Welcome to Wi-Fi Trek

New Orleans 2016

David A. Westcott

IT Professional Wi-Fi Trek 2016

Contact Info

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Welcome

- Attendee Introductions
- How many of you are CWNA certified?
- How many of you have multiple CWNP certifcations?
- CWNEs – Please stand up

Keynote Presentation

- Thank You CWNP!
- 1st thoughts – Oh my gosh! Wow! Really? Me?
- 2nd thoughts – What the heck am I supposed to present?
- Key role of a keynote speaker?
  - Establish a main underlying theme
  - Elevate and inspire the audience to think about the broader frame of the event
  - Energize and set the tone for the remainder of the conference

My Conclusion?

- I'm the opening act, the warm up band. Cool!
- Rolling Stone Magazine 10 Best Opening Acts
  - The Monkees – Jimi Hendrix (1967)
  - The Who – The Clash (1982)
  - Vanilla Fudge – Led Zeppelin (1968)
  - Mott the Hoople – Queen (1974)
  - The Rolling Stones – Prince (1981)
  - Red Hot Chilli Peppers/Smashing Pumpkins – Pearl Jam (1991)
  - Motley Crue – Guns N' Roses (1987)
  - Aerosmith – Guns N' Roses (1988)
  - The Rolling Stones – Stevie Wonder (1972)
  - David Bowie – Nine Inch Nails (1995)

Past Experience

Past, Present, & Future

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Presentation Topics

- My background - How I wound up in the Wi-Fi industry
- Wi-Fi Industry
  - Past – History of the Wi-Fi Industry
  - Present – Current status of the Wi-Fi Industry
  - Future – Challenges ahead for Wi-Fi
- The journey into Wi-Fi is rarely typical
- Call to Arms

You may remember me from last year's conference

Compliments of
David Coleman

I Missed Another Conference (I was teaching a class in Tokyo)

And Rumors Started To Spread Across Twitter About My True Identity

Compliments of
Joshua Williams

All I Can Say Is The Following

I can neither confirm nor deny those rumor!

My Journey

From The Beginning

- Born in Hoboken NJ in the year 11110101010
- (also birthplace of Frank Sinatra)

Grew Up In Palisades Park, NJ

- No famous people
- Not the home of Palisades Amusement Park (it was actually in Cliffside Park and Fort Lee)

College Years (and years, and years)

Stevens Institute of Technology (1 yr plan)

Union County Technical Institute (AAS)

Seton Hall University

Portland State University

Boston College (BA) ‘92

(BA Business Administration – with honors)

My Career Begins

Early Career

- C.R. Bard (Murray Hill, NJ)
  - Office Automation (OA) Administrator
  - Wang Word Processing

Early Career

- RCA (Somerville, NJ)
  - OA Administrator
  - IBM PC Support

Early Career

- RCA/Sharp (Vancouver, WA)
  - 15th Employee
  - $400 million joint venture startup – VLSI Wafer Fab
  - PC LAN Administrator (3Com EtherSeries LAN)
  - PC Jack-of-All-Trades (including training)
  - Laid off (GE bought RCA)

Early Career

- BusinessLand (Boston, MA)
  - Systems Engineer
  - 3Com EtherSeries, 3Com 3+, IBM PC LAN, Netware 2.01, Appletalk, AutoCAD

Early Career

- Digital Equipment Corporation (DEC)
  - PC Pre-Sales Support
  - Laid off

Westcott Consulting, Inc. is Born

- Network Consulting
- Certified Training
  - MCNE, MCNI, MCSE, MCT, CCNA, A+, CTT+
- Boston University – Adjunct Faculty (10 years)
  - Novell, Microsoft, Cisco, CompTIA, Linux

Before We Continue

Important Interruption about Luck

“Luck is what happens when preparation meets opportunity.”

– Source is disputed

CWNP Arrives

- Attended the second CWNA class (2002)
- Became CWNA and CWNT certified
- Bought equipment and started teaching

CWSP/CWAP/CWNE

- Attended CWSP alpha class 4/2003
- Attended CWAP alpha class 5/2004
- CWNE #007 in 2006

Original CWNE Roundtable (circa 2006)

Courted Wireless Vendors for Work & Vendors Courted Us for Exposure

Airspace

Aruba

Bluesocket

Proxim

Symbol

Trapeze

Vernier

These Days

- Contract trainer for Aruba (ACMX #23)
- Teach onsite CWNP and wireless classes
- Writing ArubaOS book (EOY 2016)
- More CWNP books in the future

Over The Years

- Trained over 10,000 students
- 6 continents
- 33 countries
- 44 states

- Million Miler with United
- Lifetime Gold with Marriot (Lifetime Platinum next year)
- Lifetime Diamond with Hilton (next year?)

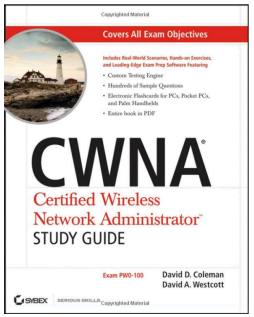
And Then There Are The Books

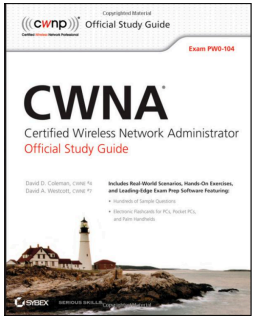
2005 Along Came Sybex (and Coleman)

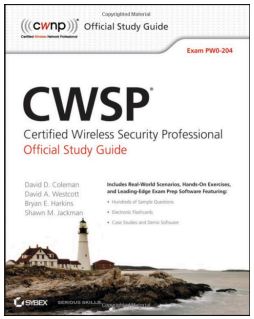
"The Davids"

Sybex Books

- 2006 - *CWNA Study Guide*
  - David Coleman & David Westcott
    - Tech Editor – Sam Coyl
- 2009 – *CWNA Study Guide 2nd Edition*
  - David Coleman & David Westcott
    - Tech Editor – Sam Coyl
- 2010 – *CWSP Study Guide*
  - David Coleman, David Westcott, Bryan Harkins, & Shawn Jackman
    - Tech Editors – Sam Coyl & Marcus Burton

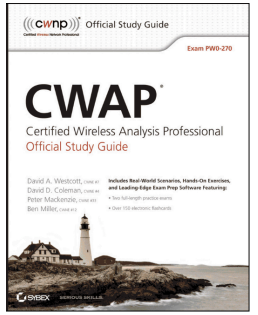




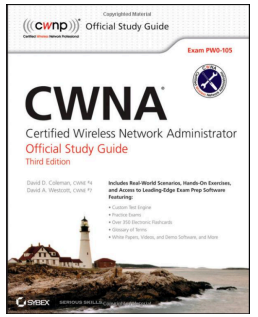


Sybex Books - We Continued to Write

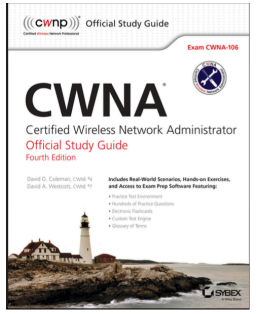
- 2011 - *CWAP Study Guide*
  - David Westcott, David Coleman, Ben Miller, & Peter Mackenzie
    - Tech Editor – Jerome Henry



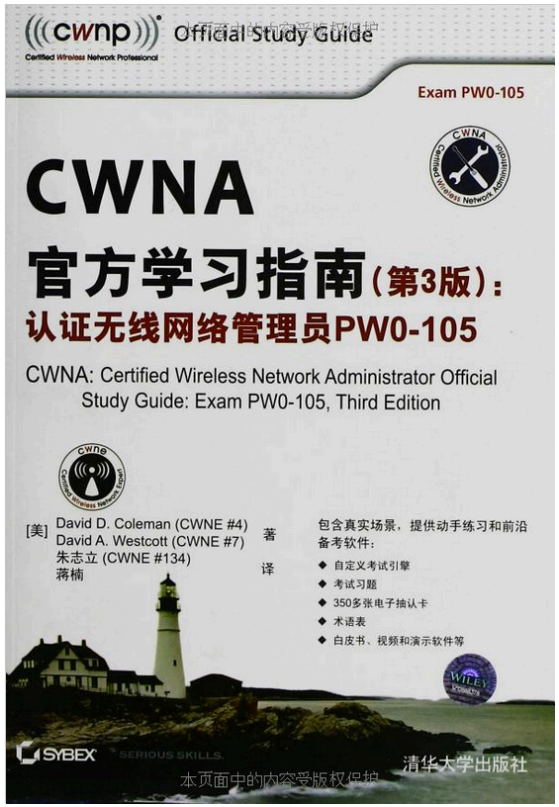
- 2012 – *CWNA Study Guide 3rd Edition*
  - David Coleman & David Westcott
    - Tech Editors – Marcus Burton and Andrew vonNagy



- 2014 – *CWNA Study Guide 4th Edition*
  - David Coleman & David Westcott
    - Tech Editors – Andrew vonNagy and Marcus Burton

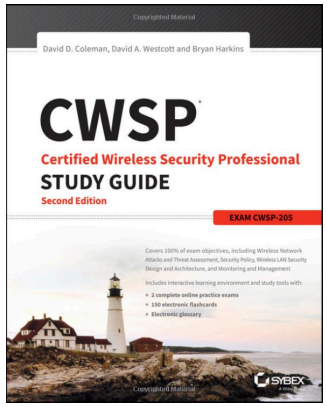


We were even translated into Simplified Chinese (Thank You Kevin Zhu)



Our Newest Book

- 2016 - *CWSP Study Guide 2nd Edition*
  - David Coleman, David Westcott,
    & Bryan Harkins
    - Tech Editors – Chris Lyttle and Ben Wilson



Official Release Date:

September 26, 2016

Reality of being an author

What is the difference between an author and a park bench?

The park bench can support a family of 4

Past, Present, & Future

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Early Network Design

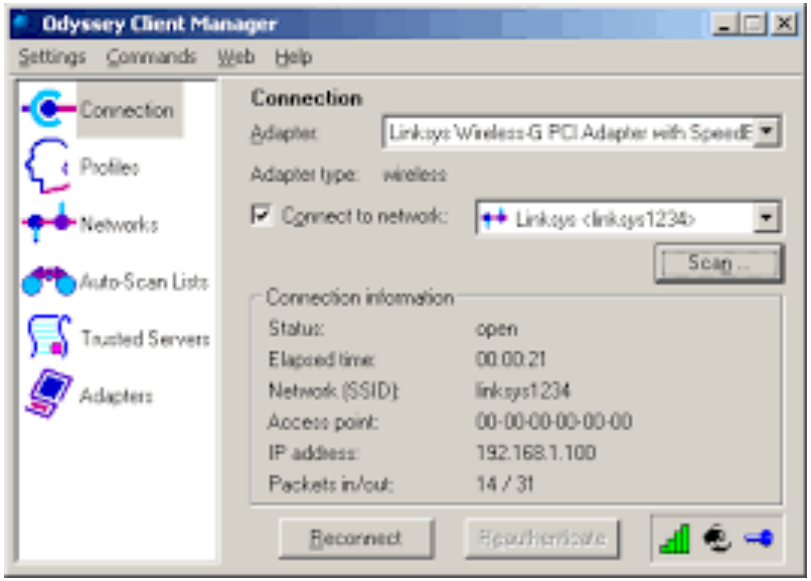
- Place an AP (APoAS)- Can you hear me now?
- Move AP and repeat
- Designed for coverage
- Line of sight was good
  - Avoid multipath
- Lots of APs in hallways

Security

- Started with WEP
- 2001 WEP was cracked
- EWG and VPN solutions were implemented
  - Bluesocket
  - Vernier

Security (continued)

- 2002 WPA came along
- 2004 802.11i/WPA2
  - Provides 802.1X/EAP to wireless
- VLAN Segregation
- Role based access control (RBAC)
- EWGs and VPNs began to fade away



Hardware Transition

- Wireless as add-on technology
- Originally Standalone APs
- External Antennas
- Centrally Managed APs Arrived
  - Controllers
  - Cooperative
  - Cloud
- Hybrid Architectures

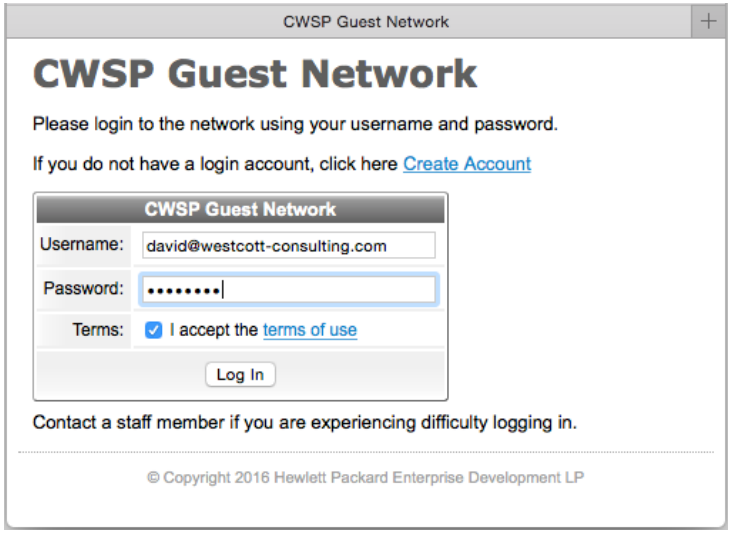
Data Rates

Year	Standard	Max Rate (Mbps)	Reality (Mbps)	Throughput (Mbps)
1997	.11	2	2	1
1999	.11b	11	11	5.5
	.11a	54	54	22
2003	.11g	54	54	20
2007	.11n(pre)	600	300 (2SS)	150
2009	.11n	600	450 (3SS)	225
2013	.11ac-1	1300	400 (2SS,40MHz)	200
2015	.11ac-2	6933	600 (3SS,40Mhz)	300

Personal/Handheld Devices Appeared

- iPhone 2007
- Android 2008
- iPad 2010
- Wireless only devices
- Consumer marketplace driven

Guest & BYOD Began



- Captive Portals
- Segregated VLANs
- Role Based Access Control (RBAC)
- Device Fingerprinting

Network Access Control (NAC)

- AAA starting to be fully realized
- No longer just who you are (Authentication)
- Now includes (Authorization)
  - What you are
  - Where you are
  - When you are
  - How you are
  - Etc.
- Tracking and modifying status (Accounting/CoA)

Vendors/Products

- Dedicated wireless vendors/companies
- Some mergers and acquisitions
  - But still wireless centric attitude
- Consulting companies
  - Initially wireless as an afterthought
  - Many became wireless focused

Past, **Present**, & Future

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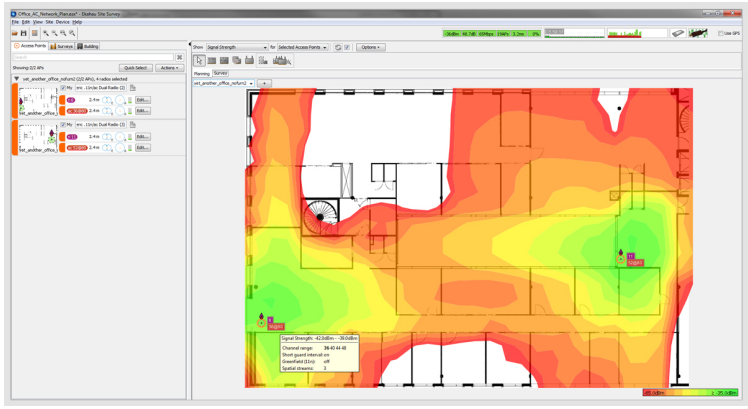
Current Network Design



- More predictive designs
- APoAS validation
- Design for capacity and airtime consumption
- Adaptive/Dynamic radio management
- With MIMO multipath is good
- Avoid APs in hallways

Security

- 802.1X/EAP-PEAP is dominant
- 802.1X/EAP-TLS (PKI) is growing
- VLAN segmentation
- RBAC

Hardware

- Wireless as primary PHY
- Many wireless only networks
- Integrated antennas
- Centrally Managed APs
  - Controllers
  - Cooperative
  - Cloud
- Hybrid Architectures

Data Rates

Year	Standard	Max Rate (Mbps)	Reality (Mbps)	Throughput (Mbps)
2007	.11n(pre)	600	300 (2SS)	150
2009	.11n	600	450 (3SS)	225
2013	.11ac-1	1300	400 (2SS,40MHz)	200
2015	.11ac-2	6933	600 (3SS,40Mhz)	300

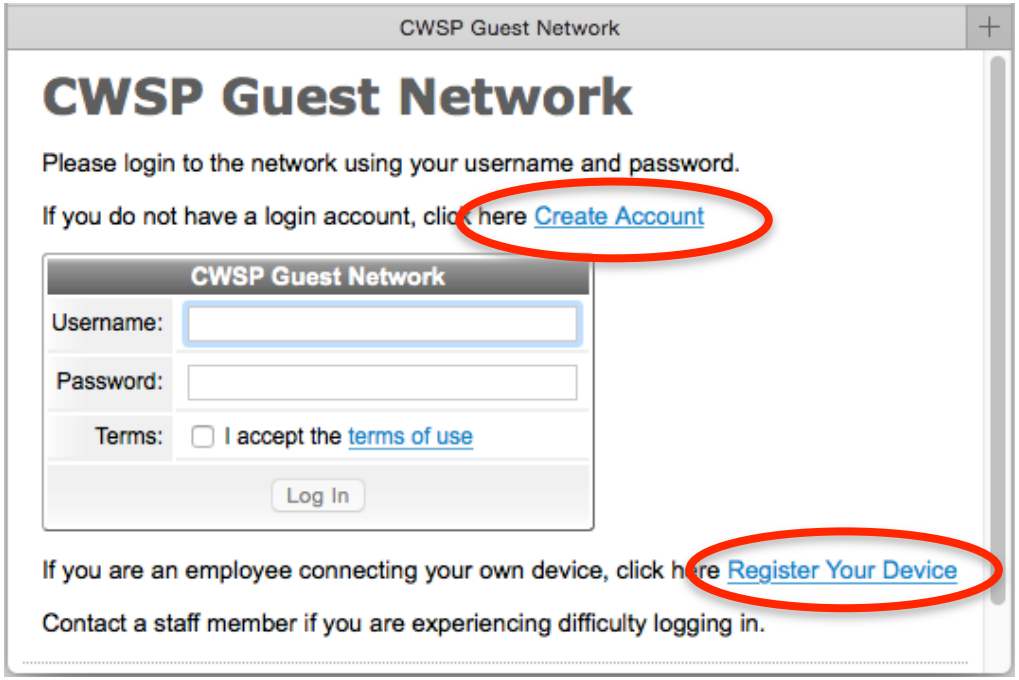
Majority of devices are 5 GHZ

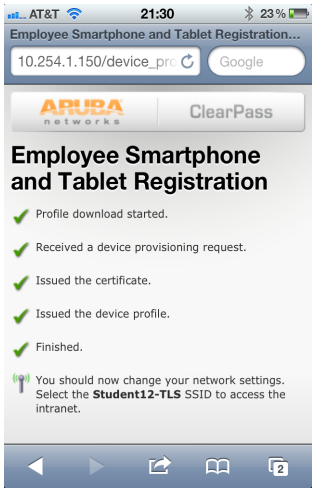
- However -

2.4 GHz says "I'm not dead yet"

BYOD

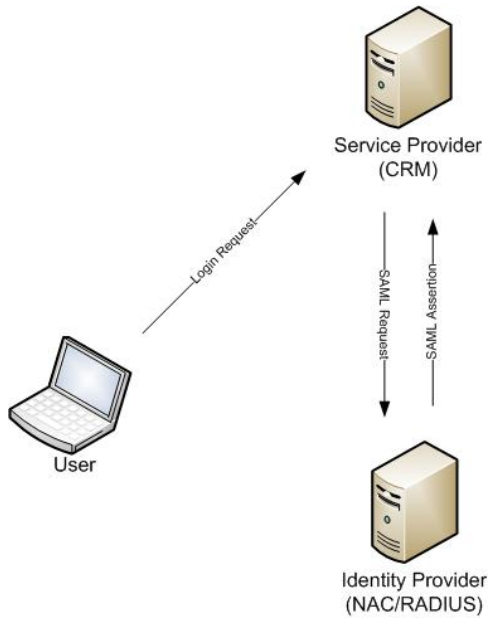
- Captive Portals
  - Self Registration
  - Sponsorship
- Segregated VLANs
- Role Based Access Control (RBAC)
- Device Onboarding
  - Self enrollment
  - Self configuration
- Device Fingerprinting
  - Selective BYOD





Network Access Control (NAC)

- AAA is a key technology
- Integration with other technologies
  - Bluetooth low energy (BLE)
  - Mobile device management (MDM)
- Single Sign-On
  - Security assertion markup language (SAML)
- Access to other resources
  - Open standard for authorization (OAuth 2.0)



Vendors/Products

- Major consolidation of vendors recently
- Wireless is now part of overall product family
- Consulting companies
  - Must have wireless specialists to survive

Past, Present, & **Future**

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Future Challenges

- Network Design
  - Physical
  - Logical
- Enhancing the PHY
- Internet of Things (IoT)
- Enhanced Guest & Public Access

Challenges - Physical Network Design

- More novices who think they know wireless
- Non-wireless person's view
  - Just put an AP every XX feet
  - How tough is it to not pull cables
  - Add another AP
  - Increase the power
- MU-MIMO becoming reality?
- Roaming – more critical than ever
- Expansion beyond the office - Outdoors

Challenges - Logical Network Design

- Monitoring, troubleshooting, intelligent analytics platforms
- API integration and expansion
  - Monitoring
  - Management
- Greater use of AAA and NAC
  - SAML
  - OAuth

Challenges - Enhancing the PHY

- Channels are limited
  - FCC potentially 36 x 20 MHz wide 5 GHz channels
  - ETSI 19 x 20 MHz wide 5 GHz channels
- MU-MIMO maturing
- 802.11ax (2018?)
  - Sub-channelization (9 subchannels) and OFDMA (multiple access)
  - More efficient use of channels and airtime for multiple stations
  - Bi-directional MU-MIMO
  - Both 2.4 GHz and 5 GHz bands
- It's about capacity and airtime consumption – not speed
- Built-in adaptive/dynamic radio management

Challenges - Internet of Things (IoT)

- Projected 20 billion+ devices by 2020
- All facets of life
  - Environmental monitoring
  - Manufacturing
  - Medical & Healthcare
  - Transportation
- How will devices keep up with
  - Technology advances
  - Exposed risk and vulnerability
- Many IoT vendors are treating Wi-Fi as an expense (inferior components)
- 2.4 GHz ISM is more universally supported over 5 GHz

Challenges - Enhanced Guest & Public Access

- Expansion of Hotspot 2.0
- Seamless access for users
- More identification/fingerprinting of devices

There Is No One Path Into Wi-Fi

Educational Background of Wi-Fi Trek Presenters (1 of 2)

- BSEE, MSEE (concentration in RF analysis)
- BS & MS in Physics
- 1st Class Honours degree in Computer Science BSc
- BS Mech Engineering (MIT), MS Mech Engineering (MIT), MBA (UConn)
- Degree in Information Technology
- BS Electrical Engineering, Masters of Engineering in Electrical and Computer Engineering
- AA Communications, AS Computers

Educational Background of Wi-Fi Trek Presenters (2 of 2)

- Aviation Administration degree with minor in Religion
- BA History/English
- Bachelors in Ministry
- Masters degrees International Trade/International Negotiation, Bachelor degrees Mandarin, Tibetan, South East Asia negotiation techniques
- BS Business Administration
- No college classes of any kind
- Bachelor degree in Philosophy (training of analytical thinking), Degree in Computer Networking

Initial Job Paths of Presenters (1 of 2)

- Antenna engineer
- Testing new technologies for clients at major telecom
- Worked for WISP running Linux servers
- Network administrator
- Consultant
- Systems engineer for semiconductor equipment manufacturer

Initial Job Paths of Presenters (2 of 2)

- Aerospace design engineering
- 10 yrs - Owned International Trade company to/from Chinese countries
- Ordained Minister
- Retail Management
- Jet engine mechanic in USAF

And…..

Taught Technical Writing to Graduate Students in China

Fire Breather and C++ Programmer

Housekeeper At Florida Hospital

Professional Dancer (18 years)

Music industry 15 years
Radio promotion and artist relations

Wi-Fi Call to Action

Things We Need To Do

- Promote the Wi-Fi Industry Outside of Wi-Fi
  - Write articles for mainstream publications
  - Politely educate and correct those that are wrong
- Promote CWNP and Certifications
  - Only 192 CWNEs
- Push Vendors and Companies Towards More Education

Final Thoughts And Thank You

How I Feel Every Day About My Career

Thank You

- CWNP Founders
  - Devin Akin
  - Kevin Sandlin
  - Scott Turner
  - Scott Williams
- Sybex, Co-authors, & Editors
- Wireless Bloggers

Thank You

- Sponsors
- CWNP Current Leadership
  - Heather Hobbs – Marketing Director
  - Josie Miller – Operations Director
  - Tom Carpenter – CTO
  - Rameshwar (Ram) Nigam – General Manager
- Attendees & CWNP Certificate holders