CCN

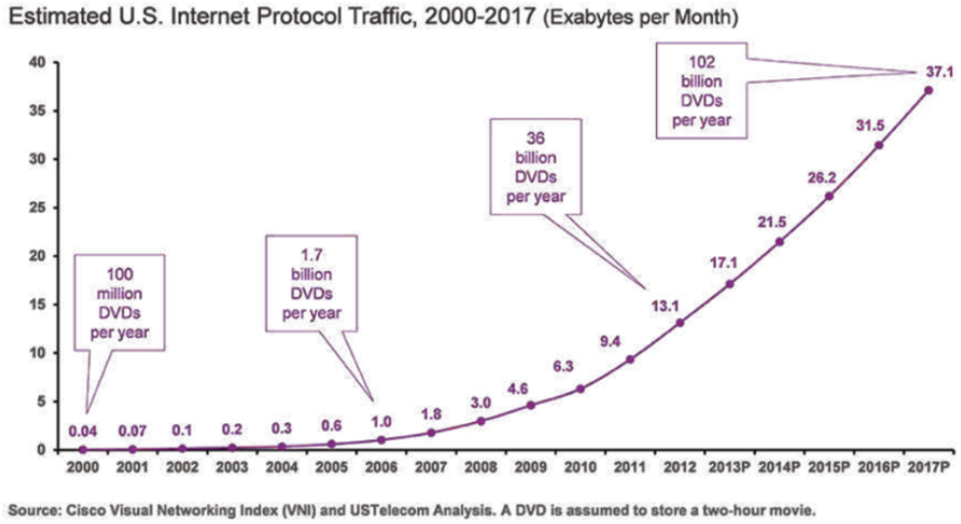
Content Centric Networks

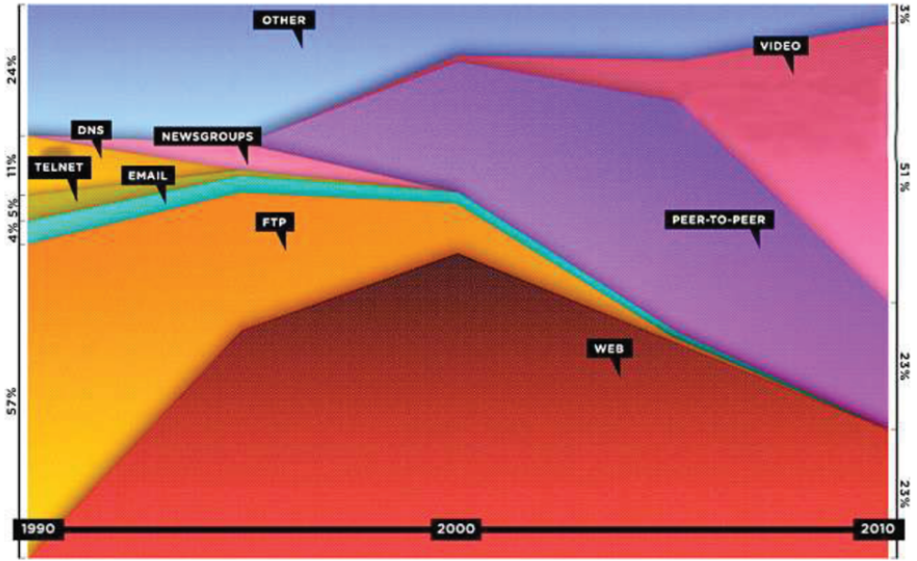
Trabalho teórico para o curso Redes de Computadores I - UFRJ

Autores: Pedro H. Boueke, Guilherme T. Borges, Erik F. Tronkos

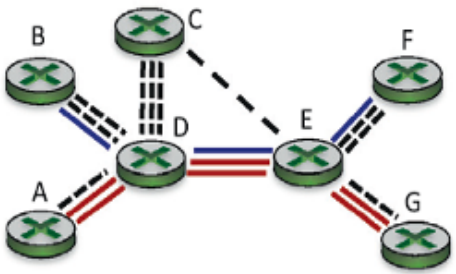
2015.1

“Nextgen Internet”



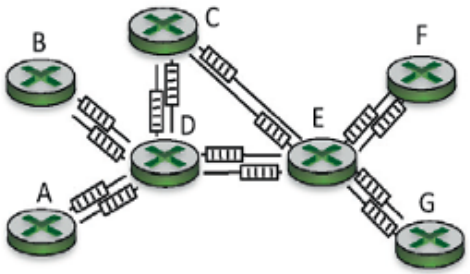


Ideia



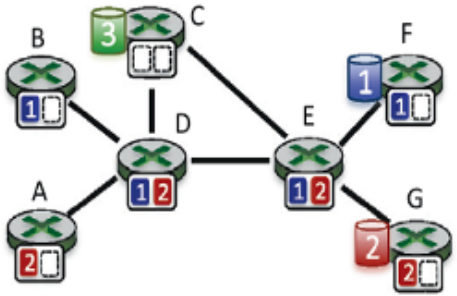
(a) Circuit Switching

Key: circuit in use
free circuit



(b) Packet Switching

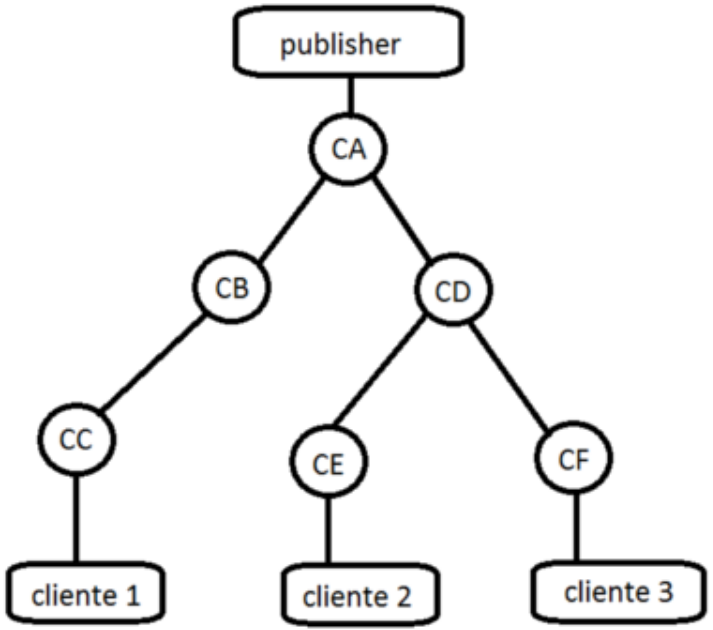
Key: packet queue

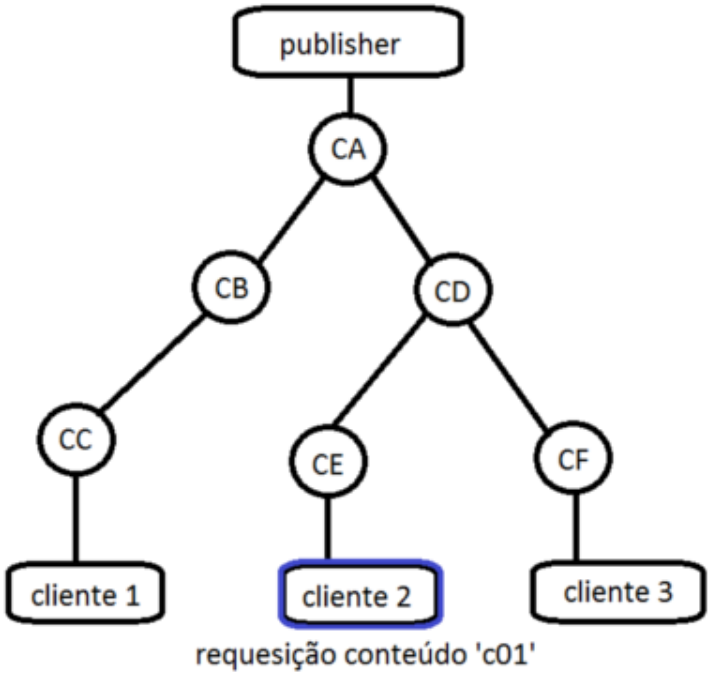


(c) Information-centric Network

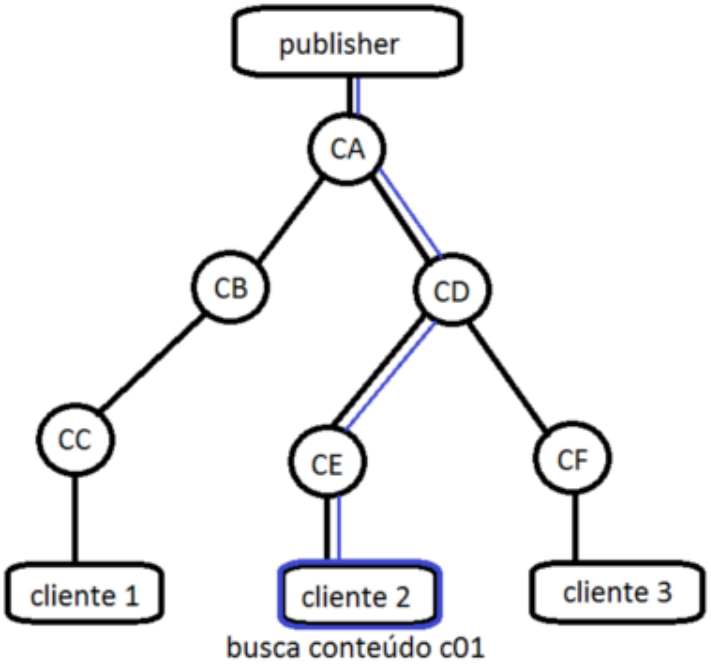
Key: custodian, content *i*
cached content *i*

Ideia


publisher
CA
CB
CD
CC
CE
CF
cliente 1
cliente 2
cliente 3


publisher
CA
CB
CD
CC
CE
CF
cliente 1
cliente 2
cliente 3
requesição conteúdo 'c01'

Ideia


publisher
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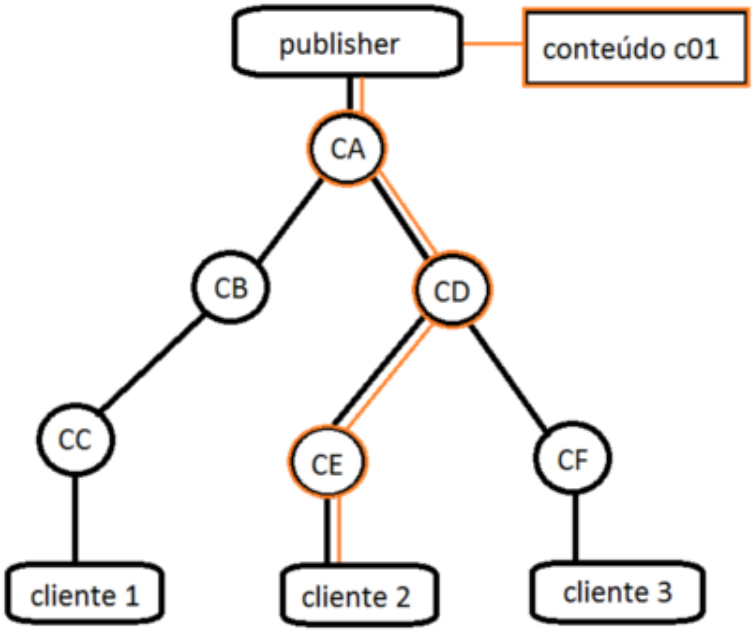
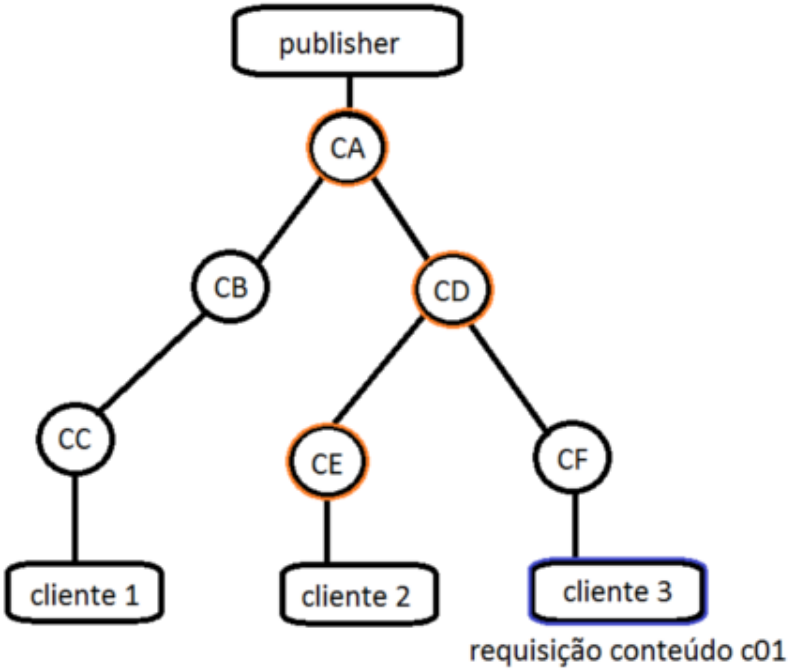
CB
CD
CC
CE
CF
cliente 1
cliente 2
cliente 3
busca conteúdo c01


publisher
conteúdo c01
CA
CB
CD
CC
CE
CF
cliente 1
cliente 2
cliente 3

Ideia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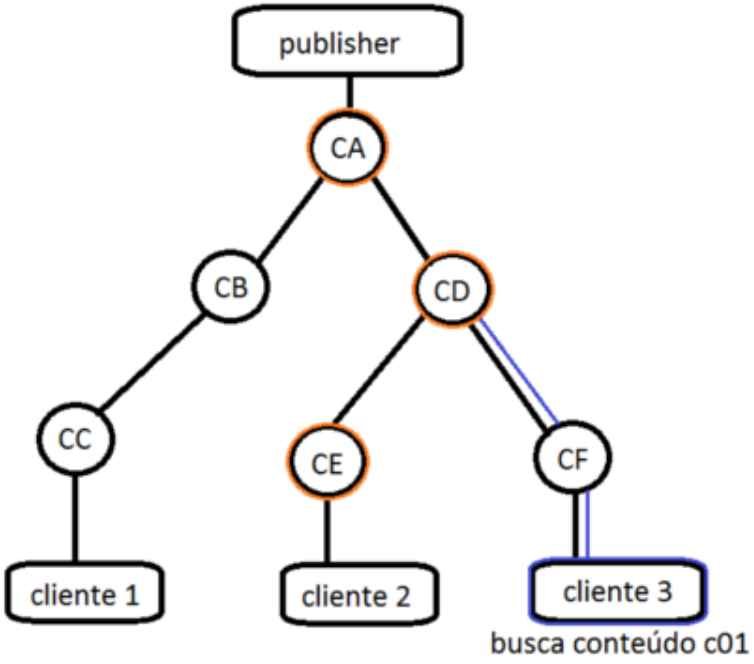
cliente 1
cliente 2
cliente 3
requisição conteúdo c01


publisher
CA
CB
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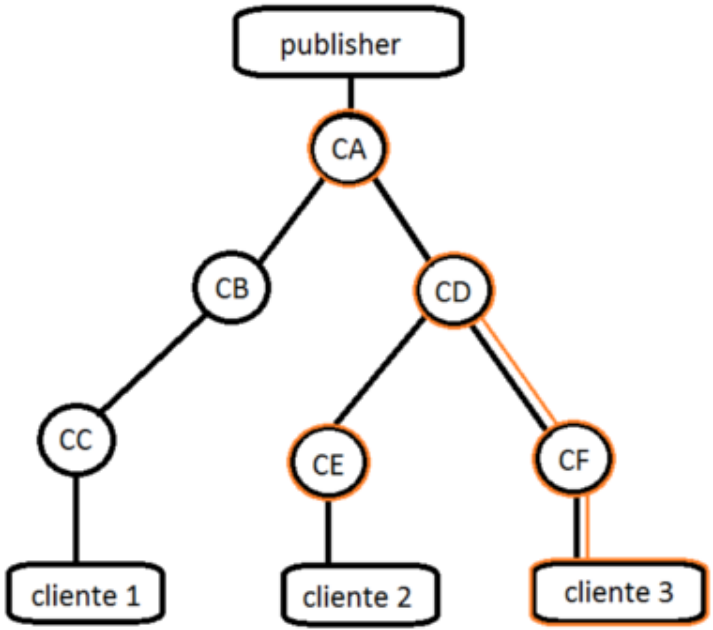
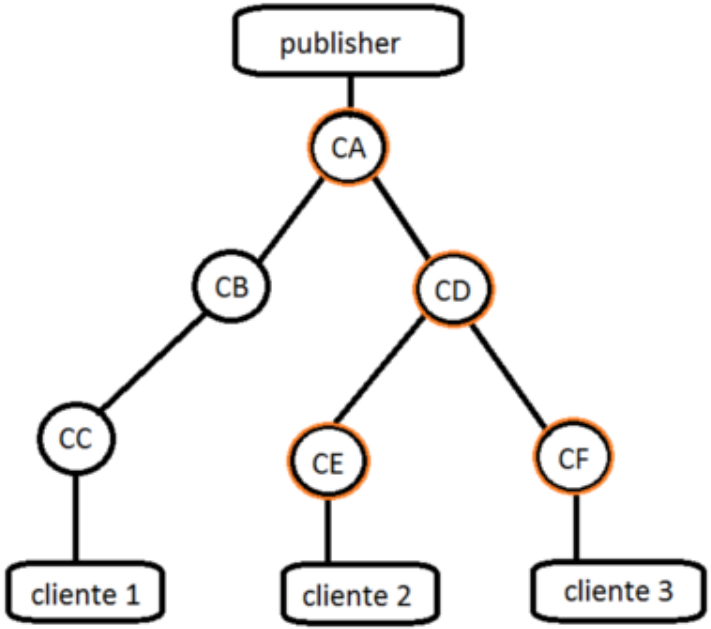
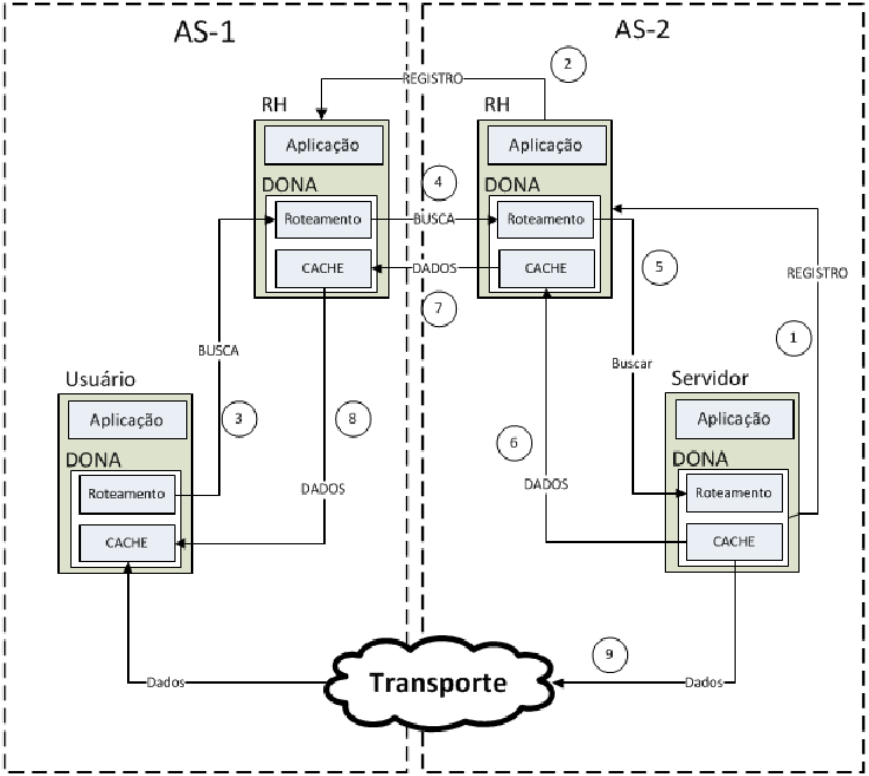
CC
CE
CF
cliente 1
cliente 2
cliente 3
busca conteúdo c01

Ideia

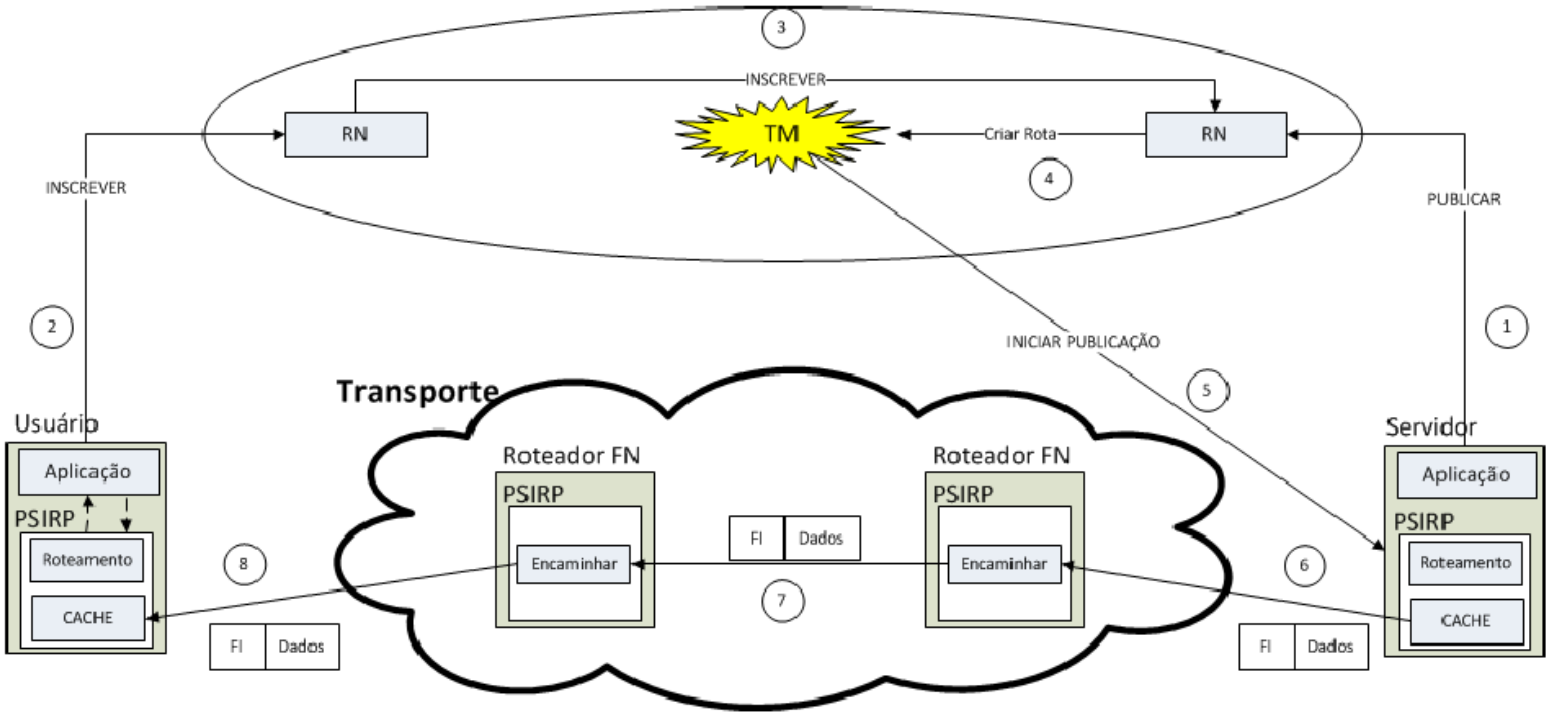

publisher
CA
CB
CD
CC
CE
CF
cliente 1
cliente 2
cliente 3


publisher
CA
CB
CD
CC
CE
CF
cliente 1
cliente 2
cliente 3

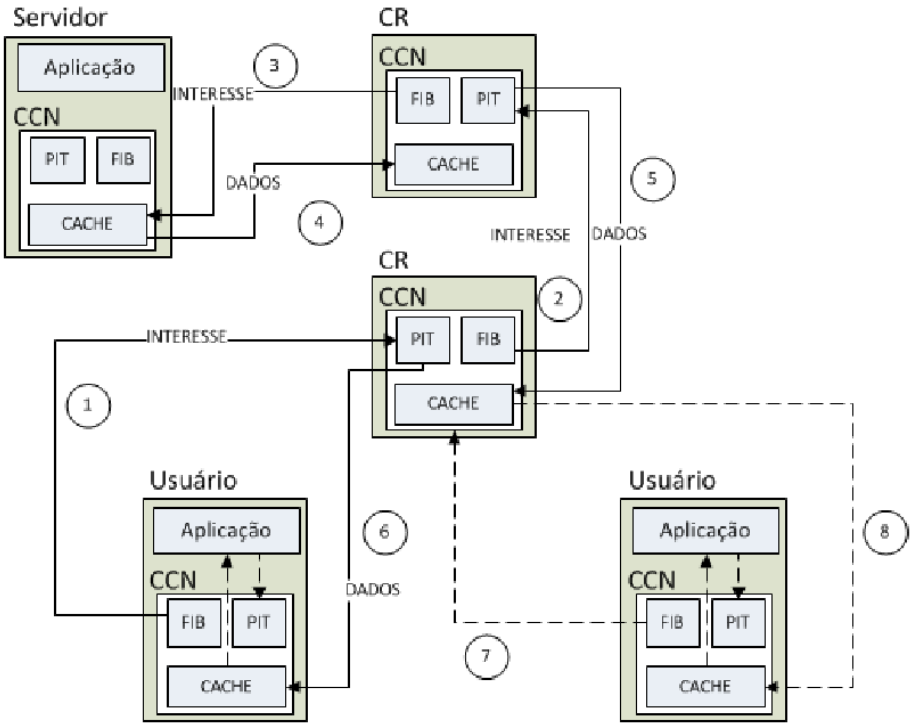
DONA


AS-1
AS-2
REGISTRO
2
RH
RH
Aplicação
Aplicação
DONA
DONA
4
Roteamento
BUSCA
Roteamento
CACHE
DADOS
CACHE
5
REGISTRO
7
1
BUSCA
Buscar
Usuário
Servidor
Aplicação
3
8
Aplicação
6
DONA
DONA
Roteamento
DADOS
DADOS
Roteamento
CACHE
CACHE
9
Dados
Transporte
Dados

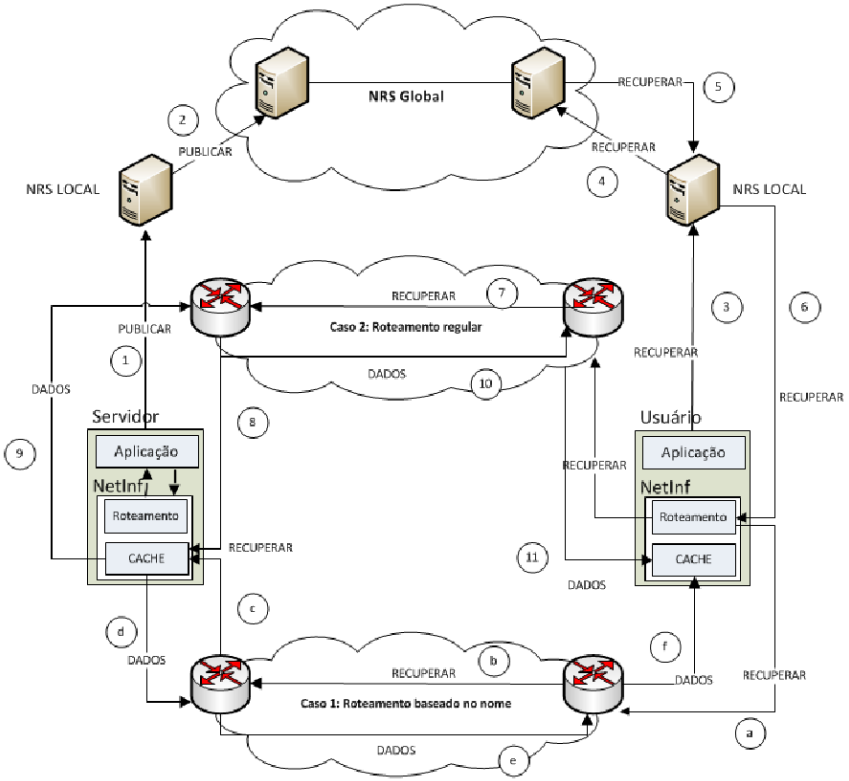
PURSUIT


3
INSCREVER
RN
TM
Criar Rota
RN
4
INSCREVER
PUBLICAR
2
1
INICIAR PUBLICAÇÃO
5
Transporte
Usuário
Aplicação
PSIRP
Roteamento
CACHE
Roteador FN
PSIRP
Encaminhar
FI
Dados
Roteador FN
PSIRP
Encaminhar
Servidor
Aplicação
PSIRP
Roteamento
CACHE
8
7
6
FI
Dados
FI
Dados

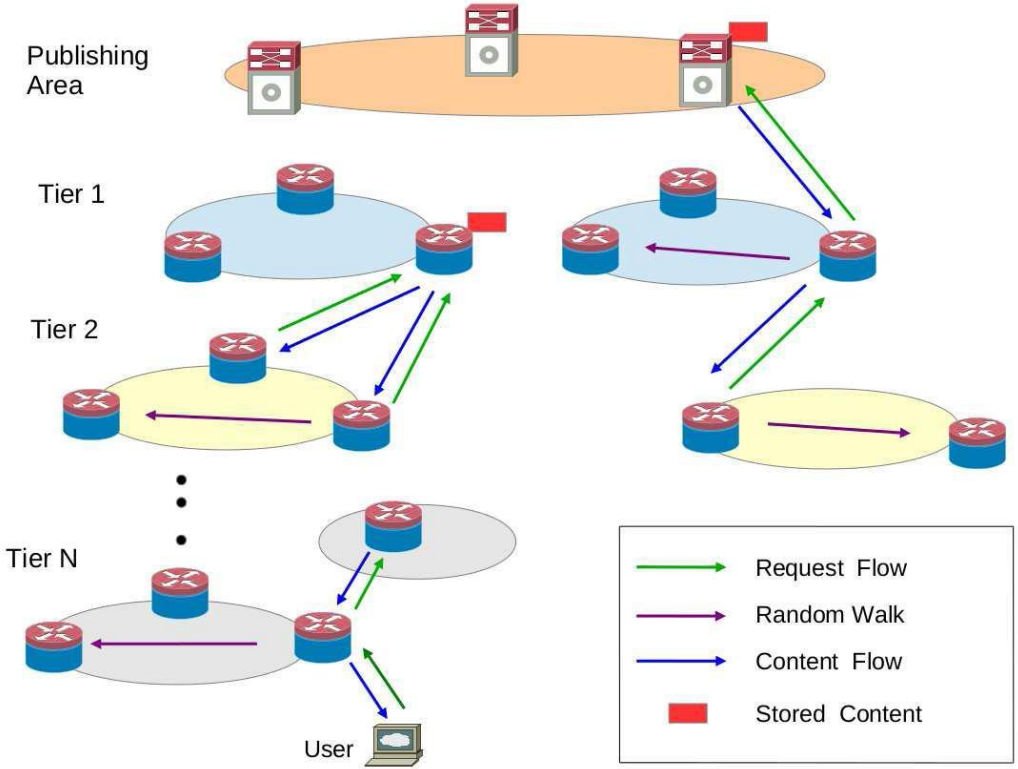
NDN


Servidor
Aplicação
CCN
PIT
FIB
CACHE
INTERESSE
DADOS
3
4
CR
CCN
FIB
PIT
CACHE
5
INTERESSE
DADOS
CR
CCN
PIT
FIB
CACHE
2
INTERESSE
1
Usuário
Aplicação
CCN
FIB
PIT
CACHE
6
DADOS
7
Usuário
Aplicação
CCN
FIB
PIT
CACHE
8

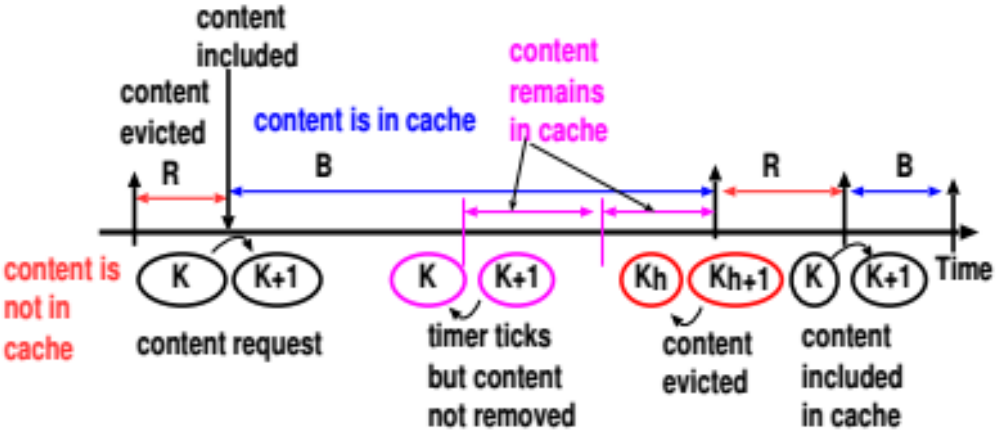
NetInf


NRS Global
RECUPERAR
5
2
PUBLICAR
RECUPERAR
4
NRS LOCAL
NRS LOCAL
RECUPERAR
7
3
6
PUBLICAR
Caso 2: Roteamento regular
1
RECUPERAR
DADOS
10
DADOS
RECUPERAR
Servidor
8
Usuário
9
Aplicação
Aplicação
RECUPERAR
NetInf
NetInf
Roteamento
Roteamento
RECUPERAR
CACHE
CACHE
11
DADOS
c
d
f
DADOS
b
RECUPERAR
DADOS
RECUPERAR
Caso 1: Roteamento baseado no nome
a
DADOS
e

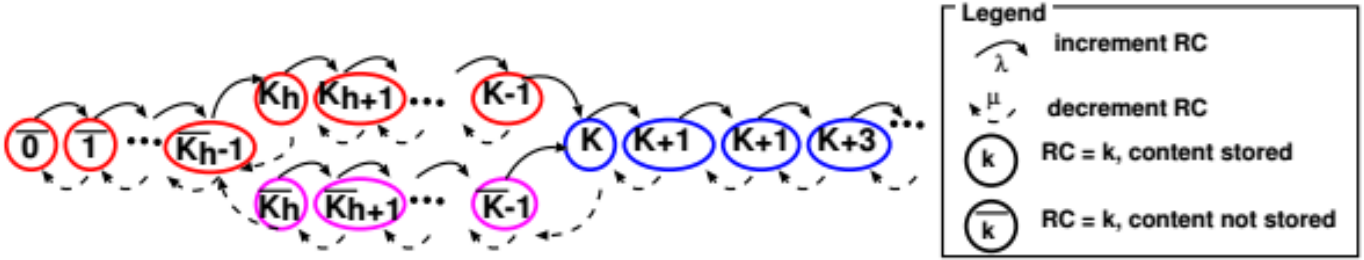
Buscas Oportunísticas



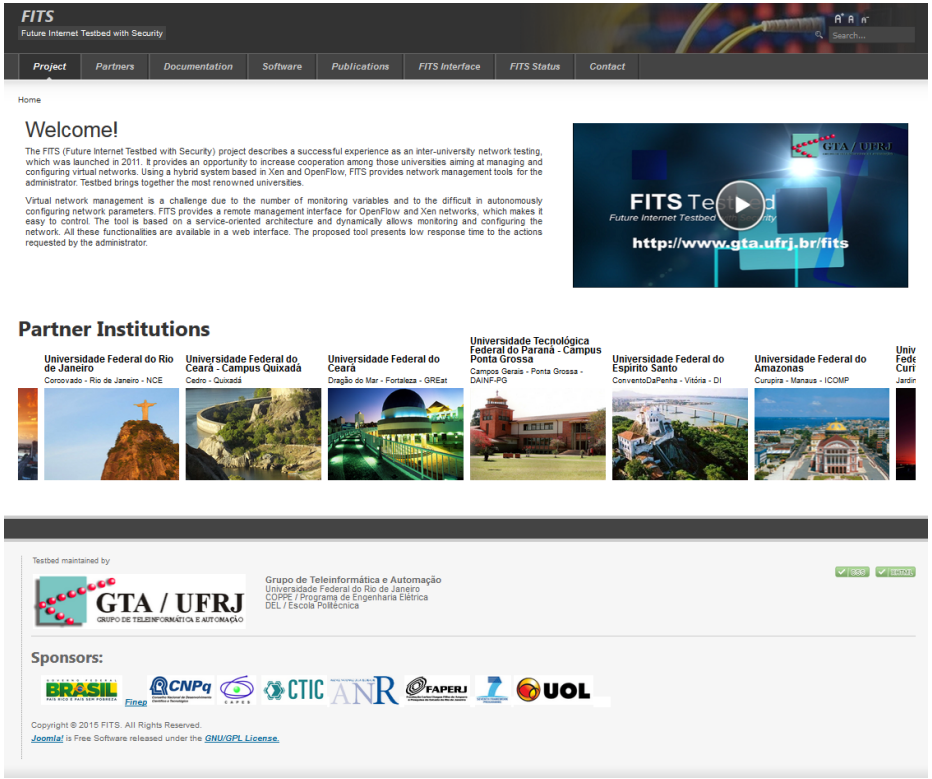
Buscas Oportunísticas



Buscas Oportunísticas



FITS



FITS Status

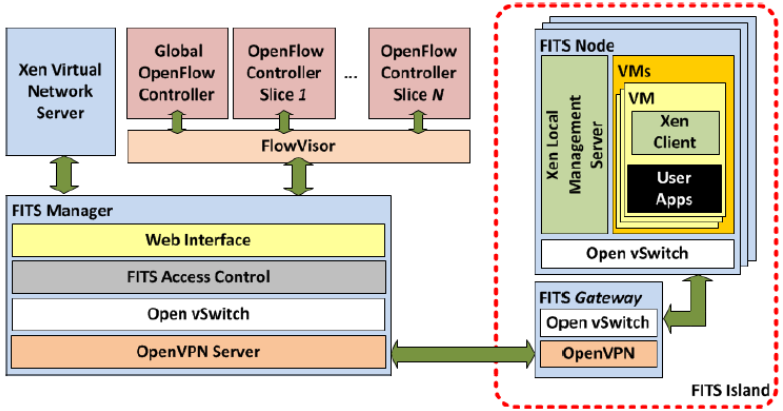
Node	Data VPN	Control VPN	Open vSwitch	Libvirt	LibFITS	Details
Raifort - ENS	●	●	●	●	●	▼
Curupira - ETSS/UFAM	○	○	○	○	○	▼
Capibaribe - GPRT/UFPE	○	○	○	○	○	▼
Guanabara - GTA/UFRJ	●	●	●	●	●	▼
Raspberry - GTA/UFRJ	○	○	○	○	○	▼
TorreDeBelem - LASIGE/UL	○	○	○	○	○	▼
Eiffel - LIP6/VirtuOR	○	○	○	○	○	▼
Palacioquitandinha - LNCC	○	○	○	○	○	▼
Taquaral - LRC/UNICAMP	○	○	○	○	○	▼
MAC - MidiaCom/UFF	●	●	●	●	●	▼
Oktoberfest - TUM	○	○	○	○	○	▼
Iracema - UECE	○	○	○	○	○	▼
Barra - UERJ	●	●	●	●	●	▼
Cedro - UFC	○	○	○	○	○	▼
DragaodoMar - UFC	○	○	○	○	○	▼
Conventodapenha - UFES	●	●	●	●	●	▼
Gaucho - UFRGS	○	○	○	○	○	▼
UFSC - UFSC	○	○	○	○	○	▼
Loki - UFSCar	○	○	○	○	○	▼
Ibira - USP	○	○	○	○	○	▼
Campos Gerais - UTFPR	○	○	○	○	○	▼
Jardim Botânico - UTFPR	○	○	○	○	○	▼

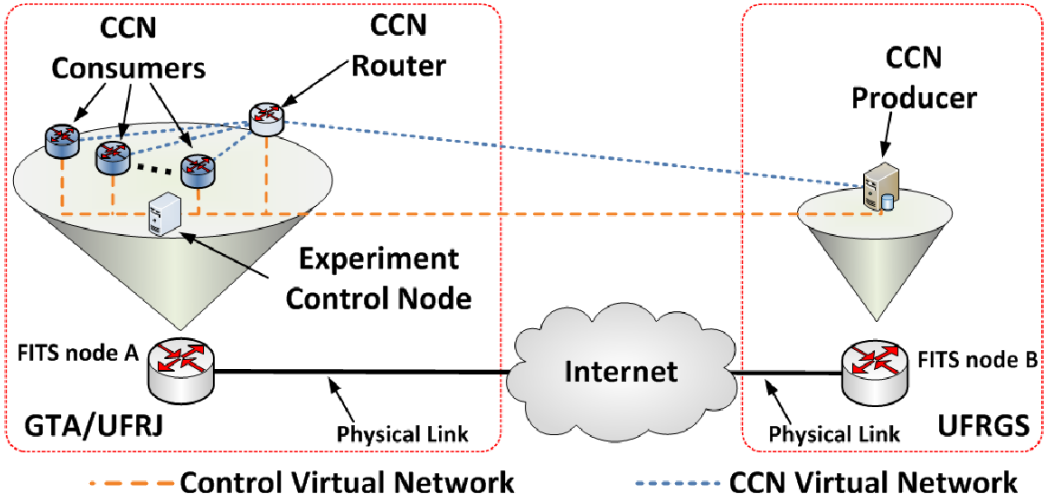
Testbed maintained by

GTA / UFRJ
GRUPO DE TELEINFORMÁTICA E AUTOMAÇÃO

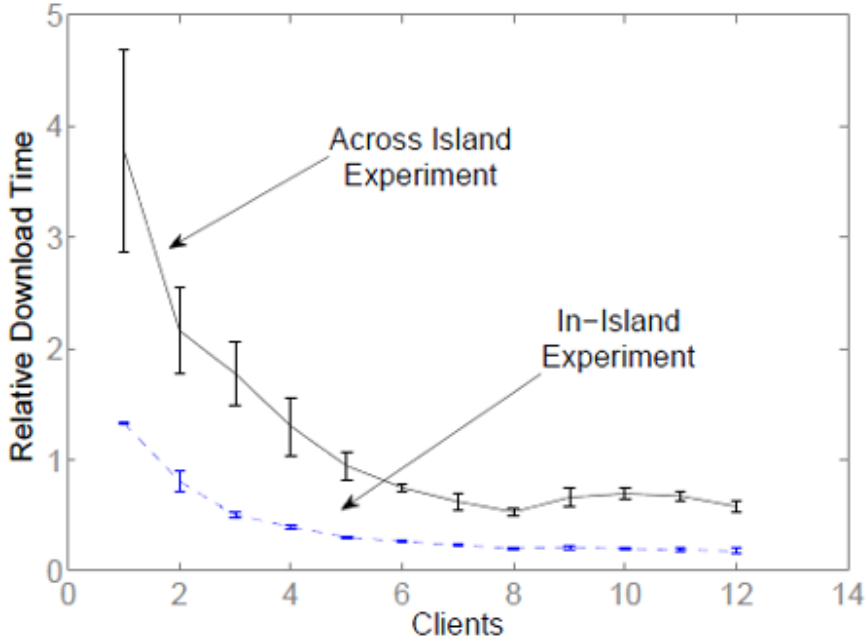
Grupo de Teleinformática e Automação
Universidade Federal do Rio de Janeiro
COPPE / Programa de Engenharia Elétrica
DEL / Escola Politécnica

FITS

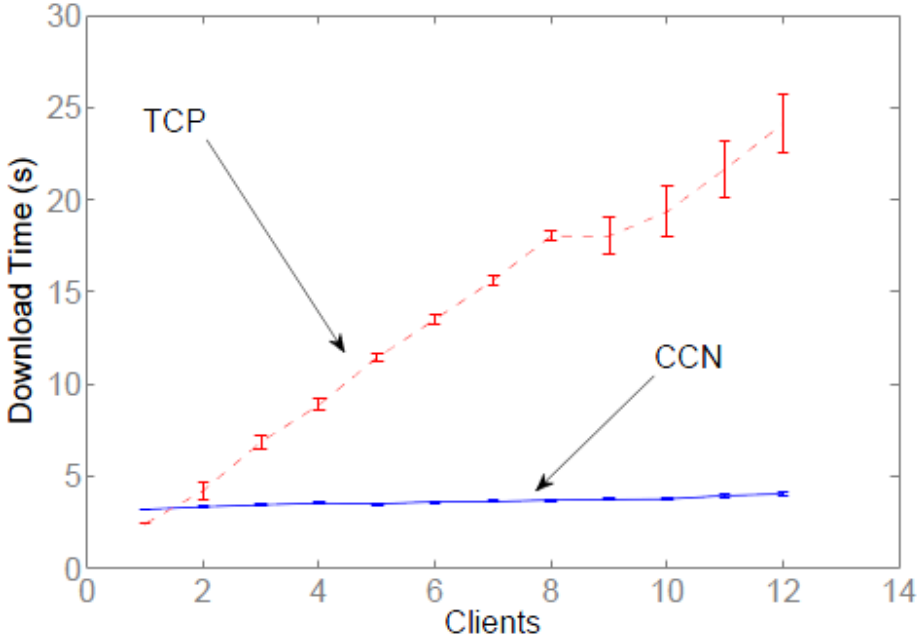

Xen Virtual Network Server
Global OpenFlow Controller
OpenFlow Controller Slice 1
...
OpenFlow Controller Slice N
FlowVisor
FITS Manager
Web Interface
FITS Access Control
Open vSwitch
OpenVPN Server
FITS Node
Xen Local Management Server
VMs
VM
Xen Client
User Apps
Open vSwitch
FITS Gateway
Open vSwitch
OpenVPN
FITS Island


CCN Consumers
CCN Router
CCN Producer
Experiment Control Node
FITS node A
GTA/UFRJ
Physical Link
Internet
FITS node B
Physical Link
UFRGS
Control Virtual Network
CCN Virtual Network

FITS


Relative Download Time
Clients
Across Island Experiment
In-Island Experiment
0
1
2
3
4
5
0
2
4
6
8
10
12
14

a.


Download Time (s)
Clients
TCP
CCN
0
5
10
15
20
25
30
0
2
4
6
8
10
12
14

b.

Críticas e Desafios

- Privacidade
- Segurança
- Escalabilidade
- Custo-benefício da transição

Conclusão

IP e CCN/ICN

Perguntas

1. Qual a principal diferença entre o modelo atual e o proposto em CCN?
2. É possível que a requisição por conteúdo leve mais tempo para ser atendida, já que temos que procura-lo nos caches?
3. No modelo de buscas oportunísticas, como a variação do TTL impacta o tempo de busca na rede?
4. No modelo de buscas oportunísticas, como podemos garantir a interconexão dos nós de mesmo domínio?
5. Na adaptação do modelo teórico para a realidade, o que representaria o maior custo em sua implementação?

Referências

http://www.ccnx.org/ http://www.gta.ufrj.br/publicacoes/ https://www.land.ufrj.br/publications/publications.php?page=papers

Fontes das imagens em:
http://www.gta.ufrj.br/ensino/eel878/redes1-2015-1/15_1/ccn/

[1] Xylomenos, G., Ververidis, C. N., Siris, V. A., Fotiou, N., Tsilopoulos, C., Vasilakos, X.,Katsaros, K. V., and Polyzos, G. C. (2014). A survey of information-centric networking research. Communications Surveys and Tutorials. IEEE COMMUNICATIONS SURVEYS & TUTORIALS, VOL. 16, NO. 2, SECOND QUARTER 2014.

[2] De Souza e Silva, E., Domingues, G., Leão, R., Menasché, D. A name resolution assisted ICN design, supported by opportunistic search, routing and caching policies. LAND/UFRJ.

[3] Kurose, J., Information-centric networking: The evolution from circuits to packets to content. University of Massachusetts.

[4] Jannibelli, D. Simulador para um modelo de busca oportunística de conteúdos em redes orientadas a informação. LAND/UFRJ - Dissertação de mestrado.

[5] Torres, J., Ferraz, L., Duarte, O., Redes Orientadas a Conteúdo Baseadas em Controladores Hierárquicos. GTA/COPPE/UFRJ.

[6] Guimarães, P., Ferraz L., Torres, J., Mattos, D., Murillo, A., Andreoni, M., Alvarenga, I., Rodrigues, C., Duarte, O,. Experimenting Content-Centric Networks in the Future Internet Testbed Environment. GTA/COPPE/UFRJ.

[7] Koponen, T., Chawla, M., Chun, B., Ermolinskiy, A., Kim, K., Shenker, S., Stoica, I. A Data-Oriented (and Beyond) Network Architecture

[8] Wood, C., Uzun, E., Flexible End-to-End Content Security in CCN. Palo Alto Research Center