

Virtuelle Exkursion des IfN 2021

NOKIA

Agenda 16. Juni 2021:

- Kurze Vorstellung von Nokia
- Ingenieure aus 3 Bereichen beschreiben ihre Erfahrung mit Nokia
 - Stefan (Bell Labs, Stuttgart)
 - Robert und Jan (Optical Networks, Stuttgart)
 - Philipp (Mobile Networks, Ulm)
- Fragen/Diskussion
- Der Weg zu Nokia



Technology leadership in each of our businesses

- Unrivalled track record of innovation
- Mobile Networks
- Optical Networks

Nokia at a Glance

Mobile Networks	Network Infrastructure
Cloud and Network Services	Nokia Technologies
Strategy and Technology: Bell Labs and Nokia Standardisation	

Purpose

Our purpose is to create technology that helps the world act together

Commitment

We deliver critical networks through technology leadership and trusted partnerships

Essentials

Open Fearless Empowered

Nokia operates in 130 countries globally.
Large German sites are Stuttgart, Ulm and Munich.

Check out for more info
@ [Life at Nokia](#).

NOKIA

Deine Ansprechpartner bei Nokia

Bell Labs

Stefan Wesemann

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Mobile Networks

Robert Meier

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Optical Networks

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Bewerbung bei Nokia – Standorte in Deutschland

Haben wir Dein Interesse geweckt?

Bewirb Dich für einen unserer Standorte in Deutschland

– für einen Job über:
www.nokia.com/about-us/careers/our-opportunities

– für ein Praktikum über:
www.nomiko.com

And stay connected with us on



● Ausbildungsstandort ● Standort

At Nokia, we create technology
that helps the world act together



Nokia at a glance

€21.9bn

Net sales
2020

€129bn

in R&D investment
(past two decades)

#1

in 5G standard
essential patents¹

World's record
in 5G speed

#1

in telco
software²

#2

in global
telecom
infrastructure³

¹ Independent study by IPLytics, April 2021

² Analysys Mason September 2020 [report](#) (2019 market share)

³ Dell'Oro Group 1H2020 [article](#)

Mobile Networks Commercial Success

160 commercial
5G deals

220+ commercial
5G agreements

63 live 5G operator
networks

Figures as of 29 April 2021

North America



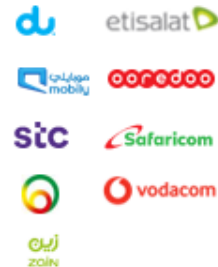
Latin America



Europe



Middle East & Africa



Asia-Pacific



Greater China



Logos reflect public operator and enterprise customers

Leading Customers of the Optical Transport Network Product Family



Bell Labs: A rich history of breakthrough innovation

9 Nobel Prizes

4 Turing Prizes

3 Emmys

2 Grammys

1 Oscar

NOKIA Bell Labs

Inventing the Future X Network

Creation of Bell Labs

The engineering departments of the American Telephone and Telegraph Company (AT&T) and Western Electric were consolidated into Bell Telephone Laboratories. Their mission was to research and design communication technologies for the rapidly expanding telephone network and to explore fundamental areas of science that could shape the future of the industry. Over the years, many transformative technologies of modern society have been invented at Bell Labs and 8 Nobel Prizes have been awarded to its researchers.

1925



1930's



1937

Electron Diffraction
Demonstrating wave nature of matter

1940's

1948
"A Mathematical Theory of Communications"
By showing that all communications channels - of any type - have a fundamental capacity limit, Claude E. Shannon founded the field of information theory

1980's

1995
Commercial DWDM
Pioneering work on wavelength multiplexing in optical fibers

1980
Demonstration of DSP
Large-scale integrated circuit for digital signal processing

1970's

1978
Commercial Cellular Network
Invention of the cellular concept and creation of the first commercial network

1978
Cosmic Microwave Background Radiation
Pioneering work on radio communications using the Holmdel Horn Antenna provides support for the Big Bang Theory

1977
Electronic Structure of Magnets and Glasses

1976
Fiber Optic Network
First demonstration of 45 Mbit/s transmission

1973
UNIX and C Language
Thompson and Ritchie's elegant design made it an immediate hit with the programming community when it was released in 1974. UNIX would later on become the Internet's foundation

1950's

1956
Transistor
To replace the vacuum tube, Bardeen, Brattain and Shockley created a working point-contact transistor. This basic building block for all digital products is the foundation for our information society

1958

LASER
In their 1958 paper, Schawlow and his brother-in-law Townes described in detail a proof of concept for the LASER. The laser enables a wide variety of applications: fiber-optic communications, digital storage, barcode scanners, precision surgery and industrial cutting tools

1960's

1962
Teletar
Transatlantic live TV broadcast via satellite

1954
Solar cells

1995
Integrated ADSL Chip
After co-inventing ADSL technology, follow-up innovations like vectoring continued to generate world records for high speed data transfer over copper telephone lines, fueling the Internet

1998
Wireless MIMO Spatial Multiplexing
Invention of wireless transmission based on multiple spatial paths

1998
Fractional Quantum Hall Effect
Discovery of a novel collective quantum fluid state of matter

1997
Laser-Based Cooling and Trapping of Atoms
To understand the fundamental limits of materials and matter

2006
Software Defined Routing
Pioneering of Software Defined Networks (SDN)

2009
Coherent 100G Optics
Invention of the future of high speed optical communications with coherent processing

2009
World's first standard compliant LTE call

2014
XG-FAST
First demonstration of 10 Gbit/sec over copper telephone wires

2016
5G Massive Connectivity
First demonstration of 1M simultaneous, ultra-low latency connections in a single cell for 5G and IoT

2015
The Future X Network: A Nokia Bell Labs Perspective
First Nokia Bell Labs book written

2015
GreenTouch
International consortium delivers new technologies to improve energy efficiency in wireless networks by more than 10,000X

2015
Optical MIMO-SDM
Pioneering work on utilizing the spatial dimension in fiber, showing greater than 10X increase in optical network capacity

2014
Fluorescence Microscopy
Ground-breaking work on sub-wavelength optical microscopy leads to super-resolution microscopy at cellular level

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The Future

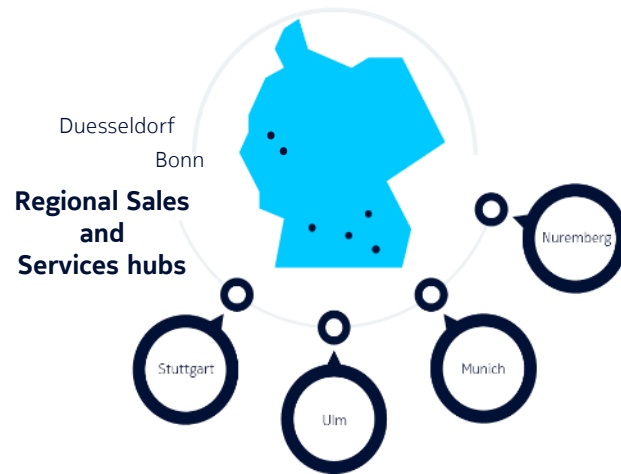
Nokia Bell Labs continues to solve the great industry challenges, producing disruptive innovations for the next phase of human existence

NOKIA

Nokia in Germany

- Global Player with ~3.000 employees across Germany
- Thereof 1.300 in Research & Development
- Expertise in areas of fiber, mobile infrastructure and IoT connectivity
- Partner for telecom operators, governments and industry
- Partnerships with regional and local eco-systems

Technology cluster Germany



Industry 4.0

Surrounded by automotive and manufacturing companies to develop new industrial solutions.

5G

City of science with many technology labs profits by close cooperation between science and economy. Driving all mobile network topics, in particular 5G.

Digitalization & Technology

Located close to important high tech partners and IoT hot spots, including our Digital Creativity Lab led by Nokia Bell Labs. Focusing on Mobility, IoT and Security and Standardization.

Optics

The technical expertise in high speed optics and large switching systems.

Nokia in Ulm is THE algorithm powerhouse

And a strong contributor to Mobile Networks

Ulm Innovation Region

- Science Park Campus (600.000m²) with University of Ulm
- Home of Automotive IT Industry in Germany



Nokia Innovation Center Ulm



2,1% Students
(PhD, MSc, BSc, Dual...)

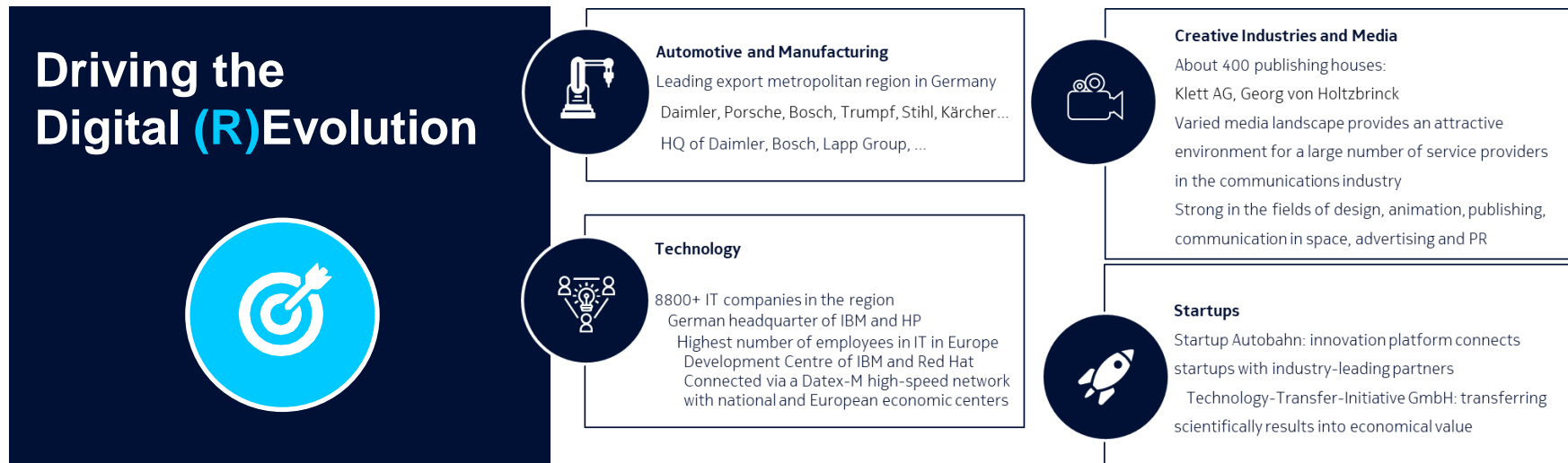
Strong contribution to
5G19, 5G19A, 5G19B
Milestones.

Key roles on Program
and Product
Management



Nokia in Stuttgart

Creating future communication technology in a leading eco-system



Almost all Nokia functions and innovation power through Bell Labs and Optics R&D.
Bell Labs in Stuttgart comprises 100+ experts and researchers.

Nokia Bell Labs in Munich

Home of Bell Labs Standards Research and Nokia Standardization

- Complementary Research, Standardization and CTO expertise in 5G/6G, security, network automation and analytics
- Co-located with Nokia Tech and IPR management for efficient IPR generation

Global
innovation
status 1H 20

Germany among TOP 5 innovate countries

Munich in TOP 4 for SEP/patent generation

- Digital Creativity Lab: a place for innovation and collaboration with ecosystem
- World-class collaboration partners e.g.:



de:hub
digital ecosystems



Key research topics and technology showcases

E2E 5G



E2E security



Digital Mobility



Industrial Automation



Nokia Optics in Nuremberg

Worldwide recognized competence center for Hi-Speed Photonics, OTN



Nuremberg

Major high-profile R&D hub for Optics with

- System Engineering & Architecture
- High Speed Photonics (Subsystems)
- Hardware, ASIC/FPGA
- Software
- Validation
- Product Line Management

~380 employees
~300 Optics
R&D/PLM engineers

Key competencies

- Optical Switching Systems (HW and SW for high-speed optics)
- Photonic Technologies (WDM)
- Optimization of optical transport networks

Additional value points:

- Close collaboration with R&D teams in Stuttgart for GMPLS Control Plane, MRN, SDN and with Bell-Labs
- Cooperations with Europe's 2nd most innovative University FAU (located next door in Erlangen)
- Common education program with Ohm University

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