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**Essential correction for IPv6 ABNF in [RFC3261](#)  
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Abstract

This memo corrects the Augmented Backus-Naur Form (ABNF) production rule associated with generating IPv6 literals in [RFC3261](#)

Table of Contents

- [1. Terminology . . . . .](#) [3](#)
- [2. Problem statement . . . . .](#) [3](#)
- [3. Resolution . . . . .](#) [3](#)
- [4. Security Considerations . . . . .](#) [4](#)
- [5. IANA Considerations . . . . .](#) [4](#)
- [6. Acknowledgments . . . . .](#) [4](#)
- [7. References . . . . .](#) [5](#)
  - [7.1. Normative References . . . . .](#) [5](#)
  - [7.2. Informative References . . . . .](#) [5](#)
- [Authors' Addresses . . . . .](#) [5](#)
- [Intellectual Property and Copyright Statements . . . . .](#) [7](#)



## 1. Terminology

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](#) [2].

## 2. Problem statement

The ABNF [4] for generating IPv6 literals in [RFC3261](#) [1] is incorrect. When generating IPv4-mapped IPv6 addresses, the production rule may actually generate the following construct:

[2001:db8::<192.0.2.1] - Note the extra colon before the IPv4 address.

The correct construct, of course, would only include two colons before the IPv4 address.

Historically, the ABNF pertaining to IPv6 references in [RFC3261](#) was derived from [Appendix B of RFC 2373](#) [6], which was flawed to begin with (see also [RFC2373](#) errata at <http://www.rfc-editor.org/cgi-bin/errataSearch.pl/doc/html/rfc2373>.) [RFC2373](#) has been subsequently obsoleted by [RFC 4291](#) [5].

The ABNF for IPv6 reference is reproduced from [RFC3261](#) below:

```
IPv6reference = "[" IPv6address "]"
IPv6address  = hexpart [ ":" IPv4address ]
IPv4address  = 1*3DIGIT "." 1*3DIGIT "." 1*3DIGIT "." 1*3DIGIT
hexpart      = hexseq / hexseq "::" [ hexseq ] / "::" [ hexseq ]
hexseq       = hex4 *( ":" hex4)
hex4         = 1*4HEXDIG
```

Note that the ambiguity occurs in the "IPv6address" production rule where the "IPv4address" non-terminal is prefixed by ":" token. Because the "hexpart" production rule is defined such that two of its alternatives already include the "::" token, this may yield to the faulty construction of an IPv6-mapped IPv4 address with an extra colon when expanding those alternatives.

## 3. Resolution

The resolution to this ambiguity is simply to use the correct ABNF for the "IPv6address" production rule from [Appendix A of RFC3986](#) [3]. For the sake of completeness, it is reproduced below:



```

IPv6address = 6( h16 ":" ) ls32
            / "::<" 5( h16 ":" ) ls32
            / [ h16 ] "::<" 4( h16 ":" ) ls32
            / [ *1( h16 ":" ) h16 ] "::<" 3( h16 ":" ) ls32
            / [ *2( h16 ":" ) h16 ] "::<" 2( h16 ":" ) ls32
            / [ *3( h16 ":" ) h16 ] "::<" h16 ":" ls32
            / [ *4( h16 ":" ) h16 ] "::<" ls32
            / [ *5( h16 ":" ) h16 ] "::<" h16
            / [ *6( h16 ":" ) h16 ] "::<"

h16 = 1*4HEXDIG
ls32 = ( h16 ":" h16 ) / IPv4address
IPv4address = dec-octet "." dec-octet "." dec-octet "." dec-octet
dec-octet = DIGIT ; 0-9
           / %x31-39 DIGIT ; 10-99
           / "1" 2DIGIT ; 100-199
           / "2" %x30-34 DIGIT ; 200-249
           / "25" %x30-35 ; 250-255

```

Accordingly, following the SIP essential corrections process [7], this memo RECOMMENDS that the "IPv6address" and "IPv4address" production rules be deleted from [RFC3261](#) and replaced with the production rules of the same name in [RFC3986](#) (and reproduced above.) These changes, when made to [RFC3261](#), will make "hexpart", "hexseq", and "hex4" production rules obsolete. Thus this memo RECOMMENDS that the "hexpart", "hexseq", and "hex4" production rules be deleted from the ABNF of [RFC3261](#).

#### 4. Security Considerations

This document does not introduce any new security considerations.

#### 5. IANA Considerations

This document does not include any IANA considerations.

#### 6. Acknowledgments

The correct ABNF for IPv6 was developed by Andrew Main ([draft-main-ipaddr-text-rep](#)) in 2005 and published in [RFC3986](#).

#### 7. References



### **7.1. Normative References**

- [1] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and E. Schooler, "SIP: Session Initiation Protocol", [RFC 3261](#), June 2002.
- [2] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [3] Berners-Lee, T., Fielding, R., and L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", STD 66, [RFC 3986](#), January 2005.
- [4] Crocker, D., Ed. and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", [RFC 4234](#), October 2005.

### **7.2. Informative References**

- [5] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", [RFC 4291](#), February 2006.
- [6] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", [RFC 2373](#), July 1998.
- [7] Drage, K., "A Process for Handling Essential Corrections to the Session Initiation Protocol (SIP)", [draft-drage-sip-essential-correction-01](#) (work in progress), March 2007.

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