Risoluzione dei problemi relativi alla velocità 802.11n

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Introduzione

Questo documento descrive i problemi più comuni da tenere in considerazione quando si risolvono i problemi relativi al throughput wireless. Questo documento include l'uso di strumenti per misurare le prestazioni e il throughput della rete wireless, con access point 802.11n (AP) di fornitori diversi rispetto all'access point Cisco 1252 in condizioni di test simili.

Prerequisiti

Requisiti

Cisco consiglia di rispettare i seguenti requisiti:

- Strumenti come iPerf e analizzatori di rete come OmniPeek e Cisco Spectrum Analysis
- 802.11n supporta i punti di accesso serie 1140, 1250, 3500 e 1260

Componenti usati

Le informazioni fornite in questo documento si basano sulle seguenti versioni software e hardware:

- Controller WS-SVC-WiSM con software versione 6.0.182
- AP AIR-LAP1142-A-K9

Convenzioni

Per ulteriori informazioni sulle convenzioni usate, consultare il documento <u>Cisco sulle convenzioni</u> nei suggerimenti tecnici.

Premesse

802.11n è nato a causa di una serie di modifiche apportate all'aggregazione di frame degli access point: A-MPDU e A-MSDU.

- Dimensione ACK blocco
- MCS e collegamento canale
- MIMO
- Utilizzo di 5 GHz su 2,4 GHz: menzionare anche Wi-Fi certifica il collegamento del canale su 5 GHz

Risoluzione dei problemi relativi alla velocità 11n

Attenersi alla seguente procedura:

1. Verificare che il supporto 802.11n sia abilitato sul controller. (WiSM-slot3-2) > show 802.11a 802.11a Network..... Enabled 11nSupport..... Enabled 802.11a Low Band..... Enabled 802.11a Mid Band..... Enabled 802.11a High Band..... Enabled 802.11a Operational Rates 802.11a 6M Rate..... Mandatory 802.11a 9M Rate..... Supported 802.11a 12M Rate..... Disabled 802.11a 18M Rate..... Supported 802.11a 24M Rate..... Mandatory 802.11a 36M Rate..... Supported 802.11a 48M Rate..... Supported 802.11a 54M Rate..... Supported 802.11n MCS Settings: MCS 0..... Supported MCS 1..... Supported MCS 2..... Supported MCS 3..... Supported MCS 4..... Supported MCS 5..... Supported

(WiSM-slot3-2) > show advanced 802.11a channel

2. I tassi N vengono raggiunti in due modi. È possibile raggiungere velocità fino allo schema MCS (Modulation Coding Scheme) 7 senza utilizzare il channel bonding. Per velocità MCS superiori a 7 e fino a 15, è necessario abilitare il channel bonding. È possibile verificare se l'associazione dei canali è abilitata utilizzando questo comando **show** sul controller:

DCA 802.11n Channel Width	40 MHz
DCA Sensitivity Level	STARTUP (5 dB)
Last Run	371 seconds ago
Channel Assignment Leader	00:1d:45:f0:d2:c0
Channel Update Contribution	SNI.
Anchor time (Hour of the day)	0
Channel Update Interval	600 seconds [startup]
Channel Assignment Mode	AUTO
Automatic Channel Assignment	

 Èinoltre possibile configurare la larghezza del canale per access point utilizzando i seguenti comandi:

```
(WiSM-slot2-2) >config 802.11a disable AP0022.9090.8e97
(WiSM-slot2-2) >config 802.11a chan_width AP0022.9090.8e97 40
Set 802.11a channel width to 40 on AP AP0022.9090.8e97
```

4. L'intervallo Guard e le velocità MCS corrispondenti consentono di determinare le velocità dati rilevate sui client 802.11n. Di seguito sono riportati i comandi per verificare questa configurazione:

(WiSM-slot3-2) >show 802.11a 802.11a Network..... Enabled 11nSupport..... Enabled 802.11a Low Band..... Enabled 802.11a Mid Band..... Enabled 802.11a High Band..... Enabled 802.11a Operational Rates 802.11a 6M Rate..... Mandatory 802.11a 9M Rate..... Supported 802.11a 12M Rate..... Disabled 802.11a 18M Rate..... Supported 802.11a 24M Rate..... Mandatory 802.11a 36M Rate..... Supported 802.11a 48M Rate..... Supported 802.11a 54M Rate..... Supported 802.11n MCS Settings: MCS 0..... Supported MCS 1..... Supported MCS 2..... Supported MCS 3..... Supported MCS 4..... Supported MCS 5..... Supported MCS 6..... Supported MCS 7..... Supported MCS 8..... Supported MCS 9..... Supported MCS 10..... Supported MCS 11..... Supported MCS 12..... Supported MCS 13..... Supported MCS 14..... Supported MCS 15..... Supported 802.11n Status: A-MPDU Tx: Priority 0..... Enabled Priority 1..... Disabled Priority 2..... Disabled Priority 3..... Disabled Priority 4..... Disabled Priority 5..... Disabled

Priority 6..... Disabled Priority 7..... Disabled Beacon Interval..... 100 CF Pollable mandatory..... Disabled CF Poll Request mandatory..... Disabled --More-- or (q)uit CFP Period..... 4 CFP Maximum Duration..... 60 Default Tx Power Level..... 1 DTPC Status..... Enabled Fragmentation Threshold..... 2346 Pico-Cell Status..... Disabled Pico-Cell-V2 Status..... Disabled Traffic Stream Metrics Status..... Disabled Expedited BW Request Status..... Disabled World Mode..... Enabled EDCA profile type..... default-wmm Voice MAC optimization status..... Disabled Call Admission Control (CAC) configuration Voice AC - Admission control (ACM)..... Enabled Voice max RF bandwidth..... 75 Voice reserved roaming bandwidth..... 6 Voice load-based CAC mode..... Enabled Voice tspec inactivity timeout..... Disabled Video AC - Admission control (ACM)..... Disabled Voice Stream-Size..... 84000 Voice Max-Streams..... 2 Video max RF bandwidth..... Infinite Video reserved roaming bandwidth..... 0

Garanzia di aggregazione dei pacchetti A-MPDU. Per ottenere risultati ottimali, i livelli QoS sono abilitati tramite questi comandi:config 802.11a 11nSupporto a-mpdu tx priorità 0 abilitazioneconfig 802.11b 11nSupporto a-mpdu tx priorità 0 abilitazione

- 5. Utilizzare tutte e tre le antenne della radio A. Assicurarsi che le antenne siano dello stesso modello.
- 6. Sulla WLAN configurata per la connettività client, WMM deve essere consentito o richiesto e deve essere utilizzata solo la crittografia AES o aperta. È possibile verificare questa condizione tramite il seguente output del comando:

(WiSM-slot2-2) >show wlan 1	
WLAN Identifier	1
Profile Name	wlab5WISMip22
Network Name (SSID)	wlab5WISMip22
Status	Enabled
MAC Filtering	Disabled
Broadcast SSID	Enabled
AAA Policy Override	Disabled
Network Admission Control	
NAC-State D	isabled
Quarantine VLAN 0	
Number of Active Clients	0
Exclusionlist Timeout	60 seconds
Session Timeout	1800 seconds
CHD per WLAN	Enabled
Webauth DHCP exclusion	Disabled
Interface	management
WLAN ACL	unconfigured
DHCP Server	Default
DHCP Address Assignment Required	Disabled
Quality of Service	Silver (best effort)
WMM	Allowed

CCX - AironetIe Support..... Enabled CCX - Gratuitous ProbeResponse (GPR)..... Disabled CCX - Diagnostics Channel Capability..... Disabled Dot11-Phone Mode (7920).... Disabled Wired Protocol..... None IPv6 Support..... Disabled Peer-to-Peer Blocking Action..... Disabled Radio Policy..... All DTIM period for 802.11a radio..... 1 DTIM period for 802.11b radio..... 1 Radius Servers Authentication..... Global Servers Accounting..... Disabled Local EAP Authentication..... Disabled Security 802.11 Authentication:..... Open System Static WEP Keys..... Disabled 802.1X..... Disabled Wi-Fi Protected Access (WPA/WPA2)..... Enabled WPA (SSN IE)..... Disabled WPA2 (RSN IE)..... Enabled TKIP Cipher..... Disabled AES Cipher..... Enabled Auth Key Management 802.1x.... Enabled PSK..... Disabled CCKM..... Disabled FT(802.11r)..... Disabled FT-PSK(802.11r).... Disabled FT Reassociation Timeout..... 20 FT Over-The-Air mode..... Enabled FT Over-The-Ds mode..... Enabled CKIP Disabled IP Security..... Disabled IP Security Passthru..... Disabled Web Based Authentication..... Disabled Web-Passthrough..... Disabled Conditional Web Redirect..... Disabled Splash-Page Web Redirect..... Disabled Auto Anchor..... Disabled H-REAP Local Switching..... Enabled H-REAP Learn IP Address..... Enabled Infrastructure MFP protection..... Enabled (Global Infrastructure MFP Disabled) Client MFP..... Optional Tkip MIC Countermeasure Hold-down Timer..... 60 Call Snooping..... Disabled Band Select..... Enabled Load Balancing..... Enabled

7. Diversità antenna: se si utilizzano solo due antenne per qualsiasi motivo, è necessario utilizzare l'antenna A e B per le porte del trasmettitore/ricevitore.

Sul lato client:

- 1. Supplicant utilizzato per controllare la scheda wireless, preferibilmente abbinare il fornitore del supplicant alla scheda wireless.
- 2. Driver client: è necessario verificare che i driver client più recenti siano in esecuzione sulle schede wireless.
- 3. Contattare il fornitore della scheda di rete wireless.
- 4. Per ottenere velocità di trasferimento dati 11n, assicurarsi di utilizzare una scheda di rete

http://www.wi-fi.org/certified_products.php

Come migliorare le prestazioni:

- Utilizzo dei canali: gli analizzatori di rete segnalano l'utilizzo dei canali in percentuale del tempo impiegato per la trasmissione e la ricezione dei frame. In questo modo è possibile misurare la variazione potenziale di velocità dovuta alla distanza da un punto di accesso. Ciò aiuterà a monitorare e a vedere, ad esempio, se un canale è completamente occupato trasmettendo a 1 Mbps in condizioni ideali si otterrebbe a 0,94 Mbps con un utilizzo del 100%.
- Anche il supporto fisico utilizzato nel wireless determina le prestazioni. L'uso di 802.11g o 802.11a su 802.11b offre un throughput molto più elevato, spesso fino a 30 mbps su 802.11b, dove una capacità radio di 6 mpbs è divisa tra tutte le stazioni associate.
- 3. Dimensioni celle: si consiglia di ridurre le dimensioni delle celle per avvicinare il più possibile i client agli access point. In questo modo si otterranno vantaggi in termini di velocità di trasferimento dati con cui il client può connettersi all'access point. A tale scopo, è possibile ridurre al minimo i livelli di alimentazione dell'access point.
- 4. La riduzione delle dimensioni della cella riduce anche l'interferenza del co-canale. Se si utilizza RRM, gli access point devono scegliere i canali in modo dinamico per ogni distribuzione. Tuttavia, se si implementa l'assegnazione dinamica dei canali, verificare che non vi siano due punti di accesso a livelli di alimentazione elevati sullo stesso canale adiacenti.
- 5. La protezione causa anche un impatto sul throughput.

Come calcolare il throughput mediante iPerf

Suggerimenti Per L'Installazione Di Iperf

Per i clienti o i tester che non possiedono Chariot, è possibile utilizzare Iperf. Il documento è disponibile all'indirizzo <u>http://www.macalester.edu/crash/software/pc/iperf/kperf_setup.exe</u>.

Misurazione della velocità effettiva TCP

Eseguire questo comando sul lato server:

Iperf -s -w 256k Eseguire questo comando sul lato client:

Iperf -c -P 6 -w 256k -r -t 60

Server lis TCP window	stening on T / size: 256	CP port 5001 KByte				
Client cor ICP window	necting to size: 256	10.10.10.10, KByte	TCP port 5001			
[1788] loc [1820] loc [1868] loc [1836] loc [1804] loc [1804] loc [1852] loc	cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10	.20 port 1155 .20 port 1153 .20 port 1150 .20 port 1152 .20 port 1154 .20 port 1154	connected with connected with connected with connected with connected with connected with	10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10	port port port port port port	5001 5001 5001 5001 5001 5001
[ID] Inte [1788] Ø. [1868] Ø. [1820] Ø. [1804] Ø. [1852] Ø. [1836] Ø.	erval .0-60.1 sec .0-60.1 sec .0-60.2 sec .0-60.1 sec .0-60.1 sec .0-60.1 sec	Iransfer 124 MBytes 123 MBytes 110 MBytes 84.6 MBytes 89.2 MBytes 86.3 MBytes	Bandwidth 17.3 Mbits/sec 17.1 Mbits/sec 15.4 Mbits/sec 11.8 Mbits/sec 12.4 Mbits/sec 12.0 Mhits/sec			
[SUM] 0.0 [1952] loc [1832] loc [1748] loc [1732] loc [1800] loc [1812] loc	0-60.2 sec cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10 cal 10.10.10	617 MBytes 20 port 5001 20 port 5001 20 port 5001 20 port 5001 20 port 5001 20 port 5001	86.0 Mbits/sec connected with connected with connected with connected with connected with connected with	10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10 10.10.10.10	port port port port port port	2663 2664 2665 2666 2667 2668
[ID] Inte [1800] 0. [1812] 0. [1952] 0. [1952] 0. [1748] 0. [1732] 0. [1832] 0. [SUM] 0.0	erval .0-60.0 sec .0-60.1 sec .0-60.1 sec .0-60.1 sec .0-60.1 sec .0-60.1 sec .0-60.1 sec	Iransfer 114 MBytes 117 MBytes 89.6 MBytes 129 MBytes 111 MBytes 112 MBytes 672 MBytes	Bandwidth 15.9 Mbits/sec 16.3 Mbits/sec 12.5 Mbits/sec 18.1 Mbits/sec 15.5 Mbits/sec 15.6 Mbits/sec 93.8 Mbits/sec			

Il primo numero cerchiato in questa immagine rappresenta la velocità effettiva a monte, il secondo numero cerchiato rappresenta la velocità effettiva a valle (da punto di accesso a client).

Misurazione del throughput UDP

Chiudere le applicazioni Iperf precedenti sul lato server e client. Entrambi devono essere configurati di nuovo, ma questa volta per il test delle prestazioni UDP.

Eseguire questo comando sul lato server:

Iperf -s -u -l 56k Eseguire questo comando sul lato client:

Iperf -c -u -b 50M -1 56k -P Questo è un esempio di acquisizioni Omnipeek per analizzare l'**unità di dati del servizio MAC** aggregata:

La traccia A-MSDU mostra un pacchetto

💏 OaniPeck -	[AH5D	UPacket-	apo]										
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Here-ch		2	🔲 (0:18:E): 8::15:77	100191890196P90398E			-	1004	24.0	14	0.000005	502.11 Ack	FU=
1	· •												
												Packet/ 2	Division (HTH11
Done													at hora

- Viene visualizzato solo il primo fotogramma secondario.
- Ènecessario ispezionare il dump esadecimale per visualizzare altri sottoframe.

A-MSDU con il fotogramma secondario successivo in coda

🔅 OuniPaek - (AMSDUPaeket app - Paeket #1)	
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_ 0 Xo TTV Options	
H T agencies layer	
e Data Inva: (1.60 hypes)	
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B T Pose Check Sequence	
	-
1400 DO DO DO DO DO TAT DE DO DO TAT DE DO TAT DE DO TAT DE DO TAT DE DO DO DO TAT DE DO DO DO DO DO DO TAT DE DO DO TAT DE DO	NR. 4 📃 🗉
1435: WE 39 75 39 15 19 55 07 05 85 AE 50 70 90 24 WE 40 37 24 72 41 01 61 75 55 36 60 38 48 10 10 16 47 10 59 24 03 59 24 03 59 24 01 60 10 10 10 10 10 10 10 10 10 10 10 10 10	5
1500: 54 18 49 29 22 84 12 88 48 04 48 P8 82 28 89 10 20 47 99 38 88 89 01 55 55 86 97 2P 20 27 58 50 08 14 46 58 97 39 54 87 00 86 10 90 38 2.0.*	
1245: 12 47 67 68 AA 01 12 25 35 10 17 20 14 55 57 12 AA 02 24 AA AO 01 01 01 01 01 01 01 01 01 00 00 45 10 14 17 AV 37 40 00 80 05 75 AS 71 AS AA 52 70 AS 71 AS A. 01 10 10 10 10 10 10 10 10 10 10 10 10	.b
1545: 30 47 67 68 AA 01 12 25 35 10 77 10 14 55 37 40 70 20 4 52 34 40 02 01 01 01 05 00 45 10 14 17 47 57 40 00 80 06 75 46 71 45 4A 62 70 48 10 12 55 36 10 14 17 47 47 47 47 47 47 47 47 47 47 47 47 47	.b

- Una A-MPDU è una struttura che contiene più MPDU, trasportata come singola PSDU dal PHY.
- Indica che il pacchetto è di tipo A-MPDU dati nella procedura di convergenza del livello fisico (PLCP).



Questo è un esempio di acquisizioni Omnipeek per analizzare l'**unità di dati del protocollo MAC aggregato**:

Configurazione A-MPDU

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Apploation 1	-1	4	₩ 05:17:DF:A6:40:99	B01:12:20:10:F0:55		1	s.,	1008	36.0	14	0.000013	502.11 Ack	FC
1	13					120	120.12			10			(C)
												Parkets 4	Duration: [B10511
Done													ing Nora

- ADDBA: conferma blocco aggiunta
- Richiesta ADDBA: contiene l'identificatore, il criterio di blocco ACK, la dimensione del buffer e

così via.

• Risposta ADDBA: consente di modificare i criteri e le dimensioni del buffer.

Configurazione A-MPDU

- Richiesta ADDBA
- AP1250 utilizza un timeout pari a zero per indicare l'assenza di timeout.



- Risposta ADDBA
- Il ricevente deve indicare che il Contratto del blocco del codice è stato stabilito correttamente.



Trasferimento dei dati A-MPDU

- L'ACK di blocchi contiene una bitmap compressa per indicare la ricezione di MPDU.
- Fare riferimento alla sezione 9.10.7 "HT-immediate Block Ack extensions" dello standard IEEE 802.11n per informazioni sull'invio del Block Ack.

👯 OmniPesk - (A	MPDUDataA	ndBlockAck.epc										_ [D] X
😩 Elle Edit Me	w <u>D</u> epture S	ien <u>d M</u> onitor <u>I</u> cok <u>W</u> indow	Help									
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Capture		II II II 🔍 💎	****									
Padoets	Factor	t Source	East retion	85510	Hegs	Channel	Signal	Data Rate	Size i	Ralab ve Time	Protocol	
C Exect		L EV 00:13:E8:36:19:77	FU 00:14:5E:67:7E:A1	00:16:01:67:03:5E	1	1	100%	130.0	78	0.000000	TCP	
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Done											Bij None	

Funzionalità annunciate nei beacon

⊟ ¶ <u>HI Capa</u>	bility Info	
😌 Elere	ent ID:	45 HT Capability Info
🎯 Lengt	th:	26
📄 🍞 НТ Са	apability Info:	%0001100001101110
		0 L-SIG TXOP Protection Support: Not Supported
- 9		.0 AP allows use of 40MHz Transmissions In Neighboring BSSs
		1 BSS does Allow use of DSSS/CCK Rates \$40MHz
		1
		0 Does Not Sunnort HT-Delayed Blocklick Operation
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E-T A-MPI	OU Parameters:	\$00011011
😏		xxx Reserved
😏		110 Minimum MPDU Start Spacing: 8 usec
i 🍞		11 Maximum Rx A-MPDU Size: 64K
🕞 두 Suppo	orted MCS Set	
😑 🏹 🖓	me Spatial Stream	\$1111111
😚	MCS Index 0 Supp	ported - BPSK. Coding Rate: 1/2
🍞	MCS Index 1 Supp	ported - QPSK. Coding Rate: 1/2
😭	MCS Index 2 Supp	ported - QPSK. Coding Rate: 3/4
🚱	MCS Index 3 Supp	ported - 16 QAM. Coding Rate: 1/2
🌍	MCS Index 4 Supp	ported - 16 QAM. Coding Rate: 3/4
🕤	MCS Index 5 Supp	ported - 64 QAM. Coding Rate: 2/3
	MCS Index 6 Supp	ported - 64 QAM. Coding Rate: 3/4
	MCS Index 7 Supp	ported - 64 QAM. Coding Rate: 5/6
- Tw	no Spatial Stream	s: %01111111
	MCS Index 8 Supp	ported - BPSK. Coding Rate: 1/2
	MCS Index 9 Supp	ported - QPSK. Coding Rate: 1/2
	MCS Index 10 Su	oported - QPSK. Coding Rate: 3/4
	MCS Index 11 Su	oported - 16 OAM. Coding Rate: 1/2
	MCS Index 12 Su	oported = 16 0RM. Coding Rate: 3/4
	MCS Index 13 Sm	monted = 64 02M. Coding Rate: 2/3
	M"S Index 14 Sm	monted - 64 02M Coding Rate: 8/4
	MCS Index 14 Day	Summarted - 64 OIM. Coding Rate: 5/6
A Ry	Ritnask h16-h23	* *00000000
	Ritmask b94-b91	\$0000000
	Ritmack 629-628	>00000000
	Bitmack bd0_bd7	\$0000000
	Ditmark bit bit	10000000
- V R	C DIUMASK D48-055	: «0000000

Funzionalità annunciate nei beacon:

```
... 😌 Rx Bitnask b64-b76: *0000000000000
 Reserved:
                $000
 $000000
 Reserved:
 Tx Supported MCS Set: %0 Not Defined
 📵 Tx and Rx MCS Set: 👘 🕸 Equal
 🎯 Tx Naximun Number Spatial Streams Supported: 500 - 1 Spatial Stream
 Tx Unequal Modulation: 40 Not Supported
                Reserved:
... 📦
                xxxx .... Reserved
 .... 0... .... Reverse Direction Responder: Supported
 .
                .
                0
                .... Reserved
                 .... .... .00. Transition Time: No Transition
 0
 63
                 .... .... .... 0 Transmitter Supports PCO: Supported
xxx. .... Reserved
 0
                 ...0 0... ... ... ... ... ... Channel Estimation Capability: 1 Space Time Stream
 0
                ..... .00. .... .... .... .... CSI Max Number of Rows: 1 Row of CSI
 .
                 .... .... 0 0... .... .... CSI Number of BF Antennas: 1 TX Antenna Sounding
 0
                .... .... .00. .... ... ... Minimal Grouping: STA Supports Groups of 1 (No Grouping)
 .
 0
                 .... 0 0... ... Compressed BF Feedback Matrix: Not Supported
 ..... 00. .... Uncompressed BF Feedback Matrix: Not Supported
 0
                 .... TxBF CSI Feedback: Not Supported
                 0
                 ..... Uncompressed BF Feedback Matrix: Not Supported
 0
                 .... D. ... ... ... ... Explicit CSI TxBF Capable: Not Supported
 0
                 ..... Calibration: Not Supported
 0
                 .... Implicit TxBF Capable: Not Supported
 0
                 .... Tx NDP Capable: Not Supported
 0
                 .... 0... Rx NDP Capable: Not Supported
                 .... .... Capable: Not Supported
 .
                 .... 0. Rx Staggered Sounding Capable: Not Supported
 .
                 .... 0 Implicit TxBF Receiving Capable: Not Supported
 0
 Antenna Selection Capability (ASEL):$0000000
 . 🕲
                z... Reserved
 ۲
                 .0.. .... Tx Sounding PPDUs Capable: Not Supported
                ... 0. .... Rx ASEL Capable: Not Supported
 ۲
 0
                ...0 .... Antenna Indices Feedback Capable: Not Supported
                .... 0... Explicit CSI Feedback: Tx AS Capable: Not Supported
 ۲
 .
                .... . 0.. Antenna Indices Feedback Based Tx ASEL Capable: Not Supported
                 .... .. 0. Re-Explicit CSI Feedback Tx ASEL Capable: Not Supported
 ۲
 ~
```

Funzionalità annunciate nei beacon:

```
61 Additional HT Information
 B Element ID:
 🗑 Length:
                     22
 Primary Channel:
                     - 6
- 🌍 Srvc Int Granularity: 4000 - 5ms
 BY SNP STAS Only: 30 Association Requests are Accepted Regardless of PSNP Capability
 🗑 RIFS Mode:
                     41 Use of RIFS Permitted
 🗑 STA Channel Width:
                     %1 Use Any Channel Width Enabled Under Supported Channel Width Set
 2nd Channel Offset: 401 Above the Primary Channel
. 🗑
                       XXXXXXXX XXX.... Reserved
   . 💮
                        .
                        .....0... Transmit Burst Limit: No Limit
  -- 🗑
                        .....1.. Non-Greenfield STAs: One or more HT STAs are Not Greenfield Capable
   . 🐨
                        HT Info Element 3:
                     $00000000000000000
   . 📦
                        xxxx.... Reserved
                        ....0.... PCO Phase: Switch To/Continue Use 20MHz Phase
  --- 🗑
                        .....0.. ....... PCO Active: Not Active in the BSS
   - 🗑
   . 🗑
                        .....0. ...... L-SIG TXOP Protection: Not Full Support
  --- 😥
                        .....0 ...... Secondary Beacon: Primary Beacon
                        ..... 0..... Duel CTS Protection: Not Required
   . 🕤
                        0
   . 📦
                        - Basic MCS Set
 📩 🐨 One Spatial Stream: 👘 %00000000
     ... 🜒 MCS Index 0 Not Supported - BPSK. Coding Rate: 1/2
     -- 😙 MCS Index 1 Not Supported - QPSK. Coding Rate: 1/2
     ... 📵 MCS Index 2 Not Supported - QPSK. Coding Rate: 3/4
     ... 🕲 MCS Index 3 Not Supported - 16 QAM. Coding Rate: 1/2
      📵 MCS Index 4 Not Supported - 16 QAM. Coding Rate: 3/4
      🌒 MCS Index 5 Not Supported - 64 QAM. Coding Rate: 2/3
      👩 MCS Index 6 Not Supported - 64 QAM. Coding Rate: 3/4
     ... 🗑 MCS Index 7 Not Supported - 64 QAM. Coding Rate: 5/6
 🗄 🍸 Two Spatial Streams: 300000000
     -- 🎯 MCS Index 8 Not Supported - BPSK. Coding Rate: 1/2
     ... 🗑 MCS Index 9 Not Supported - QPSK. Coding Rate: 1/2
     . 🜒 MCS Index 10 Not Supported - QPSK. Coding Rate: 3/4
      😋 MCS Index 11 Not Supported - 16 QAM. Coding Rate: 1/2
      🜒 MCS Index 12 Not Supported - 16 QAM. Coding Rate: 3/4
     -- 😏 MCS Index 13 Not Supported - 64 QAM. Coding Rate: 2/3
     ... 🕲 MCS Index 14 Not Supported - 64 QAM. Coding Rate: 3/4
    📖 🎯 MCS Index 15 Not Supported - 64 GAM. Coding Rate: 5/6
    Rx Bitnask b16-b23: *00000000
   🕲 Rx Bitnask b24-b31: 👘 \00000000
    🝘 Rx Bitnask b32-b39:
                        $00000000
   💼 Rx Bitnask b40-b47:
                        $00000000
```

Associazione simile all'aggiunta della configurazione del blocco ACK per A-MPDU:

194	🕎 00:13:E8:1D:F0:55	BO:17:DF:A6:4C:90	802.11 Ack			100%	6.0	14
195	EE 00:17:DF:A6:4C:90	FgEthernet Broadcast	802.11 Beacon	m 00:17:DF:A6:4C:90	*	100%	6.0	204
196	E 00:13:28:1D:F0:55	FP Ethernet Broadcast	802.11 Probe Reg	Ethernet Broadcast	*	100%	1.0	81
197	FE 00:17:DF:A6:4C:90	P2 00:13:E8:1D:F0:55	802.11 Probe Rsp	FP 00:17:DF:A6:4C:90	*+	100%	6.0	204
198	📰 00:13:E8:1D:F0:55	00:17:DF:A6:4C:90	802.11 Ack		¥	100%	6.0	14
199	00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast		100%	1.0	87
200	N:13:E8:36:19:77	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	100%	1.0	81
201	00:17:DF:A6:4C:90	00:13:E8:36:19:77	802.11 Probe Rsp	B) 00:17:DF:A6:4C:90	*+	100%	6.0	204
202	Image: 00:13:E8:36:19:77	00:17:DF:A6:4C:90	802.11 Ack		¥	100%	6.0	14
203	BO:13:E8:36:19:77	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	100%	1.0	74
204	00:13:E8:36:19:77	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	100%	1.0	81
205	BO:17:DF:A6:4C:90	00:13:E8:36:19:77	802.11 Probe Rsp	IN 00:17:DF:A6:4C:90	*+	100%	6.0	204
206	00:13:E8:36:19:77	B) 00:17:DF: A6:4C:90	802.11 Ack		#	100%	6.0	14
207	00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	52%	1.0	55
208	00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	97\$	1.0	55
209	B) 00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	100%	1.0	87
210	D0:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast		100%	1.0	55
211	00:17:DF:A6:4C:90	Ethernet Broadcast	802.11 Beacon	00:17:DF:A6:4C:90	*	100%	6.0	204
212	00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	95%	1.0	55
213	00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Req	Ethernet Broadcast	*	100%	1.0	87
214	00:13:CE:89:DC:A2	Ethernet Broadcast	802.11 Probe Reg	Ethernet Broadcast	*	100%	1.0	55
215	E 00:13:E8:1D:F0:55	F 00:17:DF:A6:4C:90	802.11 Auth	FE 00:17:DF:A6:4C:90	*	100%	36.0	34
216	E2 00:17:DF:A6:4C:90	F 00:13:E8:1D:F0:55	802.11 Ack		<i>i</i> i	100%	36.0	14
217	E 00:17:DF:A6:4C:90	E 00:13:E8:1D:F0:55	802.11 Auth	E 00:17:DF:A6:4C:90	×	100%	36.0	34
218	🕎 00:13:E8:1D:F0:55	F2 00:17:DF:A6:4C:90	802.11 Ack		ÿ	100%	36.0	14
219	FE 00:13:E8:1D:F0:55	FE 00:17:DF:A6:4C:90	802.11 Assoc Req	FE 00:17:DF:A6:4C:90	*	100\$	36.0	134
220	E 00:17:DF:A6:4C:90	E 00:13:E8:1D:F0:55	802.11 Ack		ÿ	100%	36.0	14
221	FE 00:17:DF:A6:4C:90	FP 00:13:E8:1D:F0:55	802.11 Assoc Rsp	FP 00:17:DF:A6:4C:90		100%	130.0	180
222	📰 00:13:E8:1D:F0:55	B 00:17:DF:A6:4C:90	802.11 Ack		¥.	100%	36.0	14
223	3 192.168.170.89	3224.0.0.1	IGNP	B00:17:DF:A6:4C:90		100%	130.0	84
224	🕎 00:13:E8:1D:F0:55	00:17:DF:A6:4C:90	802.11 Ack		#	100%	36.0	14
225	2 192.168.170.89	3224.0.0.1	IGMP	B) 00:17:DF:A6:4C:90	+	100%	130.0	84
226	00:13:E8:1D:F0:55	00:17:DF:A6:4C:90	802.11 Ack		9	100%	36.0	14
227	00:17:DF:A6:4C:90	00:13:E8:1D:F0:55	WLCCP	E) 00:17:DF:A6:4C:90		100\$	130.0	92
228	00:13:E8:1D:F0:55	00:17:DF:A6:4C:90	802.11 Ack		¥.	100%	36.0	14
229	E 00:17:DF:A6:40:90	F 00:13:E8:1D:F0:55	802.11 Action	Per 00:17:DF:A6:40:90		100%	130.0	37
230	00:13:E8:1D:F0:55	B 00:17:DF:16:4C:90	802.11 Ack		¥	100%	36.0	14
231	EE 00:13:28:1D:F0:55	00:17:DF:A6:4C:90	802.11 Action	00:17:DF:A6:4C:90	×	100%	36.0	37
232	00:17:DF: 16:4C:90	B00:13:E8:1D:F0:55	802.11 Ack		ý.	100%	36.0	14

Verifying A-MPDU is enabled on the controller

in the second second second		
a a strongenerity mes	AL AND AN AND A MARK AND A MARK	
Element ID:	45 HT Capability Date (81)	
- Unigth:	26 (04)	
T HT Capability Info:	4000110000110110 (05-06)	
- 9	0 Supported	
	.0 30 allows use of 4000x Transmissions In Meighboring SDDs	
-9	Device/855 does Not Support use of 25MP	
	d Transmitter does Not Support Ty SIDC	
	1. Both 1984s and 4985s foresting is forested	
	A 1997 radius analyticity for Personal	
100 0 0000		A-MPDU enabled and seen in the
- T A-RPDU Facameters	V00011011 [177]	+ here
	REF Beserved [07 Bank Octo]	beacon
	210 Miniana MNDV Flart Specing: # same [87 Bask DolC]	
	11 Mexianm Rx 3-0000 Sine: 64K [07 Back 0x00]	
T Supported BCS Set		

Above is a beacon frame from an SSID enabled for n rates

- interface Dot11Radio1
- Radio AIR-RM1252A, Base Address 00119ea6.8520, BBlock version 0.00, Software version 2.10.20
- Serial number: FOC1212405A
- Number of supported simultaneous BSSID on Dot11Radio1: 16
- Carrier Set: Americas (OFDM) (US) (-A)
- Uniform Spreading Required: Yes
- Configured Frequency: 5180 MHz Channel 36 40MHz, extended above
- Compared Prequency: 5159 MHz Channel 36 40MHz, extended above Allowed Frequencies: 5180(36) 5200(40) 5220(44) 5240(48) *5260(52) *5280(56) *5300(60) *5320(64) *5500(100) *5520(104) *5540(108) *5560(112) *5590(116) *5660(132) *5680(136) *5700(140) 5745(148) 5765(153) 5785(157) 5805(161) 5825(165) * = May only be selected by Dynamic Frequency Selection (DFS) Listen Frequencies: 5180(36) 5200(40) 5220(44) 5240(48) 5260(52) 5280(56) 5300(60) 5320(64) 5500(100) 5520(104) 5540(108) 5560 (112) 5580(116) 5660(132) 5680(136) 5700(140) 5745(149) 5765(153) 5785(157) 5805(161) 5825(165) Beacon Flags: 0, Interface Flags 20105; Beacons are enabled; Probes are enabled Compared Brance Methy Allow (12)

- Configured Power: 14 dBm (level 1)
- Active power levels by rate
- 6.0 to 54.0 , 14 dBm
- 6.0-bf to 54.0-b, 8 dBm, changed due to regulatory maximum m0. to m15.-4, 11 dBm, changed due to regulatory maximum
- OffChnl Power: 14, Rate 6.0
- Allowed Power Levels: -1 2 5 8 11 14 --More--
- --More--Allowed Client Power Levels: 2 5 8 11 14
- Receive Antennas : right-a left-b middle-c
- Transmit Antennas : right-a left-b, ofdm single
- Antenna: external, Gain: Allowed 11, Reported 0, Configured 0, In Use 11
- Active Rates: basic-6.0 9.0 basic-12.0 18.0 basic-24.0 36.0 48.0 54.0
- Current Rates: basic-6.0 9.0 basic-12.0 18.0 basic-24.0 36.0 48.0 54.0
- Allowed Rates: 6.0 9.0 12.0 18.0 24.0 36.0 48.0 54.0
- All Rates: 6.0 9.0 12.0 18.0 24.0 36.0 48.0 54.0 m0. m1. m2. m3. m4. m5. m6. m7. m8. m9. m10. m11. m12. m13. m14. m15.
- Default Rates: basic-6.0 9.0 basic-12.0 18.0 basic-24.0 36.0 48.0 54.0 m0. m1. m2. m3. m4. m5. m6. m7. m8. m9. m10. m11. m12. m13. m14. m15.
- Best Range Rates: basic-6.0 9.0 12.0 18.0 24.0 36.0 48.0 54.0 m0. m1. m2. m3. m4. m5. m6. m7. m8. m9. m10. m11. m12. m13. m14. m15.
- Best Throughput Rates: basic-6.0 basic-9.0 basic-12.0 basic-18.0 basic-24.0 basic-36.0 basic-48.0 basic-54.0 m0. m1. m2. m3. m4. m5. m6. m7. m8. m9. m10. m11. m12. m13. m14. m15.

MCS Rates on 802.11n beacon

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Supported MCS rates

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	Will Index 3 Supported - 54 (dB), Collar Rete: 1/1	
	- Will Index 4 Supported - 14 GMK, Coding Bater 1/4	
	- 🖉 MCS Index 5 Supported - 68 QMK. Coding Aster: 2/9	
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	La MEL Indus 7 Supporter - de QME, Collary Arter 5/4	
	We special information of the second state and	
	Rel Index 9 Superstal - ONE, Collar later 1/2	
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	Rightet Tameried Robert Row (01/701)	
	• Reserved: \$400000 (17 Back 0217)	
	- Tx Supported BCS Set: 90 Ref Defined 2100 Ball dodts	*

802.11a with N rates Enabled

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802.11A Beacon frame

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🛊 🎢 (6-23) 🛛 🗰 18.12 KBC Reader Version-O Type=400 Xotoproot Subtype=41000 Joscon Duration-O Xicrosectrals Destination-Off/Friff-IFr-IFr-IFr-IFr-IFr-IFr-IFr-IFr-IFr-IFr	Nev HE NASED-001 342 971 BAL	
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3 T Venice Specific ID-221 Venice Specific Leaved 000-00-40-40 Muta-12 System)		
b) T Weaker Specific IB-221 Vender Specific Least 000-00-40-96 Sata-(2 hyper)		
a T ICS - Frame Clark Segment		
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Informazioni correlate

Documentazione e supporto tecnico – Cisco Systems