

A FIB for DTN?

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Introduction

- A high level walk-through of a DTN FIB design.
- Asking questions of the community:
 - “Have we considered X ?”
- Triggering productive discussion around a common set of terms and architectures.
- Is this worthwhile work for the WG?

Disclaimer

- I expect you know all this already.
- I have probably missed something important.
- Keith Scott covered a lot of this in 2008! [1]

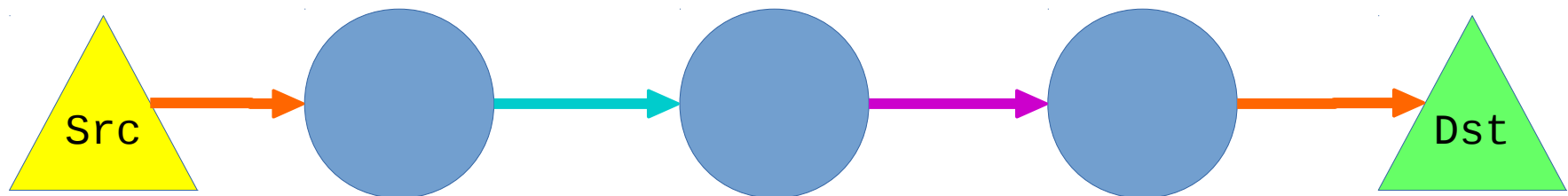
FIB?

Forwarding Information Base

- The minimum information required by a forwarding agent to pass a bundle to the next agent along a route to the bundle endpoint.

Forwarding?

- Passing bundles received externally or from local processes to the next hop along a route.
- Just one-hop, not end-to-end routing.
- Bundles are passed via convergence layers.
- Filtering happens before forwarding.



Information Base?

- The set of information to be stored.
- A conceptual model, not an implementation design.
- Commonly described as a table:

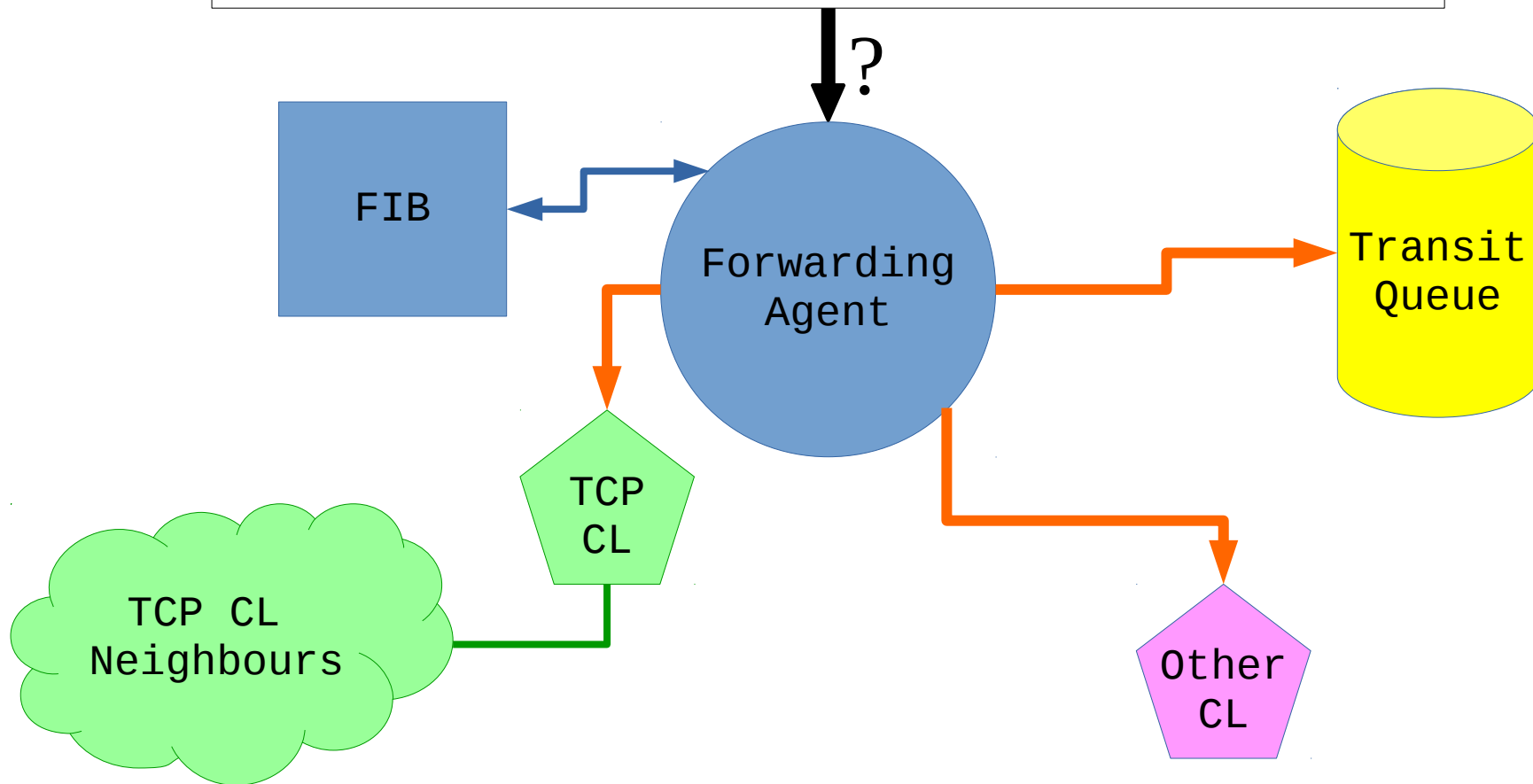
Destination EIDs like <i>X</i>	Do <i>Y</i>
Destination EIDs like <i>R</i>	Do <i>S</i>

Who uses the FIB?

- The forwarding agent consults the FIB to move bundles.
- Convergence layers update the FIB as neighbours are discovered.
- Routing protocol instances update the FIB as routes are discovered.

Conceptual Architecture

Destination: dtn://somewhere_over_the_rainbow
Payload: ...bytes...



So what goes in the FIB?

‘Match expression’ for the
bundle destination endpoint
identifier

Forwarding action

The diagram illustrates the structure of a Forwarding Information Base (FIB) table. It consists of two columns: 'Match expression' and 'Forwarding action'. The 'Match expression' column contains two entries: 'Destination EIDs like X' and 'Destination EIDs like R'. The 'Forwarding action' column contains two entries: 'Do Y' and 'Do S'. Arrows point from the text labels above to the corresponding columns in the table.

Destination EIDs like X	Do Y
Destination EIDs like R	Do S

Match expression?

- In IP networks this an Address/Prefix pair:
 - Longest match wins.
 - This keeps the FIB compact.

But:

- DTN has no concept of address aggregation (subnets)!
- DTN2 uses a regular expression (glob):
 - Flexible, if basic.

But:

- Requires a pre-agreed endpoint id syntax!

Handling complex endpoint ids

- Perhaps separating name resolution from forwarding is the answer?
 - A ‘name server’ that resolves endpoints into numeric node ids.
 - I don’t mean DNS.
 - Transform endpoint id handling into an ‘address book’ management process/protocol that populates the FIB.
 - Such a service need not be on every forwarding agent.
 - Good for constrained devices

Forwarding action parameters

- Definitely need the convergence layer adaptor identifier.
- Do we need to include a 'via' endpoint identifier?

EIDs like <i>X</i>	Give to CLA: 1
EIDs like <i>R</i>	Give to CLA: 2

Or:

EIDs like <i>X</i>	Give to CLA: 1	Send Via <i>Y</i>
EIDs like <i>R</i>	Give to CLA: 2	Send Via <i>S</i>

Via?

The answer is ‘Yes’ and ‘No’!

- Convergence layers perform neighbour discovery, and if the bundle destination endpoint is a neighbour, then ‘No’.
- Otherwise some external routing protocol will have learnt a route and populated the FIB with the endpoint id of the next hop along the route, so ‘Yes’.
- Is ‘Via’ a node id, or can it be a generic endpoint id?
 - Recursive lookup?

No match?

- What happens if a matching entry is not found?
 - Added to the transit queue.
 - When the FIB is updated:
 - Contents of transit queue are rechecked against the FIB.
- Is there such a thing as a ‘default route’?

Other issues

- I suggest that ‘blackhole’ or ‘prohibit’ entries have no place in the FIB.
 - The same functionality can be provided by bundle filtering prior to forwarding.
 - That is not to say that routing protocols shouldn’t share them.
- ‘Multicast’ endpoints:
 - I have no idea!
- Breaking ties?
- Source-based forwarding?
 - Builds on a simpler FIB

Why is this useful?

- It may provide a set of minimal requirements for:
 - Higher-level functions such as routing.
 - Convergence-layer adaptors.
- Defining a FIB may highlight gaps in the current architecture.

Questions?

References

- [1] <http://cwe.ccsds.org/sis/docs/SIS-DTN/Other%20Documents/DTN%20Naming%20and%20Addressing3.docx>