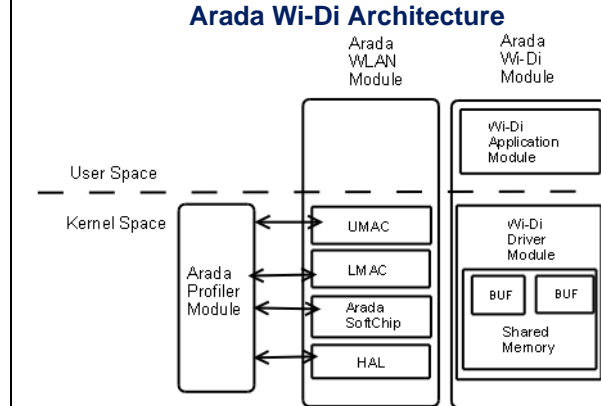


## Wi-Fi Diagnostics

A Powerful Debugging Tool for Wi-Fi Developers and Engineers



## Solution Highlights

Wireless Diagnostics and Performance tool (WiDi) has been specifically developed to simplify the field debugging process and improve the overall user experience for field issues.

Arada Wi-Di can be used to isolate troubled devices and gather enough information to debug the issue offline. It helps to collect debugging and system state information for a developer/support engineer to do post analysis and come up with a permanent fix – without the need for removing the device or going on-site to diagnose the problem.

Its powerful features can be used by developers to debug and optimize their programs. It can help network administrators to identify problems and threats in the networking environment.

WiDi provides comprehensive information and statistics about the wireless environment including detailed channel and packet statistics, information about security threats, node identification and capabilities, and performance statistics.

It is typically used in the following scenarios:

- Tracing problems in the wireless environment
- Identifying performance bottlenecks
- Identifying malicious attacks in Wi-Fi environments
- WLAN driver debugging

**Arada Profiler** is a powerful add-in used in profiling the kernel and kernel modules without changing the host kernel configuration. It saves on development time and effort and leads to higher productivity.

Arada Profiler is a comprehensive profiling system. Like the standard `oprofile` program, it can profile all parts of a running system from the kernel (including modules and interrupt handlers) to shared libraries to binaries—without the need to reconfigure and re-flash the kernel.

## Software Specification

Wi-Di Statistics	
<b>Channel Statistics</b>	<p><i>Per node:</i>            Channel occupied by a wireless node            Channel occupied because of retries            Channel occupied because of errors like</p> <ul style="list-style-type: none"> <li>- CRC</li> <li>- Duplicate</li> <li>- MIC</li> <li>- Decrypt</li> </ul> <p><i>Summary:</i>            Channel Idle            Channel Busy</p>
<b>Packet Statistics</b>	<p><i>Per node:</i>            Total number of packets transmitted by this node            Total number of packets received by this node            Number of packets transmitted by this node with particular rate            Number of packets received by this node with particular rate            Number of retried packets from this node            Number of retried packets per rate            Number of CRC error packets from this node            Number of PHY error packets from this node            Number of duplicate packets from this node            Number of decrypt errors from this node            Number of MIC errors from this node            Average, Min, Max IFS for node            Number of WLAN fragments from node            Number of Unicast packets from node            Number of broadcast packets from node            Number of aggregate packets from node            Number of aggregate retries            Number of short GI Packets            Number of 20MHz packets            Number of 20/40 MHz packets</p> <p><i>Per pair statistics (statistics between N1 and N2) (valid when tool is running in Sniffer Mode):</i>            Number of packets exchanged            Number of packets exchanged with particular rate            Number of retries per rate            Number of CRC errors            Number of PHY errors            Number of MIC errors            Number of decrypt errors</p>

	<p>Number of unicast packets          Number of broadcast/ multicast packets          Min / Avg/ Max IFS          Number of aggregate packets from node          Number of aggregate retries          Number of short GI Packets          Number of 20Mhz packets          Number of 20/40 MHz packets  <i>Summary:</i>          Total Packets exchanged          Total Unicast packets          Total Broadcast packets          Total number of packets seen with particular rate          Number of CRC errors          Number of PHY errors          Number of MIC errors          Number of decrypt errors          Number of aggregate packets from node          Number of aggregate retries          Number of short GI Packets          Number of 20MHz packets          Number of 20/40 MHz packets</p>
<p><b>Node Classification</b></p>	<p><i>AP</i>          Number of stations associated with AP          Capabilities of AP:              - Broadcast BSSID              - ERP capabilities              - QoS              - Supported Rates              - Encryption              - 11a/b/g/NA/NG mode              - 11n capabilities              a. AMPDU densities              b. AMPDU limit              c. 11n rates              d. 20/40 supported          Number of beacons generated              - Channel time occupied by beacons          Number of other management packets like probe responses, authentication, de-authentication, association, de-association packets              - Channel time occupied by the above management packets          Number of control packets (RTS, CTS, ACK)              - Channel time occupied by the above control packets          Number Of AP reboots</p>

	<p>WDS capabilities</p> <p>UAPSD Frames</p> <p>Background scanning</p> <ul style="list-style-type: none"><li>- Total amount of time spent</li><li>- Average time per channel</li><li>- Number of channels scanned</li></ul> <p>Per STA statistics</p> <ul style="list-style-type: none"><li>- Total number. of packets transmitted</li><li>a. Channel time occupied in transmission</li><li>- Total number of packets received</li><li>a. Channel time occupied in receive</li><li>- Number of packets transmitted with particular rate</li><li>- Number of packets received with particular rate</li></ul> <p>Number of retried packets</p> <ul style="list-style-type: none"><li>a. Channel Time wasted in retries</li><li>- Number of retried packets per rate</li><li>- Number of CRC error packets</li><li>- Number of PHY error packets</li><li>- Number of duplicate packets</li><li>- Number of decrypt errors</li><li>- Number of MIC errors</li><li>- Average, Min, Max IFS</li><li>- Number of WLAN fragments</li><li>- RSSI</li><li>- Number of unicast packets</li><li>- Number of broadcast packets</li><li>- Number of aggregate packets</li><li>- Number of aggregate retries</li><li>- Number of short GI Packets</li><li>- Number of 20MHz packets</li><li>- Number of 20/40 Mhz packe</li></ul> <p>STA</p> <p>AP to which it is associated</p> <p>STA capabilities</p> <ul style="list-style-type: none"><li>- ERP capabilities</li><li>- QoS</li><li>- Supported rates</li><li>- Encryption</li><li>- 11a/b/g/NA/NG mode</li><li>- 11n capabilities</li><li>a. AMPDU densities</li><li>b. AMPDU limit</li><li>c.11n rates</li><li>d. 20/40 supported</li></ul> <p>Management packets like probe requests, auth., deauth., assoc., deassoc. packets</p> <ul style="list-style-type: none"><li>- Channel time occupied by the above</li></ul>
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	<ul style="list-style-type: none"> <li>management packets</li> <li>No of control packets (RTS, CTS, ACK) <ul style="list-style-type: none"> <li>- Channel time occupied by the above packets</li> </ul> </li> <li>Power Save <ul style="list-style-type: none"> <li>- No of Times STA went to power save</li> <li>- Duration of power save</li> </ul> </li> <li>UAPSD Frames</li> <li>Background scanning <ul style="list-style-type: none"> <li>- Total amount of time spent</li> <li>- Average time per channel</li> <li>- Number of channels scanned</li> </ul> </li> <li>Per STA statistics <ul style="list-style-type: none"> <li>- Total number. of packets transmitted <ul style="list-style-type: none"> <li>a. Channel time occupied in transmission</li> </ul> </li> <li>- Total number of packets received <ul style="list-style-type: none"> <li>a. Channel time occupied in Receive</li> </ul> </li> <li>- Number of packets transmitted with particular rate</li> <li>- Number of packets received with particular rate</li> <li>- Number of retried packets <ul style="list-style-type: none"> <li>a. Channel time wasted in retries</li> </ul> </li> <li>- Number of retried packets per rate</li> <li>- Number of CRC error packets</li> <li>- Number of PHY error packets</li> <li>- Number of duplicate packets</li> <li>- Number of decrypt errors</li> <li>- Number of MIC errors</li> <li>- Average, Min, Max IFS</li> <li>- Number of WLAN fragments</li> <li>- RSSI</li> <li>- Number of unicast packets</li> <li>- Number of broadcast packets</li> <li>- Number of aggregate packet</li> <li>- Number of aggregate retries</li> <li>- Number of short GI Packets</li> <li>- Number of 20MHz packets</li> <li>- Number of 20/40 MHz packets</li> </ul> </li> <li><i>ADHOC modes</i></li> <li>BSSID of the ad-hoc network</li> <li>Number of nodes in the network</li> <li>STA capabilities <ul style="list-style-type: none"> <li>- ERP capabilities</li> <li>- QoS</li> <li>- Supported rates</li> <li>- Encryption</li> <li>11a/b/g/NA/NG Mode</li> <li>- 11n capabilities</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>a. AMPDU densities</li> <li>b. AMPDU limit</li> <li>c. 11n rates</li> <li>d. 20/40 supported</li> </ul> <p>Management packets like probe requests, auth., deauth., assoc., deassoc. packets</p> <ul style="list-style-type: none"> <li>- Channel time occupied by the above management packets</li> </ul> <p>No of Control packets (RTS, CTS, ACK)</p> <ul style="list-style-type: none"> <li>- Channel time occupied by the above packets</li> <li>- Total number of packets transmitted</li> </ul> <p>a. Channel time occupied in transmission</p> <ul style="list-style-type: none"> <li>- Total Number of packets received</li> </ul> <p>a. Channel Time occupied in receive</p> <ul style="list-style-type: none"> <li>- Number of packets transmitted with particular rate</li> <li>- Number of packets received with particular rate</li> <li>- Number of retried packets</li> </ul> <p>a. Channel time wasted in retries</p> <ul style="list-style-type: none"> <li>- Number of retried packets per rate</li> <li>- Number of CRC error packets</li> <li>- Number of PHY error packets</li> <li>- Number of duplicate packets</li> <li>- Number of decrypt errors</li> <li>- Number of MIC errors</li> <li>- Average, Min, Max IFS</li> <li>- Number of WLAN fragments</li> <li>- RSSI</li> <li>- Number of unicast packets</li> <li>- Number of broadcast packets</li> <li>- Number of aggregate packets</li> <li>- Number of aggregate retries</li> <li>- Number of short GI Packets</li> <li>- Number of 20MHz packets</li> <li>- Number of 20/40 MHz packets</li> </ul>
<b>Antenna Statistics</b>	<p><i>Per Antenna Statistics</i></p> <ul style="list-style-type: none"> <li>Number of packets received</li> <li>RSSI seen on each chain</li> <li>Number of PHY errors</li> <li>Number of CRC errors</li> </ul>
<b>ANI log</b>	<ul style="list-style-type: none"> <li>Log of SPUR and other ANI parameters</li> </ul>
<b>Security Threats</b>	<ul style="list-style-type: none"> <li>Duration attack - packets with large value in duration field</li> <li>Malformed packet - packet with same source and destination address</li> <li>Authentication flood attack</li> <li>Deauthentication flood attack</li> </ul>

	Association flood attack Disassociation flood attack RF jamming attack EAPOL-Start attack EAPOL-Logoff attack Broadcast attacks <ul style="list-style-type: none"> <li>- Disassociation broadcast attack</li> <li>- Deauthentication broadcast attack</li> </ul> Overload Attack
<b>Rate Control</b>	Log of Rate Variation with Time

<b>Performance Statistics (Profiler)</b>	
<b>WLAN</b>	Number of WLAN interrupts <ul style="list-style-type: none"> <li>- Tx completion interrupts</li> <li>- Rx interrupts</li> <li>- Beacon interrupts</li> <li>- Other Interrupts</li> </ul> CPU utilization <ul style="list-style-type: none"> <li>- Total % CPU used by WLAN</li> <li>- Tx tasklet</li> <li>- Rx tasklet</li> <li>- Beacon tasklet</li> </ul>
<b>Ethernet</b>	CPU utilization Number of interrupts Tx tasklet Rx tasklet
<b>Tx Path delays within AP</b>	Avg. Time to receive packet into Ethernet driver Avg. Time to receive packet from Ethernet to WLAN Tx tasklet (including all higher layer processing) Avg. Time to transmit packet out (including queuing packets, getting ACK from other side)
<b>Rx Path delays within AP</b>	Avg. Time to receive packet into WLAN driver Avg. Time to receive packet from WLAN Rx tasklet to Ethernet driver (including all higher layer processing) Avg. Time to transmit packet out of Ethernet