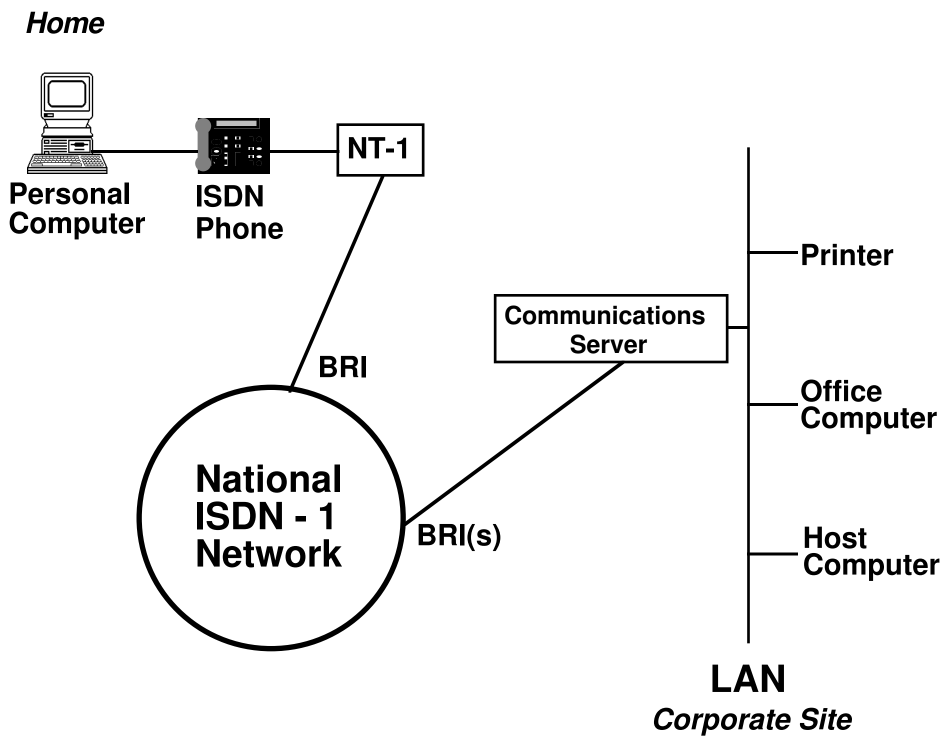
3.1.19 Telecommuting with casual data requirements

ISDN can provide a person who works at home or in a satellite office with value-added casual access to the corporate computing environment using D channel packet switching at speeds up to 9.6 kbps. For example, a user may need electronic mail or access to corporate directories. Security can be maintained by using the ISDN X.25 Fast Select feature within the application on the corporate system to allow access from only a particular set of users. Packet access is reliable and relatively inexpensive. With one ISDN line, the user has both voice and data; two analog lines are unnecessary. With ISDN, the user benefits from advanced voice features like those available at the office. Calling number identification can cut down on interruptions by letting the user screen incoming calls.

Configuration: (1, **2**, 3, 4)



How It Works:

Using a 9600 bps D channel packet-data call, the telecommuter can call into the Communications Server and access applications on the LAN. The Communications Server supports the internetworking of Personal Computers on ISDN interfaces with printers, file servers, and computers on the LAN. The Telecommuter can also use the X.25 Fast Select feature to "piggyback" security information onto the call request as Call User Data. The Communications Server uses this information to control access to the LAN. The Communications Server is set up with a Multiline Hunt Group (MLHG). With a hunt group, users all dial in to the same number (the Hunt DN), greatly simplifying administration and spreading access uniformly over all lines. The Communications Server may also be set up to accept charges for dial-in calls on behalf of the telecommuter.

Obtain Equipment with These Capabilities

Personal Computer

- Applications software, compatible with communications software and far end.
- Optional communications software support for the use of Fast Select.
- Compatible interface to ISDN Phone (e.g., RS-232, RS-449, V.35).

ISDN Phone

- B channel capabilities:
  - Voice calling on a single B channel.
  - If using NI-1, support for one Directory Number (DN) and Service Profile ID (SPID) will be needed.
- D channel capabilities:
  - Packet-data on the D channel.
  - If using NI-1, support for a separate DN (with fixed TEI) will be needed.
  - Packet Assembler & Disassembler (PAD) function, supporting X.3, X.28, X.29.
  - Support for the packet-data features listed under "Network Interface to ISDN Phone".
- Physical interfaces:
  - Serial connection to Personal Computer (e.g., RS 232, RS-449, or V.35).
  - RJ-45 connector to NT-1, or integrated NT-1.

Communications Server

- Application software compatible with communication software and with far end.
- Security screening application: verify employee access based on Calling or Redirecting Number, optionally using Call User Data with Fast Select.
- Multiple BRIs to meet network traffic requirements,.
- B channel capabilities for each BRI:
  - Packet-data on each B channel.
  - Support for the packet-data features listed under "Network Interface to Communications Server."
- Physical interfaces:
  - Local LAN (e.g., Ethernet or Token Ring).
  - RJ-45 connector to NT-1, or integrated NT-1.

Request These Capabilities From ISDN Service Provider

Network Interface to ISDN Phone

Network Services Required:

- One BRI. (1B+D)
- One B channel for voice calls, with voice DN and SPID.
- Packet-data on the D channel, with packet-data DN and fixed TEI.
- Voice Features:
  - None required.
  - Optional Call Forwarding - Variable, Call Forwarding - Interface Busy, Call Forwarding - Don't Answer, and Message Waiting Indicator.
  - Optional Flexible Calling (includes 3-Way Conference Calling, Hold, Transfer, and Drop).
  - Optional Calling Number Identification Services.
- Packet-Data Features:
  - Logical Channels: At Least 1 Two-Way LC.
  - Throughput Class : 9600 bps.
  - Maximum User Data Field: 128 Octets.
  - Packet Window Size: 2.
  - Optional Fast Select (Unrestricted) & Fast Select Acceptance.
  - Optional Reverse Charging.
  - Optional Throughput Class Negotiation.
  - Optional Flow Control Parameter Negotiation.

Subscription or Ordering Information:

- This interface is configured for simultaneous voice calls and packet-data on the D channel (NIIG 6). Other NIIGs which have this functionality include 8, 20-23, 25, 27, and 28.
- Parameter Groups for Optional Voice Features:
  - NIPG 2 - Advanced Call Forwarding for Voice.
  - NIPG 3 - Flexible Calling for Voice.

- Parameter Groups for Packet-Data Features:
    - NIPG 7 - Basic D Channel Packet-Data. In addition request Flow Control Parameter Negotiation (window size and packet size), and Throughput Class Negotiation.

Network Interfaces to Communications Server

Network Services Required:

- One or more BRI. (2B)

For each BRI:

- Packet-data at 9.6 Kbps on each B channel (semi - permanent), with packet-data DN for each.
- Packet-Data Features:
    - Multiline Hunt Group, with Hunt DN
    - Logical Channels: As many as needed to serve callers.
    - Throughput Class : 9600 bps.
    - Maximum User Data Field: 256 Octets.
    - Packet Window Size: 2.
    - Fast Select (Unrestricted) & Fast Select Acceptance.
    - Reverse Charge Acceptance

Subscription or Ordering Information:

- This interface is configured for packet-data calls on two B channels (NIIG 19).
- Parameter Groups for Packet-Data Features:
    - NIPG 9 - Basic B Channel Packet-Data. Select number of Logical Channels.
    - A la carte: Multiline Hunt Group.

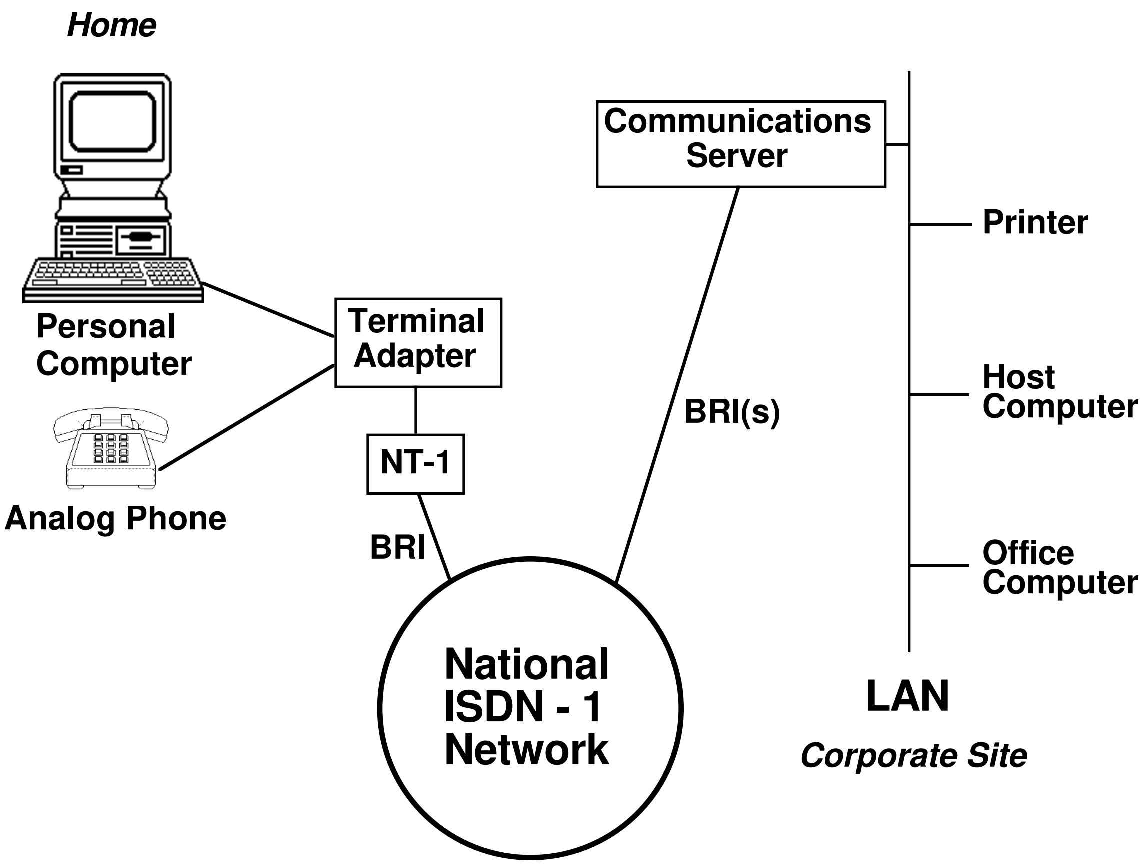
Technical Notes

- This example shows that the packet-data B channels in the MLHG terminate directly into the Communications Server. It is also possible that the packet-data B channels could terminate on an ISDN Terminal Adapter, which in turn would connect to the ports on the Communications Server using conventional X.25 interfaces (e.g. RS-449 or V.35 at the physical level).
- In some cases, the packet-data configuration of the Phone and the Communications Server will not be the same. In these cases, it will be more likely that calls are completed if the Phone, the Communications Server and their packet-data DNs also support Throughput Class Negotiation & Flow Control Parameter Negotiation.
- For additional information on Multiline Hunt Group, see Section 5.1.7.
- For details on subscription and ordering information using NIUF ISDN Interface Groups (NIIG) and NIUF ISDN Parameter Groups (NIPG), see Section 5.1.11.
- For detailed Signaling Flow Diagrams for this application, see Sections 5.2.1.4 (Voice Call Setup), 5.2.1.7 (packet-data Call Setup & Clearing) and 5.2.1.8 (packet-data Fast Select Setup & Clearing).

3.1.20 Telecommuting and transferring files

ISDN can provide a person who works at home or in a satellite office the ability to access, use, and send back files to corporate computing resources at speeds up to 64 kbps. For instance, a person might retrieve a large spreadsheet or word processing file and then work on that file on a home personal computer. When the work has been completed, the person could send the updated file. The solution shown here uses an X.25 data transfer mode that is always active. Such a solution is especially suitable when significant information transfer is expected between the end points but not enough to justify the cost of a leased line.

Configuration: (1, 2, <u>**3**</u>, 4,)



How It Works:

This example demonstrates B channel packet-data calling. From the personal computer's communications software, the Terminal Adapter dials a packet-data call to the Communications Server, an X.25 Gateway that interworks with the corporate network. After establishing the connection and bringing up an internetworking protocol, the user can access computing resources of the corporate network. Several packet-data features are demonstrated in this example, such as Multiline Hunt Group so users need only call in with a single number and fast select which delivers user data in the initial "call request" message to the Communications Server. It can be used for passwords and reverse charging so the corporation is billed directly for usage.

Obtain Equipment with These Capabilities

Personal Computer

- Application software compatible with communications software and far end.
- Serial connection to Terminal Adapter (e.g., RS-232, RS-449, V.35).

Terminal Adapter

- B channel capabilities:
  - Voice calling on a single B channel.
  - If using NI-1, support for one Directory Number (DN) and Service Profile ID (SPID) will be needed.
  - Packet-data on one B channel at 19.2 kbps.
  - If using NI-1, B channel packet is configured "semi-permanently" to one B channel. A single DN is assigned.
  - Packet Assembler & Disassembler (PAD) function, supporting X.3, X.28, and X.29.
  - At least one Logical Channel.
  - Support for the packet-data features listed under "Network Interface to ISDN Terminal Adapter".
- Physical interfaces:
  - Analog phone jack.
  - Serial connection to Personal Computer (e.g., RS-232, RS-449, or V.35).
  - RJ-45 connector to NT-1, or integrated NT-1.

Communications Server

- Application software compatible with communication software and with far end.
- Access control and accounting functions as required by corporation.
- Multiple BRIs to meet network traffic requirements.
- B channel capabilities for each BRI:
  - Packet-data on both B channel at 19.2 kbps.
  - If using NI-1, B channel packet is configured "semi-permanently" to each B channel. A single DN is assigned to each.
  - At least three Logical Channels.
  - Support for the packet-data features listed under "Network Interface to Communications Server".
- Physical interfaces:
  - Local LAN (e.g., Ethernet or Token Ring).
  - RJ-45 connector to NT-1, or integrated NT-1

Request These Capabilities From ISDN Service Provider

Network Interface to ISDN Terminal Adapter

Network Services Required:

- One BRI. (2B)
- One B channel for voice calls, with voice DN and SPID.
- Packet-data at 19.2 kbps on one B channel (semi-permanent), with packet-data DN .
- Voice Features:
  - None required.
- Packet-Data Features :
  - Logical Channels: At Least 1 Two-Way LC.
  - Throughput Class : 19.2 kbps.
  - Maximum User Data Field: 256 Octets.
  - Packet Window Size: 2.
  - Fast Select (Unrestricted) & Fast Select Acceptance.
  - Reverse Charging.

Subscription or Ordering Information:

- This interface is configured for simultaneous voice calls and packet-data on the B channel (NIIG 13). Other NIIGs which have this functionality include 18, 23, and 28.
- Parameter Groups for Packet-Data Features:
  - NIPG 10 - Advanced B Channel Packet-Data.

Network Interface to Communications Server

Network Services Required:

- One or more BRI. (2B)

For each BRI:

- Packet-data at 19.2 kbps on each B channel (semi - permanent), with packet-data DN for each.
- Packet-Data Features:
  - Multiline Hunt Group, with Hunt DN
  - Logical Channels: At Least 3 two-Way LC.
  - Throughput Class : 19.2 kbps.
  - Maximum User Data Field: 256 Octets.
  - Packet Window Size: 2.
  - Fast Select (Unrestricted) & Fast Select Acceptance.
  - Reverse Charge Acceptance

Subscription or Ordering Information:

- This interface is configured for simultaneous packet - data calls on two B channels (NIIG 19). Other NIIGs which have this functionality include 29.
- Parameter Groups for Packet-Data Features:
  - NIPG 10 - Advanced B Channel Packet-Data. Specify number of logical channels.
  - A la carte: MultiLine Hunt Group.

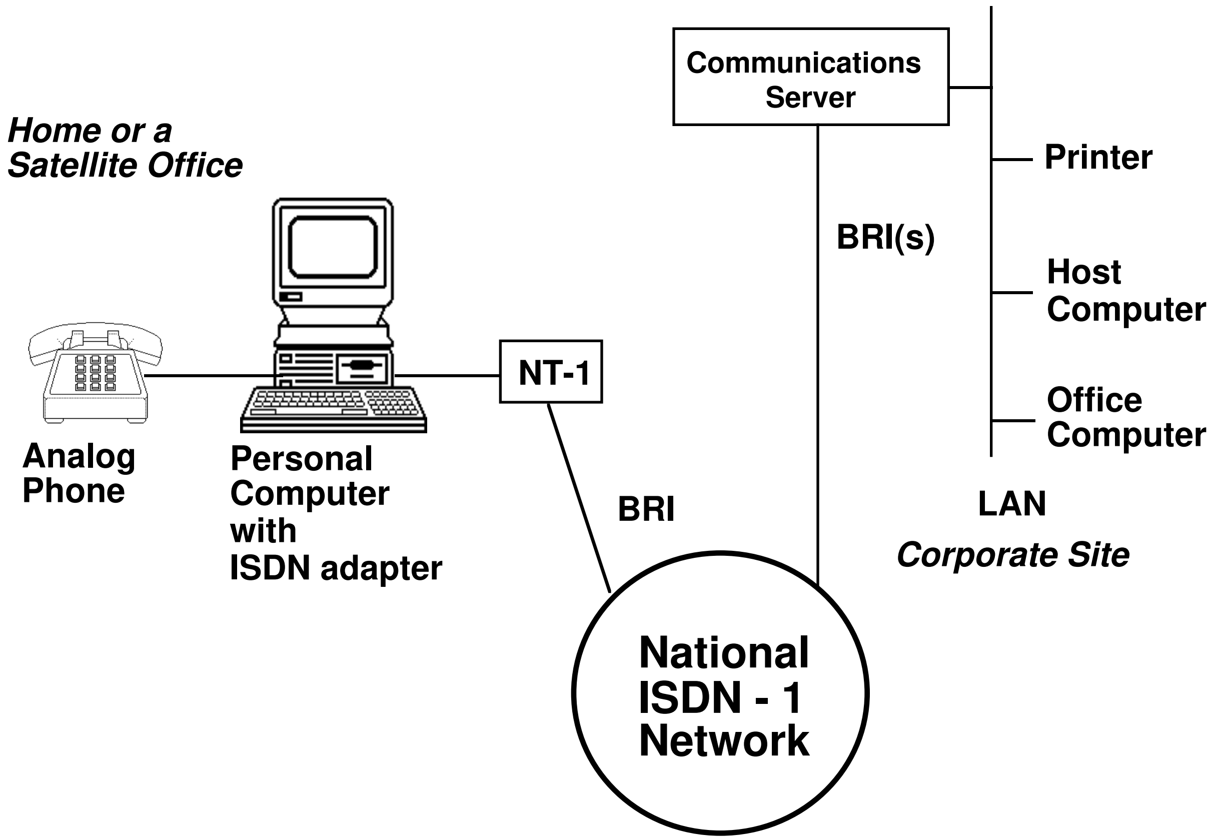
Technical Notes

- The Communications Server can accept the charges for dial-in calls. To do so, the TA is configured with Reverse Charging and the Server is configured with Reverse Charging Acceptance.
- In some cases, the configuration of the TA and the Communications Server will not be the same. In these cases, the likelihood of packet-data call completion will be much higher if the TA, the Communications Server are configured with Throughput Class Negotiation & Flow Control Parameter Negotiation.
- This example shows the ISDN lines terminating directly on the Communications Server. It is also possible that the BRIs could terminate on ISDN Terminal Adapters which in turn would connect to the ports on the Communications Server using conventional X.25 interfaces (e.g. RS-449 or V.35 at the physical level).
- For additional information on MLHG, see 5.1.7.
- For details on subscription and ordering information using NIUF ISDN Interface Groups (NIIG) and NIUF Parameter Groups (NIPG) , see Section 5.1.11.
- For detailed Signaling Flow Diagrams for this application, see Sections 5.2.1.4 (Voice Call Setup), 5.2.1.6 (Voice & Circuit-data Call Clearing), 5.2.1.7 (packet-data Call Setup & Clearing) and 5.2.1.8 (packet-data Fast Select Setup & Clearing).

3.1.21 Telecommuting accessing interactive services

ISDN can provide a person who works at home or in a satellite office on-line access to the corporate computing environment and use of interactive applications like screen editors and database programs. With data exchanged at rates of 38.4 or 64 kbps, performance is much improved over modems that are typically limited to speeds up to 14.4 kbps.

Configuration: (1, 2, 3, 4, 5)



How It Works:

Through the communications software, the user at the personal computer places a circuit-data call to the communications server. The communications server can provide accounting and access control if needed. Depending on what the user wants to do, the Network Operating System sets up connections to the appropriate servers.

Obtain Equipment with These Capabilities

Personal Computer with ISDN Adapter

- Application software compatible with communication software and far end.
- B channel capabilities:
  - Voice calling on a single B channel.
  - Circuit-data calling on a single B channel.
  - If using NI-1, support for two Directory Numbers (DNs) and Service Profile IDs (SPIDs) will be needed.
  - Support rate adaptation for rates lower than 64 kbps. For example, asynchronous communications may be rate adapted using V.120.
- Physical interfaces:
  - Analog phone jack.
  - RJ-45 connector to NT-1, or integrated NT-1.

Communications Server

- Application software compatible with communication software and with far end.
- Multiple BRIs to meet network traffic requirements.
- B channel capabilities for each BRI:
  - Simultaneous circuit-data calling on two B channels.
  - If using NI-1, support for two Directory Numbers (DNs) and Service Profile IDs (SPIDs) will be needed.
  - Support rate adaptation for rates lower than 64 kbps. For example, asynchronous communications may be rate adapted using V.120.
  - Support for the circuit-data features listed under "Network Interface to Communications Server".
- Physical interfaces:
  - Local LAN (e.g., Ethernet or Token Ring).
  - RJ-45 connector to NT-1, or integrated NT-1

Request These Capabilities From ISDN Service Provider

Network Interface to Personal Computer with ISDN Adapter

Network Services Required:

- One BRI. (2B)
- One B channel for voice calls, with voice DN and SPID.
- One B channel for circuit-data calls, with circuit-data DN and SPID.
- Voice Features:
  - None required.
- Circuit-Data Features:
  - None required.

Subscription or Ordering Information:

- This interface is configured for simultaneous voice calls and circuit-data calls (NIIG 11). Other NIIGs which have this functionality include 12, 15, 17, 21, 22, 25, and 27.
- Parameter Groups for Optional Voice Features:
  - NIPG 2 - Advanced Call Forwarding for Voice.
  - NIPG 3 - Flexible Calling for Voice.

Network Interface to Communications Server

Network Services Required:

- One or more BRI. (2B)

For each BRI:

- Two B channels for circuit-data calls, with circuit-data DNs and SPIDs.
- Circuit-Data Features:
  - Multiline Hunt Group.

Subscription or Ordering Information:

- This interface is configured for two simultaneous circuit-data calls (NIIG 14). Other NIIGs which have this functionality include 15, 17, 24, 25, and 27.
- Parameter Groups for Circuit-Data Features:
  - A la carte: Multiline Hunt Group

- NIPG 6 - Advanced Call Forwarding for Circuit-Data. (Optional)

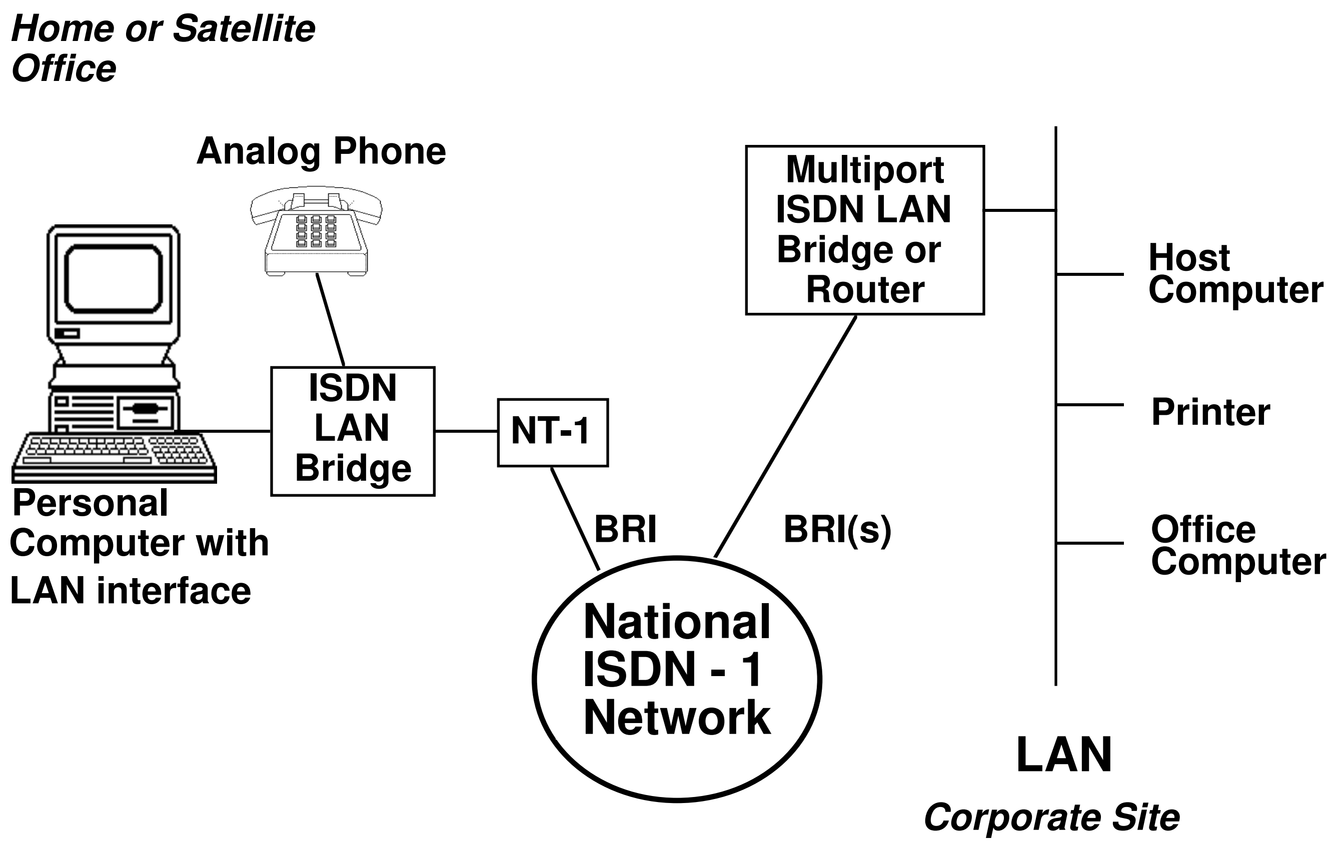
Technical Notes

- An existing communications server (dial-up router, or terminal server) can be adapted to support ISDN access. Change out modems or CSU/DSUs for Terminal Adapters. See Section 4 for products.
- As an alternative to Multiline Hunt Group, the lines at the communications server can use call forwarding. Users all call in with the same DN, when that number is busy, the call is forwarded to the next line. Each DN is "chained" to the next in the group by call forwarding.
- Voice features, such as call forwarding, 3-way calling, transfer, and calling number delivery can give the telecommuter the advanced features that they expect when working.
- The Lower Layer Compatibility Information Element (LLC-IE) can communicate rate-adaptation details end-to-end. For details on V.120 rate adaptation, and the use of the LLC Information Element for circuit data calls, see Sections 5.1.4 and 5.1.5.
- For details on subscription and ordering information using NIUF ISDN Interface Groups (NIIG) and NIUF Parameter Groups (NIPG) , see Section 5.1.11.
- For detailed Signaling Flow Diagrams for this application, see Sections 5.2.1.4 (Voice Call Setup), 5.2.1.5 (Circuit-data Call Setup), and 5.2.1.6 (Voice & Circuit-data Call Clearing).

3.1.22 High-performance telecommuting (interactive graphics and text)

ISDN can provide a person who works at home or in a satellite office on-line access to the corporate computing environment with the ability to exchange large quantities of data at high speed. Examples include interactive graphics and desktop publishing. With data exchanged at rates of 64 or 128 kbps, many applications will run almost as fast as they do at the main office.

Configuration: (1, 2, 3, 4, 5)



How It Works:

The home computer functions just like one of the personal computers attached directly on the corporate network. The Network Operating System routes traffic to/from the remote personal computer without noticing the presence of ISDN. A Local Area Network is limited by distance. To grow the network, bridges and routers can be used, which forward LAN datagrams between LAN segments, and learn addresses dynamically. ISDN LAN Bridges function in pairs, with the two halves connected by two simultaneous circuit-data calls. LAN datagrams are forwarded between segments as necessary using circuit-data connections. ISDN LAN Bridges and Routers have a variety of different features, such as address screening for security and the ability to automatically dial (or hang-up) based on traffic.

Obtain Equipment with These Capabilities

Personal Computer with LAN Interface

- Applications compatible with Network Operating System and far end
- LAN interface (e.g., Ethernet, Token Ring) compatible with far end.

ISDN LAN Bridge

- LAN bridge functions compatible with far end and local LAN (e.g., Ethernet or Token Ring).
- Address screening based on calling number or MAC address.
- B channel capabilities:
  - Simultaneous circuit-data calling on two B channels.
  - Simultaneous voice and circuit-data calling.
  - If using NI-1, support for two Directory Numbers (DNs) and Service Profile IDs (SPIDs) will be needed.
  - Combine two 64 kbps signals to/from the BRI into 128 kbps signal in a way that is compatible with far end.
  - Support for the circuit-data features listed under "Network Interface to ISDN LAN Bridge".
- Physical interfaces:
  - Analog phone jack.
  - Local LAN (e.g., Ethernet or Token Ring).
  - RJ-45 connector to NT-1, or integrated NT-1.

Multiport ISDN LAN Bridge or Router

- LAN bridge or router functions compatible with far end and local LAN (e.g., Ethernet or Token Ring).
- Address screening based on calling number or MAC address.
- Multiple BRIs to meet network traffic requirements.
- B channel capabilities for each BRI:
  - Simultaneous circuit-data calling on two B channels .
  - If using NI-1, support for two Directory Numbers (DNs) and Service Profile IDs (SPIDs) will be needed.
  - Combine two 64 kbps signals to/from the BRI into 128 kbps signal in a way that is compatible with far end.
  - Support for the circuit-data features listed under "Network Interface to Multiport ISDN LAN Bridge or Router".
- Physical interfaces:
  - Local LAN (e.g., Ethernet or Token Ring).
  - RJ-45 connector to NT-1, or integrated NT-1.

Request These Capabilities From ISDN Service Provider

Network Interface to ISDN LAN Bridge

Network Services Required:

- One BRI. (2B)
- One B channel for circuit-data calls, with circuit-data DN and SPID.
- One B channel for alternate voice and circuit-data calls. For NI-1, this requires both a voice DN and SPID and a circuit-data DN and SPID.
- Voice Features:
  - None required.
- Circuit-Data Features:
  - Calling Number Identification Services.

Subscription or Ordering Information:

- This interface is configured for simultaneous circuit - data calls and alternate voice and circuit-data calls (NIIG 15). Other NIIGs which have this functionality include 17, 25, and 27.
- Parameter Groups for Voice Features:
  - None required.
- Parameter Groups for Circuit-Data Features:
  - A la carte: Calling Number Identification Services.

Network Interface to Multiport ISDN LAN Bridge or Router

Network Services Required:

- One or more BRI. (2B)

For each BRI:

- Two B channels for circuit-data calls, with circuit-data DNs and SPIDs.
- Circuit-Data Features:
  - Calling Number Identification Services

Subscription or Ordering Information:

- This interface is configured for two simultaneous circuit-data calls (NIIG 14). Other NIIGs which have this functionality include 15, 17, 24, 25, and 27.
- Parameter Groups for Circuit-Data Features:
  - A la carte: Calling Number Identification Services.

Technical Notes

- A Multiport LAN ISDN Bridge or Router can be replaced by multiple single port bridges or routers.
- Many multiport ISDN Bridges and Routers can utilize a PRI or multiple BRI lines for network access.
- Some ISDN LAN Bridges support data compression, so effective data throughput may be higher.
- The terminal configuration shown here uses a Personal Computer/Workstation with a standalone ISDN LAN Bridge. Some LAN adapter cards may have integrated ISDN LAN bridges.
- Dial-back options can improve security. When the person calls in, the corporate Computer will refuse the call and then dial back, after verifying that access is permitted, for greater security. The performance tradeoff with dial back is added delay.
- For details on subscription and ordering information using NIUF ISDN Interface Groups (NIIG) and NIUF Parameter Groups (NIPG), see Section 5.1.11.
- For detailed Signaling Flow Diagrams for this application, see Sections 5.2.1.4 (Voice Call Setup), 5.2.1.5 (Circuit-data Call Setup), and 5.2.1.6 (Voice & Circuit-data Call Clearing),