

Systemové programování Windows

Synchronizace vláken

Obsah

- ▶ **Uživatelský režim**
 - ▶ Interlocked...
 - ▶ CriticalSection

- ▶ **Objekty jádra**
 - ▶ Event
 - ▶ Mutex
 - ▶ Semaphore



Špatně

```
//  
//TAKTO NIKDY NE  
//  
void Lock( void )  
{  
    //cekani na zamek  
    while ( _locked )  
    {  
        Sleep(100);  
    }  
  
    //uzamceni  
    _locked = true;  
}
```



Interlocked...

```
LONG __cdecl InterlockedIncrement(  
    _Inout_ LONG volatile *Addend );
```

```
LONG __cdecl InterlockedDecrement(  
    _Inout_ LONG volatile *Addend );
```

```
LONG __cdecl InterlockedCompareExchange(  
    _Inout_ LONG volatile *Destination,  
    _In_ LONG Exchange,  
    _In_ LONG Comparand );
```



CriticalSection

```
VOID InitializeCriticalSection(PCRITICAL_SECTION cs);
```

```
VOID DeleteCriticalSection(PCRITICAL_SECTION cs);
```

```
VOID EnterCriticalSection(PCRITICAL_SECTION cs);
```

```
VOID LeaveCriticalSection(PCRITICAL_SECTION cs);
```



WaitForSingleObject

```
DWORD WaitForSingleObject(  
    HANDLE objectHandle,  
    DWORD milliseconds );
```

Návratové hodnoty:

- ▶ WAIT_OBJECT_0
- ▶ WAIT_TIMEOUT
- ▶ WAIT_FAILED



Event

```
HANDLE CreateEvent (  
    PSECURITY_ATTRIBUTES sa,  
    BOOL manualReset,  
    BOOL initialState, //true = signaled  
    PCTSTR name );
```

```
BOOL SetEvent (HANDLE eventHandle);
```

```
BOOL ResetEvent (HANDLE eventHandle);
```



Mutex

```
HANDLE CreateMutex (  
    PSECURITY_ATTRIBUTES sa,  
    BOOL initialOwner,  
    PCTSTR name );
```

```
BOOL ReleaseMutex (HANDLE mutexHandle);
```



Semaphore

```
HANDLE CreateSemaphore (  
    PSECURITY_ATTRIBUTE sa,  
    LONG initialCount,  
    LONG maximumCount,  
    PCTSTR name );
```

```
BOOL ReleaseSemaphore (  
    HANDLE semaphoreHandle,  
    LONG releaseCount,  
    PLONG previousCount );
```



C++11 Mutexes

- ▶ `std::mutex` - non-recursive, no timeout support
- ▶ `std::recursive_mutex` - recursive, no timeout support
- ▶ `std::timed_mutex` - non-recursive, timeout support
- ▶ `std::recursive_timed_mutex` - recursive, timeout support



C++11 Locks

▶ `std::lock_guard`

```
std::mutex m; // mutex object
{
std::lock_guard<std::mutex> L(m); // lock m
... // critical section
} // unlock m
```

▶ `std::unique_lock`

```
using RCM = std::recursive_timed_mutex; // typedef
RCM m; // mutex object
{
std::unique_lock<RCM> L(m); // lock m
... // critical section
L.unlock(); // unlock m
...
} // nothing happens
```



C++11 condition_variable

```
std::atomic<bool> readyFlag(false);
std::mutex m;
std::condition_variable cv;
{
    std::unique_lock<std::mutex> lock(m);

    //1
    while (!readyFlag) // loop for spurious wakeups
        cv.wait(lock); // wait for notification

    //2
    cv.wait(lock, []{ return readyFlag; }); // library loops

    ... // critical section
}

{
    readyFlag = true;
    cv.notify_one();
}
```



A mnohem více ...

- ▶ Slim Reader/Writer (SRW) Locks
- ▶ Waitable Timers Objects
- ▶ Synchronization Barrier



Díky za pozornost

