FABRÍCIO CARVALHO

College of Computing, Federal University of Mato Grosso do Sul, Brazil
fabricio.carvalho@ufms.br - https://carvalhof.github.io

EDUCATION

Ph.D. in Computer Science at UFMS, Brazil **2018 – present**
Advisor: Ronaldo A. Ferreira

M.S. in Computer Science at UFMS, Brazil 2012 – 2014
Advisor: Ronaldo A. Ferreira
Thesis: *Construction of Causal Paths in Software Defined Networking (Portuguese)*

B.S. in Computer Science at UFMS, Brazil 2008 – 2011
Advisor: Marcelo Henriques de Carvalho
Thesis: *An Efficient Algorithm for Course Scheduling (Portuguese)*

SELECTED PUBLICATIONS

* **Dyssect: Dynamic Scaling of Stateful Network Functions**
F. B. Carvalho, R. A. Ferreira, Í. Cunha, M. A. M. Vieira, M. K. Ramanathan.
IEEE INFOCOM, 2022

* **DWT in P4: Periodicity Detection in the Data Plane**
B. R. Huaytalla, A. S. Jacobs, M. V. B. Silva, F. B. Carvalho, R. A. Ferreira, W. Willinger, L. Granville.
IEEE GLOBECOM, 2022

* **A Verified Session Protocol for Dynamic Service Chaining**
P. Zave, F. B. Carvalho, R. A. Ferreira, J. Rexford, M. Morimoto, X. K. Zou.
IEEE/ACM Transactions on Networking (ToN), 2021.

* **State Disaggregation for Dynamic Scaling of Network Functions (Under review)**
F. B. Carvalho, R. A. Ferreira, Í. Cunha, M. A. M. Vieira, M. K. Ramanathan.
Submitted to *IEEE/ACM Transactions on Networking (ToN), 2022.*

RESEARCH INTERESTS

Operating Systems

Programmable Data Planes

Kernel-bypass Technologies (DPDK, RDMA)

Network Function Virtualization (NFV) and Software Defined Networking (SDN)

TECHNICAL SKILLS

Fluent in Bash, C, C++, Rust, and Python

Advanced knowledge of Assembly x86, DPDK, P4, and OpenFlow

RELEVANT PROJECTS

* **Ph.D. Research**
  I am currently implementing and evaluating different architectures for supporting multiple cores on the Demikernel, a flexible datapath OS for μs-scale datacenter systems under development at Microsoft Research. In particular, I am evaluating the tradeoffs of performing network stack and application processing on the same or on different cores.

  As part of my Ph.D., I have also implemented a framework for supporting the dynamic scaling of stateful network functions. The framework uses BESS with DPDK and combines hardware features (e.g., tuning the RSS indirection table of a commodity NIC or offloading heavy tasks to a programmable NIC) and software for dispatching packets to cores to guarantee flow affinity and avoiding the use of synchronization primitives.

* **Significant Systems Projects**
  Implementation of the Discrete Wavelet Transform (DWT) to analyze time-series data with low computational overhead using P4 and Micro-C in the Netronome NFP-4000 SmartNIC. This implementation explores an efficient online algorithm that I developed to circumvent various limitations of existing P4-programmable data plane devices and performs the DWT decomposition entirely in the data plane. Source code available at `https://github.com/ComputerNetworks-UFRGS/p4wavelets`.

  Implementation of the Dysco Protocol (SIGCOMM'17) in BESS with DPDK. I implemented several extensions to the original Dysco Protocol for dealing with middleboxes that change the 5-tuple of a packet (e.g., NAT). Source code available at `https://github.com/dysco/dysco-us`.

  Implementation of a mini Operating System in C and Assembly with boot loader, process scheduling, IPC, virtual memory, and file system. This project was based on Princeton's OS course (COS318). For details, see the description at `https://www.cs.princeton.edu/courses/archive/fall15/cos318/projects.html`.

* **M.S. Research**
  As part of my M.S., I implemented an SDN tool (S-Trace) for building causal paths and detecting failures and bottlenecks in a network. To build a causal path, S-Trace intercepts library function calls for IPC (shared memory, fork, pipe, etc.) and network communication (accept, connect, send, recv, select, etc.) to collect communication events between processes and uses record and replay techniques in SDN to correlate the events.

LANGUAGE SKILLS

Portuguese: native

English: fluent

TEACHING EXPERIENCE

Lecturer at Federal University of Mato Grosso, Brazil 2015 – 2022
Taught the Following Undergraduate Courses:

- Computer Networks
- Object-Oriented Programming
- Algorithms and Data Structures
- Project of Computer Engineering
- Mathematical Foundations of Computer Science

REFERENCES

Ph.D. Advisor: Prof. Ronaldo A. Ferreira
`https://www.facom.ufms.br/~raf`
`raf@facom.ufms.br`

Prof. Ítalo Cunha
`https://dcc.ufmg.br/~cunha`
`cunha@dcc.ufmg.br`

Other references available upon request.