

[MS-FCIADS]: File Classification Infrastructure Alternate Data Stream (ADS) File Format

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Revision Summary

Date	Revision History	Revision Class	Comments
12/16/2011	1.0	New	Released new document.
03/30/2012	1.0	No change	No changes to the meaning, language, or formatting of the technical content.
07/12/2012	1.0	No change	No changes to the meaning, language, or formatting of the technical content.
10/25/2012	1.1	Minor	Clarified the meaning of the technical content.
01/31/2013	1.1	No change	No changes to the meaning, language, or formatting of the technical content.
08/08/2013	2.0	Major	Significantly changed the technical content.

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1 Introduction

The File Classification Infrastructure Alternate Data Stream (ADS) File Format is a subset of the functionality specified in the File Server Resource Manager Protocol [\[MS-FSRM\]](#) that persists metadata information for files into NTFS alternate data streams that follow the formats defined in this document.

Sections 1.7 and 2 of this specification are normative and can contain the terms MAY, SHOULD, MUST, MUST NOT, and SHOULD NOT as defined in RFC 2119. All other sections and examples in this specification are informative.

1.1 Glossary

The following terms are defined in [\[MS-GLOS\]](#):

big-endian

cyclic redundancy check (CRC)

little-endian

UTC (Coordinated Universal Time)

UTF-16LE (Unicode Transformation Format, 16-bits, little-endian)

The following terms are specific to this document:

FCIADS stream: The NTFS alternate data stream ([MSFT-NTFSWorks]) named FSRM{ef88c031-5950-4164-ab92-eec5f16005a5} that stores Property Definition Instance ([MS-FSRM] section 3.2.1.6.5) abstract data model (ADM) element instances for files.

Normal Property: A property assigned to a file or folder that cannot affect security.

Secure Property: A property assigned to a file or folder that can affect security.

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as described in [\[RFC2119\]](#). All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

References to Microsoft Open Specifications documentation do not include a publishing year because links are to the latest version of the documents, which are updated frequently. References to other documents include a publishing year when one is available.

A reference marked "(Archived)" means that the reference document was either retired and is no longer being maintained or was replaced with a new document that provides current implementation details. We archive our documents online [\[Windows Protocol\]](#).

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information. Please check the archive site, <http://msdn2.microsoft.com/en-us/library/E4BD6494-06AD-4aed-9823-445E921C9624>, as an additional source.

[MS-DTYP] Microsoft Corporation, "[Windows Data Types](#)".

[MS-FSRM] Microsoft Corporation, "[File Server Resource Manager Protocol](#)".

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, <http://www.rfc-editor.org/rfc/rfc2119.txt>

1.2.2 Informative References

[MS-FSA] Microsoft Corporation, "[File System Algorithms](#)".

[MS-FSCC] Microsoft Corporation, "[File System Control Codes](#)".

[MSFT-NTFSWorks] Microsoft Corporation, "How NTFS Works", March 2003, [http://technet.microsoft.com/en-us/library/cc781134\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc781134(WS.10).aspx)

[MS-GLOS] Microsoft Corporation, "[Windows Protocols Master Glossary](#)".

1.3 Overview

The structures defined in this document are used to store metadata for files. The metadata information is derived from the **Property Definition Instance** ([\[MS-FSRM\]](#) section 3.2.1.6.5) ADM element instances that the File Server Resource Manager [\[MS-FSRM\]](#) protocol creates. Using these structures, the File Server Resource Manager persists metadata for each file into an NTFS alternate data stream ([\[MS-FSCC\]](#) section 5) with the name FSRM{ef88c031-5950-4164-ab92-ec5f16005a5}. This type of NTFS alternate data stream ([\[MSFT-NTFSWorks\]](#)) is referred to as an **FCIADS stream**.

1.4 Relationship to Protocols and Other Structures

The File Server Resource Manager protocol creates the FCIADS stream and stores **Property Definition Instance** ([\[MS-FSRM\]](#) section 3.2.1.6.5) ADM element instances into it using the structures defined in this document. The File Server Resource Manager protocol can also read the information in an FCIADS stream to recreate a **Property Definition Instance** ADM element instance for the file.

The File System Algorithms specified in [\[MS-FSA\]](#), define the properties of a **DataStream** ADM element. An **Alternate Data Stream** is an NTFS **DataStream** ADM element instance with a nonempty **Name** ADM attribute.

1.5 Applicability Statement

The FCIADS is applicable when the File Server Resource Manager Protocol [\[MS-FSRM\]](#) persists a **Property Definition Instance** ([\[MS-FSRM\]](#) section 3.2.1.6.5) ADM element instance for a file.

1.6 Versioning and Localization

To provide compatibility, the FCIADS uses the same structure versions for Windows Server 2008 R2 operating system, Windows 8 operating system, and Windows Server 2012 operating system.

1.7 Vendor-Extensible Fields

The FCIADS has no vendor-extensible fields.

2 Structures

The following structures specify the formats of the FCIADS stream when written. Unless otherwise specified, all noncharacter fields are stored as unsigned integers in **little-endian** format, and all strings are null-terminated and are stored as **UTF-16LE (Unicode Transformation Format, 16-bits, little-endian)**. **GUID** ([\[MS-DTYP\]](#) section 2.3.4.2) fields are stored with the **Data1** (the first 4 bytes), **Data2** (the next 2 bytes), and **Data3** (the next 2 bytes) fields in little-endian format; the **Data4** field (the last 8 bytes) is stored in **big-endian** format.

2.1 ADSSStreamHeader

The **ADSSStreamHeader** structure specifies fields that are used to provide status and basic information about an FCIADS stream.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
VersionId (16 bytes)																															
...																															
Crc																															
...																															
TimeStamp																															
...																															
StreamLength																															
FirstFieldExtensionOffset																															
Flags																															
NonSecurePropertyCount																															
FileHash																															
...																															
NonSecureProperties (variable)																															
...																															
FieldExtensionHeaders (variable)																															
...																															

VersionId (16 bytes): A **GUID** ([\[MS-DTYP\]](#) section 2.3.4.2) that identifies the FCIADS stream. MUST be set to 43ee0c5f-e038-421c-8a3e-ab4eb1166124.

Crc (8 bytes): A bit-reversed CRC-64 hash of the FCIADS stream from the **TimeStamp** field to the end of the structure that can be used to validate the integrity of the FCIADS stream. The **cyclic redundancy check (CRC)** polynomial is $x^{64} + x^{61} + x^{58} + x^{56} + x^{55} + x^{52} + x^{51} + x^{50} + x^{47} + x^{42} + x^{39} + x^{38} + x^{35} + x^{33} + x^{32} + x^{31} + x^{29} + x^{26} + x^{25} + x^{22} + x^{17} + x^{14} + x^{13} + x^9 + x^8 + x^6 + x^3 + 1$, with the leading 1 implied. The normal representation is 0x92C64265D32139A4.

TimeStamp (8 bytes): A **FILETIME** ([\[MS-DTYP\]](#) section 2.3.3) structure containing the time in **UTC (Coordinated Universal Time)** at which the cache was last written.

StreamLength (4 bytes): A 32-bit unsigned integer set to the length of the FCIADS stream, in bytes, from the start of the structure. [<1>](#)

FirstFieldExtensionOffset (4 bytes): A 32-bit unsigned integer set to the offset, in bytes, from the start of the FCIADS stream of the first, if any, [ADSEFieldExtensionHeader \(section 2.2\)](#) structure stored in the FCIADS stream. Subsequent **ADSEFieldExtensionHeader** structures can follow this first structure. If no field extension header structures are present in the FCIADS stream, this field has the value zero (0x00000000).

Flags (4 bytes): The state of an FCIADS stream represented as a bitwise OR of **ADSCacheFlags** ([\[MS-FSRM\]](#) section 2.2.1.2.18) enumeration values. [<2>](#)

NonSecurePropertyCount (4 bytes): A 32-bit unsigned integer that specifies the number of **Property Definition Instance** ([\[MS-FSRM\]](#) section 3.2.1.6.5) ADM element instances stored in the FCIADS stream.

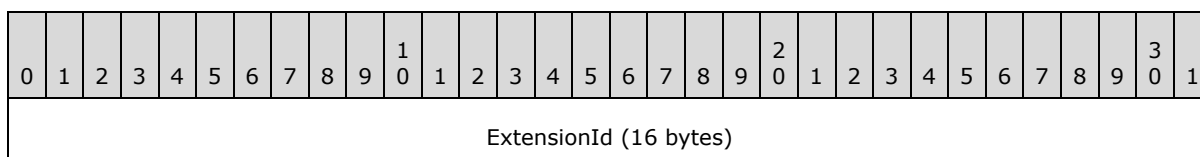
FileHash (8 bytes): A bit-reversed CRC-64 hash of a data structure containing the 64-bit file ID, the 64-bit parent directory ID, the file path and name, and the last write time (in UTC) of the file as a **FILETIME** structure. If a newly computed **FileHash** field value does not match an existing **FileHash** field value, the cache may be out of date. The CRC polynomial is $x^{64} + x^{61} + x^{58} + x^{56} + x^{55} + x^{52} + x^{51} + x^{50} + x^{47} + x^{42} + x^{39} + x^{38} + x^{35} + x^{33} + x^{32} + x^{31} + x^{29} + x^{26} + x^{25} + x^{22} + x^{17} + x^{14} + x^{13} + x^9 + x^8 + x^6 + x^3 + 1$. The normal representation is 0x92C64265D32139A4.

NonSecureProperties (variable): Contains zero or more **Property Definition Instance** ADM element instances of a file stored in [ADSENonSecurePropertyHeader \(section 2.5\)](#) structures.

FieldExtensionHeaders (variable): Contains zero or more field extension header structures of a file stored in **ADSEFieldExtensionHeader** structures. Some of these structures can be of type [ADSESecurePropertiesExtensionHeader \(section 2.3\)](#). The offset to the first structure (if any) is stored in the **FirstFieldExtensionOffset** field.

2.2 ADSEFieldExtensionHeader

The **ADSEFieldExtensionHeader** structure extends the [ADSEStreamHeader \(section 2.1\)](#) structure to store information that cannot be determined for this version of the structure format.



...
BlockLength
Data (variable)
...

ExtensionId (16 bytes): Contains the **GUID** ([\[MS-DTYP\]](#) section 2.3.4.2) that identifies the field extension.

BlockLength (4 bytes): A 32-bit unsigned integer set to the size, in bytes, of the **ADSFieldExtensionHeader** structure, including the length of the **Data** field.

Data (variable): Contains unformatted data.

2.3 ADSSecurePropertiesExtensionHeader

The **ADSSecurePropertiesExtensionHeader** structure extends the FCIADS stream format to store **Secure Properties**.<3>

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ExtensionId (16 bytes)																															
...																															
BlockLength																															
PropertyCount																															
Properties (variable)																															
...																															

ExtensionId (16 bytes): A **GUID** ([\[MS-DTYP\]](#) section 2.3.4.2) that identifies the field extension as a secure property field extension. MUST be set to 35c8acd4-a0db-426d-85fc-7911cb780e4e.

BlockLength (4 bytes): A 32-bit unsigned integer set to the length, in bytes, of the **ADSSecurePropertiesExtensionHeader** structure, including the length of the **Data** field.

PropertyCount (4 bytes): A 32-bit unsigned integer set to the number of [ADSSecurePropertyHeader \(section 2.4\)](#) structures that are stored in the **Properties** field.

Properties (variable): Contains zero or more **ADSSecurePropertyHeader** structure instances.

2.4 ADSSecurePropertyHeader

The **ADSSecurePropertyHeader** structure specifies fields that correspond to the ADM attributes of a **Property Definition Instance** ([\[MS-FSRM\]](#) section 3.2.1.6.5) ADM element instance with a **Property Definition Instance.Secure** ADM attribute set to TRUE and that are written to an FCIADS stream. Each such **Property Definition Instance** ADM element instance is referred to as a Secure Property.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
SecureType																															
Flags																															
Length																															
ValueOffset																															
Name (variable)																															
...																															
Value (variable)																															
...																															

SecureType (4 bytes): A 32-bit unsigned integer that specifies whether the type of the Secure Property is an integer or a string value. MUST be set to only one value of the **FCI_ADS_SECURE_PROPERTY_TYPE** ([\[MS-FSRM\]](#) section 2.2.1.2.20) enumeration. If the Secure Property has a **Property Definition Instance.Type** ADM attribute **FsrmpPropertyDefinitionType** ([\[MS-FSRM\]](#) section 2.2.2.3.1.1) enumeration value of **FsrmpPropertyDefinitionType_MultiChoiceList**, **FsrmpPropertyDefinitionType_String**, or **FsrmpPropertyDefinitionType_MultiString**, this field SHOULD be set to **FCI_ADS_SECURE_PROPERTY_TYPE_STRING**. If the Secure Property has a **Property Definition Instance.Type** ADM attribute **FsrmpPropertyDefinitionType** enumeration value of **FsrmpPropertyDefinitionType_OrderedList**, **FsrmpPropertyDefinitionType_Int**, or **FsrmpPropertyDefinitionType_Bool**, this field SHOULD be set to **FCI_ADS_SECURE_PROPERTY_TYPE_INT64**. All other **Property Definition Instance.Type** ADM attribute values MUST NOT be stored in this field.

Flags (4 bytes): A 32-bit unsigned integer that indicates the state of the Secure Property as a bitwise OR of values of the **ADSCachePropertyFlags** ([\[MS-FSRM\]](#) section 2.2.1.2.19) enumeration.

Length (4 bytes): A 32-bit unsigned integer set to the length, in bytes, of the **ADSSecurePropertyHeader** structure.

ValueOffset (4 bytes): A 32-bit unsigned integer set to the offset, in bytes, of the **Value** field from the beginning of the **ADSSecurePropertyHeader** structure.

Name (variable): A null-terminated string encoded in UTF-16LE format that specifies the **Property Definition Instance.Name** ADM attribute of the Secure Property in the FCIADS stream.

Value (variable): A null-terminated string encoded in UTF-16LE format that specifies the **Property Definition Instance.Value** ADM attribute of the Secure Property in the FCIADS stream.

2.5 ADSNonSecurePropertyHeader

The **ADSNonSecurePropertyHeader** structure specifies fields that correspond to the ADM attributes of a **Property Definition Instance** ([MS-FSRM] section 3.2.1.6.5) ADM element instance with a **Property Definition Instance.Secure** ADM attribute set to FALSE and that are written to an FCIADS stream. Each such **Property Definition Instance** ADM element instance is referred to as a **Normal Property**.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Type																															
Flags																															
Length																															
ValueOffset																															
Name (variable)																															
...																															
Value (variable)																															
...																															

Type (4 bytes): A 32-bit unsigned integer that specifies whether the type of the Normal Property is an integer or a string value. MUST be set to only one value of the **FsrPropertyDefinitionType** ([MS-FSRM] section 2.2.2.3.1.1) enumeration. If the Normal Property has a **Property Definition Instance.Type** ADM attribute set to an **FsrPropertyDefinitionType** enumeration value of **FsrPropertyDefinitionType_MultiChoiceList**, **FsrPropertyDefinitionType_String**, **FsrPropertyDefinitionType_OrderedList**, or **FsrPropertyDefinitionType_MultiString**, this field SHOULD be set to **FCI_ADS_SECURE_PROPERTY_TYPE_STRING**. If the Normal Property has a **Property Definition Instance.Type** ADM attribute set to an **FsrPropertyDefinitionType** enumeration value of **FsrPropertyDefinitionType_Date**, **FsrPropertyDefinitionType_Int**, or **FsrPropertyDefinitionType_Bool**, this field SHOULD be set to **FCI_ADS_SECURE_PROPERTY_TYPE_INT64**. All other **Property Definition Instance.Type** ADM attribute values MUST NOT be stored in this field.

Flags (4 bytes): A 32-bit unsigned integer that indicates the state of the Normal Property as a bitwise OR of values of the **FsrPropertyFlags** ([\[MS-FSRM\]](#) section 2.2.2.6.1.1) enumeration.

Length (4 bytes): A 32-bit unsigned integer set to the length, in bytes, of the **ADSNonSecurePropertyHeader** structure.

ValueOffset (4 bytes): A 32-bit unsigned integer set to the offset, in bytes, of the **Value** field from the beginning of the **ADSNonSecurePropertyHeader** structure.

Name (variable): A null-terminated string encoded in UTF-16LE format that specifies the **Property Definition Instance.Name** ADM attribute of the Normal Property in the FCIADS stream.

Value (variable): A null-terminated string encoded in UTF-16LE format that specifies the **Property Definition Instance.Value** ADM attribute of the Normal Property in the FCIADS stream.

3 Structure Examples

The following example depicts an FCIADS stream as an [ADSStreamHeader \(section 2.1\)](#) structure followed by two Normal Properties encoded as two [ADSNonSecurePropertyHeader \(section 2.5\)](#) structures.

```

00000000 5F 0C EE 43 38 E0 1C 42-8A 3E AB 4E B1 16 61 24 *_.C8..B.>.N..a$*
00000010 53 65 C6 80 73 17 DA CE-EB DB F4 99 B2 34 C9 01 *Se..s.....4..*
00000020 8A 00 00 00 00 00 00 00-00 00 00 00 02 00 00 00 *.....*
00000030 D8 AE 24 AF CF 9C 94 1F-01 00 00 00 08 00 00 00 *..$......*
00000040 36 00 00 00 2E 00 00 00-42 00 75 00 73 00 69 00 *6.....B.u.s.i.*
00000050 6E 00 65 00 73 00 73 00-49 00 6D 00 70 00 61 00 *n.e.s.s.I.m.p.a.*
00000060 63 00 74 00 00 00 48 00-42 00 49 00 00 00 07 00 *c.t...H.B.I.....*
00000070 00 00 08 00 00 00 1C 00-00 00 18 00 00 00 50 00 *.....P.*
00000080 49 00 49 00 00 00 31 00-00 00 *I.I...1...*

```

Field Name	Offset	Value
VersionId	0x00	{43ee0c5f-e038-421c-8a3e-ab4eb1166124}
Crc	0x10	0xceda1773`80c66553
TimeStamp	0x18	0x01c934b2`99f4dbeb (2008-10-23 01:56:44)
StreamLength	0x20	0x0000008a (138 bytes)
FirstFieldExtensionOffset	0x24	0x00000000
Flags	0x28	0x00000000
NonSecurePropertyCount	0x2C	0x00000002 (2)
FileHash	0x30	0x1f949ccf`af24aed8
-----	-----	-----
Property 1 Type	0x38	0x00000001 (FsrPropertyDefinitionType_OrderedList)
Property 1 Flags	0x3C	0x00000008 (FsrPropertyFlags_SetByClassifier)
Property 1 Length	0x40	0x00000036 (54 bytes)

Field Name	Offset	Value
Property 1 ValueOffset	0x44	0x0000002e
Property 1 Name	0x48	"BusinessImpact"
Property 1 Value	0x38 + 0x2E = 0x66	"HBI"
-----	-----	-----
Property 2 Type	0x38 + 0x36 = 0x6E	0x00000007 (FsrPropertyDefinitionType_Boolean)
Property 2 Flags	0x72	0x00000008 (FsrPropertyFlags_SetByClassifier)
Property 2 Length	0x76	0x0000001c (28 bytes)
Property 2 ValueOffset	0x7A	0x00000018
Property 2 Name	0x7E	"PII"
Property 2 Value	0x6E + 0x18 = 0x86	"1"

4 Security

4.1 Security Considerations for Implementers

None.

4.2 Index of Security Fields

None.

5 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs:

- Windows Server 2008 R2 operating system
- Windows 8 operating system
- Windows Server 2012 operating system
- Windows 8.1 operating system
- Windows Server 2012 R2 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms SHOULD or SHOULD NOT implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term MAY implies that the product does not follow the prescription.

[<1> Section 2.1](#): An FCIADS stream is limited to 4 KB in length.

[<2> Section 2.1](#): An ADS stream containing these structures always sets the **ADSCache_PropertyFlagsValid** flag if it is generated on Windows 8, Windows Server 2012, Windows 8.1, or Windows Server 2012 R2. An ADS stream generated on Windows Server 2008 R2 never sets this flag.

[<3> Section 2.3](#): Only Windows 8, Windows Server 2012, Windows 8.1, and Windows Server 2012 R2 process **Property Definition Instance** ([\[MS-FSRM\]](#) section 3.2.1.6.5) ADM element instances with **Property Definition Instance.Secure** ADM attributes set to TRUE. Because these **Property Definition Instance** ADM element instances are stored in an [ADSSecurePropertiesExtensionHeader \(section 2.3\)](#) structure, which conforms to the layout of the [ADSFieldExtensionHeader \(section 2.2\)](#) structure, Windows Server 2008 R2 retains but does not act on them when manipulating an FCIADS stream.

6 Change Tracking

This section identifies changes that were made to the [MS-FCIADS] protocol document between the January 2013 and August 2013 releases. Changes are classified as New, Major, Minor, Editorial, or No change.

The revision class **New** means that a new document is being released.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

- A document revision that incorporates changes to interoperability requirements or functionality.
- An extensive rewrite, addition, or deletion of major portions of content.
- The removal of a document from the documentation set.
- Changes made for template compliance.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **Editorial** means that the language and formatting in the technical content was changed. Editorial changes apply to grammatical, formatting, and style issues.

The revision class **No change** means that no new technical or language changes were introduced. The technical content of the document is identical to the last released version, but minor editorial and formatting changes, as well as updates to the header and footer information, and to the revision summary, may have been made.

Major and minor changes can be described further using the following change types:

- New content added.
- Content updated.
- Content removed.
- New product behavior note added.
- Product behavior note updated.
- Product behavior note removed.
- New protocol syntax added.
- Protocol syntax updated.
- Protocol syntax removed.
- New content added due to protocol revision.
- Content updated due to protocol revision.
- Content removed due to protocol revision.
- New protocol syntax added due to protocol revision.

- Protocol syntax updated due to protocol revision.
- Protocol syntax removed due to protocol revision.
- New content added for template compliance.
- Content updated for template compliance.
- Content removed for template compliance.
- Obsolete document removed.

Editorial changes are always classified with the change type **Editorially updated**.

Some important terms used in the change type descriptions are defined as follows:

- **Protocol syntax** refers to data elements (such as packets, structures, enumerations, and methods) as well as interfaces.
- **Protocol revision** refers to changes made to a protocol that affect the bits that are sent over the wire.

The changes made to this document are listed in the following table. For more information, please contact protocol@microsoft.com.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
5 Appendix A: Product Behavior	Modified this section to include references to Windows 8.1 and Windows Server 2012 R2.	Y	Content updated.

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