# Security of Timing Infrastructure – Network based threats and CVEs

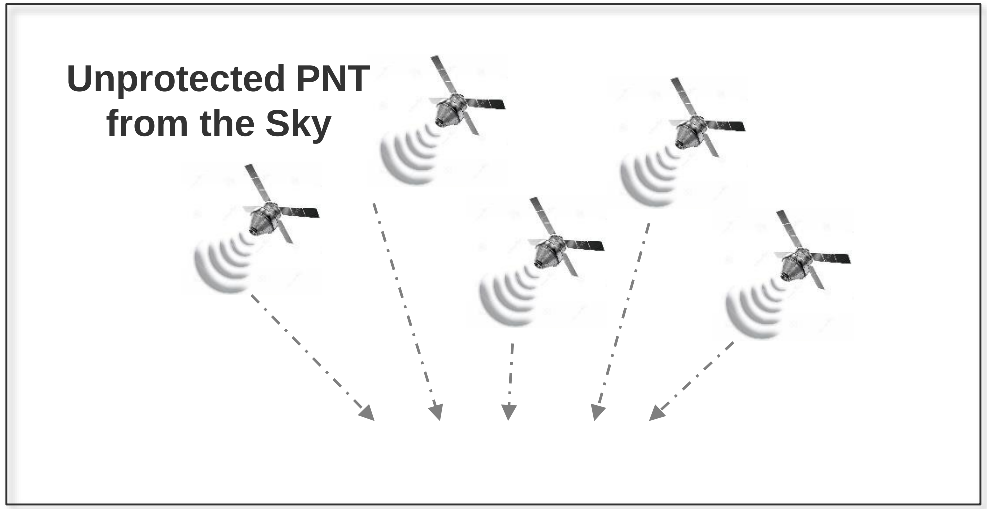
**Barry Dropping**

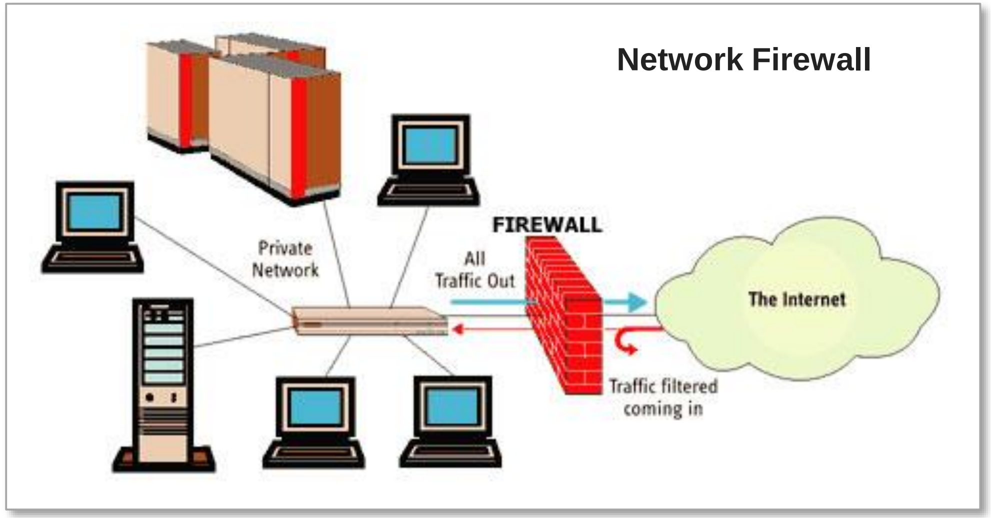
**March 2019**

# Agenda

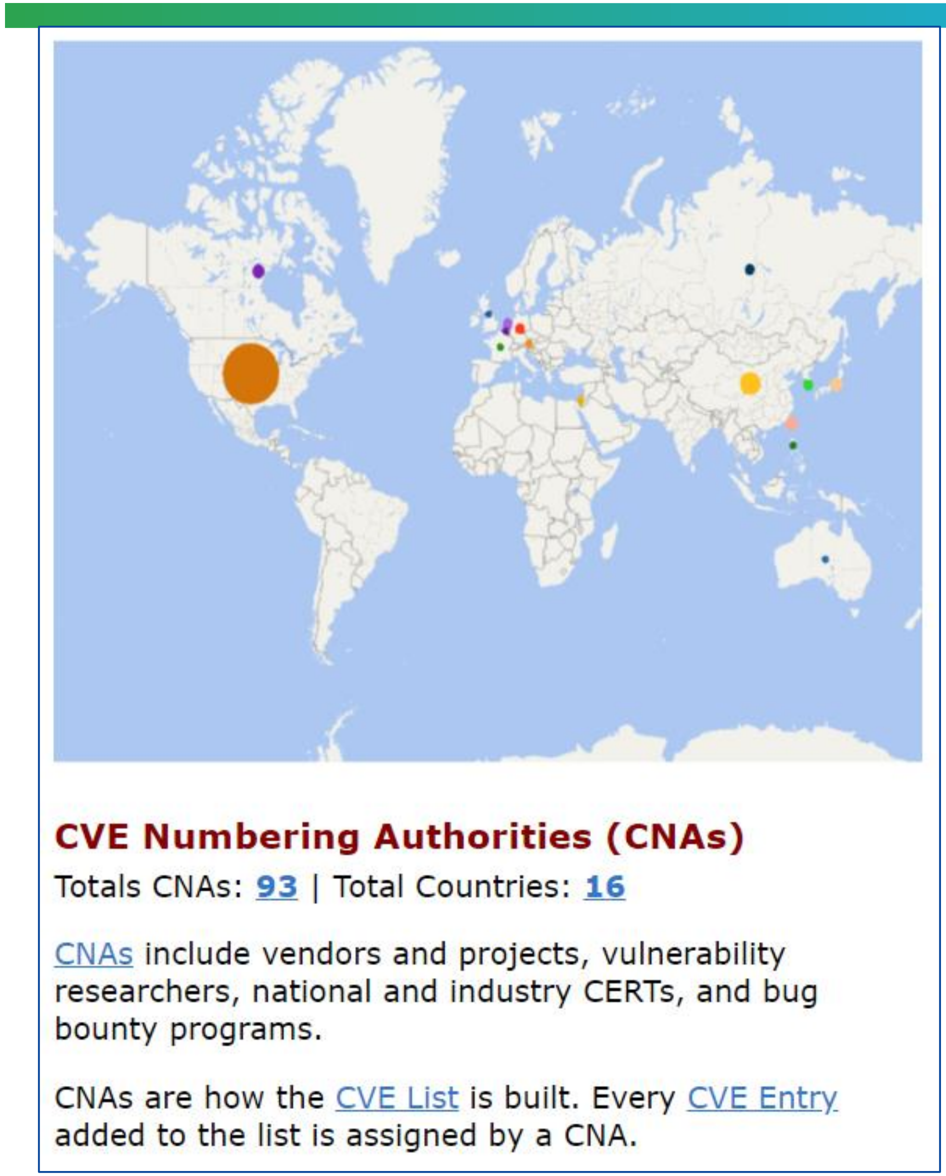
- “Security Perimeter” of network based time servers
- Common Vulnerabilities and Exposures (CVE) Update
- Best practices in addressing CVEs
- Additional security requirement in the financial industry
  - Payment Card Industry - Data Security Standard (PCI-DSS)
- Conclusions

# Timing System “Security Perimeter”


Unprotected PNT from the Sky


Network Firewall

# Common Vulnerabilities and Exposures (CVE) Update



**CVE Numbering Authorities (CNAs)**

Totals CNAs: 93 | Total Countries: 16

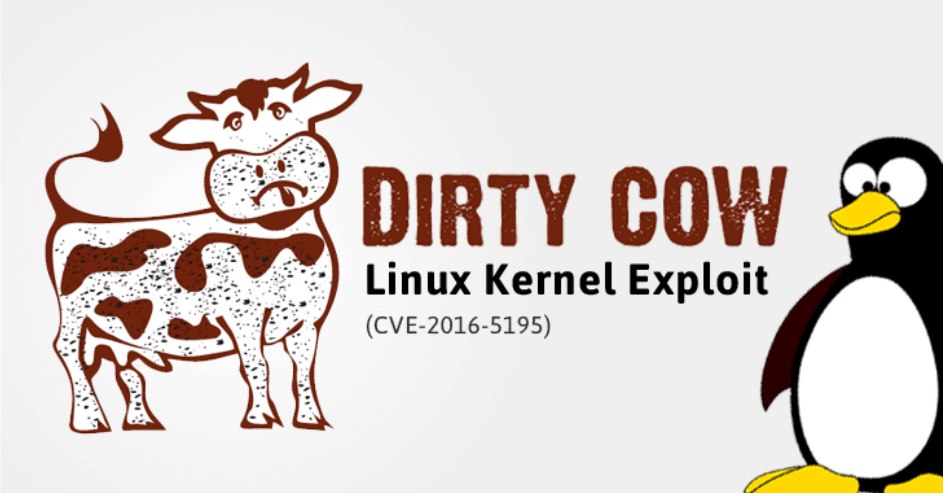
CNAs include vendors and projects, vulnerability researchers, national and industry CERTs, and bug bounty programs.

CNAs are how the CVE List is built. Every CVE Entry added to the list is assigned by a CNA.

- The Common Vulnerabilities and Exposures (CVE) system provides a reference-method for publicly known information-security vulnerabilities and exposures
- CVE Numbering Authorities (CNAs) Assign and publish CVEs
- Funded by US DHS, and operated by Mitre Corporation
- Refer to https://cve.mitre.org/index.html

# Anatomy of a CVE

- The CVE system establishes a standard for reporting and tracking vulnerabilities
- Every CVE is given a unique number in the format “CVE-YEAR-NUMBER”
  - For example:  CVE-2019-1234
- CVEs are assigned a severity level from “None” to “Critical”
- Some famous CVEs are given names and even logos

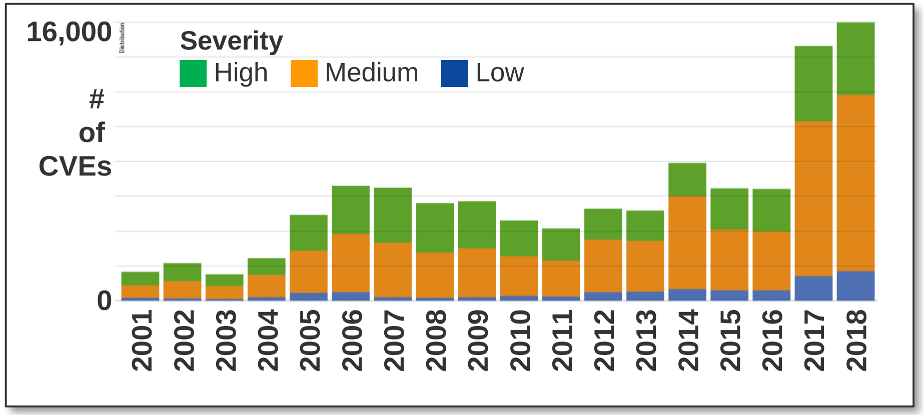


# Equifax Security Breach

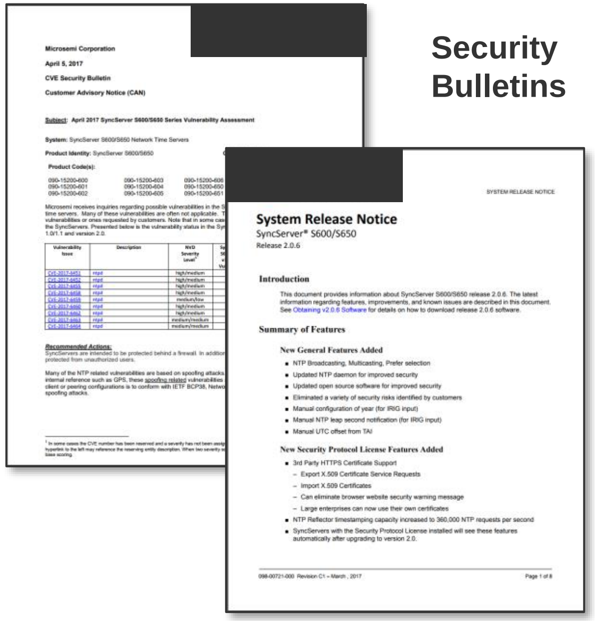
- 148 Million people impacted with stolen information including social security numbers
- Breach was traced to a single internet facing web server with down level SW
- Exploit was open and undetected for 76 days
- The vulnerability exploited was Apache Struts CVE-2017-5638

# CVE Exposures are Increasing

- Record number of CVEs documented in 2018



- CVE Activity
  - Investigated 86 possible CVEs*
  - Identified and mitigated 2 applicable CVEs
  - This is valuable to ALL customers



[redacted]

Microsemi Corporation

April 5, 2017

CVE Security Bulletin

Customer Advisory Notice (CAN)

Subject: April 2017 SyncServer S600/S650 Series Vulnerability Assessment

System: SyncServer S600/S650 Network Time Servers

Product Identity: SyncServer S600/S650

Product Code(s):

090-15200-600 090-15200-603 090-15200-606
090-15200-601 090-15200-604 090-15200-650
090-15200-602 090-15200-605 090-15200-651

Microsemi receives inquiries regarding possible vulnerabilities in the S
time servers. Many of these vulnerabilities are often not applicable. T
vulnerabilities or ones requested by customers. Note that in some cas
the SyncServers. Presented below is the vulnerability status in the Sy
1.0/1.1 and version 2.0.

| Vulnerability Issue | Description | NVD Severity Level[1] |
|---|---|---|
| CVE-2017-6451 | ntpd | high/medium |
| CVE-2017-6452 | ntpd | high/medium |
| CVE-2017-6455 | ntpd | high/medium |
| CVE-2017-6458 | ntpd | high/medium |
| CVE-2017-6459 | ntpd | medium/low |
| CVE-2017-6460 | ntpd | high/medium |
| CVE-2017-6462 | ntpd | high/medium |
| CVE-2017-6463 | ntpd | medium/medium |
| CVE-2017-6464 | ntpd | medium/medium |

***Recommended Actions:***
SyncServers are intended to be protected behind a firewall. In addition
protected from unauthorized users.

Many of the NTP related vulnerabilities are based on spoofing attacks
internal reference such as GPS, these spoofing related vulnerabilities
client or peering configurations is to conform with IETF BCP38, Netwo
spoofing attacks.

[1] In some cases the CVE number has been reserved and a severity has not been assig
hyperlink to the left may reference the reserving entity description. When two severity s
base scoring.

**Security Bulletins**

[redacted]

SYSTEM RELEASE NOTICE

## System Release Notice

SyncServer® S600/S650
Release 2.0.6

### Introduction

This document provides information about SyncServer S600/S650 release 2.0.6. The latest information regarding features, improvements, and known issues are described in this document. See Obtaining v2.0.6 Software for details on how to download release 2.0.6 software.

### Summary of Features

#### New General Features Added

- NTP Broadcasting, Multicasting, Prefer selection
- Updated NTP daemon for improved security
- Updated open source software for improved security
- Eliminated a variety of security risks identified by customers
- Manual configuration of year (for IRIG input)
- Manual NTP leap second notification (for IRIG input)
- Manual UTC offset from TAI

#### New Security Protocol License Features Added

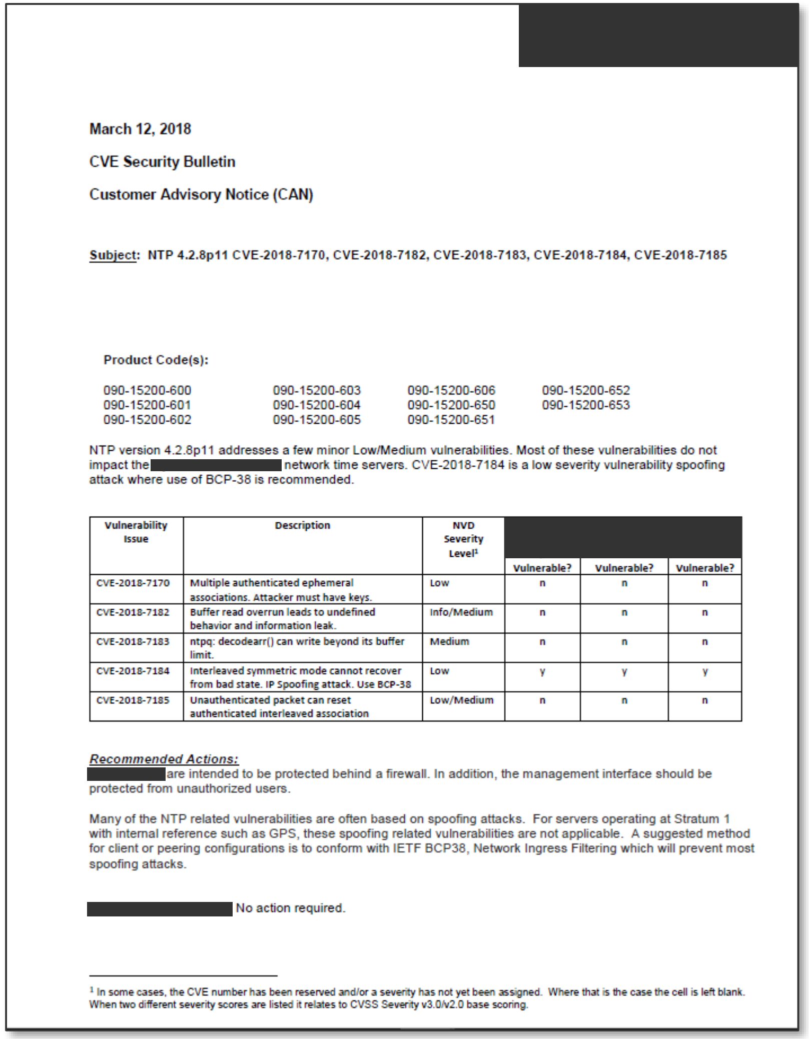
- 3rd Party HTTPS Certificate Support
  - Export X.509 Certificate Service Requests
  - Import X.509 Certificates
  - Can eliminate browser website security warning message
  - Large enterprises can now use their own certificates
- NTP Reflector timestamping capacity increased to 360,000 NTP requests per second
- SyncServers with the Security Protocol License installed will see these features automatically after upgrading to version 2.0.

098-00721-000 Revision C1 – March , 2017 Page 1 of 8

**System Release Notices (SRN)**

* CVE-2018-0739, CVE-2018-1087, CVE-2018-1118, CVE-2018-1120, CVE-2018-1130, CVE-2018-1283, CVE-2018-1301, CVE-2018-1302, CVE-2018-1303, CVE-2018-1312, CVE-2018-3620, CVE-2018-3639, CVE-2018-3646, CVE-2018-3665, CVE-2018-3693, CVE-2018-5750, CVE-2018-5803, CVE-2018-5953, CVE-2018-5995, CVE-2018-6412, CVE-2018-6554, CVE-2018-6555, CVE-2018-7182, CVE-2018-7170, CVE-2018-7182, CVE-2018-7183, CVE-2018-7184, CVE-2018-7185, CVE-2018-7754, CVE-2018-7755, CVE-2018-10322, CVE-2018-10323, CVE-2018-10675, CVE-2018-10840, CVE-2018-10853, CVE-2018-10872, CVE-2018-10876, CVE-2018-10877, CVE-2018-10878, CVE-2018-10879, CVE-2018-10880, CVE-2018-10881, CVE-2018-10882, CVE-2018-10883, CVE-2018-10901, CVE-2018-10902, CVE-2018-10938, CVE-2018-12232, VCE-2018-12233, CVE-2018-12327, CVE-2018-12633, CVE-2018-12714, CVE-2018-12904, CVE-2018-13093, CVE-2018-13094, CVE-2018-13095, CVE-2018-13096, CVE-2018-13097, CVE-2018-13098, CVE-2018-13099, CVE-2018-13100, CVE-2018-13405, CVE-2018-13406, CVE-2018-13982, CVE-2018-14609, CVE-2018-14610, CVE-2018-14611, CVE-2018-14612, CVE-2018-14613, CVE-2018-14614, CVE-2018-14615, CVE-2018-14616, CVE-2018-14617, CVE-2018-14619, CVE-2018-14625, CVE-2018-14678, CVE-2018-14734, CVE-2018-15471, CVE-2018-15572, CVE-2018-15594, CVE-2018-16276, CVE-2018-16597, CVE-2018-16658, CVE-2018-17182, CVE-2018-18386, CVE-2018-1000204

# Security Bulletins



[redacted]

March 12, 2018

CVE Security Bulletin

Customer Advisory Notice (CAN)

<u>Subject</u>: NTP 4.2.8p11 CVE-2018-7170, CVE-2018-7182, CVE-2018-7183, CVE-2018-7184, CVE-2018-7185

Product Code(s):

| | | | |
|---|---|---|---|
| 090-15200-600 | 090-15200-603 | 090-15200-606 | 090-15200-652 |
| 090-15200-601 | 090-15200-604 | 090-15200-650 | 090-15200-653 |
| 090-15200-602 | 090-15200-605 | 090-15200-651 | |

NTP version 4.2.8p11 addresses a few minor Low/Medium vulnerabilities. Most of these vulnerabilities do not impact the [redacted] network time servers. CVE-2018-7184 is a low severity vulnerability spoofing attack where use of BCP-38 is recommended.

| Vulnerability Issue | Description | NVD Severity Level[1] | [redacted] | | |
|---|---|---|---|---|---|
| | | | Vulnerable? | Vulnerable? | Vulnerable? |
| CVE-2018-7170 | Multiple authenticated ephemeral associations. Attacker must have keys. | Low | n | n | n |
| CVE-2018-7182 | Buffer read overrun leads to undefined behavior and information leak. | Info/Medium | n | n | n |
| CVE-2018-7183 | ntpq: decodearr() can write beyond its buffer limit. | Medium | n | n | n |
| CVE-2018-7184 | Interleaved symmetric mode cannot recover from bad state. IP Spoofing attack. Use BCP-38 | Low | y | y | y |
| CVE-2018-7185 | Unauthenticated packet can reset authenticated interleaved association | Low/Medium | n | n | n |

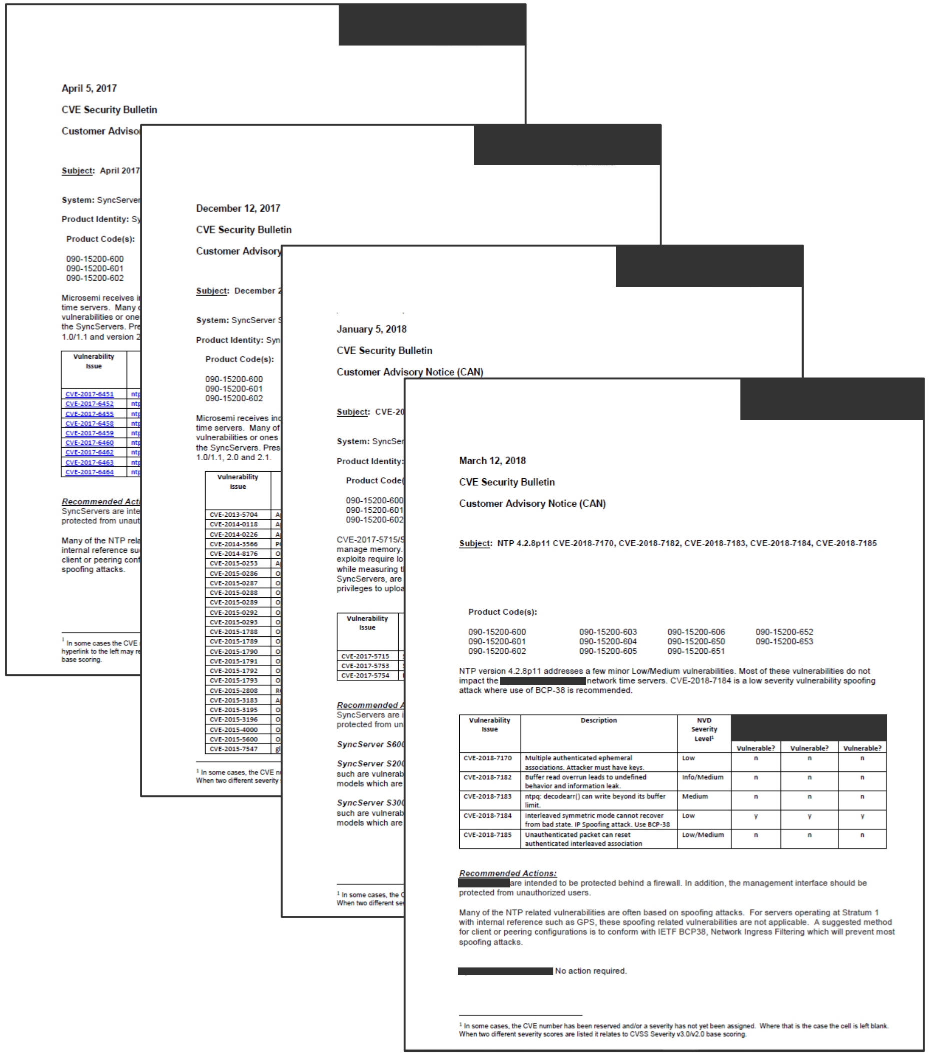
***<u>Recommended Actions:</u>***

[redacted] are intended to be protected behind a firewall. In addition, the management interface should be protected from unauthorized users.

Many of the NTP related vulnerabilities are often based on spoofing attacks. For servers operating at Stratum 1 with internal reference such as GPS, these spoofing related vulnerabilities are not applicable. A suggested method for client or peering configurations is to conform with IETF BCP38, Network Ingress Filtering which will prevent most spoofing attacks.

[redacted] No action required.

[1] In some cases, the CVE number has been reserved and/or a severity has not yet been assigned. Where that is the case the cell is left blank. When two different severity scores are listed it relates to CVSS Severity v3.0/v2.0 base scoring.



April 5, 2017

CVE Security Bulletin

December 12, 2017

CVE Security Bulletin

January 5, 2018

CVE Security Bulletin

Customer Advisory Notice (CAN)

March 12, 2018

CVE Security Bulletin

Customer Advisory Notice (CAN)

Subject: NTP 4.2.8p11 CVE-2018-7170, CVE-2018-7182, CVE-2018-7183, CVE-2018-7184, CVE-2018-7185

# Financial Services and Banking Requirements

Financial Services

- The financial services and banking industries take security very seriously
- It is very common for them to perform exhaustive security assessments on vendor equipment and demand fixes and enhancements as part of the equipment approval process
- A good example is the Payment Card Industry Data Security Standard (PCI-DSS)

# Payment Card Industry Data Security Standard (PCI-DSS)

- PCI DSS is an information security standard for organizations that handle branded credit cards from the major card companies
- Created to increase controls around cardholder data to reduce credit card fraud
- The PCI Data Security Standard specifies twelve requirements for compliance
- Requirement 10 covers tracking and monitoring all access to cardholder data and network resources, and includes specific requirement on the use of Network Time Protocol (NTP).

# PCI DSS Timing Requirements

Payment Card Industry (PCI)
**Data Security Standard**

**Requirements and Security Assessment Procedures**

**Version 3.2.1**
May 2018

- PCI DSS Requirements
  - Build and Maintain a secure Network and Systems
  - Protect Cardholder Data
  - Maintain a Vulnerability Management Program
  - Implement Strong Access Control Measures
  - Regularly Monitor and Test Networks
  - Maintain and Information Security Policy
- PCI DSS Requirement 10.4 Mandates Time Synchronization for all logs
  - All systems must synchronize their logs to centralized time servers
  - Only central time servers are allowed to receive time from external sources
  - External time sources must be based on TAI or UTC
  - If multiple centralized time servers are used, they must “peer” with each other to keep accurate time

# Conclusions

- A robust security perimeter is required for all Timing Systems used in critical infrastructures
- CVEs must be proactively monitored and addressed to close vulnerabilities
- Stringent financial services and banking requirements regarding security of timing infrastructure benefit all industries

# Thank you

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