Practical Assignment 1

Lab session on HSDF
Lab session on CSDF

Bart Theelen
Dataflow Models of Computation

Balancing expressive power and analyzability of qualitative and quantitative properties

Expressiveness hierarchy
- Scenario-Aware Dataflow
- Cyclo-Static Dataflow
- Synchronous Dataflow (Weighted Marked Graphs)
- Homogeneous Synchronous Dataflow (Marked Graphs)

Analyzability

Expressiveness and succinctness
- implemented efficiency

Implementation efficiency

Analyzability
Impact of Dynamism

Conservative worst-case abstraction  Dynamics captured in scenarios & state machines

SDF  

MPEG-4 SP Decoder  

Throughput = 0.252525  

SADF  

Throughput = 0.425571
Lab Session on HSDF

• Self-contained exercises on Homogeneous Synchronous Dataflow with varying execution times
  – Reference to paper on case study is background material

MPEG-4 AVC Decoding
Lab Session on CSDF

• Self-contained exercises on Cyclo-Static Dataflow
  – Reference to paper on case study is background material
Cyclo-Static Dataflow

• Actors *repeat a fixed sequence* of alternative behaviors
  – Alternative behaviors are referred to as *phases*
  – *Phases* can differ in consumption/production rates and execution time
    • Consumption/production rates of 0 are allowed

• CSDF extends some SDF concepts
  – Balance equations
  – Repetition vector
  – Consistency
  – Iteration

Conceptual understanding of these aspects for SDF is sufficient to do the CSDF exercises
Cyclo-Static Dataflow

• Consider a CSDF graph with actors $A$ and channels $C$

• A repetition vector is a function $q: A \rightarrow \mathbb{N}_0$ given by
  
  $$q(a) = N \cdot r(a)$$

  for all $a \in A$, where $r$ is a function $r: A \rightarrow \mathbb{N}_0$ such that for each channel $(o, i) \in C$ from actor $a \in A$ to $b \in A$

  $$r(a) \cdot \sum_{0 \leq k < N} rate(o, k) = r(b) \cdot \sum_{0 \leq k < N} rate(i, k)$$

• A CSDF graph is called consistent if and only if it has a non-trivial repetition vector. The unique smallest non-trivial repetition vector of a consistent CSDF graph is designated as the repetition vector of the CSDF graph

Tools

- $\text{SDF}^3 = \text{set of command line tools for analyzing qualitative and quantitative properties of dataflow models}$


Dataflow Modeller

SDF3 Wizard

Basic documentation provided as part of material to exercises

https://modeltech.org
Dataflow Modeller
Multi-platform GUI for modelling and analysing dataflow

- Duplicate names allowed (except for CSDF phases and SADF subscenarios)
- Possibility to create invalid models is minimized: emptying field auto-corrects to default values (e.g., for rates, execution times, weights)
- Several options only via context menu (right-hand mouse button)
- Positioning mouse pointer is rather sensitive
- Instantiating classes by drag & drop from class list to diagrams
- No undo facilities
- Minimal auto-layouting of diagrams
- No debugger / simulator

https://modeltech.org
Dataflow Modeller
Multi-platform GUI for modelling and analysing dataflow

Feedback appreciated on dedicated QEES forum on Coursera (QFM)

Interested in improving the tools? → Let me know!

Possibility to get some payment and/or to connect your efforts to a trainee/master project on dataflow related topics if you are interested

https://modeltech.org
Organizational Aspects

• Perform lab sessions in a group of 2 to 3 students from same site (same group for both practical assignments)

• Hand in *single pdf* file *per group* with answers
  – Include names of all group members and student IDs
  – TUD: upload pdf to dedicated folder in Brightspace
  – UT: email pdf to a.k.i.remke@utwente.nl
  – TU/e: email pdf to p.j.l.cuijpers@tue.nl

• Hand in pdf *before* 23:59h on 27 November 2017

• Assignment is awarded with pass or fail
  – Not handed in on time → fail
  – If fail then you will get extra assignment on 15 December 2017