IARIA

NexTech 2010
October 25-30 Florence, Italy

Dr. R. Reda , ICTmc

Keynotes
Smart Grid: Emerging Technologies, Future Trends and Impact to the Global Power Engineering and Energy Strategy

NexTech 2010
Florence

Dr. R. Reda , ICTmc

It`s all about:

In Life — Money

In Economy — GDP

In Management — Time

In Science — Power /Energy

Overview

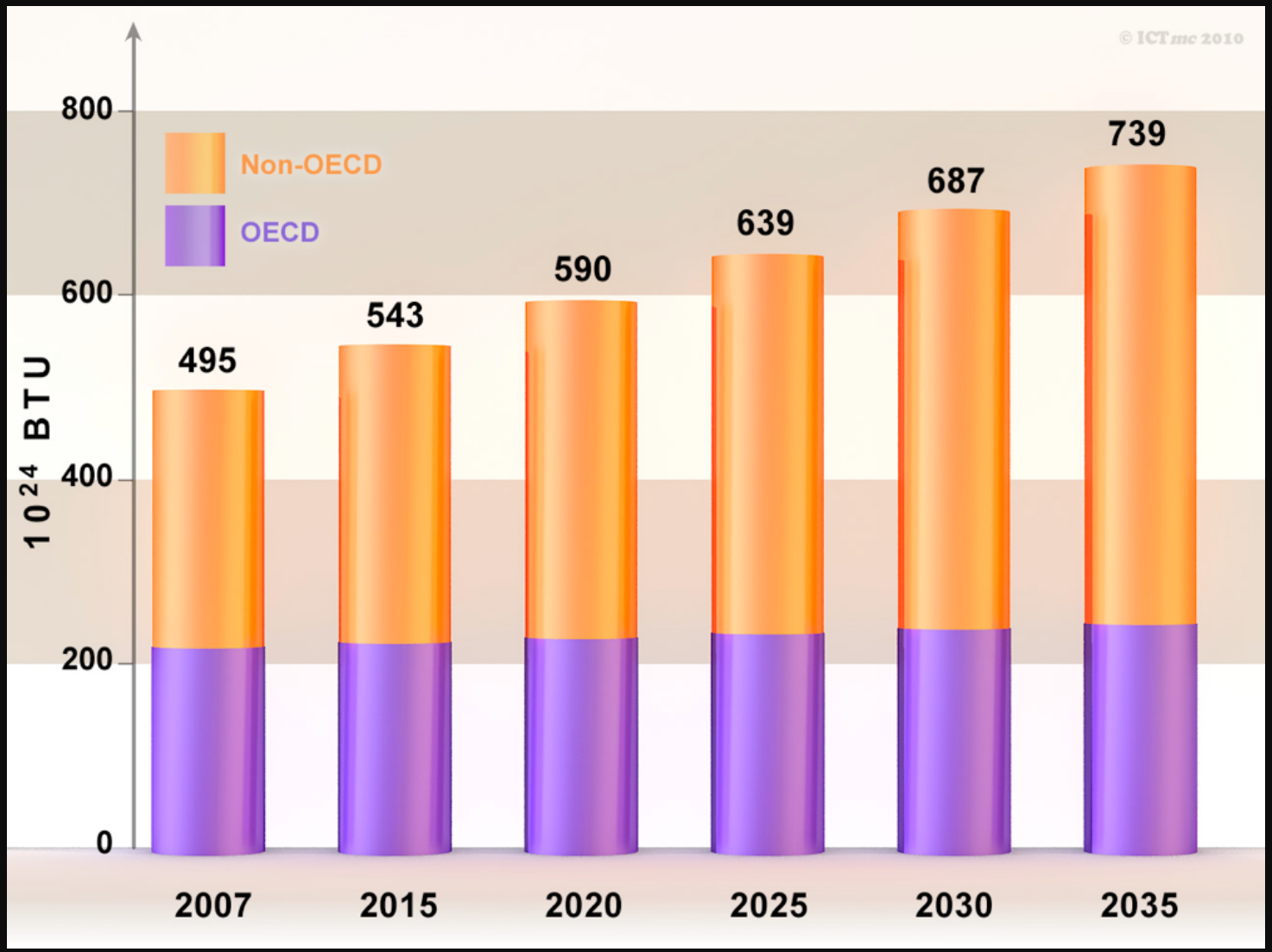
It`s all about:

Overview

- **The Big Problem: Energy**
- The Smart Solution: SG
- Future Trends
- The Big Picture

The Big Problem:

Energy Consumption & Production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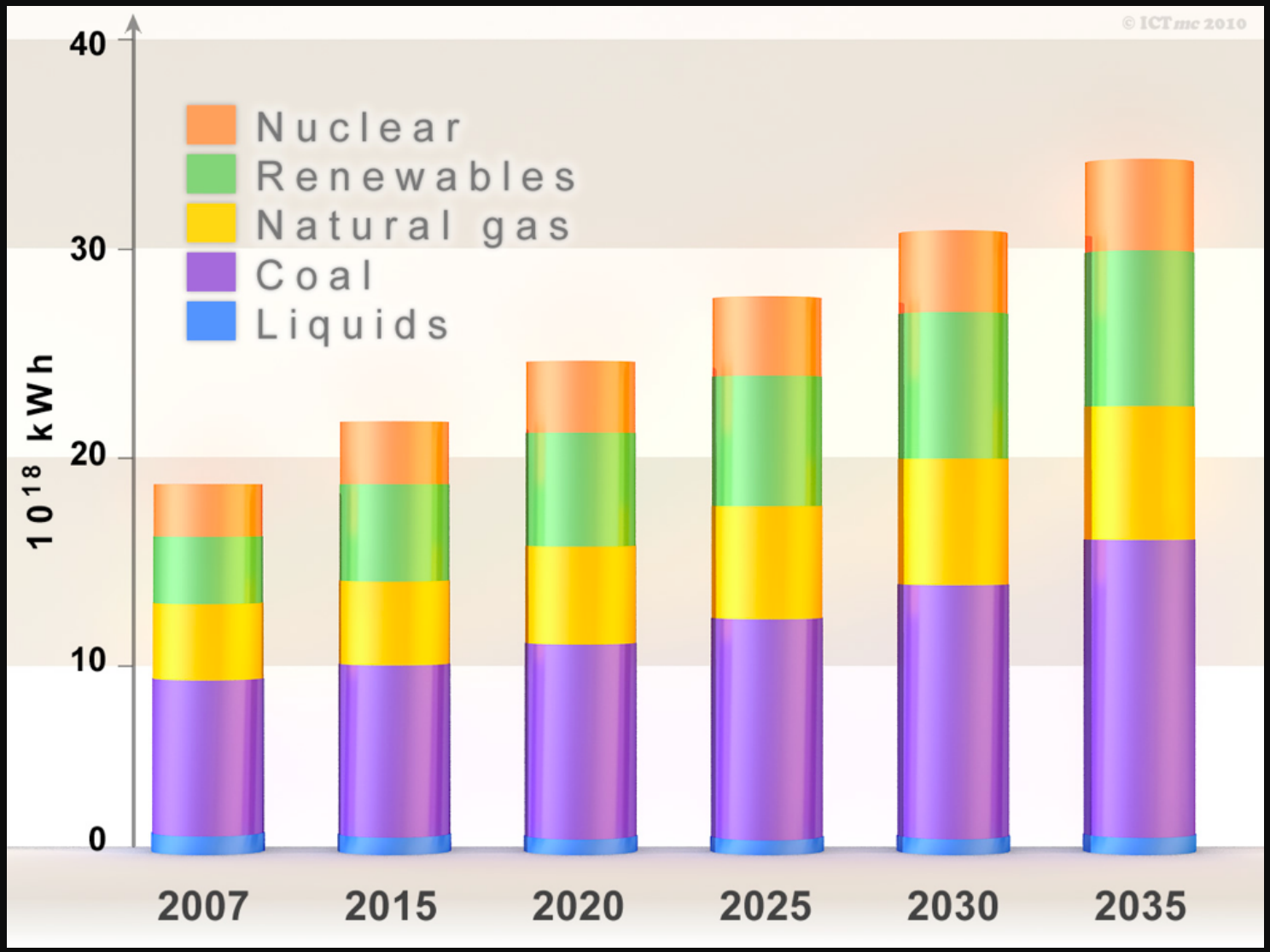
800
600
400
200
0
10^24 BTU
Non-OECD
OECD
495
543
590
639
687
739
2007
2015
2020
2025
2030
2035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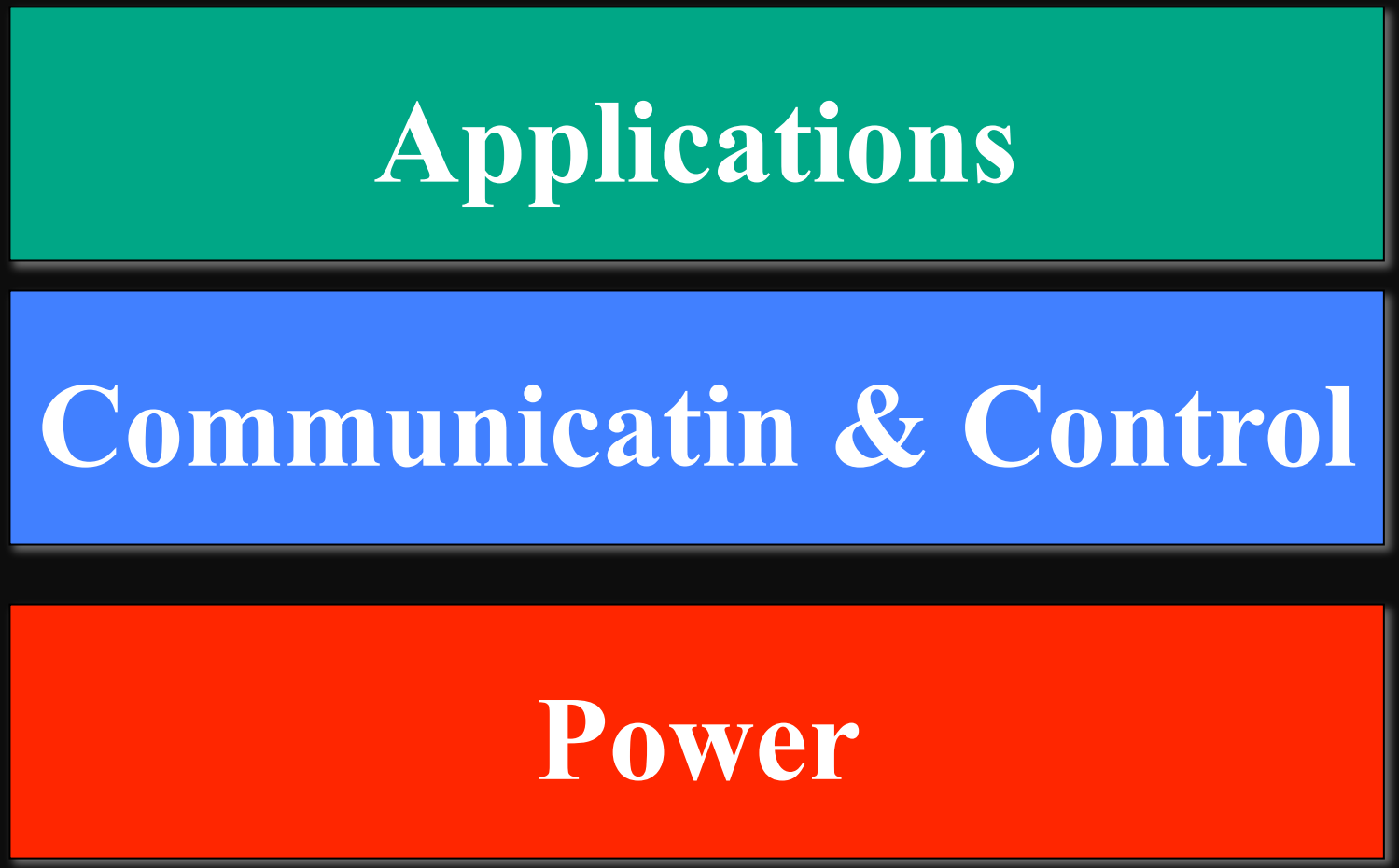
40
30
20
10
0
10 18 kWh
Nuclear
Renewables
Natural gas
Coal
Liquids
2007
2015
2020
2025
2030
2035

Overview

- The Big Problem: Energy
- **The Smart Solution: SG**
- Future Trends
- The Big Picture

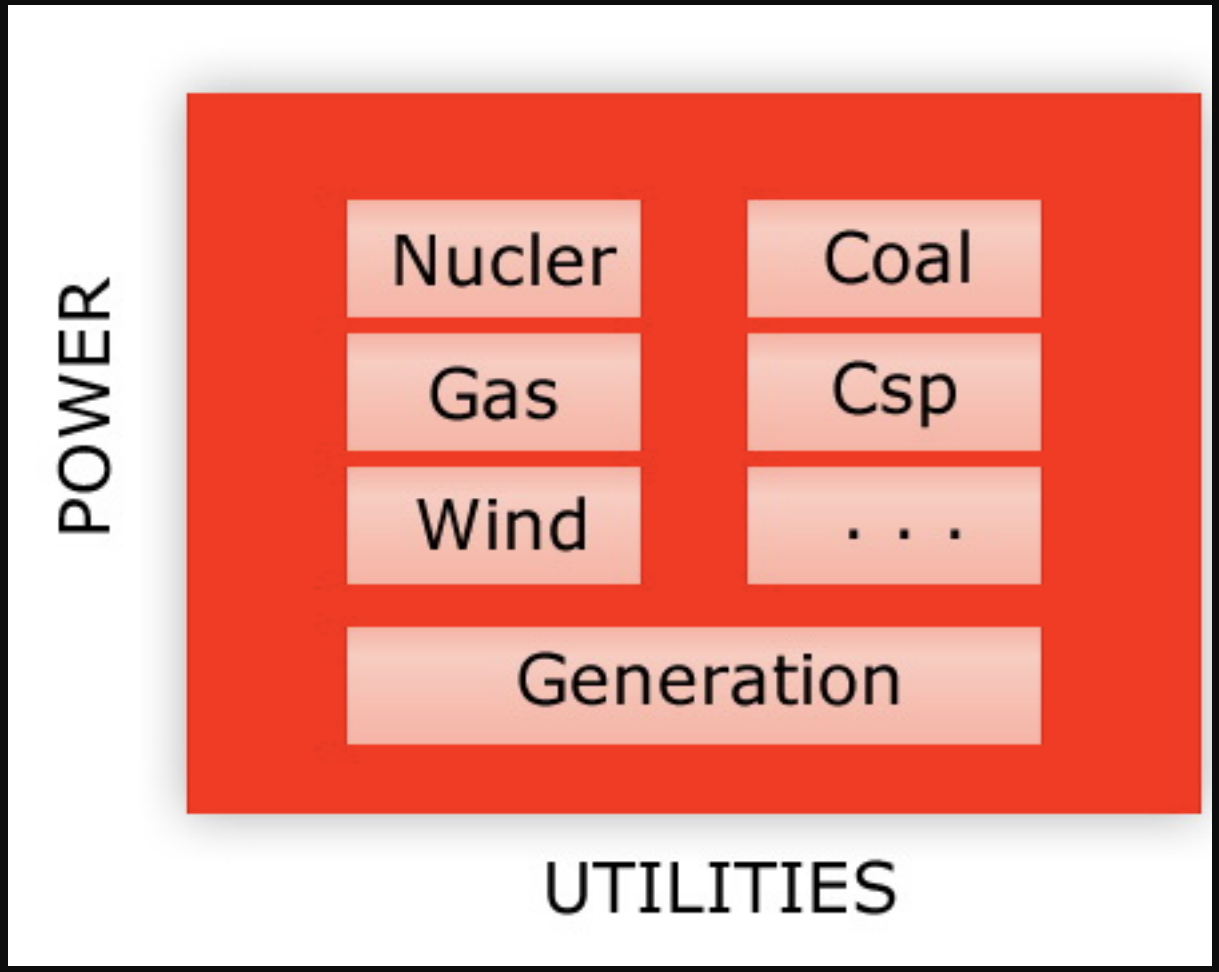
The Matrix

Smart Grids, the 3 Layers:



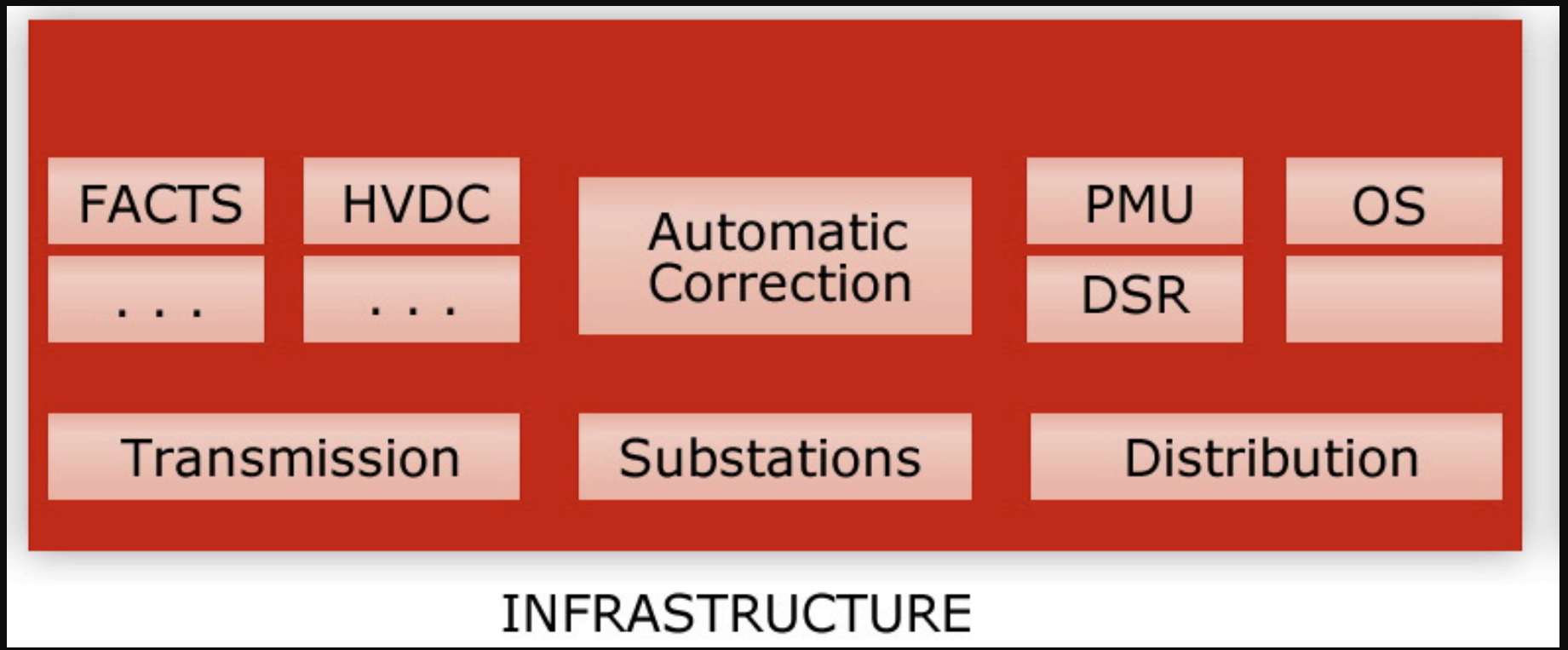
Utilities

Power



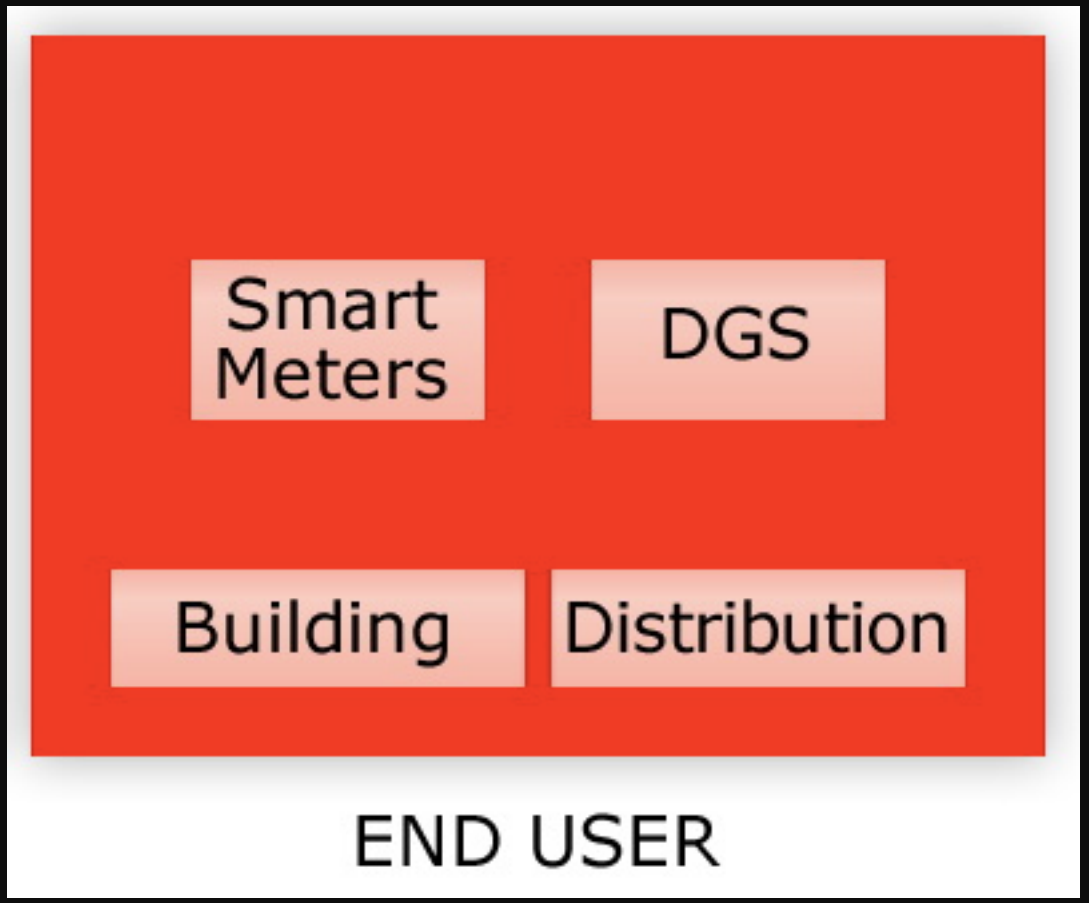
Power

Infrastructure

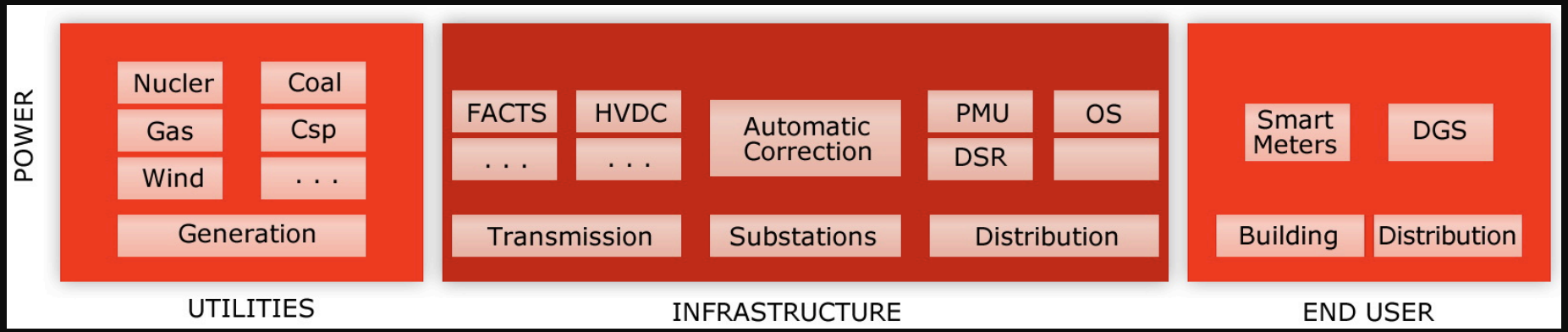


Power

End User



Power


POWER
Nucler
Coal
Gas
Csp
Wind
. . .
Generation
FACTS
HVDC
. . .
. . .
Automatic Correction
PMU
OS
DSR
Transmission
Substations
Distribution
Smart Meters
DGS
Building
Distribution
UTILITIES
INFRASTRUCTURE
END USER

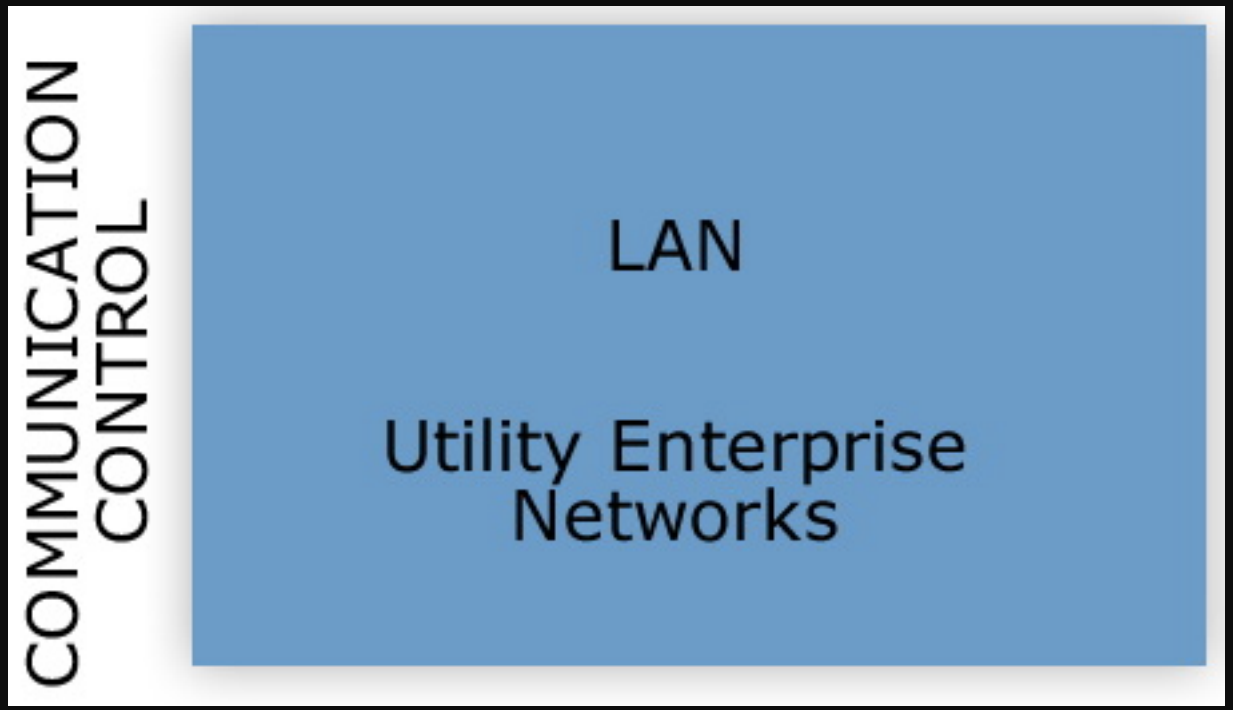
Power

- Future Trends:
- Power Generation
- Transmission
- Processors

Communicatin & Control

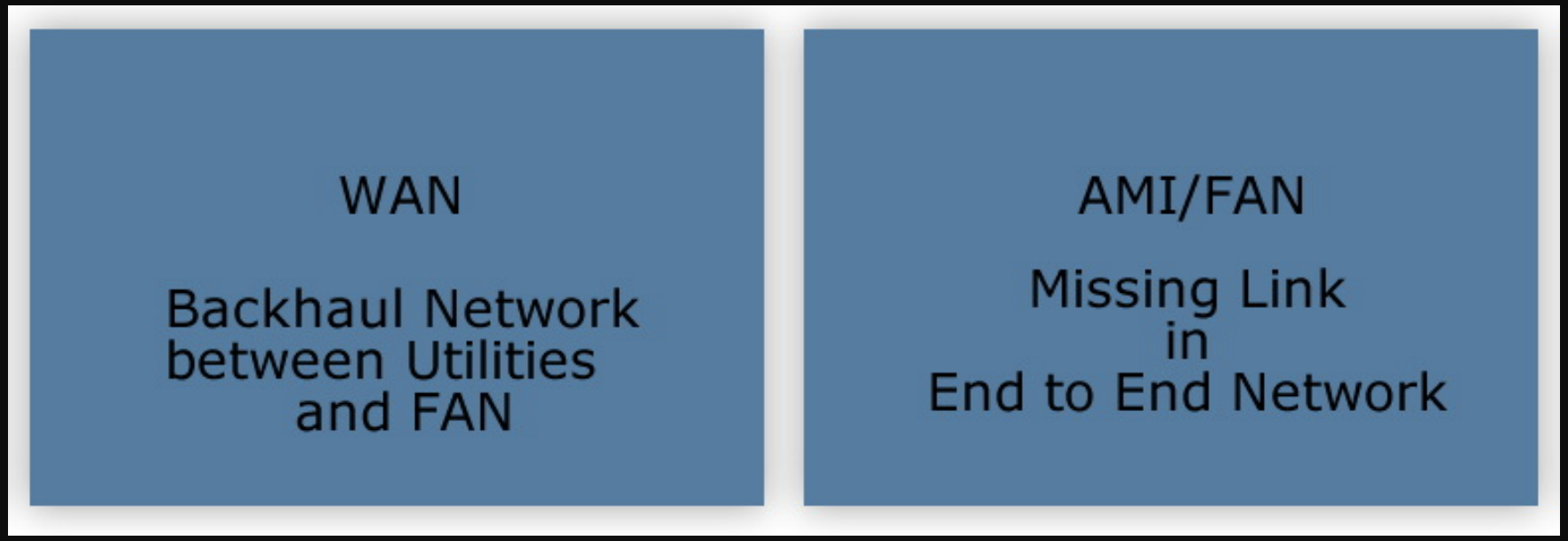
Utilities

Communicatin & Control



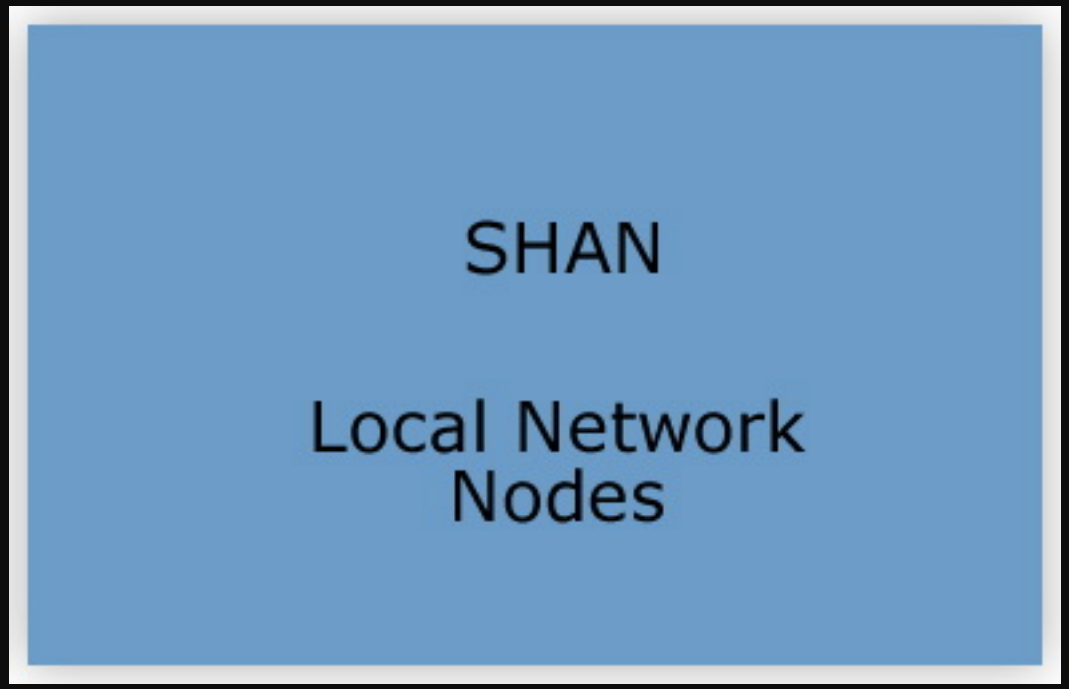
Infrastructure

Communicatin & Control

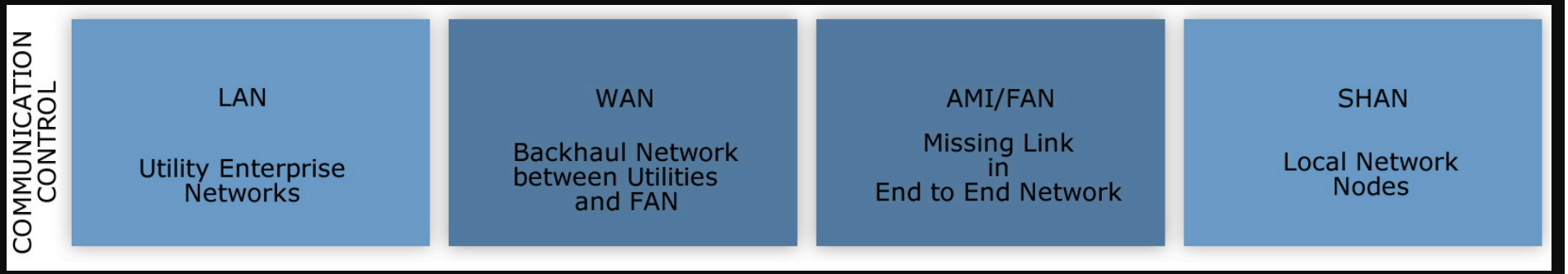


Communicatin & Control

End User

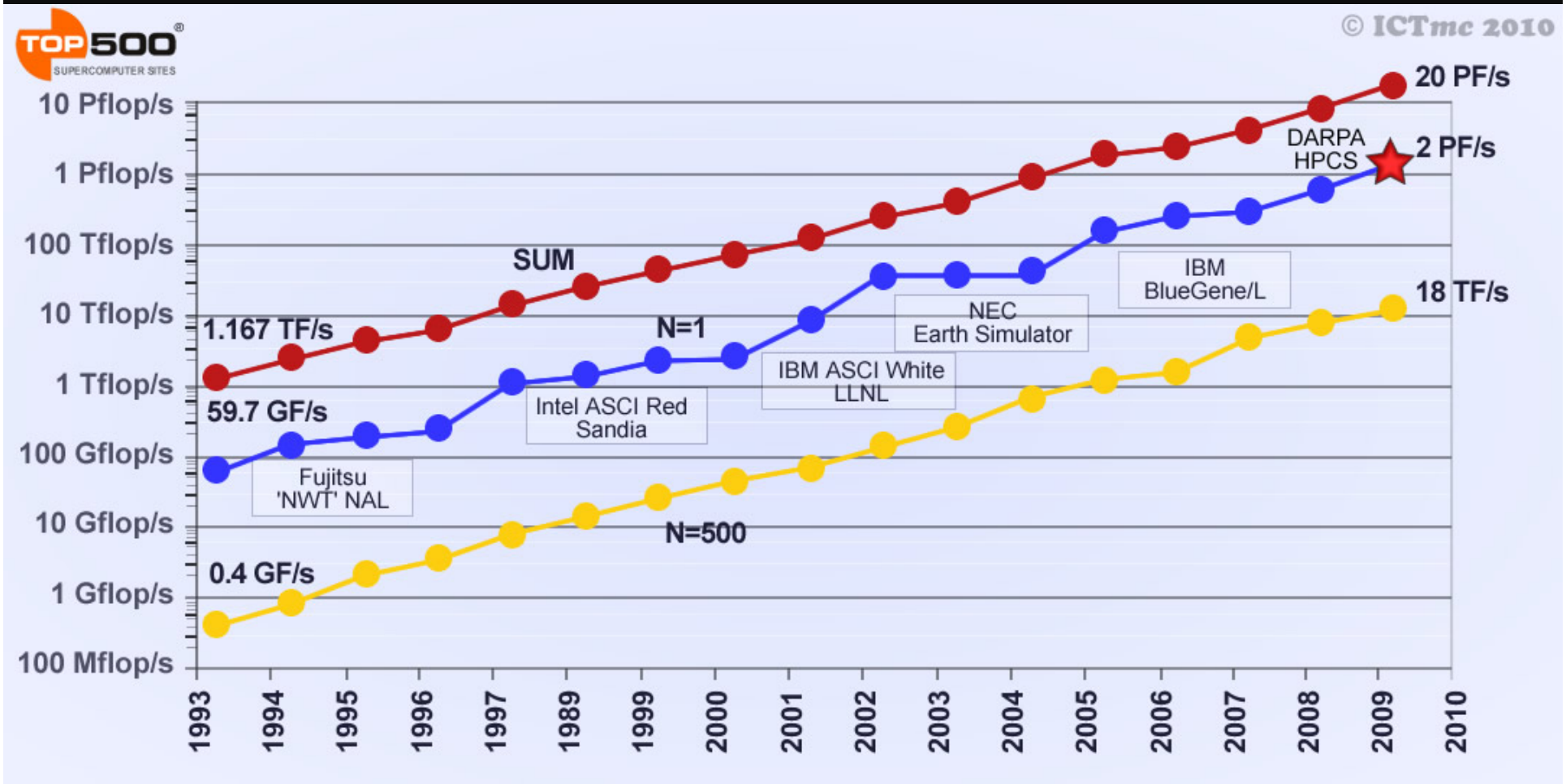


Communicatin & Control



ICT - Emerging & Future Technologies

HPC IPC !!!

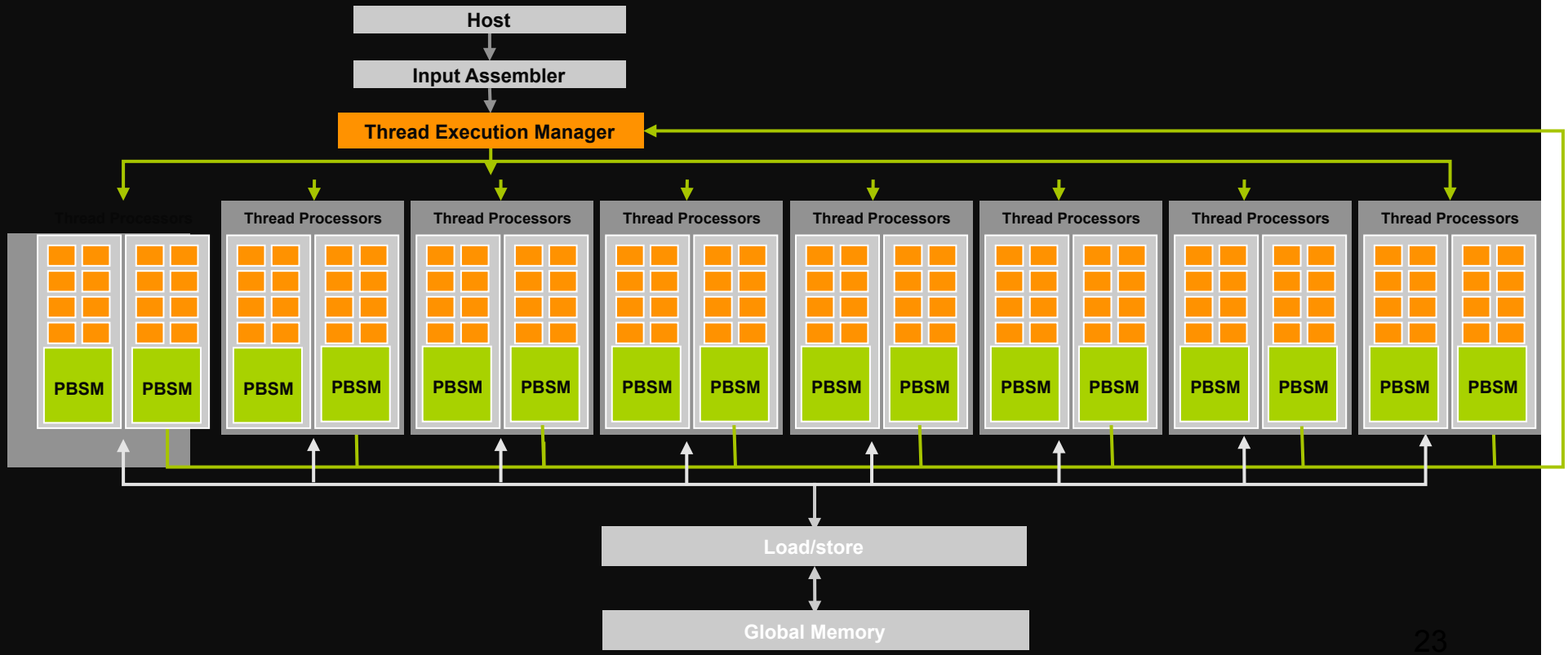


GPU Block Reduced Inter-Processor Com

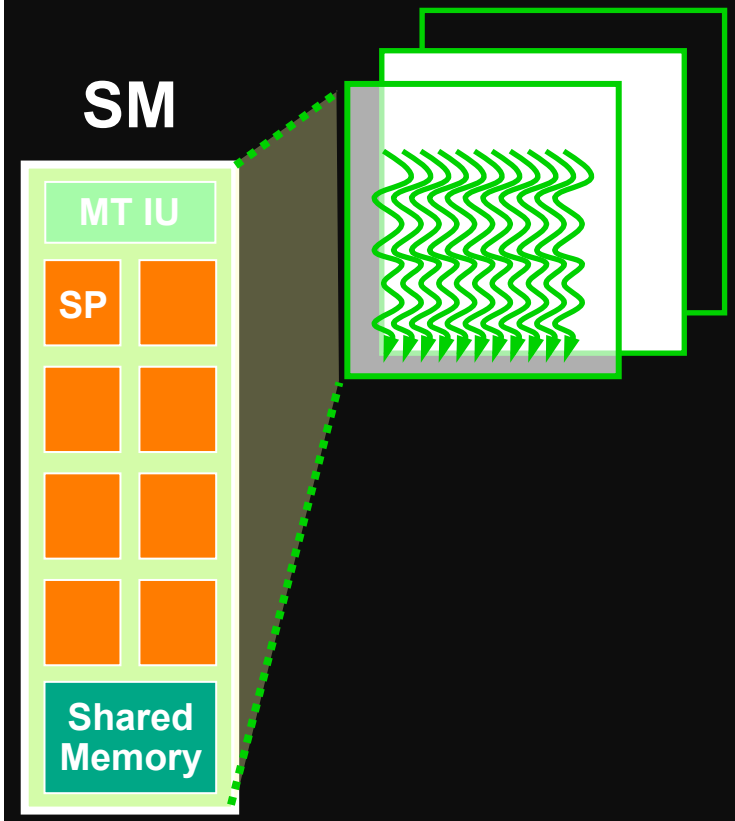
128 Thread Processors execute kernel threads

Up to 12,288 parallel threads active

Per-block shared memory (PBSM) accelerates processing



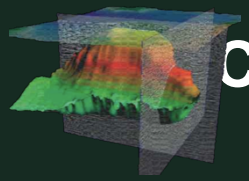
Streaming Multiprocessor (SM)



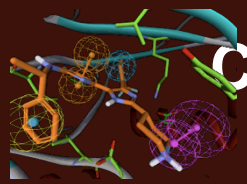
- Processing elements
  - 8 scalar thread processors (SP)
  - 32 GFLOPS peak at 1.35 GHz
  - 8192 32-bit registers (32KB)
    - ½ MB total register file space!
  - usual ops: float, int, branch, …
- Hardware multithreading
  - up to 8 blocks resident at once
  - up to 768 active threads in total
- 16KB on-chip memory
  - low latency storage
  - shared amongst threads of a block
  - supports thread communication

Smart Grids

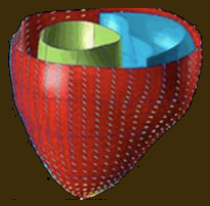
GPU Computing Example Markets



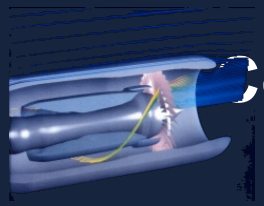
Computational Geoscience



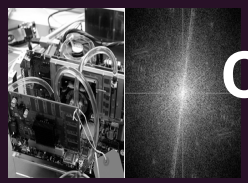
Computational Chemistry



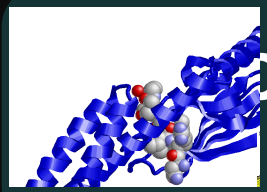
Computational Medicine



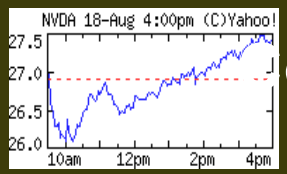
Computational Modeling



Computational Science



Computational Biology



Computational Finance

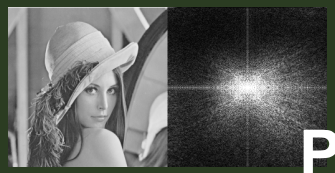


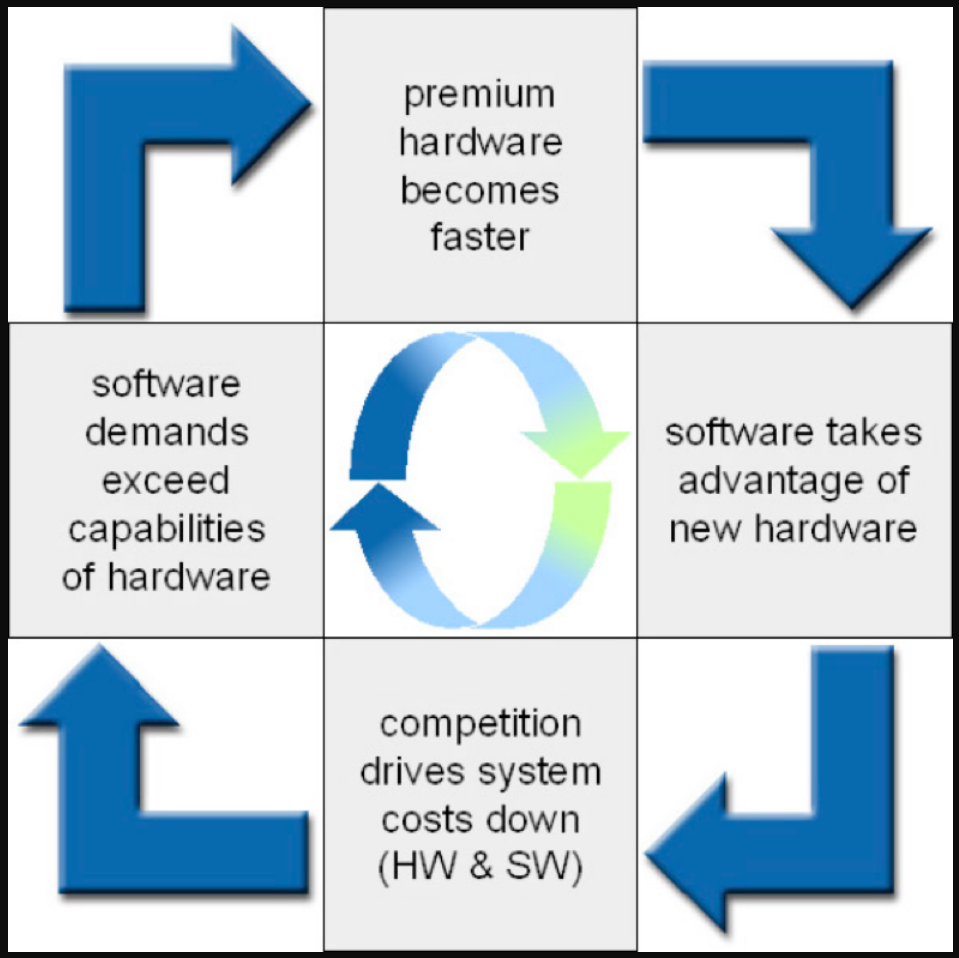
Image Processing

Smart Grids

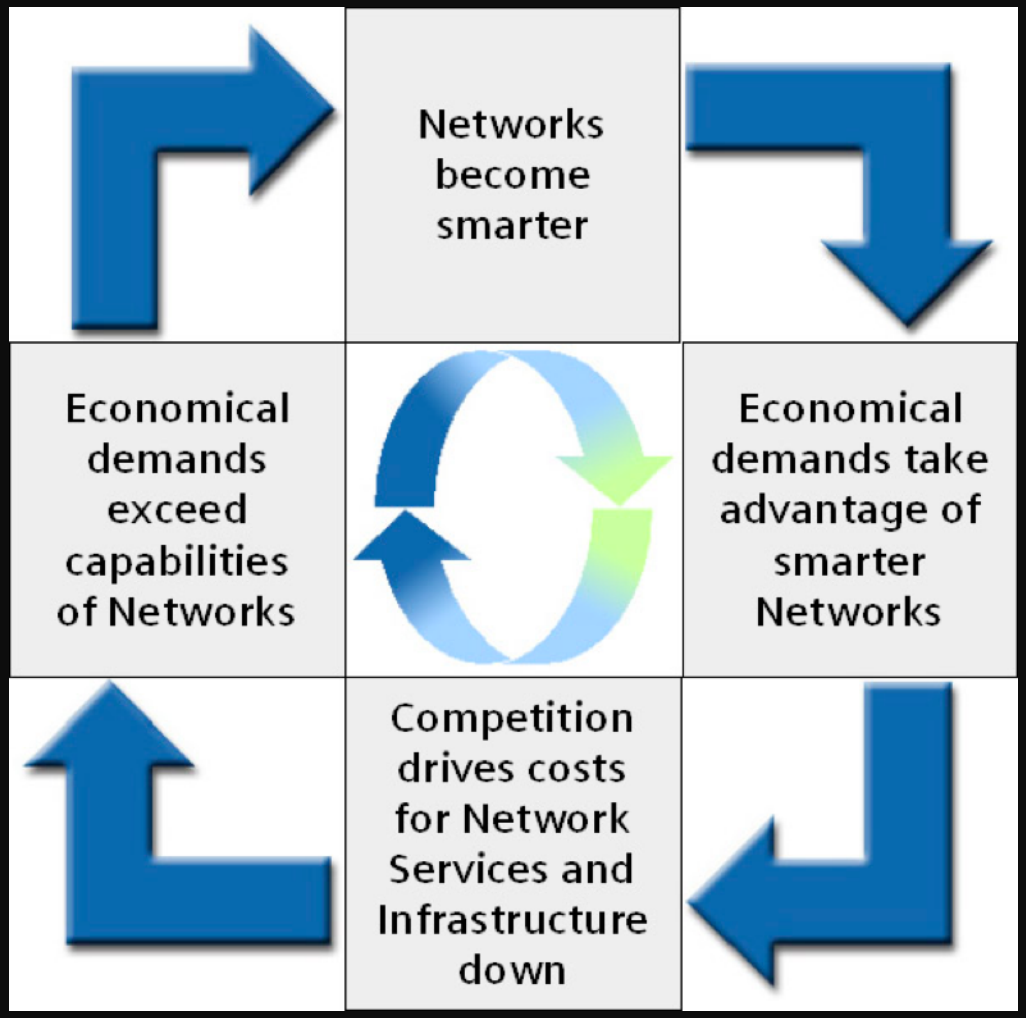
GPU Applications Examples-

- 3D image analysis
- Adaptive radiation therapy
- Acoustics
- Astronomy
- Audio
- Automobile vision
- Bioinfomatics
- 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
- Visualization
- Wireless
- X-ray

Smart Grids

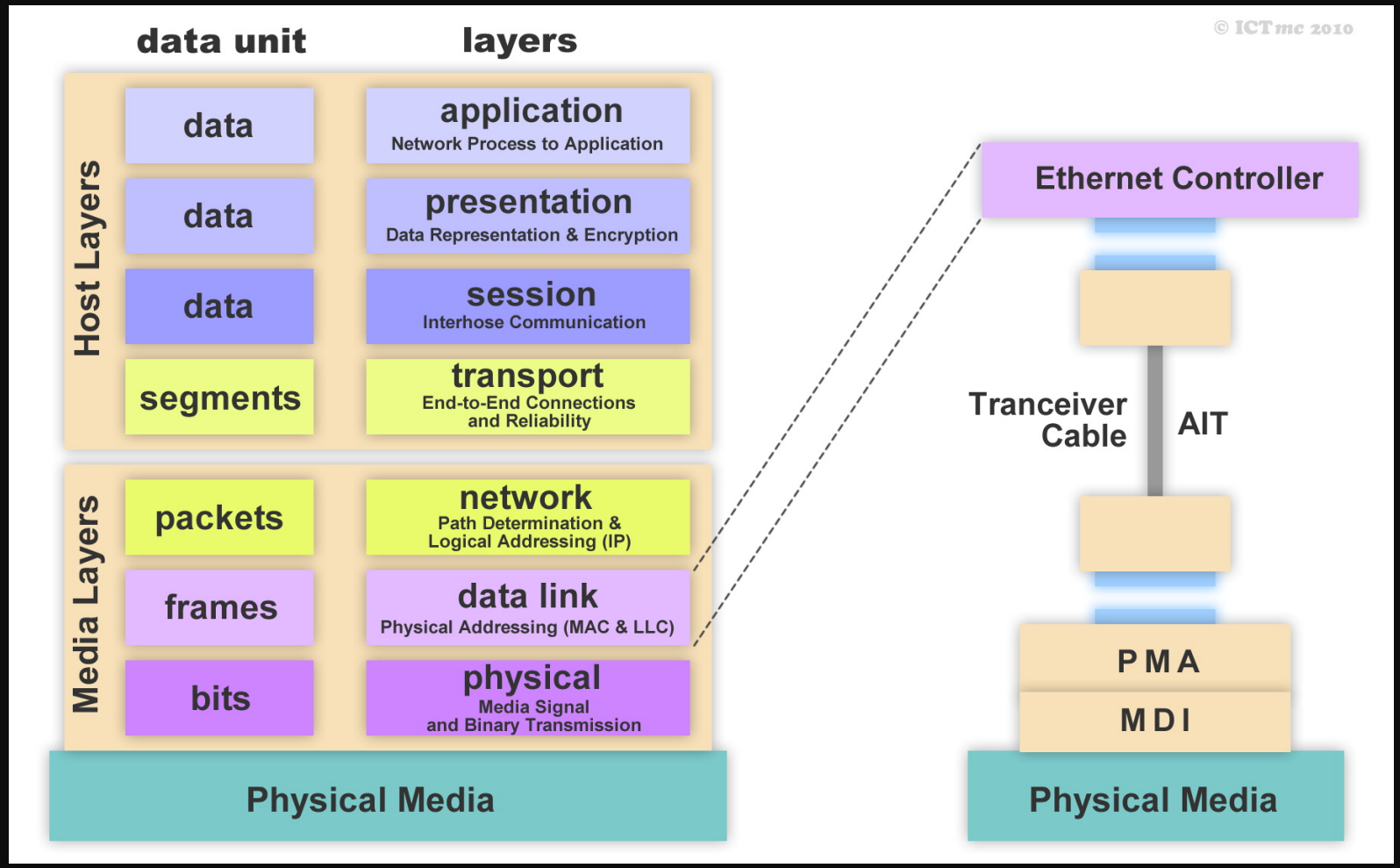

premium hardware becomes faster
software takes advantage of new hardware
competition drives system costs down (HW & SW)
software demands exceed capabilities of hardware

Smart Grids

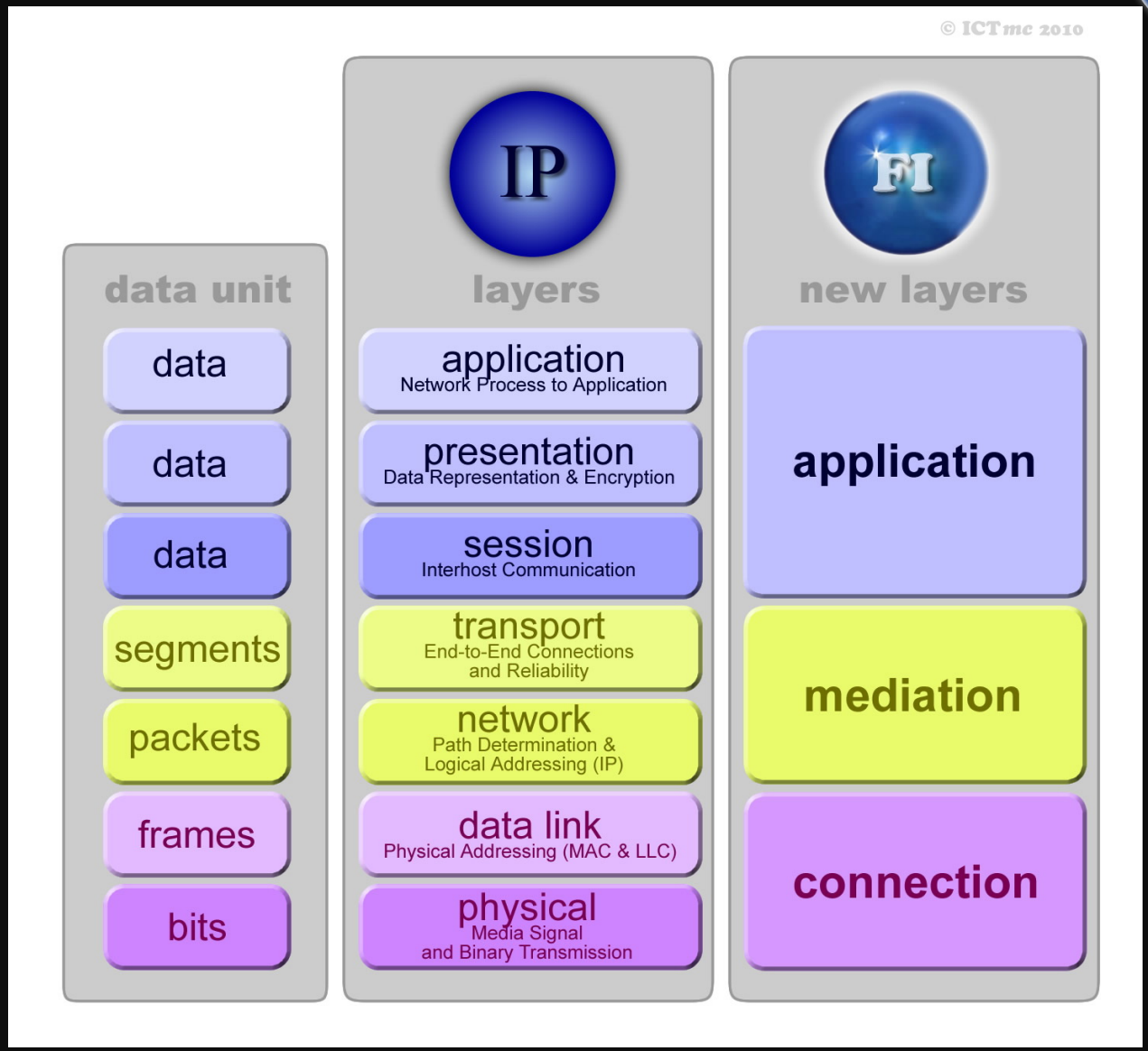

Networks become smarter
Economical demands take advantage of smarter Networks
Competition drives costs for Network Services and Infrastructure down
Economical demands exceed capabilities of Networks

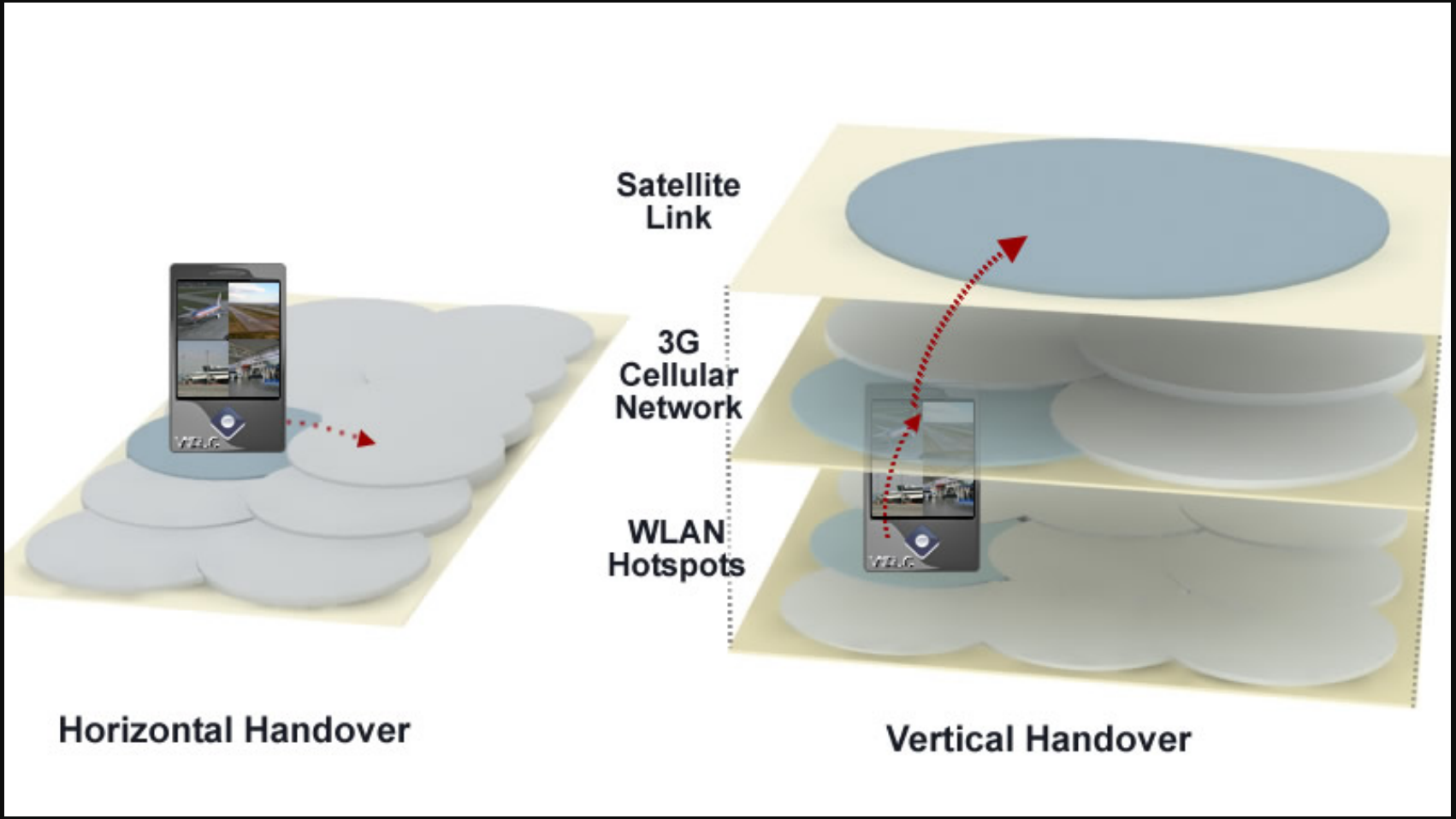
ICT - Emerging & Future Technologies

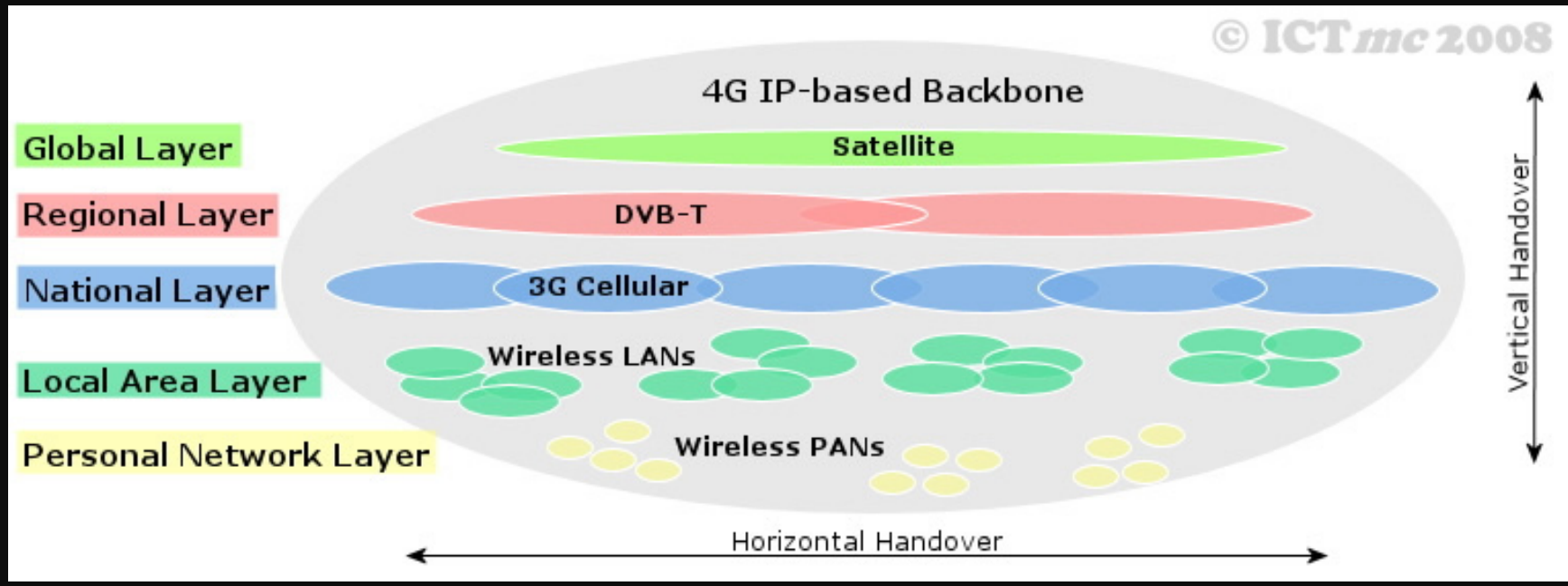
ICT - Emerging & Future Technologies



ICT - Emerging & Future Technologies




Satellite Link
3G Cellular Network
WLAN Hotspots
Horizontal Handover
Vertical Handover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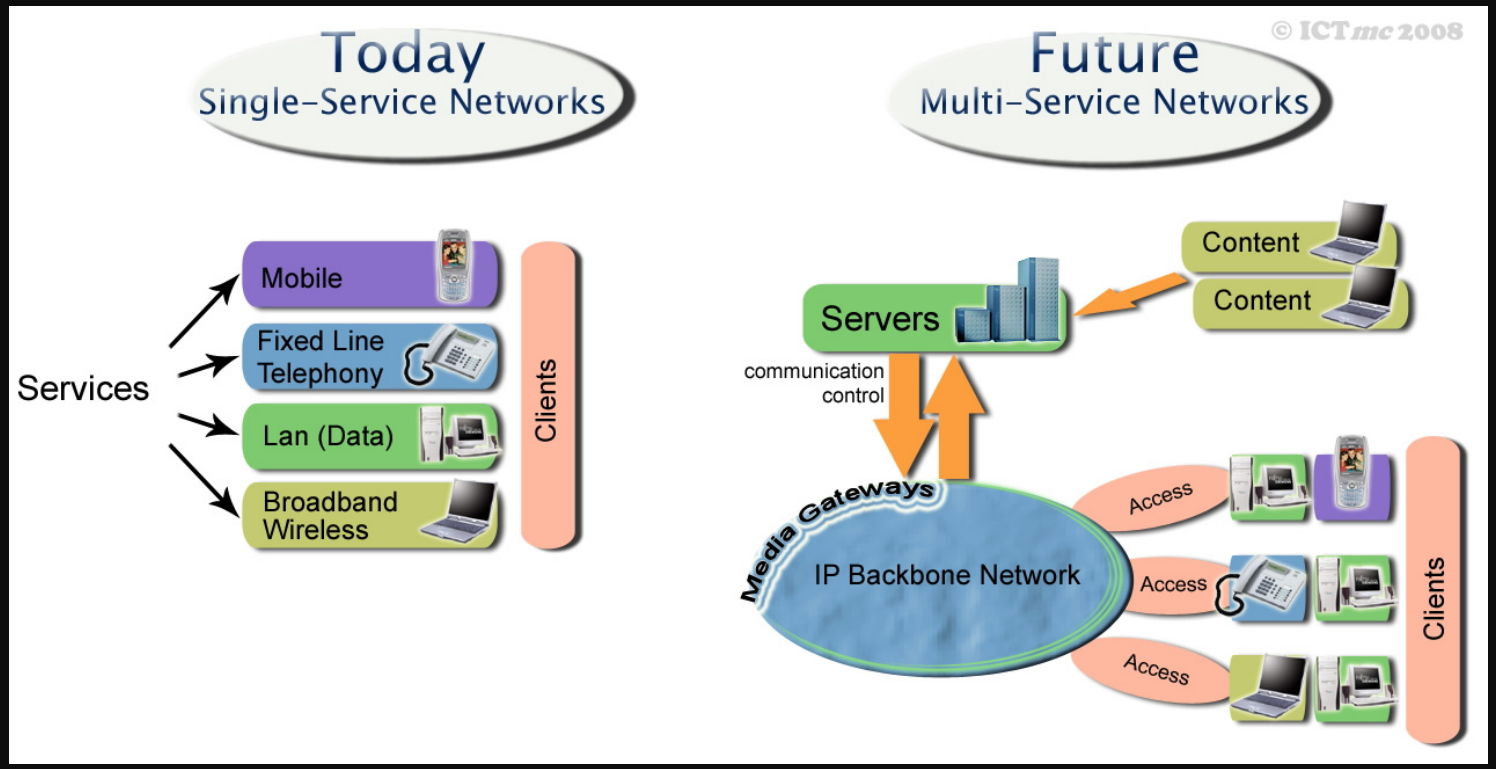
4G IP-based Backbone
Global Layer
Satellite
Regional Layer
DVB-T
National Layer
3G Cellular
Local Area Layer
Wireless LANs
Personal Network Layer
Wireless PANs
Vertical Handover
Horizontal Handover


Today
Single-Service Networks
Future
Multi-Service Networks
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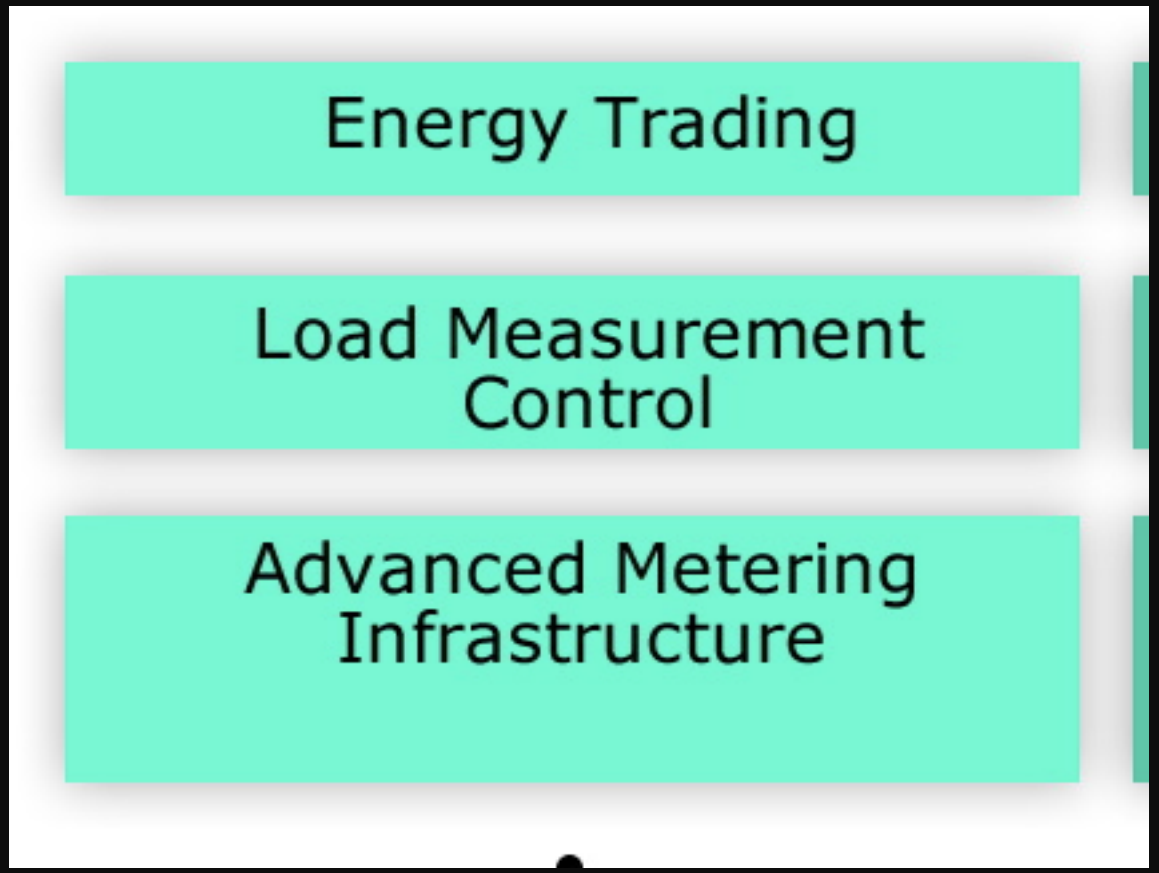
Services
Mobile
Fixed Line Telephony
Lan (Data)
Broadband Wireless
Clients
Content
Content
Servers
communication control
Media Gateways
IP Backbone Network
Access
Access
Access
Clients

Applications



Utilities

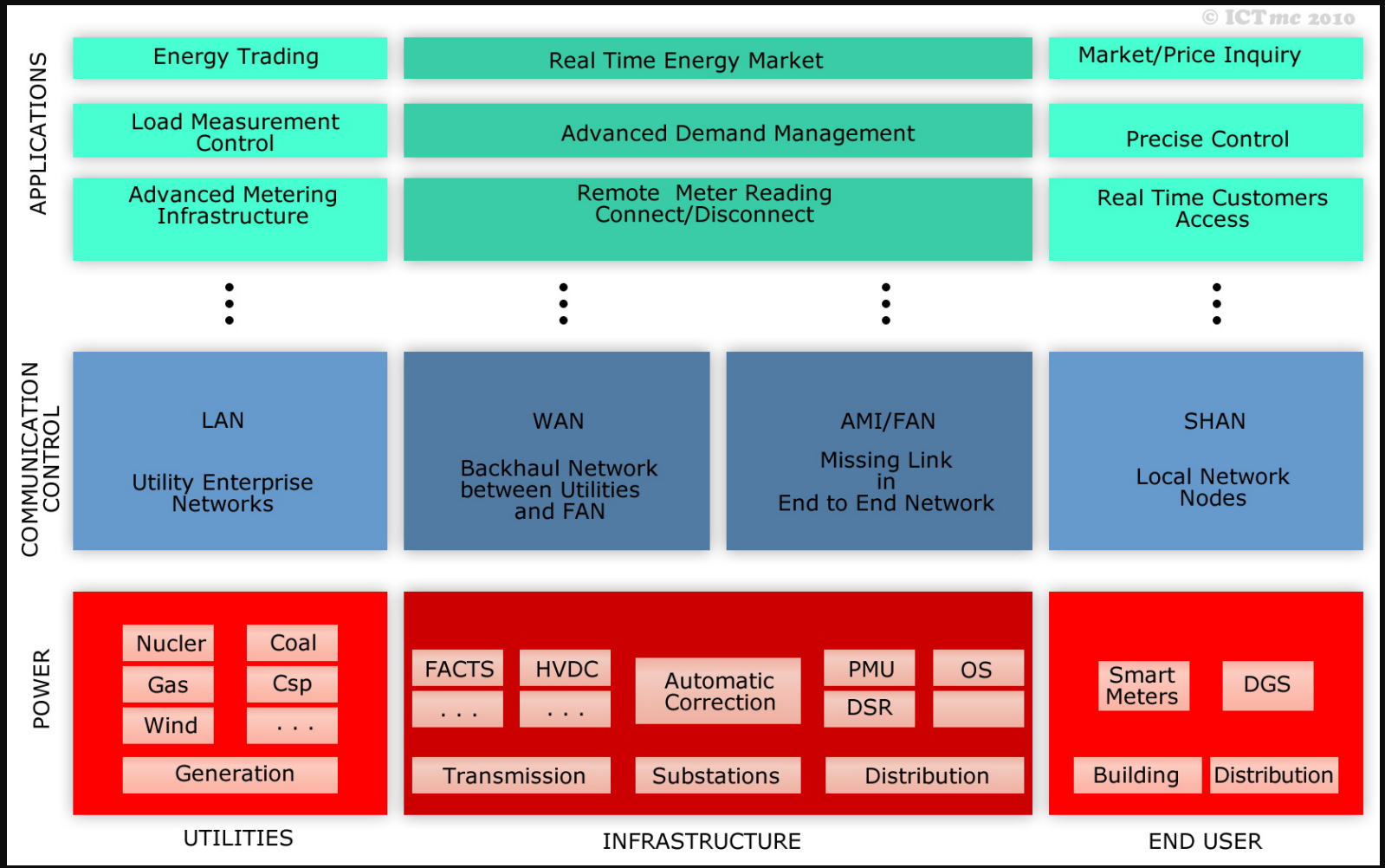
Applications

Infrastructure

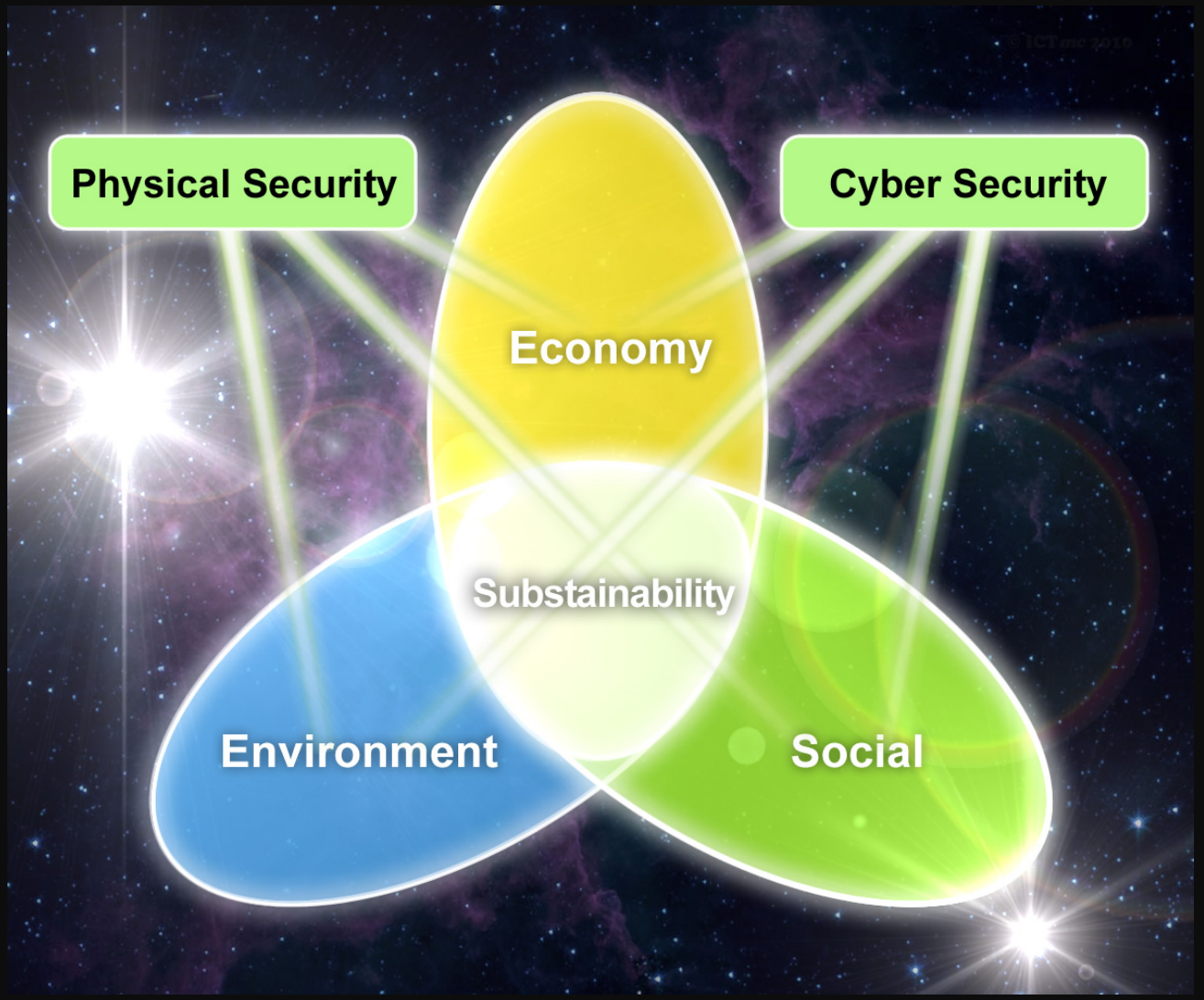
Applications

End User

The Big Picture



The Intertwining

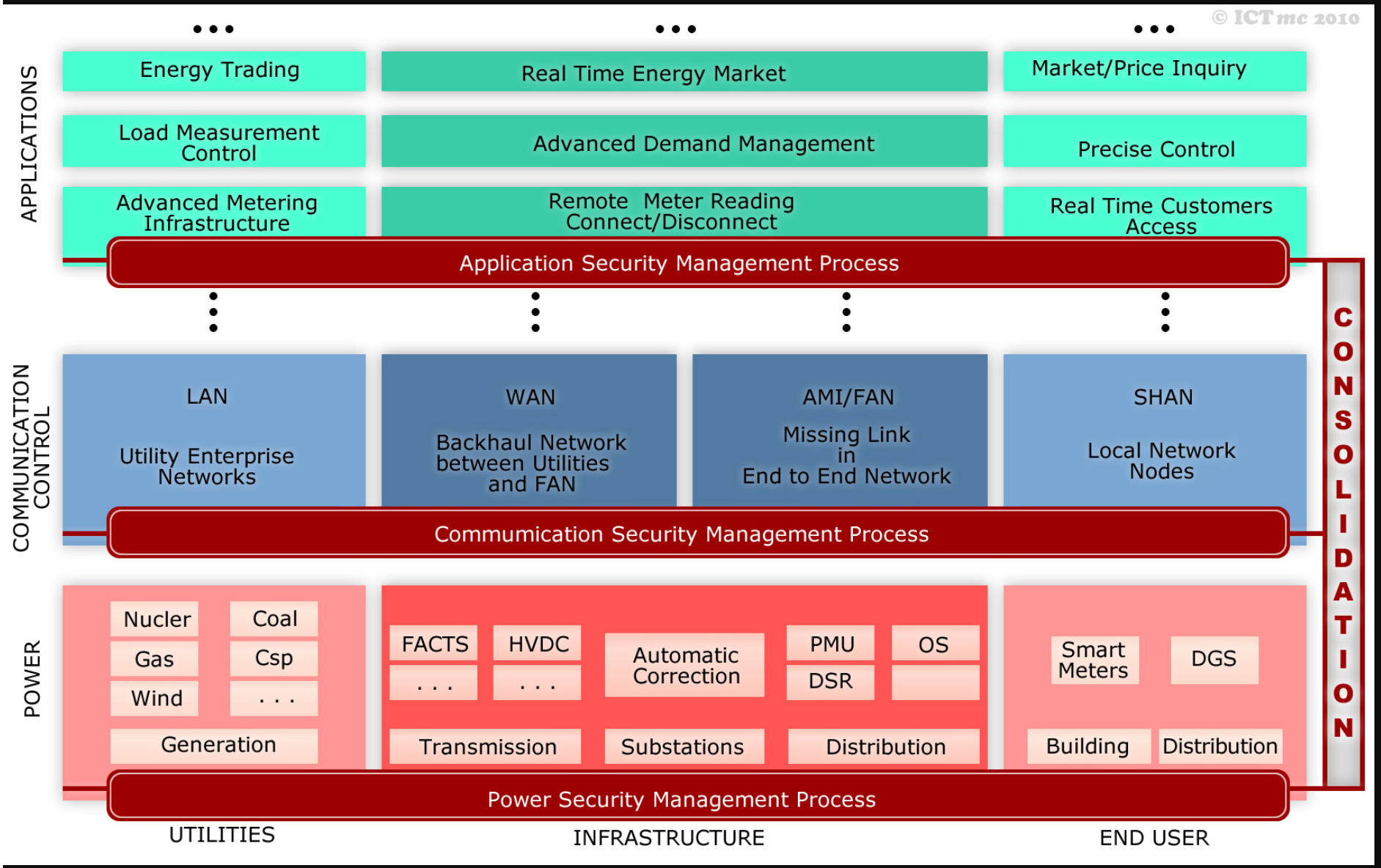


Future Vision

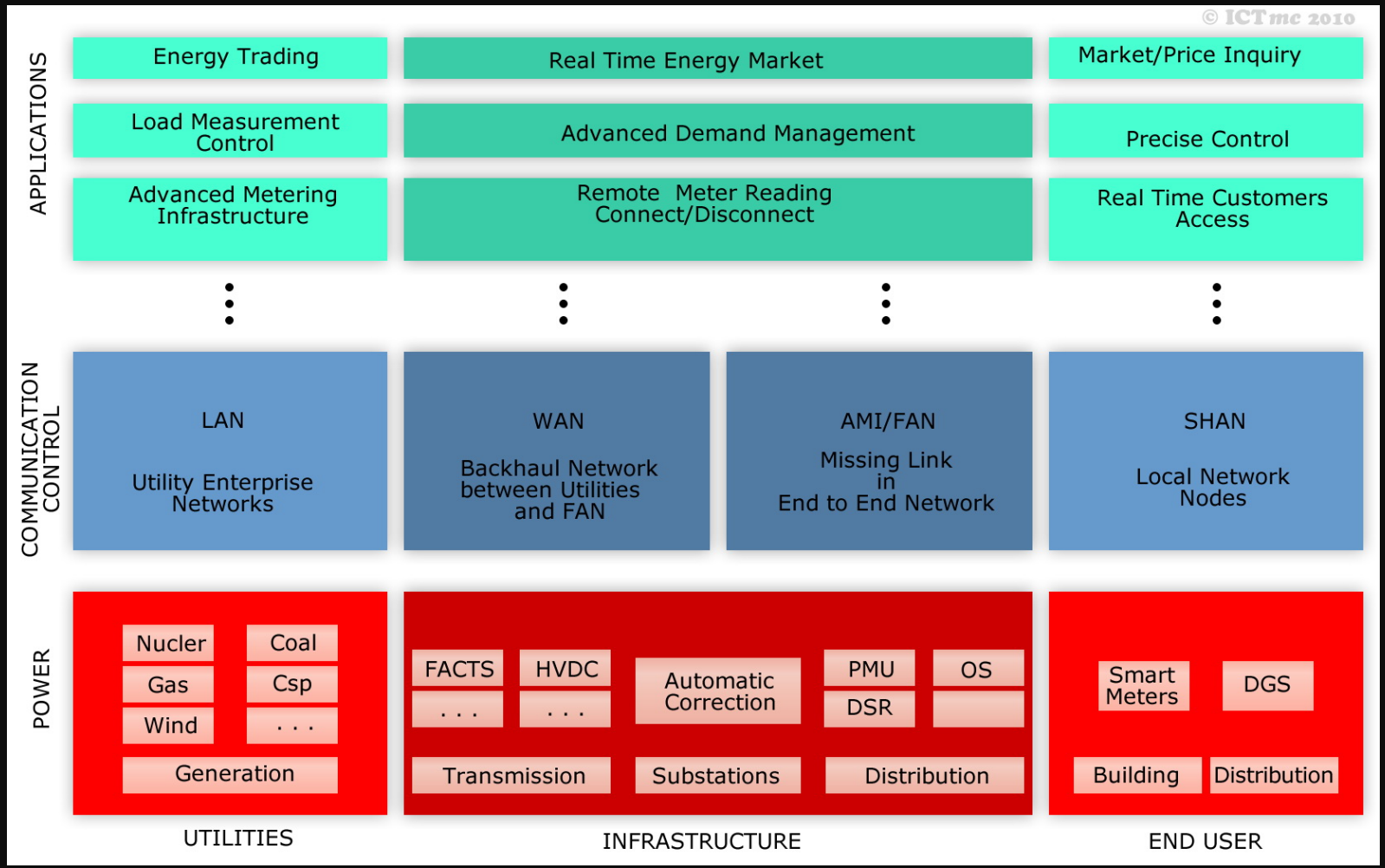
- Energy, Energy, Energy, Energy……
- MTBF
- Technology Penetration

ILLUSION !!!

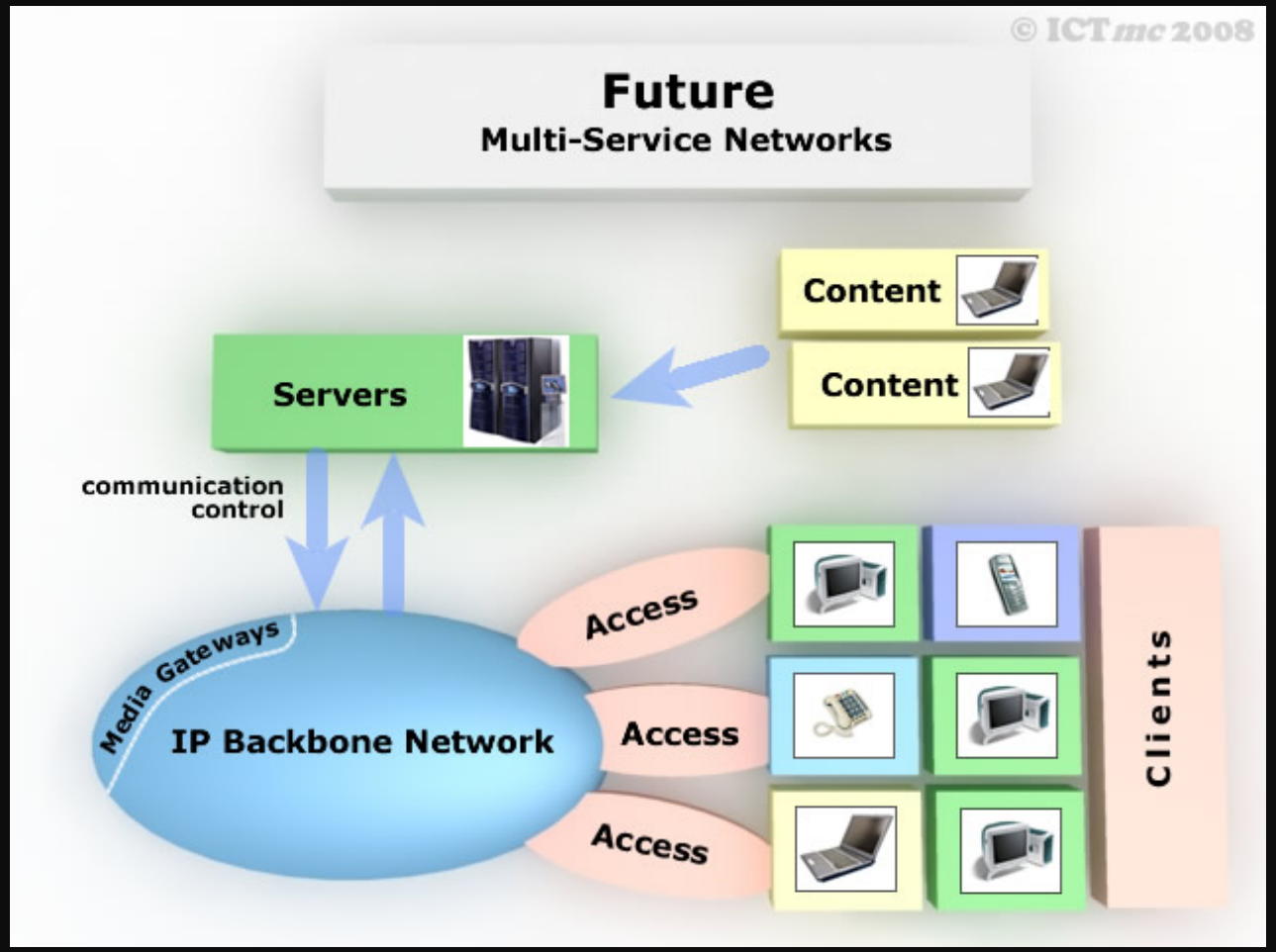
Smart Grids



The Big Picture



Smart Grids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Future
Multi-Service Networks
Content
Content
Servers
communication
control
Media Gateways
IP Backbone Network
Access
Access
Access
Clients

FI The Big Picture

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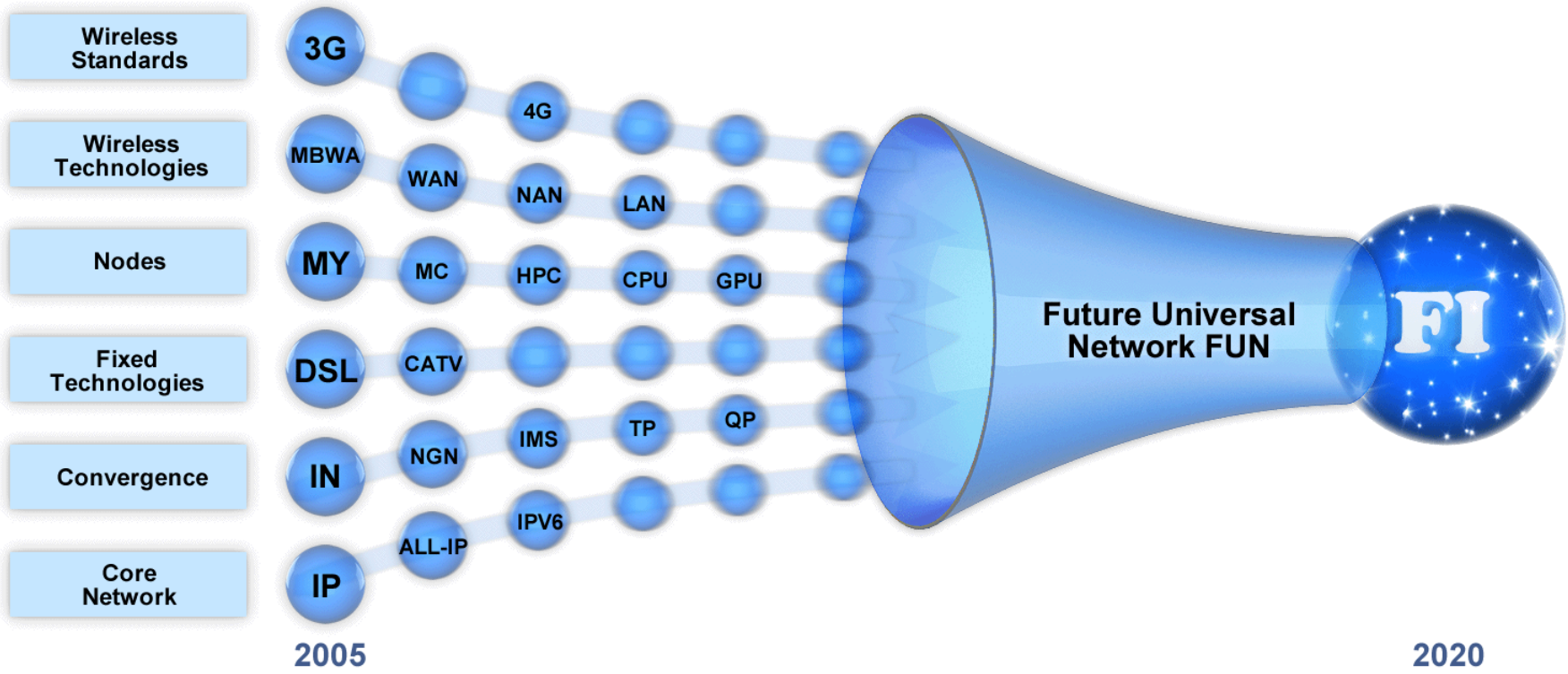
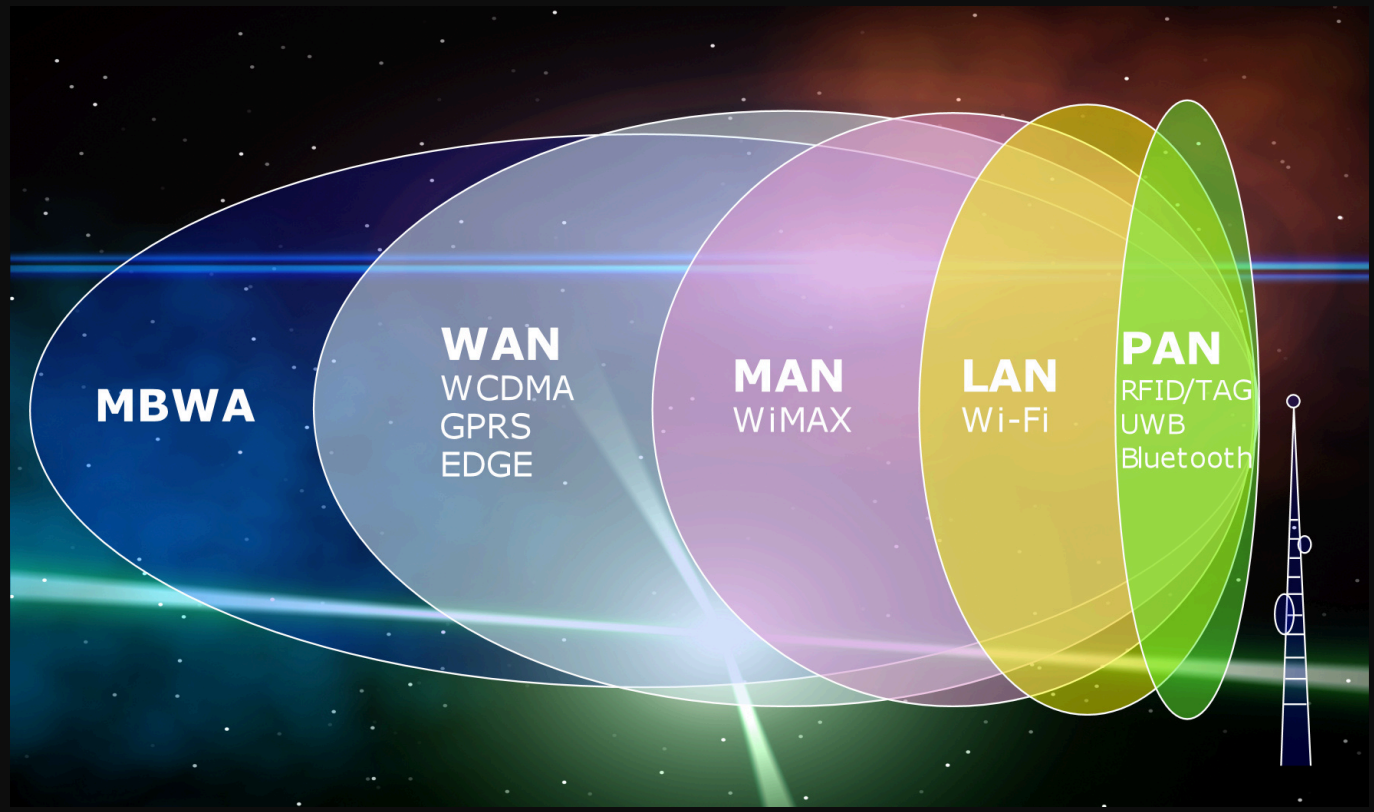
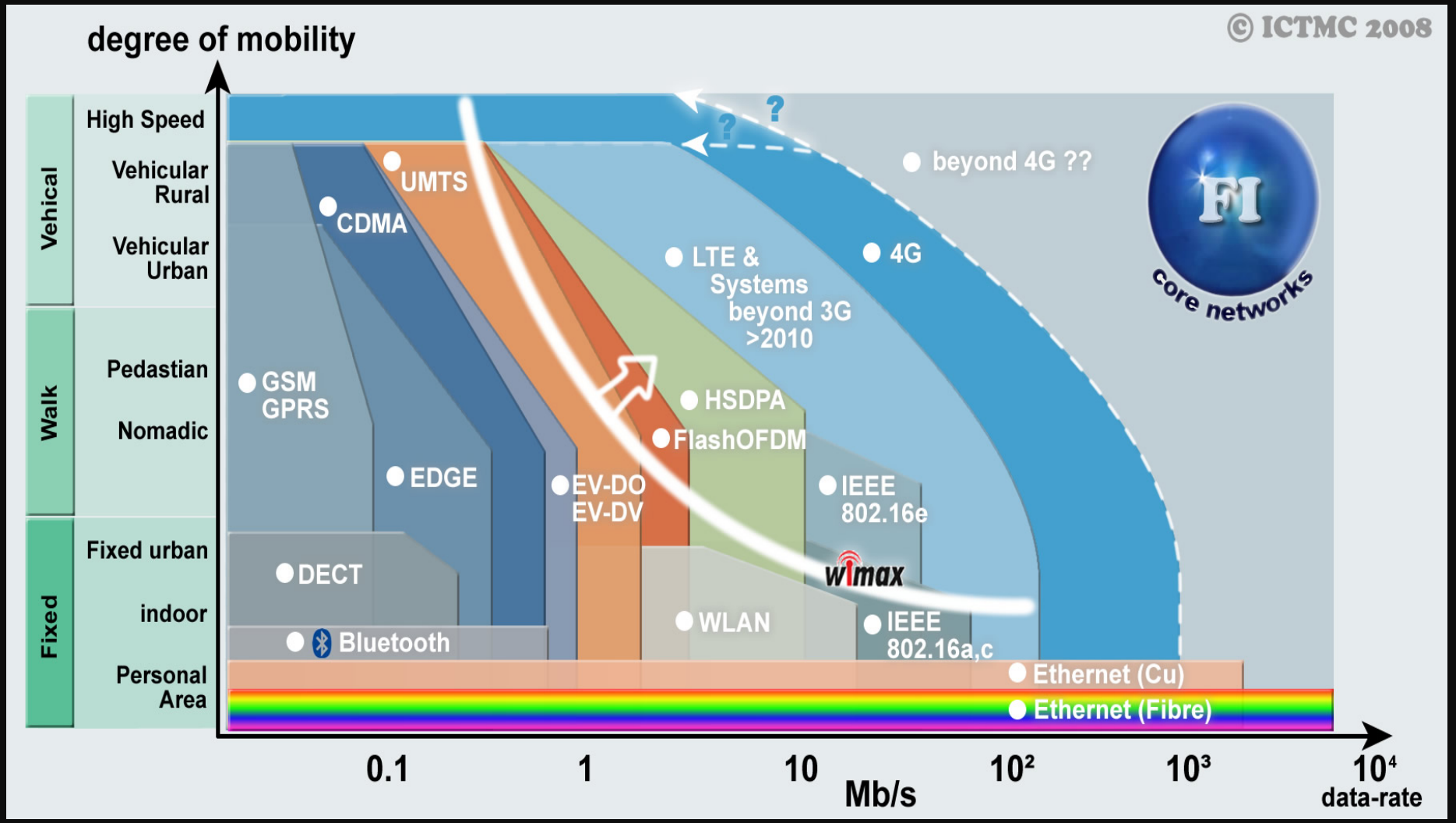


Wireless Standards

Smart Grids




degree of mobility
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Vehical
Walk
Fixed
High Speed
Vehicular Rural
Vehicular Urban
Pedastian
Nomadic
Fixed urban
indoor
Personal Area
UMTS
CDMA
GSM GPRS
EDGE
DECT
Bluetooth
EV-DO EV-DV
HSDPA
FlashOFDM
WLAN
LTE & Systems beyond 3G >2010
4G
beyond 4G ??
IEEE 802.16e
wimax
IEEE 802.16a,c
Ethernet (Cu)
Ethernet (Fibre)
FI
core networks
0.1
1
10
Mb/s
10²
10³
10⁴
data-rate

Communicatin & Control

Future Trends:

- FI
- Wireless Technologies

Thank You

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Q: ???