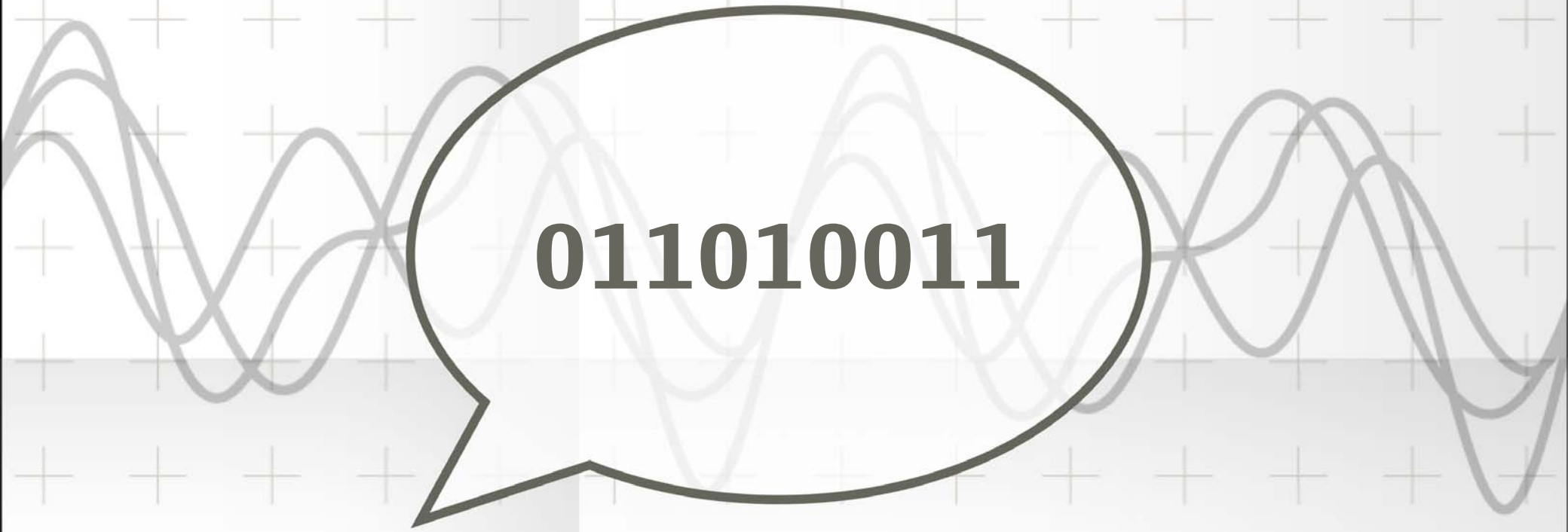
A Little Paper Pulp Goes a Long Way

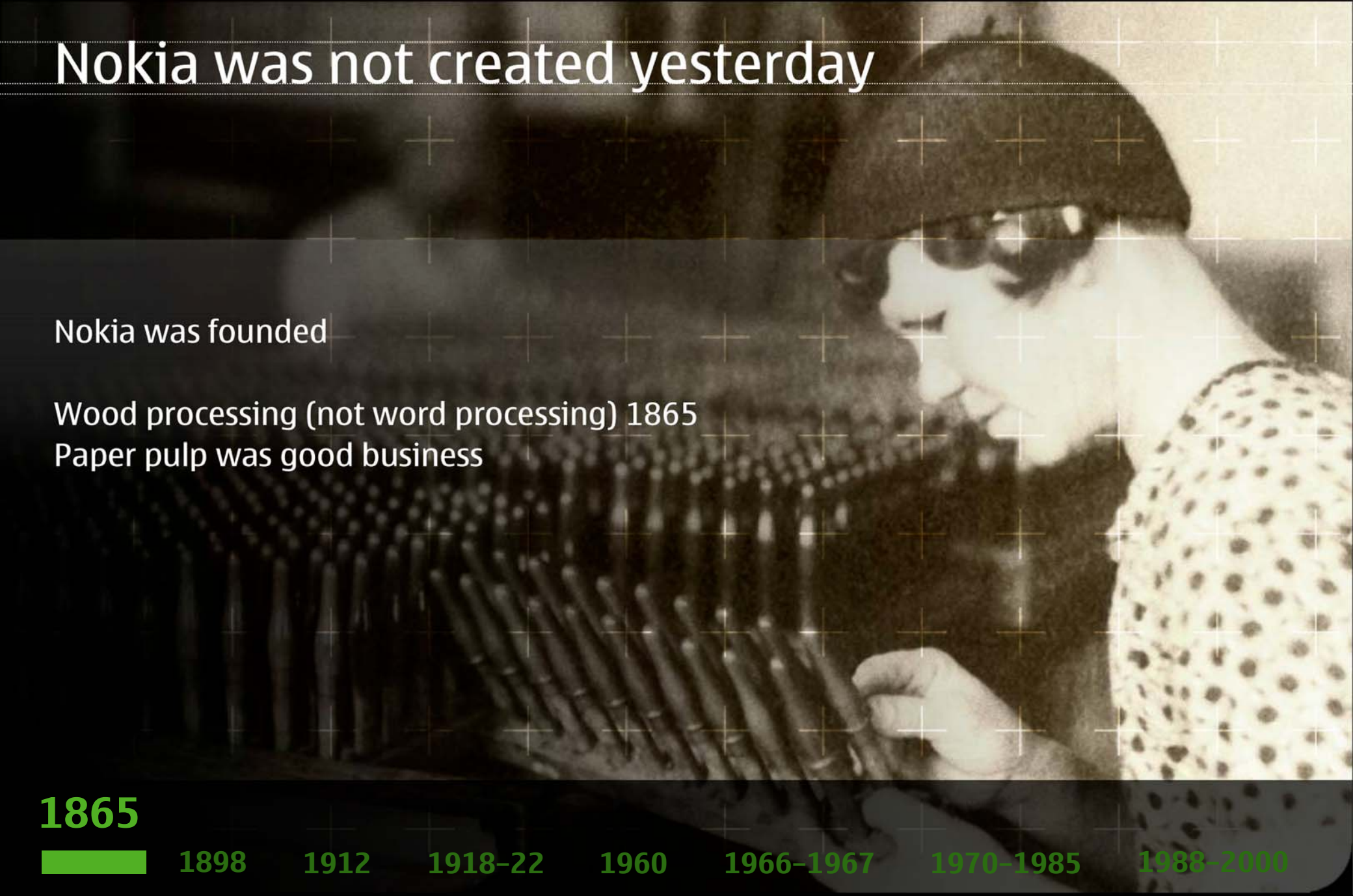


Bob Iannucci
SVP, Head of Nokia Research Center

Agenda

- Agility is at least as important as new technologies in delivering innovation
- Success breeds complexity
- Mobile phones are moving from embedded computing systems to PC-challengers - creating a significant opportunity
- Agility, complexity and opportunity are leading to re-thinking of how innovation is done

Nokia was not created yesterday



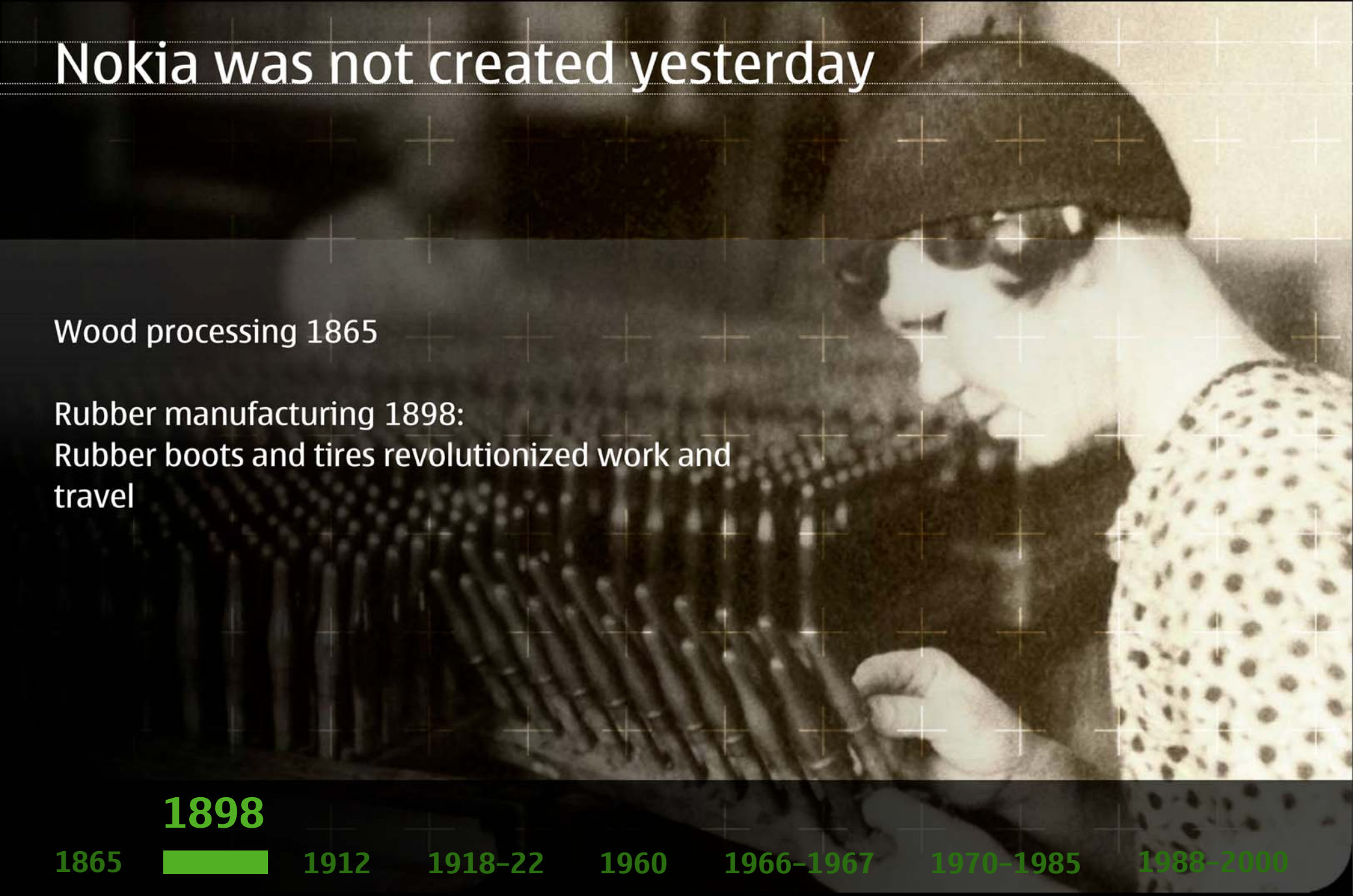
Nokia was founded

Wood processing (not word processing) 1865
Paper pulp was good business

1865 | 1898 | 1912 | 1918–22 | 1960 | 1966–1967 | 1970–1985 | 1988–2000

NOKIA

Nokia was not created yesterday



Wood processing 1865

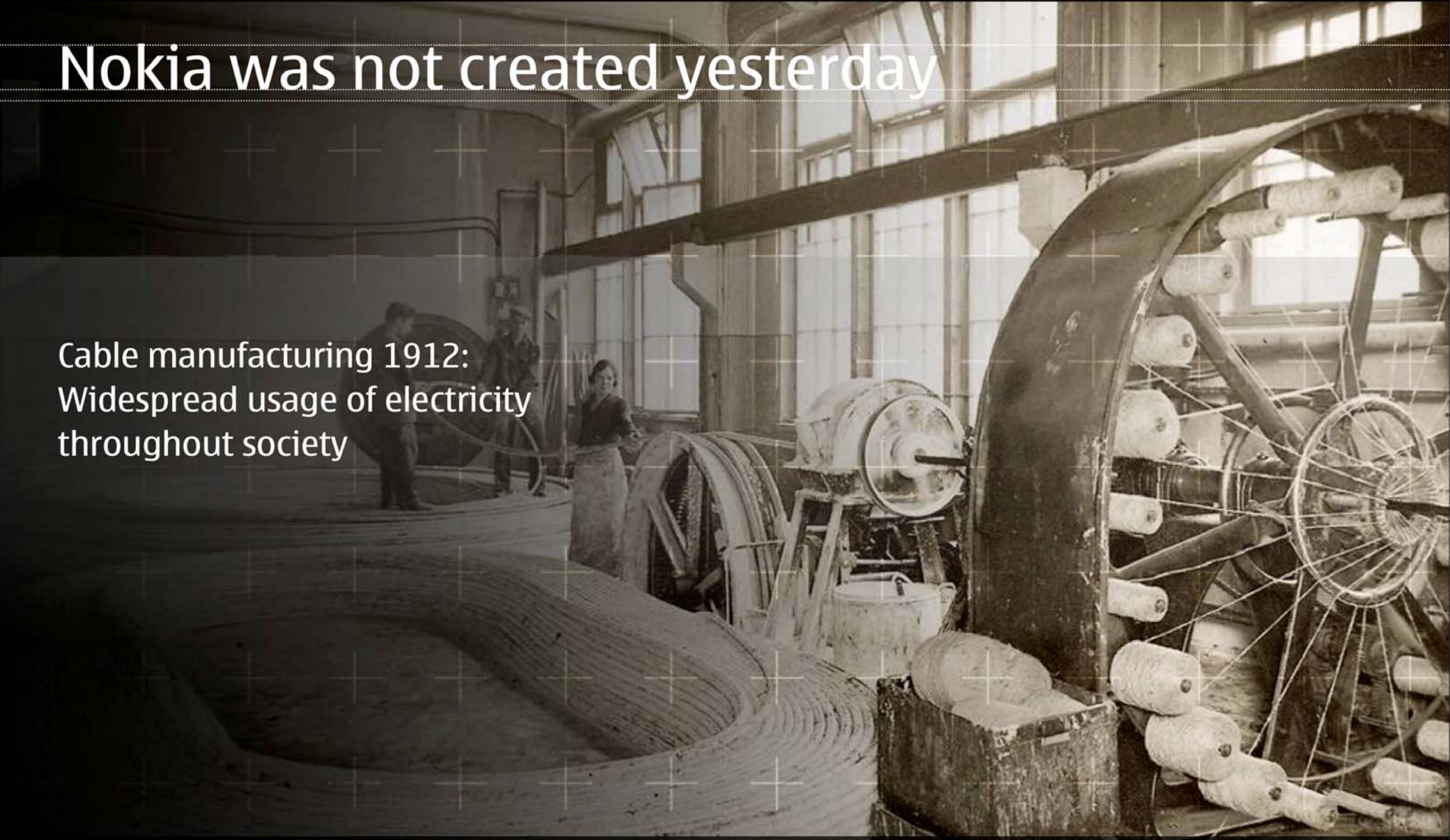
Rubber manufacturing 1898:
Rubber boots and tires revolutionized work and travel

1898

1865 | 1912 | 1918–22 | 1960 | 1966–1967 | 1970–1985 | 1988–2000

NOKIA

Nokia was not created yesterday

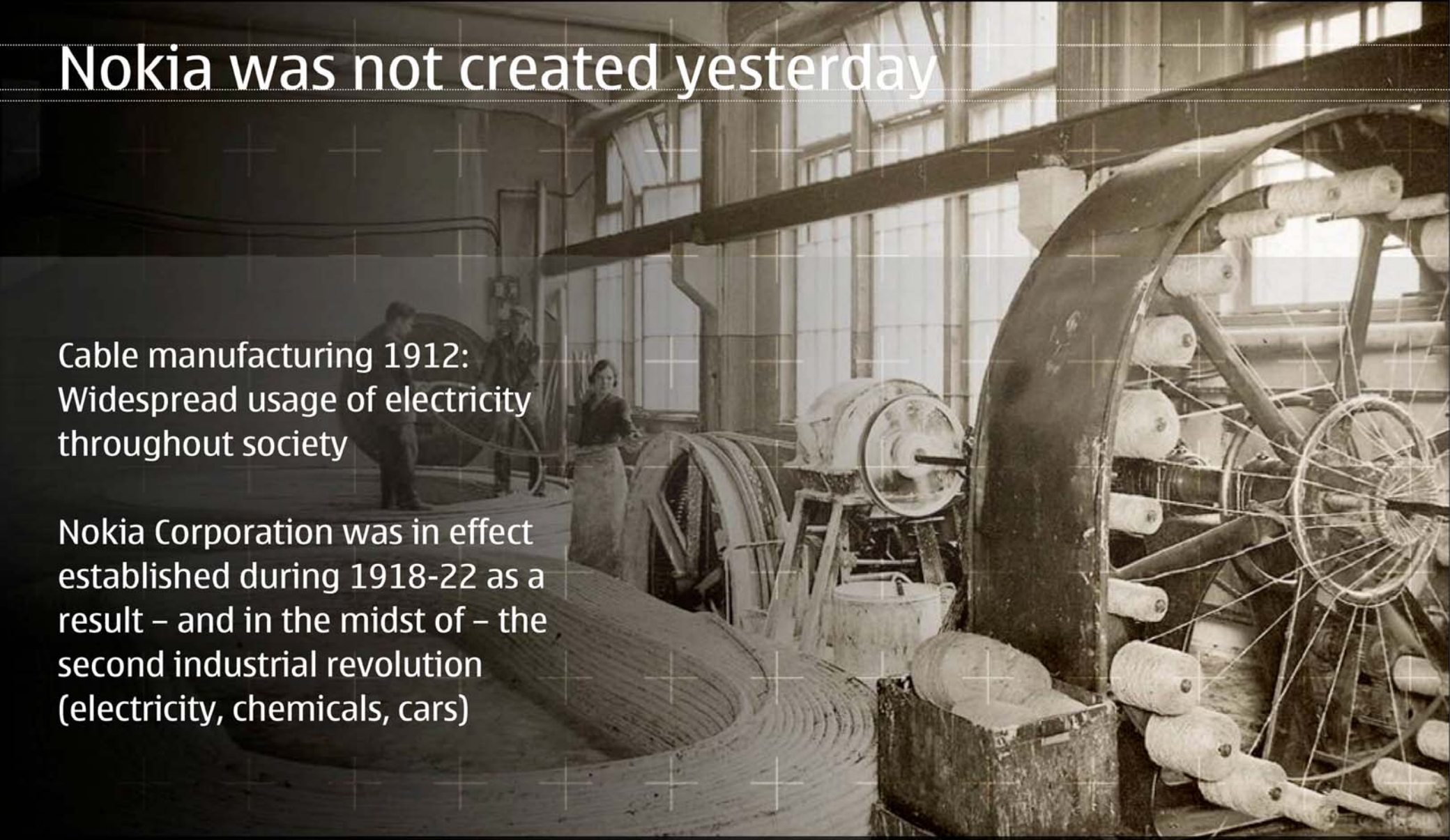


Cable manufacturing 1912:
Widespread usage of electricity throughout society

1865 1898 **1912** 1918–22 1960 1966–1967 1970–1985 1988–2000

NOKIA

Nokia was not created yesterday



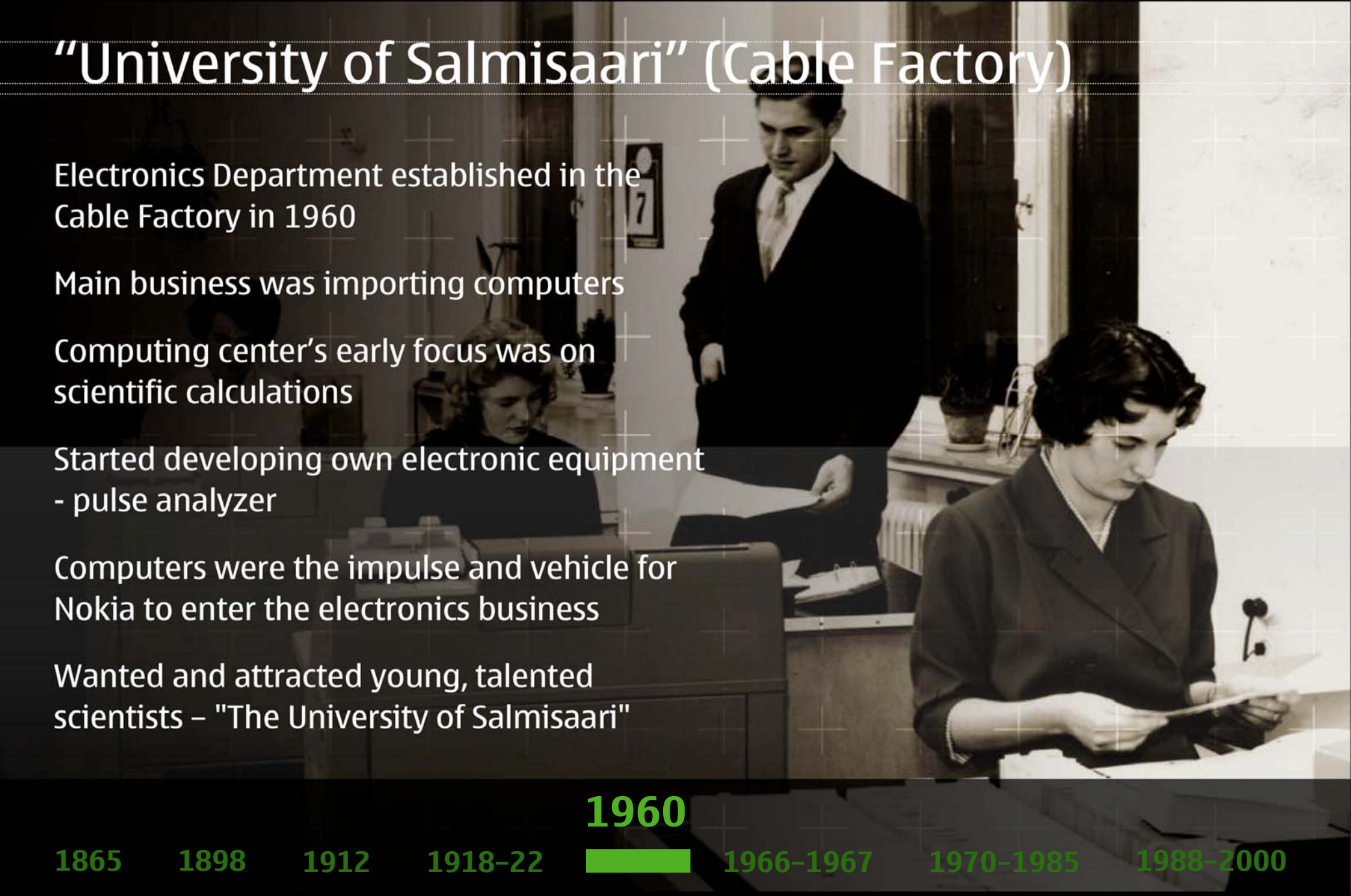
Cable manufacturing 1912:
Widespread usage of electricity throughout society

Nokia Corporation was in effect established during 1918-22 as a result – and in the midst of – the second industrial revolution (electricity, chemicals, cars)

1865 1898 1912 **1918–22** 1960 1966–1967 1970–1985 1988–2000

NOKIA

“University of Salmisaari” (Cable Factory)



Electronics Department established in the Cable Factory in 1960

Main business was importing computers

Computing center’s early focus was on scientific calculations

Started developing own electronic equipment - pulse analyzer

Computers were the impulse and vehicle for Nokia to enter the electronics business

Wanted and attracted young, talented scientists – "The University of Salmisaari"

1960

1865 1898 1912 1918–22 1966–1967 1970–1985 1988–2000

NOKIA

The merger 1966 – 1967

Suomen Kumitehdas (The Finnish Rubber Works) and Suomen Kaapelitehdas (the Finnish Cable Works) were merged into the forestry company Nokia Ab in 1966–67

The new company, Oy Nokia Ab started its operations officially in early 1967

Business areas included rubber, cable, forestry industry, electronics and power generation

1966–1967

1865 1898 1912 1918–22 1960 1970–1985 1988–2000

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Industrial electronics, computers, switches, radiotelephones 1970 – 1985

Control systems in atomic energy plants

Nokia's own computers: Mikko and MikroMikko

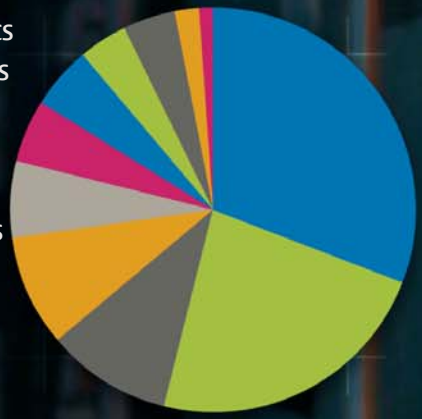
Telephone switches challenged the dominance of Ericsson in systems

National ARP (1970), international NMT (1981) gave a boost to radiotelephony

"Technology-Finland" born in 1982: Consistent effort to boost technology

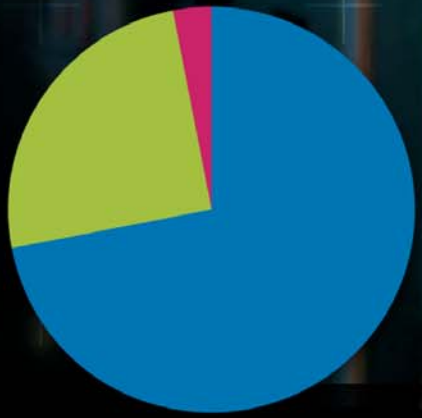
NOKIA

From conglomerate to telecommunications
1988 – 2000



31% Consumer Electronics
23% Information Systems
10% Paper
9% Cables
6% Rubber
5% Telecommunicatons
5% Mobile Telephones
4% Electrical Wholesale
4% Machinery
2% Chemicals
1% Floorings

1988



72% Mobile Phones
25% Infrastructure
3% Other

2000

1865 1898 1912 1918–22 1960 1966–1967 1970–1985 **1988–2000**

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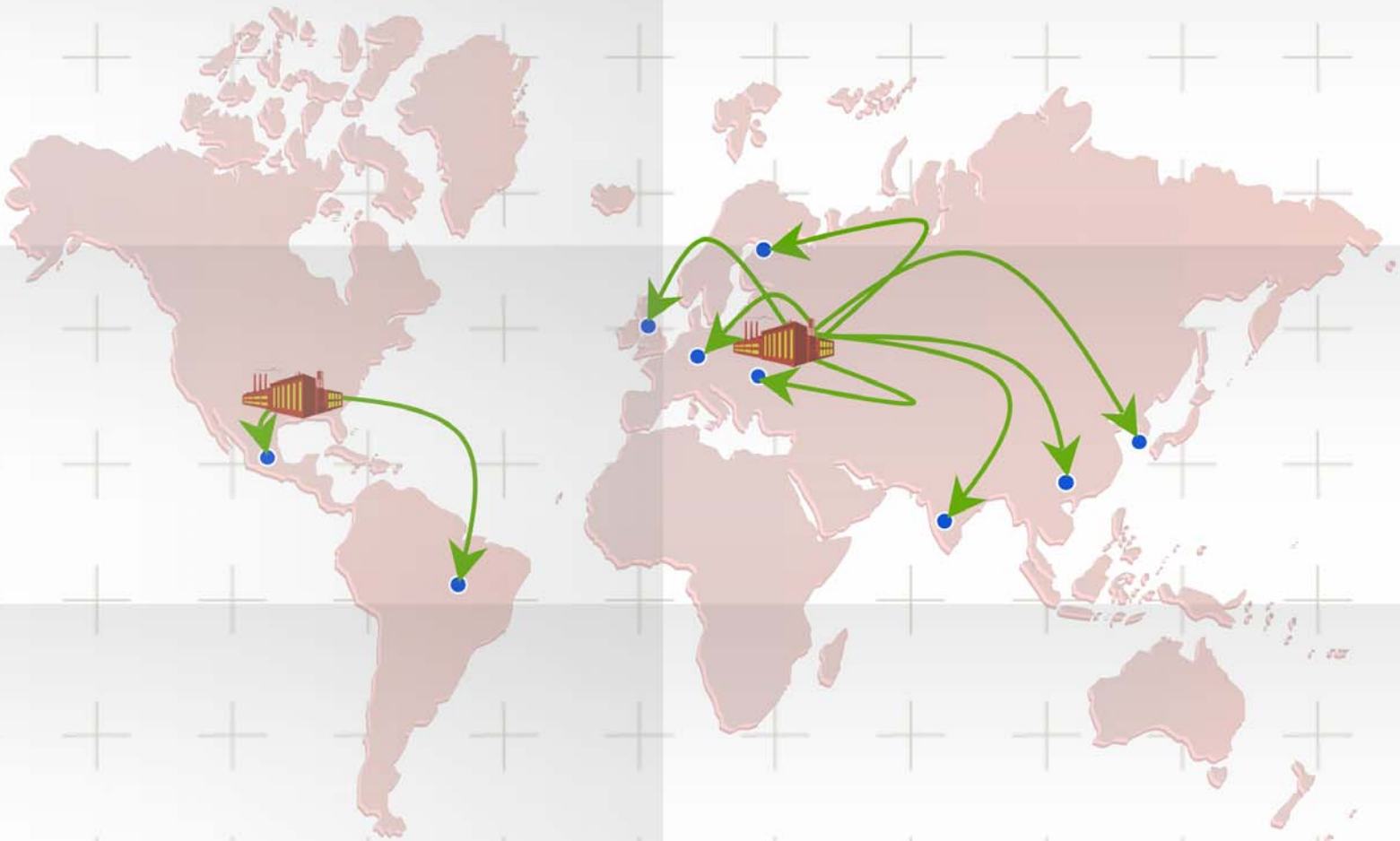
Observation

- Some companies start in paper pulp and end up making their money with high tech
- Other companies start in high tech and end up making their money with paper pulp

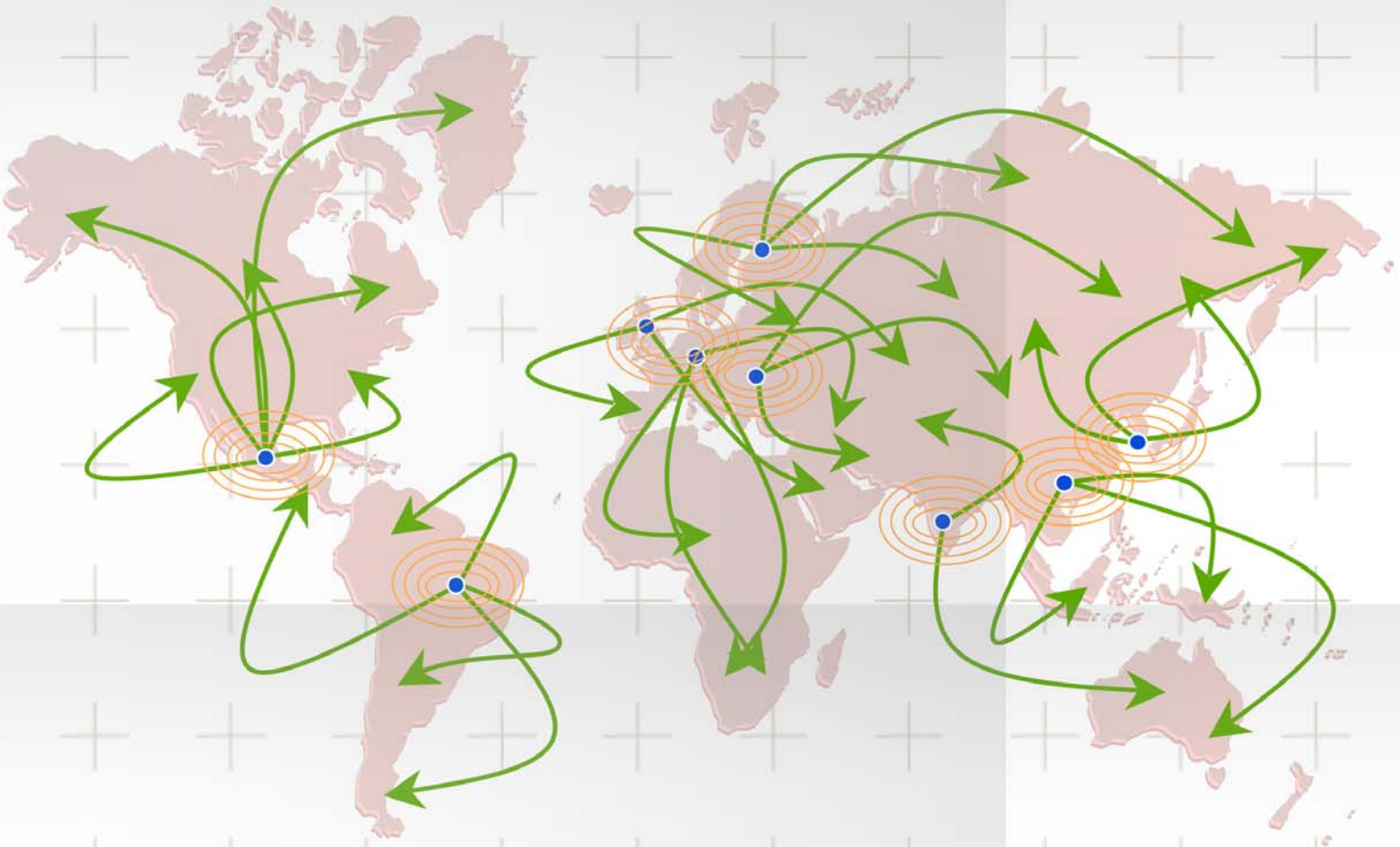
Complexity I: Every day, Nokia sources 329 million parts…



And builds a million phones in 100+ different models

NOKIA

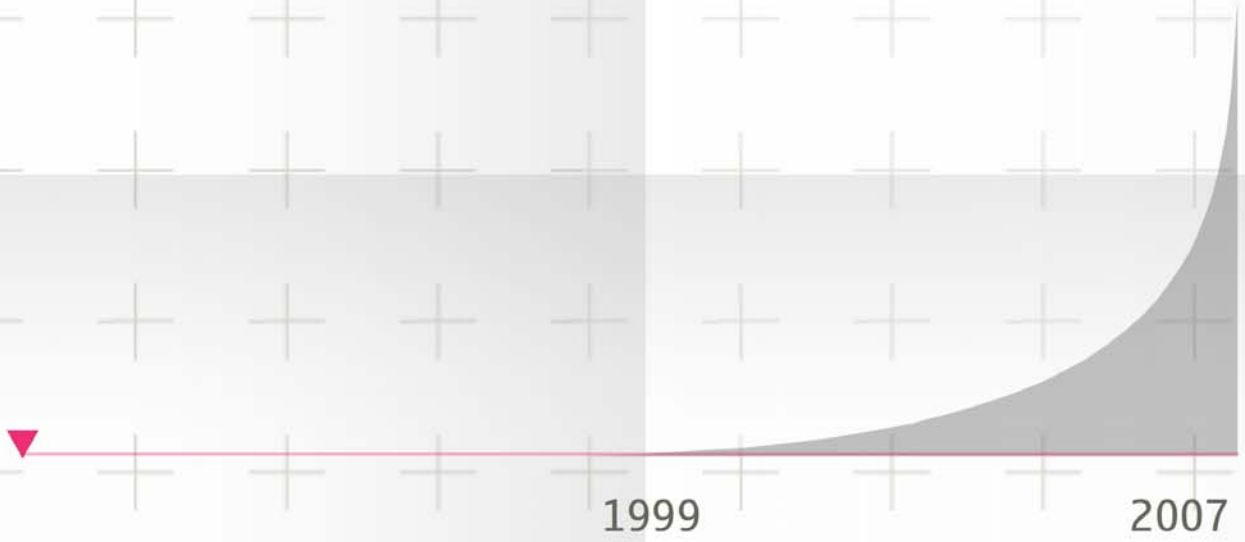
And distributes numerous variants in about 70 different languages to 150 countries



Complexity II: small is big

1982 – Mobira Senator NMT450

Car phone, ~10 kg



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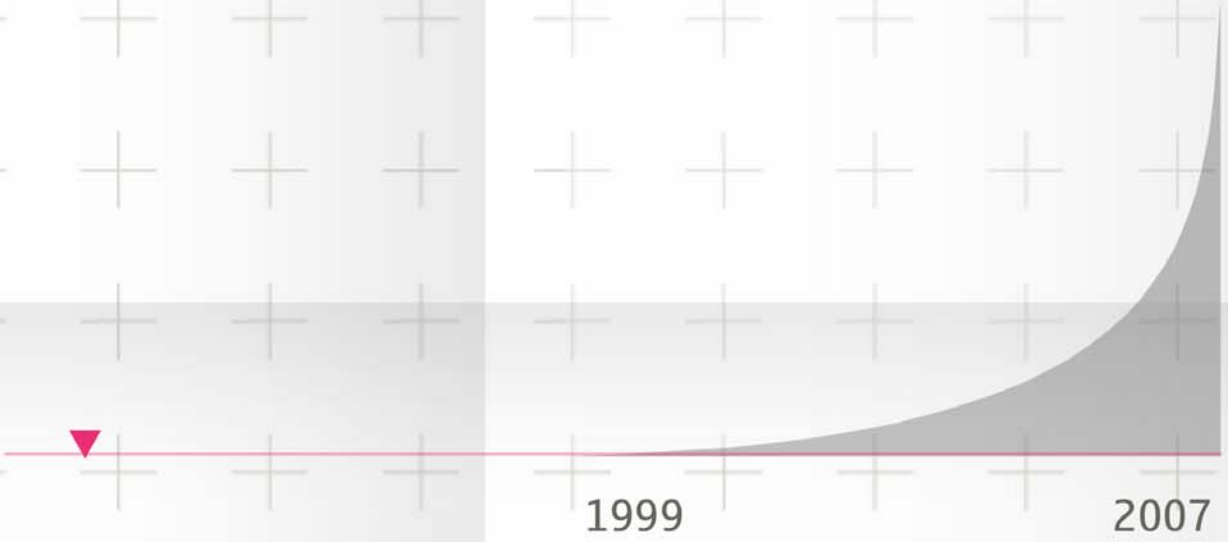
1987 – Mobira Cityman 900

NMT900 hand-held mobile phone

770 g

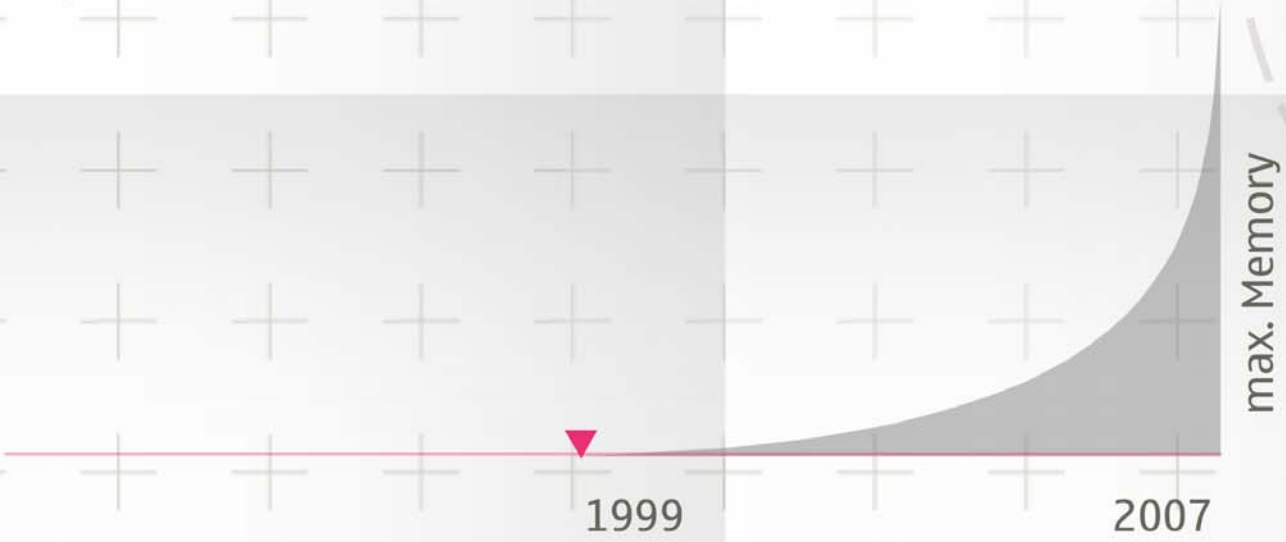


1999 – Nokia 8210

At the time of its release, the smallest, lightest Nokia phone on the market.

Memory:

- Up to 250 names in phone
- Up to 50 calendar notes

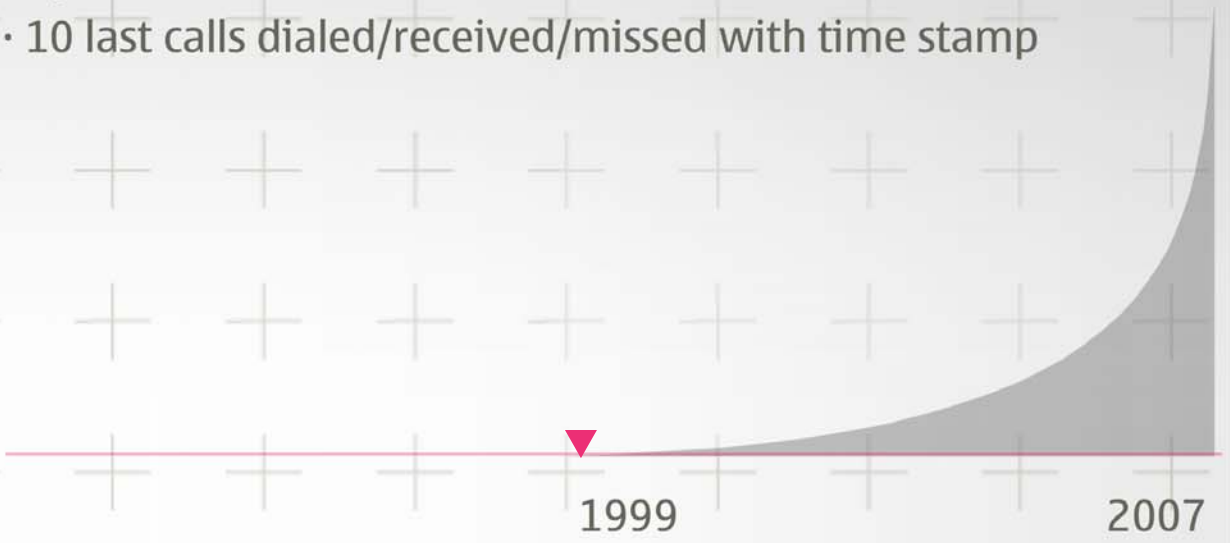


1999 – Nokia 7110

World's first mobile phone with the Wireless Application Protocol (WAP)

Memory:

- Up to 1000 names in phone
- Up to three numbers and one text field for each name
- 10 last calls dialed/received/missed with time stamp

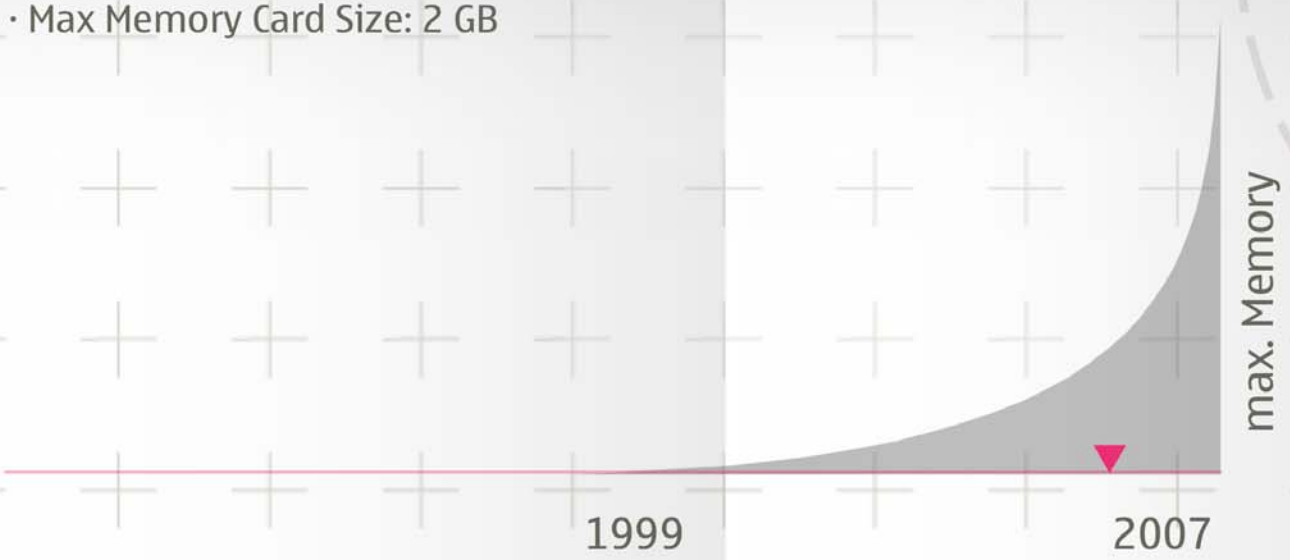


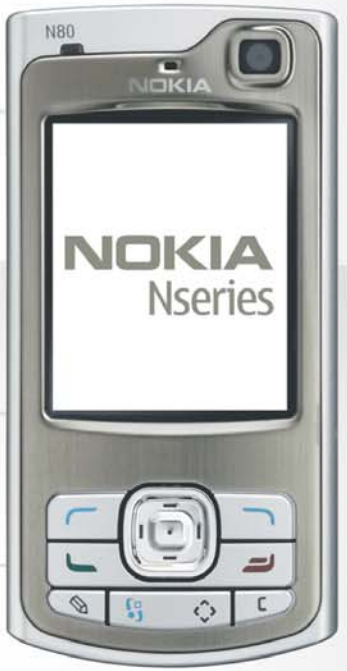
2005 – Nokia N80

Nokia's first UPnP phone.

Memory:

- Max User Storage: 40 MB
- NAND Memory: 128 MB
- SDRAM Memory: 64 MB
- ~18 MB Free Executable RAM Memory
- Memory Card: Mini SD
- Max Memory Card Size: 2 GB



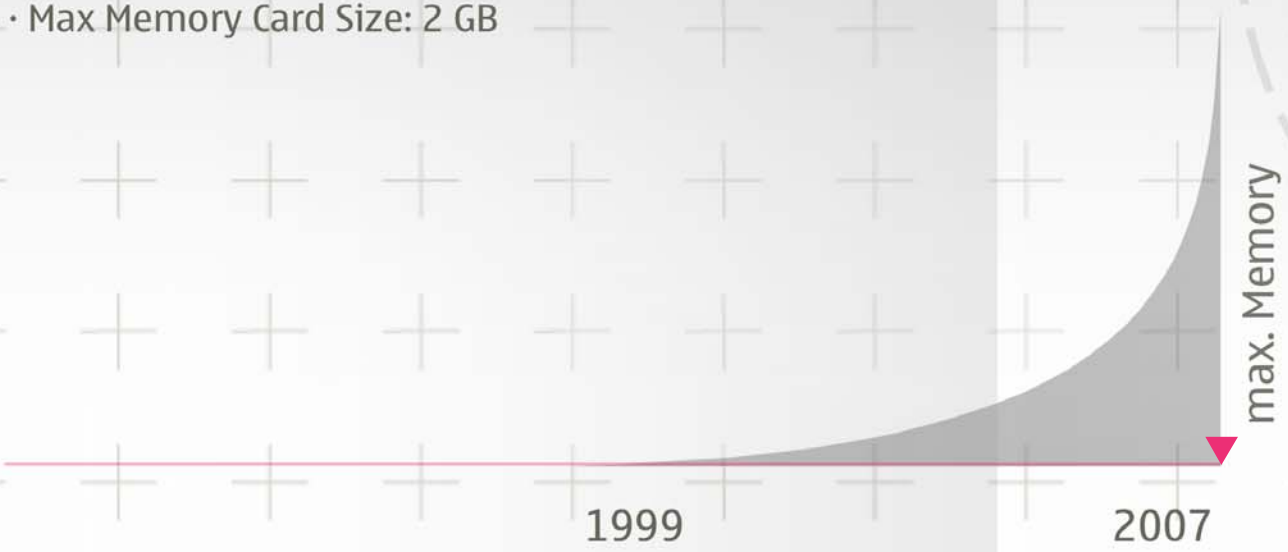


2006 – Nokia N95

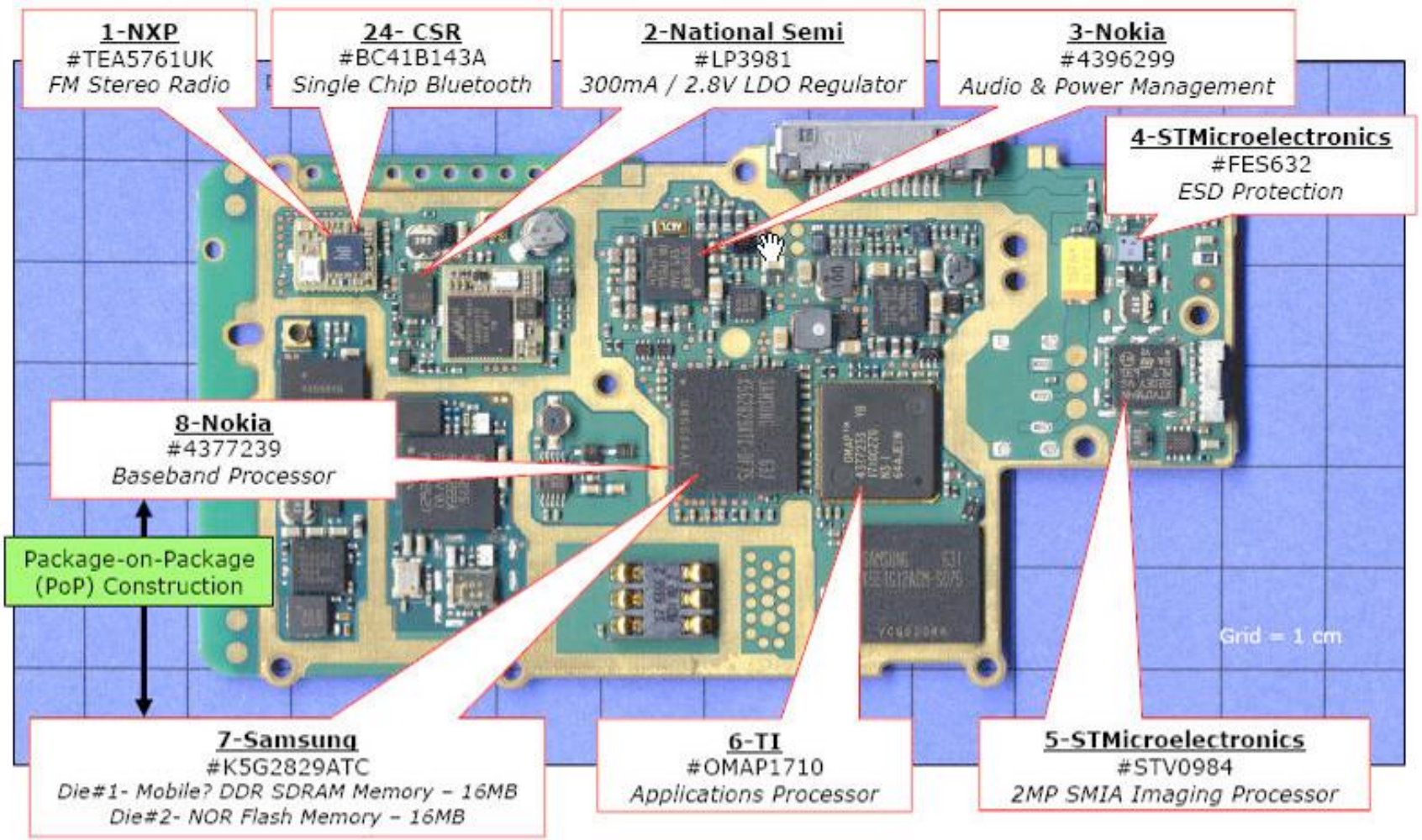
Nokia's first GPS phone.

Memory:

- Max User Storage: 160 MB
- NAND Memory: 256 MB
- SDRAM Memory: 64 MB
- ~20 MB Free Executable RAM Memory
- Memory Card: Micro SD
- Max Memory Card Size: 2 GB



Complexity III: lots of stuff inside



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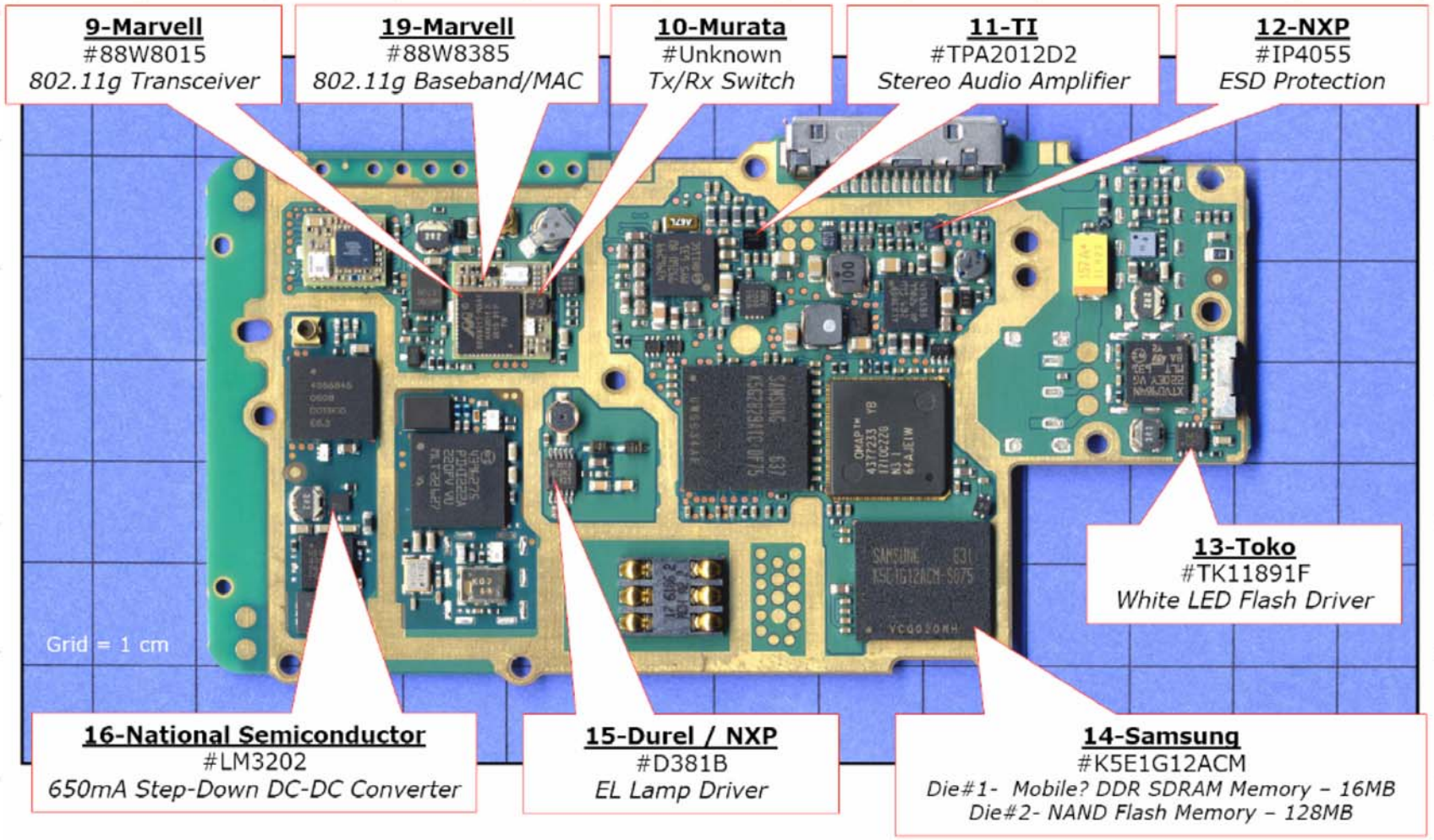
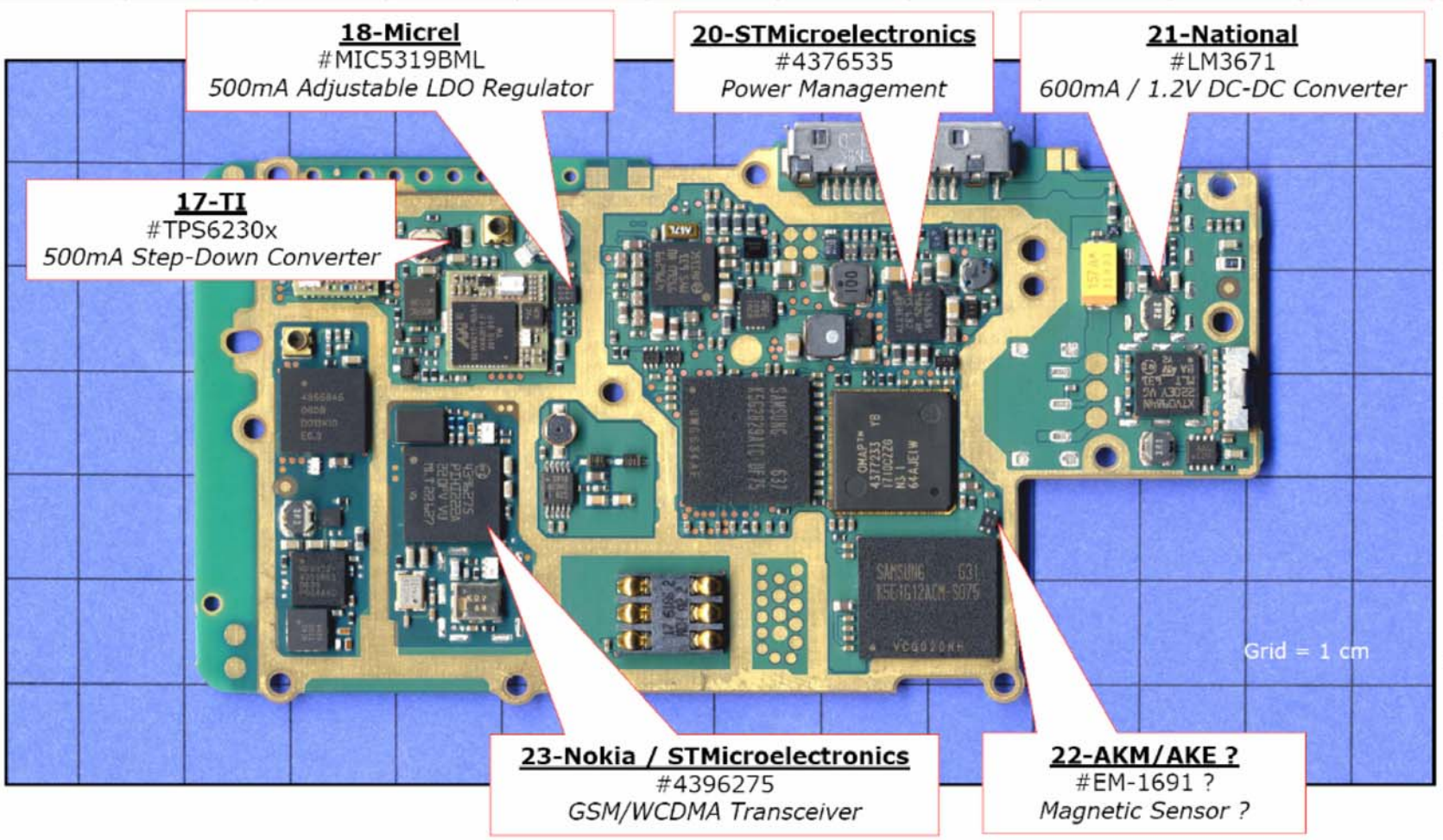
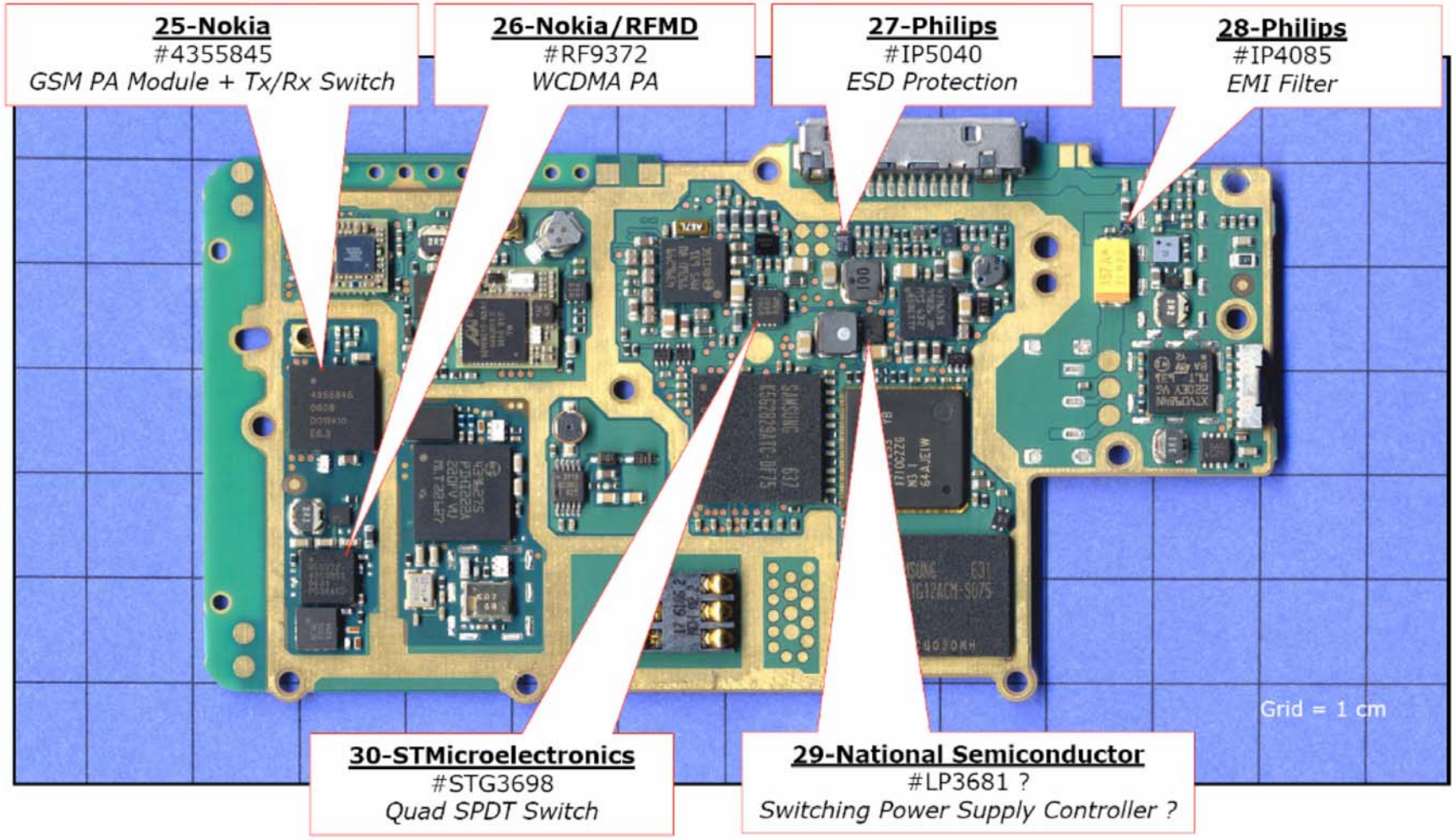

9-Marvell
#88W8015
802.11g Transceiver
19-Marvell
#88W8385
802.11g Baseband/MAC
10-Murata
#Unknown
Tx/Rx Switch
11-TI
#TPA2012D2
Stereo Audio Amplifier
12-NXP
#IP4055
ESD Protection
13-Toko
#TK11891F
White LED Flash Driver
Grid = 1 cm
16-National Semiconductor
#LM3202
650mA Step-Down DC-DC Converter
15-Durel / NXP
#D381B
EL Lamp Driver
14-Samsung
#K5E1G12ACM
Die#1- Mobile? DDR SDRAM Memory – 16MB
Die#2- NAND Flash Memory – 128MB


18-Micrel
#MIC5319BML
500mA Adjustable LDO Regulator
20-STMicroelectronics
#4376535
Power Management
21-National
#LM3671
600mA / 1.2V DC-DC Converter
17-TI
#TPS6230x
500mA Step-Down Converter
Grid = 1 cm
23-Nokia / STMicroelectronics
#4396275
GSM/WCDMA Transceiver
22-AKM/AKE ?
#EM-1691 ?
Magnetic Sensor ?



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… and high expectations for user experience

Desktop browser, but still
pixel-challenged and
input modality challenged

Full-fledged platform computing @ 3 watts

Mobile Web server

- Sharing
- Accessing
- Hosting

Browser as runtime

- Web services
- Widgets
- Mash-Ups

Integrated mobile UI

- Services through one UI
- Rich application interplay

Opportunity: How is value shifting?

Internet

- UI
- Applications
- Core Software
- Operating System
- Multimedia HW
- Modem HW

Services

Differentiators:

- UI/UE and industrial design
- Consumer internet services

Declining differentiation:

- Core OS
- Commodity hardware
- Non-core applications

Enablers:

- Common development target
- Standard HW / SW interfaces
- Growing availability of broadband wireless access

Research Directions

Very Human Interface

(social conventions, policies, voice as a first-class element)

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Physical world

("Out-of-phone experience":
sensors, actuators, borrowed peripherals)

Research Directions

Very Human Interface

(social conventions, policies, voice as a first-class element)

Application development platform

(distributed programming, creating a large developer community)

Physical world

("Out-of-phone experience": sensors, actuators, borrowed peripherals)

Research Directions

Virtual information spaces

(WWW, corporate DBs, other information sources)

Very Human Interface

(social conventions, policies, voice as a first-class element)

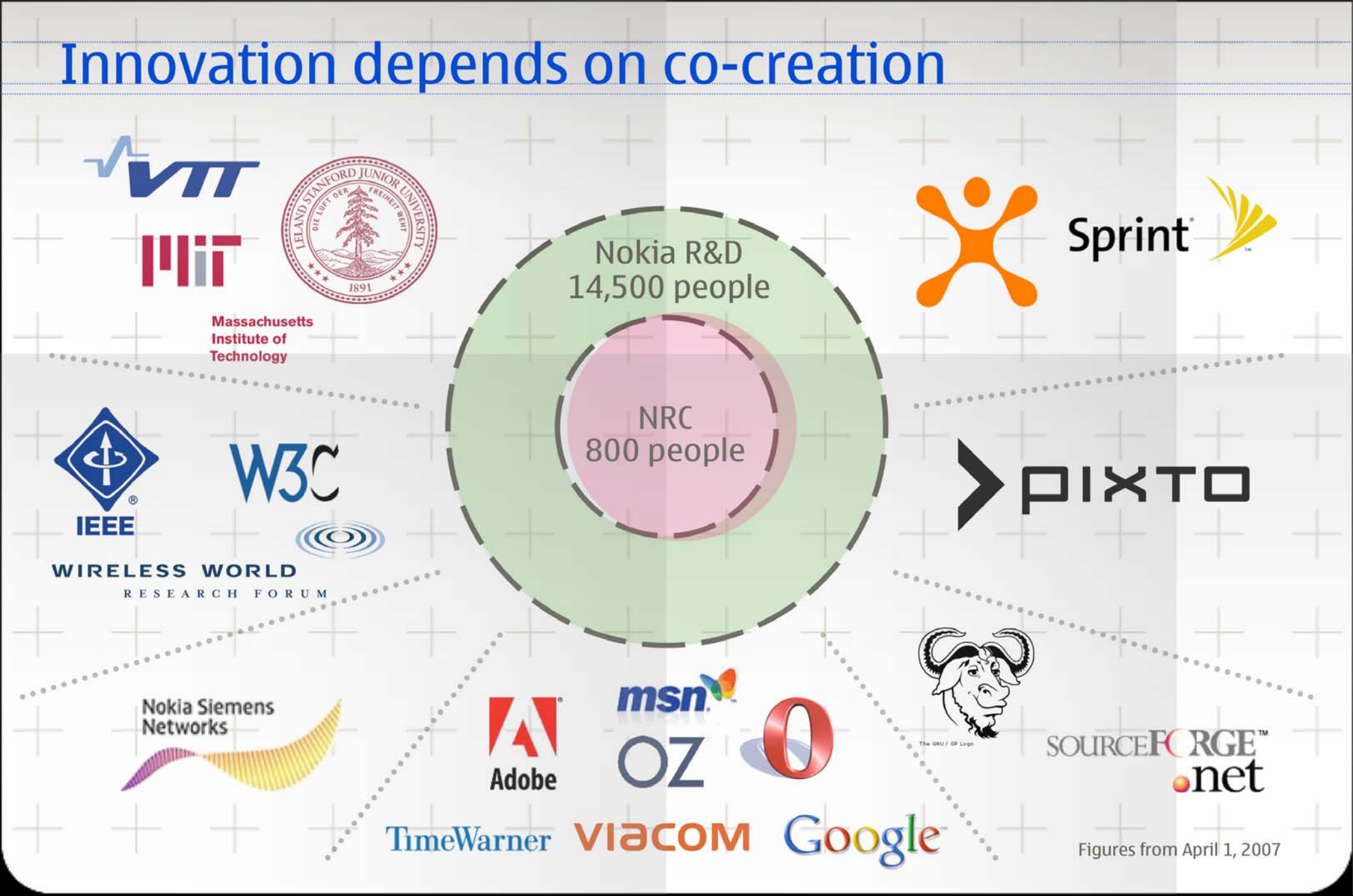
Application development platform

(distributed programming, creating a large developer community)

Physical world

("Out-of-phone experience": sensors, actuators, borrowed peripherals)

Innovation depends on co-creation



Collaboration - go where the experts are

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Collaboration with MIT

Motivation:

- Speech recognition
- UI
- Computing architecture

TEXAS INSTRUMENTS

CSAIL
MIT COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE LABORATORY

- SIMONE: Spoken interaction applications in English and Chinese for mobile phones.
- StartMobile: Using Natural Language text input in mobile environments

Summary

- Agility is at least as important as new technologies in delivering innovation
- Success breeds complexity
- Mobile phones are moving from embedded computing systems to PC-challengers - creating a significant opportunity
- Agility, complexity and opportunity are leading to re-thinking of how innovation is done: from closed to open
- Help us invent the next wave of computing
- Happy Birthday Arvind!

