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Software Identification and Entitlement Usage Metrics

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Abstract

The Software License Management (SLM) Incubator was created and its charter approved in December 2010.

The Incubator was formed to develop recommendations focused on the challenges surrounding software licensing management and to move the industry in a direction to effectively manage licensed software product(s), and work toward interoperable solutions.

The intent of this work is to be applicable to licensed software. It is applicable to software products that are developed in various ways, including open source software.

This white paper outlines the technical aspects required to address the requirements, use cases, scenarios and solutions identified. For example:

- The representation of the identity of a licensable product (i.e. virtual machine instance, on premise product, etc.)
- How it is associated with a running instance or a particular operating system
- Who and what (device) are assessing that instance, and
- The ability to discover if and where the product instance is running.

Foreword

The *Software Identification and Entitlement Usage Metrics* (DSP-IS0301) was prepared by the DMTF Software License Management Incubator.

DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems management and interoperability. For information about the DMTF, see http://www.dmtf.org.

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Software Identification and Entitlement Usage Metrics

1 Executive summary

Today's data center already places a heavy burden on the enterprises to manage the licensing of their products. In spite of being a primarily static environment in terms of mobility of desktops and applications, enterprises have significant difficulty in tracking entitlements and confirming compliance. The emergence of cloud computing along with virtualization adds additional complexity to software license management for platform vendors, application providers and their customers. Desktop and application migration makes the problem of getting an accurate inventory and ensuring compliance an order of magnitude more difficult. While the cloud brings the pay-as-you-go model for end customers, the cloud providers face added complexity of licensing and compliance.

The increased mobility of workloads and the ability to clone virtualized systems increases the challenge for organizations to track software license compliance associated with the virtualized instances. The mobility of licensed software to public and private clouds makes it more difficult to accurately identify and inventory deployed software, to trace its use and correlate the use to an entitlement. These challenges, however, create an opportunity to address customer pain points and to unlock the value and realize the efficiencies offered by these new virtualized and cloud technologies.

In order to fully realize the value of virtualization and cloud technologies standards are needed to sufficiently identify licensed software products, and to trace and gather the use of the software and other entitlement usage metrics across the span of deployments.

To effectively manage their licensed software product(s) and product usage, customers have the need to:

- Record and enumerate software product usage. This could encompass what instances, users, CPUs or other measurable units that may be running, where (e.g., whether in an operating system on hardware server, or a virtualized or cloud computing environment), with what device (i.e., on which processor of a given hardware server), and by whom.
    - Include non-hardware usage in entitlement usage metrics to accommodate virtualization technologies (for example, usage of features or capacities within the software product).
- Uniquely identify the software licensed product(s) associated with a particular usage.
- Technically express product usage information of licensed product(s) for pre-deployment or reporting purposes. For example, software entitlement usage metrics requirements in a package such as Open Virtualization Format (OVF).
- Rationalize and serialize usage metrics that are generated by software products which run on or migrate between virtualized environments

1.1 Recommendations

The SLM Incubator has identified four key recommendations for future work. These recommendations seek to address the requirements identified in the preceding summary and suggest the development or use of:

- Standard for the identity of a licensed product offering
- Standard format for capturing the core entitlement usage metric requirements that reflect measurable product use rights
- Standard log format and a normative schema to capture the consumption of an entitlement

- Process and use cases utilizing the above three standards that enable the automation of the core licensing management use cases and to enable the determination of the state of compliance to the corresponding license terms.

One intended usage of the above standards is that the product identity and the core metric requirements can be carried in an Open Virtualization Format (OVF) package for use by an automated deployment system or as part of a private or public cloud deployment package.

172 # 2 Common terminology

Term	Definition	DMTF Reference	External Reference
Application	Software that provides functions that are required by an IT Service. Each application may be part of more than one IT Service. An application instance can run on one or more computing systems.	CIM_ApplicationSystem	
Client Software	The part of a client-server Application that the user directly interfaces with. For example: an email client.		
Client Access License (CAL)	A software license that legally permits client computers to connect to server software. CALs apply to either a "device" (as defined in the license agreement) or a "user". A Per-User CAL allows one user to connect to the server software. Any user can connect, but only one user may use a given CAL at any given time. Any number of devices may connect to the server software, but only a set number of users can connect to it at once. A Per device CAL operates in much the same way, but limits connections made by devices, rather than users. One CAL enables one device to connect to and use the server software, regardless of how many users are connecting.		http://en.wikipedia.org/wiki/Client_Access_License
Cloud Computing	A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.		http://www.nist.gov/manuscript-publication-search.cfm?pub_id=909616
Computing Device	The hardware technology upon which the software is installed or executed.		
Computing System	One or more virtual or physical computing devices including applicable operating system or firmware that support installation and execution of applications.		
Consumer	Consumer is a legal entity that purchases, installs, deploys or uses a product.		
Central Processing Unit (CPU)	An integrated circuit chip installed in a computing device comprised of one or more processors that perform the instructions of a computer's programs. Modern CPUs usually contain on-chip memory referred to as "level 1" cache.		

Term	Definition	DMTF Reference	External Reference
Data Center	A data center is a physical location that provides computing resources and may contain physical and virtual systems, storage and networking.		
Deployment	The process of installing a service instance in a reserved or prepared environment.	CIM_Action	
Deployment System	The system that installs a software package or appliance.		
Entitlement (Software)	Legal ownership of software license use rights as defined through agreements between a software purchaser and the software copyright holder.		
Feature (Software)	A collection of software elements that performs a particular function or role of a software product. This level of granularity is intended to be meaningful to a consumer or user of the application to choose. This concept allows software products or application systems to be decomposed into units that have a meaning to users rather than units that reflect how the product or application was built (i.e., software elements).	DMTF Application Management Model	
Globally Unique Identifier (GUID)	A unique reference number used as an identifier in computer software.		
Guest Software	The software running on a virtual machine, stored on the virtual disks, that runs when a virtual machine is powered on The guest is typically an operating system and some user-level applications and services.		
Identity	A name that is used to uniquely identify a user or person for the purposes of granting/assigning software use rights. Example might be the username “SmithJ”.		
Image	Exact copy of the storage (disk) contents of a computing device for the purposes of recovery or provisioning of a duplicate system. This encompasses the full instantiation of a deployed operating environment, all applications, data and configuration settings.		

Term	Definition	DMTF Reference	External Reference
Infrastructure as a Service (IaaS)	A service delivery model where the capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).		http://www.nist.gov/manuscript-publication-search.cfm?pub_id=909616
Instance (Software)	An installed copy of a software product or application whose presence can be identified through manual or automated means.		
IT Service	A set of related functions provided by IT systems in support of one or more business areas, which in turn may be made up of software, hardware and communications facilities, perceived by the customer as a coherent and self-contained entity. An IT service may range from access to a single application, such as a general ledger system, to a complex set of facilities including many applications, as well as office automation that might be spread across a number of hardware and software platforms.		http://www.knowledgetransfer.net/dictionary/ITIL/en/IT_Service.htm
License (Software)	Legal rights to use software in accordance with terms and conditions specified by the software copyright owner		
Licensee (Software)	A legal entity, typically a person or organization, contractually bound to a given software license agreement that provides rights to use the associated software in accordance with the terms and conditions as specified by the copyright owner.		
Physical Location	A physical place associated with a specific geographical reference.		
Platform	A combination of hardware and software operating environment upon which applications can be installed and operate.		

Term	Definition	DMTF Reference	External Reference
Platform as a Service (PaaS)	A service delivery model where the capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.		http://www.nist.gov/manuscript-publication-search.cfm?pub_id=909616
Processor	The set of logic circuitry within a CPU that responds to and processes the basic instructions that perform the intended functions of a computing device. Modern processors may contain more than one core and/or have multithread capabilities that allow for execution of multiple instructions.		
Product Activation	Activation associates an event that recognizes the intended use of a software product with a specific device or system.		
Product Edition	A specific edition (i.e. a SKU variation) related to a specific version of a licensed software product.		
Product Version	A specific release of a licensed software product.		
Provisioning (Software)	The process of selecting, reserving resources, or creating an instance of a service offering.		
Relationship (Software)	A connection or interaction between one or more products, solutions, software components, applications or IT Service. Suites and bundles are clear examples of where knowledge of the relationships involved is important to properly manage a product or solution during packaging, provisioning, or addressing license compliance. A more complex example is an IT Service and its requisite applications, where documenting and maintaining the relationships between all the various elements involved is crucial for proper change and performance management.		
Resource	A generic term that includes IT infrastructure, people, money, hardware components or anything else that might help to deliver an IT Service.		

Term	Definition	DMTF Reference	External Reference
Server (Software)	The part of a client-server application that the client software interacts with. For example: an email server.		
Service Delivery Model	The approach used to deliver a given service to its intended consumers. As it applies to software, Service Delivery Models vary to address different ways in which software can be sold, managed and accessed, such as Software as a Service vs. software that must be installed by the customer on their own server, etc.		
Service Catalog	Self-service portals and/or eProcurement systems that contain a list of available services and products that can be requested/ordered in an automated manner.		
Software as a Service (SaaS)	A service delivery model where the capability provided to the consumer is to use the provider's application(s) running on a cloud infrastructure accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.		http://www.nist.gov/manuscript-publication-search.cfm?pub_id=909616
Software Bundle	A grouping of software products which is the result of a marketing/licensing strategy to sell entitlements to multiple products as one purchased item. As these are multiple licensed products there may be no way to determine that an individual installed product was purchased as a bundle.	CIM_SoftwareFeature	
Software Catalog	A subset of the service catalog that contains the list of software titles available for request/order through self-service portals and/or eProcurement systems.		
Software Element	A general term that is used to mean one discrete software part of a more complex software product or application.	CIM_SoftwareElement	
Software Product	One or more applications governed by one license, which may include procedures, documentation and data, commercially available as a single item for a fee to a licensee.	CIM_Product	

Term	Definition	DMTF Reference	External Reference
Software Package	A set of related software components that are combined into a single payload or a distributable installable item. For example, a software package is a set of files that can be used to install software on a computing device and can be distributed via CD or electronic means. An Open Virtualization Format (OVF) package is an example of a package for cloud deployment.		
Software Suite	A set of individually licensable software products or software features, that is combined and licensed as a separate single product.		
Solution	A combination of one or more applications, which may also include one or more computing systems, made available as a single IT Service.	CIM_ApplicationSystem	
Solution Multiplexing	Correlation of use of multiple individually licensed software components that compose a licensed application. For example, a web tier application with a single sign on to a data tier application may need to track those requests on a user's behalf that result in requests to the data tier		
Stock-Keeping Unit (SKU)	A number or string of alpha and numeric characters that uniquely identify a product. SKUs are often called part numbers, product numbers, and product identifiers, and may be represented by a universal number such as a UPC.		http://www.techterms.com/definition/sku
Thread	In programming, a part of a program that can execute independently of other parts. Operating systems that support multithreading capabilities of processors enable programmers to design programs whose threaded parts can execute concurrently.		
Uniform Resource Identifier (URI)	A string of characters used to identify a name or a resource usually on the internet.		
User	A person who uses an IT service. Users are distinct from customers, as some Customers do not use IT services directly.		
Virtual	As it applies to information technology, not physically existing as such but made by software to appear to do so.		
Virtualization Platform	Infrastructure enabling virtualization provided by a host system that enables the deployment of virtual systems.		

Term	Definition	DMTF Reference	External Reference
Virtual Machine (VM)	The virtual representation of a computing device including the CPU, memory, controllers, network interfaces, and storage that supports the execution of guest software in a virtualized environment.		
Virtual System	A virtual operating system environment that includes virtual machine(s), the operating systems and applications. The virtual system is a computer system operated in a virtualized environment that includes its software running in that environment.		

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3 Software licensing concepts and environment

Licensed software products can be packaged or made available in many different ways for a consumer. The variability of software packaging and distribution methods increases the complexity to uniquely identify and track usage for any given licensed software product. Licensing models, programs, and licensing terms also may influence how a licensed software product is packaged or made available.

Licensed software products are packaged or made available in some of the following ways:

- End user acquired products
- Organizational acquired products
- Single Executable
- Single product
- Software Suite
- Server offering
- Software Bundle

Software products are licensed based on factors such as: their use, the party that will use or access them, on what device, number of processors, and the amount of system memory, running location, and what other products are required to run them.

Licensed software products are to be used based on one or more software entitlements. Common metrics used to define and determine software entitlements include:

- Site (by physical geographic location or logical location(s) within an organizational entity)
- Subscription (within a specified timeframe)
- Type of use (i.e., personal vs. business) or consumption (how the software is accessed or duration of access)
- Client Access License (CAL)
  - Device
  - User
  - Internal, external
- Concurrent Use (by a maximum number of concurrent accesses by discrete, individual users or devices)
- Instance (by each installation on each given computing device)
- Feature (by one or more specific “features” within a software product)
- Capacity (by one or more definable “capacity” attributes typically associated with the computing device upon which the software product is installed)
- Product specific entitlements

The Use Rights for and consumption of a licensed software product are tied to its entitlement. Use Rights typically provide boundaries for:

- Operating System requirements
- License Life span
- Transfer rights[1]
  - Computer System
  - Physical Location
- Number of unique Users
- Number of Installations
- Number of unique Devices
- Maximum number of processors\ virtual processor
- Maximum amount of system memory
- Location
- Type of Device/system (desktop, server, phone, …)
- Secondary Use Rights

Entitlement usage metrics are generated from events that measure the use of a software product instance. Entitlement usage metrics may be gathered on the consumption of a licensed software product instance.

A licensed software product and its constituent components, where applicable, should be normatively identifiable to enable traceability through its lifecycle for identification and consumption purposes to correlate entitlement usage metrics.

Today products are delivered to a physical or virtual computing through a virtualized environment, from the cloud and through an enterprise data center. The characteristics of and consumption of a licensed software product instance should be traceable regardless of the environment of which it may be made available.

Application virtualization is where the technology isolates and packages applications in a way that they are dissociated from the underlying physical machine and operating system. Correspondingly, desktop virtualization is where the technology isolates the entire user experience (or desktop) from a physical machine and makes it available across one or more client devices.

The characteristics of a licensed software product may be captured in a computable package such as an Open Virtualization Format (OVF) package. OVF 1.1 (see Relevant standards, page 28) is a DMTF Standard, and very recently was approved as an ISO/IEC International Standard. OVF is a standard format for packaging virtual appliances or machines. This allows the virtual machine to be more easily moved and deployed across virtualization platforms.

[1] There is no requirement for a standard derived from this whitepaper to accommodate the transfer of license rights from a system that does not follow the same standard. Support for such a transfer is out of scope.

Licensed software products may also be available or deployed in the cloud. As shown in Figure 1, there are currently several acknowledged categories of clouds: private, public, community, and hybrid.

- Private Cloud - A private cloud is one that serves a single organization. Private clouds facilitate security, compliance, and quality of service improvements due to network optimization and isolation.
- Public Cloud - A public cloud is one that is available to the general public and is owned by an organization selling cloud services. Public clouds provide efficiencies through large economies of scale.
- Community Cloud - A Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party and hosted internally or externally. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the benefits of cloud computing are realized.
- Hybrid Cloud - A hybrid cloud is a composition of two or more clouds (private, public, or community) that remain separate and autonomous but allow for data and/or application portability between themselves via standard or proprietary technologies.

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263 Figure 1 evidences the complexity of identifying and tracking consumption for licensed software product
264 instances through the product lifecycle.

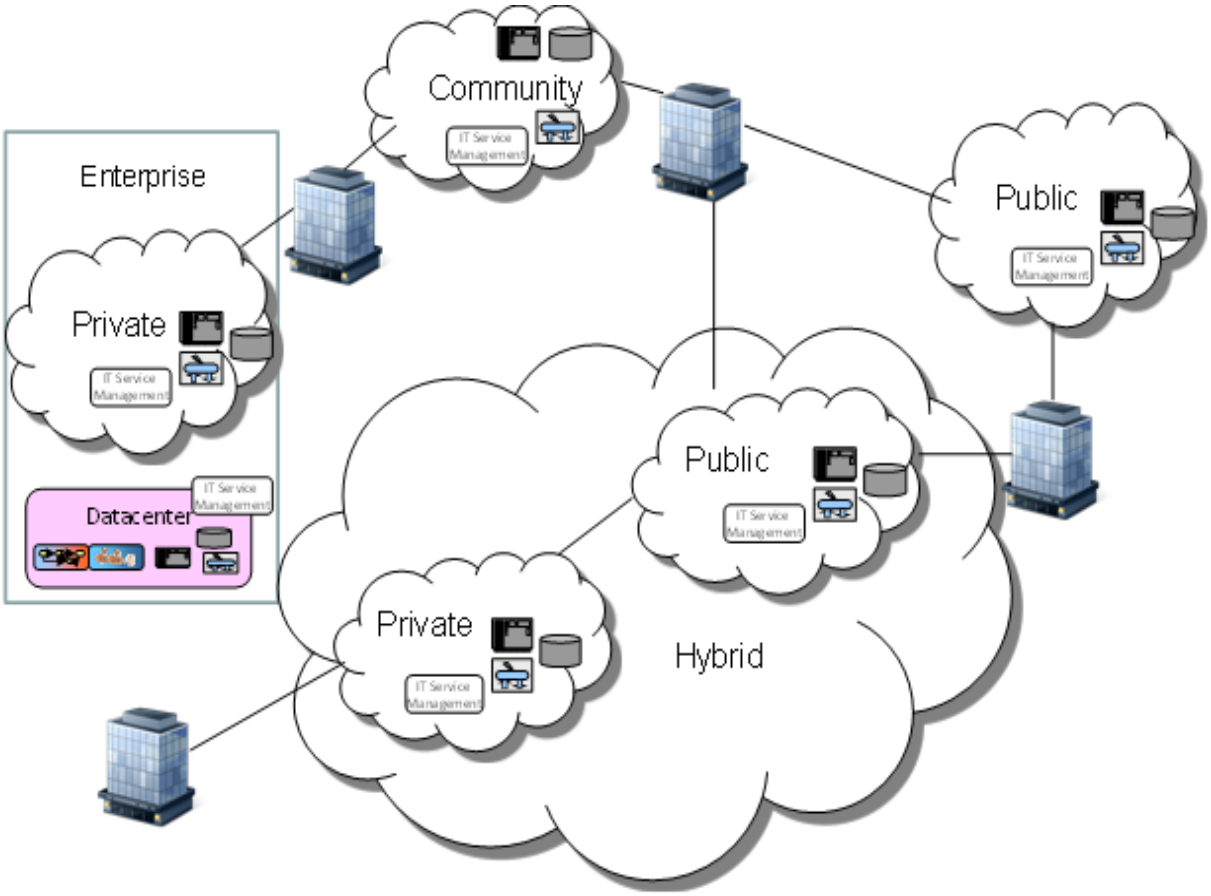

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Figure 1 – Cloud deployment environments

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268 In the following clauses, we identify several key scenarios that further describe the identification of and
269 consumption for a licensed software product instance through its lifecycle.

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4 Scenarios

This clause describes key entitlement usage metric scenarios that focus on top level product deployment scenarios. The entitlement usage metric scenarios can be summarized as below:

- What software do I have
- Who or what is using the software
- Where and when is the software being used

The scenarios are written to illustrate the requirements needed to answer these questions in a normative process across a range of deployment scenarios. The Use Cases derived from the deployment scenarios place requirements on software packaging, deployment, installation and upgrade, and runtime logging by the software. These requirements are the focus of this white paper.

Also note that parts of the included scenarios are outside of the scope of Software License Management Incubator and their inclusion is not an effort to make a recommendation for standardization. They are listed to explore and illustrate the requirements for the data artifacts required to standardize product identification and entitlement usage metrics.

The scenarios focus on separate environments with some overlapping requirements.

1) The packaging and development of software, solutions or applications for deployment in a cloud.
2) Desktop deployment of software in an enterprise
3) Software delivered as a service
4) Application and desktop virtualization
5) The packaging and installation of software on a server in a data center. It is possible that the data center is an enterprise data center or a cloud data center.
6) Cloud deployment scenarios

The packaging and development requirements focus on software identity and a manifest of licensable software within a package. The data center use cases utilizes a software identity artifact, but also focuses on the entitlement usage metrics to track the “who”, “what”, “when” and “where” of an installed software instance throughout its lifecycle. Entitlement usage metrics should be traceable, discoverable and available for reporting. The cloud deployment scenarios focus on the additional requirements of tracking software utilization or entitlement usage metrics in a remote computing environment. The scenarios are described from the perspective of the described set of actors.

4.1 Scenario actors

A group of actors are identified that may participate in the scenarios defined in this document.

- IT Pro/Administrator
  a) Software or Asset Administrator: Corporate software assets – match assets against the licenses acquired [Persona: IT Pro]
  b) System Administrator [Persona: IT Pro]
  c) Deployment Manager – Deployment on virtual machine [Persona: IT Pro]
- Product Provider
- Procurement Manager [Persona: Business Development Manager]
- Business Manager: Vendor or contract manager [Persona: Business Development Manager]

- Compliance officers
    a) Compliance Manager: Assesses reports against regulatory, corporate and other requirements (i.e., Business Conduct). Responds to information provided by IT Auditor. Compliance Manager develops set of criteria for IT auditor. [Persona: Business Development Manager]
    b) IT Auditor (internal) [Persona: Business Development Manager]
    c) Auditor (external): Reviews Compliance Manager's output and verifies or certifies the results, and approves the compliance plans.
- Security Manager: Access control [Persona: none defined]
- Service Manager [Persona: IT Pro]
- End user

4.2 Usage scenarios

The usage scenarios focus on the usage of licensed software products. Usage scenarios are identified for on-premise and enterprise or cloud data centers.

4.2.1 End user scenarios

The end user scenarios are a set of scenarios that focus on software used on a desktop computer, terminals or mobile devices. Multiple core scenarios are in practical use today:

- On-premise deployment of end user requested desktop software from a software offering catalog
- End user use of virtual applications on a client device
- End user access of server resources
- End user use of a virtualized desktop

4.2.2 End user request software for a desktop system

An end user requests software from an enterprise software catalog for use on a desktop target system. The software is licensed by the enterprise and available for use. The software is provided, installed and then used by the end user.

When the software is installed, a trial license may be activated by the software and may have an expiry date.

Entitlement, utilization, and product metrics are gathered from both the software catalog and the user's desktop system to track the lifecycle of the software instance including additions, upgrades and removal.

Refer to ANNEX A for a detailed look at the use cases and the need for entitlement usage metrics across the life cycle of a product for this scenario.

4.2.3 End user entitlement to software use via a licensing server

An enterprise acquires software and a number of licenses for a software product and ties the acquired licenses to a licensing server.

End user software is deployed and installed though any means, CD, software download or preload in an image file. As part of installation a license server is discovered or the user is prompted to provide the address of the license server.

When a client uses the software the software connects to the license server, and requests a use license.

- If the customer has a “Concurrent User License” and the software is available for use, the client is granted access.
- If the customer has “Per User/Device License” and if a license is available, the client is granted access.
- If the license server is not found, the client is either not allowed to run the software or given a temporary use license.

In an enterprise, an end user can check out licensed software any time (not necessary at the use time), as long as the check-out/check-in period covers the usage period.

Entitlement usage metrics should be gathered on the acquisition and release or expiry of a license and the products use. Entitlement usage metrics are also generated on the licensing server.

The license is validated per usage. User access is based on consumption (per-use).

In cases where the software cannot access the server due to network restrictions or network failure, the end user may provide a file containing the details of the machine (in which the software is installed) to a System Administrator and request that the license be withdrawn for a specific term on the end user’s behalf. The System administrator inputs the file to the license server, generates the license, and sends it to the end user.

4.2.4 Serving a single pool of licenses using multiple license server instances

In a distributed system, a shared pool of licenses may be served by multiple license server instances. For example, these multiple server instances may be needed to implement failover, load balancing, or regional access scenarios.

These multiple license server instances must consistently represent the license rights specified by their shared pool and must consistently log usage of license rights from that pool.

For example, increased use of virtualization can cause these multiple license server instances to frequently migrate between host environments or run on a host environment that is decommissioned or deleted. These server instances must guarantee that data input to them and output from them will persist, regardless of the properties of their host environment.

Another potential scenario is that a license may be acquired from one server instance and returned to another instance.

Therefore, these multiple server instances must log usage for their shared pool of licenses so that the log accurately represents the sequence in which the usage has occurred.

For example, consistent usage logging can be implemented using a shared log, a shared logging service, or a store and forward mechanism.

4.2.5 End user access to software as a service

Software may also be provided through an application delivery system or appliance which provides enterprise level services to an end user commonly through a web based interface. The software is delivered as a service to the end user.

In this scenario the software mainly exists on the servers providing the service. Often a thin software client (i.e., applet or ActiveX control) is downloaded or installed on the client. Entitlement usage metrics are gathered on the servers providing the service.

4.2.6 End user access to software- plus service

A Solution may consist of a “thick” client software that, to implement particular features, accesses configuration data or additional software on potentially remote servers providing a service that controls the associated entitlement(s).

Entitlement usage metrics are gathered on the servers providing the service and on the thick client software. These metrics need to be collected in such a way that they can be processed as metrics for the Solution.

4.2.7 End user use of remote application

Stateless client application can be virtualized on a server and run on demand by a user and delivered to the user through a remote console protocol like Microsoft Remote Desktop Services or Citrix XenApp. In these cases it is assumed that the license tracking would be performed on the server that is hosting the application.

When a virtualized client application is not delivered through a remote console protocol, such as when it is run directly from the file system of, for example a hardware dongle, usage tracking would be performed on the client.

4.2.8 Entitlement consumption scenarios

When a license is requested by software product, there are two major dimensions that drive how that software product acquires and returns the license:

- Whether the request is for use of a single capability or for use of a capacity count
- Whether the requested capability or capacity count can be returned after it has been used so that it can be: 1) available to be used by others or 2) once used, cannot be used again, even by the original requester.

The return of a capability or capacity count can be triggered by a variety of events. For example, application termination, completion of a task, etc.

Not all entitlement usage metrics will include both capabilities and capacity counts; some may include one but not the other.

In addition to the entitlement usage metrics listed in 5.1.2, the usage that should be logged for this scenario is:

- the request parameters, including the capability or capacity count requested and whether the capability or capacity count is returnable or not, and if the capacity count is returnable, whether a subset of the count can be returned
- the grant of the request, along with any conditions
- the denial of the request and the reason(s) for the denial
- the return of the grant and the reason(s) for the return

The log of the denials will help the customer to plan for upgrading his entitlement or optimizing their usage policies.

The entity granting requests, honoring returns, and logging usage metrics is a license service. Two example implementations of this service are: 1) as a server process with which the software product communicates or 2) as a library embedded into the software product.

4.3 Packaging and deployment scenarios

Licensed software products can be packaged to form solutions, suites, bundles and virtual appliances. To ease the burden of licensing management the deployment scenarios place requirements on the software developer, systems integrator or software vendor to include the product identification for each licensable product in the package in a normative and machine readable format. The following scenarios illustrate the value of a normative list of licensable products and required entitlement usage metrics contained in the software deployment package.

4.3.1 Packaging for data center deployments

Broader use of virtualization in enterprise data centers or private clouds has changed the typical data center deployments from an install in place or provisioning of software on a server to the deployment of fully provisioned images. Without the knowledge of the licensed software contained in the image it is hard for the IT Pro to assure licensing compliance. A normative manifest in the deployment package could contain both a list of the installed products and the metric requirements for those products to complete the following scenario.

A standards compliant OVF deployment package is scheduled for deployment in a data center. Before deployment the Software Administrator opens the package and extracts the product identification section from the package and, if available, any packaged license entitlements to assure that the proper entitlements are available to comply with the licensing requirements of the products in the package.

Based on the available entitlements for each product the Software Administrator either appends to an existing set of entitlement usage metric requirements or places an entitlement usage metric requirements data structure into the package for deployment by the Deployment Manager.

4.3.2 Cloud deployment

Four cloud deployment scenarios have been identified as follows:

Product provider packages a solution targeted at a cloud deployment that contains multiple separately licensed products. Included in the package is a manifest that contains the software Identification of all of the products contained in the product. The products included in the package may possess an inbuilt activation mechanism for instant activation of the product, with or without user interaction. Such inbuilt activation mechanism that does not require any user interaction may be used by the product in scenarios where the solution needs to be activated as part of automated cloud deployment.

Deployment manager receives a packaged solution to deploy into an enterprise private cloud. Before deployment the licensed products in the package are inventoried and checked against available entitlements to assure license usage compliance. The deployment manager determines whether to constrain a deployment, migration or movement of a package.

An IT Pro wants to move a line of business application from a set of dedicated servers to the enterprises private cloud. The IT Pro queries each of the servers to obtain a list of the software products contained in the servers that are used in the application. The IT Pro includes this list in the application package being developed to deploy the application in the private cloud. The IT Pro also delivers the list to the asset manager to obtain free up or transfer the entitlements that are required to run the package in the private cloud. IT Pro also places a data structure into the package that includes the entitlement usage metric requirements before deploying the package on the cloud service.

In a public cloud, a licensing server could be hosted and maintained by cloud providers as a licensing service. Cloud consumers use standard interfaces supplied by cloud providers to manage licensing usage information. The license usage information is generated by cloud providers and queried by cloud consumers for various purposes such as auditing. The definitions of communication between cloud consumers and cloud providers are out of the scope of this Incubator.

4.3.3 Product deployment in an enterprise data center

Three enterprise data center scenarios have been identified as follows:

Compliance Manager takes an inventory of all the licensable software products in a data center. For each of the discovered products, entitlement usage metrics are harvested from the system logs identifying life cycle and usage events for the product. The Compliance Manager correlates the lifecycle and usage logs against the relevant entitlements to assure that the data center is in compliance with the entitlements for the products. This includes inventory usage for product instances accessed indirectly through another licensed software product on behalf of a user.

The Software Administrator uses the correlation between the entitlements and the installed products, and entitlement usage metrics to forecast, adjust the continuing license requirements. For example, product usage and activations could determine the necessity to adjust licensing requirements.

An IT Pro set up an automated system to track product usage against a set of entitlement policies set by the Software Administrator. An example is a service that requires a Client Access License (CAL) per unique user or client device. The IT Pro registers for the relevant indications (events) based on the standard set of entitlement usage metrics delivered by each software product instance. Based on the dynamic usage events received each month the IT Pro is able to deliver a report to the Software Administrator with recommendations to increase or decrease the available entitlements or the type of entitlement required. For example, the IT Pro uses an automated system to differentiate per-processor or per-server product usage for the same license type and different entitlement usage metrics. Or, the IT Pro tracks product usage based on access to domain and member servers irrespective of where the usage occurs.

4.3.4 Data center/Server software deployment

During deployment of software or a packaged software solution, suite, or bundle, a deployment manager is able to discover the products contained in the package and the required entitlement usage metrics before the installation on the server(s). Entitlement usage metrics requirements are expressed in a standard way.

The Deployment Manager uses the available metric requirements to select a suitable server and/or create a virtual machine template that matches the entitlement usage metrics requirements.

When a licensed software product(s) are deployed, an artifact for each product is created that captures the relevant entitlement usage metrics relating to the environment into which the software is deployed (i.e. location, hardware definition, and VM definition).

As part of the deployment the Deployment Manager may also configure any settable system configurations parameters that are expressed in the entitlement usage metric requirements as packaged by the software asset manager.

4.3.5 Administrator-deployed software on desktop system

A software administrator deploys software products to an individual or a group of desktop system. Entitlement usage metrics are generated when the software is actually deployed, used or removed from a system. An example would be an IT managed installation of an antivirus product across an enterprise's desktop systems.

5 Management data artifacts requirements

To support the monitoring and management of relevant events related to software entitlements, events for the installed instance should be logged according to the defined standards for entitlement usage metrics. The Software usage lifecycle clause lists the relevant but not exhaustive list of software life cycle events that a system should capture.

5.1 Software usage lifecycle

To support the monitoring of relevant events related to software entitlements these events for the software instance should be logged according to a to-be-defined standard for entitlement usage metrics. The following list shows the relevant software life cycle events that should be captured.

- Request for software
- Acquisition of software and/or entitlement
- Addition to software offering catalog or software made available for use (consumption).
- Deployment or installation
- Product use
- Application migration
- VM migration
- Removal
- Modification of the software instance
- Upgrade or Downgrade
- Expiry
- Retirement

An example of a detailed description of a complete lifecycle, the end user request for software scenario is included in ANNEX A. The following two clauses Product Identification and Entitlement usage metric Requirements describe the relevant aspects that should be captured in each event.

5.1.1 Product identification

A licensed software product instance should be identifiable by a normative set of properties. This structure should contain all of the information required to completely identify the software product and optionally to describe the entitlement usage metrics that the product generates through its life cycle. For example:

- Vendor
- Software ID
- Software ID Type
- Product Title
- Product Category
- Product Family
- Edition
- Release Date
- Software version
- Software edition
- Version Type
- Patch Level
- Product Dependencies
- Certificates
- Security Token

5.1.2 Entitlement usage metrics

Entitlement usage metrics capture the relevant measureable or discoverable events in a system that relate to the licensing of a product. Since a software product instance can be run within multiple environments during its lifetime (e.g., Hyper-V Live Migration, VMotion, etc.), a software product instance may have more than one of the following records associated with it.

- The environment, unique users, devices, and usages related to the licensed software product instance
  - Number and type of virtual processors\cores
  - Amount of memory
  - Number and type of underlying hardware processors\cores
  - Timestamp
  - Administration domain
  - File location of binaries\executable
  - User Identity
  - User privilege
  - privilege level
  - Client device identity and\or
  - server identity
  - Tenant
  - Server or device type
  - Operating system Identity
  - Event type (reflect the life cycle)
    - Use
    - Operation state change (running, paused, stopped …)
    - Installation
    - Uninstall
    - Migration departure
    - Migration arrival
    - Upgrade/
    - Servicing
- Usage Metrics
  - running time
  - processor time
  - memory usage
  - timer based metrics
  - feature usage
  - capacity usage

6 Relevant standards

Organization	Specification	Date	Description
DMTF	DSP0140 Application White Paper	June 2003	The CIM Application Management Model is an information model that describes the details commonly required to manage software products and applications. This model can describe applications with various structures – ranging from standalone desktop applications to a sophisticated, multi-platform distributed, Internet-based application. Likewise, the model can be used to describe a single software product as well as a group of interdependent software products that form a business system.
DMTF	DSP0243 Open Virtualization Format (OVF 1.1)	January 2010	The Open Virtualization Format (OVF) Specification describes an open, secure, portable, efficient and extensible format for the packaging and distribution of software to be run in virtual machines.
DMTF	DSP1054 1.2.0 Indications Profile	June 2011	The Indications Profile defines the CIM elements that are used to subscribe for indications of unsolicited events, to advertise the possible indications, and to represent indications used to report events in a managed system.
OASIS	Solution Deployment Descriptor (SDD)	Sept. 2008	This specification defines schema for two XML document types: Package Descriptors and Deployment Descriptors. Package Descriptors define characteristics of a package used to deploy a solution. Deployment Descriptors define characteristics of the content of a solution package, including the requirements that are relevant for creation, configuration and maintenance of the solution content. The semantics of the descriptors are fully defined, allowing software implementations to precisely understand the intent of the descriptor authors and to use the information provided in the descriptors to support solution deployment.
IETF	Application Management MIB	May 1995	This specification defines an experimental portion of the Management Information Base (MIB) for use with network management protocols in the Internet Community. In particular, it defines objects used for the management of applications. This MIB complements the System Application MIB, providing for the management of applications' common attributes which could not typically be observed without the cooperation of the software being managed
ISO/IEC	19770-2:2009 Software Identification Tag Standard	2009	ISO/IEC 19770-2:2009 establishes specifications for tagging software to optimize its identification and management.

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596 7 Standards currently under development

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ISO/IEC	19770-3 Software Entitlement Tag Standard	Under development	ISO/IEC 19770-3 focuses on capturing and defining the information necessary to describe how software may be used, known as the entitlement. This standard will provide a framework and criterion of measurement for creating unambiguous definitions of entitlements.

ANNEX A

Use cases

A.1 Use cases for end user desktop system

The following are the use cases for just one of the above scenarios, automated end user requested software for their desktop system. The diagrams are shown only as an illustration of the type of interactions and the metrics required completing the scenario and track and managing the software licenses involved in the scenario. The scenario and the use cases described were used to determine the necessity and the requirements for software license management. Although this use case addresses a desktop deployment scenario, many of the use cases around the usage metrics and licensable events are true for the server scenarios that were discussed in the Incubator.

Short descriptions are followed by representative diagrams of these use cases.

A.1.1 Make software available

An administrator adds a software offering to a software catalog and makes it available for request. An administrator may verify the software offering and activate it in the software catalog.

A.1.2 Request software

A requestor (actor) requests software from a software catalog to deploy to a desktop system. The software request and deployment environment are used to complete the request. Software should be owned and available in the software offering to fulfill the request. As this is a licensable event, other licensing and software dependency checks are made before the software request can be completed. An authorization occurs when the request for software and other checks are made.

A.1.3 Deploy software

When a software request is complete, software is delivered to the desktop system for deployment. Deployment can be by manual or automated means. Entitlement usage metrics are captured throughout the deployment of the software. A licensing key may be required to activate the software instance.

A.1.4 Identify relationship

A software request, and deployment and access are related to and accounted for by a business entity. Entitlement usage metrics are created and captured on the software instance once the business entity-software instance relationship is set. The business entity is the consumer of the entitlement. Creating the relationship between the software request, the business entity, and the entitlement could occur in parallel to or in conjunction with other phases (i.e. Request Software, Deploy Software).

A.1.5 Use software

Entitlements metrics are captured when a software instance is accessed and used for the lifecycle of the software instance.

A.1.6 Change software

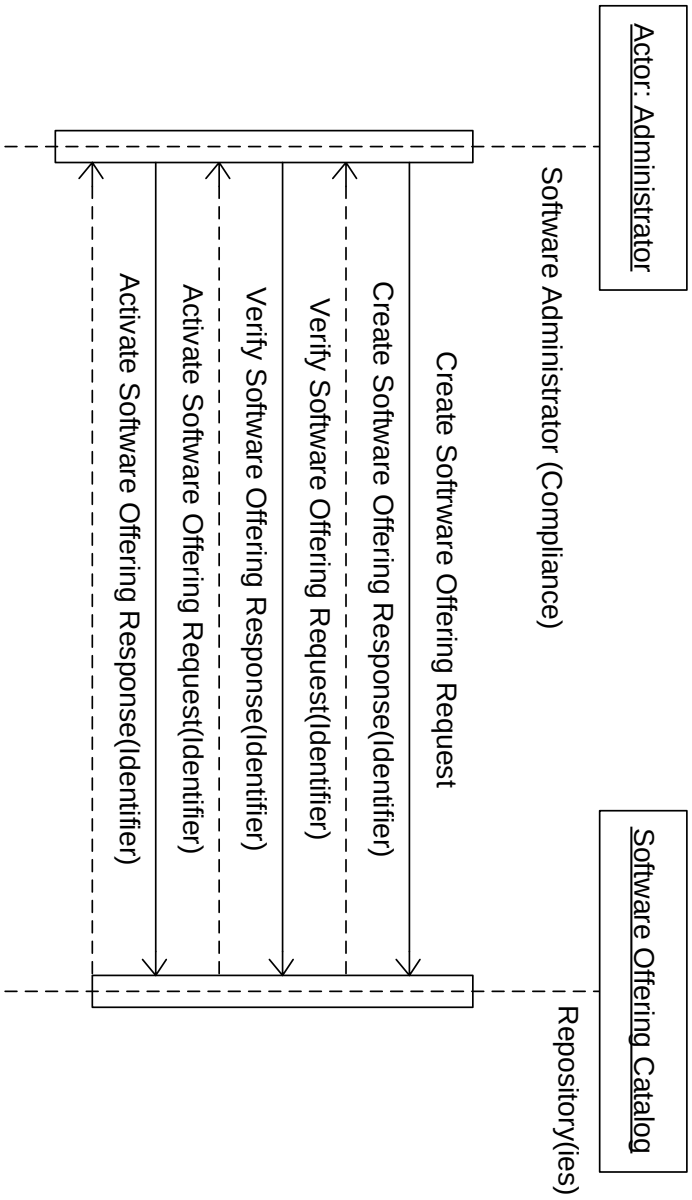
Requests to change a software instance may occur during its lifecycle and metrics captured on licensable events. Software may be added (i.e. for upgrade or new) or software removed (i.e. for replacement). A software upgrade may require a new software request and deployment, and removal of existing software. Such a request may result in a change in entitlement.

A.1.7 Discovery and reporting

The Entitlement usage metrics are available for discovery and reporting. The metrics are created at key points in the software instance lifecycle - at deployment, by actor usage, when an entitlement is used, and if the software instance is used or accessed (utilization).

A.1.8 Remove software

The software instance may be retired or returned to the software offering catalog when a request is made to remove that instance. The software may be returned to the software catalog and made available for re-deployment. If required, licensing keys may also be returned. The entitlement usage metrics are created to reflect the removal of the software instance and the associated entitlement.



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648 **Figure 2 – Make software available**

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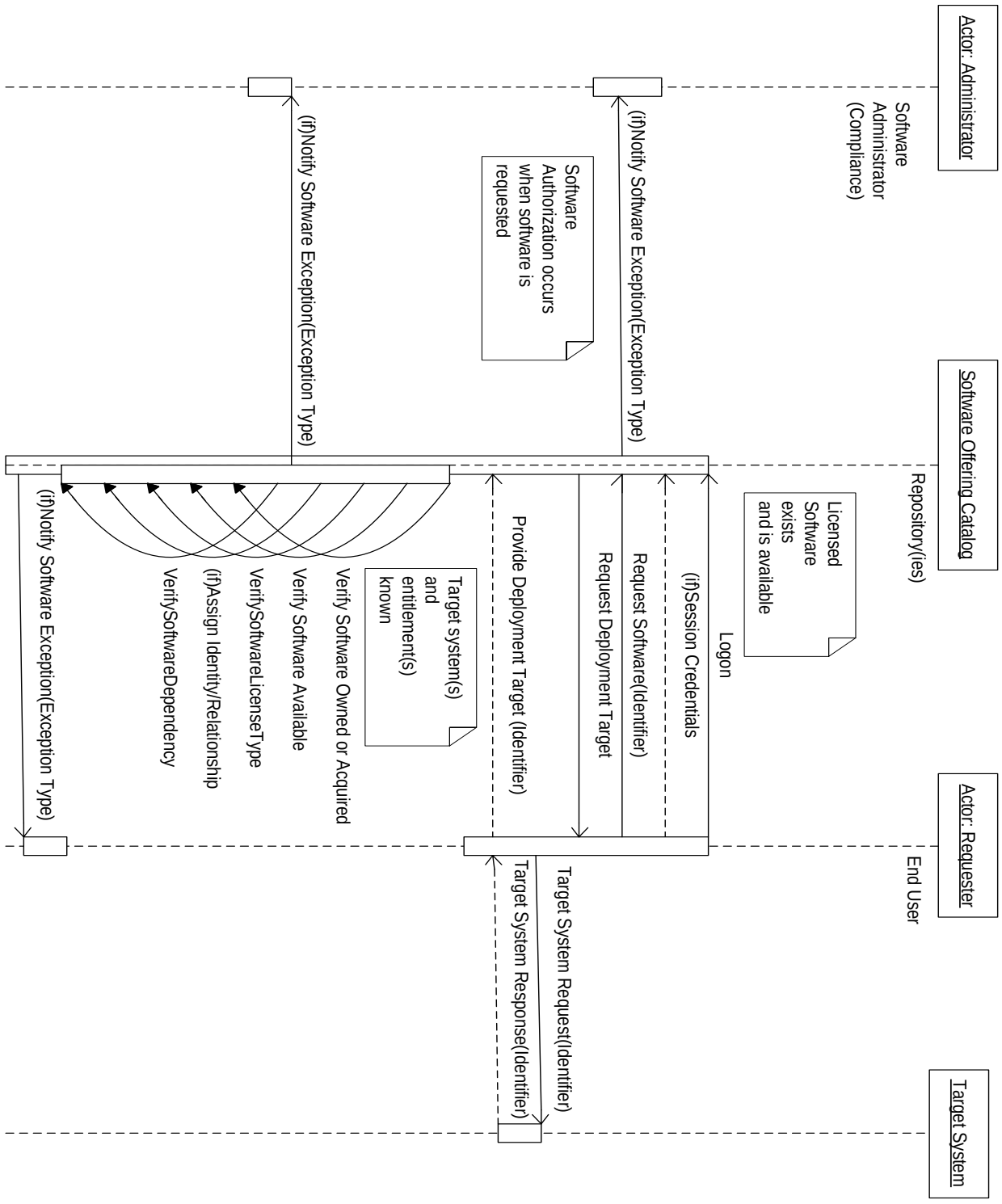

650

651 **Figure 3 – Request software**

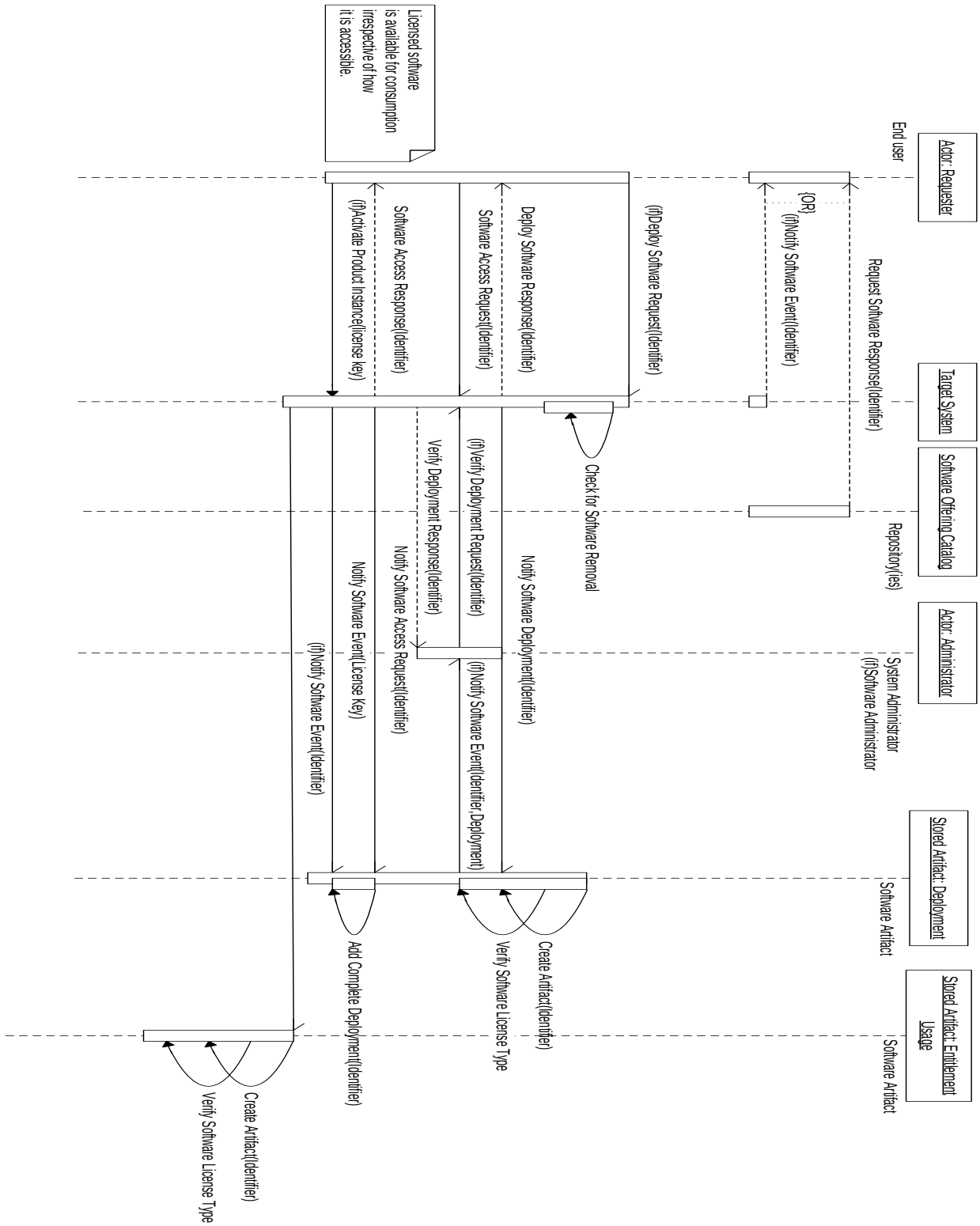

Figure 4 – Deploy software

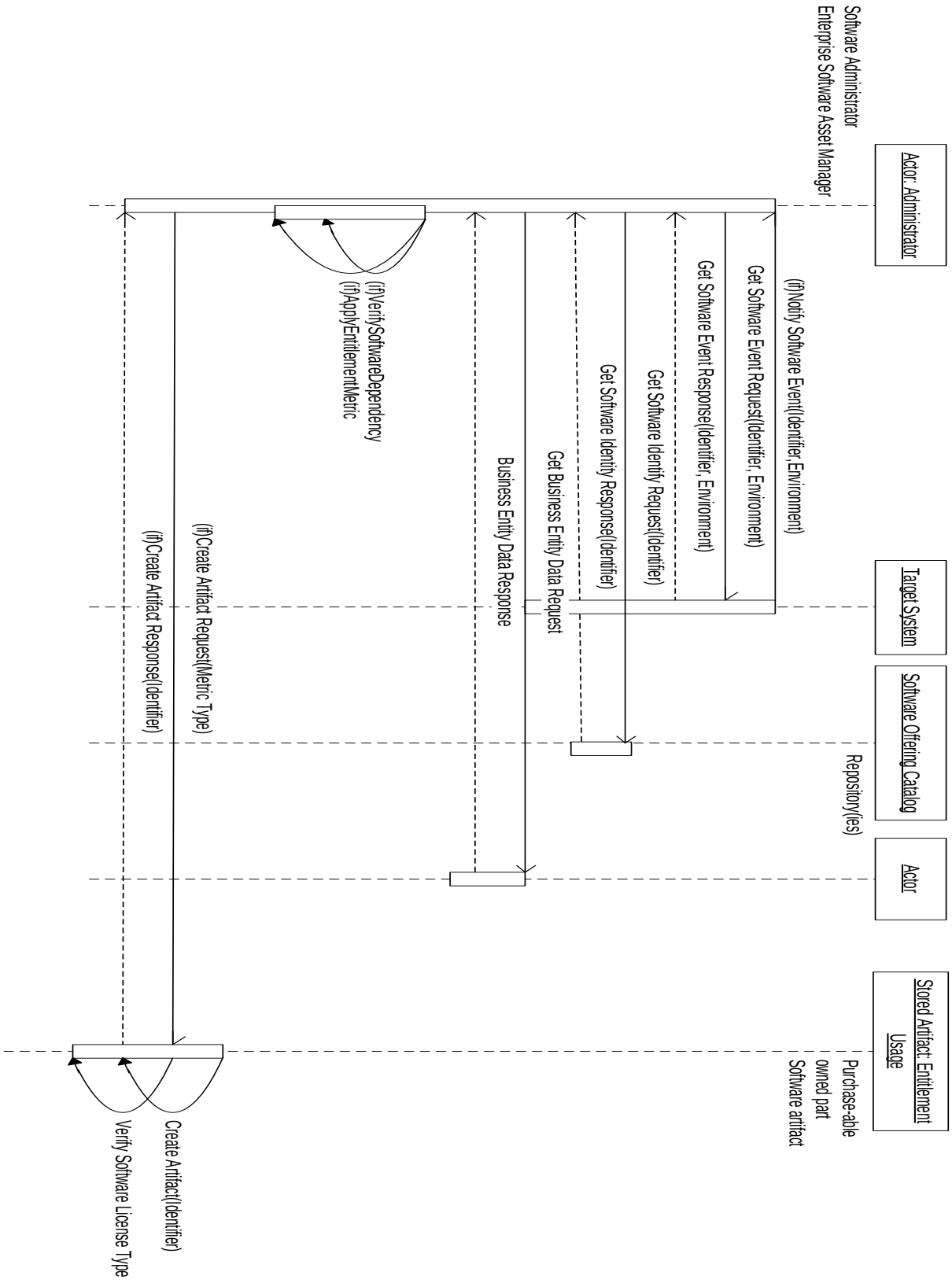

Figure 5 – Identify relationship

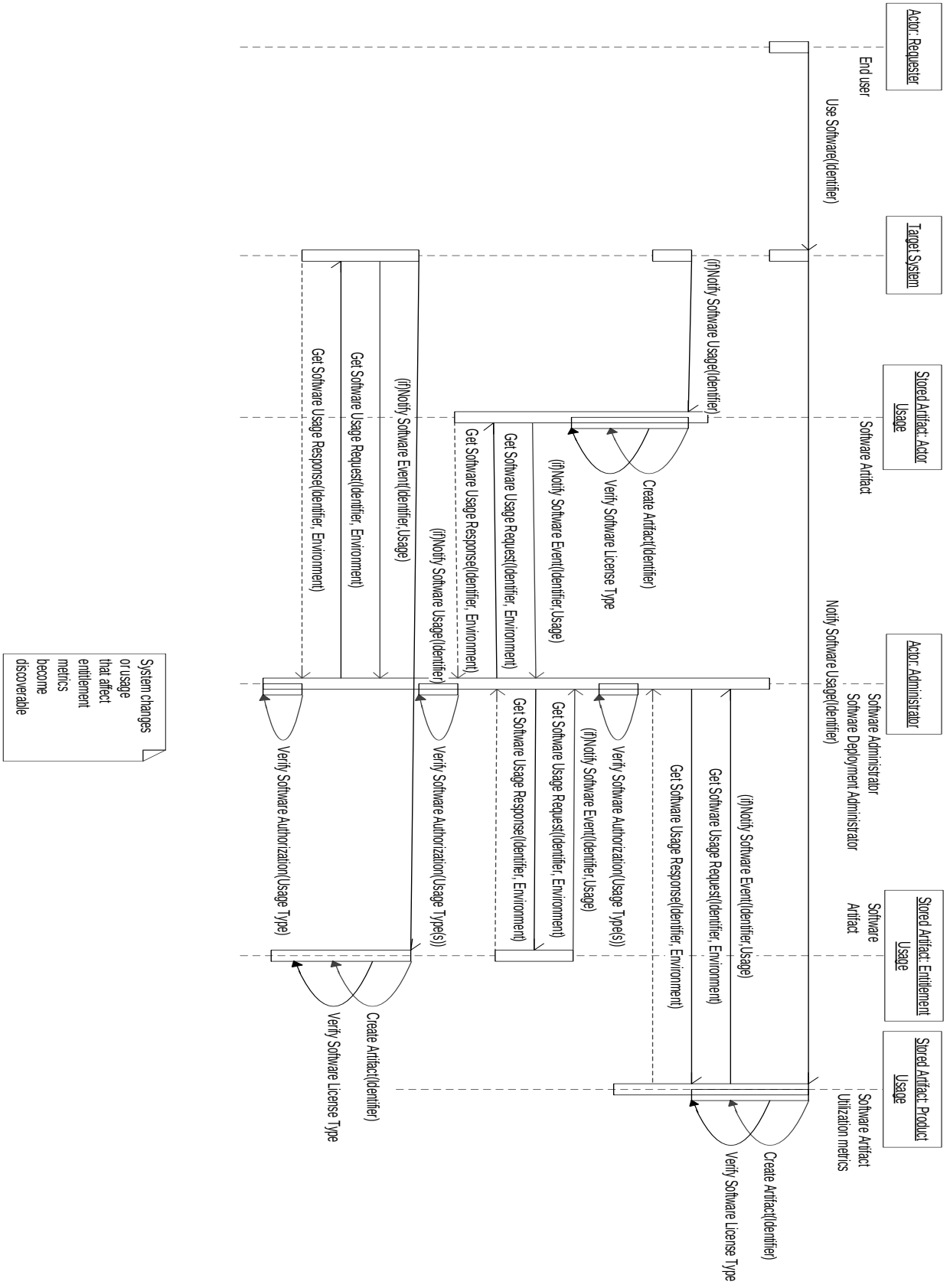

Figure 6 – Use software

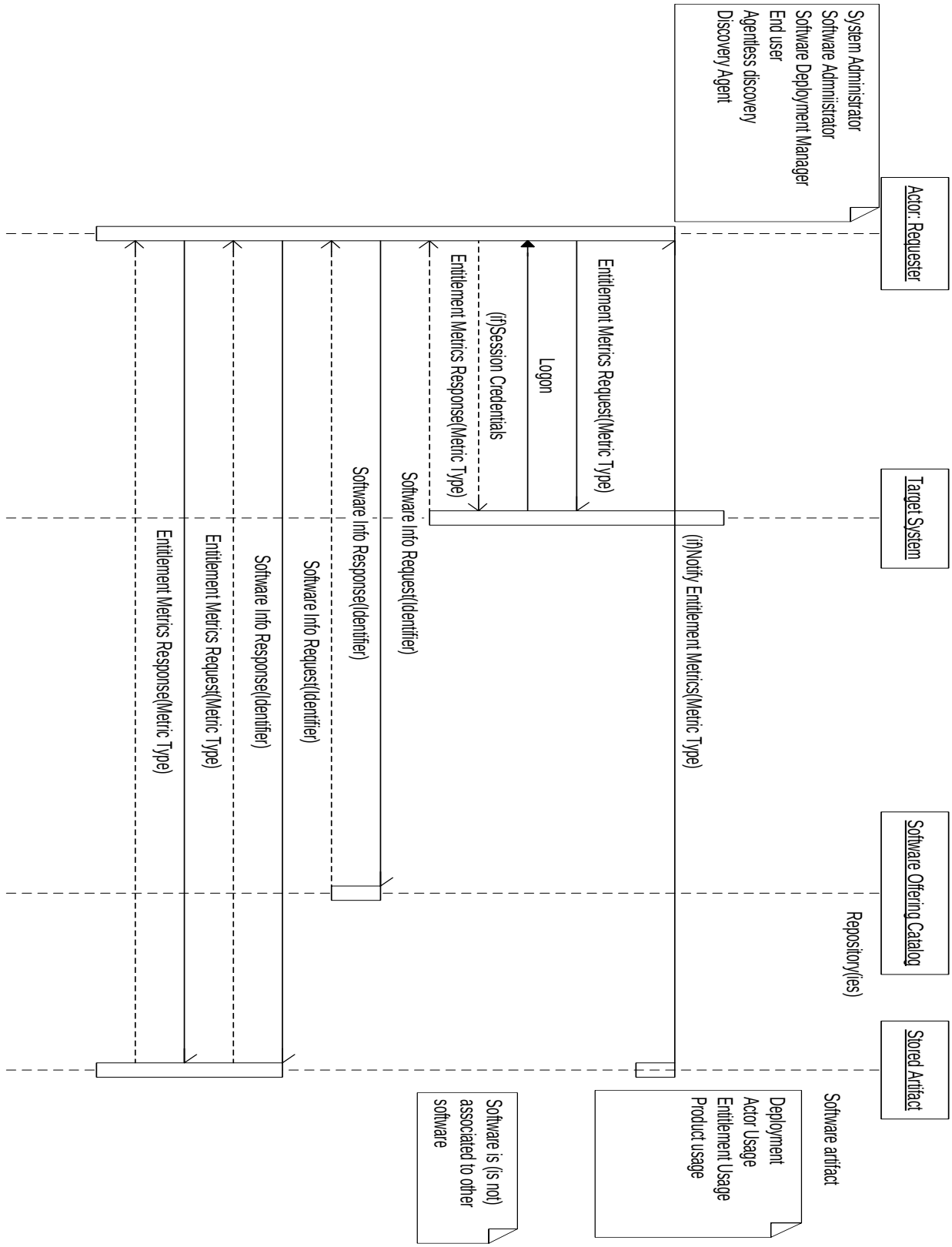

Figure 7 – Discovery and reporting

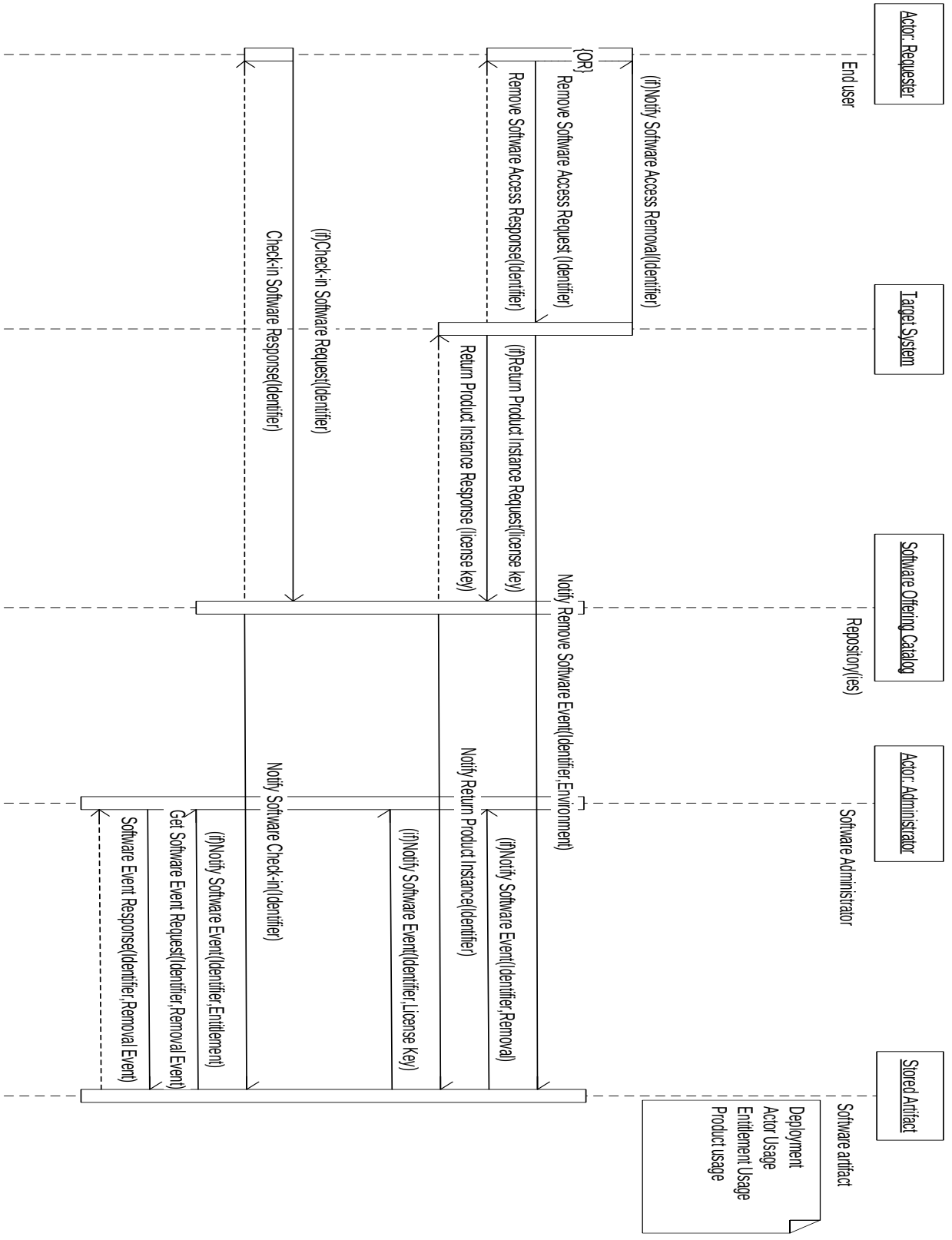

Figure 8 – Remove software

665 # ANNEX B
666 # (informative)
667
668
669 # Change log

Version	Date	Description
1.0.0	2012-05-20	

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