# Synchronization in C

Stefano Quer

Dipartimento di Automatica e Informatica

Politecnico di Torino

This slide introduces the topic of synchronization in C, which is crucial for managing access to shared resources in concurrent programming.

## License Information

## Semaphore implementations

- Mutexes in C are
  - Represented by object of type **mtx_t**
  - Defined in threads.h, i.e., insert
    - #include <threads.h>

Representation: Mutexes are represented by objects of type mtx_t.
Header File: Defined in threads.h, so you need to include this header file using #include <threads.h>.

- See documentation for
  - Atomic operation and fences (barriers) in C

Barriers are introduced in unit 06 section 07

## Mutual exclusion

Table of Functions:
int mtx_init(mtx_t *mtx, int mtxtype);
Meaning: Create a mutex (mtx) with some properties (mtxtype).
void mtx_destroy(mtx_t *mtx);
Meaning: Destroy the mutex pointed to by mtx.
int mtx_lock(mtx_t *mtx);
Meaning: Blocks the calling thread until it obtains the mutex referenced by mtx.
int mtx_trylock(mtx_t *mtx);
Meaning: Try to obtain the mutex referenced by mtx without blocking the thread.
int mtx_timedlock(mtx_t *mtx, const struct timespec *ts);
Meaning: Try to obtain the mutex referenced by mtx but blocks the thread only for a specific time.
int mtx_unlock(mtx_t *mtx);
Meaning: Releases the mutex referenced by mtx.

For more operations see the reference documentation

| Type | Meaning |
|---|---|
| int mtx_init(mtx_t *mtx, int muxtype); | Create a mutex (mtx) with some properties (muxtype). |
| void mtx_destroy(mtx *mtx); | Destrpy the mutex pointed by mtx. |
| int mtx_lock(mtx_t *mtx); | Blocks the calling thread until it obtain the mutex referenced by mtx. |
| int mtx_trylock(mtx_t *mtx); | Try to obtain the mutex referenced by mtx but it does not block the thread. |
| int mtx_timedlock(mtx_t *mtx, cont struct timespec *ts); | Try to obtain the mutex referenced by mtx but it blocks the thread only for a specific time. |
| int mtx_unlock(mtx_x *mtx); | Releases the mutex referred by mtx. |

This slide provides a summary of the functions used to manage mutexes in C. Here's a detailed explanation of each function:
1. mtx_init:
Purpose: Initializes a mutex with specified properties.
Parameters:
mtx_t *mtx: Pointer to the mutex to be initialized.
int mtxtype: Properties of the mutex (e.g., whether it is recursive).

```
mtx_t myMutex;
mtx_init(&myMutex, mtx_plain); // Initializes a plain mutex
```

mtx_destroy:
Purpose: Destroys a mutex, freeing any resources it may be using.
Parameters:
mtx_t *mtx: Pointer to the mutex to be destroyed.
Usage: