ISO/IEC JTC 1

Information technology

Secretariat: ANSI (United States)

Document type:	Proposed NP (Open)
Title:	Letter Ballot for NP 23510, Proposal for a New Work Item on 3D Printing and scanning - Framework for Additive Manufacturing Service Platform (AMSP)
Status:	Please submit your vote via the online balloting system.
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Form 4: New Work Item Proposal

Circulation date: 2018-05-07 Closing date for voting: 2018-07-30	Reference number: ISO/IEC NP 23510 (to be given by Central Secretariat) ISO/IEC JTC 1 **N 13717**
Proposer (e.g. ISO member body or A liaison organization) SAC	
Secretariat ANSI	

A proposal for a new work item within the scope of an existing committee shall be submitted to the secretariat of that committee with a copy to the Central Secretariat and, in the case of a subcommittee, a copy to the secretariat of the parent technical committee. Proposals not within the scope of an existing committee shall be submitted to the secretariat of the ISO Technical Management Board.

The proposer of a new work item may be a member body of ISO, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Technical Management Board or one of the advisory groups, or the Secretary-General.

The proposal will be circulated to the P-members of the technical committee or subcommittee for voting, and to the O-members for information.

☒ The proposer has considered the guidance given in the Annex C during the preparation of the NWIP.

Proposal (to be completed by the proposer)

Title of the proposed deliverable.

English title:

Information technology -- 3D Printing and Scanning -- Framework for Additive Manufacturing Service Platform (AMSP)

French title:

(In the case of an amendment, revision or a new part of an existing document, show the reference number and current title)

Scope of the proposed deliverable.

This international standard specifies the framework for Additive Manufacturing Service Platform (AMSP). The framework supports the requirements and functionalities of AMSP. This international standard also provides an overview of basic service models that AMSP could offer and describes some typical use cases.
This standard is applicable when individuals or organizations (e.g. commercial enterprises, government agencies, and non-profit organizations) build AMSP or improve existing ones to provide printing and relevant services.

Purpose and justification of the proposal*

This standard was developed in response to the needs of mass customization of additive manufacturing technology by taking full advantage of information and communication technology (ICT). Additive Manufacturing Service Platform (AMSP) provides a website or app where users, designers, and manufacturing centres have connections based on their own needs. With the help of an AMSP, customers could purchase specific AM objects/parts and relevant services as they required rather than prebuilt AM equipment and feedstock, and do not have to have skilled staffs nor be professionalized in AM. No up-front costs or investments is required when adopting AMSP.

Consider the following: Is there a verified market need for the proposal? What problem does this standard solve? What value will the document bring to end-users? See Annex C of the ISO/IEC Directives part 1 for more information. See the following guidance on justification statements on ISO Connect:
https://connect.iso.org/pages/viewpage.action?pageId=27590861

Preparatory work (at a minimum an outline should be included with the proposal)

☒ A draft is attached ☐ An outline is attached ☐ An existing document to serve as initial basis

The proposer or the proposer's organization is prepared to undertake the preparatory work required:

☒ Yes ☐ No

If a draft is attached to this proposal:

Please select from one of the following options (note that if no option is selected, the default will be the first option):

☒ Draft document will be registered as new project in the committee's work programme (stage 20.00)

☐ Draft document can be registered as a Working Draft (WD – stage 20.20)

☐ Draft document can be registered as a Committee Draft (CD – stage 30.00)

☐ Draft document can be registered as a Draft International Standard (DIS – stage 40.00)

If the attached document is copyrighted or includes copyrighted content:

☐ The proposer confirms that appropriate permissions have been granted in writing for ISO or IEC to use that copyrighted content.

Is this a Management Systems Standard (MSS)?

☐ Yes ☒ No

NOTE: if Yes, the NWIP along with the Justification study (see Annex SL of the Consolidated ISO Supplement) must be sent to the MSS Task Force secretariat (tmb@iso.org) for approval before the NWIP ballot can be launched.

Indication(s) of the preferred type to be produced under the proposal.

☒ International Standard ☐ Technical Specification

☐ Publicly Available Specification ☐ Technical Report

Proposed development track

☐ 18 months* ☐ 24 months ☐ 36 months ☒ 48 months

Note: Good project management is essential to meeting deadlines. A committee may be granted only one extension of up to 9 months for the total project duration (to be approved by the ISO/TMB).

*DIS ballot must be successfully completed within 13 months of the project's registration in order to be elligible for the direct publication process

Draft project plan (as discussed with committee leadership)

Proposed date for first meeting:

Dates for key milestones: DIS submission

Publication

Known patented items (see ISO/IEC Directives, Part 1 for important guidance)

☐ Yes ☒ No

If "Yes", provide full information as annex

Co-ordination of work: To the best of your knowledge, has this or a similar proposal been submitted to another standards development organization?

☐ Yes ☒ No

If “Yes”, please specify which one(s):

A statement from the proposer as to how the proposed work may relate to or impact on existing work, especially existing ISO and IEC deliverables.
The proposer should explain how the work differs from apparently similar work, or explain how duplication and conflict will be minimized.

The proposed work specifies a service platform for additive manufacturing applications and provides service models where users, designers and manufacturing centers interact with each other. Rather than focusing on raw materials, process/equipment, parts and so on, the proposed work aims to offer an online service platform from a global standpoint which will in turn allow JTC 1 to study additive manufacturing from ICT perspective while covering a wide range of different industries.

A listing of relevant existing documents at the international, regional and national levels.

ISO 17296 Additive manufacturing — General principles
ISO/IEC 17788:2014 Information technology — Cloud computing — Overview and vocabulary
ISO/ASTM 52900 Additive Manufacturing - General Principles — Terminology
ISO/ASTM 52901 Additive Manufacturing — General Principles — Requirements for Purchased AM Parts

Please fill out the relevant parts of the table below to identify relevant affected stakeholder categories and how they will each benefit from or be impacted by the proposed deliverable(s).

	Benefits/impacts	Examples of organizations / companies to be contacted
Industry and commerce large industry	Relevant service providers will take advantage of the interoperable approach to additive manufacturing business models.	Stakeholders of AMSP including users, designers and manufacturing centers
Industry and commerce SMEs	Relevant service providers will take advantage of the interoperable approach to additive manufacturing business models.	Stakeholders of AMSP including users, designers and manufacturing centers
Government		
Consumers	Relevant service providers will take advantage of the interoperable approach to additive manufacturing business models.	Stakeholders of AMSP including users, designers and manufacturing centers
Labour		
Academic and research bodies		
Standards application businesses		
Non-governmental organizations		
Other (please specify)		

Liaisons:

A listing of relevant external international organizations or internal parties (other ISO and/or IEC committees) to be engaged as liaisons in the development of the deliverable(s).

ISO TC 261,
ISO TC 184

Joint/parallel work:

Possible joint/parallel work with:

☐ IEC (please specify committee ID)

☐ CEN (please specify committee ID)

☐ Other (please specify)

A listing of relevant countries which are not already P-members of the committee.

Note: The committee secretary shall distribute this NWIP to the countries listed above to see if they wish to participate in this work

Proposed Project Leader (name and e-mail address)	**Name of the Proposer** (include contact information)
LI Haibin 13811239453@139.com	SAC (LI Yubing ,) KATS (Hongki Cha) liyb@sac.gov.cn; cha8476@etri.re.kr

This proposal will be developed by:

☐ An existing Working Group:

☒ A new Working Group: (title: JTC 1/WG 12 was approved via JTC 1 Russia resolution 11 (October 2017))

(Note: establishment of a new WG must be approved by committee resolution)

☐ The TC/SC directly

☐ To be determined:

Supplementary information relating to the proposal

☒ This proposal relates to a new ISO document

☐ This proposal relates to the adoption as an active project of an item currently registered as a Preliminary Work Item

☐ This proposal relates to the re-establishment of a cancelled project as an active project

Other:

Maintenance agencies and registration authorities

☐ This proposal requires the service of a maintenance agency. If yes, please identify the potential candidate:

☐ This proposal requires the service of a registration authority. If yes, please identify the potential candidate:

NOTE: Selection and appointment of the MA or RA is subject to the procedure outlined in the ISO/IEC Directives, Annex G and Annex H, and the RA policy in the ISO Supplement, Annex SN.

☐ Annex(es) are included with this proposal (give details)

Additional information/question(s)

This NWIP has been submitted jointly by SAC and KATS

ISO/IEC JTC 1 - N:####(X)

ISO/IEC JTC 1

Secretariat: ANSI

Information technology — 3D Printing and Scanning — Framework for Additive Manufacturing Service Platform (AMSP)

PWI stage

To help you, this guide on writing standards was produced by the ISO/TMB and is available at http://www.iso.org/iso/how-to-write-standards.pdf

A model manuscript of a draft International Standard (known as "The Rice Model") is available at http://www.iso.org/iso/moddis.pdf

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Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The Study Group responsible for this document is ISO/IEC JTC 001/SG 03 "3D Printing and scanning".

Introduction

This standard was developed in response to the needs of mass customization of additive manufacturing technology by taking full advantage of information and communication technology (ICT).

Additive Manufacturing Service Platform (AMSP) provides a website or app to which users, designers, and manufacturing centres can have connections based on their own needs. With the help of an AMSP, users can purchase specific AM objects/parts and relevant services as they are required rather than AM equipment and feedstock, and do not have to have skilled staff professionalized in AM either. There need be no up-front costs or investments when turning to AMSP.

Note to entry: This standard was initially proposed at ISO TC 261/WG 4 in 2016. The proposers consequently agreed to submit to ISO/IEC JTC 1/SG 3 as a new work item.

Information technology — 3D Printing and Scanning — Framework for Additive Manufacturing Service Platform (AMSP)

1 Scope

This international standard specifies the framework for the Additive Manufacturing Service Platform (AMSP). The framework supports the requirements and functionalities of AMSP. This international standard also provides an overview of basic service models that AMSP could offer and describes some typical use cases.

This standard is applicable when individuals or organizations (e.g. commercial enterprises, government agencies, and non-profit organizations) build an AMSP or improve existing ones to provide printing and relevant services.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For updated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17296-4 Additive manufacturing — General principles — Part 4: Overview of data processing

ISO/IEC 17788:2014 Information technology — Cloud computing — Overview and vocabulary

ISO/ASTM 52900 Additive Manufacturing — General Principles — Terminology

ISO/ASTM 52901 Additive Manufacturing — General Principles — Requirements for Purchased AM Parts

ISO/IEC 21320-1:2015 Information technology — Document Container File — Part 1: Core

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 17788:2014, ISO/ASTM 52900:2015 and the following apply.

3.1
additive manufacturing service platform, AMSP
The platform uses additive manufacturing technology and information technology to provide services (e.g., objects/parts made by AM technology, 3D model designs, and other relevant services) according to users' requirements.

Note 1 to entry: A typical AMSP usually consists of an online platform to gather needs of users, a group of skilled staff to deal with users' requirements, 3D scanning equipment, specialized AM machines as well as different kinds of feedstock.

Note 2 to entry: A typical AMSP could sometimes cooperate with individuals, organizations professionalized in specific industries (e.g., aerospace, medicine, etc.).

3.2
user
individual or organization that needs parts manufactured by AM technology and would like to turn to AMSP for service with while or section of the process including designing, printing, and etc. of the parts.

3.3
designer
Individual working for an AMSP and usually skilled in 3D model design and 3D scanning according to users' requirements.

Note 1 to entry: "Individual" here not only indicates someone who is hired by the organization that owns the AMSP, but the ones who are qualified to register on the platform to provide services.

3.4
infrastructure as a Service (IaaS)
Cloud service category in which the cloud capability type provided to the cloud service user is an Infrastructure capability type.

[SOURCE: ISO/IEC 17788:2014 3.2.24]

3.5
software as a Service (SaaS)
Cloud service category in which the cloud capability type provided to the cloud service user is an application capability type.

[SOURCE: ISO/IEC 17788:2014 3.2.36]

3.6
manufacturing centre
Places where parts are manufactured according to the user's requirement. A manufacturing centre usually consists of several kinds of specialized AM systems and corresponding feedstock.

Note 1 to entry: A manufacturing centre could be owned by organisations that manage the AMSP or organisations/individuals who own some AM equipment and are qualified to be registered on the platform to provide services.

3.7
3D model
profile containing 3-dimensional information of an object and could be transformed into digital information used by AMSP.

3.8
3D scanning
Method of acquiring the shape and size of an object as a 3-dimensional representation by recording x, y, z coordinates on the object's surface and converting the collection of points into digital data using software.

[SOURCE: ISO/ASTM 52900:2015 2.4.1, ISO/IEC JTC 1/SG 3 Study Group Report on 3D Printing and Scanning]

4 Conventions

In this standard:

- "shall" indicates a requirement
- "should" indicates a recommendation
- "may" is used to indicate that something is permitted
- "can" is used to indicate that something is possible, for example, that an organization or individual is able to do something

Note 1 to entry: In the ISO/IEC Directives, Part 2, Seventh edition, 2016, 3.3.3, a requirement is defined as an "expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed.".

Note 2 to entry: In the ISO/IEC Directives, Part 2, Seventh edition, 2016, 3.3.4, a recommendation is defined as an "expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others.".

5 Requirements

5.1 General

AMSP should support the following requirements to meet the basic needs of consumers. It should be noted that not all requirements listed below are mandatory. An AMSP is built or improved according to its own purpose, or even expands the functions such as logistic service, online shops, etc.

5.2 Requirements

5.2.1 User management

AMSP should manage user information registered on AMSP. AMSP should also be able to ensure consistent and secure user authentication and login. It can also provide users registered on AMSP with access to all kinds of service that AMSP can offer.

5.2.2 Product design

Users can logon to AMSP either to upload 3D models they already have or create 3D models online (use online design apps or 3D scanning equipment to scan existing objects/parts), or even find designers on AMSP to help with the design. Usually, users can pick colours, material etc. according to the desired property of the objects/parts. In order to ensure the printability, AMSP should check the 3D models either automatically or manually.

Note 1 to entry: in order to facilitate online design, AMSP could provide databases such as typical 3D models, feedstock, and post processes to choose.

Note 2 to entry: while using 3D scanning technology to generate 3D models, users usually need to deliver existing objects/parts to AMSP or go to offline AMSP shops when necessary.

5.2.3 Order management

After receiving the 3D data models with necessary information such as colour, material etc., AMSP should generate a price for users. When the price has been confirmed, AMSP may generate an order and will track the whole process while the objects/parts are being manufactured (including printing and post processing when necessary).

Sometimes, in order to promote the efficiency of manufacturing, AMSP should be able to rearrange the orders containing different objects/parts according to the size, material, and process of the objects/parts (see figure 1). In these circumstances AMSP needs to track the information about each object/part and be able restore the original orders.

Note 1 to entry: sometimes, AMSP can even track the information after a user receives the finished objects/parts and to gather feedback from users' comments on these. Whole life tracking of the order is recommended.

5.2.4 Printing service

Printing service is one of the core requirements of an AMSP. If necessary, AMSP will slice the 3D models of objects/parts (sometime with the help of skilled staff working for AMSP) and send the information to specific manufacturing centres connected to it. The manufacturing centre will begin printing with the help of professional AM equipment and corresponding feedstock after confirming the order.

Note 1 to entry: sometime, in order to promote work efficiency, AMSP will divide the orders containing objects/parts with different properties such as size, material, quality etc. Also, objects/parts with similar properties could be combined for manufacturing with a single AM equipment as a printing group.

Note 2 to entry: AMSP can also send 3D models directly to manufacturing centres without slicing the models if the control allows this. Online slicing may still be necessary for simpler control or for stricter control, security etc.

5.2.5 3D intelligent detection and correction

AMSP should detect 3D model data errors and correct these intelligently.

5.2.6 Security management

AMSP should provide uniform security services, mainly including hardware security, network security. There should be a data access security policy, user permission authentication system and system log record, etc.

5.2.7 Operation monitoring

AMSP should monitor the entire manufacturing process and warn of anomalous events in advance. Major monitoring objects include platform data traffic, the number of concurrent users and business response rate, etc. to ensure that the AMSP works properly.

6 Framework

6.1 General

Figure 1 specifies a framework of an AMSP with seven layers. It should be noted that not all seven layers in figure 1 are necessary. An AMSP is built or improved according to its own purpose, or even expand the functions by adding more layers, such as logistic, API/SDK and etc.

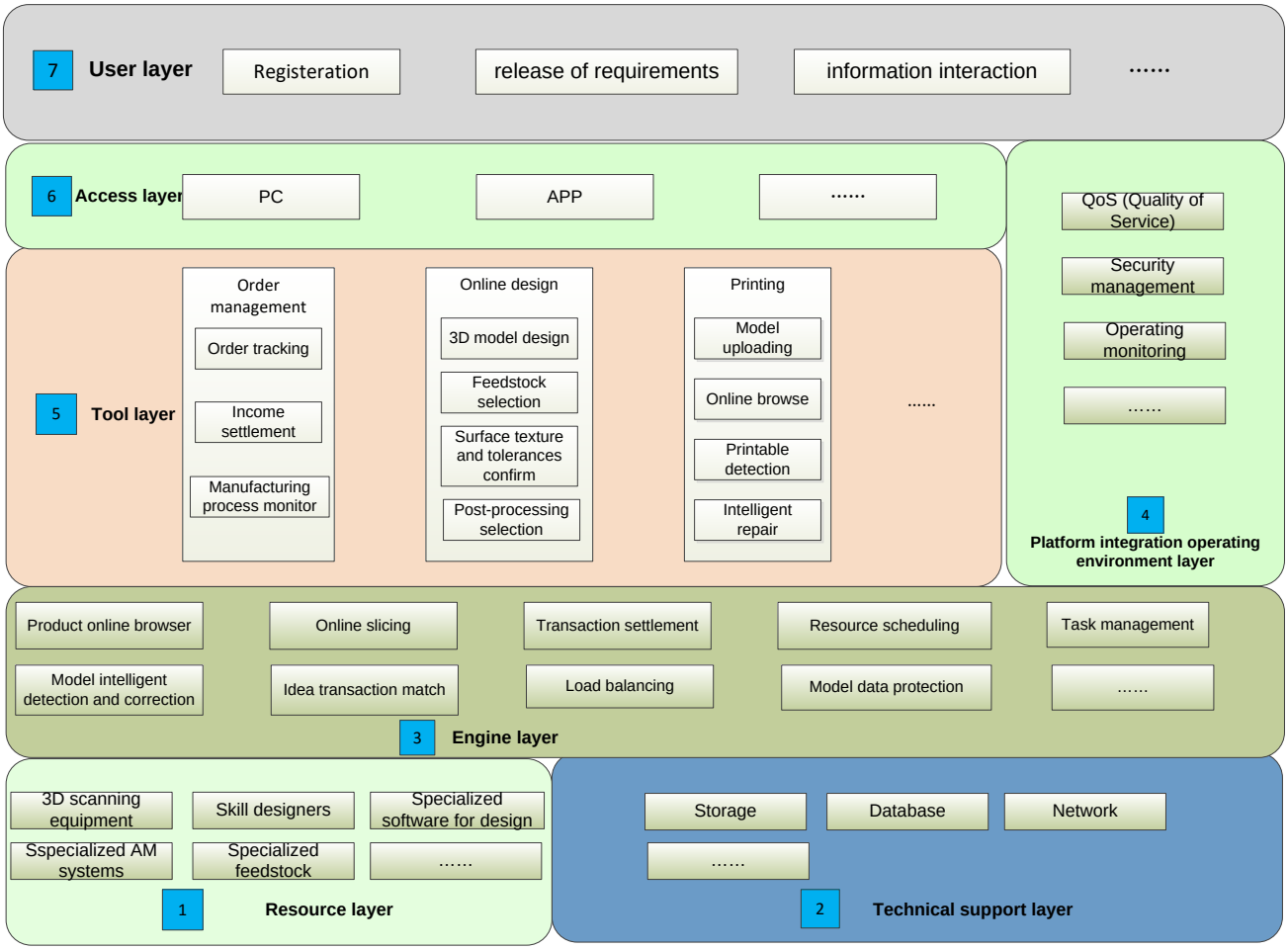

Figure 1—typical system framework of AMSP

6.2 Functions of the layers

6.2.1 Resource layer

The resource layer consists of necessary elements including 3D scanning equipment, specialized software for design, specialized AM systems and feedstock, etc. By using these elements, the resource layer is able to support the entire service procedure from 3D model design to objects/parts manufacturing.

6.2.2 Technical support layer

The technical support layer provides basic technical support for the platform including data base (e.g., typical 3D models, processes, feedstock, post-processing, etc.), storage equipment, network etc. AMSP should use IaaS and SaaS to generate an environment both for users and designers of the platform.

6.2.3 Engine layer

AMSP should develop engines such as a product online browser, 3D model intelligent detection and correction, online slicing, data protection and etc., to provide basic support to realize the whole procedure from 3D model design to objects/parts manufacturing.

6.2.4 Platform integration operating environment layer

Platform integration operating environment layer is a critical layer to improve the operating efficiency and security. The AMSP should have the basic toolkit+ to monitor and manage the platform integration operating environment.

6.2.5 Tool layer

AMSP should provide friendly human-machine interaction applications for users. These tools will ensure AMSP achieves convenient registration, order management, printing etc.

6.2.6 Access layer

The access layer provides access for the users. The access methods may include traditional PC, smart mobile app, and other kinds of access such as USB, CD etc.

6.2.7 User layer

User layer is the interface that provides users with access and browsing services as well as registration and release of user requirements. With a unique ID, AMSP should ensure users are able to logon to it in order to release requirements, track the orders, communicate with designers and etc.

6.3 Correlation between framework and requirements

Each layer of the framework is built upon the requirements identified in Clause 5. Table 1 describes correlation of the functional layers and the requirements which are supported by specific corresponding layers.

Table 1 Correlation of the functional layers and the requirements

	Resource layer	Technical support layer	Engine layer	Platform integration operating environment layer	Tool layer	Access layer	User layer
User management		x		x		x	x
Product design	x	x	x	x	x	x	x
Order management		x	x		x		
Printing service	x	x	x	x	x		
3D intelligent detection and correction	x	x	x		x		
Security management	x			x			
Operation monitoring	x	x	x	x	x		

7 Basic service models

Figure 2 describe the relationship and interaction among Stakeholders including users, designers and manufacturing centres gathered on an AMSP. Figure 3 describes a typical work flow of AMSP from user needs to printing.

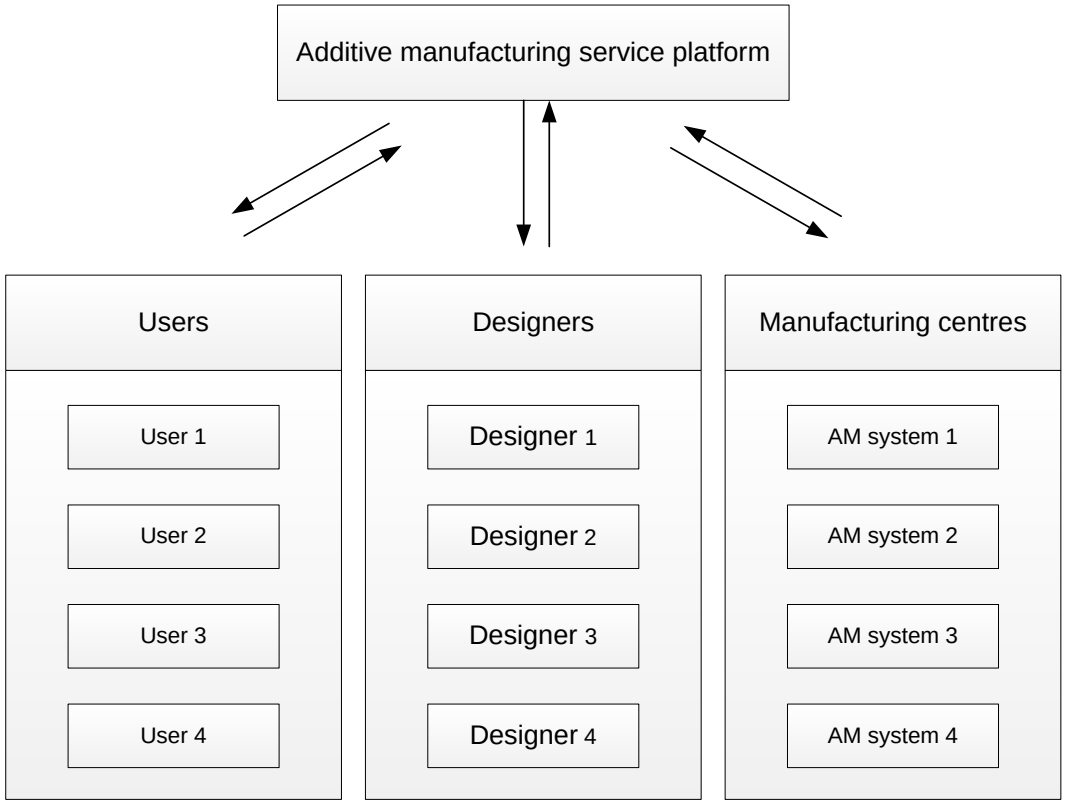

Figure 2—interaction between users, designers and manufacturing centres on AMSP

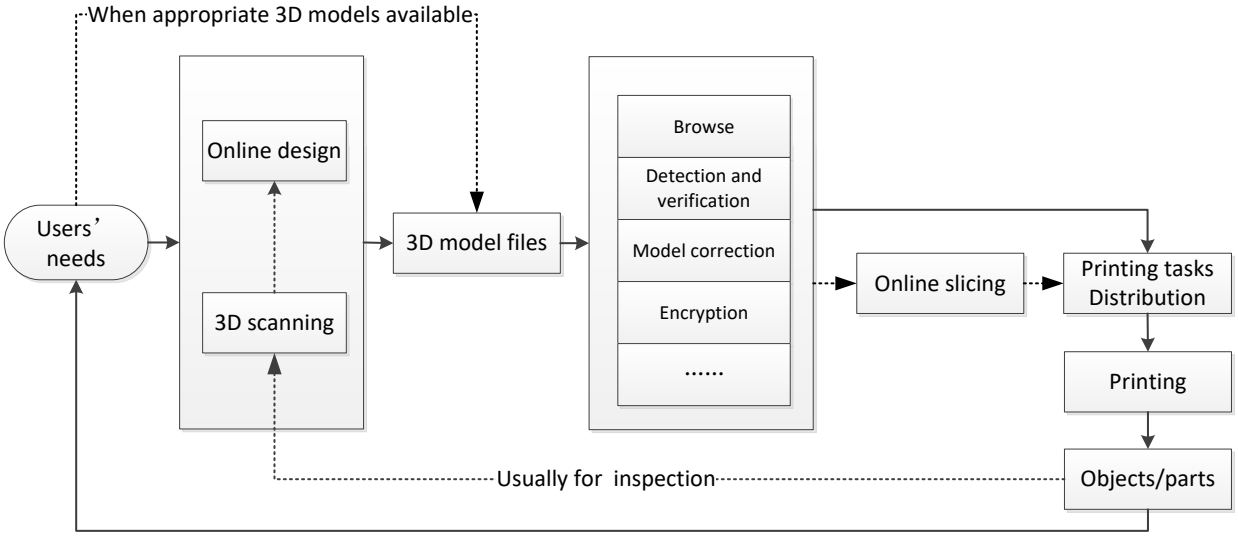

Figure 3—typical work flow of an AMSP

7.1 Users' needs releasing

Users are supposed to be able to release their needs on AMSP by ether creating 3D models by using accessible design software provided on the platform, finding designers on AMSP to help them achieve

their ideas, using 3D scanning technology to generate 3D models, or even selecting 3D models directly on AMSP when there are the ones that meet the users' need in the data base.

Sometimes, after the users' releasing their needs, designers will get commissions distributed by AMSP. They can communicate with users to improve their ideas and modify the 3D models. More importantly, they can ensure that 3D models are suitable for printing.

Finally, there should be the 3D model files that include necessary information such as size, feedstock, tolerance, post-processing requirement and etc.

7.2 Model processing

After getting the 3D model files, AMSP should finish several necessary Model processing steps such as model detection and correction, slicing, data protection and etc. for before distributing printing task to manufacturing centres.

Sometime, model correction can be carried out by various automated, semi-automated, and manual techniques.

As for data compression, it complies with, but not limited to, ISO/IEC 21320-1:2015. Data compression should occur prior to encryption, otherwise compression is not possible due to pseudo-random nature of encryption results. In addition, it is recommended to limit the range of encryption to sensitive, confidential, or part which needs intellectual property protection. Ensuring the metadata of models beyond encryption allows better reference, access, and unnecessary decryption. It should be noted that methodologies of encryption and decryption are out of scope of this document.

7.3 Printing and deliver

After getting the printing task, manufacturing centres will start the printing service (see 5.2.4).

When necessary, after the printing (sometimes including post-processing as well), AMSP will deliver the objects/parts to the users.

Sometimes, AMSP may use 3D scanning technology to inspect whether the objects/parts meet the users' requirements.

For typical use cases an AMSP could provide, please see annex A.

8 Considerations

8.1 Copyright protection

AMSP should allow users to upload or create personalized 3D models online in a convenient manner. The data of 3D models is usually easily spread or stolen illegally through the transmitting procedure over the internet. Meanwhile, the model data is also easily printed without permission, which will cause a loss to the designer or model provider. Therefore, the data security of the 3D model during the data storage, transmission and printing shall be ensured and the intellectual property of designers and model providers must be protected.

8.2 Quality inspection

The performance requirements and inspection methods of the final objects/parts delivered to the user from the AMSP should meet the requirements in international standards ISO 17296-3 2014 and ISO/ASTM DIS 52901.

Annex A
(informative)
Use cases of AMSP

A.1 Use case 1

Users may upload pre-designed 3D models and create an order online (print physical product).

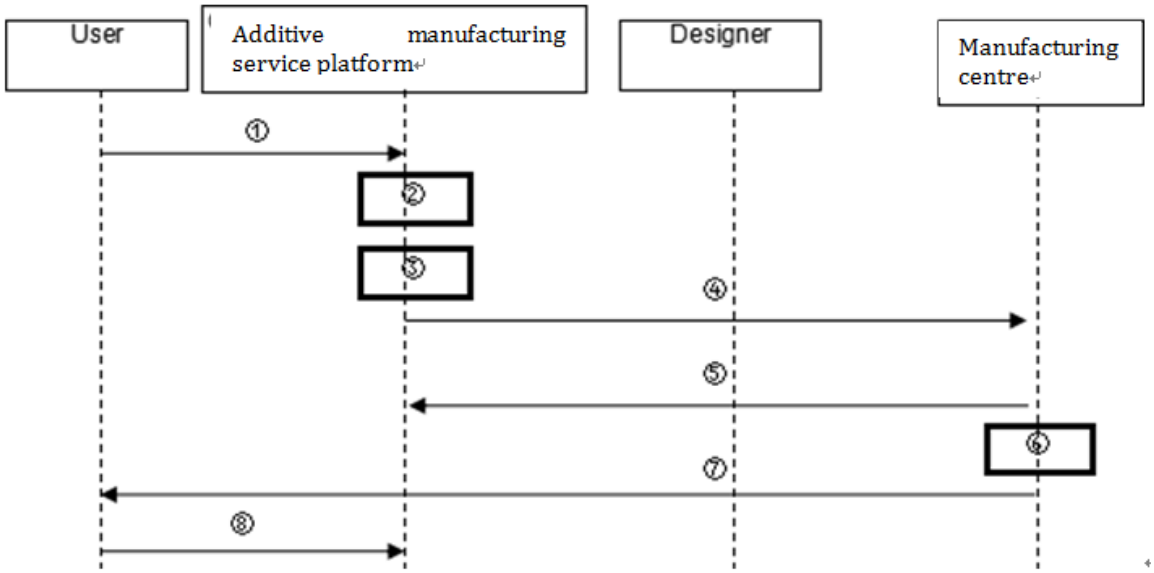

Figure A.1 — Sequential diagram of Use case 1

Figure A.1 is a sequential diagram of Use case 1. This use case involves users, AMSP, manufacturing centres but does not involve designers.

① Users upload the designed 3D models and set parameters for requirements of the objects/parts on the AMSP according to ISO/ASTM 52901.

② AMSP will detect whether the 3D models and corresponding parameter requirements are feasible for printing after receiving the orders.

③ After confirming the orders, AMSP will rearrange the orders according to the size, material, and process of the objects/parts (see Figure A.2). Rearranging the order is especially efficient for industrial players who usually require a variety of different parts and materials for testing before proceeding to mass production.

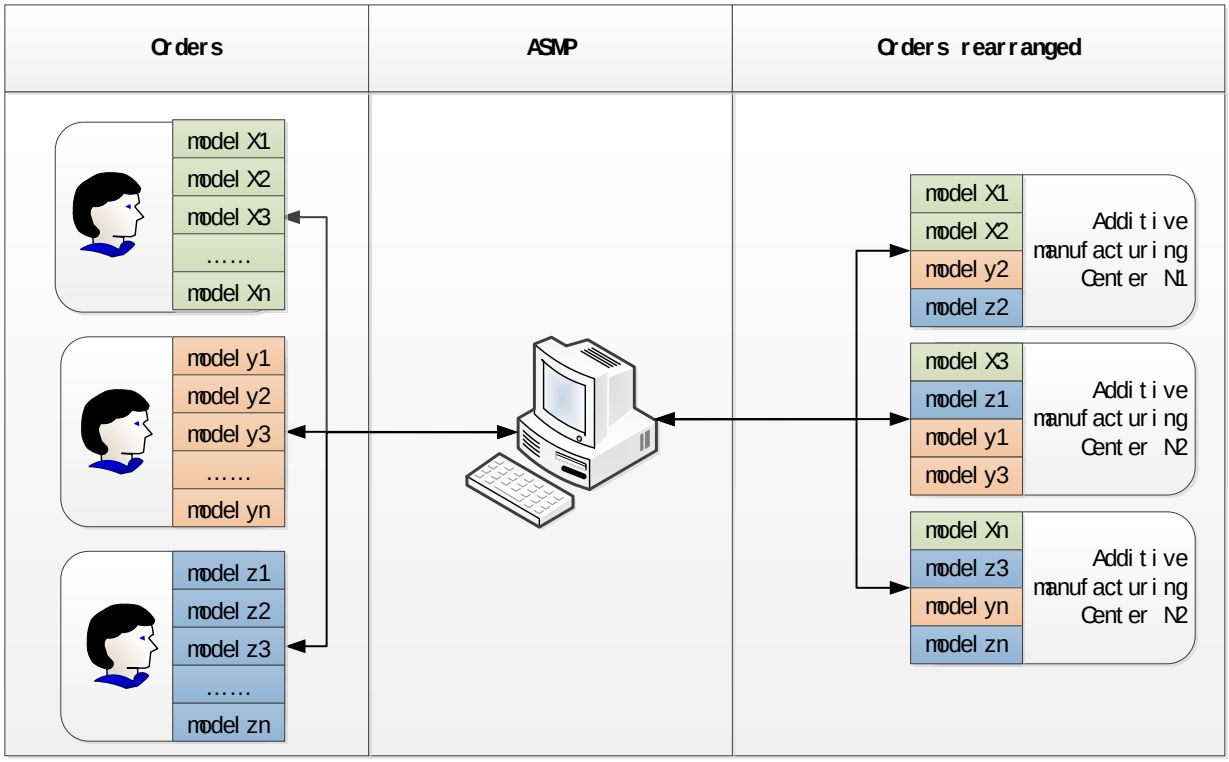

Figure A.2 Rearrange orders

④ AMSP will send the orders rearranged to corresponding additive manufacturing centres for manufacturing. Distributing the orders and allocating them into appropriate manufacturing centres will save time and resource for all actors: users, AMSP and manufacturing centres.

⑤ Manufacturing centres receives and confirms order information.

⑥ Specific AM systems will print the objects/parts according to the order information.

⑦ AMSP will delivers the final objects/parts to the user when finished.

⑧ The user may submit comment and feedback about the product and service quality to the platform after receiving the objects/parts.

A.2 Use case 2

Users may design objects/parts directly on the AMSP and create an order online (print physical product).

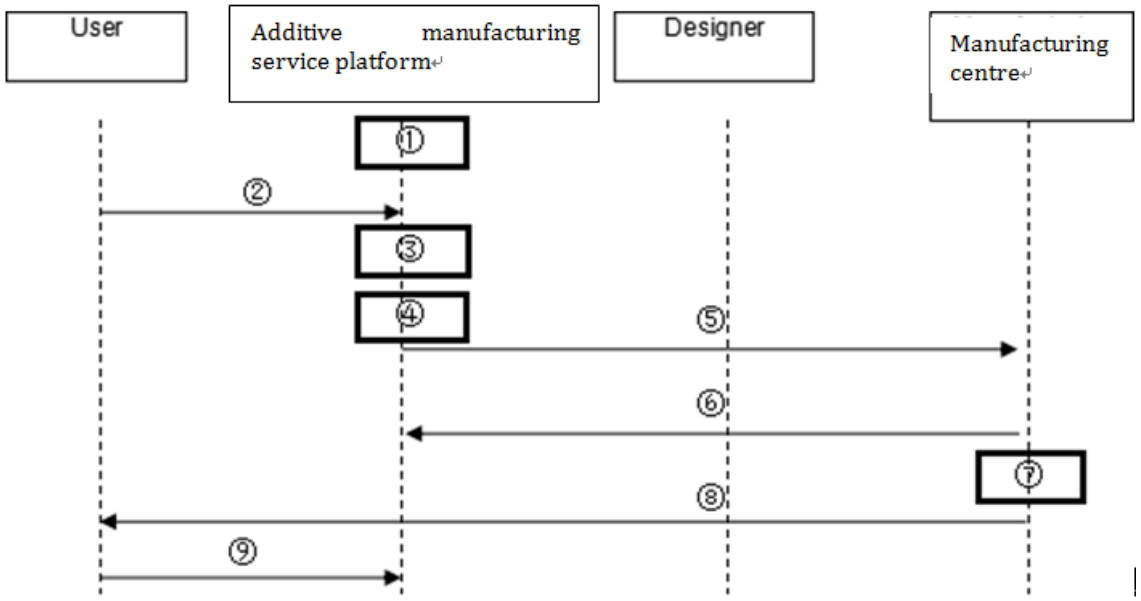

Figure A.2 —Sequential diagram of Use case 2

Figure A.2 is a sequential diagram of Use case 2. This use involves users, AMSP, manufacturing centres but does not involve designers.

① AMSP provides a database containing typical 3D models and an accessible online design function

② Users are able to design objects/parts directly on the AMSP and set parameters for requirements of the objects/parts on the AMSP according to ISO/ASTM 52901

The other steps are the same as the steps ③ ~ ⑧ of use case 1.

A.3 Use case 3

Users find skilled designers registered on AMSP to complete the design.

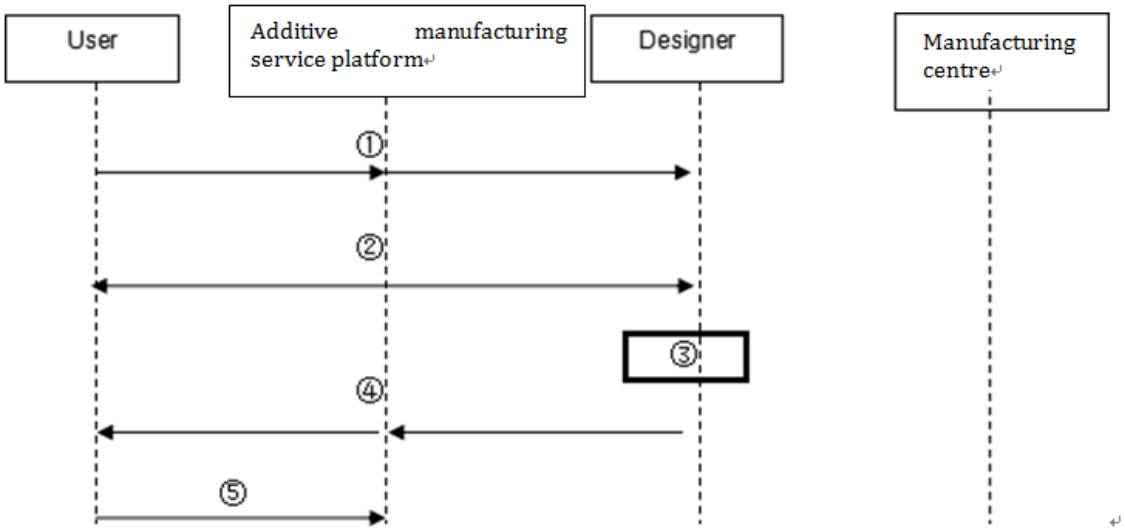

Figure A.3 —Sequential diagram of Use case 3

Figure A.3 is a sequential diagram of Use case 1. This use involves users, AMSP, designers, and manufacturing centres.

① The user releases the design demands (see Figure A.2) on AMSP by description or other methods.

② AMSP sends design demands to appropriate designers according to designer ability and the properties of the demands. Designers vary from graphic designers, fashion designers to interior designers, industrial designers, etc. Users benefit from a wide range of different designers to meet their demands.

③ Designers will help to design the 3D models and can communicate with users to promote the design.

④ Designers can send the designed 3D models to users through AMSP.

⑤ Users can submit comments and feedback about the 3D models and service quality to AMSP and upload the 3D models after confirming the design. The other steps are the same as steps ③ ～⑧ of use case 1.

Bibliography

[1] ISO/IEC JTC 1/SG 3 Study Group Report on 3D Printing and Scanning

