Building Fast but Flexible Software Routers

MoonRoute a high-performance software router build on top of libmoon/DPDK

Features & Architecture

MoonRoute is a flexible framework for implementing high-performance software routers based on libmoon/DPDK [2].

▶ Flexibility: possibility to add/change Lua script code (almost) anywhere in the packet processing queue
▶ Code reuse: existing C libraries can be mixed with Lua script code using the foreign function interface of LuaJit
▶ Performance: a single server is able to saturate multiple 10 GbE ports with minimum-sized packets
▶ Scalability: the framework incorporates the benefits and challenges modern multi/many-core architectures employing RSS, multi-queue & hardware filters
▶ Multiple processing paths: Packets can be processed in a high-performance fast path, a feature-rich slow path, or handled by the host OS minimizing the overall implementation effort

Design principles

MoonRoute’s design is optimized for maximum scalability:

▶ Lock free data structures are used (queues)
▶ Shared data is kept to a minimum
▶ Immutable data structures are used for sharing

MoonRoute’s routing table is easily replacable:

▶ Currently DPDK’s routing table is used (DIR-24-8)
▶ Double buffering is used for routing table updates:
  – One read-only routing table is used for routing
  – Another routing table is updated
  – Routing tables are switched on update

MoonRoute supports multiple batching strategies:

▶ Batching on high-performance paths:
  – Flagging avoids expensive rebatching
▶ Creating new batches for low-performance paths:
  – Reduces load on slow path

Scalability and Influence of Batching

MoonRoute’s sample router scales perfectly, using a single/randomly chosen flows for fully-populated routing table

Optimal performance for batch size of 128 packets

Comparison

▶ MoonRoute achieves superior performance to a number of different software routers (tested with a single routing entry on the same hardware):

<table>
<thead>
<tr>
<th>Router</th>
<th>Mpps</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoonRoute</td>
<td>14.6</td>
<td>100%</td>
</tr>
<tr>
<td>FastClick (DPDK 2.2) [1]</td>
<td>10.4</td>
<td>72%</td>
</tr>
<tr>
<td>Click (DPDK 2.2) [3]</td>
<td>4.3</td>
<td>29%</td>
</tr>
<tr>
<td>Linux 3.7</td>
<td>1.5</td>
<td>10%</td>
</tr>
</tbody>
</table>

Availability

▶ A full paper, the MoonRoute framework, and a sample router implementation are available at:

Full paper

MoonRoute repository


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