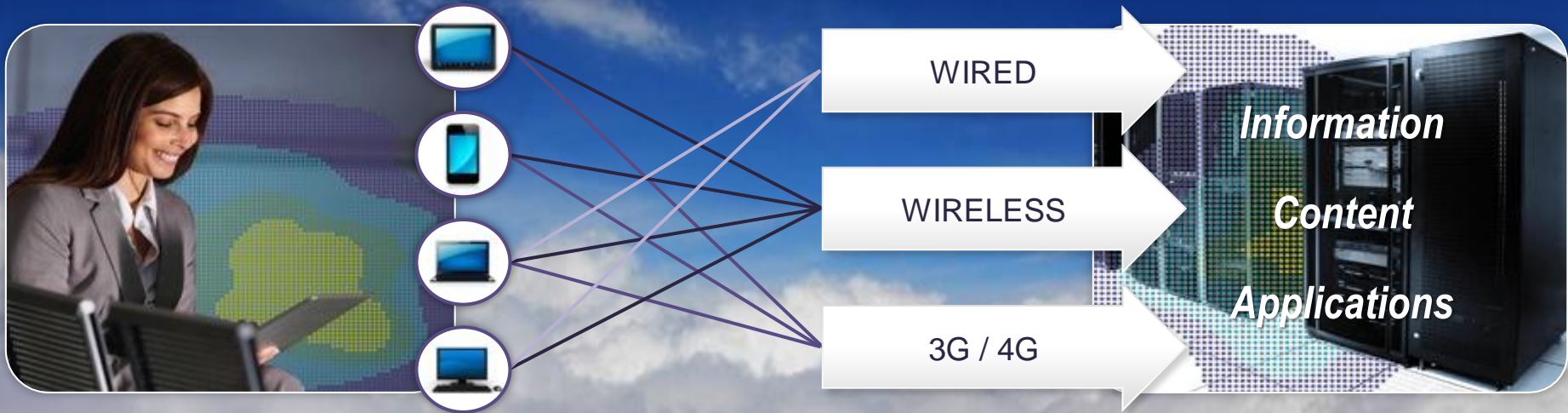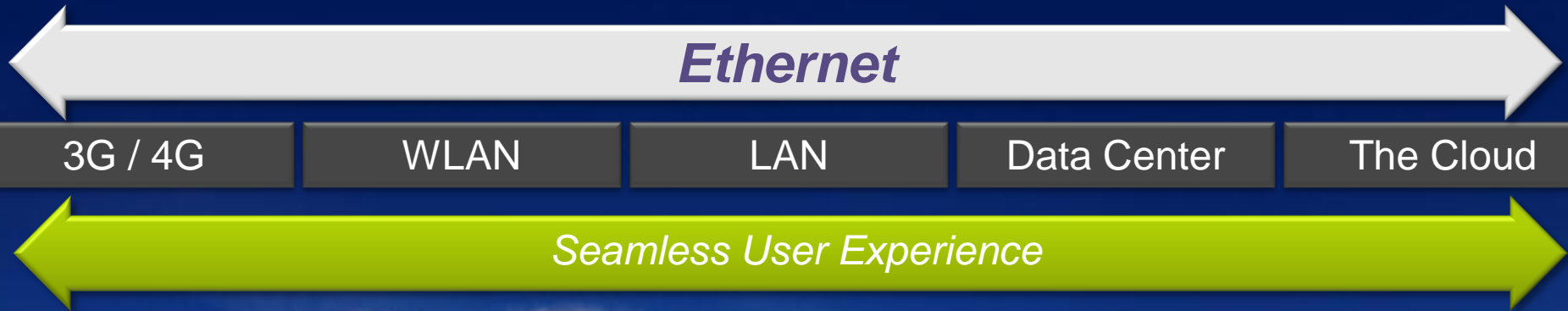# SOFTWARE DEFINED NETWORKING: FROM CAMPUS TO CARRIER TO CLOUD

Shehzad T. Merchant

**extreme** networks™

*Make Your Network Mobile*

# Two Major Themes: Convergence and Mobility

**Ethernet**

| 3G / 4G | WLAN | LAN | Data Center | The Cloud |

*Seamless User Experience*

WIRED

WIRELESS

3G / 4G

*Information*

*Content*

*Applications*

## Businesses Are Being Mobilized

*SDN Can Deliver High Value & Make This a Reality*

# Mobility and Multi-Tenancy In the Campus

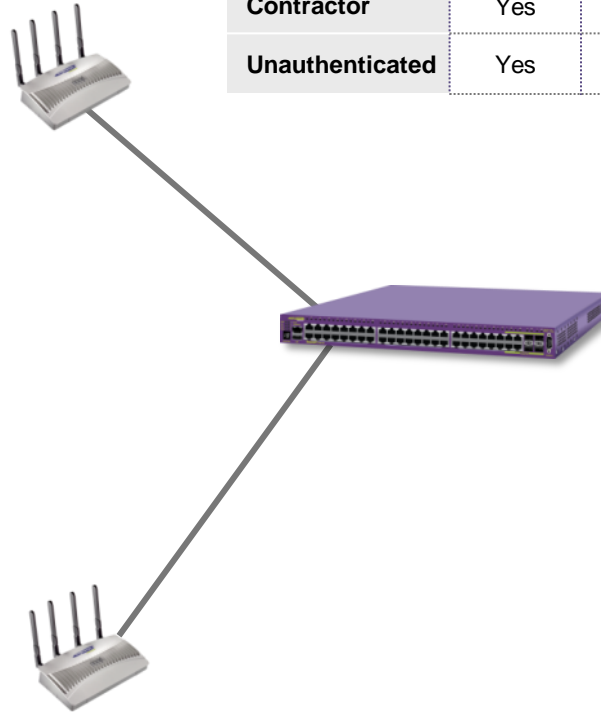| Role | Internet | Intranet | Mail | CRM/Database | VLAN |
|------|----------|----------|------|--------------|------|
| **Employee** | Yes | Yes | Yes | Yes | Default |
| **Contractor** | Yes | Yes | No | No | Default |
| **Unauthenticated** | Yes | No | No | No | Default |

User:   John
**Role:  Employee**
Resource Access = Permit All

User:   Alice
**Role:  Contractor**
Resource Access = Deny Mail and CRM

User:   Bob
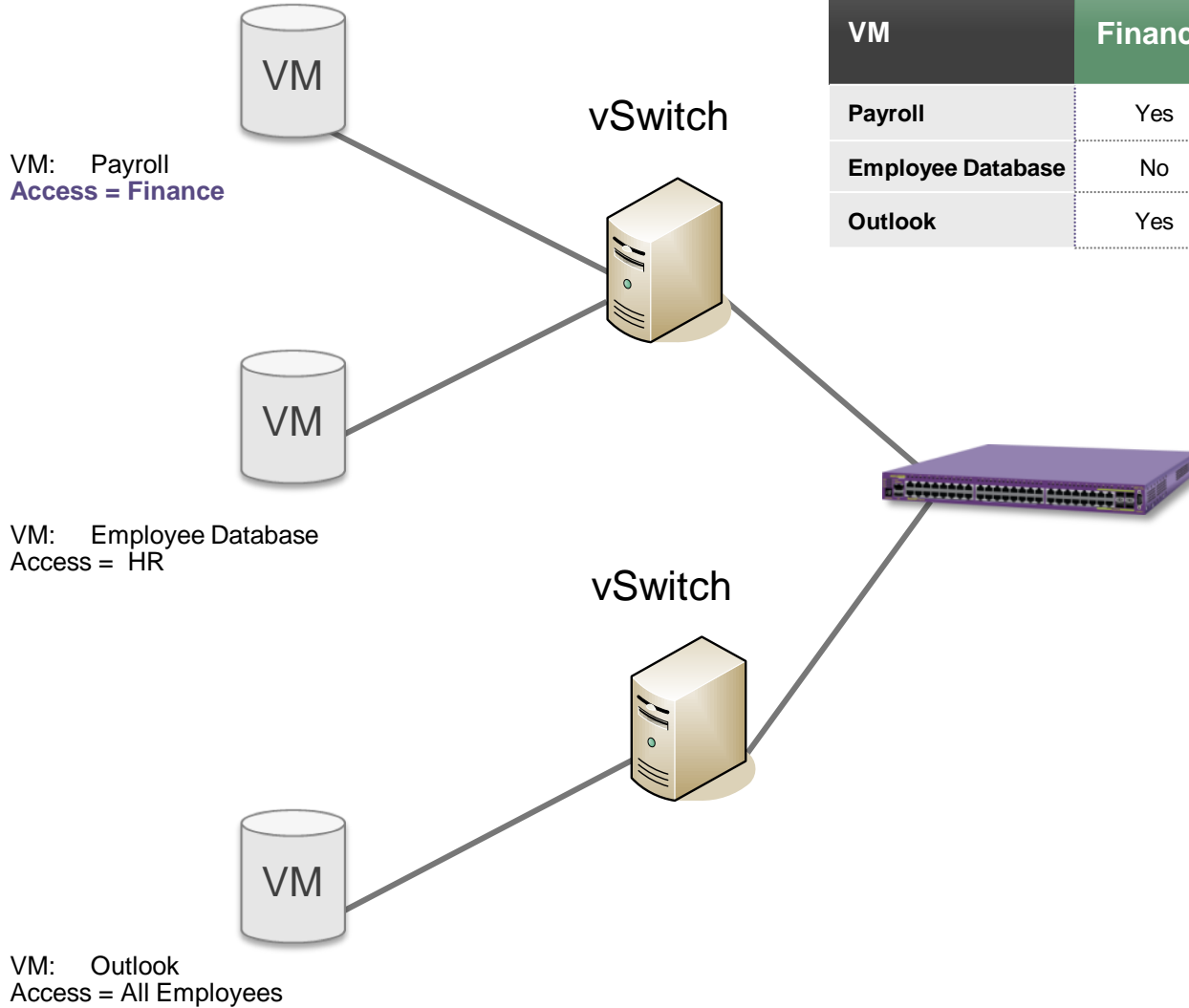**Role:  Unauthenticated**
Resource Access = Internet Only

# Mobility and Multi-Tenancy In the Data Center

| VM | Finance | Accounting | Engineering | VLAN |
|---|---|---|---|---|
| **Payroll** | Yes | No | No | Default |
| **Employee Database** | No | Yes | No | Default |
| **Outlook** | Yes | Yes | No | Default |

VM

VM

vSwitch

VM: Payroll
**Access = Finance**

VM: Employee Database
Access = HR

vSwitch

VM: Outlook
Access = All Employees

# Enter Software Defined Networking

- De-Couple Forwarding and Policy Decisions From Network Transport and Topology

- Single, Consistent Policy and Management Model
  - Campus edge to DC server edge and into the mobile carrier edge



**Ethernet**

| 3G / 4G | WLAN | LAN | Data Center | The Cloud |

**SDN – Common Forwarding and Policy Framework**

WIRED

WIRELESS

3G / 4G

*Information*

*Content*

*Applications*

**Businesses Are Being Mobilized**

*SDN Can Deliver High Value & Make This a Reality*
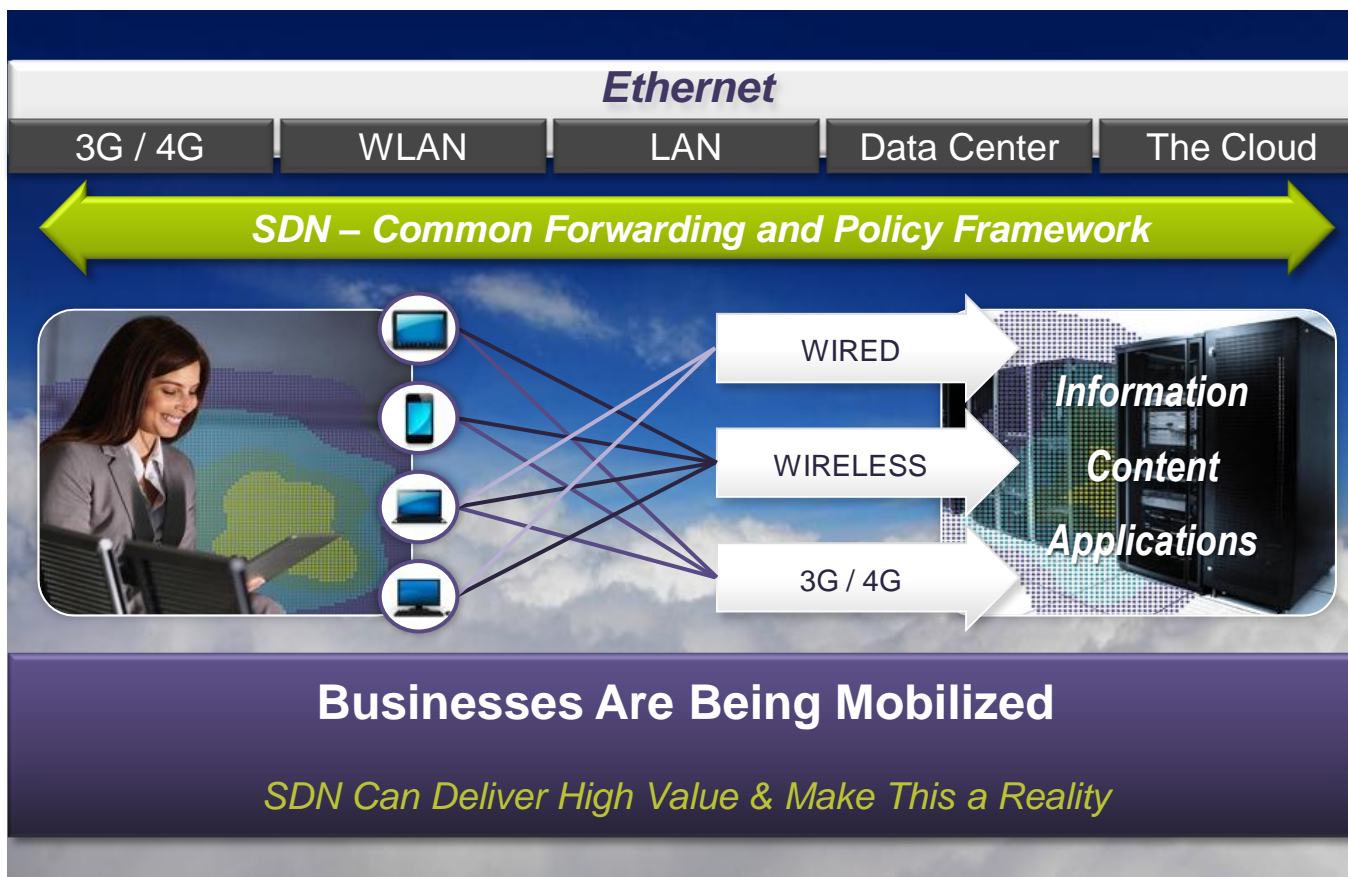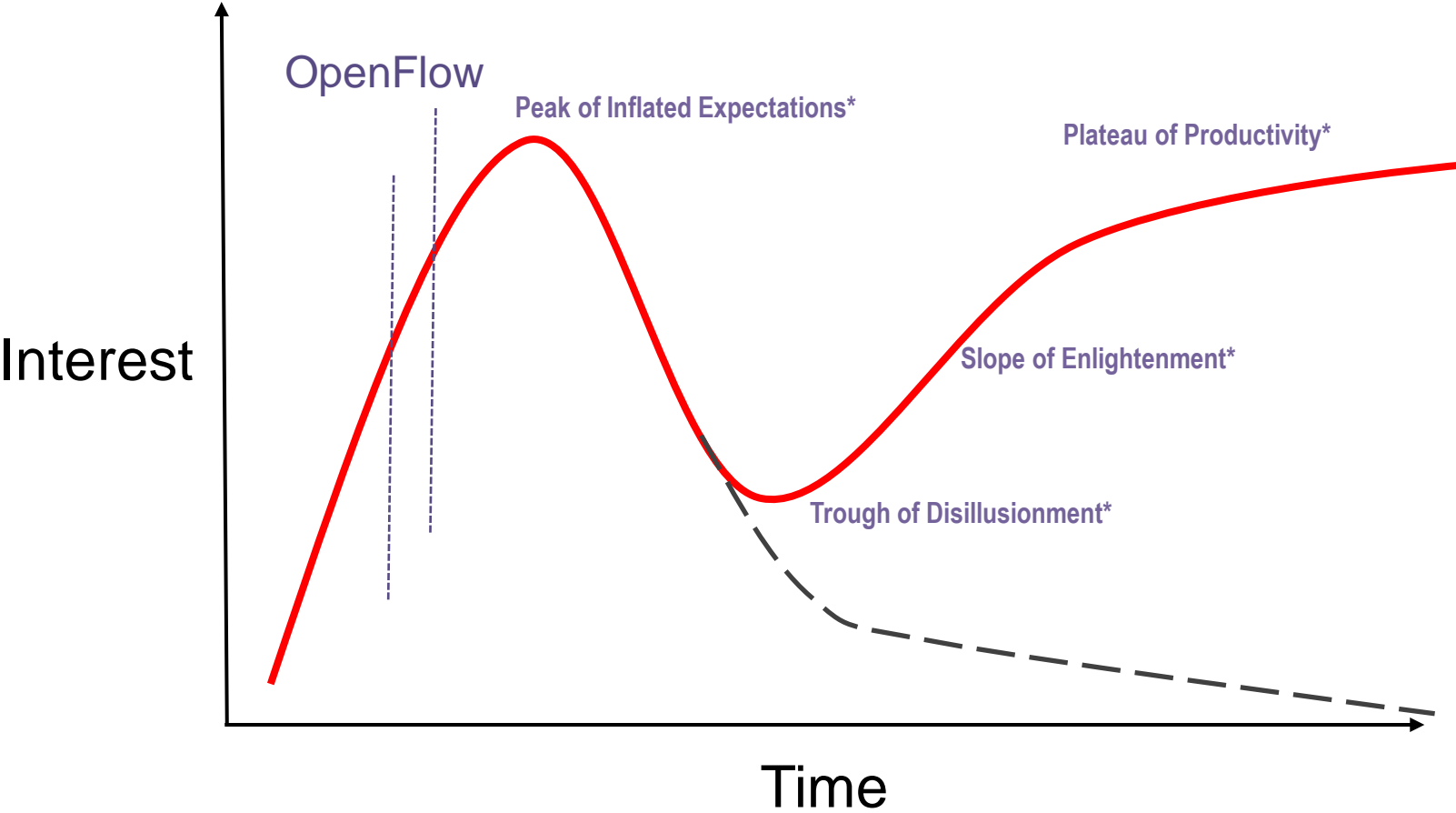
# Where Are The Deployments?

- Mostly Early Trials
  - Large Universities, Large Enterprise Campus, DC and Cloud
  - Across all geographies
- Building Knowledge, Expertise and Comfort
- Solutions still evolving
- Eco-system integration evolving
- But, With Growing Interest…
  - Reflecting the growing pain points

University of Essex

UMASS LOWELL

ACADEMIA SINICA

NTT DaTa

CROC

# Overcoming Deployment Challenges

- Maturity

- Standards Changing/Evolving Quickly

- Silicon Support

- Vendor and Solution Interoperability
  - Controller, Switch, Security, Policy, Active Directory, Other Components

- Expectations

- Demonstrable ROI v/s Existing Vendor Approach

# Technology Adoption Cycle



Interest

Time

OpenFlow

Peak of Inflated Expectations*

Plateau of Productivity*

Slope of Enlightenment*

Trough of Disillusionment*

# Looking To the Future

- OpenFlow becomes the Android of networking
  - Open network OS for Ethernet switches and routers
  - OpenFlow and related specifications all available as Open Source
- Apps for every need
  - From QoS, to PBR, to Identity Management, to Mobility Management, to multi-tenancy and so on
- Controller vendors eventually become application developers
  - Apps come in free, premium, and freemium models
- Switch vendors continue to build and sell switches
  - Much like phone vendors continue to sell phones
- ONF facilitates the Marketplace for OpenFlow and SDN Apps?

# THANK YOU

*Make Your Network Mobile*