On the Role of Routing in NDN

Beichuan Zhang
The University Of Arizona
Control Plan and Data Plane

Routing Updates

Routing Protocol

Data Traffic

Table Lookup

Control Plane

Data Plane

Routing Protocol

FIB
Data plane is stateless and dumb. Control plane has all the intelligence, needs to be correct all the time.
Stateful data plane with explicit storage
The question

What’s the implication of having a stateful data plane? Especially to the control plane?

• If we can handle transient failures at the data plane, it would make control plane simpler and more scalable.
Fault Detection

NDN

Data plane is able to detect failures by observing the Interest-Data exchange at each hop.

IP

Rely on routing to detect “hard” failures and end-host for “soft” failures
Fault Recovery

Explore alternatives, i.e., strategies

- will know whether a nexthop works or not
  - Data vs. NACK/Timeout
Link Failures

![Graph showing link failure rates for different path splicing configurations and NDN protocols. The graph illustrates the fraction of disconnected pairs (%) against the probability of link failure (%). The different lines represent various path splicing configurations and NDN protocols, each with distinct markers and colors. The x-axis represents the probability of link failure, while the y-axis shows the fraction of disconnected pairs. The graph highlights the performance of IP, Path Splicing with different parameters (s=5, r=5, s=5, r=20, s=10, r=20), NDN, and the best possible scenario.]
Impact on routing protocol

Take OSPF as an example, vary hello interval.

<table>
<thead>
<tr>
<th>Hello Interval</th>
<th>1s</th>
<th>10s</th>
<th>60s</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Delivery</td>
<td>97.9%</td>
<td>90.5%</td>
<td>71.8%</td>
</tr>
<tr>
<td>NDN Delivery</td>
<td>98.9%</td>
<td>98.9%</td>
<td>98.5%</td>
</tr>
<tr>
<td># HELLO</td>
<td>502026</td>
<td>51200</td>
<td>8576</td>
</tr>
<tr>
<td># LSA</td>
<td>33696</td>
<td>22893</td>
<td>9716</td>
</tr>
<tr>
<td># SPF</td>
<td>13544</td>
<td>8817</td>
<td>2750</td>
</tr>
</tbody>
</table>
The role of routing in NDN

When data plane can handle transient failures, requirements on control plane is relaxed.

• Routing focuses on disseminate long-term topology and policy information, less on handling churns.

Benefits for routing design

• Better stability and scalability
  • Mask short-lived failures from routing protocols
• Enable routing schemes that don’t work well in IP