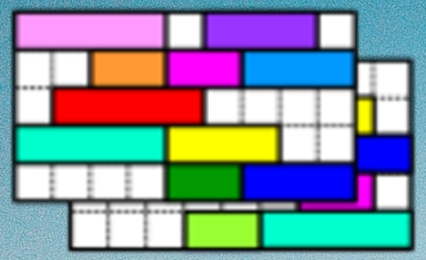


UniTime

OPEN APEREO 2019

The Higher Education Open-Source Conference Los Angeles, CA June 2-6

Photo by Bart Jaillet on Unsplash

PURDUE UNIVERSITY

Student Scheduling at Purdue University

Tomáš Müller

apereo

Agenda

Agenda

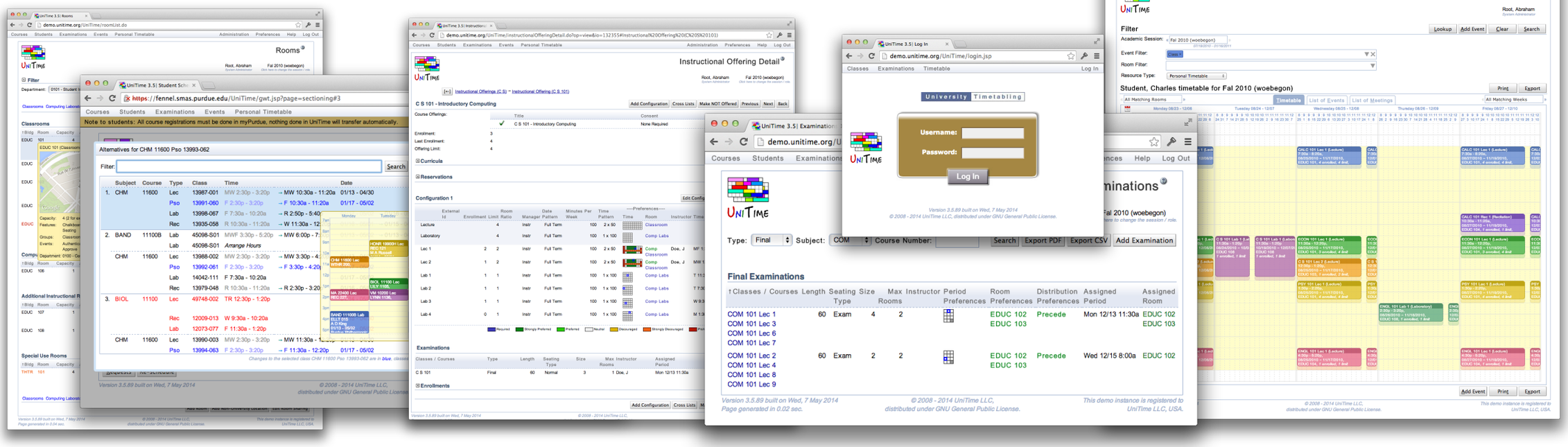
- Short introduction to student scheduling in UniTime
- Components: course timetabling, batch, online
- Student Scheduling at Purdue
  - Input data: course requests (student course & free-time demands)
  - Course request validation
  - Output: student schedules (student class enrollments)
  - Results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

This presentation is available at www.unitime.org/present/apereo19-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



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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

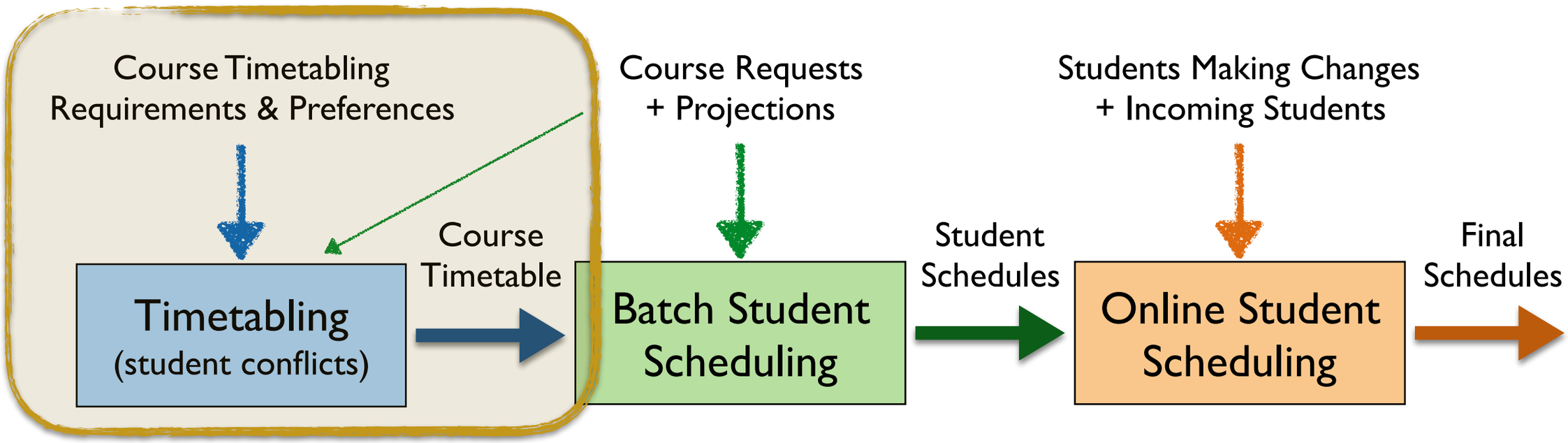
- Student fills in course requests, including alternatives, free times, etc.
- System provides a schedule that meets student needs
- Students have the ability to modify their schedule

Photo of Echo Park Lake provided by L.A. Tourism

Student Scheduling Process

Step 1: 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



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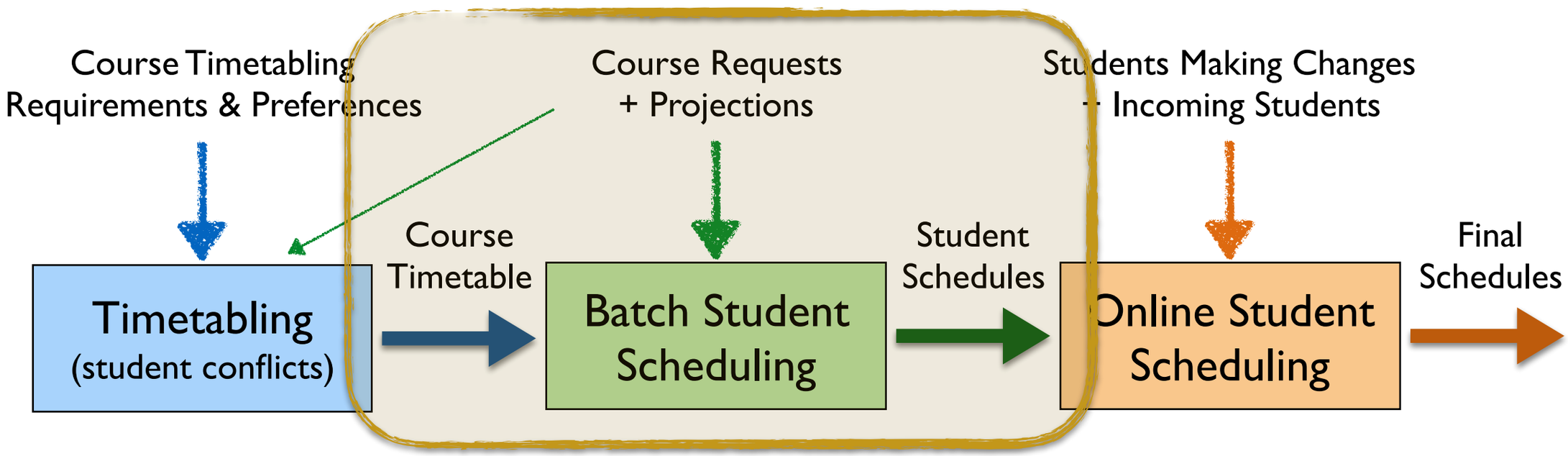
Student Scheduling Process

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



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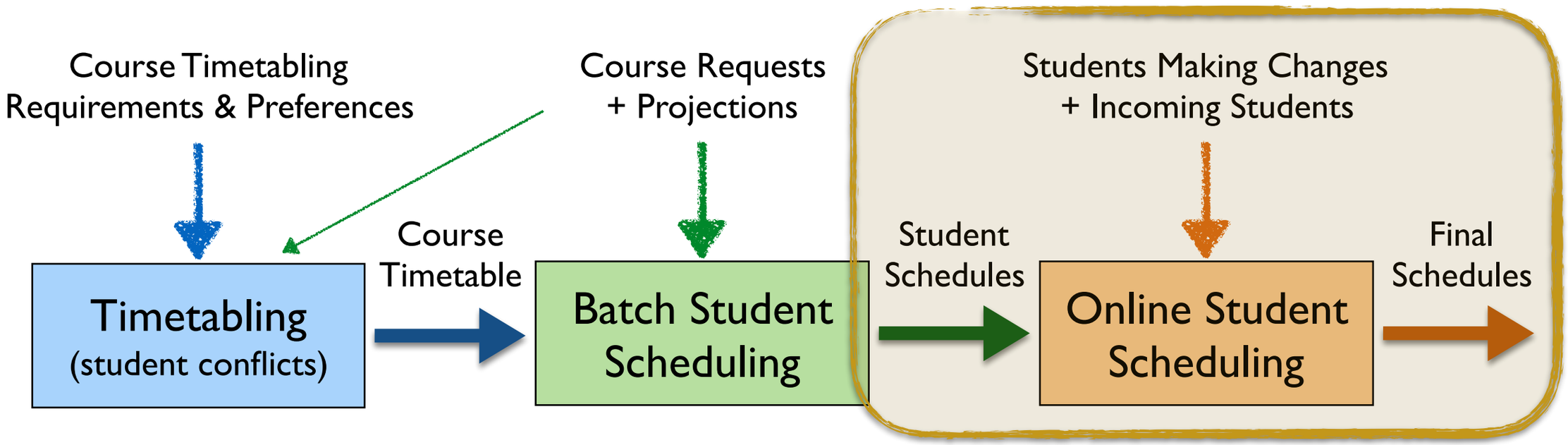
Student Scheduling Process

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



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Purdue University

Student Scheduling at Purdue

- Course Timetabling: using last-like demands (and curricula for Mgmt)
- Batch Student Scheduling
  - Starting with Fall 2018, batch scheduling was used for the incoming students (~ 8,600 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
- Registration Errors
  - Banner registration errors are checked during both batch and online
  - Students can request overrides, advisors (and others) may approve
  - The approval process is done outside of UniTime (there is an API)

STAR / Virtual STAR

Summer Transition, Advising and Registration (STAR)

- A day long program (mid June - mid July)
  - 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
- Students can start making schedule changes immediately afterwards

Course Requests

Entered by students

- 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 4.4

- University core courses
- Critical courses
- Required preferences

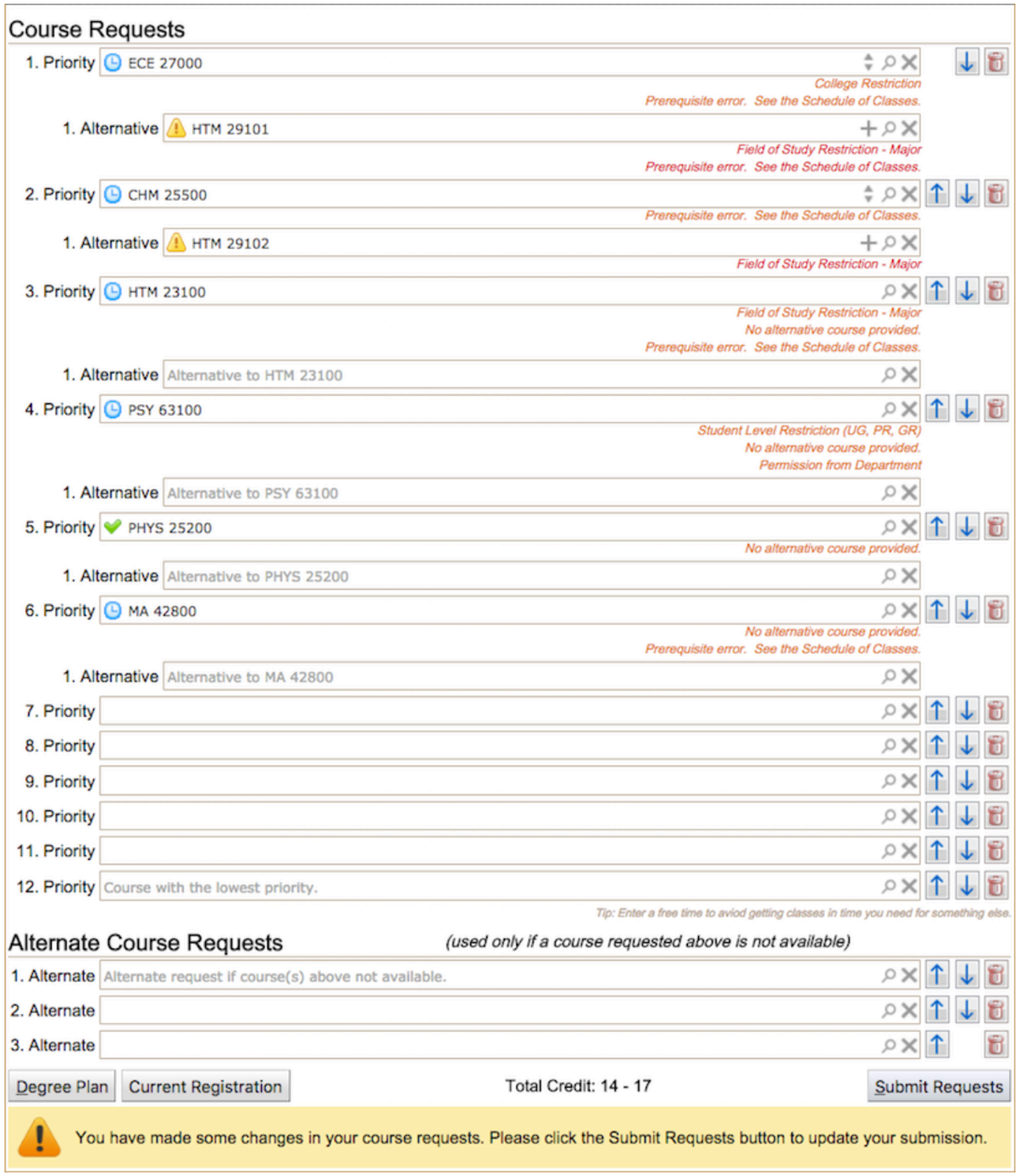


Photo of Echo Park Lake provided by L.A. Tourism

Custom Validation

Course Requests / UniTime | **Special Registration / SIS**

RESTful API / JSON

Log in

Check Eligibility to Register, Check Status →

Is student eligible, returns existing override requests

Enter / Change Course Requests

Validate Requests →

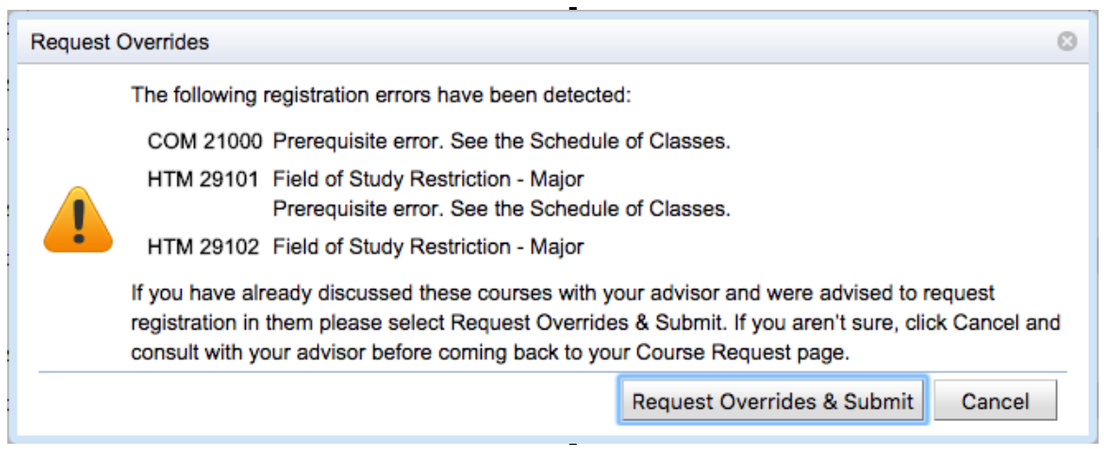
Registration errors, overrides needed max requested credit, other warning

Request Overrides

Submit Override Requests →

Override status

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



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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)

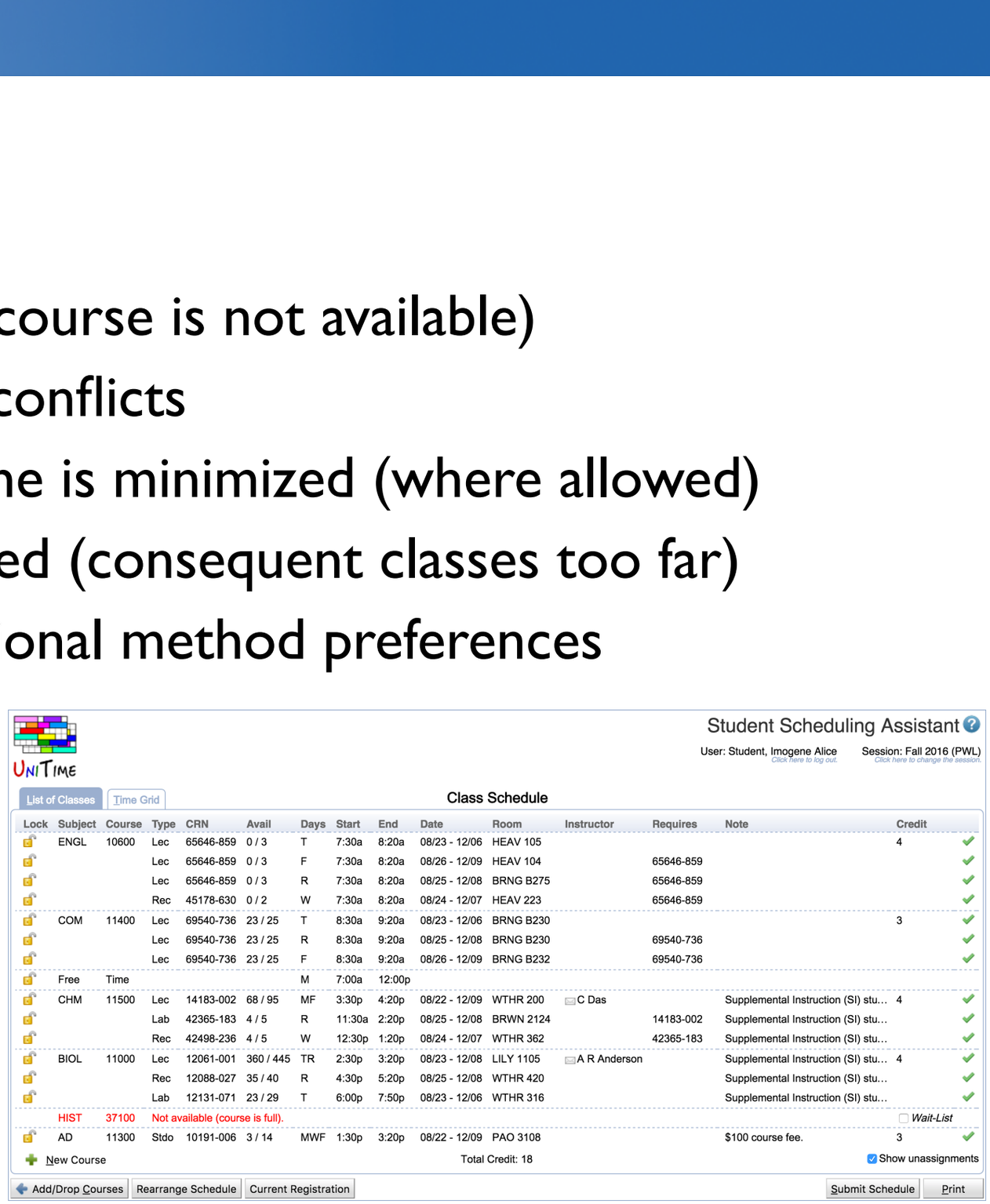
Student Schedule

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



Fall 2018 STAR

How did we did?

- 8,600 students (original plans were about 8,000 students)
- 96.8% assigned course requests (over 45k course enrollments)
- 83.9% students received a complete schedule
  - 94% students did not get one course
- 91.4% first, 7.2% second, 1.2% third choice course assigned
- 94.6% student preferences met
- Well balanced
- 300 distance conf.

Subject Type	Course CRN-SectionId	Title	Time	Date	Consent	Room	Available	Projection	Enrollment ↑	Not-Enrolled	Alternative
ENGL	10600						0 / 819	1364	819	493	112
COM	11400						1 / 1122	1790	1121	195	362
ME	29700C						0 / 74	59	74	86	4
BIOL	13500						0 / 125	118	125	77	9
HONR	19900W						0 / 25	-	25	37	-
EDPS	31500						0 / 172	230	172	28	134
SCLA	10100						2[r] / 547	539	545	24	235
BIOL	11000						2 + 2[r] / 996	1360	992	19	4
ENGL	10800						0 / 209	258	209	19	75
AT	10200						0 / 66	132	66	14	-
FR	10200						0 / 41	108	41	13	1
ENGR	10300MED						0 / 48	37	48	12	4

Photo of Echo Park Lake provided by L.A. Tourism

Reporting

Student Scheduling Dashboard

- Monitor student progress (requested courses / credit, etc.)
- Advisors: can allow students in and out (student status)
- Various information, including overlaps, distances, credits, alternatives, student details, and logging
- Last test runs

Additional Reports

- Additional APIs

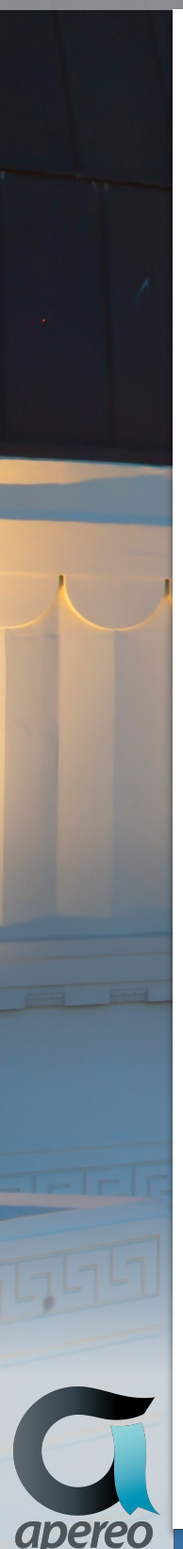
Photo by David Mark from Pixabay

Lessons Learned

Lessons Learned

- Nightly schedule test runs are very useful
  - Find issues early (e.g., courses with not enough space)
  - Added ability to share results within the community
- It is important to provide alternatives
  - Two alternative courses are often enough
- Timing can be an issue (e.g., AP/transfer credits)
- If there is not enough space, preferential treatment may be needed
  - Critical courses (courses needed to make progress)
  - Reservations
- No need to grant short time windows
  - Much smaller peaks (no need to be the first one in)
- It is important to get everyone on board

Future



Fall 2019

- (Almost) same as Fall 2018
  - Only the STAR/VSTAR students
  - There will be more of them than last year (again)
  - With various improvements done to the process and UniTime
  - A couple of pilots: communication courses, using degree plan, Spring 2020 pre-registration for Aviation Tech. students

Spring 2020+

- Extending pre-registration to other students
- Various scenarios on the table, including one with all undergraduate students doing pre-registration
- Work in progress…

Photo of Griffith Observatory provided by Los Angeles Tourism & Convention

Fall 2019 Pre-Registration

UniTime 4.4 Improvements

- Published Schedule Runs (sharing results of a test run)
- Student Schedule Quality (early/late times, lunch, travel, etc.)
- Min/Max Credits (e.g., ensure students get at least min credits)
- Critical Courses (courses essential to graduate)
- Solver Reports API (additional reports for higher ups)
- Student Preferences & Requirements (improved handling + required)

Process Changes

- Learning Communities (batched together with other students, using reservations)
- Communication Courses (pre-populated with default alternatives)
- Degree Planning (+critical course indication, ap/transf. credit)
- University Core Courses (easier lookup, degree plan)

Photo of Echo Park Lake provided by L.A. Tourism

Conclusion

Student Scheduling at Purdue University

- So far, introducing batch student scheduling has been a success
- There is a clear commitment at Purdue to continue this direction
- Still a lot of work ahead of us

For more details, please see us at the conference

- ~~Introducing UniTime (Sunday, 1:30pm - 4:30pm in Crocker)~~
- ~~UniTime: State of the Project (Monday, 11:15am - 12:00pm in Watercourt A)~~
- ~~UniTime at Faculty of Medicine (Monday, 1:30pm - 2:15 pm in Watercourt A)~~
- Student Scheduling at Purdue (Tuesday, 11:15am - 12:00pm in Watercourt A)
- Event Management in UniTime (Wed, 11:00am - 11:45am in Watercourt A)
- Or visit www.unitime.org

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