Barista: A Highly Composable NOS Brewing Framework for Software-Defined Networks
Jaehyun Nam*, Hyeonseong Jo*, Yeonkeun Kim*, Seungwon Shin*, Pillip Porras® and Vinod Yegneswaran®
KAIST, Daejeon, Korea
®SRI International, CA, USA

Motivation

- Popularity of Software-Defined Networks
  - Deployment of SDN in diverse network environments (e.g., enterprise, data center and cloud networks)
- Specialized NOSs in different dimensions
  - ONOS and OpenDaylight for distributed scalability
  - Rosemary and SE-Floodlight for enhanced security

Five Dimensions of today’s NOSs (SP-CIA)

- Scalability
- Performance
- Confidentiality
- Integrity
- Availability

Contributions

- Analysis of existing NOSs and their constituent elements (components)
- NOS building framework with common and specialized components
- Automated algorithm for optimally assembling NOS components

Key Insight

“Let me know what you want. I will make a new customized NOS for you.”

Design

Barista architecture

Base components
- Applications
- Application layer
- Application handler
- Message arbiter
- Protocol parser
- Core layer
- Network manager
- Southbound layer

Extensible components
- Core-App separation
- Application authentication
- Role-based authorization
- Cluster Mastership
- Flow rule cache
- Static rule enforcement
- Control flow integrity
- Message verification
- Resource manager
- Flow rule conflict
- SB-Core separation
- Event handler

Integration of extensible components

Component optimizer

- Prerequisite for optimization
  - High-level priorities for SP-CIA
  - Importance metrics for each comp.
  - Restrictions of CPU and memory
- Optimization process (based on LP)
  - Discovering components fit into specific needs while maximizing resource utilization

Examples

- NOS for high confidentiality and integrity
- NOS for high scalability and performance

Evaluation

Test environment

Barista
Barista
Barista
CBench

Xeon E5-1650 (12 cores, 3.50 GHz)
64GB memory

Intel i5 (4 cores, 3.50 GHz)
16GB memory

< Component microbenchmark >

< Comparison with contemporary NOSs >