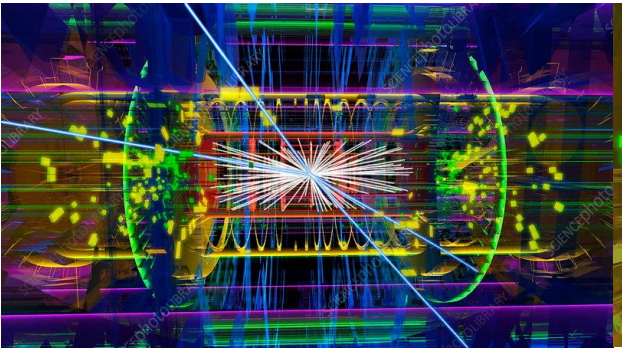
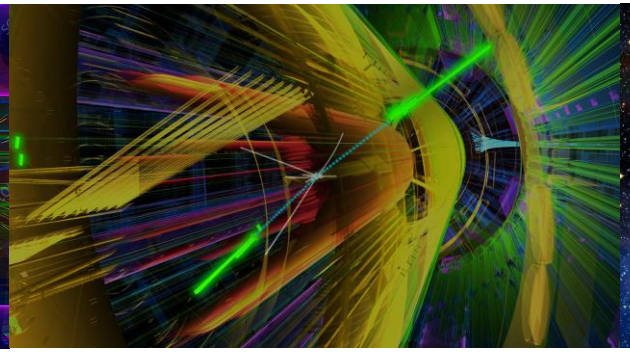
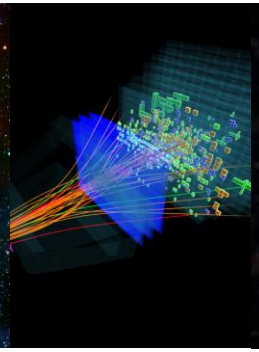
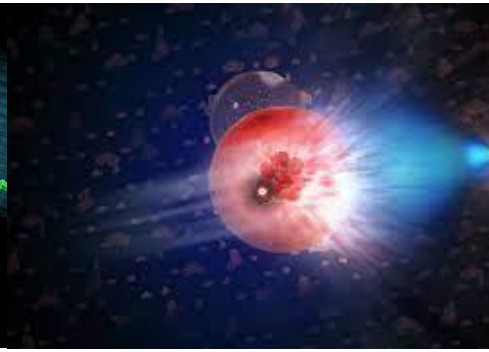
# THINK PHASE 2

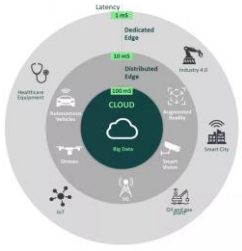



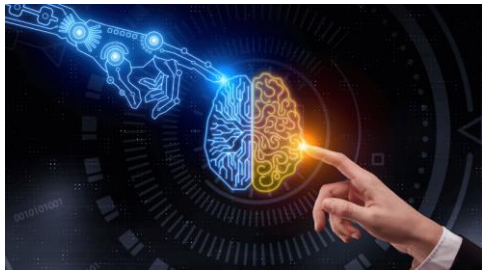



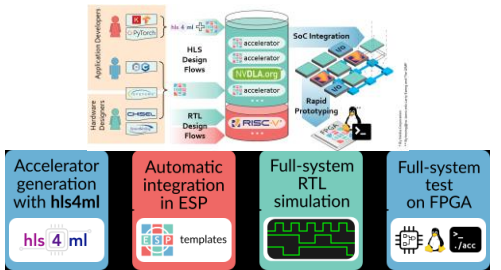
➔Contexte

➔Thèmes

➔ Fiche Projet 2024-2027



# Three mains technics

DATA DRIVEN

COMPUTING DRIVEN

## Supervised Learning

- Makes machine Learn explicitly
- Data with clearly defined output is given
- Direct feedback is given
- Predicts outcome/future
- Resolves classification and regression problems


## Unsupervised Learning

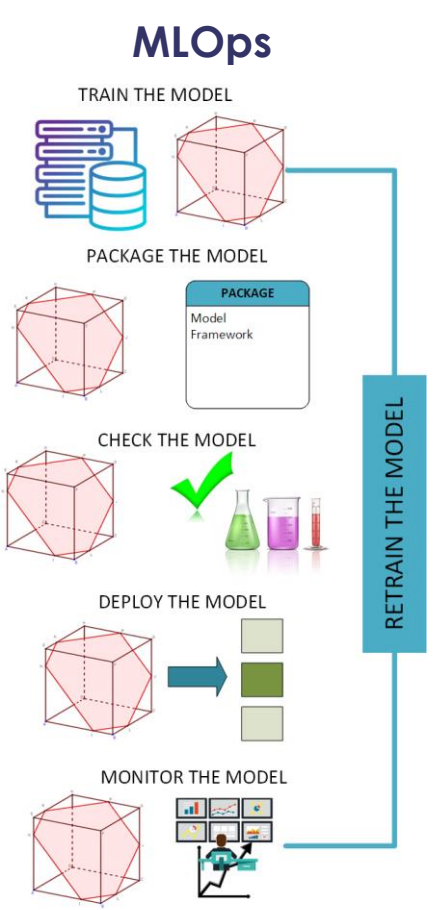
- Machines understands the data (Identifies patterns/ structures)
- Evolution is qualitative or indirect
- Does not predict/find anything specific


## Reinforcement Learning

- An approach to AI
- Reward based learning
- Learning from +ve & +ve reinforcement
- Machine Learns how to act in a certain environment
- To maximize rewards


Embedded System

# Stakesholders ➔ Responsive AI on the Edge




AI-Centric cloud

Big Data firms

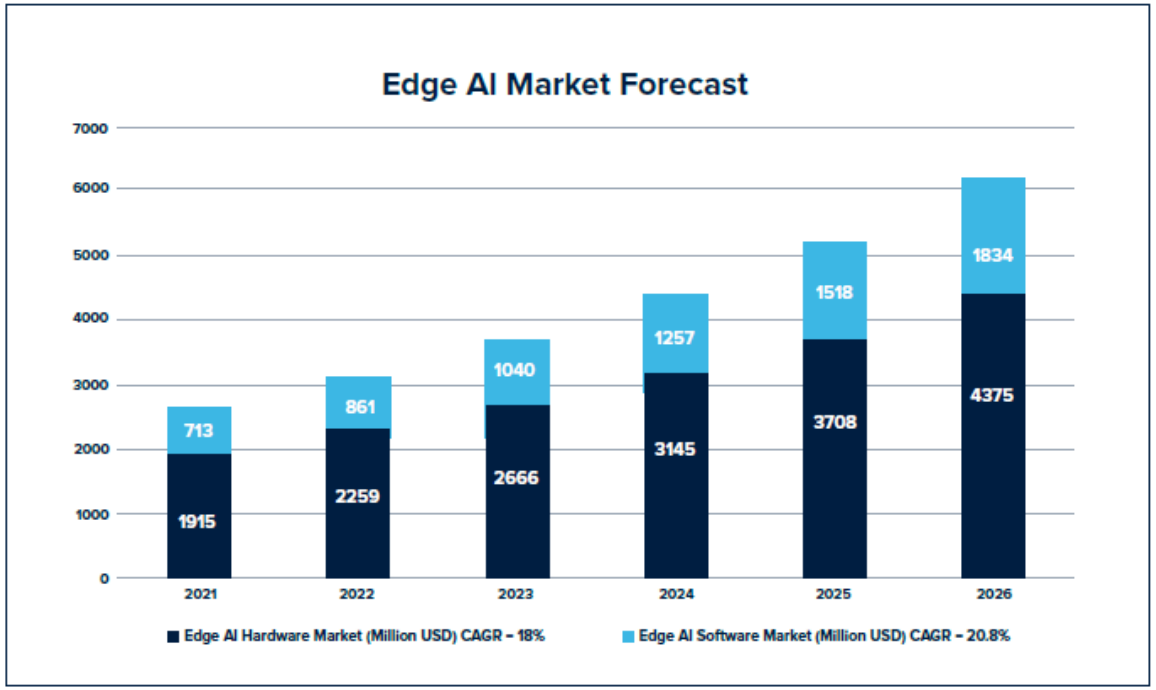
- Hungry in Electrical power
- Hungry in bandwidth
- Hungry in data quality

Migration

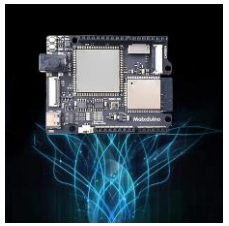
**Embedded components network for edge AI**

New Paradigme

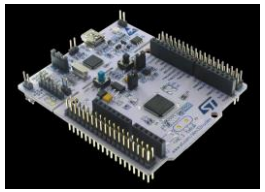
STMicroelectronics 2022



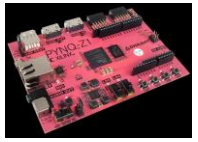

Kendryte K210



STM32 Cube AI




Digilent



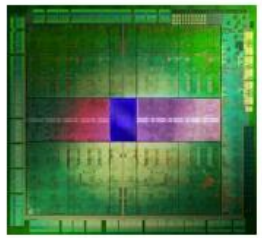
AMD-Xilinx

Intel

# THINK Technologies Selection

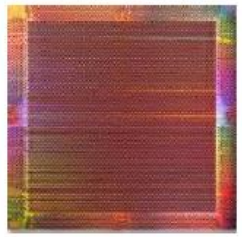
CPUs

**MPPA**



GPUs

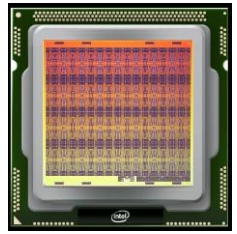
nVidia

FPGAs

*DE10-Agilex*

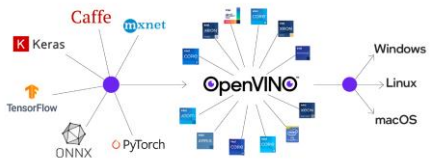
*ZCU102, ZCU104*

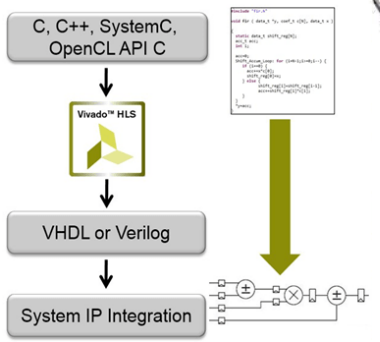


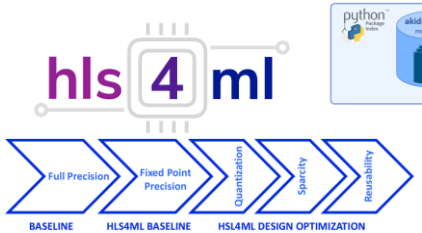
NMC

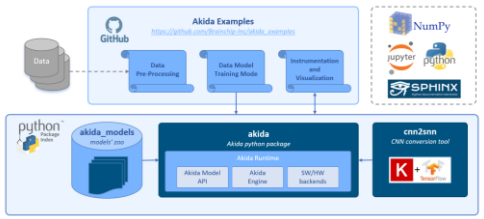
VCK190

https://think.in2p3.fr/

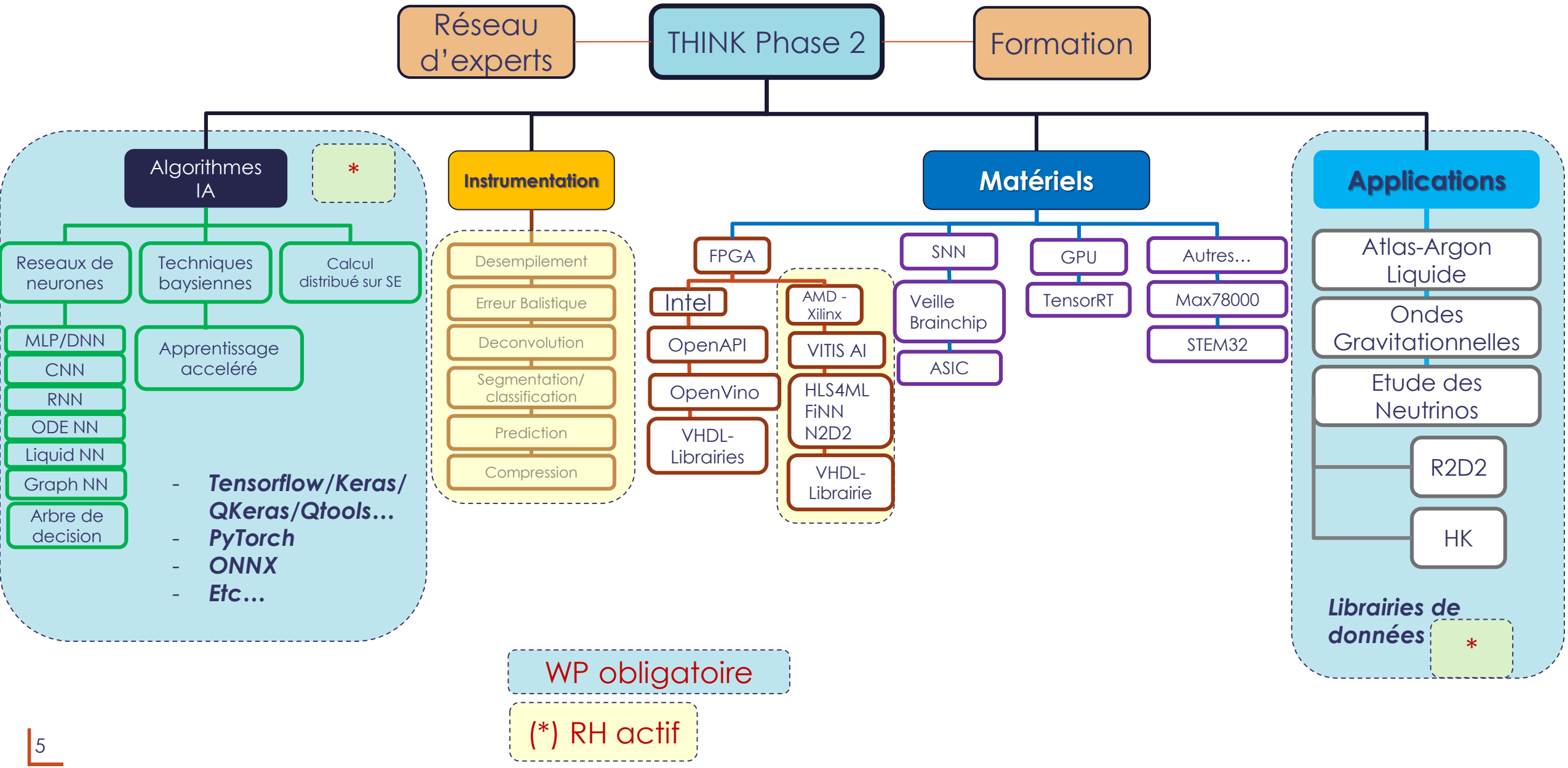



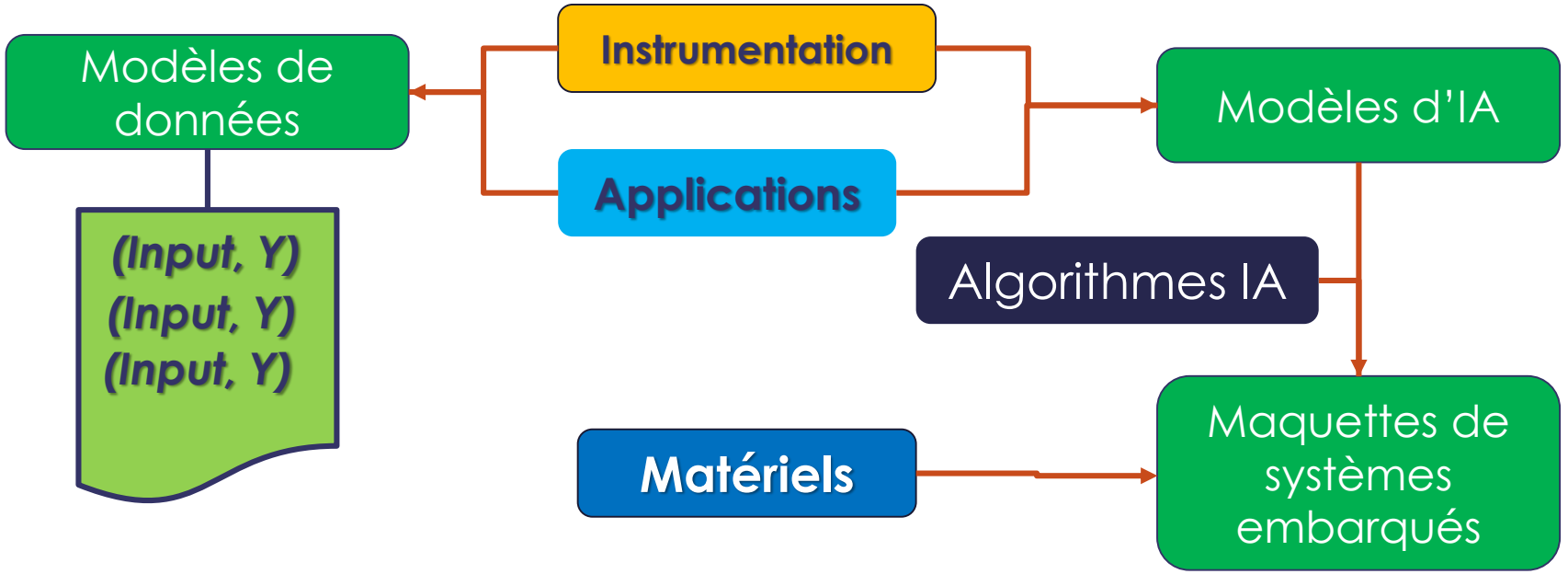



# Thèmes

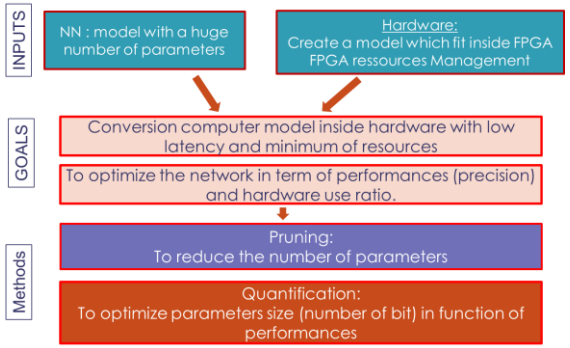

Réseau d'experts
THINK Phase 2
Formation
Algorithmes IA
*
Reseaux de neurones
Techniques baysiennes
Calcul distribué sur SE
MLP/DNN
CNN
RNN
ODE NN
Liquid NN
Graph NN
Arbre de decision
Apprentissage acceléré
- Tensorflow/Keras/ QKeras/Qtools…
- PyTorch
- ONNX
- Etc…
Instrumentation
Desempilement
Erreur Balistique
Deconvolution
Segmentation/ classification
Prediction
Compression
Matériels
FPGA
Intel
OpenAPI
OpenVino
VHDL-Librairies
AMD - Xilinx
VITIS AI
HLS4ML FiNN N2D2
VHDL-Librairie
SNN
Veille Brainchip
ASIC
GPU
TensorRT
Autres…
Max78000
STEM32
Applications
Atlas-Argon Liquide
Ondes Gravitationnelles
Etude des Neutrinos
R2D2
HK
Librairies de données
*
WP obligatoire
(*) RH actif

# Déploiement des thèmes




$$y = f(x, input, \theta)$$

$$y(t) = f(x(t), input(t), \theta, t)$$

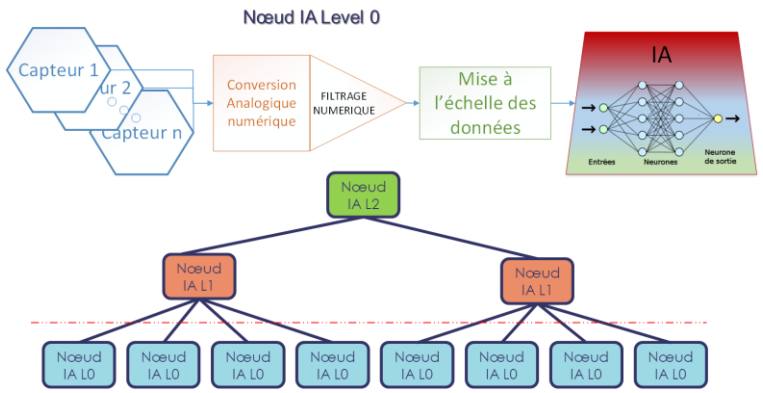


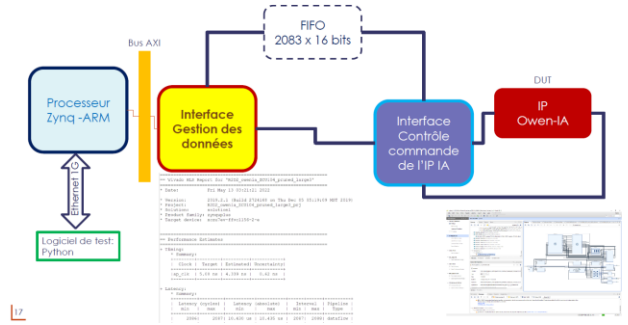

Utilisateurs

**Site Web think.in2p3.fr**

**Site collaboratif OSMOSE**

**Site de versionning GIT**



# challenges of ML

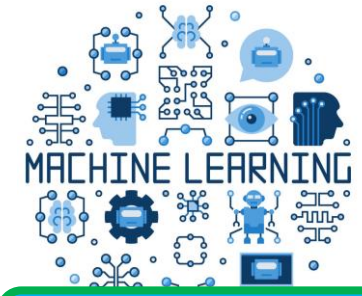
## Roles & competencies

- *Data Physicist*
- *System Engineering team*
- *ML Engineer*
- *Software Engineer*
- *Hardware Engineer*
- *Infra & Security teams*

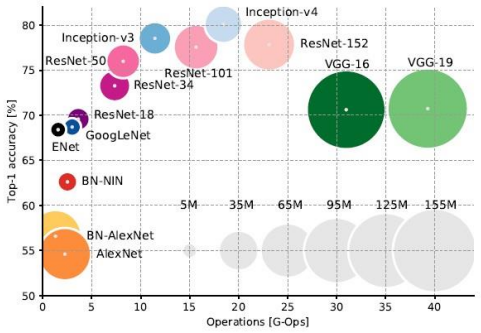
## Tools

- *ML Tools:*
  - *TF-KERAS, PyTorch …*
- *HLS4ML (Xilinx…)*
- *HLS*
- *Brevitas & FiNN(Xilinx)*
- *CONIFER (LLR)*
- *N2D2 (CEA)*
- *VHDL*

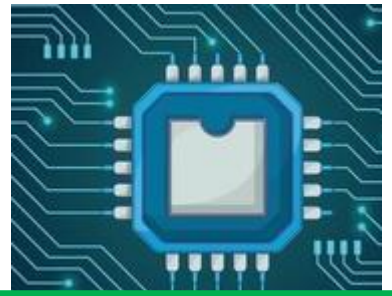
…




## Artefacs & ML zoology




- *Model*
- *Code source…*



## Digital hardware technologies

- *CPU*
- *FPGA SOM*
- *SNN*
- *MPPA*
- *GPU*
- …


## Deployement & Operational AI

- *GitLab/Git*
- *Training Service skew*
- *Model Monitoring*
- *Responsible AI*
- …

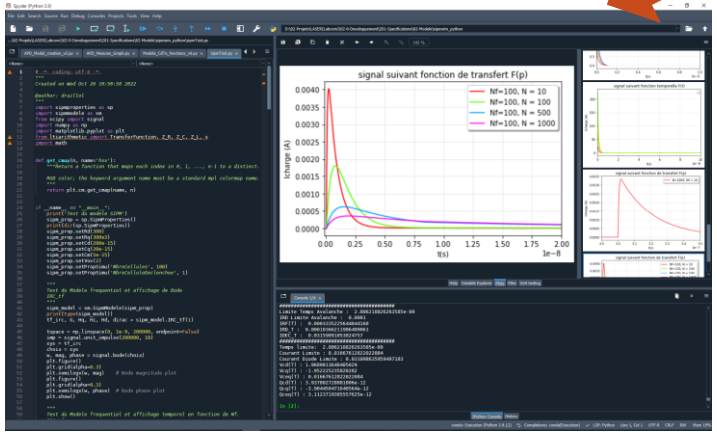
# Modeliser les données avec Python librairies : numpy & scipy

python

NumPy

SciPy

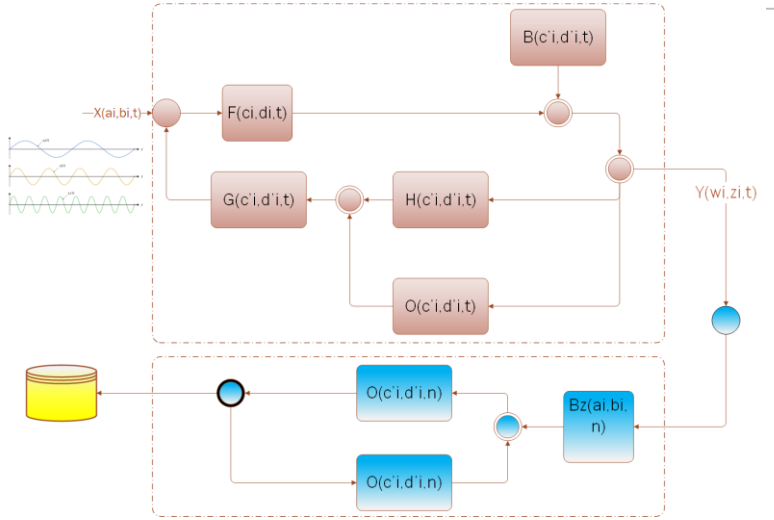
SymPy

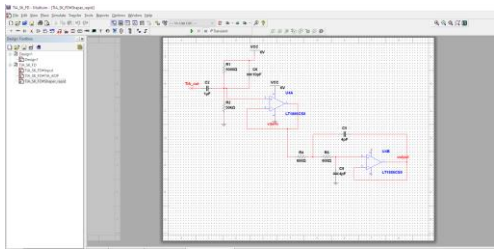




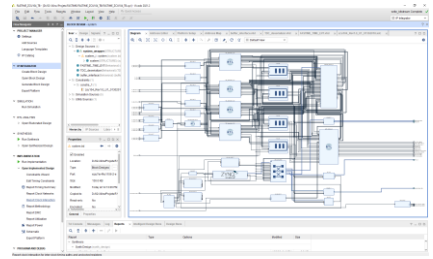
Trouver:

- F(ci;bi,t)
- O(ci,di,n)



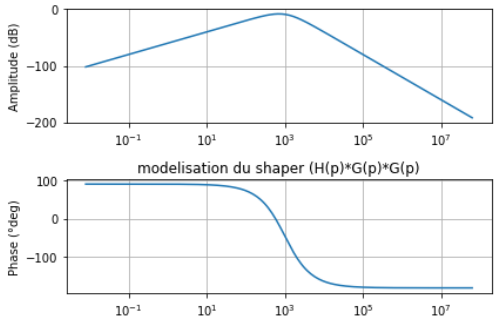



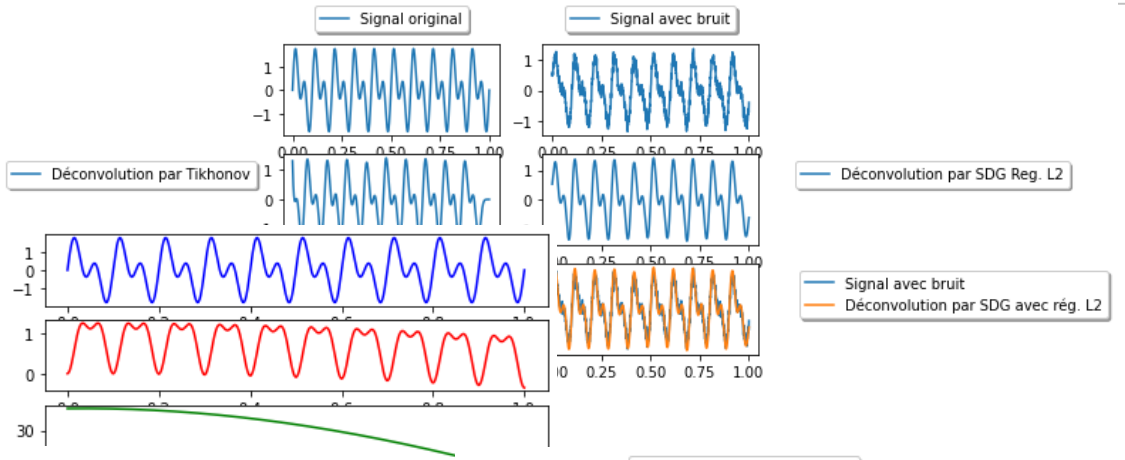
- X(t)
- F(t)
- O(n)
- Y(n)

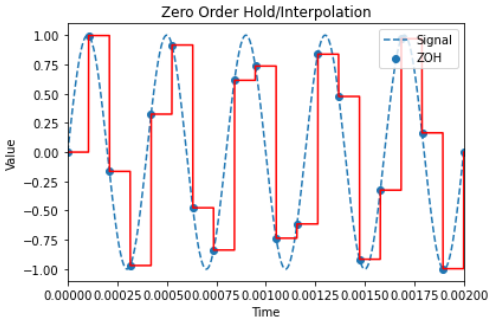


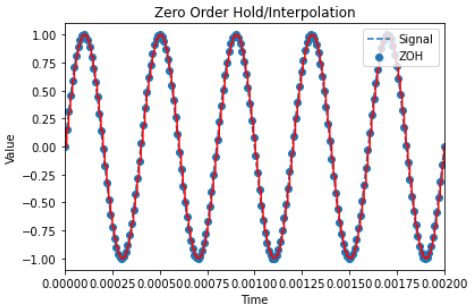
# Créer des données et valider des systèmes

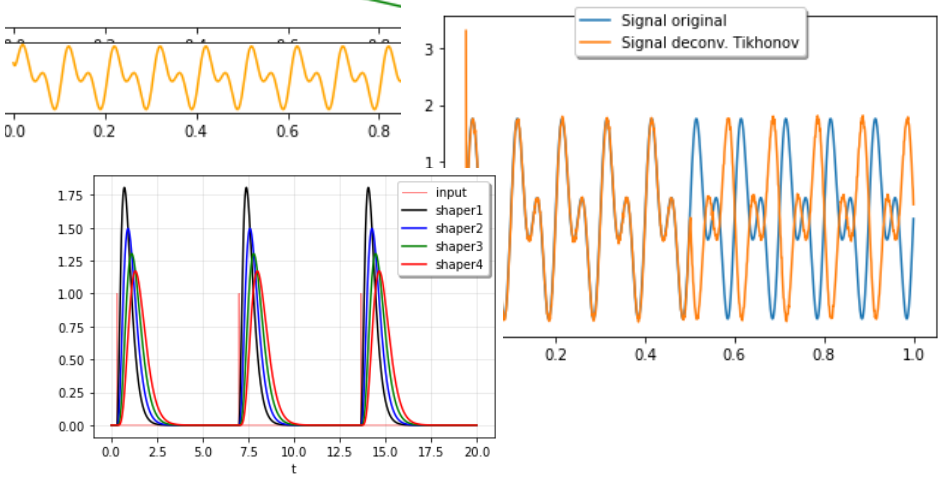
- Chaine de mesure
- Statistiques
- Interpolation
- Déconvolution
  - Descente du gradient



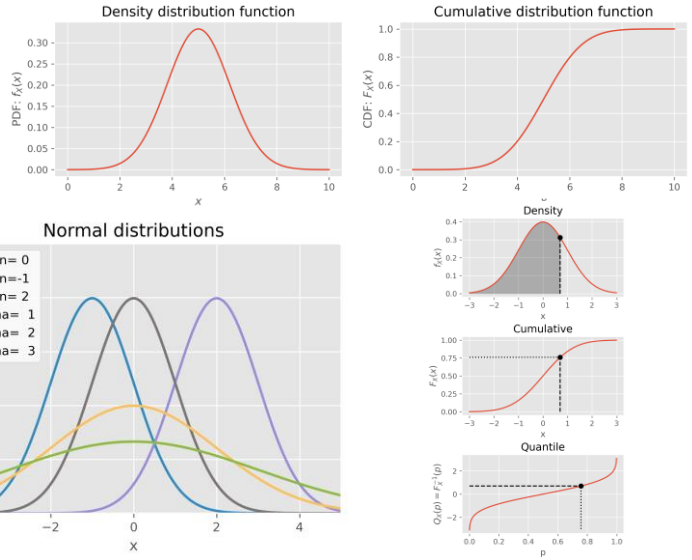



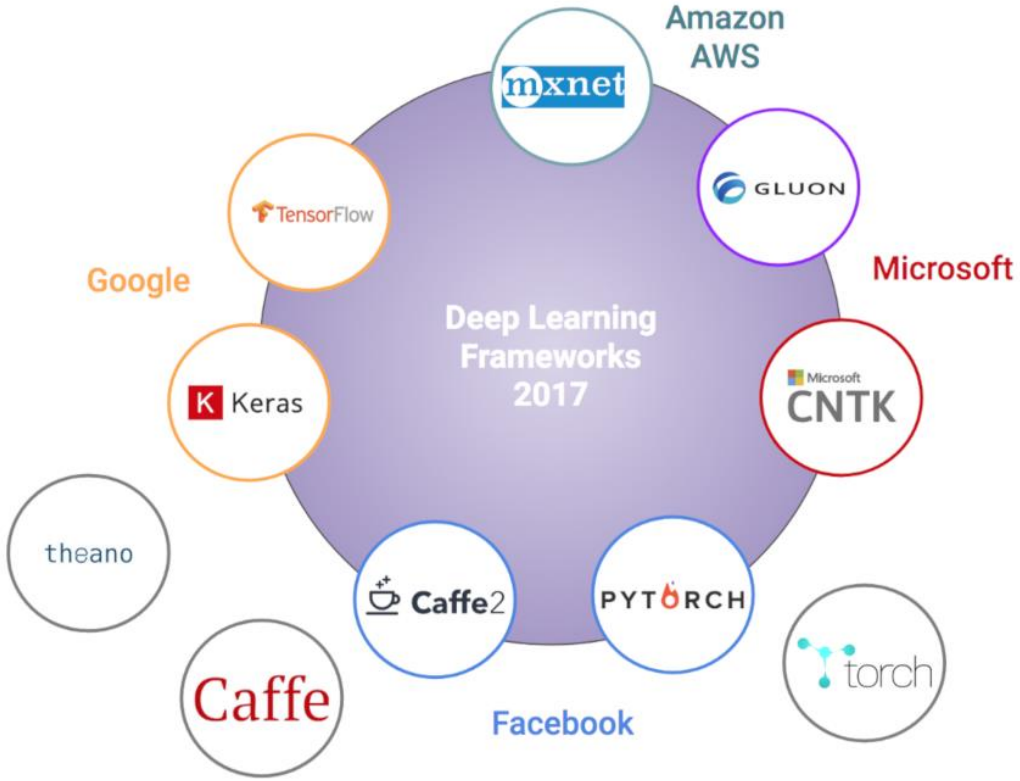



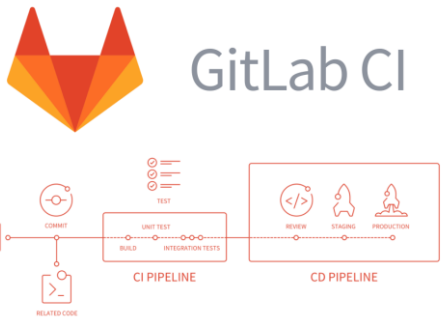




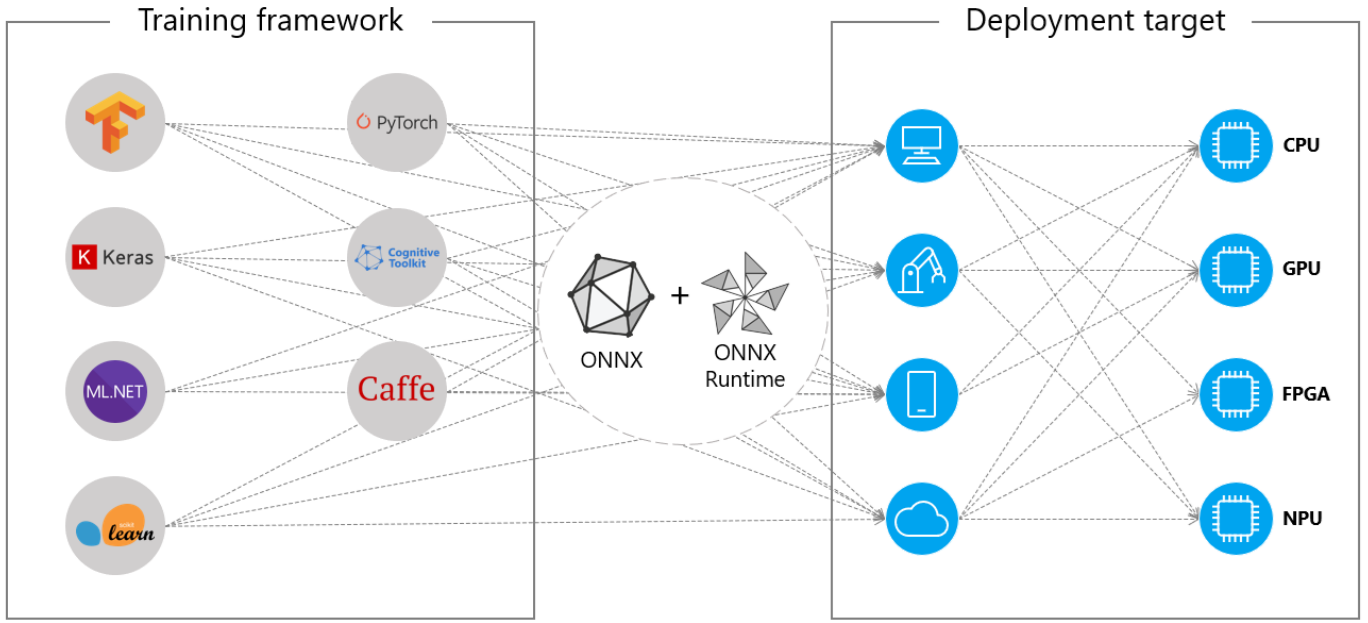


# Les outils



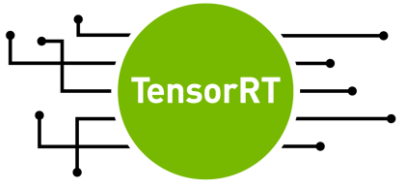




GitLab CI




MODELE ONNX: STANDARD







# Fiche projet à construire

**Construire le projet**

**➔ Construire la fiche projet**

- Objectifs Technologiques
- Cadre Scientifique
- Estimation TRL
- Description du projet
- Description des travaux techniques
- Responsabilités (Qui fait quoi ?)
- Organisation
- Analyse de risques du projet
- Ressources Budgetaires du projet
- Ressources humaines
- Ressources de Calcul
- Calendrier du projet


**LP2I**
**LAPP**
**IP2I**
**GANIL**
**CPPM**
**IJCLab**
**Subatech**
**LLR**
**IPHC**



- *Investir dans des nouveaux composants*
- *Workshops*
- *Développements firmware/software*

# Conclusion

- THINK Phase 1 a débroussaillé la technologie de l'IA embarqué
- THINK phase 2 est le développement de l'IA embarqué pour nos instruments
- THINK veut répondre aux enjeux de la physique à venir
- THINK est multi-usage, multi-technologie
- THINK permet de faire évoluer nos compétences

➔ Plus on sera actif et nombreux, plus on réalisera de thèmes.

➔ engagez-vous pour apporter vos idées

➔ Promouvoir la technologie auprès des physiciens

**Le projet THINK a besoin de vous**

**Réunion RH, Budget et WP le 29 Juin en Visio**