



ONK Spring & DevCon

SDI : 오픈소스 소프트웨어를 통한 SDN/NFV의 진화

2016. 4

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Software Defined Infrastructure

“(네트워크커들의) SDI에 대한 일반적인 생각”

SDI

= SDN+NFV+Cloud

= OPNFV (incl. ODL)

'Telco SDI' for 5G Mobile Network

“Virtualization First, NFV Second, SDN Third”

PAST

NE Oriented
(eNB, SGW, PGW, MME)

Standard (Only)

Uncontrollable Network

5G

Function Oriented
(eNB & VNF's)

Software APIs (Major)

Controllable Network

'Telco SDI' for 5G Mobile Network

“SDN/NFV-based METIS2020 Architecture”

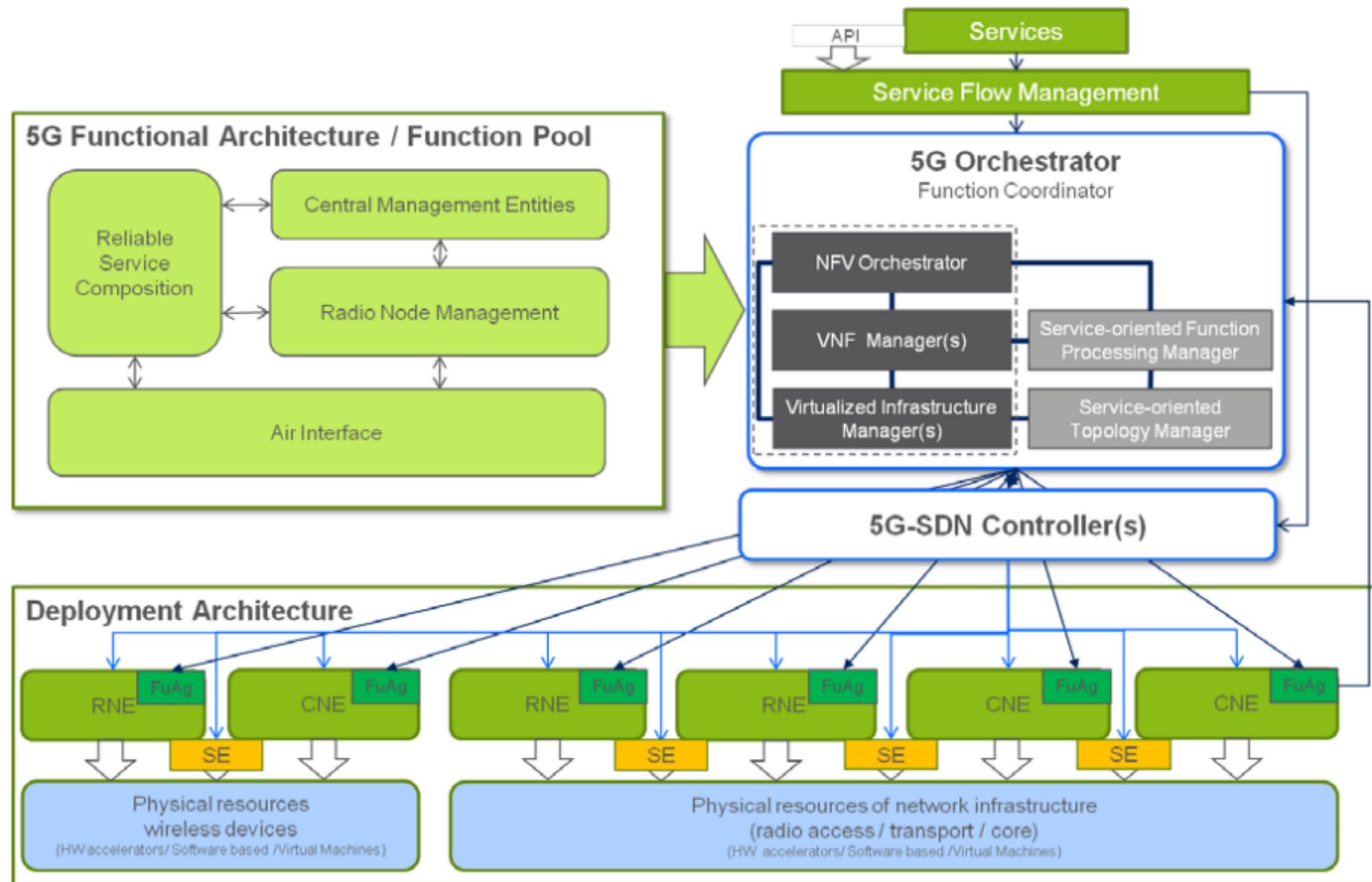


Figure 3-6: Orchestration & Control Architecture View of METIS 5G System.

'Telco SDI' for 5G Mobile Network

“METIS2020 - Network & Device Communication”

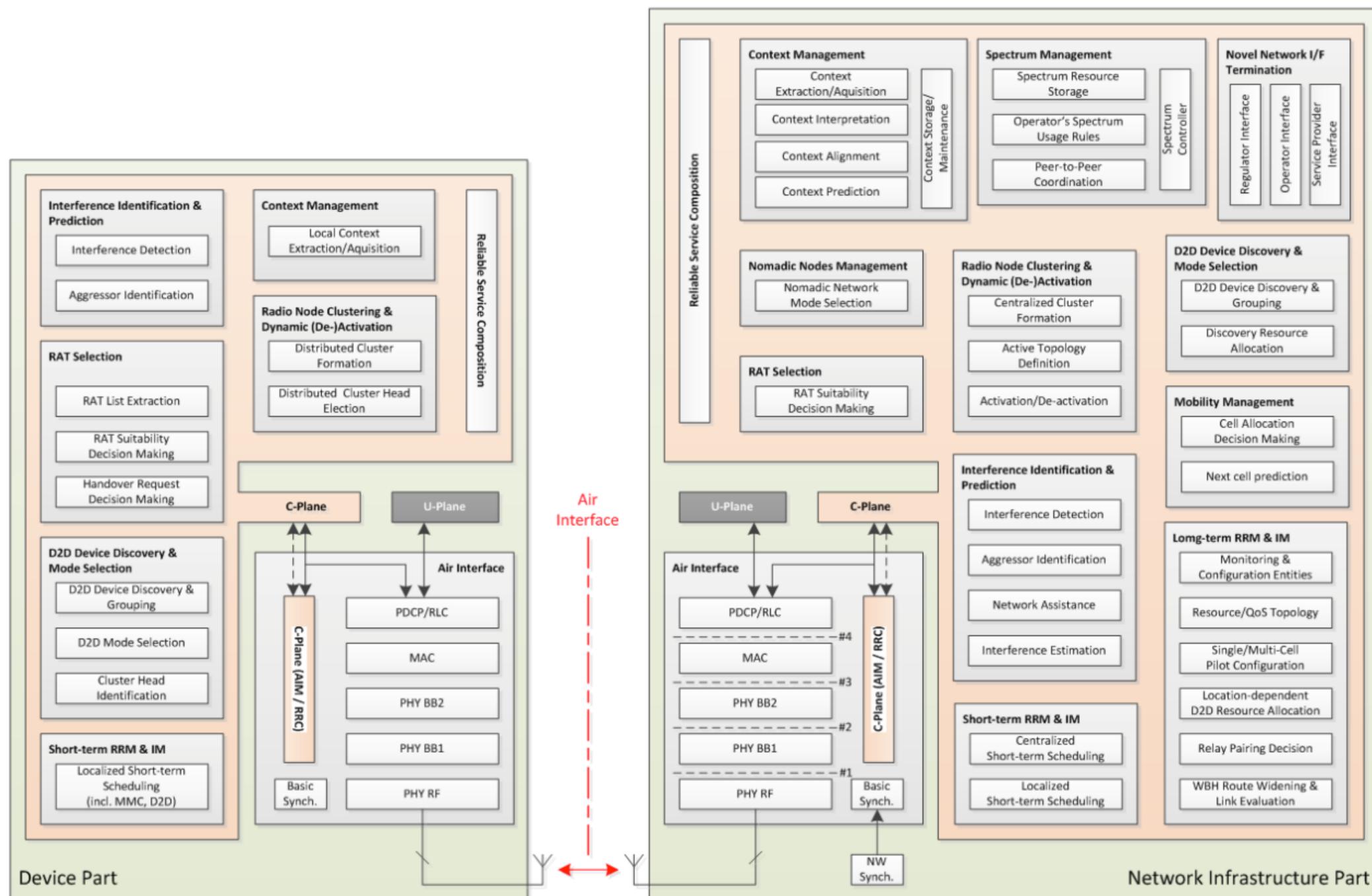


Figure 3-4: Generic functional architecture of METIS 5G System considering interrelations between infrastructure and device part (network-to-device communication).

What is OPNFV ?

“OPNFV(Open Platform for NFV) 구성 요소”

OPNFV=

- + OpenStack : Cloud Computing
- + Ceph : Software Storage
- + KVM : Virtualization
- + Open vSwitch : Software Switch
- + Linux : Operating System
- + ODL : SDN Controller

Anatomy of OPNFV Components

“OPNFV 구성 요소들에 대해서 알아본다면”

	OpenStack	Ceph	KVM	Open vSwitch
시작 년도	2010년	2007년 이전	2007년 이전	2007년 (공식은 2009년)
최초 개발	NASA, RackSpace	Sage Well (박사학위논문)	Kivity	-
관리 주체	OpenStack Founcation	RedHat	Open Virtualization Alliance	openvswitch.org
참여 기관	500여사	-	200여사	-
개발 언어	Python	C++, Perl	C	C

Anatomy of OPNFV Components

“정책면에서 OPNFV는 2015년생. 기술면에서도?”

OPNFV=

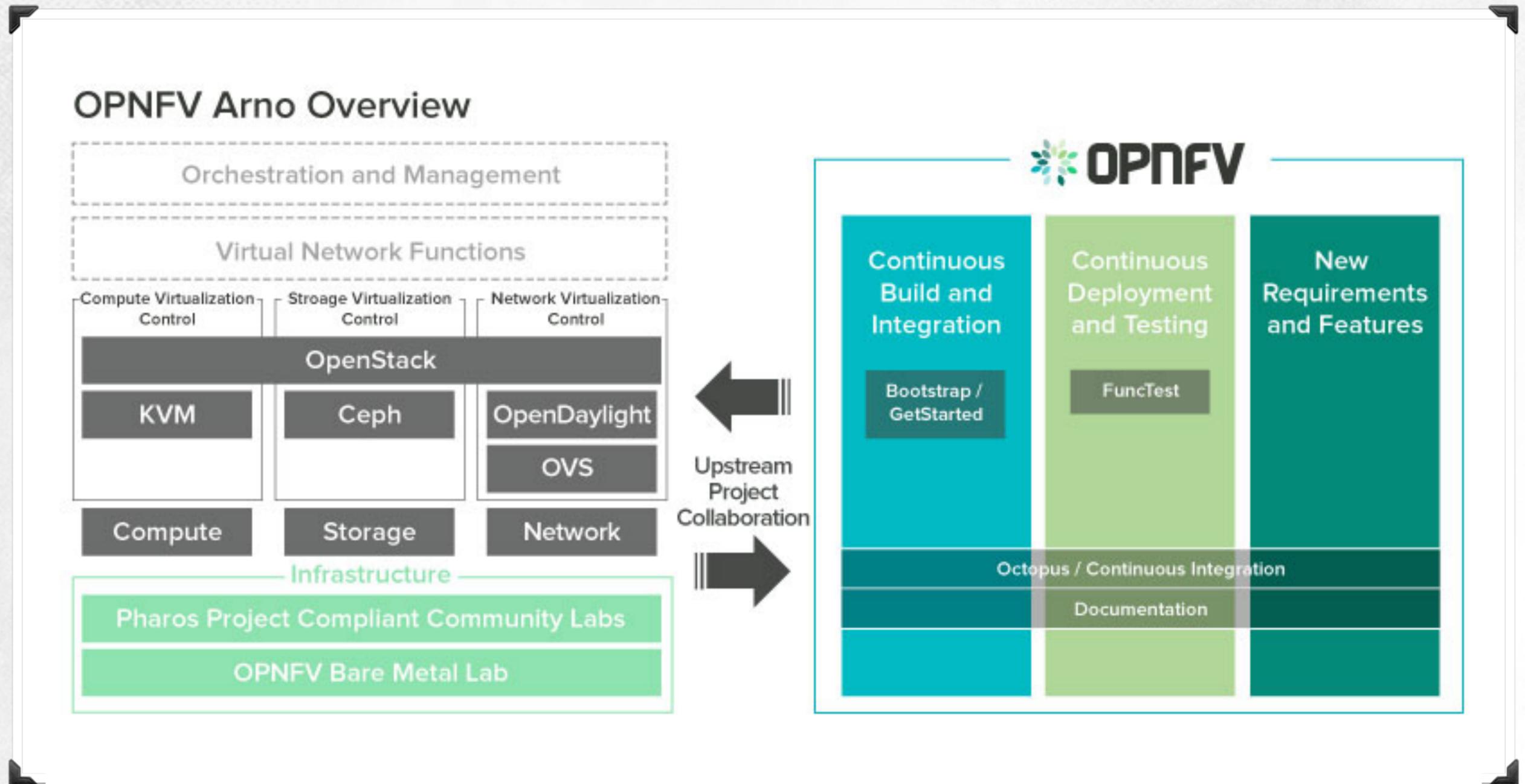
- + Linux
- + Ceph
- + OpenFlow
- + Open vSwitch
- + KVM
- + OpenStack

New Born?

- : 1991
- : 2007
- : 2007
- : 2007 (or 2009)
- : 2007
- : 2010

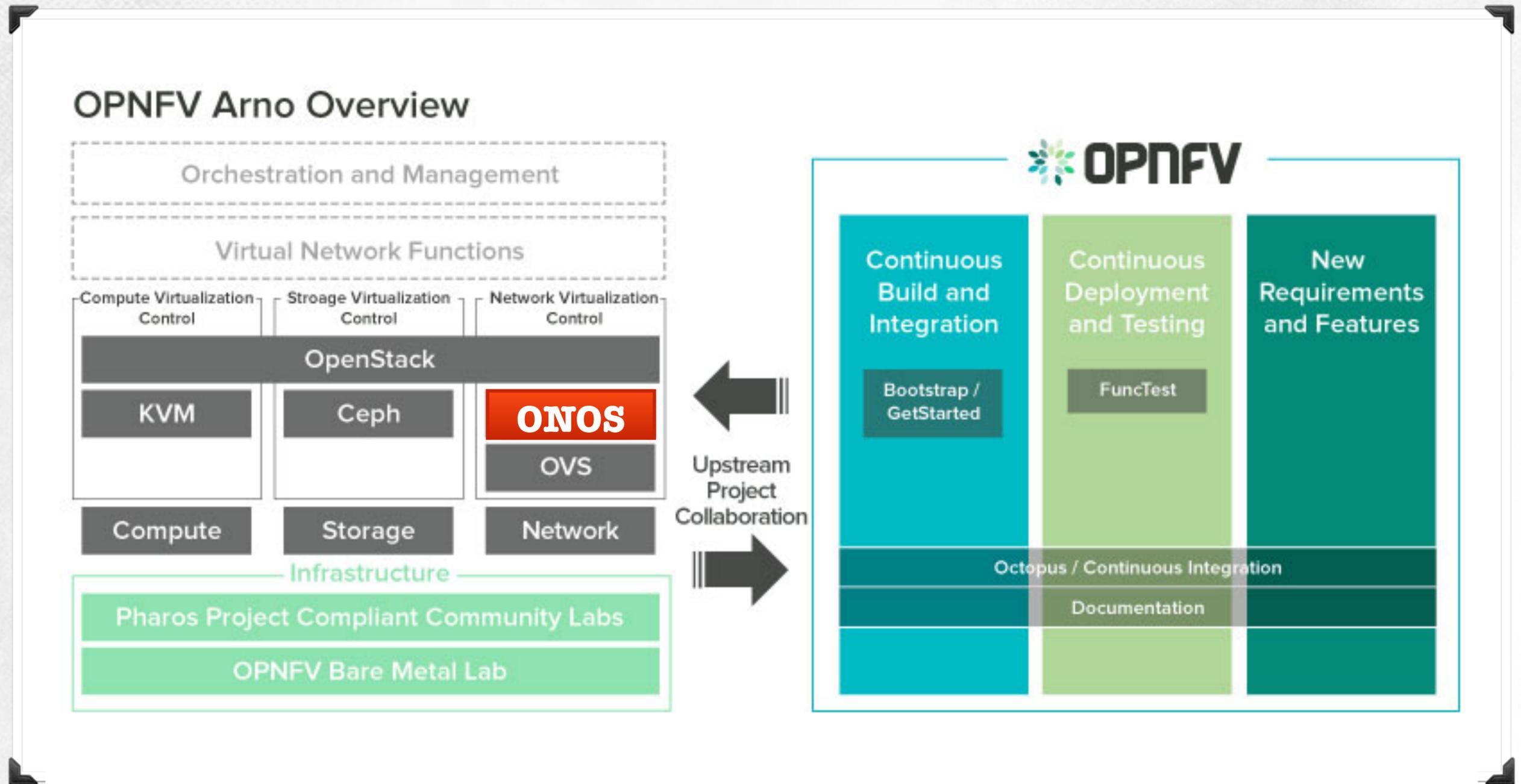
Today's SDI

TYPE #1: Telco Friendly Approach



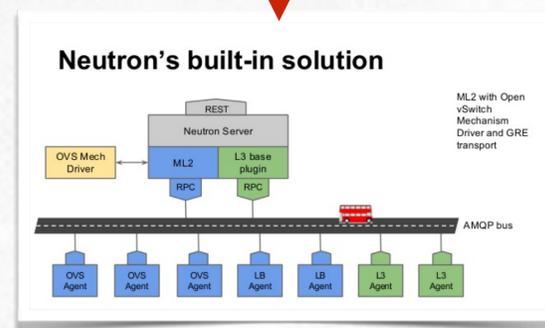
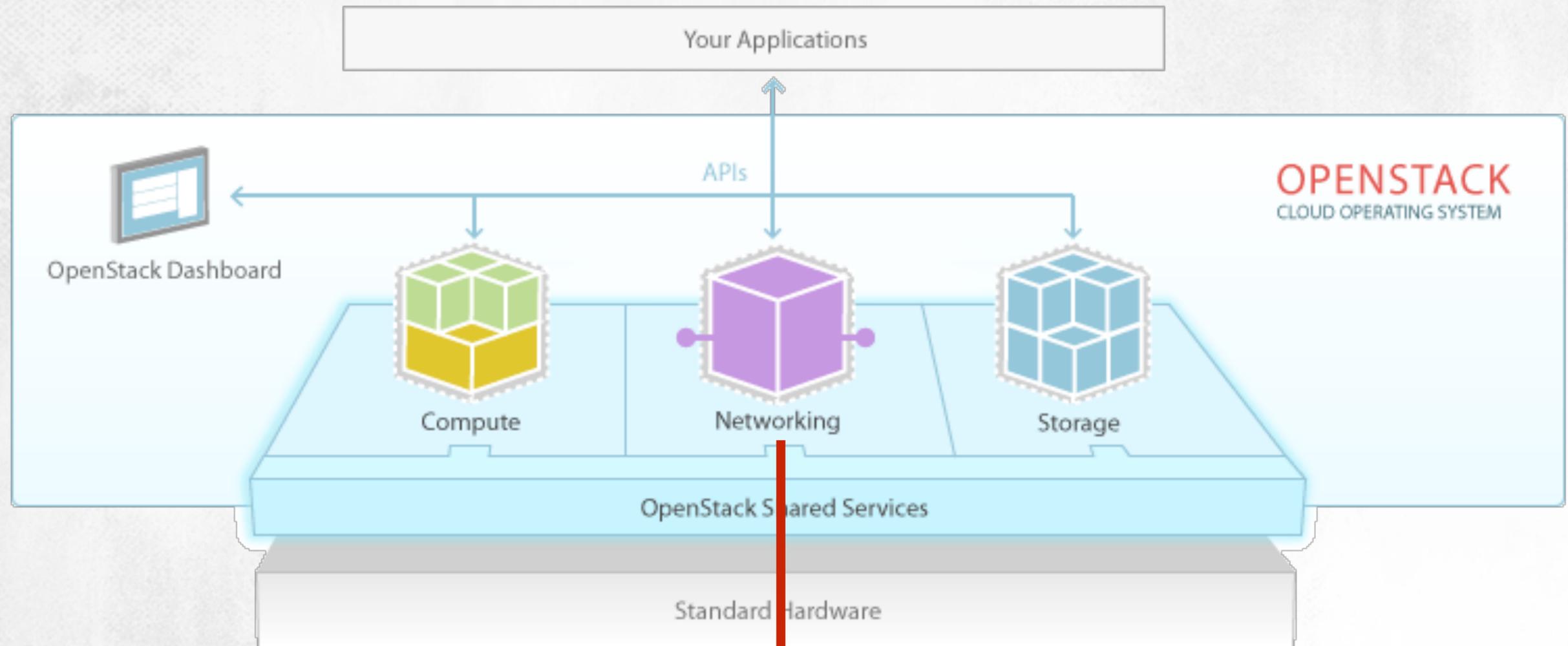
Today's SDI

TYPE #2: Telco Friendly Approach (**ONOS** replacing ODL)



Today's SDI

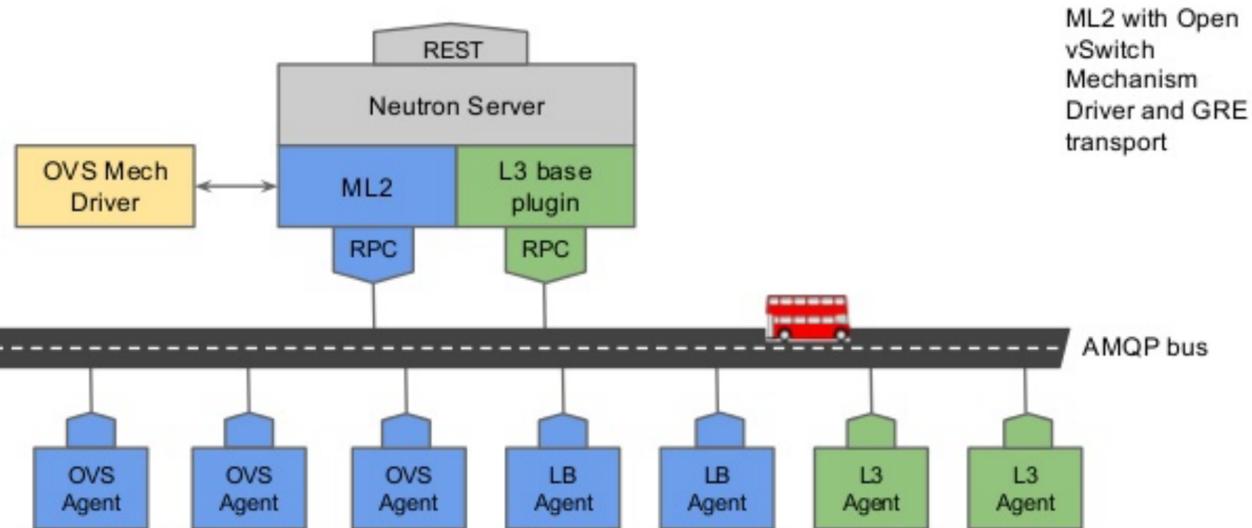
TYPE #3: IT Friendly Approach (Network as a Service)



Today's SDI

TYPE #3: IT Friendly Approach (Network Abstraction)

Neutron's built-in solution



- [Open vSwitch Plugin](#)
- [Cisco UCS/Nexus Plugin](#)
- [Cisco Nexus1000v Plugin](#)
- [Linux Bridge Plugin](#)
- [Modular Layer 2 Plugin](#)
- [Nicira Network Virtualization Platform \(NVP\) Plugin](#)
- [Ryu OpenFlow Controller Plugin](#)
- [NEC OpenFlow Plugin](#)
- [Big Switch Controller Plugin](#)
- [Cloudbase Hyper-V Plugin](#)
- [MidoNet Plugin](#)
- [Brocade Neutron Plugin](#)
- [PLUMgrid Plugin](#)
- [Mellanox Neutron Plugin](#)
- [Embrane Neutron Plugin](#)
- [IBM SDN-VE Plugin](#)
- [CPLANE NETWORKS](#)
- [Nuage Networks Plugin](#)
- [OpenContrail OpenContrail Plugin](#)
- [Extreme Networks Plugin](#)
- [Ruijie Networks Plugin](#)
- [Juniper Networks Neutron Plugin](#)
- [Calico Neutron Plugin](#) ([docs](#))

Why SDI at Today ?

“미래를 위해서는 이제라도 제대로된 접근법이 필요하다”

우리는 뭘한거지?

OpenFlow Protocol을 제외하고
네트워킹을 연구/개발하는 사람이 한게 뭔가?

Back to the BASIC

“다시 처음으로 돌아가서, 과거를 토대로 미래를 준비해 보자”

네트워킹은 수단인가 목적인가?



SDN/NFV



현)네트워킹 기능의 가상화가 우리의 목표인가?

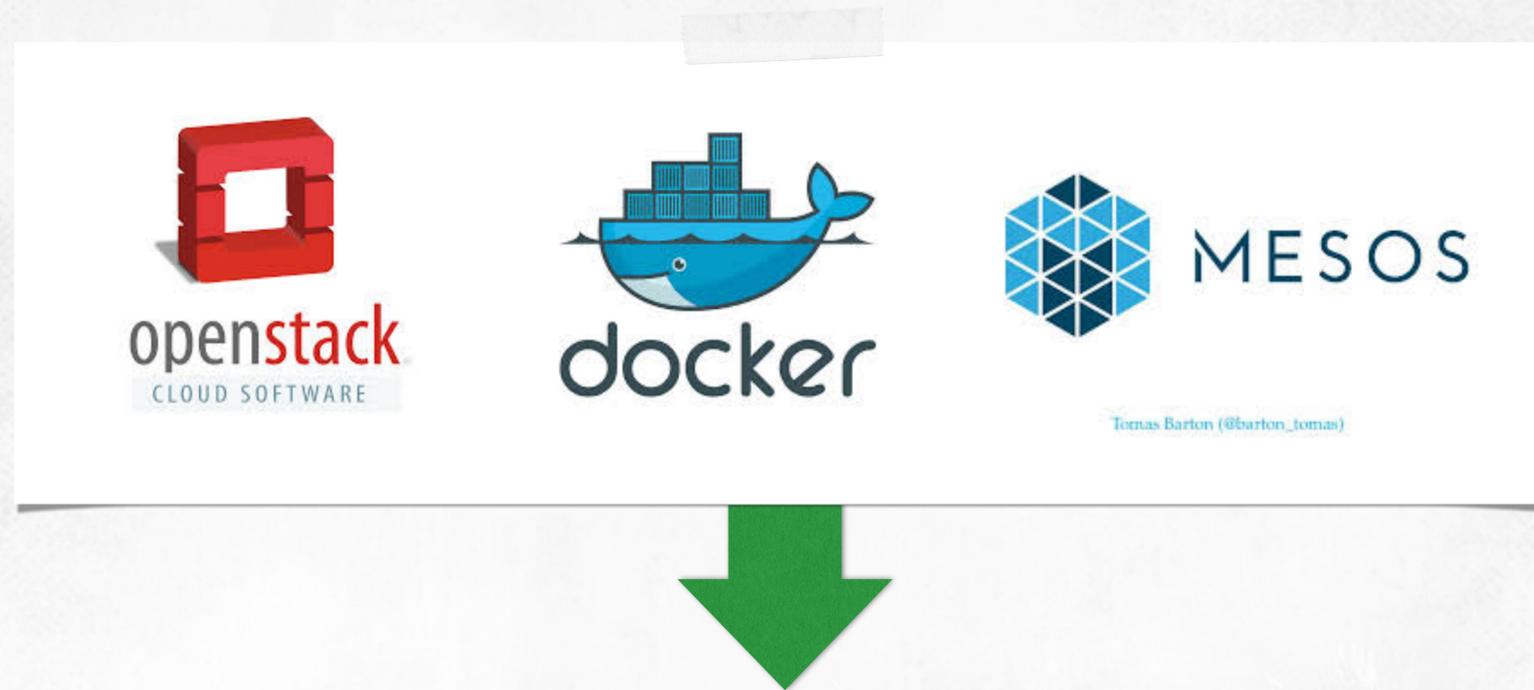
Back to the BASIC

“한정된 분야를 가르키는 단어를 버리고 다시 처음으로 가보자”

Computing
Storage
Networking
Orchestration

Computing

Beyond Server-Virtualization: Job & Service Scheduling



Computing

“모두가 서버 가상화를 원하지는 않는다”

“When Apple moved to bare metal with Mesos, one of the big reasons why they did it was, first, they did not need the virtual machines and, second, they got a big performance improvement. The virtualization tax that we often talk about is very real and for Apple it was on the order of 30 percent.”

OpenStack

Case A

OpenStack

Case B

OpenStack

Case C

OpenStack

Case D

MESOS

Case E

docker

Case F

Networking

L3 Rising: IP Routing in SDN & Datacenter-Networking



Calico has redefined the way to build out data center networks using a pure Layer 3 approach that is simpler, higher scaling, better performing and more efficient than the standard approach of using overlay networks.

Through environment specific plug-ins, calico integrates seamlessly with cloud orchestration systems such as OpenStack and Docker to provide networking between local and geographically distributed workloads.

Removing the packet encapsulation associated with the standard Layer 2 solution simplifies diagnostics, reduces transport overhead and improves performance.

The Calico approach of using a pure IP network combined with BGP for route distribution allows internet scaling for virtual networks.

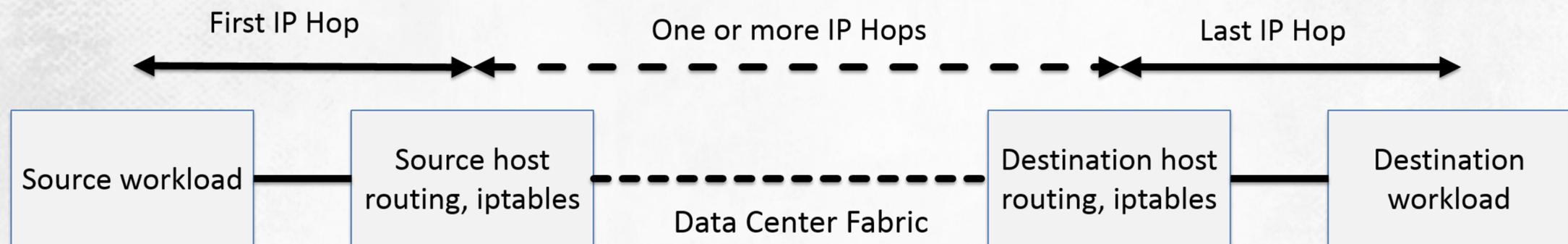
Neuron Initiative

Project Calico is part of Metaswitch's Neuron Initiative, a path toward intelligent network function virtualization for network operators. The Neuron Initiative delivers a framework for NFV by combining a foundation for intelligent virtualization with a realistic approach to SDN-centric, high-scale data center and wide area infrastructures that meet both the technical and business challenges of this emerging carrier architecture. For more on Metaswitch's Neuron Initiative, please visit: <http://www.metaswitch.com/nfv>.

Networking

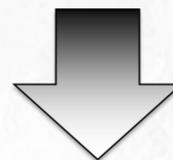
L3 Rising: IP Routing in SDN & Datacenter-Networking

Connectivity through IP Routing



Scalability, Performance and Simplicity

Outer MAC	Outer IP	Outer UDP	VXLAN	VM			
			N	MAC	IP	TCP/UDP	Data



Host	VM		
MAC	IP	TCP/UDP	Data



Networking

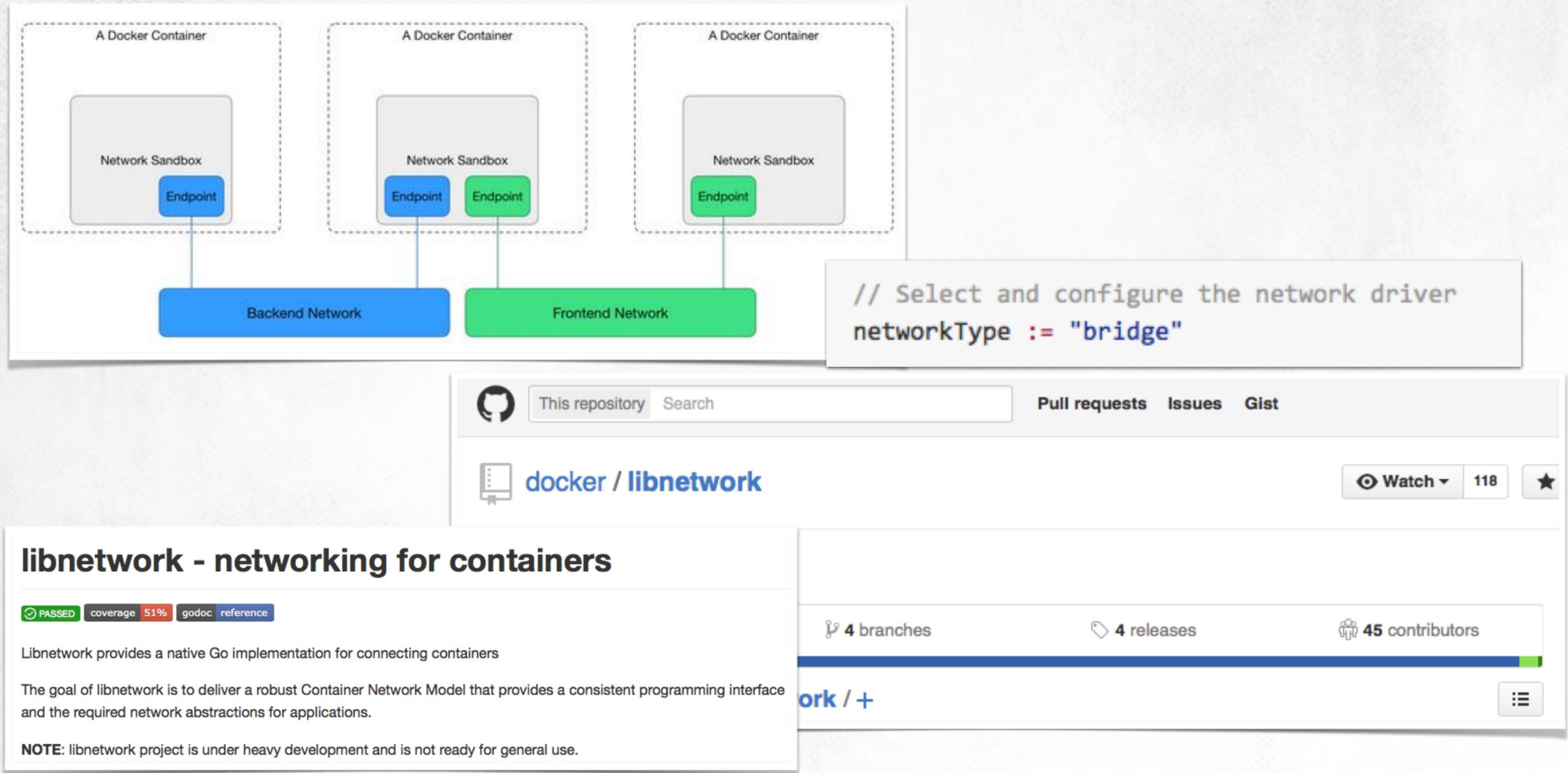
L3 Rising: IP Routing in SDN & Datacenter-Networking



L2 Approach	L3 Approach
<ul style="list-style-type: none">• Scale challenges above few hundred servers / thousands of workloads.• Difficult to troubleshoot due to packet encapsulation.• On/off-ramp device (or virtual router hop) required to access non-virtualized devices.• Every node in the network is state-heavy (e.g. VLANs, tunnels).• Virtual NAT device required to connect a workload to a public “floating IP”.• High availability / load balancing across links requires additional LB function and/or app-specific logic.• Geographically distributed data centers require inter-DC tunnels.• CCNA or equivalent required to understand end-to-end networking	<ul style="list-style-type: none">• Scale to millions of workloads with minimal CPU and network overhead• What is happening is “obvious” – traceroute, ping, etc., work as expected; routing and ACL rules tell you everything you need to know• Path from workload to non-virtualized device is just a route• Physical fabric is state-light (standard IP forwarding only)• External connectivity is achieved by assigning a public IP• Equal Cost Multi-Path (ECMP) any Anycast just work, enabling scalable resilience and full utilization of physical links• Traffic between data centers is natively L3 routed• Basic IP networking knowledge only required

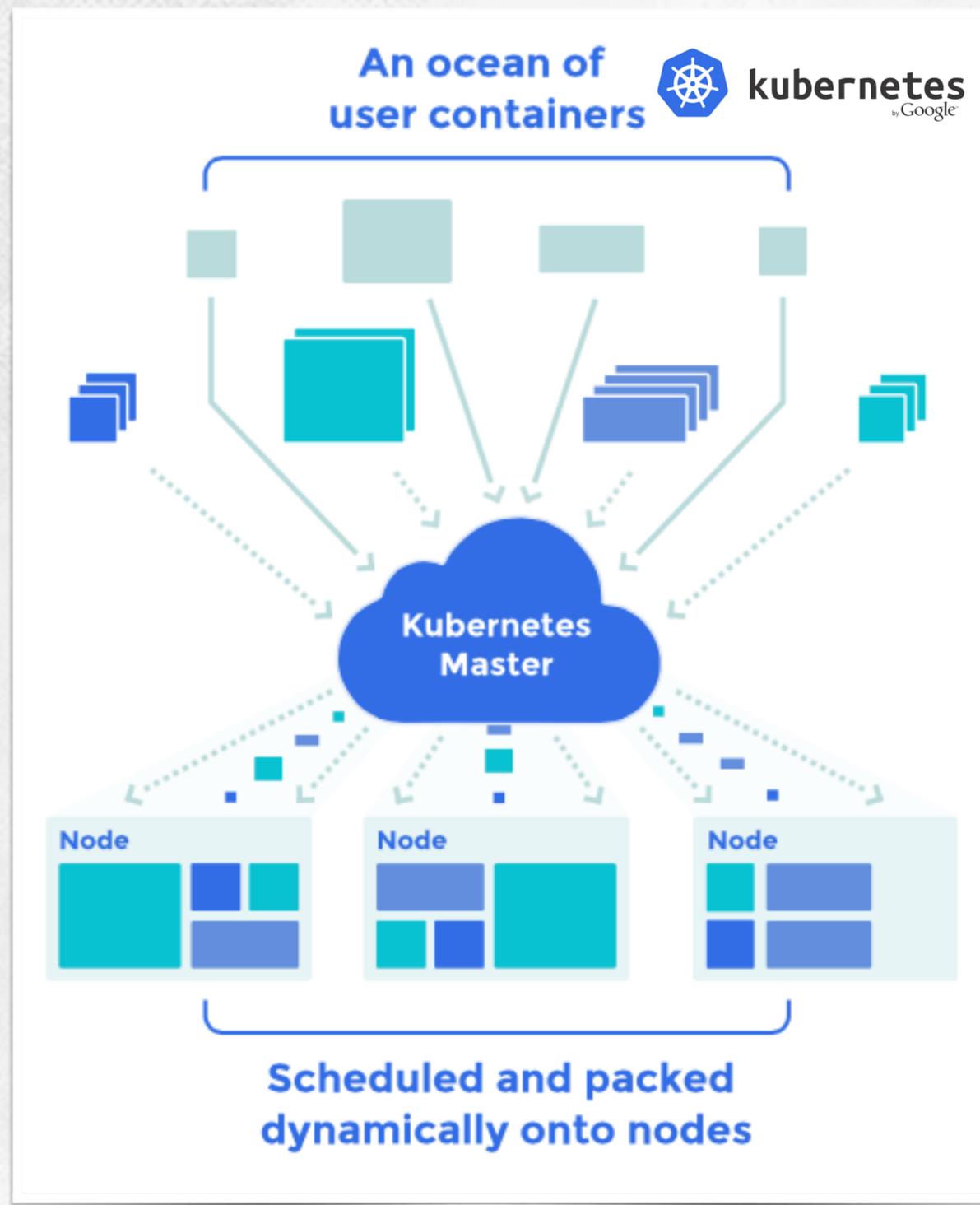
Networking

Container Networking: Docker Container Network Model, libnetwork



Orchestration

Orchestrate WHAT?



What is Mesos?



A distributed systems kernel

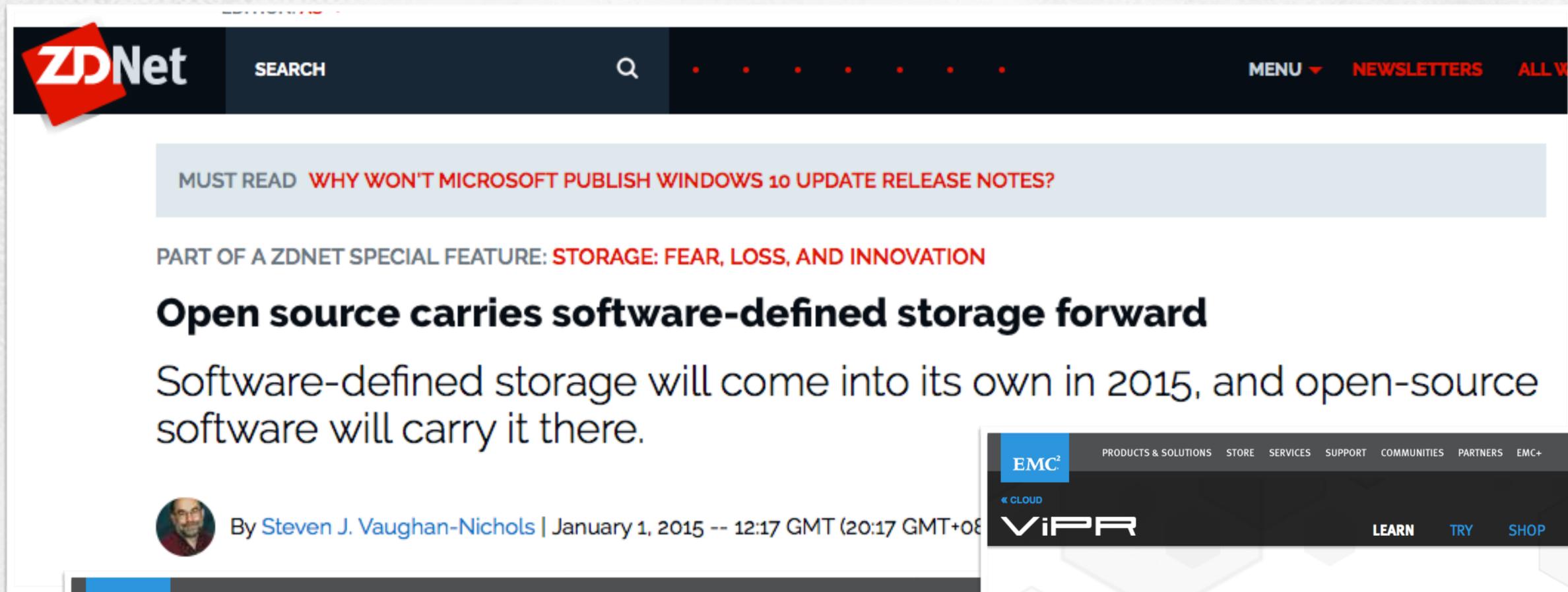
Mesos is built using the same principles as the Linux kernel, only at a different level of abstraction. The Mesos kernel runs on every machine and provides applications (e.g., Hadoop, Spark, Kafka, Elastic Search) with API's for resource management and scheduling across entire datacenter and cloud environments.

Project Features

- Scalability to 10,000s of nodes
- Fault-tolerant replicated master and slaves using ZooKeeper
- Support for Docker containers
- Native isolation between tasks with Linux Containers
- Multi-resource scheduling (memory, CPU, disk, and ports)
- Java, Python and C++ APIs for developing new parallel applications
- Web UI for viewing cluster state

Storage

COMING: Open Source Storage, Software Defined Storage



ZDNet SEARCH MENU NEWSLETTERS ALL W

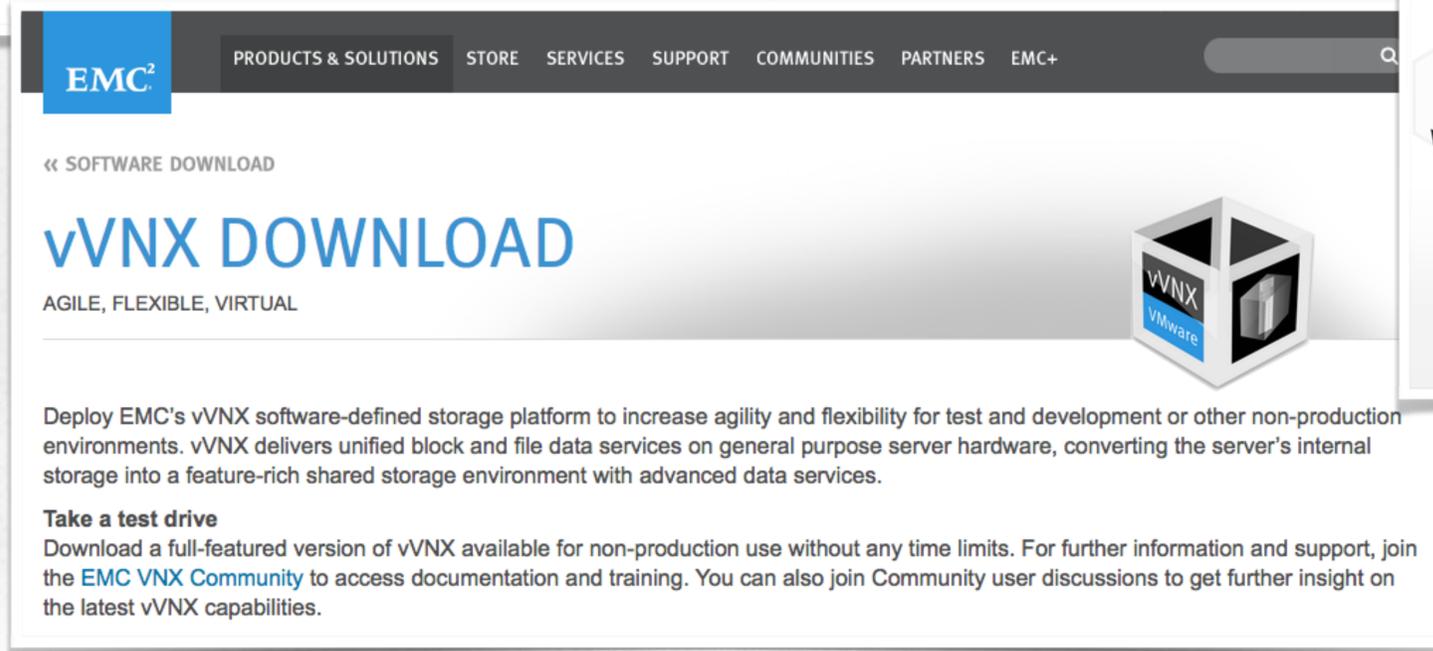
MUST READ **WHY WON'T MICROSOFT PUBLISH WINDOWS 10 UPDATE RELEASE NOTES?**

PART OF A ZDNET SPECIAL FEATURE: **STORAGE: FEAR, LOSS, AND INNOVATION**

Open source carries software-defined storage forward

Software-defined storage will come into its own in 2015, and open-source software will carry it there.

By  Steven J. Vaughan-Nichols | January 1, 2015 -- 12:17 GMT (20:17 GMT+08)



EMC² PRODUCTS & SOLUTIONS STORE SERVICES SUPPORT COMMUNITIES PARTNERS EMC+

« SOFTWARE DOWNLOAD

vVNX DOWNLOAD

AGILE, FLEXIBLE, VIRTUAL



Deploy EMC's vVNX software-defined storage platform to increase agility and flexibility for test and development or other non-production environments. vVNX delivers unified block and file data services on general purpose server hardware, converting the server's internal storage into a feature-rich shared storage environment with advanced data services.

Take a test drive
Download a full-featured version of vVNX available for non-production use without any time limits. For further information and support, join the [EMC vVNX Community](#) to access documentation and training. You can also join Community user discussions to get further insight on the latest vVNX capabilities.



EMC² PRODUCTS & SOLUTIONS STORE SERVICES SUPPORT COMMUNITIES PARTNERS EMC+

« CLOUD SUPPORT

ViPR

LEARN TRY SHOP TECHNICAL COMMUN



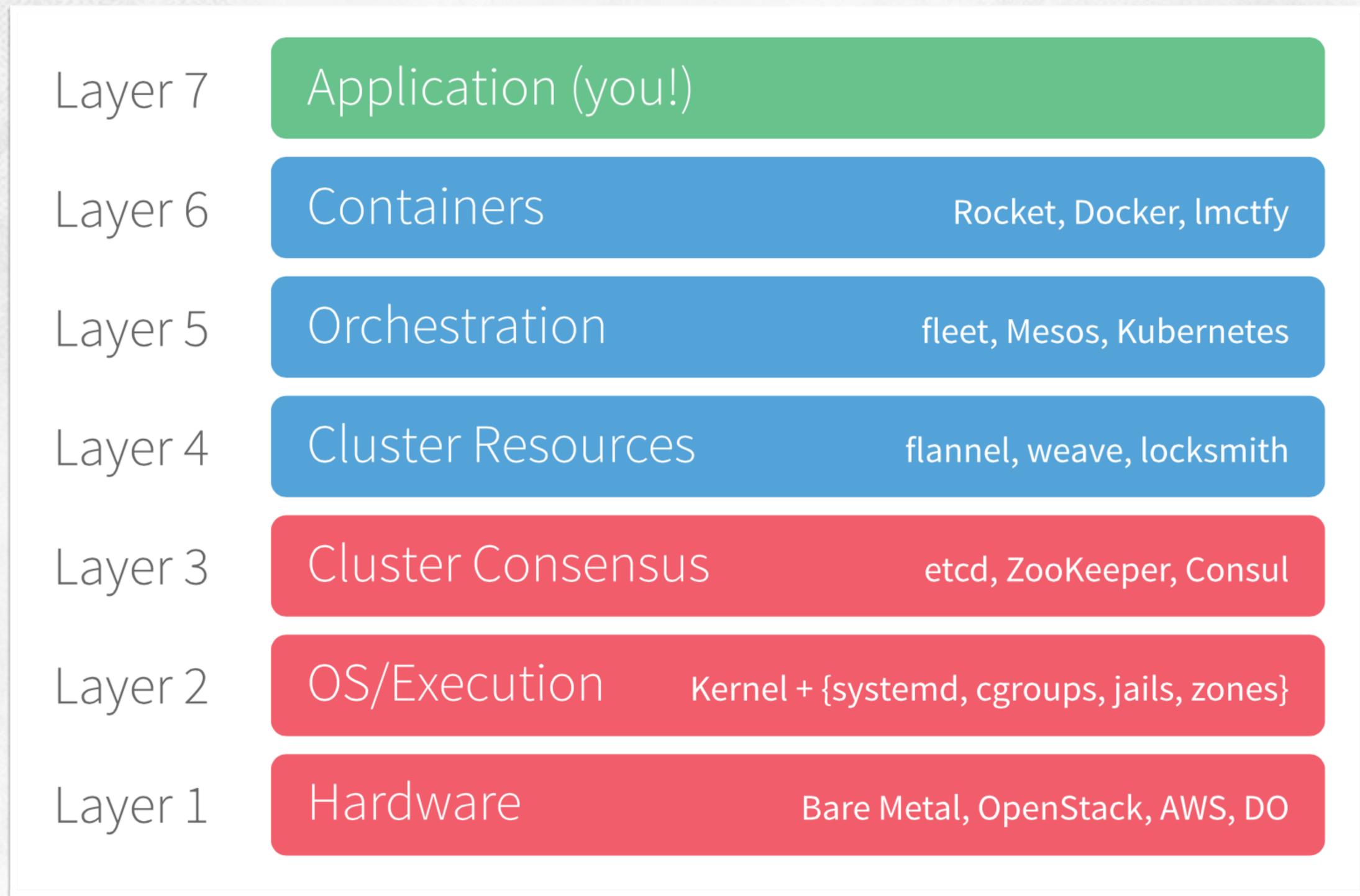
SOFTWARE-DEFINED STORAGE

EMC provides intelligent software-defined storage solutions that help organizations drastically reduce management overhead through automation across traditional storage silos and pave the way for rapid deployment of fully integrated next generation scale-out storage architectures.

[Data Sheet](#) [Interactive Demo](#)

New OSI Layer

Datacenter Oriented View



Keep the Frame !

“SDN/NFV가 중요한 것이 아니고, 우리가 사용할 기술의 Category가 중요”

Computing
Storage
Networking
Orchestration

SDI 목적

“SDI는 어떤 문제를 해결해야 할까?”

Telco	IT
내가 가진 네트워크의 제어 및 관리	내가 하고 싶은 서비스를 위한 Computing 및 Storage 자원의 연결

SDI 방향 정의

“SDI 도입은 어떤 방향으로 추진되어야 하는가?”

Telco	IT
필요한 SDI 기술을 어떻게 빠르고 안정적으로 도입할 수 있을까?	어떻게 무선/이동 통신 네트워킹을 내 맘대로 사용할 수 있을까?
어떻게 새로운 서비스를 만들어서 수익을 창출 할 수 있을까?	어떻게 단말을 제어하여 새로운 서비스를 창출할 수 있을까?

Wireless: Open Source Cellular

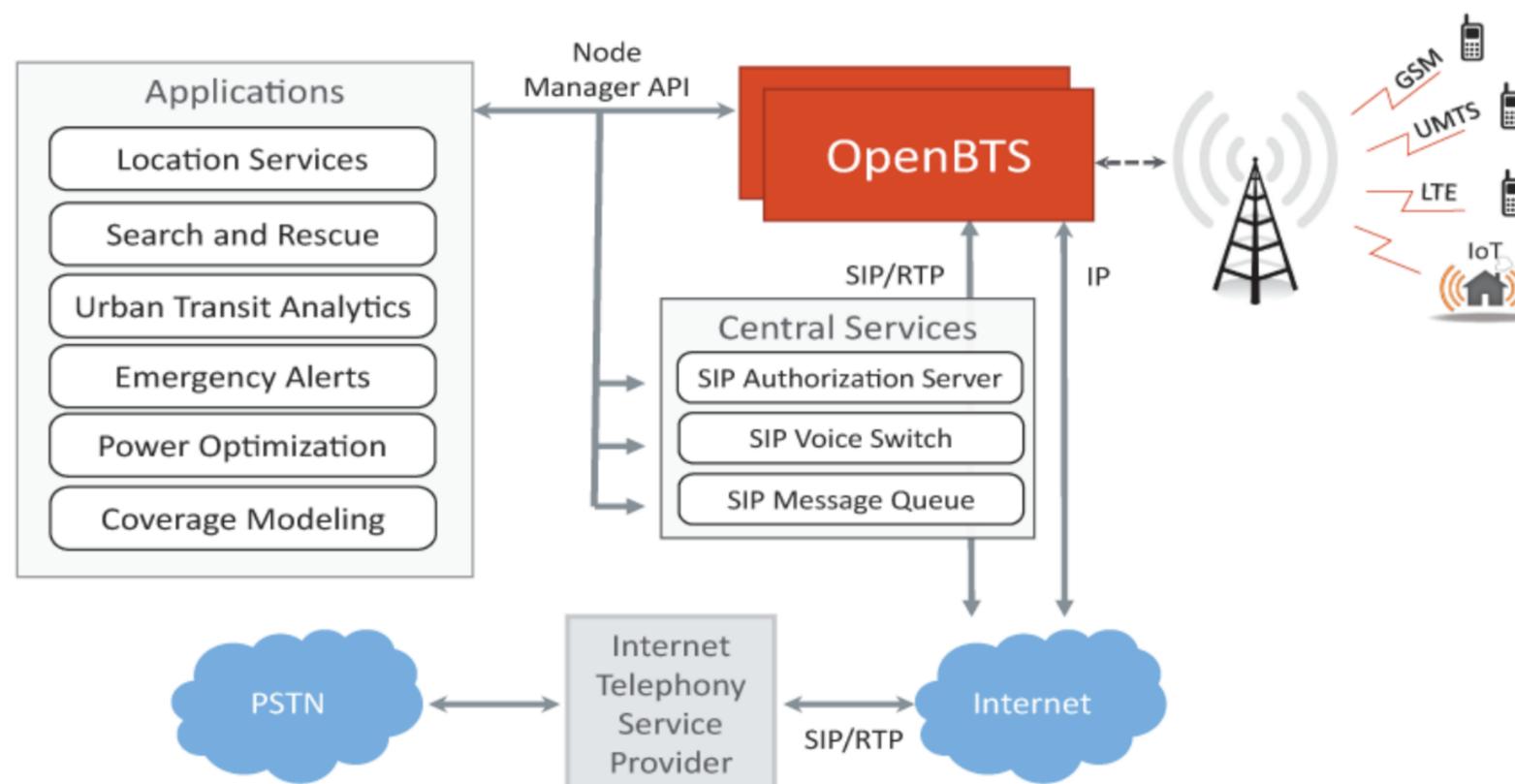
No New Thing ... But Growing Up

A Platform for Innovation

The OpenBTS software is a Linux application that uses a software-defined radio to present a standard 3GPP air interface to user devices, while simultaneously presenting those devices as SIP endpoints to the Internet. This forms the basis of a new type of wireless network which promises to expand coverage to unserved and underserved markets while unleashing a platform for innovation, including offering support for emerging network technologies, such as those targeted at the Internet of Things.

Internet Simplicity, Flexibility & Costs:

- It's all software, it's all IP, and it's open for innovation.
- A handset or modem appears as a SIP device, without the need for any special software on the device.
- For small networks, the network hardware can be reduced to a single commodity server with a software-defined radio.
- Any IP connection can serve as backhaul, including point-to-point WiFi.
- All of the software runs on Linux and connects with commonly used IP protocols, so the core network can be virtualized as a cloud service.
- Proprietary software found in a conventional cellular network can be replaced with open-source applications.
- Because the new network is based on IETF internet-age protocols, developers do not require additional training to deal with archaic legacy technologies.



OPENAIR5GLAB AT EURECOM

The openair5GLAB@EURECOM provides truly open-source solutions for prototyping 5th generation mobile networks and devices

Open-source has made a very significant impact in the extremities of current networks, namely in the terminals due to the Android ecosystem and in cloud infrastructure due, in part, to the OpenStack ecosystem (<http://www.openstack.org/>). EURECOM has recently created the OpenAirInterface (OAI) Software Alliance (OSA), a separate legal entity from EURECOM, which aims to provide a similar ecosystem for the core (EPC) and access-network (EUTRAN) of 3GPP cellular systems with the possibility of interoperating with closed-source equipment in either portion of the network.

In addition to the huge economic success of the open-source model, the alliance will be a tremendous tool used by both industry and academia. More importantly it will ensure a much-needed communication mechanism between the two in order to bring academia closer to complex real-world systems, which are controlled by major industrial players in the wireless industry. In the context of the evolutionary path towards 5G, there is clearly the need for open-source tools to ensure a common R&D and prototyping framework for rapid proof-of-concept designs.

The EPC software is known as openairCN, while the access-network software goes under the name of openair5G. OAI currently provides a standard-compliant implementation of a subset of Release 10 LTE for UE, eNB, MME, HSS, SGW and PGW on standard Linux-based computing equipment (Intel x86 PC architectures). The majority of the software is freely distributed by the OSA under the terms stipulated by a new open-source licence catering to the intellectual property agreements used in 3GPP, which allows contributions from 3GPP members holding patents on key procedures used in the standard. The team is working closely with ETSI to harmonise the software licence with the intellectual property policy of 3GPP. The software can be used in conjunction with standard RF laboratory equipment available in many labs (e.g. National Instruments/Ettus USRP and PXle platforms), in addition to custom RF hardware provided by EURECOM, to implement these functions to a sufficient degree to allow for real-time interoperation with commercial devices.

Some industrial users have working OAI-based systems integrated with commercially-deployable remote radio-head equipment (e.g. Alcatel-Lucent Bell Labs, China Mobile) and have provided demonstrations at major industrial tradeshows (Mobile World Congress Asia 2014, Mobile World Congress Barcelona in 2014/2015, IMIC 2013). The current major industrial users of OAI for collaborative projects are Alcatel-Lucent, China Mobile, TCL, Thales, National Instruments, Orange, Intel, TCS, Canonical, Ercom, Keysight, Malaysia Telecom, Telecom Italia, Swisscom, and ARELIS (Thomson Broadcast). Leading research centres using and

contributing to the software development include B-COM, Fraunhofer IIS, Fraunhofer FOKUS, IMST, TNO, Winlab, ITRI, and many other university labs worldwide.

Although OAI is now a collaborative effort spanning the globe, EURECOM will remain the driving force behind the OpenAirInterface Software Alliance and will lead in the definition of its scientific strategy. The primary future objective is to use OAI to foster innovation in the 5G standardisation process and to bring the academic world closer to 3GPP. We aim first to consolidate relationships through the OAI Software Alliance with national partners (e.g. ALU, Orange, Ercom, B-COM, CEA-List, CEA-Leti and IMT) through project funding programmes like FUI from the Ministry of Industry, or the ANR programmes from the Ministry of Research. In addition, we aim to make OAI technology available to small enterprises to accelerate development of 3GPP-based systems in France with the help of FUI and other similar projects. The European dimension aims at partnerships within European framework programmes (H2020 and Celtic+) and we target collaboration with the best research institutes (e.g. Fraunhofer, IMST, TNO, etc.). Several such labs are already using the software and building projects with us at the European level to benefit from it. We expect to play a significant role in the second phase of the 5GPPP.

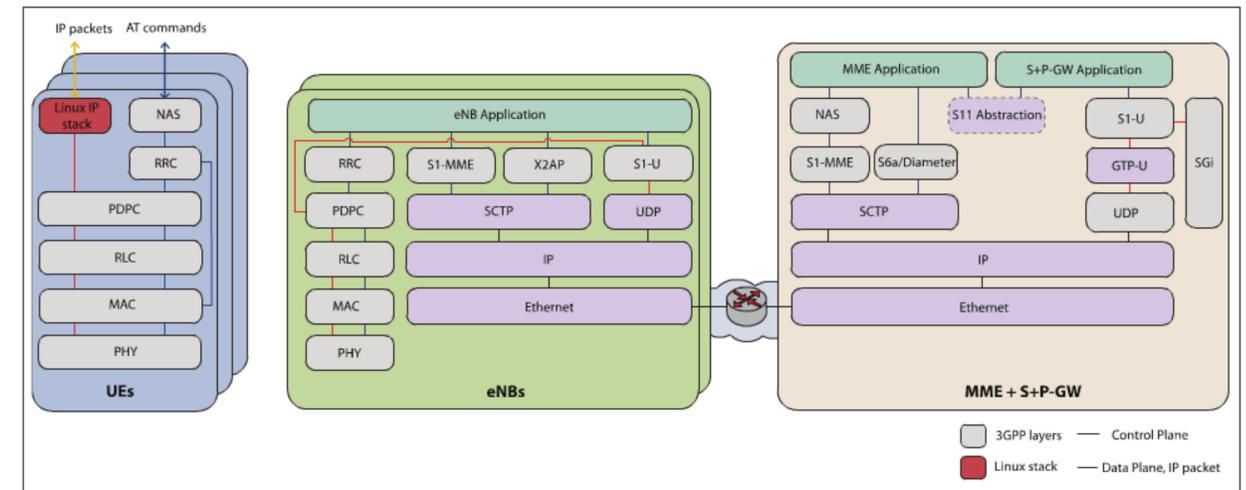
The key areas of the lab are outlined in the following sections.

'Softwarisation' of hardware and networking functions

This comprises areas such as network-function virtualisation (NFV), Cloud or Virtual Radio-Access Networks (CRAN), Software-Defined Networking (SDN) and Mobile Edge Computing (MEC). This is a key area of research identified for developing the networking architectures for future 4G and 5G systems. It is one of the pillars defined in the 5G framework laid out by the NGMN Alliance. Specific collaboration efforts include the FP7 Mobile Cloud Networking Project, and the National RADIS and ELASTIC projects. The lab also contributes to the 5GPPP (H2020 ICT-14) COHERENT project focusing on SDN and MEC in RAN and building a proof-of-concept prototype for a true programmable and sliceable RAN based on OAI. EURECOM, in collaboration with Canonical who is the distributor of the Ubuntu Linux distributions, has brought openairCN into Canonical's JuJu orchestration framework for OpenStack. This collaboration aims at a fully open-source demonstration of LTE-based NFV at the 2016 Mobile World Congress in Barcelona.

Internet of Things (IoT)

EURECOM began studying new core and access-network architecture in support of the IoT, especially to cater to low-end and energy-efficient devices, in the context of the LOLA FP7 project where it was project leader. Two national projects, WL-BOX



(FUI) and DataTweat (ANR) consider infrastructure elements of machine-type communications (MTC), in particular related to LTE-based gateways for MTC. These are key areas of research today in the context of 5G and a common theme in many of the 5GPPP projects. Several new paradigms for access-stratum protocols for massive numbers of low-cost terminals were considered and integrated in the OAI framework in the context of LOLA, and can be exploited to innovation demonstrations in upcoming 5G activities.

To this end, EURECOM is currently pursuing the integration of new waveforms (UF-OFDM) proposed by Alcatel-Lucent into the LTE uplink, while reusing some of the LOLA protocol development. A common experimentation framework for studying co-existence of IoT and broadband traffic in the same cell is planned in the coming months to showcase the efficiency of the new waveform and access-protocols. In the context of NFV and SDN, EURECOM will pursue specific architectural challenges for the support of IoT traffic.

Spatiotemporal signal processing

This work aims to enhance the knowhow of the OAI team in receiver design for multi-antenna transceivers operating at very high spectral-efficiency. Specifically we are addressing receiver strategies for 2-4 antenna terminals which operate either for point-to-point MIMO channels, multiuser-MIMO channels and interference channels. We aim to find computationally efficient algorithms for fixed-point processing under real-time processing constraints. We also consider distributed techniques in support of advanced relaying or distributed MIMO. This is work carried out in collaboration with Orange and Thales Communications in the context of the SHARING Celtic+ project.

Here we use OAI to innovate in the area of multi-relaying and device-to-device communications (D2D). We first investigate the use of multiple-relays for eMBMS single-frequency transmission to serve difficult to reach areas in a collaborative fashion. Secondly, the D2D scenario augments the OAI protocol stack to allow terminals to act as relays to offload content to other terminals using the uplink frequency. This is a somewhat more futuristic scenario than what is proposed in Rel-12/13 3GPP systems. Finally, OAI is being used to build an LTE-based

massive MIMO demonstrator, both using EURECOM experimental radios (ExpressMIMO2) as well as with partners facilities based on National Instruments hardware. Our main focus is on efficient ways to exploit channel reciprocity in massive antenna systems (32-64 antenna elements).

Networks for experimentation

This research item addresses the use of OAI in infrastructure deployment for remote experimentation. This is addressed firstly at a regional level through Com4Innov, then in a European dimension through our involvement in the FIRE+ and finally in a North American level via GENI. Com4Innov is an experimental 4G network deployed in Sophia Antipolis using commercial Ericsson basestations and core network. We have access to the Ericsson core at Eurecom premises and have successfully interconnected it with OAI eNodeB's and commercial UEs. This opens the door to deployment of TD-LTE solutions (2.6 and 3.5GHz) on the SophiaTech campus in the coming months which can allow for experimentation with fully open-source basestations interconnected with a commercial core network.

EURECOM is involved in one central FIRE+ project, FLEX, which aims to interconnect OAI equipment with a commercial core at several sites (Volos, Gent) to allow for remote experimentation. Finally, OAI is currently one of the candidates for the cellular wireless components of the GENI research infrastructure in the USA. Several main labs in GENI are strong supporters of the software and are deploying test systems.



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<http://www.openairinterface.org/>
<http://www.eurecom.fr/>

One More: Instant Networking

Dawning of New DIY SDI

‘Toll-Free Network’

‘Wiring-Free Networking’

‘Anti-Cloud (= Localized)’

‘Server-less Communication’

What is Seeds ?

Raspberry Pi

OpenWrt & Linux

What is Seeds ?

Raspbian is the Foundation's official supported Operating System. Download it here, or use **NOOBS**, our easy installer for Raspbian and more.

THIRD PARTY OPERATING SYSTEM IMAGES

Third party images are also available:

- NOOBS
- RASPBIAN
- UBUNTU MATE
- SNAPPY UBUNTU CORE
- WINDOWS 10 IOT CORE
- OSMC
- OPENELEC
- PINET
- RISC OS

Ubuntu MATE for the Raspberry Pi 2

Martin Wimpress and Rohith Madhavan have made an Ubuntu MATE image for the Raspberry Pi 2 which you can download or build yourself.

The image is functional and based on the regular Ubuntu `armhf` base, not the new Snappy Core, which means that the installation procedure for applications is the same as that for the regular desktop version, ie using `apt-get`.

We have done what we can to optimise the build for the Raspberry Pi 2 and one can comfortably use applications such as LibreOffice, which in fact is a joy to use :) But the microSDHC I/O throughput is a bottleneck so **we recommend that you use a Class 6 or Class 10 microSDHC card**. If you build the image yourself we recommend you use the `f2fs` filesystem.

You'll need a microSD card which is 4GB or greater to fit the image. The file system can be resized to occupy the unallocated space of the microSD card, similar to Raspbian.

NOTE! There are no predefined user accounts. The first time you boot the Ubuntu MATE image it will run through a setup wizard where you can create your own user account and configure your regional settings. The first boot is quite slow, but once the first boot configuration is complete subsequent boots are much quicker.

Ubuntu MATE 15.10

Welcome to Ubuntu MATE! Thank you for joining our community. Each menu below will take you to a little page that will help to explain what Ubuntu MATE is, get you orientated with your new operating system and guide you through some initial configuration.

Documentation

- Introduction
- Features
- Getting Started

Support

- Community
- Chat Room
- Software

Project

- Get Involved
- Shop
- Donate

System Monitor

raspberrypi

"Ubuntu"

Release 15.10 (Wily Werewolf) 32-bit
Kernel Linux 4.1.10-v7+ armv7l
MATE 1.10.2

Hardware

Memory: 925.9 MiB
Processor: ARMv7 Processor rev 5 (v7l) x 4

System Status

Available disk space: 431.1 MiB

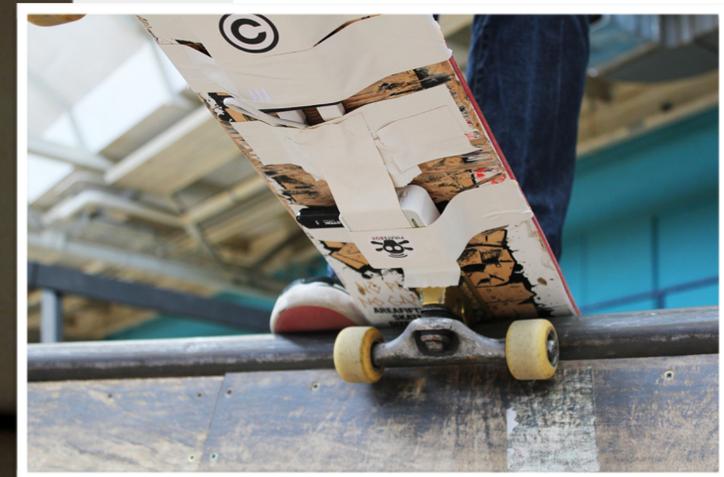
Ubuntu MATE 15.10 running on the Raspberry Pi 2.

PirateBox

PirateBox is a **DIY anonymous offline file-sharing and communications system** built with free software and inexpensive off-the-shelf hardware.

Learn More...

Build a PirateBox now!



What is the PirateBox?

PirateBox creates offline wireless networks designed for **anonymous file sharing, chatting, message boarding, and media streaming**. You can think of it as your very own **portable offline Internet in a box!**

How does it work?

When users join the **PirateBox** wireless network and open a web browser, they are automatically redirected to the **PirateBox** welcome page. Users can anonymously chat, post images or comments on the bulletin board, watch or listen to streaming media, or upload and download files inside their web browser.

RADICAL / NETWORKS

October 24-25, 2015
NYU Poly, Brooklyn, NY

From mass surveillance to the over-commercialization of the Internet, the technology that we depend upon for community and connection is being compromised. The recent accessibility of networking technology through devices such as the Raspberry Pi and software such as BATMAN Adv has made it affordable and possible for everyday citizens to learn how to design their own web servers and networks.

GOALS

- To understand how the technology can be used as a method of control and how to subvert that.
- Teach people how to use networking technology for themselves.
- Encourage creative and social exploration with computer networks.

IDEALS

- Promoting free and open networks built with free and open hardware and software.
- Decentralizing the control of where networks exist and what and whom are served by them.
- Maintaining control of our own content, hardware, and means of deployment.
- Community and free expression first.

In Partnership with

EYE BEAM

Hosted by



8th Floor, MAGNET
2 Metrotech Center
Brooklyn, NY 11201

TICKETS ON SALE NOW!





CASE STUDIES



STATISTICS



PICTURES



TRAINING PARTNERS

WIRELESS NETWORKING IN THE DEVELOPING WORLD

A practical guide to planning and building low-cost telecommunications infrastructure



Wireless Networking in the Developing World is a free book about designing, implementing, and maintaining low-cost wireless networks.

This book is a practical guide to designing and building wireless networks in local communities written by subject matter experts who have vast experience in deploying wireless networks in the field and connecting communities to the global Internet.

READ

DOWNLOAD

BUY



Pictures from Gambia



CASE STUDIES



OPEN TECHNOLOGY INSTITUTE

KYUNG HEE UNIVERSITY
Red Hook Initiative Wifi & Tidepools



AIRJALDI'S GARHWAL NETWORK

Building Sustainable networks in Rural In...



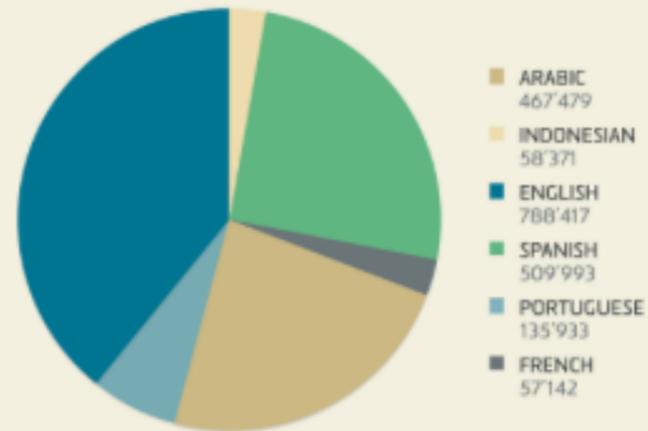
PISCES PROJECT

Solar Powered Wifi Links in Micronesia



UNIVERSITY OF GHANA

Campus Wireless Network

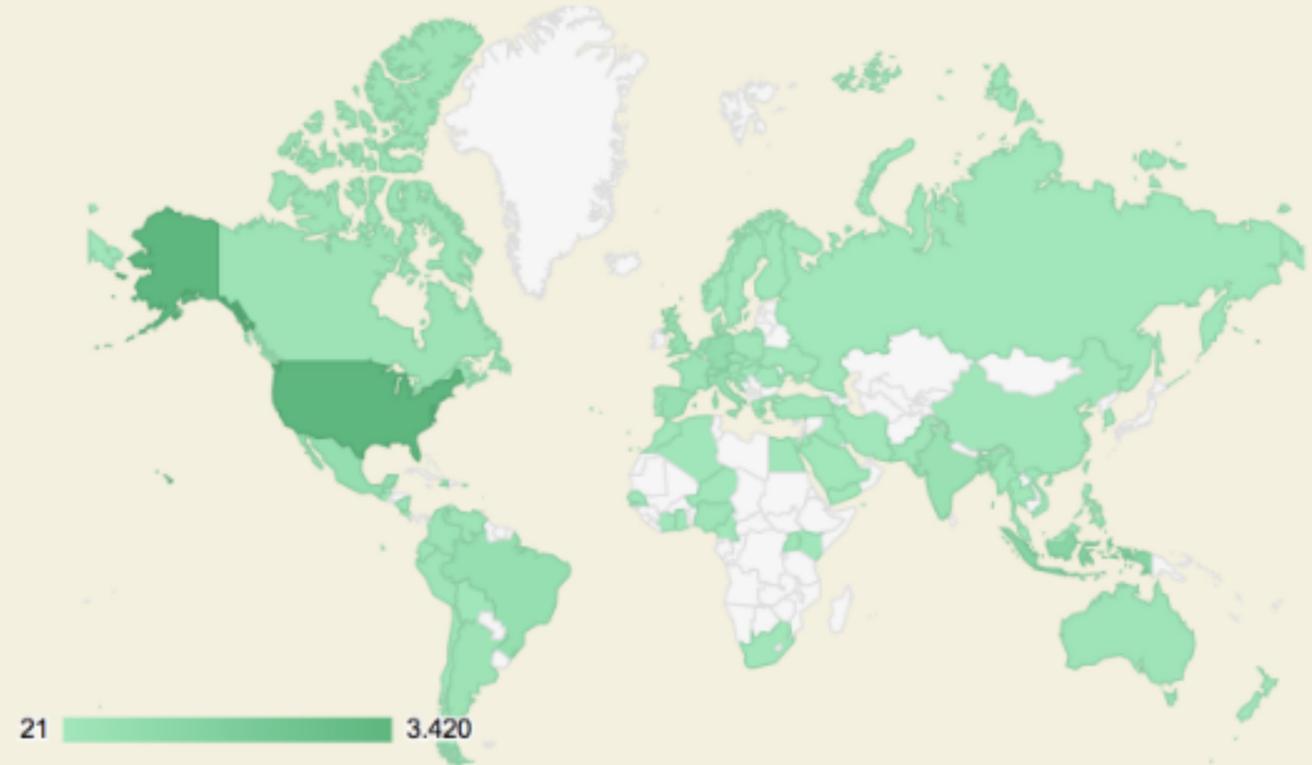


2'000'000 +

TWO MILLION PLUS DOWNLOADS OF THE 2ND EDITION

WNDW is available for free in seven languages. If you haven't checked it out already, download a copy for yourself.

THANK YOU.



WNDW

WIRELESS NETWORKING
IN THE DEVELOPING WORLD

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- Training Partners
- Glossary
- Links

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WIRELESS NETWORK IN DEVELOPING WORLD

A free book about designing, implementing, and maintaining low-cost wireless networks.

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개요

작업내역

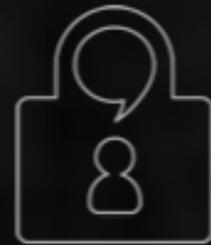
위키

Welcome to Open Mesh

This page serves as development platform for a collection of tools to build free and open mesh networks.

B.A.T.M.A.N.

B.A.T.M.A.N. (better approach to mobile ad-hoc networking) is a routing protocol for multi-hop ad-hoc mesh networks. This is the main development website, we have source code, binary packages, documentation and further information available:



A New Kind of Instant Messaging

With the rise of government monitoring programs, Tox provides an easy to use application that allows you to connect with friends and family without anyone else listening in. While other big-name services require you to pay for features, Tox is totally free and comes without advertising.

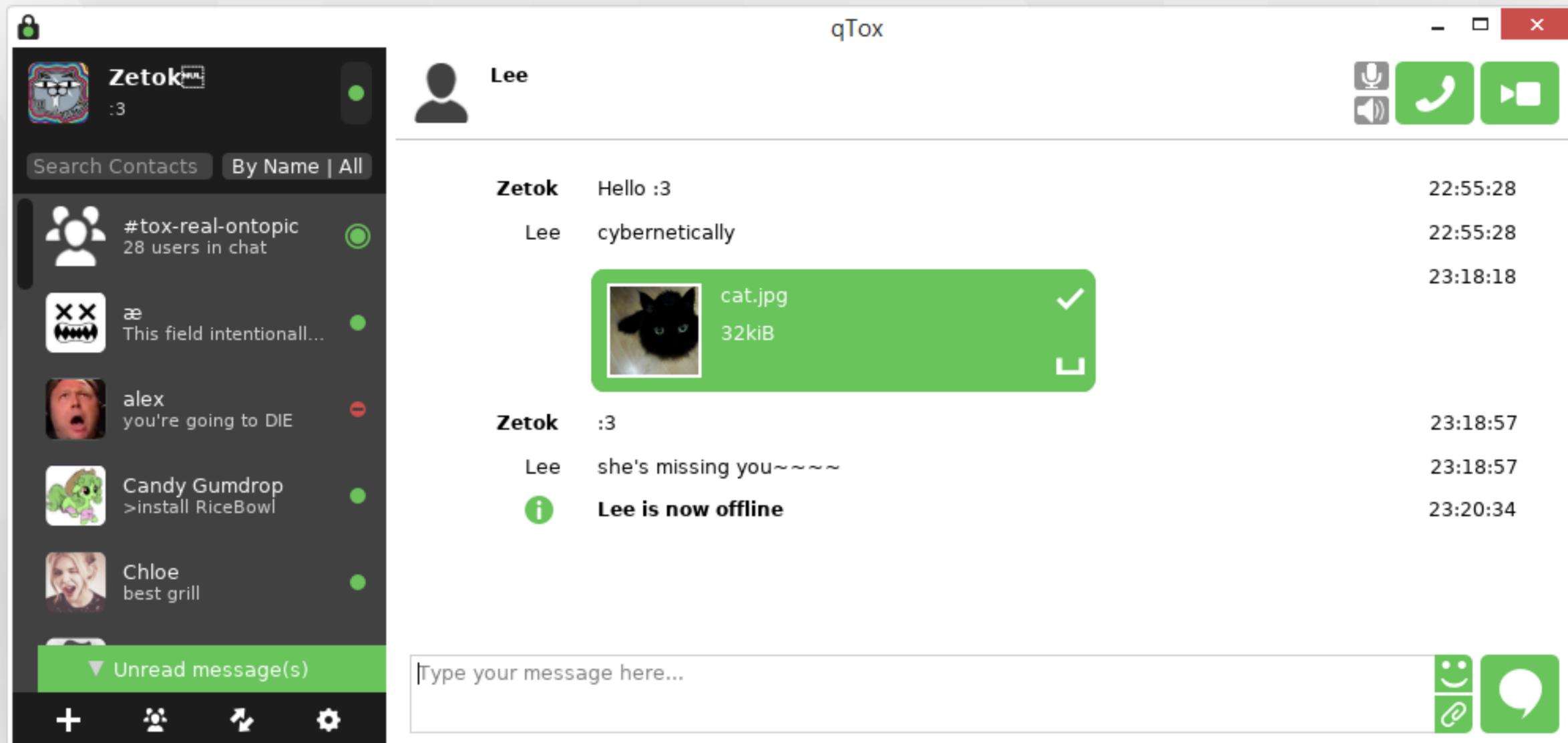
 Download Tox

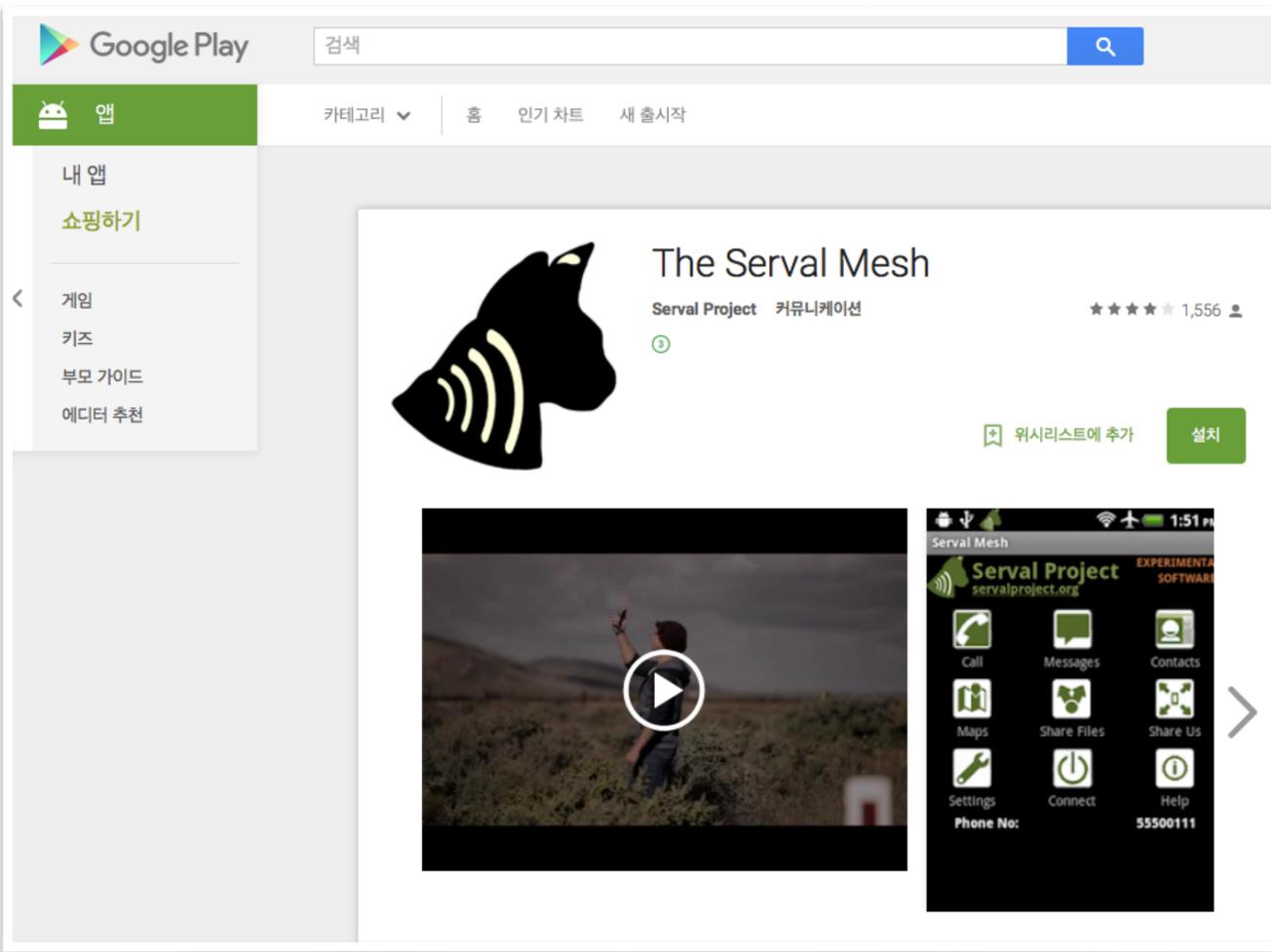
Other clients & platforms

Note: Tox is still under heavy development — expect to run into some bugs.

Instant messaging, audio calling and much more.

Send messages, files, create groups and make Tox to Tox audio and video calls. Securely.





Mobile phones normally can't be used when cellular networks fail, for example during a disaster. This means that millions of vulnerable people around the world are deprived of the ability to communicate, when they need it most.

We have spent the past four years working with the New Zealand Red Cross to create a solution. We call it the Serval Mesh, and it is free software that allows smart-phones to communicate, even in the face of catastrophic failure of cellular networks.

It works by using your phone's Wi-Fi to communicate with other phones on the same network. Or even by forming impromptu networks consisting only of mobile phones. Mesh communications is an appropriate technology for complementing cellular networks. Think of it like two-way radio or CB radio that has been propelled into the 21st century. For long-range communications you will still need to make use of cellular or fixed telephone networks or the internet.

This software allows you to easily make private phone calls, send secure text messages and share files in caves, in subways, in the Outback, in Australia or Africa, in Europe or the United States – even when cellular networks fail or are unavailable.

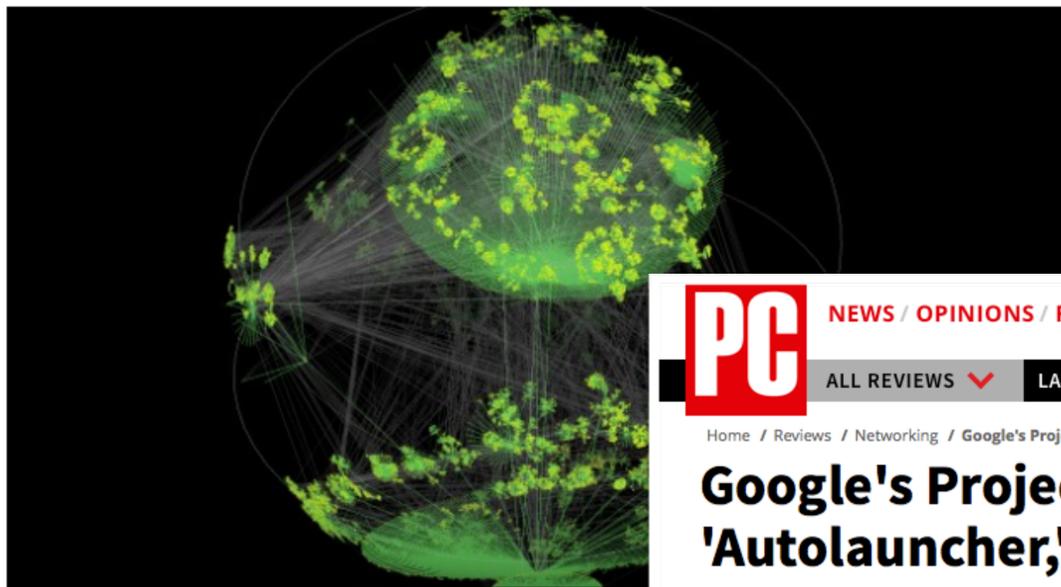
You can also keep using your existing phone number on the mesh, which is really important in a disaster when people are trying to get back in contact with each other.

Our software:

- * Is completely open and open-source; free for all
- * Can be carried and activated in seconds by those who need it when it is needed
- * Is carrier independent
- * Can be installed during an emergency from only one phone
- * Is distributed nature makes network resilient
- * Can use your existing phone number
- * Encrypts mesh phone calls and mesh text messages by default
- * Can distribute pictures, videos and any other files

What is mesh networking, and why Apple's adoption in iOS 7 could change the world

By Sebastian Anthony on March 24, 2014 at 2:29 pm | 37 Comments



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433
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seems that Google is working to add mesh networking to ubiquitous connectivity, mobile computing, and the growing is not hyperbolic to say that mesh networking could change ask, what is mesh networking? I'm glad you asked.

OpenSourceMesh.org

HOME OUR GOOGLE CHAT DOWNLOADS IMPORTANT LINKS YOUR EMAIL ABOUT US CONTACT

Hello!

Welcome to our rapidly developing group!!

This group is only a few weeks old and we have over 80 members and growing!! We need more programmers and those willing to trial and test new products! We are all volunteers! So we must be keen!!

What's New?

There's a voice

There's a voice that keeps on calling me. Down the road, that's where I'll always be. ...

Every stop I make

Every stop I make, I make a new friend. Can't stay for long, just turn around and I'm gone again. Maybe tomorrow, I'll want to settle down, Until tomorrow, I'll just keep moving on.

Our Downloads!

Yes we are moving fast! Antonio is working on the Batman/Robin software using the small boxes from Accton plus Ubiquiti units. Please read on [More...](#)

We are working hard on porting to all our old compaq and dell! [Links](#) here with info at our [Downloads](#) page or at [x86 section...](#)

- Enjoy!
- Be Happy!

Public chat

OpenSourceMesh Chit Chat hosted by liansalmonsoffice.

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Home / Reviews / Networking / Google's Project Loon Gets 'Autolauncher,' Mesh Networking

Google's Project Loon Gets 'Autolauncher,' Mesh Networking

BY DAVID MURPHY MAY 30, 2015 02:49PM EST 4 COMMENTS

Google's Internet-delivering stratospheric balloons now need far fewer ground stations for their connections.

734



At this rate, there might be a lot more Google balloons in the sky before you know it. According to the latest updates from Google I/O, the company's developer conference held in San Francisco this past week, Google has two major updates surrounding its ambitious Project Loon program.

Project Loon, if you're unaware, is Google's effort to bring Internet connectivity to areas of the world that wouldn't otherwise have it. A fleet of weather balloons—for lack of a better way to describe

them—get launched into the stratosphere (about 20 kilometers or so above the Earth's surface). The balloons themselves are designed to last about 100 days in the air or so, and each one gives LTE connectivity to a ground area around 40 kilometers wide.

Google's first major advancement, mentioned to **Bloomberg** by Google vice president Mike Cassidy, involves the way in which Google gets these balloons up into the air to begin with. Previously, the process used to take around 45 minutes or so per balloon, and Google could only launch its somewhat-fragile balloons when the wind was six miles per hour or less.

What is Coming ?

INTEGRATION WITH

OpenStack,
Docker & Kubernetes,
Mesos & ONOS.



SDI : 오픈소스 소프트웨어를 통한 SDN/NFV의 진화

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