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Abstract: This TD contains the initial output of draft new Recommendation ITU-T F.3DCS-reqts "Requirements and functional architecture for 3D collaborative design services", discussed at Q21/16 sessions of SG16 meeting, held in Rennes, from 15-26, April 2024.

NOTE – Editorial adjustments performed by TSB. Issues needing editor's attention are identified in WinWord comments. Editors are requested to carefully read the Author's Guide for drafting ITU-T Recommendations, <https://www.itu.int/oth/TOA0F000004/en>.

This initial new draft Recommendation is based on the discussion of contribution [SG16-C556-R1](#) at SG16 meeting, held in Rennes, from 15-26, April 2024.

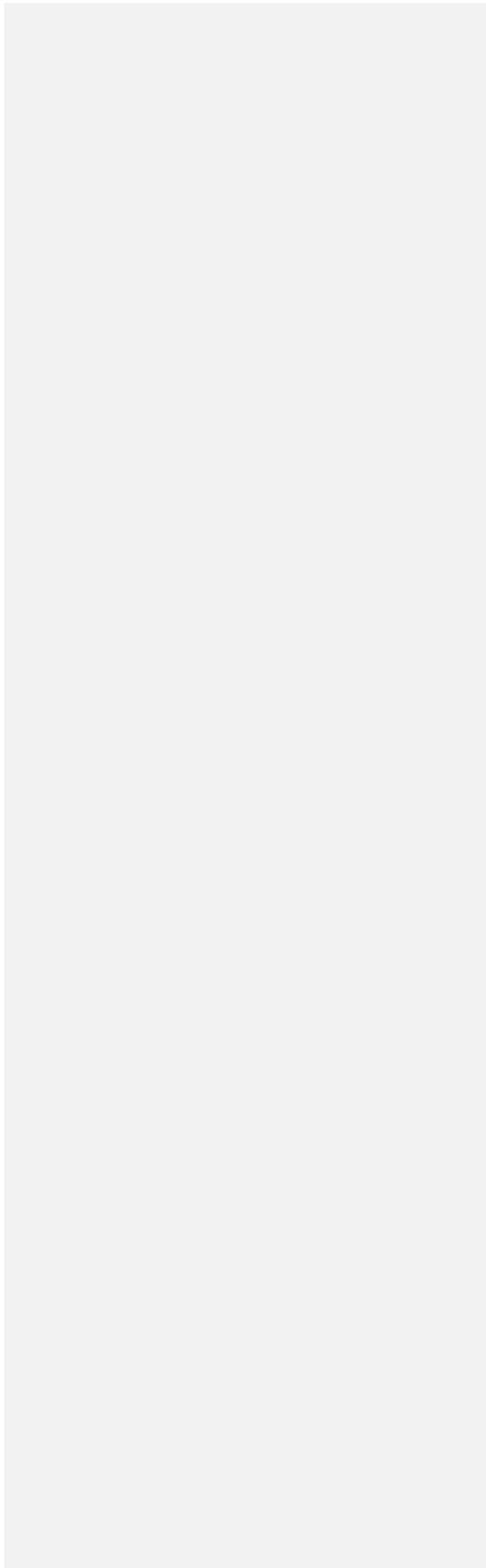
Document	Source	Title	Agreements
SG16-C556-R1	China Unicom, Huawei Technologies	New: F.3DCS-reqts: Proposed new work item on requirements and reference architecture for 3D collaborative design services	Accepted

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Draft new Recommendation ITU-T F.3DCS-reqts

Requirements and functional architecture for 3D collaborative design services

Summary

This draft Recommendation ~~identifi~~specifieses the requirements and functional architecture for 3D collaborative design services, including the overview~~concept~~ and definition, functional architecture and requirements.

Keywords

3D collaboration, 3D design

1 Scope

This draft Recommendation ~~specifies~~identifies the requirements and functional architecture for 3D collaborative design services. In particular, the scope of this draft Recommendation includes:

- Overview~~Concept~~ and definition for 3D collaborative design services
- Functional architecture for 3D collaborative design services
- ~~Scenarios for 3D collaborative design services~~
- Requirements ~~and~~ for 3D collaborative design services

Additionally, relevant scenario~~requirements~~ and procedures~~use cases~~ are ~~defined~~provided in this recommendation.

2 References

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2011), *Terms and definitions for next generation networks*.

[TBD]

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application [b-ITU-T Y.2091]: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

3.1.2 3D design: It refers to create a digital model of a three-dimensional shape or object. Organizations and professionals across industries use 3D design to communicate ideas, create products and customer experiences, teach concepts, and more.

3.1.3 Collaborative software [b-collab-software]: type of computer program that shares data between computers for processing.

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3.2 Terms defined in this Recommendation

3.2.1 3D collaborative design services (adapted from [b-3D-design]): A set of services that provide 3D data processing and design capabilities, offering a range of collaborative design tools such as 3D data processing, modeling, editing, profiling, and more. These services enable multiple users to operate simultaneously within the 3D models or scenes, allowing them to browse, create, and edit 3D data. *[NOTE: Need to be modified in the future output]*

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4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

TBD

5 Conventions

In this Recommendation:

- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.
- The keywords "can optionally" and "may" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Overview

6.1 Background

With the development of cloud computing and edge integration computing technology, enterprises will move more business to cloud, including 3D data and tools. It significantly alleviates the high cost of traditional desktop software deployment, including high price, high hardware costs, high training costs and so on. At the same time, the cloud also makes the industry chain upstream and downstream collaboration possible, because the cloud itself has a strong link attribute.

Using [IMT-2020 Connect5G](#) and cloud technology, the integration of 3D design, simulation, rendering, visualization, collaboration and data management is moved to the cloud to maximize work collaboration and break the boundaries of time and space, greatly simplifying the enterprise digital architecture and accelerating the business process.

In the past ten years, enterprises have gradually completed the digital transformation and upgrading of internal organizational processes and management, after which they began to gradually extend from the internal organization to the upper and lower reaches of the industrial chain, through digital tools or platforms, to further improve the efficiency of industrial synergy, especially in the product life cycle process (including: design, production, marketing, etc.), to achieve business model upgrading and innovation.

At the same time, product R&D in the vertical field also involves many 3D design software, and the design software used in the upstream and downstream of the industry is even more different. Collaboration is inefficient when using individual software, which leads to a lot of design waste and

missed product launches. Because of the strong specialization of 3D industry, general collaboration tools (such as video, AR/VR and other streaming-media-based collaboration) will lose the inherent logic of 3D data) cannot solve the 3D data management and collaboration requirements. Therefore, cloud-based 3D data management and collaborative services will be urgently needed in the future market.

An optimized architecture for 3D design collaborative services has the potential to facilitate the effective integration of people, 3D data, business processes, and industrial technologies, thereby accelerating decision making and the digital innovation.

6.2—Scenarios

6.2.1—Reduce product Research & Development Time

The 3D collaborative design services speeds up the process of innovating and testing new ideas as it facilitates rapid back and forth between development and simulation in a unified 3D environment. By connecting all disciplines together, the platform is the only version of the real data needed to turn ideas into innovative products and experiences. It simplifies collaboration and reduces time between concept phase and prototype development, thereby reducing IPO time for products, services and experiences.

6.2.2—More comprehensive collaboration

Digitally connect all participants to the innovation process through secure, real-time collaboration across disciplines. By sharing a common infrastructure, everyone can share their ideas, plans, and work using a common language and product definitions. People working remotely or teams not previously involved in the development cycle can easily contribute to the innovation process.

6.2.3—Improve traceability

Leveraging the traceability of various changes and decisions enables better visualization of related processes and projects. By combining design, engineering, manufacturing and project management perfectly, by establishing an integrated view in order to manage projects and processes in real-time. This digital representation allows everyone to visualize project status at any given time and quickly access all project information.

6.2.4—Increase test speed

Not only can it provide the ability to create a virtual twin experience, but it also increases knowledge and expertise over an ongoing cycle, while closing the gap between experimentation and learning. With virtual twins, realistic test scenarios can be realized in a fraction of the time required in the real world, with the best combination to achieve the desired results. The involved personnel can experiment continuously, gaining knowledge by exploring all possibilities and scenarios.

6.2.5—Professional technology sharing

The 3D collaborative design services collecting and providing information on past projects, such as design libraries, project templates and quality profiles, it facilitates the development of best practices. It will help young designers, engineers and professionals entering the workforce accelerate their acquisition of industry knowledge.

7—Use cases

7.1—Communicate, revision and display

Users need to use a high-fidelity multimedia system to discuss the project, or to present the content to some known remote client, in case the field personnel encounter a problem that can not be solved

with localization support, the 3D cooperative application makes use of the remote expert cooperation system to share the visual angle through the AR terminal, and makes the remote expert quickly sense the scene condition. And can call 3D interactive content, auxiliary line more comprehensive three-dimensional cognitive operation object, accurate contrast operation.

7.2 Remote collaborative design, shared experience, consumer customization

In the field of industrial design, cross-platform, cross-terminal and multi-role collaboration based on 3D collaboration, can invite partner members to engage in remote and immersive collaboration, get feedback and evaluation from other stakeholders (such as other designers, engineers, sales and marketing, or external customers, etc.) in a timely manner, thus improve the efficiency of the whole design process.

8.7 Reference Functional architecture for 3D collaborative design services

The modules for 3D collaborative design services can be deployed according to infrastructure, data alignment processing, information aggregation, 3D processing core component, 3D collaboration enable tools, 3D collaborative design operation, users configuration and adapter/scheduler as shown in Figure 1.

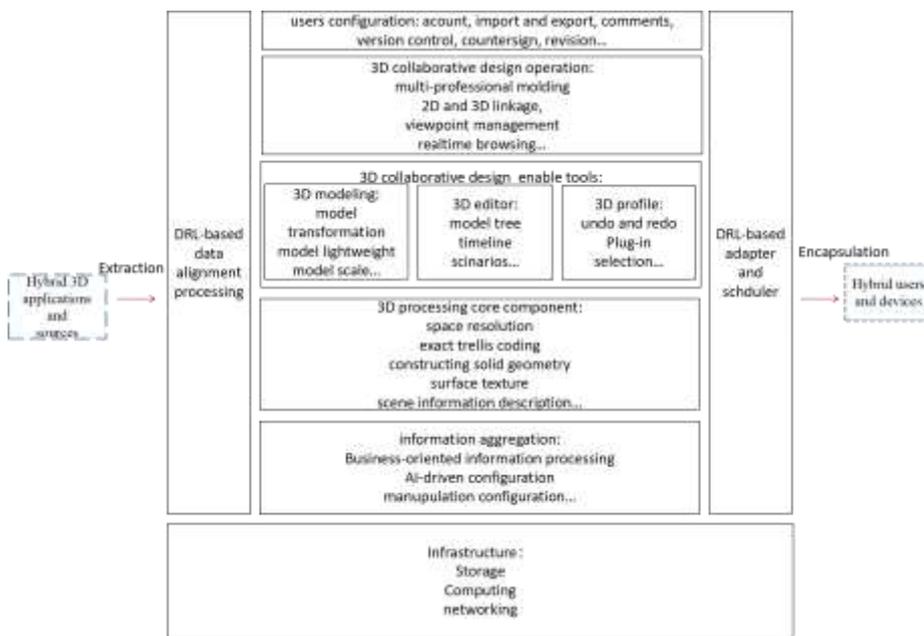


Figure 1– Reference Functional architecture for 3D collaborative design services

9.8 Requirements for 3D collaborative design services

8.1 Infrastructure requirements

- **IR-01:** It is required to support on-site edge computing node facilities.
- **IR-02:** It is recommended dedicated storage and real-time processing equipment and computing nodes for VR/AR services.

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- [IR-03](#): It is required to end-to-end controllable secure connections.

9.18.2 Functional requirements

9.28.3 Hybrid resources extraction

- [HE-01](#): It is required to have the ability to manage data resources, including storing, querying, updating, and deleting data.
- [HE-02](#): It is required to have the ability to manage configuration resources, including configuration definition, creation, modification, and deletion.
- [HE-03](#): It is required to have the ability to implement multiple scenarios that are consistent with the business logic of the enterprise.

9.38.4 Data alignment processing

- [AP-01](#): It is required to normalize the input multi-modal data to make it comparable.
- [AP-02](#): It is required to have the ability to build mathematical models of multi-modal data and to analyse their correlations and interactions.
- [AP-03](#): It is required to have the ability of connecting 2D and 3D data from the same data source.
- [AP-04](#): It is recommended to denoise and augment the feature of the fused data.

9.48.5 Information aggregation

[TBD]

9.4.18.5.1 3D data processing

9.4.1.18.5.1.1 Scene and content generation

- [SCG-01](#): It is required to have the ability to develop lightweight strategy templates according to the scenarios.
- [SCG-02](#): It is recommended that the scenario is customizable.
- [SCG-03](#): It can optionally support for algorithm-driven scene generation.

9.4.1.28.5.1.2 Spatial operation and interaction

- [SOI-01](#): It is required to have the ability of logical operation on spatial data, such as union set, intersection set, difference set, etc.
- [SOI-02](#): It is required to have the ability of radiometric analysis of spatial data to form the mapping relationship between spatial data.
- [SOI-03](#): It is required to have the ability of ranging spatial data and to determinate the distance and position relationship between spatial data.
- [SOI-04](#): It is required to have the target detection, eye tracking, voice interaction, motion capture module.
- [SOI-05](#): It is recommended that the target tracking module can be customized according to the scene, and also can be tracked according to the motion characteristics.

9.4.1.38.5.1.3 3D rendering and visualization

- [RV-01](#): It is required to have the ability to load texture of the 3D model and to set lighting and shadow effects.

- [RV-02](#): It is required to have the ability of classification and segmentation of the 3D model, which is convenient to set up and generate the model structure in accordance with the application.
- [RV-03](#): It is required to provide 3D model rotation, scaling, translation and selection functions, so that users can view the model from different angles and scales.
- [RV-04](#): It is required to have the measurement, tagging and profiling capabilities to enable users to perform detailed analysis and tagging of models.

[9.4.28.5.2](#) 3D collaborative design [enable](#) tools

[TBD]

[9.4.38.5.3](#) 3D collaborative design operation

[TBD]

[9.4.48.5.4](#) User configuration

[TBD]

[9.4.58.5.5](#) Device Management, security and authentication

- [S-01](#): It is recommended the equipment registration management based on the Internet of things and extensive interconnection
- [S-02](#): It is recommended that the authentication management of identity access is based on block-chain platform.

[9.4.68.5.6](#) Adaptation and encapsulation

[TBD]

Appendix I Scenarios

(This appendix does not form an integral part of this Recommendation.)

This appendix includes the 3D collaborative design services related scenarios based on which the corresponding functional requirements are derived.

I.1.1 Reduce product Research & Development Time

The 3D collaborative design services speeds up the process of innovating and testing new ideas as it facilitates rapid back and forth between development and simulation in a unified 3D environment. By connecting all disciplines together, the platform is the only version of the real data needed to turn ideas into innovative products and experiences. It simplifies collaboration and reduces time between concept phase and prototype development, thereby reducing IPO time for products, services and experiences.

I.2.2 More comprehensive collaboration

Digitally connect all participants to the innovation process through secure, real-time collaboration across disciplines. By sharing a common infrastructure, everyone can share their ideas, plans, and work using a common language and product definitions. People working remotely or teams not previously involved in the development cycle can easily contribute to the innovation process.

I.3.3 Improve traceability

Leveraging the traceability of various changes and decisions enables better visualization of related processes and projects. By combining design, engineering, manufacturing and project management perfectly, by establishing an integrated view in order to manage projects and processes in real time. This digital representation allows everyone to visualize project status at any given time and quickly access all project information.

I.4.4 Increase test speed

Not only can it provide the ability to create a virtual twin experience, but it also increases knowledge and expertise over an ongoing cycle, while closing the gap between experimentation and learning. With virtual twins, realistic test scenarios can be realized in a fraction of the time required in the real world, with the best combination to achieve the desired results. The involved personnel can experiment continuously, gaining knowledge by exploring all possibilities and scenarios.

I.5.5 Professional technology sharing

The 3D collaborative design services collecting and providing information on past projects, such as design libraries, project templates and quality profiles, it facilitates the development of best practices. It will help young designers, engineers and professionals entering the workforce accelerate their acquisition of industry knowledge.

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Appendix II Use-cases

(This appendix does not form an integral part of this Recommendation.)

NOTE: This appendix needs to be merged with the Scenarios!

This appendix includes the 3D collaborative design services related use cases based on which the corresponding functional requirements are derived.

II.1.1 Communicate, revision and display

Users need to use a high-fidelity multimedia system to discuss the project, or to present the content to some known remote client, in case the field personnel encounter a problem that can not be solved with localization support, the 3D cooperative application makes use of the remote expert cooperation system to share the visual angle through the AR terminal, and makes the remote expert quickly sense the scene condition. And can call 3D interactive content, auxiliary line more comprehensive three-dimensional cognitive operation object, accurate contrast operation.

II.2.2 Remote collaborative design, shared experience, consumer customization

In the field of industrial design, cross-platform, cross-terminal and multi-role collaboration based on 3D collaboration, can invite partner members to engage in remote and immersive collaboration, get feedback and evaluation from other stakeholders (such as other designers, engineers, sales and marketing, or external customers, etc.) in a timely manner, thus improve the efficiency of the whole design process.

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Bibliography

- [b-ITU-T Y-Sup.44] Recommendation ITU-T Y Suppl.44 (2017), *Standardization and open source activities related to network softwarization of IMT-2020.*
- ~~[b-3GPP TS 23.501] 3GPP TS 23.501 (2019), *3rd Generation Partnership Project – Technical Specification Group Services and System Aspects – System architecture for the 5G System (5GS); Stage 2.*~~
- [b-collab software] Collaborative Software. (n.d.). In *Encyclopædia Britannica*.
<https://www.britannica.com/technology/collaborative-software>
- [b-3D-design] Coursera. (n.d.). 3D Design.
<https://www.coursera.org/articles/3d-design>
- [b-collab-software] Collaborative Software. (n.d.). In *Encyclopædia Britannica*.
<https://www.britannica.com/technology/collaborative-software>

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