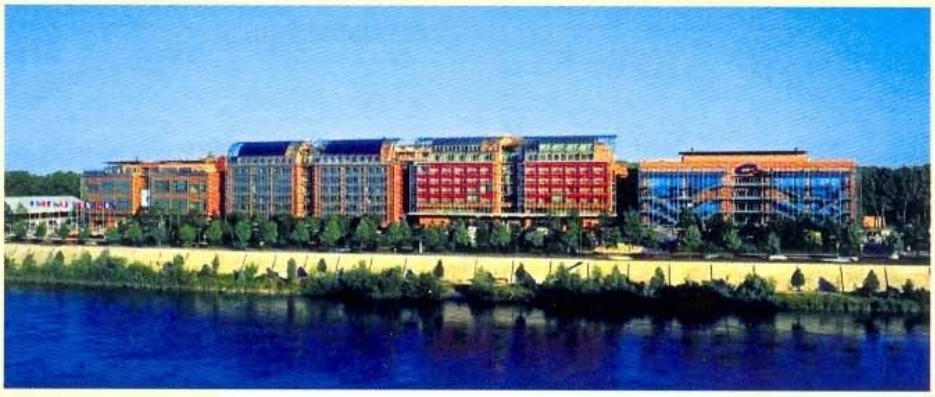
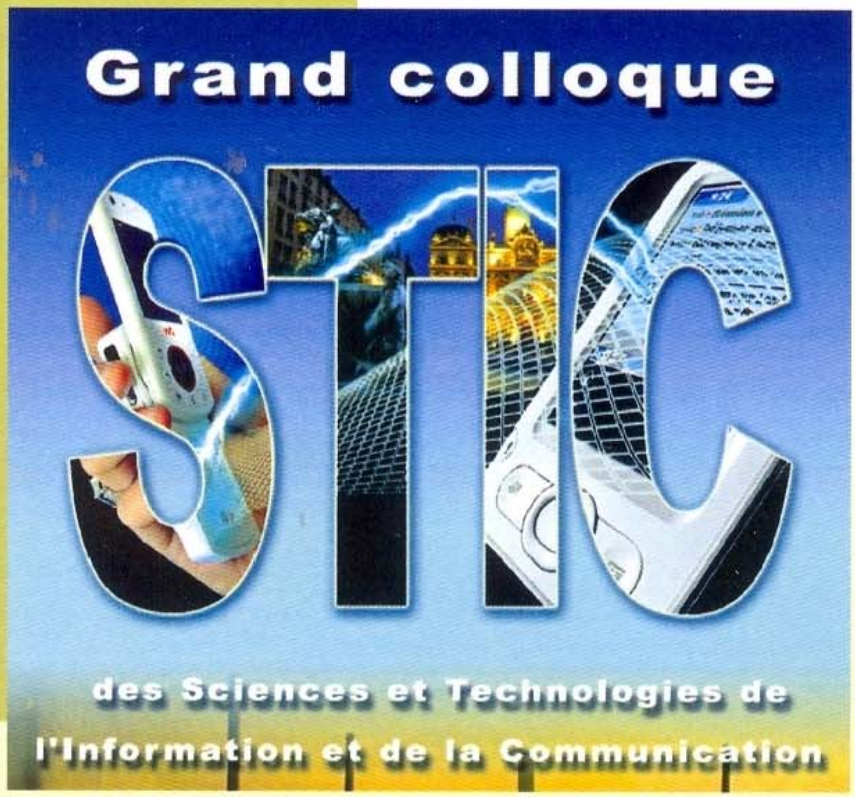
Programme



GRAND COLLOQUE STIC - 2006

RIAM - RNRT - RNTL
Réseaux de recherche
et d'innovation technologiques



LYON
Centre
de congrès

15 et 16
novembre
2006

riam RNRT RNTL

Coordination Action within FP6

BREAD

***BR*oadband in *E*urope for *A*ll: a multi-*D*isciplinary approach**

Contact: peter.vandaele@intec.ugent.be

Agenda

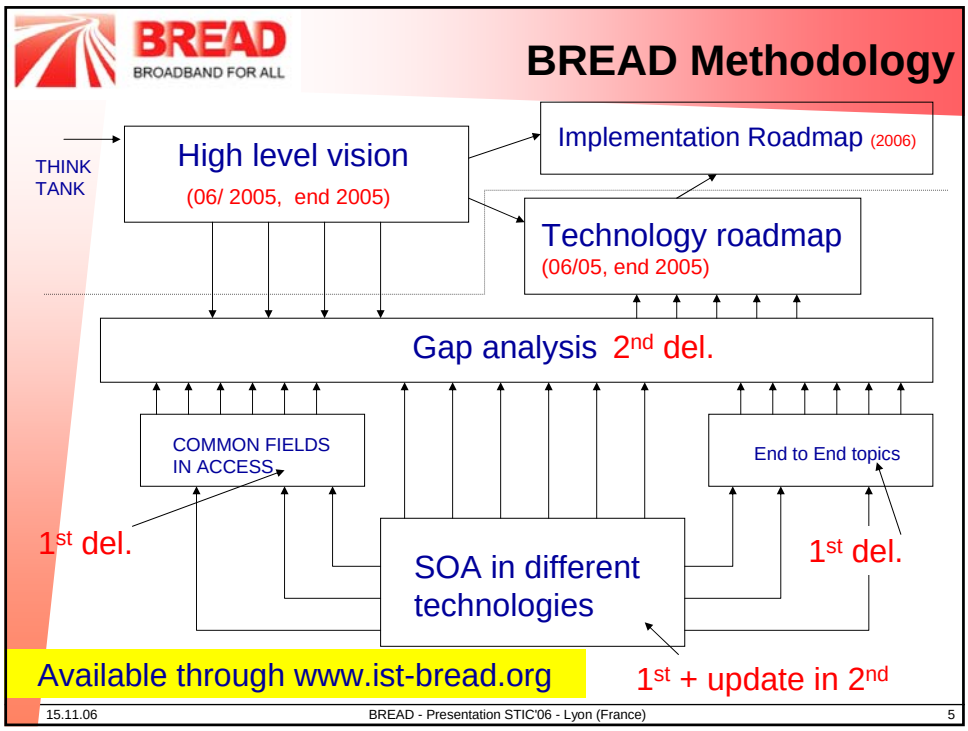
1. BREAD Introduction
2. BREAD Roadmap planning & methodology
3. Why a Multi-disciplinary approach is needed
4. Challenges to the network
5. Convergence
6. Core & Access evolution
7. Where are we now?
8. Conclusions

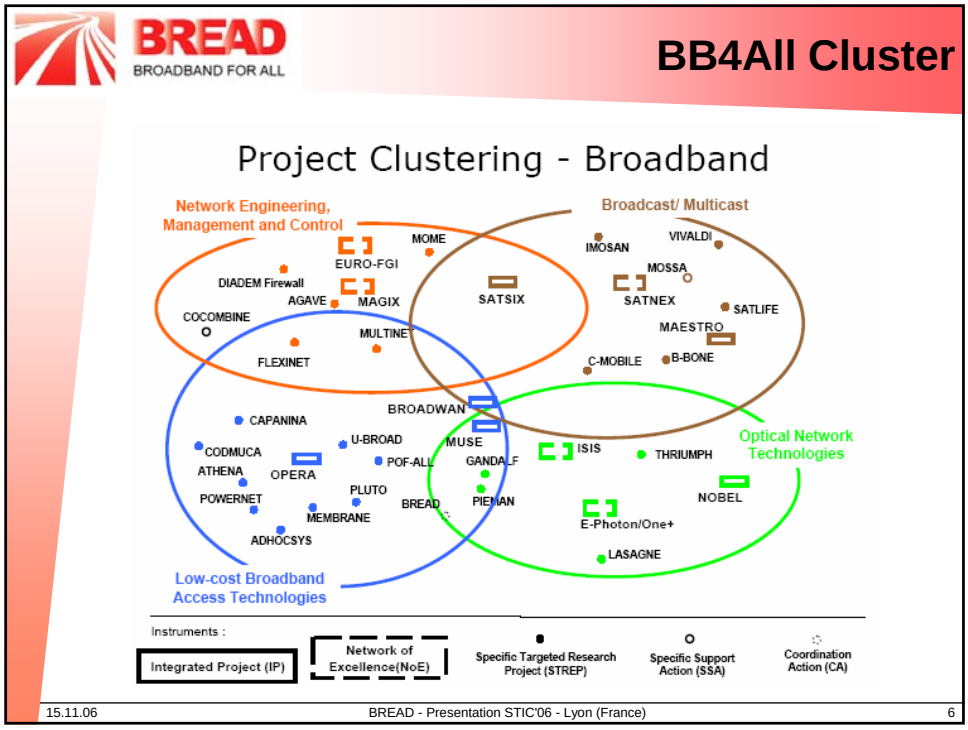
BREAD Introduction

- **IMEC (co-ordinator)** **B**
- University of Essex UK
- Research Center COM / CTI DK
- Groupe des Ecoles des Télécommunications F
- FhG/HHI D
- TELSCOM consulting CH
- JRC - Institute of Prospective Technological Studies E
- JCP - Consult F

BREAD Objectives

- Develop a multi-disciplinary view for the realisation of ***'broadband for all'***
- Combine forces in the area of
  - state-of-the-art results in R&D on the technological level
  - expertise towards the economic sustainability and the in-time adoption of adequate business models
  - expertise and study towards the regulatory aspects on EU level and the re-conciliation of customers' and industries' interests
- Develop a more holistic vision encompassing technical, as well as economical and regulatory aspects
- Identify roadblocks on European, national/regional level
- Share visions and best practices on national level to EU level (ERA)
- Benchmarking the EU situation with US & AP develop.


BREAD
BROADBAND FOR ALL
BREAD Methodology
THINK TANK
High level vision
(06/ 2005, end 2005)
Implementation Roadmap (2006)
Technology roadmap
(06/05, end 2005)
Gap analysis 2nd del.
COMMON FIELDS IN ACCESS
End to End topics
1st del.
SOA in different technologies
1st del.
Available through www.ist-bread.org
1st + update in 2nd
15.11.06
BREAD - Presentation STIC'06 - Lyon (France)
5


BREAD
BROADBAND FOR ALL
BB4All Cluster
Project Clustering - Broadband
Network Engineering, Management and Control
Broadcast/ Multicast
Optical Network Technologies
Low-cost Broadband Access Technologies
MOME
EURO-FGI
DIADEM Firewall
AGAVE
MAGIX
SATSIX
COCOMBINE
MULTINE
FLEXINET
IMOSAN
VIVALDI
MOSSA
SATNEX
SATLIFE
MAESTRO
C-MOBILE
B-BONE
BROADWAN
CAPANINA
CODMUCA
U-BROAD
MUSE
ATHENA
OPERA
POF-ALL
GANDALF
ISIS
THRIUMPH
POWERNET
PLUTO
BREAD
PIEMAN
NOBEL
MEMBRANE
E-Photon/One+
ADHOCSYS
LASAGNE
Instruments :
Integrated Project (IP)
Network of Excellence(NoE)
Specific Targeted Research Project (STREP)
Specific Support Action (SSA)
Coordination Action (CA)
15.11.06
BREAD - Presentation STIC'06 - Lyon (France)
6

The BREAD Project

Develop a multi-disciplinary view for the realisation of ***'broadband for all'***

www.ist-bread.org

www.bbeurope.org

BroadBand Europe

A Multi-disciplinary approach

Information & Communication Technologies

Information and communications are at the heart of human life and social development

People have always worked together by sharing information and knowledge through speech, writing, the printed word and, more recently, telephony and broadcasting

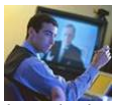
Sharing information empowers individuals and communities, and enables whole societies to benefit from the experience of everyone within them

A Multi-disciplinary approach

Teleworking / e-learning

eCare

home security



video telephony

Unified messaging

conferencing

TV and video

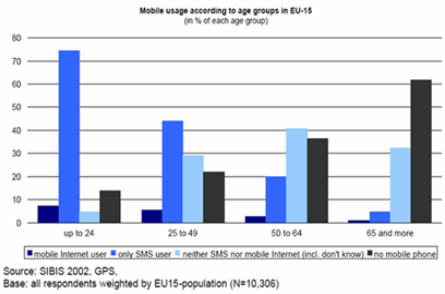
music

gaming

Information **Communication** **Entertainment**

A Multi-disciplinary approach

In the developed world, ICT has become a crucial enabling factor in the functioning of society and economy

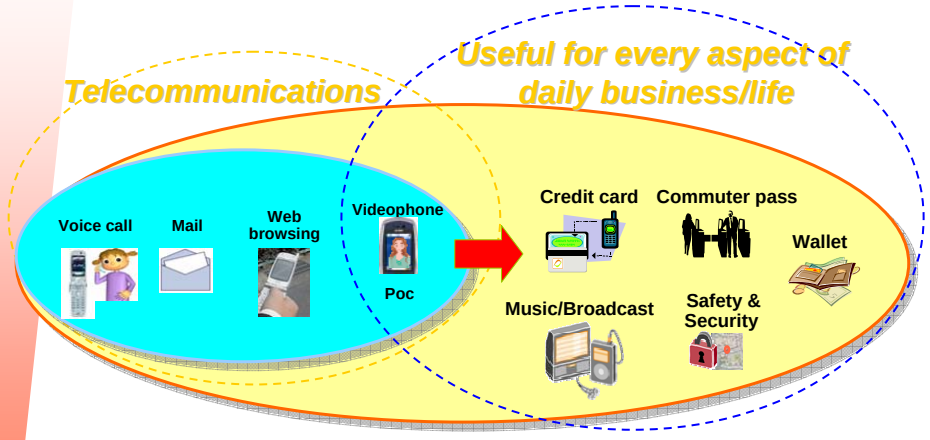


ICT has a fast growing influence on the societal behaviour of people

BREAD
BROADBAND FOR ALL

Challenges to the network

From "Telecom" services to "Lifestyle Infrastructure"



Sharing information empowers individuals and communities, and enables whole societies to benefit from the experience of everyone within them

(after Dr. J. Schwarz da Silva, EU Commission)

BREAD
BROADBAND FOR ALL

Challenges to the network

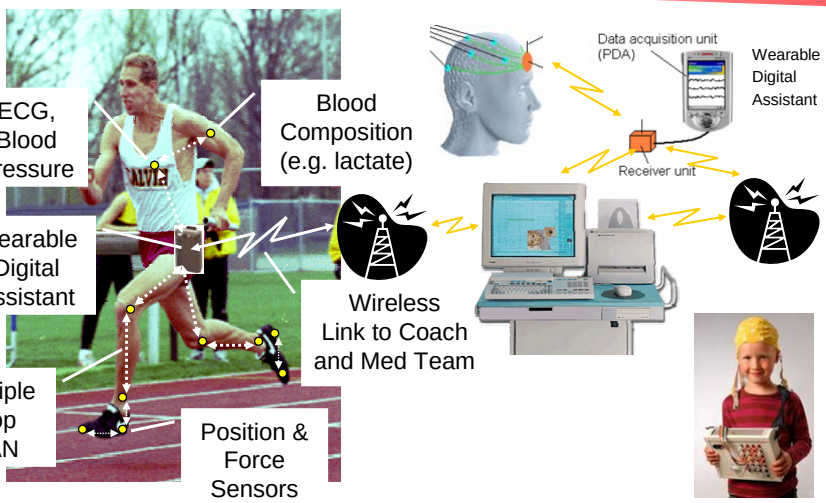
Add Tags and Sensors - over 1 trillion

Source: Forrester Research, as cited in BusinessWeek.com, 20/02/05

(after J. Oberstar, Cisco Optics)

BREAD
BROADBAND FOR ALL

Body Area Networks



(after Dr. A. de Albuquerque, EU Commission)

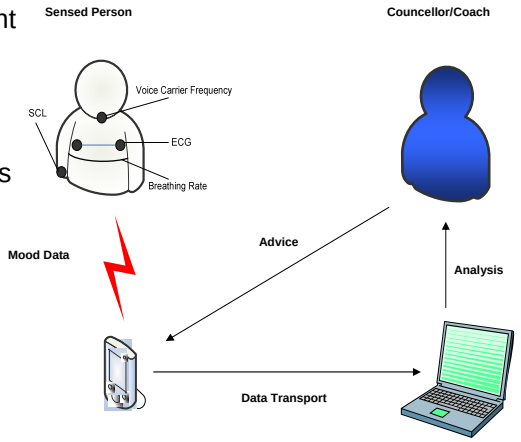
BREAD
BROADBAND FOR ALL

Sensor networks

Health counselling

For people who have constant fear (e.g. phobia) or suffer from depression

A monitoring by psychologists and counsellors to provide advice and support to overcome their worries.

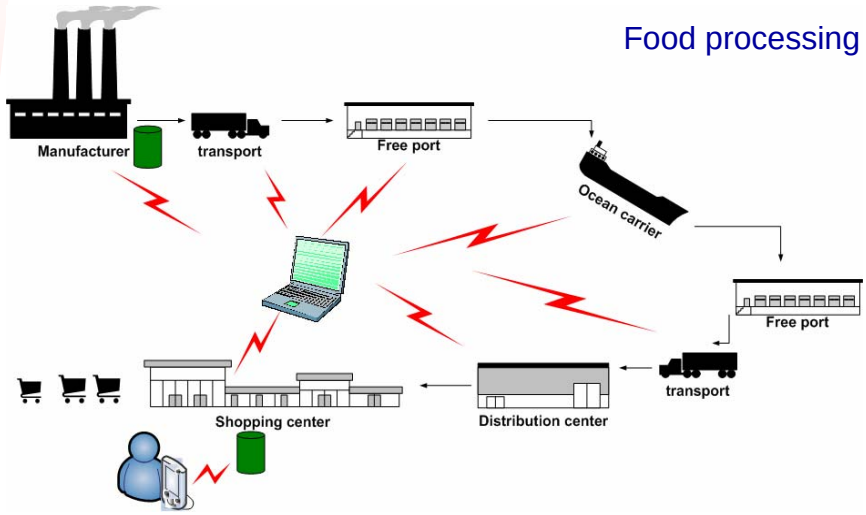


Reliability – liability – security - privacy

BREAD
BROADBAND FOR ALL

Sensor networks

Food processing



Cost – size – integration – lifetime

BREAD
BROADBAND FOR ALL

Ambient Intelligence

- Person-to-Anything (Physical) Interaction
  - leading to more natural means of interactions
- Enablers are Sensor Networks (actuators and sensors)
  - ubiquitous computing
  - '*disappearing technologies*'
- Context Information for

  Context aware
  applications
  services
  communications

BREAD
BROADBAND FOR ALL

Current Networks

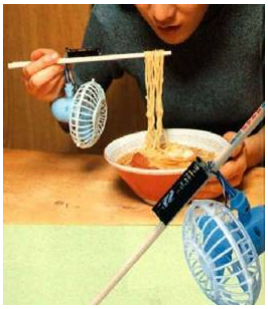
Access specific terminals & services
Independent service platforms
Multiple customers identifiers
Separate billing & regulation

(after Dr. Phil Holmes, Motorola)

BREAD
BROADBAND FOR ALL

Future Converged Networks

Convergence is about the collapse of disparate technology, equipment and services into a set of common and ubiquitous technology, equipment and services

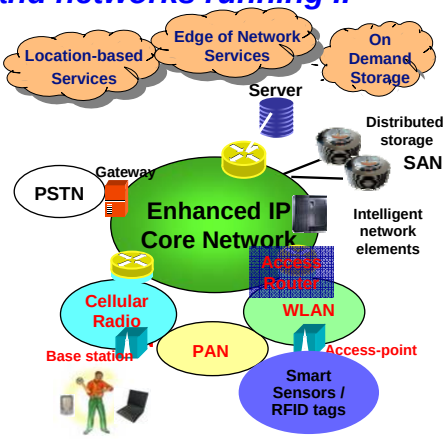


(after Dr. J. Schwarz da Silva, EU Commission)

Future Converged Networks

Data, voice and multimedia will be carried over heterogeneous broadband networks running IP

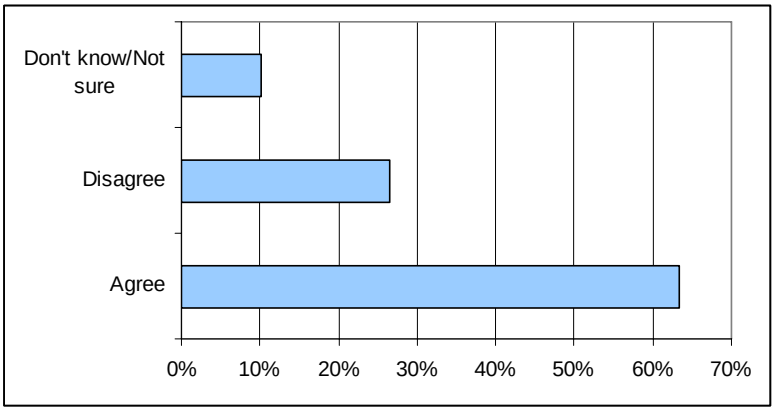
- Supporting very large number and variety of devices
  - Wireless communicators: Cell phones, PDA's, pagers …
  - Interactive "smart" sensors: health monitors, environmental sensors …
  - RFID tags



(after Dr. J. Schwarz da Silva, EU Commission)

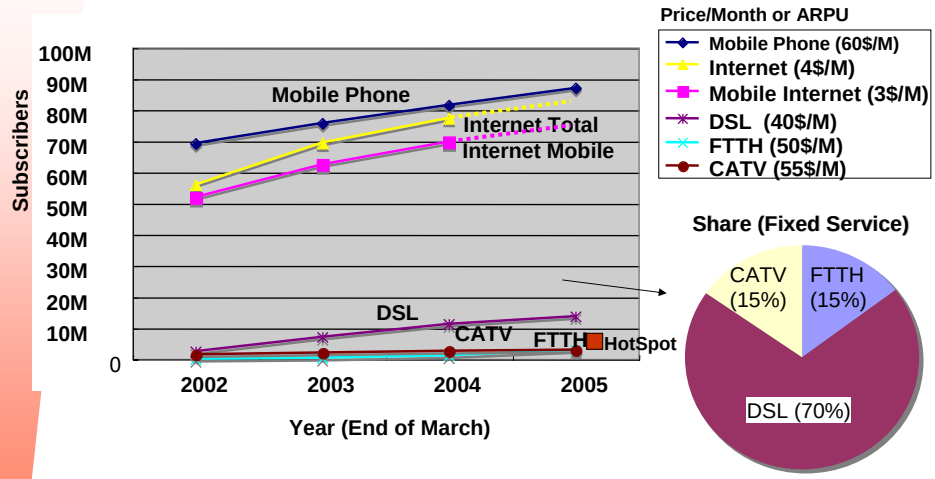
… but all buy the vision

"Within the next decade, the first link in every network will always be wireless-cellular, WiFi, WiMax, UWB, and so on-and devices will automatically choose the most appropriate type of wireless link based on location, price, and bandwidth."



Source: Heavy Reading Survey of Service Provider Attitudes to Fixed-Mobile Convergence, November 2004. Base: 109 Service Providers

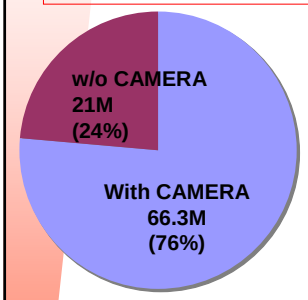
Internet Access in Japan

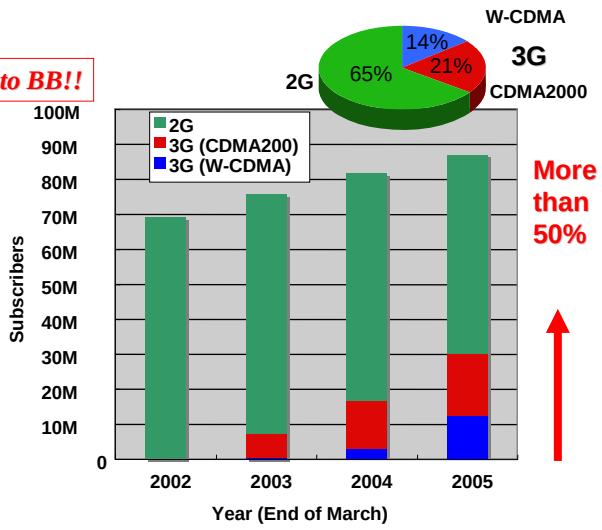


(after S. Komaki, Osaka University)

Mobile Terminals in Japan

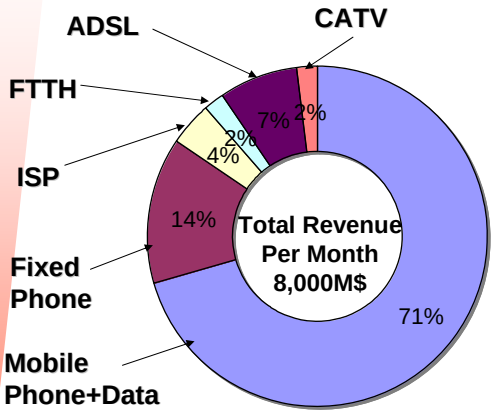
Mobile Phone is changing to BB!!





(after S. Komaki, Osaka University)

Revenue Per Month

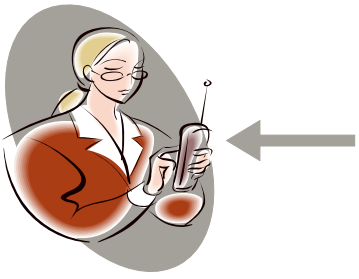


- **Mobile is dominated in Subscriber Numbers and also Revenue**
- **Even if the FTTH replaces ADSL, revenue is not larger than mobile**
- ***FMC* is key for Future**

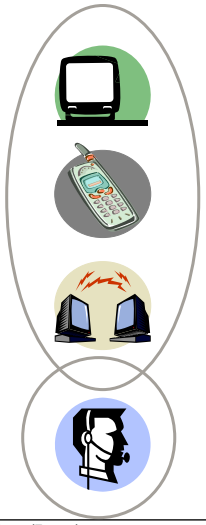
(after S. Komaki, Osaka University)

Packaging is critical

- The winners will be those who bundle the right packages for customers



User is looking for:
- experience
- personalisation
- mobility



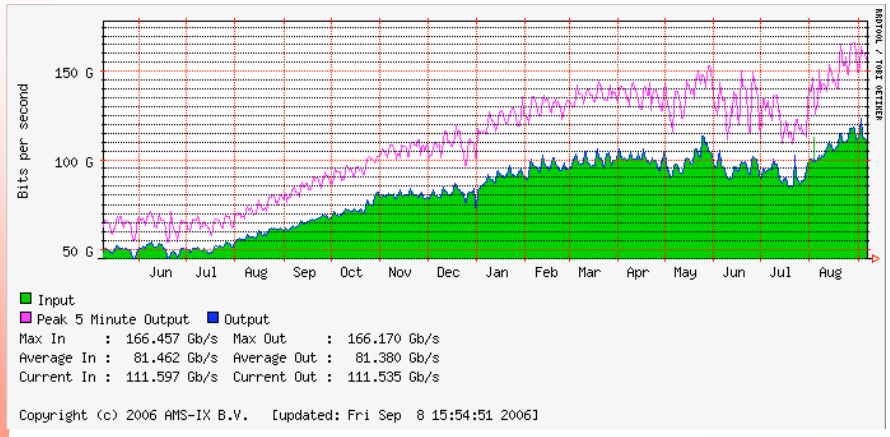
Content

Applications

Network

Customer service

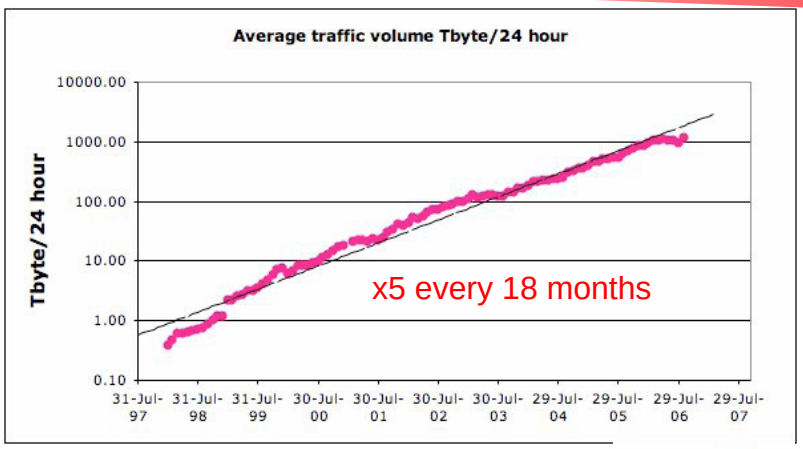
Internet Traffic Growth



Source: "End user perspective on higher speed Ethernet" by Henk Steenman, IEEE Higher Speed Interest Group meeting, Knoxville, TN, Sept 2006

(after M. Wale, Bookham)

Traffic Growth in Amsterdam Internet Exchange



Source: "End user perspective on higher speed Ethernet" by Henk Steenman, IEEE Higher Speed Interest Group meeting, Knoxville, TN, Sept 2006

(after M. Wale, Bookham)

Is this what Petabit/s will look like?

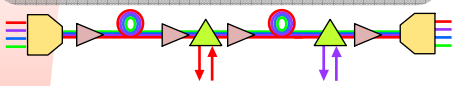
Challenges to the network

- **Very high growth rates in IP traffic might stimulate to reconsider:**
  - **Network architectures**
  - **Components**
  - **Transmission**
  - **…..**

… or we might encounter an optical bottleneck

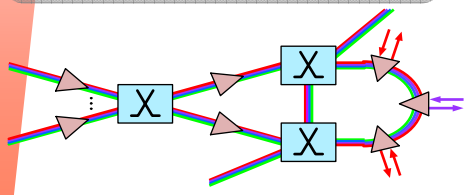
Core Network Evolution

Today
Fixed WDM/multipoint network
10Gb/s line rate
SONET / SDH transport



Key Technology
Fixed wavelength sources
Passive mux / demux
EDFA
In line dispersion compensation
Fixed wavelength OADM

Emerging
ROADM configured Mesh WDM network
10Gb/s and 40Gb/s line rate
Ethernet compatibility



Key Technology
Full-Band tunable sources
Tunable mux / demux
Raman/EDFA hybrid amplifiers
In line dispersion compensation
Electronic Dispersion Compensation
Per channel residual compensation
N-degree node ROADM
Optical performance monitoring

(after M. Wale, Bookham)

Optics in BB4All

Factors influencing broadband development

- Country configuration
  - •GDP per capita
  - •population density (Canada vs Belgium)
  - •demography of a country
  - •climate
  - •cultural characteristics
    - open to foreign influences (Belgium, Netherlands),
    - embracing new technologies (South Korea, Japan)
  - •knowledge of the English language

-> highest take-up:
rich country with fairly equally income distribution, high population density where a relatively young population is concentrated in urban areas rather than suburbs, bad weather and widespread knowledge of English – …….

(FP6-BREAD Deliverable)

Emerging Internet uses

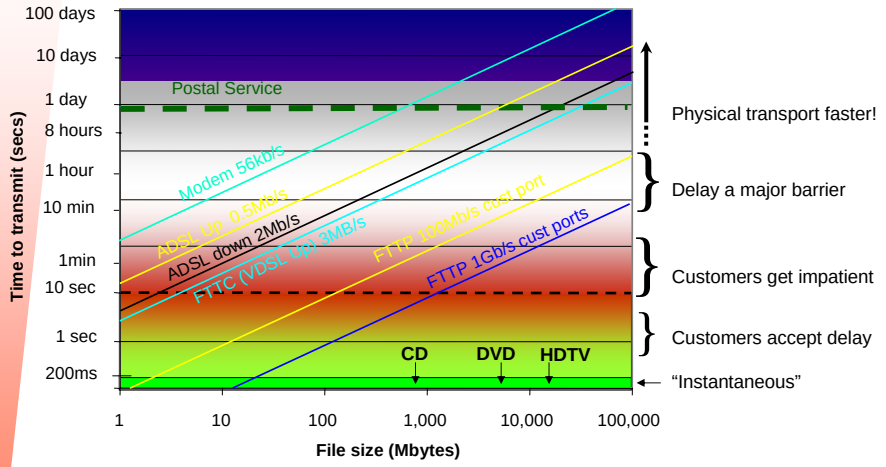
- Voice, video chat
- Peer-to-Peer file sharing
  - Estimated >100 Petabytes/month
- Blogging, photo sharing, user generated content
  - "Uploading your Life"
  - Estimated 32M blog sites worldwide
  - Flickr! – 120M photos, adding 500k/day
- Video clip search
  - YouTube sold to Google this week for $1.65B (1.5B Euro)
  - 100M videos viewed each day, 72M users
  - Most popular video clips downloaded 7M times
- Massively multi-player online role play games
  - Estimated 1.8M players in UK

Major growth areas are not always the ones that are expected

Source: DAIWA EuroTelco Snapshot, April 2006

(after M. Wale, Bookham)

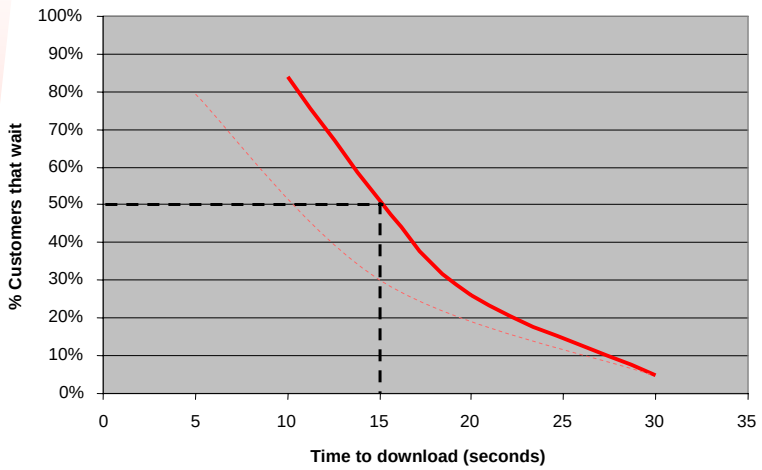
Time to transmit files



(after D. Payne, BT Exact)

BREAD
BROADBAND FOR ALL

Impatience Index



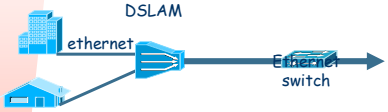
(after D. Payne, BT Exact)

BREAD
BROADBAND FOR ALL

Access Network Evolution

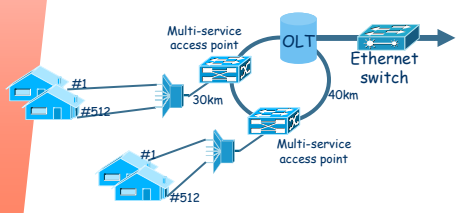
Today
Copper / DSLAM / Ethernet aggregation
BPON / GEPON prevalent GPON emerging
2.5G maximum line rate

Key Technology
DSLAM boxes
Ethernet switches
Diplexers / Triplexers
Passive splitters for PON (eg 1:32)



Emerging
Integration of Access and Metro – LRPON
Access to service edge – node consolidation
10Gb/s downstream rate

Key Technology
DWDM EDFA
Passive splitters (1:512)
Pluggable EDFA
ROADM
Reflective ONU (SOA)
Burst mode electronics to 10G
Pluggable tunables
Burst wavelength switching
Tunable filters
Carrier class dependability

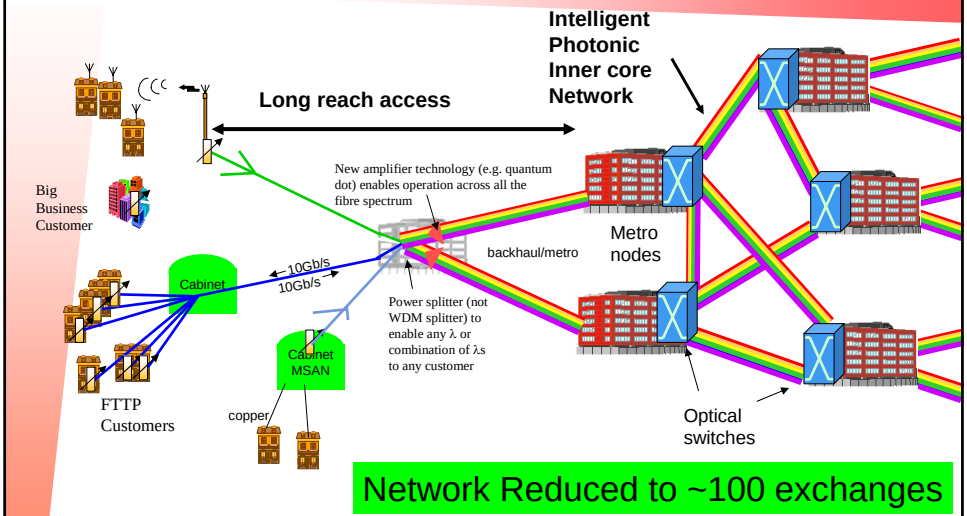


(after M. Wale, Bookham)

BREAD
BROADBAND FOR ALL

Integrated access and backhaul with photonic core

Longer Term Vision – Flexible wavelength assignment & DBA



Network Reduced to ~100 exchanges

Tunable & self install ONU (for residential customers)

(after D. Payne, BT Exact)

BREAD
BROADBAND FOR ALL

Benefits

Based on Ipswich Exchange serving ~15,000 customers

Today

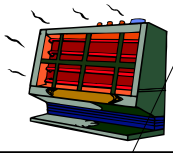
900 racks

826 kw

21C MSAN

20 racks

50-100 kw



Long Reach PON

<1 rack

100W

1 per
~1000 customers

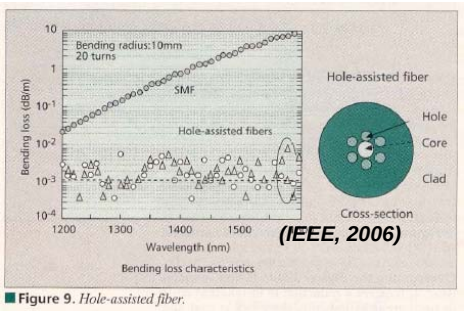
(after D. Payne, BT Exact)

Is it good enough?

- Deployment cost is mostly due to laying fiber cables
- The fiber medium offers about 200x125GHz = 25,000 GHz of useable bandwidth
- Current PONs offer no more than 2.5GHz of bandwidth shared among 32 users
  - Not much different than xDSL technologies
  - It is as efficient as we were to drive ~500,000 Hp cars
- Can optical systems and devices allow significant better use of the expensive infrastructure?

Design Challenges for Optics

- **Higher DATA RATE**
- **Higher THERMAL / Lower POWER CONSUMPTION**
- **Higher FLEXIBILITY: Pluggable, Tunable**
- **Lower SIZE / Higher PORT DENSITY**
- **Lower COST**
- **New COMPONENTS**



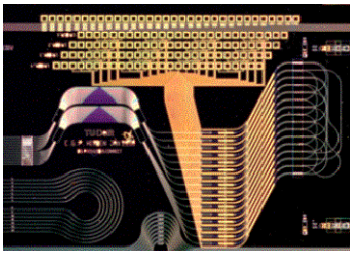
(IEEE, 2006)

Figure 9. *Hole-assisted fiber.*

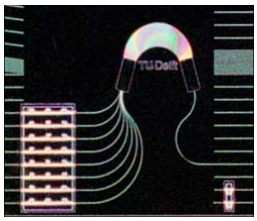
(after J. Oberstar, Cisco Optics)

Examples of Photonic ICs

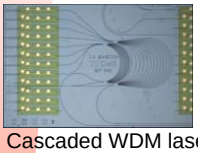
optical crossconnect



(4λ OXC, Herben, PTL, 1999)

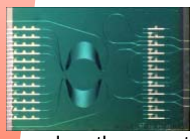


multiwavelength laser



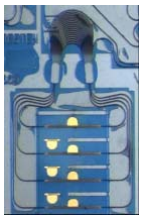
Cascaded WDM laser

tunable multiwavelength laser

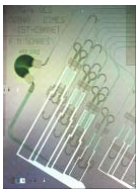


wavelength converter

picosecond pulse laser



WDM ring laser

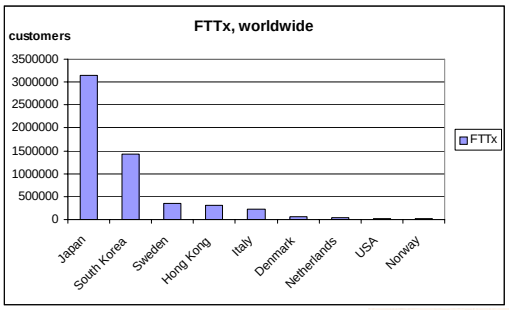


WDM-TTD switch

Photonics - VLSI =
Very Little Significant Integration

(after M.Smit, COBRA)

Where are we now?



(Point Topic, September 2005)

(FP6-BREAD Deliverable)

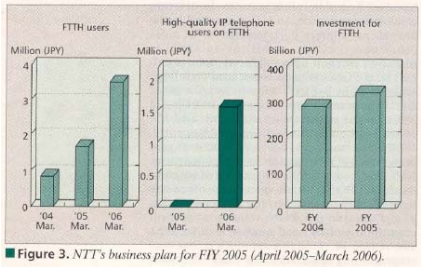
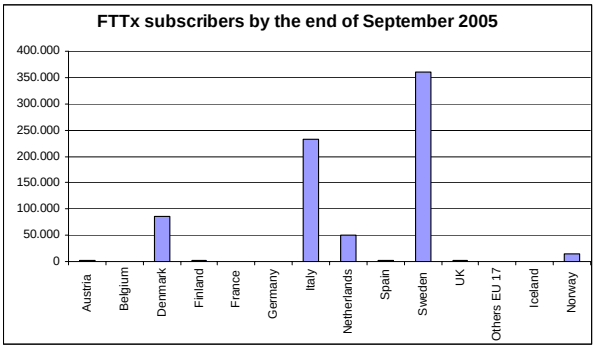


Figure 3. *NTT's business plan for FIY 2005 (April 2005–March 2006).*

(IEEE, 2006)

Where are we now?



Incumbent operators	8	7,8%
Municipalities / power utilities	72	69,9%
Alternative operators / ISPs	9	8,7%
Housing companies & Other	14	13,6%

• *Table 1: Players involved in FTTx initiatives in Europe*

(FP6-BREAD Deliverable)

Where are we now?

Who is (not) deploying (in Europe)?

Who's not?

- Traditional telecom operators
- Cable operators

Who is?

- Housing corporations
- Utility companies
- City and local communities

Organizations that are close to the end-user!

Why?

- Their future is linked to the success of the community
- They can transform the benefit of fiber to return-on-investment
- They have a long term vision

(after G. van den Hoven, Genexis)

Where are we now?

The key to high penetration …

Business case is only successful at high penetration rates

- Cost of infrastructure is divided over the active users
- “Homes passed” don’t bring in any money!

3-step marketing model

1. Offer broadband internet for free
2. When all is up and running, offer voice and TV at competitive prices
3. Start charging for internet (again at competitive prices)

… user addiction!

(after G. van den Hoven, Genexis)

Conclusions

Conclusion #1

- Broadband is an addiction
- The thirst for broadband will never quench
- Ever step in demand for broadband opens opportunities for photonics technology

Conclusion #2

- Make sure legislation does not get in the way of the fiber/broadband revolution
- Public parties should actively stimulate deployment of broadband fiber infrastructure

(after G. van den Hoven, Genexis)

Conclusions

Conclusion #3

- Photonics technology is needed to continuously feed the capacity and capabilities of broadband communication system
- In other words: Photonics technology is required to fulfil “beyond” Moore law.

It’s market pull,
not technology push

“Would it be too much to ask to get a DSL in here?”