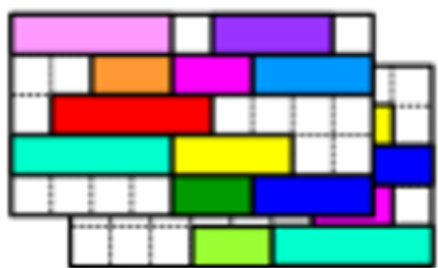




Credit: Photo by Loïc Romer



UNITIME

Student Scheduling at Purdue University

Tomáš Müller





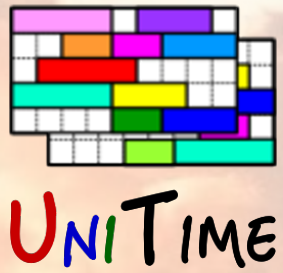
Agenda

Agenda

- Short introduction to student scheduling in UniTime
- Components: course timetabling, batch, online
- Student Scheduling at Purdue
 - Input data: course requests (student course & free-time demands)
 - Course request validation
 - Output: student schedules (student class enrollments)
- Other features



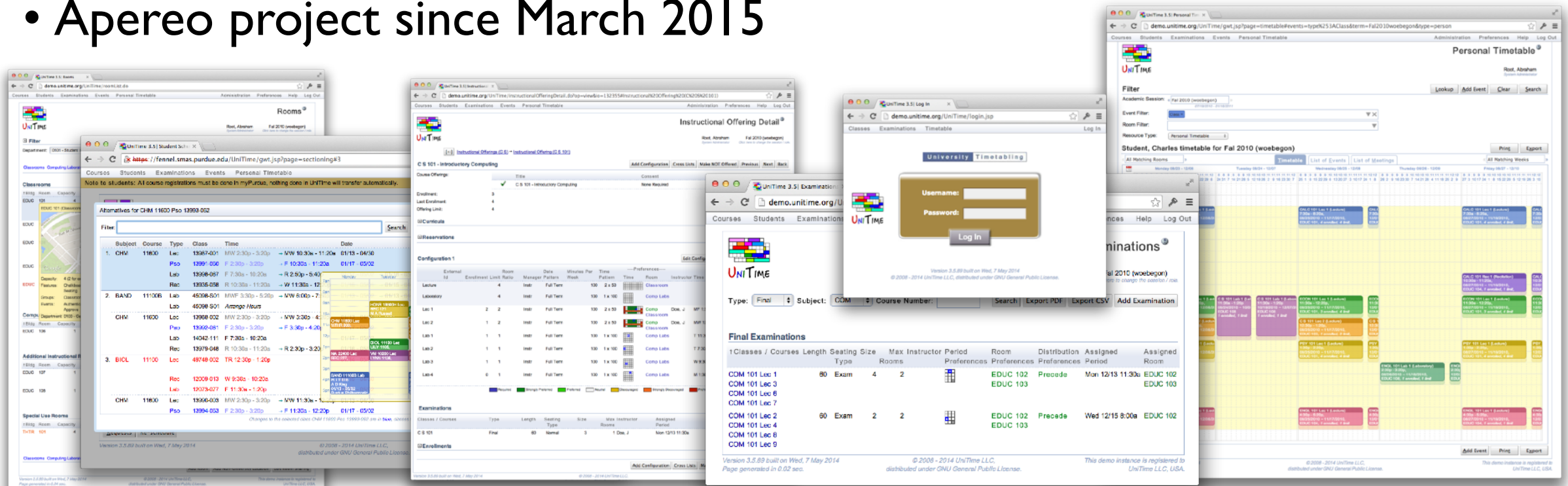
This presentation is available at www.unitime.org/present/apereo18-students.pdf

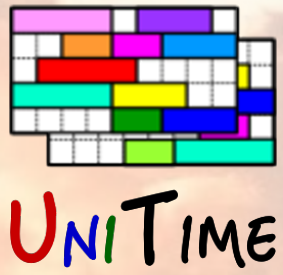


Introduction

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

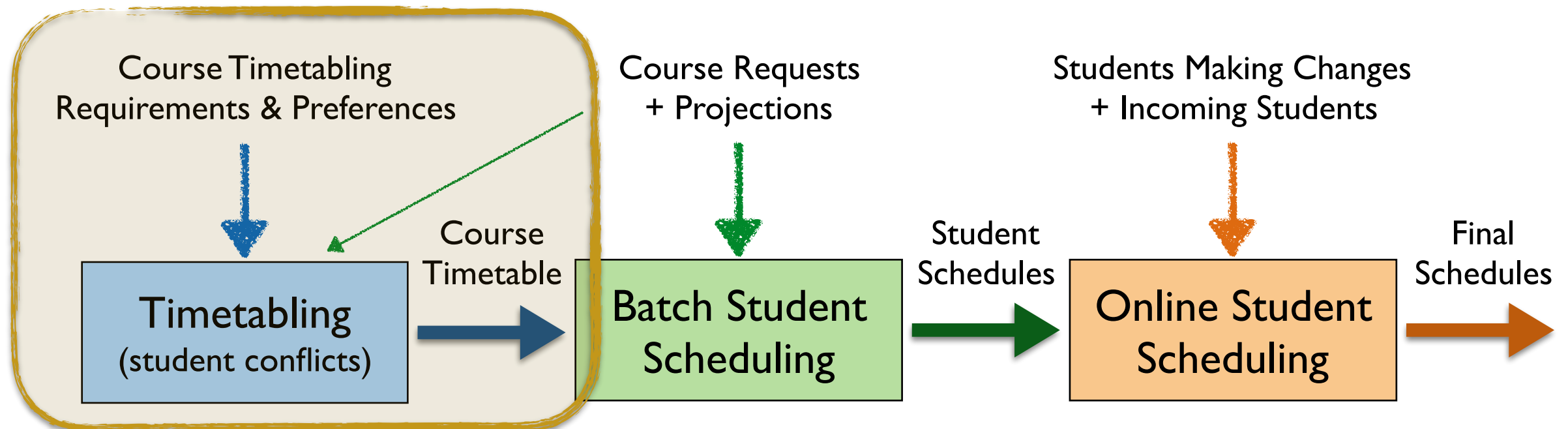
- Student fills in course requests, including alternatives, free times, etc.
- System provides a schedule that meets student needs
- Students have the ability to modify their schedule



Student Scheduling Process

Step I: Course Timetabling

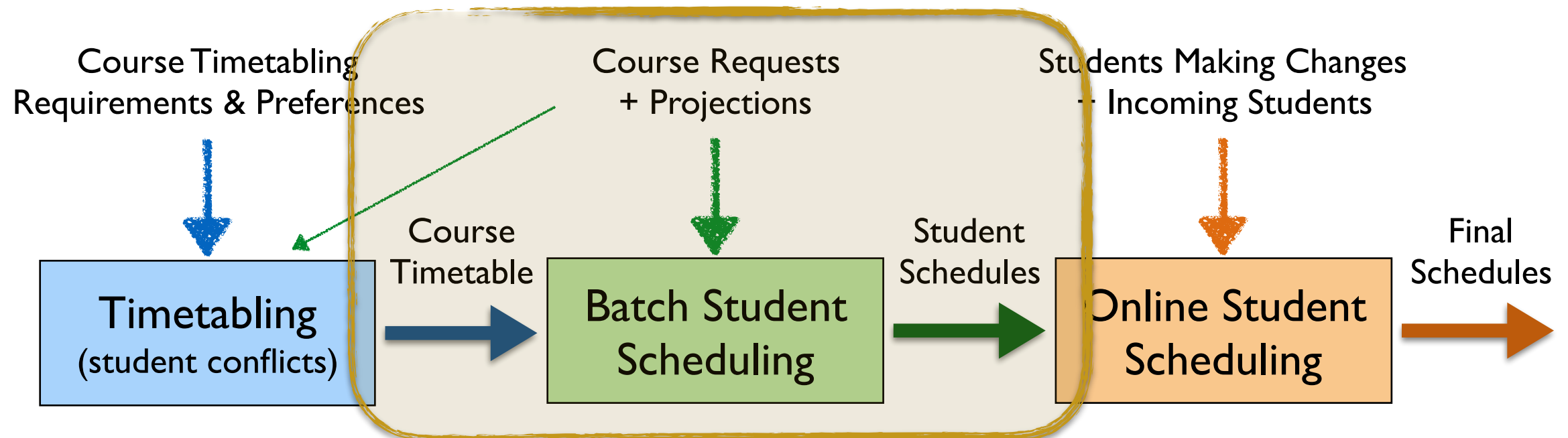
- Minimizing student conflicts together with faculty preferences
 - Last-like student course enrollments
 - Curricula (e.g., *list of courses for each program and year*)
 - Courses Requests (pre-registration)
 - A combination of these



Student Scheduling Process

Step 2: Batch Student Scheduling

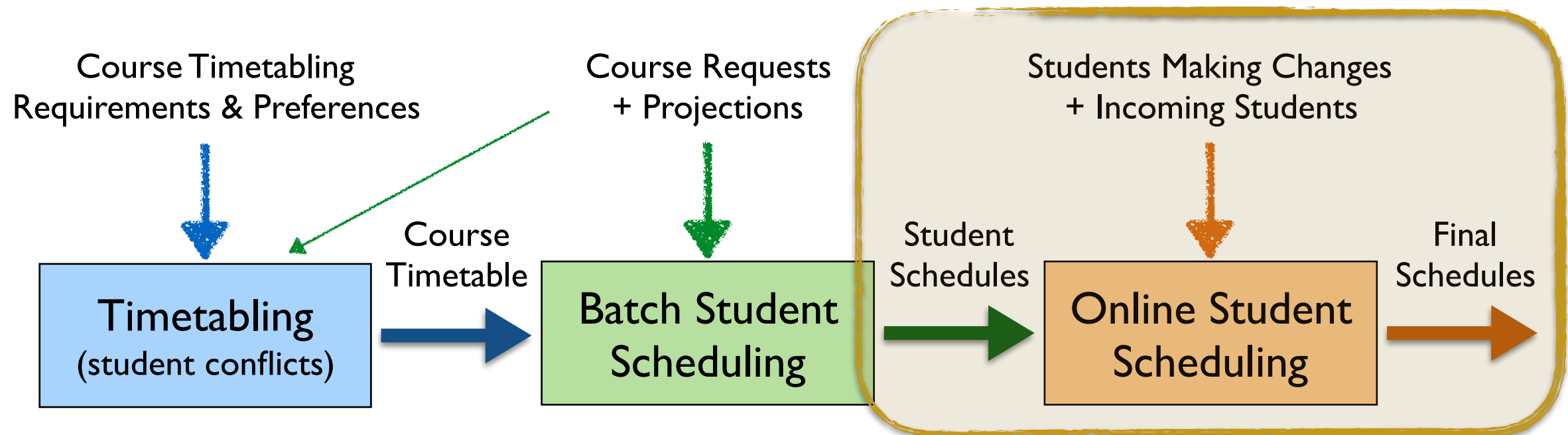
- After a timetable is produced
- Using pre-registrations and student course demand projections
- To provide students with initial schedules
- An optimization process, using the (student scheduling) solver
- It is possible to iterate
 - With the ability to keep already enrolled students unchanged or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



Student Scheduling Process

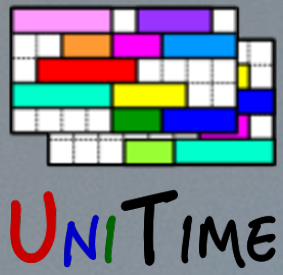
Step 3: Online Student Scheduling

- 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



Student Scheduling at Purdue

- Course Timetabling: using last-like demands (and curricula for Mgmt)
- Batch Student Scheduling
 - Starting this summer, we will use the batch scheduling for the incoming students (over 7,500 students)
 - Purdue's Summer Transition, Advising and Registration (STAR) program
- Online Student Scheduling
 - Students are using the Scheduling Assistant to get a schedule and/or to make changes
 - Using Banner XE API to synchronize the changes
- Still To Do
 - Curricula / course requests in course timetabling
 - Batch scheduling of current students (in discussion)
 - Wait-listing, Expectations



STAR / Virtual STAR

Summer Transition, Advising and Registration (STAR)

- A day long program (June 18 - July 13)
 - New undergraduate students meet their academic advisor
 - Create initial academic plan and **request their fall courses**
 - Learn about degree requirements, complete optional placement testing, explore student support options, attend sessions on dining plans, residential life, etc.
- Virtual STAR for international (and other) students
 - Complete an online VSTAR course, meet the advisor online, request fall courses
- Purdue creates course schedules for all participants (mid July) to meet the greatest possible number of student priorities

See www.purdue.edu/orientation/star for more details.



Course Requests

- Each requested course can have alternatives
- There can also be additional alternate course requests to get the desired number of courses
- There can be free time requests in the list
- Preferences on sections and instructional methods

New in UniTime 4.3

- Custom Validation
- Status Icons
- Print Confirmation

Course Requests

1. Priority	ECE 27000			
			<i>College Restriction</i> <i>Prerequisite error. See the Schedule of Classes.</i>	
1. Alternative	HTM 29101			
			<i>Field of Study Restriction - Major</i> <i>Prerequisite error. See the Schedule of Classes.</i>	
2. Priority	CHM 25500			
			<i>Prerequisite error. See the Schedule of Classes.</i>	
1. Alternative	HTM 29102			
			<i>Field of Study Restriction - Major</i>	
3. Priority	HTM 23100			
			<i>Field of Study Restriction - Major</i> <i>No alternative course provided.</i> <i>Prerequisite error. See the Schedule of Classes.</i>	
1. Alternative	Alternative to HTM 23100			
4. Priority	PSY 63100			
			<i>Student Level Restriction (UG, PR, GR)</i> <i>No alternative course provided.</i> <i>Permission from Department</i>	
1. Alternative	Alternative to PSY 63100			
5. Priority	PHYS 25200			
			<i>No alternative course provided.</i>	
1. Alternative	Alternative to PHYS 25200			
6. Priority	MA 42800			
			<i>No alternative course provided.</i> <i>Prerequisite error. See the Schedule of Classes.</i>	
1. Alternative	Alternative to MA 42800			
7. Priority				
8. Priority				
9. Priority				
10. Priority				
11. Priority				
12. Priority	Course with the lowest priority.			

Tip: Enter a free time to avoid getting classes in time you need for something else.

Alternate Course Requests *(used only if a course requested above is not available)*

1. Alternate	Alternate request if course(s) above not available.			
2. Alternate				
3. Alternate				

Degree Plan Current Registration Total Credit: 14 - 17 **Submit Requests**

You have made some changes in your course requests. Please click the Submit Requests button to update your submission.

Custom Validation

Course Requests / UniTime

Special Registration / SIS

Log in

RESTful API / JSON

Enter / Change
Course Requests

Check Eligibility to Register, Check Status

Is student eligible, returns existing override requests

Validate Requests

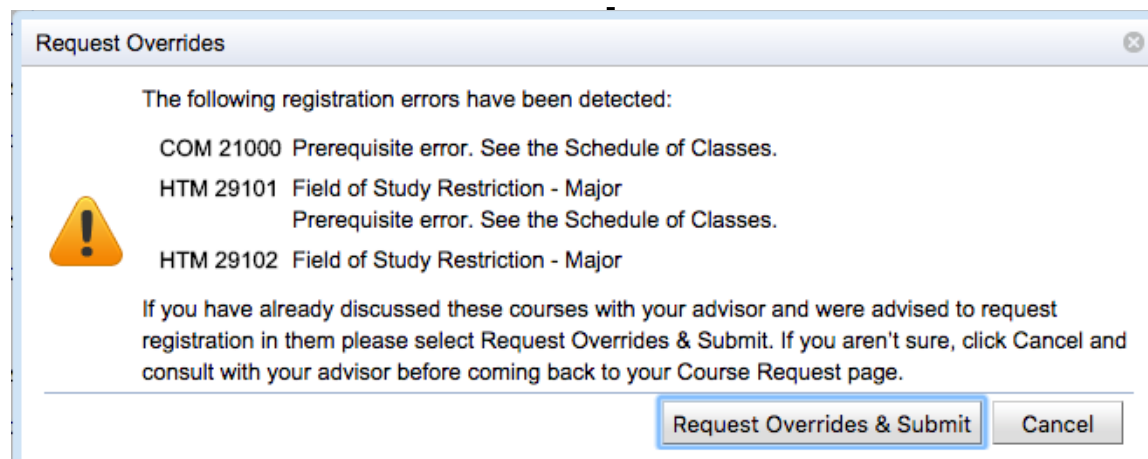
*Registration errors, overrides needed
max requested credit, other warning*

Request
Overrides

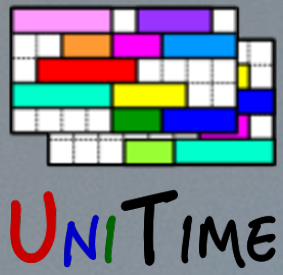
Submit Override Requests

Override status

Notify advisors, tracks overrides, escalation
Advanced placement credit, etc.



[illegible]



Batch Student Scheduling

Student Scheduling Solver

- Using student course requests of all STAR/VSTAR participants
- Provide students with initial schedules
- An optimization process, using the (student scheduling) solver
 - **Constraints:** course structure, time conflicts, class/course limits, reservations, ...
 - **Optimization:** request priority, overlapping time (where allowed), distance conflicts, ...
- Requested Overrides
 - Course requests are re-validated (for the AP credits etc.)
 - Course requests that have not been approved are ignored
- Test runs, reporting
- Interface with Banner XE (validation, enrollment)





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)
- Maximize section and instructional method preferences

Additional Criteria

- Section balancing
- Avoid arrange hour classes
- Keep students of the same group together

Student Scheduling Assistant

User: Student, Imogene Alice Session: Fall 2016 (PWL)

Class Schedule

Lock	Subject	Course	Type	CRN	Avail	Days	Start	End	Date	Room	Instructor	Requires	Note	Credit
	ENGL	10600	Lec	65646-859	0 / 3	T	7:30a	8:20a	08/23 - 12/06	HEAV 105				4
			Lec	65646-859	0 / 3	F	7:30a	8:20a	08/26 - 12/09	HEAV 104		65646-859		
			Lec	65646-859	0 / 3	R	7:30a	8:20a	08/25 - 12/08	BRNG B275		65646-859		
			Rec	45178-630	0 / 2	W	7:30a	8:20a	08/24 - 12/07	HEAV 223		65646-859		
	COM	11400	Lec	69540-736	23 / 25	T	8:30a	9:20a	08/23 - 12/06	BRNG B230				3
			Lec	69540-736	23 / 25	R	8:30a	9:20a	08/25 - 12/08	BRNG B230		69540-736		
			Lec	69540-736	23 / 25	F	8:30a	9:20a	08/26 - 12/09	BRNG B232		69540-736		
	Free	Time				M	7:00a	12:00p						
	CHM	11500	Lec	14183-002	68 / 95	MF	3:30p	4:20p	08/22 - 12/09	WTHR 200	C Das		Supplemental Instruction (SI) stu...	4
			Lab	42365-183	4 / 5	R	11:30a	2:20p	08/25 - 12/08	BRWN 2124		14183-002	Supplemental Instruction (SI) stu...	
			Rec	42498-236	4 / 5	W	12:30p	1:20p	08/24 - 12/07	WTHR 362		42365-183	Supplemental Instruction (SI) stu...	
	BIOL	11000	Lec	12061-001	360 / 445	TR	2:30p	3:20p	08/23 - 12/08	LILY 1105	A R Anderson		Supplemental Instruction (SI) stu...	4
			Rec	12088-027	35 / 40	R	4:30p	5:20p	08/25 - 12/08	WTHR 420			Supplemental Instruction (SI) stu...	
			Lab	12131-071	23 / 29	T	6:00p	7:50p	08/23 - 12/06	WTHR 316			Supplemental Instruction (SI) stu...	
	HIST	37100			Not available (course is full)									
	AD	11300	Sido	10191-006	3 / 14	MWF	1:30p	3:20p	08/22 - 12/09	PAO 3108			\$100 course fee.	3
	New Course													
Total Credit: 18														

Submit Schedule Print



Reservations

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)



Expectations

- During batch sectioning, we can use projected demands to
 1. 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

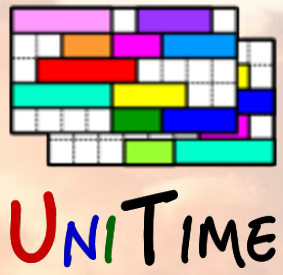
- Students are diverted from classes that are over-expected (expected + enrolled \geq limit)
- Expectations are kept up to date as the new students are coming in

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:
 1. 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

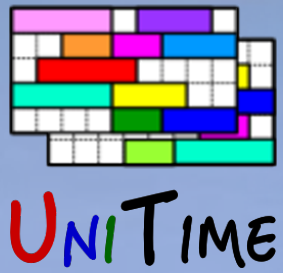


Online: Course Locking

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
 1. 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





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, please see us at the conference

- Getting Started with UniTime (Sunday, 9 am in Liszt)
- UniTime: State of the Project (Monday, 2:30 pm in Debussy)
- UniTime Introduction (Monday, 5:30 pm, Showcase Reception)
- Student Scheduling at Purdue University (Tuesday, 11:15am in Debussy)
- Internationalization of UniTime (Wednesday 11:00 am in Debussy)
- Or visit www.unitime.org

An online demo is available at <https://demo.unitime.org>

