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(54) **USER ACCESS IN A MULTI-TENANT CLOUD ENVIRONMENT**

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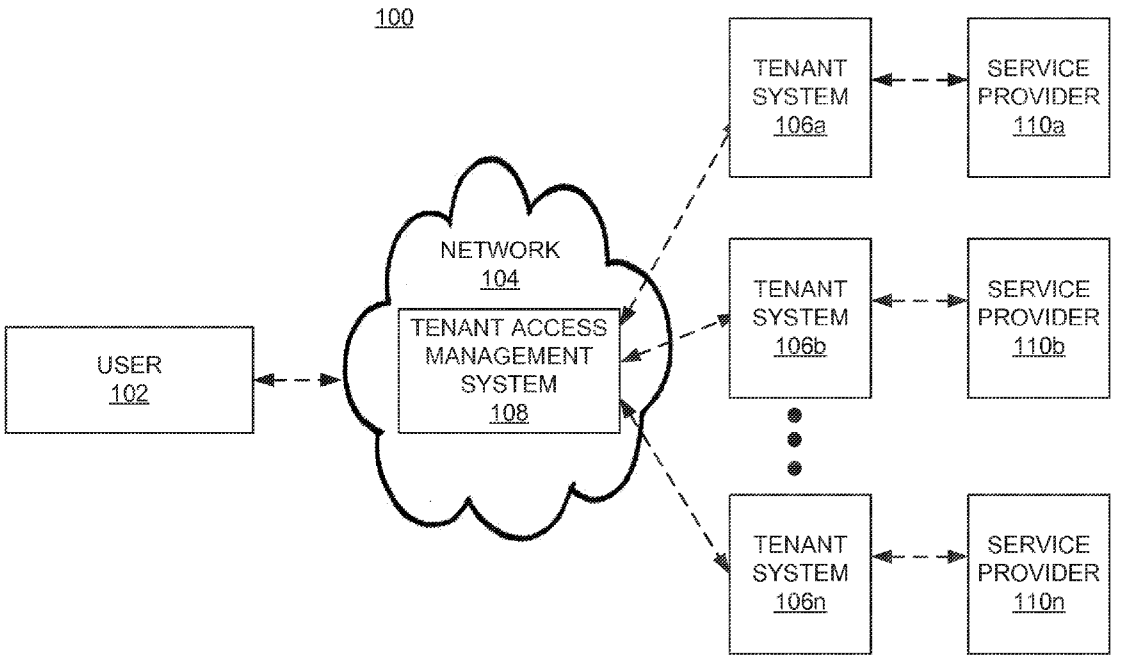
(57) **ABSTRACT**

Systems and methods for allowing one or more users to access a number of tenant systems in a multi-tenant cloud environment are disclosed. The method includes registering a user to the tenant systems based on an identity information received from the user. The same identity information is associated with each of the tenant systems. The method also includes creating an account corresponding to each of the tenant systems for the user. The method further includes allowing the user to access one or more of the tenant systems based on the identity information entered by the user. The user accesses the tenant systems by entering the same identity information. Further, the same identity information is used for identifying the user in each of the tenant systems.



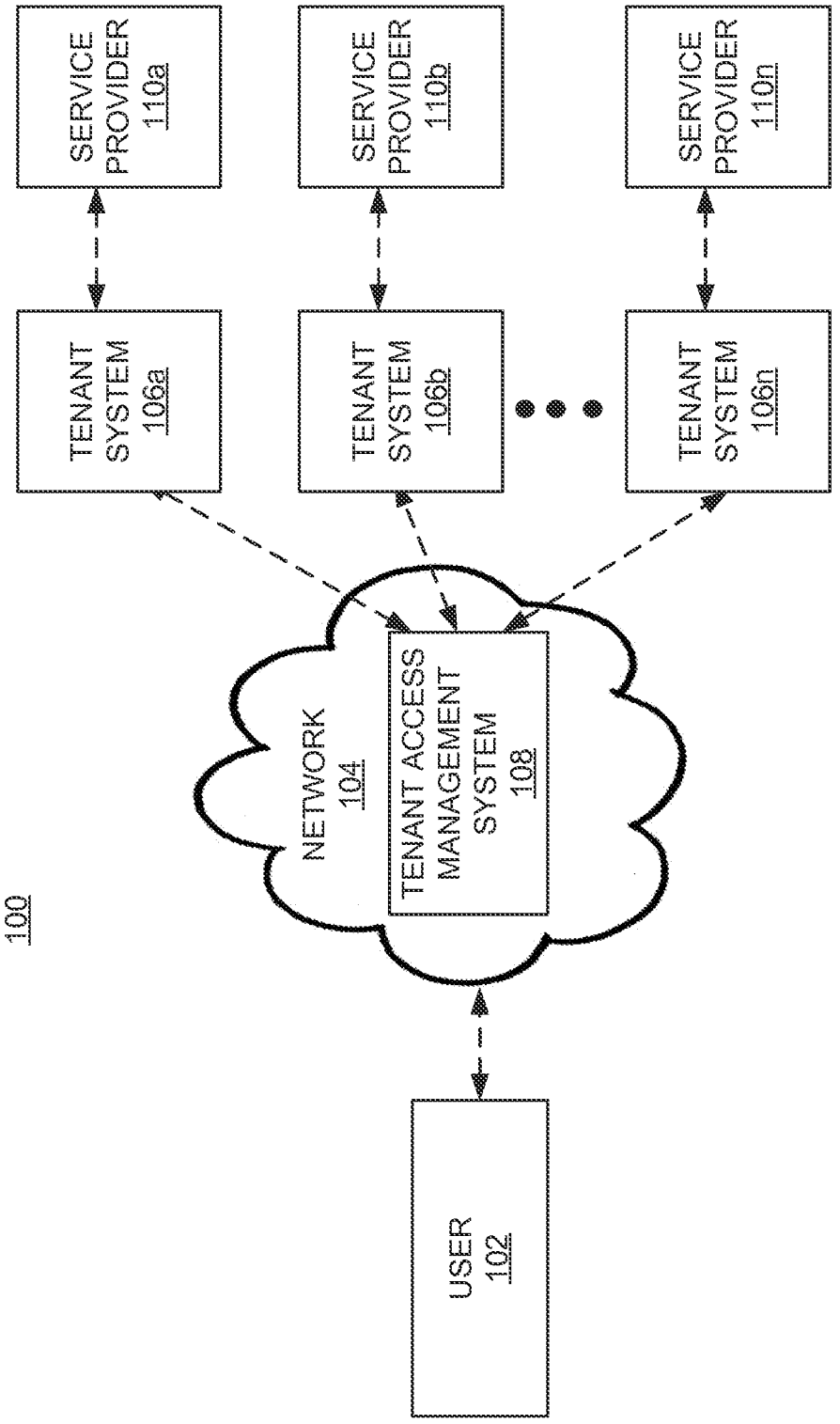

SERVICE PROVIDER 110a
SERVICE PROVIDER 110b
SERVICE PROVIDER 110n
TENANT SYSTEM 106a
TENANT SYSTEM 106b
TENANT SYSTEM 106n
NETWORK 104
TENANT ACCESS MANAGEMENT SYSTEM 108
USER 102
100

FIG. 1

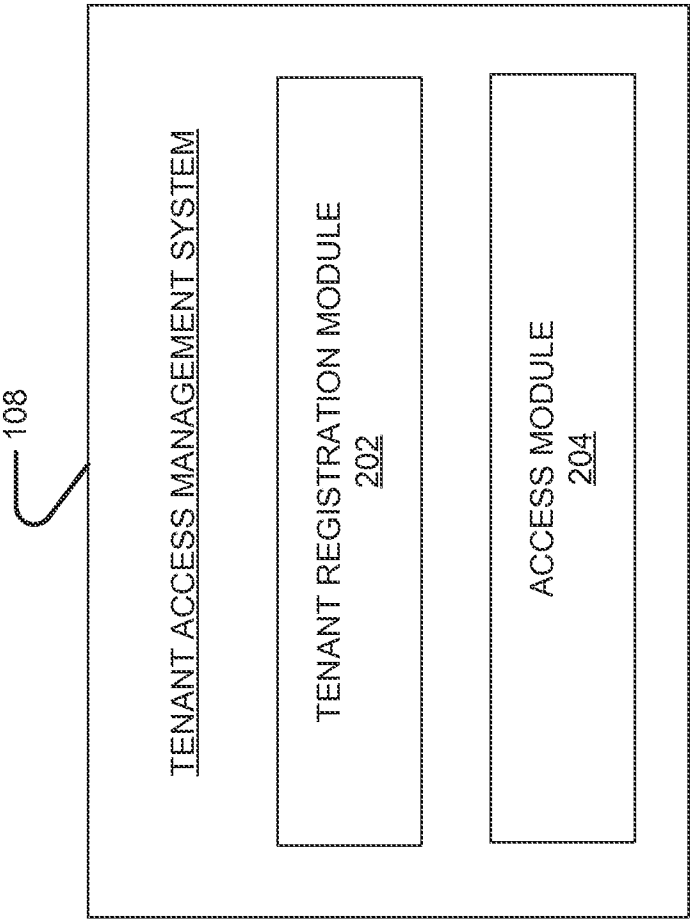

108
TENANT ACCESS MANAGEMENT SYSTEM
TENANT REGISTRATION MODULE
202
ACCESS MODULE
204

FIG. 2

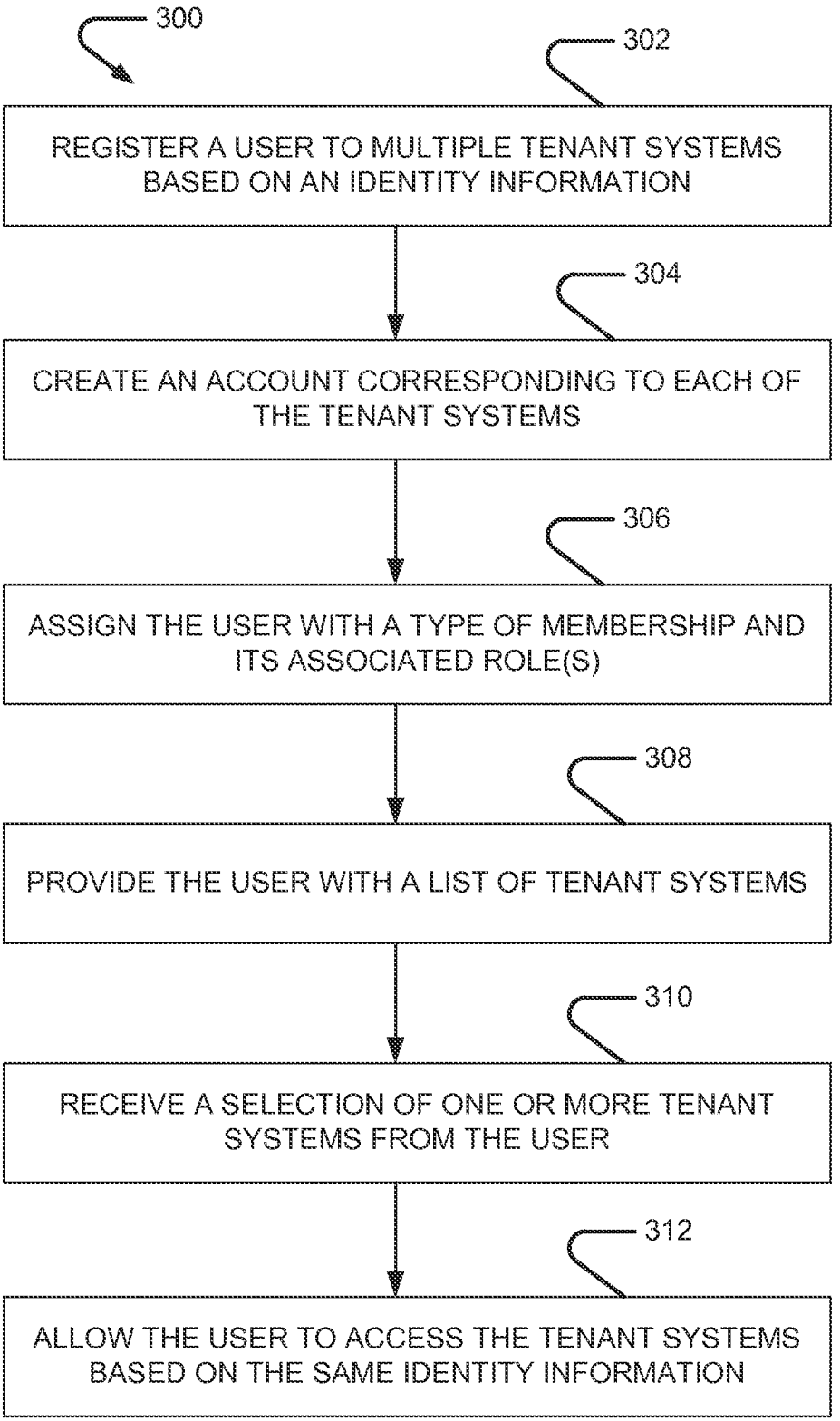

300
302
REGISTER A USER TO MULTIPLE TENANT SYSTEMS BASED ON AN IDENTITY INFORMATION
304
CREATE AN ACCOUNT CORRESPONDING TO EACH OF THE TENANT SYSTEMS
306
ASSIGN THE USER WITH A TYPE OF MEMBERSHIP AND ITS ASSOCIATED ROLE(S)
308
PROVIDE THE USER WITH A LIST OF TENANT SYSTEMS
310
RECEIVE A SELECTION OF ONE OR MORE TENANT SYSTEMS FROM THE USER
312
ALLOW THE USER TO ACCESS THE TENANT SYSTEMS BASED ON THE SAME IDENTITY INFORMATION

FIG. 3

USER ACCESS IN A MULTI-TENANT CLOUD ENVIRONMENT

FIELD OF THE DISCLOSURE

[0001] This disclosure relates to cloud networks and more specifically to methods and systems for providing user access to multiple tenant systems in a multi-tenant cloud environment/network.

BACKGROUND OF THE DISCLOSURE

[0002] In the multi-tenant cloud environment, which is essentially the fabric of hosted (cloud based) applications, each user (equivalent to a customer account hosted in the cloud based system) is given a personal space of its own. User accounts are created in each tenant system and the user may have access to operate within that tenant system only. But at times, it is necessary to have one human user access multiple tenant accounts to perform legitimate operations. The existing system and solutions mandates that the user gets as many user login accounts as the number of tenant systems the user needs to operate in. This may become very cumbersome and unmanageable for the user.

[0003] In a multi-tenant cloud environment, many users or tenant systems can host their respective resources/services, and sensitive data, which legitimately belong to the users or tenant systems only. Typically, in a multi-tenant cloud environment, various complex business and security rules are required or implemented to allow an end user to access resources of another tenant system to which the end user doesn't belong. Further, in some scenarios, the user may require cross tenant access. Existing IT systems deploy complex protocols for allowing cross tenant access to resources and also for allowing rights to perform tasks on behalf of the user in the tenant system. These protocols often involve exchanging digital certificates, delegation rights, and time bound expiration of the access rights. Such an implementation is typically deployed in IT setup that involves heterogeneous and distributed components which are usually supplied by multiple vendors. For single vendor solution, such an infrastructure is an overkill and unviable. Some IT systems issues individual credentials to the user for every tenant system the user needs to access or register. This means the user has to remember many login credentials in order to access multiple tenant systems/accounts. In some multi-tenant cloud environment, the user is given impersonation rights to perform tasks on behalf of other users. The problem with such a solution is the fact that impersonation in such a fashion is often a security risk and may lead to unintended exposure to sensitive data.

[0004] Therefore, in light of above discussion and limitations with conventional systems, there exists need for techniques to allow users to access multiple tenant systems in a multi-tenant cloud environment or network.

SUMMARY OF THE DISCLOSURE

[0005] An embodiment of the present disclosure provides a method for allowing one or more users to access a number of tenant systems in a multi-tenant cloud environment. The method includes registering a user to the tenant systems based on identity information received from the user. The same identity information is associated with each of the tenant systems. The method also includes creating an account corresponding to each of the tenant systems for the user. The method further includes allowing the user to access one or more of the tenant systems based on the identity information entered by the user. The user accesses the tenant systems by entering the same identity information. Further, the same identity information is used for identifying the user in each of the tenant systems.

[0006] Another embodiment of the present disclosure provides a system for allowing one or more users to access a number of tenant systems in a multi-tenant cloud environment. The system includes a tenant registration module for registering a user to the tenant systems based on identity information received from the user. The same identity information is associated with each of the tenant systems. The tenant registration module creates an account corresponding to each of the tenant systems for the user. The system also includes an access module for allowing the user to access one or more tenant system of the tenant systems based on the identity information entered by the user. The user accesses the tenant systems by entering the same identity information. The same identity information is used for identifying the user in each of the tenant systems. The user rights in a given tenant system is controlled by the roles given to each of the users in the context of that tenant system which can be different from the roles in another tenant system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Non-limiting and non-exhaustive embodiments of the present invention are described with reference to the following drawings. In the drawings, like reference numerals refer to like parts throughout the various figures unless otherwise specified.

[0008] For a better understanding of the present disclosure, reference will be made to the following Detailed Description, which is to be read in association with the accompanying drawings, wherein:

[0009] FIG. **1** illustrates an environment where various embodiments of the present disclosure can function;

[0010] FIG. **2** is a block diagram illustrating various system elements of a tenant access management system; and

[0011] FIG. **3** is a flowchart illustrating a method for providing access to a user in a multi-tenant cloud environment, in accordance with some embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0012] The following detailed description is provided with reference to the figures. Exemplary, and in some case preferred, embodiments are described to illustrate the disclosure, not to limit its scope, which is defined by the claims. Those of ordinary skill in the art will recognize a number of equivalent variations in the description that follows.

[0013] In the multi-tenant cloud environment, each tenant (equivalent to a customer account hosted in the cloud based system) is given a personal space of its own. In complete disclosure, for description purposes, a tenant refers to a user registered to one or more tenant system. User accounts are created in each tenant system and the user may have access to operate within that tenant system only. In existing environment, a user is given multiple accounts to get membership to more than one tenant system to manage their activities in multi-tenant cloud environment. This implies that the user has to remember so many login credentials, such as login ID,

password, and so forth, corresponding to multiple accounts for logging in to multiple tenant systems. This may be very cumbersome and unmanageable from administration point of view for the user.

[0014] The present disclosure solves the above mentioned problems by providing methods and systems for allowing a user to become member of multiple tenant systems in a multi-tenant cloud environment with only one identity information. The present disclosure allows the user to access any of the tenant systems to which the user is given membership to, by using same user account and same identity information. Further, when the user is a member of multiple tenant systems then the user may be prompted to choose one of the tenant systems.

[0015] The presently disclosed subject matter dramatically reduces the complexity by introducing two simple concepts, i.e., memberships and native versus external users. By virtue of this, the user is neither required to remember multiple identity information (or login credentials) nor needs to be given impersonation rights or digital certificates. In a hosted multi-tenant cloud environment, a service provider may create a tenant account for every customer/user the service provider sells hosted services to. Typically, the operations team and the sales agents of the service provider need to be given rights to perform tasks on behalf of the users (tenants). It is also possible that a user has multiple tenant accounts in the system and hence the user may need access to all the tenant accounts created for the user.

[0016] FIG. **1** illustrates an environment **100** where various embodiments of the present disclosure can function. As shown, the environment **100** includes a user **102** and multiple tenant systems **106***a*-**106***n*. It will be appreciated, that the environment **100** can include more than one user **102**. The environment **100** can be a multi-tenant cloud environment **100**. Each of the multiple tenant systems **106***a*-**106***n* is configured to provide or host one or more resources and services to the user **102** (or users) present in a network **104**. The network **104** can be a local area network (LAN), a wide area network (WAN), the Internet, and so forth. The multiple tenant systems **106***a*-**106***n* have associated service providers **110***a*-**110***n*. The service providers **110***a*-**110***n* can provide one or more services or resources to the user **102** or other users in the network **104**. The user **102** may be given access tenant systems **106***a*-**106***n* either on permanent basis or on temporary basis, i.e., for a particular time period.

[0017] The user **102** can register to or become a member of one or more of the tenant systems **106***a*-**106***n* by providing one or more details or identity information. The user **102** can register to each of the tenant systems **106***a*-**106***n* by using same identity information. Examples of the identity information include, but are not limited to, a username, a password, a telephone number, an email identity (ID), and so forth. The registering of the user **102** can be moderated and verified by the associated service provider(s) **110***a*-**110***n* of the multiple tenant systems **106***a*-**106***n*.

[0018] The user **102** has an associated device (not shown), and through which the user **102** can access one or more resource(s) and/or service(s) associated with the tenant system(s) **106***a*-**106***n* to which the user **102** is registered. The device can be a suitable device capable of connecting or communicating with the multiple tenant systems **106***a*-**106***n* via the network **104**. Examples of the device may include, but are not limited to, a mobile phone, a smart phone, a tablet computer, a laptop computer, a desktop computer, any hand-held communication device, and so forth.

[0019] The network **104** also includes a tenant access management system **108** for managing and providing the user **102** with access to various resources or services associated with the multiple tenant systems **106***a*-**106***n*. The tenant access management system **108** can be software, hardware, firmware, or a combination of these. In some embodiments, the tenant access management system **108** can be a fully automatic machine based system. In alternative embodiments, the tenant access management system **108** can be a partial automatic or partial machine based system and/or may have one or more associated human operator for managing one or more functions/tasks of the tenant access management system **108**. The tenant access management system **108** may be present on any device such as a server in the network **104**. In some embodiments, each of the service providers **110***a*-**110***n* includes the tenant access management system **108**.

[0020] The tenant access management system **108** is configured to provide access to the user **102** based on the registration of the user **102** with respective tenant system(s) **106***a*-**106***n*. The registration of the user **102** may be based on the identity information received from the user **102**. The same identity information is associated with each of the multiple tenant systems **106***a*-**106***n* for registering the user **102**. The tenant access management system **108** may also create an account corresponding to each of the multiple tenant systems **106***a*-**106***n* for the user **102**.

[0021] Further, the tenant access management system **108** may assign a type of membership to the user **102** while registering the user **102** to the tenant systems **106***a*-**106***n*. In some embodiments, the membership type can be a 'native membership' and/or an 'external membership'. Further one or more roles may be assigned to the user **102** based on the type of membership. The native membership is a permanent membership, and the user **102** having the native membership belongs permanently to a tenant system (e.g. **106***a*) of the tenant systems **106***a*-**106***n* unless the user **102** unregisters from the respective tenant system (i.e. **106***a*). On the other hand, the external membership is a temporary membership and is revoked based on one or more conditions. Examples of the conditions includes, but are not limited to, timeframe, date, one or more events, and so forth. In some embodiments, when the user **102** is an external member than the user **102** may be allowed to perform one or more tasks on behalf of a native tenant, which can be another user. In some embodiments, the sevice providers **110***a*-**110***n* may assign the type of membership to the user **102** based on a number of tasks, which the user **102** intend to perform in each of the multiple tenant systems **106***a*-**106***n*.

[0022] After registration with one or more of the tenant systems **106***a*-**106***n* the user **102** may become a tenant of the one or more of the tenant systems **106***a*-**106***n*. Hereinafter, the user **102** registered to the tenant systems **106***a*-**106***n* may be referred as the tenant **102**. The tenant access management system **108** may allow the tenant **102** to access one or more tenant systems **106***a*-**106***n* based on the identity information entered by the tenant **102**. The tenant access management system **108** may authenticate the user **102** prior to providing access to the user **102** to the multiple tenant systems **106***a*-**106***n* based on the identity information. The tenant **102** can access the multiple tenant systems **106***a*-**106***n* by entering the same identity information. Hence, the tenant **102** is not

required to remember multiple identity information for accessing the multiple tenant systems **106***a*-**106***n*.

[0023] The tenant access management system **108** may provide the tenant **102** with a list of the tenant systems **106***a*-**106***n* to which the tenant is registered, prior to allowing the tenant **102** to access the tenant systems **106***a*-**106***n*. In some embodiments, the list of the tenant systems **106***a*-**106***n* may be displayed on the device associated with the tenant **102**. The tenant **102** can select one or more tenant systems **106***a*-**106***n* from the displayed list of tenant systems **106***a*-**106***n*. The tenant access management system **108** may allow the tenant **102** to access the one or more of the tenant systems **106***a*-**106***n* based on the selection received from the user **102**.

[0024] FIG. **2** is a block diagram illustrating various system elements of tenant access management system **108** of FIG. **1**. As discussed with reference to FIG. **1**, the tenant access management system **108** may be located anywhere in the network **104** or may be present on any device connected to the network **104**. The device can be a server present in the network **104**. As shown, the tenant access management system **108** includes a tenant registration module **202** and an access module **204**. The tenant registration module **202** can register the user **102** to multiple tenant systems **106***a*-**106***n* based on identity information received from the user **102**. The same identity information is associated with each of the tenant systems **106***a*-**106***n*. Hence, the user **102** is required to remember the same identity information for accessing the multiple tenant systems **106***a*-**106***n*. The tenant registration module **202** can create an account corresponding to each of the tenant systems **106***a*-**106***n* for the user **102**.

[0025] The tenant registration module **202** also assigns a type of membership to the user **102** while registering the user **102** to the multiple tenant systems **106***a*-**106***n*. The type of the membership can be such as, but not limited to, a 'native membership or an 'external membership'. The tenant registration module **202** assigns the type of membership to the user **102** based on tasks, which the user **102** intend to perform in each of the tenant systems **106***a*-**106***n*. When the user **102** has the native membership then the user **102** may belong permanently to a tenant system (e.g. **106***a*) of the tenant systems **106***a*-**106***n* unless the user **102** unregisters from the tenant system (i.e. **106***a*). When the user **102** has an external membership of a tenant system then the user **102** is a temporary user of the tenant system. The external membership is a temporary membership and can be revoked based on one or more conditions, such as, time, date, one or more events, and so forth. The user **102** having the external membership may be allowed to perform one or more tasks on behalf of another native tenant in the tenant system (e.g. **106***a*).

[0026] Further, the tenant registration module **202** can assign one or more roles to the user **102** in the tenant systems **106***a*-**106***n* based on the type of membership of the user **102**. The rights of the user **102** in the multiple tenant system(s) **106***a*-**106***n* may be controlled by the roles assigned or given to the user **102** in the context of a tenant system which can be different from the roles of the user **102** in another tenant system. For example, the user **102** may be a native member of the tenant system **106***a* and may be an external member of another tenant system **106***b*. Further, when the user **102** is logged in the context of a tenant system, such as the tenant system **106***a*, then the capacity of the user **102** is restricted by the rights associated with the roles of the user **102**. In some embodiments, the user **102** can be given multiple roles in a membership. Further, the effective set of rights may be a union of all the rights of all the roles given to the user **102**.

[0027] Further, the membership may also expire. For example, the native users memberships never expire by themselves until the user is deactivated in the tenant system or the user's individual memberships are removed. For external users, the membership can be given permanently or for specific period of time at the end of which the memberships can auto expire.

[0028] In an exemplary scenario, a user John owns two companies, a legal counseling firm who purchased hosted email services and, a travel consultant who purchased a hosted CRM application. John naturally belongs to both the companies and therefore John is native member of both tenant systems. John purchased the services from a service provider called 'could hosting incorporated'. The service provider has a specialized team to deal with email services and a separate one for provisioning customer support for CRM systems. Another user Mary is an email consultant given an external membership to legal counseling firm to configure email accounts of that tenant system. Another user Miss Eliza is a CRM expert having an external membership to the travel consultant tenant system. Mary and Eliza, both have native membership to the service provider account.

[0029] The access module **204** can allow the registered user **102** or the tenant **102** to access one or more of the tenant systems **106***a*-**106***n* based on the identity information entered by the tenant **102**. The tenant **102** may enter the identity information on an interface on the device associated with the user **102**. The tenant **102** can access the resources or services of the multiple tenant systems **106***a*-**106***n* by entering the same identity information. The access module **204** identifies or authorizes the user or tenant **102** in each of the tenant systems **106***a*-**106***n* based on the same identity information. In some embodiments, the tenant **102** is given access to the resources or services of the multiple tenant systems **106***a*-**106***n* post authentication. The access module **204** may also provide the registered user **102** with a list of the tenant systems **106***a*-**106***n* prior to providing access to the user **102** to the tenant systems **106***a*-**106***n*.

[0030] Further, the tenant systems **106***a*-**106***n* are associated with a number of service providers **110***a*-**110***n*. The registering of the user **102** is moderated and verified by the service providers **110***a*-**110***n*. In some embodiments, each of the service provides **110***a*-**110***n* may include the tenant registration module **202** and the access module **204**.

[0031] FIG. **3** is a flowchart illustrating a method **300** for providing access to the user **102** to multiple tenant systems **106***a*-**106***n* in a multi-tenant cloud environment **100**, in accordance with some embodiments of the present disclosure. As discussed with reference to FIG. **1**, the multi-tenant cloud environment **100** includes the user **102** which can be a member of the multiple tenant systems **106***a*-**106***n* and can access the resources and services of the multiple tenant systems **106***a*-**106***n* after becoming the member.

[0032] At step **302**, the user **102** registers to one or more of the tenant systems **106***a*-**106***n* by entering identity information. As discussed with reference to FIG. **2**, the tenant registration module **202** of the tenant access management system **108** registers the user **102** to the one or more tenant systems **106***a*-**106***n*. The identity information can include, but not limited to, username, password, and so forth. At step **304**, the tenant registration module **202** creates an account corresponding to each of the one or more tenant systems **106***a*-

106*n* for the user **102**. Then at step **306**, the tenant registration module **202** assigns the user **102** with a type of membership and associated roles. The user **102** may be assigned with different roles in different tenant systems **106*a*-106*n***. Further, corresponding to each of the memberships, the user **102** may be assigned with different specific roles.

[0033] At step **308**, the access module **204** provides the user **102** with a list of tenant systems **106*a*-106*n*** to which the user **102** is registered. The list of the tenant systems **106*a*-106*n*** may be displayed at a device associated with the user **102**. The device can be a laptop, a smart phone, a computer, and so forth. At step **310**, the access module **204** receives a selection of the one or more of the tenant systems **106*a*-106*n*** from the user **102**. Thereafter, at step **312**, the access module **204** allows the user **102** to access the multiple tenant systems **106*a*-106*n*** based on the same identity information. The access module **204** authenticates the user **102** based on the same identity information prior to allowing the access to any of the tenant systems **106*a*-106*n***.

[0034] In accordance with presently disclosed subject matter, in the multi-tenant cloud environment, the user is created as an entity that is independent of the tenant system(s) or the service provider(s) the user belongs to. The user can be given memberships to multiple tenant systems based on the tasks the user needs to perform in respective tenant systems. Further, the user having one login account to a tenant system can be given membership to an unlimited set of tenant systems in the multi-tenant cloud environment. Therefore, the user have to remember only one login credential or identity information, and based on membership of the user in each of the tenant systems, the user can gain access to multiple tenant systems with specific rights to perform certain tasks.

[0035] It is believed that the disclosure set forth herein encompasses multiple distinct inventions with independent utility. While each of these inventions has been disclosed in its preferred form, the specific embodiments thereof as disclosed and illustrated herein are not to be considered in a limiting sense as numerous variations are possible. Each example defines an embodiment disclosed in the foregoing disclosure, but any one example does not necessarily encompass all features or combinations that may be eventually claimed. Where the description recites "a" or "a first" element or the equivalent thereof, such description includes one or more such elements, neither requiring nor excluding two or more such elements. Further, ordinal indicators, such as first, second or third, for identified elements are used to distinguish between the elements, and do not indicate a required or limited number of such elements, and do not indicate a particular position or order of such elements unless otherwise specifically stated.

[0036] The above specification provides a description of the manufacture and use of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention also resides in the claims hereinafter appended.

What is claimed is:

1. A method for allowing one or more users to access a plurality of tenant systems in a multi-tenant cloud environment, the method comprising:

registering a user to the plurality of tenant systems based on an identity information received from the user, wherein the same identity information is associated with each of the plurality of tenant systems;

creating an account corresponding to each of the plurality of tenant systems for the user; and

allowing the user to access one or more tenant system of the plurality of tenant systems based on the identity information entered by the user, wherein the user accesses the plurality of tenant systems by entering the same identity information;

wherein the same identity information is used for identifying the user in each of the plurality of tenant systems.

2. The method of claim **1** further comprising assigning the user a type of membership including at least one of a native membership or an external membership.

3. The method of claim **2**, wherein one or more roles are assigned to the user based on the type of membership of the user.

4. The method of claim **3**, wherein the native membership is a permanent membership, wherein the user having the native membership belongs permanently to a tenant system of the plurality of tenant systems unless the user unregisters from the tenant system.

5. The method of claim **4**, wherein the external membership is a temperory membership and is revoked based on one or more conditions, wherein the user having the external membership is allowed to perform one or more tasks on behalf of a native tenant.

6. The method of claim **5** further comprising providing the user with a list of the plurality of tenant systems prior to allowing the user to access the plurality of tenant systems, wherein the user is registered to the plurality of tenant systems.

7. The method of claim **6**, wherein the user is allowed to access the one or more tenant system of the plurality of tenant systems based on a selection of the one or more tenant system received from the user.

8. The method of claim **7**, wherein the plurality of tenant systems are associated with a plurality of service providers.

9. The method of claim **8**, wherein the registering of the user is moderated and verified by the plurality of service providers associated with the plurality of tenant systems.

10. The method of claim **9**, wherein the plurality of sevice providers associated with the plurality of tenant systems assigns the type of membership to the user based on a plurality of tasks, which the user intend to perform in each of the plurality of tenant systems.

11. A tenant access management system for allowing one or more users to access a plurality of tenant systems in a multi-tenant cloud environment, the system comprising:

a tenant registration module configured for:

registering a user to the plurality of tenant systems based on an identity information received from the user, wherein the same identity information is associated with each of the plurality of tenant systems;

creating an account corresponding to each of the plurality of tenant systems for the user; and

an access module configured for allowing the user to access one or more tenant system of the plurality of tenant systems based on the identity information entered by the user, wherein the user accesses the plurality of tenant systems by entering the same identity information and the same identity information is used for identifying the user in each of the plurality of tenant systems.

wherein the users rights in a given tenant system is controlled by the roles given to each of the users in the

context of that tenant system which can be different from the user's roles in another tenant system.

12. The system of claim **11**, wherein the tenant registration module is also configured for assigning the user a type of membership including at least one of a native membership or an external membership.

13. The system of claim **12**, wherein the tenant registration module is also configured for assigning one or more roles to the user based on the type of membership of the user.

14. The system of claim **13**, wherein the native membership is a permanent membership, wherein the user having the native membership belongs permanently to a tenant system of the plurality of tenant systems unless the user unregisters from the tenant system.

15. The system of claim **14**, wherein the external membership is a temporary membership and is revoked based on one or more conditions, wherein the user having the external membership is allowed to perform one or more tasks on behalf of a native tenant.

16. The system of claim **15**, wherein the access module is further configured for providing the user with a list of the plurality of tenant systems prior to providing access to the user to the plurality of tenant systems, wherein the user is registered to the plurality of tenant systems.

17. The system of claim **16**, wherein the access module is configured for providing the user with the access to the one or more tenant system of the plurality of tenant systems based on a selection of the tenant system received from the user.

18. The system of claim **17**, wherein the plurality of tenant systems are associated with a plurality of service providers.

19. The system of claim **18**, wherein the registering of the user is moderated and verified by the plurality of service providers associated with the plurality of tenant systems, further wherein each of the plurality of service providers comprises the tenant registration module and the access module.

20. The system of claim **19**, wherein tenant registration module is configured for assigning the type of membership to the user based on a plurality of tasks the user intend to perform in each of the plurality of tenant systems.

* * * * *