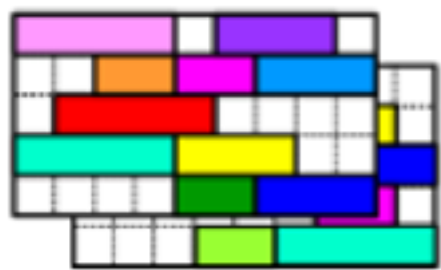OPEN APEREO 2017
PHILADELPHIA 4-8 JUNE

UNITIME

Course Timetabling Around the World

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Agenda

- Short introduction to course timetabling and UniTime
- Course timetabling around the world
  - How it is done with UniTime

This presentation is available at www.unitime.org/present/apereo17-courses.pdf
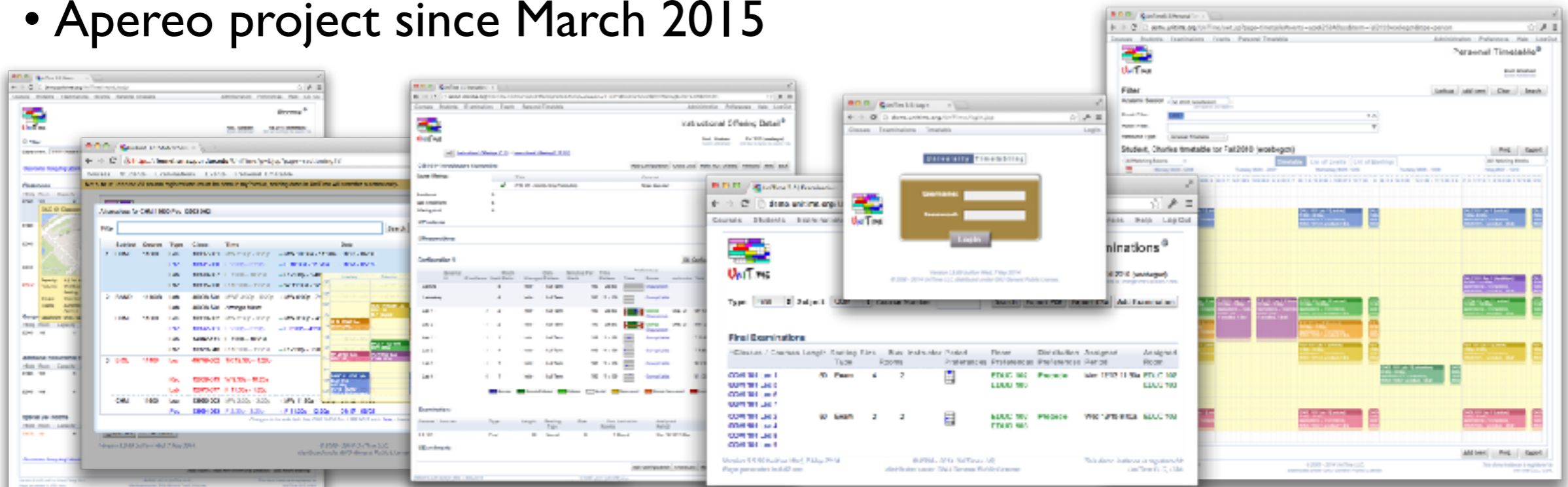
What is Course Timetabling?

- The process of assigning **times** and **rooms** to **classes**

- Creating a course timetable for **students**

- Respecting various restrictions and preferences
  - Courses: size, room equipment, structure, …
  - Instructors: availability, preferred times, …
  - Students: curricula, pre-registrations, …
  - Other: number of rooms available and their sizes, …
- It is a difficult optimization problem

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

Why is it needed?

- Minimize student conflicts to help students receive degrees on time

- Help use limited resources more effectively

- Make process more transparent and sustainable

- Fairness and satisfaction with the timetable

- What-if scenarios

- Ability to adapt to changes (curriculum, facilities, etc.)

Around the World

- 256 institutions from 79 countries filled our voluntary registration
  - 55 institutions from 40 countries have indicated that they use UniTime in production
  - USA, Czech Republic, Pakistan, Croatia, Poland, Turkey, Peru, Kuwait, Canada, Malaysia, Spain, UAE, Palestine, Zambia, Kenya, Bulgaria, Saudi Arabia, …
- Mostly course timetabling and event management
- Many variations
  - Curricula vs Last year's enrollments vs Registrations
  - Student groups vs Individual students (level of choice)
  - Traditional vs Distance Learning vs Online
  - Professors & TAs vs Lecturers
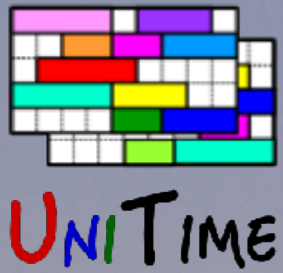 - …

Various Approaches

- Courses having lectures, labs, recitations, usually grouped together

	Limit	Date Pattern	Minutes Per Week	Time Pattern	Time	----Preferences---- Room	Distribution	Instructor
MA 170 STAT 170	40	**Statistics I** Introductory statistics						
Lecture	40	Full Term	50	1 x 50		Classroom		
Laboratory	40	Full Term	150	3 x 50		EDUC CompPr	Same Room	
Lec 1	40	Full Term	50	1 x 50		ThtrSeat Classroom		G. Newman
Lab 1	20	Full Term	150	3 x 50		EDUC CompPr	Same Room	J. Smith
Lab 2	20	Full Term	150	3 x 50		EDUC CompPr	Same Room	J. Smith

Various Approaches

- Courses having lectures, labs, recitations, usually grouped together
- Very structured, following standard time patterns

2 x 75

	from:	7:30a	9:00a	10:30a	12:00p	1:30p	3:00p	4:30p
	to:	8:45a	10:15a	11:45a	1:15p	2:45p	4:15p	5:45p
TTh								

3 x 50

	from:	7:30a	8:30a	9:30a	10:30a	11:30a	12:30p	1:30p	2:30p	3:30p	4:30p
	to:	8:20a	9:20a	10:20a	11:20a	12:20p	1:20p	2:20p	3:20p	4:20p	5:20p
MWF											

E.g., at Purdue University most classes follow 3x50 or 2x75 time pattern

Various Approaches

- Courses having lectures, labs, recitations, usually grouped together
- Very structured, following standard time patterns
- Each class meets once a week, typically for two hours

2h

from:	7:30a	8:25a	9:20a	10:15a	11:10a	12:05p	1:00p	1:55p	2:50p	3:45p	4:40p	5:35p	6:30p
to:	9:10a	10:05a	11:00a	11:55a	12:50p	1:45p	2:40p	3:35p	4:30p	5:25p	6:20p	7:15p	8:10p
Mon													
Tue													
Wed													
Thu													

1 x 100

from:	8:00a	10:00a	12:00p	2:00p	4:00p	6:00p
to:	9:50a	11:50a	1:50p	3:50p	5:50p	7:50p
Mon						
Tue						
Wed						
Thu						
Fri						

E.g., at Masaryk University most classes have a 2h weekly
However, each college has different start times

Various Approaches

- Courses having lectures, labs, recitations, usually grouped together
- Very structured, following standard time patterns
- Each class meets once a week, typically for two hours
- A class meets just a few times a semester

This impacts the quality of a student schedule

Individual Students

- Last year's course enrollments
- (Pre-)registrations

Student Groups / Curricula

- For a group of students of the same major and year/semester
- List of courses and their expected attendance
- May include mandatory, elective, and optional courses

Course Projections

Group	Course		01
Required	ALG 101	🔍	100.0%
Required	CALC 101	🔍	100.0%
Active	ENGL 101	🔍	50.0%
Elective	SPAN 101	🔍	40.0%
	BIOL 101	🔍	10.0%
	CHM 101	🔍	20.0%

Course Projections

Group		Course		01
M1 and M2	M or N or O	M1	🔍	50.0%
M1 and M2		M2	🔍	50.0%
N1 and N2	M or N or O	N1	🔍	30.0%
N1 and N2		N2	🔍	30.0%
O1 and O2	M or N or O	O1	🔍	20.0%
O1 and O2		O2	🔍	20.0%
			🔍	

Individual Students

- Last year's course enrollments
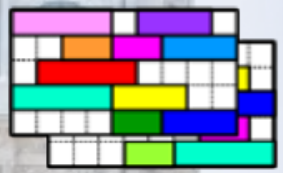- (Pre-)registrations

Student Groups / Curricula

- For a group of students of the same major and year/semester
- List of courses and their expected attendance
- May include mandatory, elective, and optional courses

Student Scheduling
- Keep students of the same group together
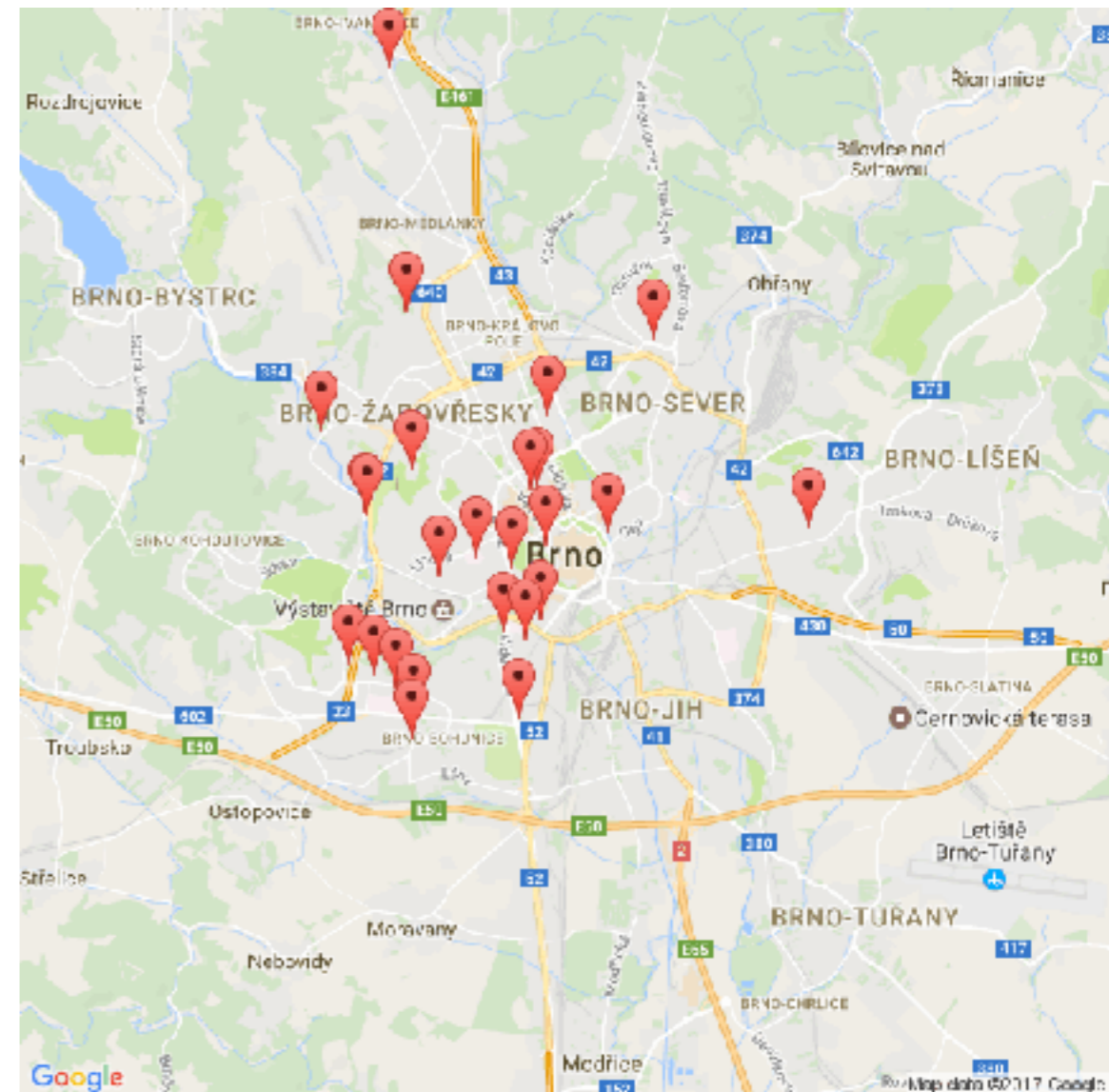- Reservations
- Distances / travel time
- Emphasis on conflicts

Travel between classes

- Some institutions do not care
- For some, it is a major hassle

Conflicts

- For students: there is a conflict when two classes overlap in time, or they are after each other too far apart
- For instructors: back-to-back classes in different buildings, long travels during the day

Various locations of Faculty of Sport Studies, Masaryk University

Various Objectives

- Faculty preferences (time)
- Room requirements and preferences (including distances)
- Distributions (lecture before labs, etc.)
- Student conflicts
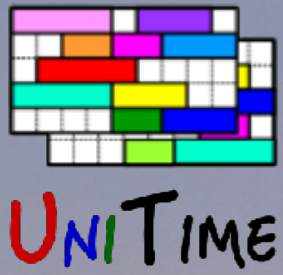- Other (unused room space, etc.)

Various Objectives

- Faculty preferences (time)
- Room requirements and preferences (including distances)
- Distributions (lecture before labs, etc.)
- Student conflicts
- Other (unused room space, etc.)

Various Weights / Priorities

- Two classes can overlap in time if it affects only a handful of students
- Most vocal faculty / schedule managers get their way
- Hidden preferences / requirements
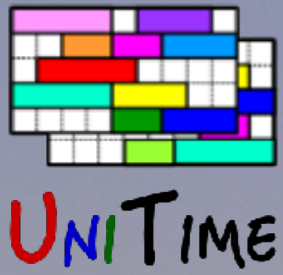- Huge gap between hard and soft constraints

Fairness

- For departments
- For instructors
- For students

Fairness

- For departments
- For instructors
- For students

Schedule Quality

- For departments: similar amount of unpopular times / rooms, time preference normalization
- For instructors: time and distribution preferences (min/max breaks, N hours a day, N hours work day)
- For students: not that much, especially when dealing with individual student requests

Typical use cases

- Students of the same curriculum (major / semester)
- Learning communities

Aim

- Keep students together as much as possible

Current Approach

- Reservations
- Pre-assignments (manual)
- New scheduling algorithm in UniTime 4.2
- Team building

Various special cases

- Tuesday following Mondays schedule
- Squatters rights
- Gender separation in Arabic countries
- Repercussions on public transport
- Continuous education
- Reducing timetabling to room assignments
- Lunch break modeled as a course
- …

- Overlapping academic sessions
- Automatic instructor assignment during course timetabling

Course Timetabling Around the World

- While every school is different, there are a lot of similarities too
- Any timetabling tool must be general enough to accommodate

For more details, please see us at the conference

- UniTime: Best Practices (Sunday, 1:30pm - 4:30pm in Flower)
- Case Study: UniTime at Masaryk University (Monday, Showcase Reception)
- UniTime 4.2: Instructor Scheduling (Tuesday, 10:15am - 11:00am in Flower)
- Course Timetabling Around the World (Tuesday, 2:30pm - 3:15pm in Flower)

- Or visit www.unitime.org

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