Dealing with Increased WiFi Capacity Demand

Pat R. Calhoun
CTO, WNBU
pcalhoun@cisco.com

Thesis

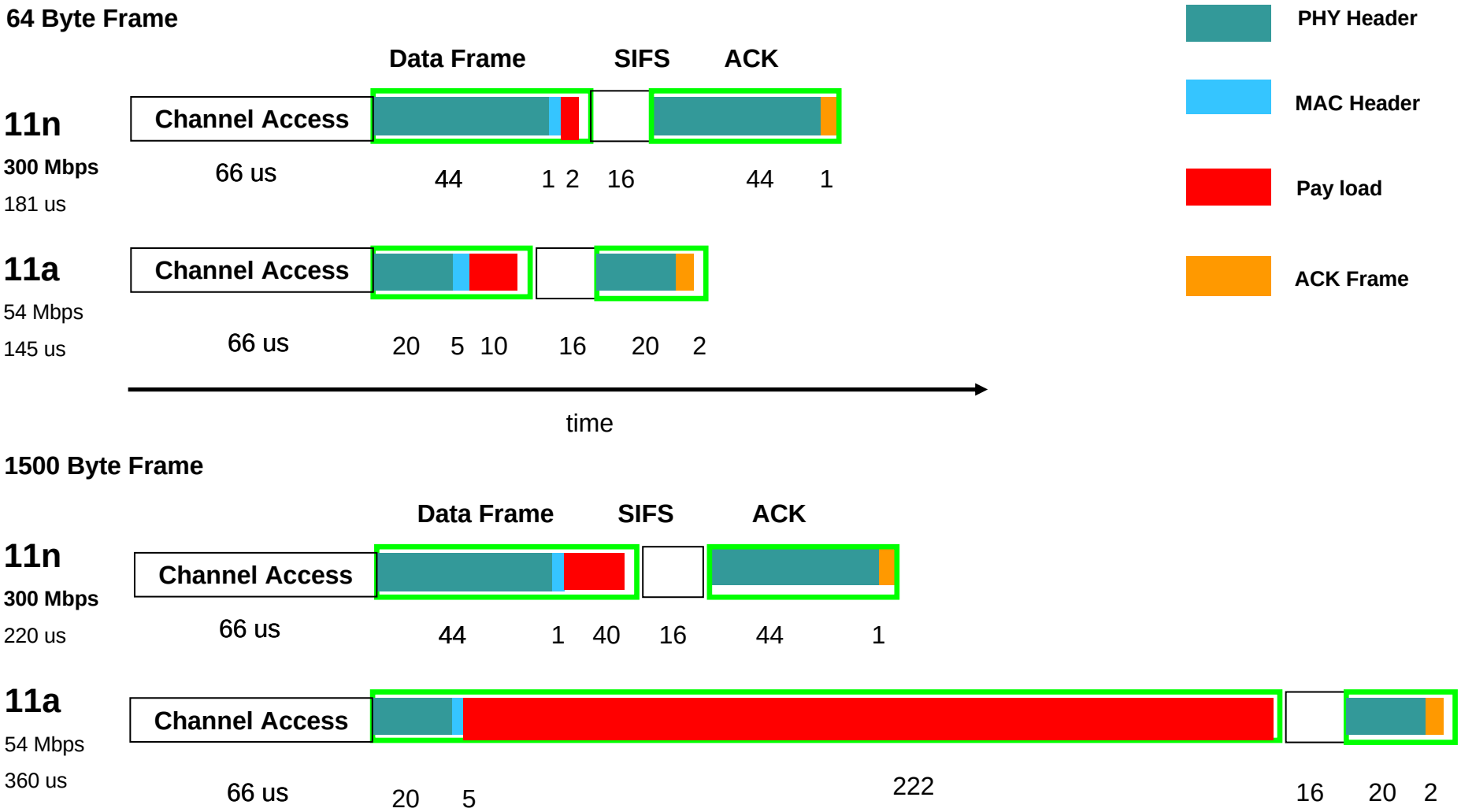
- **Few networks today have capacity issues**
- **The trends driving wireless networks towards the capacity cliff include:**

  Voice and small packet application

  High bandwidth Wireless applications (e.g., MP3 players, streaming video, File-sharing servers, Skype)

  Outdoor Mesh Networks

VoIP packets are not ideal for 802.11n



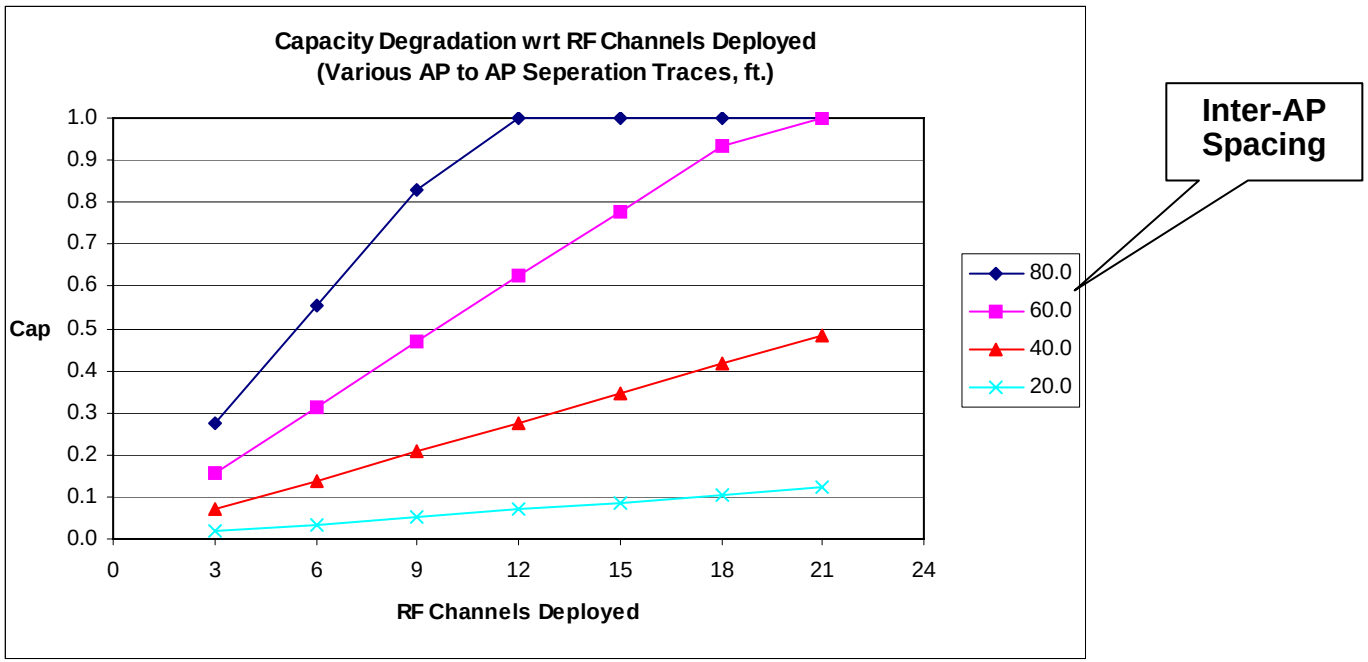
Aggregation increases performance

Packet Size	PHY Payload Rate	11A/G	11N	11N 3X A-MSDU Aggregation	11N Max.A-MPDU Aggregation
64 Bytes	**6 Mbps**	**1.8**	**1.6**	**3.0**	**5.6**
	54 Mbps	**3.5**	**2.6**	**7.1**	**44**
	13 Mbps		**2.1**	**4.7**	**12**
	65 Mbps		**2.7**	**7.1**	**50**
	150 Mbps		**2.8**	**8.1**	**90**
	300 Mbps		**2.8**	**8.5**	**140**
1500 Bytes	**6 Mbps**	**5.5**	**5.4**	**5.8**	**5.6**
	54 Mbps	**33**	**29**	**42**	**51.5**
	13 Mbps		**10.7**	**12**	**12.2**
	65 Mbps		**32.5**	**48**	**62**
	150 Mbps		**48**	**87**	**143**
	300 Mbps		**55**	**121**	**287**

Note VoIP traffic patterns doesn't allow for packet aggregation.

Co-Channel Capacity Degradation

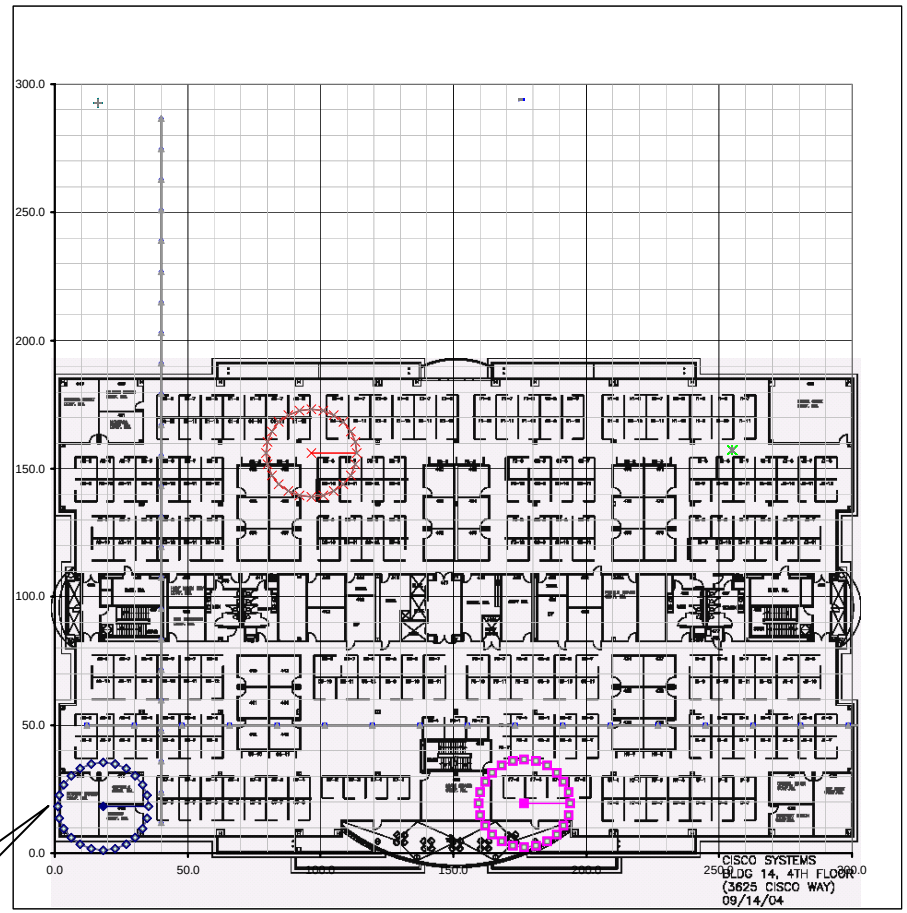
- **Simple (1/n) approximate degradation for fixed building floor space. Assuming 60,000 ft^2 floor area and all AP's can hear each other.**



Note 1.0 is the total system capacity.

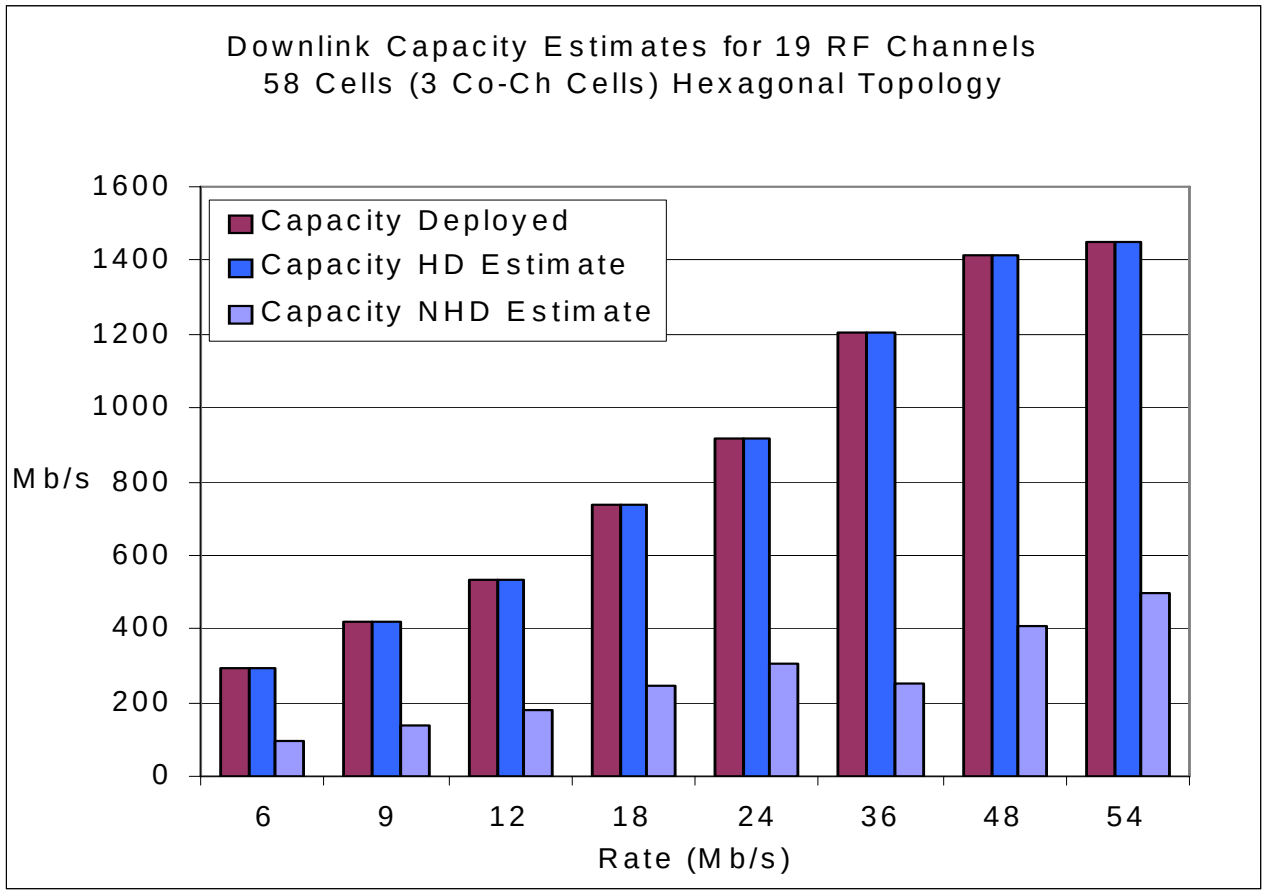
Download Capacity with 19 Channels

- **Density of 58 AP's w/ 3 APs per Channel**
  - **Office Space 60,000 sq. ft.**
  - **Cell Radius ~ 18 ft.**
  - **Adjacent Cell Separation ~ 31 ft.**
  - **Co-Channel Separation ~ 137 ft.**
  - **Co-Channel Interference Only**
  - **Max. Transfer Rate (1500 Byte Mac Efficiency)**
  - **Hexagonal Topology**



Separation between APs on same channel

HD vs. Non-HD Performance Comparison



Pico provides significant performance benefits

Pico Challenges

- Dynamic transmit power and receiver sensitivity
- Pico support on the client side
- Client roaming algorithm
- Roaming load on infrastructure
  - Increased handoffs will require 802.11r (fast handoff)