leviathan
security group

Flirting with MIME Types:

A Browser's Perspective

Blake Frantz (bfrantz@leviathansecurity.com)

February 11, 2008

Contents

Background 3
Browser MIME Detection 3
Methodology 3
Results 3
Conclusion 4
Future Work 4
Acknowledgments 4
Bibliography 4
Appendix A 5
- Testing Results 5
- Browser MIME Detection Details 7
  - Internet Explorer 7
  - Firefox 8
  - Opera 8
  - Safari 8
- Testing Environment 9
  - Browsers Tested 9
  - MIME Types Used 9
  - Content-Disposition 9
  - Data Files Used 9
- MIME Types Tested 11

Background

An increasing number of websites are providing file upload capabilities. Additionally, social networking sites are encouraging their user communities to upload arbitrary files to be shared with other users of the site. File upload features increase the risk to the hosting site and its users. These mechanisms can allow malicious users to introduce harmful content through malformed file formats, malware, or active content. It is the latter threat that is the focus of this paper – to determine under which MIME related conditions a browser will render data as active content[1].

This is not the first attempt to determine how browsers behave when faced with a range of MIME and data types. Previous research has uncovered several security issues related to improper handling of MIME types. However, previous research did not systematically cover available browsers and MIME types.

Browser MIME Detection

Popular web browser software detects MIME types in various ways[2]. Based on our analysis of the published mechanisms, one would expect all of them to render content, such as HTML, for only a limited set of Content-Types, including "text/html". Our testing demonstrated this is not always the case, however, as we will show later.

Methodology

Testing involved the generation of an HTML document that contains an array of specially crafted URLs. Once loaded in a browser, the web page iterates over the list of URLs directing an internal iframe to these URLs. Each URL points to a web service that parses the request to determine the type of response to deliver. This includes information regarding the content to send, the Content-Disposition to use, and the Content-Type to advertise the content as. Each response is embedded with an IMG tag pointing to an alerter service. If the browser renders the content it will request the embedded image. The alerter service then uses information within the request to determine which URL caused the rendering. This information is then logged for analysis. See the Testing Environment section for additional information on the methodology used.

Results

The goal of this testing was to determine the MIME type related conditions under which popular web browser software will render active content. Overall, 735 Content-Types were incorporated into 13158 tests across four (4) web browsers. The following table provides the number of Content-Types that resulted in rendered active content for each browser:

Browser	Content-Types Rendered
Internet Explorer	696
Opera	14
FireFox	8
Safari	7

[1] This document does not address scenarios where a browser plug-in or extension renders active content or HTML. Implications for delivering active content in the form of an ActiveX, Java Applet, Flash, or QuickTime objects were not tested.

[2] See Browser MIME Detection Details in Appendix A

Of the browsers tested, Internet Explorer demonstrated the least discrimination between data and active content, rendering 696 Content-Types as HTML. Leviathan believes this to be potentially dangerous behavior as end-users and content hosts could be exposed to malicious active content in unexpected situations. Based on the information explored in the Browser MIME Detection Details section, Firefox, Safari and Opera browsers performed as expected. For a complete list of testing results, see the Testing Results section in Appendix A. Additionally, no test resulted in active content being rendered when the Content-Disposition HTTP header was set to "attachment".

Conclusion

Based on our initial research, Leviathan recommends that websites delivering content from un-trusted sources set the Content-Disposition type to "attachment"[3] to more strictly specify expected behavior of MIME data. This will avoid undesired side effects caused by the unexpected rendering of active content.

Leviathan also encourages those organizations responsible for browser development to maintain a public list of conditions under which their respective browser will render data as active content. This will provide developers with the information necessary to make informed security decisions when hosting or distributing content.

Future Work

The current testing was designed to identify how browsers behave when faced with forms of HTML-based active content and contradicting Content-Types. However, additional scenarios remain to be tested. Those scenarios include:

1. The impact of various Content-Encoding headers on the browser's rendering behavior.
2. The impact of altering the file extension of the file name attribute within the Content-Disposition header. All tests in this round used "txt" as the internal extension where applicable.
3. The impact of various multi-part MIME formats on the browser's rendering behavior

Acknowledgments

The author would like to acknowledge the following people for their assistance: Mike de Libero and Richard Johnson of Microsoft Corp.; and Chad Thunberg, Michael Eddington, Myles Conley, Matt Miller, and Rex Warren of Leviathan Security Group.

Bibliography

[1] Opera, S. (n.d.). *Changing preferences for file types in Opera*. Retrieved February 11, 2008, from Opera Software: http://www.opera.com/support/search/view/758/

[2] Anonsen, E. B. (2002, August 16). *Opera-Linux ListServ*. Retrieved February 11, 2008, from mime-settings: http://list.opera.com/pipermail/opera-linux/2002-August/003428.html

[3] Apple. (2007, 12 11). *NSURLResponse Class Reference*. Retrieved February 11, 2008, from Apple Developer Connection: http://developer.apple.com/documentation/Cocoa/Reference/Foundation/Classes/NSURLResponse_Class/Reference/Reference.html#//apple_ref/occ/instm/NSURLResponse/MIMEType

[4] Biesinger (Mozilla), C. (2005, March 7). *How Mozilla Determines File Types*. Retrieved February 11, 2008, from Mozilla Developer Center: http://developer.mozilla.org/en/docs/How_Mozilla_determines_MIME_Types

[3] See [6] for additional information on the Content-Disposition HTTP header

[5] Microsoft. (n.d.). *MIME Type Detection in Internet Explorer*. Retrieved February 11, 2008, from MSDN: Internet Explorer Developer Center: http://msdn2.microsoft.com/en-us/library/ms775147.aspx
[6] R. Troost. (1997, August). *Communicating Presentation Information inInternet Messages: The Content-Disposition Header Field*. Retrieved February 11, 2008, from IEFT: http://www.ietf.org/rfc/rfc2183.txt
[7] N. Freed. (1996, November). *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodie*. Retrieved February 11, 2008, from IEFT: http://www.ietf.org/rfc/rfc2045.txt
[8] N. Freed. (1996, November). *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*. Retrieved February 11, 2008, from IEFT: http://www.ietf.org/rfc/rfc2045.txt
[9] K.Moore. (1996, November). *Multipurpose Internet Mail Extensions (MIME) Part Three: Message Header Extensions for Non-ASCII Text*. Retrieved February 11, 2008, from IEFT: http://www.ietf.org/rfc/rfc2047.txt
[10] Microsoft. (2008). *MIME Type Detection in Internet Explorer*. Retrieved February 11, 2008, from MSDN: http://msdn2.microsoft.com/en-us/library/ms775147(VS.85).aspx
[11] Microsoft. (2008). *How Mozilla determines MIME Types.* Retrieved February 11, 2008, from Mozilla developer center: http://developer.mozilla.org/en/docs/How_Mozilla_determines_MIME_Types
[12] IANA. (2008). *IANA MIME Media Types.* Retrieved February 11, 2008, from IANA: http://www.iana.org/assignments/media-types/

Appendix A

Testing Results

Below is a summary of behaviors exhibited by the browsers during testing.

1. Internet Explorer will render active content (HTML) under the following circumstances. We believe this to be potentially dangerous behavior as end-users could be exposed to malicious active content in unexpected situations.
    - Content-Disposition is not present or set to “inline”
      and
    - Content-Type is **NOT**[4]
        - application/hta
        - application/macbinhex40
        - application/mac-binhex40
        - application/pkcs10
        - application/pkcs7-mime
        - application/pkcs7-signature
        - application/pkix-cert
        - application/pkix-crl
        - application/rss+xml
        - application/sdp
        - application/vnd.fdf
        - application/vnd.ms-pki.seccat
        - application/vnd.ms-pki.stl
        - application/vnd.pwg-xhtml-print+xml
        - application/x-latex

[4] During these tests, Internet Explorer rendered data as HTML for all other advertised Content-Types, including text/plain. See MIME Types Tested for the complete list. Many of the above Content-Types (e.g. video/audio/pkcs/etc) did not render as HTML because of default handlers such as Media Player and Certificate Manager.

- application/xml
- application/xml-dtd
- application/xml-external-parsed-entity
- application/x-ms-wmd
- application/x-ms-wmz
- application/x-pkcs7-certreqresp
- application/x-stuffit
- application/x-tar
- application/x-troff-man
- application/x-x509-ca-cert
- audio/midi
- audio/mpeg
- audio/mpegurl
- audio/mpegurl
- audio/vnd.qcelp
- audio/x-gsm
- audio/x-mpegurl
- audio/x-ms-wax
- audio/x-ms-wma
- audio/x-scpls
- audio/x-wav
- image/x-icon
- message/rfc822
- text/css
- text/xml
- video/mp4
- video/mp4v-es
- video/x-ms-asf
- video/x-ms-wm
- video/x-ms-wmv
- video/x-ms-wmv
- video/x-ms-wmx
- video/x-ms-wmx
- video/x-ms-wvx

2. Firefox will render active content (HTML) under the following circumstances:
    - Content-Disposition is not present or set to “inline”
      and
    - The Content-Type is either:
        - application/rdf+xml
        - application/vnd.mozilla.xul+xml
        - application/xhtml+xml
        - application/xml
        - application/vnd.pwg-xhtml-print+xml
        - image/svg+xml
        - text/html
        - text/xml

3. Opera will render active content (HTML) under the following circumstances:
    - Content-Disposition is not present or set to “inline”
      and
    - The Content-Type is either:
        - application/beep+xml
        - application/docbook+xml
        - application/rdf+xml
        - application/rss+xml
        - application/vnd.irepository.package+xml
        - application/vnd.mozilla.xul+xml
        - application/vnd.pwg-xhtml-print+xml
        - application/xhtml+xml
        - application/xml
        - application/vnd.pwg-xhtml-print+xml
        - image/svg+xml
        - text/html
        - text/vnd.wap.wml
        - text/xml

4. Safari will render active content (HTML) under the following circumstances:
    - Content-Disposition is not present or set to “inline”
      and
    - The Content-Type is either:
        - application/xhtml+xml
        - application/xml
        - application/vnd.pwg-xhtml-print+xml
        - image/svg+xml
        - text/html
        - text/xml
        - text/xsl

Browser MIME Detection Details

Each browser has a documented method for determining the MIME type of an online resource. The following articulates those methods according to each browser developer.

Internet Explorer

According to Microsoft[5], Internet Explorer will perform the following actions to determine the appropriate MIME type for downloaded content:

1. Obtain the server-supplied MIME type (typically via the Content-Type HTTP header), if available
2. Examine the actual contents associated with a downloaded URL
3. Obtain the file name associated with the downloaded content (assumed to be derived from the associated URL)
4. Enumerate registry settings (file extension/MIME type associations or registered applications) impacted during the download

Firefox

According to Biesinger of Mozilla[4], Mozilla browsers will perform the following actions to determine the appropriate MIME type for the downloaded content:

1. Obtain the server-supplied MIME type, if available
2. When the Content-Type sent by the server is one of (case-sensitively):

    - text/plain
    - text/plain; charset=ISO-8859-1
    - text/plain; charset=iso-8859-1

    and the server did not send a Content-Encoding header, Mozilla will evaluate the first block of data it gets and check for non-text bytes. Text bytes are 9-13, 27, and 31-255. When encountering a non-text byte, the helper app dialog will be shown, showing the MIME type corresponding to the extension of the file.

3. If the server did not send a Content-Type header, Mozilla uses the unknown decoder to find a MIME type.

    3.1 Checks the start of the file for "magic numbers"; this can currently detect PDF and Postscript.
    3.2 If the file starts with <?xml, asks the ExternalHelperAppService for a MIME type for the URI. This is done because the generic text/xml MIME type does not work for XUL files, and XHTML files get a different DOM when interpreted as text/xml.
    3.3 The Image Library will be asked for the MIME type given the content. This should allow reliable detection of all image types Mozilla supports.
    3.4 Checks whether the data is HTML by looking for some common HTML tags.
    3.5 The URI is handed to the ExternalHelperAppService for MIME type guessing
    3.6 If all else fails, the buffer (i.e. the first few bytes of the file) is searched for embedded nulls; if none are found, text/plain will be used, otherwise application/octet-stream.

Opera

We could not find an authoritative and comprehensive resource to describe how Opera determines the appropriate MIME type. According to Opera[1] and Anonsen[2], it appears that Opera performs the following steps to determine how to process a given resource:

1. Evaluate the advertized type from the Content-Type HTTP header.
2. Evaluate the file extension of the resource.
3. “Detect” the Content-Type by examining the resource.

Safari

According to Apple[3], Safari will perform the following actions to determine the appropriate MIME type for downloaded content:

The MIME type is often provided by the response’s originating source. However, that value may be changed or

corrected by a protocol implementation if it can be determined that the response's source reported the information incorrectly.
…
If the response's originating source does not provide a MIME type, an attempt to guess the MIME type may be made.

Testing Environment

The following section describes the testing environment used to derive the results presented in this document.

Browsers Tested

The following browser versions were tested[6].

Browser	URL
Internet Explorer 7.0.6000.16575 (Win32)	http://www.microsoft.com/windows/products/winfamily/ie
FireFox 2.0.0.11 (Win32)	http://www.mozilla.com/en-US/firefox/
Opera 9.25 (Win32)	http://www.opera.com/download/
Safari 3.0.4 (Win32)	http://www.apple.com/safari/download/

MIME Types Used

735 MIME types[7], in conjunction with the various data files, and Content-Dispositions we used to test each browser. For a complete list of MIME types used see MIME Types Tested in Appendix A.

Content-Disposition

The "Content-Disposition" HTTP header is used to convey presentation information along with MIME messages [6]. The following three (3) Content-Disposition scenarios were tested.

Disposition Scenario	Comment
None	No Content-Disposition header was sent
Inline	Content-Disposition header specifying "inline" was sent by the server.
attachment	Content-Disposition header specifying "attachment" was sent by the server.

Data Files Used

The following data files were sent for each MIME Content-Type and Content-Disposition value. Often, browser rendering behavior varies with HTML conformance. To address this, these forms of HTML content were sent to the browser to ensure our ability to detect an attempt to render HTML content.

Note: each `%s` variable is replaced at request time with data used to track which request was rendered.

HTML4

```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01//EN" "http://www.w3.org/TR/1999/REC-html401-19991224/strict.dtd">
```

[6] Internet Explorer was tested within the Internet Zone with default security settings applied. The test system was a fully patched instance of Microsoft Vista Ultimate. Installed software packages may have altered the browser's rendering behavior.

[7] See [8] and [12] for additional information on MIME Types.

```
<HTML>
  <HEAD>
    <TITLE>TEST</TITLE>
  </HEAD>
  <BODY>
        <DIV id="foo"><IMG src="%s" alt="foo"></DIV>
  </BODY>
</HTML>
```

HTML4 without DOCTYPE

```
<HTML>
  <HEAD>
    <TITLE>TEST</TITLE>
  </HEAD>
  <BODY>
        <DIV id="foo"><IMG src="%s" alt="foo"></DIV
  </BODY>
</HTML>
```

HTML4 with XSL Reference

```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01//EN" "http://www.w3.org/TR/1999/REC-html401-
19991224/strict.dtd">
<?xml-stylesheet type="text/xsl" href="http://127.0.0.1:8000/xsl,txtxsl,none,0,0"?>
<HTML>
  <HEAD>
    <TITLE>TEST</TITLE>
  </HEAD>
  <BODY>
     %s
  </BODY>
</HTML>
```

HTML4 without DOCTYPE with XSL Reference

```
<?xml-stylesheet type="text/xsl" href="http://127.0.0.1:8000/xsl,txtxsl,none,0,0"?>
<HTML>
  <HEAD>
    <TITLE>TEST</TITLE>
  </HEAD>
  <BODY>
     %s
  </BODY>
</HTML>
```

XSL Referenced by Other Data Files

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">
<xsl:template match="/">
<HTML>
        <BODY>
        <div id="foo">
          <img src="%s" alt="foo">
        </div>
</BODY>
</HTML>
</xsl:template>
</xsl:stylesheet>
```

XHTML

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/2002/REC-xhtml1-
20020801/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <title>TEST</title>
  </head>
  <body>
        <div id="foo">
          <img src="%s" alt="foo" />
        </div>
  </body>
</html>
```

XHTML without DOCTYPE

```
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <title>TEST</title>
  </head>
  <body>
        <div id="foo">
          <img src="%s" alt="foo" />
        </div>
  </body>
</html>
```

MIME Types Tested

application/vnd.ecowin.filerequest	chemical/x-cache	application/activemessage

application/vnd.ecowin.fileupdate	chemical/x-cache-csf	application/andrew-inset
application/vnd.ecowin.series	chemical/x-cactvs-binary	application/applefile
application/vnd.ecowin.seriesrequest	chemical/x-cdx	application/atomicmail
application/vnd.ecowin.seriesupdate	chemical/x-cerius	application/base64
application/vnd.enliven	chemical/x-chem3d	application/batch-SMTP
application/vnd.epson.esf	chemical/x-chemdraw	application/beep+xml
application/vnd.epson.msf	chemical/x-cif	application/cals-1840
application/vnd.epson.quickanime	chemical/x-cmdf	application/commonground
application/vnd.epson.salt	chemical/x-cml	application/cu-seeme
application/vnd.epson.ssf	chemical/x-compass	application/cybercash
application/vnd.ericsson.quickcall	chemical/x-crossfire	application/dca-rft
application/vnd.eudora.data	chemical/x-csml	application/dec-dx
application/vnd.fdf	chemical/x-ctx	application/docbook+xml
application/vnd.ffsns	chemical/x-cxf	application/dsptype
application/vnd.flographit	chemical/x-embl-dl-nucleotide	application/dvcs
application/vnd.framemaker	chemical/x-galactic-spc	application/edi-consent
application/vnd.fsc.weblaunch	chemical/x-gamess-input	application/edi-x12
application/vnd.fujitsu.oasys	chemical/x-gaussian-checkpoint	application/edifact
application/vnd.fujitsu.oasys2	chemical/x-gaussian-cube	application/eshop
application/vnd.fujitsu.oasys3	chemical/x-gaussian-input	application/font-tdpfr
application/vnd.fujitsu.oasysgp	chemical/x-gaussian-log	application/futuresplash
application/vnd.fujitsu.oasysprs	chemical/x-gcg8-sequence	application/ghostview
application/vnd.fujixerox.ddd	chemical/x-genbank	application/hta
application/vnd.fujixerox.docuworks	chemical/x-hin	application/http
application/vnd.fujixerox.docuworks.binder	chemical/x-isostar	application/hyperstudio
application/vnd.fut-misnet	chemical/x-jcamp-dx	application/iges
application/vnd.grafeq	chemical/x-kinemage	application/index
application/vnd.groove-account	chemical/x-macmolecule	application/index.cmd
application/vnd.groove-identity-message	chemical/x-macromodel-input	application/index.obj
application/vnd.groove-injector	chemical/x-mdl-molfile	application/index.response
application/vnd.groove-tool-message	chemical/x-mdl-rdfile	application/index.vnd
application/vnd.groove-tool-template	chemical/x-mdl-rxnfile	application/iotp
application/vnd.groove-vcard	chemical/x-mdl-sdfile	application/ipp
application/vnd.hhe.lesson-player	chemical/x-mdl-tgf	application/isup
application/vnd.hp-HPGL	chemical/x-mmcif	application/java
application/vnd.hp-PCL	chemical/x-mol2	application/java-archive

application/vnd.hp-PCLXL	chemical/x-molconn-Z	application/java-serialized-object
application/vnd.hp-hpid	chemical/x-mopac-graph	application/java-vm
application/vnd.hp-hps	chemical/x-mopac-input	application/mac-binhex40
application/vnd.httphone	chemical/x-mopac-out	application/mac-compactpro
application/vnd.hzn-3d-crossword	chemical/x-mopac-vib	application/macbinhex40
application/vnd.ibm.MiniPay	chemical/x-ncbi-asn1	application/macwriteii
application/vnd.ibm.afplinedata	chemical/x-ncbi-asn1-ascii	application/marc
application/vnd.ibm.modcap	chemical/x-ncbi-asn1-binary	application/mathematica
application/vnd.informix-visionary	chemical/x-ncbi-asn1-spec	application/mathematica-old
application/vnd.intercon.formnet	chemical/x-pdb	application/msaccess
application/vnd.intertrust.digibox	chemical/x-rosdal	application/msword
application/vnd.intertrust.nncp	chemical/x-swissprot	application/news-message-id
application/vnd.intu.qbo	chemical/x-vamas-iso14976	application/news-transmission
application/vnd.intu.qfx	chemical/x-vmd	application/ocsp-request
application/vnd.irepository.package+xml	chemical/x-xtel	application/ocsp-response
application/vnd.is-xpr	chemical/x-xyz	application/octet-stream
application/vnd.japannet-directory-service	image/bmp	application/oda
application/vnd.japannet-jpnstore-wakeup	image/cgm	application/ogg
application/vnd.japannet-payment-wakeup	image/g3fax	application/parityfec
application/vnd.japannet-registration	image/gif	application/pdf
application/vnd.japannet-registration-wakeup	image/ief	application/pgp-encrypted
application/vnd.japannet-setstore-wakeup	image/jpeg	application/pgp-keys
application/vnd.japannet-verification	image/naplps	application/pgp-signature
application/vnd.japannet-verification-wakeup	image/pcx	application/pics-rules
application/vnd.koan	image/pjpeg	application/pkcs10
application/vnd.lotus-1-2-3	image/png	application/pkcs7-mime
application/vnd.lotus-approach	image/prs.btif	application/pkcs7-signature
application/vnd.lotus-freelance	image/prs.pti	application/pkix-cert
application/vnd.lotus-notes	image/svg+xml	application/pkix-crl
application/vnd.lotus-organizer	image/tif	application/pkixcmp
application/vnd.lotus-screencam	image/tiff	application/postscript
application/vnd.lotus-wordpro	image/vnd.cns.inf2	application/prs.alvestrand.titrax-sheet

application/vnd.mcd	image/vnd.djvu	application/prs.cww
application/vnd.mediastation.cdkey	image/vnd.dwg	application/prs.nprend
application/vnd.meridian-slingshot	image/vnd.dxf	application/qsig
application/vnd.mif	image/vnd.fastbidsheet	application/rar
application/vnd.minisoft-hp3000-save	image/vnd.fpx	application/rdf+xml
application/vnd.mitsubishi.misty-guard.trustweb	image/vnd.fst	application/remote-printing
application/vnd.mobius.daf	image/vnd.fujixerox.edmics-mmr	application/riscos
application/vnd.mobius.dis	image/vnd.fujixerox.edmics-rlc	application/rss+xml
application/vnd.mobius.msl	image/vnd.mix	application/rtf
application/vnd.mobius.plc	image/vnd.net-fpx	application/sdp
application/vnd.mobius.txf	image/vnd.svf	application/set-payment
application/vnd.motorola.flexsuite	image/vnd.wap.wbmp	application/set-payment-initiation
application/vnd.motorola.flexsuite.adsi	image/vnd.xiff	application/set-registration
application/vnd.motorola.flexsuite.fis	image/x-cmu-raster	application/set-registration-initiation
application/vnd.motorola.flexsuite.gotap	image/x-coreldraw	application/sgml
application/vnd.motorola.flexsuite.kmr	image/x-coreldrawpattern	application/sgml-open-catalog
application/vnd.motorola.flexsuite.ttc	image/x-coreldrawtemplate	application/sieve
application/vnd.motorola.flexsuite.wem	image/x-corelphotopaint	application/slate
application/vnd.mozilla.xul+xml	image/x-emf	application/smil
application/vnd.ms-artgalry	image/x-icon	application/timestamp-query
application/vnd.ms-asf	image/x-jg	application/timestamp-reply
application/vnd.ms-excel	image/x-jng	application/vemmi
application/vnd.ms-lrm	image/x-ms-bmp	application/vnd.3M.Post-it-Notes
application/vnd.ms-pki.seccat	image/x-photoshop	application/vnd.accpac.simply.aso
application/vnd.ms-pki.stl	image/x-png	application/vnd.accpac.simply.imp
application/vnd.ms-powerpoint	image/x-portable-anymap	application/vnd.acucobol
application/vnd.ms-project	image/x-portable-bitmap	application/vnd.aether.imp
application/vnd.ms-tnef	image/x-portable-graymap	application/vnd.anser-web-certificate-issue-initiation
application/vnd.ms-works	image/x-portable-pixmap	application/vnd.anser-web-funds-transfer-initiation
application/vnd.mseq	image/x-rgb	application/vnd.audiograph
application/vnd.msign	image/x-wmf	application/vnd.bmi
application/vnd.music-niff	image/x-xbitmap	application/vnd.businessobjects

application/vnd.musician	image/x-xpixmap	application/vnd.canon-cpdl
application/vnd.netfpx	image/x-xwindowdump	application/vnd.canon-lips
application/vnd.noblenet-directory	inode/blockdevice	application/vnd.cinderella
application/vnd.noblenet-sealer	inode/chardevice	application/vnd.claymore
application/vnd.noblenet-web	inode/directory	application/vnd.commerce-battelle
application/vnd.novadigm.EDM	inode/directory-locked	application/vnd.commonspace
application/vnd.novadigm.EDX	inode/fifo	application/vnd.comsocaller
application/vnd.novadigm.EXT	inode/socket	application/vnd.contact.cmsg
application/vnd.oasis.opendocument.chart	message/delivery-status	application/vnd.cosmocaller
application/vnd.oasis.opendocument.database	message/disposition-notification	application/vnd.ctc-posml
application/vnd.oasis.opendocument.formula	message/external-body	application/vnd.cups-postscript
application/vnd.oasis.opendocument.graphics	message/http	application/vnd.cups-raster
application/vnd.oasis.opendocument.graphics-template	message/news	application/vnd.cups-raw
application/vnd.oasis.opendocument.image	message/partial	application/vnd.cybank
application/vnd.oasis.opendocument.presentation	message/rfc822	application/vnd.dna
application/vnd.oasis.opendocument.presentation-template	message/s-http	application/vnd.dpgraph
application/vnd.oasis.opendocument.spreadsheet	model/iges	application/vnd.dxr
application/vnd.oasis.opendocument.spreadsheet-template	model/mesh	application/vnd.ecdis-update
application/vnd.oasis.opendocument.text	model/vnd.dwf	application/vnd.ecowin.chart
application/vnd.oasis.opendocument.text-master	model/vnd.flatland.3dml	application/x-killustrator
application/vnd.oasis.opendocument.text-template	model/vnd.gdl	application/x-koan
application/vnd.oasis.opendocument.text-web	model/vnd.gs-gdl	application/x-kpresenter
application/vnd.osa.netdeploy	model/vnd.gtw	application/x-kspread
application/vnd.palm	model/vnd.mts	application/x-kword
application/vnd.pg.format	model/vnd.vtu	application/x-latex
application/vnd.pg.osasli	model/vrml	application/x-lha
application/vnd.powerbuilder6	multipart/alternative	application/x-lzh
application/vnd.powerbuilder6-s	multipart/appledouble	application/x-lzx
application/vnd.powerbuilder7	multipart/byteranges	application/x-maker
application/vnd.powerbuilder7-s	multipart/digest	application/x-mif

application/vnd.powerbuilder75	multipart/encrypted	application/x-ms-wmd
application/vnd.powerbuilder75-s	multipart/form-data	application/x-ms-wmz
application/vnd.previewsystems.box	multipart/header-set	application/x-msdos-program
application/vnd.publishare-delta-tree	multipart/mixed	application/x-msdownload
application/vnd.pvi.ptid1	multipart/parallel	application/x-msi
application/vnd.pwg-xhtml-print+xml	multipart/related	application/x-netcdf
application/vnd.rapid	multipart/report	application/x-ns-proxy-autoconfig
application/vnd.rim.cod	multipart/signed	application/x-nwc
application/vnd.s3sms	multipart/voice-message	application/x-object
application/vnd.seemail	text/calendar	application/x-oz-application
application/vnd.shana.informed.formdata	text/comma-separated-values	application/x-pkcs7-certreqresp
application/vnd.shana.informed.formtemplate	text/css	application/x-pkcs7-crl
application/vnd.shana.informed.interchange	text/directory	application/x-python-code
application/vnd.shana.informed.package	text/english	application/x-quicktimeplayer
application/vnd.smaf	text/enriched	application/x-redhat-package-manager
application/vnd.sss-cod	text/h323	application/x-rx
application/vnd.sss-dtf	text/html	application/x-sh
application/vnd.sss-ntf	text/iuls	application/x-shar
application/vnd.stardivision.calc	text/mathml	application/x-shellscript
application/vnd.stardivision.draw	text/parityfec	application/x-shockwave-flash
application/vnd.stardivision.impress	text/plain	application/x-stuffit
application/vnd.stardivision.math	text/prs.lines.tag	application/x-sv4cpio
application/vnd.stardivision.writer	text/rfc822-headers	application/x-sv4crc
application/vnd.stardivision.writer-global	text/richtext	application/x-tar
application/vnd.street-stream	text/rtf	application/x-tcl
application/vnd.sun.xml.calc	text/scriptlet	application/x-tex-gf
application/vnd.sun.xml.calc.template	text/t140	application/x-tex-pk
application/vnd.sun.xml.draw	text/tab-separated-values	application/x-texinfo
application/vnd.sun.xml.draw.template	text/texmacs	application/x-trash
application/vnd.sun.xml.impress	text/uri-list	application/x-troff
application/vnd.sun.xml.impress.template	text/vnd.DMClientScript	application/x-troff-man
application/vnd.sun.xml.math	text/vnd.IPTC.NITF	application/x-troff-me
application/vnd.sun.xml.writer	text/vnd.IPTC.NewsML	application/x-troff-ms
application/vnd.sun.xml.writer.global	text/vnd.abc	application/x-ustar

application/vnd.sun.xml.writer.template	text/vnd.curl	application/x-videolan
application/vnd.svd	text/vnd.flatland.3dml	application/x-wais-source
application/vnd.swiftview-ics	text/vnd.fly	application/x-wingz
application/vnd.symbian.install	text/vnd.fmi.flexstor	application/x-x509-ca-cert
application/vnd.triscape.mxs	text/vnd.in3d.3dml	application/x-xcf
application/vnd.trueapp	text/vnd.in3d.spot	application/x-xfig
application/vnd.truedoc	text/vnd.latex-z	application/x-xpinstall
application/vnd.tve-trigger	text/vnd.motorola.reflex	application/x-zip-compressed
application/vnd.ufdl	text/vnd.ms-mediapackage	application/x400-bp
application/vnd.uplanet.alert	text/vnd.sun.j2me.app-descriptor	application/xhtml+xml
application/vnd.uplanet.alert-wbxml	text/vnd.wap.si	application/xml
application/vnd.uplanet.bearer-choice	text/vnd.wap.sl	application/xml-dtd
application/vnd.uplanet.bearer-choice-wbxml	text/vnd.wap.wml	application/xml-external-parsed-entity
application/vnd.uplanet.cacheop	text/vnd.wap.wmlscript	application/zip
application/vnd.uplanet.cacheop-wbxml	text/x-bibtex	audio/32kadpcm
application/vnd.uplanet.channel	text/x-c++hdr	audio/basic
application/vnd.uplanet.channel-wbxml	text/x-c++src	audio/dvi4
application/vnd.uplanet.list	text/x-chdr	audio/g.722.1
application/vnd.uplanet.list-wbxml	text/x-crontab	audio/g722
application/vnd.uplanet.listcmd	text/x-csh	audio/g723
application/vnd.uplanet.listcmd-wbxml	text/x-csrc	audio/g726-16
application/vnd.uplanet.signal	text/x-haskell	audio/g726-24
application/vnd.vcx	text/x-java	audio/g726-32
application/vnd.vectorworks	text/x-literate-haskell	audio/g726-40
application/vnd.vidsoft.vidconference	text/x-makefile	audio/g728
application/vnd.visio	text/x-moc	audio/g729
application/vnd.vividence.scriptfile	text/x-pascal	audio/g729d
application/vnd.wap.sic	text/x-pcs-gcd	audio/g729e
application/vnd.wap.slc	text/x-perl	audio/gsm
application/vnd.wap.wbxml	text/x-psp	audio/gsm-efr
application/vnd.wap.wmlc	text/x-python	audio/l16
application/vnd.wap.wmlscriptc	text/x-server-parsed-html	audio/l8
application/vnd.webturbo	text/x-setext	audio/lpc

application/vnd.wrq-hp3000-labelled	text/x-sh	audio/midi
application/vnd.wt.stf	text/x-tcl	audio/mp4a-latm
application/vnd.xara	text/x-tex	audio/mpa
application/vnd.xfdl	text/x-vcalendar	audio/mpa-robust
application/vnd.yellowriver-custom-menu	text/x-vcard	audio/mpeg
application/whoispp-query	text/xml	audio/mpegurl
application/whoispp-response	text/xsl	audio/parityfec
application/wita	video/avi	audio/pcma
application/wordperfect	video/bmpeg	audio/pcmu
application/wordperfect5.1	video/bt656	audio/prs.sid
application/x-123	video/celb	audio/qcelp
application/x-abiword	video/dl	audio/red
application/x-apple-diskimage	video/dv	audio/telephone-event
application/x-bcpio	video/fli	audio/tone
application/x-bittorrent	video/gl	audio/vdvi
application/x-cdf	video/h261	audio/vnd.cisco.nse
application/x-cdlink	video/h263	audio/vnd.cns.anp1
application/x-chess-pgn	video/h263-1998	audio/vnd.cns.inf1
application/x-compressed	video/h263-2000	audio/vnd.digital-winds
application/x-core	video/jpeg	audio/vnd.everad.plj
application/x-cpio	video/mp1s	audio/vnd.lucent.voice
application/x-csh	video/mp2p	audio/vnd.nortel.vbk
application/x-debian-package	video/mp2t	audio/vnd.nuera.ecelp4800
application/x-director	video/mp4	audio/vnd.nuera.ecelp7470
application/x-dms	video/mp4v-es	audio/vnd.nuera.ecelp9600
application/x-doom	video/mpeg	audio/vnd.octel.sbc
application/x-dvi	video/mpv	audio/vnd.qcelp
application/x-executable	video/nv	audio/vnd.rhetorex.32kadpcm
application/x-flac	video/parityfec	audio/vnd.vmx.cvsd
application/x-font	video/pointer	audio/wav
application/x-freemind	video/quicktime	audio/x-aiff
application/x-futuresplash	video/vnd.fvt	audio/x-gsm
application/x-gnumeric	video/vnd.motorola.video	audio/x-mpegurl
application/x-go-sgf	video/vnd.motorola.videop	audio/x-ms-wax
application/x-graphing-calculator	video/vnd.mpegurl	audio/x-ms-wma
application/x-gtar	video/vnd.mts	audio/x-pn-realaudio
application/x-gzip-compressed	video/vnd.nokia.interleaved-multimedia	audio/x-pn-realaudio-plugin
application/x-hdf	video/vnd.vivo	audio/x-realaudio

application/x-ica	video/x-flv	audio/x-scpls
application/x-internet-signup	video/x-la-asf	audio/x-sd2
application/x-iphone	video/x-mng	audio/x-wav
application/x-iso9660-image	video/x-ms-asf	chemical/x-alchemy
application/x-java-applet	video/x-ms-wm	x-world/x-vrml
application/x-java-bean	video/x-ms-wmv	
application/x-java-jnlp-file	video/x-ms-wmx	
application/x-javascript	video/x-ms-wvx	
application/x-jmol	video/x-msvideo	
application/x-kchart	video/x-sgi-movie	
application/x-kdelnk	x-conference/x-cooltalk	