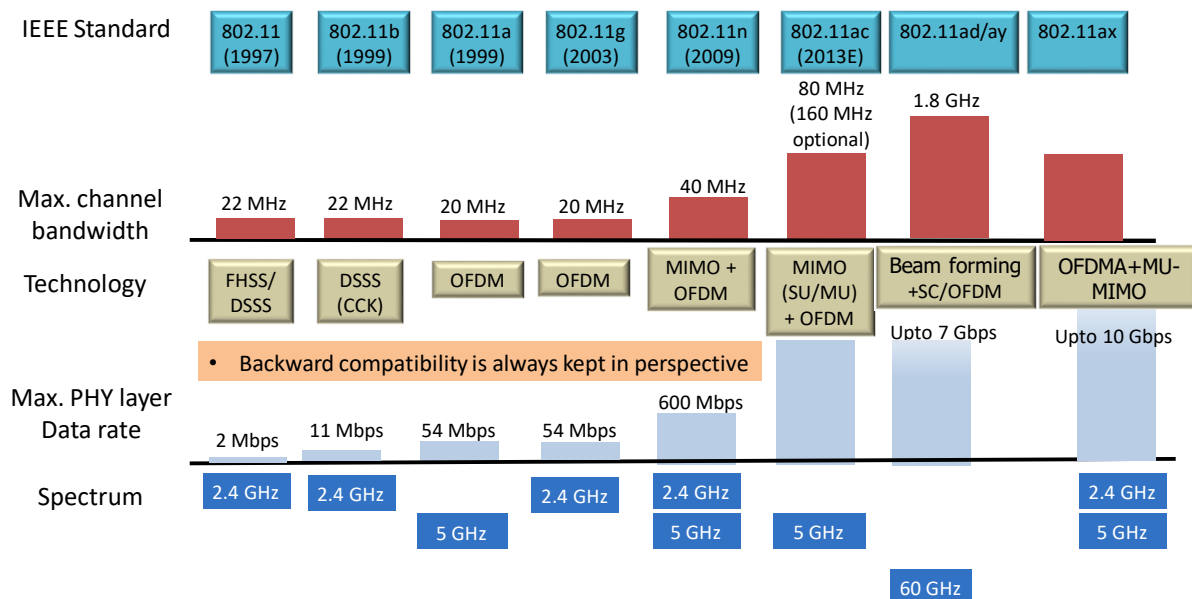


Wi-Fi Technology; Where are we and what to expect (?)

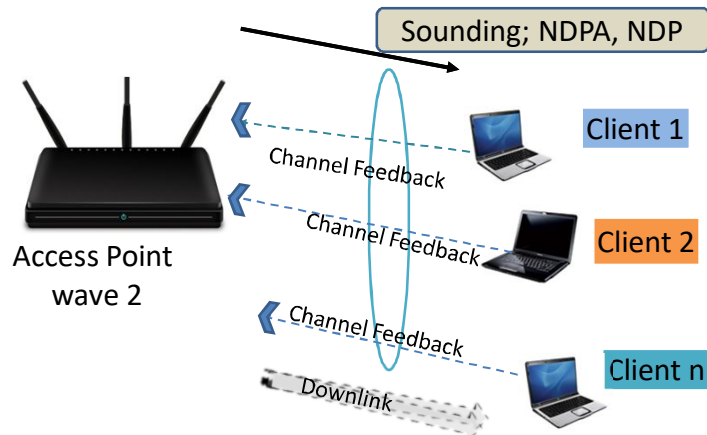
Dr. Srikanth Subramanian, CKO, Nanocell Networks

Wi-Fi Rates and Speeds



MU-MIMO in 11ac - Summary

MU-MIMO only on DL and in 5 GHz only



Works only with high SNR clients and has no impact on range/coverage

Can support upto 4 users on DL but 4x4 preferably upto 3, 3x3 upto 2, 2x2 -none

Along with a capable AP u need atleast 2 active MU-MIMO capable clients to get benefits

11ac MU-MIMO ACK and Feedback processes are inefficient

Can 11ac MU-MIMO Solve the HD problems?

Expensive sounding process; polled feedback, large sizes

Client measurements, heavy duty processing to be done quickly, potential for errors in feedback

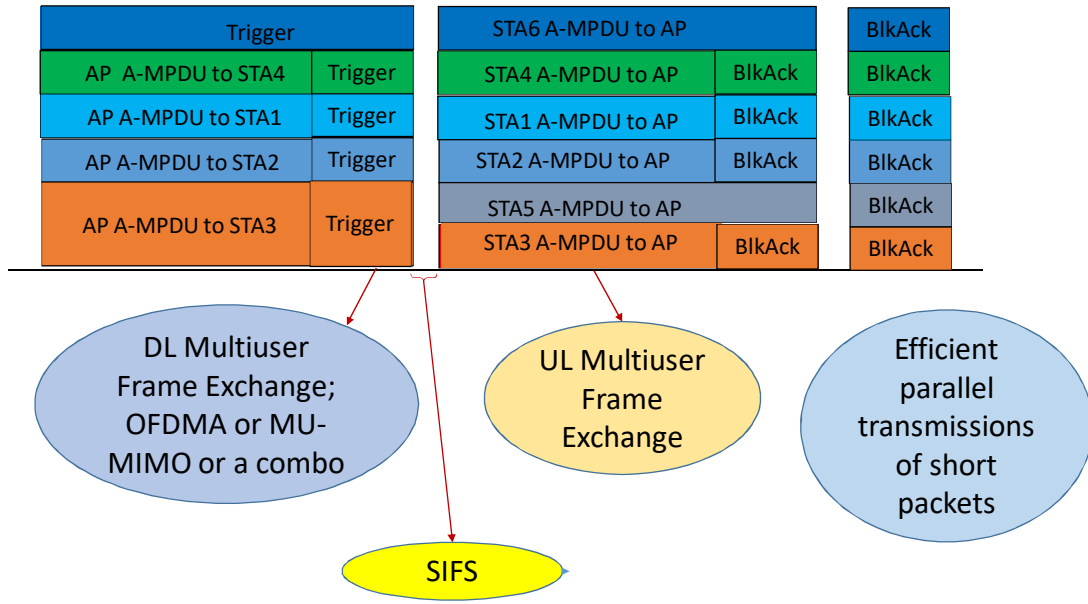
No UL mechanisms to support sending of 802.11 and TCP ACKs efficiently

MU-MIMO (802.11ac)

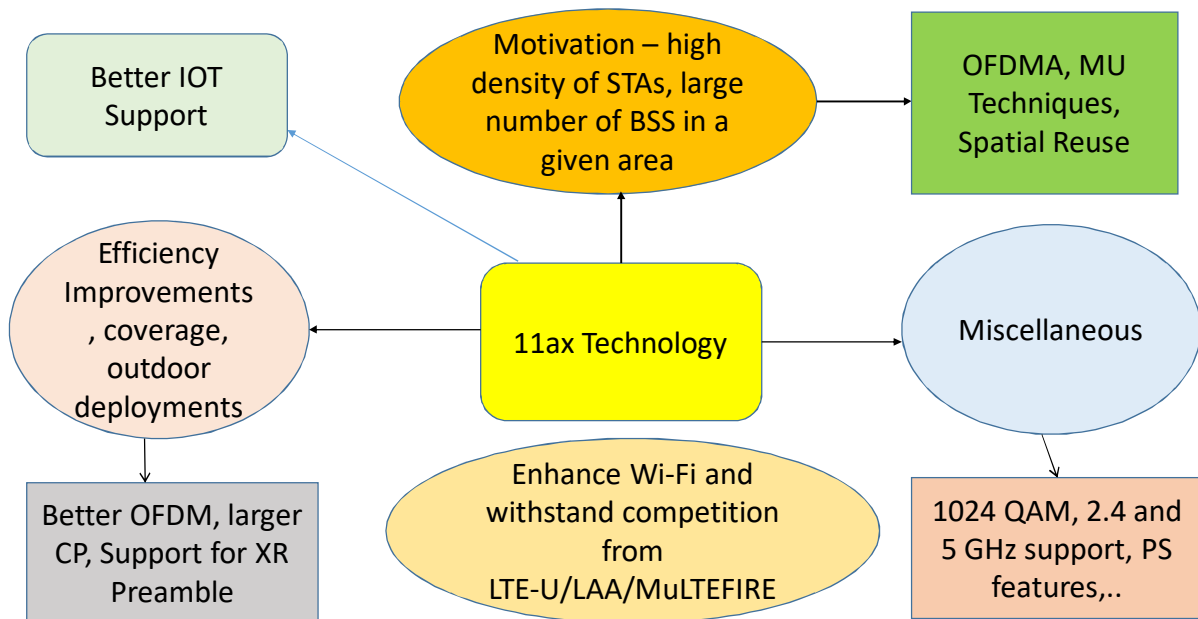
High processing load to separate user transmissions by AP; works only in certain conditions, good SNR, no mobility etc.

11ac MU-MIMO not a great fit for short-packet HD use cases

Key concept in 802.11ax

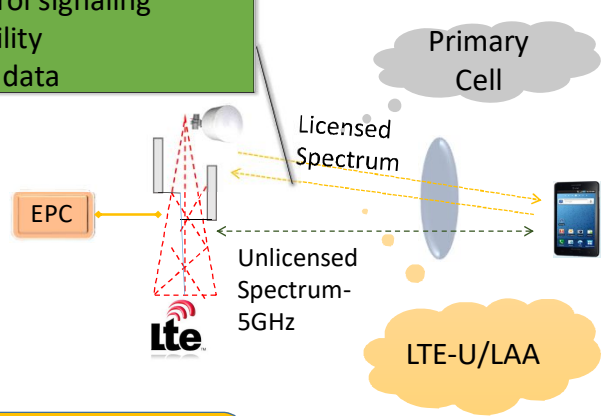


11ax Technology Summary



Wi-Fi Competition?; LTE and Unlicensed Spectrum

- Control signaling
- Mobility
- User data

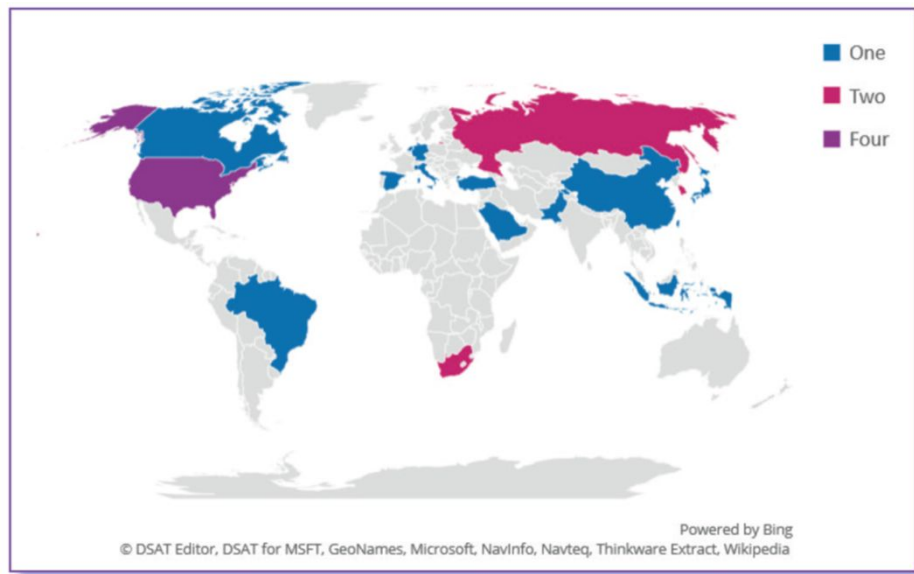


MuLTFire;
standalone LTE
based
unlicensed
technology

Aggregation of
Licensed + Unlicensed

LWA/LWIP
also in the
picture

LTE Unlicensed – Deployment plan across the globe



Enough operators, network vendors, chipset players for handsets seem to have announced solutions for LTE unlicensed approaches

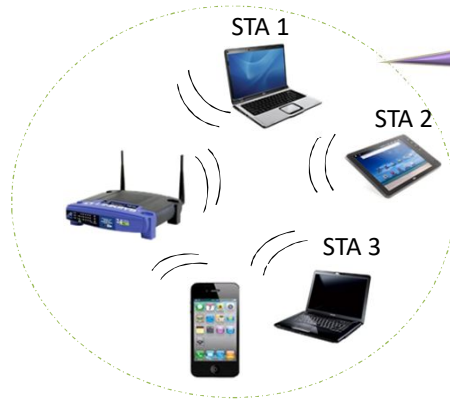
Source: GSA

Wi-Fi Features

IOT Handling

RRM,
Band
steering,
etc.

Location
and related
applications



Security

QoS

Wi-Fi systems
using
Mesh/WDS/..

Mobility

Why do we need multiple APs @ home?.



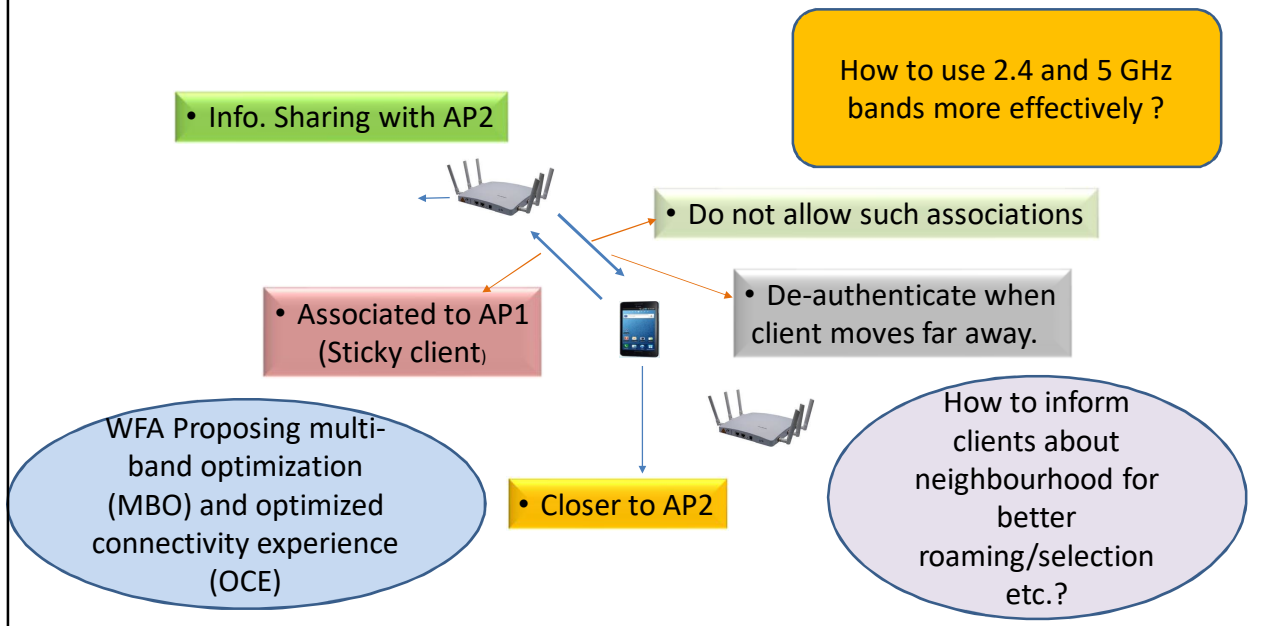
Better Wi-Fi Signal
everywhere in a large home
especially 5 GHz signal
seems to lead to a better
user experience ..

Running wires/using
powerline etc. have
been tried and have
not been successful

IOT, Wi-Fi Calling
and so on have
made this
compelling
especially given
that 2 and 3-radio
solutions are
becoming quite
common

Enterprise features coming to home Wi-Fi products !!

Managing Clients – Motivation for MBO and OCE



MBO – Do we need new IEEE Standards?

802.11v – wireless network management to help steer users

802.11r for fast roaming once you steer an associated user to a new BSS

802.11u for preassociation related exchanges using ANQP

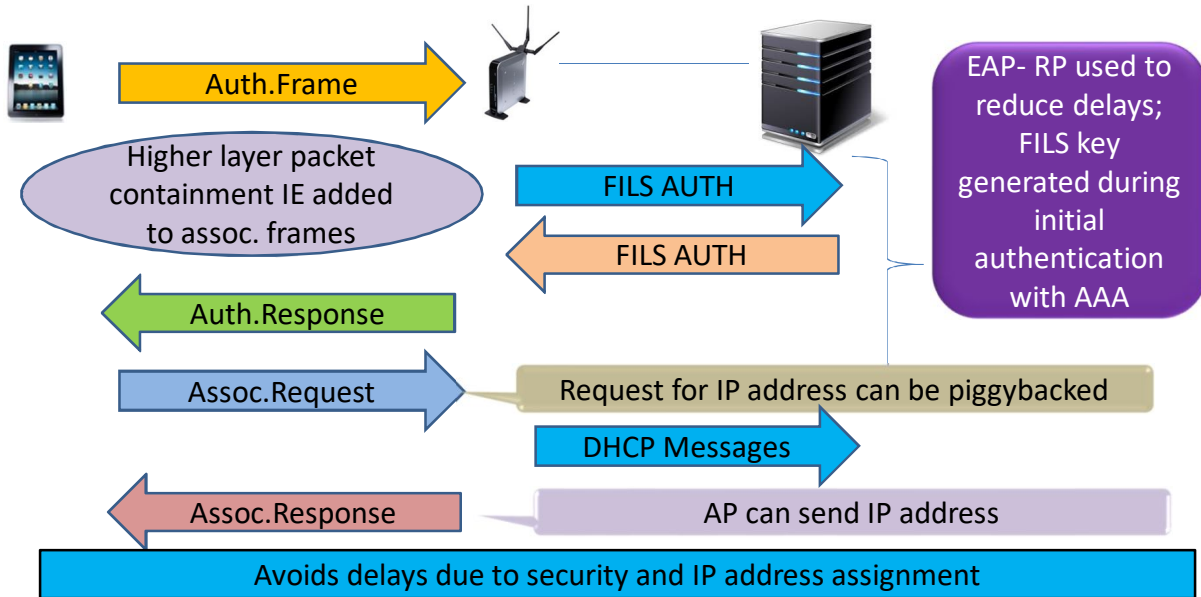
802.11k radio measurements for exchanging info. about other APs and their signal strengths

Wi-Fi Agile Multiband

802.11w management frame protection to secure exchanges

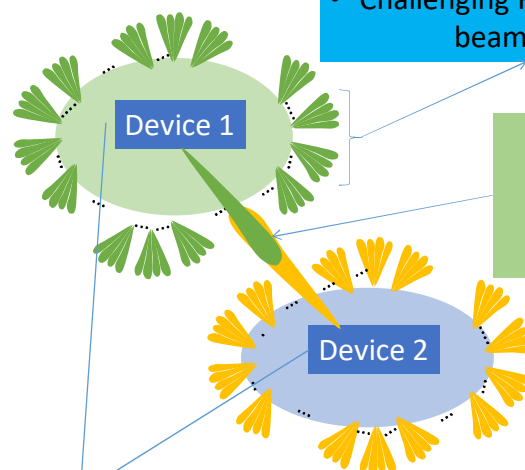
Some WFA IEs to help manage the features

OCE: Short Connection Times



60 GHz Wi-Fi

60 GHz
802.11ad..will
11ay become a
hit (?); current
implementations
are for
backhaul..



- Challenging RF overcome by beamforming

- Cable replacement technology for high bandwidth applications; VR (?)

5G mm wave move could help overall technology

- Potential future band (?) due to large bandwidth availability

AP Evolution Story



Typically 1 antenna, 2.4 GHz radio, multiple Ethernet ports, 802.11b/g days, no RRM/mobility..



Multiple antennas, multiple radios (2.4 and 5 GHz, dual band concurrent radios), multiple Ethernet ports, integrated cable/DSL/.. For retail markets



Lots of antennas, 3 radio support, sensing/traffic generator plus normal AP functionality, application layer monitoring features..RRM/mobility/mesh..IOT..60 GHz (?).. Location..

Future of Wi-Fi (?)

MBO for smoother band steering and transitions..load balancing.. association control

OCE for faster connection times..avoid unnecessary probing etc.

No low rate beacons and probe frames..

IEEE 802.11ax for HD and IOT..use of multi-BSS Beacons..and TF-R and TWT

What all are needed to make Wi-Fi great

802.11w management frame protection to secure exchanges

Help manage multi-AP products.. Mesh..Channel assignments..backhaul etc.

WPA3?