Huawei's "New IP" Proposal

Frequently Asked Questions

February 2022

Q1: What is the "New IP" proposal? Who is promoting it and supporting it?

A: Originally, "New IP" was a set of proposals that were submitted by Huawei to the ITU-T's Telecommunications Standardization Advisory Group (TSAG) in September 2019, to initiate an ITU-T-wide project based on the "New IP" contribution in TSAG C-83. Huawei developed these proposals with support from China Mobile, China Unicom and CAICT. Further, in January 2020, Huawei submitted a "New IP" proposal to the Focus Group on Technologies for Networks 2030. They proposed to develop new network protocols and architectures "by extending and redesigning the traditional IP [Internet Protocol]" to support new services for a "new Internet" by 2030.

Huawei describes "New IP" as:

> "New IP can be characterized as a technology study initiative, driven by a vision on scenarios for utilizing Internet technologies in many facets of the future digital industry and society. As such research initiative, it is centered on study areas that address aspects of the Internet data plane as well as its associated architecture, technologies and protocols."[1]

Currently we see the term "New IP" used as a description of proposals that share features and concepts from the original submission to the ITU-T.

Q2: What is the relationship between "New IP", "Future Vertical Communication Network" (FVCN) and "Network2030"?"

A: The terms "Network 2030" and "NET2030" generally denote the anticipated requirements on and capabilities of networks in the year 2030. The ITU-T's Focus Group on Technologies for Network 2030 (FG NET-2030) was formed under Study Group 13 (SG13) in 2018 "to study the capabilities of networks for the year 2030 and beyond, when it is expected to support novel forward-looking scenarios, such as holographic type communications, extremely fast response in critical situations and high-precision

[1] https://www.huawei.com/us/industry-insights/innovation/new-ip

communication demands of emerging market verticals." The Focus Group wrapped up its work in June 2020 and its deliverables are available at ITU's website.

Huawei's "New IP" purports to be the solution to meet the requirements for the Network 2030 (e.g., as presented in contribution NET2030-I-115 to the January 2020 FG-NET2030 meeting).

The new term "Future Vertical Communications Networks" was introduced at the July 2020 meetings of ITU-T SG11 and SG13, in response to the feedback on the "New IP" proposal. Huawei modified its proposals to ITU-T, changing the term "New IP" to "Future Vertical Communication Networks" (FVCN) with the stated intention of interconnecting a multiplicity of vertical networks, each running its own set of protocols. The substance of the proposals remains the same.

At the December 2020 plenary session of SG13 and SG11, the decision was taken to:

- Not to accept "New IP" related questions as new work items
- Stop discussing "New IP" at least until WTSA in March 2022.

Q3: What types of services in the future do proponents claim will need new network architectures?

A: The future services supposedly requiring a new network architecture are:

- Holographic Type Communications
- Digital Senses, Digital Reality, Digital Twin
- Haptic Communications, Tactile Internet
- Telemedical/Remote Surgery
- Industrial Internet of Things
- Space-Terrestrial Integrated Network
- Vehicular Networking

For a brief description of these proposed future services, please refer to *New IP Networking for Network 2030*, a presentation by Sheng Jiang.

Q4: What are the primary new technologies/capabilities promoted by the proponents of "New IP"?

A: The main features/capabilities of the "New IP" system are described as (see Figure 1):

- Semantic addressing
- Flexible length addressing
- ManyNets support

- Deterministic services
- Intrinsic Security and Privacy
- High throughput
- Endpoint-definable Forwarding Operations

For a brief description of these proposed features, please visit Huawei's website.

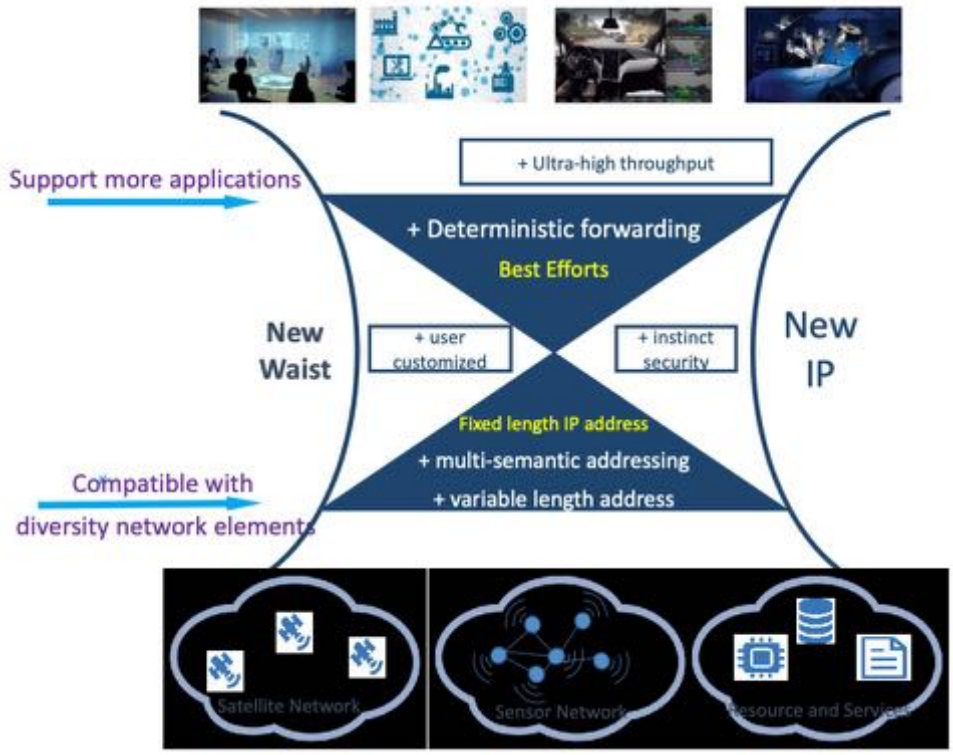

Figure 1 [Source: *New IP Networking for Network 2030*, presentation by Sheng Jiang]

This high-level architectural picture communicates that the "New IP" architecture intends to replace the 'waist' of the Internet —essentially, it suggests an overhaul of the Internet Architecture.

Q5: What is the current status of the "New IP" and related approaches at the ITU-T?

A: As mentioned above, at the December 2020 plenary session of SG13 and SG11, the decision was taken to not to accept "New IP" related questions as new work items, and to stop discussing "New IP" at least until WTSA in March 2022.

However, since December 2020, elements of the "New IP" proposal continue to appear as new proposals in different study groups at ITU-T:

- March 2021: Proposal for a New Work Item on "*Polymorphic Networking*" in SG13.

- March 2021: Proposal for a New Work Item on "*Immersive real-time communications*" in SG13.
- June 2021: Discussion on forming a Focus Group on "*6G Networking Technologies*" based on outcomes of FG FN2030, at SG13 Workshop for Africa.
- September 2021: Proposal for a New Work Item on "*Security guidelines of deterministic communication services for IMT-2020 networks and beyond*" in SG17.

Q6: What are the key concerns about the "New IP" proposal and its elements?

A: The European Telecommunications Operators Group (ETNO), in an official contribution to the Chair of SG13, dated December 2020, identified the key concern as follows:

- The development of a new Internet Protocol (provided there is a real need for it) would put at risk the ***high investments devoted to telecommunication network infrastructures***, which might need to be replaced before being fully amortized, thus affecting the return on investment of the sector and putting their sustainability at significant risk.
- To ***avoid duplication of efforts***, there should be no (or minimal) overlap in work done in different standards development organizations (SDOs): the ITU should not take on work on the IP architecture and the capacity of current transport networks being implemented by IETF and IEEE.
- Internet protocols and their architecture should continue to be developed in an ***open, multistakeholder, and bottom-up fashion***—such as those led by the IETF and IEEE—and not driven by top-down processes, as in the ITU.

Source: *ETNO position paper on the New IP proposal*

The key concerns also include:

- ***Lack of Interoperability*** as the proposed architecture is not backwards compatible with the existing architecture of the global Internet. In particular, the proposed multi-semantic addressing scheme is not compatible with the existing IP addressing schemes designed at the IETF. This lack of interoperability would most likely result in a fragmentation of the global Internet into islands running different protocol stacks.
- ***Innovation*** and standards should be ***incremental*** – evolution not revolution.
- Selling future technologies against current network services. The "New IP" proposals compare the services and technologies currently deployed on the Internet to the capabilities of a future network that has not yet been built. This approach ignores, for example, capabilities that have been developed but not deployed on the Internet (but might be deployed on private networks) and current studies and research on the technologies under question (e.g., Path Aware Networking and Information-Centric Networking research groups in IRTF).

- Lack of Deployment in networks does not translate directly into lack of capability. Network operators make decisions on what features to turn on in networks based on more than just what is possible or what is in a standard. There must be a business case. For example, while Internet Service Providers don't usually offer fine-grained Quality of Service (QoS) (e.g., called "Integrated Services") as a service to everyone, enterprise (vertical) networks (e.g., financial networks, utilities) have deployed QoS for many years in their networks to meet specific requirements. An Internet draft in the IRTF provides a good summary compendium of different reasons a technology is not deployed. It focuses on path aware networking but is applicable to any technology. In addition, work done in the Computing in the Network Research Group (coinrg) at the IRTF is very relevant to this point.

These concerns reflect the ones shared by the Internet Society in the Discusion Paper, and by the IETF in the liaison statement.

Q7: What are the false claims presented in the "New IP" proposal?

A: Claim: The current networking environment is only the Internet

In addition to comparing its future capabilities to typical Internet service, the "New IP" proposals ignore non-Internet services. For example, it ignores Metro Ethernet Forum (MEF) services and IEEE's newer technologies to support the FG-NET2030 deliverables. The current rich networking environment allows customers to deploy networks based on their requirements. A customer might use Internet service to meet some requirements, but use a private connection (e.g., MEF E-Line service) to meet other requirements.

Claim: Current networking technologies can't handle heterogeneous networks

One of the original design goals of the Internet was to support diverse networks. The flexible way the Internet incorporates new technologies and networks has allowed for tremendous innovation in the development of new technologies in networks to meet any unique requirements for that environment. Internet design treats such a network as a "subnetwork" (e.g., Ethernet) and routes over it, decoupling the complexity of the subnetwork from the Internet and vice versa.

As an example, SpaceX's Starlink has designed a protocol and routing system that takes into account the special characteristics of its Low Earth Orbiting (LEO) satellite constellation (selecting the best path through satellites in different orbits). The Internet will see this as a subnetwork and route over it, hiding the complexity of the satellite constellation from the Internet as a whole (and the complexity of the Internet from the satellite network.

Claim: The Internet can't support ultra-high throughput.

When Huawei, et al. says the Internet can't support ultra-high throughput, they are really talking about a particular variant of the transport protocol, TCP. The "New IP" proposal compares its new

requirements to vanilla TCP/IP, ignoring current research on TCP[2] existence of other transport protocols (e.g., RTP, SCTP, QUIC) and the ability for the IETF to design new transport protocols when needed. This claim also ignores the on-going work on supporting ultra-high throughput in IEEE and 3GPP. In addition, the Internet Congestion Control Research Group at the IRTF, and the TCPM group at the IETF, are continually evolving TCP and congestion control to improve throughput.

The definition of ultra-high throughput has changed over the years. In the late '70s when TCP and IP were defined, 45 Mbit/sec would be considered ultra-high throughput, today it is in the gigabits per second, tomorrow it could be in the terabits/sec.

CLAIM: EXTREMELY LOW LATENCY REQUIRED GLOBALLY

These claims set by the proponents are incompatible with the laws of physics. Given that the speed of light is 300kms per second, one millisecond latency is only possible over distances less than 300kms. This is clearly explained in the liaison statement from SG12 to TSAG in September 2020.

Q8: What is the status of "New IP" in IETF and IRTF? What are the current developments by standardization bodies in reference to challenges mentioned above?

A: In March 2020, the IETF responded to a liaison from ITU-T's Telecommunications Standardization Advisory Group (TSAG) asking for input on the "New IP" proposal. The IETF's liaison clarified some misconceptions in the "New IP" proposal and expressed interoperability concerns if a modified Internet protocol is developed in ITU-T based on that proposal. The liaison statement can be found at IETF's website.

The IEEE also submitted a contribution (TSAG-C156) to the September 2020 meeting of TSAG supporting the importance of open standards and communication and collaboration between standards groups to avoid duplicative effort. The IEEE also noted the work of the IEEE 802.1 Time Sensitive Networking (TSN) task group on deterministic networking and how that group was working with ITU-T SG15, IETF and 3GPP.

In November 2019 at IETF-106, a side meeting took place around the topic of "New IP". A side meeting is not considered part of the formal IETF agenda. Unfortunately, while some informal discussions about aspects of "New IP" in the IRTF, no official proposal to the IRTF was submitted.

Since July 2020, several submissions have been made to IETF related to aspects of the "New IP" proposal:

- "Scenarios for Flexible Address Structure", intended Informational
- "Flexible IP: An Adaptable IP Address Structure", intended to be Standards Track

[2] https://blog.apnic.net/2017/05/09/bbr-new-kid-tcp-block/

- RFC8799 (Informational) - Carpenter, B. and B. Liu, "Limited Domains and Internet Protocols", RFC 8799, DOI 10.17487/RFC8799, July 2020.
- Forwarding Layer Use Cases (13 July 2020), considers the new and emerging use cases for IP.
- Forwarding Layer Problem Statement (20 July 2020), considers the problems that need to be addressed in IP in order to cover the use cases and new network services described in draft-bryant-arch-fwd-layer-uc-00.

In November 2021 at the IETF 112, a side meeting addressed the topic of "Internet Addressing – Gap Analysis". No concrete proposal resulted from the ongoing discussion.

More recently, IEEE responded to an ITU-T Study Group 13 request, noting IEEE's work on TSN is coordinated with multiple other SDOs on their needs for supporting new applications and clarifying TSN does support multi-domain networks and large-scale networks."

Q9: What are the IETF and ITU-T collaboration guidelines?

A: Collaboration between standard developing organizations (SDOs) is required and outlined by the internationally accepted guidelines and principles such as *Principles for the Development of International Standards, Guides and Recommendations* (item 5) and Infographic on the 5 Core Principles of OpenStand (principle 1).

The collaboration between the ITU-T and the IETF follows the following guidelines:

The ITU-T A series – Supplement 3 (07/2012) recommendation provides guidance for the collaboration on standards development between the Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T) and the Internet Engineering Task Force (IETF) of the Internet Society (ISOC). Early identification of topics of mutual interest will allow for constructive efforts between the two organizations based on mutual respect.

Formal liaison statements from the Internet Architecture Board (IAB), the Internet Engineering Steering Group (IESG), the IETF, an IETF working group or area to the ITU-T are generated, approved, and transmitted according to the procedures described in RFC 4053 and Recommendation ITU-T A.1. Formal communication is intended to allow the sharing of positions between the IETF and the ITU-T outside of actual documents. This covers such things as comments on documents and requests for input.

Q10: Is the existing architecture scalable/evolvable or is a completely new architecture for the Internet needed? How can the existing traditional IP architecture address new future requirements that are arising from recent developments in emerging technologies?

A: The layered and modular architecture of the Internet has allowed it to evolve over the last 40 years to incorporate new networking technologies and meet new requirements. The modular character of the Internet architecture allows for innovation in one area without having to rearchitect the entire Internet. Lower layers (e.g. physical media) can evolve without having to modify the upper-layer applications and vice versa.

For example, over this time, the physical speeds supported by the Internet has evolved from 2400 bits per second dial-up modems to multi-gigabit per second fiber optic connections. The Internet has evolved to run over a multitude of lower-level networking technologies such as Token Ring, Ethernet, Frame Relay, ATM, ISDN, MPLS, etc. The modular character of the Internet Architecture allows for one part of the Internet to deploy a new technology (e.g., satellite, aerospace, industrial ethernet, wireless innovations) without having to upgrade the entire Internet.

The Internet has also evolved from supporting a few hundred hosts to billions of devices with widely different capabilities (low powered sensors to supercomputers).

While "New IP" is generic term, "Traditional IP" refers to the core Internet protocols, TCP/IP, there has been considerable evolution in the transport layer to meet new requirements. TCP itself has evolved to better meet network conditions such as congestion and latency and to provide higher throughput. New transport protocols have also been developed to support specific requirements, e.g., RTP for telephony and video-conferencing over the Internet and QUIC to provide for more efficient secure HTTP traffic exchange.

IETF working groups continue to investigate new capabilities in coordination with multiple SDOs to meet new requirements while considering the effect new capabilities will have on other applications and on the Internet as a whole.

Q11. How are the existing IP (IPv4 and IPv6) architecture addressing the requirements of claims proposed in the new architecture, i.e., how is the existing IP framework going to support heterogeneous networks, deterministic forwarding, intrinsic security, ultra-high throughput and user-defined customized request for network services?

A: The Internet and its IP-based architecture have always supported heterogeneous networks—wired and wireless, low and high bitrates, etc. They have *demonstrated* to be flexible enough to support many different applications.

There might be highly specialized applications where IP is not the protocol of choice—these are often also cases where inter-networking may not be required. A set of factory robots may not (and probably should not) be connected directly to the Internet, their controller may. In other words, the network between the controller and the robots is highly specialized whilst the controller is generic.

Some of the requirements are related not to the IP protocol itself, but other protocols of the TCP/IP suite, for instance transport protocols. It is entirely possible to develop a new protocol on top of IP to meet such specific requirements. An example of such development is QUIC.

The IETF liaison statement makes the case that "*heterogeneous address spaces without a common substrate implies complex translation to achieve interchange among the different domains. Such translation likely increases fragility and latency while requiring additional network state to achieve interoperability.*"

Q12. What are the current positions of developments by domestic/ international standardization bodies in reference to challenges mentioned in Q11?

A: Ongoing work is taking place within several multi-stakeholder standards development organizations like the IETF, IEEE, and W3C to continue the Internet's technical evolution.

Please refer to the IETF liaison statement. In addition, we note that deterministic networking is being studied and standards are being developed in several key organizations:

- IEEE 802.1 Time Sensitive Networking (TSN) Task Group [TSN] is developing extensions to support time sensitive networking using IEEE 802.1 networks.
- IETF Deterministic Networking (detnet) and Reliable and Available Wireless (raw) working groups are developing RFCs to support deterministic networking on routed networks and to interwork with IEEE 802.1 TSN. The IETF's Transport Area also continues its work in this area, for example its investigation of Low Latency, Low Loss, Scalable Throughput (L4S) Internet Service and active queue management.
- 3GPP is defining standards to support its 5G ultra-reliable low latency communications (URLLC) capability over the Radio Access Network (RAN) as well as interworking with 802.1 TSN networking.
- ITU-T SG15 is working with IEEE 802.1 TSN and 3GPP (5G) related to its transport-related recommendations.

The above listed efforts tend to focus on applications that exist within a single administrative domain. While a single administrative domain is the initial focus, as the technology matures, there is nothing precluding extending it to multi-domain.

It should also be noted that the 5G architecture, of which the IP architecture is an integral element, offers possibilities for specific applications through its slices. In addition, current LTE (4G) mobile services use IP as the data bearer in worldwide deployed network architectures.