GaN Systems

GaN AND INDUSTRY 4.0

A SMALL CHANGE THAT IS REVOLUTIONIZING THE INDUSTRY

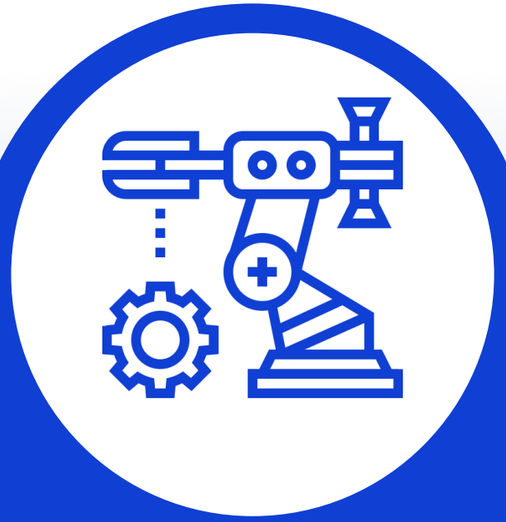
THE FOURTH INDUSTRIAL REVOLUTION

1.0

Mechanization thru water and steam power

2.0

Mass production and assembly lines, intro of electricity



3.0

Computers and automation

4.0

Intelligent & near autonomous systems, cyber-physical systems, IIoT, M2M communications

INDUSTRIAL REVOLUTION

+

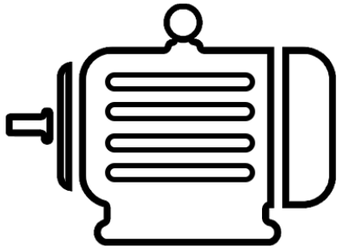
INFORMATION REVOLUTION

Industry 4.0

- Agriculture
- Food and Beverage
- Electronics
- Pharmaceuticals
- Chemical
- Transportation
- Medical Devices
- Fulfillment Centers

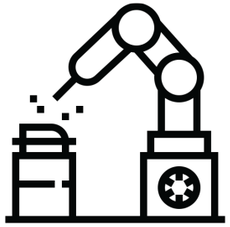
GaN Systems

Flexible and decentralized approach to factory and manufacturing design



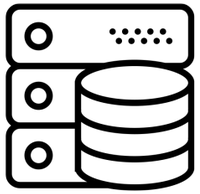
Motors & Motor Drives

Flexible designs and energy efficiency



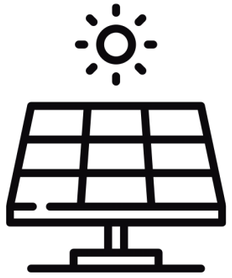
Robots and Robotics

Speed, precision, and autonomy



Data

Generation, storage, analysis, intelligence



Energy

Renewable energy generation and storage

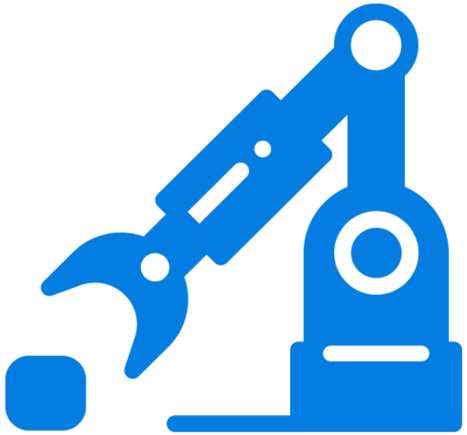
CHALLENGES FACING INDUSTRY 4.0

GaN Systems

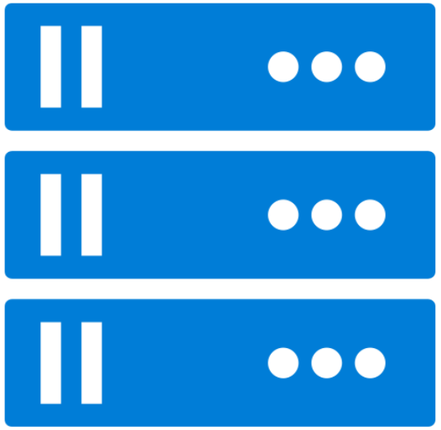
- IT Security
- Machine to Machine Communications
- Data and Machine Learning
- Technology Interoperability
- Flexible Factory Design
- Operating & Capital Costs
- Energy Use & Renewable Sources

GaN TECHNOLOGY AND INDUSTRY 4.0

Motors and Motor Drives



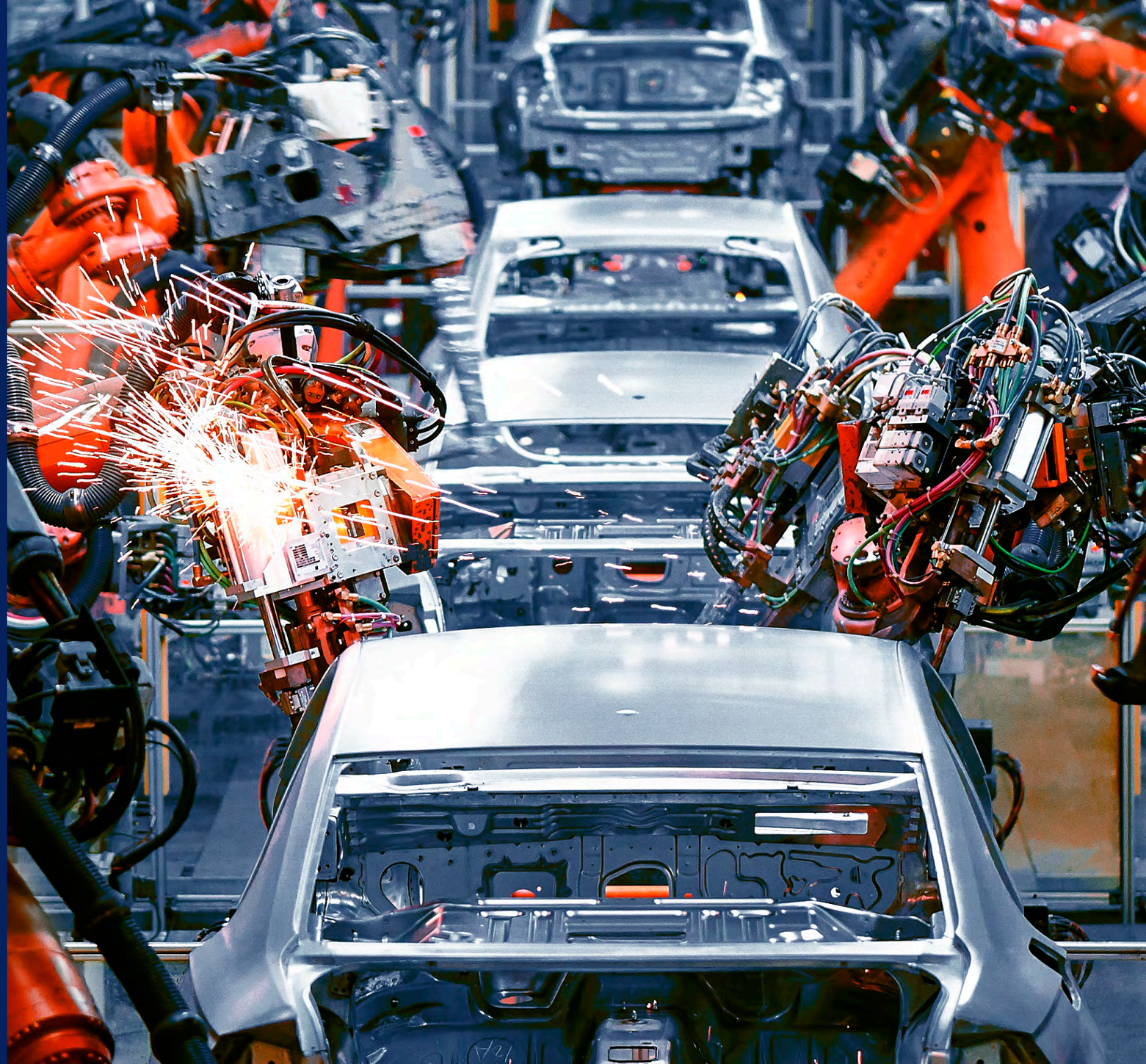
Robots and Robotics



Data Centers

MOTORS AND MOTOR DRIVES

- Robotics
- Storage & retrieval shuttles
- Bulk conveying
- Continuous processing
- Packaging machines
- Handling and assembly systems
- Pumps and fans



GaN Systems

MOTORS & MOTOR DRIVES

45%

of the world's electricity usage is for industry

300M

installed worldwide

10%

growth rate

2/3RD

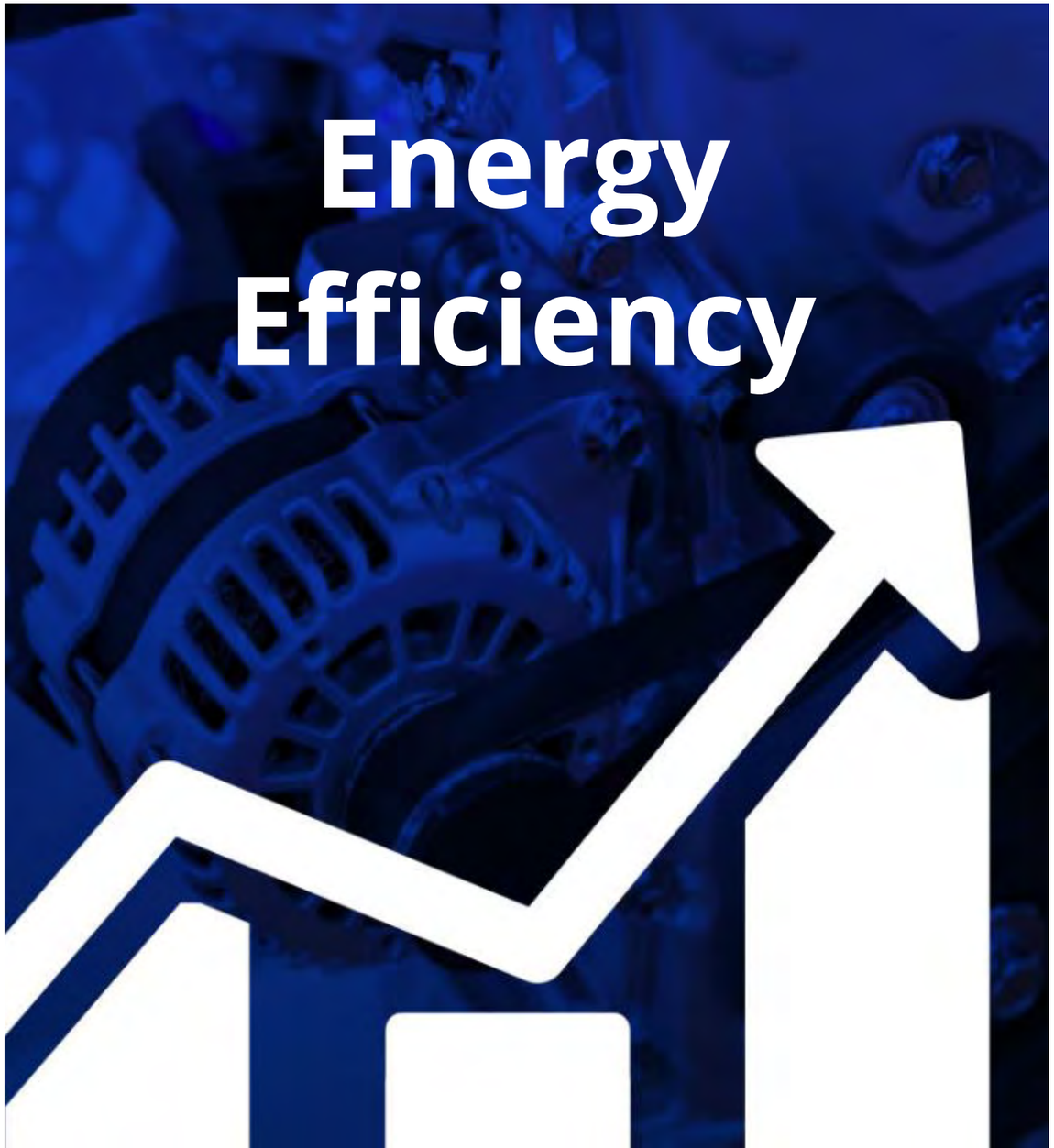
of industry electricity use is motors

30%

energy wasted

GaN Systems

MOTORS AND MOTOR DRIVES WITH GaN



MOTORS AND MOTOR DRIVES WITH GaN

GaN Systems

Energy Efficiency

Increased Energy Saving

- 98+% energy conversion efficiency versus 92% for Si
- Regeneration, active infeed results in ~22% lower power consumption
- 25% overall less electricity usage with GaN

Design Barriers

Increased Design Flexibility

- 50% smaller size
- 15% lower Motor Drive cost
- Big cost savings with unshielded cables and no external filters
- No acoustic noise
- Increased motor lifetime

ROBOTS AND ROBOTICS

- Integration
- Precision
- Autonomy

GaN Systems

ROBOTICS – SIZE & INTEGRATION

GaN Based Power System

Higher Switching Frequencies

Small Size No Heat-sink Integrated

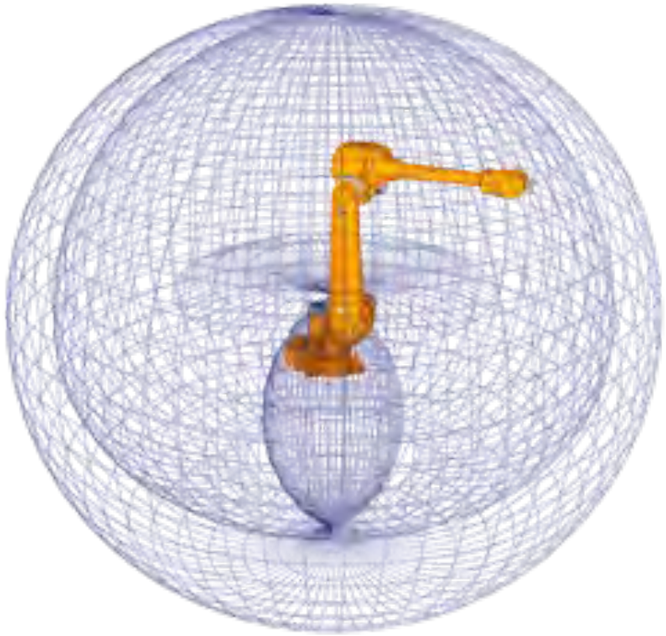
- High frequency leads to smaller magnetics, capacitors, filters
- GaN lower power losses leads to small motors without heat sinks
- Small size leads to integration

ROBOTICS – PRECISION

Fast Switching → Increased Control Bandwidth → Precise Positioning and Faster Response → More Precise Motor Control

Precision, flexibility, dexterity & speed are critical

- Small-parts assembly (dexterity, speed, and precision)
- Part transfer (speed and software-driven decision making)
- Part presentation (precision and speed)
- Dispensing (speed and precision path)
- Packaging (speed and flexibility)
- Multiple part types (flexibility and dexterity)



ROBOTS – AUTONOMY

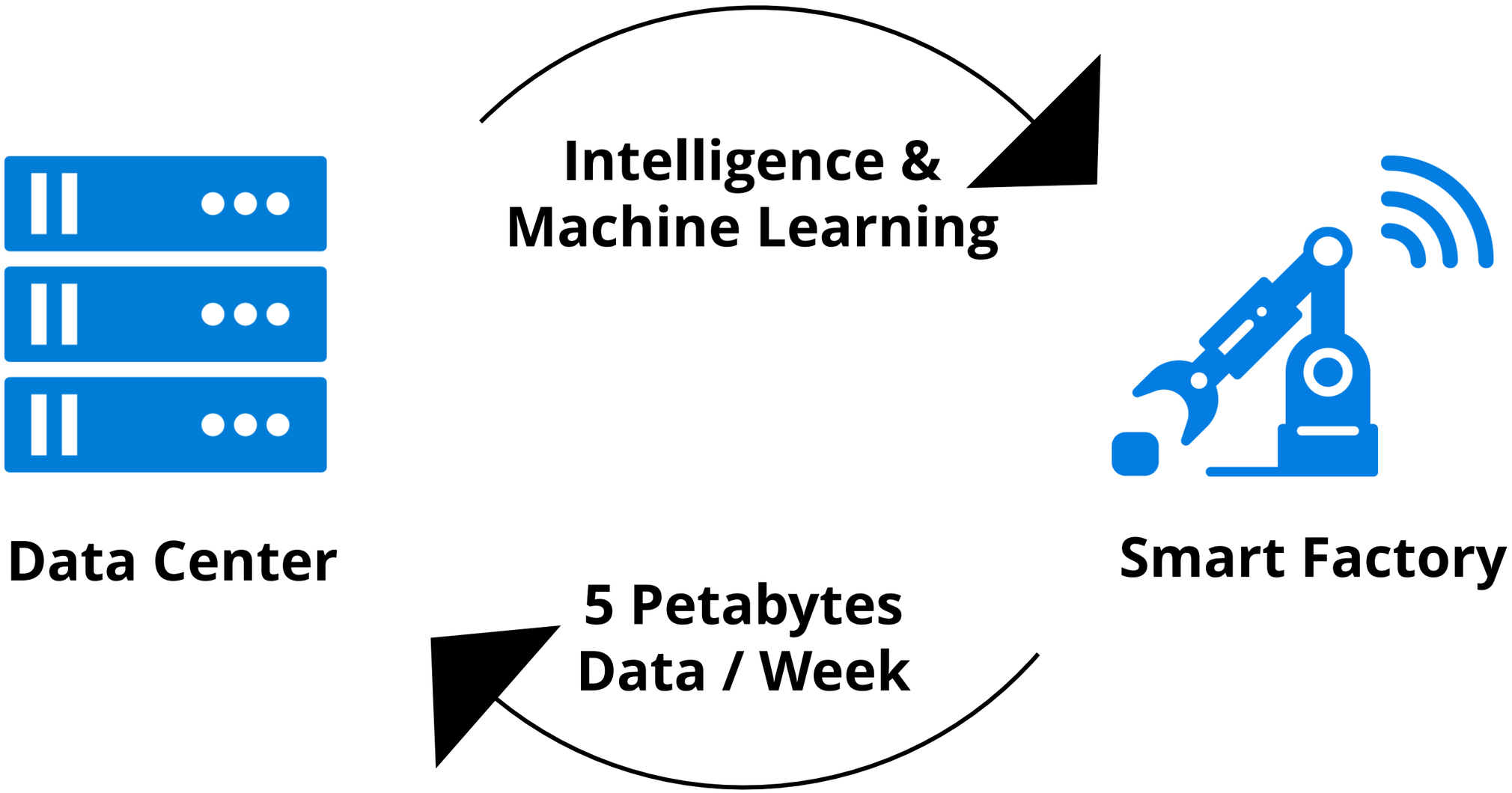
GaN Based Power System

Higher Operating Frequencies

High Power and Spatial Freedom

- Wireless charging brings true autonomy to mobile robots

DATA AND DATA CENTERS



DATA AND ENERGY ARE CONNECTED

GaN Systems

40% of Data Center Operating Cost is Energy

GaN based PSU in the Data Center

- Higher energy efficiency
  - $461M lower energy bill
- 10% more servers per rack
  - $1.4B additional revenue
  - $1.1B lower CAPEX

THE INDUSTRY IS ACTING NOW

Motors and Motor Drives

Robots and Robotics

Data Centers

It’s Time to Act.
For Individual Businesses.
For the Planet.

GaN Systems

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