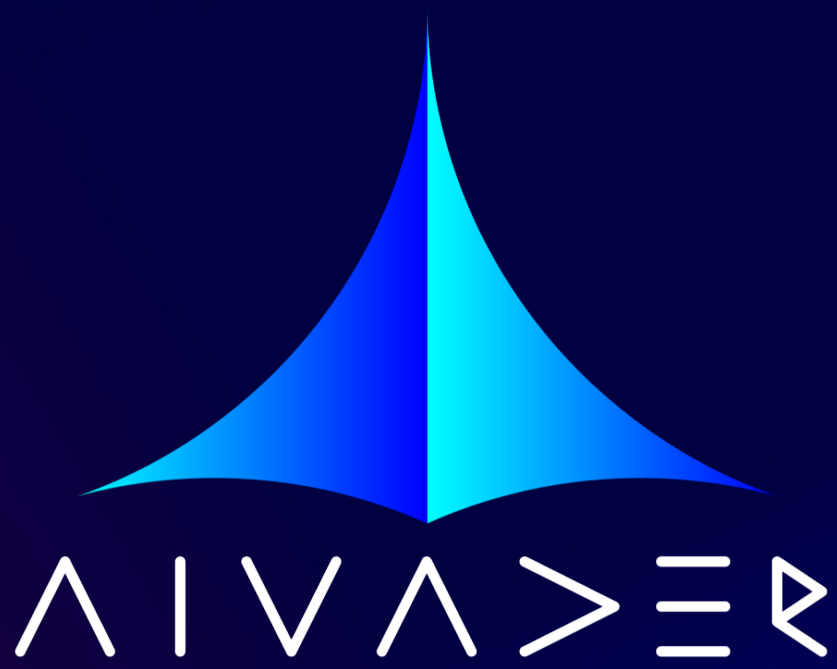
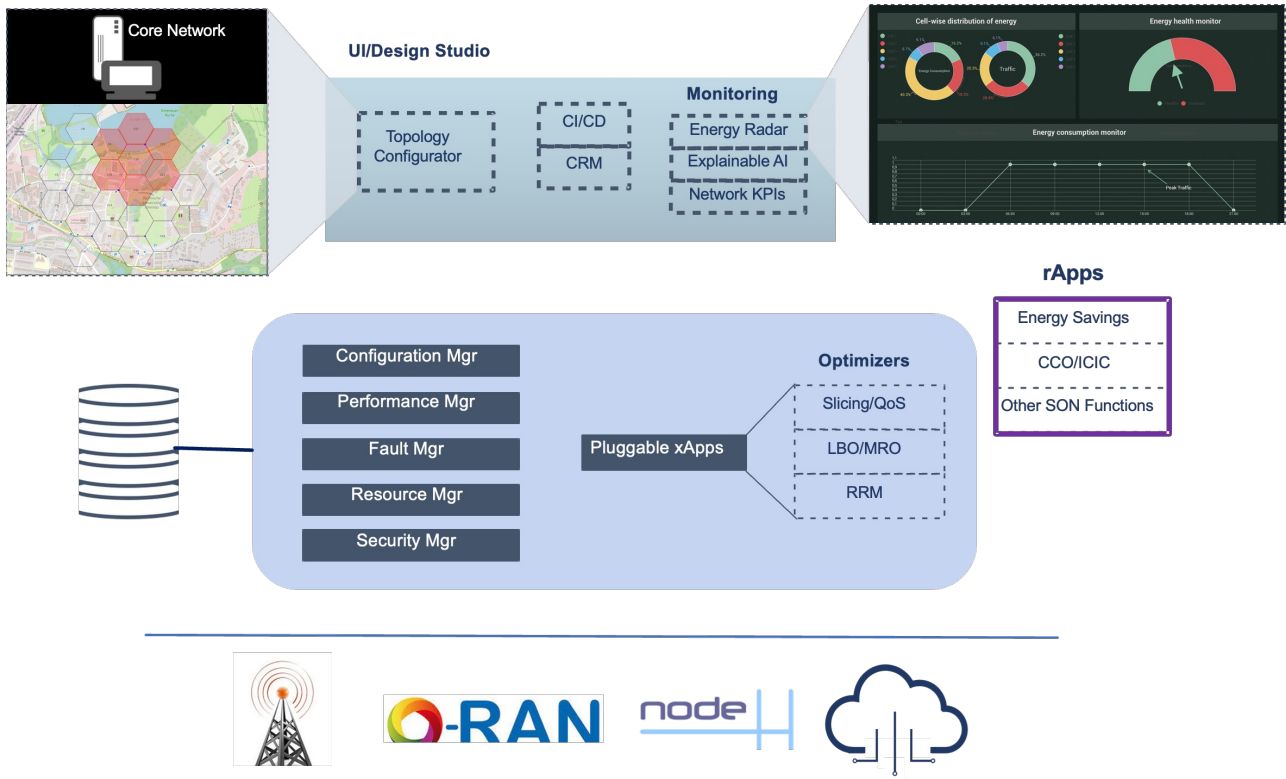


Andreas Mitschele-Thiel, Zubair Shaik

www.aivader.com

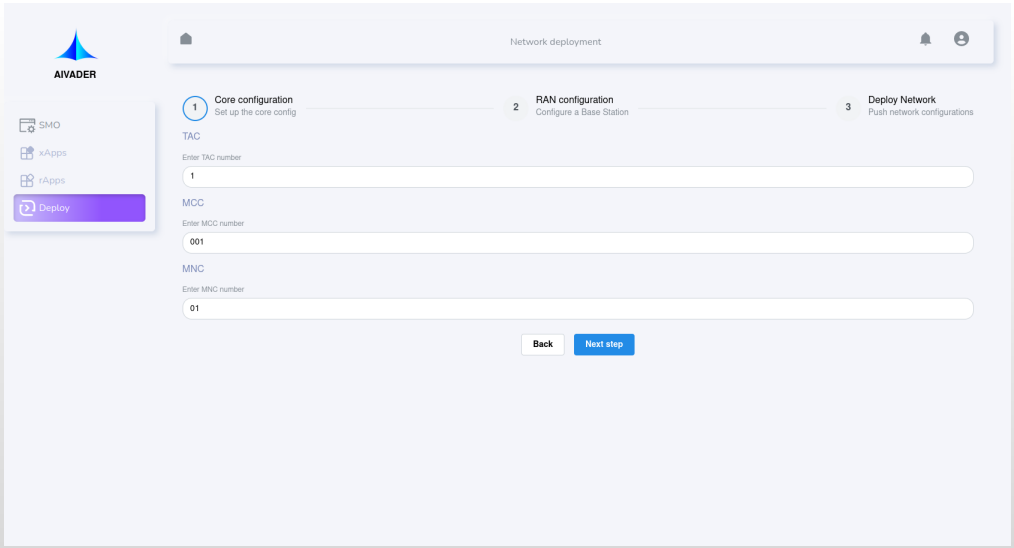
AiVader in a Nutshell

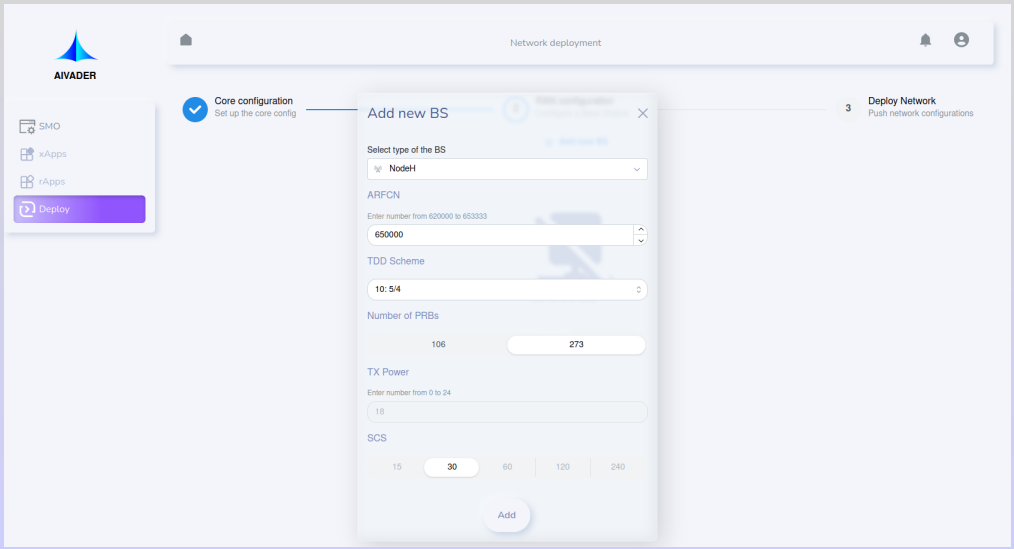
- Spin-off of Integrated Communications Systems (ICS) Group from Technische Universität Ilmenau
- Based in Ilmenau, Germany
- **Solutions**
  - **5G-in-a-box** solution for easy setup of test environments
  - **Ai-Luminos**: SMO for E2E management and orchestration of campus networks
  - **Ai-Savvy**: ML-based SON functions as xApps and rApps
- **Key Expertise**
  - ML-based radio network management (SON)
  - Application of xAI methods to network management chain
  - Prototyping of 5G systems and applications



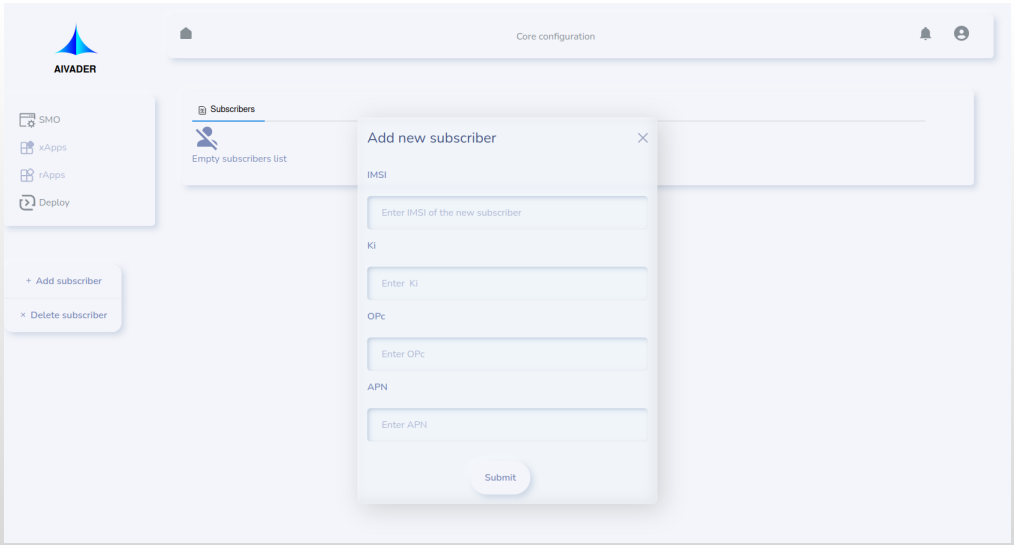
Ai-Luminos: SMO for E2E Management

Deployment and configuration

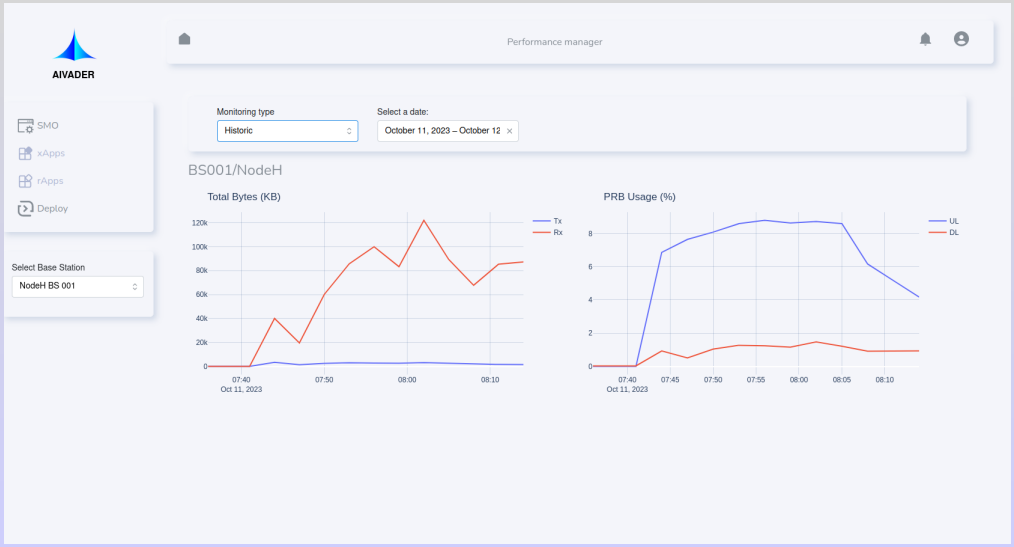




Subscriber management

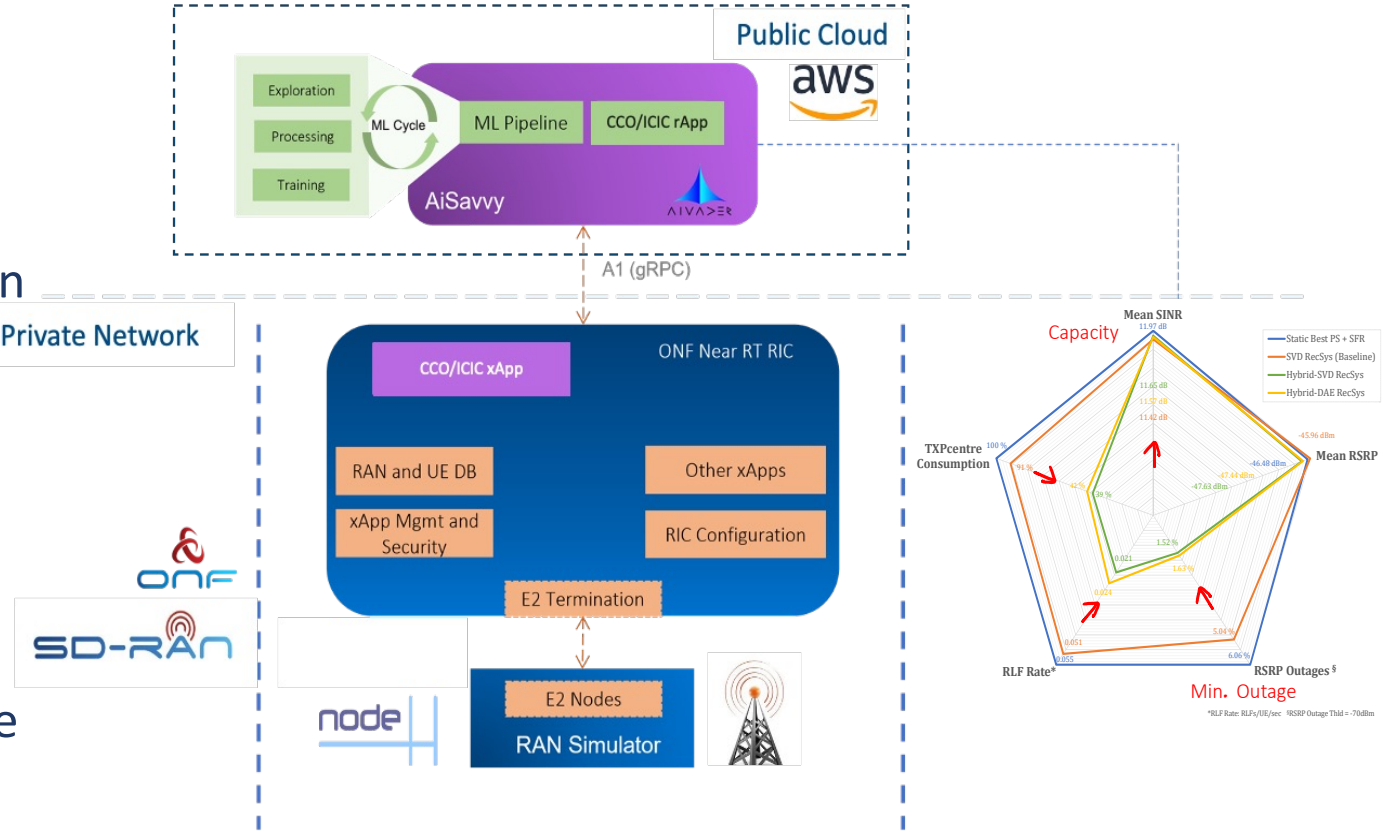


Logging & monitoring

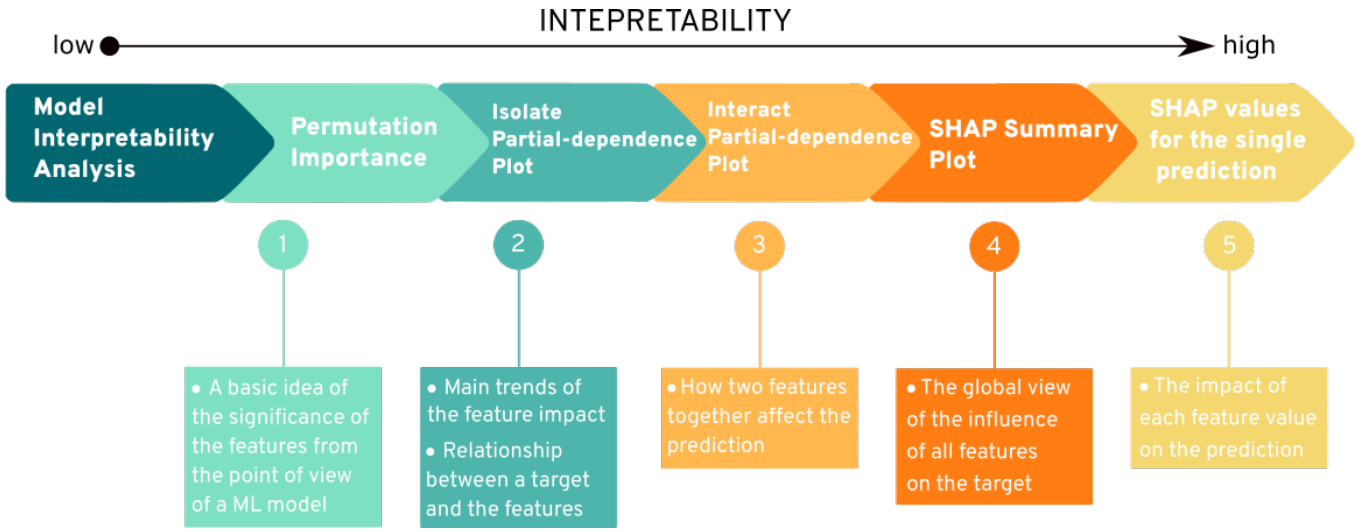


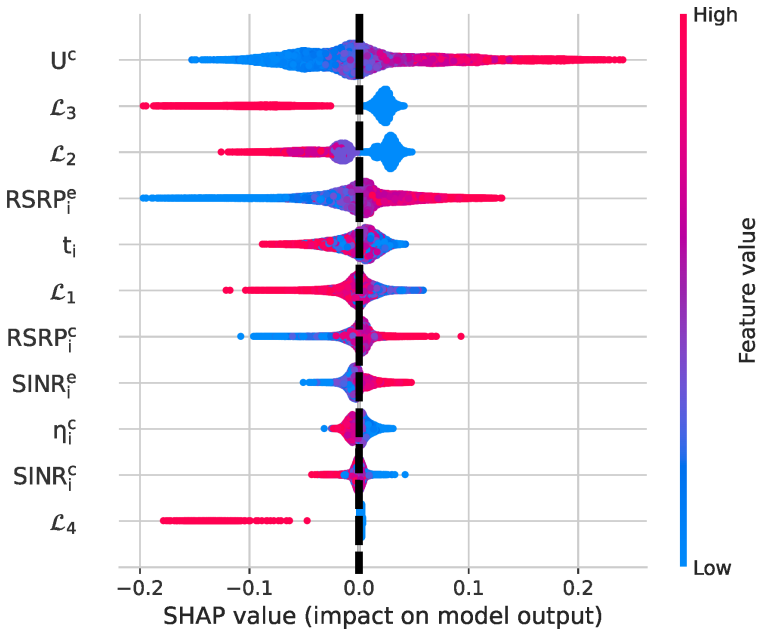
Ai-Savvy: ML-based Network Optimization

- **SON Functions** (rApps and xApps)
  - Coverage, Capacity and Interference Optimization
  - Energy Saving
  - Traffic Steering
  - Network Slicing
  - Mobility and Load Balancing Optimization
- **Tooling**
  - Cloud- and Microservices-based architecture
  - DevOps and MLOps
- **Validation**
  - Ecosystem with commercial, open-source and simulation components
  - OpenRAN-based RIC



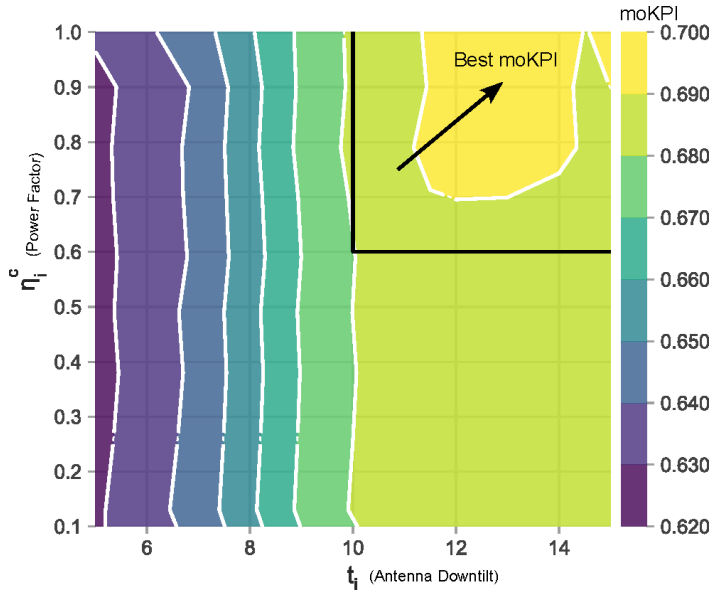
Explainable AI (xAI) Applied to Network Management





U^c: Percentage of center users
t_i: i-th antenna's downtilt
η_i^c: power factor in cell center
$\mathcal{L}_1$: Roamers IF<-60 dBm
$\mathcal{L}_2$: Roamers -60 < IF < -50 dBm
$\mathcal{L}_3$: Roamers -50 < IF < -40 dBm
$\mathcal{L}_4$: Roamers IF>-40 dBm
$RSRP_i^c$: Mean RSRP in cell center
$RSRP_i^e$: Mean RSRP in cell edge
$SINR_i^c$: Mean SINR in cell center
$SINR_i^e$: Mean SINR in cell edge

- xAI to gain a deep understanding of the problem, anomalies, and solution space
- A „computerized tomography" scan of the ML model
- Example: impact of center load, tilt and center power on KPI



KPI Values for High Values of U^c

Reference: F. Nazmetdinov, D. Preciado and A. Mitschele-Thiel, "Trust Me: Explainable ML in Self-Organized Network Management," *2023 IEEE/IFIP Network Operations and Management Symposium* (***NOMS 2023***), Miami, FL, USA, 2023 (**Best Paper Award**).

Projects & Partners

- **5G-KIMA**: AI-based network management of OpenRAN-based campus networks
- **5G-ECOnet**: Energy saving in campus networks
- **FraudDetect**: AI-based detection of fraud in distributed networks for the energy sector
- **6G Campus Ilmenau**: Flexibly expandable campus network with fast packet processing capabilities

MicroNova Software and Systems
Fraunhofer IIS
exceeding solutions innovative. engineering. company.
CUCULUS
nodeH
Technische Universität Ilmenau
Keysight Technologies
vmware
THALES Building a future we can all trust
HMF smart solutions
5G Berlin
(one6G)
ONF
INNONET Innovative Netztechnologien
Bundesministerium für Digitales und Verkehr
Bundesministerium des Innern und für Heimat
Bundesamt für Sicherheit in der Informationstechnik
Freistaat Thüringen
Ministerium für Wirtschaft, Wissenschaft und Digitale Gesellschaft

Thank you!

Contact:
Prof. Dr. Andreas Mitschele-Thiel
Email: mitsch@aivader.de
Phone: +49 178 174 2819

Contact:
M.Sc. Zubair Shaik
Email: Zubair.shaik@aivader.com
Phone: +49 176 434 88799