# Labeled Segments and the CCNx URI Scheme

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# Overview

- In CCNx names, each path segment may have a distinct type.
- Specifies a way to represent this in a URI.
- Submitted Jan 2015, updated June 2015.
- Lastest update April 2016 changed schema to ccnx: from lci: and fixed an error in the grammar.

# In a nutshell

- General URI derived syntax
  - Reserve the "=" character.
    - Must be percent encoded if appears.
  - Specify that each path segment is of the form label=value.
  - Does not specify any labels.
- ccnx: scheme
  - Specifies labels
  - Specifies normalization rules

# Labeled Segment (LS) URIs

- Similar to URIs defined RFC3986
- A LS-URI has a scheme, hierarchical part, optional query, and optional fragment

```
LS-URI = scheme ":" ls-hier-part ["?" ls-query] ["#" fragment]
```

# LS-URI Hierarchical Parts

- Composed of an absolute path
- The first segment, if present, is special: it must be a labeled segment **with a non-zero length.**

```
ls-segment-nz  = lpv-segment-nz / v-segment-nz
lpv-segment-nz = label [":" param] "=" s-value-nz
```

- The remaining segments can be labeled segments or plain values and may have zero length

```
ls-segment = lpv-segment / v-segment
```

# Implicit labels

- The LS-URI scheme allows the omission of the label and "=" so one may write simple URIs.
- In this case, a specific scheme MUST specify what the implicit label is.
- URIs with implicit labels have labels and when displayed are displayed with the label
  - E.g. ccnx:/foo/bar ➔ ccnx:/NAME=foo/NAME=bar

# The first path segment

- ls-uri:/ (OK)
  - This is a name with no segments. It is not an implicit label.
- ls-uri:/label= (NOT ALLOWED)
  - This is a name with 1 segment and no value. This could be an implicit label with no value (case 1) so to avoid ambiguity is not allowed.
- ls-uri:/label=foo/ (OK)
  - 2 segment name with second segment implicit and empty ➔ ls-uri:/label=foo/implicit=

# LS Queries and Fragments

- A query is composed of at least one labeled or value segment
- More segments may be appended with the proper '&' concatenation marker

```
ls-query = *1 ( lpv-component / v-component
              *( "&" (lpv-component / v-component) ) )
```

- Fragments are are as defined in RFC3986

# Normalizing URIs

- LS URIs must be normalized (using the methods in RFC3986 before comparison) such that:
  - Unrestricted percent-encodings are restricted
  - Numerical values are decimal or hexadecimal
  - Value-only segments or components that are assigned a default type should be normalized to a that type
  - Unknown labels should be normalized to a default value (per the scheme)

# The CCNx URI Scheme

# Overview

- The CCNx URI scheme is denoted “ccnx:”
  - The previous Labeled Content Identifier “lci:” scheme is deprecated
- The scheme specifies types for labeled segments
  - Name segment: a generic name that includes arbitrary octets
  - Payload identifier: a unique identifier for a CCNx message (interest)
  - Application type N: an application-specific type

# Restrictions

- CCNx URIs MUST NOT include an Authority, Query, or Fragment
  - Names with these components are treated as errors

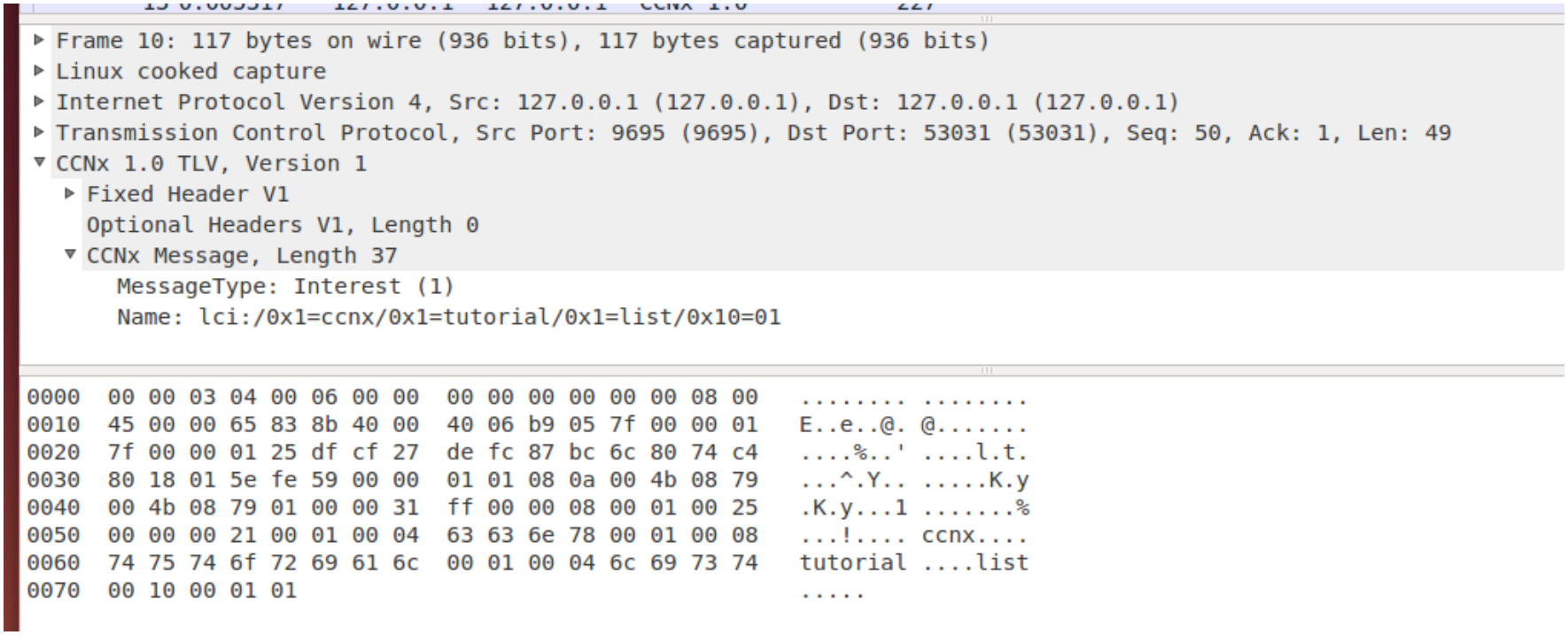
# More on Labels

- Name labels are denoted as “Name=value”
  - This is the implicit type for unlabeled segments
- Payload ID labels are denoted as “IPID=value”
- Application-specific labels are denoted as “App:N=value”, where N = 0,…,255

# Examples

| Simple Representation | Canonical Representation | Description |
|---|---|---|
| / | ccnx:/ | 0-length name |
| /Name= | ccnx:/Name | 1-segment name of 0-length |
| /foo/bar | ccnx:/Name=foo/Name=bar | Equivalent to<br>ccnx:/foo/Name=bar<br>ccnx:/foo/bar<br>Etc. |
| /foo/bar with App:2=%x09 | ccnx:/Name=foo/Name=bar/App:2=0x09 | |
| /foo/bar with App:1 %xA0 and App:2 value 0x09 | ccnx:/Name=foo/Name=bar/App:1=0xA0/App:2=0x09 | |

# Wireshark Example



# Comparing CCNx Names

- Two options: compare binary-encoded versions or normalize and compare URI string versions
- Normalization rules include (at minimum):
  - Case normalization
  - Percent encoding normalization
    - Percent encodings of unreserved characters must be converted to the unreserved character
  - Path segment normalization
    - Must be resolved first
  - ...

# Construction from Code

- Default name

```
CCNxName *name1 = ccnxName_CreateFromCString(“ccnx:/”);
CCNxName *name2 = ccnxName_CreateFromCString(“lci:/”);
```

**Output:** “ccnx:/”

- With %-encoding

```
char *str = ccnx:/test/Name=MiISAg%3D%3D”;
CCNxName *name3= ccnxName_CreateFromCString(str);
```

**Output:** “ccnx:/Name=test/Name=MiISAg%3D%3D”

ccnx:/name=done