CONIX RESEARCH CENTER

WebAssembly (WASM) in the Augmented Reality Edge Networking Architecture (ARENA)

JUMP

Sponsored by the CONIX Research Center, one of six centers administered by the JUMP phase of the Focused Center Research Program (FCRP), a Semiconductor Research Corporation program sponsored by MARCO and DARPA.

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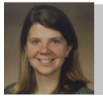
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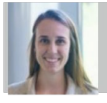
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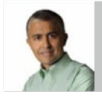
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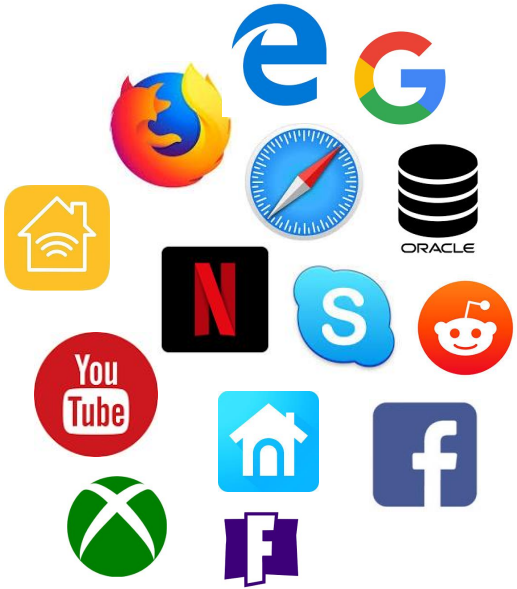
Sponsored by SRC and DARPA

CONIX is one of 6 SRC centers working on distributed computing paradigms towards a roadmap for the semiconductor industry

A new *computing* tier is emerging



Traditional Distributed Apps

Autonomous Cars

Droids and Drones

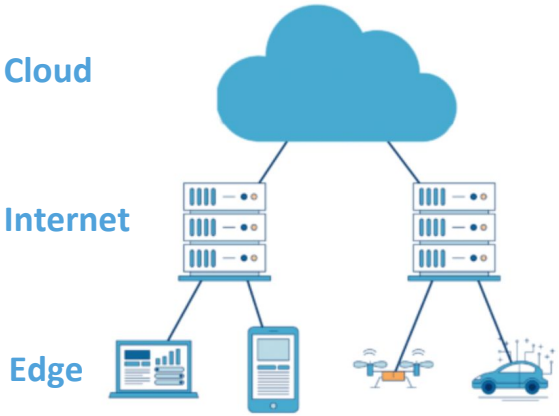
Smart Cities

Mixed Reality

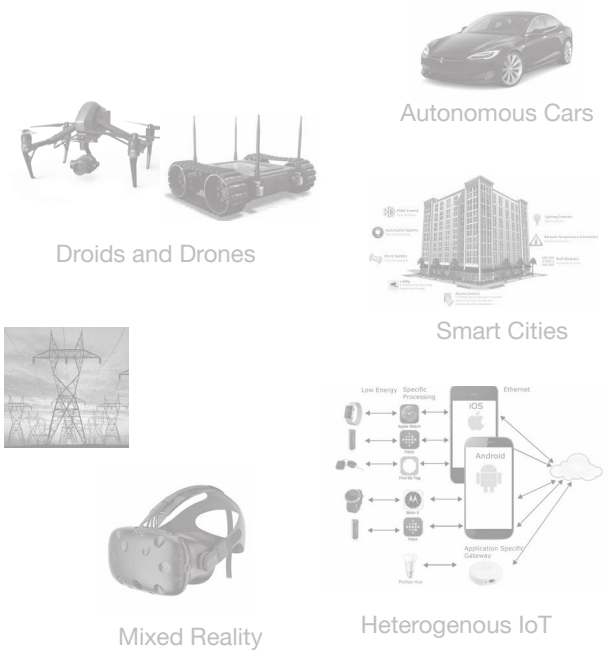
Heterogenous IoT

Emerging Applications

A new *computing* tier is emerging

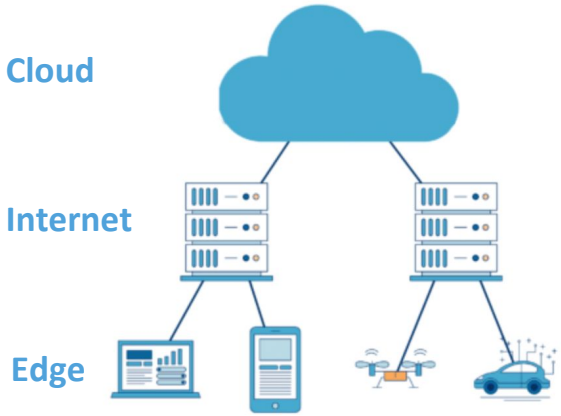


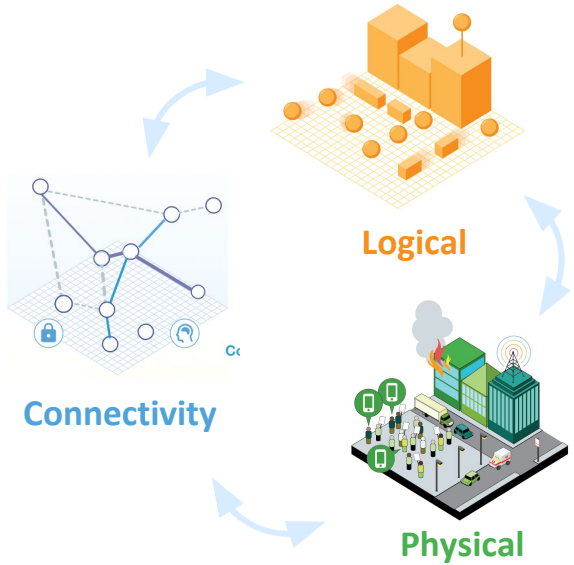
Traditional Distributed Apps



Emerging Applications

A new *computing* tier is emerging





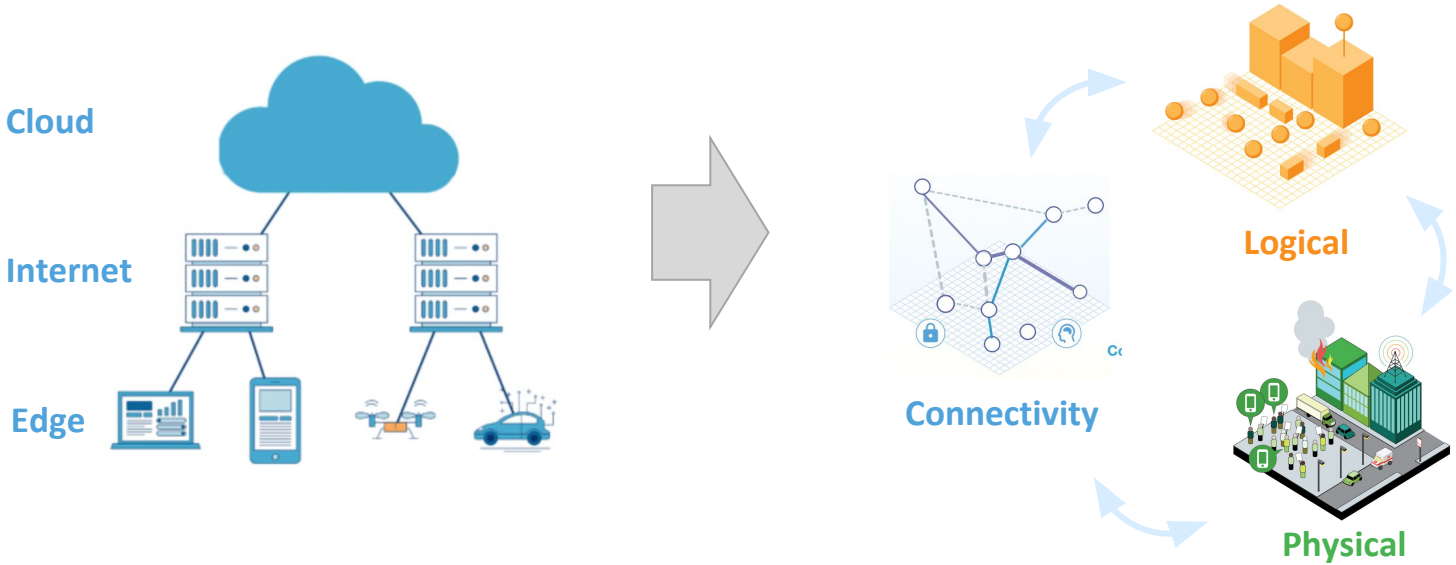
Traditional Distributed Apps

Emerging Applications

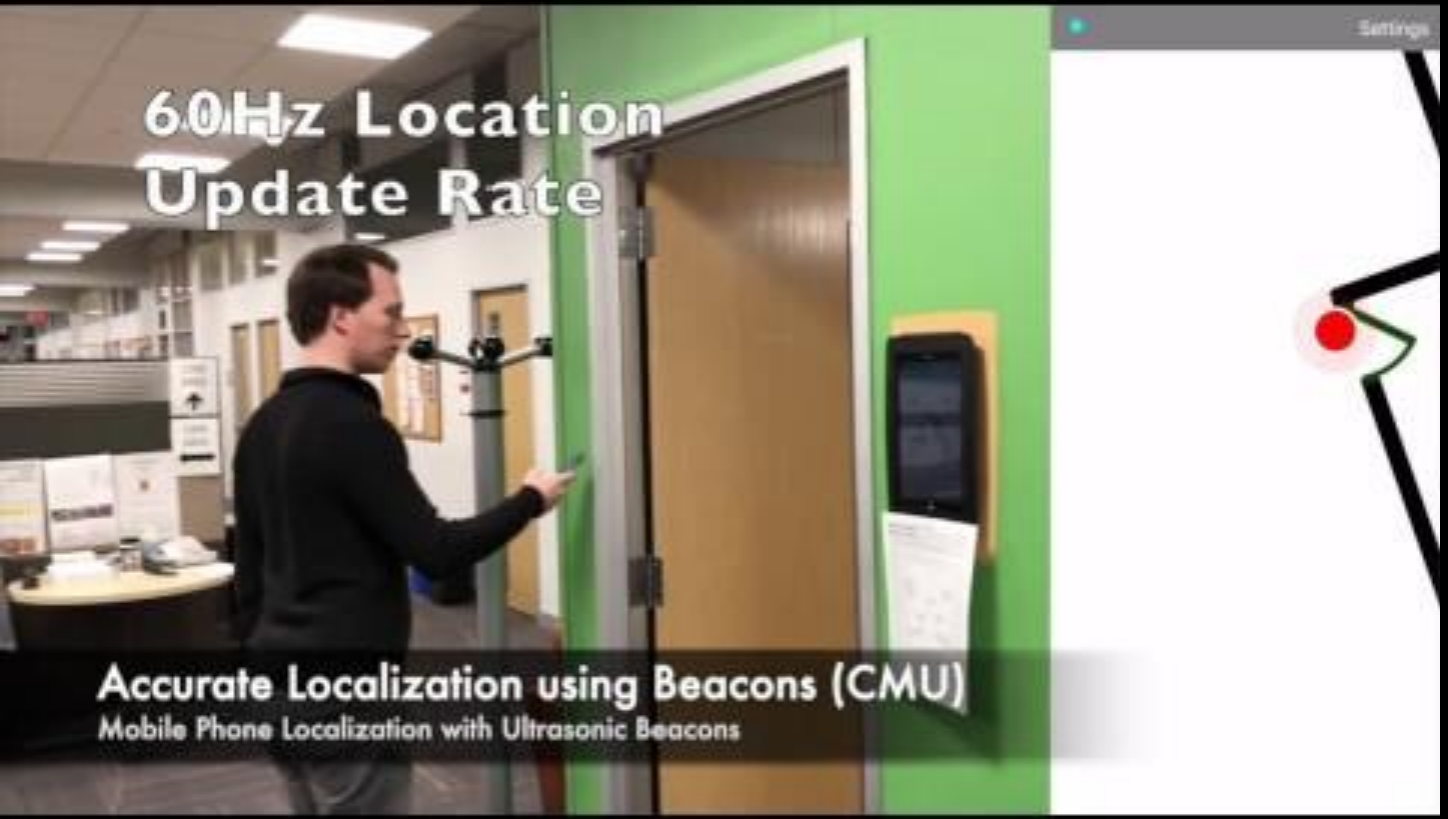
Claim: trillions of edge devices will require new *programming models*

Image Courtesy of Janusz Bryzek, Fairchild and chair of Tsensor Summit

Claim: trillions of edge devices will require new *system architectures*



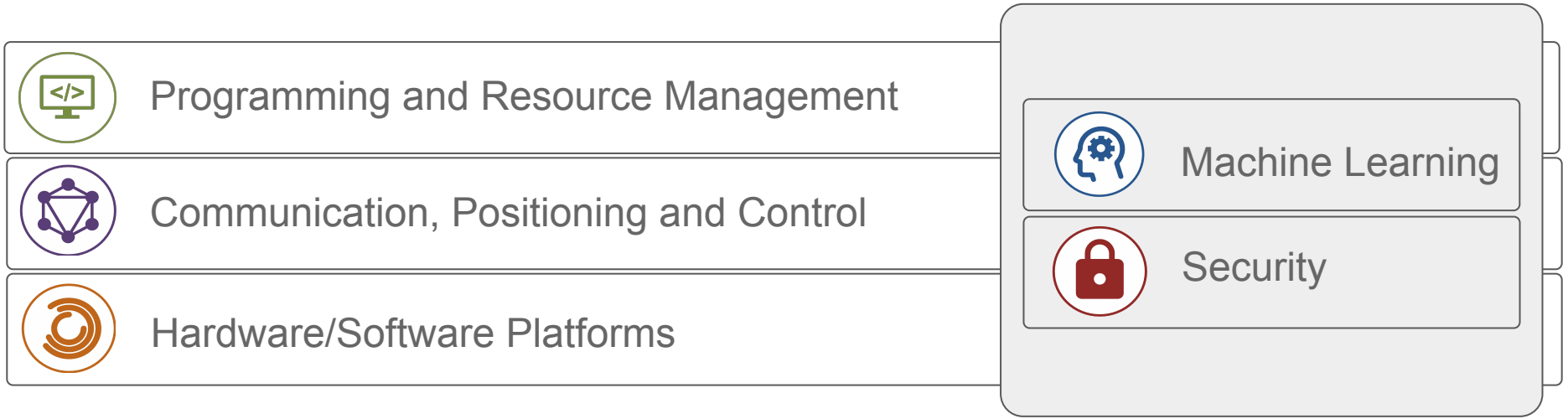
Glimpse of the CONIX Vision in Action



A video that illustrates:

- AR Interactions
- Platforms
- Tracking
- Localization
- Compute Migration

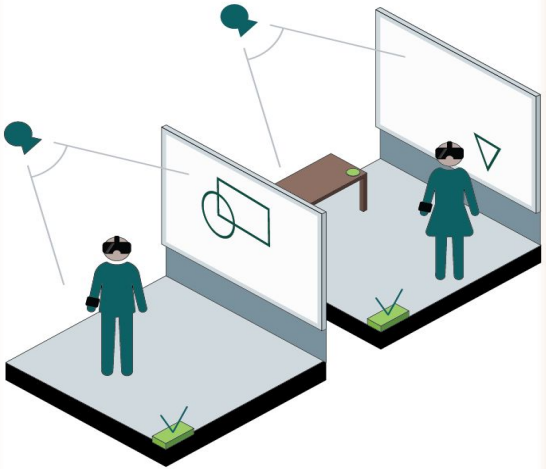
CONIX Research Themes



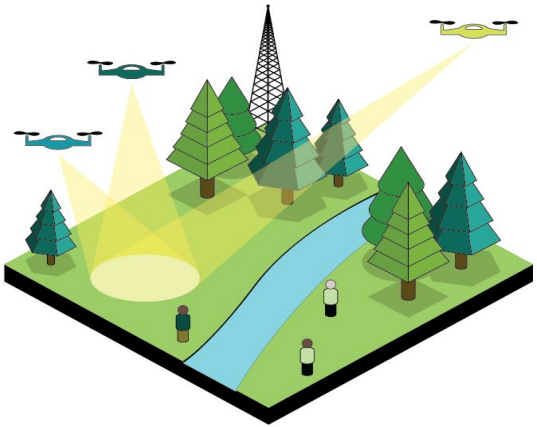
Demonstrator applications to drive systems research

Smart Cities

Mixed Reality (MR) Systems



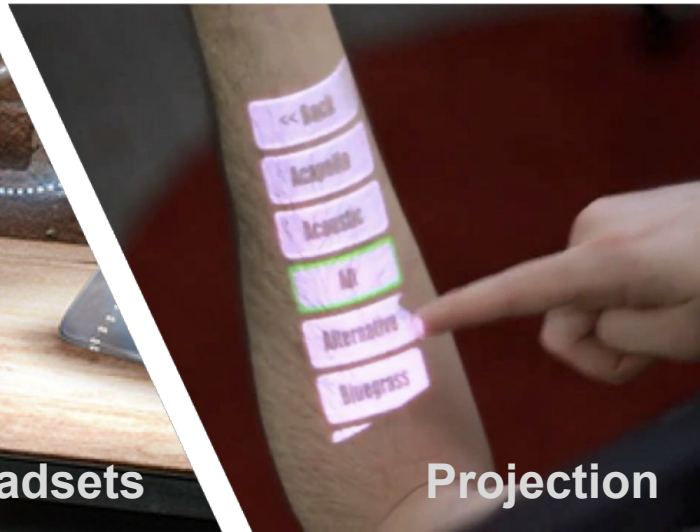
Enhanced Situational Awareness



Multiple forms of Mixed Reality (MR)

Headsets

Portable “Window”



Projection

Collaborative MR is still a challenge

- Precise Instant-on Localization
- Pervasive sensing
- New user interfaces
- Advances in wearable and mobile hardware
- Advances in communication and storage
- **New ways of programming MR experiences**
- **Device provisioning, discovery and interfacing**

The Augmented Reality Edge Networking Architecture (ARENA)

- Platform for supporting real-time MR interaction between multiple users and the physical world
  - Find content linked to global locations
  - Render/visualise
  - Network layer for multi-user interaction
  - Services to link into physical world

The Augmented Reality Edge Networking Architecture (ARENA)

Collaborative,
Multiuser MR Scene

Geographic queries

ATLAS

Scene Description + Application behavior (WASM)

Native Renderer

CONIX WA

Hololens

Browser Renderer

CONIX WA

WebXR-enabled platforms

Pubsub message bus (scene updates, sensor inputs, ..)

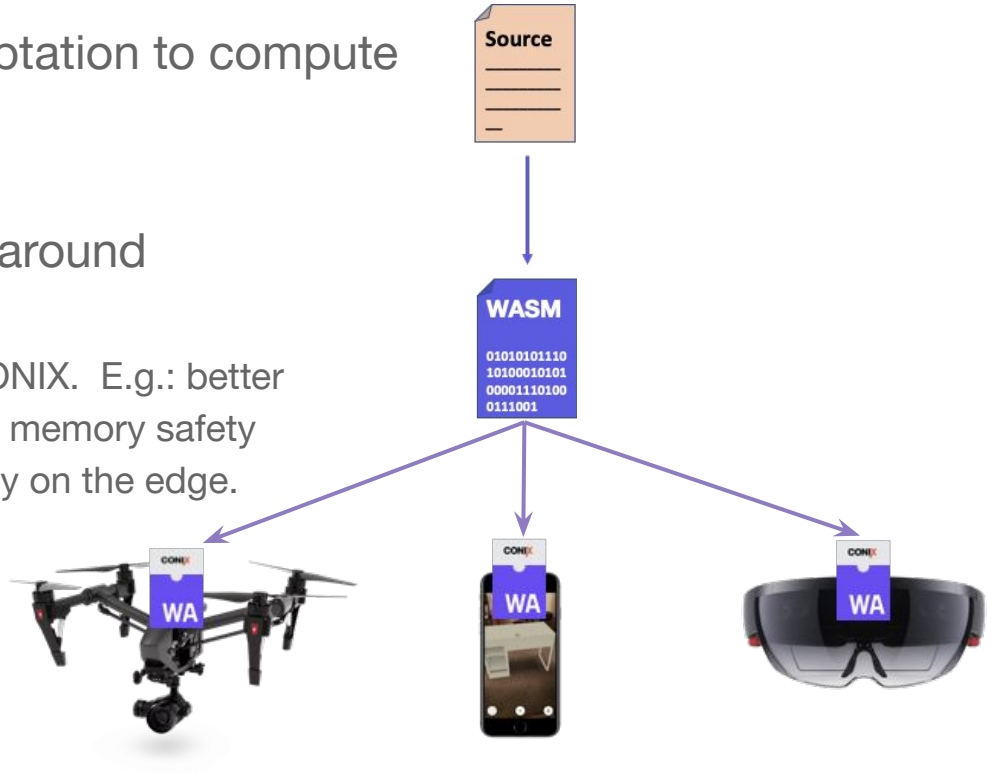
Services
-Localization
-Resource Manager

Sensor Inputs

UWB

The Vision for WASM in CONIX

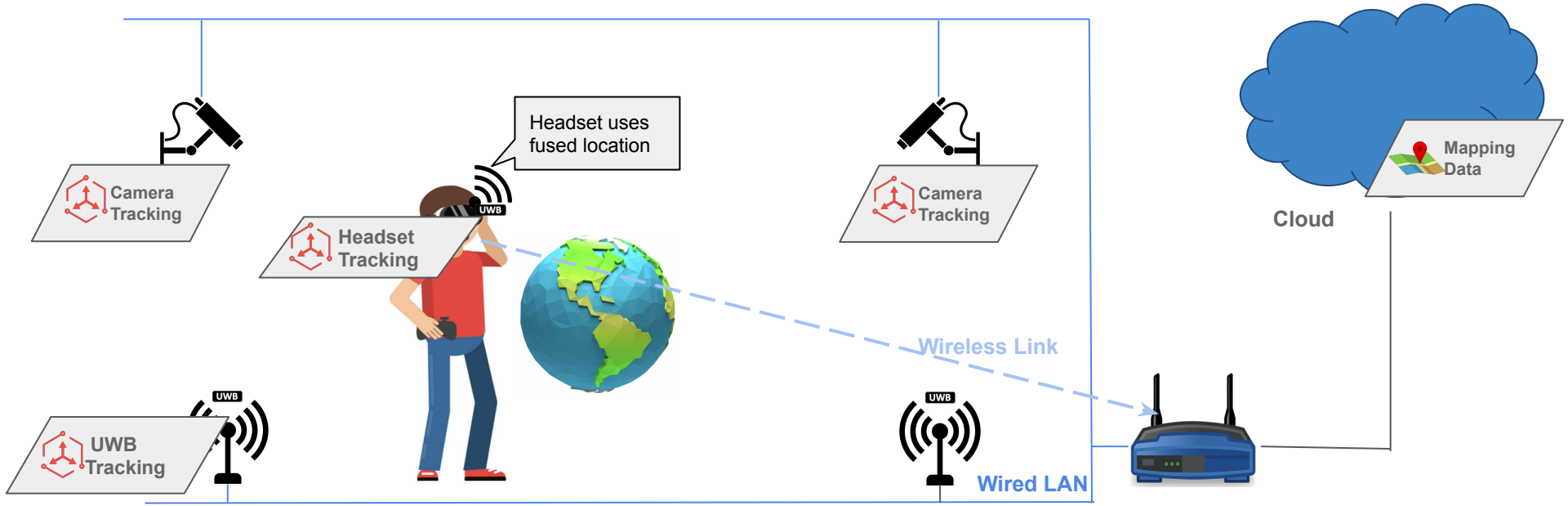
- Common runtime to enable adaptation to compute and network resources
- Leverage the strong ecosystem around WebAssembly
  - including work developed within CONIX. E.g.: better isolation of native libraries, stronger memory safety guarantees and secure cryptography on the edge.



Adaptation for Localization

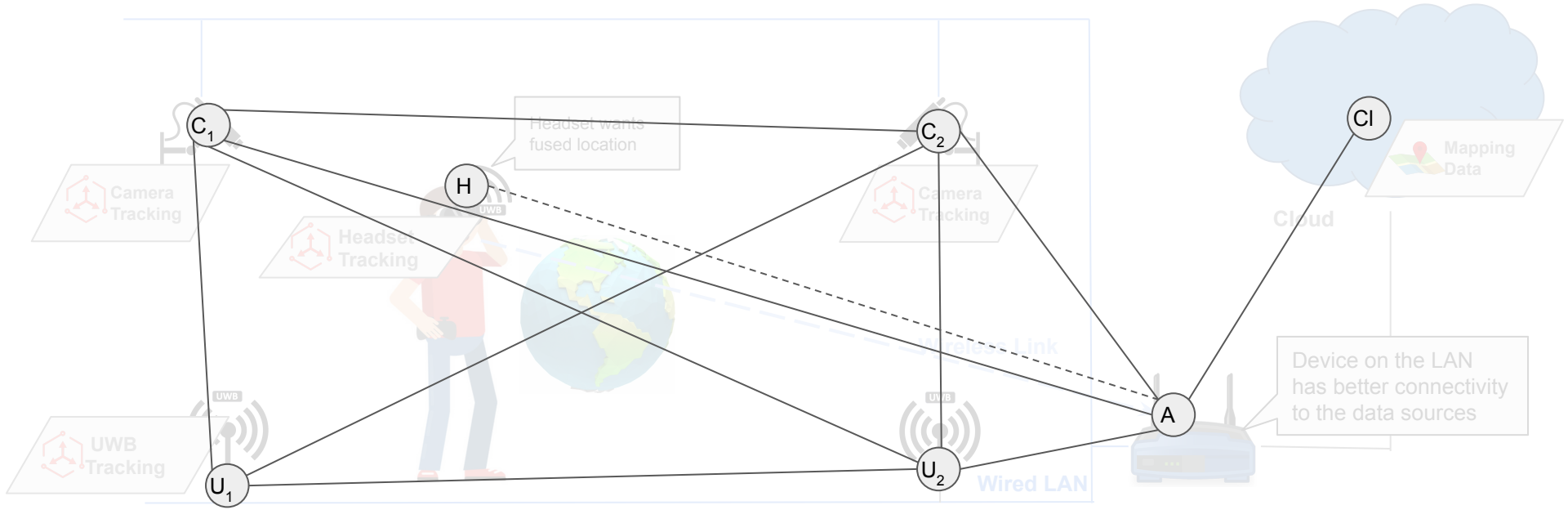
Localization Services

- Fuse different location data (cameras, headset sensors, UWB tags) to produce the location of a device(s)
- Run the location solver on the network, according to network/computing constraints



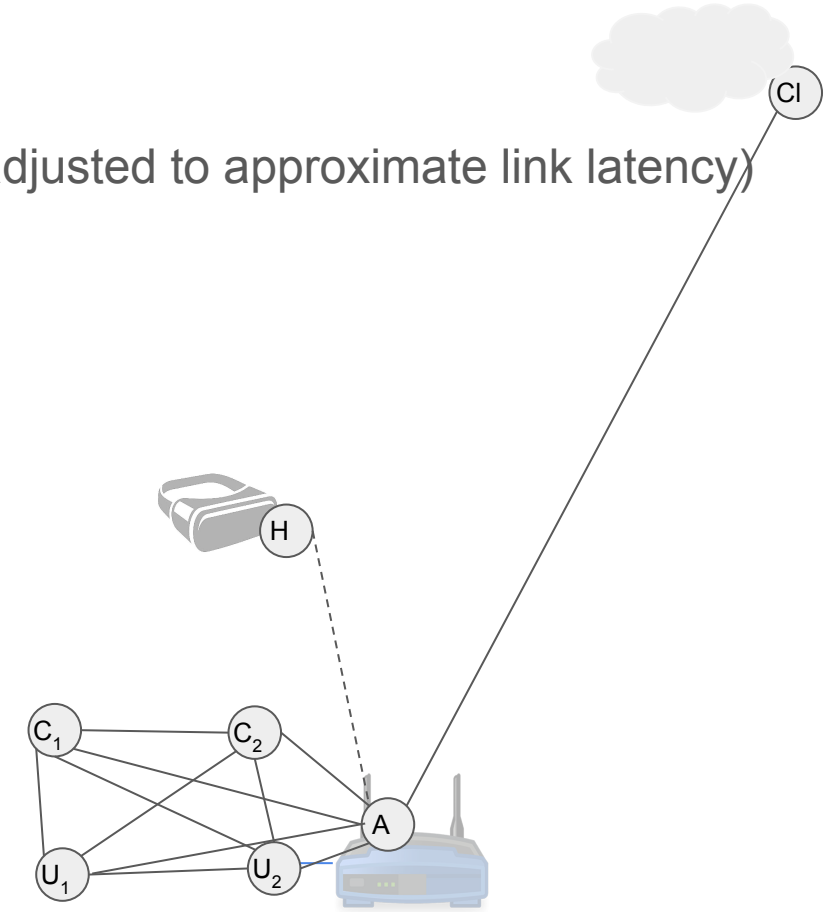
Adaptation for Localization

Graph representation of the network



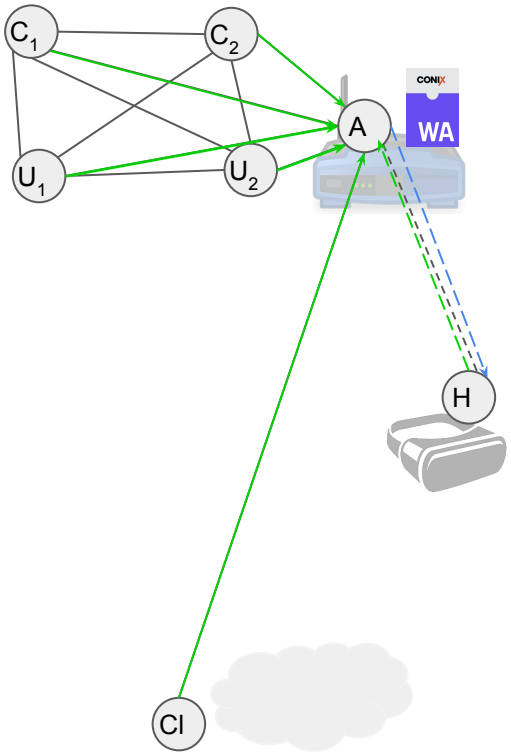
Adaptation for Localization

Graph representation of the network (edges adjusted to approximate link latency)

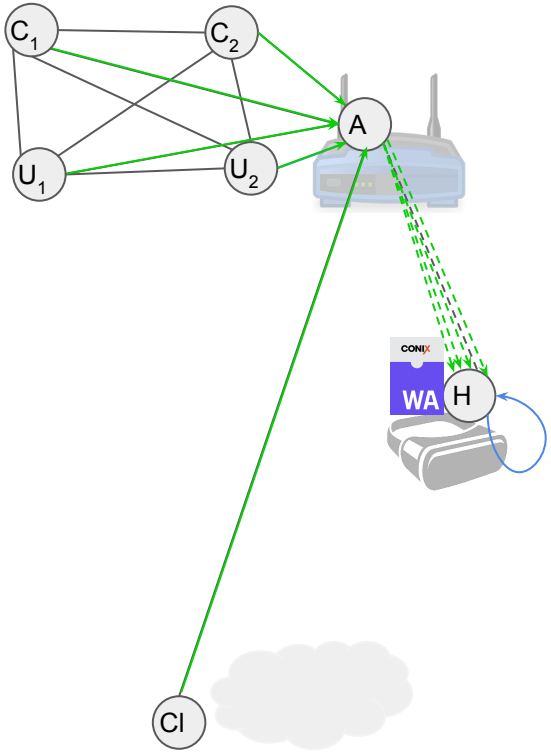


Adaptation for Localization

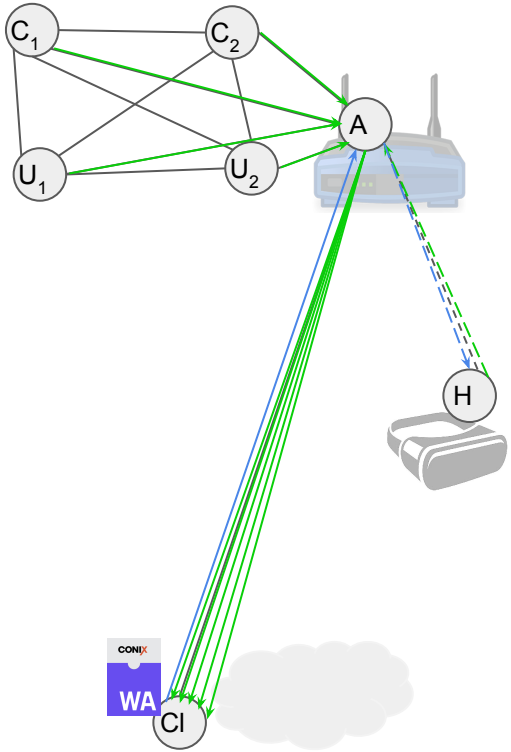
a) Solver in the Access Point



b) Solver in the Headset

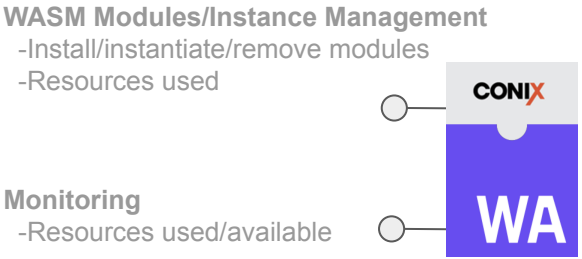


c) Solver in the Cloud



WASM CONIX Runtime

The enabler of compute migration in the ARENA



- Networking as a priority, particularly support for pubsub
- Monitoring of resources
- Management of WASM modules/instances
- Support for “small” embedded devices

- Currently working with Intel’s WebAssembly Micro Runtime (WAMR)
  - Extend/modify application manager, better resource monitoring
  - Experiment/Extend runtime
    - Networking calls, pubsub
    - Experiment with a *embedded system* interface

Collaborative AR

- Virtual objects placed persistently in physical space
- Multiple users sharing a single experience