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XML Media Types

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Abstract

This document proposes two new media subtypes, text/xml and application/xml, for use in exchanging network entities which are conforming Extensible Markup Language (XML). XML entities are currently exchanged via the HyperText Transfer Protocol on the World Wide Web, are an integral part of the WebDAV protocol for remote web authoring, and are expected to have utility in many domains.

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1 Introduction

The World Wide Web Consortium (W3C) has issued a Recommendation [REC-XML] which defines the Extensible Markup Language (XML), version 1. To enable the exchange of XML network entities, this document proposes two new media types, text/xml and application/xml.

XML entities are currently exchanged on the World Wide Web, and XML is also used for property values and parameter marshalling by the WebDAV protocol for remote web authoring. Thus, there is a need for a media type to properly label the exchange of XML network entities. (Note that, as sometimes happens between two communities, both MIME and XML have defined the term entity, with different meanings.)

Although XML is a subset of the Standard Generalized Markup Language (SGML) [ISO-8897], and currently is assigned the media types text/sgml and application/sgml, there are several reasons why use of text/sgml or application/sgml to label XML is inappropriate. First, there exist many applications which can process XML, but which cannot process SGML, due to SGML's larger feature set. Second, SGML applications cannot always process XML entities, because XML uses features of recent technical corrigenda to SGML. Third, the definition of text/sgml and application/sgml [RFC-1874] includes parameters for SGML bit combination transformation format (SGML-bctf), and SGML boot attribute (SGML-boot). Since XML does not use these parameters, it would be ambiguous if such parameters were given for an XML entity. For these reasons, the best approach for labeling XML network entities is to provide new media types for XML.

Since XML is an integral part of the WebDAV Distributed Authoring Protocol, and since World Wide Web Consortium Recommendations have conventionally been assigned IETF tree media types, and since similar media types (HTML, SGML) have been assigned IETF tree media types, the XML media types also belong in the IETF media types tree.

2 Notational Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC-2119].

3 XML Media Types

This document introduces two new media types for XML entities, text/xml and application/xml. Registration information for these media types are described in the sections below.

Every XML entity is suitable for use with the application/xml media type without modification. But this does not exploit the fact that XML can be treated as plain text in many cases. MIME user agents (and web user agents) that do not have explicit support for application/xml will treat it as application/octet-stream, for example, by offering to save it to a file.

To indicate that an XML entity should be treated as plain text by default, use the text/xml media type. This restricts the encoding used in the XML entity to those that are compatible with the requirements for text media types as described in [RFC-2045] and [RFC-2046], e.g., UTF-8, but not UTF-16 (except for HTTP).

XML provides a general framework for defining sequences of structured data. In some cases, it may be desirable to define new media types which use XML but define a specific application of XML, perhaps due to domain-specific security considerations or runtime information. This document does not prohibit future media types dedicated to such XML applications. However, developers of such media types are recommended to use this document as a basis. In particular, the charset parameter should be used in the same manner.

Within the XML specification, XML entities can be classified into four types. In the XML terminology, they are called "document entities", "external DTD subsets", "external parsed entities", and "external parameter entities". The media types text/xml and application/xml can be used for any of these four types.

3.1 Text/xml Registration

MIME media type name: text

MIME subtype name: xml

Mandatory parameters: none

Optional parameters: charset

Although listed as an optional parameter, the use of the charset parameter is STRONGLY RECOMMENDED, since this information can be used by XML processors to determine authoritatively the character encoding of the XML entity. The charset parameter can also be used to provide protocol-specific operations, such as charset-based content negotiation in HTTP. "UTF-8" [RFC-2279] is the recommended value, representing the UTF-8 charset. UTF-8 is supported by all conforming XML processors [REC-XML].

If the XML entity is transmitted via HTTP, which uses a MIME-like mechanism that is exempt from the restrictions on the text top-level type (see section 19.4.1 of HTTP 1.1 [RFC-2068]), "UTF-16" (Appendix C.3 of [UNICODE] and Amendment 1 of [ISO-10646]) is also recommended. UTF-16 is supported by all conforming XML processors [REC-XML]. Since the handling of CR, LF and NUL for text types in most MIME applications would cause undesired transformations of individual octets in UTF-16 multi-octet characters, gateways from HTTP to these MIME applications MUST transform the XML entity from a text/xml; charset="utf-16" to application/xml; charset="utf-16".

Conformant with [RFC-2046], if a text/xml entity is received with the charset parameter omitted, MIME processors and XML processors MUST use the default charset value of "us-ascii". In cases where the XML entity is transmitted via HTTP, the default charset value is still "us-ascii".

Since the charset parameter is authoritative, the charset is not always declared within an XML encoding declaration. Thus, special care is needed when the recipient strips the MIME header and provides persistent storage of the received XML entity (e.g., in a file system). Unless the charset is UTF-8 or UTF-16, the recipient SHOULD also persistently store information about the charset, perhaps by embedding a correct XML encoding declaration within the XML entity.

Encoding considerations:

This media type MAY be encoded as appropriate for the charset and the capabilities of the underlying MIME transport. For 7-bit transports, data in both UTF-8 and UTF-16 is encoded in quoted-printable or base64. For 8-bit clean transport (e.g., ESMTP, 8BITMIME, or NNTP), UTF-8 is not encoded, but UTF-16 is base64 encoded. For binary clean transports (e.g., HTTP), no content-transfer-encoding is necessary.

Security considerations:

See section 4 below.

Interoperability considerations:

XML has proven to be interoperable across WebDAV clients and servers, and for import and export from multiple XML authoring tools.

Published specification: see [REC-XML]

Applications which use this media type:

XML is device-, platform-, and vendor-neutral and is supported by a wide range of Web user agents, WebDAV clients and servers, as well as XML authoring tools.

Additional information:

Magic number(s): none

Although no byte sequences can be counted on to always be present, XML entities in ASCII-compatible charsets (including UTF-8) often begin with hexadecimal 3C 3F 78 6D 6C ("<?xml"). For more information, see Appendix F of [REC-XML].

File extension(s): .xml, .dtd
Macintosh File Type Code(s): "TEXT"

Person & email address for further information:

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Intended usage: COMMON

Author/Change controller:

The XML specification is a work product of the World Wide Web Consortium's XML Working Group, and was edited by:

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The W3C, and the W3C XML working group, has change control over the XML specification.

3.2 Application/xml Registration

MIME media type name: application

MIME subtype name: xml

Mandatory parameters: none

Optional parameters: charset

Although listed as an optional parameter, the use of the charset parameter is STRONGLY RECOMMENDED, since this information can be used by XML processors to determine authoritatively the charset of the XML entity. The charset parameter can also be used to provide protocol-specific operations, such as charset-based content negotiation in HTTP.

"UTF-8" [RFC-2279] and "UTF-16" (Appendix C.3 of [UNICODE] and Amendment 1 of [ISO-10646]) are the recommended values, representing the UTF-8 and UTF-16 charsets, respectively. These charsets are preferred since they are supported by all conforming XML processors [REC-XML].

If an application/xml entity is received where the charset parameter is omitted, no information is being provided about the charset by the MIME Content-Type header. Conforming XML processors MUST follow the requirements in section 4.3.3 of [REC-XML] which directly address this contingency. However, MIME processors which are not XML processors should not assume a default charset if the charset parameter is omitted from an application/xml entity.

Since the charset parameter is authoritative, the charset is not always declared within an XML encoding declaration. Thus, special care is needed when the recipient strips the MIME header and provides persistent storage of the received XML entity (e.g., in a file system). Unless the charset is UTF-8 or UTF-16, the recipient SHOULD also persistently store information about the charset, perhaps by embedding a correct XML encoding declaration within the XML entity.

Encoding considerations:

This media type MAY be encoded as appropriate for the charset and the capabilities of the underlying MIME transport. For 7-bit transports, data in both UTF-8 and UTF-16 is encoded in quoted-printable or base64. For 8-bit clean transport (e.g., ESMTP, 8BITMIME, or NNTP), UTF-8 is not encoded, but UTF-16 is base64 encoded. For binary clean transport (e.g., HTTP), no content-transfer-encoding is necessary.

Security considerations:

See section 4 below.

Interoperability considerations:

XML has proven to be interoperable for import and export from multiple XML authoring tools.

Published specification: see [REC-XML]

Applications which use this media type:

XML is device-, platform-, and vendor-neutral and is supported by a wide range of Web user agents and XML authoring tools.

Additional information:

Magic number(s): none

Although no byte sequences can be counted on to always be present, XML entities in ASCII-compatible charsets (including UTF-8) often begin with hexadecimal 3C 3F 78 6D 6C ("<?xml"), and those in UTF-16 often begin with hexadecimal FE FF 00 3C 00 3F 00 78 00 6D or FF FE 3C 00 3F 00 78 00 6D 00 (the Byte Order Mark (BOM) followed by "<?xml"). For more information, see Annex F of [REC-XML].

File extension(s): .xml, .dtd
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4 Security Considerations

XML, as a subset of SGML, has the same security considerations as specified in [RFC-1874].

To paraphrase section 3 of [RFC-1874], XML entities contain information to be parsed and processed by the recipient's XML system. These entities may contain and such systems may permit explicit system level commands to be executed while processing the data. To the extent that an XML system will execute arbitrary command strings, recipients of XML entities may be at risk. In general, it may be possible to specify commands that perform unauthorized file operations or make changes to the display processor's environment that affect subsequent operations.

Use of XML is expected to be varied, and widespread. XML is under scrutiny by a wide range of communities for use as a common syntax for community-specific metadata. For example, the Dublin Core group is using XML for document metadata, and a new effort has begun which is considering use of XML for medical information. Other groups view XML as a mechanism for marshalling parameters for remote procedure calls. More uses of XML will undoubtedly arise.

Security considerations will vary by domain of use. For example, XML medical records will have much more stringent privacy and security considerations than XML library metadata. Similarly, use of XML as a parameter marshalling syntax necessitates a case by case security review.

XML may also have some of the same security concerns as plain text. Like plain text, XML can contain escape sequences which, when displayed, have the potential to change the display processor environment in ways that adversely affect subsequent operations. Possible effects include, but are not limited to, locking the keyboard, changing display parameters so subsequent displayed text is unreadable, or even changing display parameters to deliberately

obscure or distort subsequent displayed material so that its meaning is lost or altered. Display processors should either filter such material from displayed text or else make sure to reset all important settings after a given display operation is complete.

Some terminal devices have keys whose output, when pressed, can be changed by sending the display processor a character sequence. If this is possible the display of a text object containing such character sequences could reprogram keys to perform some illicit or dangerous action when the key is subsequently pressed by the user. In some cases not only can keys be programmed, they can be triggered remotely, making it possible for a text display operation to directly perform some unwanted action. As such, the ability to program keys should be blocked either by filtering or by disabling the ability to program keys entirely.

Note that it is also possible to construct XML documents which make use of what XML terms "entity references" (using the XML meaning of the term "entity", which differs from the MIME definition of this term), to construct repeated expansions of text. Recursive expansions are prohibited [REC-XML] and XML processors are required to detect them. However, even non-recursive expansions may cause problems with the finite computing resources of computers, if they are performed many times.

5 The Byte Order Mark (BOM) and Conversions to/from UTF-16

The XML Recommendation, in section 4.3.3, specifies that UTF-16 XML entities must begin with a byte order mark (BOM), which is the ZERO WIDTH NO-BREAK SPACE character, hexadecimal sequence 0xFEFF (or 0xFFFE, depending on endian). The XML Recommendation further states that the BOM is an encoding signature, and is not part of either the markup or the character data of the XML document.

Due to the BOM, applications which convert XML from the UTF-16 encoding to another encoding SHOULD strip the BOM before conversion. Similarly, when converting from another encoding into UTF-16, the BOM SHOULD be added after conversion is complete.

6 Examples

The examples below give the value of the Content-type MIME header and the XML declaration (which includes the encoding declaration) inside the XML entity. For UTF-16 examples, the Byte Order Mark character is denoted as "{BOM}", and the XML declaration is assumed to come at the beginning of the XML entity, immediately following the BOM. Note that other MIME headers may be present, and the XML entity may

contain other data in addition to the XML declaration; the examples focus on the Content-type header and the encoding declaration for clarity.

6.1 text/xml with UTF-8 Charset

Content-type: text/xml; charset="utf-8"

<?xml version="1.0" encoding="utf-8"?>

This is the recommended charset value for use with text/xml. Since the charset parameter is provided, MIME and XML processors must treat the enclosed entity as UTF-8 encoded.

If sent using a 7-bit transport (e.g. SMTP), the XML entity must use a content-transfer-encoding of either quoted-printable or base64. For an 8-bit clean transport (e.g., ESMTP, 8BITMIME, or NNTP), or a binary clean transport (e.g., HTTP) no content-transfer-encoding is necessary.

6.2 text/xml with UTF-16 Charset

Content-type: text/xml; charset="utf-16"

{BOM}<?xml version='1.0' encoding='utf-16'?>

This is possible only when the XML entity is transmitted via HTTP, which uses a MIME-like mechanism and is a binary-clean protocol, hence does not perform CR and LF transformations and allows NUL octets. This differs from typical text MIME type processing (see section 19.4.1 of HTTP 1.1 [RFC-2068] for details).

Since HTTP is binary clean, no content-transfer-encoding is necessary.

6.3 text/xml with ISO-2022-KR Charset

Content-type: text/xml; charset="iso-2022-kr"

<?xml version="1.0" encoding='iso-2022-kr'?>

This example shows text/xml with a Korean charset (e.g., Hangul) encoded following the specification in [RFC-1557]. Since the charset parameter is provided, MIME and XML processors must treat the enclosed entity as encoded per [RFC-1557].

Since ISO-2022-KR has been defined to use only 7 bits of data, no content-transfer-encoding is necessary with any transport.

6.4 text/xml with Omitted Charset

```
Content-type: text/xml

{BOM}<?xml version="1.0" encoding="utf-16"?>
```

This example shows text/xml with the charset parameter omitted. In this case, MIME and XML processors must assume the charset is "us-ascii", the default charset value for text media types specified in [RFC-2046]. The default of "us-ascii" holds even if the text/xml entity is transported using HTTP.

Omitting the charset parameter is NOT RECOMMENDED for text/xml. For example, even if the contents of the XML entity are UTF-16 or UTF-8, or the XML entity has an explicit encoding declaration, XML and MIME processors must assume the charset is "us-ascii".

6.5 application/xml with UTF-16 Charset

```
Content-type: application/xml; charset="utf-16"

{BOM}<?xml version="1.0"?>
```

This is a recommended charset value for use with application/xml. Since the charset parameter is provided, MIME and XML processors must treat the enclosed entity as UTF-16 encoded.

If sent using a 7-bit transport (e.g., SMTP) or an 8-bit clean transport (e.g., ESMTP, 8BITMIME, or NNTP), the XML entity must be encoded in quoted-printable or base64. For a binary clean transport (e.g., HTTP), no content-transfer-encoding is necessary.

6.6 application/xml with ISO-2022-KR Charset

```
Content-type: application/xml; charset="iso-2022-kr"

<?xml version="1.0" encoding="iso-2022-kr"?>
```

This example shows application/xml with a Korean charset (e.g., Hangul) encoded following the specification in [RFC-1557]. Since the charset parameter is provided, MIME and XML processors must treat the enclosed entity as encoded per [RFC-1557], independent of whether the XML entity has an internal encoding declaration (this example does show such a declaration, which agrees with the charset parameter).

Since ISO-2022-KR has been defined to use only 7 bits of data, no content-transfer-encoding is necessary with any transport.

6.7 application/xml with Omitted Charset and UTF-16 XML Entity

Content-type: application/xml

{BOM}<?xml version='1.0'?>

For this example, the XML entity begins with a BOM. Since the charset has been omitted, a conforming XML processor follows the requirements of [REC-XML], section 4.3.3. Specifically, the XML processor reads the BOM, and thus knows deterministically that the charset encoding is UTF-16.

An XML-unaware MIME processor should make no assumptions about the charset of the XML entity.

6.8 application/xml with Omitted Charset and UTF-8 Entity

Content-type: application/xml

<?xml version='1.0'?>

In this example, the charset parameter has been omitted, and there is no BOM. Since there is no BOM, the XML processor follows the requirements in section 4.3.3, and optionally applies the mechanism described in appendix F (which is non-normative) of [REC-XML] to determine the charset encoding of UTF-8. The XML entity does not contain an encoding declaration, but since the encoding is UTF-8, this is still a conforming XML entity.

An XML-unaware MIME processor should make no assumptions about the charset of the XML entity.

6.9 application/xml with Omitted Charset and Internal Encoding Declaration

Content-type: application/xml

<?xml version='1.0' encoding="ISO-10646-UCS-4"?>

In this example, the charset parameter has been omitted, and there is no BOM. However, the XML entity does have an encoding declaration inside the XML entity which specifies the entity's charset. Following the requirements in section 4.3.3, and optionally applying the mechanism described in appendix F (non-normative) of [REC-XML], the XML processor determines the charset encoding of the XML entity (in this example, UCS-4).

An XML-unaware MIME processor should make no assumptions about the charset of the XML entity.

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8 Acknowledgements

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