

# Japanese Telecommunications as Network Industry: Industrial Organization for the BISDN Generation Technology

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## Abstract

This study proposes a new industrial structure for the Japanese information infrastructure in the 21st century. The proposed industrial organization has a hierarchical structure with five layers, each of which corresponds to a functional description of BISDN technology. Each layer is then assigned a market structure (i.e., competition, regulated competition, or regulated monopoly). The proposed industrial organization can serve as not only a backbone of the BISDN-based information infrastructure but also as a conceptual framework for guiding the NTT divestiture planned for 1995.

## I. BISDN Technology

### A. Components of BISDN

1. Large-scale implementation of optical fiber
2. ATM
3. Multimedia terminals

### B. Hierarchical Structure

1. Physical layer
2. ATM layer
3. AAL (ATM adaptation layer)
4. Upper layers 1 and 2

The ATM and AAL are not separated in the conventional analog telephone network.

## II. Alternatives for the Organization of Telecommunications Industry

### A. Single public firm, regulated monopoly

### B. Regional separation (regional or prefecture-oriented segmentation)

1. Domestic and international services

2. Local and long-distance services

### C. Separation by type of services provided

1. Transmission services and user-access services

2. Public switched telephone service, local network service, and wireless telephone service

3. Voice and image services

### D. Vertical separation

1. Desirable Industrial Organization for BISDN

2. For PSTN:

enhanced and basic services

Note: RM (Regulated Monopoly)

RC (Regulated Competition)

C (Competition)

## III. Factors to be considered for desirable industrial organization

### A. Competition and regulation

Balance between the benefits produced by competitive markets and other benefits of regulation

### B. Competition:

Price reduction, service enhancement, and the creation of new services

### C. Regulation:

1. Reduction of production cost and enhancement of benefits due to large-scale operation, exploiting economies of scale and economies of scope

2. Providing universal services

3. Setting technical standards

4. Investment for research and development

5. Ability to absorb risky investments

## 6. Protection of the communication rights of sovereign states

### IV. Vertical Separation

#### A. Benefits and shortcomings

##### 1. Shortcoming:

- (a) Economies of scope may be lost
- (b) Cost of interfaces

##### 2. Benefits:

- (a) Promotion of competition within each layer
- (b) Easy implementation of regulation
- (c) Reduced transaction costs
- (d) Simple accounting structure
- (e) Easy identification of internal and external cross-subsidization
- (f) The value-added due to regulated monopoly will be reduced to its lowest level  
(i.e., to minimize the level of inefficiency due to monopoly or regulation)
- (g) Reduction of interface cost is expected in the future

#### B. Current analog telephone network

Three levels; upper service, basic service, and traffic line infrastructure

Ideal and actual (present) industrial structures

Transition process

#### C. Working of the “ATM Layer (Level IA)”

##### 1. Public operation or heavily regulated private operations

##### 2. Transmission of “cells”

Maintaining the ATM network

Maintaining user access (including user ID's)

(Upper or lower-level activities are prohibited at the ATM Layer)

##### 3. Monopsony toward Level 0 providers

(Renting switches and physical circuits)

Cost minimization

##### 4. Monopoly toward Level IB operators

(Supplying cell-transmission services (only))

No profit maximization

Setting relative prices of services (ratio of service prices)

Passing the cost from Level 0 to Level IB

(I.e., work as if an auctioneer in the competitive market. Both Level 0 and Level IB providers are price takers.)

5. Execute:

- a. Universal service and other pricing and distribution policies by setting an appropriate **relative** prices
- b. Standard setting
- c. Support basic research from its income
- d. Support infrastructure construction  
(by using its nationwide coverage)
- e. Protect the rights of sovereign states  
(by using its monopoly power)
- f. Bypassing the ATM Level is strictly prohibited

D. Working of the Level IB (Multimedia Service Providers):

1. Competition by many providers, free entry, free pricing, no restriction of services
2. Purchase “cell-transmission services” from the ATM Layer (Level IA) and produce telecom services (to be sold to users).
3. Services may include telephony, video telephony, video conferences, VOD, broadcasting, tele-schooling, and many others.

E. Working of the Level 0 (Infrastructure Layer):

1. Construction and maintenance of telecom facilities  
(switches, circuits, wireless facilities, etc.)
2. Selling the services of facilities to Level IA competitively.  
(Not allowed to sell to others.)
3. Right of way, etc. (if needed), is to be purchased from the regulator competitively  
(through auctions).
4. Bear the risk of obsolescence of facilities.

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**Table 1: Hierarchical Structure for BISDN Services Supply (BISDN Protocol)**

Hierarchy (Layer)		Function
Upper Layer	2	Video, Broadcasting Supply (Library), Enhanced Information Service, Teleservice (Data Base, Education and Medial Applications), and Various Services Associated with Information Context
	1	Telephone, TV-Telephone, TV-Conference, Telephone-Meeting, E-mail, Image Transmission, Public Broadcasting, LAN, WAN and Specific Services not Associated with Information Context
AAL (ATM Adaptation Layer)		Information Formats such as Voice, Image, Data, Signal (Control Data), information Transmission Methods Depending Upon Specific Transmission (One-to-One Connection, and One-to-Many Connections)
ATM Layer		Transmission for ATM Cell (Not Depending upon Specific Service and Information Format)
Physical Layer		Optical Fibers, Coaxial Cables and Information Transmission between Two Physical Facilities

**Table 2: Market Divestiture of Telecommunications Services**

Criterion for Market Divestiture	Divested Markets
Regional Divestiture	Domestic (Area or Prefecture) International
Distance Divestiture	Local Long-Distance International Communications
Service Divestiture	User Access (Public Switched Telephone Network, Private Network and Wireless Services)  Transmitting Services
Vertical Divestiture	Enhanced Services Basic Services Infrastructure

**Table 3: Divestiture of Telecommunications Market: Segment of Multiple Criteria**

**(1) Service and Region**

<div> <div>Service</div> <div>Region</div> </div>		A	B	C	.....	The United States
User Access	Public Network	RM				RM
	Private Network	RC				RC
	Wireless	RC	RC	RC	RC	RC
Transmitting Service		RC				C
Others						

**Note: RM (Regulated Monopoly), RC (Regulated Composition), and C (Competition).**

**(2) Vertical Separation and Distance**

<div> <div>Vertical Separation</div> <div>Distance</div> </div>	Local	Long-Distance	International
Enhanced Service	C		RC
Basic Service	RM	RC	RC
Lines (Infrastructure)			



### (3) Distance and Region

<div>Region</div> <div>Distance</div>	A	B	C	.....	The United States
International	RC				
Long-Distance	RC				
Local	RM				

### (4) Distance and Region (NTT Divestiture Plan in 1990)

<div>Region</div> <div>Distance</div>	A	B	C	.....	The United States
International	RC				
Long-Distance	RC				
Local	RM	RM	RM	RM	RM

**Table 4: Industrial Structure for Future Japanese Telecommunications  
(Upper and Lower divestiture, BISDN/FTTH, Long Term Objective)**

Level	Services	Layer	Market Structure
II	Enhanced Information Services: Broadcasting, Video Program, Education and Medical Service, Data Base Service, Supply and Transmission of Information Environment	Upper Layer 2	Competition
IB	Telecommunications Services: User Access (Telephone, TV-Telephone, Private Connection, VAN), TV Conference, E-Mail, Image Transmission, CATV, LAN/WAN	Upper Layer 1	Competition
		AAL	
IA	ATM Network Services: Cell Transmission/Control	ATM Layer	Public or Regulated Monopoly
0	Telecommunications Facilities Services: Physical Line Services (Information Transmission between Two Points), Transmitting Machine Service	Physical Layer	Competition (User Lines under Regulated Monopoly)

**Table 5: Current Industrial Organization for Japanese Telecommunications**

Level	Services								
II	Program Making				Type II Common Carriers				
		Broad-casting Agents							
IB	Broad-casting Suppliers (Public, Private)		Broad-casting Agents, and CATV Suppliers		NTT			NTT DoCoMo NCC (Wireless)	
IA									KDD and NCC (Transmission, International)
O	Broad-casting Facility and Satellite		Lead-in Cables		Leased Circuit		Transmitting Fiber-Optic Cables		
	Broad-casting Wave (MPT)								
							Wireless Communication Facility		
							Wireless Wave		