Secure Cloud-Assisted Smart Cars: Architecture and Authorization Framework
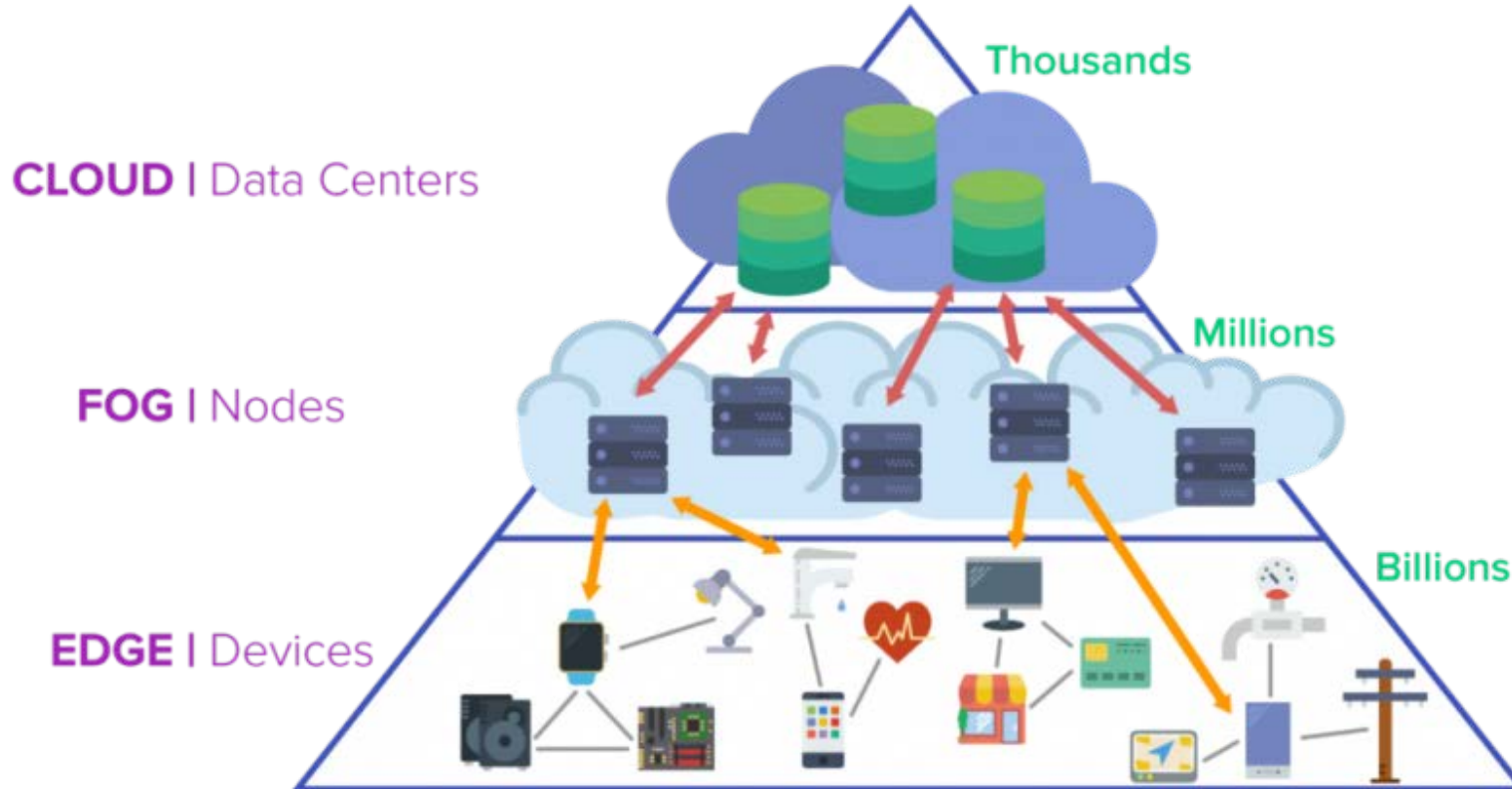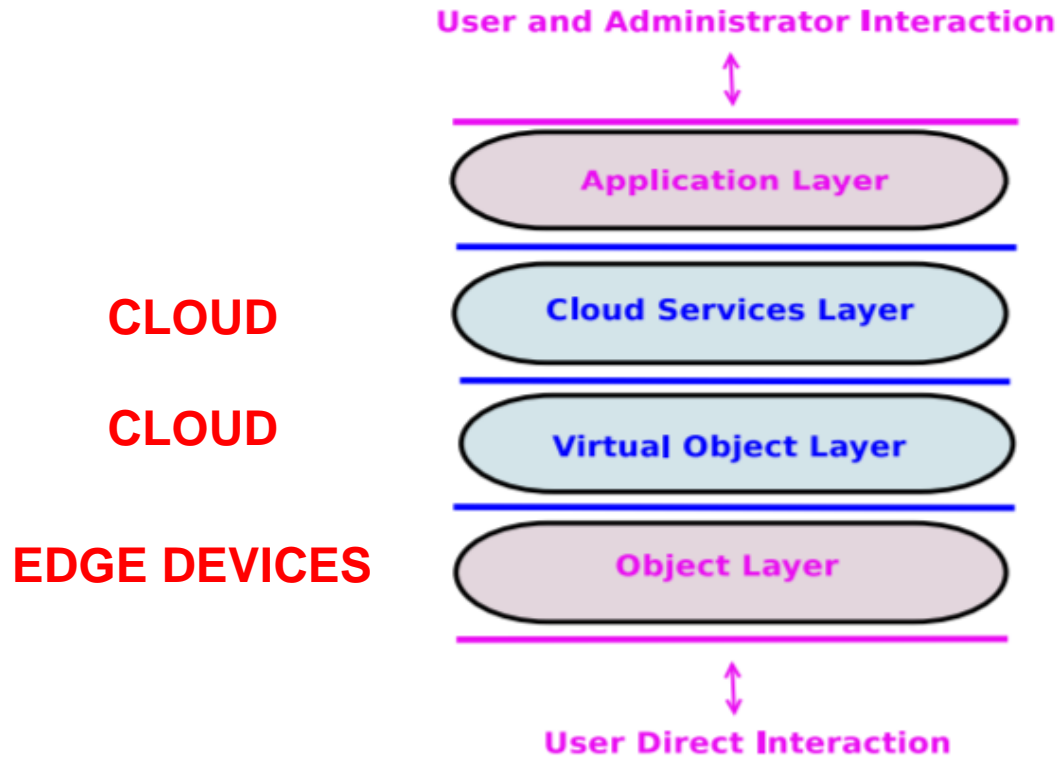
Maanak Gupta and Ravi Sandhu

L13-1
CS6393
Spring 2020

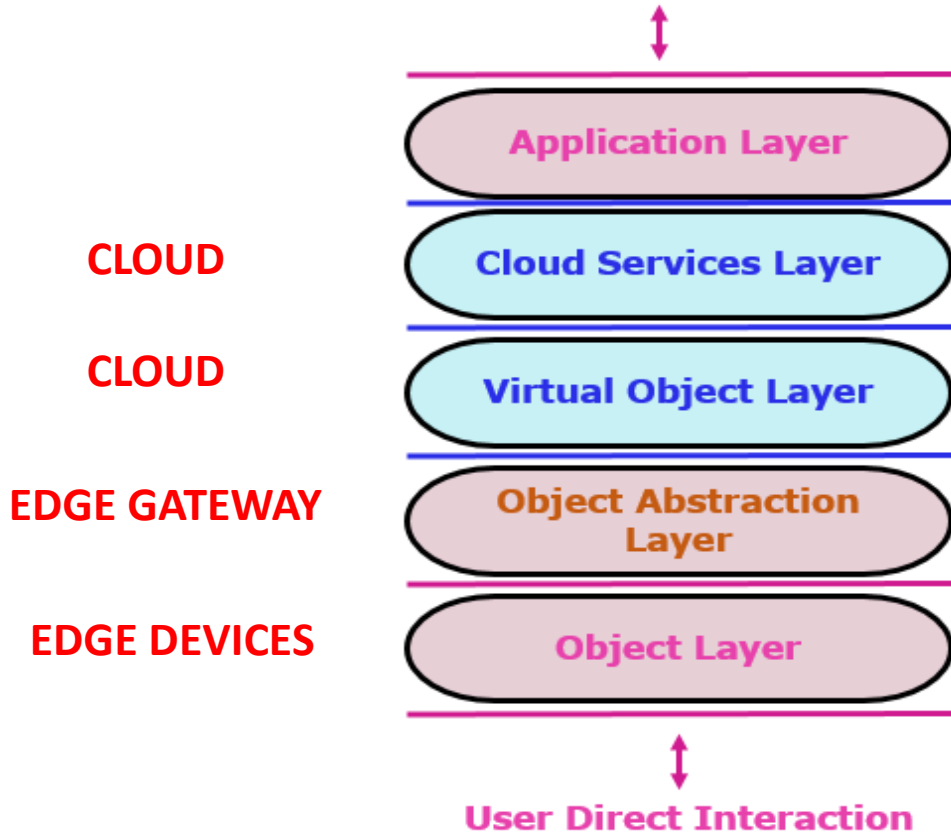*World Leading Research with Real World Impact!*

Yousefpour et al, All one needs to know about fog computing and related edge computing paradigms: A complete survey. Journal of Systems Architecture, 2019.

User and Administrator Interaction

Application Layer

CLOUD — **Cloud Services Layer**

CLOUD — **Virtual Object Layer**

EDGE DEVICES — **Object Layer**

User Direct Interaction

* Alshehri, A., Sandhu, R.: Access control models for cloud-enabled internet of things: a proposed architecture and research agenda. In: 2nd IEEE International Conference on Collaboration and Internet Computing (CIC), pp. 530–538. IEEE (2016)

World-Leading Research with Real-World Impact!

I·C·S The Institute for Cyber Security

C·SPECC Center for Security and Privacy Enhanced Cloud Computing

CLOUD

CLOUD

EDGE GATEWAY

EDGE DEVICES
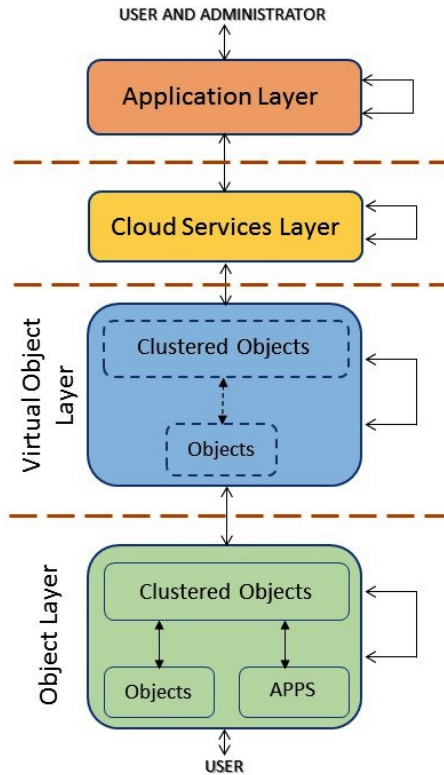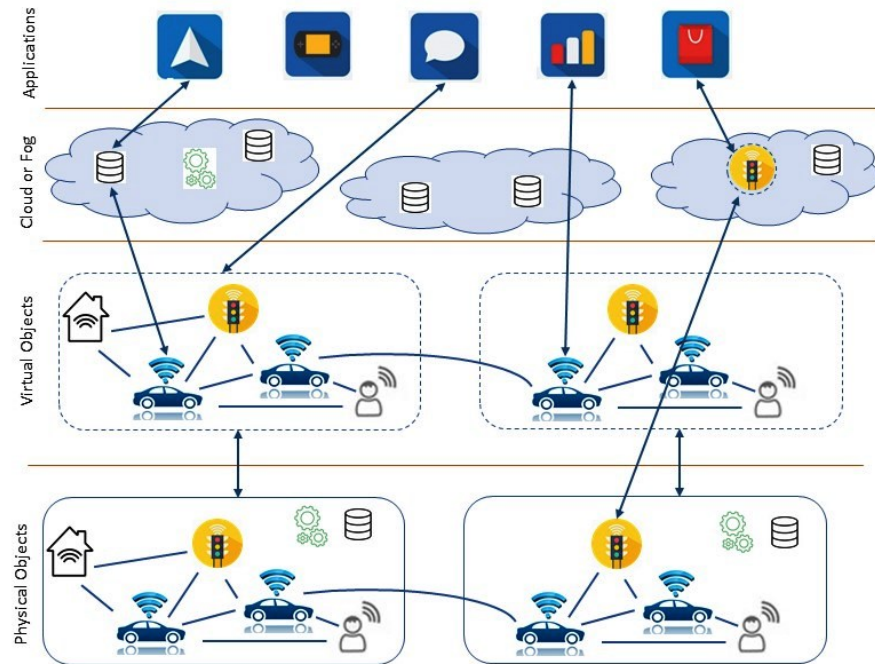
a) Enhanced ACO Architecture for WIoT

b) IoT Components in ACO Layers

Bhatt et al, An Access Control Framework for Cloud-Enabled Wearable Internet of Things. IEEE CIC 2017.

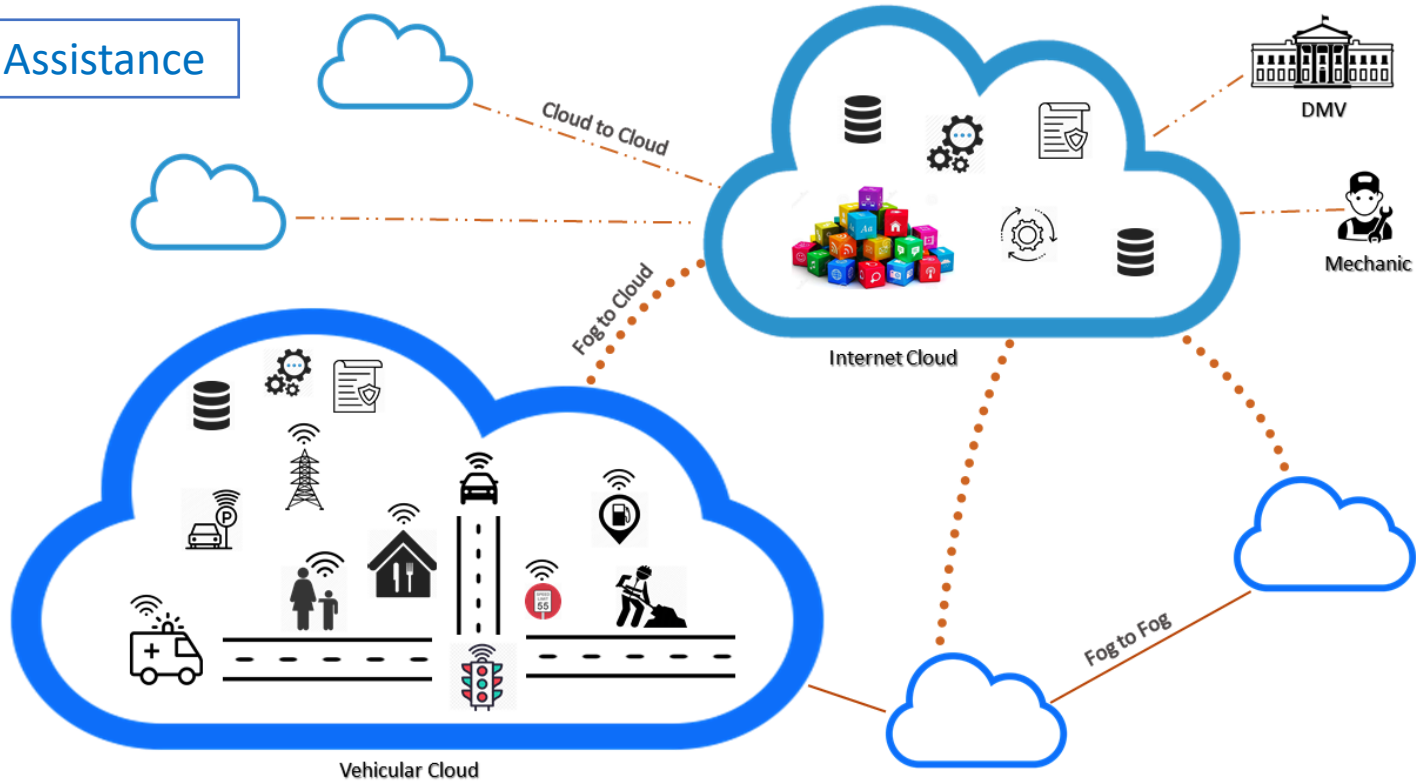*World-Leading Research with Real-World Impact!*

UTSA Computer Science

a) Extended ACO Architecture for Connected Car and IoV

b) Connected Car and Vehicular IoT Components in Extended ACO Layers

World Leading Research with Real World Impact!

Smart Cars Ecosystem

Safety and Assistance

Cloud to Cloud

Fog to Cloud

Internet Cloud

DMV

Mechanic

Vehicular Cloud

Fog to Fog
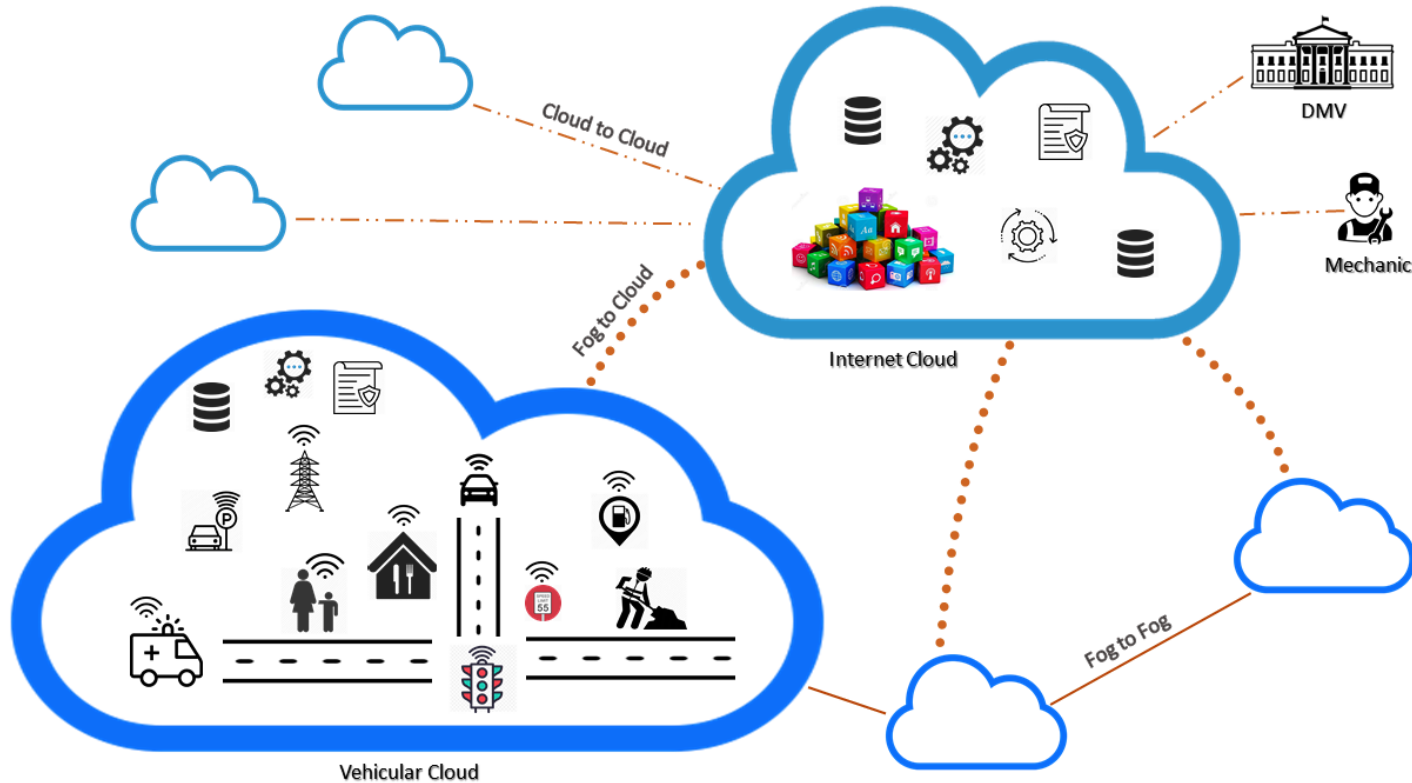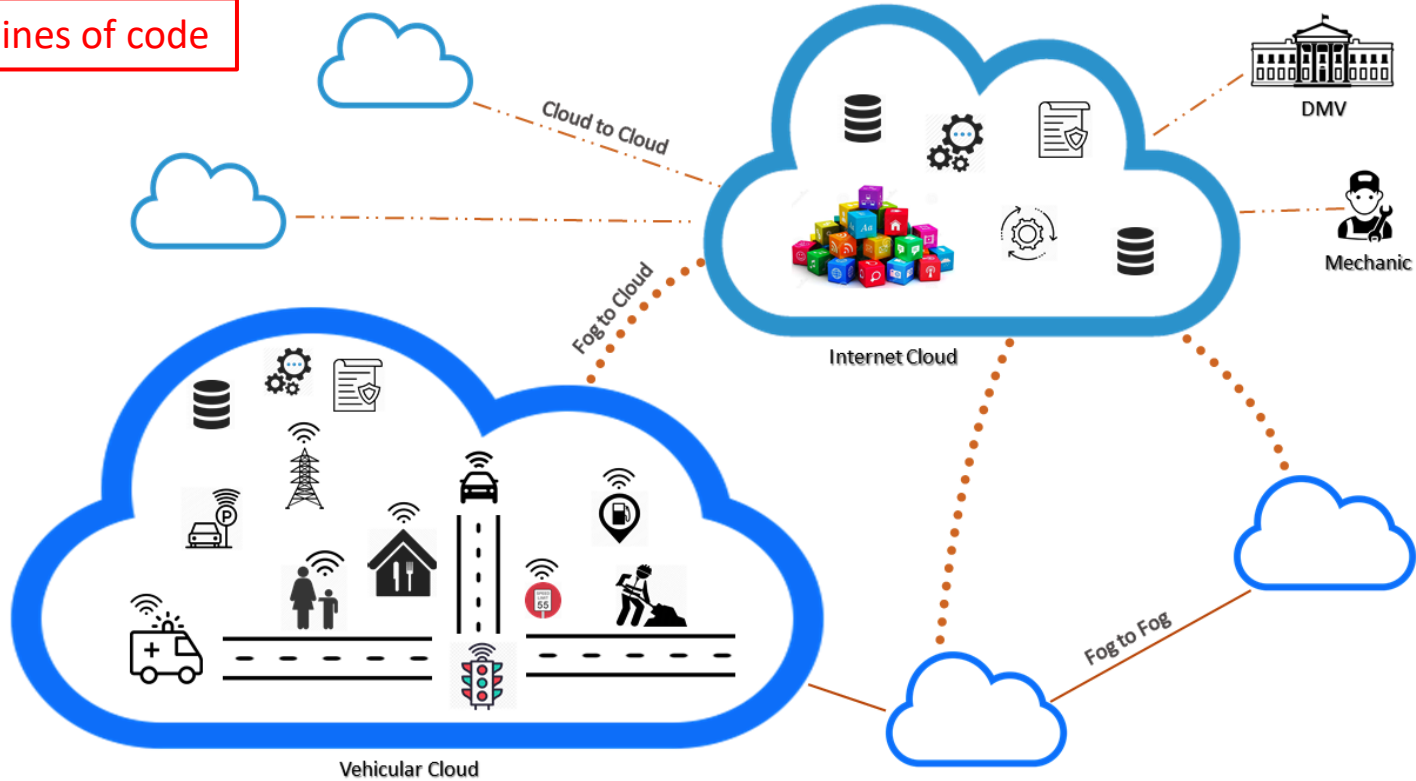
Information and Entertainment

High Mobility, Location Centric
Time Sensitive, Dynamic Pairing
Multiple Fog/Cloud Infrastructures

No More Isolated.!

**100 million lines of code**

Cloud to Cloud

Fog to Cloud

Internet Cloud

DMV

Mechanic

Fog to Fog

Vehicular Cloud

Software Reliance , Broad Attack Surface, Untrusted Entities

World Leading Research with Real World Impact!

I·C·S
The Institute for Cyber Security

C·SPECC
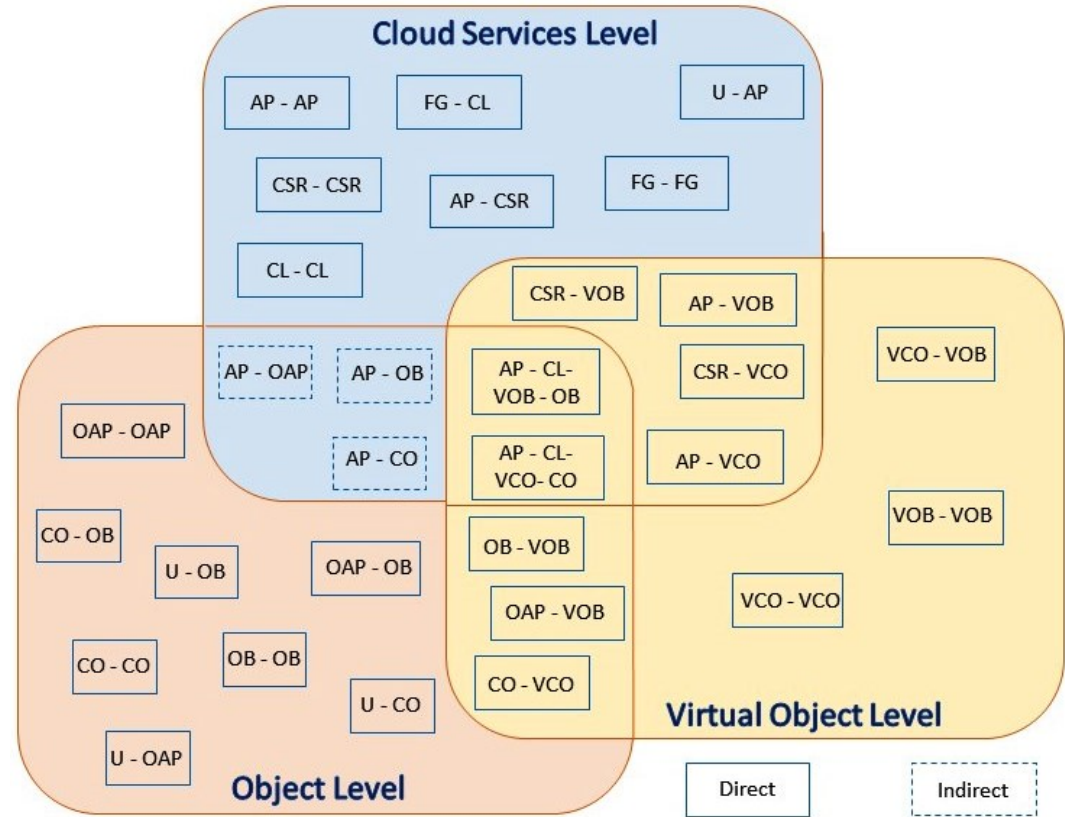Center for Security and Privacy
Enhanced Cloud Computing

- ❏ On-Board Application and Sensors
- ❏ Over the Air updates
- ❏ V2X fake messages
- ❏ In-vehicle ECU communication
- ❏ Personal Data
- ❏ Third Party devices
- ❏ User Privacy Preferences
- ❏ Spoofing, Ransomware, Injection...
- ❏ Loss of Information in Cloud
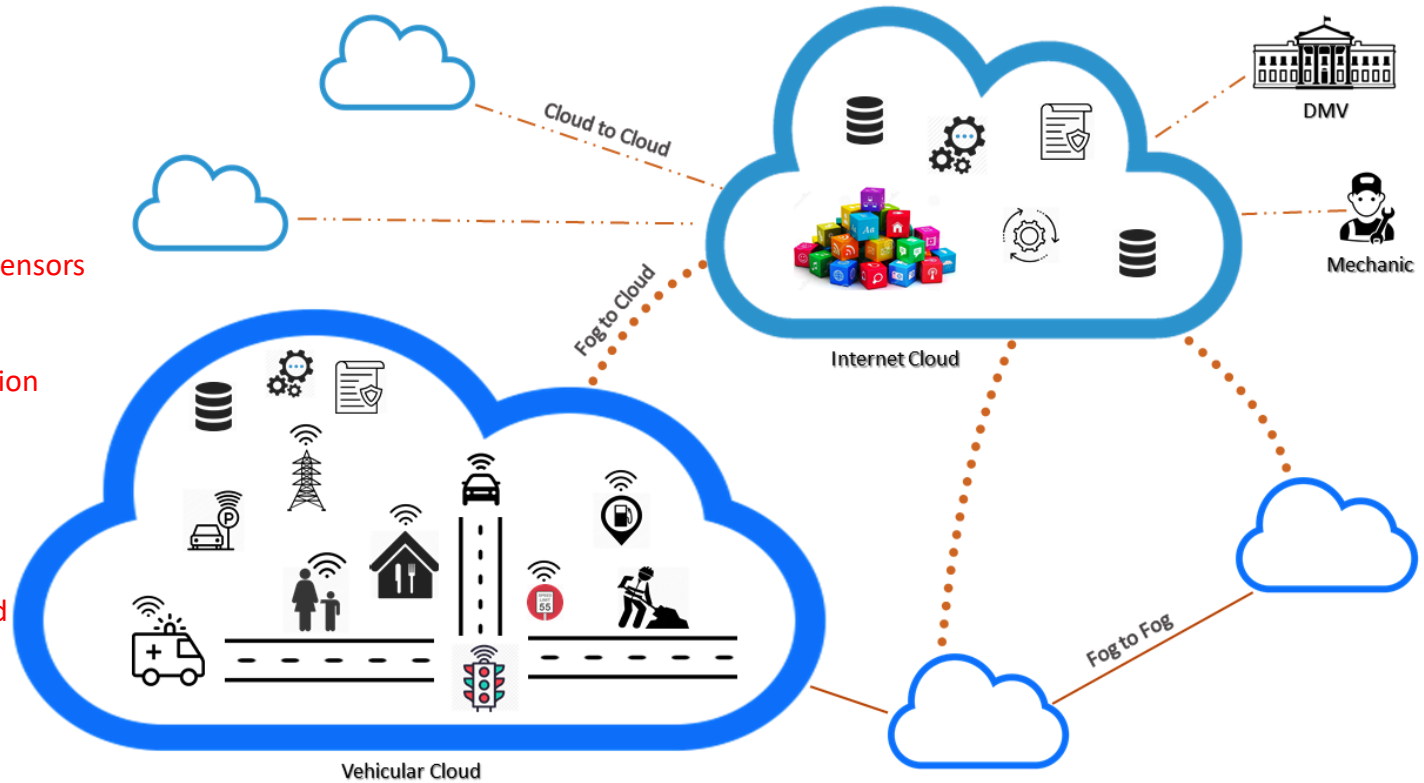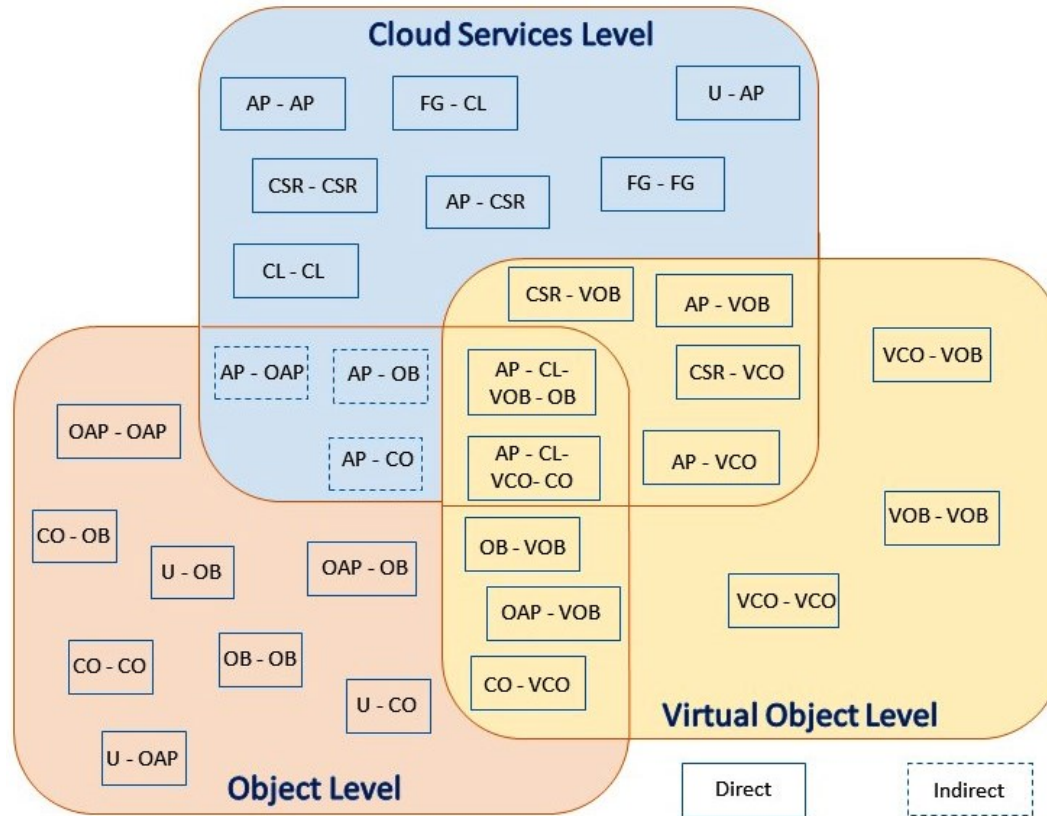
Cloud to Cloud

Fog to Cloud

Internet Cloud

DMV

Mechanic

Vehicular Cloud

Fog to Fog

U: User CO: Clustered Objects OB: Objects OAP: Object Layer Applications CL: Cloud FG: Fog
CSR: Cloud Services VCO: Virtual Clustered Objects VOB: Virtual Objects AP: User Applications

Access Control Strategies

- ❑ Static vs Dynamic
- ❑ What kind of relationship they have?
  - • Owner, Manufacturer, Friend…
- ❑ Multi-Layered
- ❑ Groups Based
- ❑ Trusted Interaction
  - • How I trust you?
  - • Previous interaction..?
- ❑ ABAC, ReBAC Models
- ❑ Who will administer?
- ❑ Data in Cloud, cross cloud sharing. How?

Cloud Services Level

AP - AP FG - CL U - AP CSR - CSR AP - CSR FG - FG CL - CL

CSR - VOB AP - VOB VCO - VOB

AP - OAP AP - OB AP - CL-VOB - OB CSR - VCO

OAP - OAP AP - CO AP - CL-VCO- CO AP - VCO

CO - OB VOB - VOB

U - OB OAP - OB OB - VOB

OAP - VOB VCO - VCO

CO - CO OB - OB CO - VCO

U - CO

U - OAP

Object Level **Virtual Object Level**

Direct   Indirect

U: User **CO:** Clustered Objects **OB:** Objects **OAP:** Object Layer Applications **CL:** Cloud **FG:** Fog
CSR: Cloud Services **VCO:** Virtual Clustered Objects **VOB:** Virtual Objects **AP:** User Applications
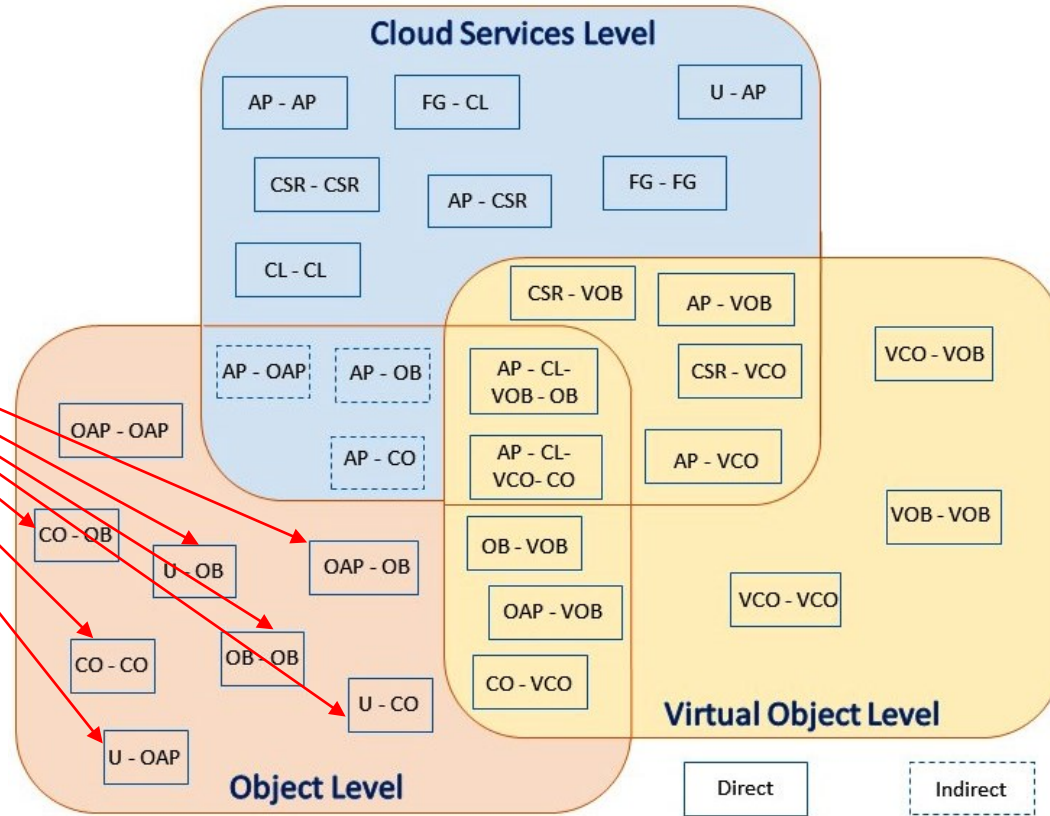
World Leading Research with Real World Impact!

CV-ABAC$_G$ Model

Cloud Supported

U: User CO: Clustered Objects OB: Objects OAP: Object Layer Applications CL: Cloud FG: Fog
CSR: Cloud Services VCO: Virtual Clustered Objects VOB: Virtual Objects AP: User Applications