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Energy-performance tradeoffs in high-speed software networks

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Les réseaux du futur : hot topic

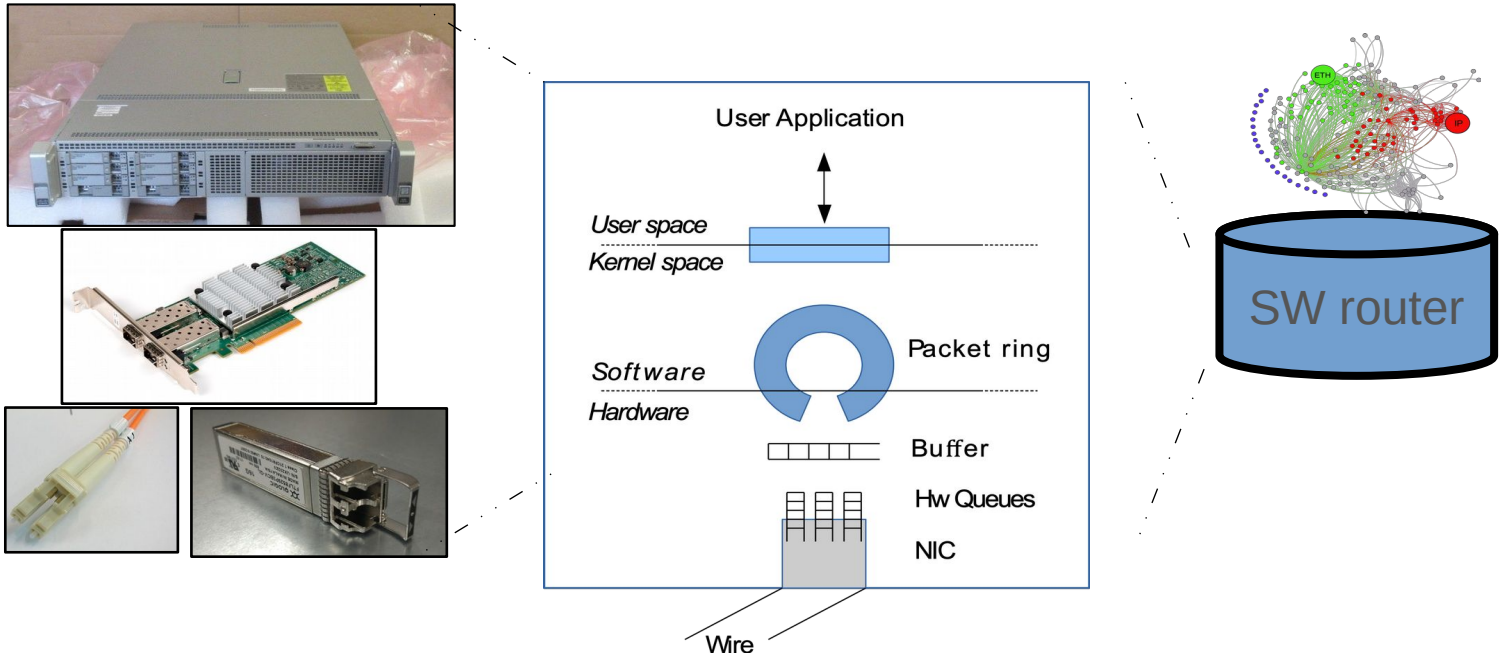
- **Projets et grants nationaux/internationaux**
  - PEPR « réseaux du futur » (5G+, 6G) (Daniel Kofman)
  - PIIEC (Philippe Martins)
  - Grants ANR (**Leonardo Linguaglossa**), ERC (François Baccelli)
- **Chaires et labos communs:**
  - Cisco (Jean-Louis Rougier)
  - SEIDO (EDF) (Jean Leneutre, **Leonardo Linguaglossa**)
  - LINCS (Nokia, SystemX, INRIA, Sorbonne, IMT) (Daniel Kofman)
- **Plateformes de recherche**
  - Plateforme 5G (Réseaux coeur, RAN) Philippe Martins
  - Plateforme Energy4Climate (E4C, IP-Paris) **Leonardo Linguaglossa**

Les sujets de recherche actuels

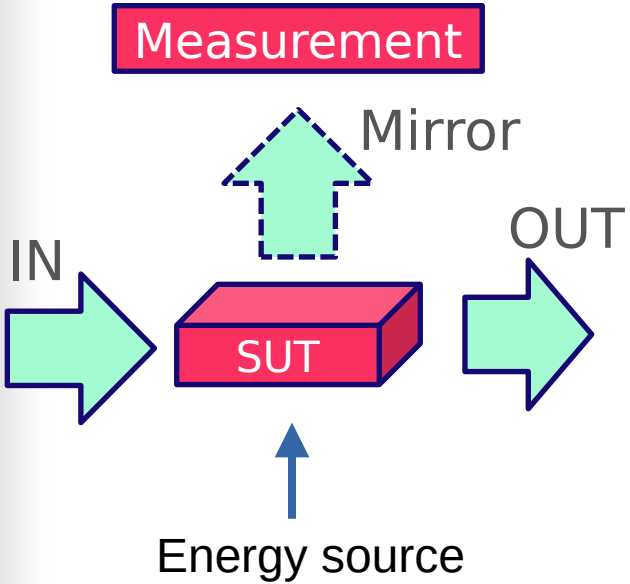
- **Sujets de recherche**
  - Réseaux et communications mobiles, réseaux NTN
  - Internet du futur et Internet de objets
  - Cloud et virtualisation, edge computing, avec des nouveaux modèles d’affaires
  - IA pour les réseaux, IA distribuée
- **Mots clés**
  - Modélisation et analyse de performances
  - Deployment, experimentation, applications (V2X, systèmes cloudifiés)
  - Prototypage/proof of concepts

Le processus de « *network softwarization* »

- Softwarization des réseaux = tradeoff performance/flexibilité



Exemple : network measurement



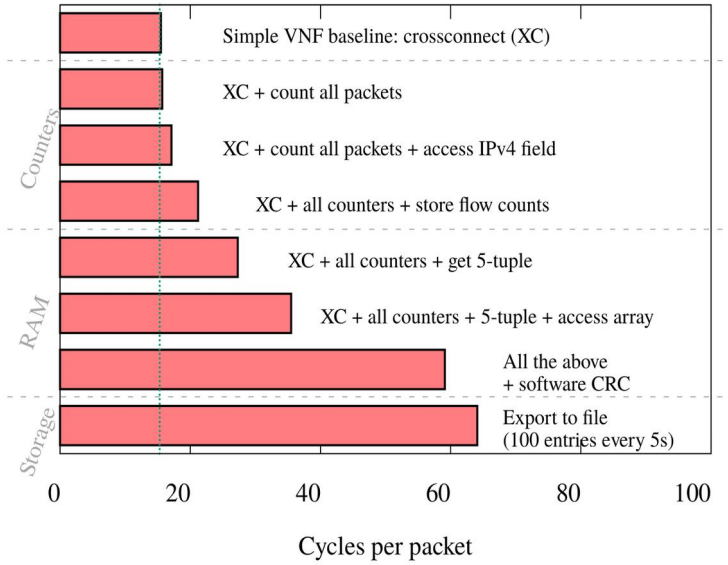
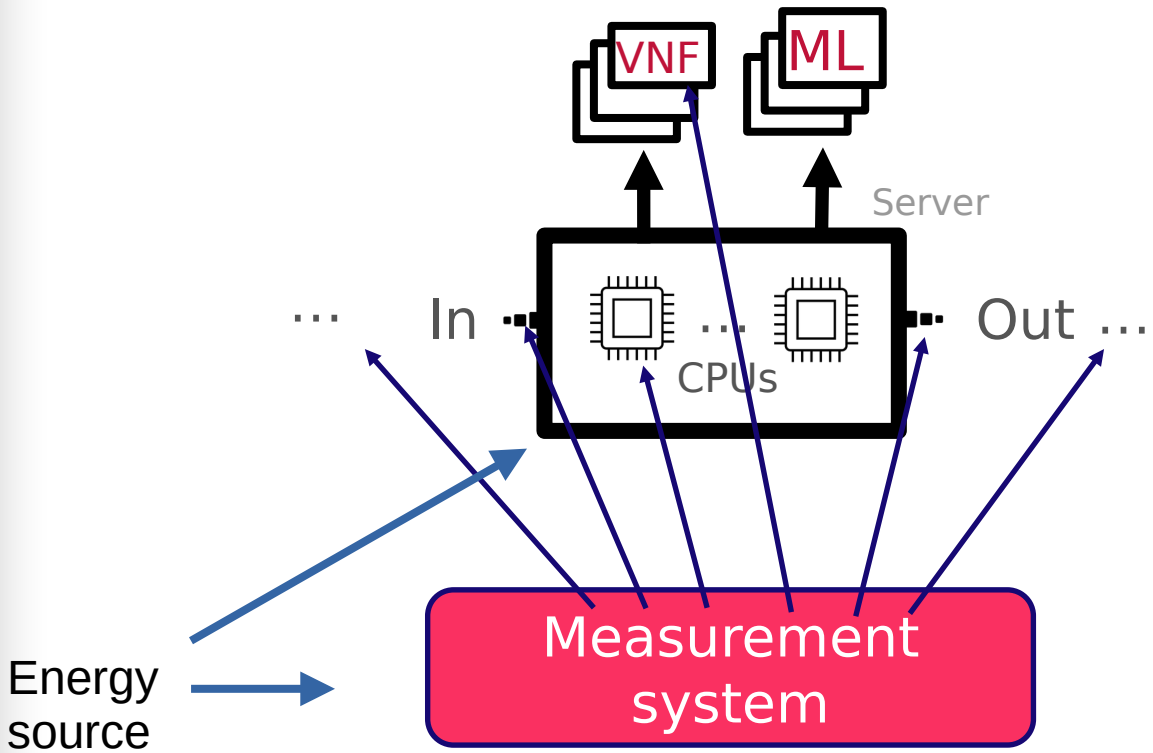
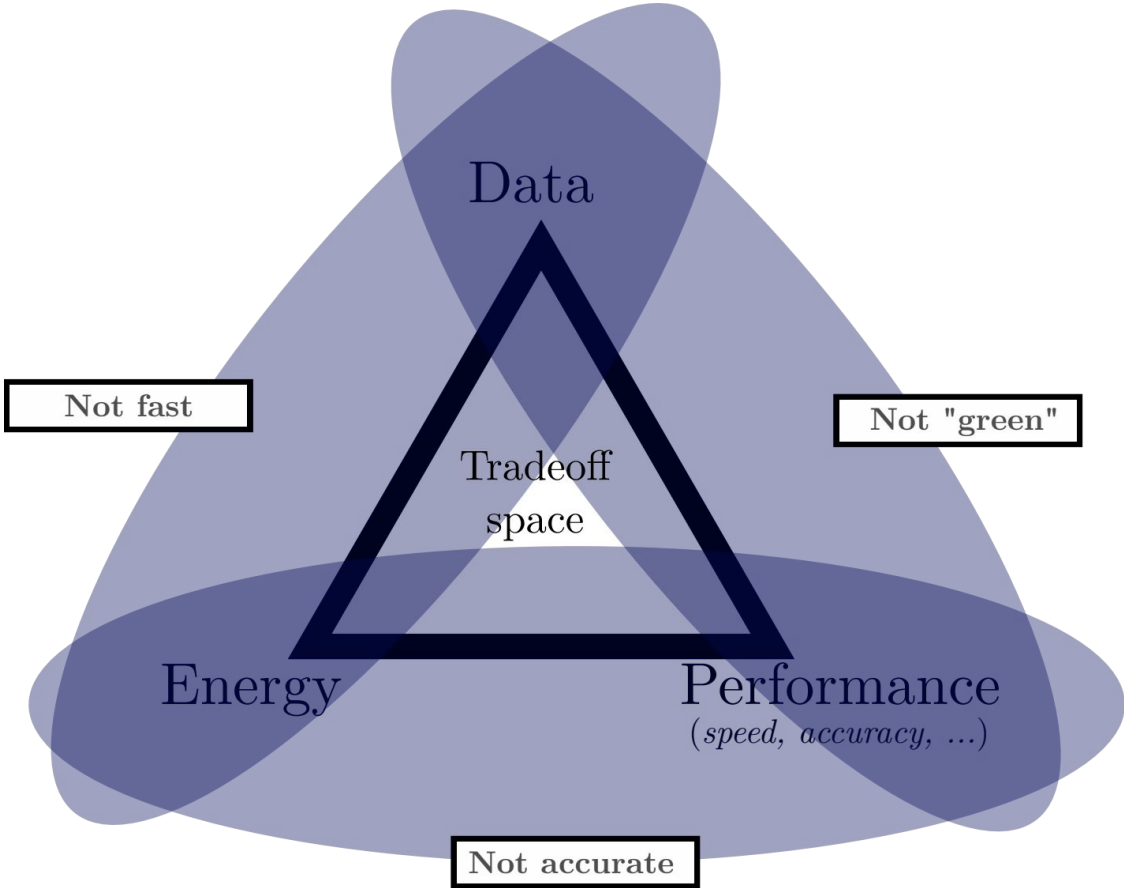


Figure from [TMA2019]

Exemple 2 : Integrated ML



Tradeoffs

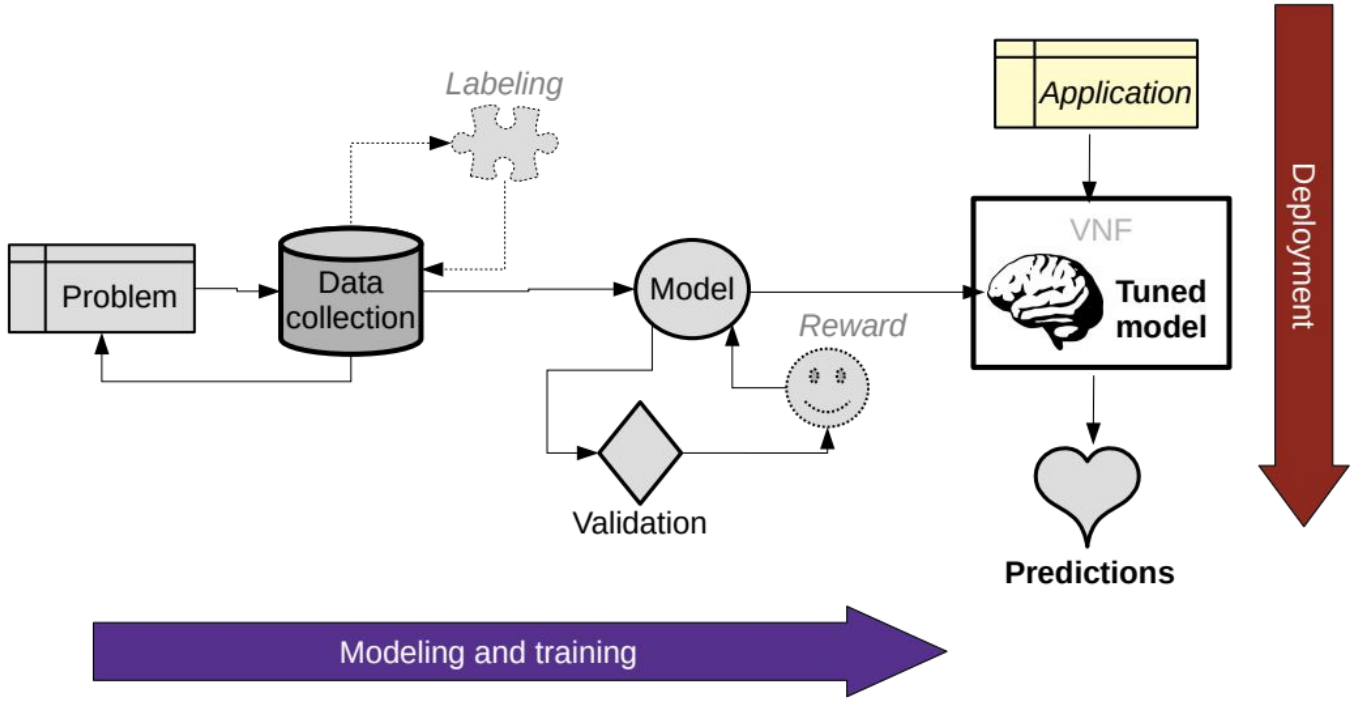

Data
Not fast
Not "green"
Tradeoff
space
Energy
Performance
(speed, accuracy, ...)
Not accurate

Study different approaches for high-speed network computation with limited resources in pure software

- Measurement problem in high-speed software network: uncertainty/observer effects
  - Exploratory project: the **Data uncertainty principle**
  - Conception de techniques de mesure **non-invasives**
  - High-cost / high-gain problem appliqué aux données réseaux
  - Target : highly efficient – highly available – low energy system
- Key ideas: (i) indirect measurements, (ii) simplify the input space, (iii) distribute the knowledge sources
- ANR JCJC
  - 1 Ph.D. student June 2023
  - 3 Internship positions + 1 Post-doc TBA
  - Collaborations académiques/industriels

PROJET FINANCÉ PAR L'ANR - PROJECT FUNDED BY THE ANR

Applications : apprentissage automatique dans les réseaux



Modeling and training can take a large amount of time…
In COTS network system, even after deployment we have strict time constraints!

Thanks

Questions ?