

Application Note

ISDN S-Bus Extensions over IP, 4 Voice Channels

System Overview

Instead of installing a separate PBX in small branch offices, stores or workshops, it is often more convenient and economical to extend a number of ISDN lines from the main PBX. The SmartNode is able to provide such remote PBX extensions and combine them with LAN-to-LAN routing and thus provide full connectivity over a single line.

To connect the locations a variety of link types may be used:

- Leased lines
- Frame Relay
- Point-to-Point Ethernet links (DSL, Radio, Laser etc.)
- Ethernet connection to an IP backbone or VPN

Especially in short distance networks across the town or on a campus point-to-point Ethernet links using DSL or wireless modems are very economical and easy to install.

To provide four voice channels (two BRI line) to the branch office the SmartNode1400 is the device of choice.

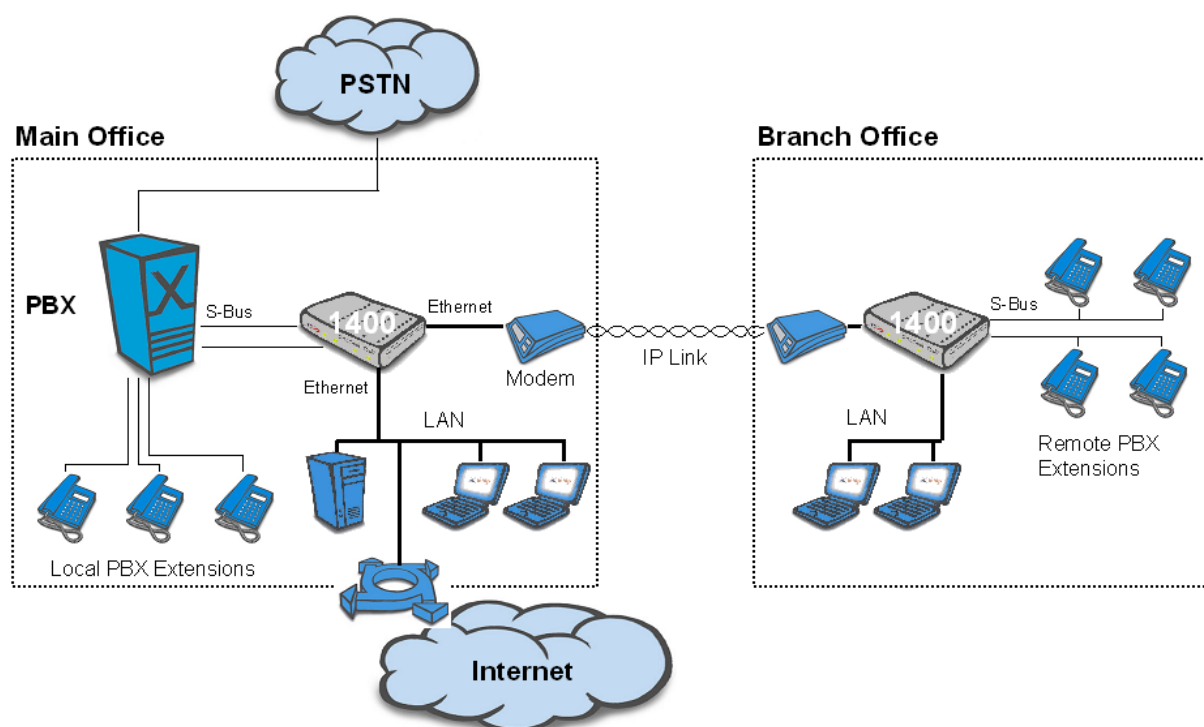


Figure 1: Schematic diagram of the example network

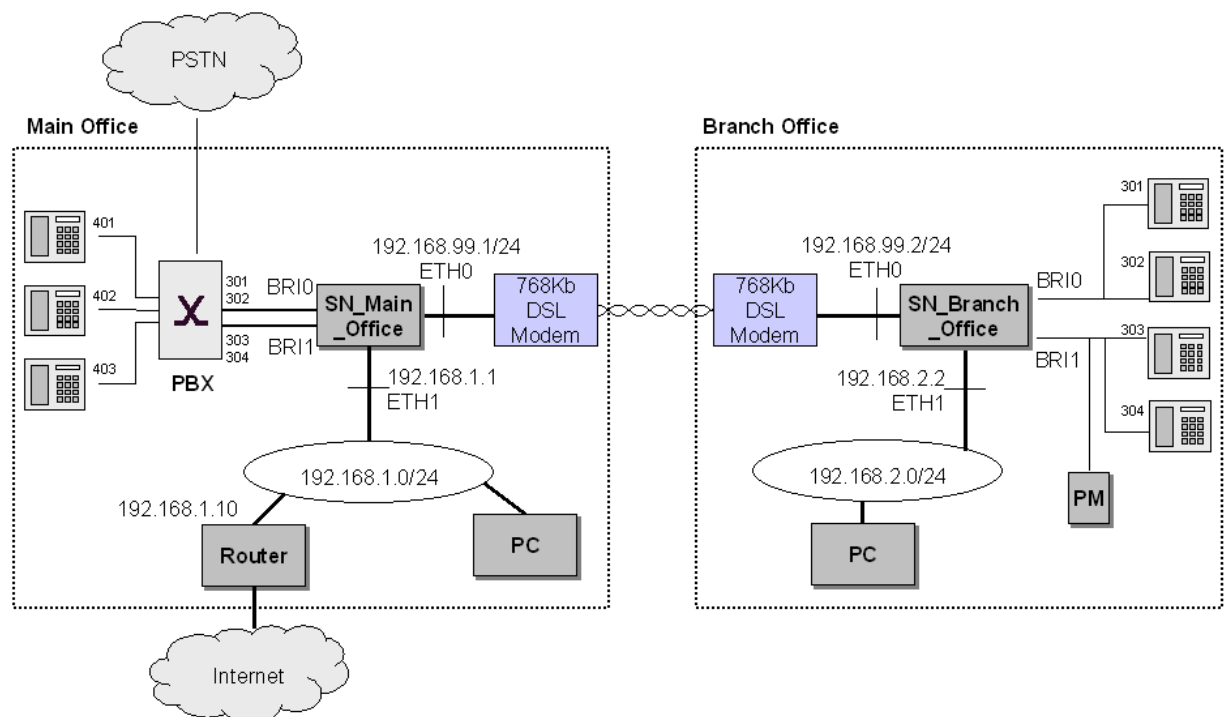


Figure 2: Detailed schematics of the complete network

Figure two presents the details of the example network i.e. IP addresses, subnets, SmartNode interfaces connected to the network, and link bandwidth. These things may be different in your network and must be adapted. Within the next section you find a detailed description about how to adapt the configuration.

Further it is important that you connect the PBX interfaces and phones with the correct SmartNode interfaces. For the example network this means: The PBX interface configured for subscriber numbers 301 and 302 must be connected to BRI0 of the Main Office SmartNode and the phones 301 and 302 must be connected to BRI0 of the Branch Office SmartNode. The PBX interface configured for subscriber numbers 303 and 304 must be connected to BRI1 of the Main Office SmartNode and the phones 303 and 304 must be connected to BRI1 of the Branch Office SmartNode.

How To Adapt To Your Network

The configuration files are available as ASCII files (.cfg) files to be downloaded from a TFTP server to the SmartNode. Please consult the Quick Start Guide for a description of this procedure.

SmartNode Main Office Configuration

```
#-----#
#                                           #
# SN1400                                #
# SmartWare R2.10 BUILD21213            #
# 2003-08-21T13:43:43                   #
# Generated configuration file           #
#                                           #
#-----#
```

cli version 2.00

```
snmp community public ro
# The snmp configuration is optional
snmp-client
snmp-client server primary 205.188.185.33 port 123 version 4
snmp-client gmtoffset + 01:00:00
system hostname SN_Main_Office
```

Link Bandwidth:

Within this configuration example a link bandwidth of 768 Kbps is assumed. This is configured with the command `rate-limit` within the profile `service-policy VoicePrio`. E.g. For a bandwidth of 2048 Kbps the command must be changed to `rate-limit 2048`.

```
profile service-policy VoicePrio
  mode wfq
  rate-limit 768

source class local-voice
  priority

source class local-default
  priority

source class default

context ip router

interface DSL
  ipaddress 192.168.99.1 255.255.255.0
  mtu 1500
  icmp router-discovery
  use profile service-policy VoicePrio out
```

LAN Address:

The IP address and subnet mask of the Main Office SmartNode is 192.168.1.1 255.255.255.0. This is set with the command `ipaddress` within the interface `LAN`. The main office SmartNode's default route leads to the router connected to the Internet (see figure 2). Do not forget to adapt the default route as well. This is done with the command `route 0.0.0.0 0.0.0.0 <router's ip address>` within context `ip router`.

In case you have to change the subnet of the branch office you must change the route to this sub network. This is done with the command `route <subnetwork> <mask> 192.168.99.2` within context `ip router`.

```
interface LAN
  ipaddress 192.168.1.1 255.255.255.0
  mtu 1500
  icmp router-discovery

context ip router
  route 0.0.0.0 0.0.0.0 192.168.1.10 0
  route 192.168.2.0 255.255.255.0 192.168.99.2 0
  multicast-send default-interface DSL

context cs switch
  no number-prefix national
  no number-prefix international
  use tone-set-profile default
```

```
interface pstn bri01
  routing dest-interface isoip1
  bind port 0 1

interface pstn bri00
  routing dest-interface isoip0
  bind port 0 0

interface isoip isoip0
  routing dest-interface bri00
  digit-collection timeout 2
  remoteip 192.168.99.2
  portaddress 100

interface isoip isoip1
  routing dest-interface bri01
  digit-collection timeout 2
  remoteip 192.168.99.2
  portaddress 200

context cs switch
  no shutdown
```

Codecs:

The codec is set with the command `codec` within `gateway isoip isoip`. To change the codec from G.711 (best voice quality but uncompressed) to G.729 (best ratio between voice quality and used bandwidth), set the command `codec g729 30` (packet length 30ms) within `gateway isoip isoip`.

```
gateway isoip isoip
  codec g711alaw64k 20
  no shutdown
  use voip-profile default

port ethernet 0 0
  medium 10 half
  encapsulation ip
  bind interface DSL router
  no shutdown

port ethernet 0 1
  medium 10 half
  encapsulation ip
  bind interface LAN router
  no shutdown

port pstn 0 0
  down
  l2proto pmp
  l3proto dss1
  max-channels 2
  uni-side usr
  up

port pstn 0 1
  down
  l2proto pmp
```

```
l3proto dss1
max-channels 2
uni-side usr
up
```

SmartNode Branch Office Configuration

```
#-----#
#
# SN1400
# SmartWare R2.10 BUILD21213
# 2003-08-21T13:56:10
# Generated configuration file
#
#-----#

cli version 2.00
snmp community public ro
snmp-client
snmp-client server primary 205.188.185.33 port 123 version 4
snmp-client gmt-offset + 01:00:00
system hostname SN_Branch_Office
```

Link Bandwidth:

Within this configuration example a link bandwidth of 768 Kbps is assumed. This is configured with the command `rate-limit` within the profile `service-policy VoicePrio`. E.g. For a bandwidth of 2048 Kbps the command must be changed to `rate-limit 2048`.

```
profile service-policy VoicePrio
mode wfq
rate-limit 768

source class local-voice
priority

source class local-default
priority

source class default

context ip router

interface DSL
ipaddress 192.168.99.2 255.255.255.0
mtu 1500
icmp router-discovery
use profile service-policy VoicePrio out
```

LAN Address:

The IP address and subnet mask of the Branch Office SmartNode is 192.168.2.2 255.255.255.0. This is set with the command `ipaddress` within the interface `LAN`. If you change the subnetwork of the branch office do not forget to change the route to this subnetwork within SmartNode Main Office.

```
interface LAN
ipaddress 192.168.2.2 255.255.255.0
mtu 1500
icmp router-discovery
```

```
context ip router
  route 0.0.0.0 0.0.0.0 192.168.99.1 0
  multicast-send default-interface DSL
```

```
context cs switch
  no number-prefix national
  no number-prefix international
  use tone-set-profile default
```

```
interface pstn bri01
  routing dest-interface isoip1
  bind port 0 1
```

```
interface pstn bri00
  routing dest-interface isoip0
  bind port 0 0
```

```
interface isoip isoip0
  routing dest-interface bri00
  digit-collection timeout 2
  remoteip 192.168.99.1
  portaddress 100
```

```
interface isoip isoip1
  routing dest-interface bri01
  digit-collection timeout 2
  remoteip 192.168.99.1
  portaddress 200
```

```
context cs switch
  no shutdown
```

Codecs:

The codec is set with the command `codec` within `gateway isoip isoip`. To change the codec from G.711 (best voice quality but uncompressed) to G.729 (best ratio between voice quality and used bandwidth), set the command `codec g729 30` (packet length 30ms) within `gateway isoip isoip`.

```
gateway isoip isoip
  codec g711alaw64k 20
  no shutdown
  use voip-profile default
```

```
port ethernet 0 0
  medium 10 half
  encapsulation ip
  bind interface DSL router
  no shutdown
```

```
port ethernet 0 1
  medium 10 half
  encapsulation ip
  bind interface LAN router
  no shutdown
```

```
port pstn 0 0
  down
  l2proto pmp
```

```
l3proto dss1
max-channels 2
uni-side net
up

port pstn 0 1
down
l2proto pmp
l3proto dss1
max-channels 2
uni-side net
up
```

Involved 3rd Party Equipment

Main Office Router (192.168.1.10)

Add the routes:

Destination 192.168.2.0/24 *Next hop* 192.168.1.1

Destination 192.168.99.0/24 *Next hop* 192.168.1.1

Main Office PC's

Default route: 192.168.1.10 (Main Office Router)

Branch Office PC's

Default route: 192.168.2.2 (SN_Branch_Office)