

COSMOS Outreach Activities and Industry Involvement

COSMOS PLATFORM FOR ADVANCED
WIRELESS RESEARCH – AN INDUSTRY BRIEFING

Thanasis Korakis, NYU
Clayton Banks, Silicon Harlem

Rutgers University, June 1 2018



COSMOS Outreach Activities

COSMOS Outreach Activities focus on:

- Education
 - Enable the COSMOS Testbed as an educational platform, especially for K12 local NYC students
- Community Engagement
 - Engage the local community to the COSMOS activities
 - Interact and support the local Industry

COSMOS Outreach Activities

Educational Activities

The Testbed as an Educational Platform

The academic partners of COSMOS have long experience through **GENI** and other NSF grants, on creating class labs based on experimentation (**classroom-as-a-service** concept):

We have created (and shared):

- **Testbed-based lab material** for complete courses in computer networks.
- **MOOCs** for teaching networking concepts through experimentation.

Through COSMOS we are planning to:

- Enhance these courses with richer/ innovative/ realistic experiments in the city scale deployment.
- **Particularly focus on developing a K12 STEM educational plan.**

STATIC ROUTING

Lab 5

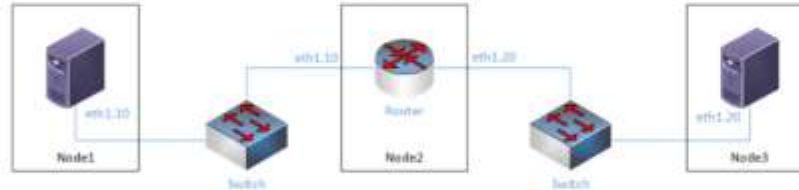
Example of a
lab run on
COSMOS:

Experiment
execution in a
networking
class lab



IP configurations

In a previous lab, you have seen how to inspect and manipulate your routing table. Using this knowledge you are going to configure the routing tables of your nodes in order to create the network topology seen in the picture below. You will use one of your nodes to serve the role of the router by forwarding the packets to/from the other two nodes.



IP configurations

For doing so, first configure your network interfaces by giving the following IPs:

Open a console, connect to your node with the minimum ID and set the eth1.10 interface (This node will be Node1 in our topology):

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ssh -X networks@10.64.98.X1 (where X1 should be replaced by the minimum ID of your nodes)
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ifconfig eth1.10 192.168.1.X1
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Then open a second console, connect to your node with the medium ID and configure both interfaces (This node will be Node2 in our topology):

LAB 5 CONTENTS

- 🔴 Aim
- 🔴 IP configurations
- 🔴 Gateway
- 🔴 Quiz
- 🔴 Quiz Answers

COSMOS and K12 STEAM Education

Academic Partners + Silicon Harlem:

- Strong Record in K12 STEAM education
- Columbia Engineering Outreach Programs
- Center for K12 STEM Education at NYU Tandon School of Engineering
- Silicon Harlem - Apps Youth Leadership Academy (AYLA)

Mission:

- Provide K12 students and teachers access to and opportunity for high quality, authentic STEM education; advance gender, ethnic/racial diversity in STEM fields



Adaptable Program Examples

Two Example Programs:

- **E.N.G. - Engineering the Next Generation (Columbia)**, a summer research opportunity for highly motivated under-represented high school students from local partner schools.
- **ARISE - Applied Research Innovations in Science and Engineering (NYU)**, a high school seven week summer research program that includes college level workshops and seminars, high level research experience, mentoring by graduate or postdoctoral students.



COSMOS K-12 Educational Plan Goals

COSMOS Plan for K-12 education focuses on the following goals:

- **Create an NGSS (Next Generation Science Standards)-aligned curriculum**
 - Create online activities that will highlight Disciplinary Core Ideas.
 - Embedding Science and Engineering Practices in hands-on research opportunities.
 - Create lab-based lessons that take Cross Cutting Concepts into account.
- **STEM teacher education and professional development**
 - Summer PD at Columbia and NYU.
 - Hands-on research with scientists.
 - Side-by-side student/teacher STEM teaching and learning.
- **K12 student education**
 - Educational modules: Lessons/labs that will support students' learning in engineering, math, physics, chemistry, life sciences.
 - Hand-on research experience: Students will be involved in the live experiments.
 - School collaboration to improve students' social capital: Conferences for students, science fairs and competitions.



COSMOS K-12 Educational Phases

COSMOS plan for developing labs for K12 Education has three phases:

- **Phase 1 (1 year):** Define and develop labs, working with teachers on:
 - Defining scientific areas/existing curriculum that can be supported by labs run remotely on the testbed.
 - Building the labs collaboratively (teachers, undergrad/graduate students and professors).
- **Phase 2 (2 years):** Bring the labs from year 1 to schools in Harlem
 - Run the labs developed in schools, get feedback from teachers and K12 students.
 - Redesign the COSMOS NGSS-aligned curriculum based on the feedback and create more labs.
- **Phase 3 (2 years):** Run the web-based labs at scale across NYC schools
 - Mature set of labs can run online by schools all over NYC.

COSMOS K12 Education: Current Activities

Current activities to support the COSMOS Educational plan:

- We are organizing a summer professional development activity (6 weeks) for 11 teachers in Columbia and NYU **through RET supplements**.
- We are putting together a **RET site proposal** (deadline September 2018).
- We are considering other **NSF funding opportunities** that focus on K12 STEM educational activities.
- We are exploring possibilities to **work together with the COSMOS industrial partners** that run STEM programs, enhancing the COSMOS educational plan.

COSMOS Outreach Activities

Community Engagement

COSMOS local Tech-projects

- Significant ongoing local tech-projects that:
 - Will act as a base for the COSMOS testbed deployment
 - Will benefit from the testbed once it is deployed
- Gigabit Center
 - Education & community resource center—& PAWR node
- S&CC, DoT/DoEd/DoE projects from user community
- New America project: resilient mesh network in East Harlem

Harlem Hospital





Multi-Disciplinary Research:



Edge Cloud + Community Governance + Digital Readiness

COSMOS Research Users: University of Arizona, University of Virginia, Fordham Law School, & Silicon Harlem

SEEC-Harlem: A Novel Architecture for Secure Energy Efficient Community Edge Clouds with Application in Harlem

- Address long standing lack of broadband access and digital readiness in dense urban areas of Harlem, NY
- Overcome legacy infrastructures, outdated legal arrangements, computer literacy deficiencies, and limited budgets



Resilient Networks & Digital Literacy

- RISE: Community wireless mesh network in East Harlem
 - Led by New America with SH
 - Novel digital steward education approach engages residents
- Seeking to expand across Harlem to connect with COSMOS
 - NSF CRISP WE-TUE proposal: CCNY, SH, NA, UA, and CU
 - Focus on women in tech workforce and data on digital literacy

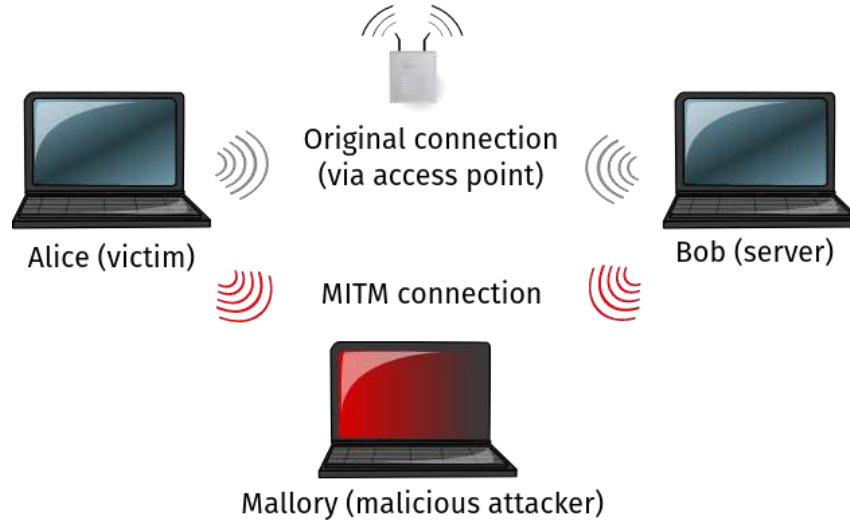


The COSMOS Testbed as a Platform for STEM education

Thank You!

Example: Man-in-the-middle attack on WiFi hotspot

- Understand the security risks associated with using a public WiFi hotspot



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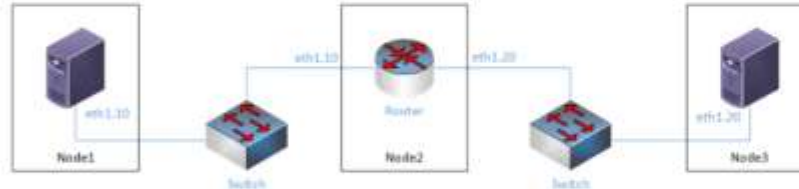
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Possible labs for students

- A set of labs/experiments that will describe the basics of wired/wireless communications
 - Electromagnetic signal propagation
- A set of labs/experiments for the environmental science curriculum
 - Real time measurements of environmental data (temperature, humidity, light, CO2) in distributed spots in Harlem, in real time
 - Definition and implementation of algorithms that correlate the data (average, min, max)
 - Implementation of policies that are activated based on the real-time data collection (if average CO2 level > XX then alert the citizens)
- A set of labs that are based on distributed monitoring of noise in Harlem
 - Based on the noise level we can define methods for monitoring and emulating street traffic
 - Depict the traffic patterns in google maps, in real time