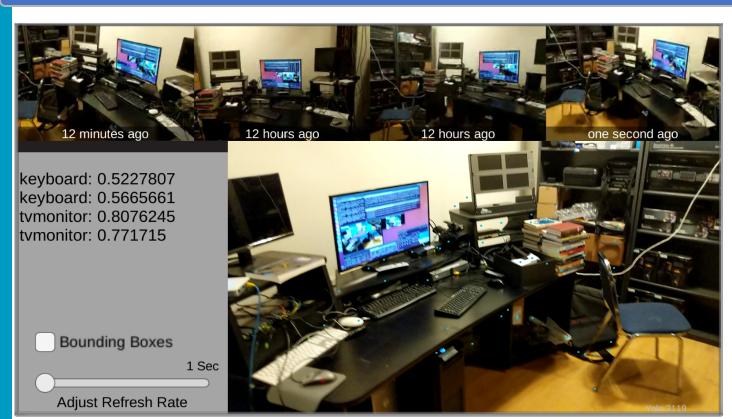


# **ICE-AR Application Progress**

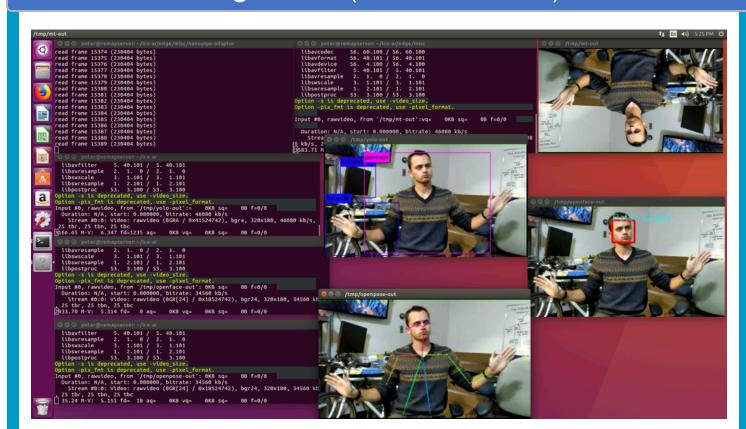
Peter Gusev, Jeff Thompson, Kevin Tolby, Therese Horey, Jeff Burke UCLA Center for Research in Engineering, Media and Performance

## Mobile Terminal (Unity/AR Core on Android)



- Phone UI screen capture
- · Augmented reality cognitive / memory aid application prototype.
- · Publish POV video via native NDN-RTC, consume context from the edge.
- · New "Common Name Library" high-level API for the C# Unity application.
- · Request "best match" for current scene from remote repo, fetch associated "memory" frames and display them. (Context-content loop.)
- · Associate context with location via AR SDK odometry.
- · Also consume and store local IoT data over NDN/Bluetooth.

# Edge Node (Dockerized C++)



- · Consume NDN-RTC video feeds from mobiles.
- · One-to-many fanout to services handled intrinsically by NDN.
- · Process "in realtime" using accelerated ML packages.
- · Publish resulting semantic scene descriptions (context) as NDN data.
- · Store context in a local repository.
- · Use of (updated) NDN Common Client Libraries.

#### **Prototype Deployment Plan for 2018** Authentication Many-to-many (more mobile clients) Mobile Mobile Mobile Mobile Mobile Mobile Two or more testbed-connected enclaves / Access AR Browser **AR Browser AR Browser AR Browser AR Browser** AR Browser Context-dependent content Control • Auth/access control implemented Managers E(POV Video) E(Context) NDN Testbed **NDN LAN** NDN LAN **Publisher Publisher** E(Content) (HTML5) (HTML5) E(Annotations) E(Annotations) F(Annotations) E(Annotations) E(Annotations) E(Annotations (JSON) (JSON) (JSON) (JSON) (JSON) (JSON) RECOGNIZE RECOGNIZE RECOGNIZE RECOGNIZE RECOGNIZE RECOGNIZE **FACES POSES OBJECTS POSES FACES OBJECTS** OpenPose OpenFace Yolo OpenPose OpenFace Yolo

# **Current system** EDGE SERVICES MOBILE TERMINAL YOLO2 MNOTATIONS ANNOTATIONS CONSUMER 4 DB INGEST DOCKER CONTAINER SEMANTIC DB MODULE FILE PIPE DB INTERFACE 0 A MODULE UI MODULE → FILE PIPES ➤ INTERNAL (FUNCTION) CALLS

## **Next Steps: Integrate Other Research Results**

- · Self-learning of available edge services => mobility between enclaves.
- Schematized trust => publisher mobility, terminal authorization.
- · Acceleration-as-a service => on-demand availability via NDN.
- Further performance optimizations based on cross-layer research.

# References and Codebase

- 1. Burke, J., 2017, July. Browsing an Augmented Reality with Named Data Networking. In Computer Communication and Networks (ICCCN), 2017 26th International Conference on (pp. 1-9).
- 2. Shang, W., Wang, Z., Afanasyev, A., Burke, J. and Zhang, L., 2017, April. Breaking out of the cloud: local trust management and rendezvous in named data networking of things. In Internet-of-Things Design and Implementation (IoTDI), 2017 IEEE/ACM Second International Conference on (pp. 3-14).

ICE-AR prototype: https://github.com/remap/ice-ar https://github.com/remap/ndnrtc BTLE Beaconing: https://tinyurl.com/ycwruya3

Common Client Lib: https://github.com/named-data/ndn-dot-net (C#)
Common Name Lib: https://github.com/named-data/PyCNL (Python)