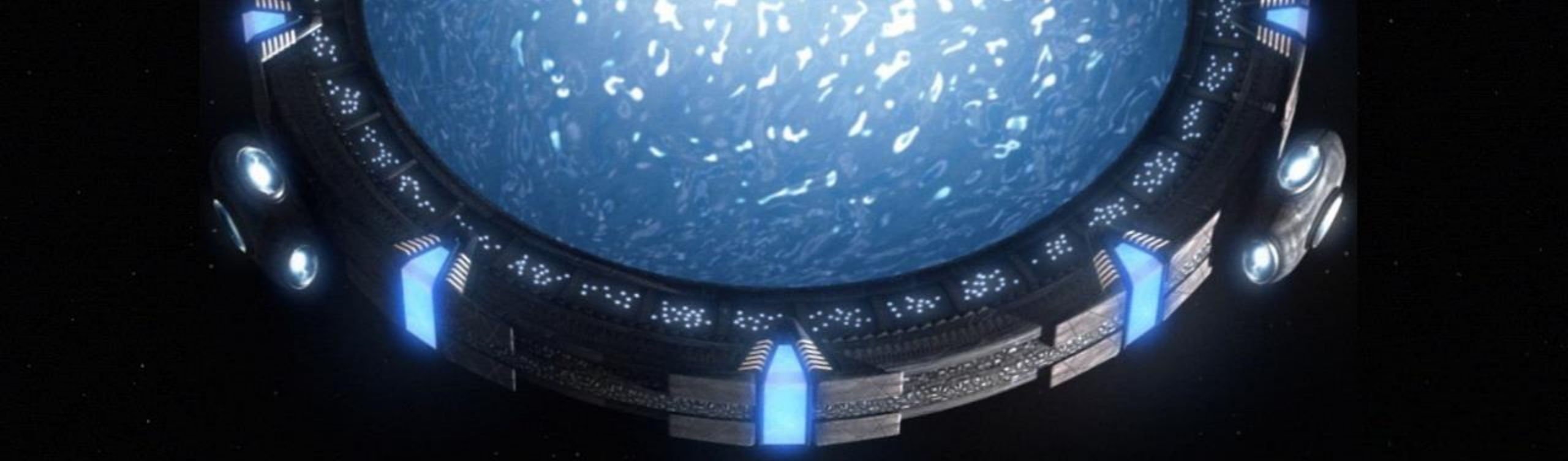


BadTunnel: How Do I Get Big Brother Power ?

Yang Yu @ Tencent's Xuanwu Lab

black hat USA 2016

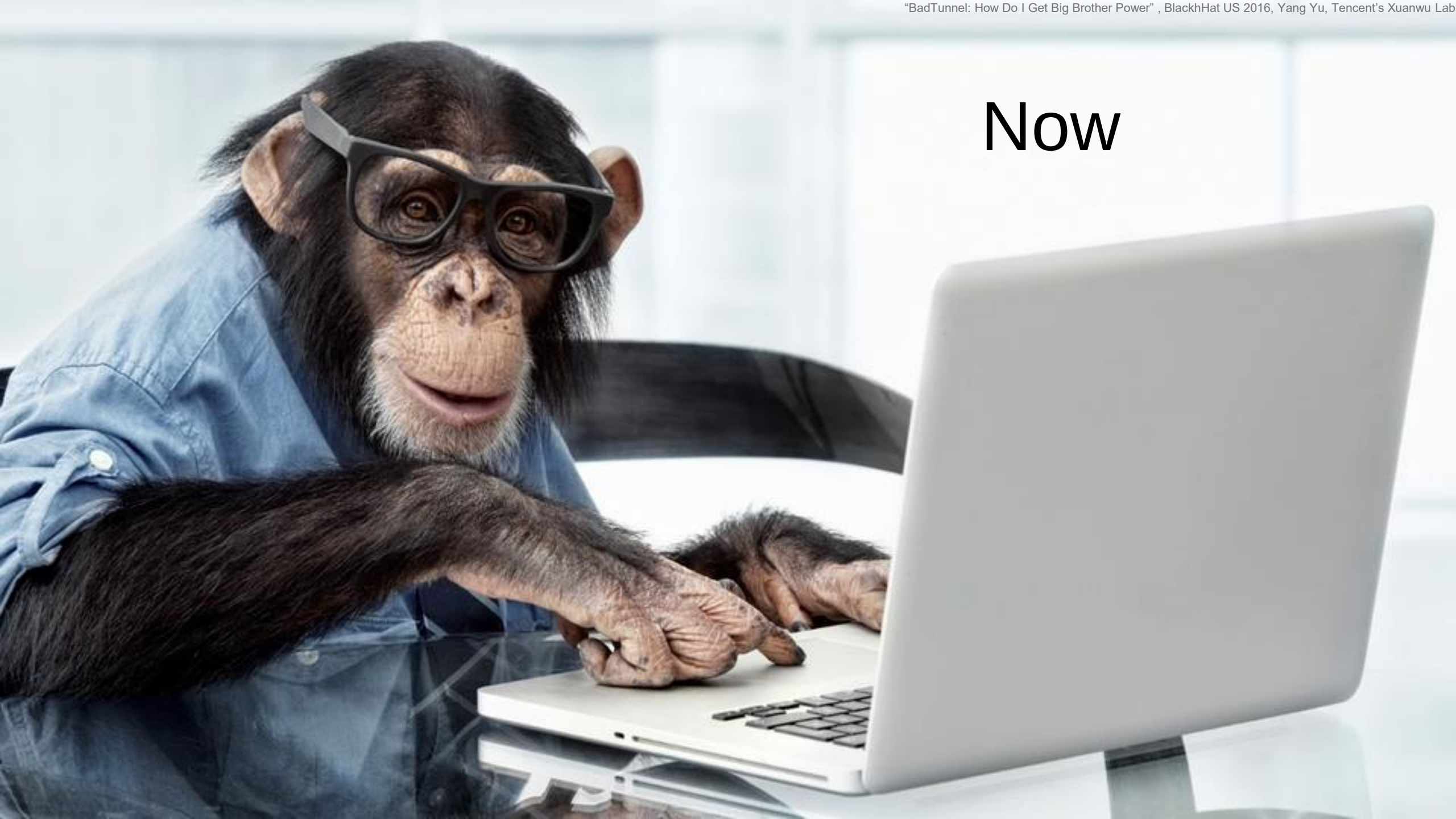
腾讯玄武实验室
TENCENT'S XUANWU LAB

Who am I?

Yang Yu, @tombkeeper

- From Beijing, China
- Director of Tencent’s Xuanwu Lab
- The guy who make the most money from Microsoft Bounty Programs ☺
- Working in information security industry since 2002

Before 2002

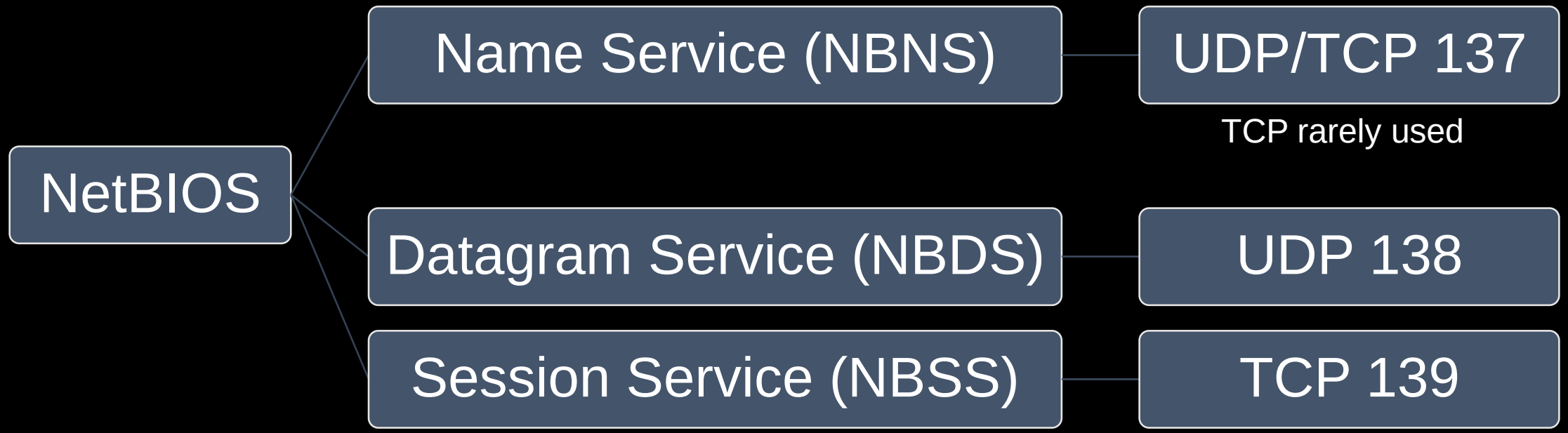

Now

Agenda

- Background knowledge
- How to create a BadTunnel
- What BadTunnel could do
- How to defend against BadTunnel attacks


Background Knowledge

Ancient NetBIOS Protocol



How ancient is NetBIOS? If you study on the research history of NetBIOS security, your will see the name *Cult of the Dead Cow*.

NetBIOS Name Service (NBNS)

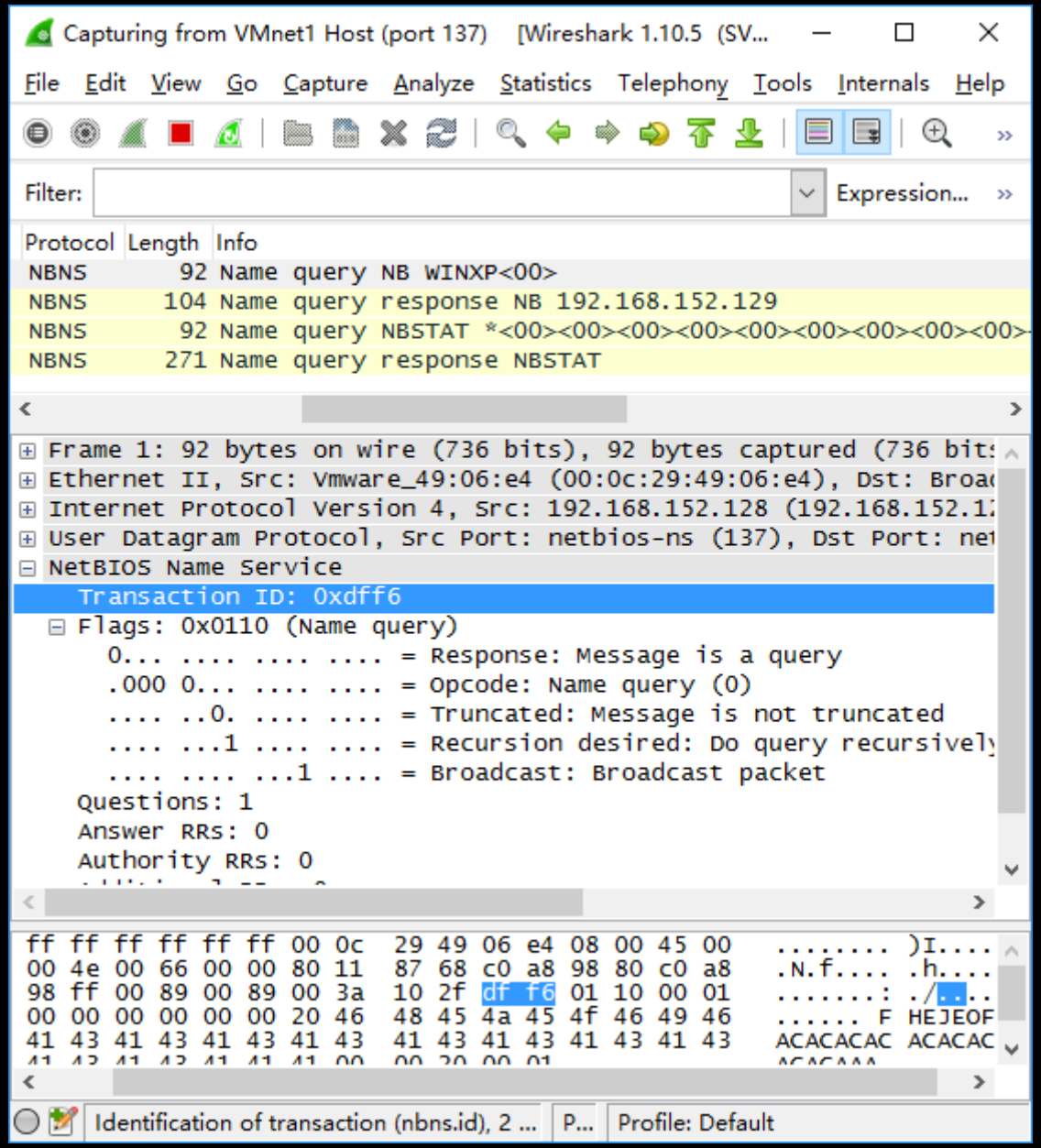
- NBNS provides a name resolution service, like DNS
- The packet formats of the NBNS are identical to DNS
  - “DNS running on port 137”
- Transaction ID of NBNS is not random but incremental
- NBNS use UDP packets sent from and to port 137

- The security of DNS protocol is completely dependent on the randomness of source port and Transaction ID. But NBNS abandoned this in design
  - However, this is understandable, considering NBNS is designed for exclusive use in the local area network. Name resolving is done using UDP broadcast, which can be received by all hosts in the same network. So it seems unnecessary to randomize the source port and Transaction ID.

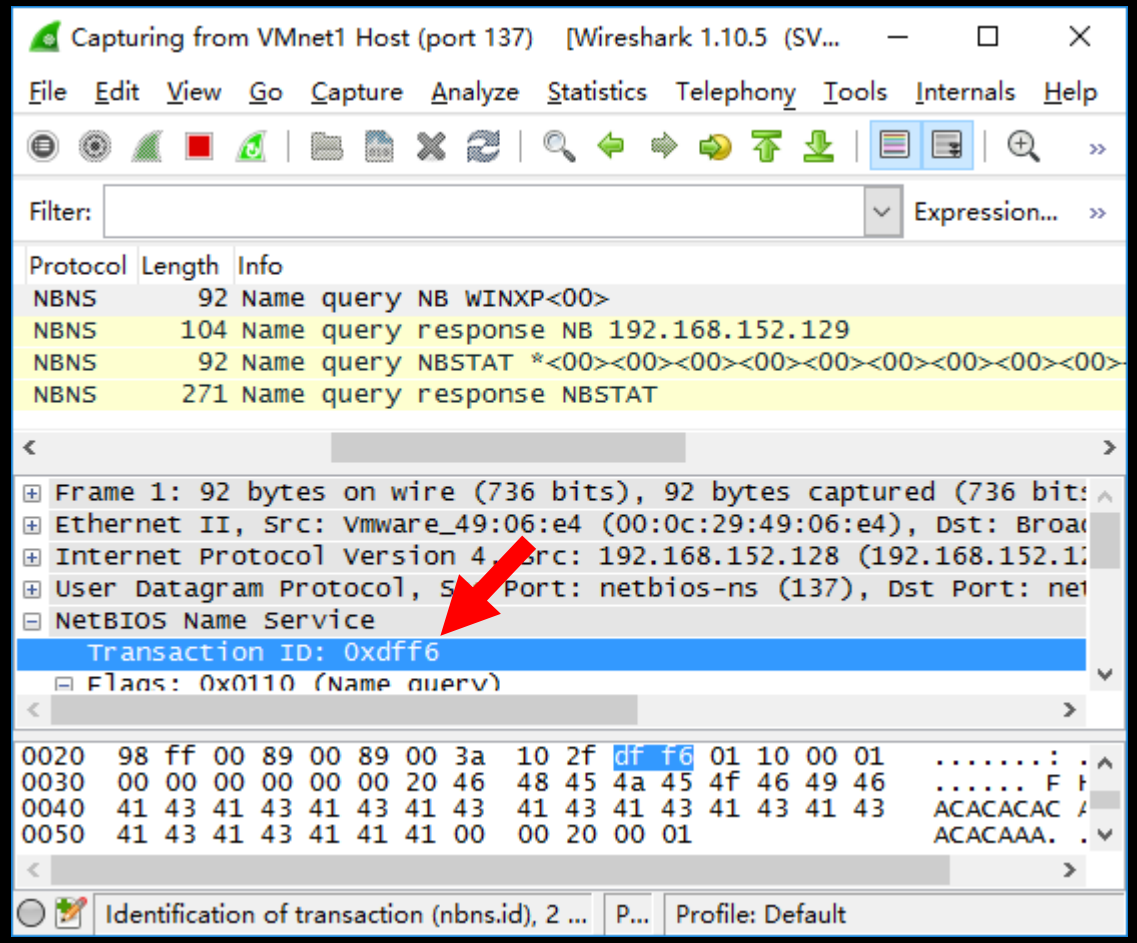
Two Types of NBNS Query

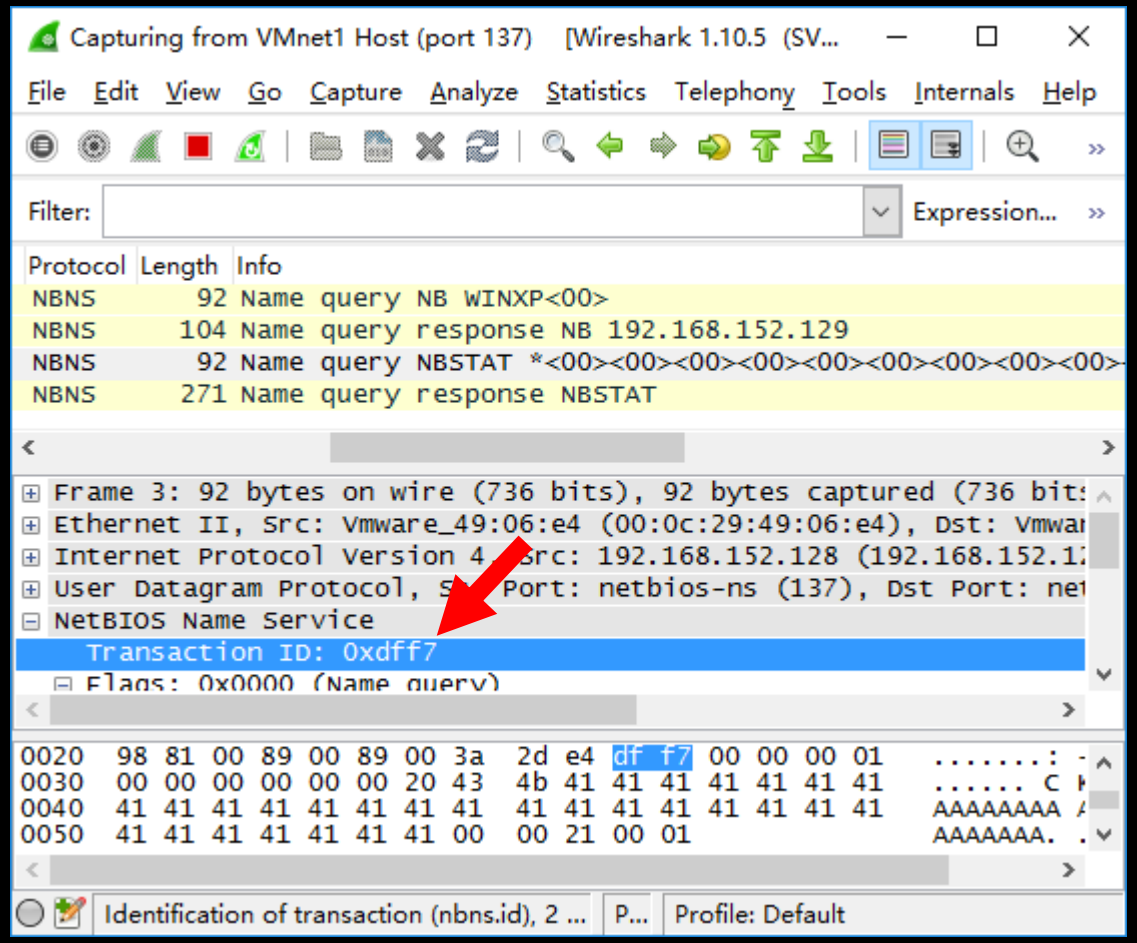
- NB query, for name resolving, can work both in broadcast mode or unicast mode
  - NB query be used to resolve names (e.g. “tencent”), but it can also be used to resolve FQDN (e.g. “www.tencent.com”)
  - For FQDN resolving, NB query is only used when there is no DNS results.
- NBSTAT query, for diagnostics, unicast
  - NBSTAT query is usually send by diagnostic tools such as nbtstat.exe the system also sent it after failing to access network share path such as \\10.10.10.10\BadTunnel
- NB query and NBSTAT query shares the same Transaction ID counter

```
C:\Users\tk>ping -n 1 WINXP

Pinging WINXP [192.168.152.129] with 32 bytes of data:
Reply from 192.168.152.129: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.152.129:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\tk>nbtstat -A 192.168.152.129

Local Area Connection:
Node IpAddress: [192.168.152.128] Scope Id: []

           NetBIOS Remote Machine Name Table

       Name               Type         Status
    ---------------------------------------------
    WINXP          <00>  UNIQUE      Registered
    WINXP          <20>  UNIQUE      Registered
    WORKGROUP      <00>  GROUP       Registered
    WORKGROUP      <1E>  GROUP       Registered
    WORKGROUP      <1D>  UNIQUE      Registered
    ..__MSBROWSE__.<01>  GROUP       Registered

    MAC Address = 00-0C-29-DA-28-A8
```

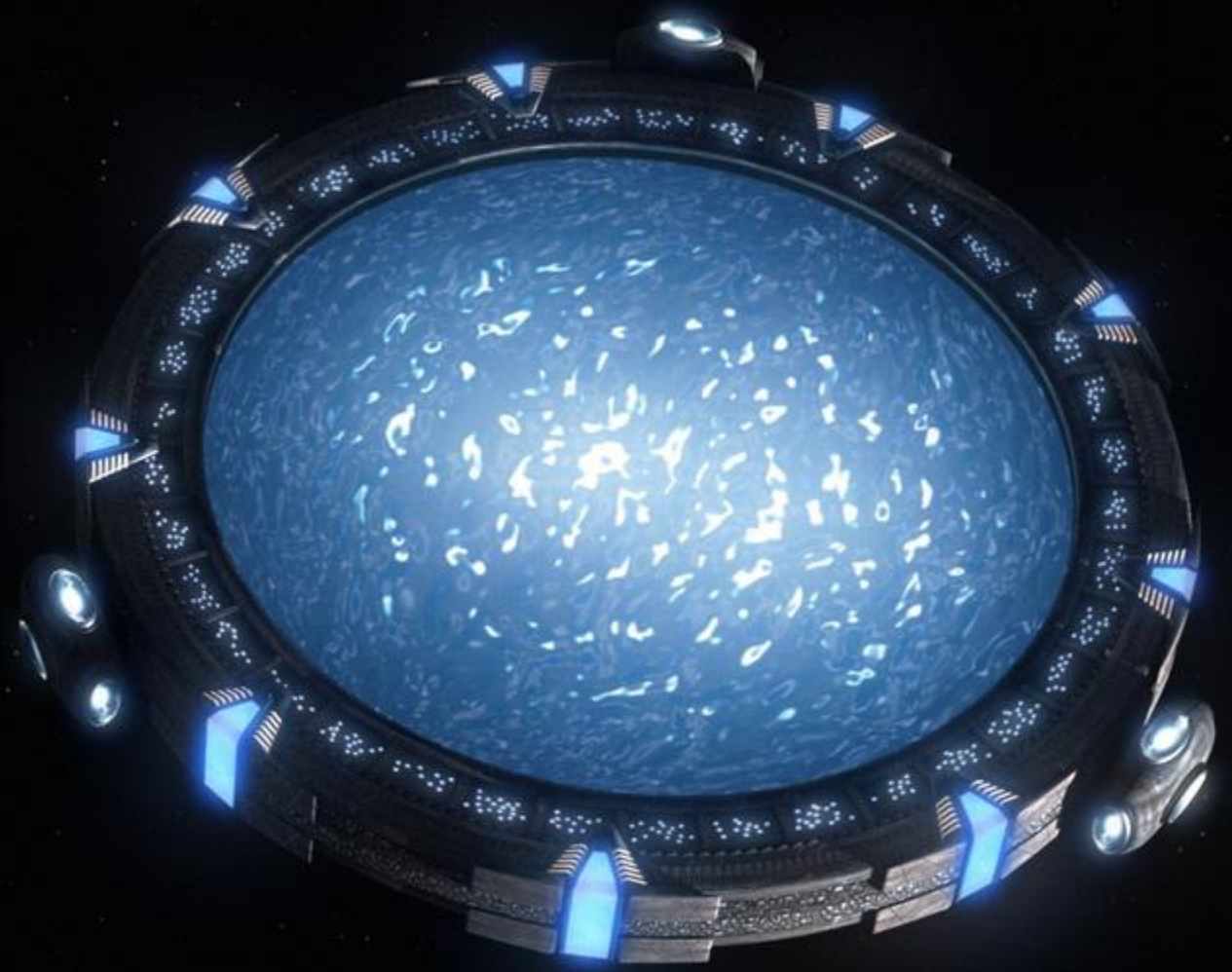


The NBNS Transaction ID is incremental.
NB query and NBSTAT query shared the same counter.

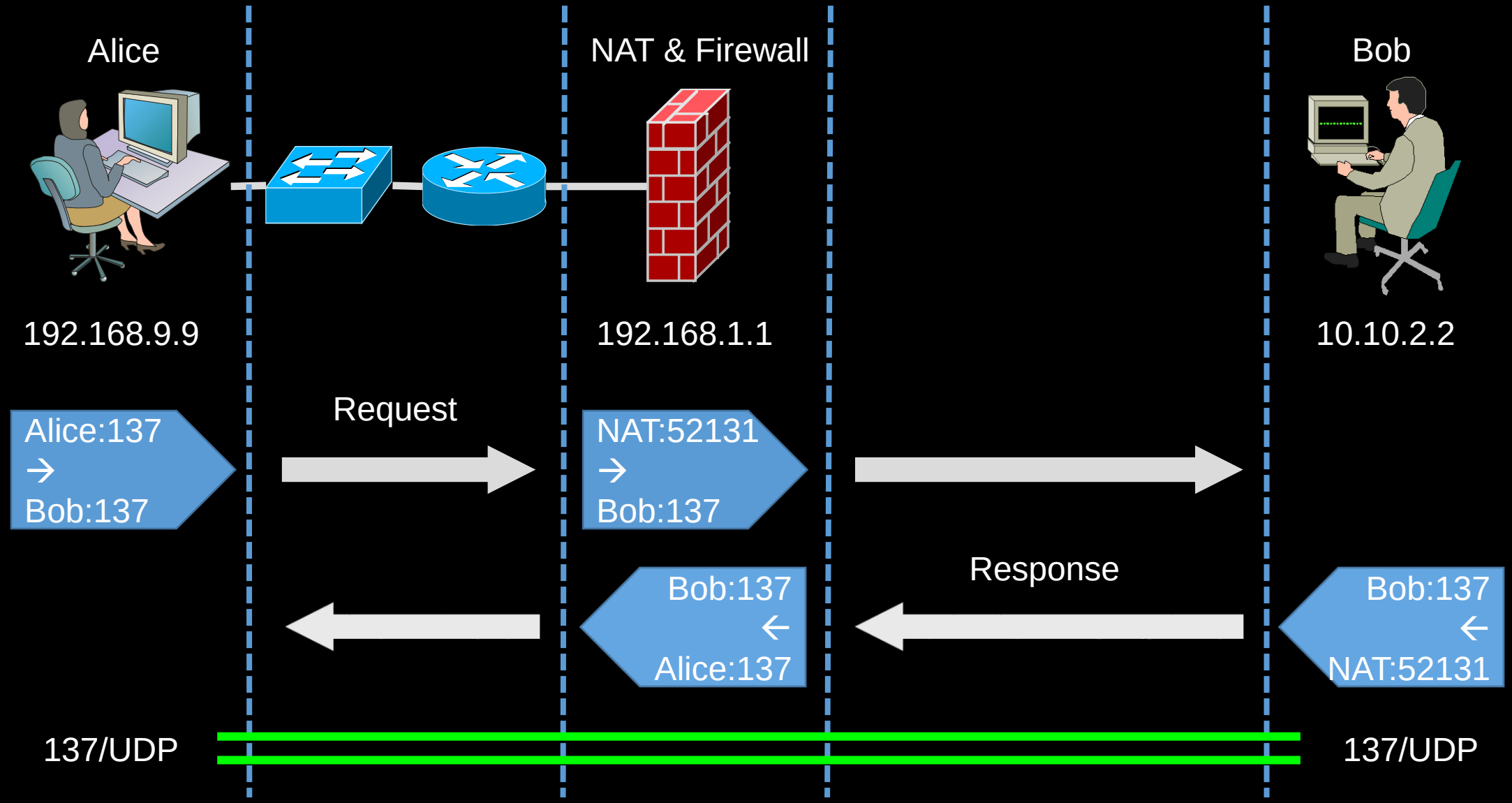




Create BadTunnel



If Alice send a NBSTAT query to Bob:



As mentioned previously, NBNS use UDP packets sent from and to port 137.

Host firewalls, network firewalls, NAT devices and any other network devices cannot distinguish which session the UDP packet belongs to, so if they allow a UDP traffic, they must allow the UDP packet on both directions.

So, the client can become the server, the server can become a client.

Now, the only question is: how to make Alice send a NBSTAT query to Bob?

When Windows is trying to access an UNC path with IP address, if the 139 and 445 port of the target is inaccessible – either timed out or been reset – the system will send a NBNS NBSTAT query to the target IP address.

There are numerous ways to make a system access a UNC path.

To web browser:

<img src="\\10.10.10.10\BadTunnel">

To MS Office:

Set TargetMode to "External" and Target to "file://10.10.10.10/A/A.png"

To shortcut:

Set IconFile to “file://10.10.10.10/A”

To web server:

http://web.server/reader.aspx?ID=\\10.10.10.10\BadTunnel

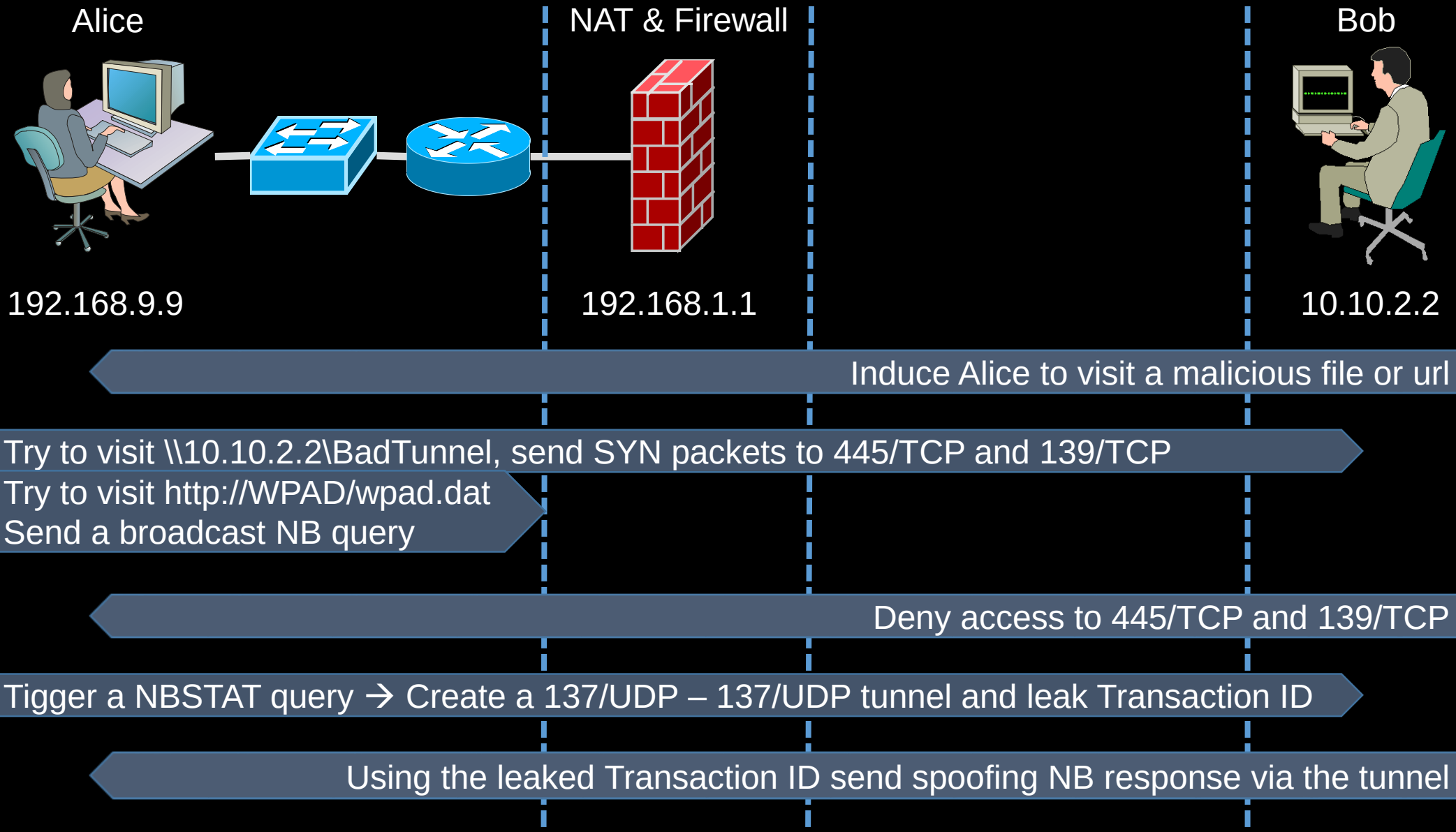
…

What BadTunnel could do

What BadTunnel Could Do?

- Hijack “WPAD”
  - The Web Proxy Auto-Discovery Protocol
  - Windows system use http://WPAD/wpad.dat to configure proxy settings
  - Hijacking WPAD + Evilgrade ≈ Execute any program
  - Hijacking WPAD = Bypass IE Sandbox
    - If the wpad.dat returns "DIRECT" for a site, IE will runs at Medium IL, outside of EPM/AppContainer
- Hijack “ISATAP”
  - ISATAP: The Intra-Site Automatic Tunnel Addressing Protocol
  - Windows use hosts named “ISATAP” as ISATAP router.
- Hijack nonexistent domain name
  - Steal Cookies
- Send NBNS NBSTAT query to get LAN host name and MAC addresses

Using BadTunnel to Hijack WPAD



With BadTunnel, you can hijack the network traffic of every version of the Microsoft Windows going back to Windows 95

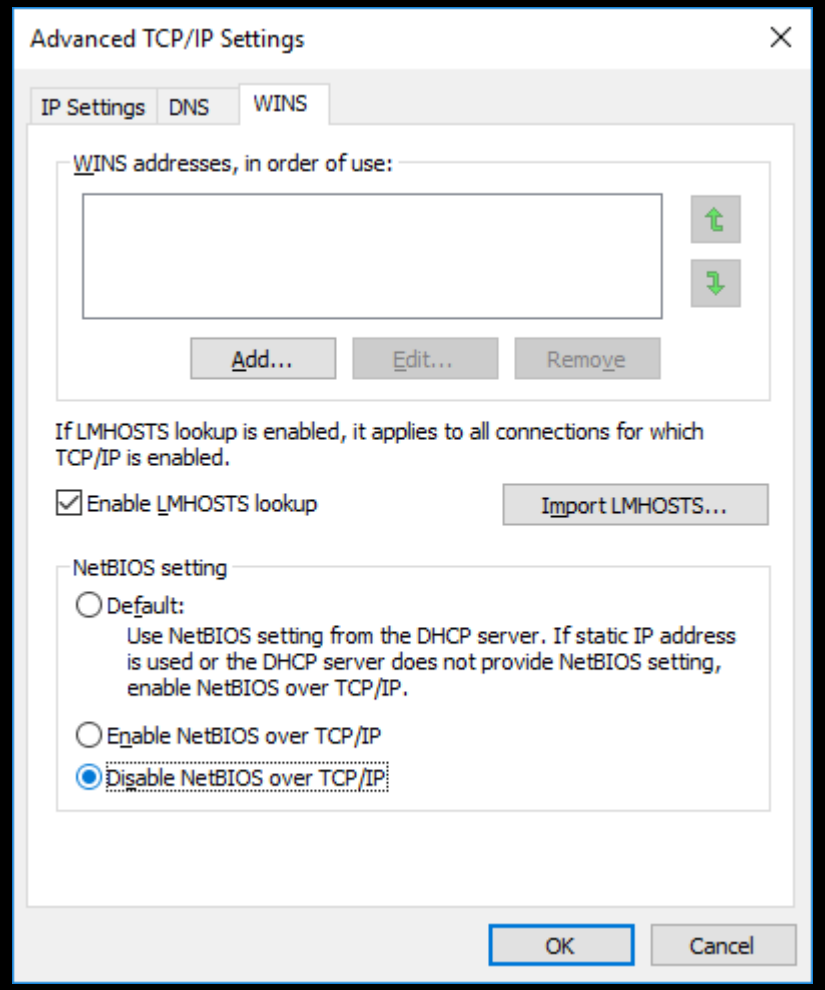
This is Big Brother power 

How to defend against BadTunnel attacks

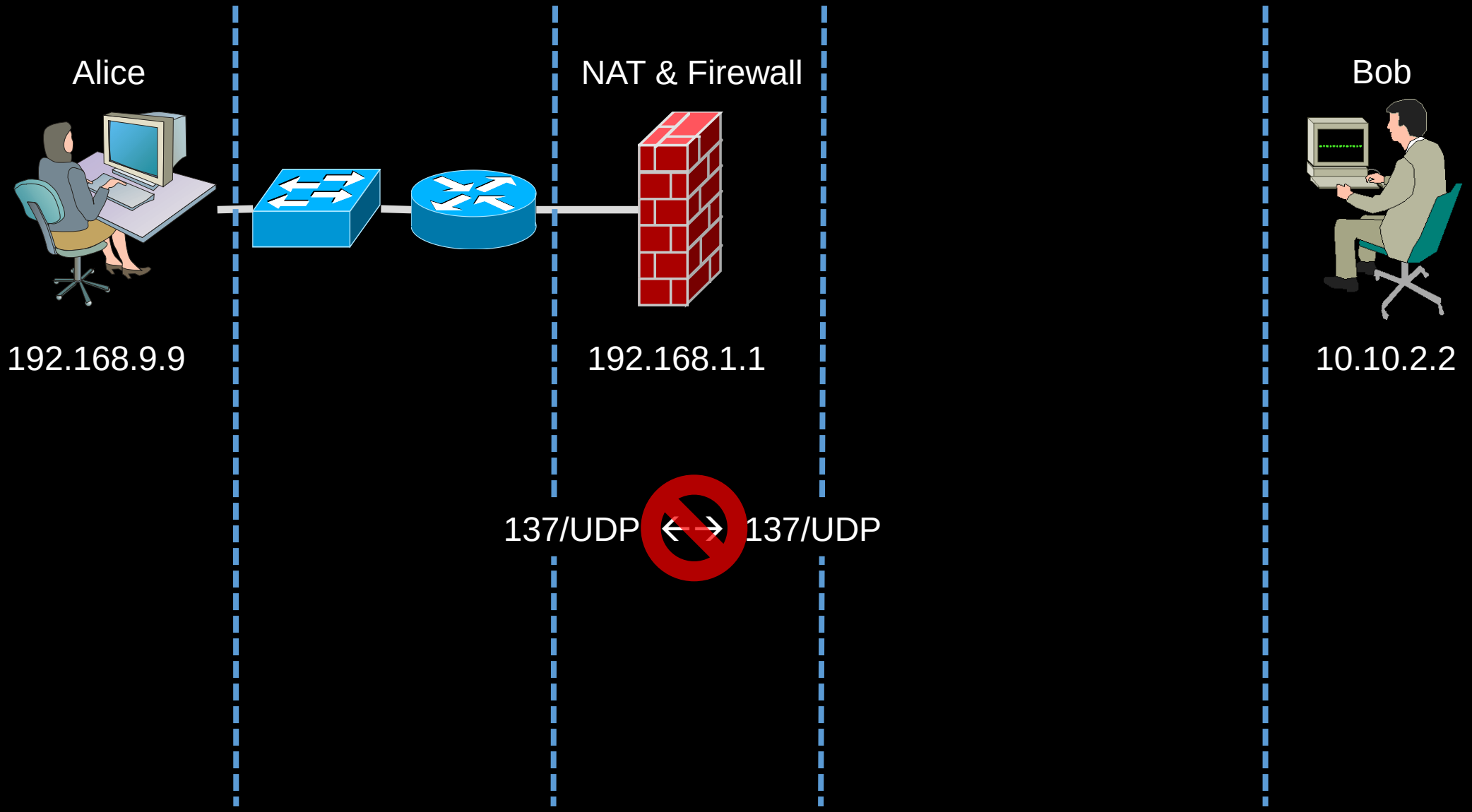
Defend Against BadTunnel

- Microsoft has fixed the vulnerability in June 2016
  - No more NBNS NBSTAT query after failed UNC path access
  - No longer use NBNS to resolve WPAD name

- If you are still using unsupported versions such as Windows XP, or otherwise can not install the patch, you could consider disabling the NetBIOS over TCP/IP.



Mitigate with Perimeter Firewall



Thank you for listening!

To explore strange attack surfaces
To seek out new flaws and new weaknesses
To boldly go where no hacker has gone before