

Flow-level analysis: wireshark and Bro

Prof. Anja Feldmann, Ph.D.

Dr. Nikolaos Chatzis

wireshark – tshark

- ❑ Network packet analyzer for Unix/Windows
 - Displays detailed packet stats
 - GUI (wireshark) or command-line (tshark)
- ❑ Intended audience:
 - Network admins (troubleshooting)
 - Security engineers (security problems)
 - Developers (debugging protocols)
 - YOU 😊
- ❑ What it is not:
 - Not for large packet traces:
 - Not for high-speed links
 - Out of memory => crash!

tshark

Usage: tshark [options] ...

Capture interface:

-i <interface>	name or idx of interface (def: first non-loopback)
-f <capture filter>	packet filter in libpcap filter syntax
-s <snaplen>	packet snapshot length (def: 65535)
-p	don't capture in promiscuous mode
-D	print list of interfaces and exit
-L	print list of link-layer types of iface and exit
-r <infile>	set the filename to read from (no pipes or stdin!)

Processing:

-R <read filter>	packet filter in Wireshark display filter syntax
-n	disable all name resolutions (def: all enabled)
-d <layer_type>==<selector>,<decode_as_protocol> ...	"Decode As", see the man page for details Example: tcp.port==8888,http
-z <statistics>	various statistics, see the man page for details

Miscellaneous:

-h	display this help and exit
-v	display version info and exit

Basic stats with tshark

❑ Protocol summary of the trace:

```
> tshark -q -z io,phs -r trace-1.pcap
```

❑ All traffic from/to a host every minute:

```
> tshark -q -z io,stat,60,ip.addr==xxx -r  
trace-1.pcap
```

❑ All TCP conversations of the trace:

```
> tshark -q -z conv,tcp -r trace-1.pcap
```

❑ All Telnet conversations of the trace:

```
> tshark -q -z conv,tcp,telnet -r trace-1.pcap
```

❑ All UDP conversations of the trace:

```
> tshark -q -z conv,udp -r trace-1.pcap
```

❑ All ICMP conversations of the trace:

```
> tshark -q -z conv,tcp -r trace-1.pcap -R 'icmp'
```

Basic stats with wireshark

- ❑ General summary of the trace
- ❑ Protocol hierarchy stats
 - IP-level protocols
 - Transport protocols
 - ARP
 - ICMP
- ❑ „Conversations“
 - Follow a telnet session
 - Follow a DNS flow
 - Check IGMP messages
- ❑ Endpoints
 - Heavy-hitters
 - Low-hitters (scans)
- ❑ Packet size distribution

The Bro system

- ❑ Real-time network analysis framework
 - Unix-based network intrusion detection system
 - Misused for traffic analysis, e.g., by INET
- ❑ Emphasis on
 - Application-level semantics
 - Manipulating packets is uncommon/painful, e.g., wireshark
 - Tracking information over time
 - Within and across flows
 - Archiving for post-mortem analysis
 - Scalability, i.e. Gbit/second links

The Bro system (2)

- ❑ Analyzing data means programming the analysis
 - No specification
 - No magic in Bro: The user has to specify what has to be detected
- ❑ Programming the analysis ~ behavioral analysis
 - No good/evil
 - But matched/unmatched

Connection summaries

- ❑ One line summary for all connections
- ❑ Basic, but saves a lot of time

```
> bro -r trace-1.pcap tcp (output in conn.log)
```

Time	Duration	Source	Destination	Service	
964953011	0.063756	10.20.12.187	207.126.127.69	http	
SrcPort	DstPort	Proto	SrcBytes	DstBytes	State
9002	80	tcp	0	?	RSTR X

- ❑ Try for UDP and ICMP

Connection summaries (2)

□ Connection states

SF	Normal establishment and termination
REJ	Connection attempt rejected
S0	Connection attempt seen, no reply
OTH	No SYN seen, partial connection
RSTO	Connection established, originator aborted
...	...

Connection summaries (3)

- Fraction of connections with a given state?
 - TCP: SF, REJ, S0, OTH, RSTO
 - UDP: SF, REJ, S0, OTH, RSTO
 - ICMP: OTH

Weird activity

- ❑ Network traffic contains lots of weirdoes
 - Activity which does not conform to standard but is not an attack
 - Example: data being sent after RST

```
> bro -r trace-1.pcap weird
```

❑ Scans

```
> bro -r trace-1.pcap scan
```

Protocol analyzer

- ❑ Protocol-specific analysis
 - Log activity
 - Check for protocol-specific attacks
- ❑ Bro ships with analyzers for many protocols:
 - FTP, HTTP, POP3, IRC, SSL, DNS, NTP, ...
- ❑ Example: FTP analyzer

```
> bro -r trace-1.pcap ftp  
> cat ftp.log
```

Packet filter

- ❑ Bro analyzes only the packets required by scripts' analysis
 - Builds dynamically packet filter
- ❑ Seeing packet filter:
 - > `bro tcp ftp smtp print-filter`
- ❑ Packet filter can be changed
- ❑ Bro skips whatever traffic does not match filters!

Dynamic protocol detection

- ❑ How does Bro know the analyzer for a connection?
- ❑ Default mechanism: examine the ports
- ❑ Problem: well-known ports are unreliable
- ❑ Bro can analyze protocols independent of ports
 - Dynamic protocol detection
 - Current support for HTTP, IRC, SMTP, SSH, FTP, POP3, BITTORRENT
 - Identifies potential protocol usage with signatures and then validates by parsing

```
> bro -r trace-1.pcap -f "tcp" http-request http-reply dpd
```

```
> bro -r trace-1.pcap -f "tcp" http-request http-reply brolite
```