Tendências em IoT, SDN e NFV

ERRC 2016

Lucas Arbiza

LUCAS ARBIZA

lucas@arbiza.com.br

Profissional

PoP-RS/RNP:

- Metropoa
- RSiX (PTT-RS)
- Rede Tchê

Acadêmico

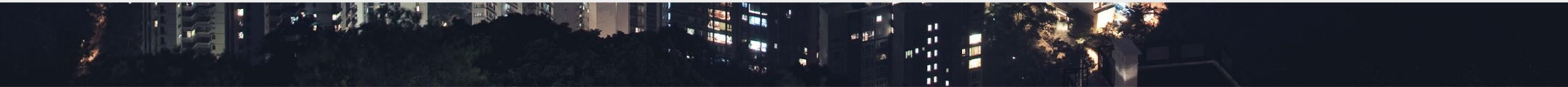
Ciência da Computação:

- Mestrado UFRGS 2016
- Bacharelado UNIPAMPA 2011

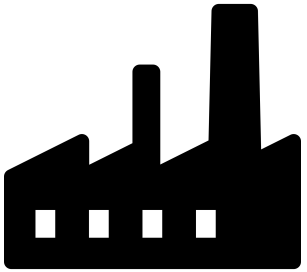
Investimento em IoT 3-4 x

>

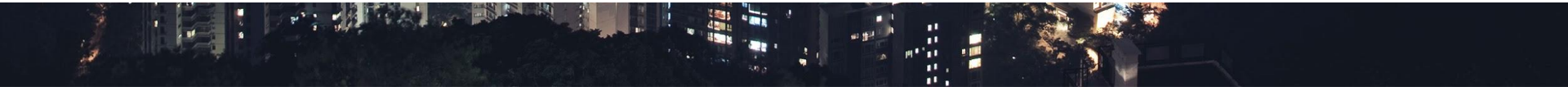
TI tradicional



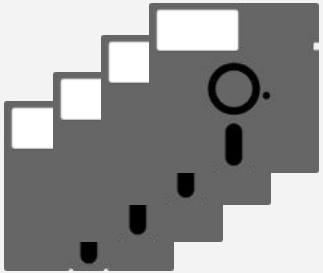
USUÁRIO FINAL



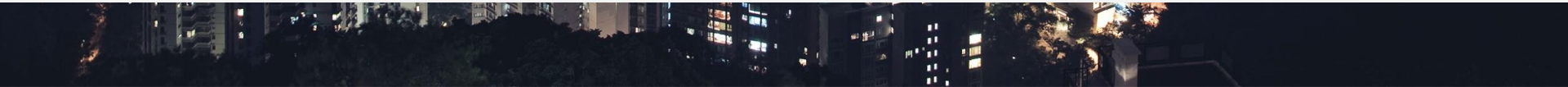
INDÚSTRIA



últimos 5000 anos



2012



2020

40%

dos dados gerados por sensores

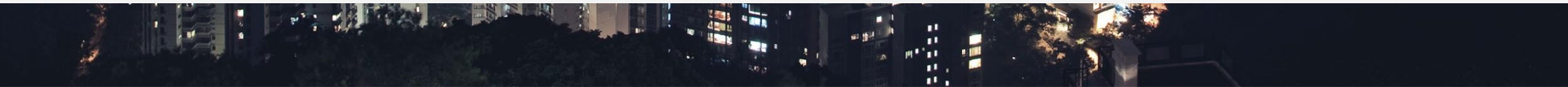


Photo by moleshko; license: CC0

CHICAGO

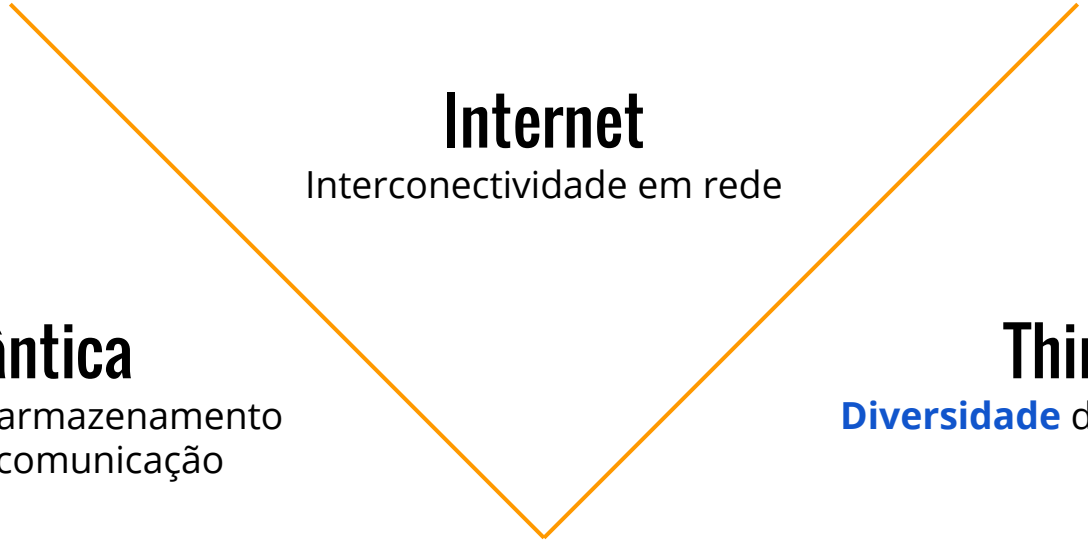
Exemplos de aplicação de IoT:

- Ratos
- Vento
- Semáforos
- etc.

CHICAGO

IoT ajuda o setor público a prover transparência sobre onde os investimentos têm sido feitos. Acelera a resposta do governo a acidentes, até mesmo predizendo-os, ou em tarefas rotineiras, como substituir uma lâmpada queimada.

Internet of Things



Internet
Interconectividade em rede

Semântica
Representação, armazenamento
e padrão de comunicação

Things
Diversidade de dispositivos

Internet of Things

- Tipo físico (tamanho, forma)
- Capacidade de se comunicar em rede
- Possuir um identificador
- Pode ser associado a um nome ou endereço
- Possuir capacidade computacional
- Ser capaz de “sentir” o ambiente
- Autonomia

Internet of Things

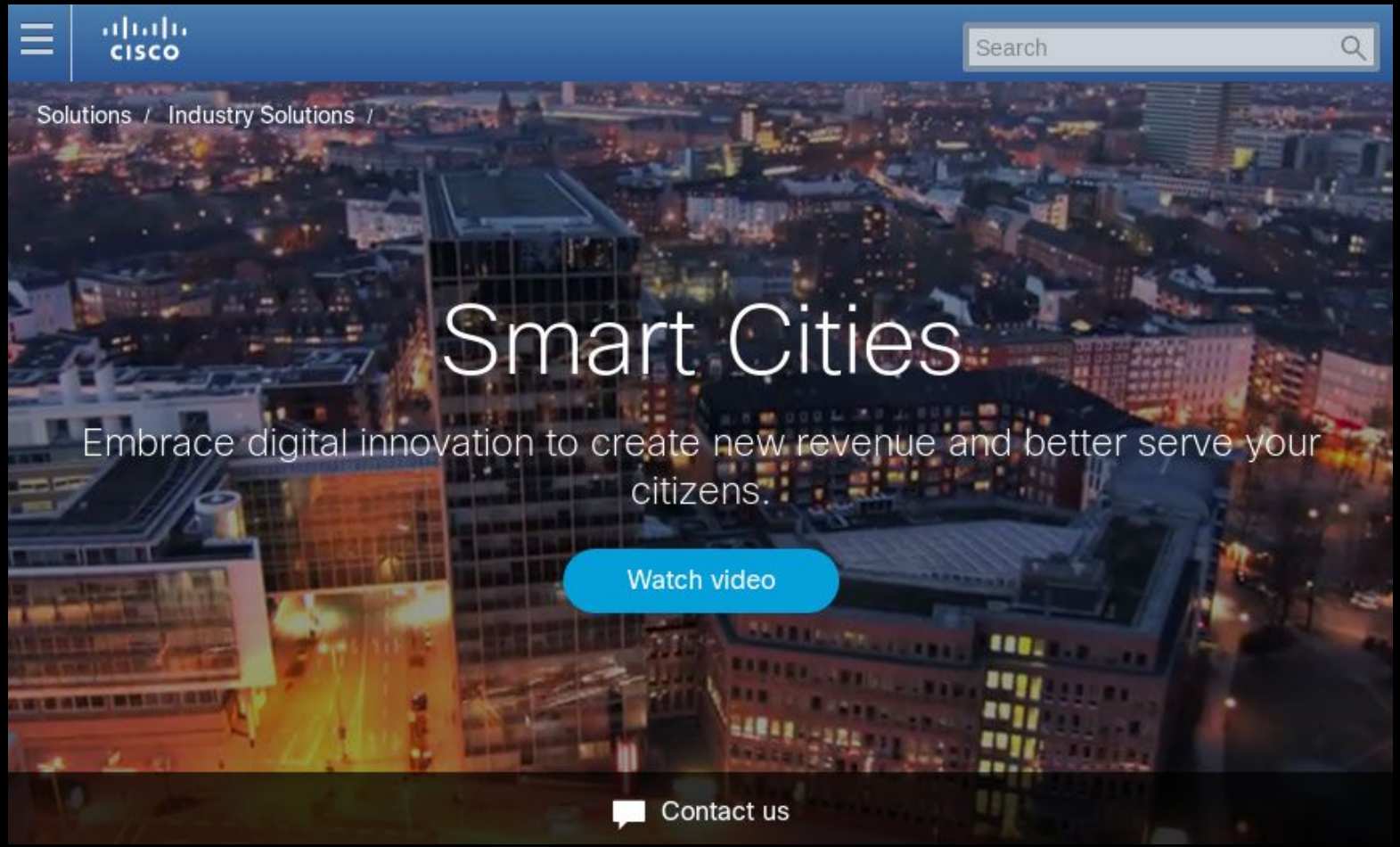
- ~~Tipo físico (tamanho, forma)~~
- Capacidade de se comunicar em rede
- Possuir um identificador
- Pode ser associado a um nome ou endereço -- PROTOCOLO
- Possuir capacidade computacional
- Ser capaz de “sentir” o ambiente
- Autonomia

Internet of Things

Representação digital do mundo físico feita através de dados enviados por dispositivos com a capacidade de sentir o ambiente.

Miorandi et al. 2012

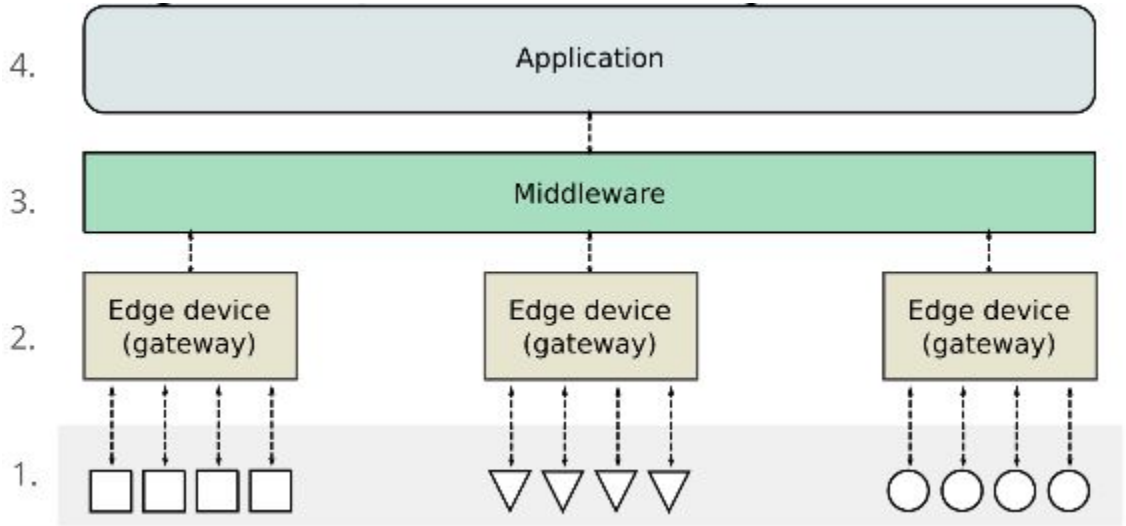
Imagem de Robson Bravo utilizada como capa do podcast Mupoca #054 do site Braimstorm9


cisco
Search
Solutions / Industry Solutions /
Smart Cities
Embrace digital innovation to create new revenue and better serve your citizens.
Watch video
Contact us

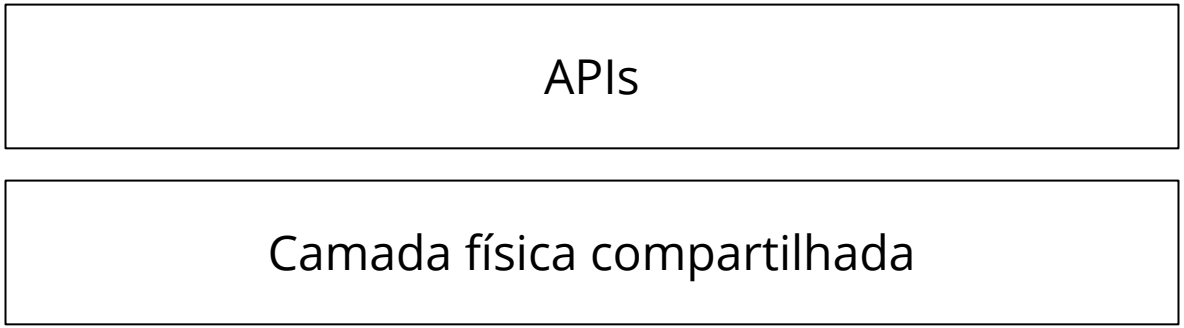
Problemas de IoT

- Silos
- Segurança/privacidade
- Gerência
- Endereçamento/identificação
- Semântica

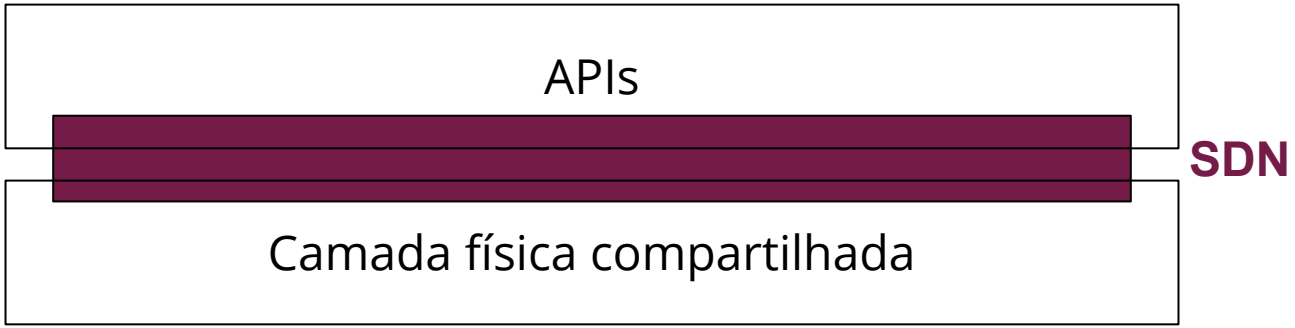
Internet of Things



Internet of Things



Internet of Things



Google

Internet of Things Software Defined Networking

Scholar

About 18,100 results (**0.07** sec)

Articles

Case law

My library

Any time

Since 2016

Since 2015

Since 2012

Custom range...

Sort by relevance

Sort by date

Search the Web

Search English, Portuguese and Spanish pages

Fog computing and its role in the **internet** of **things**

F Bonomi, R Milito, J Zhu, S Addepalli - Proceedings of the first edition of ..., 2012 - dl.acm.org

... Keywords Fog Computing, Cloud Computing, IoT, WSAN, **Software Defined** Networks, Real Time Systems, Analytics **...** of interest that substantiate our argument in favor of the Fog as the natural component of the platform required for the support for the **Internet** of **Things**. **...**

Cited by 525 Related articles All 7 versions Cite Save

Internet of **things** strategic research roadmap

O Vermesan, P Friess, P Guillemin... - ... al., **Internet** of **Things** ..., 2011 - books.google.com

... New efficient multiuser detection schemes. • **Software defined** radios to remove need for hardware upgrades when new protocols emerge. **...** For this vision to be realized, the **Internet** of **Things** architecture needs to be built on top of a **network** structure that integrates wired and **...**

Cited by 341 Related articles All 9 versions Cite Save

The **internet** of **things**: A survey

L Atzori, A Iera, G Morabito - Computer networks, 2010 - Elsevier

... fact, they can cooperate with RFID systems to better track the status of **things**, ie, their **...** protocol stack, which is necessary for the seamless integration of sensor nodes into the **Internet**. **...** A SOA approach also allows for **software** and hardware reusing, because it does not impose a **...**

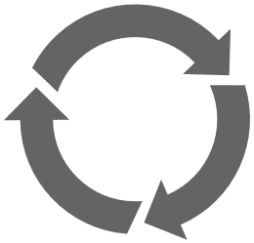
Cited by 4293 Related articles All 32 versions Cite Save

[PDF] **Software-defined networking**

N McKeown - INFOCOM keynote talk, 2009 - cs.rutgers.edu

... 2. Allows the infrastructure on top to be **defined** in **software Internet**: Routing protocols,

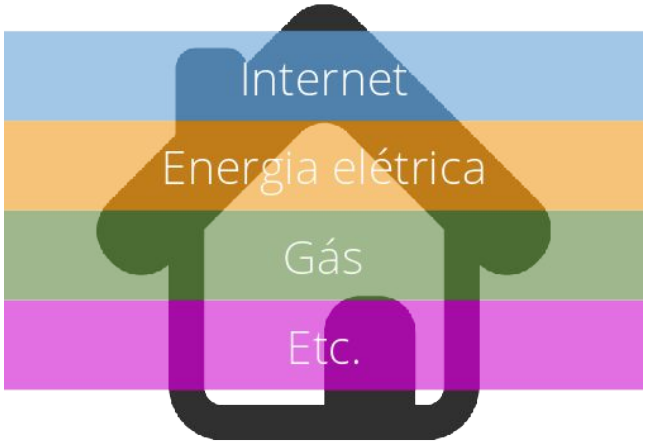
Chetty e Feamster (2012)

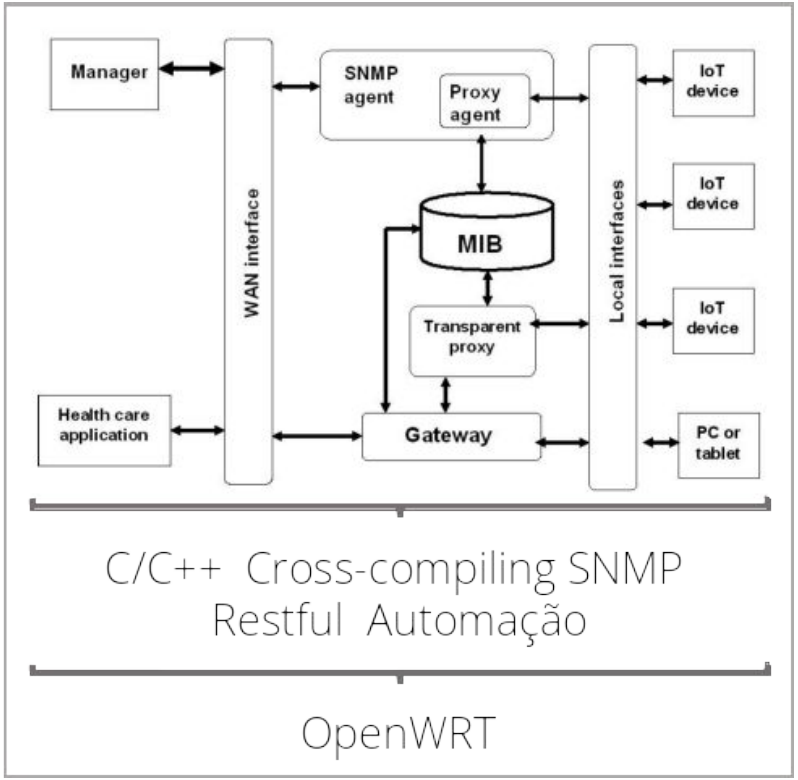


Refatoração
SDN

Yiakoumis et al. (2011)

Divisão da rede
em “fatias”




Manager
WAN interface
SNMP agent
Proxy agent
MIB
Transparent proxy
Gateway
Health care application
Local interfaces
IoT device
IoT device
IoT device
PC or tablet
C/C++ Cross-compiling SNMP
Restful Automação
OpenWRT

REFATORAÇÃO

Melhor comunicação ponta a ponta.

(Don Clark, 2016)

OpenFlow: Enabling Innovation in Campus Networks

March 14, 2008

Nick McKeown
Stanford University

Tom Anderson
University of Washington

Hari Balakrishnan
MIT

Guru Parulkar
Stanford University

Larry Peterson
Princeton University

Jennifer Rexford
Princeton University

Scott Shenker
University of California, Berkeley

Jonathan Turner
Washington University in St. Louis

ABSTRACT

This whitepaper proposes OpenFlow: a way for researchers to run experimental protocols in the networks they use every day. OpenFlow is based on an Ethernet switch, with an internal flow-table, and a standardized interface to add

is almost no practical way to experiment with new network protocols (e.g., new routing protocols, or alternatives to IP) in sufficiently realistic settings (e.g., at scale carrying real traffic) to gain the confidence needed for their widespread deployment. The result is that most new ideas from the networking research community go untried and untested; hence

SDN: Novas possibilidades

- Segurança (SDN firewall)
- Engenharia de tráfego (predição, localização de recursos)
- Serviços (virtualização de redes)
- Gerência
- SDN Wan
- Datacenter
- Software-Defined Everything

SDN: Novas possibilidades (de problemas)

- Substituição de protocolos bem estabelecidos
- Desenvolvimento
  - Conhecimento em redes e desenvolvimento
  - Infraestrutura para desenvolvimento
  - Manutenção de código
- Custos/licenças

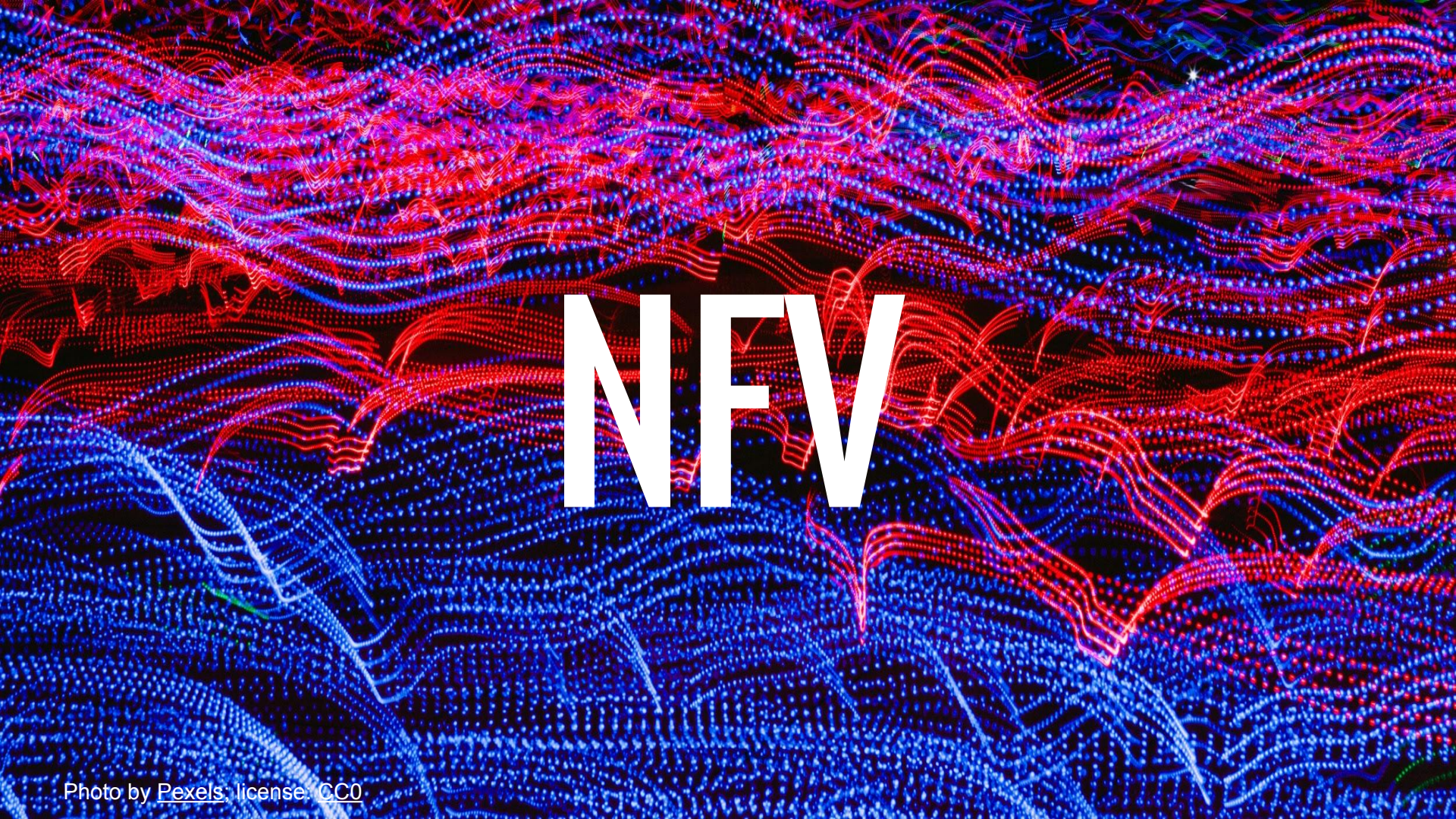


Photo by Pexels, license: CC0

NETWORK FUNCTIONS VIRTUALIZATION

NFV is a really simple concept (network services packaged in VM format), what makes it complex is all the infrastructure you need around it.

Ivan Pepelnjak

NETWORK FUNCTIONS VIRTUALIZATION

- Rodar serviços em hardware de uso geral
- Implantar, remover e escalar funções facilmente
- Implantar funções onde elas são necessárias
- Entrega orquestrada e automatizada de serviços

Conteúdo de Cisco, “ NFV - Network Functions Virtualization”

NETWORK FUNCTIONS VIRTUALIZATION

BENEFÍCIOS:

- Menos custos com hardware específico
- suporte ao modelo “pay-as-you-grow”
- Menor custo *datacenter*
- Reduz o tempo de entrega/produção
- Escala

NETWORK FUNCTIONS VIRTUALIZATION

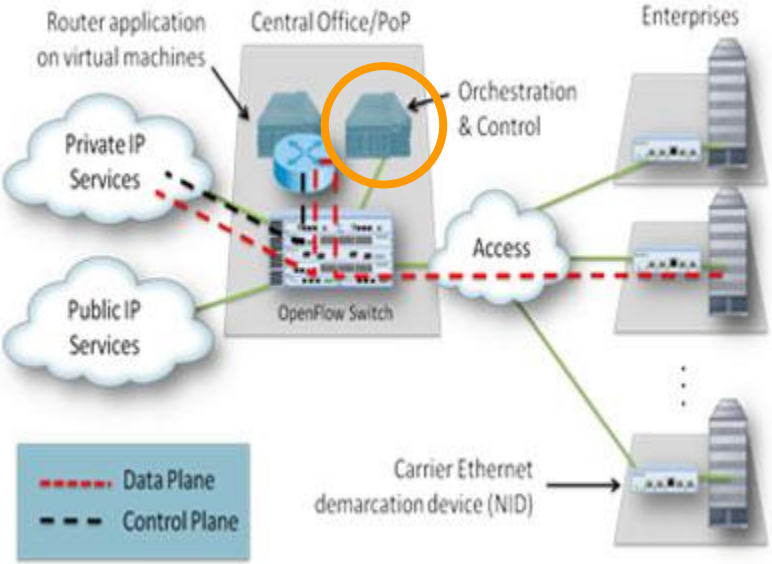
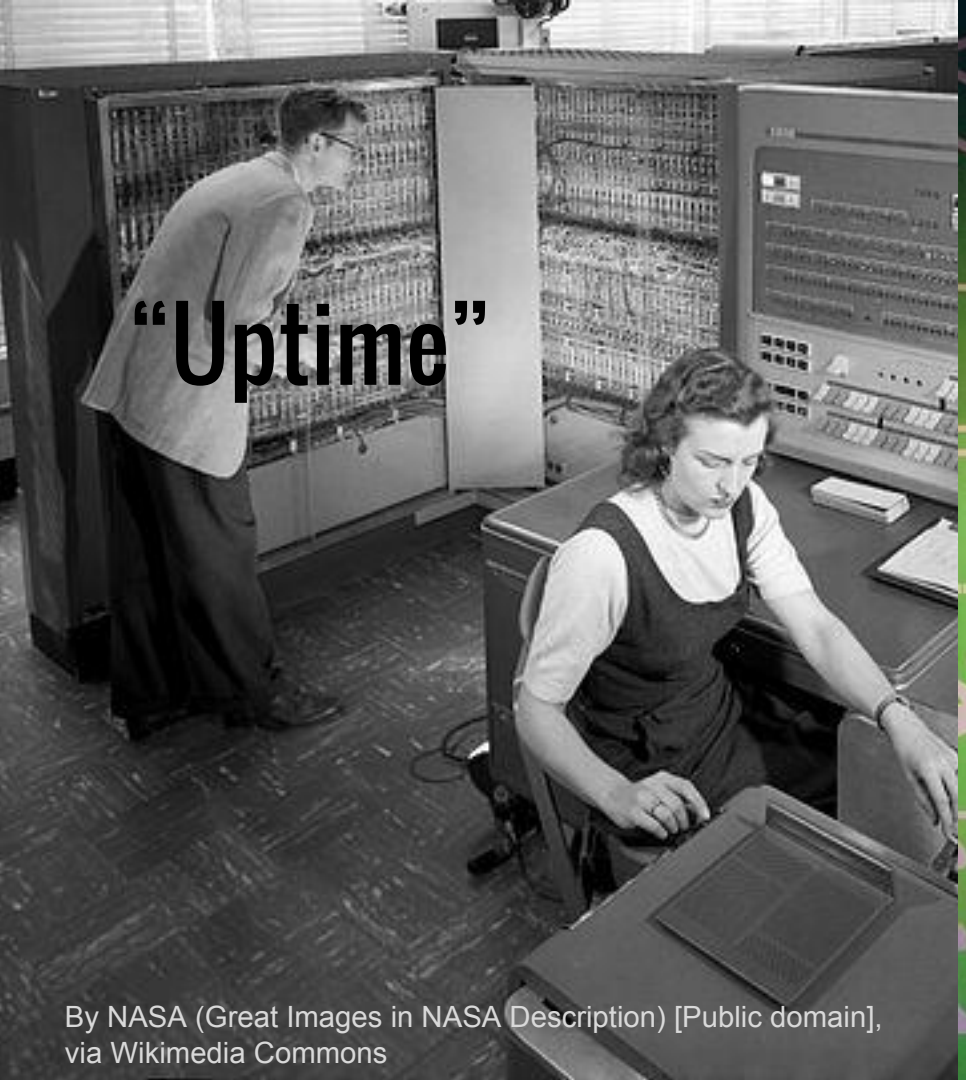


Imagem de SDxCentral, “What is NFV – Network Functions Virtualization – Definition?”



By NASA (Great Images in NASA Description) [Public domain], via Wikimedia Commons

Photo by Nkululeko Masondo; license: CC BY-SA

LAB NO NOTE:

- Open vSwitch
- Docker
- Docker Compose
- ovs-docker
- Ryu Controller
- Terminal “bom” (Terminator, Tmux, etc.)

CONTATO

Lucas Arbiza

lucas@arbiza.com.br

REFERÊNCIAS

B. Han, V. Gopalakrishnan, L. Ji, and S. Lee, “Network function virtualization: Challenges and opportunities for innovations,” IEEE Commun. Mag., vol. 53, no. 2, 2015.

Cisco, “ NFV - Network Functions Virtualization”, Online.
http://www.cisco.com/c/en/us/solutions/service-provider/network-functions-virtualization-nfv/index.html

D. Miorandi, S. Sicari, F. De Pellegrini, and I. Chlamtac, “Internet of things: Vision, applications and research challenges,” Ad Hoc Networks, vol. 10, no. 7, pp. 1497–1516, 2012.

D. Clark, “A Healthy Dose of SDN,” Open Networking Foundation, 2016. [Online]. Available: https://www.opennetworking.org/?p=2411&option=com_wordpress&Itemid=471.

Guto Carvalho, “O que é DevOps afinal?”, 2013. Online.
http://gutocarvalho.net/octopress/2013/03/16/o-que-e-um-devops-afinal/

REFERÊNCIAS

H. E. Egilmez, S. T. Dane, K. T. Bagci, and A. M. Tekalp, “OpenQoS: An OpenFlow controller design for multimedia delivery with end-to-end Quality of Service over Software-Defined Networks,” in Signal & Information Processing Association Annual Summit and Conference (APSIPA ASC), 2012 Asia-Pacific, 2012, pp. 1–8.

J. Liu, Y. Li, M. Chen, W. Dong, and D. Jin, “Software-defined internet of things for smart urban sensing,” IEEE Commun. Mag., vol. 53, no. 9, 2015.

L. Atzori, A. Iera, and G. Morabito, “The Internet of Things: A survey,” Comput. Networks, vol. 54, no. 15, pp. 2787–2805, 2010.

L. M. R. Arbiza, L. M. R. Tarouco, L. M. Bertholdo, and L. Z. Granville, “SDN-Based Service Delivery in Smart Environments,” in Intelligent Distributed Computing IX, P. Novais, D. Camacho, C. Analide, A. E. F. Seghrouchni, and C. Badica, Eds. Guimarães, Portugal: Springer International Publishing, 2016, pp. 475–484.

REFERÊNCIAS

L. M. R. Arbiza, L. M. Bertholdo, C. R. P. dos Santos, L. Z. Granville, and L. M. R. Tarouco, “Refactoring Internet of Things Middleware Through Software-defined Network,” in Proceedings of the 30th Annual ACM Symposium on Applied Computing, 2015, pp. 640–645.

L. M. R. Arbiza, “SDN no contexto de IoT : refatoração de middleware para monitoramento de pacientes crônicos baseada em software-defined networking,” Universidade Federal do Rio Grande do Sul, 2016.

L. M. R. Tarouco, L. M. Bertholdo, L. Z. Granville, L. M. R. Arbiza, F. Carbone, M. Marotta, and J. J. C. de Santanna, “Internet of Things in Healthcare : Interoperatibility and Security Issues,” in IEEE International Conference on Communications, International Workshop on Mobile Consumer Health Care Networks, Systems and Services, 2012, pp. 6121–6125.

M. Chetty and N. Feamster, “Refactoring network infrastructure to improve manageability: a case study of home networking,” SIGCOMM Comput. Commun. Rev., vol. 42, no. 3, pp. 54–61, 2012.

REFERÊNCIAS

N. McKeown, T. Anderson, H. Balakrishnan, G. Parulkar, L. Peterson, J. Rexford, S. Shenker, and J. Turner, “OpenFlow: enabling innovation in campus networks,” SIGCOMM Comput. Commun. Rev., vol. 38, no. 2, pp. 69–74, Mar. 2008.

“OpenFlow Switch Specication: Version 1.3.2.” The Open Network Foundation, ONF, 2013.

RouteFlow, http://routeflow.github.io/RouteFlow/

R. Gomes and L. A. Bianchin. “ Docker para desenvolvedores”, 2016. Online. https://leanpub.com/dockerparadesenvolvedores

S. Noble. “Network Function Virtualization or NFV Explained”, 2015. Online. Network Function Virtualization or NFV Explained

“SDX, A Software Defined Internet Exchange Point”. Online. http://sdx.cs.princeton.edu/

REFERÊNCIAS

SDxCentral. “What is NFV – Network Functions Virtualization – Definition?”. Online. https://www.sdxcentral.com/nfv/definitions/whats-network-functions-virtualization-nfv/

“Software-Defined Networking: The New Norm for Networks.” The Open Network Foundation, p. 12, 2012.

“Using all wireless networks around me”. Stanford's OpenFlow Channel on YouTube, 2010. https://www.youtube.com/watch?v=ov1DZYINg3Y

Y. Yiakoumis, K.-K. Yap, S. Katti, G. Parulkar, and N. McKeown, “Slicing Home Networks,” in Proceedings of the 2Nd ACM SIGCOMM Workshop on Home Networks, 2011, pp. 1–6.

W. Elfrink, “The Internet of Things: Capturing the Accelerated Opportunity.” Internet of Things World Forum - IoTWF 2014, Chicago, USA, 2014.

LICENSE