Trusted IPU exaPOD by Graphcore and Atos.
Why AI matters

The data-ization and connection of all things alongside a massive rise in computing power is making AI a reality now; turning data into valuable insights and creating tremendous opportunities for business. Because data is so critical it must be protected, regulated and efficiently processed. As the European leader in Cloud, Big Data and High Performance Computing, Atos brings the necessary expertise and technology solutions to make AI a reality for your business.

Why now?

3 key factors

- Everything is a connected device producing Data
- Structured and unstructured data are unified as Knowledge
- Machine Learning is affordable with today computing power

Supercomputing powers the AI revolution
40% of new enterprise applications implemented by service providers will include smart machine technologies by 2021
* Source: Gartner

The global artificial intelligence market size was valued at USD 39.9 billion in 2019 and is expected to grow at a compound annual growth rate (CAGR) of 42.2% from 2020 to 2027.
* Source: Grand View Research
**Proposed Architecture**

- **Legend**
  - HighSpeed 100Gbe
  - Ethernet 100Gbe
  - BMC 1Gb
  - Ethernet 10Gb/s

- **Service Nodes**
  - Management Nodes
  - FastML node
  - Login Dev / TF Nodes

- **Customer Network**
  - Tenant 1
    - FastML App Service VM
  - AI Users
    - Tenant 1
    - Tenant n

- **AI Compute**
  - 32 IPU-POD64
  - 512 M2000
  - 2048x GC200

- **Parallel Storage**
  - 8 AI400NVX
  - 192 NVMe SSD
  - 2.5PB RAW Storage

- **Compute/Poplar**
  - 32 BullSequana X440-A5
  - 128x Dual socket Server
  - 4096 AMDcore

- **FastML Node**

- **Management**

- **HighSpeed 100Gbe**

- **BMC network**

- **HA network**

- **Ethernet network**

- **1024**

- **512**

- **128**

- **64**

- **32 BullSequana X**

- **DDN AI400X™**
100Gbe High Speed IPU-Fabric
• Maximizes bandwidth across IPU-Links

Service & Management Nodes
• Multi-Tenant service VM (Atos Codex AI suite)
• Cluster Manager (Monitoring/provisioning)
• Slurm Job Scheduler (Poplar Server & IPU Allocation)

Poplar Software Stack
Technology.

Management Software Strategy

**Design Benefits**

Smart Management Center xScale

**Keep the production running whatever happen!**
- Market leader components with Atos & Red Hat expertise
- Native health checking design (including some multi-failure support)
- Transparent update/upgrade/extension as also rollback (HW & SW)
- Native load balancing
- Modification tracking and rollback
- Per key components disaster recovery procedure

**Modifiable & Extensible**
- API-based design for replaceable component or extension
- Market standard components with large communities

**Make administrator life easier for day to day operations**
- Unique management system regardless of cluster size, e.g. 10k-node or 100k-node system
- With fully centralized management system, easy to upgrade towards Exascale eliminating complexity related to system extension
**Fast ML Engine**

**HPC Compatible**
Deploy AI workloads on top of HPC scheduler

**Graphcore**
Leverage the best of AI frameworks

**Enhanced MLOps**
Improve Security

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**Fast ML Engine Features**

- **Training Management**
- **Model Management**
- **Framework Management**
- **Datasets Management**
- **Hyper Parameter Optimization**
- **Distributed Training**
- **Monitoring Management**
- **Notebooks Management**
- **Security**
- **Containers Support**

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**Graphcore Technology**

**IPU ADVANTAGE**

**Massive Performance Leap**
- up to 10–50x faster on training and inference
- model held inside the processor
- 100x memory bandwidth

**Much More Flexible**
- every network type supported efficiently
- small batch size for fewer epochs
- latency reduced by over 10x

**Easy to Use**
- ML framework support
- Poplar® software stack

AlexNet network visualization from POPLAR®
**IPU-POD Switched Ethernet Approach**

**IPU-POD Switched Implementation**
- POD64 supports 64K IPUs in a direct rack to rack architecture
- Alternatively 16K GC200 IPUs through a switched architecture
- 4.1 ExaFLOPs FP16.16 (256x 16PFLOPs)
- 1.8 ExaBytes IPU-M2000 Memory (256x 7TB)
- 16 Switch Planes non-redundant
- Additional 16 planes for High Availability
Graphcore IPU Scaleout

**Graphcore IPU Scaleout**

Storage 32x IPU-POD64 Utility

**GC200 Processor**
- 4 IPUs
- 1 PetaFlops

**IPU-M2000 Shelf**
- 64 IPUs
- 16 PetaFlops

**IPU-POD64 Rack**
- 64k IPUs
- 16 ExaFlops

**IPU-POD64k 1024 Racks**
Worldwide Leader in HPC, AI & Quantum
Industries

Data Center & Internet

Research
Higher Education

Automotive

Healthcare

Finance

Trusted IPU exaPOD by Graphcore and Atos.
**Overall Solution**

**512 AI Pflops FP16.16 System**
- 32 IPU-POD64 each based on 16 Graphcore IPU-M2000

**One High Speed Interconnect**
- Arista Ethernet 100GbE
- Fat tree non-blocking topology
- One IPU Compute fabric & one storage/Management fabric

**One Full AI Data Management solution**
- 8x DDN AI400X
- 2.5 PB NVMe
- 384GB/s read, 240GB/s write

**Management Software stack**
- Atos Software management stack
- Atos AI Software for Multi-tenant user service
- Slurm Job Scheduler
Graphcore Benchmarks

State of the art performance with today’s large, complex models

Natural Language Processing - BERT Large: Training

The IPU delivers over 80% faster time-to-train with the BERT language model, training BERT-base in 14.5 hours in an IPU-POD64 system. Estimate of up to ~2x TCO vs leading competitive solution.

![BERT-LARGE Time-to-Train](image)

**NOTES:**
- BERT-Large using Wikipedia dataset + SQuAD 1.1
- POD64 (16x IPU-M2000 Server) using PopART (SDK 1.3.0)| Mixed Precision Ph1 SL=128, Ph2 SL=384.

Computer Vision - EfficientNet-B0: Inference

The Graphcore IPU-M2000 achieves 80x higher throughput and 20x lower latency compared to a leading alternative processor. High throughput at the lowest possible latency is key in many of the important use cases today such as visual search engines and medical imaging.

![EFFICIENTNET-B0: INFERENCE](image)

**NOTES:**
- EfficientNet-B0 | Synthetic Data | headline comparisons using lowest latency
- 1x IPU-M2000 using TensorFlow | FP 16.16 | (SDK 1.3.0+272), Applications Bundle ‘m2000-applications-01’ | Batch size 4 through 144 | Assumes linear scaling
- GPU: 1x V100 (FP32) using TensorFlow & published Google reference. Batch Size 1-32
- A100 results unavailable
AI Supercomputing.

Sharing our knowledge with you

- Building the AI ecosystem
- Speed-up AI production
- Enabling new breakthroughs in AI
- Increase your PRODUCTIVITY
- Explore next gen COMPUTING
- Increase your KNOWLEDGE
The World's Best AI Supercomputer

Trusted IPU exaPOD by Graphcore and Atos

Scalable Servers  Scalable AI  Scalable Storage