

## Student Scheduling in UniTime



UNITIME November 2016

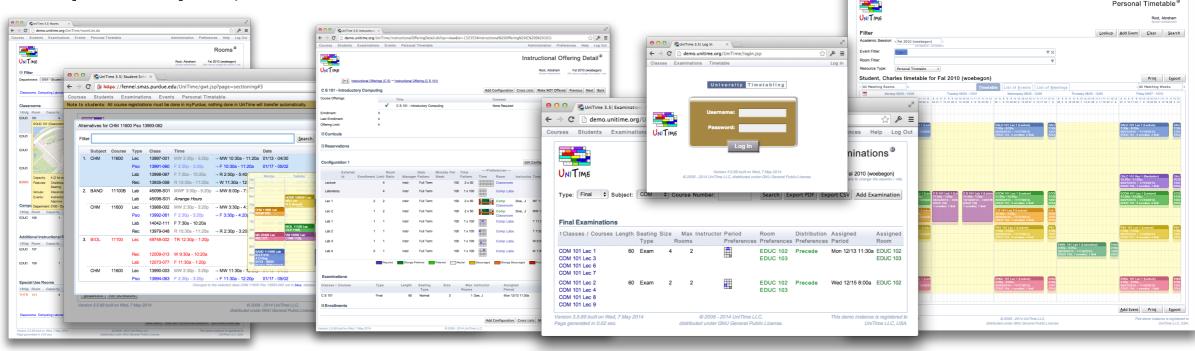
Tomáš Müller





### What is UniTime?

- Comprehensive academic scheduling solution
- Four components: course timetabling, examination timetabling, student scheduling and event management
- Open source, web-based, written in Java using modern technologies
- Using state-of-the-art optimization algorithms
- Distributed data entry and timetabling in multi-user environments
- Apereo project since March 2015





# Student Scheduling

#### What is Student Scheduling?

• Enrollment of students into classes in a way that maximizes the ability for students to get the courses they need

### Why needed?

- To ensure that students will be able to get the courses they need in a multi-section environment
- Students who come early may block later students from being able to get the courses they need
- Getting a workable schedule can be a tedious process for a student

#### Goal

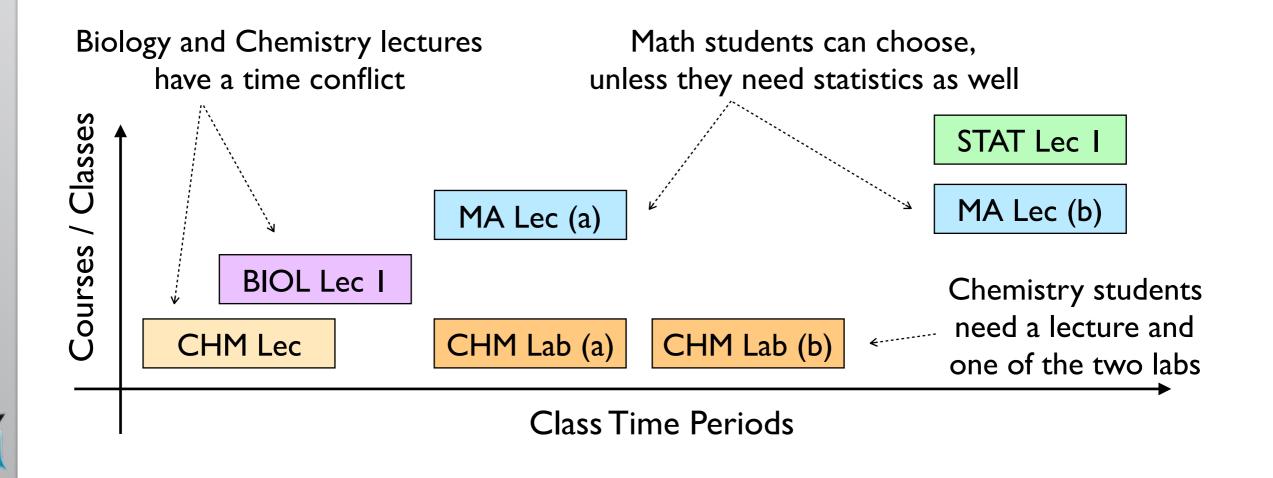
- Student fills in course requests, including alternatives, free times, etc.
- System provides a schedule that meets student needs
- Students have the ability to modify their schedule



# Why needed?

#### A student cannot take a combination of courses

- Because there is a (time) conflict
  - Classes are offered at overlapping times or one after the other in rooms that are too far apart
- Or, there is not enough space in a non-conflicting combination of classes

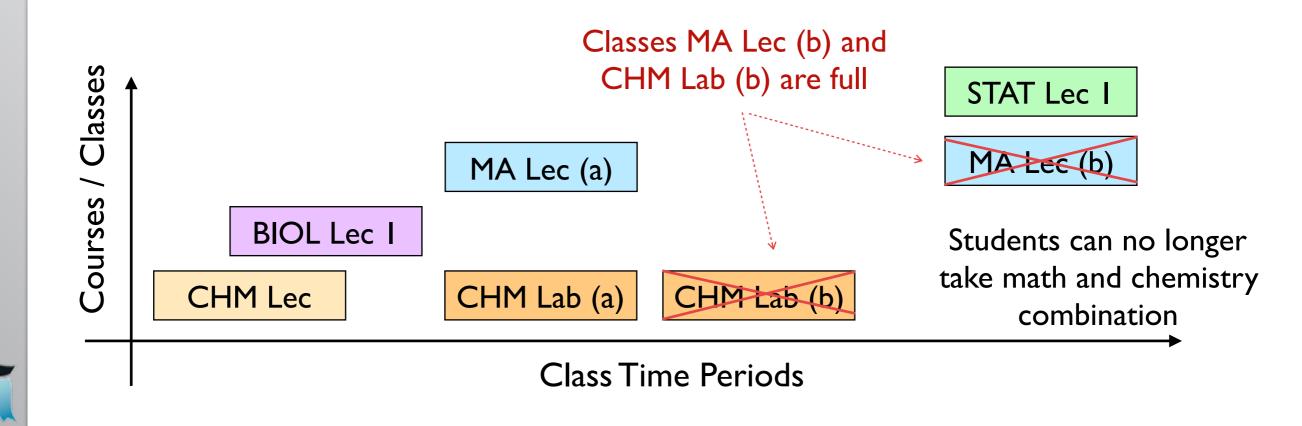




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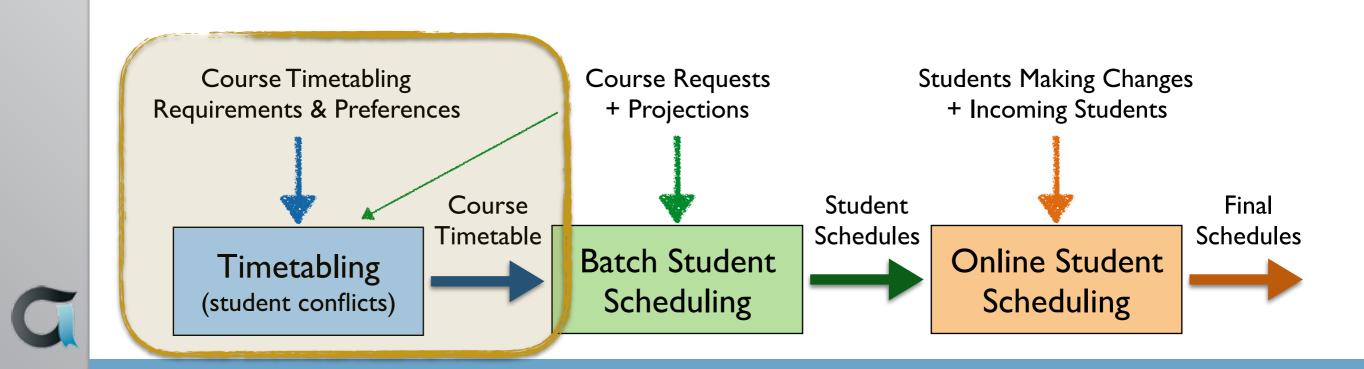




# Student Scheduling Process

## Step I: Course Timetabling

- Minimizing student conflicts together with faculty preferences
  - Last-like student course enrollments
  - Curricula (e.g., list of courses for each program and year)
  - Courses Requests (pre-registration)
  - A combination of these

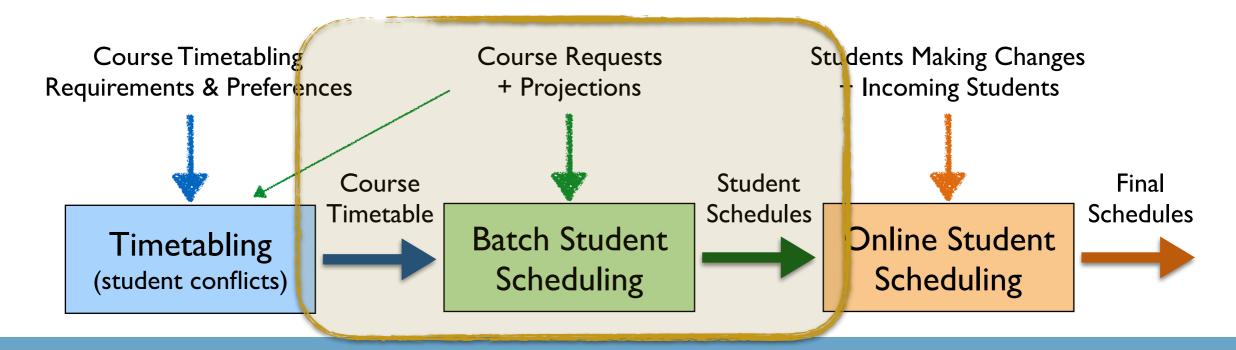




# Student Scheduling Process

### Step 2: Batch Student Scheduling

- After a timetable is produced
- Using pre-registrations and student course demand projections
- To provide students with initial schedules
- An optimization process, using the (student scheduling) solver
- It is possible to iterate
  - With the ability to keep already enrolled students unchanged or to minimize changes

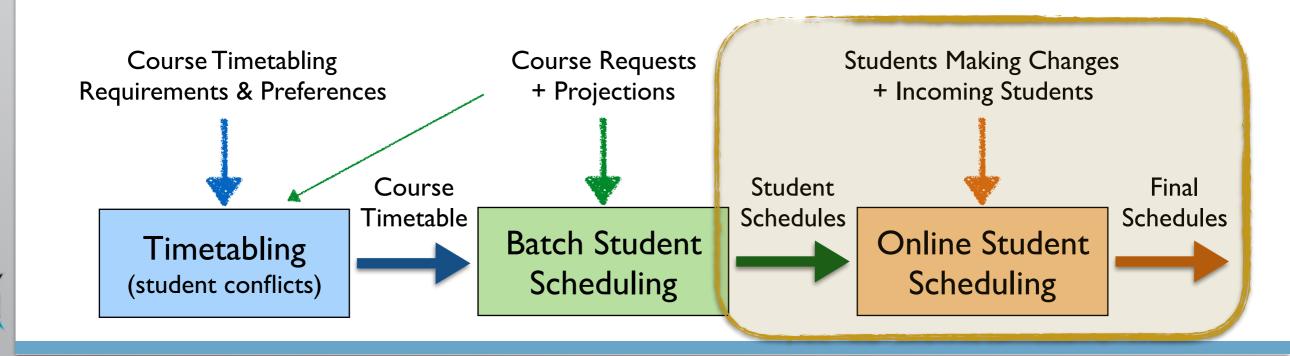




# Student Scheduling Process

## **Step 3: Online Student Scheduling**

- Students without pre-registration can enroll online (incoming freshmen and students that did not register)
- All students can make adjustments to their schedules
- Automatically reserve space in sections based on projections
- Solver provides suggestions
  - Ordered by their quality, with the ability to filter through





# Course Requests

#### **Course Requests**

- Each requested course can have up to two alternatives (or it can be wait-listed)
- There can also be additional alternate course requests to get the desired number of courses Student Scheduling A
- There can be free time requests in the list

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## Course Requests



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## Course Structure

#### Classes are organized in a course structure

- Intuitive data entry and display of classes and their requirements
- Helps to define a way how students can enroll into the course
- Additional relations can be derived from the structure
- Used to build a class timetable

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Recitation	40	Full Term	100	1 x 100		THTR		
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Lab 1	10	Full Term	150	3 x 50		EDUC CompPr	Same Room	Smith, John Willia
Lab 2	10	Full Term	150	3 x 50		EDUC CompPr	Same Room	Smith, John Williar
Lec 2	20	Full Term	50	1 x 50		ThtrSeat Classroom		Newman, George
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Lab 4	10	Full Term	150	3 x 50		EDUC Comp CompPr	Same Room	Doe, Joe
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Configuration 2 (DO)	10							
Distance Learning	10	Full Term	250					



# Student Enrollment

#### Student enrollment into the course

- One class of each instructional type (subpart) of a configuration
- Follow the nesting relations, if defined
- No time and limit conflicts, respecting reservations

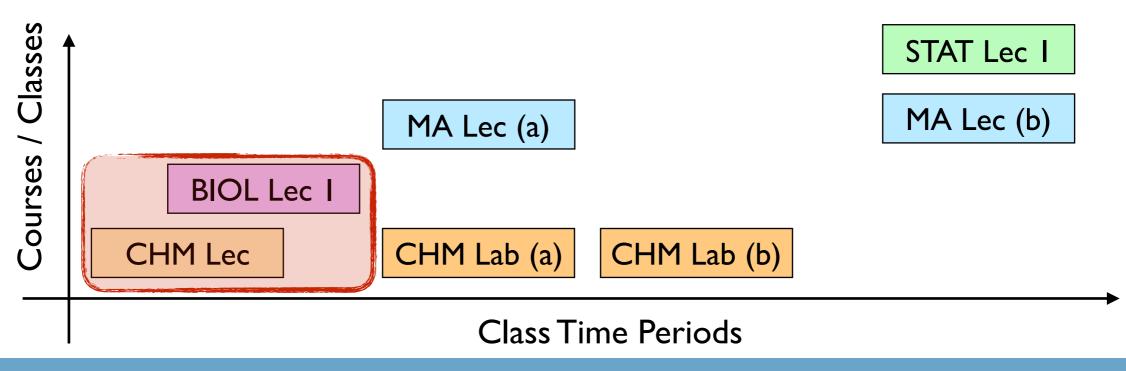
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Lecture	40	Full Term	1 x 50				
Laboratory	40	Full Term	3 x 50				• Lec 2, Lab 3, Rec
Recitation	40	Full Term	1 x 100				• Lec 2, Lab 4, Rec
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Lab 2	10	Full Term	3 x 50	Smith, John William	MWF 11:30a-12:20p	EDUC 102	
Lec 2	20	Full Term	1 x 50	Newman, George	T 1:30p-2:20p	EDUC 101	
Lab 3	10	Full Term	3 x 50	Doe, Joe	MWF 3:30p-4:20p	EDUC 102	
Lab 4	10	Full Term	3 x 50	Doe, Joe	MWF 1:30p-2:20p	EDUC 102	+ Pasamatiana
Rec 1	40	Odd Wks	1 x 100	Newman, George	Th 9:30a-11:20a	THTR 101	+ Reservations
Configuration 2 (DO)	10						+ Other Constraints
Distance Learning	10	Full Term					
Dist 1	10	Full Term	Arr 5 Hrs	Newman, George			



# Student Constraints

### Time Conflicts

- Student time conflicts are in general not allowed
- There are, however, a few exceptions
  - I. Some parts of a course may allow for time overlaps
  - 2. Certain class combinations may ignore student conflicts
  - 3. A student may be given an individual reservation
- If allowed, the solver tries to minimize the overlapping time in this case
- Online: If a class moves in time, conflicting students are rescheduled

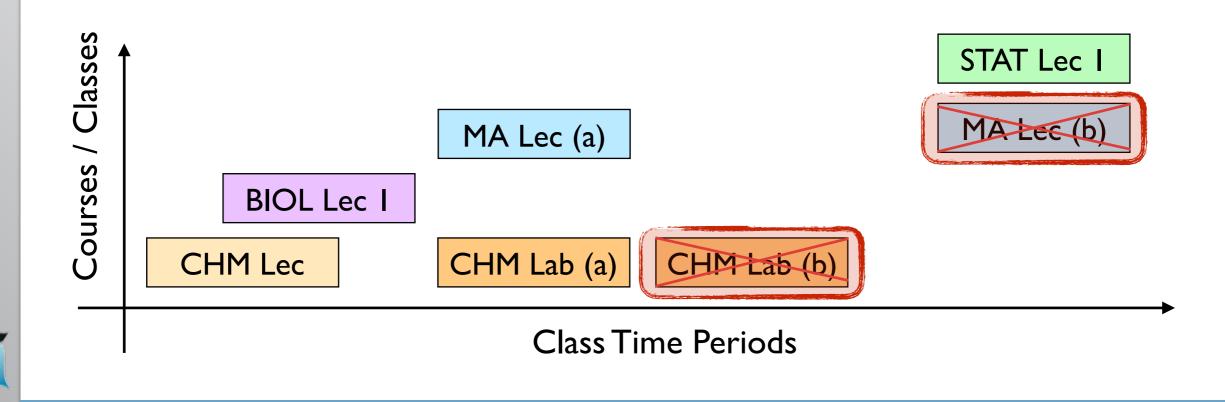




# Student Constraints

#### Limits

- There are class limits, configuration limits, and reservation limits
- A class may be disabled for student scheduling (acts as zero limit)
- If a limit is decreased, the existing students are left in the class
- Online: If a class is cancelled, enrolled students may be automatically rescheduled







#### Reservations

- Reservations can be used to restrict certain parts of an offering to a certain group of students
- Type: Individual, Student Group, Curriculum, Course
- A reservation has a limit (can be unlimited) and may have a deadline

#### **Additional Properties**

- Reservation priority: individual before student group, etc; if same type more restrictive first
- Some reservations must be used (individual, student group), even when there is some unreserved space in the course
- Individual reservations allow for signing up over the limit and for a time conflict (with other course)
- A course may require reservations (even if there would be unreserved space available otherwise)



## Student Schedule

#### Student Schedule

- As complete as possible (alternatives are used when a course is not available)
- Priorities are used to resolve conflicts
- The amount of overlapping time is minimized (where allowed)
- Distance conflicts are minimized (consequent classes too far)

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## Student Schedule

#### Student Schedule

- As complete as possible (alternatives are used when a course is not available)
- Priorities are used to resolve conflicts
- The amount of overlapping time is minimized (where allowed)
- Distance conflicts are minimized (consequent classes too far)

## **Additional Criteria**

- Avoid over-expected classes
- Keep previous schedule
- Section balancing
- Avoid arrange hour classes
- Keep students of the same group together (batch)

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# **Online: Expectations**

#### Expectations

- During batch sectioning, we can use projected demands to
  - I. Fill in the remaining space (requested vs. projected)
  - 2. Keep students off the class combinations that will be needed later
  - 3. Use this information to track the expectations for each class during online scheduling
- Expectations are like reservations, except fully automatic
- Typical Example: 1st year students are not around for the batch run

## **During Online Student Scheduling**

- Students are diverted from classes that are over-expected (expected + enrolled  $\geq$  limit)
- Expectations are kept up to date as the new students are coming in



# **Online: Automated Wait-Listing**

### Wait-Lists

- Wait-lists are defined on the offering level (for the whole course)
- Getting on the list:
  - When entering course demands: student can choose between providing an alternative or getting on a wait-list
  - If a student is dropped from a course due to a course change
- Deadlines also apply to wait-lists

## Wait-List Processing

- Order based on time stamp, reservation priority, the reason for getting on the list, etc.
- Wait-Lists are automatically processed:
  - I. When there is a new space in the course (e.g., a class opens up)
  - 2. When there is a course change
- UniTime is not allowed to change other courses of a student



# **Online: Course Locking**

## Course Management During Online Scheduling

- An offering must be locked before an operator can make a change
- When an offering is locked, no enrollment changes are allowed (students can drop the course, but any other change will put them on a wait-list)
- Once the course is updated, it can be unlocked
  - I. All existing enrollments of the offering are validated
  - 2. Students with a change that does not break any constraint are notified
  - 3. Students with a conflict are removed and put on the top of the wait-list
  - 4. Wait-list is processed and the affected students are notified (it tries to minimize changes for students from the previous step)
- The Class Assignment page (that is used to move a class) shows how many students will have a conflict with a new time placement



## Other Features

### **Enrollment Deadlines (Online)**

- Online student scheduling allows for add, drop, and change deadlines
- Defined in the number of weeks after the class starts
- Defaults are set on the academic session (for the whole term), but can be overridden on a particular course

### **Distribution Constraints**

- Linked Sections: Certain classes (of different courses) may be linked together
  - If a student is taking both courses, taking one class in a link means that he must take the other class of the link
- Ignore Student Conflicts: Certain classes (of different courses) may allow to ignore student time conflicts
  - Useful, e.g., when two courses share a lecture
  - The overlapping time is minimized in this case (if possible)



## Other Features

### **Email Notifications**

• Students are automatically notified when they have a change in their schedule

#### Consents

- Some courses may need a consent (of a department or an instructor)
- UniTime lets the student in, consent is either given or the enrollment is rejected

### Monitoring

- Scheduling Dashboard page shows how the courses are filling up as well as how the students are progressing
- There is also extensive logging that can be used for tracking issues and showing enrollment history of a student
- There are also various reports that can be very handy (showing student time and availability conflicts, class balancing, etc.)



## Other Features

#### **More Features**

- Departmental, Instructor, and Advisor roles (to give consent and to make changes on behalf of a student)
- Student Status
- Mass Cancel

•

- Ability to Customize
  - Student eligibility check and enrollment (Ellucian Banner XE)
  - Retrieve degree plan (Ellucian DegreeWorks)
  - Email template, retrieve course details, etc.
- Ability to run batch solver for subsets of students



# Purdue University

#### **Current State**

- Batch student scheduling is only used for a few groups of students (Management, Learning Communities, etc.)
- Students are using the Scheduling Assistant to get a schedule
- At the moment they can choose whether to use Banner or UniTime
  - No automated waitlisting and no expectations
  - Students have time windows and limits are manually updated instead
- We are using the Banner XE Student API to synchronize the changes
  - Banner does all the necessary eligibility checking
- We have added recently an integration with degree planning tool (DegreeWorks)

### Vision

- Build the course timetable based on the individual student degree plans
- Use the batch solver to provide all students with an initial schedule
- Still debating how to deal with incoming freshmen



# New in UniTime 4.2

### **Already Implemented**

- Responsive design
- Ability to provide more than two alternative courses
- Preferences on instructional methods and/or individual sections
- Keep students of a group together (batch)

## Work in Progress

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• Avoid times when a student is teaching (for Teaching Assistants)

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Add/Drop Courses | Rearrange Schedule

Print



## Short Demo

Of the Student Scheduling Assistant...





## Conclusion

### Student Scheduling in UniTime

- Maximize ability for the students to get the courses they need
- Offers a lot of functionality
- Can be used in many different ways (batch, online, or a combination)

### For more details

- Visit <u>www.unitime.org</u>
- Email us at <a href="mailto:support@unitime.org">support@unitime.org</a>