

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

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IRG Track 2, FY2017

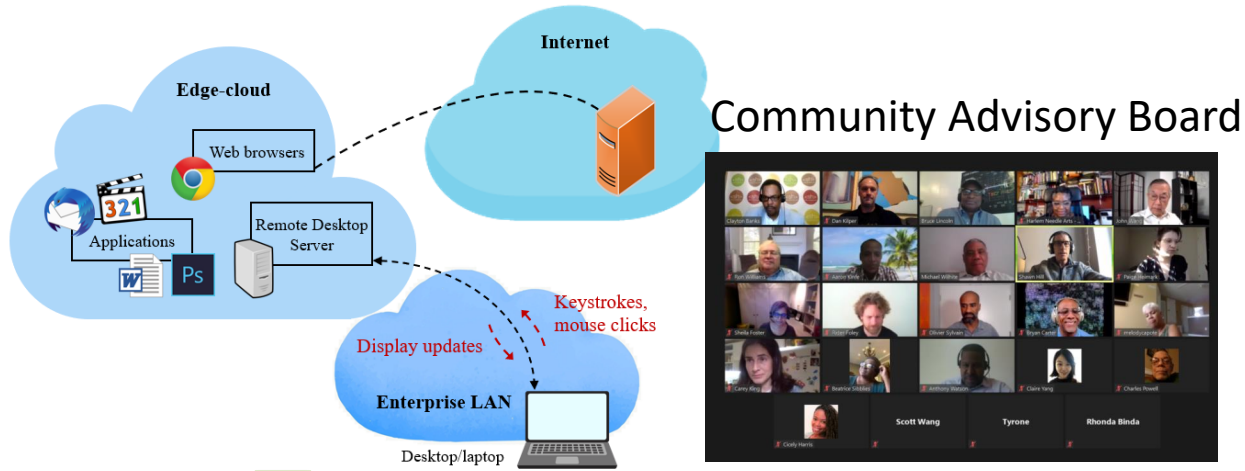
## Principal Research Investigators

- Bryan Carter, University of Arizona
- Rider Foley, University of Virginia
- Sheila Foster, Georgetown University
- Olivier Sylvain, Fordham University
- Ronald Williams, University of Virginia

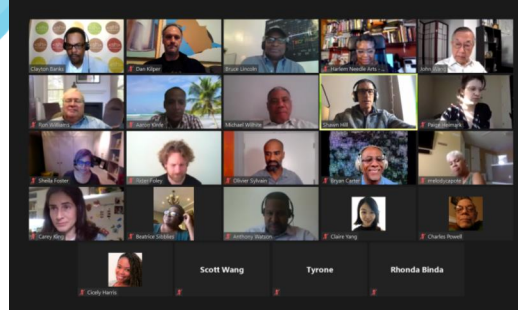
## Community Partners

- Clayton Banks, Silicon Harlem
- Bruce Lincoln, Silicon Harlem

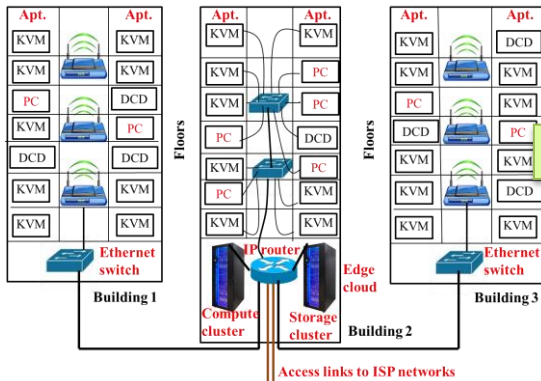
# Project Overview



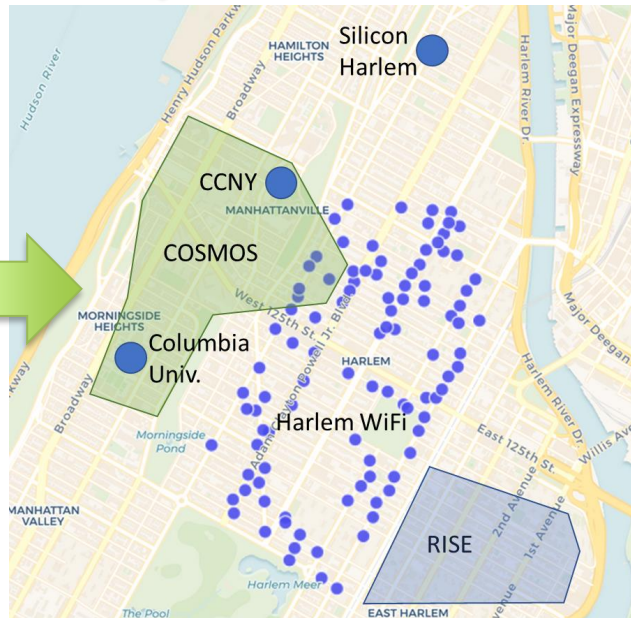
Community Advisory Board



Servers in Community Edge Cloud Connected to Users



Silicon Harlem Deployment



1. Use 5G edge cloud to disaggregate computing/ICT devices: lower cost through sharing, better security, ease of use and full range of performance and capabilities through computers in the edge cloud
2. Community network as digital constructed commons resource: distributed community governance of Internet resources: equitably provide benefits & transferrable to other communities
  - Pilot community edge cloud and large-scale user trial of virtual desktop computing throughout community

# Project Overview

## Use-Inspired Research

- How to provide affordable, secure, efficient and accessible computing that is responsive to the needs of dense urban communities such as Harlem in New York City, NY, without creating a lower performance class of digital citizenry
- Community partner Silicon Harlem has played a key role in defining the problem, engaging the community, shaping the solution and now is looking toward scaling it into the future

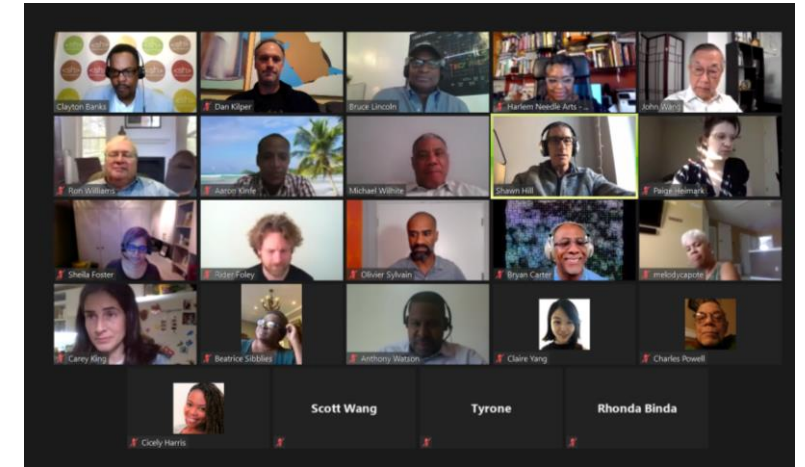
## Fundamental Research Contributions

- New mesh edge cloud network architectures capable of supporting virtual desktop devices throughout a community
- Novel approach to integrating diverse stakeholder values and perspectives into the design of edge-cloud computing through the formation of a community governance board.

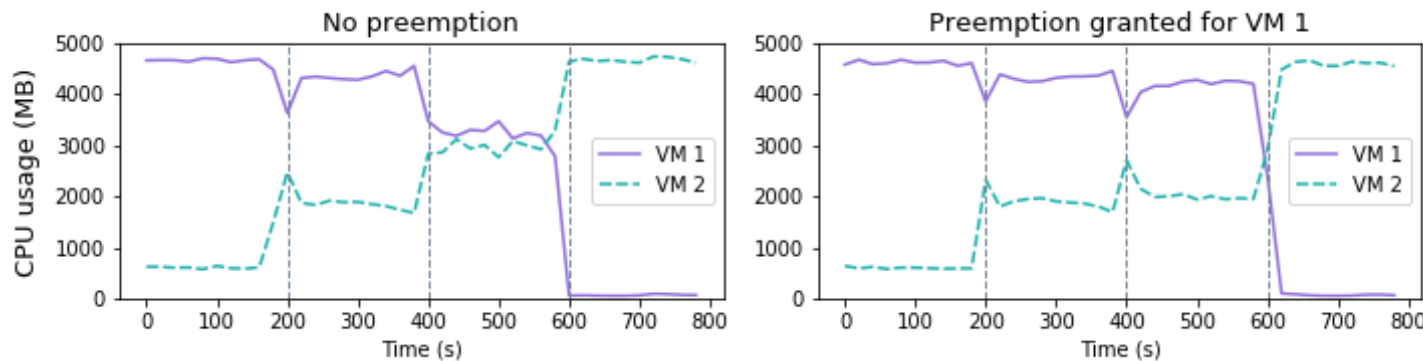
# Project Update

- Completed experiments on different VDI protocols and architectures: established network performance requirements incl. 10 ms edge cloud latency threshold & provisioning strategies
- Organized Community Advisory Board: Discuss technology, identify community needs, provide feedback on technology design for trials

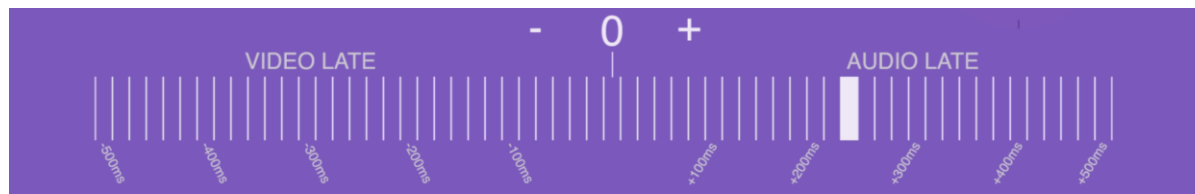
## Community Advisory Board



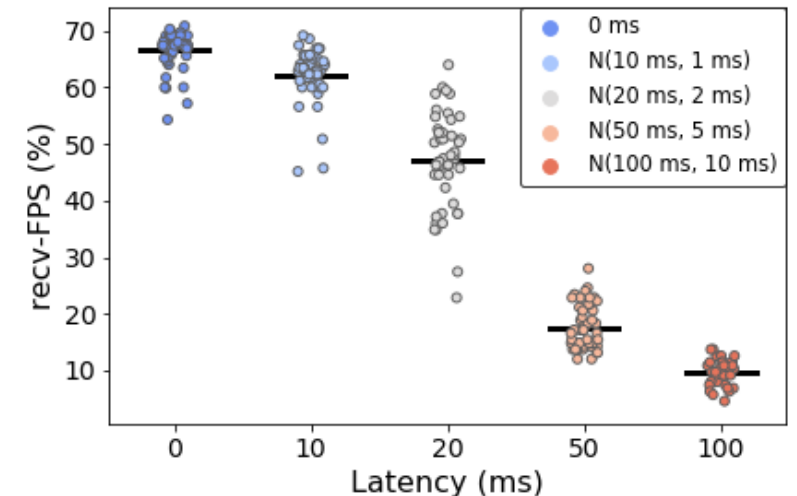
## Virtual Machine Provisioning Experiments



## Video-Audio Misalignment Experiments over Edge Cloud



## 10 ms Latency Threshold for Video

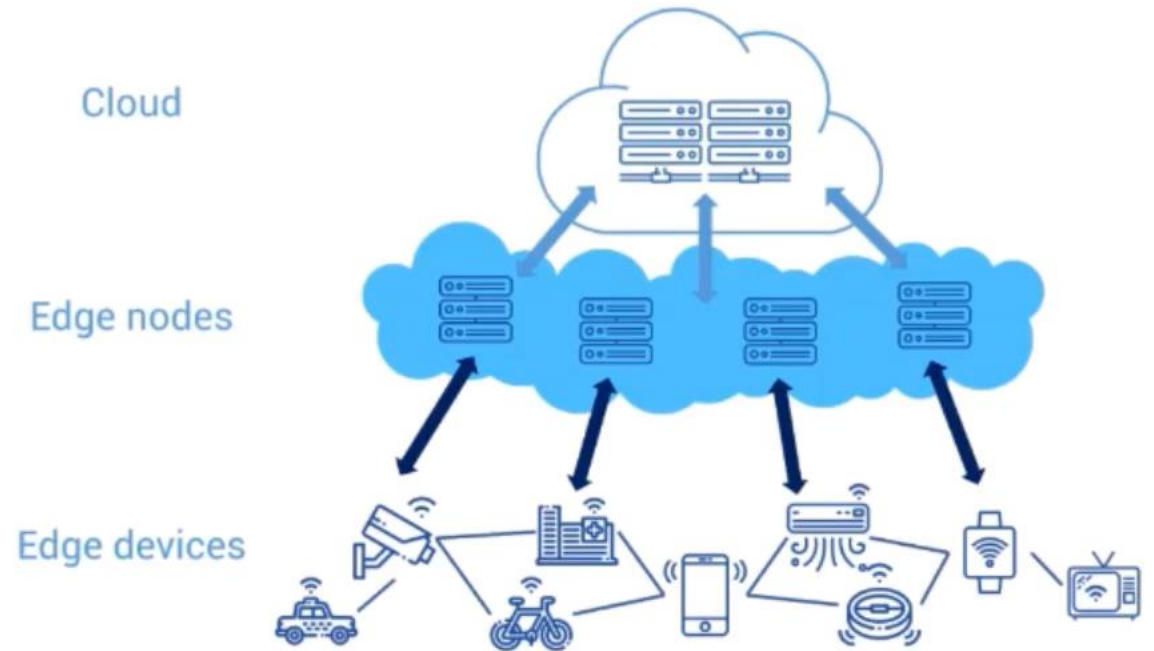




# Silicon Harlem's Community Cloud:



## *UPTOWN SPACE*



# Project Evolution

*“We learned that the residents really care about their data and who handles it and how its handled. They are frustrated by the lack of control that they experience and are eager to gain understanding about and agency over their data and the applications using that data.”*

*“We came to realize that the community edge cloud concept is perhaps the most important contribution of our project because it brings the data back into the community and allows the community the opportunity to have a role in governing how it is used and what it can be used for, as well as a platform for education and agency over digital technologies impacting the world around us. Fully understanding this came from our meetings with the community members and what they expressed to us.”*

# Impact on Communities

The SEEC Harlem project continues to prepare the community for advanced technology for all. With over 20 community organizations and stakeholders, representing over 1000 constituents of all ages, the project has embraced the voice of Harlem and the community to have a significant role in providing insight and critical inquiries that have informed and improved our SEEC project research. In online project meetings, the team discusses the progress of the project and are able to have feedback in real time. The community has expressed its concern about devices in the home for education, health, and work. The community understands that the project is addressing this issue through research. As a result, the community advisory board will be identifying people in the community that will participate in our user trial phase. Co-creating with the community ensures that we are inclusive. A quote from one of our stakeholders: "I am proud that you have invited me to be a part of this project, this is a first".

# Anticipated Outcomes & Next Steps

Use COSMOS and Harlem WiFi networks to connect SH edge data center to users for large scale trial (late summer 2021)

Growing momentum within community and SH partner to provide digital services to upper Manhattan

- Established gigabit center digital maker space, Uptown Space, in upper Manhattan with community edge cloud data center from Microsoft
- Community handover and SH scaling: other cities?
- Will community edge clouds be the future of community-centered smart cities?

