

Implementing and Evaluating **MPTCP** on the **SCION** Future Internet Architecture

Presentation master thesis
Michael A. Flückiger

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On the menu

- › Introduction
- › Functionality of Shila
- › Performance evaluation
- › Future work

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Introduction Ingredients?

TCP (Transmission Control Protocol)

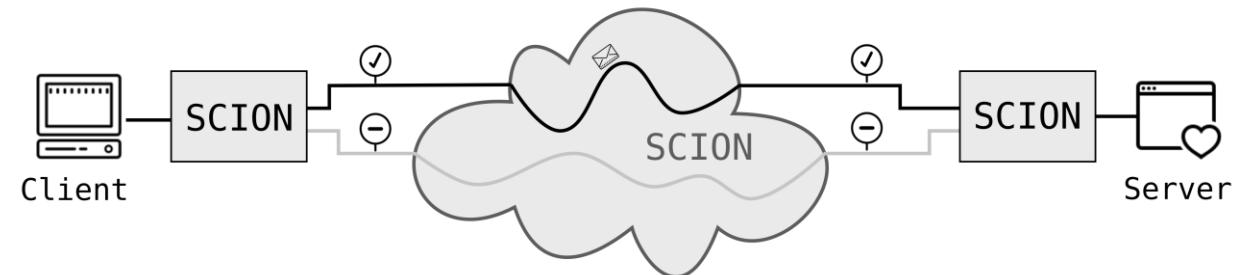
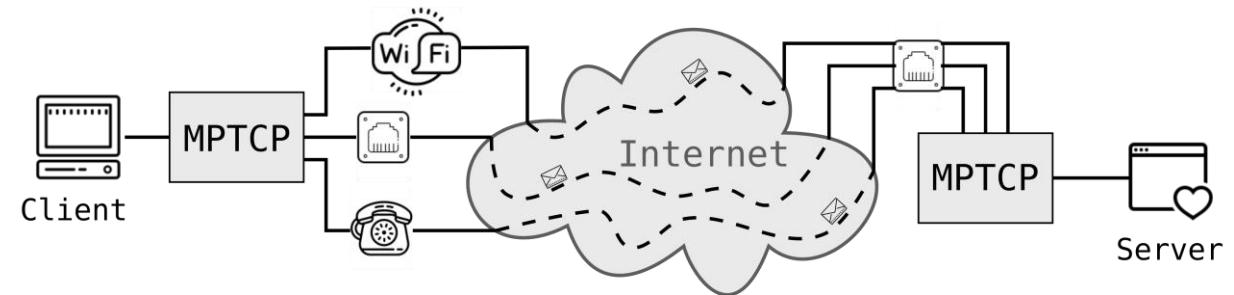
- › Dominant transport protocol in today's Internet
- › One path per connection

MPTCP (Multipath TCP)

- › Extension to TCP
- › Multiple paths (flows) per connection

SCION (Scalability, Control and Isolation on next-generation networks)

- › More secure network architecture
- › Implements path transparency
- › Support for multiple paths

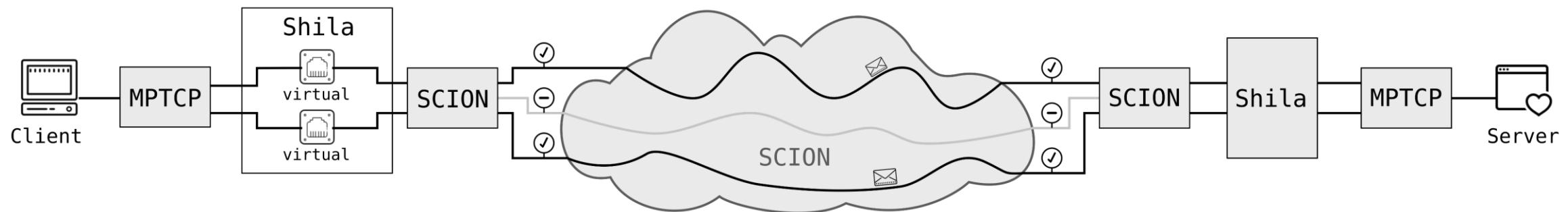


Introduction

What?

Main objective and contribution of the presented work:

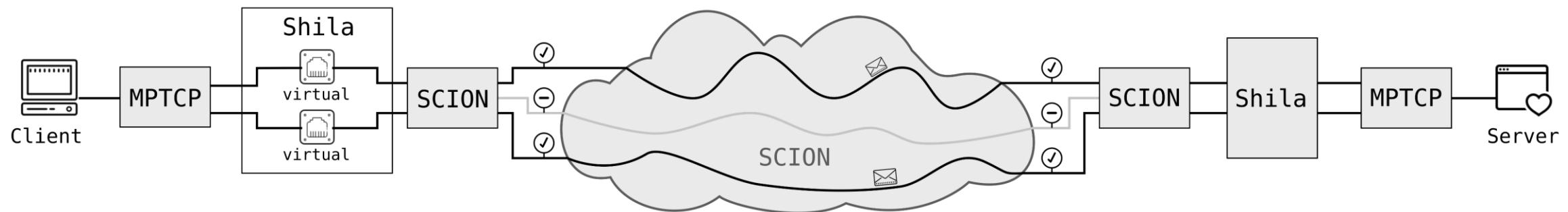
Implementation (and evaluation) of a shim layer that allows the usage of MPTCP over SCION.



What?

Main objective and contribution of the presented work:

Implementation (and evaluation) of a Shim layer that allows the usage of MPTCP over SCION.



Why?



Facilitates promotion and development of SCION

- › Straightforward use TCP applications over SCION



Benefit for endpoints with MPTCP support

- › Increase of redundancy thanks to multiple paths



Potential through mediating role of Shila in between

- › Shila is aware and under control of paths used through SCION

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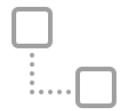
Functionality of Shila

Three Parts



Setup

- › Getting Shila ready to mediate between MPTCP and SCION



Connection establishment

- › Establish the connection between the client and server of a TCP application
- › Main-Flow and Sub-Flows

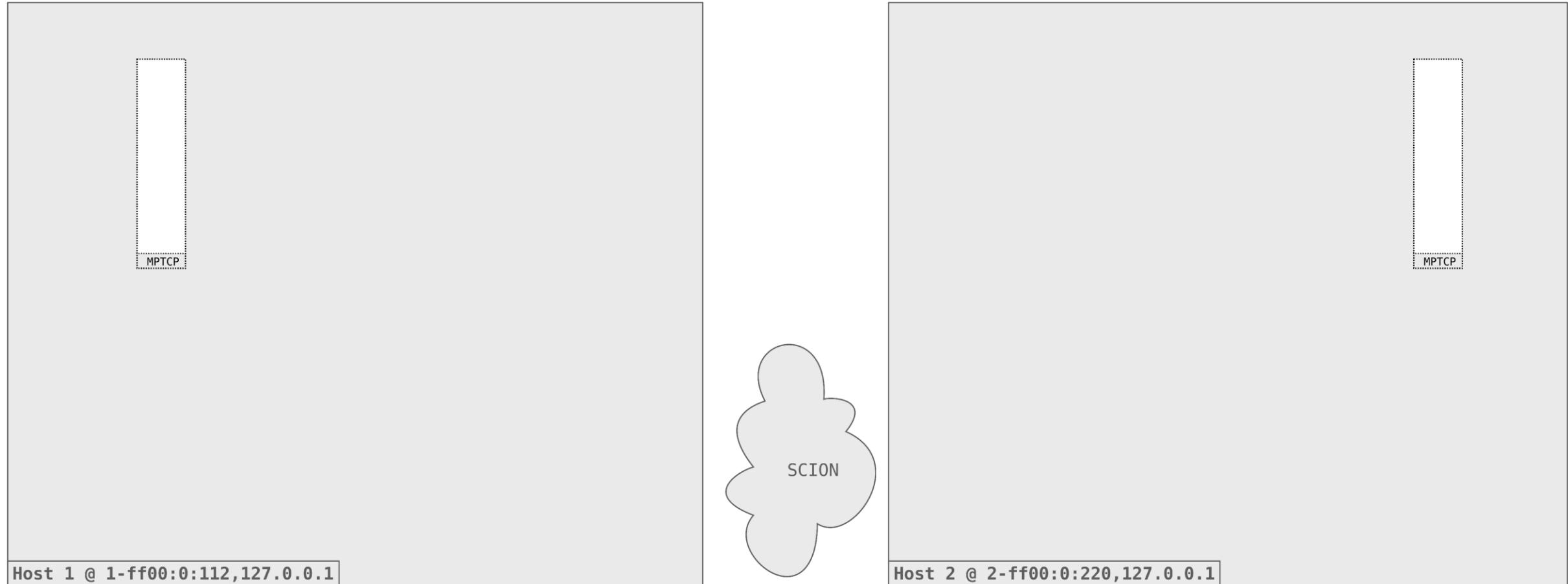


Data exchange

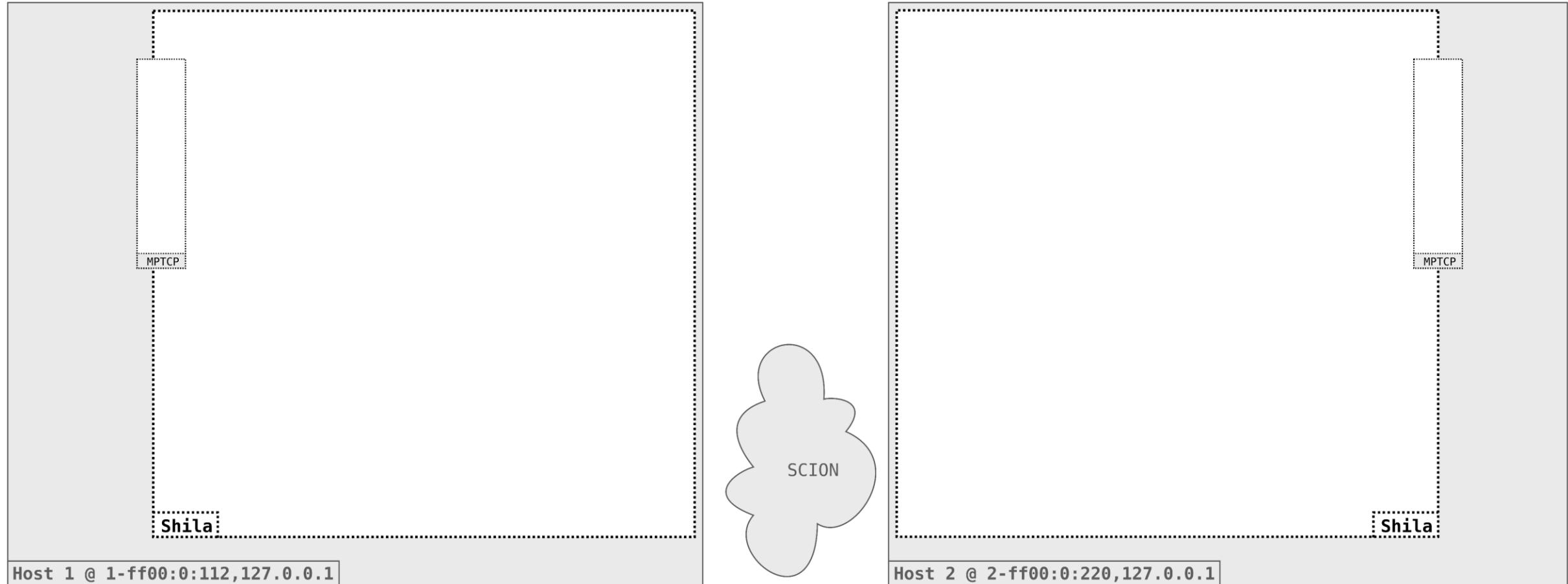
- › Operational mode once connection is up

Functionality of Shila

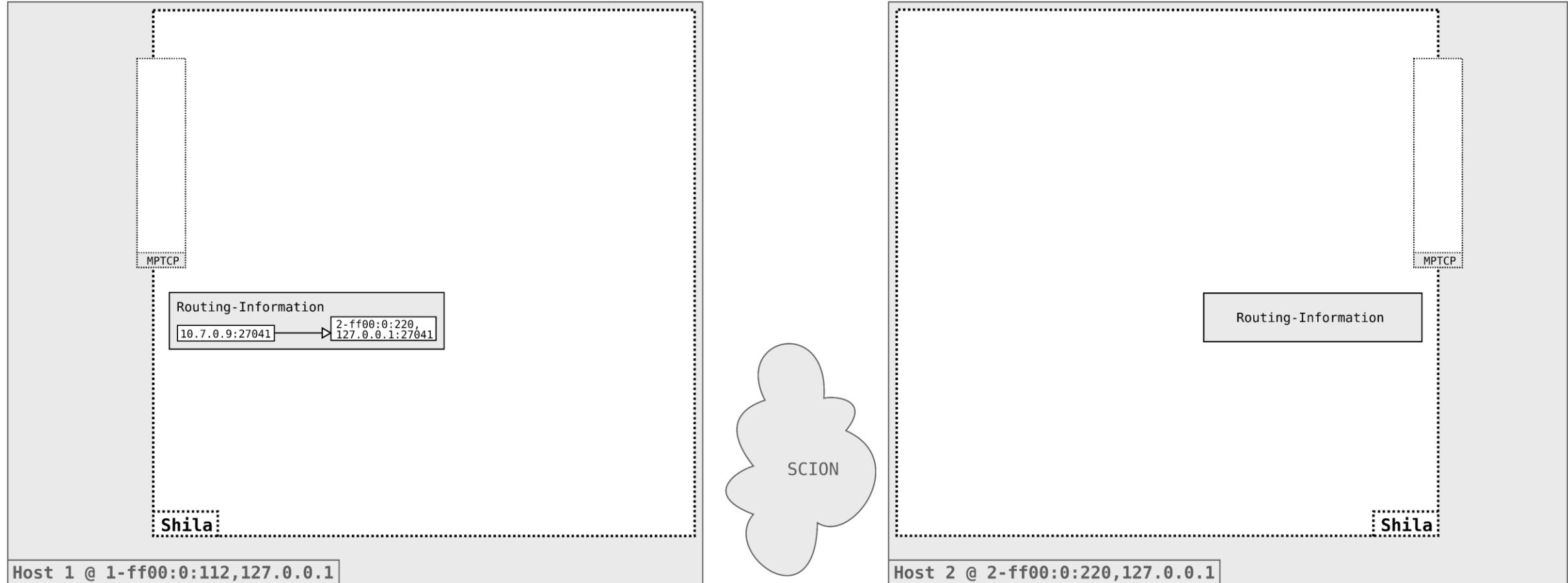
Initial situation



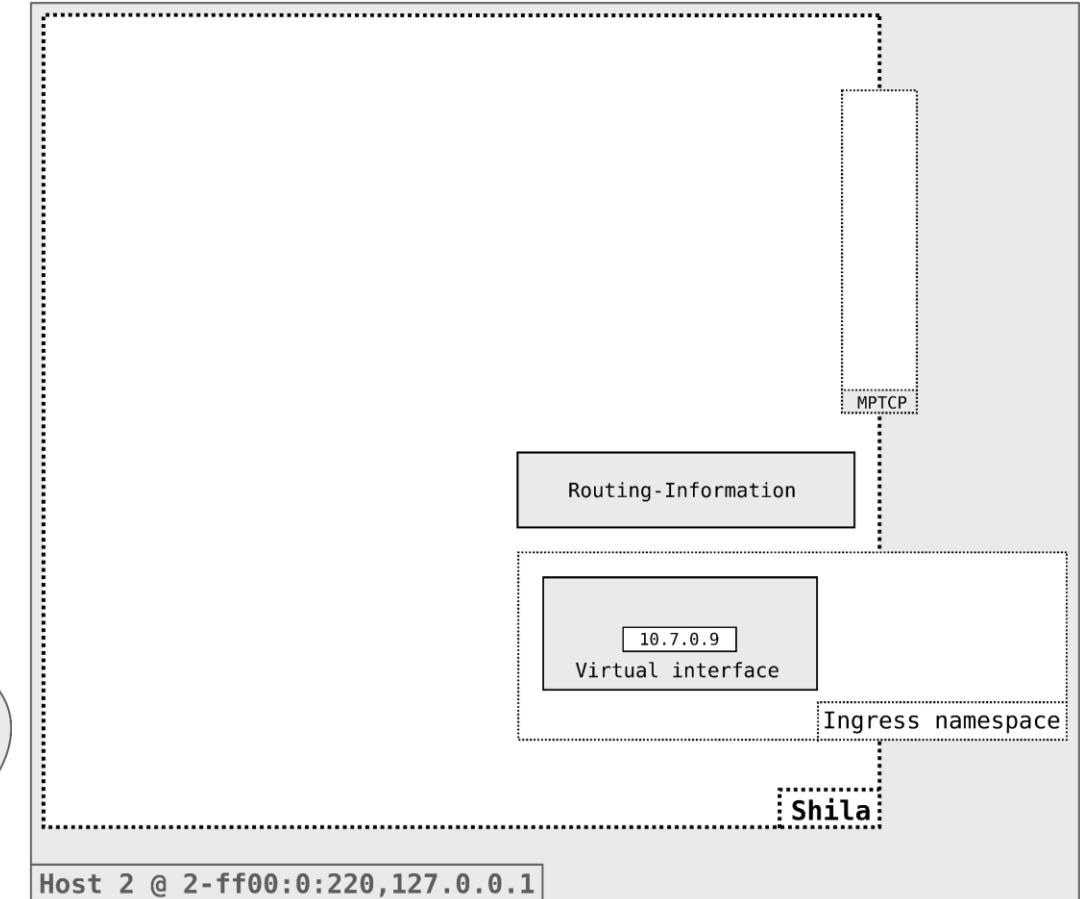
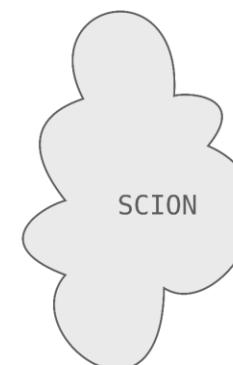
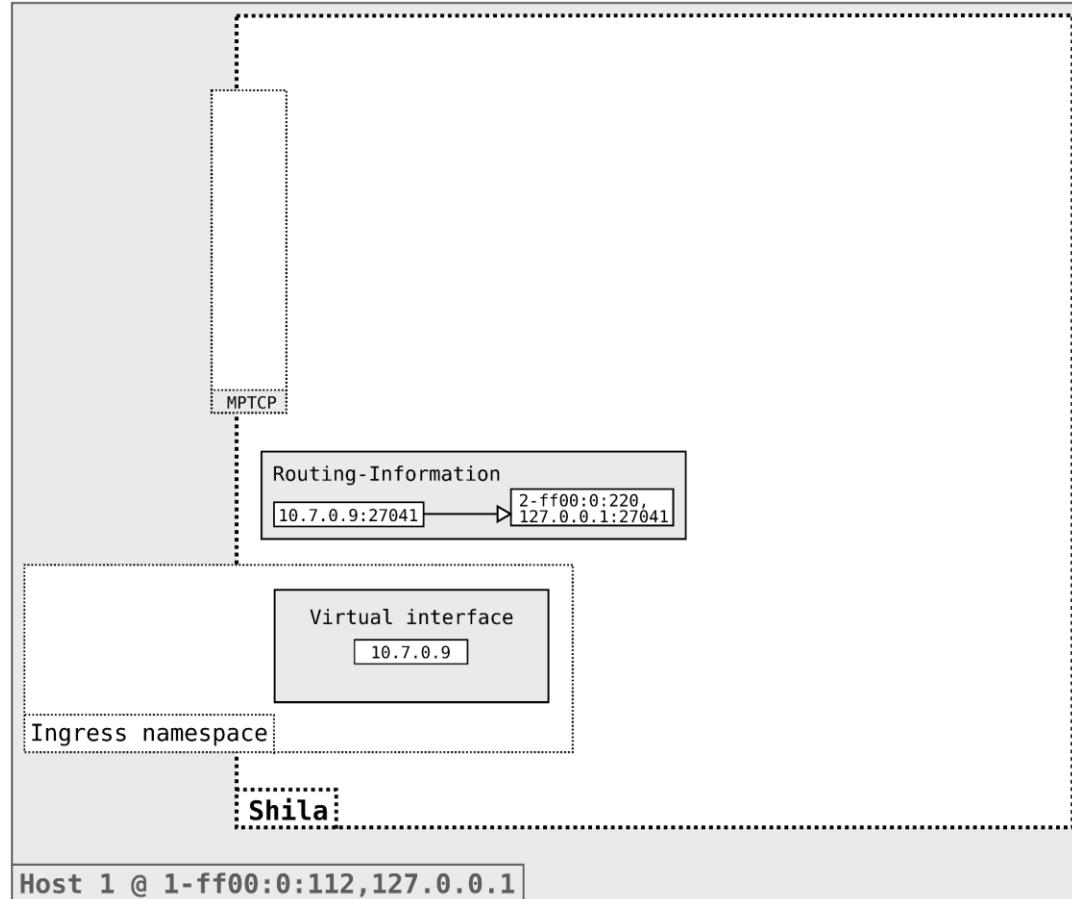
Functionality of Shila Setup



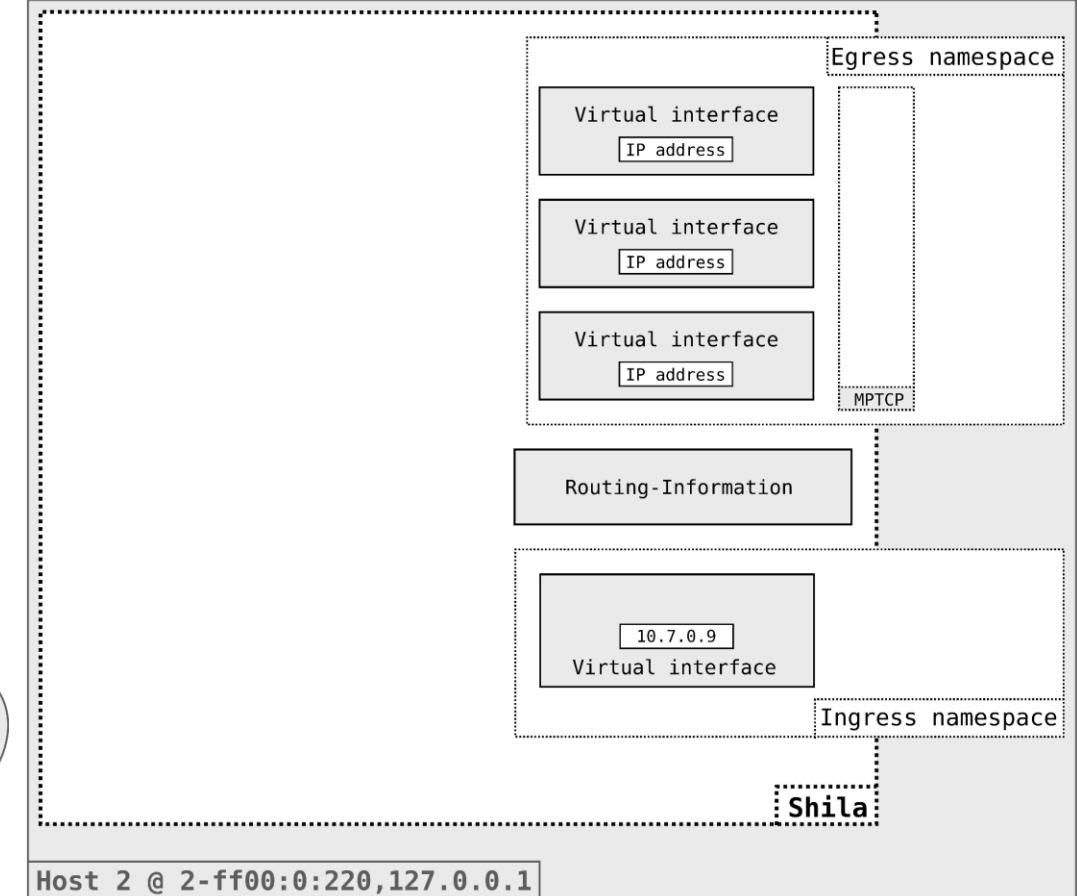
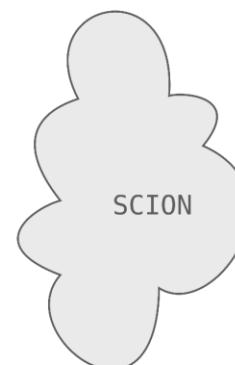
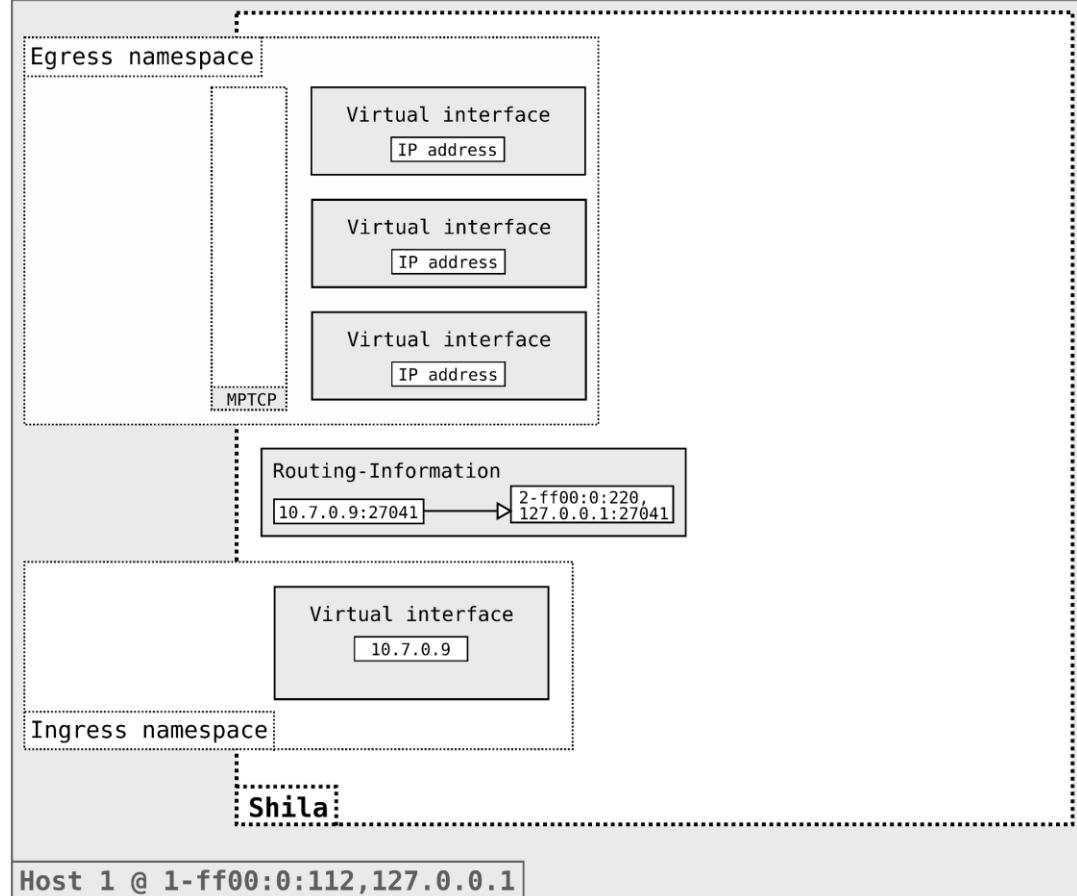
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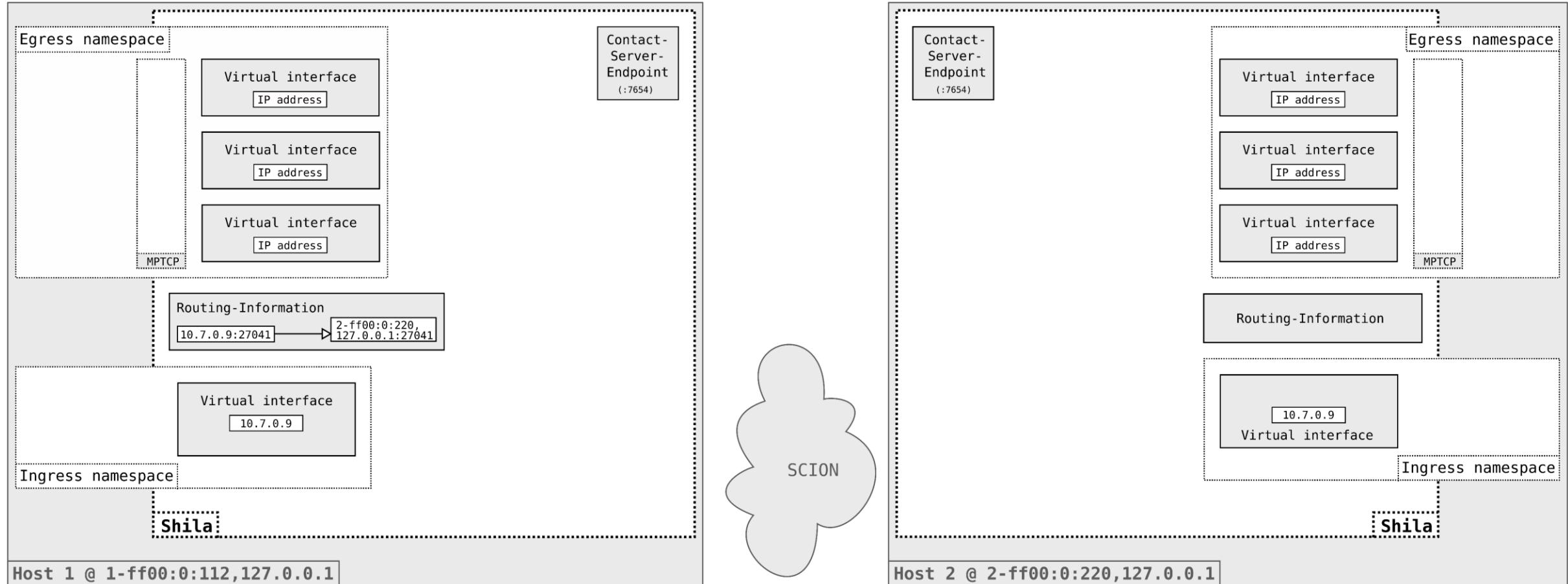
Functionality of Shila Setup



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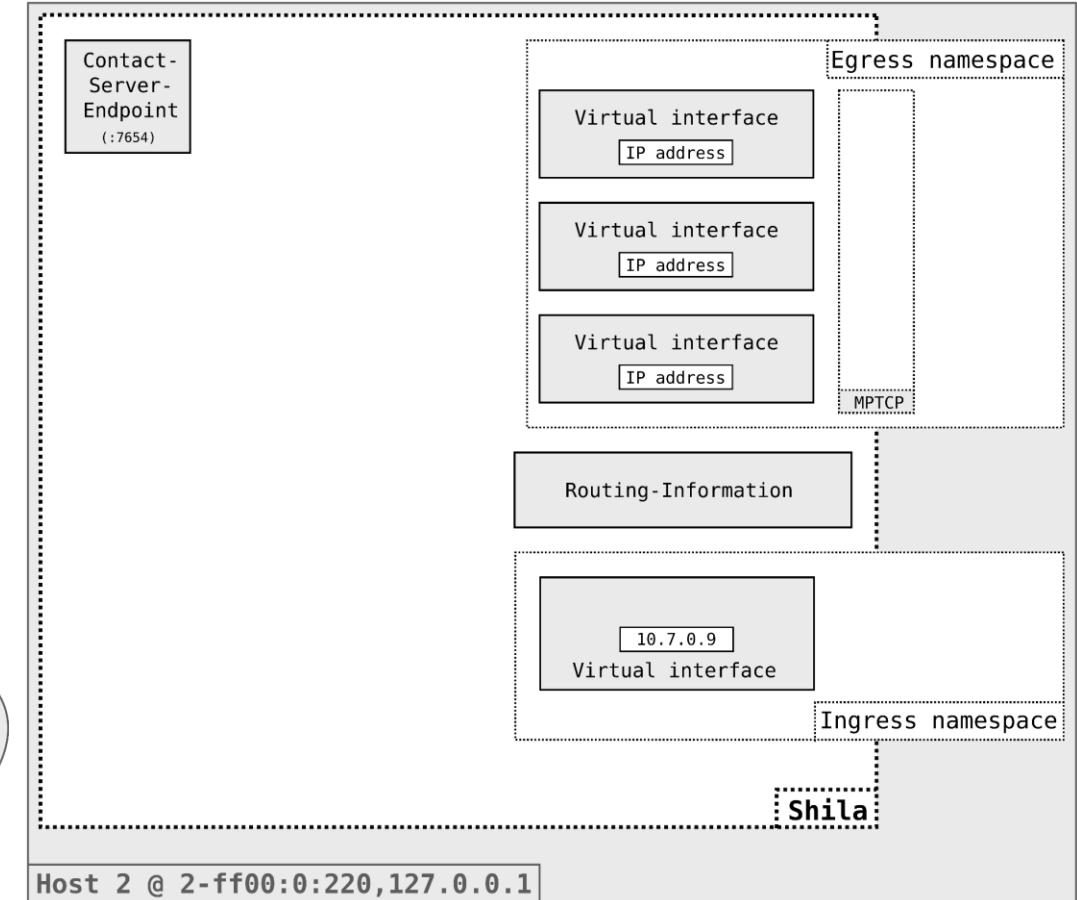
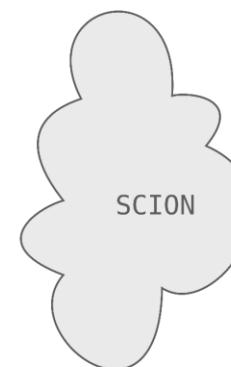
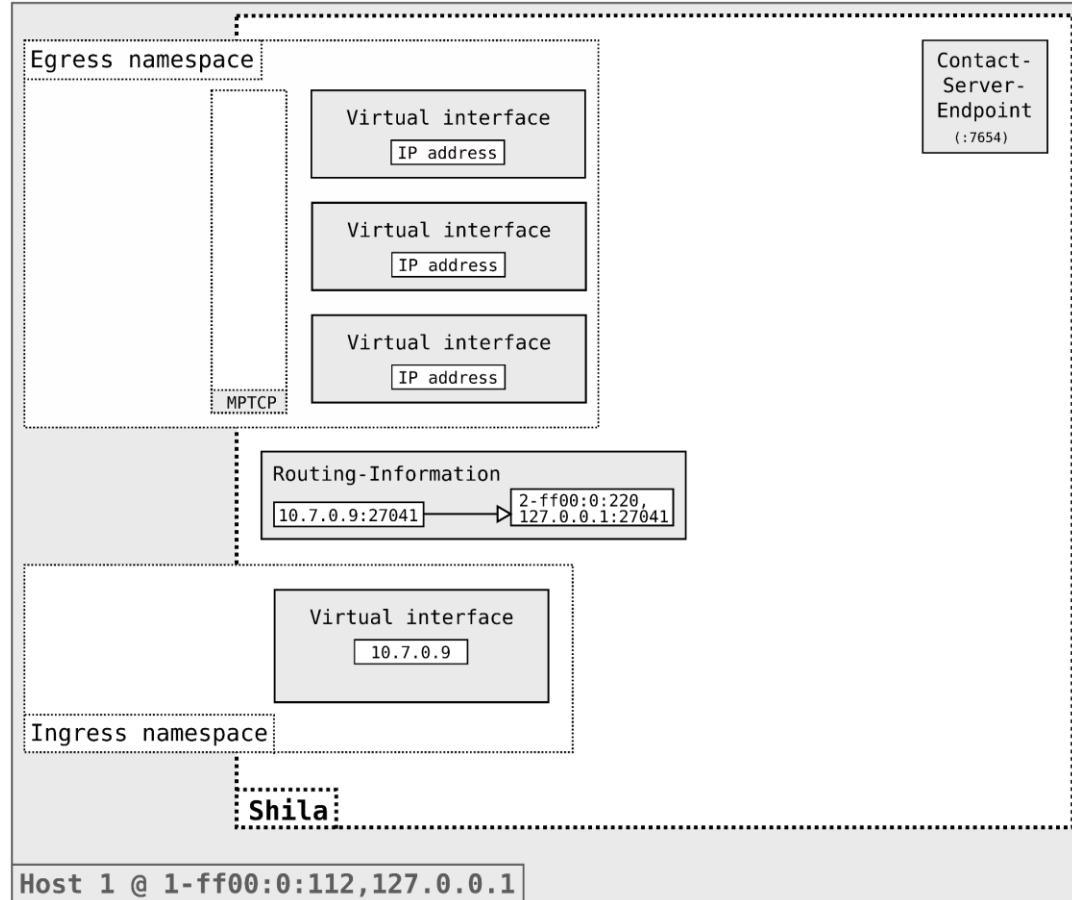


Functionality of Shila Setup



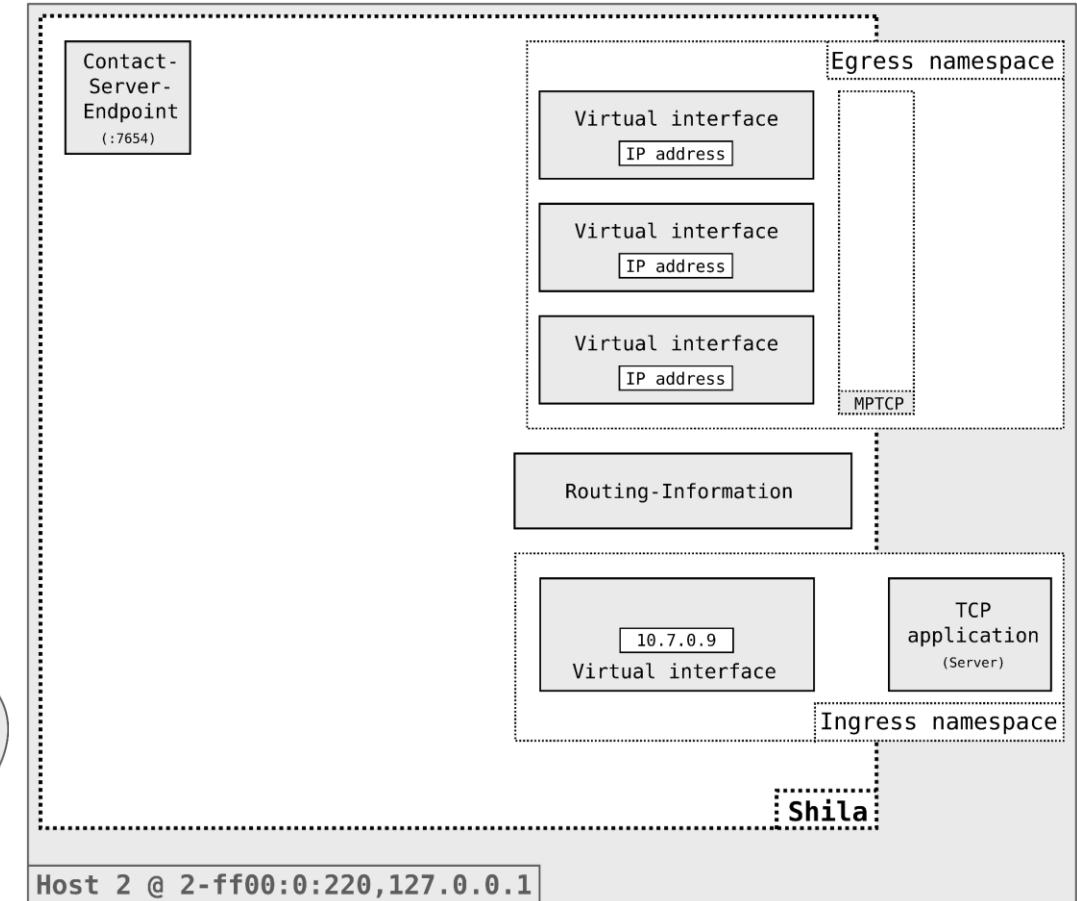
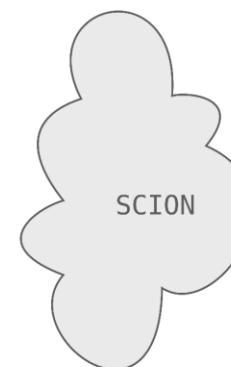
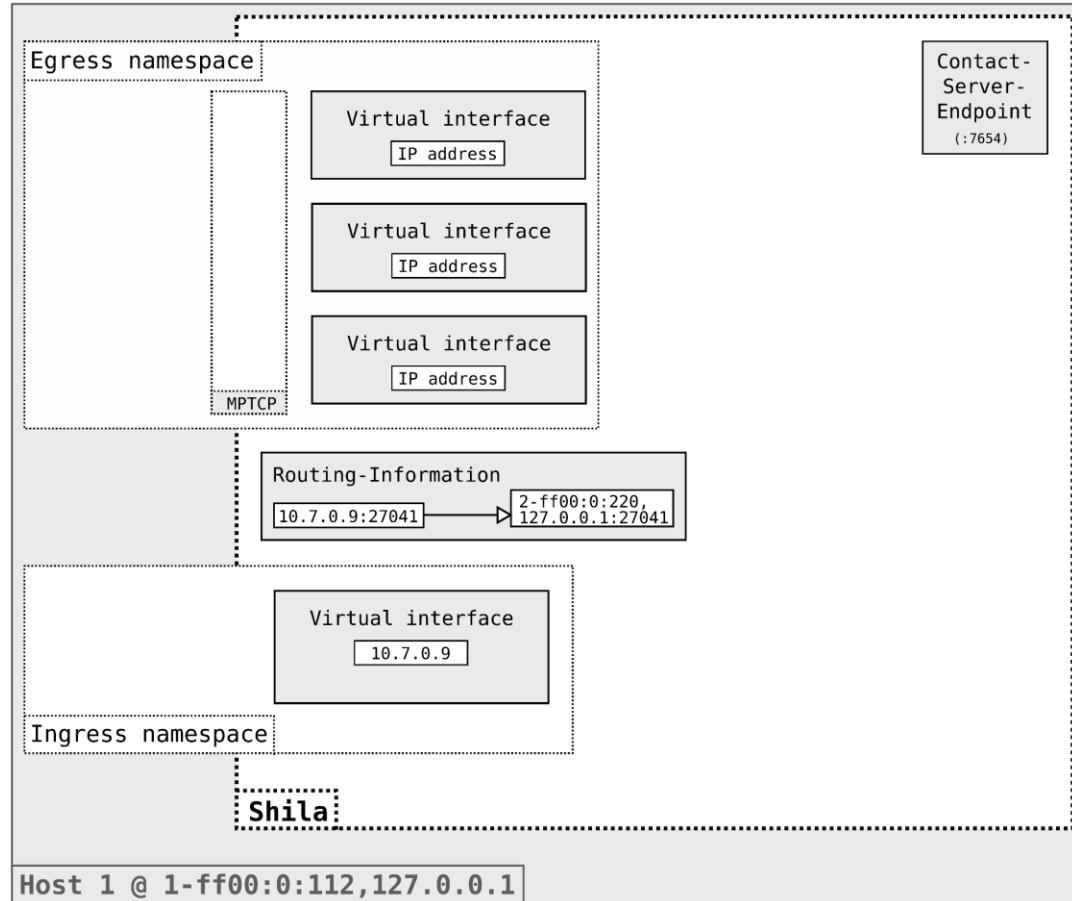
Functionality of Shila

Main-Flow Establishment



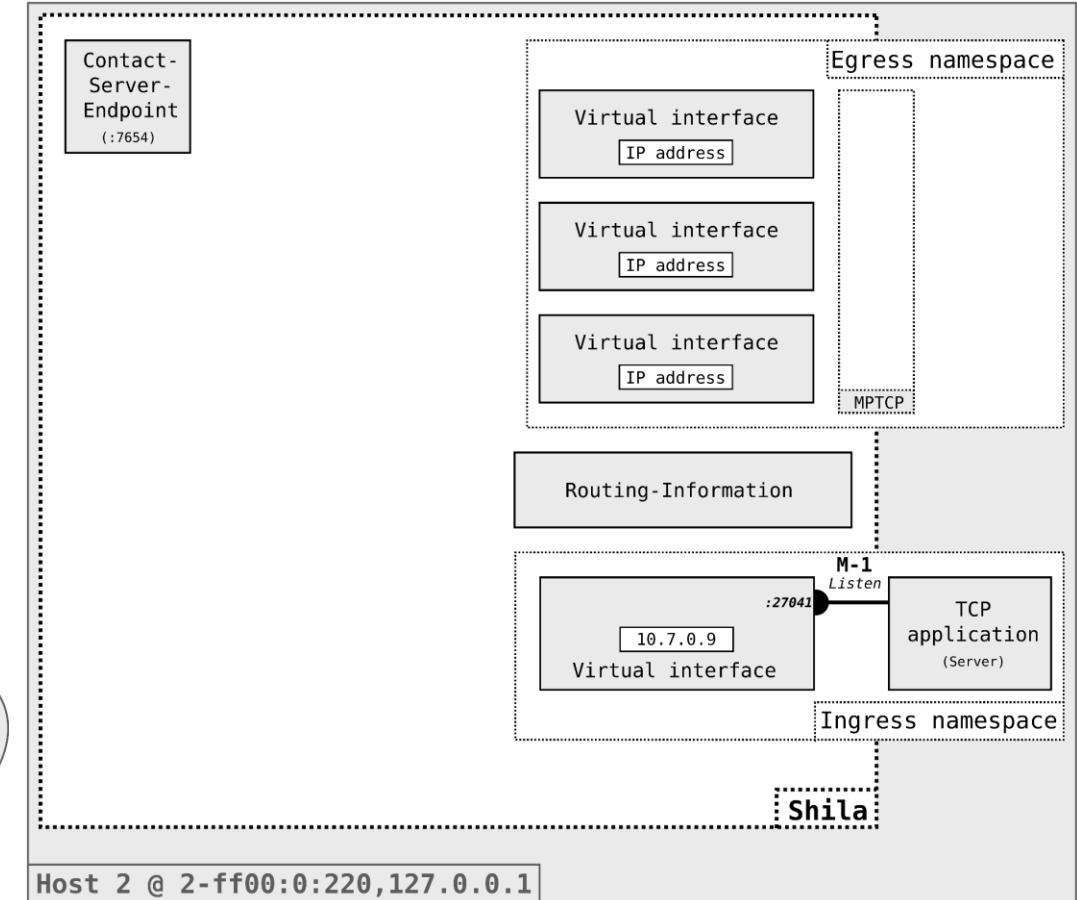
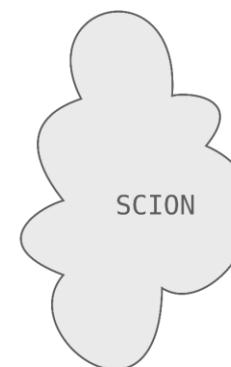
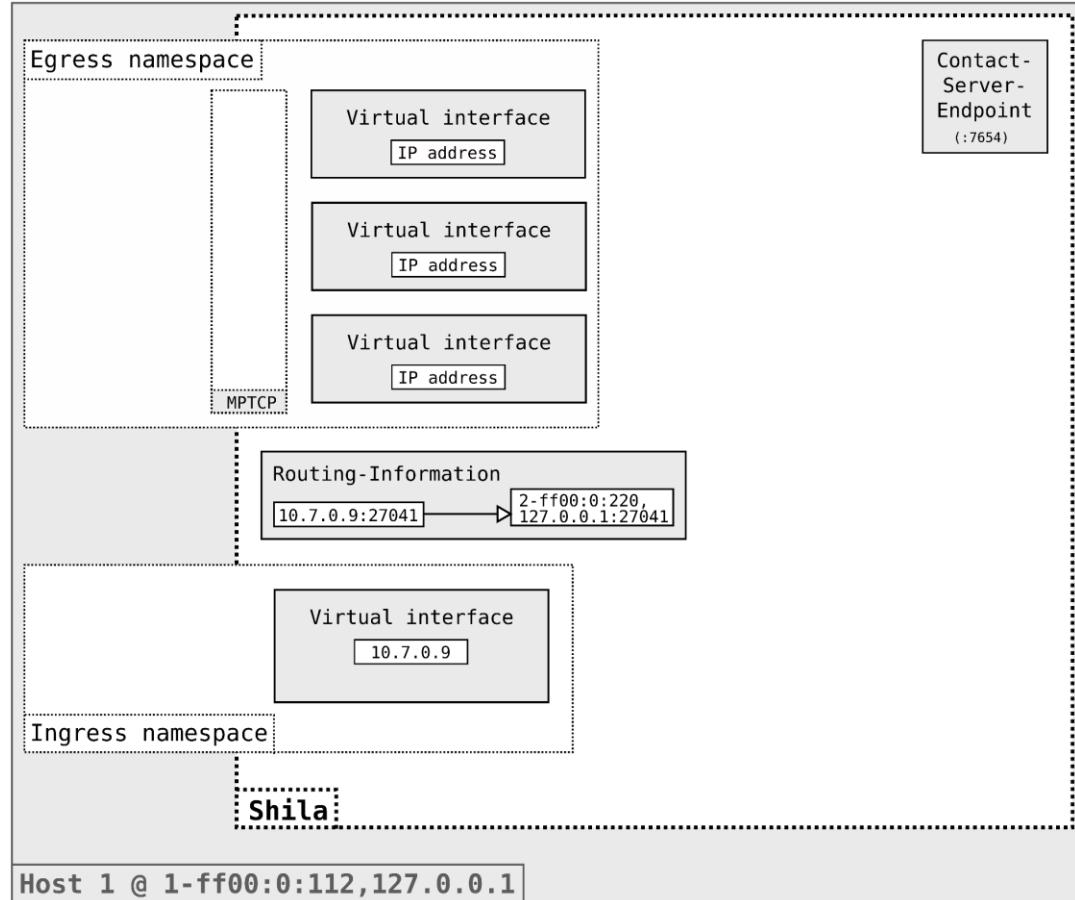
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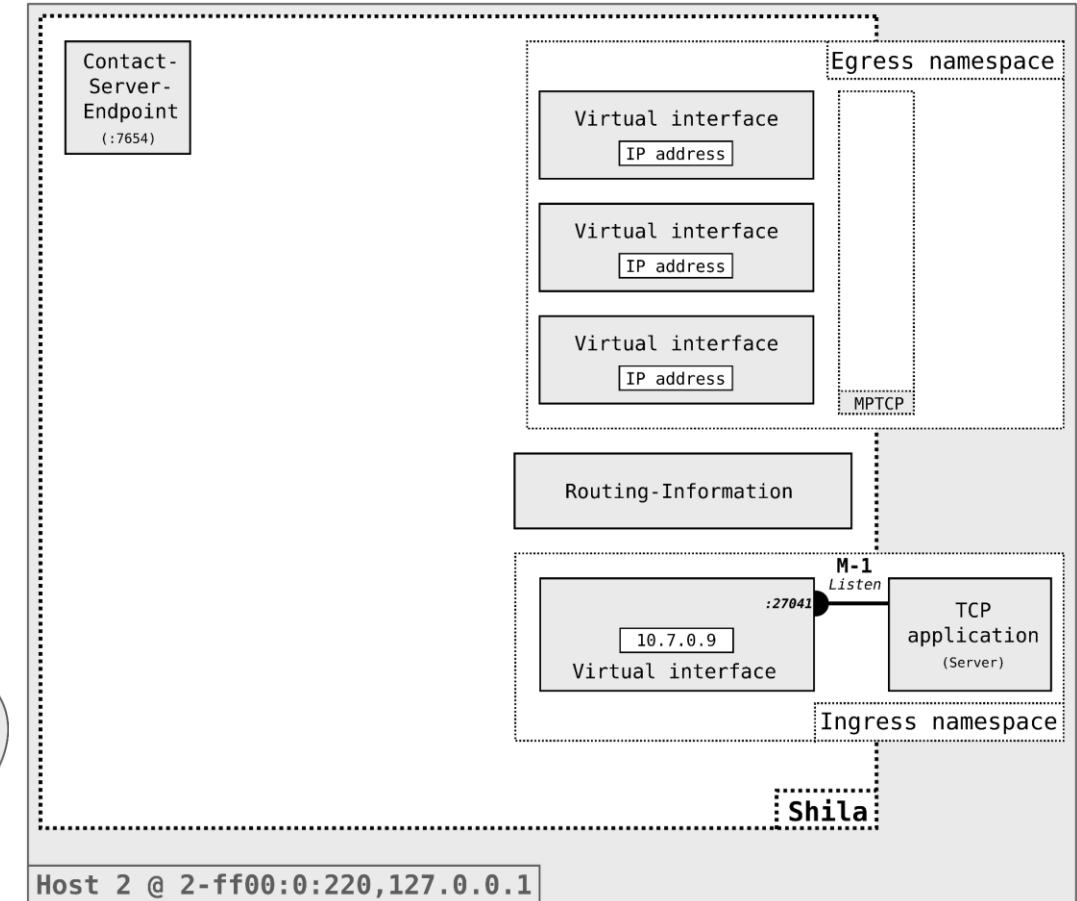
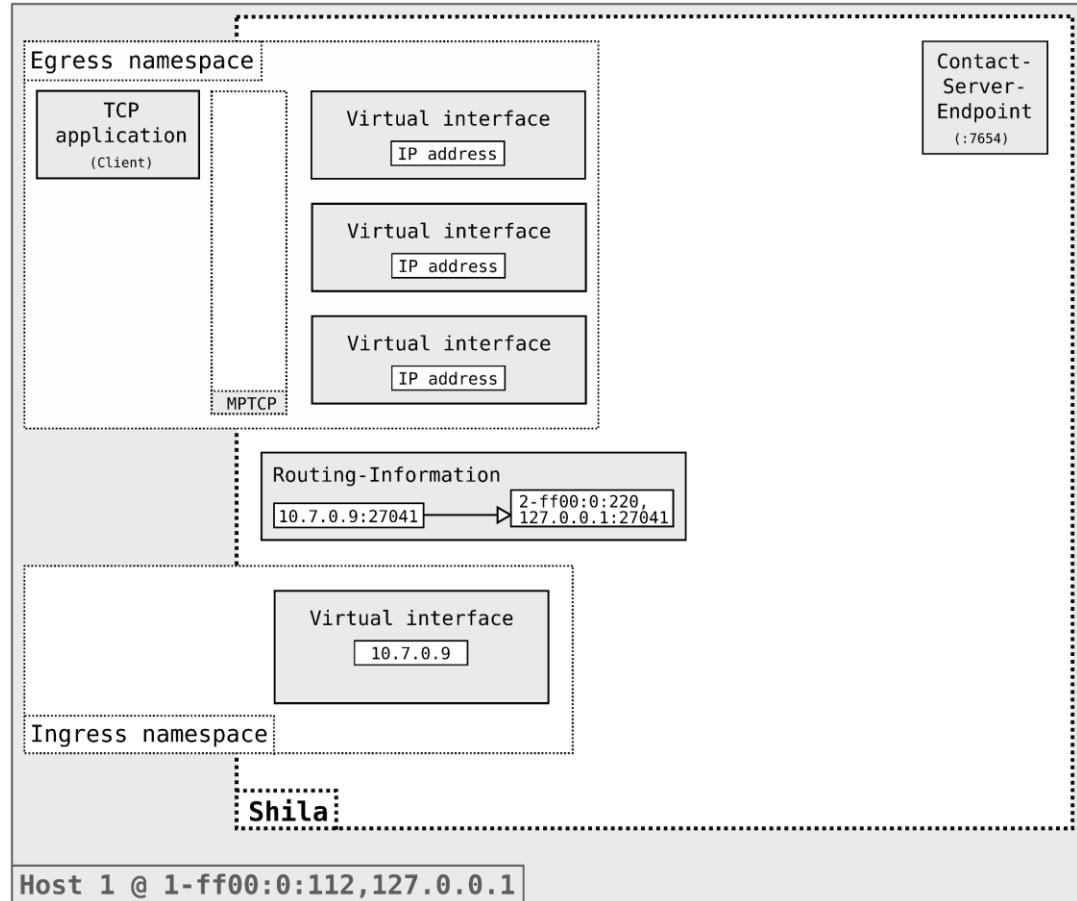
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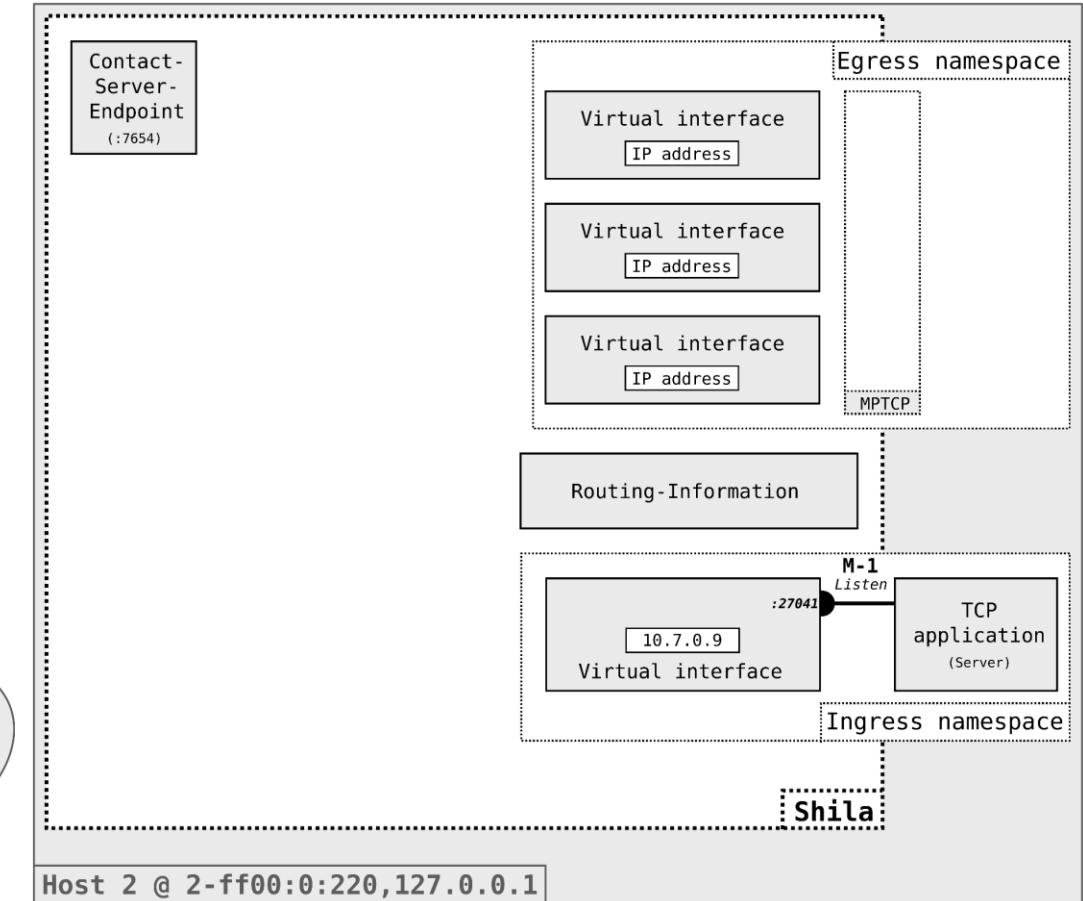
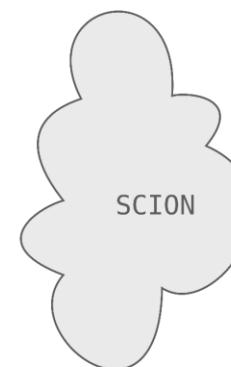
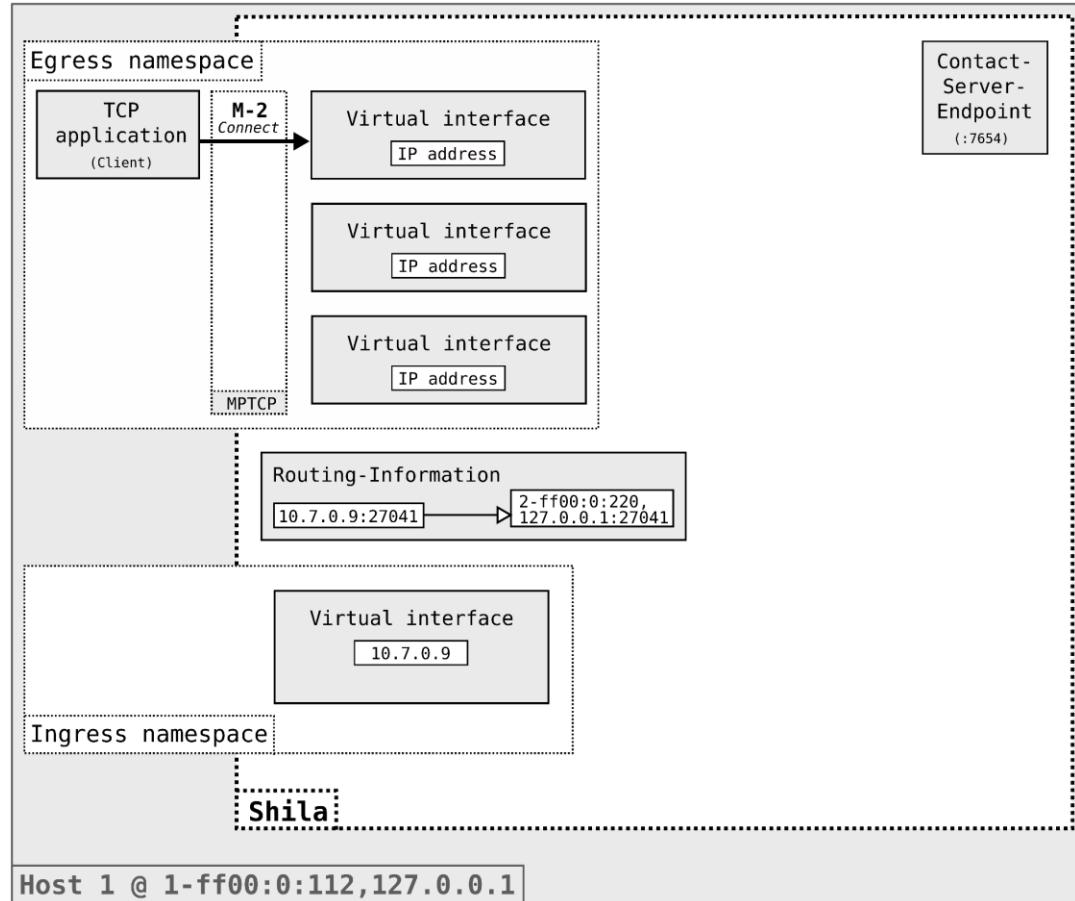
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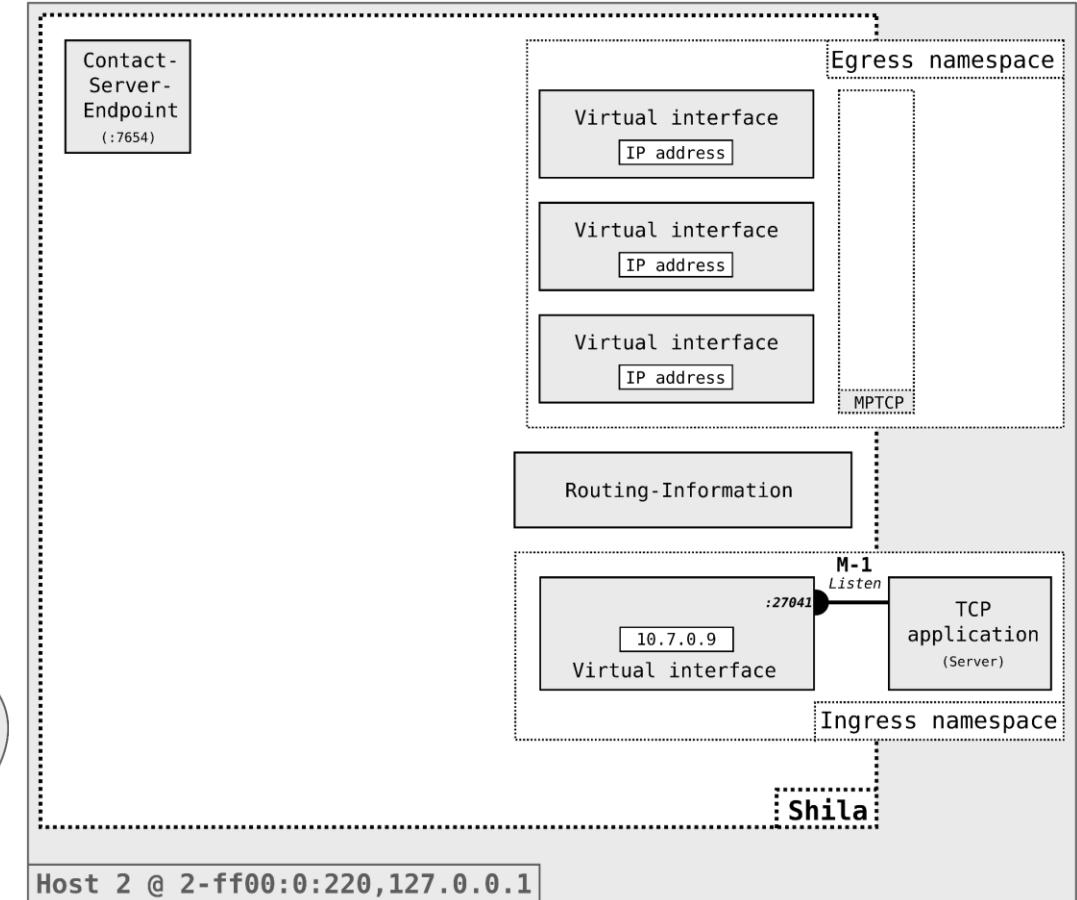
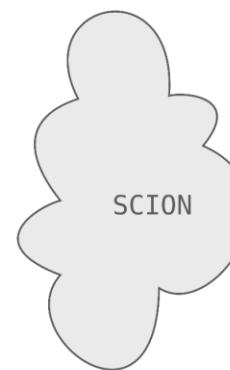
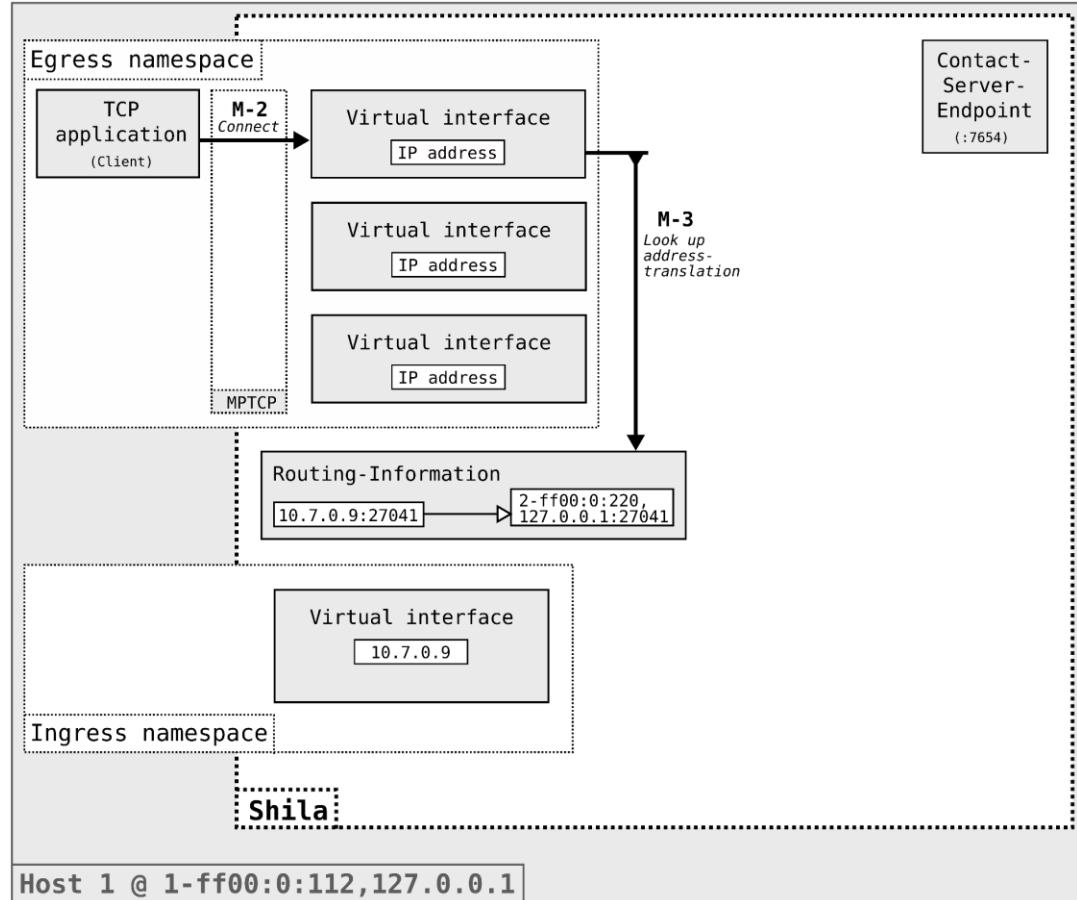
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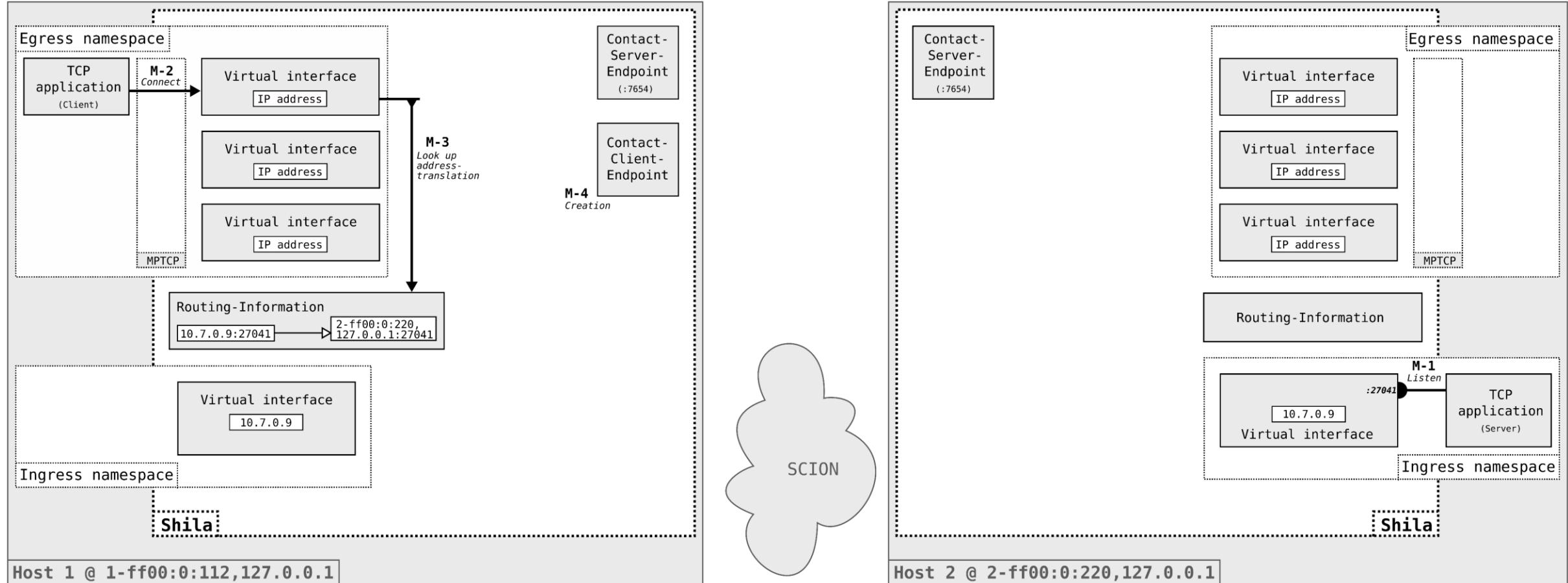
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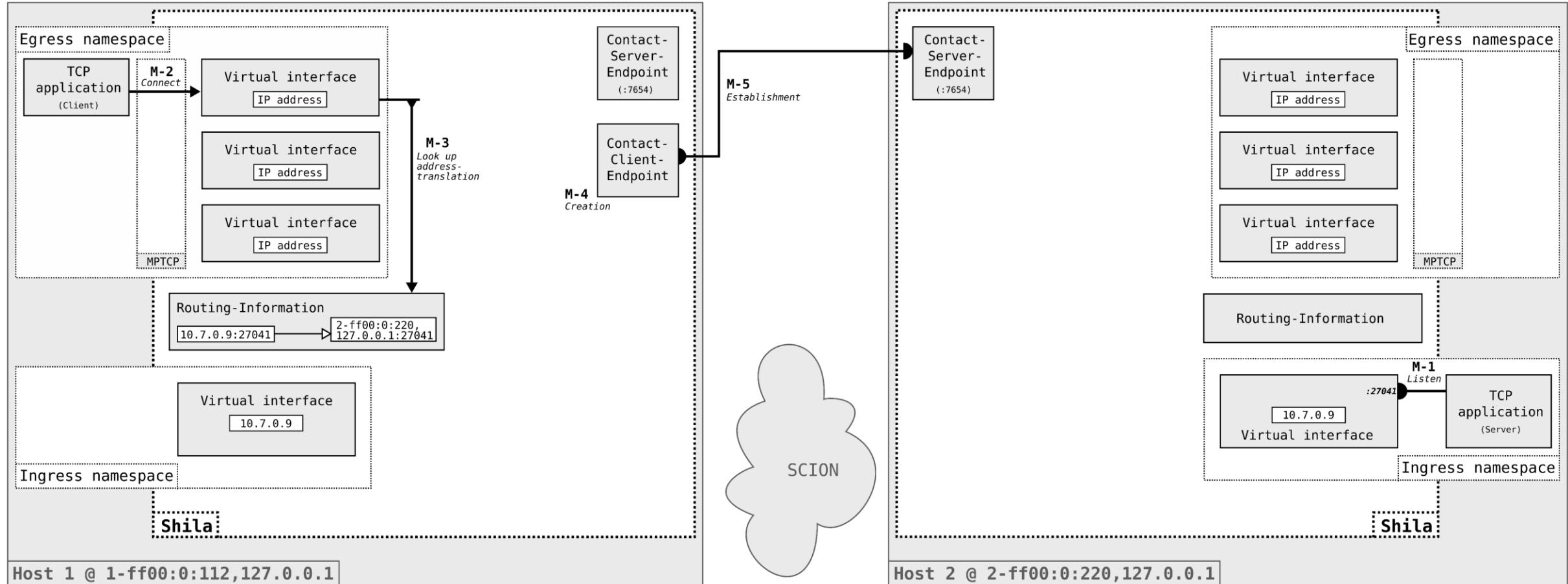


Functionality of Shila

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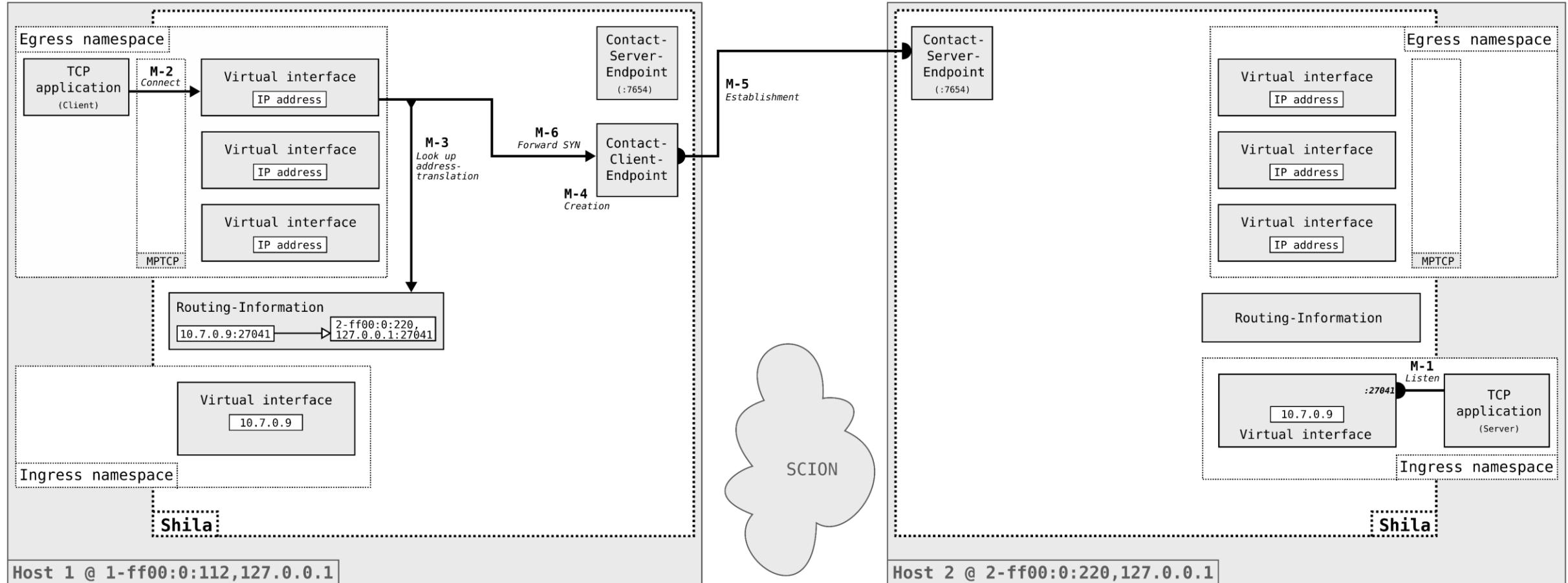


Main-Flow Establishment



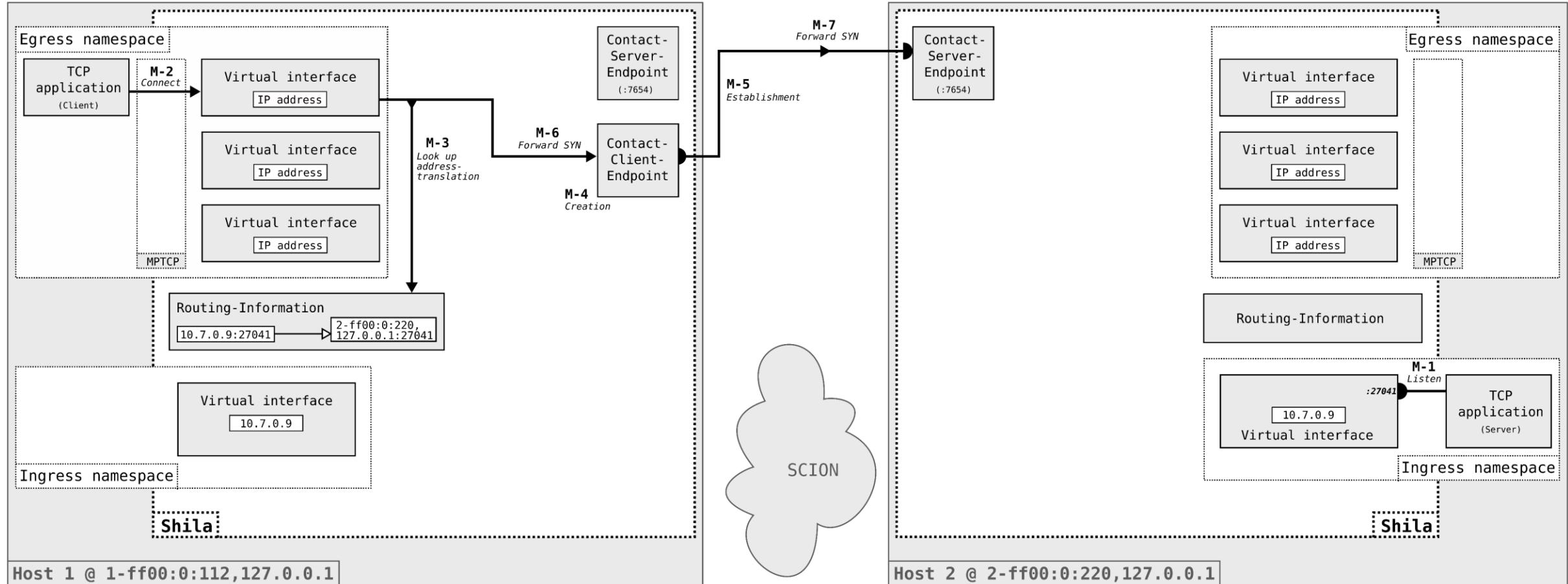
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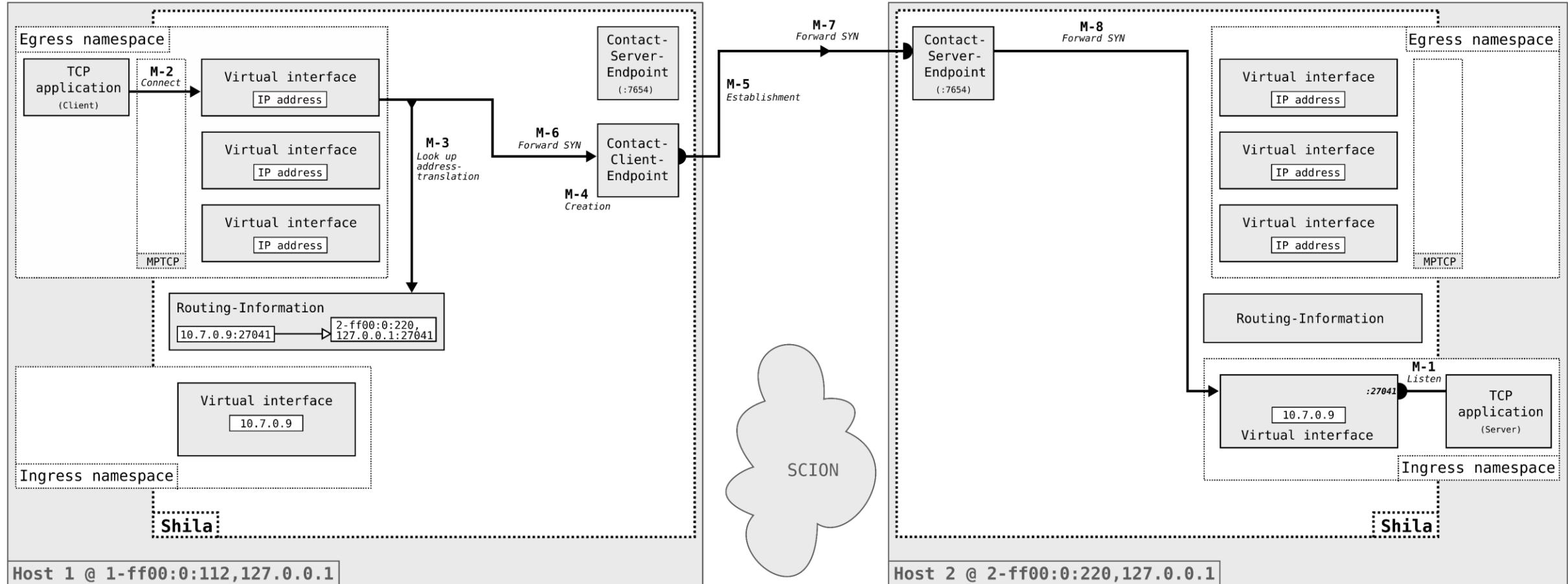
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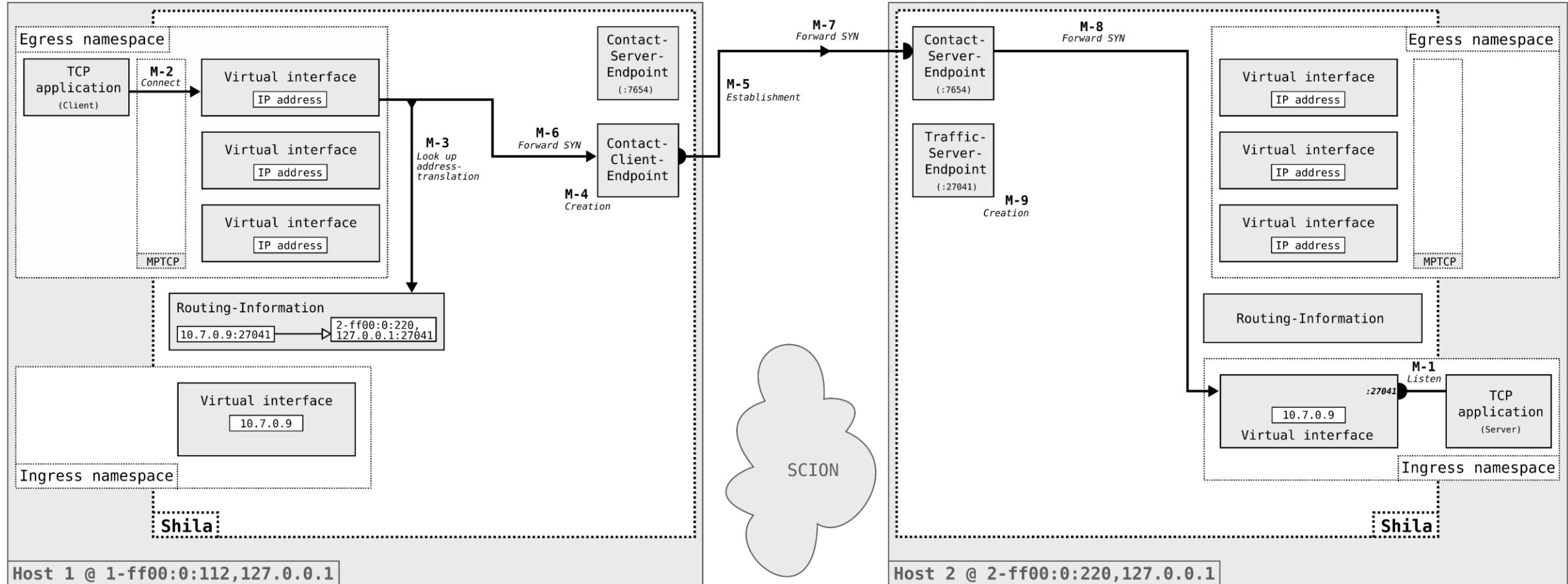
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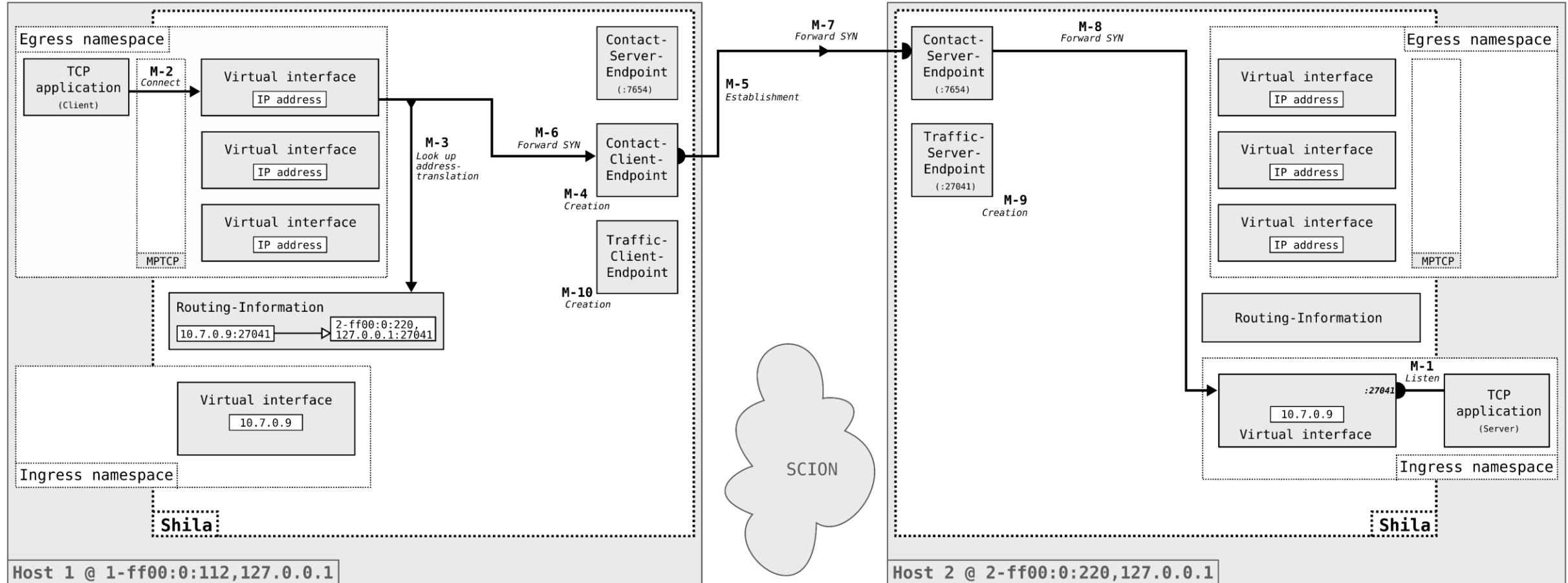
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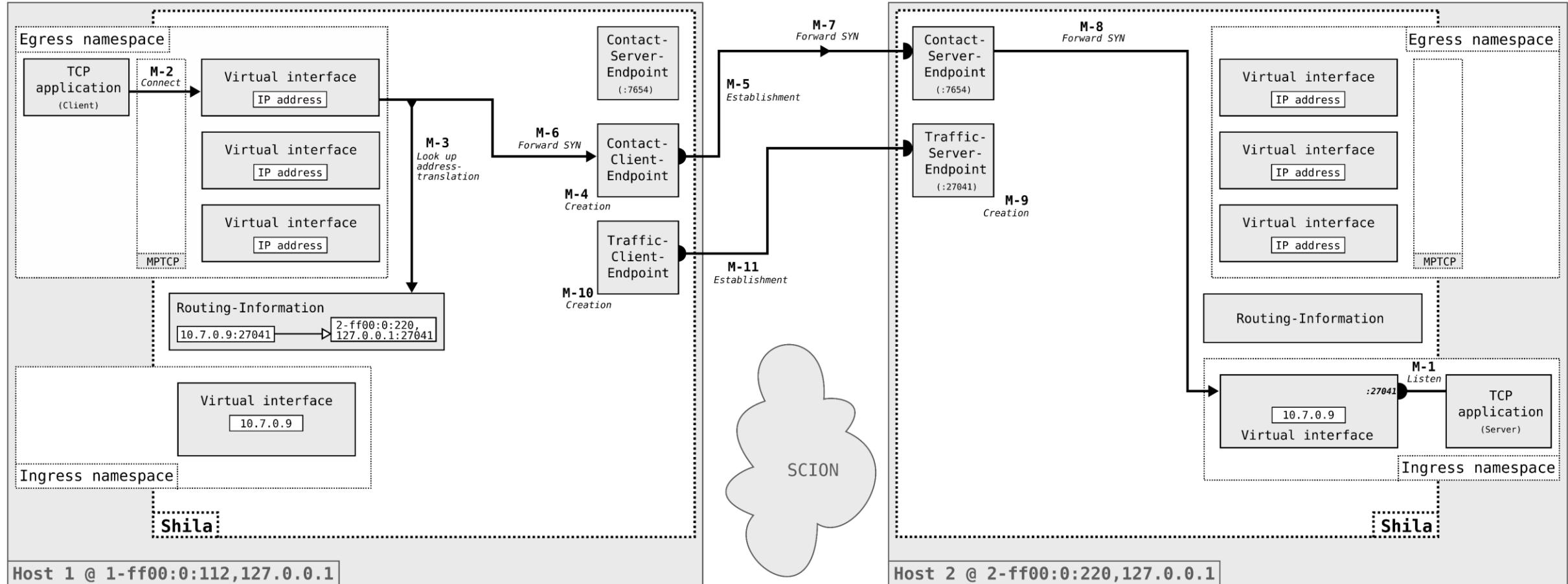
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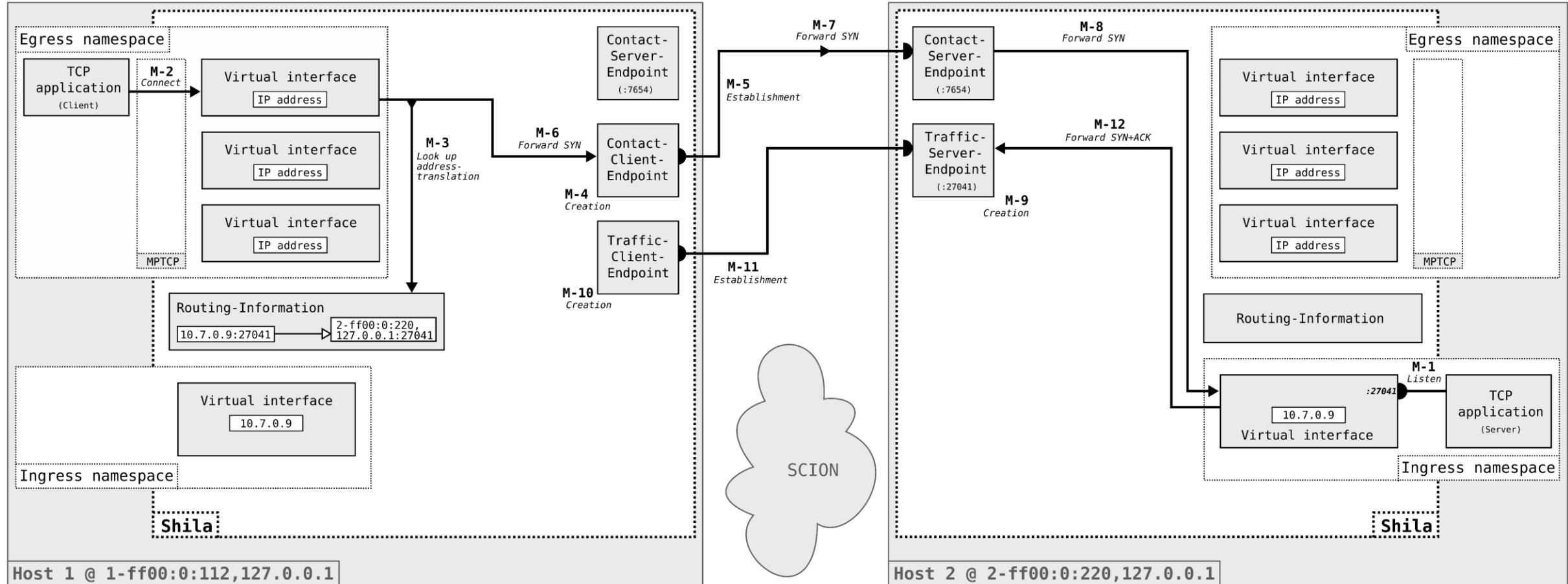
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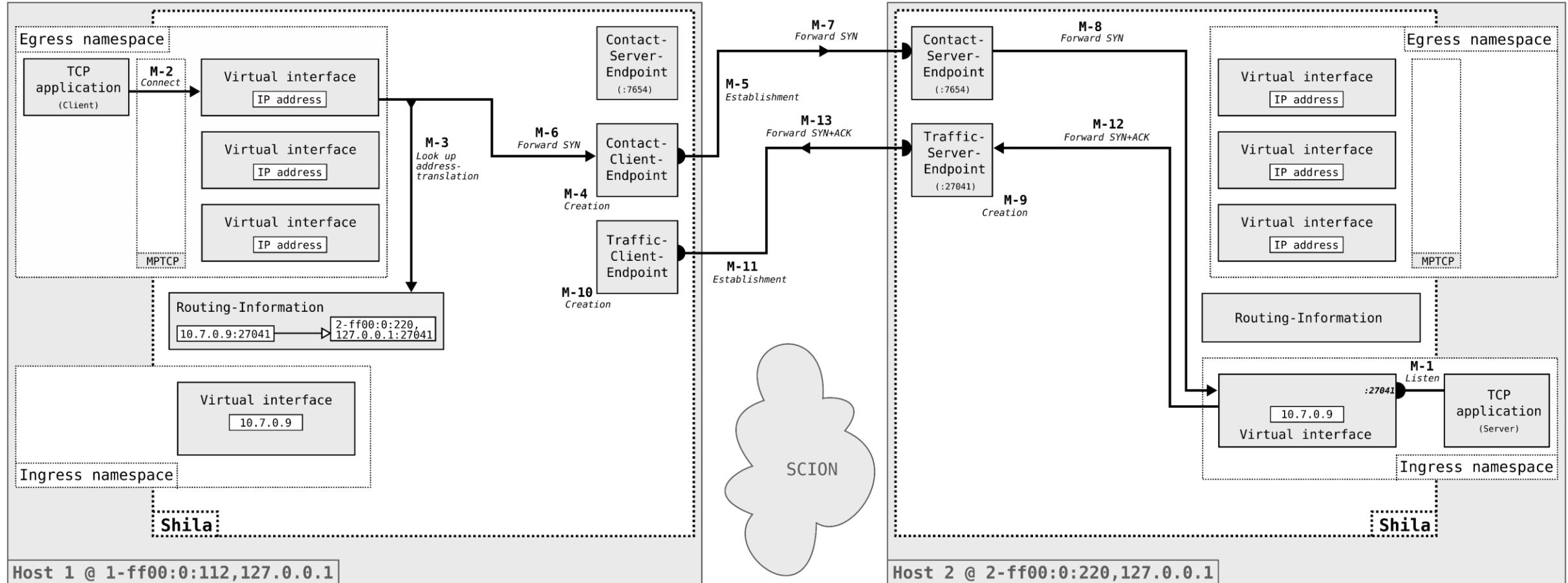
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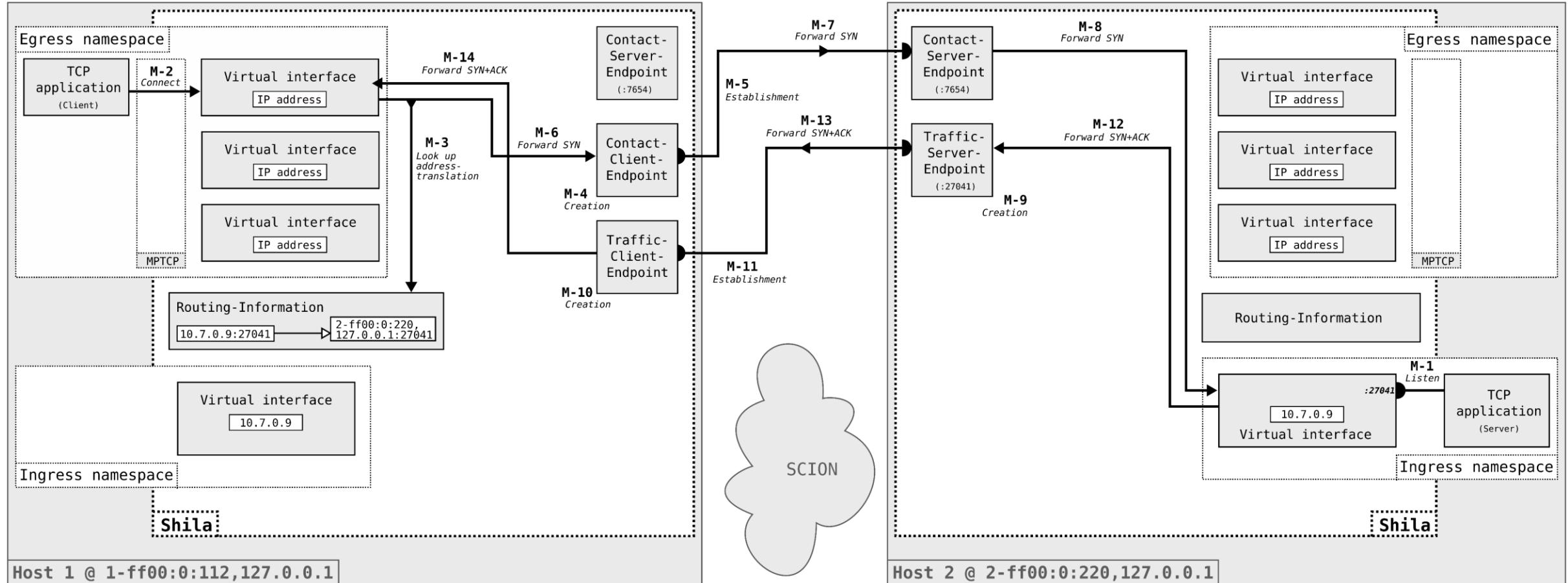


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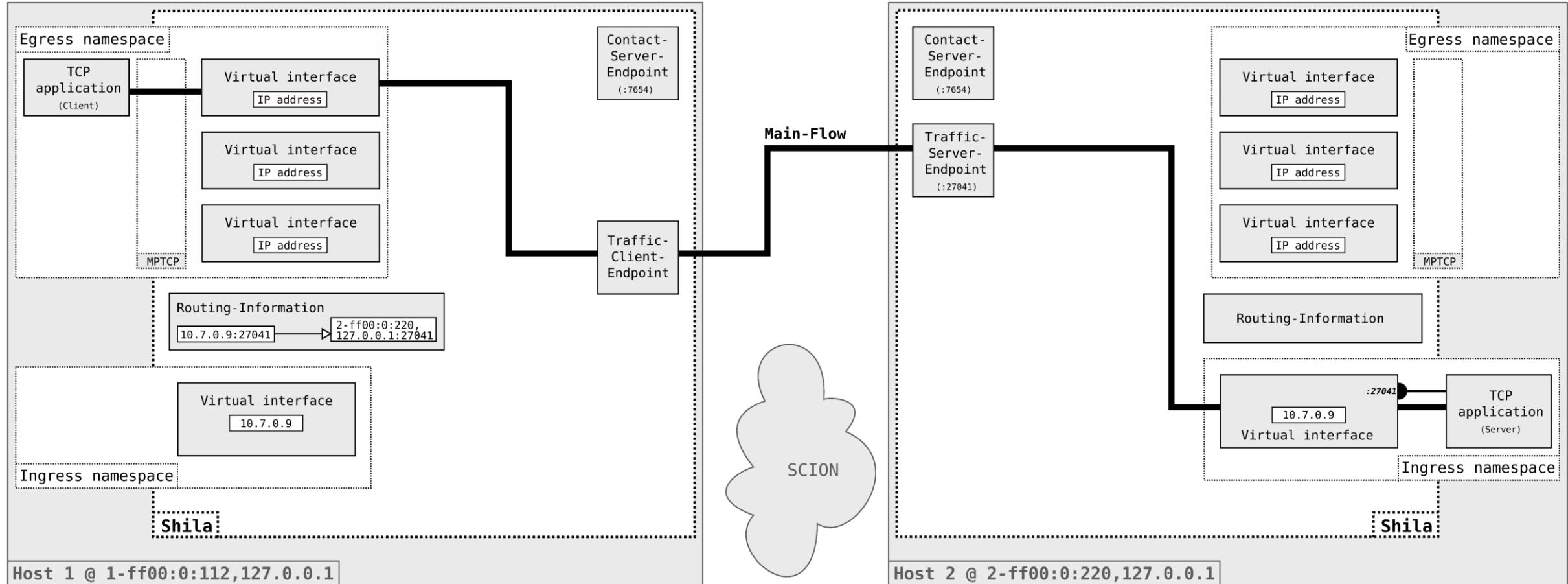


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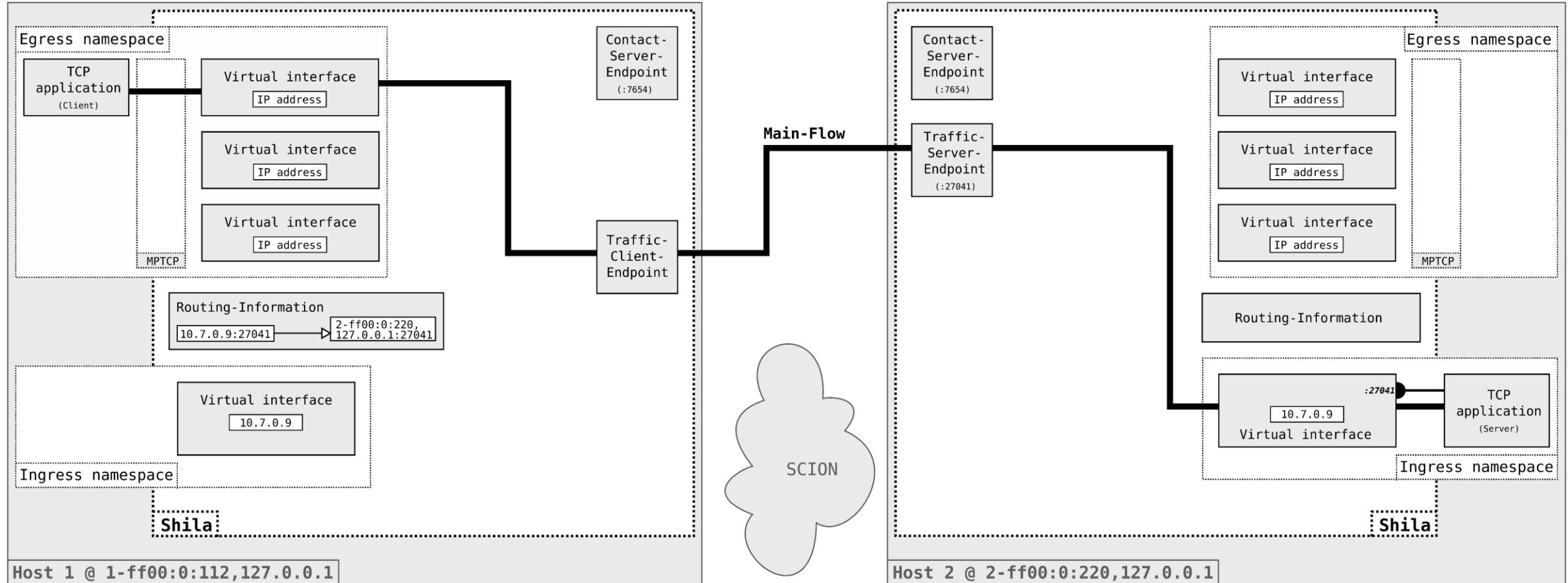


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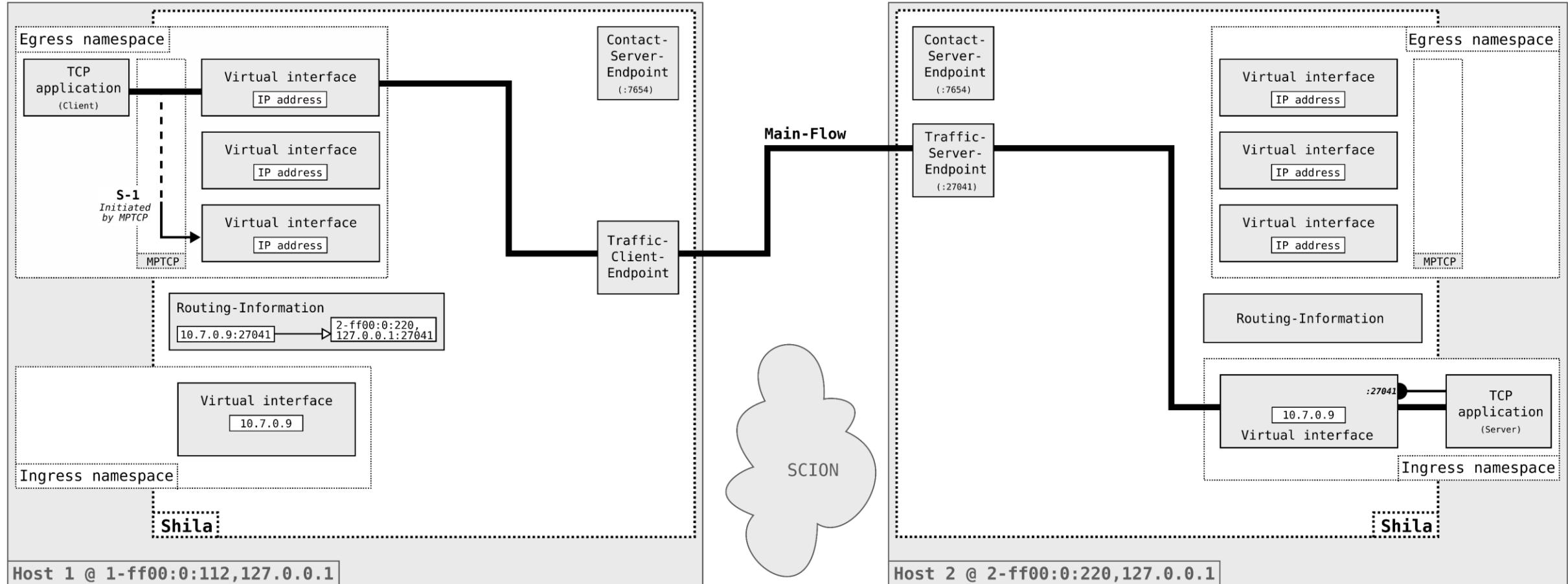
Main-Flow Establishment



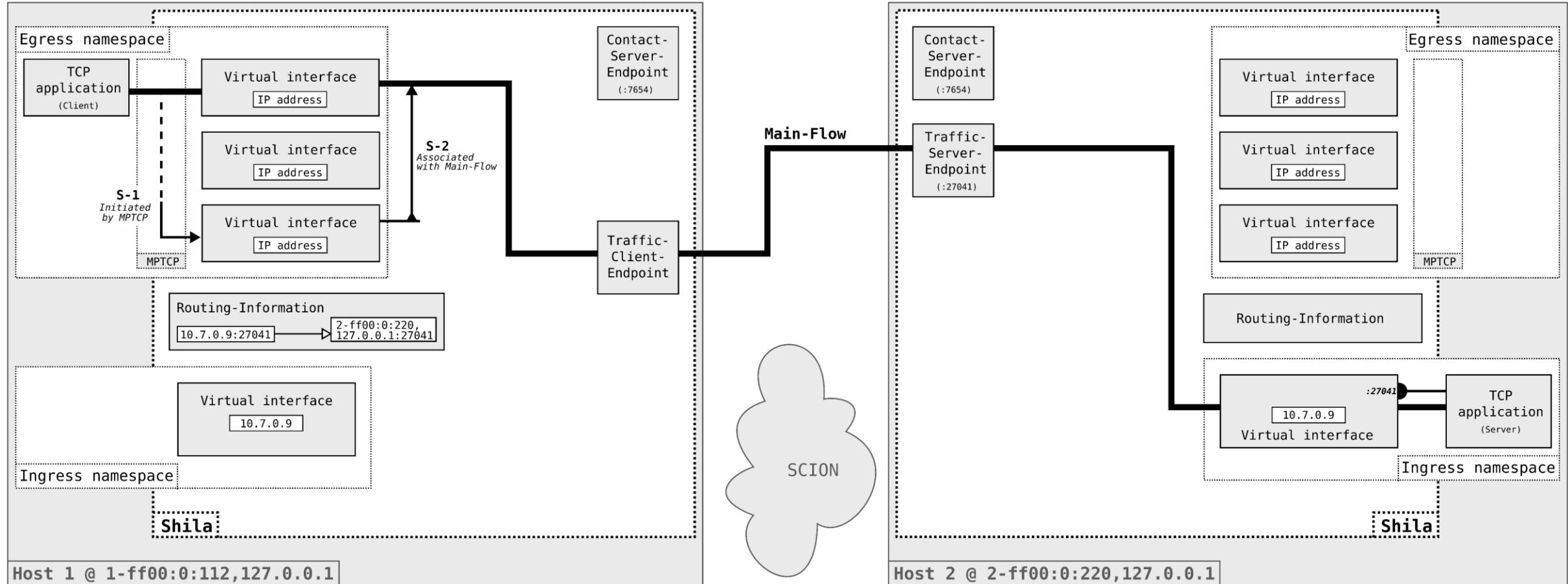
Functionality of Shila Sub-Flow Establishment



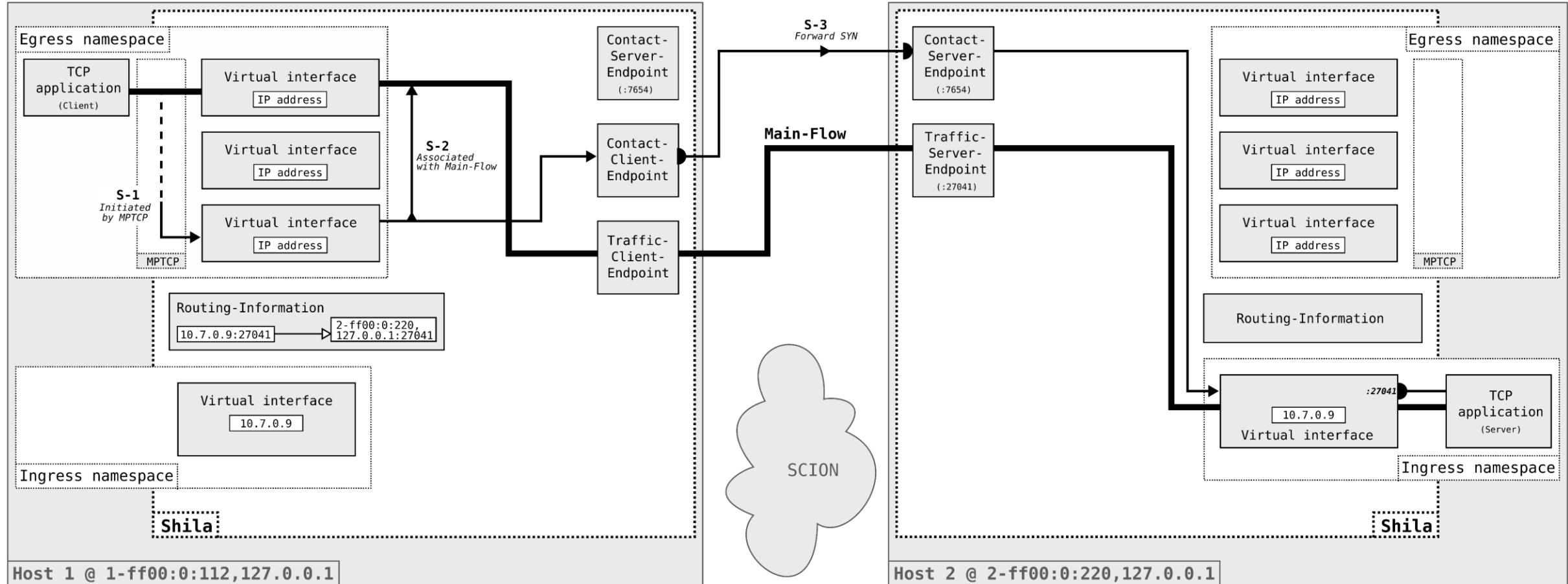
Functionality of Shila Sub-Flow Establishment



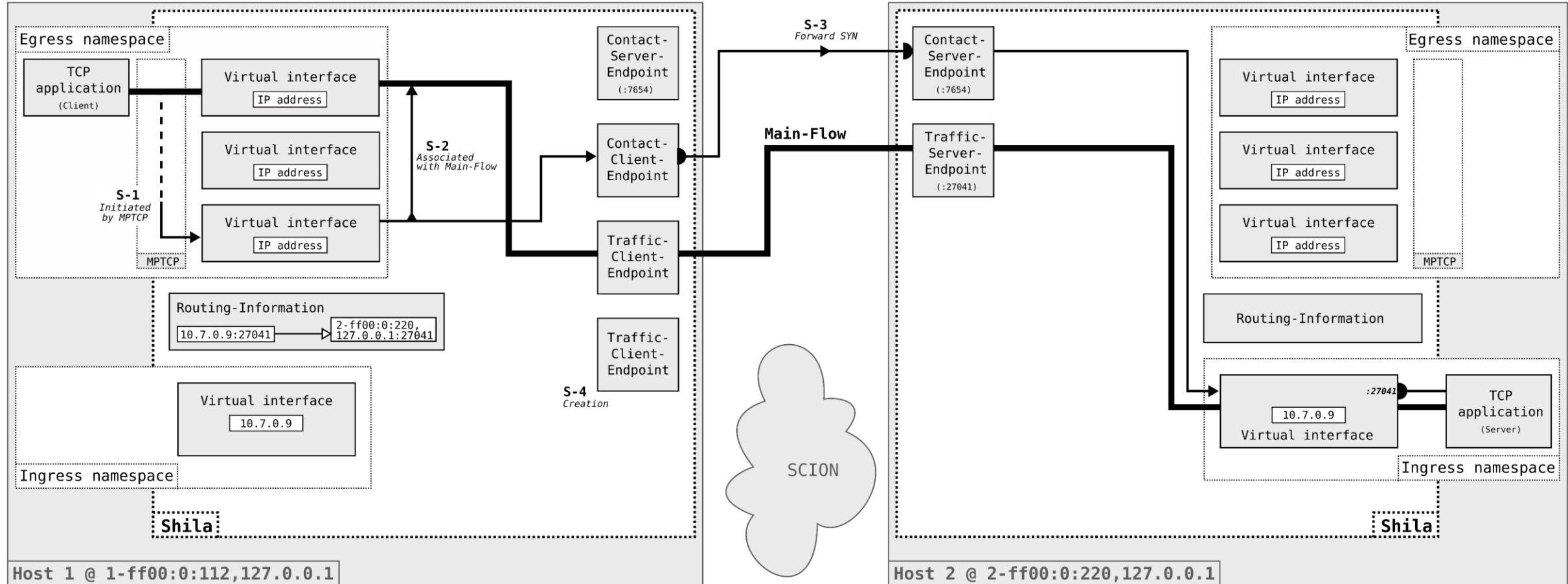
Functionality of Shila Sub-Flow Establishment



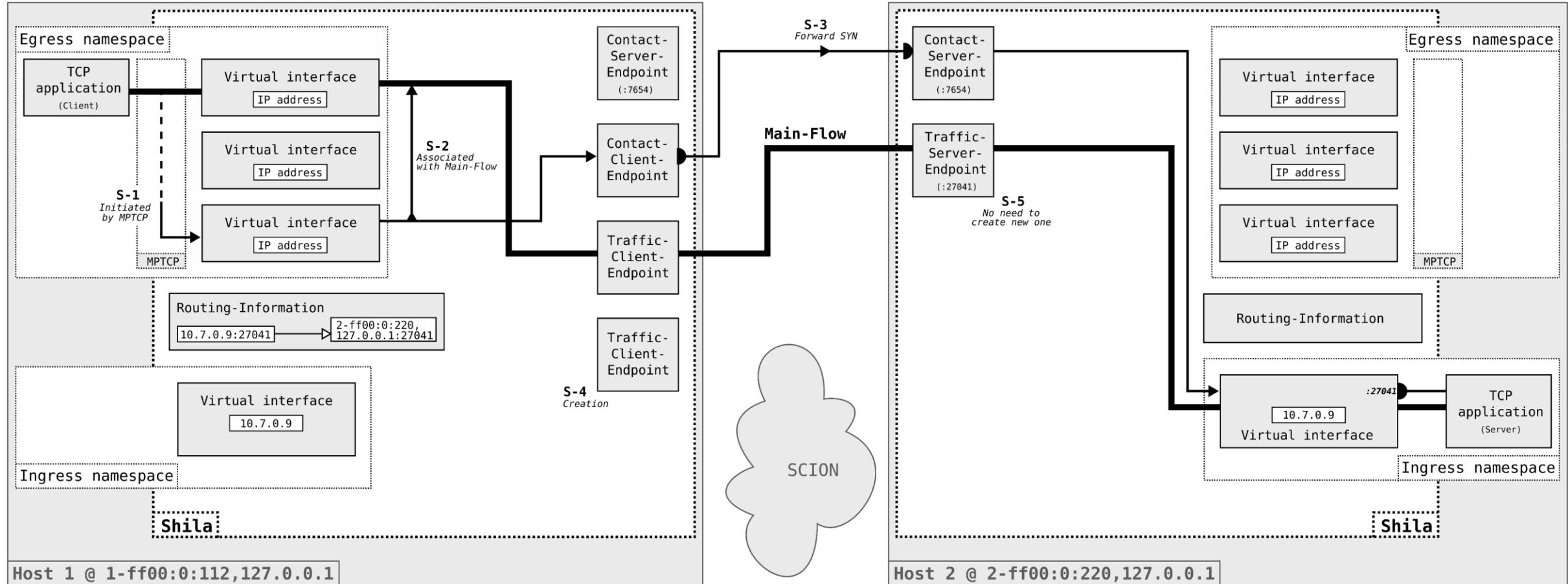
Functionality of Shila Sub-Flow Establishment



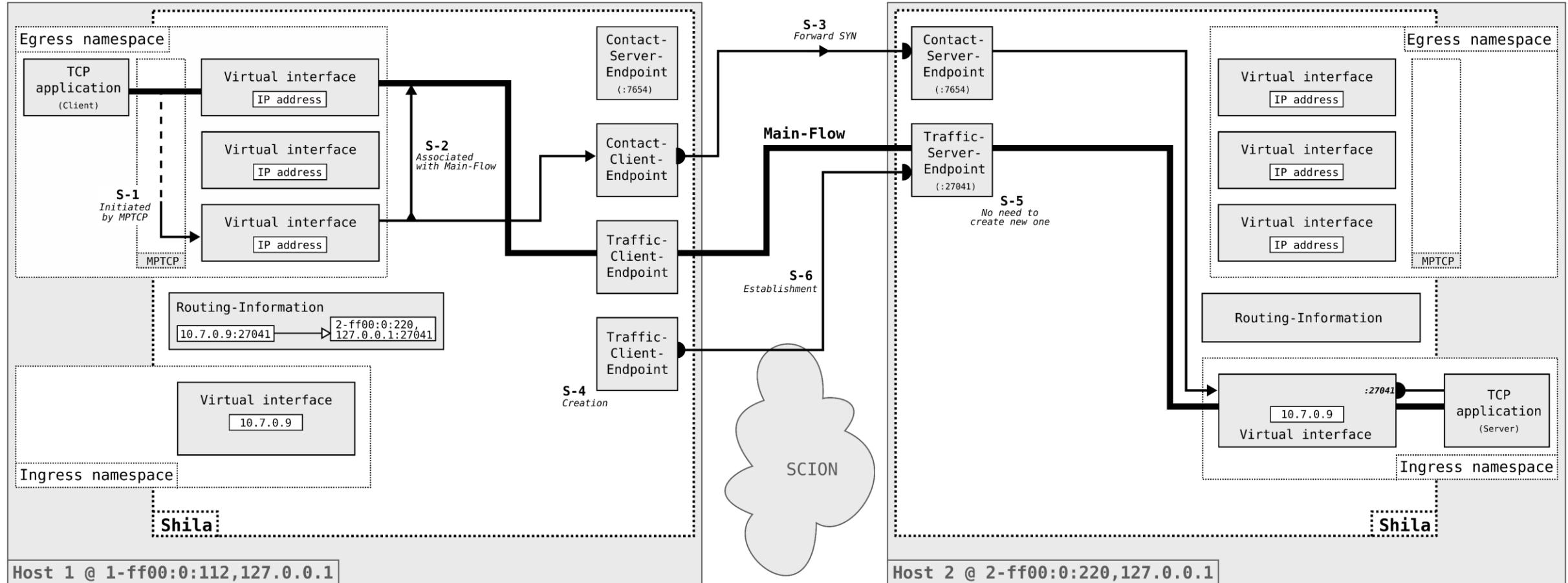
Functionality of Shila Sub-Flow Establishment



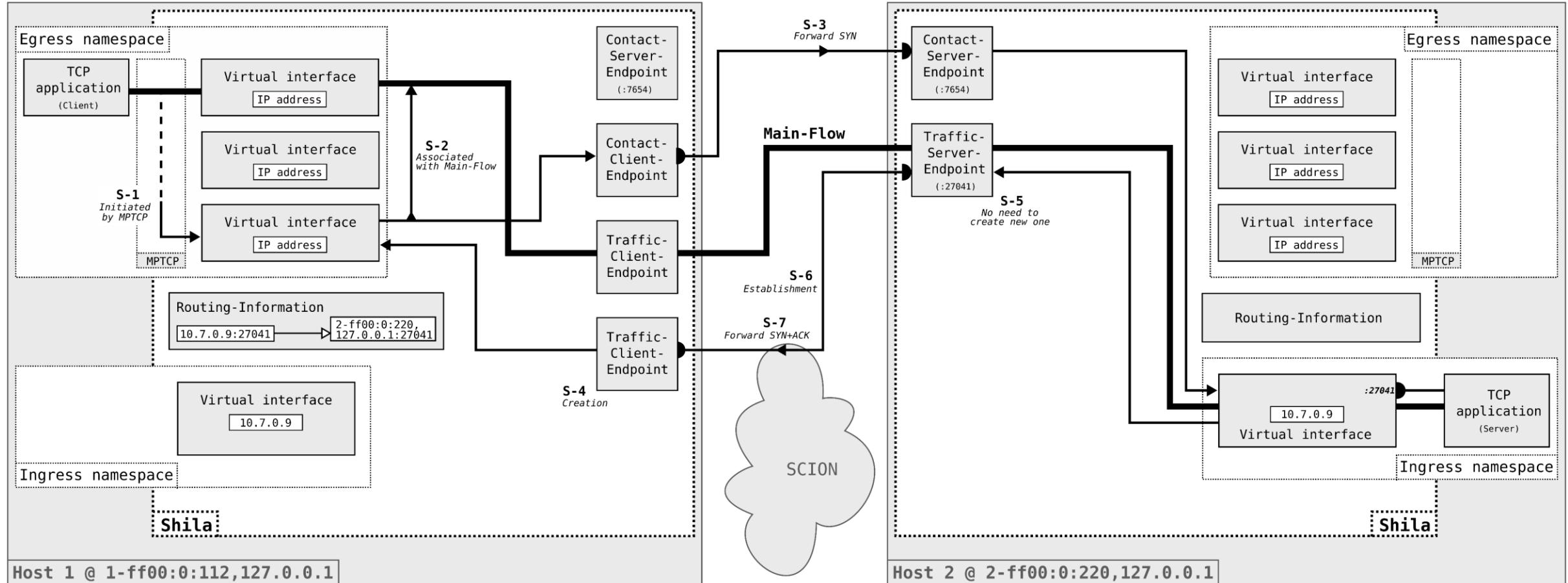
Functionality of Shila Sub-Flow Establishment



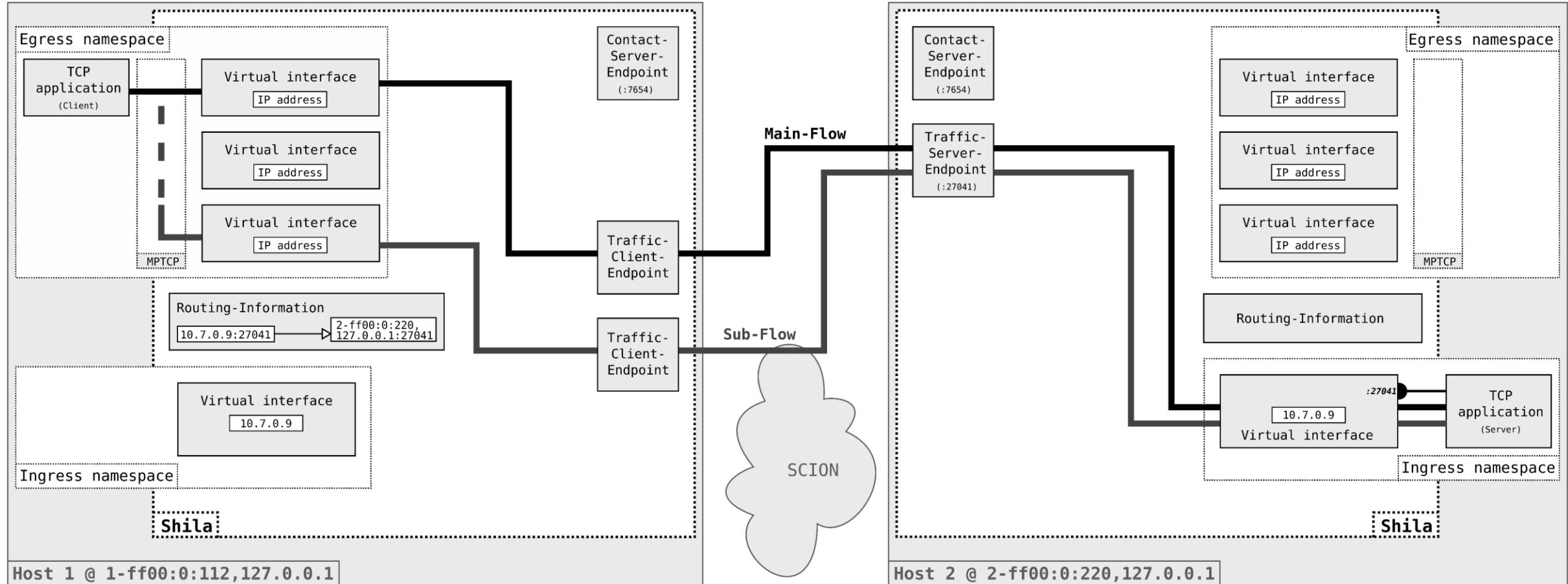
Functionality of Shila Sub-Flow Establishment



Functionality of Shila Sub-Flow Establishment



Functionality of Shila Data Exchange



On the menu

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Questions of interest



How does the performance behave in relation to the number of paths used for a connection?



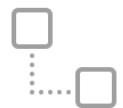
How well does Shila perform compared to QUIC over SCION?

Setup



Infrastructure

- › Three custom ASes within the SCIONLab
- › Shorter inter-European and longer overseas connection



Measure

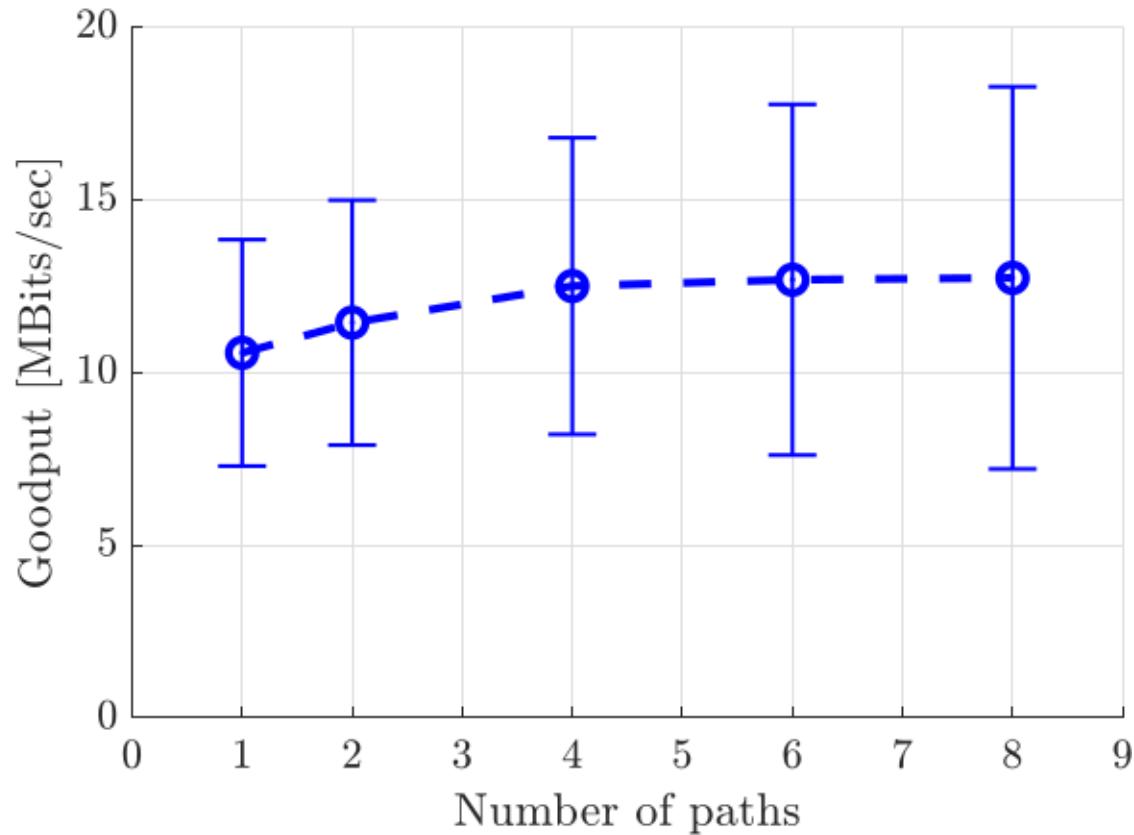
- › Goodput with iPerf3 as TCP application
- › Throughput computed offline from packet capture



Methodology

- › Data exchange for 30s between distinct ASes
- › Variation in the number of paths used (1,2,4,6,8)
- › 10 repetitions per fixed set of parameters, random order

Result



How does the performance behave in relation to the number of paths used for a connection?

An increase in the number of paths leads to an increase of the average goodput.

Performance evaluation

Result

Paths	Shila		QUIC over SCION	
	Goodput	Throughput	Goodput	Throughput
1	10.75 ± 3.28	17.45 ± 5.91	33.31 ± 3.28	36.82 ± 3.62
8	12.74 ± 5.53	19.37 ± 8.36	-	-

MBits/s
≈ 2.6 ×

How well does Shila perform compared to QUIC over SCION?

Shila gets outperformed by QUIC over SCION with respect to goodput as well as overhead.

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Future work

What is next?



Conduction of revision cycles

- › Improve implementation of Shila
- › Further testing



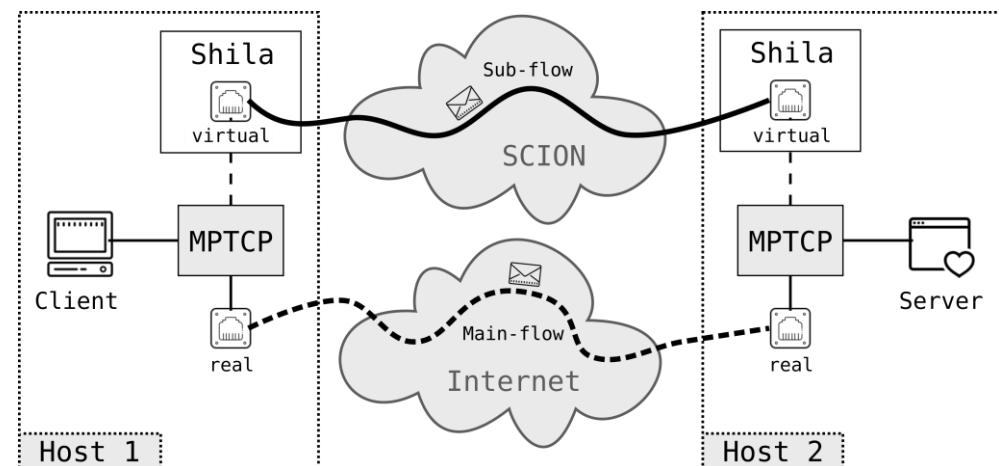
Addition of flexibility

- › Provide mapping between TCP and SCION destination address upon connection establishment
- › Remove need for namespaces



Side-by-side approach

- › Main-flow over conventional Internet
- › Sub-flow(s) over SCION





Thank you.