# Programming Languages
# A Journey into Abstraction and Composition

## Course Introduction

Prof. Dr. Guido Salvaneschi

# About me

Guido Salvaneschi
- Heading the Programming Group
- University of St.Gallen

Research in programming languages
- PL for distributed systems
- PL and security
- PL for software quality
- Domain specific,
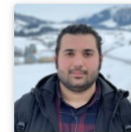  e.g., Infrastructure as code

https://programming-group.com/

**PL**

**SYS**

**SE**
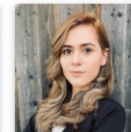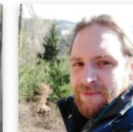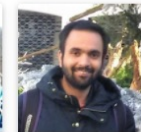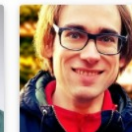
Formalization of RP/CEP
[ICFP'18]

Adaptive placement for CEP
[SEAMS'17] [DEBS'18]

Java generics and exceptions
[PLDI'15][PLDI'16]

Engineering Distributed
Data-intensive Applications

CEP on mobile devices
[DEBS'18]

Concurrent RP
[OOPSLA'18]



Programming for Failures in
Edge Computing

e2 = e1.filter(x >10)

e3 = e2.map(x.toString)

fire e1(10)

[R.Mogk, J.Drechler, G.Salvaneschi, M.Mezini, **A Fault-tolerant Programming Model for Distributed Interactive Applications**, OOPSLA 2019]
[R.Mogk, L.Baumgaertner, G.Salvaneschi, B.Freisleben, M.Mezini, **Fault-tolerant distributed reactive Programming**, ECOOP 2018]

Fault tolerance
[ECOOP'18]
[OOPSLA'19]
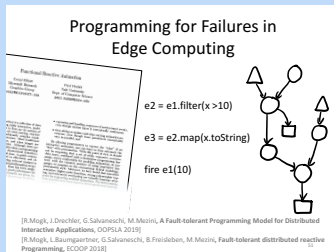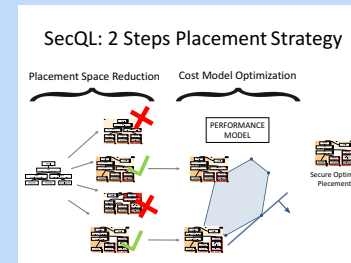


SecQL: 2 Steps Placement Strategy

Placement Space Reduction    Cost Model Optimization

PERFORMANCE MODEL

Secure Optimal Placement

Privacy-preserving Queries
[OOPSLA'19]

Incrementality
[OOPSLA'14]

Distributed RP
[OOPSLA'14]



Flink

Eliminated **23** non-exhaustive pattern matches
and **8** type casts

ScalaLoci: Tierless Programming
[OOPSLA'18]

ConSysT Consistency Types
[OOPSLA'20]

Tierless Modules
[ECOOP'19]

Debugging RP
[ICSE'16]



ConSysT Programming Framework

class Concert {
    Date date;
    Ref<@Weak ConcertHall> hall;
    Ref<@Weak Band> band;
    Ref<@Strong Counter> soldTickets;
    ...
}

Programming model supports
explicit consistency levels

Information flow static analysis
ensures safe mixing of consistency levels

Multiple
consistency levels
[TSE'18]

Controlled experiments on RP
[FSE'14] [TSE'17]

Infrastraucture as Code
[FSE'20]

Refactoring RP
[ASE'19]
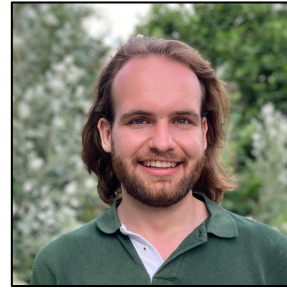
Thank you

# THANKS!

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