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## JavaScript Object Notation

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### Abstract

JSON (JavaScript Object Notation) is a light-weight, text-based, language-independent, data interchange format. It was derived from the ECMAScript Programming Language Standard. JSON defines a small set of formatting rules for the portable representation of structured data.

### Conventions used in this document

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](#)].

The grammatical rules in this document are to be interpreted as described in [[RFC-4234](#)].

## [1](#). Introduction

JSON, or JavaScript Object Notation, is a text format for the serialization of structured data. It is derived from the object literals of JavaScript, as defined in the ECMAScript Programming Language Standard [[ECMA](#)].

JSON can represent four primitive types (strings, numbers, booleans, and null) and two structured types (objects and arrays).

A string is a sequence of zero or more Unicode characters.

An object is an unordered collection of zero or more name/value pairs, where a name is a string, and a value is a string, number, boolean, null, object, or array.

An array is an ordered sequence of zero or more values.

The terms "object" and "array" come from the conventions of JavaScript.

JSON's design goals were to be minimal, portable, textual, and a subset of JavaScript.

## [2](#). JSON Grammar

A JSON text is a sequence of tokens. The set of tokens includes six structural characters, strings, numbers, and three literal names.

A JSON text is a serialized object or array.

JSON-text = object / array

These are the six structural characters:

begin-array       = ws %x5B ws   ; [ left square bracket

begin-object       = ws %x7B ws   ; { left curly bracket

end-array          = ws %x5D ws   ; ] right square bracket

end-object         = ws %x7D ws   ; } right curly bracket

name-separator = ws %x3A ws ; : colon

value-separator = ws %x2C ws ; , comma

Insignificant whitespace is allowed before or after any of the six structural characters.

```
ws = *(
    %x20 /           ; Space
    %x09 /           ; Horizontal tab
    %x0A /           ; Line feed or New line
    %x0D             ; Carriage return
)
```

## 2.1. Values

A JSON value MUST be a object, array, number, or string, or one of the three literal names:

false    null    true

The literal names MUST be in lower case. No other literal names are allowed.

value = false / null / true / object / array / number / string

false = %x66.61.6c.73.65 ; false

null = %x6e.75.6c.6c ; null

true = %x74.72.75.65 ; true

## 2.2. Objects

An object structure is represented as a pair of curly brackets surrounding zero or more name/value pairs (or members). A name is a string. A single colon comes after each name, separating the name from the value. A single comma separates a value from a following name.

object = begin-object [ member \*( value-separator member ) ]  
          end-object

member = string name-separator value

## 2.3. Arrays

An array structure is represented as square brackets surrounding zero or more values (or elements). Elements are separated by commas.

```
array = begin-array [ value *( value-separator value ) ]
        end-array
```

## 2.4. Numbers

The representation of numbers is similar to that used in most programming languages. A number contains an integer component which may be prefixed with an optional minus sign, which may be followed by a fraction part and/or an exponent part.

Octal and hex forms are not allowed. Leading zeros are not allowed.

A fraction part is a decimal point followed by one or more digits.

An exponent part begins with the letter E in upper or lower case, which may be followed by a plus or minus sign. The E and optional sign are followed by one or more digits.

Numeric values that cannot be represented as sequences of digits (such as Infinity and NaN) are not permitted.

```
number = [ minus ] int [ frac ] [ exp ]
```

```
decimal-point = %x2E          ; .
```

```
digit1-9 = %x31-39           ; 1-9
```

```
e = %x65 / %x45              ; e E
```

```
exp = e [ minus / plus ] 1*DIGIT
```

```
frac = decimal-point 1*DIGIT
```

```
int = zero / ( digit1-9 *DIGIT )
```

```
minus = %x2D                  ; -
```

```
plus = %x2B                    ; +
```

```
zero = %x30                    ; 0
```

## 2.5. Strings

The representation of strings is similar to conventions used in the C family of programming languages. A string begins and ends with quotation marks. All Unicode characters may be placed within the quotation marks except for the characters which must be escaped: quotation mark, reverse solidus, and the control characters (U+0000 through U+001F).

Any character may be escaped. If the character is in the Basic Multilingual Plane (U+0000 through U+FFFF) then it may be represented as a six-character sequence: a reverse solidus followed by the lower case letter u followed by four hexadecimal digits which encode the character's code point. The hexadecimal letters A through F can be in upper or lower case. So, for example, a string containing only a single reverse solidus character may be represented as `"\u005C"`.

Alternatively, there are two-character sequence escape representations of some popular characters. So, for example, a string containing only a single reverse solidus character may be represented more compactly as `"\\"`.

To escape an extended character that is not in the Basic Multilingual Plane, then the character is represented as a twelve-character sequence, encoding the UTF-16 surrogate pair. So, for example, a string containing only the G clef character (U+1D11E) may be represented as `"\uD834\uDD1E"`.

```
string = quotation-mark *char quotation-mark
```

```
char = unescaped /
      escape (
          %x22 /           ; "      quotation mark  U+0022
          %x5C /           ; \      reverse solidus  U+005C
          %x2F /           ; /      solidus           U+002F
          %x62 /           ; b      backspace         U+0008
          %x66 /           ; f      form feed         U+000C
          %x6E /           ; n      line feed         U+000A
          %x72 /           ; r      carriage return   U+000D
          %x74 /           ; t      tab                U+0009
          %x75 4HEXDIG )   ; uXXXX                U+XXXX
```

```
escape = %x5C           ; \
```

```
quotation-mark = %x22   ; "
```

```
unescaped = %x20-21 / %x23-5B / %x5D-10FFFF
```

### 3. Encoding

JSON text SHOULD be encoded in Unicode. The default encoding is UTF-8.

Since the first two characters of a JSON text will always be ASCII characters [[RFC-0020](#)], it is possible to determine if an octet stream is UTF-8, UTF-16 (BE or LE), or UTF-32 (BE or LE) by looking at the pattern of nulls in the first four octets.

```
00 00 00 xx  UTF-32BE
```

00	xx	00	xx	UTF-16BE
xx	00	00	00	UTF-32LE
xx	00	xx	00	UTF-16LE
xx	xx	xx	xx	UTF-8

#### [4.](#) Parsers

A JSON parser transforms a JSON text into another representation. A JSON parser **MUST** accept all texts that conform to the JSON grammar. A JSON parser **MAY** accept non-JSON forms or extensions.

An implementation may set limits on the size of texts that it accepts. An implementation may set limits on the maximum depth of nesting. An implementation may set limits on the range of numbers. An implementation may set limits on the length and character contents of strings.

#### [5.](#) Generators

A JSON generator produces JSON text. The resulting text **MUST** strictly conform to the JSON grammar.

#### [6.](#) IANA Considerations

The MIME media type for JSON text is text/json. See [section 7](#).

#### [7.](#) Registration Template

To: ietf-types@iana.org  
Subject: Registration of media type text/json

Type name: text

Subtype name: json

Required parameters: n/a

Optional parameters: n/a

Encoding considerations: 8bit

Security considerations: See [section 9](#) below.

Interoperability considerations: n/a

Published specification: RFC-XXXX

Applications that use this media type: See <http://www.JSON.org>.

Additional information:

Magic number(s): n/a  
File extension(s): .json  
Macintosh file type code(s): TEXT

Person & email address to contact for further information:  
Douglas Crockford  
douglas@crockford.com

Intended usage: COMMON

Restrictions on usage: none

Author: Douglas Crockford

Change controller: Douglas Crockford

## 8. Security Considerations

Generally there are security issues with scripting languages. JSON is a subset of JavaScript, but it is a safe subset that excludes assignment and invocation.

A JSON text can be safely passed into JavaScript's `eval()` function (which compiles and executes a string) if all of the characters not enclosed in strings are in the set of characters which form JSON tokens. This can be quickly determined in JavaScript with two regular expressions and calls to the `test` and `replace` methods.

```
var my_JSON_object = !(/[^\s,:{}\[\]0-9.\-+Eaeflnr-u \n\r\t]/.test(
    text.replace(/\"(\\"|.)*\"/g, ''))) &&
    eval('(' + text + ')');
```

## 9. References

### 9.1 Normative References

- [ECMA] European Computer Manufacturers Association, "ECMAScript Language Specification 3rd Edition", December 1999, <<http://www.ecma-international.org/publications/files/ecma-st/ECMA-262.pdf>>.
- [RFC-0020] Cerf, V., "ASCII format for Network Interchange", [RFC 0020](#), October 16, 1969.
- [RFC-2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [RFC 2119](#), March 1997.
- [RFC-4234] Crocker, D., "Augmented BNF for Syntax Specifications: ABNF", [RFC 4234](#), October 2005.
- [UNICODE] The Unicode Consortium, "The Unicode Standard

Version 4.0", 2003,  
<<http://www.unicode.org/versions/Unicode4.1.0/>>.

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