HUNTING THROUGH RDP DATA

BROCON 2015

JOSH LIBURDI

Quick Introduction

Currently: Senior Consultant at CrowdStrike

Previously: Large-scale detection at Fortune 5

Bro user for 2+ years

Focus on network forensics and incident response

Twitter: @jshlbrd

GOALS FOR THIS TALK

You'll learn something new about RDP

You'll see one of the newest Bro analyzers in action

You'll leave with some useful methods to find bad guys in your network

WHAT'S THE DEAL WITH RDP?

RDP Key Points

Enables remote system access across the network

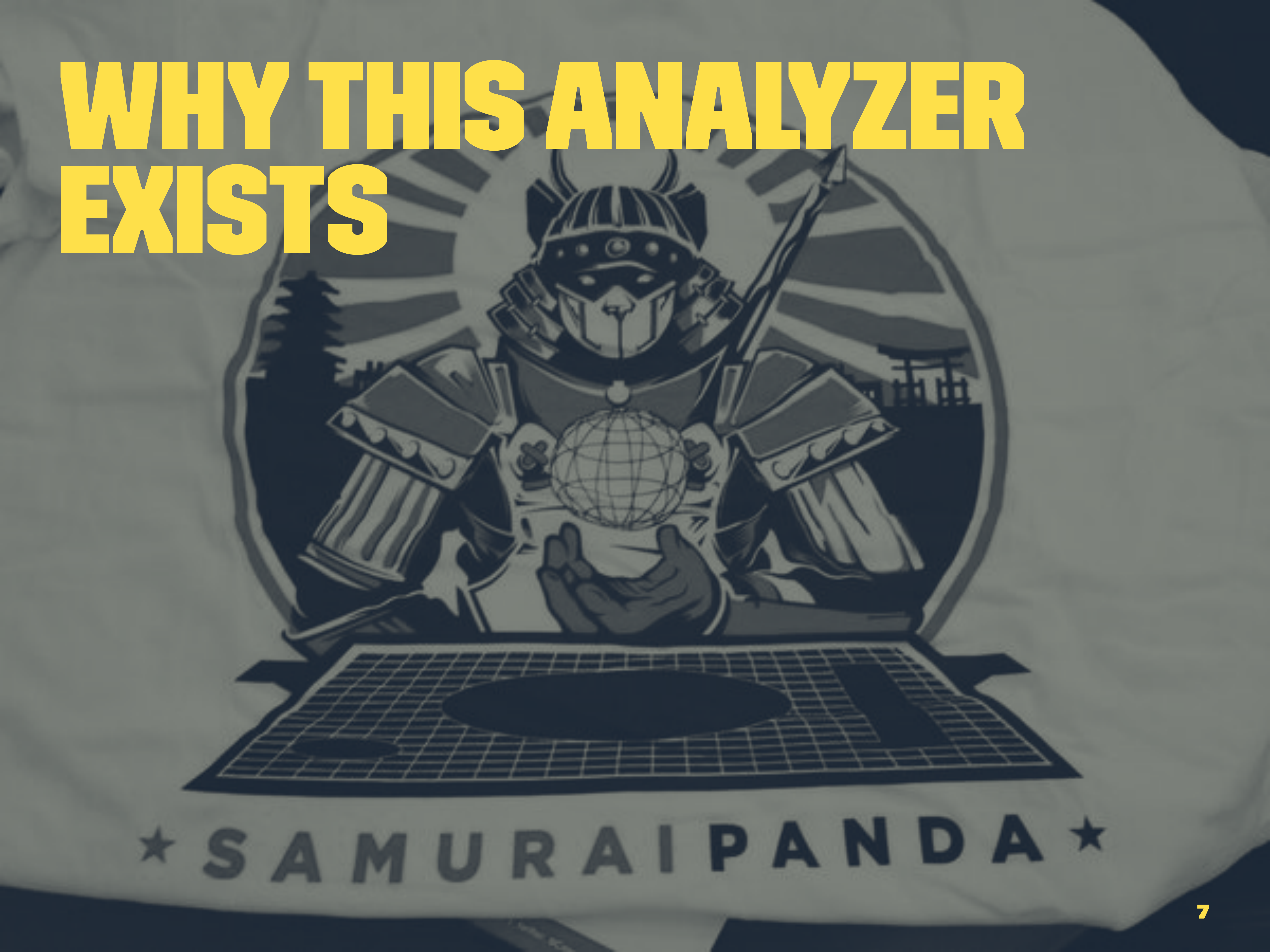
Connection is encrypted

Definitely being used in your organization

Why I'm talking about RDP

Bro 2.4 has an RDP analyzer!

WHY THIS ANALYZER EXISTS

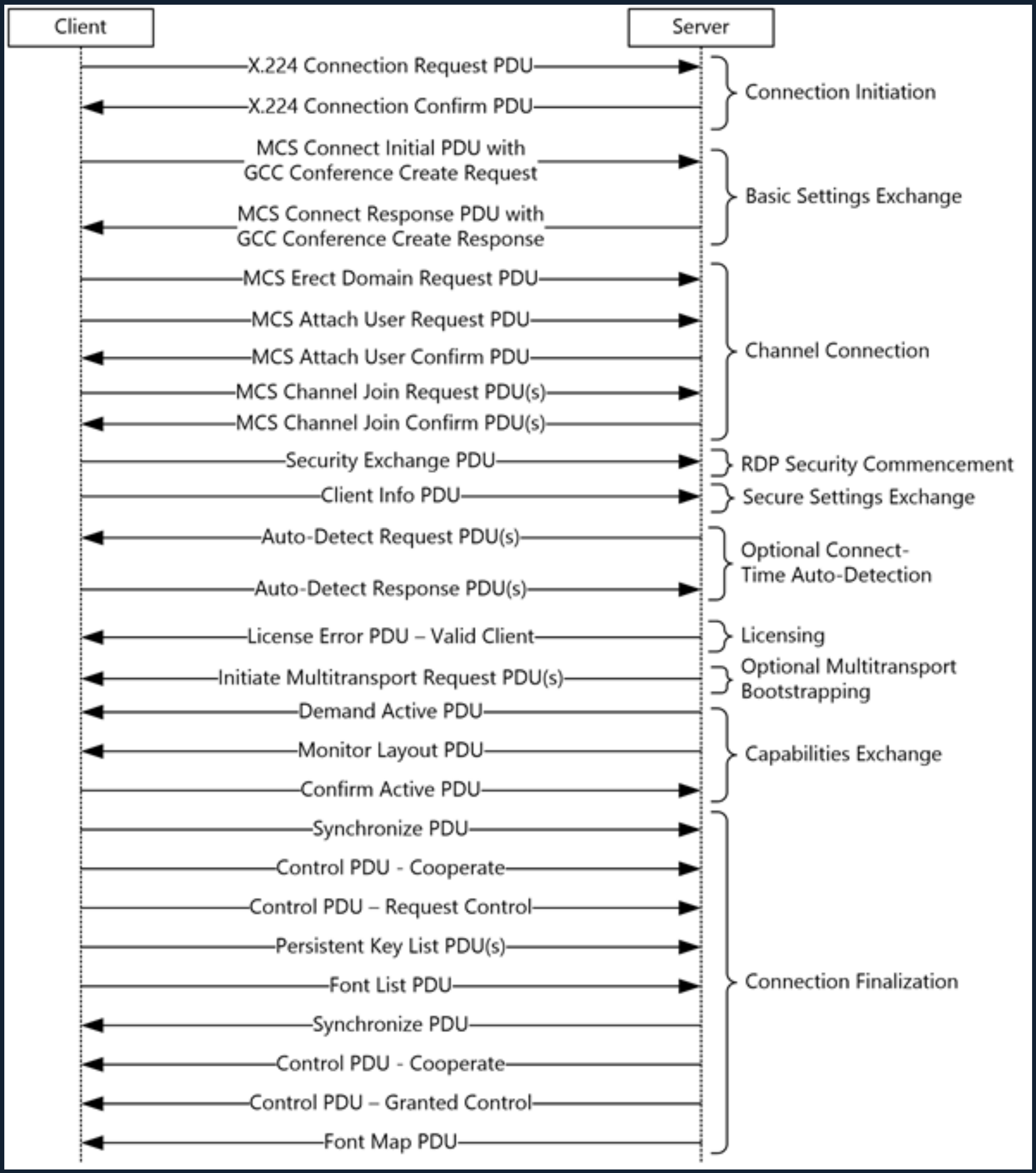


PROTOCOL DETAILS

PROTOCOL DETAILS
RDP CONNECTION SEQUENCE

Everything that happens over TCP ->

We care about a very small part of this
- Connection Initiation
- Basic Settings Exchange



Protocol Details
X.224 Connection Request (C)

Client initiates connection
- Client-supported security protocols
- Connection correlation identifier
- Optional routing token / cookie

Protocol Details
X.224 Connection Confirm (S)

Server responds to connection initiation
- Successful? Server selected protocol
- Unsuccessful? Reason request failed

Protocol Details
MCS Connect Initial (C)

Client sends settings data
- Client computer name
- Keyboard language settings
- RDP client version

Protocol Details
MCS Connect Response (S)

Server sends response settings data
- RDP server version
- Encryption method and level
- Server certificate

PROTOCOL CHALLENGES

Protocol Challenges
Encryption!

`No cookie == no identifiable packet data`

Protocol Challenges
Data Availability!

Most forensically useful metadata is optional
- Cookie
- Client computer name

PROTOCOL CHALLENGES
COOKIES!

```
Length ranges from 9 to ~127 characters

Introduces 'user collision'
- Multiple users appear to be one user

15 chars: DOMAIN\samantha
09 chars: DOMAIN\sa
12 chars: DOMAIN\sally
09 chars: DOMAIN\sa
```

IDENTIFYING RDP

Identifying RDP
in the raw

```
T 10.226.41.226:13178 -> 10.226.29.74:3389 [AP]
  ...$.......Cookie: mstshash=A70067..
#
T 10.226.29.74:3389 -> 10.226.41.226:13178 [A]
  ......
#
T 10.226.29.74:3389 -> 10.226.41.226:13178 [AP]
  .........4.
#
T 10.226.41.226:13178 -> 10.226.29.74:3389 [AP]
  ........e...........0..."....................0.................... ...0......................
  ........../....|...&........Duca...........`.........(...I.S.D.2.-.K.M.8.4.1.7.8.................
  ..................................................................................5.5.2.7.4.-.O.E.
  M.-.0.0.1.1.9.0.3.-.0.0.1.0.7.....................................,.....rdpdr.......clip
  rdr.....rdpsnd......
#
T 10.226.29.74:3389 -> 10.226.41.226:13178 [AP]
  ...M....f..A......0..."..............................|..*.v.......McDn..........................
  ........... .......w.......=6.....R.r0.....b.."f.3r.............\.RSA1H.......?..........|..Zr..
  \....F.p.:.X..........k&.b...8[Z..._)...,.C..................H...rI.x/.}L.../1d.`......h=.g....#
  u.vz........G.. .NT.oja..W.%..?........
```

IDENTIFYING RDP

DETECTION STRINGS

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Identifying RDP

Detection strings++

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  ........e...........0..."......................0..................... ...0......................
  ........../....|...&.......Duca...........`.........(...I.S.D.2.-.K.M.8.4.1.7.8.................
  ...............................................................................5.5.2.7.4.-.O.E.
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Detection Strings++

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                  .........................................................
  rdpsnd 0.0.1.0.7.........................................,... rdpdr
#
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  ...M....f..A......0..."..............................|..*.v.......McDn.........................
  ........... .......w.......=6.....R.r0.....b.."f.3r..............\.RSA1H.......?...........|..Zr..
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  ........../....|...&...  .......`.........(...I.S.D.2.-.K.M.8.4.1.7.8.................
                          ...........................................................
  rdpsnd                  0.0.1.0.7...........................................,...rdpdr
#
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  ...M....f..A......0..."..............................|..*.v.McDn.....................
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  u.vz........G.. .NT.oja..W.%..?........
```

Identifying RDP
<= Bro 2.3

```
event connection_state_remove(c: connection)
{
if ( c$id$resp_p == 3389/tcp
  && c$conn$orig_bytes >= 1000
  && c$conn$resp_bytes >= 1000 )
  print "found RDP?";
}
```

Identifying RDP
<= Bro 2.3++

```
signature dpd_rdp_client {
    ip-proto == tcp
    # Client request
    payload /.*(Cookie: mstshash\=|Duca.*(rdpdr|rdpsnd|drdynvc|cliprdr))/
    requires-reverse-signature dpd_rdp_server
    enable "rdp"
}

signature dpd_rdp_server {
    ip-proto == tcp
    payload /(.{5}\xd0|.*McDn)/
}
```

(Actually the dpd.sig for RDP in Bro 2.4)

Identifying RDP
The problem (until now)

Network detection isn't useful
Network detection doesn't scale
Detecting RDP on the network wastes analyst time

IDENTIFYING RDP
BRO 2.4

```
cookie:              A70067
keyboard_layout:     English - United States
client_build:        RDP 5.1
client_hostname:     ISD2-KM84178
desktop_width:       1152
desktop_height:      864
result:              Success
security_protocol:   RDP
encryption_level:    High
encryption_method:   128bit
```

Identifying RDP
Analyzer Caveats

It's not magic
- Won't identify RDP over SSL
- Won't identify RDP over SSH

It's most useful when monitoring internal-to-internal sites

"Success" != successful authentication
- Still need to validate with non-network data

RDP HUNTING

RDP HUNTING
A QUICK NOTE ON HUNTING ...

Hunting is a proactive approach to identifying threats on the network

It gives you the opportunity to identify new types or new variants of threats

Many things affect your ability to hunt
- Knowledge
- Skillset
- Toolset
- Leadership

RDP Hunting
A quicker note on RDP metadata

You have to hunt through it
- IOCs (IP addresses) won't help you
- IDS alerts will waste your time

RDP HUNTING
BRO HUNTING METHODS

Stacking
- Simple outlier analysis
- Complex outlier analysis

Tracking
- Using inside knowledge to identify attacker activity

Timelines
- Monitoring activity across a distinct range of time

RDP Hunting
Simple Stacking

Primary use: identify new users and computers in the network

Identify new users in the network

```
bro-cut cookie < rdp.log | sort | uniq -c | sort -n
```

Identify new computers in the network

```
bro-cut client_name < rdp.log | sort | uniq -c | sort -n
```

RDP HUNTING
COMPLEX STACKING

Primary use: identify scanning and worms, compromised user accounts

Identify users connecting to a high number of systems

```
sourcetype=bro source=*rdp* cookie=*
| stats dc(dest_ip) AS dc_dest_ip by cookie
```

RDP Hunting
Complex Stacking++

Identify multiple users on a single computer

```
sourcetype=bro source=*rdp* client_name=* cookie=*
| stats values(cookie) dc(cookie) AS dc_cookie by client_name
| where dc_cookie > 1
```

RDP Hunting
Tracking

Primary use: identify lateral movement

Dependencies
- Knowledge of network and organization
- Accessible, organized data

RDP Hunting
Tracking++

Scenario
- Sensor A monitors traffic between business units X and Y
- Net block B belongs to business unit X
- Net block C belongs to business unit Y
- RDP between the two is uncommon
- Business unit Y develops high-value projects

RDP HUNTING
TRACKING++

Identify users accessing abnormal sections of the network

```
sourcetype=bro source=*rdp* cookie=* sensor=a
( tag::src_ip=nb_b tag::dest_ip=nb_c )
OR ( tag::src_ip=nb_c tag::dest_ip=nb_b )
| stats count by src_ip,dest_ip,cookie
```

RDP HUNTING
TRACKING++

Identify computers accessing abnormal sections of the network

```
sourcetype=bro source=*rdp client_name=* sensor=a
( tag::src_ip=nb_b tag::dest_ip=nb_c )
OR ( tag::src_ip=nb_c tag::dest_ip=nb_b )
| stats count by src_ip,dest_ip,client_name
```

RDP HUNTING
TIMELINES

Primary use: identify anomalous access

Effective use is dependent on how much data you have
- Search all computers vs. single computer

Identify access time by computer

```
sourcetype=bro source=*rdp* client_name=*
| timechart useother=F span=1hr count by client_name
```

CASE STUDIES

Case Studies
Scanning / Worms

Fairly easy to identify when hunting – they're noisy

Found by stacking cookie X id.resp_h
- Look for users to connect to a high number of systems

Especially useful if you isolate events into periods of time
- User A connected to N number of systems in T minutes

Case Studies
Scanning / Worms++

One week of RDP activity

cookie	uniq # id.resp_h
rdp_logon_screen.nbin	1384
os_fingerprint_rdp.nbin	1375
Administr	253
	30
a	25

Note: the search from slide 34 can identify this activity

CASE STUDIES
SCANNING / WORMS++

One week of RDP activity

cookie[count]	threat
rdp_logon_screen.nbin[1384]	Nessus
os_fingerprint_rdp.nbin[1375]	Nessus
Administr[253]	Collision
[30]	???
a[25]	Morto worm

Case Studies
Remote Attacker Access

Identifying inbound attacker access w/ RDP metadata is a difficult game to win

Monitoring VPN nodes is the best chance to identify remote attackers

Scenario
- Single factor VPN
- Dealing with potentially compromised user accounts

Case Studies
Remote Attacker Access++

Identified attacker connecting to the network via VPN

Found by tracking inbound connections between 2:00 and 12:00 UTC

```
#fields     keyboard_type   keyboard_layout client_build
client_name     client_dig_product_id   desktop_width   desktop_height

Japanese    English - United States RDP 7.1
<client_name>   <client_dig_product_id >    1576    928
Japanese    English - United States RDP 5.2
<client_name>       (empty)     1576    928
Japanese    English - United States RDP 5.2
<client_name>       (empty)     1576    928
Japanese    English - United States RDP 7.1
<client_name>   <client_dig_product_id >    1576    928
```

CASE STUDIES
REMOTE ATTACKER ACCESS++

Couldn't rely on attacker always connecting from the same VPN node

Could rely on client_name, desktop_width, and desktop_height remaining the same

```
#fields     keyboard_type   keyboard_layout client_build
client_name     client_dig_product_id   desktop_width   desktop_height

Japanese    English - United States RDP 7.1
<client_name>   <client_dig_product_id >    1576    928
Japanese    English - United States RDP 5.2
<client_name>       (empty)     1576    928
Japanese    English - United States RDP 5.2
<client_name>       (empty)     1576    928
Japanese    English - United States RDP 7.1
<client_name>   <client_dig_product_id >    1576    928
```

QUESTIONS?

References

» https://msdn.microsoft.com/en-us/library/Cc240452.aspx

» https://msdn.microsoft.com/en-us/library/cc240469.aspx

» http://www.snakelegs.org/2011/02/06/rdp-cookies-2/