SDNFV – Softwarization and Virtualization

Professor Chien-Chao Tseng

Department of Computer Science
National Yang Ming Chiao Tung University
cctseng@cs.nctu.edu.tw

AT&T to Move 75% of Network to Software Defined by 2020

AT&T COMPANY INVESTORS VALUES CAREERS NEWS

TECHNOLOGY **BLOG**

AT&T first outlined its virtualization project back in 2013

December 16, 2014

Setting the Pace with Our Next-Gen Network

By John Donovan

https://about.att.com/innovationblog/121514settingthepace

After a solid start earlier this year, we're planning to kick our transition to a software-centric network into high gear in 2015.

In fact, I'm putting a line in the sand today: our goal is to virtualize and control over 75 percent of our network using this new architecture by 2020.

- We're collaborating with open source groups like OpenStack, ON.Lab, Open Daylight, OPNFV and others to develop the software that will be the

SDNFV

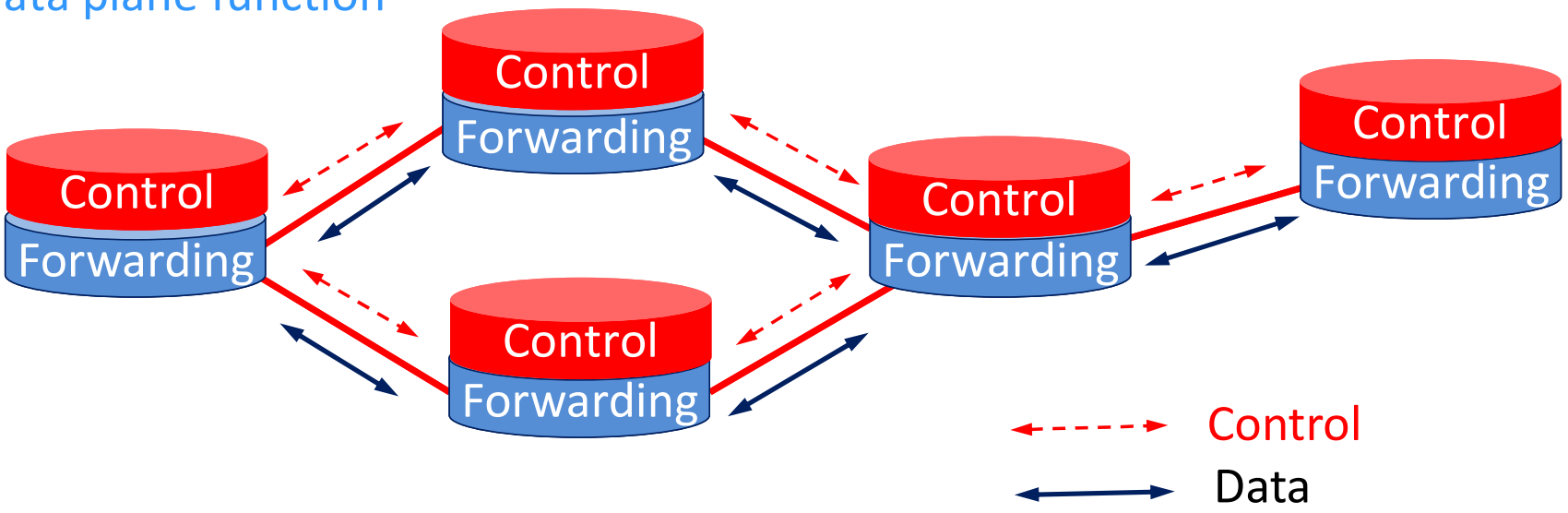
Software Defined Networking

Act 1

"Network owners take charge of their **control plane**"

Traditional Networking

- Integrated Control and Data Planes
- Distributed Control
  - Distributed algorithm running between neighbors
  - Vender lock-in
- Fixed data plane function

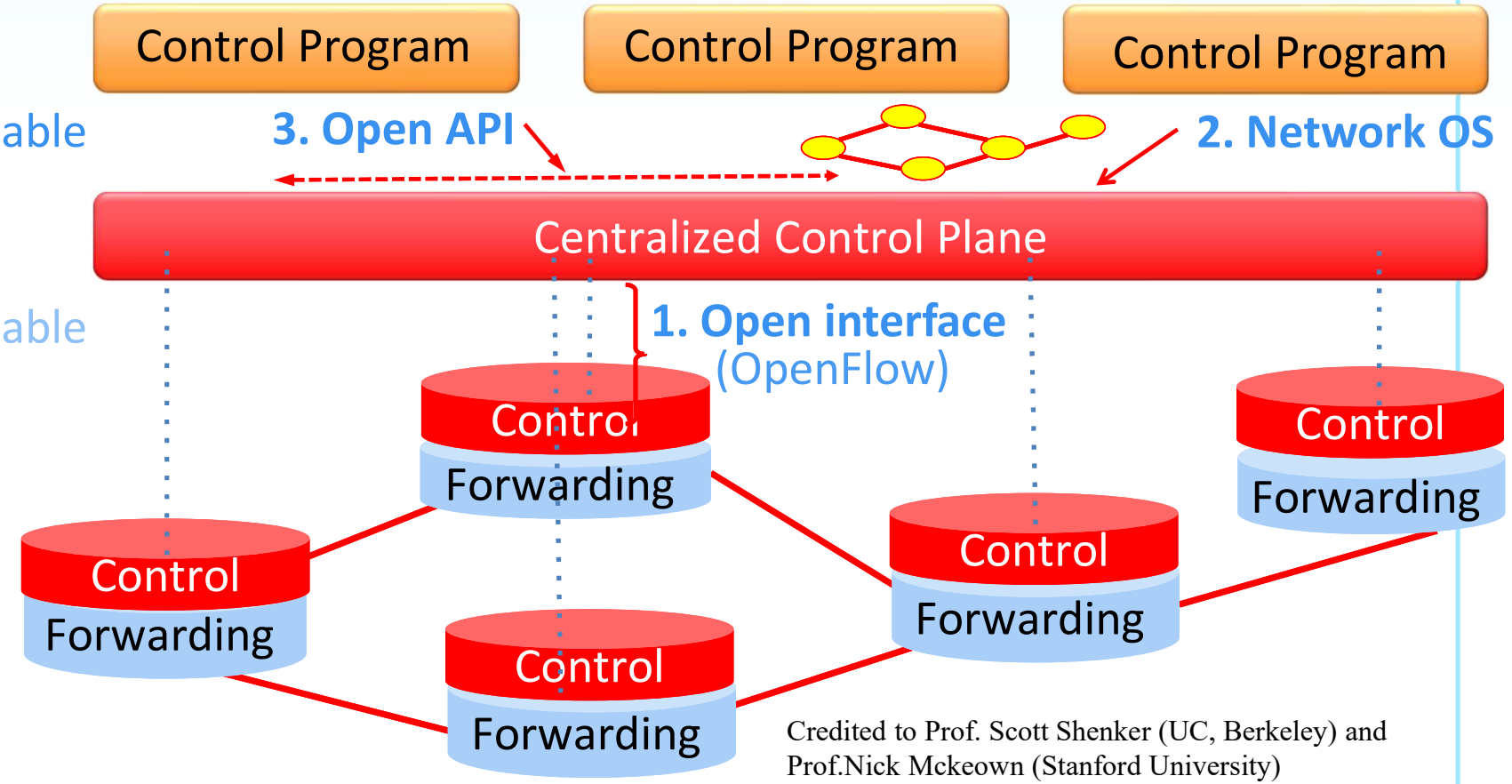


Credited to Prof. Scott Shenker (UC, Berkeley) and Prof.Nick Mckeown (Stanford University)

Software Defined Network (SDN)

- Separation of Control Plane and Data Plane
- Centralized Control
  - Programmable
- Data plane function
  - Programmable

- Network owners take charge of their **control plane**



Credited to Prof. Scott Shenker (UC, Berkeley) and Prof.Nick Mckeown (Stanford University)

SDNFV

Network Function Virtualization

Network Function Virtualization

(Minimizing Dependence on Hardware Constraints)

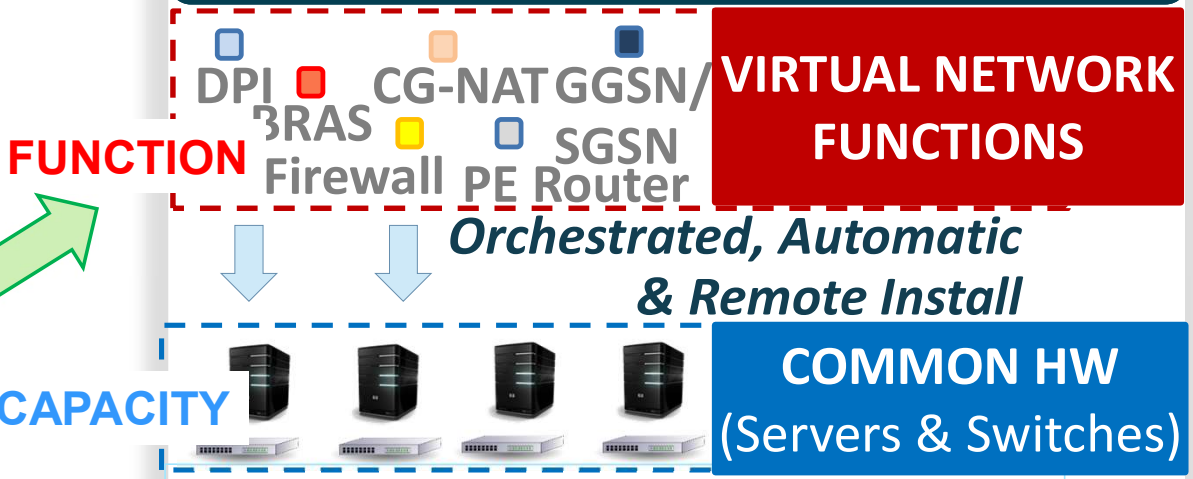
- Coupling NW Function with HW

Traditional Network Model: Physical Appliances

- Network Functions are based on specific HW&SW
- One physical node per **role**

- Decoupling of NW Function and HW Capability

Virtualised Network Model: Virtual Appliances



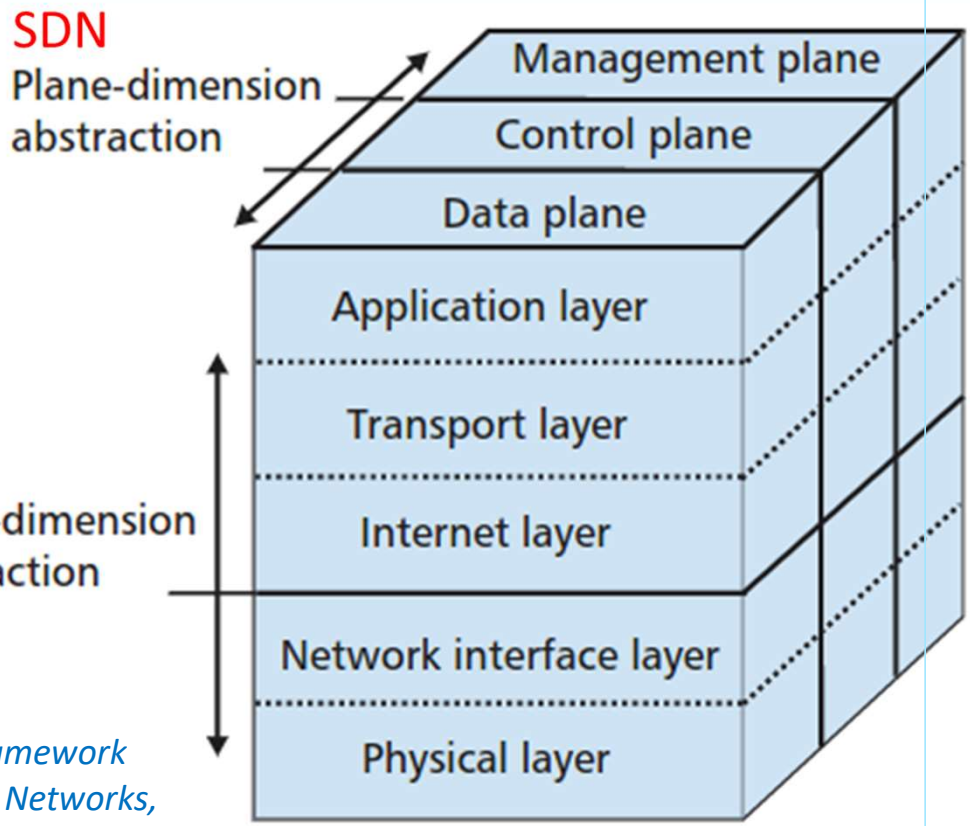
- Network Functions are SW-based over well-known HW
- Multiple roles over **same HW**

DPI: Deep Packet Inspector, BRAS: Broadband Remote Access Server, CG-NAT: Carrier-grade NAT, GGSN/SGSN: Gateway GPRS Support/Serving Node, PE Router: Provider Edge Router,

Credited to: Diego R. Lopez, Telefonica I+D, NFV

SDNFV – Layer-Plane Abstract

- **SDN: Plane-dimension Abstraction**
  - Plane abstraction of traditional telecom system
    - Data, Control, Management Planes
- **NFV: Layer-dimension Abstraction**
  - Layer abstraction of Internet architecture
    - TCP/IP Layer Stack
- Two abstraction dimensions are orthogonal
  - in principle are independent



Source: Software-Defined Network Virtualization: An Architectural Framework for Integrating SDN and NFV for Service Provisioning in Future Networks, IEEE Network, 2016

SDNFV

Software Defined Network (SDN)

Act 2

"Network owners take charge of their **forwarding plane too**"

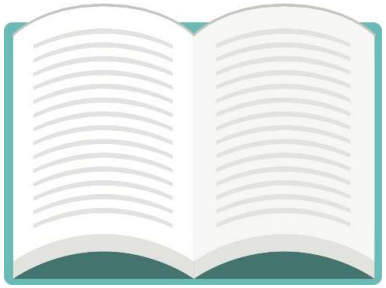
- Separation of Control Plane and Data Plane
  - Centralized Control
    - Programmable
  - Data Plane function
    - Programmable

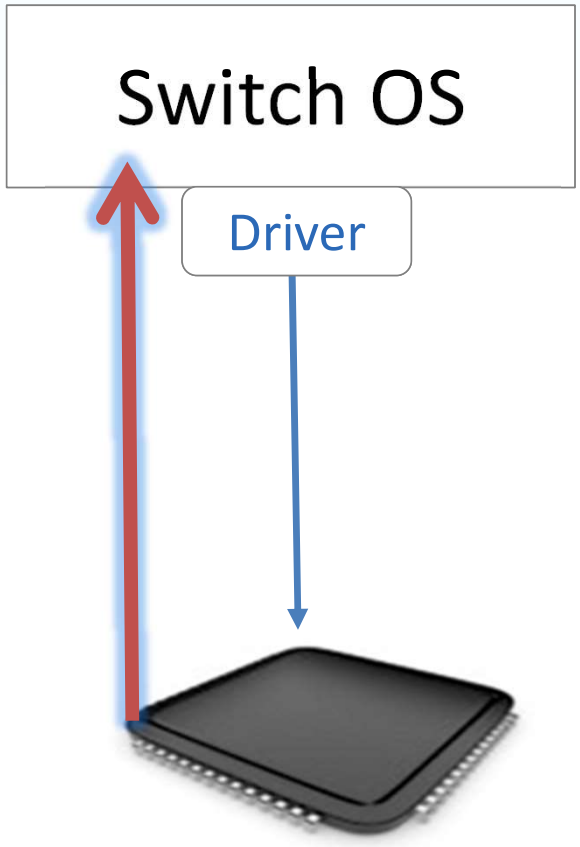
Credited to

1. Prof. Scott Shenker (UC, Berkeley) and Prof.Nick
2. Mckeown (Stanford University)

Network Systems were built “Bottoms-up”

“This is how I process packets …”





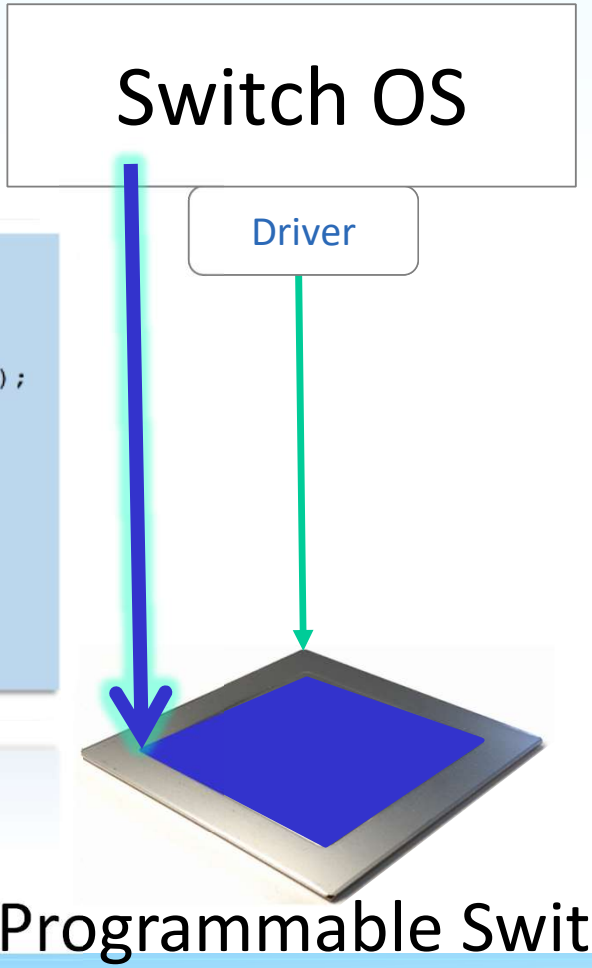
Fixed-function switch

Network Systems are Starting to be Programmed "top-down"

"This is precisely how you must process packets"

```
table int_table {
  reads {
    ip.protocol;
  }
  actions {
    export_queue_latency;
  }
}
```

```
action export_queue_latency (sw_id) {
  add_header(int_header);
  modify_field(int_header.kind, TCP_OPTION_INT);
  modify_field(int_header.len, TCP_OPTION_INT_LEN);
  modify_field(int_header.sw_id, sw_id);
  modify_field(int_header.q_latency,
               intrinsic_metadata.deq_timedelta);
  add_to_field(tcp.dataOffset, 2);
  add_to_field(ipv4.totalLen, 8);
  subtract_from_field(ingress_metadata.tcpLength,
                      12);
}
```

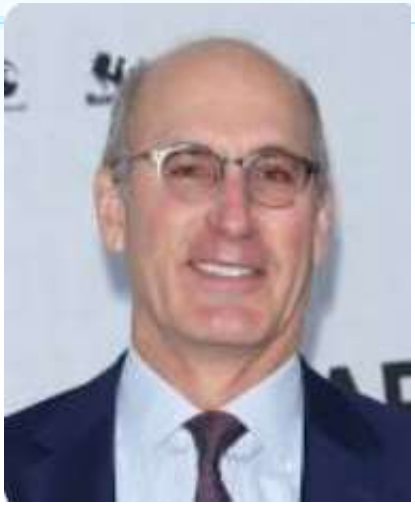


SDNFV

Paradigm Shift

AT&T – An Open-source SDNs Company

AT&T 2017 DEVELOPER SUMMIT



January 2017, Las Vegas

- **John Stankey, AT&T CEO**

  "**AT&T is no longer the phone company**, but rather **the open-source software-defined networks company**."

- https://sdn.ieee.org/newsletter/july-2017/towards-the-world-brain-with-sdn-nfv

AT&T Cannot Make its Goal by itself!

- **AT&T's ECOMP:**
  Platform of **Enhanced Control, Orchestration, Management and Policy** for SDNFV
- In production but **needs more maturation**.
- Without that progression, AT&T won't be able to make its goal

  "Virtualizing 75 percent of its network functions by 2020"

➢ AT&T committed ECOMP to open source.

➢ To leverage Open-source Community

✓ **ECOMP is now part of ONAP**
  – **ONAP: Open Network Automation Platform https://www.onap.org/**

https://www.sdxcentral.com/articles/news/open-source-ecomp-att-needs-help/2017/02/

AT&T on Taget

- Virtualizing **more than 55%** of its network functions in **2018**
- Reaching **65%** at the end of **2019**

FIERCE Telecom

AT&T on target for virtualizing 75% of its network by 2020

- https://www.fiercetelecom.com/telecom/at-t-target-for-virtualizing-75-its-network-by-2020

- **Scott Mair, AT&T President**

  "We aim to control 75% of our core network functions with software by the end of 2020, and by reaching 65% at the end of 2019, we're nearly there,"

https://about.att.com/innovationblog/2020/01/2019_5g_recap.html

New Year, New Ways for AT&T Customers to Connect

by Scott Mair

January 03, 2020

- Creating **smart ways to control the network with software:**
  - AT&T is using SDN and NFV with apps running on servers.
    - to essentially replace network hardware equipment
  - Infrastructure is backed by SDN

    "100% of the data traffic that runs through the infrastructure connecting the elements of our core network together is backed by SDN."
- **Increasing the speed at which we can deploy and innovate. (O-RAN)**
  - Developed new ways to control radio network: 5G RAN Intelligent Controller (RIC)
  - The Linux Foundation and The O-RAN Alliance had come together for a new approach for RAN software and hardware
    - Speeds innovation, controls costs and gives more flexibility to ensure great 5G coverage.

https://about.att.com/innovationblog/2020/01/2019_5g_recap.html

AT&T: SDN, NFV helped meet COVID-19 traffic demands

LightReading

News Analysis

MIKE DANO, Editorial Director, 5G & Mobile Strategies

4/2/2020

COMMENT (0)

AT&T said that its investments into software-defined networking (SDN) and network function virtualization (NFV) have been instrumental in the company's efforts to keep pace with rising Internet traffic stemming from the new coronavirus.

"You don't design a network for a pandemic. But it turns out that building your network on software and open hardware specifications can help make it ready for just about anything," wrote AT&T networking chief Andre Fuetsch in a blog post on the company's website.

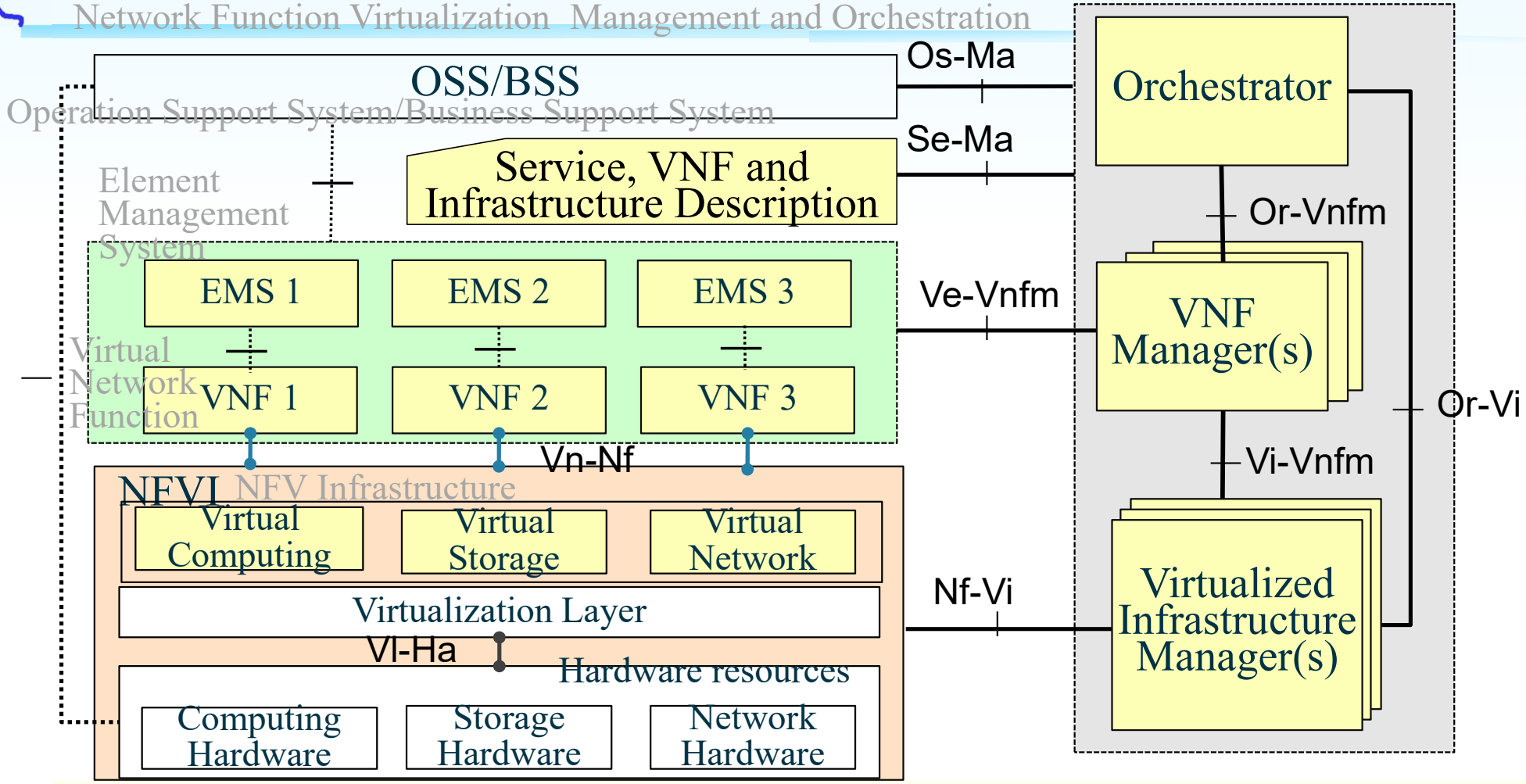
Fuetsch explained that demand for the company's Virtual Private Network (VPN) offering skyrocketed 700% during the past few weeks as millions of Americans began working from home. He said that AT&T's network-based IP remote access VPN – AT&T Network-Based IP VPN Remote Access (ANIRA) – uses a cloud-based software platform and a plug-and-play white box gateway that doesn't require a professional installer.

NYC https://www.lightreading.com/cloud-native-nfv/atandt-sdn-nfv-helped-meet-covid-19-traffic-demands/d/d-id/758661

European Telecommunications Standards Institute

ETSI NFV-MANO Reference Architecture

Network Function Virtualization Management and Orchestration



Accelerating Software Defined Network Deployments

Ryan van Wyk – VP Network Cloud, AT&T **February 06, 2020**

- Fiction to adopting SDN at scale
  - Operator and suppliers have implemented NFVi differently,
    - Even though in most cases using many of the same open-source SW projects
      - Likes ONAP, OpenStack, Airship and Kubernetes.
    - Need to customize VNFs or NFVi for every operator installation.
- AT&T and CNTT jointly to accelerate Software Defined Networking
  - Held working sessions for a **Common Industry Framework for NFVi**
    - **75+ e**ngineers and tech. leaders from 26 telecom operators and suppliers
- CNTT: Cloud iNfrastructure Telco Taskforce
  - Incubated in 2019 through a partnership between GSMA and Linux Foundation
  - Aims to create a **Common Industry Framework for NFVi**

GSMA: GSM Association

GSM: Global System for Mobile Communications

https://about.att.com/innovationblog/2020/02/accelerating_sdn.html

How CNTT Does

- How CNTT does
  - Documenting common NFVi designs
  - Putting in place the **testing**,
    - Utilizing **Open Platform for NFV (OPNFV)** https://www.opnfv.org/
- **OPNFV**:
  - Testing and integration project of Linux Foundation Networking (LNF)
  - To ensure an NFVi conformant to the standards. https://www.lfnetworking.org/
    - Allow for simpler adoption of NFVi and
    - Accelerate the rollout of VNFs and CNFs
- Good for communication operators, suppliers and ultimately for business and consumers
- https://wiki.lfnetworking.org/display/LN/Cloud+iNfrastructure+Telco+Taskforce+-+CNTT