

Programando a Internet do Futuro por meio das Redes Definidas por Software

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\$ whoami

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Mestrando em Informática - UFES

Membro do NERDS

SaaS no pag!

Eterno aprendiz



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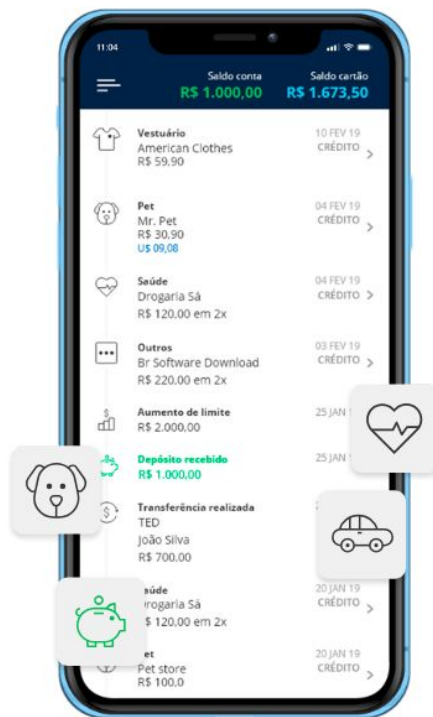
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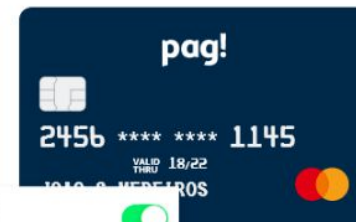
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Agenda

Agenda

- Motivação
- Revisão de redes de computadores
- Quais são as limitações atuais da internet
- O que são redes definidas por softwares (SDN)?
- Vantagens de SDN
- Desvantagens de SN
- Aplicações práticas de SDN
- Ferramentas
- Exemplos de código
- Conclusão

Motivação



Gartner Gartner Gartner

“Ethane: taking control of the enterprise”,
Martin Casado,
Michael J. Freedman,
Justin Pettit, Jianying
Luo, Nick McKeown,
and Scott Shenker.
SIGCOMM 2007

The State of
SDN Adoption
by Andrew
Lerner, June 16,
2014
<https://gtnr.it/2ScBRqJ>

Predicting SDN
Adoption by
Andrew Lerner,
December 8,
2014
<https://gtnr.it/2Jw6IRG>

The State of
SDN
by Andrew
Lerner, August
29, 2017
<https://gtnr.it/2LSvIUS>



ARPANET
THE FIRST INTERNET

ARPANET
adopted TCP/IP on
January 1, 1983,
and from there
researchers began
to assemble the
“network of
networks” that
became the
modern Internet.

“OpenFlow: enabling
innovation in campus
networks.”, Nick
McKeown, Tom
Anderson, Hari
Balakrishnan, Guru
Parulkar, Larry Peterson,
Jennifer Rexford, Scott
Shenker, and Jonathan
Turner. SIGCOMM 2008



Happy Birthday,
Cisco Application
Centric
Infrastructure!
Gideon Tam
, November 14,
2014
<https://bit.ly/2Y10mg2>



Espresso makes
Google cloud
faster, more
available and cost
effective by
extending SDN to
the public internet
Apr 4, 2017
<https://bit.ly/32paUop>

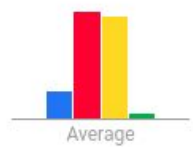


Rush hour
traffic in the
data center?
Bring it on! By
Mat Mathews,
June 04, 2019
<https://bit.ly/3OqDUdI>



Mundo

Interest over time ?




Interest over time ?



Brasil





The screenshot shows the IDC website header with navigation links: Home, About IDC, Analysts, Products & Services, Events, Contact Us, myIDC, and IDC Blog. The breadcrumb trail reads: IDC > About IDC > IDC Media Center > Four Providers of Datacenter Software-Def... The article title is "Four Providers of Datacenter Software-Defined Networking Named IDC Innovators" dated 28 Mar 2018. The main text states: "FRAMINGHAM, Mass., March 28, 2018 – International Data Corporation (IDC) today published an IDC Innovators report focusing on four technology providers that are considered key emerging vendors in the software-defined networking (SDN) market. The four companies named as IDC Innovators are Apstra, Inc., Big Switch Networks, Inc., Plexxi, and Pluribus Networks. SDN, and its evolutionary extension into intent-based networking (IBN), represents an architectural approach to datacenter networking in the cloud era. It is defined by an abstracted architectural model that better aligns network infrastructure with the needs of application workloads through automated (thereby faster) provisioning, programmatic network management, pervasive application-oriented visibility and, where needed, direct integration with cloud orchestration platforms. These capabilities can translate into significant operational savings while providing organizations with the means of faster time to business outcomes and revenue realization." A contact section for Michael Shirer (press@idc.com, 508-935-4200) is also visible.

<https://bit.ly/2JzoCxL>



<https://www.apstra.com/>



<https://www.plexxi.com/>



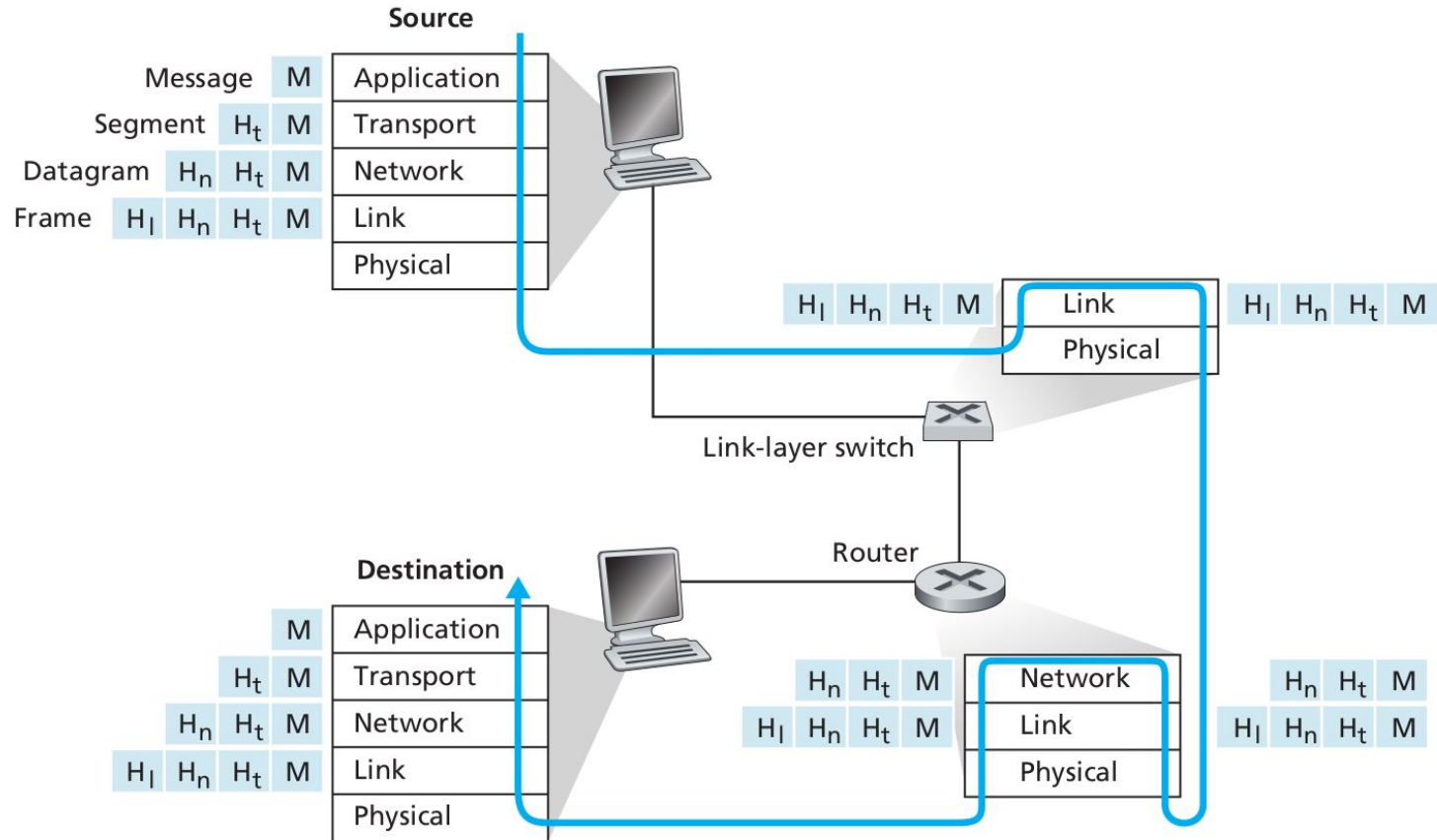
<https://www.bigswitch.com/>



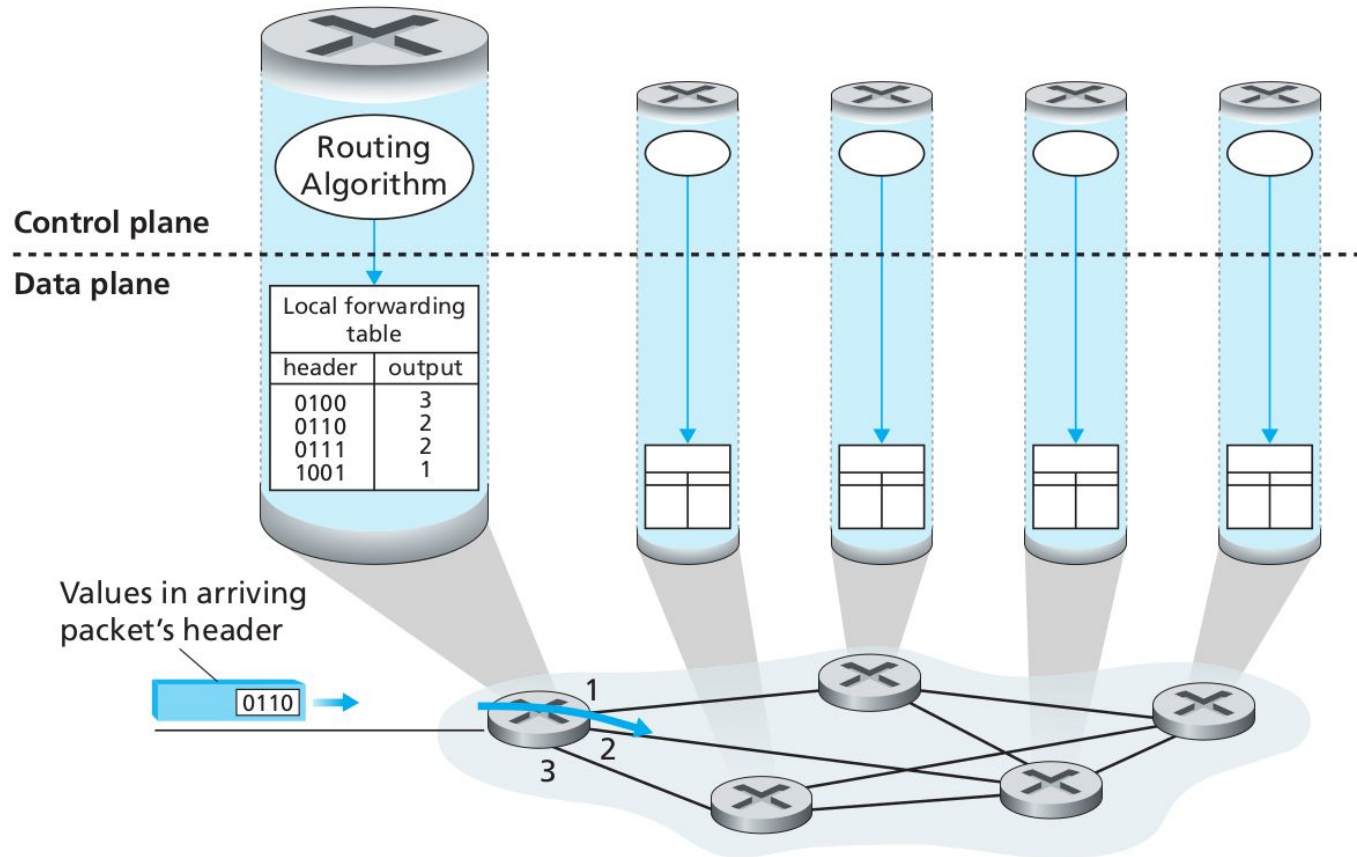
<https://www.pluribusnetworks.com/>

Revisão de redes de computadores

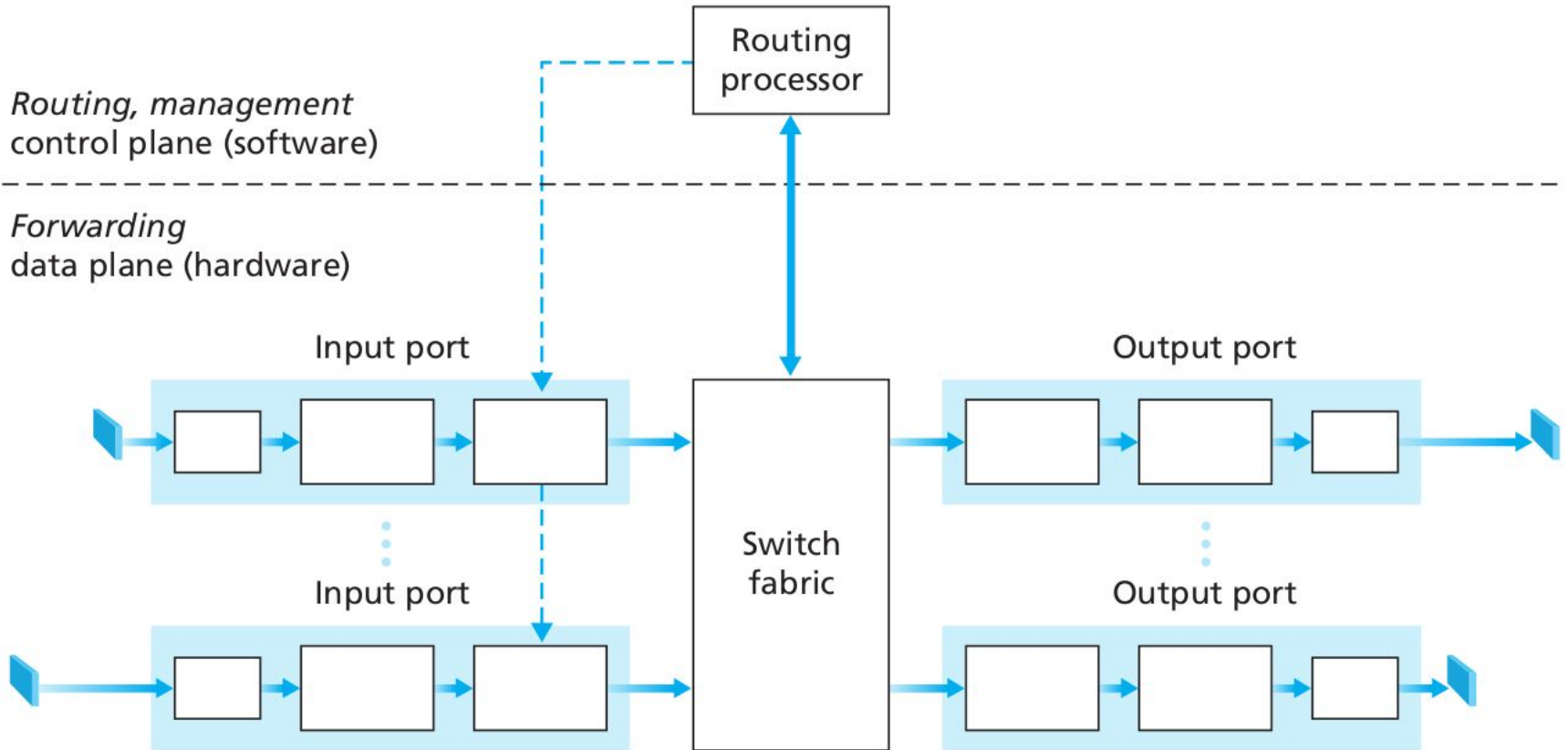
Revisão de redes de computadores



Revisão de redes de computadores



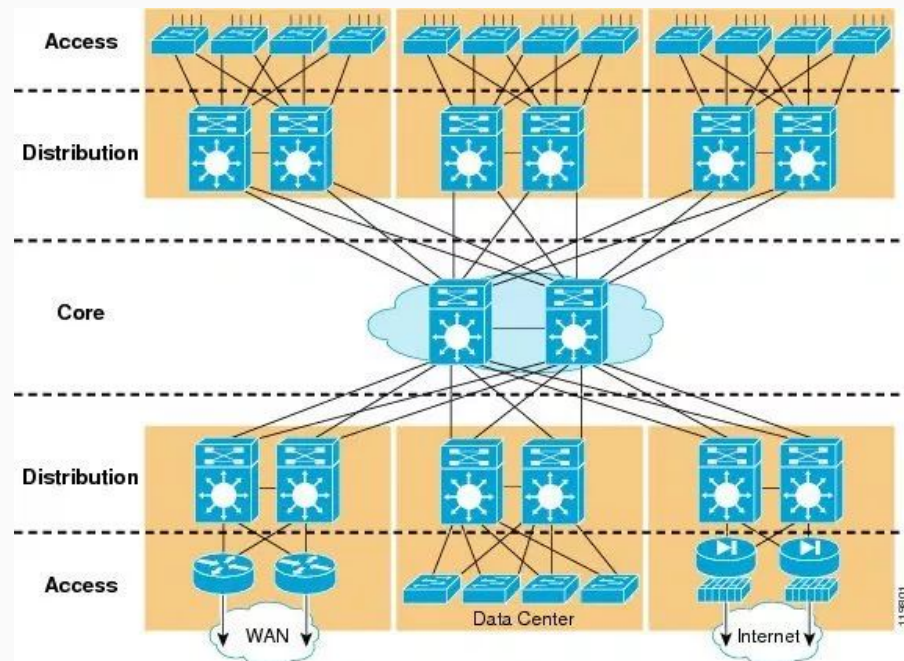
Revisão de redes de computadores



Quais são as
limitações atuais
da internet

Quais são as limitações atuais da internet

- “Hierarchical inter-networking model” tem um alto custo;
- Excessos de “hops” (saltos) entre aparelhos para entregar a mensagem;
- Complexidade em mudar arquitetura; e
- Evoluir hardware é complexo e caro.



O que são redes definidas por softwares (SDN)?

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Configurável



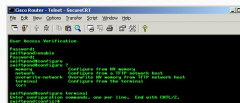
Cisco's Catalyst 3560 series



ANSIBLE

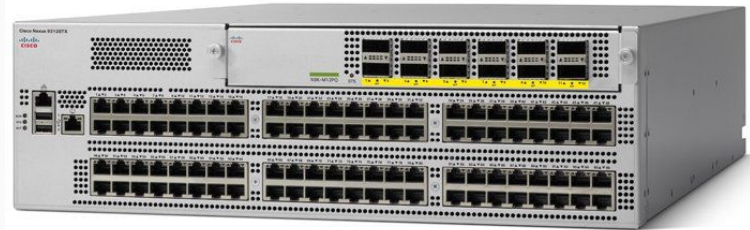


SALTSTACK



VS

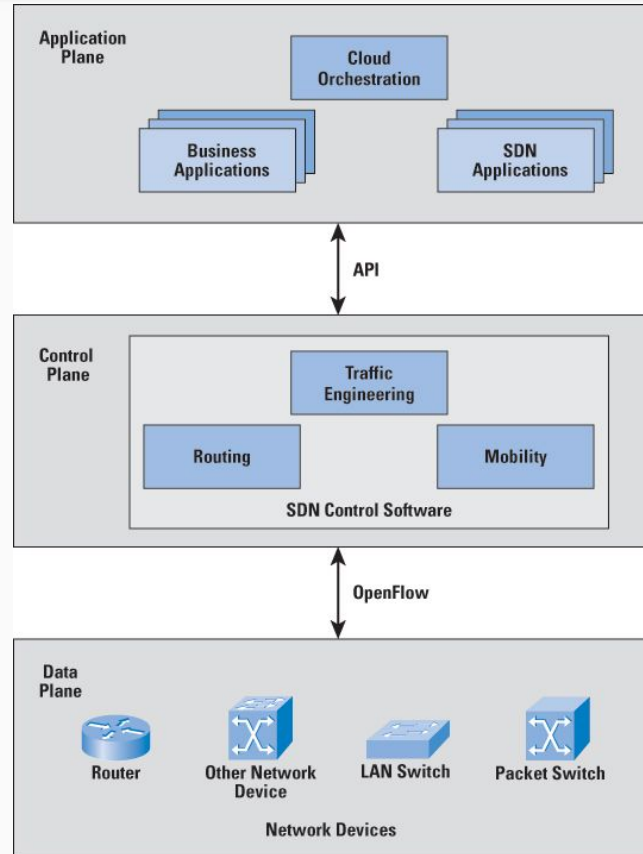
Programável



Cisco's Nexus 9000 series

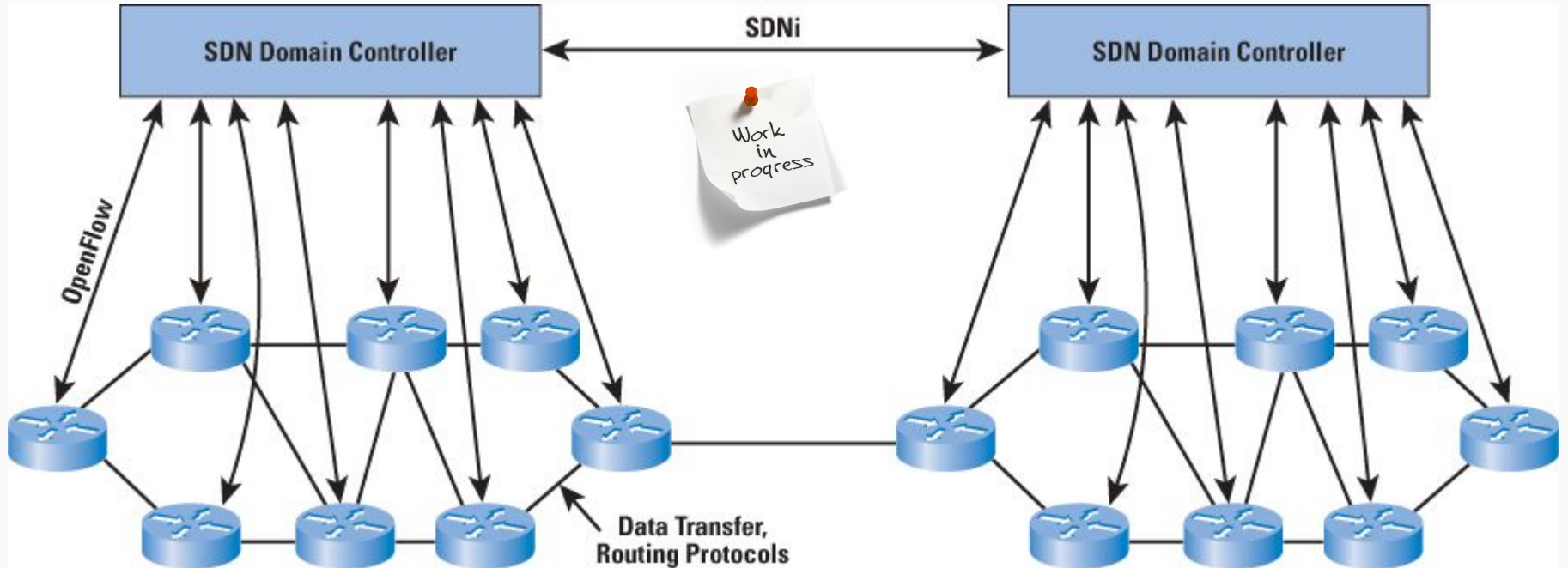


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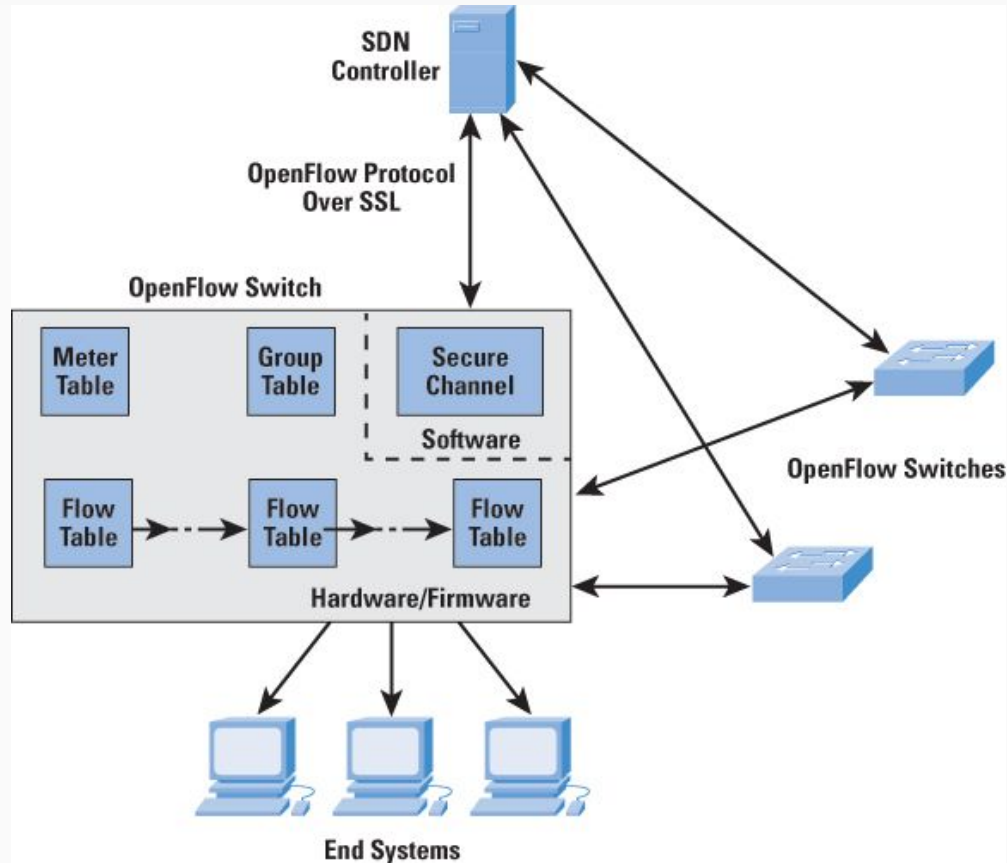


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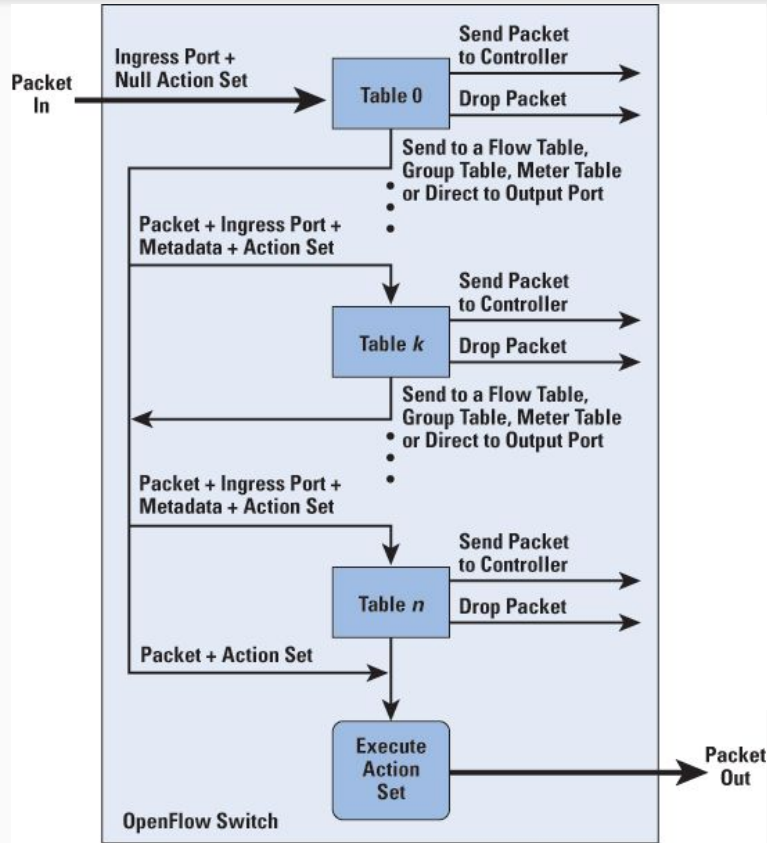
<https://tools.ietf.org/html/draft-yin-sdn-sdni-00>



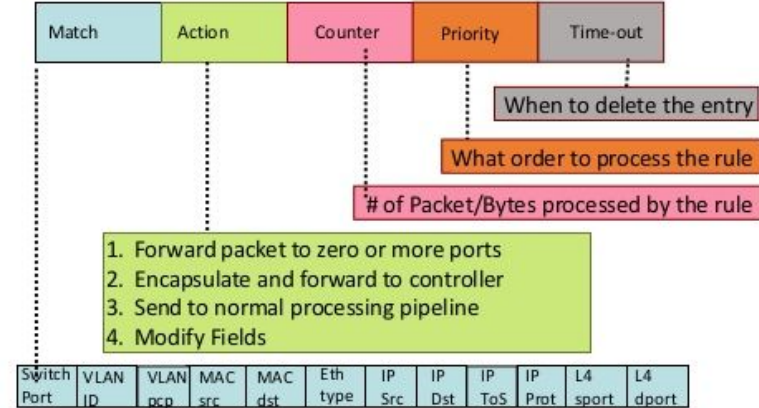
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OpenFlow: Anatomy of a Flow Table Entry



Vantagens de SDN

Amazon, Facebook internet outage: Verizon blamed for 'cascading catastrophic failure'

Cloudflare loses 15 percent of traffic due to an error at Verizon.



By [Liam Tung](#) | June 25, 2019 -- 11:31 GMT (04:31 PDT) | Topic: [Networking](#)



A Verizon error resulted in a "cascading catastrophic failure" that triggered widespread internet outages on Monday, affecting Cloudflare, Amazon, Facebook, and others.

Website accelerator firm Cloudflare described the event as a "small heart attack" that left websites that rely on it, [such as voice and text chat app Discord](#), unreachable from many parts of the internet for about two hours. And, according to Cloudflare, it was completely avoidable.

The outage was due to a so-called route leak from a Verizon customer. In Cloudflare's case, this meant traffic that normally goes through Verizon and Level 3 Communications to reach Cloudflare instead went through a metal maker called Allegheny Technologies, Pennsylvania-based ISP DQE, and Cogent Communications onwards to Cloudflare.

Allegheny and DQE's networks weren't up to the task of such a massive spike in traffic.

At the heart of yesterday's outage was the [Border Gateway Protocol](#), which networks use to share information about what routes to take. Cloudflare says DQE incorrectly announced routes from its network to its customer, Allegheny.

MORE FROM LIAM TUNG



Government : US
AT&T to auto block fraud robocalls for free, but blocking spam calls will cost extra



Artificial Intelligence
Now Microsoft wants to use AI to save history



Enterprise Software
Facebook just released this new open source JavaScript engine



Tech Industry
After Trump Twitter ruling, Ocasio-Cortez is sued for blocking critics

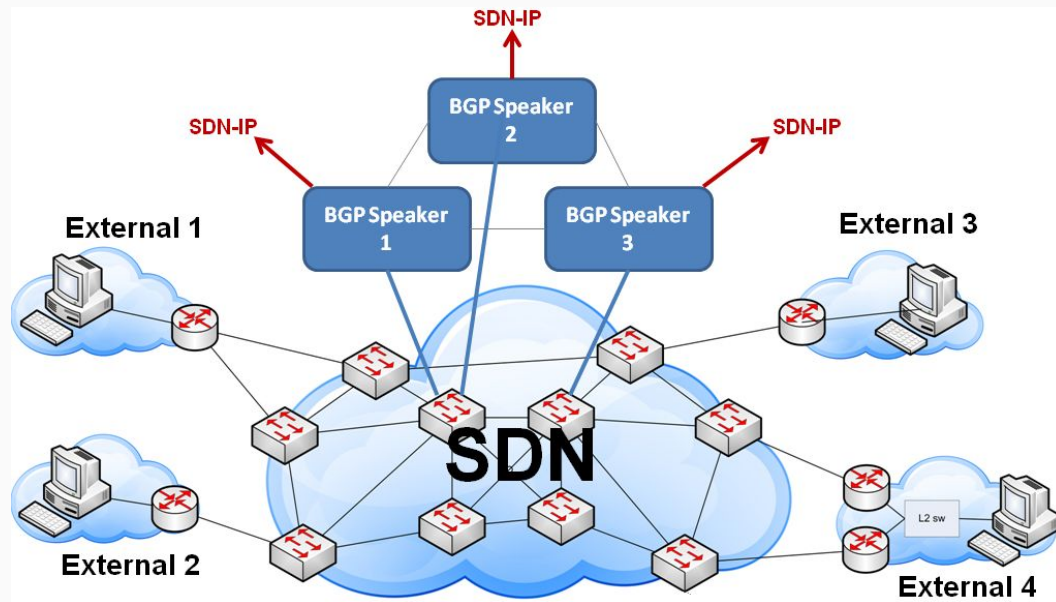
NEWSLETTERS

ZDNet Mobility & Telecoms

A weekly report covering everything from the newest devices to the latest industry news.

<https://zd.net/31RVgSd>

- Provisionamento centralizado;
- Escalabilidade;
- Segurança; e
- Otimização do uso do hardware.



Desvantagens de SDN

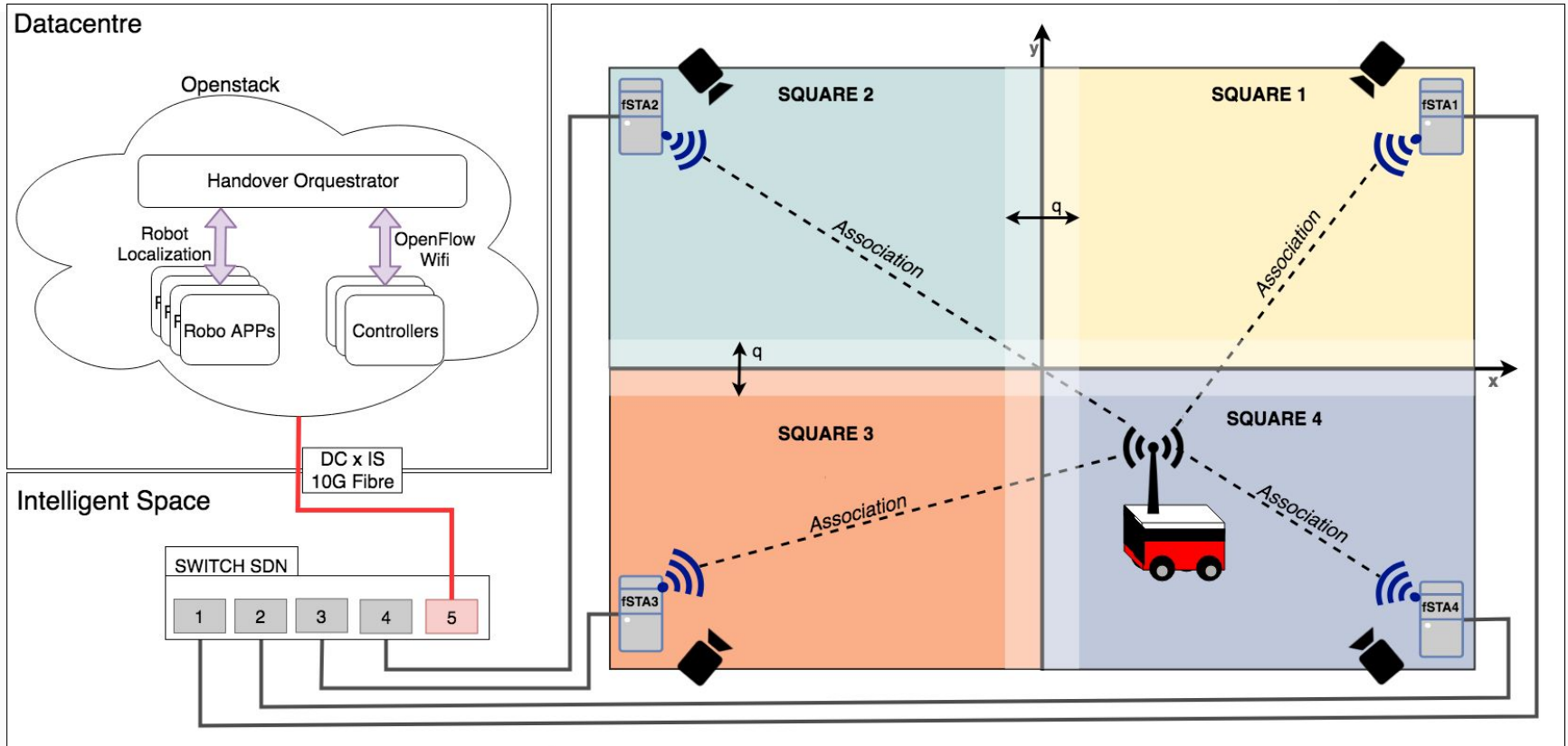
- Latência;
- Gerência limitada; e
- Gerência de rede mais complexa.



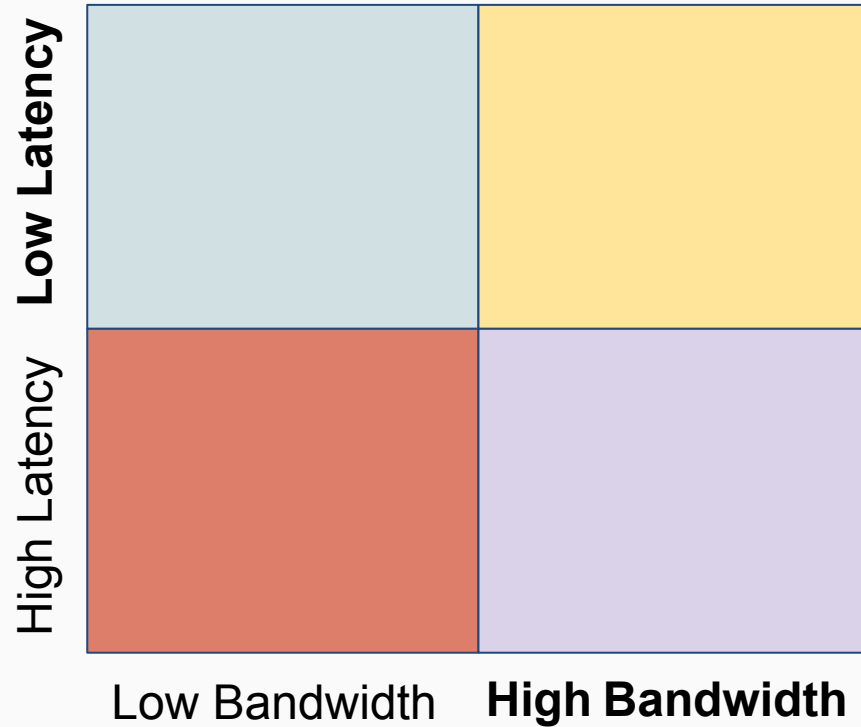
Aplicações práticas de SDN

Aplicações práticas de SDN

Real-time Remote Control of Robots over an SDN Infrastructure - UFES, Intel and UNIVBRIS



Real-time Remote Control of Robots over an SDN Infrastructure - UFES, Intel and UNIVBRIS



Real-time Remote Control of Robots over an SDN Infrastructure - UFES, Intel and UNIVBRIS



<https://youtu.be/UVsRU0PHZfM>

Smart Internet Lab - Bristol

<https://www.youtube.com/channel/UC9DqjLWcRcdJqegVvsBmoGg>

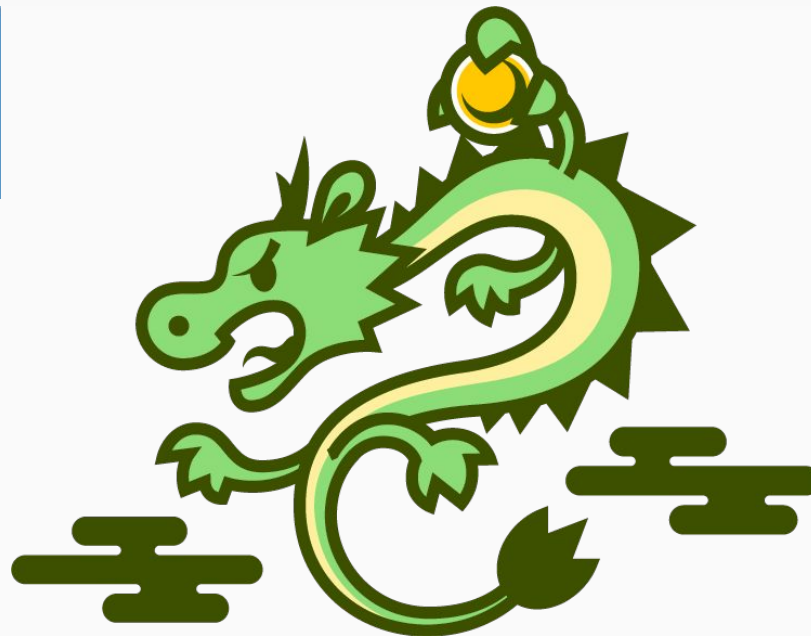
Ferramentas

Mininet

An Instant Virtual Network on your Laptop (or other PC)



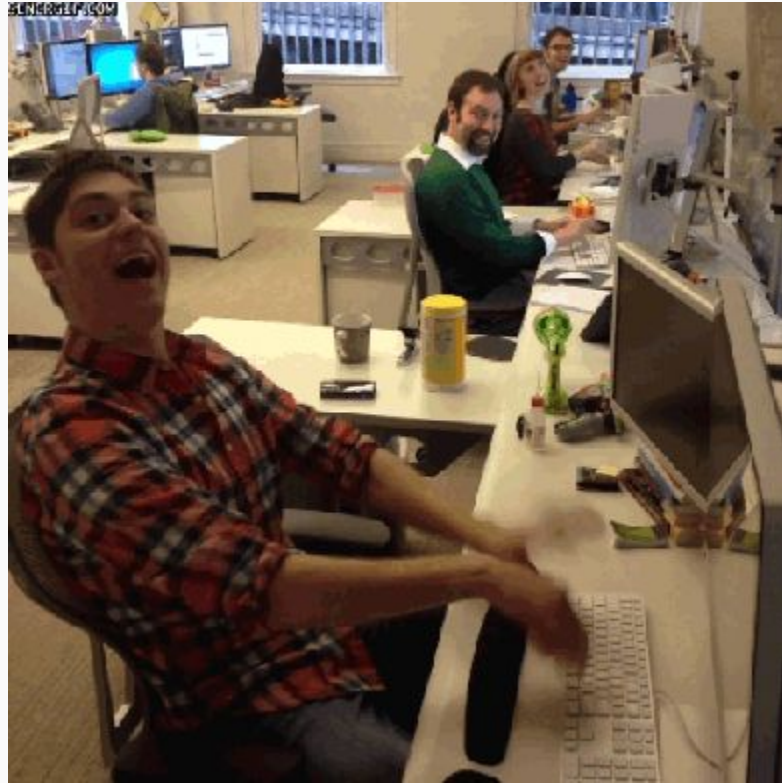
Open vSwitch



Ryu

Exemplos de código

Exemplos de código



Conclusão

Conclusão

Referências bibliográficas:

- Computer Networking: A Top-Down Approach (7th Edition) por James Kurose e Keith Ross
- Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud por William Stallings

Ferramentas:

- Mininet <http://mininet.org/>
- Open vSwitch (OVS) <https://www.openvswitch.org/>
- Ryu <https://osrg.github.io/ryu/>

Grupos de pesquisa:

- NERDS <http://nerds.ufes.br/>
- Smart Internet Lab <http://www.bristol.ac.uk/engineering/research/smart/>

Códigos:

- Github <https://github.com/jvrmaia/tdc-sp-2019-cloud-computing>

Contatos:

- E-mail: joao@joaovrmaia.com
- Twitter / Github / LinkedIn: <URL base>/jvrmaia

Perguntas?

Obrigado!