Parallelism
Synchronous mechanism

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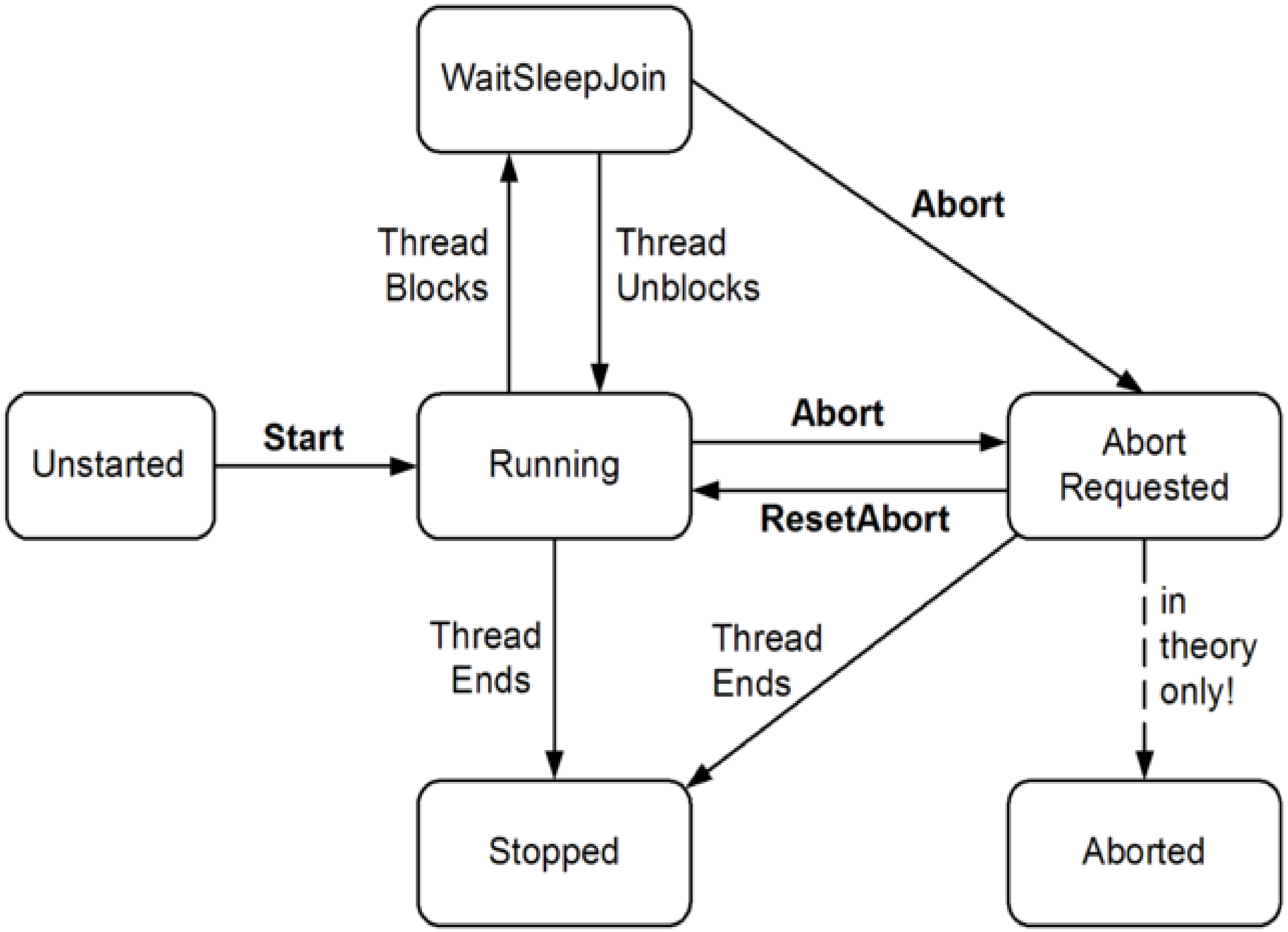
Time consuming operations

Two categories

- CPU-bound operations
- I/O-bound operations

Thread Life cycle



Thread in C#

```
Thread t = new Thread (-- delegate Method --);
t.Start();
…
t.Join(); // wait here until t is completed
```

? Delegate Method

Thread in C# - executing

```
class ThreadTest
{
  static bool done;    // Static fields are shared between all threads

  static void Main()
  {
    new Thread (Go).Start();
    Go();
  }

  static void Go()
  {
    if (!done) { done = true; Console.WriteLine ("Done"); }
  }
}
```

Parallelism in C# - An Overview

Levels of parallelism:

• Thread	-- Basic structure for parallelism (in most programming languages)
• Task	-- C# smooth variant i.e. Task.Run(<<delegate method>>)
• Parallel.Invoke	-- Can start several threads (continues after all thread is completed)
• Parallel.For/Foreach	-- Can start several threads in a loop (continues after all thread is completed)
• Plinq	-- Can execute a Linq expression in parallel

High End Parallelisme **async / await**

- Use of built in features **async / await**

  Do not create a new thread but make use of a coroutine i.e. program continue and ‘jumps’ back to the await call when it is ready.

- Where to use
  - I/O-bound operations – Like network, accessing files etc.

Good Practice

- How to use
  - Method is async – like public async Task<int> DoSomethingAsync()
  - In method body … somewhere

    await …..   return anInteger;

What is Async / Await ?

- The use of Async / Await is **not** directly the same as a **thread** / task !

- But the program will wait at ‘await’ until this job is done
- And you can continue do other stuff in between
  e.g. show information about ‘work in progress’ (Jacob Nielsen – System status)

```
Task<List<Picture>> pictures = await ReadPicturesFromFile(“somefile.pic”);
Status = “Getting pictures …”;      // set system status
foreach(var pic in pictures.Result){
    …
}
```

Demo

Opgaver C#Exercises Prog.3.6+3.7