

DMARC
Internet-Draft
Obsoletes: [7489](#) (if approved)
Intended status: Standards Track
Expires: 25 October 2021

A. Brotman (ed)
Comcast, Inc.
23 April 2021

DMARC Aggregate Reporting
draft-ietf-dmarc-aggregate-reporting-02

Abstract

DMARC allows for domain holders to request aggregate reports from receivers. This report is an XML document, and contains extensible elements that allow for other types of data to be specified later. The aggregate reports can be submitted to the domain holder's specified destination as supported by the receiver.

This document (along with others) obsoletes [RFC7489](#).

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 25 October 2021.

Copyright Notice

Copyright (c) 2021 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the [Trust Legal Provisions](#) and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	2
1.1.	Terminology	3
2.	DMARC Feedback	3
2.1.	Aggregate Reports	3
2.1.1.	DKIM Signatures in Aggregate Report	5
2.2.	Extensions	6
2.3.	Changes in Policy During Reporting Period	6
2.4.	Recommended Reporting Periods	7
2.5.	Report Request Discovery	7
2.6.	Transport	7
2.6.1.	Email	7
2.6.2.	Other Methods	9
3.	Verifying External Destinations	9
4.	Extensible Reporting	11
5.	IANA Considerations	12
6.	Privacy Considerations	12
6.1.	Data Exposure Considerations	12
6.2.	Report Recipients	13
6.3.	Data Contained Within Reports (Tkt64)	13
7.	Security Considerations	14
8.	Appendix A. DMARC XML Schema	14
9.	Appendix B. Sample Report	21
10.	Normative References	22
11.	Informative References	23
	Author's Address	23

[1. Introduction](#)

A key component of DMARC is the ability for domain holders to request that receivers provide various types of reports. These reports allow domain holders to have insight into which IP addresses are sending on their behalf, and some insight into whether or not the volume may be legitimate. These reports expose information relating to the DMARC policy, as well as the outcome of SPF [[RFC7208](#)] & DKIM [[RFC6376](#)] validation.

1.1. Terminology

The keywords MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL, when they appear in this document, are to be interpreted as described in [[RFC2119](#)].

2. DMARC Feedback

Providing Domain Owners with visibility into how Mail Receivers implement and enforce the DMARC mechanism in the form of feedback is critical to establishing and maintaining accurate authentication deployments. When Domain Owners can see what effect their policies and practices are having, they are better willing and able to use quarantine and reject policies.

2.1. Aggregate Reports

The DMARC aggregate feedback report is designed to provide Domain Owners with precise insight into:

- * authentication results,
- * corrective action that needs to be taken by Domain Owners, and
- * the effect of Domain Owner DMARC policy on email streams processed by Mail Receivers.

Aggregate DMARC feedback provides visibility into real-world email streams that Domain Owners need to make informed decisions regarding the publication of DMARC policy. When Domain Owners know what legitimate mail they are sending, what the authentication results are on that mail, and what forged mail receivers are getting, they can make better decisions about the policies they need and the steps they need to take to enable those policies. When Domain Owners set policies appropriately and understand their effects, Mail Receivers can act on them confidently.

Visibility comes in the form of daily (or more frequent) Mail Receiver-originated feedback reports that contain aggregate data on message streams relevant to the Domain Owner. This information includes data about messages that passed DMARC authentication as well as those that did not.

The report may include the following data:

- * The DMARC policy discovered and applied, if any
- * The selected message disposition

- * The identifier evaluated by SPF and the SPF result, if any
- * The identifier evaluated by DKIM and the DKIM result, if any
- * For both DKIM and SPF, an indication of whether the identifier was in alignment
- * A separate report should be generated for each 5322.From subdomain, regardless of which policy domain was used during receipt of messages
- * Sending and receiving domains
- * The policy requested by the Domain Owner and the policy actually applied (if different)
- * The number of successful authentications
- * The counts of messages based on all messages received, even if their delivery is ultimately blocked by other filtering agents.

The format for these reports is defined in [Appendix A](#).

DMARC Aggregate Reports MUST contain two primary sections; one consisting of descriptive information and the other a set of IP-focused row-based data. Each report MUST contain data for only one Author Domain. A single report SHOULD contain data for one policy configuration. If multiple configurations were observed during a single reporting period, a reporting entity MAY choose to send multiple reports, otherwise the reporting entity SHOULD note only the final configuration observed during the period. See below for further information.

The informative section MUST contain two sub-sections. One will be the metadata section which MUST contain the fields related to "org_name", "email", "report_id", and "date_range". Optional fields MAY include "extra_contact_info", an "error" field, and an optional "version" field. The version field, if present, MUST contain a "1.0" [!@RFC7489] or "2.0" [RefNeeded], noting to which version of the aggregate reporting specification the report adheres. The "date_range" section which will note "begin" and "end" values as epoch timestamps. The other sub-section will be the "policy_published", and record the policy configuration observed by the receiving system. Mandatory fields are "domain", "p", "sp", "pct". Optional fields are "fo", "adkim", "aspf".

Within the data section, the report will contain row(s) of data stating which IPs were seen to have delivered messages for the Author Domain to the receiving system. For each IP that is being reported, there will be a "record" element, which will then have each of a "row", "identifiers", and "auth_results" sub-element. Within the "row" element, there MUST be "source_ip" and "count". There MUST also exist a "policy_evaluated", with subelements of "disposition", "dkim", and "spf". There MAY be an element for "reason", meant to include any notes the reporter might want to include as to why the "disposition" policy does not match the "policy_published", such as a Local Policy override (possible values listed in [Appendix A](#)). The "dkim" and "spf" elements MUST be the evaluated values as they relate to DMARC, not the values the receiver may have used when overriding the policy. Within the "identifiers" element, there MUST exist the data that was used to apply policy for the given IP. In most cases, this will be a "header_from" element, which will contain the 5322.From domain from the message.

There MUST be an "auth_results" element within the 'record' element. This will contain the data related to authenticating the messages associated with this sending IP. The "dkim" subelement is optional as not all messages are signed, while there MUST be one "spf" subelement. These elements MUST have a "domain" that was used during validation, as well as "result". Optionally, the "dkim" element MUST include a "selector" element that was observed during validation. For the "spf" element, the "result" element MUST contain a lower-case string where the value is one of none/neutral/pass/fail/softfail/temperror/permerror. The "dkim" result MUST contain a lower-case string where the value is one of none/pass/fail/policy/neutral/temperror/permerror.

2.1.1.1. DKIM Signatures in Aggregate Report

Within a single message, the possibility exists that there could be multiple DKIM signatures. When validation of the message occurs, some signatures may pass, while some may not. As these pertain to DMARC, and especially to aggregate reporting, reporters may not find it clear which DKIM signatures they should include in a report. Signatures, regardless of outcome, could help the report ingester determine the source of a message. However, there is a preference as to which signatures are included.

1. A signature that passes DKIM, in strict alignment with the 5322.From domain
2. A signature that passes DKIM, in relaxed alignment with the 5322.From domain

3. Any other DKIM signatures that pass
4. DKIM signatures that do not pass

A report SHOULD contain no more than 100 signatures for a given "row", in decreasing priority.

2.2. Extensions

There MAY be an optional section for extensions within the "feedback" element. The absence or existence of this section SHOULD NOT create an error when processing reports. This will be covered in a separate section.

2.3. Changes in Policy During Reporting Period

Note that Domain Owners or their agents may change the published DMARC policy for a domain or subdomain at any time. From a Mail Receiver's perspective, this will occur during a reporting period and may be noticed during that period, at the end of that period when reports are generated, or during a subsequent reporting period, all depending on the Mail Receiver's implementation. Under these conditions, it is possible that a Mail Receiver could do any of the following:

- * generate for such a reporting period a single aggregate report that includes message dispositions based on the old policy, or a mix of the two policies, even though the report only contains a single "policy_published" element;
- * generate multiple reports for the same period, one for each published policy occurring during the reporting period;
- * generate a report whose end time occurs when the updated policy was detected, regardless of any requested report interval.

Such policy changes are expected to be infrequent for any given domain, whereas more stringent policy monitoring requirements on the Mail Receiver would produce a very large burden at Internet scale. Therefore, it is the responsibility of report consumers and Domain Owners to be aware of this situation and allow for such mixed reports during the propagation of the new policy to Mail Receivers.

2.4. Recommended Reporting Periods

Aggregate reports are most useful when they all cover a common time period. By contrast, correlation of these reports from multiple generators when they cover incongruent time periods is difficult or impossible. Report generators SHOULD, wherever possible, adhere to hour boundaries for the reporting period they are using. For example, starting a per-day report at 00:00; starting per-hour reports at 00:00, 01:00, 02:00; etc. Report generators using a 24-hour report period are strongly encouraged to begin that period at 00:00 UTC, regardless of local timezone or time of report production, in order to facilitate correlation.

2.5. Report Request Discovery

A Mail Receiver discovers reporting requests when it looks up a DMARC policy record that corresponds to an [RFC5322](#).From domain on received mail. The presence of the "rua" tag specifies where to send feedback.

2.6. Transport

Where the URI specified in a "rua" tag does not specify otherwise, a Mail Receiver generating a feedback report SHOULD employ a secure transport mechanism.

The Mail Receiver, after preparing a report, MUST evaluate the provided reporting URIs in the order given. Any reporting URI that includes a size limitation exceeded by the generated report (after compression and after any encoding required by the particular transport mechanism) MUST NOT be used. An attempt MUST be made to deliver an aggregate report to every remaining URI, up to the Receiver's limits on supported URIs.

If transport is not possible because the services advertised by the published URIs are not able to accept reports (e.g., the URI refers to a service that is unreachable, or all provided URIs specify size limits exceeded by the generated record), the Mail Receiver SHOULD send a short report (see [Section 7.2.2](#)) indicating that a report is available but could not be sent. The Mail Receiver MAY cache that data and try again later, or MAY discard data that could not be sent.

2.6.1. Email

The message generated by the Mail Receiver MUST be a [MAIL] message formatted per [MIME]. The aggregate report itself MUST be included in one of the parts of the message. A human-readable portion MAY be included as a MIME part (such as a text/plain part).

The aggregate data MUST be an XML file that SHOULD be subjected to GZIP compression. Declining to apply compression can cause the report to be too large for a receiver to process (a commonly observed receiver limit is ten megabytes); doing the compression increases the chances of acceptance of the report at some compute cost. The aggregate data SHOULD be present using the media type "application/gzip" if compressed (see [GZIP]), and "text/xml" otherwise. The filename SHOULD be constructed using the following ABNF:

```
filename = receiver "!" policy-domain "!" begin-timestamp
          "!" end-timestamp [ "!" unique-id ] "." extension

unique-id = 1*(ALPHA / DIGIT)

receiver = domain
          ; imported from [MAIL]

policy-domain = domain

begin-timestamp = 1*DIGIT
                  ; seconds since 00:00:00 UTC January 1, 1970
                  ; indicating start of the time range contained
                  ; in the report

end-timestamp = 1*DIGIT
                ; seconds since 00:00:00 UTC January 1, 1970
                ; indicating end of the time range contained
                ; in the report

extension = "xml" / "xml.gz"
```

The extension MUST be "xml" for a plain XML file, or "xml.gz" for an XML file compressed using GZIP.

"unique-id" allows an optional unique ID generated by the Mail Receiver to distinguish among multiple reports generated simultaneously by different sources within the same Domain Owner.

For example, this is a sample filename for the gzip file of a report to the Domain Owner "example.com" from the Mail Receiver "mail.receiver.example":

```
mail.receiver.example!example.com!1013662812!1013749130.gz
```

No specific MIME message structure is required. It is presumed that the aggregate reporting address will be equipped to extract MIME parts with the prescribed media type and filename and ignore the rest.

Email streams carrying DMARC feedback data MUST conform to the DMARC mechanism, thereby resulting in an aligned "pass" (see [Section 3.1](#)). This practice minimizes the risk of report consumers processing fraudulent reports.

The [RFC5322](#).Subject field for individual report submissions SHOULD conform to the following ABNF:

```
dmARC-subject = %x52.65.70.6f.72.74 1*FWS      ; "Report"
                %x44.6f.6d.61.69.6e.3a 1*FWS    ; "Domain:"
                domain-name 1*FWS                ; from RFC 6376
                %x53.75.62.6d.69.74.74.65.72.3a ; "Submitter:"
                1*FWS domain-name 1*FWS
                %x52.65.70.6f.72.74.2d.49.44.3a ; "Report-ID:"
                msg-id                            ; from RFC 5322
```

The first domain-name indicates the DNS domain name about which the report was generated. The second domain-name indicates the DNS domain name representing the Mail Receiver generating the report. The purpose of the Report-ID: portion of the field is to enable the Domain Owner to identify and ignore duplicate reports that might be sent by a Mail Receiver.

For instance, this is a possible Subject field for a report to the Domain Owner "example.com" from the Mail Receiver "mail.receiver.example". It is line-wrapped as allowed by [MAIL]:

```
Subject: Report Domain: example.com
        Submitter: mail.receiver.example
        Report-ID: <2002.02.15.1>
```

This transport mechanism potentially encounters a problem when feedback data size exceeds maximum allowable attachment sizes for either the generator or the consumer. See [Section 7.2.2](#) for further discussion.

[2.6.2](#). Other Methods

The specification as written allows for the addition of other registered URI schemes to be supported in later versions.

[3](#). Verifying External Destinations

It is possible to specify destinations for the different reports that are outside the authority of the Domain Owner making the request. This allows domains that do not operate mail servers to request reports and have them go someplace that is able to receive and process them.

Without checks, this would allow a bad actor to publish a DMARC policy record that requests that reports be sent to a victim address, and then send a large volume of mail that will fail both DKIM and SPF checks to a wide variety of destinations; the victim will in turn be flooded with unwanted reports. Therefore, a verification mechanism is included.

When a Mail Receiver discovers a DMARC policy in the DNS, and the Organizational Domain at which that record was discovered is not identical to the Organizational Domain of the host part of the authority component of a [URI] specified in the "rua" or "ruf" tag, the following verification steps are to be taken:

1. Extract the host portion of the authority component of the URI. Call this the "destination host", as it refers to a Report Receiver.
2. Prepend the string "_report._dmarc".
3. Prepend the domain name from which the policy was retrieved, after conversion to an A-label if needed.
4. Query the DNS for a TXT record at the constructed name. If the result of this request is a temporary DNS error of some kind (e.g., a timeout), the Mail Receiver MAY elect to temporarily fail the delivery so the verification test can be repeated later.
5. For each record returned, parse the result as a series of "tag=value" pairs, i.e., the same overall format as the policy record (see [Section 6.4](#)). In particular, the "v=DMARC1" tag is mandatory and MUST appear first in the list. Discard any that do not pass this test.
6. If the result includes no TXT resource records that pass basic parsing, a positive determination of the external reporting relationship cannot be made; stop.
7. If at least one TXT resource record remains in the set after parsing, then the external reporting arrangement was authorized by the Report Receiver.
8. If a "rua" or "ruf" tag is thus discovered, replace the corresponding value extracted from the domain's DMARC policy record with the one found in this record. This permits the Report Receiver to override the report destination. However, to prevent loops or indirect abuse, the overriding URI MUST use the same destination host from the first step.

For example, if a DMARC policy query for "blue.example.com" contained "rua=mailto:reports@red.example.net", the host extracted from the latter ("red.example.net") does not match "blue.example.com", so this procedure is enacted. A TXT query for "blue.example.com._report._dmarc.red.example.net" is issued. If a single reply comes back containing a tag of "v=DMARC1", then the relationship between the two is confirmed. Moreover, "red.example.net" has the opportunity to override the report destination requested by "blue.example.com" if needed.

Where the above algorithm fails to confirm that the external reporting was authorized by the Report Receiver, the URI MUST be ignored by the Mail Receiver generating the report. Further, if the confirming record includes a URI whose host is again different than the domain publishing that override, the Mail Receiver generating the report MUST NOT generate a report to either the original or the override URI. A Report Receiver publishes such a record in its DNS if it wishes to receive reports for other domains.

A Report Receiver that is willing to receive reports for any domain can use a wildcard DNS record. For example, a TXT resource record at "*._report._dmarc.example.com" containing at least "v=DMARC1" confirms that example.com is willing to receive DMARC reports for any domain.

If the Report Receiver is overcome by volume, it can simply remove the confirming DNS record. However, due to positive caching, the change could take as long as the time-to-live (TTL) on the record to go into effect.

A Mail Receiver might decide not to enact this procedure if, for example, it relies on a local list of domains for which external reporting addresses are permitted.

4. Extensible Reporting

A DMARC report should allow for some extensibility, as defined by future documents that utilize DMARC as a foundation. These extensions MUST be properly formatted XML and meant to exist within the structure of a DMARC report. They MUST NOT alter the existing DMARC structure, but instead exist self-contained within an "<extensions>" element. This element MUST be a child of the "<feedback>" element.


```
<feedback>
...
<extensions>
  <extension1 definition="https://path/to/spec">
    <data>...</data>
  </extension1>
</extensions>
</feedback>
```

A DMARC report receiver SHOULD NOT generate a processing error when this "<extensions>" element is absent or empty. Furthermore, if a processor is unable to handle an extension in a report, it SHOULD ignore the data, and continue to the next extension.

5. IANA Considerations

TBD

6. Privacy Considerations

This section will discuss exposure related to DMARC aggregate reporting.

6.1. Data Exposure Considerations

Aggregate reports are limited in scope to DMARC policy and disposition results, to information pertaining to the underlying authentication mechanisms, and to the identifiers involved in DMARC validation.

Aggregate report may expose sender and recipient identifiers, specifically the [RFC5322](#).From addresses.

Domain Owners requesting reports will receive information about mail claiming to be from them, which includes mail that was not, in fact, from them. Information about the final destination of mail where it might otherwise be obscured by intermediate systems will therefore be exposed.

When message-forwarding arrangements exist, Domain Owners requesting reports will also receive information about mail forwarded to domains that were not originally part of their messages' recipient lists. This means that destination domains previously unknown to the Domain Owner may now become visible.

Disclosure of information about the messages is being requested by the entity generating the email in the first place, i.e., the Domain Owner and not the Mail Receiver, so this may not fit squarely within

existing privacy policy provisions. For some providers, aggregate reporting is viewed as a function similar to complaint reporting about spamming or phishing and are treated similarly under the privacy policy. Report generators (i.e., Mail Receivers) are encouraged to review their reporting limitations under such policies before enabling DMARC reporting.

[6.2.](#) Report Recipients

A DMARC record can specify that reports should be sent to an intermediary operating on behalf of the Domain Owner. This is done when the Domain Owner contracts with an entity to monitor mail streams for abuse and performance issues. Receipt by third parties of such data may or may not be permitted by the Mail Receiver's privacy policy, terms of use, or other similar governing document. Domain Owners and Mail Receivers should both review and understand if their own internal policies constrain the use and transmission of DMARC reporting.

Some potential exists for report recipients to perform traffic analysis, making it possible to obtain metadata about the Receiver's traffic. In addition to verifying compliance with policies, Receivers need to consider that before sending reports to a third party.

[6.3.](#) Data Contained Within Reports (Tkt64)

Aggregate feedback reports contain aggregated data relating to messages purportedly originating from the Domain Owner. The data does not contain any identifying characteristics about individual users. No personal information such as individual email addresses, IP addresses of individuals, or the content of any messages, is included in reports.

Mail Receivers should have no concerns in sending reports as they do not contain personal information. In all cases, the data within the reports relates to the domain-level authentication information provided by mail servers sending messages on behalf of the Domain Owner. This information is necessary to assist Domain Owners in implementing and maintaining DMARC.

Domain Owners should have no concerns in receiving reports as they do not contain personal information. The reports only contain aggregated data related to the domain-level authentication details of messages claiming to originate from their domain. This information is essential for the proper implementation and operation of DMARC. Domain Owners who are unable to receive reports for organizational reasons, can choose to exclusively direct the reports to an external processor.

7. Security Considerations

TBD

8. [Appendix A](#). DMARC XML Schema

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://dmarc.org/dmarc-xml/0.2">

  <!-- The time range in UTC covered by messages in this report,
    specified in seconds since epoch. -->
  <xs:complexType name="DateRangeType">
    <xs:all>
      <xs:element name="begin" type="xs:integer"
        minOccurs="1" maxOccurs="1"/>
      <xs:element name="end" type="xs:integer"
        minOccurs="1" maxOccurs="1"/>
    </xs:all>
  </xs:complexType>

  <!-- Within the metadata, a list of domains that are
    reported to have received messages during
    the report time period -->
  <xs:complexType name="ReceivingDomainsType">
    <xs:all>
      <xs:element name="domain" type="xs:string"
        minOccurs="0" maxOccurs="unbounded"/>
    </xs:all>
  </xs:complexType>

  <!-- Report generator metadata. -->
  <!--
    org_name: Reporting Organization
    email: Contact to be used when contacting
           the Reporting Organization
    extra_contact_info: Additional contact details
    report_id: UUID, specified elsewhere
    date_range: Timestamps used when forming report data
```



```
error: ?
receiving_domains: List of domains which received messages for
                    the domain in this report
-->
<xs:complexType name="ReportMetadataType">
  <xs:sequence>
    <xs:element name="org_name" type="xs:string"
      minOccurs="1" maxOccurs="1"/>
    <xs:element name="email" type="xs:string"
      minOccurs="1" maxOccurs="1"/>
    <xs:element name="extra_contact_info" type="xs:string"
      minOccurs="0" maxOccurs="1"/>
    <xs:element name="report_id" type="xs:string"
      minOccurs="1" maxOccurs="1"/>
    <xs:element name="date_range" type="DateRangeType"
      minOccurs="1" maxOccurs="1"/>
    <xs:element name="error" type="xs:string"
      minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="receiving_domains" type="ReceivingDomainsType"
      minOccurs="0" maxOccurs="1"/>
  </xs:sequence>
</xs:complexType>

<!-- Alignment mode (relaxed or strict) for DKIM and SPF. -->
<xs:simpleType name="AlignmentType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="r"/>
    <xs:enumeration value="s"/>
  </xs:restriction>
</xs:simpleType>

<!-- The policy actions specified by p and sp in the
      DMARC record. -->
<xs:simpleType name="DispositionType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="none"/>
    <xs:enumeration value="quarantine"/>
    <xs:enumeration value="reject"/>
  </xs:restriction>
</xs:simpleType>

<!-- The policy actions utilized on messages for this record. -->
<!--
  "none": No action taken
  "pass": No action, passing DMARC w/enforcing policy
  "quarantine": Failed DMARC, message marked for quarantine
  "reject": Failed DMARC, marked as reject
-->
```



```
<xs:simpleType name="ActionDispositionType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="none"/>
    <xs:enumeration value="pass"/>
    <xs:enumeration value="quarantine"/>
    <xs:enumeration value="reject"/>
  </xs:restriction>
</xs:simpleType>

<!-- The DMARC policy that is published by the sending domain
in this report. -->
<xs:complexType name="PolicyPublishedType">
  <xs:all>
    <!-- The domain at which the DMARC record was found. -->
    <xs:element name="domain" type="xs:string"
      minOccurs="1" maxOccurs="1"/>
    <!-- The version declared in the DMARC record found. -->
    <xs:element name="version_published" type="xs:decimal"
      minOccurs="1" maxOccurs="1"/>
    <!-- The DKIM alignment mode. -->
    <xs:element name="adkim" type="AlignmentType"
      minOccurs="0" maxOccurs="1"/>
    <!-- The SPF alignment mode. -->
    <xs:element name="aspf" type="AlignmentType"
      minOccurs="0" maxOccurs="1"/>
    <!-- The policy published for messages from the domain. -->
    <xs:element name="p" type="DispositionType"
      minOccurs="0" maxOccurs="1"/>
    <!-- The policy published for messages from subdomains. -->
    <xs:element name="sp" type="DispositionType"
      minOccurs="0" maxOccurs="1"/>
    <!-- The percent declared in the DMARC record -->
    <xs:element name="pct" type="xs:integer"
      minOccurs="0" maxOccurs="1"/>
    <!-- Failure reporting options in effect. -->
    <xs:element name="fo" type="xs:string"
      minOccurs="0" maxOccurs="1"/>
  </xs:all>
</xs:complexType>

<!-- The DMARC-aligned authentication result. -->
<xs:simpleType name="DMARCResultType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="pass"/>
    <xs:enumeration value="fail"/>
  </xs:restriction>
</xs:simpleType>

<!-- Reasons that may affect DMARC disposition or execution
```



```
        thereof. -->
<xs:simpleType name="PolicyOverrideType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="forwarded"/>
    <xs:enumeration value="sampled_out"/>
    <xs:enumeration value="trusted_forwarder"/>
    <xs:enumeration value="mailing_list"/>
    <xs:enumeration value="local_policy"/>
    <xs:enumeration value="other"/>
  </xs:restriction>
</xs:simpleType>

<!-- How do we allow report generators to include new
      classes of override reasons if they want to be more
      specific than "other"? -->
<xs:complexType name="PolicyOverrideReason">
  <xs:all>
    <xs:element name="type" type="PolicyOverrideType"
      minOccurs="1" maxOccurs="1"/>
    <xs:element name="comment" type="xs:string"
      minOccurs="0" maxOccurs="1"/>
  </xs:all>
</xs:complexType>

<!-- Taking into account everything else in the record,
      the results of applying DMARC. -->
<xs:complexType name="PolicyEvaluatedType">
  <xs:sequence>
    <xs:element name="disposition" type="ActionDispositionType"/>
    <xs:element name="dkim" type="DMARCResultType"/>
    <xs:element name="spf" type="DMARCResultType"/>
    <xs:element name="reason" type="PolicyOverrideReason"
      minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<!-- Credit to Roger L. Costello for IPv4 regex
      http://mailman.ic.ac.uk/pipermail/xml-dev/1999-December/018018.html -->
<!-- Credit to java2s.com for IPv6 regex
      http://www.java2s.com/Code/XML/XML-Schema/IPv6addressesareeasytodescribeusingasimpleregex.htm -->
<xs:simpleType name="IPAddress">
  <xs:restriction base="xs:string">
    <xs:pattern value="((1?[0-9]?[0-9]|2[0-4][0-9]|25[0-5]).){3}
      (1?[0-9]?[0-9]|2[0-4][0-9]|25[0-5])|
      ([A-Fa-f0-9]{1,4}:){7}[A-Fa-f0-9]{1,4}"/>
  </xs:restriction>
```



```
</xs:simpleType>

<xs:complexType name="RowType">
  <xs:all>
    <!-- The connecting IP. -->
    <xs:element name="source_ip" type="IPAddress"
      minOccurs="1" maxOccurs="1"/>
    <!-- The number of messages for which the
    PolicyEvaluatedType was applied. -->
    <xs:element name="count" type="xs:integer"
      minOccurs="1" maxOccurs="1"/>
    <!-- The DMARC disposition applied to matching
    messages. -->
    <xs:element name="policy_evaluated"
      type="PolicyEvaluatedType"
      minOccurs="1" maxOccurs="1"/>
  </xs:all>
</xs:complexType>

<xs:complexType name="IdentifierType">
  <xs:all>
    <!-- The envelope recipient domain. -->
    <xs:element name="envelope_to" type="xs:string"
      minOccurs="0"/>
    <!-- The RFC5321.MailFrom domain. -->
    <xs:element name="envelope_from" type="xs:string"
      minOccurs="1"/>
    <!-- The RFC5322.From domain. -->
    <xs:element name="header_from" type="xs:string"
      minOccurs="1"/>
  </xs:all>
</xs:complexType>

<!-- DKIM verification result, according to RFC 7001
Section 2.6.1. -->
<xs:simpleType name="DKIMResultType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="none"/>
    <xs:enumeration value="pass"/>
    <xs:enumeration value="fail"/>
    <xs:enumeration value="policy"/>
    <xs:enumeration value="neutral"/>
    <xs:enumeration value="temperror"/>
    <xs:enumeration value="permerror"/>
  </xs:restriction>
</xs:simpleType>

<xs:complexType name="DKIMAuthResultType">
```



```
<xs:all>
  <!-- The "d=" parameter in the signature. -->
  <xs:element name="domain" type="xs:string"
    minOccurs="1" maxOccurs="1"/>
  <!-- The "s=" parameter in the signature. -->
  <xs:element name="selector" type="xs:string"
    minOccurs="1" maxOccurs="1"/>
  <!-- The DKIM verification result. -->
  <xs:element name="result" type="DKIMResultType"
    minOccurs="1" maxOccurs="1"/>
  <!-- Any extra information (e.g., from
    Authentication-Results). -->
  <xs:element name="human_result" type="xs:string"
    minOccurs="0" maxOccurs="1"/>
</xs:all>
</xs:complexType>

<!-- SPF domain scope. -->
<xs:simpleType name="SPFDomainScope">
  <xs:restriction base="xs:string">
    <xs:enumeration value="helo"/>
    <xs:enumeration value="mfrom"/>
  </xs:restriction>
</xs:simpleType>

<!-- SPF result. -->
<xs:simpleType name="SPFResultType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="none"/>
    <xs:enumeration value="neutral"/>
    <xs:enumeration value="pass"/>
    <xs:enumeration value="fail"/>
    <xs:enumeration value="softfail"/>
    <!-- "TempError" commonly implemented as "unknown". -->
    <xs:enumeration value="temperror"/>
    <!-- "PermError" commonly implemented as "error". -->
    <xs:enumeration value="permerror"/>
  </xs:restriction>
</xs:simpleType>

<xs:complexType name="SPFAuthResultType">
  <xs:all>
    <!-- The checked domain. -->
    <xs:element name="domain" type="xs:string"
      minOccurs="1" maxOccurs="1"/>
    <!-- The scope of the checked domain. -->
    <xs:element name="scope" type="SPFDomainScope"
      minOccurs="1" maxOccurs="1"/>
  </xs:all>
</xs:complexType>
```



```
<!-- The SPF verification result. -->
<xs:element name="result" type="SPFResultType"
    minOccurs="1" maxOccurs="1"/>
</xs:all>
</xs:complexType>

<!-- This element contains DKIM and SPF results, uninterpreted
    with respect to DMARC. -->
<xs:complexType name="AuthResultType">
    <xs:sequence>
        <!-- There may be no DKIM signatures, or multiple DKIM
            signatures. -->
        <xs:element name="dkim" type="DKIMAuthResultType"
            minOccurs="0" maxOccurs="unbounded"/>
        <!-- There will always be at least one SPF result. -->
        <xs:element name="spf" type="SPFAuthResultType" minOccurs="1"
            maxOccurs="unbounded"/>
    </xs:sequence>
</xs:complexType>

<!-- This element contains all the authentication results that
    were evaluated by the receiving system for the given set of
    messages. -->
<xs:complexType name="RecordType">
    <xs:sequence>
        <xs:element name="row" type="RowType"/>
        <xs:element name="identifiers" type="IdentifierType"
            minOccurs="1" maxOccurs="1"/>
        <xs:element name="auth_results" type="AuthResultType"
            minOccurs="1" maxOccurs="1"/>
    </xs:sequence>
</xs:complexType>

<!--
version: Version of the report format
-->
<!-- Parent -->
<xs:element name="feedback">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="version"
                minOccurs="1" maxOccurs="1" type="xs:decimal"/>
            <xs:element name="report_metadata"
                minOccurs="1" maxOccurs="1"
                type="ReportMetadataType"/>
            <xs:element name="policy_published"
                minOccurs="1" maxOccurs="1">
```



```
        type="PolicyPublishedType"/>
      <xs:element name="record" type="RecordType"
        minOccurs="1" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:schema>
```

9. [Appendix B](#). Sample Report


```
<feedback>
  <version>2.0</version>
  <report_metadata>
    <version>2</version>
    <org_name>Sample Reporter</org_name>
    <email>report_sender@example-reporter.com</email>
    <extra_contact_info>...</export_contact_info>
    <report_id>3v98abbp8ya9n3va8yr8oa3ya</report_id>
    <date_range>
      <begin>161212415</begin>
      <end>161221511</end>
    </date_range>
  </report_metadata>
  <policy_published>
    <domain>example.com</domain>
    <p>quarantine</p>
    <sp>none</sp>
    <pct>100</pct>
  </policy_published>
  <record>
    <row>
      <source_ip>192.168.4.4</source_ip>
      <count>123</count>
      <policy_evaluated>
        <disposition>quarantine</disposition>
        <dkim>pass</dkim>
        <spf>fail</spf>
      </policy_evaluated>
    </row>
    <identifiers>
      <header_from>example.com</header_from>
    </identifiers>
    <auth_results>
      <dkim>
        <domain>example.com</domain>
        <result>pass</result>
        <selector>abc123</selector>
      </dkim>
      <spf>
        <domain>example.com>
        <result>fail</result>
      </spf>
    </auth_results>
  </record>
</feedback>
```

10. Normative References

- [RFC6376] Crocker, D., Ed., Hansen, T., Ed., and M. Kucherawy, Ed., "DomainKeys Identified Mail (DKIM) Signatures", STD 76, [RFC 6376](#), DOI 10.17487/RFC6376, September 2011, <<https://www.rfc-editor.org/info/rfc6376>>.
- [RFC7208] Kitterman, S., "Sender Policy Framework (SPF) for Authorizing Use of Domains in Email, Version 1", [RFC 7208](#), DOI 10.17487/RFC7208, April 2014, <<https://www.rfc-editor.org/info/rfc7208>>.

11. Informative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.

Author's Address

Alex Brotman
Comcast, Inc.

Email: alex_brotman@comcast.com

