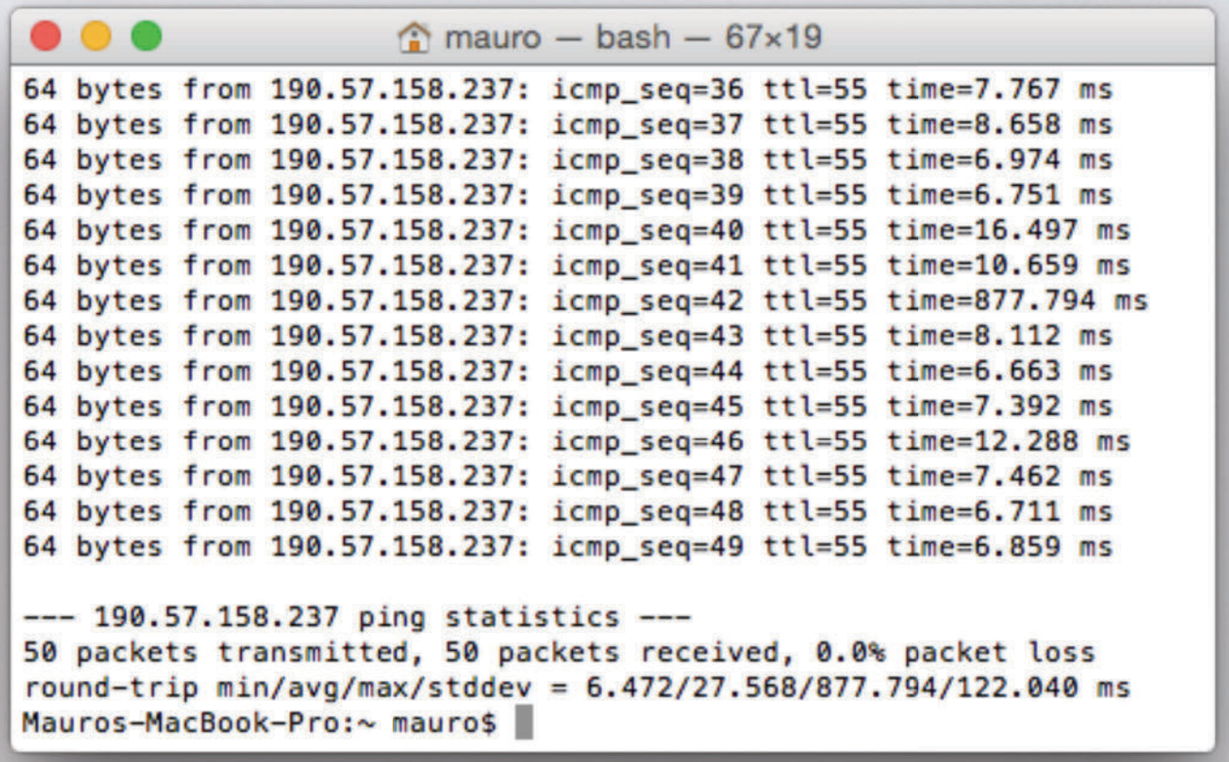


ESCENARIO INICIAL

AP + 1 estación : Tiempo de Respuesta de PC basado en condiciones iniciales

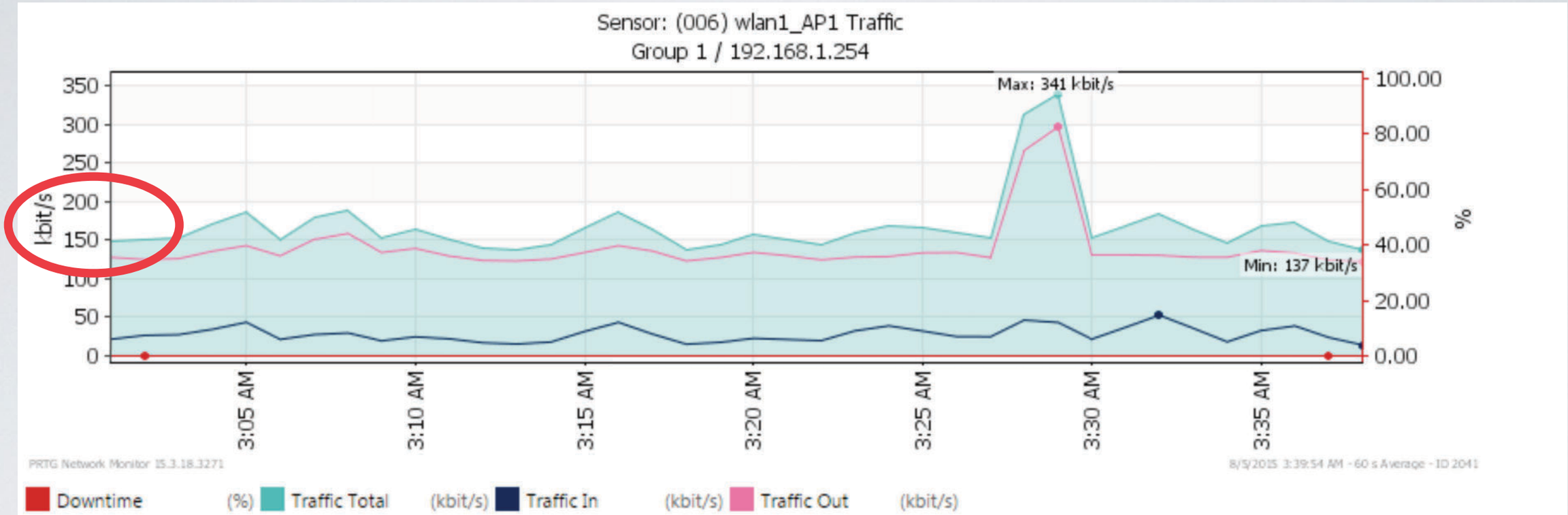
Prueba de PING:

- Destino google.com
- 190.57.158.237
- Se utiliza la dirección IP fija en lugar del nombre de dominio ya que puede resolver con otra dirección IP
- 50 paquetes de ping



ESCENARIO INICIAL

AP + 1 estación : Tráfico monitoreo SNMP en el AP



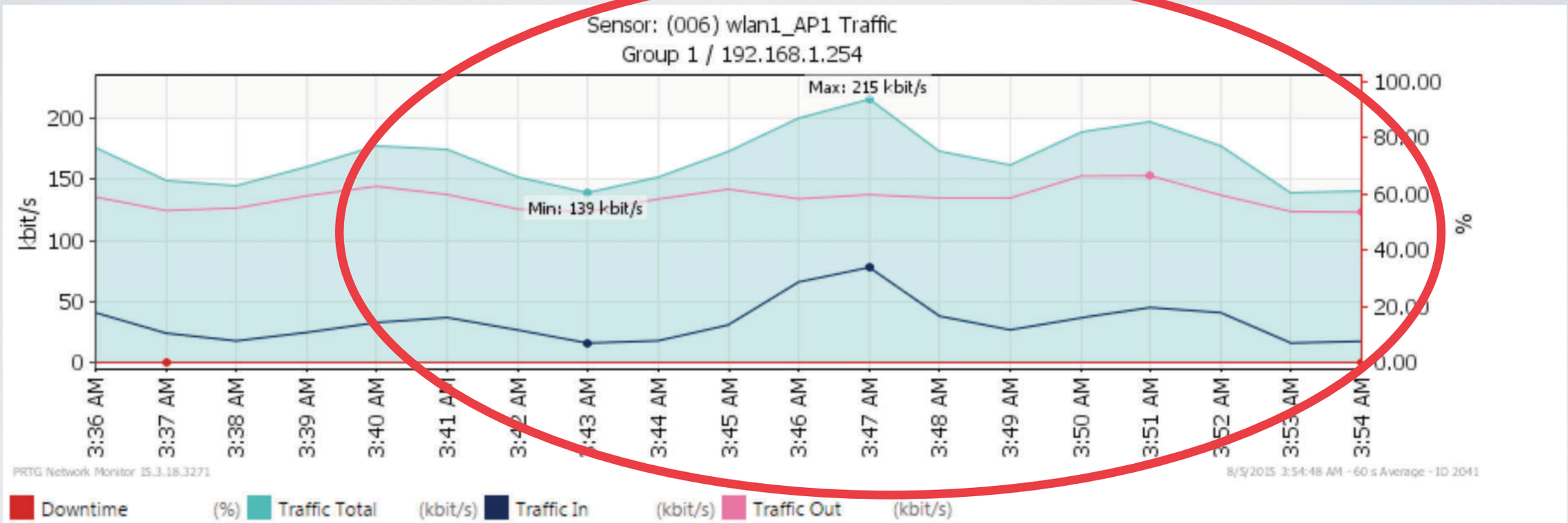
Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
Sums (of 38 values)	46,824 KByte		7,878 KByte		38,946 KByte			
Averages (of 38 values)	1,232 KByte	168 kbit/s	207 KByte	28 kbit/s	1,025 KByte	140 kbit/s	0 %	99 %

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
8/5/2015 3:00:00 AM – 3:01:00 AM	1,590 KByte	150 kbit/s	230 KByte	22 kbit/s	1,360 KByte	128 kbit/s	0 %	100 %
8/5/2015 3:01:00 AM – 3:02:00 AM	1,113 KByte	152 kbit/s	196 KByte	27 kbit/s	917 KByte	125 kbit/s	0 %	100 %
8/5/2015 3:02:00 AM – 3:03:00 AM	1,127 KByte	154 kbit/s	202 KByte	28 kbit/s	925 KByte	126 kbit/s	0 %	100 %
8/5/2015 3:03:00 AM – 3:04:00 AM	1,249 KByte	171 kbit/s	253 KByte	35 kbit/s	996 KByte	136 kbit/s	0 %	100 %
8/5/2015 3:04:00 AM – 3:05:00 AM	1,369 KByte	187 kbit/s	320 KByte	44 kbit/s	1,049 KByte	143 kbit/s	0 %	100 %

ESCENARIO INICIAL

AP + 1 estación : Tráfico monitoreo SNMP en el AP

Se agrega tráfico SPOTIFY = tráfico casi invariable



Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
Sums (of 19 values)	23,503 KByte		4,702 KByte		18,801 KByte			
Averages (of 19 values)	1,237 KByte	169 kbit/s	247 KByte	34 kbit/s	990 KByte	135 kbit/s	0 %	98 %

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
8/5/2015 3:35:00 AM – 3:36:00 AM	1,872 KByte	176 kbit/s	433 KByte	41 kbit/s	1,439 KByte	136 kbit/s	0 %	100 %
8/5/2015 3:36:00 AM – 3:37:00 AM	1,087 KByte	148 kbit/s	176 KByte	24 kbit/s	912 KByte	124 kbit/s	0 %	100 %
8/5/2015 3:37:00 AM – 3:38:00 AM	1,056 KByte	144 kbit/s	129 KByte	18 kbit/s	927 KByte	127 kbit/s	0 %	100 %
8/5/2015 3:38:00 AM – 3:39:00 AM	1,180 KByte	161 kbit/s	180 KByte	25 kbit/s	1,000 KByte	137 kbit/s	0 %	100 %

ESCENARIO INICIAL

AP + 1 estación : Tráfico monitoreo SNMP en el AP

Se agrega tráfico SPOTIFY = tráfico casi invariable

Prueba de PING:

- Tiempo de respuesta prácticamente invariable

mauro — bash — 67×19

```
64 bytes from 190.57.158.237: icmp_seq=36 ttl=55 time=7.767 ms
64 bytes from 190.57.158.237: icmp_seq=37 ttl=55 time=8.658 ms
64 bytes from 190.57.158.237: icmp_seq=38 ttl=55 time=6.974 ms
64 bytes from 190.57.158.237: icmp_seq=39 ttl=55 time=6.751 ms
64 bytes from 190.57.158.237: icmp_seq=40 ttl=55 time=16.497 ms
64 bytes from 190.57.158.237: icmp_seq=41 ttl=55 time=10.659 ms
64 bytes from 190.57.158.237: icmp_seq=42 ttl=55 time=877.794 ms
64 bytes from 190.57.158.237: icmp_seq=43 ttl=55 time=8.112 ms
64 bytes from 190.57.158.237: icmp_seq=44 ttl=55 time=6.663 ms
64 bytes from 190.57.158.237: icmp_seq=45 ttl=55 time=7.392 ms
64 bytes from 190.57.158.237: icmp_seq=46 ttl=55 time=12.288 ms
64 bytes from 190.57.158.237: icmp_seq=47 ttl=55 time=7.462 ms
64 bytes from 190.57.158.237: icmp_seq=48 ttl=55 time=6.711 ms
64 bytes from 190.57.158.237: icmp_seq=49 ttl=55 time=6.859 ms

--- 190.57.158.237 ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.472/27.568/877.794/122.040 ms
Mauros-MacBook-Pro:~ mauro$
```

mauro — bash — 67×19

```
64 bytes from 190.57.158.237: icmp_seq=36 ttl=55 time=7.939 ms
64 bytes from 190.57.158.237: icmp_seq=37 ttl=55 time=6.546 ms
64 bytes from 190.57.158.237: icmp_seq=38 ttl=55 time=9.752 ms
64 bytes from 190.57.158.237: icmp_seq=39 ttl=55 time=6.667 ms
64 bytes from 190.57.158.237: icmp_seq=40 ttl=55 time=6.738 ms
64 bytes from 190.57.158.237: icmp_seq=41 ttl=55 time=7.249 ms
64 bytes from 190.57.158.237: icmp_seq=42 ttl=55 time=201.210 ms
64 bytes from 190.57.158.237: icmp_seq=43 ttl=55 time=10.152 ms
64 bytes from 190.57.158.237: icmp_seq=44 ttl=55 time=6.384 ms
64 bytes from 190.57.158.237: icmp_seq=45 ttl=55 time=6.907 ms
64 bytes from 190.57.158.237: icmp_seq=46 ttl=55 time=11.360 ms
64 bytes from 190.57.158.237: icmp_seq=47 ttl=55 time=6.448 ms
64 bytes from 190.57.158.237: icmp_seq=48 ttl=55 time=13.525 ms
64 bytes from 190.57.158.237: icmp_seq=49 ttl=55 time=9.950 ms

--- 190.57.158.237 ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.106/13.000/201.210/27.328 ms
Mauros-MacBook-Pro:~ mauro$
```

LABORATORIO DE PRUEBA

- Se conectarán en total 20 estaciones
    - R1 hasta R20
    - band = 2GHz-only-G
    - frequency = 2412
    - supported-rates-a/g = 36, 48, 54
    - basic-rates-a/g = 36, 48, 54
    - distance = indoors (ack timeout)
    - tx-power = 12
- Se realizarán varios eventos de pruebas para el análisis de tráfico
- 20 estaciones conectadas, 19 sin tráfico, 1 con tráfico (escenario inicial)

ESCENARIOS DE PRUEBA

20 estaciones conectadas - Tráfico progresivo

1) **19 estaciones sin tráfico, 1 estación con tráfico (escenario inicial)**
    - Mediremos tiempo de respuesta
2) **20 estaciones con tráfico (200 Kbps)**
    - Consumo promedio aproximado de 200 Kbps por estación
    - Mediremos tiempo de respuesta
3) **20 estaciones con tráfico (500 Kbps)**
4) **20 estaciones con tráfico (750 Kbps)**
5) **20 estaciones con tráfico (850 Kbps)**
6) **20 estaciones con tráfico (1.0 Mbps)**
7) **20 estaciones con tráfico (1.5 Mbps)**
8) **20 estaciones con tráfico (2.0 Mbps)**

ESCENARIO DE PRUEBA

20 estaciones conectadas - Tráfico progresivo

- Todas las estaciones estarán en mode=bridge
- Recibirán una IP administrativa vía DHCP Server

ESCENARIO DE PRUEBA # 1

19 estaciones sin tráfico, 1 estación con tráfico (escenario inicial)

Managed | Neighbors

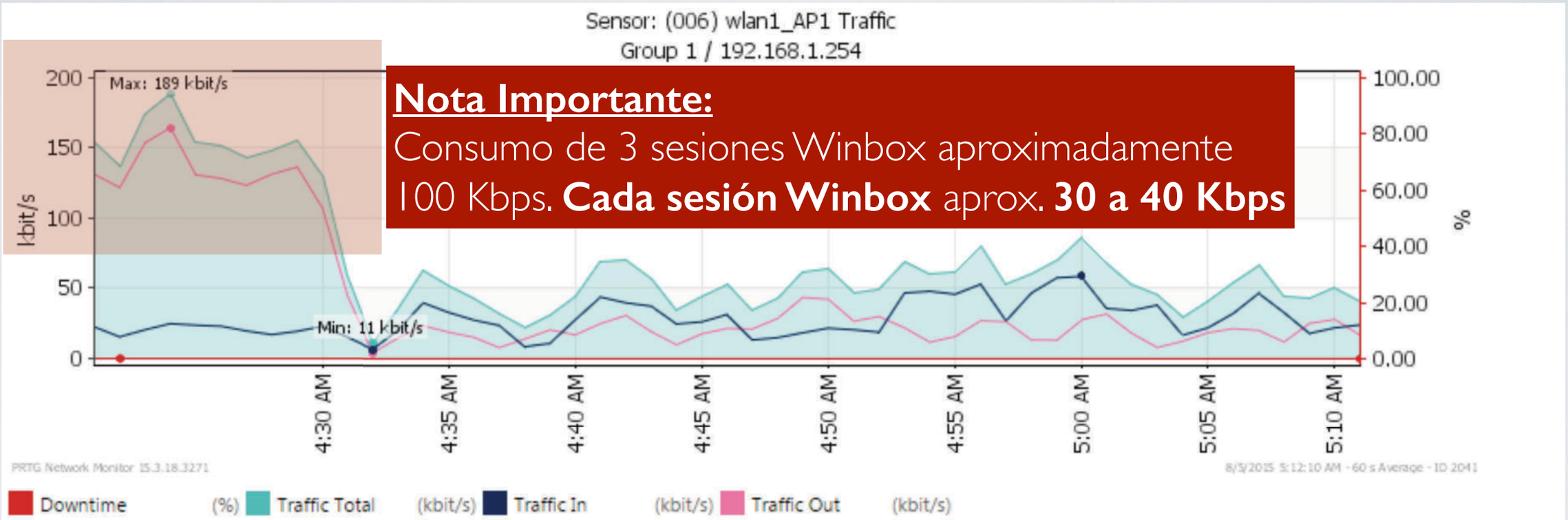
Refresh | Find | all

MAC Address	IP Address	Identity	Version	Board	Type
A					
D4:CA:6D:A6:12:D1	192.168.1.254	AP1	6.30.2	RB751U-2HnD	IPv4 only
R					
D4:CA:6D:E5:7F:DE	192.168.1.1	R1	6.30.2	RB951G-2HnD	IPv4 only
00:0C:42:B7:C9:0E	192.168.1.212	R2	6.30.2	RB951G-2HnD	IPv4 only
D4:CA:6D:B4:31:19	192.168.1.209	R3	6.30.2	RB751U-2HnD	IPv4 only
D4:CA:6D:C2:7F:0A	192.168.1.210	R4	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:0C:2D:A2	192.168.1.206	R5	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:0C:2F:55	192.168.1.207	R6	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:0C:2F:37	192.168.1.208	R7	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:0C:2F:00	192.168.1.211	R8	6.30.2	RB941-2nD	IPv4 only
D4:CA:6D:C2:7F:63	192.168.1.213	R9	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:0C:2B:F0	192.168.1.216	R10	6.30.2	RB941-2nD	IPv4 only
D4:CA:6D:C2:7F:E0	192.168.1.217	R11	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:59:FA:25	192.168.1.214	R12	6.30.2	RB941-2nD	IPv4 only
4C:5E:0C:0C:2F:5A	192.168.1.215	R13	6.30.2	RB941-2nD	IPv4 only
D4:CA:6D:C2:7D:BA	192.168.1.218	R14	6.30.2	RB941-2nD	IPv4 only
E4:8D:8C:87:06:38	192.168.1.205	R15	6.30.2	RB951Ui-2HnD	IPv4 only
4C:5E:0C:AF:D0:B2	192.168.1.204	R16	6.30.2	RB951Ui-2HnD	IPv4 only
E4:8D:8C:83:3C:4E	192.168.1.203	R17	6.30.2	RB951Ui-2HnD	IPv4 only
4C:5E:0C:2D:82:2C	192.168.1.219	R18	6.30.2	RBcAP2n	IPv4 only
4C:5E:0C:84:DD:10	192.168.1.220	R19	6.30.2	RBcAP2n	IPv4 only
4C:5E:0C:59:F9:BC	192.168.1.221	R20	6.30.2	RB941-2nD	IPv4 only

21 items

ESCENARIO DE PRUEBA # 1

19 estaciones sin tráfico, 1 estación con tráfico (escenario inicial) - **Winbox cerrado**



Nota Importante:
Consumo de 3 sesiones Winbox aproximadamente 100 Kbps. **Cada sesión Winbox** aprox. **30 a 40 Kbps**

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
Sums (of 51 values)	27,019 KByte		10,552 KByte		16,467 KByte			
Averages (of 51 values)	530 KByte	72 kbit/s	207 KByte	28 kbit/s	323 KByte	44 kbit/s	0 %	99 %

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
8/5/2015 4:20:00 AM – 4:21:00 AM	1,634 KByte	154 kbit/s	239 KByte	23 kbit/s	1,395 KByte	131 kbit/s	0 %	100 %
8/5/2015 4:21:00 AM – 4:22:00 AM	1,005 KByte	137 kbit/s	113 KByte	15 kbit/s	892 KByte	122 kbit/s	0 %	100 %
8/5/2015 4:22:00 AM – 4:23:00 AM	1,276 KByte	174 kbit/s	150 KByte	20 kbit/s	1,126 KByte	154 kbit/s	0 %	100 %
8/5/2015 4:23:00 AM – 4:24:00 AM	1,388 KByte	189 kbit/s	182 KByte	25 kbit/s	1,205 KByte	165 kbit/s	0 %	100 %
8/5/2015 4:24:00 AM – 4:25:00 AM	1,133 KByte	155 kbit/s	174 KByte	24 kbit/s	959 KByte	131 kbit/s	0 %	100 %
8/5/2015 4:25:00 AM – 4:26:00 AM	1,109 KByte	151 kbit/s	169 KByte	23 kbit/s	940 KByte	128 kbit/s	0 %	100 %

ESCENARIO DE PRUEBA # 1

19 estaciones sin tráfico, 1 estación con tráfico (escenario inicial) - **Winbox cerrado**

mauro — bash — 67×19

```
64 bytes from 190.57.158.237: icmp_seq=36 ttl=55 time=7.767 ms
64 bytes from 190.57.158.237: icmp_seq=37 ttl=55 time=8.658 ms
64 bytes from 190.57.158.237: icmp_seq=38 ttl=55 time=6.974 ms
64 bytes from 190.57.158.237: icmp_seq=39 ttl=55 time=6.751 ms
64 bytes from 190.57.158.237: icmp_seq=40 ttl=55 time=16.497 ms
64 bytes f                                              659 ms
64 bytes f                                             .794 ms
64 bytes f                                              12 ms
64 bytes from 190.57.158.237: icmp_seq=44 ttl=55 time=6.663 ms
64 bytes from 190.57.158.237: icmp_seq=45 ttl=55 time=7.392 ms
64 bytes from 190.57.158.237: icmp_seq=46 ttl=55 time=12.288 ms
64 bytes from 190.57.158.237: icmp_seq=47 ttl=55 time=7.462 ms
64 bytes from 190.57.158.237: icmp_seq=48 ttl=55 time=6.711 ms
64 bytes from 190.57.158.237: icmp_seq=49 ttl=55 time=6.859 ms

--- 190.57.158.237 ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.472/27.568/877.794/122.040 ms
Mauros-MacBook-Pro:~ mauro$
```

Una sola estación

mauro — bash — 67×14

```
64 bytes from 190.57.158.237: icmp_seq=41 ttl=55 time=6.809 ms
64 bytes from 190.57.158.237: icmp_seq=42 ttl=55 time=9.071 ms
64 bytes from 190.57.158.237: icmp_seq=43 ttl=55 time=7.323 ms
64 bytes fro                                              ms
64 bytes fro                                              ms
64 bytes fro                                              ms
64 bytes fro                                              ms
64 bytes fro                                              ms
64 bytes fro                                              ms

--- 190.57.158.237 ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.128/12.548/121.753/17.240 ms
Mauros-MacBook-Pro:~ mauro$
64 bytes from 190.57.158.237: icmp_seq=43 ttl=55 time=7.570 ms
64 bytes from 190.57.158.237: icmp_seq=44 ttl=55 time=7.994 ms
64 bytes from 190.57.158.237: icmp_seq=45 ttl=55 time=6.994 ms
64 bytes from 190.57.158.237: icmp_seq=46 ttl=55 time=8.402 ms
64 bytes from 190.57.158.237: icmp_seq=47 ttl=55 time=6.365 ms
64 bytes from 190.57.158.237: icmp_seq=48 ttl=55 time=6.354 ms
64 bytes from 190.57.158.237: icmp_seq=49 ttl=55 time=7.238 ms

--- 190.57.158.237 ping statistics ---
50 packets transmitted, 50 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.275/13.065/136.332/19.782 ms
Mauros-MacBook-Pro:~ mauro$
64 bytes from 190.57.158.237: icmp_seq=43 ttl=55 time=7.460 ms
64 bytes from 190.57.158.237: icmp_seq=44 ttl=55 time=8.515 ms
64 bytes from 190.57.158.237: icmp_seq=45 ttl=55 time=8.960 ms
64 bytes from 190.57.158.237: icmp_seq=46 ttl=55 time=7.077 ms
64 bytes from 190.57.158.237: icmp_seq=47 ttl=55 time=57.345 ms
64 bytes from 190.57.158.237: icmp_seq=48 ttl=55 time=6.905 ms
64 bytes from 190.57.158.237: icmp_seq=49 ttl=55 time=22.926 ms

--- 190.57.158.237 ping statistics ---
50 packets transmitted, 49 packets received, 2.0% packet loss
round-trip min/avg/max/stddev = 6.373/13.009/166.139/23.737 ms
Mauros-MacBook-Pro:~ mauro$
```

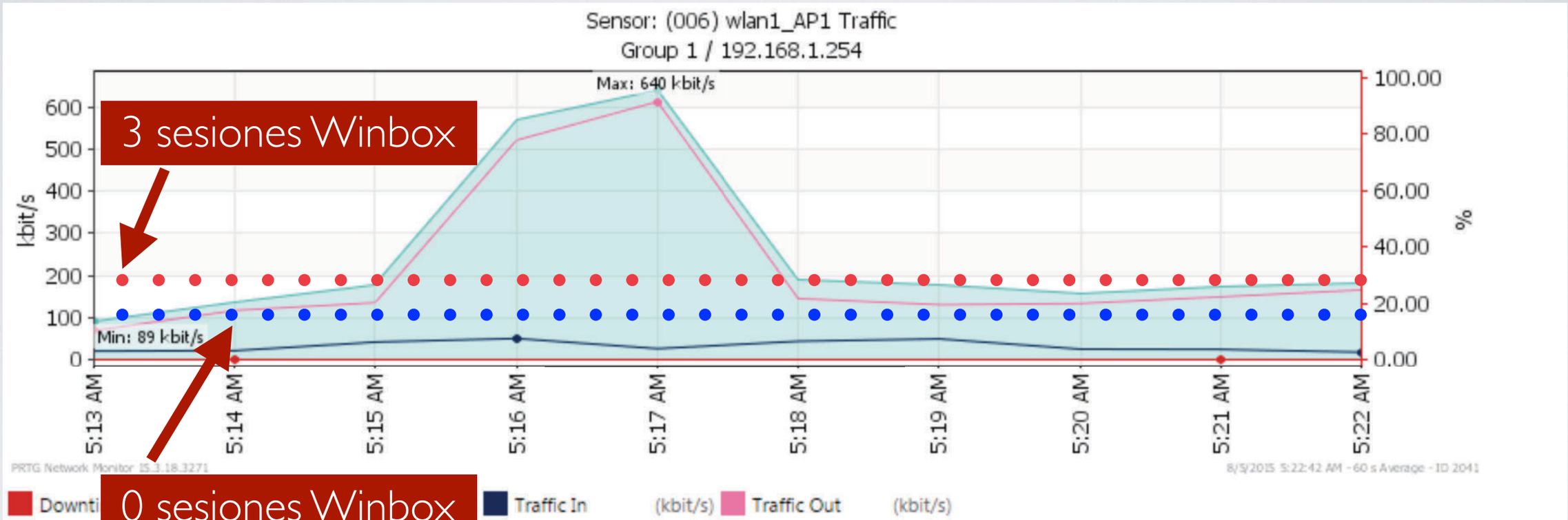
20 estaciones conectadas

Prueba de PING:

- Tiempo de respuesta prácticamente invariable

ESCENARIO DE PRUEBA # 1

19 estaciones sin tráfico, 1 estación con tráfico (escenario inicial) - **3 sesiones Winbox**

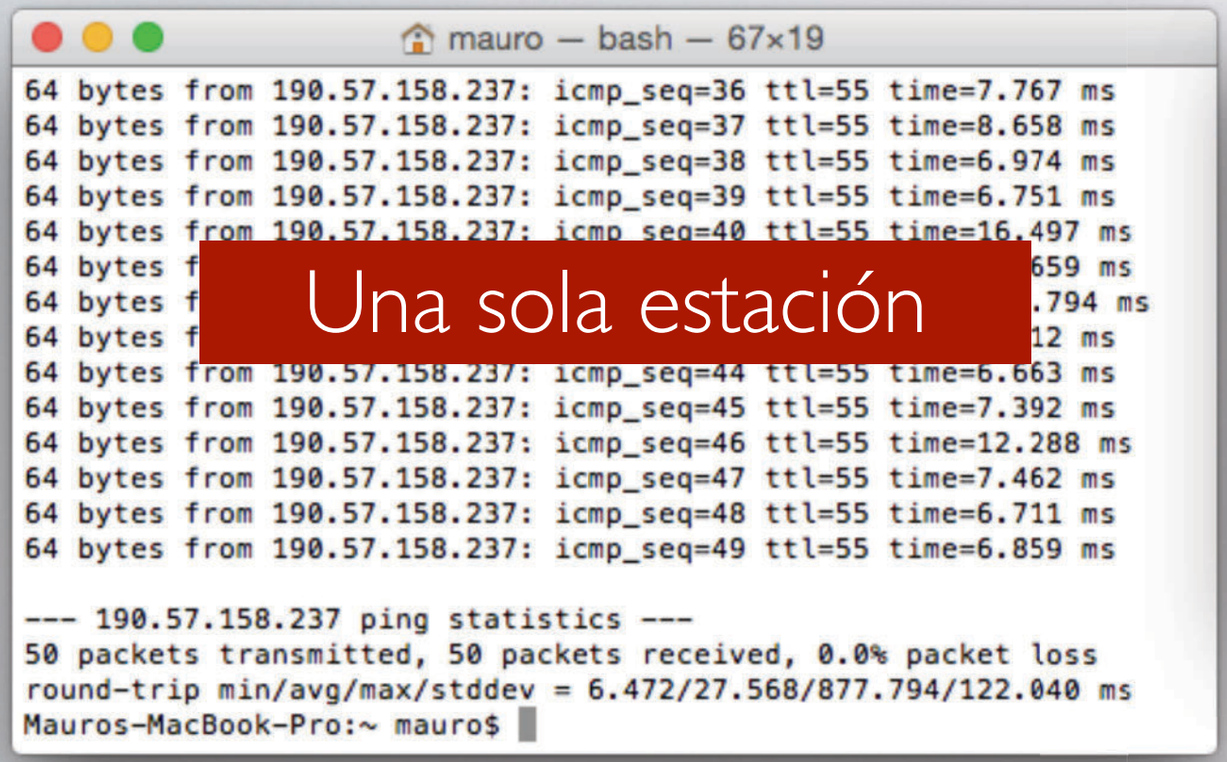


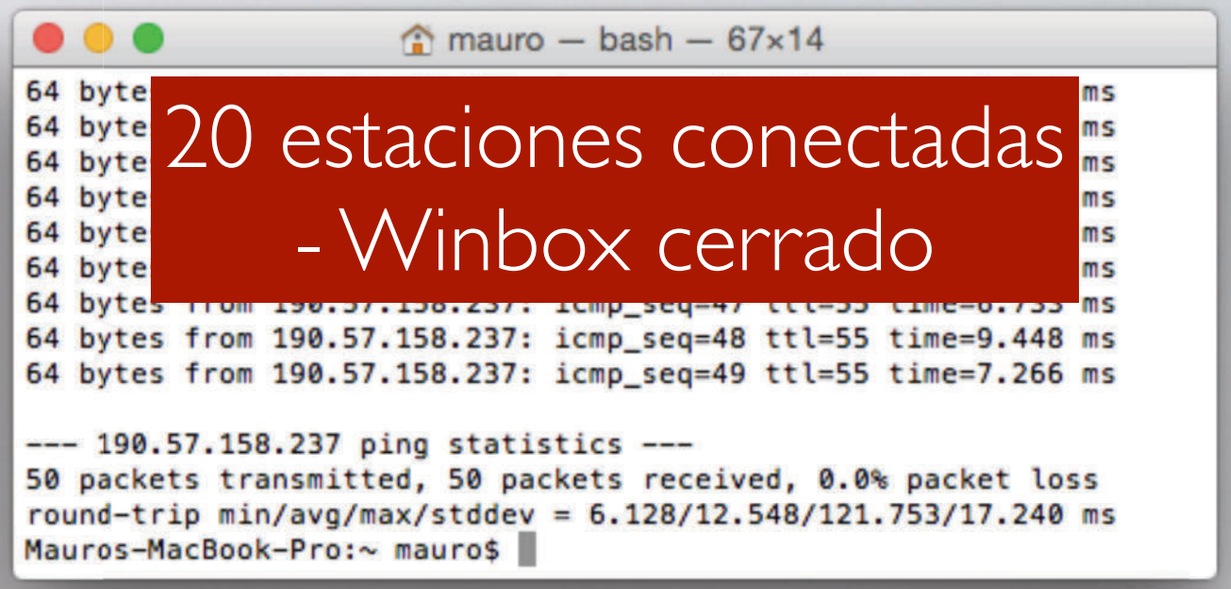
Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume)	Traffic Out (speed)	Downtime	Coverage
Sums (of 10 values)	17,998 KByte		2,342 KByte		15,656 KByte			
Averages (of 10 values)	1,800 KByte	246 kbit/s	234 KByte	32 kbit/s	1,566 KByte	214 kbit/s	0 %	95 %

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume)	Traffic Out (speed)	Downtime	Coverage
8/5/2015 5:12:00 AM – 5:13:00 AM	946 KByte	89 kbit/s	213 KByte	20 kbit/s	733 KByte	69 kbit/s	0 %	100 %
8/5/2015 5:13:00 AM – 5:14:00 AM	1,012 KByte	138 kbit/s	156 KByte	21 kbit/s	857 KByte	117 kbit/s	0 %	100 %
8/5/2015 5:14:00 AM – 5:15:00 AM	1,298 KByte	177 kbit/s	305 KByte	42 kbit/s	992 KByte	136 kbit/s	0 %	100 %
8/5/2015 5:15:00 AM – 5:16:00 AM	4,190 KByte	572 kbit/s	368 KByte	50 kbit/s	3,822 KByte	522 kbit/s	0 %	100 %
8/5/2015 5:16:00 AM – 5:17:00 AM	4,685 KByte	640 kbit/s	191 KByte	26 kbit/s	4,495 KByte	614 kbit/s	0 %	100 %
8/5/2015 5:17:00 AM – 5:18:00 AM	1,382 KByte	189 kbit/s	319 KByte	44 kbit/s	1,063 KByte	145 kbit/s	0 %	100 %

ESCENARIO DE PRUEBA # 1

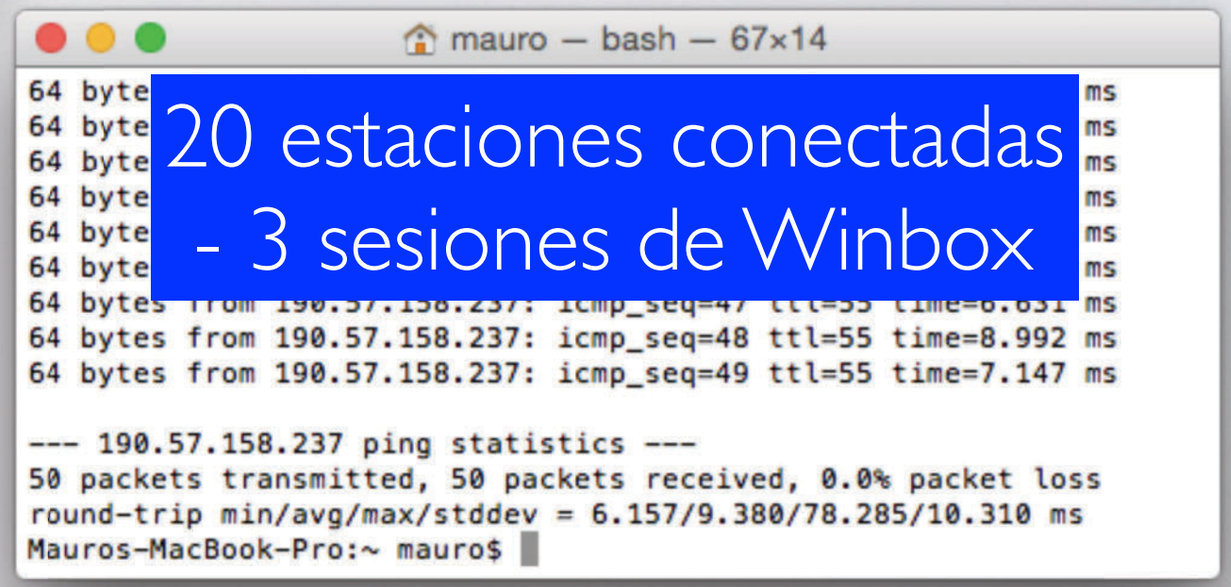
19 estaciones sin tráfico, 1 estación con tráfico (escenario inicial) - **3 sesiones Winbox**





Prueba de PING:

- Tiempo de respuesta prácticamente invariable
- A partir de este punto se tendrán siempre abiertas 3 sesiones de Winbox



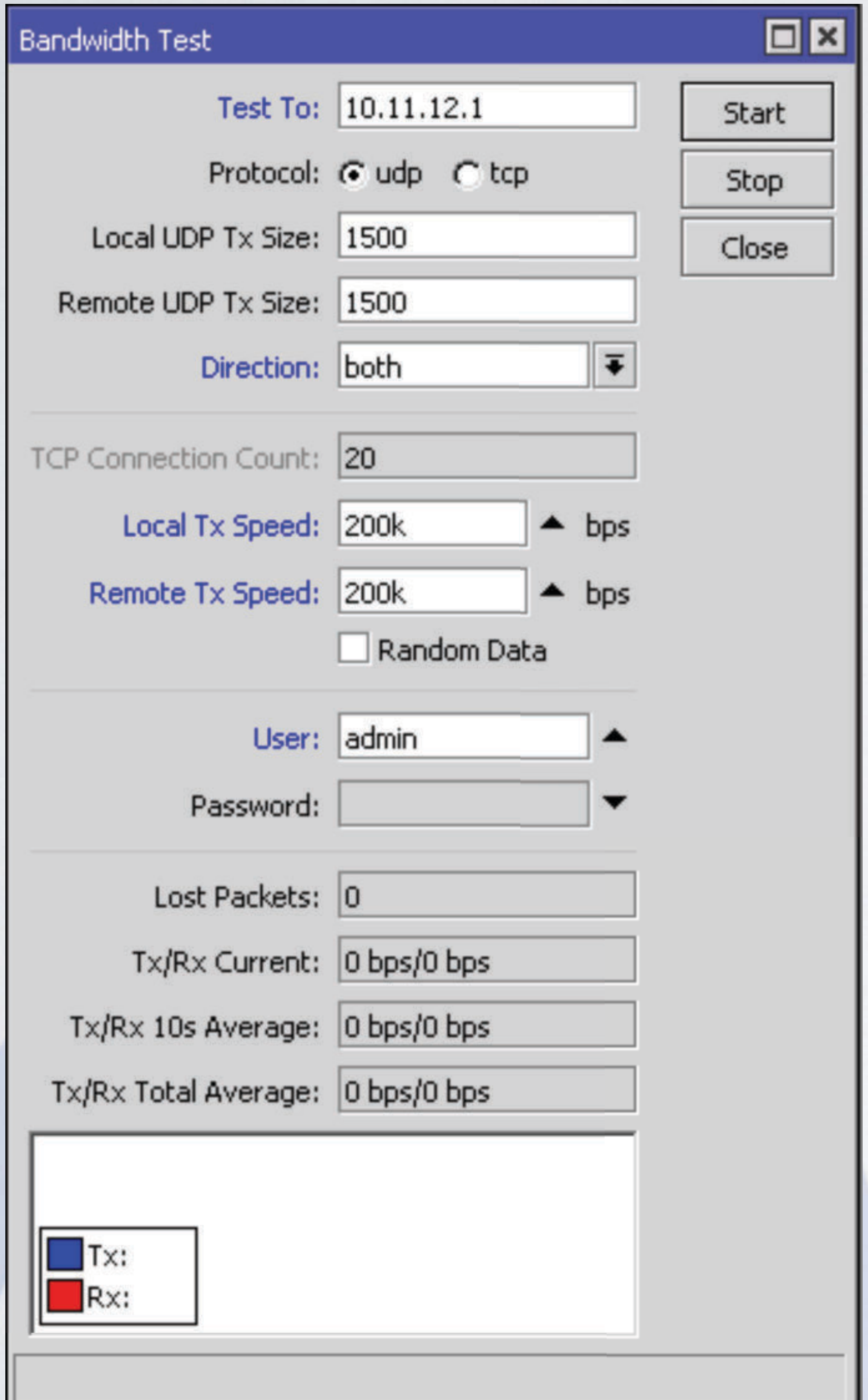
ESCENARIO DE PRUEBA # 2

20 estaciones con tráfico (200 Kbps)

- Bandwidth test para generar tráfico

ESCENARIO DE PRUEBA # 2

20 estaciones con tráfico (200 Kbps) - Bandwidth Test

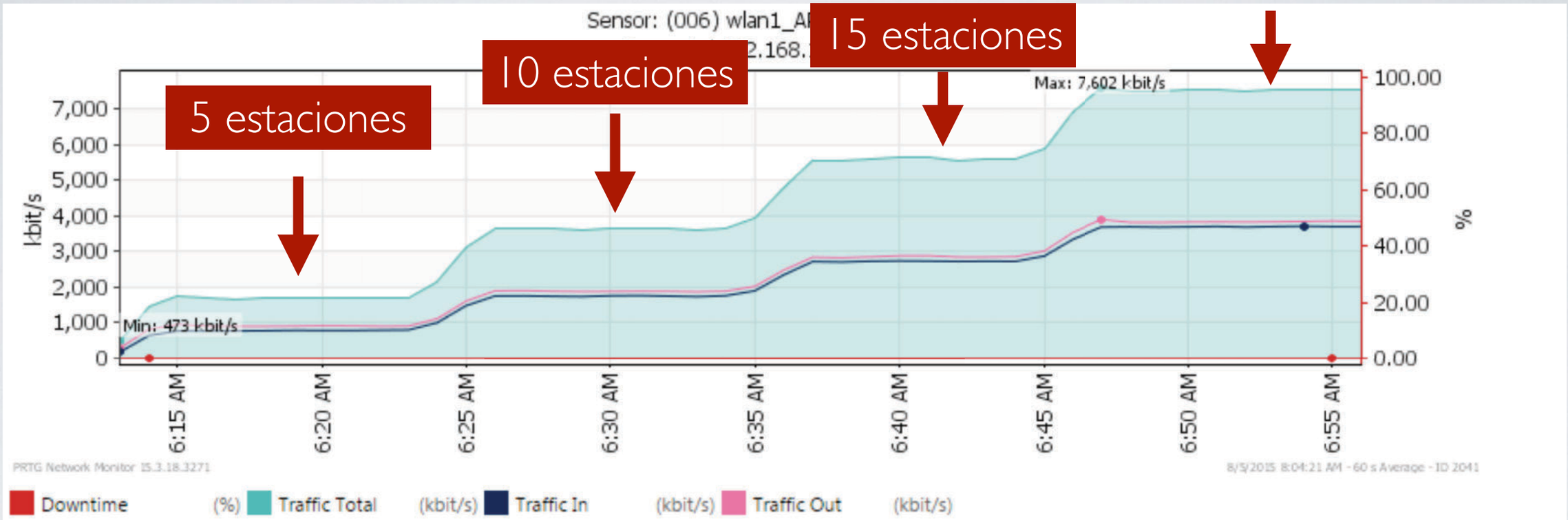



```
/tool bandwidth-test address=10.11.12.1\
    protocol=udp direction=both\
    local-tx-speed=200K\
    remote-tx-speed=200K user=admin
                 status: running
               duration: 21s
             tx-current: 192.0kbps
   tx-10-second-average: 193.1kbps
       tx-total-average: 191.9kbps
             rx-current: 192.0kbps
   rx-10-second-average: 190.7kbps
       rx-total-average: 190.2kbps
           lost-packets: 0
            random-data: no
              direction: both
                tx-size: 1500
                rx-size: 1500
```

- Este comando se ejecutará en cada una de las 20 estaciones.
- Se ingresará remotamente a cada estación vía Telnet IP para NO recargar significativamente el tráfico por sesiones Winbox abiertas

ESCENARIO DE PRUEBA # 2

20 estaciones con tráfico (200 Kbps)

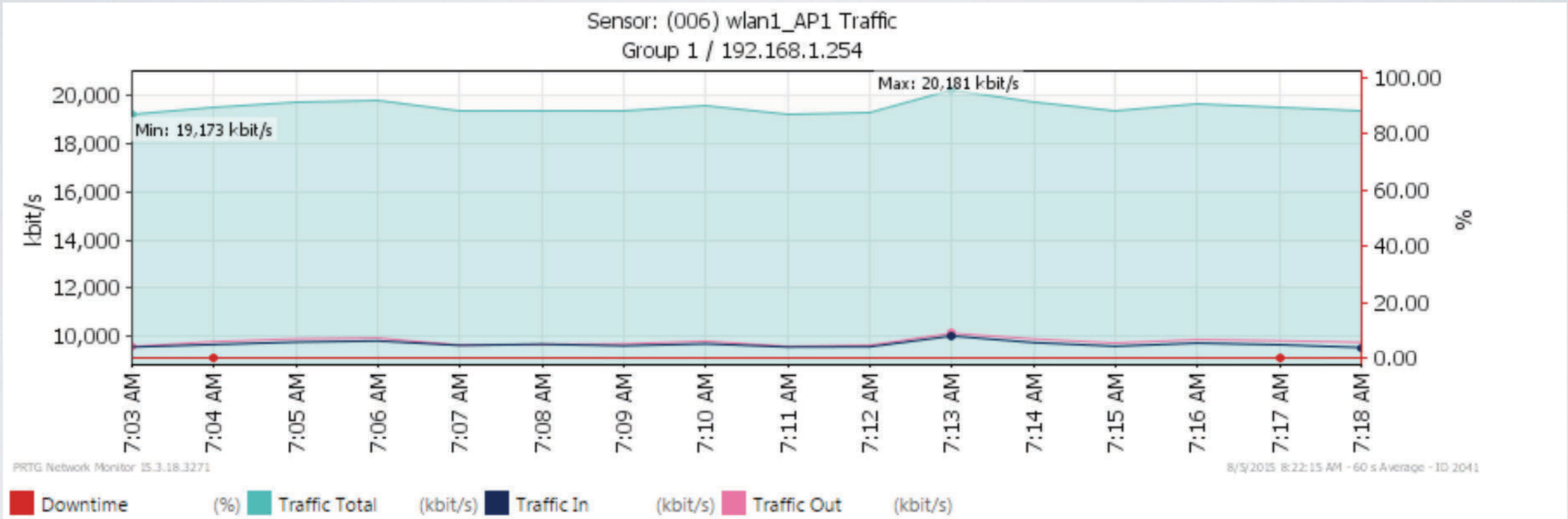


Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
Sums (of 44 values)	1,420,962 KByte		688,543 KByte		732,419 KByte			
Averages (of 44 values)	32,295 KByte	4,410 kbit/s	15,649 KByte	2,137 kbit/s	16,646 KByte	2,273 kbit/s	0 %	99 %

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
8/5/2015 6:12:00 AM – 6:13:00 AM	5,026 KByte	473 kbit/s	1,908 KByte	180 kbit/s	3,118 KByte	294 kbit/s	0 %	100 %
8/5/2015 6:13:00 AM – 6:14:00 AM	10,733 KByte	1,465 kbit/s	4,730 KByte	646 kbit/s	6,003 KByte	820 kbit/s	0 %	100 %
8/5/2015 6:14:00 AM – 6:15:00 AM	12,727 KByte	1,738 kbit/s	5,674 KByte	775 kbit/s	7,052 KByte	963 kbit/s	0 %	100 %
8/5/2015 6:15:00 AM – 6:16:00 AM	12,340 KByte	1,685 kbit/s	5,673 KByte	775 kbit/s	6,667 KByte	910 kbit/s	0 %	100 %
8/5/2015 6:16:00 AM – 6:17:00 AM	12,301 KByte	1,680 kbit/s	5,686 KByte	776 kbit/s	6,615 KByte	903 kbit/s	0 %	100 %
8/5/2015 6:17:00 AM – 6:18:00 AM	12,357 KByte	1,687 kbit/s	5,725 KByte	782 kbit/s	6,632 KByte	906 kbit/s	0 %	100 %
8/5/2015 6:18:00 AM – 6:19:00 AM	12,467 KByte	1,702 kbit/s	5,796 KByte	791 kbit/s	6,671 KByte	911 kbit/s	0 %	100 %

ESCENARIO DE PRUEBA # 3

20 estaciones con tráfico (500 Kbps)



Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
Sums (of 16 values)	2,286,411 KByte		1,137,657 KByte		1,148,753 KByte			
Averages (of 16 values)	142,901 KByte	19,482 kbit/s	71,104 KByte	9,694 kbit/s	71,797 KByte	9,788 kbit/s	0 %	97 %

Date Time	Traffic Total (volume)	Traffic Total (speed)	Traffic In (volume	Traffic In (speed)	Traffic Out (volume	Traffic Out (speed)	Downtime	Coverage
8/5/2015 7:02:00 AM – 7:03:00 AM	202,735 KByte	19,173 kbit/s	101,271 KByte	9,578 kbit/s	101,463 KByte	9,596 kbit/s	0 %	100 %
8/5/2015 7:03:00 AM – 7:04:00 AM	142,674 KByte	19,483 kbit/s	70,895 KByte	9,681 kbit/s	71,779 KByte	9,802 kbit/s	0 %	100 %
8/5/2015 7:04:00 AM – 7:05:00 AM	144,283 KByte	19,699 kbit/s	71,644 KByte	9,782 kbit/s	72,639 KByte	9,918 kbit/s	0 %	100 %
8/5/2015 7:05:00 AM – 7:06:00 AM	144,876 KByte	19,780 kbit/s	71,988 KByte	9,829 kbit/s	72,888 KByte	9,952 kbit/s	0 %	100 %
8/5/2015 7:06:00 AM – 7:07:00 AM	141,397 KByte	19,305 kbit/s	70,664 KByte	9,648 kbit/s	70,733 KByte	9,657 kbit/s	0 %	100 %

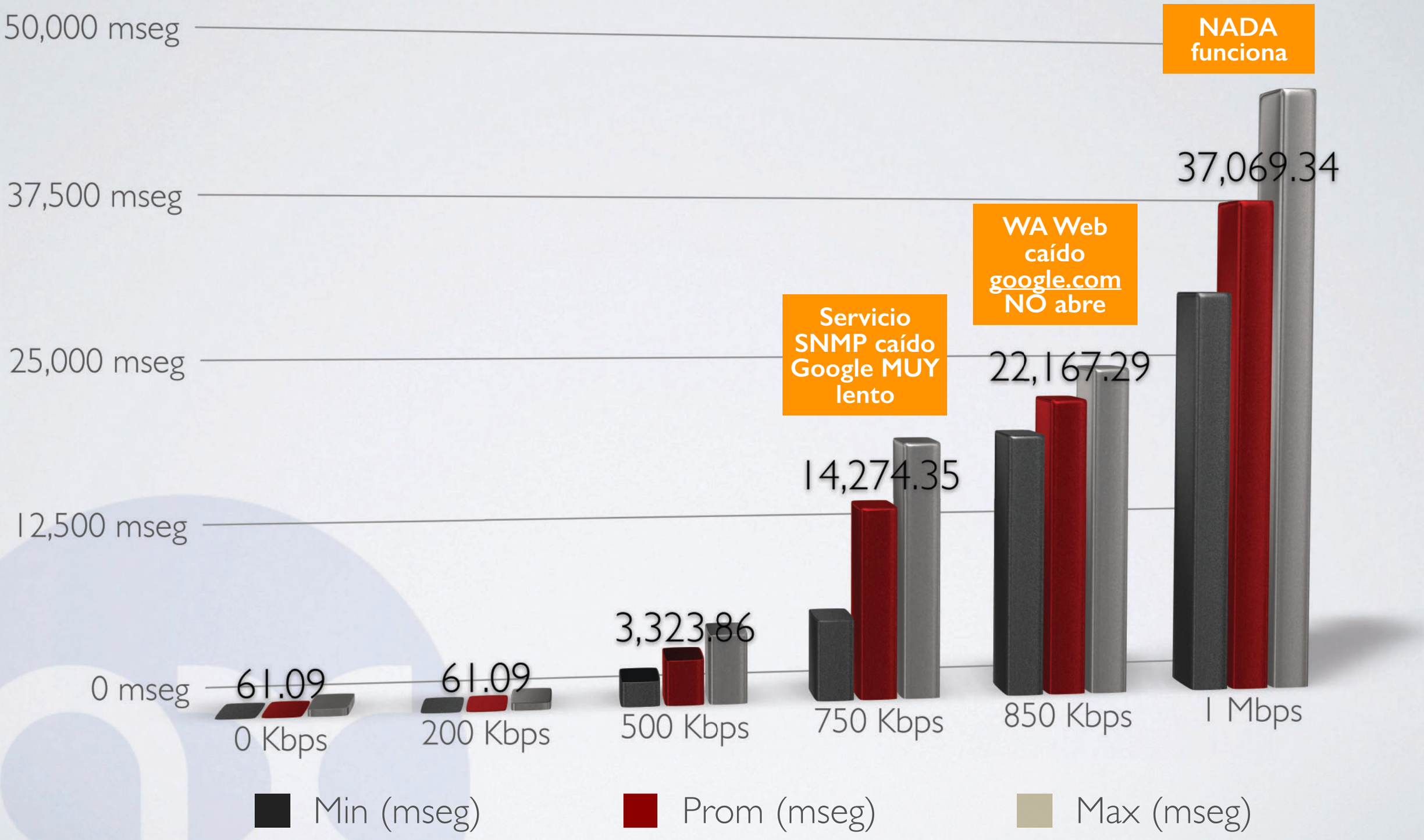
ESCENARIOS DE PRUEBA # 4 AL 8

20 estaciones con tráfico…

- A partir de aquí compararemos rendimiento del CPU del AP y tiempos de respuesta en PING del Cliente (PC) basado en la carga de 20 estaciones.
- Se expondrá el resultado en los demás escenarios de prueba: **750** Kbps, **850** Kbps, **1.0** Mbps, **1.5** Mbps, y **2.0** Mbps
- Únicamente se representarán estándares G, N(1x1) y N(2x2)

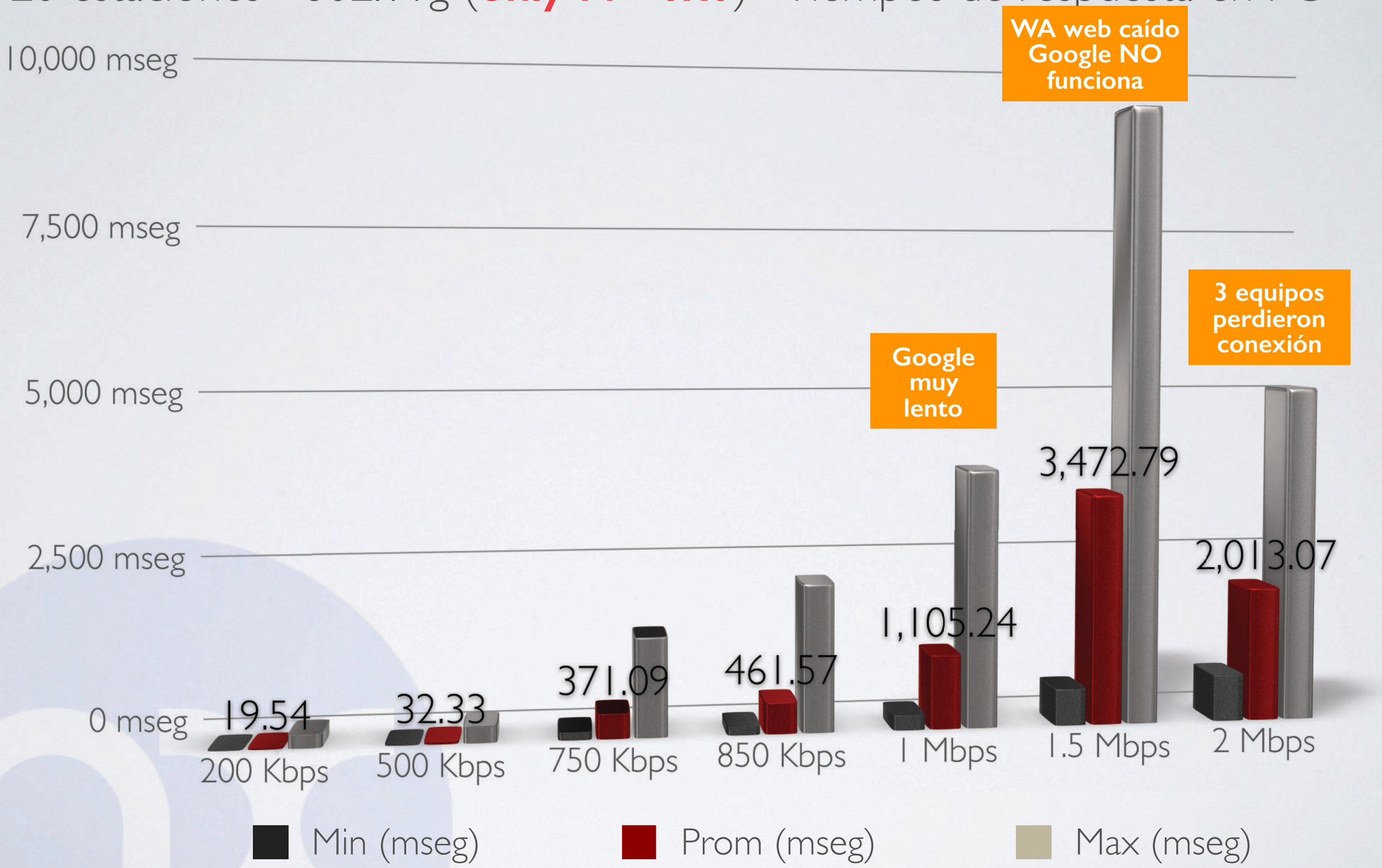
PRIMER CUADRO ESTADÍSTICO

20 estaciones - 802.11g (**only G**) - Tiempos de respuesta en PC



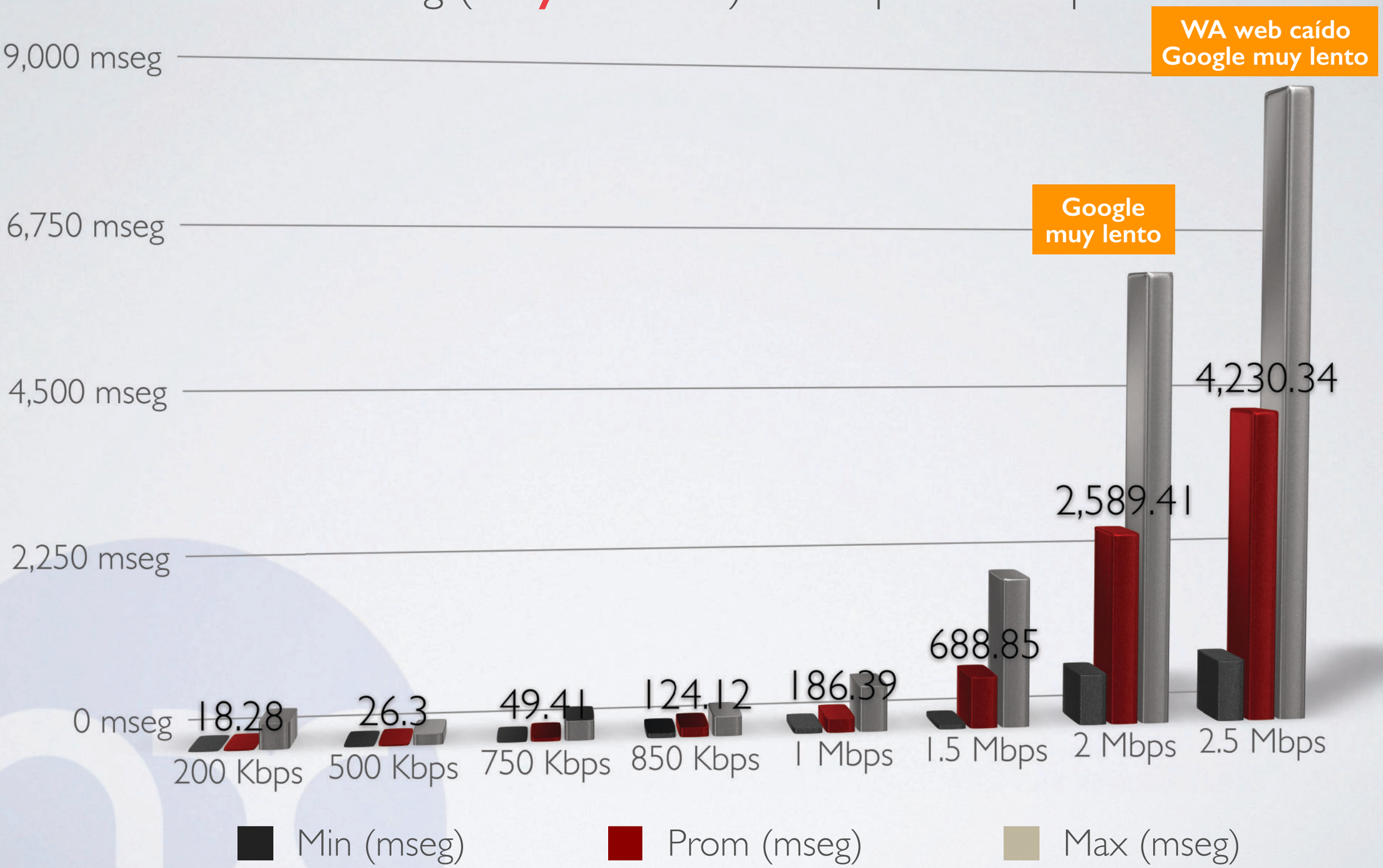
SEGUNDO CUADRO ESTADÍSTICO

20 estaciones - 802.11g (**only N - 1x1**) - Tiempos de respuesta en PC



TERCER CUADRO ESTADÍSTICO

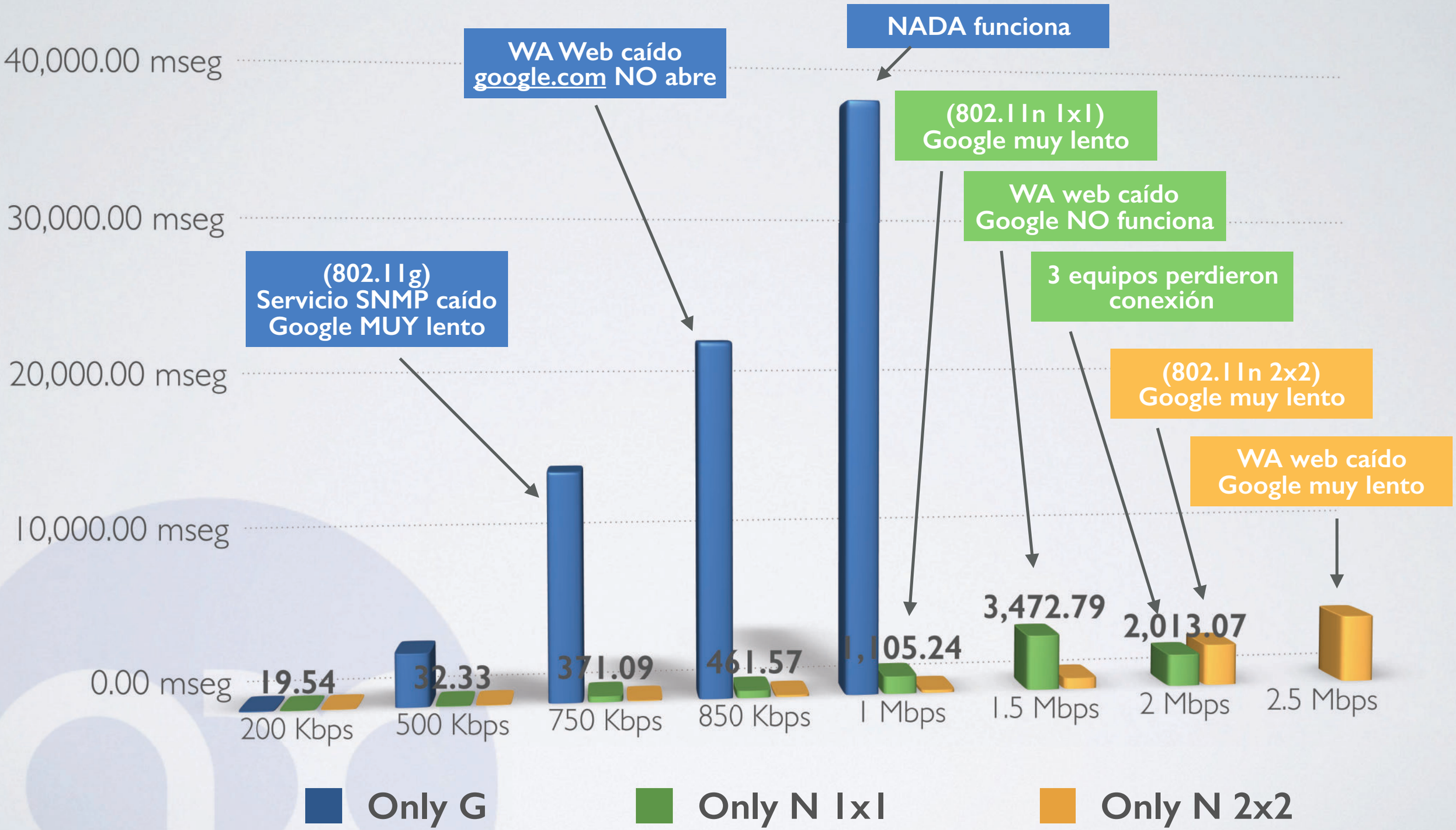
20 estaciones - 802.11g (**only N - 2x2**) - Tiempos de respuesta en PC



Compararemos únicamente los valores promedio

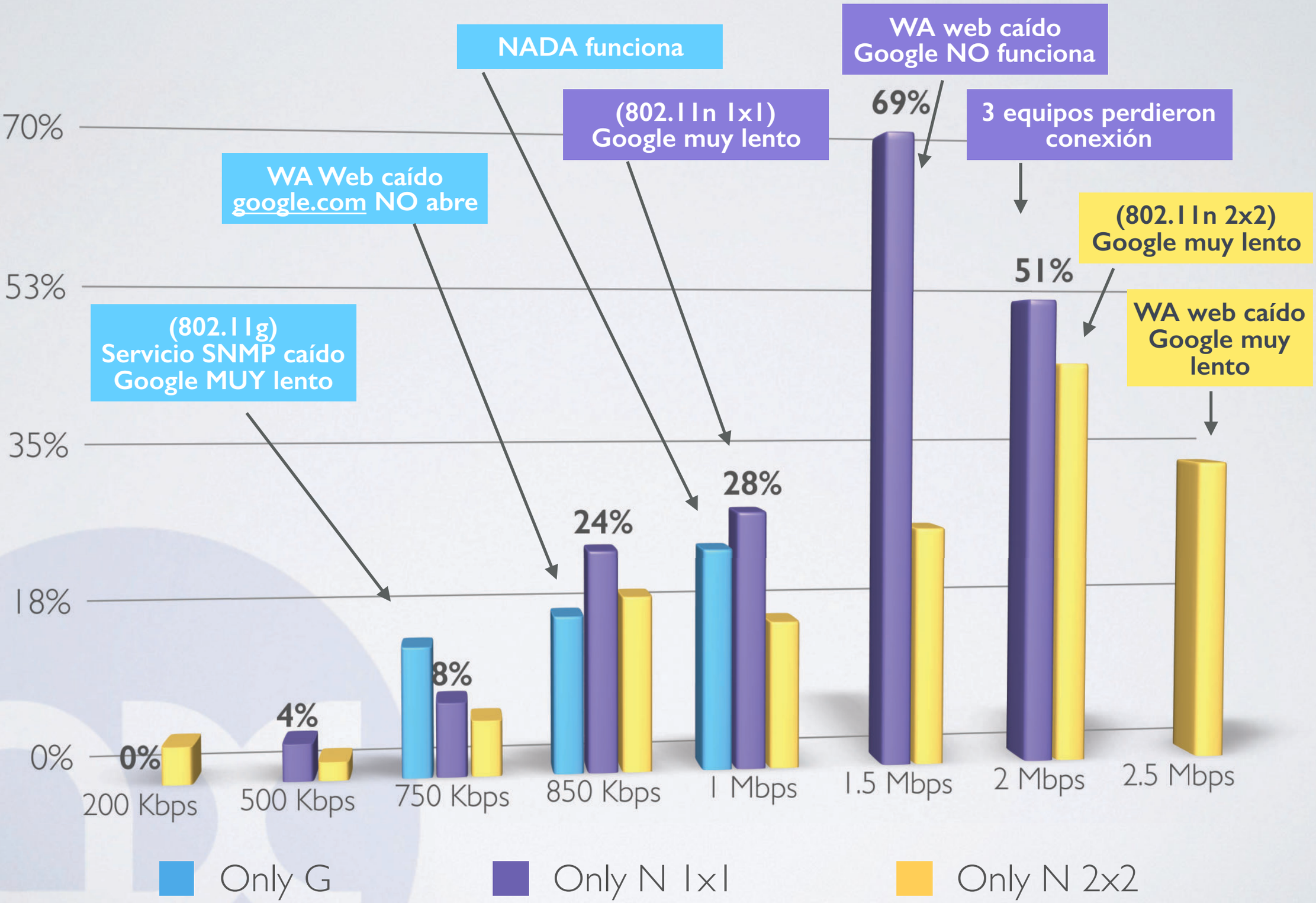
CUADRO COMPARATIVO (PING)

20 estaciones - 802.11g (**only G, N - 1x1, N - 2x2**) …valores promedio



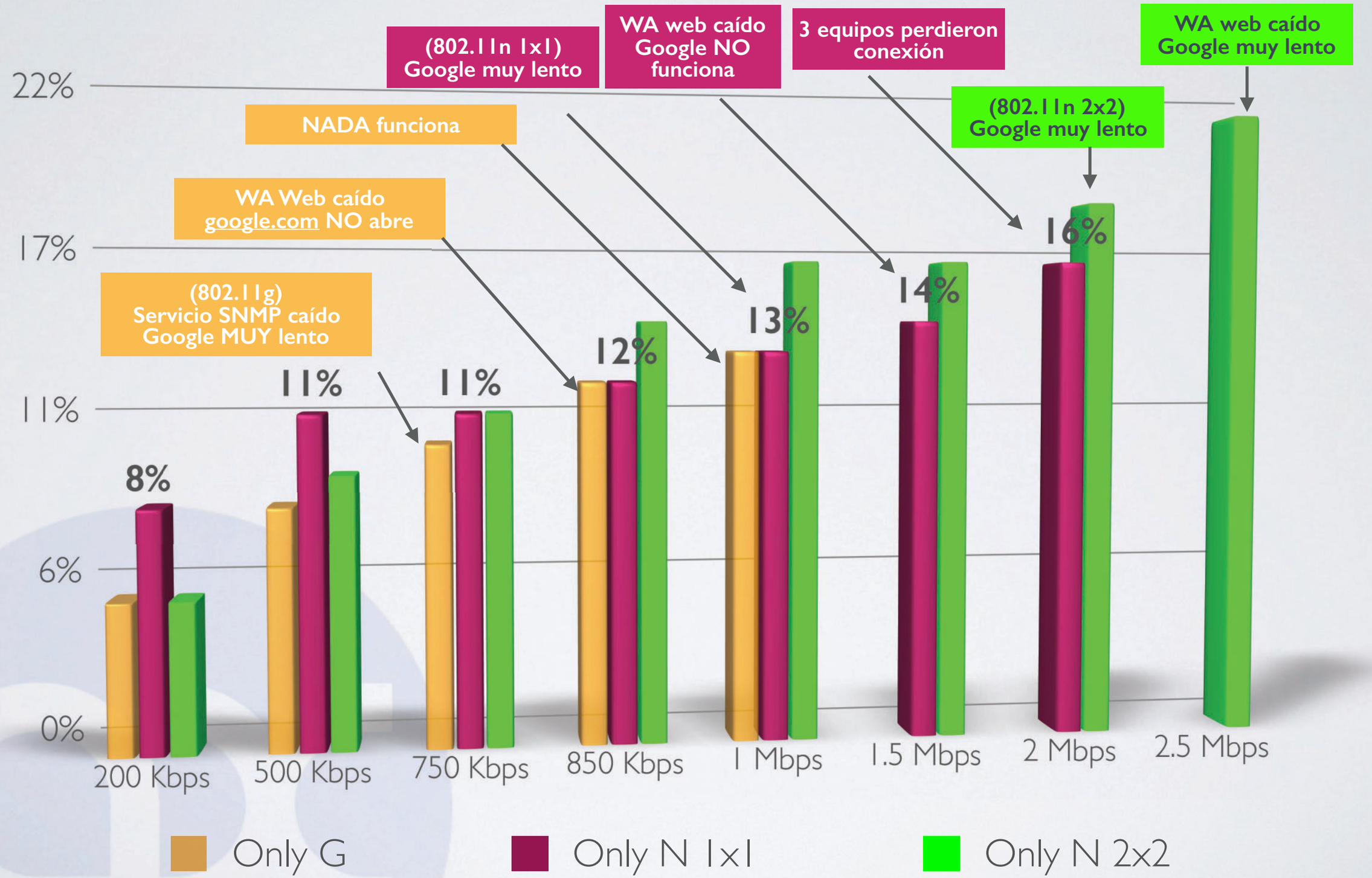
CUADRO COMPARATIVO (PACKET LOSS)

20 estaciones - 802.11g (**only G, N - 1x1, N - 2x2**) …valores promedio



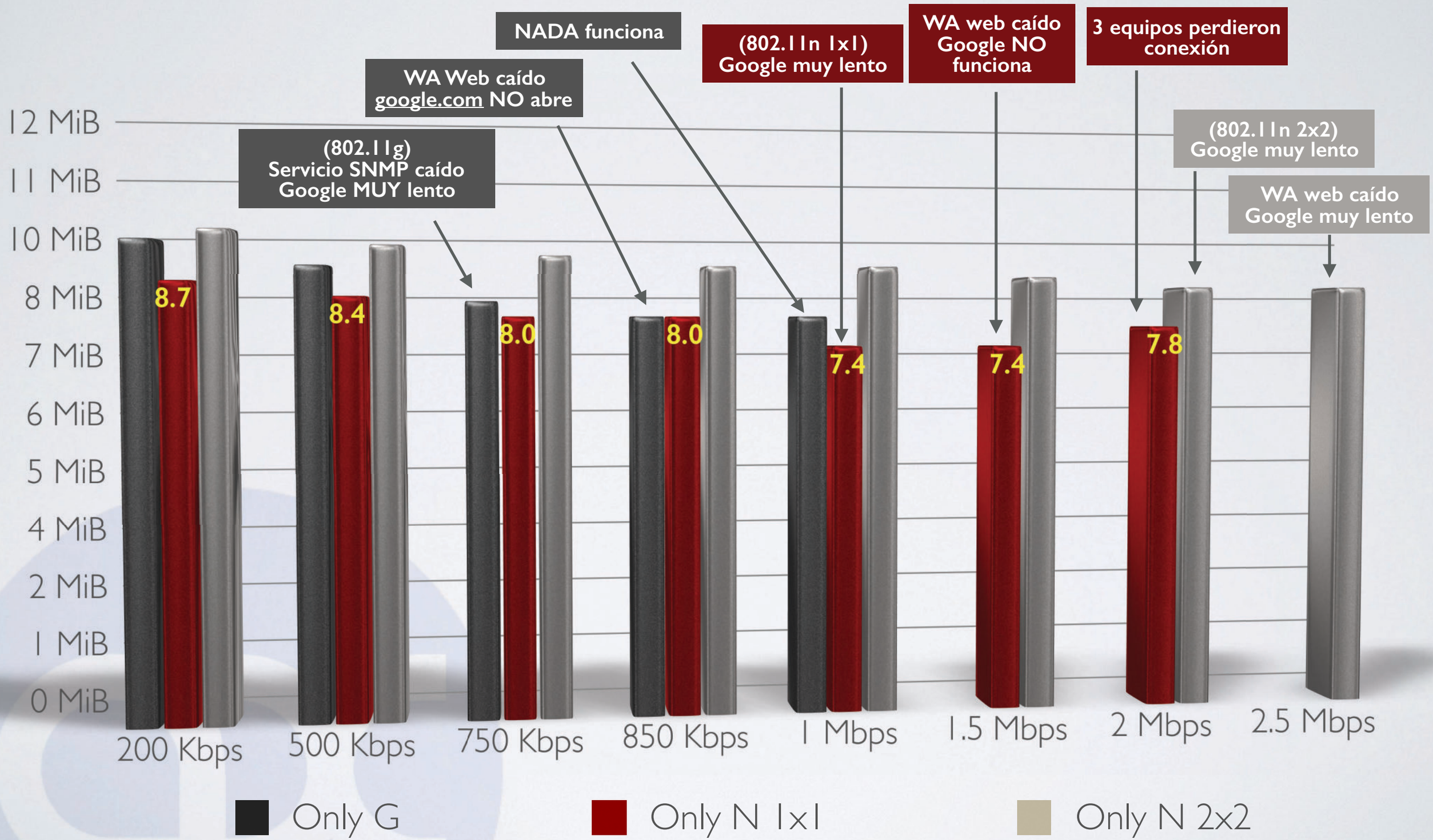
CUADRO COMPARATIVO (CPU %)

20 estaciones - 802.11g (**only G**, **N - 1x1**, **N - 2x2**) …valores promedio



CUADRO COMPARATIVO (FREE-MEM)

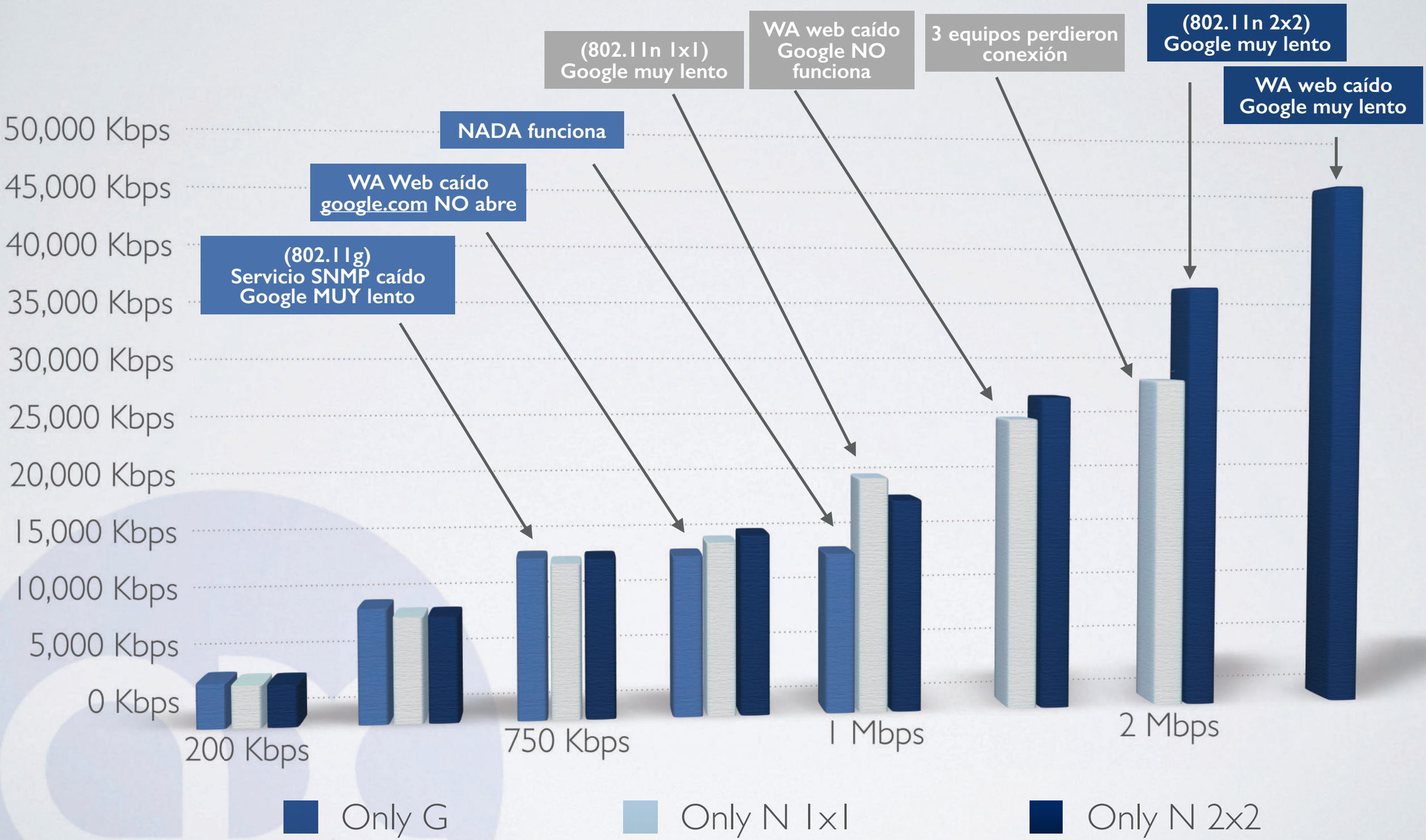
20 estaciones - 802.11g (**only G**, **N - 1x1**, **N - 2x2**) …valores promedio



Analicemos Tráfico de Entrada y Tráfico de Salida en Kbps

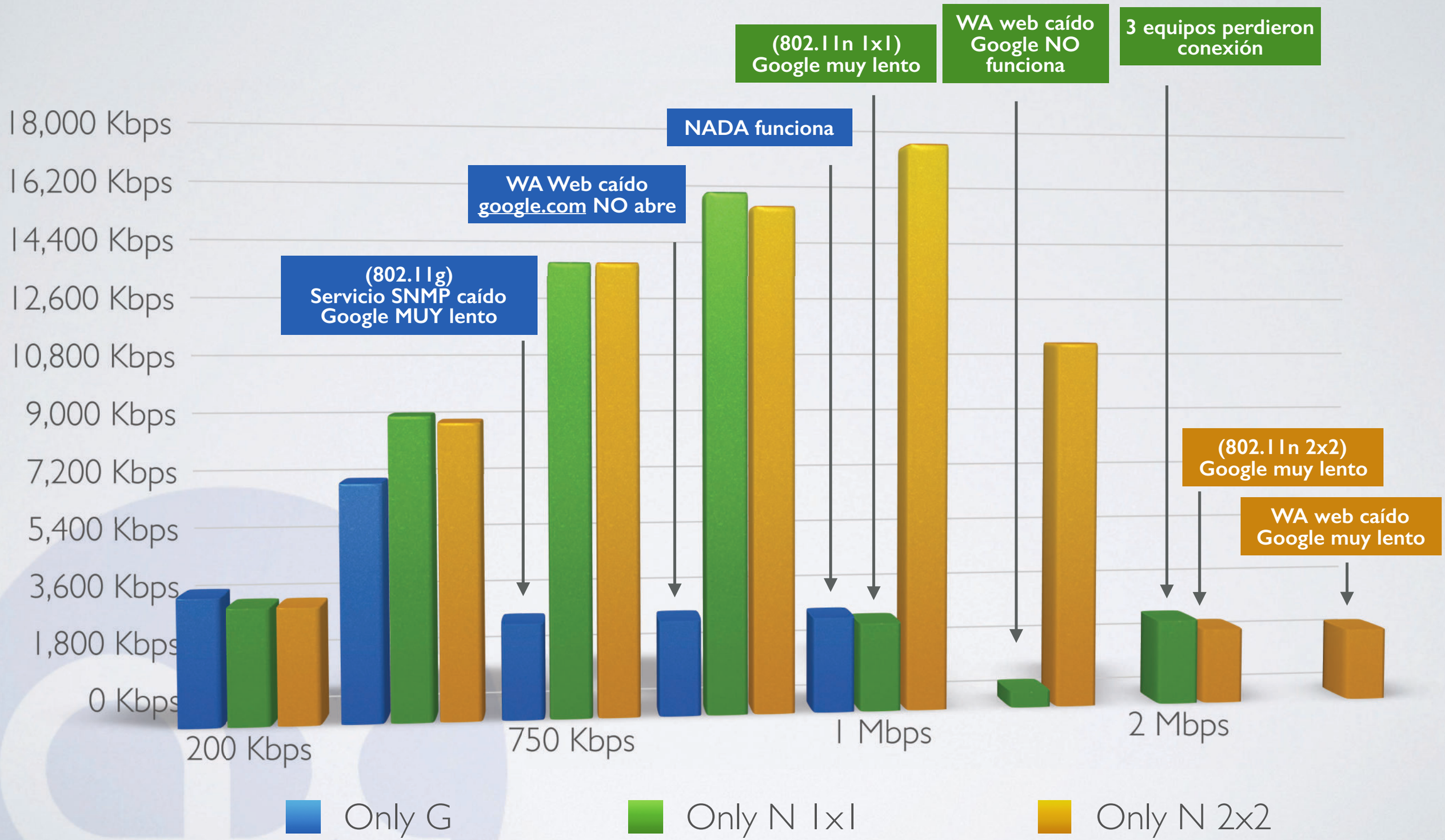
CUADRO COMPARATIVO (TRAFFIC-IN)

20 estaciones - 802.11g (**only G, N - 1x1, N - 2x2**) …valores promedio



CUADRO COMPARATIVO (TRAFFIC-OUT)

20 estaciones - 802.11g (**only G, N - 1x1, N - 2x2**) …valores promedio

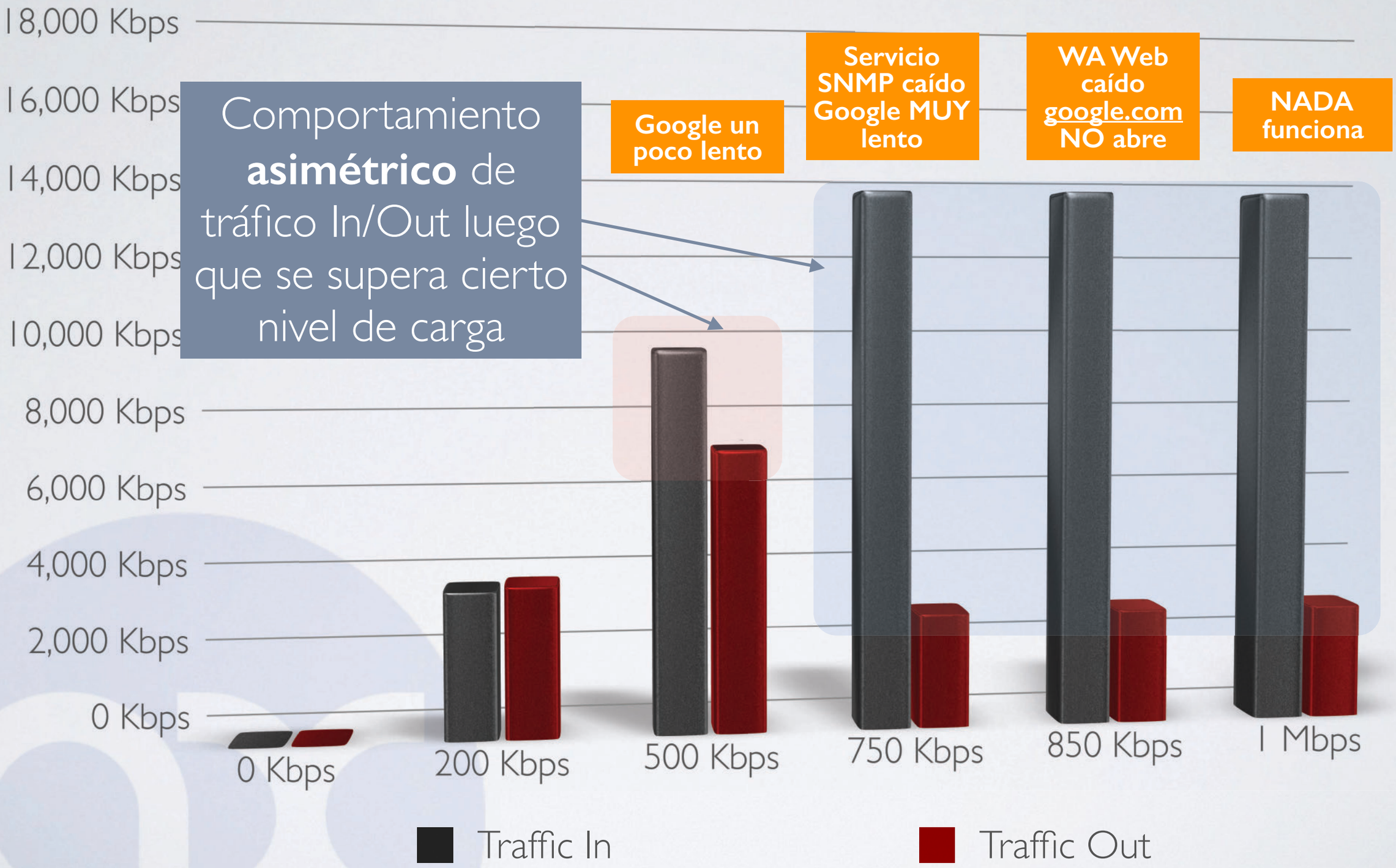


Comparemos Tráfico Entrada vs. Salida en Kbps

COMPARACION IN-OUT (KBPS)

20 estaciones - 802.11g (**only G**) - Tiempos de respuesta en PC

Comportamiento **asimétrico** de tráfico In/Out luego que se supera cierto nivel de carga



COMPARACION IN-OUT (KBPS)

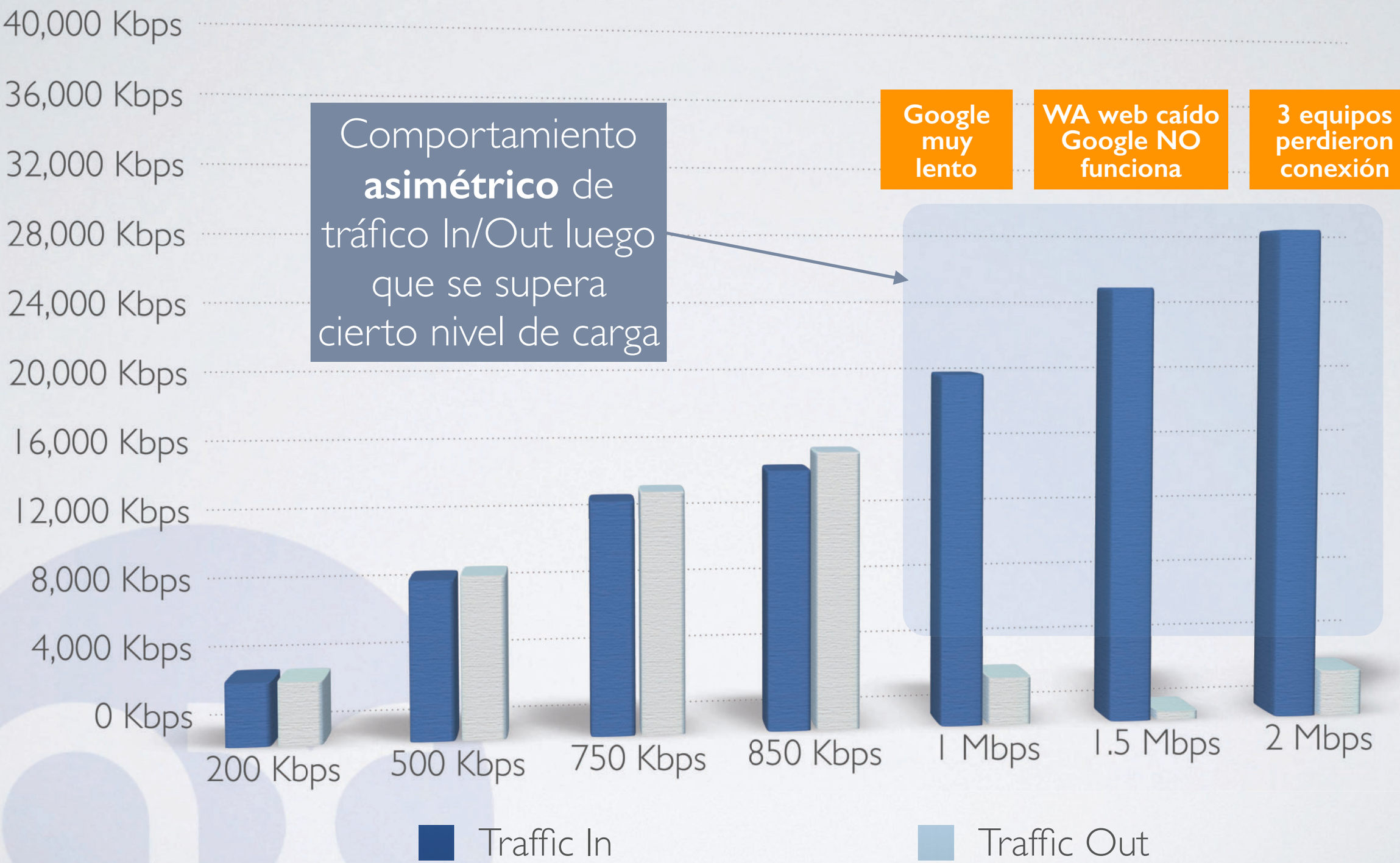
20 estaciones - 802.11g (**only N - 1x1**) - Tiempos de respuesta en PC

Comportamiento **asimétrico** de tráfico In/Out luego que se supera cierto nivel de carga

Google muy lento

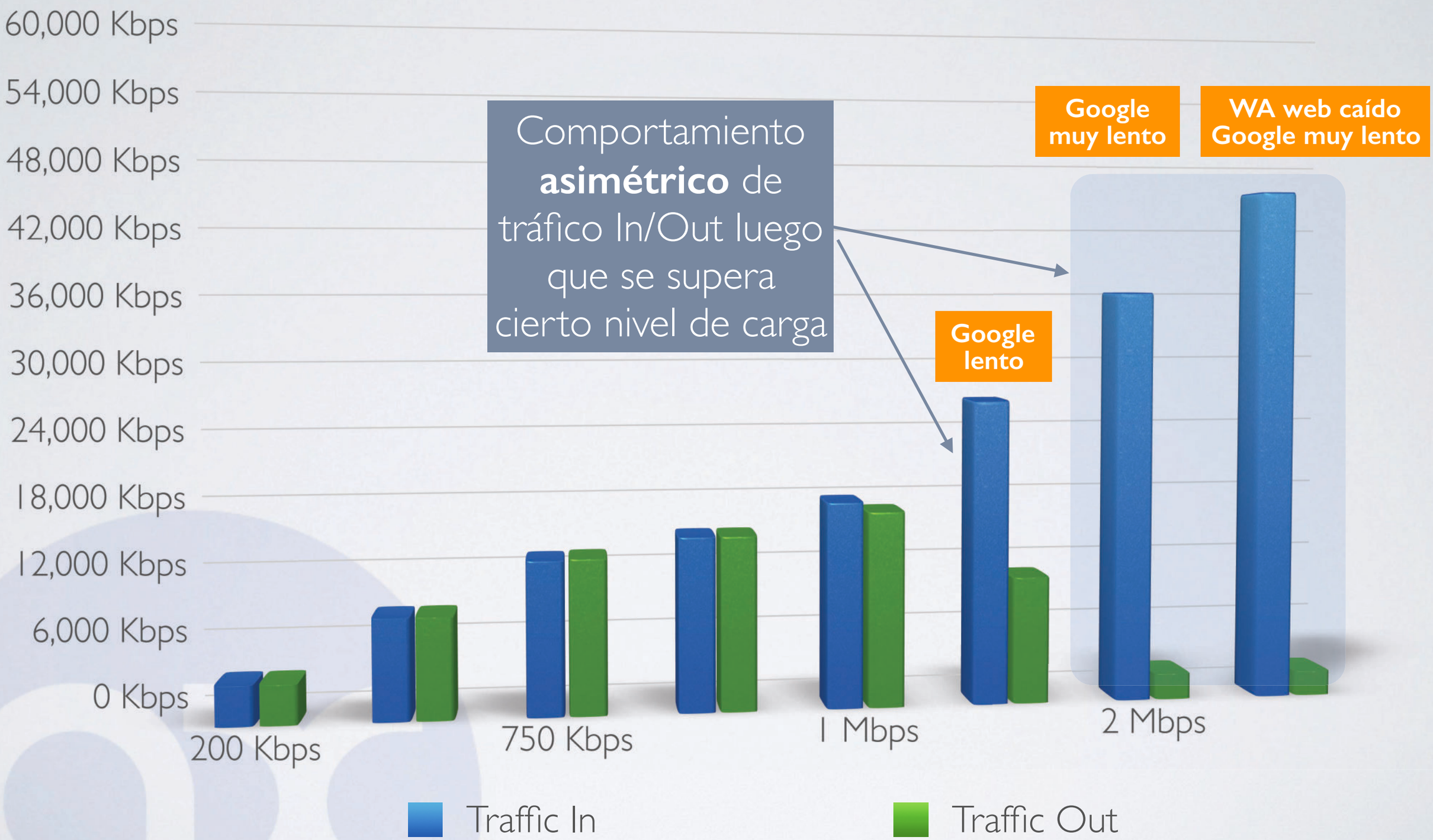
WA web caído Google NO funciona

3 equipos perdieron conexión



COMPARACION IN-OUT (KBPS)

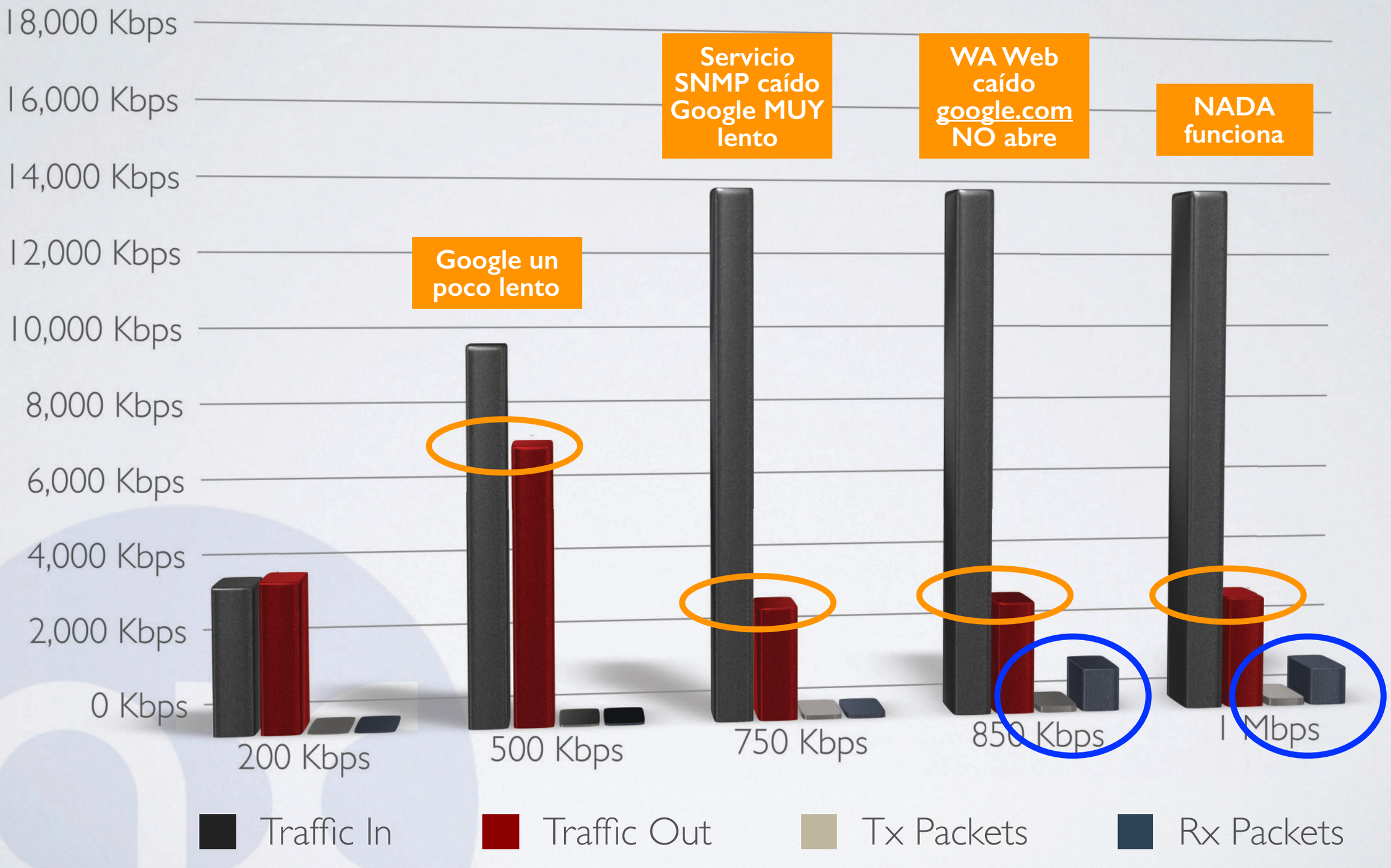
20 estaciones - 802.11g (**only N - 2x2**) - Tiempos de respuesta en PC



Comparemos Tráfico In/Out
Relación entre Kbps y Paquetes Por Segundo

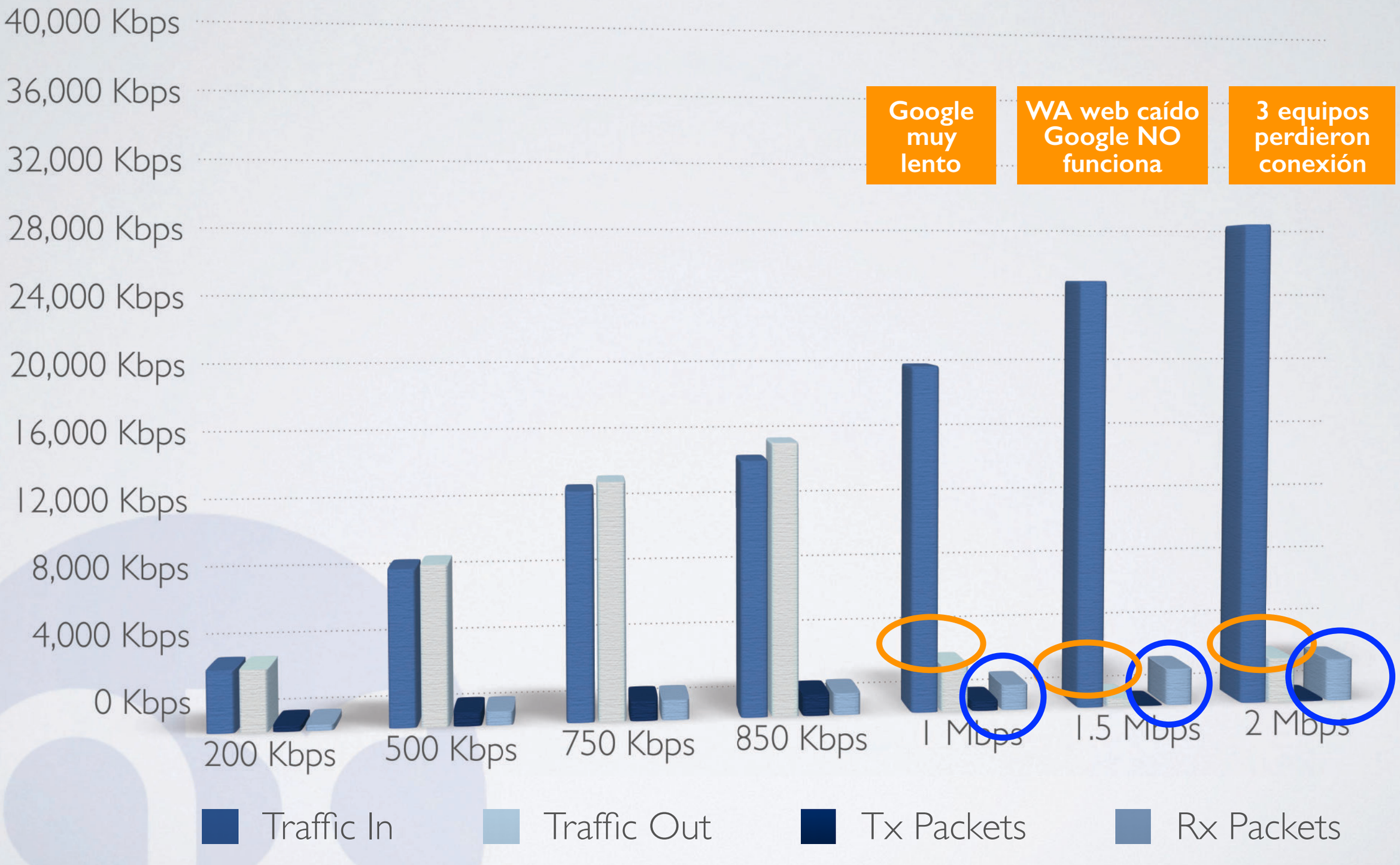
COMPARACION IN / OUT (KBPS-PPS)

20 estaciones - 802.11g (**only G**) - Tiempos de respuesta en PC



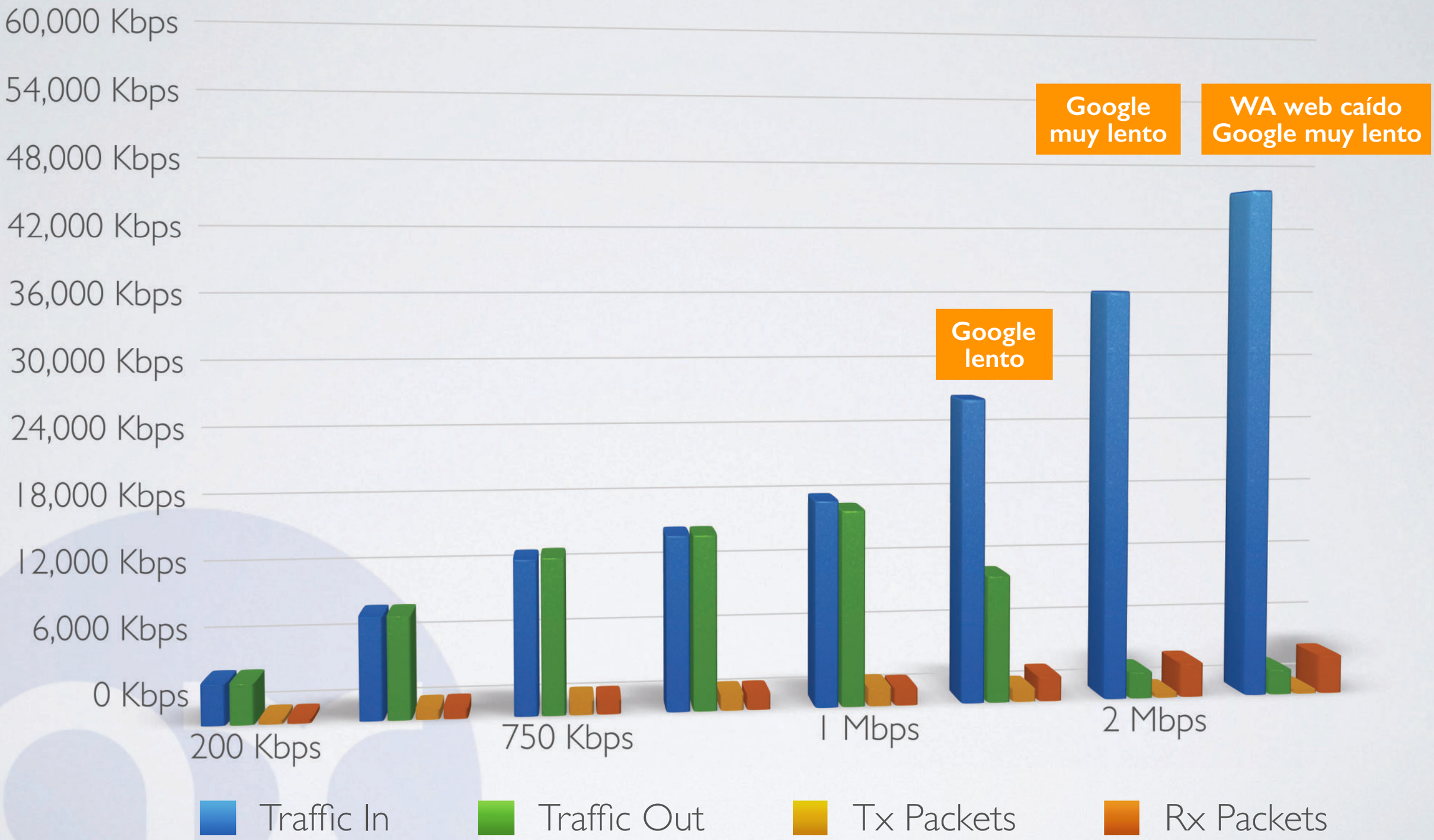
COMPARACION IN-OUT (KBPS)

20 estaciones - 802.11g (**only N - 1x1**) - Tiempos de respuesta en PC



COMPARACION IN-OUT (KBPS)

20 estaciones - 802.11g (**only N - 2x2**) - Tiempos de respuesta en PC



COMPARACIÓN DE DIFERENTES DISPOSITIVOS

01-Feb-2016

	RB751Ui-2HnD	CAP2n	hAP	RB2011UiAS-2HnD-IN
Wireless Chip	AR9283-AL1A	QCA9531	AR9331	AR9344
CPU (MHz)	400	400	650	600
RAM (MB)	32	64	64	128
Antenna (dBi)	2.5	2	1.5	4

abc xperts

academy xperts

QRT 5 ac

Dual chain 5GHz 802.11a/n/ac QCA9882, 128
gain

DynaDish 5

Dual chain 5GHz 802.11a/n/ac QCA9882, 128
gain

NetMetal 5

Triple chain 5GHz integrated 802.11ac AP/Bac
slot, Gigabit Ethernet, waterproof metal enclos

NetMetal 5

Dual chain 5GHz integrated 802.11ac AP/Back
slot, 2xRPSMA connectors, Gigabit Ethernet, w

NetMetal 5

Triple chain 5GHz integrated 802.11ac AP/Bac
2000mW TX power, Gigabit Ethernet, waterpro

NetMetal 5

Dual chain 5GHz integrated 802.11ac AP/Back
2000mW TX power, Gigabit Ethernet, waterpro

SXT 5 ac

802.11ac up to 540Mbit, 1300mW RF output, Ic

SXT SA5 ac

802.11ac up to 540Mbit, 1300mW RF output, w

SXT HG5 ac

Dual chain 5GHz 802.11a/n/ac QCA9882, 128 M
gain

NetBox 5

802.11ac support for up to 540Mbits, waterproo

SXT Lite2

10dbi integrated CPE/Backbone, 2Ghz dual chai

SXT Lite5

16dBi integrated CPE/Backbone, 5Ghz dual chai

Groove 52HPn

2.4Ghz/5Ghz Backbone/CPE, 500mW TX, N-male

GrooveA 52HPn

2.4Ghz/5Ghz AP/Backbone/CPE, 500mW TX, N-
6dBi Omni Antenna

SXT 2

10dbi 60 degree integrated AP/Backbone/CPE,

SXT 5

16dBi integrated CPE/Backbone, high power 125

BaseBox 2

2.4Ghz integrated AP/Backbone/CPE, 2xRPSMA connectors, 1000mW TX power, miniPCI-e slot, Gigabit Ethernet

BaseBox 5

5Ghz integrated AP/Backbone/CPE, 2xRPSMA connectors, 1000mW TX power, miniPCI-e slot, Gigabit Ethernet

OmniTIK U-5HnD

7.5dBi Integrated AP, 5Ghz Dual chain, 5xEthernet ports

SXT HG5

17dbi integrated AP/Backbone/CPE, Gigabit Ethernet

SXT SA5

14dBi integrated Sector AP, 90 degrees beamwidth, 1000mW TX power, Gigabit Ethernet

OmniTIK UPA-5HnD

7.5dBi Integrated AP, 5Ghz Dual chain, 5xEthernet ports with PoE output

Metal 9HPn

900MHz Integrated AP/Backbone/CPE, 500mW TX power, N-male connector

Metal 2SHPn

2.4Ghz Integrated AP/Backbone/CPE, 1600 mW TX power, N-male connector, 6dBi Omni antenna

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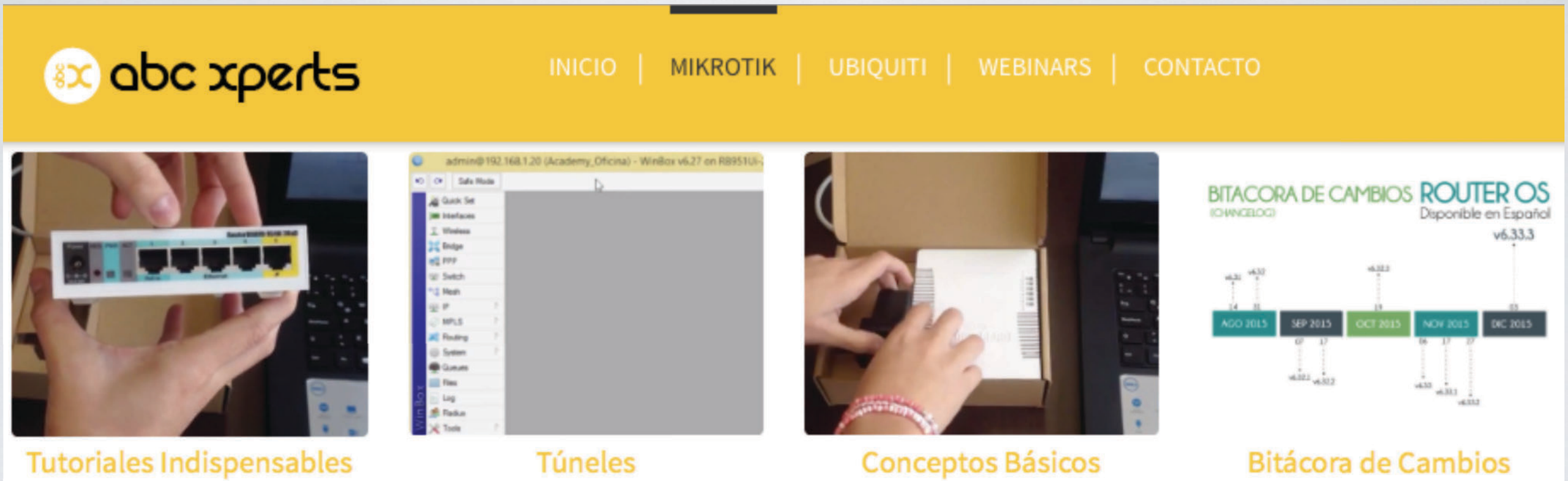

Estudio sobre Pruebas de Estrés en una red wireless 802.11 a/b/g/n PARTE 1

Gracias…Totales !