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FG NET2030-DEMOs 2020

Network 2030 – Sixth ITU Workshop and Demo Day – 13 January 2020 demonstrations

Summary

This Technical Report provides a description of demonstrations for Network 2030 Sixth ITU Workshop on Network 2030 and Demo Day, including new IP demonstration, computing power network demonstration, self-generated intent-based system demonstration and enabling Internet-scale holographic-type communications demonstration.

Keywords

Computing power network, holographic-type communications, Network 2030, new IP, self-generated intent-based system.

NOTE

This is an informative ITU-T publication. Mandatory provisions, such as those found in ITU-T Recommendations, are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

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1 Foreword

"Network 2030: A pointer to the new horizon for the future digital society and networks in the year 2030 and thereafter." – Dr Richard Li, FG NET-2030 Chairman.

The Focus Group, studied 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 communication demands of emerging market verticals. The study aimed to answer specific questions on what kinds of network architecture and the enabling mechanisms that are suitable for such novel scenarios.

This Technical Report provides a description of demonstrations for Network 2030 during the Sixth ITU Workshop on Network 2030 and Demo Day (13 January 2020), including new IP demonstration, computing power network demonstration, self-generated intent-based system demonstration and enabling Internet-scale holographic-type communications demonstration.

2 Abbreviations and Acronyms

This Technical Report uses the following abbreviations and acronyms:

AI	Artificial Intelligence
AR	Augmented Reality
CPN	Customer Power Network
HTC	Holographic Type Communications
IBN	Intent-Based Networking
IoT	Internet of Things
IIoT	Industrial IoT
IP	Internet Protocol
IT	Information Technology
NCC	Network and Computing Convergence
NFV	Network Function Virtualization
QoS	Quality of Service
SDN	Software Defined Network
VR	Virtual Reality

3 Presentation of new IP

Xiuli Zheng (Huawei Technologies Co., Ltd.)

Presentation

Sub-group 1 of Focus Group Network2030 has defined lots of use case towards Network 2030, which include holographic type communication, digital twin, tactile Internet for remote operations, space-terrestrial integrated network, industrial Internet of things (IIoT) with cloudification, etc. Based on

the requirements of these use cases, Sub-group 2 has defined new services and capabilities for Network 2030, including foundational services such as in-time and on-time services, compound services such as holographic-type communication services, and some other capabilities of future networking services, containing security, privacy, trustworthiness, accountability, among others. New Internet protocol (IP), known as a novel Internet protocol framework, focuses on the key requirements (flexible addressing, deterministic forwarding, ultra-high throughput transmitting, intrinsic security) of some typical Network 2030 scenarios, such as industrial networks, cyber-physical communication and holographic communication, and aims to enhance traditional IP capabilities or services to meet these new requirements, including ManyNets interconnecting service, deterministic forwarding service and intrinsic security service. The demonstration showed three use cases, including new IP for cyber-physical communication, new IP for IIoT and new IP for space-terrestrial integrated network (see Figure 1). Flexible variable-length IP addressing mechanism of new IP interconnecting diverse heterogeneous networks and massive physical, virtual entities was verified.

Figure 1 – Demonstration showing an introduction of new IP

4 Computing power network

Sophie Zhang, Jianglong Wang (China Telecom)

Presentation

With the recent proliferation development of cloud computing and edge computing, computing resources in the network extending from the cloud to edge are forming ubiquitous computing power and providing various computing functions for numerous innovative applications in future network. Considering the significant trend of network and computing convergence evolution (NCC use case) presented in NET-2030, it is necessary to research the "computing power network" (CPN) which supports high collaboration between computing and network resources, with optimal user experience. CPN is an innovative interworking solution of cloud, network and edge, providing users with the optimal computing power allocation and network connection, achieving the optimal use of all resources, by distributing the information of computing nodes including the computing power

information, storage information and algorithm information through networks and combining them with network information (such as latency and bandwidth).

The demonstration in Figure 2 shows a computing power network scheduling solution with computing power orchestration based on the software defined network or network function virtualization (SDN/-NFV) technologies. A funny and familiar game- Dino Runner could be played as a demonstration, but with gesture recognition instead of keyboard input. Gesture recognition function utilize a significant amount of artificial intelligence (AI) capability, which proposes strict requirements on network latency and computing power. The main purpose of the demonstration shows a better experience for users with CPN scheduling.

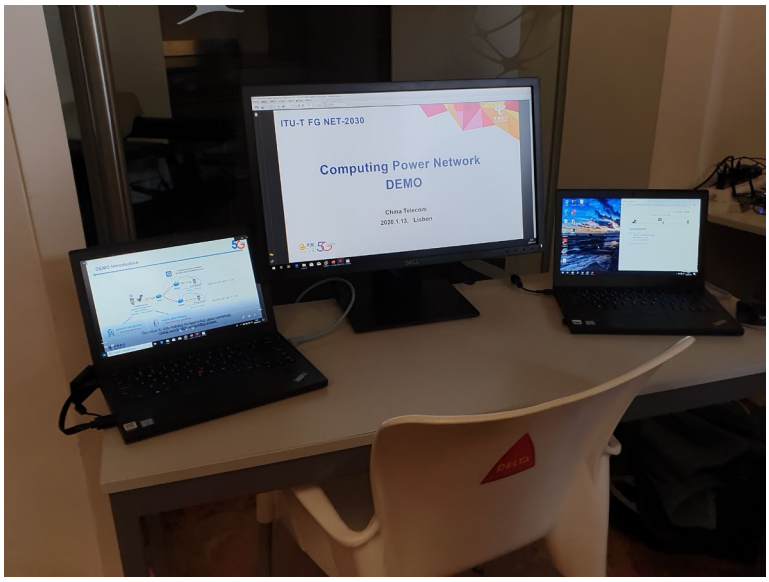

Figure 2 – A demonstration of computer power network

5 Self-generated intent-based system

Mehdi Bezahaf (Lancaster University)

Recently, intent and intent-based networking (IBN) concepts have created enormous interest in academia and industry, although the idea is not original at all. In fact, in 2015, the concept of IBN has been presented in RFC 7575, *Autonomic Networking: Definitions and Design Goals*, and proposed as a new network management framework in OpenDaylight Network Intent Composition. The idea behind these concepts is to allow the user and the operator to express their intentions (i.e., a desired state or behaviour) without the need to specify every technical detail of the process and operations to achieve it. The IETF Network Management Research Group (NMRG) has already submitted three "work in progress" Internet-drafts about the topic. In their active work, they define the concept, and they give an overview of Intent-based networking, a classification of different intents, and they also propose a framework of intents.

The demonstration in Figure 3 proposes a new approach where the intent is not only generated by the end-user, the application, or the operator but also by the system itself. In fact, for quality of service (QoS) purposes, the system can itself detect network improvements and expresses them through intents. The feasibility of such an approach is demonstrated under a flexible testbed based on mininet, OVS switches, and the ONOS OpenFlow controller.

Figure 3 – The concept of self-generated intent-based system

6 Internet-scale holographic-type communications

Ioannis Selinis (University of Surrey)

Holographic-type communication (HTC) has been widely deemed as an emerging type of augmented reality (AR) media which offers Internet users deeply immersive experiences. In contrast to the traditional video content transmissions, the characteristics and network requirements of HTC have been much less studied in the literature. Due to the high bandwidth requirements and various limitations of today's HTC platforms, large-scale HTC streaming has never been systematically attempted and comprehensively evaluated till now. Figure 4 shows a novel HTC based teleportation platform leveraging cloud-based remote production functions, also supported by newly proposed

adaptive frame buffering and end-to-end signalling techniques against network uncertainties, which for the first time is able to provide assured user experiences at the public Internet scale. In the demonstration a live HTC-based teleportation sourced from the University of Surrey in Guildford was performed from the UK to the ITU-T Network 2030 Focus Group workshop at Lisbon, through AWS cloud based platform deployed at London. Figure 5 shows the user QoE performances in terms of HTC frame per second (FPS) statistics in real-time.

Figure 4 – HTC based teleportation platform

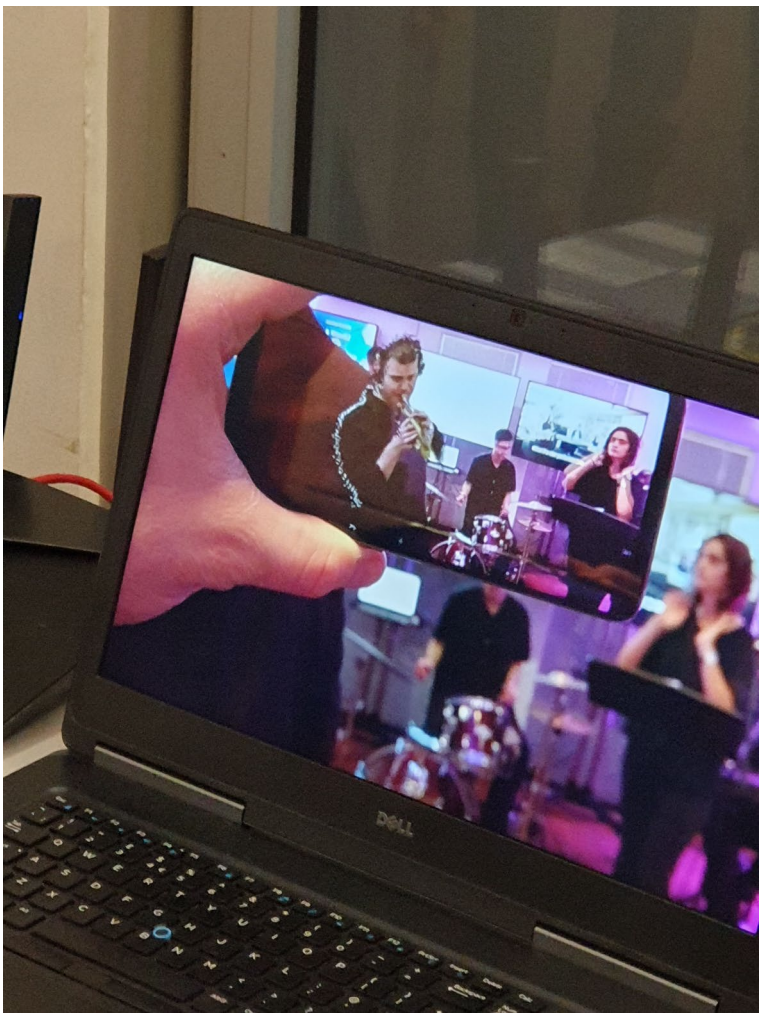

Figure 5 – Performances in terms of HTC FPS statistics in real-time