TECHNICAL SPECIFICATION

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Information technology for learning, education and training — Nomadicity and mobile technologies —

Part 1: Nomadicity reference model

Technologies de l'information pour l'apprentissage, l'éducation et la formation — Nomadisme et technologies mobiles —

Partie 1: Modèle de référence du nomadisme

Reference number
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Foreword

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, the joint technical committee may decide to publish an ISO/IEC Technical Specification (ISO/IEC TS), which represents an agreement between the members of the joint technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/IEC TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/IEC TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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ISO/IEC TS 29140-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, SC 36, *Information technology for learning, education and training*.

ISO/IEC TS 29140 consists of the following parts, under the general title *Information technology for learning, education and training — Nomadicity and mobile technologies*:

— *Part 1: Nomadicity reference model*

— *Part 2: Learner information model for mobile learning*

Introduction

The number of people working as “global nomads” has been rising in the last few decades. The traditional nomad (tribal, ethnical, cultural) is a vanishing species, but globalization and the ease of travel has given a real boost to the number of professional nomads. These professional nomads are people who work in a variety of occupations (educators, trainers, learning specialists, sales people, service people, sports professionals, junior and senior managers in international companies, tourism industry workers, disaster relief and aid workers, military personnel, etc.). Information and communication technology (ICT) has the potential to provide learners with increased access to information and learning materials, and to support learning and working “on the go” and from anywhere rather than from a specific location at a certain time. There are many possible ways to approach the situation, two of which are provided below.

First, this part of ISO/IEC TS 29140 focuses on an approach to nomadic learning. In situations where nomadicity is involved, the learner, educator, or other participants may be in transit between different locations or require access to services as they travel to different locations. It is essential that learning, education and training (LET) activities are seamless. The environment must accommodate the needs and requirements of learners who are travelling from place to place. The ever-changing environment of the learner is considered with respect to the context in which LET takes place. The question regarding which devices are employed to support learning will change over time as new innovations and emerging technologies become available. The learner may use mobile devices, stationary equipment supplied at different locations where learning is taking place, or use whatever combination of devices is available locally or through distributed networks. This means that information regarding the learning context will be crucial to enable learning processes. It is recommended that this part of ISO/IEC TS 29140 be consulted in conjunction with ISO/IEC TS 29140-2 when designing ITLET systems that will support nomadicity.

Second, when using the mobile learning approach, emphasis is placed on the technical device that the learner is using. When mobile learning is implemented properly, it has the potential to increase efficiency and productivity within the various sectors (public, private, and voluntary). Mobile technologies have the potential to provide learners with new opportunities to connect, create and explore during LET activities. Where learning, education, and training activities involve mobile devices to support nomadic learning, this part of ISO/IEC TS 29140 and ISO/IEC TS 29140-2 would be consulted. It should be noted that not all LET activities where mobile devices are used involve nomadic learning. For example, mobile devices may be used in a classroom to teach school-age children about disease transmission patterns, in medical education to support students learning about bedside clinical practice, in a desktop Personal Digital Assistant (PDA) system to support people with aphasia. In these cases, it is likely that only ISO/IEC TS 29140-2 would be consulted. More information regarding the use of a mobile learning approach is provided in ISO/IEC TS 29140-2.

There are a number of research teams around the world who are working on nomadicity (nomadic learning) and mobile learning. Additionally, work is already in progress in various countries around the world on related topics such as ubiquitous learning, nomadicity, and learning using smartphones. Work is in progress on some of these issues at the W3C and the ITU-T as well.

Information technology for learning, education and training — Nomadicity and mobile technologies —

Part 1: Nomadicity reference model

1 Scope

This part of ISO/IEC TS 29140 provides guidance regarding learning, education and training (LET) situations in which learners are nomadic (travel from place to place, from one location to another or require access to services as they travel to different locations). It can be used as a reference by software developers, implementers, instructional designers, and others to ensure that LET environments reflect the specific needs of these learners. Specifically, this part of ISO/IEC TS 29140 provides

— a definition of nomadicity within LET,

— a nomadicity reference model indicating the elements required to support learners engaged in activities within LET environments that involve nomadicity,

— a description of the elements and relationships between the elements, and

— an introduction to the characteristics of nomadicity that impact on LET activities.

This part of ISO/IEC TS 29140 also identifies ITLET standards and fields of standardization within ITLET impacted by nomadicity and may be used as a basis for further standardization work and harmonization efforts.

This part of ISO/IEC TS 29140 is intended to support interoperability by providing a nomadicity reference model that can be used by developers, implementers, instructional designers, and others. ISO/IEC TS 29140-2 provides a learner information model specific to mobile learning that can be used as a reference by software developers, implementers, instructional designers, teachers, instructors, and others to ensure that LET environments reflect the specific needs of mobile learners.

It is essential to differentiate between nomadicity and mobile learning approaches because the former is considered to be independent of the ICT involved. A concise view and understanding is needed of how nomadic learners' needs and requirements can be met using standardization efforts. The focus of this part of ISO/IEC TS 29140 is to ensure that not only is the concept of “nomadicity” understood, but that the user needs and requirements have been addressed.

1.1 Exclusions

The scope of this part of ISO/IEC TS 29140 does not include the following:

— in-depth technical review of issues related to adaptability to culture, language, and individual needs;

— broad or in-depth technical interoperability issues of nomadic computing domains;

— security;

— authentication.

1.2 Areas not currently addressed

This part of ISO/IEC TS 29140 currently does not include

— privacy,

— accessibility, and

— detailed information regarding complementary work within other organizations that might be relevant (ITU-T, W3C, etc.).

It is anticipated that some or all of these requirements will be addressed in future editions of this part of ISO/IEC TS 29140, or in companion International Standards or Technical Specifications.

2 Normative references

No normative references are cited.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
learning
acquisition of knowledge, skills or attitudes

[ISO/IEC 2382-36:2008 (2.23.01.01)]

3.2
nomadicity
tendency of a person, or a group of people, to move from one location to another with relative frequency

EXAMPLE A learner has to access the learning materials from different locations, varying time zones and within another environment during a single learning episode.

4 Abbreviated terms

LMS	Learning Management System
LCMS	Learning Content Management System
PDA	Personal Digital Assistant
PMP	Portable Multimedia Player
RFID*	Radio-Frequency Identification
Tablet PC*	Tablet Personal Computer
UMPC*	Ultra-Mobile Personal Computer
WiBro*	Wireless Broadband

* For further descriptions of these items, see Annex E (Informative).

5 Nomadicity reference model

Where ITLET systems are designed to support nomadicity it is important to consider the range of typical or likely requirements to enable learning. Learners need to be supported by technologies so that they can improve their learning in an efficient and effective manner. The underlying role of technologies is to support learners by enhancing communication, convenience, and connection. There are several components that are essential to supporting learners' requirements within nomadicity contexts as noted in Figure 1.

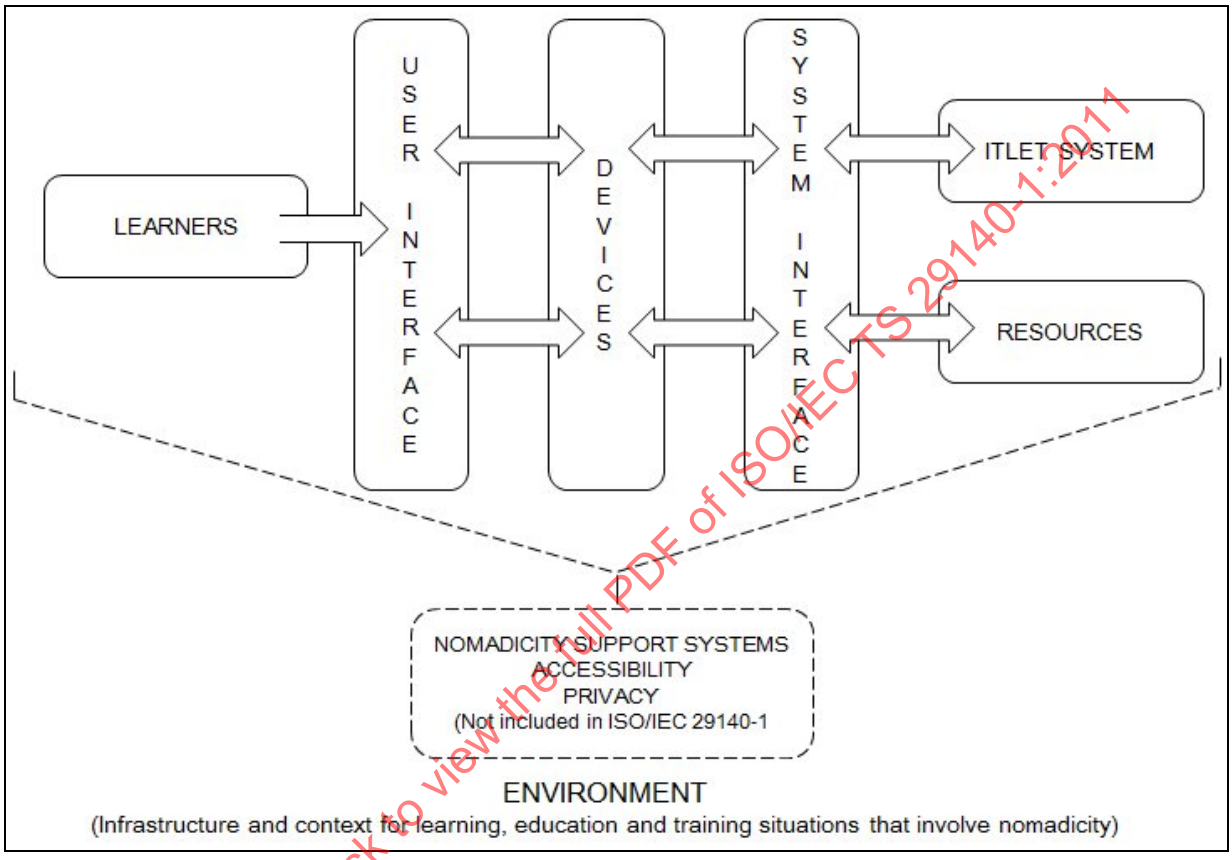

Figure 1 — Nomadicity reference model

- **Learners** - specific contextual information that impacts on the seamless and straightforward delivery of learning, education and training information. This may include information such as current location, estimated geographic coordinates based on mode of transport, learning levels, and specific preferences for display.

- **Resources** - Resources include items or information about items that are required to support learners who are participating in learning, education, or training activities and can be divided into the following:

  - content refers to the actual digital items themselves such as text, image, audio, video, and others.

  - content also may involve information produced to improve findability of digital items for educational purposes or to support education in nomadicity environments (e.g., metadata for learning resources, pedagogical information, social tagging, etc.). Resources need to be provided in a manner that is consistent with learner requirements given the learners' contexts and surrounding environments including elements such as current network condition, interface characteristics, device functionality and state, etc.

- **ITLET systems** - These include information technologies that are specifically designed to support learning, education, and training and where learning takes place (e.g., Learning Management Systems (LMS), Learning Content Management Systems (LCMS) as well as numerous Web applications and services that can be harnessed for LET purposes).

- **Devices** - Devices are tools that are used by learners to access resources and ITLET systems. Learners can use devices to access learning services and to manage their learning information and personal information. Devices have to support various functions for learning, education, and training in environments that involve nomadicity. This means that they may be used as input or output devices, as well as appropriate storage devices for offline services.

- **Interface** – As noted in Figure 1 above, interface may involve interactions between the individual learner and the device(s) (User Interface) and interactions between the device(s) and the ITLET system or resources (System Interface). Both User Interface and System Interface involve technologies and tools that are used to connect learners to resources and other systems such as LMSs. User Interface characteristics could include interactions defined by personal preference profiles, optimal use of device screen size, audio and video capability, and other functionalities. System Interface characteristics enable interactions between device and resources (e.g., identification and search functionality for the use of resources that are appropriate or required for an activity), and interactions between device and ITLET system (e.g., recording of test responses, delivery of feedback, etc.) Both User and System Interface have to support various functions for learning within nomadicity. It should be noted that the interface components should (where possible) incorporate the most current information related to human factors research. In addition, accessibility approaches (as suggested in companion International Standards such as ISO/IEC 24751) may be integrated within interface components.

- **Environment** - This includes all information on the location: such as time zone, geographical information (if needed), applicable norms and standards for telecommunication. Information is required regarding technical implementation (e.g., firewalls, usable or allowed ports, bandwidth and any restrictions regarding file size and extensions, etc.). This also includes the technical environment such as wireless environment that is required to support nomadicity. Without adequate infrastructure support all learning, education, and training activities that the nomadic learner tries to engage in will be impossible. This means that the environment is a key consideration for learning within nomadicity. Some characteristics that need to be considered for environment include infrastructure support and availability in current and projected locations. Other considerations include current noise levels and other environmental factors that may impact on delivery modes required by the learner.

6 Description of nomadicity reference model elements

6.1 Learners

6.1.1 Who are nomadic learners?

Nomadic learners are characterized by their way of living and learning. They move between different places out of necessity, as a private lifestyle choice, or to fulfil professional commitments. Examples of nomadic learners are people who work in a variety of occupations (e.g., educators, trainers, learning specialists, salespeople, service people, sports professionals, junior and senior managers in international companies, tourism industry workers, disaster relief and aid workers, military personnel, etc.). Their way of living and learning implies that they move between different environments, unique contexts, and using either their own technologies or technologies and connections supplied at the respective locations. Therefore, the context where learning takes place may be more important than the devices being used.

Nomadic learners should be able to study using learning resources easily without regard to specific place and devices. The resources, the interfaces employed, the ITLET system, the environment, and the unique context of the learner, all can play a powerful role to support learner interactions. All of these elements need to work together in a manner that enhances convenience, communication, and connection to support learning, education, and training activities. For example, learners should be able to check the status of their own

learning processes and to manage their learning effectively while travelling between locations by using devices that allow them to connect to an ITLET system (such as an LMS) and related resources in real time.

The five characteristics of learning for learners who move from place to place are as follows: (Jung, 2004)

- The learner is supported in self-directed learning. The Learner is able to process his or her learning resources and choose the technologies as required. This characteristic focuses on the Nomadicity Reference Model (NRM) components Learner and Resources.

- Devices and User/System Interfaces enable exchanges to take place between Learner and Resources. IT systems that enable LET are ubiquitous enabling the Learner to be able to study anytime, anywhere. This characteristic focuses on NRM components Learner and the Environment with the Devices, with User and System Interface enabling activities taking place between these two components.

- The Learner is supported on demand with instant connectivity. The Learner can study when needed and can resume activities while travelling between different locations with devices set up for network connection whenever and wherever he or she requires. The primary focus is on the Learner and the ITLET System (if used) or Resources (if used). Other supportive NRM components are: Devices, User and System Interface, and Environment.

- Learner personalization is supported. The Learner can select suitable resources to meet requirements depending on the interface functionality (e.g., device type functionality), network condition, and environmental characteristics, etc. The focus for this characteristic is on the Learner. The other components are supportive, enabling personalization.

- Learners can form learning communities easily by interacting with other learners, teachers, and mentors using wireless network connections. The primary focus for this characteristic is on linking the Learner to others through an ITLET system or Resources. Other components, such as Devices, User and System Interface, and Environment are supportive.

6.2 Implications regarding resources for nomadicity

Learning where nomadicity is involved implies that there may be potential changes (e.g., context, locale, environment, technical considerations, etc.). This may impact on learning, education and training resources. Some implications for consideration have been provided below including:

- Resources that are time sensitive, like tests at specific times, may not be suitable if the learner is in another time zone. The same applies to resources required for learning, education, and training activities that are based on collaborative learning efforts or require real time communication between learner and another role-player in the learning process. The main Nomadicity Reference Model components involved here would be Learner and Resources. Environment, User and System Interface, Devices and potentially ITLET system could be involved as well.

- Resources that require certain bandwidth or specific data speed may not be suitable in specific contexts. Environment and Resources would be two of the main components from the Nomadicity Reference Model involved in this case.

- In some cases, there may be restrictions on the timeslots available by the nomadic learner. For example, students, who are professional sportspersons participating in a contest or a show event or military people, serving abroad, may have strict schedules. So the duration of a learning unit may not exceed the duration of these timeslots. Additionally, it may be helpful if interactions can be resumed at the same point where learners had to discontinue their activity at a previous point in time. Another restriction may be that the resources the learner needs are available only at given times by the supplier in the specific environment (e.g., open or business hours, etc.). Here Learner, Resources, and Environment are key Nomadicity Reference Model components. The other components potentially may play supportive roles.

- Resources that require specific input or output (e.g., for technical subjects or language training), may be more challenging, or may not even be transferable over different points in time and from different locations. The primary focus would be Learner, Resources, User Interface, and Devices with ITLET system and System Interface playing supportive roles.

Resource developers and delivery systems for nomadic learners need to consider these implications and specific solutions may be necessary.

6.3 ITLET systems for nomadicity

Learning within nomadicity also places unique challenges on ITLET systems. About ITLET systems for nomadicity, there are further requirements such as:

- Participant's information data should include the 'nomadic' aspect. Schedules that provide logistical information regarding the participant may vary over time and this information may be very useful. For example, mobile phone connections may require phones that follow a regional standard or the use of another phone number. Roaming is very expensive, so the use of a local network may be advisable for the learner. Nomadicity Reference Model components that are key would be Learner, Devices, ITLET system, and Environment.

- Participant's information may be even more important when consideration is given to collaborative forms of learning that are being used more frequently and may require specific information related to nomadicity. Information on the location of a learning partner may be made public to other learners as well[1]. In this case, privacy may be a concern that needs to be addressed; however, specific implementation recommendations related to privacy are outside the scope of this Technical Specification. Learner and Environment, and ITLET system are three components from the Nomadicity Reference Model that would be relevant.

- The participant may be forced to use devices or user surfaces (e.g., keyboards (Qwerty or Azerty), signs, foreign language instructions) that he or she has not used before. This may hamper learner interactions when the learner engages in learning, education or training activities. Learner, Devices, and ITLET system would be three important Nomadicity Reference Model elements in this case.

- The ITLET system such as an LMS has to record the technical context, where the participant is working from, and has to deliver the resources in a didactical and technical format, so the learning process is not interfered with. Here Learner, ITLET system, and Environment are key elements from the Nomadicity Reference Model that may impact on learning.

- The inclusion of the student in collaborative forms of learning (for example, in a virtual classroom) may depend on factors such as the learner's time zone, learner's availability at a given time, etc. In this case the Nomadicity Reference Model Learner and ITLET system components would be key considerations.

- The ITLET system, such as an LMS, has to store the resources that could not be delivered due to the restrictions of learning within nomadicity and should offer them automatically, as required by the learner (either at the same point where the learner left off or at a point chosen by the learner) when the context allows. Resources, ITLET system, Environment, and Learner are Nomadicity Reference Model components that need to be considered in this situation.

In some countries, research is ongoing regarding integration of ITLET systems using emerging technologies, such as using LMSs, to support u-learning in ubiquitous environments (e.g., Yun Gyu Kim, 2007). More information on this is provided in Section B.4.

1) For the growing importance of collaborative learning have a look on: http://christytucker.wordpress.com/. Chris provides a very interesting blog on developments in e-Learning.

6.4 Devices for nomadicity

A nomadic learner needs adequate interface support while using portable digital devices, tools, and technologies with available wireless networks for their learning, education, and training activities. For example, a nomadic learner may need to use a combination of different mobile devices (e.g., Personal Digital Assistant (PDA), Tablet PC, Ultra-Mobile PC (UMPC), Smartphone, portable multimedia player (PMP), etc.). These smaller devices may allow for input using different methods (e.g., display screen with touch input, miniature keyboard, voice, etc.). Each device has various interface functionalities and thus may impact on the learning, education or training activity in different ways. It is essential that designers, developers and others involved in planning, implementing, and evaluating the impact of devices be aware of the various interface capabilities of these differing devices. Also, information regarding how these devices are being used or may need to be used should be provided to the manufacturers of these differing devices

In addition to mobile devices, there are various other devices, tools and technologies that can be used to support learning within nomadic contexts. It is possible that a nomadic learner has an advantage when carrying his or her own device, but this is not always the case. The nomadic learner also may use appropriate devices, tools, and technologies supplied at the learning location by a third party.

6.5 Interfaces for nomadicity

To connect the learner to his or her changing environment, specific interfaces will be used. The purpose of the interface is to close the gap between the environment, the ITLET system used and the specific device the learner is using or has to use.

1) Administrative interface

This has to provide the necessary data to login within the specific environment and involves

- connectivity
- encryption information
- device identification
- necessary identification systems and data-support systems
- integration into the local ITLET system (e.g., LMS system) (if necessary) - localization data
- content management system (Resources) to build learning units

2) User interface

- easy installation wizard
- software check (to ensure all necessary software is available to perform the learning, education or training activity)
- online and offline routines so that it is possible to get access to learning units for situations where internet access is not available (for example please refer to United States use case in Appendix D)
- learner data, such as learner's progress, schedule, tests and other tasks to perform and group integration
- download of bandwidth intensive resources like films and large images
- providing a comfortable platform to choose learning units out of a “catalogue”, and so on.

This interface may be part of the learners’ tools (see also: Appendix C).

6.6 Environment supporting nomadicity

Existing and emerging information technologies may be used to make the learning environment ubiquitous and to support learners within nomadic contexts. Currently, implementations of these environments are being studied or researched in different countries. For example

- Information may be used to identify or track items (e.g., landmarks, art, products, etc.). The information may be stored and retrieved remotely (e.g., Radio Frequency Identification (RFID), Google Maps for Mobile, Google Goggles, etc.)

- Environments may be developed to support the use of high speed internet from anywhere at anytime to offer various functionalities, such as telephone broadcasting, internet, educational resources, games, and email, when needed by the learner (e.g., Wireless Broadband (WiBro) being developed by the South Korean telecom industry, offers telephone broadcasting, Internet by TPS (Triple Play Service)).

  - Buildings (e.g., residential, commercial, industrial, etc.) may be provided with ubiquitous networking systems that are designed and developed to enable data transfer between devices as needed to increase efficiency, effectiveness, and convenience.

  - Specific regions (such as cities and regional corridors) may have enhanced services that provide appropriate data and information automatically dependent on user-determined preferences (e.g., U-City).

- A suite of specific technologies and devices may be provided in order to perform specific functions (for example an 'e-bag' used by children from nomadic families and is equipped with devices that detect the learning environment via Bluetooth automatically and connect the students to the needed resources like access points, printers, libraries, etc.)

- Mobile context aware hyper media systems can provide enhanced and augmented experiences to support learning, education and training (for example information may be supplied on any enabled device to support learner interactions with museum displays and so on).

6.7 Some additional considerations to support nomadic learners

When considering teaching and learning to support learners' nomadicity, the following considerations should be noted:

- **Variability in Learners, Environments, Devices** - Due to the transitory nature of learning within nomadicity, the relativity of specific place and specific device may be variable over time. In some instances, environmental characteristics may become more dominant, while in others the interface limitations of the specific device may become more important. Additionally, two learners in the same environment may have completely different requirements to support their learning. The learner can study using various interfaces including mobile devices, within different environments such as ubiquitous environments, and using different connections. For this characteristic, it should be noted that any single element within the nomadicity reference model or any combination of elements may dominate during a learning activity. For example, learner preferences may predominate in a noisy environment in which different learners have requested alternative media to support their learning. These resources in turn may place different requirements on the user interface and the system interface and be constrained by the functionality of the devices being used by the respective learners.

- **Pull/Push Service** - Learning where nomadicity is involved may necessitate either pull service or push service. If infrastructure is adequate and environmental conditions are favourable, it is possible that pull service can be converted into push service. For example, if the learner can connect to the internet at all times, then the learner may not need to look for any devices and places in order to use the internet. The learner should also be able to access suitable learning materials at their level from an ITLET system such as an LMS. This characteristic may be applicable to all technical elements that support the pull/push service (e.g., ITLET system, system interface, etc.), However, it is

essential that first and foremost the system needs to support learner preferences for push/pull service.

- **Flexibility** - There needs to be flexibility in order to allow for the appropriate level of learning guidance and to offer ordered information from component level information like mobile device delivery methods to other types of information like learning level, feedback, etc.

- **Communication with others** - The learner should be able to communicate with other learners, teachers, and mentors conveniently while mobile.

- **Regular recording of information** - Pedagogical information and data that is being gathered during learning within nomadicity such as achievement of the learner, learner's response, etc., should be recorded regularly to avoid interruptions to service. The information and data gathered will allow the system to offer teaching and learning methods appropriate to various levels and requirements of different learners.

- **Feedback** – Learners and others (e.g., instructors) may need to receive and respond to feedback on any information regarding the teaching-learning process at anytime from anywhere.

- **Mobility and portability** - Mobility (one of the features of a nomadic environment) and portability may impact on learning and will need to be managed effectively and efficiently to enhance convenience, communication, and connection.

7 Relationships among the model elements

In Figure 1 above, each element and the relationships between the elements for the Nomadicity Reference Model are introduced. These elements or components include different parts that must work in a coordinated and seamless manner. Additional information regarding the relationships among the different components is provided below.

Learner and Device - Learner can get information using interfaces provided through devices, tools, and technologies and access learning resources, data (personal, general) from the ITLET system (such as an LMS). In addition, learners can transfer their own data to be saved in an ITLET system (e.g., an LMS). So, device should be designed by considering the resources required, potential environments, specific contexts; and, most importantly interfaces need to provide learners with convenience, communication, and connection.

Learner and User Interface - Learner can use various devices and access resources through various interfaces, which should be designed by considering personal preferences, accessibility, and privacy of learners.

Interface and ITLET system - The role of interface is to support learner interactions with ITLET systems. Data, orders, and preferences are received from learners and are transferred through the System Interface to the ITLET system. The ITLET system (such as an LMS) also delivers data to learners through the User and System Interface that connects to Learners who are using Devices Interfaces and ITLET systems should be designed while considering several things such as data transmission protocol, connection conditions, etc.

Interface and Resources - Resources are offered to learners through an interface that is used by a device to interpret learner requirements. Therefore, resources should be designed and developed considering various conditions that impact on the interface used by the device, tool, or technology such as network speed, screen size, etc. In addition, interfaces should be designed so that interactivity may be enhanced between learner and resources, as interactivity can impact the effectiveness and efficiency of learning, education and training activities.

Resources and ITLET system - Resources should be developed and described using standardized metadata in order to be more effectively and efficiently managed and to enhance sharing and interoperability with other systems.

Environment and Components (learner, device, interface, resources, ITLET system) - All components can be impacted by environmental considerations such as infrastructure and context.

Annex A
(informative)

Use cases of nomadicity in e-learning in Germany

A.1 Title

Wellness und Gesundheitstrainer (STB)- trainer for wellness and health (German sports association) - tertiary education (vocational training).

A.2 Players

Students (adults), teacher, trainer, tutor, stakeholder: Sports Association (STB).

A.3 Definition

Nomadicity is a type of lifestyle, either private or professional, where the learner changes context of learning (spatial, temporal) in a more or less unpredictable way.

A.4 Description

STB is offering vocational training to students all over the state of Baden-Württemberg. Several are professional or semi-professional athletes, who for competition reasons are moving quite frequently during the season (also internationally). Their time schedule is not predictable, since it depends on competition schedules and the success of the individual student at the single competition. The course is of a blended learning type, where the e-learning parts are to be delivered during the season.

We use WBT, Chat, virtual class-room (fixed times), fixed time-slots of 24 hours duration for test and examination.

The course is certified (ISO 9001), so funding by public authorities is possible.

A.5 Context

Different types of devices (sometimes there is an Internet-facility on the stadium, sometimes we have WAN, sometimes we have to rely on very poor ISDN-connections).

Different time-zones to cover.

Very variable learning times.

A.6 Problems encountered in e-learning for nomadicity lifestyles

A) technical

- Connectivity - very important during tests and examination ii. Bandwidth
- Technical problems with Modems and similar devices, often in connection with UTMS

- Every kind of problems connected with the use of internet, Trojans, worms, denial of service attacks and so on
- The students often lack the capability of dealing with even the simplest of problems (computer literacy) in IT. So a very expensive system of technological support has to be maintained. The most used way of contact to this support is by phone.

B) Teaching problems

- Need for support (tutorial) at very varying times
- Really high differences in learning achievement, due to differing time availability, really hampering collaborative work
- Motivational problems (feeling 'alone'), which could be solved (partly) by fixed, regular sessions within the virtual classroom
- Testing is very difficult, due to different devices

A.7 Data - tables

3 courses up to now (A fourth has started autumn 2009 with 16 students up to now.

App. 40 students, age from 20 to 45

Annex B
(informative)

Use cases of nomadicity environment in Korea

For adapting nomadicity environment in school, we should consider various conditions such as infrastructure like wireless network and policies about education with nomadicity, etc.

B.1 Education infrastructure

When ubiquitous infrastructure comes true, nomadicity will be available.

Following are items and roles related infrastructure for adapting nomadicity in school.

- Learning Management System - To manage lecture, test, curricula deign, subject counsel and others
- Education Information System - To manage teachers' work, facilities of school and others related school operating
- School affairs system - To manage and save learners' personal data and learning data
- External education infrastructure - Infrastructure that learner can use their study such as museum, library, public offices, etc.

B.2 Organization and policy

Learner can use learning resources of school as well as outside of school, because learner can access resources anywhere with portable devices and wireless network. Education area will expand more and more.

- Teaching-Learning activity organization - To manage and make activity group of various learning, learning activities after school and connect between school and social networks

- Teaching-Learning study organization - To research and study on teaching-learning method and learning resources

- Educational administration organization - To manage school administration, to plan school curricula, etc.

- School affairs management organization - To manage school affairs such as learners' grade, teachers' activities, etc.

B.3 Human resource

Human resource refers to those people who are able to help so that learners can use ubiquitous school environment effectively.

- Instructor - Instructors who do teaching-learning activities in school within nomadicity environments. They must have competency related to nomadicity

- Learner - Learners who study within nomadicity environments to access content and achieve learning outcomes

- Assistant instructor - Instructors who support teaching-learning activities

- Promotion of learning – People who help with educational policy and promote teaching-learning activities can be supported in nomadicity environments
- Administration – People who carry out school administrative functions
- Parents of learner – People who take care of learners and support learners' studies
- Mentor – People who support learning and activities as a coach or mentor
- Experts – Those involved in the research and improvement of teaching and learning within noamdicity environments

B.4 u-Learning Support System

A u-LSS (u-Learning Support System) is defined as a system that provides learners with learning opportunities in a ubiquitous environment so that they can learn whenever and wherever they want. The main beneficiaries of u-LSS are learning services providers and learners. In order to support ubiquitous learning, the system was developed in a way that not only operates within a unit school but the entire learning space where access is guaranteed.

The basic framework of u-LSS is composed of six sub-systems:

- teacher support system;
- learner support system;
- administrator support system;
- information support system;
- collaboration support system; and,
- customization support system.

The six sub-systems of u-LSS and functions of each subsystem are described in Table 1.

Table 1— Six sub-systems of u-LSS and their functions (example)

Sub-system	Functions
Teacher support system	- assignment - teacher training, teaching methods - my page - prerequisite learning management - teaching materials management - scaffolding - statistical analysis support - assessment support - feedback, classroom facility management - learner management
Learner support system	- assignment - information on subject matters - surveys - reflections, scaffolding - my page - assessment - learning, learning materials, learning styles

Sub-system	Functions
Administrator support system	- posting on BBS - teaching & learning status management - teaching & learning facilities management - regulations & data management - user authority management - distance support - resources management - information security and management - contents & portal site management
Information support system	- digital data library - item bank for assessment - learning materials per subject matter - edutainment software per subject matter - digital library - metadata search - sharing best practices
Collaboration support system	- messenger & blogs - forums & discussions - after-school group teaching - Q&A - learning communities - coaching, feedback - counselling on learning - video conferences & chatting - presentation - shared whiteboards - offline support for team activities
Customization support system	- revising and adding assessment items - data sourcing, statistics - producing presentation materials - writing reflection journals - making scaffolds - supporting knowledge DB - remanufacturing resources - creating teaching & learning processes - utilizing tools

Annex C
(informative)

eSchoolbag

An electronic schoolbag is also an important component in building ad hoc classrooms. An eSchoolbag consists of a number of components, such as the electronic book, parents' contact book, pencil case and can be accessed through a notebook computer or PDA. The key point is that this e-schoolbag connects automatically to any environment where the student is located, so that it can provide the student with access to additional services (printing, libraries, and so on) without the need for him/her to perform complex actions. In the eSchoolbag project, they present a vision for school work where everything is done through the PDA, from reading and doing exercises to communicating with the students' parents. While this eSchoolbag project supports the idea of making digital information accessible outside of the classroom and on the move, it should also be emphasized that supplying the students and teachers with a range of technologies to support school work is important.