



# Course Planning and Scheduling: Getting Started

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## Introduction

This is brief guide to the Course Planning and Scheduling (CPS) specification from IMS Global. The guide explains what CPS is, the problems it solves, and how an organization would start implementing their CPS solution.

## What is Course Planning and Scheduling?

Course Planning and Scheduling (CPS) is an application profile of the Learning Information Services (LIS) specification from IMS Global. CPS has been developed by a

consortium of industry leaders in the Student Information and Planning and Allocation disciplines.

As resources and space are at a premium in educational institutions it is important that classrooms and equipment are used optimally. The Planning and Allocation System (PAS) specializes in optimizing the use of rooms and resources. The PAS contains information about the size of rooms, the best use of rooms (e.g. not putting a lecture into a laboratory), and the locations of rooms. A PAS system is typically used by an institution to ensure that rooms are allocated to classes sensibly. For example, a class with 10 people should not be placed into a lecture theatre that seats 150 people, or making sure that the rooms for a 9am lecture and a 10am lecture are not 5 miles apart.

The Student Information System (SIS) contains data about students, courses and enrolments. The SIS typically does not know about the sizes of classrooms or where course sections are held. An SIS keeps track of the course sections and the students who are enrolled in them.

Previously, there was no standard way to share data between an SIS and a PAS. In the past, administrators in the institutions use spreadsheets, “cutting and pasting”, and manual rekeying to move information from one system to the other which is a tedious and error prone process.

Utilizing CPS can ease this process, by presenting a mechanism where information can be shared between SIS and PAS.

In addition to room and resources allocation, CPS provides a service interface to allow end users to access personal schedules, either for themselves or for rooms and resources.

## How Does My Organization Implement CPS?

Implementers should make sure that they understand the Learning Information Services (LIS) specification. Details on the specification can be downloaded from the IMS Global website, at <http://www.imsglobal.org/developers/lisalliance/specification.cfm>

In particular, CPS is built upon the Bulk Data Exchange Service, as well as, live services for membership, course sections, section associations, and course offerings.

The Event service interface, which allows end users to access their scheduling information, as well as scheduling information for rooms and resources, requires knowledge of the iCalendar specification, at <http://www.ietf.org/rfc/rfc2445.txt>

When planning to implement CPS, an organization should follow a sensible workflow, such as:

- Obtain the documentation

- Read and understand the documentation
- Check all of the technical files (WSDLs, VDEX vocabs, etc.)
- Join the relevant IMS Global alliance (LIS in this case)
- Develop your code
- Ask questions / collaborate
- Refine your code
- Test your code with the IMS Certification Test Suite for CPS
- Submit for IMS conformance
- Release your code

LIS is a web service bound specification, using Simple Object Access Protocol (SOAP) to send point to point messages between systems. The LIS services are described in Web Services Definition Language (WSDL), and the WSDL files are published by IMS Global as part of the specification documentation.

CPS builds on LIS by using the same services, but also extends those services by adding extra information to the data model. CPS extensions are defined in VDEX files which are part of the specification documentation.

The precise mechanics of development methodology are beyond the scope of this document, and there are many approaches (agile, waterfall etc.). Likewise, given the wide range of languages which support web services, it is not appropriate for this document to make recommendations on specific libraries or technologies.

## **Which LIS Services Need to be Implemented?**

The precise services which are required will vary depending on the type of system that will utilize the CPS.

However, the backbone of CPS is the Bulk Data Exchange service. Both SIS and PAS need to implement Bulk Data Exchange, although the data that both will send is different.

For full details on the Bulk Data Exchange Service, refer to the LIS documentation. This section will assume a passing familiarity with Bulk Data and all other LIS services.

The SIS will need to be able to make Bulk Data announcements to the PAS. The bulk data that the SIS will transfer relates to People (students and faculty), course offerings

(a 'shell' course, bound by a timeframe, but still needing classes (sections) created for it), groups (to describe the academic session), and crucially, memberships (describing the pre-enrolment choices of the students).

The SIS will need to be able to receive the bulk data report back from the PAS. Thus, in LIS terminology, the SIS needs to be able to act as a Bulk Data Reference Agent, and the PAS as a Bulk Data Synchronization Agent (see below for more information).

The PAS will then go away and calculate optimal scheduling. This will take some time.

The PAS will then need to be able to make Bulk Data announcements to the SIS. The bulk data that the PAS will transfer relates to Course Offerings, Course Sections (actual classes), Section Associations (the relationships between classes), and memberships (showing the actual enrolment into the offering and sections).

The PAS will need to be able to receive the bulk data report back from the SIS. Thus in LIS terminology, the PAS needs to be able to act as a Bulk Data Reference Agent, and the SIS as a Bulk Data Synchronization Agent.

The net effect of these two statements is that BOTH the PAS AND the SIS need to implement Bulk Data Exchange in BOTH directions – i.e., they need to both be capable of receiving bulk data, and sending bulk data.

## **Live Services for the PAS**

The PAS is also required to implement two “live” services.

1. The LIS Membership Management Service, which needs to be able to listen for changes from the SIS, as students use the SIS to switch between courses.
2. The Event Service, which is unique to CPS, and allows users to query for timetables (either individual, or for rooms / equipment).

## **Live Services for the SIS**

The SIS is required to implement three “live” services.

1. The LIS Membership Management Service, which needs to be able to listen for changes from the PAS, as students use the PAS to switch between courses.
2. The LIS Course Section Management Service, which needs to be able to listen for changes from the PAS, as it creates new classes in response to Student Demand.

3. The LIS Section Association Service, which needs to be able to listen for changes from the PAS, as it describes changes to the relationships between course sections due to changes in student demand.

As noted previously, implementers of CPS need to be aware of the extensions that have been added to the data models. The extensions were added to provide richer functionality to LIS. The extensions are described in detail in the CPS documentation, but here is a sample:

- **MembershipType:** This extends the Membership Record to indicate if an enrolment is a pre registration “intention”, or a “scheduled” enrolment onto a course.
- **SectionType:** This extends the CourseSection Record to introduce a vocabulary to describe the type of a class, e.g., a Lecture or Tutorial.
- **AssociationType:** This extends the SectionAssociation Record to describe the type of an association between sections.

The other extensions are related to delivery rules, which are explained briefly:

A delivery rule is a mechanism whereby the PAS can describe to the SIS some logic to allow changes to be made to enrolments. When students wish to change from one class to another, there can often be an impact on other classes. For example, where a professor teaches a lecture but also wishes to teach the same students in a seminar. If a student decides to register for the lecture, the SIS also needs to know to register the student for the seminar as well.

The delivery rule mechanisms cut across course offerings and course sections, and are typically codified in the section associations. An offering will have a number of possible configurations, and each course section corresponds to part of a configuration. The associations then detail the other course sections which depend on that “parent” section.

PAS implementers will need to know how to create the delivery rules for the courses that they schedule.

SIS implementers will need to know how to honor the delivery rules, so that classes do not become oversubscribed, or students remain enrolled on courses that they do not intend to participate in.

## Testing

Testing an implementation for conformance to CPS is done via software provided by IMS Global. This software will check that the PAS or SIS is capable of sending and receiving the bulk data messages, as well as addressing the live services. The software asks what type of system is being tested, and then runs automated tests. There are also

some manual tests, described in scripts, that implementers will also need to run in order to pass conformance certification. All details for CPS testing are available in the Learning Information Services Alliance.

## **Conclusion**

Full information can be found in the LIS and CPS specifications. Implementers are strongly urged to join the LIS alliance for further help and to network with peers.