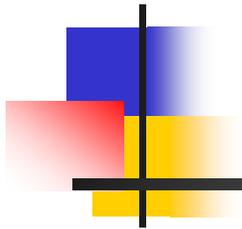




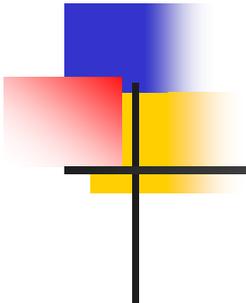
# Beyond 3G: from 3G to Seamless Intertechnology Wireless Networks



*Minoru Etoh, Ph.D.  
President & CEO*

*DoCoMo Communications Labs USA, Inc.*





# Outline

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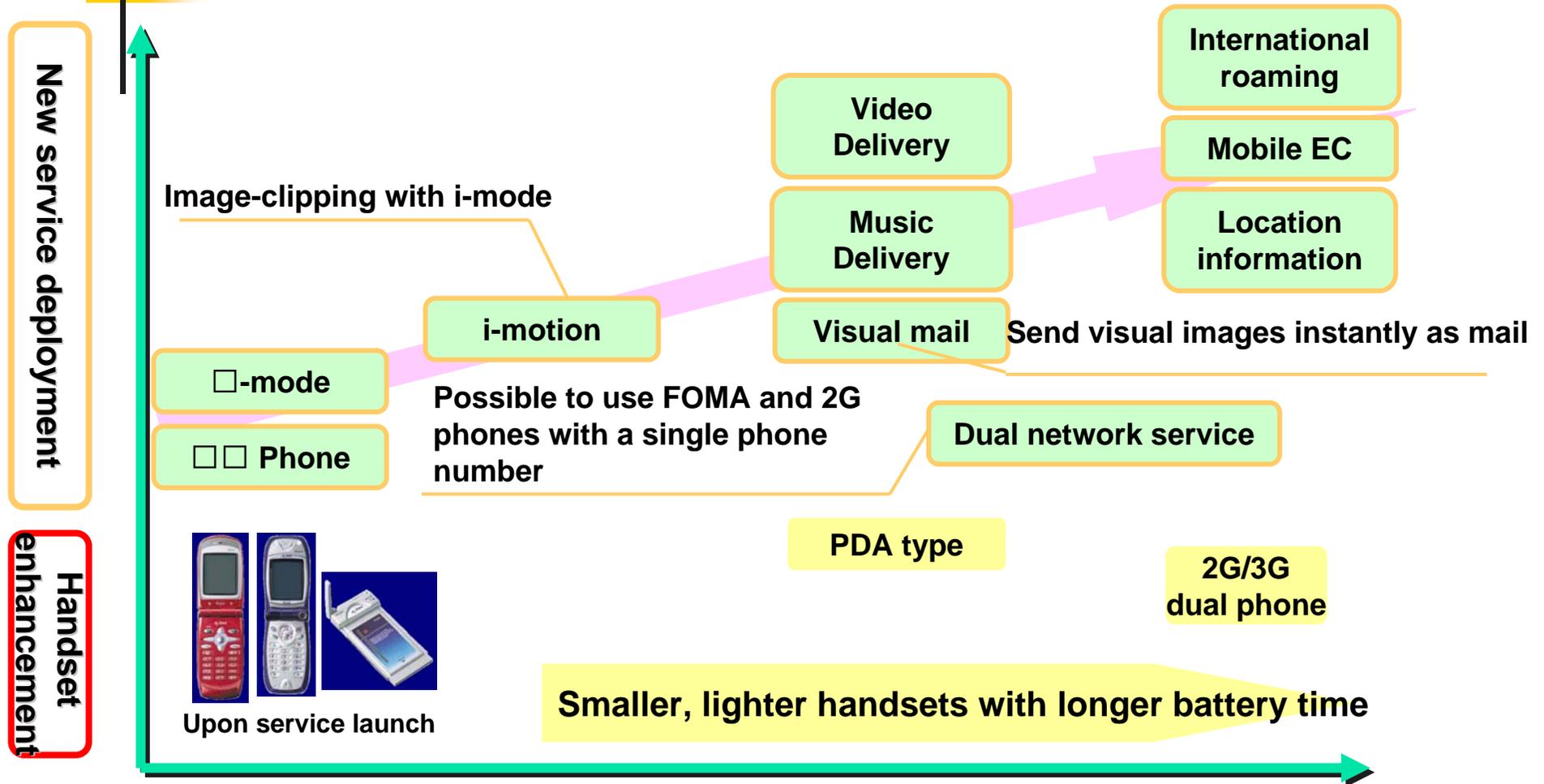
- Lessons from 3G
- What we need: Killer Applications
- 4G Mobile Networks: why, what, how
- 4G Imperatives: RAN, IP Network, and Service Ubiquity
- Conclusion

# Lessons from 3G

- UMTS deployments in Europe is slow so far.
  - may be 2.5G/GPRS + WLAN/802.11
    - Will 802.11 work in small devices? → No.
    - Issues: Power consumption, no high speed mobility. → Primarily a laptop medium.
- Heavy standardization
  - cost, optimality, etc..
- DoCoMo's 3G Network
  - High bandwidth, lots of capacity
  - It has been said that no significant eye- or ear-catching services yet.

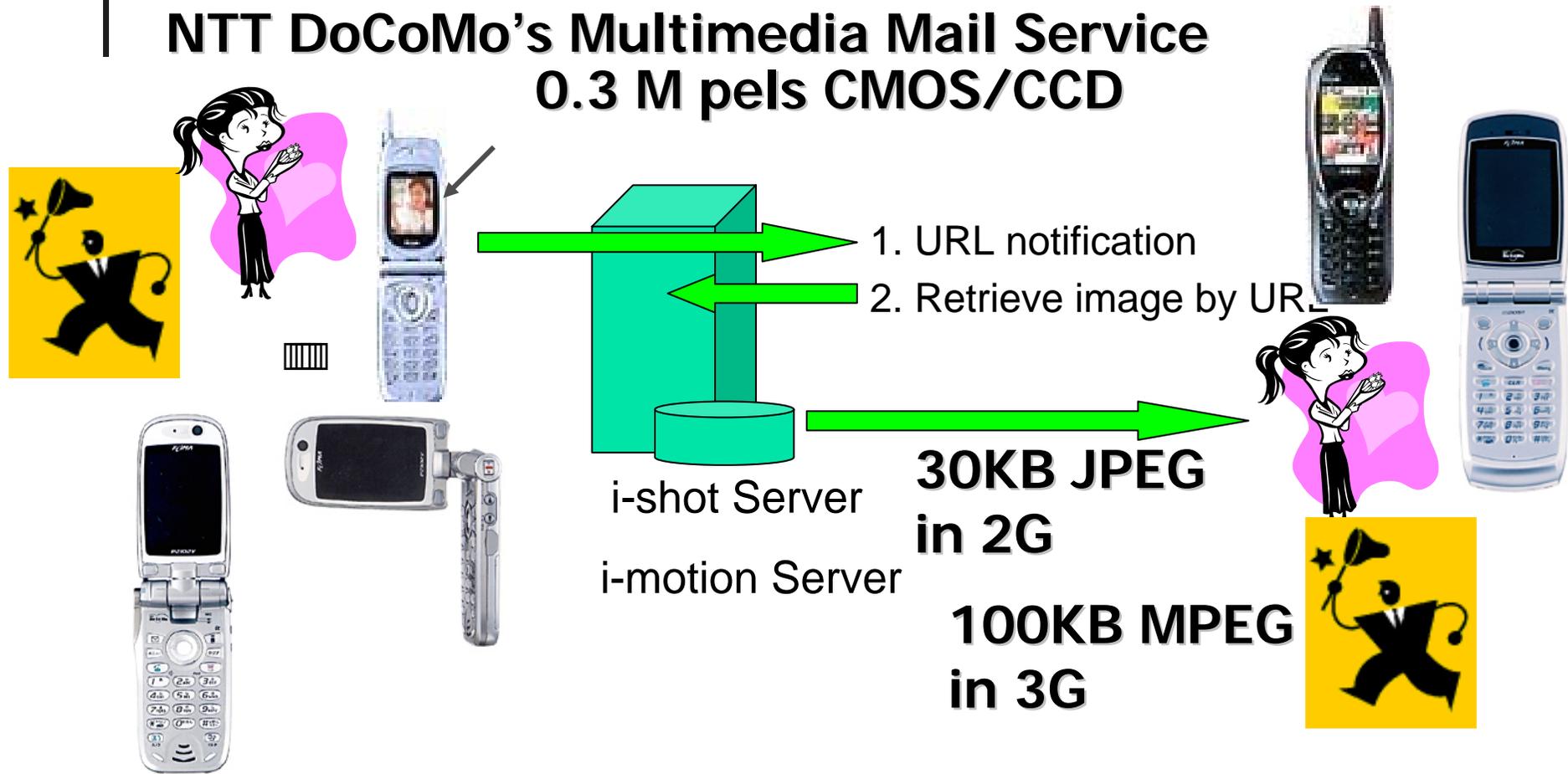
But ...

# Application Plan in 3G



# Current Picture Mail Services

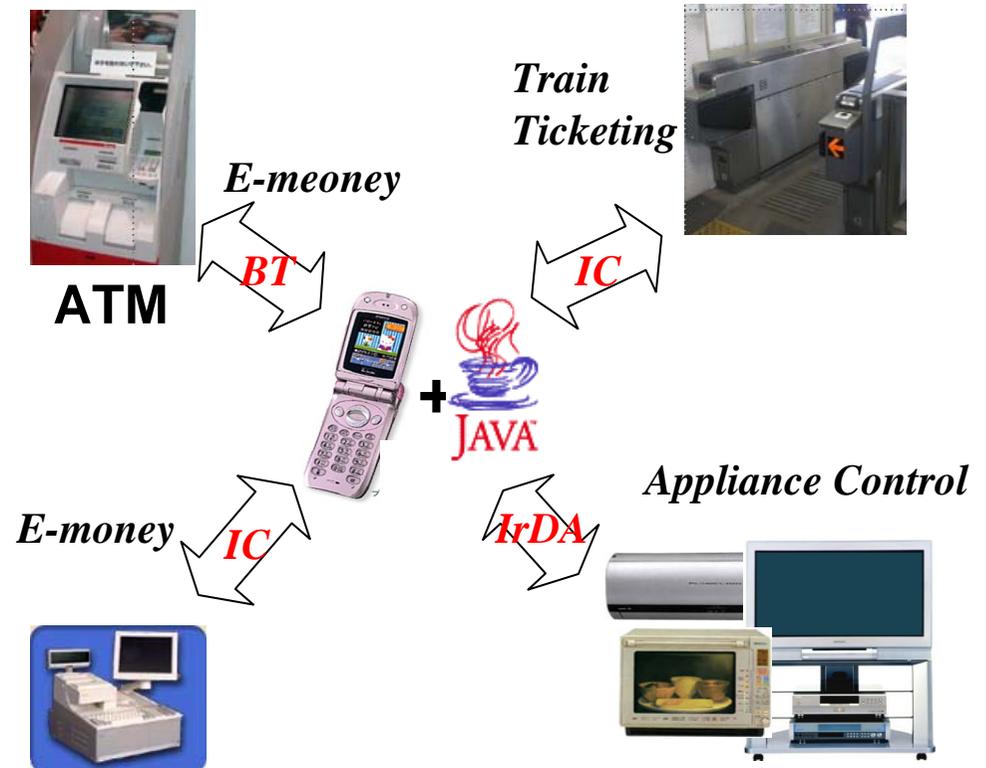
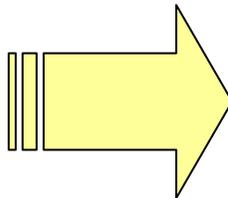
## NTT DoCoMo's Multimedia Mail Service 0.3 M pels CMOS/CCD



# DoCoMo's Java Phone is now comparable to i-PAQ, and more than Palm.

Ubiquitous Computing  
World enabled by

APIs for IrDA, Bluetooth  
and Non-contact IC,  
100KB footprint  
10MB Memory Space  
Authorized download  
XML-protocol, etc.



# Two approaches to creating Killer Applications



- to follow what successfully happened in the legacy Internet.

Example: E-mail and web browsing in i-mode

- to recognize what value 'mobile' adds. That is “ubiquity”, in other words, service availability.

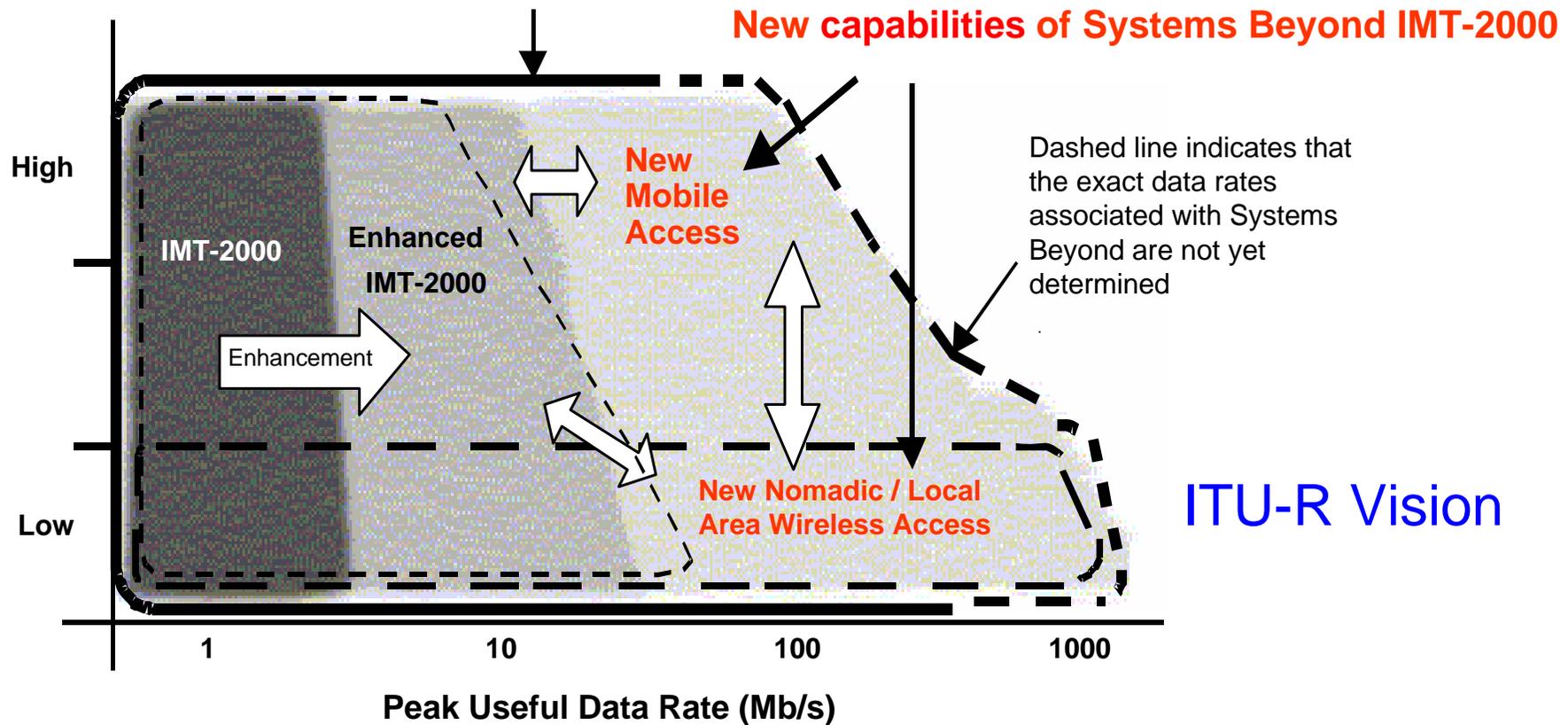
Example in Consumer Electronics: Sony's Walkman

Multimedia mail and Java Applications(e-commerce) are now taking-off.

# 4G Imperatives: RAN

Spectrum will remain the vital resource.

Mobility



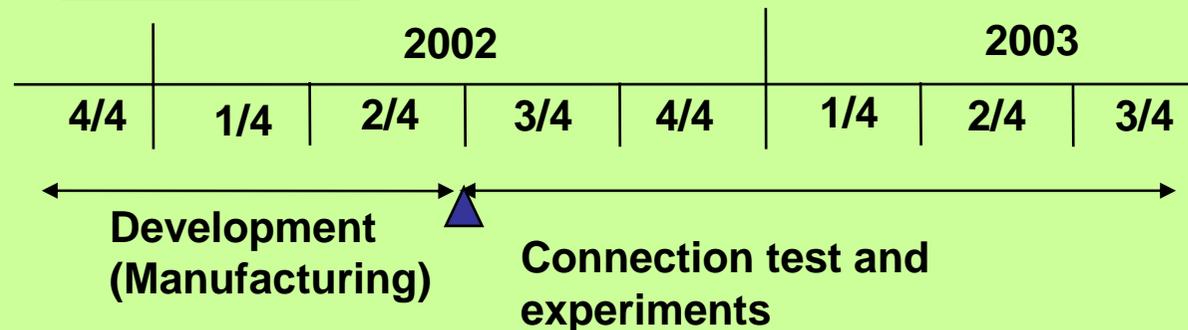
# DoCoMo's 4G Broadband Packet Wireless Access Test-bed



## Purpose

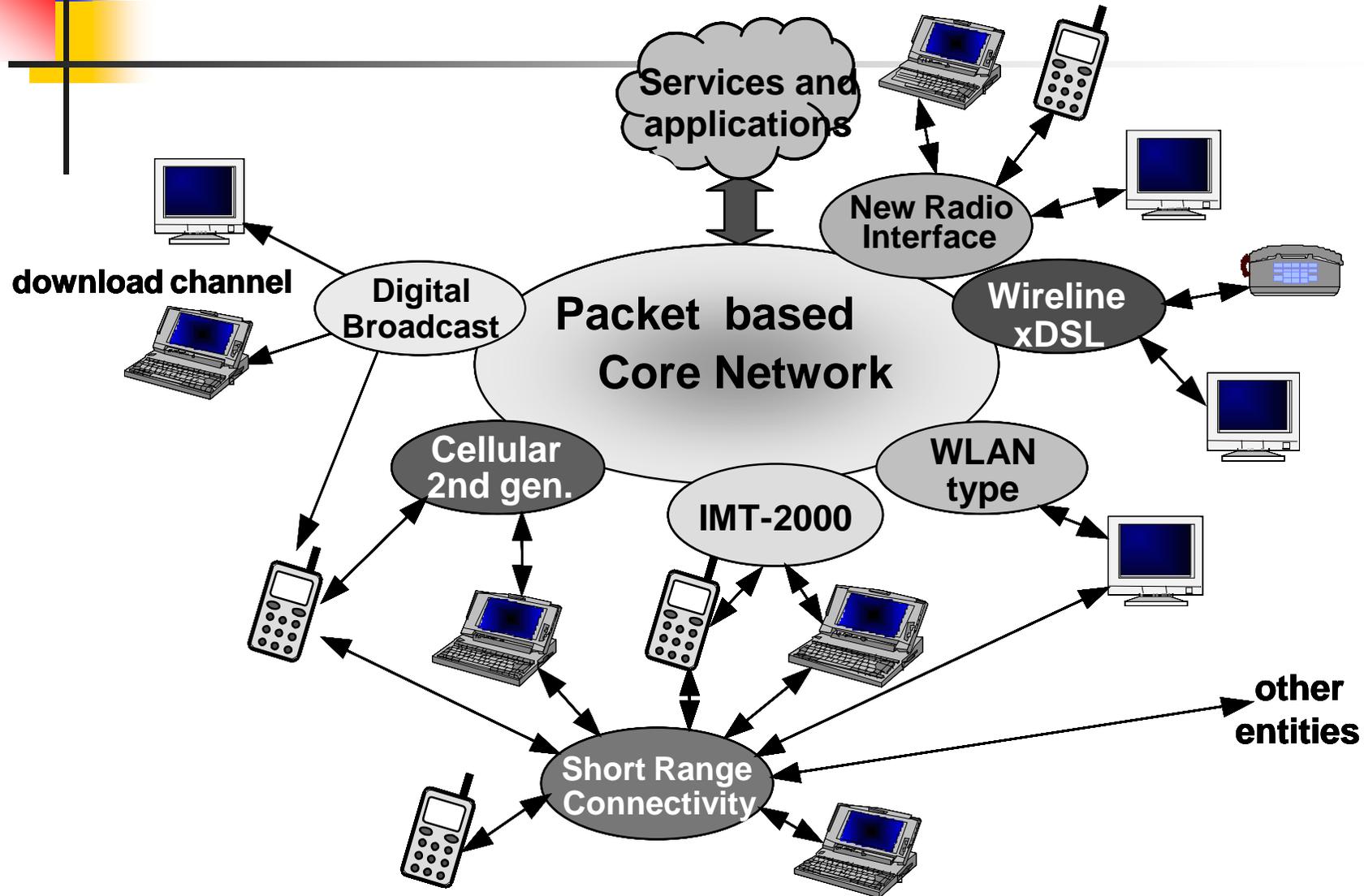
- Demonstrate maximum throughput of more than 100Mbps and 20Mbps in the forward and reverse links
- Clarify key technologies for broadband packet wireless access
- Evaluate real broadband channel conditions
- Evaluate IP packet transmission via real wireless channel

## Schedule



# 4G: ITU-R view

## Seamless Intertechnology Wireless Networks



# 4G Imperatives: IP Network

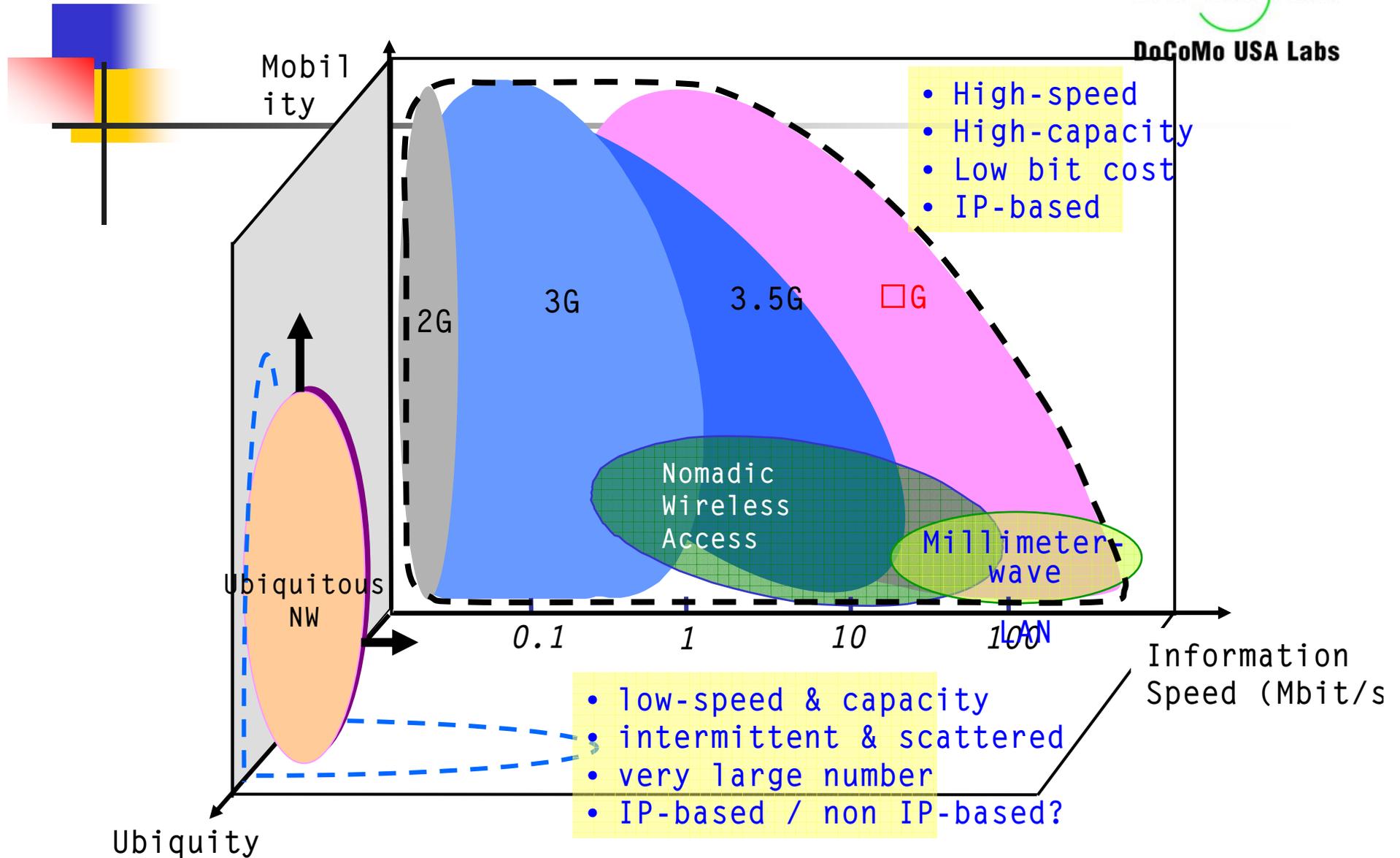


- True convergence with the Internet is critical
  - ⇒ IP must be supported efficiently
    - ⇒ Not primarily to decrease costs **but to enable services**
  - ⇒ Remove discontinuities at the wired/wireless interface and the data/voice interface
  - ⇒ The Internet must also evolve to support wireless mobility and ubiquity efficiently.

# Ubiquity as Service Availability



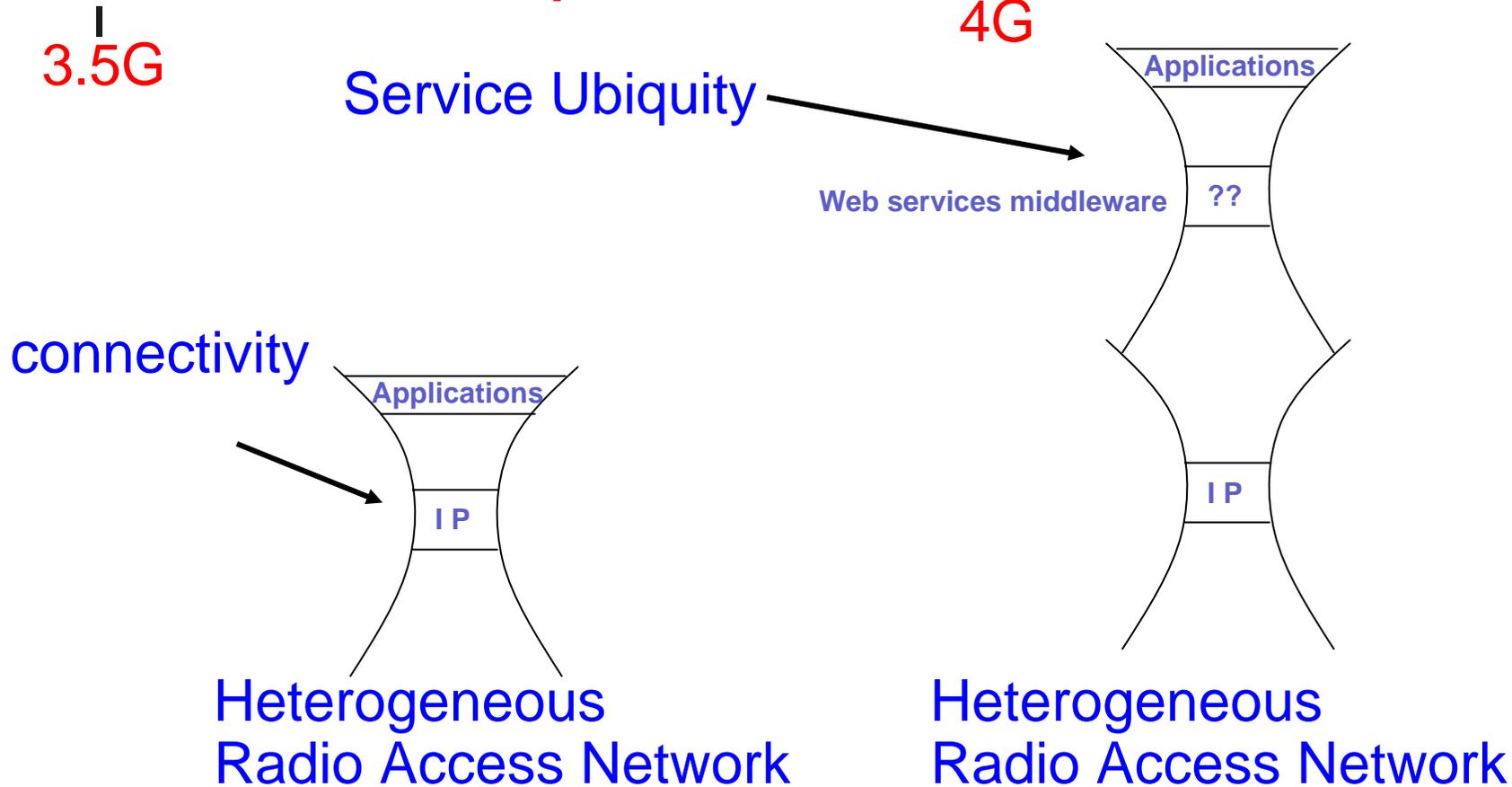
DoCoMo USA Labs

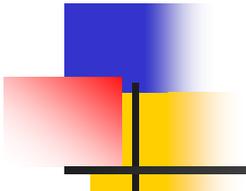


□ number of terminals/distribution density/real time/total information volume,  $\rho$

# 4G Imperatives: Ubiquitous Service Platform

Functional Leap with the second waist

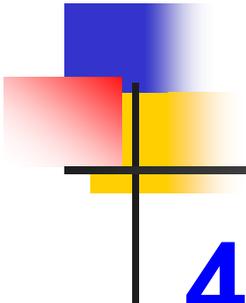




# Summary

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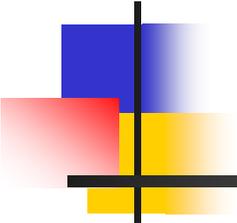
- Lessons from 3G → We need Killer Applications  
Candidates: Enhanced Web Access, Multimedia Mail, Java applications
- 4G Imperatives: RAN, IP Network, and Ubiquitous Service Platform.
- 4G should be defined in terms of applications, services & markets
  - Not purely by air interface protocol, (IP) backbone or bandwidth
- ‘Ubiquity’ is the key word to go further beyond 3G.



## Definition of 4G Network

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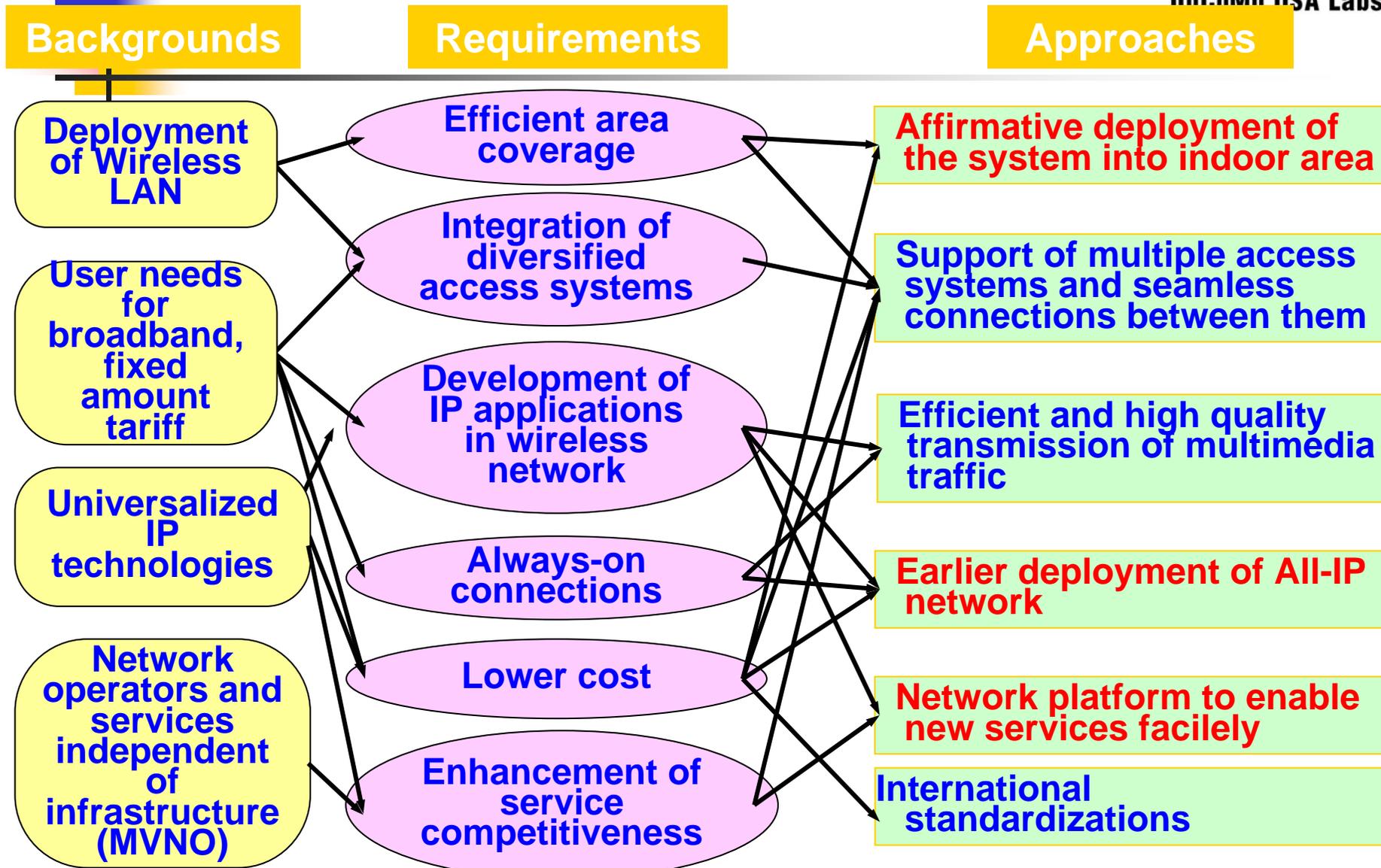
**4G Network =**  
**Heterogeneous RAN +**  
**Advanced IP Network +**  
**Service Ubiquity +**  
**Business Model - COST**



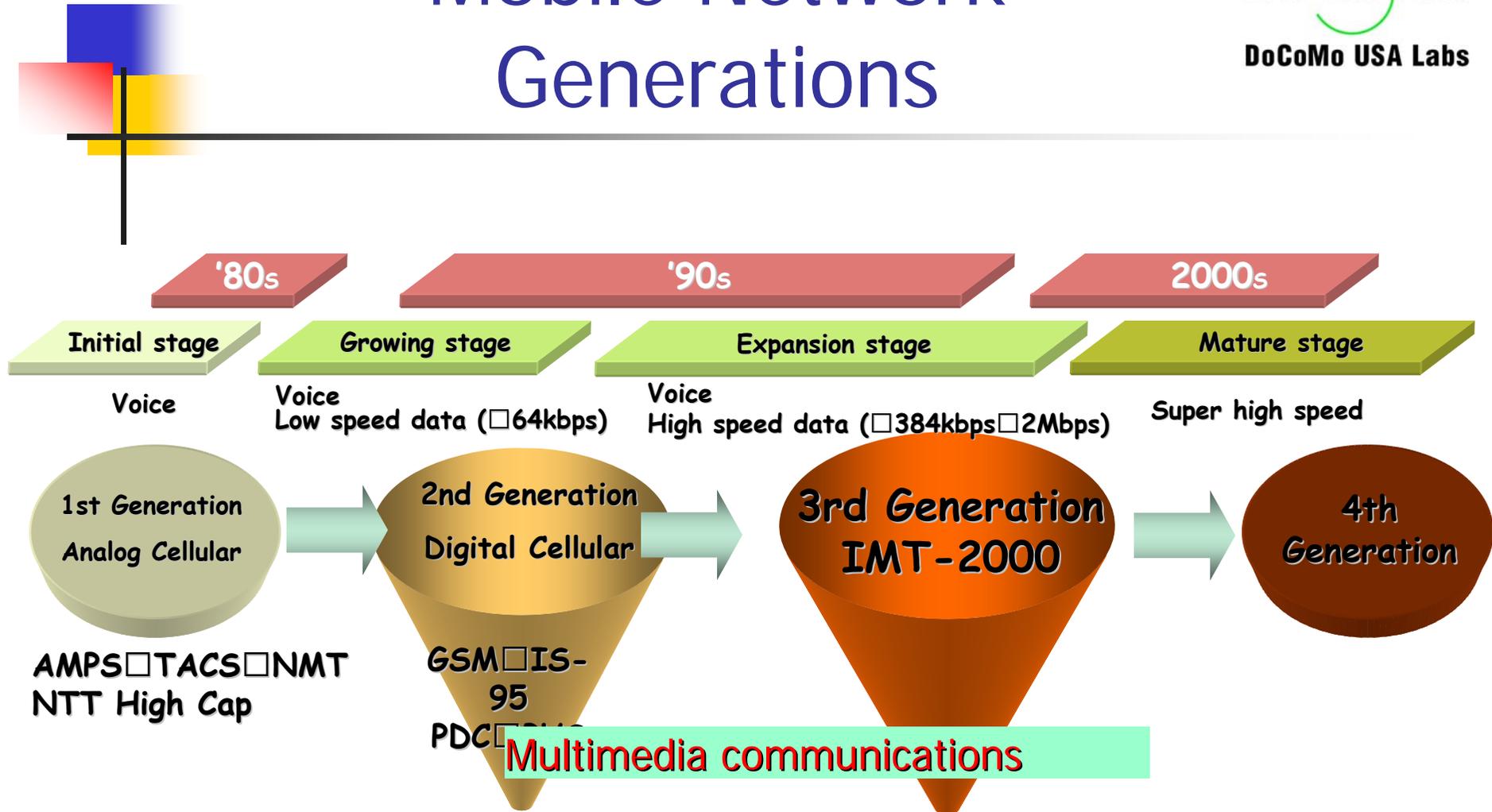
# Appendix

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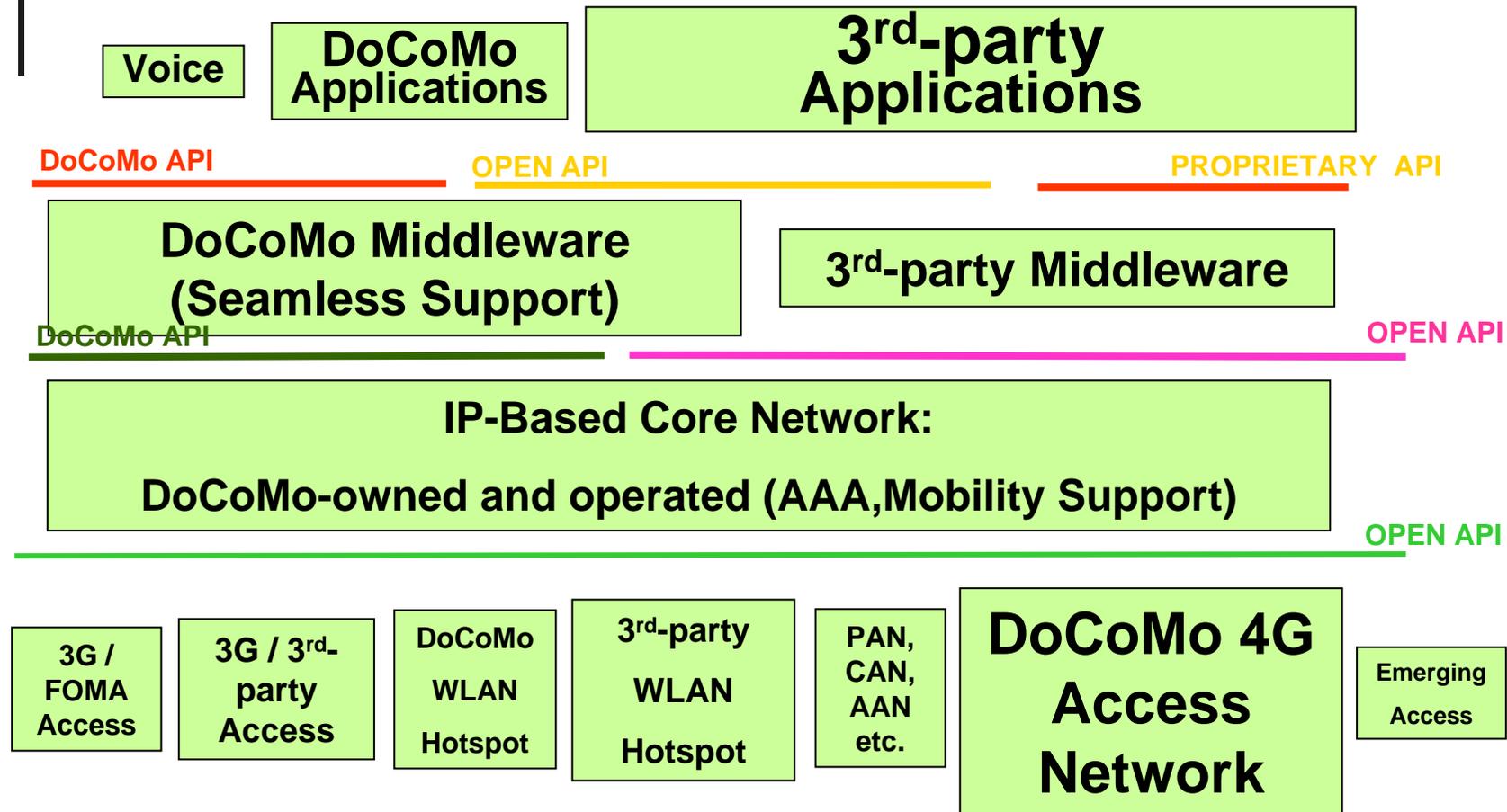
# DoCoMo's Approaches to 4G System Infrastructure Development



# Mobile Network Generations



# 4G Ubiquitous Architecture: The Basic Model of DoCoMo US Labs



# 4G Imperatives: IP Network



- True convergence with the Internet is critical
  - ⇒ IP must be supported efficiently
    - ⇒ Not primarily to decrease costs **but to enable services**
  - ⇒ Remove discontinuities at the wired/wireless interface and the data/voice interface
  - ⇒ The Internet must also evolve to support wireless mobility and ubiquity efficiently. Examples:
    - IP is in the RAN
    - VoIP is in the core and backbone
    - Data handoff occurring between heterogeneous radio technologies

# 4G Imperatives: Ubiquitous Service Platform



- Innovative applications, not voice, will be the key revenue generator

- ⇒ Programmability and Open APIs

- AAA, mobility and ‘plug and access’

- (Note: programmability does not equal “active networks” a la DARPA)

- ⇒ Foster a 3<sup>rd</sup>-party app developer community

- Build on work centered on fixed networks (Parlay, JAIN, OSA)

- ⇒ The search for the killer app should never end

- Any static portfolio of applications and services will eventually become a commodity

- ⇒ Radical personalization and niche applications

- Applications with a market size of 1*

- COPYRIGHT NTT DoCoMo and DoCoMo USA Labs*