平成5年度
帰国研修員フォローアップチーム報告書
―公開技術セミナー―

ディジタル交換技術
通信網計画設計

平成6年1月

国際協力事業団
東京国際研修センター

平成５年度

帰国研修員フォローアップチーム報告書

－公開技術セミナー－

ディジタル交換技術

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序

途上国の技術者に対する研修の実施に携わる者にとって、現地に赴き、帰国した研修員がどのように研修成果を日々の業務に活用しているかを知ることは、より有益で効果的研修プログラムを組む上で必要不可欠なことである。

上述の考えに基づき、従来フォローアップ調査は、特定集団研修の帰国研修員のみをその対象としてきたが、昭和61年度からは、公開で技術セミナーを開催し、帰国研修員に対する調査と併せて、関連分野の関係者に対して、必要と思われる技術情報を提供することにより、より大きな成果を上げてきている。

電気通信は国家基盤の重要な構成要素であり、この分野で世界でもトップレベルの技術を持つわが国に対する途上国の期待は大きいものがある。その気概の片鱗はこの報告書からも伺うことができる。

今回の調査団はケニアとタンザニアの２ヵ国で、技術開発の最新動向をテーマにセミナーを実施した。その中心項目であるISDNは21世紀の通信の基盤と目される最新技術であり、途上国の通信技術者の関心は並々ならぬものがある。

この報告書が、将来において研修プログラムを組む際の一指針となり、研修の質向上に役立つならばこれ以上の喜びはない。

今回の公開技術セミナー開催に当たっては、外務省、郵政省、日本電信電話株式会社、在外公館、JICA帰国研修員同窓会ならびに各国関係機関それぞれの専門家、担当者から惜しみないご協力を頂いた。末筆ながら関係各位に心から御礼申し上げる。

平成６年１月

国際協力事業団
東京国際研修センター
所長　田口　定則

目　　次

平成５年度

ディジタル交換技術・通信網計画設計コース帰国研修員フォローアップ調査団

1. 派遣目的

ディジタル交換技術、及び通信網計画設計コース帰国研修員の帰国後の業務における日本での技術研修の有効性を調査し、同コースの今後の計画・運営の参考にすると共に、ケニア及びタンザニアにおける電気通信分野の現況、さらには当該分野における人材育成の状況を確認する。同時に帰国研修員及び関係機関技術者への最新技術情報提供の機会として、「電気通信分野における最新の技術開発動向」というタイトルで公開セミナーを実施する。

2. 派遣期間

1993年11月20日～1993年12月7日（18日間）

3. セミナー開催地

ナイロビ（ケニア）、ダルエスサラーム（タンザニア）

4. 団員構成

	（氏名）	（担当分野）	（所属先）
(1)	山崎秀人	団長・総括	郵政省電気通信局電気通信技術システム課 設備係長
(2)	増田正樹	技術指導	ＮＴＴ中央研修センタ ネットワーク研修部門　担当課長
(3)	穂積武寛	業務調整	東京国際研修センター　研修第１課

5. 調査日程

11/20　東京発

11/21　ナイロビ到着

11/22　ＪＩＣＡ事務所訪問　打ち合せ
大統領府人事局表敬訪問
在ケニア日本大使館表敬訪問
運輸通信省表敬訪問
ケニア通信技術学園（ＫＣＣＴ）見学
11/23　ケニア郵電公社（ＫＰＴＣ）表敬訪問
同施設見学　ナイロビ局交換機設備
電話交換台
課金センター
ＫＥＮＰＡＣシステム
移動電話交換機
ミリマニ交換局
ＥＸＴＥＬＣＯＭ　ＨＯＵＳＥ
国際交換機
同網計画部訪問
11/24　公開技術セミナー　第１日
11/25　公開技術セミナー　第２日
ＫＰＴＣ総裁表敬訪問
11/26　ＪＩＣＡ事務所報告
ニエリ交換局訪問・施設見学
11/27　移動、資料整理
11/28　ナイロビ発
ダルエスサラーム着
11/29　ＪＩＣＡ事務所訪問　打ち合せ
在タンザニア日本大使館表敬訪問
タンザニア郵電公社（ＴＰＴＣ）表敬訪問
11/30　同施設見学
ＴＰＴＣスタッフカレッジ見学
12/1　公開技術セミナー　第１日
12/2　公開技術セミナー　第２日
12/3　ＪＩＣＡ事務所報告
日本大使館報告
12/4　資料整理
12/5　ダルエスサラーム出発
12/7　東京着

6. 主要面談者

6-1. ケニア

(1) 大統領府人事局

Mr. James O.Ndisi	Senior Assistant Director Manpower Development Division

(2) 運輸通信省

Mr. Matui	Deputy Secretary

(3) ケニア通信技術学園（ＫＣＣＴ）

Mr. N.B. Muriuki	Deputy Director, Academic Affairs
Mr. Patrick Omutia	Deputy Director, Finance &Administration

(4) ケニア郵電公社（ＫＰＴＣ）

Mr. S.K. Chemai	Managing Director
Mr. Omondi	General Manager, Telecommunications Services
Mrs. Maluki	General Manager, Postal Services
Mr. Omukuba	General Manager, Project & Engineering
Mr. J.A. Bett	Manager, Maintenance International
Mr. Mbogoh	Senior Assistant Manager/ Personal Assistant to General Manager, Telecommunications Services
Mr. Musyoki	Senior Assistant Manager, Nairobi Central
Mr. J.M. Mwaniki	Telecommunications Manager, KPTC Nyeri

(5) ケニアＪＩＣＡ帰国研修員同窓会（ＪＥＰＡＫ）

Mr. L.N. Kihuria	Chairman

(6) 在ケニア日本国大使館

阪井　清志	一等書記官

(7) ＪＩＣＡ関係者

杉本　勉	個別専門家（電気通信技術）
長島　俊一	ＪＩＣＡケニア事務所長
高木　美早	同所員

(8) 公開技術セミナー

参加者 計５４名

6-2. タンザニア

(1) タンザニア郵電公社（ＴＰＴＣ）

Mr. S.B.J. Ngalambe	Acting Deputy Director General for Telecommunications
Mr. M.S. Mazana	Principal Telecommunications Controller
Dr. J.S. Kilongora	Principal Executive Engineer International Telephone Switching Centre
Mr. Mponzi	Assistant Engineer, GX Central Section
Mr. G. Manongi	Assistant Engineer, C400 Section
Mr. Machoke	Assistant Engineer, SXS Section

(2) ＴＰＴＣスタッフカレッジ

Mr. E.A. Mallango	Principal
Mr. I.S. Lusama	Principal Instructor

(3) 在タンザニア日本国大使館

花谷　卓治	参事官
勝見　隆	二等書記官

(4) ＪＩＣＡ関係者

平川　潔	ＪＩＣＡタンザニア事務所長
平山　剛道	同所員

(5) 公開技術セミナー

参加者 計５７名

7. 公開技術セミナー

現地においては下記の内容でそれぞれ２日間の公開技術セミナーを開催した。

(1) JICA研修事業紹介　　穂積団員

(2) 日本の電気通信政策　　山崎団長

a. 電気通信事業の歴史

b. 通信網拡充への取組

c. 現在の電気通信サービス

d. 将来の展望

(3) 電気通新技術の最新動向　　増田団員

a. 技術開発

a-1. 技術開発の目的

a-2. 技術開発に対する姿勢の変遷

a-3. VI&Pコンセプト

a-4. VI&Pコンセプトを支える技術

a-5. 新サービス開発／サービスの進化

a-6. 業務の効率化

a-7. オペレーション・システム

b. ISDNの概要

b-1. ISDNに対するNTTの取組

b-2. 日本のISDN市場

b-3. NTTのISDNサービス運営

8. 調査団所見

今回の調査に係る各国の電気通信の現状に関する所見は次の通り。

8-1. ケニア

8-1-1. ネットワーク計画について

ネットワークを構成する施設については各国の設備が導入されており、統一性が見られない。将来の需要を十分勘案して設備の整備をしているのか不明である。国内のネットワークを整備するには、少なくとも同一サービスのネットワークについては統一性のとれた施設を整備すべきである。

その際には電気通信ネットワークは規模の有効性が特に働く分野であるから、その構築にあたっては、将来の需要を十分検討に入れる他に、政策的観点から、ナイロビだけではなく、他の主要な地方都市についても積極的に整備し、都市間の利用効率を高めることも考える必要があるのではないか。

ネットワーク構築の効率的な計画策定については、定期的な実行結果のフィードバックなどにより、修正を図ることを徹底すべきである。

現時点においてケニアにとっては、先端的なサービスを小規模で導入するよりも、ディジタル技術による公衆電話網の拡充を図る方が職員のスキル向上の点からも有効ではないか。

8-1-2. 設備管理について

ネットワーク全体のトラヒック管理が不十分ではないかと思われる。メーカーの異なる多機種の設備を効率的に運用するためには、総合的なトラヒック管理が必要であると考える。

8-1-3. 保守運営体制について

組織構成が縦割りになりすぎ、横断的な調整機能が不十分ではないかと思われる。効率的な組織運営を促進するためには、例えば設備タスクフォースとして一本化することも有効であると考える。

8-1-4. 人材育成について

技術者の育成が設備毎に専担化しているように思われる。今後、多機種の設備を効率的に維持・運営するためには、設備導入計画に基づいた技術者の計画的な育成が必要であると考えられる。

また、ケニア通信技術学園は、電気通信分野の基礎的な技術研修施設としては、東アフリカ有数とも言える設備を備えており、宿泊設備も含めその規模は拡大しつつある。今後は専門家派遣や機材供与により同学園の拡充を引続きサポートすると共に、当該分野における第２、３国研修の実施機関としてこれまで以上の積極的な活用が望まれる。

8-2. タンザニア

8-2-1. ネットワーク計画について

施設の整備について将来の需要を十分勘案しているのか不明である。より現実的な中期的及び長期的な整備計画を立てることが急務である。その際には電気通信ネットワークはスケールメリットが特に働く分野であるから、その構築にあたっては、将来の需要を十分検討に入れる他に、政策的観点から、ダルエスサラームだけではなく、アルーシャ、ドドマ、モシ、ザンジバル等主要な地方都市についても積極的に整備し、都市間の利用効率を高めることも考える必要があるのではないか。他方、積滞解消については利用効率を高めるような利用形態を考えるべきである。参考例としては、１本の加入者線路を複数の

加入者が共同で使用する方式（共同電話）等も有効と思われる。

ネットワークを構成する施設については各国の設備が導入されており、統一性が見られない。また、国内のネットワークを整備するには、少なくとも同一サービスのネットワークについては統一性のとれた施設を整備すべきである。

ネットワーク構築の効率的な計画策定については、定期的な実行結果のフィードバックなどにより、修正を図ることを徹底すべきである。

現時点においてタンザニアにとっては、先端的なサービスを小規模で導入するよりも、ディジタル技術による公衆電話網の拡充を図る方が職員のスキル向上の点からも有効ではないか。

8-2-2. 設備管理について

クロスバ交換機共通機器の輻輳状態への対応など、ネットワーク全体のトラヒック管理が不十分ではないかと思われる。メーカーの異なる多機種の設備を効率的に運用するためには、総合的なトラヒック管理が必要であると考える。

8-2-3. 保守運営体制について

保守技術者が違う機種毎に配置されており、交換ユニット間の調整が不十分ではないかと思われる。総合的なネットワーク管理を行うためには、例えば設備タスクフォースとして一本化することも有効であると考える。

8-2-4. 人材育成について

技術者の育成が設備毎に専担化しているように思われる。今後、多機種の設備を効率的に維持・運営するためには、設備導入計画に基づいた技術者の計画的な育成が必要であると考えられる。なお、将来における設備の拡充において、複数の機種の導入が考えられる場合は、効率的な保守を行うために技術者の二層化（専門技術者及び複合技術者）が有効であると考える。

9. 質問書集計結果及び解説

最初の訪問国ケニアの首都ナイロビにて開催した公開セミナーには２日間計で５４名が参加し、うち４６名が質問書に回答した（うち帰国研修員２１名）。２番目の訪問国タンザニアの首都ダルエスサラームでは２日間計で５３名が参加、全員が回答した（うち帰国研修員１９名）。

質問書の質問１～５までは本人の氏名、年齢、居住地、所属機関及び現職を聞くものなのでここでは割愛する。

パート１：　セミナー参加者全員対象
質問６　今回のセミナーは職務上有益であるか。その理由。

〔ケニア〕	ＹＥＳ　４４	ＮＯ　０	無回答　２
〔タンザニア〕	ＹＥＳ　５２	ＮＯ　０	無回答　１

理由としては両国の参加者とも「新しい技術の知識を得たことは励みになった。」「将来の技術動向がわかって良かった。」など、純粋にふだん得難い情報を得たことを喜ぶコメントが大多数であった。しかし両国とも国内網のディジタル化を積極的に推進していることもあり、セミナーの内容はすぐに日常の業務に適用できるような類のものではなかったにせよ、自分達の将来進むべき道が示された、と感じた人が多かったようだ。

両国において数名からは「ＮＴＴの民営化の話が聞けてよかった。」というコメントがあったが、これも両方の国で郵便事業と通信事業の分割、将来的には通信事業の民営化が議論されていることを反映している。その意味では「ＮＴＴのサービスに対する取り組みの話が参考になった。」というコメントは、彼らの間に通信事業は本来営利事業であるという意識が強まりつつあることの証ではないだろうか。

ケニアのある参加者からは、「質疑応答でＮＴＴがこれまでどのような問題にどういうふうに取り組んできたかが聞けて良かった。」というコメントがあった。事実セミナー最後の質疑応答の際に参加者側からでた質問は、セミナーの内容に関するものというよりは、回線の不正使用や積滞、不正確な課金制度など、自分達が日常抱えている問題の解決のためのアドバイスを求めるものが目だった。相手国のこういった実情を鑑みれば、通信網の整備における日本の過去の経験などをセミナーの題材にしても非常に有効なフォローアップになるのではないかと考えさせられた。

質問７通信分野における主要な技術的問題は何か。

〔ケニア〕

（回答人数）

・必要な技術研修が受けられない、技術研修の施設が貧弱、業務管理、運営に関する研修がない、技術指導者養成研修の不備	１８
・設備の保守管理、必要な部品の調達、工具・計測機器の不備	１６
・経験豊富な技術者が不足している	8
・資金不足	8
・通信線路が貧弱	7
・新型機器導入の遅れ	7
・技術の進歩が早すぎ、導入した設備がすぐ旧式になる	7
・国内（電話）網の整備拡張の遅れ	4
・輻輳	4
・網計画・運営管理の不備	4
・新旧設備の混在	4
・課金にミスが多い	3
・回線数が足りない	3
・異なるメーカーの機種が混在している	2
・料金が一般市民には高い	2
・回線の不正使用	2
・積滞	2
・研究開発のための施設がない	2
・設備のマニュアル類の不足	2

〔タンザニア〕

（回答人数）

・国内通信線路網が旧式で品質が非常に悪い。	２２
・設備の保守管理、必要な部品の調達、工具・計測機器の不備	２１
・設備の老朽化	１２
・新旧設備の混在	8
・必要な技術研修が充分に受けられない	8
・経験豊富な技術者の不足	7
・資金不足	6
・積滞	5

・輻輳	5
・回線の容量不足	5
・技術の進歩が早すぎ、導入した設備がすぐ旧式になる	5
・異なるメーカーの機種が混在している	4
・網の運営管理がまずい	3
・課金にミスが多い	2
・電力供給が不安定	2
・網計画が充分でない	1

この設問に対する回答は途上国においてよく見られる電気通信の課題が両国においても顕在であることを示している。すなわち、

・人材不足、および人材育成のための施設の不備

・資金不足

・国内通信網の老朽化、低信頼性

・新旧通信設備の混在

このうち、人材育成に関してケニアにおいてはケニア通新技術学園（KCCT）が国内だけではなく東アフリカ随一の規模と施設を持ち、現在各国の援助を得つつ、その規模拡大、訓練機械の新型化が進められている。これがうまく機能すればケニアおよび東アフリカ地域における人材育成の問題は相当緩和されるものと思われる。

タンザニアにおいてはTPTCスタッフカレッジがその中心的人材育成機関であるが、規模が小さく、特に高度な技術者養成に関しては外国の研修機関に頼らざるを得ないのが現状のようである。

こういった施設面の不備のほか、両国における理数科教育の遅れも慢性的な技術者不足に大きく影響していると思われる。これは技術者の母集団ともいうべき大学の理系、特に工学系の学位修得者が少ないというところに問題がある。したがって、これもまた途上国の電気通信技術者の経歴においてしばしば見られることだが、高卒でとりあえず見習いのような形で通信会社に入社し、その後実戦で基礎技術を体得するかたわら会社から資金援助を受けて大学などの高等教育を受けるというようなことが、ケニア、タンザニアの場合にも多いものと思われる。これはもちろん人材育成の方法としては非効率的だし時間と金もかかる。両国における教育制度全体の改善が進むことを期待するほかはない。

通信設備に関する問題点について、その大きな背景要素となっているのが、電気通信技術の進歩のスピードである。それはまさに日進月歩であり、来るべき高度情報社会における主導権を握るべく日米欧のメーカーが研究開発競争にしのぎを削っている。そして各メーカーがさまざまな形で途上国に売り込み合戦を仕掛け、財源的余裕がなく、長期的設備導入計画を持たない途上国においてはさまざまなメーカーの機械が混在することにな

る。しかもせっかく導入した設備もめまぐるしい技術進歩のなかでは１０年たたないうちに完全に旧式化してしまう。しかし全く動かないわけではないから、旧型の機械をいつまでも使い続けることになる。

こうしてでき上がる複数メーカー、新旧モデルの混在という設備の図式がケニア・タンザニア両国においても存在し、それはそのまま国内通信網の信頼性の低さ（旧型の設備は故障が多い）、保守管理の難しさ（異なったメーカー間でインターフェースがとりにくい）、人材育成の難しさ(それぞれのメーカーに特化した形でしか人材が育成できない)というような課題を生み出している。

いま一つ財政的困難に関しては、ケニア、タンザニア双方において郵便事業と合体したこれまでの組織編成を見直し、電気通信事業を切り離して独立採算の公社として再スタートさせるための準備が進められている。これの背景にあるのがIMFや世界銀行などからの構造調整の圧力や、世界的な通信事業の民営化の波などである。両国の関係者の口から民営化という言葉がよく聞かれるが、彼等のイメージする民営化とはとりあえず通信事業を独立採算性にしようとすることで、先進国において進められてきた通信の自由化・民営化とはその性質が異なる。

どちらの国においても郵便事業は赤字であり、電気通信事業の利益を食いつぶしていたため、この２つの事業が分離されればこれまで以上に設備投資がしやすくなると、両国の通信関係者は期待をかけている。

質問８　そのような課題を解決するために日本はどのような援助ができるか。
（選択肢：　日本での研修、専門家派遣、機材調達、その他）

	(ケニア回答数)	(タンザニア回答数)
・日本での研修	４２	５１
・専門家派遣	２２	２０
・機材調達	３９	３８
・その他	７	７

(複数回答)

ケニア・タンザニア双方においてより多くの研修の機会を望む声は圧倒的であった。その理由として、日本の方がより研修機材、教材、インストラクターが整っているという意見が多勢を占めた。研修内容としてはやはりディジタル交換機の保守管理、ディジタル伝送技術、ＩＳＤＮなど通信技術の先端分野が多かった。今回のセミナーにおいて触れた

内容は最新通信技術の大まかな概要の域を出たものではなかったが、それでも本セミナーが好評であったように、両国の技術者の間には最新技術情報に対する強い渇望があり、それが本邦研修を望む大多数の意見に反映されている。

また日本での研修と専門家派遣は組み合わされるべきであるという意見も複数あり、その具体的形態として、技術者の短期交換プログラムを提案したものもあった。これは総括においても述べるとおり、国別人材育成計画を整備することで研修員受け入れと専門家派遣を計画的に組み合わせようとする国際協力事業団の方向性を後押しするものである。

少数ながら個々の技術専門家の派遣のほかに網計画の専門家や事業の運営管理の専門家を派遣してほしいという意見もあり、近い将来に迫った独立、民営化を視野にいれ、通信運営体としてのマネジメント力強化の必要性を感じていることも見てとれた。

機材面に関しては現存している旧態然としたアナログ機器をディジタル化したいという願望が強く出て、ディジタル交換機およびディジタル伝送路といったネットワークの大きなレベルでのグレードアップの支援を要望する意見がほとんどであった。

パート２：帰国研修員対象

質問９　研修形態と参加コース（個別の場合は研修テーマ）名　　（複数回答）

（ケニア）	集団　２１	個別　１
（タンザニア）	集団　１７	個別　２

なお、参加した研修コースには本調査団対象以外の電気通信分野の集団研修もある。

質問１０は本邦研修に参加した年を聞くものなのでここでは割愛する。

質問１１　参加時の所属機関および職位

ケニア・タンザニア両国とも参加時と現在で所属機関を変えた研修員はいなかった。ただし、通信の現場と人材育成機関との間での人事は数例見られる。

質問１２　日本から帰国して以後に勤めた部署

これも専門分野を大きくはずれて移動したようなものはいない。もともとの人材不足もあってか、一つの分野での定着性は高い。

質問１３　日本での研修は業務において有効であったか。

回答全てが肯定的なものであった。

質問１４　どういう場面において日本での研修の成果を利用しているか。

交換機、伝送路などの保守管理、通信網拡充の際の網計画立案、機材導入計画の立案、などの技術面での応用と、職員研修の教材開発、職員研修のカリキュラム作成など人材育成の面で応用する２つの回答パターンが見られた。後者のような回答を得られたことは、技術移転という視点から見て非常に評価できるものであるといえる。

質問１５　JICAフォローアップに対する要望

以下のようなコメントが得られた。

・今回のようなセミナーをより頻繁に開催してほしい。
・現地で研修コースを開催してほしい。
・最新の技術動向に関する書籍、雑誌などを供与してほしい。
・最新の技術動向について定期的にニューズレターなどで知らせてほしい。
・メーカーの通信機器開発の状況を知らせてほしい。
・メーカーの動向や最新の技術情報が得られる場所を作ってほしい。
・専門家を短期でフォローアップで職場に派遣してほしい。
・電気通信分野は技術革新が激しいので、フォローアップはより頻繁に実施されるべきである。

以上、最新の技術動向や関連情報に対する要望が圧倒的に多い。メーカーの情報を求めるというのもその一つの現われである。これについては確かにJICAの現在の研修事業制度では研修員の帰国後に技術情報を送るというシステムはないし、現実にその様な制度を整備することはかなり困難であると思われる。

フォローアップの頻度に対する要望も、現行のフォローアップチーム派遣スキームでは限界にあるといわざるを得ない。

10. 施設見学

10-1. ケニア

No	見学局所等	設備区分等	設備状況及び所見等
1	ナイロビ局	交換機	①市外：GTD-5C（1991;ｲﾀﾘｱ;5,000/10,800端子 ;保:5人） ②市内ﾀﾝﾃﾞﾑ，市内 ：GTD-5C（1990;ｲﾀﾘｱ ;19,000/21,000端子 ;保10人/ 宿 2人）
		移動電話交換機	①ﾓｰﾋﾞﾙ ：（1992; NEC ; /2,000回線 ﾅｲﾛﾋﾞ1,200 ﾓﾝﾊﾞｻ400 ｷｽﾞﾑ80 ﾅｸﾙ80等）
		手動交換台	①手動台： ？（1940;ｲｷﾞﾘｽ ; 60台？; 要員 300人 600呼／日人，取扱時間：平均 3分） ②電子手動台：UT-20（1993予定; ｲｷﾞﾘｽ? 研修実施後ｻｰﾋﾞｽ開始予定） ③ﾎﾟｹｯﾄﾍﾞﾙの手動呼び出し（1993）
		KENPAC ｼｽﾃﾑ	①ﾊﾟｹｯﾄ ｽｲｯﾁﾝｸﾞ ｼｽﾃﾑ： Telenet（1991; USA; 260/1,200回線; 保14人 遠隔収容含む：ﾓﾝﾊﾞｻ，ﾅｸﾙ、ﾆｴﾘ，ｷｽﾞﾑ）
		課金センタ	①ｺﾝﾋﾟｰﾀｰ&ﾊﾞｯﾁ処理（投入は手作業がメイン）： ICL（1966 ｲｷﾞﾘｽ;32台; 要員 250人／宿 4人 30万加入を処理可能，誤請求等ミス多）
2	ミリマニ交換局 （ ﾅｲﾛﾋﾞ ｴﾘｱ ）	交換機	①市外：NEAX-61（1990; 日電; 3,500/10,000端子 ;ｺﾝﾃﾅｰﾀｲﾌﾟ 屋外設置） ②市内：C400 （1981; 日立; 5,400/10,000端子） 保 5人
3	EXTELECOM HOUSE	国際交換機	①交換：AXE-10（1984 ：ｴﾘｸｿﾝﾎｽｳｪｰﾃﾞﾝ ; 3,000端子） ②交換：FX800 <XB>（1970 :FUJITSU ; 1,000端子） ③衛星：ﾅｲﾛﾋﾞ郊外 標準 Aﾀｲﾌﾟ2ｼｽﾃﾑ運用中/1ｼｽﾃﾑ工事中 保 交換14人，伝送10人
4	ニエリ交換局 （ ﾙｰﾗﾙ ｴﾘｱ ）	交換機	①市外 ：C5 （1986;日立 ; 760/ 2,000 端子） ②市外・市内：GTD-5C（1993;ｲﾀﾘｱ; ｻｰﾋﾞｽ 開始予定） ③市内 ：C400 （1983;日立 ; / 端子）
		手動交換台	①手動台 ：旧式（1983: 日本; 16台 ; 要員 人） ②電子手動台：UT-20（1993予定; ｲｷﾞﾘｽ? 研修実施後ｻｰﾋﾞｽ開始予定）
		KENPAC ｼｽﾃﾑ	①ﾊﾟｹｯﾄ ｽｲｯﾁﾝｸﾞ ｼｽﾃﾑ： Telenet 1992; USA; 保守はﾅｲﾛﾋﾞからの遠隔
5	ケニア通信技術学園 （ＫＣＣＴ）	研修設備	①設立：1948 東ｱﾌﾘｶ3ｶ国の訓練校として設立 1967 各国が個別に訓練校を設置 1991 KCCTを設置 ②組織＆研修内容： 4部門 ﾃﾚｺﾑ ｴﾝｼﾞﾆｱﾘﾝｸﾞ 75人 ﾃﾚｺﾑ ｵﾍﾟﾚｰｼｮﾝ 30人 ﾎｽﾃﾙ ｱﾄﾞﾐﾆｽﾄﾚｰｼｮﾝ 10人 ﾋﾞｼﾞﾈｽ ｱﾄﾞﾐﾆｽﾄﾚｰｼｮﾝ 20人 交換機 20人 電 力 4人 伝 送 10人 無 線 10人 線 路 18人 端 末 10人 ｲﾝｽﾄﾗｸﾀ:その他含め約 200人 （職員数：約 640人） ③研修生数： 5,000人／年間（ｱﾌﾘｶ諸国含む） ④研修施設：現在拡張中 （現宿泊設備： 180名？） ⑤その他 第三国研修希望(ﾃｨｼﾞﾀﾙ ﾏｲｸﾛ:1991等過去実施 JICA研修は上級を NEAX導入希望 C23 実施中）

10-2. タンザニア

No	見学局所等	設備区分等	設備状況及び所見等
1	ダルエスサラーム	交換機	①市内ﾀﾝﾃﾞﾑ：GX5000(1993;XMITEL-ｶﾅﾀﾞ 1,200/1,500端子) ②市内：　GX5000(1993;XMITEL-ｶﾅﾀﾞ;1,200/1,500端子) NEAX (19 ;NEC ;) C400 (1979;日立 ; 8,000/10,000 端子) C23 (19 ;日立 ;) SXS (1973;BT-ｲﾝﾄﾞ-ｲｷﾞﾘｽ;〃/10,000 端子)
		国際交換機	①交換：SYSTEM12 (1991;ｱﾙｶﾃﾙ- ; 800/2,000端子) :FX800 <XB> (1977 ;FUJITSU ; 休止中→転用) ②衛星： (1991 ;インド・大西洋各 1) 保 11人（地球局は除く） ③伝送：TELLETRA (1991 ;) FM6G-10H (19 ;FUJITSU) ④電信：NGA-24AA (1979 ;NEC) :GTE ○問題点 国内の交換設備(XB,SBS)不良のため 入呼不接 電圧変動により地球局に悪影響
2	タンザニア郵電公社 スタッフカレッジ TP&TC Staff (College)	研修設備	①設立：1967？ タンザニアも独自に訓練校を設立 ②組織＆研修内容： インストラクタ数：約60人 （職員数：約 180人） └→内通信関係約40人 研修内容：長期コース→1年間 (ﾃﾚｺﾑ ｺﾝﾄﾛｰﾗ を育成，隔年10～12人 └→ﾄﾗﾋｯｸ，ｾｰﾙｽ，ｵﾍﾟﾚｰｼｮﾝ) 短期コース→1W～6M ├ ディジタル交換機 ├ 伝送 ├ 無線 ├ 線路 ├ コンピュータ └ セールス・マーケティング ③研修生数： ④研修施設：40ｴｰｶｰ(19ha) 約 240人収容可能 ：ｱﾙｶﾃﾙ，GX 研修設備有 NEAX 研修設備無→商用前にさわる ⑤職員の採用：大卒は通信有資格者をﾘｸﾙｰﾄ 育成 1年間 通信未経験者 …… 育成 2年間 ⑥その他 第三国研修実施中（BT，ｶﾅﾀﾞ）

資　料

SEMINAR ON DIGITAL SWITCHING ENGINEERING AND TELECOMUNICATIONS NETWORK PLANNING AND DESIGNING

PROGRAMME:

DATE: 24th (Wednesday) and 25th (Thursday) November 1993

VENUE: Hotel Inter Continental, Turkana Room

24th (WEDNESDAY)

09.00 - 09.30	Registration
09.30 - 10.00	Opening Remarks by:
	Team Leader Representative from JICA Kenya, Office Representative from Kenya Side
10.00 - 11.00	Introduction of JICA's Training Programme
11.00 - 11.15	TEA BREAK

...../2

11.15 - 12.30	OUTLINE OF JAPAN'S TELECOMMUNICATIONS SERVICES
	1) History of Telecommunuications Business
	2) Work on Telecommunications Plant Expansion
	3) Current state of Telecommunications Service
	4) NTT's Service Vision Towards the 21st Century
	Question & Answer Session
12.30	LUNCHEON - Hosted by JEPAK
14.00 - 15.00	TECHNOLOGY DEVELOPMENT
	1) Objectives of Technology Development
	2) Change in Attitude Towards Technical Development
15.00 - 15.15	TEA BREAK
15.15 - 16.00	3) VI & P Concept
	4) Technology to Support the VI & P Concept
	Question and Answer Session

...../3

25th (THURSDAY)

TECHNOLOGY DEVELOPMENT (Cont.)

09.00 - 10.30	5) New Service Development/Service Advancement
	6) Making Work More Efficient/Rational
	7) Operation Systems
	Question and Answer Session
10.30 - 10.45	TEA BREAK
10.45 - 13.15	OUTLINE OF ISDN
	1) Work on ISDN Service in NTT
	2) ISDN Market in Japan
	3) Operation of ISDN Service in NTT
	Question & Answer Session
13.30	LUNCHEON Hosted by Team Leader

Dar es Salaam, December 1, 1993

TANZANIA POSTS AND TELECOMMUNICATIONS CORPORATION

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Welcome to the "Seminar on the Latest Development in Telecommunications Technology", organized as the follow-up activity for the group training courses in DIGITAL SWITCHING ENGINEERING and TELECOMMUNICATIONS NETWORK PLANNING AND DESIGNING.

Date: December 1,2

Time: 9:30 a.m.~5 p.m.

Place: British Council

Lecturers: (Member of follow-up team)

Mr.Hidehito Yamasaki/The team leader
Assistant Director
Telecommunications Systems Division,Telecommunications Bureau
Ministry of Posts & Telecommunications(MPT),Government of Japan

Mr.Masaki Masuda
Manager
Telecommunications Network Department,Central Training Institute
Nippon Telegraph and Telephone Corporation (NTT)

Mr.Takehiro Hozumi
Training Officer
First Training Division, Tokyo International Centre
Japan International Cooperation Agency(JICA)

- FOLLOW UP SEMINAR SCHEDULE -

1st December.

*

09:30～10:00 Registration of Participants

10:00～10:30 Opening Ceremony

- Opening address and welcome speech by the team leader /Mr.Hidehito Yamasaki
- Speech by JICA resident representative /Mr.Kiyoshi Hirakawa
- Speech by TPTC representative /Mr.Ngalambe(The Acting Director General for Telecomms)

(10:30～11:00 Break)

11:00～12:00 Lecture"General guidance of training affairs of JICA"

13:30～14:30 Lecture"The telecommunications buiness and Recent trend of Telecommunications policy in Japan"

14:30～15:30 Lecture"Outline of Japan's telecommunications service"

(15:30～15:45 Break)

15:45～16:45 Q&A

2nd December.

*

09:30～12:00 Lecture "Technology Development - Part I"

(10:30～10:45 Break)

13:30～14:30 Lecture "Technology Development - Part II" (including Outline of ISDN)

14:30～15:30 Q&A

15:30～16:00 Seminar's summery & Closing address by the team leader

16:00～17:30 Reception

GM93-No. 6

TECHNOLOGY DEVELOPMENT

NIPPON TELEGRAPH AND TELEPHONE CORPORATION

JAPAN INTERNATIONAL COOPERATION AGENCY

C O N T E N T S

1. Objectives of Technology Development

Development of technology must contribute to business. Nippon Telegraph and Telephone Corporation (NTT) has been pursuing technology development that fulfills its responsibility as the leading company in its field with two objectives, the first being to ensure the company's competitiveness, and the second to offer the best, most reliable services for the telecommunications that have become such an important part of society's infrastructure.

1.1 Ensuring competitiveness

NTT's business is set in an environment of very severe competition. In order to beat that competition, it must maintain its full competitive power.

(1) Development of new services/integration of services

Due to the liberalization of telecommunication services, competition with the new common carriers (NCCs) that have entered the market is becoming severe. At present, competition is centered on charges for calls but, in the future, it will develop in the services area, as well. Thus, it is necessary to develop new services that make the differences between NTT and the other companies clear in order to promote competition to the best advantage.

The company is developing high-added-value services (advanced telephone services aimed at increasing revenues from dialed-call charges, new services to replace current telephone services, etc.) and expanding its market to increase revenues.

The role that telecommunications service is expected to play is becoming more advanced and more complicated than just that of information transmission medium. Thus, it is necessary to integrate services in order to meet the more sophisticated, more diversified demands of the user.

(2) Improvement of service quality

Telecommunications service is indispensable to modern society, which gives NTT a compelling duty to provide its services. Thus, there is very strong interest in the quality of telecommunications services. NTT can get the confidence and satisfaction from users by an inprovement of service quality.

(3) Making work more efficient/rational

Introduction of the most suitable operating system is indispensable for operating telecommunications services efficiently. In addition, it is important to improve the man/machine interface to reduce the load on maintenance personnel. Introducing the most suitable and advanced operation

system, etc., and making the work more efficient/rational strengthens the management base.

1.2 Responsibilities of a leading company

Since the Nippon Telegraph and Telephone Public Corporation era, NTT has had the responsibility of contributing to the expansion and development of telecommunication services in Japan. Now that the public corporation has become Nippon Telegraph and Telephone Corporation (NTT), its responsibilities are stipulated in the Nippon Telegraph and Telephone Corporation Law. Therefore, NTT has been conducting technology development aimed at offering the best possible service and reliability.

NTT has proposed the concept of Visual, Intelligent and Personal (VI&P) Communication Service to describe what telecommunications should be for the advanced information society of the 21st century. To realize this concept, it will be necessary to open up new services, such as multi-media communication, and improve network technology.

(1) Duties during the age of Nippon Telegraph and Telephone Public Corporation

Nippon Telegraph and Telephone Public Corporation, was established in 1952 to reconstruct the telephone services that had been totally destroyed by World War II, and to fulfill two major responsibilities: establishment of telephone system that provided "telephones that would be available soon after subscription" (elimination of backlogs) and "telephones that could reach any location within in the country" (realization on undelayed calls throughout the country), and to significantly contribute to the expansion and development of telephone service in Japan.

To promote much greater development and integration of telecommunication services, it was decided to introduce the principle of competition into the field of communications. Nippon Telegraph and Telephone Public Corporation was therefore privatize and became Nippon Telegraph and Telephone Corporation (NTT) in 1985.

(2) Duties of Nippon Telegraph and Telephone Corporation (NTT)

NTT's responsibility is to "fairly provide services under proper conditions, and to contribute to ensuring stable service throughout the country", as stipulated in the NTT Acts. Thus, the expectations placed on NTT for telephone services in Japan are huge.

In the 21st century, the world is expected to develop more peacefully, with increased demanding for mutual cooperation and strengthened coexistence. To achieve this, intellectual exchange and active communication will become indispensable as a means of deepening mutual understanding. Telecommunications

must play a large role in this. Thus, NTT must have a clear vision of the future of telecommunications and must endeavor to realize that future.

In accordance with its concept of what telecommunications should be in the advanced information society of the 21st century, NTT has set the year 2005 as the target for offering Visual, Intelligent and Personal (VI&P) Communication service. To realize this VI&P concept, new services must be exploited, and it is NTT's mission to develop and introduce those new services.

2. Change in attitude toward technical development

Until several years ago, NTT's policy for technology development was primary to further develop its telecommunications facilities and expand its telecommunications services. However, as it became necessary to ensure its competitiveness and provide more advanced telecommunications services with high-reliability for the future, NTT has changed its policy toward technology development to one of developing network systems and proposing new services.

(1) From contracted services to proposal of services (Market Creation)

Due to the liberalization of telecommunication services, competition with the NCCs is becoming more aggressive.

However, to keep in line with the original objectives of liberalization, rather than just staying with the competition concerning charges, it is necessary for NTT to propose and introduce the telecommunication services demanded by the integration of society. Thus, NTT has changed its development policy from its current contract orientations, which follows after needs, to one that is based on proposal of new services.

In accordance with this change in technology development policy, high value-added services are being proposed to pursue the capability of convenience in order to contribute to the integration of society. Such services will stimulate and activate the telecommunication service market and will create new markets.

(2) From development of single products as network elements to development centered on network systems

Until now, NTT placed greatest importance on the development of telecommunication facilities, that is on single products for use as elements in a network, that would extend telecommunications service as soon, as quickly, as inexpensively and as efficiently as possible. However, when technology development policy changed to a service proposal orientation, importance shifted to development centered on network systems.

(3) Product Out, Market In

During the period of expansion of telecommunication services, systems were developed with primary interest placed on economy and introduction capability, and mass introduction was utilized extensively. However, in this period of competition, development must be conducted from the viewpoint of marketing based on investigation of market trends.

Video Communication Service

●High-definition/large-screen/multi-screen video

- Video shopping, remote medical monitoring/examinations
- Video data bases (electronic art museum, electronic library, fashion information, etc.)
- High-realism video transmission (full-size video transmission, video of unexplored regions and Polar Regions etc.
- Remote environment monitoring, video bulletinboards, multi-point video conferencing

●3-D video

- 3-D conferences, High-Realism 3-D video transmission, 3-D video transmission
- 3-D video data bases

(2) Intelligent service

Advanced information processing functions will be added to the network to realize translated communication and communication service with a high degree of confidentiality through the use of coding.

It will be possible to offer electronic secretarial services and various ordermade services for business, which the customer able to change service contents freely.

projected use.

(2) "Text mail" service

Text mail is communication by means of characters and still images. It can be sent at any time and stored until the time desired for the designated party to receive it. This is means of communication makes the relation between the sender and the receiver equal.

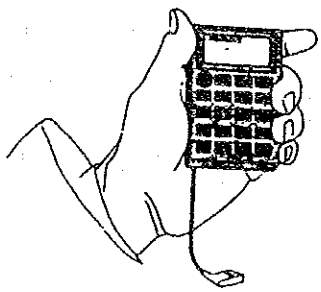
Interconnection among multiple personal computer communication networks to enable communication with personal computers in any network. This will be a major service in the ISDN age.

(3) "Visual telephone" service

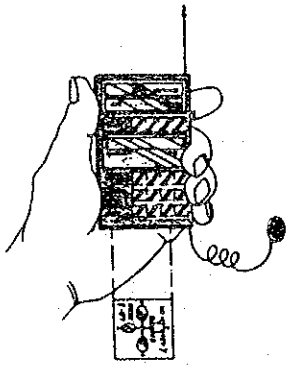
The visual telephone is rising as a new means of communication of one-to-one video images, It gives an increased feeling of presence, and is capable of transferring visual information, such as the surroundings and pictures taken previously, in addition to the faces of the communicating parties, after editing by the sending party.

It will provide the same quality as conventional TV and is expected to be a major service for high-speed/wide-band ISDN.

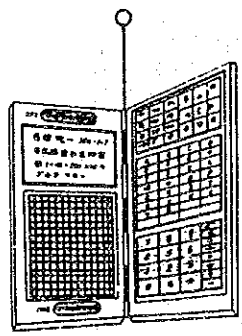
Folding Type



Card Type



Built-in Record and
Replay Function Type



Built-in Electronic Notebook Type

Figure. 3.1 Examples of Pocket Telephones

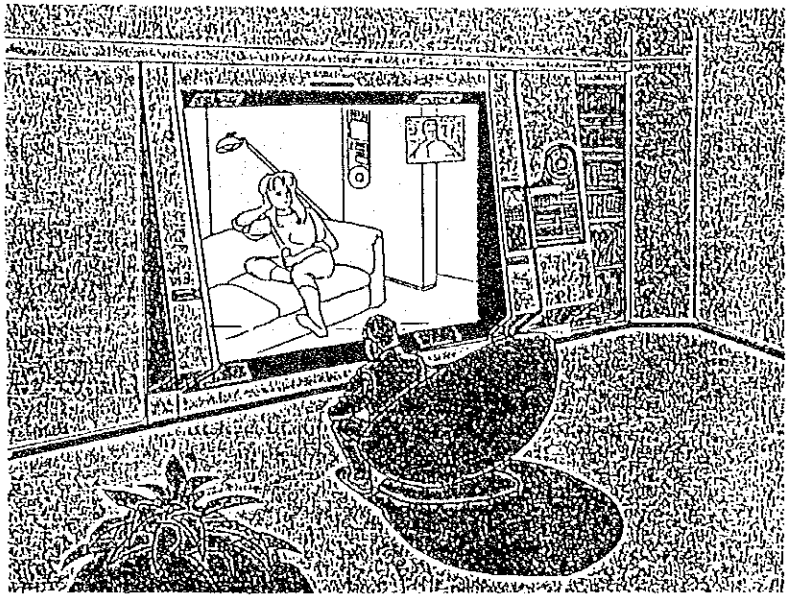


Figure 3.2 Visual Telephone (Wall Type)

3.2 Advanced communication services

Advanced communication services will be a further development of the basic communication services. It is expected they will be created to be more applicable during competition over a broad range, and spread by competition among the telecommunications carriers. Thus, they will develop and be introduced focused on the following services as forerunners.

(1) Video communication service

Various services are being considered for utilization of advanced video processing technology. They will provide high-definition video communication that can display natural expressions, and clear characters and graphics. Such communication will include full-size screens, multi-screen video that allows free selection of desired screens, and three-dimensional video that give a full feeling of presence.

Video communication services will be useful in creating a comfortable living environment that produces an abundance of leisure and hobbies, not just a means of communication for business.

3. VI&P Concept

VI&P refers to "Visual, Intelligent and Personal" communication service. It utilizes ISDN (integrated service digital network), which provides higher-speed, wider bandwidth and greater intelligence, for easy selection of desired services from an abundance of services available at any location.

VI&P will provide basic communication services, such as telephone, text mail and video telephone services fairly throughout the country, just as conventional telephone service is now provided, as well as developing and/or introducing advanced communication services, such as a variety of video communications, intelligent services and personal services.

Meaning of VI&P

- "Visual" service: Primarily video images
- "Intelligent" service: Able to find the called party wherever that party can make connection, and able to provide an abundance of information.
- "Personal" service: Responding to each individual's interests
- "More Abundant" service: Various media centered on video images, a variety of terminal equipment, plentiful information, charge that make such services easy to use.
- "Easily accessible from any location": Use of individual numbers and portable equipment to make communication easy at any location, and use of artificial intelligence to enable easy operation.
- "Select as desired": Selection of the desired contents, time, zones and quality of services.

3.1 Basic communication service

VI&P will place "Telephone", "Text mail" and "Visual telephone" as basic communication service. These are conversation type services for one-to-one communication, and it is planned that they will be offered fairly throughout the country.

(1) "Telephone" service

The telephone will continue to play an important role as a fundamental means of voice communication. Especially, the portable/pocket telephone which are

Intelligent Service

●Translation languages

- Translation text communication, translation telephone

●Intellectual support

- Highly confidential communication, voice recognition dialing, time-designated communication
- Communication for the handicapped (recognition/conversion of characters, voice, sign language, lip reading, braille)
- Electronic secretary (answering information storage, retrieval support, schedule management, etc.)
- Retrieval (fuzzy retrieval, natural language retrieval), electronic information retrieval
- Voice/text bulletin boards, Shared-Uses trategic information system

●Flexible network

- Customized service with designated service contents
- Variable private networks

(3) Personal services

Personal services will include "automatic person-to-person calls" based on numbers (multiple) assigned to individual persons and uses by application (business, home, community) to enable communication with another party wherever that party is, "confidential calls" that only the designated person can receive and "selective calls" that can prevent reception of unwanted phone calls, etc., as well as personal charging data.

Memory/information processing functions contained in IC card that include information on the individual person will be used and will be the basis for payment of charges.

Personal Services

- Improved convenience for calling and called user
  - Caller-ID Display, Name-Designated Calls, Automatic Person-to-Person Communication
  - Call Blocking (Receive Designated Calls Only: Others to Answering Machine)
  - Personal ID Number (Remain Unchanged Regardless of Location in Japan)
- Privacy Protection
  - Telephone Service
- Flexible Charging
  - Charging Selection (Designate Charged-Party for Each Call), Itemized Billing Statement
- IC Cards Usage
  - Electric Ticketing, Charge Settlement

3.3 Networks in the VI&P age

The network that supports VI&P will be high-speed/broadband ISDN To integrate the handling of voice, text and video signals, all homes must be connected by optical fiber (FTTH: Fiber To The Home), as well as long-distance systems for high-speed digital communication. This will start in 1995, with digitalization of the network to be completed by then, and will have a target for completion of 20 years, which is the year 2015.

In addition, to provide such advanced communication services as personal services and intelligent services, advanced information processing functions must be added to the network to make it an intelligent network. At the same time, the functions and connection requirements for the network will be standardized in succession to make interconnection by multiple business operators easier.

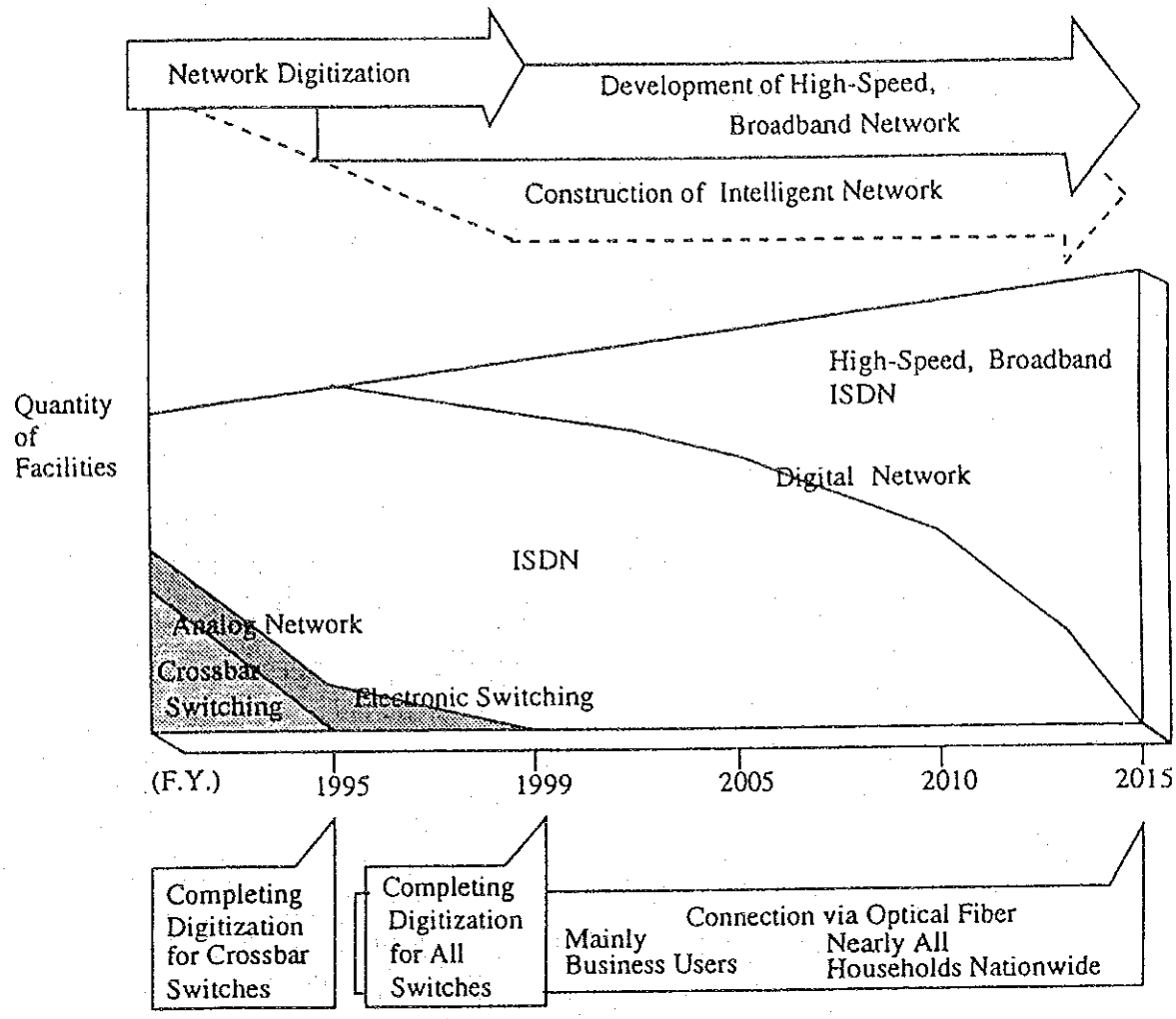


Figure 3.3 Network Development: Digitized, High-speed, Broadband

4. Technology to Support the VI&P Concept

For realization of VI&P, in addition to conventional N-ISDN, it will be necessary to realize B-ISDN with higher speed, a wider bandwidth and more advanced intelligence, as well as advanced optical cable distribution technology.

4.1 ISDN

4.1.1 N-ISDN

(1) Outline of INS-Net services

ISDN that provides communication rates of up to 1.5 Mb/s is generally called N-ISDN. NTT calls the services that it provides using N-ISDN "INS-Net". The service menu offered by INS-Net includes telephone (voice), stereo music, facsimile, data, still picture and simple animated picture transmission.

CCITT recommends that two types of interface be provided for these services. One is the basic rate interface, the other the primary rate interface. NTT calls the former INS-Net 64 and the later INS-Net 1500.

(a) INS-Net 64

INS-Net 64 utilizes the exiting metallic cable to provide two 64 kb/s information channels (B channels) and one 16 kb/s signaling channel (D channel). In addition to being able to provide facsimile communication while a telephone call is being made, this service can also be used for data communication, monitoring and Video conferencing with simple animated pictures.

(b) INS-Net 1500

INS-Net 1500 utilizes the optical fiber cable to provide twenty-three 64 kb/s B channels and one 64 kb/s D channel.

It is primarily used for the high-volume data communication, video communication, etc.

The INS-Net B and D channels can also be utilized to provide packet-switched communication (INS-P).

Table 4.1 INS-Net service

Service		Number of Subscribers	Start of Service
INS-Net Service	INS-Net 64 (circuits)	84,139	1988. 4
	INS-Net 1500 (circuits)	1,751	1989. 6
	INS-P (included in above figures)	27,809	1990. 6

Note) Number of Subscribers is the total as the end of March, 1993.

(2) Characteristics of INS-Net service

INS-Net service has the following characteristics.

(a) Economical digital public network

INS-Net is a public network, so the other party is not set, as it is with leased line service, and a metered rate system is utilized. Thus, it can provide economical digital communication for users sending small amounts of information to numerous destinations. In addition, the numbering plan is based on that for the existing telephone network, so communication can be conducted using the same numbering system.

(b) High-speed/high-quality communication

INS-Net is capable of providing higher communication quality due to its use of digital transmission. It is also capable of high-speed communication, with information transfer rates of 64 Kb/s, 384 Kb/s and 1536 Kb/s. Thus, it can be utilized for transfer of high-speed/high-density pictures, video images and data communication.

(c) Utilization of one interface for multiple channels

INS-Net provides for utilization of multiple channels using one interface. There fore, various communication equipment can be connected to perform communication with different parties at the same time, or for simultaneous multi-media communication.

(d) Integrated service

INS-Net is capable of receiving circuit-switched and packet-switched services through the same interface, and service can be selected for each communication.

(e) Abundant variety of additional services

The information channels are separate from the signal channel. Thus, signals can be sent and received freely during communication. In addition, the capacity of the signal channel is large, so it is possible to realize a variety of services by sending/receiving high-volume signals.

(f) Communication equipment with international and all-purpose capabilities

INS-Net adheres to international standards. Thus, only communication equipment that complies with the appropriate recommendations can be connected to INS-Net.

(3) Functions and network configuration required by INS-Net services

The following describes the functions required by INS-Net services and the equipment that realizes them.

(a) Sorting functions

To realize the services demanded by users, functions must be selected and split within the network, and there must be control signal processing to establish circuits between terminals.

In INS-Net, the I-interface Subscriber Module (ISM) is added to the existing D70 digital switching system to realized the required sorting functions.

(b) 64 kb/s circuit switching functions

These functions set up and disconnect the communication path for the terminal-terminal interval, and transmit 64 kb/s digital signals.

The communication path is occupied from the beginning of communication until the end of communication.

INS-Net realizes 64 kb/s circuit switching functions in its existing D70 and D60 digital switching systems, which perform relay switching.

(c) Medium-/high-speed circuit switching functions

These functions set up and disconnect the communication path for the terminal-terminal interval and transmit digital signals at speeds above 64 kb/s. The communication path is occupied from the beginning of communication until the end of communication.

INS-Net realizes medium/high speed circuit switching functions through the utilization of an H1 Module (H1M).

(d) Packet switching functions

The communication path for the terminal-terminal interval is occupied only when information is being sent, and digital signal packets are sent to the other party's terminal as is.

INS-Net realizes packet switching system functions through utilization of a Packet Handler Module (PHM).

(e) Common channel signaling functions

These functions transfer the control information signals required to set up and disconnect communication paths between switching systems in the network.

INS-Net realizes common channel signaling functions in existing Signal Transfer Points (STPs).

As described above, NTT has added new processing equipment (ISMs, HIMs and PHMs) to its basic digital telephone network to realize INS-Net service at lower cost and within a shorter period.

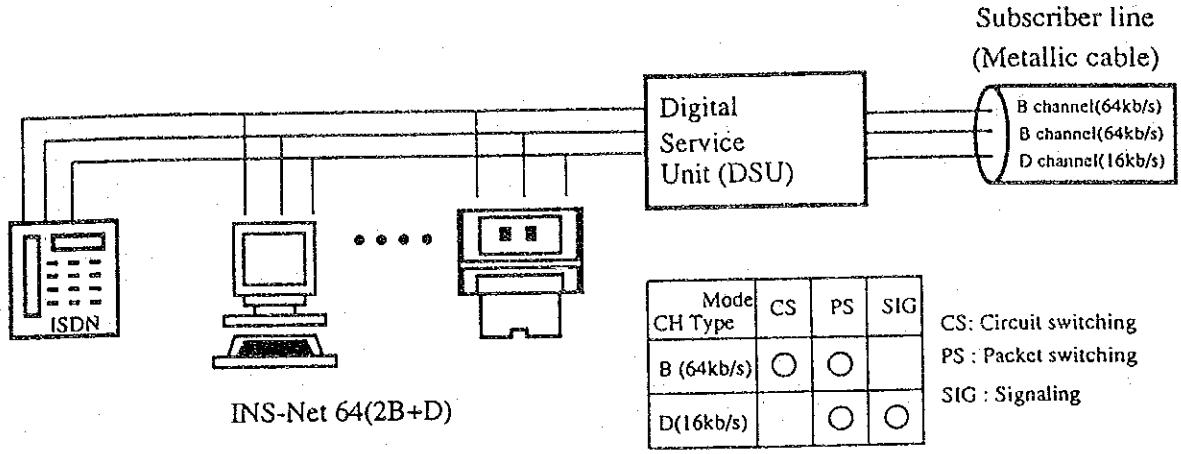


Figure 4.1 INS-Net 64 Service

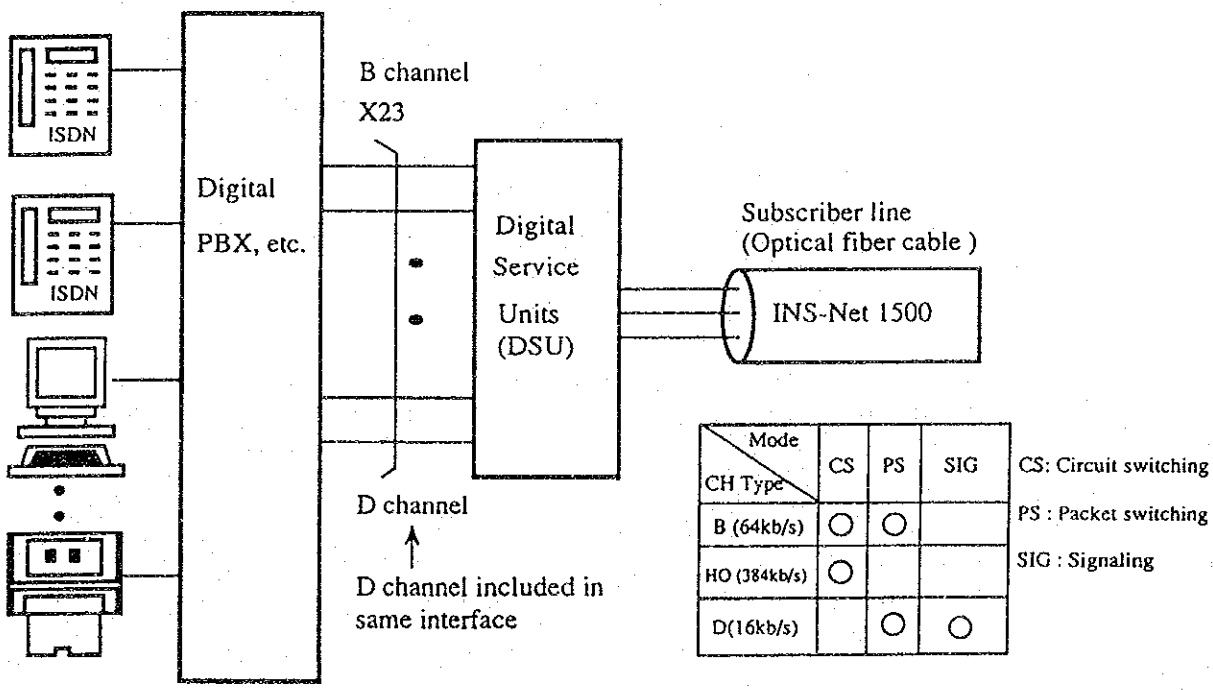


Figure 4.2 INS-Net 1500 Service

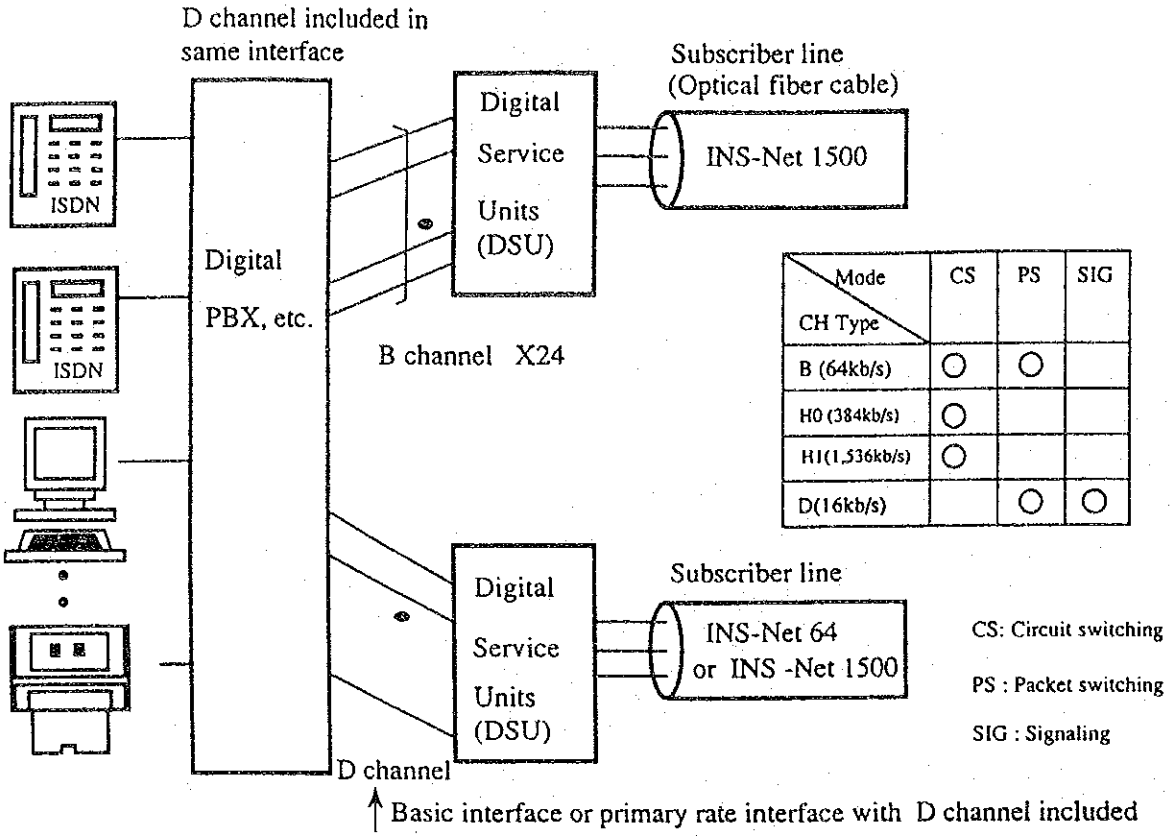


Figure 4.2 INS-Net 1500 Service

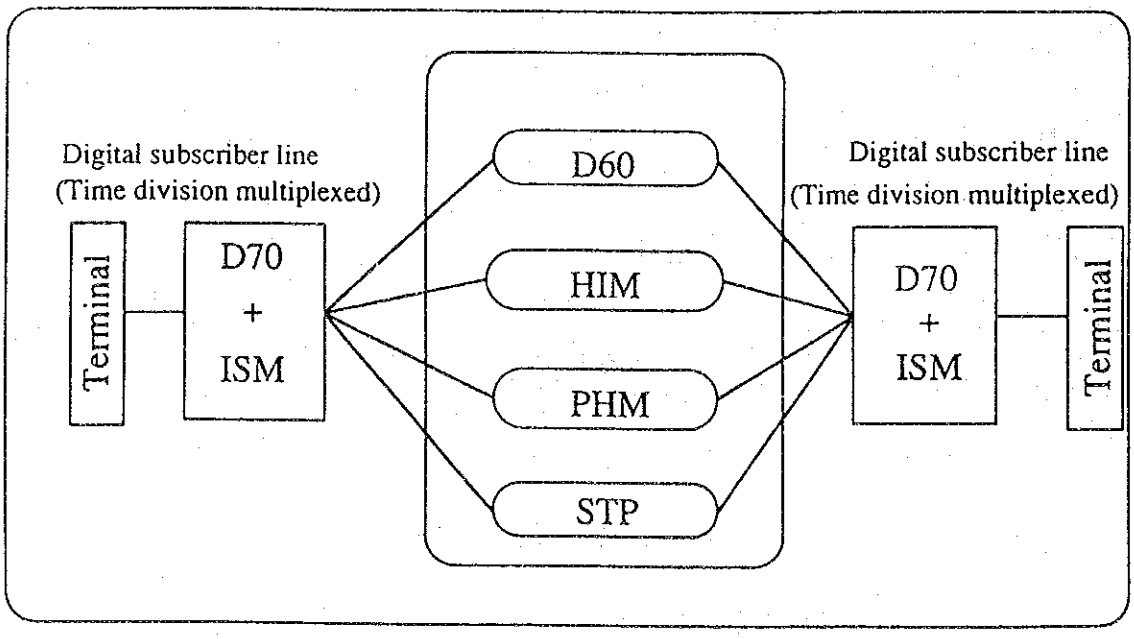


Figure 4.3 Network Configuration for INS-Net Service

(4) Typical services that utilize INS-Net

Explanation of Call Transfer Service.

(a) Call Transfer Service

If there is an incoming call to subscriber A, who has contracted for call transfer service, that subscriber can transfer the call to a third party subscriber using the same B channel.

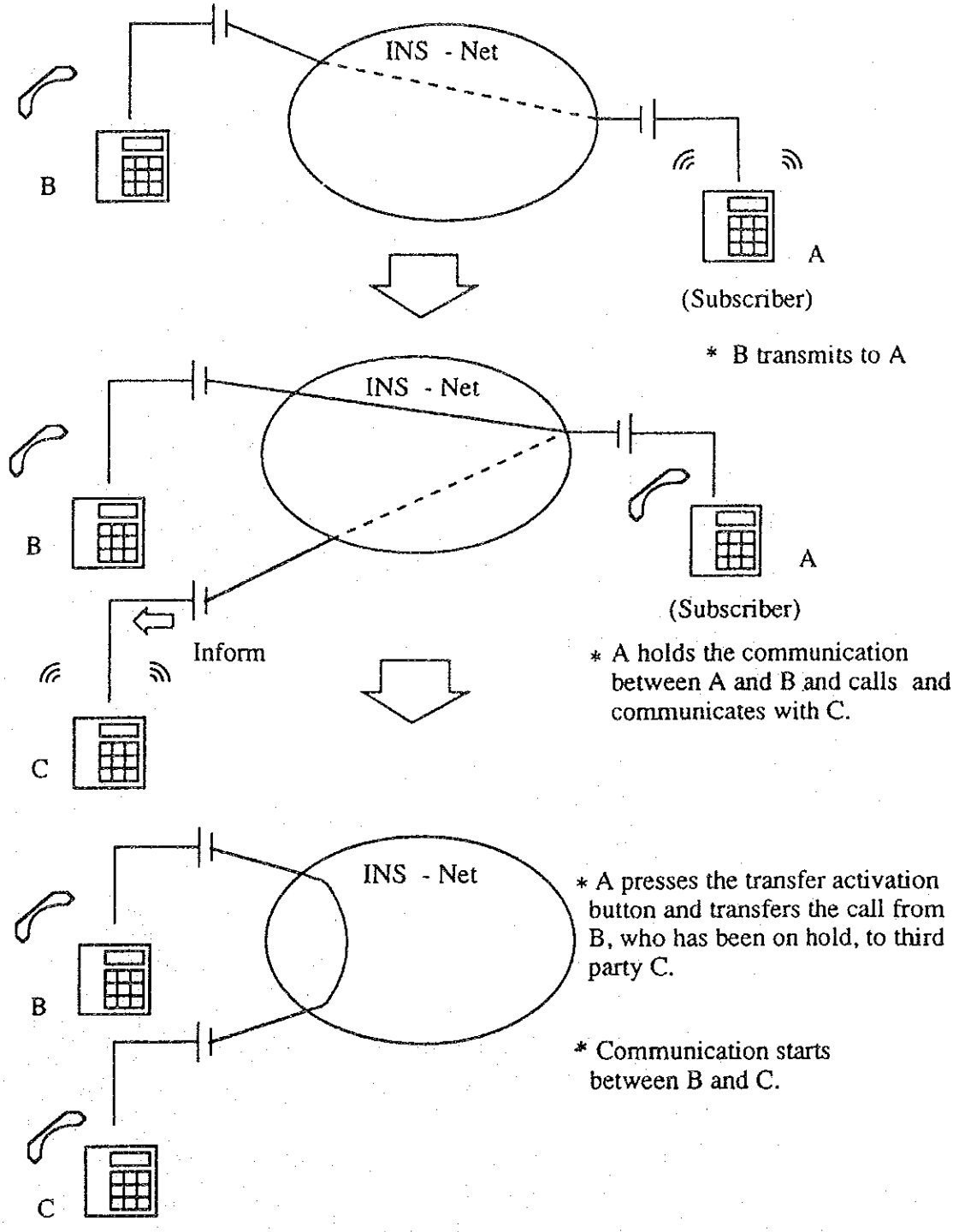


Figure 4.4 Call Transfer Service

4.1.2 B-ISDN

(1) Outline of B-ISDN

B-ISDN will realize high-speed, broadband communication services. Whereas N-ISDN service provides primarily B, and H0/H1 channels, B-ISDN will provide high speed system channels in addition to those provided by N-ISDN, such as H2 channels with speeds of 30 - 40 Mb/s and H4 channels with a speed of approximately 135 Mb/s.

The schedule for experiments on the practical use of B-ISDN is separated into three periods:

1994 ～ : Experiments not involving the use of ATM technology [1st period]

Around 1996 ～: Experiments aimed at specific users [2nd period]

Around 1998 ～: Comprehensive experiments using ATM technology based on the final CCITT Recommendation [3rd period]

(2) Characteristics/objectives of B-ISDN

While the objective of N-ISDN is communication of voice, medium-/low-speed data, still pictures and simple animated pictures, B-ISDN will have the additional objective of easy, high-speed/large capacity communication, such as high-density image transmission and large-volume file transfer.

B-ISDN is expected to be the new communication infrastructure for the advanced information society in the 21st century, which will by far exceed the frame of existing communications and broadcasting.

(3) Technologies/systems required for the realization of B-ISDN

In the future, B-ISDN must be able to respond to demands for any communication speed, mode, quality and connection format.

To achieve that, the transit network must be a single, integrated network, that is used in common by various media and has a fuller range of network operation functions than now, and must provide high-performance, interoffice signal transfer functions. Thus, to respond to new demands by customers in the future, an integrated transmission network that uses ATM technology will be the base for B-ISDN to serve as a single, common service platform. Another important support for B-ISDN will be the changing of subscriber lines to optical fiber. Ultimately, the format will be fiber optics up to the customer's premises, that is realization of FTTH.

(4) Flow for system configuration/connection of B-ISDN service

N-ISDN service is an extension of existing services, such as voice and data services, so the transit network supporting INS-Net service is divided into

three systems, the existing basic rate interface system (B system), a primary rate interface system (H system) and a packet system. The transit network for B-ISDN service, however, will consist of an integrated transport network that utilizes ATM technology and optical fiber subscriber lines.

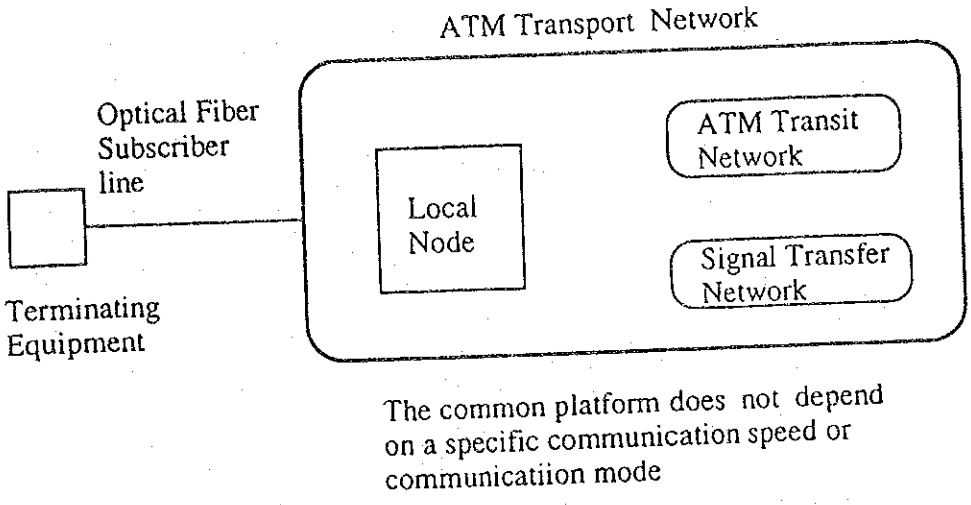


Figure 4.5 Network Configuration for B-ISDN

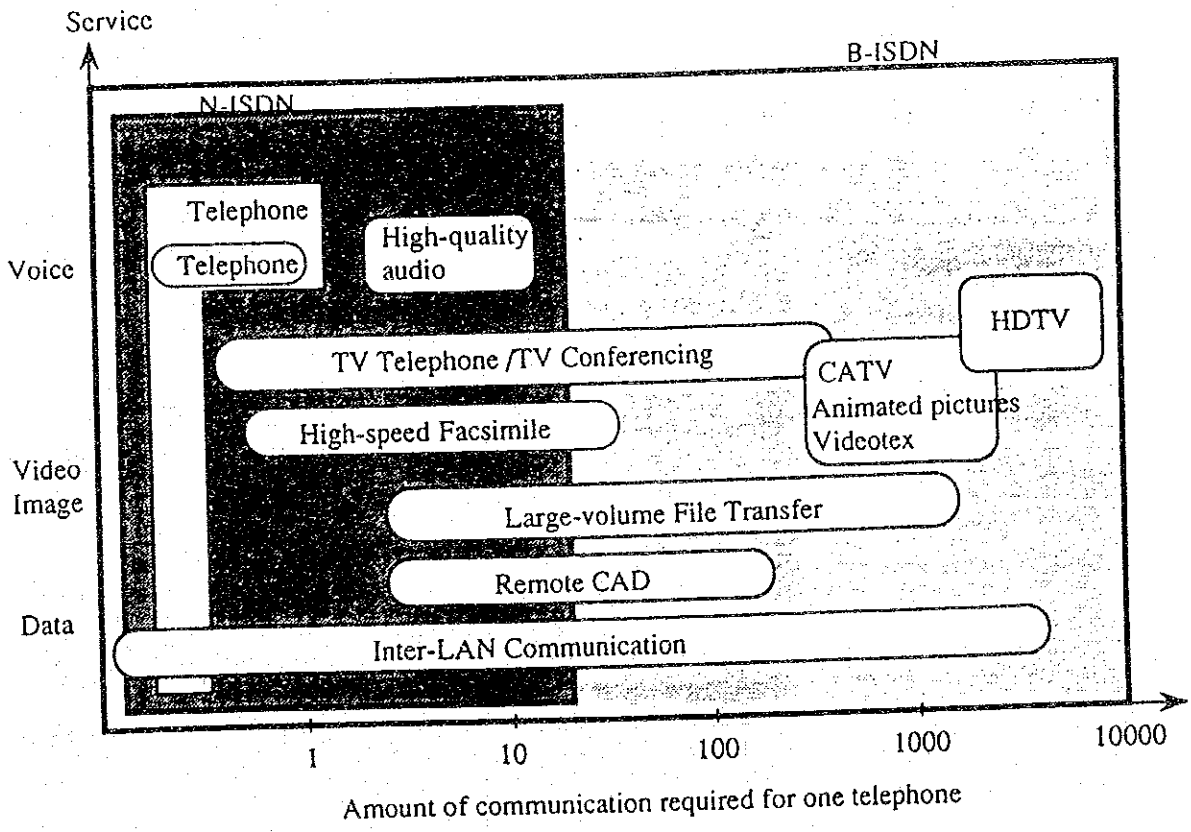


Figure 4.6 B-ISDN Service Menu

Table 4.2 Expected B-ISDN Services

Service class	Type of information	Typical B-ISDN Service
Conversational Services	Moving pictures (vidio) and sound	Broadband vidio-telephony
		Broadband videoconference
		Video-surveillance
		Video/audio information transmission service
	Sound	Multiple audio program signals
	Data	High-speed unrestricted digital information transfer service
		Large-volume file transfer service
		High-speed telemetry
	Document	High-speed telefax
		High-resolution video communi-cation service
		Document communication service
Messaging Services	Moving pictures (video) and sound	Video mail service
	Document	Document mail service
trieval Services	Text, data, graphics, sound, still image, moving picture	Broadband videotex
		Video retrieval service
		High-resolution video retrieva service
		Document retrieval service
		Data retrieval service
Distribution Service without user individual Presentation Control	Video	Conventional TV distribution service (PAL, SECAM, NTSC)
		Advanced-function TV distribution service — EDTV — High quality TV
		High resolution video distribution service
		Pay TV
	Text, figure, still picture	Document distribution service
	Data	High-speed unrestricted digita information distribution servi
	Animated picture	Video information distribution service
Distribution Service with user individual Presentation Control	Text, figure, voice, still picture	Videography

4.2 ATM (Asynchronous Transfer Mode)

(1) Necessity of ATM

N-ISDN integrates the existing telephone network, packet switching network, etc., while B-ISDN will be required to provide such services as video-telephony, videoconference HDTV, in addition to integration of the network. Thus, B-ISDN should be able to efficiently handle speeds from 64 Kb/s to 600 Mb/s. However, since demand for various services and traffic trends will be uncertain, it is necessary to construct a network that can adapt to any information transfer speeds, rather than specify an information transfer speed.

ATM technology meets these two requirements, and it provides the characteristics of both a conventional circuit switching system and a packet switching system.

(2) Outline of ATM

(a) ATM handles all information by dividing it into fixed lengths data block. This divided information, which is called a cell, is composed of a 5-bytes header and a 48-bytes information field to be transferred. The address to which the information is to be transferred is contained in the header, and the actual information that the user desire to transfer is contained in the rest of the cell.

(b) The originating ATM terminal divides the information to be sent into 48-byte units and adds the 5-byte header to each unit to form a cell. The cell is transferred to the ATM switching system from the originating terminal. The ATM switching system then performs routing processing (self-routing) based on the address stored in the header, and transfer the cell to the answering ATM terminal. The answering ATM terminal then deletes the header from the transferred cell and regenerates the information.

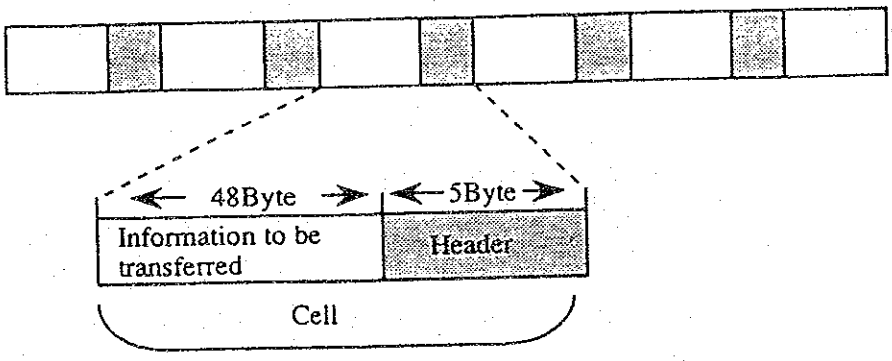


Figure 4.7 ATM Cell

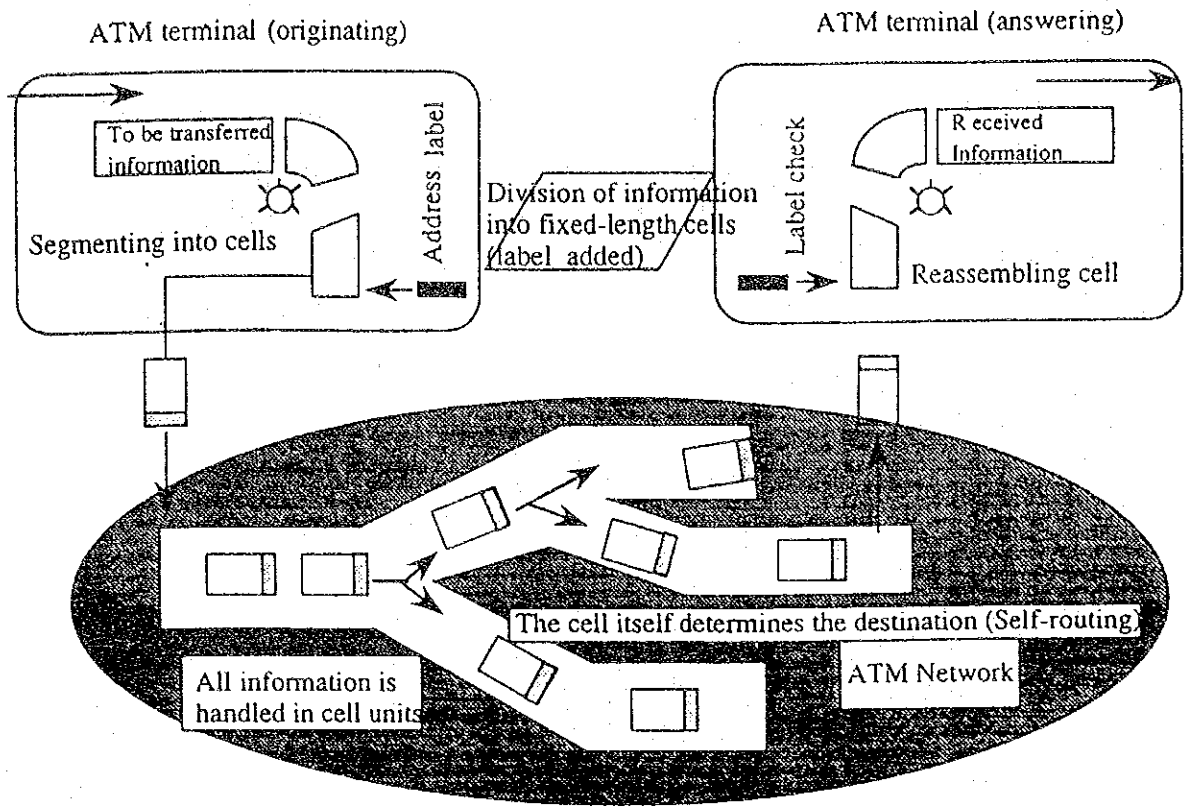


Figure 4.8 Principle of ATM

(3) Characteristics of ATM

In ATM, cells are output according to the amount of information generated. That is, it outputs fewer cells per second for low-speed information transfer and more cells for high-speed information transfer to enable information transfer at any speed.

Since the cell length is fixed, when the header for one cell is located, the position of headers for the following cells is automatically determined. Therefore, the processing load of routing is less and it is possible to process with hardware. Since one network can handle information transfer at any speed, high-speed transfer of information is possible.

Since ATM utilizes optical fiber, there is almost no information transmission error. ATM does not require error checking/resending control for services requiring high quality, such as data transmission, because error checking/resending control protocols are set up between terminals. This is another reason ATM can provide high-speed transfer of information.

(4) Basic technologies for realization of ATM

Technology that divides voice information into units of appropriate length and

adds a header to generate the cell. Also, technology to delete the header from the cell and regenerate the voice information.

LSI technology to realize faster routing processing of cell by hardware.

Mounting technology to dissipate heat in the ATM switching system caused by high-speed processing.

Table 4.3 Strengths and Weaknesses of Circuit/Packet Modes

	Circuit mode	Packet mode
Higher speed	Easy	Difficult
Multi-media transfer	Difficult	Easy
Efficiency of network resources	Low	High
Processing cost for switching	Fixed regardless of amount of information	Increases in proportion to amount of information

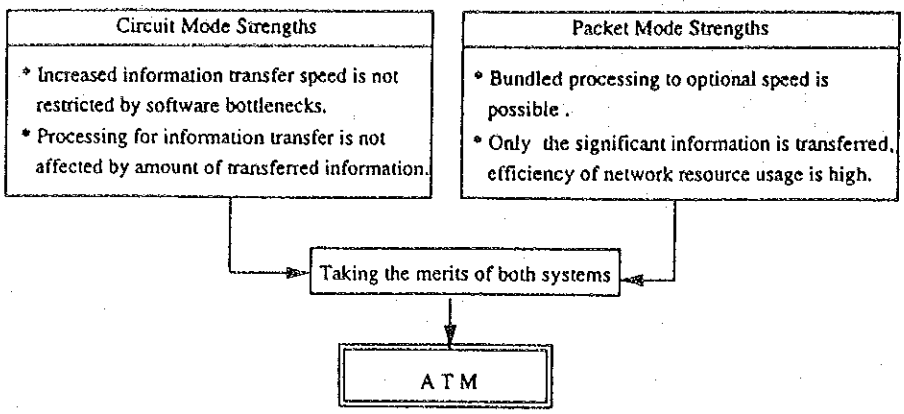
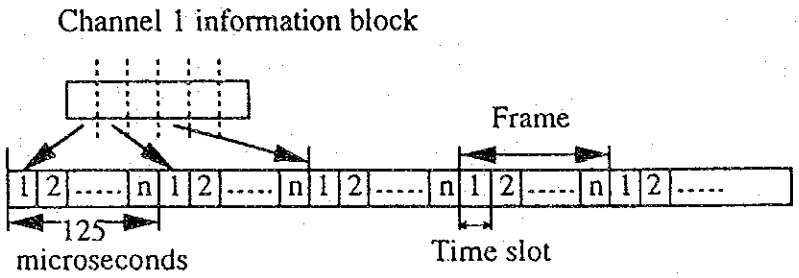
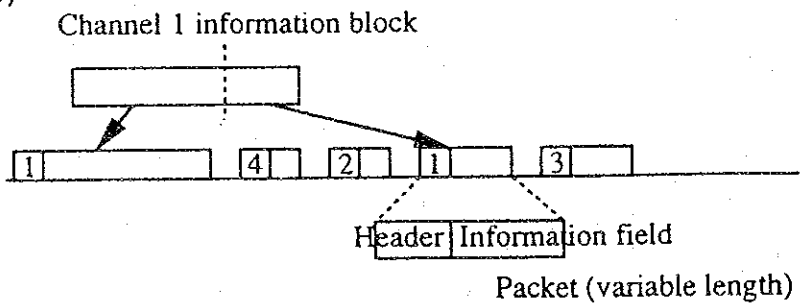


Figure 4.9 Characteristics of ATM

(a) STM



(b) Packet (X.25)



(c) ATM

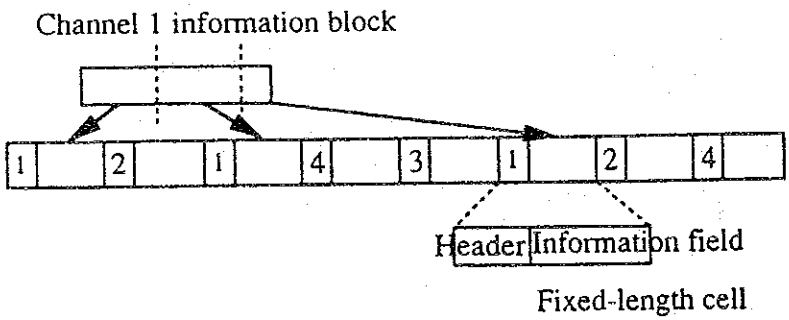


Figure 4.10 Composition of Multiplexed Frames for Transmission Modes

4.3 Frame relay

(1) Outline of Frame Relay Service

This service is capable of high-speed transfer of information to multiple parties at the same time.

It is scheduled to start the service in 1994.

(2) Frame relay characteristics

(a) High-speed communication using a simple protocol Only Layer 2 core functions are provided (only error checking is performed) to provide simplified protocol processing that enables high-speed data communication at up to 2 Mb/s.

(b) Practical use of Typical user protocols

Since the protocol for frame relay is regulated only by Layer 2 core functions, the maker's original network architecture can be used for the upper layers.

(c) Congestion control

When the network becomes congested, the network reports this status to the user.

(d) Frame multiplexing functions

By use of the appropriate control information (DLCI) corresponding to logical channels in packet communication system, multiple logical channels can be set on one physical circuit and it's possible to link simultaneously to multiple parties through one circuit.

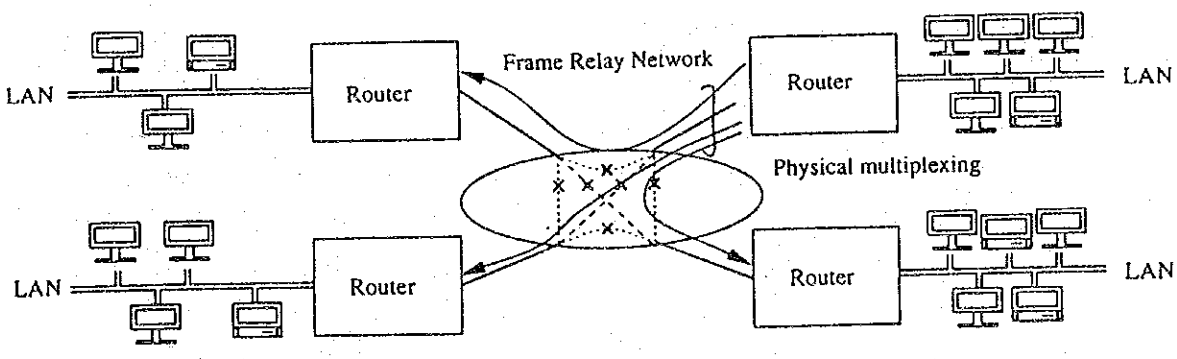


Figure 4.11 Frame Relay Connection

(3) Service outline

(a) Subscriber line speed (1.5 Mb/s planned)

The major application form for frame relay assumes the use of LAN interconnection. Since LAN transmission speeds are from several Mb/s to several 10 Mb/s, which is the mainstream, and the effective throughput of

LANs is about 20% of transmission speed, the service is planned to be provided at 1.5 Mb/s.

(b) Connection format (PVC: Permanent Virtual Connection)

Since LAN interconnection should be needed primarily for in-company communication, it is assumed that the connecting parties are fixed. Thus, it is planning to offer the PVC service to ensure security.

4.4 Optical cable distribution system (FTTO/FTTH)

(1) Outline of FTTO/FTTH

Introduction of optical fiber to the subscriber system has progressed primarily in the cities and utilizing an optical access system (CT/RT system) that enables both telephone service and ISDN service. To respond to the variety of needs for communication expected in the future, it will be necessary to promote the introduction of optical fiber efficiently into the subscriber system in order to realize an integrated subscriber network. The method of introducing optical fiber is FTTO/FTTH.

① FTTO (Fiber To The Office)

Within the business areas in large cities, the target is large-scale office buildings. Optical fiber is led up to the building and an optical access system is utilized to efficiently provide low-speed system service. This is called FTTO.

② FTTH (Fiber To The Home)

While FTTO targets large-scale buildings, FTTH is designed for general homes.

(2) Characteristics and purpose of FTTO/FTTH

Currently, NTT is proceeding with (1) establishment of a policy of quick response to demand for high-speed/broadband service for business, such as Super Digital (high-speed digital transmission service) and INS Net 1500, (2) countermeasures to overcome the deadlock in underground structures (conduits, cable tunnels, etc.) in the city, (3) inclusion of communication services in large-scale area redevelopment, and (4) introduction of optical fiber and optical access systems whenever there is an opportunity to update portable analog switching systems. At the same time, it is positively developing FTTO in the business areas to flexibly respond to various needs in office buildings utilizing optical fiber and optical access systems.

Currently, introduction of optical fiber to the subscriber system and setting up of optical access systems for user buildings has not been quantitatively facilitated enough to be called an infrastructure. However, construction of an optical subscriber network is required for realization of high-speed, broadband

service in the 21st century. The first step is FTTO and, after FTTO is realized, a shift to FTTH. That is how the subscriber network will be changed to optical fiber.

(3) Making an optical system for other than business areas (FTTZ)

Outside of the business area, the general home will be the main body for demand but, at this point, there is no specific image or need for new service that would require each home to have optical fiber. In addition, the cost of optical communication is relatively higher than that for a metallic system. Thus, the development of FTTH, as well as when it will start, is uncertain. However, to provide the capability for quick response to demand for the high-speed, broadband service in this area, it is necessary to develop FTTZ (Fiber To The Zone) as a way of promoting changes in telephone service, etc., which is the main body of demand, into on optical system for the area, which has economic merit. "Zone" refers to the area covered by an optical access system. It's objective will be an entire subscriber block, which may consist of from 1000 subscribers, or so, down to a very small area of a few circuits.

In the FTTZ, the facilities from the access system to the user will be metallic, so that optical fiber can be extended close to the user by realization of an economical, small-capacity optical access system. In areas with low demand density, updating of portable switching systems with optical access systems is proceeding positively to improve customer service and make operation more efficient. The idea is to position FTTZ, then shift to FTTH following the same process as for general areas.

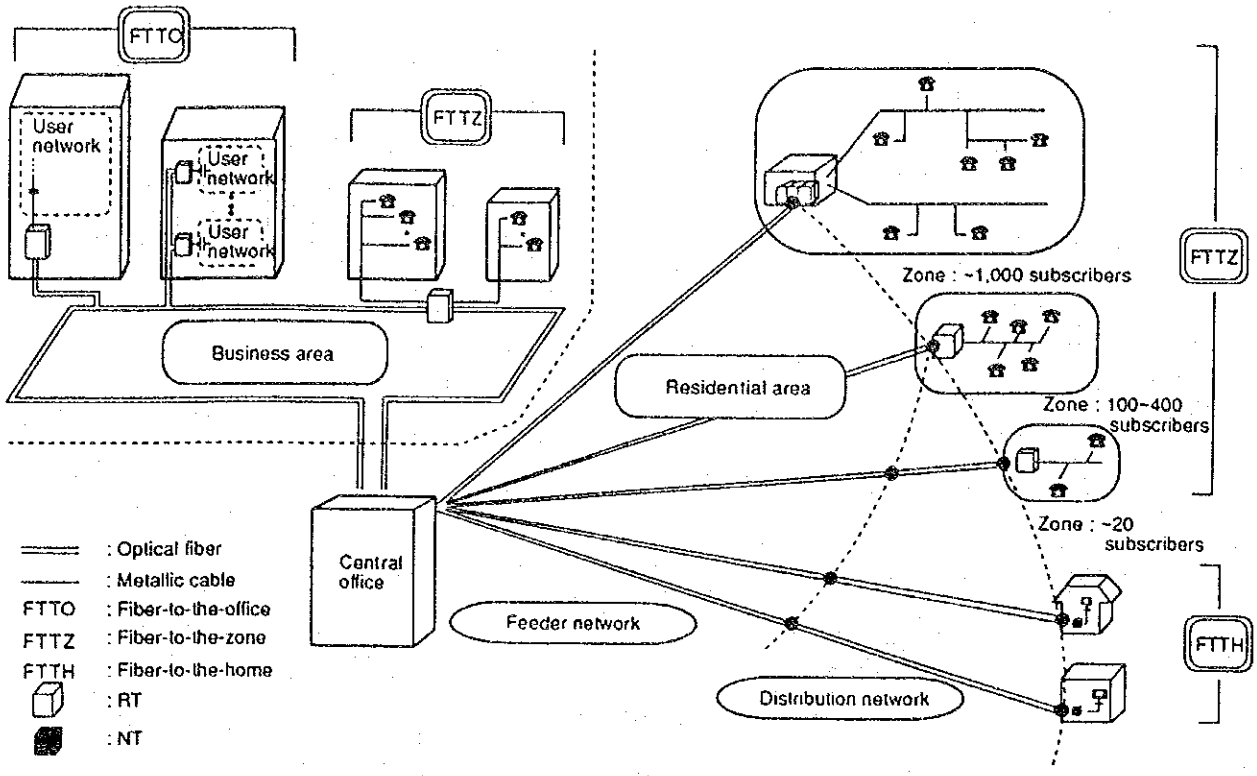


Figure 4.12 Composition of the Optical Subscriber Network

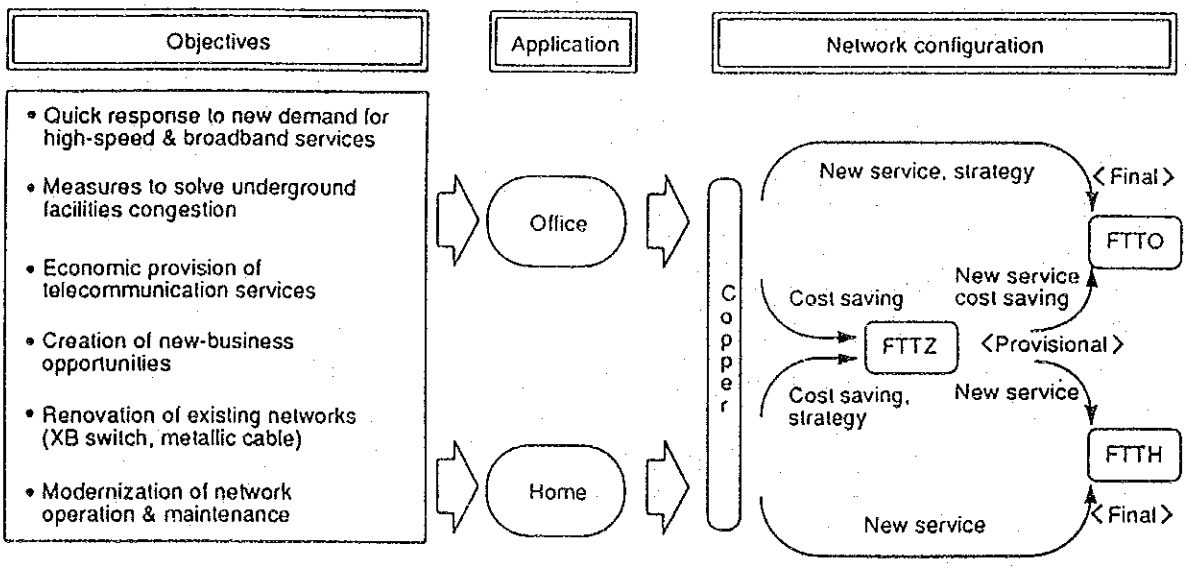


Figure 4.13 Shifting Formats to an Optical Subscriber Network and their Primary Factors

4.5 Intelligent Network (IN)

The desire for telecommunication services is becoming more advanced and diversified every year, and demand for early realization of services is getting stronger. In addition, the fact that direction of service development may shift from the customized service to personalized service cannot be treated lightly. When considering this situation, the important point for development of services in the future is how to offer a variety of services in a timely manner.

To develop services for VI&P, it is essential that an advanced network should be constructed. Thus, it is necessary to construct a so-called intelligent network (IN) that distributes the various functions required for services within the network based on a systematic network architecture.

4.5.1 Necessity of an intelligent network (IN)

Usually, to realize the additional services, part of the communication network is changed, because this is a precondition for basic connection service. However, this makes it difficult to respond to demand for various services. Thus, a new network composition is becoming necessary. One such network is the intelligent network (IN).

An intelligent network is classified and split each function the network needs to offer service and makes them into parts. It then flexibly assembles them to respond to diversification of service, and to quickly respond to service development. That is, it is aimed at realization of customized service.

The intelligent network provides the opportunity to broadly reform the network, which has been prepared as an infrastructure, from the viewpoint of network service.

4.5.2 Intelligent network architecture

(1) Classification of network functions into a hierarchy

Intelligent network functions can be divided into three classes (those concerned with service operation of the physical network, service operation of the logical network and the service network) to arrange service management and service definition into a hierarchy.

The service operation of the physical network consists of the physical resources, such as switching systems, circuits and voice storage equipment.

The service operation of the logical network provides the logic between the network's functions and resources required to realize an intelligent network.

The service network exists to provide service to the intelligent network. It consists of network functions, logical resources, etc.

The customer selects the appropriate network functions and logical resources

from the service network to define a network that meets that customer's needs.

(2) Making of service definitions into a hierarchy

The system designer, service designer and customer use the advanced service generation environment to generate services corresponding to each level.

The system designer describes the relationships between the physical network and the service operation logical network in an operation scenario (Scenario A), which is a program that uses a high-level language.

The service designer describe the relationships between the service operation logical network and the service network using a network control scenario (Scenario N), which uses the information flow to build logical definitions.

The customer defines the functions needed in the customer network using a servic scenario (Scenario S), which combines functions within the service network.

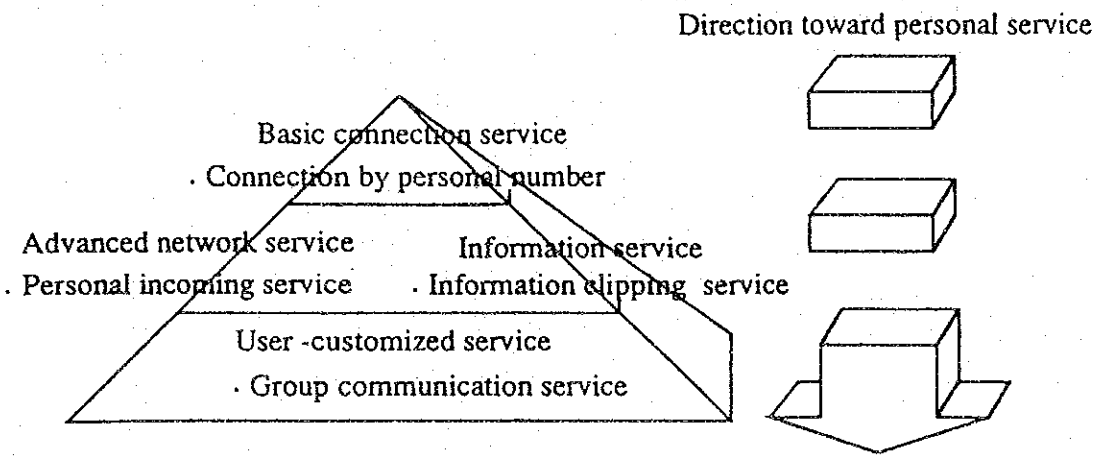


Figure 4.14 Development of Personalized Services

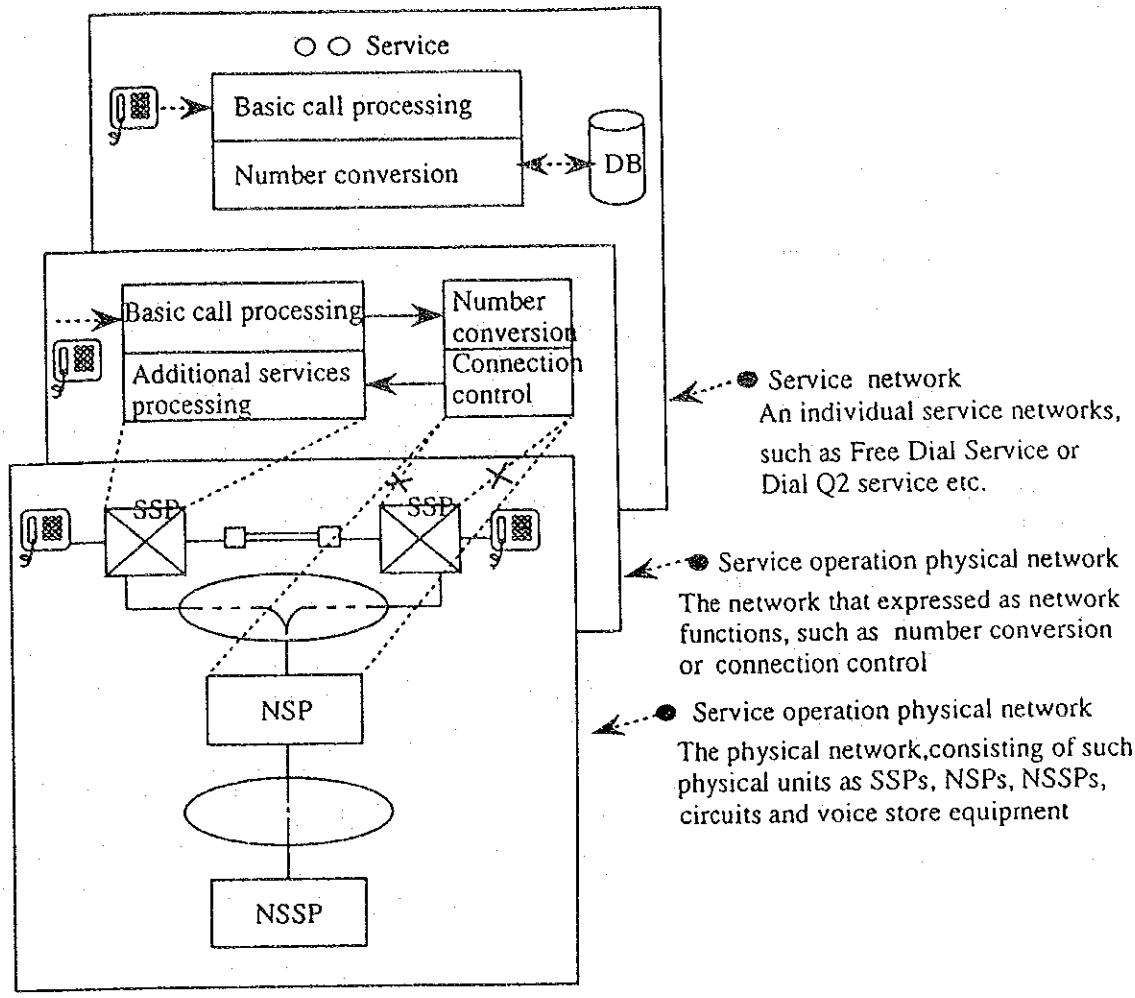


Figure 4.15 Shaping Network Functions into a Hierarchy

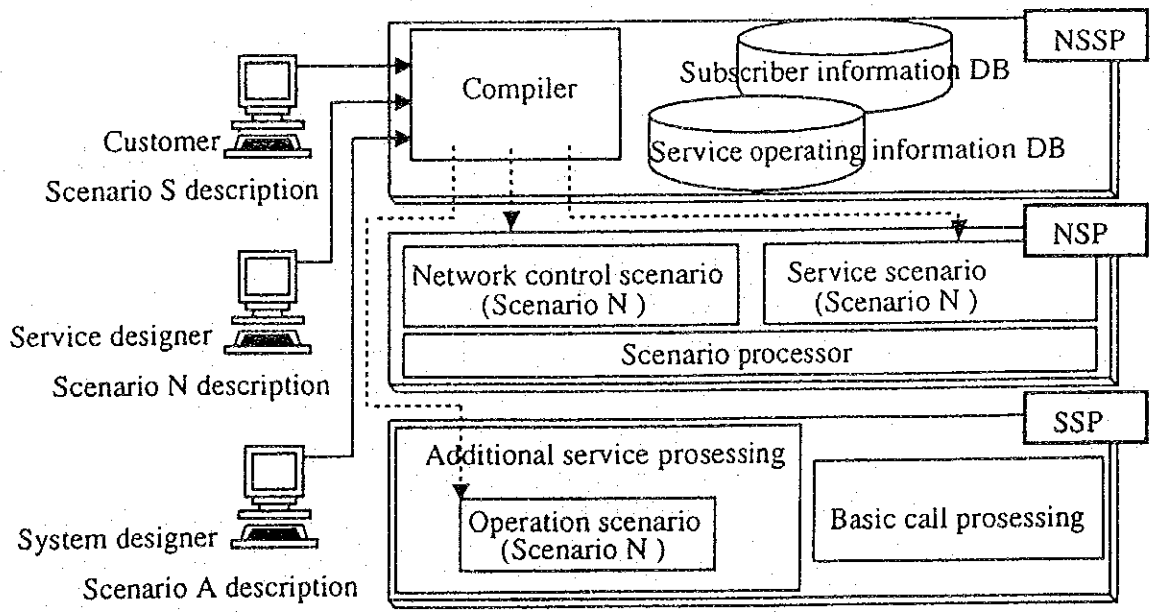


Figure 4.16 Shaping Service Definitions onto a Hierarchy

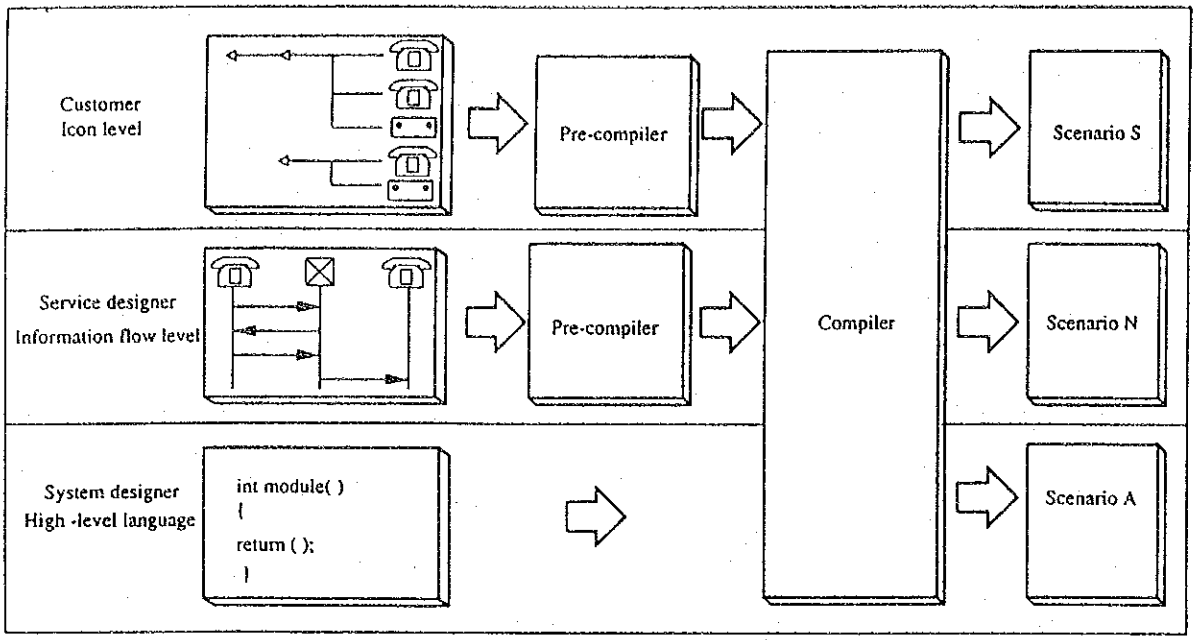


Figure 4.17 Scenario Description

5. New service development/service advancement

Targets of new service development and service advancement

(a) Development of new services and clarification of differences from other companies to attract users.

(b) Development of high value-added services and creation of markets to increase revenues.

(c) Response to more advanced and diversified user demands.

5.1 Advanced telephone services

5.1.1 Free Dial Service

(1) Outline of Free Dial Service

With Free Dial Service, The side receiving a call bears the charges for that call. This service responds to the desire to broaden customer service, such as sales companies bearing call charges for orders or inquiries from concumers concerning goods. This service is similar to the "800 Number" service available in the United States, the "Green Number" service in French and the "130 Number" service in Germany.

Free Dial Service is targeted at large , medium and small companies.

Service was initiated in December 1985. (There were 269,000 Free Dial circuits a of the end of March, 1992)

(2) Features and aims of Free Dial Service

In addition to responding to companies desiring to expand their customer services by bearing the cost of dialed calls, Free Dial Service is a means of increasing dialed call revenues.

There is no discrimination of numbers by area, such as toll numbers. The numbering system is uniform throughout the country, with a common prefix of "0120" plus a 6 digit number.

An abundance of Free Dial Services are available, such as designation of areas from which incoming Free Dial calls will be received, transfer of telephone calls made to one Free Dial number to another Free Dial number, and notifying the person attempting to make a Free Dial call outside of the hours designated by the Free Dial Service subscriber that such is the case (when call receiving hours have been designated).

(3) Network configuration and connection flow for free dial service

(a) The sender dials the free dial number (0120-XXXXXX).

(b) The network transfers the free dial number (0120-XXXXXX) to the data base.

(c) The data base then translates the free dial number (0120-XXXXXX) into the general service telephone number (03-YYYY-ZZZZ) and obtains the information necessary for connection.

(d) The network connects the sender with the general telephone (03-YYYY-ZZZZ) based on the information from the data base.

(e) The network supervises the call status and charges the call to the free dial number.

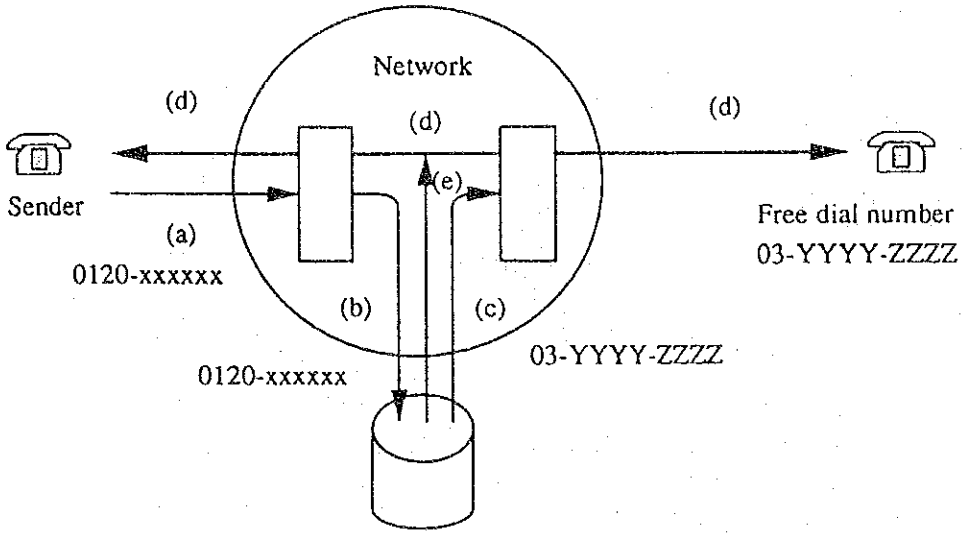


Figure 5.1 Network Configuration for Free Dial Service

(4) Network functions required for provision of Free Dial Service

Translation of the Free Dial number into a general service telephone number.

Billing of call charges to the Free Dial number.

Control of calls according to the terms of subscription to Free Dial Service.

5.1.2 Information charge collection agent service (Dial Q^2)

(1) Outline of Dial Q^2 Service

With Dial Q^2 Service, NTT acts as the collection agent for a company desiring to provide toll information service via NTT telephone circuits. That is, the information service fee is added to communication fee, and callect charges from numerous, unspecified users at low cost. In addition to telephone service, Dial Q^2 Service can be provided for voice mail, personal computer communication and facsimile information service. Thus, it can be used to provide a variety of toll information.

Dial Q^2 Service is targeted at information providers and general users.

Service was initiated in July 1989 (as of the end of March, 1992, there were

contracts for 50,000 circuits, with 8,500 programs being provided).

(2) Features/aims of Dial Q² Service

Dial Q² Service enriches such information providing services as telephone service, provides an agent for collection of the information fees requested by information providers, and increases the profit from dialed calls.

There is no discrimination of numbers by area, such as toll numbers. The numbering system is uniform throughout the country, with a common prefix of "0990" plus a 6 digit number.

A flexible metering system has been adopted for information fees. The communication fee for the number of metered seconds is added to the information fee, and the user is charged this combination fee.

Previously, information providers had to select an information fee from among the types of charges (information fee ranks) designated by NTT.

(3) Network configuration and connection flow for Dial Q² Service

(a) The sender dials the Dial Q² number (0990-XXXXXX).

(b) The network transfers the Dial Q² number (0990-XXXXXX) to the data base.

(c) The data base then translates the Dial Q² number (0990-XXXXXX) into the general service telephone number (03-YYYY-ZZZZ) and returns the necessary connection information to the network.

(d) The network notices the sender as follows "This information will be charged XX Yen per XX seconds."

(e) The network connects the sender with the general telephone (03-YYYY-ZZZZ) based on the information from the data base.

(f) The network supervises the call status and meters the caller's telephone.

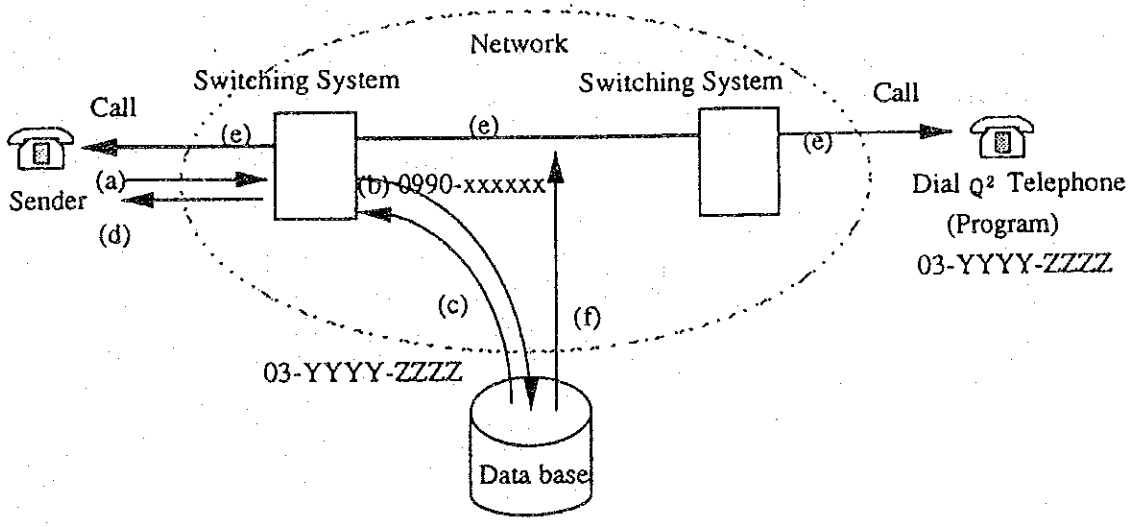


Figure 5.2 Dial Q² Network Configuration

(4) Network functions required for provision of Dial Q^2 Service

Translation of the Dial Q^2 number into a general telephone number. Voice guidance to provide the caller with unit charge information. Identification of the information charge rank, call charges and information fee to make the appropriate charge.

5.1.3 TeleJyozu

(1) Outline of TeleJyouze Service

Pay a fixed amount for every month, then discount the total call charge at the discount hours (Weekends, Holidays: Whole day, and Week day:10:00 P.M-8:00 A.M.) for one month. Four service plans are provided to meet application conditions.

The target for this service is all telephone subscribers.

Service was initiated in April 1992. (About 1.22 million subscribers as of February 1993)

(2) Features/aims of TeleJyouzu Service

The objectives of TeleJouzu Service are to promote the making of calls during time periods when traffic is way down, such as late hour, and to increase profit.

Depending on application, the user can select from four types of TeleJyouzu Service (TeleJyouzu 2000, 3000, 5000 or 8000), at discount rates of from 12.5% to 15%.

(3) Network configuration for TeleJyouzu Service

(a) The call between A and B is completed.

(b) A detailed record (detailed information) is created and stored.

(c) Details information are transferred to the detailed information center.

(d) Detailed information is totaled and transferred to the charging system

(e) The discounted charge is calculated and a bill and detailed statement are presented to A.

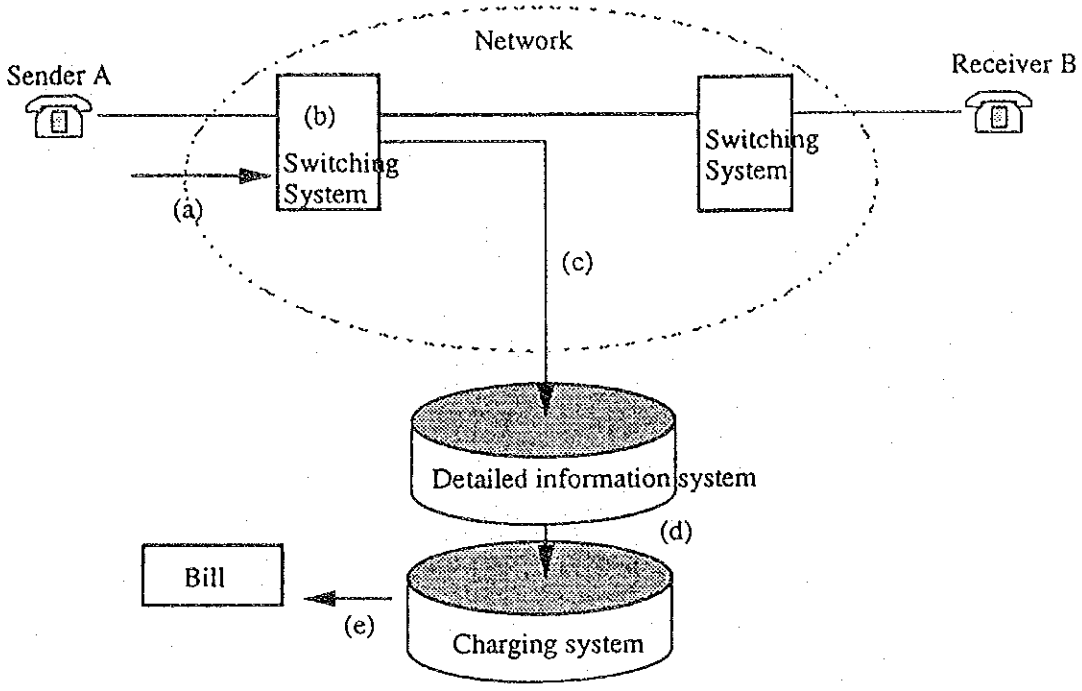


Figure 5.3 Network Configuration for TeleJyouzu Service

(4) Required technology

TeleJyouzu service accumulates calls made during the discount time period and calculates the discount rate. Thus, detailed records of these calls (detailed information) is required.

6. Making Work More Efficient/Rational

6.1 Customer Service Total System (CUSTOM)

(1) Outline of CUSTOM

CUSTOM (Customer Service Total System) supports the work performed by the Customer Service Task Division, specifically handling of service orders, charging, repair, and inside/outside facilities management. Currently, these tasks are handled by four in-company systems, plus an overall charging service system. CUSTOM integrates these five in-company systems.

Introduction is planned for August 1994.

(2) Features/aims of CUSTOM

The aim of CUSTOM is to uniformly systemize the work performed by the Customer Service Task Division in order to quickly respond to customer needs, make such work more efficient and save energy, and improve customer service.

(a) Characteristics of service order work

Combined orders for multiple telephone numbers can be prepared on one order sheet. (free format)

The contents of service order are converted by switching system and construction is executed automatically.

(b) Characteristics of charging work

One terminal can quickly and easily handle such referencing as billing information, detailed charge information and history of inquiries.

Information can be retrieved when customers need to be pressed for payment, so payment reminders can be done faster.

(c) Characteristics of failure treatment work

Circuit testing can be performed while the customer information is displayed, which decreases testing time.

Processing from acceptance of a trouble report to completion of repairs can be managed to respond correctly to each report from a customer.

(d) Characteristics of in-house and outside facilities management

The status of telephone numbers and attached facilities, such as in use, reserved or vacant, can be managed automatically, so management by-the-book is not necessary.

Workers outside the office can input data on construction processes and construction cost using handheld computers (HHCs). Workers can also receive the schedule for the next repair task by HHC.

(3) Systems/functions required to realize CUSTOM Service

(a) CULTAS (Customer Loop Test And Trouble Inquiry Call Receiption System)

Provision of maintenance over a broad area and intensive response to receipt of trouble reports (broad area trouble report acceptance)

Making of a data base for trouble histories and progress of trouble management.

(b) EOS (ESS Operation System)

Intensive maintenance of switching systems over a broad area (broad area monitoring control)

Remote control of switching system failure processing

Connection to CUSTOM to develop the work flow (SO acceptance - automatic switching system construction)

(c) New Line Control (Revision of the Outside Plant Facilities Control System)

Making of a data base for facility management related to outside facilities

Connection to CUSTOM to develop the work flow (facilities control, obtaining substitute conductors according to the SO).

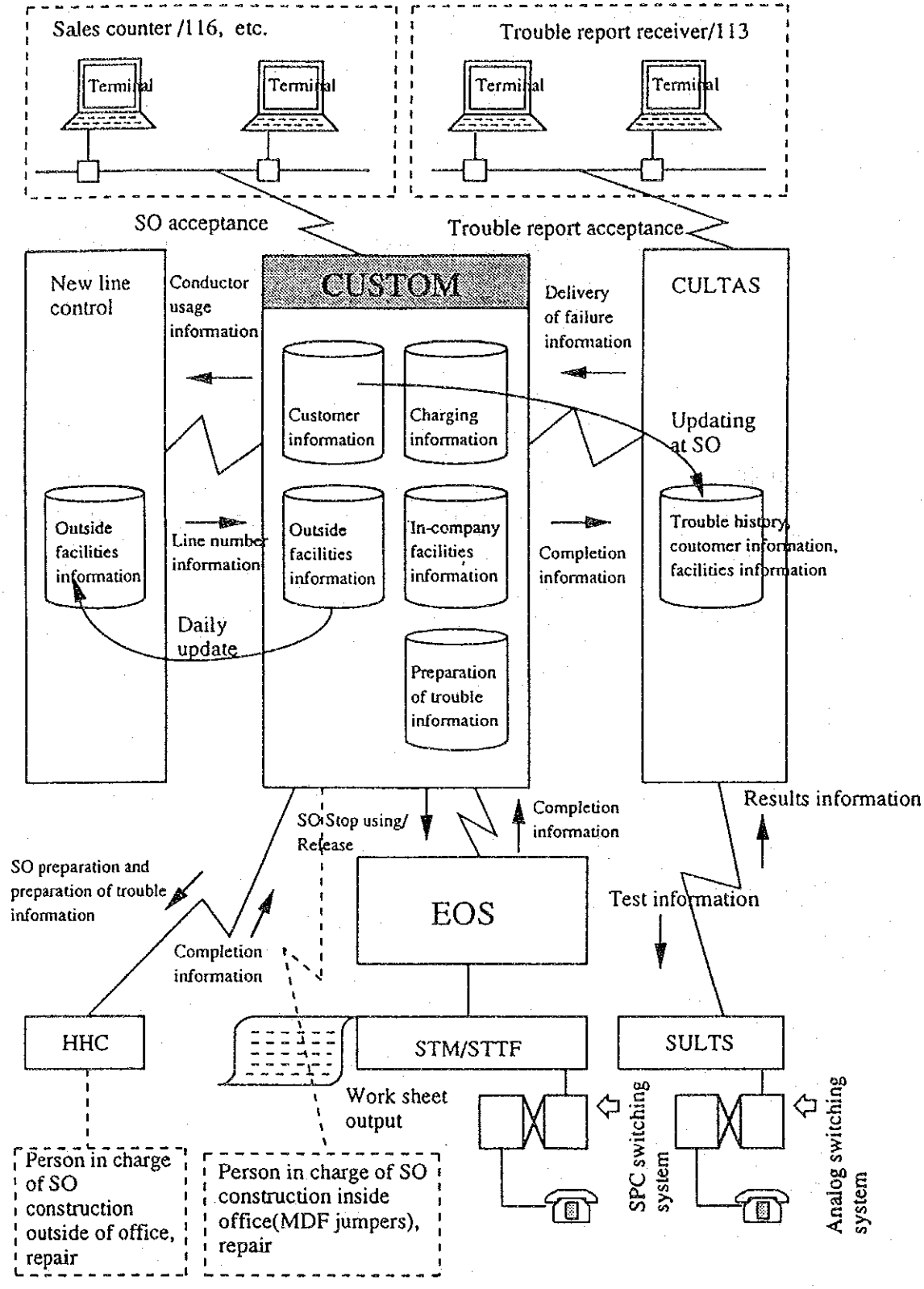


Figure 6.1 Composition of CUSTOM and other Operations Systems

6.2 Expert system

(1) Outline of the expert system

If a specialist inputs the knowledge he/she has obtained from education and experience into computer memory, then average people can perform almost the same level of work.

Expert systems (ESs) utilize special knowledge in a specific field stored in a computer to solve problems with almost the capability as a specialist.

Since ES is a computer, it cannot perform marketing activities or take care of problems through human communication. Thus, it only provides the information, data, etc., required for human activities to support work.

In Japan, about 250 companies, primarily major companies in the finance, construction and electric power fields, are tackling the development of ESs. At NTT, many expert systems have been developed and about 20 systems are actually being utilized as substitutes for and to support the work of specialists.

(2) Features/aims of the expert system

An ES utilizes a skilled person's knowledge, so it is suitable for non-fixed work, that is, in fields where specific processes and procedures have not been established. For example, it is suitable in cases where assemble is complicated and there are many changes in contents (efficiently finding the appropriate combination of various devices) or in complicated design work (design of circuits) to make processing more efficient.

An ES is also suitable for use in systems in which the regular work commonly use data and efficient calculation processes are required.

ESs are expected to make various tasks more efficient, such as maintenance/ opera tions work, marketing, and internal work.

(3) Expert system configuration/connection flow

(a) Knowledge (know-how, regulations, etc.) obtained from experience is inputted into the computer and stored as data.

(b) User makes an inquiry to the system.

(c) In response to that inquiry, inferences are drawn from the stored data (knowledge) and an answer is given.

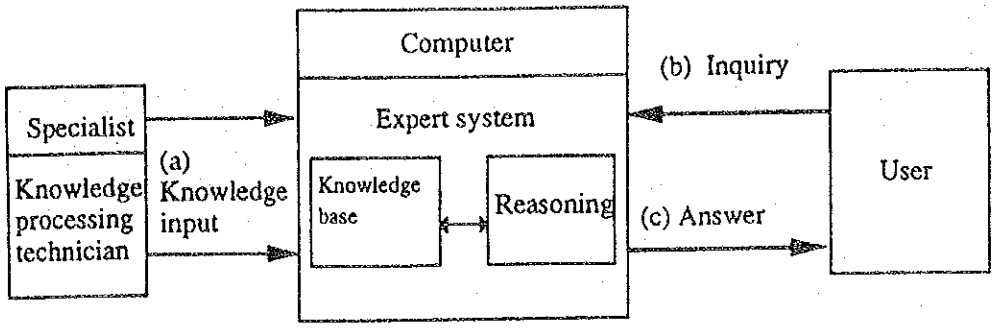


Figure 6.2 Composition of an Expert System

(4) Necessary functions for expert systems

Knowledge base: Accommodate the knowledge that obtained from experience, such as know-how and regulations concerning sales and facilities maintenance, the composition of products and facilities and the relations between them.

Reasoning: Retrieval from the knowledge base according to the data contained in the inquiry to find the correct or most appropriate answer.

7. Operation Systems (OpSs)

An operations system is an in-company information system that performs a series of tasks, such as handling of service orders, repair and network operation, more efficiently and faster. The work the operations system is involved in is important work that actually controls service quality.

The operations system enables the operation of network elements (NEs) which provides efficient monitoring/testing/control of those elements. At the same time, it provides operation services aimed at improvement of service quality, and makes work more efficient and faster.

7.1 Basic principle of operations system development

The objective of an operation system is to improve user service, and to make work more efficient and faster in close cooperation with the network elements that provide telecommunications service. This requires construction of an appropriate system that organically couples operations systems to provide smooth distrubution of information and enable efficient execution of a series of tasks based on a unified terminal operation procedure.

(1) Making the work flow

Humans and systems must be united and processing of operation tasks such as, from subscription to the opening of a circuit, from acceptance to retrieval, or arrangement for repair, must be almost like the flow of water from beginning to end.

(2) Free area

Usually, the host and terminal equipment for operations are installed as attachments to network elements. However, the new system must enable this equipment to be installed wherever it is required. That is, it must be possible to set up an operations center to perform the actual work wherever it is needed. It must also guarantee freedom of employee assignment, design of operation systems and the drawing up of an appropriate operation plan in order to realize a composition that meets the characteristics of the division or area.

(3) Unification of man/machine interfaces

When driving multiple operations systems to accomplish a series of tasks, the operations procedures, methods for input/output at terminals, etc. must be unified to enable operation just as if only one system were involved.

7.2 Future trends in operations system development

(1) Further improvement of user services

To realize functions that quickly and accurately provide the various information needed for user service improvement, the appropriate data bases must be prepared, and the information from the facilities operation system must be distributed efficiently.

The objective must be to fulfill front functions for large- and medium-volume users, and to provide customer control that allows users to operate the system freely according to their own objectives.

(2) Realization of intensive, broad-area maintenance

To make work more rational and efficient, there must be intensive, broad-area maintenance for network facilities. In addition, consideration must be given to operation of the operations system itself, with positive promotion of remote/automatic operation.

(3) Promotion of totalization

Rather than just integration of functions for an individual operation system, organical interconnection of relevant operating systems must be promoted for totalization that enables quick response to requests from customers or management and more efficient work processing within NTT.

(4) Unification of operations system platforms

To execute operations system development efficiently, thorough re-use of software (making it into modules) and common use of applications (APs) that have similar functions is necessary.

Various hardware, os, and middle software are being used in existing operation systems, and AP interfaces are diversified, so it has been difficult to effectively use existing software during new development or updating of systems.

In the future, operations systems will seek to unify platforms and standardize AP interfaces. Specifically, they will be determined with consideration given to the productivity, the capability for distribution and expansion, and the multi-vender compatibility of software.

7.3 Operations system architecture

(1) Facility operation system layer

The operation systems that control (monitor/test/control) individual network elements.

(2) Network operations system layer

The operations systems that control the status and service quality of the entire communication network.

(3) Service operations system layer

The operations systems that control the conditions for specific services, such as leased line and ISDN service, and present the results to the user.

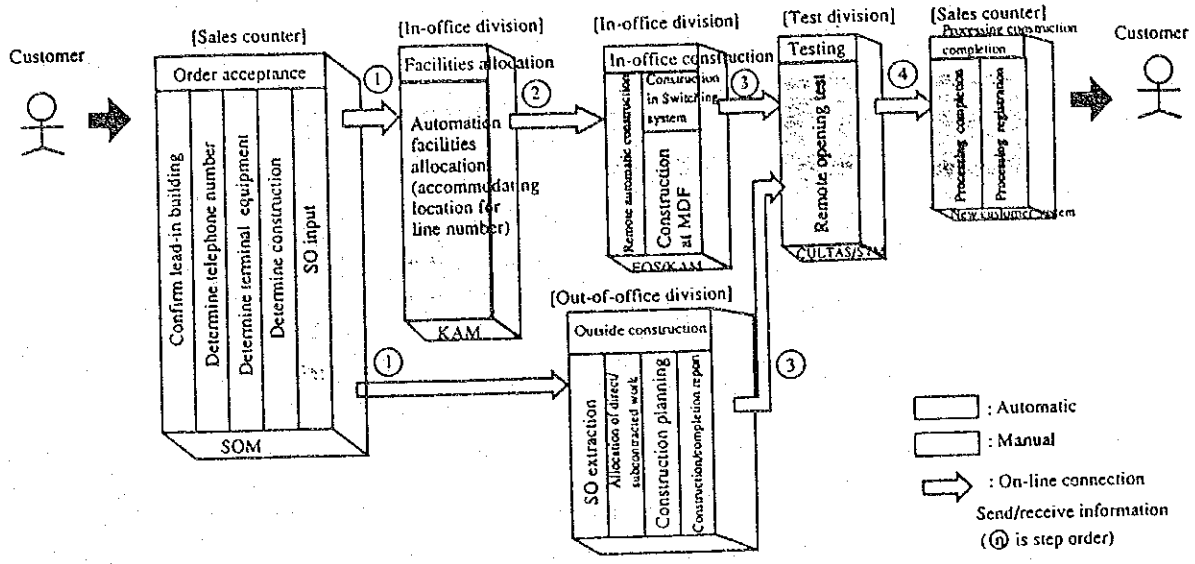


Figure 7.1 SO Work Flow (typical)

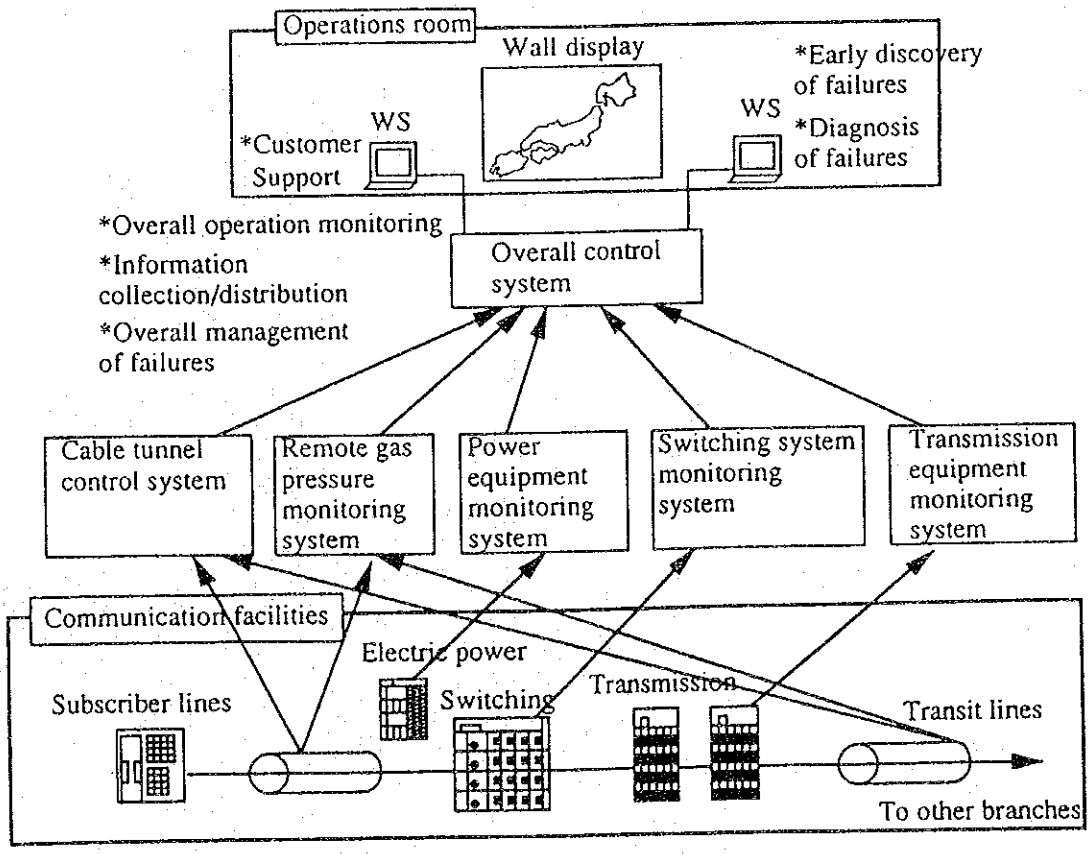


Figure 7.2 Totalization Concept

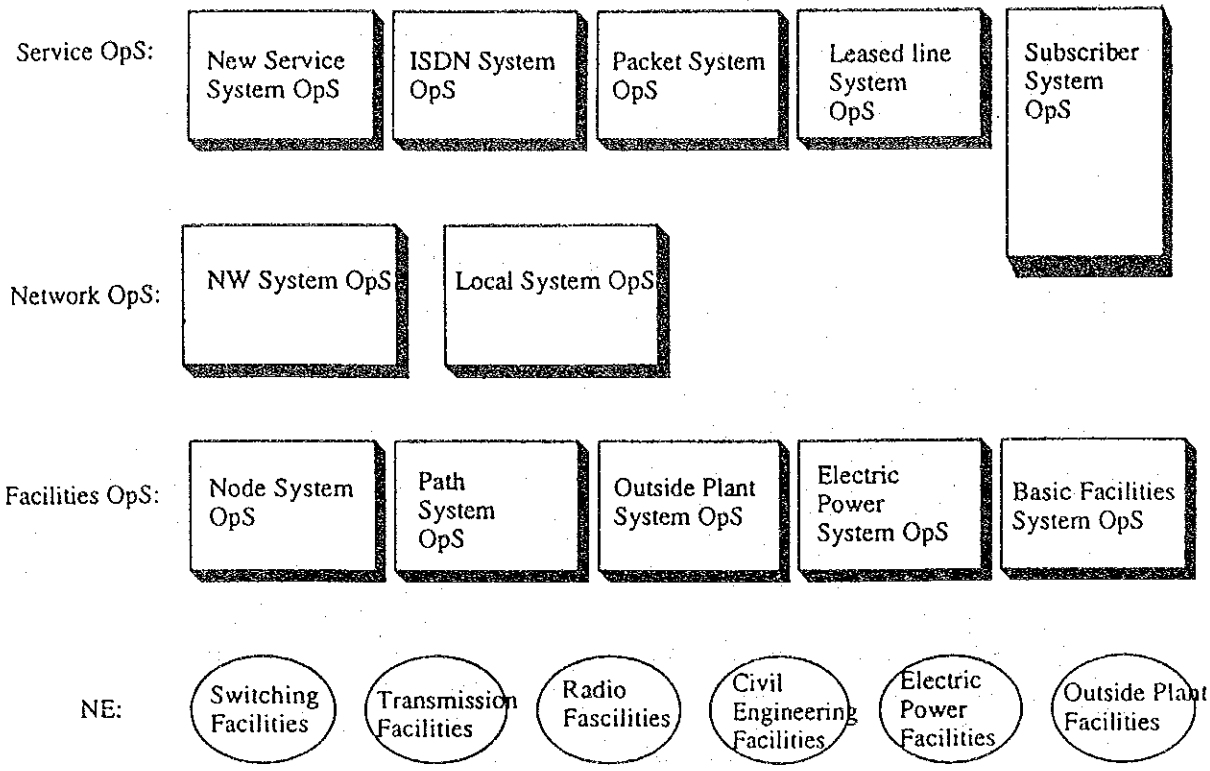


Figure 7.3 OpS Architecture

Table 7.1 Outline of Functions for Major Operation Systems 1/2

Classification	Name	Outline of Functions
Service Operations Systems	DNSS (DDX Network Supervising System)	Supervises the operating condition of the DDX network, communication traffic control.
	DNTS (DDX Network testing system)	Opening test, failure separation testing of user circuits in the DDX network.
	DNCS (DDX Network Control system)	Remote control of the packet switching system, collection/retrieval of switching system information.
	X-PA (DDX Advanced Protcol Analyzer)	Analysis/diagnosis of communication protocols for the packet switching network.
	I-DB (ISDN User Databace system)	Control of basic information, facilities information, failure histories, etc., for ISDN users.
	I-OPE (ISDN Operating Desk Equipment)	Failure separation testing for ISDN user circuits.
	SONIA (Service Order Navigation and Administrator)	SO acceptance of leased lines, SO processing progress control, unitary granting of leased circuit IDs.
	DIANA (Databace Integrator and Administrator for Leased Line)	Unitary control of original register data bases related to leased lines.
	SULTS (Subscriber Line Testing System)	Testing of subscriber lines.
	SIFS (Subscriber Information Filling System)	Storage/control of subscriber line information.
	ARIES (Arithmetic Outside Plant Meintenance Supporting System)	Control of work arrangements and work progress related to outside plant construction.
	CULTAS (Customer Loop Test and Trouble Inquiry Call Reception System)	Repair flow, high speed and advanced testing and failure history retrieval for subscriber lines.
	SOM (Service Order Interface Module)	Processing of order receiveds for large-scale SO, instruction on outside plant work.
	KAM (Kaisen Assignment System)	Allocation of switching system accommodation locations, remote control of automatic MDFs.
Network Operation System	TS-ATOMICS(TS-Adovanced Traffic Observation and Management Information Collecting System)	Collection and management of toll telephone network traffic.
	TCS-V2(Traffic Congestion Control System V2)	Congestion control and detour control related to new service calls.

Facilities Operation System	STM(Supervisory and Testing Module)	Supervision/testing/control of ISDN switching systems, etc.
	XB-ES(XB-Expert System)	Failure diagnosis of x-bar switching systems
	EOS(ESS Operations System)	Unitary supervision/testing/control of switching systems.
	COSMICS(Centralized Operation Support and Management Information Control system)	Supervision/testing/control of transmission networks.
	CAROLINE(Centralized Maintenance Administration and Operation System for Local Integrated Transmission Network)	Supervision/testing/control of local transmission networks.
	ATROS(Advanced Total Radio Operation System)	Supervision/testing/control of radio transmission networks.
	LCTS(Leased Circuit Testing System)	Failure separation testing and switching of leased circuits.
	DENON(DMS-10 Engineering System of NTT)	Design and facilities control for DMS-10 switching systems.
	D70CAD(D70 Computer Assisted Design)	Facilities design, calculation of the rate of progress for construction of D70 switching systems.
	ALICE(Advanced Power Plants Integrated Maintenance Control System)	Remote monitoring and control, processing of maintenance statistics for power plants.
	FITAS(Fiber Transfer and Test System)	Switching,testing of toll system optical fiber lines.
	AURORA(Automatic Optical Fiber Operation Support System)	Supervision/testing of subscriber system optical fiber lines, management of conductor information.
	CAPS(Computer Aided Outside Plant Designing System)	Facilities planning, design, addition for outside plants.
	NOPS (New outside plant control system)	Control of outside plants, creation of construction data, management of work progress.

<Reference Material>

Major Technology Developed for Realization of VI&P (1 of 2)

Field	Equipment/System Developed	Functions, Features, Etc.	When Introduced
1. Technology to Realize Various Services	Message-in Service	Message-in Service allows a caller to leave a message on a voice storage equipment (VSE) unit, under password protection entered by touch tone dialing. Anyone knowing the password can retrieve and/or delete the message.	July 1991
	TeleAssist 3000 (Multifunction Telephone Set with Image Data Communication Facility)	This multifunction telephone set integrates a modem, large liquied crystal display and printer into one compace unit. When an IC memory card containing the application software is inserted into the set, a user has access to a variety of services, including firm banking, home banking and home trading of securities instruments.	September 1991
	7-kHz Wide-band strereo Communications System (SB-1)	The SB-1 system automatically compensates for the phase lag between the two B-channels of INS-Net 64 to provide high-quality stereo vice communications. By combining the SB-1 with the 7-kHz voice codec "HC7000", which NTT released earlier, users can enjoy stereo communications in the 7-kHz band.	February 1992
	Super-compact Cellular Mobile Telephone (mova)	This ultrasmall and light celluar mobile phone measures only 150 cc in volume and weighs just 230 g. It can store up to 100 names and telephone numbers in its electronic telephone directory. Its wealth of functions include automatic dialing, sound and light alerts for incoming calls and three-way selection of call rings.	April 1991
	Enhancement of Face-Mate Teleconferencing System Line-up	New models were introduced to expand the line-up of Face-Mate teleconferencing systems, which are compatible with CCITT Recommendations and the standards established by the Telecommunication Technology Committee (TTC). Added this time were the FM-MC10 and FM-MC30 multipoint tele-conferencing control units, which support communications to as many as 24 destinations, the FM-5000 terminal equipment which provides two 37" monitors and an 11" preview monitor, and the FM-C700 video codec which allows communications at speeds between 64 kb/s and 1.5 Mb/s.	March 1992
	Advanced Satellite Digital Communications System (SDCS-2)	The SDCS-2 adopts multicarrier time division multiple access (TDMA) technology to increase the circuit accommodation efficiency of satellite transponders. This makes it possible to provide service to a greater number of customers more efficiently.	August 1991
2. Technology for Network Integration	Upgraded D60 Digital Switching System	The improved D60 digital switch features expanded call switching capacity and more powerful processors with greater processing capacity. In addition, it also provides network node interface (NNI) compatibility that allows direct connection to transmission lines to support communications at 52 Mb/s. These enhancements work to reduce total system costs.	October 1991
	Single Slot Type Trunk Optical Fiber Cable	Work is proceeding throughout Japan on the construction of an optical fiber trunk network, with the aim of achieving the early implementation of a nationwide digital telecommunications network. Conventional trunk optical fiber cable has been developed, which can accommodate 300 optical fibers and supports the construction of small-diameter, lightweight and long-span trunk cables.	August 1991
	High-speed Packet Switch	A high-speed packet switch has been developed to facilitate easy and economic expansion of the network to accommodate the rapid increase in demand for packet communications service. It supports the construction of a high-performance trunk network for packet communications.	September 1991
	Dynamic Channel Assigning and Routing Satellite-aided Digital Network II	This ISDN satellite communications system sets up circuits on an individual call basis and is applicable to both trunk and subscriber networks. It has been developed to allow immediate response to demand for INS-Net services in areas where terrestrial digital facilities have not yet been implemented.	December 1991
	Anti-Shake Damper for Steel Microwave Communications Towers	This anti-shake damper works to reduce horizontal vibration of steel microwave communications towers caused by earthquakes. The damper is installed on the	December 1991

Field	Equipment/System Developed	Functions, Features, Etc.	When Introduced
		topmost platform of a tower and can easily suppress translational motion of the tower caused by a large earthquake.	
3. Operation Technology, Support Technology	Integrated Mobile Communications Operation System	An integrated operation system has been developed for mobile communications, including automobile and portable telephone, radio pagin, maritime telephone and aeronautical telephone services.	March 1992 *
	Field Service Vehicle Incorporating Compact Elevator (Sky Pal)	Service order installation or repair work done at high places is generally performed with the use of ladders or by climbing telephone poles. This entails certain risks and service personnel sometimes fall or suffer other accidents. In addition, the bucket vehicles currently employed in service order work are difficult to use on narrow streets because of their large size. A compact field service vehicle has been developed around a minivan, which is fitted with a compact elevator for working at high places. This low-cost vehicle provides excellent maneuverability.	July 1991 *
	PMF Super-shield Tunneling Method	A new shield tunneling technology has been developed in which a slurry plasticizer, consisting mainly of paper microfiber, is injected at the front of the shield machine. As a result, this method improves the stability of the cutting face, reduces construction costs and allows safe excavation under a condition of high subterranean water pressure.	December 1991 *
	Customer Oriented Service Management Operation System (COSMOS)	A system has been developed that supports quick service restoration by automatically providing comprehensive operations information when a failure occurs, including a list of affected circuits, indicating the impact on service and present traffic conditions. By providing an accurate picture of the service impact, it enables corrective measures to be prioritized and allows service to be restored promptly, thereby providing customers with improved quality of service.	January 1992 *
	Integrated Software Design Automation System (SoftDA)	SoftDA is an integrated computer-aided software engineering (CASE) system that has been developed to improve software quality and the productivity of software development. It runs on a workstation and supports all processes of software development from analysis and design to debugging.	February 1992 *
4. Advanced/ Basic Technology to Carry Future Telecommunication	Initiation of Comprehensive VI&P Experiments	NTT is moving ahead with the development of a wide range of advanced technologies to achieve its VI&P vision of visual, intelligent and personal communications services in the 21st century. Comprehensive experiments have been initiated to evaluate and confirm various VI&P services incorporating the results achieved to date, as well as the network functions and technologies forming the infrastructure for the provision of these future services. The Yokosuka R&D Center is playing a central role in conducting these experiments.	February 1992 *
	Master Reference System for Assessment of B-ISDN Service Quality	NTT has pioneered the world's first standard reference system for assessing service quality in broadband ISDN. This system incorporates functions for evaluating various factors affecting digital service quality and can simulate a variety of B-ISDN conditions. These capabilities make it possible to conduct subjective service quality evaluations.	October 1991 *
	Efficient Digital Signature Scheme (ESIGN)	A digital signature scheme has been developed which adopts advanced encryption technology to allow easy and secure use of electronic documents prepared on word processors or personal computers. This technology makes it possible to verify the sender's identity in facsimile or PC communications and to check whether the data have been tampered with.	July 1991 *
	15" Three-dimensional Video Display Unit	A large-size three-dimensional video display has been developed which enables viewers to see vivid, stereoscopic images directly even in a bright room withou using any special glasses.	June 1991 *

Field	Equipment/System Developed	Functions, Features, Etc.	When Introduced
4. Advanced/ Basic Technology to Carry Future Telecommunication	High-quality Color Facsimile	A high-quality color facsimile with ISDN (INS-NET 64) compatibility has been developed, which adopts a new ion-flow printing system that delivers superb quality rivaling that of color photographs.	June 1991 *
	Personal Multimedia-Multipoint Teleconference System (PMTC)	The PMTC is a new desktop teleconference system that supports voice, full-motion video and data such as text and drawings. This system allows connections to a maximum of 20 sites and provides a real sense of presence.	July 1991 *
	Successful Experiment on Holographic Optical Switch Using Liquid Crystal Display	The operation of a holographic optical switch built with a liquid crystal display was successfully confirmed. This switch is aimed at the development of an optical switching system and can switch multiple light beams in parallel when holograms are written to different areas of the LCD.	November 1991 *
	Interface for Real-time Operating Systems (IROS)	The IROS Specification has been developed to support the implementation of various vendors' systems in real-time applications, such as for switching, transmission and communications processing.	November 1991 *
	Successful Transmission of 10 Gb/s Optical Signals	NTT conducted the world's first successful transmission of 10 Gb/s optical signals over a distance of 1,260km via optical fibers installed in a commercial route from Tokyo to Hamamatsu. The test confirmed that 10 Gb/s transmission is possible just by replacing conventinal transmission equipment.	January 1992 *
	Fiber-optic Subcriber Network Systems Field Trial	Experimental fiber-optic systems have been developed and are now undergoing field trial testing to confirm their functional operation under real-world conditions, along with examining the associated engineering methods. Such systems will provide the infrastructure for implementing NTT's VI&P vision of future communications services.	February 1992 *
	Digital Mobile Communications Equipment	Prototypes of the base station equipment for a digital mobile communications system were developed and their principal functions and characteristics were tested. The equipment include an amplifier, modulator/ demodulator, voice processor and controller, all of which comply with the Japanese standard specifications.	October 1991 *
	Synchrotron Orbital Radiation Lithographic System for Development of VLSIs with Ultrafine 0.2 μm Features	A synchrotron orbital radiation (SOR) lithographic system has been developed for use in R&D work on VLSIs having ultrafine circuit patterns on the order of 0.2 μm.	September 1991 *
	0.1 μm Gate CMOS/SIMOX Device	A 0.1 μm gate CMOS (complimentary metal oxide semiconductor) device has been fabricated and operated at room temperature for the first time in the world. It adopts SIMOX (separation by implanted oxygen) process technology.	December 1991 *
	Nonlinear Electrooptic Polymer	A new electric polymer has been developed whose second-order nonlinear optical susceptibility is about seven times higher than conventional light modulating inorganic crystal; $LiNbO_3$. The material can be used to fabricate lowvoltage-driven ultrafast waveguide type optical modulators and switches.	October 1991 *
	Submicron Magnetic Storage Media Using PointMagnetic Recording Concent	Basic reserch is being conducted on high density storage media as one part of NTT's R&D work on future storage systems. Using the point magnetic recording concept, record/playback/erase operations have been confirmed for the world's smallest magnetic bits, having a cell size of about 0.4 μm in diameter.	July 1991 *
	New Silicon Material Capable of Emitting Light — Formation of Quantum Boxin a Flask	A silicon cube, in which the silicon atoms are orderly arragned in three orthogonal directions, has been fabricated for the first time in the world by making use of the chemical reactions occurring in a solution in a flask. As an application of this synthesis technology, a new silicon material has been developed that emits visible light over a wide range of wavelengths.	May 1991 *

(*: Indicates date information released; others are dates service initiated)

NTT's ISDN

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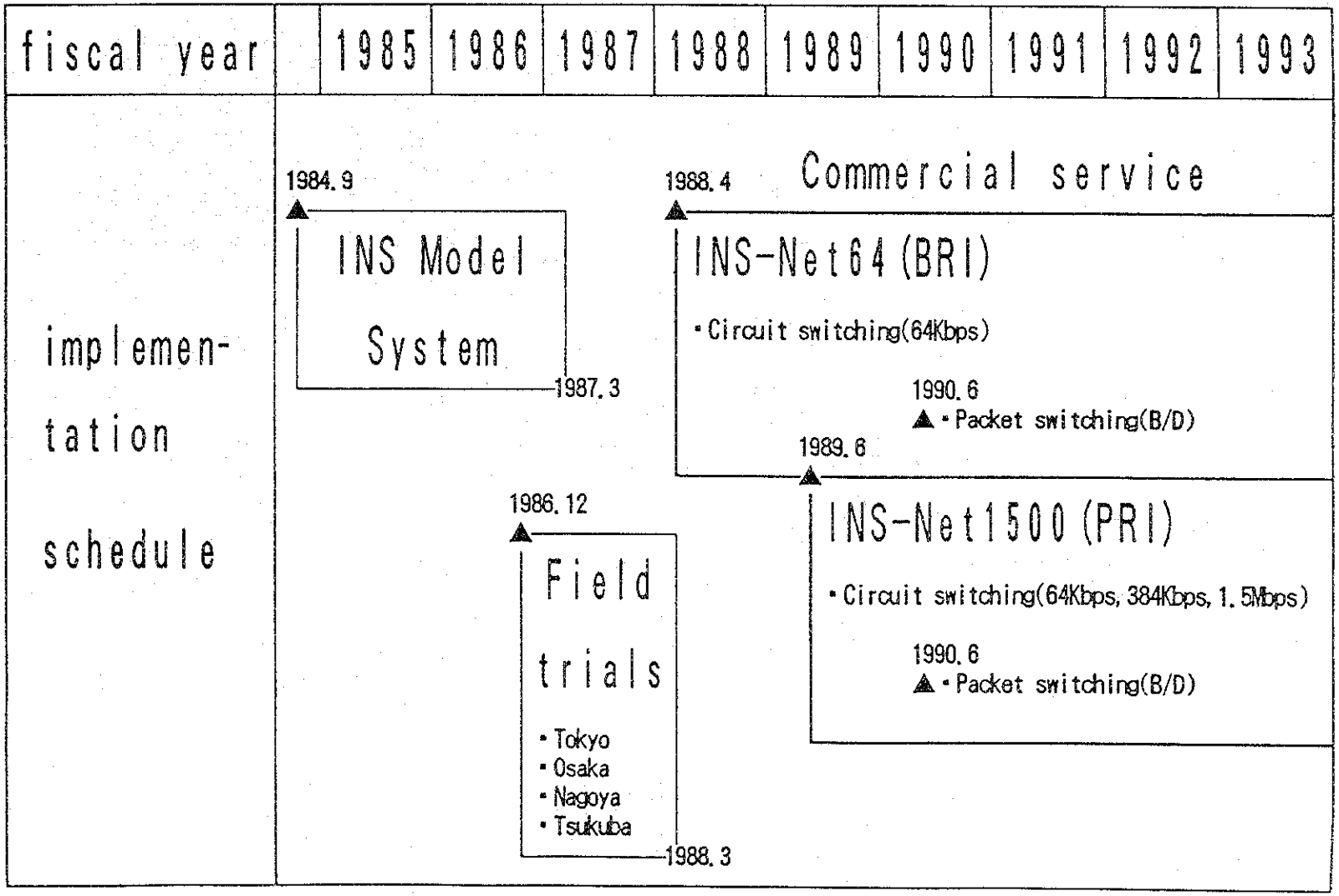
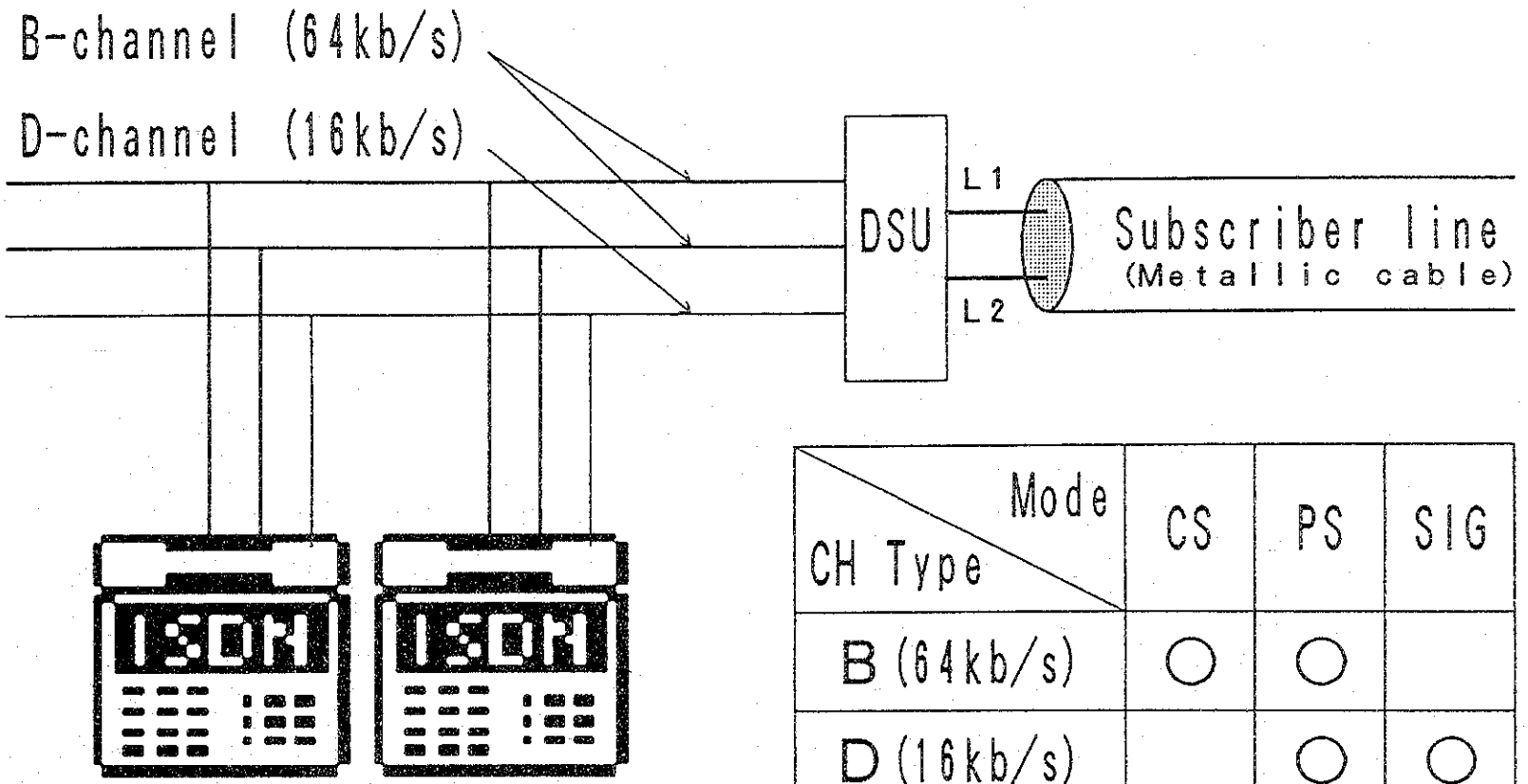
NTT's ISDN Implementation Schedule



INS-Net64 (BRI) Service

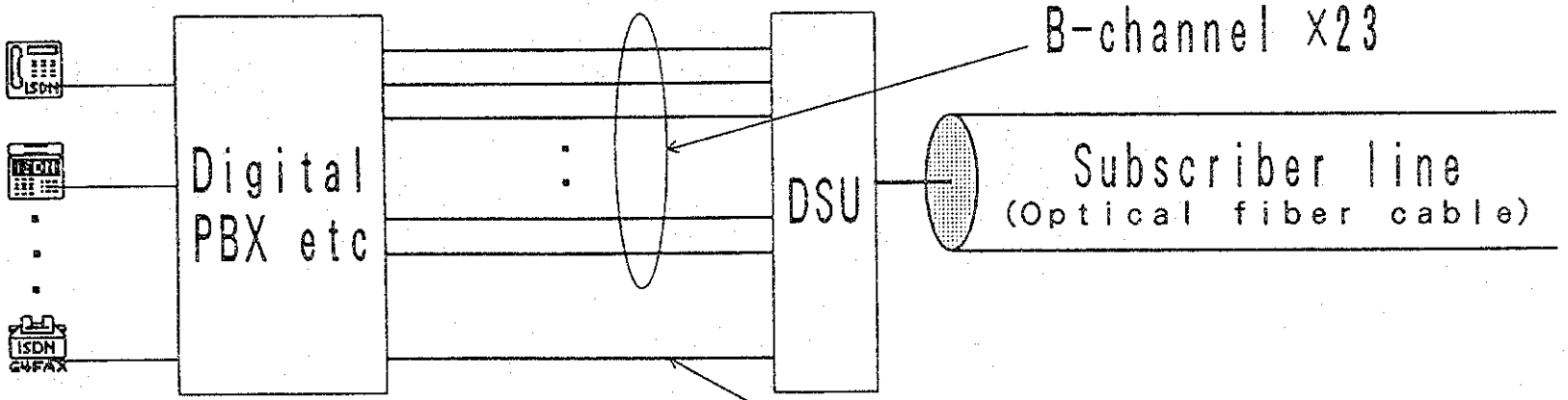


INS-Net64 (2B+D)

CH Type \ Mode	CS	PS	SIG
B (64kb/s)	○	○	
D (16kb/s)		○	○

DSU: Digital Service Unit
CS: Circuit switching
PS: Packet switching
SIG: Signaling

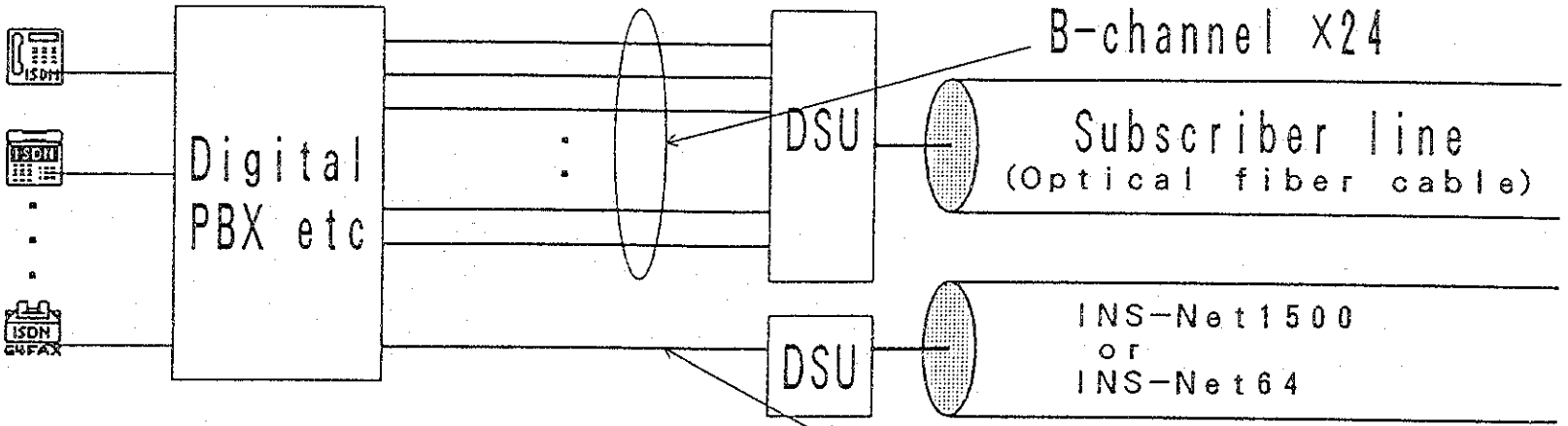
INS-Net1500 (PRI) Service
Used as 23B+D (Type I)



Mode / CH Type	CS	PS	SIG
B (64kb/s)	○	○	
H0 (384kb/s)	○		
D (64kb/s)		○	○

DSU: Digital Service Unit
CS: Circuit switching
PS: Packet switching
SIG: Signaling

INS-Net1500 (PRI) Service
Used as 24B/D (Type II)



CH Type \ Mode	CS	PS	SIG
B (64kb/s)	○	○	
H0 (384kb/s)	○		
H1 (1536kb/s)	○		
D (16or64kb/s)		○	○

DSU: Digital Service Unit
CS: Circuit switching
PS: Packet switching
SIG: Signaling

INS-Net Bearer Service

information transfer mode	information transfer capability	transmission speed	channel type
circuit mode	unrestricted	64Kbps	B
		384Kbps	H0
		1.5Mbps	H11
	speech	64Kbps	B
	audio	64Kbps	
packet mode	unrestricted	depending on throughput class	B D

Supplementary Service

- Calling line identification
- Sub addressing
- Advice of charge
- Direct dialing in

(from Apr. 1988)

- Terminal portability
- Call waiting
- Three party service
- Call deflection
- Call transfer

(from Aug. 1989)

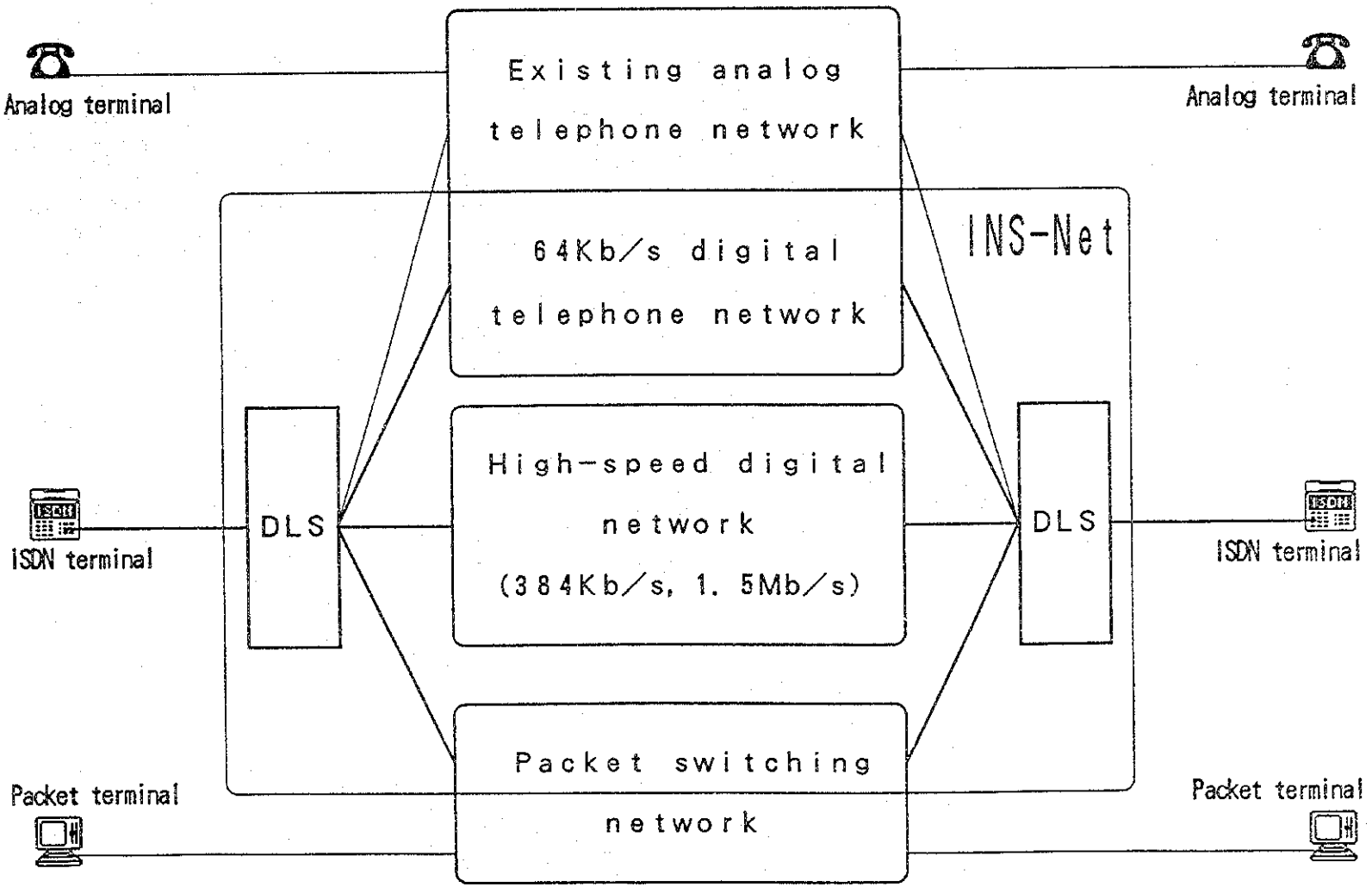
- User-to-user signaling

(from Set. 1990)

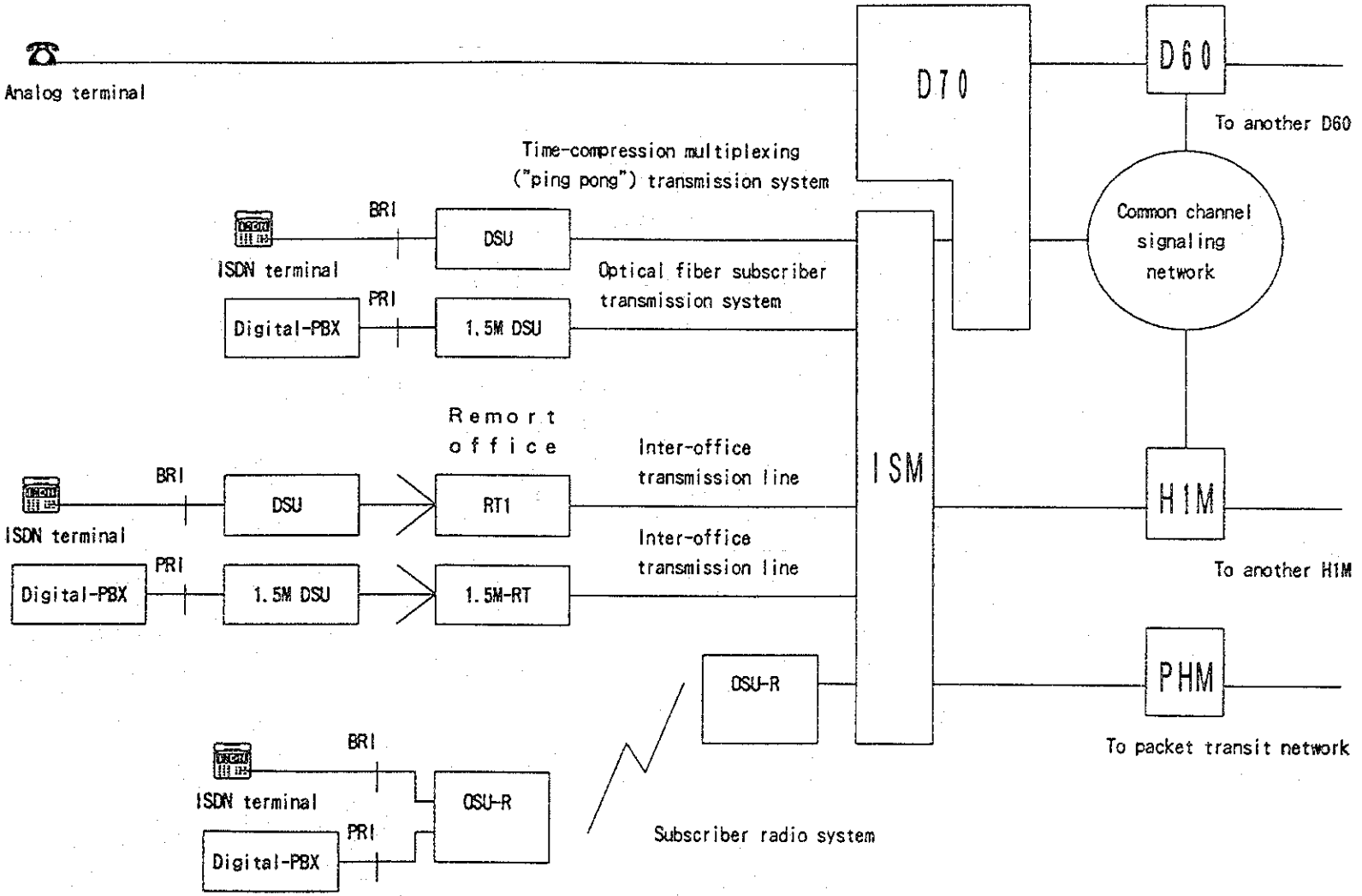
- Closed user groupe (CUG)

(from Oct. 1992)

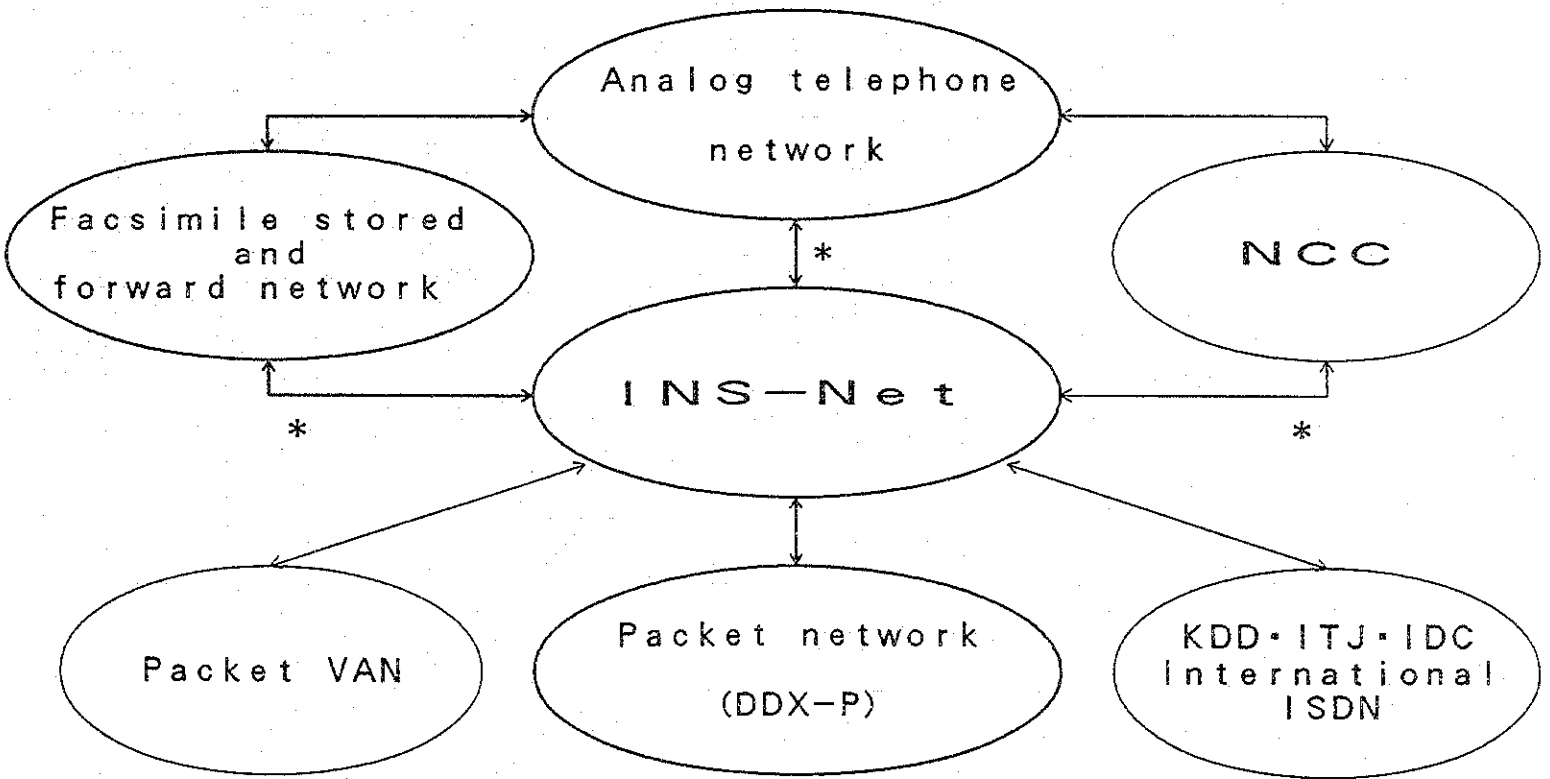
Network Configuration



ISDN System Configuration



Interconnection between INS-Net and Other Networks



NCC; New common Carriers *: only voice mode

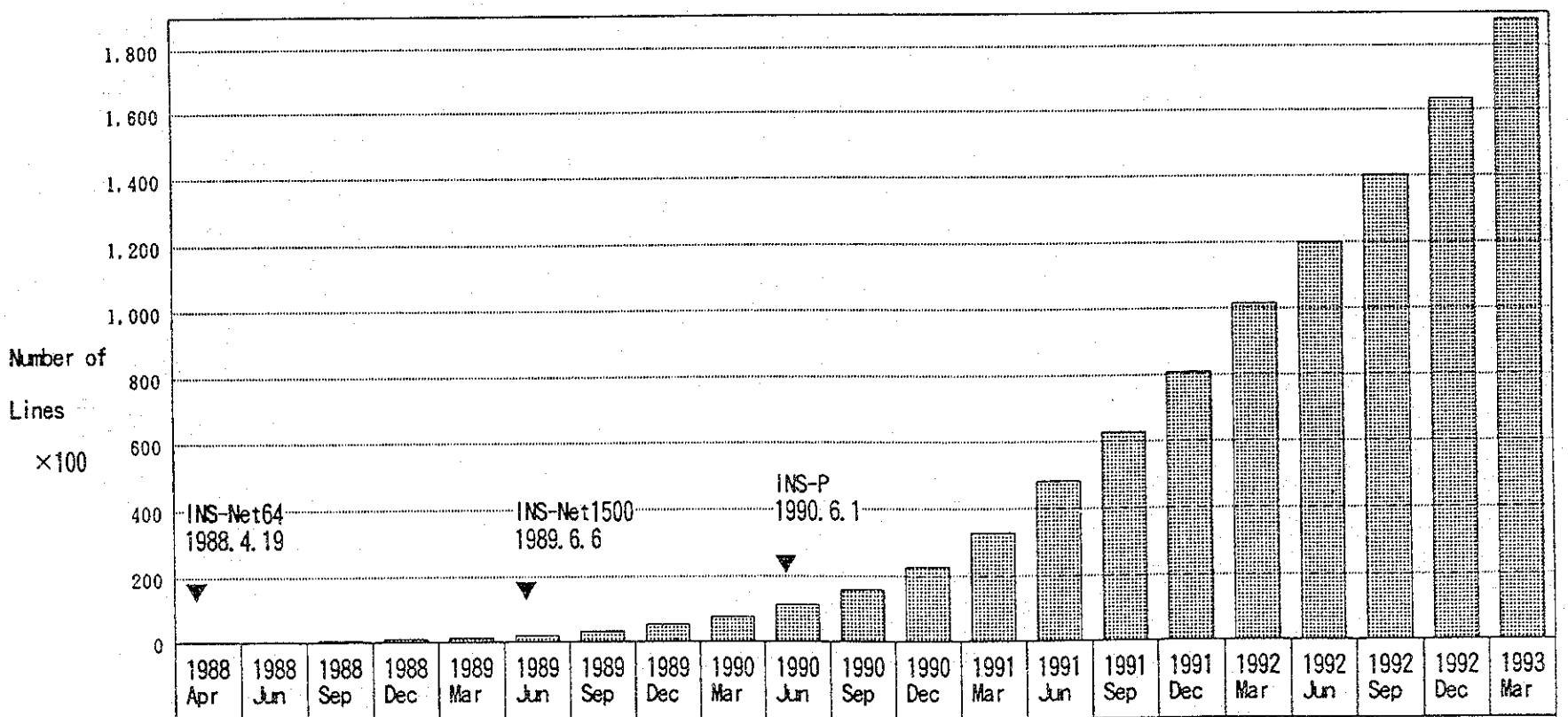
・U. S. A.	・France	・Belgium	・Denmark
・U. K.	・Italy	・Spain	・New Zealand
・Singapole	・Vatican City	・Holland	・Hawaii
・Australia	・San Marino	・Sweden	・Luxemburg
・Hong Kong	・Germany	・Switzerland	・Norway etc.

Example of Value-added Applications

Main Media		Main Equipment or Technology	INS-Net Features Utilized					Typical Applications or Results
			Speed	Quality	Digital	ID signal	Multiple channels	
Speech/Audio		Hi-Fi telephone (7KHz, Stereo)			○		○	Music transmission Live radio broadcasts on location
		Telemarketing system				○		Receptionist agency system
Image	FAX	G4 facsimile	○	○				Gateway multi-address system
		G4 facsimile + Database	○	○				Database of newspaper and magazine articles
	Still images	Color image communication unit	○	○	○			Transmission of news photographs Electronic pamphlets
		High resolution image communication unit	○	○	○			Transmission of design drawings
	Natural motion picture	Video conferencing unit or videophone	○	○	○			Video conferencing Financial consulting
		Remote monitoring unit	○	○	○			Cash dispenser corner monitoring
Data		High speed file transfer	○	○				Transmission of floppy disk data CAD/CAM data transfer
		LAN-to-LAN connection	○	○				Database sharing between headoffice and branches

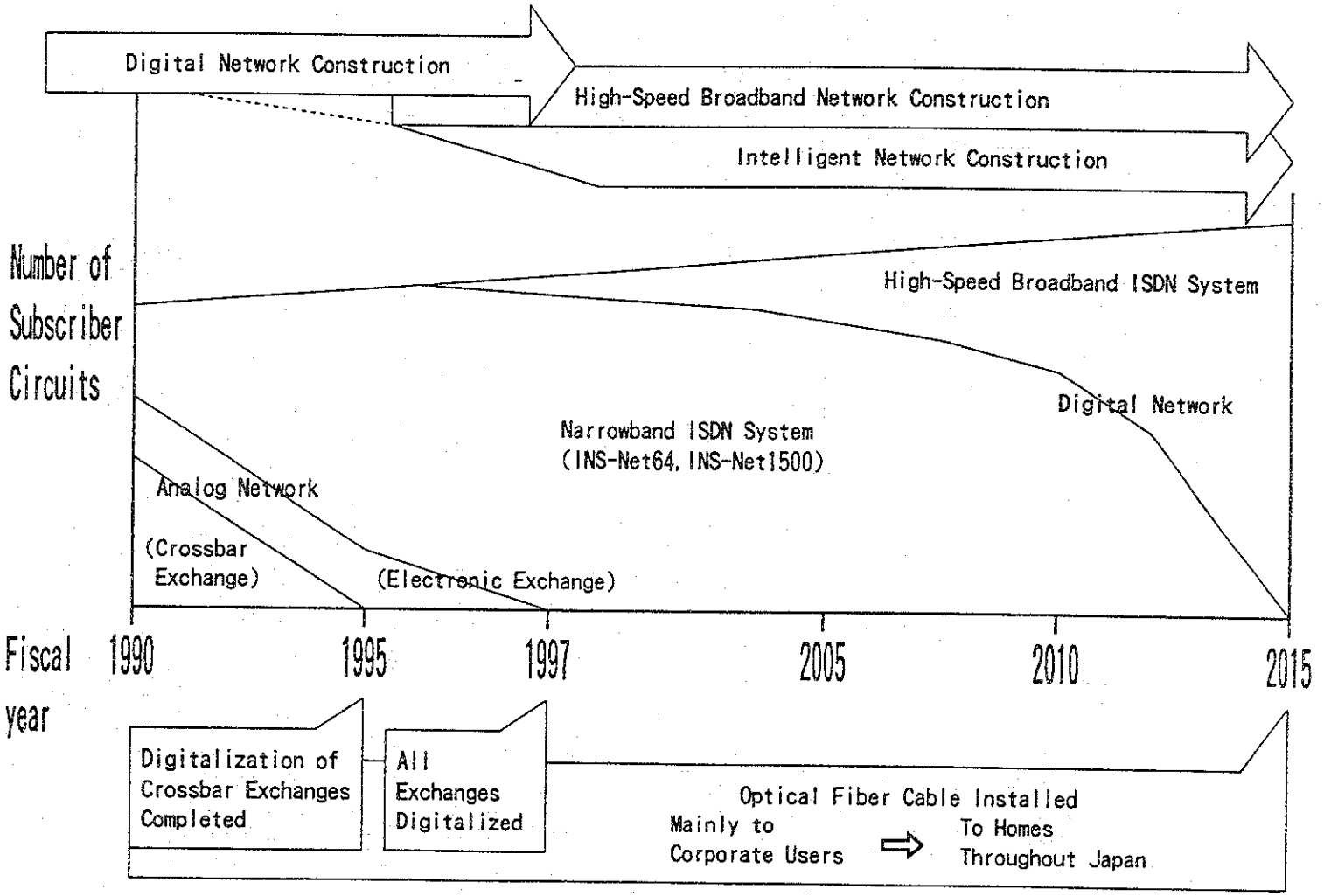
(11)

Increase in INS-Net Subscriber Lines



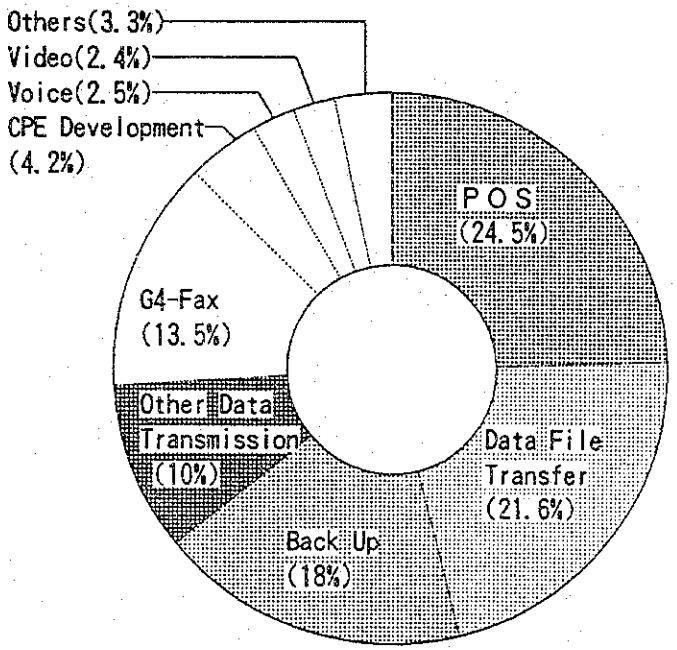
INS-Net64	1,198	6,574	27,313	84,139	156,811
INS-Net1500	———	117	560	1,751	3,109
INS-Net Total	1,198	7,744	32,913	101,649	187,901
Service Areas	29	195	1,222	2,049	2,430

Network Diditization Schedule



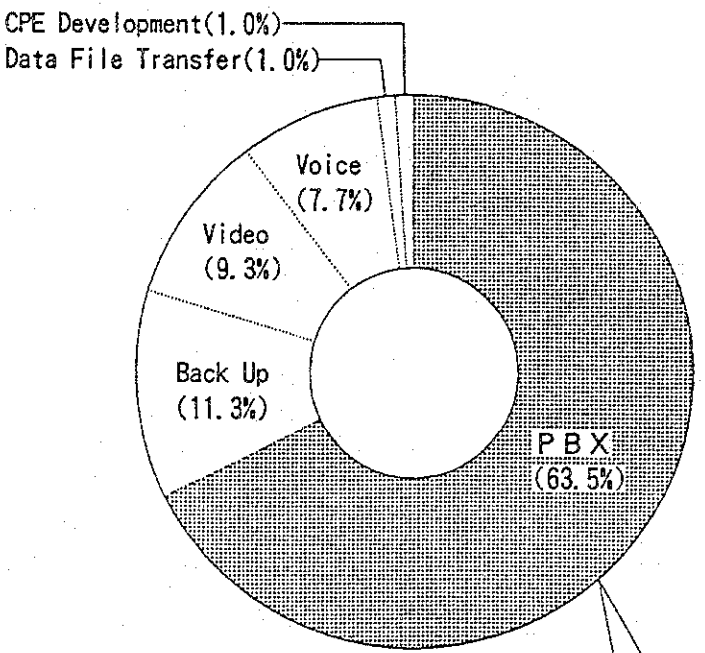
ISDN Applications

INS-Net64



Data Transmission
(74.1%)

INS-Net1500



PBX
(63.5%)

Charge for INS-Net64

Initial Cost (Non-recurring)	Contract fee Installation fee Packet communications use for the 1st channel for additional channel	800yen (per subscriber line) 72,000yen (per subscriber line) 2,000yen (the 1st channel only) 1,000yen/channel
Monthly Charges	Line charge Business Use Residential Use Packet communications surcharge B channel packet D channel packet Wiring equipment usage charge * Equipment rental charge *	3,630yen/month(per subscriber line) 2,830yen/month(per subscriber line) 3,500yen/month(per B channel) 1,000yen/month(per D channel) 60yen/month(per wired line) 1,700yen/month(per DSU)
Call Charges	Telephone mode (Speech/3.1kHz Audio) Digital communication mode (64kb/s) Packet communication mode	Same as ordinary analog telephone charge unit;10yen 180sec(local) to 10sec(over 160km) 0.4yen(up to 100km) for up to 128oct 0.5yen(over 100km) for up to 128oct
User-to-user signalling Charge		0.4yen/1 message (Max.128octets)
Charge for Supplementary Services	Incoming call notification during transmission Flexphone service (Multiple connections of call deflection, Call waiting, Three party service, Call transfer) Services now offered in analog public network (Direct dialling in, Free dial etc.) etc.	—— 1,000yen/month (Use in various combination of four function) Same as ordinary analog telephone

Note: * are necessary when using equipment rented from NTT.
Basic services: Calling line identification presentation, Sub-addressing, Advice of charge, Terminal portability etc.

Charge for INS-Net1500

Initial Cost (Non-recurring)	Contract fee	800yen (per subscriber line)
	Installation fee	102,000yen (per subscriber line)
	High-speed communications use	1,000yen (per subscriber line)
	Packet communications use for the 1st channel	2,000yen (the 1st channel only)
	Packet communications use for additional channel	1,000yen/channel
Monthly Charges	Line charge	31,000yen/month(per subscriber line)
	High-speed communication surcharge	2,000yen/month(per subscriber line)
	Packet communications surcharge B channel packet	3,500yen/month(per B channel)
	Packet communications surcharge D channel packet	1,000yen/month(per D channel)
	Wiring equipment usage charge *	2,000yen/month(per wired line)
	Equipment rental charge *	12,000yen/month(per DSU)
Call Charges	Telephone mode (Speech/3.1kHz Audio)	Same as INS-Net64
	Digital communication mode (64kb/s)	Same as INS-Net64
	(384kb/s)	charge unit;30yen 90sec(local) to 6sec(over 320km)
	(1.5Mb/s)	charge unit;60yen 50sec(local) to 4.5sec(over 320km)
	Packet communication mode	Same as INS-Net64
User-to-user signalling Charge		Same as INS-Net64
Charge for Supplementary Services	Incoming call notification during transmission Flexphone service Services now offered in analog public network (Direct dialling in, Free dial etc.) etc.	Same as INS-Net64

Note: * are necessary when using equipment rented from NTT.
Basic services: Calling line identification presentation, Sub-addressing, Advice of charge, Terminal portability etc.

TECHNOLOGY DEVELOPMENT

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N T T

1. Objectives of technology Development
2. Change in attitude toward technical development
3. VI&P concept
4. Technology to support the VI&P concept
5. New service development/service advancement
6. Making work more efficient / rational
7. Operation system

NTT