

MULTICAST E MBONE

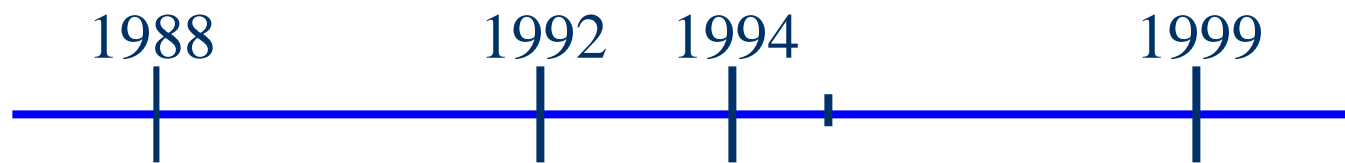
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Programa

- Histórico
- Implementações
- Estrutura atual
- DVMRP
- MROUTED
- Ferramentas de Debug
- Softwares Multicast
- Bookmark

Histórico



1988: Descrito por Steve Deering (tese Ph.D.)

1992: Primeiro uso em larga escala (IETF MEETING em San Diego)

1994: Primeiro uso no Brasil (ITS'94 – Rio de Janeiro)

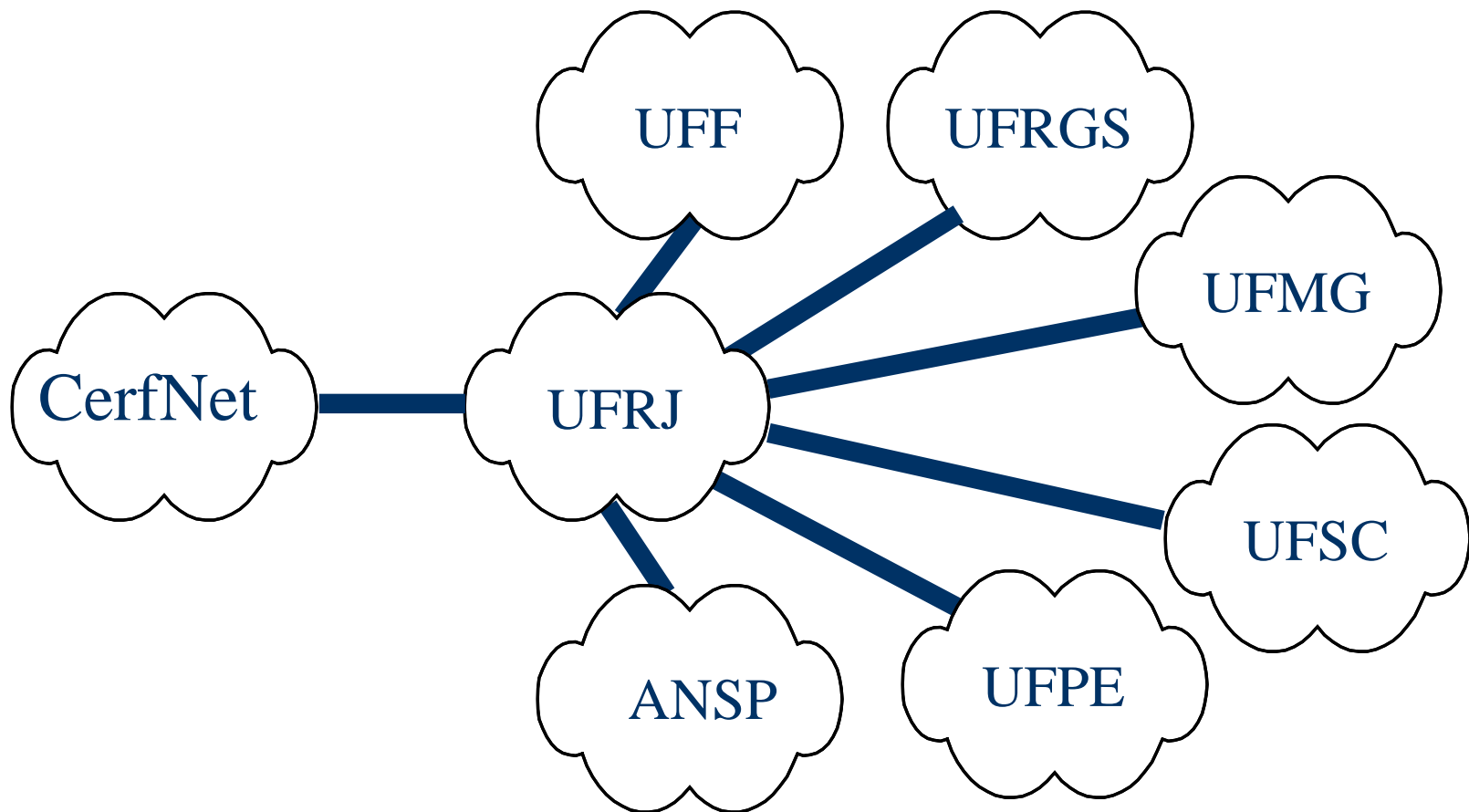
1995: CHEP'95 (Computing On High Energy Physics)

1999: Proposta para implementação de um backbone multicast no Brasil

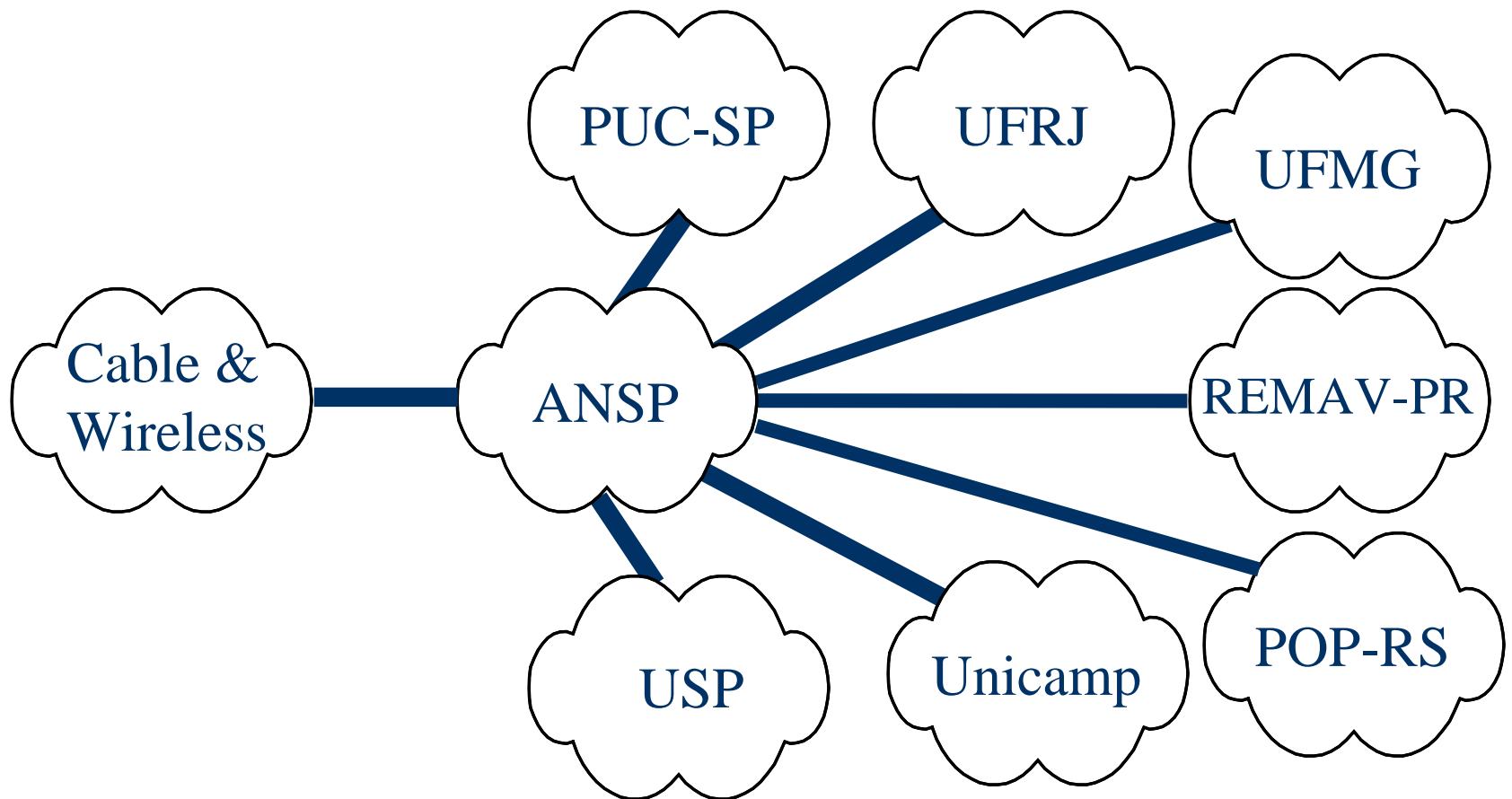
Implementações

- Uso de estações Sun Sparc IPX
 - Solaris 2.2 c/patch para suportar o mouted
- Túnel com CerfNet (San Diego - Califórnia)
 - Canal de 256kbps (RedeRio: UFRJ/CerfNet)
 - Canal dedicado para Califórnia: 384kbps (ITS'94)
- Aquisição de roteadores Cisco 7206 (IOS 11.1)
 - Túneis com CerfNet e várias universidades brasileiras

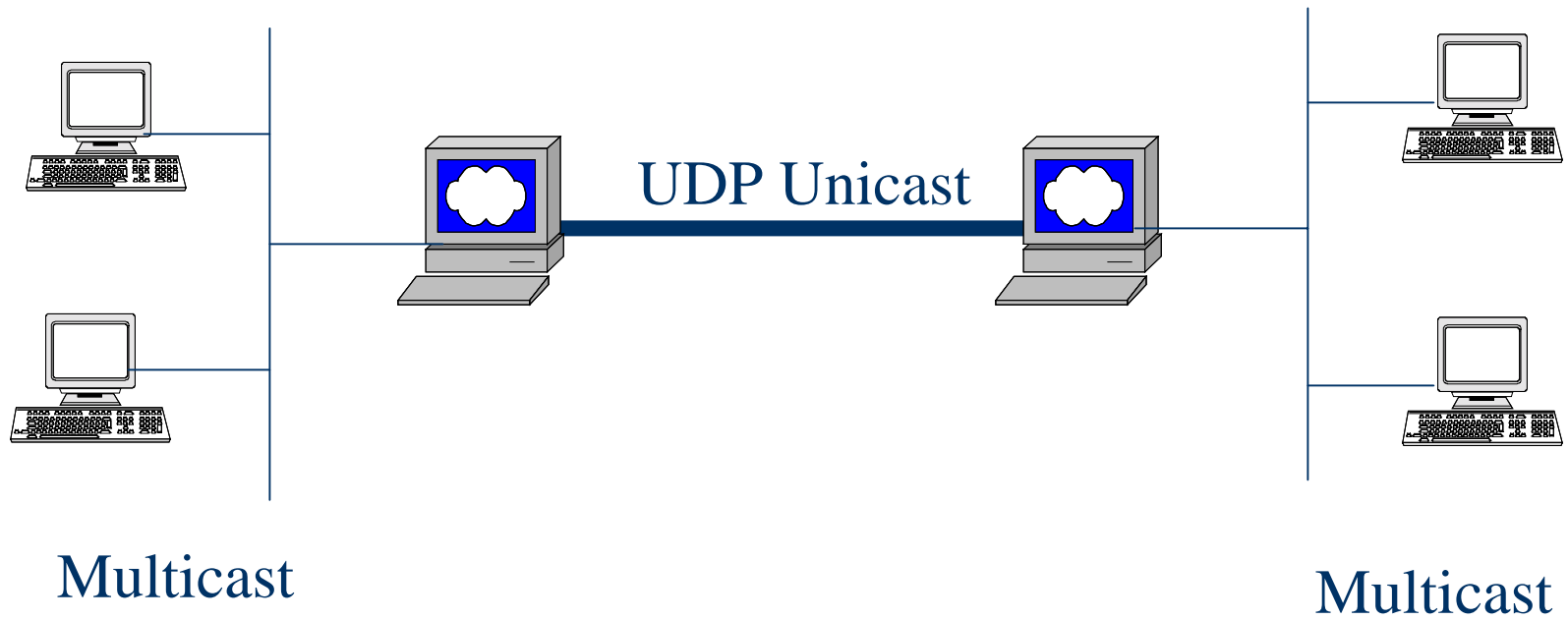
MBONE-BR Estrutura Inicial



MBONE-BR Estrutura “Atual”



Uso de Túneis Multicast

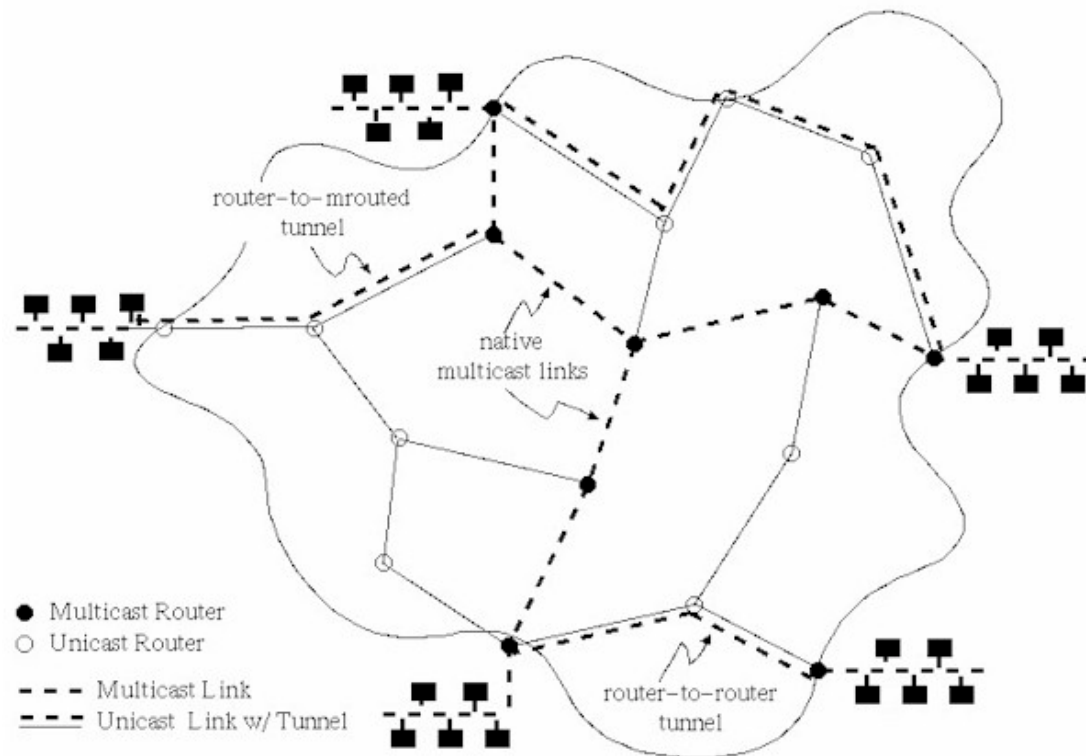


Distance Vector Multicast Routing Protocol (DVMRP)

- Dense Mode Protocol (Broadcast-and-Prune)
- Reverse Path Forwarding (RPF)
- Leaf Router
 - IGMP Queries
 - Pruning
 - Desvantagem: todos os roteadores precisam manter o estado para cada fonte

MROUTED

- Topologia Multicast



MROUTED

- Usar mrouted 3.9beta3 ou superior
- Plataformas
 - Solaris
 - SunOS
 - FreeBSD (I386)
 - DEC Alpha
 - Linux
 - HP-UX
- Opções com suporte a SNMP

MROUTED

- Instalação

- Compilar Kernel com o suporte a multicast, quando necessário
- Solaris
 - Já vem com suporte a muticast
- Linux
 - <http://jukie.net/~bart/multicast/Linux-Mrouted-MiniHOWTO.html>

MROUTED

- Instalação (Free BSD – I386)
 - Gerar código fonte
 - `cd /sys/I386/conf`
 - Copiar o arquivo de configuração utilizado na compilação anterior do Kernel, normalmente o Generic, com outro nome (usar comando `uname -a` para identificar o arquivo)
 - Inserir a linha abaixo no arquivo novo (Kernel-novo)
 - `options MROUTING`
 - Gerar código fonte
 - `/usr/sbin/config <Kernel-novo>`
 - Compilar kernel
 - `cd ../../compile/<Kernel-novo>`
 - `make depend; make; make install`

MROUTED

- Arquivo de configuração (/etc/mrouted.conf)

```
# $Id: mrouted.conf,v 3.8 1995/11/29 22:40:47 fenner Rel $
#
# This is the configuration file for "mrouted", an IP multicast router.
# mrouted looks for it in "/etc/mrouted.conf".
#
# Command formats:
#
# name <boundname> <scoped-addr>/<mask-len>
# cache_lifetime 3600      # seconds
# pruning on
#
# phyint <local-addr> [disable] [metric <m>] [threshold <t>] [rate_limit <b>]
#           [boundary (<boundname>|<scoped-addr>/<mask-len>)]
#           [altnet (<subnet>/<mask-len>|<subnet>)]
phyint ed0 igmpv1
# tunnel <local-addr> <remote-addr> [srcrt] [metric <m>]
#           [threshold <t>] [rate_limit <b>]
#           [boundary (<boundname>|<scoped-addr>/<mask-len>)]
#
# NOTE: rate_limit is in kilobits, and defaults to 500 for tunnels
```

MROUTED

- Arquivo de configuração (/etc/mrouted.conf)

```
# Example of named boundary:
#name LOCAL 239.255.0.0/16
#name EE 239.254.0.0/16      # i.e. the EE dept wants local groups
#
# Example of use of named boundary
#phyint le1 boundary EE      # le1 is our interface to comp sci,
#                          # keep them away from our local groups
# Template tunnel for mcast_install
tunnel 146.164.248.101 146.164.10.68 metric 1 threshold 64 rate_limit 500
#   boundary LOCAL
#
# You might want to specify a boundary on your tunnel to the outside world,
# as above.
#
# NOTE: ONLY uncomment the following if you are running mrouted.snmp!
#sysName      "mymrouter"
sysContact    "Peixoto <peixoto@me.com> +x.yyy.zzz-zzzz"
sysVersion    "MyOS 4.1.3 and mrouted"
sysLocation   "The MBONE"
```

Ferramentas de Debug

- Verificando a tabela de roteamento (SignalUSR1)
 - Arquivo: /var/tmp/mrouted.dump

Virtual Interface Table

| Vif | Name | Local-Address | | M | Thr | Rate | Flags |
|-----|------|---------------|--------------------------|---|-----|------|------------|
| 0 | ed0 | 146.164.200.1 | subnet: 146.164.200.0/26 | 1 | 1 | 0 | querier le |

af IGMPv1

group host (time left): 224.0.0.2 146.164.200.1 (0:04:00)
224.0.0.4 146.164.200.1 (0:04:00)

IGMP querier: 146.164.200.1 (this system)

Nbr bitmaps: 0x0000000000000000

pkts/bytes in : 0/0

pkts/bytes out: 0/0

Ferramentas de Debug

- Verificando a tabela de roteamento (SignalUSR1)
 - Arquivo: /var/tmp/mrouted.dump

Multicast Routing Table (17 entries)

| Origin-Subnet | From-Gateway | Metric | Tmr | Fl | In-Vif | Out-Vifs |
|-------------------|---------------|--------|-----|----|--------|----------|
| 143.106.99.24/30 | 146.164.10.68 | 4 | 10 | .. | 2 | 0* 1* |
| 146.164.47.192/26 | 146.164.10.68 | 3 | 10 | .. | 2 | 0* 1* |
| 146.164.10.64/26 | 146.164.10.68 | 2 | 10 | .. | 2 | 0* 1* |
| 143.106.84.0/26 | 146.164.10.68 | 6 | 10 | .. | 2 | 0* 1* |
| 143.106.80.0/26 | 146.164.10.68 | 5 | 10 | .. | 2 | 0* 1* |
| 143.106.51.0/26 | 146.164.10.68 | 5 | 10 | .. | 2 | 0* 1* |
| 143.106.30.64/26 | 146.164.10.68 | 6 | 10 | .. | 2 | 0* 1* |
| 143.106.2.0/25 | 146.164.10.68 | 4 | 10 | .. | 2 | 0* 1* |
| 200.136.225/24 | 146.164.10.68 | 7 | 10 | .. | 2 | 0* 1* |

Ferramentas de Debug

- Verificando a cache (SignalUSR2)
 - Arquivo: /var/tmp/mrouted.cache

Multicast Routing Cache Table (147 entries)

| Origin | Mcast-group | CTmr | Age | Ptmr | IVif | Forwvifs |
|-----------------|---------------|------|-----|------|------|----------|
| 13.2.116/22 | 224.2.127.255 | 3m | 2m | - | 0 | 1 |
| >13.2.116.19 | | | | | | |
| >13.2.116.196 | | | | | | |
| 138.96.48/21 | 224.2.127.255 | 5m | 2m | - | 0 | 1 |
| >138.96.48.108 | | | | | | |
| 128.9.160/20 | 224.2.127.255 | 3m | 2m | - | 0 | 1 |
| >128.9.160.45 | | | | | | |
| 198.106.194/24 | 224.2.135.190 | 9m | 28s | 9m | 0P | |
| >198.106.194.22 | | | | | | |

Ferramentas de Debug

- Opções de debug do MROUTED
 - Routing
 - Pruning
 - IGMP
 - Neighbors

Ferramentas de Debug

- MRINFO

- Apresenta informações sobre um roteador multicast
 - Versão do mrouted
 - Estado operacional dos túneis configurados

```
mbone# mrinfo
```

```
127.0.0.1 (localhost) [DVMRPv3 compliant]:
```

```
146.164.200.1 -> 0.0.0.0 (local) [1/1/querier/leaf]
```

```
146.164.248.101 -> 0.0.0.0 (local) [1/1/querier/leaf]
```

```
146.164.248.101 -> 146.164.10.68 (mbone.ufrj.br) [1/64/tunnel]
```

Ferramentas de Debug

- MTRACE

- Coleta estatísticas sobre o tráfego no MBONE

```
Mtrace from 143.108.30.25 to 146.164.10.68 via group  
224.2.127.254
```

```
Querying full reverse path...
```

```
0 mbone.ufrj.br (146.164.10.68)
```

```
-1 mbone.ufrj.br (146.164.10.68) DVMRP thresh^ 1
```

```
-2 ? (143.108.30.25) DVMRP thresh^ 64
```

```
-3 ? (143.108.30.25)
```

```
Round trip time 12 ms
```

Ferramentas de Debug

- MTRACE

- Coleta estatísticas sobre o tráfego no MBONE

Waiting to accumulate statistics... Results after 10 seconds:

| Source | Response | Dest | Packet Statistics For | Only For Traffic |
|---------------|---------------|-----------|-----------------------|--------------------|
| 143.108.30.25 | 146.164.10.68 | | All Multicast Traffic | From 143.108.30.25 |
| v | ___/ | rtt 10 ms | Lost/Sent = Pct Rate | To 224.2.127.254 |
| 143.108.30.25 | ? | | | |
| v | ^ | ttl 64 | 0/0 = --% 0 pps | 0/0 = --% 0 pps |
| 146.164.10.68 | mbone.ufrj.br | | | |
| v | _ | ttl 65 | 0 | 0 pps |
| 146.164.10.68 | 146.164.10.68 | | | |
| Receiver | Query Source | | | |

Ferramentas de Debug

- MAP-MBONE

- Mostra a topologia da rede de todos os roteadores multicast alcançáveis

143.108.30.25: <v3.255>

143.108.24.1: 166.49.72.163 [1/64/tunnel/down]

143.108.30.25: 143.107.45.46 (sushi.ime.usp.br) [1/16/tunnel]

143.108.22.11 (dexter.ansp.br) [1/16/tunnel/down]

200.144.145.39 (nucc9.pucsp.br) [1/64/tunnel/down]

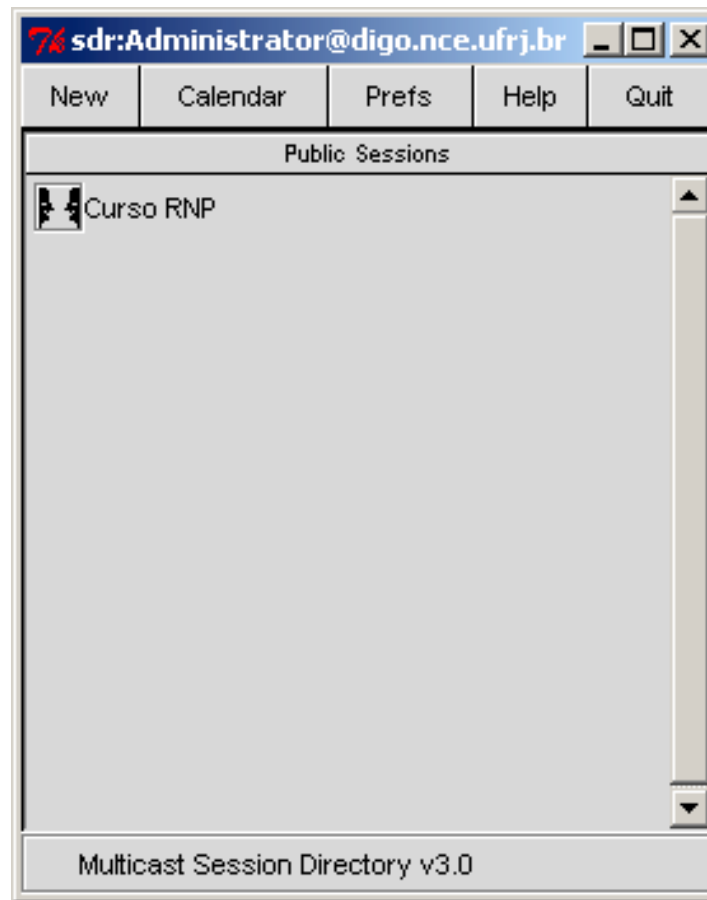
200.255.251.194 (monit01.rjo.embratel.net.br) [1/16/tunnel/down]

200.131.1.55 (mariamole.pop-mg.rnp.br) [1/16/tunnel/down]

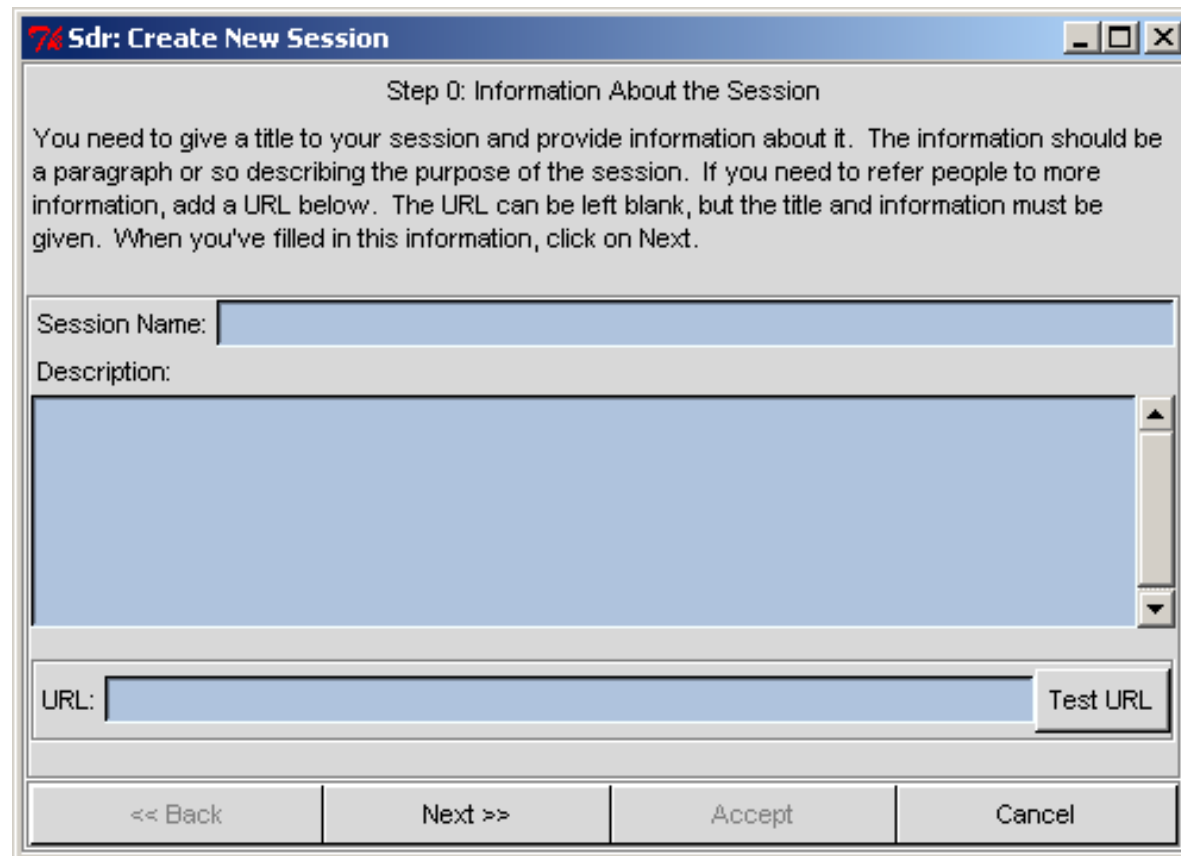
Softwares Multicast

- Session Directory (SDR)
- Videoconferencing Tool (VIC)
- Robust Audio Tool (RAT)
- Network Text Editor (NTE)
- Whiteboard (WBD)

Session Directory (SDR)



Session Directory (SDR)



Sdr: Create New Session

Step 0: Information About the Session

You need to give a title to your session and provide information about it. The information should be a paragraph or so describing the purpose of the session. If you need to refer people to more information, add a URL below. The URL can be left blank, but the title and information must be given. When you've filled in this information, click on Next.

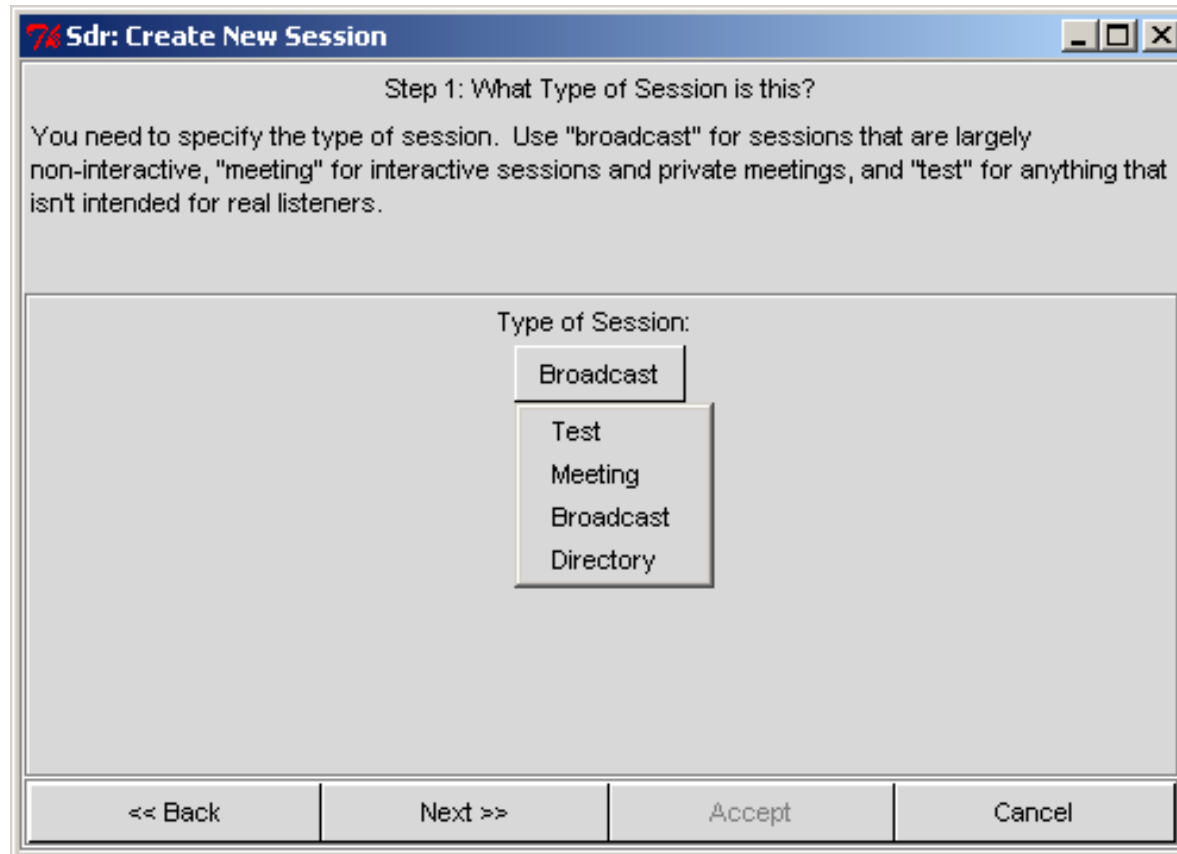
Session Name:

Description:

URL:

<< Back Next >> Accept Cancel

Session Directory (SDR)



Session Directory (SDR)

Sdr: Create New Session

Step 2: When will the session be active?

You need to configure when the session will be active so people will know when to join it. For example, if the session is active on Monday and Thursday each week for four weeks, configure Monday's start time and duration in the first row, Thursday's start time and duration in the second row, set both to be "Weekly" and configure "Repeat for" to be "4 weeks".

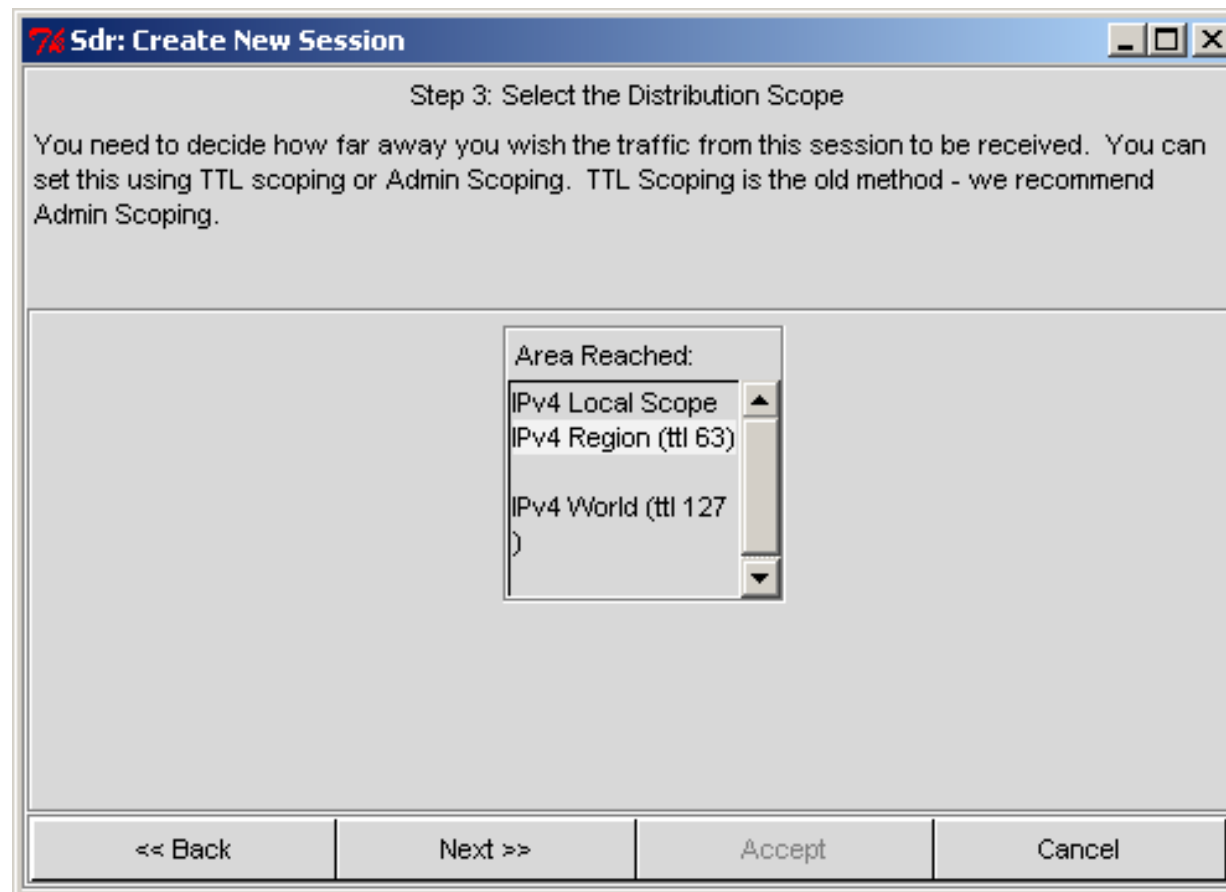
| how often it takes place | when it first takes place | how long each time |
|--------------------------|------------------------------|--------------------|
| Once | from: Sun 9 Dec at 21:30 for | 2 hours |

⌚ Ses Length of Repeat

-
- Once
- Daily
- Weekly
- Every Two Weeks
- Monthly by Date
- Monday thru Friday

<< Back Next >> Accept Cancel

Session Directory (SDR)








Session Directory (SDR)

7x Sdr: Create New Session [-] [□] [X]

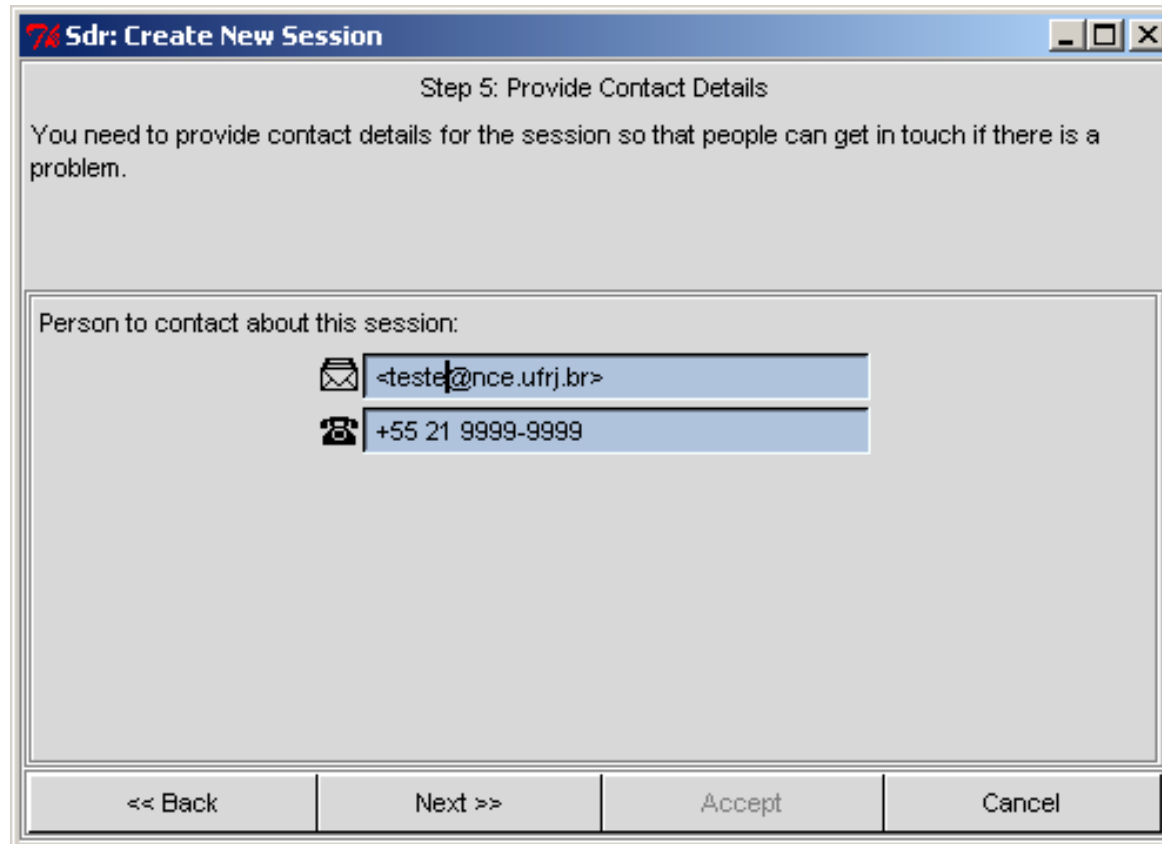
Step 4: Choose and configure the media?

You need to decide which media the session will use. For each medium, you need to choose the protocol and format. Some formats also let you choose the number of layers in the encoding.

| | | | | | |
|-------------------------------------|---|------------|---------|---|--------------------------|
| <input checked="" type="checkbox"/> |  | audio | DVI | 1 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> |  | video | H.261 | 1 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> |  | whiteboard | wb | 1 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> |  | text | UCL NTE | 1 | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> |  | directory | | | <input type="checkbox"/> |

<< Back Next >> Accept Cancel

Session Directory (SDR)





Sdr: Create New Session

Step 5: Provide Contact Details

You need to provide contact details for the session so that people can get in touch if there is a problem.

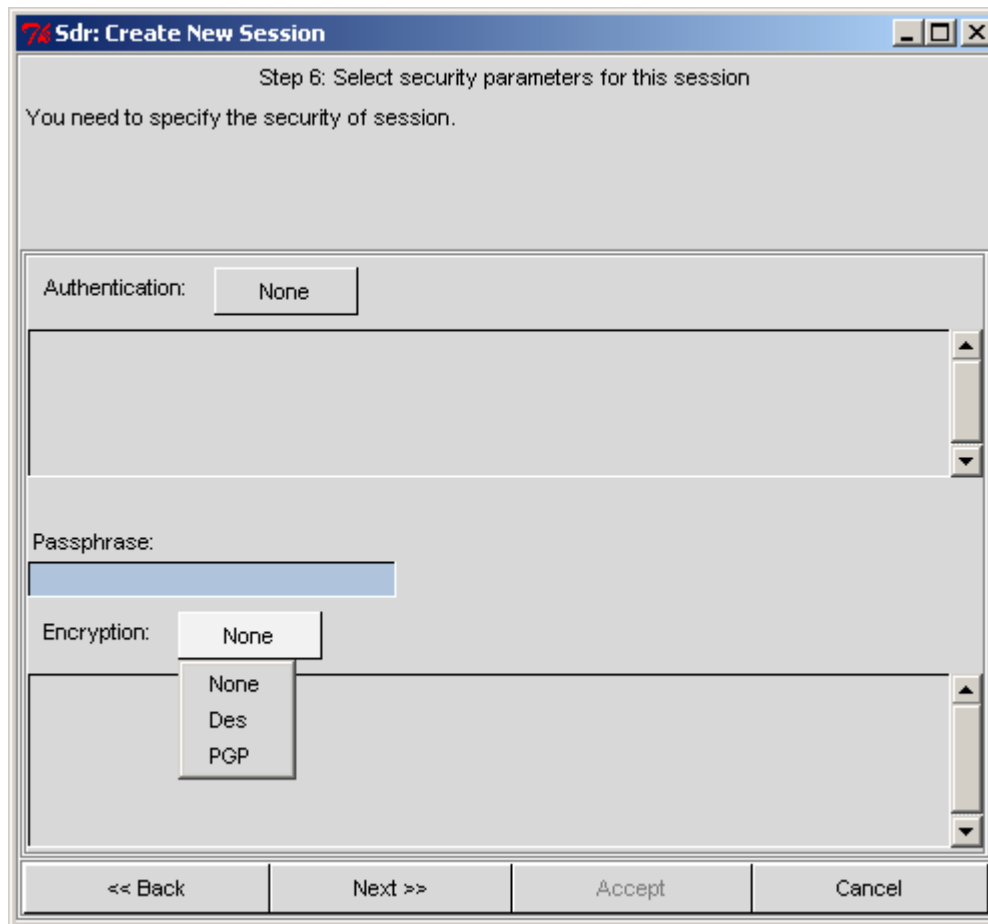
Person to contact about this session:

 <teste@nce.ufrj.br>

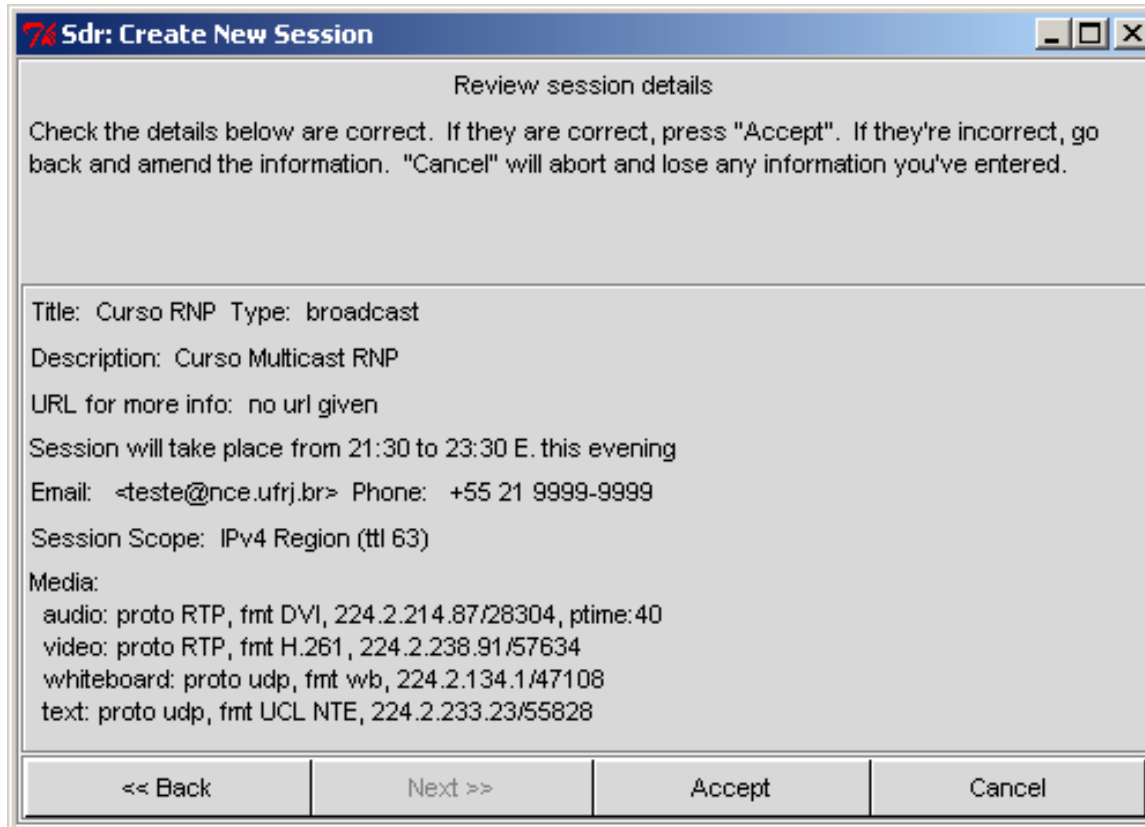
 +55 21 9999-9999

<< Back Next >> Accept Cancel

Session Directory (SDR)



Session Directory (SDR)



Sdr: Create New Session

Review session details

Check the details below are correct. If they are correct, press "Accept". If they're incorrect, go back and amend the information. "Cancel" will abort and lose any information you've entered.

Title: Curso RNP Type: broadcast
Description: Curso Multicast RNP
URL for more info: no url given
Session will take place from 21:30 to 23:30 E. this evening
Email: <teste@nce.ufrj.br> Phone: +55 21 9999-9999
Session Scope: IPv4 Region (ttl 63)
Media:
audio: proto RTP, fmt DVI, 224.2.214.87/28304, ptime:40
video: proto RTP, fmt H.261, 224.2.238.91/57634
whiteboard: proto udp, fmt wb, 224.2.134.1/47108
text: proto udp, fmt UCL NTE, 224.2.233.23/55828

<< Back Next >> Accept Cancel

Session Directory (SDR)





7 Sdr: Session Information

Encryption: none (noenc) Curso RNP Authentication: none (noauth)

Curso Multicast RNP

Session will take place
from 21:30 to 23:30 E. this evening

Contact Details

| | | | | | | | |
|--|--|---|---|--|--------------------------------------|---------------------------|---|
|  audio | Format: <input type="text" value="DV"/> | Proto: <input type="text" value="RTP"/> | Addr: <input type="text" value="224.2.214.87"/> | Port: <input type="text" value="28304"/> | TTL: <input type="text" value="63"/> | Key: <input type="text"/> | Vars: <input type="text" value="ptime:40"/> |
|  video | Format: <input type="text" value="H.261"/> | Proto: <input type="text" value="RTP"/> | Addr: <input type="text" value="224.2.238.91"/> | Port: <input type="text" value="57634"/> | TTL: <input type="text" value="63"/> | Key: <input type="text"/> | |
|  whiteboard | Format: <input type="text" value="wb"/> | Proto: <input type="text" value="udp"/> | Addr: <input type="text" value="224.2.134.1"/> | Port: <input type="text" value="47108"/> | TTL: <input type="text" value="63"/> | Key: <input type="text"/> | |
|  text | Format: <input type="text" value="UCL"/> | Proto: <input type="text" value="udp"/> | Addr: <input type="text" value="224.2.233.23"/> | Port: <input type="text" value="55828"/> | TTL: <input type="text" value="63"/> | Key: <input type="text"/> | |

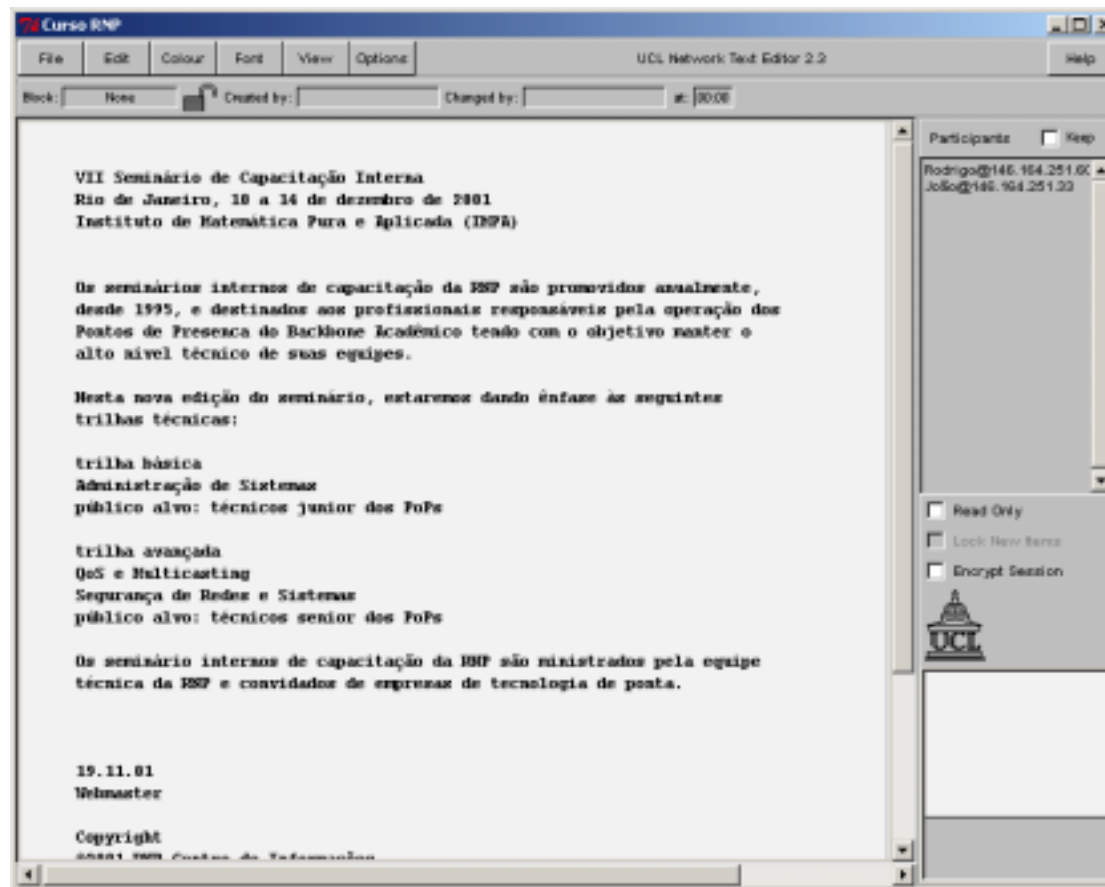
Heard from 146.164.200.2 at 09 Dec 2001 21:38 E. South America Standard Time

| | | | | | |
|------|--------|--------|------|--------|---------|
| Join | Invite | Record | Edit | Delete | Dismiss |
|------|--------|--------|------|--------|---------|

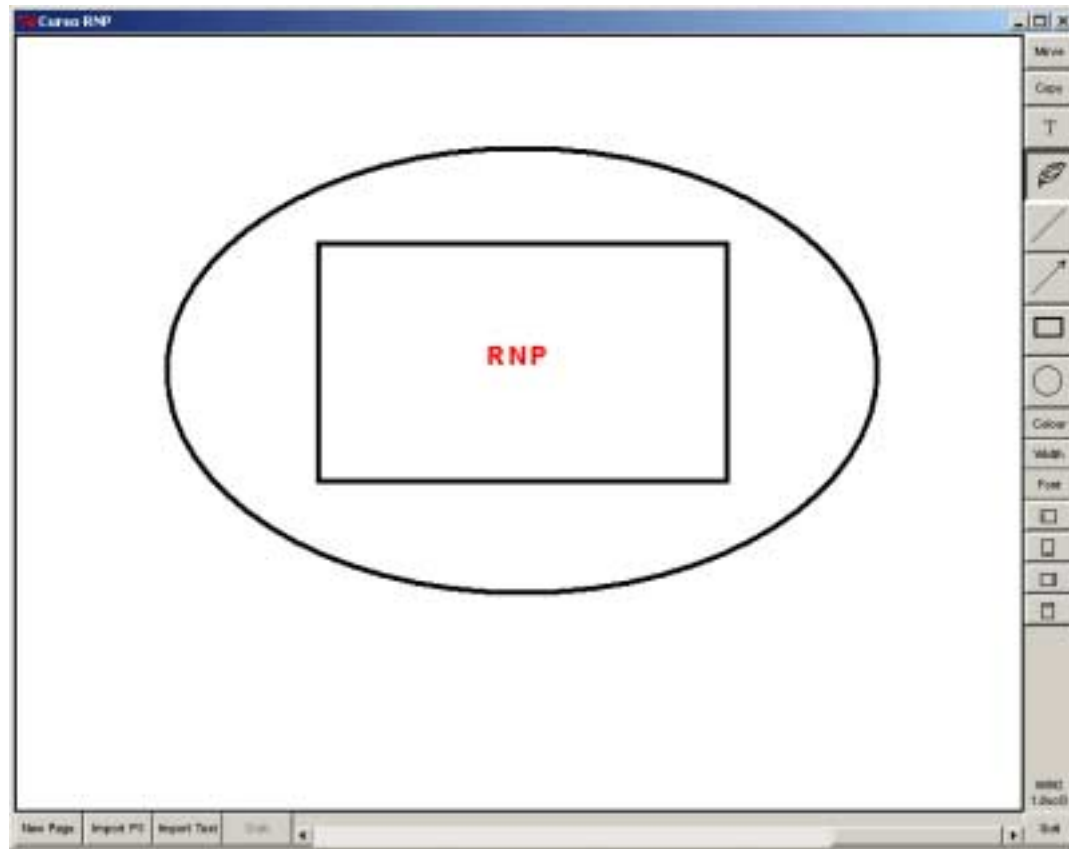
Videoconferencing Tool (VIC)



Network Text Editor (NTE)



WhiteBoard



Bookmark

- Homepage Kevin C. Almeroth
 - <http://www.cs.ucsb.edu/~almeroth/>
- Evolução do Multicast
 - <http://www.stardust.com/multicast/whitepapers/interdomain.htm>
- Ferramentas multicast
 - <http://www-mice.cs.ucl.ac.uk/multimedia/software/>
 - <http://www.mich.net/~mbone/>