

Network Working Group  
Internet-Draft  
Intended status: Informational  
Expires: December 14, 2012

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June 12, 2012

Principles for Unicode Code Point Inclusion in Labels in the DNS  
draft-iab-dns-zone-codepoint-pples-00

Abstract

IDNA makes available to DNS zone administrators a very wide range of Unicode code points. Most operators of zones should probably not permit registration of U-labels using the entire range. This is especially true of zones that accept registrations from outside parties, including (and most importantly) the root. It is unfortunately not possible to generate algorithms to determine whether a code point is intrinsically safe to permit. This memo presents a set of principles that can be used to guide the decision of whether a Unicode code point may be wisely included in the repertoire of permissible code points in a U-label in a zone.

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## 1. Introduction

Operators of a DNS zone need to set policies around what Unicode code points are allowed in labels in that zone. Typically there are a number of important goals to consider when constructing such policies. These include, for instance, possible visual confusability between two labels, possible confusion between Fully-Qualified Domain Names (FQDNs) and IP address literals, and other usability and accessibility issues.

This document provides a set of principles that zone operators can use to construct their code point policies in order to improve usability and clarity and thereby reduce confusion.

### 1.1. Terminology

This document uses the following terms.

LDH Label: a string consisting of ASCII letters, digits, and the hyphen, with additional restrictions as explained in [Section 2.3.1 of \[RFC5890\]](#).

A-label: an LDH label that starts with "xn--" and meets all the IDNA requirements, with additional restrictions as explained in [Section 2.3.2.1 of \[RFC5890\]](#).

U-label: a string of Unicode characters that meets all the IDNA requirements and includes at least one non-ASCII character, with additional restrictions as explained in [Section 2.3.2.1 of \[RFC5890\]](#).

Public zone: in this document, a DNS zone that accepts registration requests from organizations outside the zone administrator's own organization. (Whether the zone performs delegation is a separate question. What is important is the diversity of the registration-requesting community.) Note that

under this definition, the root zone is a public zone, though one that has a unique function in the DNS.

Character: a member of a set of elements used for the organization, control, or representation of data. See [Section 2 of \[RFC6365\]](#) for more details.

Language: a way that humans communicate. The use of language occurs in many forms, the most common of which are speech, writing, and signing. See [Section 2 of \[RFC6365\]](#) for more details.

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Rendering: the display of a string of text. See [Section 5 of \[RFC6365\]](#) for more details.

Script: a set of graphic characters used for the written form of one or more languages. See [Section 2 of \[RFC6365\]](#) for more details.

Writing system: a set of rules for using one or more scripts to write a particular language. See [Section 2 of \[RFC6365\]](#) for more details.

This memo does not propose a protocol standard, and the use of words such as "should" follow the ordinary English meaning, and not that laid out in [\[RFC2119\]](#).

## [2.](#) Background

In recent communications ([\[IABCOMM1\]](#) and [\[IABCOMM2\]](#)), the IAB has emphasized the importance of conservatism in allocating labels conforming to IDNA2008 ([\[RFC5890\]](#), [\[RFC5891\]](#), [\[RFC5892\]](#), [\[RFC5893\]](#), [\[RFC5894\]](#), [\[RFC5895\]](#)) in DNS zones, and especially in the root zone. Traditional LDH-labels in the root zone used only alphabetic characters (i.e., ASCII a-z or A-Z). Matters are more complicated with U-labels, however. The IAB communications recommended that U-labels permit only code points with a General\_Category (gc) of Ll (Lowercase\_Letter), Lo (Other\_Letter), or Lm (Modifier\_Letter), but noted that for practical considerations other code points might be permitted on a case-by-case basis.

The IAB recommendation does, however, leave some issues open that need to be addressed. First, it is by no means clear that all of the code points with General\_Category Ll or Lm and which are permitted under IDNA2008 are appropriate for a zone such as the root zone. To take but one example, the code point U+02BC MODIFIER LETTER APOSTROPHE has a General\_Category of Lm. In practically every rendering (and we are unaware of an exception), U+02BC is indistinguishable from U+2019 RIGHT SINGLE QUOTATION MARK, which has a General\_Category of Pf (Final\_Punctuation). U+02BC will also be read by large numbers of people as being the same character as U+0027 APOSTROPHE, which has a General\_Category of Po (Other\_Punctuation). U+02BC is PROTOCOL VALID (PVALID) under IDNA2008 (see [[RFC5892](#)]), whereas both other code points are DISALLOWED. So, to begin with, it is plain that not every code point with a General\_Category of Ll, Lo, or Lm is consistent with the type of conservatism principle discussed in [Section 4.1](#) or the IAB recommendation.

To make matters worse, some languages are dependent on code points

with General\_Category Mc (Spacing\_Mark) or General\_Category Mn (Nonspacing\_Mark). This dependency is particularly common in Indic languages, though not exclusive to them. (At the risk of vastly oversimplifying, the overarching issue is mostly the interaction of complex writing systems and the way Unicode works.) To restrict users of those languages only to code points with General\_Category of Ll, Lo, or Lm. would be extremely limiting. While DNS labels are not words, or sentences, or phrases (as noted in [[RFC4690](#)]), they are intended to support useful mnemonics. Mnemonics that diverge wildly from the usual conventions in a language are likely to attract strong objections, particularly in the root. The objections might drag the discussion away from sound management of the DNS zone in question and towards discussions of cultural hegemony. That sort of discussion itself might present risks for the operation of the zone.

Many of the issues above turn out to be relevant to all public zones. Moreover, the overall issue of developing a policy for code point permission is common to all zones that accept A-labels or U-labels for registration. As [section 4.2.4 of \[RFC5891\]](#) says, every registry at every level of the DNS is "expected to establish policies about label registrations."

For reasons of sound management, it is not desirable to decide whether to permit a given code point only when an application containing that code point is pending. That approach reduces predictability and is bound to appear subject to special pleas. It is better instead to come up with the rules governing acceptance of code points in advance.

As is evident from the foregoing discussion about the Letter and Mark categories, it is simply not possible to make code point decisions algorithmically. If it were possible to develop such an algorithm, it would already exist: the DNS is hardly unique in needing to impose restrictions on code points while accommodating many different linguistic communities. Rules can nevertheless be made sensibly by using overarching principles to guide the rule-making. These principles function as meta-rules, guiding the establishment of rules for inclusion of any code point (from those permitted by IDNA) in labels in a given zone.

## [2.1.](#) Less-restrictive Rules Going Down the DNS Tree

A set of principles derived from the above ideas follows in [Section 3](#) through [Section 5](#) below. Such principles fall into three categories. Some principles apply to every DNS zone. Some additional principles apply to all public zones, including the root zone. Finally, other principles apply only to the root zone. This means that zones higher in the DNS tree tend to have more restrictive rules (since additional

principles apply), and zones lower in the DNS tree tend to have less restrictive rules, since they are used within a more narrow context. In general, the relevant context for a principle is that of the zone, not that of a given subset of the user community; for the root zone, for example, the context is "the entire Internet population".

## [3.](#) Principles applicable to all zones

### [3.1.](#) Longevity Principle

Unicode properties of a code point ought to be stable across the versions of Unicode that users of the zone are likely to have installed. Because it is possible for the properties of a code point to change between Unicode versions, a good way to predict such

stability is to ensure that a code point has in fact been stable for multiple successive versions of Unicode. This principle is related to the Stability Principle in [Section 4.5](#).

The more diverse the community using the zone, the greater the importance of following this principle. The policy for a leaf zone in the DNS might only require stability across two Unicode versions, whereas a more public zone might require stability across four or more releases before the code point's properties are considered long-lived and stable.

### [3.2](#). Usability Principle

Every zone administrator should be sensitive to the potential use of a code point to be permitted, and to be as cautious as practical in permitting code points in the zone. The Conservatism Principle outlined in [Section 4.1](#) is in general a good idea, though less conservatism may be appropriate in the case of well-delineated and less-diverse user communities. Zone administrators should especially consider whether a candidate code point could be used maliciously or could present difficulty if the code point is encountered outside the usual linguistic circumstances.

## [4](#). Principles applicable to all public zones

### [4.1](#). Conservatism Principle

Public zones are, by definition, zones that are shared by different groups of people. Therefore, any decision to permit a code point in a public zone (including the root) should be as conservative as practicable. Doubts should always be resolved in favor of rejecting a code point for inclusion rather than in favor of including it, in

order to minimize risk.

### [4.2](#). Inclusion Principle

Just as IDNA2008 starts from the principle that the Unicode range is excluded, and then adds code points according to derived properties of the code points, so a public zone should only permit inclusion of a code point if it is known to be "safe" in terms of usability and

confusability within the context of that zone. The default treatment of a code point should be that it is excluded.

#### [4.3.](#) Simplicity Principle

The rules for determining whether a code point is to be included should be simple enough that they are readily understood by someone with a moderate background in the DNS and Unicode issues. This principle does not mean that a completely naive person needs to be able to understand the rationale for why a code point is included, but it does mean that the reason for inclusion of very peculiar code points, even if the code points are safe in themselves, will be too difficult to understand and such code points will therefore be rejected.

The meaning of "simple" or "readily understood" is context-dependent. For instance, the root zone has to serve everyone in the world; for practical purposes, this means that the reasons for including a code point need to be comprehensible even to people who cannot use the script where the code point is found. In a zone that permits a constrained subset of Unicode characters (for instance, only those needed to write a single alphabetic language) and that supports a clearly-delineated linguistic community (for instance, the speakers of a single language with well-understood written conventions), more complicated rules might be acceptable. Compare this principle with the Usability Principle in [Section 3.2](#).

#### [4.4.](#) Predictability Principle

The rules for determining whether a code point is to be included should be predictable enough that those with the requisite understanding of DNS, IDNA, and Unicode will usually reach the same conclusion. This is not a requirement for algorithmic treatment of code points; as previously noted, that is not possible. It is rather to say that the consistent application of professional judgment is likely to yield the same results; combined with the principle in [Section 4.1](#), when results are not predictable the anomalous code point would not be permitted.

Just as in [Section 4.3](#), this principle tends to cause more

restriction the more diverse the community using the zone; it is most



restrictive for the root zone. This is because what is predictable within a given language community is possibly very surprising across languages.

#### [4.5.](#) Stability Principle

Once a code point is permitted, it is at least very hard to stop permitting that code point. In public zones (including the root), the list of code points to be permitted should change very slowly, if at all, and usually only in the direction of permitting an addition as time and experience indicates that inclusion of such a code point is both safe and consistent with these principles.

### [5.](#) Principle specific to the root zone

#### [5.1.](#) Letter Principle

In keeping with the spirit of the note in [\[RFC1123\]](#) that top-level labels "will be alphabetic", U-labels in the root zone should exclude code points that are not normally used to write words, or that are in some cases normally used for purposes other than writing words. This is not the same as using Unicode's General\_Category to include only letters. It is a restriction that expands the possible class of included code points beyond the Unicode letters, but only expands so far as to include the things that are normally used the way letters are. Under this principle, code points with (for example) General\_Category Mn (Nonspacing\_Mark) might be included -- but only those that are used to write words and not (for instance) musical symbols. This principle should be applied as narrowly as possible; as [\[RFC4690\]](#) says, "While DNS labels may conveniently be used to express words in many circumstances, the goal is not to express words (or sentences or phrases), but to permit the creation of unambiguous labels with good mnemonic value."

### [6.](#) Conclusion

The principles outlined in this document can be applied when considering any range of Unicode code points for possible inclusion in a DNS zone. It is worth observing that doing anything (especially in light of [Section 4.5](#)) implicitly disadvantages communities with a writing system not yet well understood and not represented in the technical and policy communities involved in the discussion. That disadvantage is to be guarded against as much as practical, but is effectively impossible to prevent (while still taking action) in light of imperfect human knowledge.

## 7. Security Considerations

The principles outlined in this memo are intended to improve usability and clarity and thereby reduce confusion among different labels. While these principles may contribute to reduction of risk, they are not sufficient to provide a comprehensive internationalization policy for zone management.

## 8. IANA Considerations

None. RFC Editor: this section may be removed on publication.

## 9. Acknowledgements

The authors thank the participants in the IAB Internationalization programme for the discussion of the ideas in this memo. Marc Blanchet made specific comments.

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