



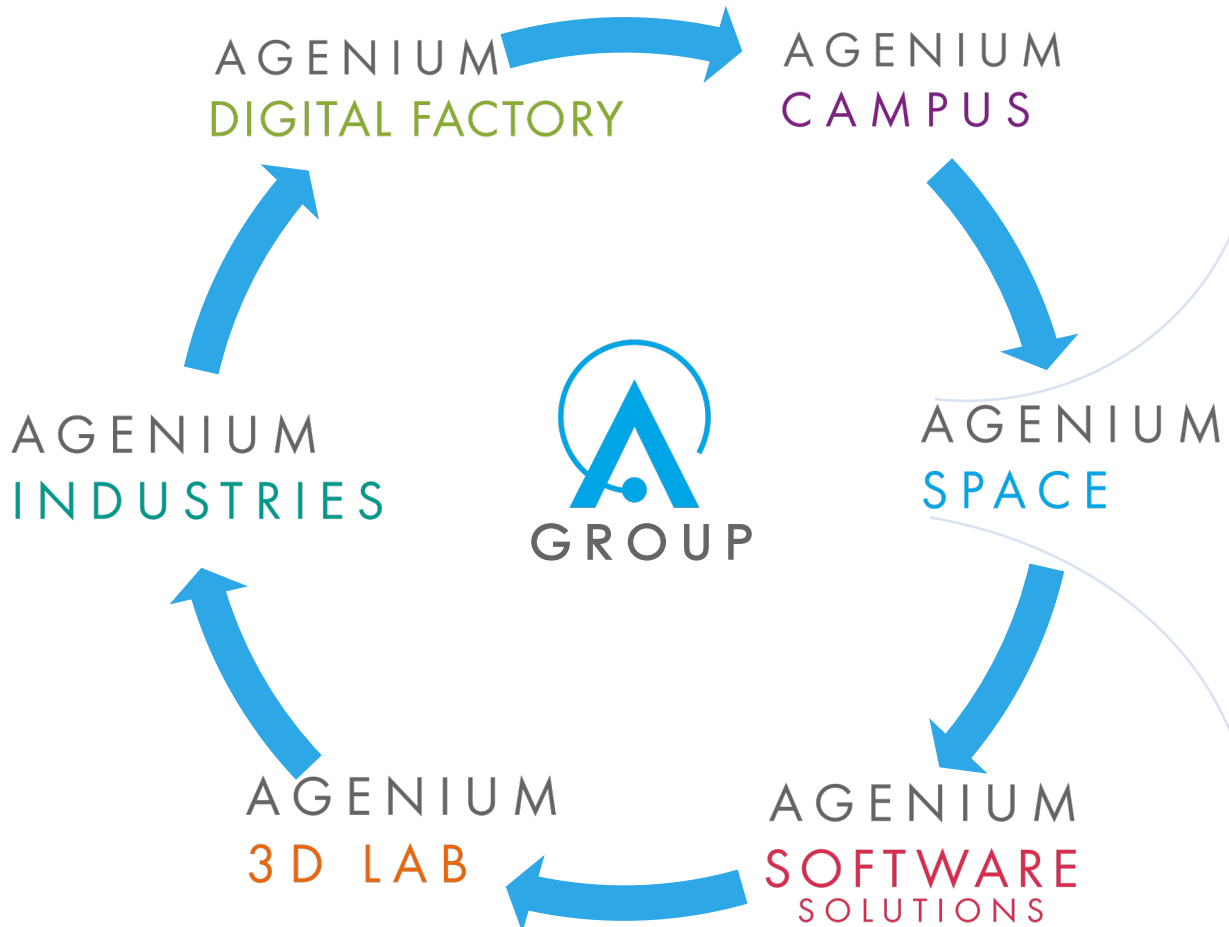
AGENIUM SPACE

We add intelligence to satellites!



COMPANY

International reference in Deep Learning (DL) and Deep Neural Networks (DNN) simplification for DL at the edge



AI challenges participated since 2018:

SpotGeo **1st place!**

<https://kelvins.esa.int/spot-the-geo-satellites/home/>

AIRQuality **2nd place!**

<https://ai4eo.eu/ai4eo-challenge1>

Space Debris, the origin **4th place**

<https://kelvins.esa.int/space-debris-the-origin/home/>

Cloud Cover Detection

Less than 1% gap with the winner

<https://www.drivendata.org/competitions/83/cloud-cover/leaderboard/>

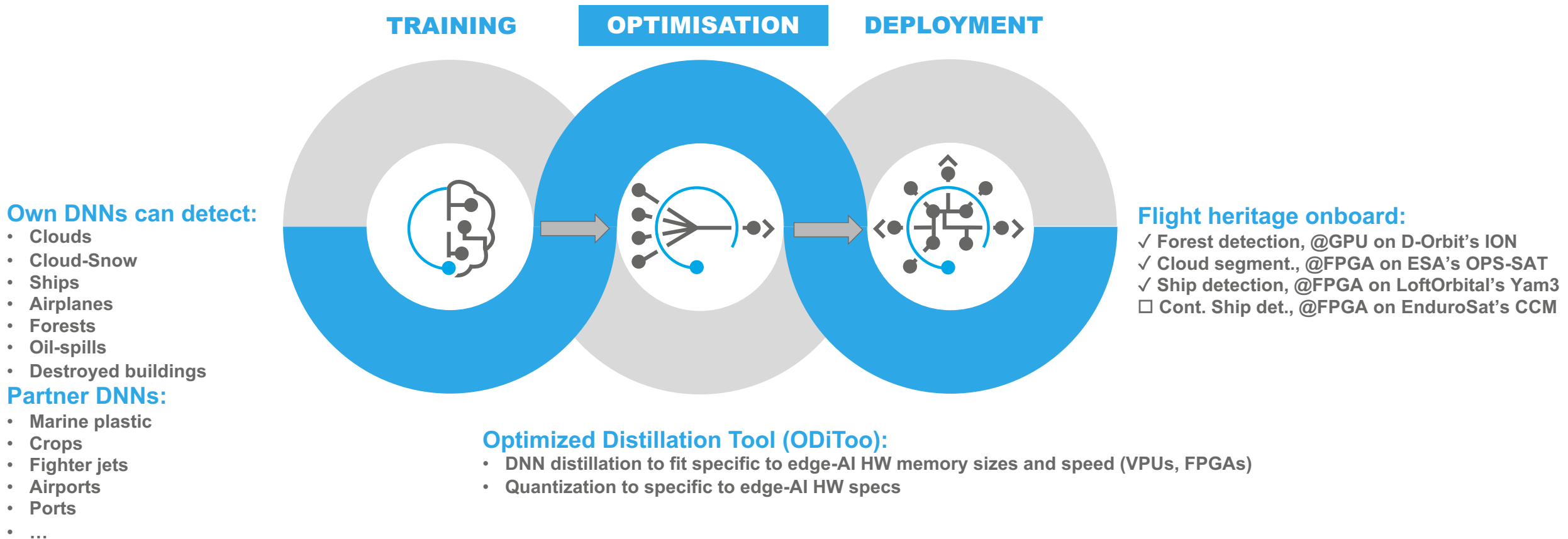


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DNN COMPETENCIES

Mastering full edge-AI deployment chain from training Deep Neural Networks to running them in space



FLIGHT-PROVEN AI

Adapting to customers' needs and HW



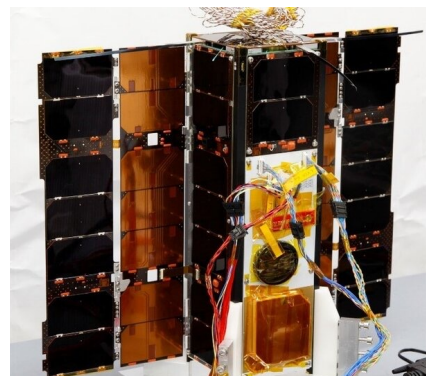
D-Orbit SCV004

- **Accomplishment:** First to demonstrate onboard-ML, followed by AWS, Trillium, etc.
- **Computing HW:** UniBap iX5, AI execution completed on AMD GPU cores
- **Camera:** images were pre-loaded
- **Date:** May'2022



ESA OPS-SAT

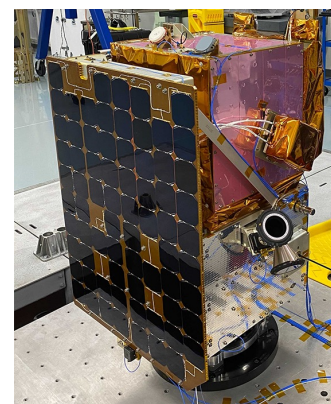
- **Accomplishment:** use of FPGA to accelerate convolution computations for AI.
- **Computing HW:** Altera Cyclone V SoC, with CNNs computed on FPGA and data feed managed on ARM Cortex-A9
- **Camera:** 12MPx, RGB, bivalent
- **Date:** Q4.2022



LOFT ORBITAL

LoftOrbital Yam-3

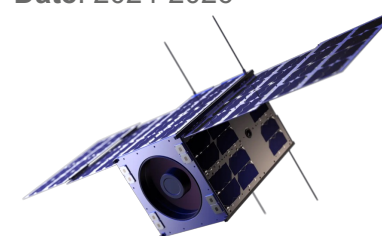
- **Accomplishment:** installation of AI onto already launched satellite, FPGA reconfiguration in flight, updates of DNN in flight.
- **Computing HW:** SoC FPGA with Xilinx Zynq7045
- **Camera:** 12MPx, Monochromatic
- **Date:** Nov.2023



ENDUROSAT

EnduroSat Balkan-1&2 ESA Copernicus Contributing Mission

- **Accomplishment-1 (ESA Copernicus Contributing Mission):** Continuous scanning of oceans for ships
- **Accomplishment-2 (Edge-SpAlce – Horizon Europe 2023):** Continuous scanning of oceans for marine-plastic littering
- **Computing HW:** SoC FPGA with Xilinx Ultrascale+
- **Camera:** 1.5m GSD, multispectral
- **Date:** 2024-2026



END-to-END EDGE-AI SOLUTION

Helping customer to build edge-AI solution in space



PLATFORM SELECTION

- Guiding to choose the right HW platform and SW framework for target App.
- Multi-platform: include wide range of on-board CPUs, GPUs, VPUs, FPGAs.



DNN SOURCING

- Internal & External sources.
- Various sensor data support: optical, thermal, multi-spectra, hyper-spectral, radar.



DNN TARGETING

- DNN distillation with <5% attrition for 98% size reduction.
- Application groups: target detection, segmentation, anomaly alarm triggering.



IMPLEMENTATION

- Low-level programming for optimized execution.
- Ground-testing on EM.
- Space-testing in orbit
- In flight service updates as small-size uploads

DNN OPTIMISATION TOOL

Equipping DNN developers with DNN distillation and quantisation tool, without sharing any sensitive data



@AGENIUM [available]

DNN and training data is provided to AGENIUM Space. Then AGENIUM runs reduction and optimisation for customer on AGENIUM's ML high performance computers.



@Customer [ETA Q2.2024]

Secured docker image delivered on a USB-stick to be run at customer's site. Computing options:

- Customer's own high performance machine-learning computer (HPC);
- AGENIUM Space's recommended HPC procured by customer;
- AGENIUM Space's leased HPC, with hard-drive removed after completion.



@Cloud [ETA Q4.2024]

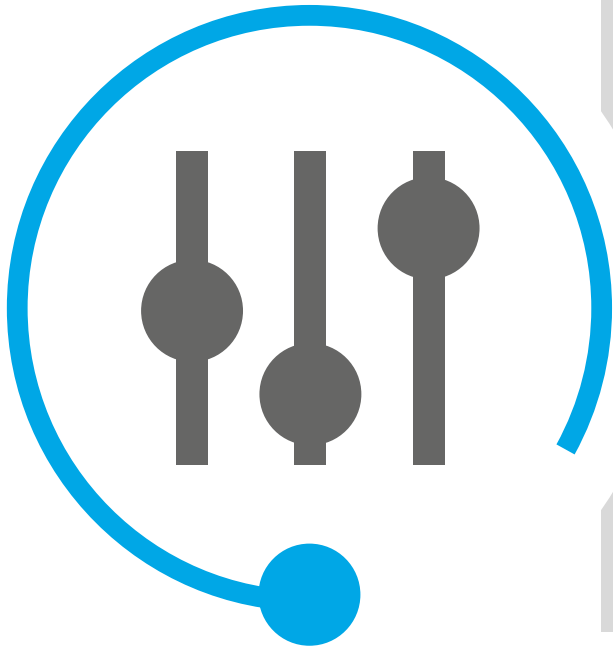
Customer uses AGENIUM Space software on a cloud platform to perform distillation, without disclosing DNN and training data.

Add-On Services

- Specific parametrization of DNN optimisation process according to customer needs.
- Adaptation of reduced-DNN & execution SW to a specific target platform (e.g. XILINX Ultrascale+ ZU9EG, Myriad X, etc.)
- Consulting for DNN source and DNN architecture improvements.
- Distillation algorithm updates optimized for specific type of data.
- Analysis of optimisation logs remotely.

OPTICAL SYSTEM CALIBRATION

Using AI to increase image quality for space assets



Sensor Calibration & Validation Activities:

- Dark current & non-uniform field correction for matrix and push-broom sensors (DSNU & PRNU corrections, ETA Q1.2024). Allowing onboard calibration of aging components.
- Automatic optical blur characterization due defocusing optics (ETA 2025).
- Estimation of satellite attitude from picture and compensation of vibrations making picture more clear for push-broom sensors (ETA 2025).

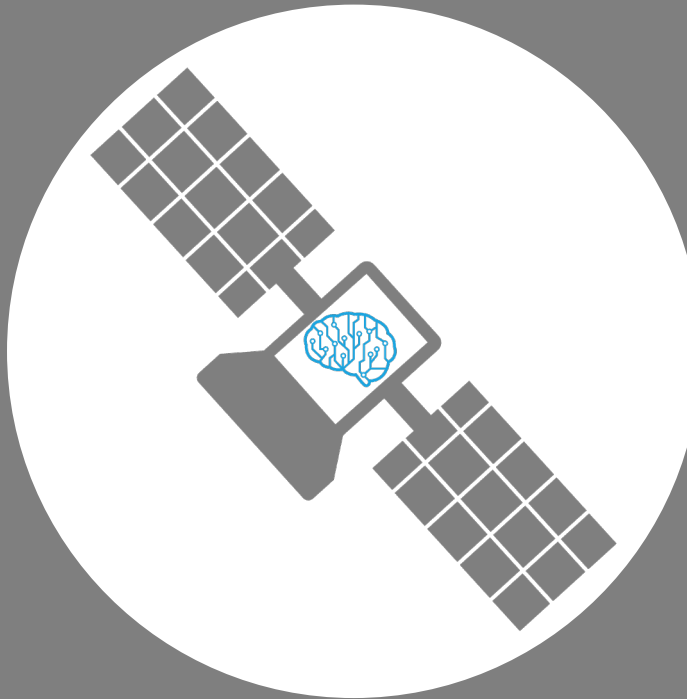
Delivering more precise images with more accurate colours.

CORE BELIEFS

The WHY of our existence



- AI can do analysis faster & more precise
- Edge-AI can productionize & automate analysis



- VAS of EO data is a huge market on the ground, ever growing
- Moving EO's VAS with help of edge-AI to space will give access to extensive data sets and reduce data latency

Edge-AI can do intellectual satellite image processing and advance the space industry

AI SERVICES

Mastering full value-chain for AI in flight



Building DNNs

Relevant data acquisition

Data transformations

Data simulations

Data labelling

External DNN sourcing

DNN training

Optimising DNNs

DNN distillation

DNN quantisation

DNN archit. optimisation

DNN layer optimisation

Deploying DNNs

SW for execution with AI framework

Code optimisation for target HW

Updating DNNs

DNN tuning using actual sensor data

Pre-building apps for target camera/orbit combination

Onboard camera calibration

Onboard pre-processing

SW Support

HW & SatOps Support

Recommendations for AI computing platform selection

Recommendations for SW framework versions

EM-testing for AI deployment

Build

Launch

Operations

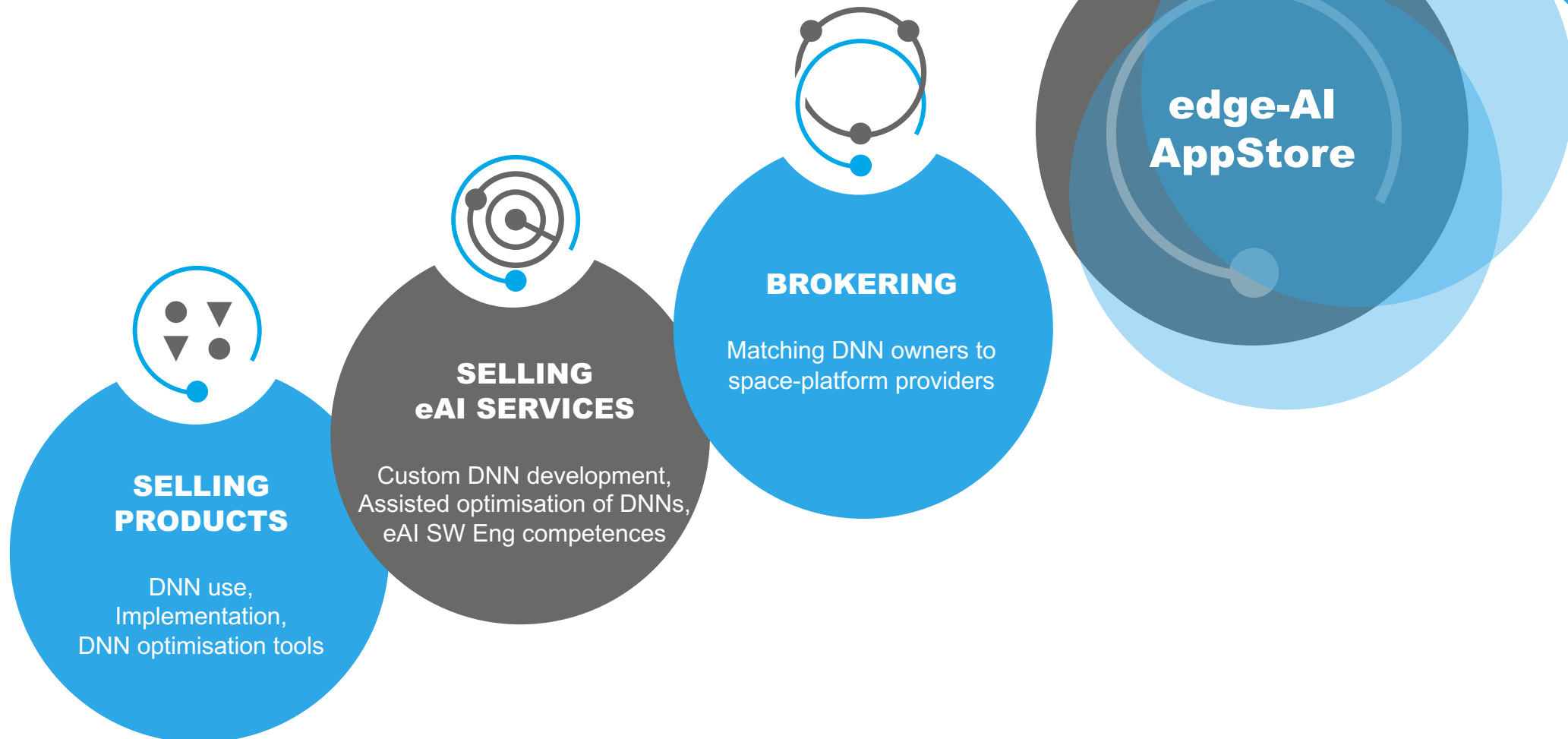
DNN deployment

DNN updating

Constrained execution design

TYPES OF BUSINESS MODELS

Business models we see us going through in coming 10years





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