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Siemens Corporate Technology

Embedded Multicore Building Blocks (EMB²)
Open Source C/C++ Library for Parallel Programming of Embedded Systems
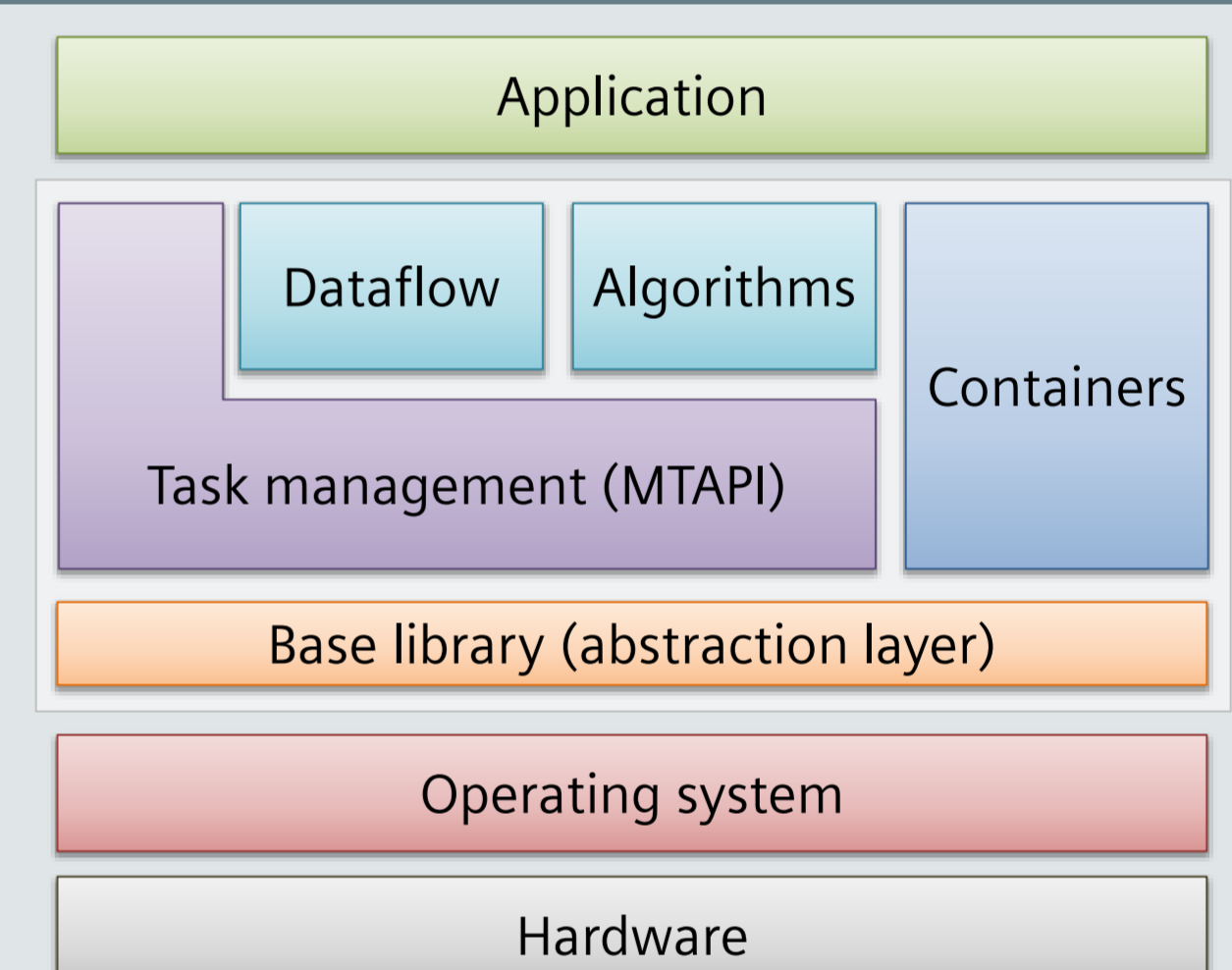
Top challenges for multicore

- Low-power scalable **heterogeneous** architectures
- Hard **real-time** systems and their programming
- Existing frameworks mainly target **desktop** and **server** applications ⇨ not suitable for embedded systems

IEEE CS 2022 Report

"In 2022, multicore will be everywhere."

EMB² at a glance

- Designed for **embedded systems** with real-time and memory constraints
- Increased application **performance** and development **productivity**
- Based on MTAPI **industry standard** for task management

Application

| Dataflow | Algorithms | |
| Task management (MTAPI) | | Containers |

| Base library (abstraction layer) |
| Operating system |
| Hardware |

https://github.com/siemens/embb

Key features

- **Resource awareness** (memory footprint / allocation)
- Fine-grained **control over hard-ware** (task priorities / affinities)
- **Lock-/wait-free** implementation
- Support for **distributed** and **heterogeneous** systems
- Portability (x86, ARM, ...)
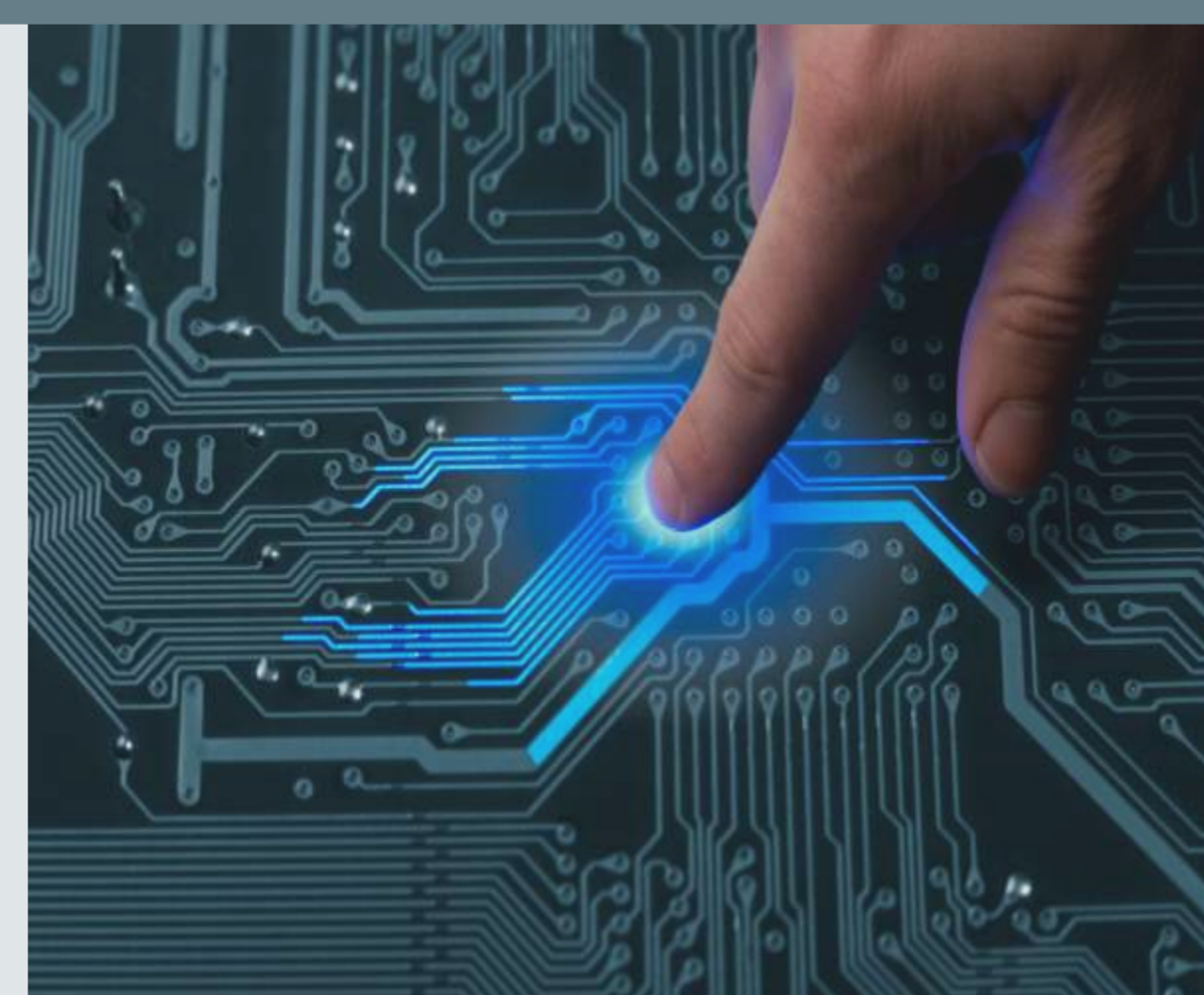
Deterministic behavior ⇨ predictability

Example

```cpp
std::vector<int> v;
// create execution policy
embb::tasks::ExecutionPolicy
  policy(2); // priority = 2
// parallel for loop
embb::algorithms::ForEach(
  v.begin(), v.end(),
  [] (int& x) {x *= 2;},
  policy);
```

Easy parallelization of legacy code

Application domains

- Industrial automation
- Energy production and management
- Health care, medical imaging
- Transportation, autonomous driving
- Building technologies
- ...

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