Information-Centric Networking (ICN)

Cisco and Internet2, as well as several leading research universities and government institutions, have partnered to focus on a significant, long-term research and development effort called **Information-Centric Networking** (ICN). The vision of the project is to develop, promote, and evaluate a new approach to a communications architecture based on an implementation of ICN called Content-Centric Networking (CCN).
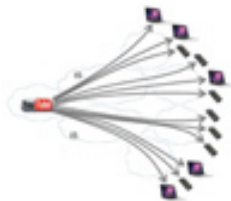
The initial participant members include:

- Clemson University
- University of Michigan
- Northwestern University
- George Washington University (w/CAAREN)
- National Institute of Standards and Technology (NIST)

The Internet was originally designed as a point-to-point communications network, but in modern use, it is increasingly a multipoint distribution network for various kinds of data. As a result, the original architecture and layers of adaptations have led to inefficiencies in mobility, security, and scale. CCN enables applications to address and request data by name rather than

location. As a result, the network can locate and retrieve the data dynamically from any potential source, leading to better mobility.

Envision replacing this: | With this:

For increased security, CCN secures and authenticates the data itself, rather than creating secure point-to-point connections to authenticated hosts. This security model enables opportunistic caching of data anywhere within a CCN network, resulting in better efficiency, availability, and scalability.

CCN is designed to run alongside, or independent of, TCP/IP and will not disrupt existing networks. The architecture enables a suite of solutions and capabilities by effectively addressing issues of naming, memory, and security.

Internet2 Involvement

Internet2's Advanced Layer 2 Service (AL2S) will provide 10G network connectivity to trial members, and Cisco has funded one UCS C240 M4 High-Density Rack Server (aka ICN Forwarders) for each member location.

Internet2 recently convened a workshop, "R&E Community Investment in National-footprint Network Services," (RECINNS) to acquire community input on future Internet2 technology and services. Documents were contributed by more than two dozen organizations, including member universities, industrial partners, and collaborating R&E networks both domestic and global.

The contributions contain excerpts such as:

- (network attribute) "...A broad technological horizon with tremendous flexibility,"
- "...mix of e-infrastructure resources in user-defined and user-controlled environments," and
- (the network) "...must allow a fruitful set of new applications to be at the center of Internet2's network to fuel a wheel of innovation."

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Internet2 has a long history of flexibility and openness to support new applications; examples include the several initiatives collectively identified with the Innovation Platform and the long-term support for the GENI environment. The RECINNS workshop reaffirmed this practice for Internet2 and, in keeping with this support, the Cisco-Internet2 ICN testbed is a trial of a radical new Internet architecture, which may have advantages both in traditional, large-scale data movement as well as in the flood of data expected as the Internet of Things (IoT) matures. The purpose of the ICN testbed is not only to deploy and improve the technology, but also to demonstrate and quantify the performance of this new architecture in typical and practical applications. The results of this trial will be one of a number of experiments that Internet2 and the R&E networking community will be closely monitoring for insight into potential future architectures. In particular, the testbed will participate in standards-based activities to harmonize CCN and a parallel architecture known as Named Data Networking (NDN), which has also been under development by the network research community.

Cisco Development Efforts

In February 2017, Cisco completed its acquisition of PARC's CCN platform. Cisco has released this platform as an open-source project within the FD.io community called Community ICN (CICN), which is governed by the Linux foundation. Cisco has also contributed its own ICN software to the project based on the Vector Packet Processing (VPP) framework, a high-performance, packet-processing stack that can run on commodity CPUs. The CICN project will allow the community to run experiments at scale in order to evaluate the advantages and benefits of the ICN architecture. Possible use cases include video delivery and anchorless mobility across 5G networks, service discovery for IoT deployments, DRM for content networks, and seamless, multihomed mobility. The CICN project is now in a phase where the technology is mature enough to move to PoC/trial.

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