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CLOUDS PI

Defining Raspberry Pi

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The Raspberry Pi is a low cost, credit-card sized computer.

The Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects.

Cloud Computing

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Cloud Computing refers to manipulating, configuring, and accessing the applications online.

Cloud Computing is both a combination of software and hardware based computing resources delivered as a network service.

Cloud Computing provides us a means by which we can access the applications as utilities, over the Internet.

It allows us to create, configure, and customize applications online.

Problem Statement

Study of a Low-Cost Raspberry-Pi-Based Micro Datacenter for Software-Defined Cloud Computing

Concepts of Cloud Computing

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There are certain services and models working behind the scene making the cloud computing feasible and accessible to end users. Following are the working models for cloud computing:

1. Deployment Models

2. Service Models

Deployment Models

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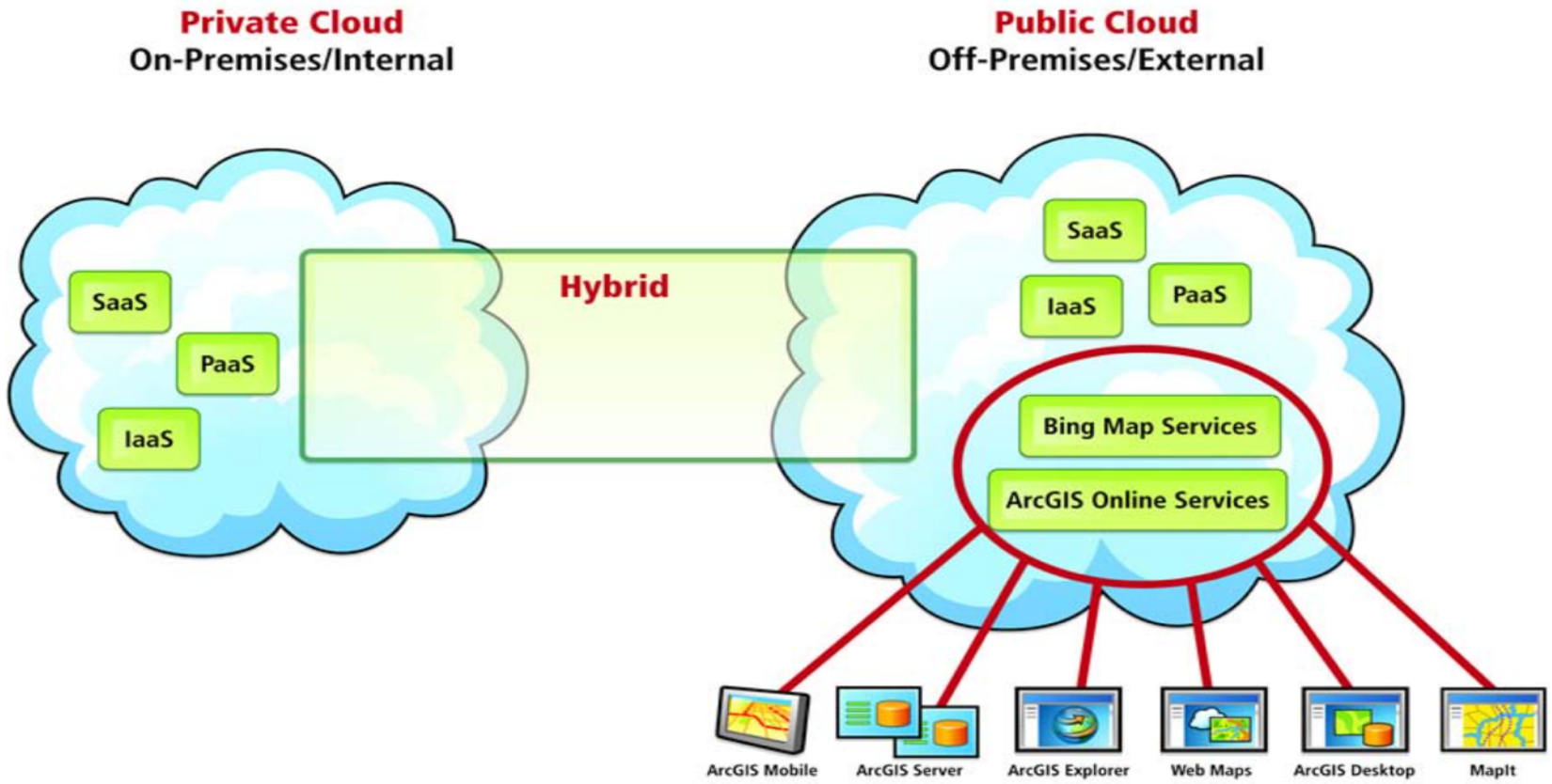
Deployment models define the type of access to the cloud, i.e., how the cloud is located?

PUBLIC CLOUD : The **Public Cloud** allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness, e.g., e-mail.

PRIVATE CLOUD : The **Private Cloud** allows systems and services to be accessible within an organization. It offers increased security because of its private nature.


Private Cloud
On-Premises/Internal
Public Cloud
Off-Premises/External
SaaS
PaaS
IaaS
Hybrid
SaaS
IaaS
PaaS
Bing Map Services
ArcGIS Online Services
ArcGIS Mobile
ArcGIS Server
ArcGIS Explorer
Web Maps
ArcGIS Desktop
MapIt

Service Models

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Service Models are the reference models on which the Cloud Computing is based. These can be categorized into three basic service models as listed below:

1.Infrastructure as a Service (IaaS) : IaaS is the delivery of technology infrastructure as an on demand scalable service.

2. Platform as a Service (PaaS) : PaaS provides the runtime environment for applications, development & deployment tools, etc.

3. Software as a Service (SaaS) : SaaS model allows to use software applications as a service to end users.

Motivation, Objectives, Outcomes

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The need for agile, flexible, and cost-efficient computer networks has formed the nucleus for the global efforts toward software-defined networking (SDN).

The aim of this research is to develop a cloud computing project, where the users can use their external hard drive's connected to Raspberry Pi through internet they can have access to anywhere from any device.

SDN not only reduces the complexity seen in today's cloud datacenter networks but also helps cloud providers manage net- work services from a central management point.

Software Defined Networking

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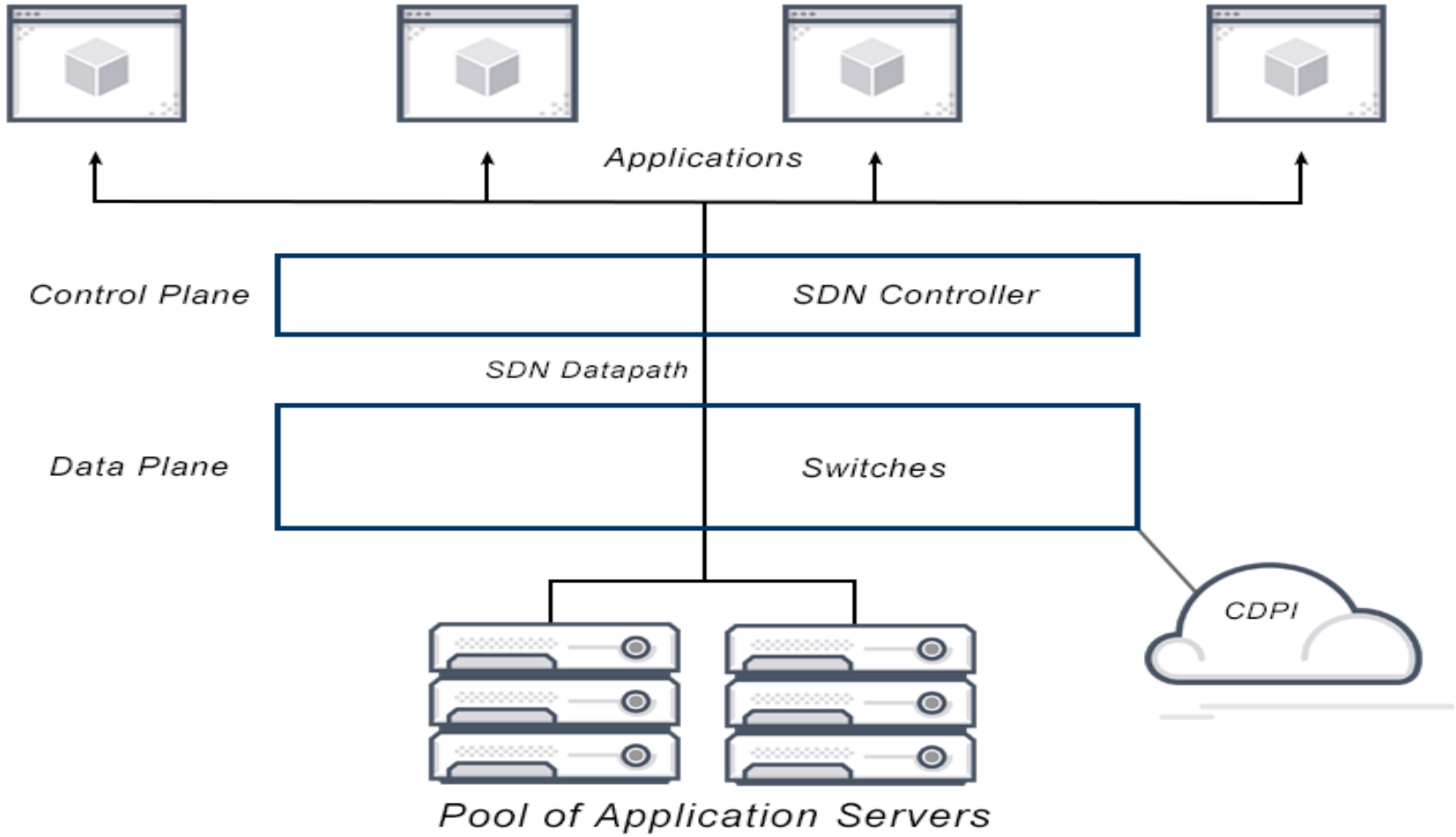
Software-defined networking (SDN) technology is an approach to network management that enables dynamic, programmatically efficient network configuration.

In order to improve network performance and monitoring making it more like cloud computing than traditional network management.

SDN is meant to address the fact that the static architecture of traditional networks is decentralized and complex while current networks require more flexibility and easy troubleshooting.

SDN attempts to centralize network intelligence in one network component by disassociating the forwarding process of network packets (data plane) from the routing process (control plane).

Software Defined Networking (SDN)



Software Defined Networking

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Data Plane: processing and delivery of packets Based on state in routers and endpoints
E.g., IP, TCP, Ethernet, etc.

Control Plane: establishing the state in routers Determines how and where packets are forwarded Routing, traffic engineering, firewall state, ...

Separate control plane and data plane entities
Have programmable data planes—maintain, control and program data plane from a central entity i.e. control plane software called controller.
An architecture to control not just a networking device but an entire network.

How does it work?

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Here are the SDN basics: In SDN (like anything virtualized), the software is decoupled from the hardware. SDN separates the two network device planes, moving the control plane that determines where to send traffic to software, and leaving the data plane that actually forwards the traffic in the hardware. This allows network administrators who use software-defined networking to program and control the entire network via a single pane of glass instead of on a device by device basis.

There are three parts to a typical SDN architecture:

Applications, which communicate resource requests or information about the network as a whole

Controllers, which use the information from applications to decide how to route a data packet

Networking devices, which receive information from the controller about where to move the data

How does it work?

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These three elements may be located in different physical locations.

Physical or virtual networking devices actually move the data through the network.

The switch checks the integrity of both the data packets and their virtual machine destinations and moves the packets along.

Benefits of software-defined networking (SDN)

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- Cost reduction
- Intelligent global connections
- Granular security
- Reduced downtime

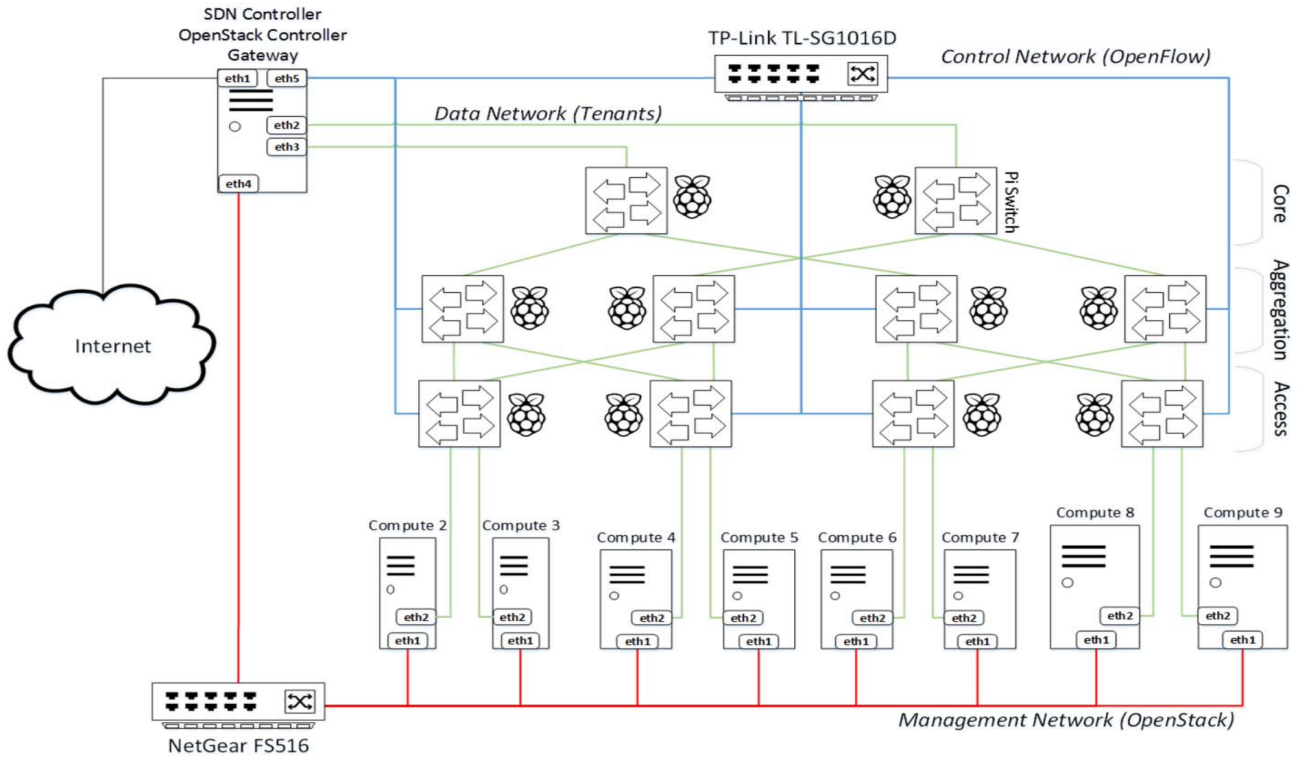
How is SDN different from traditional networking?

The key difference between SDN and traditional networking is infrastructure: SDN is software-based, while traditional networking is hardware-based.

Because the control plane is software-based, SDN is much more flexible than traditional networking. It allows administrators to control the network, change configuration settings, provision resources, and increase network capacity.

There are also security differences between SDN and traditional networking , because software-defined networks use a centralized controller, securing the controller is crucial to maintaining a secure network, and this single point of failure represents a potential vulnerability of SDN.

System Architecture of SDN



Layers of SDN

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Infrastructure layer: it is the foundation layer consists of both physical and virtual network devices such as switches and routers.

Control layer: This layer consists of a centralized control plane that is decoupled from the physical infrastructure to provide centralized global view to entire network.

Application layer: It consists of network services, application and orchestration tools that are used to interact with control layer.

Dynamic Flow Scheduling

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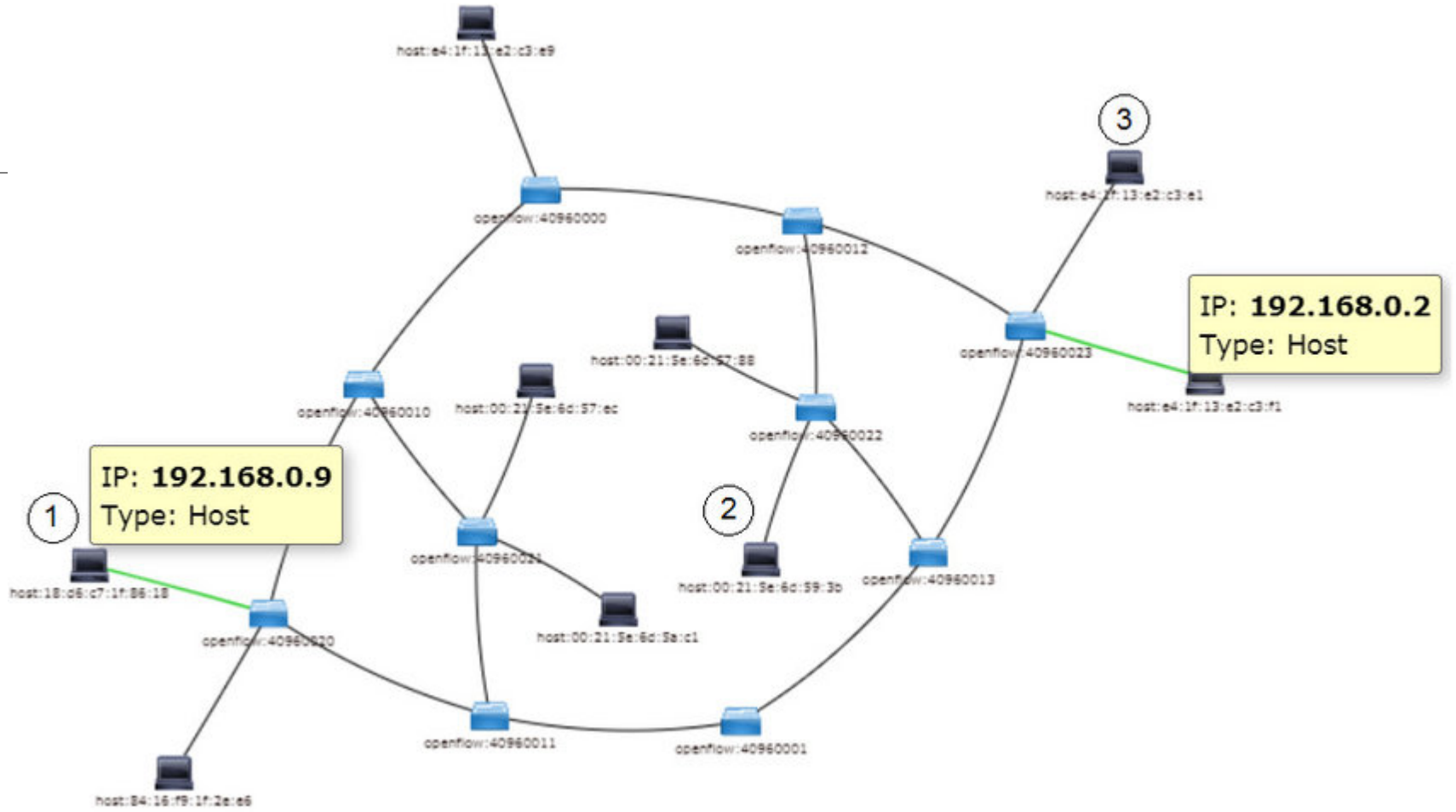
Datacenter network topologies such as fat trees typically consist of many equal-cost paths between any given pair of hosts.

Traditional network forwarding protocols often select a single deterministic path for each pair of source and destination, and sometimes protocols such as equal-cost multipath (ECMP) routing 11 are used to evenly distribute the load on multiple paths.

This static mapping of flows to paths does not take into account network utilization and the duration of flows. We propose and demonstrate the feasibility of building dynamic flow scheduling for a given pair of hosts in our multirooted-tree testbed using ODL APIs.


IP: 192.168.0.9
Type: Host
1
IP: 192.168.0.2
Type: Host
2
3

Virtual-Machine Management

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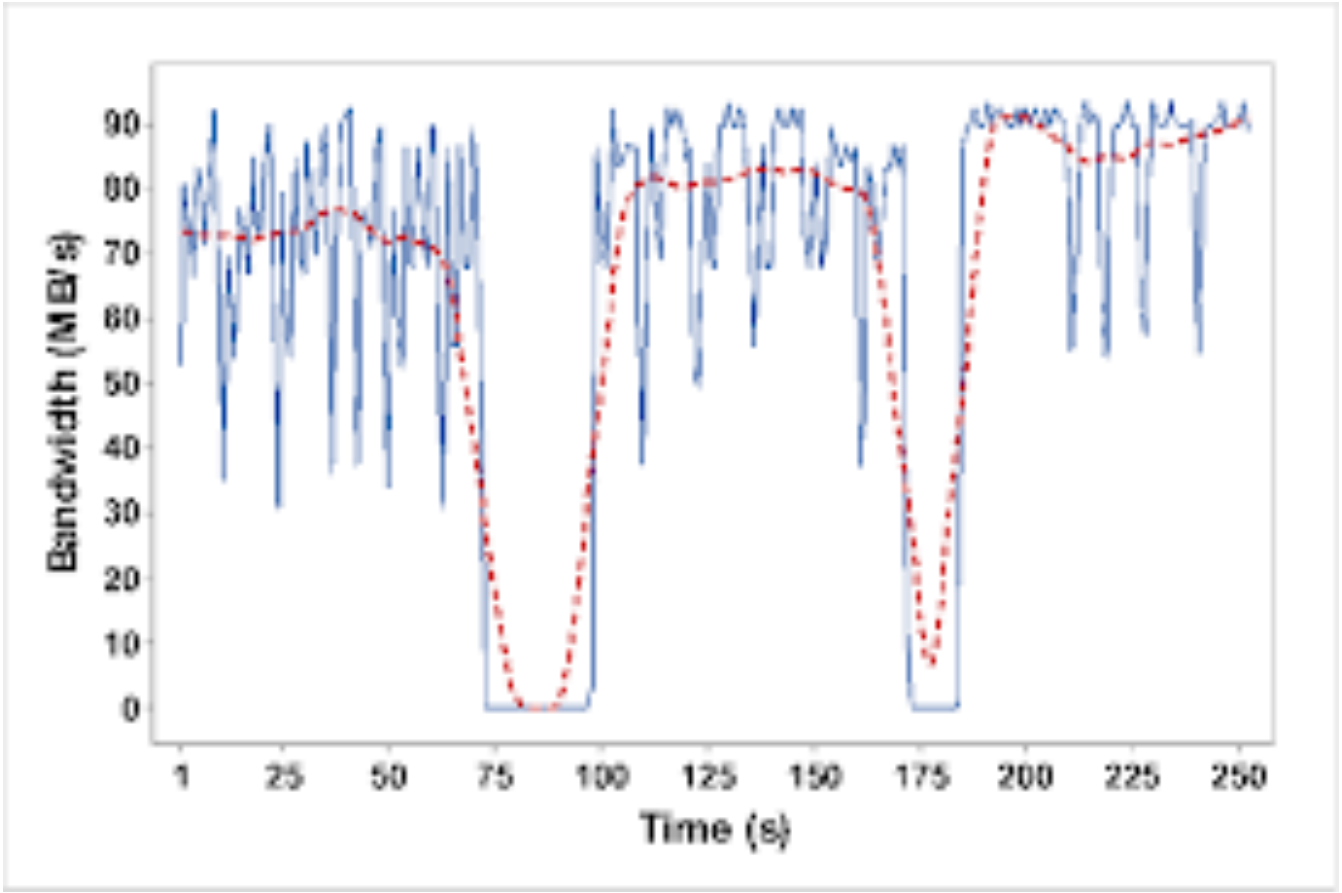
Live migration, one of the core concepts in modern datacenters, allows moving a running VM between physical hosts with no impact on the VM's availability.

While VMs in datacenters are often migrated between hosts to reduce energy consumption or for maintenance purposes, live VM migration also provides an opportunity to enhance link utilization and reduce network-wide communication costs.

This can be done by relocating communicating VMs to nearby hosts with fewer connecting links in the higher layers of the datacenter network topology.


Bandwidth (MB/s)
90
80
70
60
50
40
30
20
10
0
1
25
50
75
100
125
150
175
200
225
250
Time (s)

Conclusion

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SDN promises to transform today's static networks into flexible ,scalable, programmable platforms with the intelligence to allocate resources dynamically.

With its many advantages and astonishing industry momentum, SDN is on the way to become- the new approach for networking.

References

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Research Papers :

https://ieeexplore.ieee.org/document/8497015

https://www.researchgate.net/publication/331975048_Raspberry_Pi_Personal_Cloud_Storage

Thank You!

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