NOKIA Bell Labs

Dr. Henning Sanneck

Department Head, Network Automation

Nokia Bell Labs, Standardization & Research

NOKIA Bell Labs

AI/ML-Enabled Cognitive Connectivity Infrastructures

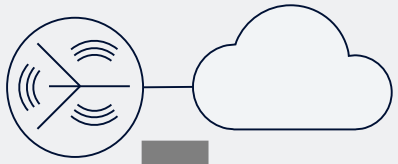
Panel

Henning Sanneck, Janne Ali-Tolppa, Simone Redana

Nokia Bell Labs Standardization & Research, Munich, Germany

AI/ML-Enabled Cognitive Connectivity Infrastructures

Use Cases: two guiding scenarios

Use cases	CSP scenario	NPN scenario
Application 	**Remote** (wide area) servicing, Remote emergency assistance (AR/VR/holography)	**Local** I4.0 production lines re-configuration and optimization, incl. AGV* operations
Communication 	**combined** ultra-reliable, ultra low-latency, ultra high throughput, sliced **public network** connectivity	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

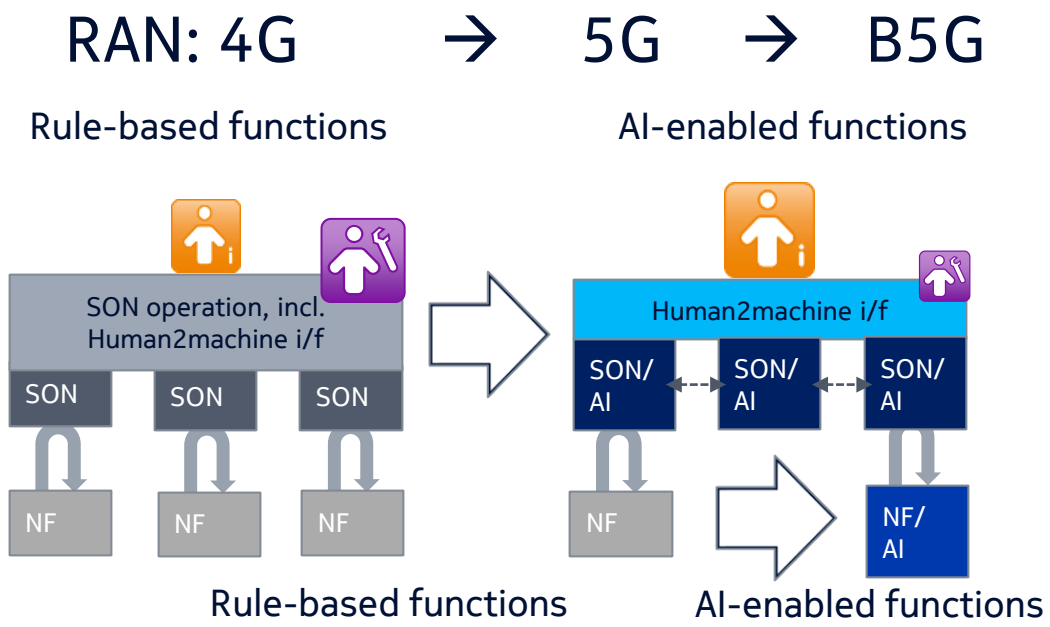
Interconnection of local NPNs

*Autonomous Guided Vehicles

AI/ML-Enabled Cognitive Connectivity Infrastructures

Challenges & Opportunities of AI/ML for Network Automation

- Opportunities / Benefits
  - Adaptation to different deployments / contexts / operating points
  - Exploitation or available data; fusion of network and application data
  - Symbiosis of human operator and machine capability
- Challenges
  - Data: amount / quality; labels; interfaces
  - Choice / adaptation of suitable AI/ML algorithms
  - "AI/ML-friendly"architecture: distributed AI/ML-processing capability, AI/ML orchestration, AI/ML-specific interfaces, integration with legacy / transition
  - "AI/ML-Explainability"; Human factor: combination of telco and data science skills

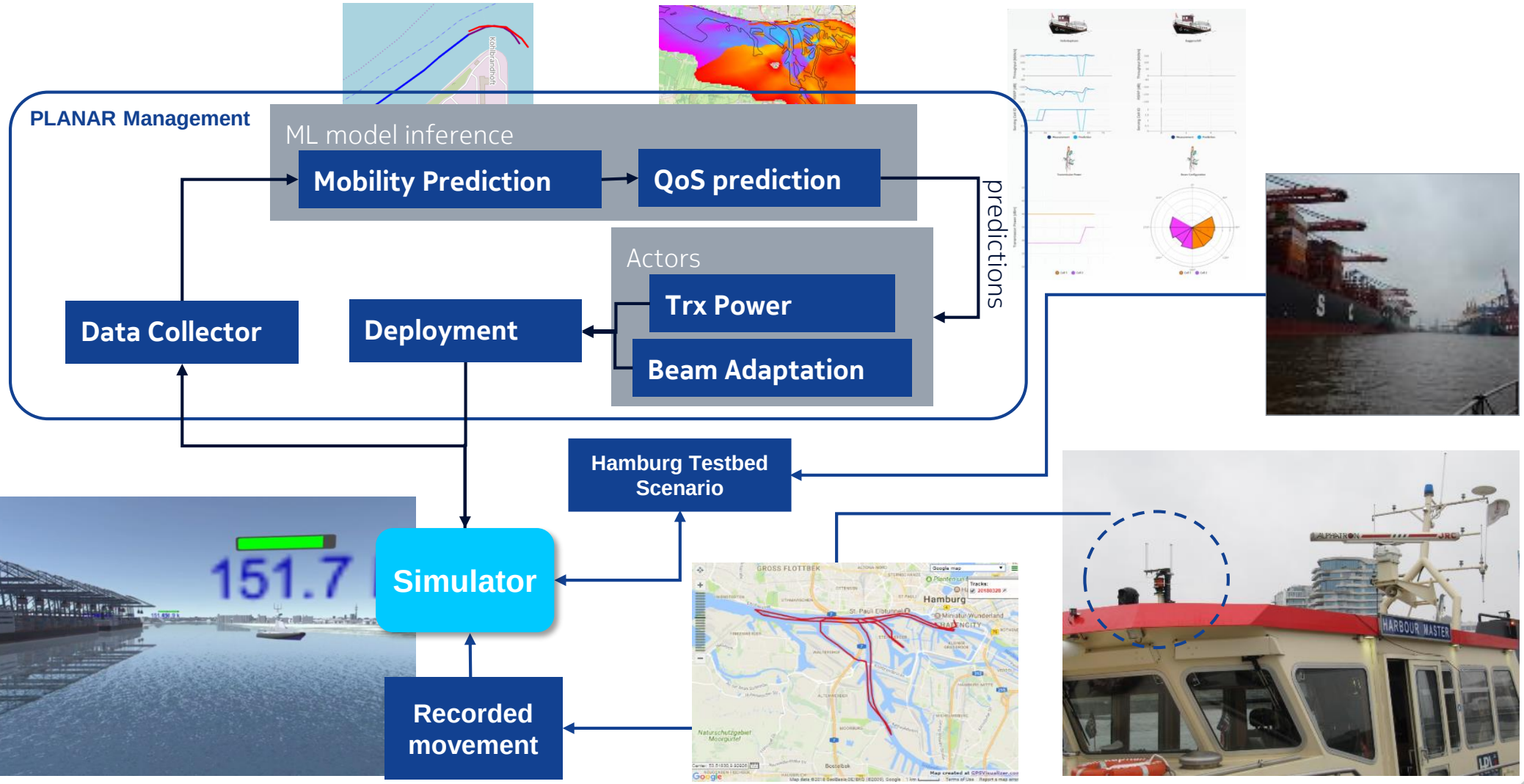


→ AI/ML-related multi-vendor requirements need to be exposed to the relevant SDOs / open source projects (→ 3GPP, ETSI ZSM, ORAN, ITU-T FG ML5G)

NOKIA Bell Labs

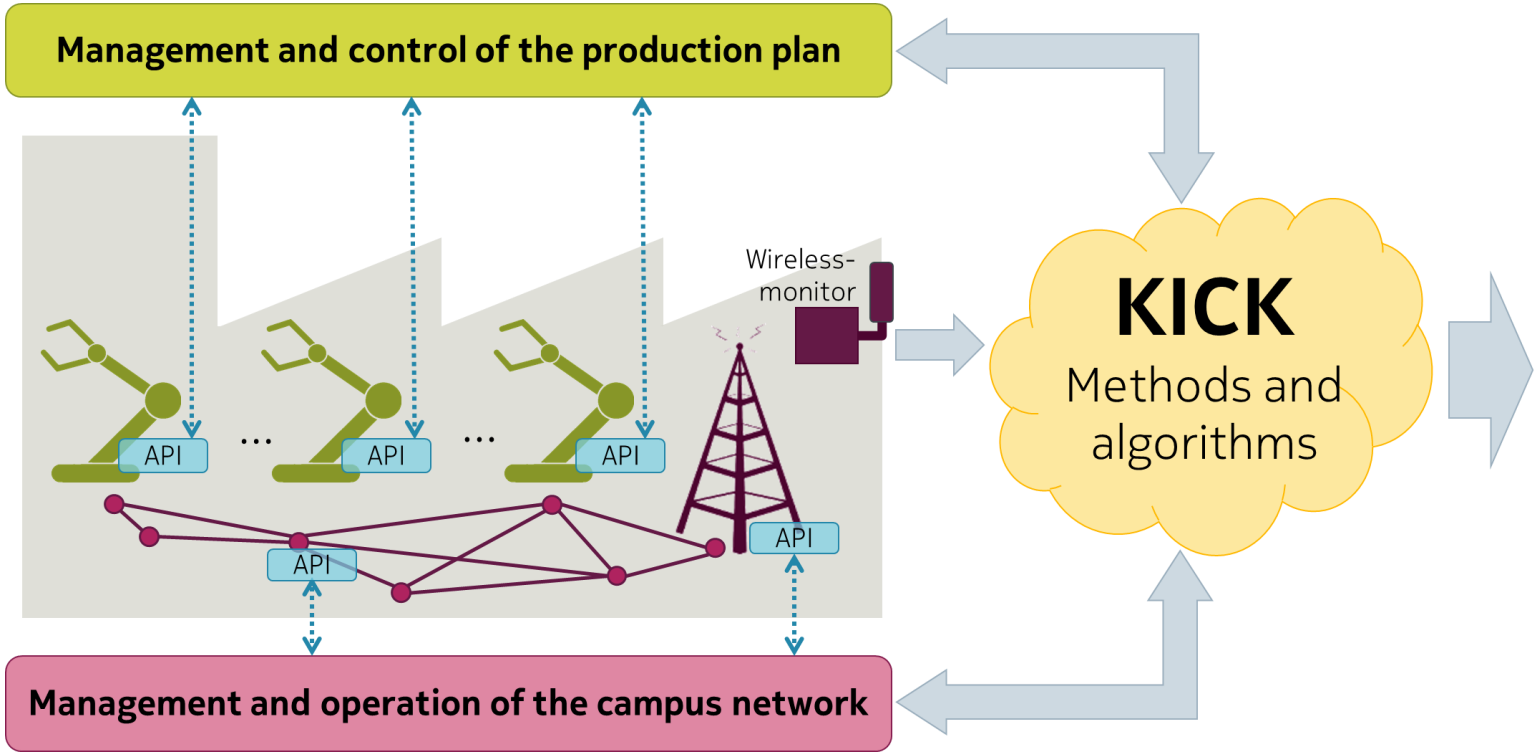
Predictive Location-Aware Network Automation for Radio (PLANAR)

Demo @ IEEE NOMS 2020, https://www.youtube.com/watch?v=nMdBbLv2G98



NOKIA Bell Labs

KICK Project (kick-project.de)
Artificial Intelligence for Campus Communication

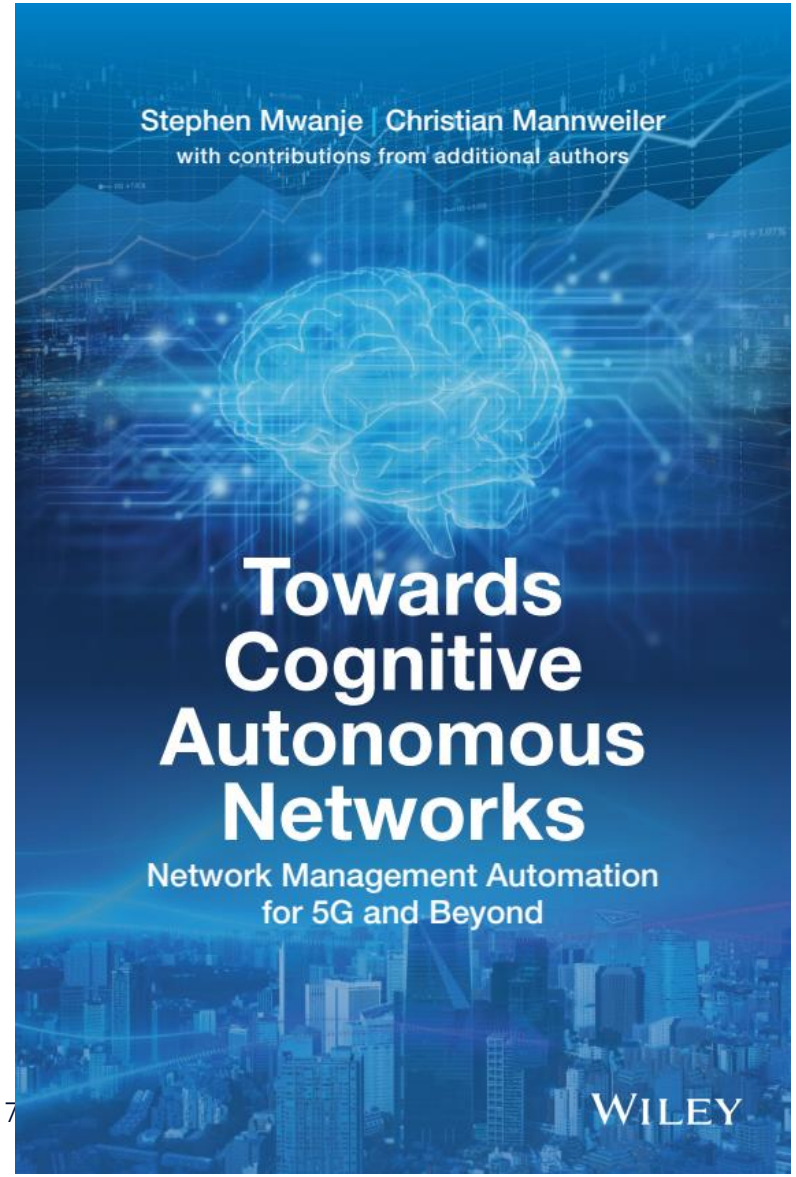


1. **Optimization** across communication and production
2. **Simplification** of the campus network operation
3. **Economical viability** of private networks in factories
4. **Validation** of AI/ML methods in the joint production and communication worlds

SPONSORED BY THE
Federal Ministry of Education and Research

Application of AI methods in a highly dynamic wireless network and flexibly reconfigurable factory environment for monitoring and controlling communication and production

Towards Cognitive Autonomous Networks
Network Management Automation for 5G and beyond



Book structure and outline

Background	Core argumentation	Solutions/Application	Open challenges
2. Network Evolution	1. Introduction	7. Cognitive Auto-Configuration	11. System Challenges of CANs
3. SON in pre-5G Networks	4. Modeling Cognition	8. Cognitive Autonomy in Optimization	12. Towards realizing CANs
	5. Classical AI for reasoning	9. Cognitive Self-Healing	
	6. ML for cognitive decision making	10. Cognitive Self-Operation	

To appear July 2020

https://www.wiley.com/en-us/Towards+Cognitive+Autonomous+Networks+%3A+Network+Management+Automation+for+5G+and+Beyond-p-9781119586388

NOKIA Bell Labs


NOKIA