Edge Computing and HPC

November 2021

www.HyperionResearch.com
www.hpcuserforum.com

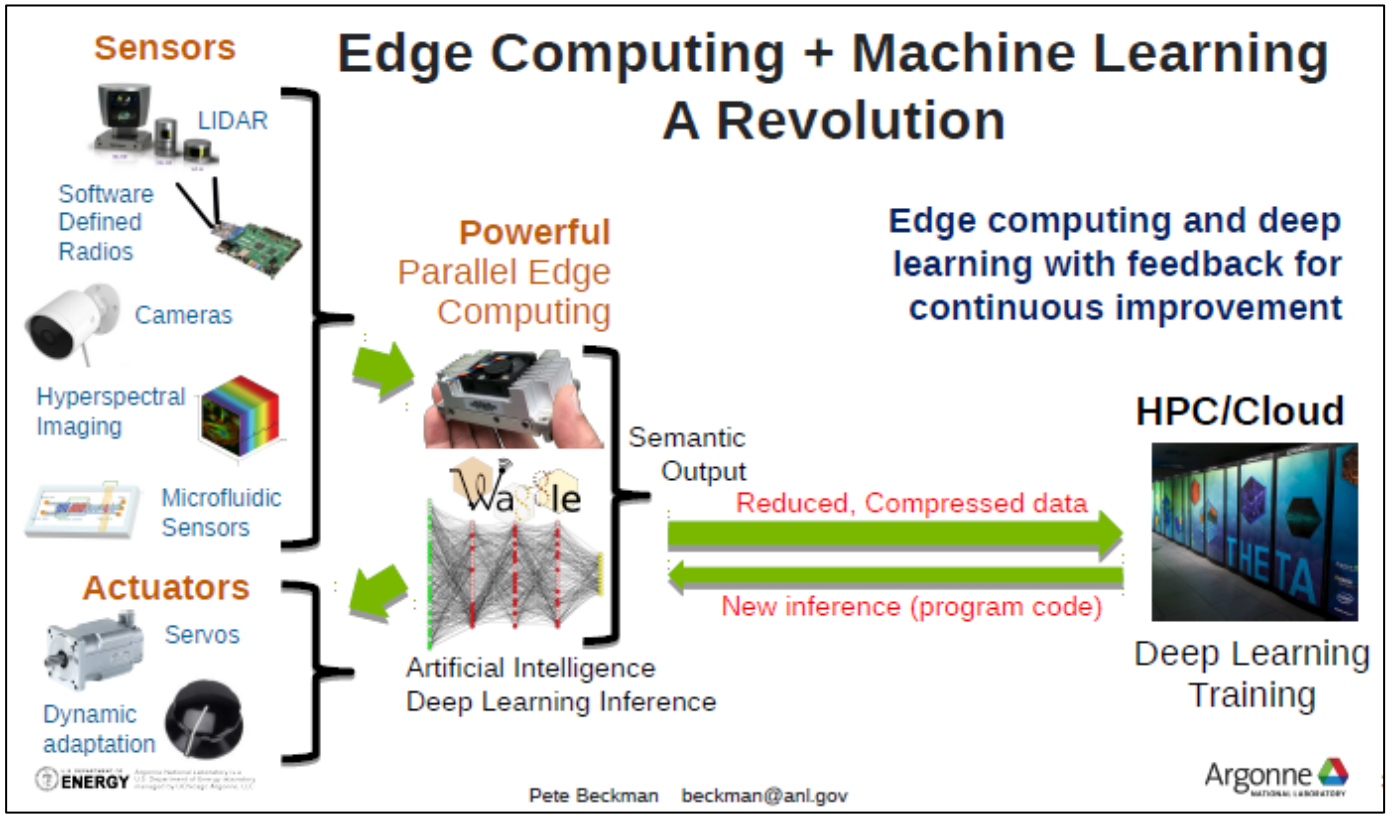
Steve Conway
sconway@hyperionres.com

What Is Edge Computing? What Is HPC's Role?

- **LOCAL: Computing at or near data sources (IoT devices)**
  - Computing *inside* edge devices (e.g., vehicles, medical devices, satellites)
  - Computing *attached* to edge devices (e.g., traffic sensors)
  - Computing *close to* edge devices ("fog computing")

- **LOCAL-DISTANT: HPC in more-distant clouds or data centers (e.g., citywide traffic control)**
  Only small subset of edge data might be sent here for wide-area analysis and control.

The Waggle Project

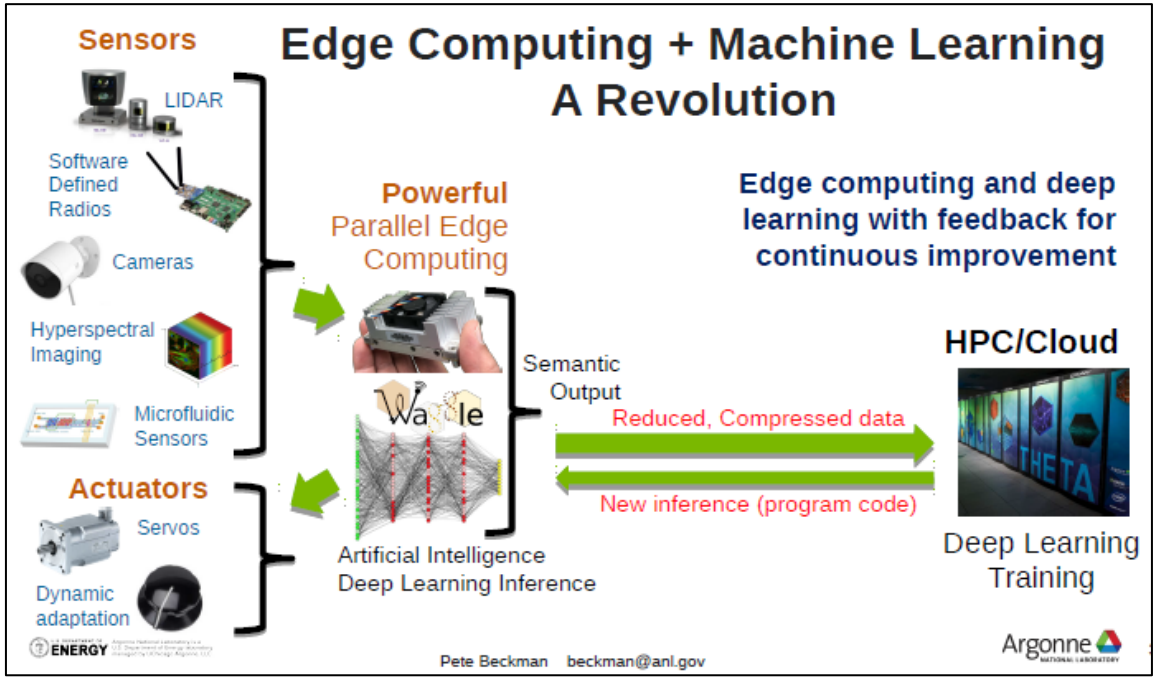


© Hyperion Research 2021

What Is Edge Computing? What Is HPC's Role?

- **LOCAL: Computing at or near data sources (IoT devices)**
  - Computing *inside* edge devices (e.g., vehicles, medical devices, satellites)
  - Computing *attached* to edge devices (e.g., traffic sensors)
  - Computing *close to* edge devices ("fog computing")
- **LOCAL-DISTANT: HPC in more-distant clouds or data centers (e.g., citywide traffic control)**
  - Only small subset of edge data might be sent here for wide-area analysis and control.

The Waggle Project



© Hyperion Research 2021

HPC & Edge Computing

"A supercomputer is a device for turning compute-bound problems into I/O-bound problems."

The late supercomputer architect Ken Batcher

"Edge computing is a device for turning I/O-bound problems into compute-bound problems."

Pete Beckman, Argonne National Laboratory

Supercomputers aren't new to edge computing. Since the 1960s-1970s:

- Governments have used HPC to monitor telco traffic.
- Governments have used HPC to forecast weather based on data from sounding balloons and ground observations.
- NASA has used HPC to analyze satellite data

© Hyperion Research 2021

Advantages of Edge Computing

- **Faster responses to local events (latency)**
  - Traffic congestion, lawbreakers, severe storms
- **Lower costs (economics)**
  - Moving all data to clouds/data centers & storing it there could become prohibitively expensive
- **Higher autonomy & reliability**
  - Avoid multi-tenancy, multiple network connections
- **Greater privacy & security**
  - Avoid multi-tenancy, decide rules for local network
- **Scalability**
  - Easier to add small, inexpensive local units than to increase cloud and data center footprint.

© Hyperion Research 2021

Edge Computing & Cybersecurity

- **Advantages of Edge Computing for Cybersecurity**
  - Large amounts of data are more difficult to steal from many edge locations than from one central server.
  - Large amounts of computing power are more difficult to hijack for nefarious purposes (e.g., cryptocurrency mining).
  - “Small data” processed at the edge its usually less mission-critical than the subset of edge data sent to central servers.
  - Keeping most data at the edge makes central servers less likely to be attacked.
- **Disadvantages of Edge Computing for Cybersecurity**
  - Edge devices may not be designed with cybersecurity in mind.
  - Commercial edge devices typically not tested for resilience to attacks, which is an important consideration of the DoD.
  - Visibility and control of edge locations via the network may be limited.
  - Loopholes and vulnerabilities in the edige security may provide network access to central servers.
  - Edge devices may be physically small enough to steal or manipulate.

© Hyperion Research 2021

HYPERION RESEARCH

THANK YOU!

info@hyperionres.com
sconway@hyperionres.com

© Hyperion Research 2021