IPN URI Schema update

https://datatracker.ietf.org/doc/draft-ietf-dtn-ipn-update/

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IETF-115

Background

An IPN scheme URI is defined in RFC6260 and RFC9171 as:

`ipn:`*node-nbr*`.`*service-nbr*

Where:

node-nbr is the **unique*** identifier of the node on which a particular service endpoint is expected to exist.

service-nbr is the identifier of the service.

* The uniqueness constraint is really important for interoperability.

The perceived problems

- The only IANA registry for *node-nbr*s is the CBHE registry
  - Predates BPv7
- There are minor inconsistencies between RFC6260, RFC7116, and RFC9171
  - Some behaviour assumed or implied, not specified, e.g. *node-nbr* uniqueness
- A single flat numbering space for all *node-nbr*s
  - Inefficient encoding in CBOR penalises later registrations
  - No reservation for convenient short *node-nbr*s as used today in private networks, resulting in unofficial use of “licensed spectrum”

Proposed solutions

1. Clarify usage of ipn scheme URI *node-nbr*s and *service-nbr*s with BPv7
2. Clone/rename IANA CBHE Node number registries to clarify BP version
3. Reserve low numbers for **Private Use** - official “unlicensed spectrum”
4. Introduce new *Numbering Authority* prefixes to allow flexibility of allocation with efficient encoding

Usage clarifications for BPv7

For *node-nbr*s:

- The value zero (0) for the *node-nbr* component MUST NOT be used except as part of the URI `ipn:0.0`.
- Values greater than or equal to 2^{64} for the *node-nbr* MUST NOT be used, to allow concise unsigned integer (type 0) CBOR encoding.
- All 'ipn' scheme URIs for endpoints co-located on a single bundle processing node MUST share the same value for the *node-nbr* component.

For *service-nbr*s:

- The value of the *service-nbr* component of an 'ipn' scheme URI of the EID of an administrative endpoint MUST be zero (0).
- Values greater than or equal to 2^{64} for the *service-nbr* component MUST NOT be used, to allow concise unsigned integer (type 0) CBOR encoding.

Rename IANA CBHE registries for BPv6

- *“CBHE Node Numbers” -> “Bundle Protocol Version 6 'ipn' Scheme URI Node Numbers”*
- *“CBHE Service Numbers” -> “Bundle Protocol Version 6 'ipn' Scheme URI Service Numbers”*
- No alteration to the current assignments or policies

This change has no impact on existing BPv6 implementations.

New IANA *node-nbr*s registry for BPv7

- "*Bundle Protocol Version 7 'ipn' Scheme URI Null Authority Node Numbers registry*"*
- All values and policies copied from CBHE Node Numbers registry, except:
  - Values $[1..2^{14})$ are now **Private Use**
  - Values $[2^{42}..2^{64})$ are now **Experimental**
  - Values $[2^{21}..2^{28})$ are no longer "Reserved for Private or Experimental Use"

This change allows:

- Official "unlicensed spectrum" with efficient encoding when interoperability is not required, as is already deployed.
- Returns a range of numbers to the available pool to be allocated.

* More on the "Null Authority" part later…

New IANA *service-nbrs* registry for BPv7

- *"Bundle Protocol Version 7 'ipn' Scheme URI Service Numbers"*
- Policies:
  - Values [0..23] are **RFC Required** -
    - 0 allocated to the "Administrative Endpoint"
  - Values [24..4095] are **Specification Required**
  - Values [4096..2^{32}) are **Private Use**
  - Values [2^{32}..2^{64}) are **Experimental Use**

This allocation policy mirrors the TCP/UDP service/port number policies.

I could find no current specifications for any active "well-known" BPv7 services that needed immediate assignment - but I could be wrong.

This sets us up perfectly for Marc Blanchet's draft on service numbers:
https://datatracker.ietf.org/doc/draft-blanchet-dtn-bp-application-framework/

Any questions so far?

Numbering Authorities

The problem:

- Allocating from a flat number space results in inefficient CBOR encoding.
  - The smallest *node-nbr* allocated to CCDS is 16384, which is encoded in a minimum of 7 octets, i.e. `ipn:16384.0` is encoded as:

```
82             # array(2)
   02          # uri-code: 2
   82          # array(2)
      19 4000  # node-nbr: 16384
      00       # service-nbr: 0
```

- Later allocations from the registry are forced to have even longer minimum encodings

Numbering Authorities

The proposal:

- Introduce an **optional** *Naming Authority* identifier as a prefix results in much more concise CBOR encoding
  - E.g. `ipn:2.1.0` encodes to 6 octets:

```
82        # array(2)
   02     # uri-code: 2
   83     # array(3)
      02  # auth-nbr: 2
      01  # node-nbr: 1
      00  # service-nbr: 0
```

- Allow **optional** *Naming Sub-authority* identifier, at the discretion of a Naming Authority.
  - E.g. `ipn:2.7.1.0`
- Managed via IANA *“Bundle Protocol Version 7 'ipn' Scheme URI Authority Numbers registry”*

Advantages

- Easy to detect by examining the array size in the CBOR encoding
  - Check is 1 octet after the “schema supported?” check
- Backwards compatible, as authorities are **optional**:
  - If no *auth-nbr* then consult the IANA *“Bundle Protocol Version 7 'ipn' Scheme URI Null Authority Node Numbers registry”* registry.
- Removes contention on the *“Bundle Protocol Version 7 'ipn' Scheme URI Null Authority Node Numbers registry”*.

Questions?