PEP-DNA: a Performance Enhancing Proxy for Deploying Network Architectures

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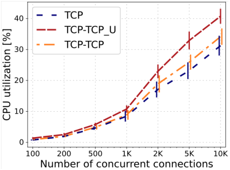
[Photo: Google Images]

This paper presents the design, implementation and evaluation of **PEP-DNA**, a **P**erformance **E**nhancing **P**roxy for **D**eploying **N**etwork **A**rchitectures

Background

Implementation



Evaluation

Background and Motivation

Design and Implementation

Performance Evaluation

The total IoT (non-IoT) connected devices worldwide is projected to amount 30.9 (10) billion units by 2025

[Photo: www.statista.com]

A closer look at the current Internet architecture shows many signs of weakness and issues related to multi-homing, mobility, security, . . .

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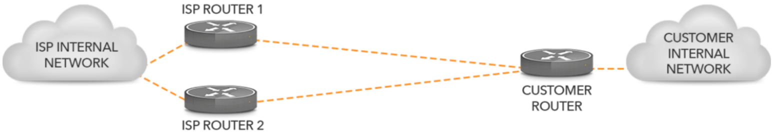

[Photo: Huawei]

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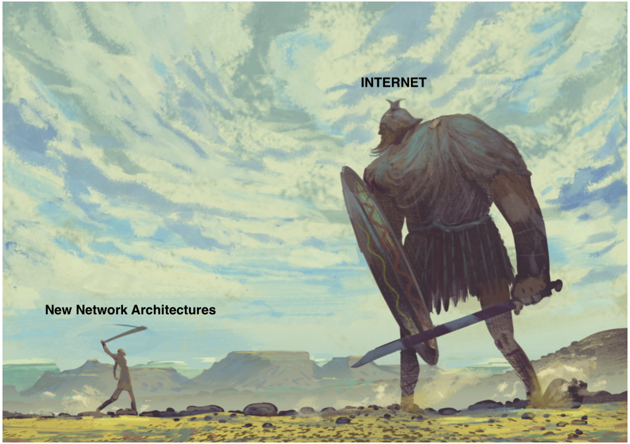
A closer look at the current Internet architecture shows many signs of weakness and issues related to multi-homing, mobility, **security**, . . .

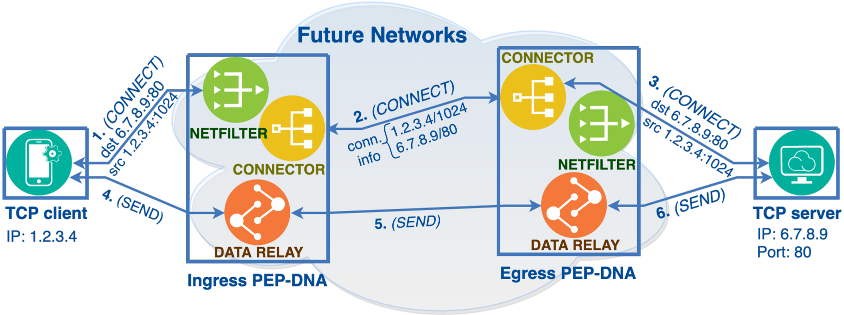
[Photo: TechWorm.net]

While plenty of new architectures have emerged over the years, their deployment *"is not happening at all"*



[Photo: behance.net]

To advance the gradual deployment of novel architectures, we introduce PEP-DNA, a TCP proxy that "translates" between TCP/IP and new technologies



Why another proxy?!

TABLE I: Overview of PEP implementations. "T" means: evaluation in a testbed; "S" means: simulation was used for performance evaluation.

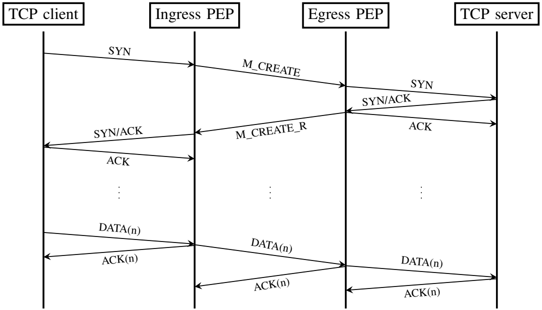
PEPs	Open source	In-kernel implementation	Evaluation	Split connection	No TCP change necessary
PEPsal	✓		T	✓	✓
XCP-PEP			T	✓	✓
HTTPEP			T	✓	
SatERN			S		✓
LTE-PEP			S	✓	✓
Mobile Accelerator			T	✓	
Snoop protocol	✓	✓	T		
Lightweight PEP			S		
vCC	✓[a]	✓	S/T		
AC/DC TCP		✓	T		✓
PEP-DNA	**✓**	**✓**	**T**	**✓**	**✓**

[a]The published open source code only contains a proof of concept implementation for vCC that patches the linux kernel's TCP stack, whereas the true vCC is implemented in proprietary VMware ESXi hypervisor.

PEP-DNA offers a realistic path towards gradual deployment of a novel network architecture

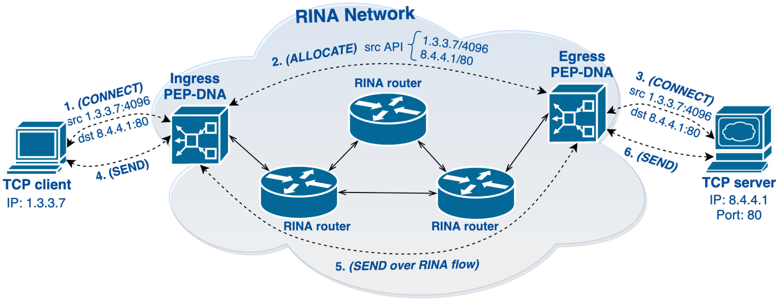
- Open source [https://github.com/kr1stj0n/pep-dna]
- Kernel-based implementation
- Transparent
- Lightweight and scalable
- Extensible [RINA, CCN, ...]

Connection Establishment and Data Transfer phases when two PEP-DNA proxies interconnect TCP applications over a RINA domain

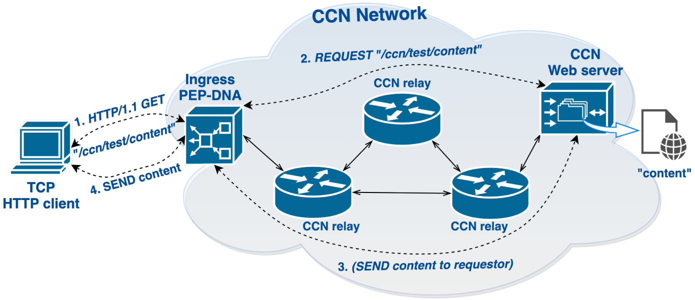


Fast establishment + Fate-sharing

In this paper we show how our proxy can seamlessly and efficiently enable interoperability between TCP/IP applications and a RINA network



In this paper we show how our proxy can seamlessly and efficiently enable interoperability between a TCP HTTP application and a CCN network

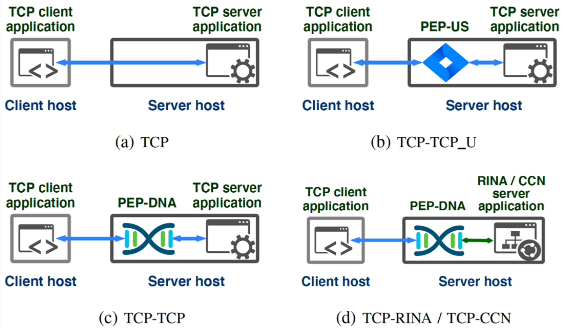


Background and Motivation

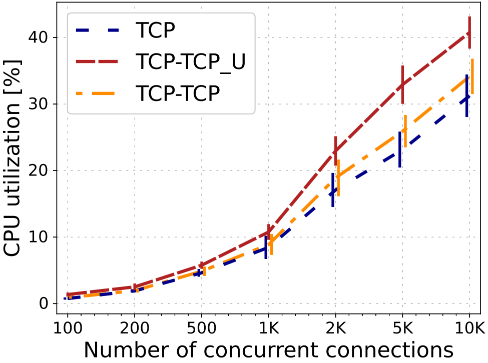
Design and Implementation

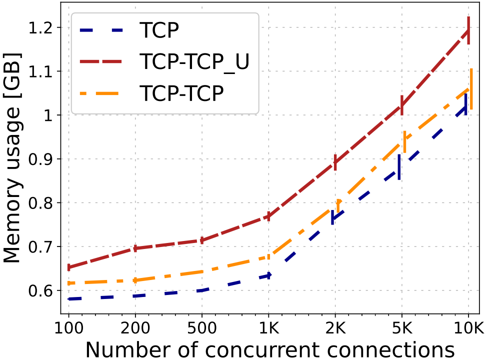
Performance Evaluation

We evaluate the performance of PEP-DNA against TCP baseline and a generic user-space proxy using the following scenarios in our local testbed



CPU utilization and Memory usage



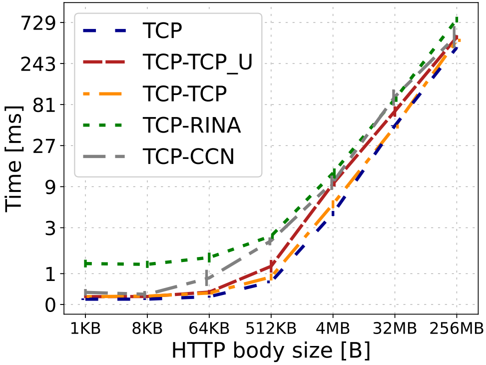


Latency overhead

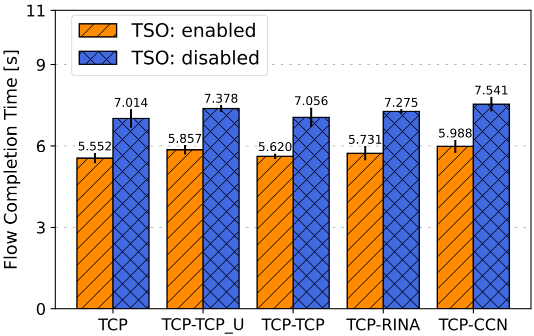
TABLE I: Latency results (mean $\mu \pm$ standard deviation σ in milliseconds), obtained from the web client by sending 100 HTTP HEAD requests to the web server with a rate of 1 request/second. NP means non-persistent HTTP connection, in which the results show how long it takes to connect, send the request and retrieve the response. In the persistent connection case (P), we measure the time between sending a request and retrieving the response.

	TCP	TCP-TCP_U	TCP-TCP	TCP-RINA	TCP-CCN
P	0.128±0.023	0.168±0.034	0.143±0.033	0.187±0.030	0.203±0.030
NP	0.186±0.025	0.247±0.051	0.218±0.038	1.273±0.059	0.267±0.035

HTTP measurements (100 runs avg/stddev)
Time between HEAD requests and corresponding responses



Flow Completion Time (FCT)



In conclusion: PEP-DNA can ease the integration and experimentation of new network architectures, and thus potentially advance their gradual deployment

Questions?

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