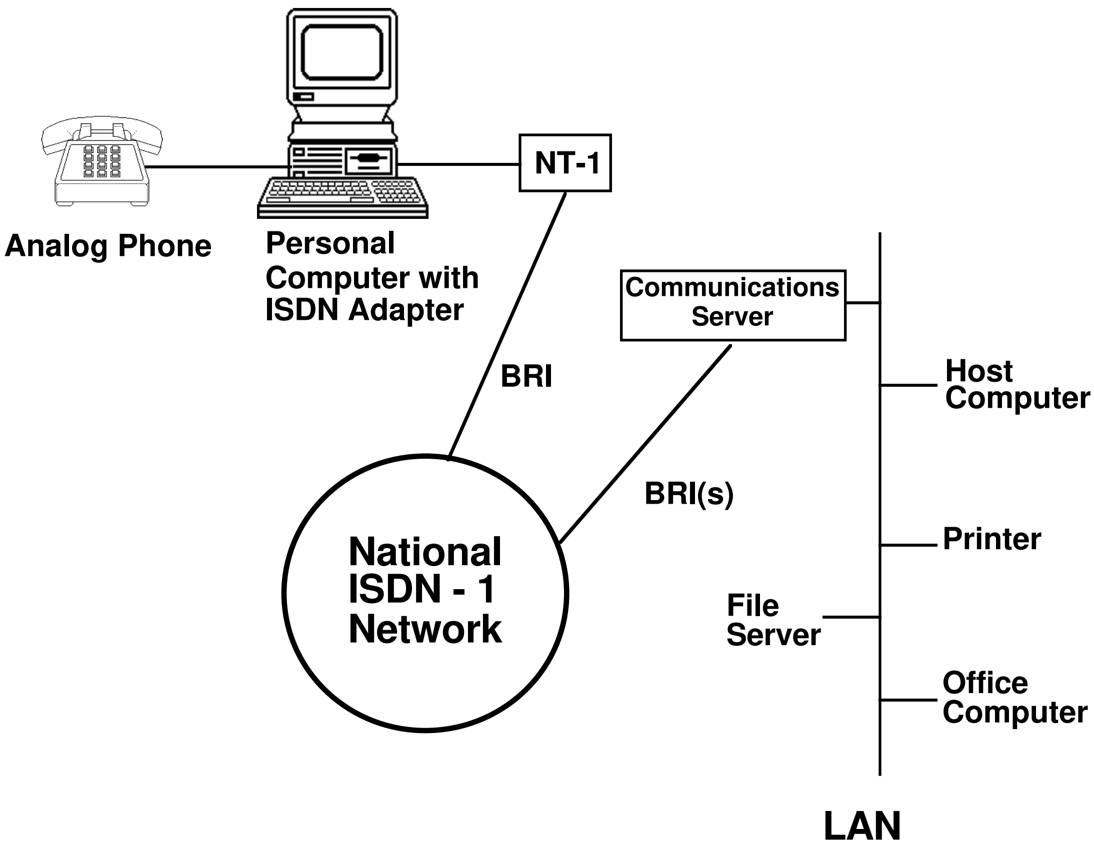
3.1.1 Integrating telephones and workstations

A workstation using ISDN can have wide area access to corporate networks (or other ISDN users) at data rates up to 128 kbps. With the call management capabilities of some products, the user can automatically place, (or accept) a voice call while maintaining data connectivity at 64 kbps. To do the same thing without ISDN, one would need three lines (one POTS and two switched 56).

Configuration: (<u>1</u>, 3, 4, 5)



How It Works:

The user, through their communications software, places a 64 kbps circuit data call to the Communications Server. If the call completes, a second call is placed. When the second call completes, the two devices create a 128 kbps channel through compatible inverse multiplexing on each computer. Inverse multiplexing splits a wideband data stream (128 kbps) onto two narrow band (64 kbps) channels when sending, and combines the channels back into the 128 kbps stream when receiving. If the calls cannot complete at 64 kbps, then 56 kbps calls are tried, for a total of 112 kbps.

The Communication Server acts as a router, providing access to computers, printers, and files on the corporate site. It can also provide access control (security) and accounting.

In order to place (or receive) a voice call, the user's workstation and communications software supports the ability to drop one of the two circuit data calls without interrupting the data channel seen by the application. With one of the two B channels freed, it can then be used for voice.

Obtain Equipment with These Capabilities

Personal Computer with ISDN Adapter

- Application software compatible with communication software and far end.
- B channel capabilities:
    - Simultaneous voice and circuit-data calling.
    - 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 (BONDING, H.221).
    - Ability to shift data rate from 128 (112) kbps to 64 (56) kbps and back again, based on voice calls to and from the personal computer.
    - Support rate adaptation for rates lower than 64 kbps. For example, asynchronous communications may be rate adapted using V.120.
    - Support for the voice features listed under "Network Interface to Personal Computer with ISDN Adapter".
    - Support for the circuit-data features listed under "Network Interface to Personal Computer with ISDN Adapter".
- Physical interfaces:
    - Analog phone jack.
    - RJ-45 connector to NT-1, or integrated NT-1.

Communications Server

- Communication software compatible with personal computers and enterprise network.
- 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 (BONDING, H.221).
    - Support rate adaptation for rates lower than 64 kbps. For example, asynchronous communications may be rate adapted using V.120.
    - Ability to shift data rate from 128 (112) kbps to 64 (56) kbps and back again, based on voice calls to and from the personal computer.
    - 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)
- Two B channels for alternate voice and circuit-data, with alternate voice and circuit-data DNs and SPIDs.
- Voice Features:
  - Call Hold and Retrieve.
  - Three Call Appearances
  - Calling Number Identification Services.
- Circuit-Data Features:
  - Calling Number Identification Services.

Subscription or Ordering Information:

- This interface is configured for two simultaneous alternate voice and circuit-data calls (NIIG 17). The only other NIIG with this functionality is 27.
- Parameter Groups for Voice Features:
  - NIPG 3 - Flexible Calling for Voice. (Also includes three-way conference calling and transfer.)
  - A la carte: Calling Number Identification Services.
- Parameter Groups for Circuit-Data Features:
  - A la carte: Calling Number Identification Services.

Network Interface to Communications Server

Network Services Required:

- One or more BRI. (2B)
- 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.

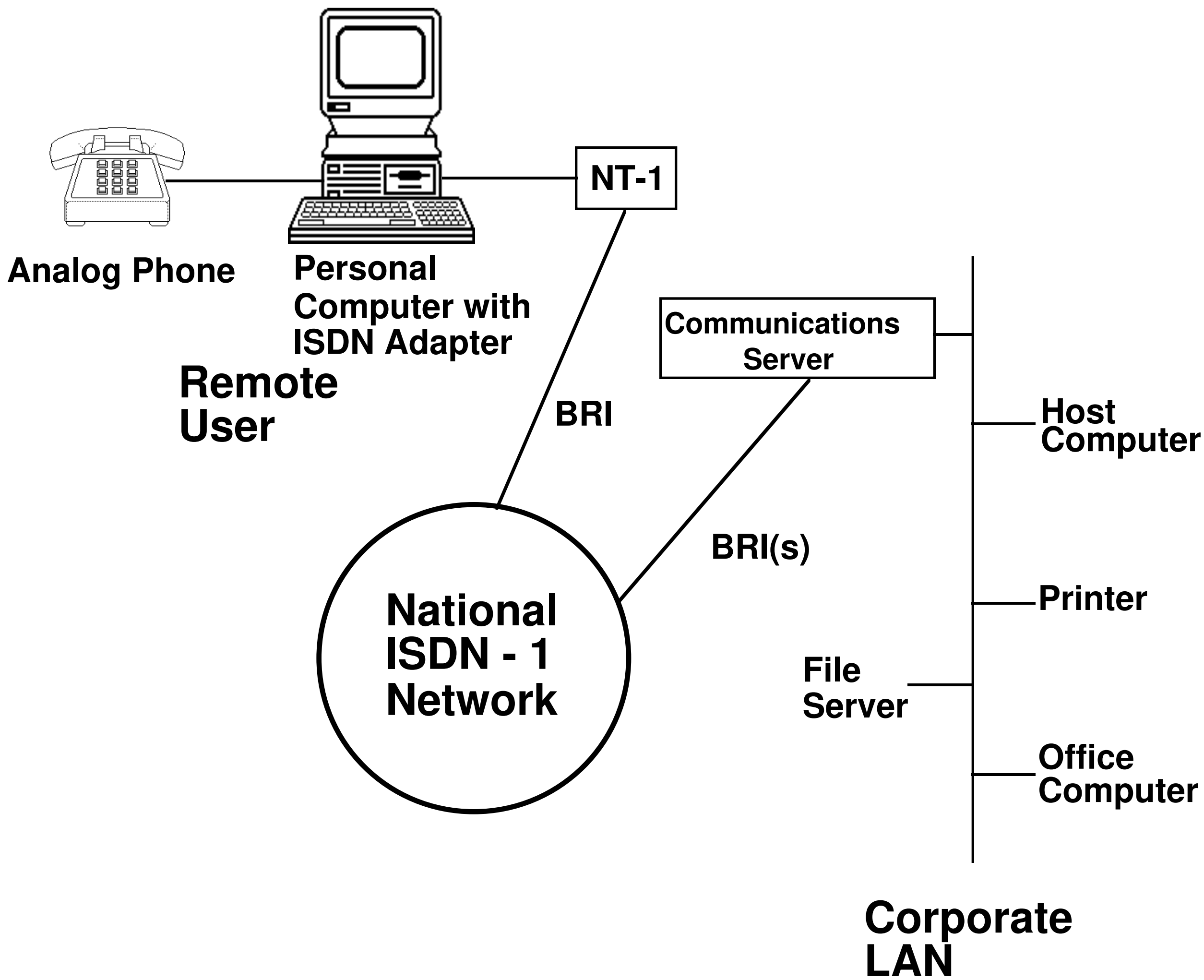
Technical Notes

- When a Voice call is already in progress, the personal computer is limited to having only a single circuit-data call active to/from the Comm. Server. When two circuit-data calls are active (a 112 or 128k data rate), the personal computer can still originate or even receive a Voice call. Originating a voice call when two circuit-data calls are active requires the communications software on both the PC and the Comm. Server to manage the data rate transition from 112/128 kbps to 56/64 kbps as one of the data calls is dropped. At this point, there is a free B channel which may be used to place the voice call. To receive a voice call while two data calls are active, the user must subscribe to (and have equipment that supports) Additional Call Offering. This service provides notification of incoming calls on the D channel. If the user wishes to answer an incoming voice call, the communications software must manage dropping one data call as before to free a B channel. The user may then accept the incoming call using the normal call control procedures.
- Additional Voice features may be useful for this application, for example: Flexible Calling (Call Transfer, 3-Way Calling), or Automatic Callback.
- 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).

3.1.2 Access on demand to local-area networks

ISDN provides high performance access to a remote local area network using standard terminal emulation software. For instance, a telecommuter or consultant might need to work for just a couple of hours per day with a text editor application or database-entry program that resides on a corporate computer that is part of a distant LAN. Data transfer can take place at up to 64 kbps, and the remote user can make and receive telephone calls, while the data application is going on, without any interference.

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



How It Works:

Through their communications software, the user places a 64 kbps circuit-data call to the Communications Server to accesses applications on the LAN. Depending on the set-up, the actual data transfer may be "rate adapted" to a slower speed. The Communications Server supports the internetworking of Personal Computers on ISDN interfaces with the corporate network. The Communications Server is set up with a Multiline Hunt Group (MLHG). With a hunt group, all users dial into the same number (the Hunt DN), greatly simplifying administration and spreading access uniformly over all lines. The Communications Server uses Calling Number Identification Services for accounting purposes.

Obtain Equipment with These Capabilities

Personal Computer with ISDN Adapter

- Application software compatible with communication software and far end.
- B channel capabilities:
  - Simultaneous voice and circuit-data calling.
  - 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 Personal Computer with ISDN Adapter".
- 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.
- Accounting and security features that use the calling number.
- Multiple BRIs to meet network traffic requirements.
- B channel capabilities for each BRI:
  - Simultaneous circuit-data calling on two B channels.
  - 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

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:
  - Calling Number Identification Services

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 Voice Features:
  - None required.
- Parameter Groups for Circuit-Data Features:
  - A la carte: Calling Number Identification Services.

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.
  - 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: Multiline Hunt Group.
  - Calling Number Identification Services.

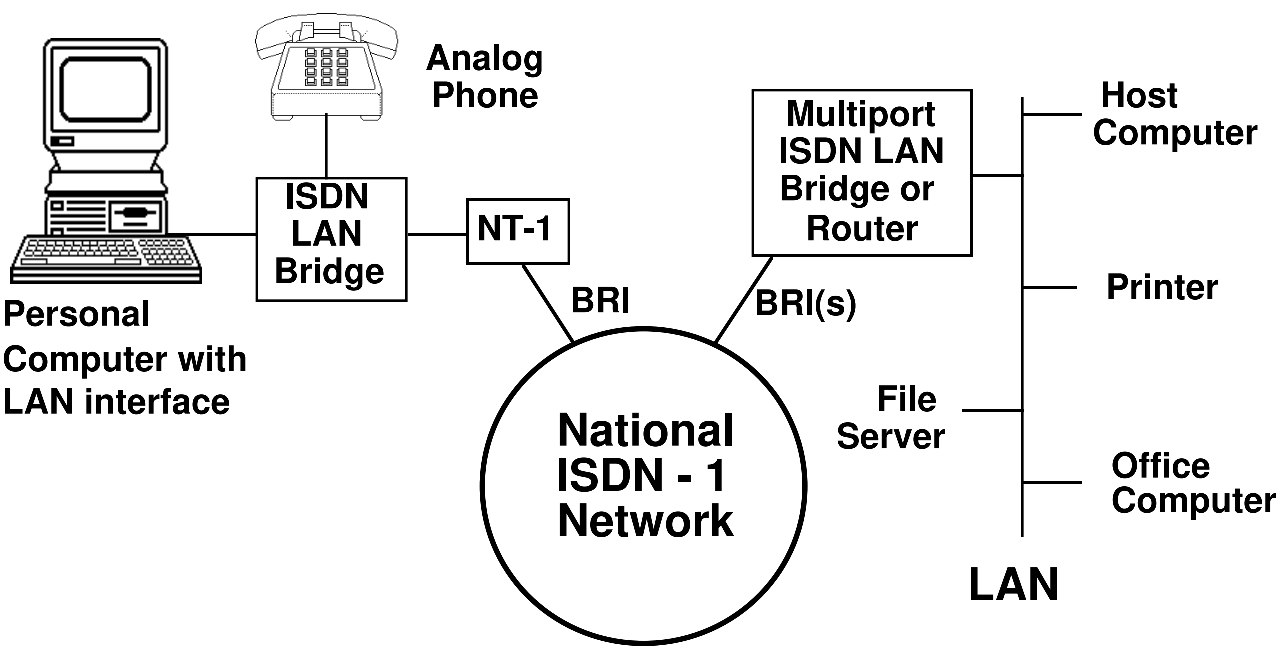
Technical Notes

- 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 as selected from Section 4.
- The Lower Layer Compatibility Information Element (LLC-IE) can communicate V.120 settings, See Section 5.1.5.
- The Communications Server has its DNs assigned to a Multiline Hunt Group (MLHG) so that those calling in remotely only have to remember one number. More details of MLHG may be found in Section 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), 5.2.1.5 (Circuit-data Call Setup) and 5.2.1.6 (Voice & Circuit-data Call Clearing).

3.1.3 High performance access on demand to local area networks -

The branch offices of a regional insurance company must operate more efficiently in order to compete. They want all personnel - regardless of location - to take advantage of on-line claims management systems in use at headquarters. Without integration, regional offices depend on paper forms, faxes, and courier services. ISDN can provide an economical, high performance connection for transferring information between a remote location, such as a branch office, and a local-area network at headquarters. ISDN provides a quick connection with reliable data transfer at up to 128 kbps using adapter or router technology. The remote user pays for the connection only when it is actually being used and is saved the cost of an underutilized leased line.

Configuration: (1, 3, 4, 5)



How It Works:

In this example, personal computers exchange information using networking protocols (for example, Netware) and standard local area networks such as Ethernet or Token Ring. Each computer is equipped with the appropriate electronics and connectors for the LAN. By their nature, each LAN segment has limited geographic scope, so larger networks are built from many segments connected by bridges or routers, which route traffic to the appropriate segment. Bridges interconnect two or more segments. ISDN LAN Bridges work like other bridges, but over a distance. They connect two segments that are separated geographically, carrying the traffic between segments over ISDN circuit-data connections.

When the ISDN LAN Bridge detects traffic for the other site, it places 64 kbps circuit-data call to other bridge . If the call cannot complete, 56 kbps calls are used. When the call completes successfully, the bridge can set up the second call. When the second call completes, the bridge uses internal inverse multiplexing to provide a 128 (112) kbps data path to the user application. The bridge can hang-up automatically when there is no traffic. If the user wants to keep a voice line open, then the second circuit-data call is not placed. Any protocols that run over the Ethernet or Token Ring can now be used over ISDN.

Obtain Equipment with These Capabilities

Personal Computer

- Application software compatible with communication software and far end LAN devices.
- LAN interface (e.g., Ethernet, Token Ring) compatible with ISDN LAN Bridge.

ISDN LAN Bridge

- LAN bridge functions compatible with far end and local LAN (e.g., Ethernet or Token Ring).
- 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).
- Multiple BRIs to meet network traffic requirements.
- B channel capabilities for each BRI:
  - Simultaneous circuit-data calling on two B channels.
  - For 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.

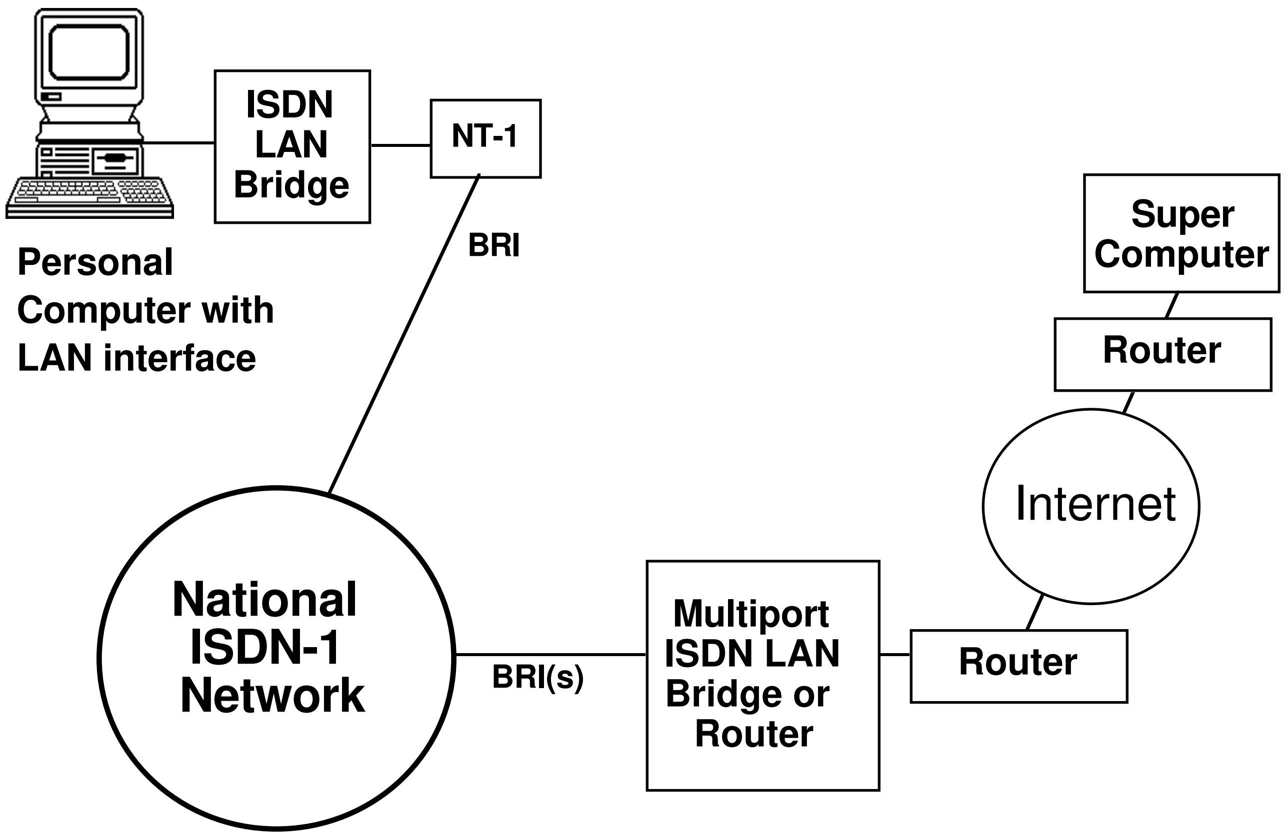
Technical Notes

- ISDN LAN Bridges and Routers can use Calling Number Identification Services for access control on incoming calls.
- The configuration shown here uses a personal computer with a standalone ISDN LAN Bridge. Some LAN adapter cards may have integrated ISDN LAN bridges.
- Many Multiport LAN Bridges and Routers can utilize a PRI or multiple BRI lines for network access.
- Some ISDN LAN Bridges and Routers support data compression, so effective data throughput may be higher. See Section 4 for products.
- 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).

3.1.4 Linking workstations with supercomputers

ISDN can link high performance workstations to high-speed computing resources, such as supercomputers, at speeds high enough to provide reasonable performance. With ISDN access to the Internet, a high speed network of research computers, the workstations can be located far from the resources of a supercomputer and still work well.

Configuration: (1, 3, 4, 5)



How It Works:

When the ISDN LAN Bridge detects traffic for the other site, it places 64 kbps circuit-data call to other bridge. If the call cannot complete, 56 kbps calls are used. When the call completes successfully, the bridge can set up the second call. When the second call completes, the bridge uses internal inverse multiplexing to provide a 128 (112) kbps data path to the user application. When there is no activity, the bridges can automatically hang up. Using TCP/IP protocols to provide end to end data transport, then internetworking across ISDN and the Internet, the end-user can run applications like the remote job entry of a compute-intensive program.

Obtain Equipment with These Capabilities

Personal Computer

- Application software compatible with communication software and far end.
- LAN interface (e.g., Ethernet, Token Ring) compatible with bridge

ISDN LAN Bridge

- LAN bridge functions compatible with far end and local LAN (e.g., Ethernet or Token Ring).
- B channel capabilities:
  - 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 ISDN LAN Bridge".
- Physical interfaces:
  - 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).
- Multiple BRIs to meet network traffic requirements.
- B channel capabilities for each BRI:
  - Simultaneous circuit-data calling on two B channels.
  - For 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.

Routers

- Routing functions compatible with communications software, including TCP/IP protocols.
- Interfaces compatible with bridge, Internet, and supercomputers as appropriate.

Supercomputers

- No change from current communications service via Internet (non-ISDN link and protocols)

Request These Capabilities From ISDN Service Provider

Network Interface to ISDN LAN Bridge

Network Services Required:

- One BRI. (2B)
- 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.

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.

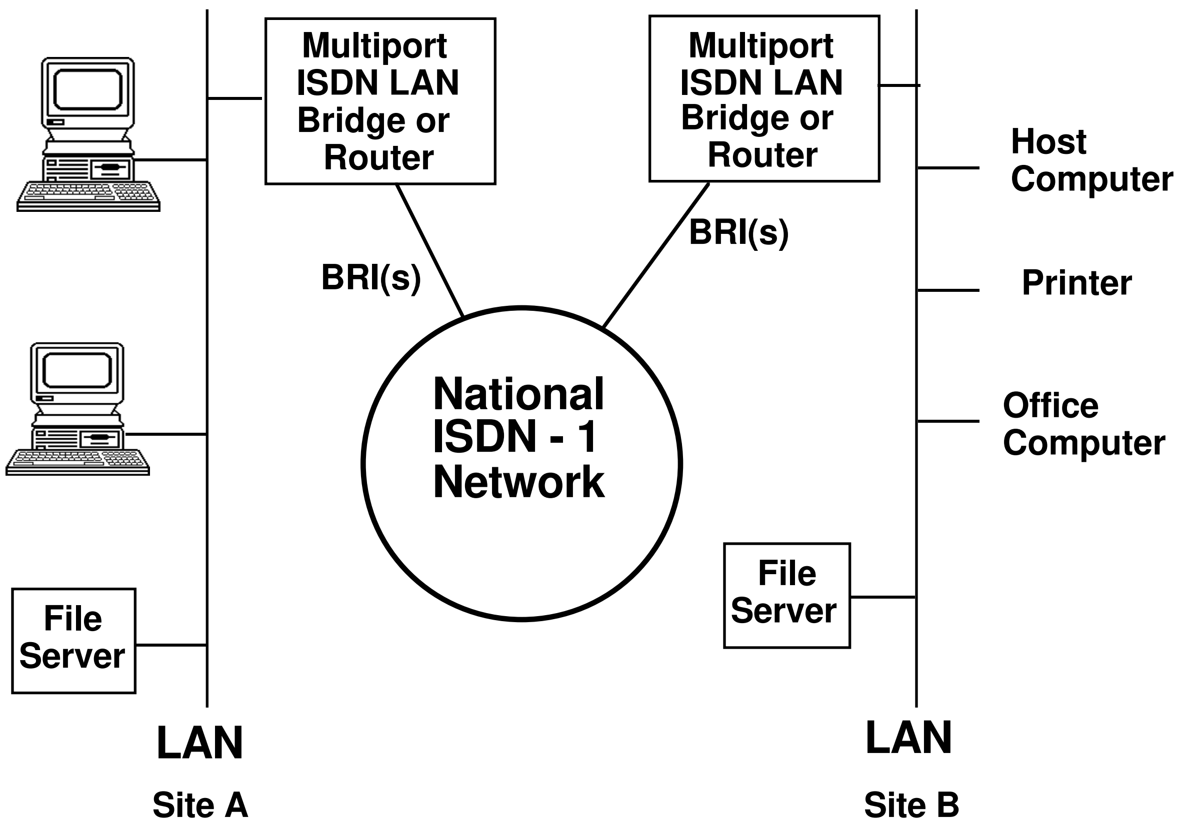
Technical Notes

- ISDN LAN Bridges and Routers use Calling Number Identification Services for access control on incoming calls.
- Many Multiport LAN Bridges and Routers can utilize a PRI or multiple BRI lines for network access.
- Some ISDN LAN Bridges and Routers support data compression, so effective data throughput may be higher. See Section 4 for products.
- The configuration shown here uses a personal computer with a standalone ISDN LAN Bridge. Some LAN adapter cards may have integrated ISDN LAN bridges. In addition, the router to the Internet may also support the ISDN LAN Bridge functionality.
- 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 5.2.1.5 (Circuit-data Call Setup), and 5.2.1.6 (Voice & Circuit-data Call Clearing).

3.1.5 Leased line replacement

ISDN can save money where leased lines are not fully utilized. For example, ISDN can connect regional offices, different departments on a geographically dispersed campus, or provide emergency back up. While you pay for ISDN only when you use it, a leased line has a fixed monthly charge whether you use it or not. As a high speed, highly reliable, switched digital service, ISDN provides nearly the same quality of service to most applications as the leased line. ISDN provides additional cost savings because it allows the host or network port and equipment to be shared over several remote locations.

Configuration: (5)



How It Works:

ISDN LAN Bridge s or Routers connect two segments that are separated geographically, carrying the traffic between segments over ISDN circuit-data connections.

When the ISDN LAN Bridge or Router detects traffic for the other site, it places 64 kbps circuit-data call to other bridge . If the call cannot complete, 56 kbps calls are used. When the call completes successfully, the bridge can set up the second call. When the second call completes, the bridge uses internal inverse multiplexing to provide a 128 kbps data path to the user application. Two 56 kbps calls can also be used to provide a 112 kbps data path. Any protocols that run over the Ethernet or Token Ring can now be used over ISDN.

Obtain Equipment with These Capabilities

Multiport ISDN LAN Bridge or Router

- LAN bridge or Router functions compatible with far end and local LAN (e.g., Ethernet or Token Ring).
- Access control for screening incoming calls based on Calling or Redirecting Number, or Media Access Control (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 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 single port LAN bridge or Router can be used, depending on traffic and cost requirements.
- Many Multiport LAN Bridges and Routers can utilize a PRI or multiple BRI lines for network access.
- Some ISDN LAN Bridges and Routers support data compression, so effective data throughput may be higher. See Section 4 for products.
- 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 5.2.1.5 (Circuit-data Call Setup), and 5.2.1.6 (Voice & Circuit-data Call Clearing).