P802.1CQ: Multicast and Local Address Assignment

Roger Marks (EthAirNet Associates), Editor of IEEE P802.1CQ Standard

IEEE Project P802.1CQ, IEEE 802.1 Working Group, is developing a draft IEEE standard on Multicast and Local Address Assignment for IEEE 802 networks.

Addresses are central to almost all networks. IEEE 802 networks are based on IEEE 802 addresses, typically known as medium-access control (MAC) addresses, as specified in IEEE Std 802. Half of the IEEE 802 addresses are globally unique addresses, typically assigned to a unit of hardware permanently. Global address blocks are assigned by the IEEE Registration Authority to applicants, who are responsible to permanently assign addresses within the block uniquely to hardware.

The IEEE Registration Authority manages the address space with the goal of ensuring that sufficient addresses are available for at least 100 years from the inception of the registry in around 1980. The rapid proliferation of devices could accelerate the exhaustion of the global address stock. Meanwhile, current developments emphasize the need for software-assigned addresses. For example, virtual machines in data centers may be assigned addresses at startup, and mobile devices increasingly seek to use temporary addresses in order to avoid a tracking trail. These trends have led to further exploitation of the previously neglected half of IEEE 802 address space: the local addresses, which are not intended to provide global uniqueness. An IEEE 802 network operates at least as well with local as with global addresses, as long as they are uniquely assigned within that network. In 2017, IEEE Std 802 was amended by IEEE Std 802c-2017, which provides a structure of the local address space that will encourage unique assignments.

The focus above is on unicast addresses, which designate a single sender/receiver, such as an end station or bridge port. However, the IEEE 802 address space is also divided equally into unicast and multicast addresses. Multicast addresses are assigned to identify groups of receivers and, accordingly, are inherently software-assigned. As an example, multimedia streams, including time-sensitive streams as specified by IEEE 802.1 Time-Sensitive Networks, are typically sent to groups of listeners, with the groups dynamically configurable.

IEEE Project P802.1CQ is taking steps to further the exploitation of the local MAC address space, and to aid in the effective use of multicast addresses, by developing standard protocols for address assignment. The current early draft (P802.1CQ/D0.5) details the "Protocol for Assignment of Local and Multicast Addresses" (PALMA). PALMA allows a client device to communicate a discover message indicating an interest in attaining one or more address assignments. A PALMA server on the network can respond with an assignment from a managed address pool. In the absence of a PALMA server, the PALMA client proceeds to self-assignment. PALMA peers respond to the client, defending their own previously self-assigned addresses, and the PALMA client self-assigns its address so as to avoid defended addresses. Many more features are detailed in the draft, and numerous rounds of ballot review and updates remain before completion. The plan is to complete the work before the expiration of the current project authorization at the end of 2021.

For more details, see the P802.1CQ project page at https://1.ieee802.org/tsn/802-1cq/

Expanding the Utility of Time-Sensitive Networking

Norman Finn (Huawei Technologies Co. Ltd), Editor of IEEE P802.1 DC Task Group

IEEE P802.1DC, "Draft Standard for Local and Metropolitan Area Networks — Quality of Service Provision by Network Systems", expands the applicability of the standards being generated by the IEEE 802.1 Time-Sensitive Networking Task Group (TSN TG).

The Time-Sensitive Networking Task Group has been working hard, standardizing new Quality of Service (QoS) features that make Ethernet networks capable of providing their traditional connectivity, while simultaneously serving the most rigorous real-time applications. This saves users the need to have separate, special-purpose networks for industrial control, automotive, cellular fronthaul, and similar applications.

But, for QoS features to work, they generally need to be present end-to-end, at every hop along the path through the network. As evidenced by the IETF Deterministic Networking Working Group (which shares a chair with the IEEE 802.1 TSN TG), there is a demand for standards for these QoS features in networks that include routers and label switches, as well as bridges.

Quoting the "Need" paragraph of the Project Authorization Request for IEEE P802.1DC:

IEEE Std 802.1Q specifies Quality of Service (QoS) features for bridges. These features are perfectly applicable to other devices, e.g. end stations, routers, or firewall appliances. In IEEE Std 802.1Q, the specifications of these features are scattered, and coupled tightly to the operation of a bridge. There is a need for simple reference points to these QoS specifications that are usable for non-bridge systems, and for managed objects for these features that are not specific to bridges.

IEEE P802.1DC is intended to provide these reference points, making it possible for standards defining equipment other than bridges to make normative references to IEEE P802.1DC for their QoS capabilities. This will make end-to-end real-time applications work over mixed bridged and routed networks.

IEEE P802.1DC is ready for its first Working Group ballot, the second of three balloting stages for an IEEE 802 standard. With roughly 40 percent of the process having been completed, its success cannot be taken for granted. But its editor reports that the sound construction of its baseline, IEEE Std 802.1Q, has made the job of picking out the QoS features much more straightforward than originally feared, so its future looks promising.

Time-Sensitive Networking in IEEE 802.1

Marina Gutiérrez (TTTech Computertechnik AG), Editor of P802.1Qcw

The IEEE 802.1 Time-Sensitive Networking Task Group (TG) is the evolution of the IEEE 802.1 Audio Video Bridging (AVB) TG that developed a set of standards for the fields of professional audio and video and infotainment. At the core of the AVB standards was time synchronization and resource reservation mechanisms that improve the quality of service of the applications. Following the success of the AVB, the group was renamed to Time-Sensitive Networking (TSN) and enhancements to the time synchronization and shaping mechanisms were proposed, as well as methods to increase reliability and management of the network. Thus the scope of the TSN TG widened to include automotive, aerospace and industrial automation applications.

The base TSN projects (802.1AS, 802.1Qbv, 802.1Qci, 802.1Qcc, 802.1CB) have been published for some years and the experience of its application is bringing new projects to the TG to refine and extend existing mechanisms. Such is the case of the recent revision of IEEE 802.1AS, whose publication this year was a major milestone for the TG; ongoing works for different traffic shaping mechanism, like P802.1Qcr and P802.1Qcz; improvements on the configuration aspects, both to the centralized (P802.1Qdj), and the distributed model (P802.1CS and

P802.1Qdd); as well as number of projects to create YANG models for the existing TSN features: P802.1Qcw, P802.1Qcx, P802.1ABcu and P802.1CBcv.

As can be seen, the growth of the TSN TG has led to the generation of an important number of new mechanisms. The volume of the work (IEEE Std 802.1Q-2018 has more than 2000 pages) can make it overwhelming for a newcomer to understand and distill what is relevant for their application. The TSN TG is aware of this difficulty and for that they are defining standard TSN profiles for different applications. In such profiles, features, options, configurations, defaults and procedures are selected to fit the requirements of a specific application field. IEEE Std 802.1BA was the first work of its kind, focusing on the original AVB use case. The first TSN profile was IEEE Std 802.1CM for telecommunication fronthaul. Recently, the TSN TG started the development of two new profiles: IEC/IEEE 60802 for industrial automation and P802.1DG for automotive in-vehicle Ethernet communications.

P802f YANG Data Model for EtherTypes

Marc Holness (Ciena), Editor of P802f

The IEEE 802.1 Working Group has created a project to work on YANG EtherType definitions. The project is an amendment to IEEE Standard 802-2014, and specifies YANG modules that contain the EtherType information, including a compact human-readable name and description. The name and description for an initial set of EtherTypes are defined for inclusion in the IEEE Registration Authority EtherType public listing. In addition, the IEEE Registration Authority EtherTypes public listing may be outdated because assignees, whose contact information is often unreliable, have not updated the information provided on their application for the EtherType. This project will create an accurate listing of the common names and descriptions used within the industry for the protocols identified by a particular EtherType.

Process changes used by the Registration Authority Committee to manage the introduction of additional fields in the EtherTypes registry, to alert interested parties when selected entries have changed, to validate and approve registry entry change requests may be required.

The P802f project is ongoing, including creation of a tool to auto-generate a YANG model from the EtherTypes registry, creation of a preliminary P802f specification draft, and providing a list of outstanding issues to be addressed in coordination with the Registration Authority Committee. Planned completion of this project is February 2022.

ITU-T Q6/2: Management Architecture and Security

Yanchuan Wang (China Telecommunications), Vice-chairman of SG2 and Rapporteur of Q6/2

Overview and Challenge

Study Group 2 (SG2) is the lead study group on telecommunication management in ITU-T. The aim of Question 6 of SG2 (Q6/2) is to study and develop the telecommunication management framework based on the requirements and priorities from service providers and network operators.

With the continuous evolution of networks, how to do operations and management of the new and legacy networks jointly is a realistic question. In the past, network management systems were seen as auxiliary and supporting tools to network operation. Now they have been transforming from a vertical and closed architecture to a cloud-based, horizontal and open architecture, in order to adapt to the digital transformation requirements of operators.

Progress Achieved

During the 2016-2020 study period, the following two Recommendations have been accomplished by Q6/2 which highlights the agile and intelligent requirements of operation management architecture.

ITU-T M.3041: This Recommendation provides a framework of Smart Operation, Management and Maintenance (SOMM). It describes characteristics, scenarios and functional architecture of SOMM to support service operation, network management, and infrastructure maintenance for both traditional non-software-defined network (SDN)/Network Function Virtualization (NFV) and SDN/NFV aware networks.

ITU-T M.3040: This Recommendation puts forward the architecture of on-site telecommunication smart maintenance (TSM) with the application of Internet of Things (IoT) and Augmented Reality (AR) technology and wearable devices. TSM architectures include the TSM functional architecture, the TSM physical architecture and the TSM information architecture.

Moving Forward

It is necessary to introduce Artificial Intelligence (AI) technology to strengthen the intelligence and automation of the telecom operation management system. A new work item named M.AI-tom is under study now. This Recommendation will provide functional architecture of AI enhanced Telecom Operation and Management (AITOM). It will also describe the AI pipeline which combines some components to enable AI based applications. This new Recommendation is scheduled to be completed and issued in 2021.

In the future, in addition to telecommunication management, information and communications technology (ICT) management will also become the research focus of the SG2 in ITU-T. SG2 is looking forward to cooperating widely with other Standard Development Organizations (SDOs) such as The TeleManagement Forum (TMF), 3GPP, ETSI and IEEE.

A Glance at ITU-T SG2 WP2

Zhili Wang (BUPT, China), ITU-T SG2 WP2 Chairman and Q7/2 Rapporteur

Working Party 2 (WP2) of ITU-T Study Group 2 (SG2), i.e. WP2/2, is responsible for international standards on the management of telecom services, networks and equipment. WP2/2 standards focus on fault, configuration, accounting, performance and security management (FCAPS) interfaces, which sit between network elements and management systems and also between two management systems.

As service offerings and networks have grown in complexity, interoperable management solutions have become essential tools to reduce operating costs. WP2 standards aim to enable quick, simple and cost-effective integration of management solutions in the operating environment.

WP2/2 has three Questions, which are Q5: Requirements, priorities and planning for telecommunication management and operation, administration and maintenance (OAM) Recommendations; Q6: Management architecture and security; and Q7: Interface specifications and specification methodology, respectively.

Recently, WP2/2 has the following main topics developed or under study:

Cloud Computing Management: With the cooperation with ITU-T SG13, WP2/2 has developed an end-to-end cloud computing management overview, resource management and service management in cloud-aware telecommunication man-

agement system, cloud-based network management functional architecture. Currently, a new work item on synergy management of cloud and SDN-based networks is still under development. It is expected to be completed by the end of 2020.

TMN Data Management: With the development of big data technology, data management of telecom management network (TMN) becomes more and more important. Here, data refer to the different categories of telecommunication data in business support systems (BSSs) and operation support systems (OSSs). WP2/2 standardized in 2020 the requirements for data management in TMN, and defined the functional framework and functional blocks for data management. The requirements for data management include metadata management, data life-cycle management, data quality management, data security management, data configuration management and data service management.

Telecom Anti-fraud Management: WP2/2 also developed a standard in 2020 on telecommunication anti-fraud management in TMN, and provided the functional framework for combating telecommunication fraud management and the description for functional requirements, which include the management of fraud detection, fraud monitoring, fraud mitigation and fraud information sharing.

REST-based Management Framework: WP2/2 is developing a Representational state transfer (REST)-based network management framework to provide a set of guidelines for managed objects modelling and a management interface, and also the REST-based management supporting services that can be shared among multiple interfaces, such as notification services, heartbeat services, and containment services. These works are expected to be completed in 2021, with coordination with the 3GPP SA5 working group. WP2/2 also started a new work item in 2020 on guidelines for REST-interface implementation conformance statements.

AI-enhanced Telecom Operation and Management: WP2/2 is also considering introducing artificial intelligence (AI) into the network management domain. WP2/2 has started a new work item on AI related network management: framework on AI-enhanced telecom operation and management (AI-TOM), for efficiency improvement, quality assurance, cost management, and security assurance. WP2/2 also started research on scenarios for applying AI in network management, such as energy saving management of 5G RAN system with AI, and work orders processing in telecom management with AI. They will be completed in 2022.

On-site Telecom Smart Maintenance: WP2/2 has developed a series of specifications, including: principles for on-site telecommunication smart maintenance; function requirements of telecom smart maintenance; and generic information model of telecom smart maintenance. These specifications will guide the use of smart devices in network maintenance.

Question 2 (Q2) of ITU-T Study Group 20 (SG 20): Use Cases, Requirements and Capabilities of IoT and Smart Cities & Communities

Marco Carugi (Huawei Technologies), Rapporteur of SG20 Q2 and SG 20 Mentor

ITU-T Study Group 20 (SG20), "Internet of Things (IoT) and Smart Cities & Communities (SC&C)", is continuing the development of technical standards accompanying the integration of diverse verticals with Information and Telecommunication horizontal infrastructures. The studies are in progress in numerous technical areas, including requirements, capabilities, architectures and protocols, as well as transversal matters such as interoperability, identification, security, privacy, trust, and data processing and management (concerning the latter, building over the results of the concluded ITU-T Focus Group on Data Processing and Management to support IoT and SC&C). SG20 pursues an active collaboration with different standards development organizations, including, but not limited to, oneM2M, TMF, ISO and IEC (a Joint ISO/IEC/ITU Task force on Smart Cities will start its activities in Autumn 2020).

Question 2 (Q2/20), critical entry point for the IoT and SC&C studies in ITU-T SG20, continues to ensure a constant production in terms of approved specifications and initiation of new studies, supported by a large and internationally distributed base of active experts, including the essential contribution from developing countries. On the basis of use cases and related ecosystem aspects for IoT and SC&C services and applications in different verticals, the Question specifies requirements and capabilities imposed on the IoT infrastructure, from both common (not vertical-dependent) and vertical-specific viewpoints.

Among numerous specifications published over the last period, a number have addressed horizontal requirements and capabilities, such as those for accessibility in IoT (Y.4204, 2019), wireless power transmission application service (Y.4219, 2019), edge computing in IoT (Y.4208, 2020) and universal communication module of mobile IoT devices (Y.4210, 2020 (under approval process)); others have been vertical-specific, such as those for retail stores (Y.4120, 2018), manufacturing in the context of the Industrial Internet of Things (Y.4003, 2018), applications for global processes of the earth (Y.4121, 2018), environmental monitoring (Y.4207, 2019), and interoperation of the smart port with the smart city (Y.4209, 2020). Published specifications have also included collections of IoT use cases (Y.Suppl.53, 2018) and SC&C use cases (Y.Suppl.56, 2019).

Similarly, the work items in progress encompass horizontal matters, such as accessibility for smart public transportation services (Q4-2020 target), edge computing enabled gateway in IoT (Q1-2021 target), business process management support (Q2-2021 target), IoT ecosystem master plan framework (Q2-2021 target), and network connectivity management (Q3-2021 target); but also a wide spectrum of IoT-enabled "smart verticals", including unmanned aircraft systems (Q2-2021 target), common requirements and capabilities for cities and communities (Q2-2021 target), buildings (Q2-2021 target), physical city assets monitoring (Q2-2021 target), railway stations (Q2-2021 target), rural community services (Q3-2021 target), utility metering (Q4-2021 target), civil engineering infrastructure monitoring (Q4-2021 target), livestock farming (Q4-2021 target), shopping malls (Q2-2022 target), digital twin system for cities (Q2-2022 target), and agriculture use cases (Q4-2022 target).

In the context of the ITU-T SG20 preparation to Next Study Period (2021-2024), the role of the "future Q2/20" is expected to remain essential.

Its activity is anticipated to continue concerning horizontal capabilities as well as use cases, requirements and capabilities for verticals, but will also include architectural framework studies, in order to strengthen the workflow linkage with the future SG20 Question focused on IoT and SC&C architectures.

The increasing integration and convergence of ICTs and emerging digital technologies (just to mention a few of these last ones: edge computing, AI/machine learning, blockchain, digital twin, and new networking technologies), makes available a large set of advanced capabilities for the support of IoT and SC&C services and applications. The future Q2/20 will have a key task in studying the integration of these capabilities in future IoT and SC&C deployments, from the use cases, requirements and architectural framework perspectives.

Finally, Q2/20 will address implementation, deployment, operation and maintenance aspects related to the above activities, for an effective linkage between IoT and SC&C standards and concrete application scenarios.

ITU-T SG20 Question 7: Evaluation and Assessment of Smart Sustainable Cities and Communities

Dr. Okan Geray (Smart Dubai), Co-Rapporteur of Q7 in SG20

ITU-T Study Group 20 (SG20) is the lead study group working to address the standardization requirements of Internet of Things (IoT) technologies, with an initial focus on IoT applications in smart cities and communities (SC&C). More specifically, Question 7 (Q7) within SG20 is tasked with the evaluation and assessment of Smart Sustainable Cities and Communities.

Question 7: Study items addressed by Question 7 include, inter alia:

- Formulating general principles that could be used to establish methodologies and frameworks to assess and evaluate the use of ICT and its impact on city sustainability.
- Defining performance measures and key performance indicators, assessing the achievement of the sustainable development goals (SDGs) in a smart city.
- Measuring and evaluating a city's specific performance and e/smart services.

Question 7 collaborates for joint activities in this field within ITU and between ITU-T and other standards development organizations (SDOs), UN agencies, consortia and fora to maximize synergies and harmonize existing standards.

Question 7 Achievements: Three Recommendations have been published in 2019 as indicated below:

- Y.4904 – "Smart sustainable cities maturity model". This Recommendation helps cities to examine their current situation and determine long-term targets, performance measures and critical capabilities needed to progress toward becoming smart sustainable cities (SSCs).
- Y.4905 – "Smart sustainable city impact assessment". This Recommendation is a holistic impact assessment framework for SSCs to address effects of digital innovation on social, economic, and environmental issues.
- Y.4906 – "Assessment framework for digital transformation of sectors in smart cities". This Recommendation is an assessment framework to help identify and enhance the sustainability of identified priority sectors in smart cities.

Three Supplements have been revised and approved in 2020 as indicated below:

- Y.Suppl.32 – "Smart sustainable cities – A guide for city leaders". This Supplement is a high-level policy document to help identify practical steps for urban decision makers to envisage and build a smart sustainable city (SSC).
- Y.Suppl.33 – "Smart sustainable cities – Master plan". This Supplement provides a guide for the implementation of SSC based on intensive use of ICTs.
- Y.Suppl.34 – "Smart sustainable cities – Setting the stage for stakeholders' engagement". This Supplement provides all interested SSC stakeholders with a clear overview of roles and responsibilities to help maximize their contributions to SSC goals.

The following three Recommendations have been consented/determined:

- Y.SSC-BKDMS-arc – "Reference architecture of blockchain-based unified KPI data management for smart sustainable cities". This Recommendation analyzes common characteristics and high-level requirements of blockchain-based unified KPI data management for SSC, defines a reference architecture and provides a common data structure of KPIs (Consented).
- Y.4903rev – "Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals". This is the revised version of SSC indicators to achieve sustainable development goals (SDGs) (Consented).
- Y.IoT-EH-PFE – "Performance evaluation frameworks of e-health systems in the IoT". This Recommendation includes a classification of e-health services and defines a performance evaluation framework for e-health systems in the IoT (Determined).

Question 7 Ongoing Work Items: Question 7 draft Recommendations and Supplements which are currently in progress are as follows:

- Y.Stra-SSC – "Standards mapping assessment for smart sustainable city (SSC) strategy". This Recommendation allows cities and stakeholders to understand the landscape of available standards from different SDOs in order to potentially utilize during the implementation phase.
- Y.Sup.digi-inc – "Guidelines for digital inclusion in the development of digital urban technology and smart cities". This Supplement includes guidelines for assessing and managing the possible social inclusion impacts of smart city technologies and strategies.
- Y.Sup-SSC-UCE – "Use Cases on implemented or evaluated SSC solutions based on ITU-T Y.4900 Recommendation Series". This Supplement will include a number of use cases for ITU-T Y.4900 Recommendation series including challenges and opportunities encountered.
- Y.IoT-SQAF – "Sensing quality assessment framework of IoT systems". This Recommendation specifies a sensing quality assessment framework for Internet of Things (IoT) systems.
- Y.SSC-NGUM – "A Methodology for Next Generation Urban Measurements". This Recommendation provides a measurement methodology to help cities apply the innovative sensing techniques to collect extensive and more frequent city data from various locations at different times.
- Y.Sup-NGUM – "Use Cases for Next Generation Urban Measurements". This Supplement provides practical use cases from real cities on how to measure selected city KPIs such as air quality, noise pollution, and traffic density by using the methodology described in Recommendation Y.SSC-NGUM.

Question 7 will expand its work program in the future based on contributions from the ITU members by developing Recommendations, Supplements and Guidelines to address a wide range of issues in Smart Sustainable Cities and Communities toward the achievement of SDGs and cities' own goals.

Emerging Requirements and New Tools to Manage IoT Data

Ken Figueredo (Market Development Consultant, Chordant Inc.), Member of oneM2M

The early IoT challenges were all about connecting applications and devices to address specific business and operational problems. oneM2M was launched as a standards development organization (SDO) with the goal of creating a standards-based framework to do this consistently. oneM2M addresses the needs of multiple verticals and re-uses established technologies and standards.

The IoT industry is now at a point where data takes precedence over connectivity. This raises a fresh set of requirements and opportunities to equip users with standardized data management tools.

Emerging Requirements for IoT Data

Among smart city users of oneM2M, there is a need to manage data semantically. Here, data modelling plays a key role. It establishes a common understanding between providers and consumers of data.

This leads to a requirement for data interoperability. The aim is to make it easier for data providers to create data in a sustainable way and to simplify the exchange of information with other parties. In doing so, solution providers can develop new services and applications more efficiently.

Data privacy raises another set of requirements around the processing and movement of personally identifiable data. Since systems based on the oneM2M standard are designed to collect and manage data, including personal and private data, they are heavily influenced by privacy-related regulations.

oneM2M's Data Management Initiatives

oneM2M members recently approved a standardization work item, WI-0095, to identify system enhancements that will support data protection requirements such as GDPR (Europe) and PIPA (Korea). This initiative is supported by AT&T, BOE, Convida, Cisco, Gemalto, Huawei, Hitachi, Hyundai Motors, KETI, NEC Europe, Nokia, NTT, TIM, and Qualcomm.

oneM2M is also extending earlier work on its Smart Device Template (SDT) to make OPC-UA, the industrial automation data exchange standard, semantically interoperable with oneM2M. SDT is a template method for modelling the capabilities, actions, and events of connected devices. Interworking between OPC-UA and oneM2M exposes new cross-domain service opportunities. For example, it becomes possible to form direct links between the smart home domain and retail or manufacturing domains.

Release 4 of oneM2M, expected to be released in Q4 2020, will contain technical specifications of SDT-based information model and mapping for several vertical industries. It will build on over 110 ModuleClass and 60 DeviceModel items spanning multiple verticals such as home, healthcare and railway domains. The goal is to find consensus across standards development organizations and industry alliances through a common approach for device modelling.

References

Documents referred to in this article are accessible via the following:
WI-0095 - oneM2M System Enhancements to Support Data Protection Regulations
WI-0102 - System enhancements to support Data License Management
WI-0028 - Industrial Domain Enablement (including OPC-UA Interworking)
WI-0017 – Smart Device Template

Continued Strides Towards Global IoT Interoperability

Roland Hechwartner, Chairman for oneM2M's Technical Plenary

Members of oneM2M, the global standards initiative, addressed topics of interest to different audiences in the IoT ecosystem at its latest (virtual) event which concluded in July this year. These included information to help developers get the best out of Release 3 and progress on new capabilities for future releases of the standard.

Guidelines for IoT Developers

oneM2M representational state transfer (REST) application programming interfaces (APIs), or REST APIs, are used to manage data from IoT device or application endpoints, and from middleware IoT platforms. Developers can use oneM2M's common APIs free of dependencies on specific platforms or software packages. The result is a true 'write once and run anywhere' experience.

During this Technical Plenary (TP46), members approved a new API Guide for Release 3 (WI-103). The guide provides an overall understanding of the main functions offered by the oneM2M architecture. It includes a full description of API operations, their applicability, pre-requirements, call flow, resource Uniform Resource Locator (URL) information, message header information and examples of request and response messages.

Progress on Standardizing New Capabilities

oneM2M's Requirements and Domain Model (RDM) working group dealt with two Release 4 work items. The first deals with Industrial Domain Information Model and semantic features that will enable oneM2M deployments in the industrial domain.

Second, work was completed on oneM2M's Smart Device Template (SDT), which is a tool developers can use to model any type of connected device using a well-accepted and standardized format. Enhancements in SDT version 4.0 support requirements from several verticals and additions to the library of information models. This evolution is a good example of how oneM2M seeks to build on and continuously enhance existing capabilities.

oneM2M's System Design & Security (SDS) working group completed work on three other items during this TP. The first of these was the work item on Enhancements on Semantic Support, building on achievements of Release 2 and 3. An example of the items progression is the definition of basic capabilities to enable semantic reasoning and basic capabilities to enable and support analytics. The second SDS work item dealt with 3GPP networks, specifying an interworking arrangement between a oneM2M service layer and Cellular IoT network features. This makes it easier for application developers since they do not need to take care of 3GPP specificities. The third SDS work item dealt with Modbus interworking, which is a widely adopted protocol in industrial and other domains. It complements earlier efforts to enable interworking with OPC Unified Architecture (OPC-UA), another industrial sector protocol.

3GPP CT WG3 and its Role in Shaping 5G expectations

Susana Fernández (Ericsson), 3GPP CT3 Chairman

The Third Generation Partnership Project (3GPP) is working actively in the development of 5G systems establishing a stable framework for the evolution of the wireless industry. 3GPP structures the work into Working Groups that comply with specific activities. The Core Network and Terminal (CT) Working Groups are focused on the protocol details of the Core Network and Terminals that satisfy the architecture requirements defined by the Service and System Aspects (SA) Working Groups.

CT Working Group 3 (CT3)'s role in the development of 5G systems is focused in the specification of Policy, Quality of Service (QoS) and Charging control solutions within the Core Network, interworking solutions between networks and the definition of Northbound Application Programming Interfaces (APIs), application-enabling services and a unified common framework that allow Application Functions from different industrial sectors (called verticals) to access the operator network for data provisioning, exposure or monitoring of network capabilities.

With the introduction of Release 15, CT3 and also CT Working Group 4 (CT4, focused on specifying Core Network aspects) have had an important role in the definition of the first full set of 5G functionality in the Core Network according to a Service Based Architecture (SBA) where network functions within the Control Plane enable other authorized network functions to access their services. A big set of new services were defined according to these principles and were fully specified by September 2018.

According to its terms of reference, CT3 conveyed the functionality under its remit within this new architecture. The same principles were also applied to Northbound APIs, which allowed the definition of consistent and homogeneous architectures.

On top of the first set of 5G functionality, Release 16, completed in June 2020, has introduced relevant enhancements with a key focus in defining new scenarios for industrial connections and improving the efficiency of the communications. CT3 has played an important role in the specification of this new functionality. QoS advanced solutions, enhanced Network Analytics solutions, specific policy control to cope with new service demands, new/modified APIs for the provisioning and reporting of service-specific data to/from external networks, have been defined to satisfy the introduction of new services (as Ultra Reliable Low Latency Services, Cellular Internet of Things (CIoT) enhanced solutions or Vehicle-to-everything (V2X) services), the support of new accesses or new network scenarios (network slicing, time sensitive networking, non-public networks).

Release 17 will mean one more step in 5G to improve New Radio efficiency and to bring further enhancements for vertical industries. Stage 3 work started in June 2020 and CT3 will have a new challenge to ensure those requirements are covered. New APIs, enhanced exposure services, and advanced policy control will come, and CT3 will be there to fulfil these high expectations.