Community Information-Centric Networking Open Source Project
Linux Foundation/Fast Data IO/CICN

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Cisco actions to push ICN adoption

PARC's CCN acquisition
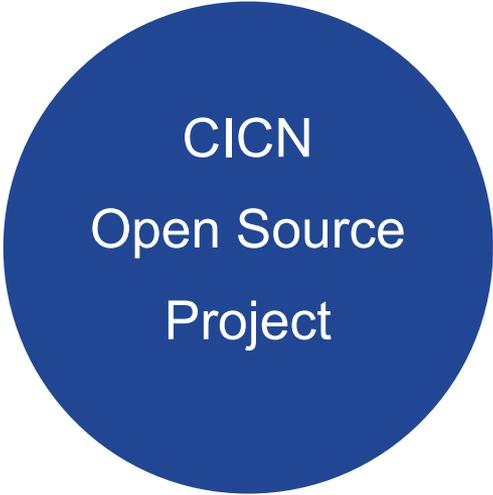
CICN Open Source Project

Hybdrid ICN

Cisco CCN acquisition: what changes?

- For IRTF and IETF if a WG is created
  - IPR clauses on CCN drafts has changed,
  - Under reasonable and non-discriminatory terms, with reciprocity, to implement and fully comply with the standard,

- Which means:
  - RAND: If standard is adopted Cisco will not assert any patents [..] against any party for making, using, selling, importing or offering for sale a product that implements the standard,
  - Reciprocity: Cisco retains the right to assert its patents against any party that asserts a patent it owns or controls [..] against Cisco in any IETF standard.

Adoption of ICN: roadmap

- Move forward with current draft towards experimental RFCs

- A starting point to involve other partners

- Do work!

- Improve the current draft and, with consensus, plan IETF WG

fd.io Intro

Introducing Fast Data: fd.io

- New project in Linux Foundation
  - Multi-party
  - Multi-project

- What does multi-party mean?
  - Multiple members - Open to all

- What does multi-project mean?
  - Multiple subprojects
  - Subproject autonomy
  - Cross project synergy
  - Open to new subprojects
  - Anyone can propose a subproject
  - Allows for innovation

Create a Platform that enables Data Plane Services that are:

Highly performant
Modular and extensible
Open source
Interoperable
Multi-Vendor

Platform fosters innovation and synergistic interoperability between Data Plane Services

Source of Continuous Integration resources for Data Plane services based on the Consortium's project/subprojects

# Community Information-Centric Networking (CICN)

- Several software components
  - VPP ICN forwarder
  - Socket based forwarder
  - ICN socket API
  - HTTP server
  - DASH video player
  - vICN for container based network deployment and orchestration

- Software is distributed under Apache 2.0 license

Packet processing in the Linux Kernel

- Packet processing in the Kernel is not efficient
  - Packets are processed one by one
  - Upstream new protocol takes long time

- User space networking projects are flourishing:
  - DPDK, Netmap, Open Fast Path others

- ICN plugin takes advantage of this framework

VPP plugins

ICN

VPP IP Stack

VPP IO

DPDK

User space

Kernel space

NIC 1

NIC 2

HW
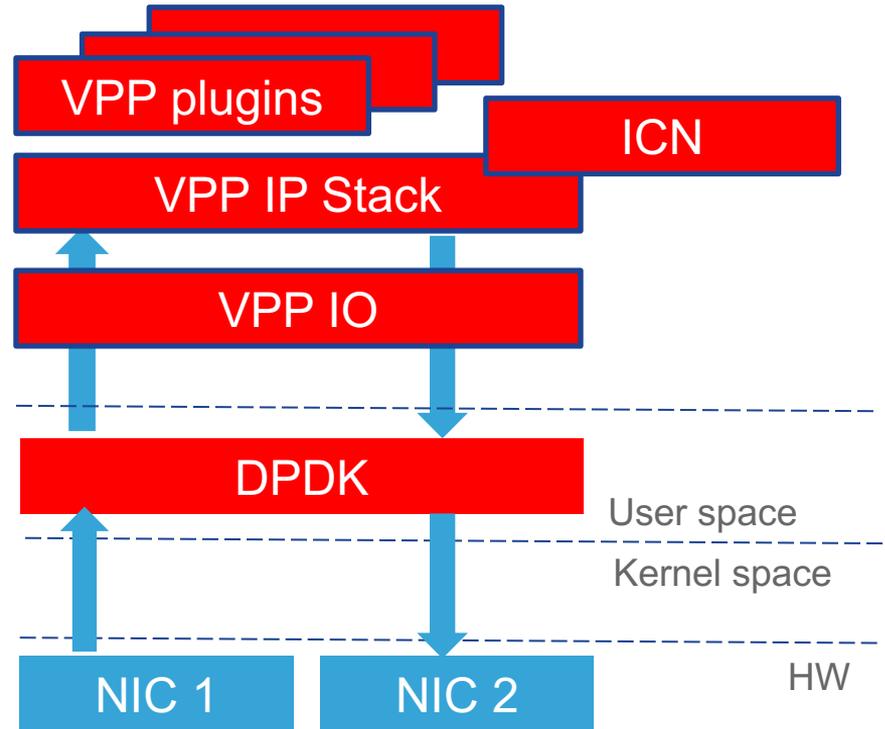
CICN module for VPP

- Written in C

- A run time loadable module

- core design based on D. Oran at al. ACM/IEEEANCS 2013

- Adjacency based on 5-tuple (ip-sr-dst, udp, port-src-dst

- Almost 1Mpps per core (5Gbps)

- Can use DPDK driver

- Can use AF-PACKET driver
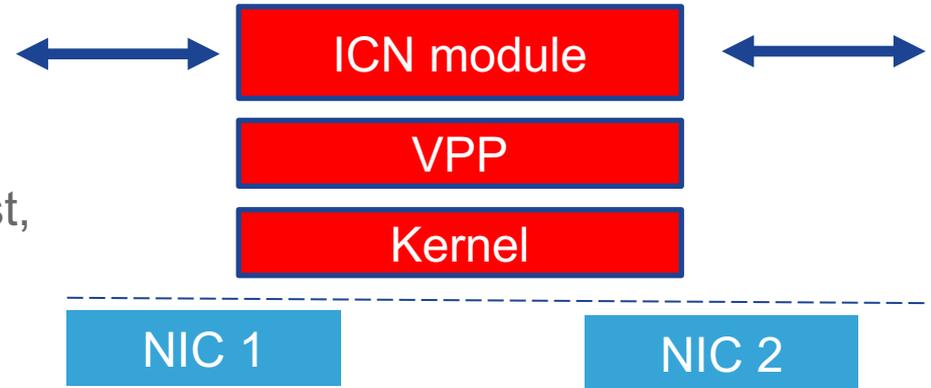
Metis: socket based forwarder

- Written in C99

- Based on PARC's metis forwarder

- Reference forwarder for end devices (Android, iOS, MacOS, Windows, Linux)

- Throughput at 300Mbps

- Can interconnect to VPP using AF-PACKET or a VPP bridge
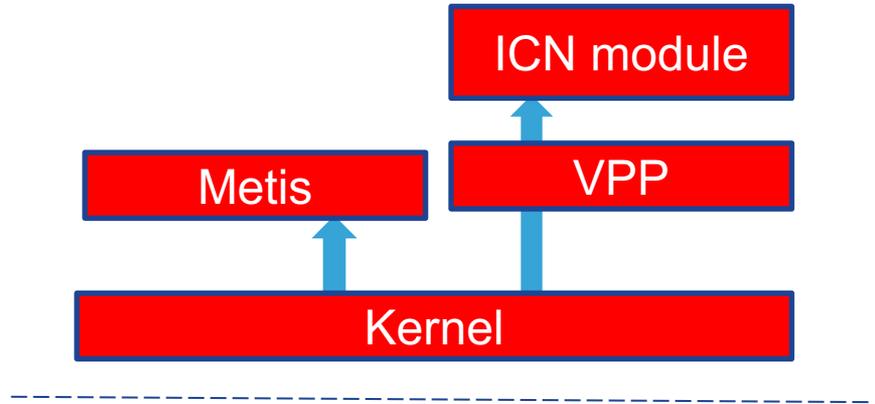
ICN socket API (libicnet)

- Written C++11

- Provide a socket api for applications

- Consumer – Producer API

- L4 manifest,

- Segmentation and Reassembly

- Reliable

- Interest Flow control

- Congestion control

- Remote Adaptive Active Queue Management

libicnet

Metis	VPP-ICN

INET socket
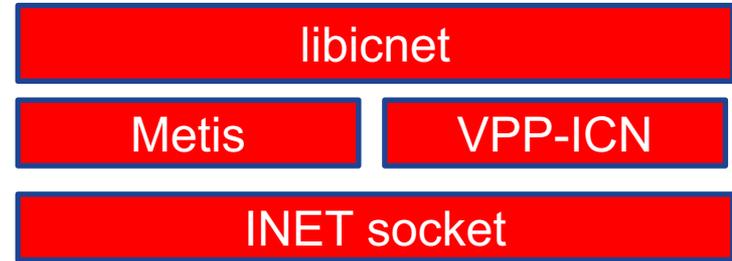
Transport based on
Carofiglio et al. IEEE ICNP 2013
API based on
Moiseenko et al ACM ICN 2015

HTTP server

- Written in C++11

- One thread per HTTP request/reply

- it uses the ICN Socket API and TCP

- It implements the HTTP GET method

- HTTP POST method soon
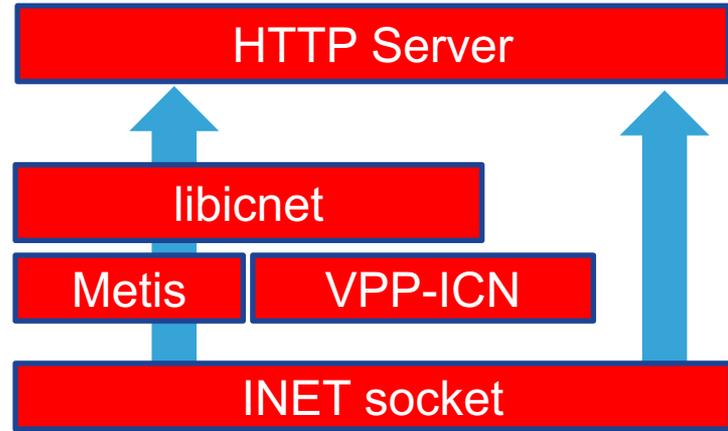
VIPER: Video PlaER

- written in C++ with a QML frontend

- DASH compatible (uses libdash)

- Several rate adaptation: adaptec, bola, panda, and others

- Use ICNET or TCP

- Support Android, MacOS, Linux and iOS ongoing

| VIPER |
| libicnet |
| Metis | VPP-ICN |
| INET socket |

vICN

Design Principles

- **Scalability**
- **Modularity**
- **Performance**
- **Distributed Computing**
- **Centralized Control**
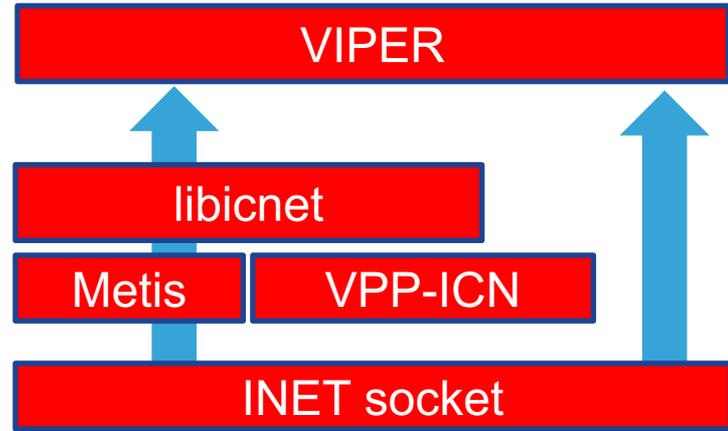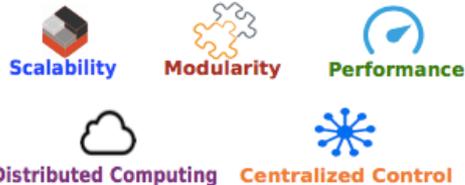
⭐ Unique Feature

VIRTUAL, REAL AND SIMULATED NODES MANAGEMENT

LIGHTWEIGHT VIRTUALIZATION:
✦ Linux containers (LXC/LXD): prebuilt images for fast prototyping and deployment

NETWORK TOPOLOGY MANAGEMENT:
✦ OVS, OVS/dpdk, VLAN ⭐
✦ OpenFlow for traffic control
✦ Linux TC for bw shaping

EMULATED WIRELESS MEDIUM: ⭐
✦ 802.11n (WiFi) and LTE wireless channels
✦ Mobility across AP/enodeB.

FAST NETWORKING:
✦ DPDK
✦ VPP

Dash Player

ICN Routers

Dash Server

Physical server 1

LINUX BASED CLUSTER

Physical server 2

vICN
✦ Centralized Control
✦ Management
✦ Monitoring

Network View

ICN MODULES:
✦ Workload (Cons./Prod.)
✦ Forwarder
✦ Face and routes mgt.
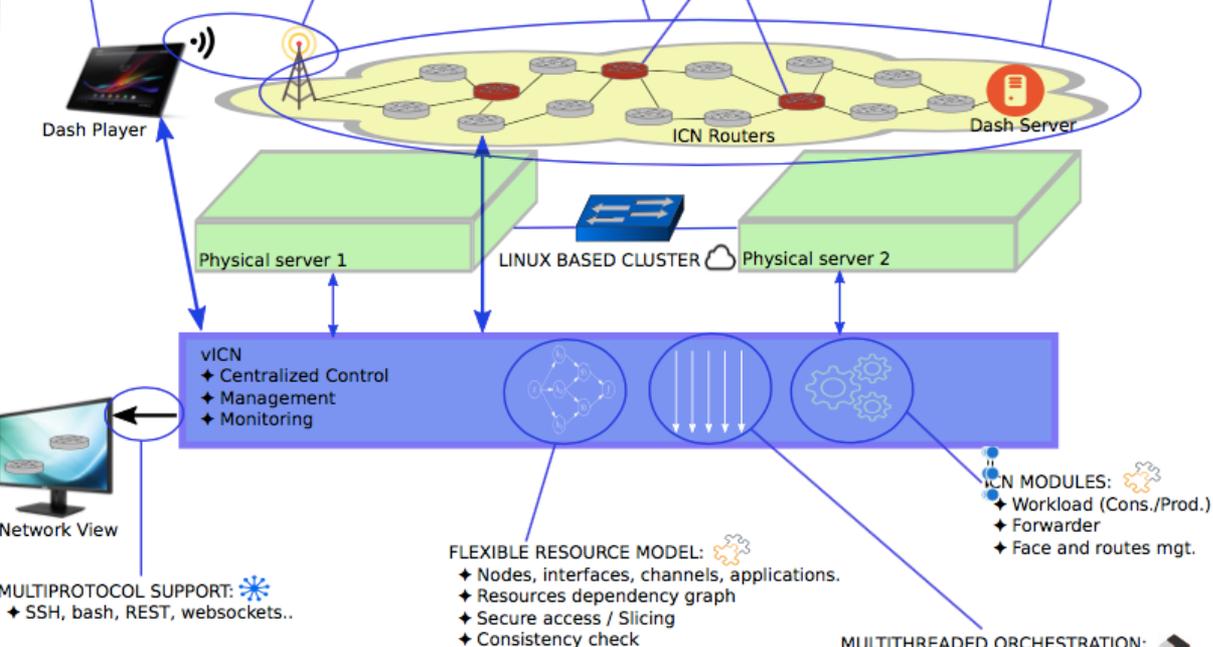
MULTIPROTOCOL SUPPORT: ✳
✦ SSH, bash, REST, websockets..

FLEXIBLE RESOURCE MODEL:
✦ Nodes, interfaces, channels, applications.
✦ Resources dependency graph
✦ Secure access / Slicing
✦ Consistency check

MULTITHREADED ORCHESTRATION:
✦ Match specification to current state and perform necessary operations for reconciliation.

Hybrid ICN in short
Deploying ICN into IP

hICN forwarding

- Put resource name in IPv6 addresses header fields

- data name as concatenation of L3 resource name and L4 segmentation names

- Define an Interest IP packet and a Named Data IP packet

- For some nodes introduce an IP packet cache
  - Implement an interest/data cache (PIT/CS)
  - Routing symmetry partially guaranteed
    - An hICN router guarantees local flow balance on an egress interface
    - An IP router does not

hICN transport

- ICNET socket API using TCP encapsulation

- Consumer Producer Socket API taken from ICN

- hICN enabled in clients as a VPN service

- ICNET socket in the server side as transport in user space

- PoC under development and testing at Cisco and partners