Secure Cloud Architecture vs Vulnerable and Malevolent Cyber-Physical Systems aka Drones/UAS:
This is NOT a Test

Presentation to North Texas UAS Safety & Integration Task Force Meeting
Oct. 27, 2020
Agenda:
A Drink from a Secure Cloud to Edge/UAS Firehose ; )

1) A Comic-Book Tale:
UAS to the Rescue v Cyberattack

2) But Seriously:
AV/UAS Security is No Joke

3) Architecting Things 101:
Secure Cloud Architecture

4) NUair: Unmanned Aerial R&D/FAA Test Corridor Assures Safe Commercialization
(in Public-Private Partnership with North Texas, and maybe AERPAW?)
A ‘Gotham’ Tale because… sometimes city officials can’t get out of their own way/lack a sense of humor : )
Breaking news... Gotham has been hit by a Cyber Attack... affecting all Communications Towers...

Hello? Hello? All of our lines are down!!

Quickly Gotham’s Chief Digital Officer Sam Edelstein springs into action and retrieves the Internet Backpack!

Mr. Mayor, we can use the backpack and get communications up and running in no time!

Internet Backpack
TO THE RESCUE!

Sam, that’s right. Great idea!

Meanwhile... Mayor Quimby contacts the fire chief to deploy the Drones to create the Mesh Network...

Our Heroes of the Gotham Fire Department prepare to launch their Drones...

The Drones are up and beginning to connect the mesh network and the backpack has connected to the network...
4 minutes later....
the Mesh Network is Setup....
Our Leaders can Communicate and Coordinate City Services!

Deputy Mayor J. Phillip Thompson. It is great we can video chat by backpack and UAS!

Mr. Mayor... I am up and connected!

Mr. Mayor... we may be down for a while!

Thanks!... the backup 911 Center is now the primary!

Yes! It is a great connection too!...

4 minutes later..... the Mesh Network is Setup.... Our Leaders can Communicate and Coordinate City Services!

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During the Press conference the next day. An Intrepid reporter asks how they were able to resolve the issues so quickly!... Mayor Quimby?

Thanks to the City implementing NIST standards, following CPAC guidelines and working with the Secure Cloud Action Cluster, what could have been a disaster was just another day at the virtual cloud office with our smart and Secure City's cyber physical Systems!

Never Remote, Always Secure and Connected!

Mayor Quimby image courtesy Kevin Stockdale - Kevin+Dan Castellaneta CC BY 2.0 https://commons.wikimedia.org/w/index.php?curid=5783508


School of Information Studies Syracuse University
How bad is IoT security? 84% of Internet of Things adopters have experienced a security breach*

- Malware 49%
- Spyware 38%
- Human Error 38%
- Phishing 30%
- Distributed denial of service attack 26%
- Physical theft 25%
- Skimming 18%
- Ransomware 14%
- Spear phishing 12%

No Internet of Things-related security breaches 13%*

Don’t know 2%*

Source: Kevin Ashton, HP Enterprises, Making sense of IoT. How the Internet of Things became humanity’s nervous system, 2017

= 15% too clueless to realize they have been breached
When UAS and Autonomous Vehicles are Hacked, Who is Liable?

The Good News: ‘Existing laws and legal precedents….should be enough to address most claims arising from… hacked vehicles,’ Rand concluded.

“<U>AV vulnerabilities are complex, numerous, and likely to be widespread. “ Even so, insurance industry will be OK in event of massive cyberattack commandeering fleets of autonomous vehicles for 9/11 scale destruction.

Source: Rand, 2019
Internet of Things
Status and implications of an increasingly connected world

Device to Gateway
Cloud to Cloud
Device to Cloud
Device to Device

Because

NUAIR = Things Management
Leading Smart City Examples with...
Cybersecurity, Privacy, Rights and Ethics By Design

NIST Smart City
Privacy and Security Risk Management Framework, 2021

City of Syracuse, NY
Syracuse Surge & NUAIR
Smart City Center & GENIUS NY
cpSriA Secure Cloud Architecture

Coral Gables, FL
NIST SCCF Smart City Privacy & Security Case

Source: Lee W McKnight, Kevin Bornatsch, Eds., Smart City and Community Challenge Cloud privacy Security rights-inclusive Architecture, July 10, 2019, GCTC SC3 CPAC cpSriA
#CISASummit
https://smartsecuresocieties.org/
Smart and Secure Cloud Architecture 101:
cyberphysical privacy, Security, rights-inclusive Architecture
\textit{cpSriA scales:} Cities, Counties, Regions, States, Nations; + Airports

\textbf{Red} sensitive data including personally identifiable information; so most controlled and restricted
\textbf{Yellow} medium sensitivity access controlled data which by law can be shared more widely; with monitoring; and
\textbf{Green} low sensitivity data - smart city/community civic/open data

\textit{Back your Red data up to a secure cloud. Please.}

Courtesy Lee W McKnight, Kevin Bornatsch, Eds., \textit{Smart City and Community Challenge Cloud privacy Security rights-inclusive Architecture}, July 10, 2019, GCTC SC3 CPAC cpSriA


https://www.afcea.org/content/cloud-architecture-offers-security-cities
Risk Framework for Smart Cities & Communities...and their UAS data too

Syracuse Case Study
- Street Lights Status
- Catch Basin Monitoring
- Water Metering Frequency
- Facial Recognition Use

Is this surveillance technology? [No]

Is there support to use it? [No]

Is there transparency about how the data will be collected and used? [No]

How should the data be stored and shared? [No]

Source: Sam Edelstein, City of Syracuse, 3rd Secure Cloud Architecture Action Cluster Meeting, 2.2020
Secure Cloud Architecture with UAS & Internet Backpacks= Smart City, Community & **North Texas** Worst Case Scenario Resiliency

“Cyber-Physical Systems (CPS) comprise interacting digital, analog, physical, and human components engineered for function through integrated physics and logic. Cyber-physical systems will bring advances in personalized health care, emergency response, traffic flow management.” NIST Office of Cyberphysical Systems

https://www.nist.gov/el/cyber-physical-systems

Images courtesy Imcon International Inc.
https://imconintl.com

School of Information Studies
Syracuse University
Conclusions

The Good News: Google/Alphabet’s ‘Wing’ delivery operational (near Virginia Tech). Amazon & UPS UAS Deliveries also FAA-Approved: excellent timing for North Texas UAS Safety & Integration Task Force work.

The Bad News: More UAS Testing and Evaluation needed for cross-jurisdiction operation (i.e., from 1 municipality to another; e.g., from Dallas to Fort Worth).

The Ugly News: “(U)AV vulnerabilities are complex, numerous, and likely to be widespread.”

In sum: **START WITH SECURE CLOUD ARCHITECTURE, OR YOU HAVE ALREADY SURRENDERED TO CYBERATTACKERS.** Syracuse University & NUAIR happy to partner with North Texas to help nation & regions scale opportunities.
NEW YORK UAS TEST SITE

CAPABILITIES & INFRASTRUCTURE

27 OCTOBER 2020

Dave Whitaker
NUAIR Chief of Development
dwhitaker@nuair.org
NYUASTS INFRASTRUCTURE

Griffiss International Airport
- 1,680 acres (680 ha)
- 11,820 x 200 ft (3,603 x 61 m) Heavy Runway
- Operating air traffic control tower (FAA contract)
- Wide body hangar facilities
- FAA Part 139, Class IV Certification

UAS Test Range
- 5,000 mi² of large UA/OPA ops up to FL 600
- 450 mi² small UAS ops up to 2500 ft AGL
- Real-time operations center including multiple USS
- Urban, rural, over water, linear infrastructure operations
- BVLOS and night flight operations capability
- Designated Airworthiness Representative (DAR)
- Test support including real-time and archived data
SUPPORTING SAFE UAS INTEGRATION INTO THE NATIONAL AIR SPACE (NAS)

Mitigating air and ground safety risk through procedure development & testing

- Detect and Avoid (DAA) including ACAS sXu
- ASTM s UAS Airworthiness Standards testing and validation
- Airworthiness Testing to the FAA Durability and Reliability (D&R) Means of Compliance
- UAS Traffic Management (UTM) testing and integration

Key Customers / Partners

- Industry
  - UAS manufacturers, operators, and users
- Public Safety
- FAA
- NASA
FAA UPP 2 Overview

Unmanned traffic management Pilot program

Multiple BVLOS operations in urban, high density, low altitude airspace with terrain/surface obstructions

Operations in controlled airspace at or below 400’ AGL.

Shared awareness, strategic de-confliction, tracking, conformance monitoring, in-flight de-confliction of cooperative and uncooperative traffic using multiple USS

Establish and test procedures to enable simultaneous manned/unmanned operations

Final flight test scheduled for early November 2020
NYUASTS PARTNERSHIP OPPORTUNITIES

Test and Evaluation
- Procedures, Air Worthiness, Operations
- Varied environments, terrain, airspace
- Flight capabilities and permissions

Fully Instrumented Environment
- Cooperative / non-cooperative
- Surveillance, communications
- Full data support for post-test analysis

Cyber Capabilities
- Large indoor ranges (hangers)
  - EMI shielded (2021)
- Smaller indoor ranges
- Expert partners
INTELLIGENT MOBILITY & SMART CITY LIVING LABORATORY

Curiosity Lab
at Peachtree Corners
WHAT RESOURCES ARE PROVIDED AT THE TRACK?

5G Wireless Environment
Powered by Sprint, 5G will be available to all companies testing or demonstrating on the track.

Fiber Optic Cable
The track has 1Gig dedicated fiber to support all IoT devices that will be tested or demonstrated.

Control Room
Located inside Innovation Center, the laboratory control center will allow companies to view live feed activity from the track and review all data being collected from the IoT devices.

Video Surveillance
20 Video cameras along the corridor will provide surveillance from the Laboratory Operations Center and additional data through IoT software.

Dedicated Short Range Communication
Four roadside units with Bluetooth and DSRC combined data collection will be available at the Laboratory Operations Center.

Track Mapping
High definition map of the test track will be available for companies testing and demonstrating on the track.

Traffic Light
Access to real world traffic signal testing.

Industry Connect
By testing on the track companies will have connections to industry leaders in fields associated with smart cities, IoT and mobility.

Fiber Optic Cable
The track has 1Gig dedicated fiber to support all IoT devices that will be tested or demonstrated.

Access to Sprint SME
Companies looking to integrate with 5G will have access to subject matter experts from Sprint to assist them with integration into a 5G wireless environment.
KEY POINTS TO REMEMBER...

• Free use of 5G while using lab
• Laboratory is owned/operated by a single governmental entity
• No charge for the use of the facilities – Come test, demo and connect with other industry leaders to use the track and its resources.
• Proprietary information remains confidential – We do not share your information, property or test results with anyone.
• City has no interest in Intellectual Property – Our interest is in the economic development of our City.
• Track is insured– City has an insurance policy to cover autonomous vehicle testing.
BeezNests Connection Ltd
A student exclusive freelance platform
Company Overview

The purpose of our student freelance platform is to enable students to obtain short and remote tasks, gigs, and opportunities which they can then add to their experiences. We aim to give students multiple opportunities so that they will feel better prepared when applying for a future full-time internship.
<table>
<thead>
<tr>
<th>1. Special Badges</th>
<th>2. Exclusive opportunities</th>
<th>3. Initiative projects</th>
<th>4. Student promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badges help you stand out on our platform</td>
<td>Remote tasks found nowhere else</td>
<td>Create your own opportunities and projects on our platform</td>
<td>Feature yourself in the Student Storyboard section of our biweekly newsletter</td>
</tr>
</tbody>
</table>
Black Girls Drone is part of community!
What are we trying to do for our community?

Support the student community. Enable students to develop their skills and experiences through short term, remote tasks. Additionally, enable students to earn some side income to support their schooling and education. All our opportunities are flexible and remote!
Thanks!

Any questions?

You can find us at:

- www.beeznests.com
- @Beeznests
Drones in the Classroom

NOVEMBER 14, 2020
Introduction

- Dr. Kenneth Berry at Southern Methodist University
- Worked with technology teachers for years: CTE, Computer Science, engineering competitions
- Growing interest among teachers around Drones
Drones are fun and inexpensive

- Last year 100 educators attended from around Texas attended
- This year we have gone Virtual
- Currently we have 150 registrants from all over the country and the world
Conference

Drone Safety

Drone Curriculum and Training

Drone Industry

Drone Hardware and Software
Drones in the Classroom Conference

- When: November 14 from 9:00 AM to 4:00 PM
- Morning is a general session
- Afternoon breakout sessions
- Where: Online
  [https://smu.zoom.us/meeting/register/tJwkcOGsqz4sGt0UsBj_ZKIysWBlfjFVmntQ](https://smu.zoom.us/meeting/register/tJwkcOGsqz4sGt0UsBj_ZKIysWBlfjFVmntQ)
- Cost: Free
Drones in the Classroom

https://smu.zoom.us/meeting/register/tJwkcOGsqz4sGt0UsBj_ZKllysWBIfjFVmntQ
North Texas UAS Safety and Integration TASK FORCE

Next Steps
The Resolution

Goal

• To add UAS Integration into the Regional Transportation Councils (RTC) transportation planning process

• The Regional Transportation Council is the independent transportation policy body of the Metropolitan Planning Organization

• The RTC's 44 members include local elected or appointed officials from the metropolitan area and representatives from each of the area's transportation providers.

• The RTC administers Millions in transportation related funds
Proposed Deal Points

• Utilize transportation planning process (continuous, comprehensive, and cooperative)

• Support safe and responsible UAS activity

• Encourage agencies to support their public safety services use of UAS systems

• Adopt “pilot” programs to demonstrate the technologies properly operated in and around a metropolitan area

• Provide UAS-oriented educational offerings to prepare workforce development of UAS aircraft pilot certification standards

• Participate in the “North Texas UAS Safety and Integration Task Force Community Integration Working Group”
Community Best Practices Forum

• Characterize community concerns
• Inventory available applications
• Inventory funding mechanisms
• Inventory available training
• Supplement existing transportation methods
• Prepare for natural disasters and other emergencies
Schedule

1. October STTC – Asking for feedback
2. November UAS Task Force – Asking for feedback
3. November RTC – Asking for feedback
4. January STTC – Update
5. January UAS Task Force – Update
6. February RTC – Update
Working Group Meetings

Meeting schedule next week 11.2.20 (agenda and virtual meeting information will be sent soon)

• Education and Public Awareness – 9:00 am to 10:00 am
• Legislation – 10:30 am to 11:30 am
• Training – 1:00 pm to 2:00 pm
• Integration – 2:30 pm to 3:30 pm
Upcoming Events

1. FAA’s 2020 Rotocraft Safety Conference – October 27-29 (Free attendance)
2. Energy Drone & Robotics Global Gathering November 10-12
3. Drones in the Classroom Virtual Conference – November 14, Register Here (Free attendance)
4. InterDrone Online – December 15-17, Register Here
5. Know Before You Fly Your Drone Workshops – December 5th
Advanced Air Mobility
Aerospace Industries Association

- AIA represents more than 300 manufacturers and government service providers

- Membership ranges from prime contractors to family-owned small-parts suppliers

- We provide a forum for industry-wide collaboration on government policy issues, manufacturing standards, and advocacy efforts

- Supplier Management Council: made up of over 250 senior supply chain representatives from system integrators and manufacturers
What is UAM?

The next generation of air travel, which will blend into a cities’ multi-modal transportation operations and will help transform the options for people to move within and between communities.
What is UAM?

- Powered by electric vertical take off and landing (eVTOL) aircraft

- Community friendly and 100x quieter than helicopters, with the safety record of aviation

- Initial operations to take place within existing regulatory authority
Industry Today

300+ vehicle designs

$3 billion+ invested in last 5 years alone

$120 billion market projected by 2030

$10- $20 billion in revenue for operators projected by 2030

Initial operations
Governments bought in at all levels

- FAA
  - 10+ open certification projects
  - UAM CONOPs
- NASA
  - Advanced Air Mobility National Campaign
  - Advanced Air Mobility Working Groups
- Department of Defense
  - Agility Prime
- US Conference of Mayors
  - UAM Resolution passed at USCM Summer Meeting
Deloitte and Aerospace Industries Association are conducting a research study into the critical factors needed to extend US leadership in the Advanced Air Mobility market.

Examine the key steps that the US needs to take as a nation to **achieve global leadership in the new aviation market**.

Analyze the **emerging aviation technologies** and examine the global race for technology leadership.

Understand the **market potential for advanced air mobility (AAM)**, current gaps, and recommendations on how to fill those gaps.

Leverage both the US industry and the federal government’s ongoing work to **shape the future of air travel**.

In the new aviation market, air taxis will be a part of everyday commutes, drones will deliver packages across the country, and artificial intelligence will be widespread.
The market for passenger Urban Air Mobility (UAM) in the US is expected to reach $18 billion by 2040, representing 20-30% of the global market. Much of this will be focused in cities.

<table>
<thead>
<tr>
<th>Year</th>
<th>UAM Passenger Market Growth (US$ billion)</th>
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<tbody>
<tr>
<td>2025</td>
<td>$3.4</td>
</tr>
<tr>
<td>2030</td>
<td>$5.7</td>
</tr>
<tr>
<td>2035</td>
<td>$6.8</td>
</tr>
<tr>
<td>2040</td>
<td>$17.7</td>
</tr>
</tbody>
</table>

Source: Deloitte analysis based on data from research and analyst reports

Testing and piloting of commercial operations using existing technologies and infrastructure

Expanded adoption using pilots and human operated traffic management. Early use of vertiports and e/hVTOL aircraft

Widespread adoption using automated aircraft and traffic management. UAM infrastructure and technology seamlessly integrated into mobility systems

Exponential growth period
Study participants agree that cities are the focal point for UAM: developing mature UAM ecosystems alongside effective policy and planning frameworks in cities is critical.

Cities Are the Focal Point for UAM

- Substantial and accelerating public and private investment
- Emerging market, characterized by new market players that will expand to a wide range of supporting industries and businesses
- Integrating and supporting future of mobility, integrating with intelligent transportation systems
- Capability to expand the geographical movement of goods and services in and out of cities
- Potential to address environment, congestion, and other social needs
UAM leaders interviewed anticipate that 10-20% of private and public transportation today will utilize UAM in 2031-2035 and drive significant economic and societal benefits.

Source: NASA / Deloitte Urban Air Mobility Concept of Operations
However, a number of challenges must be overcome to realize the full potential of UAM

**Air traffic management**
Developing air traffic and airspace procedures to accommodate UAM, integrating unmanned air traffic management systems into the National Airspace System to accommodate high volumes

**Technology maturity**
Development of ground, aircraft and air traffic technologies to accommodate high volume urban air transportation safely and efficiently

**Psychological barriers**
Building passenger confidence in UAM safety and ride quality, as well as excitement and acceptance by local stakeholders (noise, safety, congestion, etc.)

**Regulations**
Adapting and evolving regulations for certification, operation, piloting as well as defining authorities and requirements for urban air transportation network development

**Safety**
Ensuring safety standards are maintained and building confidence across stakeholders (regulators, public, industry, etc.)

**Infrastructure**
Developing, planning and building UAM infrastructure and supporting systems integrated into transportation and city planning

*Source: Deloitte analysis*
Cities are challenged with planning/developing a transportation system that integrates aviation to maximize economic and societal benefit – safely and equitably

**Community Integration** –
Use cases that support public interest (e.g. equity, benefits/costs, job growth) and address community concerns

**Integrated Transportation Planning** –
Long-term multi-modal system strategy, modeling and planning

**Harmonization/alignment Regulation & Roles** –
Define and align jurisdictions, authorities, roles, and approaches

**Institutional capacity** –
Build institutional capacity support for UAM development and ensure city priorities / needs are addressed (GDP, equity, environment)

**Financing** –
Consider financing, cost recovery, revenue generation associated with 4th dimension of transportation in cites
Effective strategies foster a UAM ecosystem tailored to local geographic, economic and societal characteristics to create jobs, drive innovation and support citizen interests/needs.
Questions

How important is urban air mobility to the future of your city (package delivery, passenger flights, cargo, etc.)?

In one word, what is your top priority when considering UAM for your city?

Would you like more information?

When poll is active, respond at PollEv.com/dwightdecarm858

Text DWIGHTDECARM858 to 22333 once to join