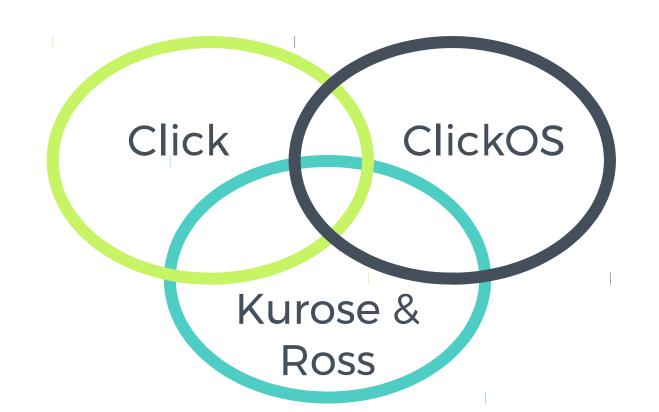
Middleware Click Middlebox ClickOS

Embasamento 🛤 🗎









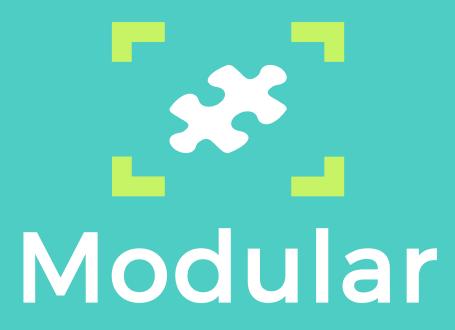
T. Click

Desde 1999

MIT

v. 2.0.1

Roteadores programáveis!



Elementos e Filas

FixIPSrc(2.0.0.1)

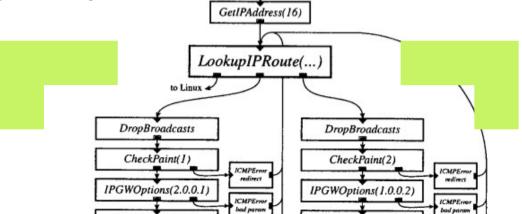
DecIPTTL

IPFragmenter(1500)

ARPQuerier(2.0.0.1, ...)

ToDevice(eth0)

from Classifier



ICMPError,

TTL expired

ICMPError

Fix1PSrc(1.0.0.2)

DecIPTTL

IPFragmenter(1500)

ARPQuerier(1.0.0.2, ...

ToDevice(eth1)

from Classifier

ICMPError.

TTL expired

ICMPError

Strip(14)

CheckIPHeader(...

- Legibilidade;
- Reusabilidade:
- Flexibilidade:
- Controle de fluxo;

Elementos e Filas (2) 🚓 🔆





```
1// define the IP address of this network function.
 2 // This IP must NOT be the same with your VM's IP.
          define($IP 192.168.3.1);
 4 // This MAC must be identical with the one you defined in config.xen
          define($MAC 00:15:17:15:5d:31);
 7 source :: FromDevice;
 8 sink :: ToDevice;
9 c :: Classifier(
10
   12/0806 20/0001.
     12/0806 20/0002,
11
       12/0800.
12
13
          -);
14
15 arpg :: ARPQuerier($IP, $MAC);
16 arpr :: ARPResponder($IP $MAC);
17
18 source -> c;
19 c[0] -> ARPPrint -> arpr -> sink;
20 c[1] -> [1]arpq;
21 Idle -> [0]arpq;
22 arpg -> ARPPrint -> sink;
23 c[2] -> CheckIPHeader(14) -> ICMPPingResponder() -> Print('Responder') -> EtherMirror() -> sink;
24 c[3] -> Discard;
25
```

Alguns adicionais 👄 👈





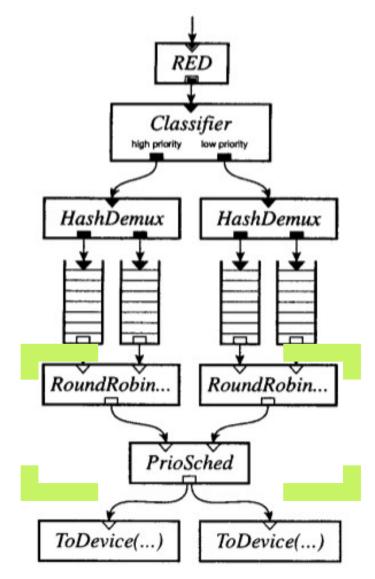
Scheduling;



Políticas de *Dropping*;



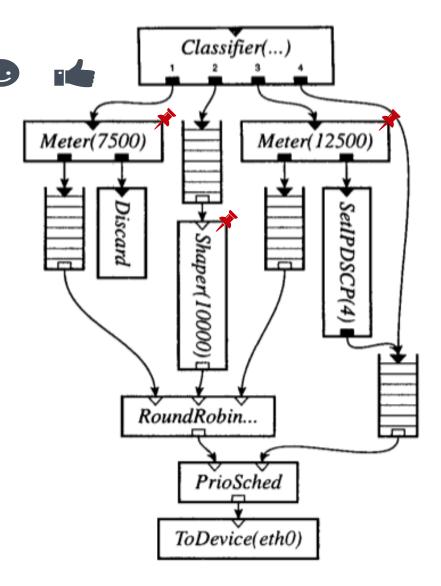
Differentiated Services:



Alguns adicionais (2) 👄 👈

- Scheduling;
- Políticas de *Dropping*;
- Differentiated Services;





Links Úteis

- Projeto https://github.com/kohler/click
- Site Oficial http://www.read.cs.ucla.edu/click/
- •Artigo http://dl.acm.org/citation.cfm?id=354874
- Evolução do Click https://youtu.be/5-2PMERD4y8

2. ClickOS

Desde 2014

NEC & Univ. Politécnica de Bucareste

v. 0.2

VNFs – Virtual Network Functions



Plataforma

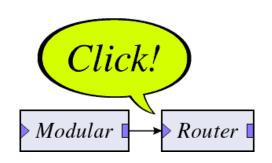


Our goal is to build a versatile, high performance software middlebox platform on commodity hardware. Such a platform must satisfy a number of performance and security requirements. [...as Flexibility, High Throughput and Low Delay, and Scalability.]

Utiliza... 💝



MiniOS

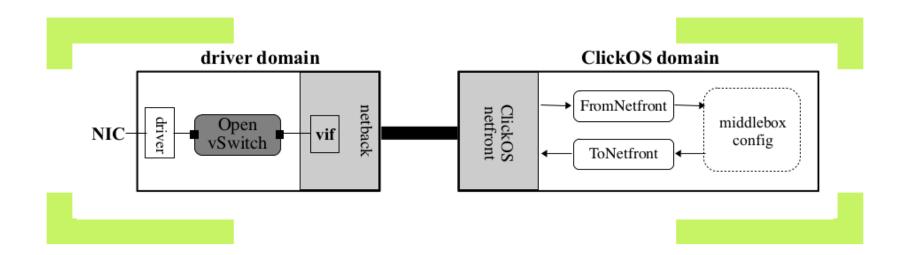


Cosmos VALE Switch

Estrutura 🤲 😊







Desempenho

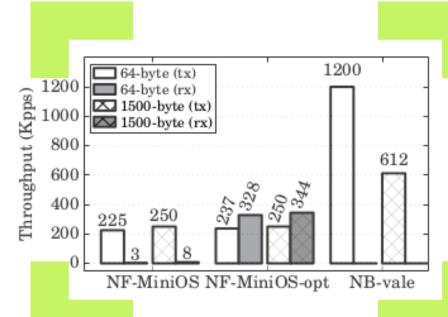






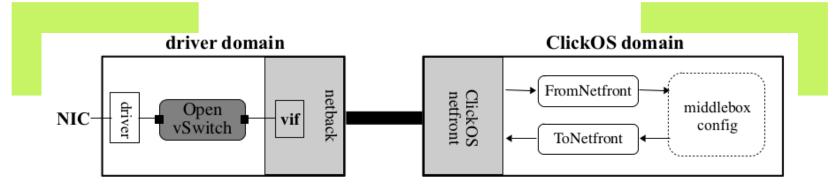


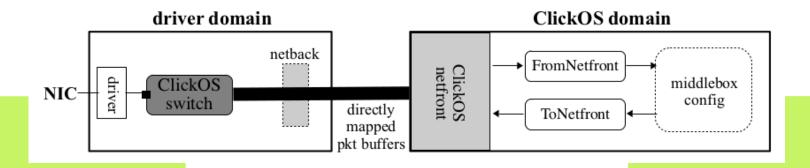
- 1) Netfront;
- 2) Netfront otimizado;
- 3) Netback VALE;



pacotes/	64- bytes	1500- bytes
10Gb/s	14,8 Mp/s	822 Kp/s

Estrutura (2) 🗫 👁





10.000.000.000

*Sim, sempre tem um porém...

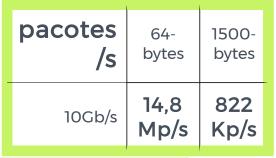
Desempenho (2) 😉 🔟

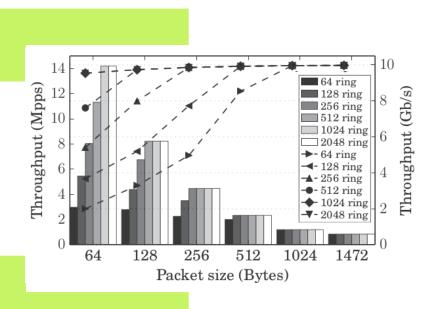


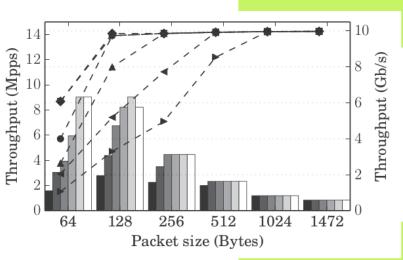












1) Envio

2)Recebimento

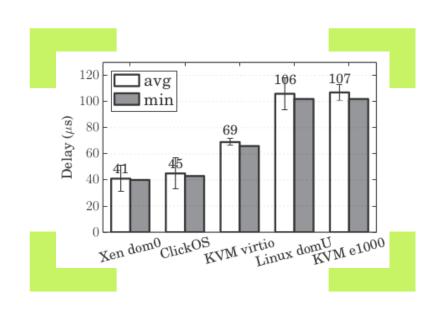
Desempenho (3) 💩 🔟 📈



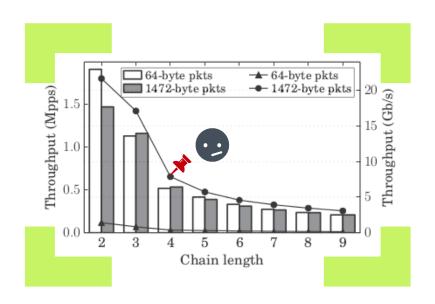








1) Atraso – 1 CPU



2)Encadeamento - 1 CPU

Desempenho (4) 😉 🔟

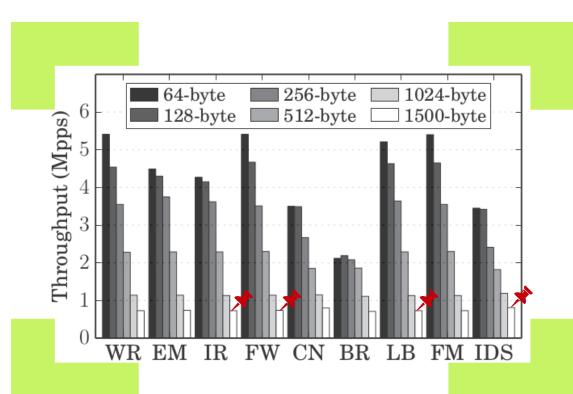








1) Implementações de middleboxes -1 CPU



Links Úteis

- Projeto https://github.com/cnplab/clickos
- Site Oficial http://cnp.neclab.eu/clickos
- Artigo e Apresentação na NSDI'14 https://www.usenix.org/node/179772

Perguntas?

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