

arm



Arm Research
SMARTER

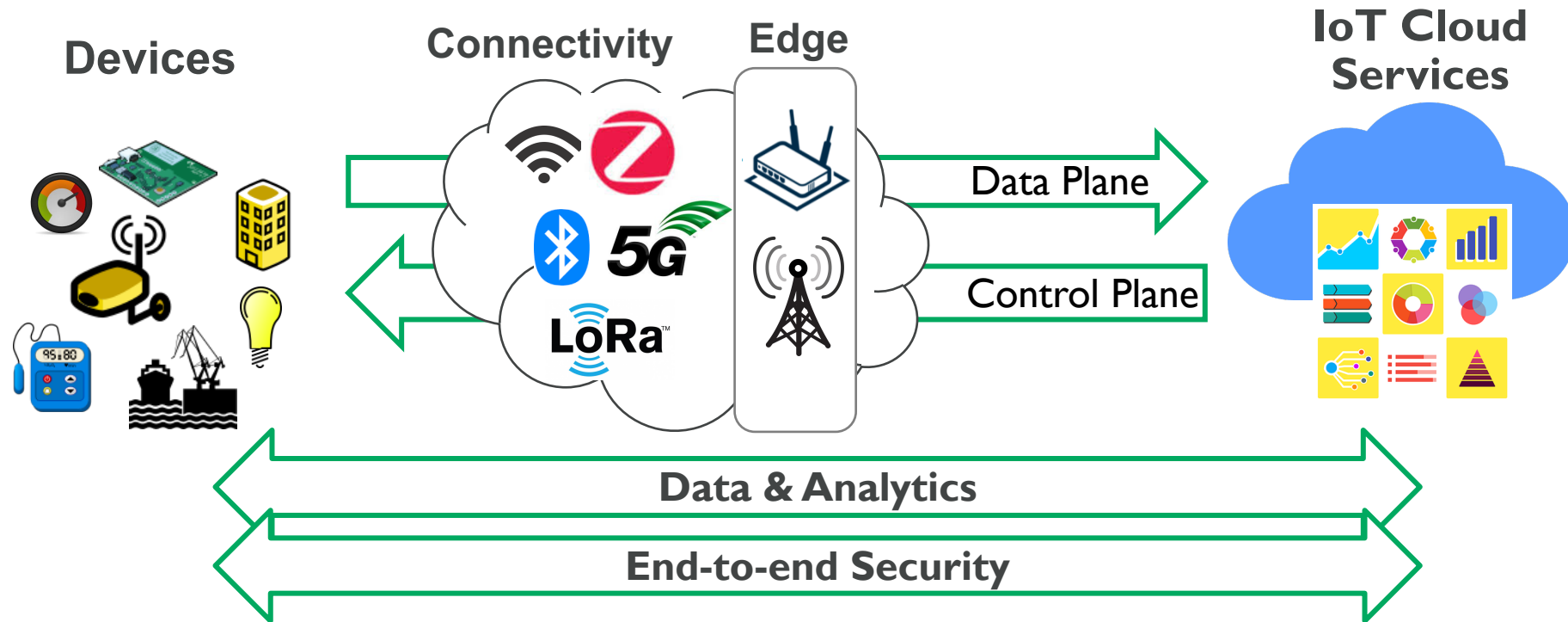
Experiences with Cloud Native on the Edge

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Edmund Grimely-Evans, Josh Minor, Mark Nutter, Luis E.
Peña, Kanak Agarwal, Jon Hermes

3rd USENIX Workshop on Hot Topics in Edge Computing (HotEdge) – June 2020

Motivation: A trillion devices from edge to cloud

Vision: To enable an intelligent and secure world with a trillion connected devices

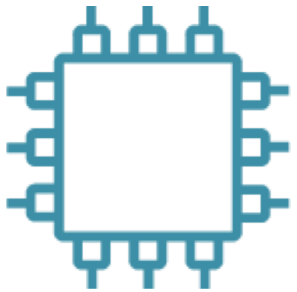


Significant R&D investment to build industry-leading IoT systems and cloud services

What's different on the Edge?



Different attack vectors require a more complete security model and potentially different approaches to securing multi-tenancy



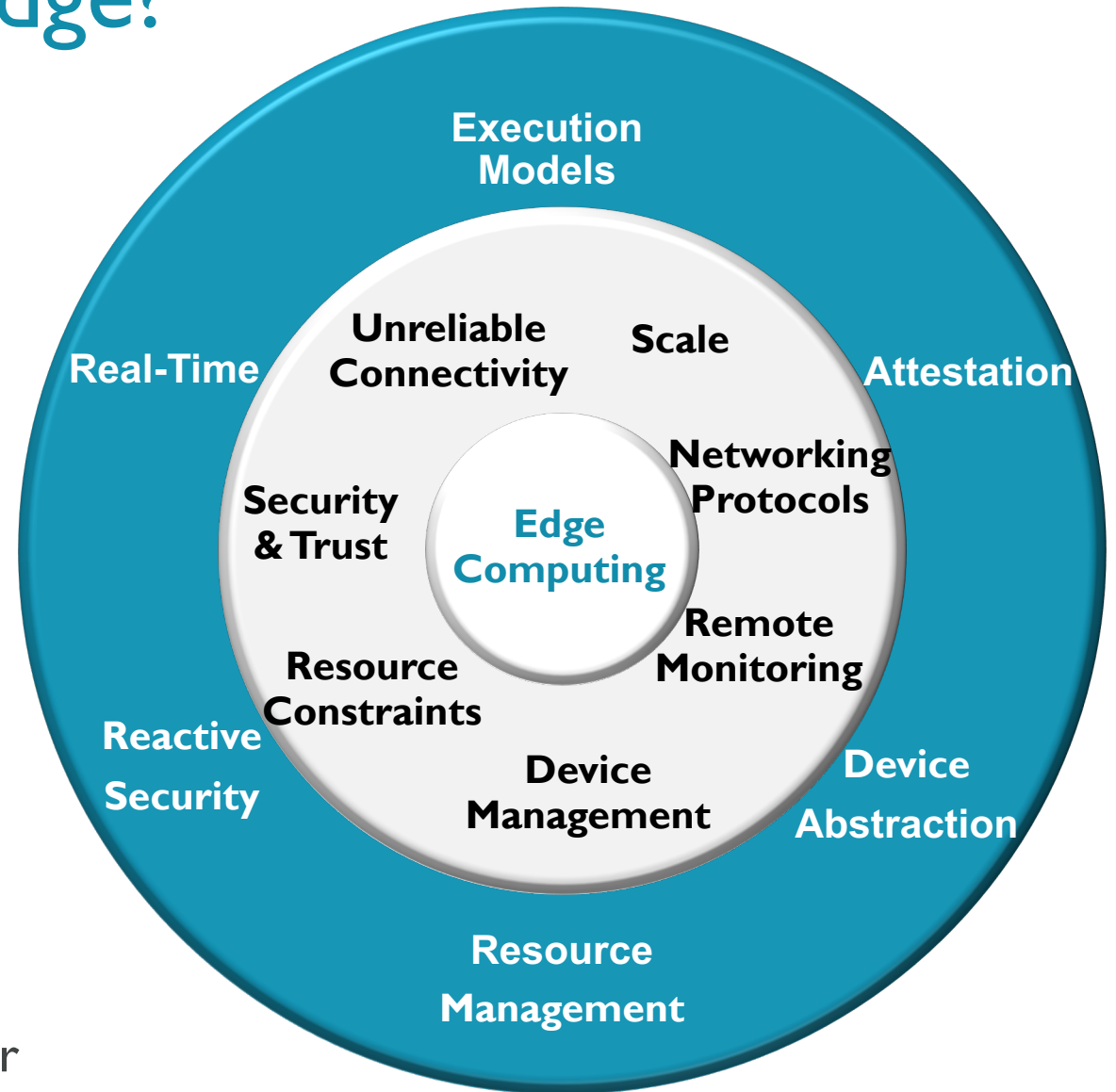
More constrained node environments, limited virtualization for devices, with no ability to scale-out to other nodes in cluster



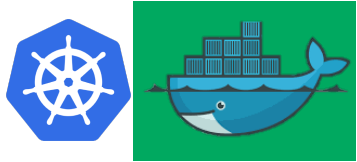
Different connectivity model, potentially unreliable, constrained metered bandwidth, and local-first service model



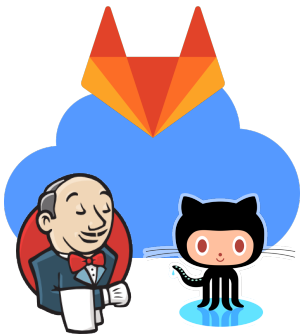
Physical sensors which must be allocated, multiplexed, secured, and managed – something that just doesn't happen in a cloud data center



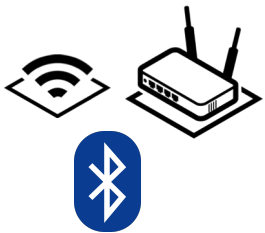
Cloud Native for the Edge



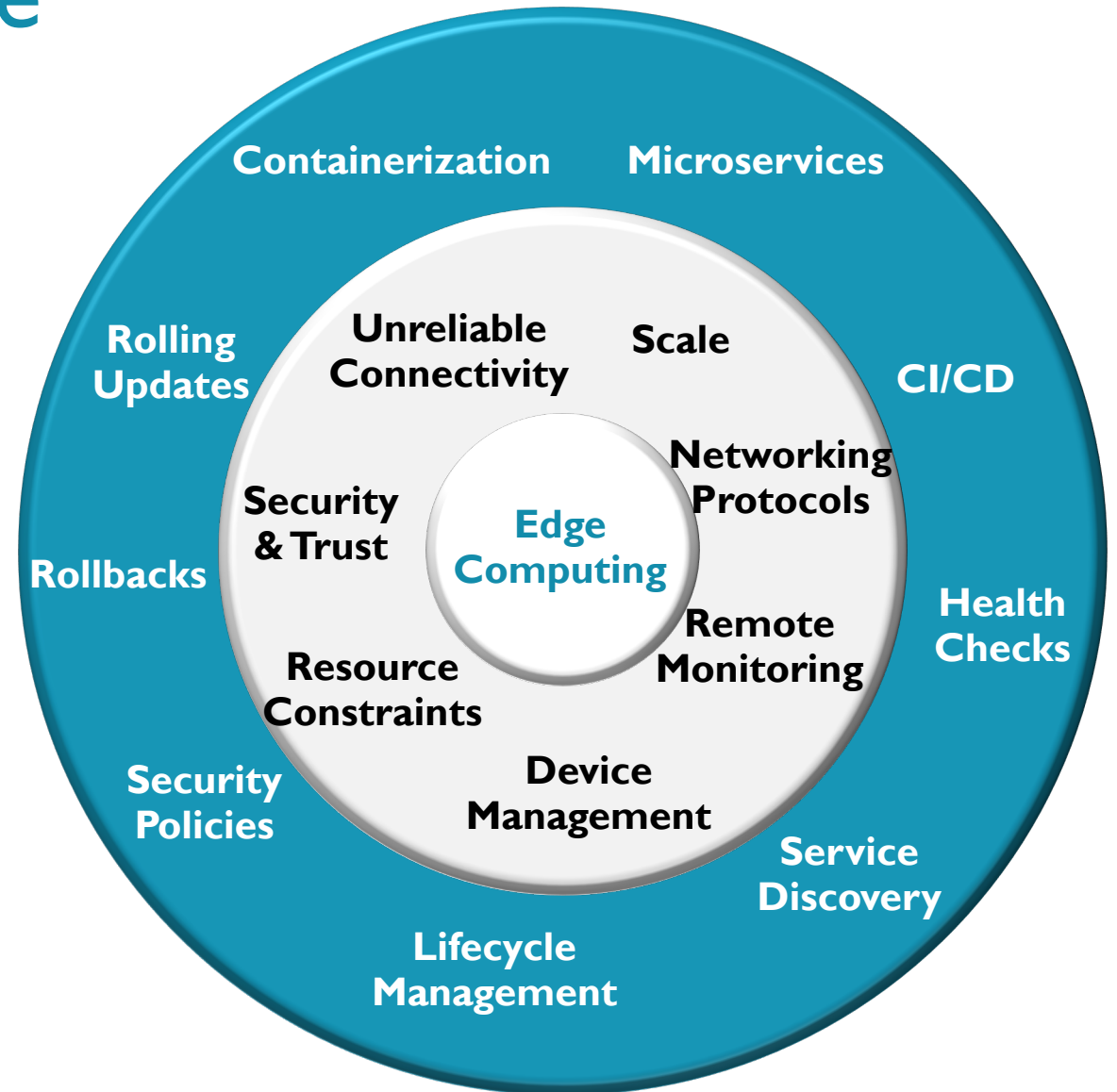
Base development environment on existing cloud-native methods, ecosystem, APIs, and tool chains.



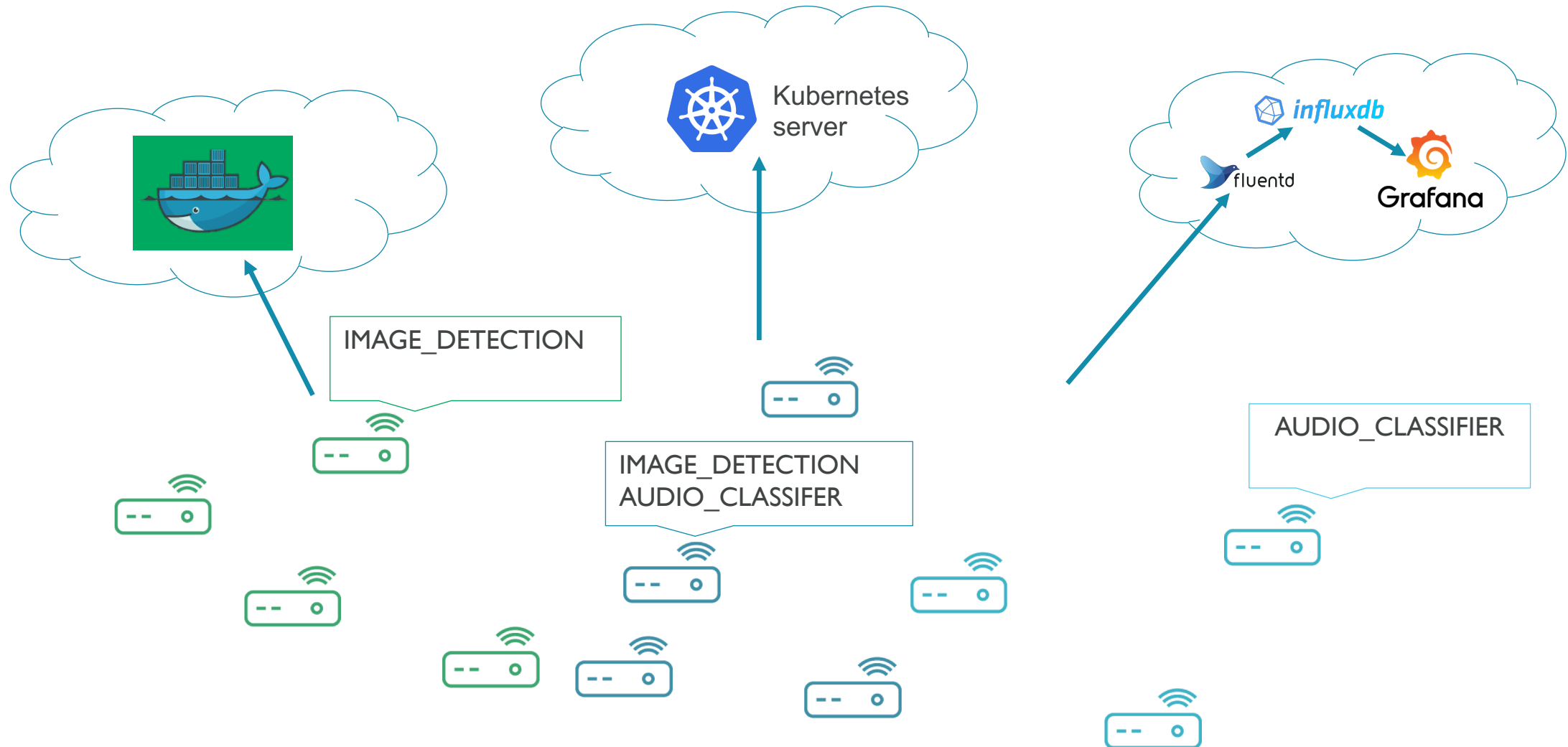
Bring server-style modern application management, continuous integration and deployment to the edge.



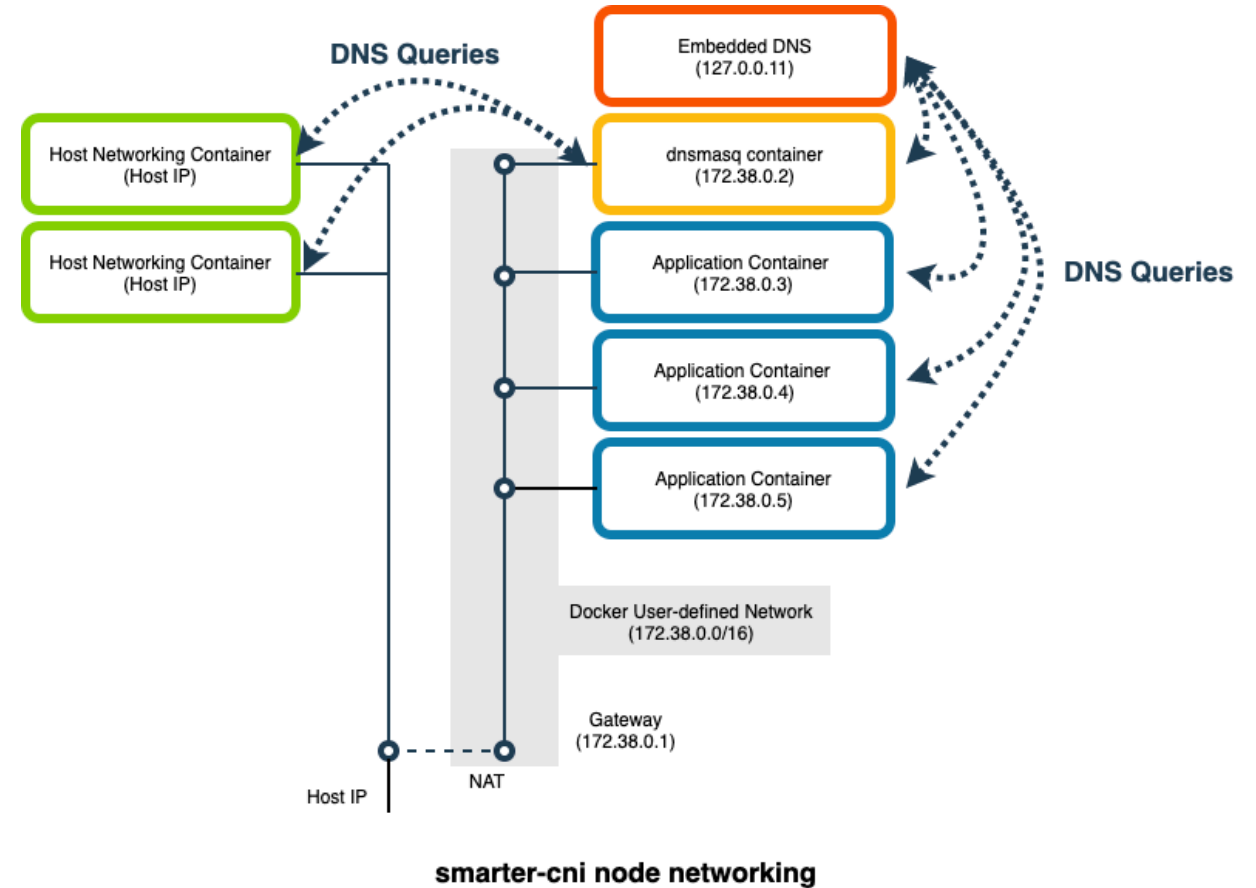
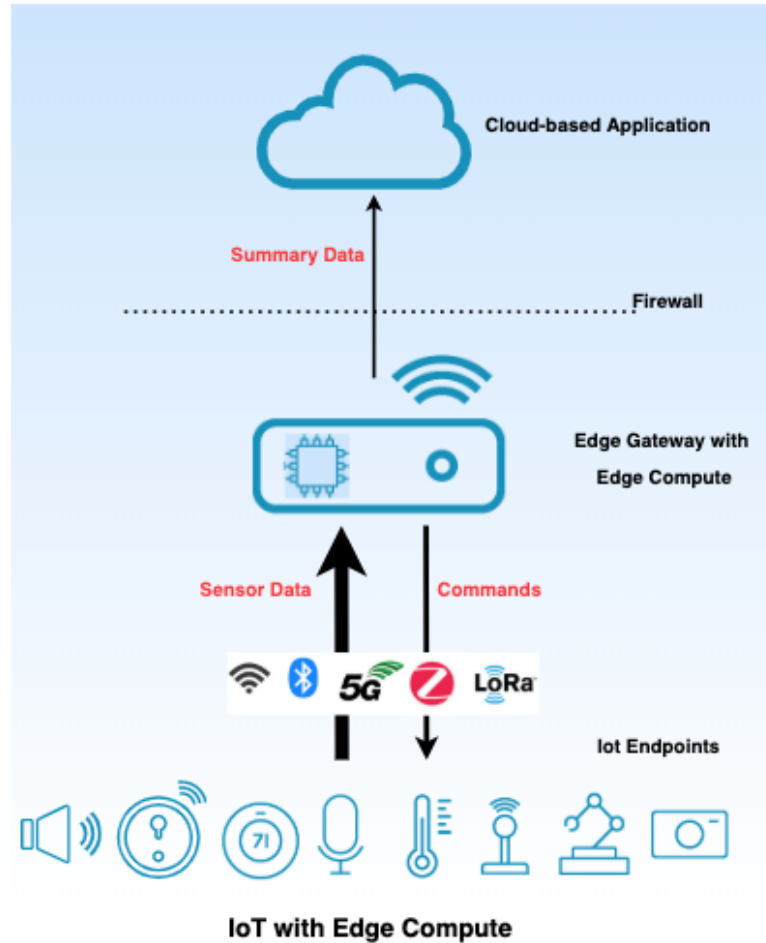
Extend tools & technology where necessary to optimize for IoT and Edge and target wide-scale versus cluster deployment.



Kubernetes – provisioning and orchestration

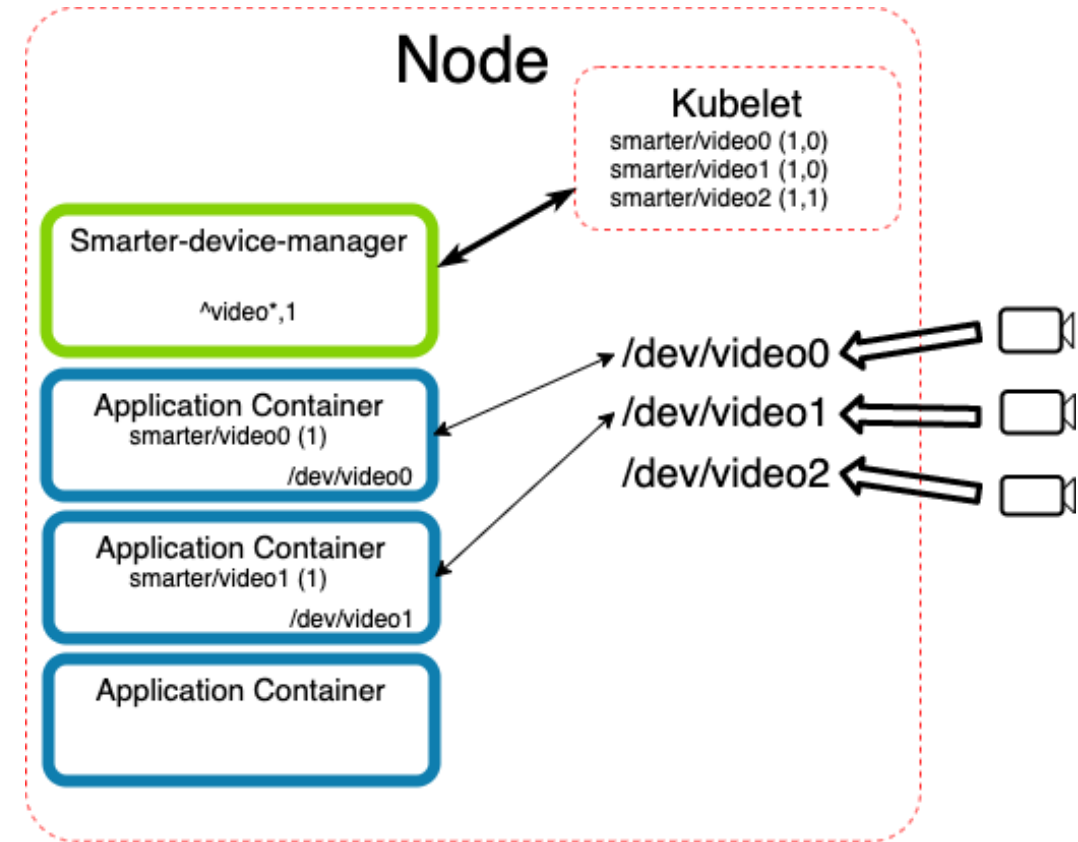


Edge Networking

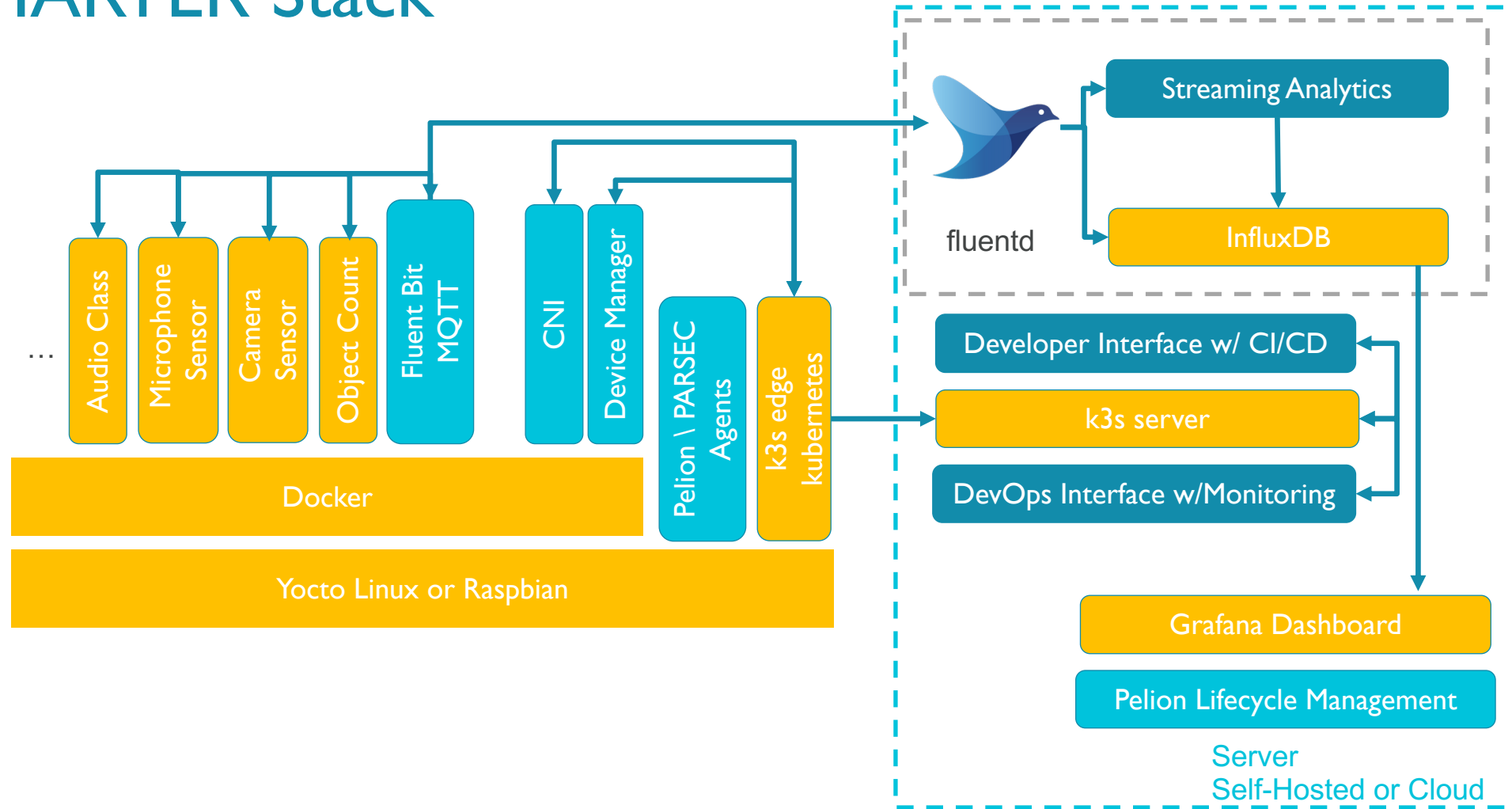


Device Management

```
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: pulseaudio
  labels:
    k8s-app: pulseaudio
spec:
  selector:
    matchLabels:
      name: pulseaudio
  template:
    metadata:
      labels:
        name: pulseaudio
    spec:
      nodeSelector:
        pulse: "enabled"
      hostname: pulse
      containers:
        - name: pulseaudio
          imagePullPolicy: IfNotPresent
          image: registry.gitlab.com/arm-research/smarter/edge-workloads/pulseaudio:v1.0.0
          resources:
            limits:
              cpu: 350m
              memory: 100Mi
              smarter-devices/snd: 1
            requests:
              cpu: 250m
              memory: 100Mi
              smarter-devices/snd: 1
          terminationGracePeriodSeconds: 15
```



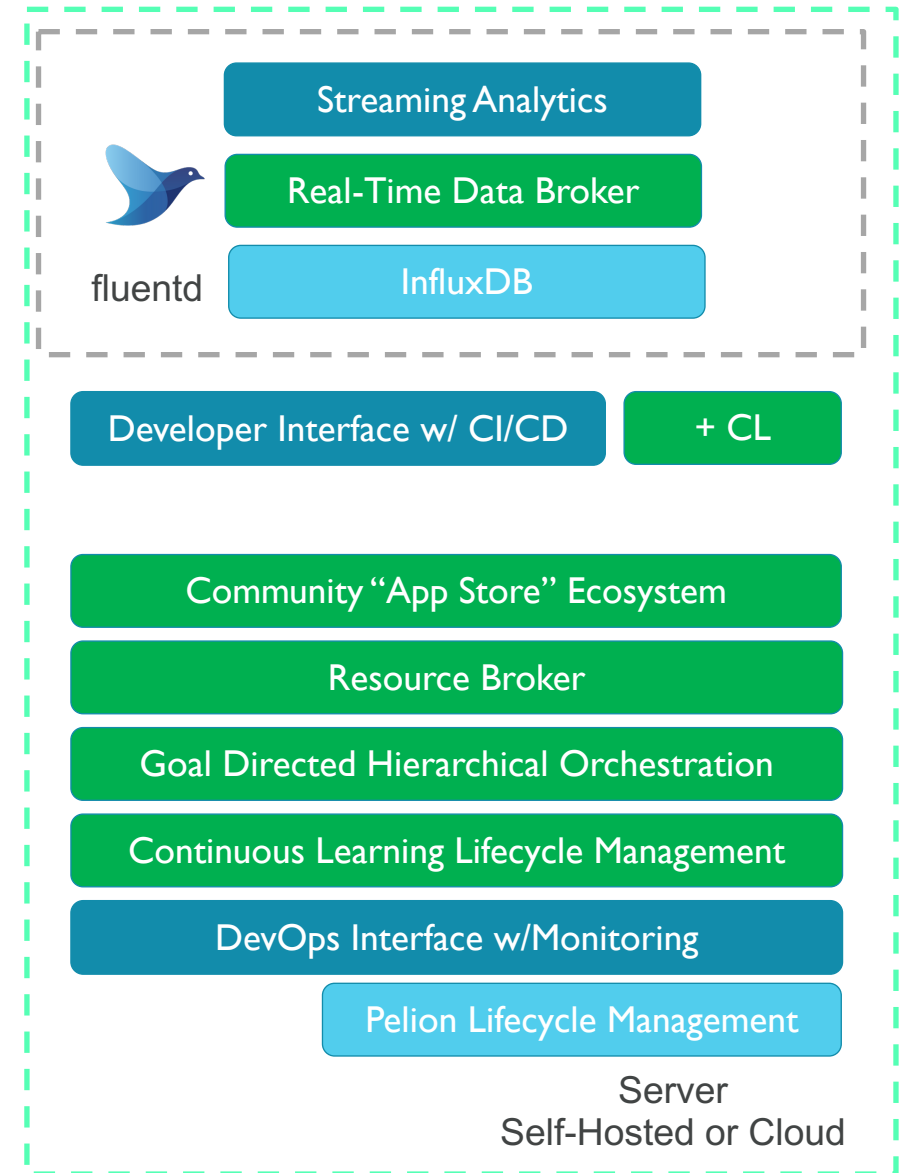
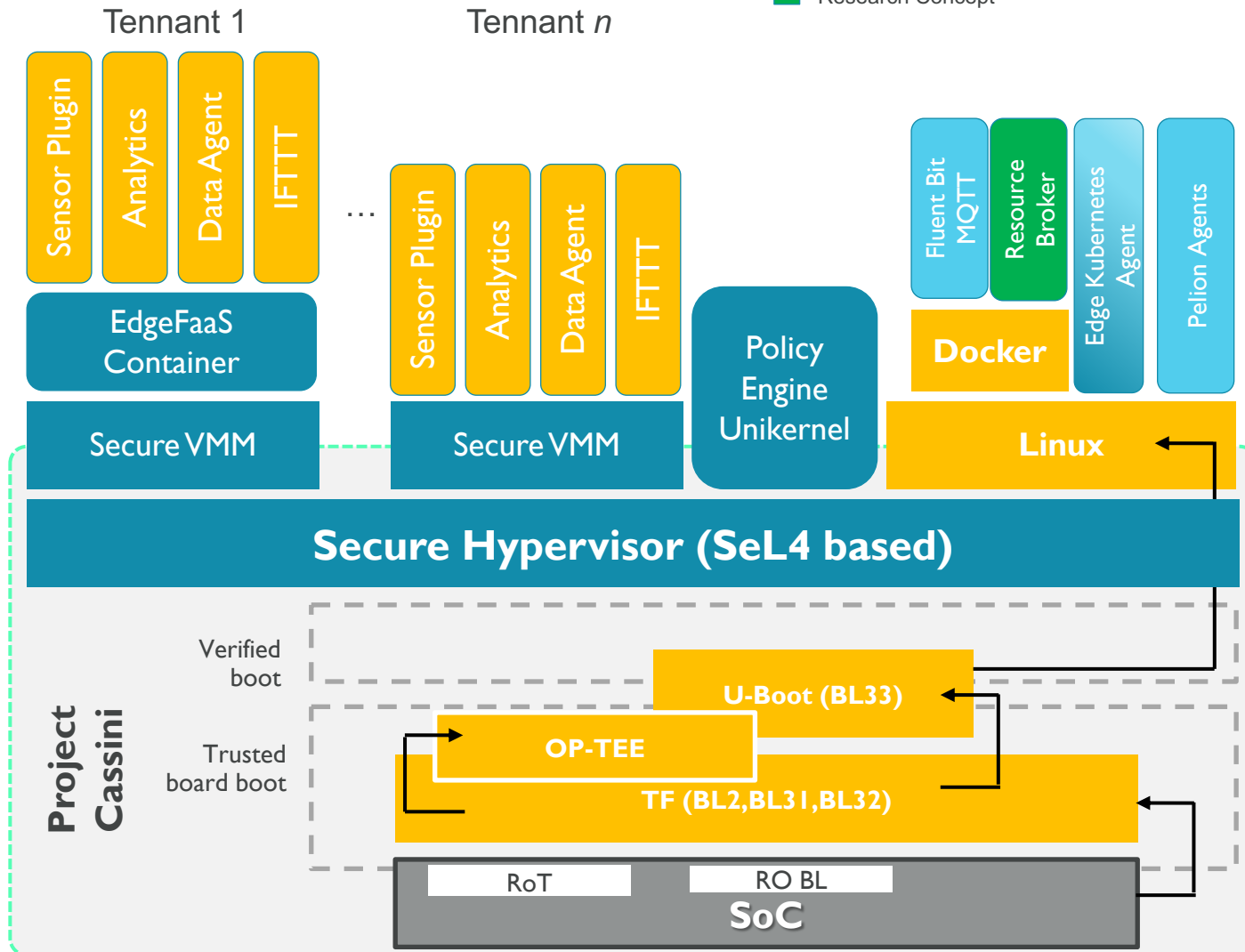
SMARTER Stack



<http://gitlab.com/arm-research/smarter/example>

Future Work

- Third Party
- Arm ISG Product
- Existing Arm Research Project
- Research Concept



For additional information....

- <http://arm-research.gitlab.io/smarter>
 - Example project contains cloud and client-side instructions to deploy pedestrian/car detector and audio classifier
- [Blogs](#) detailing specific components and methodologies
- [CNCF webinar](#) including SMARTER example
- [Array of Things](#) and Waggle Platform (inspiration for base architecture and applications)
- [Arm Project Cassini](#)
- [Arm Pelion Edge](#)

SMARTER is an open-source reference, please comment, contribute, extend!

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