Introduction to FastFlow programming

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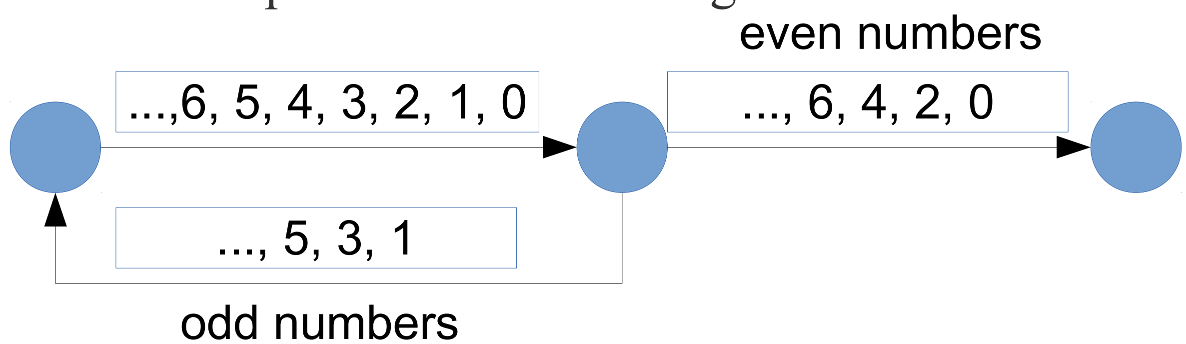
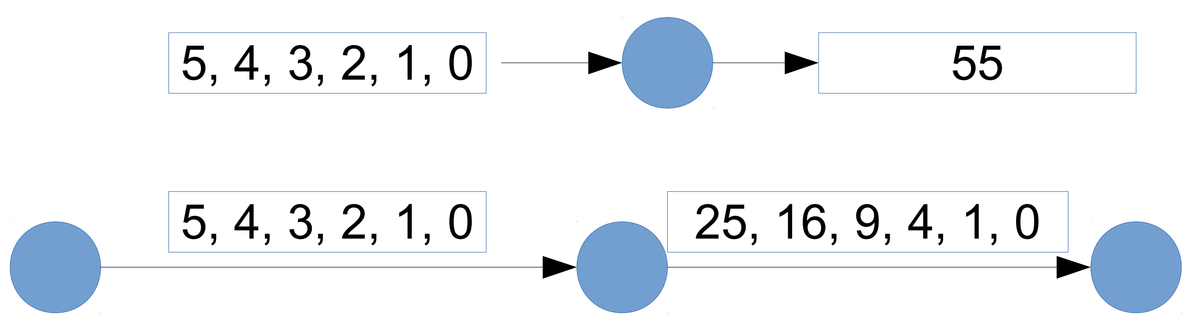
ClassWork1

- Modify *hello_pipe_feedback.cpp* (provided to the students in the ClassWork1 folder) in order to implement the following behavior:

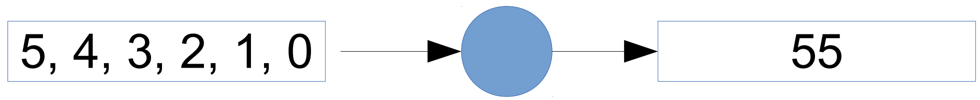


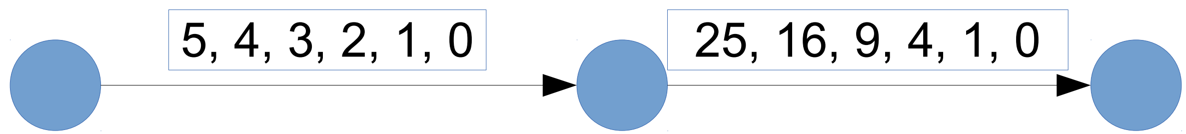
- Computing the sum of the square of the first N numbers using a pipeline.



ClassWork1: comments

- Computing the sum of the square of the first N numbers using a pipeline.






```
// 3-stage pipeline
ff_Pipe<> pipe( first, second, third );
pipe.run_and_wait_end();
```

```
// 1st stage
struct firstStage: ff_node_t<float> {
  firstStage(const size_t len):len(len) {}
  float* svc(float *) {
     for(long i=0;i<len;++i)
        ff_send_out(new float(i));
     return EOS; // End-Of-Stream
  }
  const size_t len;
};
```

```
// 2nd stage
struct secondStage: ff_node_t<float> {
  float* svc(float *task ) {
       float &t = *task;
       t = t*t;
       return task;
   }
};
```

```
// 3rd stage
struct thirdStage: ff_node_t<float> {
  float* svc(float *task ) {
        float &t = *task;
       sum +=t;
       delete task;
       return GO_ON;
   }
   void svc_end() { std::cout << “sum = “ << sum << “\n”; }
   float sum = {0.0};
};
```

Possible extention: think about how to avoid using many new/delete

Core patterns: *ff_farm* (1)

task-farm pattern

```
struct myNode: ff_node_t<myTask> {
   myTask *svc(myTask * t) {
      F(t);
      return GO_ON;
}};

std::vector<std::unique_ptr<ff_node>> W;
W.push_back(make_unique<myNode>());
W.push_back(make_unique<myNode>());

ff_Farm<myTask>
                    myFarm(std::move(W));

ff_Pipe<myTask>
     pipe(_1, myFarm, <...other stages...>);

pipe.run_and_wait_end();
```

- Farm's workers are ff_node(s) provided via an std::vector
- By providing different ff_node(s) it is easy to build a MISD farm (each worker computes a different function)
- By default the farm has an Emitter and a Collector, the Collector can be removed using:
  - myFarm.**remove_collector();**
- Emitter and Collector may be redefined by providing suitable ff_node objects
- Default task scheduling is pseudo round-robin
- Auto-scheduling:
  - myFarm.**set_scheduling_ondemand()**
- Possibility to implement user's specific scheduling strategies (**ff_send_out_to**)
- Farms and pipelines can be nested and composed in any way

Core patterns: *ff_farm* *(2)*

task-farm pattern

```
myTask *F(myTask * t,ff_node*const) {
   .... <work on t> ....
   return t;
}

ff_Farm<myTask> myFarm(F, 5);
```

- Simpler syntax
- By providing a function having a suitable signature together with the number of replicas
  - 5 replicas in the code aside
- Default scheduling or auto-scheduling

```
myTask *F(myTask * t,ff_node*const) {
   .... <work on t> ....
   return t;
}

ff_OFarm<myTask> myFarm(F, 5);
```

- Ordered task-farm pattern
- Tasks are produced in output in the same order as they arrive in input
- In this case it is not possible to redefine the scheduling policy

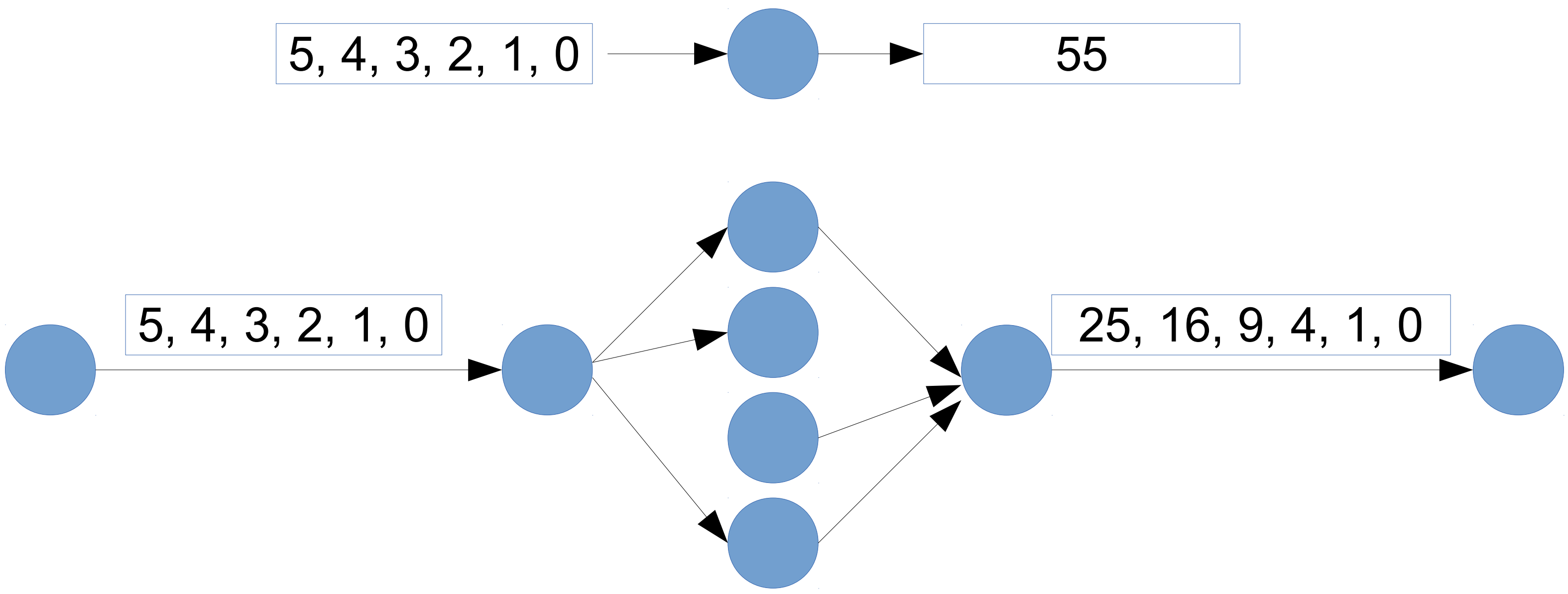
Simple *ff_farm* examples

- Let's comment on the code of the 2 simple tests presented in the FastFlow tutorial:
  - hello_farm.cpp
  - hello_farm2.cpp

- Then, let's take a look at how to define Emitter an Collector in a farm:
  - hello_farm3.cpp
- A farm in a pipeline without the Collector:
  - hello_farm4.cpp

ClassWork2

- Considering again the ClassWork1. Then, transform the middle stage of the pipeline in a task-farm.



- When it works, then try to remove the collector from the farm.