

Data to Decision

E Embedded
tech trends

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Simon Collins

Senior Product Manager



Leading EDGE COMPUTING



DATA TO DECISION



Enabling Good Decision-making

The Military relies on the timely analysis of aggregated Intelligence to fulfill short-term mission and long-term strategic aims.

The enabling technology needs to be both open and robust, to ensure rapid deployment and efficient use of resources in the face of loss of connectivity while being secure against attack.

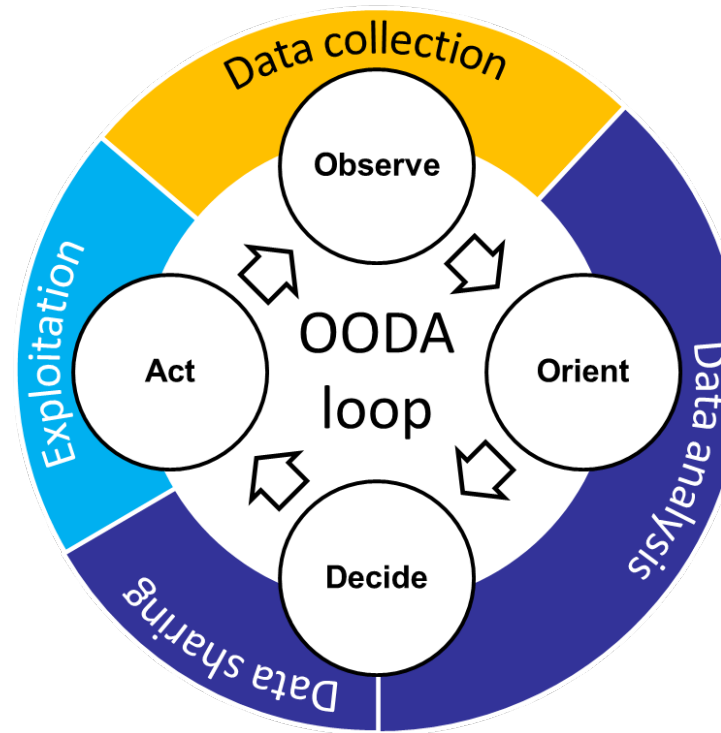
This presentation will look at architectures providing solutions to convert data into decisions.

Data: The biggest Defense Challenge

“We’re going to find ourselves in the not too distant future swimming in sensors and drowning in data”

January 2010

Lt. Gen. David A. Deptula,
Air Force deputy chief of staff for Intelligence, Surveillance and Reconnaissance



Military needs
**Application-Ready
Intelligent Platforms** to
make sense of the data

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“Success can only be achieved by acting inside the enemy’s cycle”

Colonel John Boyd, USAF

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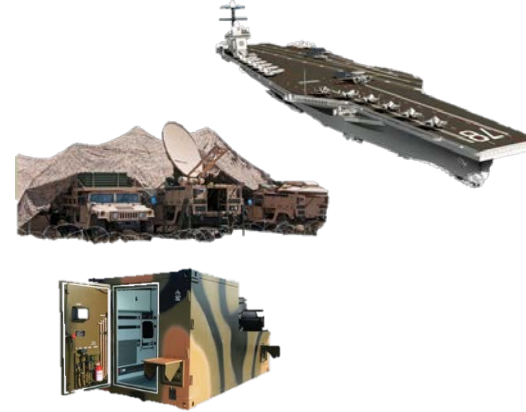
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Huge number of sensors connected to both mobile and “fixed” installations in the battlefield

SENSOR

PLATFORM



Multiple command posts

BATTLEFIELD
COMMAND



Strategic command & Intelligence Community

STRATEGIC
COMMAND

Data: The Response



Cloud Computing

US DoD and Agencies all moving towards Cloud Computing

- establish a **single, secure information environment** that
- enables commanders to connect to, access and share the information they need
- in order to operate effectively.

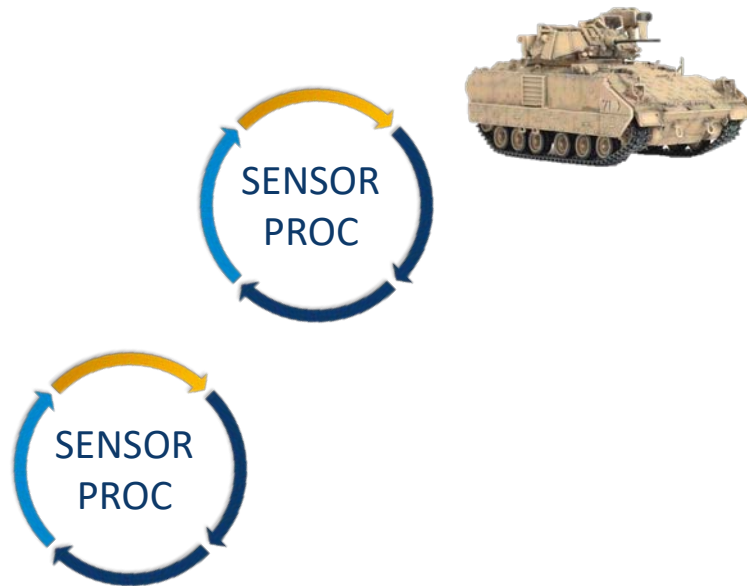
Maintain a strategic and tactical advantage over adversaries through **information dominance** by fully leveraging an optimal mix of approved government and commercial cloud service providers.

Cloud computing, when coupled with the appropriate applications and a common data structure, will enable authorized users to harness the power of Big Data analytics that enables low-latency access to required data elements, **regardless of location or device.**

But, Cloud technologies are not always available at the edge because of performance and resource constraints.

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Sensor Processing



Local sensor processing still needed!

- Reduce the raw incoming sensed data into a coherent data set
- E.g. raw radar data → identified terrain and objects

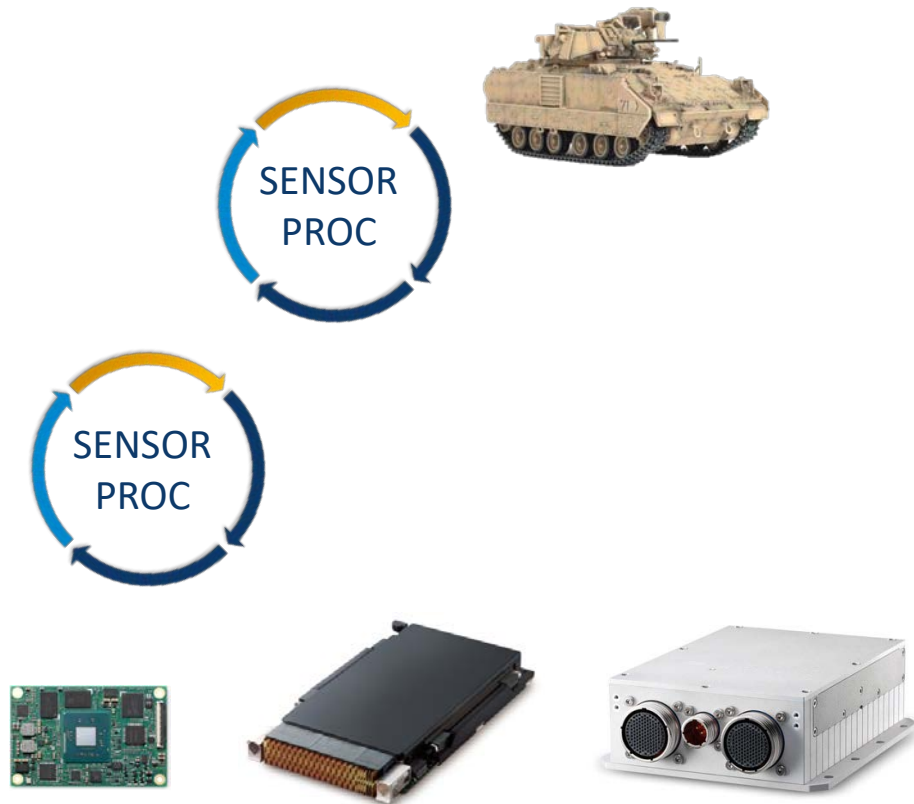
Local exploitation of raw data needed in real time, e.g.

- Target identification & tracking
- IED detection

May store the raw data for offline processing at a later date

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Sensor Processing



Technology trend means:

- Able to do the traditional applications in lower SWAP
 - E.g. Intel Atom, ARM
- Able to do more sophisticated applications in existing SWAP envelope
 - E.g. Intel[®] Xeon[®], NVIDIA GPU

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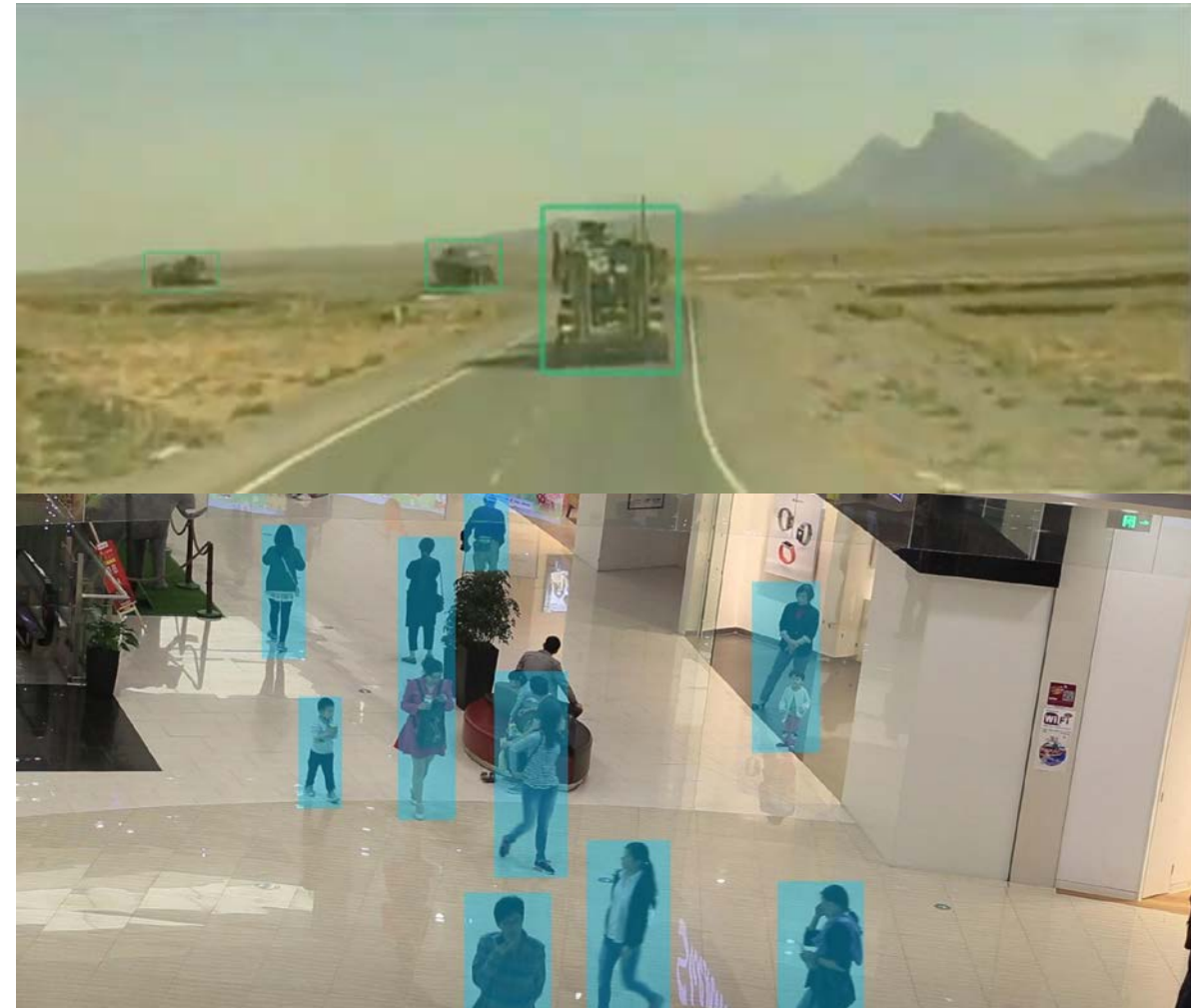
Machine Learning in High Performance Embedded Computing

Machine Learning and AI are experiencing an exponential growth in use cases across many industries.

- Autonomous cars
- Natural language processing
- Medical diagnostics
- Defense

Parallel processing using GPUs was key to this growth.

- NVIDIA CUDA-optimised Deep Learning libraries CuDNN
- **Training** on large compute nodes, **inference** on embedded GPUs



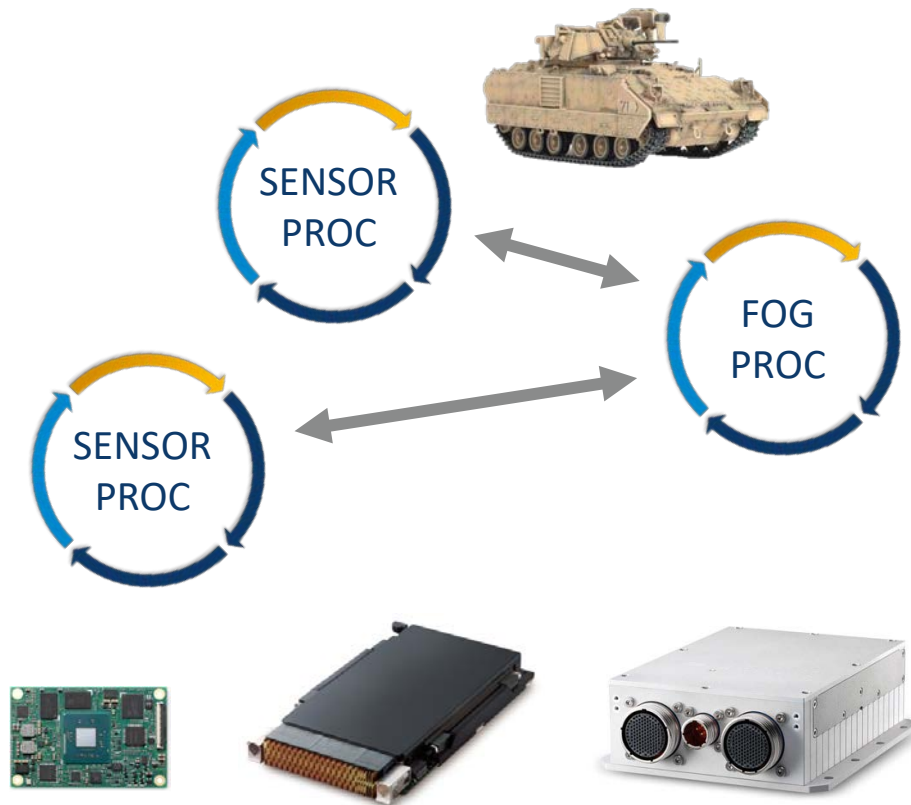
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Fog Computing

Fog Computing extends the Cloud Computing paradigm to the edge of the network

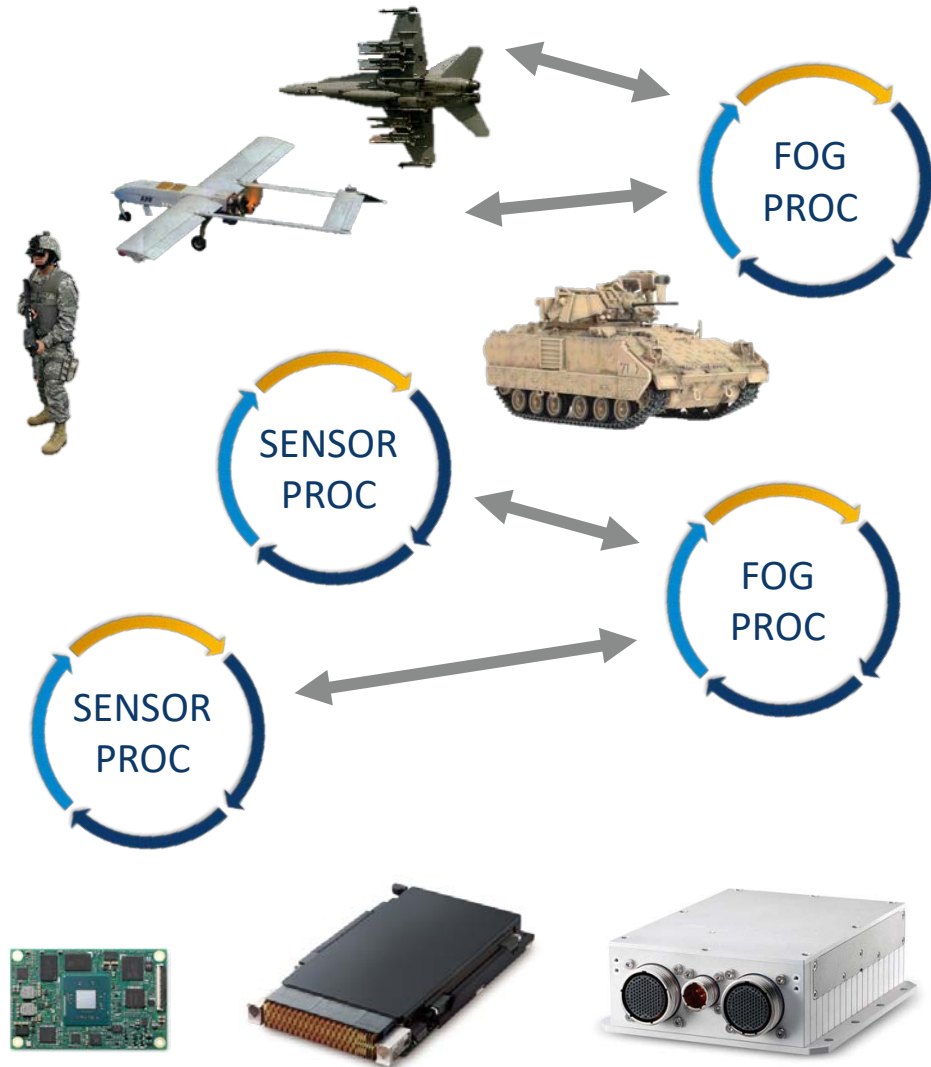
...and overcomes latency and poor or intermittent bandwidth connectivity.

Fog enables the **secure** forwarding of data between Fog subsystems containing edge node applications communicating with each other on a Local Area Network (LAN)



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Fog Computing



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...and overcomes latency and poor or intermittent bandwidth connectivity.

Fog enables the **secure** forwarding of data between Fog subsystems containing edge node applications communicating with each other on a Local Area Network (LAN)

...and other nodes and subsystems that are connected over a Wide Area Network (WAN).

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Field command posts must aggregate the information and fuse it into advanced situational awareness.

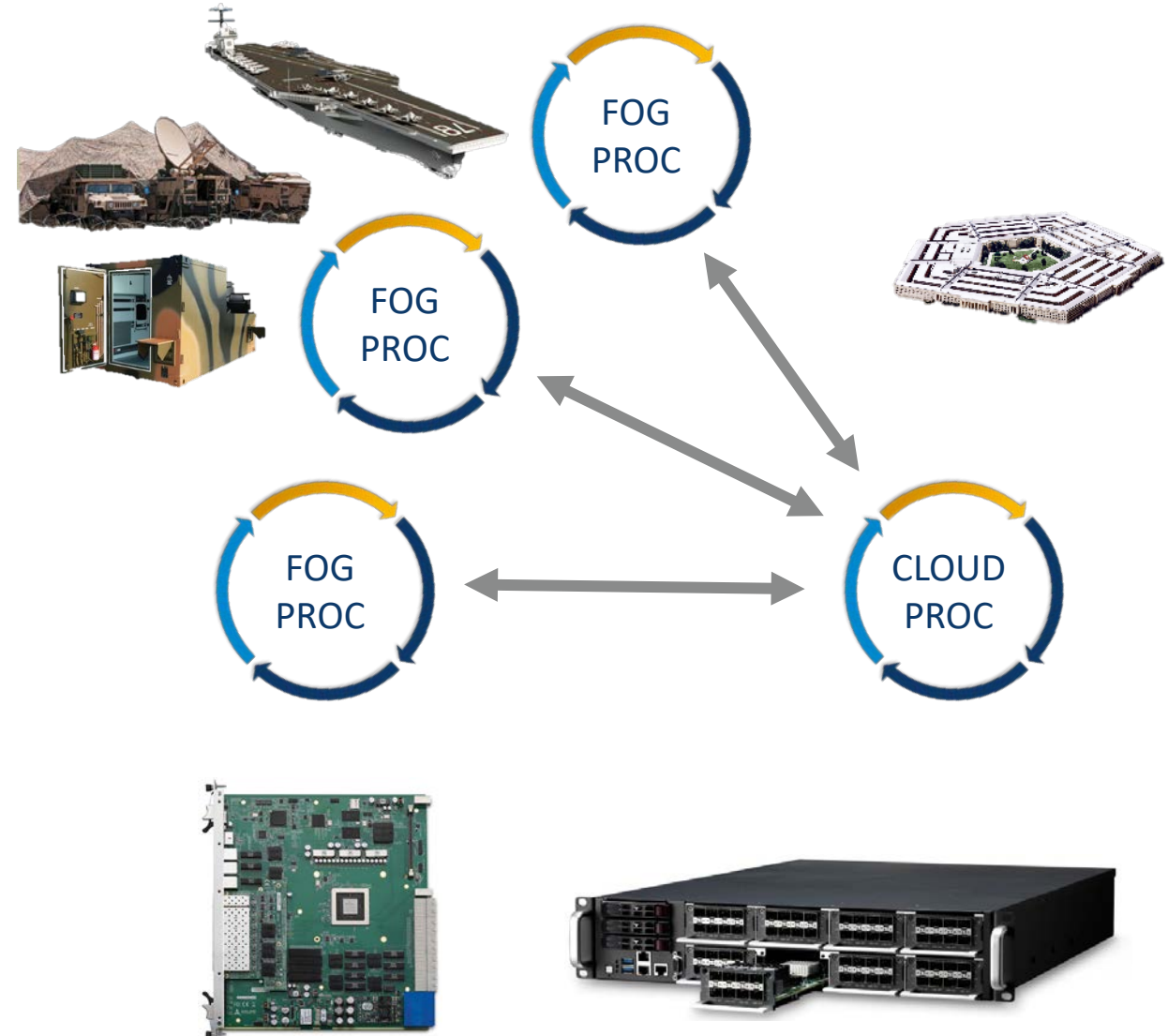
Large processing power and large network bandwidth required.

- Intel Xeon servers, 40G Ethernet, NVIDIA GPU

Fog processing applies here, too.

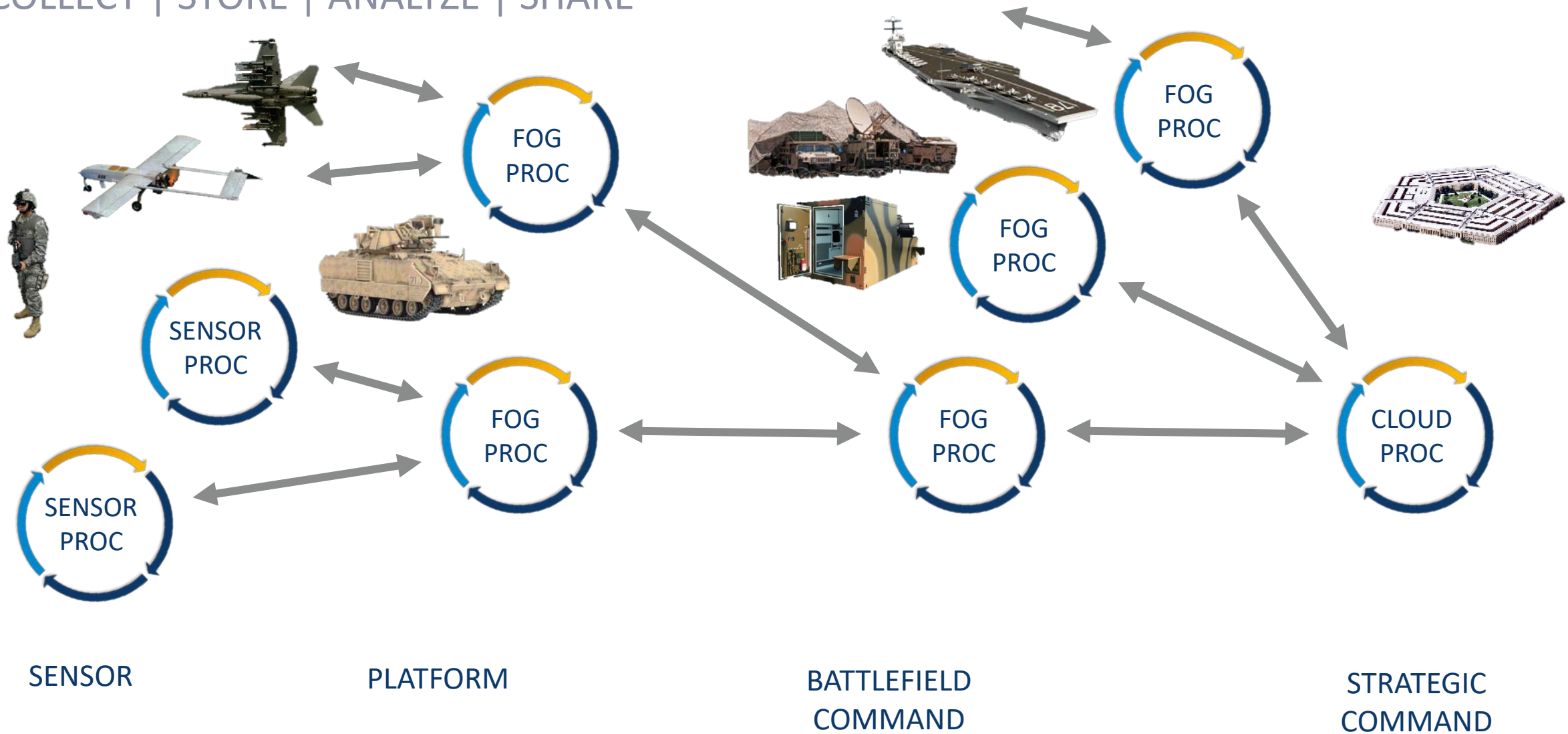
- Also referred to as Deployed Cloud

Ultimately, both Government and Commercial Cloud installations used to harness all of the existing data.



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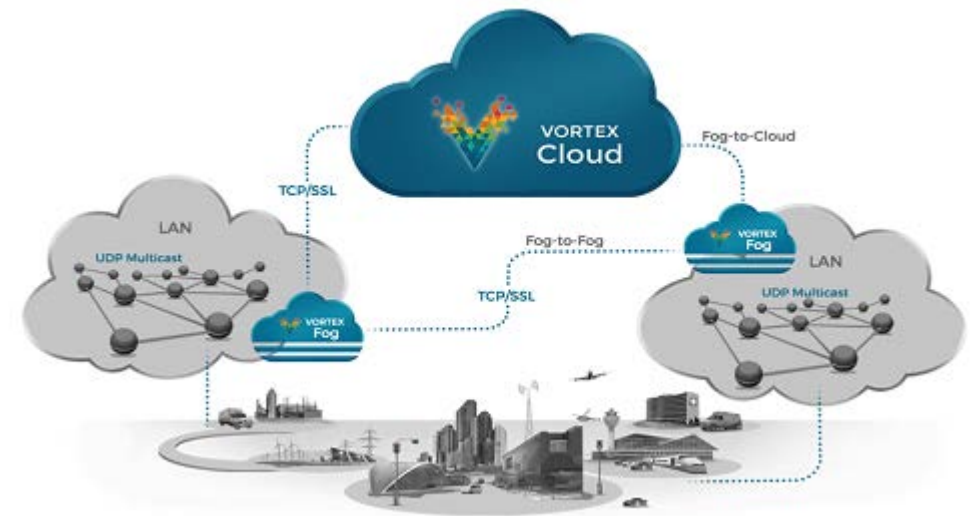
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Fog Computing Traits

Based on open standards

- Real-time performance and reliability
- Location- and resource-aware deployment
- Resource and device virtualization
- Resource-aware application provisioning
- Tamper-proof security

Driven by commercial markets, including Industrial Internet of Things and Telecoms (Mobile Edge Computing or MEC)



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Summary

Today's Industrial challenges are similar to those faced by the Military.

Secure Cloud and Fog technologies will be vital to the effective exploitation of battlefield data.

Machine Learning and AI will help “view” the vast quantity of data and draw new insights.

Developments in commercial technology continue to drive advanced capabilities in the Defense market.

Open standards for hardware, software and middleware enable rapid uptake of these commercial technologies.

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Thank you!

Simon Collins
Senior Product Manager

