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Information Technology — Software Engineering Environment Services

Technologies de l'information — Services d'environnement en ingénierie du logiciel

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC 15940 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering.*

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Introduction

Software engineering environments, or “SEEs” refer to a collection of software services, partially or fully automated by software tools, that are used to support the execution of human activities in software engineering.

These activities are usually carried out within a software development/maintenance project, and cover such areas as the specification, development, re-engineering or maintenance of software-based systems. ISO/IEC 12207 describes in a comprehensive manner all of the processes, activities and tasks performed during the software life cycle.

The term "Software Engineering Environment" may cover several situations; from the mere juxtaposition of a few tools running on the same operating system, to the fully integrated environment, able to handle, monitor, and even control all the data, processes, and activities in the software life cycle. A SEE provides support to human activities through a series of services that describe the capabilities of the environment. The software process supported by a SEE becomes an assisted or automated software process. This International Standard describes SEE services and relates them to ISO/IEC 12207:1995, ISO/IEC 12207:1995/Amd.1:2002 and ISO/IEC 12207:1995/Amd.2:2004 in a manner applicable to a range of organizations. In defining a life cycle process for an organization, the user needs to find the appropriate level of automation provided by a software engineering environment. This may result in establishing a new SEE or improving an existing one.

Through the automation of activities, either partially or fully, the SEE provides benefits to an organization through reduced cost (higher productivity), improved management and from the higher product quality that can result. For example, the automation of repetitive activities such as the execution of test cases provides not only productivity gains, but can also help to ensure completeness and consistency in the testing activities.

This International Standard defines the SEE services conceptually in a reference model that can be adapted to any SEEs to automate one or more software engineering activities.

For a user interested in a specific process, this International Standard describes the relationship between given software engineering processes, the software engineering services, and the corresponding exemplary software engineering tools.

The suite of SEE services described supports the process definitions in ISO/IEC 12207. The purpose is to define a set of SEE Services that are compatible with ISO/IEC 12207:1995, ISO/IEC 12207:1995/Amd.1:2002 and ISO/IEC 12207:1995/Amd.2:2004, and that can be used either as a general reference, or to define an automated software process.

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Information Technology — Software Engineering Environment Services

1 Scope

This International Standard provides a description of SEE services that supports all of the software life cycle processes defined in ISO/IEC 12207.

The services are intended as a complete set and can be used in any software engineering development or support organization where there is a need to select one or more SEE services. Such an organization may or may not have software projects that use the ISO/IEC 12207 process framework.

A reference model for SEE Services is provided within this International Standard. This reference model has been produced starting from references [8] and [9]. This document was produced using material originally published by the Software Engineering Institute (Carnegie Mellon University, USA), NIST and ECMA, which finally resulted in a joint effort from ECMA and NIST indicating a broad consensus at the time of publication. In addition to this background process, structure from ISO/IEC 12207:1995, ISO/IEC 12207:1995/Amd.1:2002, and ISO/IEC 12207:1995/Amd.2:2004 has been used as a baseline.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply. From other International Standards.

2.1
life cycle model
framework containing the processes, activities and tasks involved in the development operation and maintenance of a software product, spanning the life of the system from the definition of its requirements to the termination of its use

[ISO/IEC 12207:1995].

2.2
CASE tool
software product that can assist software engineers by providing automated support for software life-cycle activities as defined in ISO/IEC 12207:1995.

[ISO/IEC 14102:1995].

2.3
organization
group of people and facilities with an arrangement of responsibilities, authorities and relationships

[ISO 9000:2005].

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2.4
Software Engineering Environment
SEE
provides automated services for the engineering of software systems and related domains (e.g., project management, process management, etc.)

NOTE It includes the platform, system software, utilities, and CASE tools installed.

2.5
SEE Service
consists of one or more service operations to support life cycle activities for the SEE

NOTE A SEE Service supplier provides a SEE Service for a SEE Service acquirer.

2.6
automated or assisted software process
software process that is performed either fully or partially supported by CASE tools

2.7
actor
organization or CASE tool that supplies and/or acquires SEE Services

2.8
operation
action needed to perform an Activity

NOTE One or more operations are necessary to execute an Activity. An operation may consist of other operations.

2.9
SEE Service acquirer
actor that acquires a SEE Service

2.10
SEE Service supplier
actor that supplies a SEE Service

3 Abbreviated terms

CASE – Computer Aided Software Engineering

SEE – Software Engineering Environment

4 Reference Model for SEE services

4.1 Categories of SEE services

This (draft) International Standard provides a reference model for SEE services. As a reference model, this (draft) International Standard uses a set of conceptual descriptions to describe each service used in a software engineering environment. The “conceptual description” indicates that the description is from a reference viewpoint, and does not deal with any specific implementation. The description is therefore general and does not assume any specific application domain, life cycle model, or tool in a project. In this way, this (draft) International Standard can be applied to any defined organizational environment.

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An actual environment is one that is built from a reference model containing conceptual descriptions. Therefore, an actual description of a specific environment would reflect a particular activity with its tools and standards. The services described in this (draft) International Standard are grouped into six categories that reflect broad functional activities within a typical software engineering organization. The six categories are:

— Software engineering services (e.g., System Design, Software Modelling, Simulation);

— Technical management services (e.g., Reuse, Configuration management);

— Project management services (e.g., Estimation, Project monitoring);

— Process management services (e.g., Process Monitoring, Process improvement);

— SEE Support services (e.g., Publishing, Policy enforcement);

— SEE infrastructure services (e.g., Repository, Communication, OS services).

4.2 Structure of service description

Each service is defined under two headings:

— Service Concept, to provide a description of the service in terms that are not related to a specific implementation.

— Service Operations, to list those operations that may be included in a service. These lists of operational capabilities represent, in most cases, primary services only and are not intended to be complete.

Exemplary automated supports for each SEE Services are listed in Annex A, it includes lists of corresponding service operations to help readers understand SEE.

4.3 Reference model

SEE services can be identified within a Reference model. This section presents those concepts that are part of this reference model (See Fig.1 SEE Reference Model described in UML). The reference model is made of the following concepts:

— Software Engineering Environment (model itself)

— SEE Service

— SEE Service Operation

— CASE Tool

— Actor

— Activity

— Organization

While engineering software systems and in related domains (e.g. project management), a life cycle Activity is achieved by one or more Operations. SEE Service operations satisfy target life cycle activities. Actor as SEE Service supplier provides SEE Service to another actor as SEE Service acquirer. SEE Service supplier and SEE Service acquirer are Organizations or CASE tools.

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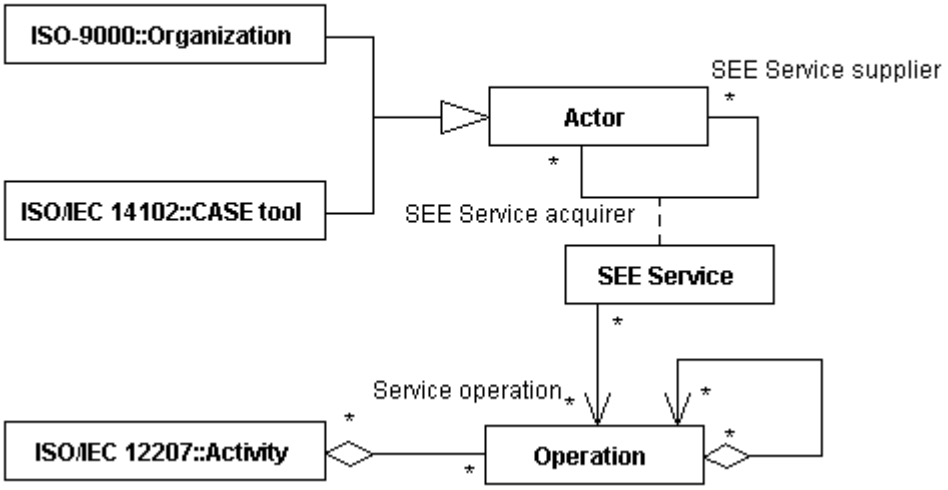
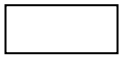
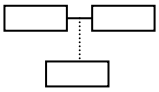


NOTE brief usages of UML notation are described here for readers benefit.

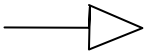


class: A class is drawn as a solid-outline rectangle with a class name. A class name proceeding package names separated by double colons (**::**) indicate a class defined in another package.

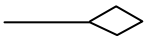


association class: An association that also has class properties (or a class that has association properties) shown as a class symbol (rectangle) attached by a dashed line to an association path.

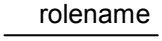
association: Binary associations are shown as lines connecting two class symbols.



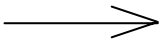
inheritance: A subclass "inherits" from the superclass, ("is a" relationship). It is represented in the image with a line starting at the subclass and ending in a white arrow at the superclass.



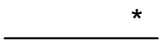
aggregation: A superclass instance "uses a" subclass instance (or more than one). It is represented in the images with a line starting at the superclass with a white diamond and ending in the subclass.



rolename: A name string near the end of the line indicates the role played by the class attached, if specified.



navigability: An arrow may be attached to the end of the line to indicate that navigation is supported toward the classifier attached to the arrow. Normally one-way navigability is shown and two-way navigability is suppressed (no-way navigability is rare in practice).



multiplicity: specifies the number of target instances that may be associated with a single source instance across the given Association. A single star '*' denotes the unlimited nonnegative integer range multiplicity that means many.

Figure 1 — SEE Reference Model described in UML

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5 Software engineering services

The services in this section support activities related to the specification, design, implementation, testing, and maintenance of software. The following services are defined and grouped in this section:

— Software requirements engineering services;

— Software reverse engineering service;

— Software re-engineering service;

— Software prototyping service;

— Software design service;

— Software modelling service;

— Software simulation service;

— Component based software generation service;

— Source code generation service;

— Compilation service;

— Debugging service;

— Software static/dynamic analysis service;

— Software testing services;

— Software verification service;

— Software integration services.

5.1 Software requirements engineering service

5.1.1 Service concept

This service provides the ability to capture, represent, analyse, validate, and refine those system requirements that are allocated to software components.

5.1.2 Service operations

This service provides the ability to:

— Elicit and capture software requirements;

— Structure the software requirements;

— Create, modify, browse, and present software requirements;

— Group and prioritise software requirements;

— Check consistency of software requirements;

— Allocate software requirements for each software component;

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— Conduct impact analysis for the addition, subtraction, or modification in a requirement against the project value, resources, and timeline;

— Validate and baseline the document specs based on stakeholders and developers.

5.2 Software reverse engineering service

5.2.1 Service concept

This service provides the ability to capture design information from source or object code, and produce structure charts, call graphs, and other design documentation to provide new functionality or support a new environment.

5.2.2 Service operations

This service provides the ability to:

— Generate design from source code;

— Generate source program from object code.

5.3 Software re-engineering service

5.3.1 Service concept

This service provides the ability to take a new or a modified set of software requirements and the existing design as input and produce a new or modified design.

5.3.2 Service operations

This service provides the ability to:

— Revise or restructure existing code;

— Perform impact analysis of new design on existing software components;

— Translate from one notation or language into another;

— Check that the new set of requirements is consistent with the existing system;

— Determine the impact of the altered design on the existing set of components.

5.4 Software prototyping service

5.4.1 Service concept

This service provides the ability to enable the production of a software system that reproduces the user interface and emulates the functionality and behaviour of the final system to be built.

5.4.2 Service operations

This service provides the ability to:

— Build a prototype from requirements;

— Invoke software modelling service if necessary and available;

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— Produce a user interface from requirements;

— Execute a prototype;

— Conduct simulations if necessary and available.

5.5 Software modelling service

5.5.1 Service concept

This service provides the ability to model requirements and/or design in order to determine the effectiveness of alternative designs with respect to such attributes as user interface characteristics or execution flow.

5.5.2 Service operations

This service provides the ability to:

— Build a software model (graphical, logical, mathematical, formal, etc.) from requirements;

— Validate a software model;

— Map and/or transform one software model into another;

— Analyse a software model.

5.6 Software simulation service

5.6.1 Service concept

This service provides the ability to simulate models in order to determine the effectiveness of alternative designs with respect to such attributes as user interface characteristics or execution flow.

5.6.2 Service operations

This service provides the ability to:

— Build a simulation model by invoking the software modelling service if necessary and available;

— Execute a software model;

— Capture simulation results of software models.

5.7 Software design service

5.7.1 Service concept

This service provides the ability to capture, represent, create, analyse, and refine the design attributes of the software components of a system or subsystem. The outcome of the software design service includes the definition of the software components and sub-components.

5.7.2 Service operations

This service provides the ability to:

— Translate requirements into architecture and design elements;

— Create and modify software architecture and design representation;

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— Validate architecture and design artefacts to requirements;

— Produce structure charts, graphs, screens or other design information from a design representation;

— Structure design specifications;

— Architecture and design documentation;

— Evaluate architecture and design representations.

5.8 Component based software generation service

5.8.1 Service concept

This service provides the ability to produce automatically and semi-automatically software components using existing components or component templates.

5.8.2 Service operations

This service provides the ability to:

— Generate a parser from a syntactic language description;

— Generate a script for the composition and interconnection of software components;

— Generate a rule-based system from a set of rules;

— Generate a user interface component for a software system.

5.9 Source code generation service

5.9.1 Service concept

This service provides the ability to generate modules from design specifications.

5.9.2 Service operations

This service provides the ability to:

— Generate modules from design specifications;

— Invoke the software static/dynamic analysis service and work-through source code;

— Provide for traceability to design specifications.

5.10 Compilation service

5.10.1 Service concept

This service provides the ability to support the translation (e.g., build, compile or interpretation) and linking of software components written in various programming languages. The principal outputs from this service are executable programs supporting the implementation of some target system.

5.10.2 Service operations

This service provides the ability to:

— Find code and inheritance dependencies among a set of software components;

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— Pre-process source code to produce modified source code;

— Apply macro expansions to source code;

— Translate a source program into some target object code language;

— Produce report on the translation; this may include source listings of various complexity, including cross-reference data, compilation speeds, CPU usage, etc.;

— Link the object code into executable images. When intended for use on a remote target, link code into loadable/bootable images;

— Update the compiled system incrementally to reflect new changes.

5.11 Debugging service

5.11.1 Service concept

This service provides the ability to locate and repair source code errors in individual software components by controlled or monitored execution of the code to track down errors and replace code.

5.11.2 Service operations

This service provides the ability to:

— Instrument source programs by inserting breakpoints, instruction traps, printing out data values, and modifying source text;

— Execute programs incrementally;

— Monitor and save execution output;

— Log and measure debugging results;

— Analyse properties of programs and their current data values.

5.12 Software static/dynamic analysis service

5.12.1 Service concept

This service provides for the static analysis, or source code analysis, of software components in order to determine execution structure within the component and for the dynamic analysis, or code in execution analysis, in order to determine execution behaviour characteristics.

5.12.2 Service operations

This service provides the ability to:

— Collect raw statistics from a software module/component;

— Compute complexity measures from a software module/component;

— Produce and graphically represent cross reference lists;

— Collect raw statistics from a software module/component in execution;

— Produce and graphically represent characteristics of the execution behaviour;

— Produce findings according predefined template or rules.

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5.13 Software testing service

5.13.1 Service concept

This service provides test software systems at the levels of individual software components (unit testing), on collections of software components (integration testing), and on complete software systems (system testing).

5.13.2 Service operations

This service provides the ability to:

— Generate test cases;

— Analyse source programs and generate reports;

— Enable traceability to requirements;

— Perform appropriate types of testing (e.g., functional, operational, security, performance etc.);

— Perform non-regression testing of required previous test cases on the object under test;

— Simulate the overall working environment and perform system load testing;

— Compare test results with expected results;

5.14 Software verification service

5.14.1 Service concept

This service provides the ability to confirm by examination and provision of evidence that the specified requirements have been fulfilled.

5.14.2 Service operations

This service provides the ability to:

— Analyse specifications for consistency;

— Review and inspect source component (either source programming language or design language);

— Identify errors (between specifications and verified object);

— Produce summary report.

5.15 Software integration service

5.15.1 Service concept

This service provides the ability to support the integration of software modules and/or components to make up the final integrated software system.

5.15.2 Service operations

This service provides the ability to:

— Prepare software modules and/or components to be integrated;

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— Manage module and/or component repository and libraries;

— Integrate modules and/or components according to a predefined architecture and model;

— Monitor integration and produce a status report.

6 Technical management services

The services in this section fall into a category that includes both Software Engineering and Project Management. These services relate to activities that are often shared by engineers and managers. This section describes the following services:

— Configuration management service;

— Change management service;

— SEE Repository management service;

— Reuse management service;

— Measurement and analysis service;

— Quality assurance service;

— Audit service;

— Software traceability service;

— Documentation service;

— Review service support.

6.1 Configuration management service

6.1.1 Service concept

This service provides facilities for the identification, documentation, and control of the functional and physical characteristics of configuration items to ensure traceability, management of interrelationships between system components, and reproducibility of a project's end products.

6.1.2 Service operations

This service provides the ability to:

— Provide unique identification of each configuration item;

— Enable access control for every element;

— Define configuration items in a system;

— Invoke change management;

— Provide selection support for configuration items of a specified version.

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6.2 Change management service

6.2.1 Service concept

This service provides facilities for the creation and control of change requests, change orders, and provides an audit trail of changes to product components. It records all decisions, task assignments, product changes, and other activities related to these items.

6.2.2 Service operations

This service provides the ability to:

— Create a change request in response to a reported error, omission, or required update;

— Support the analysis of the impact of the proposed change;

— Classify, and retain a historical record of a change request;

— Create, evaluate, and track a change order based on a change request;

— Permit communication channels within the stakeholders.

6.3 SEE repository management service

6.3.1 Service concept

This service provides the ability to create, access, and modify information objects (i.e. requirements specifications, test cases, simulation cases, diagrams, etc) in the SEE repository management and recording the relationships between them.

6.3.2 Service operations

This service provides the ability to:

— Create, access, and modify information objects;

— Create, access, and modify groups of information objects;

— Create, access, and modify relationships among information objects;

— Manage access control;

— Provide multi-user and collaborative working environments.

6.4 Reuse Management service

6.4.1 Service concept

This service provides facilities for the identification, storage, classification, inspection, and reuse of assets related to the engineering processes.

6.4.2 Service operations

This service provides the ability to:

— Deposit, acquire, or submit asset into the repository;

— Catalogue, register, and classify the asset;

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— Search or browse the repository;

— Examine or extract the asset;

— Register the extractor or submitter;

— Report of limitations/usage requirements of an asset.

6.5 Measurement and analysis service

6.5.1 Service concept

This service provides facilities for the collection and organization of primitive data into meaningful information to the end-users of the SEE.

6.5.2 Service operations

This service provides the ability to:

— Allow definition of measures and measurement criteria;

— Allow the definition of artifacts such as patterns and rules to support analysis;

— Check consistency of measurement and analysis model if necessary;

— Insert and delete data from data set;

— Pick appropriate model for given data set;

— Compare data set to the predictive model;

— Compute general statistics on a data set;

— Support different viewpoints for different stakeholders at repository level;

— Capture an appropriate number of characteristics according to non-functional requirements, such as reliability, criticality or dependability for the software product.

6.6 Quality assurance service

6.6.1 Service concept

This service provides facilities for the definition, tracking, and performance of quality assurance activities and the analysis of their results.

6.6.2 Service operations

This service provides the ability to:

— Establish and maintain records of Quality Assurance activities;

— Define specific product and/or process items that are subject to Quality Assurance review;

— Analyse Quality Assurance data for compliance with requirements.

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6.7 Audit service

6.7.1 Service concept

This service provides facilities for the planning and performance of audits and the analysis and reporting of their results. The audit may include environment, process, and project.

6.7.2 Service operations

This service provides the ability to:

— Maintain a set of audit checklists and support user creation and customisation of checklists;

— Support audit preparation and scheduling;

— Provide for retention of audit data;

— Provide for analysis of audit data (e.g., pass/fail, trend analysis).

6.8 Software traceability service

6.8.1 Service concept

This service provides facilities for the ability to record the relationships between items of the software lifecycle process. This service is obtained through the repository subschema exploitation.

6.8.2 Service operations

This service provides the ability to:

— Create, update, and destroy relationships between two items;

— Query and report current status of relationships;

— Query relationship history;

— Trace requirements throughout stages of the life cycle process;

— Navigate relationships and items.

6.9 Documentation service

6.9.1 Service concept

This service provides facilities for the development, integration, configuration management and traceability analysis of any media documentation (e.g. on-line, paper, and other relevant media of documentation).

6.9.2 Service operations

This service provides the ability to:

— Author documentation;

— Allow linking context sensitive documentation;

— Build online documentation into delivery package;

— Manage and control documentation;

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— Produce any relevant media formats;

— Flag dependent documentation items due to software changes;

— Enable document version management;

— Review cycle management;

— Enable access control.

6.10 Review service support

6.10.1 Service concept

This service provides facilities for various review activities in the software development life cycle.

6.10.2 Service operations

This service provides the ability to:

— Prepare documents for review;

— Annotate comments, refer/paste/link related documents to the review documents;

— Find/retrieve keywords from the documents and the SEE repository;

— Report and catalogue review results.

7 Project management services

The services in this section support the activities related to planning and executing a project. Following project initiation, detailed planning of the project activities will be necessary, together with ongoing monitoring and re-planning of the project to ensure its continued progress. This section describes the following services:

— Project Planning Service;

— Project Estimation Service;

— Project Risk management Service;

— Project monitoring and scheduling Service;

— Project Evaluation Service.

7.1 Project planning service

7.1.1 Service concept

This service supports operations that permit handling of data according to a set of project objectives relevant to a project's constraints.

7.1.2 Service operations

This service provides the ability to:

— Translate project objectives into key project events;

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— Quantify inputs and outputs for work activities;

— Allow assignment of relationships (dependencies) between activities;

— Estimate event lead times;

— Calculate start and finish dates;

— Analyse critical paths;

— Generate detailed event schedules;

— Enable resource allocation;

— Register assignment of work responsibilities to individuals or organizations;

— Establish communication channels within the project team including the identification of the communication medium, frequency and content;

— Establish evaluation criteria.

7.2 Project estimation service

7.2.1 Service concept

This service supports quantification, analysis, and prediction of project costs and resource needs

7.2.2 Service operations

This service provides the ability to:

— Create and modify cost, size, time and resource estimates;

— Maintain history of cost, size, time and resource estimates;

— Generate estimates for variable parameters such as workload mixes or for differing design;

— Compare estimates against actual results.

7.3 Project risk management service

7.3.1 Service concept

This service supports those planning and assessment activities that consider elements related to the success or failure of a project.

7.3.2 Service operations

This service provides the ability to:

— Perform trade-off analyses based on differing parameters for resource allocation and scheduling data;

— Evaluate risks due to cost, resource, schedule, and failure;

— Estimate cost and probability of failure;

— Manage risk mitigation;

— Generate reports for various allocation strategies.

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7.4 Project monitoring and scheduling service

7.4.1 Service concept

This service supports tracking of project progress including cost, schedule, and user requirements.

7.4.2 Service operations

This service provides the ability to:

— Gather measurement data related to current status of a project and its constituent work activities;

— Compare cost, size, time and resource estimates with actual results;

— Read and display status of all project variables, and produce project data and summary information;

— Track the evolution of user requirements.

7.5 Project evaluation service

7.5.1 Service concept

This service supports the analysis, evaluation, and decision making associated with the tracking service, measurement data collection, and user acceptance criteria.

7.5.2 Service operations

This service provides the ability to:

— Evaluate actual cost, size, time and resource data against tracking service data and project planning data;

— Create/Modify/Store user comments, recommendations, and software errors;

— Elicit user acceptance for each requirement against the project product;

— Collect measurement data to support trade-off analysis and impact analysis.

8 Process management services

The services in this section support projects in achieving discipline, control, and clear understanding in their life-cycle development processes as understood in ISO/IEC 12207 and individual process steps. This section describes the following services:

— Process definition service;

— Process library service;

— Process initiation service;

— Process usage service;

— Process monitoring service;

— Process improvement support service;

— Process documentation service.

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8.1 Process definition service

8.1.1 Service concept

This service supports the establishment of the organizational processes covering the software life cycle through adaptation and tailoring a set of higher order reference processes. This adaptation includes the specifics of the organization's policies, including its infrastructure technology, methods, and procedures.

8.1.2 Service operations

This service provides the ability to:

— Analyse process requirements, including domain-specific analysis and application-specific analysis;

— Instantiate, compose, decompose, tailor, and modularise process definitions;

— Simulate, model, and validate process definitions against organization standards, guidelines and policies.

8.2 Process library service

8.2.1 Service concept

This service supports reuse capabilities for processes, including creation, update, deletion, certification, measurement, and management of process assets (activities, tasks, etc.). Process assets may range from complete life-cycle process definitions to individual process steps. Process assets may also be objects that can be versioned.

8.2.2 Service operations

This service provides the ability to:

— Create, update, and delete process assets;

— Certify, measure, and administer process assets;

— Provide access control to process assets if necessary.

8.3 Process initiation service

8.3.1 Service concept

This service supports the assignment of a life cycle model, a set of processes and the SEE to meet the requirements and constraints for a particular project.

8.3.2 Service operations

This service provides the ability to:

— Review project criteria and constraints and select life cycle model;

— Define relationships and tailor processes and activities;

— Define process roles and responsibilities;

— Provide process training, if necessary.

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8.4 Process usage service

8.4.1 Service concept

This service supports guidance of users' in the selection and control of process steps, navigational and help facilities and the query of institutionalised processes for information on previous and subsequent actions.

8.4.2 Service operations

This service provides the ability to:

— Process help and guidance facility for project team members;

— Query and report on process utilisation and status;

— Specify, collect, and report on project process measures;

— Allow interaction between process definition simulations and high-level representations with SEE data management.

8.5 Process monitoring service

8.5.1 Service concept

This service supports the observation, detection, logging, and tracking of process activities (within projects).

8.5.2 Service operations

This service provides the ability to:

— Set up monitoring conditions and criteria;

— Observe the evolving enactment state of processes;

— Detect and log the occurrence of specific process events;

— Report the monitoring results.

8.6 Process improvement support service

8.6.1 Service concept

This service supports the assessment, measurement and modifications of the organizational and project specific processes, and project life cycles.

8.6.2 Service operations

This service provides the ability to:

— Define effectiveness goals;

— Identify measurements correlated to the goals;

— Set threshold values for goal attainment;

— Assess process capability;

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— Prepare assessment reports that compare the actual data with target or baseline data;

— Provide data to schedule assessments.

8.7 Process documentation service

8.7.1 Service concept

This service supports the services related to process documentation.

8.7.2 Service operations

This service provides the ability to:

— Identify the documentation requirements;

— Design and develop the documents;

— Produce and edit the document;

— Distribute the document;

— Maintain those documents.

9 SEE support services

The services in this section comprise services that the rest of the services will require to become operational. They generally include those services associated with processing, formatting, and disseminating human-readable information and data. This section describes the following services:

— SEE Common Support Service;

— SEE Publishing Service;

— SEE Cooperative work support service;

— SEE User Communication Support Service;

— SEE Administration Service;

— SEE Policy Enforcement Service

— SEE Data/Information mining services.

9.1 SEE common support service

9.1.1 Service concept

This service provides the ability to create and manipulate text, graphics and image, audio and video objects information within the SEE.

9.1.2 Service operations

This service provides the ability to:

— Create, modify, edit and save text, formulas and spreadsheets, graphics, images or figures;

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— Import or export text, graphics or images in various file formats;

— Format and print text, graphics or images;

— Create, capture, modify, store, playback and transmit audio & video objects;

— Transform audio and video objects into other formats.

9.2 SEE publishing service

9.2.1 Service concept

This service provides for creating, modifying, editing, and structuring of the objects that compose documents, for storing, printing, and sharing these documents.

9.2.2 Service operations

This service provides the ability to:

— Create, modify and save document objects and documents;

— Create tables of contents, indices, bibliographies, and glossaries;

— Format, build, preview, and print documents, create and print templates;

— Create or modify layouts or styles for documents;

— Control document versions.

9.3 SEE cooperative work support service

9.3.1 Service concept

This service provides the ability to support cooperative work in single and multiple locations.

9.3.2 Service operations

This service provides the ability to:

— Support the sharing of repositories;

— Support conferencing;

— Support the sharing of project/group/user scheduling;

— Support concurrent engineering.

9.4 SEE user communication support service

9.4.1 Service concept

This service provides the ability for communications among customers and supplier teams including mail, bulletin board, conferencing and online messaging on a network.

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9.4.2 Service operations

This service provides the ability to:

— Receive, archive, compose, send, reply, forward, broadcast, and acknowledge messages;

— Customise the mail's communication capabilities;

— Subscribe and post messages;

— Reply or add information to posted messages;

— Open and close connections;

— Support local area network, wide area network, public network, Internet connectivity, etc.

9.5 SEE administration service

9.5.1 Service concept

This service provides the ability to control user access to the SEE, to define users to the system, and to monitor and control SEE operations, in order to adjust the environment to improve its availability and performance. It also provides online information for users in the form of an interactive tutorial and/or invoked as part of “help” facility.

9.5.2 Service operations

This service provides the ability to:

— Manage user access;

— Display the SEE status by invoking the SEE infrastructure management service;

— Set user privileges and access to resources.

9.6 SEE policy enforcement service

9.6.1 Service concept

This service provides facilities for enacting policy enforcement on security, access control, integrity of data and objects, secure exchange of data and objects, backup, recovery and audit process.

9.6.2 Service operations

This service provides the ability to:

— Support the establishment of security information;

— Identify users and properly associate with access rights;

— Govern access to information contents;

— Protect data and objects from unauthorized or unconstrained modification;

— Export and import data and objects in a secure manner;

— Provide tracking and control information for a security-related audit;

— Back up and recovery.

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9.7 SEE data/information mining service

9.7.1 Service concept

9.7.2 This service provides the ability for data/information mining on a SEE repository to understand software development, to support predictions about software development, and to plan various aspects of software projects. Service operations

This service provides the ability to:

— Recover useful data/information from repositories;

— Integrate mined data/information from repositories;

— Visualize and present the mined data/information;

— Extract and analyse the changing patterns present in the repositories;

— Support modelling of software characteristics using data/information from repositories;

— Support of software reuse.

10 SEE Infrastructure services

The services in this section comprise the infrastructure of a SEE and will be required to support a SEE actually implemented. This section describes the following services:

— SEE infrastructure management service;

— SEE information sharing service;

— SEE repository service;

— SEE Operating System service.

10.1 SEE infrastructure management service

10.1.1 Service concept

This service provides the ability to manage SEE infrastructure resources.

10.1.2 Service operations

This service provides the ability to:

— Add, delete, or amend resources (including tools);

— Query status and provide statistics of a resource;

— Make a resource available to a specific user and/or a category of users defined by a role;

— Send diagnostic messages to the system administrator;

— Transfer data or tool between SEEs;

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— Transfer user and/or a category of users defined by a role between SEEs;

— Transfer task descriptions between SEEs;

— Install/un-install, register/de-register tools and update to a new tool version;

— Monitor and diagnose SEE facilities.

10.2 SEE information sharing service

10.2.1 Service concept

This service provides facilities for a standard communication mechanism that can be used for communication through the network and information sharing among networks.

10.2.2 Service operations

This service provides the ability to:

— Support information processing and sharing;

— Provide primitive operating system process communications;

— Support communication among collection of processes between same and/or different machines;

— Allow communication over a distributed collection of services and tools;

— Support the notification of messages based upon certain triggering conditions.

10.3 SEE repository service

10.3.1 Service concept

This service provides the definition, storage, maintenance, management, and access of information and data object entities and the relationships among them.

10.3.2 Service operations

This service provides the ability to:

— Allow meta-data to operate according to the structure of the objects;

— Define and initiate a data transaction;

— Support management and access of distributed objects;

— Allow archiving and versioning operations;

— Restore the development environment to a consistent state after any failure;

— Retrieve sets of objects according to defined properties and values;

— Offer two-way translation between data repositories in the same or different environments.

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10.4 SEE Operating System service

10.4.1 Service concept

This service provides virtual operating system services to emulate the target operating environments on top of a basic operating system, especially in cross platform developments, or to make common portable operating environments among a variety of operating systems. The set of services includes system process management, file management, resource management, I/O management and other mechanisms of operating systems.

10.4.2 Service operations

This service provides the ability to:

— Provide operating system process management;

— Provide operating system synchronization;

— Provide generalized input and output;

— Manage storage;

— Provide asynchronous event/messaging;

— Provide interval timing;

— Provide resource management.

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Annex A
(informative)

Exemplary automated support for the SEE Services

Table A.1 — Exemplary automated supports for each SEE Services

NOTE The Service Operations match the normative part of this document.

SEE Service	Service operation	Exemplary automated support
5. Software engineering services		
5.1 Software requirements engineering service	Elicit and capture software requirements; Structure the software requirements; Create, modify, browse, and present software requirements; Group and prioritise software requirements; Check consistency of software requirements; Allocate software requirements for each software component; Conduct impact analysis for the addition, subtraction, or modification in a requirement against the project value, resources, and timeline; Validate and baseline the document specs based on stakeholders and developers.	Requirements traceability support; Repository management support; Requirements modification and querying support; Requirements presentation support; Consistency checking support; Impact Analysis support Requirements validation support.
5.2 Software reverse engineering service	Generate design from source code; Generate source program from object code.	Design documents generation support; Source code generation support; De-compilation support; Code translation support; Automated cross-referencing support
5.3 Software re-engineering service	Revise or restructure existing code; Perform impact analysis of new design on existing software components; Translate from one notation or language into another; Check that the new set of requirements is consistent with the existing system; Determine the impact of the altered design on the existing set of components.	Software translation support; Design specification generation support; Consistency checking support; Impact analysis support.
5.4 Software prototyping service	Build a prototype from requirements; Invoke software modelling service if necessary and available; Produce a user interface from requirements; Execute a prototype; Conduct simulations if necessary and available.	Software model visualization support; Software Model construction support; Software model execution support.

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5.5 Software modelling service	Build a software model (graphical, logical, mathematical, formal, etc.) from requirements; Validate a software model; Map and/or transform one software model into another; Analyse a software model.	Software model visualization support; Mathematical and logical model analysis support; Software model validation support.
5.6 Software simulation service	Build a simulation software model by invoking the software modelling service if necessary and available; Execute a software model; Capture simulation results of software models.	Software model visualization support; Software model simulation support; Simulation results comparison support.
5.7 Software design service	Translate requirements into architecture and design elements; Create and modify software design representation; Validate architecture and design artefacts to requirements; Produce structure charts, graphs, screens or other design information from a design representation; Structure design specifications; Architecture and design documentation; Evaluate architecture and design representations.	Traceability and consistency checking support; Repository design support; Repository data reuse support; Design representation support; Design representation support; Schema generation support.
5.8 Component based software generation service	Generate a parser from a syntactic language description; Generate a script for the composition and interconnection of software components; Generate a rule-based system from a set of rules; Generate a user interface component for a software system.	CBS (Component based software) service architecture support; CBS construction support; Traceability support; Parser Generation support.
5.9 Source code generation service	Generate modules from design specifications; Invoke the software static/dynamic analysis service and work-through source code; Provide for traceability to design specifications.	Source code to design specifications linking support; Traceability support; Work-through support.
5.10 Compilation service	Find code and inheritance dependencies among a set of software components; Pre-process source code to produce modified source code; Apply macro expansions to source code; Translate a source program into some target object code language; Produce report on the translation; this may include source listings of various complexity, including cross-reference data, compilation speeds, CPU usage, etc.; Link the object code into executable images. When intended for use on a remote target, link code into loadable/bootable images; Update the compiled system incrementally to reflect new changes.	Source code compilation support; Compilation error and source code listing support; Compilation reporting support; Object code optimisation support; Object code linking support.

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5.11 Debugging service	Instrument source programs by inserting breakpoints, instruction traps, printing out data values, and modifying source text; Execute programs incrementally; Monitor and save execution output; Log and measure debugging results; Analyse properties of programs and their current data values.	Execution output monitoring and saving support; Source code instrumentation support; Incremental execution support; Error data collection and presentation support; Defect analysis support.
5.12 Software static/dynamic analysis service	Collect raw statistics from a software module/component; Compute complexity measures from a software module/component; Produce and graphically represent cross reference lists; Collect raw statistics from a software module/component in execution; Produce and graphically represent characteristics of the execution behaviour; Produce findings according predefined template or rules.	Complexity measure computation support; Code characteristics analysis support; Control flow analysis support; Code complexity analysis support; Cross reference list generation support; Data flow analysis support; Findings reporting support; Execution behaviour visualisation support.
5.13 Software testing services	Generate test cases; Analyse source programs and generate reports; Enable traceability to requirements; Perform appropriate types of testing(e.g., functional, operational, security, performance etc.); Perform non-regression testing of required previous test cases on the object under test; Simulate the overall working environment and perform system load testing; Compare test results with expected results;	Test data database management support; Test cases archiving support; Test data cases and scenario generation support; Test case execution support; Test result presentation support; Test case/plan generation support; Source programs analysis support; Requirements traceability and cross referencing support; Automatic window operation testing support.
5.14 Software verification service	Analyse specifications for consistency; Read source component (either source programming language or design language); Identify errors (between specifications and verified object); Produce summary report.	Consistency-checking support; Specifications and object comparisons support; Inconsistency identification and pinpointing support.
5.15 Software integration services	Prepare software modules and/or components to be integrated. Manage module and/or component repository and libraries; Integrate modules and/or components according to a predefined architecture and model; Monitor integration and produce a status report.	Module/Component interfaces management support; Software module/Component Integration support.

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6. Technical management services		
6.1 Configuration management service	Provide unique identification of each configuration item; Enable access control for every element; Define configuration items in a system; Invoke change management; Provide selection support for configuration items of a specified version.	Configuration items identification support; Configuration item changes traceability support; Configuration items selection support; Access control support.
6.2 Change management service	Create a change request in response to a reported error, omission, or required update; Support the analysis of the impact of the proposed change; Classify, and retain a historical record of a change request; Create, evaluate, and track a change order based on a change request; Permit communication channels within the stakeholders.	Historical record archiving support; Change request history retention support; Change order tracking support; Communication support.
6.3 SEE Repository management service	Create, access, and modify information objects; Create, access, and modify groups of information objects; Create, access, and modify relationships among information objects; Manage access control; Provide multi-user and collaborative working environments.	Data/information objects management support; SEE Repository access control support.
6.4 Reuse management service	Deposit, acquire, or submit asset into the repository; Catalogue, register, and classify the asset; Search or browse the repository; Examine or extract the asset; Register the extractor or submitter; Report of limitations/usage requirements of an asset.	Asset registration and cataloguing support; Asset recording support; Repository searching support; Asset browsing within the repository support.
6.5 Measurement and analysis service	Allow definition of measures and measurement criteria; Allow the definition of artifacts such as patterns and rules to support analysis; Check consistency of measurement and analysis model if necessary; Insert and delete data from data set; Pick appropriate model for given data set; Compare data set to the predictive model; Compute general statistics on a data set; Support different viewpoints for different stakeholders at repository level; Capture an appropriate number of characteristics according to non-functional requirements, such as reliability, criticality or dependability for the software product.	Primitive data collection support; Measurement model selections support; New model creation support; Data set import and export support; Various statistical calculations support; Data set visualisation support; Non-egression analysis support.

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6.6 Quality assurance service	Establish and maintain records of Quality Assurance activities; Define specific product and/or process items that are subject to Quality Assurance review; Analyse Quality Assurance data for compliance with requirements.	Impact analysis of Quality Assurance failure on a specific process assurance item support; Quality Assurance data linking with audit checklists support.
6.7 Audit service	Maintain a set of audit checklists and support user creation and customisation of checklists; Support audit preparation and scheduling; Provide for retention of audit data; Provide for analysis of audit data (e.g., pass/fail, trend analysis).	Audit checklist linking with requirements support; Schedule of audits linking with key project events support; Audit data creation, storage, and analysis support.
6.8 Software traceability service	Create, update, and destroy relationships between two items; Query current status of relationships; Query relationship history; Trace requirements throughout stages of the life cycle process; Navigate relationships and items.	Traceability analysis support; Traceability analysis reports presentation support; Communication and distribution of analysis results support.; Query and navigation support.
6.9 Documentation service	Author documentation; Allow linking context sensitive documentation; Build online documentation into delivery package; Manage and control documentation; Produce any relevant media formats; Flag dependent documentation items due to software changes; Enable document version management; Rreview cycle management ; Enable access control.	Documentation authoring support; Context sensitive documentation linking support; Online documentation into delivery package construction support; Printing support; Media formats conversion support; Software change dependent documentation items flagging support; Document version management and access control support; Review cycle management support.
6.10 Review service support	Prepare documents for review; Annotate comments, refer/paste/link related documents to the review documents; Find/retrieve keywords from the documents and the SEE repository; Report and catalogue review results.	Information mining support on SEE repository; Retrieving support for the SEE repository; Cross-referencing support of the documents; Review reports cataloguing support.

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7. Project management services		
7.1 Project planning service	Translate project objectives into key project events; Quantify inputs and outputs for work activities; Allow assignment of relationships (dependencies) between activities; Estimate event lead times; Calculate start and finish dates; Analyse critical paths; Generate detailed event schedules; Enable resource allocation; Establish project control schemes; Register assignment of work responsibilities to individuals or organisations; Establish communication channels within the project team including the identification of the communication medium, frequency and content; Establish evaluation criteria.	Key project events visualisation support; Resource levelling support; Critical path analysis support; Impact analysis support; Budget calculations and forecasts support.
7.2 Project estimation service	Create and modify cost, size, and resource estimates; Maintain history of cost, size, and resource estimates; Generate estimates for variable parameters such as workload mixes or for differing design; Compare estimates against actual results.	Change impact estimation support; Variable parameter sensitivity analysis support.
7.3 Project risk management service	Perform trade-off analyses based on differing parameters for resource allocation and scheduling data; Evaluate risks due to cost, resource, schedule, and failure; Estimate cost and probability of failure; Manage risk mitigation; Generate reports for various allocation strategies.	Cost and schedule measuring support; Trade-off analysis support.
7.4 Project monitoring and scheduling service	Gather measurement data related to current status of a project and its constituent work activities; Compare cost, size, and resource estimates with actual results; Read and display status of all project variables, and produce project data and summary information; Track the evolution of user requirements.	Measurement data gathering support; Support of a trend analysis for deviation of costs, size, and resource estimates from the actual amounts; Triggering or alarming support when actual data differ from planned resource usage, or when action items have not been closed after a certain period.
7.5 Project evaluation service	Evaluate actual cost and time data against tracking service data and project planning data; Create/Modify/Store user comments, recommendations, and software errors; Elicit user acceptance for each requirement against the project product; Collect measurement data to support trade-off analysis and impact analysis.	Project/product outcomes evaluation support against user acceptance criteria; Impact analysis support to assist in the determination of a recovery path for minimal impact

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8. Process management services		
8.1 Process definition service	Analyse process requirements, including domain-specific analysis and application-specific analysis; Instantiate, compose, decompose, tailor, and modularise process definitions; Simulate, model, and validate process definitions against organization standards, guidelines and policies.	Analysis support for process requirements, including domain-specific analysis and application-specific analysis; Process definition lifecycle support; Support simulation, modelling, and validation of process definitions.
8.2 Process library service	Create, update, and delete process assets; Certify, measure, and administer process assets; Provide access control to process assets, if necessary.	Process assets storage and versioning support; Access control and status reporting support.
8.3 Process initiation service	Review project criteria and constraints and select life cycle model; Define relationships and tailor processes and activities; Define process roles and responsibilities; Provide process training, if necessary.	Support of relationship definition and tailoring of processes and activities; Process definition support Process training support.
8.4 Process usage service	Process help and guidance facility for project team members; Query and report on process utilisation and status; Specify, collect, and report on project process measures; Allow interaction between process definition simulations and high-level representations with SEE data management.	Process utilisation and status querying and reporting support.
8.5 Process monitoring service	Set up monitoring conditions and criteria; Observe the evolving enactment state of processes; Detect and log the occurrence of specific process events; Report the monitoring results.	Detection and logging monitoring support; Monitored data visualisation support; Monitored data distribution support.
8.6 Process improvement support service	Define effectiveness goals; Identify measurements, correlated to the goals; Set threshold values for goal attainment; Assess process capability; Prepare assessment reports that compare the actual data with target or baseline data; Provides schedule of assessments.	Measurement data collection support; Process capability assessment support; Assessment reports preparation support Assessment scheduling support.
8.7 Process documentation service	Identify the documentation requirements; Design and develop the documents; Produce and edit the document; Distribute the document; Maintain those documents.	Documentation design, production, and editing support; Documentation distribution and maintenance support.

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9. SEE support services		
9.1 SEE common support service	Create, modify, edit and save text, formulas and spreadsheets, graphics, images or figures; Import or export text, graphics or images in various file formats; Format and print text, graphics or images; Create, capture, modify, store, playback and transmit audio & video objects; Transform audio and video objects into other formats.	Supporting create, modify, edit and save various objects; Supporting import or export of various objects in various file formats; Supporting format and print various objects; Supporting create, capture, modify, store, playback and transmit various objects; Supporting transform various objects into other formats.
9.2 SEE publishing service	Create, modify and save document objects and documents; Create tables of contents, indices, bibliographies, and glossaries; Format, build, preview, and print documents, create and print templates; Create or modify layouts or styles for documents; Control document versions.	Document objects and documents lifecycle support; Support of create tables of contents, indices, bibliographies, and glossaries; Support of format, build, preview, and print documents, create and print templates; Support of create or modify layouts or styles for documents; Document version control support.
9.3 SEE cooperative work support service	Support the sharing of repositories; Support conferencing; Support the sharing of project/group/user scheduling. Support concurrent engineering.	Shared repositories support; Conferencing support; Schedule sharing support; Concurrent engineering support.
9.4 SEE user communication support service	Receive, archive, compose, send, reply, forward, broadcast, and acknowledge messages; Customise the mail's communication capabilities; Subscribe and post messages; Reply or add information to posted messages; Open and close connections. Support local area network, wide area network, public network, Internet connectivity, etc.	Receive, archive, compose, send, reply, forward, broadcast, and acknowledge messages support; Communication (mail, chat, messaging, etc...) customising support; Message handling and management support; Messaging over network support.
9.5 SEE administration service	Manage user access; Monitor the SEE status by invoking the SEE infrastructure management service; Set user privileges and access to resources.	Managing user access support; Monitoring the SEE status support; Resource access control support.
9.6 SEE policy enforcement service	Support the establishment of security information; Identify users and properly associate with access rights. Govern access to information contents; Protect data and objects from unauthorized or unconstrained modification; Export and import data and objects in a secure manner; Provide tracking and control information for a security-related audit; Back up and recovery.	Identification and authentication support; Mandatory and discretionary access control support; Integrity protection support; Back up and recovery support; Exportation and importation security support.

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9.7 SEE data/information mining services	Recover useful data/information from repositories; Integrate mined data/information from repositories; Visualize and present the mined data/information; Extract and analyse the changing patterns present in the repositories; Support modelling of software characteristics using data/information from repositories; Support of software reuse;	Useful data/information selection from repository support; Mined data/information integration support; Useful patterns analysis and extraction support; Data/information visualising support; Software characteristic modelling support; Invoking reuse management support.
10. SEE infrastructure services		
10.1 SEE infrastructure management service	Add, delete, or amend resources (including tools); Query status and provide statistics of a resource; Make a resource available to a specific user and/or a category of users defined by a role;Send diagnostic messages to the system administrator; Transfer data or tool between SEEs; Transfer user and/or a category of users defined by a role between SEEs; Transfer task descriptions between SEEs; Install/un-install, register/de-register tools and update to a new tool version; Monitor and diagnose SEE facilities.	SEE infrastructure resource management support; Query and reporting services support of the SEE resources; Self-testing support of SEE facilities; Administration messaging to the system administrator support; Support making sharable data and/or tools, user and/or role, task information among SEEs; Support notification of the SEE environmental changes to all users.
10.2 SEE information sharing service	Support information processing and sharing; Provide primitive operating system process communications; Support communication among collection of processes between same and/or different machines; Allow communication over a distributed collection of services and tools; Support the notification of messages based upon certain triggering conditions.	Data sharing support; Inter-process communication support; Message handling support; Event notification support.
10.3 SEE repository service	Allow meta-data to operate according to the structure of the objects; Define and initiate a data transaction; Support management and access of distributed objects; Allow archiving and versioning operations; Restore the development environment to a consistent state after any failure; Retrieve sets of objects according to defined properties and values; Offer two-way translation between data repositories in the same or different environments.	Meta-data base and object database management support; Object data transaction support; Version and archive control support; Query/retrieving support; Object data interchange support.

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10.4 SEE Operating System service	Provide operating system process management; Provide operating system synchronization; Provide generalized Input and Output; Manage storage; Provide asynchronous event/messaging; Provide interval timing; Provide resource management.	Operating system process management support; Operating system synchronization support; Generalized Input and Output support; File storage management support; Asynchronous event/messaging support; Interval timing triggering support; Resource management support.

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Annex B
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Services mapped on to ISO/IEC 12207 activities

Table B.1 — ISO/IEC-12207:1995 mapping on to SEE Services

ISO/IEC 12207:1995 Activities	SEE Services
5.1.1 Acquisition process Initiation	7.1 Project planning service 7.2 Project estimation service 9.2 SEE publishing service
5.1.2 Request for proposal [-tender] preparation	5.1 Software requirements engineering service 9.2 SEE publishing service 9.4 SEE user communication support service
5.1.3 Contract preparation and update	7.3 Project risk management service 7.5 Project evaluation service 9.4 SEE user communication support service
5.1.4 Supplier monitoring	7.4 Project monitoring and scheduling service 9.4 SEE user communication support service
5.1.5 Acceptance and completion	7.5 Project evaluation service
5.2.1 Supply process: Initiation	7.3 Project risk management service 7.5 Project evaluation service
5.2.2 Preparation of response	7.1 Project planning service 7.2 Project estimation service 9.2 SEE publishing service
5.2.3 Supply process: Contract	6.2 Change management service 6.4 Reuse management service 9.6 SEE policy enforcement service
5.2.4 Supply process: Planning	7.1 Project planning service 7.3 Project risk management service 9.6 SEE policy enforcement service
5.2.5 Supply process: Execution and control	7.4 Project monitoring and scheduling service 8.5 Process monitoring service 9.6 SEE policy enforcement service
5.2.6 Supply process: Review and evaluation	7.5 Project evaluation service 9.4 SEE user communication support service
5.2.7 Supply process: Delivery and completion	7.5 Project evaluation service 9.4 SEE user communication support service
5.3.1 Development Process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service

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5.3.2 System requirements analysis	5.1 Software requirements engineering service 6.9 Documentation service 9.4 SEE user communication support service
5.3.3 System architectural design	5.7 Software design service 6.8 Software traceability service 7.5 Project evaluation service
5.3.4 Software requirements analysis	5.1 Software requirements engineering service 5.4 Software prototyping service 9.4 SEE user communication support service
5.3.5 Software architectural design	5.7 Software design service 5.5 Software modelling service 5.6 Software simulation service 7.5 Project evaluation service
5.3.6 Software detailed design	5.7 Software design service 5.5 Software modelling service 5.6 Software simulation service 5.12 Software static/dynamic analysis service
5.3.7 Software coding and testing	5.9 Source code generation service 5.11 Debugging service 5.13 Software testing service
5.3.8 Software integration	5.13 Software testing service 5.15 Software integration service 6.5 Measurement and analysis service
5.3.9 Software qualification testing	5.13 Software testing service 6.9 Documentation service 6.5 Measurement and analysis service
5.3.10 System Integration	5.13 Software testing service 5.15 Software integration service 6.5 Measurement and analysis service
5.3.11 System qualification testing	5.13 Software testing service 6.9 Documentation service 6.5 Measurement and analysis service
5.3.12 Software installation	6.9 Documentation service 5.4.7 Process documentation 9.4 SEE user communication support service
5.3.13 Software acceptance support	5.13 Software testing service 6.9 Documentation service 9.4 SEE user communication support service
5.4.1 Operation process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service

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5.4.2 Operational testing	6.9 Documentation service 5.13 Software testing service 9.4 SEE user communication support service
5.4.3 System operation 5.4.4 User support	6.9 Documentation service 6.2 Change management service 9.4 SEE user communication support service 9.6 SEE policy enforcement service
5.5.1 Maintenance process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
5.5.2 Problem and modification analysis	6.2 Change management service 7.3 Project risk management service 7.5 Project evaluation service
5.5.3 Modification implementation	5.2 Software reverse engineering service 5.3 Software re-engineering service 6.1 Configuration management service 6.9 Documentation service
5.5.4 Maintenance review and acceptance	5.14 Software verification service 7.5 Project evaluation service
5.5.5 Migration	7.1 Project planning service 7.5 Project evaluation service 9.4 SEE user communication support service
5.5.6 Software retirement	7.1 Project planning service 9.4 SEE user communication support service
6.1.1 Document process: Process implementation	6.1 Configuration management service 9.6 SEE policy enforcement service
6.1.2 Documentation Process: Design and development	6.4 Reuse management service 9.1 SEE common support service 9.2 SEE publishing service
6.1.3 Documentation Process: Production	9.2 SEE publishing service 9.4 SEE user communication support service 9.6 SEE policy enforcement service
6.1.4 Documentation Process: Maintenance	6.4 Reuse management service 9.2 SEE publishing service 9.6 SEE policy enforcement service
6.2.1Configuration management process: Process implementation	6.1 Configuration management service 9.6 SEE policy enforcement service
6.2.2 Configuration identification	6.1 Configuration management service 6.3 SEE Repository management service
6.2.3 Configuration control	6.2 Change management service 9.6 SEE policy enforcement service 10.3 SEE Repository service

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6.2.4 Configuration status accounting	6.5 Measurement and analysis service 8.7 Process documentation service
6.2.5 Configuration evaluation	6.7 Audit service 7.5 Project evaluation service 9.6 SEE policy enforcement service
6.2.6 Release management and delivery	6.3 SEE Repository management service 9.6 SEE policy enforcement service
6.3.1 Quality assurance process: Process implementation	6.1 Configuration management service 9.6 SEE policy enforcement service
6.3.2 Product assurance	6.6 Quality assurance service 7.4 Project monitoring and scheduling service
6.3.3 Process assurance	6.6 Quality assurance service 6.7 Audit service 8.5 Process monitoring service
6.3.4 Assurance of quality systems	6.6 Quality assurance service 6.7 Audit service 8.5 Process monitoring service
6.4.1 Verification process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
6.4.2 Verification	5.14 Software verification service 6.8 Software traceability service 7.5 Project evaluation service
6.5.1 Validation process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
6.5.2 Validation	5.12 Software static/dynamic analysis service 5.13 Software testing service
6.6.1 Joint review process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
6.6.2 Project management reviews	6.5 Measurement and analysis service 7.4 Project monitoring and scheduling service 7.5 Project evaluation service
6.6.3 Technical reviews	5.14 Software verification service 6.8 Software traceability service 7.5 Project evaluation service
6.7.1 Audit process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
6.7.2 Audit	6.7 Audit service 9.6 SEE policy enforcement service
6.8.1 Problem resolution process: Process implementation	6.2 Change management service 7.3 Project risk management service 7.5 Project evaluation service

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6.8.2 Problem resolution	6.5 Measurement and analysis service 8.7 Process documentation service
7.1.1 Management process: Initiation and scope definition	9.6 SEE policy enforcement service
7.1.2 Management process: Planning	7.1 Project planning service 7.2 Project estimation service 7.3 Project risk management service
7.1.3 Management process: Execution and control	6.5 Measurement and analysis service 7.4 Project monitoring and scheduling service 8.5 Process monitoring service
7.1.4 Management process: Review and evaluation	6.5 Measurement and analysis service 7.5 Project evaluation service
7.1.5 Management process: Closure	9.4 SEE user communication support service
7.2.1 Infrastructure process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
7.2.2 Establishment of the infrastructure	7.1 Project planning service 9.6 SEE policy enforcement service 10.1 SEE infrastructure management service
7.2.3 Maintenance of the infrastructure	9.6 SEE policy enforcement service 10.1 SEE infrastructure management service 10.2 SEE information sharing service
7.3.1 Improvement process: Process establishment	8.1 Process definition service 8.3 Process initiation service 8.4 Process usage service
7.3.2 Process assessment	7.5 Project evaluation service 8.2 Process library service 8.5 Process monitoring service
7.3.3 Process improvement	6.5 Measurement and analysis service 8.6 Process improvement support service 8.7 Process documentation service
7.4.1 Human Resources Management process: Process implementation	7.1 Project planning service 9.6 SEE policy enforcement service
7.4.2 Training material development	6.9 Documentation service 8.7 Process documentation service 9.2 SEE Publishing service 9.7 SEE data/information mining service
7.4.3 Training plan implementation	6.5 Measurement and analysis service 7.5 Project evaluation service

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Table B.2 — Activities in ISO/IEC 12207:1995/AMD.1:2002 Annex F and ISO/IEC 12207:1995/Amd.2:2004 mapping on to SEE Services

ISO/IEC 12207 Activities in Annex F	SEE Services
F.1.1.1 Acquisition Preparation	7.1 Project planning service 7.2 Project estimation service 9.2 SEE publishing service
F.1.1.2 Supplier Selection	5.1 Software requirements engineering service 9.2 SEE publishing service 9.4 SEE user communication support service
F.1.1.3 Supplier Monitoring	7.3 Project risk management service 7.4 Project monitoring and scheduling service 7.5 Project evaluation service 9.4 SEE user communication support service
F.1.1.4 Customer Acceptance	7.5 Project evaluation service
F.1.2.1 Supplier tendering	6.9 Documentation service 7.1 Project planning service 7.2 Project estimation service 7.3 Project risk management service 7.5 Project evaluation service 9.2 SEE publishing service
F.1.2.2 Contract agreement	6.2 Change management service 6.9 Documentation service 9.6 SEE policy enforcement service
F.1.2.3 Product release	6.1 Configuration management service 6.9 Documentation service 9.4 SEE user communication support service
F.1.2.4 Product acceptance support	5.13 Software testing service 6.9 Documentation service 9.4 SEE user communication support service
F.1.3.1 Requirements Elicitation	5.1 Software requirements engineering service 6.9 Documentation service 7.1 Project planning service 9.6 SEE policy enforcement service
F.1.3.2 System Requirements Analysis	5.1 Software requirements engineering service 5.2 Software reverse engineering service 5.3 Software re-engineering service 5.4 Software prototyping service 6.9 Documentation service 9.4 SEE user communication support service
F.1.3.3 System Architecture Design	5.7 Software design service 6.8 Software traceability service 7.5 Project evaluation service

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F.1.3.4 Software Requirements Analysis	5.1 Software requirements engineering service 5.2 Software reverse engineering service 5.3 Software re-engineering service 5.4 Software prototyping service 5.5 Software modelling service 5.6 Software simulation service 9.4 SEE user communication support service
F.1.3.5 Software Design	5.5 Software modelling service 5.6 Software simulation service 5.7 Software design service 5.12 Software static/dynamic analysis service 7.5 Project evaluation service
F.1.3.6 Software Construction (Code and Unit Test)	5.8 Component based software generation service 5.9 Source code generation service 5.11 Debugging service 5.13 Software testing service
F.1.3.7 Software Integration	5.13 Software testing service 5.15 Software integration service 6.5 Measurement and analysis service
F.1.3.8 Software Testing	5.13 Software testing service 6.9 Documentation service 6.5 Measurement and analysis service
F.1.3.9 System Integration	5.13 Software testing service 5.15 Software integration service 6.5 Measurement and analysis service
F.1.3.10 System Testing	5.13 Software testing service 6.9 Documentation service 6.5 Measurement and analysis service
F.1.3.11 Software Installation	6.9 Documentation service 5.4.7 Process documentation 9.4 SEE user communication support service
F.1.4.1 Operational use	7.1 Project planning service 9.4 SEE user communication support service 9.6 SEE policy enforcement service
F.1.4.2 Customer support	6.9 Documentation service 5.13 Software testing service 9.4 SEE user communication support service

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F.1.5 Maintenance Process	5.12 Software static/dynamic analysis service 5.15 Software integration service 6.2 Change management service 7.1 Project planning service 7.3 Project risk management service 7.5 Project evaluation service 9.4 SEE user communication support service 9.6 SEE policy enforcement service
F.2.1 Documentation Process	6.1 Configuration management service 6.4 Reuse management service 6.7 Audit service 9.1 SEE common support service 9.2 SEE publishing service 9.4 SEE user communication support service 9.6 SEE policy enforcement service 10.3 SEE Repository service
F.2.2 Configuration Management Process	6.2 Change management service 6.3 SEE Repository management service 6.5 Measurement and analysis service 6.7 Audit service 6.9 Documentation service 9.6 SEE policy enforcement service 10.3 SEE Repository service
F.2.3 Quality Assurance Process	6.1 Configuration management service 6.6 Quality assurance service 9.6 SEE policy enforcement service
F.2.4 Verification Process	5.14 Software verification service 6.8 Software traceability service 7.1 Project planning service 7.5 Project evaluation service 9.6 SEE policy enforcement service
F.2.5 Validation Process	5.12 Software static/dynamic analysis service 5.13 Software testing service 7.1 Project planning service 9.6 SEE policy enforcement service

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F.2.6 Joint Review Process	5.14 Software verification service 6.5 Measurement and analysis service 6.8 Software traceability service 6.10 Review service support 7.1 Project planning service 7.4 Project monitoring and scheduling service 7.5 Project evaluation service 9.3 SEE cooperative work support service 9.4 SEE user communication support service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service 10.3 SEE Repository service
F.2.7 Audit Process	6.7 Audit service 7.1 Project planning service 9.3 SEE cooperative work support service 9.4 SEE user communication support service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service
F.2.8 Problem Resolution Management Process	6.2 Change management service 6.5 Measurement and analysis service 6.9 Documentation service 9.3 SEE cooperative work support service 9.4 SEE user communication support service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service
F.2.9 Usability process	9.3 SEE cooperative work support service 9.4 SEE user communication support service 9.6 SEE policy enforcement service
F.2.10 Product Evaluation Process	6.5 Measurement and analysis service 6.6 Quality assurance service 9.3 SEE cooperative work support service 9.4 SEE user communication support service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service
F.2.11 Change Request Management Process	6.2 Change management service 6.9 Documentation service 7.3 Project risk management service 9.3 SEE cooperative work support service 9.4 SEE user communication support service 9.6 SEE policy enforcement service

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F.3.1.1 Organizational Alignment	7.1 Project planning service 7.2 Project estimation service 7.3 Project risk management service 9.6 SEE policy enforcement service
F.3.1.2 Organization Management	6.5 Measurement and analysis service 7.4 Project monitoring and scheduling service 8.5 Process monitoring service 9.4 SEE user communication support service
F.3.1.3 Project Management	7.1 Project planning service 7.4 Project monitoring and scheduling service 7.5 Project evaluation service 8.5 Process monitoring service 9.6 SEE policy enforcement service
F.3.1.4 Quality Management	7.5 Project evaluation service 9.7 SEE data/information mining service
F.3.1.5 Risk management	7.2 Project estimation service 7.3 Project risk management service 9.7 SEE data/information mining service
F.3.1.6 Measurement	6.5 Measurement and analysis service 9.7 SEE data/information mining service
F.3.2 Infrastructure Process	6.2 Change management service 6.9 Documentation service 9.7 SEE data/information mining service 10.1 SEE infrastructure management service
F.3.3.1 Process Establishment	8.1 Process definition service 8.3 Process initiation service 8.4 Process usage service 9.6 SEE policy enforcement service
F.3.3.2 Process Assessment	7.5 Project evaluation service 8.2 Process library service 8.5 Process monitoring service
F.3.3.3 Process improvement	6.5 Measurement and analysis service 8.2 Process library service 8.5 Process monitoring service 8.6 Process improvement support service 8.7 Process documentation service
F.3.4.1 Human Resource Management	6.3 SEE repository management service 7.1 Project planning service 7.5 Project evaluation service 9.6 SEE policy enforcement service

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F.3.4.2 Training	6.5 Measurement and analysis service 9.6 SEE policy enforcement service
F.3.4.3 Knowledge Management	6.3 SEE repository management service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service
F.3.5 Asset Management Process	6.3 SEE repository management service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service
F.3.6 Reuse Program Management Process	6.3 SEE repository management service 6.4 Reuse Management service 9.4 SEE user communication support service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service
F.3.7 Domain Engineering Process	5.1 Software requirements engineering service 5.2 Software reverse engineering service 5.3 Software re-engineering service 5.4 Software prototyping service 5.5 Software modelling service 5.6 Software simulation service 5.7 Software design service 9.6 SEE policy enforcement service 9.7 SEE data/information mining service

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Annex C
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Application of this International Standard

C.1 General

This (draft) International Standard can provide benefits to software engineers who use tools, those involved in process improvements and who acquire tools, suppliers who provide tools, and educators and software engineering consultants who provide advise on tools and SEEs.

C.2 Users/software engineers

People involved in the execution of one or more processes equivalent to those defined in ISO/IEC 12207, and presently using individual tools or SEEs will be able to:

— Get a better understanding of the relationship between the activities in which they are involved and the tools in which they use;

— Identify processes or activities that can be improved through better support by a SEE;

— Get an objective basis for a better comparison, evaluation, and assessment of tools and environments.

C.3 Tool and SEE suppliers

Suppliers of software engineering tools will be able to:

— Develop tools consistent with ISO/IEC 12207;

— Have a basis to develop more interoperable tools;

— Identify areas (processes, activities) for which more exemplary automated support would be necessary.

C.4 Acquirers

People responsible for software development projects or for process improvement, involved in the purchase of software engineering tools will be able to:

— Review new SEE services that can contribute to process improvement;

— Identify criteria for selecting software engineering tools.

C.5 Software engineering educators

People responsible for education and training of software engineers will be able to:

— Use a commonly agreed basis for presentation of SEEs;

— Teach software engineering based on a full range of services.

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C.6 Software engineering consultants

People or organisations consulting on project development, process evaluation, or process improvement will able to:

— Consistently describe the relationship between the client's software engineering activities and the tools used;

— Provide advice on identifying processes or activities that can be improved through better support by a SEE.

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Annex D
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Illustrated image of SEE concept

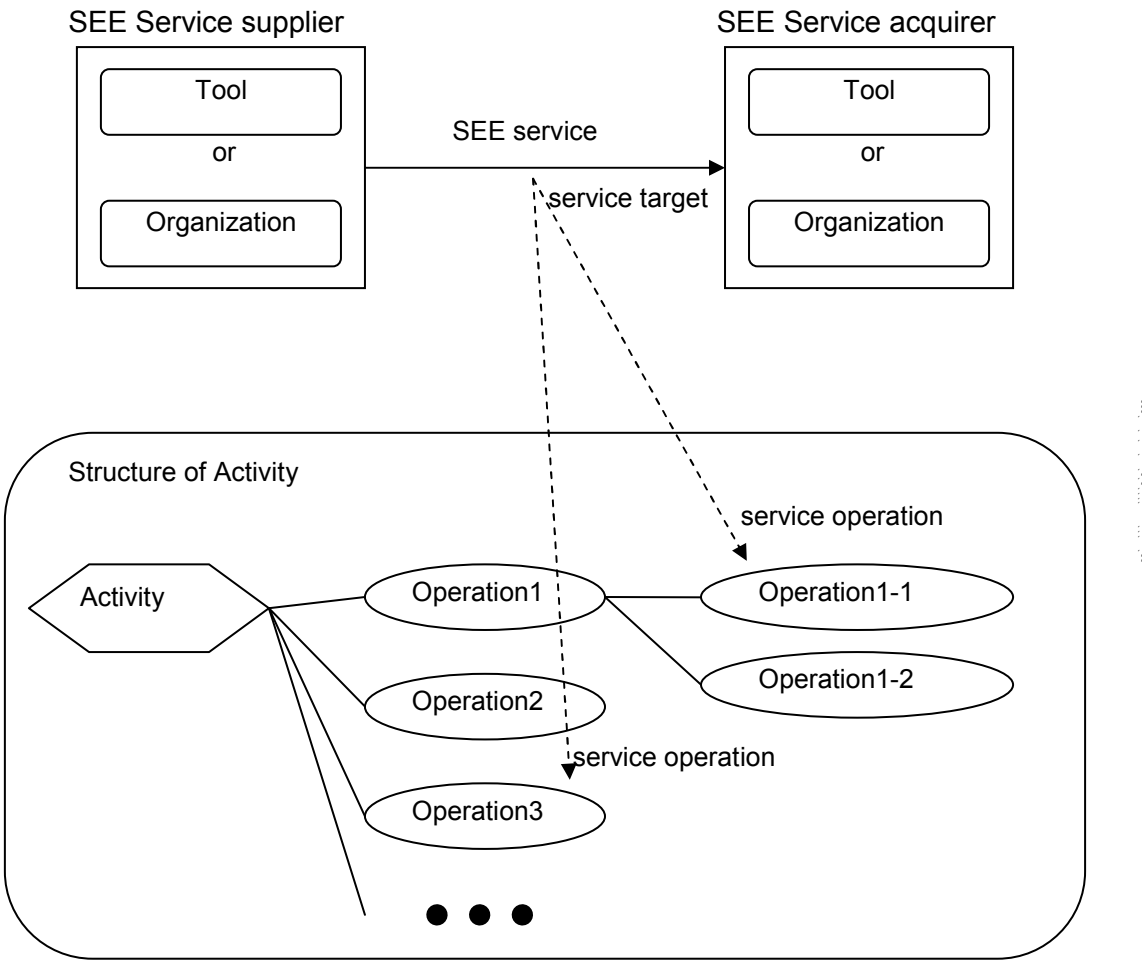

Figure D.1 — Illustrated image of SEE concept

Figure D.1 illustrates an image of SEE services in an Activity. In this picture, an Actor as “SEE Service supplier” provides SEE Service to other Actor “SEE Service acquirer” through service operations which consists of several operations to implement a life cycle activity.

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Annex E
(informative)

WG4 Standards Architecture (from WG4 business plan)

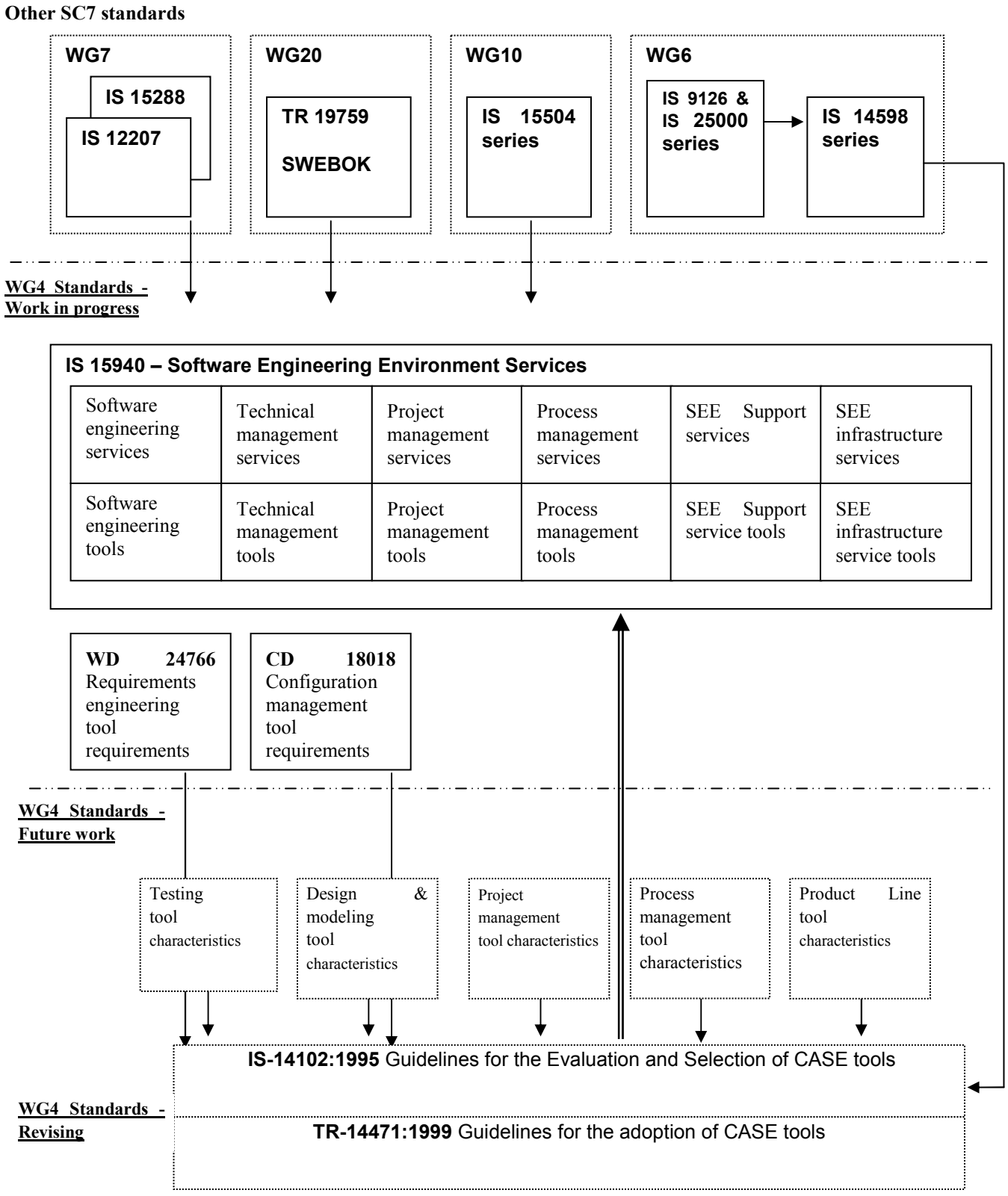

Figure E.1 — WG4 standards architecture

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Annex F
(informative)

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