Internationalized Domain Names Tutorial

ICANN Meeting
São Paulo, Brazil
3 December 2006

Tina Dam
IDN Program Director
ICANN

Email: tina.dam@icann.org

Remote Participation

- Jabber room is open:
  - IDNQUESTIONS@jabber.icann.org
  - Frank Fowlie will manage questions posted to the room

Agenda

- IDN General Information
  - Definition
  - IDN Status Quo Overview
  - The Need for IDNs
  - Internationalization
  - Protocol and Functionality
  - Punycode, stored form vs. displayed form
  - Languages and scripts
  - Unicode and ASCII
- Confusable IDN Issues
  - Same script different language
  - Same language multiple and mixed scripts
  - Visual confusables
- IDN Program Plan
- Sao Paulo Activities
- Summary

What is an IDN?

- IDN stands for Internationalized Domain Name
  - Domain name labels containing non-host name characters.
    - Valid hostname characters are: a-z, 0-9, “-”
    - Valid hostname characters sometimes referred to as ASCII or LDH
  - Only host name strings are entered into the DNS
  - IDN in general refers to both displayed form (Unicode) and stored form (punycode) of the domain name

- Example: rødgrød.tld → xn--rdgrd-vuad.tld
  - ø is LATIN SMALL LETTER o WITH STROKE: U+00F8
  - Used in for example Danish, Norwegian, Faroese

Domain Names in General

- Domain names are not general natural language expressions
- Domain names that are not lexically words in a language are possible and quite common
- Domain names are identifiers that help users uniquely reference information in the Internet using sequence of characters into strings
- Domain names must be unique
- Not all words in all languages will be available as domain name labels

Internationalization Overview

Domain Names Based on ASCII / LDH Rule	➢ ➢	IDN second level Internationalized top level
ASCII based browser/email clients/…	➢	Application upgrades to get web access in local chars + IDN enabled emails…
Content have been available in many languages for some time	➢	Expected to continue to expand

example.test → 실례.test and 실례.테스트

(stored form: example.test → xn--9n2bp8q.test and xn--9n2bp8q.xn--9t4b11yi5a)

Aim: An internationalized Internet

Internationalization cont.

- Internationalization of the internet means that the internet is equally accessible from all languages and scripts

- Domain names represent only a small part of internationalization of the internet

- Controversy about how important the domain names are compared to search capabilities…etc…
  - Accessibility from all languages is important which means that the way IDNs are handled is very important
  - Continuously making characters available as much as possible as these are added to Unicode
  - Disagreement about whether domain names are used by typing into browsers and usability of IDNs
    - But agreement that email addresses based on local characters are necessary for large parts of the world,
    - and URL's listed in offline documents need to be usable by local communities

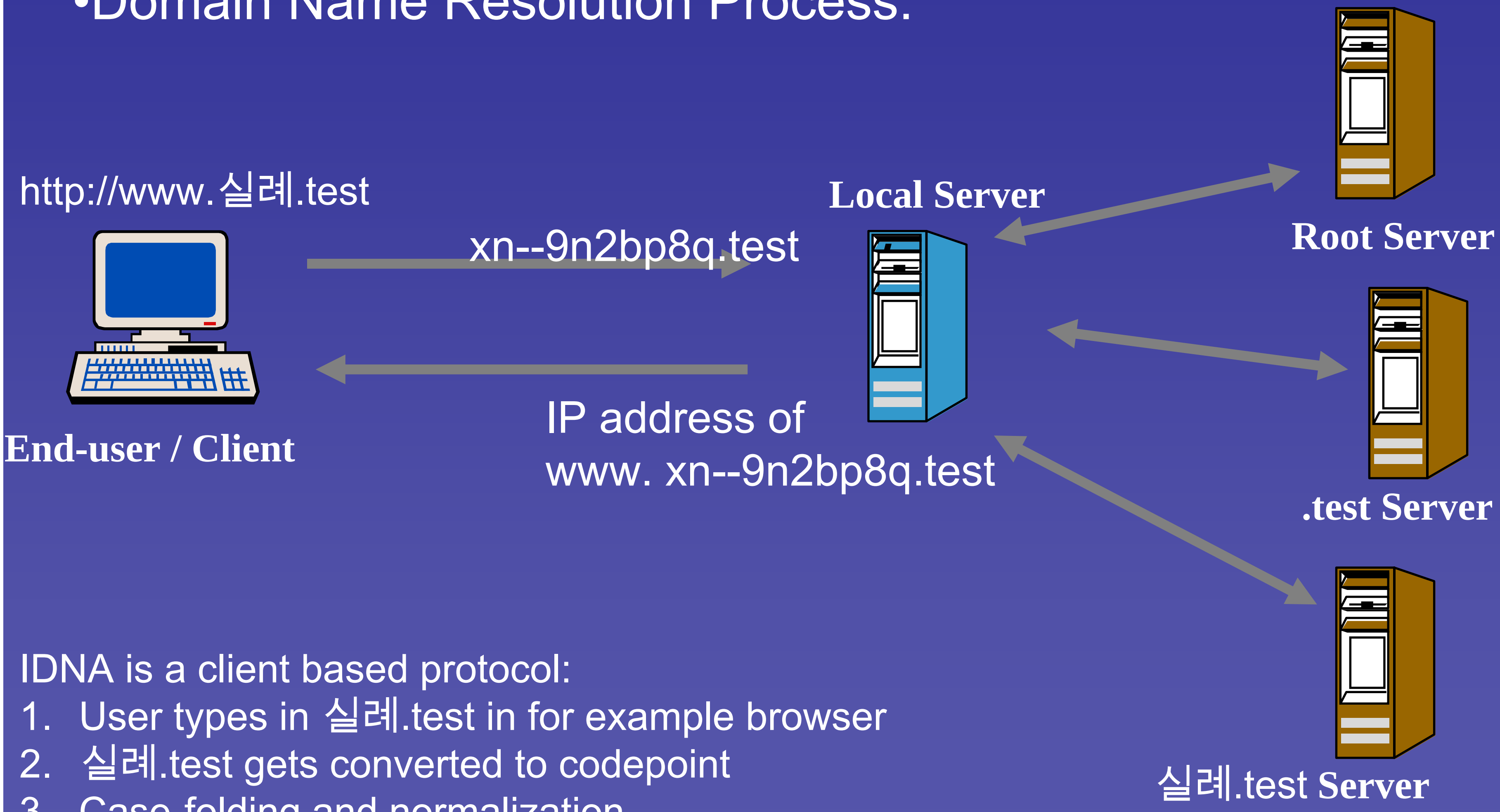
The Need for IDNs and Internationalization

- Geographic expansion of the Internet
  - IDNs match needs of increased use by linguistic groups
  - IDNs used for identification of content reflecting linguistic diversity
- Internationalization is
  - A means to localization
  - Necessary given the global nature of the Internet
- Localized system adapted to
  - Language
  - Writing system and character codes
  - Location
  - Interests
- Global Interoperability
  - Network strength is to interoperate globally
  - Security and stability is primary focus
  - Avoid fragmentation of the Internet

ICANN

IDNA – Protocol Functionality

- Domain Name Resolution Process:



http://www.실례.test

End-user / Client

xn--9n2bp8q.test

IP address of www. xn--9n2bp8q.test

Local Server

Root Server

.test Server

실례.test Server

IDNA is a client based protocol:

1. User types in 실례.test in for example browser
2. 실례.test gets converted to codepoint
3. Case-folding and normalization
4. Stringprep filter
5. Punycode convertion → xn--9n2bp8q.test

ICANN

More Protocol Information

- IDNA is the acronym for the IDN protocol, developed within the IETF and published in June 2003
- IDNA stands for
  - Internationalized Domain Names in Application.
- Technical details are available in the IETF RFCs:
  - RFCs 3490, 3491, and 3492
- IDNA is currently under revision
  - RFC4690 and associated internet drafts suggesting revisions and solutions to some problems
  - More about this later…

Displayed Form vs. Stored Form

- Historically the domain name you register is also the domain names stored and usable in the DNS
- This is changed with introduction of IDNs
- Usually the stored form does not make any meaning
  - Example: فرسالنهر.tld → xn--mgbtbg2evaoi.tld
- However, there are exceptions:
  - xn--gibberish - decodes into the Arabic characters ب٩٧٨فأإ
  - xn--trademark - with different versions of trademarks
  - This is coincidentally and hence not intentionally

- xn-- prefix specifically designates a system called Punycode
- xn-- prefix indicates to application software that the label needs to be decoded back into Unicode for proper display to the user

More Punycode and Some User Perspective

- Intention that Punycode (xn--….) never be exposed to users, but there are exceptions
  - situations where IDNs could not be displayed as Unicode characters
  - in such cases the utility of IDN depends on user recognition and understanding of Punycode
- Otherwise, as a user all you need is the name you want to register
  - TLD Registries will supply a list over available characters, usually in Unicode
  - Registries will handle all encodings needed during registration process
- May be useful to consider usability of the name, keyboards, business cards, and other practical limitations
- Encodings by for example:
  - http://josefsson.org/idn.php
  - Others are made available by TLD registries

ICANN

Language and Script

- Languages are used by humans to interact
  - Best guesses estimate 5000-7000 languages worldwide, of which 100-200 are mainly used
  - RFC3066 discusses languages in more detail
  - Examples: Arabic, Greek, Portuguese
- Script is a set of graphic characters used for the written form of one or more languages (ISO10646 definition)
  - Examples: Arabic, Cyrillic, Greek, Han
- Computers don’t understand languages instead any characters will have an associated code-point

Unicode and ASCII

- Unicode is one of many character encoding systems in use.
  - Encoding systems are lists that assign a unique number to each character in the list
- Unicode accommodate a Universal Character Set and contains different ways for representing characters
  - Not all is adequate for handling IDNs partly due to variations in language and user perceptions
  - http://www.unicode.org, technical reports UTR36 and UTR39, and more details in RFC4690
- The DNS uses a different encoding system, ACE is an ASCII Compatible Encoding
  - American Standard Code for Information Interchange
  - Punycode (the xn- - form) is the ACE used for IDNs
- This is what we saw before with the displayed form in Unicode and the stored form in Punycode (ASCII)

How far did we make it….

- IDN General Information
  - Definition
  - IDN Status Quo Overview
  - The Need for IDNs
  - Internationalization
  - Protocol and Functionality
  - Punycode, stored form vs. displayed form
  - Languages and scripts
  - Unicode and ASCII
- Confusable IDN Issues
  - Same script different language
  - Same language multiple and mixed scripts
  - Visual confusables
- IDN Program Plan
- Sao Paulo Activities
- Summary

Same Script Different Language Issue

- Language specific character issues
  - Jorgen =Jørgen = Jörgen in Danish, Swedish, Norwegian
  - But users don’t always think that o equal ø and ö
  - ø is LATIN SMALL LETTER o WITH STROKE (U+00F8)
  - ö is 'LATIN SMALL LETTER o WITH DIAERESIS' (U+00D6)

- Not possible to make generic rule at the protocol level
- Need for specific rules at TLD registry level

- Some registries have submitted character tables to the IANA repository to show variants
  - Example: the .se table displays that:
    - The letter Ü is referred to in Swedish as a # "German Y" and is # considered to be a variant of the letter Y.
    - The letter Å is not considered to be a variant of the letter A…Earlier practice substituted AA, which is no longer recommended but will still be encountered
- http://www.iana.org
  - (link to IANA Repository at bottom left of main page)

Same Language Multiple Scripts Issues

- Some languages can be expressed by multiple scripts
  - Eastern European and Central Asian languages can be expressed in Cyrillic or Latin characters
  - African and Southeast Asian languages can be expressed in Arabic or Latin characters
  - Other languages are written in a combination of scripts- Kanji, Kana, Romanji for Japanese & Hangul and Hanji for Korean
- Hence, same word, same language can be expressed in different ways
  - Some words can only be expressed use a single script
  - Some words are expressed by mixing of scripts
- Result is that script definition is very important and sensitive in terms of IDNs

Visual Confusion Issues

- Well-known example: paypal.com
  - Second character is U+0430, Cyrillic small a
  - Looks like Roman/ASCII “a”
  - This is now prevented by “one label, one script” rule per the IDN Guidelines with exceptions for mixed script languages
- Other example:
  - Russian ccTLD is .ru
    - Cyrillic “r” and “u” is: р and у
    - Which looks like p y (in latin) is ccTLD for Paraguay
    - **Note: Russia did not ask for .py, this is just an example**
  - Process needed to determine labels matching ccTLDs

General Overview of User Confusion Issues

- IDNs Expanding Risk of Known Problems
- Many characters can be confused with others
  - Problem exists in ASCII as well
    - Digit “1” and lower-case “l”
    - Digit “0” and upper-case “O”
  - IDNs increasing the character collection
    - From 64 in ASCII (LDH)
    - To tens of thousands in Unicode
- This kind of confusion
  - create opportunities for user mistakes
  - and fraud

Mid-way Summary

We have looked at some of the main issues related to IDNS – what about solutions…

Some user confusion is being solved by
- protocol adjustments
- IDN guidelines revisions
- implementation of adequate registry policies

Remaining user confusion need to be solved by
- education of community

IDN Program Plan

- A new program within ICANN
  - IDN Program recently established within ICANN to achieve the possibility to insert internationalized top level labels in the root zone.
- IDN dedicated staff
  - Existing Technical, Policy, IANA Staff
  - New positions of CTO, Writer, Project Coordinator, etc
- Goals with program includes
  - Enable introduction of internationalized top level labels
  - Response to increased geographic use of the internet
  - Global interoperability and keeping the internet secure and stable

Towards Introduction of Internationalized TLDs

- The Program Plan is comprised of several Projects that may be planned and managed separately but have independencies.

- Projects focuses on following objectives:
  - Security and Stability of the DNS
  - Results and recommendations from the IETF’s Review of IDNA
  - Promoting consumer choice and avoiding user confusion
  - Developing consensus policy to guide implementation
  - Increasing Outreach and communication plans

IDN Laboratory Testing Goals

- Demonstrate that the insertion of IDN strings into the root has no appreciable negative impact on existing resolutions
- Obtain agreement of US DoC that internationalized top level labels can be inserted (potentially initially for test purposes) live in the DNS
- Reach consensus opinion with RSSAC and the root-ops that internationalized top level labels can be inserted (potentially initially for test purposes) in the DNS

ICANN

IDN Laboratory Testing: Project Milestones

- July 2006:
  - Meeting with IDN-PAC and root-server operators during Marrakesh and Montreal meetings
  - Plan NS and DNAME testing as two parallel running tracks
- September 2006:
  - ICANN retained Autonomica to perform laboratory test
    - Highly DNS experienced staff
    - Test plans will be made publicly available for replication opportunities
- October 2006
  - IDN-PAC agrees on method to select the strings for the laboratory test
  - Set of strings are provided Autonomica and initial testing are commenced
    - Preliminary tests already performed and while successful, demonstrated that some applications have not implemented IDNA in accordance with the existing protocol standard
- December 2006
  - More test details expected to be provided

IDN Laboratory Testing Details

- Autonomica will develop and ICANN will publish the test procedure
  - plan detail will be sufficient so that others may replicate the test
  - ICANN will publish the results received of any other test performed in accordance with the publish test plan
- The laboratory test plans includes the following:
  - insertion of NS records into a copy of the root zone
  - tests performed in closed laboratory environment with a series of systems implemented to replicate as closely as possible the server software of the various root servers. This includes:
    - versions of BIND server software, and
    - use of the most popular DNS resolver software packages
- No further end-user or application testing is included as the laboratory environment is closed and not accessible from outside

Development of Laboratory test strings

- Test strings was delivered by ICANN as coordinated through the IDN-PAC

- Normal Unicode-Punycode conversion
  - flod18häst → .xn--flod18hst-12a
- Performance with a 63-character long TLD string
  - .hippo18potamushippo18potamushippo18potamushippo18po

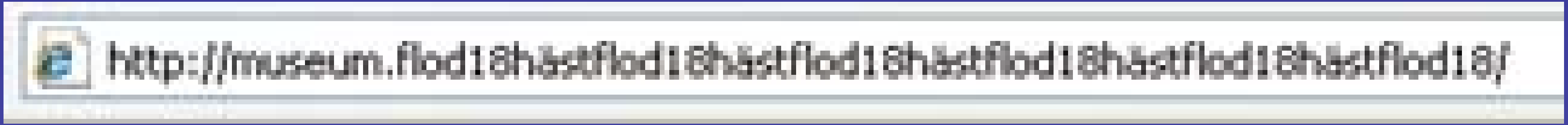
- Right to left, embedded characters with opposing directional properties

- Left to right script with sophisticated shaping properties

- Non-alphabetic script

First IDN Test Complete

- First IDN Test Run successfully completed in October 2006



http://museum.flod18hästflod18hästflod18hästflod18hästflod18hästflod18/

  - 63 letter Top Level Domain
  - Conducted at the .museum IDN lab, in association with Autonomica
- Preliminary Results
  - Resolver software in test environment worked without problems
  - End-user software showed difference that was not related to implementation of the IDNA protocol, and is currently being corrected

Application Software Testing

- A positive result from the laboratory tests will allow move to a “Live” IDN TLD test
- These additional tests are intended to ensure that application software will work with internationalized domain names
  - Introduce <.test> in various scripts to ensure participant understanding that this is for testing only
  - Test scripts are intended to be determined after consultation with Internet community
  - Plans will be main topic for IDN-PAC meeting in Sao Paulo
  - Plans will need further discussion with technical community

IDNA Protocol Revision,
By IETF

Proposed Revisions to IDNA Protocol

- Revising the IDNA protocol will build an “inclusion” based model for determining what scripts may be used for IDNs and potentially increase the number of scripts available for IDN deployment.

- The revision will base the protocol on Unicode 5.0 (containing 64 scripts), the existing protocol is based on Unicode 3.2 (containing 45 scripts).

- The revision to the protocol will:
  - Potentially increase available blocks of characters
  - Include revision process to include additional scripts in the future
  - include technical review of protocol functionality

- The revision effort is being managed through the IAB/IETF

- The Basic Framework was published Sept-06
  - RFC4690

Revisions suggestions of IDNA Protocol

- Three internet-drafts were published providing suggestions for solutions to the issues raised in RFC4690:
- An overview with proposed issues and changes for IDNA
  - http://www.ietf.org/internet-drafts/draft-klensin-idnabis-issues-00.txt
- A suggestion for solving an IDNA problem in right-to-left scripts by revising the stringprep profile
  - http://www.ietf.org/internet-drafts/draft-alvestrand-idna-bidi-00.txt
- An overview of suggested inclusion based IDNA Unicode Codepoints based on Unicode 5.0
  - http://www.ietf.org/internet-drafts/draft-faltstrom-idnabis-tables-00.txt
- A status report will be provided in the IDN workshop
  - Wednesday, 6 December 2006, 17.30-19.30

Communication and Outreach

IDN Outreach and Communication Focus

- ICANN regional road-trip in Middle East, October 2006
  - Arabic script vs. language issues
- Internet Days Forum
  - Stockholm 24-26 October 2006
- Internet Governance Forum, IDN workshop
  - Athens 31 October 2006
- APTLD meeting with IDN focus
  - 14 November 2006
- ccTLD meeting for Middle East
  - Dubai 20 November 2006
- Sao Paolo ICANN Meeting with IDN sessions
  - 2-8 December 2006

- RSS feed available for IDN Communications
- Online Calendar for IDN events available

Sao Paulo Activities

- GNSO IDN working group
- IDN Tutorial
- IDN workshop
  - Statuses on various projects
- GNSO, ccNSO joint work
- GAC IDN working group
- IDN Presidents Advisory Committee
- Additional other meetings…
- Resources:
  - http://www.icann.org/topics/idn
  - http://www.icann.org/meetings/saopaulo/idn-agenda-saopaulo-2006.htm

Summary of IDN Principles

- Global uniqueness and interoperability of the DNS
  - unique and unambiguous domain names
  - Same functionality regardless of geographic placement of access
  - URLs and emails connect as expected regardless of geographic placement of access
- Promote “Future-Proof” solutions
  - Define Unicode characters to be allowed
  - Provides ability for adding new languages, new characters far in the future
- Avoid or diminish as much as possible user confusion
  - Technical limitations
  - Implementation requirements
  - Registry restricted list and policies
  - User education
- Promote multi-stakeholder involvement