NORTEL
NORTHERN TELECOM

DPN-100 ISRB Engineering and Scalability Guidelines

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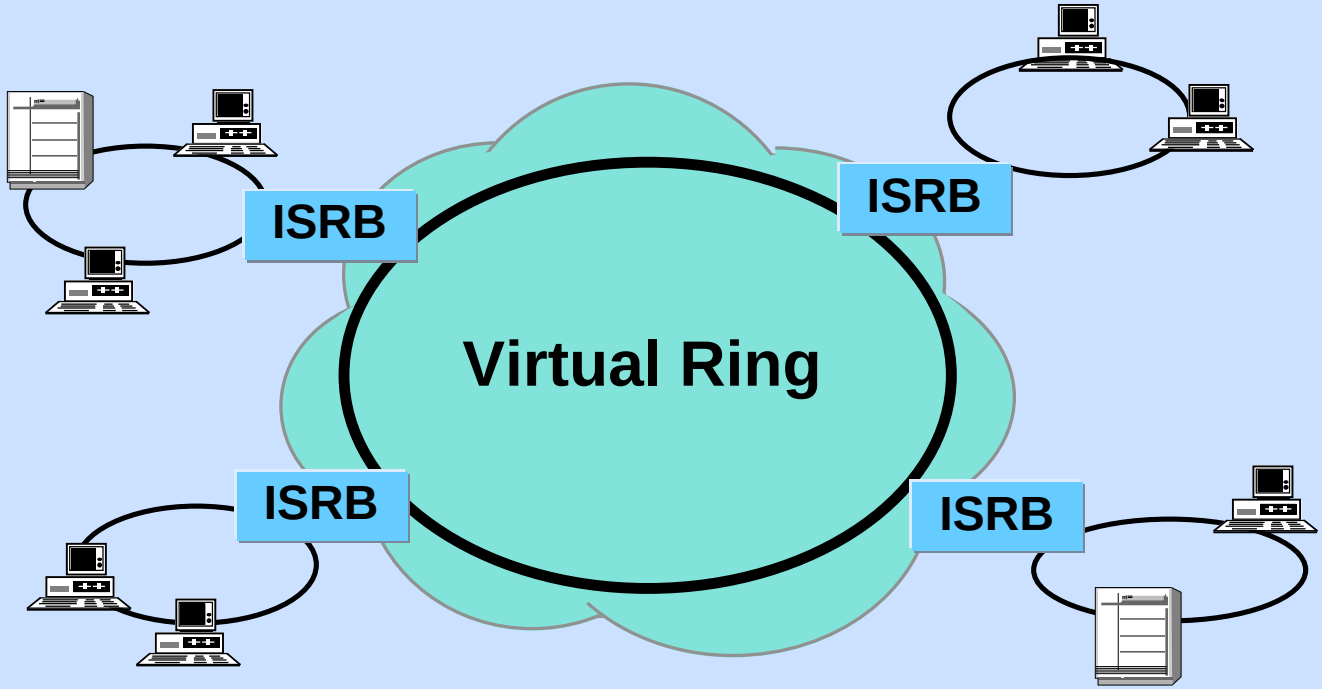
Agenda

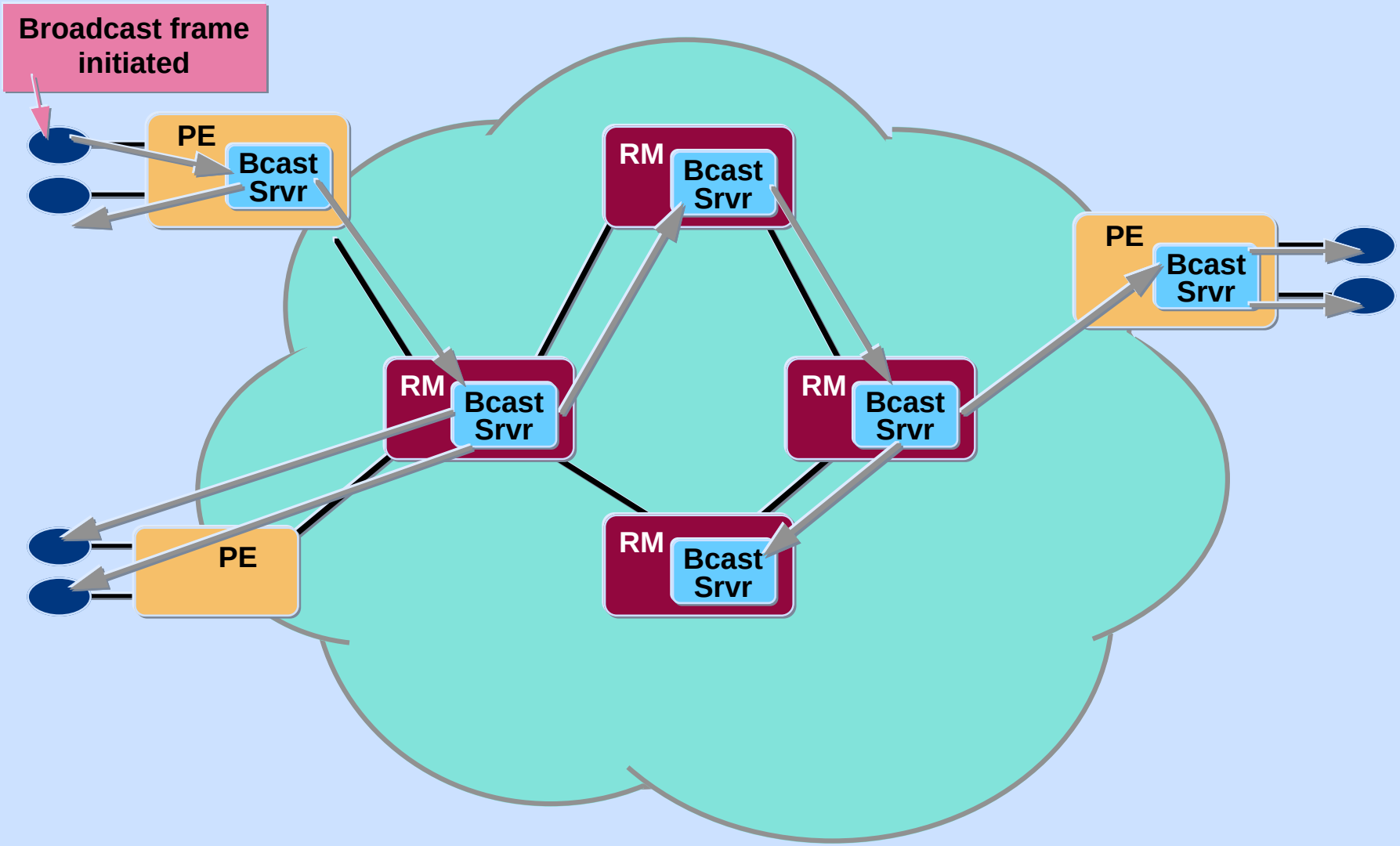
- **ISRB Overview**
- **Engineering Constraints**
- **Broadcast Traffic Sources**
- **Network Topology Considerations**
- **LanCalc Tool**
- **Interworking with Routers**

ISRB Overview



- Reduced broadcast overheads
- Exploit DPN intelligent routing
- WAN topology transparent to end users
- Supports source routing compatible applications

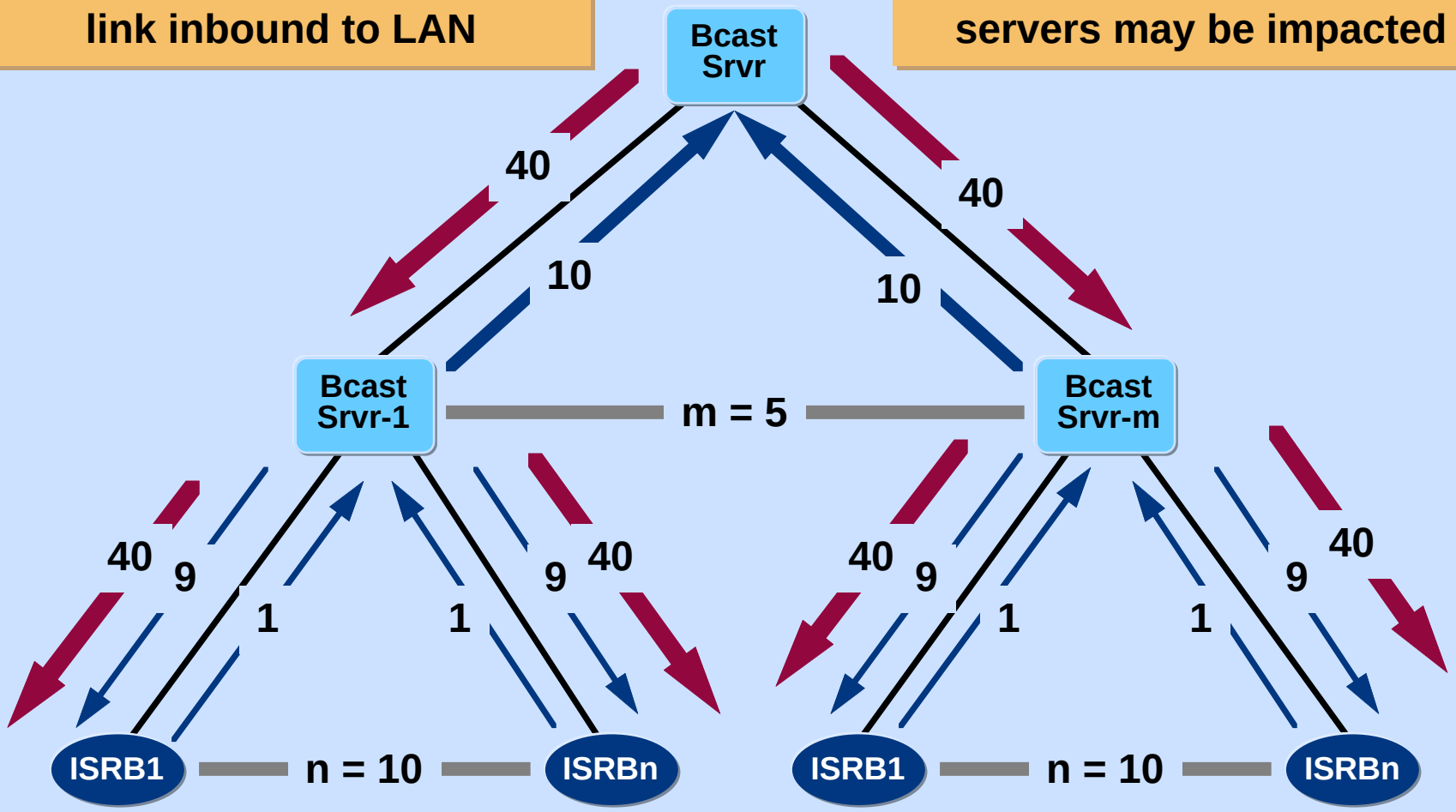
ISRB Broadcast Data Flows



Broadcast Traffic Distribution

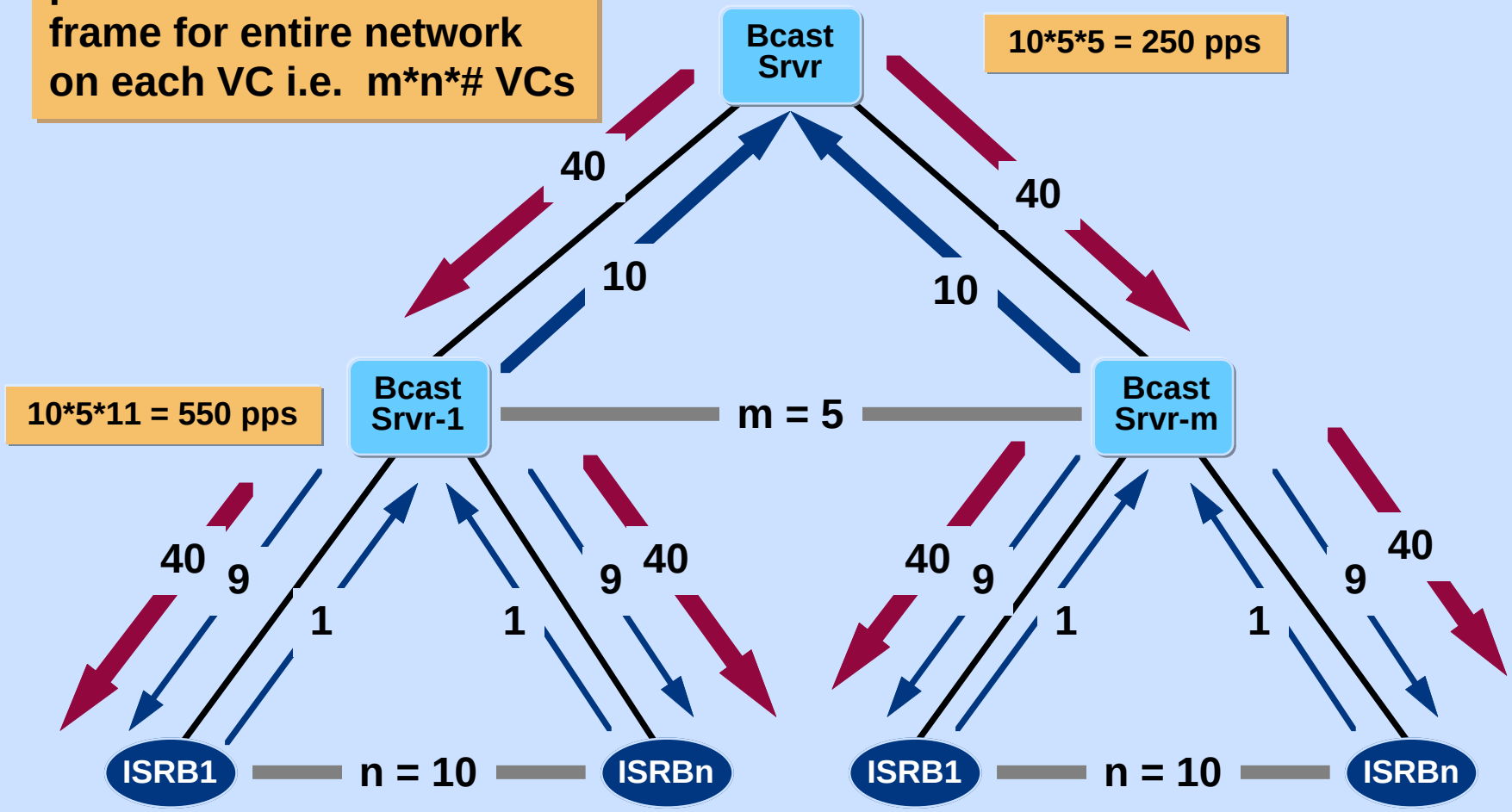
Broadcast traffic dominates link inbound to LAN

Data retrieval from remote servers may be impacted

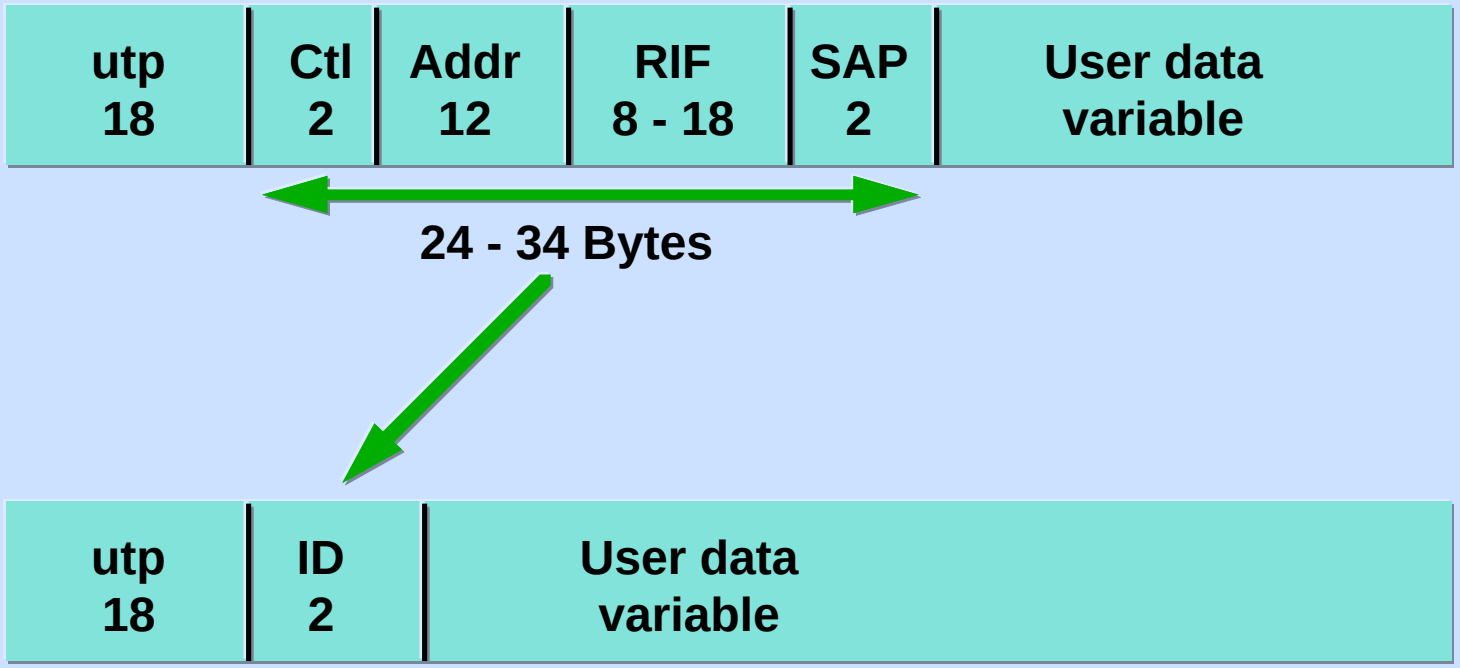


Broadcast Server PE Utilization

Each broadcast server processes each broadcast frame for entire network on each VC i.e. m*n*# VCs

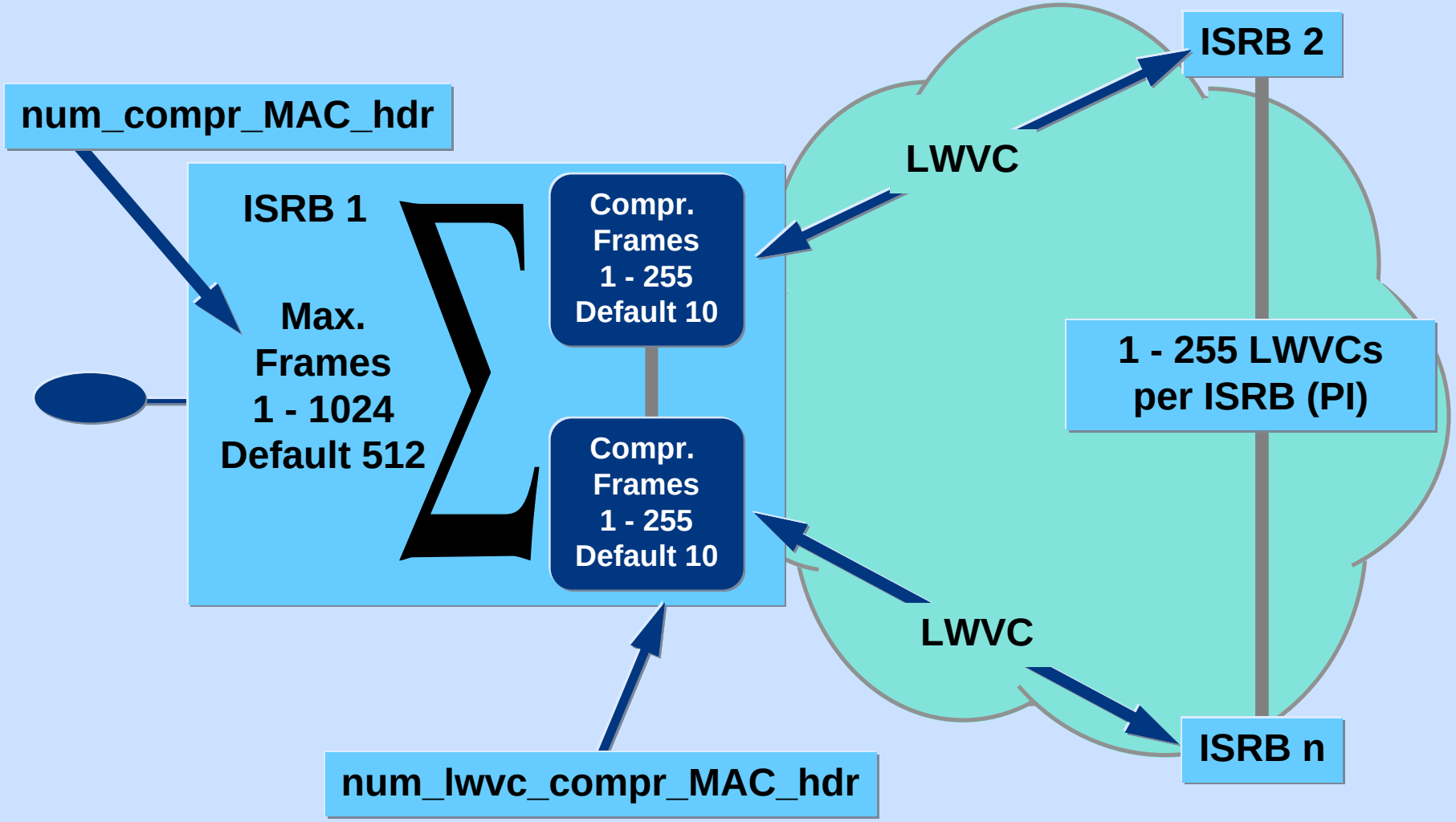


MAC Header Compression



Significant savings, particularly for short frames such as keep alive frames

MAC Header Compression Tables



MAC Header Compression Benefit

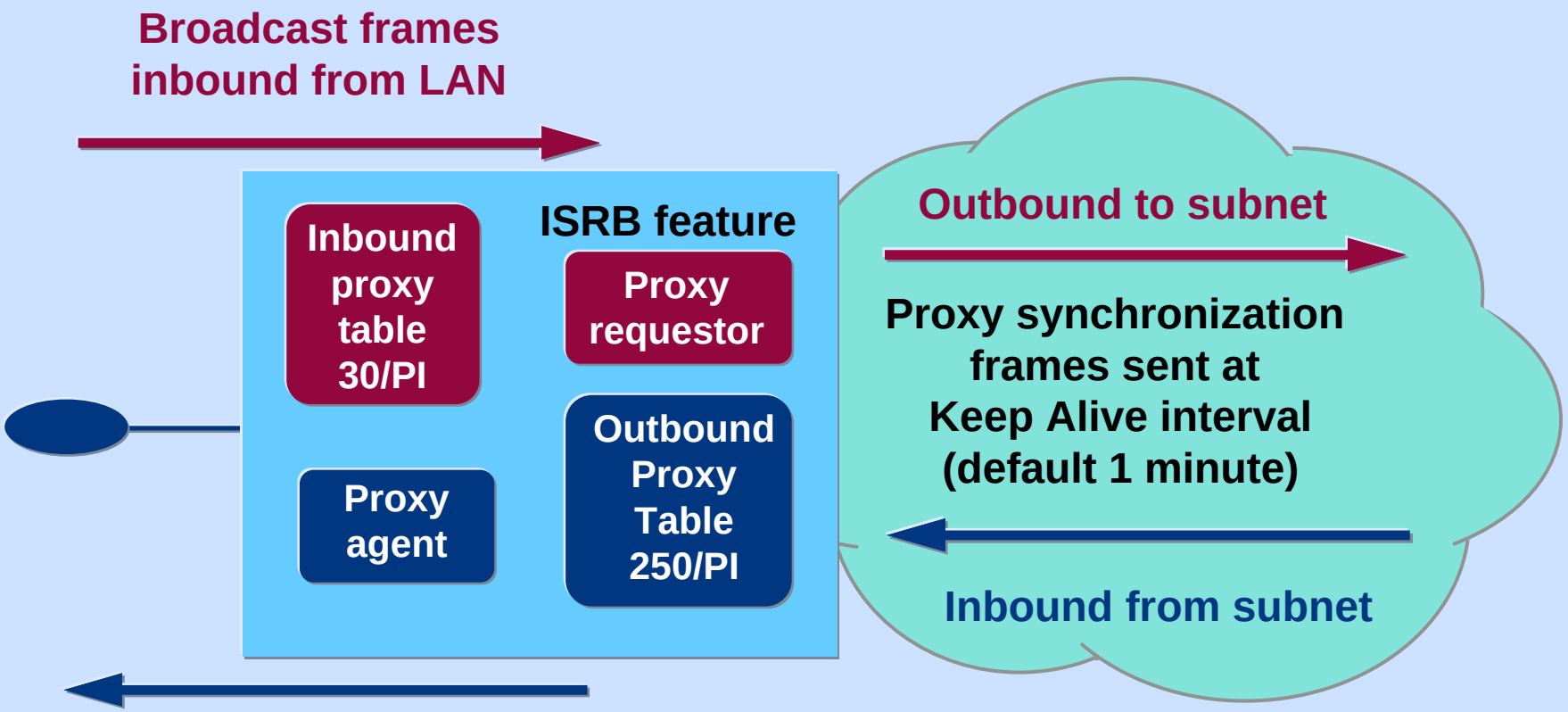
Transaction Description	Protocol ID	Options MHC	Options Proxy	Kbps Traffic Specific Route In	Kbps Traffic Specific Route Out	PE Utilization % ISRB Access	PE Utilization % Bcast Server	PE Utilization % Total Acc + Server	Link Util % In	Link Util % Out
20/50 bytes										
	TCP Interactive	N	N	2.9	2.5	0.6%	0.0%	0.6%	29.7%	25.6%
	TCP Interactive	Y	N	2.3	1.9	0.5%	0.0%	0.5%	23.6%	19.4%
100/1000 bytes										
	TCP Interactive	N	N	3.5	1.1	0.3%	0.0%	0.3%	36.9%	11.9%
	TCP Interactive	Y	N	3.3	0.9	0.3%	0.0%	0.3%	34.4%	9.4%

Approx 20% Savings

Approx 7% Savings

Compression savings greatest for small frames such as LLC2 Keep Alive frames; approximately 83%

Proxy Broadcast Server



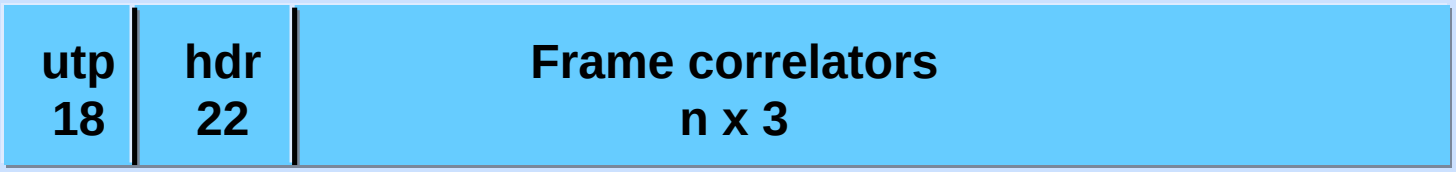
Size of proxy tables is hard coded and may be a scalability limit

Proxy Eligible Frames

- **Novell Netware RIP (Routing Information Protocol)**
- **Novell Netware SAP (Service Advertisement Protocol)**
- **IBM LanServer \MAILSLOT\NET\ NETLOGON**
- **IBM LanServer \MAILSLOT\LANMAN**
- **Netbios Name Query ***

Note: Other RIP frames such as IP RIP are NOT proxy eligible in current ISRB implementation

Proxy Synchronization Frames



- UTP header of 18 bytes
- Proxy broadcast header is 22 bytes
- Each proxiable frame is represented by a 3 byte frame correlator
- Maximum size of frame (excluding utp header) is limited to packet size defined between ISRB and broadcast server
- Proxy Requestor limited to 30 frames in Inbound table
- Maximum frame size = 18 + 22 + (30 x 3) = 130 bytes

Proxy Broadcast Savings

Protocol ID	Options MHC	Options Proxy	Kbps Traffic Summary: Specific Route In	Specific Route Out	Broadcast In	Broadcast Out	Cumulative Frame Counts: Proxied In	Proxied Out	MHC Total	MHC perVC	PE Utilization %: ISRB Access	Bcast Server	Total Acc + Server	Link Util %: In	Out
Novell SAP	N	N	0.0	0.0	10.4	0.1	0	0	0	0	0.6%	11.8%	12.4%	18.6%	0.1%
Novell SAP	N	Y	0.0	0.0	1.2	0.0	1	200	0	0	0.2%	9.4%	9.6%	2.2%	0.0%
							Proxy Server savings				61.7%	20.3%	22.2%	88.2%	90.5%

Significant savings from use of Proxy Server for example:

Access PE	**60%**
Server PE	**20%**
Access Link	**90%**

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- **Engineering Constraints**
- Broadcast Traffic Sources
- Network Topology Considerations
- LanCalc Tool
- Interworking with Routers

Engineering Constraints

- **Multiple possible constraints**
  - **network link bandwidth**
  - **access PE utilization**
  - **broadcast server PE utilization**
  - **Proxy Table sizes**
  - **MAC Header Compression Table sizes**
- **Weakest link determines scalability limit**

1. **Establish criteria for each potential constraint**
2. **Use LanCalc Tool to evaluate each resource**
3. **Determine scalability based on limiting constraint**
4. **Each network and application is unique**

Network Link Utilization

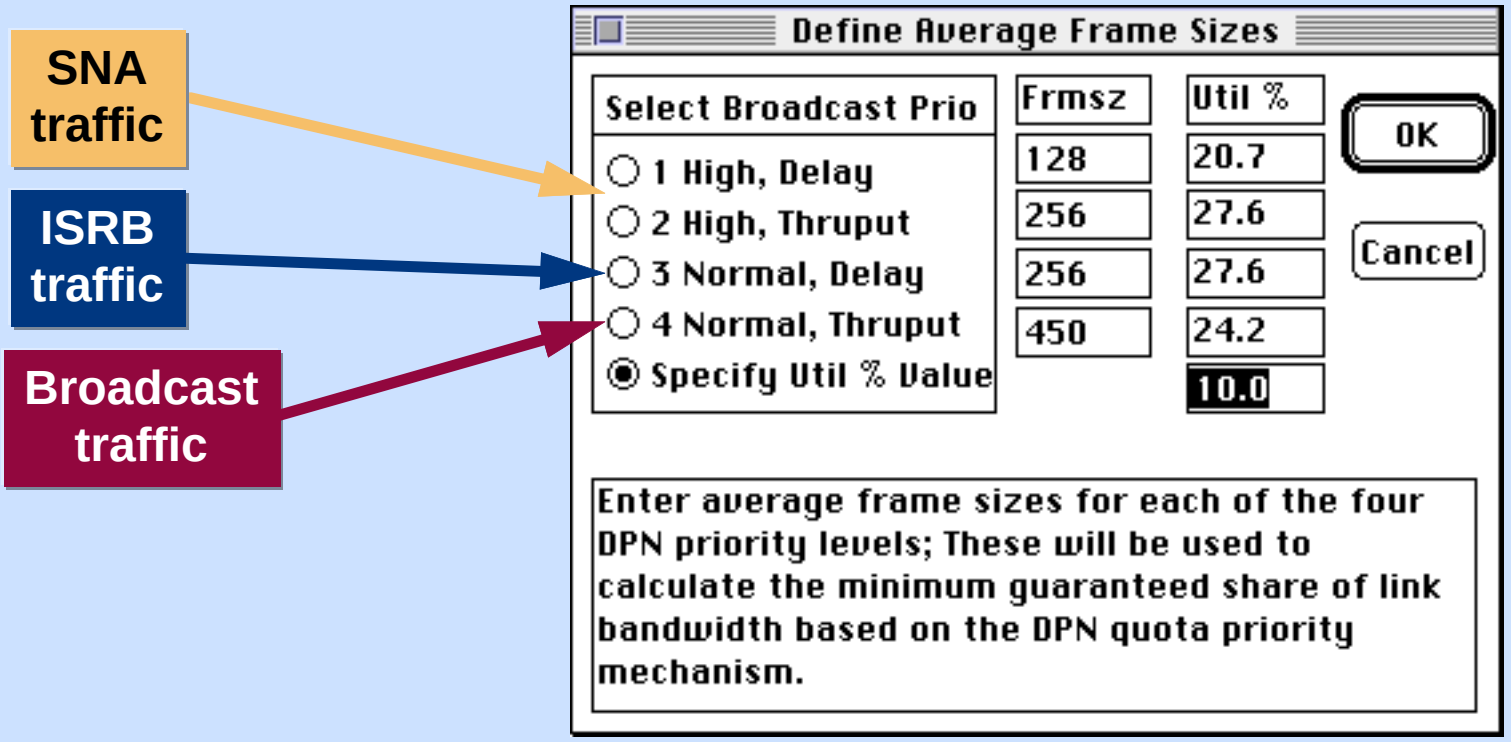
- Function of network size, number of devices, application protocols, frame sizes, and ISRB options
- Separate criteria for broadcast traffic and specifically routed traffic
- Protocols such as TCP and SPX burst mode use all available bandwidth
- Slowest speed network link normally the limiting constraint

Need a methodology to establish maximum allowable broadcast traffic

Broadcast Traffic Limitation

- **Constrain broadcast traffic to lowest priority of DPN 4 Q mechanism**
- **Determine percentage share of network link for each priority level**
  - **function of average frame size for each level**
  - **evaluate statistics to determine average frame sizes**
  - **use LanCalc tool to determine percentage share**
- **Determine percentage to allow for broadcast**
- **Consider other features sharing Broadcast Server**
  - **T2.1 Router; ITI, or X.25 Broadcast**

Broadcast Traffic Limit Example



- Each network will be different
- Exploit DPN prioritization mechanism

PE Type and Broadcast Server

- **Use of Broadcast Server on a MAS is a double edged sword**
  - **netlink utilization will be reduced**
  - **broadcast server must process all broadcast frames, and may consume too much of PE utilization, becoming the weakest link**
- **Only applies if there are multiple ISRB capable PIs on the MAS, or downstream MAS-based nodes in a cascaded configuration**

LanCalc tool makes it easy to examine this tradeoff

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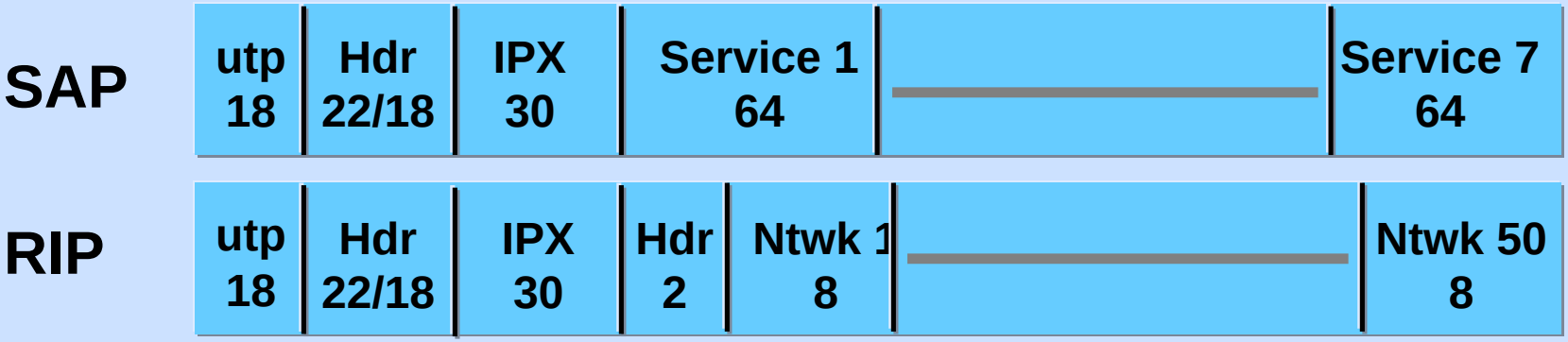
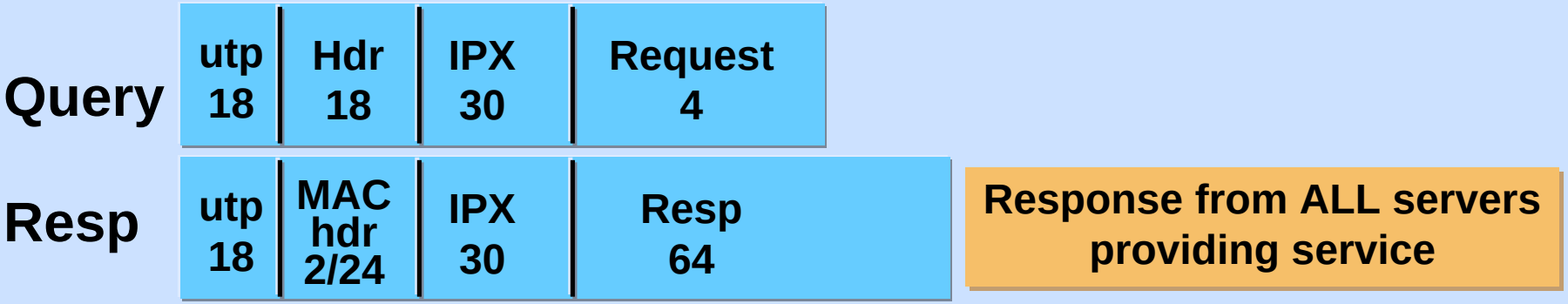
Novell Netware Broadcast Sources

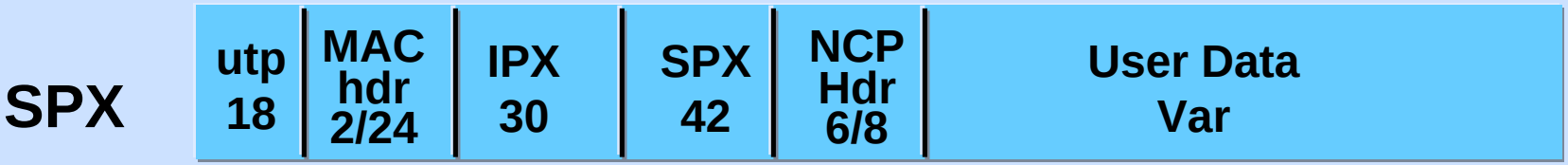
- **SAP (Service Advertising Protocol)**
  - **broadcast every 60 seconds by every server**
  - **frame size a function of number of services**
- **RIP (Routing Information Protocol)**
  - **broadcast every 60 seconds by every IPX router**
  - **frame size a function of topology of network**
- **Service query**
  - **broadcast by every Novell user station to locate nearest servers**
  - **use Sniffer to determine relevant frequency**

Netware Frame sizes

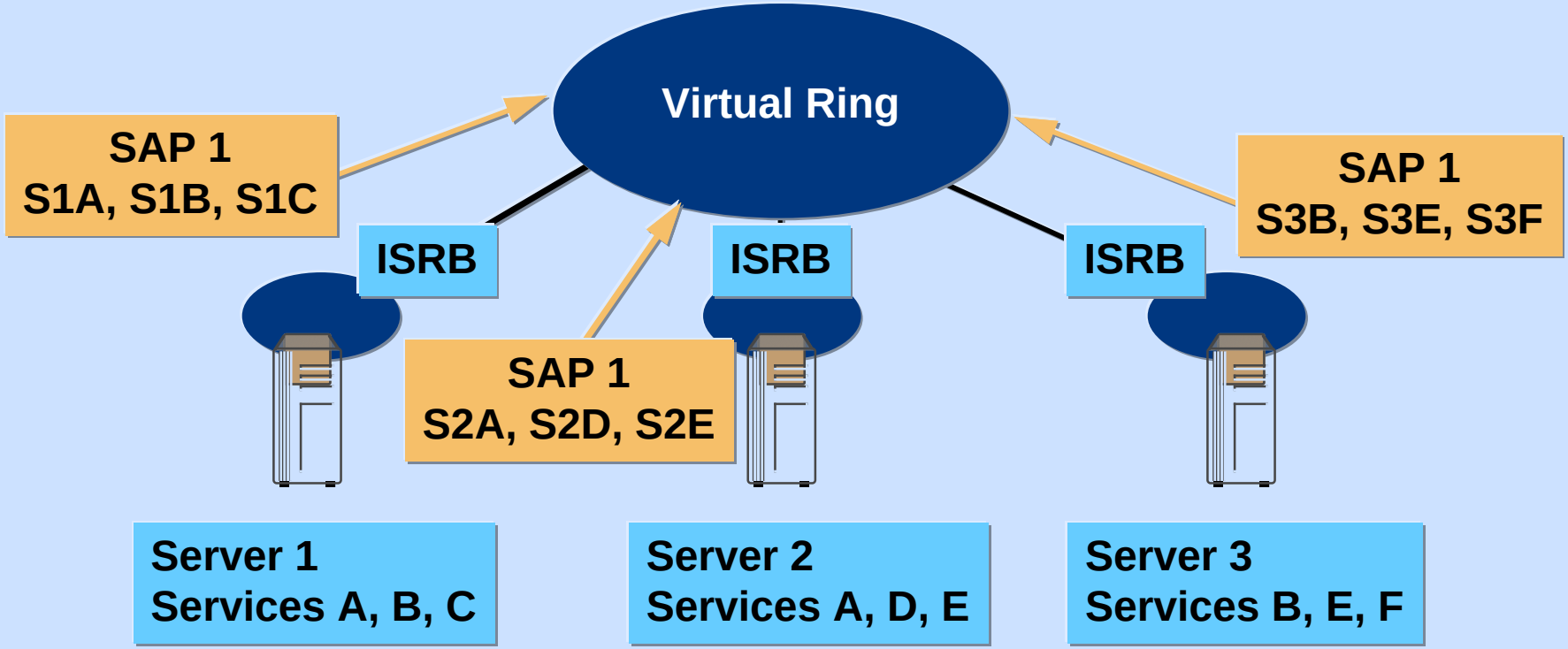


Nearest service:

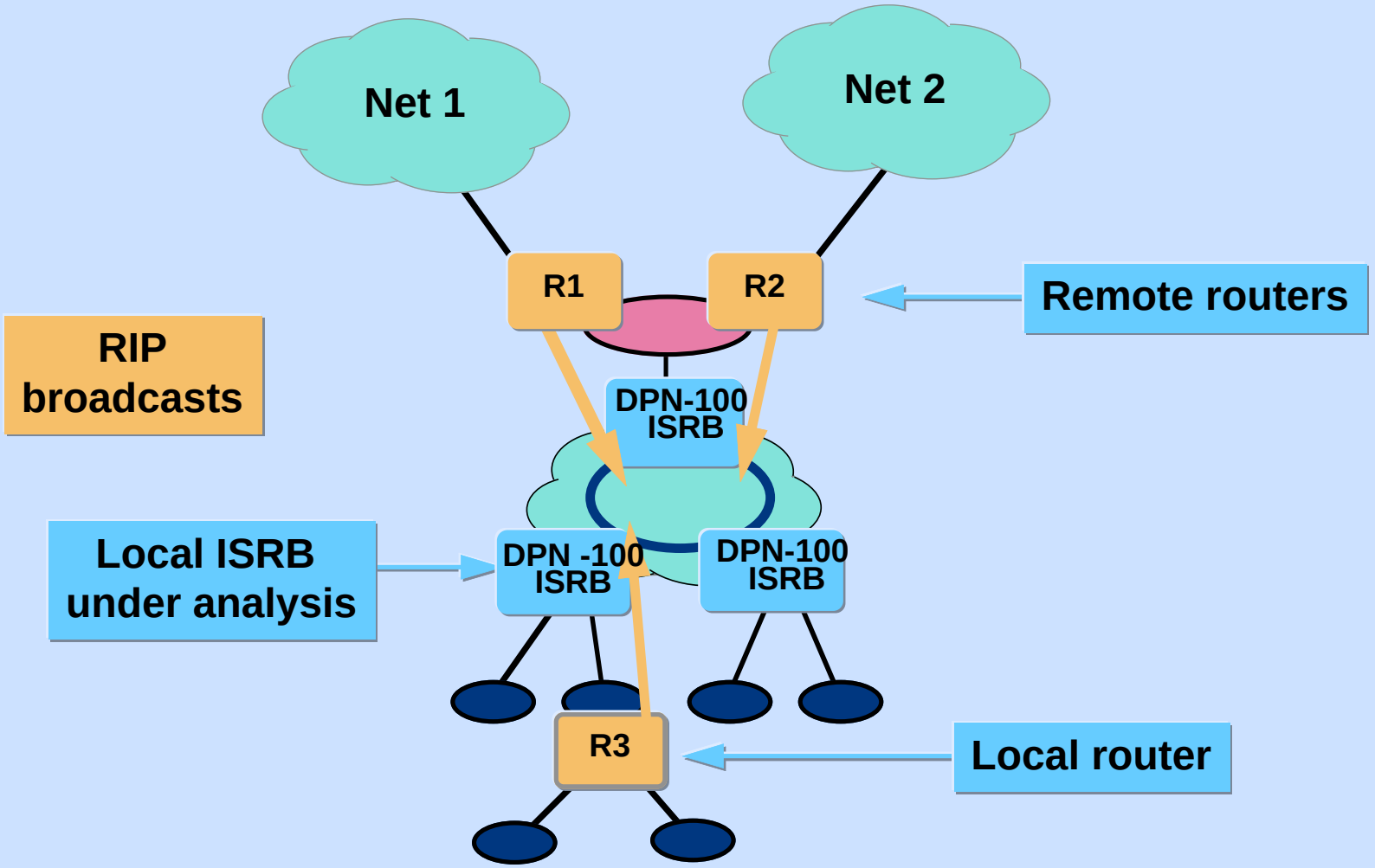




Netware SAP Detail



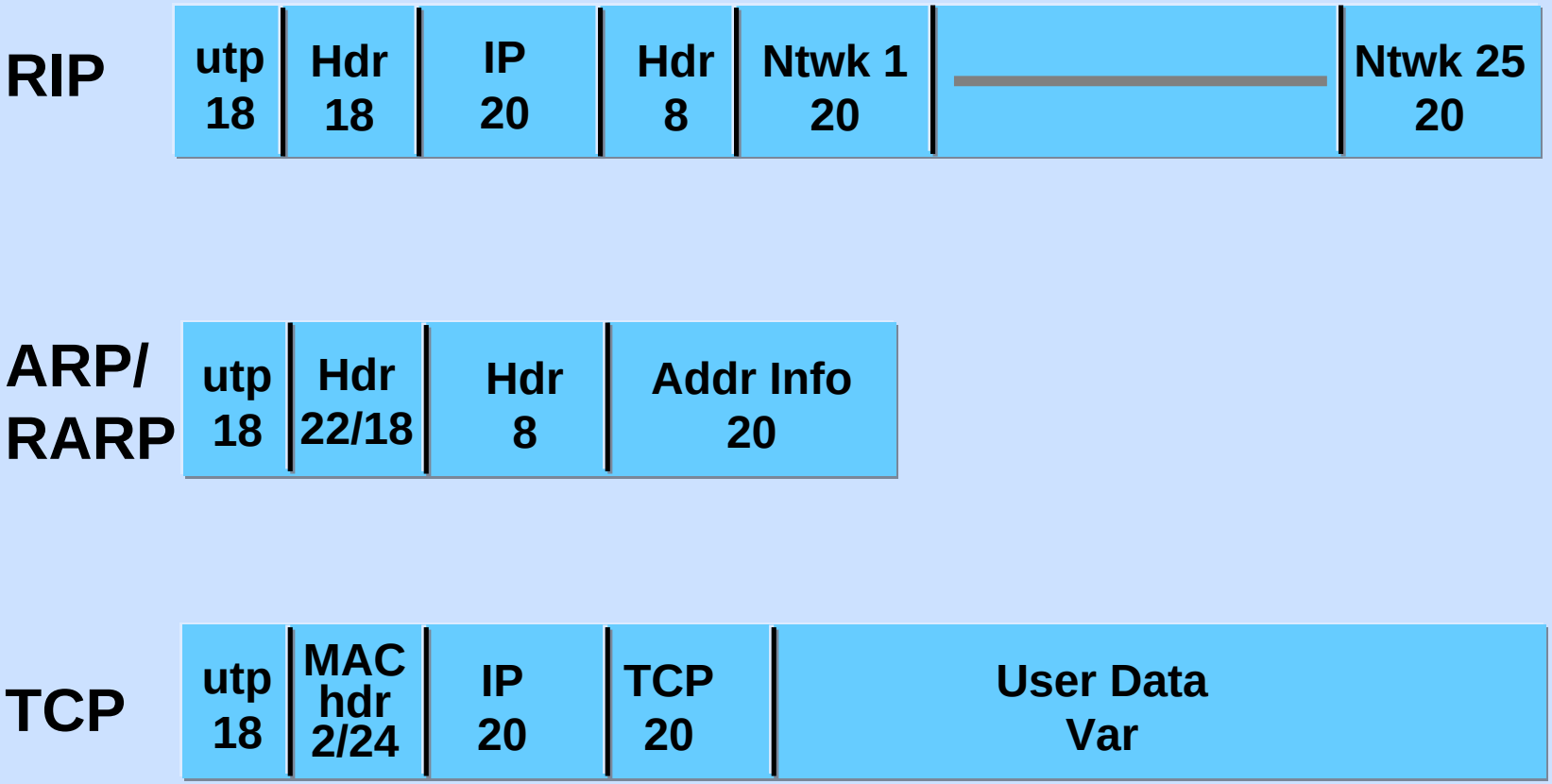
RIP Overview



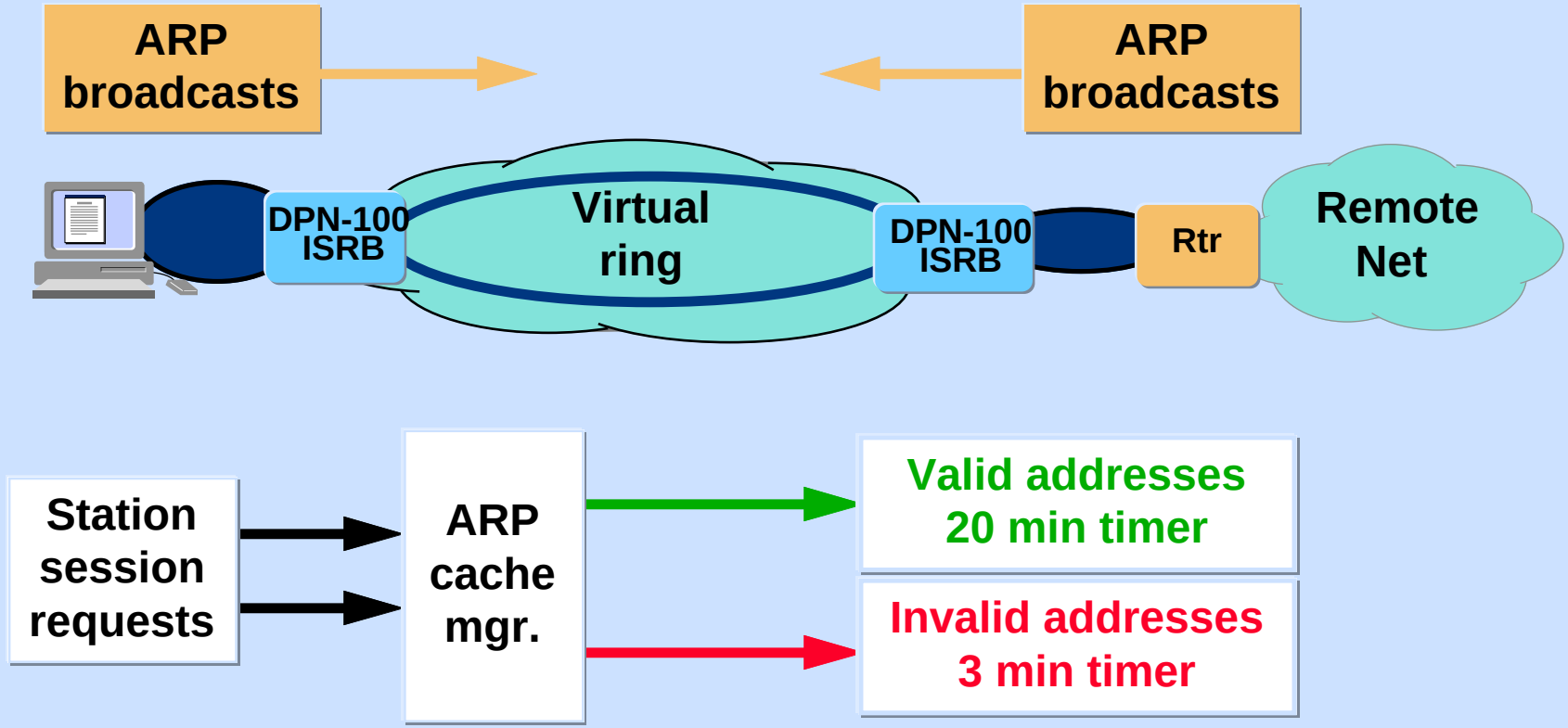
IP Broadcast Sources

- **RIP (Routing Information Protocol)**
  - **broadcast by every router every 30 seconds**
  - **frame size a function of network topology**
- **IP ARP (Address Resolution Protocol)**
  - **broadcast by individual stations to determine MAC address associated with a given IP addr**
  - **frequency a function of appl'n characteristics**
  - **use Sniffer to determine frequency**
- **IP RARP (Reverse Address Resolution Protocol)**
  - **used by diskless workstations to locate their server**
  - **potential source of broadcast storms**

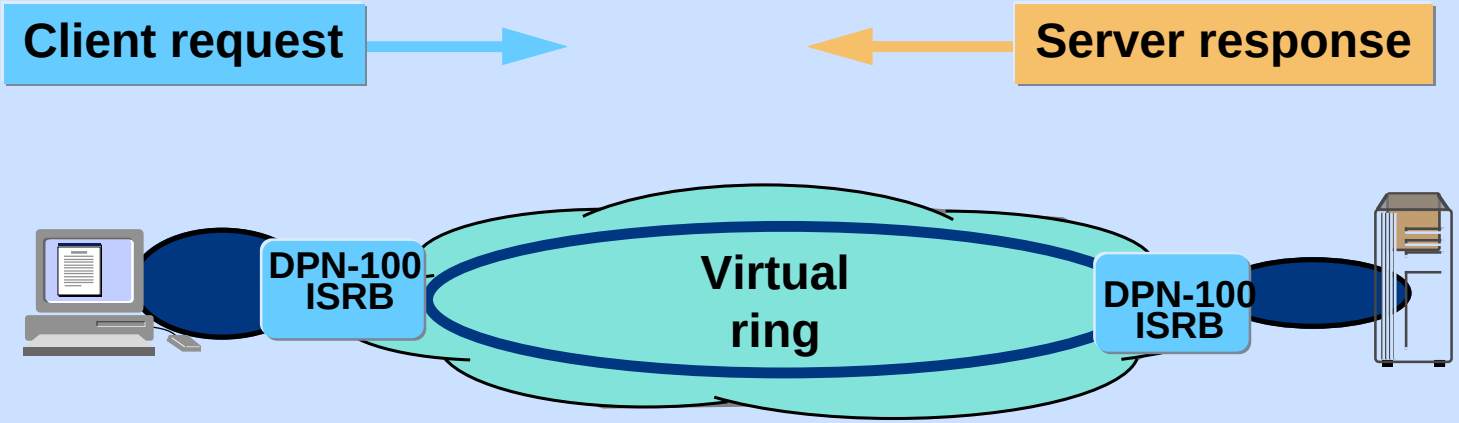
TCP/IP Frame Sizes



ARP Overview



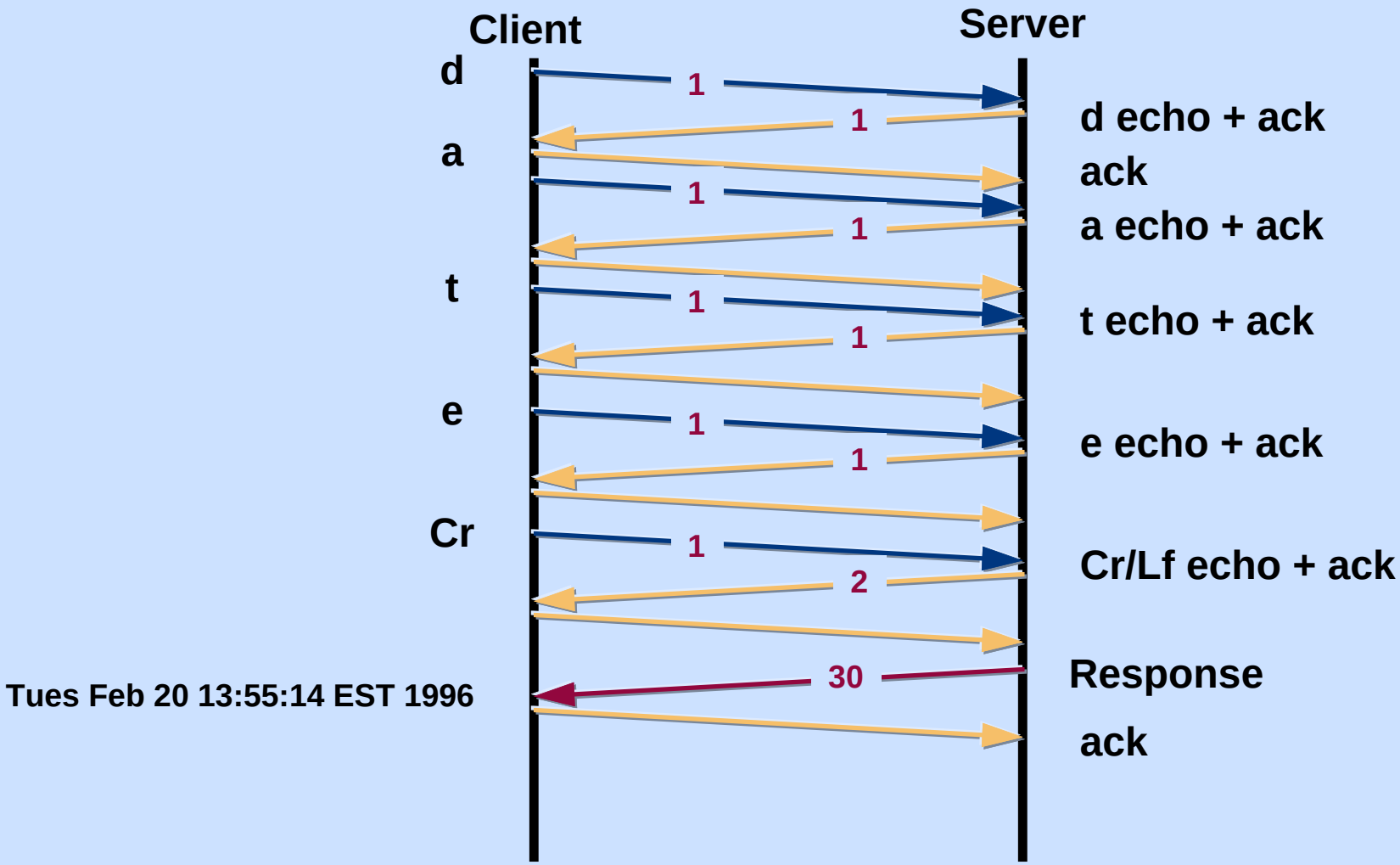
Telnet and Rlogin Overview



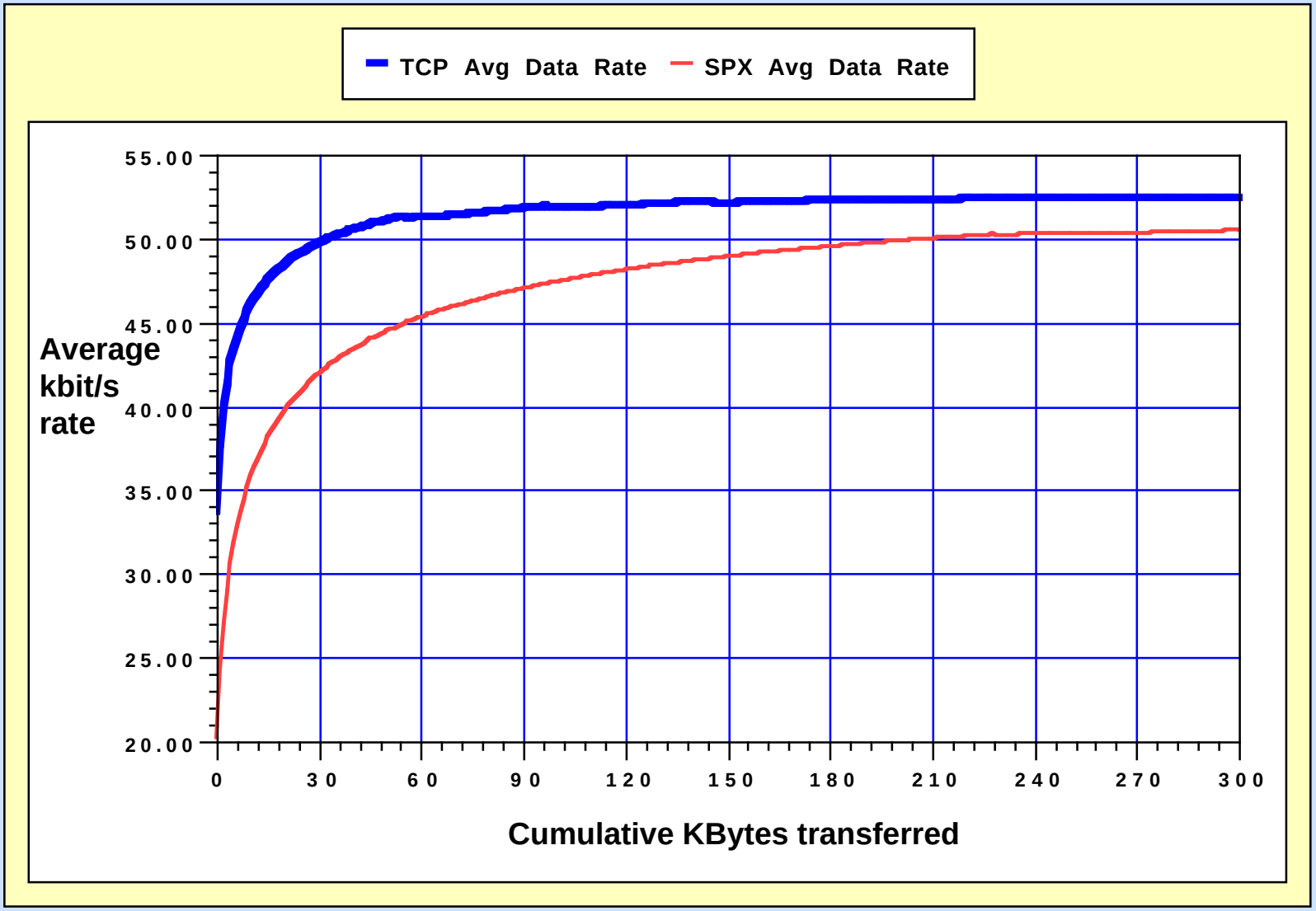
Character Mode:
1 byte packets
Line Mode:
Multi byte packets

Nagle Algorithm:
Buffers characters as a function of round trip time. Reduces negative impact of Character Mode operation.
Use Sniffer to determine average packet size

Telnet Character Mode



TCP and Novell File Transfer



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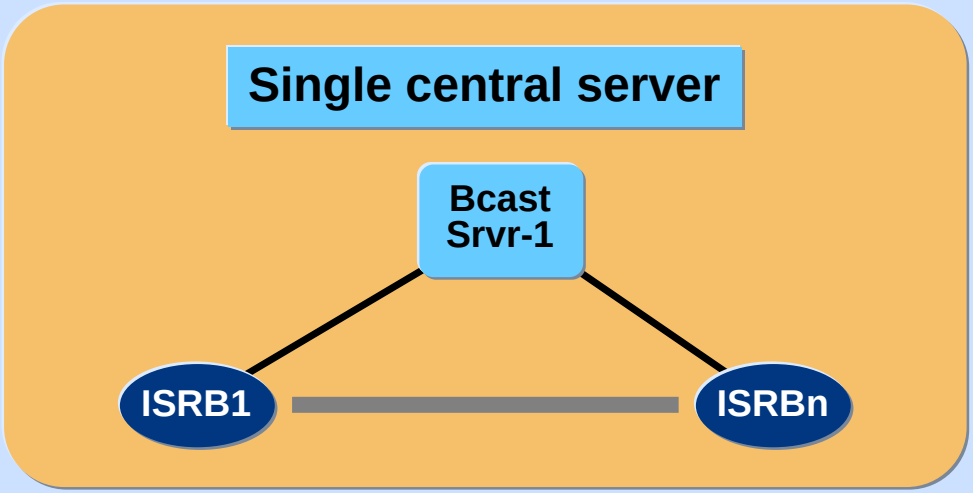
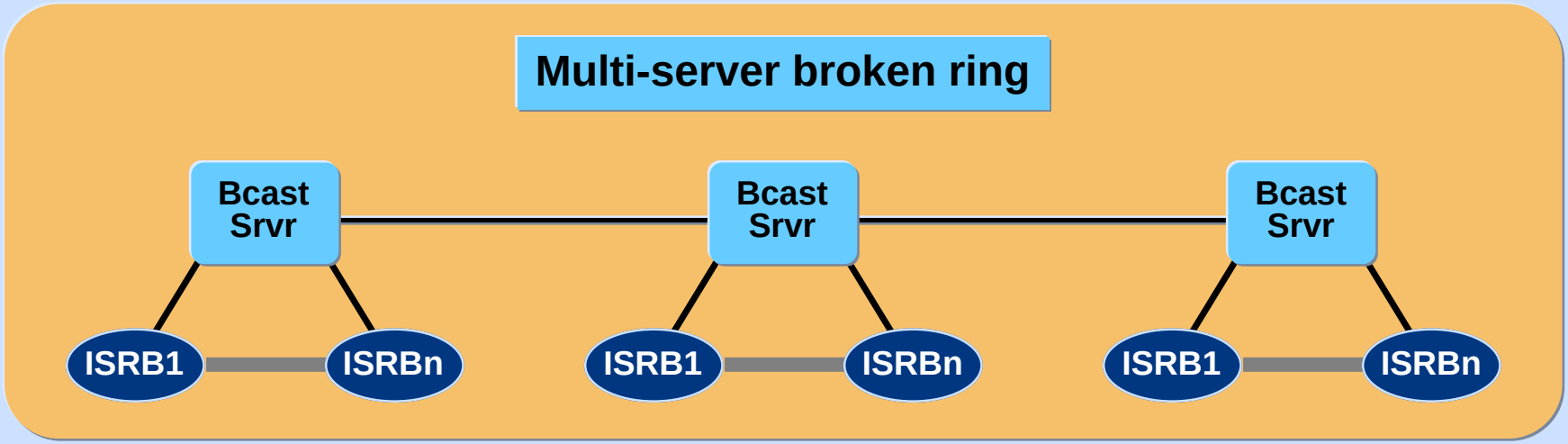
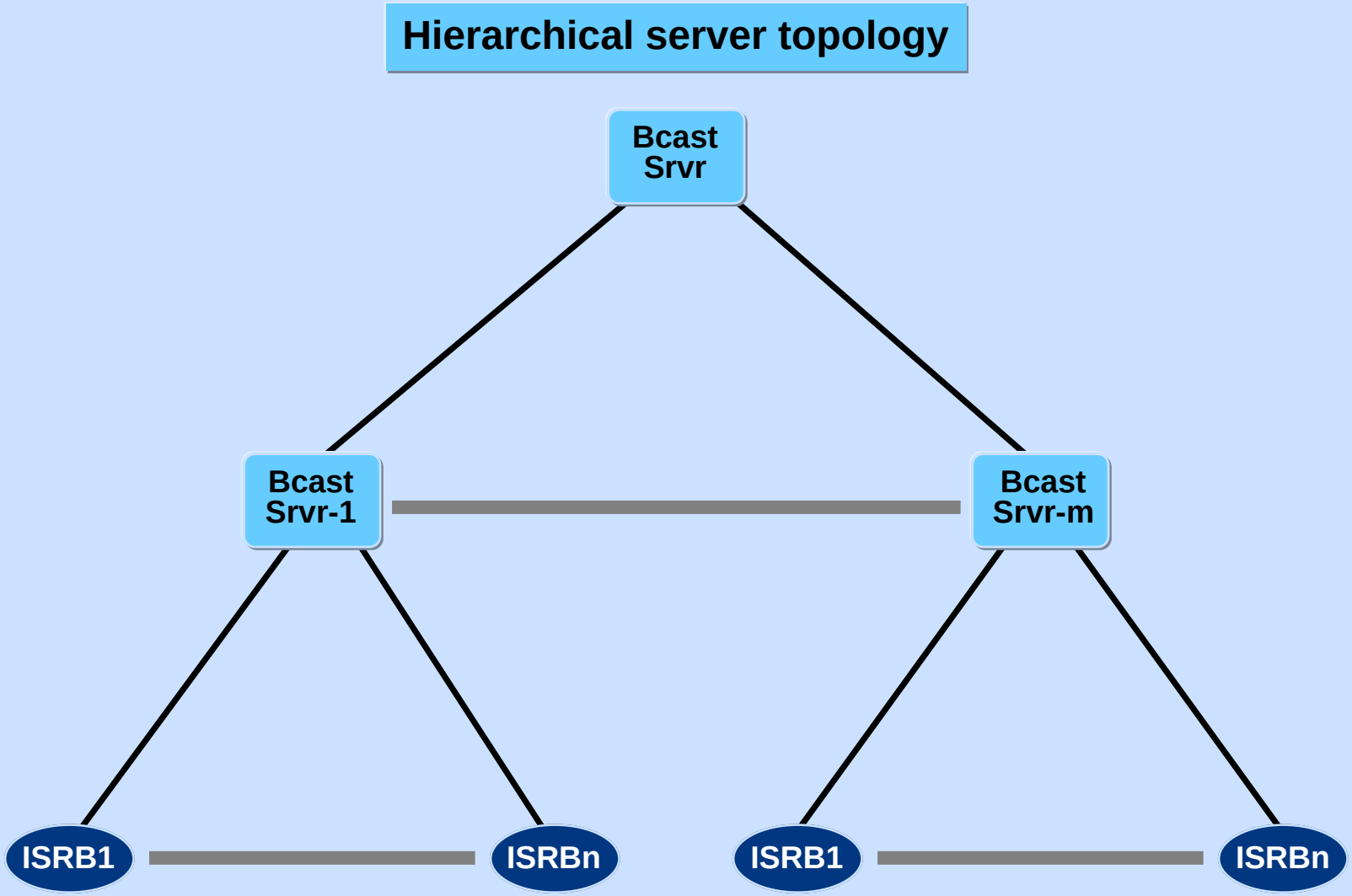
Broadcast Server Topologies 1



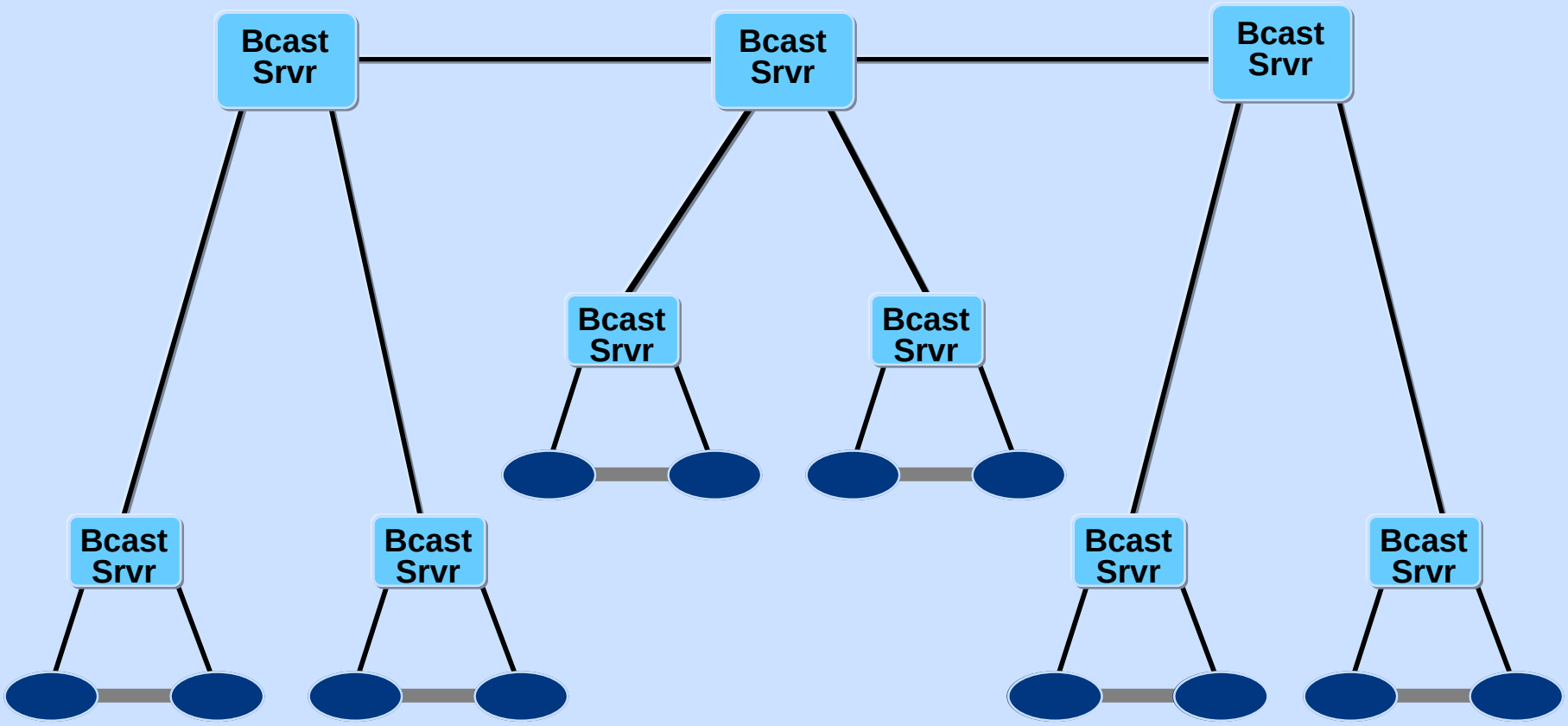


Broadcast Server Topologies 2

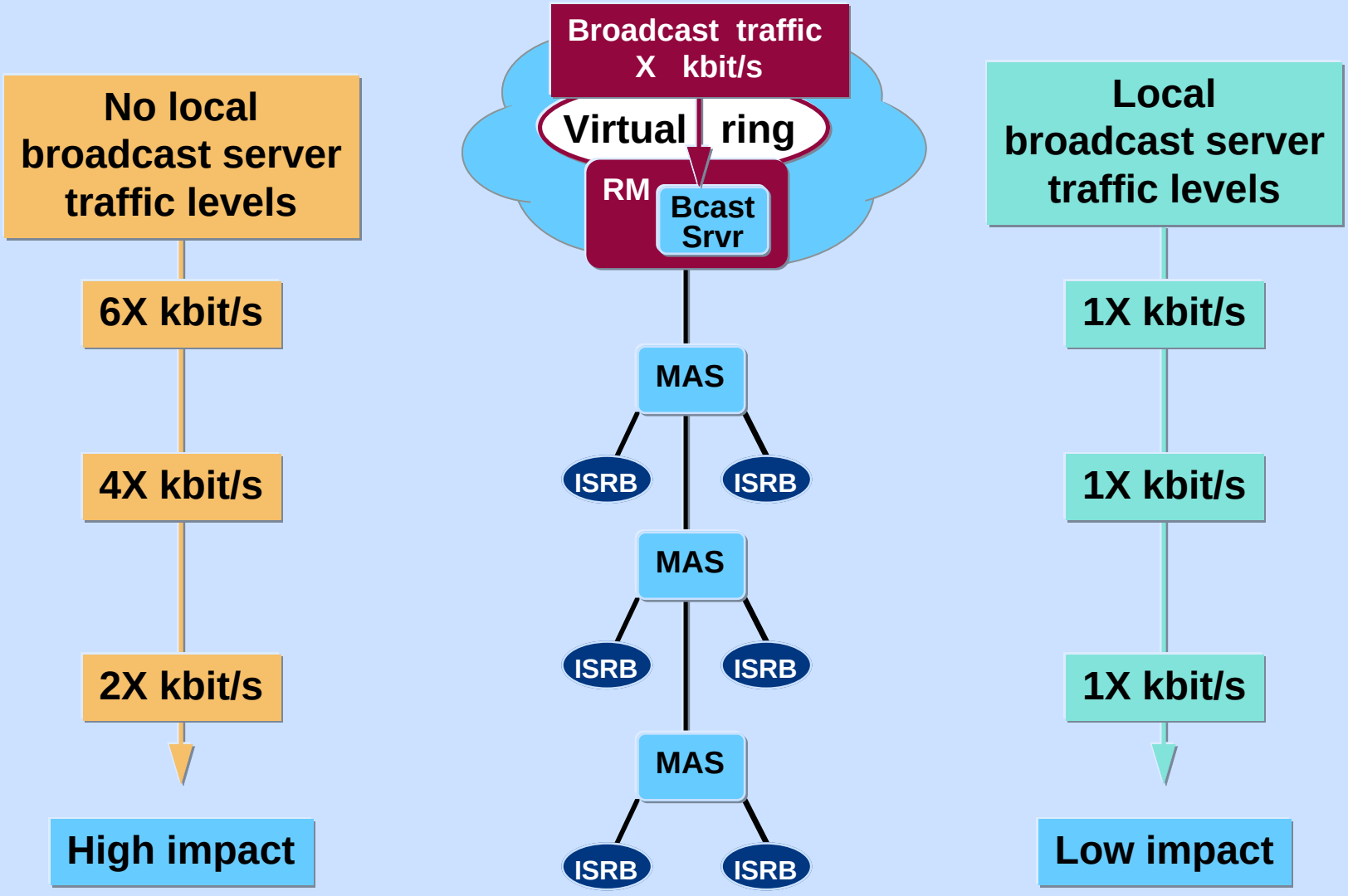


Broadcast Server Topologies 3

Hierarchical multi-server broken ring



Tandem Server Considerations



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- **LanCalc Tool**
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LanCalc Overview

- **Wingz spreadsheet-based tool available for PC, MAC, and Unix platforms**
- **Dialog boxes for all data entry**
- **Context sensitive help**
- **Table driven to make extensions easy and permit key parameters to be changed**
- **Detailed error log for parameters and inputs out of range**
- **All logic coded in Hyperscript to prevent inadvertent change and speed execution**

Wingz available from IISC worldwide

LanCalc Main Page

Global parameter dialog boxes (3)

	Global Access Variables			Global Broadcast Variables			Link Limits	Frmsz	Util	Kbps
12-Feb-96	PE Type	MAS HPPE ; SEL ; UTP NL		PE Type	MAS 386		High,Delay 1	100	17.6%	11.3
	Link Speed Kbps	64.0		Max # Srvr VCs	10		High, Thruput 2	200	23.5%	15.0
	Subnet Pktsz	512		ProxyKeepAlive	1	min.	Normal,Delay 3	300	35.3%	22.6
	Avg. # LWVCs	4		MTU (Frame Size)	512		Normal,Thruput4	400	23.5%	15.0
							Limiting Broadcast Util%		**5.0%**	3.2

		Options		Kbps Traffic Summary				Cumulative Frame Counts				PE Utilization %			Link Util %		Erro
Transaction	Protocol			Specific Route		Broadcast		Proxied		MHC		ISRB	Bcast	Total	In	Out	Msg
Description	ID	MHC	Proxy	In	Out	In	Out	In	Out	Total	perVC	Access	Server	Acc + Server			
Case1																	
	Novell SAP	N	N	0.0	0.0	10.4	0.1	0	0	0	0	0.6%	16.0%	16.6%	16.3%	0.1%	1 err
	Novell SAP	N	Y	0.0	0.0	1.2	0.0	1	200	0	0	0.2%	12.2%	12.4%	1.9%	0.0%	
	Novell RIP	N	Y	0.0	0.0	0.6	0.0	1	100	0	0	0.1%	6.1%	6.2%	0.9%	0.0%	

Input parameters via dialog box

Summary output results area

LanCalc Input Parameters Page

		Input Parameter Names & Values									
Trans'n	Protocol	Parm 1		Parm 2		Parm 3		Parm 4		Parm 5	
ID	ID	Name	Val	Name	Val	Name	Val	Name	Val	Name	Val
Case1											
	Novell SAP	# Local Servers	1	# Local Services	6	# Rmt Servers	100	# Rmt Services	10		
	Novell SAP	# Local Servers	1	# Local Services	6	# Rmt Servers	100	# Rmt Services	10		
	Novell RIP	# Remote Rtrs	100	RmtNetsPerRtr	10	# Local Rtrs	1	LocNetsPerRtr	10		
	Novell RIP	# Remote Rtrs	100	RmtNetsPerRtr	10	# Local Rtrs	1	LocNetsPerRtr	10		
	IP RIP	# Remote Rtrs	10	RmtNetsPerRtr	100	# Local Rtrs	1	LocNetsPerRtr	25		
	IP ARP	Local Stations	10	Remote Stations	100	Sessions/Station	10	Frequency in min.	1		
	TCP Interactive	Local Stations	10	Sessions/Station	1	Msg Size Outboun	100	Msg Size Inbound	100	Interval in min.	1

Protocol ID

Parameter name and value up to six parameters

LanCalc Intermediate Results

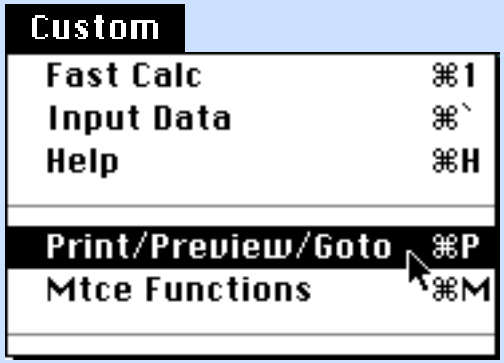
	Specific (Non Broadcast) Traffic Intermediate Calculations															
	Outbound from LAN								Inbound to LAN							
Protocol	frms	pkts	Kbytes	Frame Size		Kbits	Link	PE	frms	pkts	Kbytes	Frame Size		Kbits	Link	PE
ID	/sec	/sec	/sec	User	Total	/sec	Util	Util	/sec	/sec	/sec	User	Total	/sec	Util	Util
	fps	pps	Kbps	Bytes	Bytes	LKbps	%	%	fps	pps	Kbps	Bytes	Bytes	LKbps	%	%
Novell SAP	0.02	0.02	0.007	436	454	0.00	0.0%	0.0%	3.33	3.33	1.240	372	390	0.00	0.0%	0.6%
Novell SAP	0.02	0.02	0.000	25	43	0.00	0.0%	0.0%	3.33	3.33	0.093	28	46	0.00	0.0%	0.2%
Novell RIP	0.02	0.02	0.000	25	43	0.00	0.0%	0.0%	1.67	1.67	0.042	25	43	0.00	0.0%	0.1%
Novell RIP	0.02	0.02	0.002	132	150	0.00	0.0%	0.0%	1.67	1.67	0.220	132	150	0.00	0.0%	0.2%
IP RIP	0.07	0.07	0.019	278	296	0.00	0.0%	0.0%	1.67	1.67	0.713	428	446	0.00	0.0%	0.3%
IP ARP	1.67	1.67	0.047	28	46	0.00	0.0%	0.1%	18.33	18.33	0.513	52	70	0.93	1.5%	1.2%

Protocol ID

Outbound **Inbound**

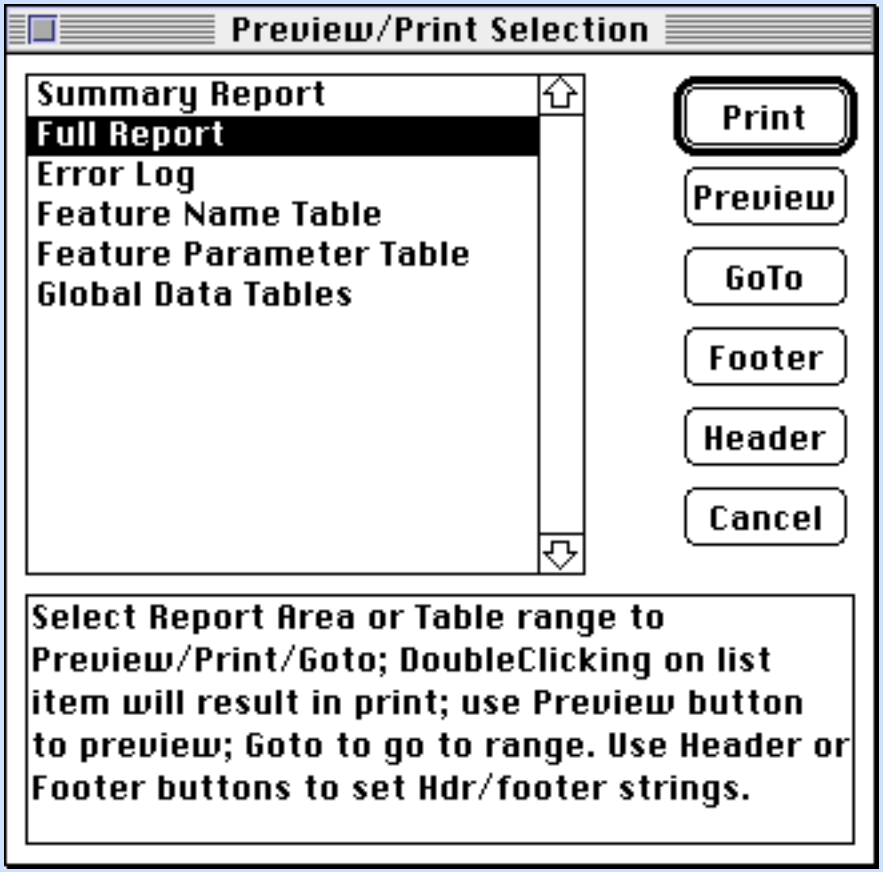
- **Intermediate calculation values**
- **Same format for broadcast traffic**
- **Incremental, not cumulative**
- **Context-sensitive help**

LanCalc Menu Dialogs

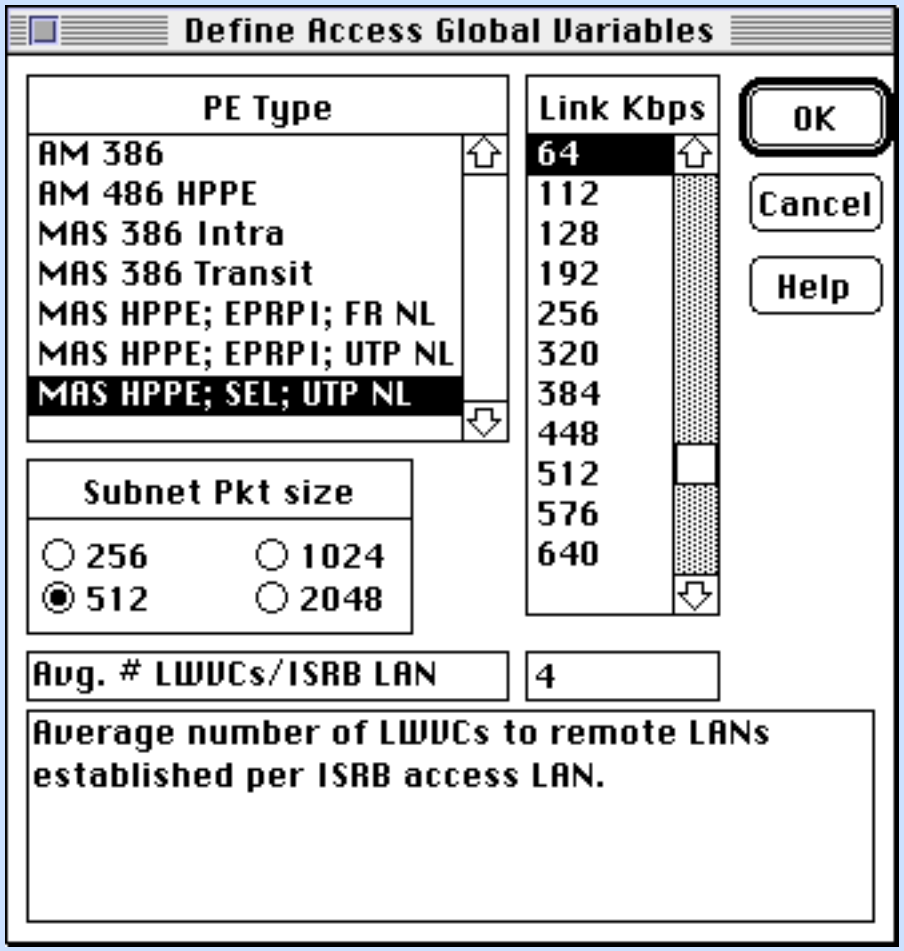


The Custom Menu item is used to:

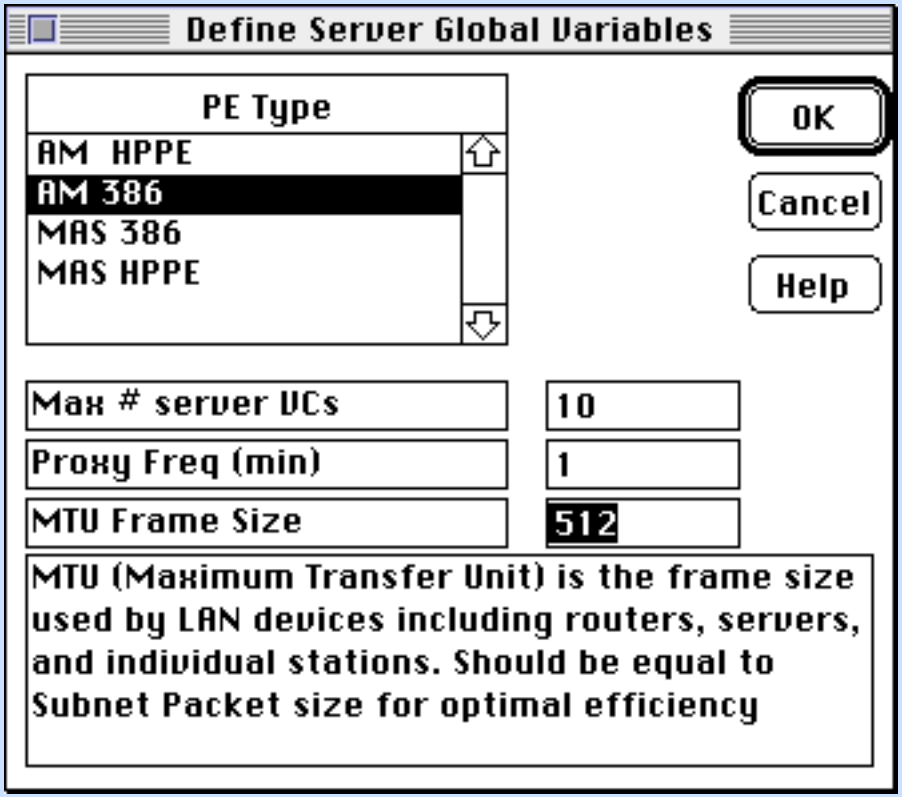
1. **Initiate calculations;**
2. **Navigate around the sheet (go to); or**
3. **Print selected reports.**



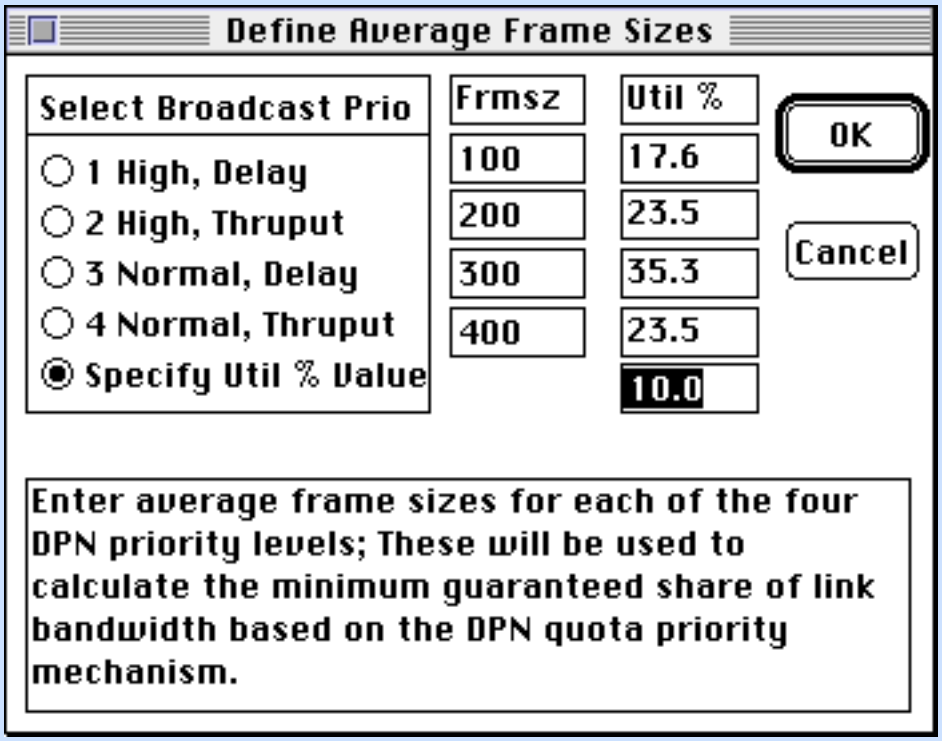
LanCalc Global Access Dialog Box



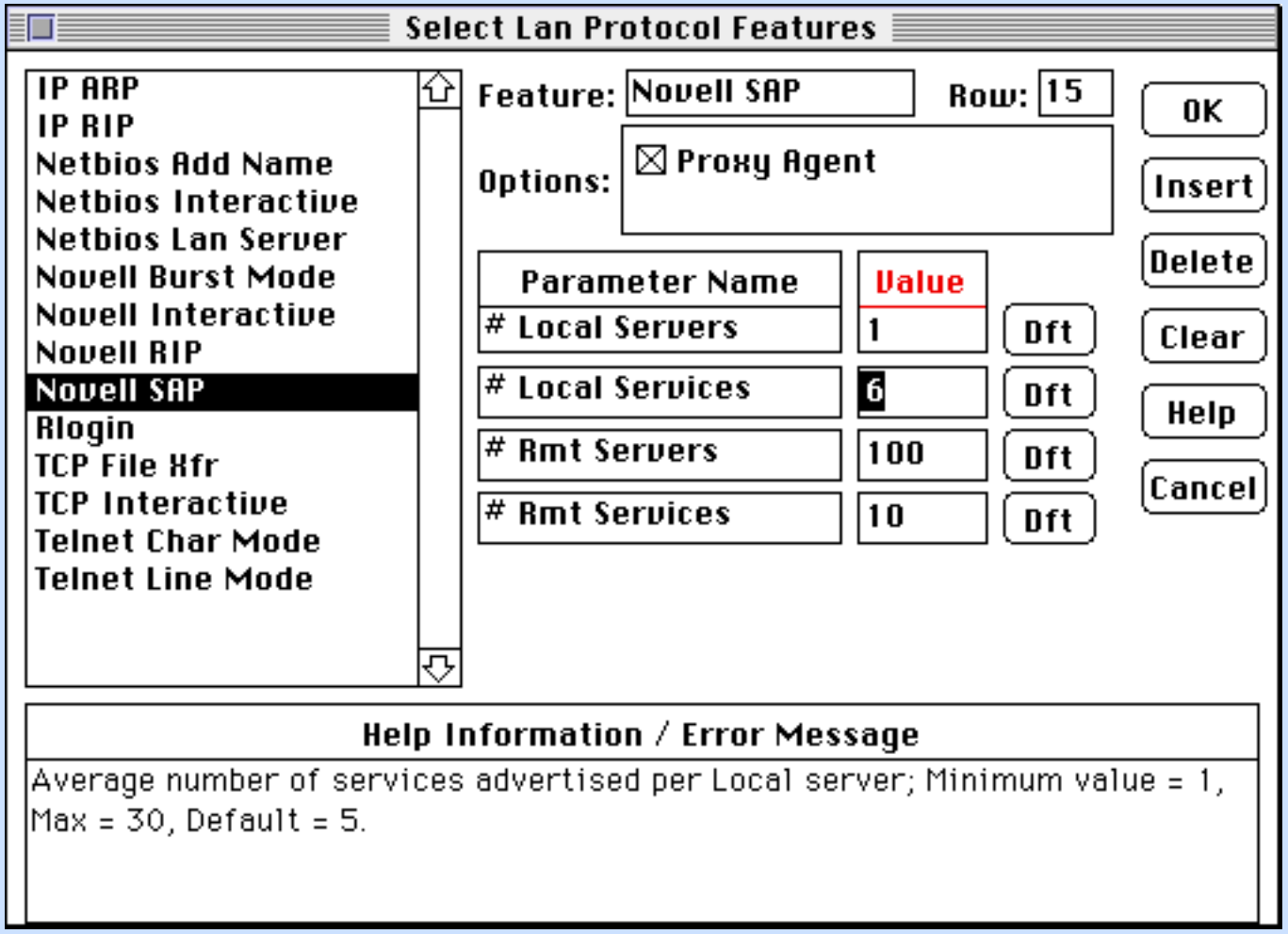
LanCalc Global Server Dialog Box



LanCalc Global Link Dialog Box



LanCalc Protocol Dialog Box



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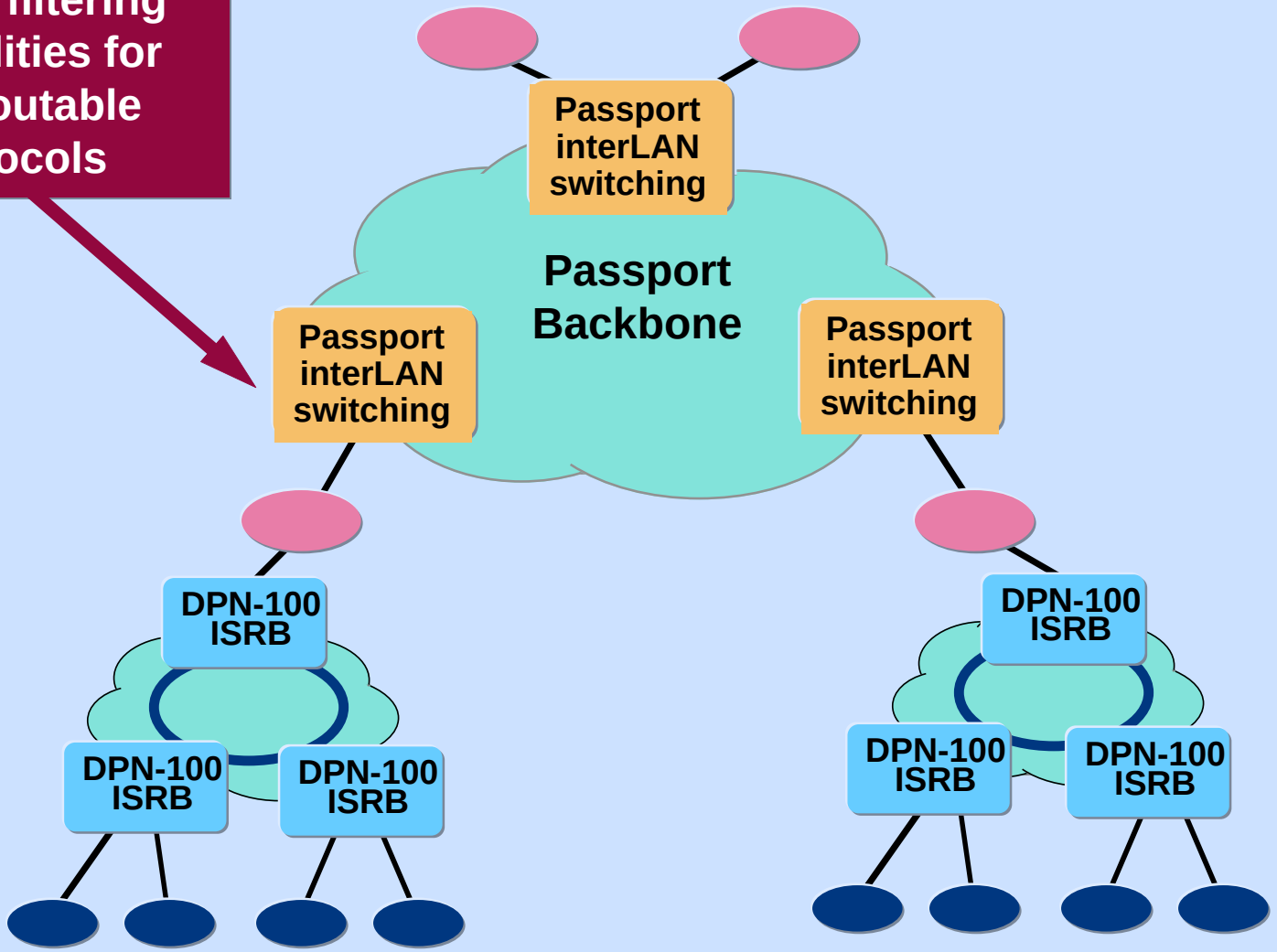
Interworking with Routers

- **Familiar maxim: "*Bridge when you must, route when you can*", still applies**
- **ISRB extends the application of bridging**
- **Magellan native LAN Routing can be exploited to extend overall solution**
  - **Passport interLAN switching**
    - **IP**
    - **Novell IPX**
  - **DPN-100 embedded router**
    - **IP, IPX, XNS, Decnet, AppleTalk, etc.**
- **External token ring gateway**
  - **can be stub ring**
  - **consider hop count constraints**

Passport DPN-100 ISRB Interworking

Exploit filtering capabilities for non-routable protocols



Summary

- **Knowledge is the key**
  - **LAN protocol suites**
  - **application characteristics**
- **Use LanCalc to quantitatively assess alternative network designs**
- **Exploit native Magellan Passport routing**
  - **upward migration path**
  - **reduces impact of broadcast storms**
- **References:**
  - **TCP/IP Illustrated** **Stevens**
  - **Netware LAN Analysis** **Chappell**
  - **LAN Protocol Handbook** **Miller**
  - **ISRB Specification and Guide** **Magellan**