Code of PLM Openness (CPO)

Basic Understanding of Openness and Associated Requirements

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Preamble

The manufacturing of complex technical products requires a multi-layered process environment in a number of different departments, from development and production right through to after-sales, with a large number of heterogeneous IT systems provided by numerous IT vendors.

Almost every one of these IT systems has to be linked with other IT systems. The amount of time and effort required by IT customers for IT integration is therefore extraordinarily high.

The openness of IT systems, especially the ability to integrate them into various IT system environments, is a key for reducing the amount of time and effort involved. This can be achieved most efficiently if the openness of the IT system is based on established standards as far as possible (cf. 2.5 Standards).

This Code of PLM Openness (CPO) is intended to provide a basic understanding of the term "openness" and describe the associated basic requirements by impartial, non-discriminating criteria graduated in Shall, Should and May. Those will be gradually enhanced and detailed to evolve PLM openness. The CPO will be updated by decision of the CPO Community to accommodate enhancement requirements.

The CPO is being created within the framework of a ProSTEP iViP project in a joint activity carried out by IT customers, IT vendors and IT service providers.

CPO-relevant definitions are defined in a glossary, which is a separate supplement to the CPO. Keywords that are defined in the glossary are underlined in the CPO.

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1.1 Focus and Aims of the CPO

Focus

- Achieving a common understanding with regard to the openness of <u>IT systems</u> and related requirements in the context of <u>PLM</u>. It is being created jointly by <u>IT customers</u> and <u>IT vendors</u> as well as <u>IT service providers</u>.

- Focusing on the product creation process at the beginning of the CPO initiative. In later phases, the CPO will address the full product lifecycle.

- Self-commitment of participating companies on a voluntary basis, which comprises non-enforceable terms and does not constitute any legal claim.

- Ongoing activity with updates by decision of the CPO Community to accommodate enhancement requirements.

- Maintenance by a CPO organization under the auspices of the ProSTEP iViP Association.

- Reporting on the usage of the CPO (companies, acceptance of regulations, feedback).

Aims

- Transparency regarding the "openness of IT systems" within the context of <u>PLM</u> using impartial, non-discriminating criteria graduated in "shall"/"should"/"may". (cf. 1.2 Definitions)

- Efficiency in communications between <u>IT customers</u> and <u>IT vendors</u> and <u>IT service providers</u> by providing a baseline for openness of <u>IT systems</u>.

- Cost benefits for all.

- Market stimulation by encouraging competition between <u>IT systems</u>.

The CPO does not aim to

- Restrict innovation and/or technical development.

- Disclose intellectual properties (IP) in any respect (e.g. source code of <u>IT vendors</u>).

- Exclude competitors from dedicated markets.

- Disclose sensitive information (e.g. prices, license costs, new product developments, strategies, etc.), when competitive information or factors such as technical and economic feasibility are concerned.

1.2 Definitions

In general, definitions are provided in the glossary (see supplementary document), but because of their importance for the understanding of the CPO, some terms are explained under "Fundamentals".

Openness

Openness is a capability provided by an <u>IT system</u>, and it is characterized by <u>interoperability</u>, <u>portability</u> and <u>extensibility</u>. These capabilities are implemented using <u>IT interfaces</u>, <u>standards</u> and the <u>IT architecture</u>. All these are technical aspects of openness, Openness is also based on non-technical aspects, which are related to the partnership between the involved partners (<u>IT customers</u>, <u>IT vendors</u> and/or <u>IT service providers)</u>. Figure 1 illustrates these key-aspects of openness.
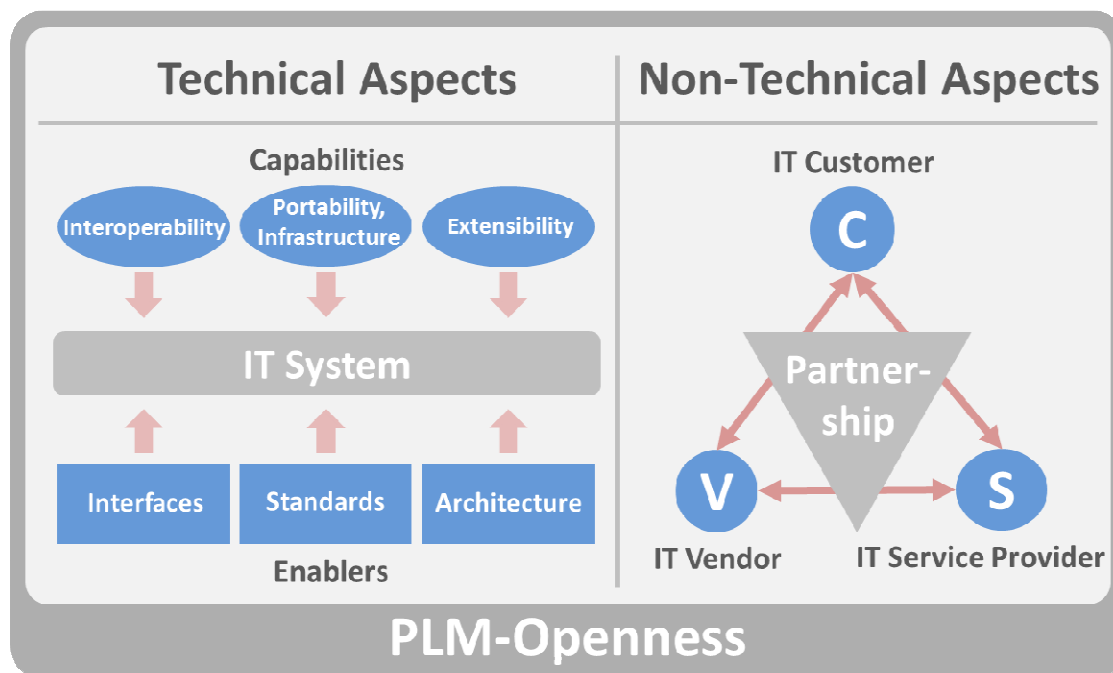

Figure 1: Key-aspects of PLM Openness

In order to promote openness effectively, certain level of quality provided by IT systems is essential, otherwise interoperability, portability and extensibility are hard to achieve.

Shall/Should/May

In order to differentiate between three different degrees of self-commitment, specific use is made of "shall", "should" and "may".

- "Shall", or the term "REQUIRED", means that the definition or statement is an absolute requirement.

- "Should", or the adjective "RECOMMENDED", means that there may be valid reasons under certain circumstances for ignoring a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

- "May", or the adjective "OPTIONAL", means that an item is truly optional. It often has the character of a best practice.

1.3 Necessity of Openness

- Designing the IT system environment is a primary task and the responsibility of IT customers.

- The IT systems use data which has to be linked or exchanged both vertically and horizontally.

- Figure 2 shows part of the whole PLM environment by way of example.

- Figure 2 classifies IT systems logically in PLM layers irrespective of their concrete technical implementation.
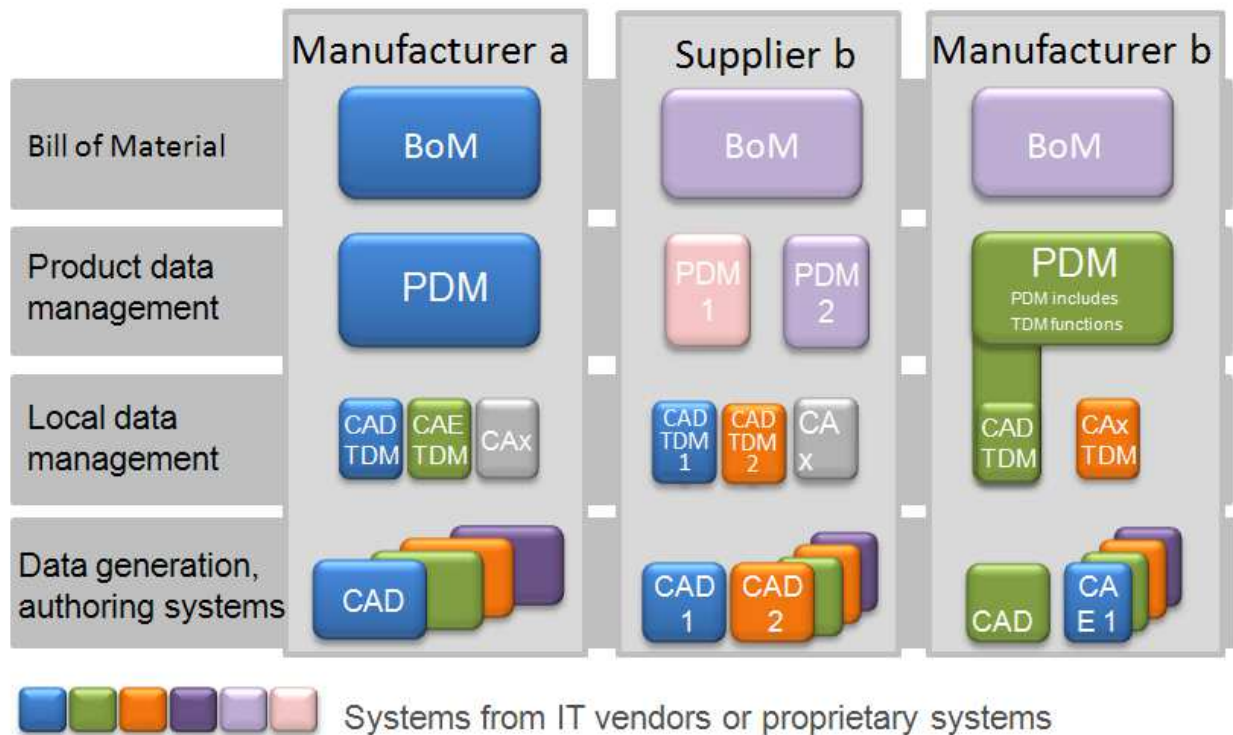

Figure 2: Example of part of a PLM environment, demonstrating the necessity of openness for connecting a variety of IT systems from different IT vendors.

2 CPO Terms

2.1 Interoperability

IT customers develop and maintain very different PLM system environments (cf. Figure 2) due to specific process needs and different PLM histories (e.g. legacy systems). Openness in this respect means that an IT system has the ability to be integrated into different environments and that it has to communicate efficiently with various other IT systems.

2.1.1   IT customers shall be able to realize system integration, on their own or via third parties, based on process requirements.

2.1.2   IT customers shall have access to their data. It shall be possible to exchange this data, including relations between the data, between IT systems.

2.1.3   Therefore IT interfaces shall be provided by the IT vendors.

      a.   These IT interfaces should be based on standards (if available).

      b.   IT customers should ask IT vendors about any risks regarding data and process integrity. IT vendors may provide best practices.

2.1.4   IT customers should use officially supported versions of IT systems and state-of-the-art levels of IT infrastructure to minimize the effort required to achieve interoperability.

2.1.5   IT vendors should endeavor to maximize version/release compatibility between versions of an IT system.

2.2 Infrastructure

IT customers bear the high investment costs involved in developing and maintaining their IT infrastructure. This IT infrastructure comprises the network and system platforms (hardware, OS). Due to the fact that the IT infrastructure is continually evolving, long-term lifecycle planning of the respective IT components is required.

Openness in this respect means that an IT system can be integrated into an existing or planned IT infrastructure environment in the long term.

2.2.1   The IT customer and the IT vendor shall share lifecycle planning with regard to applied/supported hardware and operating systems. The IT customer and the IT vendor should agree on the HW/SW platforms to be supported to minimize development and maintenance costs (i.e. Linux derivates, virtualization etc.).

2.2.2   Lifecycle plans may be subject to change, but because of the severe consequences (costs, long timeline) involved, deviations from these lifecycle plans shall be communicated as early as possible. This communication may be at least one year in advance.

2.3 Extensibility

IT customers have to establish efficient processes based on suitable IT systems (cf. Figure 2) to achieve competitiveness in their market. The functionality provided by IT systems in the market frequently does not completely cover requirements in this regard.

Openness in this respect means that IT customers have the option of extending the functionality of an IT system in order to implement required process adaptations and to map their own know-how in the IT system.

2.3.1 IT vendors shall provide development environments for implementing extensions, which in particular

  a. should provide the build-time environment for implementing changes/add-ons to the data model, the business logic and rules, and the user interface.

  b. should provide the tools needed to create a runtime executable that can be implemented on top of the standard installed code.

  c. should provide appropriate documentation of the interfaces (APIs) and the integration architecture.

2.3.2 Based on their license agreements with an IT vendor, IT customers shall be able to commission third parties to realize extensions to that IT vendor's IT system.

2.3.3 IT vendors shall provide a change request system and feedback regarding change requests within an agreed timeframe.

2.3.4 IT vendors should provide implementation guidelines to minimize the efforts when extensions are realized.

2.3.5 In case of an IT system upgrade, IT vendors should endeavor that the application of extensions realized by IT customers (or by third parties commissioned by these IT customer) is unaffected. IT customers should use the implementation guidelines and/or tools provided by IT vendors to assist in this endeavor.

2.4 Interfaces

In order to realize the required interoperability (2.1) and extensibility (2.3) of an IT system, IT customers need access to available, documented and performing IT interfaces.

2.4.1 IT interfaces shall be documented based on a common understanding and methods of documentation.

2.4.2 IT vendors shall provide maintenance information for IT interfaces to IT customers one year in advance. Details should be delivered in time before the release update. The current release shall be supported one year after release update.

2.4.3 IT vendors shall endeavor to maximize version and release compatibility with regard to new releases of and changes to IT interfaces and related input/output data.

2.4.4 IT vendors should offer the same IT interfaces to IT customers (or third parties commissioned by these IT customers) as those used internally by the IT vendors, insofar as they have been published.

2.4.5 There should be no difference in the functionality and performance of IT interfaces with regard to batch processing and direct interaction.

2.4.6 Cancellation of an interface shall be announced as early as possible.

    a. Cancellation of an IT interface by an IT vendor should be announced at least one year in advance.

    b. In the case of a cancellation, the IT vendor should provide an adequate replacement or, if this cannot be done in time, a workaround.

2.5 Standards

The term "standard" as used here is synonymous with norm, standard, industry standard, vendor-specific standard.

The development and maintenance of a complex system environment (cf. Figure 2) can only be done efficiently if standards are used as far as possible. This is valid for all the previously mentioned aspects of openness (interoperability, IT infrastructure and extensibility).

2.5.1   IT vendors should support relevant standards and document their usage. IT vendors shall provide a list of the standards that support openness.

2.5.2   With regard to the support of future standards, IT vendors should provide a roadmap relating to the usage of these standards for specific processes.

2.5.3   If supporting a standard, IT vendors should adhere to the related best practices and use cases (if available).

2.5.4   To ensure standards-based interoperability, IT vendors and/or third parties (delegated partners) should participate in the related Implementor Forum (if available) and Benchmark (if available).

2.6 Architecture

The IT architecture comprises the components making up an IT system, the relationships between these components and the way in which they interact and have been integrated. IT customers need access to the individual components so that

- they can create GUIs (clients) for specific user groups which leverage the capabilities of the different IT systems, and

- administration and continued operation of the different layers (e.g. OS, DB, application and client) can be delegated to the appropriate internal organizations.

2.6.1   The IT system shall have a documented architecture, including all given tiers.

2.6.2   If applicable, the IT system shall have a clear and documented separation of the individual tiers (e.g. n-tier architecture, peer-to-peer etc.).

2.6.3   If applicable, it should be possible to adapt the tiers independently of one another. This applies in particular to the presentation tier.

2.7 Partnership, IT customers, IT vendors and IT service providers

The openness of an <u>IT system</u> is between the <u>IT vendor</u>, if applicable the <u>IT service provider,</u> and the <u>IT customer</u>:

- Contractual stipulations regarding customer-supplier relationships and, for example, third-party solutions are part of the overall "openness" picture.

- The requirements of <u>IT customers</u> and their purchasing behavior influence the further development of the openness of marketable <u>IT systems</u>.

2.7.1   <u>IT customers</u>, <u>IT vendors</u> and <u>IT service providers</u> show mutual respect for their respective intellectual property, e.g. any confidential product or roadmap information shall be treated as agreed between the partners.

2.7.2   <u>IT vendors</u> who signed the CPO agree to apply the CPO terms to their CPO-related <u>IT systems</u> and report on fulfillment (CPO Statement).

      This CPO statement may be part of the presentation of new <u>IT systems</u> or <u>IT system</u> updates/upgrades.

2.7.3   <u>IT customers</u> who signed the CPO agree to the terms and definitions of the CPO and recognize the CPO as an evaluation criterion for <u>IT systems</u>.

2.7.4   <u>Data</u> generated by <u>IT users</u> with an <u>IT system</u> is and remains the intellectual property of these <u>IT users</u>. Appropriate <u>IT interfaces</u> shall be available for accessing this intellectual property.

2.7.5   Co-operations (e.g. joint ventures) between <u>IT customers</u> should be made possible by means of license agreements from the <u>IT vendors</u>.

2.7.6   <u>IT vendors</u> shall support the information and materials regarding <u>integration</u> and <u>extension</u> provided with their <u>IT systems</u> to enable <u>IT customers</u> and/or their subcontracted <u>third parties</u> to build <u>integrations</u> and <u>extensions</u>.

2.7.7   <u>IT vendors</u> should offer appropriate partnership models for <u>third-party</u> companies.

2.7.8   <u>IT users</u> and innovation communities should be supported by the <u>IT vendors</u>.

2.8 Validity and Prerequisites

The validity and the prerequisites of the "Fundamentals" and the "CPO Terms" described in the sections 2.1 – 2.7 have to be determined:

- All interested companies, <u>IT customers</u>, <u>IT vendors</u> and <u>IT service providers</u>, should sign the CPO. <u>IT vendors</u> who have signed the CPO shall determine and provide a list of their relevant products and the degree of fulfillment as a "CPO Statement". IT service providers may do the same. The purpose of the CPO Statement is to describe the extent to which an <u>IT system</u> meets the CPO terms.

- <u>IT vendors</u> of <u>IT niche systems</u> may join the CPO initiative and subject their systems to the terms of the CPO as far as this is reasonable.

- All the companies that have signed the CPO (<u>IT vendors</u>: signature plus CPO Statement) and are members of the ProSTEP iViP Association belong to the so-called "CPO Community".

- As a new release of the CPO becomes available, <u>IT customers</u>, <u>IT vendors</u> or <u>IT service providers</u> shall review it, decide whether to sign up again and provide an updated version of their relevant CPO-Statement.

- If an <u>IT customer</u>, <u>IT vendor</u> or an <u>IT service provider</u> no longer wants to apply the CPO terms to their CPO-related products or no longer wants to be part of the CPO Community, they shall inform the ProSTEP iViP Board by a registered letter.

- The CPO terms should to be applied to the latest version of marketable <u>IT systems</u>.

- If the marketable <u>IT system</u> provided by an <u>IT vendor</u> does not meet with the terms, a convergence path should be described.

3 Supplementary Documents

3.1 Glossary

The glossary constitutes part of the CPO (cf. page 14 ff.).

To help understand the CPO properly, all the underlined key words are defined in the glossary.

4 Signatures

With our signature, we support the Code of PLM Openness (CPO), in form of a self-commitment on voluntary basis, which comprises non-enforceable terms and does not constitute any legal claim.

……………………..

Person(s) responsible

Company

Supplementary Document: Glossary

All definitions are to be seen in the context of PLM and the CPO.

Key words	Definitions
Architectural layer	Typical term for the different functional areas within an IT architecture.
Build time / runtime	Creation/execution of program code.
Business logic	Business logic describes the functional algorithms that handle the exchange of information between a database, the application (client/server) and a user interface. Business logic can be implemented by business rules and workflows thus describing the business behavior of an IT solution. While most of the business logic can typically be customized, there are always areas that need to be protected against user access for IP or data consistency reasons.
Cancellation of - interfaces - software products	The cancellation (withdrawal) of IT Systems, interfaces as well as APIs is individually managed as part of software contracts and in relation of warranty terms & conditions.
Data, "their data"	IT users own the input used in their interaction with an IT system and, at a minimum, the explicit output information.
Development environment	An environment for extending the data model and business behavior of a system. Typically, it is an integrated software application or a set of tools that provide comprehensive facilities for software development. The IT vendor provides a development environment or defines a set of tools for customizing/enhancing the PLM IT solution and defines the required prerequisites, which need to be provided by a customer or a third party.
Extensibility	Capability of an IT system to support functional extensions or adaptation by IT customers or third parties.
Industry standard	Vendor- independent document, proven in practice. An (inter)national norm/standardization process was not performed.
Integration - process - data - system	Integration is a process involving the pre-agreed and defined exchange of information relating to data (data integration), processes (process integration) or IT systems (system integration).
Interoperability	Capability of independent, heterogeneous IT systems to work together as seamlessly as possible in order to exchange information in an efficient and usable manner.
IT	IT - Information Technology
IT architecture	Structured arrangement of the IT components in an IT system as well as documentation of their relationships (including interaction)
IT components	IT components are prerequisites for assuring proper functionality in a PLM solution. Information on relevant IT components comprises release information, including supported and/or certified Hardware, Operating Systems, Middleware and Databases.

IT customer	Company that uses IT systems and/or tools for their business processes and which purchases/leases software licenses and/or services.
IT infrastructure	IT infrastructure refers to all tangible and intangible assets which allow the operation of IT systems.
IT interface (Software)	External or internal documented access to a software application/or layer API - Application Programming Interface
IT niche system	An IT system that is developed to meet very specific requirements (industry-specific, customized, smaller, more manageable group of users, special solution for a particular task). Software for performing a specifically defined task complementing one or more IT systems.
IT service provider	Companies which provide services, e.g. perform integration tasks for IT customers.
IT system	Software for supporting PLM process areas. From a technical perspective, an IT system consists of IT components with a defined functional boundary. The IT system is based on an IT architecture. IT interfaces enable communication between IT components and communication with these components.
IT user	Single person using an IT system or tool.
IT vendor	Company that develops/delivers IT systems or tools to IT customers as stipulated in a contract. Typically the IT vendor is also the IT manufacturer.
Lifecycle plan	General description of applied or supported hardware and operating systems etc. as well as planned changes with respect to cancellations.
Maintenance information	General description of planned changes of IT interfaces, which affect the continuation of the operation after a release update. This includes the documentation of the IT interface changes (add, change, delete), the potential impact on the functional behavior, the related input/output data and PCS (Performance, Capacity, Scalability). This information may be detailed over the time.
N-tier	Indicates the number (n) of architecture layers describing the software infrastructure of an IT system. Typically known is the 3-tier architecture: user interface (client), server and database.
OEM (Original Equipment Manufacturer)	The manufacturer of a consumer product (not limited to automotive manufacturers).
Platform	In the context of HW/SW, it is typically a specific combination of hardware and an operating system that allows software applications to be executed.
PLM - Product Lifecycle Management	In industry, product lifecycle management (PLM) is the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal.
PLM layer	Logical function unit which is part of PLM. Recognized units include but are not limited to CAD (design), TDM (Team Data Management), PDM (Product Data Management) and ERP (manufacturing bill of materials). The units can be arranged into a layer model PLM (PLM layer model).
Portability	Capability offered by an IT system that allows it to be executed in different operating environments.

Roadmap	Specific details about future development plans. IT vendors, IT service provider and IT customers use it to announce the availability of new technologies/products/functions: Any product and roadmap information provided under CPO terms are not legally binding.
Service	1- Contractual fee based service engagement 2- Programming interface (higher level of aggregation than APIs)
Standard "relevant standard"	A document which is developed with the participation of all interested parties and which has their approval. Standards are issued by (inter)national standardization organizations (DIN, ISO, OMG, W3C, OASIS, ProSTEP iViP etc.). "Relevant standard" refers to common practice in the majority of enterprises in the industry.
Supplier	A manufacturer of modules, components for a retail product.
TDM - Team Data Management	IT system for data management relating to one or more specific authoring systems (data-generating IT system). The TDM is usually closely integrated with a CAx system.
Third party	IT vendors which provide niche systems or extensions to IT systems for IT customers.
Vendor-specific standard	Company-specific (proprietary) document from a manufacturer whose application is considered by many users as beneficial.
Version/release compatibility	Upward compatibility of a new IT system release (version) means to support the same features or functionality, the same data structures and the same integration capabilities introduced by a previous release (version). A new release either directly reads data from the previous version or requires a data migration. Downward compatibility is required to support processes established in previous releases/versions. In this case a new release may generate data that can be read by previous releases. In order to support innovation new releases may introduce changes to the data model, the functional behavior or changes to API's that prevent previous releases from fully interpreting the new data.
Virtualization	Virtualization is the concept of separating the logical device from the physical machine.
Web service	A web service is a method of communication between two electronic devices via a network

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