Users and Information Resources:
An Extension of the
Analytical Model of Collections and their Catalogues
into Usage and Transactions

A Study undertaken on behalf of UKOLN by

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Contents

1. Introduction

1.1

The contracted task has been to extend the work *An Analytical Model of Collections and their Catalogues (AMCC)* to take account of services providing access to collections and to include users in the model. The agreed method is to concentrate on the entities and their relationships involved and their attributes, and to characterise the transactions between them including the temporal aspects of the transactions.

1.2 Static and variable resources

Some resources are static in the sense that, when examined at any time after their creation, they always correspond to the same value set. Others have a high degree of variance in their value over time. Collections and Collection-Descriptions are *static* in this sense. This does not preclude occasional change of values but these are the exception. Some may be constantly changing in *aggregative content* by accrual but such changes do not change the underlying structure of the Collection. Users also have some static attributes (for example, names). In many cases, though not all, static attributes can be considered to characterise *inherent* qualities of the resource.

1.3 Interaction with the outside world.

In order to interact with the outside world Collections and Collection-Descriptions must be *mediated*. The process of mediation takes place in time. There are certain attributes of the process which may exist in more than one state (for example, a library may be *open* or *closed* on any given day). The value of a state may persist over a period of time, but is liable to change. In this paper such states are termed *variable*. Users also have such variable states, for example, a role-status such as ‘student’.

1.4 Transient attributes

A user uses a resource at a given point in time, in a sequence of events or *transactions*. At this point the relevant attributes of the user (both static and variable) and of the resource (both static and variable) are compared to verify whether the transaction can take place. If they are, various attributes may be set to *authenticate* the transactions. These attributes are *transient* and do not persist after the sequence of transactions has terminated.

1.5 Variability and Transience

The distinction between *variable* and *transient* attributes may sometimes appear arbitrary, and is complicated by the interposition of intermediaries between the user and the resource. For example, a user’s access rights may be authenticated in a transaction for a period of, say, eight hours, though the user may engage in transactions for an initial period of, say one hour. If the user returns to the resource six hours later, he/she will find that the original validation is still in force, and may perceive this as a persistent *variable* attribute rather than a *transient* attribute.

1.6 Tokens

In this model static attributes are invariably modelled as attributes of the core agents and objects. Some variable attributes are also modelled as such attributes. Some attributes may have a part to play in transactions, in authenticating, for a transient event or sequence of events, the user to the resource mediator. This has been modelled

here by identifying such attributes in ***Tokens,*** which can be issued and/or held by any of the Agents. The Tokens consist of collections of a few attributes of the appropriate Agent, and usually persist over several sessions (typically for a year or more on the part of the user) – i.e. they are typically entities whose variable attributes are the most significant.

1.7 From Finding to Retrieving

The concepts above, developed below, do not in themselves analyse in detail the issues discussed by Andy Powell and Liz Lyon in their *JISC Information Environment Architecture Functional Model*, but they describe some of the transactions that must take place before the sequence of transactions described under the single action 'Enter' in the functional model can be successful.

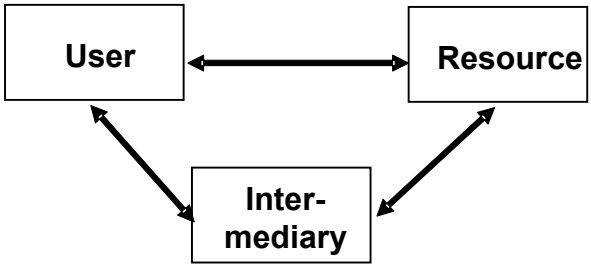
1.8 Locations and Services

One of the immediate reasons for extending the model was to explore the relationship between the concepts of 'Location' and 'Administrator/Administers' in the model and the Dublin Core type names 'Location' and 'Service'. The extension does this by introducing a new entity 'ResourceMediator' corresponding to the agent-like aspects of Dublin Core 'Service'. It is noteworthy that 'Service' is the only element in the DCMI Type Vocabulary which carries implications of events and transactions as well as objects and states.

2. Entities

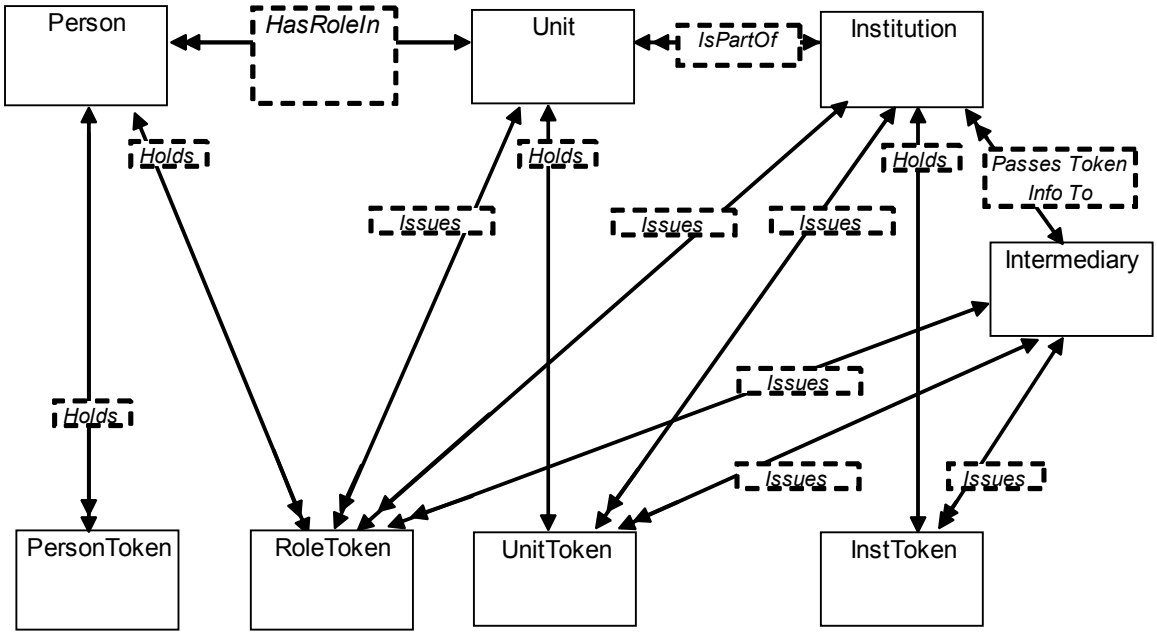
2.1 Using Resources

The whole process under review consists, at the simplest level, of bringing a User and a Resource together. The entities fall into these two natural camps: those appertaining to the User side of the equation and those appertaining to the Resource side. Each set of entities has a distinct set of interests. In some cases the User and the Resource are brought together via an Intermediary acting as an 'honest broker' between the two.



[Figure1: Transaction overview]

2.2 User-centred entities and relationships



[Figure2: User-centred entities and relationships]

2.2.1 Users

Users are a class of agent entities which initiate and follow through the process of seeking, finding, identifying, selecting and retrieving information. In this analysis they pursue this activity by means of UserTokens, for which see section 3.2. The entity Intermediary in the diagram is discussed in section 2.4. The list of User

attributes given below has been taken from a variety of sources including vCard, Athens and the work of Gordon Dunsire.

2.2.2 Entity Person

The Person is the human agent seeking access to a resource. As such he/she has all the attributes of a human. The attributes listed below are those most pertinent to the current analysis. They are the attributes which exist independent of any institutional affiliation. (This analysis does not attempt to incorporate the activities of robotic agents such as harvesters.)

2.2.2.1 Name attributes *(repeatable, with flag for preferred form)*
[Family]Name
GivenName(s)
NameAsKnown
Nickname
Title

2.2.2.2 Age attributes
Birthdate
    Age derived from Birthdate
?Deathdate

2.2.2.3 Contact attributes *(repeatable, with flag for preferred form)*
PersonalAddress
PersonalPostcode
PersonalEmail
PersonalPhone
PersonalFax
PersonalMobile
PersonalWebpageURL
?TimeZone

2.2.2.4 Non-text identifiers
Image
Signature
E-signature
?AudioString
Fingerprint
RetinalScan

2.2.2.5. Alphanumeric identifiers
IDNumber *(repeatable for different types e.g. Passport, NI)*
PersonalUserid *(repeatable)*
    PersonalPassword
    PersonalUseridStartDate
    Personal useridEndDate
PersonalPublicKey *(repeatable)*
[PersonalCreditDetails] *(repeatable)*

2.2.2.6 Characteristics
Language *(repeatable, with flag for preferred form)*
Interests *(repeatable)*
Description

2.2.2.7 Search behaviour
InterestProfile *(repeatable)*
SavedSet *(repeatable)*

2.2.3 Entity Institution
The Institution is a corporate body to which the Person stands in some relationship. The attributes listed below are those most pertinent to the current analysis.

2.2.3.1 Name attributes
Name

2.2.3.2 Age attributes
[n/a]

2.2.3.3 Contact attributes *(repeatable)*
InstAddress
InstPostcode
InstEmail
InstPhone
InstFax
InstWebpageURL
HoursOfOperation
?TimeZone

2.2.3.4 Non-text identifiers
Logo

2.2.3.5. Alphanumeric identifiers
SiteCode
[InstCreditDetails]
IPRange
?Generic InstUserid
    ?Generic InstPassword
    ?Generic InstUseridStartDate
    ?Generic Inst useridEndDate

2.2.3.6 Characteristics
Language
Sector
Description

2.2.3.7 Search behaviour
?UserGroup
?[Guest accounts]

2.2.4. Entity Unit
A Unit is a constituent part of an Institution. Its attributes by and large mirror those of the Instititution. Additional attributes have been added to the Unit list of attributes under Search behaviour, to capture cases where a Unit (for example a University department) may wish to receive collective notification of relevant updates and so has a Unit-level Interest Profile.

2.2.4.1 Name attributes
Name

2.2.4.2 Age attributes
[n/a]

2.2.4.3 Contact attributes *(repeatable)*
UnitAddress
UnitPostcode
UnitEmail
UnitPhone
UnitFax
UnitWebpageURL
HoursOfOperation
?TimeZone

2.2.4.4 Non-text identifiers
Logo

2.2.4.5. Alphanumeric identifiers
SiteCode
[UnitCreditDetails]
IPRange
?Generic UnitUserid
    ?Generic UnitPassword
    ?Generic UnitUseridStartDate
    ?Generic Unit useridEndDate

2.2.4.6 Characteristics
Language
Sector
Description

2.2.4.7 Search behaviour
?UserGroup
?[Guest accounts]
InterestProfile *(repeatable)*
SavedSet *(repeatable)*

2.2.5 Relationship HasRoleIn
The Person's relationship with the Institution is characterised as the Person having a *Role* within the Institution. This is mapped here as being entirely via the Unit as part of the Institution, but some parts of the Role may also, or alternatively, be

characterised as relating directly to the Institution – for example, the WorkID may be assigned by the Institution not the Unit.

The attributes of the Role relationship are crucial in the analysis of user transactions in the identification and retrieval or resources.

2.2.5.1 Name attributes
RoleTitle
Status
?Usergroup

2.2.5.2 Age attributes
StartDate
ExpiryDate

2.2.5.3 Contact attributes *(repeatable)*
Work Address
WorkPostcode
WorkEmail
WorkPhone
WorkFax
WorkMobile
Pager
WorkWebpageURL

2.2.5.4 Non-text identifiers
[n/a]

2.2.5.5. Alphanumeric identifiers
IDNumber
    IDStartDate
    IDExpiryDate
WorkUserid
    WorkPassword
    WorkUseridStartDate
    Work useridEndDate
WorkPublicKey
[WorkCreditDetails]
?StaticIPAddress

2.2.5.6 Characteristics
Subject
Description

2.2.5.7 Search behaviour
InterestProfile *(repeatable)*
SavedSet *(repeatable)*

2.2.6 Relationship IsPartOf

2.2.6.1 Attributes
Relation Identifier e.g. 'Department'

2.2.7 Holds [UserToken]
The 'Holds' relationship describes the situation where, for the purposes of the model, the agent (Person, Unit, Institution) possesses and can present identification or other data not issued by another entity within the model. If there is an issuing agent, it is a body with no immediate relevance to the model – for example, a Passport Office, a Bank, a third-party ISP.

2.2.8 Issues [UserToken]
The act of issuing a Token so that the recipient can present it at will. This is used where one entity in the model issues a Token which the recipient may use independently of the issuing body (e.g. a User does not have to refer back to the University every time he/she uses a University card). There may be restrictions on use associated with the issuing of a card (e.g. not using it to benefit third parties).

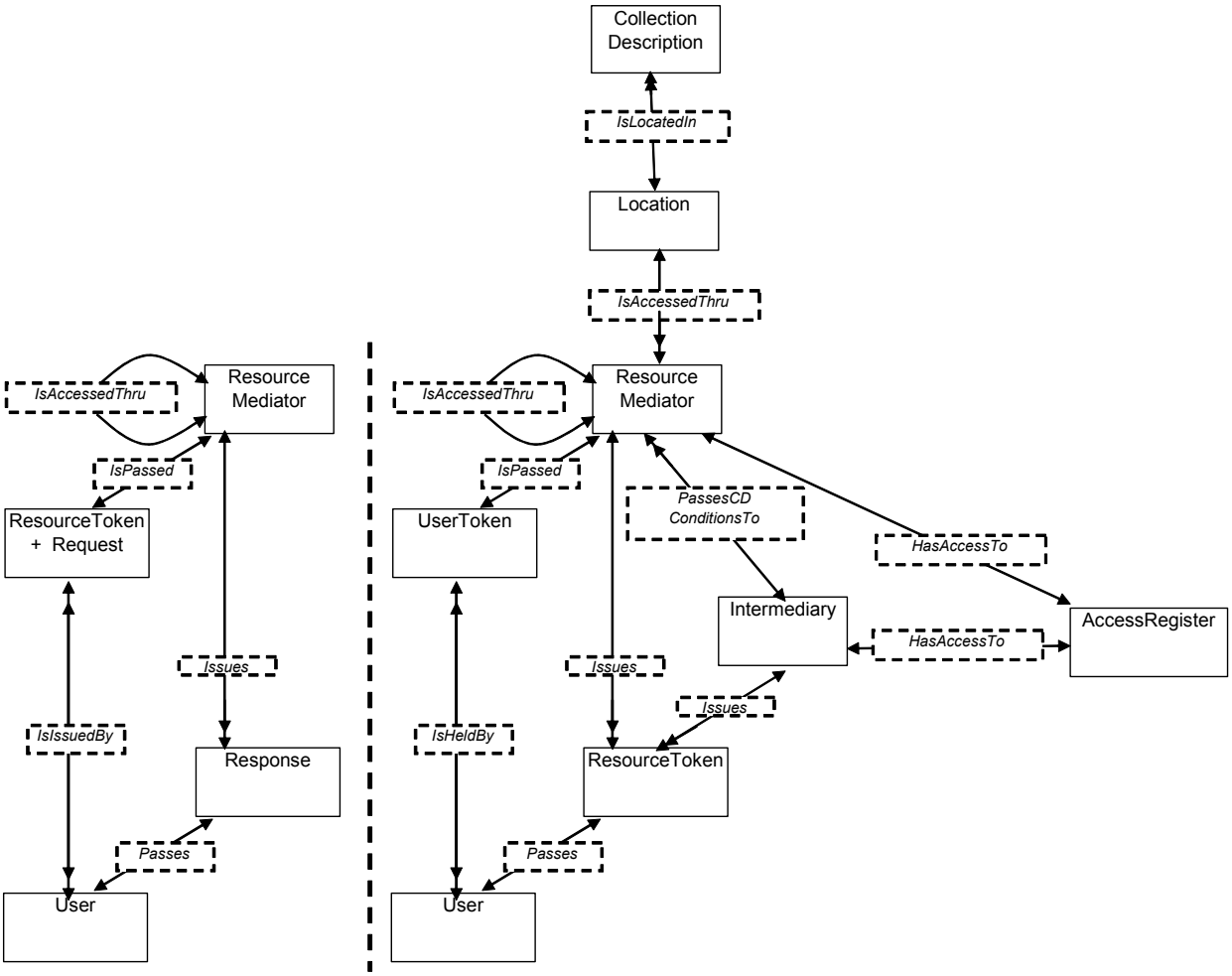
2.2.8.1 Attributes
TermsOfUse

2.2.9 PassesTokenInfoTo
This relationship links User-centred entities to an Intermediary. It has been modelled as linking only Institutions to and Intermediary, but in some circumstances an entity characterised as a Unit may also have the relationship. It entails the passing of information normally used to Issue a UserToken to an Intermediary so that the Intermediary may issue an equivalent Token.

2.2.9.1 Attributes
UserIDGroup
TermsOfUse

2.3. Resource-centred entities and relationships

2.3.1 Introduction
One of the reasons for conducting the current analysis has been the need to identify more clearly the concepts of 'Location' and 'Administrator/Administers' in the Collection Description model and the Dublin Core term names 'Location' and 'Service'. The original model is of collection descriptions and their catalogues. Many Collection Descriptions for which the model was designed have taken the form of Unitary Finding Aids, and it is unlikely that there will be any access restrictions for those Aids as such; what needs to be presented to the User is *information* about the access restrictions. Where the Collection Description consists of one of the other types of Finding Aid (Analytical, Hierachical or Indexing) it is more likely that there will be access restrictions to online use of the descriptions.



[Figure3: Resource-centred entities and relationships]

Figure 3 represents the Resource-centred entities and relationships and in addition characterises a static view of the way in which these interact with Users to enable transactions to take place. Two states are represented in the lower half of the diagram: on the right, the initial issuing of a resource token; on the left, the outline of a Request-and-Response sequence subsequently initiated by a User. These are discussed more fully in section 4.

The entities Intermediary and ResourceToken in Figure 3 are discussed in sections 2.4 and 3.3.

2.3.2 Entity Collection Description
This comprises a Collection Description entity as identified in *AMCC* Section 5, including as an attribute a listing of all the entities and relationships present in the Description. Beyond this entity lies the collection itself, and in the case of an online resource and a non-Unitary Finding Aid, the collection itself may be accessible.

The following entities and relationships are relevant for the present exercise. The list as given in *AMCC* has been extended using the additional attributes proposed by Gordon Dunsire in *Collection landscaping in the common information environment:*

Creator/Assignee.Name
Producer/Assignee.Name
Owner.Name
Administrator.Name
Content.Date

[Creator/Assignee]-Creates-[Content].Date
[Creator]-ContractsWith-[Producer].Date
[Producer]-Produces-[CollectionDesc].Date
[?Producer]-Produces-[CollectionDesc].DateOfRevision
[Producer]-SellsTo-[Owner].Date
[Owner]-Owns-[CollectionDesc].Date
[Owner]-DelegatesTo-[Administrator].Date
[Collection]-IsLocatedIn-[Location].DateOfDeposit

Content.Identifier
Content.AudienceLevel
Content.Text.Language
[&c]

Creator/assignee.Address
Creator/assignee.Postcode
Creator/assignee.Email
Creator/assignee.Phone
Creator/assignee.Fax
Creator/assignee.Webpage

Producer/assignee.Address
Producer/assignee.Postcode
Producer/assignee.Email
Producer/assignee.Phone
Producer/assignee.Fax
Producer/assignee.Webpage

Owner.Address
Owner.Postcode
Owner.Email
Owner.Phone
Owner.Fax
Owner.Webpage

Administrator.Address
Administrator.Postcode
Administrator.Email
Administrator.Phone
Administrator.Fax
Administrator.Webpage

2.3.3 Entity Location

2.3.3.1 AMCC modelling

The entity 'Location' in *AMCC* was defined (section 5.1.4) as 'The place (identified physically or electronically) where a Collection is held.' The following attributes were listed for 'Location' in *AMCC*:

Subtype: Physical repository
Attribute: Place [Country, city, building]
Attribute: Identifier
Subtype: Electronic repository
Attribute: Site
Attribute: URL

To these should be now be added (mainly from Dunsire):

2.3.3.2 Name attributes

Name
[&c]

2.3.3.3. Time attributes

HoursOfOperation
?TimeZone

2.3.3.4 Contact attributes

Collection-InstAddress
Collection-InstPostcode
Collection-InstEmail
Collection-InstPhone
Collection-InstFax
Collection-InstWebpageURL
Collection-InstIPAddress

2.3.3.5 Non-text identifiers

Logo

2.3.3.6. Alphanumeric identifiers

SiteCode

2.3.3.7 Characteristics

Sector
AccessConditions

2.3.4 Entity Resource Mediator

2.3.4.1

The entity 'Administrator' in *AMCC* was defined (section 5.2.6) as 'An Agent who has responsibility for the physical or electronic environment in which a Collection is held.' Associated with the Administrator was the Relationship 'Administers' (*AMCC* section 5.4.11), for which see 2.3.8 below. The attributes of an Administrator were given as:

Subtype: Person
Attribute: Name

Attribute: Date
Subtype: Corporate Body
Attribute: Name
Attribute: Date
Attribute: Place
Attribute: Logo

The Entity is now re-designated as 'Resource Mediator' to emphasise the active aspects of the agent. A further subtype is defined, **Software Agent.**

Subtype: SoftwareAgent

Attribute: URL
Attribute: ResourceType
Attribute: SupportedProtocol
[e.g. HTTP; Z39.50; Dublin Core]

More than one ResourceMediator may manage access to the Collection Description. In a physical environment, for example, there may be separate library admissions office and library ILL unit. Where the resource is electronic and access is managed directly by the holding institution, there may be methods of accessing the resource via different software agents and protocols.

The Resource Mediator plays the crucial role in mediating transactions. Note also that a succession of ResourceMediators may interpose between User and Location, with information passed from one to the next. As modelled here the passage of data is a transparent process; it may also be seen as the issuance of a succession of Tokens between ResourceMediators.

To the initial list of Administrator attributes should be added, for ResourceMediator (again, mainly from Dunsire):

2.3.4.2 Name attributes
Name
[&c]

2.3.4.3. Time attributes
HoursOfOperation
[Owner]-DelegatesTo-[Administrator].Date
[i.e. the date embedded in the 'Delegates-To' relationship in *AMCC* section 5.4.6]
?TimeZone

2.3.4.4 Contact attributes
ResMedAddress
ResMedPostcode
ResMedEmail
ResMedPhone
ResMedFax
ResMedWebpageURL

ResMedIPAddress

2.3.4.5 Non-text identifiers
Logo

2.3.4.6. Alphanumeric identifiers
SiteCode

2.3.4.7 Characteristics
Language
Sector
Description
[SupportedPaymentMethod] *(repeatable)*

2.3.4.8 ResourcePermissions attributes
These consist of data taken from the Collection Description model. The ResourceMediator uses them in determining whether to issue a ResourceToken in response to the presentation of a given UserToken:

[Author]-Creates-[Content.[Rights]
[Creator]-ContractsWith-[Producer].Terms
[Producer]-Produces-[CollectionDesc].Copyright
[Producer]-SellsTo-[Owner].Rights
[Owner]-Owns-[CollectionDesc].AccessControl
[Owner]-DelegatesTo-[Administrator].Terms
[Administrator]-Administers.[Location].AccessConditions

2.3.5 Relationship IsLocatedIn
This relationship is identical with the relationship IsLocatedIn in *AMCC* section 5.4.14.

2.3.5.1 Attributes

2.3.6 Relationship IsAccessedThru

2.3.6.1
This relationship is intended as the reciprocal of the relationship *Administers* in *AMCC* section 5.4.11, where it is defined as 'A Relationship between an Administrator and a Location specifying the manner in which the Administrator administers the Location. … The Administrator Administers the Location by opening and closing it; and by admitting or not admitting classes of user to the Location, on certain terms. In many – most – cases the Administrator will be the same Agent as the Owner; or may be exercising rights of the Owner that have been Delegated-To the Administrator. (For example, there may be distinct charges for access to the Location and to the Collection.)'.

In *AMCC* the attribute 'Access conditions [Hours of access, classes of permitted user, &c]' was identified. The list of attributes in the Collection Description which may affect access conditions is given in section 2.3.4.8.

2.3.6.2. Time attributes
TimesOfAccess [days/hours]
StartDateOfAllowedAccess
EndDateOfAllowedAccess
(NB these are Dates inherent to the resource, not Dates associated with an accredited User)

2.3.7 Passes/IsPassed
See section 3.7.1 for discussion of this transaction.

2.3.8 PassesCDConditionsTo
This relationship links Resource-centred entities to an Intermediary; it may be seen as either part of the static entity-relationship model of Resources or as part of the transactional model. See sections 2.4 and 4.4.

2.3.9 HasAccessTo
This is a placeholder relationship to allow for actions which take place during the transaction phase. The ResourceMediator may read data from an AccessRegister or may change entries and/or values in it.

2.3.9.1 Attributes
ActionType
Values LooksUp; Updates

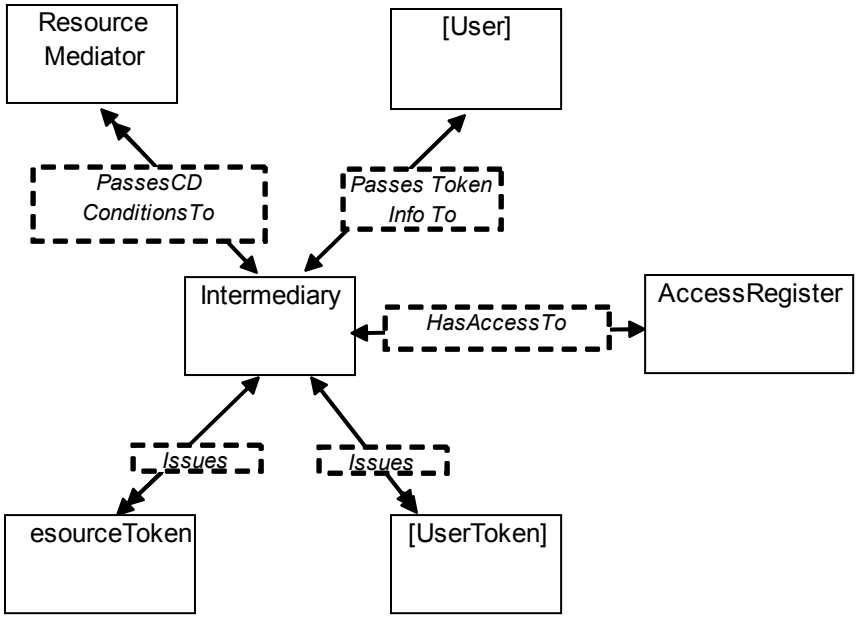
2.3.10 Issues/IsIssuedBy
Unlike UserTokens (see section 2.2.8), ResourceTokens are issued only as part of a sequence of transactions to gain access to resources. This relationship is discussed in the transactional part of the model, see section 3.3.

2.3.11 Holds/ IsHeldBy [ResourceToken]
Unlike UserTokens (see section 2.2.7), ResourceTokens are issued only as part of a sequence of transactions to gain access to resources and are then Held by the User. This relationship is discussed in the transactional part of the model, see section 3.3.

2.4 Intermediary entities and relationships

2.4.1 Role of intermediaries
The transaction sequences outlined below rely on Users obtaining Tokens identifying them, which are used by Resource Mediators to assess access rights and to issue (or deny) ResourceToken granting access to the resources. An Intermediary can act as an 'honest broker' issuing UserTokens to users and ResourceTokens for access to resources.

Note that the entity 'Intermediary' in Figures 2 and 3 is the **same** entity, as indicated in outline form in Figure 1. A more complete representation of the linking role of Intermediary between User and Resource is given in Figure 4 below.



[Figure 4: Role of Intermediary]

2.4.2 Entity Intermediary

2.4.2.1
The Intermediary substitutes for the ResourceMediator and as such shares its attributes.

2.4.2.2 Name attributes
Name
[&c]

2.4.2.3. Time attributes
HoursOfOperation
[Owner]-DelegatesTo-[Administrator].Date [i.e. the date embedded in the 'Delegates-To' relationship in *AMCC* section 5.4.6]
?TimeZone

2.4.2.4 Contact attributes
IntermediaryAddress
IntermediaryPostcode
IntermediaryEmail
IntermediaryPhone
IntermediaryFax
IntermediaryWebpageURL
IntermediaryIPAddress

2.4.2.5 Non-text identifiers
Logo

2.4.2.6. Alphanumeric identifiers
SiteCode

2.4.2.7 Characteristics
ResourceType
Language
Sector
Description
SupportedProtocol
[Payment methods]

3. Transactional entities and relationships

3.1. Entities: Tokens

Tokens are bundles of attributes, usually few in number, which are derived from the attributes of a User or of a ResourceMediator and are passed between them in transactions to establish rights and provide access to services. To take a typical instantiation, UserTokens and ResourceTokens begin as the equivalent of the Origin side and Target side in Shibboleth; but in this model the ResourceToken, though originating on the Target side, is passed to and used by the Origin side.)

3.2 UserToken

A User Token can be any set of attributes held by an entity or issued to it, which can be presented as the basis on which a User may be granted access rights to a Collection or Collection Description. It is impossible to be prescriptive or to list exhaustively in advance each set of attributes that might be present on a Token (or required by a ResourceMediator) and so what follows is a set of typical examples of the kinds of attributes which may be gathered together. The attributes are derived from those available to the holding or issuing User.

A UserToken may be any one of the four types of Token listed below. In the transactional analysis which follows in section 4 they are all subsumed under the object class UserToken.

3.2.1 PersonalToken

3.2.1.1 Introduction

This is any form of ID which the User Holds (see section 3.4.1) without reference to the Institutional environment. It can function as a UserToken if on presenting it the User can gain access to a resource.

3.2.1.2 Physical

Typical examples of physical ID are a passport, a driving licence, or a bank card. A passport, for example, will authenticate the User's name, date of birth, signature and physical appearance. Although such Tokens are issued by appropriate authorities after due authentication procedures, they function in this model as Tokens the User Holds as of right.

3.2.1.3 Electronic

A UserID and Password issued by a third-party ISP may function to identify a User sufficiently in some circumstances.

Person.Name
Person.GivenName
Person.Title
Person.PersonalEmail
Person.PersonalUserID

3.2.1.4 Biometric

The User's actual physical features may be the basis for a virtual Authentication (see section 3.7) – for example, face recognition, fingerprint, or retinal scan, in which case the User's body acts as the Token.

3.2.2 RoleToken

3.2.2.1 Physical
A RoleToken – exemplified by an institutional ID card – is the most common form of identification used in non-online envrionments. It will typically have most or all of the following elements (using the entity and attribute names of the model):

Person.Name
Person.GivenName
Role.Title
Role.ExpiryDate
Role.IDNumber
Role.IDExpiryDate
Role.WorkEmail
Role.Status
Unit/Inst.Name

The card may provide facilities only for visual inspection for verification of its details (e.g. presentation at a Library entrance); or it may have some encoded elements (on magstripe and/or barcode) – these are often limited to, e.g., Role.IDNumber and Role.IDExpiryDate; or it may be a smart card which encodes this and other information, for example cash-information to pay for resource use.

Although none of the elements is compulsory in any sense, the absence of one or another may cause practical problems – for example, the absence of a Role.ExpiryDate or a Role.IDExpiryDate may cause rejection by a ResourceMediator on the grounds that there is no evidence that the identification is still valid.

3.2.2.2 RoleID registration
This is the form of identification used within institutions and typically has the following elements:

Role.Userid
Role.WorkPassword
Role.IDExpiryDate

The User him/herself uses the Role.Userid and Role.WorkPassword to log on to Institutional resources. The Institution verifies these against its records for correctness and, using the Role.WorkUserIDEndDate attribute, for continuing validity.

3.2.2.3 Biometric
Although biometric attributes are inherently derived from the Personal User, they may be used to confirm identity if they have been securely derived in the context of the role the User plays in the Unit/Institution.

3.2.3 Unit/InstitutionalToken

3.2.3.1 Units and Institutions
In most cases Tokens are issued by the Institution rather than by a Unit. Whatever entity is involved, the same kinds of Tokens are issued, so InstToken and UnitToken are treated here as equivalent, and are described at the level of the Institution only.

3.2.3.2 GroupIDToken
Generic userids may be issued by an Institution for use by any members. These function like UserID registrationsbut lack personal information and have the attributes:

Inst.Userid
Inst.InstPassword
Inst.InstUserIDEndDate

3.2.3.3 Group address
Broadcasting from within a range of designated IP addresses may function as sufficient identification and therefore act as an InstToken.

Inst.IPRange

3.2.4 ThirdPartyToken
Third PartyTokens will normally be expected only in a non-electronic environment, for example where the ResourceMediator's list of ResourcePermissions attributes (see section 2.3.5.8 above) indicates that Owner's explicit permission is required; or that a user must be from an academic institution; or that there is a free-text description of allowed forms of recommendation for access. It would be equally if not more valid to indicate this in the model by a relationship line direct between User and RightsOwner. However, RightsOwner would not otherwise be present in this implementation and so that relationship has been left informally characterised as here.

CertifyingName
CertifyingInst
CertifyingDescription

3.3 ResourceToken
3.3.1 Introduction
ResourceToken is the entity produced when a ResourceMediator acknowledges the validity of a Token and grants access to the resource.

3.3.2 Physical ResourceToken
The ResourceMediator may issue its own equivalent to a UserToken, e.g. a Library card for an external user, and it will typically have similar attributes. It may additionally carry information about the level of access granted.

User.Name
User.GivenName
Role.Title
Role.ExpiryDate

ResourceToken.IDNumber
ResourceToken.IDExpiryDate
Role.Status
Unit/Inst.Name
AccessLevel

3.3.3 Electronic ResourceToken
In the electronic environment the typical ResourceToken will take the form of a cookie, containing at least an ResourceToken.IDNumber and possibly other information. The other information may be copied into the AccessRegister

Role.Userid
ResourceToken.IDNumber
ResourceToken.IDExpiryDate
AccessLevel

3.3.4 Biometric
The User's actual physical features may be the basis for a virtual ResourceToken – for example, face recognition, fingerprint, or retinal scan.

3.3.5 Session attributes
A ResourceToken may also have associated with it a constantly modified set of attributes describing a session. The attributes may be embedded within the Token itself but may also be tracked in the AccessRegister or elsewhere. Typically a history of the actions carried out in the session may be stored.

SessionHistory

3.4 AccessRegister

3.4.1
The AccessRegister contains a table of UserTokens and their matching ResourceTokens. Information about the following ResourceToken attributes may be copied into/held in the AccessRegister:

ResourceToken.IDExpiryDate
AccessLevel

3.4.2 User Permissions attributes
Especially in an online environment the AccessRegister may hold information about users in advance of the presentation of a Token. Attributes relating to this kind of information are:

AllowedUserid
    AllowedPassword
    AllowedUseridStartDate
    AllowedUseridEndDate
?AllowedPortNumber
AllowedIPRange
    AllowedIPRangeStartDate

AllowedIPRangeEndDate
MaxSimultaneousUsers
?AllowedCollection-DescriptionSubset

3.4.3 IntermediaryPermissions attributes
PermissionSet
A distinctive attribute is the existence of PermissionSets in AccessRegisters maintained by by some Intermediaries, pre-associating groups of resources with groups of users.

3.5 Request
In a Session (see section 4 below) the User passes Requests to the ResourceMediator. Each Request will be formulated according to a given set of protocols, which may be characterised as attributes of the Request:

CommunicationsProtocol
[e.g. HTTP, Telnet,Z39.50] (Note: disaggregate?)
FormatProtocol
[e.g. SQL,Dublin Core, MARC]
ContentProtocol
[e.g. LCSH]

Repeated Request may successively lead the User through the processes of finding, identifying, selecting and retrieving information.

3.6 Response
A Request which is passed to a CollectionDescription invokes a Response with corresponding attributes, which is returned to the User.

3.7. Relationships

3.7.1 Passes
The act of communicating information between entities. In each case the Recipient can receive only the information in the entity which is passed. This is usually a Token, but in the case of an Intermediary the passing of Collection Description Access Conditions can be seen as a transaction and is modelled here as such; it may be done in real time in response to a request or be done in advance of requests. The relationship may also involve the Passing of both a token and a Request, and of a Response.

3.7.2. LooksUp
At the beginning of any session the ResourceMediator must check any UserToken received, for prior data in the AccessRegister. 'LooksUp' compares data in the Token with data in the AccessRegister. Thereafter the ResourceMediator must check ResourceTokens for validity in respect of the action requested.

3.7.3 Matches

The action of comparing data in a UserToken with data in the Collection Description Access Conditions to determine whether the User may have access to the Collection Description and on what terms.

3.7.4 Updates
Information in the AccessRegister must be changed by updating as ResourceTokens are issued, lapse or are revoked.

3.7.5 Issues
The ResourceMediator may copy elements of the UserToken and add data attributes relating to expiry, resources to which access has been granted, and other terms and conditions and pass an appropriate ResourceToken to the presenter of the UserToken. The terms and conditions may be embedded directly in the ResourceToken or may be referenced there merely by a pointer to data in the AccessRegister.

3.7.6 Denies
Any Token or Request may not match information in the AccessRegister and if it does not the ResourceMediator denies the requested action.

3.7.7. Leaves
Where a physical use is taking place, the User has to leave the premises of CollectionInstitution before the session can end.

4 Transaction sequences (Sessions)

4.1 Introduction

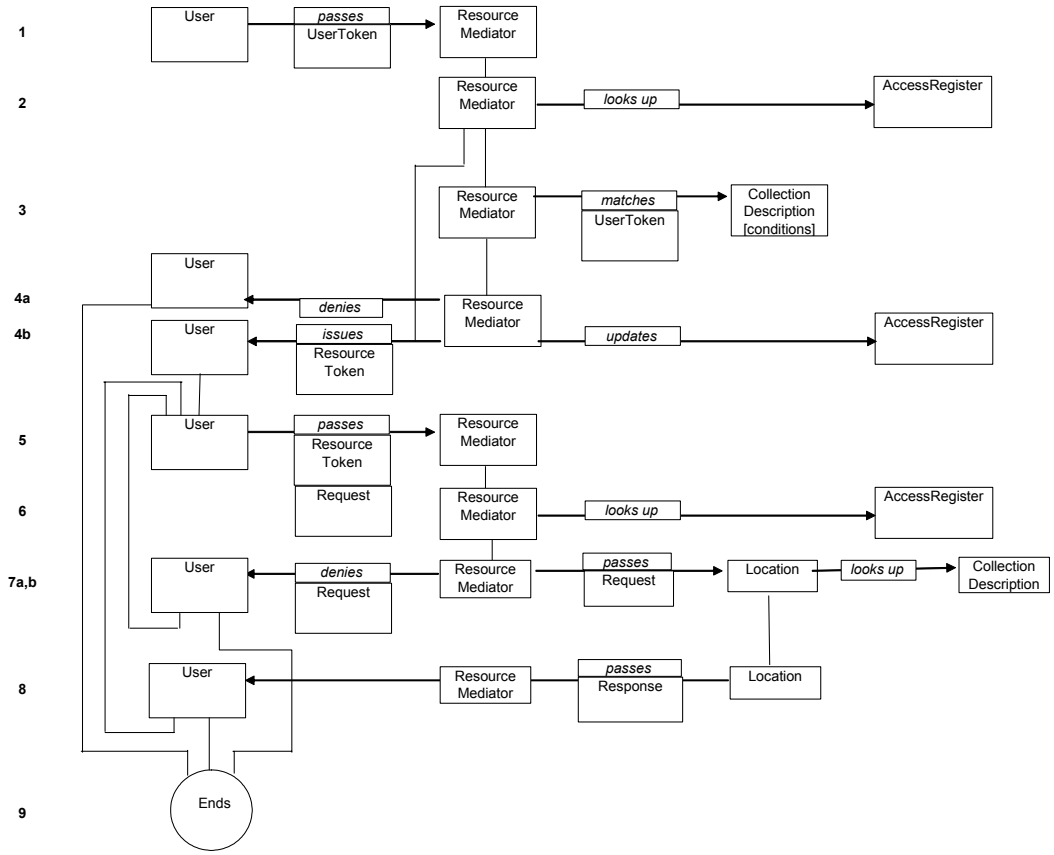
Three typical and illustrative transaction sequences are modelled in the following sections. Other sequences are possible are may be constructed on the same principles. Because these are transaction sequences the same sets of events can happen in different orders without affecting the outcome; and different sets of events can happen.

The three sequences modelled are:

- Direct Access to an online collection
- Access to a physical collection
- Access to online collection via Intermediary

The sequences presume that the actions inherent in the static model have taken place and that the User has a Token and that the ResourceMediator holds the necessary information about collections

4.2 Direct Access to an online collection



[Figure 5: Direct access to an online Collection Description]

The sequence of events identified here consists of the following actions:

1. The User passes a UserToken to the ResourceMediator of a CollectionDescription. This maybe, for example, a Token consisting of userid and password.

2. The ResourceMediator looks up the AccessRegister to verify whether this UserToken is known. If it is already known, the ResourceMediator moves to stage 4b and issues a ResourceToken.

3. If the UserToken is not recognised, the ResourceMediator matches its attributes against the access conditions associated with the Collection Description.

4a. If the UserToken does not match the access conditions associated with the Collection Description it is denied and the sequence ends (event 9).

4b. If the UserToken matches the access conditions associated with the Collection Description, the ResourceMediator issues a ResourceToken and updates the AccessRegister

5. The User passes a Request associated with the ResourceToken to the ResourceMediator.

6. The ResourceMediator looks up the AccessRegister to verify that this Request is valid for this ResourceToken.

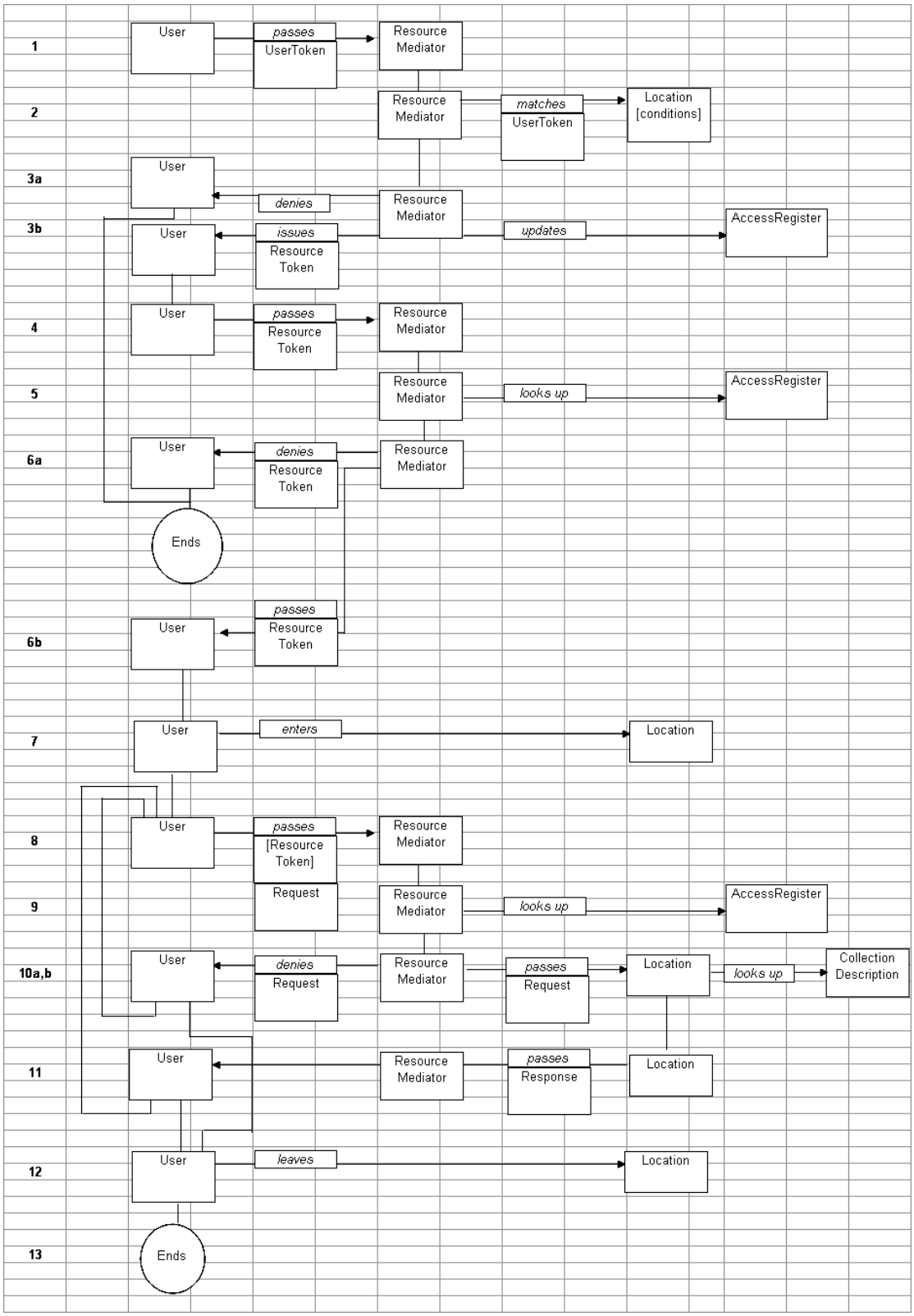
7a. If the ResourceMediator denies the Request the User may repeat from event 5 or may end (event 9).

7b. If the ResourceMediator accepts the Request the Request is passed via the Location to the Collection Description

8. The Collection Description responds to the Request.

9. The User may repeat from event 5 or may end.

4.3. Access to a physical collection



[Figure 6: Direct access to a physical Collection Description]

1. The User presents a UserToken to the ResourceMediator of a Location. This maybe, for example, an institutional identity card.

2. The ResourceMediator matches the attributes of the UserToken against the access conditions associated with the Location.

3a. If the UserToken does not match the access conditions associated with the CollectionInstitution it is denied and the sequence ends (event 6a).

3b. If the UserToken matches the access conditions associated with the CollectionInstitution, the ResourceMediator issues a ResourceToken and updates the AccessRegister.

4. The User passes the ResourceToken to the ResourceMediator. (For example, goes to the library entrance carrying a local admission card)

5. The ResourceMediator looks up the AccessRegister to verify that this ResourceToken is valid.

6a. If the ResourceToken is invalid (e.g. has lapsed since its issue) the ResourceMediator denies the User and the sequence ends.

6b. If the ResourceMediator passes the ResourceToken…

7. The User enters the Location.

8. The User passes a Request associated with the ResourceToken to the ResourceMediator.

9. The ResourceMediator looks up the AccessRegister to verify that this Request is valid for this ResourceToken.

10a. If the ResourceMediator denies the Request the User may repeat from event 5 or may end (event 9).

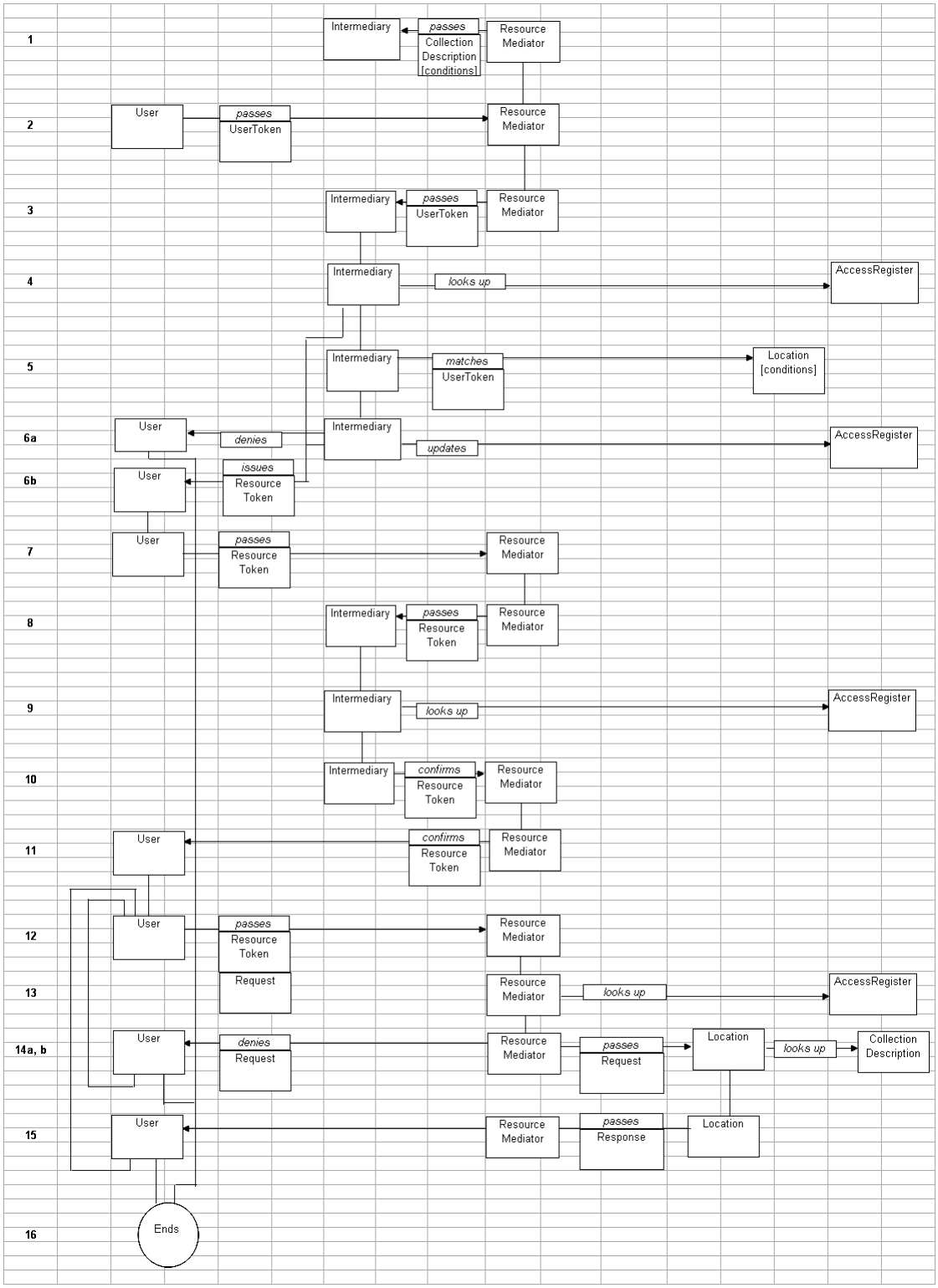
10b. If the ResourceMediator accepts the Request the Request is passed to the Location which looks up the Collection Description.

11. The Location responds to the Request through the ResourceMediator.

12. The User may repeat from event 5 or may leave the Location…

13….ending the sequence.

4.4 Access to online collection using an Intermediary (where the User first approaches the ResourceMediator)



[Figure 7: Access to an online Collection Description via an Intermediary]

1. At some point prior to the User-initiated sequence, the ResourceMediator passes details of the access conditions for the CollectionDescription to the Intermediary.

2. The User presents a UserToken to the ResourceMediator of a CollectionDescription.

3. The ResourceMediator passes the UserToken to the Intermediary for verification.

4. The Intermediary looks up the AccessRegister to verify whether this UserToken is known. If it is already known, the ResourceMediator moves to stage 6b and issues a ResourceToken.

5. If the UserToken is not recognised, the Intermediary matches its attributes against the access conditions associated with the Collection Description.

6a. If the UserToken does not match the access conditions associated with the Collection Description it is denied and the sequence ends (event 9).

6b. If the UserToken matches the access conditions associated with the Collection Description, the Intermediary issues a ResourceToken and updates the AccessRegister

7. The User passes the ResourceToken to the ResourceMediator.

8. The ResourceMediator passes the ResourceToken to the Intermediary for verification.

9. The Intermediary looks up the AccessRegister to verify the ResourceToken.

10. The Intermediary verifies the ResourceToken to the ResourceMediator. (the case where the Token is denied is not considered further here.)

11. The ResourceMediator confirms the ResourceToken back to the User.

12. The User passes a Request associated with the ResourceToken to the ResourceMediator.

13. The ResourceMediator looks up the AccessRegister to verify that this Request is valid for this ResourceToken.

14a. If the ResourceMediator denies the Request the User may repeat from event 5 or may end (event 9).

14b. If the ResourceMediator accepts the Request the Request is passed to the Location which looksup the CollectionDescription

15. The Location responds to the Request via the ResourceMediator.

16. The User may repeat from event 5 or may end.

5. Conclusion

5.1
The comparatively static universe of the Collection Description model is complemented by a similarly static universe describing Users. The process of bringing these two together involves transactions in which information is passed back and forth between them.

5.2
This extension to the *AMCC* model attempts to retain a degree of generality so that it can apply to a variety of transaction types, both physical and electronic, which involve access to collections.

5.3
The issue of rights is central to any transaction, and the User, as the seeker of information, has to demonstrate that he/she is entitled to access it. The ResosurceMediator has to have some list of allowed categories of Users and a means of judging whether new Users fall within one or more of these categories.

5.4
The model tries to capture the fact that, in negotiating access rights, the parties to the transaction do not know, or have available to them, everything about each other, and rely on establishing and being able to exchange a few key pieces of information. The model represents these key pieces of information as Tokens.

5.5
A transactional model, by its nature, does not have the same level of generality as a static model. Even if the entities and their relationships can be defined, the precise sequence of transactions may be variable. If, in order to allow a User access to a Collection Description, three transactions/exchanges of information have to take place, then it may be immaterial whether they take place in the order A,B.C or C,A,B any of the other four possible combinations. It may be possible for variable or transient information to be held, for the duration of a session, under the control of a User, or ResourceMediator, or AccessRegister, and provided it can be passed to or accessed by the right body when needed, it does not matter how the model is implemented. This analysis gives just three possible implementations of given scenarios – the entities and relationships are no more than building blocks which can be assembled in different sequences to model different sets of transactions, or even the same set of transactions in a different implementation.

5.6
This model therefore cannot claim the same level of generality or universality as the *Analytical Model of Collections and their Catalogues*: it can only be an effective tool as a guide in the development of individual services delivering resources to users.

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