NOKIA Bell Labs

Beyond 5G and Artificial Intelligence (AI)

Panel

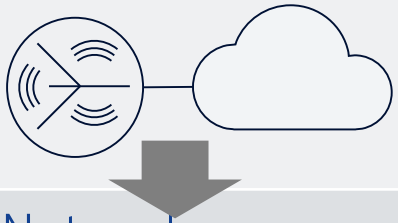
June 21, 2019

Henning Sanneck

Nokia Bell Labs Research, Munich, Germany

Beyond 5G and Artificial Intelligence (AI)

Two guiding scenarios

Use cases	CSP scenario (B5G)	NPN scenario (5G)
Application 	**Remote** (wide area) servicing, Remote emergency assistance (AR/VR/holography)	**Local** I4.0 production lines re-configuration and optimization, incl. AGV* operations
Communication 	**B5G: combined** ultra-reliable, ultra low-latency, ultra high throughput, sliced **public network** connectivity	**5G:** eMBB-, mMTC-, cMTC-sliced **private network** connectivity
Network Automation (NA) 	Optimisation / prediction for **radio** and (ultra) **far edge** (scalable to **wide area**), efficient **human / machine** interface	**Zero touch** reconfig and optimization of **local RAN**, incl. 5G/TSN integration
AI/ML for NA 	**AI/ML „orchestration“ and „platform“** (interfaces, workflows, training, validation). **Cross-layer** optimisation involving RAN and edge cloud	**Fusion** of I4.0 production and network data; **network state** diagnosis / prediction, **transfer learning**

Logistics

Interconnection of local NPNs

*Autonomous Guided Vehicles

Beyond 5G and Artificial Intelligence (AI)

Network Infra → Automation → applied AI/ML

B5G Network Automation (NA): E2E management complexity (distributed data / ML and computing / energy consumption)

- Management of NFs, slices AND context/environment → network states
- Beam configuration and prediction
- ML model distribution and management

NA Applications

NA Platform

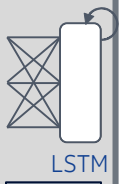
Network Infrastructure

B5G Network Infra:
numerous (indoor) small cells, decomposed RAN functions, highly distributed edge clouds ("fog"), scalable Core

- Ultra dense networks (mmWave → THz radio, narrow beamforming, D2D): extreme, but volatile capacity → multi-connectivity, quality prediction
- ML-enabled PHY/MAC, e.g., channel model learning
- Environment as Network Infra, e.g., smart reconfigurable surfaces
- Dynamic network slicing, e.g., per campus network production line
- AI/ML-specific processing capabilities everywhere

AI/ML for Network Automation:

- Autoencoder, LSTM RNN



- Reinforcement learning
- Distributed learning, Transfer learning
- "Explainable" models → human / machine interface
- "ML platform": orchestration / pipelining, standard interfaces

NOKIA Bell Labs