A Bro Script Case Study

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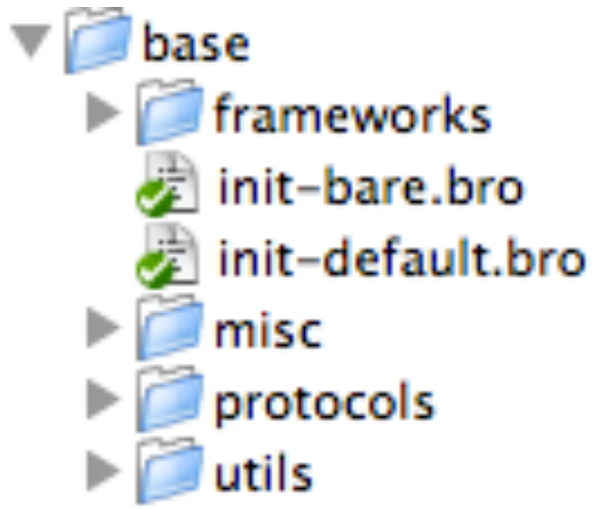
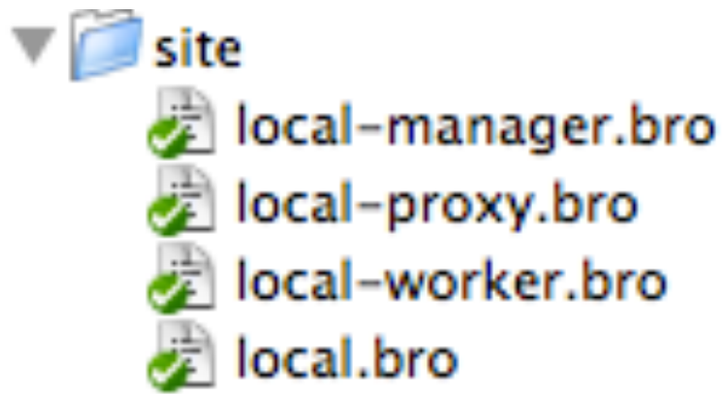
NCSA, Urbana-Champaign, IL

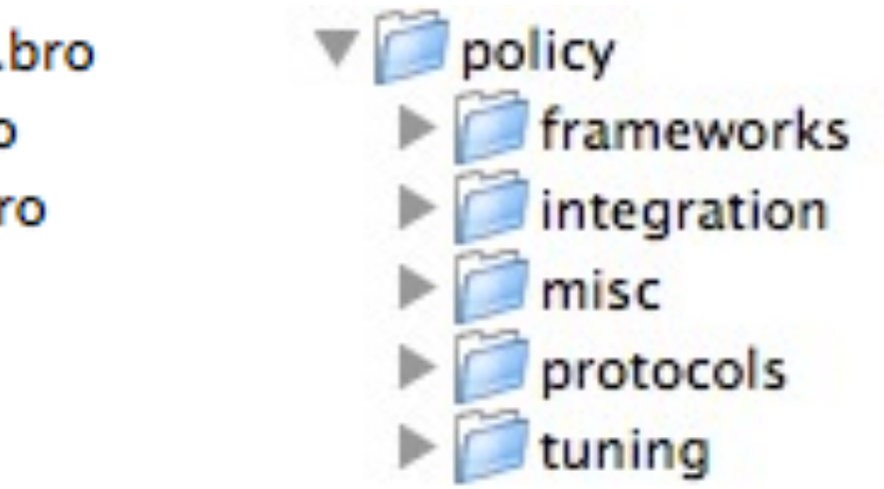
- No deep detail now, just enough to understand basic constructs.
- Important to focus on script structure and data flow.

Script layout changes in 2.0

Important script directories.







Found at: <prefix>/share/bro/

base/ directory

- Everything is loaded by default.
  - Possible to disable with a Bro command line argument, but not recommended.
- The scripts are only meant to enable analyzers, collect state, generate protocol logs, and provide reusable frameworks and function libraries.
- base/ is not in the default $BROPATH!

policy/ directory

- Nothing here is loaded by default.
- This is where many of the detections that Bro does out of the box take place.
- Almost any functionality that doesn't fit into base/ goes here.

site/ directory

- This is where local configuration goes.
- Files are not overwritten during installation.
- We include a “suggested” configuration in site/local.bro
- It’s mostly just a long list of @load statements.

SSL Base Scripts

Quick aside about module layout

- __load__.bro is an auto load file. We can now load directories.
- main.bro is a convention we use for consistency. There is no special language support for it.

__load__.bro

```
@load ./consts
@load ./main
@load ./mozilla-ca-list
```

Found at: <prefix>/share/bro/base/protocols/

Create the skeleton

```
module SSL;

export {
    redef enum Log::ID += { LOG };

    type Info: record {

    };

    global log_ssl: event(rec: Info);
}

redef record connection += {
    ssl: Info &optional;
};

event bro_init() &priority=5
    {
    Log::create_stream(SSL::LOG, [$columns=Info, $ev=log_ssl]);
    }

redef dpd_config += {
    [[ANALYZER_SSL]] = [$ports = ports]
};
```

Define the log

```
type Info: record {
    ts:              time              &log;
    uid:             string            &log;
    id:              conn_id           &log;
    version:         string            &log &optional;
    cipher:          string            &log &optional;
    server_name:     string            &log &optional;
    session_id:      string            &log &optional;
    subject:         string            &log &optional;
    not_valid_before: time             &log &optional;
    not_valid_after:  time             &log &optional;

    cert:            string            &optional;
    cert_chain:      vector of string  &optional;
};
```

Create a helper function

```
function set_session(c: connection)
    {
    if ( ! c?$ssl )
        c$ssl = [$ts=network_time(), $uid=c$uid,
                 $id=c$id, $cert_chain=vector()];
    }
```

SSL Client Hello

```
event ssl_client_hello(c: connection, version: count, possible_ts: time,
                       session_id: string, ciphers: count_set) &priority=5
    {
    set_session(c);

    # Save the session_id if there is one set.
    if ( session_id != /^\x00{32}$/ )
        c$ssl$session_id = bytestring_to_hexstr(session_id);
    }
```

SSL Server Hello

```
event ssl_server_hello(c: connection, version: count, possible_ts: time,
                       session_id: string, cipher: count,
                       comp_method: count) &priority=5
    {
    set_session(c);

    c$ssl$version = version_strings[version];
    c$ssl$cipher = cipher_desc[cipher];
    }
```

Certificates

```
event x509_certificate(c: connection, cert: X509, is_server: bool,
                       chain_idx: count, chain_len: count,
                       der_cert: string) &priority=5
    {
    set_session(c);
    if ( chain_idx == 0 )
        {
        # Save the primary cert.
        c$ssl$cert = der_cert;
        # Also save other certificate information about the primary cert.
        c$ssl$subject = cert$subject;
        c$ssl$not_valid_before = cert$not_valid_before;
        c$ssl$not_valid_after = cert$not_valid_after;
        }
    else
        {
        # Otherwise, add it to the cert validation chain.
        c$ssl$cert_chain[|c$ssl$cert_chain|] = der_cert;
        }
    }
```

server_name extension

```
event ssl_extension(c: connection, code: count,
                    val: string) &priority=5
    {
    set_session(c);

    if ( extensions[code] == "server_name" )
        c$ssl$server_name = sub_bytes(val, 6, |val|);
    }
```

Finish the log

```
event ssl_established(c: connection) &priority=5
    {
    set_session(c);
    }

event ssl_established(c: connection) &priority=-5
    {
    Log::write(SSL::LOG, c$ssl);
    delete c$ssl;
    }
```