The Unavoidable Pain Of Backups

—

Security Deep-Dive Into The Internals Of NetBackup

Nicolas Devillers, Jean-Romain Garnier
@AirbusSecLab – Hexacon 2022

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1 INTRODUCTION

2 **LET'S MEET NETBACKUP**
Target Overview: Key Technical Aspects

3 **HOW WE DUG INTO NETBACKUP**
The Approach, The Challenges And How We Tackled Them

4 **FINDINGS**
Overview Of Vulnerabilities And Attack Paths

5 **TAKEAWAYS**

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WHO ARE WE?

Airbus Security Lab

SPEAKERS

Nicolas Devillers (@nikaiw)
10+ years in offensive security
Focus on vulnerability research and red teaming
Member of Airbus security lab

Jean-Romain Garnier (@JRomainG)
Security evaluator for 2 years
Focus on reverse engineering and low-level security
Member of Airbus security lab

CO-AUTHORS

Mouad Abouhali (@_m00dy_)
Security evaluator

Benoît Camredon (@ben64_)
Security evaluator

Anaïs Gantet
Security evaluator

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Missions include:

- As an internal offensive team, evaluating products that Airbus uses (or intends to) or sells to **increase the company's overall security**
- Performing red teaming, vulnerability research, tooling development…

Checkout https://airbus-seclab.github.io and @AirbusSecLab

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MOTIVATIONS

Why Backup Software?

BUSINESS PERSPECTIVE

- Proper backup deployment paramount for resilience
- Specialized software required for large-scale infrastructure
- Often considered as “last line of defense”

RED TEAM PERSPECTIVE

- Widely deployed across infrastructure with high privileges
- Potential access to sensitive/critical data
- Ability to move large amounts of data

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MOTIVATIONS

Why NetBackup?

NetBackup

The #1 enterprise backup and recovery solution.

87% of the Fortune Global 500 choose NetBackup.

Source: veritas.com/protection/netbackup

1987 Chrysler

1990 AWBUS

1993 BackupPlus & NetBackup

1997 Veritas

2005 Symantec

2016 Veritas

BeeRumP Paris 2016, *APT Cyber-Numérique Sur Sauvegardiciel Connecté* – Émilien Girault

Full Disclosure 2017 – Sven Blumenstein, Xiaoran Wang and Andrew Griffiths from Google Security

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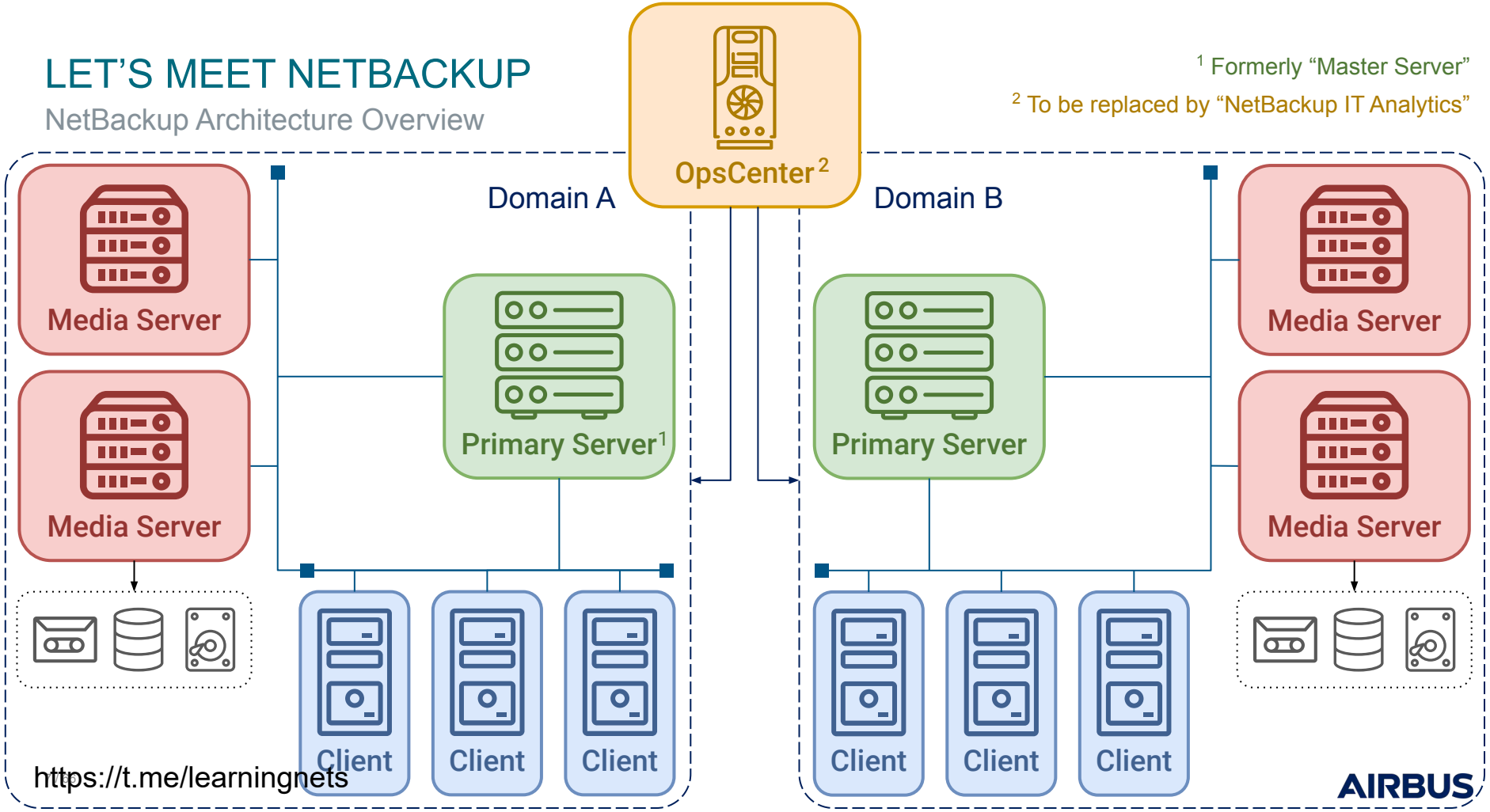
LET'S MEET NETBACKUP

NetBackup Architecture Overview

[1] Formerly "Master Server"

[2] To be replaced by "NetBackup IT Analytics"



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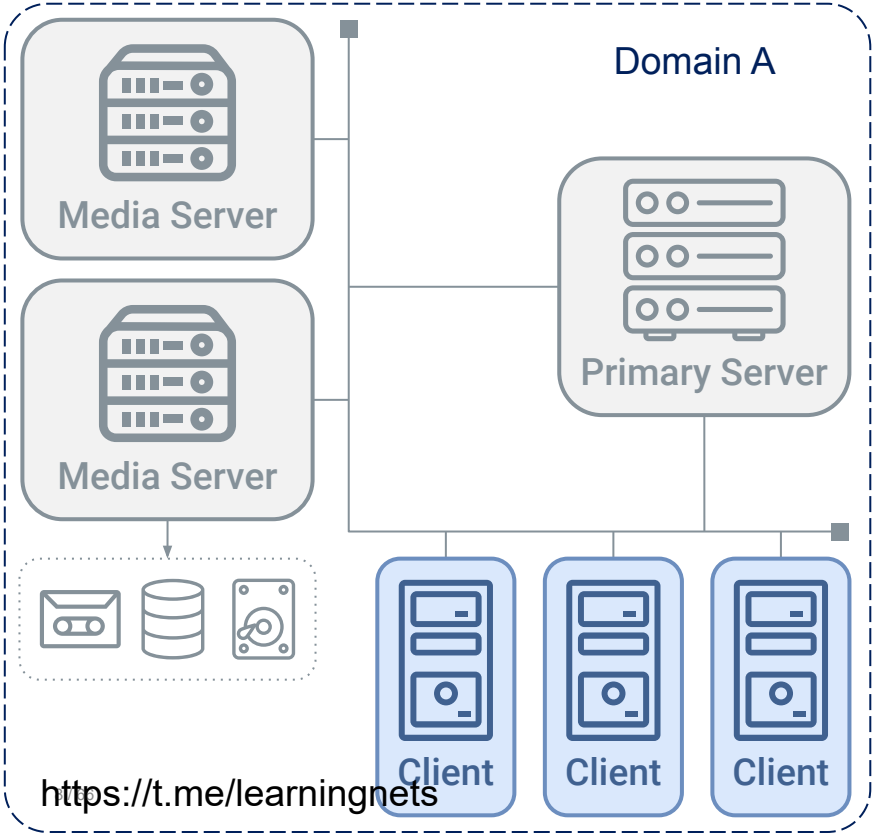
LET'S MEET NETBACKUP

More About NetBackup Clients



CLIENT DEPLOYMENT OPTIONS

Bare-metal | Cloud | Virtualized | Database

OPERATING SYSTEM

Windows | Red Hat | IBM AIX | HP-UX | ...

CONFIGURATION

Client-side Encryption | Secure communication | HTTP Tunneling | ...

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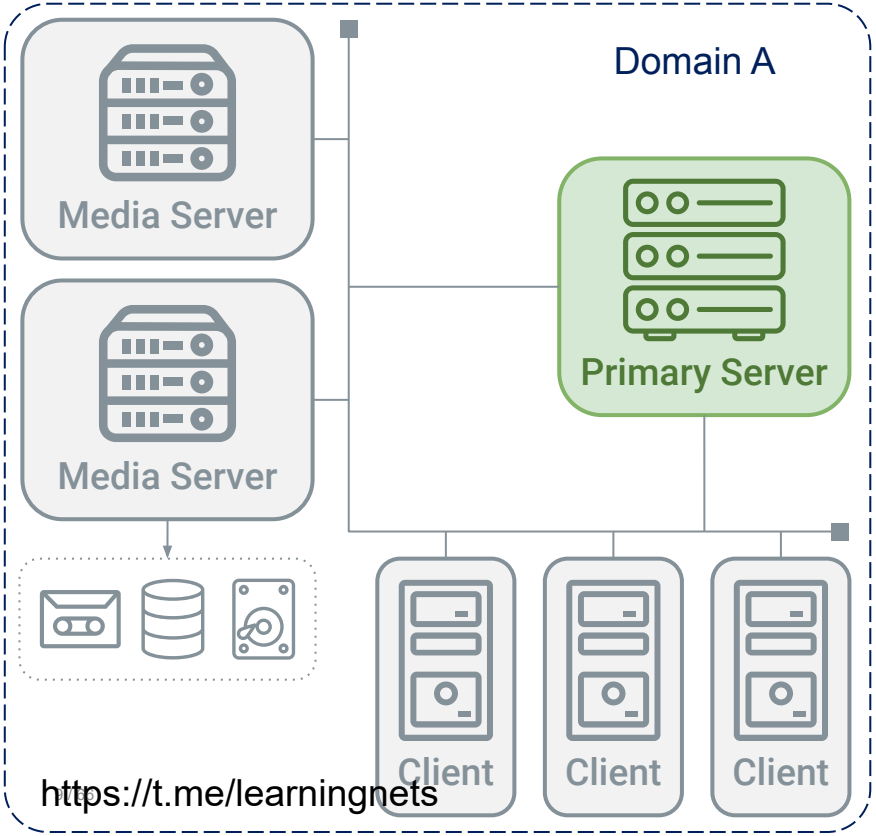
LET'S MEET NETBACKUP

More About NetBackup Primary Servers



PRIMARY SERVER DEPLOYMENT OPTIONS

Cluster
Media
Appliance
...

BACKUP COMPONENTS

Policies
Catalog
API
Web UI
...

SECURITY CONFIGURATION

Secure communication
...

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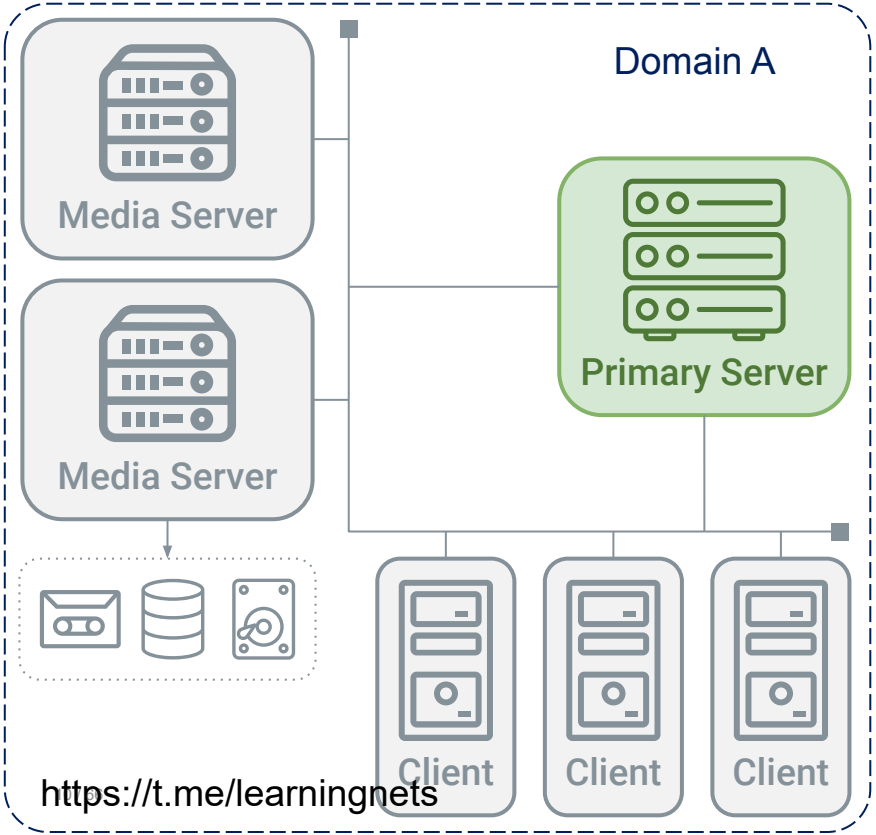
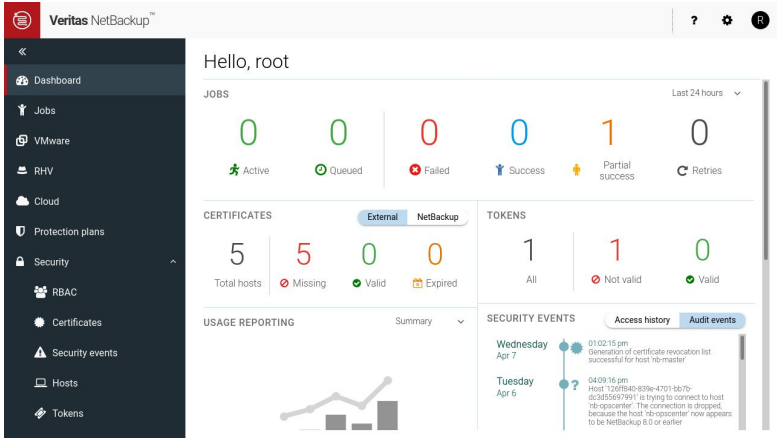
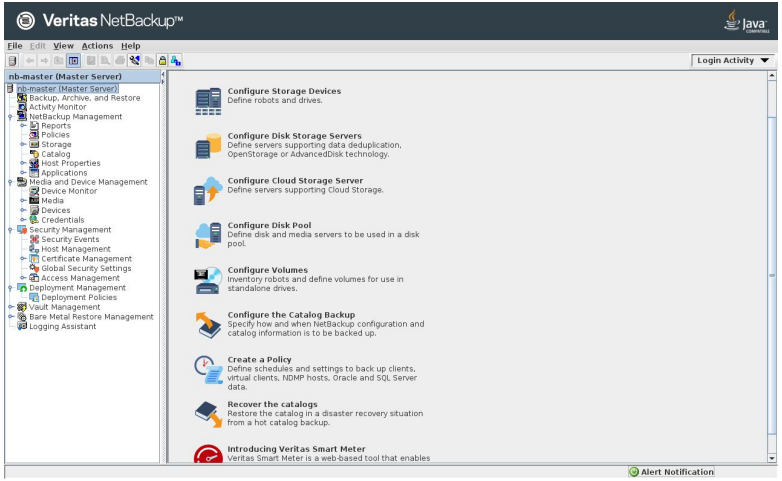
LET'S MEET NETBACKUP

More About NetBackup Primary Servers







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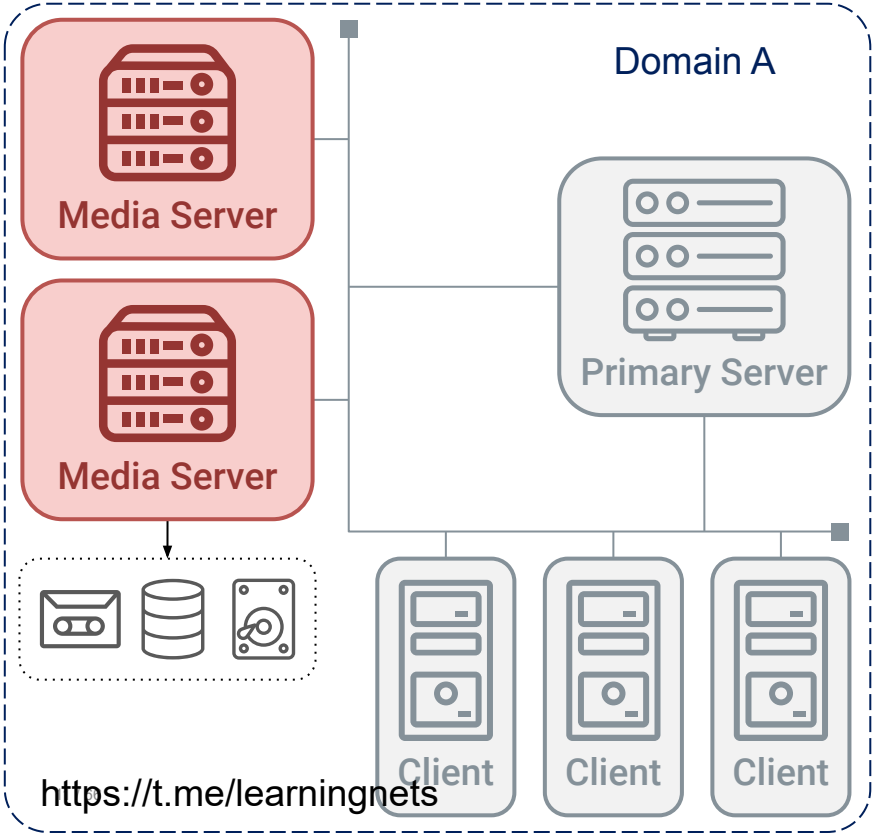
LET'S MEET NETBACKUP

More About NetBackup Media Servers



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MEDIA SERVER DEPLOYMENT OPTIONS

Disk pool

Tape library

Appliance

STORAGE CONFIGURATION

Deduplication

Catalog

...

STORAGE SECURITY

Data encryption

Offline storage

WORM

...

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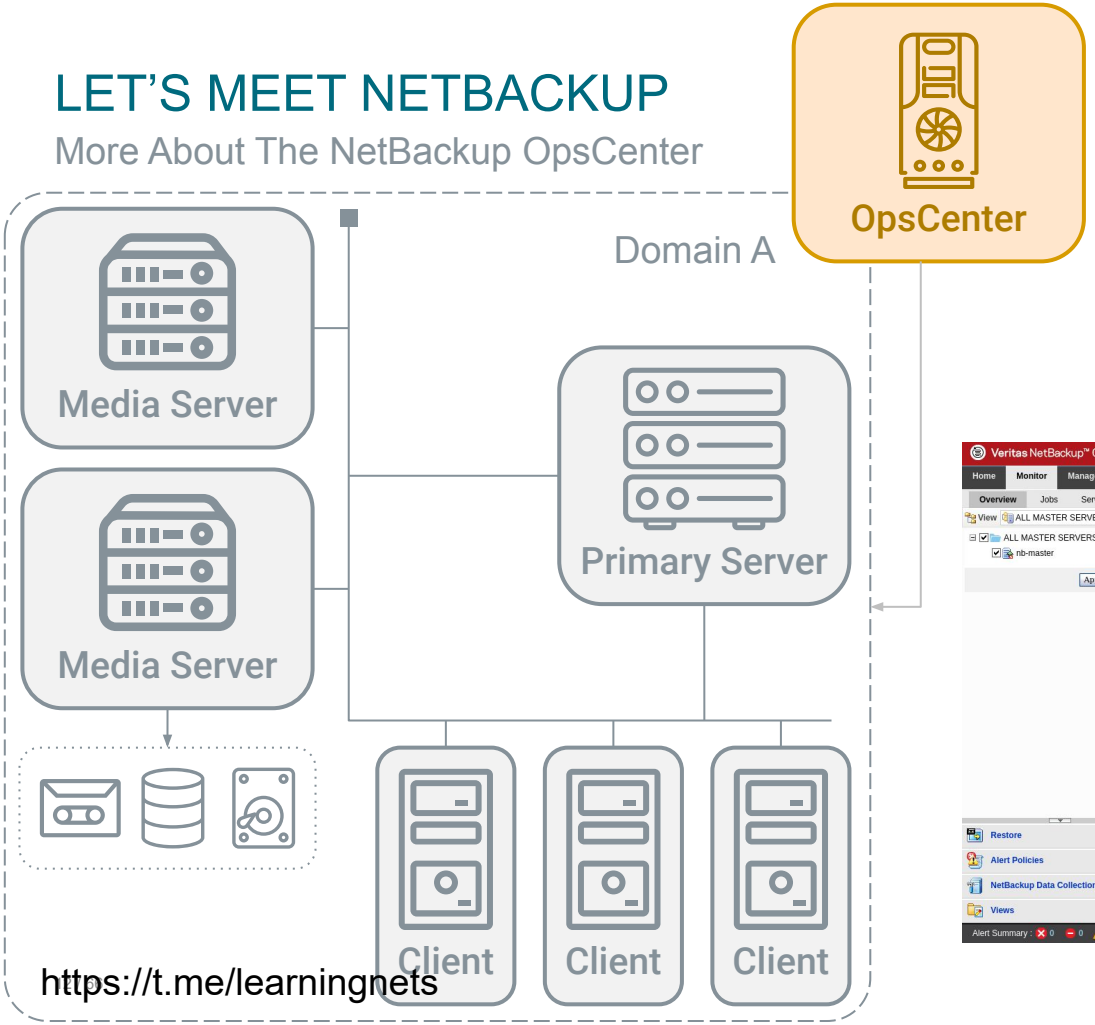
LET'S MEET NETBACKUP

More About The NetBackup OpsCenter



OPSCENTER ROLES

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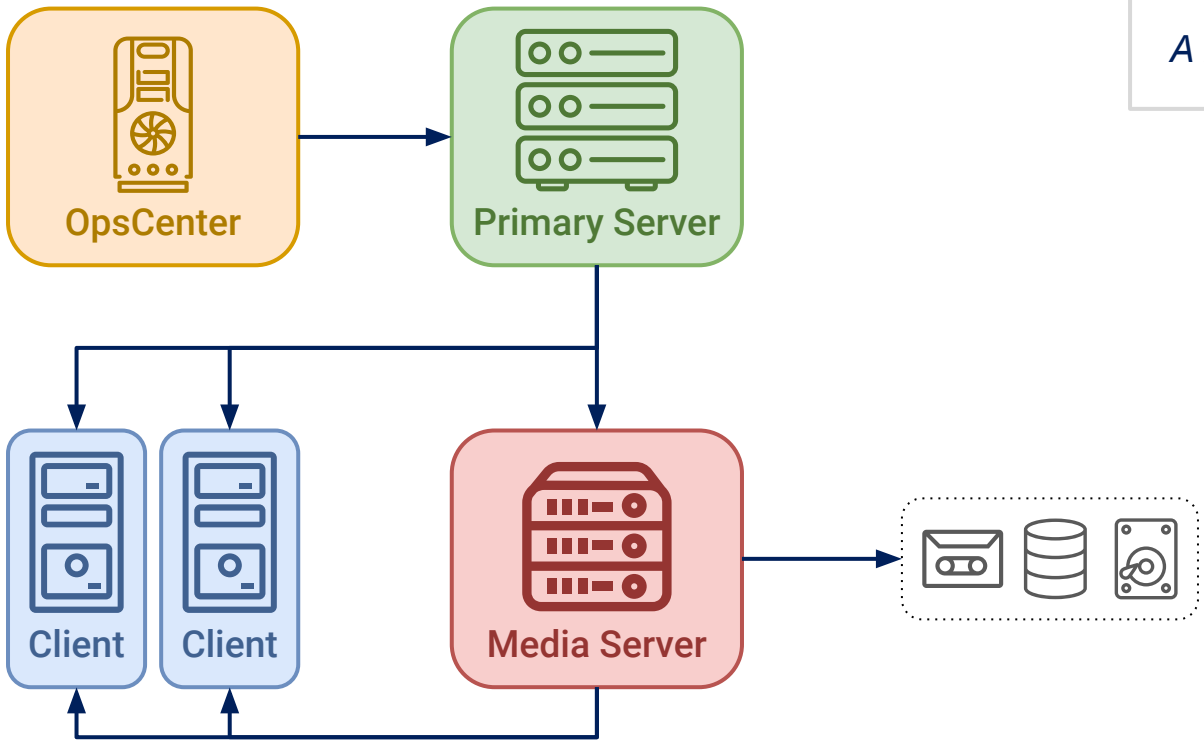
LET'S MEET NETBACKUP

NetBackup Trust Model



Caption

A → B

A is trusted by B

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HOW WE DUG INTO NETBACKUP

Starting Point: Asking Security Questions (And Quick Spoilers)

1. What would it take for an attacker to exploit NetBackup?
⇒ Specific tooling & workflow knowledge, not out of reach of motivated attackers

2. Can a Primary Server be compromised from a NetBackup client?
⇒ Yes, and more:

CVE-2022-36948, CVE-2022-36949, CVE-2022-36950, CVE-2022-36951, CVE-2022-36953, CVE-2022-36954,
CVE-2022-36955, CVE-2022-36984, CVE-2022-36985, CVE-2022-36986, CVE-2022-36987, CVE-2022-36988,
CVE-2022-36989, CVE-2022-36990, CVE-2022-36991, CVE-2022-36992, CVE-2022-36993, CVE-2022-36994,
CVE-2022-36995, CVE-2022-36996, CVE-2022-36997, CVE-2022-36998, CVE-2022-36999, CVE-2022-37000,
CVE-2022-42299, CVE-2022-42300, CVE-2022-42301, CVE-2022-42302, CVE-2022-42303, CVE-2022-42304,
CVE-2022-42305, CVE-2022-42306, CVE-2022-42307, CVE-2022-42308

3. Could the NetBackup system be used as a pivot to attack other interconnected systems?
⇒ Follow along for a full-chain demo!

4. Which data could an attacker target to prevent NetBackup recovery?
⇒ Backup data *or* backup metadata, more details later on

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HOW WE DUG INTO NETBACKUP

Our Approach To Discover What's Under The Hood

Find a team of motivated people
⇒ 5 evaluators over the course of several months

Read some documentation
⇒ Learn about main components & concepts

Setup some labs
⇒ Use customer installers (8.2–9.1), apply & check understanding, find questions

Talk with architects
⇒ Get practical knowledge, understand risks & ask questions

Read more documentation
⇒ Don't forget about security & administrator guides

Play with our labs
⇒ Don't forget to go back to previous steps

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HOW WE DUG INTO NETBACKUP

Our Approach To Discover What's Under The Hood

Play with our labs?

⇒ What does it even mean?

First naive questions
• What processes are running on each component? • How do components communicate with each other? • What services are exposed remotely? Locally?

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HOW WE DUG INTO NETBACKUP

Too Many Binaries, Too Little Time: `$ ps` To The Rescue

```
Java Web Server
ops_atd
OpsCenterDBd
OpsCenterServerd
pbx_exchange
```

```
bpcd
bpcompatd
bpdbm
bpjobd
bprd
Java Web Server
ltid
nbars
nbatd
nbaudit
nbazd
nbdisco
nbemm
nbevtmgr
nbim
nbjm
nbkms
nbpem
nbproxy
nbrb
nbrmms
nbsl
nbstserv
nbsvcmon
nbvault
NB_dbsrv
pbx_exchange
vmd
vnetd
```

```
avrd
bmrbd
bmrd
bmrpxeserver
bpinetd
nbostpxy
PXEMTFTP
spoold
spad
```

```
bpcd
nbdisco
nbrmms
nbsl
nbsvcmon
pbx_exchange
vmd
vnetd
```

```
avrd
bpinetd
nbcssc
nbostpxy
nbrntd
```

```
bpcd
bpbkar
nbdisco
pbx_exchange
vnetd
```

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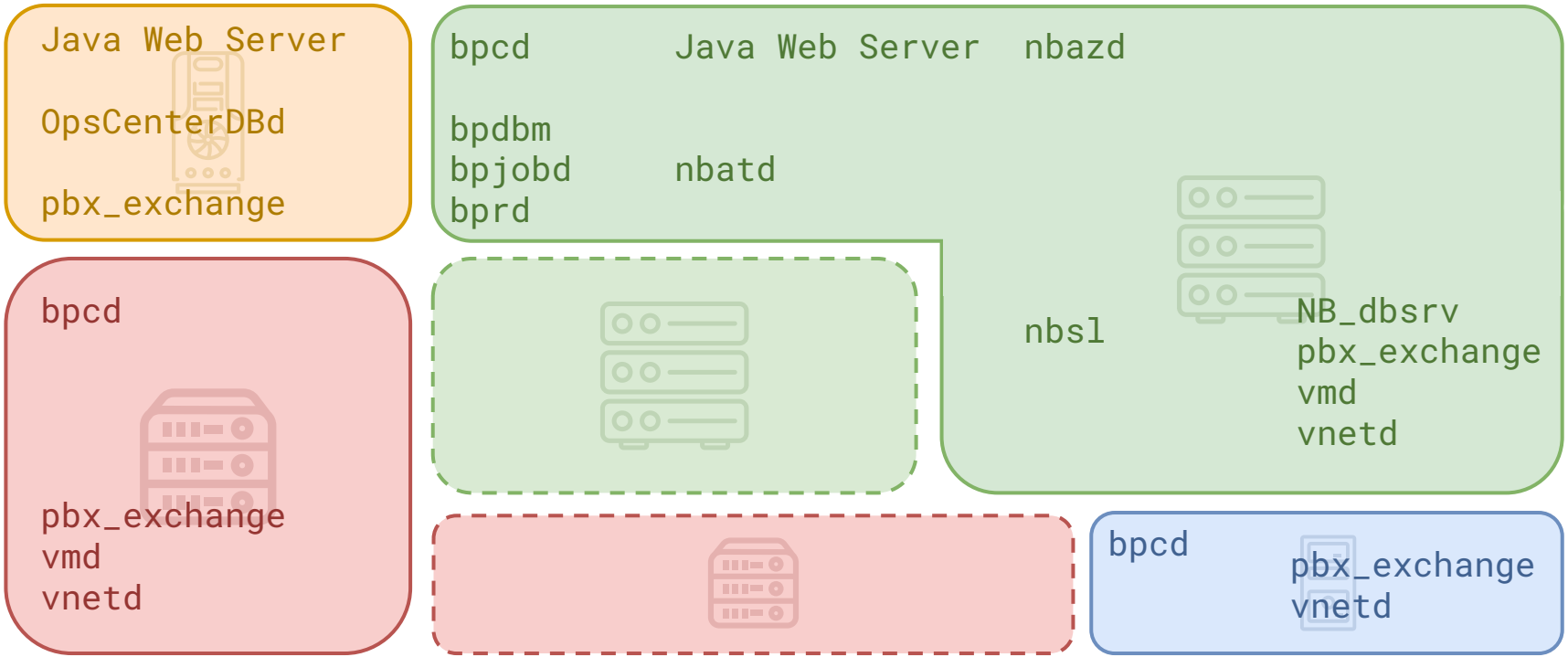
Same user account / SYSTEM; newer versions have an option to change user on some components

HOW WE DUG INTO NETBACKUP

Too Many Daemons, Too Little Time: `$ ss` To The Rescue



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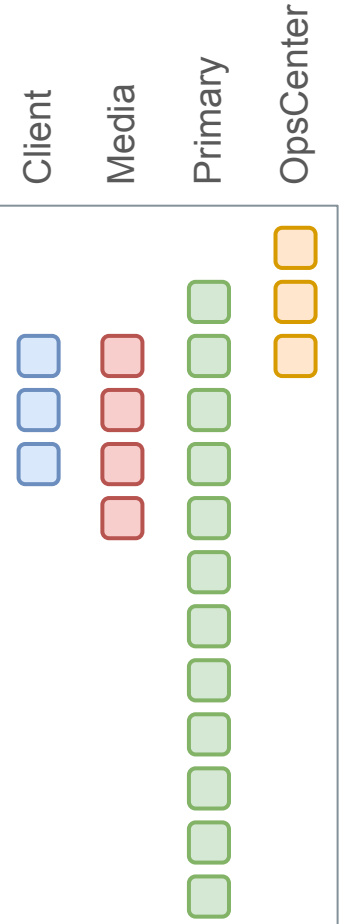
HOW WE DUG INTO NETBACKUP

Too Many Daemons, Too Little Time: `$ ss` To The Rescue

Binary name	Address:Port
OpsCenterDBd	127.0.0.1:13786
Java Web Server	0.0.0.0:8443
pbx_exchange	0.0.0.0:1556
vnetd	0.0.0.0:13724
bpcd	0.0.0.0:13782
vmd	0.0.0.0:13701
bprd	0.0.0.0:13720
bpdbm	0.0.0.0:13721
nbazd	0.0.0.0:13722
bpjobd	0.0.0.0:13723
nbatd	0.0.0.0:13783
NB_dbsrv	0.0.0.0:13785
nbsl	127.0.0.1:9284



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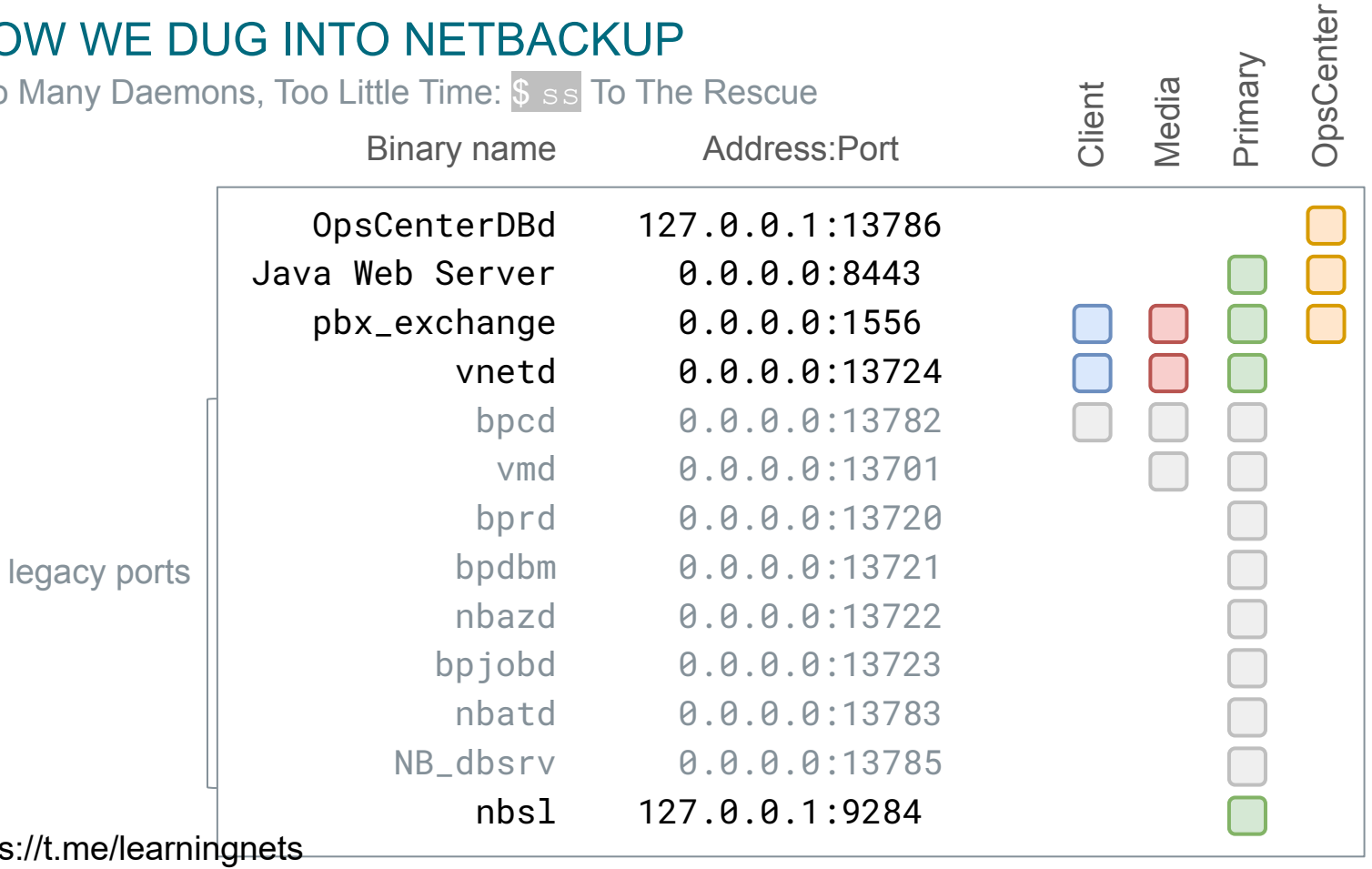

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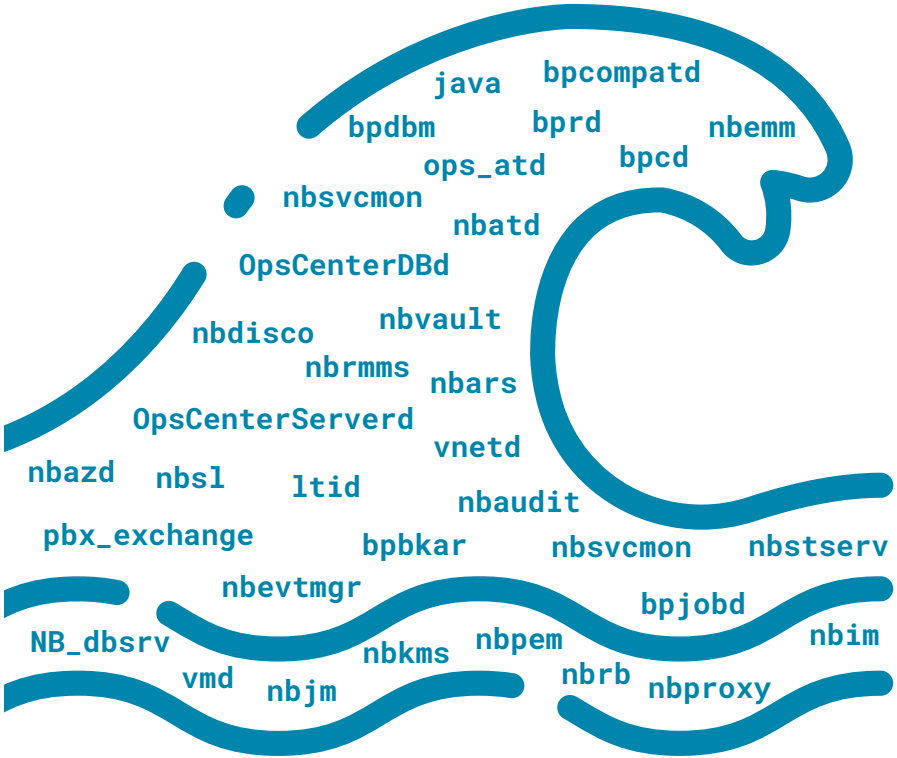
HOW WE DUG INTO NETBACKUP

How To Navigate An Ocean Of Binaries To Understand What's Under The Hood



C/C++
Java
CORBA
Sybase

How to keep going on

- Read more documentation
- Play real use cases and observe
- Choose binaries of interest

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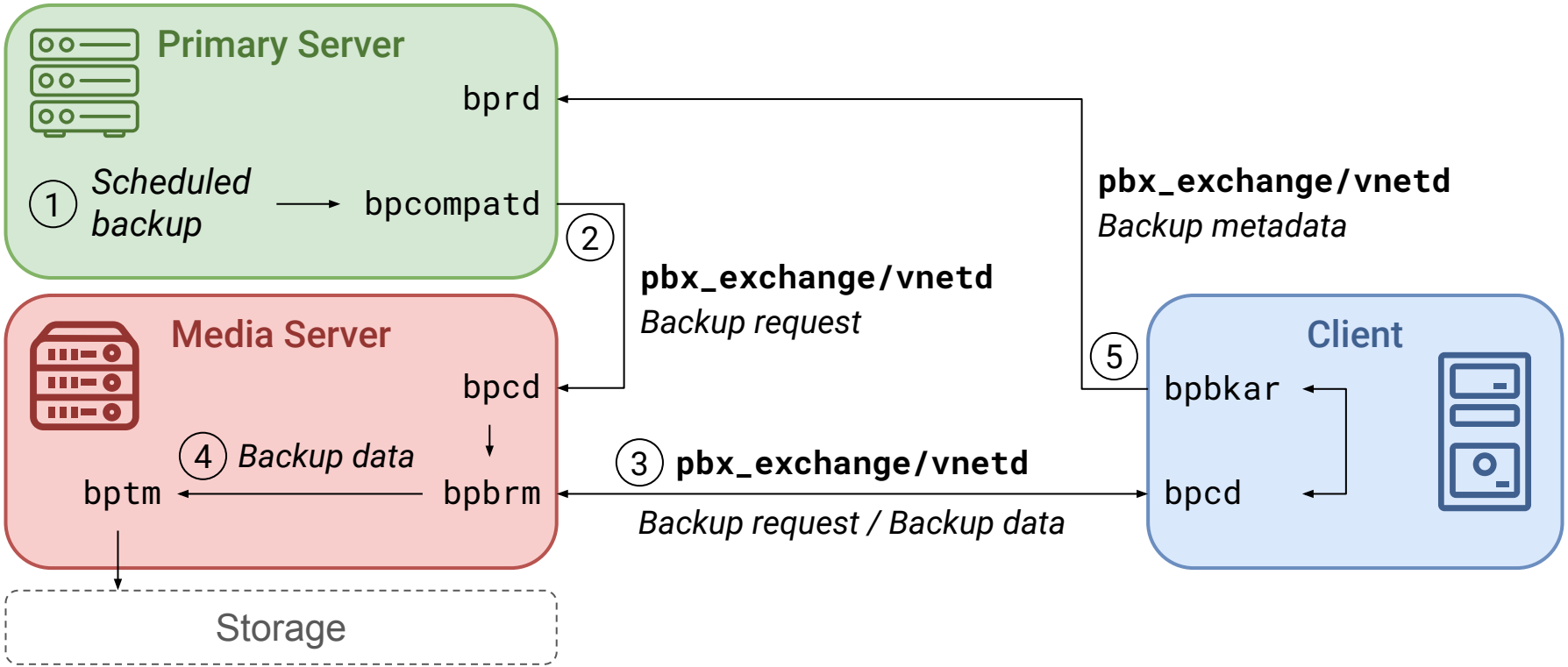
HOW WE DUG INTO NETBACKUP

Understanding A (Simplified) Workflow: The Use Case Of A Client Backup



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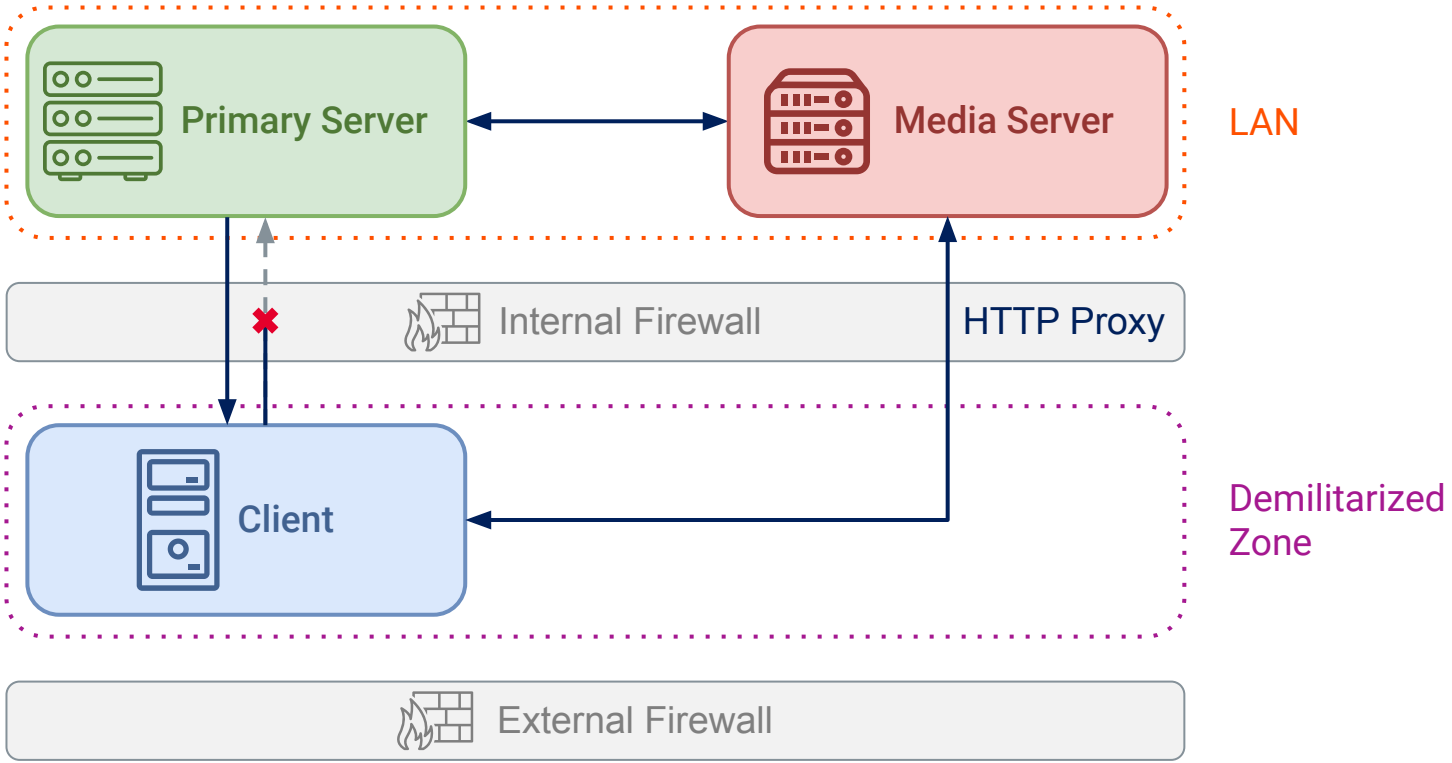
HOW WE DUG INTO NETBACKUP

Understanding The Workflow Of Some Edge Cases: The Use Case Of Dmz Clients



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HOW WE DUG INTO NETBACKUP

Our Covered Attack Surface

Binary name	Acronym meaning	Client	Media	Primary	OpsCenter
`ops_atd`	OpsCenter Authentication Daemon				☐
`OpsCenterServerd`	OpsCenter Server Daemon				☐
`pbx_exchange`	Private Branch Exchange Service	☐	☐	☐	☐
`vnetd`	NetBackup Network Communications Service Daemon	☐	☐	☐	
`bpcd`	NetBackup Client Service Daemon	☐	☐	☐	
`nbsl`	NetBackup Service Layer		☐	☐	
`bprd`	NetBackup Request Daemon			☐	
`nbatd`	NetBackup Authentication Daemon			☐	
`NB_dbsrv`	NetBackup Relational Database Manager			☐	

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HOW WE DUG INTO NETBACKUP

Going Back To A More Standard Approach

Component-specific documentation
⇒ Veritas knowledge base

Static analysis
⇒ Linux & Windows

Process debugging
⇒ perf-tools (ebpf), GDB / x64dbg, function hooking

Network traffic analysis
⇒ Wireshark, MITM (pynet), TLS decryption

Custom tooling
⇒ Scripts, plugins, etc.

Follow logs
⇒ Debug level contains *a lot* of *very useful* information
⇒ inotify, Git to track modified files

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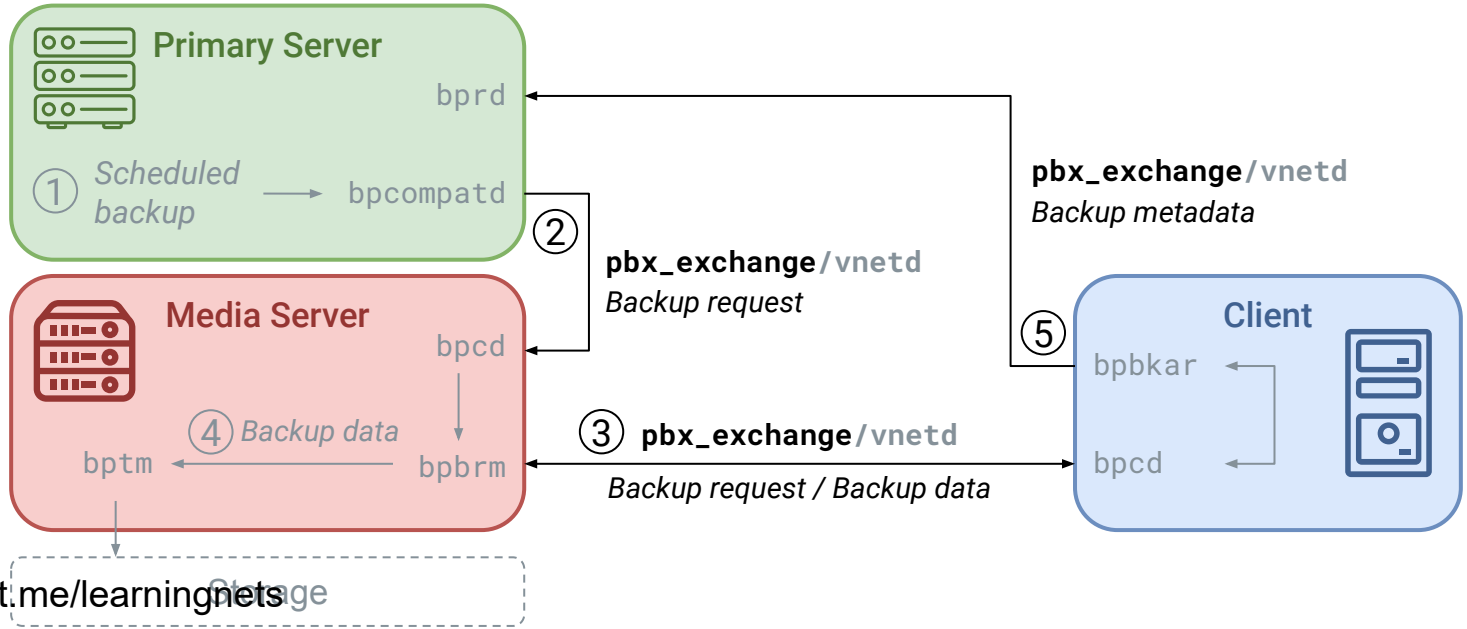
HOW WE DUG INTO NETBACKUP

The Role Of pbx_exchange

> **pbx_exchange**
> The Private Branch Exchange (PBX) service provides single-port access to clients outside
> the firewall that connect to Veritas product services



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HOW WE DUG INTO NETBACKUP

The Role Of pbx_exchange

> **pbx_exchange**
> The Private Branch Exchange (PBX) service provides single-port access to clients outside
> the firewall that connect to Veritas product services

```
# ss | grep pbx_exchange
127.0.0.1:42437     pbx_exchange
127.0.0.1:33075     pbx_exchange
127.0.0.1:1557      pbx_exchange
0.0.0.0:1556        pbx_exchange
```

```
# ss | grep pbx_exchange
127.0.0.1:36493     pbx_exchange
127.0.0.1:35003     pbx_exchange
127.0.0.1:1557      pbx_exchange
0.0.0.0:1556        pbx_exchange
```

```
# ss | grep pbx_exchange
127.0.0.1:41011     pbx_exchange
127.0.0.1:32841     pbx_exchange
127.0.0.1:1557      pbx_exchange
0.0.0.0:1556        pbx_exchange
```

```
# ss | grep pbx_exchange
127.0.0.1:36227     pbx_exchange
127.0.0.1:33765     pbx_exchange
127.0.0.1:1557      pbx_exchange
0.0.0.0:1556        pbx_exchange
```

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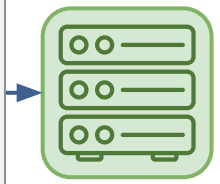
HOW WE DUG INTO NETBACKUP

The Role Of pbx_exchange

pbx init

secure comm init

TLS handshake



```
ack=25
extension=bprd

........"{"remote_proxy_info": {"ca_roots": ["126ff840-839e-4701-bb7b-dc3d55697991"], "ca_roots_excluded":
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"accept_reverse": false}}..............[PR........r.L..x.......Ab.Y..n.0.,.($...
.........k.j.i.h.9.8.7.6.2...*.&.......=.5./.+.'.#...    .........g.@.?.>.3.2.1.0.1.-.).
%.......<./.....I.........
...................#...
. .....................................B...>...Z....k.      .....'.....>Mx...f_.2.i..
0.................#.....................0...0..P.......V.'.....0
.      *.H..
..
..071.0
..U....broker1.0...U....root@nb-master1.0 ..U.
..vx0..
210201085844Z.
220201101344Z0P1-0+..U...$126ff840-839e-4701-bb7b-dc3d556979911.0...U...      NBU_HOSTS1.0  ..U.
..vx0..0
.      *.H..
.........0.......!....j[.../H.b2.T.Xa.Py2.Y....i..s....C.
..U.[4xJ,V.5h|..u`...8.^...;.:yW\...9..R...t 2[.~...~.w.....8..........z.......z}~.H..C.........
.....0...U.......0.0...*...
```

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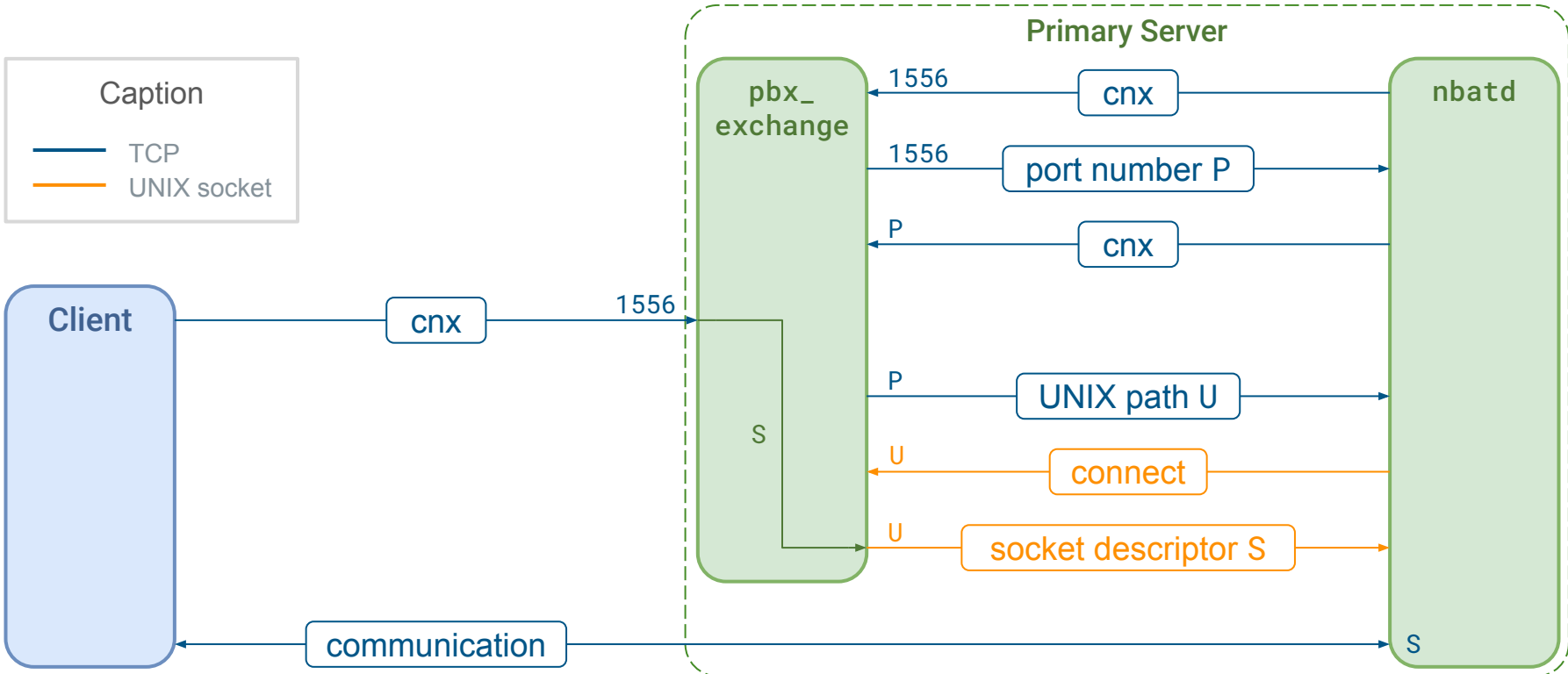
HOW WE DUG INTO NETBACKUP

Component Communication With pbx_exchange: Example Of nbatd



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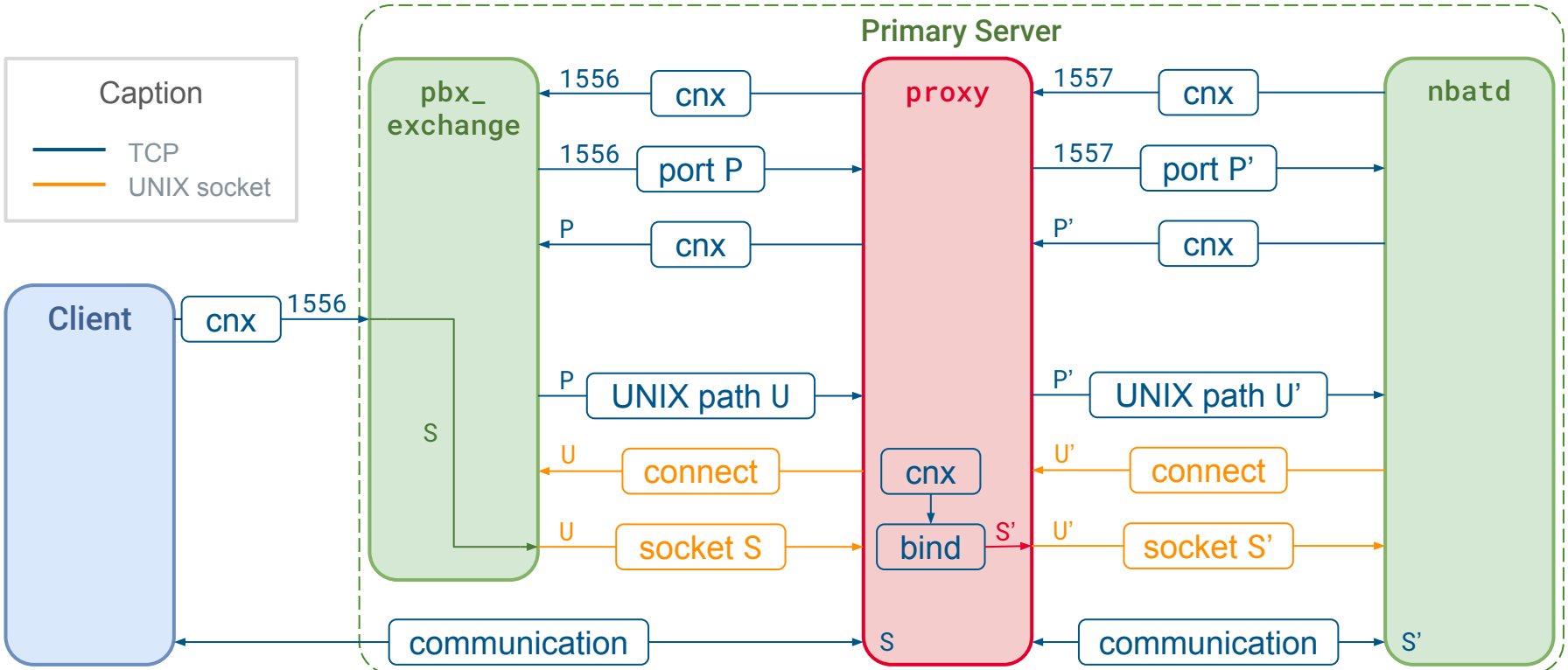
HOW WE DUG INTO NETBACKUP

Component Communication With pbx_exchange: MITM-ing nbatd



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HOW WE DUG INTO NETBACKUP

Remote Procedure Call: Example Of CORBA

BeeRumP Paris 2016: *APT Cyber-Numerique Sur Sauvegardiciel Connecté* – Émilien Girault

Time	Source	Destination	Protoco	Length	Info
2 1989.2637314…	192.168.122.238	192.168.122.26	GIOP	200	GIOP 1.2 Request, s=120 id=0: op=_non_existent
6 1989.3415779…	192.168.122.26	192.168.122.238	GIOP	368	GIOP 1.2 Reply, s=288 id=0: Location Forward

```
▸ Frame 7086: 368 bytes on wire (2944 bits), 368 bytes captured (2944 bits) on interface 0
▸ Linux cooked capture
▸ Internet Protocol Version 4, Src: 192.168.122.26, Dst: 192.168.122.238
▸ Transmission Control Protocol, Src Port: 1556, Dst Port: 41985, Seq: 2, Ack: 155, Len: 300
▸ General Inter-ORB Protocol
▸ General Inter-ORB Protocol Reply
```

```
0000  00 00 00 01 00 06 52 54  00 59 5f d4 00 00 08 00   ·····RT ·Y_·····
0010  45 00 01 60 6d a0 40 00  40 06 55 9e c0 a8 7a 1a   E··`m·@· @·U···z·
0020  c0 a8 7a ee 06 14 a4 01  f3 ad 5f 79 13 fa b1 f1   ··z····· ··_y····
0030  80 18 00 eb 77 ac 00 00  01 01 08 0a 01 f3 a0 2f   ····w··· ·······/
0040  9f 68 b4 d5 47 49 4f 50  01 02 01 01 20 01 00 00   ·h··GIOP ···· ····
0050  00 00 00 00 03 00 00 00  00 00 00 00 2d 00 00 00   ········ ····-···
0060  49 44 4c 3a 56 65 72 69  74 61 73 2f 4e 65 74 42   IDL:Veri tas/NetB
0070  61 63 6b 75 70 2f 48 6f  73 74 53 65 73 73 69 6f   ackup/Ho stSessio
0080  6e 46 61 63 74 6f 72 79  3a 31 2e 30 00 00 00 00   nFactory :1.0····
0090  01 00 00 00 01 49 43 4f  d4 00 00 00 01 01 02 00   ·····ICO ········
00a0  0a 00 00 00 6e 62 2d 6d  61 73 74 65 72 00 14 06   ····nb-m aster···
00b0  05 00 00 00 6e 62 73 6c  00 00 20 00 1b 00 00 00   ····nbsl ·· ·····
00c0  14 01 0f 00 52 53 54 d2  59 3d 63 ec de 04 00 00   ····RST· Y=c·····
00d0  00 00 00 01 00 00 00 01  00 00 00 00 04 00 00 00   ········ ········
00e0  00 00 00 00 08 00 00 00  01 28 52 03 00 4f 41 54   ········ ·(R··OAT
00f0  01 00 00 00 14 00 00 00  01 28 52 03 01 00 01 05   ········ ·(R·····
0100  00 00 00 00 09 01 01 00  00 00 00 00 00 49 43 4f   ········ ·····ICO
0110  18 00 00 00 01 28 a7 00  86 00 00 00 0c 00 00 00   ·····(·· ········
0120  6e 62 73 6c 5f 73 65 63  73 76 63 00 03 00 00 00   nbsl_sec svc·····
0130  3c 00 00 00 01 28 52 03  0f 00 00 00 31 39 32 2e   <····(R· ····192.
0140  31 36 38 2e 31 32 32 2e  32 36 00 00 14 06 00 00   168.122. 26······
0150  05 00 00 00 6e 62 73 6c  00 00 a7 00 86 00 00 00   ····nbsl ········
0160  0c 00 00 00 6e 62 73 6c  5f 73 65 63 73 76 63 00   ····nbsl _secsvc·
```

⇒ CORBA with proprietary layer (PBXIOP) in C++ binaries

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HOW WE DUG INTO NETBACKUP

Remote Procedure Call: `find` To The Rescue

```
[root@nb-opscenter ~]# find / -iname "*orb*.jar" -o -iname "*iop*.jar" 2>/dev/null
/opt/SYMCOpsCenterServer/lib/pbxiop2.jar
/opt/SYMCOpsCenterServer/lib/corbaservice.jar
/opt/SYMCOpsCenterServer/lib/nbu_corba.jar
/opt/SYMCOpsCenterServer/lib/corbaservice_idl.jar
/opt/SYMCOpsCenterServer/lib/jacorb-omgapi.jar
/opt/SYMCOpsCenterServer/lib/jacorb-services.jar
/opt/SYMCOpsCenterServer/lib/jacorb.jar
/opt/SYMCOpsCenterServer/lib/vxssiop2.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/corbaservice_idl.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/jacorb-omgapi.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/jacorb-services.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/jacorb.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/nbu_corba.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/pbxiop2.jar
/opt/SYMCOpsCenterGUI/webserver/webapps/opscenter/WEB-INF/lib/vxssiop2.jar
```

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HOW WE DUG INTO NETBACKUP

Remote Procedure Call: (Not) Learning CORBA

```
public static synchronized DiscoveryService getDiscoveryService(String serverHostname) {
  String servantName = "DiscoveryService";
  String pbxServiceName = "DiscoveryService";
  org.omg.CORBA.ORB localOrb = makeLocalOrb(servantName, pbxServiceName);
  String corbaloc = OrbUtil.createPBXCorbaLoc(serverHostname, 1556, pbxServiceName, servantName, false);
  org.omg.CORBA.Object remoteObject = localOrb.string_to_object(corbaloc);
  return DiscoveryServiceHelper.narrow(remoteObject);
}
public static synchronized void testDiscoSvc(String serverHostname) {
  DiscoveryService service = getDiscoveryService(serverHostname);
  service.registerExplorer("A", "B", "C", "D", AuthorityType.AT_ANYANDALL, (short)10);
}
public static void main(String[] args) {
  String serverHostname = "192.168.1.100";
  testDiscoSvc(serverHostname);
}
```

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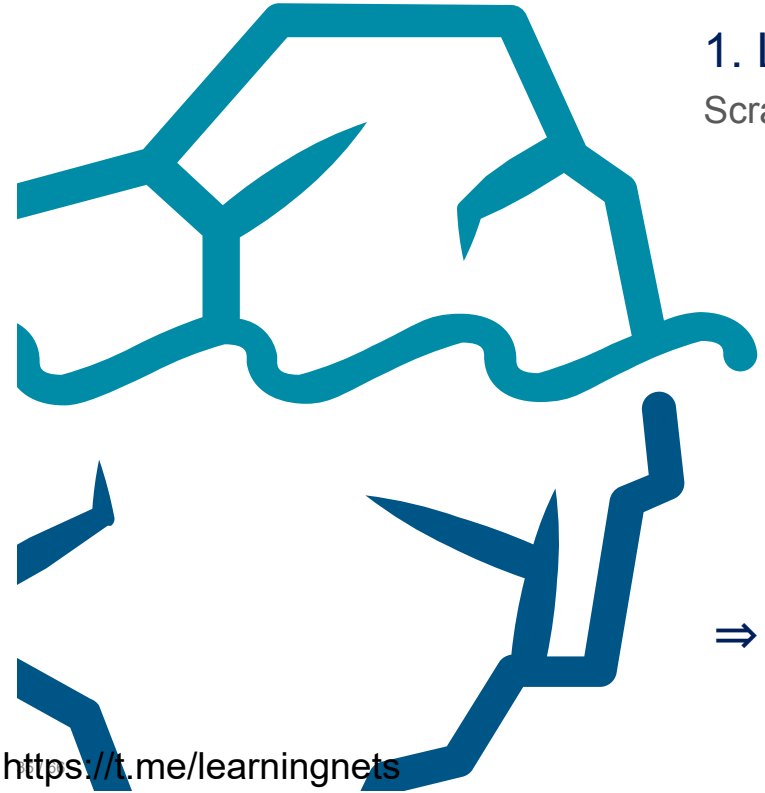
HOW WE DUG INTO NETBACKUP

Summary



1. Learned about the target

Scratched the surface to avoid falling too deep

2. Tried to keep head out of the water

Took step back when lost: relied on documentation & architects

3. Dove deeper into ~8 binaries

Focused on (our understanding of) critical components

⇒ ~30 CVEs published

⇒ Only the top of the iceberg has been studied!

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1 **INTRODUCTION**

2 **LET'S MEET NETBACKUP**
Target Overview: Key Technical Aspects

3 **HOW WE DUG INTO NETBACKUP**
The Approach, The Challenges And How We Tackled Them

4 **FINDINGS**
Overview Of Vulnerabilities And Attack Paths

5 **TAKEAWAYS**

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FINDINGS

Disclaimer

- Coordinated disclosure with Veritas
  - Disclosed vulnerabilities
  - Patches are available to customers
  - Veritas published CVEs & security advisories
- Present *our* understanding
  - We are in no way NetBackup experts
  - Did not study every configuration option
  - Focused on version 8.2

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FINDINGS

Quick Overview Of Discovered Vulnerabilities

Binary name	Vulnerabilities
bpcd	LPE
bprd	Authenticated RCE, arbitrary file read/write, arbitrary traversal file write, DoS, info leak, arbitrary directory creation
nbatd	Pre-auth DoS
nbsl	Authenticated RCE
ops_atd	Pre-auth DoS
pbx_exchange	Arbitrary file deletion, XXE, DoS
OpsCenterServerd	Unauthenticated RCE, unauthorized account creation, LPE, info leak
Ops Java Web Server	Unauthenticated RCE, web UI authentication bypass
bpdgclone	Local command injection
nbars	XXE, DoS
DiscoveryService	SQLi, DoS, XML injection, path traversal, DOM XSS

Severity: Critical, High, Medium, Low

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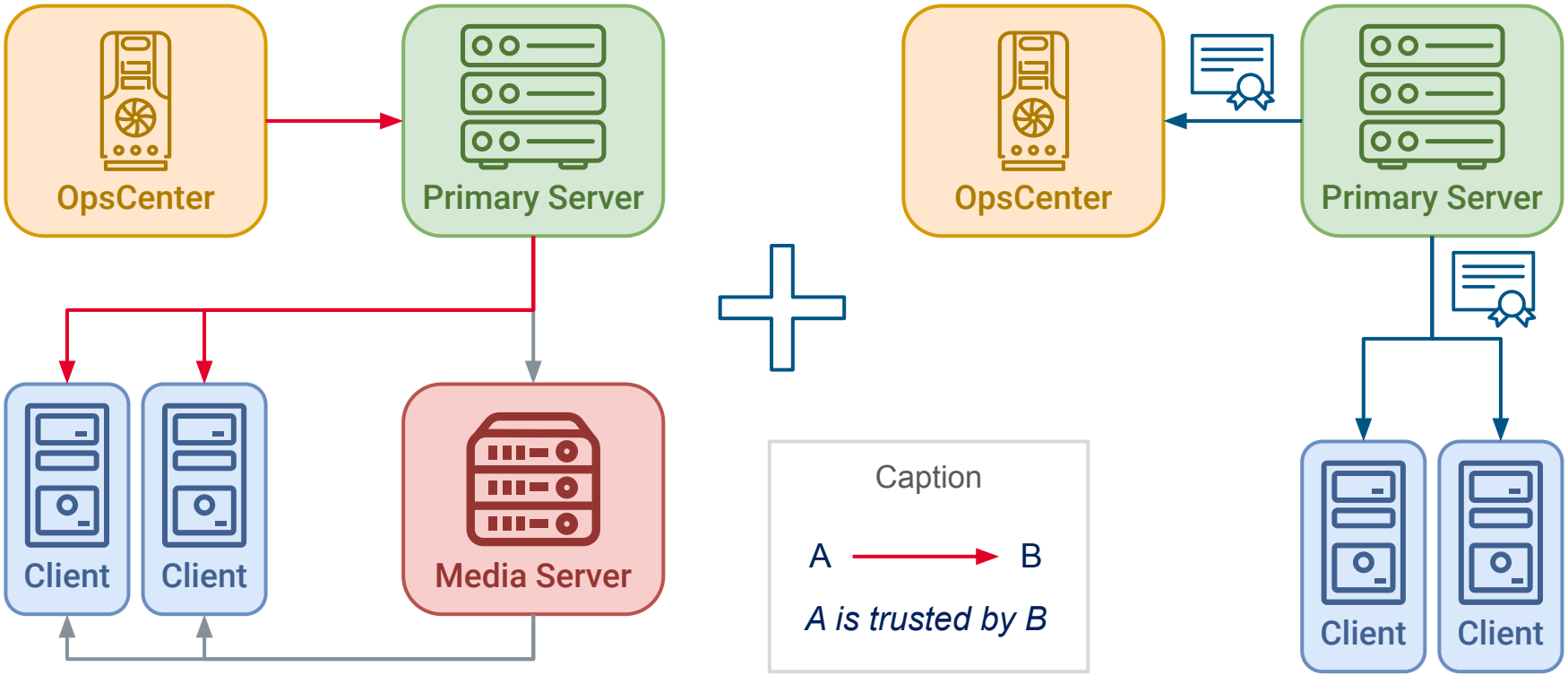
FINDINGS

Example: Exploiting The Trust Chain With Secure Communication And NBAC



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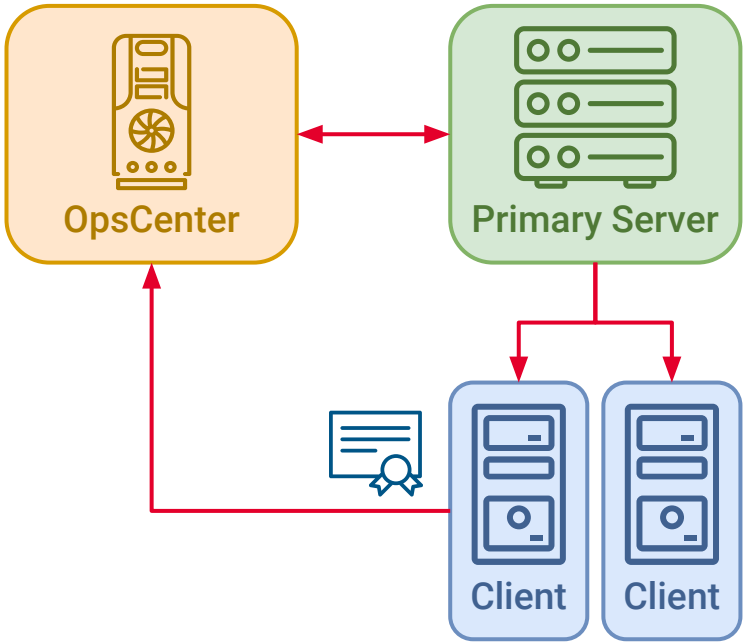
FINDINGS

Example: Understanding The *Practical* Trust Chain With NBAC



⇒ Access to authenticated endpoints (CORBA)

```
UserImpl user = new UserImpl();
user.uniqueIdentifier = "backdoor";
// ...
SecurityMemberImpl member = new SecurityMemberImpl();
member.uniqueId = "backdoor";
member.password = "password";
// ...
manager.createUser(user, member, true, viewList);
```

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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers - Attacking From The LAN

Approach:

- Attempted to open CORBA connection to all known `pbx_exchange` services
  - Checked for `NO_PERMISSION` / `OBJECT_NOT_EXIST` / `COMM_FAILURE` errors
- Discovered services with unauthenticated CORBA endpoints:
  - `DiscoveryService (DiscoveryService)`
  - `nbevtmgr (Event.EventMgr)`
  - `NBFSMCLIENT (FSM.ClientClusterMgr)`
- Found a variety of vulnerabilities, some more interesting than others

  ⇒ Let's talk about a couple of them!

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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – SQL injection (CVE-2022-42302)

```
ClientClusterMgr manager = getClientClusterMgr(serverHostname);
manager.updateActiveAppClusters("injection');--", new String[0], false);
```

```
SELECT A.MachineKey, A.MachineID, A.FQMachineName, [...]
FROM EMM_Machine A
left outer join EMM_Machine X ON A.ParentKey = X.MachineKey
[...]
WHERE UPPER(EMM_MachineAlias.MachineAliasName)
= UPPER('injection');-- ) AND EMM_MachineAlias.MachineNbuType [...]
```

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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – Dead End?

Permissions:

- SQLAnywhere runs as `root` / `SYSTEM`
- `EMM_MAIN` database user has access to list of hosts, disks, jobs, some credentials…

Limitations:

- Requests are not stackable
- Blind injection
- Many functions are undefined (e.g. `xp_cmdshell`)
- `EMM_MAIN` user doesn't have permission to read / write files
- Valid NetBackup hosts require a database entry + a file
- No interesting data found in our lab in these tables

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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – Digging Around

Where to go from there?

- Requests are stackable in newer versions
- SQLAnywhere allows `INSERT in SELECT` statement!
- Second order SQLi can be triggered in `JOBD_MAIN` database (CVE-2022-42303)
- Still no RCE in sight…

⇒ What if we abuse NetBackup features and logic?

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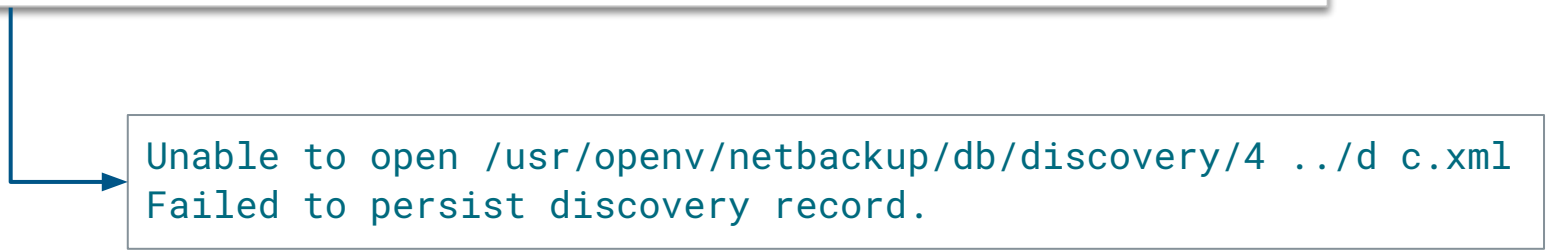
FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – Path Traversal (CVE-2022-42305)

```
service.registerExplorer(
  "A", "B", "C", "../D", AuthorityType.AT_ANYANDALL, (short)10
);
```



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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – URL encoding / decoding

```
service.registerExplorer(
  "A", "B", "/C1\\\0\0blahblah", "\\plopiplop\0\01234",
  AuthorityType.AT_ANYANDALL, (short)10
);
```

```
-rw-r--r-- 1 root root 181 '4 \plopiplop %252fc1%255c.dat'
-rw-r--r-- 1 root root 325 '4 \plopiplop %252fc1%255c.xml'
```

decoded encoded

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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – Path Traversal + Alternate Data Stream

```
service.registerExplorer(
  "A", "B", "C", "/../../../../../../../Temp/win%3a",
  AuthorityType.AT_ANYANDALL, (short)10
);
```

(Ab)use special NetBackup files to bypass authentication:

- `/usr/openv/var/bprd/remote_ops/<hostname>`
- `/usr/openv/var/vxss/credentials/dhcp_cred`
- `/usr/openv/var/vxss/credentials/match_required.txt`
- `/usr/openv/var/vxss/credentials/no_match_required.txt`

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FINDINGS

Example: A Tale Of CORBA On Windows Primary Servers – Full Chain

1. Path traversal (CVE-2022-42305)
⇒ Create `../../../var/bprd/remote_ops/<hostname>`

2. SQL injection (CVE-2022-42302)
⇒ Add host as “known” NetBackup client in `EMM_MAIN` database

Authentication bypass

3. Authenticated RCE (e.g. CVE-2022-36989)
⇒ Execute arbitrary code from NetBackup client to Primary Server

4. Let’s see a demo!
⇒ Exploit full chain of vulnerabilities

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DEMO
CVE-2022-36989, CVE-2022-42302, CVE-2022-42305
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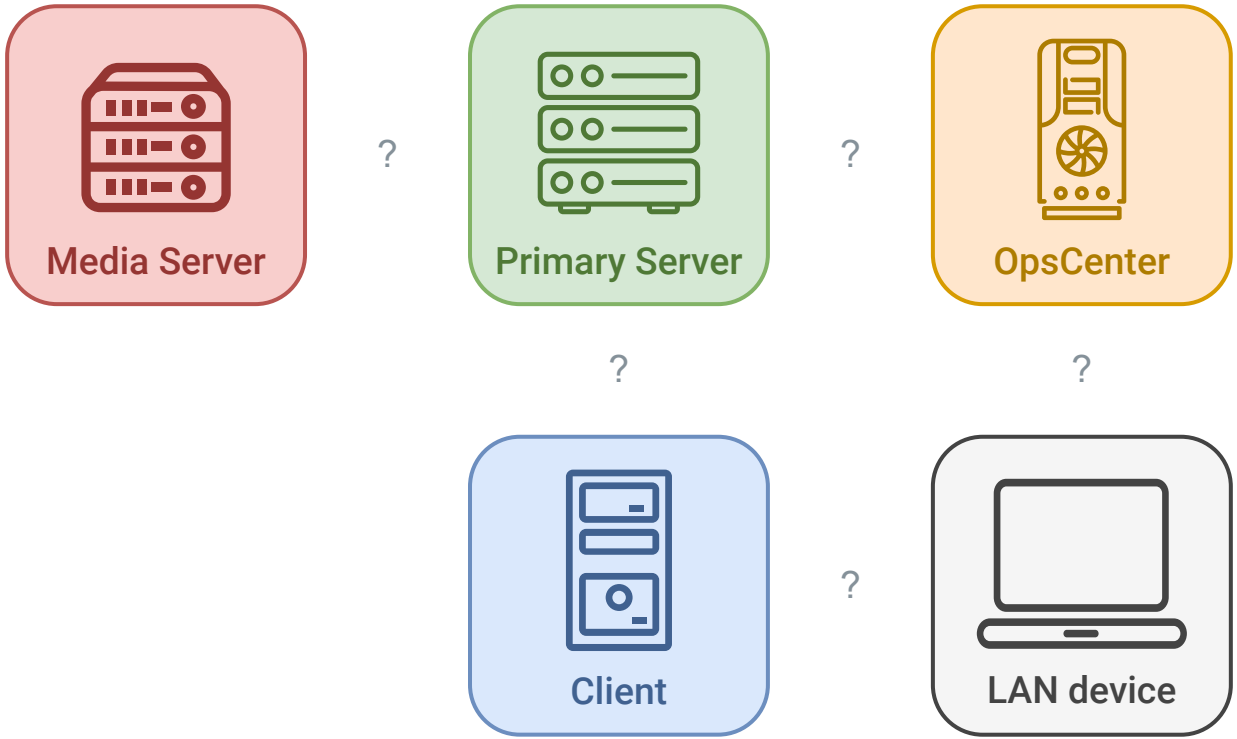
FINDINGS

Playing Out Attack Scenarios



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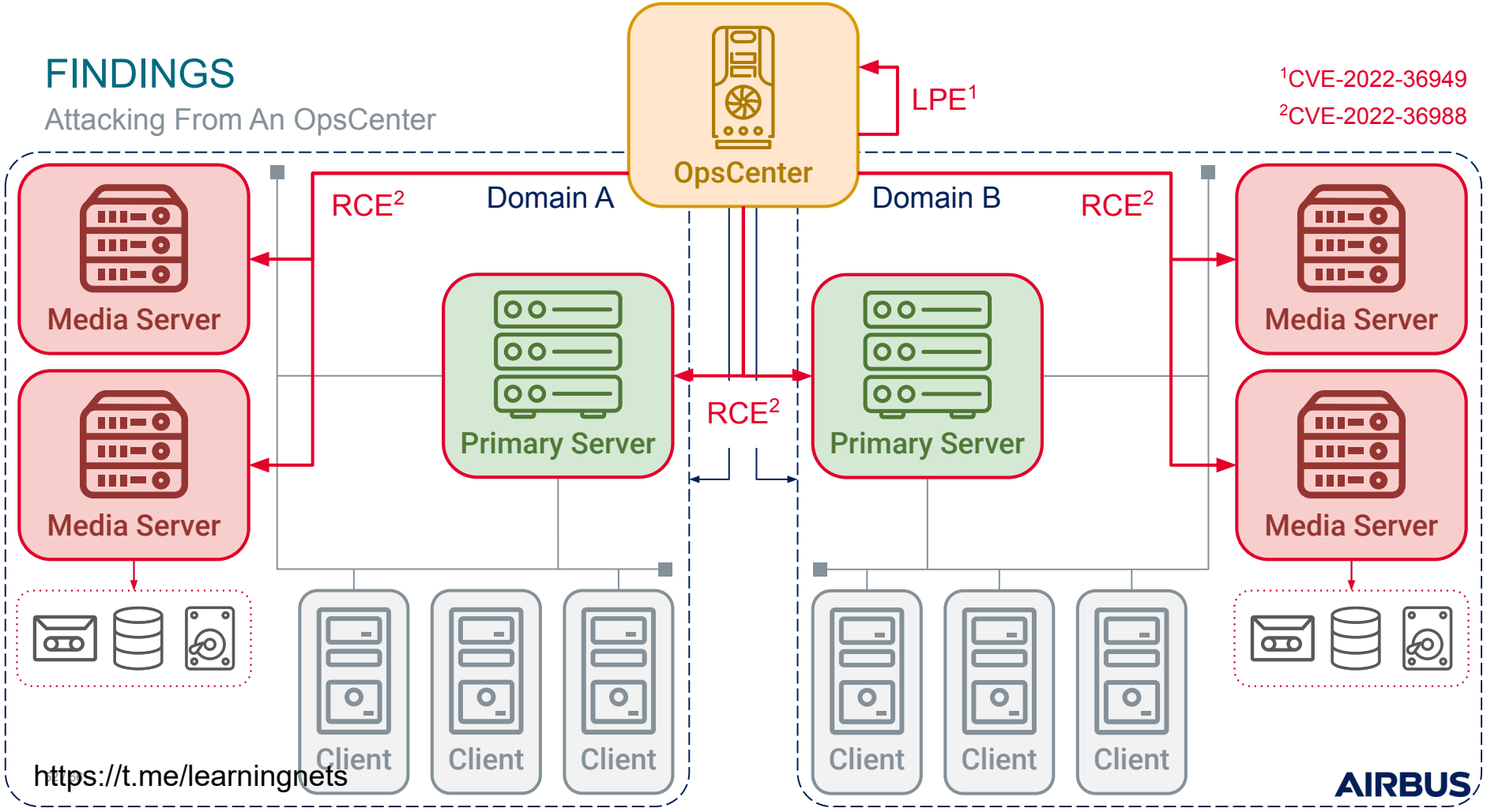
FINDINGS

Attacking From An OpsCenter

[1]CVE-2022-36949
[2]CVE-2022-36988



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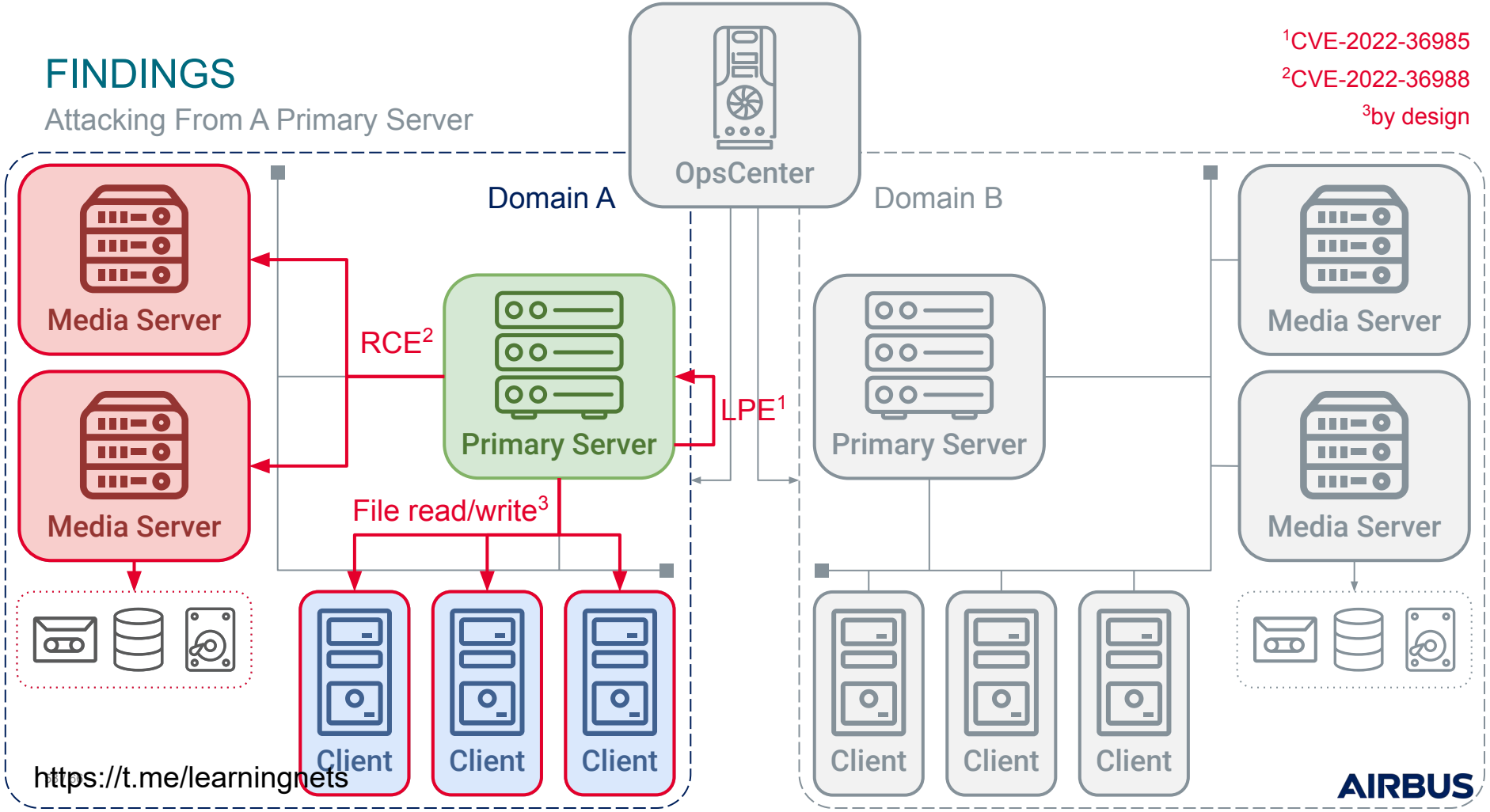
FINDINGS

Attacking From A Primary Server

[1]CVE-2022-36985
[2]CVE-2022-36988
[3]by design



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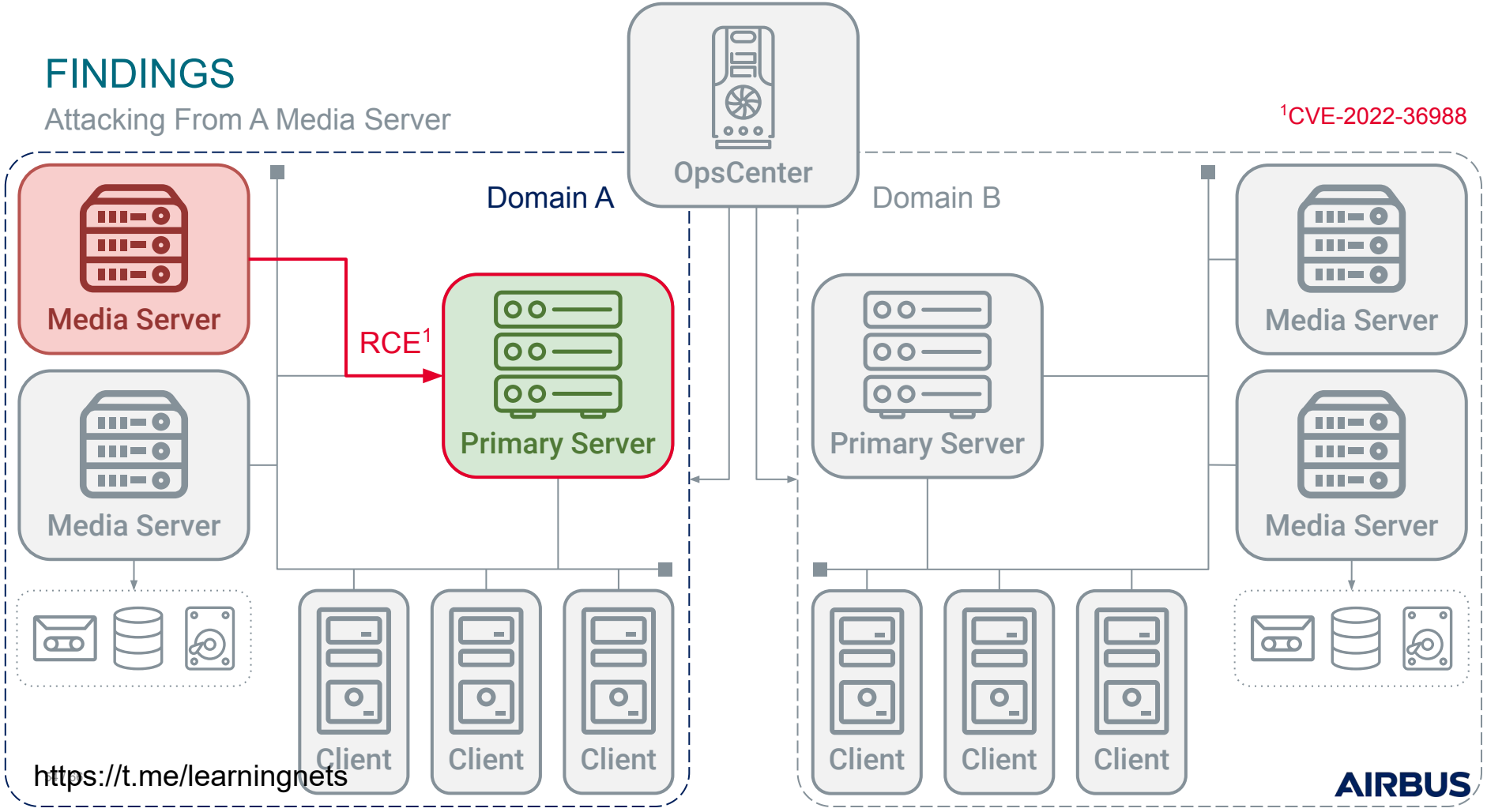
FINDINGS

Attacking From A Media Server

[1]CVE-2022-36988



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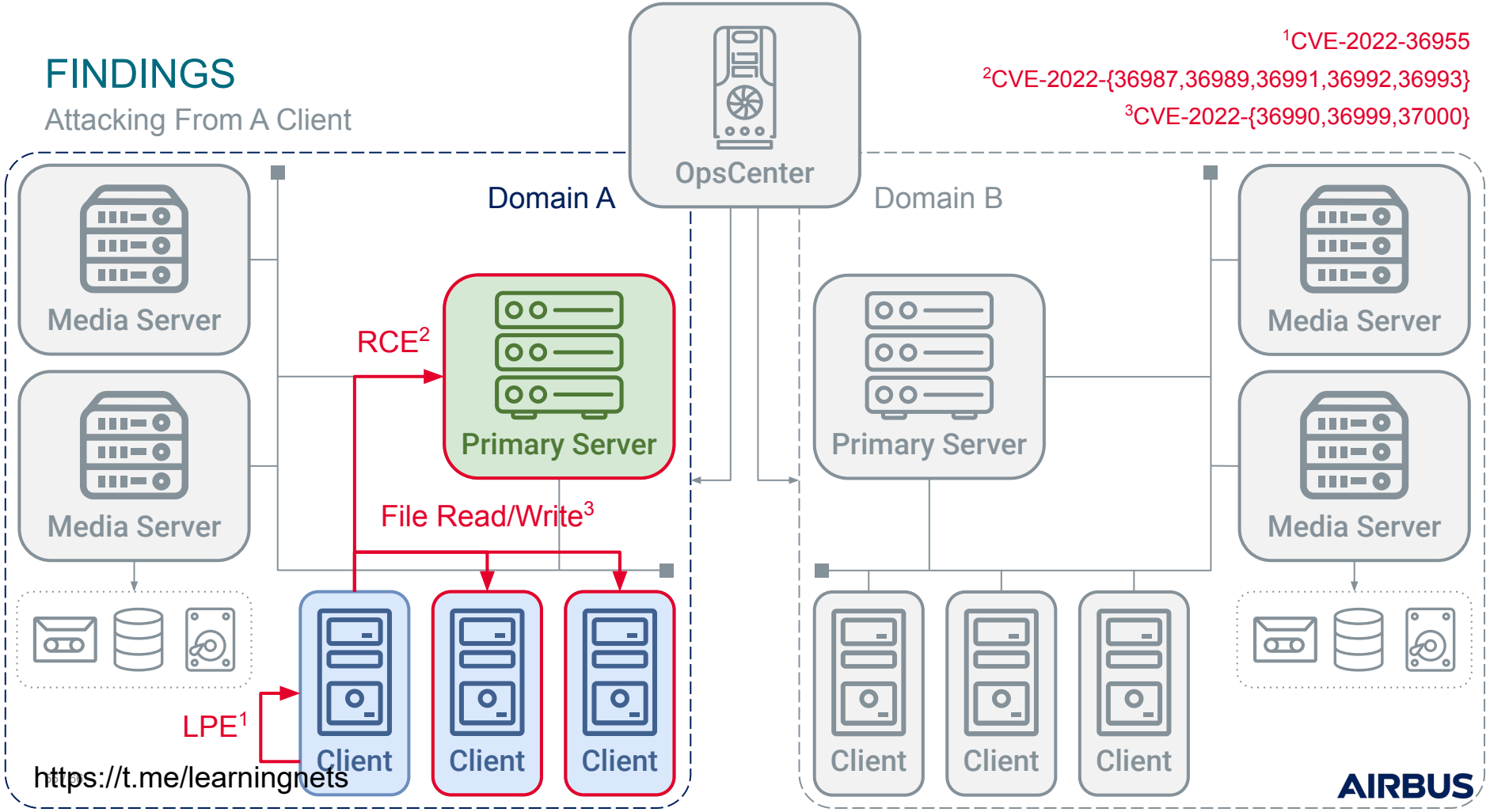
FINDINGS

Attacking From A Client

[1]CVE-2022-36955

[2]CVE-2022-{36987,36989,36991,36992,36993}

[3]CVE-2022-{36990,36999,37000}



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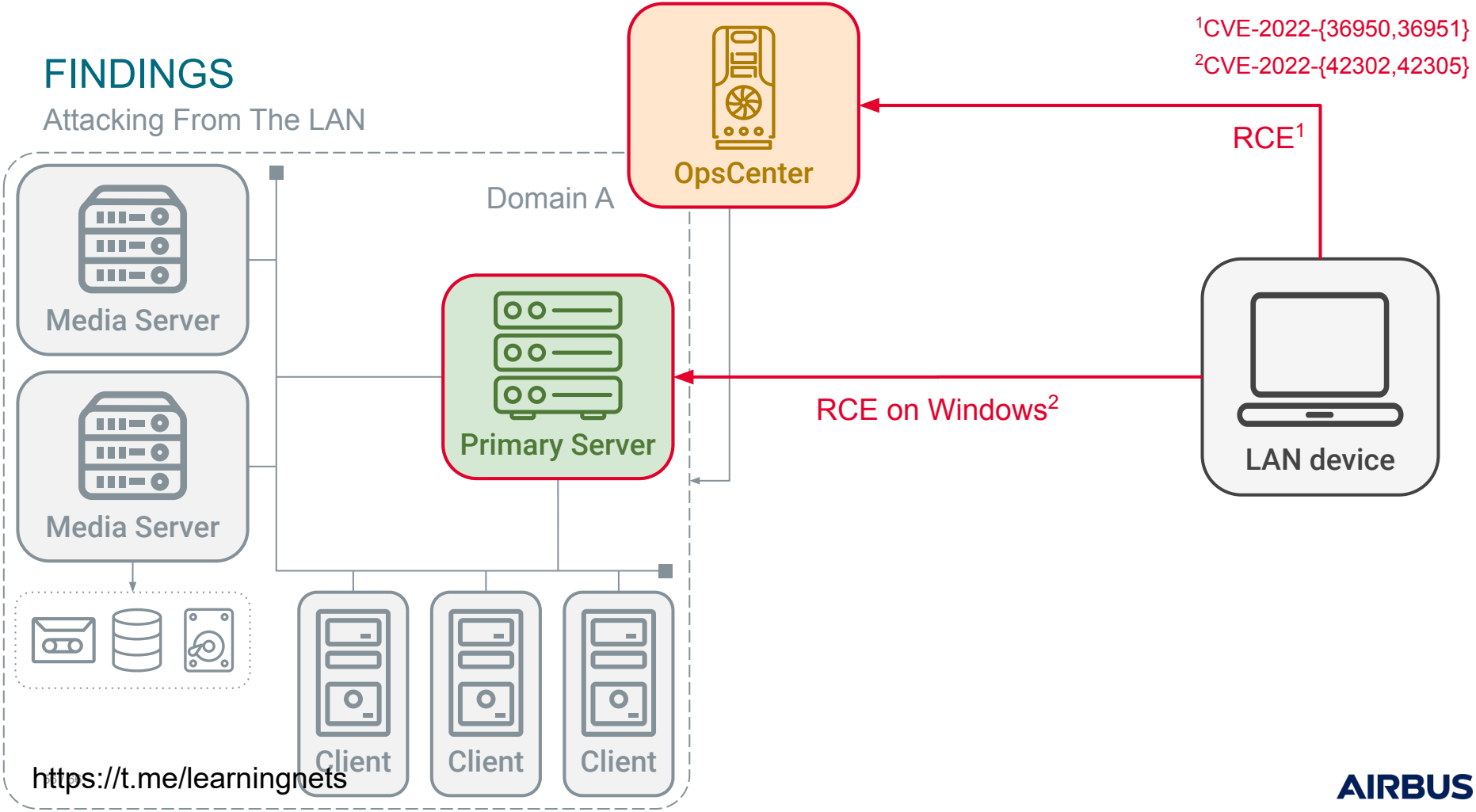
FINDINGS

Attacking From The LAN



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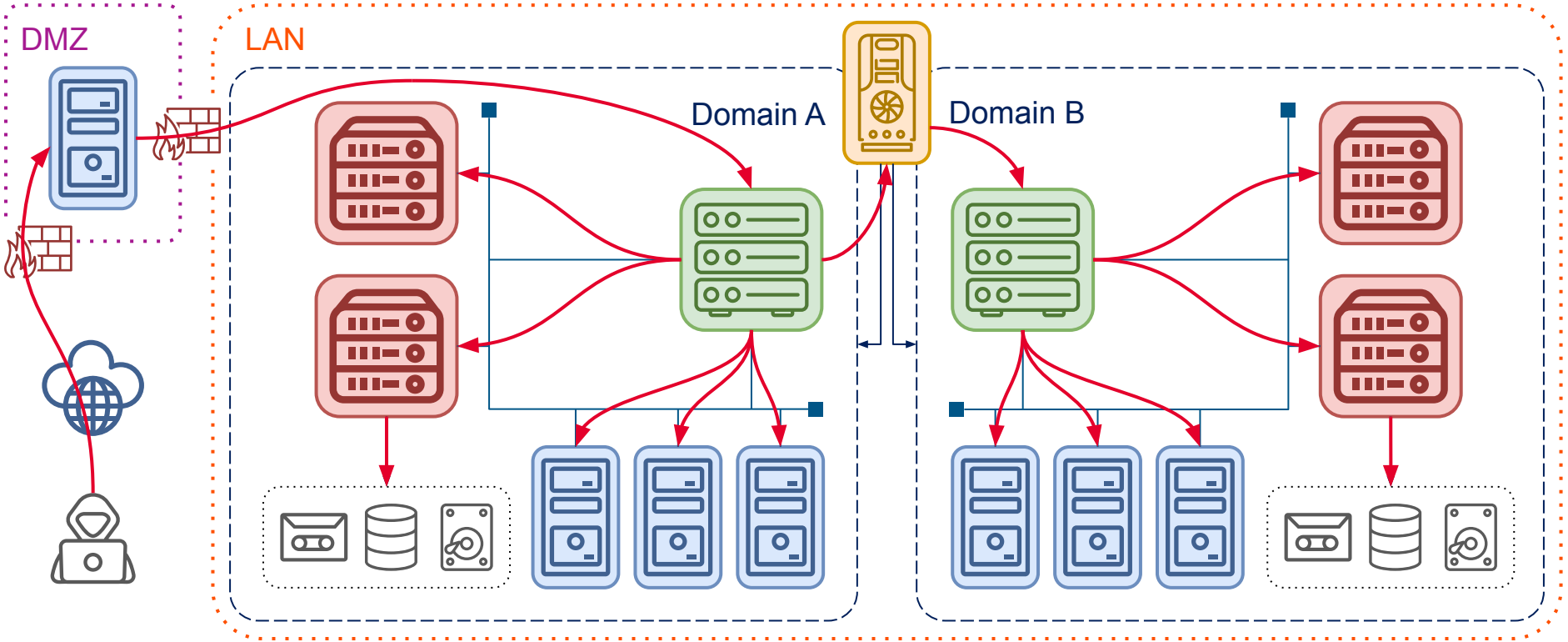
FINDINGS

Example Real World Scenario



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DEMO
CVE-2022-36951, CVE-2022-36988, CVE-2022-36989
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FINDINGS

Reviewing Security Questions

1. What would it take for an attacker to exploit NetBackup?
⇒ Specific tooling & workflow knowledge, not out of reach of motivated attackers
⇒ pbx_exchange, backup policies, trust model, NetBackup commands, etc.

2. Can a Primary Server be compromised from a NetBackup client?
⇒ Yes, and much more

3. Could the NetBackup system be used as a pivot to attack other interconnected systems?
⇒ Yes, as shown in our demo

4. Which data could an attacker target to prevent NetBackup recovery?
⇒ Let's take a step back

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FINDINGS

Minimal Requirements To Restore A NetBackup Infrastructure

Backup data (obviously)
⇒ To restore clients' files

Primary server catalog
⇒ To know where to find clients' data

Media server deduplication catalog (if enabled)
⇒ To rebuild full backups

Encryption secret(s) (if enabled)
⇒ To decrypt stored data

Disaster recovery file (optional)
⇒ To automate some recovery steps

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FINDINGS

Reviewing Security Questions

1. What would it take for an attacker to exploit NetBackup?
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⇒ Yes, and much more

3. Could the NetBackup system be used as a pivot to attack other interconnected systems?
⇒ Yes, as shown in our demo

4. Which data could an attacker target to prevent NetBackup recovery?
⇒ Backup data, catalogs, encryption secrets, disaster recover file

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FINDINGS

Disclosure Timeline

FIRST VULNERABILITY REPORT

- **2021-10-13:** SecLab sent first report to Veritas.
- **2021-11-22:** Veritas acknowledged the report and ask some more details.
- **2021-12-13:** SecLab provided answer to Veritas and a reminder about the 90 days policy.
- **2022-01-26:** Veritas answered with the expected timeline of patch for the different component.
- **2022-02-28:** Veritas provided patches of NetBackup OpsCenter to SecLab for review.
- **2022-05-10:** First patch for NetBackup Primary Server, Media Servers released.
- **2022-07-13:** Veritas released patches and a security advisory for NetBackup OpsCenter: VTS22-009.
- **2022-07-18:** Veritas released a security advisory for NetBackup Clients, Primary Server, Media Server: VTS22-004 , VTS22-008.
- **2022-09-21:** Veritas released hotfix patches for Clients related to VTS22-008.

SECOND VULNERABILITY REPORT

- **2022-04-11:** SecLab sent a 2nd report to Veritas with more findings.
- **2022-04-11:** Veritas acknowledged the 2nd report.
- **2022-08-01:** Veritas released patch for NetBackup Clients (VTS22-010).
- **2022-08-29:** Veritas released patch for NetBackup Primary Server, Media Server. (VTS22-011)
- **2022-09-23:** Veritas released hotfix patches for NetBackup Primary Server, Media Server. (VTS22-010, VTS22-011)
- **2022-09-26**: New advisories released VTS22-010; VTS22-011; VTS22-012; VTS22-013.

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1 **INTRODUCTION**

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Target Overview: Key Technical Aspects

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TAKEAWAYS

1. Discovered vulnerabilities illustrate wide attack surface & security impact

~30 CVEs attributed to Airbus Security Lab, official patches available

Presented attack paths showcase possible impact & complexity

2. Work presented only scratches the surface

Plenty of attack surface not yet studied: there's a lot of room for more work!

Your work is needed and there are plenty of uncharted waters for you to have fun

3. Your favorite enterprise backup software can be broken / better protected

Consider this a gift to convince your employers to let you have an offensive / defensive deep dive!

Skilling-up on such software can help red teaming, pentesting, detecting, etc.

4. The unavoidable pain of backups

Backups are a pain, but French people eat pain for breakfast! 🥖

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Thank you for your attention!
Any questions?

https://airbus-seclab.github.io

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