FlyNet: An 'On-the-fly' Deeply Programmable End-to-end Network-Centric Platform for Edge-to-Core Workflows

CHI@Edge Workshop

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FlyNet Team

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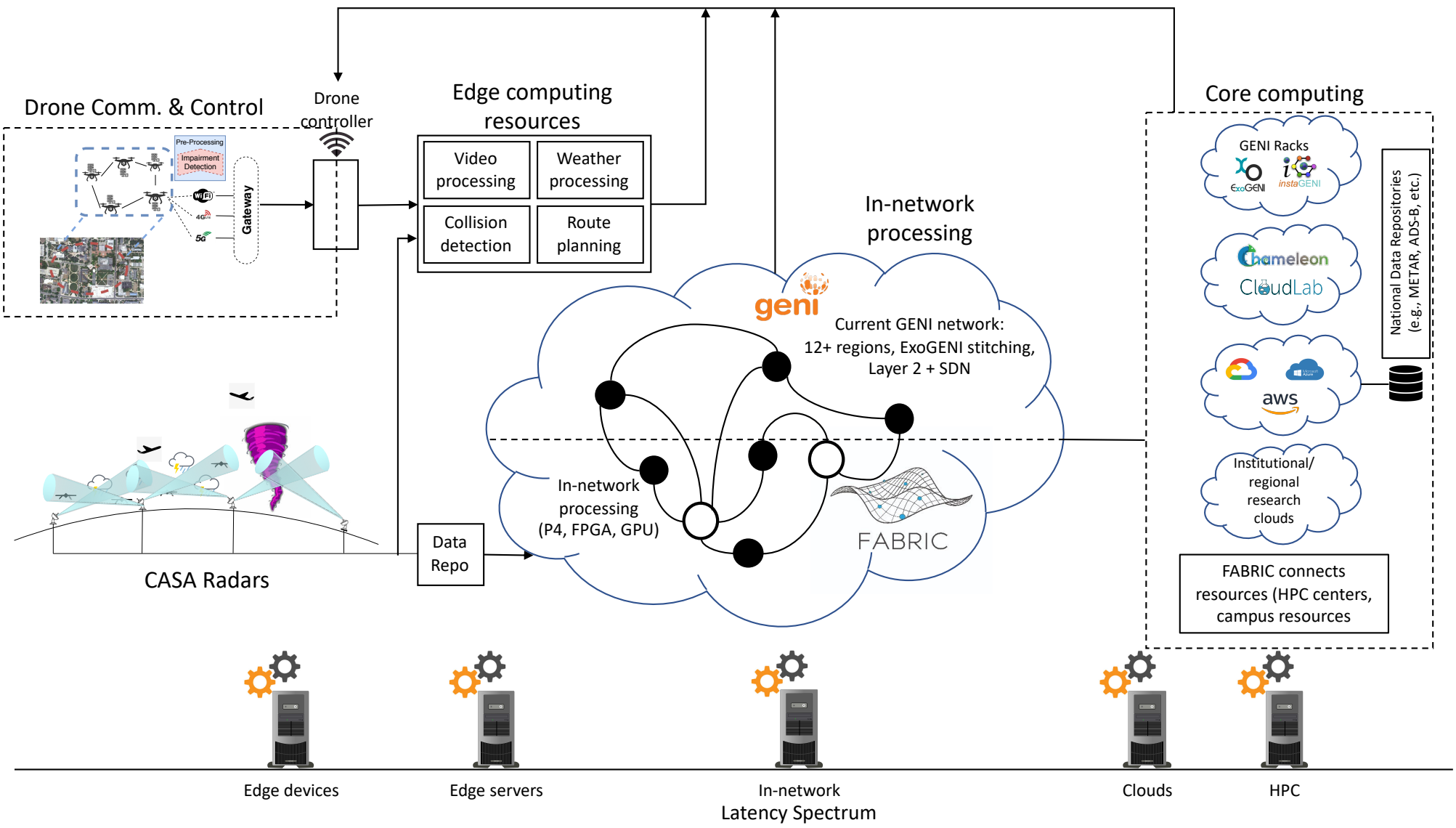
Overview


Drone Comm. & Control
Pre-Processing
Impairment Detection
Gateway
Drone controller
Edge computing resources
Video processing
Weather processing
Collision detection
Route planning
In-network processing
geni
Current GENI network:
12+ regions, ExoGENI stitching,
Layer 2 + SDN
In-network processing
(P4, FPGA, GPU)
FABRIC
Data Repo
CASA Radars
Core computing
GENI Racks
ExoGENI
instaGENI
Chameleon
CloudLab
aws
Institutional/ regional research clouds
National Data Repositories (e.g., METAR, ADS-B, etc.)
FABRIC connects resources (HPC centers, campus resources
Edge devices
Edge servers
In-network
Latency Spectrum
Clouds
HPC

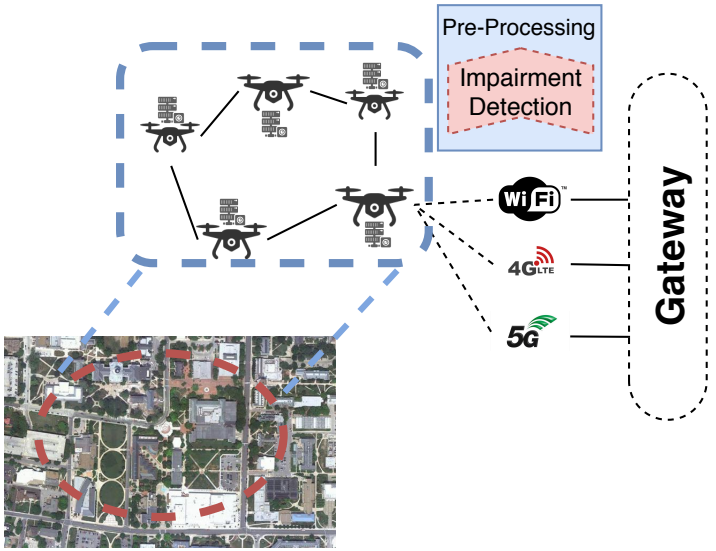
Motivation and Objective

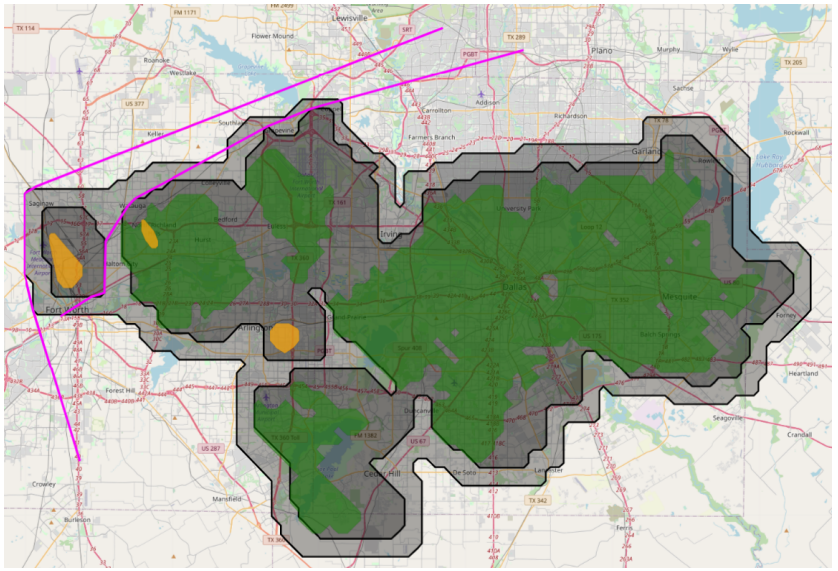
- Provide an architecture and tools that will enable scientists to include edge computing devices in their computational workflows

- Critical for low latency and ultra-low latency applications:
  - Drone video analytics
  - Route planning for drones

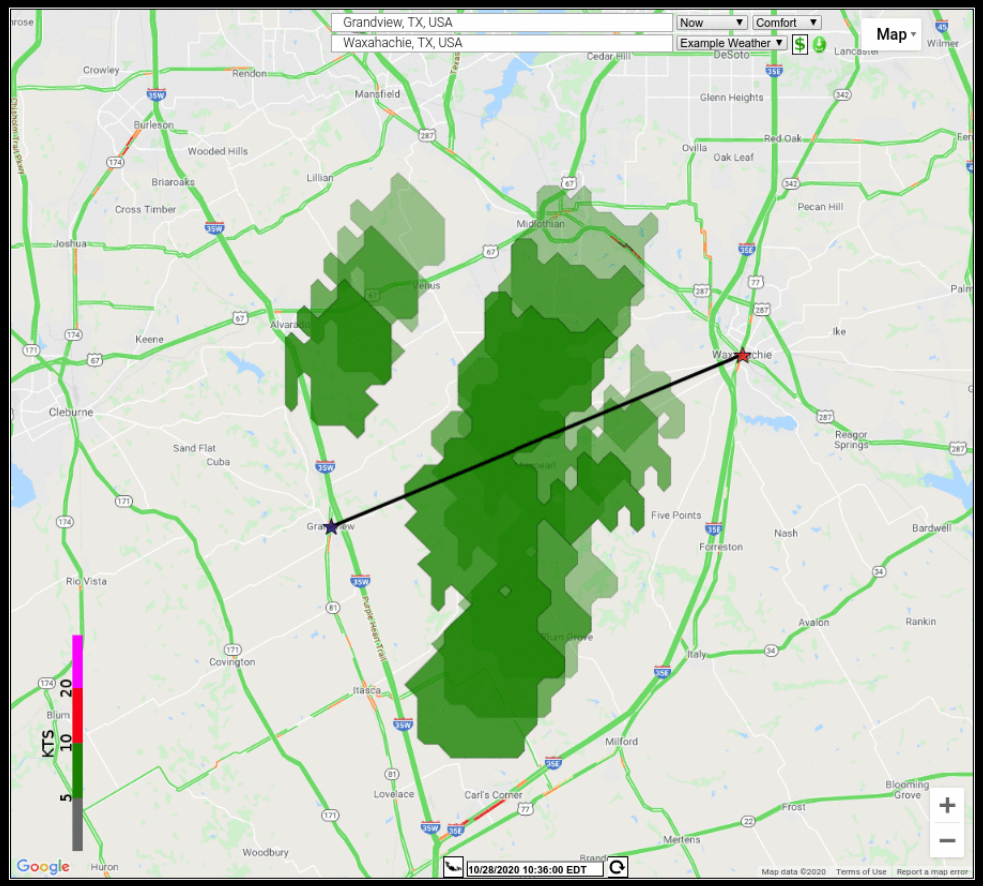
- Four major tasks:
  - Integration of cutting-edge compute and networking infrastructure
  - In-network processing
  - End-to-end monitoring
  - Leverage Pegasus Workflow Management for in-network and edge processing

- Specific needs from CHI@Edge?
  - Stitching between CHI@Edge and CHI@TACC/CHI@UC
  - Integration of third-party IoT resources
  - Long-term reservations
  - Best practices





Demo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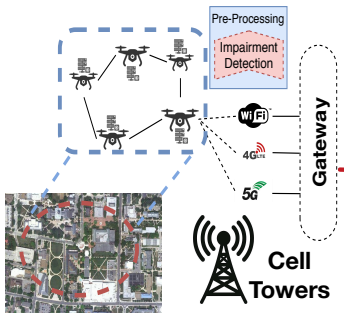
Waxahachie, TX, USA
Now
Comfort
Example Weather
Map
KTS
20
10
5
10/28/2020 10:36:00 EDT
Google
Map data ©2020
Terms of Use
Report a map error

Simulation Architecture



Small Edge Server
Represents Drone base station
Runs iperf measurements
Queries Prometheus server
Edge resource selection

BASE STATION FUNCTIONALITY

Small Edge Server
Runs ffmpeg server
Runs Prometheus client

FFMPEG SERVER

FlyNet Resource Provisioning and Service Orchestration

Small Edge Server
Simulates Drone flight,
cell tower connectivity, and
streams frames with ffmpeg client

DRONE SIMULATOR and FFMPEG CLIENT

Small Edge Server
Runs video analytics client
Runs Prometheus client

VIDEO ANALYTICS CLIENT

Large Edge Server + Cloud
Runs video analytics server
Runs Prometheus client

VIDEO ANALYTICS SERVER

Simulated portion of scenario

Actual execution portion of scenario