snarf Documentation

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CONTENTS

CHAPTER

ONE

OVERVIEW

`snarf` is a distributed alert reporting system. Applications can use `snarf`'s libraries to send network alert messages, which can then be routed to multiple destinations in a configurable manner. `snarf` is designed to allow application and script developers to emit network alert messages without being concerned with the details of how the messages will be formatted downstream, or what destinations they will be routed to.

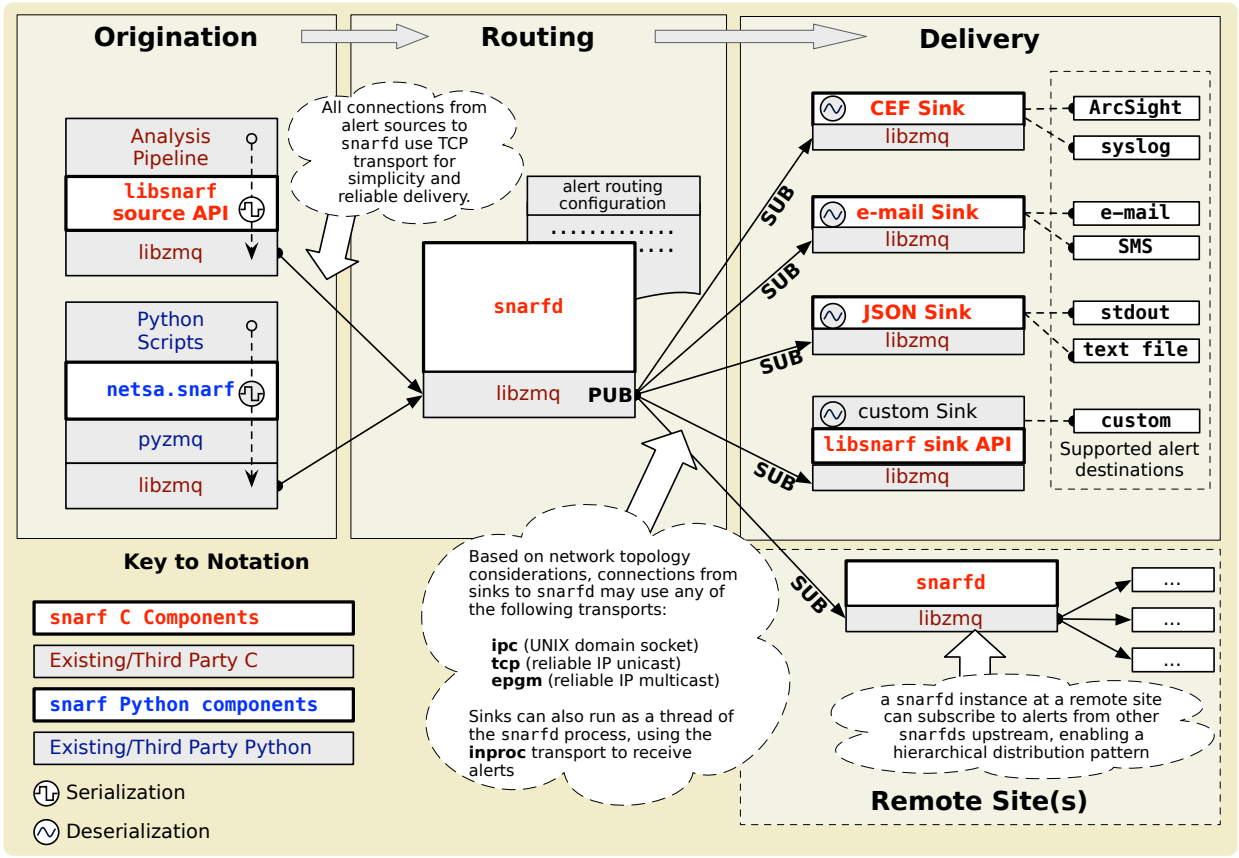
Alert processing happens in three steps:

- **origination** - An alert begins with an application call to either the alert and source APIs of libsnarf or *snarf-python*. Alert sources use these APIs to build alerts and send them to snarfd, an alert routing daemon.
- **routing** - snarfd matches fields in the alert's envelope against a set of configured routing rules, and routes the alert message to the appropriate destination(s) via a publish-subscribe mechanism. To support a distributed, hierarchical alerting architecture, snarfd processes can subscribe to alert channels on another snarfd upstream to distribute alerts from remote sites.
- **delivery** - Alert sinks subscribe to alert channels published by snarfd, delivering the alerts to the appropriate destination.

The `snarf` suite consists of the following software components:

- libsnarf, a C library for constructing, sending, and receiving alerts.
- *snarf-python*, a Python module for snarf alerting.
- snarfd, an alert routing daemon

The following system diagram details the flow of alert messages through these software components, and how these components interact with external systems.



1.1 Requirements

`libsnarf` requires the following third-party software:

- glib version 2.36 or later
- zeromq version 3.x
- protobuf-c version 1.01 or later

`snarfd` has the same requirements as `libsnarf`, along with:

- libyaml version 0.1.4 or later

`snarf-python` requires Python >= 2.7, along with the following Python modules and third-party packages:

- pyzmq version 14.3 or later
- netsa-python version 1.4 or later
- protobuf version 2.5.0 or later

1.2 Installation

If you're running RedHat Enterprise Linux 7 or CentOS 7, we recommend using the cert-forensics-repository and installing using `yum`.

After configuring this repository, install snarf with, e.g.:

```
$ yum install snarf snarf-devel snarf-python
```

Installation of `libsnarf` and `snarfd` is accomplished through a standard `./configure && make && make install` process. If a supported Python installation is detected during installation, `snarf-python` will also be installed.

1.3 License

- GNU General Public License (GPL) Rights pursuant to Version 2, June 1991
- Government Purpose License Rights (GPLR) pursuant to DFARS 252.227-7013

1.4 Support

For help with snarf installation/usage, or to submit a bug report, send email to netsa-help@cert.org

CHAPTER

TWO

LIBSNARF

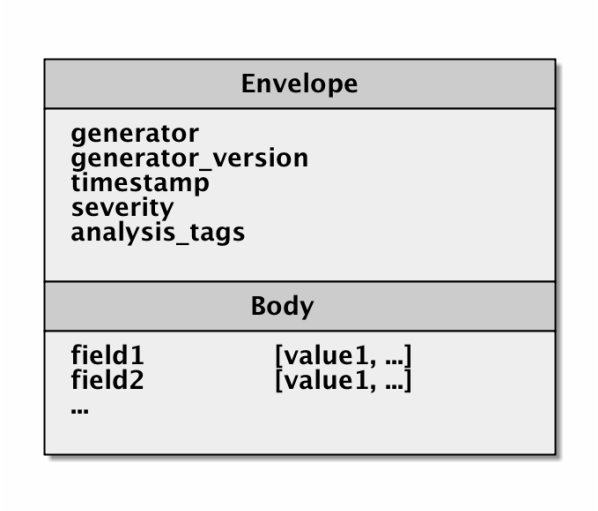
`libsnarf` is a library that enables application developers to:

- build and parse snarf alert messages from C applications
- send alerts to a `snarfd` for routing to alert destinations
- subscribe to and receive alerts

These three capabilities correspond respectively to the `snarf` alert_api, source_api, and sink_api.

2.1 Alert API

A `snarf` alert is structured as follows:



The envelope contains all mandatory fields that must be present in every alert. These fields are used to route the alert to the appropriate destination based on routing logic defined in the snarfd configuration file.

The fields and values present in the alert body are application-specific, but it is recommended that the set of fields and values are consistent among alerts tagged with a particular analysis tag. The receiver of the alert can then use these tags to determine which fields to expect in the alert body.

2.1.1 Constructing Alerts

To create a snarf alert object, use the snarf_alert_new function:

snarf_alert_t ***snarf_alert_new**(*snarf_alert_severity_t severity*, uint64_t *timestamp*)
Create a new alert.

The new alert will have the 'severity' and 'timestamp' fields set based on those arguments.

Parameters

- `severity`: the severity of the alert
- `timestamp`: 64-bit (epoch microsecond) timestamp of the alert

The severity field should be one of:

enum snarf_alert_severity_t
Values:

ALERT_VERYLOW = 1

ALERT_LOW = 2

ALERT_MEDIUM = 3

ALERT_HIGH = 4

ALERT_VERYHIGH = 5

2.1.2 Adding Fields

Fields can be added to the alert with the following functions:

void **snarf_alert_add_flow_v4**(snarf_alert_t **alert*, uint64_t *stime*, uint32_t *elapsed*, uint32_t *sip*, uint32_t *dip*, uint16_t *sport*, uint16_t *dport*, uint8_t *proto*, uint32_t *packets*, uint32_t *bytes*, uint8_t *flags*, uint8_t *flags_initial*, uint16_t *application_id*, char **sensor_name*, char **flow_class*, char **flow_type*)
Add an IPv4 flow to an alert.

The sip and dip arguments should be in the host machine's byte order, as in struct sockaddr_in.sin_addr.s_addr

void **snarf_alert_add_flow_v6**(snarf_alert_t **alert*, uint64_t *stime*, uint32_t *elapsed*, uint8_t *sip*[16], uint8_t *dip*[16], uint16_t *sport*, uint16_t *dport*, uint8_t *proto*, uint32_t *packets*, uint32_t *bytes*, uint8_t *flags*, uint8_t *flags_initial*, uint16_t *application_id*, char **sensor_name*, char **flow_class*, char **flow_type*)
Add an IPv6 flow to an alert.

The sip and dip arguments should be in network byte order, as in sockaddr_in6.sin6_addr

void **snarf_alert_add_text_field**(snarf_alert_t **alert*, **const** char **name*, **const** char **value*)
Add a text field to an alert.

Parameters

- `alert`: a snarf alert structure
- `name`: the name of the field to add
- `value`: the text to add

void **snarf_alert_add_int_field**(snarf_alert_t **alert*, **const** char **name*, int64_t *value*)
Add an integer field to an alert.

Parameters

- `alert`: a snarf alert structure
- `name`: the name of the field to add
- `value`: the integer to add

void **snarf_alert_add_double_field**(snarf_alert_t **alert*, **const** char **name*, double *value*)
Add a double field to an alert.

Parameters

- `alert`: a snarf alert structure
- `name`: the name of the field to add
- `value`: the double value to add

void **snarf_alert_add_ipset_field**(snarf_alert_t **alert*, **const** char **name*, uint8_t **data*, size_t *len*)
Add an IPSet field to an alert.

Parameters

- `alert`: a snarf alert structure
- `name`: the name of the field to add
- `data`: the IPset's binary data
- `len`: the length of the IPset's binary data

void **snarf_alert_free**(snarf_alert_t **alert*)
Free an alert's memory.

Parameters

- `alert`: Pointer to the alert structure to be freed

2.1.3 Accessing Alert Data

Alert sink code should use the following functions to work with alert objects once they are received:

int **snarf_alert_severity**(snarf_alert_t **alert*)
Get an alert's severity as an integer.

Return the alert's severity

Parameters

- `alert`: a snarf alert structure

snarf_field_t ***snarf_alert_get_field**(snarf_alert_t **alert*, **const** char **key*)
Retrieve a field from an alert.

Return a snarf field structure

Parameters

- `alert`: a snarf alert structure
- `key`: the name of the field to retrieve

int **snarf_alert_field_value_count** (snarf_field_t *_field_)
Get the number of values in the given field.

snarf_value_t ***snarf_alert_field_value** (snarf_alert_t *_alert_, char *_fieldname_, int _index_)
Get a value stored in an alert field.

Return a snarf value structure

Parameters

- `alert`: a snarf alert structure
- `fieldname`: the name of the field to retrieve
- `index`: an index into the list of values

2.1.4 Printing / Formatting Alert Messages

`snarf` Output Buffers

`snarf` output buffers handle some aspects of field delimiting and formatting for you.

To print alerts, first create an output buffer to hold the printed data:

snarf_output_buffer_t ***snarf_output_buffer_new** (size_t _len_)

To customize formatting in an alert buffer, use the following functions:

void **snarf_output_buffer_set_format** (snarf_output_buffer_t *_outbuf_, *snarf_output_format_t* _format_)

The built-in output formats are:

enum snarf_output_format_t
Values:

SNARF_OUTPUT_BUFFER_RAW = 0

SNARF_OUTPUT_BUFFER_DELIMITED

SNARF_OUTPUT_BUFFER_JSON

SNARF_OUTPUT_BUFFER_XML

For the delimited output format, you can set the delimiter with:

void **snarf_output_buffer_set_delimiter** (snarf_output_buffer_t *_outbuf_, char _delim_)

Alert severity can be printed as either a symbolic name e.g. `LOW`, or an integer:

void **snarf_output_buffer_set_severity_format** (snarf_output_buffer_t *_outbuf_, *snarf_output_severity_format_t* _format_)

enum snarf_output_severity_format_t
Values:

SNARF_OUTPUT_SEVERITY_FORMAT_INT = 0

SNARF_OUTPUT_SEVERITY_FORMAT_NAME

The format of the alert timestamp can be changed with:

void **snarf_output_buffer_set_timestamp_format**(snarf_output_buffer_t **outbuf*, snarf_output_timestamp_format_t *format*)

The available timestamp formats are:

enum snarf_output_severity_format_t
Values:

SNARF_OUTPUT_SEVERITY_FORMAT_INT = 0

SNARF_OUTPUT_SEVERITY_FORMAT_NAME

The format of any TCP flags printed in the alert's flow fields can be set with:

void **snarf_output_buffer_set_tcp_flags_format**(snarf_output_buffer_t **outbuf*, *snarf_output_tcp_flags_format_t* *format*)

The available TCP flag formats are:

enum snarf_output_tcp_flags_format_t
Values:

SNARF_OUTPUT_TCP_FLAGS_FORMAT_COMPACT = 0

SNARF_OUTPUT_TCP_FLAGS_FORMAT_VERBOSE

After you're done with the output buffer, free it with:

void **snarf_output_buffer_free**(snarf_output_buffer_t **outbuf*)

Field Printing Helpers

Several helper functions are available for printing alert data:

void **snarf_alert_print_envelope_field**(snarf_output_buffer_t **outbuf*, snarf_alert_t **alert*, **const** char **fieldname*)
Print a field from an alert's envelope.

Parameters

- `outbuf`: a snarf output buffer
- `alert`: a snarf alert
- `fieldname`: the name of the envelope field to print

void **snarf_alert_print_value**(snarf_output_buffer_t **outbuf*, snarf_value_t **value*)
Print a field value from an alert.

Parameters

- `outbuf`: a snarf output buffer
- `value`: the value to print

void **snarf_alert_print_string**(snarf_output_buffer_t **outbuf*, char **str*)
Print a string to an output buffer.

Parameters

- `outbuf`: a snarf output buffer
- `str`: the string to append

void **snarf_alert_print_string_raw**(snarf_output_buffer_t *_outbuf_, char *_str_)
Print a string to an output buffer with no field delimiting or special formatting.

Parameters

- `outbuf`: a snarf output buffer
- `str`: the string to append

void **snarf_alert_print_flow_field**(snarf_output_buffer_t *_outbuf_, snarf_value_t *_value_, **const** char *_fieldname_)
Print a flow field value to an output buffer.

Parameters

- `outbuf`: a snarf output buffer
- `value`: a flow value
- `fieldname`: the name of the flow field to print

void **snarf_alert_write_ipset**(**const** char *_filename_, snarf_value_t *_value_)
Write an IPset value to a file.

Parameters

- `filename`: the name of the file to write to
- `value`: an IP set value

2.2 Source API

To begin send `snarf` alerts, create a new alert source with:

snarf_source_t ***snarf_source_init**(char *_source_name_, char *_source_version_, char *_destination_)
Initialize an alert source.

Should be called once on program startup.

Return a snarf alert source

Parameters

- `source_name`: name of the alerting software
- `source_version`: version of the alerting progrma
- `destination`: socket specifier for the remote socket to send alerts to, which may be NULL to print alerts locally

By convention, source names should be in the form of the reverse fully-qualified domain name of the software publisher, followed by the name of the software – e.g., if an alert detection program "foobar" is published by the "hackers" division of Acme Corporation at http://www.hackers.acme.com/ the generator string should be "com.acme.hackers.foobar".

The `dest` argument is a *socket specifier*.

Once the alert has been constructed using the alert API, it can be sent with:

int **snarf_source_send_alert**(snarf_source_t *source, char *tags, snarf_alert_t *alert)
Send an alert.

Sends the alert to the destination given when the alert context was created. The alert is freed once it has been sent.

Parameters

- `source`: a snarf alert source
- `tags`: a comma-separated list of tags that inform upstream components of what type of analysis was used to generate the alert.
- `alert`: a snarf alert

When your application is done sending alerts, you should free the source with:

void **snarf_source_destroy**(snarf_source_t *source)
Shutdown the alert source and free its resources.

Parameters

- `source`: a snarf alert source

2.3 Sink API

The `snarf` sink API facilitates the development of programs that wish to subscribe to alerts.

To begin receiving alerts, create a new alert sink with:

snarf_sink_t ***snarf_sink_init**(char *origin)
Initialize an alert sink.

The sink will receive alerts on socket 'origin'

Parameters

- `origin`: a socket specifier for the remote socket where alerts are published.

If you simply want to output alerts using one of the built-in output formats, you can do so by configuring the sink with the following function:

int **snarf_sink_configure**(snarf_sink_t *sink, **const** char *sink_id)
Configure an alert sink using one of the built-in alert output types.

Return zero on success, nonzero on error

Parameters

- `sink`: a snarf sink
- `sink_id`: the identifier for the sink in the sink configuration

- `config`: a configuration object passed into the sink callback functions

For more custom alert processing, configure the sink with this function:

int **snarf_sink_configure_full**(snarf_sink_t **sink*, snarf_sink_init_fn_t *init_fn*, snarf_sink_alert_fn_t *process_fn*, snarf_sink_destroy_fn_t *destroy_fn*, snarf_config_t **config*)

Configure an alert sink for custom processing using callback functions.

Return zero on success, nonzero on error

Parameters

- `sink`: a snarf sink
- `init_fn`: the custom sink's initialization function
- `process_fn`: the custom sink's processing (alert dispatch) function
- `destroy_fn`: the custom sink's termination function
- `config`: a configuration object passed into the sink callback functions

To subscribe to specific alert channels, call:

int **snarf_sink_subscribe**(snarf_sink_t **sink*, **const** char **channel*)

Subscribe to the given alert channel.

Return zero on success, nonzero on error

Parameters

- `sink`: a snarf sink
- `channel`: the name of the channel to subscribe to

Keep in mind that if you do not subscribe to a specific channel, you will receive all alerts broadcast on the sink's destination socket.

To being processing alerts:

int **snarf_sink_process**(snarf_sink_t **sink*)

Begin processing alerts using the sink's processing callback function.

The callback function will be executed in a background thread.

Return zero on success, nonzero on error

Parameters

- `sink`: a snarf alert sink

To stop processing of alerts:

void **snarf_sink_destroy**(snarf_sink_t **sink*)

Shutdown an alert sink, unsubscribing from the alert channel.

This will terminate the sink's background processing thread and free up any resources used.

Parameters

- `sink`: a snarf alert sink

CHAPTER

THREE

SNARF-PYTHON

Much like the `libsnarf` APIs, the structure of `snarf`'s application interfaces is divided into alert, source, and sink components.

3.1 `snarf` — SNARF Python Interface

3.1.1 `snarf.alert` — SNARF Alert Class

snarf.alert

The *`snarf.alert`* module provides classes to represent network alert messages and various components of such messages, such as network flows.

class `snarf.alert.`**`Alert`**(*fields*, *generator=None*, *generator_version=None*, *severity=1*, *timestamp=None*, *analysis_tags=None*)

A class representing network alerts. Each alert has a fixed set of required "envelope" fields and set of variable "alert body" fields.

classmethod `from_message`(*envelopemsg*, *bodymsg*)

Build an *`Alert`* object from a protobuf message.

`to_message`()

Serialize an *`Alert`* object to a protobuf message.

`get_generator`()

Returns an identifier representing thed entity that generated the alert (e.g., "org.cert.netsa.pipeline".)

`get_generator_version`()

Returns a string representation of the version of the generator.

`get_timestamp`()

Returns a `datetime.datetime` object representing the time at which the alert was generated.

`get_tags`()

Returns a list of strings corresponding to tags associated with an alert. Different generators may impose additional semantics on tags; it is up to the user to apply those semantics appropriately.

`get_fields`()

Returns a dict of the alert fields.

`add_tags`(*tags*)

Tag an alert with one or more tags.

class `snarf.alert.`**`AlertSeverity`**(*severity*)

An object representing the perceived importance of an alert.

class snarf.alert.**AlertFlow**(*stime*, *elapsed*, *sip*, *dip*, *sport*, *dport*, *proto*, *packets*, *bytes*, *flags*, *flags_initial*, *sensor_name*, *flow_class*, *flow_type*, *application_id*)

Representation of a network flow.

3.1.2 snarf.source — SNARF Alert Source Class

snarf.source

The *snarf.source* module provides an interface for applications to send alerts to snarf alert destinations.

In the following example, an alert object is created for each line of input coming from the SiLK rwcut(1) tool:

```
from snarf import *
import fileinput

# create the source
source = Source("org.cert.netsa.test", "0.0.1",
    destination="tcp://localhost:5555",
    default_tags=["type=Evaluation"])

# generate input with:
# rwcut --no-titles --no-columns \
#     --fields=sTime,duration,sIP,dIP,sPort, \
#     dPort, protocol,packets,bytes,flags,initialFlags,sensor, \
#     class,type,application
for line in fileinput.input():

    (stime, elapsed, sip, dip, sport, dport, proto,
    packets, bytes, flags, flags_initial,
    sensor_name, flow_class, flow_type,
    application_id, dummy) = line.split('|')
    elapsed = int(float(elapsed) * 1000)
    sport = int(sport)
    dport = int(dport)
    proto = int(proto)
    packets = int(packets)
    bytes = int(bytes)
    application_id = int(application_id)
    f = AlertFlow(stime, elapsed, sip, dip, sport, dport, proto,
         packets, bytes, flags, flags_initial,
         sensor_name, flow_class, flow_type, application_id)
    a = Alert({'flow': f})
    source.send(a, tags=["foo=bar", "baz"])
```

class snarf.source.**Source**(*name: str*, *version: str*, *endpoint:str*, *default_tags: list*)

A class representing a producer of network alerts.

"name" and "version" should be the name and version of the program sending the alerts. "destination" is a socket specifier of the remote socket to send alerts to. If desired, a list of tags can be added to all alerts sent by this source by supplying the default_tags argument.

3.1.3 snarf.sink — SNARF Alert Sink Class

snarf.sink

The *snarf.sink* module provides an interface for applications to receive network alerts.

Using a snarf sink is simply a matter of defining a callback function that takes a *snarf.alert.Alert* object as its only argument, and processes that alert as needed. Then, create a *Sink* object, and pass the callback into the *Sink*'s constructor:

```
from snarf import *

def process_alert(alert):
    print "[%s %s] %d %s" %(alert.get_generator(),
                           alert.get_generator_version(),
                           alert.get_severity(),
                           alert.get_timestamp())
sink = Sink(process_alert,
            origin="tcp://localhost:5556",
            channel=channel)
# process_alert now being called for each alert in the background

# use the .stop() method when you're done
sink.stop()
```

class snarf.sink.**Sink**(*callback*, *endpoint: str*, *channel: str*)

A class representing a consumer of network alerts. The given callback function will be called for each alert received on the given channel.

stop()

Terminate a Sink's background processing.

CHAPTER

FOUR

SNARFD

`snarfd` is an alert routing daemon. Configuring a `snarfd` is accomplished by defining:

- a set of *sockets* on which alerts are received and sent
- a list of *routes* that map alert attributes to *alert channels*

Routes are organized into *route groups* that all operate on the same set of sockets. Simpler installations with just a single receiving and sending socket will only need a single route group, but more complex architectures may create multiple route groups, e.g. a group for local alerts, groups for alerts received from remote sites, etc.

Each route in a route group is defined by a set of input attributes, which map to an output alert channel.

It may be easier to explain these concepts by looking at an example snarfd configuration file:

```
# SNARF configuration file
%YAML 1.1
---
# This configuration file allows you to customize how snarfd routes alerts.

# Begin snarfd configuration
snarfd:

    # if this is true, snarfd will reload the conf file when it's modified
    reload: true

    sockets:
        # Use the "sockets" section to define a list of sockets snarfd listens
        # on.  The simplest mode of operation would be two sockets, one for
        # inbound messages and one for outbound messages.  The format of each
        # entry in this list is:
        #
        # <name>:
        #     endpoint: <endpoint>
        #     type: [pub|sub|pull]
        #     identity: <identity>
        #     hwm: <hwm>
        #     channel: <channel>
        #
        # where:
        #
        #     <name> is a meaningful symbolic name for the socket, such as "in".
        #     No spaces are allowed.  This symbolic name is used to refer to the
        #     socket in the "routes" section below.
        #
        #     <endpoint> is a socket specifier in protocol://address:port
        #     format, with "protocol" being one of:
```

```
    #
    #             * tcp: TCP sockets (reliable unicast)
    #             * epgm: EPGM sockets (reliable multicast)
    #             * ipc: UNIX domain sockets (for processes on the same
    #             * host)
    #
    #     <type> indicates what the socket does.  Valid types are:
    #
    #         * pull - a socket for receiving alerts from alert sources
    #         * pub - a socket for publishing alerts for alert subscribers
    #         * sub - a socket for subscribing to published alerts
    #
    #     <hwm> is an optional "high water mark" setting.  This is an
    #     integer specifying how many messages to keep in memory while
    #     waiting for the receiver to get them.  The default is 1024.
    #
    #     <channel>, which is only valid for "sub" socket types, is the name
    #     of an alert channel to subscribe to on the remote snarfd.  For
    #     more info on alert channels, see the "routes" section.

    inbound:
        # A socket named "inbound" that receives alerts on TCP port 5555
        endpoint: tcp://127.0.0.1:5555
        type: pull

    outbound:
        # a socket named "outbound" that publishes alerts on TCP port 5556
        endpoint: tcp://127.0.0.1:5556
        type: pub
        hwm: 256

    remote:
        # a socket named "remote" that subscribes to another snarfd's
        # "events" channel
        endpoint: tcp://10.10.10.10:5557
        type: sub
        channel: events

stats:
    # snarfd can output alerts containing statistics on the number of alerts
    # processed.  Change "enabled" to true and stats will be sent to the
    # <socket> channel every <interval> seconds.
    enabled: false
    socket: inbound
    interval: 60

routes:
    # The "routes" section contains directives which define how alerts are
    # routed to subscribers via the sockets defined above.  For simplicity,
    # routes are organized into "route groups" that operate on the same
    # incoming and outgoing sockets.
    #
    # The structure of each route group is:
    #
    # - from: <in-socket>
    # - to: <out-socket>
    # - rules:
    #     -
```

```
#         - in:
#             - <attribute>:
#                 - <value>
#                 - <value>
#             - <attribute>:
#                 - <value>
#                 - <value>
#         - out:
#             - <channel>
#
# where:
#
#     <in-socket> is the symbolic name of a socket defined in the
#     "sockets" section above that receives alerts from alert sources.
#     Only sockets of types "pull" and "sub" are valid as "in" sockets
#     in route group definitions.
#
#     <out-socket> is the symbolic name of a socket defined in the
#     "sockets" section above that publishes alerts to alert sinks.
#     Only sockets of type "pub" are valid as "out" sockets in route
#     group definitions.
#
#     Each item in the rules: section of a route group specifies routing
#     rules that apply to messages received on the "in:" socket.  The
#     routing is based on a set of attributes and a list of values for
#     each of those attributes.  At this time, the recognized attributes
#     are:
#
#         * generator - identifies the software that detected and
#           generated the alert.  By convention, generator strings
#           should be in the form of the reverse fully-qualified domain
#           name of the software publisher, followed by the name of the
#           software -- e.g., if an alert detection program "foobar" is
#           published by the "hackers" division of Acme Corporation at
#           <http://www.hackers.acme.com/>, the generator string should
#           be "com.acme.hackers.foobar"
#
#         * tag - identifies one or more textual tags in the alert that
#           describe the alert contents.  These are nothing more than
#           free-form textual strings, with no spaces allowed.  Alert
#           sources can also define a key=value structure within these
#           tags, e.g. "color=blue", but this is optional.
#
#     For each attribute in a routing rule, you may specify one or more
#     values to match that attribute with.  The syntax of these <value>
#     definitions allows the wildcard characters ? and * to match any
#     single character or any number of characters, respectively.
#
#     <channel> should be an alphanumeric name for a published alert
#     channel.  Channels aloow alert subscribers to indicate the type of
#     alert messages they would like to receive without needing to know
#     any details about the attributes of the alerts themselves.  In
#     this manner, snarfd can be used not only to route alerts, but to
#     organize them into meaningful collections.

- # route group "inbound" to "outbound"
    - from: inbound
    - to: outbound
```

```
            - rules:
                - # route all alerts generated by the "foobar" software from
                  # Acme Corp. to the "foo" channel
                  - in:
                      - generator:
                              - com.acme.hackers.foobar
                  - out:
                      - foo
                - # route all alerts with the "evilhosts" tag to the "evil"
                  # channel
                  - in:
                      - tag:
                              - evilhosts
                  - out:
                      - evil
                - # route all alerts generated by Acme Corp. with the "urgent"
                  # or "critical" tags, as well as any tag beginning with "bad",
                  # to the "zomg" channel
                  - in:
                      - generator:
                              - com.acme.*
                      - tag:
                              - urgent
                              - critical
                              - bad*
                  - out:
                      - zomg

        - # route group "remote" to "outbound"
            - from: remote
            - to: outbound
            - rules:
                - # route alerts from an upstream snarfd to the "feeds.events"
                  # channel
                  - in:
                      - generator:
                          - org.example.data
                      - tag:
                          - color=blue
                  - out:
                      - feeds.events

# The "sink" section contains configuration for various alert destinations.
# Each sub-section within the "sink" section denotes a single sink
# configuration.  At a minimum, each "sink" sub-section must consist of an
# identifier for the sink and a type: attribute that specifies the type of the
# sink.  Currently-supported sink types are "json", "email", and "cef".
sink:

    # A JSON (JavaScript Object Notation) sink.  JSON allows any snarf alert
    # data to be expressed in textual form using the same field structure that
    # snarf uses internally.
    json:
        type: json
        # JSON sinks support an "output_file" option for specifying the location
        # of the output.  If not specified, it defaults to standard output.
        # outut_file: foo.txt
```

```
    # An email sink, which sends alert data to a specified email address.
    email:
        type: email
        from: root          # the email address to send alerts from
        to: root            # the email address to send alerts from
        sms_format: false   # if true, alert format is shortened for SMS

    # A CEF (Common Event Format) sink.  Used for sending alerts to ArcSight.
    cef:
        type: cef

        # Configure syslog output for CEF alerts.
        syslog:
            enabled: true    # if true, send alerts to syslog (stdout otherwise)
            facility: local4 # syslog facility to use local1 .. local7 or user

        # Each entry in the "fields" sub-section maps a CEF output field to
        # a field in the snarf alert.  The format of each field mapping is:
        # - output_field:
        #     - field_type: input_field
        # where field_type is one of:
        #     flow (a flow field in the alert),
        #     field (a non-flow field in the alert)
        #     string (raw text to be included verbatim in the alert output)
        fields:
            - src:
                - flow: sip
            - dst:
                - flow: dip
            - spt:
                - flow: sport
            - dpt:
                - flow: dport
            - proto:
                - flow: proto
            - start:
                - flow: stime
            - end:
                - flow: etime
            - cn1:
                - flow: packets
            - cn1Label:
                - string: Packets count
            - in:
                - flow: bytes
            - cn2:
                - flow: elapsed
            - cn2Label:
                - string: duration of flow in msec
            - cs1:
                - flow: sensor_name
            - cs1Label:
                - string: sensor name
            - cs2:
                - flow: flow_class
            - cs2Label:
                - string: class of sensor
            - cs3:
```

```
                - flow: flow_type
            - cs3Label:
                - string: type of sensor
            - cs4:
                - flow: icmp_type_code
            - cs4Label:
                - string: ICMP type,code
            - cs5:
                - flow: flags
            - cs5Label:
                - string: TCP flags bitwise OR
            - app:
                - flow: application_id
            - sourceGeoCountryCode:
                - field: sip.cc
            - destinationGeoCountryCode:
                - field: dip.cc

# End snarfd configuration
```

CHAPTER

FIVE

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