

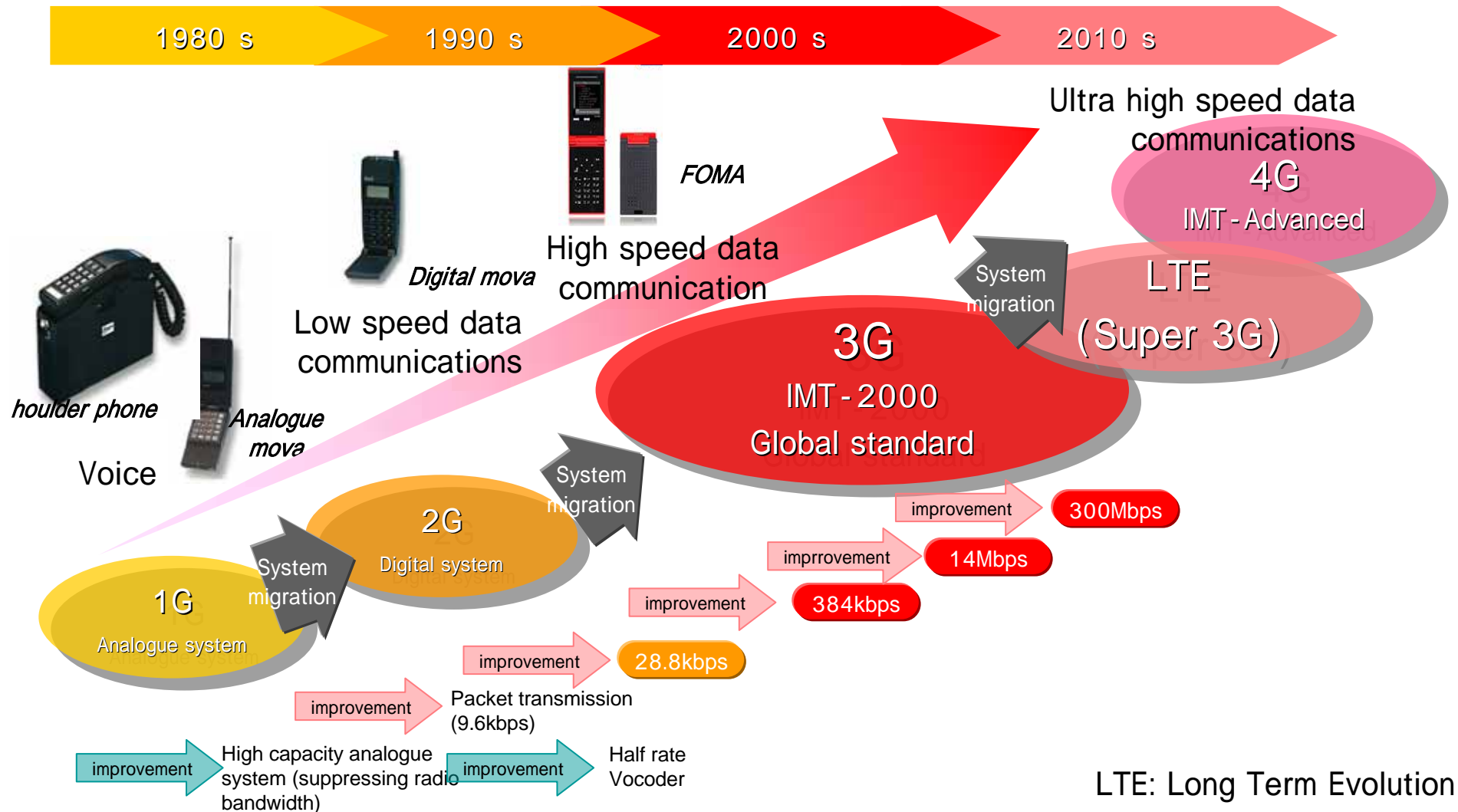
# Development of LTE Network

**NTT DOCOMO, INC.**

**Radio Access Network Development Department**

# Improvement and Migration of Mobile Cellular System

Mobile cellular system migrates every 10-years.  
Some improvements are conducted within a generation.

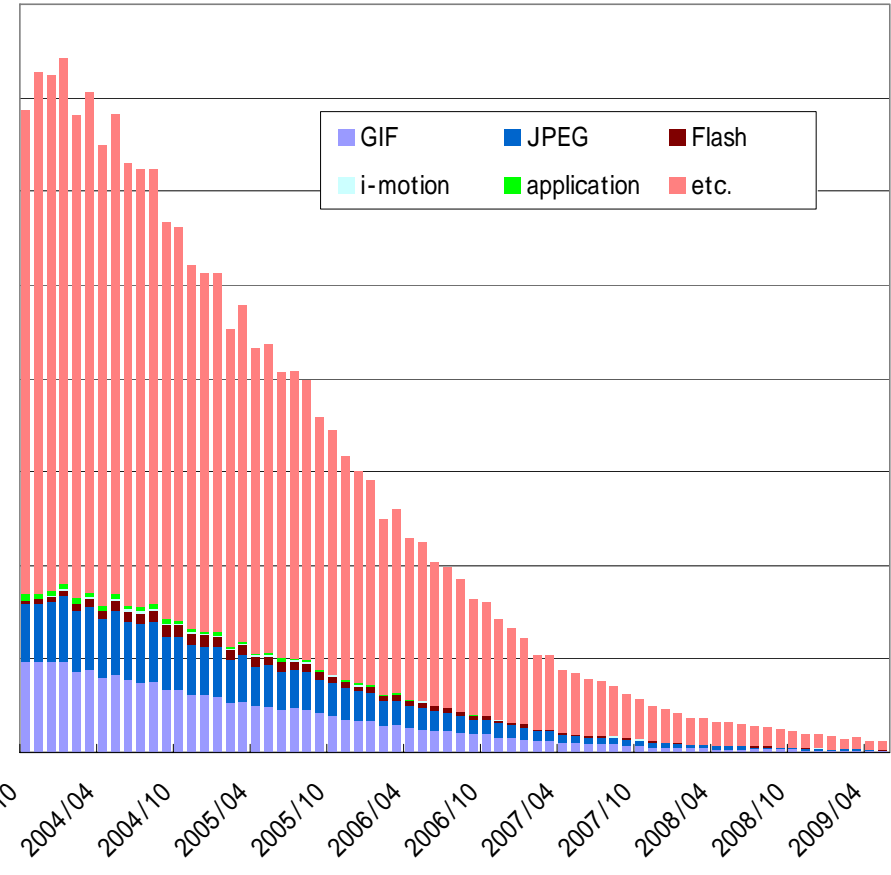
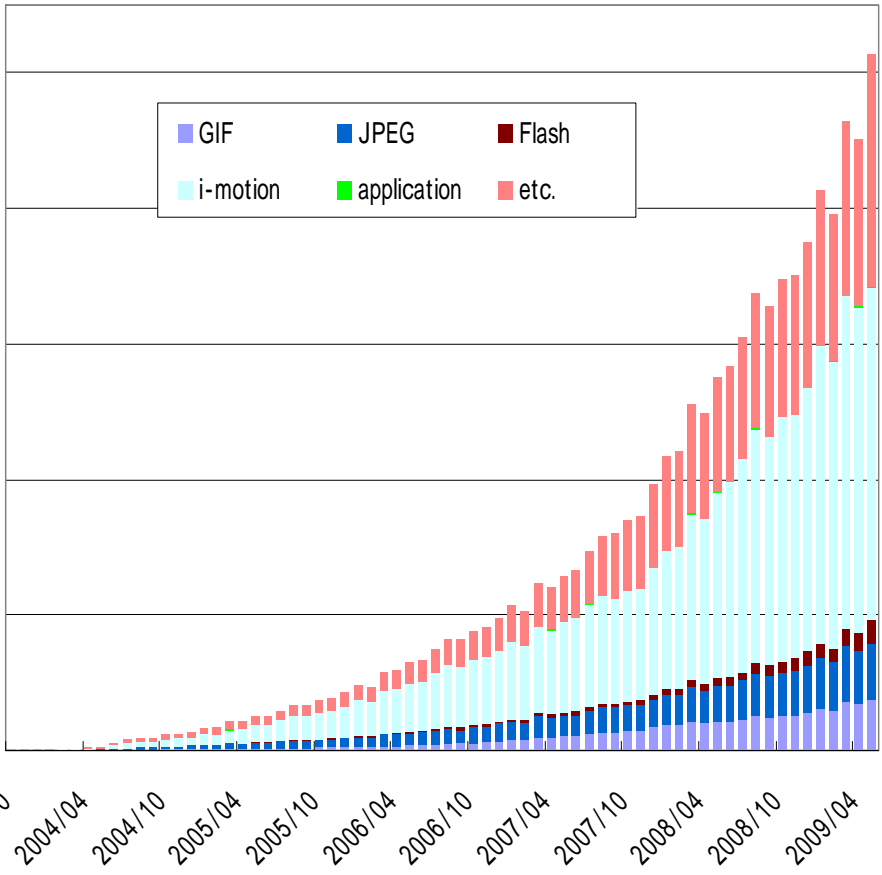


LTE: Long Term Evolution

# Growth of Packet Traffic in 3G

FOMA

PDC



\*: "application" does not consists of active packet

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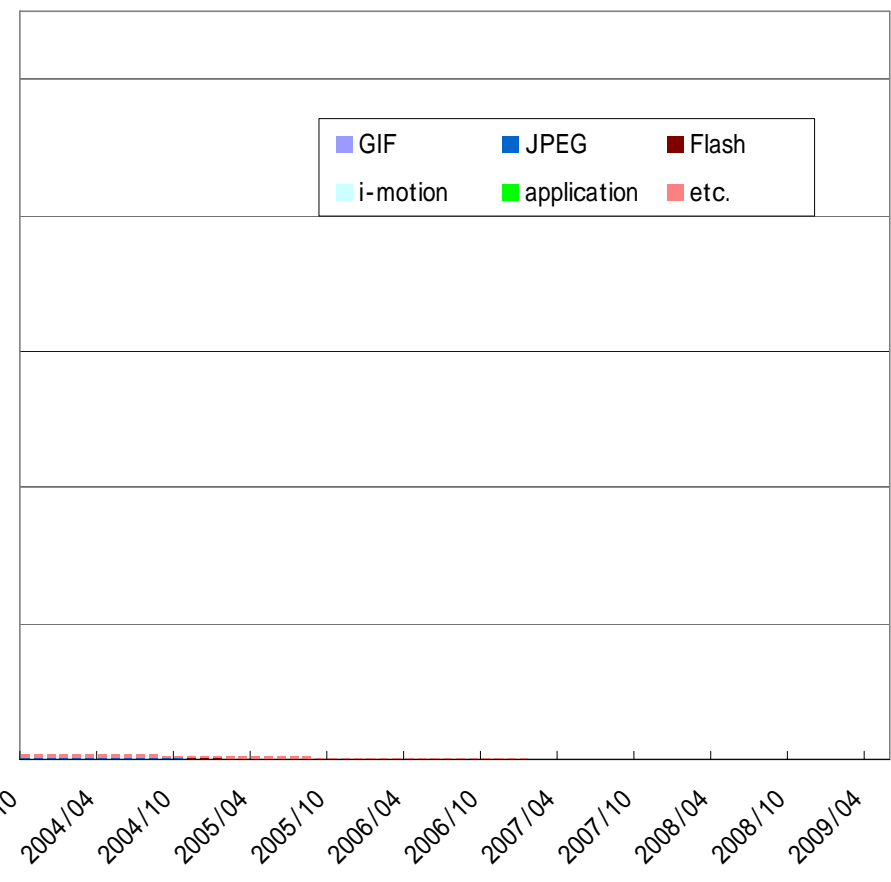
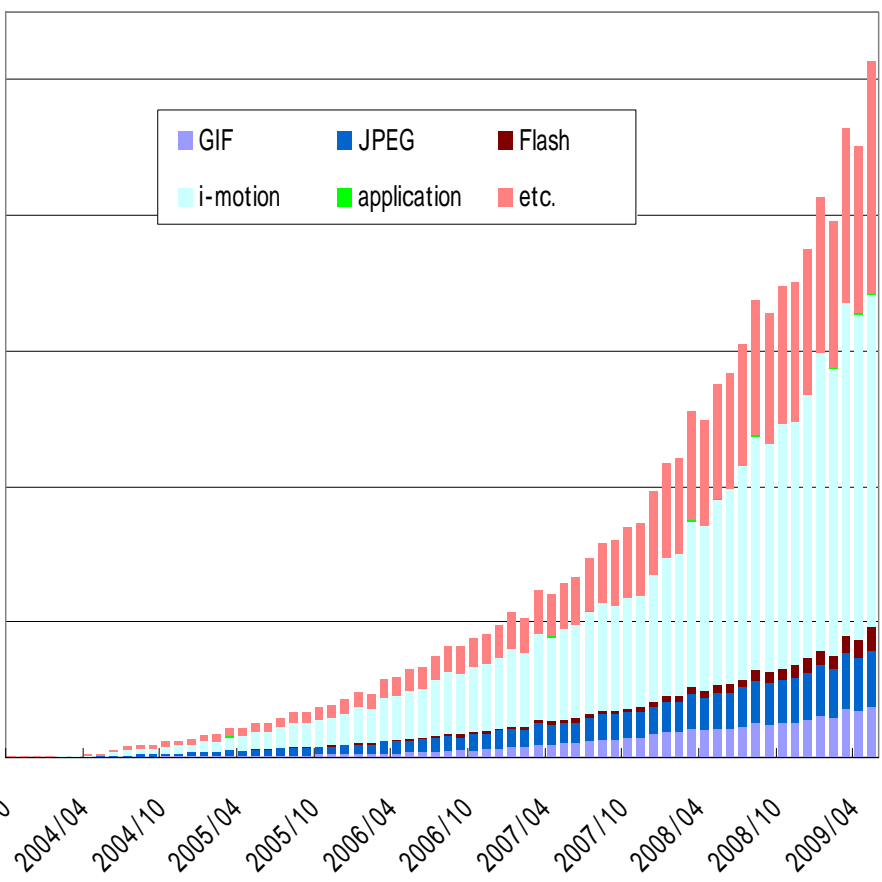
Most of packets carries HTML in PDC and i-motion, GIF and JPEG in FOMA.  
 Ratio of i-motion is further increasing in the latest years

# Growth of Packet Traffic in 3G

FOMA

the same scale

PDC



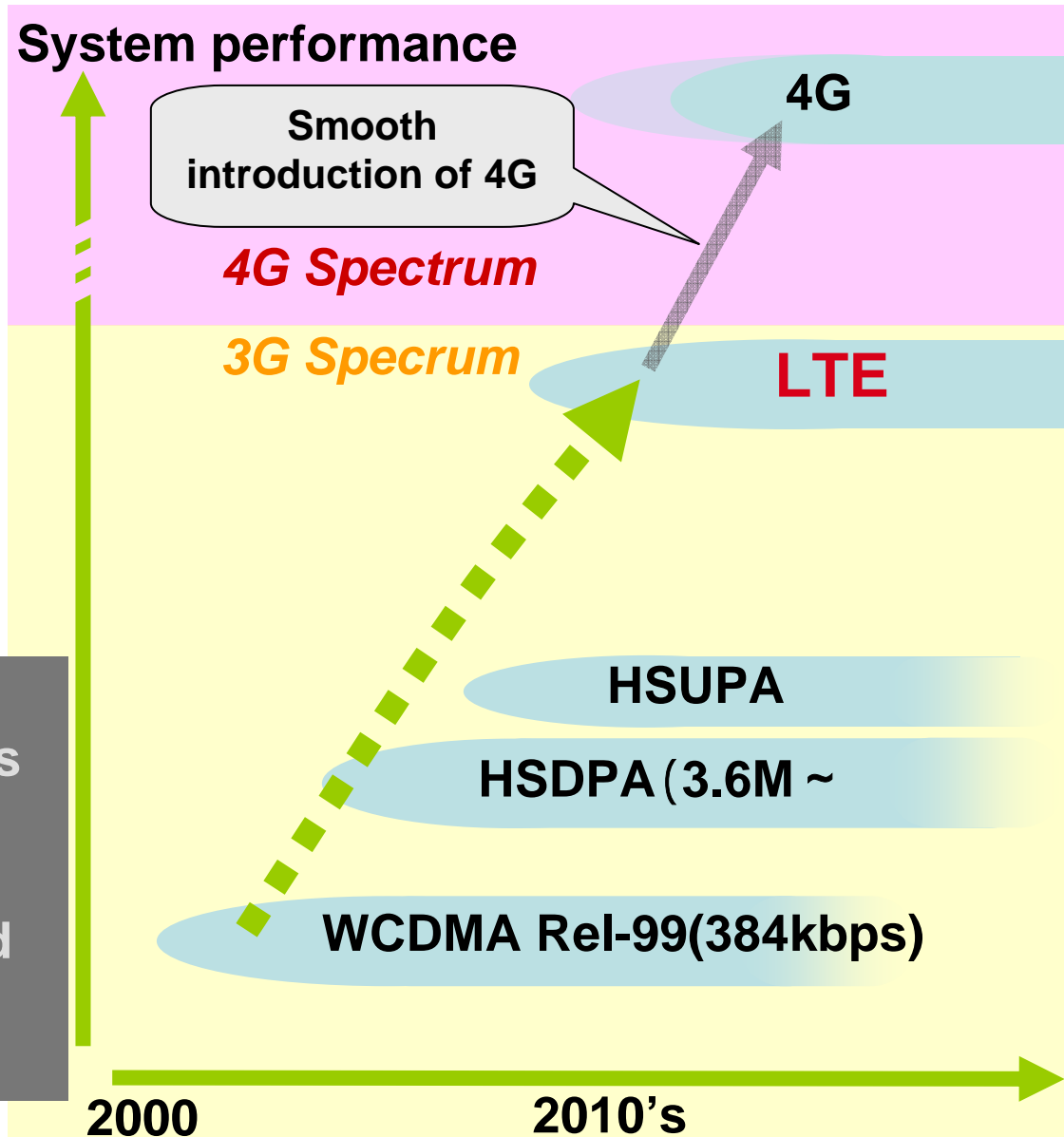
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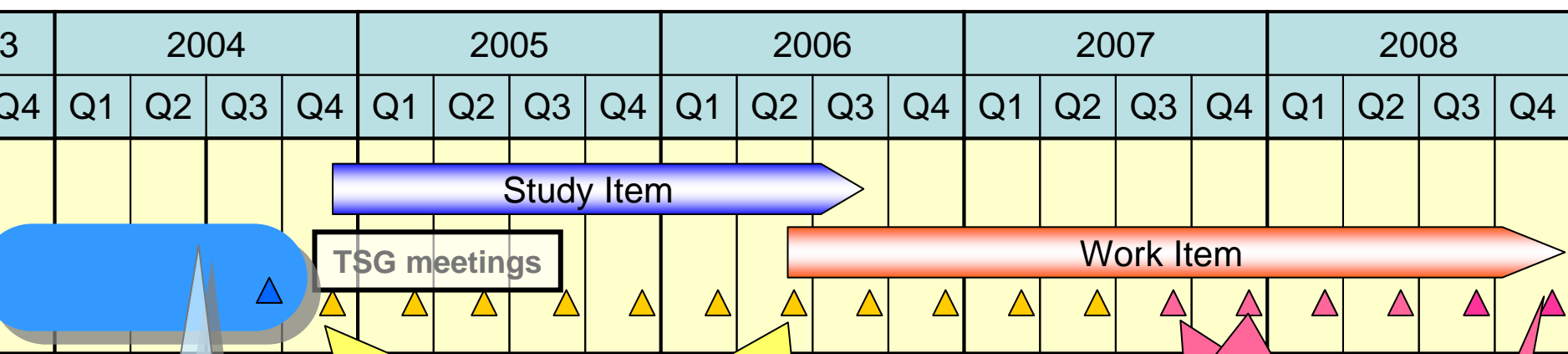
# DOCOMO's position on LTE and 4G

- High-level objective
  - To ensure the continuous and long-term growth of the mobile communication industry
    - To maintain the competitiveness of 3G even in the 4G era
    - To provide a smooth path to 4G introduction



- Providing a smooth path towards 4G was DOCOMO's original motivation for LTE
- In those days, showing no interest in 4G, 3GPP agreed to start the study for 3G evolution itself.

# LTE History, Status and plan in 3GPP



*Dec. 2004*

- Study Item on *Evolved UTRA and UTRAN* was proposed by 26 companies and approved.

*June 2006*

- The detailed specification work (Work Item) started.

*Sep-Dec. 2007*

- Major core specifications were approved.

**Concept of Super 3G was proposed.**

**DOCOMO started development of LTE system**

**Completion of LTE spec. (Rel.8)**

# Advantage of LTE

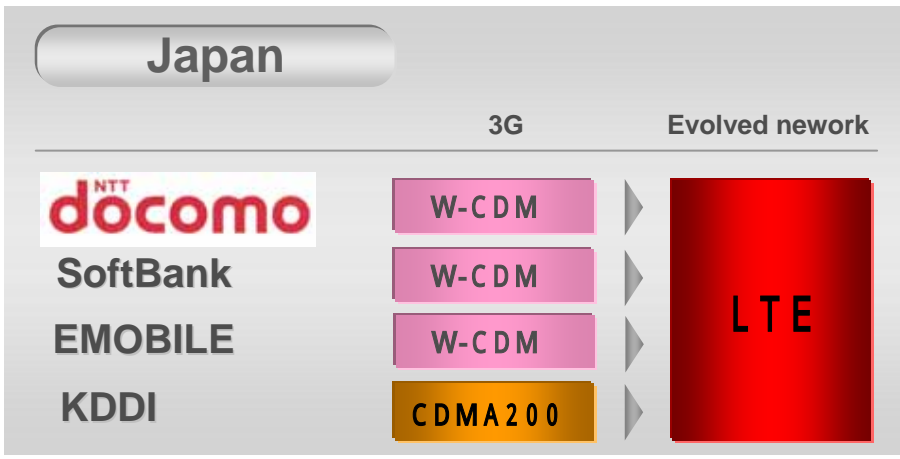
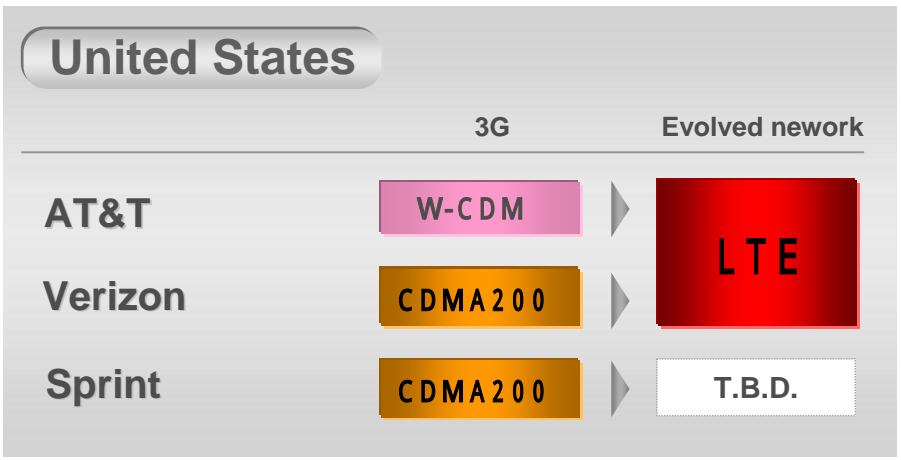
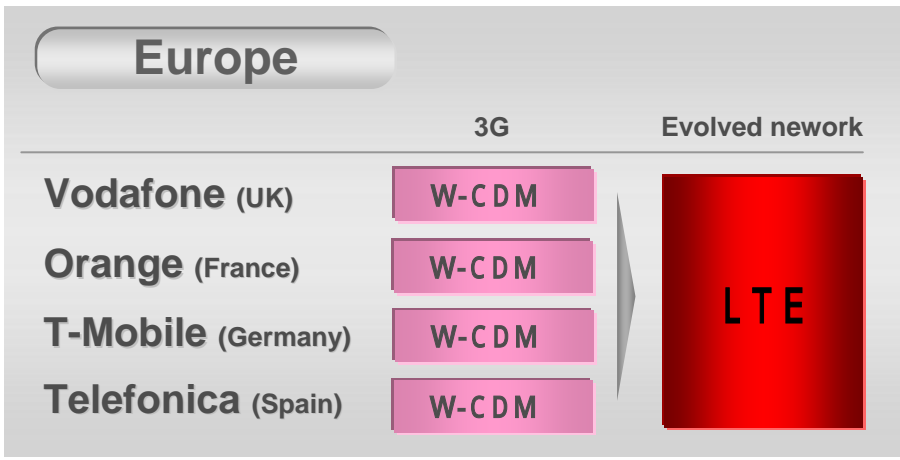
- **LTE provides ultra high peak data rate**
  - ◆ e.g., 300Mbps using 4x4 MIMO
- **LTE realizes ultra short latency**
  - ◆ e.g., 5 msec in RAN (oneway)
- **LTE has very high capacity**
  - ◆ e.g., 2-4 times larger than HSPA

# Status toward LTE Introduction in Japan

- Introduction of 3.9G mobile communications system has been studied in telecommunications council in Japan since April 2008
  - In the council, LTE was proposed as one of 3.9G system to be studied
  - As the study results, feasibility of LTE was confirmed in terms of meeting requirements of 3.9G and co-existence with existing radio systems
- In June, 2009, Japanese MIC approved the 4 operators' application for the introduction of 3.9G network and newly assigned the following spectrum.
  - 1.5 GHz band for 3 operators and 1.7 GHz band for 1 operator
- As a condition of the new spectrum assignment, 4 operators are requested to deploy 3.9G (e.g., LTE) and/or 3.5G+ (e.g., HSPA+, DC-HSDPA) network of 50% population coverage within five years.
- DOCOMO plans to launch LTE using 2 GHz band from 2010 considering utilization of existing NW facilities and inter-national IOT band. 1.5 GHz band will be used from 2012.

# LTE Trend in the World

● Most operators decided to introduce LTE for evolution of current 3G networks

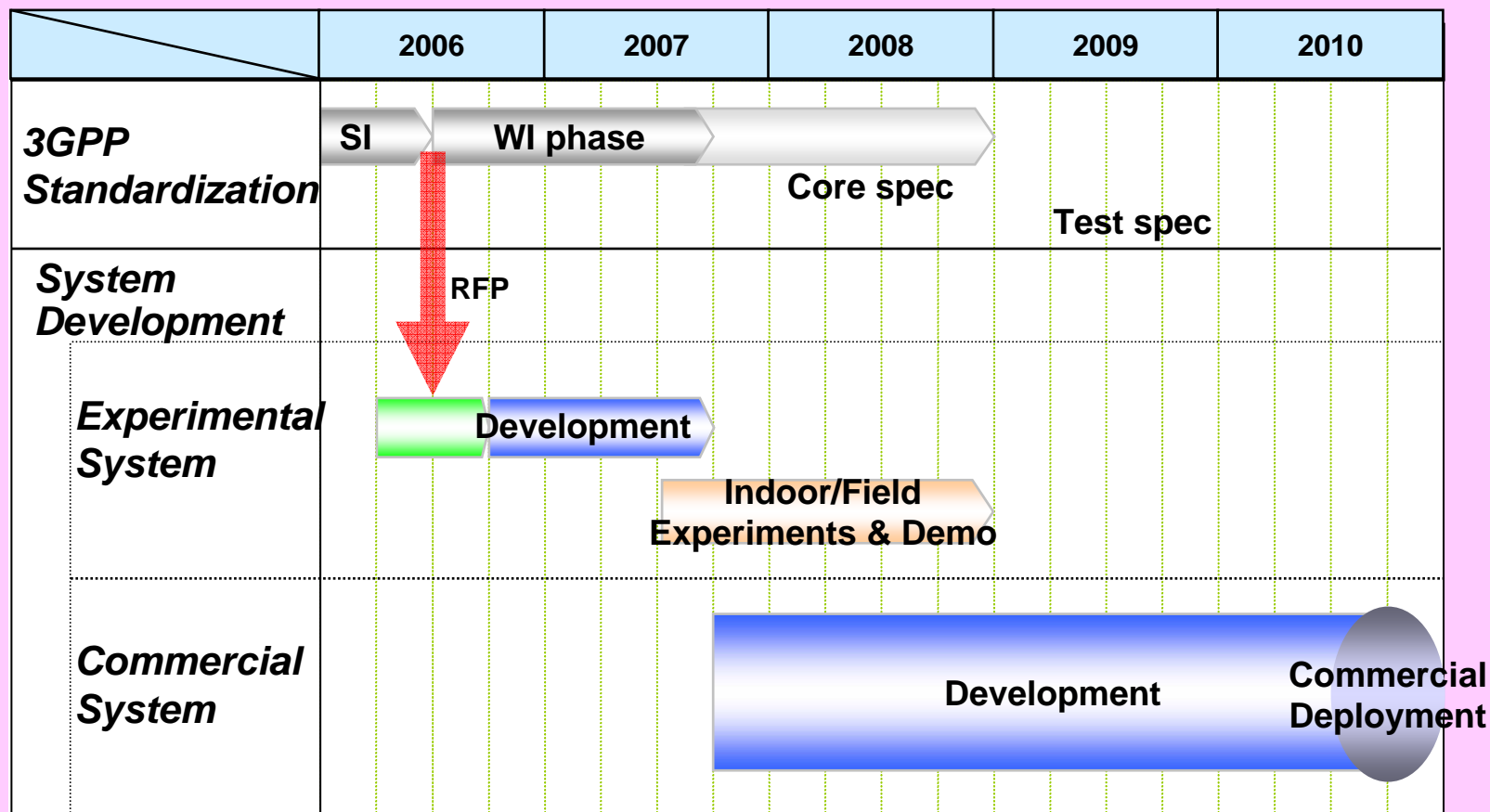


## Time plan

	2009	2010	2011 ~
NTT docomo			Commercial Deployment
Major carriers			Commercial Deployment

Extracted from newspaper articles  
Some of above contents are still under consideration

# Overall LTE Time Plan of DOCOMO

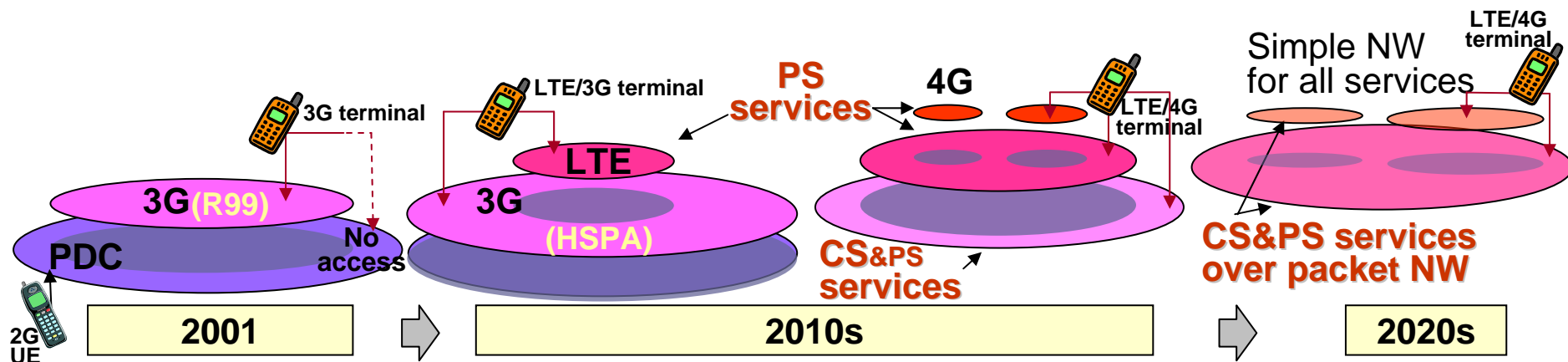


- DOCOMO will launch LTE as one of the leading operators in the world.
- To ensure the interoperability, we will keep watching the global status.
- DOCOMO's plan is in line with that of other leading operators.

# Towards LTE Launch

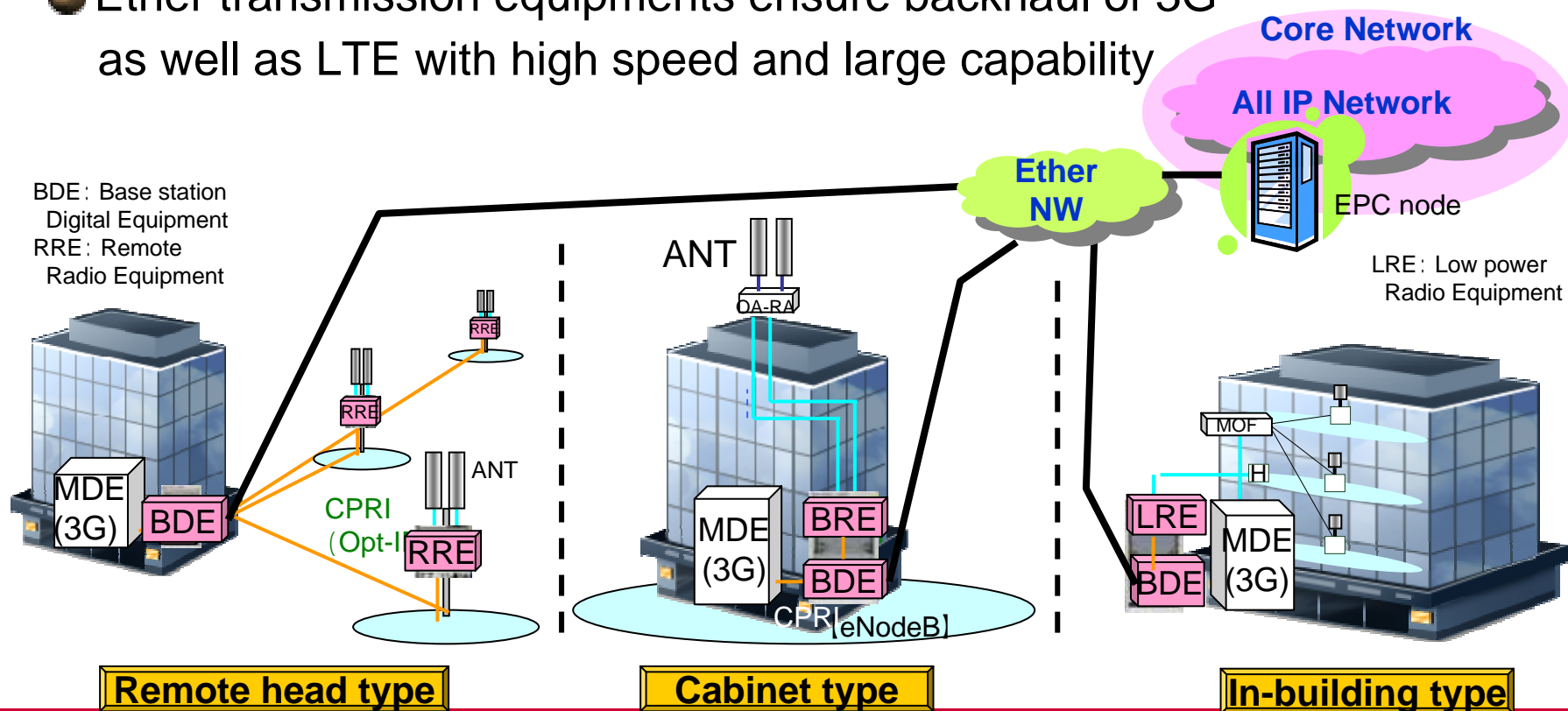
# Deployment Scenario

- At the LTE launch,
  - LTE area will be overlaid over the legacy 3G area
  - LTE UEs will have legacy 3G functionality
- CS services will be provided by the legacy 3G systems with CS fallback
  - After LTE UEs and enhanced services become widely available
  - CS services will be provided by LTE on the PS domain



# Overview of eNodeB configuration for variety of deployment scenario

- eNode B equipment
  - Three possible configurations enable versatile deployment.
  - Uses certain RF components also used for current 3G BTS.
  - Common OAM functionality enables multi-vendor network.
- DOCOMO introduced 3G-compatible LTE remote heads in 2009.
- Ether transmission equipments ensure backhaul of 3G as well as LTE with high speed and large capability

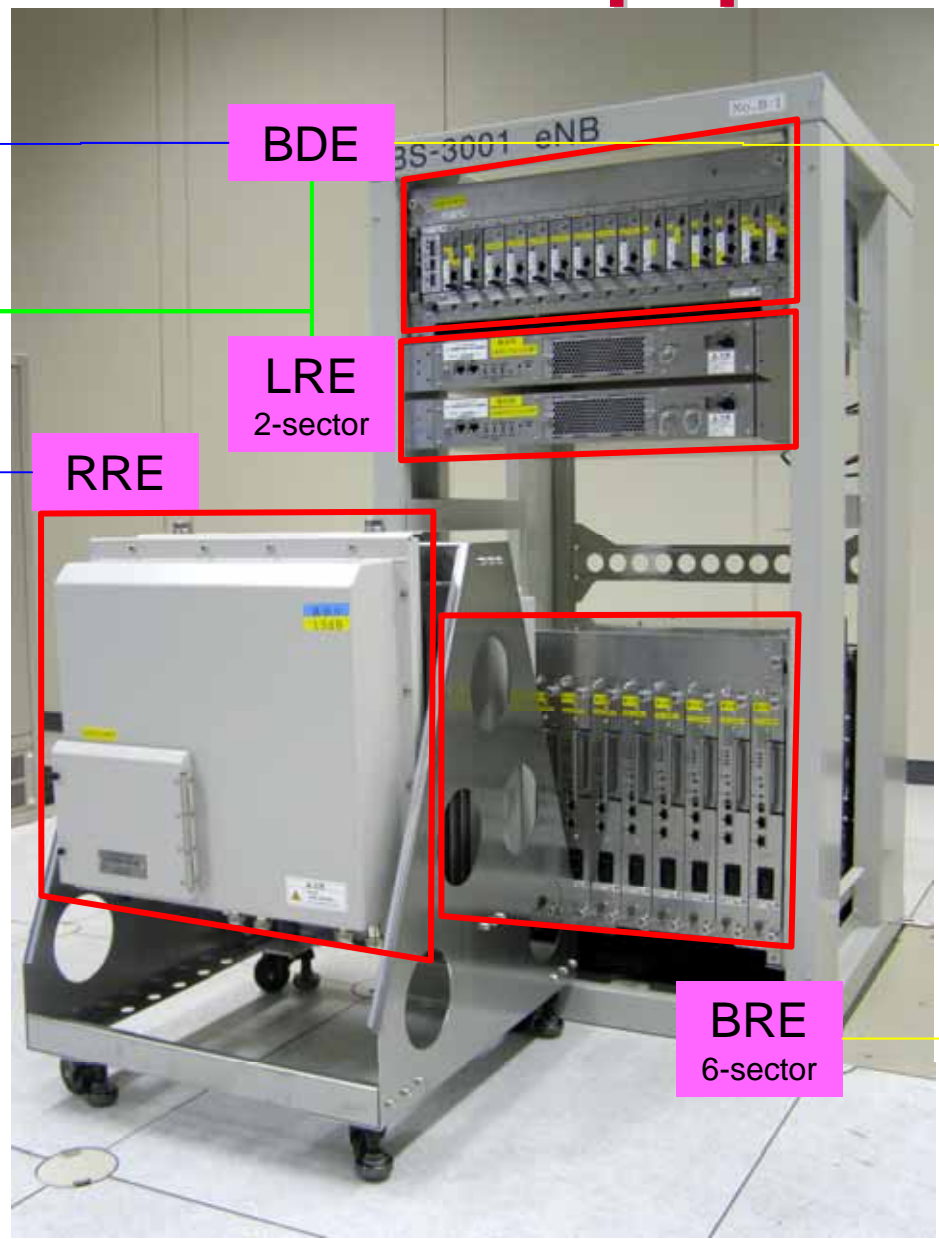


# Commercial eNodeB Equipments

Remote head type  
→ BDE+RRE

In-building type  
→ BDE+BRE

AMP type  
→ BDE+BRE



BDE

LRE  
2-sector

RRE



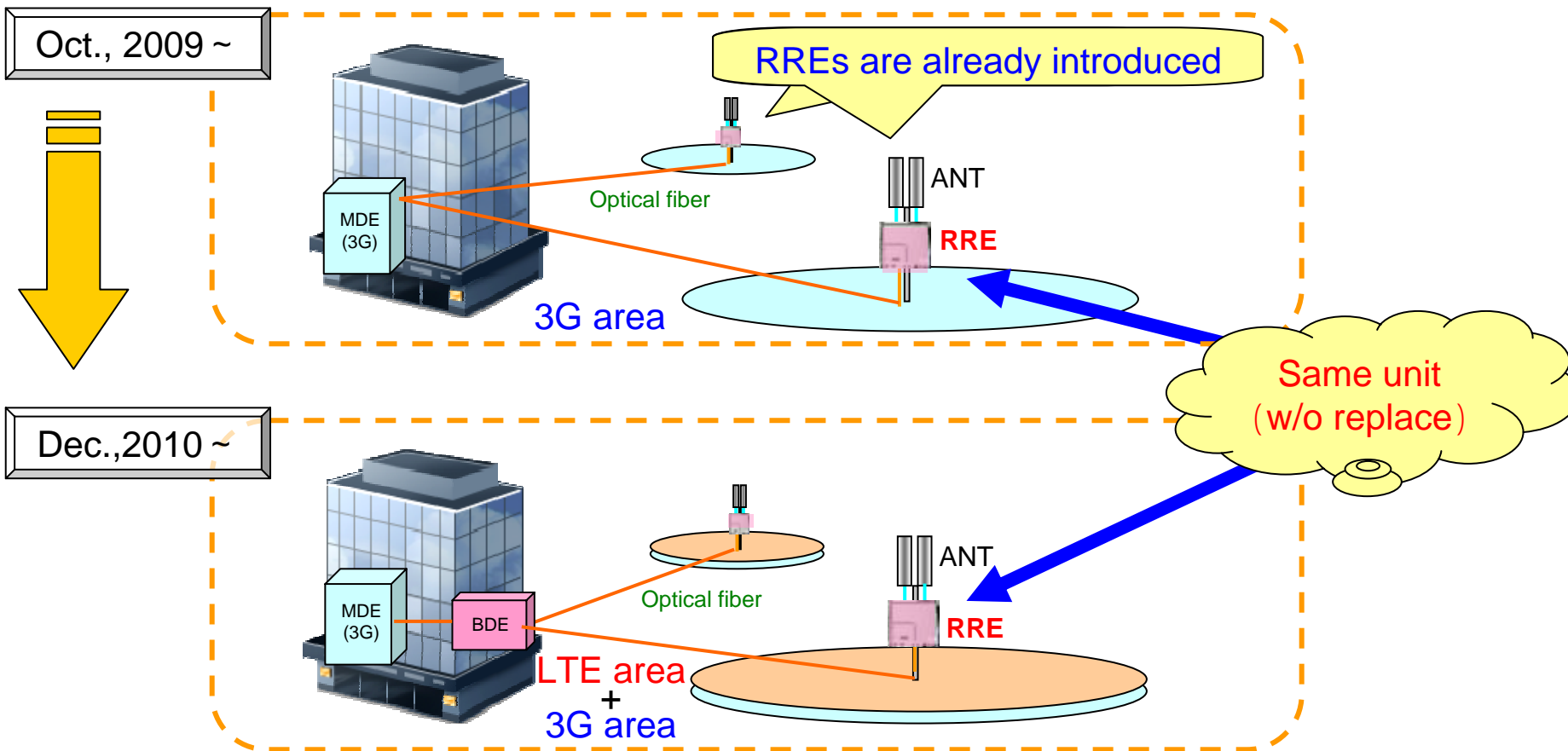
BRE  
6-sector

# Efforts to Reduce CAPEX

## - Deployment Scenario of RRE -

### Deployment scenario

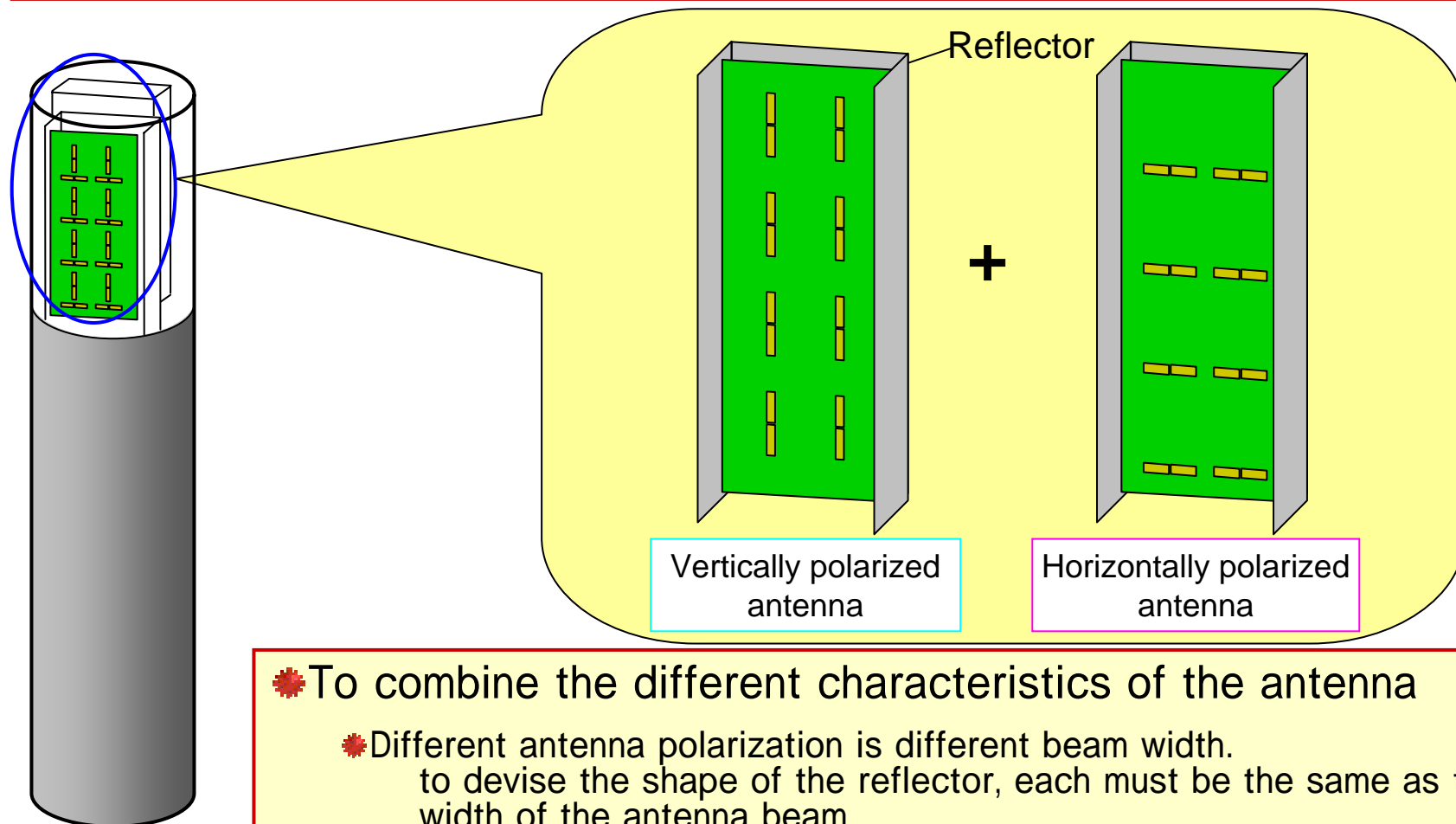
- Prior to LTE launch in 2010, DOCOMO already introduced remote radio heads for LTE to share with 3G in Oct. 2009.



# Efforts to Reduce CAPEX

## – MIMO antenna –

- DOCOMO has already used multiple antennas to improve the quality of the network. (e.g. Transmit diversity technique)
- In LTE, by utilizing its facilities, 2x2MIMO is feasible at low cost.



# Laboratory Tests and Field Trial

- DOCOMO has been working on final tests with test bed as well as Inter-operability tests (IOT).
- Towards LTE launch in 2010, DOCOMO is also conducting Field Trial near by Tokyo.
  - Following items are verified and confirmed in the trail.
    - Systematic confirmation using total LTE network nodes (multiples vendors)
    - Confirmation of connectivity and mobility functions
    - Confirmation of handover between 3G and LTE
    - Parameter optimization to maximize LTE performance

**NTT**  
**docomo**