

Reduced OpEx and assured SLAs in public Wi-Fi Deployment through intelligent QoE measurement



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SUMMARY

Providing reliability in wireless environments is always challenging. Irrespective of best efforts in Quality Assurance (QA) from OEMs, WiFi Access Points are prone to problems in the field. Enormous time is spent by the support engineers to troubleshoot the wireless network, contributing up to 70% of operating cost. Identifying the problem in wireless networks is a pretty cumbersome process even for expert support engineers. A significant chunk of the time (say around 90%), during the process of resolution of an issue, solely goes towards getting to the bottom of it. A primary reason, that can be attributed for this is the fundamental nature of the resolution mechanism, which was always designed as a responsive and actionable act upon the emergence and cognisance of an issue. Not to mention the visual limitations associated with the holistic understanding of the issue from the perspective of the environment and experience from an end-user standpoint. This is exactly where Aprecomm's cutting edge technology, which through a combination of its VWE with HFCL Ion Aps, working in tandem with each other, makes addressal and redressal of the issue with exponential efficiency, both in terms of time and cost.

VWE-Ion does the following to ease network troubleshooting

- 24x7 Wireless Network Monitoring (WNM)
- Real-time Wireless Experience Measurement (WEM)
- Constantly analyse the reasons for poor experience using AI
- Communicate with the Pervasive cloud to derive at potential reasons for the failures
- Provide insights to solve wireless network problems with the single click of a mouse button
- 360 Degree visibility of your wireless network
- Analyse the issues at microscopic or macroscopic level eg:
 - Specific to a deployment
 - Specific to all deployments of a customer
 - Specific to all deployments of all customers
- Compare the configurations across multiple sites and correlate best configuration.
- Evolve with maturing intelligence both at edge and cloud.

24x7 Realtime Insights from the cloud and User Experience measurement using VWE (Virtual Wireless Expert) hiSense.

90% reduction in Downtimes due to Wi-Fi Issues. Automated root cause analysis, no more browsing through tons of logs identifying the issue.

70% of time is spent in gathering information from the customer. With VWE Macro to Micro level insights troubleshooting can happen in a jiffy.

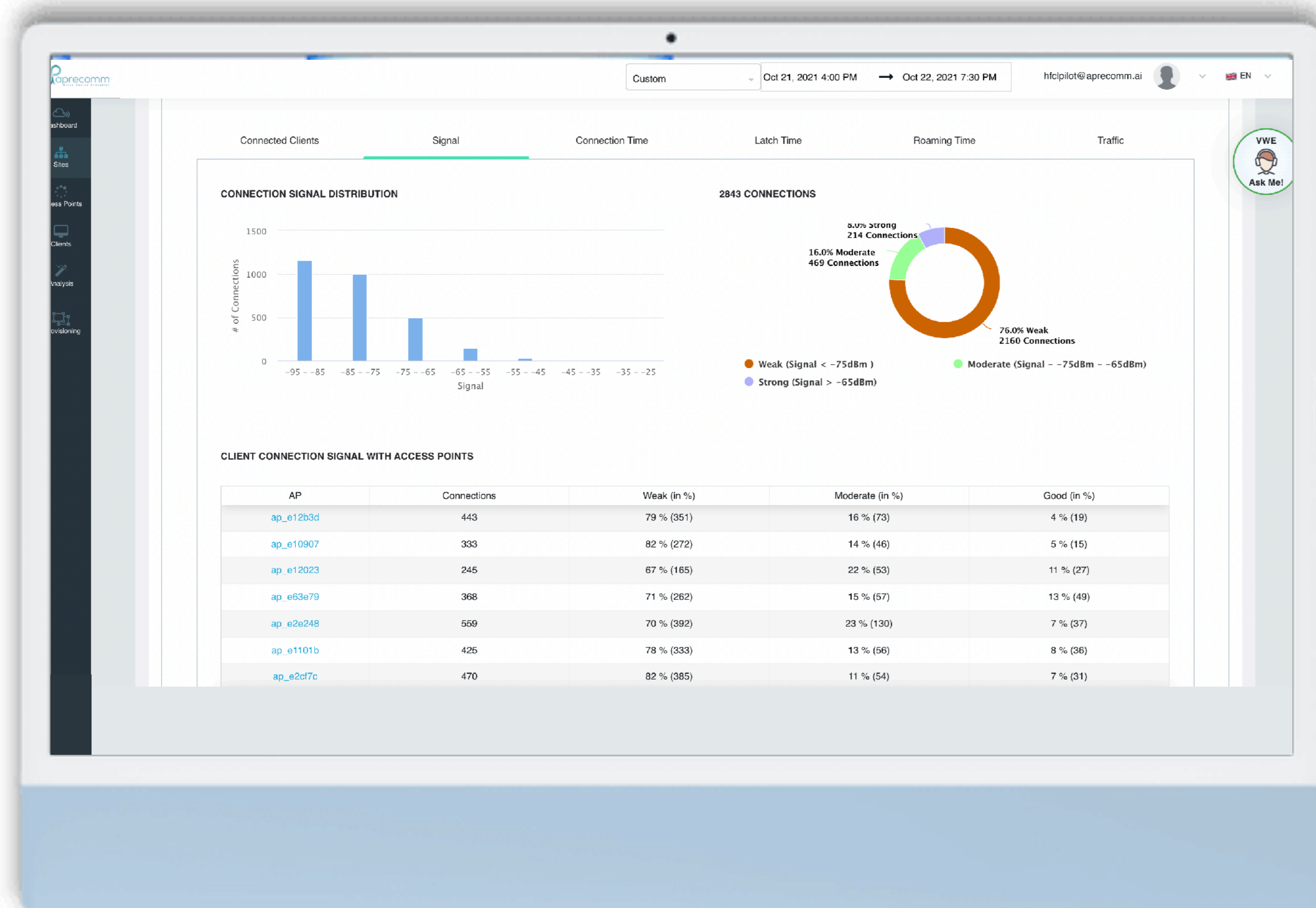
70% reduced operation cost and reliable service, no special expertise required to operate and maintain your Wi-Fi Networks

Aprecomm VWE integrated HFCL Ion Access Points proactively keeps analysing and measuring Quality of Experience of every deployed APs and WiFi devices connected in the network in real-time, whilst performing automated optimizations and providing insights into issues requiring human intervention.

RURAL WI-FI CHALLENGES / USE CASES

Dynamic Coverage holes due to obstructions

Environmental changes can occur in various forms. It could be like an extra floor addition on a building or a new billboard or a tilted antenna can affect your wireless coverage. Say for example if you have planned and deployed your AP with antennas positioned based on surroundings, chances are your Wi-Fi experience when these antennas got titled (due to wind or obstructed by the added floor) won't be the same. An intelligent system which can raise alert on the possible changes in the environment by baselining the experience from time to time is needed

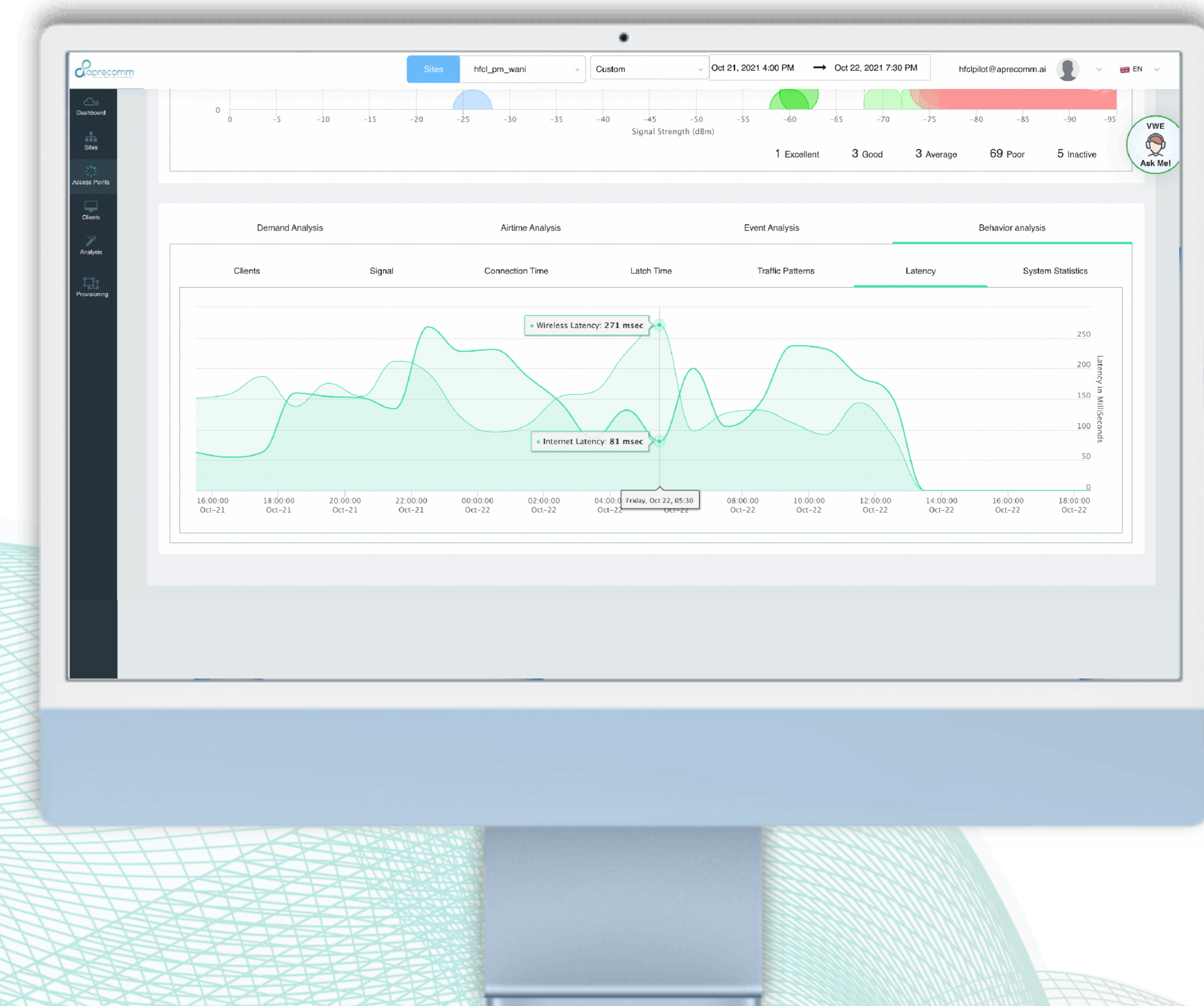


Adapting Configuration based on Demands

Wi-Fi AP generally have various thresholds / settings that are programmed during the deployment for optimal performance. These configurations often work well when the deployed environment is not prone to having Wi-Fi clients with diversified capabilities. Rural Wi-Fi deployment will have heterogeneous devices which can have a range of capabilities from Wi-Fi 1 to Wi-Fi 6, the static threshold programmed may not honour all these clients. For example, a configuration like force preferred band to 5 ghz, when programmed statically may fail where a greater number of clients are connecting to 5 and 2.4 band is relatively free. Depending on the concentration of different types of client's time to time these thresholds must adapt. This requires the system to constantly monitor the overall user experience and automatically change the configurations to provide optimal experience to end users.

Backhaul Reliability

Latencies / packet loss / frequent internet disruptions are common in Rural Wi-Fi deployment due to inherent challenges posed to backhaul service providers by weather and terrains in rural areas. These issues need to be monitored and notified when the occurrence is higher, or service disruption happens for longer durations.



Expertise to handle analytical tools

OEM vendors provide analytical & statistical insight on issues happening in Wi-Fi networks. Often Rural-Wi-Fi deployments are maintained by local public owners, and they may not have the required expertise to comprehend graphs to manage Wi-Fi networks. A simple support portal through APP or a web interface providing simplified instructions is required.

Stability Issues

AP reboot due to power fluctuations or sudden burst of demand loading the AP resources can result in reboot, disrupting the services. This often goes unnoticed as service breakout periods are small. But if they happen frequently this can impact end-user experience.

Access issues on recurring failures

Recurring failures and complaints results in sending support engineers to the deployed site to collect insights of the issue. Onsite troubleshooting is expensive in the case of Rural Wi-Fi deployments. An intelligent analytics system is required to provide insights while notifying issues to eliminate the need to send support engineers in case of recurring failures.

Troubleshooting challenges

Due to the dynamic nature of the environment, it is hard to reproduce issues happening in the field in OEM labs for the purpose of troubleshooting. Historical analysis and inference can help root cause issues that have happened before, in turn saving money and time reproducing the same.

Compatibility issues

Public Wi-Fi environments can have Wi-Fi clients that might have interoperability issues with the AP and may fail to connect. The proactive system can notify such failures with the details of the manufacturer and model information of a client to OEM / Service providers. This will help OEM / Service Providers to fix these issues happening often for similar clients across deployments.

What can QoE Measurement Offer?

- **Proactive Notification to reduce operation cost**
 - Inference & Recommendations
 - Connection Drops
 - Application Experience Degradation
 - Steering Performance
 - Best Channel Recommendations based on Historical Analysis
 - Wired/Wireless Network issues (Latency/ARP/DNS/DHCP/Packet Drops)
 - Anomaly Detections
 - Environmental changes
 - Client behaviours
- **Ensuring SLAs by Measuring User Experience**
 - Real-Time QoE Measurement
 - QoE based Adaptive Steering
 - QoE based Adaptive Channel Selection
 - QoE based Adaptive power adjustments
- **Support Portal**
 - Simple to use support portal through mobile APP.
 - Users can resolve and raise tickets with any network expertise.
- **Remote Management Portal**
 - Analytics which can provide a picture of the whole deployment.



RURAL WI-FI MANAGEMENT REQUIREMENTS

Support Portal

The VWE support portal with HFCL Ion APs allows the Rural Public Wi-Fi upholder to search for an AP based on Device ID, MAC or Phone numbers. The portal provides insights on current online users and their experience. In case of any issues found which requires human intervention, the system sends alerts providing simple suggestions to resolve.

Ability to measure end-user experience

User Experience can be improved if it is quantified. Understanding Wi-Fi Experience is always a challenge due to number of parameters involved in it. VWE simplifies and quantifies Wi-Fi Quality of Experience using a metric called hiSense. hiSense basically reflects the happiness index of the end user. hiSense considers various factors to correlate end-user experiences.

- **Radio parameters** such as Channel, Bandwidth, Congestion, Signal, Uplink, Downlink Data Rates
- **Client related information** such as client capabilities, supported rates, bandwidth, supported streams etc.
- **Network related information** like Internet speed, Latencies, DHCP Server latencies, DNS etc.
- **Application related information** like application demand in terms of bandwidth, IPGs , behaviour etc.

Scoping and Root cause analysis

Apart from measuring the Customer Wi-Fi Experience, VWE dashboard provides insights into reasons leading to the Experience Degradation. Typical reasons of Experience degradation could be due to:

- Varying network demands for each application
- Onboarding/Connectivity issues
- Environmental change leading to obstructions and interference.
- Device behaviours
- Network or Backhaul issues

Management Portal

VWE Management Portal provides correlate insights instead of statistical data. This helps HFCL Ion backend team to act immediately and mitigate a service disruption. Improving MTTR upto 70% whilst reducing operation overheads.

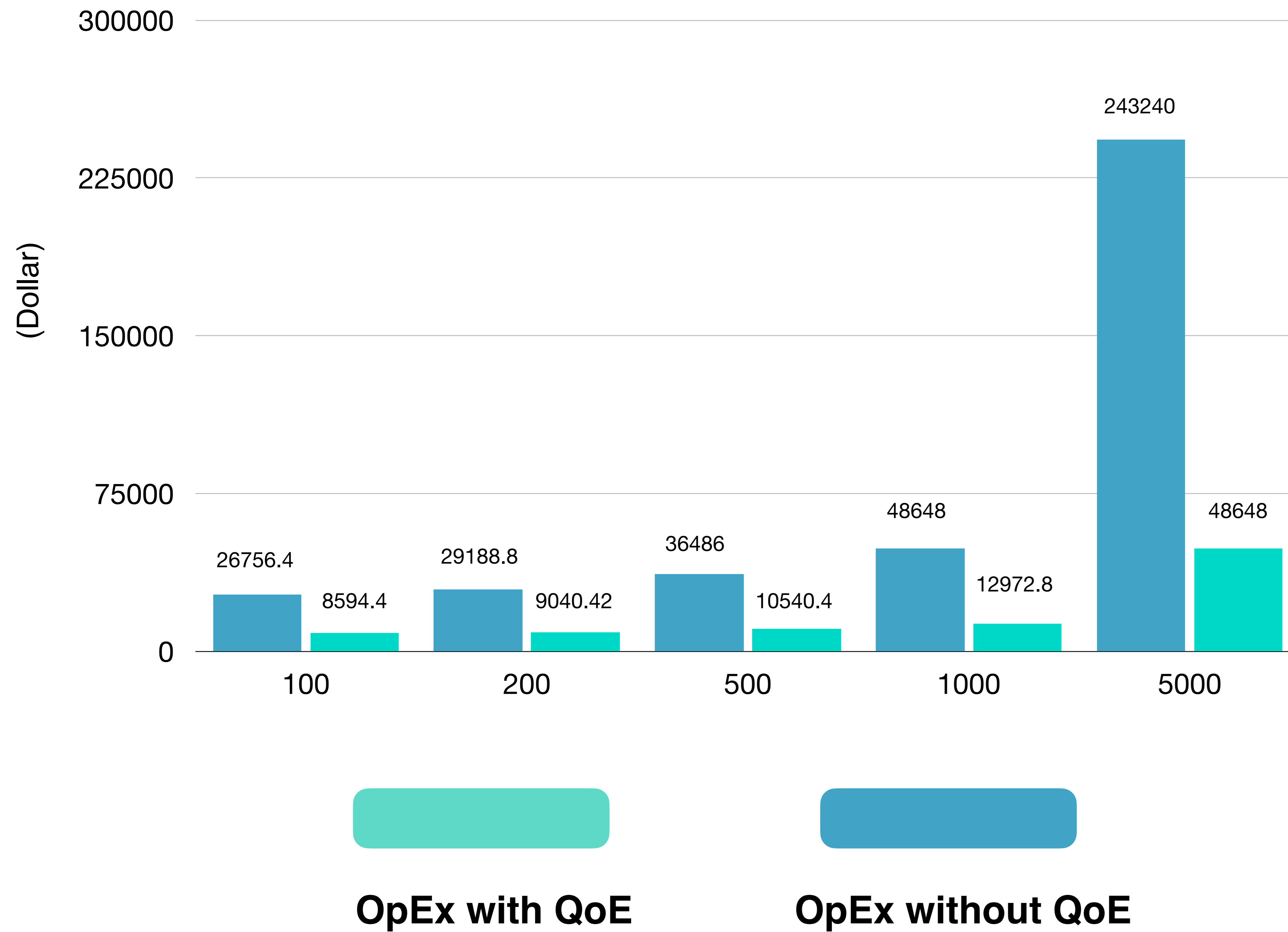
- Measures user experiences across firmwares
- Identify which AP models are working well in the field
- Compare similar size deployments & provide suggestions to improve QoE
- Proactively understands the firmware roll out or roll back performance, alerts if some untoward incident is seen.
- Type of Wi-Fi devices used by the subscribers and its performance
- Stationary vs Agile clients, to estimate the coverage needs
- Distribution of clients based on their capabilities

BENEFITS OF QoE MEASUREMENT

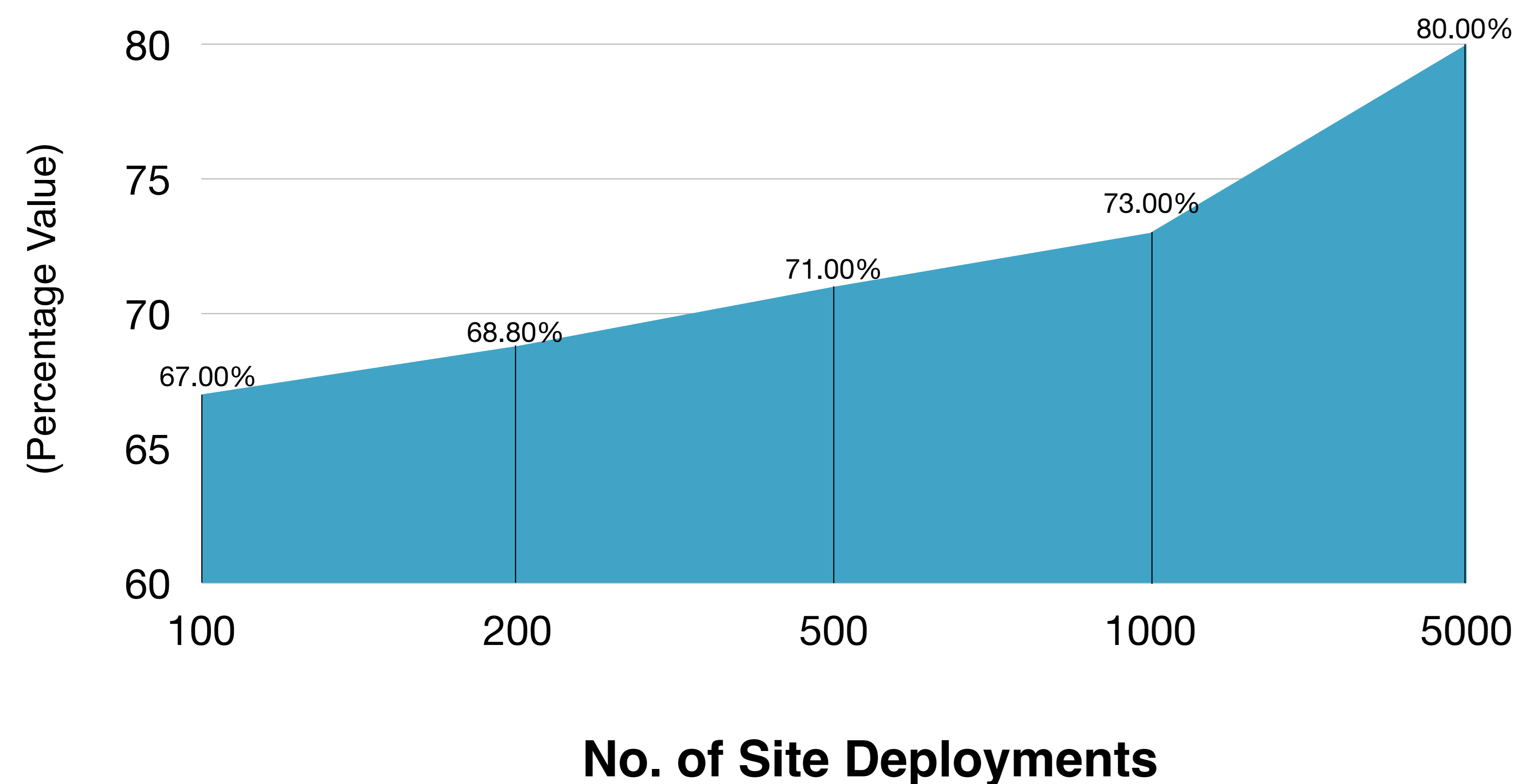
HFCL ion APs integrated with Aprecomm VWE is deployed in prestigious PM-WANI Project, an initiative by Govt of India to facilitate ease of doing business and encourage local shops and small establishments to become Wi-Fi providers. The Data collected from these deployments show that OpEx cost can be saved up to 80 % with QoE measurement APs.

Operational Challenge	OpEx w/o QoE measurement	OpEx with QoE measurement	Savings with VWE	% Savings
Coverage holes due to obstructions	Physical site visit by expert engineer is required to understand if there is an obstruction – \$20.27 per site per month	No physical site visit required. Local person can be advised just by looking at data to clear obstructions.	Site visit came down from 10 visits per month to 2 visits per month for a site having 100 deployments	80%
Configuration based on demands	Manual configuration required after an expert engineer understands the problems / requirements based on data analysis.	Data analysis and configuration changes are fully automated. No manual intervention required. One engineer for a cluster of 1K sites is enough and only one shift is required.	Engineering cost reduced by 2/3.	66%
Expertise to handle analytic tools	Usually it is not possible to find local experts to use analytics tools to monitor and maintain QoE. We need to send engineers in case of failures.	VWE's simplified support portal helps local upholders to identify and resolve issues with simple click.	Local help is able to deflect up to 75% issues which otherwise get escalated to support.	75%
Backhaul reliability issues	An expert engineer visit is required to understand the root cause of backhaul issues.	Issues are monitored proactively site visits are reduced, except cases where manual intervention is required.	60% site visits are reduced	60%
AP Stability issues	Manual actions are required to analyse such scenarios and this process delays in rectification which impacts customer satisfaction.	No manual action required. Notification & alert system provides insights to resolve and rollout new firmware to resolve issue before customer notices.	Indirect savings by ensuring minimum customer churn	85% decrease in customer churn

OpEx SAVINGS (CALCULATIONS)



PERCENTAGE SAVINGS



OpEx TRENDS WITH AND WITHOUT QoE MEASUREMENT

Aprecomm VWE solution removes the need to deploy Support engineers or local expertise in Rural Wi-Fi environments. The VWE system deployed monitors 24x7 and proactively updates configuration to resolve issues before it becomes critical and disrupts the services. With increasing deployments and client density it has been observed more issues are appearing due to changes in environment and client behaviours. Static configuration often fails to address arising issues in this case. With VWE deployed, these issues are getting resolved through our A.I engine “Evolv” making the devices to self-organizing themselves. This has led to larger OpEx savings as the deployment sizes are growing.

In addition to lower OPEX, additional benefits include reduced customer complaints, improved reliability and reduced field visits. Aprecomm VWE demonstrates up to 80 percent saving in total cost of ownership (TCO) on maintaining a deployed rural wifi over a similarly deployed solution without VWE. Field visits to Rural-WiFi deployment are quite expensive. VWE’s A.I driven system pro-actively alerts Service Provider support teams where human interventions is required and provides insights to resolve issue remotely. With 5000 APs deployed with VWE, Rural Wifi Service Providers today saves a total of **\$1,94,592** which translates to an average saving of **\$39** per deployed access point per annum.

Apart from the monetary benefits, as critical services like Education and Health moves online, a system like VWE which helps to minimise service disruptions can be of immense value to human lives.