Development of Mobile Phone Markets

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Nokia Mobile Phones

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Program between now and 18.15

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

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Setting the Nokia Scene

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.

Fredrik Idestam (1838-1916)

Founder of Nokia

President of Nokia Company 1871-1894

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From Multibranch
to Telecommunications

Floorings 1%
Chemicals 2%
Machinery 4%
Electrical
Wholesale 4%
Mobile Telephones 5%
Telecommunications
5%
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

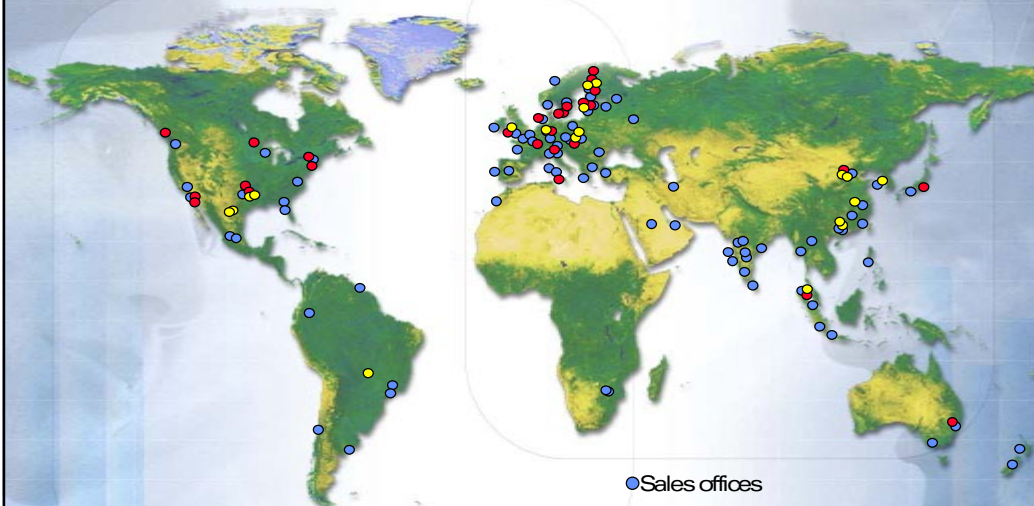**1988** **1999** **2000**

5   © NOKIA
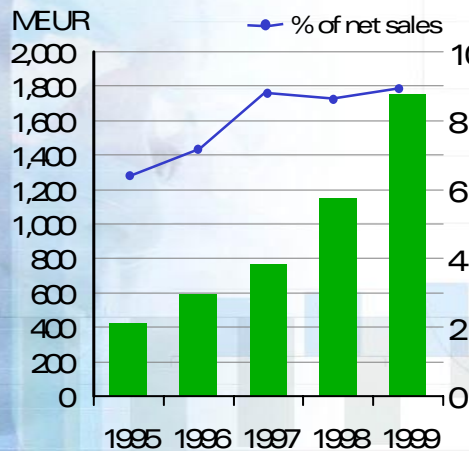
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Nokia Worldwide

● Sales offices
● R&D
● Production, incl.
   joint ventures

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31 % of Nokia Employees in R&D
R&D expenditure MEUR 1 755 in 1999 (8.9% of net sales)

MEUR

—●— % of net sales

Chart showing MEUR bars (green) and % of net sales (line) for years 1995–1999:

- Left axis: 0 to 2,000 (200 increments)
- Right axis: 0 to 10

Year	MEUR (approx)
1995	~420
1996	~600
1997	~770
1998	~1,160
1999	~1,755

- Global network with 52 R&D centers in 14 countries
- Over 17 000 people in R&D at the end of December 1999
- Nokia Research Center is the corporate R&D unit of Nokia

1 EUR = 1.008 USD (December 31, 1999)

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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.

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Some Key Trends

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The Exploding Market

Nokia estimate

Million units

Annual sales volumes for Passenger Cars, PC's and Mobile Phones

Watches -98: 1240 million

	Passenger Cars
	PCs
	Cellular Terminals

450
400
350
300
250
200
150
100
50
0

1991 1992 1993 1994 1995 1996 1997 1998 1999 2000

Sources: Nokia, IDC, DataQuest, EIU

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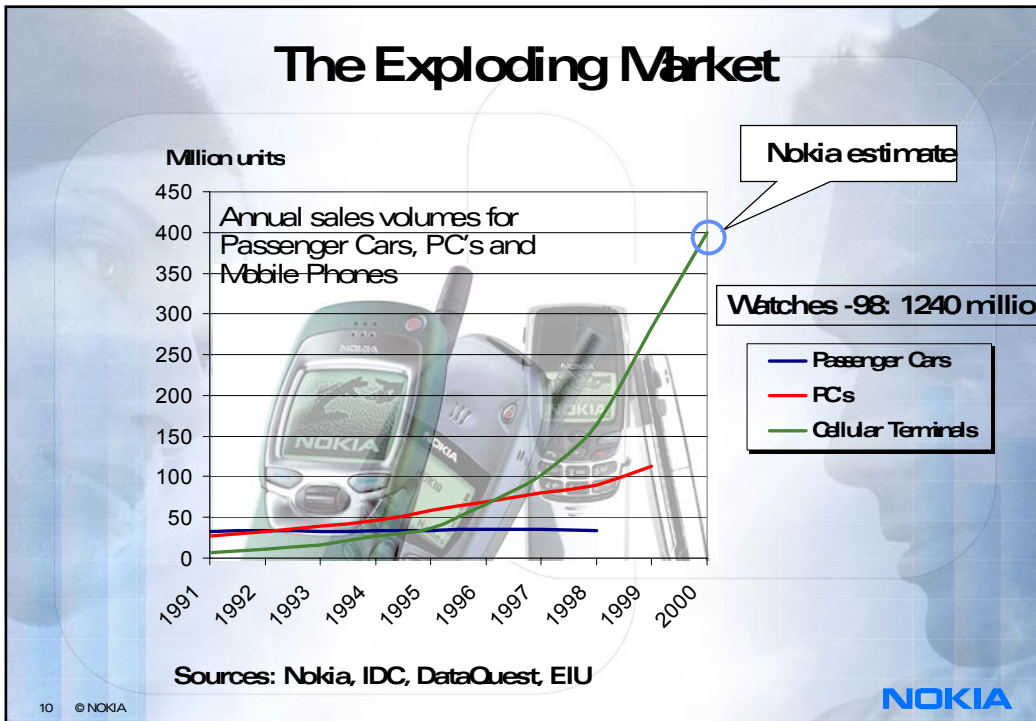
Internet Connectivity Outlook

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*)

1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

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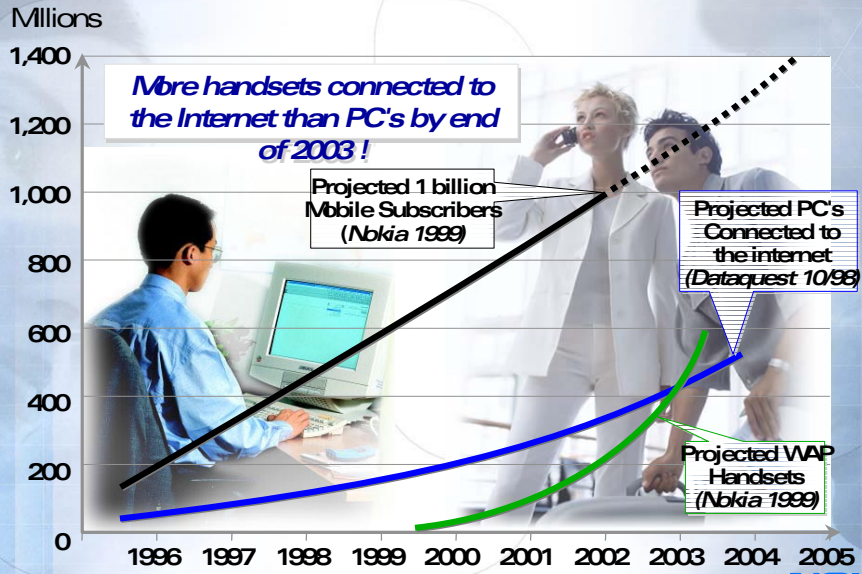
Mobility Adds Value to Multimedia

Without Mobility Multimedia is just

Virtual Reality

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

With Mobility you are taken into

Real Life

- Instant purchasing with M-Commerce
- 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

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The Valuable Mobility

100 Mbit somewhere is less significant
than 100 kbit anywhere

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Digital Industries Converge
to Form a New Fast-moving Industry

Disney.com   YAHOO!   CNNin interactive

AOL.COM   amazon.com

SONY   ERICSSON

Microsoft

Lucent Technologies

IBM

Information Technology

Cisco Systems

NOKIA   *Telecom*

PHILIPS   AT&T   New, fast-moving industry

Consumer Electronics

TEXAS INSTRUMENTS   MOTOROLA

Panasonic

A Look at Technologies
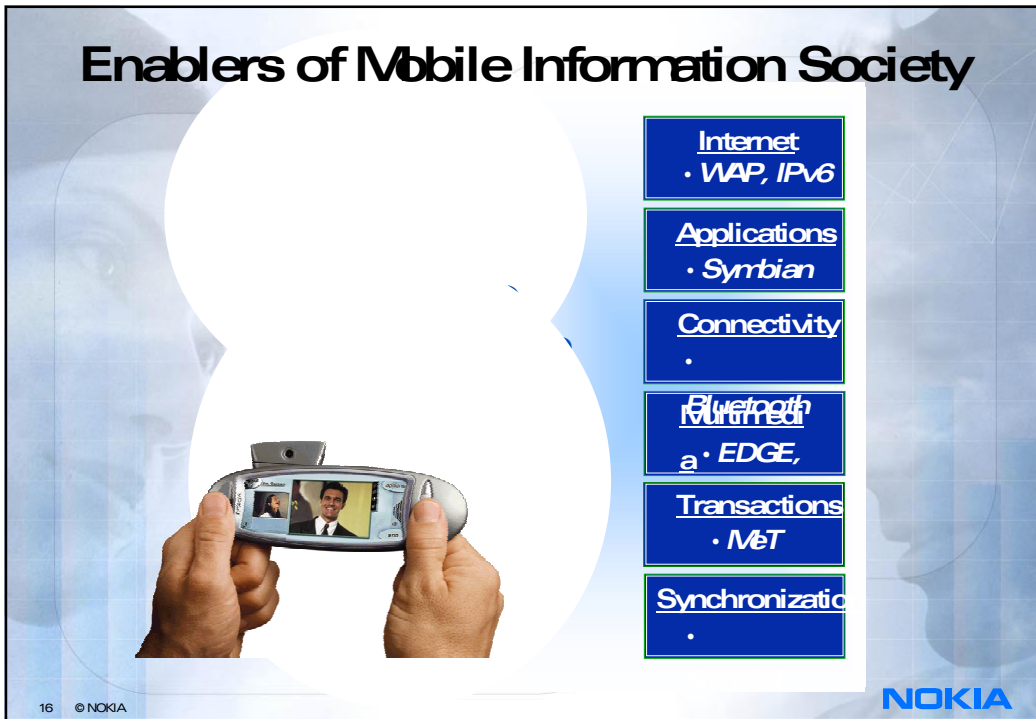
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Enablers of Mobile Information Society

Internet
· WAP, IPv6

Applications
· Symbian

Connectivity
·

Bluetooth

Multimedia
· EDGE,

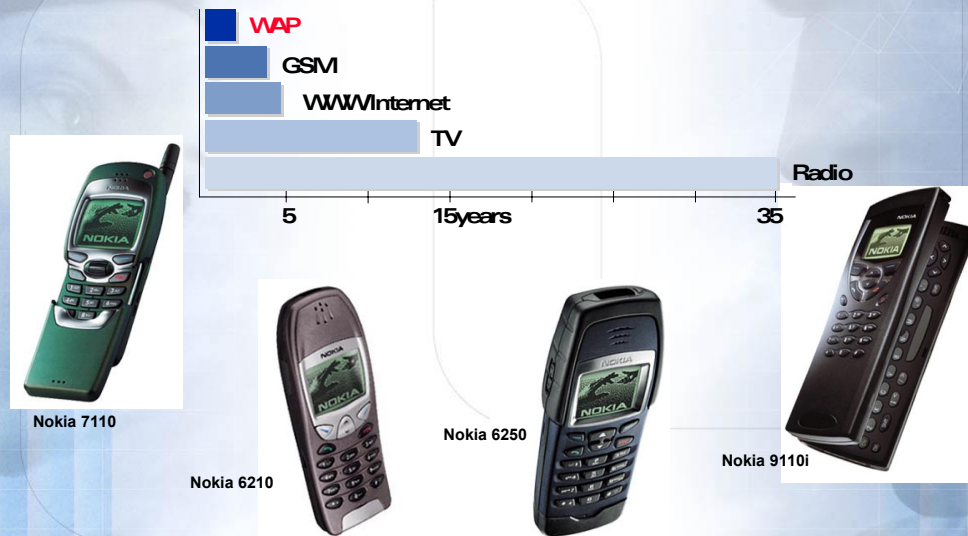**Transactions**
· MeT

Synchronization
·

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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

WAP

GSM

WWW Internet

TV

Radio

5　　　　15years　　　　35

Nokia 7110

Nokia 6210

Nokia 6250

Nokia 9110i

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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

symbian

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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.

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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 trhrough 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 (4.29×10^9)
  - addresses are distributed unevenly
  - increase in mobile IP devices makes current address space insufficient

- IPv6: 128 bit address - address space 3.4×10^{38}
  - almost 8×10^{28} times more than in IPv4
  - 3×10^{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

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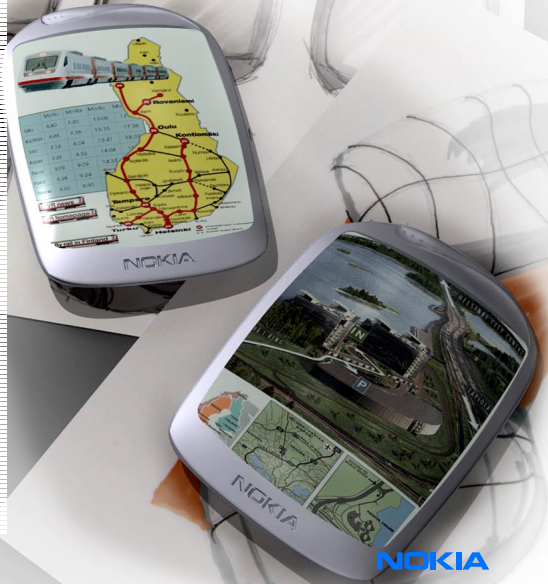
3G Terminal Platform

Network
- Servers (IP)
- Packet Networks
- GSMMAP 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
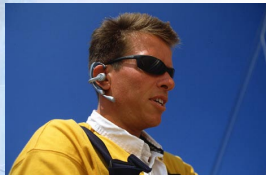- Speech, AMR, VoIP
- Multimedia
- H.324, H.323 MPEG4, H.263

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3G Terminal Services

Early services

Real-Time Communication & Rich Call

Additional services

Messaging - MMS, Email, SMS

Location based services

Browsing - WAP

Execution environment - WAP, Java

Access to Intranet/Internet

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Multimedia Messaging Migration - From SMS to Mobile Multimedia

Versatility of Content and User Benefits

Mobile Multimedia

Multimedia Message Service

Picture Messaging

SMS

Text

Text & Graphics

Digital image input

New content types

Time
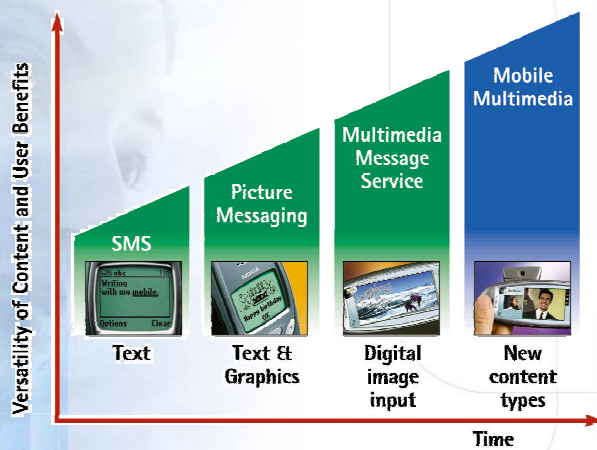
- The **only** standardised mobile messaging technology for 3G launch = a must for a good roll-out of any person-to-person service

- Gradual evolution in content versatility

- Similar user experience and charging model

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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

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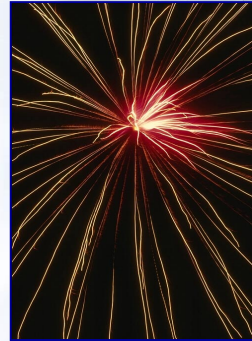
MPEG-7 for Multimedia Browsing

- 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

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m-Commerce and the MeT Initiative

- The Digital economy is based on trust

- The customer must feel secure in all transaction

- 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

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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

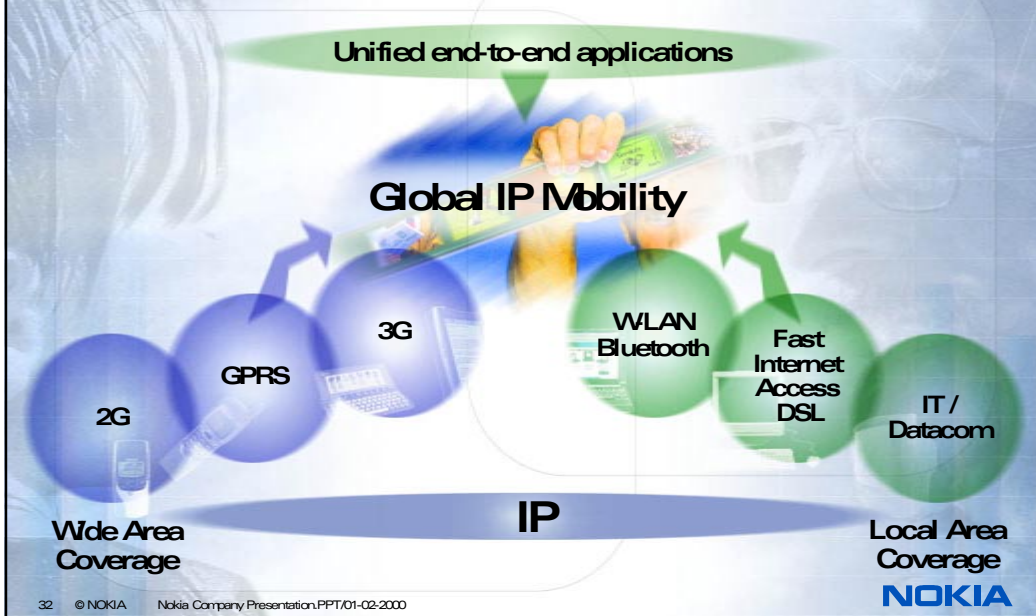- First SyncML compliant products to be expected in early 2001

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Emerging Mobile Information Society

Seamless services

Mobile Information Society

Mobile telephony

Messaging internet always on

Mobile multimedia

Wireless, secure, high speed access

Fast Internet & Intranet

Shared databases & applications

Wide Area Coverage

Local Area Coverage

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Global IP Mobility

Unified end-to-end applications

Global IP Mobility

2G

GPRS

3G

WLAN Bluetooth

Fast Internet Access DSL

IT / Datacom

IP

Wide Area Coverage

Local Area Coverage

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Implications to the Terminal

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Evolution of Mobile Phone Categories

Communicator

Premium

Classic

Media

Fashion

Basic

Nokia Talkman
Nokia Cityman
101
121
2110
8110
9000
9910
8850
8800
6100
6150
7100
8210
2010
1610
3110
5100
3210

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Cellular Mobile Telephones

8800
Premium

8200
Fashion

6100
6210
Classic

5100
3210
3310
**Basic**

6250
Tough

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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
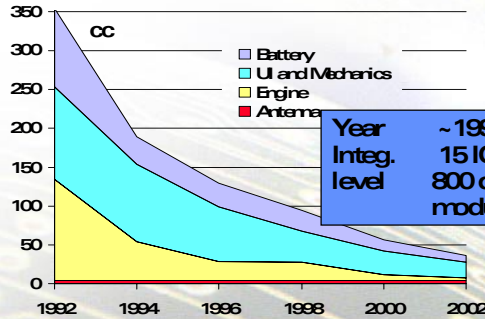
Amount of SW in the Terminal Is Growing

MCU SW

DSP code

Analog   1st gen digital   WCDMA
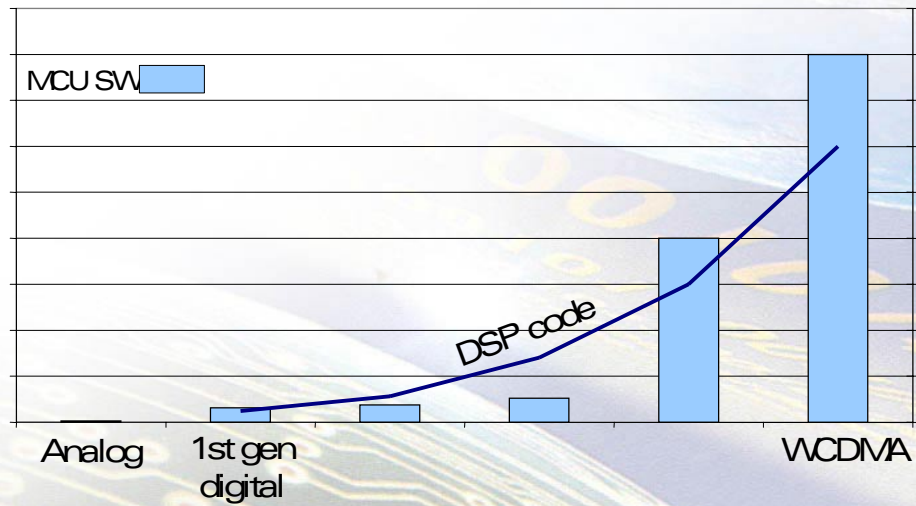
Source: NMP

Multimedia Demands Processing Power

	2G Terminal 1998	2002	3G Terminal 2002
Memory Size	4 MBit	16 MBit	64 MBit
Radio Channel	30 MIPS	30 MIPS	>200 MIPS
Speech Coding	3-30 MIPS	3-30 MIPS	30 MIPS
Voice Control		50 MIPS	50 MIPS
Video Coding			>200 MIPS
Control Processor	8-16 bits, 10 MHz		16-32 bits, >100 MHz

Terminal Technology Evolution

	1992	1994	1996	1998	2000
Gate density (gates/mm2)	2 000	5 000	15 000	30 000	50 000
Processing power (MIPS)	20	50	80	120	200
Relative power consumption (1/MHz)	100	30	10	3	1
Relative power consumption (max MIPS)	100	75	40	18	10

125 cc

~90 cc

cc

- Battery
- UI and Mechanics
- Engine
- Antenna

350
300
250
200
150
100
50
0

1992 1994 1996 1998 2000 2002

Year	~1994	~1996	~2000
Integ. level	15 IC's 800 discretes modules	10 IC's 500 discretes modules	6 IC's 250 discretes modules

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In Conclusion

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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)