

# EASY WI-FI QoE FRAMEWORK

INVENTORS:

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Description:

The patent idea is based on the Easy Wi-Fi App project (D4664)

The Framework provides a comprehensive set of tools to assess the user Quality of Experience (QoE) and assist the user and ISP to enhance the QoE. It also includes a set of to defined the number of Mesh AP needed in a home and to best position the Mesh APs. It includes:

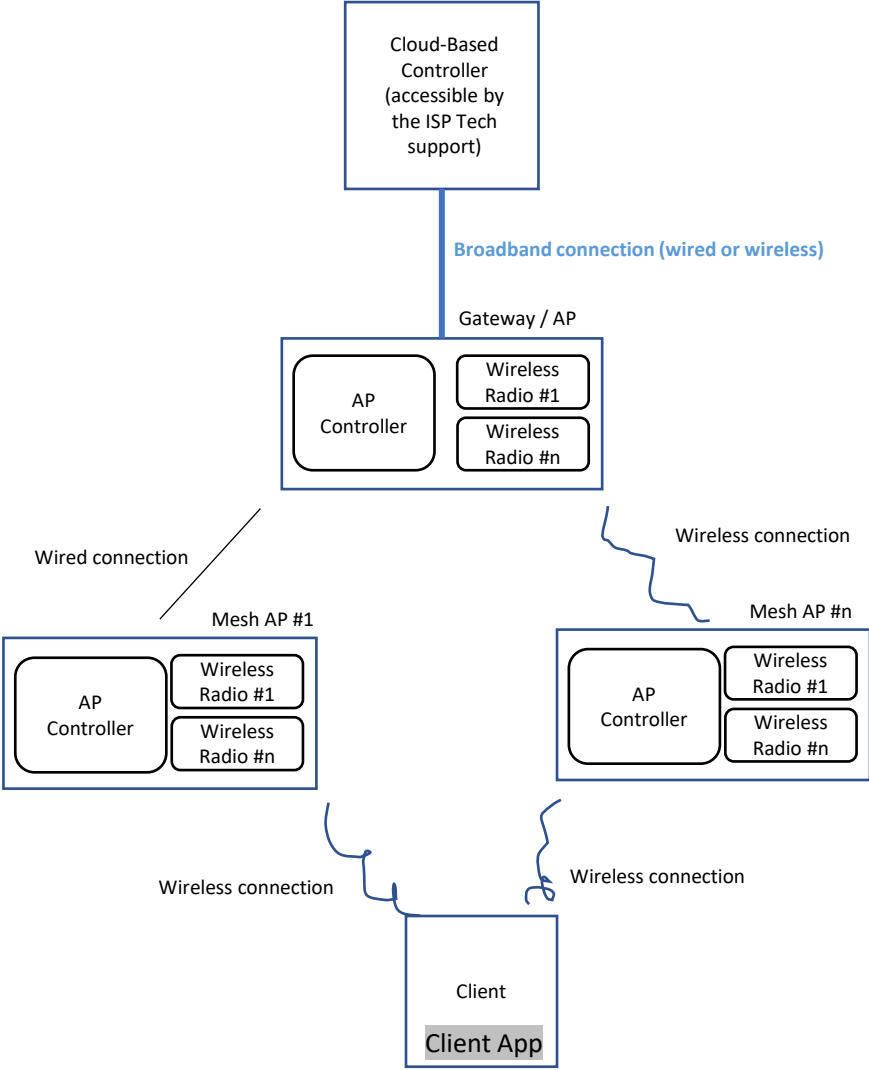
- (1) Insights of the network performance and identification of bottlenecks (WLAN, LAN, WAN)
- (2) Assist the user to recommend the need of Mesh APs and assist the user with positioning the gateway and the Mesh APs in their home.
- (3) Identification of potential lack of resources on the client

The framework is composed of:

- An application running on the wired or wireless client
- A SW entity embedded in the GTW
- A controller located in the cloud

Easy Wi-Fi QoE Framework implements a compressive toolset to assess and increase the user QoE connected to a broadband connection with a wireless link.

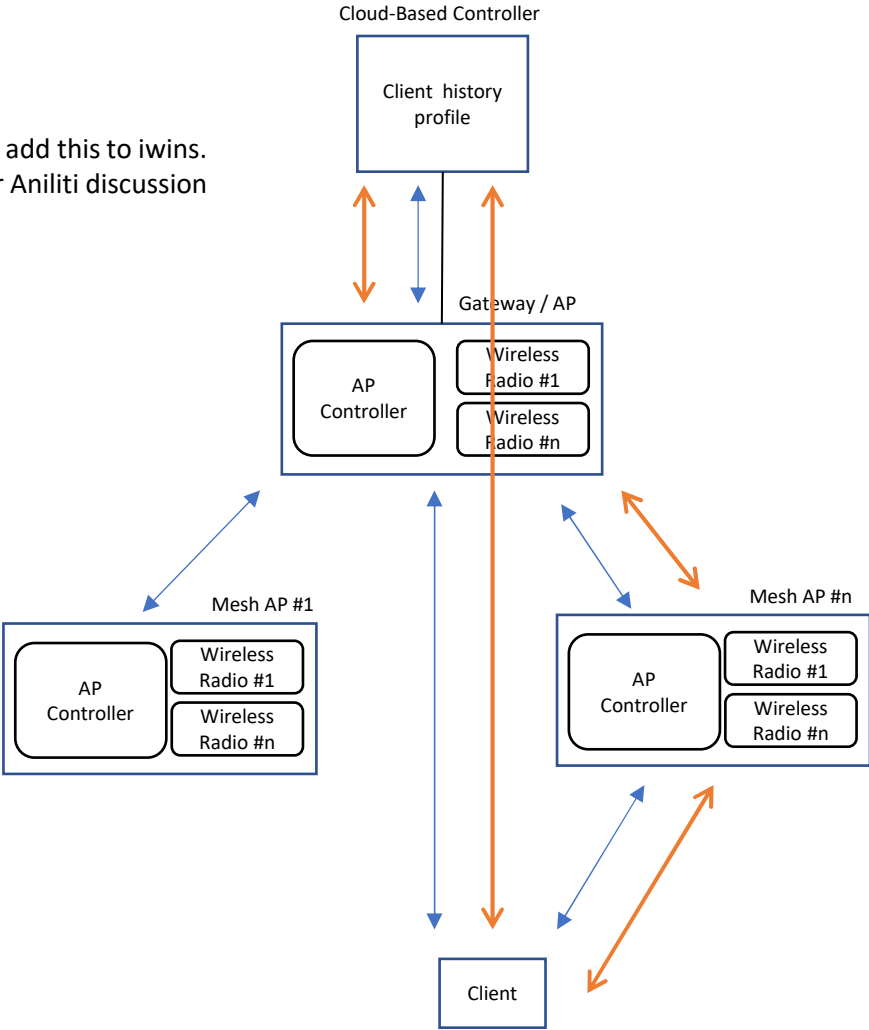
# System Overview



# Network Performance

- ↔ TCP speed test launched by the user or the ISP (LAN or WAN)
- ↔ Low duty cycle test (LAN)

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# Easy Wi-Fi Framework

The Framework provides a comprehensive set of tools to assess the user Quality of Experience (QoE) and assist the user and ISP to enhance the QoE. It also includes a set of tools to defined the number of Mesh AP needed in a home and to best position the Mesh APs. It includes:

- (1) Insights of the network performance and identification of bottlenecks (WLAN, LAN,WAN) (See flow diagram - John)
- (2) Assist the user to recommend the need of Mesh APs and assist the user with positioning the gateway and the Mesh APs in their home. (See flow diagram)
- (3) Identification of potential lack of resources or capabilities on the client

The framework is composed of:

- An application running on the wired or wireless client
- A SW entity embedded in the GTW
- A controller located in the cloud

## **(1) Insights on the network performance includes the following set of tools:**

- TCP Speed tests** are run between i) the client and each of the Mesh APs ii) the client and the cloud server, iii) the gateway and the cloud server iv) between Mesh APs. It allows to identify where is the network bottleneck. This test is launched by app on the client or a server on the Gateway or the controller in the cloud. In the former case, the Gateway acts as a proxy to launch the test on the client. When running the test, the user indicates what is the location of the client in the home (i.e., kitchen or bedroom).
- Low duty cycle tests** are tests that are not disrupting the network like speed test do. The test asses the system capacity available to the user as well as uplink and downlink latency. Low duty cycle tests comprise a server and a client. Low duty cycle tests are run between i) the client and each of the Mesh APs ii) the client and the cloud server, iii) the gateway and the cloud server iv) between Mesh APs.
  - Every x msec (typically 100 msec):
    - the server send a small UDP packet (i.e., 400B) to the client and the client answer with a large UDP packet (i.e., Xvbytes).
    - the server send a large UDP packet (i.e., XB) to the client and the client answer with a large UDP packet (i.e., 400 bytes).
    - the server send a small UDP packet (i.e., 400B) to the client and the client answer with a small UDP packet (i.e., 400B).
    - the server send a large UDP packet (i.e., XB) to the client and the client answer with a large UDP packet (i.e., X bytes).
    - The results are used to estimate the network capacity available to the user and the uplink and downlink latency
- Latency tests** based on UDP and TCP round trip time

Based on the KPIs recorded in steps a, b and c, the controller changes the AP or Mesh APs configurations such as channels, bands, transmit power, roaming threshold etc. ...

## **(2) Assist the user to recommend the need of Mesh APs and assist the user with positioning the gateway and the Mesh APs in their home.**

The user launches the tests defined in (1) for each room in the house and the app records the location. The results are sent to the cloud controller that uses these information to define the number of Mesh APs needed for that home. Once Mesh AP have been position, app running in the background the app monitor the usage for any better recommendation.

Could use the localization on 3 APs (check IEEE 802.11az)

## **(3) Identification of potential lack of resources on the client and QOE assesment**

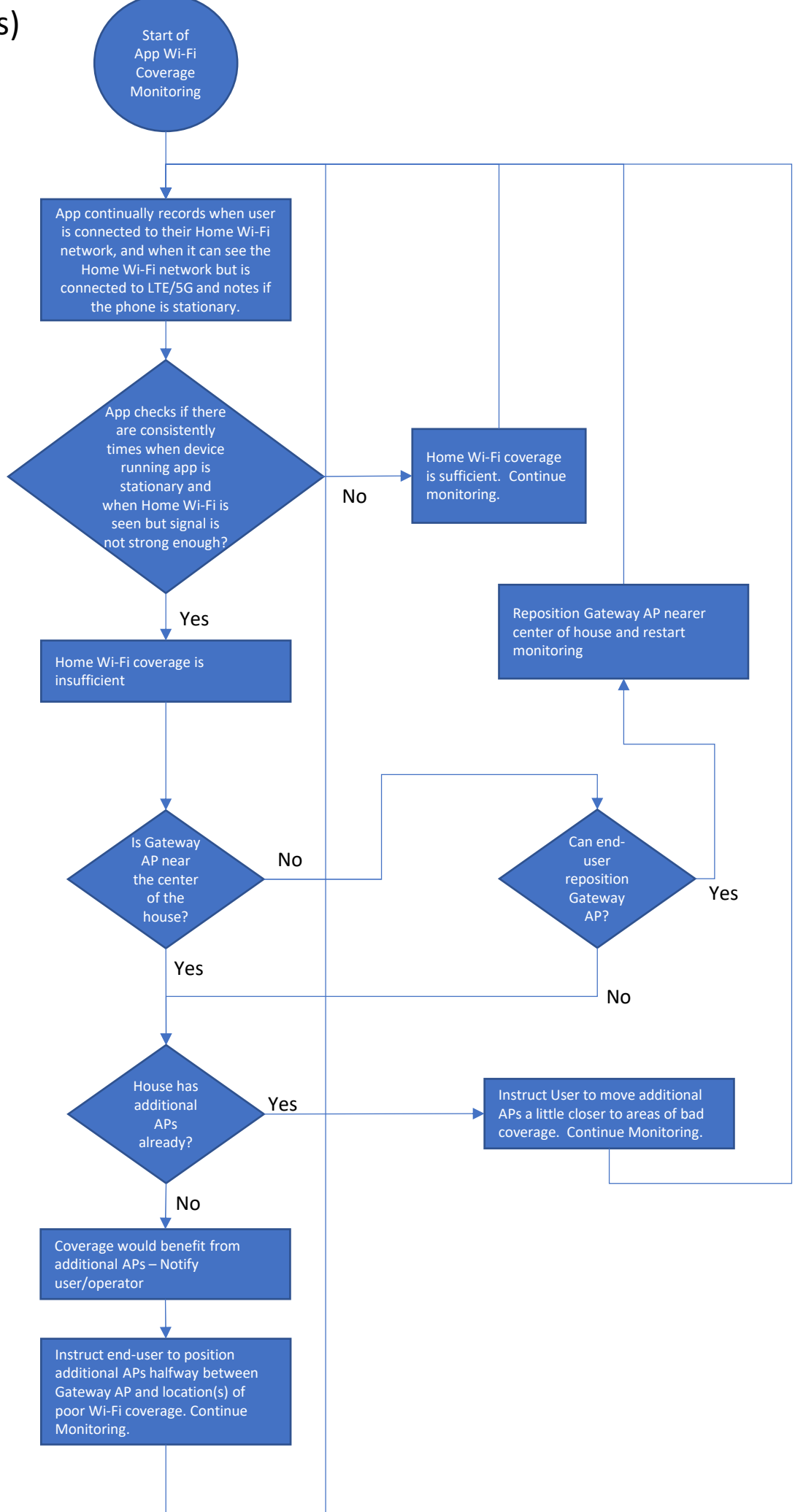
The gateway hosts an application server that is capable of serving various applications such as 4K video, 8K video, video conference, voice, browser etc. .... The user can launch the app on the client to run a selected application. While the application is running, KPIs specific to this application are recorded (i.e., latency & jitter for gaming). The app also acquires and records the amount of resources that are used by the clients. All information are sent to the cloud to be analyzed and identify if the client has a connectivity issue or a device issue. [Detail the method \(John\)](#).

1 and 3 can be applied to other types and environment of network.

# Flow Diagram(s)

## Wi-Fi Coverage:

Determination of good / bad Wi-Fi Coverage;  
Repositioning of Gateway AP;  
Determination of need for additional APs;  
Initial locations for additional APs;  
Guidance to reposition additional APs



# Flow Diagram(s)

Wi-Fi Performance:

Determination of good / bad Wi-Fi Coverage;  
 Repositioning of Gateway AP;  
 Determination of need for additional APs;  
 Initial locations for additional APs

