Nokia WiFi Cloud Controller: Network Console

Level 2 support

Brochure
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What is the Nokia WiFi Cloud Controller – Network Console?

The Nokia WiFi Cloud Controller – Network Console is a powerful tool for 2nd level support agents who need high visibility of the home WiFi networks of subscribers. While this means that agents have access to a very broad range of insights in the form of KPIs, alerts, and network mapping, the purpose of this guide is to take you through some of the most common and key use cases.

Key WiFi optimization features

The optimization features of the Network Console have proven to maximize subscriber quality of experience (QoE) via automating management and optimization of WiFi networks while providing detailed real time & historical visibility to customer care and network operations team.

Radio Resource Management (RRM)

On access point (AP) bootup, the Cloud Controller allocates the operating channel based on its knowledge of neighboring APs both managed by operator and unmanaged (neighboring APs in the vicinity), their locations and proximity, the resources being used by them, and signal strengths from the APs using both current and historical data. Current channel conditions, such as the presence of noise, interference or congestion, also factor into the RRM initial channel selection algorithm. Initial channel selection is a fast process.

The Home Agent running on the AP periodically collects a series of metrics, including:

- Neighbor AP information in terms of channel utilization, signal strength, proximity
- Client QoE statistics including downlink and uplink throughputs, instantaneous transmit and receive bit rates, packet error rates, signal strength, noise level, signal-noise ratio, interference, and so on
- Channel utilization information indicating how congested the AP’s channel is, as well as usage conditions on other channels that may be candidates to configure the AP to use

This information is aggregated within the AP and then sent to the Cloud Controller based on a configurable time period. The Cloud Controller collects this information from all the managed APs and stores the information in the database. The RRM process within the Cloud Controller periodically evaluates each AP for performance degradation based on the received metrics from a configurable number of reports. The RRM process triggers a channel change for an AP if it detects that the operational channel is in a degraded state.

Band Steering

The Cloud Controller’s band steering algorithm is designed to ensure best possible connection for the client and works in both directions (from 2.4GHz to 5GHz and vice versa) to ensure a high QoE. The band steering algorithm takes into account client capabilities, client count, Modulation and Coding Scheme (MCS) rate, signal-to-noise ratio (SNR), Received Signal Strength Indicator (RSSI), channel utilization, frame retransmissions for each band, and past success rate for individual clients while making steering decision.
**Client Steering**

The Cloud Controller tracks individual client performance in real-time and seamlessly steers clients between APs as clients roam across the home. This ensures that clients always maintain the best possible AP connections, thus significantly improving QoE. The system manages home network performance in terms of number of APs within the home, RF performance across multiple APs, load distribution, and individual client metrics like throughput and SNR. Without client steering, many devices will not roam to the best APs, bringing down their performance and that of other clients in the home network.

**Load Balancing**

In a multi-AP scenario within the home, the Cloud Controller tracks individual AP performance and ensures no single AP is overloaded. It smartly steers some of the devices to other lightly loaded APs in the home to ensure all devices have a good experience.

**Airtime Management**

The Cloud Controller supports airtime fairness to ensure no single client deteriorates performance for the whole network. It also enables configuring the rules for managing how much bandwidth is delivered to different devices or WiFi networks. This allows operators to define preferences for devices, applications and networks automatically.

**Automatic Failure Avoidance and Recovery**

While a lot of WiFi issues relate to radio interface issues (e.g. interference, coverage, mobility, resource allocation, etc.) there are more reasons why a customer has a poor experience. Often, especially with existing deployed WiFi Access Points (APs), simple hardware faults (e.g. memory, CPU, radio, etc.) and/or software faults (e.g. application/firmware issues) can cause a WiFi AP to crash or be unable to service clients.

In addition to automatically handling radio interface issues, the Cloud Controller uniquely provides a comprehensive solution for these Hardware / Software (HW/SW) faults. That solution includes:

- Active monitoring of HW / SW status to proactively identify issues before they cause an outage
- Policy based recover from HW / SW faults including the ability to automatically reboot the entire router, specific HW components (e.g. radio, chipset, etc.), and restart applications.
- Comprehensive alarm management and event logging to notify the operator when actions are taken and identify customer homes that may need to be provided upgraded equipment
- Auto-reboot policy that can be scheduled (e.g. daily, weekly, monthly, etc.) as well as ad-hoc based on HW / SW conditions of a specific AP.
- Ability to define specific policies and apply to operator-defined groups of APs (e.g. based on manufacturer, location, business relationship, etc.)
Visibility & Analytics

One of the key benefits of deploying a cloud server managed WiFi solution is to enable a rich set of analytics. Unfortunately, many alternative solutions fall short in this area. Through extensive customer engagements, Nokia has created many different analytics capabilities as part of the Nokia WiFi Cloud Controller. Key analytics features include:

- **Proactive customer care analytics**
  - Scoring the quality of service (e.g. red, yellow, green) for a specific subscriber based on HW status, WiFi performance, individual client performance and backhaul performance (via integrated Speed Test capability).
  - Reports to identify homes suffering from poor coverage, significant interference and bad client behavior to enable proactive outreach (e.g. offer new Mesh System)
  - Dashboards that summarize the overall QoE status of homes in the deployment enabling to identify homes that need attention as well as the how overall customer experience is trending overtime.

- **System performance analytics**
  - Series of reports that capture the performance impact of all Radio Resource Management (RRM) and Self-Organizing Network (SON) features. This includes capturing the impact of channel changes, band steering, client steering, power changes and so on.
  - Reports enable the operator to tune RRM / SON policies and identify if they are achieving the desired impact. It also allows to actively track and promote the benefit of the solution.

- **Client / User Equipment analytics**
  - Provides a picture of the experience of a specific client device. This includes time spent on specific WiFi APs and radios, average bit rates and throughputs, connection quality, coverage, and so on.
  - Provides information on the clients connected to the operators WiFi CPEs (this includes device types, manufacturers, etc.)

- **WiFi Network analytics**
  - Ability to analyze the performance of WiFi and usage of unlicensed spectrum in a specific geographic area.
  - Ability to detect, automatically recover from, and model potential solutions to coverage issues. Through a coverage hole detection mechanism, the system identifies holes, increases power (if not at full power) to fix holes, flags coverage holes and provides the ability for the operator to model specific fixes (e.g. adding an AP) through the cloud server GUI.
  - These analytics are critical for home spot (i.e. second SSID in the home) and public access networks to understand the performance of the open WiFi footprint in a specific location.
Network Console - Overview

The Nokia WiFi Cloud Controller’s user interface provides extensive analytics and performance management information (i.e. KPIs) for the entire WiFi network. This includes information at the System, Region (i.e. user selectable area), Home, router/CPE and individual client levels. Nokia implements a common set of capabilities across all the analytics tools, which includes:

• Access to real-time and historical data
• Ability to view multiple KPIs in a consolidate screen to facilitate multi-variable analysis
• Ability to export the data from the system for offline processing and analysis operational

The visualization in real-time network allows the Network Operations to understand the performance across its network independent of WiFi AP manufacturer / CPE. At the network level, the performance dashboard tools, heat map, coverage and visualize coverage interval analysis (i.e., coverage holes identification tools) are available in real time. In addition, historical data are available in all panels and analysis tools and all system data can be exported to third-party tools and / or Excel spreadsheets for offline analysis. Figure below shows some of the network-level views available.

In addition, to the visibility and reporting, the Network Performance control panel provides operators a clear view of system performance and capacity utilization across the network. Network Operations can see how performance statistics, channel use, the AP density per channel, noise, interference, etc., vary over time. The mean and variance statistics are provided for metrics such as utilization per channel in a band, allowing the CSP to assess the effectiveness of the balanced load and AP allocation across all channels in a band.
Statistics per Home/CPE

At the Home/CPE level, the system provides overall status and configuration information. This includes:

- AP manufacturer name
- MAC address
- Connected Server address
- AP Agent firmware version number
- Name of the Home Network the AP is part of (this, in effect, identifies the subscriber using the AP)
- AP role (router/gateway or extender)
- Indication of backhaul type (wired vs. wireless)
- AP uptime
- Internet (backhaul) connectivity status
- Backhaul speed and latency
• Alarms (Critical/Major/Minor/Clear) received for the AP
• Reboots, with cause
• Number of channel changes
• Then, on a per-band (2.4/5GHz) level:
  – SSIDs
  – Channel allocated to each radio
  – Bandwidth used on the radio
  – Transmit power used by each radio
  – WiFi mode (802.11a/b/g/n/ac)
  – Count of band steering events.

Per Home/AP Summary View

• A summary list of all clients connected to the AP (per radio) – providing, for each client, its MAC address, hostname, uplink and downlink throughputs, signal strength, and instantaneous transmit and receive bit rates (MCS level). These are selectable not just for a current snapshot, but can go back in time, and are averaged over a selectable time period around that time.
AP Client & throughput Summary

The AP stats also include performance analytics per radio (2.4/5GHz), per-SSID and per client device. These are viewable on an adjustable timeline that shows current data and can go back to a selected point in time. The viewable window can be adjusted to cover various lengths of time, e.g. a day, multiple days, a week, month etc.

These include the following statistics:

- Downlink and uplink throughputs
- Channel utilization (both total utilization of the radio’s channel, and out-of-BSS – utilization by other APs)
- Signal strength
- Noise level
- Signal-to-noise ratio (SNR)
- Instantaneous transmit and receive bit rates
- Physical error rate and packet retransmission rate
Tx & Rx Bitrate View per AP

Per Home/AP Summary View
Each of the above statistics is viewable per-radio (2.4/5GHz) overall, and within the radio – per-SSID defined on the radio and per-client connected to that radio.

Neighbor list information for the AP are provided by heat map screens that show, for the AP, its list of neighbor APs (APs managed by the operator and unmanaged APs), listing the following information:

- Neighbor AP MAC address
- Channel used by neighbor AP
- Signal strength received from neighbor AP.
- Neighbor information is selectable by radio (i.e. 2.4 or 5GHz).

Some of the screenshots for per Home/AP level statistics are included here to show the rich set of data system provides:

AP Channel Usage & Signal Strength View
AP Client & throughput Summary

**Client/Device Information**

At the client level, the following statistics are supported:

- Downlink and uplink throughputs, on a real-time, adjustable timeline
- Channel utilization (both total utilization of the radio’s channel, and out-of-BSS – utilization by other APs)
- Signal strength, on a real-time, adjustable timeline
- Noise level, on a real-time, adjustable timeline
- Signal-to-noise ratio (SNR), on a real-time, adjustable timeline
- Instantaneous transmit and receive bit rates (mapping to MCS), on a real-time, adjustable timeline
- Physical error rate and packet retransmission rate, on a real-time, adjustable timeline
- Brand/OS
- Channel bandwidth used
- Hostname

Additionally, a client capabilities screen provides information on specific clients – such as HT mode and bandwidth capability.
Historical client steering information is also provided, on a per home network basis, that provides specifics on client steering events – indicating APs a client has moved between, success and failure statistics, steering time, signal strengths at the source and destination APs, and so on.

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<th>Client MAC ID</th>
<th>Station name</th>
<th>Feature Control/Status</th>
<th>Dual-Band</th>
<th>Connection Quality</th>
<th>Connected</th>
<th>WAN Address</th>
<th>Latest band</th>
<th>Last RSSI</th>
<th>Avg. RSSI (1h)</th>
<th>Extra info</th>
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<td>✓</td>
<td>✓</td>
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<td>-91 dBm</td>
<td>-63 dBm</td>
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<td>Adch Nest Dining Room</td>
<td>Exclude steering</td>
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<td>✓</td>
<td>✓</td>
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<td>Adch Nest Bedroom</td>
<td>Exclude steering</td>
<td>▼</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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</tr>
</tbody>
</table>

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