Towards Unified Tool Support for Real-Time Calculus and Deterministic Network Calculus

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ECRTS 2017 WiP
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One Calculus or two Calculi?


- A Calculus for Network Delay, Part I: Network Elements in Isolation
  - Bounding functions for data/task arrivals as well as forwarding service/computing resource
One Calculus or two Calculi?


- A Calculus for Network Delay, **Part I**: Network Elements in Isolation
  - Bounding functions for data/task arrivals as well as forwarding service/computing resource

- A Calculus for Network Delay, **Part II**: Network Analysis
  - Compute results per server and compose to an end-to-end WCTT / WCET
One Calculus or two Calculi?

Deterministic Network Calculus (DNC)
Focus on improving this part:
- A Calculus for Network Delay, **Part II**: Network Analysis
  - Compute results per server and compose to an end-to-end WCTT / WCET
- **Ever more accurate network analysis results**

Server analysis          Tandem analysis          Feed-forward network analysis

<table>
<thead>
<tr>
<th>TFA</th>
<th>SFA</th>
<th>PMOO</th>
<th>OBA</th>
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One Calculus or two Calculi?

Real-Time Calculus (RTC)

Has a larger focus on improving this part:

- A Calculus for Network Delay, **Part I**: Network Elements in Isolation
  - Bounding functions for data/task arrivals as well as forwarding service/computing resource
- **More accurate workload and resource characterizations**

### Server analysis

- TFA
  - [Cruz91]
  - 1991

### Tandem analysis

- SFA
  - [LeBoudec01]
  - 2001
- PMOO
  - [Fidler03]
  - 2003
- OBA
  - [Schmitt08]
  - 2008

### Feed-forward network analysis

- LP, ULP
  - [Bouillard10]
  - 2010
- TMA
  - [Bondorf17]
  - 2017
- RTC
  - [Thiele00]
  - 2000
- Finitary RTC
  - [Guan13]
  - 2013
- Generalized Finitary RTC
  - [Lampka17]
  - 2017

### Single GPC analysis (results are composed to WCET)

**Real-Time Calculus (RTC)**

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One Calculus or two Calculi? Tool Support?


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**Feed-forward network analysis**
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- Generalized Finitary RTC [Lampka17] 2017

**Single GPC analysis (results are composed to WCET)**

**RTC toolbox**

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Steffen Bondorf – Towards Unified Tool Support for RTC and DNC – ECRTS 2017 WiP
One Calculus or two Calculi? Tool Support?

- Towards a Real-Time Calculus Toolbox, Wandeler and Thiele, 2006
- The DISCO Network Calculator, Schmitt and Zdarsky, 2006

It has become too complex!
We need to help our users!

Server analysis
- TFA [Cruz91]
- SFA [LeBoudec01]
- RTC [Thiele00]
- 2000

Feed-forward network analysis
- GPC network analysis
- ... 1991

DiscoDNC
- Generalized Finitary RTC [Bondorf17]
- 2017

Single GPC analysis (results are composed to...)
- TMA [Bondorf17]
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The Real-Time Calculus Toolbox, Wandeler and Thiele, 2006
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... 2000

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One Calculus or two Calculi? Tool Support?

- Our Goal: Unify both tools, gain both their benefits!
  - RTC More accurate workload and resource characterizations
  - DNC More accurate network analysis results
  - Novel results? Only a single implementation necessary 😊

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DiscoDNC

Unified Tool

RTC toolbox

TFA [Cruz91]

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SFA [LeBoudec01]

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RTC [Thiele00]

…

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2017

…
One Calculus or two Calculi? Tool Support?

- Current State [ECRTS2017WiP]:
  - RTC More accurate *workload and resource characterizations*
  - DNC More accurate network analysis results

- The DiscoDNC can use the RTC curve implementation ✓
  - Proof of concept ✓ (details are in the paper and on the poster)
  - Cannot use the operations yet ✗ (future work)
References


