Case study: Locating performance problems aided by network virtualization
Network diagnosis

Problem:
Implementation/configuration issue surface in large-scale, long-term deployments with real user traffic

Goal:
- Do not change network under test
- Avoid probe effect

Diagnosis methods:
- Instrumentation
- Regression tests
Instrumentation

- Pair production VNet with monitoring VNet
- Copy all/selected packets to monitoring VNet
- Processing is accounted to monitoring VNet
Regression testing – Shadow Vnet

Input dist'ed to Vnet 1.0 and Vnet 1.1

Output of Vnet 1.0 dist'ed to ext entities

V1.0
V1.1
Ctrl

V1.0
V1.1
Ctrl

Substrate
VNet running V1.0
VNet running V1.1
Control Vnet
Run **VNet1.0, VNet1.1** monitoring VNet
- Distribute external input to both **VNet1.0** and **VNet1.1**
- Ctrl compares output behavior of **VNet1.0** and **VNet1.1** for semantic equality
- Only output of **VNet1.0** is distributed to external entities
Example: VoIP with background load

- **Phase 1**: Minimal background traffic
- **Phase 2**: Background traffic increases
- **Phase 3**: Start ShadowVNet: VNET B
- **Phase 4**: Enable QoS in VNET B
- **Phase 5**: VNET B becomes operational
Example: VoIP with background load

- User perceived quality is restored when the ShadowVNet is activated
Lessons learned

- New network debugging features
  - Instrumentation
  - Regression tests
  - Distributed debugger

- Goals
  - To **not change** network under test
  - Avoid **probe effect**

- Solution: Network virtualization
  - **Isolation**
  - **Accounting of resources**
CSD: Reshaping the Internet

- Impact on **users**:  
  - Ease of access to relevant information  
  - New control plane with new capabilities  
  - Easy to introduce new applications with new features  
  ➢ Security, mobility, quality of service

- Impact of new **economic models**:  
  - New interfaces between providers (network/service)  
  - New value-chain and new roles for providers  
  - Open interfaces may enable new ecosystems of business alliances

- Impact on **society**:  
  - Information society

- Impact on **operators**:  
  - Easier network management