Hybrid Learning Cloud Platform with Private Cloud Platforms and Public Cloud Platforms for Smart Learning

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Nowadays learning contents for e-learning have various types and formats of multimedia, and get bigger. Especially learning contents, as like as big data(e-mail, computational data for medicine development or astronaut, movies, etc.), require high quality of delivery service, high bandwidth, big volume of storage, and high computing capacity for contents play. Learning access system(learning devices operating system, learning contents play application, etc.) and learning support system(LMS, LCMS, and student affair system) require periodically maximum computing capacity at the midterm, final term, and applicationfor admission. But university governmentcan not afford and do not need to develop new IT systems only for midterm, final term, and application for admission, since the peak usages of the system are not so long and cost of new IT system development is too big. But, in order to share learning contents with other university and other educational institutes, semantic and syntactic search, format adaptation and modification for learning contents should be support and adjustment of learning sequencing should be support for various learning environment such as learning devices types, learners' learning properties, learning capacities. For learning interests, game-based learning contents could be delivered to learners. Lastly, learning support systems should trace learner's learning activities and delivers statistics analysis for learner's learning activities in SNS, exams, home works, reacts of learning contents. Thus, due to the above reasons, capacity of learning access system and learning support system should be flexibly managed.

For the flexibility and the expandability of learning access system and learning support system, we propose hybrid learning cloud platform that can support learning service infrastructure and flexible learning service environment with private cloud platform and public cloud platform.And our proposed hybrid learning cloud platform combines public cloud platform for flexible IT system capacity with private cloud platform forinternal services for secure educational data and secure electronic documents. In order to combine public cloud platform with private cloud platform, we propose hybrid cloud server that supplies development environment for developers with data access API between public cloud platform and private cloud platform.Ordinarily private cloud platform is not open to other users and does not supply outer users with virtual organizations(resources). In contrast, public cloud platform is basically constructed for offering social computing resources to other users. Thus hybrid cloud server performs a role as a bridge between private cloud platform and public cloud platform.Services built on public cloud platform can be accessed and used by users who have usage contract with private cloud platform. Thus learning contents provision services, learning contents adaptation services, game-based learning contents services can be offered by public cloud platform. Learning contents provision services delivers learning contents to learners through wired communication and wireless communication. Learners can receive learning contents with desk-top computer, smart phones and tablet computers.Learning contents provision services guarantees quality of learning contents delivery services with physically distributed learning contents provision services providers on public cloud platform.Learning contents adaptation services modify and adapt learning contents for learning preferences and learning devices resource characteristics as like monitor size, kids of input tools, CPU capacity, main memory size, etc..Learners can receive modified and optimized learning contents according to learning environment(learner's learning preferences, monitor size, kids of input tools, CPU capacity, main memory size, etc.). Sometimes learner's physical learning conditions(blinds, deaf, etc.) could be considered by learning contents adaptation services, that modifies learning contents for handicapped learners. Learning contents adaptation services guarantees personalized and optimized learning contents for learners.game-based learning contents services manage and deliver game-based learning contents. Learners shouldplay and complete each learning stage that is made according to learning progress. After completing each learning stage, learner is granted learning rank.Game-based learning contents server are distributed on public cloud platform.
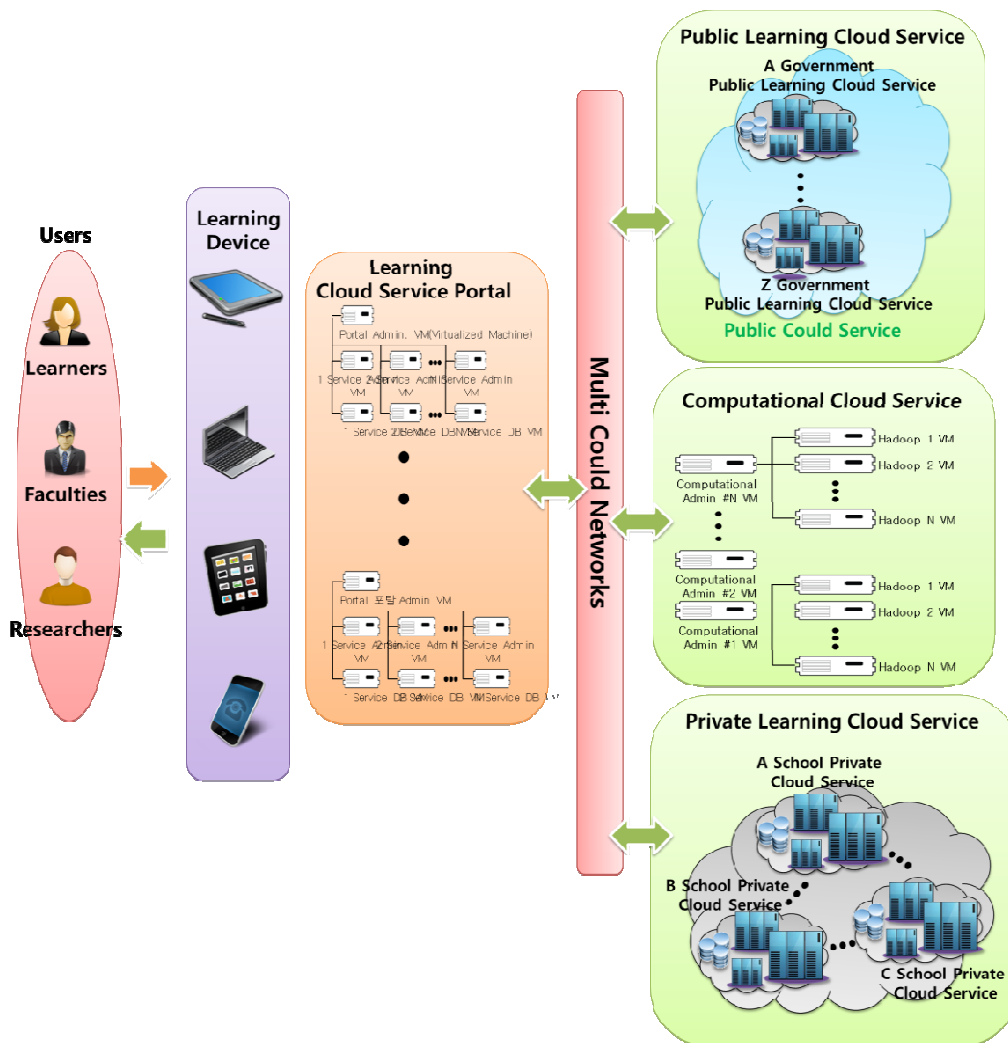
Services built on private cloud platform can be accessed and used by only users who have permission for services on private cloud platform. Thus intelligent automated tutoring services, learning activity tacking services, SNS analysis services are offered by private cloud platform, since they manipulate learner's personal information. Learning activity tracking services traceand gather learner's learning activities, and statistically analyze the gathered learner's learning activities. The statistically analyzedinformation could be used for automated feedback to learners, and is private so that should be managed securely. Intelligent automated tutoring services are support personalized learning environment, as like personalized learning feedback. Intelligent automated tutoring services use learner's statistically analyzed information, learner's learning preferences, and learner progress and competency in order to send personalizedlearning feedback. SNS analysis services trace and gather learner's SNS activities, and statistically and semantically analyze the gathered learner's SNS learning activities. The statistically and semantically analyzed information could be used for personalized learning guide and automated feedback to learners, and is private so that should be securely managed.

Learning cloud platform architectureis shown in figure 1. Hybrid cloud server performs learning cloud portal. Learning cloud portal authenticates and authorizes users, and maintains services and users' information. And each organization and university can build their own learning portal for their students, faculties and researchers.

And learning cloud portal can be accessed by various mobile devices and desk-top computers.
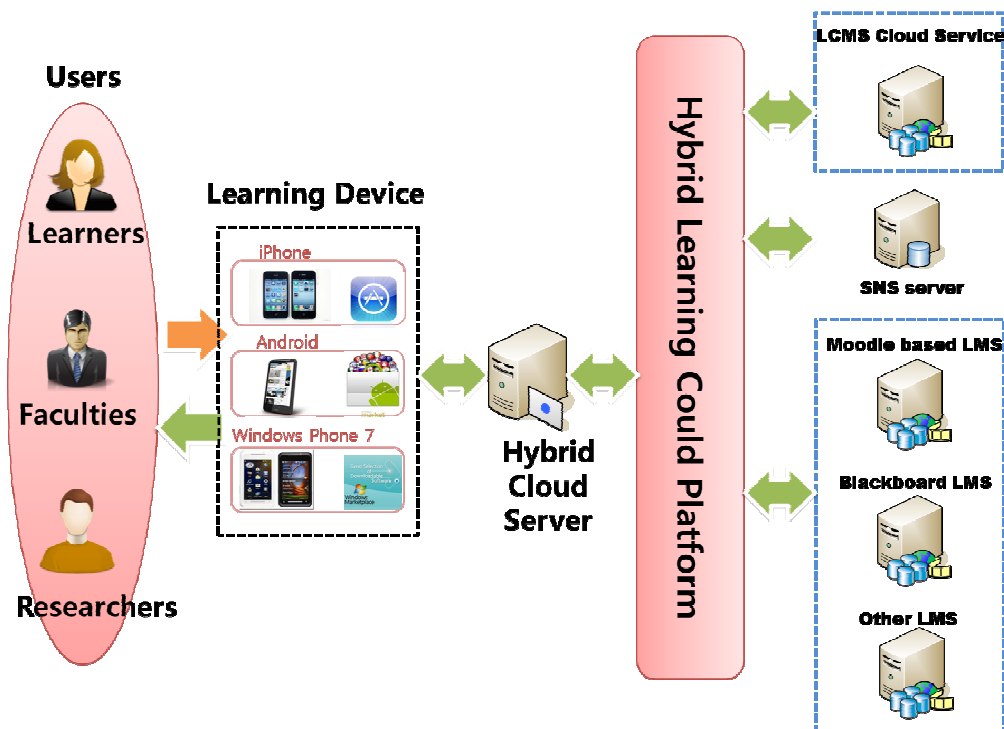
Students, faculties and researchers view hybrid learning cloud platform as a stand-alone web based services as like figure 2. Students, faculties and researchers access to hybrid learning cloud networks, grant permission from learning cloud portal(hybrid cloud server) and consider various learning cloud services as stand-alone system.

Students can be offered e-mail service, web based word manipulation(documents editing, presentation slides editing) service, recorded lecture watching service, home works submission service, class scheduling service, etc.. Faculties can use LMS as class management service, home works management service, notification and feedback service, etc..Researchers can use research documentations sharing service, peer communication service, etc..
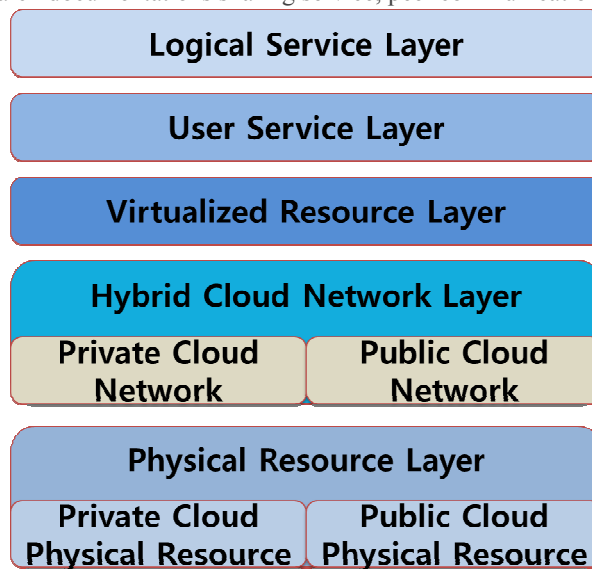
Hybrid learning cloud platform architecture consists of logical service layer, user service layer, virtualized resource layer, hybrid cloud network layer, and physical resource layer. Logical service layer is a view of users(students, researchers, and faculties). Learning cloud service users consider all services as stand-alone system, and need not to know 'where services come from' or 'who support services'. In user service layer, learning cloud portal is managed, and virtualized resources are assigned to each service. Each service and assigned virtualized resources should be

managed for fault tolerance, SLA and QoS. Virtualized resources layer virtualized various type of resources(CPU, memory, storage, Network connector, and etc.). In hybrid cloud network layer, hybrid cloud server manages connection and service relay between private cloud network and public cloud network. In physical resource layer, each community as like universities, or institutes build their own cloud resources and manage their own cloud services.