Binary Protocol Analysis with CANAPE

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44CON

Schedule

1. What is CANAPE?
2. Say Hello to SuperFunkyChat
3. Proxying and Capturing Traffic
4. NetGraphs
5. Modelling State Transitions
6. Removing SSL/Layers
7. Traffic Manipulation and Replay
8. Developing Network Clients
9. Wrap Up

https://www.github.com/tyranid/44con_2014

Playing Along at Home

- Pre-built binaries available at:
- https://www.github.com/tyranid/44con_2014
- Example projects and slides will come later

ASK QUESTIONS

https://www.github.com/tyranid/44con_2014

What is CANAPE?

- Arbitrary Network Protocol Capture Tool
- Specifically designed for Binary Protocols
- Windows focused (some Mono support)
- Open source, GPLv3, written in C#
  - https://www.github.com/ctxis/canape

https://www.github.com/tyranid/44con_2014

What Makes CANAPE Different?

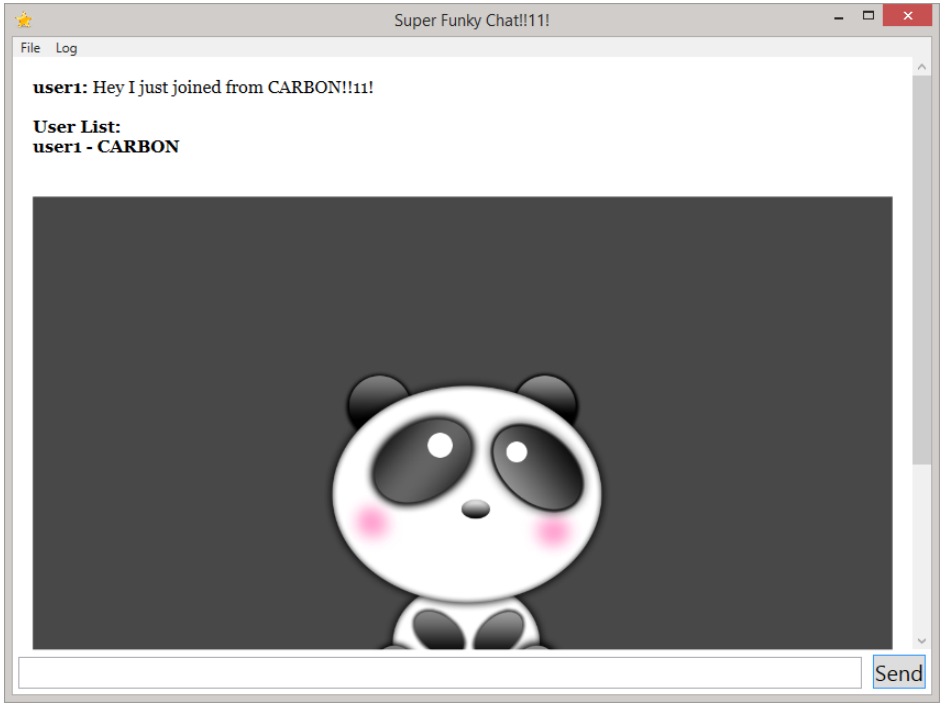
- Number of tools to generate or fuzz network traffic
  - Scapy, Peach, Sulley etc.
- Takes Web Application Testing Paradigm and applies to arbitrary protocols
  - GUI
  - Easy packet manipulation
  - Quick feedback

https://www.github.com/tyranid/44con_2014

Workshop 0:
Quick Tour of CANAPE

https://www.github.com/tyranid/44con_2014

Say Hello to Super Funky Chat!!11!



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SuperFunkyChat

- Simple Windows IM Application
- Written originally as a CTF and CANAPE tutorial
  - Uses a binary protocol
  - Supports SOCKS
  - Has a few "Undocumented" features
- Sourcecode available at https://www.github.com/tyranid/SuperFunkyChat
- Don't use as a real IM system ☺

https://www.github.com/tyranid/44con_2014

Workshop 1:
Quick Tour of SuperFunkyChat

https://www.github.com/tyranid/44con_2014

Proxying and Capturing Traffic

- CANAPE Supports Many Ways of Proxying Traffic:
  - TCP/UDP Port Forwarding
  - SOCKS v4/v5 Proxy
  - HTTP Forward and Reverse Proxies
- Can develop your own extensions to support other types of networks (NamedPipes, COM ports)
- Also supports Servers and Clients

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Identifying Suitable Traffic

- Need to work out what traffic to capture
  - Reverse Engineering
  - Wireshark/PCAP

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Forcing Traffic Through CANAPE

- CANAPE works at Application Level (TCP/UDP) not network
- Traffic from Application needs to go through CANAPE
  - Proxy support
  - DNS redirecting
  - DNAT
  - SOCKSifying tools (Proxifier for example)

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Services

- CANAPE insolates your project into a set of services.
- You define a template for your service:
  - Data flow
  - State model
  - Dynamic content
- When a new connection is made an Instance is instantiated based on the template

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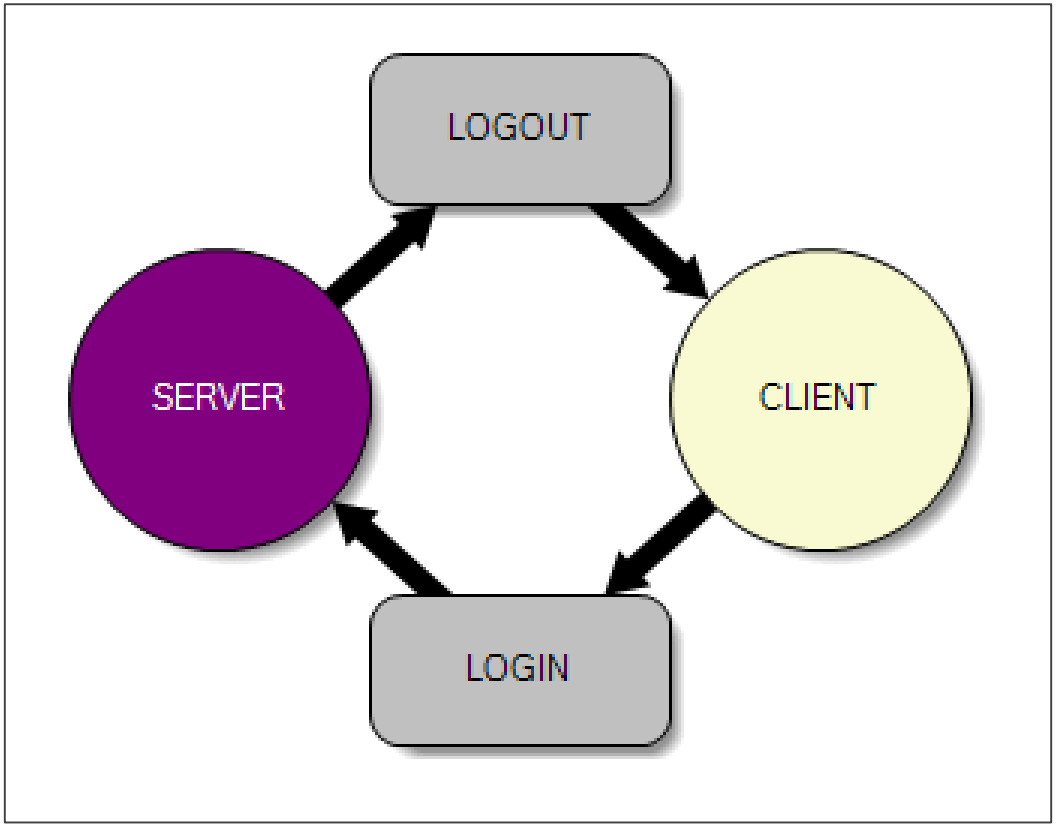
Workshop 2:
Capturing SuperFunkyChat

https://www.github.com/tyranid/44con_2014

NetGraphs



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NetGraphs

- NetGraphs used to mode data flow and state
- Specified as a directed graph
- Standard graph nodes available
- Can implement custom nodes in C#/IronPython

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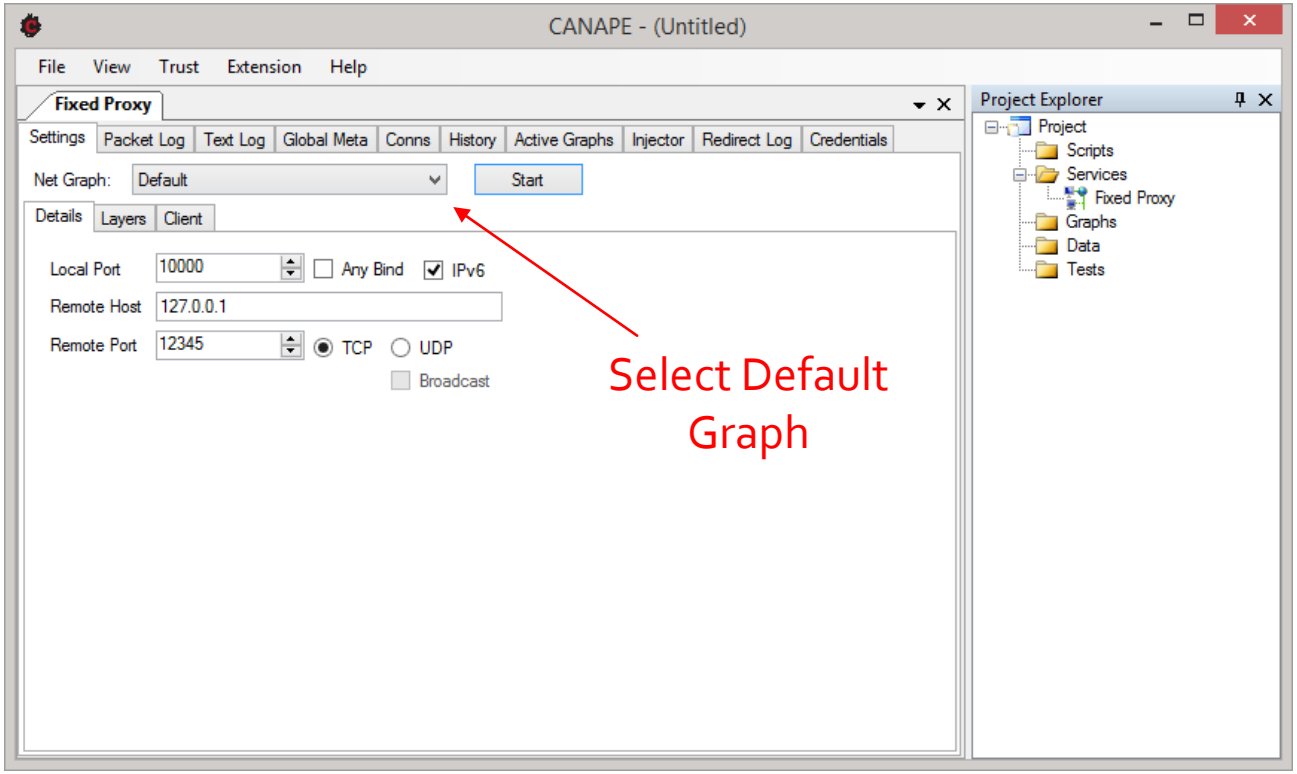
Specifying a NetGraph



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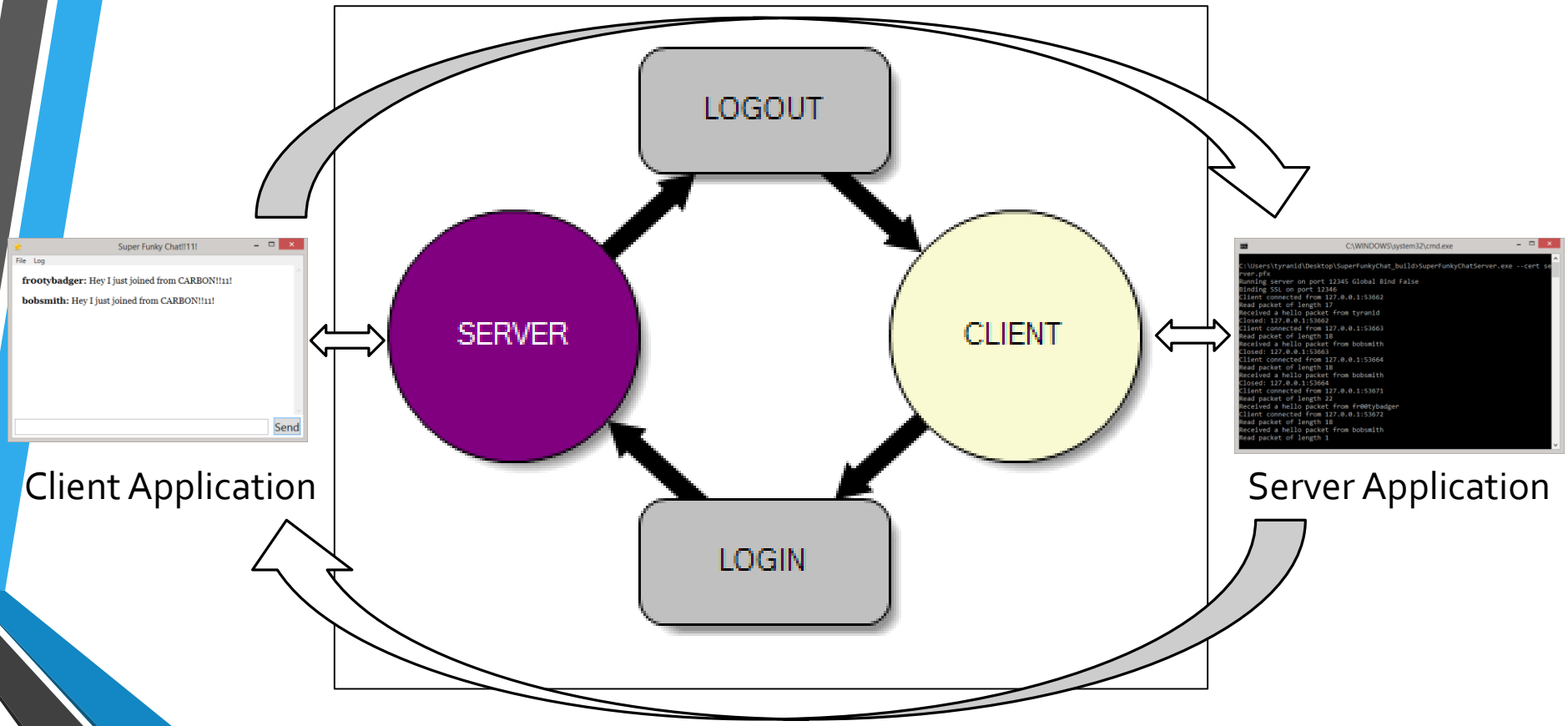
Netgraph in Service Context



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Some Standard Nodes

Name	Description
Log Node	Logs packets as they traverse the node
Decision Node	Performs an IF condition on packets
Switch Node	Select on output based on state
Edit Node	Displays a dialog to allow manual packet editing
Dynamic Node	Scripted content
Layer Section	Graph container and layer processing

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Graph User Interface

- Create a new graph by right clicking project explorer
- Left Click to Select and Drag Nodes
- Right Click to Add Nodes
- Hold and Drag Middle Button to Add Edges
  - Can also hold left Control and use Left button
- Nodes can be disabled from right click menu

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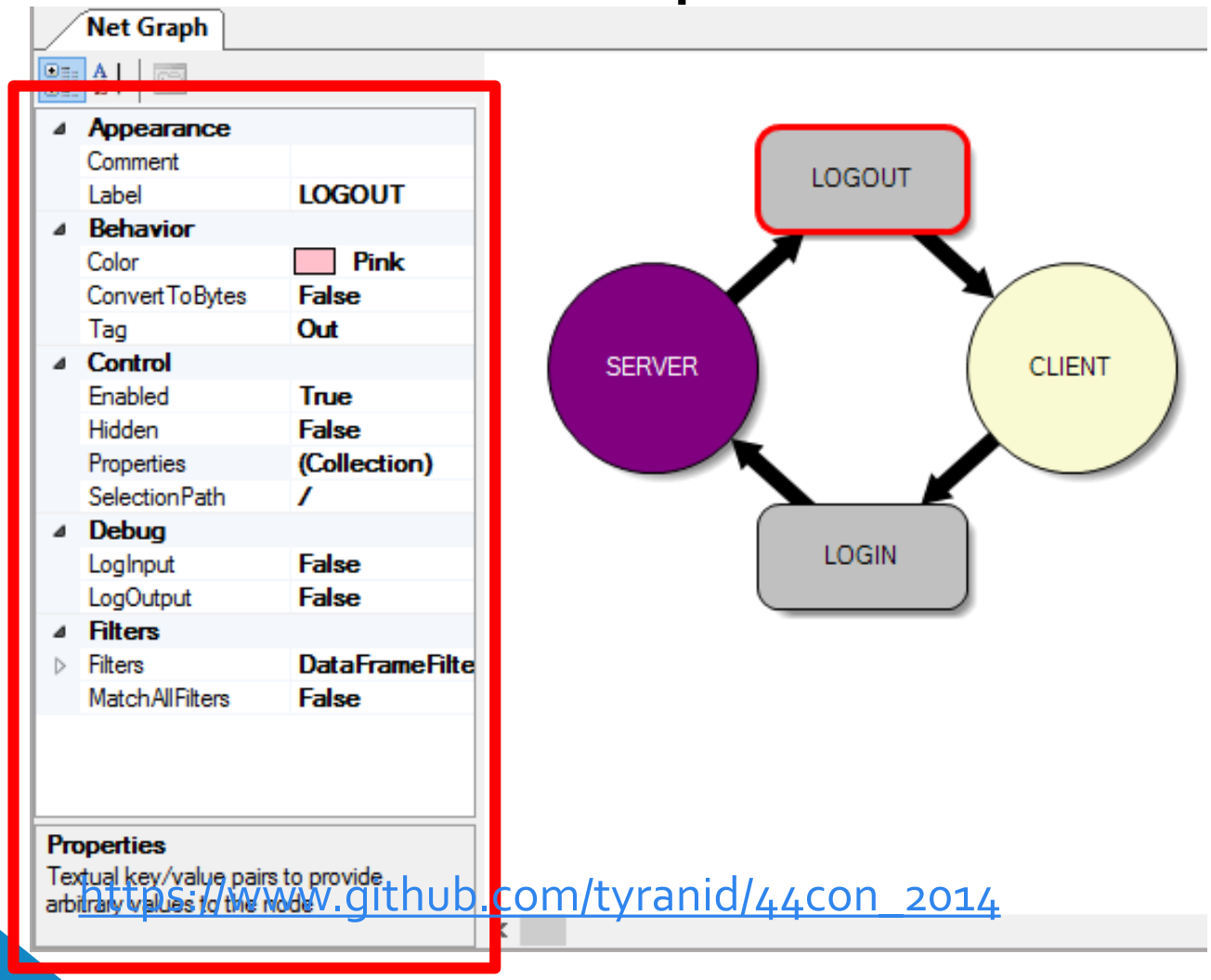
Node Properties



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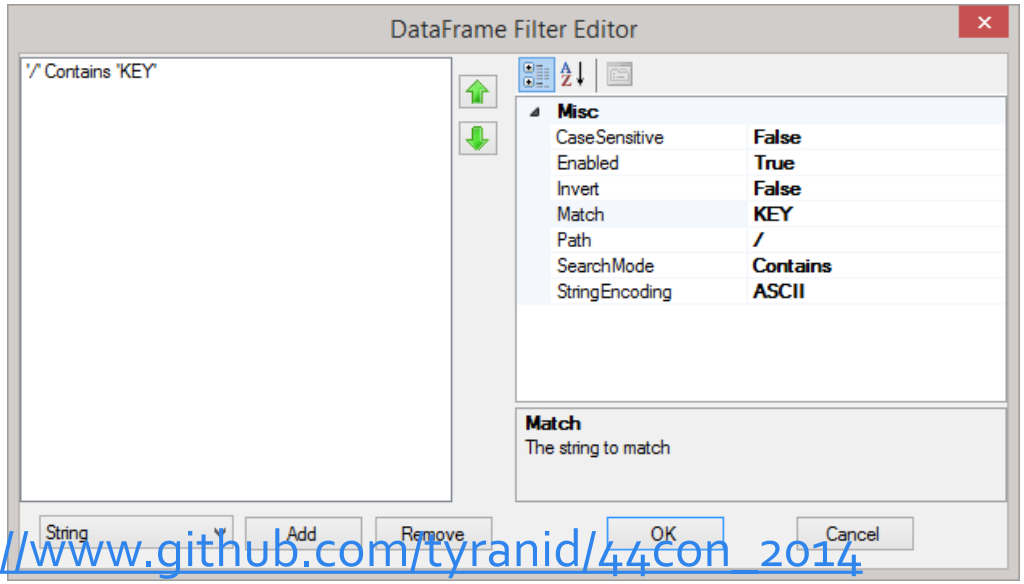
Node Filters

- Each node has a Filters property
- Defines match rules for what packets the node will process



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Workshop 3:
Playing with Netgraphs

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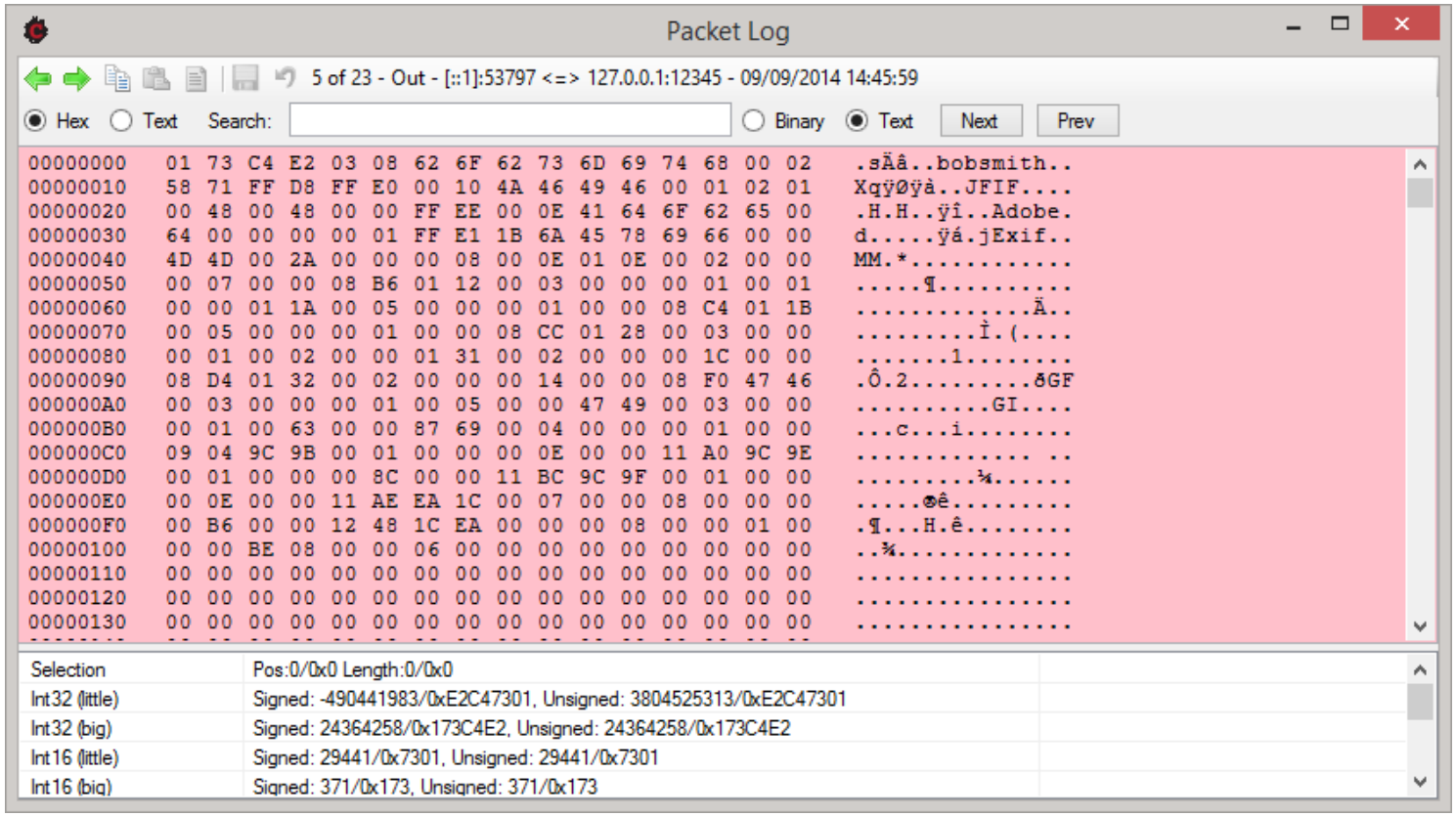
Traffic Analysis



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Packet Logging

- Only packets which traverse a log node in a graph end up being logged (well unless you do it manually)
- Affected by node filters
- Can specify a number of properties:
  - Colour
  - Logged Name

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Workshop 4:
Packet Logging Interface

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Packet Tools

- Analysis of traffic means looking at binary data
- Many different tasks:
  - Comparing packets and sequences of packets
  - Importing and exporting data
  - Searching

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Workshop 5: Packet Tools

https://www.github.com/tyranid/44con_2014

Parsing Traffic

- CANAPE's data pipeline can be scripted using C# or Python
- Not necessarily easy thing to do
- Parser editor to the rescue

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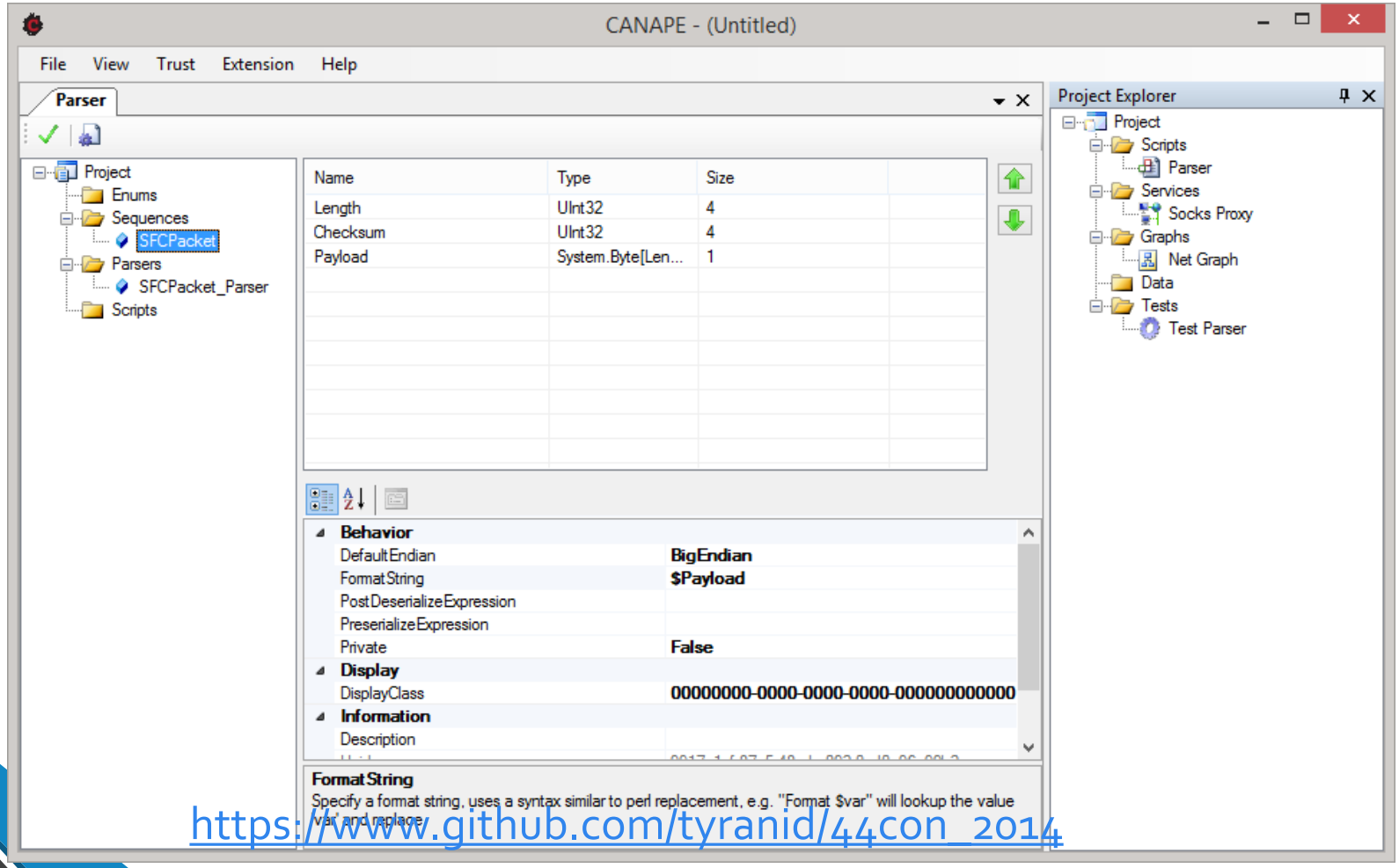
Parser Editor



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Parser Editor

- Build protocol structure in GUI
- Defines 3 types:
  - Sequences
  - Enumerations
  - Parsers
- Supports complex expressions, TLV, sub-sequences etc.
- Compiles to C# parser script, can be exported and tweaked

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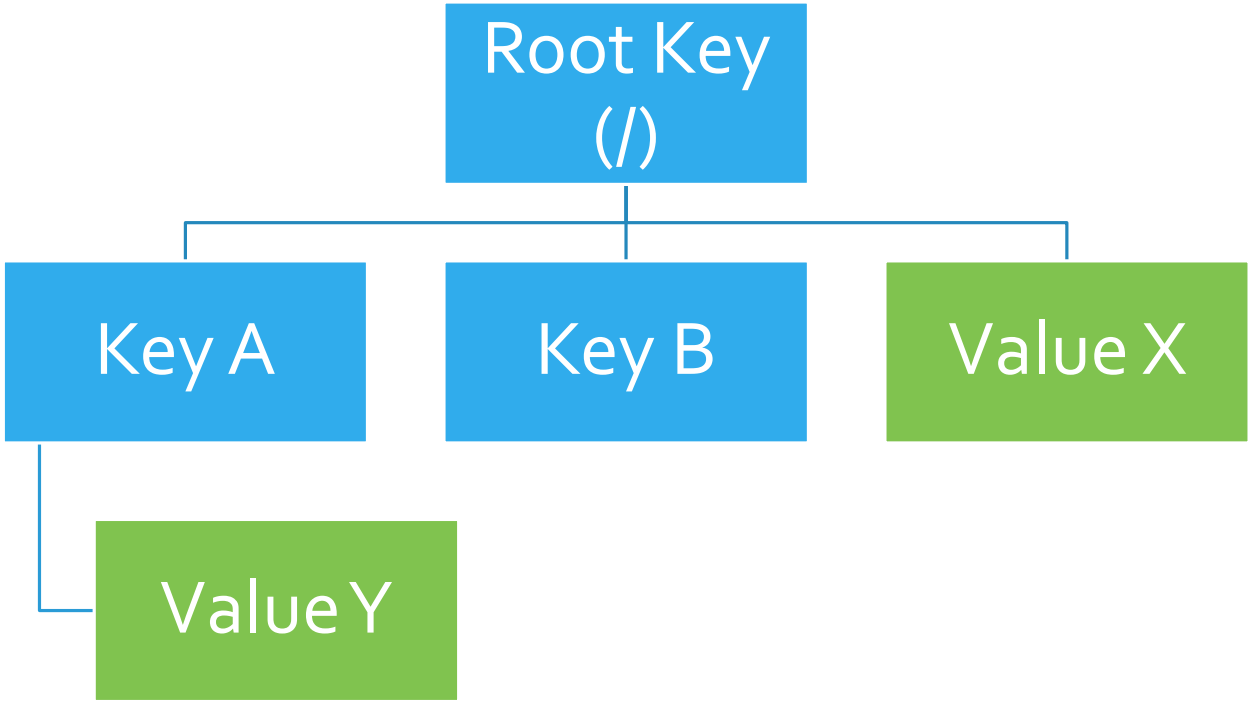
Parsed Packet Format

- Nodes and filtes support a Selection Path
- Uses an XPATH syntax to determine selection



SelectionPath = /A/Y

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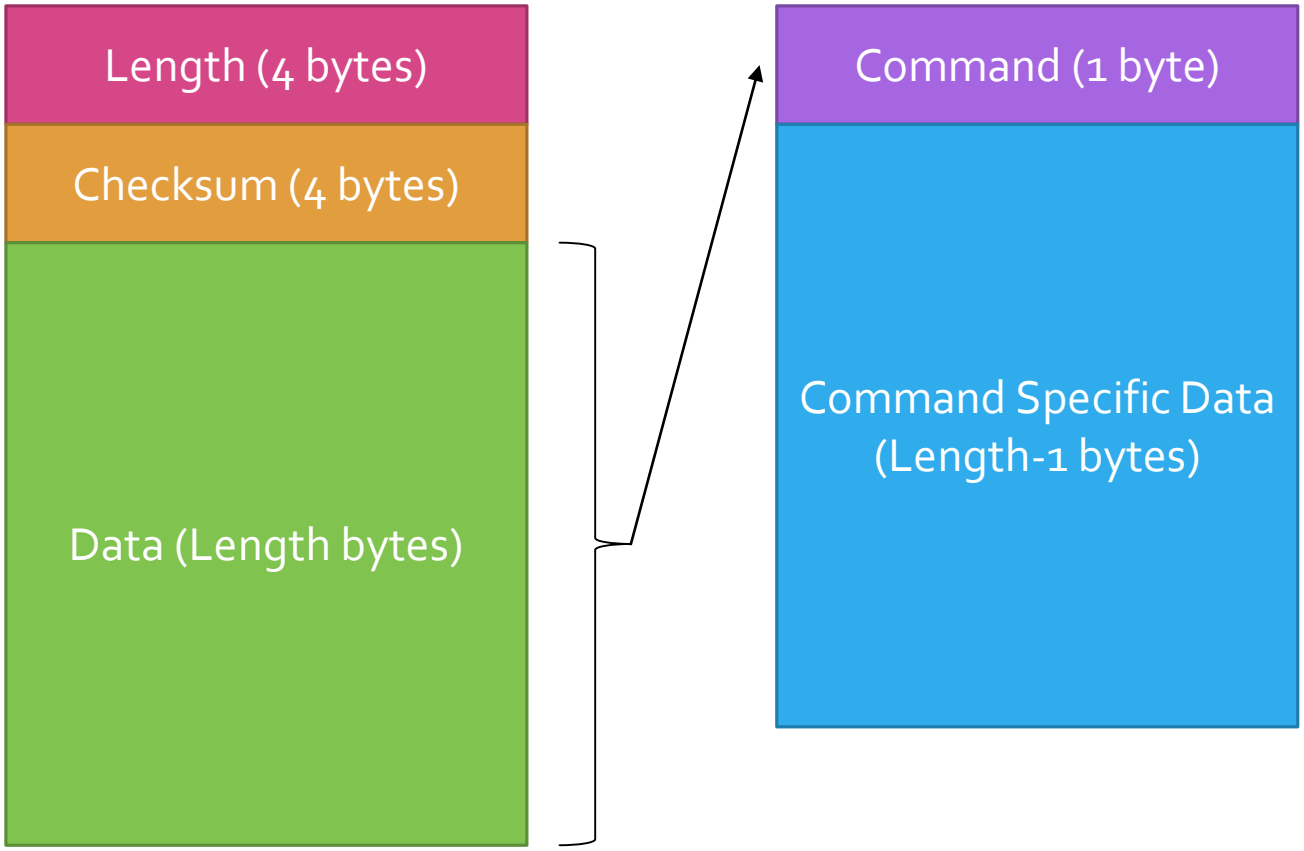
SuperFunkyChat Packet Structure



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Workshop 6:
Parser Development

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Removing TLS/Layers

- One of the most common security protocols is TLS/SSL
- CANAPE doesn't assume it knows better than you whether a connection is TLS or not
- Can wrap and decrypt entire connection

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Workshop 7:
Remove TLS Encryption

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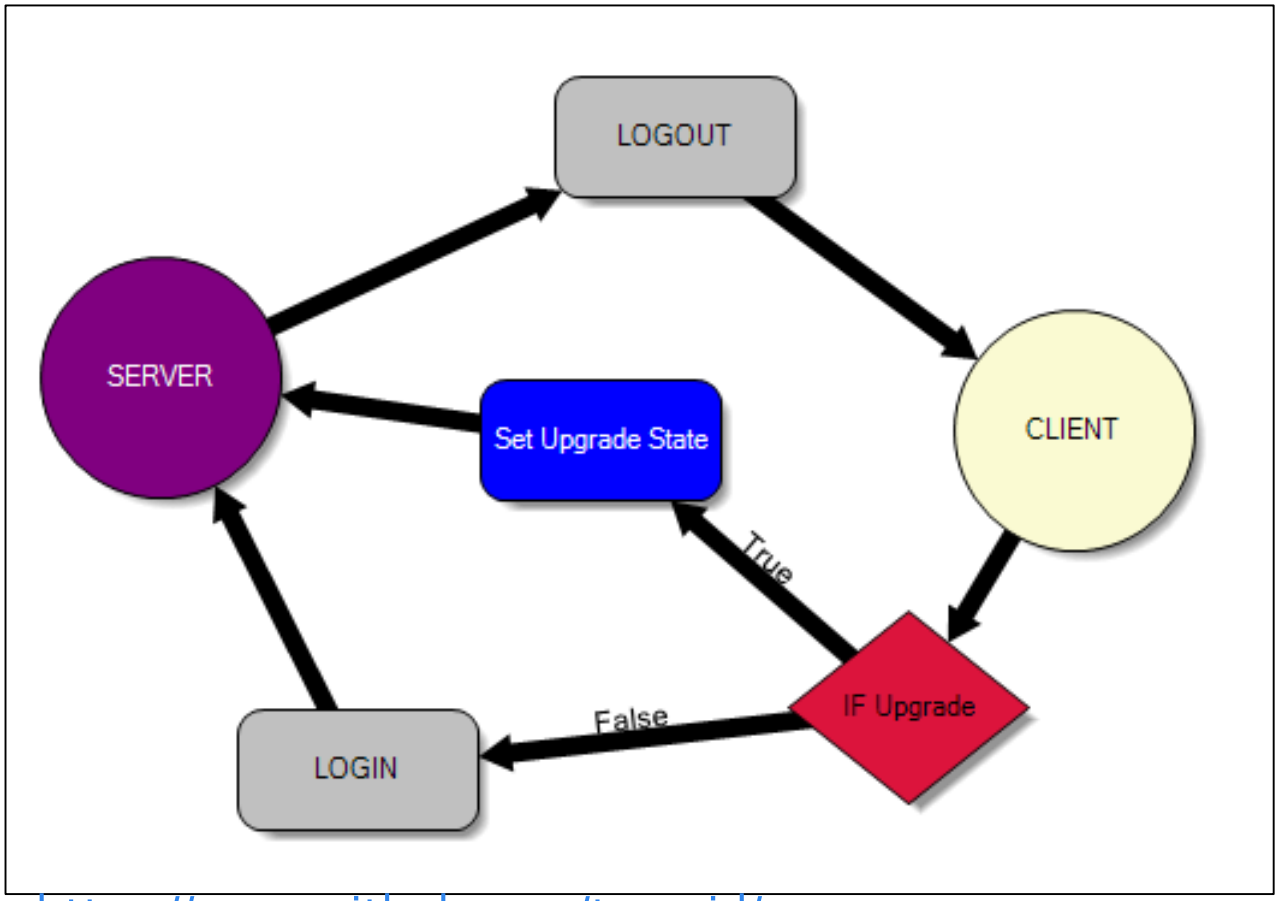
State Modelling



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State Modelling

- Most protocols aren't simple streams of data
- Need to deal with State
- Main way of handling this in CANAPE is through the netgraphs
- Also simpler interface using state graphs

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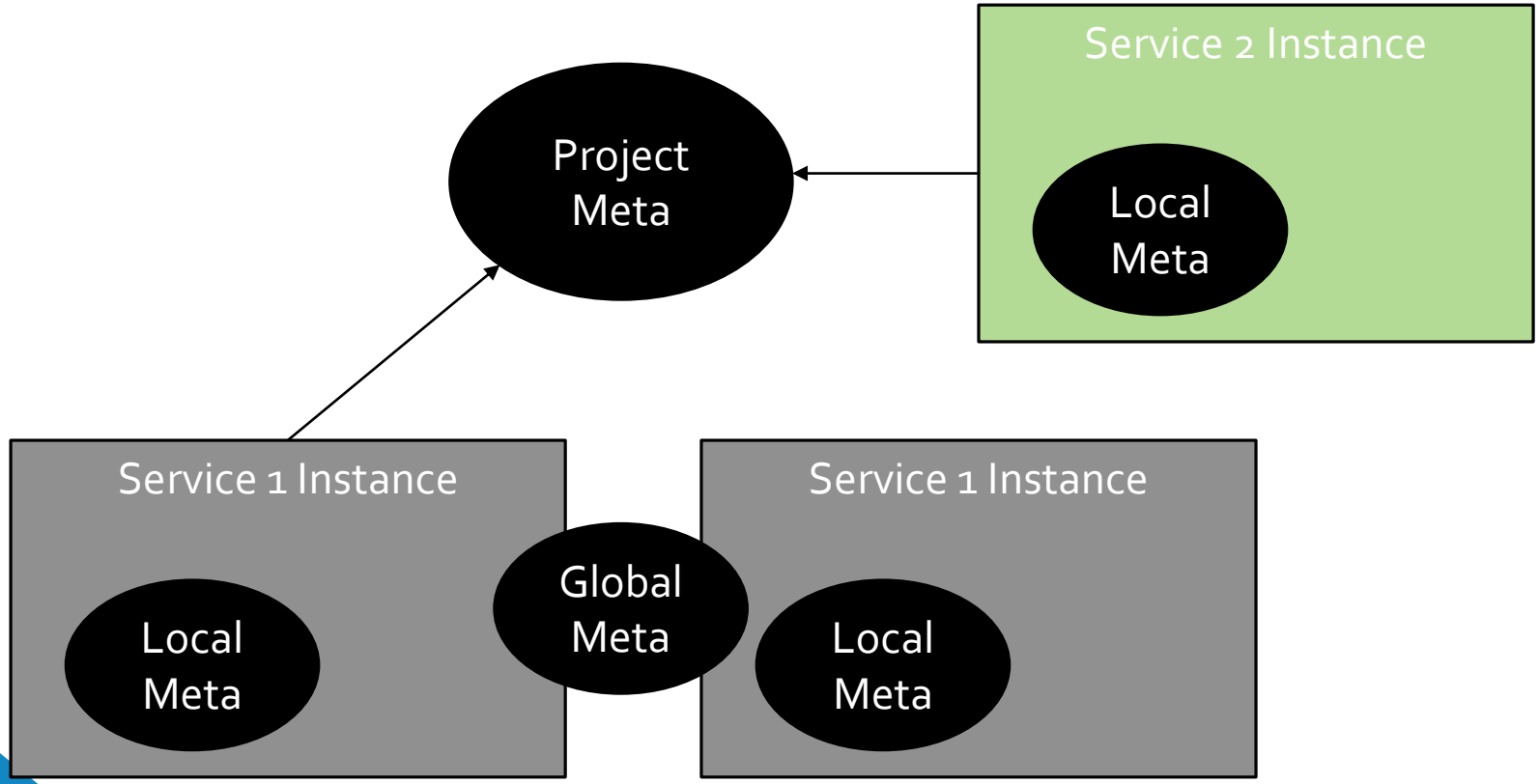
Meta Data Storage



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Accessing Meta Data Storage

- Local (Graph.Meta)
- Global (Graph.GlobalMeta)
- Project (CANAPEProject.CurrentProject.GlobalMeta)
- Layers (this.Meta/this.GlobalMeta)

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MetaSelection

- Already seen XPATH SelectionPath
- Filters can also select on MetaData
- Examples:
  - #MetaName – Select the local meta value
  - $MetaName – Select the global meta value

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Workshop 8:
Developing XOR Decryption

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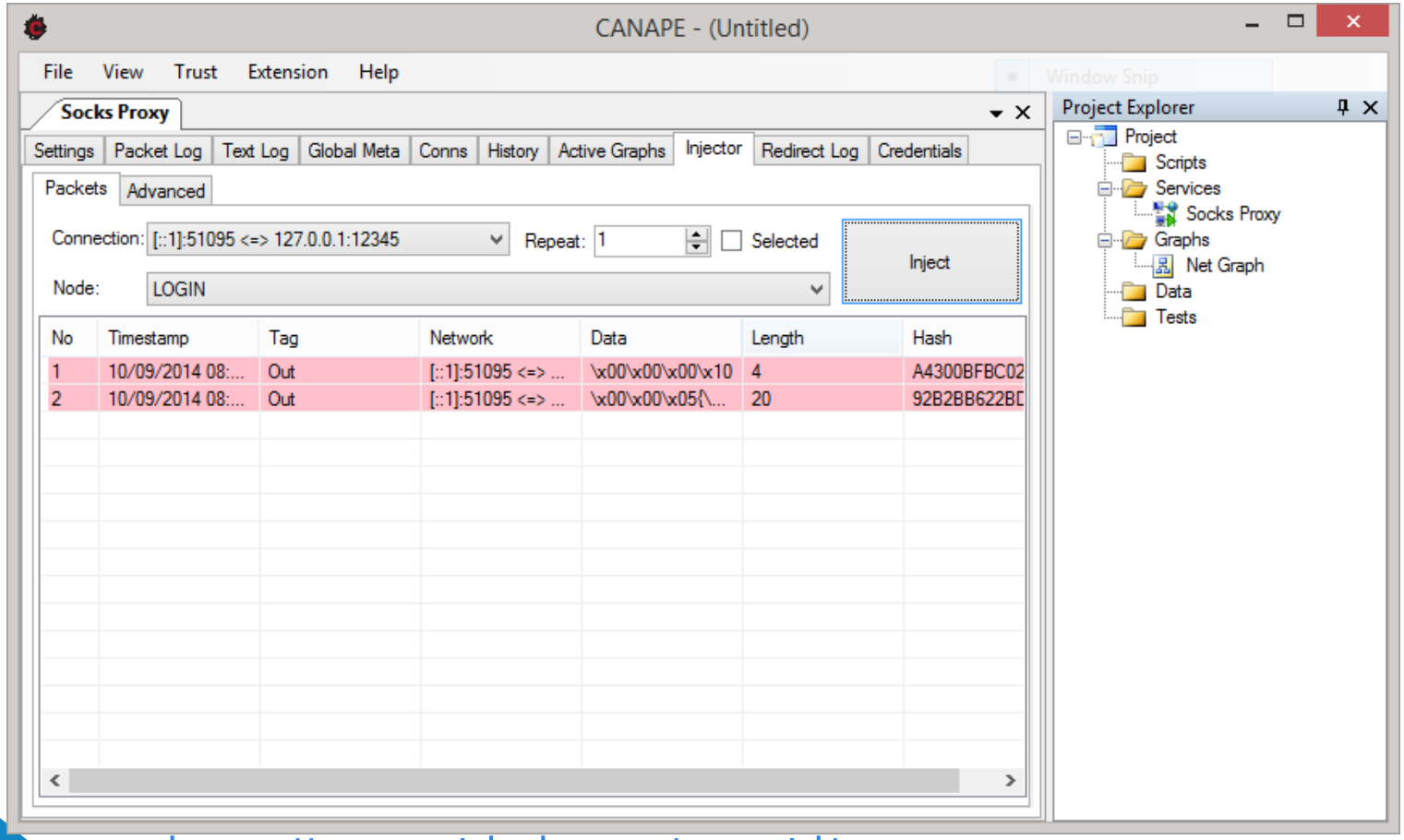
Traffic Manipulation and Replay



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Dealing with Checksums

- Up to now we've only looked at packets, never changed and replayed them
- Something prevents us doing this, the checksum
- Could write a script to fix up checksum after modification
- Parser editor also gives some basic functions to do this for us

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Expressions

- Parser editor supports a python-like syntax expression evaluator
- Combine with calculated values to recalculate checksum
- Can even use python snippets:

```
def RunMe(command, payload):
    chk = command
    for b in payload:
        chk = chk + b
    return chk
```

```
DoChecksum.RunMe(Command, bytes(Payload))
```

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Workshop 9:
Packet Replay and Injection

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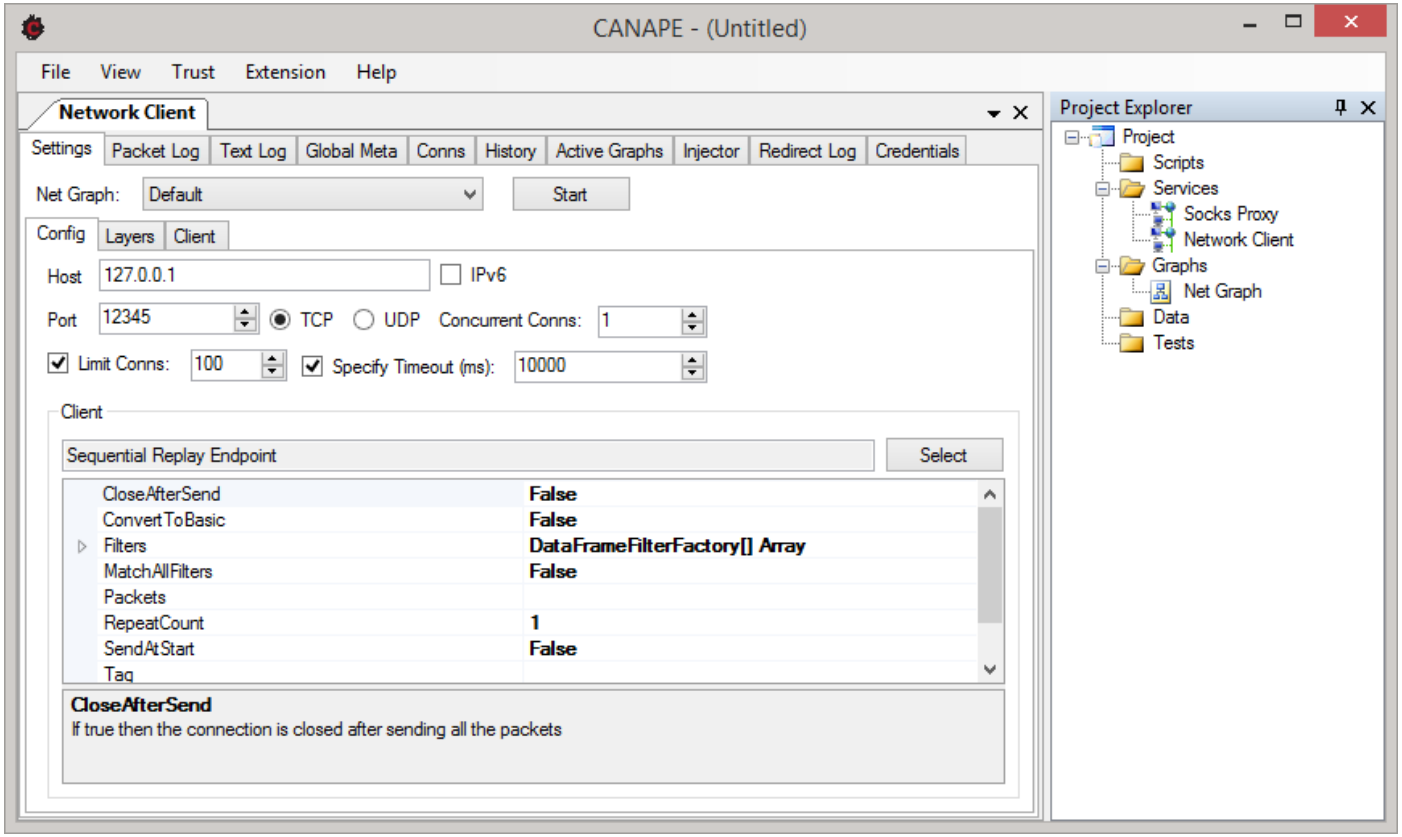
Developing Network Clients



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Network Clients

- CANAPE supports developing network clients
- Designed to allow reuse of work developed through MitM (graphs/scripts) to be reused with the minimal of effort
- Can be used for fuzzing or other automated tasks.

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Workshop 10: Command Fuzzer

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Wrap Up

https://www.github.com/tyranid/44con_2014