



## Combining Attestation and Provenance to Improve Reproducibility and Debugging on FABRIC

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### Introduction

- Troubleshooting at-scale network experiments can be difficult and time consuming
- Reproducibility and correctness relies on being able to verify the processes that created research artifacts
- Both issues can be addressed within the same scope – tools which generate provenance both verify artifact creation and can highlight issues during troubleshooting
- This work combines the P4 sample software switch BMv2 with a provenance-recorder SPADE to address these issues

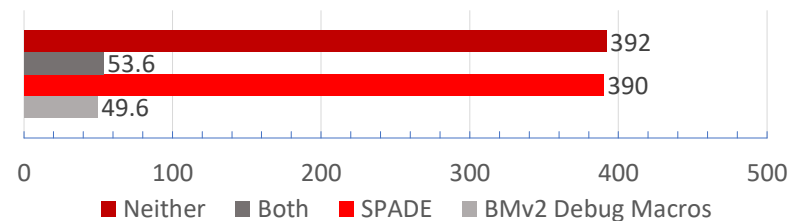
### Approach

- A programmable network element (BMv2 Simple Switch) is extended to support Remote Attestation primitives that broadcast evidence of its state
- This evidence is centralized in SPADE to provide a database showing how the element has changed over time
- This is extended by connecting flows in the data plane with the state of the switch they were processed under
- The recording done can be tailored by the user to minimize collecting unwanted data

### Results

- Issues such as misconfigurations are more clearly visible
- Results that are unexpected or confusing can be verified through querying
- State is directly linked to provenance, improving reproducibility by clarifying the artifacts
- SPADE outputs are generated without the performance impact of normal BMv2 logging

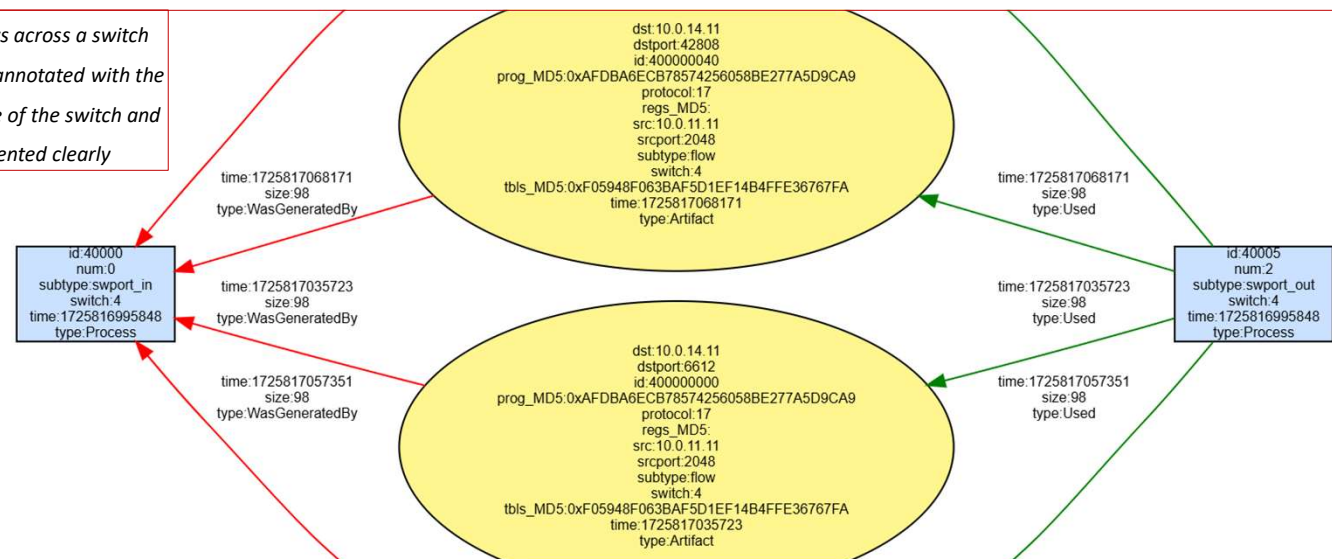
Received Mbps in iperf3 UDP 1Gbps for 300s using SPADE or In-Built BMv2 Debug Logging



### Motivation

1. Troubleshooting tools can assist researchers both experienced and new
2. Easily-reproducible experiments enable faster review and growth of the field
3. This work also provides a foundation for exploring security through remote attestation

Flows across a switch are annotated with the state of the switch and presented clearly



### Acknowledgement

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