Program between now and 18.15

- Setting the Nokia Scene
- Some key trends
- A Look at Technologies
- Implications to the terminal
- Conclusion
Setting the Nokia Scene

Fredrik Idestam (1838-1916)
Founder of Nokia
President of Nokia Company 1871-1894

The Roots of Nokia

- Founded in Tampere in 1865. Soon moved to neighboring town of Nokia. First product was groundwood.
- Finnish Rubber Works Ltd. Founded in Helsinki in 1898. Soon moved to Nokia. First product was rubber galoshes.
- Finnish Cable Works Ltd. founded in Helsinki in 1912. First product was imported copper wire coated with rubber-impregnated textile layer.
- Nokia Corporation formed in 1966 through the merger of Nokia Company, Finnish Rubber Works, and Finnish Cable Works.
From Multibranch to Telecommunications

- Floorings: 1%
- Chemicals: 2%
- Machinery: 4%
- Electrical: 4%
- Wholesale: 4%
- Mobile Telephones: 5%
- Telecommunications: 23%
- Rubber: 6%
- Information Systems: 23%
- Cables: 9%
- Paper: 10%
- Consumer Electronics: 31%
- Mobile Phones: 66%
- Infrastructure: 29%
- Other: 5%
- Intelligent networks
- Transmission systems
- Fixed networks
- Access networks
- Wireless/mobile data
- TETRA networks and terminals
- GSM networks
- Smart traffic products
- Multimedia
- Internet
- Digital exchanges
- Mobile phones
- Base stations

1988
1999
2000

Nokia Worldwide

- Sales offices
- R&D
- Production, incl. joint ventures
The Vision

- Our vision is the **Mobile Information Society**, in which an increasing part of all human communication is taking place with personal wireless terminals.

- The content of personal mobile communication evolves from **voice to text to images to multimedia**.

- The mobile phone is evolving to a **Personal Trusted Device** to be utilized for any kind of virtual or physical transactions.
Some Key Trends

The Exploding Market

Annual sales volumes for Passenger Cars, PCs, and Mobile Phones

Sources: Nokia, IDC, DataQuest, EIU
Internet Connectivity Outlook

Projected 1 billion Mobile Subscribers (Nokia 1999)

Projected PC's Connected to the internet (Dataquest 10/98)

Projected WAP Handsets (Nokia 1999)

Internet Connectivity Outlook

Millions

1,400
1,200
1,000
800
600
400
200
0


More handsets connected to the Internet than PC's by end of 2003!

Projected 1 billion Mobile Subscribers (Nokia 1999)

Projected PC's Connected to the internet (Dataquest 10/98)

Projected WAP Handsets (Nokia 1999)

Mobility Adds Value to Multimedia

Without Mobility Multimedia is just

- Home Shopping
- PC games
- Point to point video conferencing
- Armchair travels
- YellowPages
- On screen gambling
- Post processing of photographs
- Livingroom entertainment
- News at nine

With Mobility you are taken into

Virtual Reality

- Instant purchasing with MCommerce
- Virtual player groups independent of location
- Video conferencing on the move
- Multimedia holiday cards from friends, travel agencies
- Personalised Location based services
- Bet on your favourite team, where ever
- Sending and receiving multimedia postcards
- Your favourite music with you all the time
- Personalised news, when ever, where ever
100 Mbit somewhere is less significant than 100 kbit anywhere

Digital Industries Converge to Form a New, Fast-moving Industry
WAP Evolution

- WAP has to evolve to address
  - End-to-end security and e-commerce
    - First phase: guaranteed terminal to gateway security
    - Second phase: guaranteed terminal to content server security
    - Identity module, user authentication, client ID
  - Multimedia extensions
    - GIF, JPEG, MP3, MIDI, streaming audio/video - same model as in Internet, include all formats & provide mechanism to inform what formats each terminal can support
  - Location based services
    - Local services, travel services, navigation
  - Smart card support
    - Combine intelligence from both WAP terminal and smart cards
  - Provisioning and billing
    - OTA programming
    - Standardised ways to charge parties in the value chain for services
  - Java support
    - Support Java Applets - like small programs running on device
    - The same application interface for all devices

Time taken to reach 50 Million users

Nokia 6250
Nokia 6210
Nokia 7110
Nokia 9110i
EPOC will be the leading operating system in the Mobile Information Society

- Symbian’s developer community now over 30,000
- Personnel from 150 to 560 in only two years
- First EPOC based Nokia products will be available in 2001
- Total market volume of EPOC and Java enabled mobile phones will exceed the sales volume of PCs in 2003, being over 200 million units

Nokia’s Bluetooth solution

- One of the most advanced Bluetooth modules on the market
- The adopted technology ensures one of the most cost efficient mass volume production
- Point-to-multipoint solution available now
- Type approval passed for FCC and ETSI
- In 2001, Nokia will have several Bluetooth enabled products in its mobile phone portfolio.
**IPv6 for Wireless Services**

- IP address needed in a vast number of devices
  - All personal wireless terminals will have WAP and GPRS
  - Bluetooth enables the embedded environment
- IPv6 brings enough IP addresses
- IP Security will improve - IPSec mandatory in IPv6
- IPv6 has built-in IP mobility ->
  - Constant global reachability through optimized routing automatically
  - Smooth handovers for changing data network (e.g. WLAN-GPRS) without disconnecting
- This is what 'Global IP Mobility' means!

---

**IPv4 vs. IPv6 Address Space**

- IPv4: 32 bit address - available address space over 4 billion (4.29x10^9)
  - addresses are distributed unevenly
  - increase in mobile IP devices makes current address space insufficient

- IPv6: 128 bit address - address space 3.4x10^38
  - almost 8x10^38 times more than in IPv4
  - 3x10^24 IP addresses per each m² on Earth
  - the number is as big as the estimated amount of sand grains on Earth
**3G Milestones**

- Nokia’s first HSCSD terminals available (eg. the 6210)
  - datarate 43 kbps
- GPRS volume market will start 1H 2001
- EDGE in the beginning of 2002
- WCDMA mass market will begin 1H 2002

**3G Terminal Platform**

**Network**
- Servers (IP)
- Packet Networks
- GSM/MAP Evolution, IS-41

**Terminals**
- 3G Radio
- Bluetooth
- WAP
- EPOC
- USIM

**User Interface**
- Symbian 'Pearl'
  - 176*208 pixels

**Applications**
- Speech
- Multimedia
- Location based services
- Imaging

**Protocols**
- Speech, AMR, VoIP
- Multimedia
- H.324, H.323
- MPEG4, H.263
3G Terminal Services

**Early services**
- Real-Time Communication & Rich Call
- Messaging - MMS, Email, SMS
- Browsing - WAP

**Additional services**
- Location based services
- Execution environment - WAP, Java
- Access to Intranet/Internet

---

**Multimedia Messaging Migration - From SMS to Mobile Multimedia**

- The only standardised mobile messaging technology for 3G launch = a must for a good roll-out of any person-to-person service
- Gradual evolution in content versatility
- Similar user experience and charging model

- Versatility of Content and User Benefits:
  - SMS: Text
  - Picture Messaging: Text & Graphics
  - Multimedia Message Service: Digital Image Input
  - Mobile Multimedia: New content types
Mastering the Information Explosion

- Finding information becomes increasingly difficult
- Tools for navigating in knowledge are vital
- Content needs to migrate towards 'machine understandability'
- Combination of semantic information and artificial intelligence
- A world where computers can do things on our behalf

MPEG-7 for Multimedia Browsing

- Multimedia Content Description Interface
- Aim: a standard for describing the multimedia content data so that some degree of interpretation of the information’s meaning is possible
- Query examples:
  - MUSIC - playing a few notes on a keyboard finds tunes
  - GRAPHICS - drawing a few lines on a screen finds images
  - VOICE - using a voice excerpt finds recordings of the artist
- Then comes MPEG-21:
  - Facilitates selection, distribution, usage, storage, and related transactions of all types of content
- "Digital Items" carry standardized information on their characteristics
m-Commerce and the MeT Initiative

- The Digital economy is based on trust
- The customer must feel secure in all transactions
- Building a wide trust is a necessity
- Key technology cornerstones for m-Commerce will be:
  - WAP security functions (WTLS, WIM)
  - Bluetooth
  - Wireless Public Key technologies (PKI)
  - Already implemented mobile payment schemes
- Examples of key m-Commerce services:
  - Payments - local and remote
  - Remote banking
  - Brokerage - Datamonitor predicts 16M people in Europe buying and selling shares via WAP phones

SyncML - the glue between MIS components

- SyncML jointly initiated by Nokia, IBM and Lotus, Motorola and Starfish, Ericsson, Psion and Palm in February, 2000
- Nearly 200 companies have by now announced their support for SyncML
- First specification and reference toolkit released in May - months ahead of schedule
- Technology demonstrated to supporters at a summit in Los Angeles on June 23rd
- First SyncML compliant products to be expected in early 2001
Emerging Mobile Information Society

- Seamless services
- Messaging, multimedia
- Mobile telephony
- Always on
- Wireless, secure, high speed access
- Internet & Intranet
- Fast Internet access
- Shared databases & applications
- Mobile messaging
- Internet

Global IP Mobility

- Unified end-to-end applications
- IP
- 2G, GPRS, 3G, WLAN, Bluetooth, Fast Internet access, DSL, IT/Datacom
- IP coverage

Wide Area Coverage

Local Area Coverage
Implications to the Terminal

Evolution of Mobile Phone Categories
Cellular Mobile Telephones

- 8800 Premium
- 8200 Fashion
- 6100 Classic
- 6210 Classic
- 5100 Basic
- 3210 Basic
- 3310 Basic
- 6250 Tough

Digital Convergence Categories

- Imaging Phone
  Emotional device optimized for interpersonal communication with rich visual content

- Mediaphone
  Personal device optimized for accessing value-added services mobile Internet

- Communicator
  Rational device as the ultimate efficiency tool
Amount of SW in the Terminal Is Growing

Memory Size
- 2G Terminal 1998: 4 MBit
- 2G Terminal 2002: 16 MBit
- 3G Terminal 2002: 64 MBit

Radio Channel
- 2G Terminal 1998: 30 MIPS
- 2G Terminal 2002: 30 MIPS
- 3G Terminal 2002: >200 MIPS

Speech Coding
- 2G Terminal 1998: 3.30 MIPS
- 2G Terminal 2002: 3.30 MIPS
- 3G Terminal 2002: 30 MIPS

Voice Control
- 2G Terminal 1998: 50 MIPS
- 2G Terminal 2002: 50 MIPS

Video Coding
- 2G Terminal: 8-16 bits, 10 MHz
- 3G Terminal: 16-32 bits, >100 MHz

Control Processor
- 2G Terminal: 8-16 bits, 10 MHz
- 3G Terminal: 16-32 bits, >100 MHz
Terminal Technology Evolution

<table>
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<th>Year</th>
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<th>Relative power consumption (1/MHz)</th>
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</table>

In Conclusion

© NOKIA
Communications Technology Always in Focus

- "Railways, express mail, steam vessels and all possible means of communication are what moves the civilized world onwards."

  - J.W. von Goethe in a letter to Mr. Zelter 6.6.1825

Limits to the growth

- Moore’s law sets the pace for technology development

- Microelectronics evolve exponentially
  - Performance doubles every 18 months
  - Size remains the same
  - Price remains the same

- What is the limit for human communication?
  - A rough estimate on the required total bandwidth for natural conversation: 2 000 - 20 000 MBit/s (all senses included)