Snort 初探

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Outline

- How to IDSs detect intrusions
- Snort’s Inner Workings
- Playing by the Rules
- Conclusion

How to IDSs detect intrusions (1/6)

- Any way they can
  - Specialized trick for BackOrifice
    - Magic string: *!*QWTY?
    - Random generator - ((holdrand = holdrand * 214013L + 2531011L) >> 16) & 0x7fff
    - Bruce force decryption
  - Snort - spp_bo.c/spp_bo.h preprocessor
- Pattern-match
  - Searching network traffic for distinctive patterns
    - Alert tcp any any -> any any (msg: “RPC EXPLOIT startdx”; content: “/bin||c74604|sh”; sid: 600;)
    - Alert tcp any any -> any any (msg: “RPC EXPLOIT startdx”, content: “/bin/|c74604|sh”; sid: 1281;)
  - Snort – sp_pattern_match detection-plugins

Ref: How ISS RealSecure Network Sensor 7.0 Detects Intrusions

How to IDSs detect intrusions (2/6)

- Reassembly
  - Data could span more than one packets
  - Snort -
    - IP deragment: spp_frag2 preprocessor
    - TCP reassembly: spp_stream4 preprocessor
- TCP connection state
  - Data is come from client or server
    - alert tcp any any -> any 21 (msg: “FTP CWD ~root”; content: “CWD ~root”; sid:336; flow: to_server;)
    - alert tcp any 21 -> any any (msg: “FTP bad login”; content: “530”; flow: from_server;)
  - Snort
    - spp_stream4 preprocessor
    - :sp_clientserver detection-plugins

How to IDSs detect intrusions (3/6)

- Protocol-decodes (Protocol-analysis)
  - Break down a packet into individual fields
    - Alert icmp any any -> any any (msg: “ICMP PING NMAP”; dsize:0; itype:8; sid:469;)
  - Snort
    - IP, TCP, UDP, ICMP decodes
    - Detection plugins: sp_icmp_code_check, sp_icmp_id_check, sp_icmp_seq_check, sp_icmp_type_check ….
- Application-layer Preprocessors/normalizers
  - Create some sort of “common” form
  - Evade rule-1
    - alert tcp any any -> any 21 (msg: “FTP CWD ~root”; content: “CWD ~root”; sid:336; flow: to_server;)
    - CWD ~root or CWD ~root
  - Evade rule-2
    - Alert tcp any any -> any 80 (msg: “WEB-CGI phf access”; content: “/phf”; sid: 886)
    - http:// example.com/cgi-bin/%2F%70%68%66?Qalias=%0Acat+/etc/password
  - Snort
    - Processors: spp_httpinspect, spp_rpc_decode, spp_telent_negotiation …

How to IDSs detect intrusions (4/6)

- State-based application-layer protocol decode
  - Understand the state of application-layer protocol
    - Command mode and data mode switching
    - Alert tcp any any -> any 25 (msg: “SMTP vrfy decode”; content “VRFY decode”; sid: 672)
  - Snort
    - spp_httpinspect, spp_rpc_decode, spp_telent_negotiation preprocessors

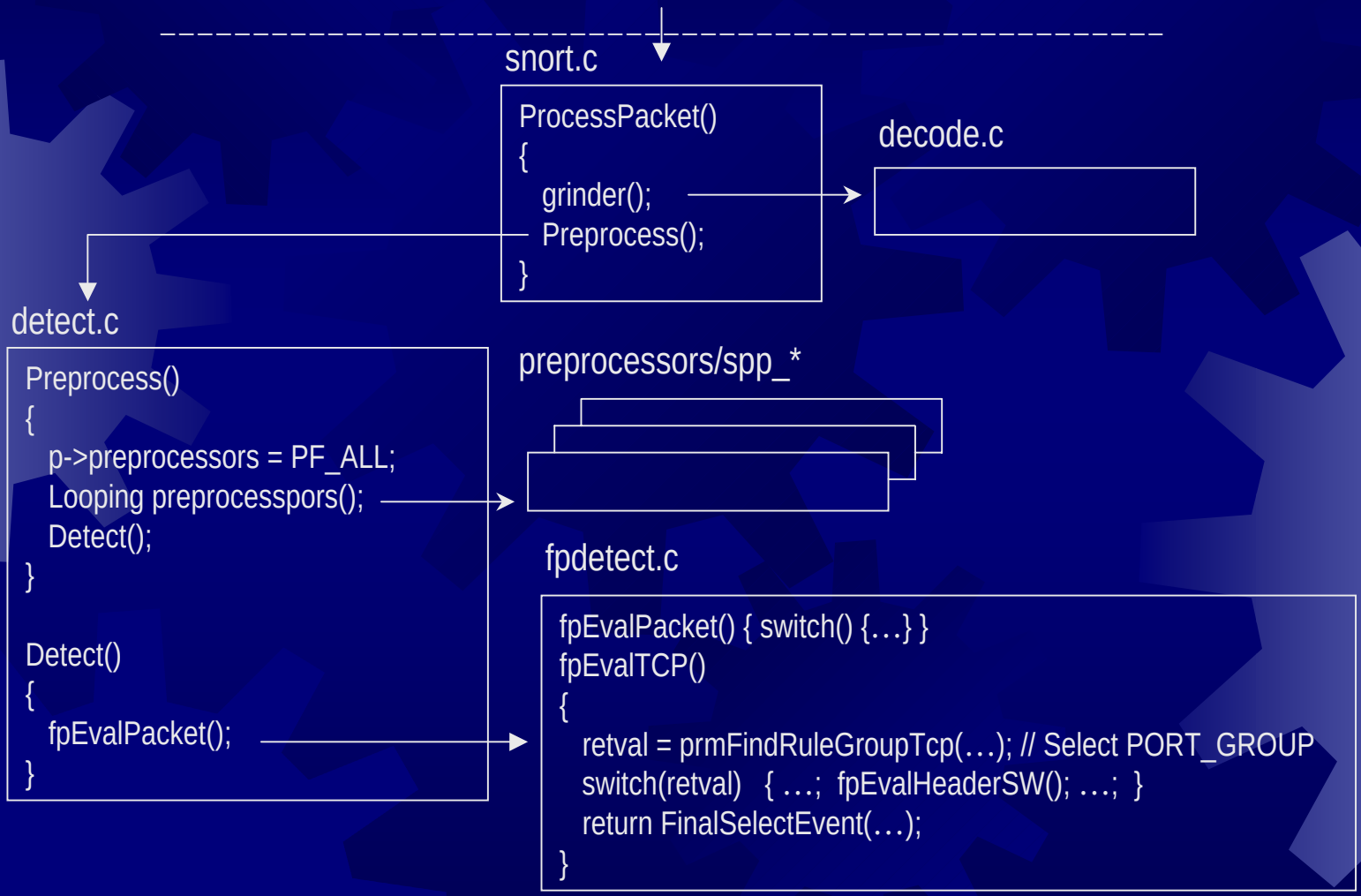
How to IDSs detect intrusions (5/6)

- Protocol-field pattern-match
  - Decoding all the fields in the packets restrict searches only to the valid contexts
    - alert tcp any any -> any 80 (msg: “WEB-CGI phf access”; uricontent: “/phf”; sid: 886;)
  - Snort
    - spp_httpinspect, spp_rpc_decode
- Protocol-validation, compliance-testing, RFC checking
  - Detection 0-day exploits
  - DNS query, HTTP method, SMTP …

How to IDSs detect intrusions (6/6)

- Other detection method
  - Protocol anomly detection
    - Too long request, overflow attempt
  - Baseline anomly detection
    - SYN flooding, UDP flooding
  - Heuristics and behavior analysis
    - Login failed times >= 3 in short time

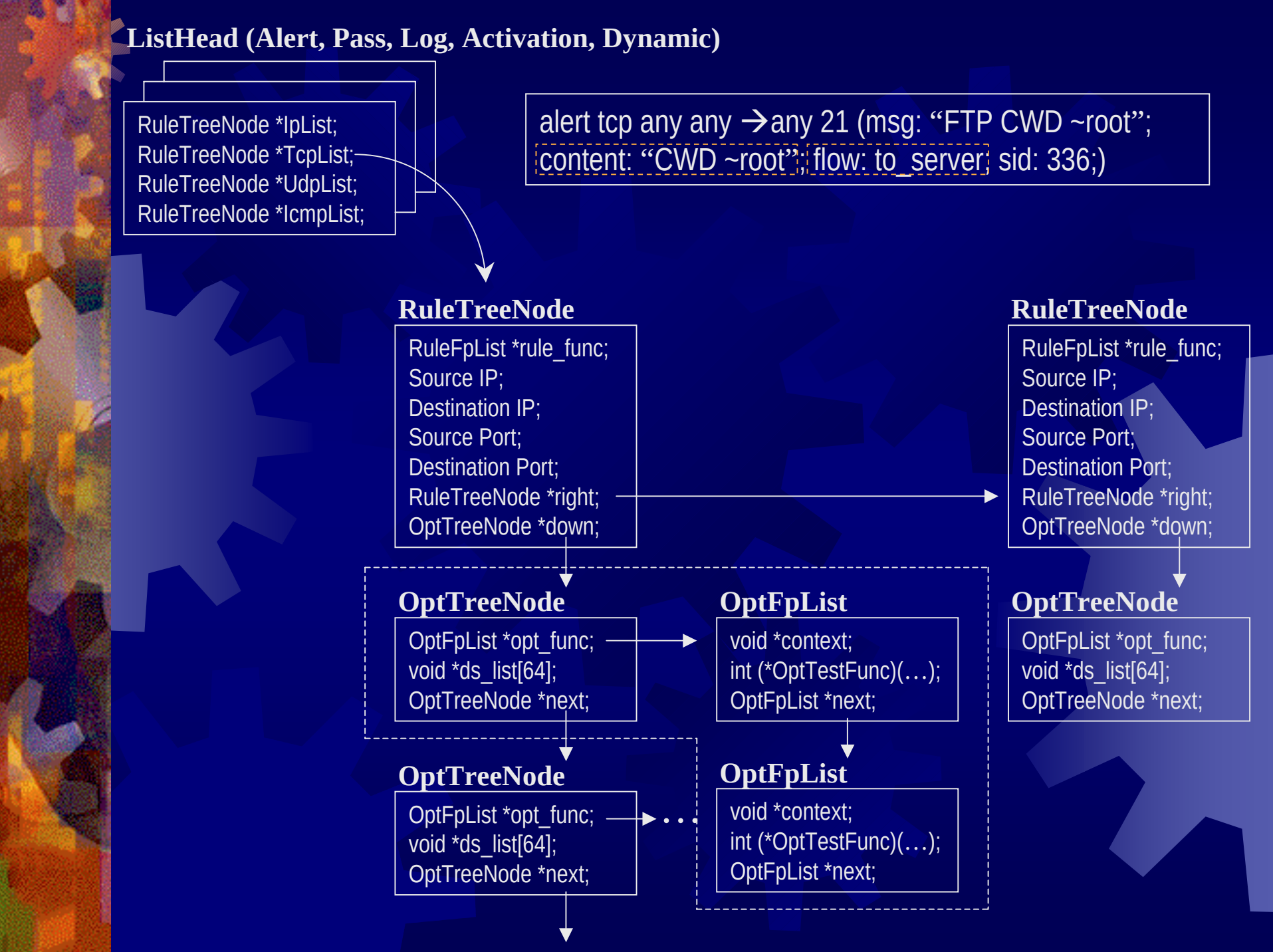
Snort's Inner Workings (1/4)

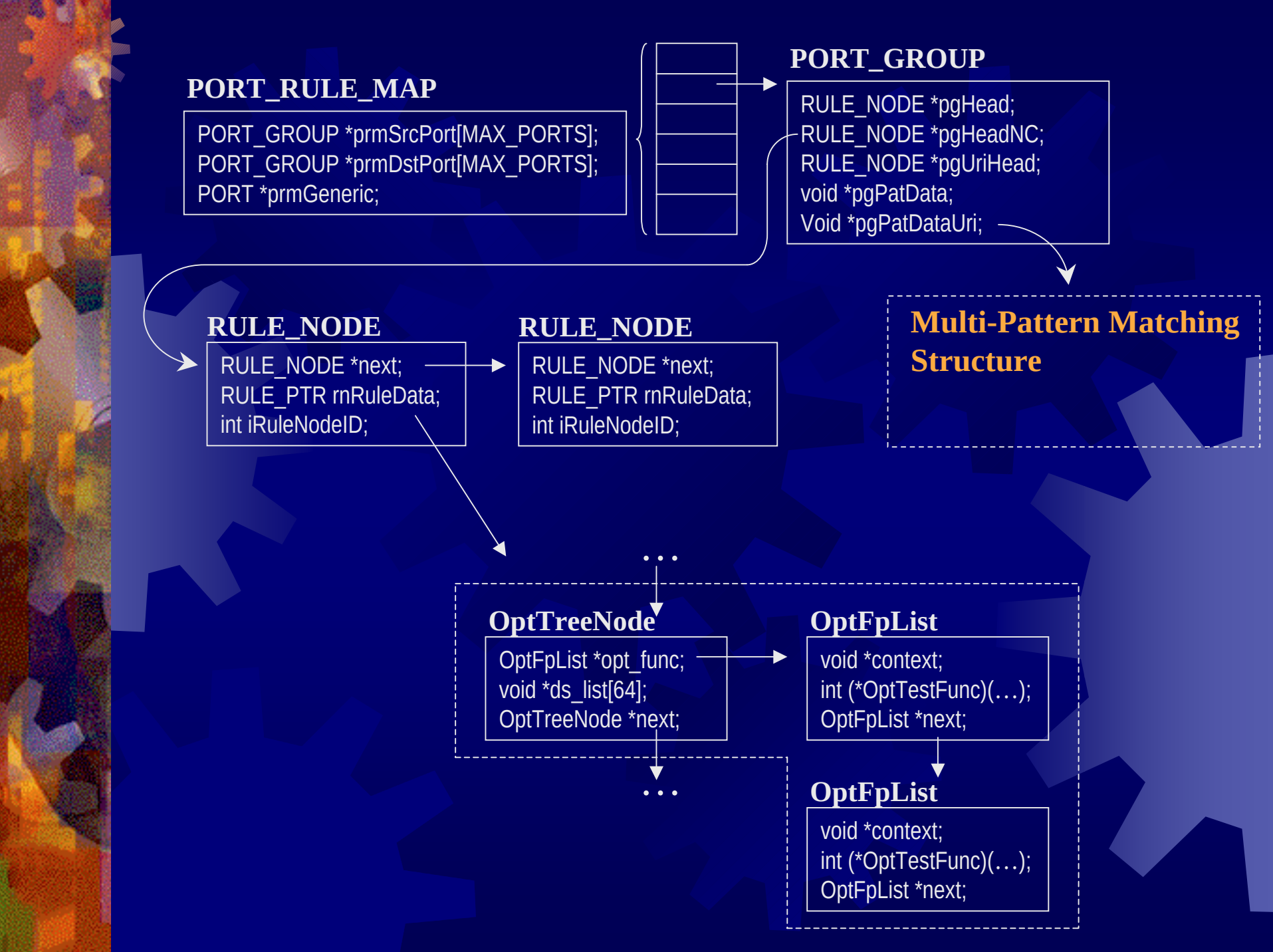


Snort’s Inner Workings (2/4)

fpdetect.c

```
fpEvalPacket() { switch() {…} }
fpEvalTCP()
{
   retval = prmFindRuleGroupTcp(…); // Select PORT_GROUP
   switch(retval)   { …;  fpEvalHeaderSW(); …;  }
   return FinalSelectEvent(…);
}
fpEvalHeaderSW()
{
   // multip-pattern detection engine
   mpseSearch(, ontx_match, );
   // No-content rules matching
   for(…)
   {
      fpEvalOTN();
      fpEvalRTN();
   }
}
```


ListHead (Alert, Pass, Log, Activation, Dynamic)
RuleTreeNode *IpList;
RuleTreeNode *TcpList;
RuleTreeNode *UdpList;
RuleTreeNode *IcmpList;
alert tcp any any →any 21 (msg: "FTP CWD ~root";
content: "CWD ~root"; flow: to_server; sid: 336;)
RuleTreeNode
RuleFpList *rule_func;
Source IP;
Destination IP;
Source Port;
Destination Port;
RuleTreeNode *right;
OptTreeNode *down;
RuleTreeNode
RuleFpList *rule_func;
Source IP;
Destination IP;
Source Port;
Destination Port;
RuleTreeNode *right;
OptTreeNode *down;
OptTreeNode
OptFpList *opt_func;
void *ds_list[64];
OptTreeNode *next;
OptFpList
void *context;
int (*OptTestFunc)(…);
OptFpList *next;
OptTreeNode
OptFpList *opt_func;
void *ds_list[64];
OptTreeNode *next;
OptTreeNode
OptFpList *opt_func;
void *ds_list[64];
OptTreeNode *next;
OptFpList
void *context;
int (*OptTestFunc)(…);
OptFpList *next;


PORT_RULE_MAP
PORT_GROUP *prmSrcPort[MAX_PORTS];
PORT_GROUP *prmDstPort[MAX_PORTS];
PORT *prmGeneric;
PORT_GROUP
RULE_NODE *pgHead;
RULE_NODE *pgHeadNC;
RULE_NODE *pgUriHead;
void *pgPatData;
Void *pgPatDataUri;
Multi-Pattern Matching Structure
RULE_NODE
RULE_NODE *next;
RULE_PTR rnRuleData;
int iRuleNodeID;
RULE_NODE
RULE_NODE *next;
RULE_PTR rnRuleData;
int iRuleNodeID;
OptTreeNode
OptFpList *opt_func;
void *ds_list[64];
OptTreeNode *next;
OptFpList
void *context;
int (*OptTestFunc)(…);
OptFpList *next;
OptFpList
void *context;
int (*OptTestFunc)(…);
OptFpList *next;

Playing by the Rules (1/10)

- Snort Rule Format

Rule Header

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 6666:7000 \
```

Rule Body

```
(msg:"EXPLOIT CHAT IRC topic overflow";
flow:to_client,established; \
content:"|EB|K[S2|E4 83 C3 0B|K|88 23 B8|Pw"; \
react: block, msg; tag: session, 10, seconds;\
reference:bugtraq,573; reference:cve,1999-0672; \
classtype:attempted-user; sid:307; rev:9;)
```

Meta-Data

Non-Payload Detection Options

Payload Detection Options

Post-Detection Rule Options

Meta-Data

Playing by the Rules (2/10)

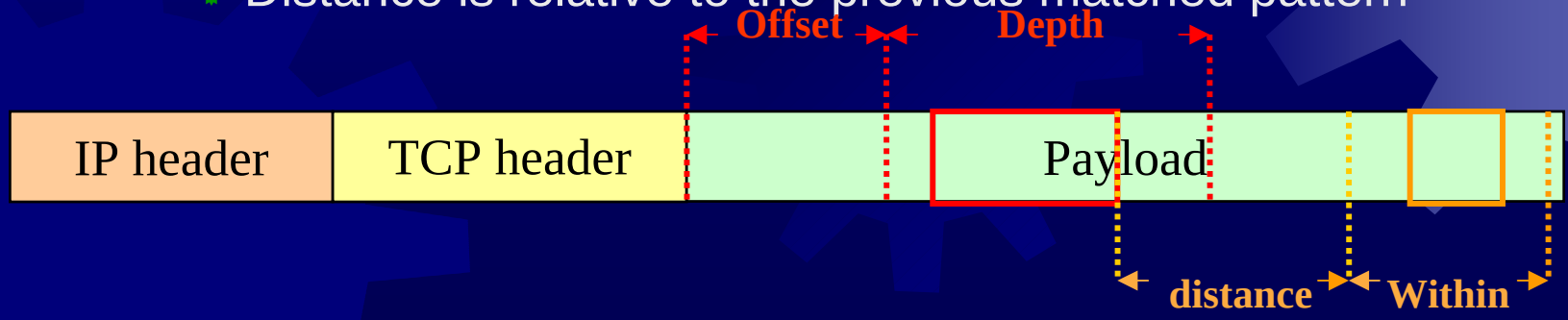
- Rule Header
  - Rule Action
    - Alert – Alert and log packets
    - Log – Log packets
    - Pass – Ignore packets (note: Snort –o : Pass|Alert|Log)
    - Activate – Alert and turn on another dynamic rule
    - Dynamic – remain idle until activated by an activate rule
  - Protocols, IP Addresses, Port Numbers, Direction operator

Playing by the Rules (3/10)

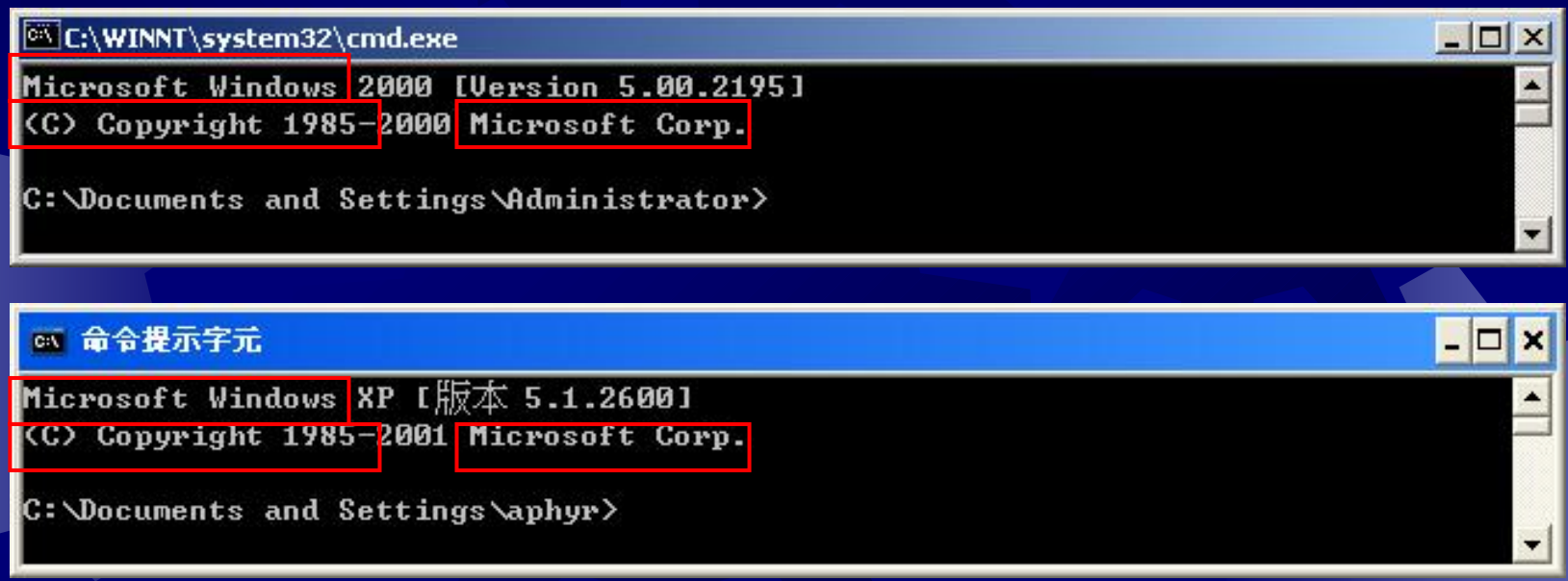
- Meta-Data Rule Options
  - Provide related information to describe the rule
  - msg, reference, rev, classtype, priority
- Payload Detection Rule Options
  - Look for the data inside the packet payload and can be inter-related
  - Options
    - content, uricontent, byte_test, pcre
    - depth, offset, distance, within, byte_jump
    - nocase, rawbytes, isdataat

Playing by the Rules (4/10)

- Payload Detection Rule Options
  - content
    - Search specified content in the payload
    - content: “abcde” or content: “|0d0a 0921|”
  - offset, within
    - Where to start searching
    - Within is relative to the previous matched pattern
  - depth, distance
    - How far into a packet snort should be search
    - Distance is relative to the previous matched pattern



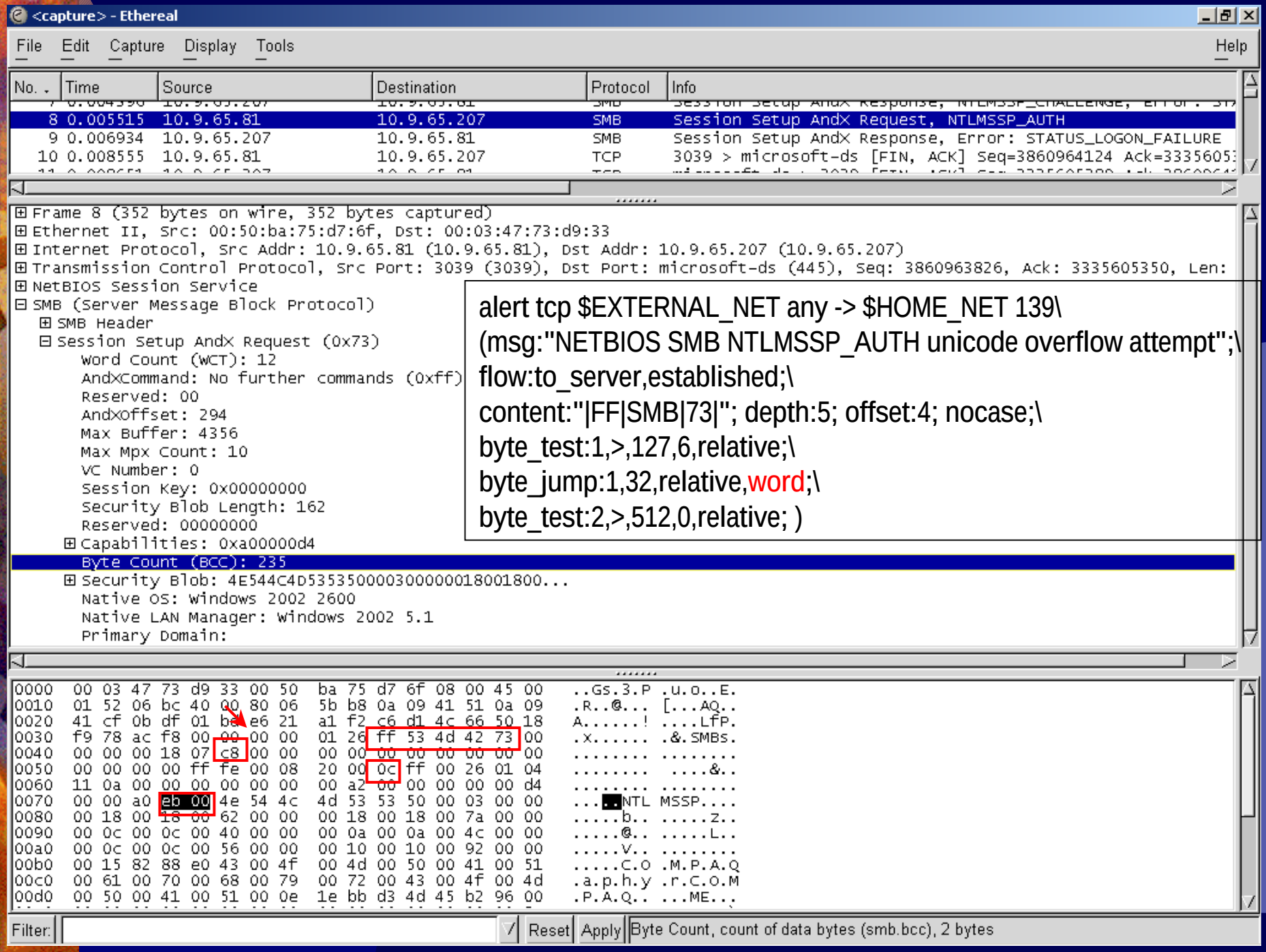
Playing by the Rules (5/10)




```
alert tcp $HOME_NET !21:23 -> $EXTERNAL_NET any \
(msg:"ATTACK-RESPONSES Microsoft cmd.exe banner";\
flow:from_server,established; \
content:"Microsoft Windows"; depth: 128;\
content:"|28|C|29| Copyright 1985-"; within:60; \
content:"Microsoft Corp."; distance:5; within:15;\
reference:nessus,11633; classtype:successful-admin; sid:2123; rev:2;)
```

Playing by the Rules (6/10)

- Payload Detection Rule Options
  - byte_test
    - Testing binary values or converting representative bytes testing
    - byte_test: <bytes_to_convert>, <operator>, <value>, <offset> ,[,[relative], [big], [little], [string], [hex], [dec],[oct]]
  - byte_jump
    - Grap bytes, convert them to values and jump up that many bytes
    - byte_test: <bytes_to_convert>, <operator>, <offset> ,[,[relative], [big], [little], [string], [hex], [dec], [oct], [align]]


<capture> - Ethereal
File Edit Capture Display Tools Help
No. Time Source Destination Protocol Info
8 0.005515 10.9.65.81 10.9.65.207 SMB Session Setup AndX Request, NTLMSSP_AUTH
9 0.006934 10.9.65.207 10.9.65.81 SMB Session Setup AndX Response, Error: STATUS_LOGON_FAILURE
10 0.008555 10.9.65.81 10.9.65.207 TCP 3039 > microsoft-ds [FIN, ACK] Seq=3860964124 Ack=3335605
Frame 8 (352 bytes on wire, 352 bytes captured)
Ethernet II, Src: 00:50:ba:75:d7:6f, Dst: 00:03:47:73:d9:33
Internet Protocol, Src Addr: 10.9.65.81 (10.9.65.81), Dst Addr: 10.9.65.207 (10.9.65.207)
Transmission Control Protocol, Src Port: 3039 (3039), Dst Port: microsoft-ds (445), Seq: 3860963826, Ack: 3335605350, Len:
NetBIOS Session Service
SMB (Server Message Block Protocol)
SMB Header
Session Setup AndX Request (0x73)
Word Count (WCT): 12
AndXCommand: No further commands (0xff)
Reserved: 00
AndXOffset: 294
Max Buffer: 4356
Max Mpx Count: 10
VC Number: 0
Session Key: 0x00000000
Security Blob Length: 162
Reserved: 00000000
Capabilities: 0xa00000d4
Byte Count (BCC): 235
Security Blob: 4E544C4D5353500003000000018001800...
Native OS: Windows 2002 2600
Native LAN Manager: Windows 2002 5.1
Primary Domain:
alert tcp $EXTERNAL_NET any -> $HOME_NET 139\
(msg:"NETBIOS SMB NTLMSSP_AUTH unicode overflow attempt";\
flow:to_server,established;\
content:"|FF|SMB|73|"; depth:5; offset:4; nocase;\
byte_test:1,>,127,6,relative;\
byte_jump:1,32,relative,word;\
byte_test:2,>,512,0,relative;)
0000 00 03 47 73 d9 33 00 50 ba 75 d7 6f 08 00 45 00 ..Gs.3.P .u.o..E.
0010 01 52 06 bc 40 00 80 06 5b b8 0a 09 41 51 0a 09 .R..@... [...AQ..
0020 41 cf 0b df 01 bd e6 21 a1 f2 c6 d1 4c 66 50 18 A.....! ....LfP.
0030 f9 78 ac f8 00 00 00 00 01 26 ff 53 4d 42 73 00 .x..... .&.SMBs.
0040 00 00 00 18 07 c8 00 00 00 00 00 00 00 00 00 00 ....
0050 00 00 00 00 ff fe 00 08 20 00 0c ff 00 26 01 04 ....&..
0060 11 0a 00 00 00 00 00 00 00 a2 00 00 00 00 00 d4 ....
0070 00 00 a0 eb 00 4e 54 4c 4d 53 53 50 00 03 00 00 .....NTL MSSP....
0080 00 18 00 18 00 62 00 00 00 18 00 18 00 7a 00 00 .....b.. .....z..
0090 00 0c 00 0c 00 40 00 00 00 0a 00 0a 00 4c 00 00 .....@.. .....L..
00a0 00 0c 00 0c 00 56 00 00 00 10 00 10 00 92 00 00 .....V.. .....
00b0 00 15 82 88 e0 43 00 4f 00 4d 00 50 00 41 00 51 .....C.O .M.P.A.Q
00c0 00 61 00 70 00 68 00 79 00 72 00 43 00 4f 00 4d .a.p.h.y .r.C.O.M
00d0 00 50 00 41 00 51 00 0e 1e bb d3 4d 45 b2 96 00 .P.A.Q.. ...ME...
Filter:
Reset
Apply
Byte Count, count of data bytes (smb.bcc), 2 bytes

Playing by the Rules (8/10)

- Payload Detection Rule Options
  - rawbytes
    - Look at the raw packet data, ignoring any decoding by preprocessing
  - uricontent
    - Searches the NORMALIZED request URI field
  - pcre (Perl Compatible Regular expression)
    - Using regular expression to search payload or URI field
    - pcre: [!]/regex/ismxAEGRUB

Playing by the Rules (9/10)

- Non-Payload Detection Rule Options
  - Look for non-payload data
  - IP fields: fragoffset, ttl, id, ipopts, fragbits, ip_proto
  - TCP fields: flags, seq, ack, window
  - ICMP fields: icode, icmp_id, icmp_seq
  - Flow: to_client, to_server, established, stateless, no_stream, only_stream
  - Flowbits: set, isset

Playing by the Rules (10/10)

- Post-detection
  - Triggers that happen after a rule fired
  - Logto – output to file
  - Session – extract user data from TCP sessions
  - Sesp – close sessions (reset)
  - React – close connection and send visible messages (to browser)
  - Tag – allow to log more than one packets after a rule is fired

Discussion