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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CONCEPTUAL MODEL FOR TC 100 STANDARDIZATION ON MULTIMEDIA CYBER TECHNOLOGY

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IEC TR XXXXX, which is a technical report, has been prepared by subcommittee XX: TITLE, of IEC technical committee XX:

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
XX/XX/DTR	XX/XX/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The National Committees are requested to note that for this document the stability date is ....

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INTRODUCTION

IEC 61998, Model and Framework for Standardization in Multimedia Equipment and Systems, has already described the cyber world application and the current some CE products with Internet service are starting to use cyber world application. On the other hand, TC 100 has only a few standards regarding this cyber world application.

“Study Session 10 - Multimedia cyber technology” was established to explain the cases of the multimedia cyber technology including IoT or CPS within the scope of TC 100, and proposes study items.

CONCEPTUAL MODEL FOR TC 100 STANDARDIZATION ON MULTIMEDIA CYBER TECHNOLOGY

1 Scope

This Technical Report describes the cases of the multimedia cyber technology including IoT or CPS within the scope of TC 100, and possible standardization items.

2 Normative references

T.B.C.

3 Terms and definitions

T.B.C.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Cyber Physical System in TC 100

The Cyber Physical System model in this document is illustrated in Figure 1. A Provider manages Contents or Services in physical world. A provider distributes Data for Contents or Services with Cyber-physical technology. The Data reach a user via network with Information technologies. The user receives Contents or Services from Data with Cyber-physical technologies.

The meaning of CPS, IT and IoT are generally thought as follows;

- CPS is a system to improve efficiency of all systems, create new services and improve productivity by collecting data obtained from the physical world into cyber world, processing and utilizing the data.
- IT is a technology related to computers and data communications.
- IoT is a mechanism that controls each other by not only information and communications equipment such as computers but also various objects existing in the physical world have a communication function, connect to the Internet and mutually communicate with each other.

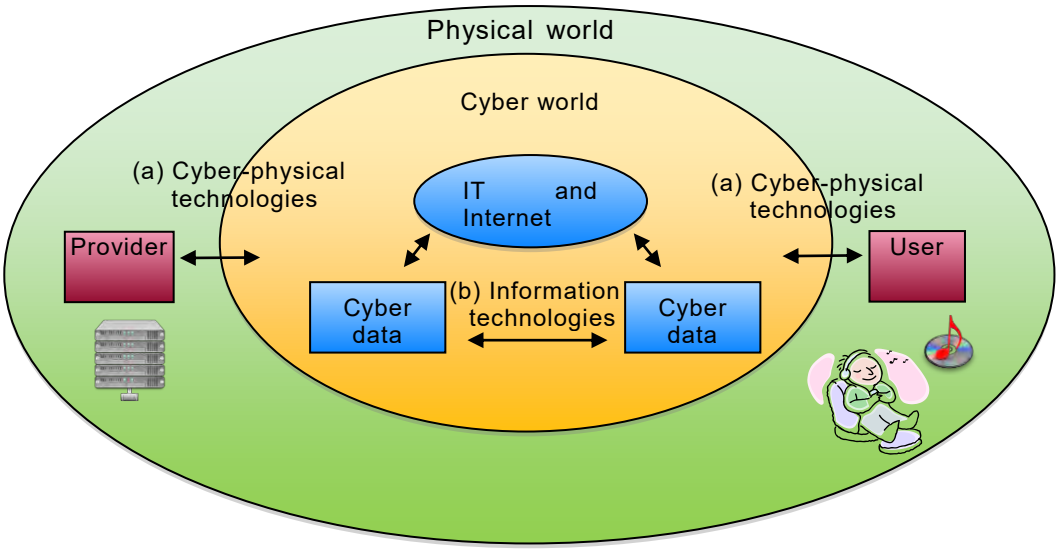


Figure 1 – Cyber Physical System model

The IEC TC 100 model from IEC 61998 Edition 2, describes entire system, includes Cyber Physical system as shown in Figure 2. Equipment and systems in TC 100 model and Data source exchange Data through Network. TC 100 model also shows the cyber world application for a variety of domains such as Home, Car and Mobile in Figure 2.

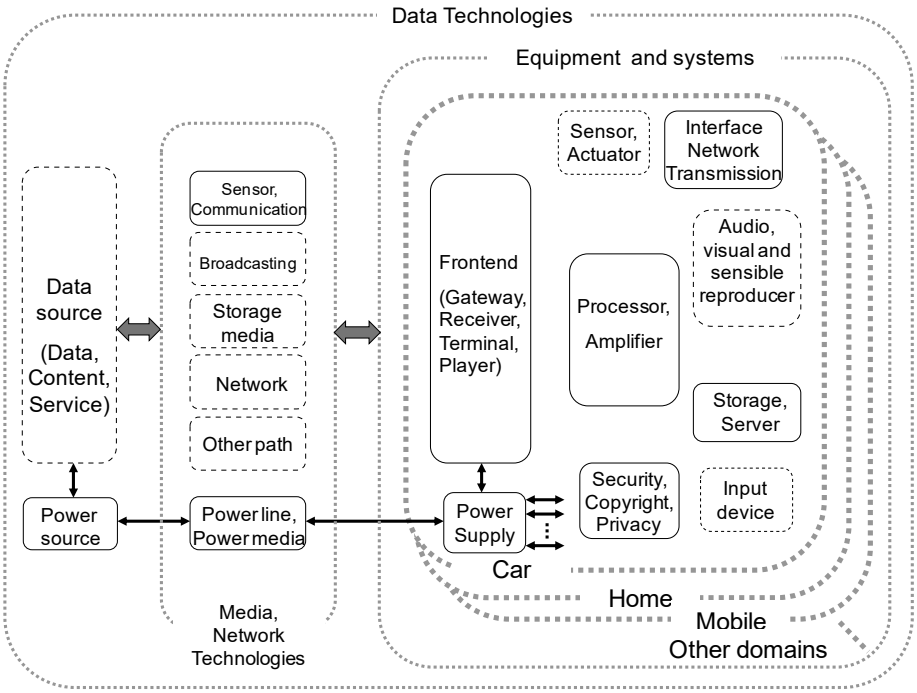


Figure 2 – TC 100 model from IEC 61998 Edition 2

Current status of activities related with cyber physical system in TC 100 is illustrated in Figure 3. Application area is not standardized yet. Plathome and Wide area network are standardized in other parties, such as Industry 4.0 so on. TA8 standardized some Local area network area items, such as ECHONET and Network configurator. Each TA standardized many devices.

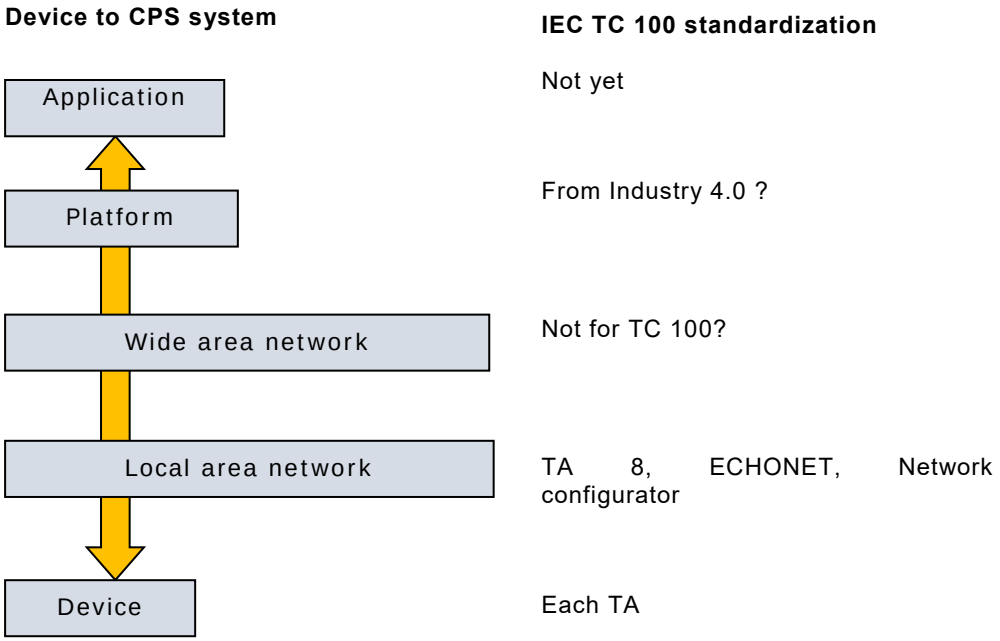


Figure 3 – Current status of activities related with cyber physical system

5 Audio video service in CPS.

5.1 General

Audio Video services are provided with IoT/CPS, such as VOD, Smart TV, Connected TV, Music MOD and Music Locker. Firstly, home music service is studied as a typical TC 100 system case. Home video services and CPS in car environment are also studied to investigate the standardization area of Multimedia Cyber technology in TC100.

5.2 Home music service

Typical music listening scene is shown in Figure 4. A music service provider offers their music through network. User can buy or subscribe the music, and listen them on several audio devices. User may also upload user's music content to the server and unify the management of the contents. Furthermore, content editing or modification will be done in the cyber system.

Currently service is content only, other information service is quite limited. Jacket picture is provided but no liner notes, related information. Some additional information, for instance a link to related content is provided.

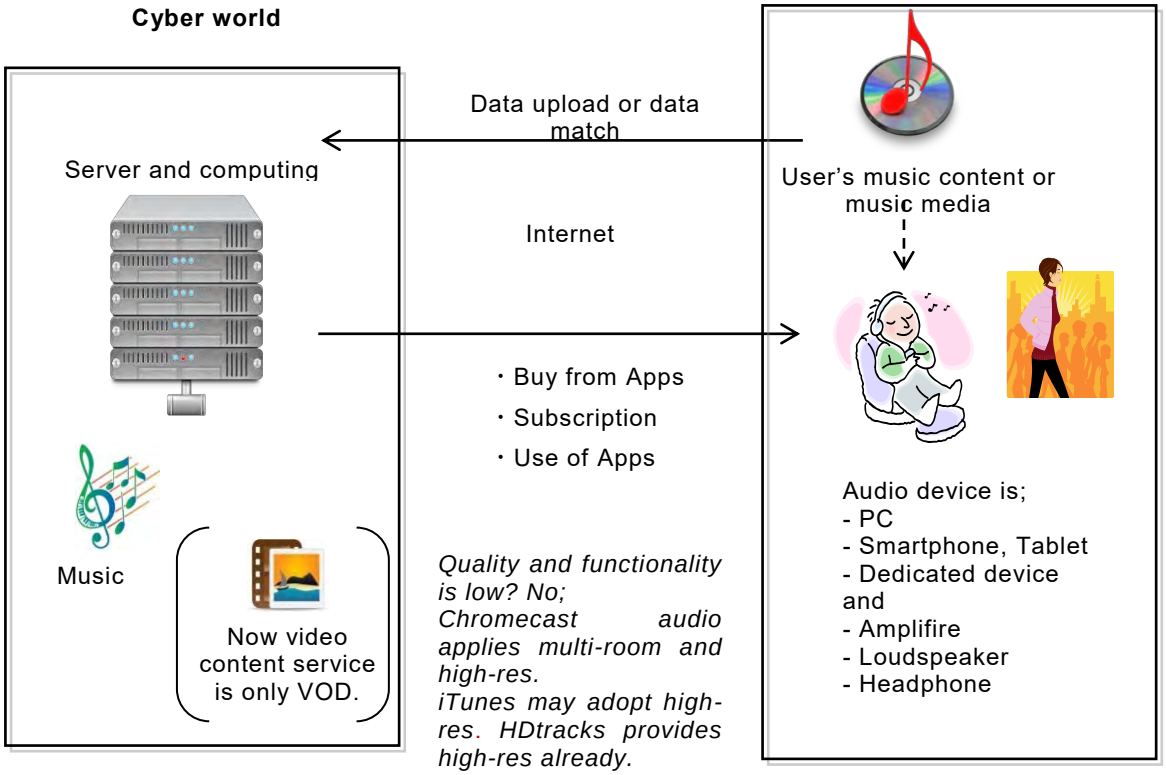


Figure 4 – Typical music listening scene

The primary client of user devices in around 2010 was the following components; Player, STB and AV amplifier, loudspeaker or headphone, monitor device, microphone, camera and other interface devices as shown in Figure 5. The entity of content came from disk media.

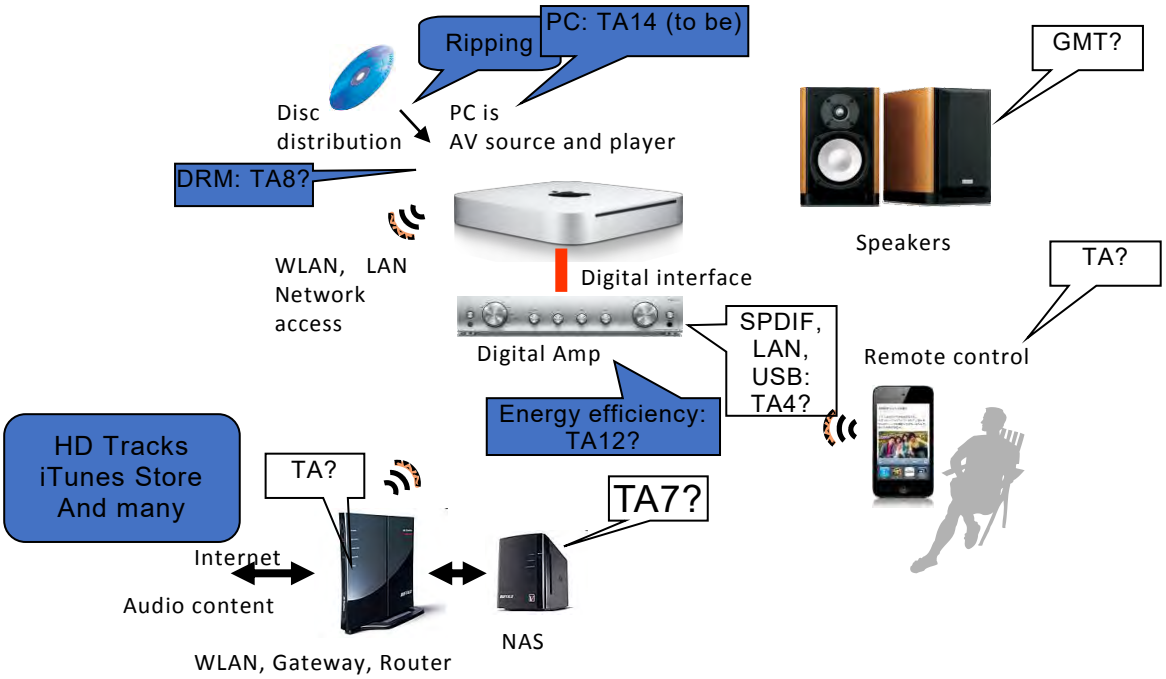


Figure 5 – The primary client in around 2010

The related activities in TC 100 are also shown in figure 5. A DRM of contents is specified by TA8. The specifications related with speakers are managed in GMT. The technologies of digital interface of audio devices are specified by TA4. The technologies related with energy efficiency are specified in TA12. The technologies related with PC are specified by TA14.

When a music service in CPS becomes widely used, not so soon, the primary client will become only the following components; smart phone, smart watch, PC and AV amplifier, loudspeaker or headphone, monitor device, microphone, camera and other interface devices. There will be no player, receiver, STB as shown in Figure 6.

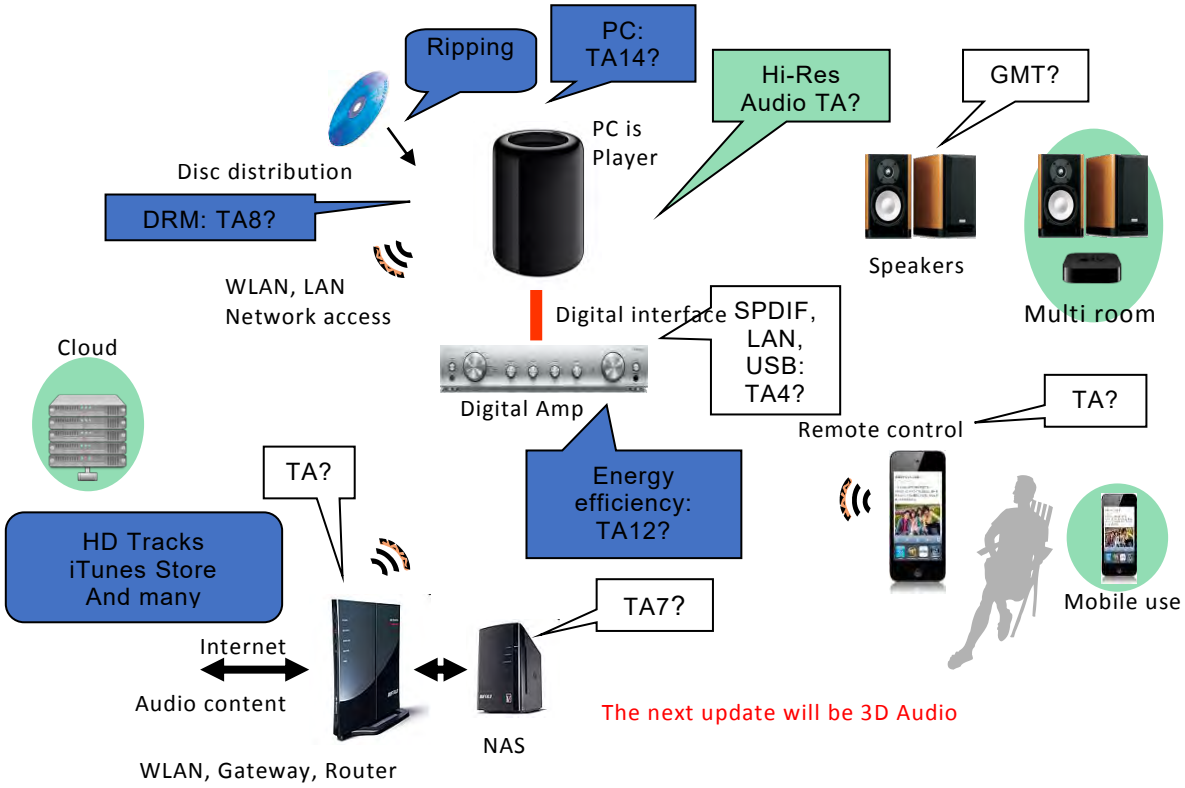


Figure 6 – The current primary client

User's client device will be such as PC/Tablet and Smartphone or the device based on PC and Smartphone architecture. Player and STB will be disappeared, but the reproduction key device such as DAC, digital amplifier, monitor, loudspeaker will exist.

The electric distribution of music via cloud services spreads instead of media distribution like CD. High-resolution audio is popular to maximize user experience. As multi room use case, when user listens to a music and moves to another room, the configuration of speakers is deferent with each room. Therefore, rendering of audio is required for each room. As mobile use case, a user becomes listening to audio everywhere and regardless of location of contents for example in mobile device, cloud server or home server system.

Digital processing is required to fit user environment such as speaker layout, reproduction capability of device, network speed. To gather each device information, a unified method or data structure is helpful.

There is also no universal scheme for all kind of such cyber domain services. If users want to access the information regarding audio content such as liner notes or content information, there is no such universal method for accessing to services.

The entity of content and service is in cyber system such as cloud or server. Physical system is disadvantage in any cost aspect of developing, manufacturing and maintenance. Only a small part of high-end system will exist in physical. This system makes consumer disk media and player disappeared. Also, user may not need to keep physical media of music in home. Most of content will exist in cyber system.

5.3 Home video service

Video service in CPS has also spread quickly. Electronic Sell Through or streaming video are popular instead of media distribution such as video tape or DVD. Video service has different requirements with music service.

There are so many type of devices, browsers and moving picture formats. It is very hard to develop home video service system to support all devices and video. Due to the difference of display resolution or type of network, it is required to transform video data to fit user's environment.

Video data is bigger than music data generally. Faster and wideband network is required for better quality. When user download video data, it takes a long time and device needs a large local memory to store it.

To establish a high-quality home video service, the followings need to be considered;

– Quality of network: When packets in network are lost often, the playback of video is interrupted.
– Bandwidth of network: High resolution video requires high bit encoding and transfer rate.
– Latency of network: If latency of network is not small, it needs longer time to response user when user makes an interaction such as cannel change.

Copy right management is one of key issues for video service. Video content especially movie requires highly copyright protected system, so that should be considered. Currently several methods, such as contract basis, are used for copy right management. On the other hand, existent video content that user has cannot be in cyber domain because of copy right, it needs to be solved. IEC 62912 of TA8 could be one solution, such standard to use cyber content is required.

5.4 Car audio video system

The different aspect is that the car system is movable on road and land, and autonomous. There are the following characteristics of car system;

- movable and autonomous, self-energy supply,
- various car working and functional modes of the car main AV system depending on the condition of car such as drive, cruise, stop, park and refuel or charge,
- human users are driver, passenger, pedestrian in and around car, and remote users from car.

CPS has been introduced into car environment with mobile network. Therefore, there is a limitation of network. Audio content in cyber world can be playback with good quality. Video content stored in a mobile phone can be played on a display which is equipped in the car. Car audio system, consists of Car main AV device and Smartphone as showed in Figure 7. This system may provide not only AV but also navigation and many services of Internet.

Figure 7 – Car audio systems consists of Car main AV device and Smartphone

Furthermore, Many CPS service are on the way. For example;

– HUD+AR will be launched soon
– Digital signage service is still limited
– Surround view monitor is standardized by TA 17, there will be more additional value services
– Drive monitor + CPS starts in some application

6 Other services

6.1 General

Some other services in cloud applications, big data applications and Internet data services other than audio video service are studied to investigate the standardization area of multimedia cyber technology within the scope of TC100.

6.2 Distributed system with IoT

IoT with IPv6 provides distributed system of content as distributed file. It also provides distributed AV & IT system and equipment. Smartphone application also provides various CPS services with location based application or user's data based services as shown in Figure 8.

Smartphone application with GPS detects user location. Content provider can provide content to user's smartphone Content arrangement service serer get a user information such as location on user, user's preference and so on. The content arrangement service server may use other person's preferences on the same location as big data. The content arrangement service server chooses contents which the user probably like using AI technology. The recommended content is in smartphone's memory, users network attached storage or content provider server. Smartphone application find the recommend contents by the content arrangement service server.

There are so many type of smartphone application, content arrangement service, and content provider. To realize any device connected with network can work with any service server, a unified management method is desired. There are several necessary elements as follows;

- Content semantics analysis and data structure

  To communicate among devices, common method is required to search, manage content and exchange the usage of application.

- Meta data

  To indicate content attribution, common metadata is required to identify content type, codec type, permission code, and so on,

- File structure

  To find content data on memory, common method is required to get content data from the storage.

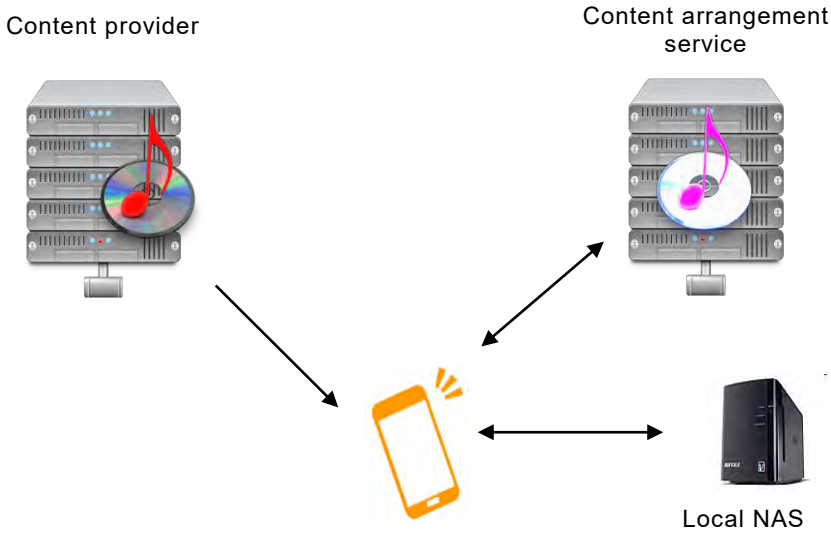


Figure 8 – An example of Distribution system with IoT

6.3 AI assisted Information services

Voice input – voice output or functional action becomes popular. Two services are shown in Figure 9 as examples. This requires a hardware of microphone-earphone (or loudspeaker) and smartphone or its like devices. For example, user asks the weather at some place, users voice is sent to a service server through an application on smartphone. Then the service server analyses user requests then reply the answer to the user. A kind of knowledge database is used to provide this service. To make and utilize the knowledge database, content/data recognition or categorization are important technologies. Categorizing, searching and recognizing are improved with AI technology. This is good system as wearable smart device, it is so-called concierge service or personal assistance.

From From

Figure 9 – Examples of AI assisted Information services

Another example of AI assisted Information service is route guidance at an event venue based on current location, personal preferences or overall trends collected from visitor's devices automatically at the event. For example, to recognize a trend, a lot of personal information is handled as big data. The big data is analysed with AI technologies to get better results. Big data processing with AI is important technology to provide improved CPS service.

AI assisted information service and control with audio (voice and talk) is popular now, AI will be incorporated into CPS in any aspects. Processing data for services, such as recommended music selection, arrangement of user's audio visual content, analysis of user's behavior for better user interface, requires AI technology to provide better services.

6.4 AI Speaker

AI speakers are announced by several companies. AI speaker provides AI assisted information services such as concierge service. AI speaker also provide control function to networked home devices such as AV receiver, TV and Room lights by user's voice. Speech recognition is one of key technologies.

AI speaker is also used for listing music. AI speaker can work with other speakers in the same room as multi-channel audio speaker. AI speaker might make speaker configuration for the room by itself or central control system like home server may communicate with AI speaker to make speaker configuration for the room. When user listens to a music and moves to another room, AI speaker or other sensor detects user movement and active speakers in the other room for user to listen to the music continuously.

6.5 AR/VR

6.5.1 General

AR/VR is hot technology to provide immersive user experience. Various input/output methods are used such as hand gesture, eye/head-move tracking, haptics, etc.

6.5.2 Consumer usage

AR, VR technology is used for consumer usage like video game. A variety of VR headsets have been introduced in the market. Ambisonic audio will be introduced. For example, a visual avatar with ambisonic audio is appeared in user's head mount display.

Figure 10 – An example of VR for consumer usage

There are so may type of device stimulating human's senses such as head mount display, multi-channel speakers, force feedback joystick, haptics, olfactory device and so on. Each device may support different formats such as display resolution, refresh rate, number of speakers, video codec, audio codec, computer graphics plathome, etc. Therefore, required capability of interface and data format are deferent with each device. Management method for devices and system is important to keep good interoperability.

6.5.3 Industrial usage

AR, VR technology is widely noticed not only for consumer usage like video game software, but also for industry area. It works in combination with hardware, software, and network as a system. This helps workers to do correct operations or to get appropriate real-time instructions.

The requirements may be different with those of consumer usage. For example, a worker fixes broken points of pipeline and the worker is instructed by overlaying digital information on a view of the real world. When the worker looks around for broken point of pipeline, the view of the real world is slightly moved. If overlaid digital information is not re-rendered with enough quick speed, the digital information is overlaid on wrong position of the view of the real world.

Figure 11 – An example of AR for industrial usage

Performance of devices and system that must be met is a critical element for industrial usage, especially. Measurement method for devices and systems is also required to recognize whether a device or system fits the required performance or not.

6.6 Connected car

Many sensors such as camera, acceleration sensor, GPS are attached to a car. In TC 100 activity, TA17 has discussed Drive Recorder for accident, Drive monitor system, and so on. User can add a sensor like camera to a main control unit in a car. For interoperability, common interface and control scheme among various devices are expected. A system may recognize driving distance and the driver's driving risk with an additional equipment. The system might make a caution to the user if the driver's driving risk is high.

When cars are connected to a network, a lot of information from sensors is collected as big data and analgised with AI technology. This makes new CPS services. For example, visual/phonic information such as expected traffic flow on the road map is provided based on the big data analysed with AI technology.

For autonomous car driving, a car communicate with near cars without going through central servers due to the capacity and delay of network. For example, an autonomous car gets information on objects sensed by sensors of other cars, recognizes objects at the blind spot such as the oncoming vehicle, pedestrians and obstacles. More sophisticated sensors (camera, radar, etc.) are used to recognize objects, road condition and so on.

Dynamic map is another CPS service for connected cars. The Dynamic map is static high-precision three-dimensional map with dynamic information such as traffic regulations, road construction, accidents and congestion. Various information such as the center line of the roadway, the pedestrian crossing, the stop line, the traffic sign, the signboard is stored in the high-precision three-dimensional map of the dynamic map, connected cars sense around and provide the information to create a dynamic map.

6.7 AAL

AAL (Active Assisted Living) aims to improve the quality of life. Some of users may have difficulties of hearing, listening, viewing and sensing because of their age, by nature or some other reasons. AAL device or system complement the weakness of the users who have some difficulties.

Information assistance services as AAL is provided using CPS technology. There are 3 kinds of information assistance for AAL area as follows;

– Audio information assistance area:

  Audio information assistance helps person listen in audio. In TC 100 activity, A series of IEC 63087 will specify requirements for the assistive listening in audio and equipment.

– Visual information assistance area:

  Visual information assistance helps person recognize video or subtitle. In TC 100 activity, tele-text speaking is specified for this area. Eye wear type device is expected with AR/VR technology to assist visual information directly.

– Cognitive assistance area:

  Cognitive Assistance helps person understand what is going on around. To recognize what happen around, mobile or wearable device with many censors are usually used. Cognitive assistance provides new opportunities for social participation to people with disabilities and senior.

Various type of devices is used to handle audio, video, multimedia data. These devices provide helps to users after signal processing sensed data by the device. Assistance by analysis of big data is important to help people's judgment for cognitive assistance, especially.

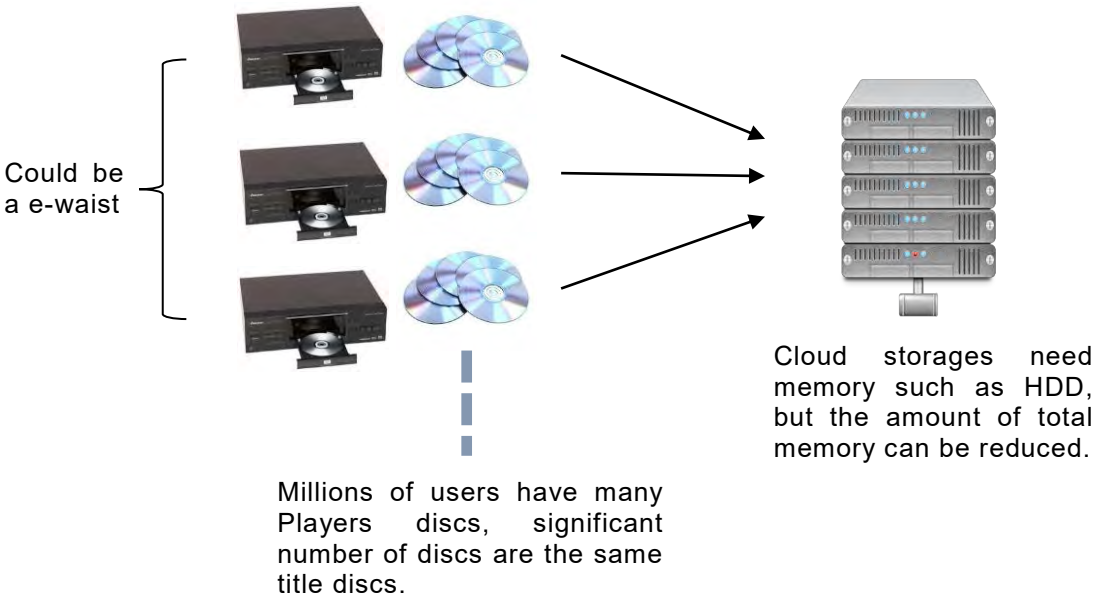
6.8 Personal wellness care

There are many type of active tracker in the market. Most of them is wearable device like a list band. Some of them works with smartphone application to provide more intelligent service. For example, a service provider gathers personal activity data such as walking distance from a user’s wearable device automatically, the service provider analysis the data and give a recommendation of exercise, foods and body care advise to the user. Service provider can provide more helpful information such as generation and regionality by analysing a lot of personal activity data as big data.

7 Environmental aspect

CPS shifts any physical properties to cyber domain, this also means e-waist can be reduced and the electric power used for device and equipment is reduced.

The content in CD, DVD and BD or Tapes, HDD can be in cyber domain. That reduces physical memory devices amount. Audio video data player, receiver or processing function is executed in cyber domain. That reduces physical equipment.



8 Safety aspect

There are many reports of hacking IoT devices such as web camera, network router. Robustness is important for each element. And firmware update mechanism is also important to against the threat increases.

In addition to that, there is unique safety requirement for IoT. A lot of devices are connected in CPS. They will be autonomous and work by interacting each other. If a device influences the other, system will not work properly and it may cause harm to users. For examples, if a remote user tries to volume up on an audio player, the sound may be too big for near listener. If a user requests to turn TV having a capability of motored-turning, the TV might hit another person or something.

Conflict requirements between devices may cause dangerous situation and the priority should be considered for each use case. It is important to make sure Safety and Interoperability. The idea of Functional Safety, which determines electrical controlling equipment's moving and its connected moving by the priority of safety, has been recently advocated.

9 Possible study items

9.1 Methodology of computing data to provide well quality reproduction

The balance between well quality reproduction of AV content and QoS of network is needed to be considered to maximise user experience. Reproduction environments are different with each user. Cyber Physical system is needs to process AV data to provide better balanced reproduction to the user. Methodology of computing data such as format conversion and modification of data to provide well quality reproduction is one of possible study item.

9.2 Measurement method for the minimum client devices and systems

There are so many type of input/output devises such as headset with eye/head-move tracking, loudspeaker for ambisonic audio, haptics device. Measurement method for each device is required to evaluate whether a device fits certain requirements or not. Measurement for not only device but also user interface, input/output interface, transmission and file format is helpful to evaluate whether a system totally fits certain requirements. Measurement method for the minimum client devices and systems is one of possible study item.

9.3 Management method for devices and systems in network

Interoperability and safety in cyber physical system are important for users. For example, user purchase a network gear such as AI speaker. Network configuration for AI speaker such as ip address, default gateway or available service server information for the user is automatically set by network configurator like home server. Another example, when home server detects something is wrong with the AI speaker, home server contacts a service center for the AI speaker automatically. Management method for devices and systems in network is one of possible study item to make sure safety and interoperability in cyber physical system.

9.4 Unified management method for content

There are so many type of smartphone application, content arrangement service, and content provider. To realize any device connected with network can work with any service server, a unified management method is desired. Unified management method for content is one of possible study item. Especially, (1) Content semantics analysis and data structure to search, manage content and exchange the usage of application, (2) Meta data to identify content type, codec type, permission code and (3) File structure to find content data on memory are candidates to study items.

9.5 Digital Signal processing schemes

To improve user experience, it is required to handle several kinds of new data such as high-resolution video/audio, 3D audio, haptics, etc These requires high speed and more power efficiency digital signal processing to TC 100 devices. Handling new data may require new interface or enhanced interface. Digital signal processing schemes is one of possible study item.

9.6 Measurement and management method for devices and systems using AR/VR technology

AR/VR technology is one of key items to improve user experience in cyber physical system. In AR/VR system, several devices such as headset, haptics and olfactory device are harmonized to maximise immersive experience. Performance of devices and system that must be met is a critical element for industrial usage, especially. Measurement method for devices and systems is required to recognize whether a device or system fits to expected performance or not. Measurement and management method for devices and system with AR/VR technology are possible study items.

9.7 QoS of network

To provide a better service to users in cyber physical system, quality of service of network is very important factor. A system providing a CPS service is required to handle QoS of network such as quality of network, bandwidth of network and latency of network.

Handling QoS of network is one of possible study item. To know a whole of network status, each device needs to report the local network status of the device. It may be required to enhance network configuration (IEC 62608).

9.8 Big data processing with AI

Data obtained from devices such as wearable, health devices or cars are processed as big data with AI technology to provide a new service or information. For example, a music and video streaming service provides a well listened music information in certain ages or a region. It is an important technology to recognize what content is used, how used, where it was used to provide a new service.

Big data processing with AI is possible study item to provide a new service for TC 100 devices and systems.

9.9 Content/data recognition or categorization with AI

Cyber physical system provides the added-value services such as automatic content arrangement or recommendation content service. A kind of knowledge database is used to provide this kind of service by recognizing and categorizing data. Categorizing, searching and recognizing the data are improved with AI technology.

Content/data recognition or categorization with AI technology are possible study item to provide a new service with better user experience in CPS.