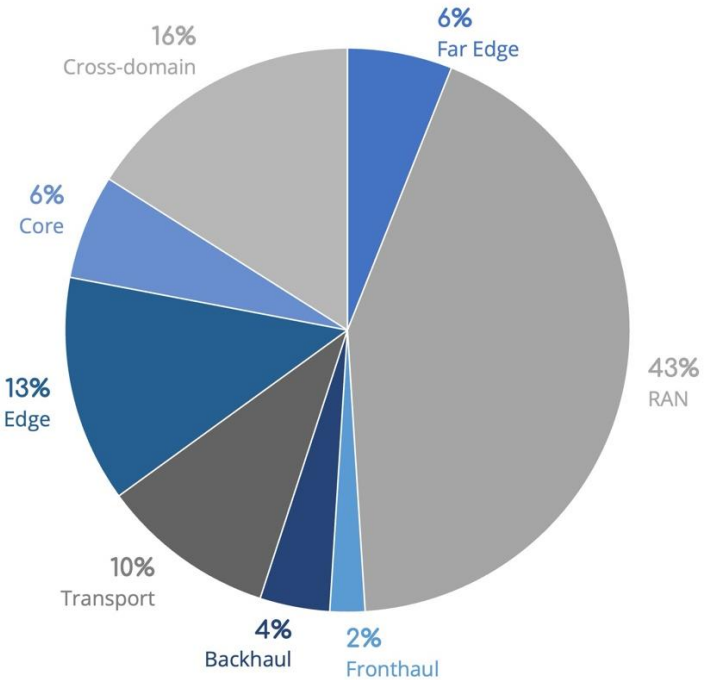
Network segments adressed

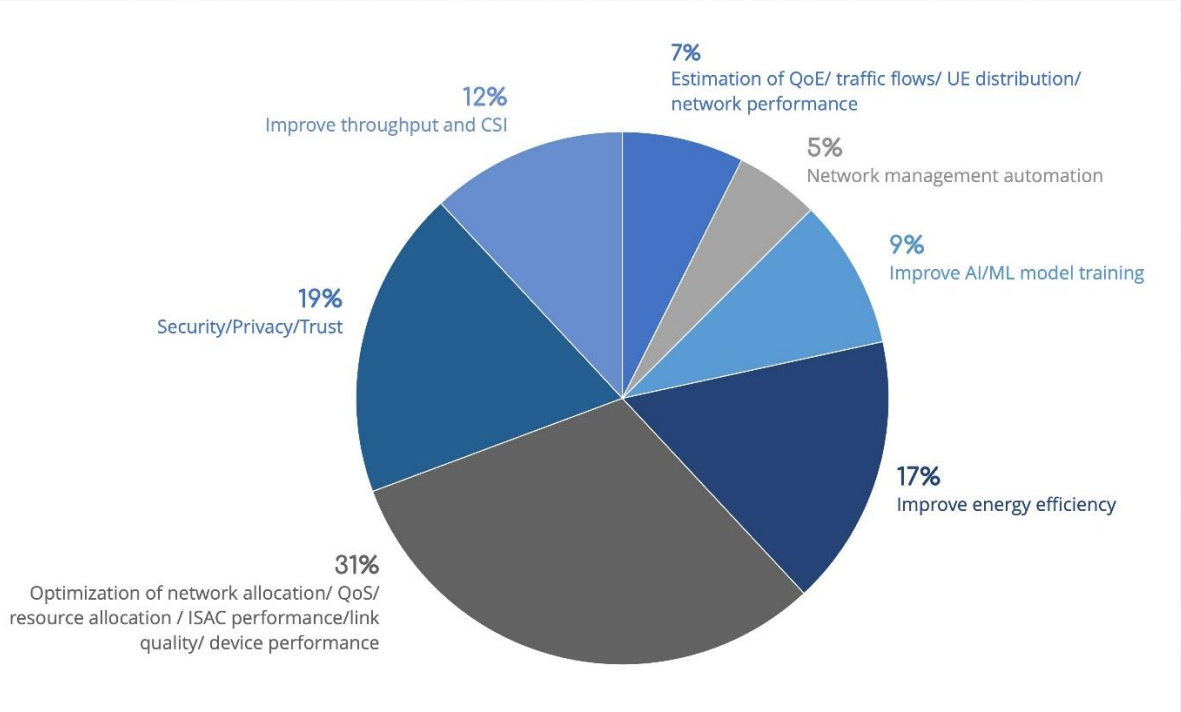
- The network segments where the SNS JU experiments develop AI/ML mechanisms.
- Multiple network segments are considered.
  - Far edge, Radio Access Network (RAN), Fronthaul, Backhaul, Transport, Edge and Core
- RAN has the highest applicability of AI/ML solutions. i.e., 43%
- AI/ML solutions are also applied in cross-domain solutions.

Targeted network segments by AI/ML mechanisms with SNS JU



Goal of AI mechanisms

- The goals of using AI/ML mechanisms in SNS projects span a great variety depending on the key focus area of the project within the scope of 6G development.
- Optimization of network resources, improved energy efficiency & security related topics are the most common goals of AI mechanisms

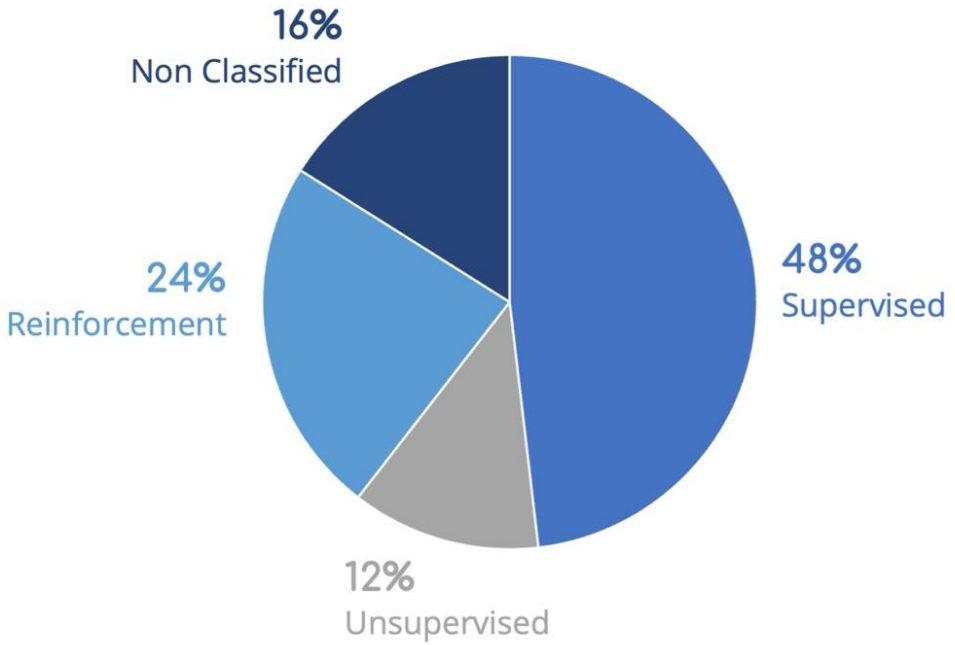


AI Learning types

- AI refers to technologies that enable machines to mimic human intelligence when it comes to decision making and problem solving.
- To achieve this behaviour the Machine Learning (ML) toolbox is used. ML includes the methods (i.e., the algorithms/processes) that enable machines to learn, i.e., to improve them in solving specific tasks with experience
- **Supervised Learning** – Decision Trees, Naive Bayes, Support vector machine, Random forest, Neural Networks, Linear regression, Logistic Regression, and K-Nearest Neighbour
- **Unsupervised Learning** – K-Means, Principal Component Analysis, and Singular Value Decomposition;
- **Reinforcement Learning (RL)** – Policy and value-based RL methods, where value-based ones include Dynamic Programming, Monte Carlo, and Temporal Difference approaches.

AI Learning types

- Study performed for 199 ML solutions from 33 SNS-JU projects.
- Supervised learning is the most used learning mechanism in SNS JU.
- Many well-defined Supervised learning algorithms with available reference implementations justify the preference against the Unsupervised ones.
- Non classified category includes semi-supervised or mixed approaches are adopted.
- The lack of data for training and the dynamic nature of the problems in network segment justify that 24% of the solutions use RL methods



AI/ML Methods

- Overview of the specific AI/ML methods used in SNS-JU projects.
- Supervised learning is the most popular followed by Reinforcement learning
- Neural networks and Deep learning methods are the most popular
- Hybrid methods combine approaches.
- E.g., Large Language Models (LLMs), Generative AI (GAI), use XAI to interpret their decisions or incorporate RL for fine-tuning responses.