Authentication and Authorization in Wired OpenFlow-Based Networks Using 802.1X

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Authentication and Authorization in SDN

► Extensive work on identity-based network control
  ▪ Kinetics, Resonance, Ethane, ...

► Status quo
  ▪ Web frontend authentication
    ▪ User interaction required (reauthentication, ...)
    ▪ Compatibility issues
  ▪ Static MAC address to identity mapping
    ▪ Highly insecure
Objectives (1/3)

- **802.1X**
  - Most widely used standard for port-based authentication and authorization in access networks (e.g. eduroam)
  - Leverages EAP (RFC 3748) and RADIUS (RFC 2865)

- **Applicability of 802.1X to SDN**
  - Transformation of 802.1X Authenticator module on legacy switches into a network application

- **Compliance to standards**
- **Modification transparent to endpoints**
Objectives (2/3)

► Authentication and authorization using RADIUS

Authentication and authorization resource (LDAP)

► Additional authentication resources (other than RADIUS)

Authentication and authorization resource (SQL database)
Session management for authorization

- Network-wide session database for identity-based network control

```json
{ test@uni-tuebingen.de : { max_sessions : 1, sessions : (  
    { aaa_time : Mo 13 Jun 2016 14:16:26 CEST,  
      aaa_method : Radius(ip=10.0.20.100, meth=EAP-TLS),  
      phys_port : OF-Switch(ip=10.0.20.222, port=1),  
      assigned_vlans : (10)},  
  )}
```

- Check for simultaneous usage boundaries

- Support for fine-grained and complex admission rules

```python
student = ["bob"]; prof = ["alice"];  
[(isrc="prof") \land (protocol="https") \land (idst="student") ]: allow;
```

- Immediate enforcement of authorization changes
Summary

- Proof-of-concept implementation
  - Application for Ryu SDN controller
  - Various test scenarios
  - Various authentication and authorization resources

- Further work
  - Performance study
  - Use of NFV to provide scalability
  - Open source
  - Documentation