Empowering Future Networks through Programmable Testbeds and Software Engineering

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Outline

- Why SDN?
- Why NOT SDN?
- Why Software Engineering?
- The PROFISSA Project
- LST

About Me

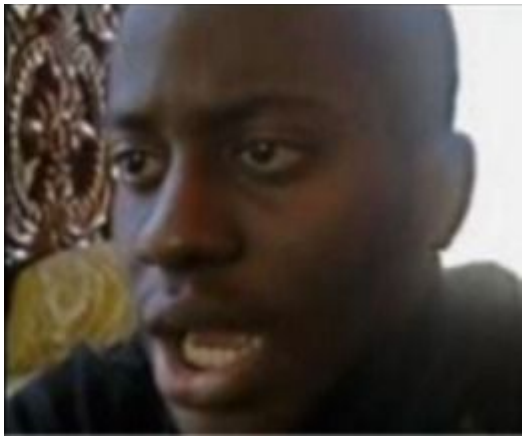
- **Lucas Bondan, Ph.D.**
  - R&D Coordinator at RNP
  - Invited Researcher at UnB
  - lbondan.wordpress.com

Why Software-Defined Networking (SDN)?

- Centralized Network Control
- Programmability and Automation
- Enhanced Network Visibility and Monitoring
- Simplified Network Management
- Cost Efficiency
- Network Innovation and Customization

Why **NOT** SDN?

- Controller Scalability and Reliability
- Integration with Legacy Infrastructure
- Lack of Standards and Interoperability
- Complexity in Network Design and Debugging
- Skill Gaps and Cultural Barriers
- Performance Overhead



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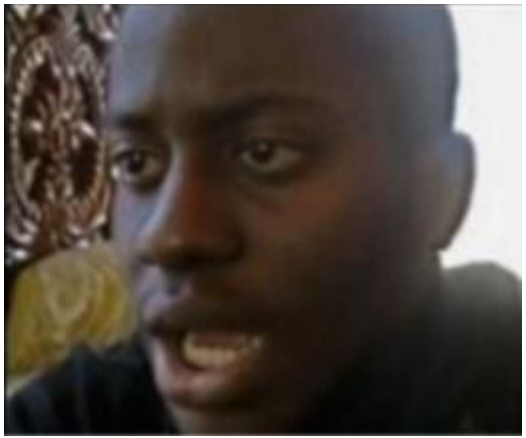

How about combining SDN with Software Engineering?

- Modularity, Encapsulation, and Separation
- Maintainability
- Reusability
- Scalability
- Testing and Reliability
- Faster Debugging and Issue Resolution

The PROFISSA Project

- Programmable Future Internet for Secure Software Architecture (PROFISSA)
  - Proposed to investigate, map and advance the use of software engineering techniques when applied to programmable networks
- Objectives
  - Improve the structural and functional quality and the process of developing network programs
  - Provide a modular and reusable code framework for network programs developed with good development practices
  - Execute the network programs developed in the project in real environments of programmable networks implemented on testbeds for the development and analysis of network software
- Members
  - RNP, UnB, UFRGS, UFABC, UFRJ

Well, it is never that easy…

- Learning Curve and Skill Gaps
- Increased Initial Development Time
- Overengineering
- Tooling and Infrastructure Requirements
- Resistance to Change

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- **Tooling and Infrastructure Requirements**
- **Resistance to Change**

Lightweight Hybrid Fog/Edge Testbed (LFT)*

- Emulated + Physical
- Custom Topology
- Radio Access
- Low Cost
- Link Configuration
- Local Deployment
- High Fidelity
- Intuitive User Interface

* A. Kaihara, L. Bondan, J. Gondim, G. Rodrigues, M. Marotta, and G. Rodrigues, “LST: Testbed Emulado Leve para Redes SDN Aplicado ao Contexto de Segurança,” in Anais Estendidos do XL Simpósio Brasileiro de Redes de Computadores e Sistemas Distribuídos, Fortaleza, Brasil, 2022, p. 41–48.

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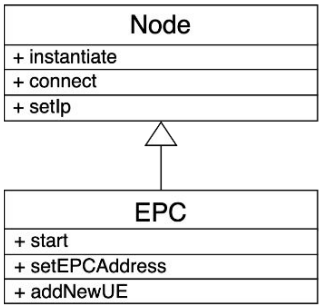
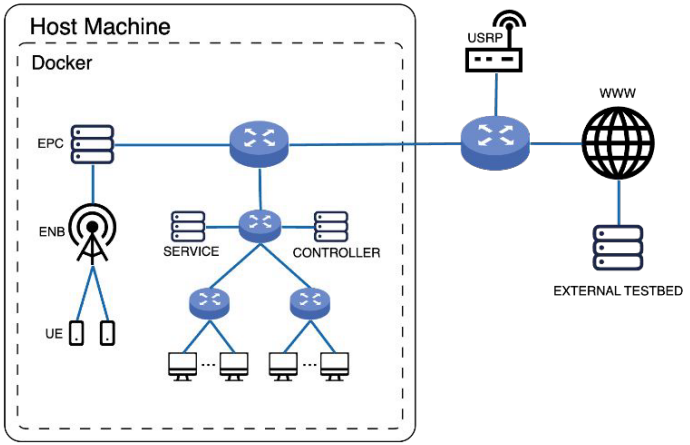



```
...  ...
41   epc = EPC('epc')
42   enb = ENB('enb')
43   ue = UE('ue')
44
45   epc.instantiate()
46   enb.instantiate()
47   ue.instantiate()
48
49   enb.connect(epc, "enbepc", "epcenb")
50   ue.connect(enb, "ueenb", "enbue")
51
52   epc.setIp('10.0.0.1', 24, "epcenb")
53   enb.setIp('10.0.0.2', 24, "enbepc")
54   enb.setIp('11.0.0.1', 24, "enbue")
55   ue.setIp('11.0.0.2', 24, "ueenb")
...  ...
76   epc.setEPCAddress('10.0.0.1')
77   epc.addNewUE(ue.getNodeName(), "5670",
78   "172.16.0.2")
79
80   enb.setEPCAddress('10.0.0.1')
...  ...
```



1. EXTEND AND CRATE SERVICES
2. CONFIGURE AND BUILD TOPOLOGY
3. RUN SCRIPT AND DEPLOY TOPOLOGY

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Thank you!

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