

eye P.A.

visual packet analysis

metageek

Eye P.A. visual packet analysis

Table Of Contents

[SYSTEM REQUIREMENTS](#)

[INSTALLATION](#)

[LIVE CAPTURE](#)

[COMPATIBLE FILE FORMATS](#)

[HOW TO GET A .pcap FILE](#)

[MAIN VIEWS](#)

[Work Flow](#)

[Filter Bar](#)

[Multi-Layered Pie Charts](#)

[Time Graph](#)

[Active Selection](#)

[Associated Data Table](#)

[Packet Viewer](#)

[MULTI-LAYERED PIE CHARTS](#)

[Packets](#)

[Bytes](#)

[Time](#)

[TIME GRAPH](#)

[Time Segment Analysis](#)

[Adjusting the Time Span](#)

[Packets, Bytes, and Time](#)

[DATA VISUALS](#)

[Multi-Layered Pie Charts](#)

[Ring Order](#)

[Drill-Down](#)

[Bread Crumbs](#)

[Hover \(Inspector Tool\)](#)

[PACKET VIEWER](#)

[UNDERSTANDING COLOR](#)

[Data Rate](#)

[Data Frames](#)

[Management Frames](#)

[Control Frames](#)

[ASSOCIATED DATA TABLE](#)

[FREQUENTLY ASKED QUESTIONS](#)

SYSTEM REQUIREMENTS

- 1) Microsoft .NET Framework 4 Client Profile
(Eye P.A. installer will direct you to download)
- 2) Microsoft .NET Framework 4 Extended
(Eye P.A. installer will direct you to download)

INSTALLATION

- 1) Download the latest version of Eye P.A. from MetaGeek
<http://www.metageek.net/products/eye-pa/download>
- 2) Once the file has finished downloading, double-click on the installer. Go through the installation dialogue. The program will install under the directory "MetaGeek."
- 3) Double click on the icon "Eye P.A." to start the application.

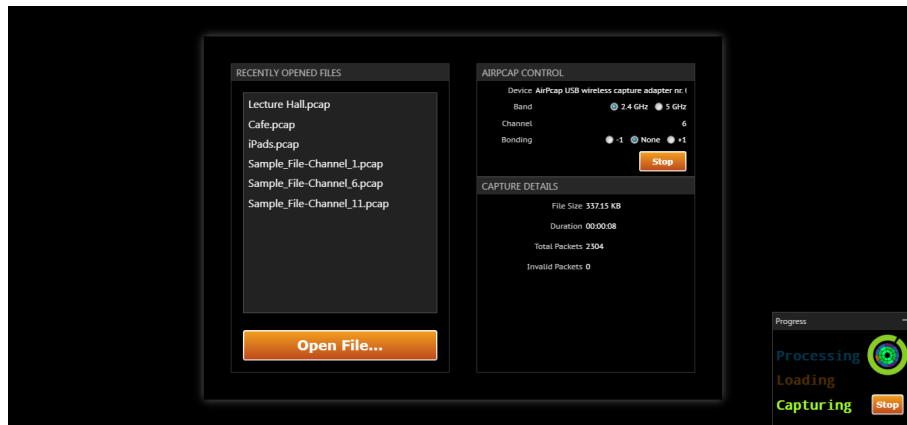
If this is the first time Eye P.A. is run, it will ask for a license key.

If you do not have a license key, click the "Continue Trial" button to run Eye P.A. in full evaluation mode free for 15 days.

DIRECT CAPTURE

Eye P.A. can capture 802.11 packets with an accompanying AirPcap Nx USB adapter.

To begin, connect your device to your computer's USB and open Eye P.A. Click the START category at the top of the screen. Here you will select your AirPcap, the 2.4 or 5 GHz band and the channel that you wish to scan. Click START CAPTURE to begin accumulating raw 802.11 frames.



COMPATIBLE FILE FORMATS

Eye P.A. visualizes 802.11 captures from a variety of sources. Files containing ethernet traffic are not compatible with Eye P.A.

.pcap

Not all .pcap files are structured in the same format. Eye P.A. requires the use of the Radiotap or 802.11-common headers to calculate the air time of the wireless packets. The most common program to generate compatible captures is WireShark for Windows, Mac or Linux.

.pcapng (WireShark 1.8)

WireShark did change its default file type in 2012 to .pcap-ng. Any version of Wireshark installed within the last year will support this file type. Pcap-NG allows more flexibility like extended-interface and host information, and contains expanded annotation, but it is not compatible with all tools.

.pkt & .apc (WildPackets Omnipcap)

WildPackets Omnipcap files containing 802.11 frames can be opened in Eye P.A. if they have the extension .pkt or .apc. Each of these files will export to WireShark in the same manner .pcap or .pcapng will.

.cap (Microsoft Network Monitor)

Microsoft added limited support for 802.11 captures with the release of Network Monitor 3.4. The full monitor-mode capabilities are limited to certain wireless cards and might provide little to no information regarding data rate, RSSI and 802.11n frames depending on your wireless access card. However, it is free.

CommView for Wi-Fi (.ncf)

Acquire full 802.11n captures on a windows machine without an AirPcap Nx, use CommView for Wi-Fi. Supporting more wireless adapters than other packet analysis applications, it may have limitations similar to Microsoft Network Monitor.

HOW TO GET A .pcap FILE

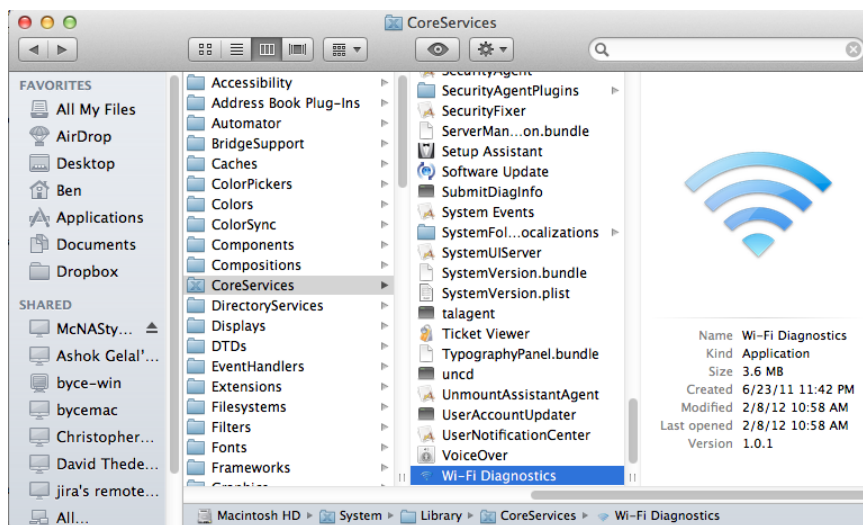
Eye P.A. is a wireless network data visualization tool. It sorts and displays data that has been captured in a .pcap file in order to make it easy for you to troubleshoot problems with your wireless network.

You can get a .pcap file in a lot of different ways. The ways listed below are the ones we're accustomed to gathering them with. We'd love to hear more about how you use .pcap files in our [user forum](#).

WITH Mac OS X Lion and WireShark

There are two methods in capturing 802.11 frames in Mac OS X Lion.

1) Use the included utility application, "Wi-Fi Diagnostics".



Open Finder and navigate to: **/System/Library/CoreServices/**
Scroll down and select the Wi-Fi Diagnostics application.
(you can also make an alias or drag the icon to your dock for easier access later)

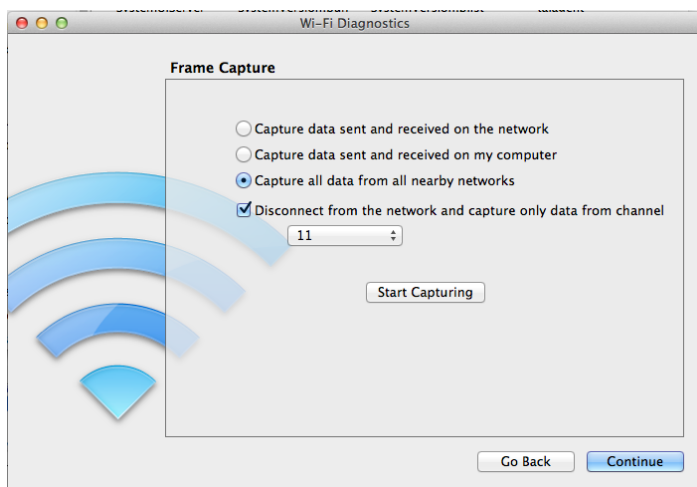
Select "Capture Raw Frames"

- Monitor Performance
- Record Events
- Capture Raw Frames
- Turn on Debug Logs

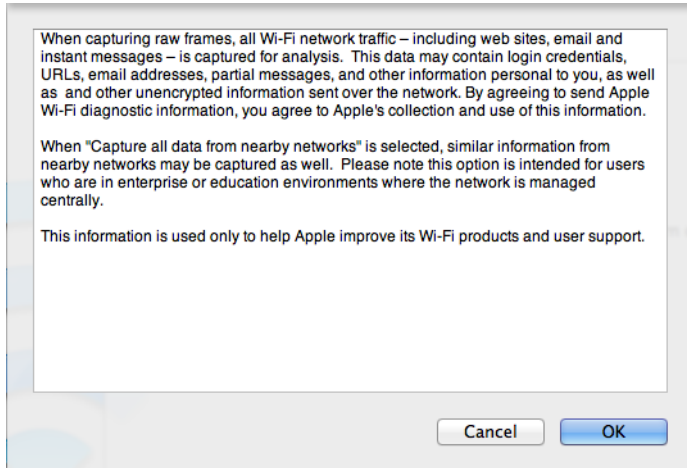
Select "**Capture all data from all nearby networks**" and

"Disconnect from the network and capture only data from channel"

Choose the channel you wish to monitor.



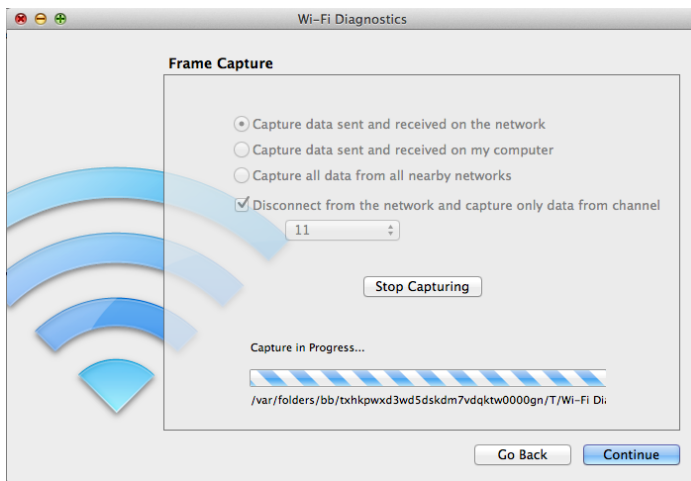
Click "OK" on the text dialogue window.



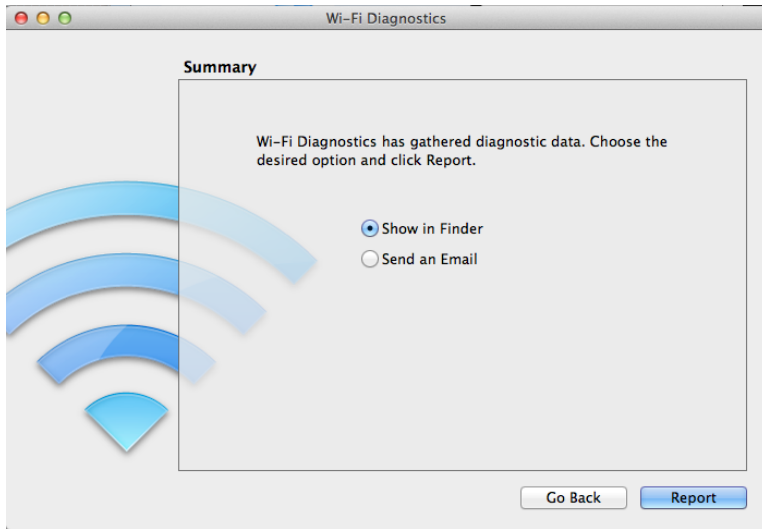
Click "Start Capture."

(Don't make the mistake of clicking "Continue" before making your capture).

Click "Stop Capture" when you are satisfied with the length of time.



Choose "Show in Finder" and extract the .tgz file to reveal a .pcap file that can be opened in WireShark or Eye P.A.



2) Use [WireShark](#) to create a pcap file using the internal wireless network interface. Select the **adapter en1** and click **options** to go into the advanced settings. Select "**Capture packets in monitor mode**" and then click **start**. WireShark will begin to log all of the wireless frames. Click **File > Save** to create a .pcap which will create a file that can be opened by Eye P.A.

WITH **Microsoft Network Monitor**

Microsoft Network Monitor is a free tool, but unfortunately it does not accurately portray HT 802.11n frames and data rates. MetaGeek recommends using an AirPcap adapter or CommView for Wi-Fi instead. However, the following will help you create files compatible with Eye P.A.

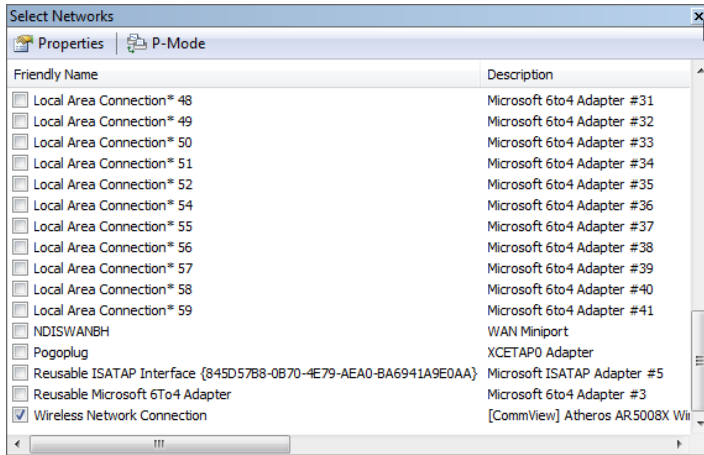
A list of Network Monitor supported Wi-Fi adapters:

<http://social.technet.microsoft.com/Forums/en-US/netmon/thread/737def6e-b927-4deb-997a-6a11e0aa94e2>

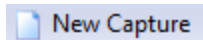
To download Microsoft Network Monitor 3.4 visit:

<http://www.microsoft.com/en-us/download/details.aspx?id=4865>

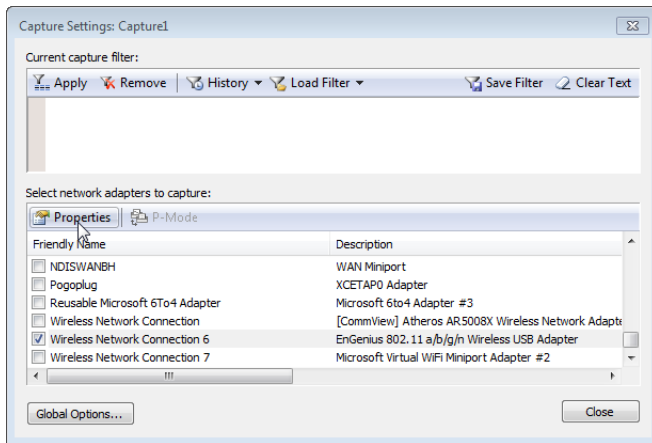
To capture 802.11 frames, deselect all of the adapters except for the wireless card in the **“Select Networks”** pane.



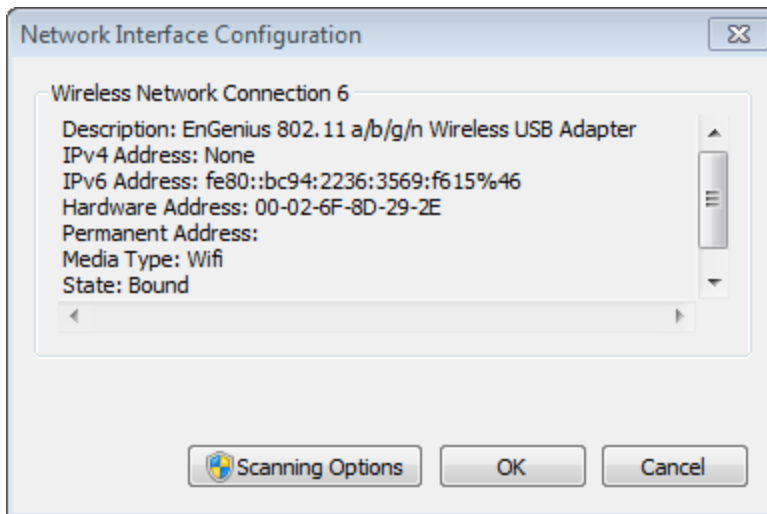
Click **“New Capture”** in the top left of the screen.



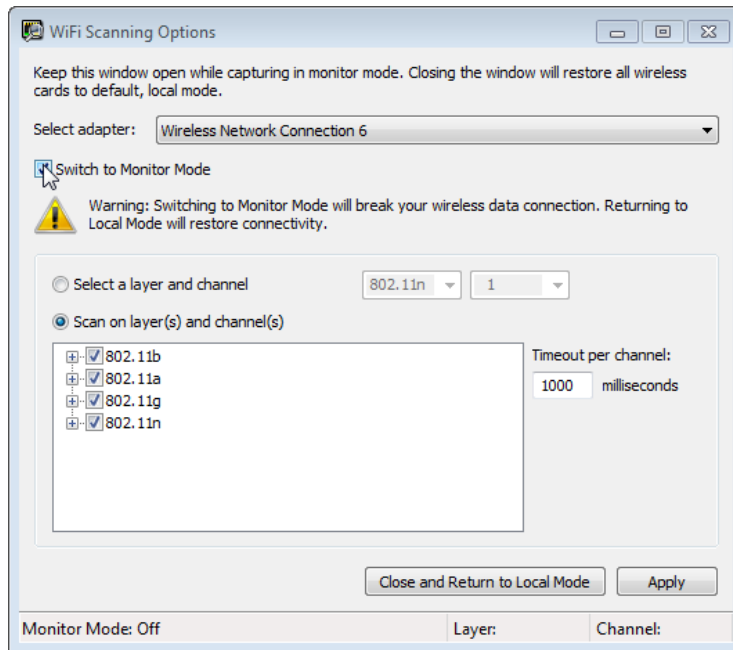
Click **“Capture Settings”** underneath the main menu. A new window will appear. Select your Wi-Fi adapter, and then click properties.



Click **“Scanning Options”** to put the Wi-Fi card in Monitor Mode.



Put a check next to “**Switch to Monitor Mode**” and then select the Wi-Fi channels and time you would like Microsoft Monitor to spend on each channel.



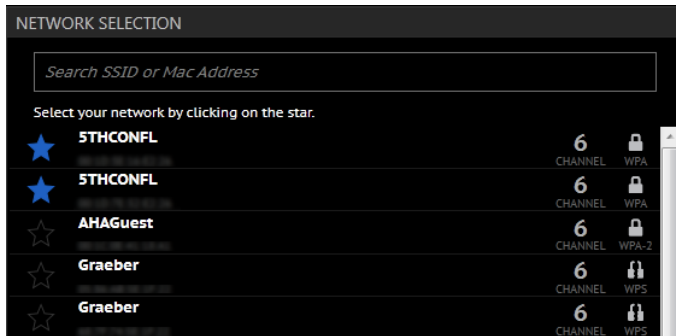
Click “**Apply.**” And leave the window open. Return to the main window and click “**Start.**”



Do not click “**Close and Return to Local Mode**” in the “**Wi-Fi Scanning Options**” unless you are done scanning.

To save the file click “**Save As**” underneath the main menu.

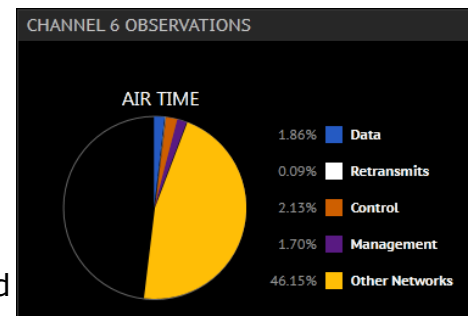
ANALYZE



Eye P.A. examines a variety of aspects of your capture, and will provide analysis based upon what it finds.

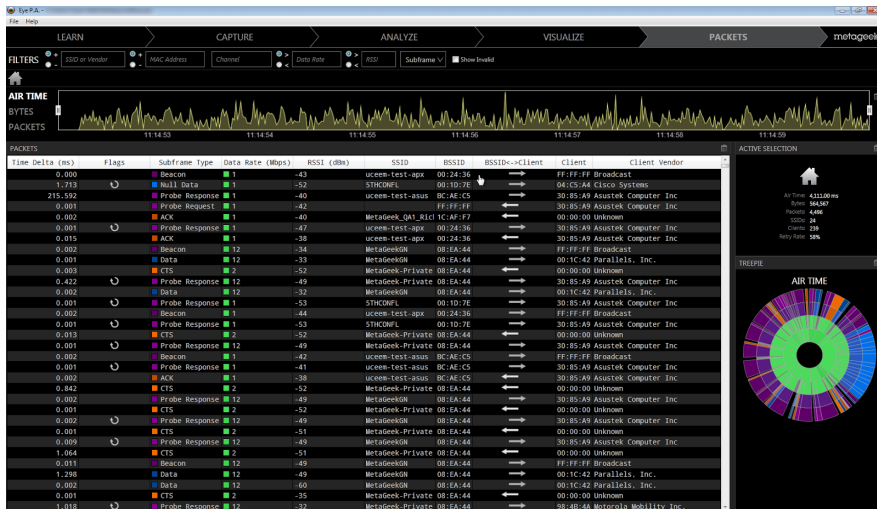
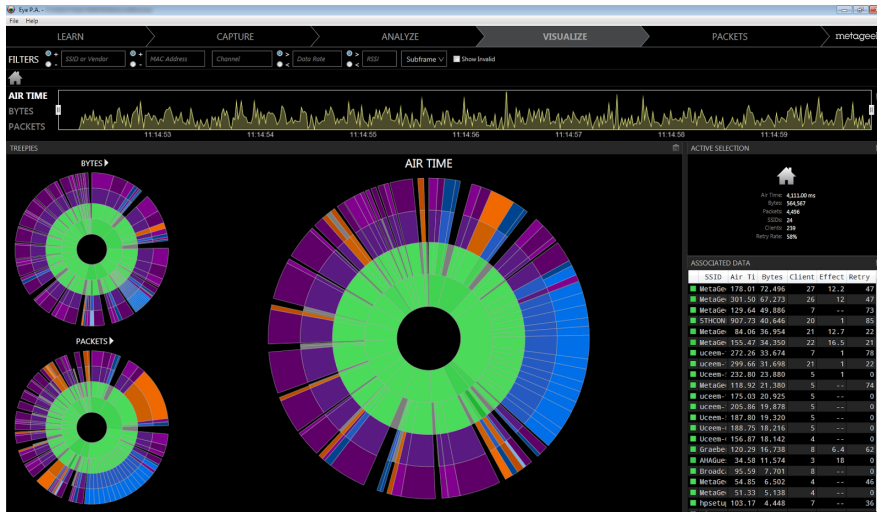
After starring the network(s) you are interested in, a pie chart will be shown that displays the percentages of the starred network's data, retransmits, control, and management packets compared to the percentage of packets belonging to other networks. The remaining black area of the pie chart represents the amount of available air time.

Below the pie chart, you will find suggestions for adjustments you can make in order to better your wireless network's performance. The areas where Eye P.A. looks for improvements include protection mechanisms, presence of legacy rates, high retransmission rates, encryption settings, and channel choice issues.



Any applicable tips will be shown for each network you star. Clicking the clipboard icon to the right of your selected network's name in the tips window will copy the tips for that network to your clipboard, allowing for easy export.

MAIN VIEWS

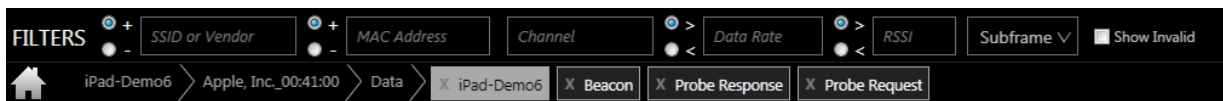


Work Flow



Across the top of Eye P.A. are 4 different categories called the Work Flow. Eye P.A. helps users learn how to use its core features in the “LEARN” tabs. The “CAPTURE” section is where users can open packet captures, or create their own capture using an AirPcap Nx. “VISUALIZE” takes the entire capture and generates Time Graphs, multi-layered pie charts, and data tables. After visually filtering the data necessary select “ANALYZE” to perform the analysis. The “PACKETS” section will display the individual packets for a more in-depth analysis.

Filter Bar



The top of the filter bar is where the user can type in the name, MAC, Channel, Data Rate or RSSI. Users can apply exclusive filters to quickly remove data from a particular access point or client by selecting the “-” before the text entry field. Selecting a “+” will build an inclusive filter. The Data Rate and RSSI can also be filtered based on a “greater than” or “less than” selection. With this filter, users can remove all frames with a RSSI less than or equal to -90dBm.

It can also be helpful to filter out certain types of packets like beacons, acknowledgements, or other non-essential frame types to focus only on the packets that matter most. To remove specific frame types from the multi-layered pie charts, click “Subframe Filters” in the Filter Bar at the top of the application. Checking and unchecking frame types allows the user to selectively choose the which packets Eye P.A. will graph.

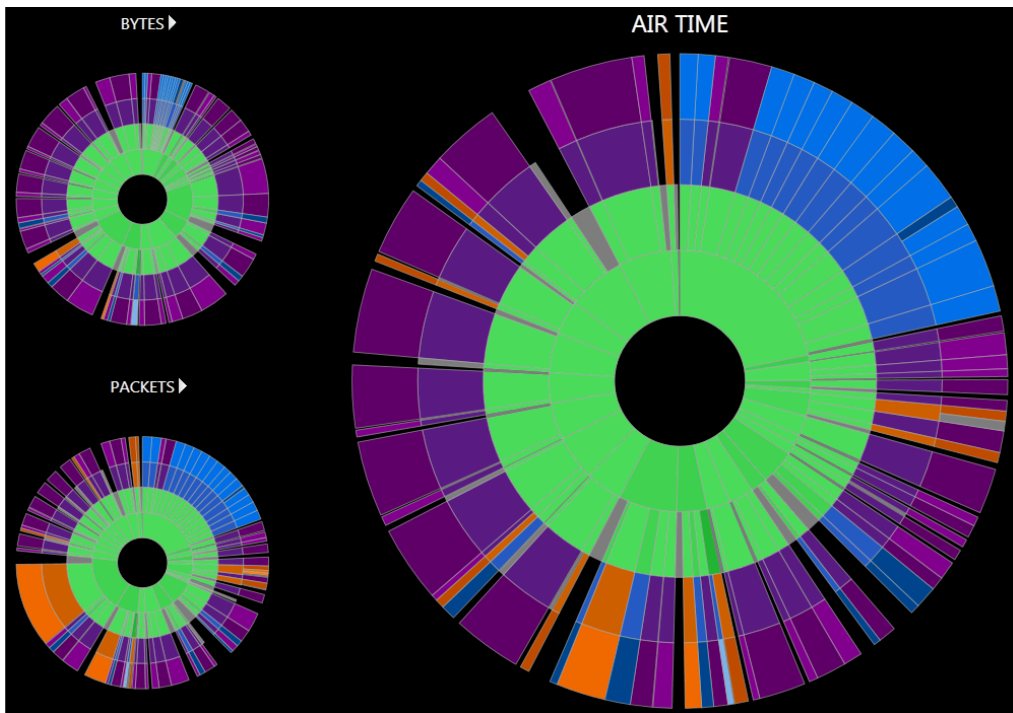
Filter Breadcrumbs

The filter bread crumbs represent the current requirements the user has manually

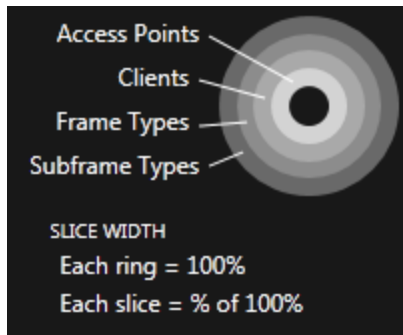
entered as filters or navigated to by means of the multi-layered pie chart. To remove a crumb click the x. Bread crumbs will either be black to represent exclusive filters or gray to show inclusive filters.

Note: Filtering packets will affect the data exported to WireShark. For example, if "Beacons" are unchecked from the display filters, they will be excluded from the data you can export to WireShark.

Multi-Layered Pie Charts



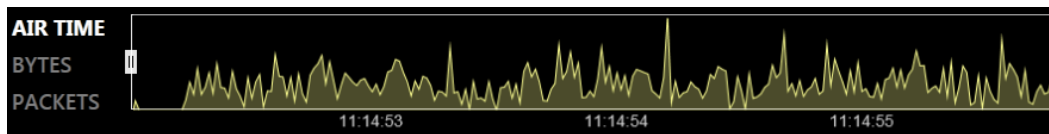
Eye P.A. uses multi-layered pie charts to display overall utilization of total packets, total bytes, and total amount of air time. The size of the slices in the rings are proportionate to the total, while the colors represent the type of data being displayed.



The data is a hierarchical breakdown by SSID > Client > Frame Type > Subframe Type. Each slice is divided into smaller slices in the next layer.

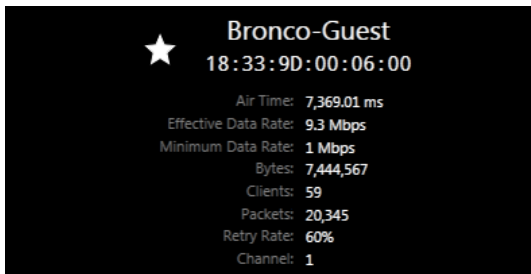
For example, by clicking on a client, Eye P.A. will draw a new multi-layered pie chart with all of the data for that particular client.

Adjustable Time Graph



Eye P.A. displays a historical summary of the data capture in the top time slider. By default, the Adjustable Time Graph in Eye P.A. selects the capture in its entirety. The user can select a different window of time by dragging the start and stop handles on either side of the time slider. When the user selects a smaller time range, both the data visuals and tables will update, only displaying data from the selected range, which helps you narrow in on unusual network activity.

Active Selection



The Active Selection legend located at 3 o'clock displays the related data to the center of the multi-layer pie chart. This data will change as the user drills down through layers. It displays total time, bytes, number of packets, BSSIDs, clients, and retry rate. By clicking the star you can select the BSSID for optimization in the Analyze tab.

Associated Data Table

ASSOCIATED DATA							
SSID	Air Time	Bytes	Clients	Effective Data Rate	Retry Rate	Channel	
5THCONFL	907.73	40,646	20	1	85	6	
AHAGuest	34.58	11,574	3	18	0	6	
Broadcast_FF:FF:FF	95.59	7,701	8	--	0	6	
Cisco Systems_41:18	42.37	13,138	9	15.5	5	6	
Cisco Systems_41:18	21.49	10,047	1	--	0	6	
Graeber	120.29	16,738	8	6.4	62	6	
HalDavis	8.29	724	4	1	67	6	
hpsetup	103.17	4,448	7	--	36	6	
MetaGeek_QA	51.33	5,138	4	--	0	6	
MetaGeek_QA1_Rich	54.85	6,502	4	--	46	6	
MetaGeekGN	178.01	72,496	27	12.2	47	6	
MetaGeekGN	84.06	36,954	21	12.7	22	6	
MetaGeek-Guest	129.64	49,886	7	--	73	6	
MetaGeek-Guest	118.92	21,380	5	--	74	6	

The table displays quantifiable metrics for the layer on the next ring out from the center (ring 1). Upon opening a .pcap file, the table will show each BSSID, the total amount of air time utilized, bytes, number of clients associated, average data frame rate, and retry rate.

The multi-layered pie chart can be rearranged by clicking the table's column headers to sort the data. Similar to a clock, the sorting will start at the 12 position and display clockwise in the pie chart with its order indicated in the table data.

MULTI-LAYERED PIE CHARTS

To alternate visually between the different types of data, click the arrow above any pie chart to select TIME, PACKETS, or BYTES and move it to the featured position. This will change the main pie chart and the Time Graph to that type of data.

Packets

This view represents the proportionate amounts of packets in comparison to the total captured.

Bytes

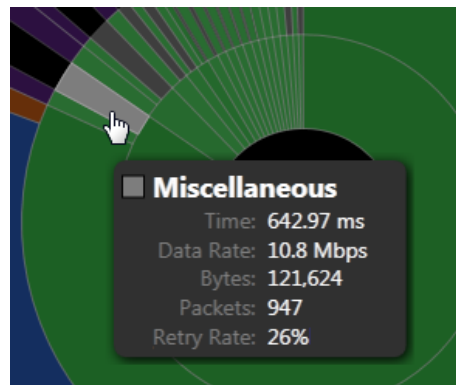
This view represents 100% of the total data captured in Bytes. Each slice is the total data sent by BSSID or client.

Air Time

This view represents the proportionate amount of air time each station utilized. It is important to note that lower data rates use more air time than higher data rates to transfer the same number of bytes.

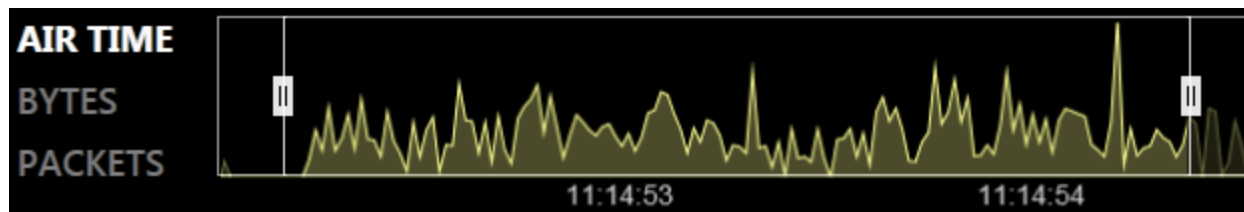
Wireless is similar to wired communication in the sense that no two devices can "talk" at the same time. Therefore the amount of time each station takes prohibits the other stations from transmitting.

To simplify and increase the performance speed of Eye P.A., the software will aggregate any small packets into a gray slice labeled "Miscellaneous." To see the contents of a gray slice, use the associated data table and double click on it. If the gray slice is on the outside of a green ring, expand its parent by clicking on it. Eye P.A. will redraw all of the outer sections to display the data that was aggregated in a gray "Miscellaneous" slice.



Time Graph

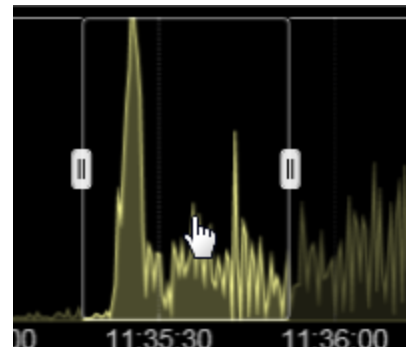
Time Segment Analysis



Wireless environments can look different within minutes. Issues may be erratic and intermittent. By adjusting the time span in the slider, users can omit time when the WLAN was functioning properly and focus on a smaller time window when an issue occurred.

Adjusting the Time Span

The time span is the line graph at the bottom of the display. When opening a .pcap file in Eye P.A., the software will automatically adjust the time span to the beginning and end of the capture. The time window has two handles that can be adjusted in and out to help you choose select times of the capture.



To move the time span, click in the middle of the handle and drag it to another location in time.

Packets, Bytes, and Air Time

The left hand side of the Time Graph will toggle between total bytes transferred, total packets, and total air time utilized. The line graph represents the current largest multi-layered pie chart and will automatically change when the user toggles between the pie charts.

DATA VISUALS

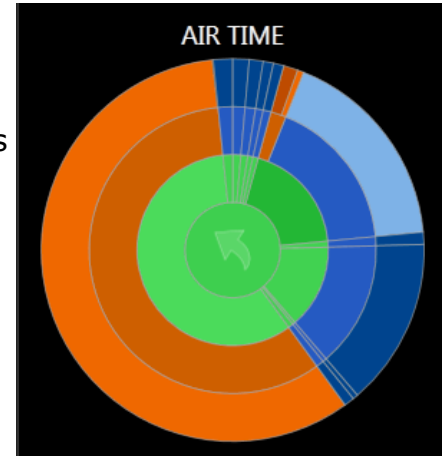
Multi-Layered Pie Charts

There are three multi-layered pie charts in the main window. Eye P.A.'s multi-layered pie charts continually divide each slice into more slices based on percentages. The size of each slice is proportionate to the total packets, bytes, or air time utilized.

Ring Order

The default ring order in Eye P.A.

1. BSSID
2. Associated Clients
3. Frame Type
4. Subframe Type



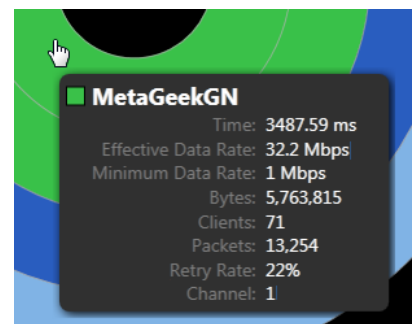
Drill-Down

Each element in the multi-layered pie chart can be clicked on, drilling down and breaking the data down into a new pie chart for easy troubleshooting.

To return to a parent layer, click the center of the pie chart, or the home icon in the top left of the window. The layer directly outside of the center is represented in the table. Double clicking on a row will change the pie charts to reflect the selected data.

Hover (Inspector Tool)

When a user hovers over a slice in the pie chart, a tool tip box will appear, providing additional details like data rate, packet count and retry rate. This information is also displayed in the Associated Data Table.



ASSOCIATED DATA TABLE

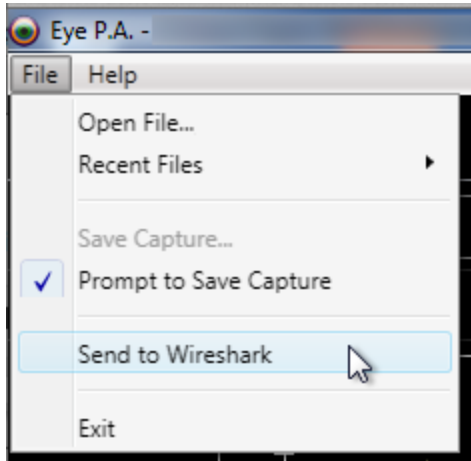
SSID	Air Time	Bytes	Clients	Effective Data	Retry Rate	Channel
5THCONFL	223.27	6,910	18	1	86	6
AHAGuest	2.86	334	2	18	0	6
Cisco Systems	6.79	908	6	15.7	12	6
Graeber	2.53	120	2	54	100	6
HalDavis	2.88	282	2	1	100	6
MetaGeek_QA	0.51	28	1	--	0	6
MetaGeek_QA1_	0.32	28	1	--	0	6
MetaGeekGN	4.34	3,102	11	12	0	6
MetaGeekGN	40.04	3,989	14	12	0	6
MetaGeek-Gues	0.01	14	1	--	0	6
MetaGeek-Gues	0.18	14	1	--	0	6
MetaGeek-Priv	41.31	4,864	13	15.6	4	6
MetaGeek-Priv	60.93	5,421	16	12	0	6
Uceem-5	13.44	98	3	--	0	6

The Associated Data Table provides details for the innermost ring (Ring 1) of the Multi Layer Pie Chart.

Table Columns

- **SSID** - This is the network name.
- **Air Time** - The amount of time used to transmit
- **Bytes** - The amount of data transferred
- **Client** - A unique identifier for each network interface (MAC)
- **Packets** - The total # of packets per BSSID
- **Retry** - The percentage of packets that had to be resent
- **Effective Data Rate** - The average data rate achieved by the client including inter frame spacing and network allocation vector times.

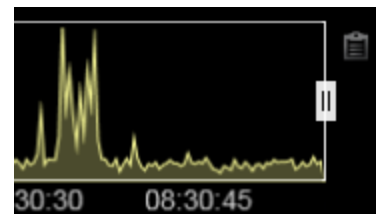
SEND TO WIRESHARK



Send any layer of the multi-layer pie chart to WireShark by clicking “File” in the main menu and then “Send to WireShark.” Conveniently, Eye P.A. automatically bundles up the data in the current multi-layer pie chart, applies the filters you’ve drilled down to select, and sends all of the packets to WireShark for more in-depth analysis.

REPORTING

In each pane of Eye P.A. you will see a clipboard icon. Clicking this will copy the contents of the pane to the user’s clipboard. The time graph and and treepies will be copied as images, while the active selection and associated data table will be copied as a csv.



FREQUENTLY ASKED QUESTIONS

What is the “Broadcast” SSID?

In 802.11, clients or stations can broadcast management frames called Probe Requests. Probe requests occur when stations are looking for access points they previously connected with. These do not occur in a network but Eye P.A. groups them into a broadcast group for organizational simplicity.

Why won't Eye P.A. open my .pcap file?

There are currently two types of .pcap files that Eye P.A. can open. The .pcap must contain 802.11 frames with Radiotap or 802.11-common PPI headers. Typically these captures are created using:

- Wireshark with Aircap adapter
- Mac OS X with Wi-Fi Diagnostics or WireShark in Monitor Mode
- Linux with WireShark or Kismet
- Export a .cap or .pcap from a wireless access point

Why are the packet counts different in WireShark and Eye P.A.?

Sometimes the capturing device receives packets that are malformed or corrupt. Eye P.A. drops any packets that do not have a proper Frame Check Sequence (FCS) in the packet, even though Wireshark will display those packets.

What is a Hidden SSID?

Some wireless network administrators may hide their SSID, which tells the router not to broadcast its name. Typically only users who know the name of the wireless network can connect to a hidden SSID.

What is the “Miscellaneous” gray slice?

The gray slices contain valid packet data from a high amount of different sources. For example a capture file may have 10 top talkers that make up 90 percent of the total traffic. However, 100 clients make up the remaining 10 percent. Instead of drawing each slice, Eye P.A. aggregates them into miscellaneous slices. They are colored gray because they may contain management, data, and control frames. To view any of the data in the gray slice, click on its parent slice and all of the data will be redrawn.

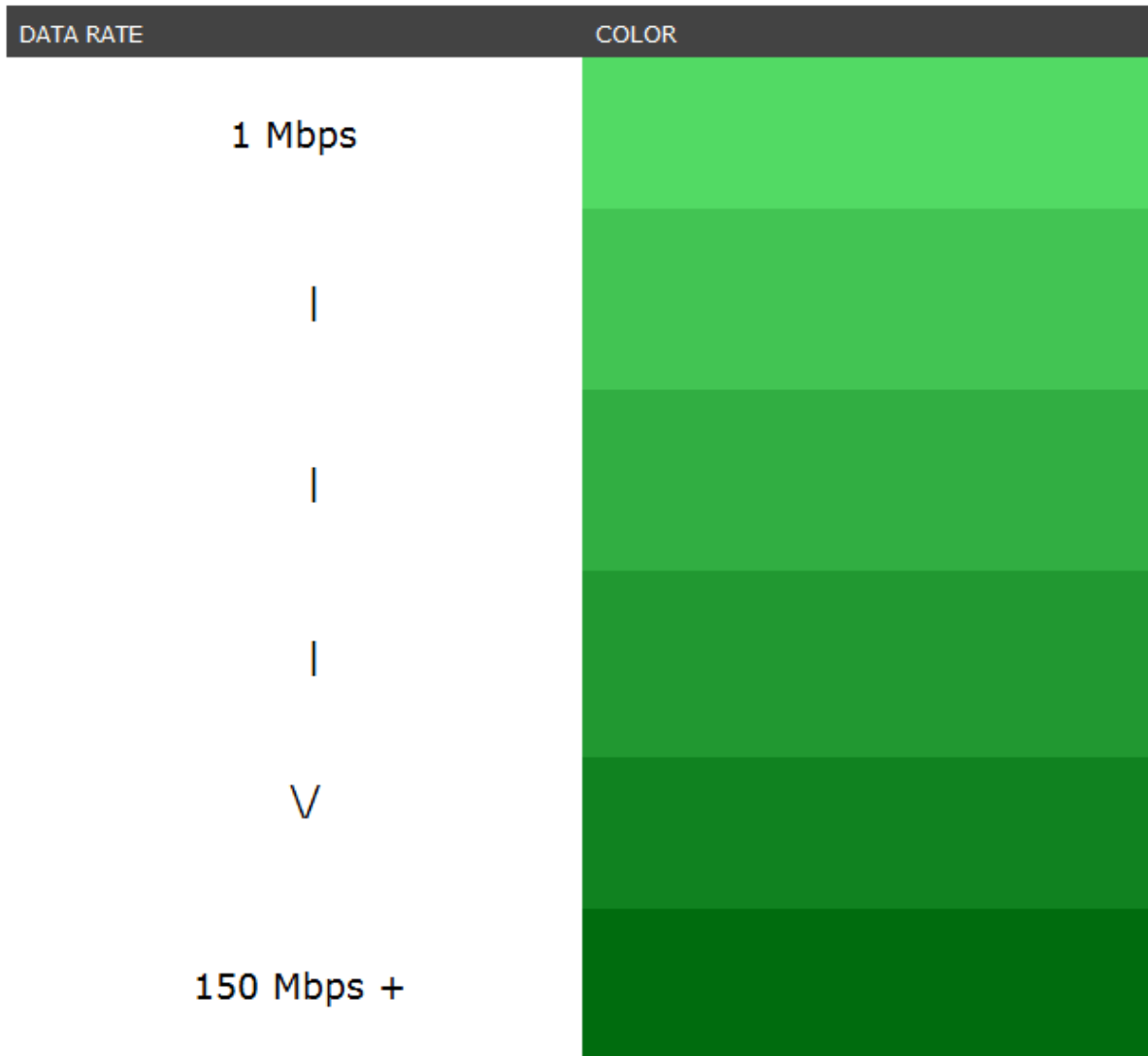
How is the Effective Data Rate calculated?

The effective data rate reflects the data frames transferred to and from a BSSID and client. Eye P.A. takes the total bytes transferred and divides it by the total air time. The air time for each frame is calculated by dividing the bytes in the payload by the data rate for that frame.

UNDERSTANDING COLOR

Data Rate

The first two layers in the multi-layered pie chart are colored by the average data rate of the traffic. The shade of green is based on a sliding scale. The minimum average data rate captured is represented by light green, while the highest is represented by dark green, with shades in between.



Data Frames

Data frames carry the actual data passed down from higher layer protocols.

DATA PACKET TYPE	COLOR
QoS Data	Light Blue
Data (Other)	Medium Blue
QoS Null	Dark Blue
Null Function No Data	Dark Blue
Data (Normal)	Very Dark Blue

Management Frames

A majority of the frame types in an 802.11 network.

Used by wireless stations to join and leave the network.

MANAGEMENT PACKET TYPE	COLOR
Disassociation	Lightest Purple
Deauthentication	
Management (Other)	Light Purple
Authentication	Medium-Light Purple
Association Request	Medium Purple
Association Response	
Reassociation Request	Medium-Dark Purple
Reassociation Response	
Probe Request	Dark Purple
Probe Response	
Beacon	Darkest Purple

Control Frames

Control frames help with the delivery of the data frames. Control frames must be able to be heard by all stations; therefore, they must be transmitted at one of the basic rates. Control frames are also used to clear the channel, acquire the channel, and provide unicast frame acknowledgments.

CONTROL PACKET TYPE	COLOR
PS Poll	
Action	
Control (Other)	
RTS	
CTS	
ACK	
Block ACK	
Block ACK REQ	

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