



# arm Research Summit

# Research Collaborations

# Research Collaboration and Enablement

## Why Collaborate with Arm?



**Proven IP, tools, platforms and expertise** to help strengthen the impact of your research



**Vibrant partner ecosystem** to help you successfully develop integrate or tape out your research platforms



**Talent development opportunities** to help your students more easily enter the semiconductor or services industries



**Credible industry support** to improve the success and impact of your research proposals



**Dedicated team** to provide you with what you need to meet your research goals

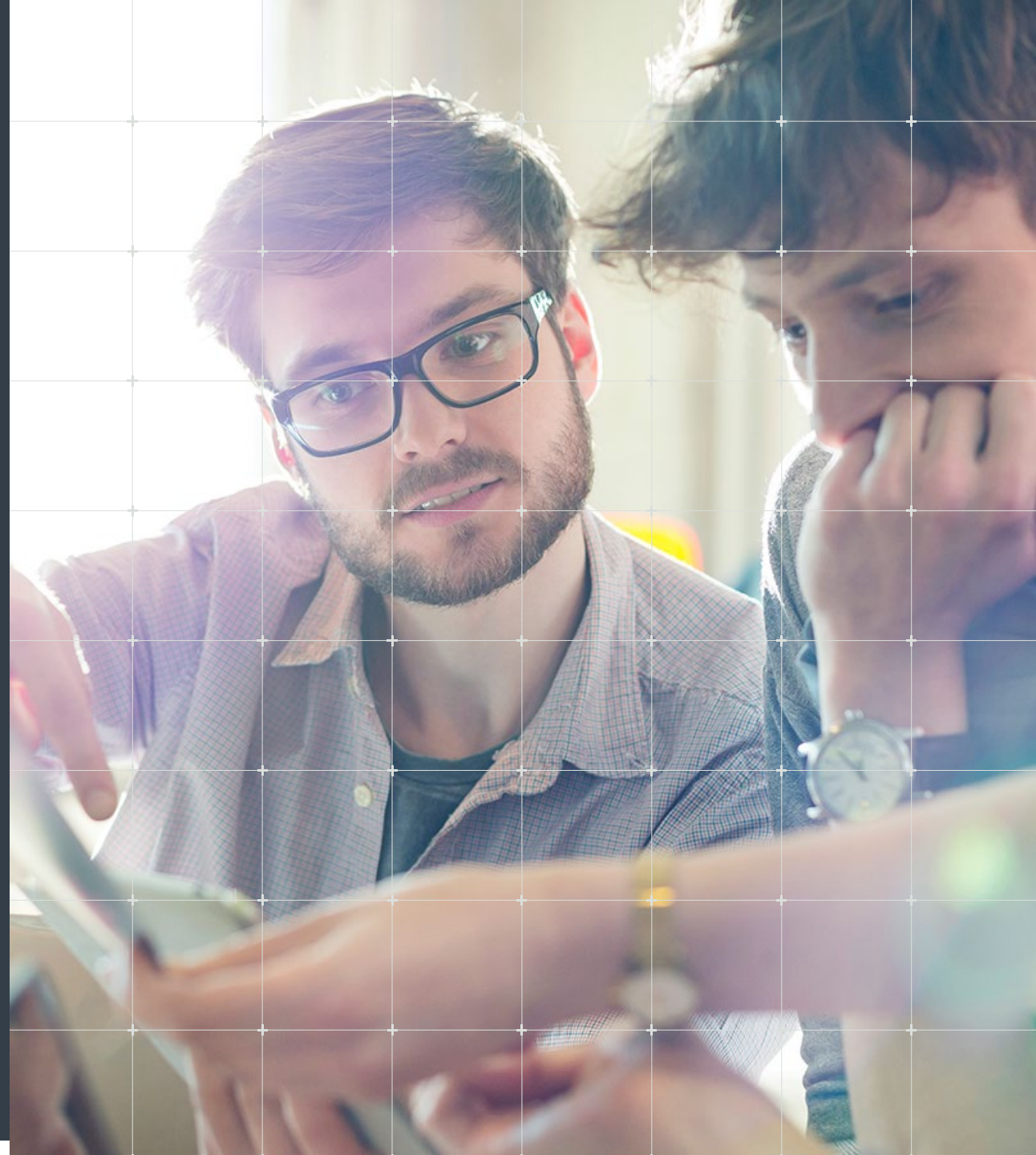
## How we collaborate:

- Sponsored projects or programs
- Partnering in funding opportunities
- Through our membership in industrial affiliate programs, government sponsored or sector driven consortia
- Through IP and tools and software delivery and support
- Hosting you or you hosting our researchers
- Internship or sponsorship for your students
- Teaching Collateral and Courseware through arm University Program
- Accessing our Developer and Innovator Ecosystems



# Contact us:

- EU: [andrea.kells@arm.com](mailto:andrea.kells@arm.com)
- US: [raffaella.montelli@arm.com](mailto:raffaella.montelli@arm.com)
- RoW: [Richard.buttery@arm.com](mailto:Richard.buttery@arm.com)
- Find out more: [arm.com/rce](https://arm.com/rce)





# arm Research Summit

Arm Research

# Collaborations Story

SMARTER Cities

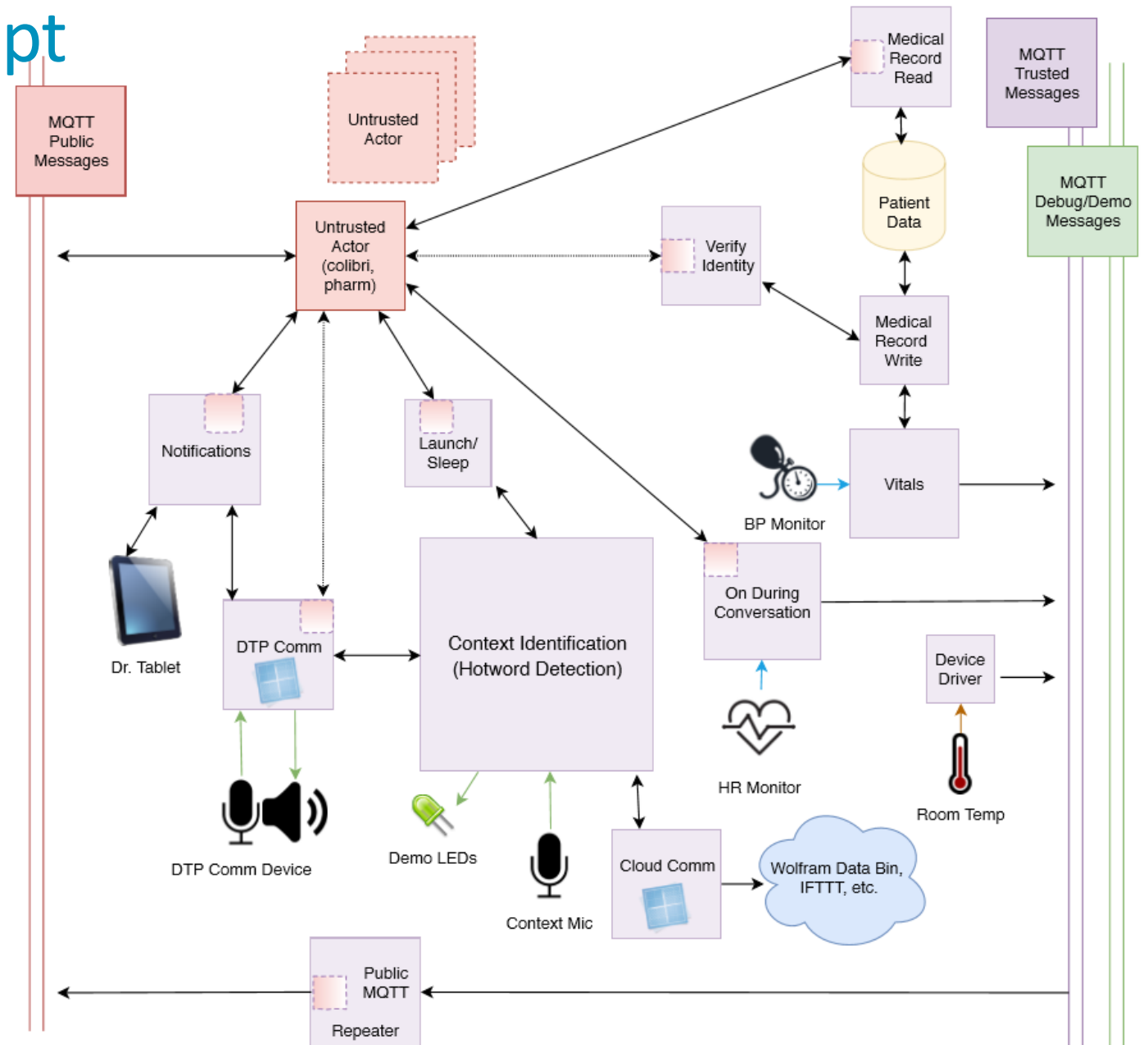
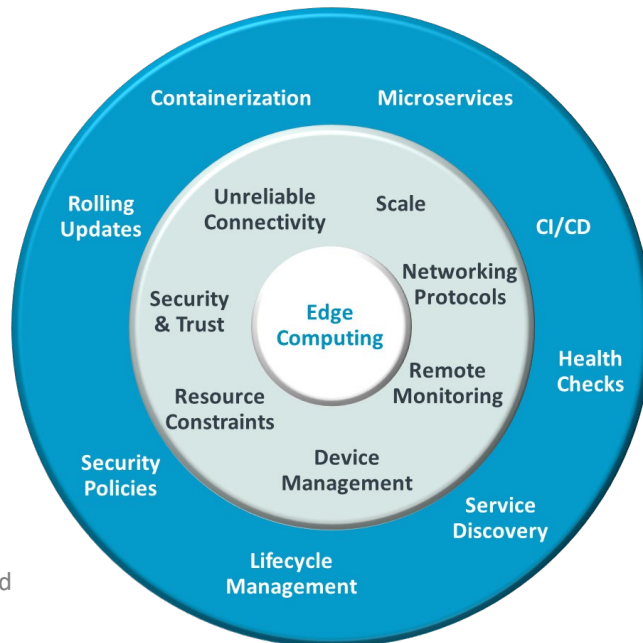
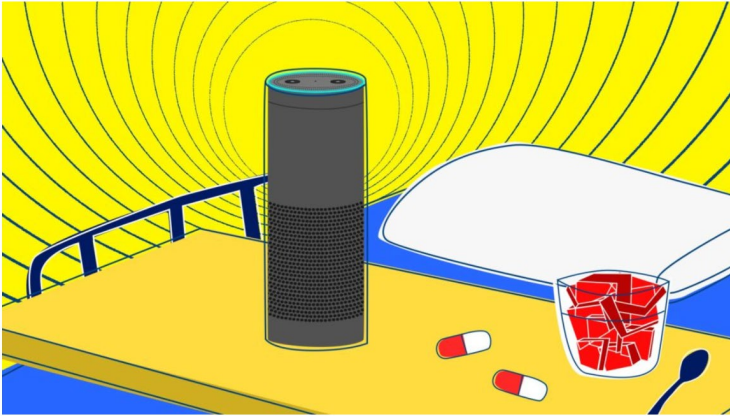
Eric Van Hensbergen  
September 2020



# Healthcare Proof of Concept

New voices at patients' bedsides:  
Amazon, Google, Microsoft, and Apple

By CASEY ROSS @cassymross / FEBRUARY 6, 2019



# AI@Edge

*Building an open infrastructure for Edge-to-Cloud AI*

for society and infrastructure: health, quality of life, environmental protection, safety



Air Quality

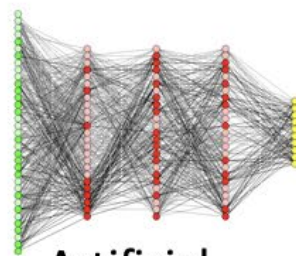


Camera, Mic, LIDAR, etc.

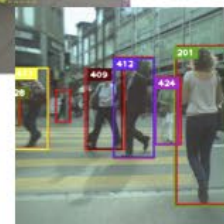
Edge Computing



Google TPU



Artificial Intelligence



AI & HPC/Cloud

Waggle Platform

Missing:

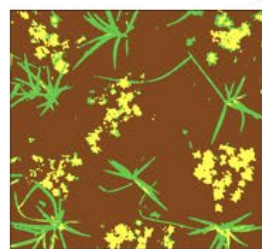
- The open programming framework for Edge-to-HPC/cloud
- A public-good global testbed to build AI to improve society
- National education curriculum for sensors and an AI future



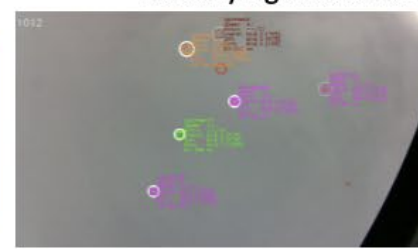
50 frames to detect flooding and segment image



Understanding plant species and growth



Identifying what is in the air



the power grid

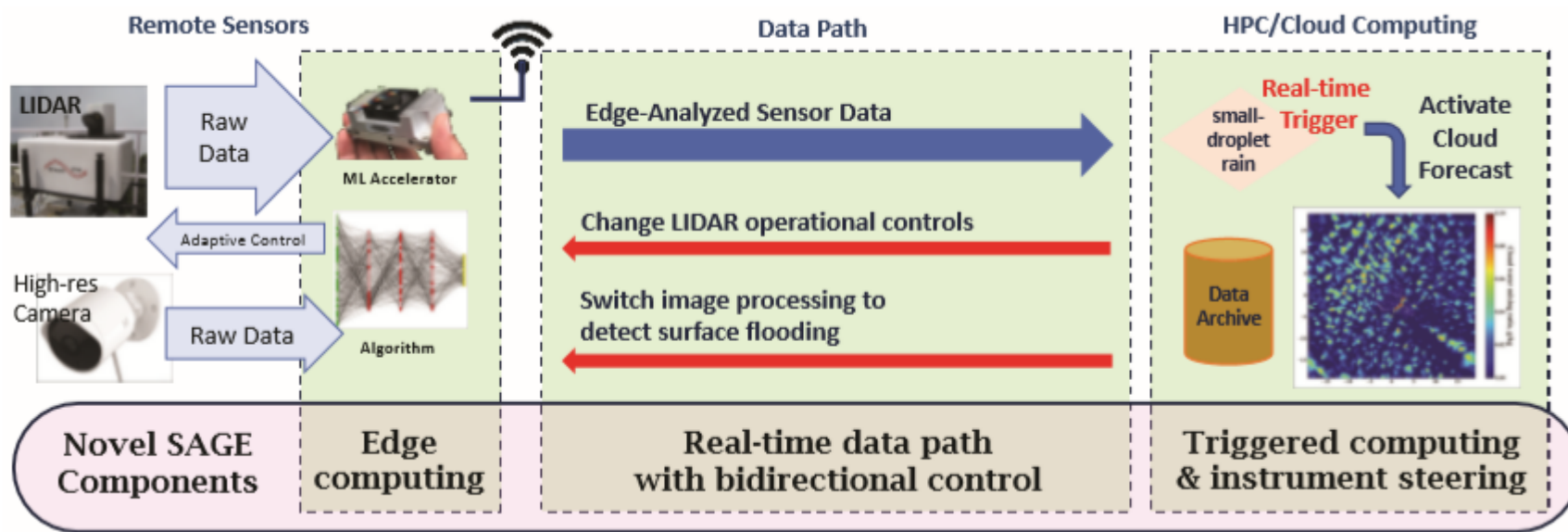
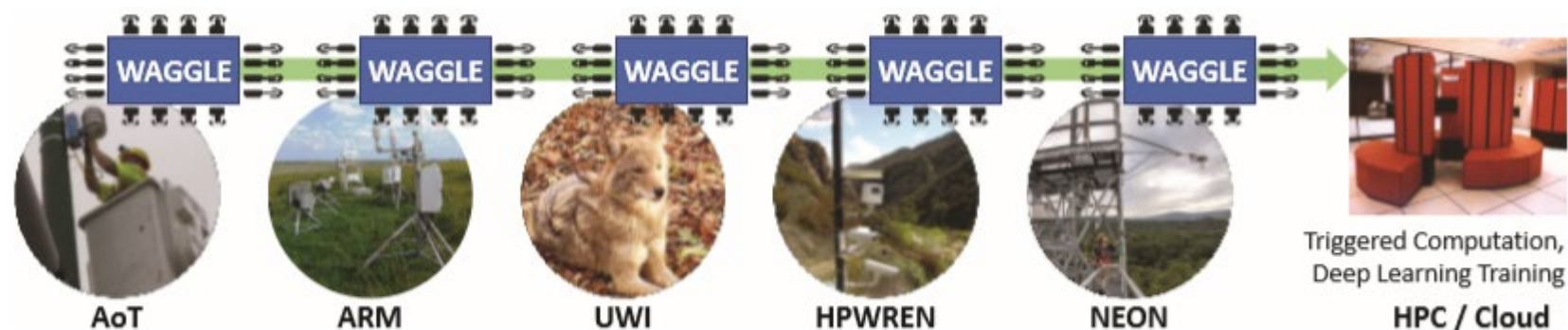


Pete Beckman, Charlie Catlett, Nicola Ferrier, Rajesh Sankaran: Argonne National Laboratory



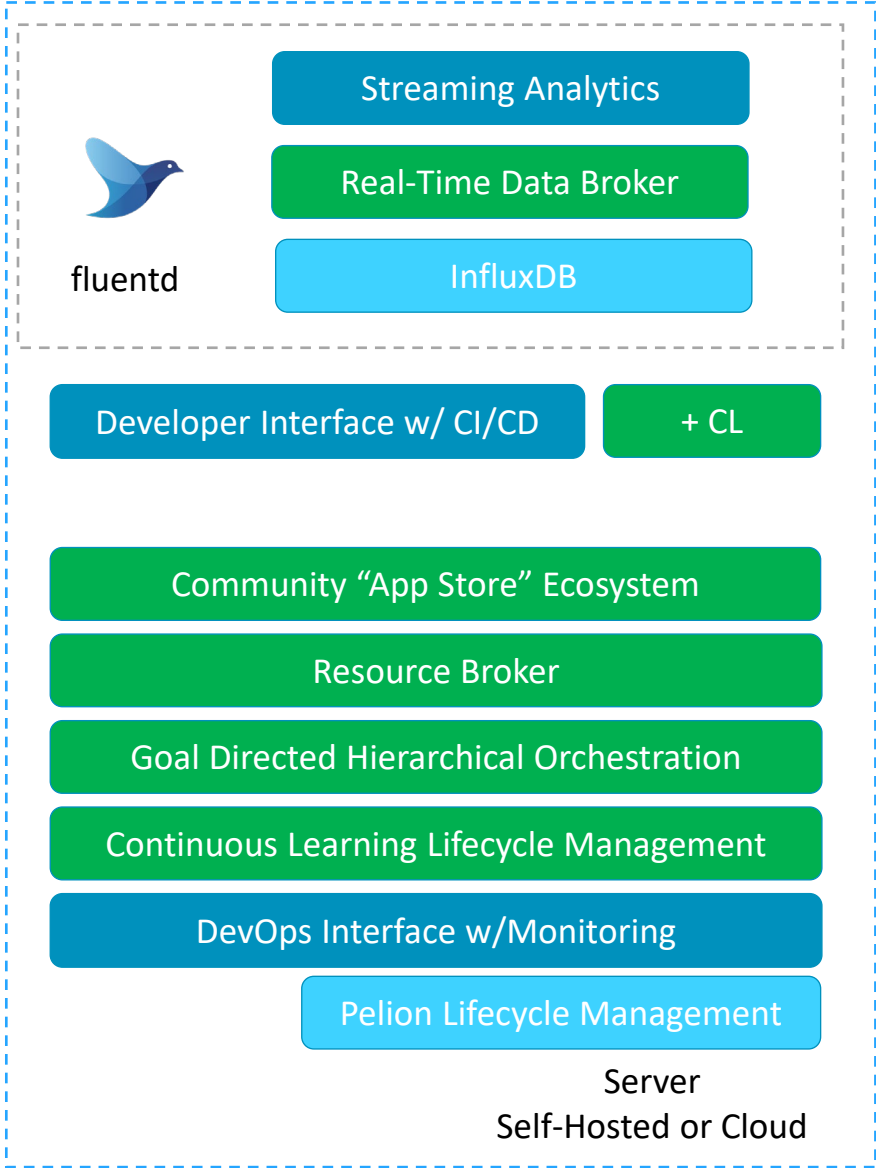
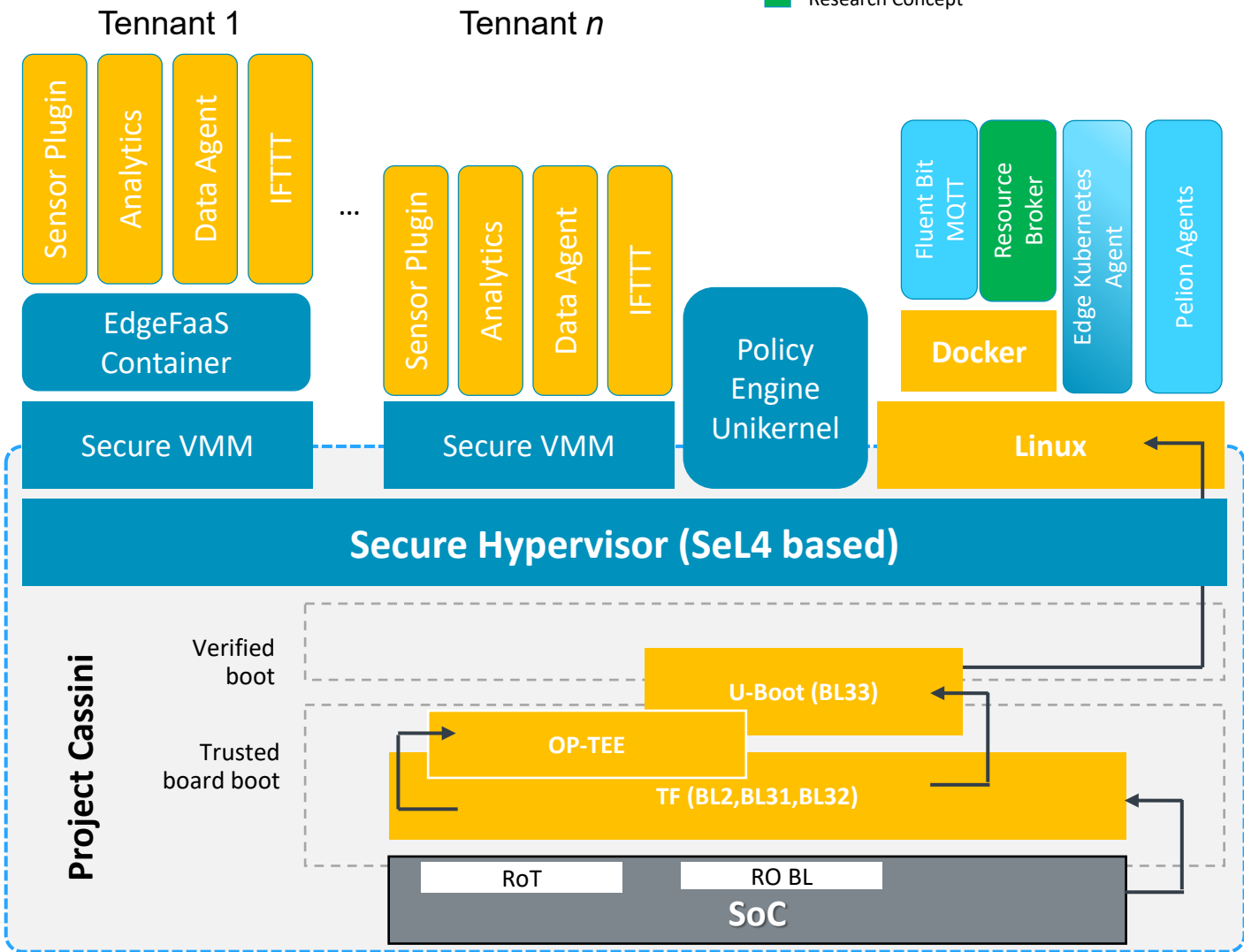
# NSF SAGE

Base Type	Common Sensors (all nodes)
Air Quality	PM2.5, EPA criteria pollutants
Environment	Meteorology, Light (ambient, IR, UV), Sound (10 octaves), Vibration, Magnetic field
Imaging	HD sky, Ground cameras
Extensions	Capabilities & Features
HD Air Quality	Airquality, Meteorology, 3D wind, Rain sensor, IR camera
Seismic	Meteorology, Seismic, Vibration, HD cameras w/ 360° View
Sky	Meteorology, Wide angle HD sky cameras, Lightning sensor
Wildfire	Meteorology, Anemometer, Air-quality, HD cameras for 360° view
Urban AoT	Airquality, Meteorology, Sky and street cameras, Microphone
Wildlife	Meteorology, Microphones, HD cameras for 360° view
Doppler Lidar	Range- and time-resolved measurements for line-of-sight air velocity, attenuated aerosol backscatter
$\mu$ -Pulse Lidar	Altitude of clouds, detection of atmospheric aerosols
$\mu$ -Rain Radar	Measurement of rain rate, liquid water content and drop size distribution, near ground to 3000 m
Wind Profiler	Radar wind and precip profiles through the boundary layer
ETCE	Eddy covariance turbulence exchange between soil, vegetation, and atmosphere



# SMARTER

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



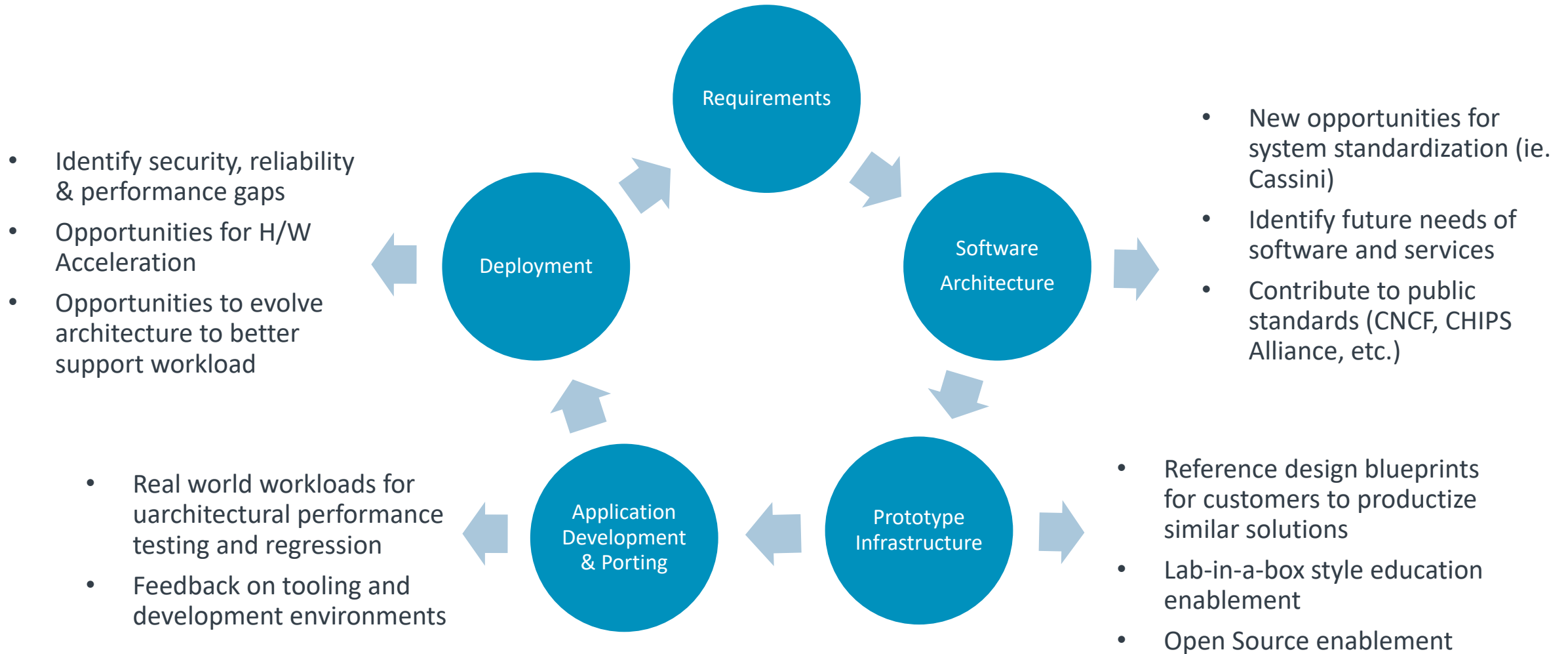


# Structure of Collaboration



- Open Source by Default Development
- Gitlab for source code, docker image registry, CI/CD, Issue Tracking and Documentation (in Markdown)
  - SAGE using github for their repos
- Continuous communication via Slack
- Video sync calls
  - SAGE right now weekly
  - Other PoCs ranging from weekly to monthly
  - Used to checkpoint status, discuss design decisions, requirements, and deep dive
- Face to face in the pre-COVID, twice a year

# Output





# For additional information....

- [Array of Things](#) and Waggle Platform
- <https://sagecontinuum.org/>
- <http://getsmarter.io>
  - Blogs, source code, webinars, documentation
- [Arm Project Cassini](#)
- [Arm Pelion Edge](#)



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



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Research Summit

Collaborative Project:



**PlasticArmPit**

Emre Ozer

Principal Research Engineer, Arm Research

Sep 9-11, 2020



# Scope



## What?

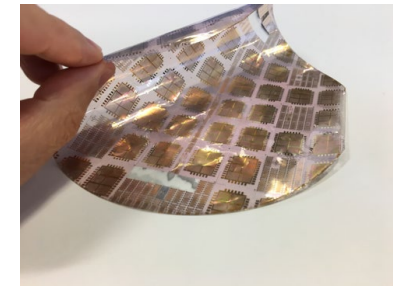


## How?

- Develop sense, digitise & compute blocks using flexible electronics fabrication technology

## Why Flexible Electronics?

- Extreme low cost (in cents)
- Thin
- Conformable



# Collaborative Nature



## Partners



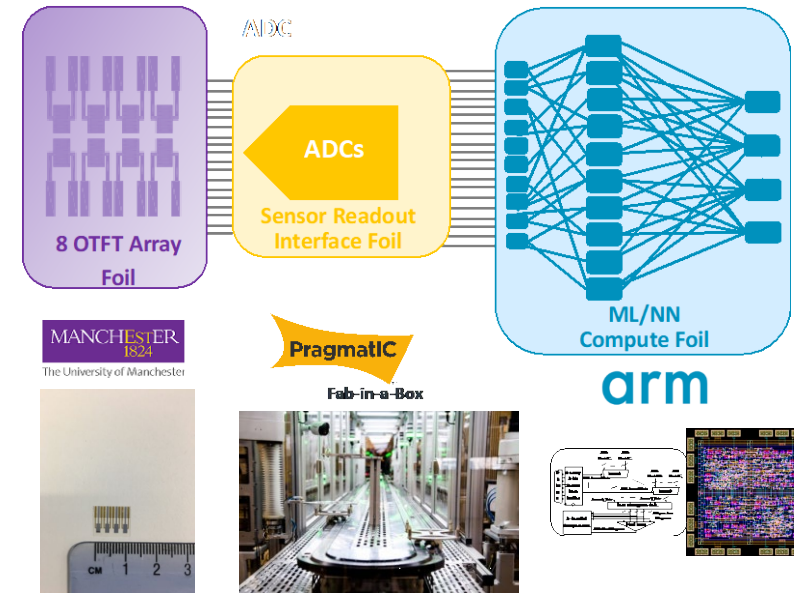
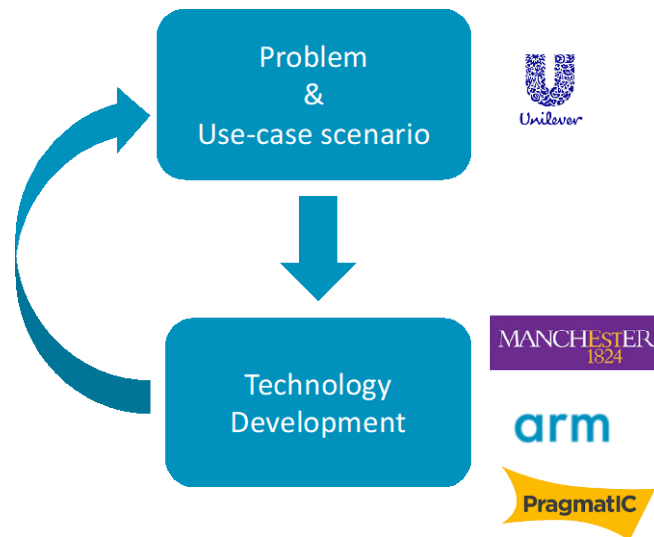
## Funding Agency



## Duration

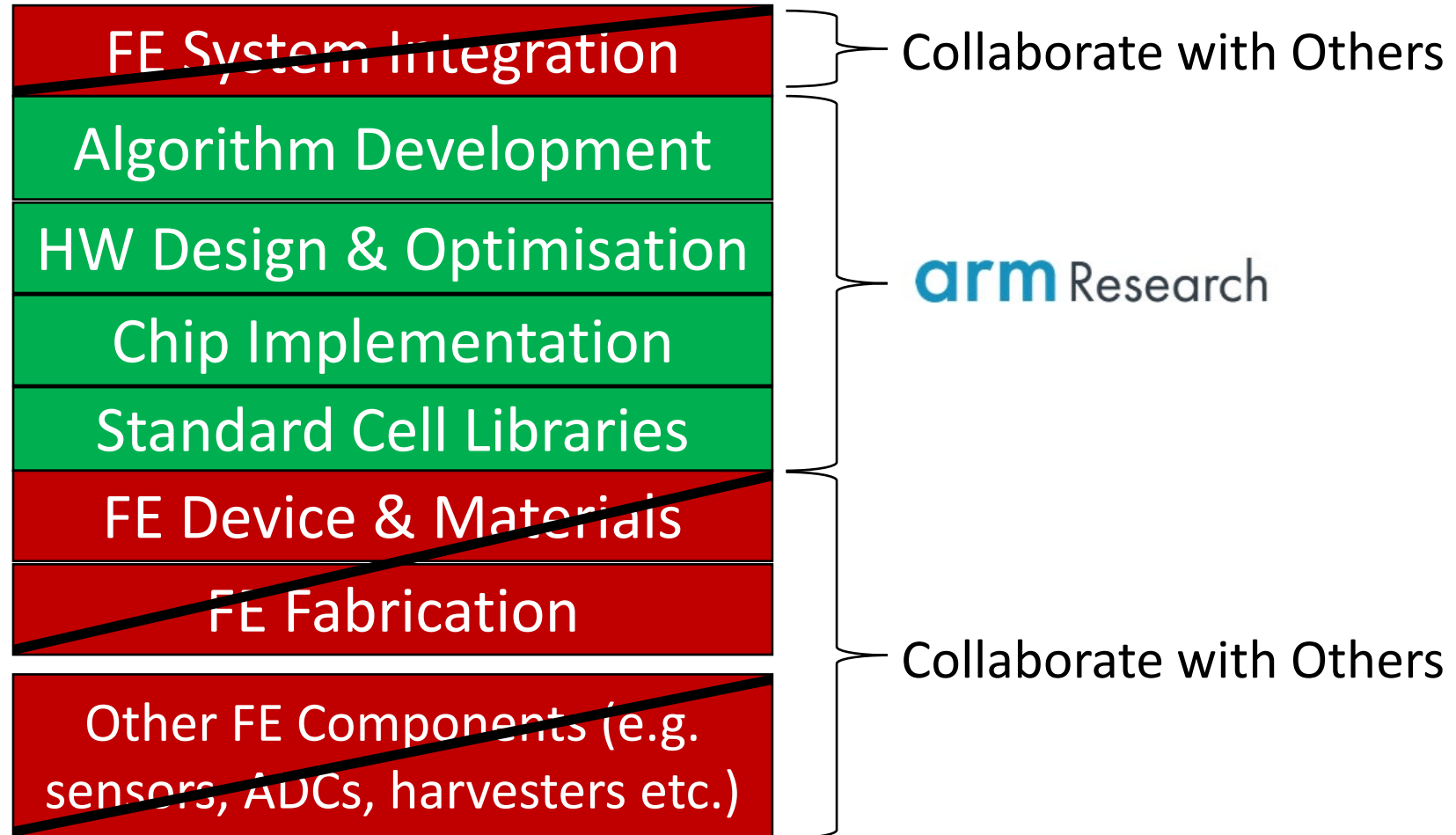
2017 – 2021

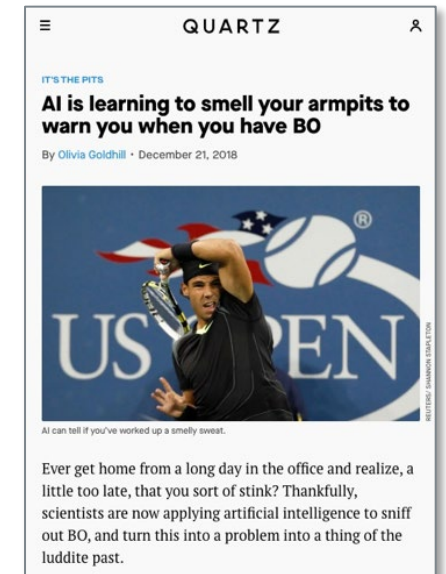
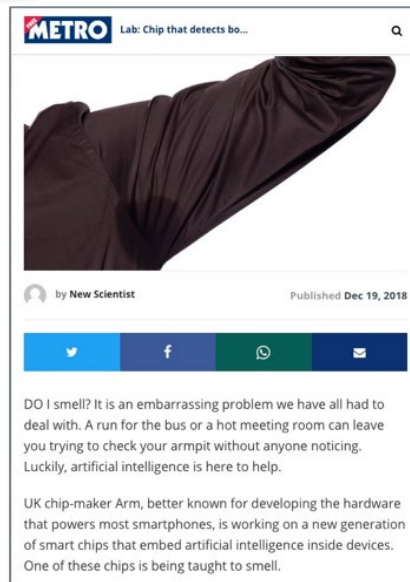
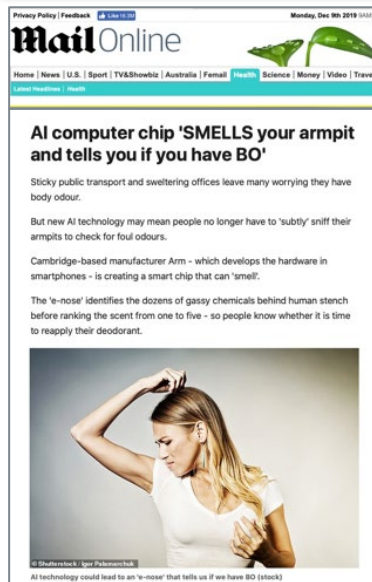
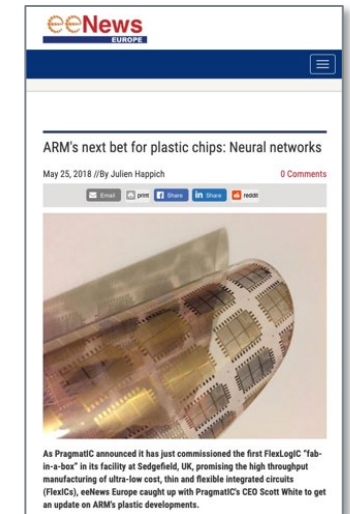
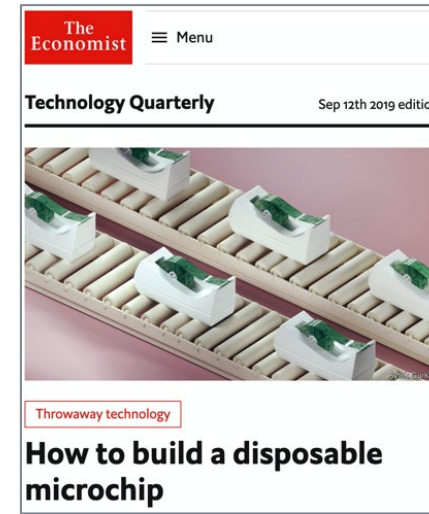
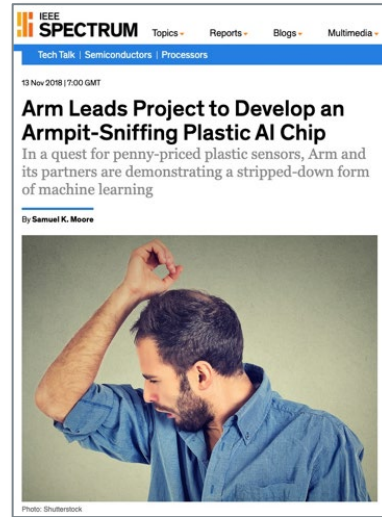
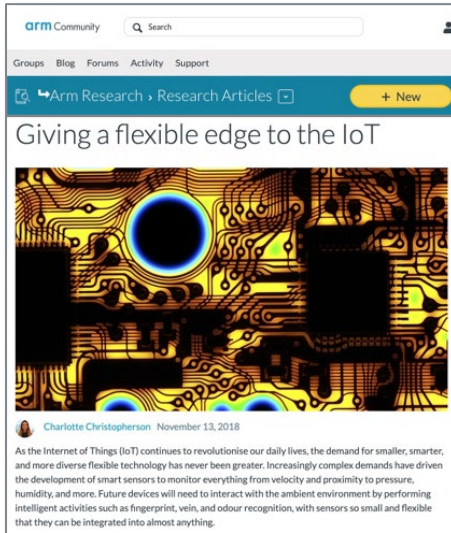
## Roles





# Flexible Electronics (FE) Research at Arm





# Key Outcome in Mid-2020



## First ML Chip on a Flexible Substrate

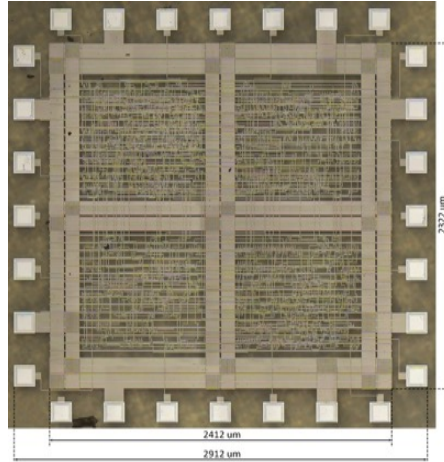


Figure of Merit	Flexible ML Chip
Area	5.6 mm <sup>2</sup>
Technology	0.8 µm Metal-oxide TFT
Logic Type	Unipolar n-type resistive load
Supply Voltage	4.5 V
Chip Pin Count	23
Number of Devices	3132 (2084 TFTs + 1048 Resistors)
Max Circuit Clock Frequency	104 kHz
NAND2-equivalent Gate Count	1024
Power Consumption	7.2 mW
Gate Density	183 gates/mm <sup>2</sup>

## Volume 3 Issue 7, July 2020



### Flexible chips hardwired for machine learning

A flexible processor chip that has hardwired parameters for machine learning and contains around 1,000 logic gates can be built using a commercial 0.8-µm metal-oxide thin-film transistor technology. The schematic illustration on the cover highlights the flexible nature of the chips, which can be used in smart applications such as odour recognition.

See [Ozer et al.](#) and [News & Views](#) by Liu et al.



# Value of Collaboration



## Complementarity

- Learn from the expertise of others (academic and industry)

## Close links with academic excellency

- Academic visits, interns, professor in residence etc.

## Visibility

- Collaborative projects allow us to have more external exposure.
- **Crossing interdisciplinary boundaries**
  - A good way to get exposed to knowledge from other disciplines

arm

Contact: [emre.ozar@arm.com](mailto:emre.ozar@arm.com)

Thank You

Danke

Merci

谢谢

ありがとう

Gracias

Kiitos

감사합니다

धन्यवाद

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