Jet Propulsion Laboratory
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Dispatches from the IoT Frontier: Practical Experiments and Business Benefits

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How do we answer the BIG questions?

How do we protect Mother Earth?

How do we divert an asteroid?

Are we alone?

How did the Universe form and where is it going?

Can we find Earth 2.0?

Is/was there life on Mars?

Human Behavior IT Trends, 2015-2018

Foretells what technologies can/will be adopted in the enterprise

WHO: INTRAPRENEURS • MAKERS • CROWD/PARTNERS • FROM EVERYWHERE AT ANY TIME

HOW: OPEN • AGILE • PROTOTYPING • CROWD SOURCING • CONSUMERIZATION

WHAT: NATURAL USER INTERFACES • WEARABLES • CONVERSATION UI

WHAT: INTERNET OF THINGS • INNOVATION VIA COMBINATIONS

WHAT: SMART DATA • ANALYTICS • CLOUD • AUGMENTED INTELLIGENCE

CHALLENGES: CHAOTIC ARCHITECTURE • AUTOMATION • CYBER SECURITY

For IoT, we double down on these trends

Embrace Interacting Naturally.

Benefit from the hype of Internet of Things.

Evolve Augmented Intelligence.

Why should we care about the Internet of Things?

Near term benefits

- Smarter, more intuitive conference rooms and work environments
- Improved interactivity with the existing systems
- Improved sensing: ensuring data-driven decisions, parking, clean rooms, …

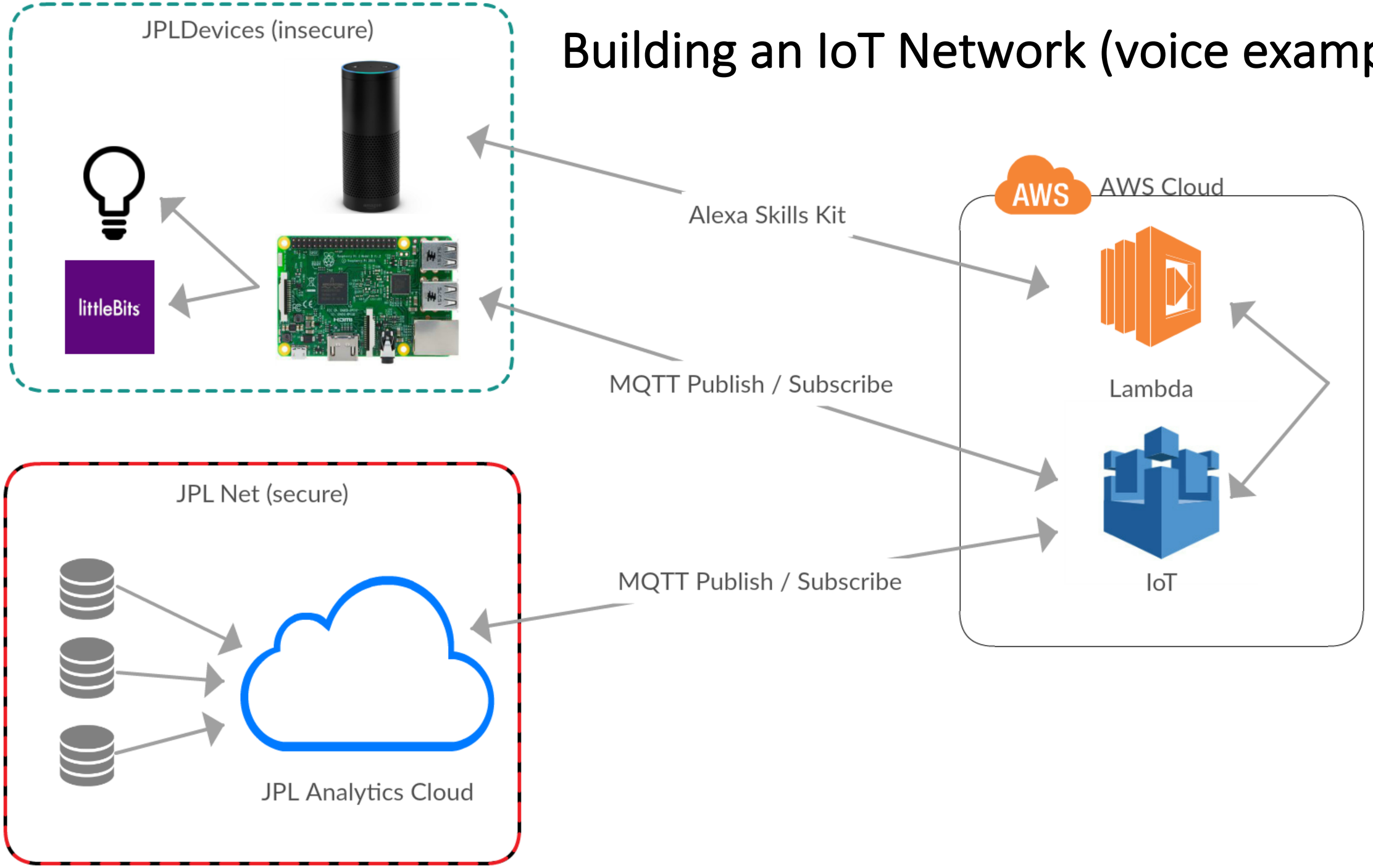
+ Growth numbers

- Gartner estimates 26B connected devices by 2020; Cisco says 50B
- McKinsey estimates IoT market size as $900M in 2015 and $3.7B in 2020
- Manufacturing, Utilities, and Transportation invested $325B in 2016 (IDC)

= Long term benefits

- Ubiquitous sensing: no more lag between real life and the data
- Truly responsive environments: no more digital butler

Building an IoT Network (voice example)



How do we interact naturally with our compute environment?

Create an **Innovation Experience Center**

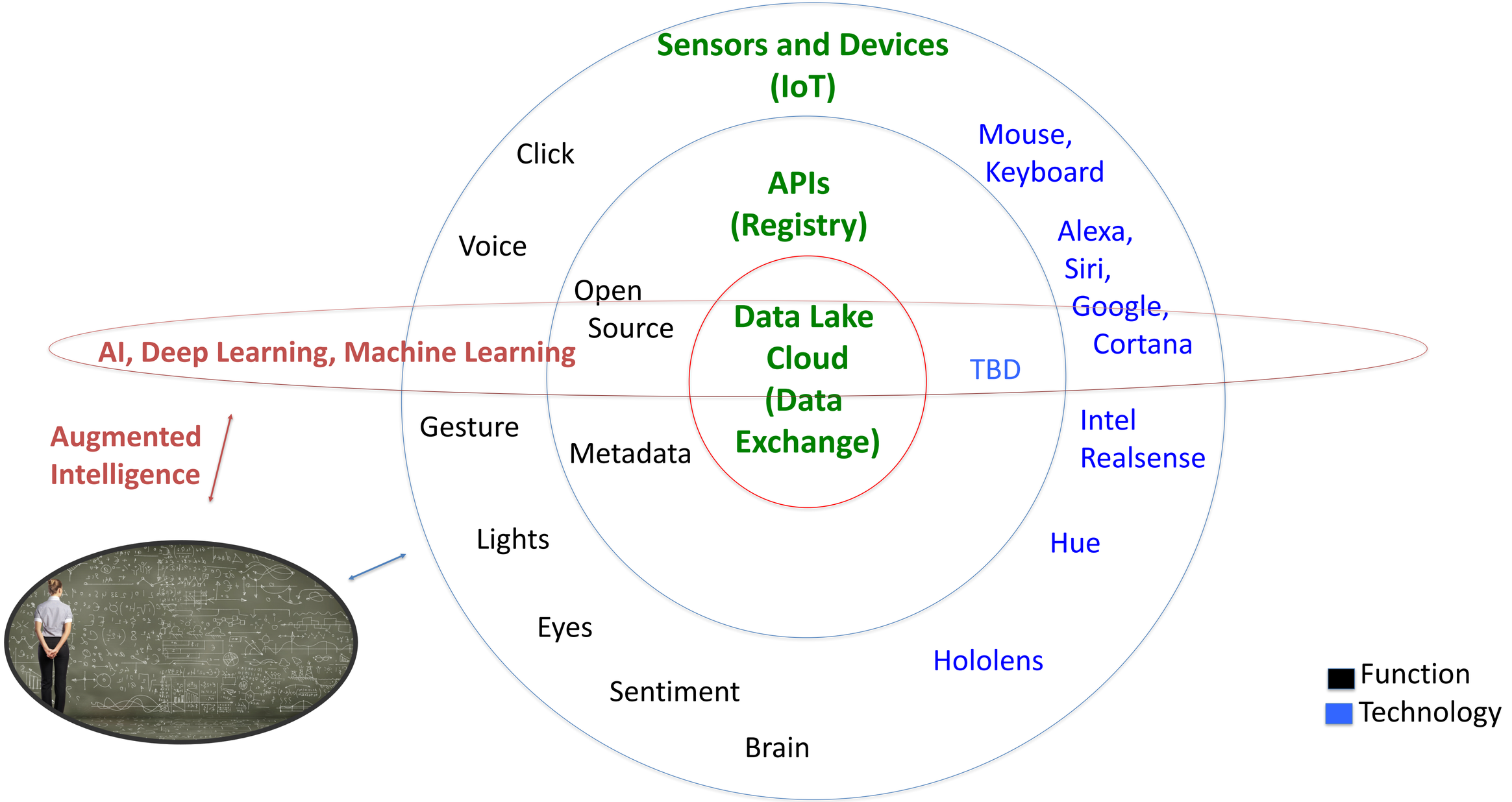
+ Click it
+ Touch it
+ Tap It
+ Swipe it
+ Approach it
+ Sign it
+ Speak it
+ Blink it
+ Think it

ACT ON IT

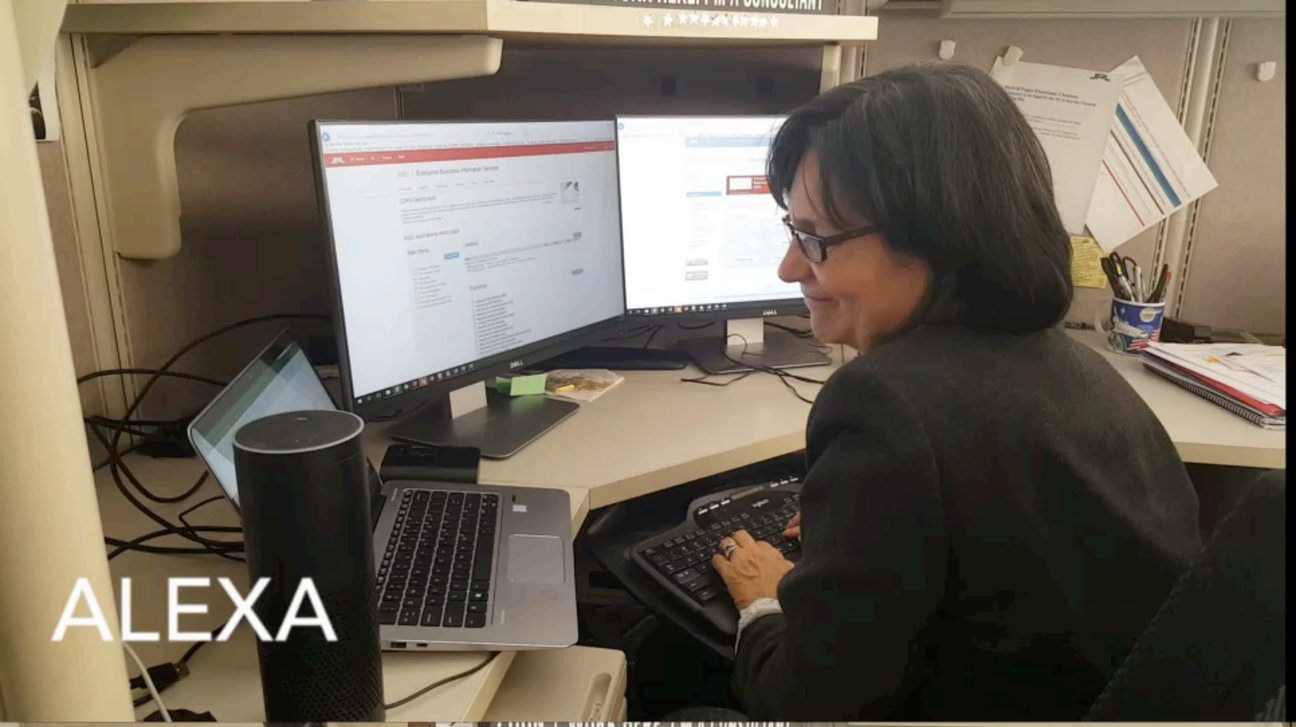
MEASURE IT

Establishing the architecture for 2018 and beyond

Leverages IOT, Programming, Smart Data, Cloud, and Augmented Intelligence

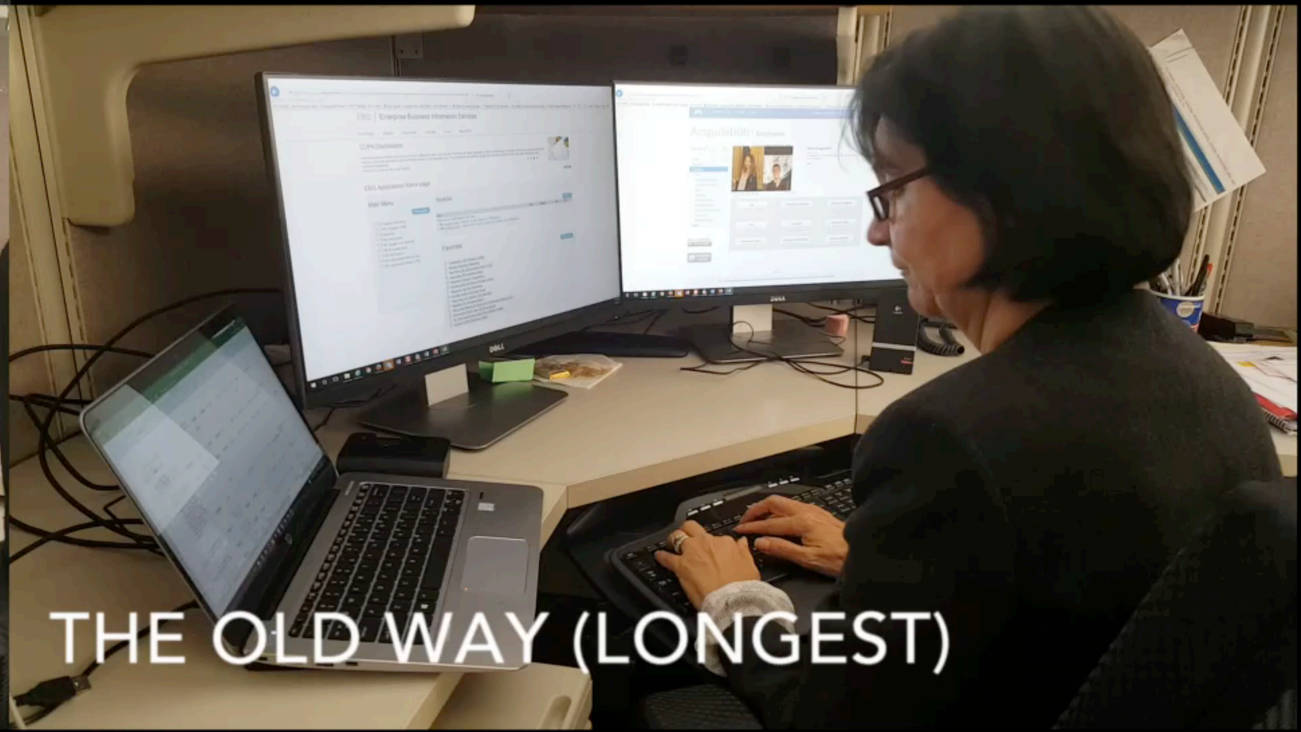


Intelligent Assistance – Querying requisitions through voice (many queries)



Acquisition IA
Proof of Concept

00 : 00 : 00



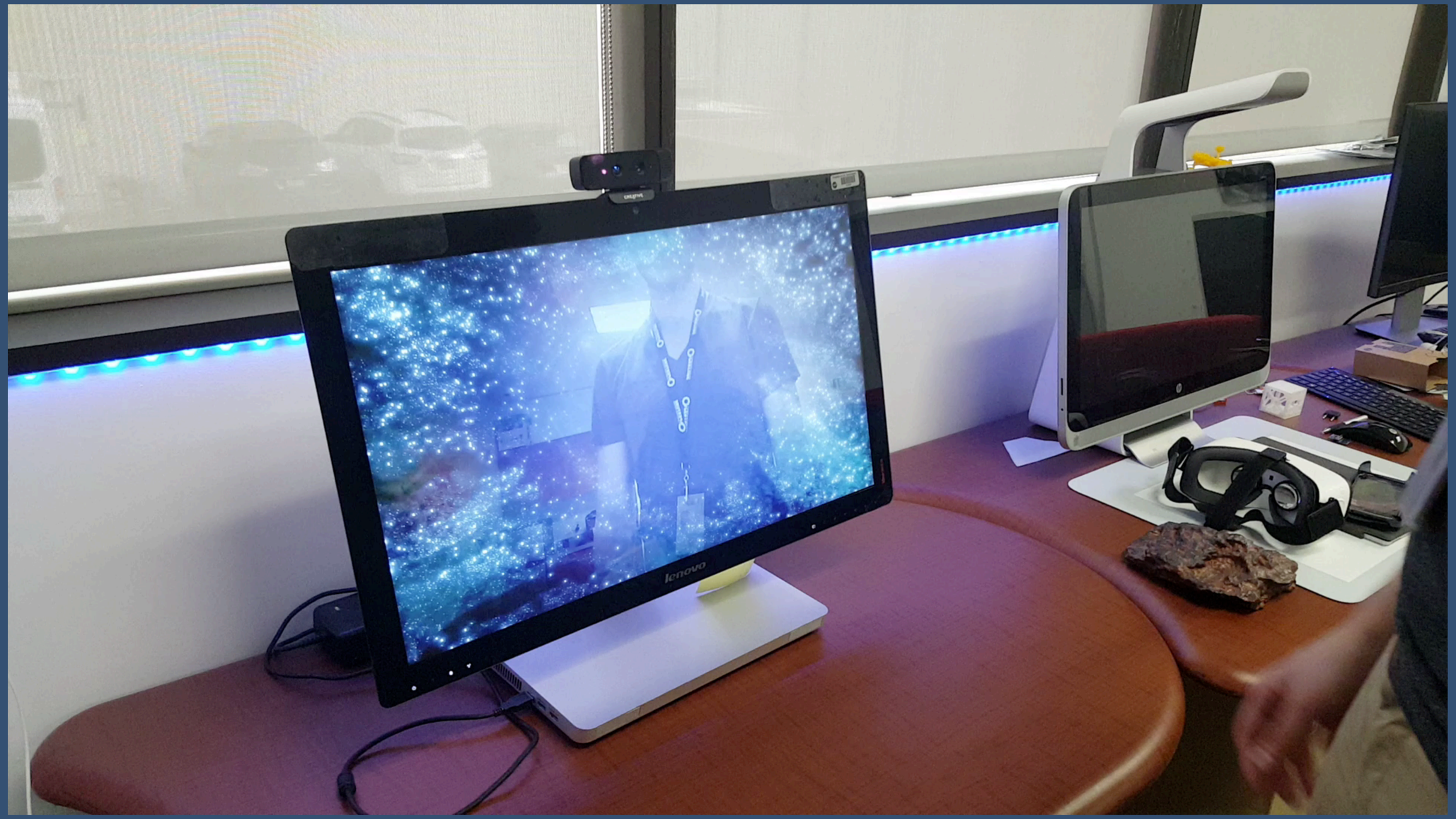
Consumer devices at Scale in the Enterprise

Expanded Team

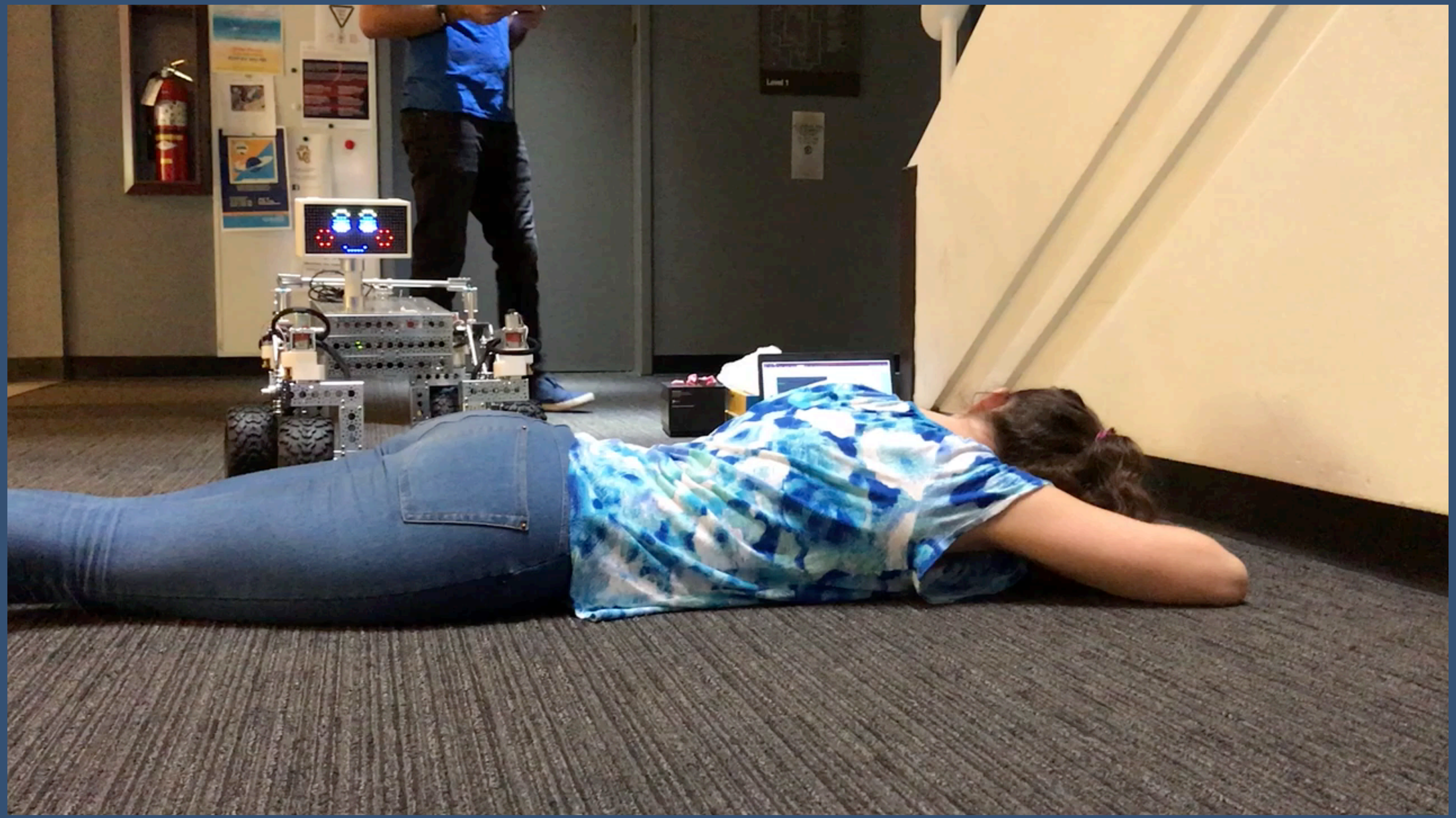
Helpdesk of the future – I need help now!

Combining multiple senses for your use case

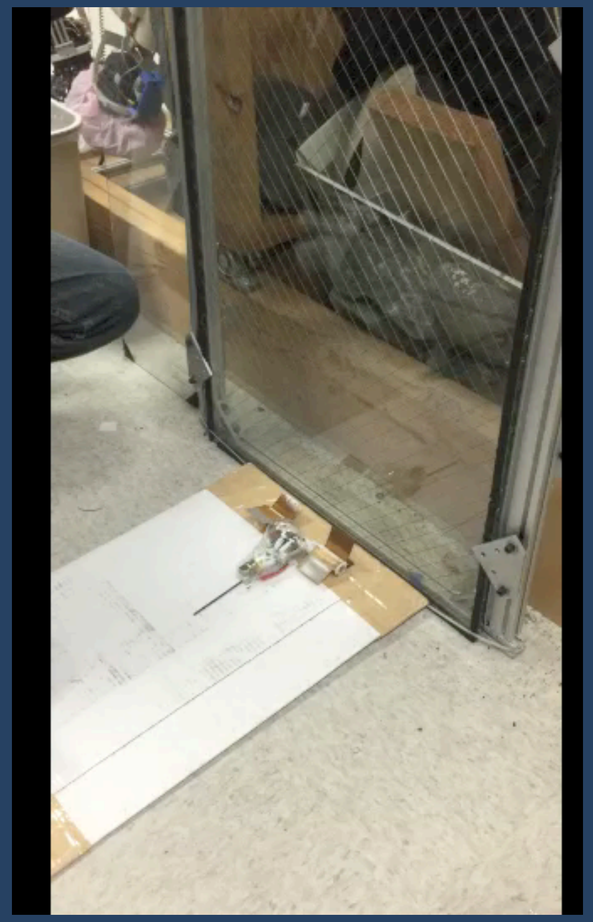
Enable with gesturing + IoT



IoT used for training, outreach, and partnering



Enable with robotics + 3D printing + startup mentality

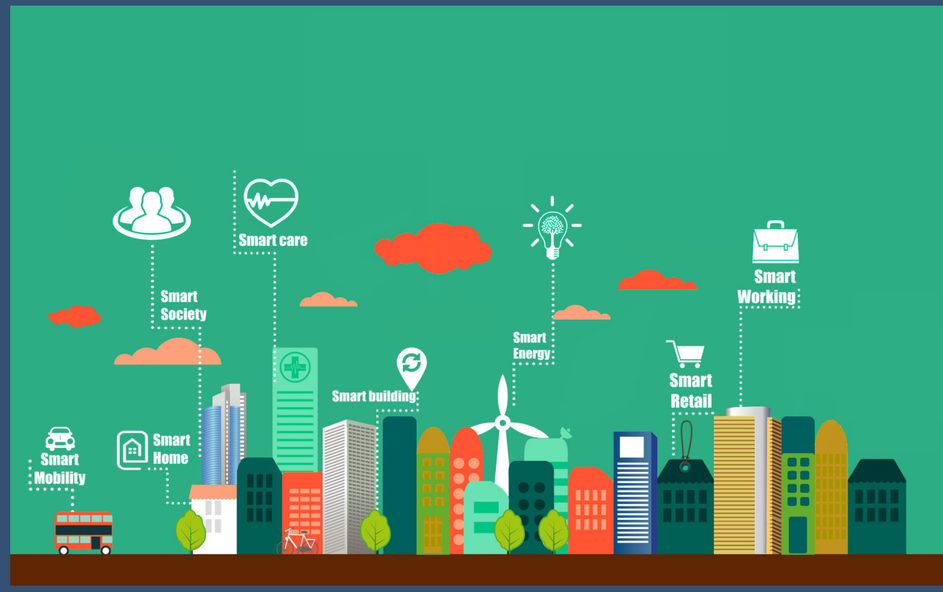


There are new IoT Use Cases every day…

Connected Vehicles
Credit: The Daily Conversation/YouTube

Fleet Management
Credit: AT&T Enterprise/YouTube

White Cane 2.0
(Credit: MIT and Economist)



Smart Cities and Smart Homes
Credit: Lux Reviews

<u>Near-term areas:</u>

Wearables
Voice
Healthcare
Transportation
Manufacturing
Security monitoring
Energy
…

A bit about the IoT technologies for reference

A few technologies related to IoT (near-term to longer term)

- **Current:** Programmable LEDs, sensors, controllers, emerging open source, …
- **Current:** 802.11ad, Bluetooth 4.2, ZigBee, Z-Wave
- **Soon:** 802.11ax, Bluetooth 5, 5G: Faster, farther, more devices, less power hungry
- **Later:** Li-Fi (Light Fidelity): Super-fast line-of-sight transmissions

Useful things for the CIO to watch

1. Underlying protocols:

- Message Queue Telemetry Transport (MQTT) (the lingua franca of IoT)
- IPv6 (have a roadmap)
- Advanced Message Queuing Protocol (AMQP) (track)

2. Platforms/OS: Contiki, LiteOS, TinyOS, SigFox, WiGig (for AR) (team and experiment)

3. Cyber Security:

- FIDO (Fast IDentity Online) (helps with SSO and has broad industry support)
- MatrixSSL (for encryption)
- Firmware updates over the air (e.g. ensure SCOTA capabilities)

Using the architecture for 2018 and beyond

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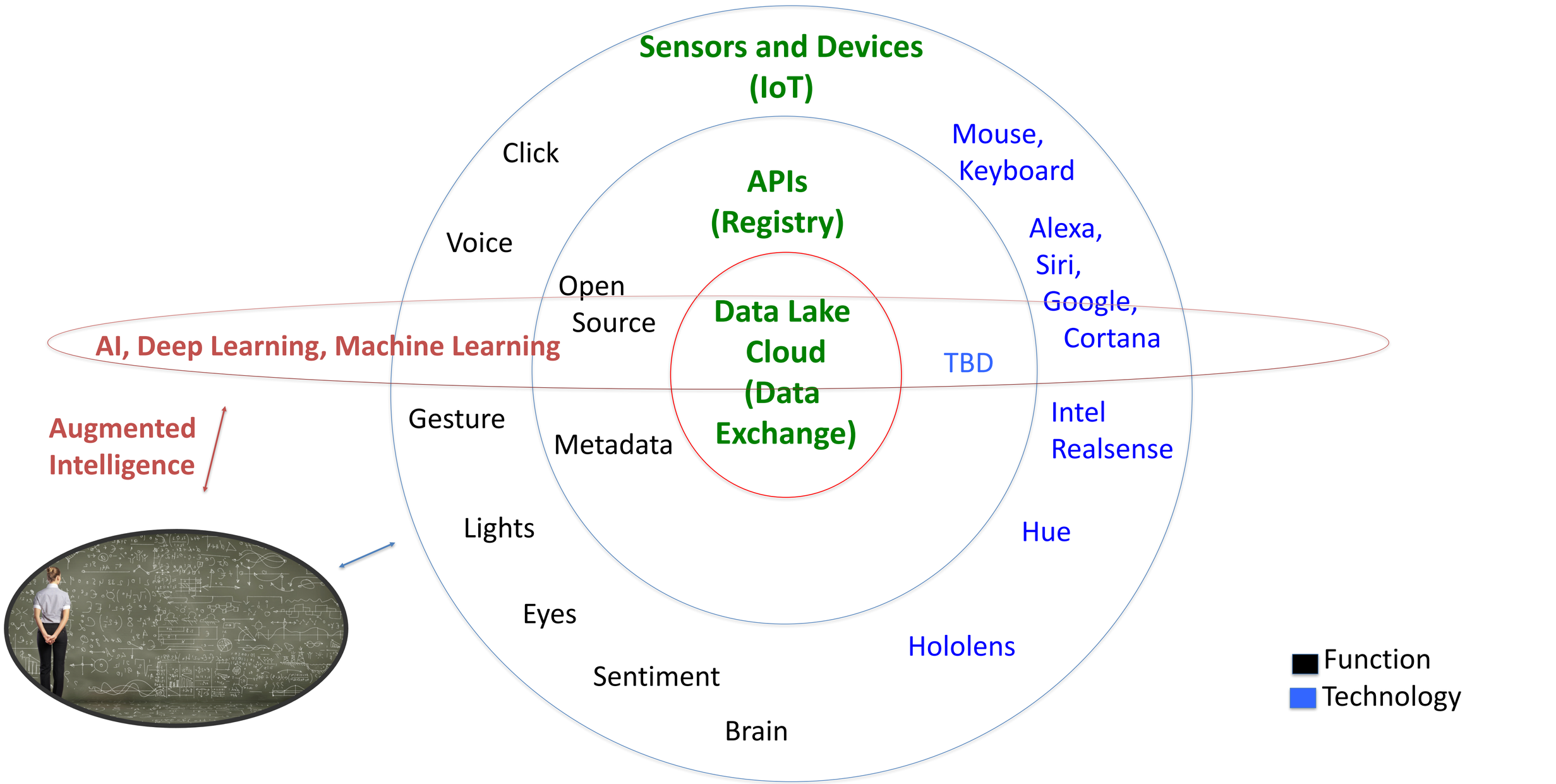
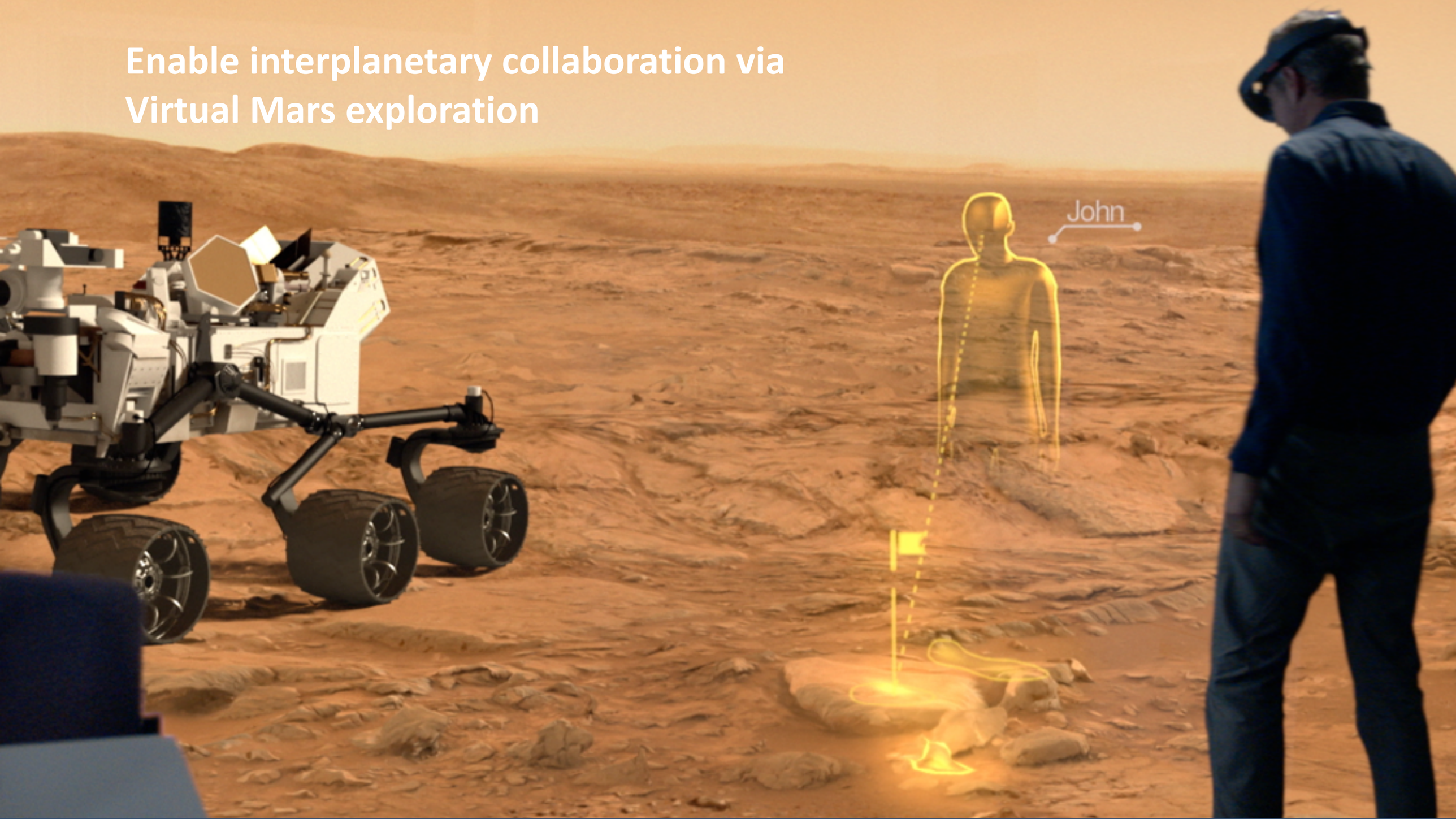
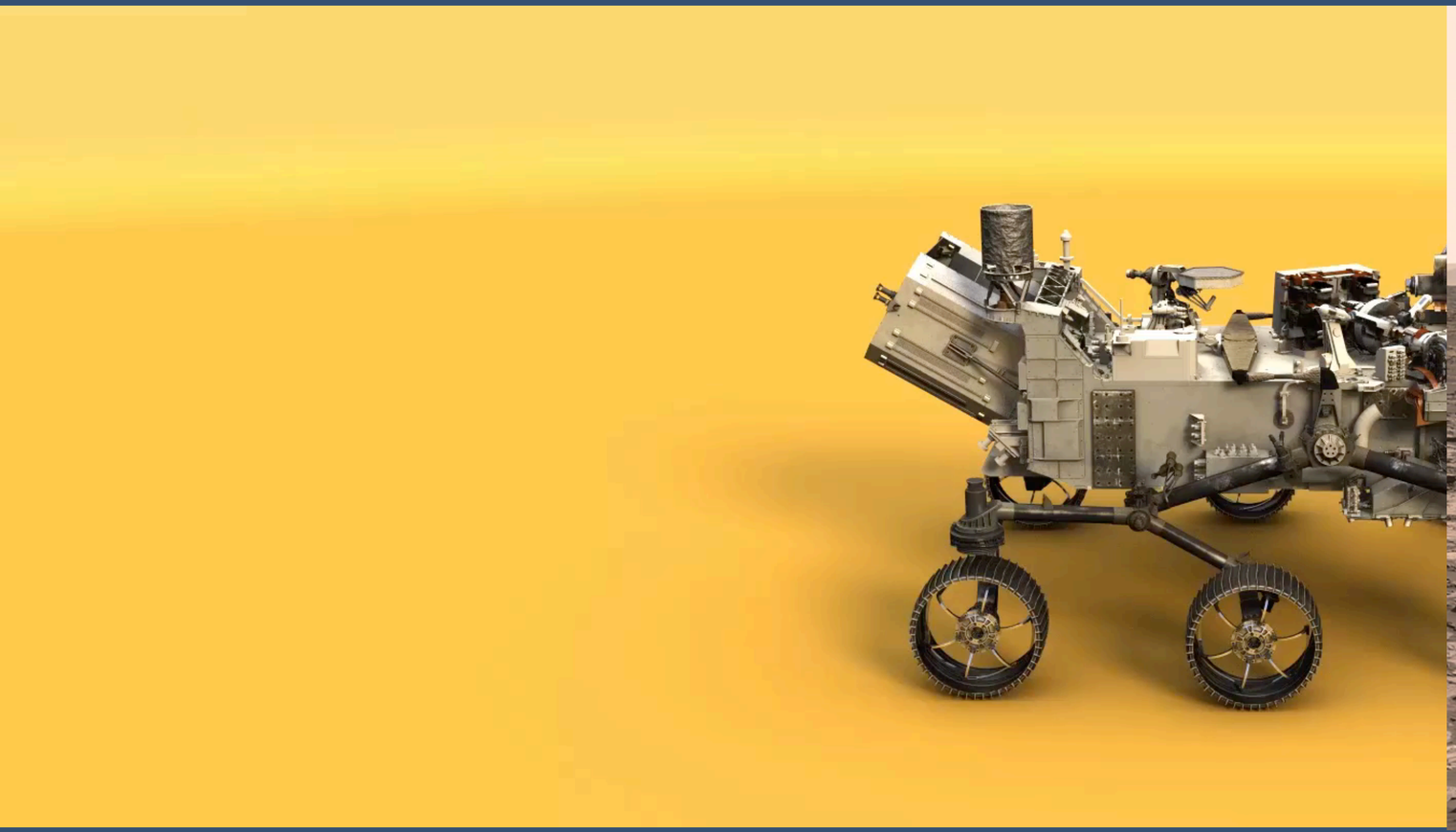
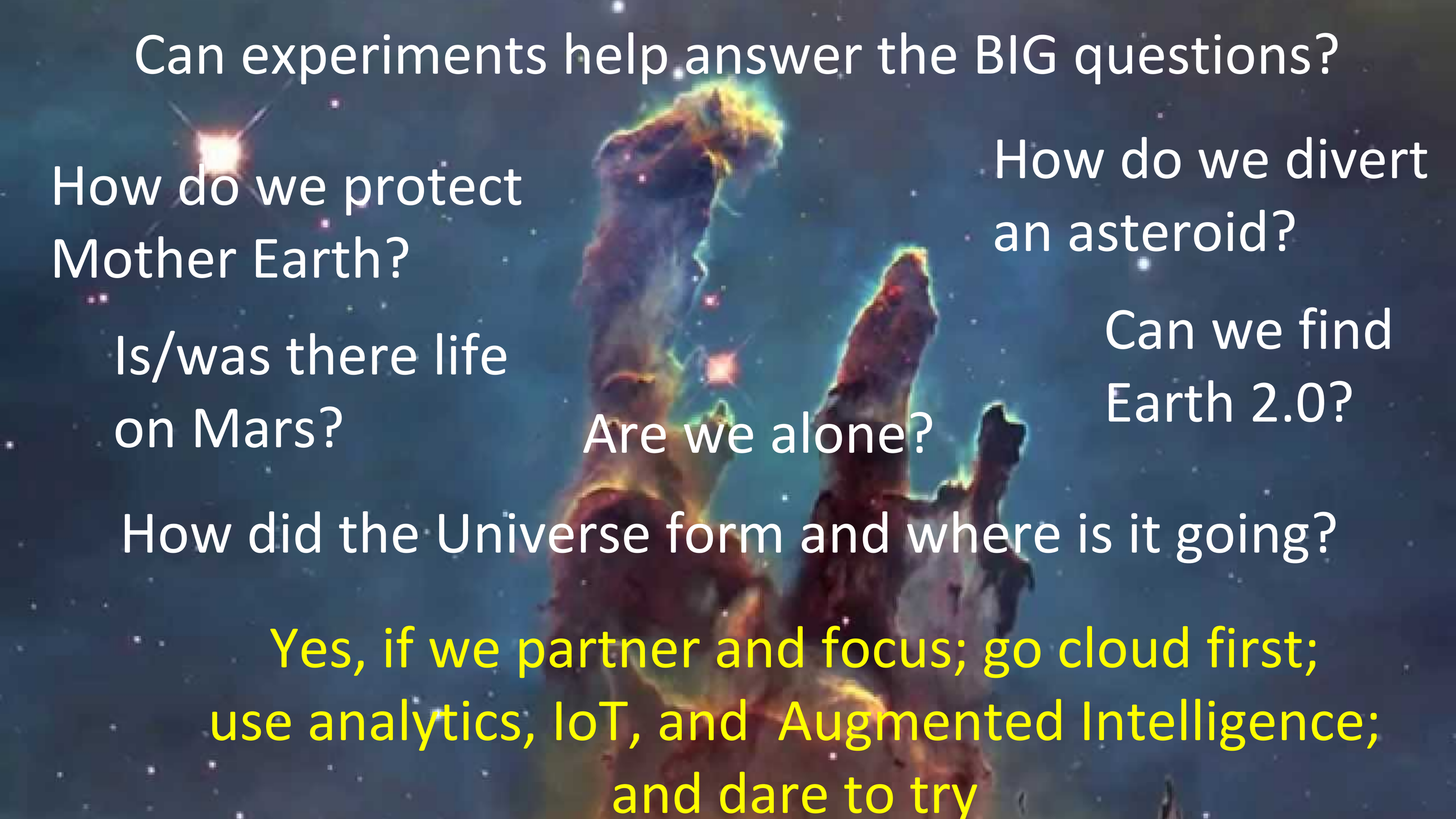


Enable interplanetary collaboration via Virtual Mars exploration



Our next mission to Mars




Can experiments help answer the BIG questions?
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Yes, if we partner and focus; go cloud first; use analytics, IoT, and Augmented Intelligence; and dare to try

Recommendations for how to benefit from IoT now

1. Think of IoT a business improvement initiative, not a technology initiative
2. We're still early in the IoT lifecycle so expect growing payback over time
3. Look for innovation through combinations (but that help you today)
4. Question Farm and prototype quickly (do the easiest Use Cases first)
5. Team up newer and experienced people (home automation, "one-pizza teams")
6. Pick an IoT standard/platform; expect it to evolve and partner with providers
7. Expect to integrate technologies and standards yourself
8. Start now and celebrate progress (KISS and tell)
9. Look to apply Augmented Intelligence today for maximum benefit long-term

You can only win if you play