A Concise Binary Object Representation (CBOR) of DNS Messages

draft-lenders-dns-cbor
(https://datatracker.ietf.org/doc/draft-lenders-dns-cbor/)

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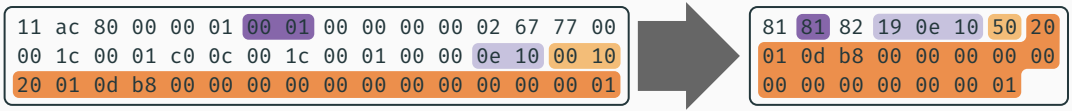
Outline

- Motivation
- Objectives
- Updates
- Next Steps
  - Summarized RRSets
  - Name Compression Based on Packed CBOR

Motivation: Concise DNS in Constrained Networks



Classic DNS

DNS+CBOR

DNS message fields map to CBOR:

`00 01` ANCOUNT = 1
`0e 10` TTL = 3600
`50` RDATALEN = 16
`20 01...` RDATA (`2001:db8::1`)

`81` Array (length 1)
`19 0e 10` `uint` 3600
`50` `bstr` (length 16)
`20 01...` `ip'2001:db8::1'`

Objectives of draft-lenders-dns-cbor (`application/dns+cbor`)

Provide concise packet format and compressed names and addresses in DNS queries and replies:

1. Using existing implementation: CBOR
2. Encoding of DNS messages in CBOR (conciseness)
3. Omit (redundant) DNS fields in DNS queries and responses (conciseness)
4. Easy to implement name compression, on-the-fly construction (compression)
5. Address and value compression using CBOR-packed (compression, optional)

Updates since IETF 121

+ Address IANA review: Provide preliminary Content-Format (no expert review yet)
  + `application/dns+cbor` ↦ 53 (*cmp.* DNS port)
  + `application/dns+cbor;packed=1` ↦ 54
- Minor editorial changes

Next Steps

Current PRs:

- **GH#6** Add capability to summarize RR sets
- **GH#7** Make name compression be based on Packed CBOR

Add Capability to Summarize RR sets

Examples:

Generic Records

```
...

type-spec-rdata = (
  ? type-spec,
  rdata: bstr//(domain-name)//(rdata-set),
)

rdata-set = (
  is-rrset: true,
  rdata-set: [ +bstr ]
) / (
  is-rrset: true,
  rdata-set: [ +[ domain-name ] ],
)
```

Structured Records

```
...

structured-ts-rd //= (
  6,    ; record-type = SOA
  ? 1,  ; record-class = IN
  (
    soa // (
      is-rrset: true, rdata-set: [ +soa ]
    )
  ),
)
```

Recap: Current Name Compression in DNS+CBOR

EDN

```
[
 ["www", "example",  "ie",
  1],
 [
  ["www", "example",  "ie",
   5,  "example",  "ie"],
  ["example",  "ie", 1,
   h'c0000207']
 ]
]
```

Binary (hex, 65 bytes)

```
82
 84 63 777777 67 6578616d706c65 62 6965
  01
 82
 86 63 777777 67 6578616d706c65 62 6965
    05 67 6578616d706c65 62 6965
   84 67 6578616d706c65 62 6965 01
    44 c0000207
```

Recap: Current Name Compression in DNS+CBOR

EDN

```
[
 ["www", "example",  "ie",
  1],
 [
  ["www", "example",  "ie",
   5,  "example",  "ie"],
  ["example",  "ie", 1,
   h'c0000207']
 ]
]
```

We have seen this sequence!

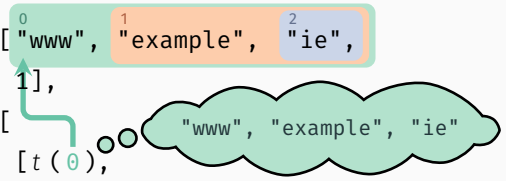
Binary (hex, 65 bytes)

```
82
 84 63 777777 67 6578616d706c65 62 6965
  01
 82
 86 63 777777 67 6578616d706c65 62 6965
   05 67 6578616d706c65 62 6965
  84 67 6578616d706c65 62 6965 01
   44 c0000207
```

Recap: Current Name Compression in DNS+CBOR

EDN

```
[
 ["www", "example", "ie",
  1],
 [
  [t (0),
   5, "example", "ie"],
  ["example", "ie", 1,
   h'c0000207']
 ]
]
```

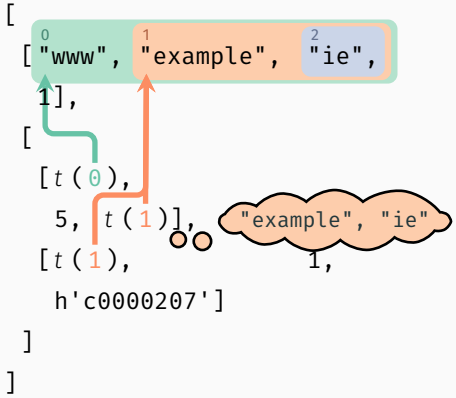


Binary (hex, 65 bytes)

```
82
 84 63 777777 67 6578616d706c65 62 6965
  01
 82
 84 ct 00
   05 67 6578616d706c65 62 6965
  84 67 6578616d706c65 62 6965 01
   44 c0000207
```

Recap: Current Name Compression in DNS+CBOR

EDN



Binary (hex, 65 bytes)

```
82
 84 63 777777 67 6578616d706c65 62 6965
  01
 82
 83 ct 00
    05 ct 01
  83 ct 01
   44 c0000207
```

Recap: Current Name Compression in DNS+CBOR

EDN

```
[
  [
    "www", "example", "ie"
  ],
  [
    t(0),
    5, t(1)],
    t(1),
    h'c0000207']
  ]
]
```

Binary (hex, 65 bytes)

```
82
84 03 7777 77 6578616d706c65 02 6965
01
83
83 ct 00
05 ct 01
04 00000207
```

Question from IETF 121

How should *t* be defined?	
1+0 tag	1+1 tag
≥2 bytes	≥3 bytes
c*t* XX	d8 *tt* XX
Similar in size to DNS pointers	Less crowded real-estate

Recap: Current Name Compression in DNS+CBOR

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Similar in size to DNS pointers	Less crowded real-estate

After the meeting: Could we use shared values (≥1 byte) instead?

Recap: Current Name Compression in DNS+CBOR

EDN

```
[
 ["www", "example", "ie",
  1],
 [
  [t(0),
   5, t(1)],
  [t(1),
   h'c0000207']
 ]
]
```

0 1 2

"www", "example", "ie"

"example", "ie"

1,

Binary (hex, 65 bytes)

```
82
 84 63 777777 67 6578616d706c65 62 6965
  01
 82
 83 ct 00
    05 ct 01
  83 ct 01
   44 c0000207
```

Name Compression Based on Packed CBOR

EDN

```
[
 ["www", "example", "ie",
  1],
 [
  [t(0),
   5, t(1)],
  [t(1),              1,
   h'c0000207']
 ]
]
```

“Virtual” Packing Table

0 "www", "example", "ie"

1 "example", "ie"

2 "ie"

Name Compression Based on Packed CBOR

EDN

```
28259([
  ["www", "example",  "ie",
   1],
  [
   [t(0),
    5,  t(1)],
   [t(1),              1,
    h'c0000207']
  ]
])
```

“Virtual” Packing Table

0 "www", "example", "ie"

1 "example", "ie"

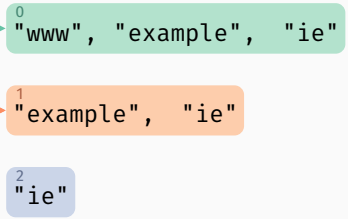
2 "ie"

Name Compression Based on Packed CBOR

EDN

```
28259([
  [0"www", 1"example",  2"ie",
   1],
  [
   [simple(0),
    5,  simple(1)],
   [simple(1),        1,
    h'c0000207']
  ]
])
```

“Virtual” Packing Table

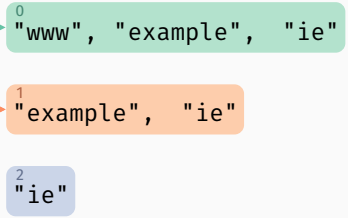


Name Compression Based on Packed CBOR

EDN

```
[
  ["www", "example",  "ie",
   1],
  [
   [simple(0),
    5,  simple(1)],
   [simple(1),        1,
    h'c0000207']
  ]
]
```

"Virtual" Packing Table



Make table setup tag 28259 implicit for `application/dns+cbor`

Name Compression Based on Packed CBOR

Question from IETF 121

How should *t* be defined?

1+0 tag	1+1 tag
≥2 bytes	≥3 bytes
c*t* XX	d8 *tt* XX
Similar in size to DNS pointers	Less crowded real-estate

After the meeting: Could we use shared values (≥1 byte) instead?

Yes with new implicit virtual table setup tag!

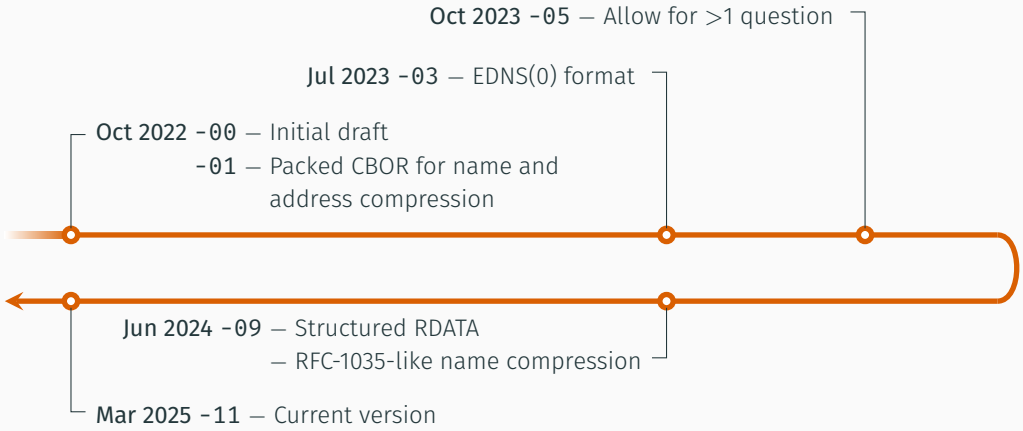
Further Optimizations?

Leftover from IETF 121: Punycode labels when shorter than UTF-8?

- Some punycode may be shorter than respective character code points (e.g. Thai domain names)

What do you think?

Key Achievements So Far



Should DNS+CBOR be adopted by the CBOR WG?