TU WIEN Informatics

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Synthesizing Plausible Infrastructure Configurations for Evaluating Edge Computing Systems

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Towards a Serverless Platform for Edge AI

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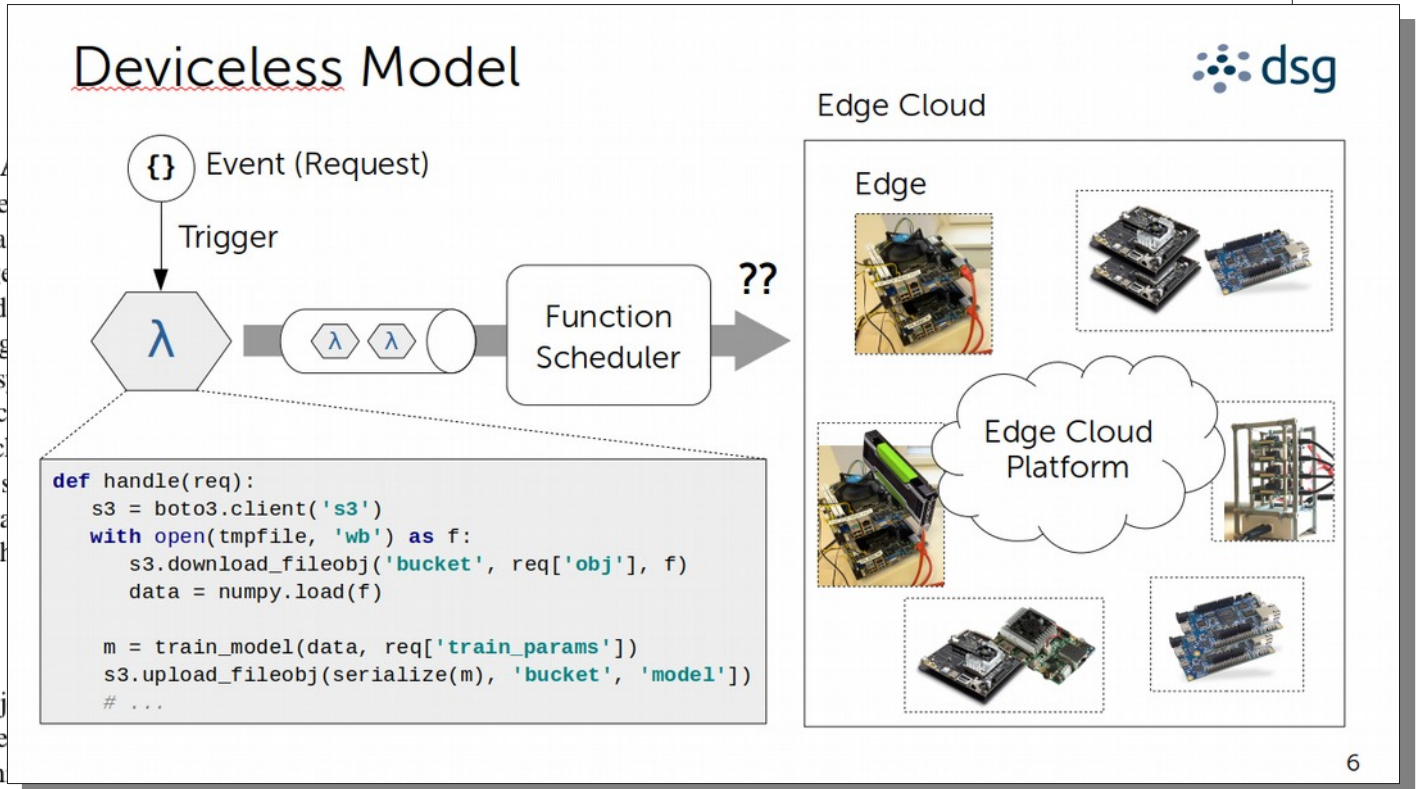

This paper proposes a se
operating edge AI applica
to illustrate the challenge
plications in edge cloud
from AI lifecycle manag
less model, we enable eas
functions. We take a devic
sources transparently as c
fine-grained control over s
we demonstrate the limita
schedulers, and present th

1 Introduction

Edge AI is one of the maj
driven by recent advance
puting systems, and min
spite the growing demand for low-latency and privacy-aware

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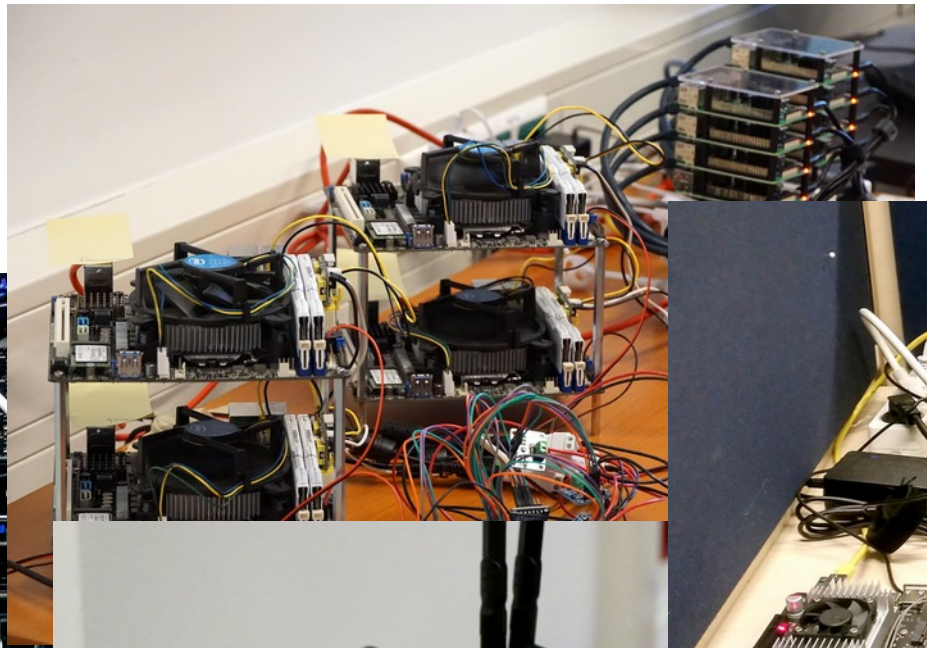
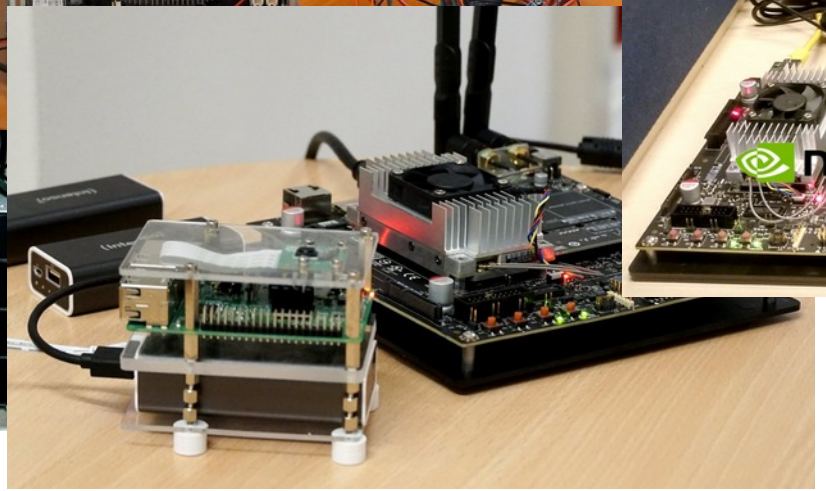
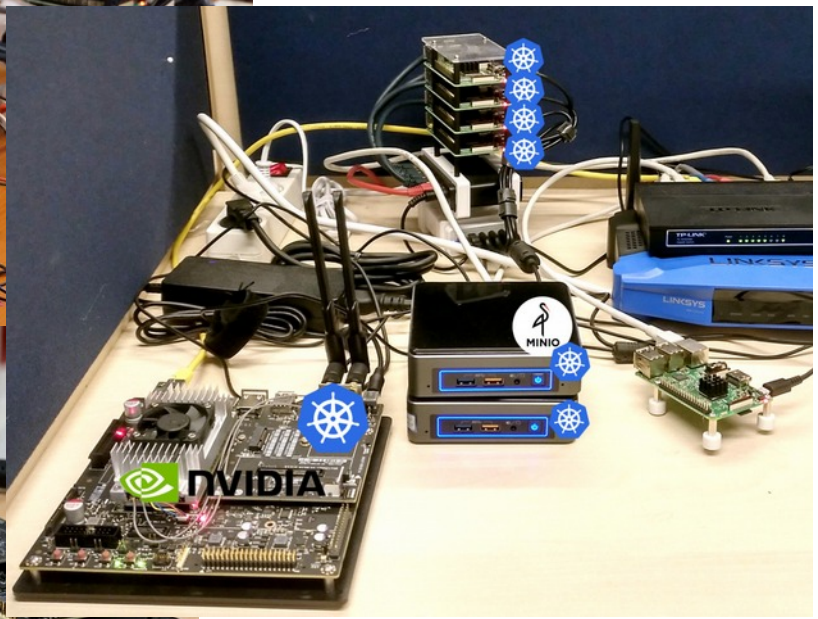
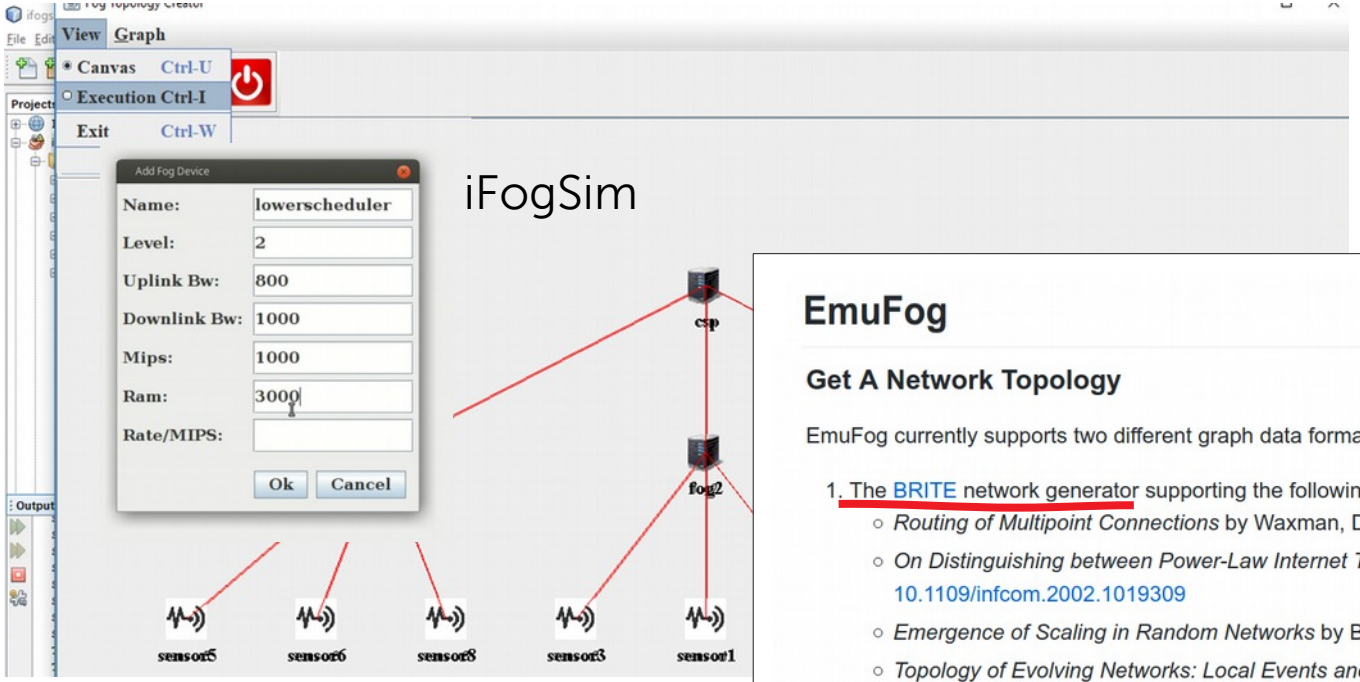






Edge systems evaluation tools



EmuFog

Get A Network Topology

EmuFog currently supports two different graph data formats:

1. The BRITE network generator supporting the following models:
   - *Routing of Multipoint Connections* by Waxman, DOI: 10.1109/infcom.2002.1019309
   - *On Distinguishing between Power-Law Internet Topology Generators* by Bu and Towsley, DOI: 10.1109/infcom.2002.1019309
   - *Emergence of Scaling in Random Networks* by Barabási and Albert, DOI: 10.1126/science.286.5439.50
   - *Topology of Evolving Networks: Local Events and Universality* by Barabási and Albert, DOI: 10.1103/ph
2. The Macroscopic Internet Topology Data Kit from Caida including measured real world internet topologies

Gupta et al. iFogSim: A toolkit for modeling and simulation of resource management techniques in the Internet of Things, Edge and Fog computing environments

Mayer et al. EmuFog: Extensible and scalable emulation of large-scale fog computing infrastructures

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What are representative infrastructure configurations for edge systems?

The Computing Landscape of the 21st Century

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ABSTRACT

This paper shows how today's complex computing landscape can be understood in simple terms through a 4-tier model. Each tier represents a distinct and stable set of design constraints that dominate attention at that tier. There are typically many alternative implementations of hardware and software at each tier, but all of

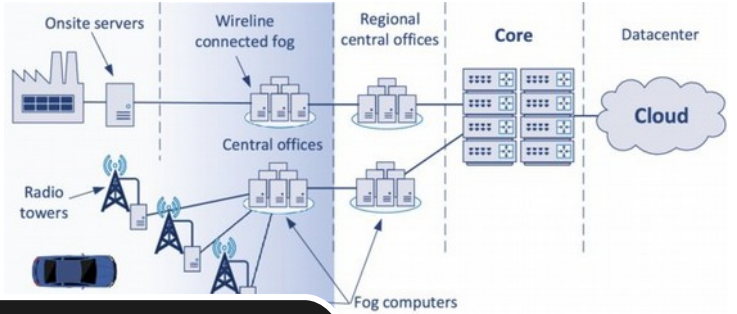
2 A Tiered Model of Computing

Today's computing landscape is best understood by the *tiered model* shown in Figure 1. Each tier represents a distinct and stable set of design constraints that dominate attention at that tier. There are typically many alternative implementations of hardware and software at each tier, but all of them are subject to the same set of

Urban Sensing

Array of Things, I

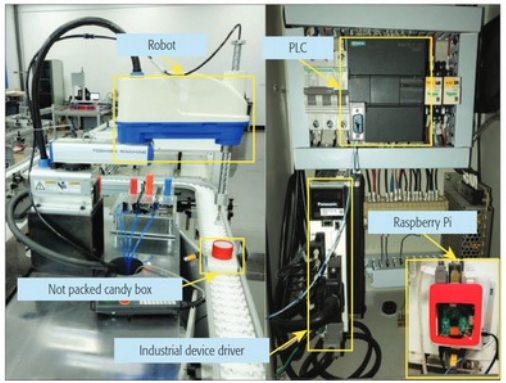
Multi-Access Edge Computing



est distribution for fog and cloud servers

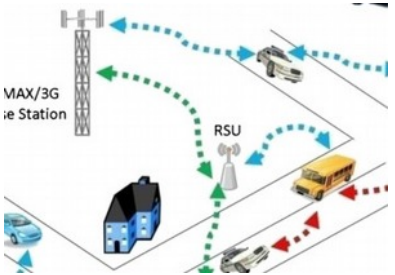
Details in the paper!

Industri



Chen et al. Edge Computing in IoT-Based Manufacturing

Networking



Eiza et al. Investigation of routing reliability of vehicular ad hoc networks

City-Scale Edge Computing Fabric

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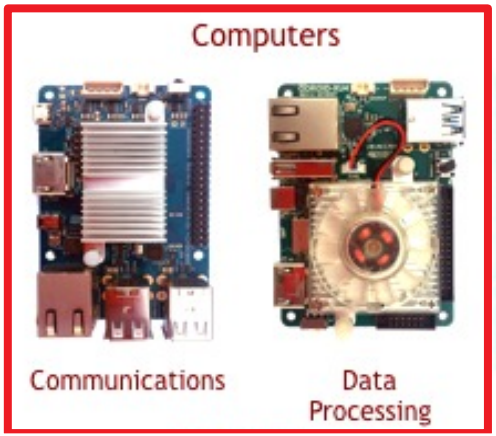
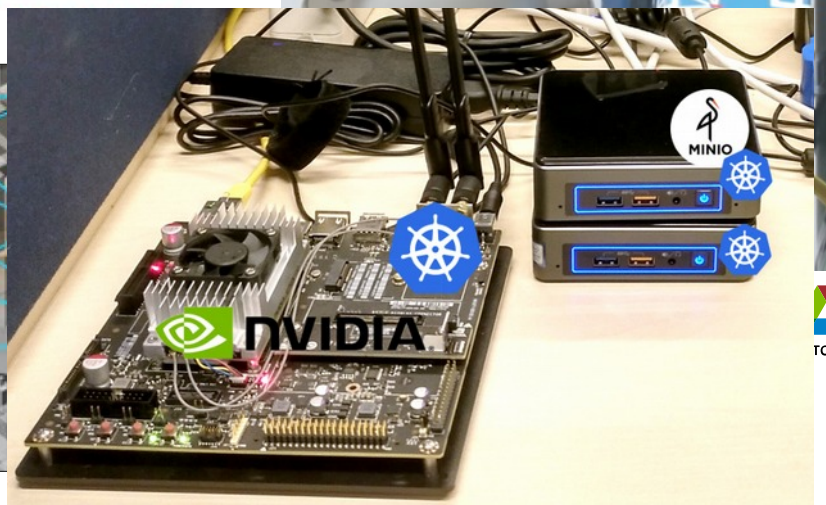
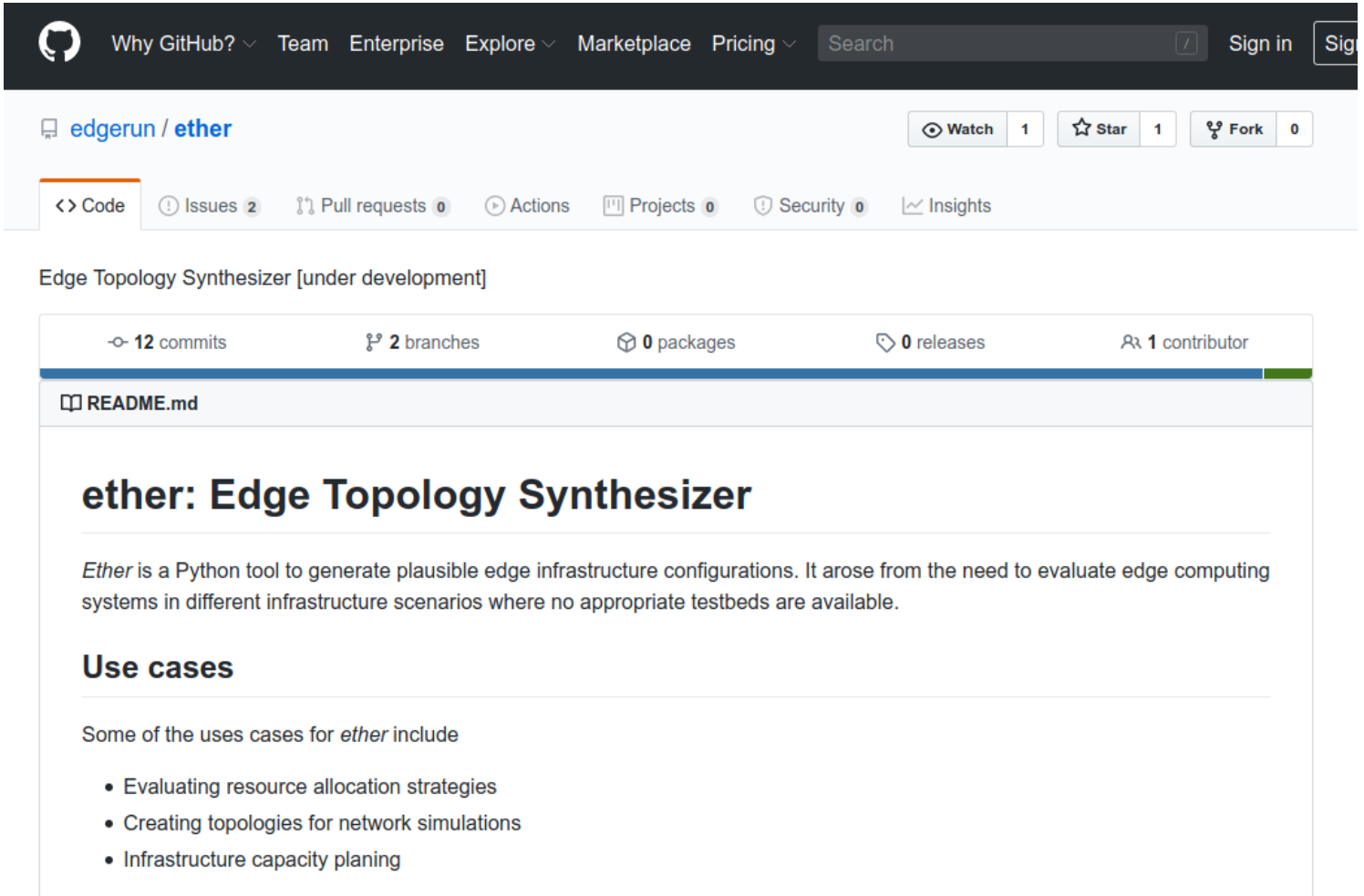
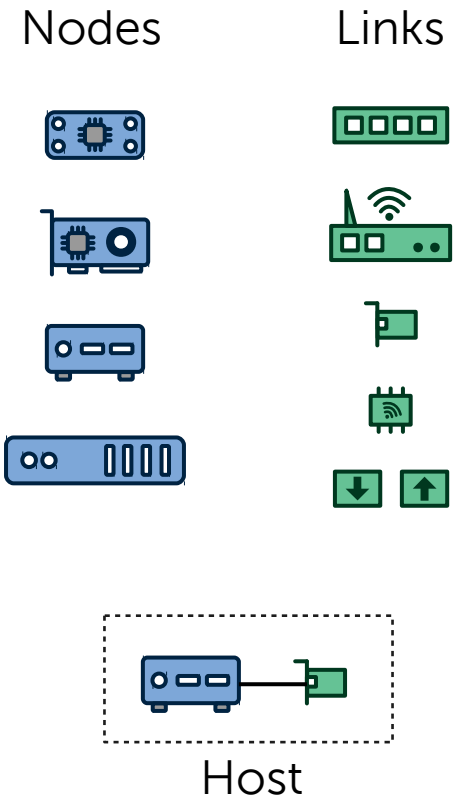


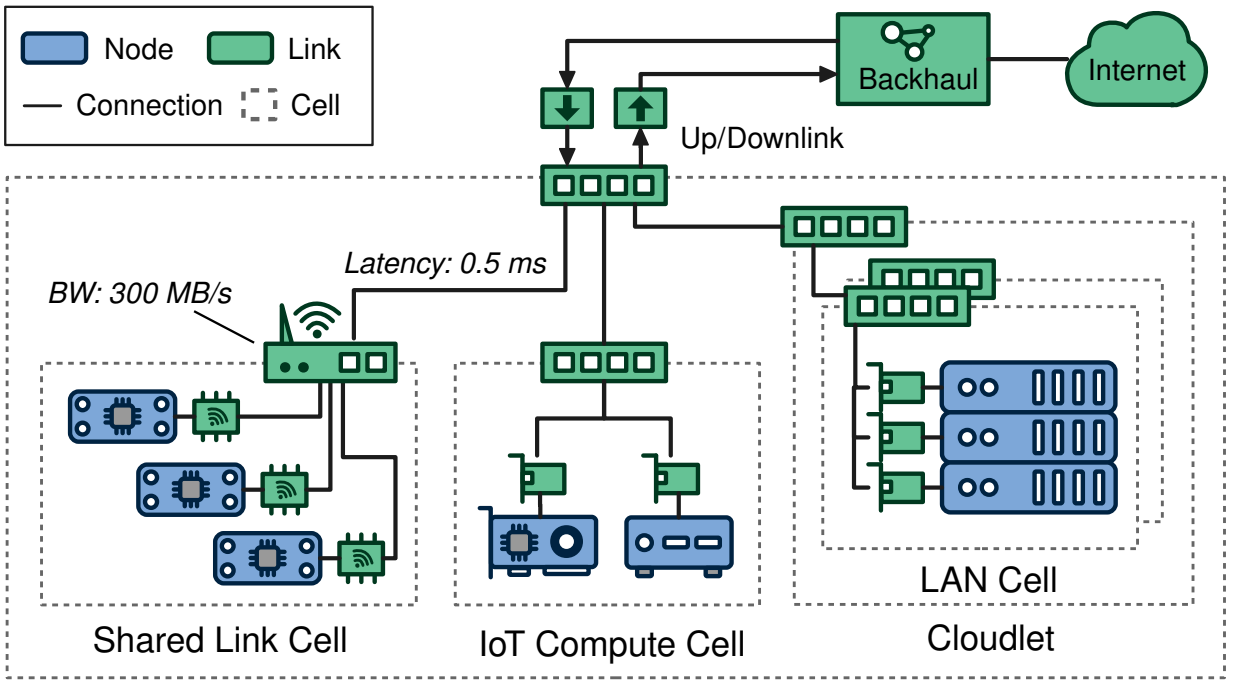


Edge Topology Synthesizer



Conceptual model





Industrial IoT Scenario

Parameterized cell synthesis

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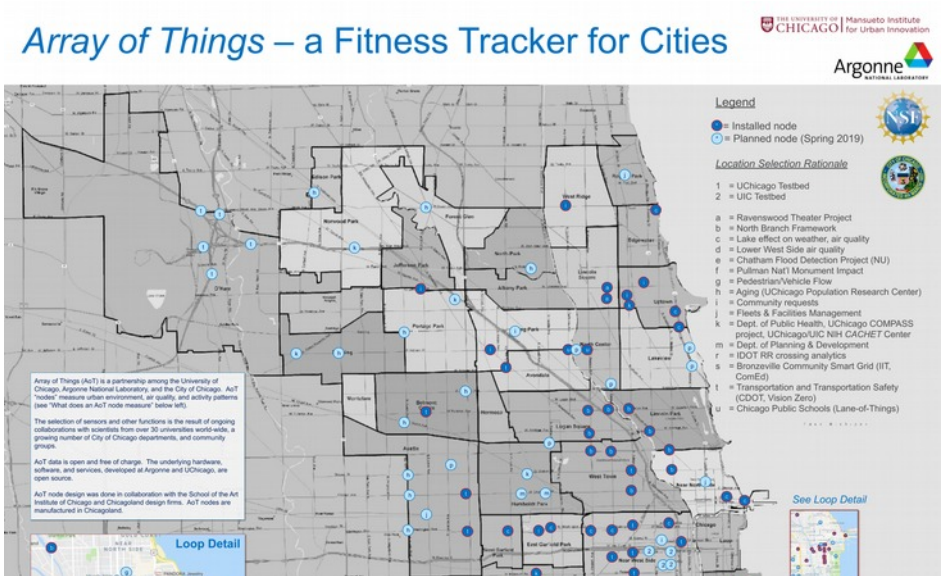
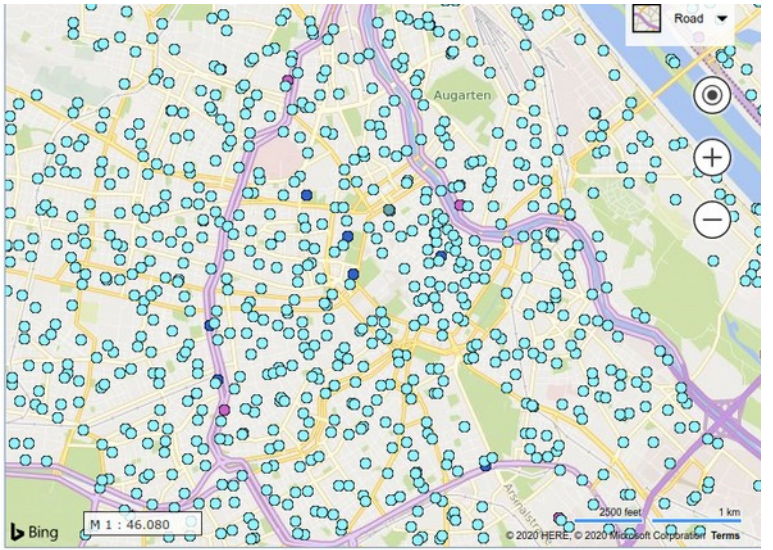
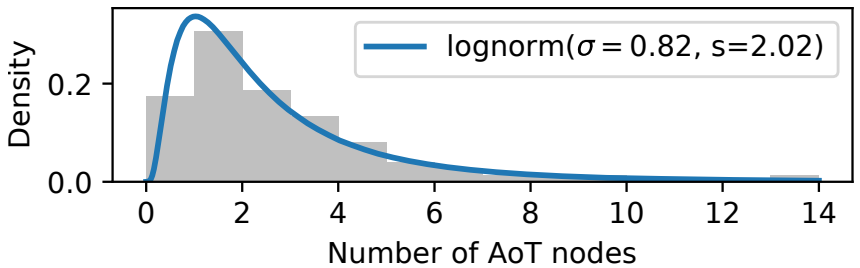
- Degree distributions? Probably not.
- Cell (cluster) size
- Heterogeneity:
  How *different* are the devices in the cell?
- Density:
  How many nodes are in this cell compared to others?
- ? What others would be useful

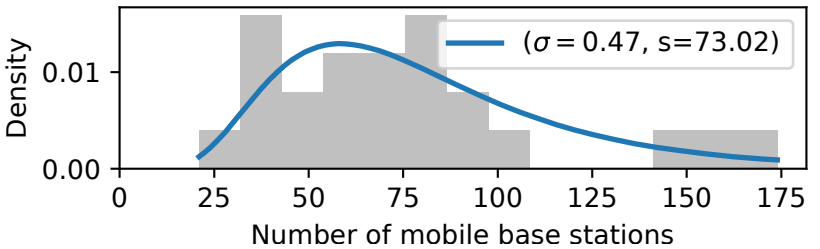
GeoCell Density





https://www.senderkataster.at/karte





Programmatic creation of topologies

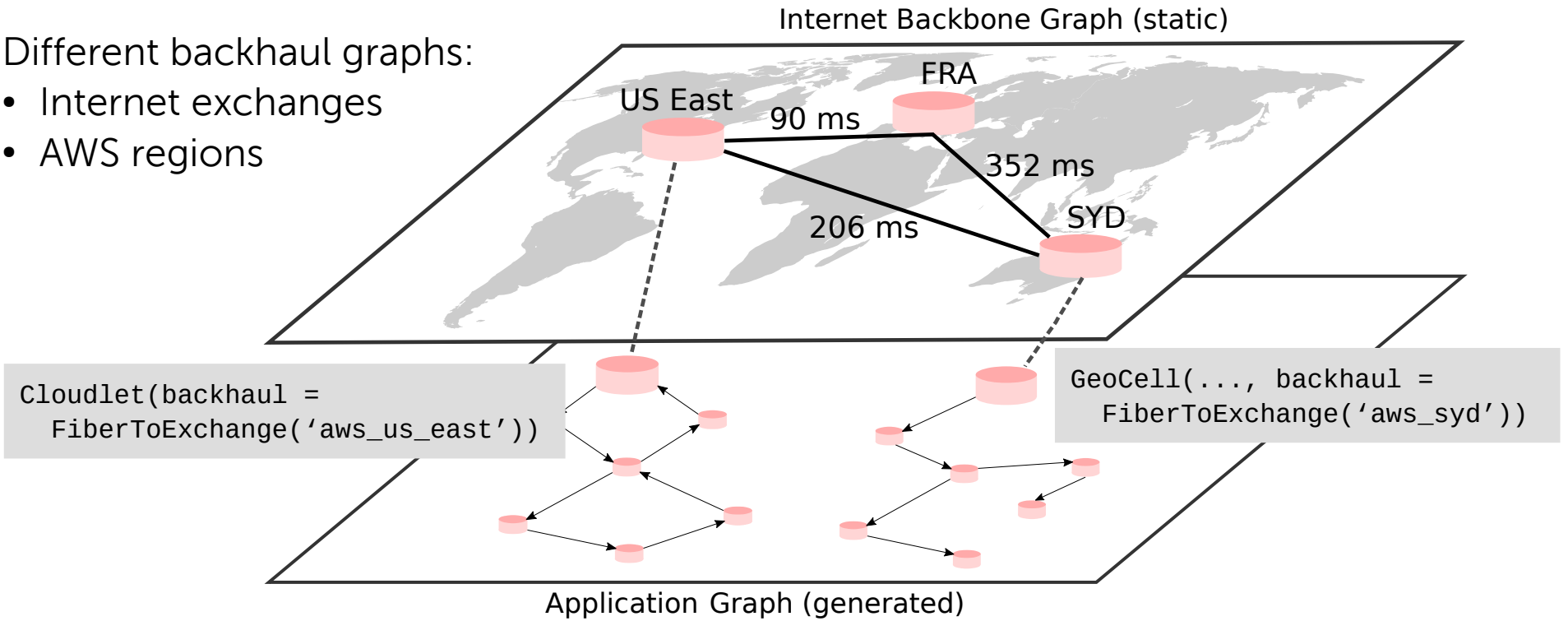
```
topology = Topology()    (= networkx graph)

aot_node = IoTComputeBox(nodes=[nodes.rpi3, nodes.rpi3])
neighborhood = lambda size: SharedLinkCell(
    nodes=[
        [aot_node] * size,
        IoTComputeBox([nodes.nuc] + ([nodes.tx2] * size * 2))
    ],
    shared_bandwidth=500,
    backhaul=MobileConnection('internet_chix'))
city = GeoCell(
    5, nodes=[neighborhood], density=lognorm((0.82, 2.02)))
cloudlet = Cloudlet(
    5, 2, backhaul=FiberToExchange('internet_chix'))

topology.add(city)
topology.add(cloudlet)
```

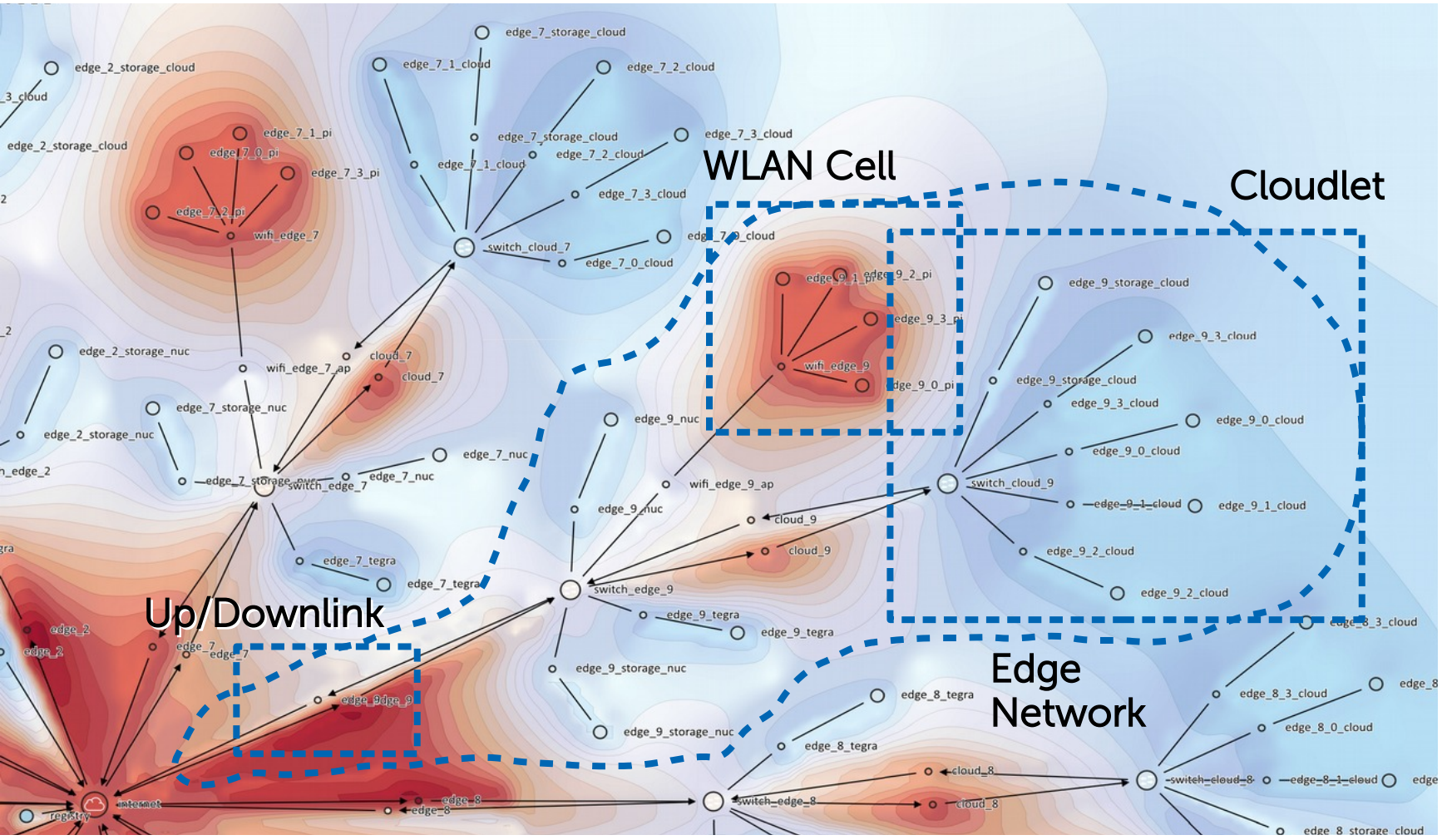
GraphML
GML
JSON
YAML
...

Interconnecting topologies

Different backhaul graphs:

- Internet exchanges
- AWS regions





Visualization by Reinhold Preiner using TAM: https://github.com/rpreiner/tam

Simulation data from faas-sim: https://github.com/edgerun/faas-sim

README.md

ether: Edge Topology Synthesizer

Ether is a Python tool to generate plausible edge infrastructure configurations. It arose from the need to evaluate edge systems in different infrastructure scenarios where no appropriate testbeds are available.

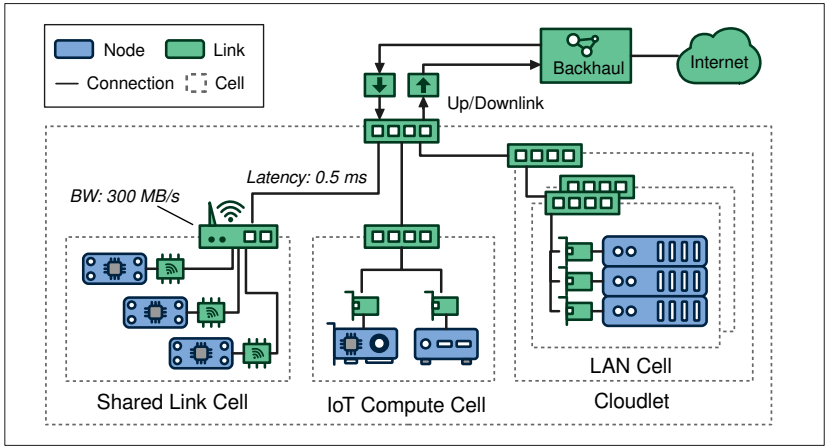
Use cases

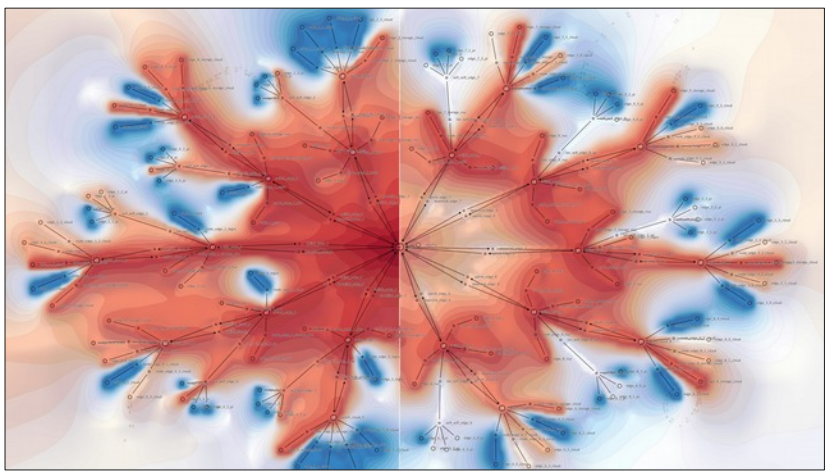
Some of the uses cases for *ether* include

- Evaluating resource allocation strategies
- Creating topologies for network simulations
- Infrastructure capacity planing

github.com/edgerun/ether

NetworkX
Network Analysis in Python





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