

How to Decode DOCSIS Certificate for Modem Stuck State Diagnosis

Contents

[Introduction](#)

[Background Information](#)

[Requirements](#)

[Components Used](#)

[Decode Procedure](#)

[Task 1. Collect the Logs](#)

[Task 2. Sanitize the Certificates](#)

[Task 3. Prepare the File for xxd Utility](#)

[Task 4. Convert Certificates from Hexdump to Binary Format](#)

[Task 5. Review Certificates](#)

Introduction

This document describes the steps to decode the DOCSIS certificate to diagnose why cable modems stuck in reject(pk) or w-reject(pk) state on Cable Modem Termination System (CMTS).

Background Information

In several cases, modems end up in reject(pk) state. It can be caused by specific conditions, for example in the CM certificate, CM issuer does not match CA subject name.

For example:

```
SLOT 5/0: May 10 10:13:48.272 CET: Got Issuer 0^A^A1^K0 ^F^CU^D^F^S^BTW1^\0^Z^F^CU^D
^S^SHitron Technologies1^00
^F^CU^D^K^S^FDOCSIS1C0A^F^CU^D^C^S:Hitron Technologies Cable Modem Root Certificate Authority
from Certificate.
SLOT 5/0: May 10 10:13:48.272 CET: Got a new Invalid CM cert from a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.272 CET: CA Cert Subject does not match CM Cert Issuer
SLOT 5/0: May 10 10:13:48.272 CET: BPI+ CM Cert Dump:

SLOT 5/0: May 10 10:13:48.272 CET: Failed CM Issuer not found. CMTS sent AUTH reject.
SLOT 5/0: May 10 10:13:48.272 CET: Sending KEK REJECT. Reason Code:6 Reason:16
SLOT 5/0: May 10 10:13:48.272 CET: BPI Authorization Reject Packet: a84e.3fdd.84c4
```

This output does not clearly show the root cause of the problem.

This article can be used to produce a readable certificate (that can be opened by openssl or KeyChain on the Mac), in order to identify the mismatch.

Requirements

Cisco recommends that you have knowledge of these topics:

- Base line privacy (BPI) in DOCSIS
- Cable Modem Termination System (CMTS)

Tip: In order to get better understanding of the base line privacy in DOCSIS, it is recommended to go through [DOCSIS 1.0 Baseline Privacy on the Cisco CMTS](#) article.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Decode Procedure

Task 1. Collect the Logs

On CMTS, in order to get the certificate hex dump, you need to enable the logs. Type these commands.

```
debug cable mac-address <cm mac> ver
debug cable privacy
debug cable privacy tlvs
debug cable privacy auth-req
debug cable privacy auth-rep
debug cable privacy auth-rej
debug cable privacy auth-info
debug cable privacy ca-cert
debug cable bpi
```

Telnet to the line card and collect the logs from the **LINECARD** on CMTS.

```
CMTS#telnet 127.0.0.XY
Trying 127.0.0.XY ... Open
```

```
clc_X_Y>en
clc_X_Y#
clc_X_Y#show log
```

You can get a similar output to this one.

```
SLOT 5/0: May 10 10:13:48.260 CET: BPI+ Manufacturer Cert Dump: a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.260 CET: CA Certificate Dump:
SLOT 5/0: May 10 10:13:48.260 CET: 0x0000: 30 82 03 22 30 82 02 0A A0 03 02 01 02 02 10 43
SLOT 5/0: May 10 10:13:48.260 CET: 0x0010: 64 B5 50 E8 ED 7E E5 57 14 5A C0 A2 67 52 EC 30
```

SLOT 5/0: May 10 10:13:48.260 CET: 0x0020: 0D 06 09 2A 86 48 86 F7 0D 01 01 05 05 00 30 6F
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0030: 31 0B 30 09 06 03 55 04 06 13 02 42 45 31 1F 30
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0040: 1D 06 03 55 04 0A 13 16 74 43 6F 6D 4C 61 62 73
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0050: 20 2D 20 45 75 72 6F 2D 44 4F 43 53 49 53 31 15
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0060: 30 13 06 03 55 04 0B 13 0C 43 61 62 6C 65 20 4D
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0070: 6F 64 65 6D 73 31 28 30 26 06 03 55 04 03 13 1F
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0080: 45 75 72 6F 2D 44 4F 43 53 49 53 20 43 61 62 6C
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0090: 65 20 4D 6F 64 65 6D 20 52 6F 6F 74 20 43 41 30
 SLOT 5/0: May 10 10:13:48.260 CET: 0x00A0: 1E 17 0D 30 34 30 38 31 33 30 30 30 30 30 5A
 SLOT 5/0: May 10 10:13:48.260 CET: 0x00B0: 17 0D 32 34 30 38 31 32 32 33 35 39 35 39 5A 30
 SLOT 5/0: May 10 10:13:48.260 CET: 0x00C0: 81 86 31 0B 30 09 06 03 55 04 06 13 02 54 57 31
 SLOT 5/0: May 10 10:13:48.260 CET: 0x00D0: 1C 30 1A 06 03 55 04 0A 13 13 48 69 74 72 6F 6E
 SLOT 5/0: May 10 10:13:48.260 CET: 0x00E0: 20 54 65 63 68 6E 6F 6C 6F 67 69 65 73 31 14 30
 SLOT 5/0: May 10 10:13:48.260 CET: 0x00F0: 12 06 03 55 04 0B 13 0B 45 75 72 6F 2D 44 4F 43
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0100: 53 49 53 31 43 30 41 06 03 55 04 03 13 3A 48 69
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0110: 74 72 6F 6E 20 54 65 63 68 6E 6F 6C 6F 67 69 65
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0120: 73 20 43 61 62 6C 65 20 4D 6F 64 65 6D 20 52 6F
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0130: 6F 74 20 43 65 72 74 69 66 69 63 61 74 65 20 41
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0140: 75 74 68 6F 72 69 74 79 30 81 9F 30 0D 06 09 2A
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0150: 86 48 86 F7 0D 01 01 01 05 00 03 81 8D 00 30 81
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0160: 89 02 81 81 00 B8 47 DA 9D F1 F6 30 1B 8E 79 BE
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0170: BE 10 C3 2D 9F 7D D6 C7 B2 50 16 AB 85 5C 1C 8C
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0180: 9E 6B F7 15 60 B2 53 F4 2F 6D 49 0C 2C 3E 76 88
 SLOT 5/0: May 10 10:13:48.260 CET: 0x0190: 8A 8A 23 6B 25 47 61 AE B9 DF A8 A7 8C 4D 51 FB
 SLOT 5/0: May 10 10:13:48.260 CET: 0x01A0: E6 C2 0F D9 C7 27 DD F7 D8 CC F0 D8 70 F8 75 75
 SLOT 5/0: May 10 10:13:48.260 CET: 0x01B0: F3 D8 B7 80 C2 36 B0 53 02 A4 E9 84 02 5F 66 AE
 SLOT 5/0: May 10 10:13:48.260 CET: 0x01C0: E7 59 9A 17 4A A0 B1 B4 BA F3 3B 63 C4 75 05 11
 SLOT 5/0: May 10 10:13:48.260 CET: 0x01D0: 40 F1 EB B3 C8 A0 E8 AD 6E 1B 59 CC 41 20 F8 94
 SLOT 5/0: May 10 10:13:48.260 CET: 0x01E0: B3 94 23 A2 99 02 03 01 00 01 A3 26 30 24 30 12
 SLOT 5/0: May 10 10:13:48.260 CET: 0x01F0: 06 03 55 1D 13 01 01 FF 04 08 30 06 01 01 FF 02
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0200: 01 00 30 0E 06 03 55 1D 0F 01 01 FF 04 04 03 02
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0210: 01 06 30 0D 06 09 2A 86 48 86 F7 0D 01 01 05 05
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0220: 00 03 82 01 01 00 09 DB 24 B9 46 76 D7 D0 9F 70
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0230: 86 59 ED 7F 9B AC 96 FD AE 19 DD B3 51 3B A5 C0
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0240: 98 DA 80 2B 53 26 42 FA 6A 11 9F 6D 16 6F 76 F8
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0250: 9A F3 81 53 E8 DB EF 22 DF AC 3F 57 78 0E 70 78
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0260: 07 30 1D FF 19 70 34 E5 7A 52 47 99 B0 EE 7F EA
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0270: 23 99 DF CB 72 FF 0D BE AB 68 20 9F 16 C0 7C 69
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0280: 88 2D 00 6A AF 4B FF 93 A5 07 D3 F2 A8 F9 5B C4
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0290: DD 9F BF 49 36 C4 12 8A 64 C8 35 41 BB E2 B9 9B
 SLOT 5/0: May 10 10:13:48.264 CET: 0x02A0: 52 45 67 38 DC 92 55 E3 33 A4 70 68 FC E7 6E 54
 SLOT 5/0: May 10 10:13:48.264 CET: 0x02B0: 96 CA 89 B4 65 8B 2C AA 58 24 FC 4D 68 D7 84 4E
 SLOT 5/0: May 10 10:13:48.264 CET: 0x02C0: 36 3B B3 CA 9A 42 13 B1 FF 8C 66 D8 52 10 56 74
 SLOT 5/0: May 10 10:13:48.264 CET: 0x02D0: C7 DD 58 C3 EE 9D E3 65 E6 C1 5D B9 75 C2 A8 C9
 SLOT 5/0: May 10 10:13:48.264 CET: 0x02E0: 54 5B A1 85 38 3B E1 E1 DC 55 5D 3E DD 90 ED F8
 SLOT 5/0: May 10 10:13:48.264 CET: 0x02F0: 3A B0 68 93 E9 4A C2 D4 7F DC 90 E3 86 E2 CF C3
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0300: F2 A3 92 84 B3 A3 9A F8 71 30 F8 24 71 C2 07 BD
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0310: E8 6C 3C F7 FC 82 08 86 84 84 1B C4 D8 97 D3 50
 SLOT 5/0: May 10 10:13:48.264 CET: 0x0320: 59 72 2D D5 4C 0B
 SLOT 5/0: May 10 10:13:48.264 CET: Found existing manufacturer certificate for a84e.3fdd.84c4
 with subject cn=Hitron Technologies Cable Modem Root Certificate Authority,ou=Euro-
 DOCSIS,o=Hitron Technologies,c=TW
 SLOT 5/0: May 10 10:13:48.264 CET: BPI: setting a84e.3fdd.84c4 caidx:3
 SLOT 5/0: May 10 10:13:48.264 CET: Mfg serial no. from a84e.3fdd.84c4 certificate:
 4364B550E8ED7EE557145AC0A26752EC
 SLOT 5/0: May 10 10:13:48.264 CET: Finger print of a84e.3fdd.84c4 manufacturer certificate
 matched.
 SLOT 5/0: May 10 10:13:48.264 CET: crl0k_clc_snmp_bpplus_broadcast_cert() CA idx:3
 state:Chained rowStatus:Active prov:0 len:1078 idx:3 state:Chained rowState:Active prov:0
 learn:1 idx:3
 SLOT 5/0: May 10 10:13:48.268 CET: BPI: Sent CA Cert to RP successfully.
 SLOT 5/0: May 10 10:13:48.268 CET: Success in validating AUTH Info message from a84e.3fdd.84c4.
 SLOT 5/0: May 10 10:13:48.268 CET: CMTS Received AUTH REQ from a84e.3fdd.84c4.

SLOT 5/0: May 10 10:13:48.268 CET: BPI Authorization Request Packet: a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.268 CET: BPKM Attributes: a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.268 CET: Found COMPOUND CM Identification (length = 173):
SLOT 5/0: May 10 10:13:48.268 CET: Found Serial Number (length = 12):
SLOT 5/0: May 10 10:13:48.268 CET: 32353331 36433030 38303433
SLOT 5/0: May 10 10:13:48.268 CET: Found Manufacturer ID (length = 3):
SLOT 5/0: May 10 10:13:48.268 CET: 0050F1
SLOT 5/0: May 10 10:13:48.268 CET: Found MAC Address (length = 6):
SLOT 5/0: May 10 10:13:48.268 CET: A84E3FDD 84C4
SLOT 5/0: May 10 10:13:48.268 CET: Found RSA Public Key (length = 140):
SLOT 5/0: May 10 10:13:48.268 CET: 30818902 818100B0 D4F2B649 87FCE340
SLOT 5/0: May 10 10:13:48.268 CET: B21FB1E0 8CFE04DD DB3D05D5 34170886
SLOT 5/0: May 10 10:13:48.268 CET: 7623EE25 4E4A61FC 6D134830 55F402CF
SLOT 5/0: May 10 10:13:48.268 CET: 89B11B34 867B3EF7 D9FE6CBE 8B4C251F
SLOT 5/0: May 10 10:13:48.268 CET: DA5A2E47 D65C2120 8EFC72E2 238D5443
SLOT 5/0: May 10 10:13:48.268 CET: 786F151A A7FE6C21 371957DD 3FEB8435
SLOT 5/0: May 10 10:13:48.268 CET: 8AA1B7A2 181DAF7A 4F7DD4E9 128D953C
SLOT 5/0: May 10 10:13:48.268 CET: 146B77F4 51A9F868 5D1A253F A9590AC0
SLOT 5/0: May 10 10:13:48.268 CET: F69D24DF 2B84C102 03010001
SLOT 5/0: May 10 10:13:48.268 CET: Found CM Certificate (length = 652):
SLOT 5/0: May 10 10:13:48.268 CET: 30820288 308201F1 A0030201 02020C41
SLOT 5/0: May 10 10:13:48.268 CET: 38344533 46444438 34433430 0D06092A
SLOT 5/0: May 10 10:13:48.268 CET: 864886F7 0D010105 05003081 81310B30
SLOT 5/0: May 10 10:13:48.268 CET: 09060355 04061302 5457311C 301A0603
SLOT 5/0: May 10 10:13:48.268 CET: 55040A13 13486974 726F6E20 54656368
SLOT 5/0: May 10 10:13:48.268 CET: 6E6F6C6F 67696573 310F300D 06035504
SLOT 5/0: May 10 10:13:48.268 CET: 0B130644 4F435349 53314330 41060355
SLOT 5/0: May 10 10:13:48.268 CET: 0403133A 48697472 6F6E2054 6563686E
SLOT 5/0: May 10 10:13:48.268 CET: 6F6C6F67 69657320 4361626C 65204D6F
SLOT 5/0: May 10 10:13:48.268 CET: 64656D20 526F6F74 20436572 74696669
SLOT 5/0: May 10 10:13:48.268 CET: 63617465 20417574 686F7269 7479301E
SLOT 5/0: May 10 10:13:48.268 CET: 170D3137 30313031 30303030 30305A17
SLOT 5/0: May 10 10:13:48.268 CET: 0D333631 32323832 33353935 395A3081
SLOT 5/0: May 10 10:13:48.268 CET: 86310B30 09060355 04061302 5457311C
SLOT 5/0: May 10 10:13:48.268 CET: 301A0603 55040A13 13486974 726F6E20
SLOT 5/0: May 10 10:13:48.268 CET: 54656368 6E6F6C6F 67696573 313D303B
SLOT 5/0: May 10 10:13:48.268 CET: 06035504 0B13344E 6F2E2034 302C2057
SLOT 5/0: May 10 10:13:48.268 CET: 752D6B75 6E672035 74682052 642E2C20
SLOT 5/0: May 10 10:13:48.268 CET: 57752D6B 752C2054 61697065 69204873
SLOT 5/0: May 10 10:13:48.268 CET: 69656E2C 20546169 77616E31 1A301806
SLOT 5/0: May 10 10:13:48.268 CET: 03550403 13114138 3A34453A 33463A44
SLOT 5/0: May 10 10:13:48.268 CET: 443A3834 3A433430 819F300D 06092A86
SLOT 5/0: May 10 10:13:48.268 CET: 4886F70D 01010105 0003818D 00308189
SLOT 5/0: May 10 10:13:48.268 CET: 02818100 B0D4F2B6 4987FCE3 40B21FB1
SLOT 5/0: May 10 10:13:48.268 CET: E08CFE04 DDDB3D05 D5341708 867623EE
SLOT 5/0: May 10 10:13:48.268 CET: 254E4A61 FC6D1348 3055F402 CF89B11B
SLOT 5/0: May 10 10:13:48.268 CET: 34867B3E F7D9FE6C BE8B4C25 1FDA5A2E
SLOT 5/0: May 10 10:13:48.268 CET: 47D65C21 208EFC72 E2238D54 43786F15
SLOT 5/0: May 10 10:13:48.268 CET: 1AA7FE6C 21371957 DD3FEB84 358AA1B7
SLOT 5/0: May 10 10:13:48.268 CET: A2181DAF 7A4F7DD4 E9128D95 3C146B77
SLOT 5/0: May 10 10:13:48.268 CET: F451A9F8 685D1A25 3FA9590A C0F69D24
SLOT 5/0: May 10 10:13:48.268 CET: DF2B84C1 02030100 01300D06 092A8648
SLOT 5/0: May 10 10:13:48.268 CET: 86F70D01 01050500 03818100 08DFC2DA
SLOT 5/0: May 10 10:13:48.268 CET: 8C3ECCDA 98289410 E1B8657A 9A3F220D
SLOT 5/0: May 10 10:13:48.268 CET: AE368029 0E89923F 0DF09E06 8142BAB7
SLOT 5/0: May 10 10:13:48.268 CET: E8A6D5B3 6D7604FF 6A07A8B8 409D0B0B
SLOT 5/0: May 10 10:13:48.268 CET: 6D568AF4 F9395199 AB54126C E9C22F1B
SLOT 5/0: May 10 10:13:48.268 CET: 6390543A 3B67EFB8 FCF0E755 F642E1E0
SLOT 5/0: May 10 10:13:48.268 CET: 273A3853 F4DDBFF1 391E63CE 8BB7BBC0
SLOT 5/0: May 10 10:13:48.268 CET: 8AFC59FC 767C3FA5 A5EB255C 8878F4AB
SLOT 5/0: May 10 10:13:48.272 CET: 63665AA9 CDCF779A 3DFE0C4C
SLOT 5/0: May 10 10:13:48.272 CET: Found COMPOUND SA Capabilities (length = 13):
SLOT 5/0: May 10 10:13:48.272 CET: Found Crypto Suite List (length = 6):
SLOT 5/0: May 10 10:13:48.272 CET: 01000200 0300

```

SLOT 5/0: May 10 10:13:48.272 CET: Found BPI Version (length = 1):
SLOT 5/0: May 10 10:13:48.272 CET: 01
SLOT 5/0: May 10 10:13:48.272 CET: Found SAID (length = 2):
SLOT 5/0: May 10 10:13:48.272 CET: 0000
SLOT 5/0: May 10 10:13:48.272 CET: END BPKM Attributes: a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.272 CET: Get a CM Certificate.
SLOT 5/0: May 10 10:13:48.272 CET: Cable5/0/12: Auth-Req contains 1 SID(s).
SLOT 5/0: May 10 10:13:48.272 CET: Cable5/0/12: AuthReq with NULL SAID - D3.0 modem.
SLOT 5/0: May 10 10:13:48.272 CET: EAE_BPI_REQ: DISABLE a84e.3fdd.84c4 - OK
SLOT 5/0: May 10 10:13:48.272 CET: BPI_AES: Encryption priority is: aes128-des56-des40.
SLOT 5/0: May 10 10:13:48.272 CET: BPI_AES: AES is a candidate.
SLOT 5/0: May 10 10:13:48.272 CET: BPI Crypto Algorithm: sid:0 cfg_mod:1, cm_cap:0x7, assigned:3
aes_support:1
SLOT 5/0: May 10 10:13:48.272 CET: CMTS generated AUTH_KEY.
SLOT 5/0: May 10 10:13:48.272 CET: CMTS received 0 as primary SAID - D3.0
SLOT 5/0: May 10 10:13:48.272 CET: CM state:2050 MAC:a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.272 CET: Parsed/Matched MAC Address:a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.272 CET: Got Issuer 0^A^A1^K0 ^F^CU^D^F^S^BTW1^\0^Z^F^CU^D
^S^SHitron Technologies1^00
^F^CU^D^K^S^FDOCSIS1C0A^F^CU^D^C^S:Hitron Technologies Cable Modem Root Certificate Authority
from Certificate.
SLOT 5/0: May 10 10:13:48.272 CET: Got a new Invalid CM cert from a84e.3fdd.84c4
SLOT 5/0: May 10 10:13:48.272 CET: CA Cert Subject does not match CM Cert Issuer

```

You can see in those logs, that there are two separate hex dumps.

1. Hex dump for CA Certificate. It start with a line in bold **CA Certificate Dump:** .
2. Hex dump for CM Certificate. It start with a line in bold **Found CM Certificate (length = 652):** .

Task 2. Sanitize the Certificates

In order for the certificate dump to be processed properly, you need to remove all extra information and keep only the hex dump values.

Note: The case (upper/lower) and spaces in the certificate dump are irrelevant for this process.

Tip: A quick and easy way to remove all line headers (slot number, timestamp, etc.) is to hold ALT key in a text editor, like Sublime or Notepad++.

An example of the CA certificate dump.

```

30 82 03 22 30 82 02 0A A0 03 02 01 02 02 10 43
64 B5 50 E8 ED 7E E5 57 14 5A C0 A2 67 52 EC 30
0D 06 09 2A 86 48 86 F7 0D 01 01 05 05 00 30 6F
31 0B 30 09 06 03 55 04 06 13 02 42 45 31 1F 30
1D 06 03 55 04 0A 13 16 74 43 6F 6D 4C 61 62 73
20 2D 20 45 75 72 6F 2D 44 4F 43 53 49 53 31 15
30 13 06 03 55 04 0B 13 0C 43 61 62 6C 65 20 4D
6F 64 65 6D 73 31 28 30 26 06 03 55 04 03 13 1F
45 75 72 6F 2D 44 4F 43 53 49 53 20 43 61 62 6C
65 20 4D 6F 64 65 6D 20 52 6F 6F 74 20 43 41 30
1E 17 0D 30 34 30 38 31 33 30 30 30 30 30 5A
17 0D 32 34 30 38 31 32 32 33 35 39 35 39 5A 30
81 86 31 0B 30 09 06 03 55 04 06 13 02 54 57 31

```

1C 30 1A 06 03 55 04 0A 13 13 48 69 74 72 6F 6E
20 54 65 63 68 6E 6F 6C 6F 67 69 65 73 31 14 30
12 06 03 55 04 0B 13 0B 45 75 72 6F 2D 44 4F 43
53 49 53 31 43 30 41 06 03 55 04 03 13 3A 48 69
74 72 6F 6E 20 54 65 63 68 6E 6F 6C 6F 67 69 65
73 20 43 61 62 6C 65 20 4D 6F 64 65 6D 20 52 6F
6F 74 20 43 65 72 74 69 66 69 63 61 74 65 20 41
75 74 68 6F 72 69 74 79 30 81 9F 30 0D 06 09 2A
86 48 86 F7 0D 01 01 01 05 00 03 81 8D 00 30 81
89 02 81 81 00 B8 47 DA 9D F1 F6 30 1B 8E 79 BE
BE 10 C3 2D 9F 7D D6 C7 B2 50 16 AB 85 5C 1C 8C
9E 6B F7 15 60 B2 53 F4 2F 6D 49 0C 2C 3E 76 88
8A 8A 23 6B 25 47 61 AE B9 DF A8 A7 8C 4D 51 FB
E6 C2 0F D9 C7 27 DD F7 D8 CC F0 D8 70 F8 75 75
F3 D8 B7 80 C2 36 B0 53 02 A4 E9 84 02 5F 66 AE
E7 59 9A 17 4A A0 B1 B4 BA F3 3B 63 C4 75 05 11
40 F1 EB B3 C8 A0 E8 AD 6E 1B 59 CC 41 20 F8 94
B3 94 23 A2 99 02 03 01 00 01 A3 26 30 24 30 12
06 03 55 1D 13 01 01 FF 04 08 30 06 01 01 FF 02
01 00 30 0E 06 03 55 1D 0F 01 01 FF 04 04 03 02
01 06 30 0D 06 09 2A 86 48 86 F7 0D 01 01 05 05
00 03 82 01 01 00 09 DB 24 B9 46 76 D7 D0 9F 70
86 59 ED 7F 9B AC 96 FD AE 19 DD B3 51 3B A5 C0
98 DA 80 2B 53 26 42 FA 6A 11 9F 6D 16 6F 76 F8
9A F3 81 53 E8 DB EF 22 DF AC 3F 57 78 0E 70 78
07 30 1D FF 19 70 34 E5 7A 52 47 99 B0 EE 7F EA
23 99 DF CB 72 FF 0D BE AB 68 20 9F 16 C0 7C 69
88 2D 00 6A AF 4B FF 93 A5 07 D3 F2 A8 F9 5B C4
DD 9F BF 49 36 C4 12 8A 64 C8 35 41 BB E2 B9 9B
52 45 67 38 DC 92 55 E3 33 A4 70 68 FC E7 6E 54
96 CA 89 B4 65 8B 2C AA 58 24 FC 4D 68 D7 84 4E
36 3B B3 CA 9A 42 13 B1 FF 8C 66 D8 52 10 56 74
C7 DD 58 C3 EE 9D E3 65 E6 C1 5D B9 75 C2 A8 C9
54 5B A1 85 38 3B E1 E1 DC 55 5D 3E DD 90 ED F8
3A B0 68 93 E9 4A C2 D4 7F DC 90 E3 86 E2 CF C3
F2 A3 92 84 B3 A3 9A F8 71 30 F8 24 71 C2 07 BD
E8 6C 3C F7 FC 82 08 86 84 84 1B C4 D8 97 D3 50
59 72 2D D5 4C 0B

Save this file with a name **cacert.txt** .

An example of CM certificate dump.

30820288 308201F1 A0030201 02020C41
38344533 46444438 34433430 0D06092A
864886F7 0D010105 05003081 81310B30
09060355 04061302 5457311C 301A0603
55040A13 13486974 726F6E20 54656368
6E6F6C6F 67696573 310F300D 06035504
0B130644 4F435349 53314330 41060355
0403133A 48697472 6F6E2054 6563686E
6F6C6F67 69657320 4361626C 65204D6F
64656D20 526F6F74 20436572 74696669
63617465 20417574 686F7269 7479301E
170D3137 30313031 30303030 30305A17
0D333631 32323832 33353935 395A3081
86310B30 09060355 04061302 5457311C
301A0603 55040A13 13486974 726F6E20
54656368 6E6F6C6F 67696573 313D303B
06035504 0B13344E 6F2E2034 302C2057
752D6B75 6E672035 74682052 642E2C20
57752D6B 752C2054 61697065 69204873
69656E2C 20546169 77616E31 1A301806

```
03550403 13114138 3A34453A 33463A44
443A3834 3A433430 819F300D 06092A86
4886F70D 01010105 0003818D 00308189
02818100 B0D4F2B6 4987FCE3 40B21FB1
E08CFE04 DDDB3D05 D5341708 867623EE
254E4A61 FC6D1348 3055F402 CF89B11B
34867B3E F7D9FE6C BE8B4C25 1FDA5A2E
47D65C21 208EFC72 E2238D54 43786F15
1AA7FE6C 21371957 DD3FEB84 358AA1B7
A2181DAF 7A4F7DD4 E9128D95 3C146B77
F451A9F8 685D1A25 3FA9590A C0F69D24
DF2B84C1 02030100 01300D06 092A8648
86F70D01 01050500 03818100 08DFC2DA
8C3ECCDA 98289410 E1B8657A 9A3F220D
AE368029 0E89923F 0DF09E06 8142BAB7
E8A6D5B3 6D7604FF 6A07A8B8 409D0B0B
6D568AF4 F9395199 AB54126C E9C22F1B
6390543A 3B67EFB8 FCF0E755 F642E1E0
273A3853 F4DDBFF1 391E63CE 8BB7BBC0
8AFC59FC 767C3FA5 A5EB255C 8878F4AB
63665AA9 CDCF779A 3DFE0C4C
```

Save this file with a name **cmcert.txt** .

Task 3. Prepare the File for xxd Utility

XXD is a Linux/Mac utility that allows to convert a hex dump into a binary file and vice versa. XXD needs the hex data to have a specific line header in order to work. Use the following python script that adds the necessary header:

```
TVANEGRO-M-N1QP:Desktop tvanegro$ cat addoffset.py
import fileinput
import sys

i = 0
for line in fileinput.input():
    line=line.replace(" ", "")
    print("%06x: %s" % (i,line.strip()))
    i = i+int(len(line.strip())/2)
```

Task 4. Convert Certificates from Hexdump to Binary Format

Run this command to convert CA certificate.

```
python3.5 addoffset.py cacert.txt | xxd -r > cacert.crt
```

Run this command to convert CM certificate.

```
python3.5 addoffset.py cmcert.txt | xxd -r > cmcert.crt
```

These generated CRT files now can be checked for any mismatch.

Task 5. Review Certificates

In order to read the files use either with Openssl or Keychain utility.

An example with openssl utility for CA certificate.

```
TVANEGRO-M-N1QP:Desktop tvanegro$ openssl x509 -inform der -in cacert.crt -noout -text
Certificate:
Data:
Version: 3 (0x2)
Serial Number:
43:64:b5:50:e8:ed:7e:e5:57:14:5a:c0:a2:67:52:ec
Signature Algorithm: sha1WithRSAEncryption
Issuer: C=BE, O=tComLabs - Euro-DOCSIS, OU=Cable Modems, CN=Euro-DOCSIS Cable Modem Root CA
Validity
Not Before: Aug 13 00:00:00 2004 GMT
Not After : Aug 12 23:59:59 2024 GMT
Subject: C=TW, O=Hitron Technologies, OU=Euro-DOCSIS, CN=Hitron Technologies Cable Modem Root
Certificate Authority
Subject Public Key Info:
Public Key Algorithm: rsaEncryption
RSA Public Key: (1024 bit)
Modulus (1024 bit):
00:b8:47:da:9d:f1:f6:30:1b:8e:79:be:be:10:c3:
2d:9f:7d:d6:c7:b2:50:16:ab:85:5c:1c:8c:9e:6b:
f7:15:60:b2:53:f4:2f:6d:49:0c:2c:3e:76:88:8a:
8a:23:6b:25:47:61:ae:b9:df:a8:a7:8c:4d:51:fb:
e6:c2:0f:d9:c7:27:dd:f7:d8:cc:f0:d8:70:f8:75:
75:f3:d8:b7:80:c2:36:b0:53:02:a4:e9:84:02:5f:
66:ae:e7:59:9a:17:4a:a0:b1:b4:ba:f3:3b:63:c4:
75:05:11:40:f1:eb:b3:c8:a0:e8:ad:6e:1b:59:cc:
41:20:f8:94:b3:94:23:a2:99
Exponent: 65537 (0x10001)
X509v3 extensions:
X509v3 Basic Constraints: critical
CA:TRUE, pathlen:0
X509v3 Key Usage: critical
Certificate Sign, CRL Sign
Signature Algorithm: sha1WithRSAEncryption
09:db:24:b9:46:76:d7:d0:9f:70:86:59:ed:7f:9b:ac:96:fd:
ae:19:dd:b3:51:3b:a5:c0:98:da:80:2b:53:26:42:fa:6a:11:
9f:6d:16:6f:76:f8:9a:f3:81:53:e8:db:ef:22:df:ac:3f:57:
78:0e:70:78:07:30:1d:ff:19:70:34:e5:7a:52:47:99:b0:ee:
7f:ea:23:99:df:cb:72:ff:0d:be:ab:68:20:9f:16:c0:7c:69:
88:2d:00:6a:af:4b:ff:93:a5:07:d3:f2:a8:f9:5b:c4:dd:9f:
bf:49:36:c4:12:8a:64:c8:35:41:bb:e2:b9:9b:52:45:67:38:
dc:92:55:e3:33:a4:70:68:fc:e7:6e:54:96:ca:89:b4:65:8b:
2c:aa:58:24:fc:4d:68:d7:84:4e:36:3b:b3:ca:9a:42:13:b1:
ff:8c:66:d8:52:10:56:74:c7:dd:58:c3:ee:9d:e3:65:e6:c1:
5d:b9:75:c2:a8:c9:54:5b:a1:85:38:3b:e1:e1:dc:55:5d:3e:
dd:90:ed:f8:3a:b0:68:93:e9:4a:c2:d4:7f:dc:90:e3:86:e2:
cf:c3:f2:a3:92:84:b3:a3:9a:f8:71:30:f8:24:71:c2:07:bd:
e8:6c:3c:f7:fc:82:08:86:84:84:1b:c4:d8:97:d3:50:59:72:
2d:d5:4c:0b
```

An example with openssl utility for CM certificate.

```
TVANEGRO-M-N1QP:Desktop tvanegro$ openssl x509 -inform der -in cmcert.crt -noout -text
Certificate:
Data:
Version: 3 (0x2)
Serial Number:
41:38:34:45:33:46:44:44:38:34:43:34
Signature Algorithm: sha1WithRSAEncryption
```



```

Issuer: C=TW, O=Hitron Technologies, OU=DOCSIS, CN=Hitron Technologies Cable Modem Root
Certificate Authority
Validity
Not Before: Jan 1 00:00:00 2017 GMT
Not After : Dec 28 23:59:59 2036 GMT
Subject: C=TW, O=Hitron Technologies, OU=No. 40, Wu-kung 5th Rd., Wu-ku, Taipei Hsien, Taiwan,
CN=A8:4E:3F:DD:84:C4
Subject Public Key Info:
Public Key Algorithm: rsaEncryption
RSA Public Key: (1024 bit)
Modulus (1024 bit):
00:b0:d4:f2:b6:49:87:fc:e3:40:b2:1f:b1:e0:8c:
fe:04:dd:db:3d:05:d5:34:17:08:86:76:23:ee:25:
4e:4a:61:fc:6d:13:48:30:55:f4:02:cf:89:b1:1b:
34:86:7b:3e:f7:d9:fe:6c:be:8b:4c:25:1f:da:5a:
2e:47:d6:5c:21:20:8e:fc:72:e2:23:8d:54:43:78:
6f:15:1a:a7:fe:6c:21:37:19:57:dd:3f:eb:84:35:
8a:a1:b7:a2:18:1d:af:7a:4f:7d:d4:e9:12:8d:95:
3c:14:6b:77:f4:51:a9:f8:68:5d:1a:25:3f:a9:59:
0a:c0:f6:9d:24:df:2b:84:c1
Exponent: 65537 (0x10001)
Signature Algorithm: sha1WithRSAEncryption
08:df:c2:da:8c:3e:cc:da:98:28:94:10:e1:b8:65:7a:9a:3f:
22:0d:ae:36:80:29:0e:89:92:3f:0d:f0:9e:06:81:42:ba:b7:
e8:a6:d5:b3:6d:76:04:ff:6a:07:a8:b8:40:9d:0b:0b:6d:56:
8a:f4:f9:39:51:99:ab:54:12:6c:e9:c2:2f:1b:63:90:54:3a:
3b:67:ef:b8:fc:f0:e7:55:f6:42:e1:e0:27:3a:38:53:f4:dd:
bf:f1:39:1e:63:ce:8b:b7:bb:c0:8a:fc:59:fc:76:7c:3f:a5:
a5:eb:25:5c:88:78:f4:ab:63:66:5a:a9:cd:cf:77:9a:3d:fe:
0c:4c

```

You can see that the **OU= (Organizational Unit)** field does not match. In the example, you see **DOCSIS** and **Euro-DOCSIS**. That is the reason why CMTS rejects the certificate.

You can use Keychain tool in Mac OS to view the certificates.

