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Attestation-Capable, Programmable Switch as 5G UPF

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Introduction

- User-Plane Function (**UPF**) devices provide essential services to 5G networks.
- Programmable dataplanes can serve as UPF to offer flexibility through programmability.
- However, a programmable dataplane has potential for misuse if an attacker gains control.
- Thus, we need to ensure the programmable resource is in a trusted state.
- This demo examines what a modern version of the "Athens Affair" attack could look like on a 5G UPF controlled by a programmable dataplane, and how Remote Attestation defends against it.

Motivation

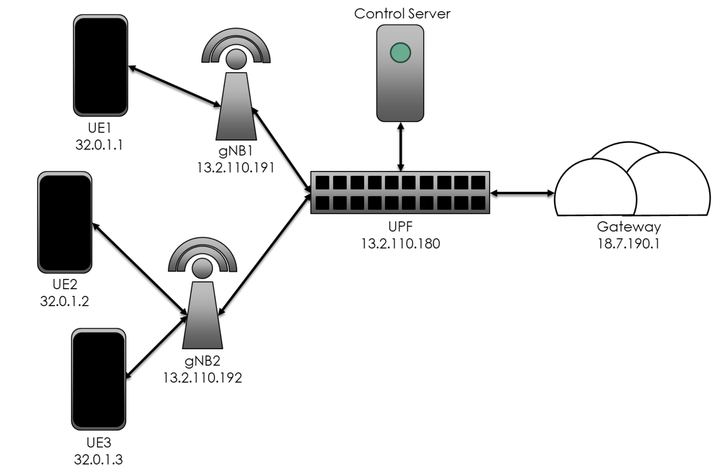
1. Demonstrate use of programmable dataplane as 5G UPF Device.
2. Explore modern version of the Athens Affair, a notable past attack on a telecom network.
3. Explore defense techniques in 5G and beyond.

Approach

- A programmable network element (**BMv2 Simple Switch**) is extended to support **Remote Attestation** primitives which verify the trustworthiness of the switch state.
- This switch serves as a UPF in a mock 5G network.
- We simulate normal **5G Network Control Functions** including IP assignment and bandwidth monitoring.
- A dedicated port connects the switch to an **RA Verifier** which confirms that the UPF is executing expected code and detects attempts to tamper with it.

Results

- The verifier confirms the switch state is correct when initialized in the correct state.
- When the program is overwritten, though the switch still reports it is correct, the verifier correctly detects that the program alteration.



./start_upf.sh: Egress() {}

```
RuntimeCmd: get_ra_data
Registers: D41D8CD98F00B204E9800998ECF8427E
Tables: CAF1A3DFB505FFED0D024130F58C5CFA
Program: 99914B932BD37A50B983C5E7C90AE93B

Monitoring UPF
```

./hostile_upf.sh: Egress() { clone() }

```
RuntimeCmd: get_ra_data
Registers: D41D8CD98F00B204E9800998ECF8427E
Tables: CAF1A3DFB505FFED0D024130F58C5CFA
Program: 99914B932BD37A50B983C5E7C90AE93B

Monitoring UPF
Warning! Potentially unauthorized program change
Old: 99914b932bd37a50b983c5e7c90ae93b
New: d9762af1dc0cf30c0e59c381dc39a538
```

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