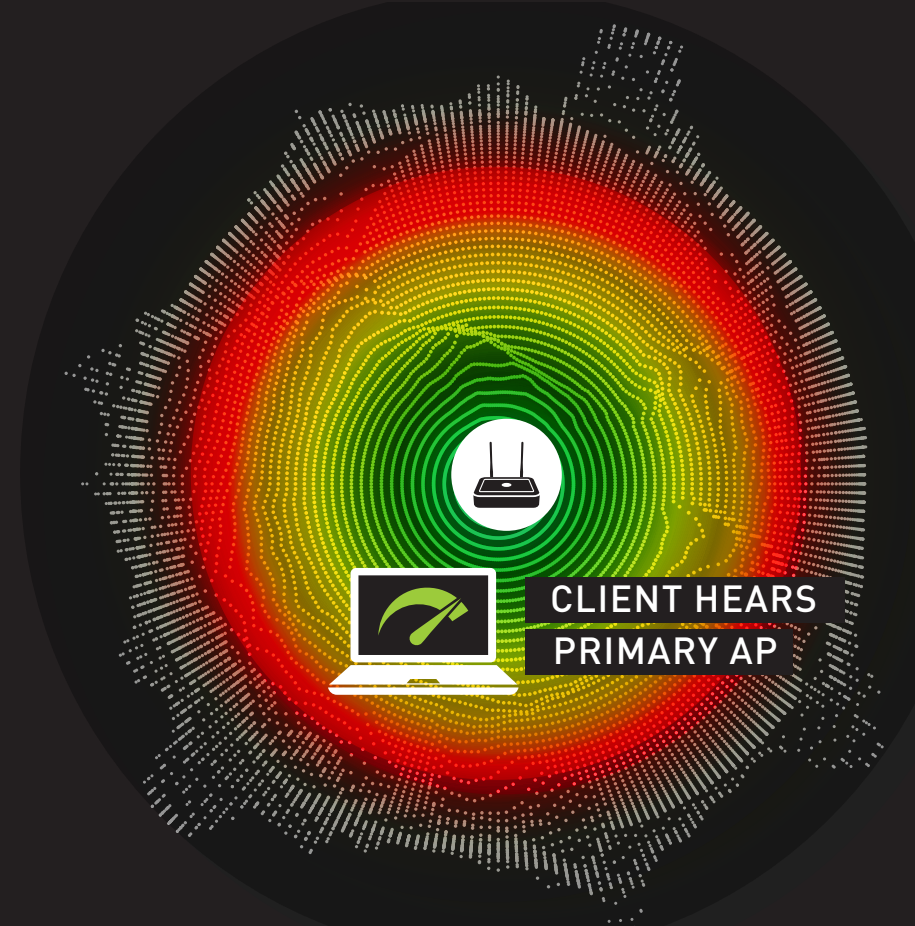# Wi-Fi Design

ekahau
WIRELESS DESIGN

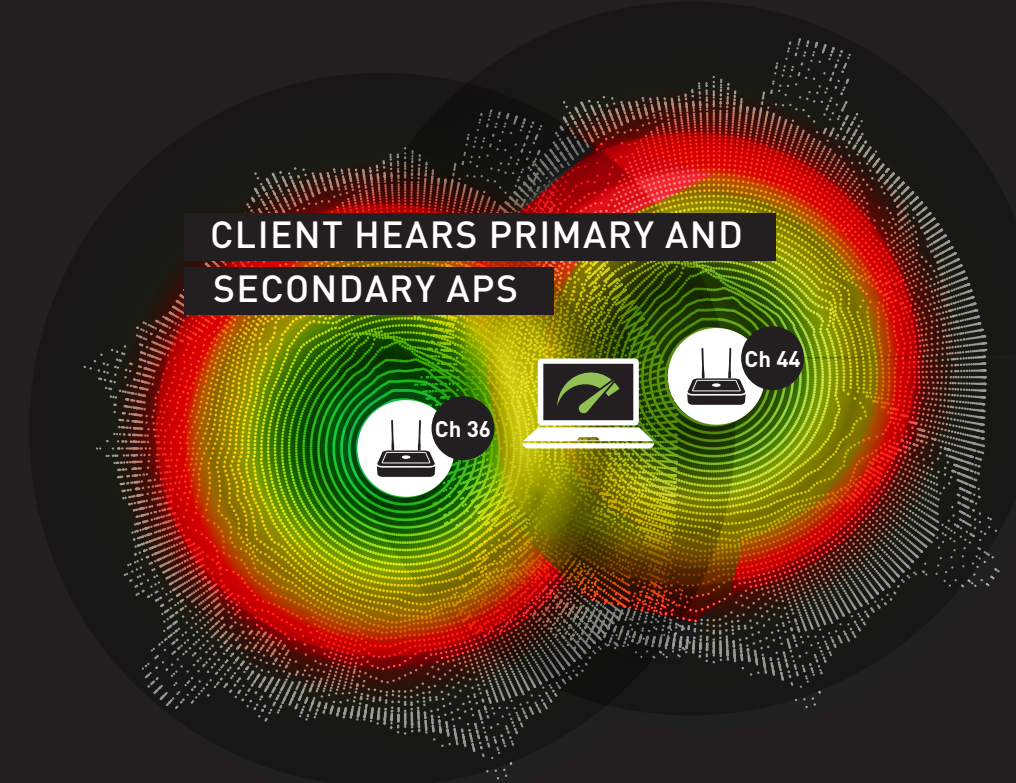## CRITICAL DESIGN ASPECTS

1. Primary Coverage Goal

OBJECTIVES
- Provide Wi-Fi service in all required locations
- High quality signal strength
- Maintain high data rates

RESULTS
- Improve airtime efficiency
- Improve density handling

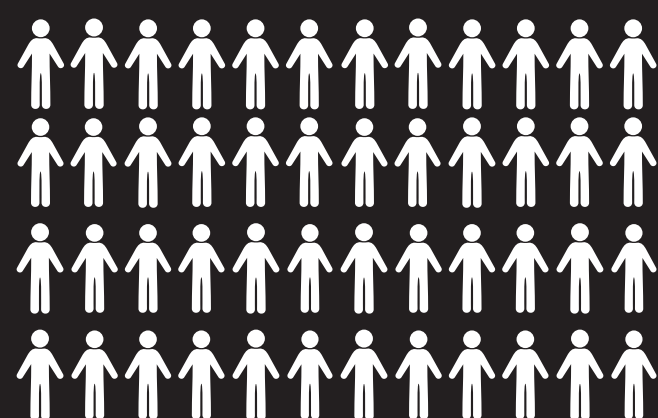CLIENT HEARS PRIMARY AP

2. Secondary Coverage Goal

OBJECTIVE
- Provide coverage for 2 APs in each location

RESULTS
- Improve client roaming
- Low latency roaming for real-time application
- Redundancy for AP failure

CLIENT HEARS PRIMARY AND SECONDARY APS

Ch 36   Ch 44

3. Capacity Plan

High Client Density

CONSIDERATIONS
- More spectrum in 5 GHz provides up to 8x the capacity of 2.4 GHz
- Understand client mix
- Client offered load / SLA
- Model airtime demand
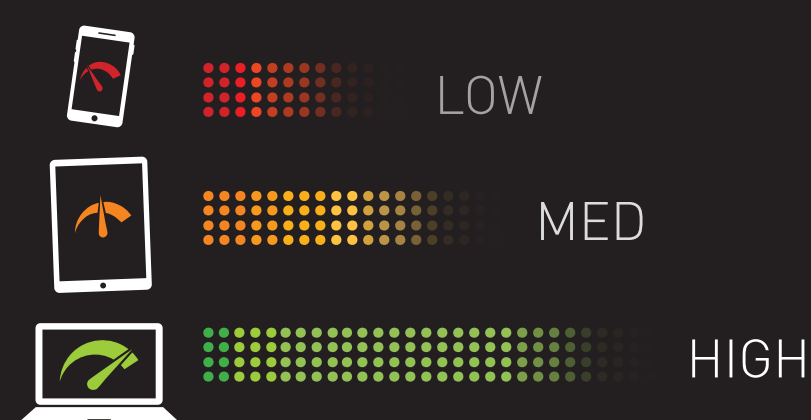- Understand airtime saturation limits (80% BE, 50% BE/VO/VI, 35% VO)

RESULTS
- Optimal number of APs
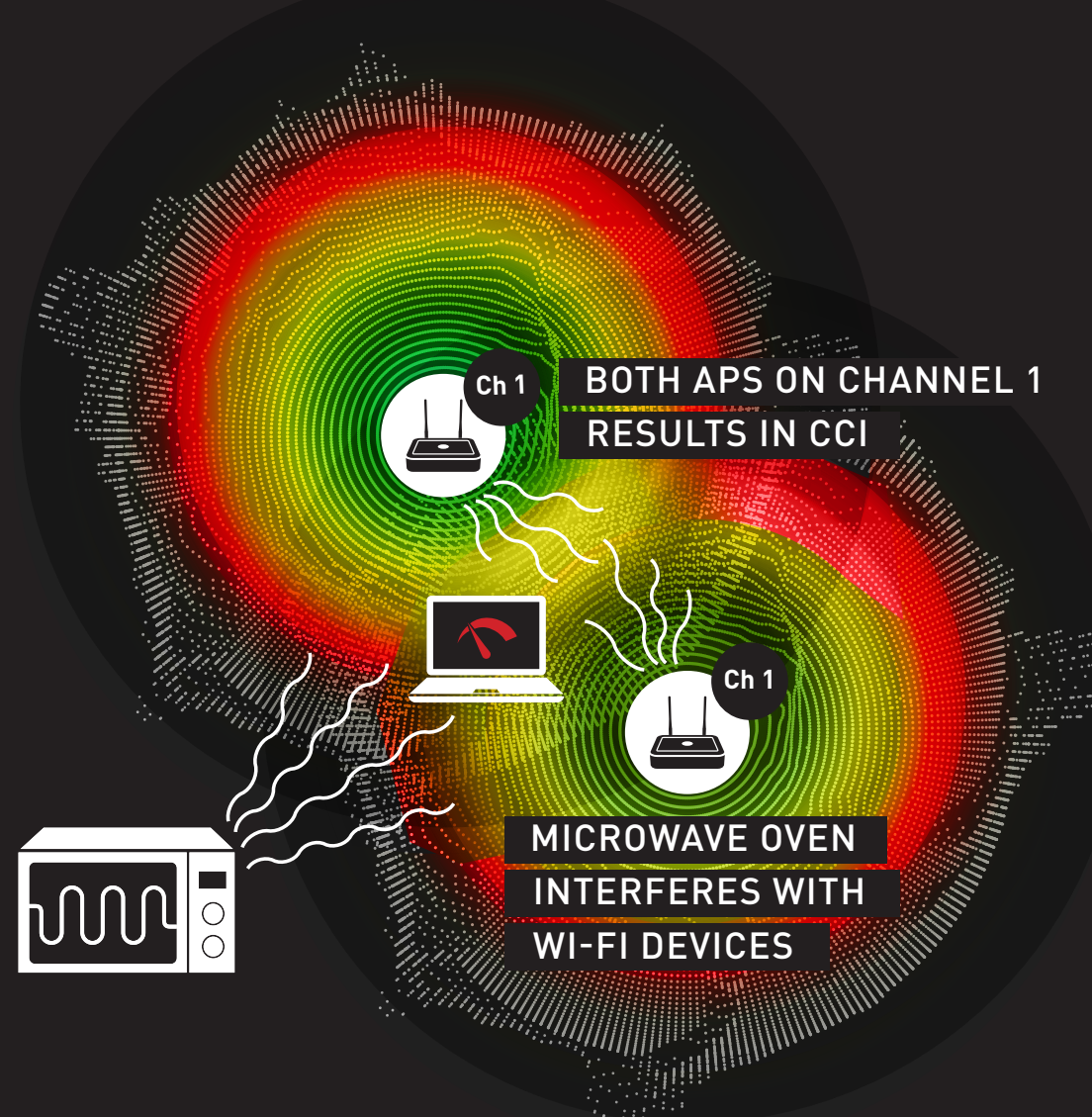- Proper client distribution between 5 GHz and 2.4 GHz
- Leave idle airtime for growth

Low Client Density

Client Device Efficiency

LOW

MED

HIGH

4. Minimize Interference

OBJECTIVES
- Isolate APs on same channel
- Reduce shared airtime
- Limit contention domains
- Eliminate external interference

RESULTS
- Minimize co-channel interference (CCI) and adjacent channel interference (ACI) between APs on the same or overlapping channels
- Ideally, only one AP audible on each channel in a physical location
- Ideally, remove sources of external RF interference or avoid impacted channels if they cannot be removed

Ch 1   BOTH APS ON CHANNEL 1 RESULTS IN CCI

Ch 1

MICROWAVE OVEN INTERFERES WITH WI-FI DEVICES

RF DESIGN PROCESS

1. GATHER REQUIREMENTS
- Blueprints / CAD drawings
- Coverage areas
- Facility layouts & construction materials
- Client number and mix
- Client density distribution
- Critical applications / business process

1

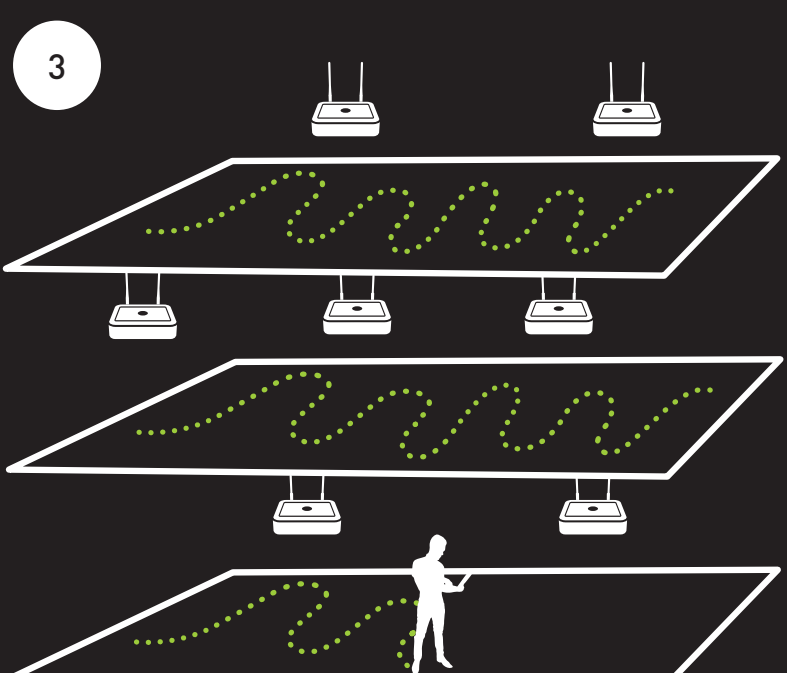### 2. PRE – INSTALLATION DESIGN
- Predictive modeling
- Wall attenuation measurements
- "AP on a stick" measurement
- Wired network integration

2

3. POST INSTALLATION VALIDATION
- RF site survey (passive / active / spectrum)
- RF tuning channel and power plans
- Association and authentication tests
- Roaming tests
- Spectrum analysis

3

HIGH PERFORMANCE WI-FI TIPS & TRICKS

1. **Design for 5 GHz as Primary**
   - The 5 GHz band provides 8 times the capacity of 2.4 GHz

2. **Define Coverage Goal(s)**
   - Too aggressive can lead to co-channel interference
   - Too conservative can lead to poor client performance

3. **Place APs Where Users Are Located**
   - In-room placement is best for client performance
   - Avoid hallways, if possible, unless required for voice roaming

4. **Tailor Coverage to the Facility**
   - Leverage RF obstructions for frequency re-use
   - Consider proper antennas and orientation for signal propagation

5. **Fine Tune AP Power Levels**
   - Align with on-site signal measurements of RF propagation
   - Align with AP density and frequency re-use requirements

6. **Disable 2.4 GHz Radios if Necessary**
   - There are fewer available channels in 2.4 GHz
   - Disabling radios can prevent co-channel interference and shared capacity between clients
   - Some APs allow switching 2.4GHz radio to 5GHz

7. **Design and Validate with Representative Client Devices**
   - Spot-check with actual client devices to ensure the design matches actual client performance
   - Alternatively, measure with a standard RF site survey adapter and compensate the signal based on actual client device characteristics

8. **Higher AP Density Requires Smaller Channel Widths**
   - Reduces co-channel interference and shared capacity between clients
   - Reduces client contention and improves network stability

9. **Disable Low Data Rates to Improve Performance**
   - 802.11b clients can significantly impact network performance
   - Reduces overhead from management frames and broadcast/multicast traffic

10. **Minimize the Number of SSIDs**
    - Network overhead increases with each SSID defined