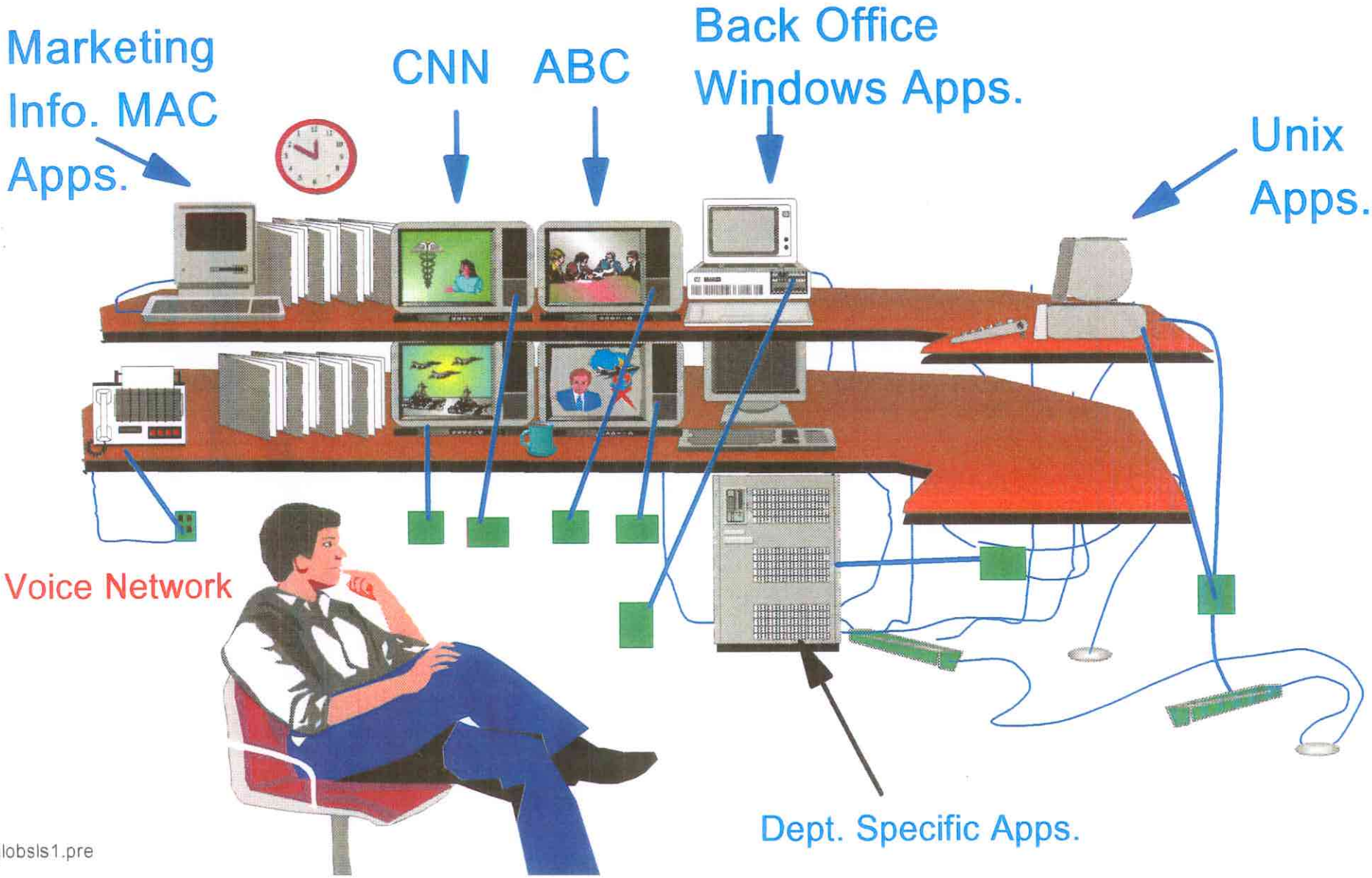
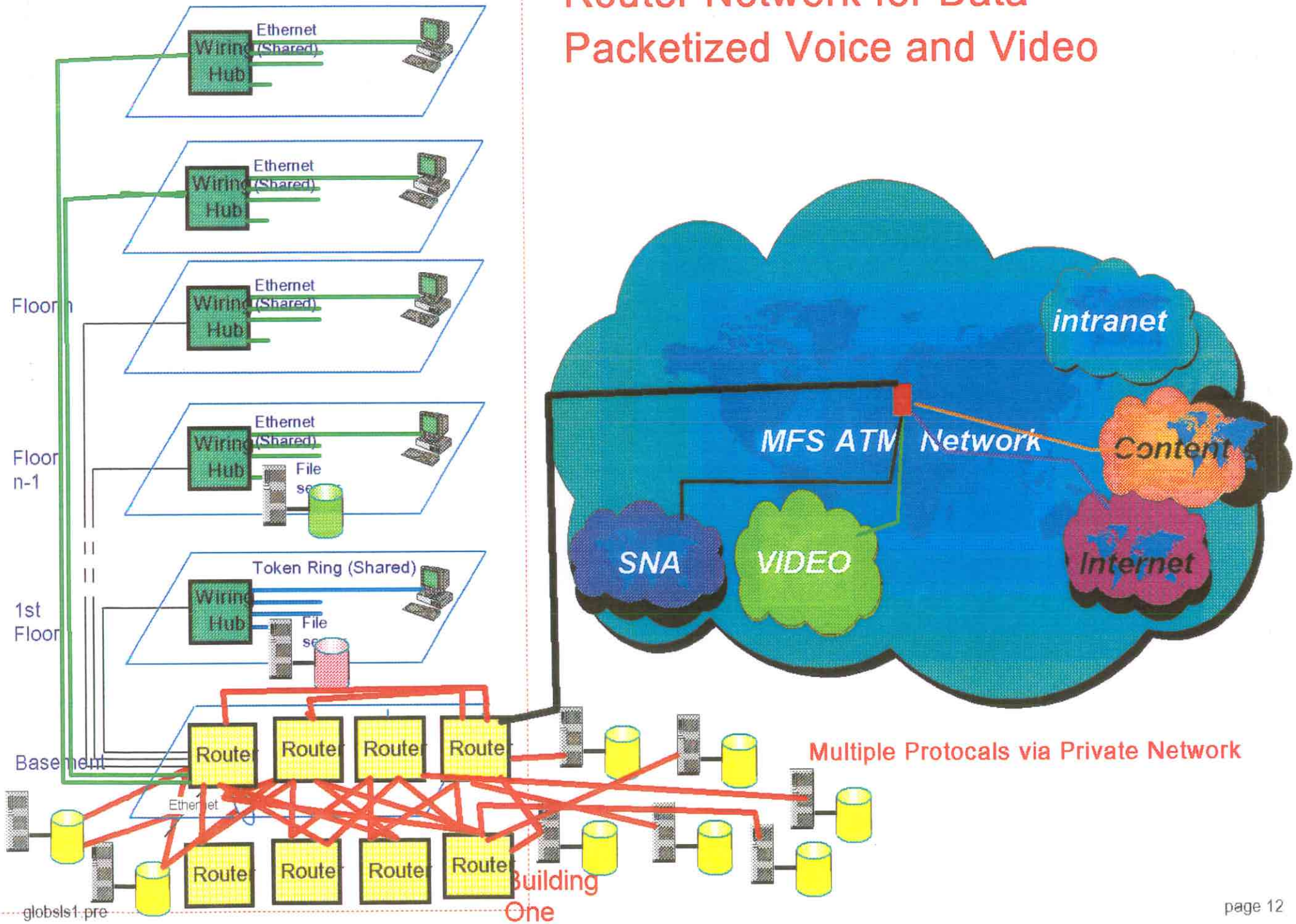
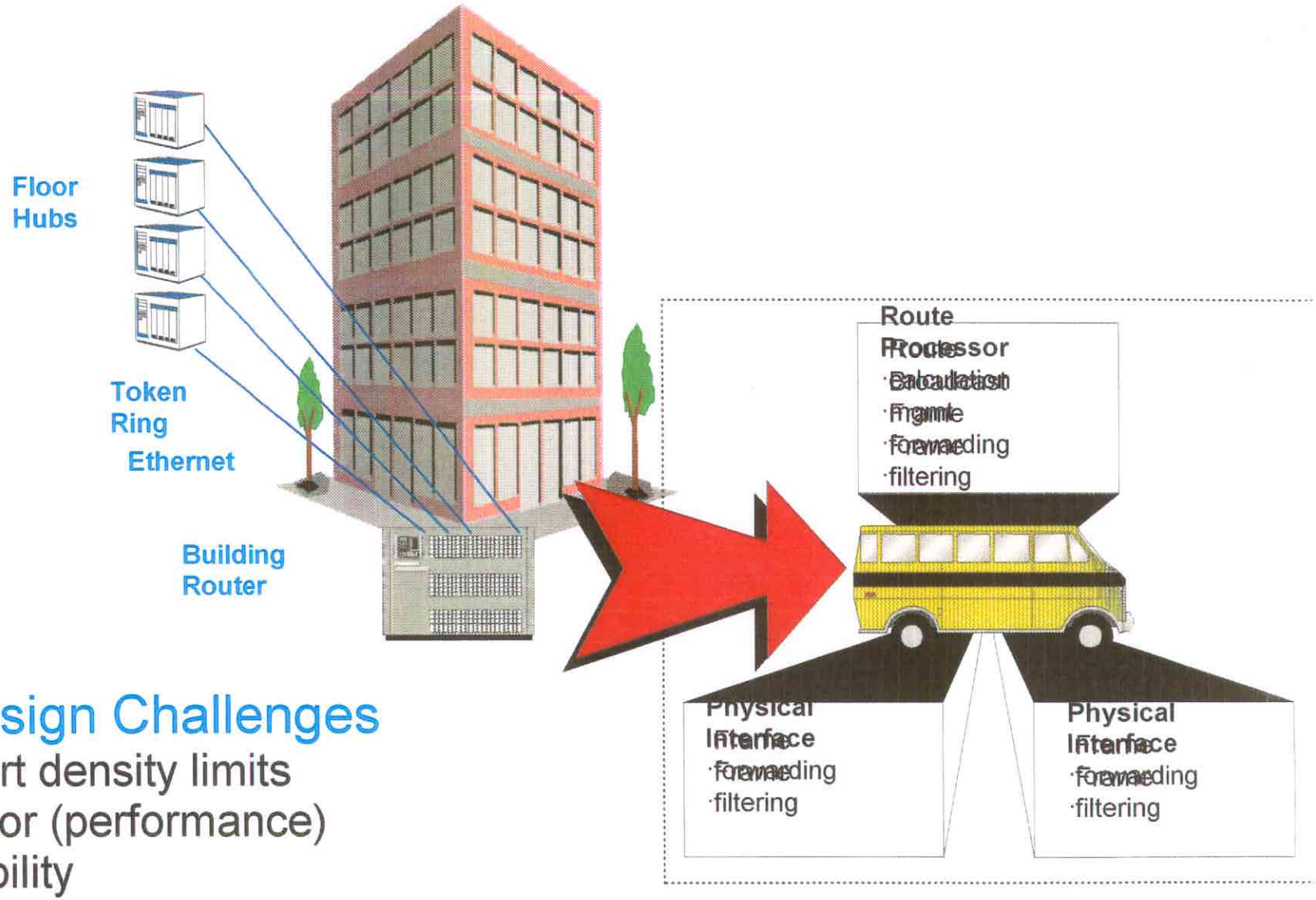
Desktop today includes Multiple Computer Platforms and LAN Protocols, Mutiiple News Feeds and Content Sources with Multiple Internal Applications requiring Host and Client/Server capabities as well as emerging Peer to Peer Collaboration via the Network & the Voice Netowrk integrated into the Desktop Solution



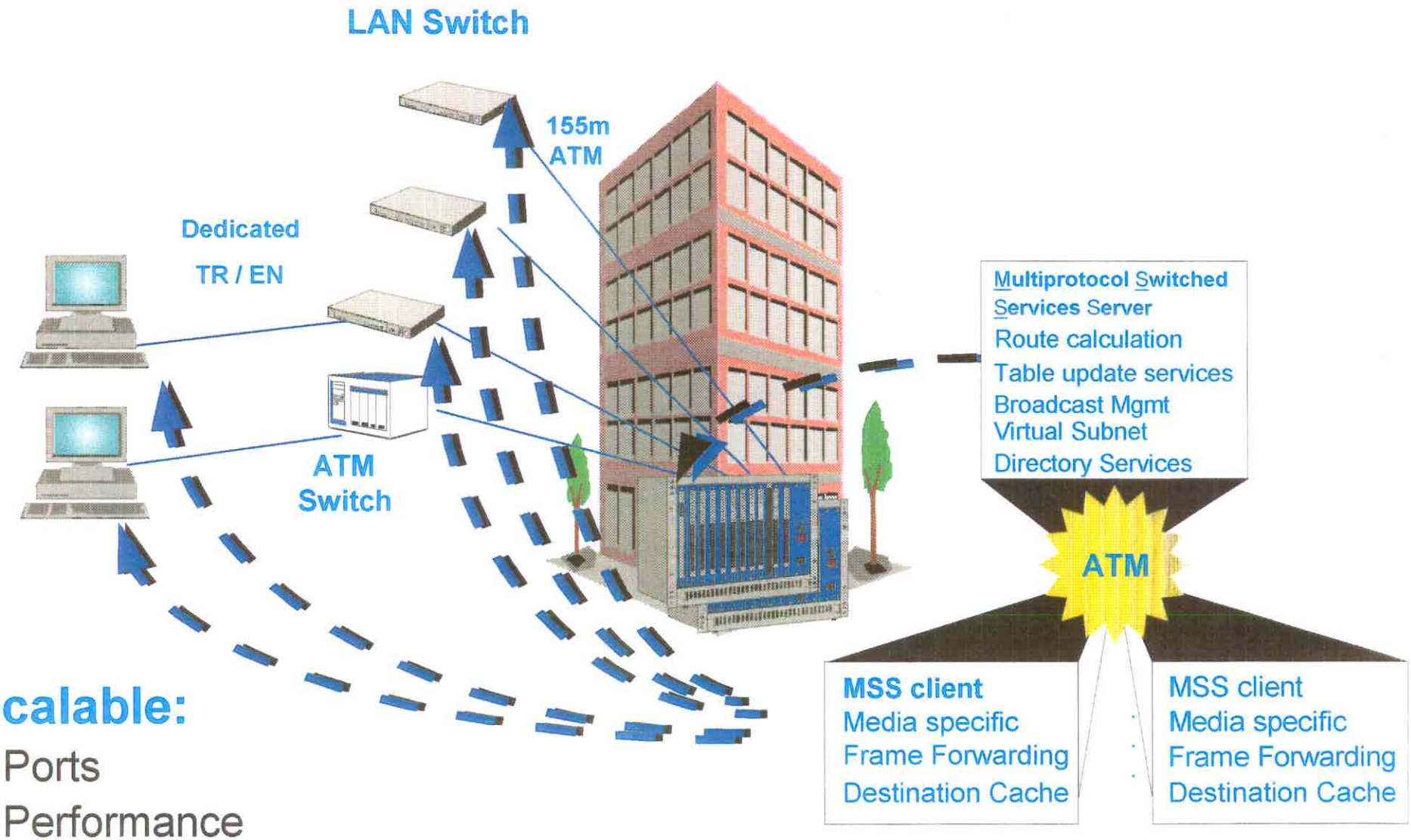
Router Network for Data Packetized Voice and Video





Router Design Challenges

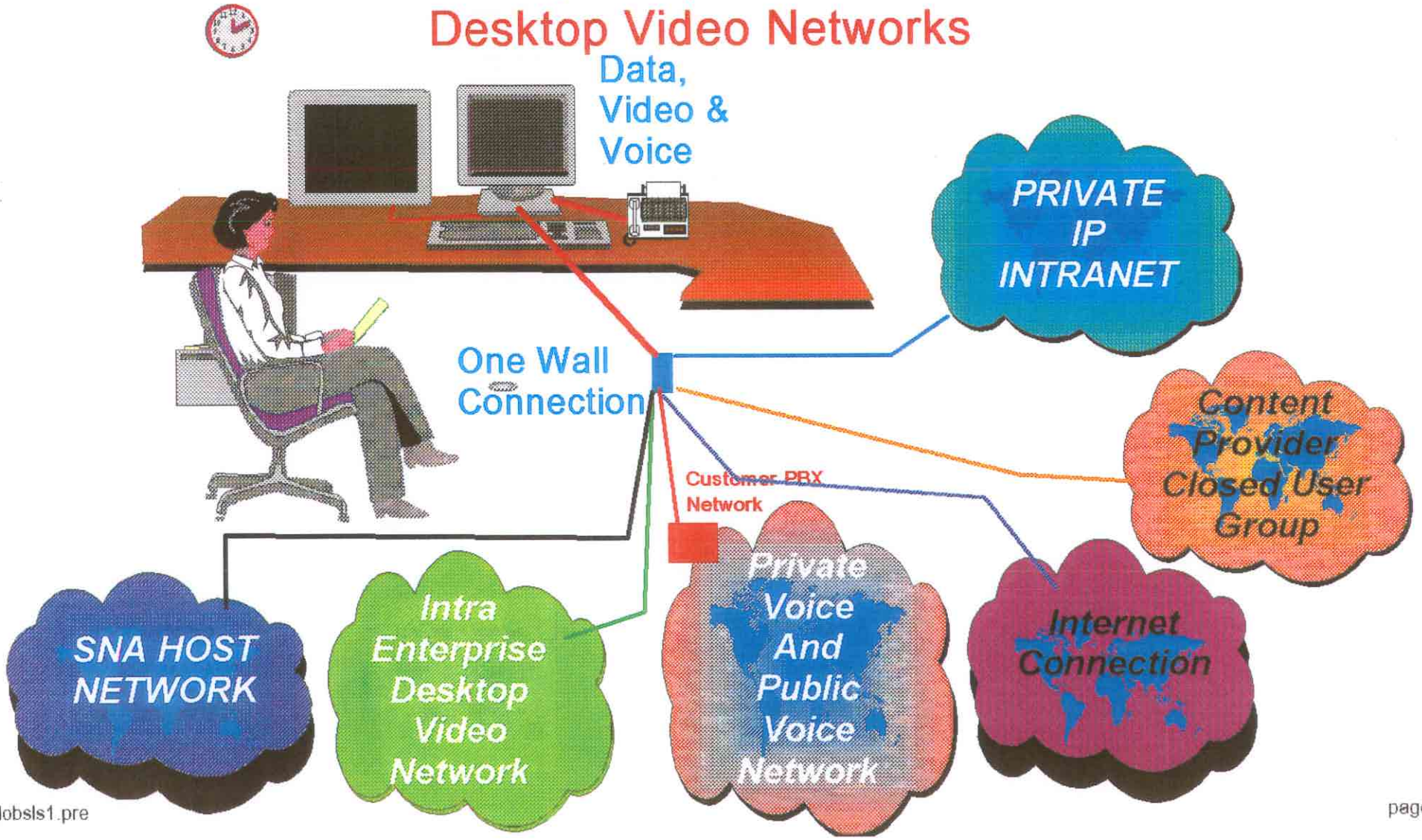
- Slot / port density limits
- Processor (performance) scalability
- Mixed processor use
  - Route Calculation
  - Frame Forwarding
- Bus Speeds



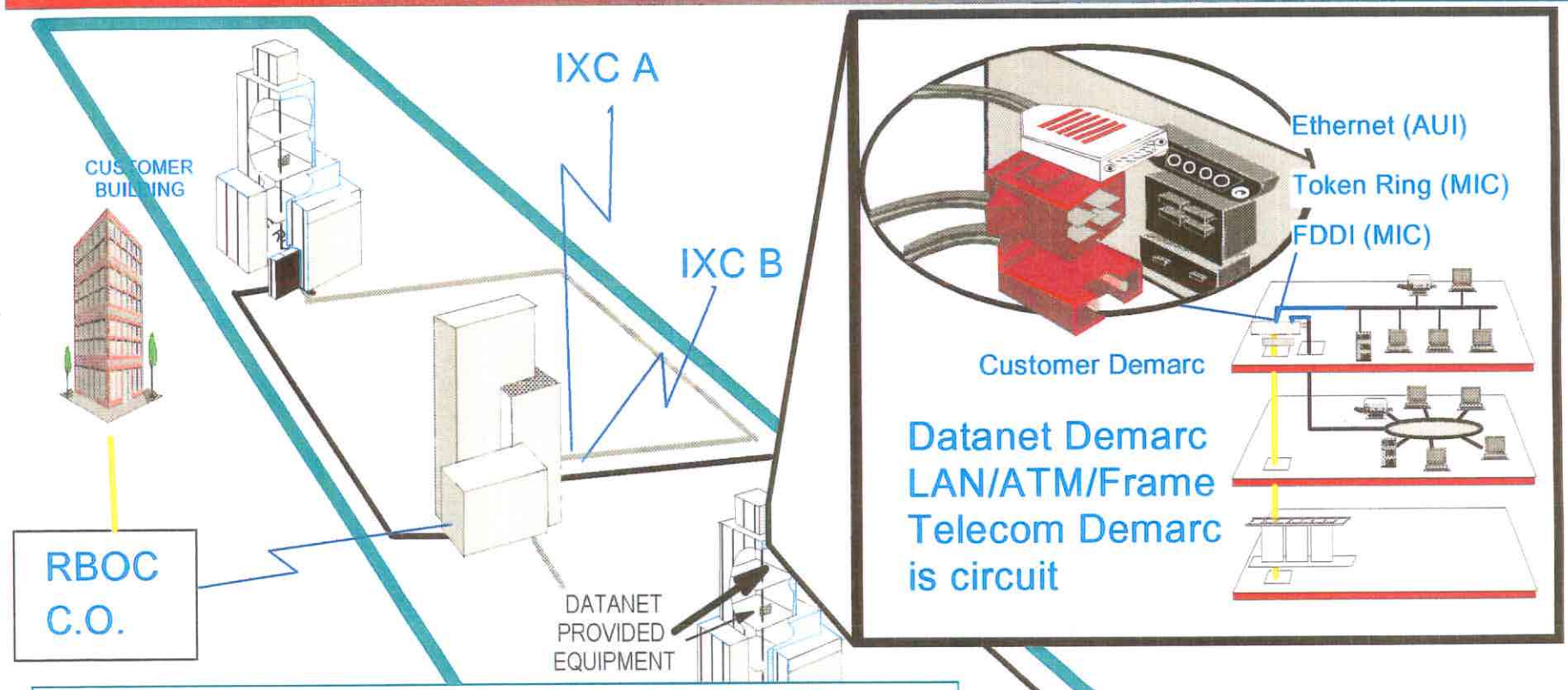
- **Scalable:**
  - Ports
  - Performance
  - Redundancy

Cutomer wants Access to all Computing Applications and Voice Services from One Desktop Unit Delivered. Service Provider must make it Easy and Economical

Voice, Multiple Data and Desktop Video Networks

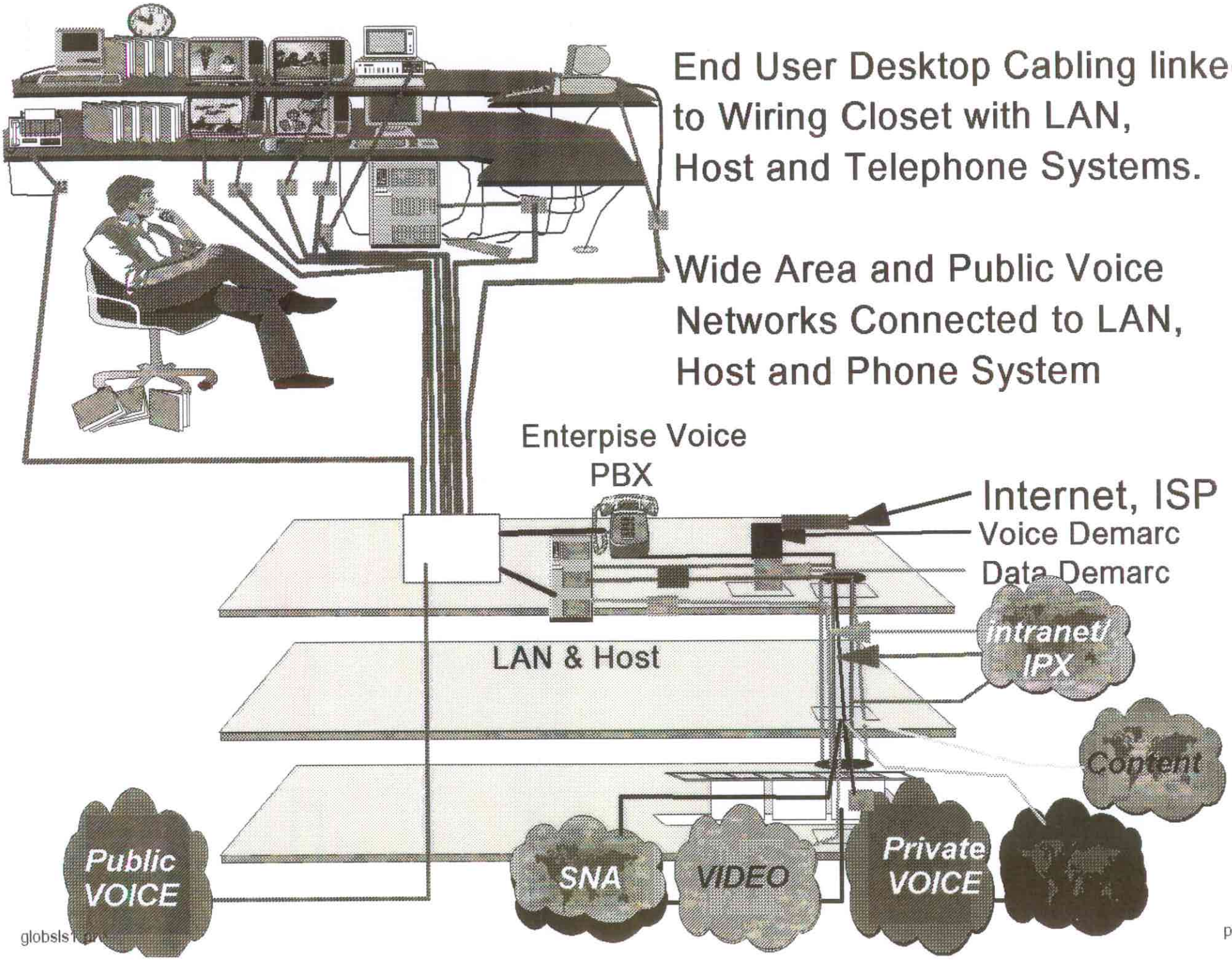


Cutomers Requested new Data Connections such as LAN Protocols and Interfaces, Frame Relay or ATM Data, & Voice and Video Demarcation as Required

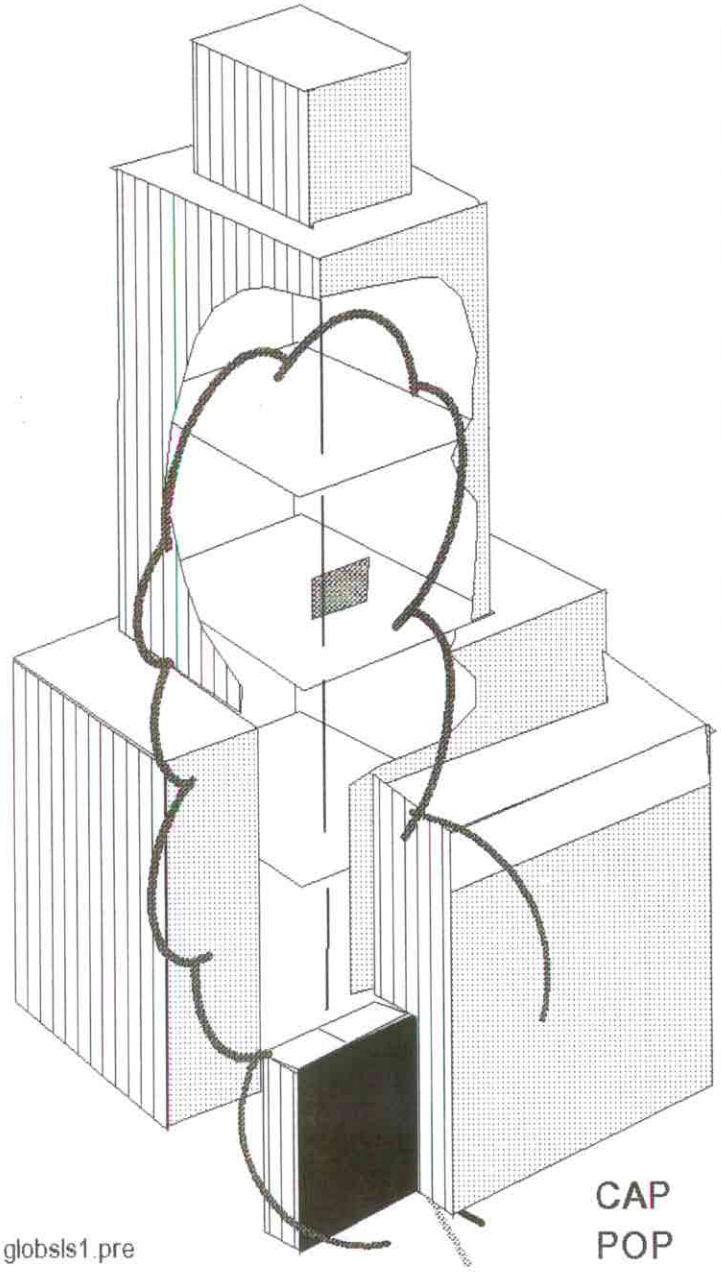


- SUPPORTS NATIVE LAN SPEEDS & STANDARDS
- NATIONAL SERVICE ORGANIZATION
- SCALEABLE - FLEXIBLE
- DESIGNED FOR ADVANCED APPLICATIONS
- NO EXPOSURE TO TECHNOLOGICAL OBSOLESCENCE
- 7 BY 24 NETWORK MANAGEMENT
- INTERFACE -TO- INTERFACE SUPPORT

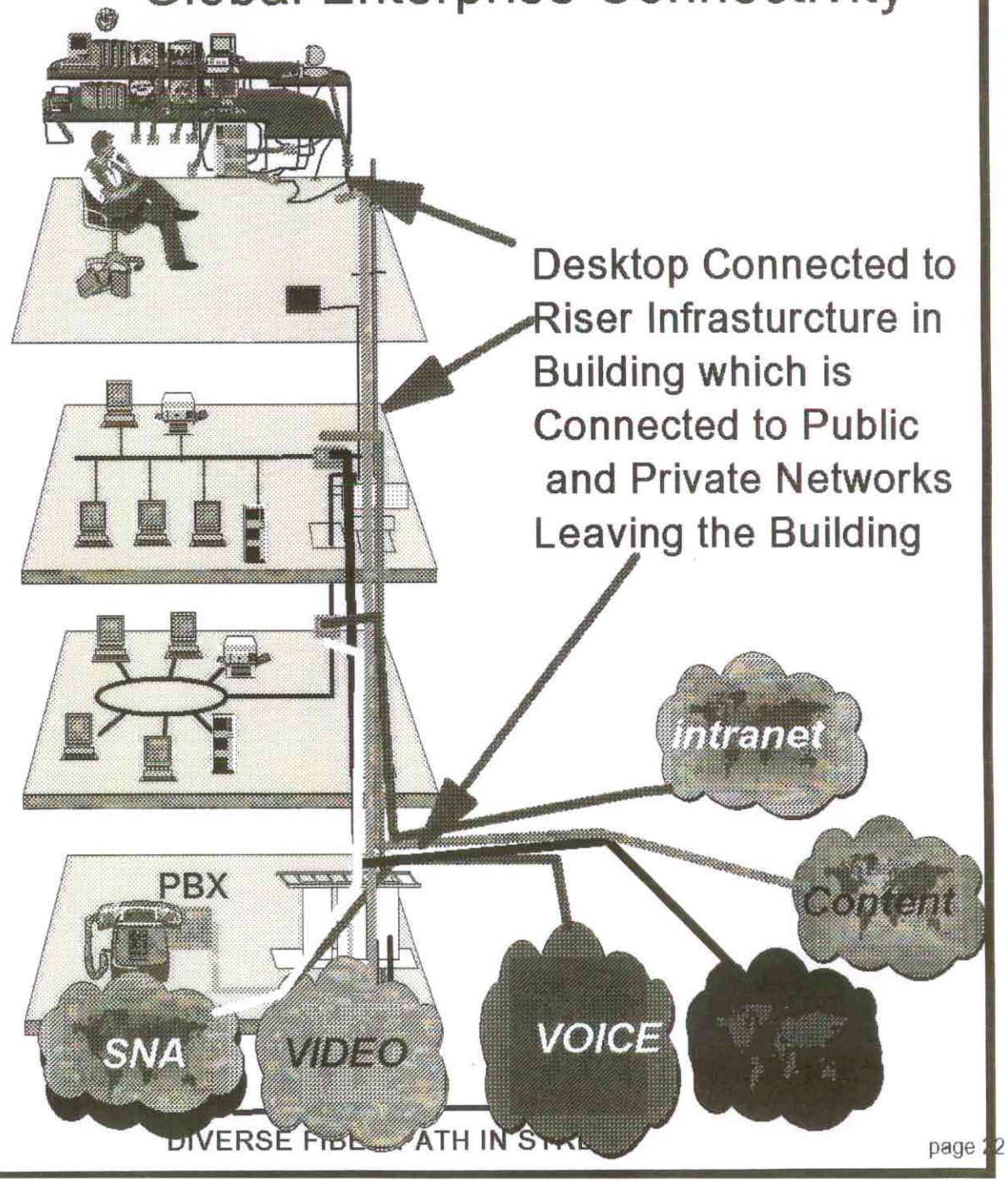
Demarc is Important to Problem Isolation, Determines How to look at Network and Approach Resolution. Datanet Resolves All Demarc issues, LAN or Circuit


End User Desktop Cabling linked to Wiring Closet with LAN, Host and Telephone Systems.
Wide Area and Public Voice Networks Connected to LAN, Host and Phone System
Enterpise Voice PBX
Internet, ISP
Voice Demarc
Data Demarc
Intranet/ IPX
LAN & Host
Content
Public VOICE
SNA
VIDEO
Private VOICE

Enterprise Desktop is Typcially in Highrise Building

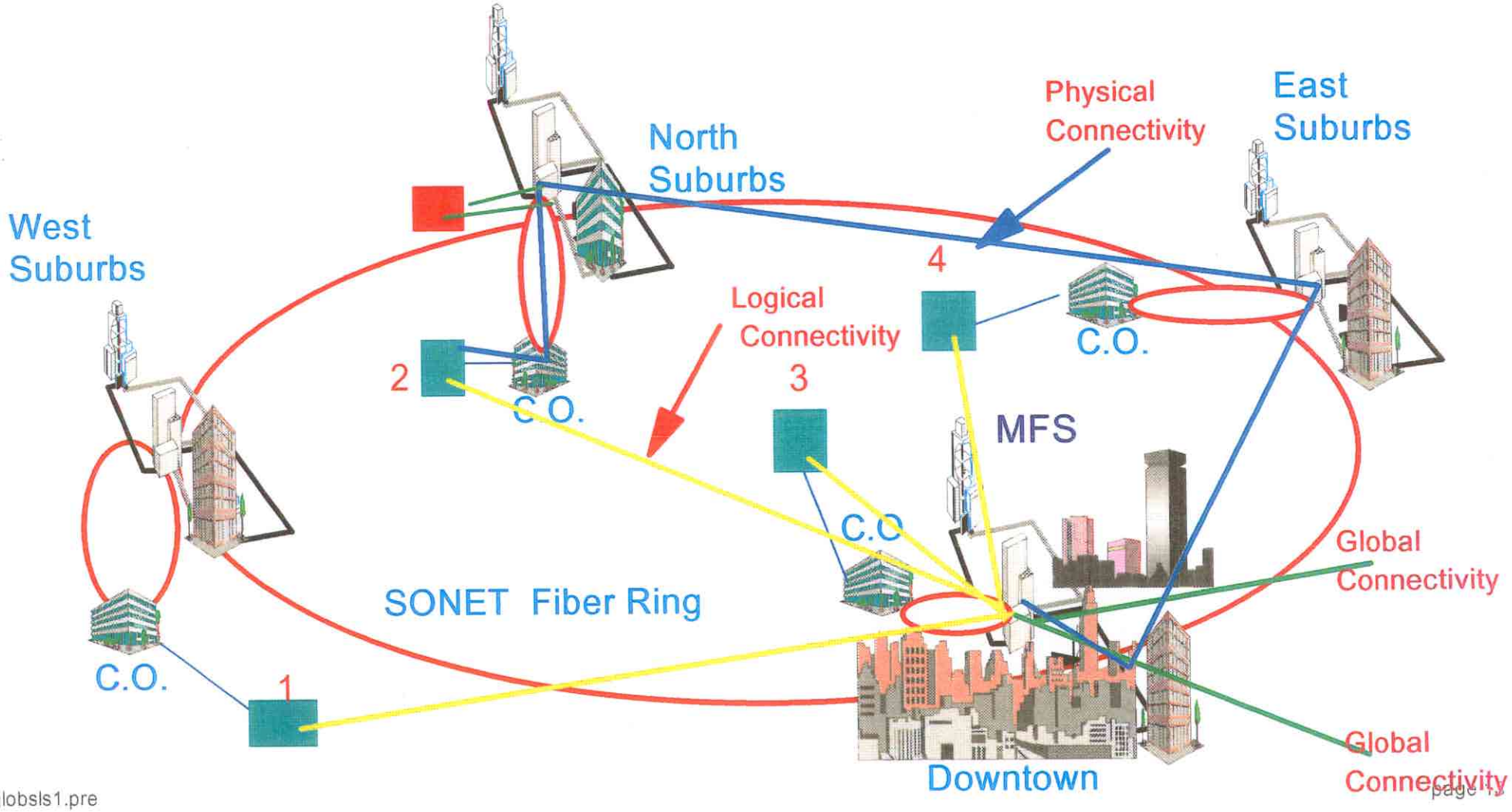


Global Enterprise Connectivity

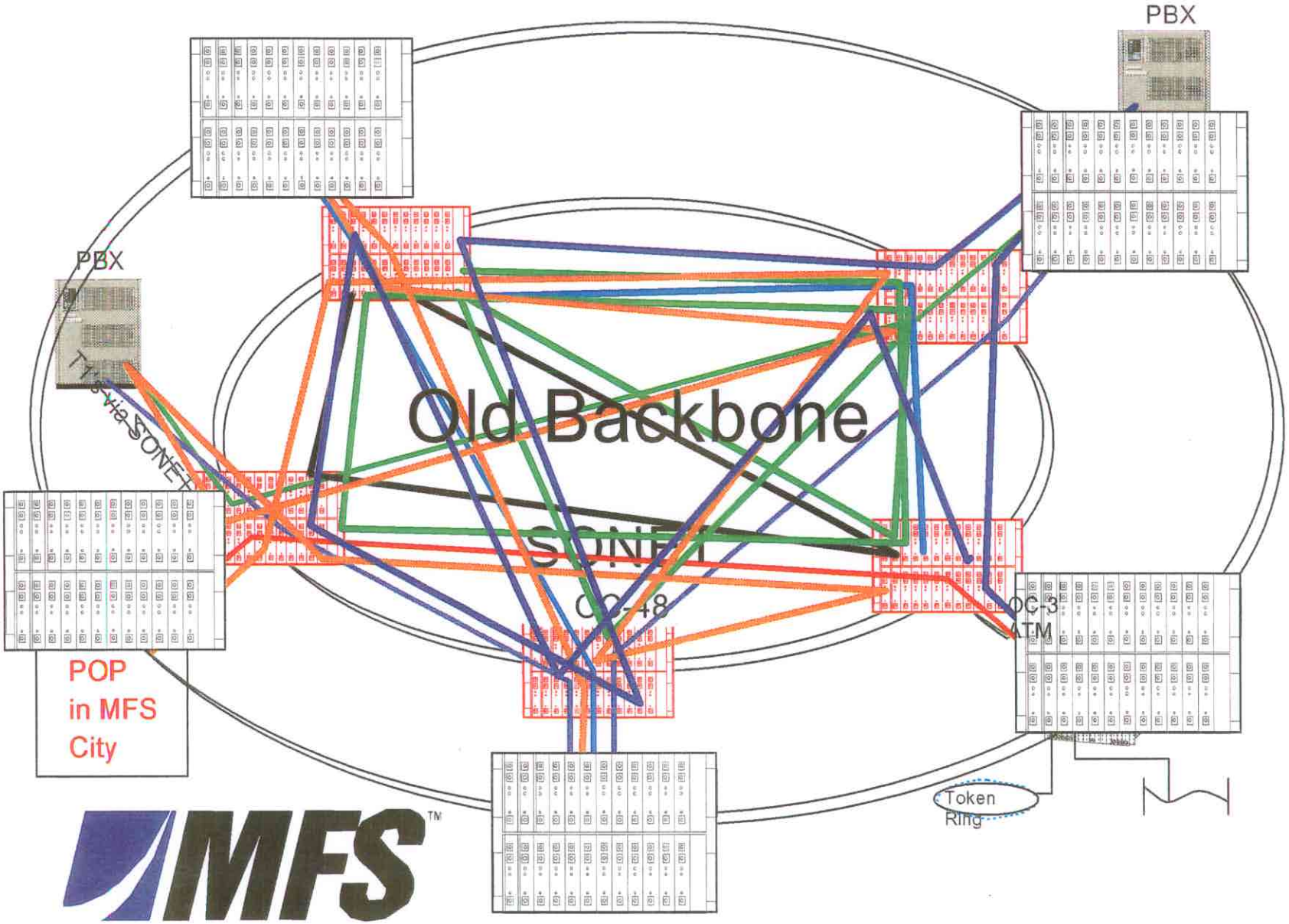


MFS uses TDM of Circuits over Metro SONET Infrastucuture & CO Interconnection "Unbundled Last Mile" to Deliver Services On Net & Off Net to Customers

Simple Sounding Starts to become Complex over time

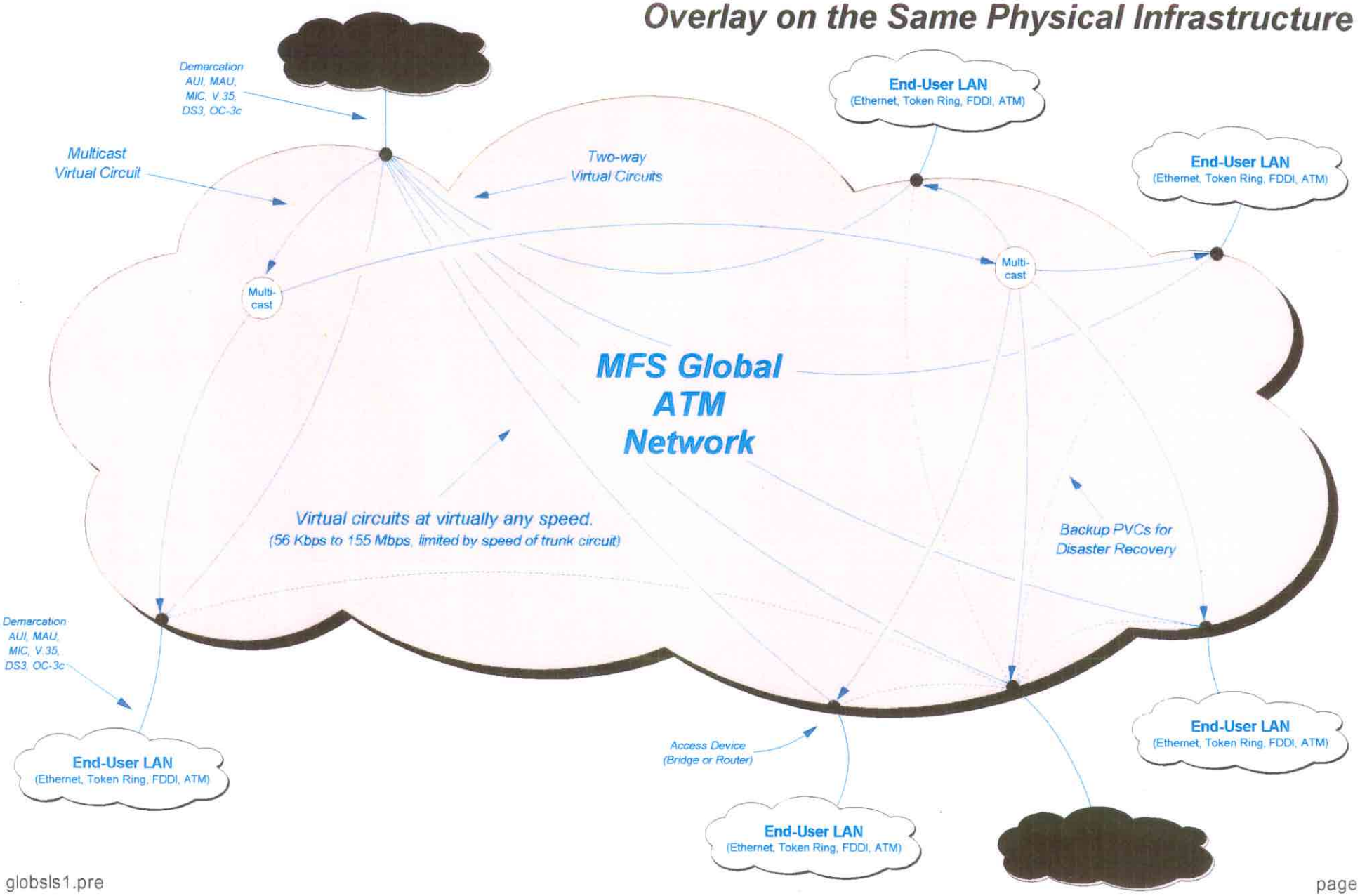


Build New SONET backbone

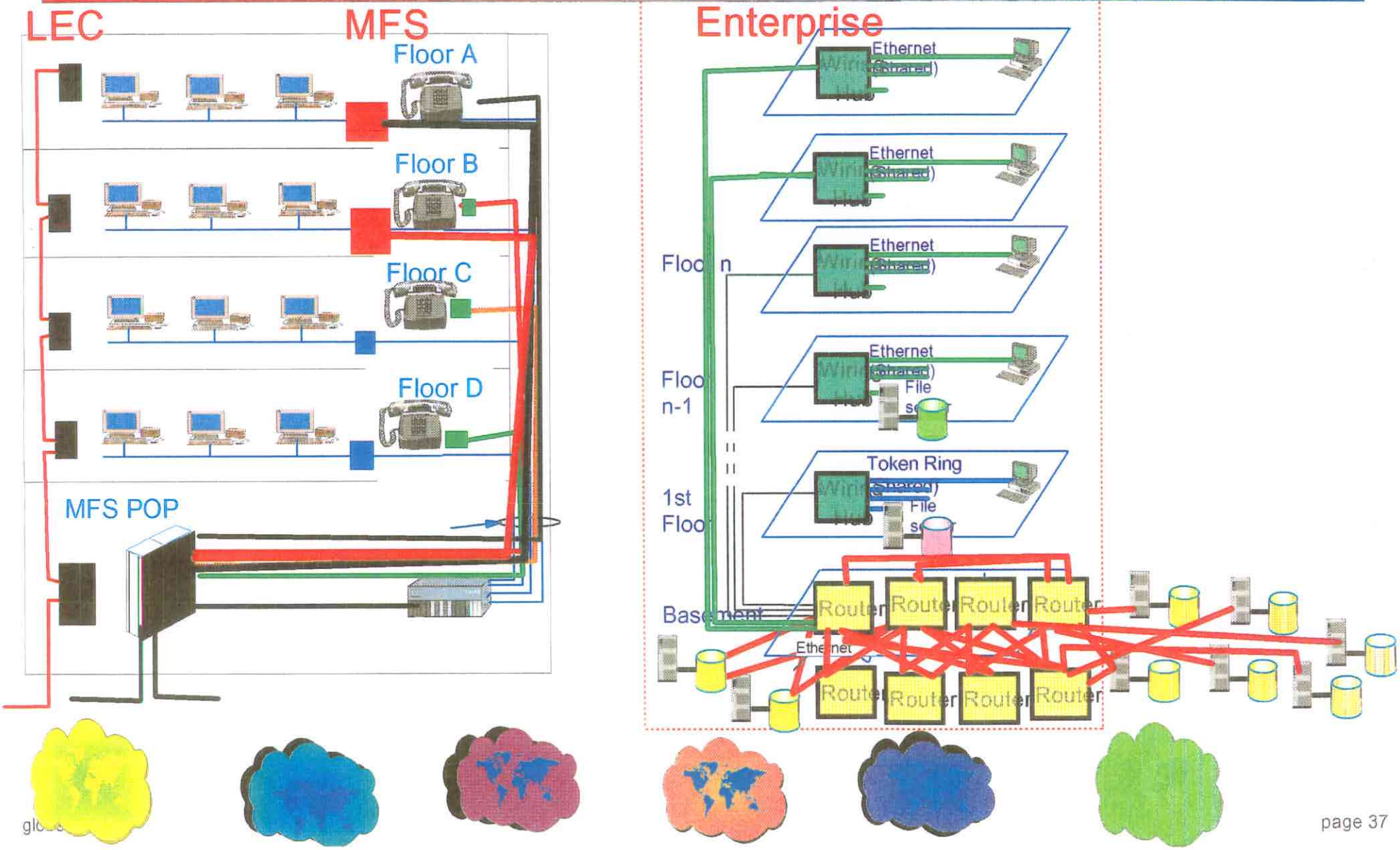


SIngle End User with multiple Closed User Group Networks for different Applications

Overlay on the Same Physical Infrastructure



Three Infrastructures Developing in One Buildings All Needing Change



SQFT ON-NET

CITY		SQ/FT - ON NET	% ON - NET	SQFT - OFF NET	% OFF NET	% VACANT
Albany	ALB	4,340,000				
Anaheim	ANH	0				
Atlanta	ATL	32,180,000	0.37	86,506,084	0.63	11.8
Baltimore	BLT	16,195,000	0.39	41,335,135	0.61	13.8
Boston	BST	45,105,000	0.47	95,476,726	0.53	9.4
Buffalo	BUF	7,779,000				
Chicago	CFO *	85,919,000	0.46	188,056,183	0.54	15.2
Columbus	CLM					
Cleveland	CLV	2,565,000	0.08	33,390,989	0.92	15.1
Dallas	DAL	36,099,000	0.32	111,331,818	0.68	19.4
Detroit	DET **					
Denver	DNV	2,515,000	0.04	62,911,165	0.96	12.1
Houston	HOU	48,982,000	0.36	135,389,859	0.64	19
Hartford	HRT *	2,155,000	0.09	25,117,592	0.91	24
Indianapolis	IND **					
Los Angeles	LSA	48,703,000	0.28	173,534,420	0.72	11.4
Miami	MIA					
Milwaukee	MIL					
Minneapolis	MIN	10,313,000	0.20	50,458,742	0.80	8.7
New Jersey	NJY	12,136,000	0.26	46,911,309	0.74	16.2
New Orleans	NOR					
Nashville	NSV					
New York	NYC	163,554,000				
Oakland	OAK **					
Orlando	ORL	5,195,000	0.29	18,118,595	0.71	10
Philadelphia	PHL	18,650,000	0.22	84,241,505	0.78	13.3
Phoenix	PHX *					
Pittsburgh	PIT	17,196,000				
Portland	PTL	560,000	0.02	23,070,259	0.98	8.2
Richmond	RIC **	210,000				
Rochester	ROC	8,279,000				
Seattle	SEA	1,715,000	0.03	51,131,296	0.97	9.4
San Diego	SND	2,578,000	0.07	39,336,767	0.93	17.7
San Francisco	SNF	26,198,000	0.39	67,274,103	0.61	8.2
San Jose	SNJ	2,458,000	0.11	23,045,420	0.89	10.2
St. Louis	STL	9,713,000	0.30	32,066,494	0.70	10.8
Stamford	STM *					
Tampa	TPA **	1,249,000	0.05	26,814,747	0.95	14.7
Washington DC	WDC	77,598,000	0.39	199,094,335	0.61	
White Plains	WHP	117,000				
		690,256,000	0.43	1,614,613,543	0.57	
* Some lit buildings have ZERO SQFT						
** Many lit buildings have ZERO SQFT						

DATE	PO#	CBL COST	CBL PLCMT	CNDT LGTH	CNDT SIZE	CNDT LABOR $	TOTAL COST
18-Jan	1963			480	4"	12,000	
18-Jan	2345	2298	3034				
22-Jan	2345	1026	1472				
24-Jan	2345	933	595				
24-Jan	2345	855	1108				
24-Jan	2345	430	290				
TOTAL		**$ 5,542.00**	**$ 6,499.00**			**$ 12,000.00**	**$ 24,041.00**
26-Mar	2330			170	4"	7200	
26-Mar	2527	171	285				
26-Mar	2527	3002	6159				
26-Mar	2527	1292	1026				
26-Mar	2527	179	142				
TOTAL		**$ 4,644.00**	**$ 7,612.00**			**$ 7,200.00**	**$ 19,456.00**
12-Apr	2568	513	1100				
15-Apr	2685	513	1305				
15-Apr	2685	359	445	40	4"	1226	
TOTAL		**$ 1,385.00**	**$ 2,850.00**			**$ 1,226.00**	**$ 5,461.00**
8-May	7	684	3897				
9-May	29	646	3000	110	4"	5000	
TOTAL		**$ 1,330.00**	**$ 6,897.00**			**$ 5,000.00**	**$ 13,227.00**
29-Jul	15/12	5130	7500	50	4"	2000	
TOTAL		**$ 5,130.00**	**$ 7,500.00**			**$ 2,000.00**	**$ 14,630.00**
13-Aug	55/21	624	1000	275	4"	14000	
24-Aug	233			350	2.5"	15700	
30-Aug	219	1436	2500				
TOTAL		**$ 2,060.00**	**$ 3,500.00**			**$ 29,700.00**	**$ 35,260.00**
18-Sep	240			125	4"	9200	
18-Sep	242	801	1700				
TOTAL		**$ 801.00**	**$ 1,700.00**			**$ 9,200.00**	**$ 11,701.00**
19-Oct	334			98	4"	4000	
19-Oct	334	534	1000				
19-Oct	350					2000	
19-Oct	350	478	2650				
TOTAL		**$ 1,012.00**	**$ 3,650.00**			**$ 6,000.00**	**$ 10,662.00**
GRAND TOT		**$21,904.00**	**$40,208.00**			**$ 72,326.00**	**$ 134,438.00**

Riser Project

I. Goals of Riser Project - Stop and take a look at how we are providing services today. Suggest new methods, services, and efficiencies for the future.

II. Today

Strengths, weaknesses and order of operations
Existing riser inefficient (Weakness)
Conduits are full and unorganized (Weakness)
What is the true cost? Does one exist?
NO plan for the Future

III. Tomorrow

DIRT FT. (Do It Right The First Time!)
True costs
Hybrid riser cost
POP costs
Closet costs
Desktop costs

IV. Benefits of Hybrid Riser under new plan:

Efficient riser saves money and time
Closet and desktop presence
Manageable, scaleable, modular desktop

V. Opportunities for the new services and new efficiencies:

Hybrid architecture to the desktop
Better serviceability and future growth.
Summary of the benefits

VI. Technology

ATM to the Desktop
ISO-Ethernet and SDC
Future technologies

VII. Summary

I. Goals of Riser Project

- Strategic goals are to minimize costs and provide enough wiring at strategic locations to accommodate future needs to the extent that we can predict them. Sufficient cabling conduit and amounts of outlets need to be anticipated five years in advance.
- As people move around buildings they should not require new cabling.
- If people move locations on the same floor - - only a plug in the computer closet should be changed. If they move from one floor to another, some shuffling of electronics may be required but running new wiring through the building should not be required.
- Buildings must be homogeneous. This will make life much easier for the staff.

Some facts to consider:

- Infrastructure cannot be overstated. Over 70% of all network downtime is caused by problems stemming from inferior cabling systems. The other 30% are power related.
- The average system crashes 23.6 times a year and is down for an average of 4.9 hours. Downtime costs range from $1000/hr to $50,000/hr
- 40% of all employees within a building move every year. Adds, moves and changes on an unstructured cabling system can cause serious work flow disruptions.
- The initial cost of a structured riser cabling system may be slightly higher, but it will save money over the life of the system.
- One of the smallest component costs of a network is the structured cabling system, a mere five percent. Considering that 70 percent of all system problems can be solved by five percent of the system investment, it makes absolute sense to invest in the very best structured cabling systems available.
- A structured cabling system will, on average, out-live all other networking components. Because of this fact, choosing the proper cabling system is a critical aspect of network design.

II. Today Strengths, weaknesses and order of operations

- Bandwidths needed for future growth are accommodated by fiber.
- Fiber is immune to interference in elevator shafts.
- If a firewall is cut open by an installer or contractor and not sealed properly. You have code violations.
- Users don't notice the 364 days that a network is running. They notice the one day of the year it is down.
- Copper will not disappear.

II. Today Existing riser inefficient (Weakness)

- Costs of cable is minimum compared to cost of installations.
- Planning is the most crucial step. Re-cabling an existing building is more complicated that designing a new one.
- Inventory existing cable media and physical structure such as conduit.
- Pulling cable costs the most, so why not pull for the future?
- Existing infrastructures are ill prepared to handle the future explosion of interactive services and bandwidth hungry multimedia applications.

II. Today Conduits are full and unorganized (Weakness)

- A non standard cabling system does not guarantee poor functionality, but you will be taking a serious gamble.
- More pairs going to outlets need bigger conduits.
- Re-cabling is often more of an art that a design function.
- Do we have "wire maps"?
- Neatness counts and makes troubleshooting easier.

II. Today What is the true cost? Does one exist?

II. Today NO plan for the Future

- Cabling is usually the last thing considered in the building design phase.
- When planning for the future always pull plenty of cable.
- It makes sense to buy ahead of the curve.
- Running new wiring on a case by case basis is very expensive

III. Tomorrow DIRT FT. (Do It Right The First Time!)

- Structured cabling systems in a building premise cabling project involves considering the entire system rather than just the wiring between your LAN hub and the workstation.
- (BICSI) Building Industry Consulting Service Intl. The structured approach.
- Warranties help win customers who purchase networks.
- Avoid a rats nest in the riser.
- It's no longer the computer that is the source of an organizations productivity. It is the network with its ability to transport information wherever it is needed.
- Cabling should last 10 years longer than equipment. Don't skimp!

III. Tomorrow True costs

III. Tomorrow Hybrid riser cost

- Cat 5 must be installed for fast Ethernet and ATM. Cat 5 accounts for 70.5% of horizontal cabling and 31.9% of vertical cabling.
- Multimode fiber accounts for 52.9% of vertical cabling.
- On the average fiber installation was estimated at $18,000 per T1 circuit.
- Vertical infrastructure is 1/4 of the network cost (closet renovation, cabling and equipment racks, and system integration) at UC Berkeley's Cory Networking Project ($225,000). This is separate from the $850,000 to $1,060,000 bid for a horizontal installation.

UC Berkeley's current operation level is $180 per user. This lower operational cost coupled with the cost of future upgrades and rearrangements is dramatically lowered compared to previous systems.

* See Matrix: "Desktop Costs" (next page)

III. Tomorrow POP costs

III. Tomorrow Closet costs

- Formula: Approximate cost of server room: Take the basic price tag of building a standard office space of similar size to your server room and multiply it by 4.
- Fire system (NFP-2001) cost $20,000.
- Air conditioning

III. Tomorrow Desktop costs

Single / Multi-Station LAN Switch Costs:

Description	Single Station	Multi Station	Multi Station	Multi Station
Cost per port	$500	$1000	$1000	$1000
Stations per port	1	10	20	40
Cost per 100 Stations	$50,000	$10,000	$5000	$3000

- A 9 port LAN switch costs well under $10,000 . The addition of 8 new segments in a router could cost an excess of $30,000.
- E-mail in a large organization cost $300/ yr. Per desk. Includes: price, installation maintenance, infrastructure, maintaining , and operations costs. The US Market for client / server data bases will increase from 3.7 billion in 1994 to 10.4 billion in 2000.

10 BASE T

- 10 Base T Ethernet adapters & hubs are appearing that cost $158.00 per unmanaged port.

100 BASE T

- Although one of the benefits of 100 Base T is its capability to operate over "existing" CAT 3 or CAT 5 Cabling, few sites will be able to do so without re-cabling. 100 Base T4 requires four cable pairs to operate with category 3 cable. Single 10 Base T requires only 2 pairs, many sites have used the remaining pairs for other purposes, or may not have wires with unused pairs to the wall plate. These sites must either re-terminate their cable or pull new cable to accommodate the additional pair needed.
- Secondly, although 100 Base T allows cable lengths of 100 meters from a concentrator to a network node, distances between concentrators are limited, only two concentrators may be placed between any two nodes. By contrast 10 Base T allows up to 100 meters between concentrators, and allows up to 4 concentrators between any 2 nodes. Existing network users who have deployed their 10 Base T cable in a distributed layout may face costly re-cabling as a result of 100 Base T's more limited layout rules. Finally 100 Base T's network span of 205 meters may require re-cabling in sites that have been cabled to take advantage of 10 Base- T's span of 2500 meters.

100 VG - ANY LAN

- Many sites must re-cable to support 100 VG - Any LAN architecture.

TCNS

- TCNS - TCNS topology does not restrict the number of hubs between nodes.
- Connection costs for adapters & hubs are less than $650.

FDDI

- Fiber based adapters range from $1500 to $3500 and hubs connections are $700 to $2000 per port. STP adapters intended for desktop use are less expensive ranging from $900 to $2000. FDDI is considered difficult to install, and the additional overhead associated with SMT management minimizes FDDI's cost effectiveness to the desktop. In addition, many users believe FDDI will be surpassed by other high speed technologies.

ATM

- ATM- Network adapters currently cost $1000 to $4000, and switches cost between $5000 and $12,000. Prices are expected to drop as the technology matures but will remain expensive related to other desktop oriented high speed solutions. ATM technology is unlikely to see widespread LAN use until 1997.
- ATM workgroup switches cost $1000 to $1500.

Costs

UC Berkeley's summary of cost for its 1700 user "Cory" network is as found: (1700 users financed for 5 years).

*NAF surcharge	$250.00 per year	per NAF payer for next 5 years
Basic shared Ethernet service	$120 one-time charge	per connection
Switched Ethernet at 10Bm/s	$280 one-time charge	per connection
Switched Ethernet at 100 Mbs	$560 one-time charge	per connection (possibly need additional hardware on workstation side as well)

* NAF (Network Access Fee)

IV. Benefits of Hybrid Riser under new plan -- Efficient riser saves money and time

- A structured cabling system creates order. It allows moves, adds, and changes in the system to be completed inexpensively.
- Once horizontal and vertical cable runs are installed in the structured system -- you should never have to change these runs; they should not be tampered with after installation. All moves, adds and changes are confined to closet.
- Easy repair!
- Investment and reconfiguring network and information sources will help achieve complete, standardized and seamless interoperability as quick as possible. This approach minimizes the incremental cost of supporting future growth of inter-network information flows.
- Today's information hungry market place needs to provide voice and data networks over a single universal structured cabling system.

IV. Benefits of Hybrid Riser under new plan -- Closet and desktop presence

- A company with 1000 employees has an average of 50 to 70 servers.
- Locate servers in the most central location. This reduces cost.
- Plan 5 - 10 years ahead - make sure closet is big.

IV. Benefits of Hybrid Riser under new plan -- Manageability, scaleable, modular desktop.

V. Opportunities for the new services and new efficiencies: Hybrid architecture to the desktop

- 43% of companies planning cable changes will install fiber to desktop.
- 62% of companies plan to use video conferencing and they need expanded bandwidth.

V. Opportunities for the new services and new efficiencies: Better serviceability and future growth.

V. Opportunities for the new services and new efficiencies: Summary of the benefits

VI. Technology -- ATM to the Desktop

- ATM requires new cabling, software, adapters, and switches . . . high costs.
- Network applications will be developed that expect higher performance to the desktop. This is not only for highly touted applications like multimedia, but for the creation of an entirely new class of network applications.

VI. Technology -- ISO-Ethernet and SDC

- Only when users have become comfortable with local "pretty" video and are confident that it will serve as an alternative to physical meetings, will they commit longer distance video collaborative relationships.
- The best solution to desktop video conferencing is almost surely to match ISO Ethernet with ATM.
- Building the right network and application framework is the biggest challenge that we face in bringing video collaboration to the market.
- Much of the multimedia benefits of switching are really benefits of ATM switching. ATM is more future proof.

VI. Technology -- Future technologies

- The problem with fiber to the desktop is not cost. It is cost of the NIC cards.
- Bandwidth required by desktop PC's increase in orders of magnitude as processors become more powerful.
- Multimedia is a potential $200 Billion Market which has created a flurry of competitive forces frantically working to leverage exiting communications infrastructures and build new ones to handle the ever increasing amounts of Data, Voice, And Video information that need to be accommodated.
- A key element in the future multimedia market is ownership of the information delivery infrastructure.
- 16 megabit token ring will become dead end technology by the end of this century. It will be replaced either by 10 megabit Ethernet or 100 + megabit networks. Networks will become more complex more heterogeneous and more difficult to debug, maintain and kept running at high service levels. We will have more operating systems to support, more variations in topologies and switches, and more variety in services and network services.
- 10 years from now over half the new investments in internetworking will be in switching.

VII. Summary Review advantages of riser project

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