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Recommendation

ITU-T J.1305 (07/2023)

SERIES J: Cable networks and transmission of television, sound programme and other multimedia signals

Cloud-based converged media services for IP and broadcast cable television

Requirements for microservices architecture for audiovisual media in the converged media cloud

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Recommendation ITU-T J.1305

Requirements for microservices architecture for audiovisual media in the converged media cloud

Summary

Recommendation ITU-T J.1305 specifies requirements for the architecture and related components of audiovisual media based on microservice technologies. Recommendation ITU-T J.1305 applies to the design, development, construction, operation and maintenance of audiovisual media systems based on microservices. Recommendation ITU-T J.1305 is based on the characteristics of microservice technology and audiovisual media business, combines the requirements of technology and business, and devises an audiovisual media microservice architecture (MMA) that meets the needs of rapid iteration and diversified services of the audiovisual media business. MMA follows the tiered architectural methodology specified in Recommendation ITU-T J.1302. Mainly from the perspective of cloud platform, Recommendation ITU-T J.1301 and Recommendation ITU-T J.1302 stipulate the system architecture of cloud-based converged media services to support Internet protocol and broadcast cable television services. From the perspective of microservice, Recommendation ITU-T J.1305 specifies the microservices architecture of integrated media based on container, virtual machine, cloud and other infrastructures to support the audiovisual media business carried out by microservices on a variety of infrastructures.

History [*]

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Keywords

CBCMS, cloud-based converged media services, converged media, microservices architecture, requirements.

[*] To access the Recommendation, type the URL https://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Introduction

This Recommendation is part 1 of a multi-part deliverable covering microservices architecture for audiovisual media in the converged media cloud, identified as follows.

Part 1: ITU-T J.1305 – Requirements

Part 2: [b-ITU-T J.1306] – Specification

Recommendation ITU-T J.1305

Requirements for microservices architecture for audiovisual media in the converged media cloud

1 Scope

This Recommendation specifies requirements for the architecture and related components of audiovisual media based on microservice technologies.

This Recommendation applies to the design, development, construction, operation and maintenance of audiovisual media systems based on microservices.

This Recommendation is based on the characteristics of microservice technology and audiovisual media business, combines the requirements of technology and business, and devises an audiovisual media microservice architecture (MMA) that meets the needs of rapid iteration and diversified services of the audiovisual media business. MMA follows the tiered architectural methodology specified in [ITU-T J.1302].

Mainly from the perspective of cloud platform, [ITU-T J.1301] and [ITU-T J.1302] stipulate the system architecture of cloud-based converged media services to support Internet protocol and broadcast cable television services. From the perspective of microservice, this Recommendation specifies the microservices architecture of integrated media based on container, virtual machine, cloud, and other infrastructures to support the audiovisual media business carried out by microservices on a variety of infrastructures.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T J.1301] Recommendation ITU-T J.1301 (2021), *Specification of a cloud-based converged media service to support Internet protocol and broadcast cable television – Requirements*.

[ITU-T J.1302] Recommendation ITU-T J.1302 (2022), *Specification of a cloud-based converged media service to support Internet protocol and broadcast cable television – System architecture*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 audiovisual media [b-ISO/TR 11219]: Documents in which sound and/or pictures are prominent, and which require the use of special equipment to be viewed and/or heard.

NOTE – This includes audio documents, pictures and films on different physical carriers.

3.1.2 cloud-based converged media service (CBCMS) [ITU-T J.1301]: A service intended for deployment by cable television operators and to support the requirements of rapid service innovation

and deployment, which enables media services to be developed by separate vendors according to the standard application programming interfaces, where appropriate.

3.1.3 container [b-ITU-T Y.3535]: A set of software to provide isolation, resource control and portability for virtualization processing of an application.

3.1.4 microservice [ITU-T J.1301]: An architectural and organizational approach to software development where software is composed of small independent microservices that communicate over well-defined application programming interfaces. Microservice architecture makes applications easier to scale and faster to develop, enabling innovation and accelerating time-to-market for new features.

3.1.5 microservices architecture [b-ISO/IEC TS 23167]: Design approach that divides an application into a set of microservices.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 converged media: New type of media that effectively combines the information technology of radio, television, newspapers and periodicals, network audiovisual and other aspects, with the help of diversified communication channels and forms.

3.2.2 media microservice architecture (MMA): A system construction method oriented to audiovisual media based on microservice technologies. Its core idea is to adopt miniaturized and distributed methodologies to provide services to users in system development, deployment and maintenance for complex application scenarios related to audiovisual media, to avoid the problem that the system is difficult to maintain and upgrade with the increasing number of business scenarios.

3.2.3 process engine; workflow engine: Software service or “engine” that provides the run time execution environment for a process instance.

NOTE – Adopted from the definition of "workflow engine" in [b-ISO 12651-2].

3.2.4 rule engine: A management service for parsing, invoking and executing rules that use predefined semantic modules to write business decisions, accept data input, interpret business rules, and make business decisions.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CBCMS Cloud-Based Converged Media Service

DDD Domain-Driven Design

MMA Media Microservice Architecture

5 Conventions

In this Recommendation:

The phrase "is required" indicates a requirement that must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The phrase "is recommended" indicates a requirement that is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The phrase "is prohibited" indicates a requirement that must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The phrase "can optionally" indicates an optional requirement that is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator or service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Recommendation.

In the body of this Recommendation and its annexes, the words *shall*, *shall not*, *should*, and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required*, *is prohibited*, *is recommended* and *can optionally*. The appearance of such phrases or keywords in an appendix or in material explicitly marked as *informative* are to be interpreted as having no normative intent.

6 Overview

The audiovisual media industry has undertaken huge efforts toward cloudification in recent years. There are many industrial players and quite a few academic organizations in the media industry that have been using microservice technology as their leading pivot tool to pry away this cloud transformation and capture measurable success. There is an urgent need to synthesize their success and make various microservice technologies exploration and usage into a common architect: MMA.

Because of its purpose-focused, process independent and loose coupling, as well as light communication distinct-distributed system features, microservice has become an excellent encompassing technology for modern software construction, especially for cloud-native applications. Microservices architecture is used to organize complexities related to microservices under a common umbrella. It is a software architecture style in which complex applications are composed of small, independent services communicating with each other using language-agnostic application programming interfaces.

Media companies and organizations, unlike well-established Internet technology giants, often face daunting challenges when choosing from dozens if not hundreds of technologies and concerns about their new system construction or legacy system modernization. A set of coherent and well-defined functional (and non-functional) requirements for microservices architecture can give clear guidance and foster collaborations among players in the media industry.

7 Key features and requirements

The primary feature or requirement for MMA must be a tiered logical structure. Tiered and layered systems mitigate development and operational complexities. In general, a tiered system consists of layers with different units of functionality. The essential characteristics of tiered systems are that a layer communicates by means of predefined interfaces and only with the layer above or below; the layers above rely on those below to perform their functions. Layers can be added, removed, modified or reordered as the architecture evolves.

Following the accumulated wisdom of the software industry, an MMA is required to address two architecture concerns simultaneously: technical and business. Figure 1 is an MMA logical diagram that features tiered architecture and has an upper business part built upon a lower technical one.

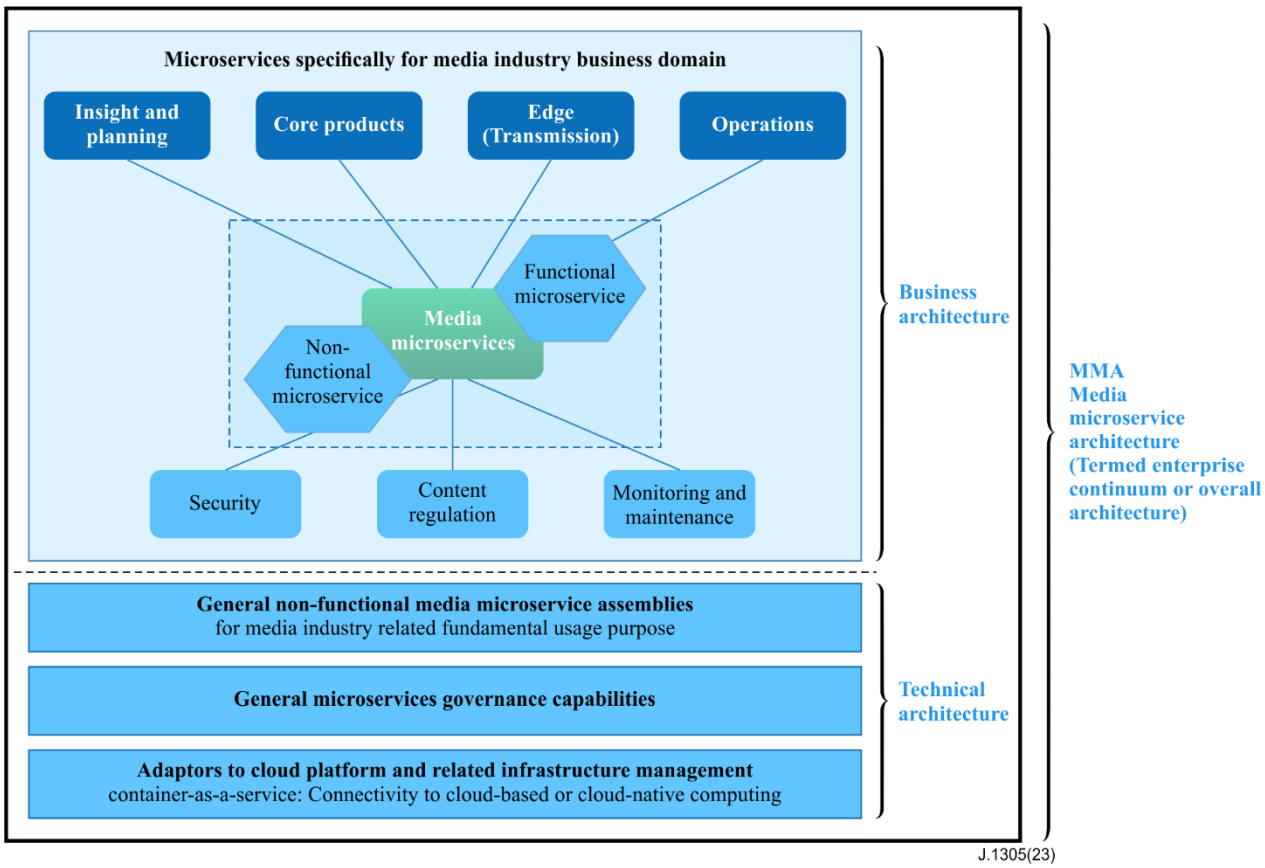

Figure 1 – Media microservice logically tiered architecture

In the logical architecture, the lower three layers belong to the technical part, and the upper layers belong to that of business. The bottommost layer is composed of immutable infrastructures, that is cloud platform and related infrastructure management. For our purposes, we only require MMA to leverage those cloud-computing capabilities [b-ITU-T Y.3500] (mainly interacting with a container beneath), MMA does not stipulate the details. The next two dark blue layers address general governance capabilities that are common among major microservice frameworks and provide fundamental non-functional common media microservice assemblies, respectively. The upper business architecture part deals with major business functionalities for the audiovisual industry. This part will follow domain-driven design (DDD) principles and guidelines to construct logical relationships.

7.1 Requirement for overall interaction and communication

Under most circumstances, an MMA should run within some cloud-computing environments. An MMA should achieve the following non-functional requirements together with the cloud beneath it:

– high performance: a high standard is required for services to interact and collaborate;

– high scalability: a design is required to support a large number of application services;

– good modifiability: a construction is required that adapts to changing requirements;

– good portability: services are required to work across systems;

– high reliability: reliability is required to withstand failures and faults at the system level.

As for the architectural layer concerned with cloud platform and related infrastructure management, an MMA only interacts and utilizes its capabilities.

7.2 Requirements for technical architecture

As summarized in Figure 1, the technical part of an MMA has the following key requirements.

– General microservice governance capabilities: This part of the architecture should cover the essential coherent functionalities related to microservice governance. It should provide effective functionalities to manage a large distributed system.

– General non-functional media microservice assemblies: Sizes of files used in the media industry are often large; hence the network bandwidth and latency requirements are high. General non-functional requirements like these that are tightly related to media industrial specialities are addressed in this architectural layer.

7.3 Requirement of business architecture

For MMA business architecture, top-level business domains are required to cover core functionalities for the media industry (e.g., insight and planning, core products, edge transmission, operations, content regulation, security, and monitoring and maintenance). An MMA business architecture is required to follow DDD general principles and adopts engines for business rules and business processes to support orchestration and choreography of business functional microservices.

Bibliography

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[b-ITU-T Y.3500] Recommendation ITU-T Y.3500 (2014), *Information technology – Cloud computing – Overview and vocabulary*.

[b-ITU-T Y.3535] Recommendation ITU-T Y.3535 (2022), *Cloud computing – Functional requirements for a container*.

[b-ISO/TR 11219] Technical Report ISO/TR 11219:2012, *Information and documentation – Qualitative conditions and basic statistics for library buildings – Space, function and design*.

[b-ISO 12651-2] International Standard ISO 12651-2:2014, *Electronic document management – Vocabulary – Part 2: Workflow management*.

[b-ISO/IEC TS 23167] Technical Specification ISO/IEC TS 23167:2020, *Information technology – Cloud computing – Common technologies and techniques*.

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