

UNI<sub>TIME</sub>

# Open Apereo 2015

Higher Education ... Open Source in a New Age

## Case Study: Course Timetabling with UniTime at Masaryk University

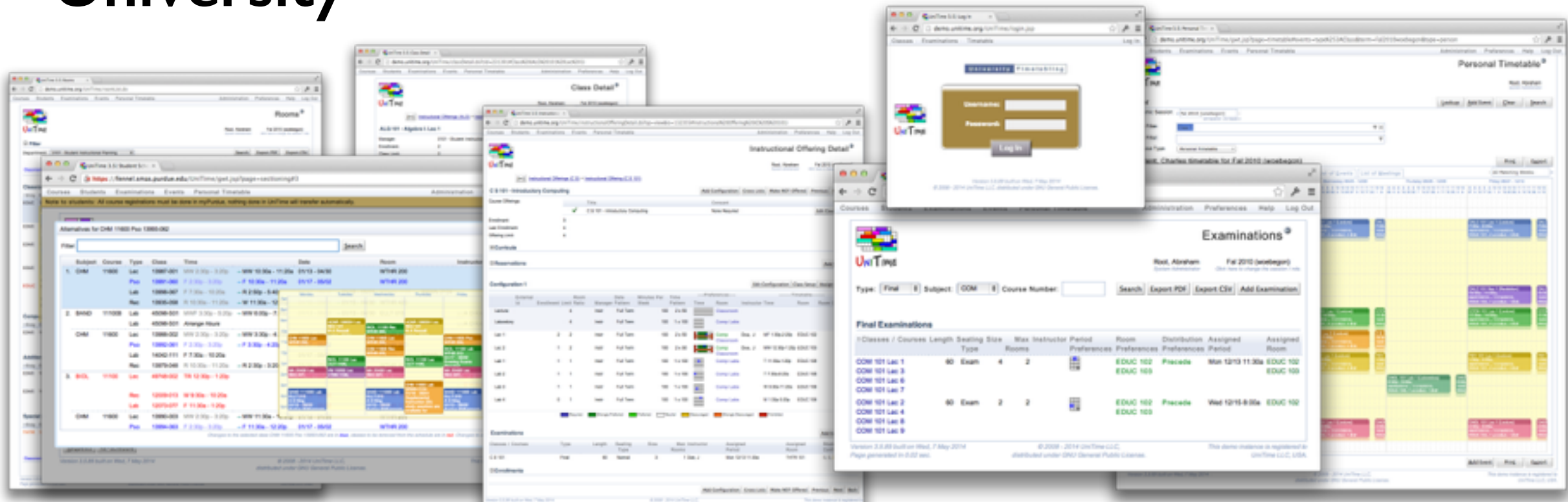
Zuzana Mullerova, Hana Rudova, Tomas Muller





# Case Study

- UniTime
- Course Timetabling
- Masaryk University
- Course Timetabling with UniTime at Masaryk University





## What is UniTime?

- Comprehensive academic scheduling solution
- Four components
  - Course timetabling
  - Examination timetabling
  - Student scheduling
  - Event management
- Open source, web-based
- Started as a research project in 2001
- First used at Purdue University in 2005
- Apereo project since 2015





# Course Timetabling

## 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 optimisation problem





# Course Timetabling in UniTime

## **Distributed or centralised data entry**

- Rooms, instructors, courses, plans of study, ...
- Requirements and preferences

## **Distributed or centralised timetabling**

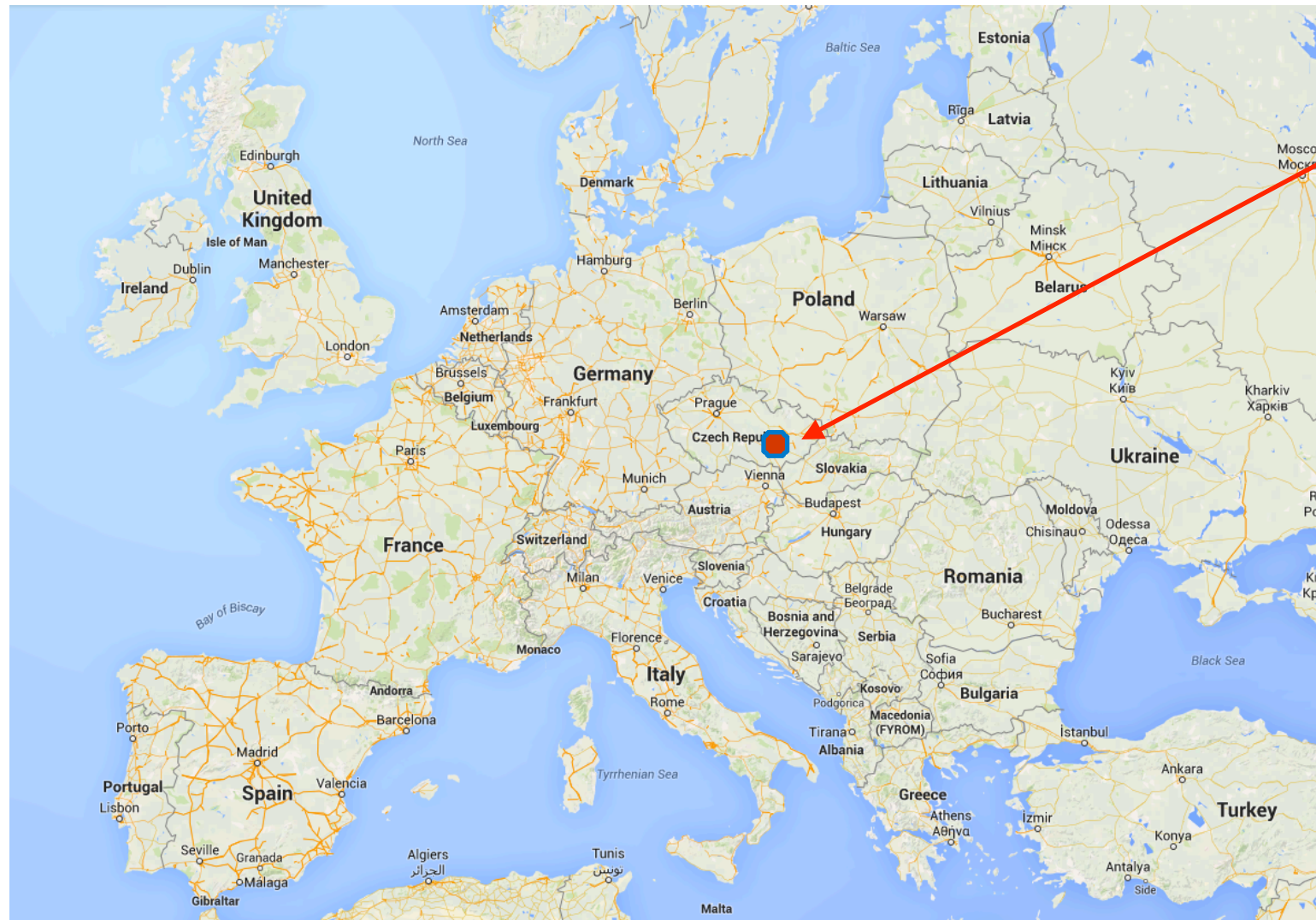
- Automatically generated timetable
- Computer aided manual modifications

## **Course management**

- Once a timetable is published







## Masaryk University Brno, Czech Republic

- Since 1919
- 2nd largest university in the Czech Republic
- 38 000 students
- 9 colleges, 200 departments
- An early adopter of UniTime



# UniTime at Masaryk University

## Four colleges (49% of students)

- Faculty of Arts (2011)
- Faculty of Education (2011)
- Faculty of Sports Studies (2012)
- Faculty of Informatics (2013)

## Usage

- Centralized x decentralized data entry
- Centralized timetabling
- Differences in student course demands





# Student Course Demands

## Student conflict

- Two classes of a student overlap in time, or
- Two classes are back-to-back, but the locations are too far away from each other

## Student course demands

- Curricula
- Last year's enrolments
- Pre-registrations







# Faculty of Sports Studies

- 1400 students, 470 courses per semester
- Reason to adopt UniTime: Schedule manager left
- Centralised data entry, centralised timetabling
- Student course demands: Curricula
- Interesting issues
  - Travel times between sport facilities
  - Time patterns

	A 50	D 20	K 73	140A	JAMU	
A 50		5	5	19	22	A 50
D 20	5		0	17	20	D 20
K 73	5	0		17	22	K 73
140A	19	17	17		10	140A
JAMU	22	20	22	10		JAMU
	A 50	D 20	K 73	140A	JAMU	

1 x 45 Old pattern

from:	7:10	7:20	7:30	8:00	8:10	8:30	8:50	9:00	9:20	9:40	9:50	10:20	10:30	10:40	11:00
to:	7:55	8:05	8:15	8:45	8:55	9:15	9:35	9:45	10:05	10:25	10:35	11:05	11:15	11:25	11:45
Mon															
Tue															
Wed															
Thu															

1 x 45 New pattern

from:	7:10	8:00	8:50	9:40	10:30
to:	7:55	8:45	9:35	10:25	11:15
Mon					
Tue					
Wed					
Thu					

versus





# Faculty of Sports Studies

## Time patterns help to better utilise rooms

- yellow and red highlight unused times in a room

A34 153 (100)	7:00	7:30	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	1
Mon			np 2117 Sem 1				np 2065 Sem 1	np 2040 Sem 2	np 2040 Před 2	np 2119 Sem 1a			
Tue			np 2120 Sem 2	np 2120 Sem 1				bp 2272 Sem 3a 5.11. - 10.12.		bp 2058 Sem 1			
Wed	bp 2010 Sem 1		bp 3216 Sem 1 18.9. - 27.11.			v 2025 Sem 1 19.12.		np 2040 Před 1	np 2040 Sem 1			np 20	
			bp 3216 Sem 2 25.9. - 4.12.										
Thu		bp 2010 Sem 2			bp 2010 Sem 3							bp 22 7.11	

Old

A34 153 (100)	7:00	7:30	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	1
Mon		bp 2010 Sem 1									bp 3216 Sem 1 15.9. - 20.10.		
											bp 2272 Sem 1a 27.10. - 1.12.		
Tue			c 961 Sem 1 16.9. - 2.12.	np 2120 Sem 2		bp 2316 Sem 1 16.9. - 21.10.			bp 2058 Sem 1		np		
						bp 2272 Sem 4a 4.11. - 2.12.							
Wed					np 2340 Sem 4			np 2340 Sem 2		bp 2272 29.10.			
Thu			bp 2010 Sem 4		bp 2010 Sem 2			p 974 Sem 3 18.9. - 4.12.					

New





# Faculty of Informatics

- **2300 students, 240 courses**
- **Reason to adopt UniTime: Schedule manager left**
- **Centralised data entry, centralised timetabling**
- **Student course demands: Combination of curricula and pre-registrations**
- **Interesting issues**
  - Majors with other colleges
  - Combining curricula with pre-registrations





# Faculty of Education

- **6000 students, 1820 courses**
- **Reasons to adopt UniTime**
  - New vice-dean - former scheduling manager
  - Substantial changes in curricula
  - Opportunity for data cleanup
- **Decentralised data entry, centralised timetabling**
- **Student course demands: Curricula**
- **Interesting issues**
  - Combined (distant) form of study
  - Shared resources between departments
  - Double majors



- **Combined form of study**
  - Continuing education and distance learning
  - **Irregular timetable** for Fridays and Saturdays
  - Each meeting needs to be timetabled separately
  - Strict curricula, schedule **compactness** vital
  - Much more complicated to timetable - besides times and rooms they select weeks of instructions (instead of 5 days you timetable 26 days on average)

bk 2002	0	25	Základy filozofie							
Přednáška	25		Kombi	Celý semestr	135	1x135	Kombi	□□□□□□□□□□	A15 207 učebna	Same Weeks
Přednáška	25		Kombi	Celý semestr	90	1x90	Kombi	□□□□□□□□□□	A15 207 učebna	Same Weeks
Přednáška	25		Kombi	Celý semestr	90	1x90	Kombi	□□□□□□□□□□	A15 207 učebna	Same Weeks
Před 1	25		Kombi	1x Za semestr	135	1x135	Kombi	□□□□□□□□□□	A15 207 učebna	Same Weeks
Před 1a	25		Kombi	1x Za semestr	90	1x90	Kombi	□□□□□□□□□□	A15 207 učebna	Same Weeks
Před 1b	25		Kombi	1x Za semestr	90	1x90	Kombi	□□□□□□□□□□	A15 207 učebna	Same Weeks





# Faculty of Arts

- 9 000 students, 1920 courses per semester
- Reason to adopt UniTime: Renovation of a building
- (De)centralised data entry and centralised timetabling
- Student course demands: Last year's enrolments
- Interesting issues
  - UniTime implemented in eight weeks
  - Originally imported departmental timetables from Excel sheets, but now moving away from that

2h

	from:	7:30	9:10	10:50	12:30	14:10	15:50	17:30	19:10
	to:	9:05	10:45	12:25	14:05	15:45	17:25	19:05	20:45
Mon									
Tue									
Wed									
Thu									
Fri									







# Lessons Learned

- **Input data** are key to a good timetable
- **Schedule managers** ought to be
  - People who are going to **stay** at the university (it takes about four semesters to be an expert schedule manager)
  - Entitled to **make decisions** (they should not just listen to faculty)
- **Help** helps





# Conclusion

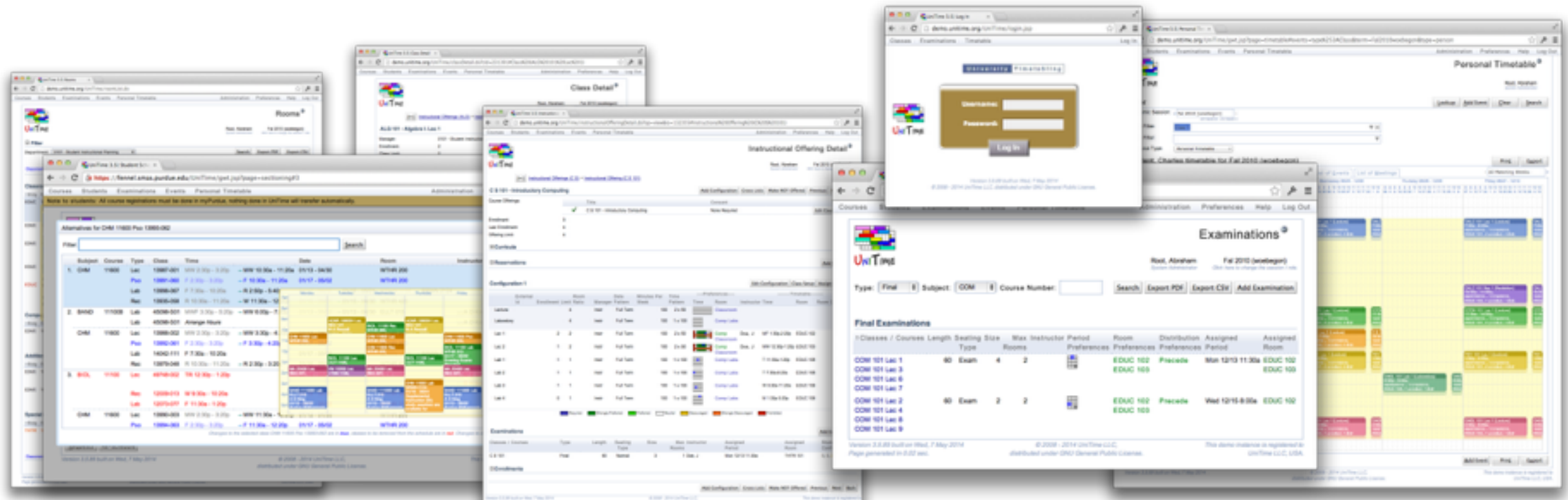
- **Four colleges have good experience with UniTime - no one went back to manual timetabling**
- **Further colleges have shown interest**
- **Plans for**
  - **Central timetabling support** at a university level (not each college independently)
  - Continuous revisions and **improvements of timetabling processes** at individual colleges and at the university level
  - Better **interface** with the student information system
  - **Research** in fairness and compactness





Come explore UniTime at [www.unitime.org](http://www.unitime.org)

Thank you!





# Resources for UniTime

- UniTime project site: [www.unitime.org](http://www.unitime.org)
- Screen documentation: <http://help.unitime.org>
- Demo: <http://demo.unitime.org>
- Manuals for data entry and timetabling in demo, under Help
- [support@unitime.org](mailto:support@unitime.org), [services@unitime.org](mailto:services@unitime.org)

