ARE YOU READY FOR VOICE OVER IP?

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Presentation handouts

- Electronic copies (and updates) at Webtorials.Com
  - www.webtorials.com/main/eduweb/perspectives/
  - Background materials also at Webtorials.Com
  - Update notification for registered users

Are You Ready for VoIP?

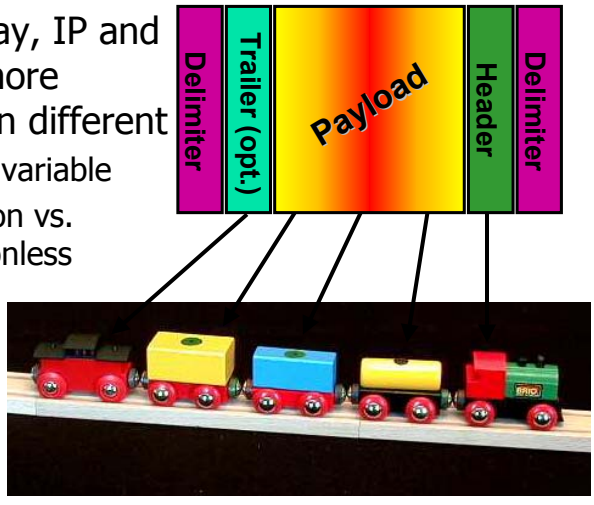
- Are You Ready?
  - Corporate mindset
  - Enslow's Law and Taylor's Corrolary
- Is Your Network Ready?
  - Is there a sufficient network infrastructure to provide
    - Security
    - Interoperability
    - QoS

Agenda

- Technology Background
- Network Security for VoIP?
- Interoperability and Network Standards?
- QoS for VoIP

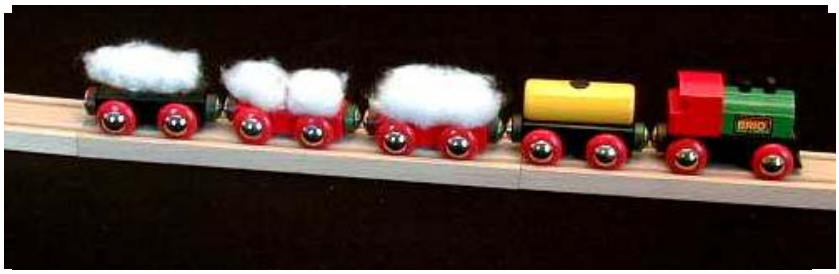
Broadband Packet Service Types

- Frame Relay, IP and ATM are more similar than different
  - Fixed vs. variable
  - Connection vs. connectionless



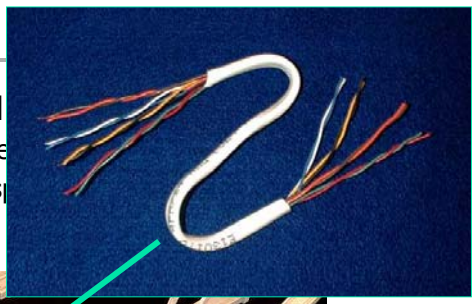
Generic Packet Format: Payload

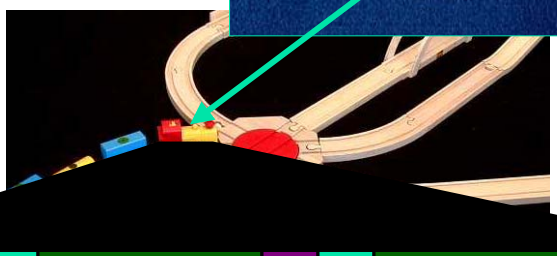
- Variable: Frames
  - Efficient use of bandwidth
  - "Frame Relay" & IP
- Fixed length: Cells (ATM)
  - Easy to process with Predictable delay
- ***Always*** the same size



Generic Packet Format: Header

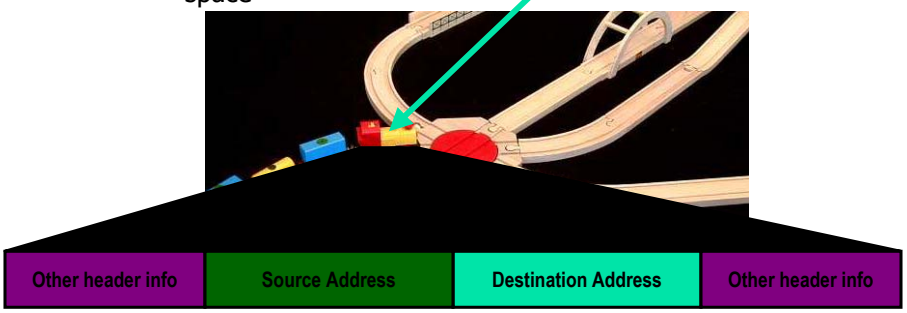
- Connection oriented
  - Virtual Circuit numbe
  - Conserves address s
  - PVCs and SVCs





Generic Packet Format: Header

- Connectionless (IP)
  - "Universal," unique address
  - Needs large address space



"Connectionless" Telephony

- Traditional Telephony
  - Well defined call setup
  - Good security
  - Dedicated connection / bandwidth
    - Low delay
    - Inefficient?
- Connectionless issues
  - No call setup?
    - Addressing?
  - Security?
    - Connectionless is typically easy to spoof
  - Lots of QoS issues

LAN/WAN Issues

- Contention solved via bandwidth rather than traffic management
  - Assume that LAN has sufficient bandwidth
    - Switched Ethernet put the issue to rest
  - Assume low latency
  - Assume minimal queuing problems
- Traditional PBX problems are solved
  - Wiring upgrade may be necessary
  - E-911 issue is a portability issue
- Major network infrastructure problems are in the WAN

Non-Issues (for this session)

- Codec Quality
  - 8 kbps sounds great – for the Codec alone
- Fax/Modem
  - Separate problem
- Regulatory
- Pricing
- CBR Services

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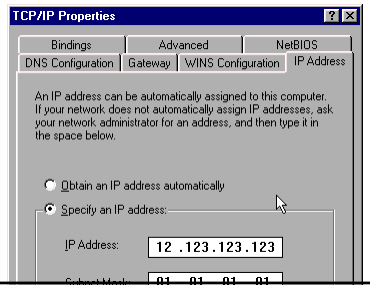
Address Spoofing: Who sets the address?

- IP address is set by the user
  - Can be spoofed
  - Need for authentication



VoIP Security Concerns

- At some point, you must assume that you can trust the service provider(s)
  - Common issue for all nets
  - Single net limits the issue
- Encryption is available
  - But not usually required
  - May add delay
- Larger issues
  - Physical security
  - Email and other applications

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SIP Basics

- Application layer control protocol
- Transported over UDP for simplicity and speed
- Text-based Internet protocol ala HTTP, SMTP
- Establishes, modifies, terminates multimedia sessions/calls
- Client-server architecture
- Relies on:
  - SDP (Session Description Protocol) for
  - media description and codec identification
  - RTP/RTCP (Real-Time Protocol) for
  - transporting media streams

Source: RADVISION

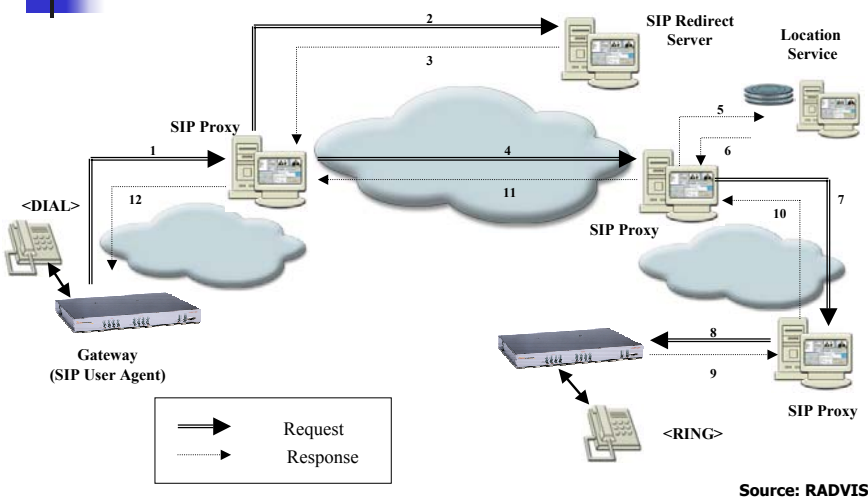
SIP: A CLOSER LOOK

SIP Entities

- User Agent (SIP "endpoints)
  - UA Client: intiates requests
  - UA Server: responds to requests
  - Resides in: softswitches, gateways, handheld
  - and wireless devices, DSL/cable equipment
- Proxy Server
  - Routes messages and hosts service logic
- Redirect Server
  - Returns routing information tot he initiating endpoint
- Registrar
  - Records SIP URL and associated IP address for
  - subscriber mobility

Source: RADVISION

SIP Call



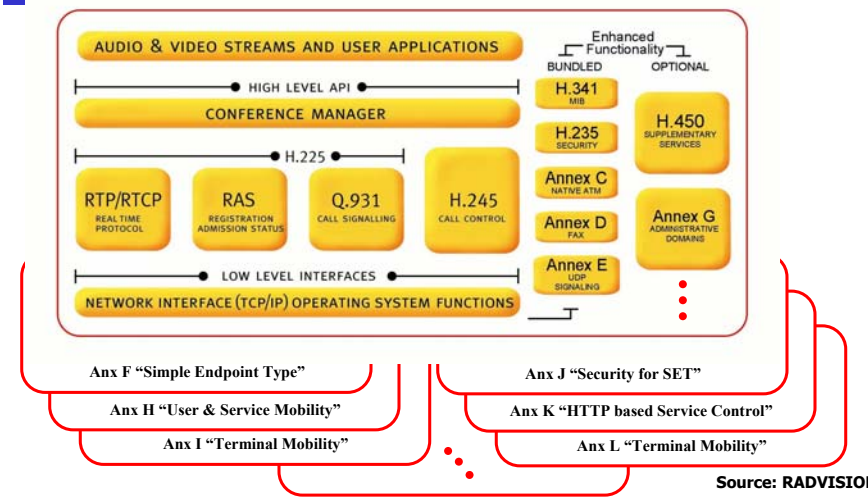
Source: RADVISION

H.323 Basics

- Application layer control protocol
- Consists of set of protocols
- Defines mechanisms for call routing, call signaling, capabilities exchange and media control
- Extensive set of modules and annexes provide enhanced functionality.
- Relies on:
  - H.245 and H.225 (Q.931, RAS) for call control
  - H.450 for supplementary services
  - RTP/RTCP (Real-Time Protocol) for
  - transporting media streams
  - H.26x and G.7xx protocols for video & audio codecs

Source: RADVISION

H.323 "Umbrella"



Source: RADVISION

H.323: A CLOSER LOOK

H.323 Entities

- Terminals (client endpoints)
  - Support real-time, two-way multimedia communication
- Gateways
  - "Translate" between packet and circuit-switch network
- MCU (Multipoint control units)
  - For conferences between 3 or more participants
  - Mandatory: MC + optional: MP
- Gatekeeper
  - For network/resource management and call control
  - Mandatory: address translation, admissions control, bandwidth control, zone management
  - Optional: call control signalling, call authorization, bandwidth management, call management

Source: RADVISION

H.323 & SIP…Side by Side

- Comparable functionality achieved with different mechanisms
- Similar QoS support
- SIP more flexible and scaleable
- H.323 better interoperability and network management (admissions/policy control)
- H.323 better because of SIP and visa versa!!
- Differences diminishing with each new version

Source: RADVISION

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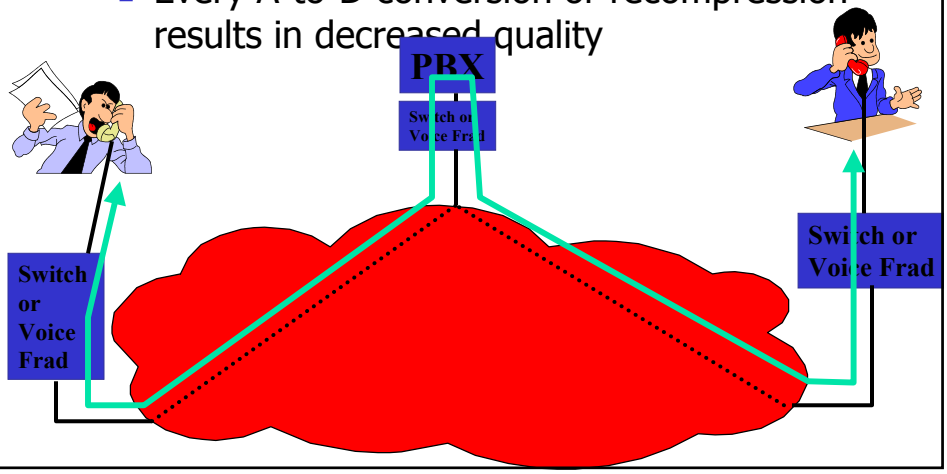
Multiple Tandems

- Every A-to-D conversion or recompression results in decreased quality



Multiple Tandems

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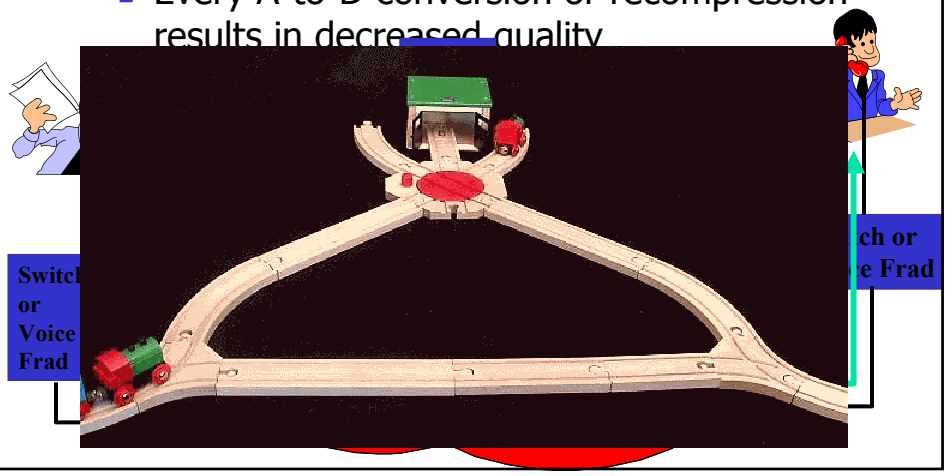


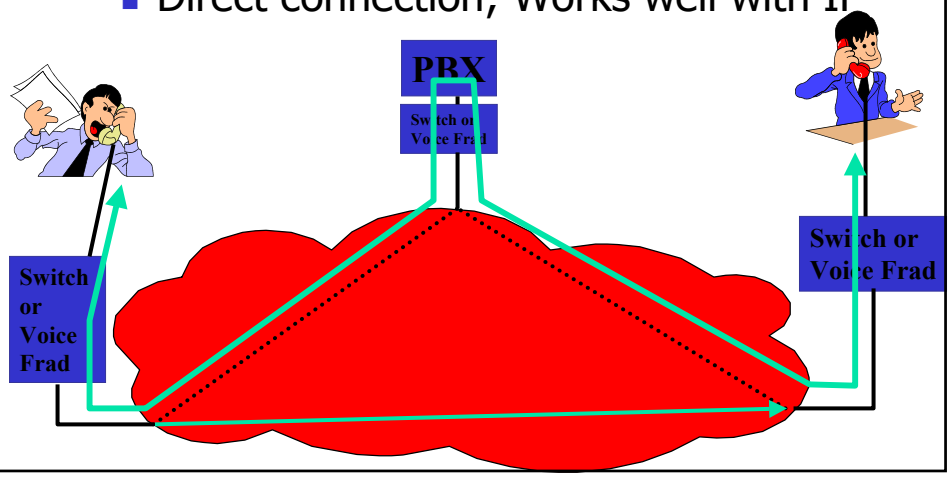
Multiple Tandem Degradation

- Also prepared by Sipro Lab Telecom Inc.
- For more information, visit http://www.sipro.com.
- Reference Samples
  - 44 khz
  - 8khz
  - 64 kbps PCM

Algorithm	1 Tandem	3 Tandems	6 Tandems	10 Tandems
G.723.1 @ 5.3 kbps				
G.729A @ 8 kbps				

Solution: Call Processing

- Direct connection; Works well with IP



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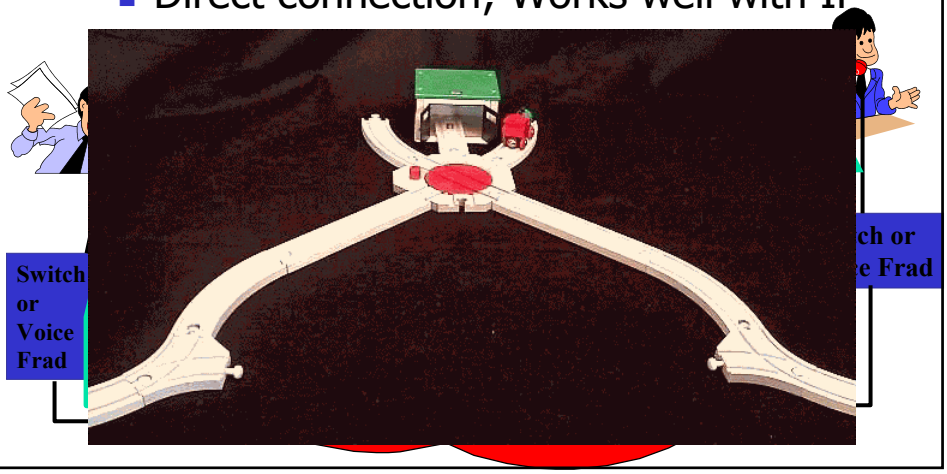
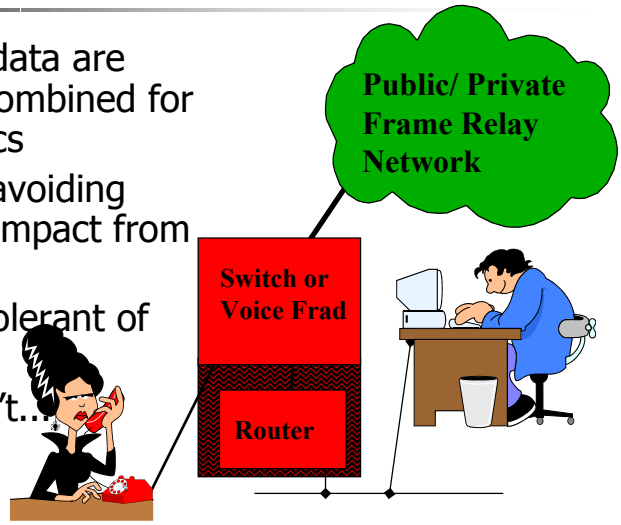


Delay

- Voice & data are usually combined for economics
- Issue is avoiding adverse impact from data
- Data is tolerant of delay
- Voice isn't...

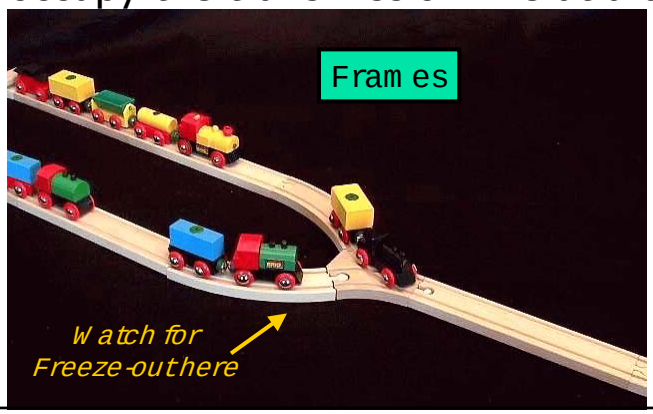


Some Delay Sources

- Delay types
  - Absolute delay
  - "Jitter" (delay variation)
- Delay is generally related to the "packet time"
  - Packet Time = (Packet Size) / Speed
- Multiple factors
  - Freeze-out, Fill time, Last cell, etc.

Freeze-Out: Frames

- Only one PDU (frame or cell) can occupy the transmission line at a time.



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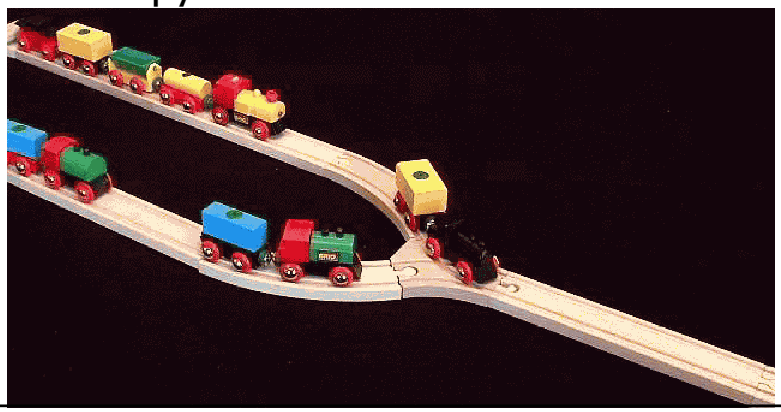
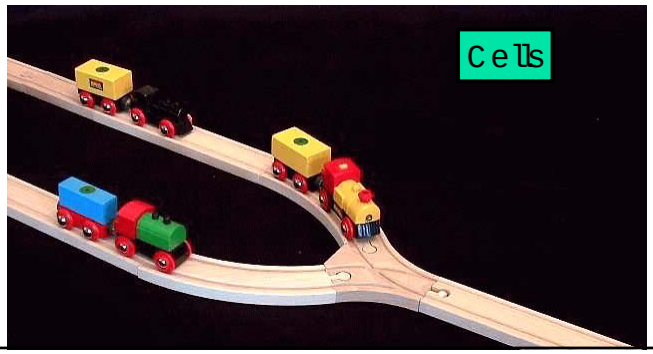


Freeze-Out: Cells

- With frames ***OR*** cells, only one PDU (frame or cell) can occupy the transmission line at a time.



Freeze-Out: Cells

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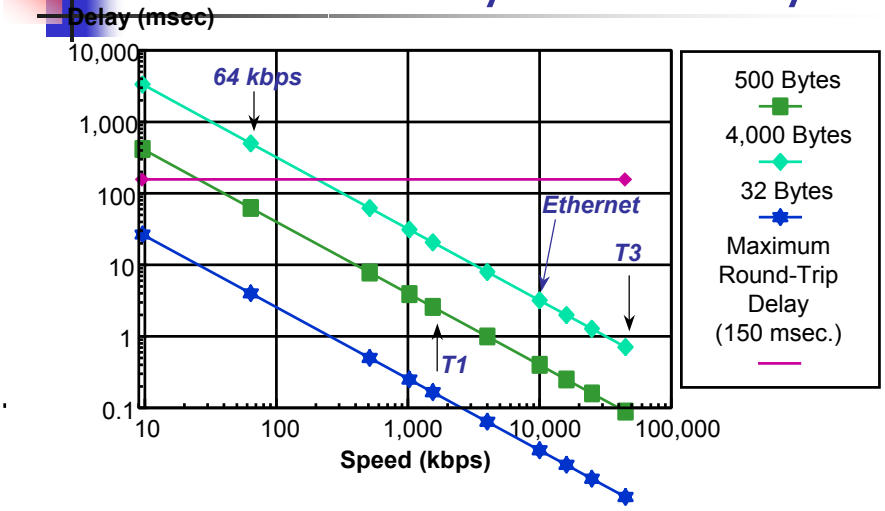
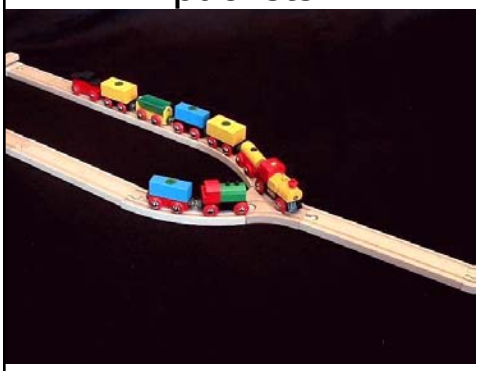
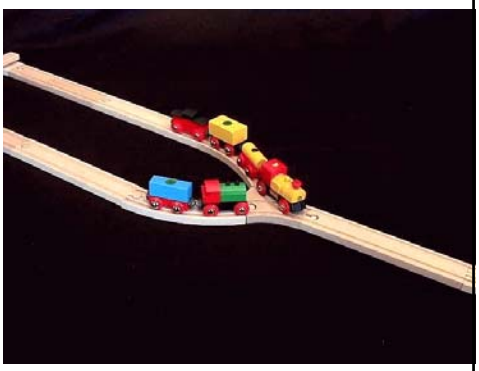
Freeze-out: Myth & Reality



Freeze-out: Bottom Line

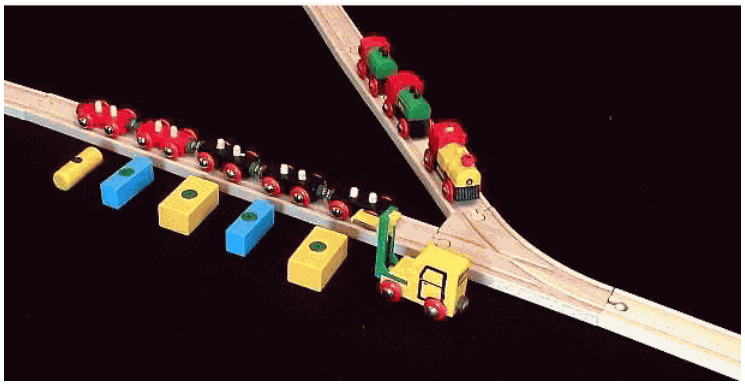
- Freezeout is a problem for long, slow packets





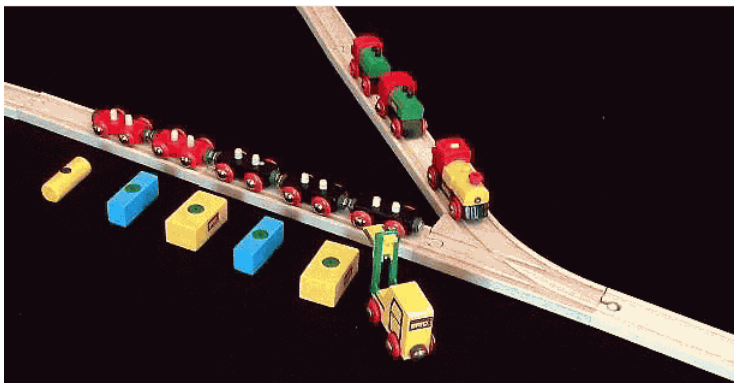
Fill Time

- Limits the maximum allowable packet size for voice



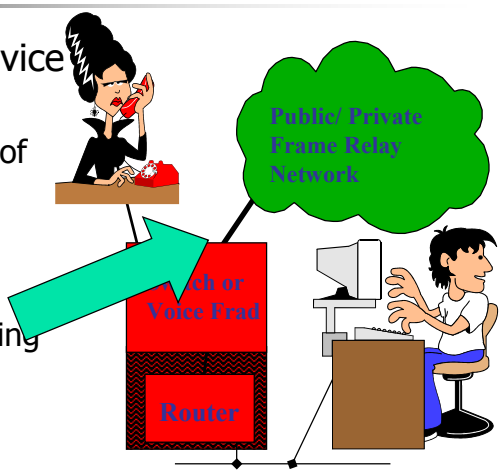
Last Cell and Packet Voice

- Packet voice payloads are very short for Frame Relay and IP



Queuing in Access

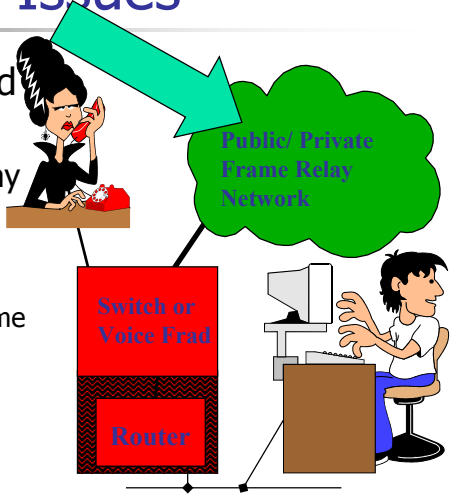
- Under access device control
  - Data is tolerant of delay
- Relatively easily controlled
  - Prioritized Queuing
  - Segmentation



Queuing in Access

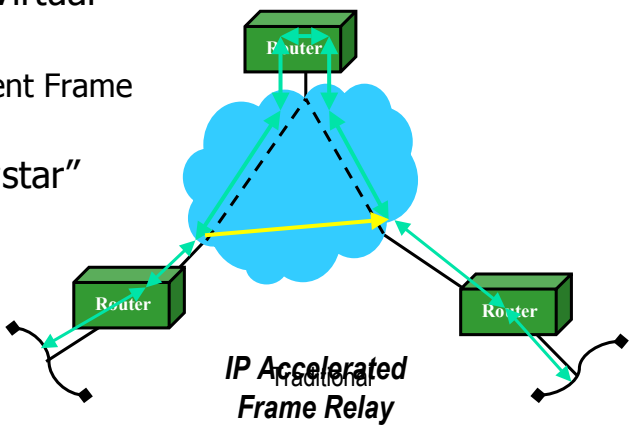
Queuing in the Network: Infrastructure Issues

- Routed vs. Switched Network
  - Processing and delay
- QoS Issues
  - ATM vs. IP vs. FR
    - IP over ATM or Frame Relay
  - MPLS



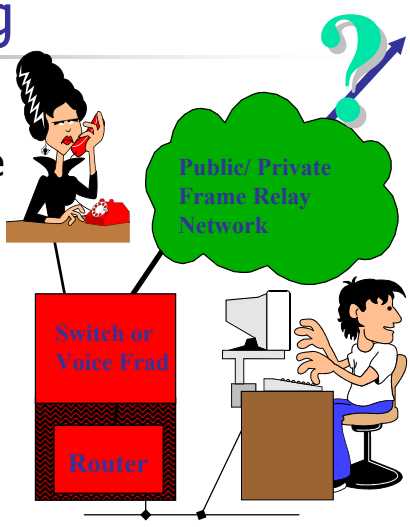
Frame Relay / ATM Interworking with IP

- Any-to-Any Virtual Topologies
  - Unlike current Frame Relay
- Eliminating "star" bottlenecks
  - E.g., IP accelerated frame relay



Output Queuing

- Active issue
- Problem for IP, Frame Relay & ATM
- Possible solutions
  - Subframe Muxing
  - Switch solutions
    - IP-Based Queuing



For more information…

- Www.Webtorials.Com
- Network World Fusion "Convergence" Newsletter
  - Free
  - Twice weekly
  - Speakers are the authors
  - Archives at www.nwfusion.com/newsletters/converg

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