Future Vision of Business Oriented Innovation in Wireless and Mobile Communication Sectors

ICWMC 2009

Dr. Reda REDA

- ICTmc Vienna/Munich
- IARIA
- IFIP
Overview

The ICT Evolution: Technology

Techno-Economic

Mobility

Security & Trust

The Industry Vision
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Memory Capacity per Chip

- Human memory
- Human DNA

- Book
- Encyclopedia
- 2 hrs CD Audio
- 30 sec HDTV

Year:
- 1970
- 1980
- 1990
- 2000
- 2010

Number of bits per chip:
- 10^4
- 10^5
- 10^6
- 10^7
- 10^8
- 10^9
- 10^10

- 64 Kbits
- 256 Kbits
- 1 Mbit
- 4 Mbits
- 16 Mbits
- 64 Mbits
- 256 Mbits
- 1 Gbit
- 4 Gbits
- 64 Gbits

- 0.15-0.2 μm
- 0.25-0.3 μm
- 0.35-0.4 μm
- 0.5-0.6 μm
- 0.7-0.8 μm
- 1.0-1.2 μm
- 1.6-2.4 μm
- 0.08 μm
Number of Transistors per IC: Scales every 4-5 Y
High Performance Computing  HPC

- The Top 500 Super Computers

- Independent Market Analysis
HPC: Number 500
HPC: Number One

[Graph showing the growth of supercomputing from 1993 to 2007, with various companies and their achievements highlighted.]
HPC: Number One
HPC: Evolution Trend
The New MC Trend

CPU vs GPU
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Single thread out of cache

$P_n = P_1 + P_2 + P_3 + P_4$
Example Fluid Algorithm

CPU

Control
ALU
Cache
P_1
P_2
P_3
P_4
\ldots

DRAM

GPU

Control
ALU
P_1, P_2, P_3, P_4
P_1, P_2
P_3, P_4

Video Memory

Single thread out of cache

Multiple passes

P_n = P_1 + P_2 + P_3 + P_4

Data/Computation

Program/Control
Example Fluid Algorithm

CPU

GPGPU

GPU Computing

Single thread out of cache

Multiple passes through video memory

Parallel execution through cache

Data/Computation

Program/Control

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The New/Future MC Applications

GPU → Sensors → Applications
GPU Computing Example Markets

- Computational Geoscience
- Computational Chemistry
- Computational Medicine
- Computational Modeling
- Computational Science
- Computational Biology
- Computational Finance
- Image Processing
Applications - Condensed

- 3D image analysis
- Adaptive radiation therapy
- Acoustics
- Astronomy
- Audio
- Automobile vision
- Bioinformatics
- Biological simulation
- Broadcast
- Cellular automata
- Computational Fluid Dynamics
- Computer Vision
- Cryptography
- CT reconstruction
- Data Mining
- Digital cinema/projections
- Electromagnetic simulation
- Equity training
- Film
- Financial - lots of areas
- Languages
- GIS
- Holographics cinema
- Imaging (lots)
- Mathematics research
- Military (lots)
- Mine planning
- Molecular dynamics
- MRI reconstruction
- Multispectral imaging
- nbody
- Network processing
- Neural network
- Oceanographic research
- Optical inspection
- Particle physics
- Protein folding
- Quantum chemistry
- Ray tracing
- Radar
- Reservoir simulation
- Robotic vision/AI
- Robotic surgery
- Satellite data analysis
- Seismic imaging
- Surgery simulation
- Surveillance
- Ultrasound
- Video conferencing
- Telescope
- Video surveillance
- Visualization
- Wireless
- X-ray

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FI vs. IP
## Current OSI Model

The OSI (Open Systems Interconnection) model is a conceptual model that describes how data is transmitted between computers. It divides the communication process into seven layers, each responsible for a specific aspect of the communication protocol.

### OSI Model

<table>
<thead>
<tr>
<th>Host Layers</th>
<th>Media Layers</th>
<th>Data Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>application</td>
<td>network</td>
<td>segments</td>
</tr>
<tr>
<td>data</td>
<td>packet</td>
<td></td>
</tr>
<tr>
<td>presentation</td>
<td>data link</td>
<td></td>
</tr>
<tr>
<td>session</td>
<td>physical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>data</td>
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<td>data</td>
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<tr>
<td></td>
<td>data</td>
<td></td>
</tr>
</tbody>
</table>

- **application**: Network Process to Application
- **presentation**: Data Representation & Encryption
- **session**: Interhost Communication
- **transport**: End-to-End Connections and Reliability
- **network**: Path Determination & Logical Addressing (IP)
- **data link**: Physical Addressing (MAC & LLC)
- **physical**: Media Signal and Binary Transmission

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OSI Model vs. FI Model

 layers

 application
 Network Process to Application
 presentation
 Data Representation & Encryption
 session
 Interhost Communication
 transport
 End-to-End Connections and Reliability
 network
 Path Determination & Logical Addressing (IP)
 data link
 Physical Addressing (MAC & LLC)
 physical
 Media Signal and Binary Transmission

 new layers

 application
 mediation
 connection
FI 3-Layers Model

- **application**: Overlay adapted to underlying layers. Increase efficiency and robustness.
- **mediation**: Supporting transport over any kind of networks.
- **connection**: Heterogeneity of network technologies. Interoperability between technologies.
FI: The New Architecture

- Global Infrastructure
- Networking Operation Infrastructure
- Wireless Access Sensors
- VS Backbone Network
- Wireless Access Actuators
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Techno-Economics: The Big Picture
IT & C : ICT Market

€ Billion

2000

1000

2006 2007 2008 2009 2010

IT market
Telekom market

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Wireless Internet Access

Wireless all CAGR 2000-2010: 11%

Wireless Internet CAGR 2000-2010: 31%
Wireless Standards

MBWA
- WCDMA
- GPRS
- EDGE

WAN
- WiMAX

MAN
- Wi-Fi

LAN
- RFID/TAG
- UWB
- Bluetooth
Wireless Technologies / Standards & Mobility

[Diagram showing various wireless technologies and standards, including 4G, LTE & Systems beyond 3G, WiMAX, IEEE 802.16, Ethernet (Cu), Ethernet (Fibre), and others, categorized by degree of mobility and data rate.]
Vision of the 4G

Broadband Celluar
- 100+ Mbps Data Rates
- Asymmetric Access
- Smart Antennae Supported

Ubiquitous Access

Adaptability
- Adaptive Modulation/Coding
- Dynamic Spectrum Assignment
- Software Radio
- QoS Control

4G Vision

Convergence
- Wireless LAN, Fixed Wireless Access
- Digital Broadcasting

Packet Centric
- true IP
- Optimal Cost

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Nightmare of Heterogeneous Networking

- Global Layer
- Regional Layer
- National Layer
- Local Area Layer
- Personal Network Layer

4G IP-based Backbone
- Satellite
- DVB-T
- 3G Cellular
- Wireless LANs
- Wireless PANs

Horizontal Handover
Vertical Handover
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The Industry Vision
Do we have SECURITY ?
Tools Available to Achieve Site Security

- Encryption
- Firewalls
- Security Tools
- Network Security Protocols
- Access Controls
- Virtual Private Networks
- Authentication
- Tunneling
- Proxy/Agent Systems
- Intrusion Detection

Security Management
NSA – www.nsa.gov
Microsoft - www.microsoft.com
Security Bla Bla ....
Tools Available to Achieve Site Security

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Security Management
Split-Out of the ICT Security Market

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Balance: A and C
SECURITY

The

R & D Trends
Information may take different physical forms...

... mechanical,

... or electronic,

... or bio-molecular,

... or quantum, etc.

There is no information without a physical carrier, and no computation without a physical process.

The laws of physics dictate what computations can be.
A classical bit is, at every point in time:
- either in state 1:
- or in state 0:

State of a classical bit: \( b \in \{0, 1\} \)

B ist ein element aus dem wertbereich 0 or 1

A quantum bit (« qubit ») is, at every point in time:
- either in basis state \( |1\rangle \):
- or in basis state \( |0\rangle \):
- or in a superposition state, i.e. at the same time \( |1\rangle \) and \( |0\rangle \):

State of a qubit:
\( |\psi\rangle \in E \)

where \( E \) is a 2-dimensional vector space
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The Industry Vision: the Magic System
System of the Year:
Properties / Performance Parameters:

SOB
BB- Wireless
Core : Fl with
  Best P.
  Best TMN of HN
Best Security and Trust
+ 4G
+ 380 mph
+ Seamless HO
+ 3S
System of the Year

The Industry Dream for 2012

SOB
BB- Wireless
Core : FI with
Best A.
Best TMN of HN
Best Security and Trust
+ 4G
+ 380 mph
+ Seamless HO
+ 3S
Thank You

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