



Routing Algorithms in NDN Networks

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Internship Environment

Goals and objectives

CISCO & PIRL

Ideas and Strategies

ICN Brief Introduction

Virtualization and Linux Containers

Virtualization and Linux Containers

Routing Strategies

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TreeOnConsumer

TreeOnProducer

MinCostMultiPath

Maximum Flow

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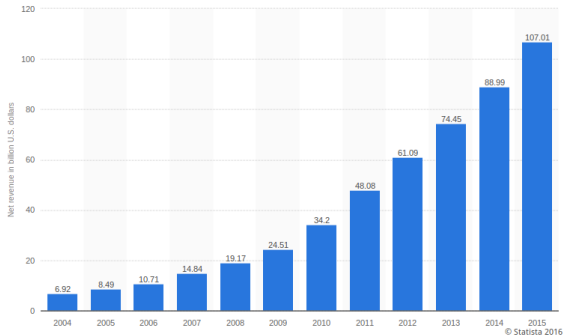
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Net Revenue for Video Delivery Applications



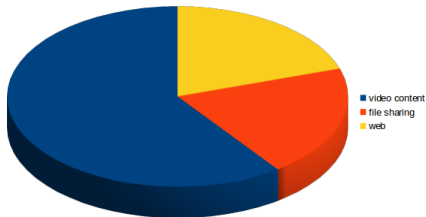
Goals and objectives

In 2016, More than 96 % of internet traffic is content.

Video → 60%

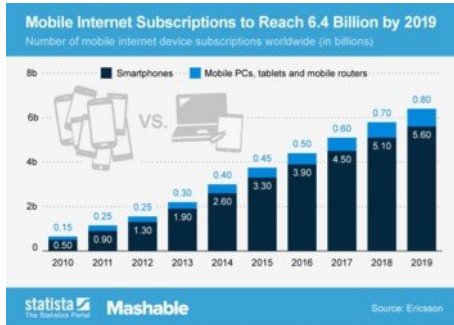
File sharing → 20%

Web → 20%



Goals and objectives

Mobile vs PC Internet Traffic user → 5G mobile networks



CISCO & PIRL

Cisco Systems France.



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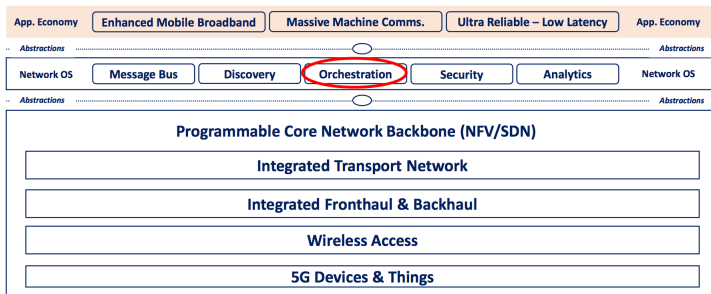
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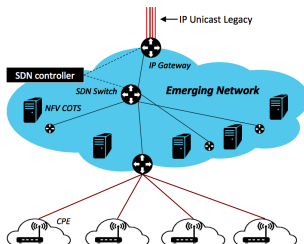
Named Data networking (NDN)

- ▶ Named Data Networking \Rightarrow **Name** base Philosophy vs TCP/IP **Calling** Networking.
- ▶ V.Jacobson et al proposition, *Networking Named Content* 2009.
- ▶ A Good fit network desiging for Video Delivery Applications in **5G**.



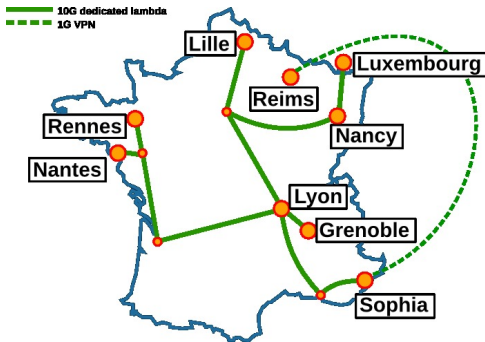
Named Data networking (NDN)

- ▶ **Lurch** is an orchestrator originally developed for ccnx.
- ▶ We developed Lurch:
 - ▶ For NFD (NDN forwarder).
 - ▶ Different interfaces to interact with strategies at run time (Client, Repositories, forwarding strategies, ...)
 - ▶ *New Routing Strategies.*



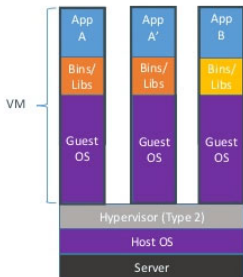
Named Data networking (NDN)

Grid5000 platform

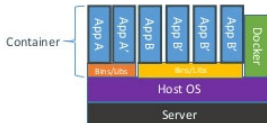


Virtualization and Linux Containers

Virtual Machines (VM) vs Linux Containers.



Containers are isolated,
but share OS and, where
appropriate, bins/libraries



Routing Strategies

We proposed 4 different routing strategies for different situation of networks which can cover all of needs:

- ▶ **TreeOnConsumer** : N clients searching the same content from one repository detected by Lurch (Multicast mode).
- ▶ **TreeOnProducer**: One client who gets the packet from N Repositories of needed data.
- ▶ **MinCostMultiPath**: Using different paths with Equal Cost to retrieve the data using a proper forwarder strategy (load-balancing).
- ▶ **MaxFlow**: Allow to maximize the throughput using paths based on maximum flow algorithm between clients and repositories.

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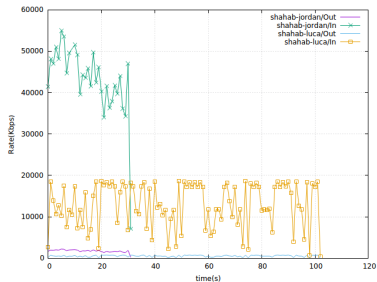
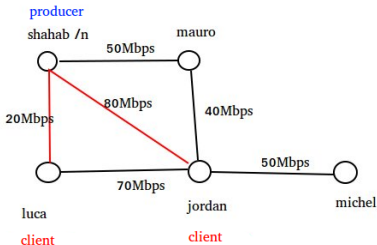
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TreeOnConsumer
TreeOnProducer
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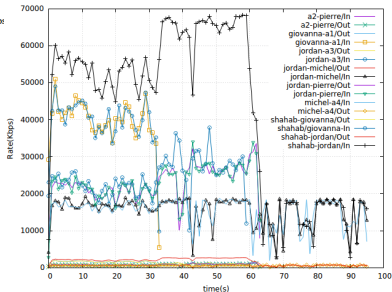
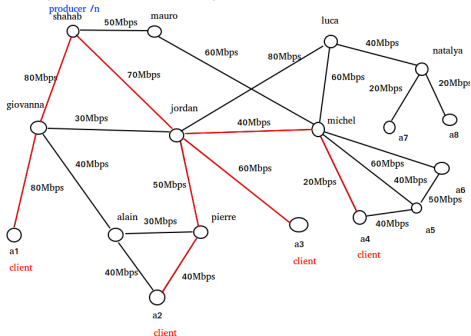
TreeOnConsumer

One producer to multiple consumer.



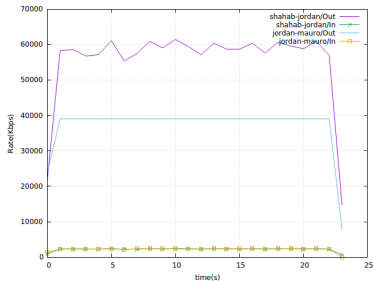
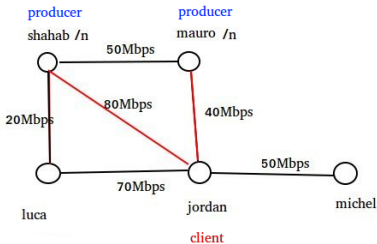
TreeOnConsumer

One producer to multiple consumer.



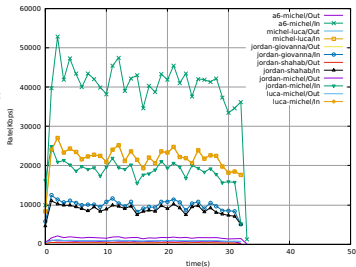
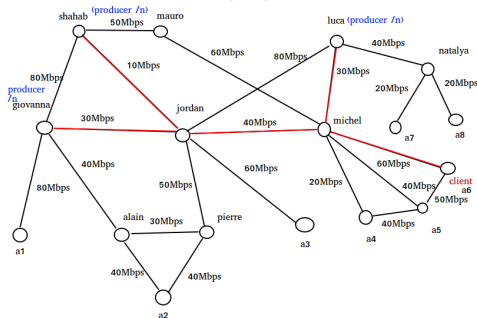
TreeOnProducer

One Consumer to multiple producer.



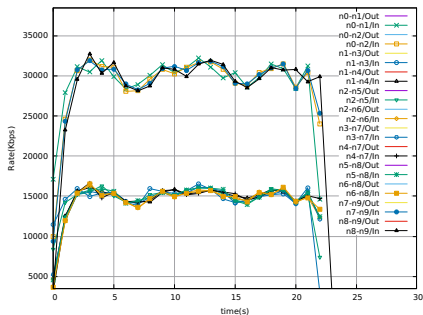
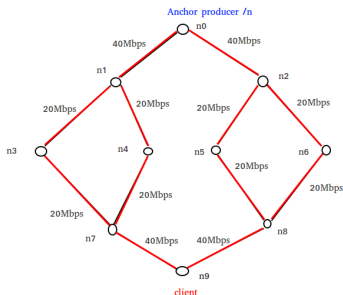
TreeOnProducer

One Consumer to multiple producer.



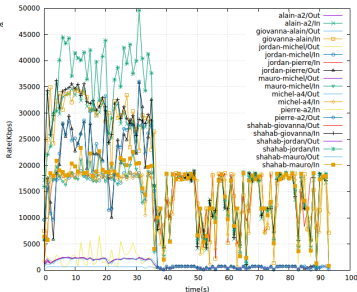
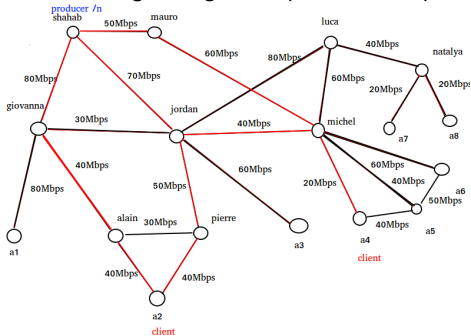
MinCostMultiPath

Load balancing strategies in equal cost multipath case.



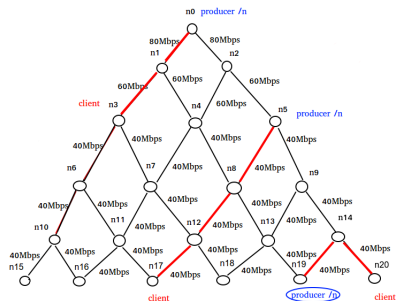
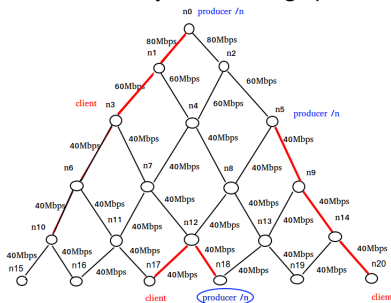
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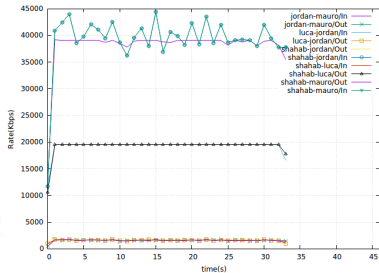
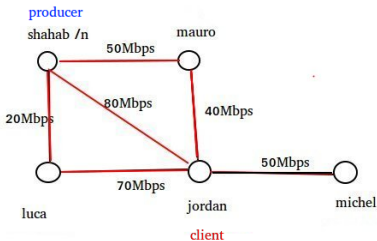
MinCostMultiPath

Load balancing strategies in equal cost multipath case.
Producer Mobility with Routing update.



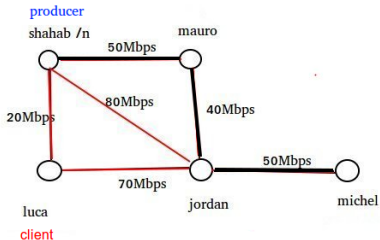
Maximum Flow

Maximum Flow algorithm chooses the path which maximizes through from consumer to producer.



Maximum Flow

Maximum Flow algorithm chooses the path which maximizes through from consumer to producer.





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- ▶ There is always some limitations in practical against pure theoretical works which can be seen when you work on experimental platforms.
- ▶ ICN is one of the most challenging domain who has a lot of passion in research and development.
- ▶ In Engineering there is always bottlenecks, understanding and discovering of where these bottlenecks are.
- ▶ Coding is beautiful idea that through it you can realize your ideas in real world.

