



# Automated SmartNIC Offloading Insights for Network Functions

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# SmartNICs are very different!



Heterogeneous compute engines (e.g., SoC cores, ASIC accelerators)



Lightweight runtime (e.g., no full OS or libc support)



Proprietary, closed-source compiler toolchains (e.g., NFCC)



Constrained programming models (e.g., microC)

- **Good program performance requires expert knowledge**

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# Clara Overview

Cross platform  
performance prediction

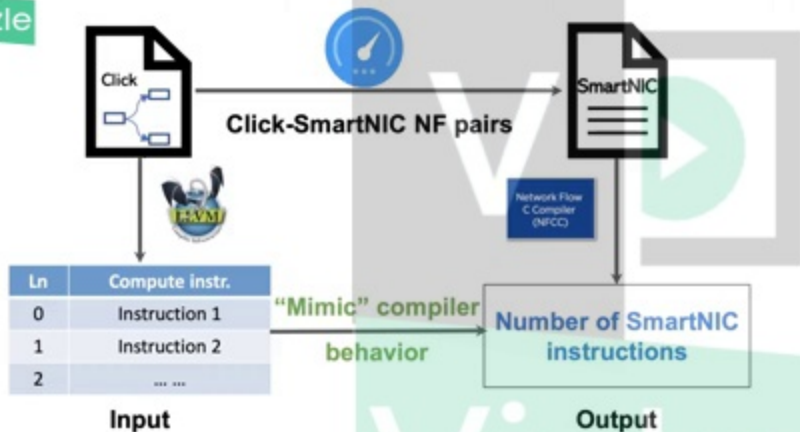


Clara

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Program analysis + Machine learning techniques

## Cross platform performance prediction



- Clara takes inspiration from **Natural Language Processing**
  - Learn from Click-SmartNIC pairs in their compiled forms
  - **Predict** by mimicking SmartNIC compiler behavior

# Performance prediction: Data generation



**Dozens of  
Legacy NF pairs**

- **Lack of real world Click-SmartNIC program pairs**
  - Adapt program generator as data synthesizer
  - Random but representative program generation

**Lack of ML training data!**

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## Evaluation setup

- Clara prototype
  - 7400 LoC
  - Extends YarpGen for data synthesis
  - Tensorflow, Scikit-learn, TPOT for ML
- A range of legacy network functions
  - Click modular router elements and confs
- SmartNIC platform
  - Netronome Agilio CX SmartNIC
  - Compilation in bare-metal mode (Micro C)



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