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Recommendation

ITU-T F.742.2 (01/2024)

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Recommendation ITU-T F.742.2

Functional architecture for distance learning services

Summary

Recommendation ITU-T F.742.2 specifies the functional architecture for distance learning services.

History *

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T F.742.2	2024-01-13	16	11.1002/1000/15760

Keywords

Collaboration, distant learning, intelligent analysis, massive online course.

* 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.

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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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Recommendation ITU-T F.742.2

Functional architecture for distance learning services

1 Scope

This Recommendation specifies a functional architecture for distance learning services.

The scope of this Recommendation includes:

– Functional architecture for distance learning services, including specification of capability sets, functional entities and reference points.

– Information flow for distance learning services, including user management, service interaction, etc.

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

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 resource [b-IETF RFC 3986]: This specification does not limit the scope of what might be a resource; rather, the term "resource" is used in a general sense for whatever might be identified by a uniform resource identifier (URI).

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ICT Information and Communication Technology

ID Identifier

URI Uniform Resource Identifier

5 Conventions

In this Recommendation, the following conventions apply.

– The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation 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" indicate an optional requirement which 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/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Overview

Distance learning services use information and communication technologies (ICTs) for education delivery. With the support of networks, learning can be anywhere, anytime. With the facilitation of cloud computing, education can be multimedia enabled, customized and widely shared, and third parties can actively participate in the activities for education content provision and software development based on distance learning ICT infrastructures.

Distance learning is beneficial for remote locations where educational resources are relatively scarce.

The use of distance learning is also vitally important as it helps prevent contagious diseases from spreading in schools and training institutes during pandemic times.

Distance learning services are composed of audio, video and message communication. Besides that, they also include service features like screen sharing. Aside from communication between human beings, it also allows users to interact with learning programs and digital learning content.

Also, apps and content feed to distance learning may come from different suppliers, applicable to different age levels. Thus, user management and third-party management are required to be specified to meet the operational requirements.

The architectural design of distance learning system should consider supporting all the features mentioned above.

Regarding the scalability of distance learning services, from a virtual classroom that supports dozens of students to a very large-scale online lecture that accommodates thousands of students, the architectural design is quite different, and a different network infrastructure is required.

7 Functional architecture

Figure 7-1 shows the functional architecture for distance learning.

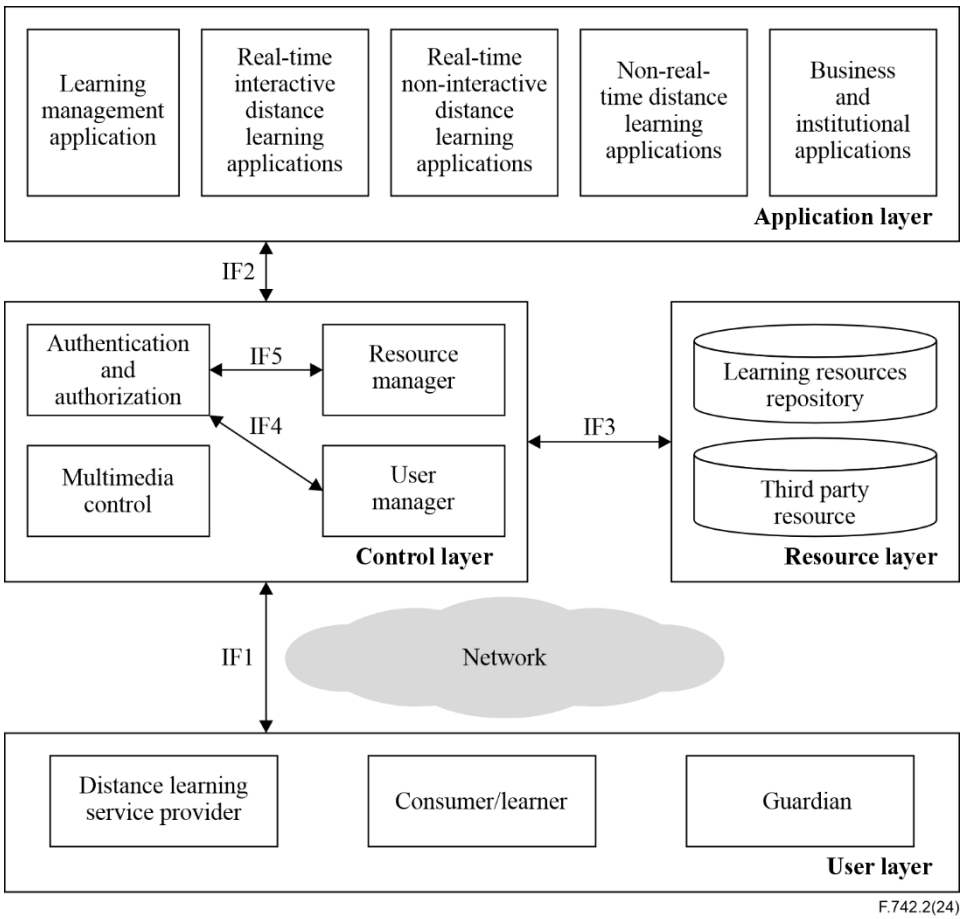

Figure 7-1 – Functional architecture for distance learning

The functional capabilities of the layers in the distance learning architecture are as follows:

– Application layer: The application layer contains five modules, which include real-time interactive distance learning applications, real-time non-interactive distance learning applications, non-real-time distance learning applications, business/institutional applications, and learning management applications. These modules provide several applications for distance learners, educators and guardians, such as virtual classrooms, online quizzes, group discussion, lecture broadcasting, attendance check, homework assignment and exam grading.

– Control layer: The control layer contains four modules, which include user management, authentication and authorization, resource management, and multimedia control. These modules provide several functions such as instant message, address book, video call, cloud storage management and third-party open platform.

– Resource layer: learning resource repository and third-party resource, for example as specified in [b-IETF RFC 3986], provide educational content for the functional layer.

– User layer: The user layer contains distance learning service providers, consumers/learners, and guardians.

8 Functional entities

8.1 Real-time interactive distance learning applications

In order to provide real-time virtual distance learning services for the users, this module should have the following functions:

RIDL-01: Provide a platform where educators can share their knowledge with learners via video or audio meeting room, web pages and other kinds of digital form educational material.

RIDL-02: Provide a platform that allows users to communicate via instant messages, text messages, group voice/video calls, live streaming and file exchanges across different organizations.

RIDL-03: Provide a platform to set up and manage online screen sharing, digital whiteboarding, attendance register, real-time co-annotation, and polling for the virtual or hybrid classroom.

8.2 Non-real-time distance learning applications

In order to provide non real-time distance learning services for the learner, the module should have the following functions:

NRDL-01: Provide a platform where educators can share their knowledge with learners via e-books, recorded video files, web pages and other kinds of digital form educational material.

NRDL-02: Provide a unified platform that allows users to communicate via text messages, forum, bulletin boards, file exchanges and e-mailing across different organizations.

NRDL-03: Provide a function where the learner could submit their assignment and complete examinations or quizzes.

NRDL-04: Provide a function for educators and guardians to view the learners' exam scores.

NRDL-05: Provide a platform to manage and push notifications and announcements within the school or across different organizations, for example, between the Department of education and schools.

8.3 Learning management application

In order to manage education services by the educator and learner, the module should have the following functions:

LM-01: Provide a function to develop curricula, such as syllabus design, course setting, course schedule and learning materials preparation.

LM-02: Provide a function for creating online assignments and tracking study progress.

LM-03: Provide a tool for creating quizzes and exams from the question repository which can be reused in different quizzes.

LM-04: Provide a tool for sharing or uploading course materials like syllabus, reference files or class rules.

LM-05: Provide a personalized dashboard for learners to establish their personal study tracking, course enrolment and view exam scores.

LM-06: Provide a tool for the educator to distribute quizzes, exams or assignments to the selected learners from the resource repository.

LM-07: Provide a grading tool for the educator to grade an assignment or exam, and for leaving personalized feedback for each assignment or exam.

LM-08: Provide a tool for educators to review selected learners' statistical performance using graphic display.

8.4 Real-time non-interactive distance learning applications

In order to provide real-time non-interactive distance learning services for the users, the communication service should have the following functions:

RNDL-01: Provide a platform that allows users to conduct live streaming, file exchanges and e-mailing across different organizations.

8.5 Authentication and authorization

In order to provide authentication and authorization functions for resource management and user management, this module should have the following functions:

AA-01: Provide the access control mechanism to user management and third party authentication.

AA-02: Provide the authorization for third party resources and learning resource repository via resource management.

AA-03: Provide a mechanism to manage the log.

8.6 User management

User management provides management of learners' and educators' profiles. It should have the following functions:

UM-01: Provide permission control to set privileges for different users.

UM-02: Provide user profile management that includes the following profile content:

– User role: educator, student or guardian (father or mother);

– User information: name, gender and user ID;

– Educational information: campus, period (kindergarten, primary school, middle school, high school), grade and class ID.

8.7 Resource management

In order to manage the resource from the learning resource repository and third party resources, this module should have the following functions:

RM-01: Manage the educational resource within the learning resource repository and third party resources, such as searching, browsing, uploading, deleting, editing and downloading educational content.

RM-02: Provide a function for third party organizations to develop more educational applications, contents and functionalities.

8.8 Multimedia control

In order to provide the multimedia control function for the application layer, this module should have the following function:

MC-01: Provide multimedia capabilities, such as group voice/video conference, online group communication, online screen sharing, online streaming, session recording, file downloading/uploading and file sharing.

9 Reference points

A description of reference points for distance learning, as shown in Figure 7-1, is provided below:

IF1: Interface 1 supports communication between the user layer and the control layer. It enables the user to interact with service modules to utilize various education services.

IF2: Interface 2 supports communication between the application layer and the control layer. It enables the functional layer's modules to provide essential functions for the control layer.

IF3: Interface 3 supports communication between the control layer and the resource layer. It enables the functional layer to access the resources both within and outside the organization.

IF4: Interface 4 is used to receive the access request from user management and provide access to user management.

IF5: Interface 5 is used to provide resource authorization for the resource management function.

10 Information flow

10.1 User accesses learning resource

Step 1: The learner or educator accesses the learning service function in the control layer as a user via IF1.

Step 2: The learning service function requests the educational material from the resource management function via IF2.

Step 3: The resource management function ingests the designated educational material from the learning resource repository via IF3 and establishes access to the user.

10.2 User contributes content to learning resource

Step 1: The educator accesses the learning management service function in the service layer as a user via IF1 to request an educational material upload.

Step 2: The resource management function allocates the educational material via IF3 in the learning resource repository and returns the result to the learning management service function.

Bibliography

[b-IETF RFC 3986] IETF RFC 3986 (2005), *Uniform Resource Identifier (URI): Generic Syntax*.

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