



Wansight 6.2 User Guide

- Console
- Sensors [Packet Sensor, Flow Sensor, SNMP Sensor, Sensor Cluster]

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Traffic Monitoring and IP Accounting with Wansight

Andrisoft Wansight is enterprise-grade software that delivers to NOC and IT teams the functionality needed for monitoring networks through a single integrated package. Andrisoft Vanguard extends Wansight with advanced anomaly detection and DDoS mitigation capabilities. To upgrade to Vanguard, simply purchase a Vanguard license.

Key Features & Benefits

- ✓ **FULL NETWORK VISIBILITY** – Supports all IP traffic monitoring technologies: packet sniffing, NetFlow version 5,7 and 9; sFlow version 4 and 5; IPFIX and SNMP.
- ✓ **ADVANCED WEB CONSOLE** – Consolidated management and reporting through a multi-tenant, interactive and highly-configurable web portal with customizable dashboards, user roles, and remote authentication.
- ✓ **PACKET SNIFFER** – A distributed packet sniffer that saves packet dumps from different network entry points. View packet details in a Wireshark-like web interface.
- ✓ **FLOW COLLECTOR** – A fully featured NetFlow, sFlow, and IPFIX Analyzer and Collector that saves flows in a compressed format for long term storage. Flows can easily be searched, filtered, sorted, and exported.
- ✓ **COMPLEX ANALYTICS** – Generates complex reports with aggregated data for hosts, departments, interfaces, applications, ports, protocols, countries, autonomous systems, and more.
- ✓ **REAL-TIME REPORTING** – Bandwidth graphs are animated and have a short-term accuracy of just 5 seconds.
- ✓ **HISTORICAL REPORTING** – You can view reports from the last 5 seconds to the last 10 years by selecting any custom time period. Bandwidth histograms contain 95th-percentile values for burstable billing.
- ✓ **SCHEDULED REPORTING** – Any report can be generated automatically and emailed to interested parties at preconfigured intervals of time.

All statistical data is stored in an internal SQL database that can be easily queried and referenced.

Software Components

Wansight Sensor provides in-depth traffic analysis, traffic accounting, and bandwidth monitoring. The collected information enables you to generate complex traffic reports, graphs, and tops; instantly pin down the cause of network incidents; understand patterns in application performance and make the right capacity planning decisions.

Wansight Console is a multi-tenant web graphical user interface that functions as the administrative core of the software. It offers single-point management and reporting by consolidating data received from all Wansight Sensors deployed within the network.

For brevity, Wansight Sensor is sometimes referred to as Sensor, and Wansight Console as Console.

Choosing a Method of Traffic Monitoring

This chapter describes the traffic monitoring technologies supported by Wansight Sensor.

There are four Wansight Sensor “flavors” that differ only in the way they obtain traffic information:

- **Packet Sensor** analyzes packets. It can be used on appliances that are either deployed in-line (servers, firewalls, routers, bridges, IDSes, load-balancers) or connected to a mirrored port or TAP.

In switched networks, only the packets for a specific device reach the device's network card. If the server running a Packet Sensor is not deployed in-line, in the main data path, then a network TAP or a switch or router that offers a “monitoring port” or “mirroring port” must be used. In this case, the network device sends copies of data packets traveling through selected ports or VLANs to the monitoring port. Packet Sensor inspects every packet it receives and conducts packet-based traffic analysis.

- **Flow Sensor** analyzes flows. It is used for monitoring NetFlow® (jFlow, NetStream, cflowd), sFlow® and IPFIX data.

Many routers and switches can collect IP traffic statistics and periodically send them as flow records to a Flow Sensor. Because the flow protocol already performs pre-aggregation of traffic data, the flow data sent to Flow Sensor is much smaller than the monitored traffic, and this makes Flow Sensor a good option for monitoring remote or high-traffic networks. The main downside of flow-based traffic analysis is that pre-aggregating traffic data adds a delay of at least 30 seconds to collecting real-time traffic statistics.

- **SNMP Sensor** monitors the bandwidth usage of routers and switches on a port-by-port basis.

When this technology is used, an SNMP Sensor queries the device (e.g. router, switch, server) for the traffic counters of each port with small data packets. These are triggering reply packets from the device. Compared to other bandwidth monitoring technologies, the SNMP option is very basic and offers no IP-specific information. SNMP creates the least CPU and network load.

- **Sensor Cluster** aggregates pre-existing Sensor traffic data into a single, unified IP graphing domain.

Sensor Cluster sums up the traffic data collected by Packet Sensors, Flow Sensor and SNMP Sensor interfaces and performs the same tasks as the other Sensors (IP graphing, IP accounting, etc.).

For redundancy, high availability and to be able to view packet traces and flow dumps, use Flow Sensor(s) and Packet Sensor(s) simultaneously.

Comparison between Packet Sniffing, Flow Monitoring, and SNMP Polling

Packet Sensor should be used when the speed of detecting attacks is critical or when there is a need for capturing raw packets for forensics or troubleshooting. Because it inspects every packet entering the network, it needs to run on servers with powerful CPUs and fast network adapters.

Flow Sensor analyzes pre-aggregated traffic information sent by routers/switches, so it can monitor multiple 10 Gbit or 40 Gbit interfaces even when it is running on a low-performance server.

Flow Sensor has some significant disadvantages:

- x it exhibits reduced speed in processing real-time data because all flow exporters aggregate traffic data over time, with delays of more than 30 seconds
- x enabling the flow exporting technology may result in increased CPU usage on the network device
- x it needs to run on servers with 4GB of RAM or more

It is recommended to use an SNMP Sensor only for devices that are unable to export flows or mirror packets, or when comparing flow and SNMP-derived statistics to ensure the flow data accuracy.

The table below lists the main differences between the Sensor types:

	Packet Sensor	Flow Sensor	SNMP Sensor
Traffic Monitoring Technology	- Sniffing packets passing an in-line appliance - Port mirroring (SPAN, Roving Analysis Port) - Network TAP	- NetFlow version 5, 7 and 9 (jFlow, NetStream, cflowd) - sFlow version 4 and 5 - IPFIX	- SNMP version 1 - SNMP version 2c - SNMP version 3
Maximum Traffic Capacity per Sensor*	10 GigE	multiples of 100 Gbps	multiples of 100 Gbps
DDoS Detection Time**	≤ 1 seconds	≥ flow export time (≥ 30 seconds) + 5 seconds	≥ 5 seconds, no details on attacked destinations
IP Graphs Accuracy	≥ 5 seconds	≥ 20 seconds	N/A
Traffic Validation Options	IP classes, MAC addresses, VLANs, BPF	IP classes, Interfaces, AS Numbers, Ingress/Egress	Interfaces
Packet Tracer	Yes	No	No
Flow Collector	No	Yes	No

* The software is not limited by the number of connections between IPs.

** Vanguard Sensor can detect which destination is under attack. Attackers and attack patterns can be detected only by Vanguard Filter.

Wansight Installation

Installing Wansight does not generate negative side effects on the network's performance. Full installation and configuration may take less than an hour.

Wansight runs exclusively on Linux platforms. To install and configure the software you need basic Linux operation skills and at least medium computer networking skills. Contact <support@andrisoft.com> if you encounter software installation issues or if you have questions about the system requirements listed below.

System Requirements

Wansight 6.2 can be installed on the following 64-bit Linux distributions: Red Hat Enterprise Linux 6 or 7 (commercial), CentOS 6 or 7 (free, Red Hat-based), Debian Linux 6 "Squeeze", 7 "Wheezy" or 8 "Jessie" (free, community-supported), Ubuntu 12, 14 or 16 (free, Debian-based). The most tested, thus recommended, Linux distribution that can be used with Wansight is CentOS 7.

Wansight was designed to be completely scalable. It can be installed either on a single server having adequate hardware resources or on multiple servers distributed across the network.

It is highly recommended to use dedicated servers instead of Virtual Machines, for the following reasons:

- Having fast and uninterrupted access to the hard disk is a critical requirement of the Console
- The resources must be provisioned in a predictable and timely manner
- Some virtualized environments do not have a stable clock source

Importance of HW resources	CPU Speed (> GHz/core)	CPU Cores (> cores)	RAM Size (> GB)	HDD Size (> GB)	HDD/SSD Speed (> Mbytes/s)	Network Adapter (Vendor, Model)
Console	High	High	High	Very High	Very High	Very Low
Packet Sensor	Very High	High	Medium	Low	Low	Very High
Flow Sensor	Low	Low	High	Medium	High	Very Low
SNMP Sensor	Very Low	Low	Very Low	Very Low	Very Low	Very Low
Sensor Cluster	Medium	Medium	Medium	Very Low	Very Low	Very Low
Packet Filter	Very High	Very High	Medium	Very Low	Very Low	Very High
Flow Filter	Low	Low	High	Very Low	Very Low	Very Low
Filter Cluster	Medium	Medium	High	Very Low	Very Low	Very High

Legend	Very High Importance	High Importance	Medium Importance	Low Importance	Very Low Importance
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Console Hardware Requirements

Capacity	Minimum Hardware Requirements for 20 Components
Architecture	64-bit x86
CPU	2.4 GHz dual-core Xeon
RAM	4 GB
NICs	1 x Fast Ethernet for management
HDDs	2 x 7200 RPM HDD, RAID 1, 80 GB (additional disk space may be needed for IP graphs)

The Console server stores the database and centralizes all operational logs, graphs and IP accounting data.

Its performance is determined by its settings, as well as the performance of the server and the performance of the applications it relies on: MySQL or MariaDB, Apache HTTPD and PHP.

To access the web interface provided by Console, use one of the following web browsers: Google Chrome, Firefox 3.5 or later, Safari 3.0 or later, Internet Explorer 8 or later. JavaScript and cookies must be enabled. Java and Adobe Flash are not required. The contextual help provided by Console may need Adobe PDF Reader.

For the best experience, use a 1280x1024 or higher resolution display.

Packet Sensor Hardware Requirements

Packet Sniffing Capacity	1 Gbit/s – 1,400,000 packets/s	10 Gbit/s – 14,000,000 packets/s
Architecture	64-bit x86	64-bit x86
CPU	2.0 GHz dual-core Xeon	3.2 GHz quad-core Xeon (e.g. Intel X5672)
RAM	2 GB	4 GB
NICs	1 x Gigabit Ethernet 1 x Fast Ethernet for management	1 x 10 GbE adapter supported by Sniffer10G, PF_RING or Netmap. 1 x Fast Ethernet for management
HDDs	2 x 5200 RPM HDD, RAID 1, 35 GB	2 x 5200 RPM HDD, RAID 1, 35 GB

Packet Sensor can run load-balanced over multiple CPU cores when used with the following hardware / Capture Engines:

- Intel 82599 chipset network adapters, such as Intel X520, Intel X540, HP X560 or Silicom PE310G4DBi9-T
- Myricom network adapters having a Sniffer 10G license
- PF_RING (with or without ZC) high-speed packet I/O framework
- Netmap high-speed packet I/O framework

To increase the packet analysis capacity to 100 Gbit/s or more, define a Sensor Cluster that aggregates multiple Packet Sensors running on different servers equipped with 10-40 Gbit/s network adapters.

Flow Sensor Hardware Requirements

Capacity	Minimum Hardware Requirements for 15,000 flows/s
Architecture	64-bit x86
CPU	2.0 GHz dual-core Xeon
RAM	8 GB
NICs	1 x Fast Ethernet for management
HDDs	2 x 7200 RPM HDD, RAID 1, 60 GB

Flow Sensor does not have a limit on the number of interfaces it can monitor or a limit of how many flows per second it can process. Each Flow Sensor can handle the flows of a single flow exporter. A server with enough RAM can run tens of Flow Sensors. The amount of RAM is much more important than the CPU speed.

Flow Sensor can store flow data on the local disk in a highly compressed binary format.

SNMP Sensor Hardware Requirements

Capacity	Minimum Hardware Requirements for 20 Devices
Architecture	64-bit x86
CPU	1.6 GHz dual-core Xeon
RAM	1 GB
NICs	1 x Fast Ethernet for management
HDDs	2 x 5200 RPM HDD, RAID 1, 20 GB

SNMP Sensor does not have a limit on the number of interfaces it can monitor. Each SNMP Sensor can monitor a single device. A server can run an unlimited number of SNMP Sensors.

Sensor Cluster Hardware Requirements

The hardware requirements for Sensor Cluster are very low because the traffic information is pre-aggregated by the associated Sensors (Flow Sensors, Packet Sensors or SNMP Sensors).

It is recommended to run Sensor Cluster on the Console server.

Software Installation

The download link is listed in the email containing the trial license key. The latest software installation instructions are listed on the Andrisoft website.

The trial license key activates all features for 30 days. You can install the trial license key on any number of servers. To switch to a full, registered version, apply a license key purchased from the online store.

Opening the Console

Wansight Console provides a web interface and centralized system through which you can control and monitor all other components. If you have correctly followed the installation instructions, from now on you will only need to log in to Console to manage and monitor servers and software components. SSH access may only be needed for updating the software.

Open the Console at `http://<console_hostname>/wansight`. If the page cannot be displayed, make sure that the Apache web server is running and the firewall does not block incoming traffic on port 80 or 443. You can also access it securely using HTTPS if the Apache web server was configured with SSL/TLS support.

If you have not licensed Wansight you will be asked to do so. Upload the *trial.key* file sent to you by email by clicking the key icon. The license key contains encrypted information about the licensed capabilities of the software. You can replace the license key in Configuration » General Settings » License Manager.

Log in to the Console using the default username/password combination: **admin/changeme**.

If the Console is installed on a public server, you should immediately change the default password of the “admin” account. To do so, click the **Admin** menu at the top-right corner of the browser window and select **<Change Password>**.

To understand how to navigate within the Console, read the dedicated chapter on page 13.

Licensing Procedure

When the trial period is over you will have to purchase as many Sensor and Filter licenses (subscriptions) as the number of Sensors and Filters configured and enabled in Configuration » Components.

- You will need as many Sensor licenses as the number of flow exporters (usually border or edge routers) monitored by Flow Sensors. Flow Sensor does not have a limit on the number of interfaces it can monitor. If you want to monitor many routers having a single interface, contact `<sales@andrisoft.com>`.
- You will need as many Sensor licenses as the number of interfaces (ports) listened by Packet Sensors. Multiple Packet Sensors listening to the same interface (e.g. when using a multi-queue NIC) use a single Sensor license. Packet Sensor can monitor an unlimited number of IPs/domains.
- You can mix Wanguard Sensor licenses with Wansight Sensor licenses.
- Sensor Cluster is free and do not require licensing.
- Console is free and it does not require licensing.

You can distribute the licensed Sensors on any number of servers without additional licensing costs. The license key must contain the hardware keys listed under Configuration » General Settings » License Manager » Requirements. The minimum licensing period is 12 months.

Quick Configuration Steps

- ➔ Estimate storage requirements, review decoders and IP graph settings – page 14
- ➔ Add your IP address ranges and important hosts to an IP Zone – page 18
- ➔ Add a Packet Sensor – page 20, Flow Sensor – page 24, or SNMP Sensor – page 29
- ➔ Watch the event log. Receive error notifications by email – page 34
- ➔ Generate reports and send them periodically by email – page 33
- ➔ Create dashboards and add widgets containing useful information – page 53
- ➔ Create personalized Console accounts for your staff or customers – page 36

Basic Concepts of Wansight Console

Please read this chapter to understand the basic premises required to operate the software properly. The next chapters cover the configuration of the software, while the last 5 chapters cover the reporting features.

To understand how to operate the Console you should be aware of the structure of the web interface:

Side Region

The Side Region is used for navigating throughout the Console. It is located at the east and/or west edge of the browser's window, according to the user's preference. If it is not visible, it has been either collapsed or hidden by an administrator. Clicking the edge of regions expands or collapses them.

The Side Region contains 2 sections – Reports and Configuration – that can be collapsed or expanded by clicking the title bars or by pressing Ctrl+R. Both sections contain multiple panels that can also collapse or expand, with such state being maintained between sessions. The panels are refreshed every 5 to 10 seconds.

The Reports section title bar contains a “Quick Search” button. Keyboard shortcut: Ctrl+S.

Central Region

Each report, dashboard or tool you select in the Side Region opens a tab (page) in the Central Region. You can switch between (sub-) tabs with a mouse or with the keyboard shortcut (Alt+) Ctrl+→ and (Alt+)Ctrl+←. You can close all tabs except for the Landing Tab (initially set to the Configuration Wizard). To change the Landing Tab, edit your user profile in Configuration » General Settings » User Management.

South Region

The South Region provides a quick way to view live data: events (system logs), animated traffic graphs, and statistics from all software components. It is located at the bottom of the browser's window. By default, it is collapsed; to expand it, click the thin line near the lower edge or press Ctrl+E.

Upper Menus

The Upper Menus are located in the top-right part of the Console window.

The Help menu contains links to the User Guide, helper tools, Software Updates, and the About window. Dependent on context, the User Guide opens the chapter describing the last-opened window or tab.

The User menu provides a Log Out option and lets you quickly change the password and a few user preferences.

Configuration » General Settings » Graphs & Storage

A very important initial step in configuring Wansight is to make sure that the server(s) the software runs on have enough resources to process and store IP graphs, flows and packet dumps. Storage-related settings can be tuned by editing Configuration » General Settings » Graphs & Storage.

In a later chapter, you will be able to configure the Sensors to generate traffic graphs, tops and accounting data for every IP that belongs to the monitored network. If you intend to use this feature, you may want to change the default IP storage settings, as changing these later will reset all existing IP graphs, tops and accounting data.

The **Sensor Top N** value (default: 20) specifies the maximum number of items stored for ordered sets of data, such as top Talkers, External IPs, ASNs, Countries, TCP/UDP ports, IP protocols, and so on.

The Packet Sensors save packet dumps on the local disk in the path configured for **Packet Traces**. The Flow Sensors save flow data on the local disk in the path configured for **Flow Collectors**. When the Console is not installed on the Sensor server, export these paths towards the Console's file system using an NFS share ([KB article link](#)). If you do not, the Console is not able to display data saved on remote servers.

All graph files are stored by the Console server, in the **Graphs Disk Path**. Graph files are optimized for storing time series data and do not grow over time. All IP graph options described below have a direct impact on the storage space required on the Console server.

The **Graph IP Sweeps** option prevents creating IP graph files for IPv4 and/or IPv6 addresses that receive traffic without sending any traffic in return. Do not set it to "Off" when monitoring unidirectional links or asymmetric traffic.

The size of each IP graph file is listed on the bottom of the window in the *Disk space required for each IP graph file* field. When Sensor Clusters are not used, the maximum number of IP graph files that could be generated can be calculated with the formula: ((number of Packet Sensors) + (number of Flow Sensor interfaces)) x (number of IPs contained in subnets with IP Graphing set to "Yes" in the IP Zone).

There are 2 mutually exclusive methods for creating and updating IP graph files, so select the appropriate one for your setup:

- **Create & update IP graph files directly on disk** – This method optimizes the long-term storage of IP graph data by allowing up to 3 **Round Robin Archives**. The values within the Round Robin Archives determine the granularity of the graphs and the interval of time they are saved. These entries specify for how long, and how accurately data should be stored. A smaller data average (5 seconds minimum) generates a very accurate graph, but requires more disk space, while a bigger data average is less accurate and uses less disk space.

On non-SSD drives, the disk seek time may be too high to update thousands of IP graph files every few minutes. If this is the case, configure the **RRDCache daemon** to increase the I/O performance of the Console server ([KB article link](#)). If the speed of updating IP graph files is not fast enough, consider the method below.

- **Update IP graph files in RAM or SSD** – This method is not optimal for long-term storage because it allows a single Round Robin Archive per IP graph file. The files are created and updated in **Graphs RAM Path**, and moved periodically onto a larger, albeit slower disk. Select this method when the previous method configured with RRDCached is not fast enough to sustain updating thousands of very high-

granularity IP graphs.

Decoders represent internal functions that differentiate and classify the underlying protocols of each packet and flow. Each enabled decoder increases the size of IP graph, top and accounting data, and causes a small performance penalty on Packet Sensor. It is recommended to enable only the decoders you are interested in.

You can define your own decoders in Configuration » General Settings » Custom Decoders. Default decoders:

Decoder	Description
TOTAL	Always enabled, matches all IP packets & flows.
TCP	Matches TCP traffic.
TCP+SYN	Matches TCP traffic with SYN flag set and ACK unset. Flow Sensor counts one packet per flow.
UDP	Matches UDP traffic.
ICMP	Matches ICMP traffic.
OTHER	Matches IP protocols that differ from TCP, UDP and ICMP.
BAD	Matches TCP or UDP port set to 0, or IP protocol set to 0.
FLOWS	Matches flow records and replaces packets/s with flows/s. Works only with Flow Sensor.
FLOW+SYN	Matches flow records with SYN flag set. Flow Sensor counts all packets per flow.
FRAGMENT	Matches fragmented IP packets. Works only with Packet Sensor.
TCP-NULL	Matches TCP traffic without TCP flags, indicative of reconnaissance sweeps.
TCP+RST	Matches TCP traffic with RST flag set.
TCP+ACK	Matches TCP traffic with SYN flag unset and ACK set.
TCP+SYNACK	Matches TCP traffic with SYN flag set and ACK flag set.
HTTP	Matches TCP traffic on source or destination port 80.
HTTPS	Matches TCP traffic on source or destination port 443.
MAIL	Matches TCP traffic on source or destination ports 25,110,143,465,585,587,993,995.
DNS	Matches UDP traffic on source or destination port 53.
SIP	Matches TCP or UDP traffic on source or destination port 5060.
IPSEC	Matches IP traffic on IP protocol 50 or 51.
WWW	Matches TCP traffic on source or destination ports 80, 443.
SSH	Matches TCP traffic on source or destination port 22.
NTP	Matches UDP traffic on source or destination port 123.
SNMP	Matches UDP traffic on source or destination ports 161, 163.
RDP	Matches TCP or UDP traffic on source or destination port 3389.
YOUTUBE	Matches IP traffic going or coming from Youtube AS 43515, 36561, or from Youtube subnets.
NETFLIX	Matches IP traffic going or coming from Netflix AS 55095, 40027, 2906, or from Netflix subnets.
HULU	Matches IP traffic going or coming from Hulu AS 23286, or from Hulu subnets.
FACEBOOK	Matches IP traffic going or coming from Facebook AS 54115, 32934, or from Facebook subnets.

Consolidation functions build consolidated values for Round Robin Archives. If you are interested in traffic spikes, check MAXIMUM. If you are interested in average values, check AVERAGE. For low traffic values, check MINIMUM.

It is highly recommended to automate the deletion of old data and monitor the disk usage of IP graphs in

Configuration » General Settings » Data Retention.

Sensor and Applications Graph Troubleshooting

- ✓ Ensure that all Sensors run correctly by verifying the event log and by viewing live statistics from Reports » Components » Overview. The troubleshooting guide for Packet Sensor is located on page 23, for Flow Sensor on page 26 and SNMP Sensor on page 31.
- ✓ Discontinuous Sensor graphs can be caused by enabling IP Accounting for too many/large subnets when there is a slow connection between the Sensor and MySQL/MariaDB running on the Console server.

IP/Subnet Graph Troubleshooting

- ✓ Ensure that all Sensors run correctly by verifying the event log and by viewing live statistics displayed in Reports » Components » Overview. The troubleshooting guide for Packet Sensor is located on page 23, for Flow Sensor on page 26 and SNMP Sensor on page 31.
- ✓ Generating IP graph data has the biggest impact on the load of the Console server. Enable each feature (IP graphing, IP accounting) sequentially for each subnet, after making sure that the Console server can handle it. The storage requirements for each subnet are listed in the IP Zone, and the current disk usage in Configuration » General Settings » Data Retention.
- ✓ The internal program used for saving IP graph data is `/opt/andrisoft/bin/genrrds_ip`. If it is overloading the Console server or the event log contains warnings such as “Updating IP graph data takes longer than 5 minutes”, use RRDCacheD, RAM/SSD updating method, faster disk drivers, enable IP graphing for fewer subnets, or deploy a Sensor Cluster configured to aggregate IP graph data.
- ✓ The internal program used for generating IP or subnet graphs is `/opt/andrisoft/bin/gengraph_ip`. Console users launch the program for each requested IP or subnet graph. If the Console server gets too loaded by `gengraph_ip`, execute “killall gengraph_ip” and configure RRDCacheD. When launched, the program does not stop until the graph is generated. The program can be slow when users request subnet graphs for subnets not specifically defined in the IP Zone. It is not possible to throttle the number of graphs requested by users.

AS and Country Graph Troubleshooting

- ✓ Ensure that all Sensors run correctly by verifying the event log and by viewing live statistics from Reports » Components » Overview. The troubleshooting guide for Packet Sensor is located on page 23, for Flow Sensor on page 26 and SNMP Sensor on page 31.
- ✓ To enable AS and Country graphs, set the Stats Generator parameter to either “Extended” for Flow Sensor, or “Full” for Packet Sensor.
- ✓ SNMP Sensor is not able to generate AS graphs or Country graphs.

Configuration » General Settings » Custom Decoders

Decoders represent internal functions that differentiate and classify the underlying protocols of each packet and flow. The predefined decoders are listed in the “Graphs & Storage” chapter on page 14. If you do not need to define custom decoders, you may safely skip this section.

To manage user-defined decoders go to Configuration » General Settings » Custom Decoders. Each custom decoder contains the following information:

- **Decoder Name** – A short name to help you identify the decoder. The field is mandatory.
- **Graph Color** – The color used in graphs for the decoder. The default color is a random one, which can be changed by entering a different HTML color code or by clicking the drop-down menu.
- **Decoder Description** – An optional short description of the decoder.
- **Packet Filtering Expression** – Enter a BPF filtering expression for packets if you intend to use a Packet Sensor and/or Packet Filter. Click the light bulb icon on the right to open a window that shows you the correct syntax. Examples:
 - To match TCP packets with the SYN flag set, enter *tcp[tcpflags] & tcp-syn!=0*
 - To match UDP packets with the destination port under 1024, enter *udp and dst portrange 1-1023*
- **Flow Filtering Expression** – Enter a filtering expression for flows if you intend to use a Flow Sensor and/or Flow Filter. Click the light bulb icon on the right to open a window that shows you the correct syntax. Examples:
 - To match TCP flows having only the SYN flag set, enter *flags S and not flags AFRPU*
 - To match flows with the MPLS label0 set to 2, enter *mpls label0=2*
- **FlowSpec Expression** – Enter a FlowSpec expression if you intend to use BGP Flowspec for traffic redirection or DDoS mitigation. Click the light bulb icon on the right to open a window that shows you the correct syntax.
- **Included Decoders** – Required if you plan to use the decoder for IP graphing. Select the decoders that include the matched traffic, or choose TOTAL if not sure.
- **Conflicting Decoders** – Required if you plan to use the decoder for IP graphing. Select the decoders that might match same traffic, but not always. The option is used only for displaying stacked decoders inside IP graphs.

Configuration » Network & Policy » IP Zone

IP Zones are hierarchical, tree-like data structures from which Sensor(s) extract per-subnet settings and learn the monitored network's boundaries.

You must add all your IP blocks to the IP Zone(s) listed in Configuration » Network & Policy. You can add prefixes (IP blocks/subnets/ranges) using the Console web interface, or from the CLI by executing the command “php /opt/andrisoft/api/cli_api.php” on the Console server.

To define a new IP Zone, go to Configuration » Network & Policy » <+> » IP Zone. You need more than one IP Zone only when you need different per-subnet settings for different Sensors. If this is the case, it may be easier to open an existing IP Zone that already contains your IP address ranges, and duplicate it by pressing the < **Duplicate** > button. A new IP Zone will be created with the same name and the word “(copy)” attached, containing the same prefixes and IP groups as the original.

The IP Zone Configuration window is divided into two vertical sections. The buttons that manage prefixes are located in the upper part of the left-hand section. When a new prefix is added, the tree below automatically updates itself. The right-hand section contains panels with user-provided settings for the selected prefix.

To enter IP addresses or IP blocks, you must use the CIDR notation. To enter individual hosts in IP Zones, you must use the /32 CIDR mask for IPv4, or /128 for IPv6. For more information about the CIDR notation, see Appendix 1 from page 59.

Every IP Zone contains at least the 0.0.0.0/0 network. Since the CIDR mask is /0, this “supernet” includes all IP addresses available for IPv4 and IPv6. For an easier configuration, every new prefix that you define inherits by default the properties of the closest (having the biggest CIDR) IP class that includes it.

The **IP Settings** panel in the right-hand section provides the following options:

- **IP Group** – This editable combo box should contain a short description of the selected prefix, or the name of the customer that uses it. Setting the same IP group for multiple prefixes allows you to generate aggregated traffic reports.
- **IP Graphing** – Set to “Yes” for the Sensor to generate graph data for every IP contained in the selected prefix. The **Graph IP Sweeps** option from Configuration » General Settings » Graphs & Storage can be used to prevent generating graph data for IPs that only receive traffic without sending any traffic in return. IP Graphing is always enabled for the subnets explicitly defined in the IP Zone. Do not enable on many/large subnets without a performance impact assessment.
- **IP Accounting** – Set to “Yes” for the Sensor to generate daily accounting data for each IP contained in the selected prefix. IP Accounting is always enabled for the subnets explicitly defined in the IP Zone. Do not enable on many/large subnets without a performance impact assessment.

The **Storage Requirements** column indicates the disk space needed to store the data generated by a single Packet Sensor or Flow Sensor interface. Enabling IP graphing and IP accounting for very large prefixes (e.g. 0.0.0.0/0) might generate (useless) data that can potentially overload the Console server.

The **Comments** panel allows you to write a comment for the selected prefix. It is not visible elsewhere.

Configuration » Servers

Any server running Sensor(s) must be listed under Configuration » Servers. The Console server is automatically added during installation.

To add a new server, click the <+> button from the title bar of the Configuration » Servers panel. To configure an existing server, go to Configuration » Servers and click its name.

The **Server Configuration** window contains the following fields:

- **Server Name** – A short name to help you identify the server.
- **Graph Color** – The color used in graphs for this server. The default color is a random one, which can be changed by entering a different HTML color code or by clicking the drop-down menu.
- **Reports Visibility** – Enable if Reports » Servers should contain icons of the components the server runs.
- **Device Group** – Optional description used within Console to group servers by location, role, etc.
- **Server ID** – Unique identifier of the server, used when exporting NFS shares.
- **IP Address** – The IP address of the server as defined during the WANsupervisor service installation. Can be public or private, IPv4 or IPv6.
- **Linux Distro** – The Linux distribution installed on the server.
- **Hardware Key** – Read-only string used for licensing purposes. The hardware key field is updated by the WANsupervisor service on installation or when the hardware, IP or hostname changes. When the string changes, ask sales@andrisoft.com to register your hardware key.
- **Monitored Network Interfaces (optional)** – The WANsupervisor service can monitor packets/s, bits/s, errors and dropped frames for each interface that exists on the server. The data is available in Reports » Servers » [Server] » Server Graphs » Data Units = Server Interfaces. These stats are provided by the OS.
- **Comments** – These observations are not visible elsewhere.

Server Troubleshooting

- ✓ For the server to be operational, make sure it always runs the WANsupervisor service and that its clock is synchronized with NTP. You can verify the operational status of each server and component in Reports » Components » Overview » Servers.
- ✓ The WANsupervisor service stops itself when the MySQL service running on the Console server is restarted or unavailable even for a short amount of time (e.g. networking issue). In this case, either restart WANsupervisor manually or use automated tools such as systemd, monitd or similar.
- ✓ You can discover performance-related issues by monitoring Reports » Server » [Server] » Server Graphs and Reports » Server » [Server] » Server Events.
- ✓ If the DB crashes (usually due to power failures) execute `/opt/andrisoft/bin/WANmaintenance repair_db`

Configuration » Components » Packet Sensor

In switched networks, only the packets for a specific device reach the device's network card. If the server running the **Packet Sensor** is not deployed in-line (in the main data path), a network TAP, or a switch/router that offers a “monitoring port” or “mirroring port” must be used. In this case, the network device sends copies of data packets traveling through selected ports or VLANs to the monitoring port. Packet Sensor inspects every packet it receives and conducts packet-based traffic analysis. The advantages and disadvantages of packet-based traffic monitoring are listed on page 6.

For instructions on how to configure switches or routers for port mirroring, consult their documentation.

To add a Packet Sensor, click the <+> button from the title bar of the Configuration » Components panel. To modify an existing Packet Sensor, go to Configuration » Components and click its name.

The **Packet Sensor Configuration** window contains the following fields:

- **Sensor Name** – A short name to help you identify the Packet Sensor.
- **Graph Color** – The color used in graphs for the Packet Sensor. The default color is a random one, which can be changed by entering a different HTML color code or by clicking the drop-down menu.
- **Reports Visibility** – If the Packet Sensor should be listed inside Reports » Components.
- **Device Group** – Optional description used within Console to group up components (e.g. by location or role). It can be used to restrict the access of Guest accounts.
- **Sensor Server** – The server that runs the Packet Sensor. The configuration of servers is described on page 19.
- **CPU Threads** – The Packet Sensor can run multi-threaded on a given set of CPU cores. Each thread increases the RAM usage. On most systems, activating more than 6 CPU threads hurts performance.
- **Sniffing Interface** – The network interface(s) listened by the Packet Sensor. If the server running the Packet Sensor is deployed in-line, then this field must contain the network interface that receives the traffic entering your network. The PF_RING framework allows listening to multiple physical interfaces simultaneously when the interfaces are entered separated by semicolon “;”.
- **Capture Engine** – Select the best packet capturing engine for your setup:
 - *Embedded LibPcap* – Select to use the built-in LibPcap 1.6.2 library.
 - *System LibPcap* – Select to use the LibPcap library installed by the Linux distribution.
 - *Myricom Sniffer10G* – Select when using a Myricom network adapter with a Sniffer 10G license. Click the button on the right for driver-specific settings.
 - *PF_RING* – Select to use the PF_RING 6.4 framework to speed up packet processing. Click the button on the right for PF_RING-specific settings.
 - *Netmap* – Select to use the Netmap framework to speed up packet processing.
- **Link Speed IN / OUT** – Enter the speed (bandwidth, capacity) of the monitored link. The values are used for percentage-based reports.

- **Sensor License** – The license used by the Packet Sensor. Vanguard provides all features; Wansight does not provide traffic anomaly detection and reaction.
- **Stats Generator** – Collects traffic tops and AS graphs:
 - *Basic* – Enables tops for Internal IPs, IP protocols, versions and TCP/UDP ports. It is the recommended value because it adds a very small performance penalty.
 - *Extended* – Enables all tops from *Basic* as well as tops for External IPs (IPs not included in the IP Zone). It adds performance penalty of over 20%, especially during spoofed attacks.
 - *Full* – Enables all tops from *Extended* as well as tops and graphs for autonomous systems. It adds a performance penalty of over 20%, especially during spoofed attacks.
- **Stats Generator Options** – When Stats Generator is set to Full you can click the button next to it. To enable Transit AS tops and graphs, enter the path to an existing **BGP Dump File** exported by BGPd in MTR format, and the IPv4 and optionally IPv6 address of the BGP router.
- **IP Zone** – Packet Sensor needs an IP Zone from which to learn about your network's boundaries and to extract per-subnet settings. IP Zones are described in the “IP Zone” chapter on page 18.
- **IP Validation** – This option is the frequently-used way to distinguish the direction of the packets:
 - *Off* – Packet Sensor analyzes all traffic and uses MAC Validation to identify the direction of traffic.
 - *On* – Packet Sensor analyzes the traffic that has the source and/or the destination IP in the selected IP Zone.
 - *Strict* – Packet Sensor analyzes the traffic that has either the source or the destination IP in the selected IP Zone.
 - *Exclusive* – Packet Sensor analyzes the traffic that has the destination IP in the selected IP Zone, but not the source IP.
- **MAC Validation/Address** – This option can be used to distinguish the direction of the packets or to ignore unwanted OSI Layer 2 traffic:
 - *None* – Packet Sensor analyzes all traffic and uses IP Validation to identify the direction of traffic.
 - *Upstream MAC* – MAC validation is active and the MAC Address belongs to the upstream router.
 - *Downstream MAC* – MAC validation is active and the MAC Address belongs to the downstream router.

The MAC Address must be written using the Linux convention – six groups of two hexadecimal values separated by colons (:).
- **BPF Expression** – You can filter the type of traffic the Packet Sensor receives using a tcpdump-style syntax.
- **Sampling (1/N)** – Must contain the packet sampling rate. On most systems, the correct value is 1.
- **Comments** – Comments about the Packet Sensor can be saved here. They are not visible elsewhere.

To start the Packet Sensor, click the small button displayed next to its name in Configuration » Components. Ensure that the Packet Sensor starts correctly by watching the event log (details on page 34).

If the Packet Sensor starts without errors, but you can't see any data collected by it in Reports » Components » Overview, follow the troubleshooting guide from page 23.

Packet Sensor Optimization Steps for Intel 82599

To distribute the packet-processing tasks of the Packet Sensor over multiple CPU cores when using an adapter with the Intel 82599 chipset (Intel X520, Intel X540, HP X560, etc.):

- ✓ Follow the documentation and optimization guides provided by the network adapter vendor.
- ✓ Install PF_RING 6.4 and switch to the PF_RING-aware ixgbe driver.
- ✓ See the number of RSS queues allocated by the ixgbe driver by executing `dmesg`, or by listing `/var/log/messages` or `/var/log/syslog`. By default, the number of RSS queues is equal to the number of CPU cores when hyperthreading is off, or double the number of CPU cores when hyper-threading is on. You can set the number of RSS queues manually, by loading `ixgbe.ko` with the `RSS=<number>` option.
- ✓ Enable multithreading in the Packet Sensor configuration or define multiple Packet Sensors, each listening to `ethX@queue_id` or `ethX@queue_range` and add them to a Sensor Cluster to have a unified reporting and anomaly detection domain. All Packet Sensors defined to listen to a single interface use a single Sensor license.

On a quad-core CPU with multithreading, the ixgbe driver allocates 8 RSS queues. In this case, if you define a Packet Sensor for `ethX@0-3` and another one for `ethX@4-7`, the packet-processing task will be distributed over 2 CPU cores. PF_RING exposes up to 32 RSS queues.

Packet Sensor Optimization Steps for Myricom

To distribute the packet-processing tasks of the Packet Sensor over multiple CPU cores with a Myricom adapter:

- ✓ Follow the documentation provided by Myricom to install Sniffer10G v2 or v3 (recommended).
- ✓ Start the driver with `/opt/snf/sbin/myri_start_stop start`
- ✓ Check that the driver is loaded successfully with `lsmod | grep myri_snf`. Check for errors in `syslog`.
- ✓ Define multiple Packet Sensors, one for each CPU core if needed.
- ✓ For each Packet Sensor, set the Capture Engine parameter to “Myricom Sniffer10G”, and click the <Capture Engine Options> button on the right. Set the **Packet Sensor Rings** parameter to the number of Packet Sensors listening to the interface. Sniffer10G v3 users must set two unique **App IDs** for Packet Sensors and Packet Tracers listening to the same interface to ensure that the traffic is directed to both applications.
- ✓ Stop all Packet Sensors before changing the **Capture Engine** parameter.
- ✓ Add the Packet Sensors to a Sensor Cluster to have a unified reporting and anomaly detection domain.

Packet Sensor Troubleshooting

- ✓ Look for warnings or errors produced by the Packet Sensor in the event log (details on page 34).
- ✓ Ensure that you have correctly configured the Packet Sensor. Each configuration field is described in depth in this chapter.
- ✓ The event log error “*License key not compatible with the existing server*” can be fixed by sending the string from Configuration » Servers » [Packet Sensor server] » Hardware Key to sales@andrisoft.com.
- ✓ Make sure that the sniffing interface is up:

```
ip link show <interface_usually_eth1_or_p1p2>
```
- ✓ Ensure that you have correctly configured the switch/TAP to send packets to the server on the configured interface.
- ✓ Verify whether the server is receiving packets through the configured interface:

```
tcpdump -i <interface_usually_eth1_or_p1p2> -n -c 100
```
- ✓ When **IP Validation** is not disabled, make sure that the selected IP Zone contains all your subnets.
- ✓ If the CPU usage of the Packet Sensor is too high, set the **Stats Generator** parameter to “Basic”, install PF_RING or Netmap to enable multi-threading, or use a network adapter that allows distributing Packet Sensors over multiple CPU cores.
- ✓ To troubleshoot Sensor graph or IP graph issues, follow the Graphs Troubleshooting guide from page 16.
- ✓ For PF_RING-related issues, contact ntop.org. To increase the maximum number of PF_RING programs from 64 to 256, increase the MAX_NUM_RING_SOCKETS defined in kernel/linux/pf_ring.h and recompile the pf_ring kernel module.
- ✓ Make sure you are running the latest version of the software.

Configuration » Components » Flow Sensor

Many routers and switches can collect IP traffic statistics and periodically export them as flow records to a **Flow Sensor**. Because the flow protocol already performs pre-aggregation of traffic data, the flow data sent to Flow Sensor is much smaller than the monitored traffic, and this makes the Flow Sensor a good option for monitoring remote or high-traffic networks. The advantages and disadvantages of flow-based monitoring are listed on page 6.

For detailed instructions on how to enable NetFlow, sFlow or IPFIX on your network device, consult its documentation. Appendix 2 from page 60 contains some examples on how to configure NetFlow on a few Cisco IOS, CatOS, and Juniper devices.

To add a Flow Sensor, click the <+> button from the title bar of the Configuration » Components panel. To modify an existing Flow Sensor, go to Configuration » Components and click its name.

The **Flow Sensor Configuration** window contains the following fields:

- **Sensor Name** – A short name to help you identify the Flow Sensor.
- **Device Group** – Optional description used within Console to group up components (e.g. by location or role). It can be used to restrict the access of Guest accounts.
- **Reports Visibility** – Enable if the Flow Sensor should be listed inside Reports » Components.
- **Sensor Server** – The server that runs the Flow Sensor. The configuration of servers is described on page 19.
- **Listener IP:Port** – The IP address (IPv4 or IPv6) of the network interface that receives flow packets, and the destination port.
- **Repeater IP:Port** – An embedded packet repeater can send all incoming flows to another flow collector or host. To use this optional feature enter the IP of the other flow collector and a port of your choice.
- **Flow Collector** – When enabled, all flow data is stored in a space-efficient binary format. Flow records can be queried in Reports » Tools » Flow Collectors.
- **Sensor License** – The license used by the Flow Sensor. Vanguard provides all features; Wansight does not provide traffic anomaly detection and reaction.
- **Flow Protocol** – The flow protocol used by the flow exporter: NetFlow, IPFIX or sFlow.
- **Flow Exporter IP** – The IP address of the flow exporter (router, switch, probe). Usually, it is the loopback address of the router. For sFlow exporters, enter the IP that sends flow packets, not the Agent IP.
- **SNMP Settings** – Click the button on the right of the Flow Exporter IP field. You must enable SNMP on the flow exporter to allow Console to automatically extract interface information. When SNMP settings are not configured, you must manually enter the SNMP index, speed, etc. for each interface.
- **Sampling (1/N)** – Enter the sampling rate configured on the flow exporter, or 1 when no sampling rate is configured. For NetFlow v9 and sFlow the value entered here is ignored because the flow protocol automatically adjusts the sampling rate. To force a particular sampling value, enter it as a negative value.
- **Flow Timeout (s)** – For flow exporters that maintain the start time of flows, such as Juniper MX routers,

set the same flow active/inactive timeout value as the one defined in the flow exporter's configuration. The value must be entered in seconds (s).

- **Time Settings** – The time offset between the time zone (TZ) of the Flow Sensor server and the flow exporter. Running NTP on both devices to keep their clocks synchronized is a critical requirement for Flow Sensor.
- **IP Zone** – Flow Sensor needs an IP Zone from which to learn the monitored network's boundaries and to extract per-subnet settings. For more information about IP Zones consult the “IP Zone” chapter on page 18.
- **Graphs Accuracy** – Low values increase the accuracy of Sensor graphs, at the expense of increasing the RAM usage. Setting this to under 20 seconds is not recommended.
- **IP Validation** – This option can be used to distinguish the direction of traffic or to ignore certain flows:
 - *Off* – Flow Sensor examines all flows and the traffic direction is established on interface level.
 - *On* – Flow Sensor examines the flows that have the source and/or the destination IP in the selected IP Zone.
 - *Strict* – Flow Sensor examines only the flows that have either the source or the destination IP in the IP Zone.
 - *Exclusive* – Flow Sensor examines only the flows that have the destination IP in the IP Zone, but not the source IP.
- **IP Validation Options** – Set the **Log Invalidated Flows** field to *Periodically* if you want to see in the event log the percentage of invalidated flows and 10 flows failing validation, once every 10 ticks.
- **AS Validation** – Flows from BGP-enabled routers can contain the source and destination Autonomous System number (ASN). In most configurations if the AS number is set to 0 the IP address belongs to your network. This rarely-used option is used for establishing traffic direction. AS validation has three choices:
 - *Off* – Disables AS validation.
 - *On* – Flow Sensor examines only the flows that have the source ASN and/or the destination ASN inside the local AS list (defined below).
 - *Strict* – Flow Sensor examines only the flows that have either the source ASN or the destination ASN inside the local AS list (defined below).
- **AS Validation Options** – When AS Validation is enabled, you can enter all your AS numbers (separated by space) into the **Local AS List** field. Set the **Log Invalidated Flows** field to *Periodically* if you want to see in the event log the percentage of invalidated flows and 10 flows failing validation, once every 10 ticks.
- **Monitored Network Interfaces** – The list of interfaces that should be monitored. To avoid producing duplicate flow entries, add only upstream interfaces. Settings per interface:
 - *SNMP Index* – The interfaces are identifiable only by their SNMP indexes. Enter the index manually, or configure the SNMP settings.
 - *Interface Name* – A short description used to identify the monitored interface. Descriptions longer than 10 characters clutter some reports.
 - *Graph Color* – The color used in graphs for the interface. The default color is a random one, which can be changed by entering a different HTML color code or by clicking the drop-down menu.

- *Traffic Direction* – The direction of traffic entering the interface, relative to your network:
 - “Auto” – Set to establish the direction of traffic by IP and/or AS Validation alone.
 - “Upstream” – Set for upstream interfaces, e.g. peering interfaces, interfaces connected to the Internet.
 - “Downstream” – Set for downstream interfaces, e.g. customer interfaces, interfaces connected to your network.
 - “Null” – Traffic to Null interfaces is discarded by the router and should be ignored.
- *Stats Generator* – Collects various traffic tops and AS (Autonomous System) data:
 - “Basic” – Enables tops for Internal IPs, IP protocols, versions and TCP/UDP ports. It adds a very small performance penalty.
 - “Extended” (recommended) – Enables all tops from “Basic” as well as tops and graphs for autonomous systems and countries, but increases the CPU usage by a few percentage points. When the router does not export AS information (e.g. non-BGP router) Flow Sensor uses an internal GeoIP database to obtain AS data. Live stats for autonomous systems and countries are not very accurate.
 - “Full” – Enables all tops from “Extended” as well as tops for external IPs (IPs not included in the IP Zone), but increases the RAM usage several times over, especially during spoofed attacks. Live stats for autonomous systems and countries are very accurate. Set the value to “Extended”, unless you know what you are doing.
- *Stats Generator Options* – When Stats Generator is “Extended” or “Full” you can click the button next to it. To enable Transit AS tops and graphs, enter the path to an existing BGP Dump File exported by BGPd in MTR format, and the IPv4 and optionally IPv6 address of the BGP router.
- *Link Speed In & Link Speed Out* – Enter the speed (bandwidth, capacity) of the interface. The values are used for percentage-based reports.
- **Comments** – Comments about the Flow Sensor can be saved here. These observations are not visible elsewhere.

To start the Flow Sensor, click the small button displayed next to its name in Configuration » Components. Ensure that the Flow Sensor starts correctly by watching the event log (details on page 34).

If the Flow Sensor starts without errors, but you can't see any data collected by it in Reports » Components » Overview after more than 5 minutes, follow the troubleshooting guide below.

Flow Sensor Troubleshooting

- ✓ Look for warnings or errors produced by the Flow Sensor in the event log (details on page 34).
- ✓ Check if you have correctly configured the Flow Sensor. Each configuration field is described in depth in the previous section.
- ✓ The event log error “*License key not compatible with the existing server*” can be fixed by sending the string from Configuration » Servers » [Flow Sensor server] » Hardware Key to sales@andrisoft.com.

- ✓ Ensure that the server is receiving flow packets on the configured **Listener IP:Port**:

```
tcpdump -i <interface_eth0_or_plp1_etc> -n -c 100 host <flow_exporter_ip> and udp
and port <destination_port>
```

- ✓ Make sure that the local firewall permits the Flow Sensor to receive flow packets:

```
iptables -L -n -v && iptables -t raw -L -n -v
```

- ✓ Ensure that the clocks of both devices are synchronized with NTP. When the devices do not reside in the same time zone, adjust the **Time Settings** parameter from the Flow Sensor configuration accordingly.
- ✓ The Flow Sensor may crash during spoofed attacks for not having enough RAM when a monitored interface has the *Stats Generator* parameter set to “Full”. It is highly recommended to set the **Stats Generator** parameter to “Extended” not to “Full” on systems with low amounts of RAM.
- ✓ When you add interfaces with the **Traffic Direction** parameter set to “Auto”, make sure that the IP Zone you have selected contains all your IP blocks because **IP Validation** and/or **AS Validation** will be used to establish traffic direction. To capture a sample of flows failing validation in the event log, set the **Log Invalidated Flows** parameter to “Periodically”.
- ✓ In order to provide fast and up-to-date traffic statistics, the Flow Sensor accepts only flows describing traffic from the last 5 minutes. All flows aged and exported with a delay exceeding 300 seconds (5 minutes) are ignored, and the event log contains the warning “*Received flow <starting/ending> <X> seconds ago*”.

When the warnings refer to the starting time, make sure that the clocks are synchronized, the flow exporter is properly configured, and the time zone and the **Flow Timeout** parameter are correctly set.

When the warnings refer to the ending time, make sure that the clocks are synchronized, the time zone is correctly set and the flow exporter is properly configured.

You can double-check whether the time of the Flow Sensor and the start/end time of flows differ by more than 300 seconds. In Reports » Tools » Flow Collectors » Flow Records, select the Flow Sensor, set Output to Debug and generate a listing for the last 5 minutes:

- The `Date_flow_received` column indicates the time when the Flow Sensor received the flow packet
- The `Date_first_seen` column indicates the time when the flow started
- The `Date_last_seen` column indicates the time when the flow ended

The Flow Sensor does not misinterpret the start/end time of flows. A few flow exporters are known to have bugs, limitations or inconsistencies regarding flow aging and stamping flow packets with the correct time. In this case, contact your vendor to make sure that the flow exporter is correctly configured, and it is able to expire flows in under 5 minutes. Try a router reboot if possible.

In JunOS there is a flow export rate limit with a default of 1k pps, which leads to flow aging errors. To raise the limit to 40k pps execute:

```
set forwarding-options sampling instance NETFLOW family inet output inline-jflow
flow-export-rate 40
```

Some Cisco IOS XE devices do not export flows using NetFlow version 5, in under 5 minutes, even when configured to do so. In this case, switch to using Flexible NetFlow.

- ✓ Ensure that you have correctly configured the flow exporter to send flows to the server for each of the monitored interfaces. To list all interfaces that send flows, go to Reports » Tools » Flow Collectors » Flow Tops, select the Flow Sensor, set Output to Debug, set Top Type to Any Interface and generate the top for the last 10 minutes. The `In/Out_if` column shows the SNMP index of every interface that exports

flows, whether or not it was configured as a monitored interface in the Flow Sensor configuration.

- ✓ If you see statistics for only one traffic direction (inbound or outbound), go to Reports » Tools » Flow Collectors » Flow Records, and generate a listing for the last 10 minutes. If all your IPs are listed in a single column, check the flow exporter's configuration and feature list. Not all devices can export flows in both directions (e.g. some Brocade equipment generates only inbound sFlow) or with the same interface SNMP index.
- ✓ The traffic readings of the Flow Sensor may differ from the SNMP Sensor or from other SNMP-based monitoring tools. Flow Sensor counts In/Out traffic as traffic entering/exiting the IP Zone (when **IP Validation** is enabled), unlike SNMP tools that count In/Out traffic as traffic entering/exiting the interface. You can double-check the traffic readings of a Flow Sensor by configuring an SNMP Sensor that monitors the same flow exporter (page 29).
- ✓ If the Flow Sensor does not show the correct statistics after upgrading the router's firmware, the SNMP index of the interfaces may have changed. In this case, enter the new SNMP index for each monitored interface.
- ✓ To troubleshoot Sensor graph or IP graph issues, follow the Graphs Troubleshooting guide from page 16.
- ✓ Make sure you are running the latest version of the software.

Configuration » Components » SNMP Sensor

SNMP Sensor monitors the bandwidth usage of routers and switches on a port-by-port basis. SNMP Sensor queries devices (e.g. routers, switches, servers) for the traffic counters of each port with small data packets. These are triggering reply packets from the device. The advantages and disadvantages of monitoring traffic by SNMP are listed on page 6.

For detailed instructions on how to enable SNMP on your network device, consult its documentation.

To add an SNMP Sensor click the <+> button from the title bar of the Configuration » Components panel. To modify an existing SNMP Sensor, go to Configuration » Components and click its name.

The **SNMP Sensor Configuration** window contains the following fields:

- **Sensor Name** – A short name to help you identify the SNMP Sensor.
- **Device Group** – Optional description used within Console to group up components (e.g. by location or role). It can be used to restrict the access of Guest accounts.
- **Reports Visibility** – Enable if the SNMP Sensor should be listed inside Reports » Components.
- **Sensor Server** – The server that runs the SNMP Sensor. It is recommended to run all SNMP Sensors on the Console server. The configuration of servers is described on page 19.
- **Polling Interval** – Polling is the process of sending the SNMP request periodically to the device to retrieve information. A low polling interval (of say 1 minute) gives you granular reports but may place an increased load on your server if you poll a large number of interfaces.
- **Sensor License** – The license used by the SNMP Sensor. Vanguard provides all features (although severely limited by the SNMP technology); Wansight does not provide traffic anomaly detection and reaction.
- **IP Zone** – When a Vanguard license is being used, the SNMP Sensor can check thresholds listed in the selected IP Zone with the following restrictions (because SNMP does not provide any information about IPs or protocols):
 - Subnet must be “0.0.0.0/0”.
 - Domain must be “subnet”.
 - Value must be absolute, not percentage.
 - Decoder must be “TOTAL”.
- **Device IP:Port** – Enter the IP address and SNMP port of the networking device. The standard SNMP port is 161.
- **Timeout (ms)** – The timeout value should be at least a little more than double the time it takes for a packet to travel the longest route between devices on your network. The default value is 1000 milliseconds (1 second).
- **Retries** – This value represents the number of times the SNMP Sensor retries a failed SNMP request defined as any SNMP request that does not receive a response within the Timeout (ms) defined above.

The default value is 2.

- **Discovery** – Activates or deactivates interface discovery:
 - *Monitor all interfaces* – Select to add all interfaces automatically to the SNMP Sensor. The interface names are based on the **Interface Name** setting available when pressing the **<OIDs and Tester>** button.
 - *Monitor defined interfaces* – Select to monitor only interfaces listed in the SNMP Sensor configuration.
- **Authentication Protocol** – Select the SNMP protocol used for authentication:
 - *SNMP v1* – The oldest version. Easy to set up – only requires a plaintext community. The biggest downsides are that it does not support 64-bit counters, only 32-bit counters and that it has little security.
 - *SNMP v2c* – Version 2c is identical to version 1, except it adds support for 64-bit counters. This is imperative when monitoring gigabit interfaces. Even a 1Gbps interface can wrap a 32-bit counter in 34 seconds, which means that a 32-bit counter being polled at one-minute intervals is useless. Select this option instead of v1 in most cases.
 - *SNMP v3* – Adds security to the 64-bit counters. SNMP version 3 adds both encryption and authentication, which can be used together or separately. Setup is much more complex than just defining a community string.
- **Community String** – SNMP v1 and v2c credentials serve as a type of password that is authenticated by confirming a match between the string provided here and the SNMP Community String stored as a MIB object on an SNMP-enabled, managed device.
- **Security Level & Name** – SNMP v3-only. SNMP Sensor supports the following set of security levels as defined in the USM MIB (RFC 2574):
 - *noAuthnoPriv* – Communication without authentication and privacy.
 - *authNoPriv* – Communication with authentication and without privacy.
 - *authPriv* – Communication with authentication and privacy.
- **Authentication Protocol & Passphrase** – SNMP v3-only. The protocols used for Authentication are *MD5* and *SHA* (Secure Hash Algorithm).
- **Privacy Protocol & Passphrase** – SNMP v3-only. An indication of whether messages sent on behalf of this user can be protected from disclosure, and if so, the type of privacy protocol which is used. This option takes the value *DES* (CBC-DES Symmetric Encryption) or *AES* (Advanced Encryption Standard).
- **Monitored Network Interfaces** – The interfaces that should be monitored. To avoid mirrored graphs, add only upstream interfaces. Settings per interface:
 - *SNMP Index* – The interfaces are identifiable by their unique indexes.
 - *Interface Name* – A short description used to identify the monitored interface. Descriptions longer than 10 characters clutter some reports. By default, the auto-filled interface name is retrieved from the ifAlias OID. To change the OID used for the interface name click the **<OIDs and Tester>** button.
 - *Graph Color* – The color used in graphs for the interface. The default color is a random one, which can be changed by entering a different HTML color code or by clicking the drop-down menu.
 - *Traffic Direction* – The direction of the traffic entering the interface, from the user's perspective:

- “Unset” – Traffic entering the interface is considered “downstream”; traffic exiting the interface is considered “upstream”.
- “Upstream” – Set for upstream interfaces, e.g. peering interfaces, interfaces connected to the Internet.
- “Downstream” – Set for downstream interfaces, e.g. customer interfaces, interfaces connected to your network.
- “Null” – Traffic to Null interfaces is ignored.
- *Link Speed In & Link Speed Out* – Enter the speed (bandwidth, capacity) of the interface. The values are used for percentage-based reports.
- **Comments** – Comments about the SNMP Sensor can be saved here. These observations are not visible elsewhere.

To start the SNMP Sensor, click the small button displayed next to its name in Configuration » Components. Ensure that the SNMP Sensor starts correctly by watching the event log (details on page 34).

If the SNMP Sensor starts without errors, but you cannot see any data collected by it in Reports » Components » Overview after more than 5 minutes, follow the troubleshooting guide below.

SNMP Sensor Troubleshooting

- ✓ Look for warnings or errors produced by the SNMP Sensor in the event log (details on page 34).
- ✓ Ensure that you have correctly configured the SNMP Sensor. Each configuration field is described in depth in this chapter.
- ✓ The event log error “*License key not compatible with the existing server*” can be fixed by sending the string from Configuration » Servers » [SNMP Sensor server] » Hardware Key to sales@andrisoft.com.
- ✓ Verify if the Console can reach the device by clicking the <OIDs and Tests> button from the SNMP Sensor Configuration window, then press <Query Device>.
- ✓ Permit the server to contact the SNMP device, by configuring its ACL.
- ✓ If Sensor graphs are very spiky, increase the Polling Interval value.
- ✓ Make sure you are running the latest version of the software.

Configuration » Components » Sensor Cluster

Sensor Cluster aggregates traffic data provided by Packet Sensors and Flow Sensors into a single IP graphing domain.

To add a Sensor Cluster, click the <+> button found on the title bar of the Configuration » Components panel. To configure an existing Sensor Cluster, go to Configuration » Components, and click its name.

The **Sensor Cluster Configuration** window contains the following fields:

- **Sensor Name** – A short name to help you identify the Sensor Cluster.
- **Graph Color** – The color used in graphs for the Sensor Cluster. The default color is a random one, which can be changed by entering a different HTML color code or by clicking the drop-down menu.
- **Reports Visibility** – Enable if the Sensor Cluster should be listed inside Reports » Components.
- **Device Group** – Optional description used within Console to group up components (e.g. by location or role). It can be used to restrict the access of Guest accounts.
- **Sensor Server** – The server that runs the Sensor Cluster. It is recommended to run Sensor Clusters on the Console server. The configuration of servers is described on page 19.
- **Link Speed IN / OUT** – The summed-up speeds (bandwidth, capacity) of the aggregated interfaces. The values are used for percentage-based reports.
- **Associated Sensors** – Select which Packet Sensors and Flow Sensor interfaces must be aggregated by the Sensor Cluster.
- **IP Zone** – Sensor Cluster extracts from the selected IP Zone per-subnet settings about thresholds and/or IP graphing. For more information about IP Zones consult the “IP Zone” chapter on page 18.
- **IP Graphing** – Select “Aggregated” to enable IP graphing by the Sensor Cluster for the summed up traffic data, and disable IP graphing by the associated Sensors. Select “Not Aggregated” to enable IP graphing by each associated Sensor and to disable IP graphing by the Sensor Cluster.
- **Comments** – Comments about the Sensor Cluster can be saved here. These observations are not visible elsewhere.

To start the Sensor Cluster, click the small button displayed next to its name in Configuration » Components.

Ensure that the Sensor Cluster starts correctly by watching the event log (details on page 34) and by monitoring Reports » Components » Overview.

Configuration » Schedulers » Scheduled Reports

One of the greatest strengths of the Console is the ease in which it can generate complex Reports. Most reports created by clicking items from the Reports Region can be printed, exported as PDFs or sent by email.

If you want to receive periodic reports by email without having to log in to Console, go to Configuration » Schedulers and click the <+> button from the title bar of the panel.

You can include more than one email address in the **Email To** field by separating addresses with a comma.

The emails are sent periodically according to the settings in the **Scheduler** tab.

To see how the email would look like without waiting for the preconfigured time, enter your email address, and then click the <**Save & Execute Now**> button. You should receive the email containing the report within a few seconds. If you do not, verify the settings from Configuration » General Settings » Outgoing Email.

All emails are formatted as HTML messages and include MIME attachments.

Configuration » Schedulers » Event Reporting

Events are short text messages that describe the change of an operational status. They are generated by Wansight components and logged by Console.

You can list events in Reports » Components » [Component Name] » [Component Type] Event sub-tab. To search, sort or filter event messages, click the small down arrow that appears when hovering over the Event column header. To see additional details about an event click the <+> button from the first column.

To see a recent list of **Latest Events**, click the small bottom edge of the window to raise the South Region or press Ctrl+E. On one side the Latest Events tab displays the latest 60 events, while on the other side it shows a list of components that can generate events and the number of events generated in the last 24 hours by each component. The number's color indicates the maximum severity of the events: red means that there are ERRORS, blue is for INFO events, etc.

The event's **severity** indicates its importance:

- **MELTDOWN** – Meltdown events are generated in severe situations, such as hardware failures.
- **CRITICAL** – Critical events are generated when significant software errors occur, such as a memory exhaustion situation.
- **ERROR** – Error events are usually caused by misconfigurations, communication errors between components, or bugs. Sensors auto-recover from errors by restarting themselves.
- **WARNING** – Warning events are generated when authentication errors occur, on I/O bottlenecks or when there are time synchronization issues.
- **INFO** – Informational events are generated when configurations are changed or when users log in to Console.
- **DEBUG** – Debug events are generated to help troubleshooting coding errors.

As an administrator, you should keep events with high severities under surveillance! Configure Console to send important events periodically by email, Syslog or SNMP in Configuration » Schedulers » Event Reporting.

To send events by SNMP, fill the **SNMP Host**, **Community**, and **SNMP OID** fields.

Configuration » General Settings » Outgoing Email

Console sends notification emails using the settings from Configuration » General Settings » Outgoing Email.

Email configuration options:

- **From Email** – The email address you would like to appear as the sender.
- **From Name** – The name as you would like it to appear on messages.
- **Mailer** – Console supports several mailing systems:
 - *PHP Mail* – Use the PHP mail() function. To use it, you may have to configure a Mail Transfer Agent (Postfix, Qmail, Sendmail) on the Console server.
 - *SMTP* – Use the integrated SMTP support to send emails directly, without using a local Mail Transfer Agent.
 - *Sendmail* – Send emails using the sendmail command. To use it, you may have to configure a Mail Transfer Agent (Postfix, Qmail, Sendmail) on the Console server.
- **SMTP Security** – Security options:
 - *None* – No encryption.
 - *SSL* – Enable SSL encryption.
 - *TLS* – Enable TLS encryption.
- **SMTP Host** – Specify the SMTP server(s). You can include backup SMTP server(s) separated by the “;” character.
- **SMTP Port** – TCP port to connect to, usually 25 (insecure) or 587 (secure, uses SSL/TLS).
- **SMTP Login/Password** – Credentials used for SMTP authentication. When the fields are empty, no authentication is performed.
- **Email Tester** – Send a test email to verify the settings.

If you can send emails through the Email Tester, but you are not receiving emails from a Response action, verify if you have added the `ixed` line from the installation instructions to `/etc/php5/cli/php.ini`.

Configuration » General Settings » User Management

To add, modify or delete Console user accounts click Configuration » General Settings » User Management.

Each Console user must be assigned to one role (access level):

- **Administrator** – Has full privileges. Can manage other user accounts. Is the only role allowed to access Configuration » General Settings » License Manager.
- **Operator** – Can change any configuration but is not authorized to modify user accounts.
- **Guest** – Has read-only access to Console, without access to any configuration. Can have a granular, permission-based access to specific reports, dashboards, Sensors, IP groups, tools, etc.

To add a Console account, press <**Add User**> and then select the desired role. You can modify an account by double-clicking it, or by selecting it and by pressing the <**Modify User**> button.

The **Active** checkbox enables or disables the selected account.

There are two **Authentication** options:

- **Local Password** – The user is authenticated with the password entered in the **Password** field. All passwords are stored encrypted.
- **Remote Authentication** – The user is authenticated by remote LDAP or RADIUS servers configured in Configuration » General Settings » User Management (details on page 37).

The **Full Name**, **Company**, **Position**, **Email**, **Phone** and **Comments** fields are optional. These details are not used anywhere else.

Landing Tab shows the tab that opens immediately after logging in. The list is dynamic and expands as you add Sensors, dashboards, IP groups, etc. Set the Landing Tab to a relevant dashboard or report.

Minimum Severity shows the minimum severity level of events displayed in Console.

Reports Region lets you switch the position of the Reports Region (described on page 13) to east or west.

Configuration Region lets you switch the position of the Configuration Region (described on page 13) to east or west.

Console Theme allows you to change how Console looks after re-login. The most popular themes are the corporate “Gray” and the futuristic/industrial “Azenis”.

Configuration » General Settings » User Authentication

To configure remote authentication mechanisms and login window settings click Configuration » General Settings » User Authentication.

Persistent Sessions enable cookie-based authentication for Console users that select the *Remember* option in the login screen. Subsequent sessions skip the login screen for the next 30 days or until the user logs off.

Authentication Mode enables or disables the authentication of Console users that are not defined in Configuration » General Settings » User Management but defined in LDAP or Radius.

Console permits the use of external Radius and LDAP servers for end user authentication.

LDAP server settings:

- **Priority** – You can set the order in which Console connects to multiple authentication services. The authentication process stops after the first successful authentication.
- **Template User** – Remotely authenticated users without a Console account have the privileges of the Template User.
- **LDAP Host** – IP or hostname of the LDAP server. To connect to an LDAP server by SSL, set this parameter as *ldaps://<IP>/*.
- **Login Attribute** – Enter the LDAP attribute that contains the username. For Active Directory it may be *mailNickname* or *sAMAccountName*, for OpenLDAP or IBM Directory Server it may be *uid*.
- **LDAP Base DN** – Specify the location in the LDAP hierarchy where Console should begin searching for usernames for authorization requests. The base DN may be something equivalent to the organization, group, or domain name (AD) of the external directory: *dc=domain,dc=com*.
- **Bind User DN/Password** – Distinguished name and password for a LDAP user permitted to search within the defined Base DN.
- **Search Filter** – Can contain rules that restrict which users are authenticated using the current configuration. For example, the string `"|(department=*NOC*)(department=ISP)"` only allows users from departments containing the string "NOC" or (|) from the "ISP" department to authenticate in Console.

RADIUS server settings:

- **Priority** – You can set the order in which Console connects to multiple authentication services. The authentication process stops after the first successful authentication.
- **Template User** – Remotely authenticated users without a Console account have the privileges of the Template User.
- **RADIUS Host** – IP or hostname of the Radius server.
- **RADIUS Port** – Port through which the Radius server is listening for authentication requests.

- **RADIUS Protocol** – Protocol used for authentication purposes:
 - **PAP** (Password Authentication Protocol) – provides a simple method for the peer to establish its identity using a 2-way handshake
 - **CHAP** (Challenge-Handshake Authentication Protocol) – authenticates a user or network host to an authentication entity
 - **MSCHAP** – is the Microsoft version of the Challenge-handshake authentication protocol, CHAP
 - **MSCHAP2** – is another version of Microsoft version of the Challenge-handshake authentication protocol, CHAP
- **RADIUS Secret** – Enter the credentials for connecting to the Radius server.

The contents of the **Login Window Notification** field is shown inside the Console login window.

The contents of the **Successful Window Notification** field is shown inside the Console window after logging in.

Reports » Tools

Reports » Tools contains links to the **Flow Collectors** and **Packet Tracers** tabs.

Reports » Tools » Flow Collectors

Reports » Tools contains a link to **Flow Collectors** if there is at least one Flow Sensor in use. The number of active Flow Collectors is displayed within the panel.

Here you can list, aggregate, filter and sort flow records, and generate traffic tops and statistics.

There are 2 sub-tabs, located at the left lower side of the window:

Flow Records

You can list and filter flow data. The options are:

- **Flow Sensors** – Select the interfaces you are interested in. Administrators can restrict the interfaces accessible by guest accounts.
- **Time Frame** – Select a predefined time frame, or select “Custom...” to enter a specific time interval, in order to list flows that started or ended inside the interval. Time zone differences between the Console server and remote Flow Sensor servers are not automatically adjusted.
- **Flow Filtering Expression** – Here you can enter a filtering expression for flows. Click the light bulb icon on the right to open a window that shows you the correct syntax. Frequently-used flow filters can be saved there and reused at a later time.
- **Output** – You can select several output formats, or you can type your own format. Click the light bulb icon on the left to open a window that shows you the correct syntax.
- **Export** – If the output is not very large, it can be viewed, emailed or printed.

If you need to list huge amounts of flow data, doing it solely from within the web browser may not be a good idea. In this case, select the “Dump” option to view the CLI command used for flow listing. You can execute that CLI command from the shell and forward the output to a file.

- **Aggregation** – By default, flows are not aggregated. By clicking on the appropriate checkboxes, you can select how to aggregate flows. You can aggregate entire subnets by selecting `src(dst)IPv4(IPv6)/<subnet bits>`.
- **Limit Flows** – List only the first N flows of the selected time slot.
- **Sorting** – When listing flows sent by different interfaces, you can sort them according to the start time of the flows. Otherwise, flows are listed in the sequence of the selected interfaces.

Flow Tops

You can generate tops from flow data. The options are:

- **Flow Sensors** – Select the interfaces you are interested in. Administrators can restrict the interfaces accessible by guest accounts.
- **Time Frame** – Select a predefined time frame, or select “Custom...” to enter a specific time interval, in order to count only flows that started or ended inside the interval. Time zone differences between the Console server and remote Flow Sensor servers are not automatically adjusted.
- **Flow Filtering Expression** – Here you can enter a filtering expression for flows. Click the light bulb icon on the right to open a window that shows you the correct syntax. Frequently-used flow filters can be saved there and reused at a later time.
- **Output** – You can select several output formats, or you can type your own format. Click the light bulb icon on the left to open a window that shows you the correct syntax.
- **Export** – If the output is not very large, it can be emailed or printed.

If you need to list huge amounts of flow data, doing so solely from within the web browser may not be a good idea. In this case, select the “Dump” option to view the CLI command used to list the top. You can execute that CLI command from the shell and forward the output to a text file.

- **Top Type** – Select the top type from the drop-down menu.
- **Aggregation** – By default, flows are not aggregated. By clicking on the appropriate checkboxes, you can select how to aggregate flows. You can aggregate entire subnets by selecting `src(dst)IPv4(IPv6)/<subnet bits>`.
- **Limit** – Limit the output to only those records whose packets or bytes match the specified condition.
- **Top** – Limit the top listing to the first N records.

Reports » Tools » Packet Tracers

Reports » Tools contains a link to **Packet Tracers** when there is at least one Packet Sensor in use. The number of active packet traces is displayed within the panel.

Here you can easily capture packets from various parts of your network using distributed Packet Sensors. You can view the contents of packets directly from Console using an integrated packet analyzer user interface that resembles the popular WireShark software.

There are 2 sub-tabs located at the lower left side of the window:

Active Packet Traces

Administrators, operators, and guests with packet capturing privileges can generate packet dumps by clicking the **<Capture Packets>** button. The options are:

- **Description** – An optional short description to help you identify the packet trace.
- **Packet Sensor** – Select which Packet Sensors can capture the traffic you are interested in. Administrators can restrict which Packet Sensors are accessible by guest accounts.
- **BPF Expression** – Click the light bulb icon on the right to open a window that explains the Berkley Packet Filter (BPF) syntax. Frequently used BPF expressions can be saved there and reused at a later time. Entering a BPF expression is mandatory. To capture all IP traffic enter “ip”.
- **Max. Running Time** – The maximum running time of the capturing thread (process).
- **Stop Capture Time** – When Max. Running Time is set to “Unlimited”, you can set the exact date when the capturing thread will stop.
- **Max. File Size (MB)** – The option is used for splitting packet dumps into multiple files of <number> Mbytes. Before writing a raw packet to a file, the Packet Sensor checks whether the file is currently larger than <number> and, if so, closes the current file and opens a new one.
- **Max. Packets** – The capture stops after receiving <number> packets.
- **Max. Files Number** – Setting this will limit the number of files created for the specified <number>, and begin overwriting files from the beginning, thus creating a “rotating” buffer. In addition, it will name the files with enough leading 0s to support the maximum number of files, allowing them to sort correctly.
- **Time Rotation (s)** – If specified, this rotates the file every <number> seconds.
- **Sampling Type & Value** – Select “None” when no packet sampling is required. Select “1 / Value” to save just one packet every <value> packets. Select “Value / 5s” to save maximum <value> packets every 5 seconds.
- **Filename Prefix** – The name of the capture file. If any file-rotation options are used, a number will be appended to the filename.
- **Snapshot (bytes/pkt)** – Snarf <number> bytes of data from each packet rather than the default of 65535 bytes. Note that taking larger snapshots both increases the amount of time it takes to process packets and, effectively, decreases the amount of packet buffering. This may cause packets to be lost. You should limit this <number> to the smallest number that will capture the protocol information you are

interested in.

- **Comments** – This field may contain comments about the packet trace.

All active Packet Traces are listed in a table having the following format:

- **Description [BPF]** – The description and BPF expression of the trace.
- **Sampling** – The type of sampling being used.
- **From** – The date when the Packet Tracer started capturing packets.
- **Until** – The time or the conditions that will cause the Packet Tracer to stop capturing the traffic.
- **Status** – Indicates the status of the Packet Tracer. It is green if it is running, and red if it is not.
- **Packet Tracer** – The Packet Sensor or the Packet Filter used for capturing packets.
- **Files / Size** – The number of dump files generated and the size of the latest dump file.
- **Packets** – The number of packets captured.
- **Actions** – Click the first icon to view the latest dump file in an integrated packet analyzer interface. Click the second icon to download the latest dump file to your computer. If downloading does not work, but viewing does, increase the values of the *max_execution_time* and *memory_limit* from php.ini. Click the third icon to stop capturing packets.

Packet Trace Archive

By default, packet traces are sorted by time in descending order. By clicking the down arrow of any column header, you can apply row filters, change sorting direction and toggle the visibility of columns.

The <+> sign from the first column expands each row for additional information about the packet trace and provides access to packet dump files. The columns are explained in the previous section.

Reports » Components

Reports » Components contains links to the **Overview**, **Device Group** and **Sensor** tabs.

The Overview tab provides a real-time view on the status of all active Wansight components and servers. The Device Group tab provides a real-time view of the Sensor(s) assigned to the selected device group. The Sensor tab provides data specific to the selected Sensor. Administrators can restrict which device groups and Sensors are accessible by guest accounts.

Reports » Components » Overview

It shows a few self-refreshing tables that display real-time system parameters collected from all active Wansight components and servers:

Console

The table displays the following data:

Status	A green check mark indicates that Console is functioning properly. When a red "X" appears, enable the WANsupervisor service on the Console server.
Online Users	Active Console sessions.
Avg. DB Bits/s (In/Out)	The average number of bits/s sent and received since the start of the Console database.
Avg. DB Queries/s	The average number of queries per second since the start of the Console database.
DB Clients	DB clients that are currently using the Console database.
DB Connections	Active connections to the Console database.
DB Size	Disk space used by the Console database.
Free DB Disk	Disk space available on the partition configured to store the Console database.
Free Graphs Disk	Disk space available on the partition configured to store IP graphs.
Time Zone	The time zone of the Console server.
Console Time	Time on the Console server.
Uptime	Uptime of the Console database.

Servers

The table displays the following data for each server that runs software components of Wansight:

Status	A green check mark indicates that the server is connected to Console. When a red “X” is displayed, start the WANsupervisor service and make sure that the clocks are synchronized between the server and the Console server.
Server Name	Displays the name of the server and a colored square with the color defined in its configuration. Click to open a new tab with data specific to the server. Administrators and operators can right-click to open the Server Configuration window.
Load	Load average reported by the Linux kernel for the last 5 minutes.
Free RAM	Available RAM. Swap memory is not counted.
CPU% User	Percentage of CPU resources used by the user space processes. Can be >100% on multiple cores/CPUs (e.g. the maximum value for a quad-core system is 400%).
CPU% System	Percentage of CPU resources used by the kernel. Can be >100% on multiple cores/CPUs (e.g. the maximum value for a quad-core system is 400%).
CPU% IOWait	Percentage of CPU resources waiting for I/O operations. A high number indicates an I/O bottleneck.
CPU% Idle	Percentage of idle CPU resources. Can be >100% on multiple cores/CPUs (e.g. the maximum value for a quad-core system is 400%).
Free Flows Disk	Disk space available on the partition that is configured to store flows.
Free Dumps Disk	Disk space available on the partition that is configured to store packet dumps.
Contexts/IRQs/SoftIRQs	Context switches, hardware interrupts and software interrupts per second.
Uptime	Uptime of the operating system.

Sensor Clusters

The table is displayed while there is at least one active Sensor Cluster.

Status	A green check mark indicates that the Sensor Cluster is connected to Console. If you see a red “X” instead, make sure that the WANsupervisor service is running and look for errors in the event log (see page 34).
Sensor Name	Displays the name of the Sensor Cluster and a colored square with the color defined in its configuration. Click to open a new tab with data specific to the Sensor Cluster. Administrators and operators can right-click to open the Sensor Cluster configuration window.
Pkts/s (In / Out)	Inbound and outbound packets/second throughput.

Inbound Bits/s	Inbound bits/second throughput and the usage percent.
Outbound Bits/s	Outbound bits/second throughput and the usage percent.
Received Pkts/s	Packet/s reported by the associated Sensors.
IPs (Int.)	IP addresses (from to the IP Zone) that send or receive traffic.
Dropped	Packets dropped by the Server Cluster.
CPU%	Percentage of CPUs used by the Sensor Cluster process.
RAM	The amount of memory utilized by the Sensor Cluster process.
Start Time	The time when the Sensor Cluster instance started.
Server	Which server runs the Sensor Cluster. Click to open a new tab with data specific to the server. Administrators and operators can right-click to open the Server Configuration window.

Packet Sensors

The table is displayed while there is at least one active Packet Sensor.

Status	A green check mark indicates that the Packet Sensor is connected to Console. If you see a red "X" instead, make sure that the WANsupervisor service is running and look for errors in the event log (see page 34).
Sensor Name	Displays the name of the Packet Sensor and a colored square with the color defined in its configuration. Click to open a new tab with data specific to the Packet Sensor. Administrators and operators can right-click to open the Packet Sensor Configuration window.
Pkts/s (In / Out)	Inbound and outbound packets/second throughput after IP or MAC validation.
Inbound Bits/s	Inbound bits/second throughput after IP or MAC validation and the usage percent.
Outbound Bits/s	Outbound bits/second throughput after IP or MAC validation and the usage percent.
Received Pkts/s	The rate of sniffed packets before IP or MAC validation.
IPs (Int / Ext)	IP addresses that sent or received traffic. The Int(ernal)/Ext(ernal) IPs are the IPs inside/outside the IP Zone. The Stats Generator parameter from the Sensor configuration enables or disables the monitoring of external IPs.
Dropped	Packets dropped by the packet capturing engine. A high number usually indicates a sniffing performance problem.
CPU%	Percentage of CPUs used by the Packet Sensor process.
RAM	The amount of memory used by the Packet Sensor process.
Start Time	The time when the Packet Sensor started.

Server	Which server runs the Packet Sensor. Click to open a new tab with data specific to the server. Administrators and operators can right-click to open the Server Configuration window.

Flow Sensors

The table is displayed while there is at least one active Flow Sensor.

Status	A green check mark indicates that the Flow Sensor is connected to Console. If you see a red "X" instead, make sure that the WANsupervisor service is running and look for errors in the event log (see page 34).
Sensor Name	Displays the name of the Flow Sensor. Click to open a new tab with data specific to the Flow Sensor. Administrators and operators can right-click to open the Flow Sensor Configuration window.
Interface	The interface name and a colored square with the configured graph color. If the interface names are missing for more than 5 minutes after the Flow Sensor has started, check the troubleshooting guide from page 26.
Pkts/s (In / Out)	Inbound and outbound packets/second throughput after IP or AS validation.
Inbound Bits/s	Inbound bits/second throughput after IP or AS validation and usage percent.
Outbound Bits/s	Outbound bits/second throughput after IP or AS validation and usage percent.
IPs (Int / Ext)	IP addresses that send or receive traffic. The Int(ernal)/Ext(ernal) IPs are the IPs inside/outside the IP Zone. The Stats Generator parameter from the Sensor configuration enables or disables the monitoring of external IPs.
Flows/s	Flows per second received by the Flow Sensor.
Flows Delay	Because traffic data must be aggregated first, flow devices export flows with a configured delay. Some devices export flows much later than the configured delay and this field contains the maximum flows delay detected by the Flow Sensor. Flow Sensor cannot run with flow delays of over 5 minutes.
Dropped	Unaccounted flows. A high number indicates a performance problem of the Flow Sensor or a network connectivity issue with the flow exporter.
CPU%	Percentage of CPU resources used by the Flow Sensor process.
RAM	The amount of RAM used by the Flow Sensor process.
Start Time	The time when the Flow Sensor started.
Server	Which server runs the Flow Sensor. Click it to open a new tab with data specific to the server. Administrators and operators can right-click to open the Server Configuration window.

SNMP Sensors

The table is displayed while there is at least one active SNMP Sensor.

Status	A green check mark indicates that the SNMP Sensor is connected to Console. If you see a red "X" instead, make sure that the WANsupervisor service is running and look for errors in the event log (see page 34).
Sensor Name	Displays the name of the SNMP Sensor and a colored square with the color defined in its configuration. Click to open a new tab with data specific to the SNMP Sensor. Administrators and operators can right-click to open the SNMP Sensor Configuration window.
Interface	Interface name and a colored square with the configured graph color.
Pkts/s (In / Out)	Inbound and outbound packets/second throughput.
Inbound Bits/s	Inbound bits/second throughput and usage percent.
Outbound Bits/s	Outbound bits/second throughput and usage percent.
Errors/s (In / Out)	For packet-oriented interfaces, it represents the number of inbound and outbound packets that contained errors, preventing them from being deliverable to a higher-layer protocol. For character-oriented or fixed-length interfaces, it represents the number of inbound transmission units that contained errors preventing them from being deliverable to a higher-layer protocol.
Discards/s (In / Out)	Inbound and outbound packets which were chosen to be discarded even though no errors had been detected to prevent them from being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.
Oper. Status	Current operational state of the interface. The <i>Testing</i> state indicates that no operational packets can be passed. If Administrative Status is <i>Down</i> then Operational Status should be <i>Down</i> . If Administrative Status is changed to <i>Up</i> then Operational Status should change to <i>Up</i> if the interface is ready to transmit and receive network traffic; it should change to <i>Dormant</i> if the interface is waiting for external actions (such as a serial line waiting for an incoming connection); it should remain in the <i>Down</i> state if and only if there is a fault that prevents it from going to the <i>Up</i> state; it should remain in the <i>NotPresent</i> state if the interface has missing (typically, hardware) components.
Admin. Status	Desired state of the interface. The <i>Testing</i> state indicates that no operational packets can be passed. When a managed system initializes, all interfaces start with the Administrative Status in the <i>Down</i> state. As a result of either explicit management action or per configuration information retained by the managed system, the Administrative Status is then changed to either the <i>Up</i> or <i>Testing</i> states (or remains in the <i>Down</i> state).
CPU%	Percentage of CPU resources used by the SNMP Sensor process.
RAM	The amount of RAM used by the SNMP Sensor process.
Start Time	The time when the SNMP Sensor started.
Server	Which server runs the SNMP Sensor. Click it to open a new tab with data specific to the server. Administrators and operators can right-click to open the Server Configuration window.

Reports » Components » Sensors

Click on a Sensor name anywhere in Console to open a tab that contains Sensor-specific information. The tab includes a few sub-tabs, located at the lower side of the window. All sub-tabs share the following common toolbar fields:

- **Sensors** – Select the Sensors you are interested in, or select “All” to select all Sensors. Administrators can restrict which Sensors are accessible by guest accounts.
- **Time Frame** – Select a predefined time frame, or select “Custom...” to enter a specific time interval.

Sensor Dashboard

The Sensor dashboard allows you to group the most relevant data collected by Sensors. The Sensor dashboard configuration does not apply to a particular Sensor, so the changes you make are visible for other Sensor dashboards as well. The operation of dashboards is described in the “Reports » Dashboards” chapter on page 53.

The configuration of Sensor widgets is outlined in the following paragraphs.

Sensor Graphs

This sub-tab allows you to view a variety of Sensor-related histograms for the selected Sensor(s):

- **Data Units** – Select one or more data units:
 - *Most Used* – Frequently-used data units.
 - *Packets* – Inbound packets/second (+ on Y-axis) and outbound packets/second (- on Y-axis).
 - *Bits* – Inbound bits/second (+ on Y-axis) and outbound bits/second (- on Y-axis).
 - *Applications* – Sensor can collect application-specific distribution data for HTTP, HTTPS, SMTP, POP3, IMAP, SNMP, FTP, SSH, TELNET, SQL, NETBIOS, MS-DS, MS-RDP, DNS, ICMP, and OTHERS. The graphs are updated when the Sensor configuration has the Stats Generator parameter set to “Basic”.
 - *Bytes* – Bytes/second throughput.
 - *Internal or External IPs* – IP addresses that send or receive traffic. Internal and External IPs are hosts inside and respectively outside the IP Zone. The Stats Generator parameter from the Sensor configuration enables or disables monitoring of External IPs. A spike in the Internal IPs graph usually means that an IP class scan was performed against your IP blocks. A spike in the External IPs graph usually means that you have received a spoofed attack.
 - *Received Frames* – For Packet Sensors, it represents the number of packets/s received before IP or MAC validation. For Flow Sensors, it represents the number of flows/s received before IP or AS validation.
 - *Dropped Frames* – For Packet Sensors, it represents the number of packets dropped by the packet capturing engine. A high number indicates a sniffing performance problem. For Flow Sensors, it represents the number of unaccounted flows. A high number indicates a wrong configuration of the

- Flow Sensor or a network connectivity issue with the flow exporter.
- *Unknown Frames* – For Packet Sensors, it represents the rate of packets not passing IP validation. For Flow Sensors, it represents the rate of invalidated flows.
- *Unknown Sources* – Source IP addresses that did not pass IP validation.
- *Unknown Destinations* – Destination IP addresses that did not pass IP validation.
- *Avg. Packet Size* – Average packet size in bits/packet.
- *CPU%* – Percentage of CPU resources used by the Sensor process.
- *RAM* – Amount of RAM utilized by the Sensor process.
- *Load* – Load reported by the Linux kernel.
- *IP Graphs* – Updated IP graphs files.
- *IP Accounting* – IP accounting records updated.
- *HW Graphs* – Traffic profiling files updated.
- *IP Graphs Time* – Seconds needed to update the IP graphs files.
- *HW Graphs Time* – Seconds needed to update the traffic profiling files.
- *Processing Time* – Seconds needed to perform traffic analysis functions.
- *IP Structures* – Internal IP structures.
- *IP Structure RAM* – RAM bytes used by each IP structure.
- **Graphs Size** – Select a predefined dimension or enter a custom one in a “<X> x <Y>” format, where <X> and <Y> are the X-axis and Y-axis pixels.
- **Graphs Title** – Graphs can have an automatically-generated title for the “Auto” option, no title for the “None” option, or you can enter your own text to be rendered as a title.
- **Graph Legend** – Select the level of detail for the graph legend.
- **Consolidation** – If you are interested in spikes, choose the *MAXIMUM* aggregation type. If you are interested in average values, choose the *AVERAGE* aggregation type. If you are interested in low values, choose the *MINIMUM* aggregation type.
- **Group Sensors** – Select to generate a single graph for the selected Sensors.
- **Stack Sensors** – Select to view the summed up, stacked values for the selected Sensors.

Sensor Tops

This sub-tab allows you to generate various traffic tops for the selected Sensor(s). The Stats Generator parameter from the Sensor configuration enables or disables data collection for various Sensor tops.

- **Top Type** – Select a top type:
 - *Talkers* – Hosts from your network that send or receive the most traffic for the selected decoder. Available only when the Stats Generator parameter from the Sensor configuration is set to “Basic”.
 - *IP Groups* – IP groups that send or receive the most traffic for the selected decoder. Available only

when the Stats Generator parameter from the Sensor configuration is set to “Basic”.

- *External IPs* – External IPs that send or receive the most traffic for the selected decoder. Available when the Stats Generator parameter from the Sensor configuration is set to “Extended” or “Full”.
- *Autonomous Systems* – Autonomous systems that send or receive the most traffic. Available only when the Stats Generator parameter from the Sensor configuration is set to “Extended” or “Full”.
- *Transit Autonomous Systems* – Transit autonomous systems that send or receive the most traffic. Available only when the Sensor is configured to extract Transit AS data from a BGP dump file.
- *Countries* – Countries that send or receive the most traffic. Available when the Stats Generator parameter from the Sensor configuration is set to “Extended” or “Full”.
- *TCP Ports* – Most-used TCP ports. Available when the Stats Generator parameter from the Sensor configuration is set to “Basic”.
- *UDP Ports* – Most-used UDP ports. Available when the Stats Generator parameter from the Sensor configuration is set to “Basic”.
- *IP Protocols* – Most-used IP protocols. Available when the Stats Generator parameter from the Sensor configuration is set to “Basic”.
- *IP Versions* – Most-used IP versions: IPv4 or IPv6. Available when the Stats Generator parameter from the Sensor configuration is set to “Basic”.
- **Decoder** – Select the decoder that analyzes the type of traffic that interests you.
- **Direction** – Direction of traffic, *Inbound* or *Outbound*.
- **Group Sensors** – When unchecked, each Sensor generates a different top. When checked, all selected Sensors generate a single top with combined data.
- **DNS** – When checked, it enables reverse DNS resolution for IP addresses. It may slow down generating tops for *Talkers* and *External IPs*.

You can increase the number of top records and change the available decoders in Configuration » General Settings » Graphs & Storage, see page 14.

Generating tops for many Sensors and long time frames may take minutes. If the report page timeouts, increase the *max_execution_time* parameter from *php.ini*.

Flow Records

You can list and filter the flow data collected by the selected Flow Sensors. The options are described in the “Flow Collectors” chapter on page 39. This sub-tab is visible only for tabs opened for Flow Sensors.

Flow Tops

You can generate tops from the flow data collected by the selected Flow Sensors. The options are described in the “Flow Collectors” chapter on page 39. This sub-tab is visible only for tabs opened for Flow Sensors.

AS Graphs

Flow Sensors and Packet Sensors can generate traffic and bandwidth histograms for autonomous systems. This feature is enabled for Packet Sensors that have the Stats Generator parameter set to “Full”, and for Flow Sensors that have the Stats Generator parameter set to “Full” or “Extended”.

The inbound traffic represents the traffic received by your AS, while outbound traffic represents the traffic sent by your AS.

- **AS Data Source** – Select one of the following options:
 - *Src/Dst ASNs* – Select to see the traffic to/from the AS number(s).
 - *Peering ASNs* – Select to see traffic to/from your AS peers (PrevAdjacentAS and NextAdjacentAS in NetFlow v9).
 - *Transit ASNs* – Select to see the traffic transited via the AS number(s).
- **AS Number(s)** – Click the lightbulb icon on the right to open a window containing the correct syntax. Frequently-searched AS numbers can be saved there, and used at a later time. To see the list of AS numbers owned by a particular organization, go to Help » IP & AS Information » AS Numbers List.
- **Graphs Size** – Select a predefined dimension or enter a custom one in a “<X> x <Y>” format, where <X> and <Y> are the X-axis and Y-axis pixels.
- **Graphs Title** – Graphs can have an automatically-generated title for the “Auto” option or no title for the “None” option, or you can enter your own text to be rendered as a title.
- **Group Sensors** – Select to view a single graph for all selected Sensors.
- **Group ASNs** – Select to view a single graph for multiple AS numbers.
- **Show Transit ASNs** – Select to view the traffic transited via the selected AS number(s).

Country Graphs

Flow Sensors and Packet Sensors can generate traffic and bandwidth histograms for countries. This feature is enabled for Sensors that have the Stats Generator parameter set to “Full” or “Extended”.

- **Countries** – Select the country or countries from the drop-down list, or click the light bulb icon on the right to open a window with saved selections for continents and world regions.
- **Graphs Size** – Select a predefined dimension or enter a custom one in a “<X> x <Y>” format, where <X> and <Y> are the X-axis and Y-axis pixels.
- **Graphs Title** – Graphs can have an automatically-generated title for the “Auto” option or no title for the “None” option, or you can enter your own text to be rendered as a title.
- **Group Sensors** – Select to generate a single graph for the selected Sensors.
- **Group Countries** – Select to view a single graph when multiple countries are selected.

Sensor Events

This sub-tab lists events generated by the selected Sensor(s) for the selected time frame. The events are described in the “Event Reporting” chapter on page 34.

Reports » Dashboards

Wouldn't it be nice to see all the relevant data in a single tab? **Dashboards** allow you to group data from any report according to your needs.

Any dashboard can be configured to refresh itself at intervals ranging from 5 seconds to 15 minutes.

A few sample dashboards are included by default. If you are a Console administrator or operator you can **create** and configure your own dashboards by clicking Reports » Dashboards » <+> » Dashboard. Guest accounts are not allowed to add or make modifications to dashboards.

In the dashboard **configuration**, you can edit the name of the dashboard, set permissions, layout, or choose to override the time frame of widgets with the time frame of the dashboard.

The dashboard contains **widgets**. To sort them, click the title bar and move them around. To collapse a widget, click the first icon on the widget title bar. To configure a widget, click the second icon from its title bar. To delete a widget, click the third icon from its title bar.

Along with few specific fields, every widget has a configurable title and height. Leave the widget's height parameter set to "Auto" for the widget to take all the vertical space it needs. To restrict the height of a widget, enter a number of pixels instead.

Widget options are self-explanatory or described in other chapters.

Reports » IP Addresses & Groups

This chapter describes how to generate detailed traffic reports for any IP address, block or group included in Configuration » Network & Policy » [IP Zone].

You can generate IP graphs only for IP addresses, blocks or groups specifically defined in your IP Zone(s), or that belong to a subnet having the IP Graphing parameter set to “Yes”.

You can generate IP accounting reports only for IP addresses, blocks or groups specifically defined in your IP Zone(s), or that belong to a subnet that has the IP Accounting parameter set to “Yes”.

Reports » IP Addresses allows you to quickly generate traffic reports for IP addresses and blocks, either entered manually on the upper side of the panel, or selected from the expandable tree below.

Reports » IP Groups lists all IP groups defined in IP Zones. Select an IP group to generate a traffic report for all IP blocks belonging to it. To search for a specific IP group, enter a sub-string contained in its name on the upper side of the panel.

The traffic report tab includes a few sub-tabs located on the lower side of the window. All sub-tabs share the following common toolbar fields:

- **Sensor** – Select the Sensors you are interested in or select “All” to select all Sensors. Administrators can restrict the Sensors accessible by guest accounts.
- **Time Frame** – Select a predefined time frame, or select “Custom...” to enter a specific time interval.

IP Dashboard

The IP dashboard allows you to group the most relevant data collected by the selected Sensors for the selected IP address, block or group. The configuration of IP dashboard does not apply to a particular IP address, block or group, and the changes you make will be visible for other IP dashboards as well. The operation of dashboards is described in the “Reports » Dashboards” chapter on page 53.

The configuration of the Decoder Graph widget and IP Accounting widget is described in the following paragraphs.

IP Graphs

Allows you to view traffic histograms generated for the selected IP block, host or group:

- **Decoders & Data Unit** – Select the decoders and data unit you are interested in. Available data units: *Packets, Bits, and Bytes*.
- **Graphs Size** – Select a predefined dimension or enter a custom one in a “<X> x <Y>” format, where <X> and <Y> are the X-axis and Y-axis pixels.
- **Graph Title** – Graphs can have an automatically-generated title for the “Auto” option or no title for the “None” option, or you can enter your own text to be rendered as a title.

- **Graph Legend** – Select the detail of the graph legend.
- **Consolidation** – If you are interested in spikes, choose the *MAXIMUM* aggregation type. If you are interested in average values, choose the *AVERAGE* aggregation type. If you are interested in low values, choose the *MINIMUM* aggregation type.
- **Direction** – Generates a graph for both directions, or only for inbound traffic or outbound traffic.
- **Grouping**
 - **Sensors** – Generates a single graph for the selected Sensors.
 - **Subnet IPs** – Uncheck this option if you want a different traffic graph displayed for every IP address contained in the selected IP block or IP group. Do not uncheck this option on large subnets.
- **Stacking**
 - **Decoders** – Select to view the summed up, stacked values for the selected decoders.
 - **Sensors** – Select to view the summed up, stacked values for the selected Sensors.
- **Permissions**
 - **Decoder Conflict** – If decoders can be included one within the other (e.g. TOTAL contains TCP that contains HTTP and HTTPS), the graph will display stacked decoders to show the most specific ones. This generates both accurate and intuitive traffic graphs. In the example above, TOTAL will be displayed as TOTAL OTHER and TCP as TCP OTHER. However, when you select TCP, HTTP and TCP+SYN as decoders, the TCP+SYN decoder can be included in both TCP and HTTP, thus generating a decoder conflict. Check this option to stop detection of conflicting decoders, in order to generate more intuitive but potentially inaccurate traffic graphs.
 - **Use Per-IP Data** – Creates a subnet graph by aggregating the IP graph data generated for every IP address contained in the selected IP block or group. This option will increase the load of the server if used frequently on large subnets. Use this option carefully, only when the IP block or group is not explicitly defined in the IP Zone but it is included in a larger subnet defined with the IP Graphing parameter set to “Yes”.

The number of decoders, data units, and aggregation types can be modified in Configuration » General Settings » Graphs & Storage (see page 14).

IP Accounting

Allows you to generate traffic accounting reports for the selected IP block, host or group:

- **Decoders & Data Unit** – Select the decoders and data unit that you are interested in. Available data units: *Packets*, *Bits*, and *Bytes*.
- **Report Type** – Select the interval used to aggregate the accounting data: *Daily*, *Weekly*, *Monthly*, *Yearly*. The maximum accuracy of traffic accounting reports is 1 day, therefore when you select a shorter time frame you will still see the accounting data collected for the whole day.
- **Group Sensors** – Generates a single traffic accounting report for the selected Sensors.
- **Show IPs** – Check this option for the traffic accounting report to display each IP address contained in the

selected IP block or group. Selecting this option also enables the option below.

- **Use Per-IP Data** – Creates a traffic accounting report by aggregating the IP accounting data generated for every IP address contained in the selected IP block or group. This option will increase the load of the server if used frequently on large subnets. Use this option carefully, only when the selected IP block or group is not explicitly defined in the IP Zone but it is included in a larger subnet defined with the IP Accounting parameter set to “Yes”.

The number of decoders can be modified in Configuration » General Settings » Graphs & Storage (see page 14).

Flow Records

This sub-tab is visible only when there is at least one Flow Sensor in use.

You can list and filter the flow data collected by the selected Flow Sensors, for the selected IP block, host or group. The options are described in the “Flow Collectors” chapter on page 39.

Flow Tops

This sub-tab is visible only when there is at least one Flow Sensor in use.

You can generate tops from the flow data collected by Flow Sensors, for the selected IP block, host or group. The options are described in the “Flow Collectors” chapter on page 39.

Reports » Servers

Click on a server name anywhere in Console to open a tab containing server-specific information. The server tab includes a few sub-tabs, located at the lower side of the window. All sub-tabs share the following common toolbar fields:

- **Servers** – Select the servers you are interested in, or select “All” to select all servers. Administrators can restrict the servers accessible by guest accounts.
- **Time Frame** – Select a predefined time frame, or select “Custom...” to enter a specific time interval.

Console / Server Dashboard

Allows you to group the most relevant server-related data. The configuration for the server dashboard does not apply to a particular server, and the changes you make will be visible for other server dashboards as well. The operation of dashboards is described in the “Reports » Dashboards” chapter on page 53.

The configuration of Server and Console widgets is described in the following paragraphs.

Console / Server Graphs

Server Graphs allows you to generate various histograms for the selected server(s):

- **Data Units** – Select one or more data units:
 - *Most Used* – Frequently-used data units.
 - *System Load* – Load reported by the Linux kernel.
 - *Free RAM* – Available RAM. The swap memory is not counted.
 - *Database/Graphs/SSD/Flow Collector/Packet Dumps Disk - Free space* – How much disk space is available for each file-system path.
 - *Uptime* – Uptime of the operating system.
 - *CPU% system/userspace/niced/idle* – Percentages of CPU resources used by the system, userspace processes, processes running with increased (nice) priority, and idle loop.
 - *Number of processes* – Total number of processes that are running.
 - *Hardware/Software CPU Interrupts* – CPU interrupts made by hardware and software events.
 - *Context Switches* – Indicates how much time the system spends on multi-tasking.
 - *Running Components* – Sensor instances.
 - *Clock Delta* – Difference of time between the selected server and the Console server, in seconds. If the value is not zero run ntpd to keep the clock synchronized on all servers.
 - *Database/Graphs/SSD/Packet Dumps/Flow Collector Disk - Total* – How much disk space is allocated

for the partitions that store the paths.

- *Database/Graphs/SSD/Packet Dumps/Flow Collector Disk - Free Inodes* – Free inodes held by the partitions that store the paths.
- *Database/Graphs/SSD/Packet Dumps/Flow Collector Disk - Ops/s* – Reads and writes made on the partitions that store the paths.
- *Database/Graphs/SSD/Packet Dumps/Flow Collector Disk - Bytes/s* – Bytes/s on the partitions that store the paths.
- *Server Interface(s) - Packets/Bits/Errors/Dropped* – Interface statistics collected for the network interfaces defined in the Configuration » Servers.
- **Graphs Size** – Select a predefined dimension or enter a custom one in a “<X> x <Y>” format, where <X> and <Y> are the X-axis and Y-axis pixels.
- **Graphs Title** – Graphs can have an automatically-generated title for the “Auto” option or title for the “None” option, or you can enter your own text to be rendered as a title.
- **Graph Legend** – Select the level of detail for the graph legend.
- **Consolidation** – If you are interested in spikes, choose the *MAXIMUM* aggregation type. If you are interested in average values, choose the *AVERAGE* aggregation type. If you are interested in low values, choose the *MINIMUM* aggregation type.
- **Group Servers** – Generate a single graph for the selected servers.
- **Group Interfaces** – Generate a single graph for the interfaces of the selected servers.
- **Stack Servers** – Shows the summed up, stacked values for the selected servers.

Server Events

Lists events generated by the selected server(s). The events are described in the “Event Reporting” chapter on page 34.

Console Events

The sub-tab is visible only when opening the Console tab. It lists events generated by Console. Events are described in the “Event Reporting” chapter on page 34.

Server Commands

Console administrators can execute CLI commands on the selected server(s) and see the output in this sub-tab. The commands are executed by the WANsupervisor service with the “andrisoft” user (non-root) privileges. To prevent the execution of CLI commands through Console, start the WANsupervisor service with the “-n” option.

Appendix 1 – IPv4 Subnet CIDR Notation

Wansight uses extensively IP addresses and IP classes with the CIDR notation. To view details about any IPv4 subnet click Help → Subnet Calculator.

CIDR	CLASS	HOSTS NO.	MASK
/32	1/256 C	1	255.255.255.255
/31	1/128 C	2	255.255.255.254
/30	1/64 C	4	255.255.255.252
/29	1/32 C	8	255.255.255.248
/28	1/16 C	16	255.255.255.240
/27	1/8 C	32	255.255.255.224
/26	1/4 C	64	255.255.255.192
/25	1/2 C	128	255.255.255.128
/24	1 C	256	255.255.255.000
/23	2 C	512	255.255.254.000
/22	4 C	1024	255.255.252.000
/21	8 C	2048	255.255.248.000
/20	16 C	4096	255.255.240.000
/19	32 C	8192	255.255.224.000
/18	64 C	16384	255.255.192.000
/17	128 C	32768	255.255.128.000
/16	256 C, 1 B	65536	255.255.000.000
/15	512 C, 2 B	131072	255.254.000.000
/14	1024 C, 4 B	262144	255.252.000.000
/13	2048 C, 8 B	524288	255.248.000.000
/12	4096 C, 16 B	1048576	255.240.000.000
/11	8192 C, 32 B	2097152	255.224.000.000
/10	16384 C, 64 B	4194304	255.192.000.000
/9	32768 C, 128B	8388608	255.128.000.000
/8	65536 C, 256B, 1 A	16777216	255.000.000.000
/7	131072 C, 512B, 2 A	33554432	254.000.000.000
/6	262144 C, 1024 B, 4 A	67108864	252.000.000.000
/5	524288 C, 2048 B, 8 A	134217728	248.000.000.000
/4	1048576 C, 4096 B, 16 A	268435456	240.000.000.000
/3	2097152 C, 8192 B, 32 A	536870912	224.000.000.000
/2	4194304 C, 16384 B, 64 A	1073741824	192.000.000.000
/1	8388608 C, 32768 B, 128 A	2147483648	128.000.000.000
/0	16777216 C, 65536 B, 256 A	4294967296	000.000.000.000

Appendix 2 – Configuring NetFlow Data Export

This appendix is a brief guide to setting up the NetFlow data export (NDE) on Cisco and Juniper routers or intelligent Cisco Layer 2/Layer 3/Layer 4 switches. If you have problems with the configuration, contact your network administrator or consultant. For devices that run hybrid mode on a Supervisor Engine (Catalyst 65xx series), it is recommended to configure IOS NDE on the MSFC card and CatOS NDE on the Supervisor Engine. For more information about setting up NetFlow on Cisco, please visit <http://www.cisco.com/go/netflow>.

Configuring NDE on older IOS Devices

In the configuration mode on the router or MSFC, issue the following to start NetFlow Export.

First, enable Cisco Express Forwarding:

```
router(config)# ip cef
router(config)# ip cef distributed
```

Turn on flow accounting for each input interface with the interface command:

```
interface
ip route-cache flow
```

For example:

```
interface FastEthernet0
ip route-cache flow
interface Serial2/1
ip route-cache flow
```

It is necessary to enable NetFlow on all interfaces through which traffic (you are interested in) will flow. Now, verify that the router (or switch) is generating flow stats – try command 'show ip cache flow'. Note that for routers with distributed switching (GSR's, 75XX's) the RP cli will only show flows that made it up to the RP. To see flows on the individual line cards use the 'attach' or 'if-con' command and issue the 'sh ip ca fl' on each LC.

Enable the exports of these flows with the global commands:

```
router(config)# ip flow-export version 5
router(config)# ip flow-export destination <ip_address> 2000
router(config)# ip flow-export source FastEthernet0
```

Use the IP address of the server running the Flow Sensor and the configured listening port. UDP port 2000 is used as an example. The 'ip flow-export source' command is used to set up the source IP address of the exports sent by the equipment.

If your router uses the BGP protocol, you can configure AS to be included in exports with command:

```
router(config)# ip flow-export version 5 [peer-as | origin-as]
```

The following commands break up flows into shorter segments: 1 minute for active traffic and 30 seconds for inactive traffic. Flow Sensor drops flows older than 5 minutes!

```
router(config)# ip flow-cache timeout active 1
router(config)# ip flow-cache timeout inactive 30
```

In enable mode you can see current NetFlow configuration and state.

```
router# show ip flow export
router# show ip cache flow
router# show ip cache verbose flow
```

Configuring NDE on a CatOS Device

In privileged mode on the Supervisor Engine enable NDE:

```
switch> (enable) set mls nde <ip_address> 2000
```

Use the IP address of the server running the Flow Sensor and the configured listening port. UDP port 2000 is used only as an example.

```
switch> (enable) set mls nde version 5
```

The following command is required to set up flow mask to full flows.

```
switch> (enable) set mls flow full
```

The following commands break up flows into shorter segments: ~1 minute for active flows and ~ 30 seconds for inactive flows. Flow Sensor drops flows older than 5 minutes!

```
switch> (enable) set mls agingtime long 8
switch> (enable) set mls agingtime 4
```

If you want to account all traffic within the specified VLANs rather than inter VLAN traffic use CatOS 7.2 or higher and issue the following command:

```
switch> (enable) set mls bridged-flow-statistics enable
```

Enable NDE:

```
switch> (enable) set mls nde enable
```

To see current NetFlow configuration and state issue the following commands:

```
switch> (enable) show mls nde
switch> (enable) show mls debug
```

Configuring NDE on a Native IOS Device

To configure NDE use the same commands as for the IOS device. In the enable mode on the Supervisor Engine, issue the following to set up the NetFlow export version 5.

```
switch(config)# mls nde sender version 5
```

The following commands break up flows into shorter segments: ~1 minute for active flows and ~ 30 seconds for inactive flows. Flow Sensor drops flows older than 5 minutes!

```
switch(config)# mls aging long 8
switch(config)# mls aging normal 4
```

On the Supervisor Engine 1 issue the following to put full flows into the NetFlow exports:

```
switch(config)# mls flow ip full
```

If you have a Supervisor Engine 2 or 720 running IOS version 12.1.13(E) or higher, issue the following commands instead:

```
switch(config)# mls flow ip interface-full
switch(config)# mls nde interface
```

Configuring NDE on a 4000 Series Switch

Configure the switch the same as an IOS device, but instead of command 'ip route cache flow' use command 'ip route-cache flow infer-fields'. This series requires a Supervisor IV with a NetFlow Services daughter card to support NDE.

Configuring NDE on IOS XE

Traditional NetFlow is being replaced with flexible NetFlow on newer IOS versions.

```
conf t
flow exporter WGFlowSensor
destination <ip_address>
source gi0/0/1
transport udp 9991
export-protocol netflow-v5
flow monitor WGFlowSensor
record netflow ipv4 original-input
exporter WGFlowSensor
cache timeout active 120 #in seconds
exit
int gi0/0/2
ip flow monitor WGFlowSensor input
exit
exit
wr mem
```

Configuring NDE on IOS XR

A sample configuration for IOS XR:

```
flow exporter-map wanguard
version v9
options interface-table timeout 300
```

```

options vrf-table timeout 300
options sampler-table timeout 300
!
transport udp <port>
source Loopback8648
destination <ip_address>
!
flow monitor-map IPV4-FMM
record ipv4
exporter wanguard
cache entries 16384
cache timeout active 60
cache timeout inactive 30
!
flow monitor-map IPV6-FMM
record ipv6
exporter wanguard
cache entries 16384
cache timeout active 60
cache timeout inactive 30
!
sampler-map 1-of-128
random 1 out-of 128
!

interface TenGigE0/0/2/1
description Upstream Interface
...
flow ipv4 monitor IPV4-FMM sampler 1-of-128 ingress
flow ipv4 monitor IPV4-FMM sampler 1-of-128 egress
flow ipv6 monitor IPV6-FMM sampler 1-of-128 ingress
flow ipv6 monitor IPV6-FMM sampler 1-of-128 egress
!

```

Configuring NDE on a Juniper Router (non-MX)

Juniper supports flow exports by the routing engine sampling packet headers and aggregating them into flows. Packet sampling is done by defining a firewall filter to accept and sample all traffic, applying that rule to the interface and then configuring the sampling forwarding option.

```

interfaces {
  ge-0/1/0 {
    unit 0 {
      family inet {
        filter {
          input all;
          output all;
        }
        address 192.168.1.1/24;
      }
    }
  }
}
firewall {
  filter all {

```

```
        term all {
            then {
                sample;
                accept;
            }
        }
    }
}

forwarding-options {
    sampling {
        input {
            family inet {
                rate 100;
            }
        }
        output {
            cflowd 192.168.1.100 {
                port 2000;
                version 5;
            }
        }
    }
}
```

Appendix 3 – Software Changelog

Wanguard 6.2+

The latest new features and bugfixes are listed on <https://www.andrisoft.com/support/portal/bugtracking>

Wanguard 6.2

Release date: March 23 2016

- BGP FlowSpec (RFC 5575) support and ExaBGP integration.
- Packet Sensor and Packet Filter can run multi-threaded over multiple CPU cores.
- Packet Sensor supports Netmap and PF_RING ZC.
- Flow Sensor supports BZ2 compression of flows for a better compression rate, at the expense of a slower access to flow data.
- Flow Sensor detects anomalies faster in some cases.
- S/RTBH support for Packet Filter, Flow Filter and Filter Cluster.
- Much faster per-subnet IP accounting, enabled for all subnets defined in the IP Zone.
- A new "Custom Script Return Value" Conditional Parameter that allows the logical combination of other Conditional Parameters.
- New Response actions:
 - Send a visual or audio notification to all logged in Console users
 - Send a custom SNMP Trap
 - Apply the filtering rule on a third-party inline device
- The CLI API allows the switching of the IP Zone used by Sensor (e.g. to have different thresholds on busy hours).
- Guest role benefits from full IP Group-based permissions in Reports » Tools.
- IP graphs can show stacked Sensors.
- When the Console server name differs from "Console", the web browser shows it in the window title.
- BGP Connection renamed BGP Connector.
- Prioritize blackhole announcements over diversion announcements when using a single Quagga bgpd without AS views.
- The network connection to quagga bgpd is initiated from the server running the BGP Connector. Previously, the connection was initiated from the Console server.
- Various small bug-fixes and enhancements.

Wanguard 6.1

Release date: December 3 2015

- Administrators can create custom decoders that identify flows or packets sharing a certain pattern (e.g. to differentiate and classify the underlying protocols) in Configuration » General Settings » Custom Decoders.
- New Filter mitigation options in Configuration » General Settings » Mitigation Options:
 - TCP SYN Proxy
 - invalid TCP flags
 - invalid DNS packets
 - private/reserved IPs
 - connection-oriented or connection-less traffic rate-limiting
 - blacklisting by IP reputation services
- Filter can apply new filtering rules for: specific packet payloads, countries, DNS transaction IDs.
- Filtering rules can be disabled, re-ordered and fine-tuned for each decoder.
- A tighter integration between Filter and the software firewall (Netfilter framework) and Chelsio hardware filters. Newly generated anomaly reports contain pass/drop graphs for mitigated attacks.
- Console users can create custom firewall rules in Reports » Tools » Firewall Rules.
- New Software Firewall options in the Filter Configuration window. A new “FW Policy” field on Whitelist rules that explicitly permits traffic through the Software Firewall.
- Configuration » General Settings » Anomaly Detection contains a new option for deduplicating anomalies that indicate the same attack matched by different decoders.
- Filter Clusters can be associated with other Filter Clusters.
- BGP Connectors can be configured to allow BGP announcement withdrawals to be done after business hours.
- Sensor graphs now use RRDCached when it is defined in Configuration » General Settings » Graphs & Storage Configuration.
- Enhanced user authentication methods. New RADIUS options and a new HTTP authentication option.
- A new TCP-ALL decoder.
- The Latest Events tab from the South Region contains selectors for severity and components.
- User role renamed Guest. Administrators can allow Guest access to Reports » Tools with greater granularity.
- Configuration » General Settings » Anomalies renamed Anomaly Detection. Reports » Alerts & Tools renamed Tools.
- Unattended installation when the following shell environment variables are set:
WANGUARD_INSTALL_DB_USER, WANGUARD_INSTALL_DB_PASS, WANGUARD_CONSOLE_IP,
WANGUARD_CONSOLE_DB_PASS.
- User Guide updated. Contains new Appendixes describing advanced BGP configurations.

Wanguard 6.0

Release date: February 16 2015

System

- The software can be installed on new Linux distributions: Red Hat 7, CentOS 7, Debian 7, Ubuntu Server 14.
- Console supports PHP 5.5 and PHP 5.6.
- Graphs for iowait in Reports » Servers » Server Graphs.
- Configuration » General Settings » Software Updates displays the latest software version and upgrading instructions.
- Emails can be sent directly by Console without requiring a local MTA. New Configuration » General Settings » Outgoing Email Settings, with configurable Sender Email.
- Fixed sending emails to CC addresses.
- Corrupted Console database can be repaired with "/opt/andrisoft/bin/WANmaintenance repair".
- 32-bit architectures are no longer supported.

Console

- A new graphical slider for quick selection of custom time frames in Reports.
- Reports and Configuration side regions can be set apart by user preference, e.g. one on the right and one on the left. New Ctrl→R keyboard shortcut toggles side regions.
- Configuration » General Settings » Data Retention shows disk usage for newly created RRD files containing IP graph data.
- Graphing IP sweeps can be enabled or disabled for IPv6 and/or IPv4 in Configuration » General Settings » Graphs & Storage.
- Changed Conditional and Dynamic Parameters: {operation}, {sensor_type}, {domain}, {class}, {filter_*}, {filter_tcpdump_size}.
- New Dynamic Parameters: {from_year}, {from_month}, {from_day}, {from_dow}, {from_hour}, {from_minute}, {until_year}, {until_month}, {until_day}, {until_dow}, {until_hour}, {until_minute}, {direction_to_from}, {software_version}, {comparison}, {direction_receives_sends}, {duration_clock}, {*_decoder_prefix} for {*_prefix}, {filter_type}, {filter}, {filter_id}, {response_actions}, {filtering_rule_log_size}, {filtering_rule_max_unit}, {filtering_rule_unit}.
- Redesigned Response Configuration window. New email templates.
- Redesigned IP Zone Configuration window.
- New widgets: Flow Records and Flow Tops.

- Dashboards can be configured to have a unique time frame for all containing widgets.
- Unprivileged users can open reports for IPs included in the allowed subnets.
- Loading of IP Zones with thousands of IPs and subnets is around 8 times faster.
- Moved Configuration » General Settings » User Management » Authentication & Login to Configuration » General Settings » User Authentication.
- Add Configuration » General Settings » User Authentication » Login Window Notification and Successful Login Notification.
- Radius authentication fixed.
- New statistics in by Reports » Components » Overall » Console.
- Reports » Attacks & Tools » Anomalies » Active Anomalies » Reverse DNS unchecked by default.
- Reports » Attacks & Tools » Anomalies » Active Anomalies shows a Flow Trace button for anomalies detected by Flow Sensors.
- The visibility of items in Reports » Components and Reports » Servers can be toggled. Right-click opens their configuration.
- Configuration » Components and Configuration » Schedulers items can be activated/inactivated with a single right click.
- Configuration » General Settings » License Manager » Requirements lists all the required licensing data.
- Various aesthetic improvements.

Sensor

- Add a new SNMP Sensor, able to monitor networking devices supporting SNMP v1, v2c or v3. One SNMP Sensor license is free.
- The Sniffing Sensor renamed Packet Sensor.
- The Virtual Sensor renamed Sensor Cluster.
- New decoders: IP fragmented, TCP-NULL, TCP+RST, TCP+ACK, TCP+SYNACK, SSDP.
- The BAD decoder matches IP NULL, SYN decoder doesn't match packets/flows with ACK flag set anymore.
- The Packet Sensor is compatible with PF_RING version 6 (Zero Copy, LibZero or DNA license not needed). PF_RING version 5 is not compatible anymore.
- The Packet Sensor supports new capture engines: System PCAP, Myricom Sniffer10G, SolarCapture (beta).
- The Sensor Cluster can aggregate IP graphs data.
- Packet Sensors listening to the same interface (e.g. for multi-queue load balancing) do not require additional licenses.
- The Packet Sensor has a new CPU affinity option.
- A new "Manage Interfaces" button in the Flow Sensor Configuration window that provides a quick way to add multiple interfaces.

- The Flow Sensor Configuration window has advanced SNMP options.
- On Flow Sensor's Traffic Direction option. "Mixed" renamed "Auto", "Inbound" renamed "Upstream", "Outbound" renamed "Downstream".

BGP

- Reports » Attacks & Tools » BGP Prefixes renamed BGP Operations.
- Added buttons Reports » Attacks & Tools » BGP Operations » Black Hole, Divert Traffic and Remove All.
- BGP Connectors can be configured to announce subnets with configurable masks for BGP peers that do not accept /32 prefixes for null-routing or cloud-based DDoS mitigation services.
- All connections to remote quagga bgpd services are initialized solely from the Console server.
- Deleting BGP announcements manually works for delayed announcements.
- BGP Announcement Archive displays BGP Connector Role.

Filter

- The Filter renamed Packet Filter.
- A new Flow Filter, able to detect attackers from flow data analyzed by a Flow Sensor.
- A new Filter Cluster, able to cluster multiple Packet Filters and Flow Filters.
- The Filters can use the hardware-based packet filter from Chelsio T4 and T5 10/40 gigabit adapters.
- New Whitelist Templates, for sharing whitelists between Filters. Add them in Configurations » Network & Policy » <+>.
- Support for adding IPv4 and IPv6 subnets in Whitelists and Whitelist Templates.
- The Packet Filter supports new capture engines: System PCAP, Myricom Sniffer10G, SolarCapture (beta).
- The Packet Filter has a new CPU affinity option.
- The Packet Filter can block private IPs when using the Software Firewall.
- The Filter also works for outgoing attacks.
- The Packet Filter is compatible with PF_RING version 6 (Zero Copy, LibZero or DNA license not needed). PF_RING version 5 is not compatible anymore.