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| Project | **IEEE 802.21 MIHS****<**[**http://www.ieee802.org/21/**](http://www.ieee802.org/21/)**>** |
| Title | **Proposed remedy for SB Comment i-12** |
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| Re: | IEEE 802.21d Sponsor Ballot comment resolution |
| Abstract | This document describes a proposed remedy for SB comment i-12 about MIH\_Configuration\_Update. |
| Purpose | For Sponsor Ballot Comment Resolution |
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# Comment i-12 (p28, 7.4.35.1.2)

When multiple certificates are revoked, it should be able to revoke them using a single message. In that case, the size of the message should be reduced as much as possible.

1. Proposed resolution

[1] Apply the following changes to MIH\_Revoke\_Certificate.indication and .request primitives:

* Change CertificateSerialNumber to CertificateSerialNumberList
* Change CERT\_SERIAL\_NUMBER to CERT\_SERIAL\_NUMBER\_INFO
* Change Description for CertificateRevocation to: "(Optional) Digital signature for a revoked X.509 certificate serial numbers generated by CA. This parameter shall be contained only if List or Bloom Filter of X.509 certificate subfield serial numbers is contained in CertificateSerialNumberList.

[2] Define the following new data types:

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| **Data type name** | **Derived from** | **Definition** |
| CERT\_SERIAL\_NUMBER\_INFO | CHOICE(LIST(CERT\_SERIAL\_NUMBER), CERT\_BLOOM\_FILTER, X509CRL)) | List or Bloom Filter of X.509 certificate subfield serial numbers or X.509 Certificate Revocation List. |
| CERT\_BLOOM\_FILTER | SEQUENCE(OCTET\_STRING, UNSIGNED\_INT(1)) | The OCTET\_STRING part contains a Bloom Filter value computed against a set of serial numbers of revoked certificates. The UNSIGNED\_INT(1) part contains Bloom Filter parameter k. See Annex V for detailed operations. |
| X509CRL | OCTET\_STRING | CertificateList defined in RFC 5280 [RFC5280]. |

[3] In 8.6.1.30, change "CertificateSerialNumber (Certificate Serial Number TLV)" to "CertificateSerialNumbers (Certificate Serial Number Info TLV)".

[4] In Table L.2 change "Certificate Serial Number" TLV of type "CERT\_SERIAL\_NUMBER" to "Certificate Serial Number Info" TLV of type "CERT\_CERIAL\_NUMBER\_INFO".

[5] Add the following Annex.

**Annex V**

(normative)

**Use of Bloom Filter for Certificate Revocation**

A Bloom Filter (BF) [Bloom] is characterized by the following parameters.

* *m*: length of BF output value in bits
* *k*: number of elements in a set of hash functions {H*i*}

In this specification, hash function H*i* is defined as follows.

H*i*(*x*) = SHA-256 ([*i*]2 || *x*) mod *m*, where [*i*]2 is 32-bit binary representation of integer *i*, 0<=*i*<=*k*-1, and “||” is an operator for concatenation of octet strings.

**V.1 Calculating Bloom Filter output for revoked certificates**

Let S be a set of serial numbers for revoked certificates, BS be a BF output value computed against S.

BS is calculated as follows.

Step 1: Set each bit of BS to zero.

Step 2: For each e in S and for each i in [0,k-1], set Hi(e)-th bit of BS to 1.

**Figure V.1 Bloom Filter example (k=3, m=32)**

**V.2 Certificate revocation check**

For a BF output, a certificate of serial number e is considered to be revoked if Hi(e)-th bit of the BF output is set to 1 for all i in [0, k-1].

**V.3 False positive case**

Since BF is computed using hash functions, there can be a false positive case in which a non-revoked certificate is considered to be revoked. When a false positive case occurs, a valid certificate suffering from the false positive case may be replaced with a new BF-negative certificate using MIH\_Push\_Ceritifcate.

[6] Add the following reference:

[Bloom] Berton H. Bloom, “Space/Time Trade-offs in Hash Coding with Allowable Errors”, Communications of the ACM, Vol. 13, No. 7, July 1970.

[RFC5280] D. Cooper, et al., “Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile”, RFC 5280, May 2008.