Leading the Migration to Packet-Based Network Services

Line-rate Traffic Management Coprocessor Solutions
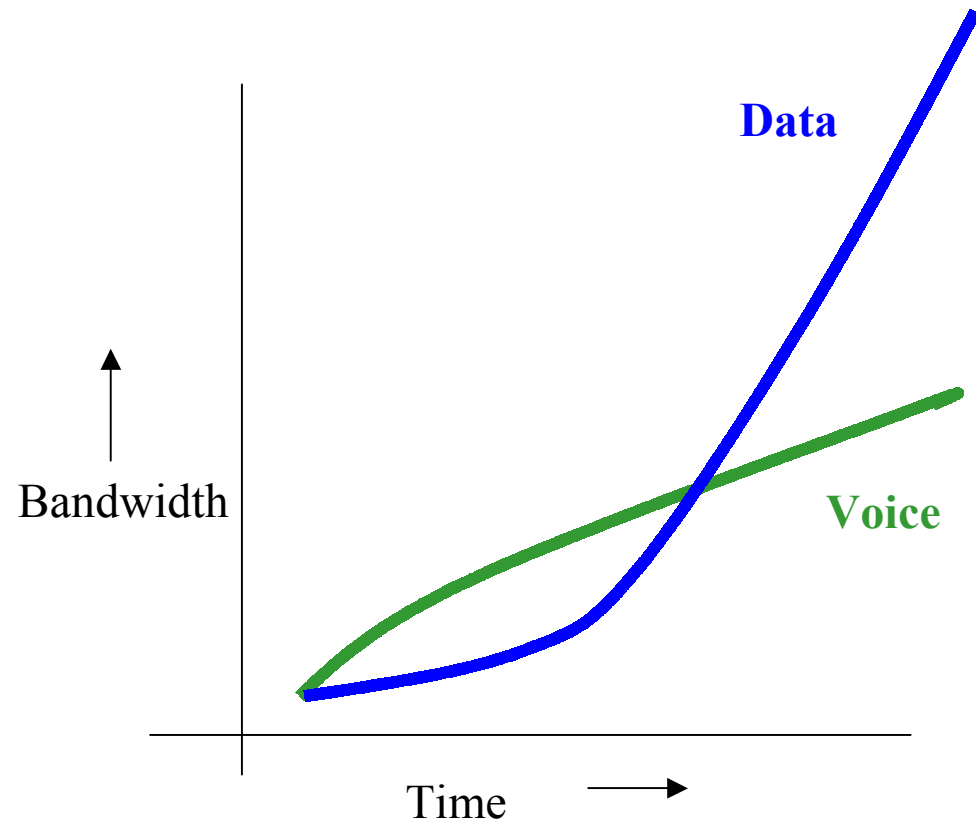
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The Network Problem

- Voice currently generates ~80% of the infrastructure revenue

- Voice accounts for slightly greater than 20% of the traffic

- Carriers are forced by the traffic load to migrate to a data optimized infrastructure

- Carriers must differentiate data services, while maintaining "telephony grade" voice quality and reliability standards

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MegaTrends

- Glut of WDM optical bandwidth at the core

- Last-mile access through 3G wireless, cable modem and DSL

- Edge aggregation becomes the stress point of the broadband networks
  - ISP/Internet Traffic
  - ATM, FR Services
  - Leased Line (T1, T3) Services
  - Metro Gigabit Ethernet

- Traffic Engineering in the Core
  - to optimize bandwidth usage (IP, MPLS, ATM)

- Traffic Management at the Edge of Core network
  - Multiprotocol (MPLS, ATM, FR, GbE, TDM, IP)
  - Millions of microflows aggregated to the core

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Requirements for the Evolution to a packet-based Network

- Per packet COS discovery enables support for packets that lack explicit service level parameters

- Supports Multiple Service Classes with a combination of guaranteed services (CBR, ...) and differentiated services (priority)

- Deterministic Traffic Management is required to deliver the appropriate services for both packets and cells

- Contract enforcement and billing support are necessary to extract value from services

- Support for "legacy" protocols (FR, ATM) enables evolutionary migration (vs. revolutionary upgrades)

- Scalable to grow with new network requirements

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Broadband Economics

- As the broadband network infrastructures are being built out, network & service providers must be able to generate sustainable revenue streams
    - Need ability to provide and enforce SLAs
        - monitor per-flow states & statistics
        - police, mark, discard & shape traffic per-flow, per user or both
    - Need ability to optimize traffic through the network
        - traffic engineering using MPLS or ATM
    - Need ability to maximize bandwidth sharing and resource prioritization
        - interpretation and delivery of QoS
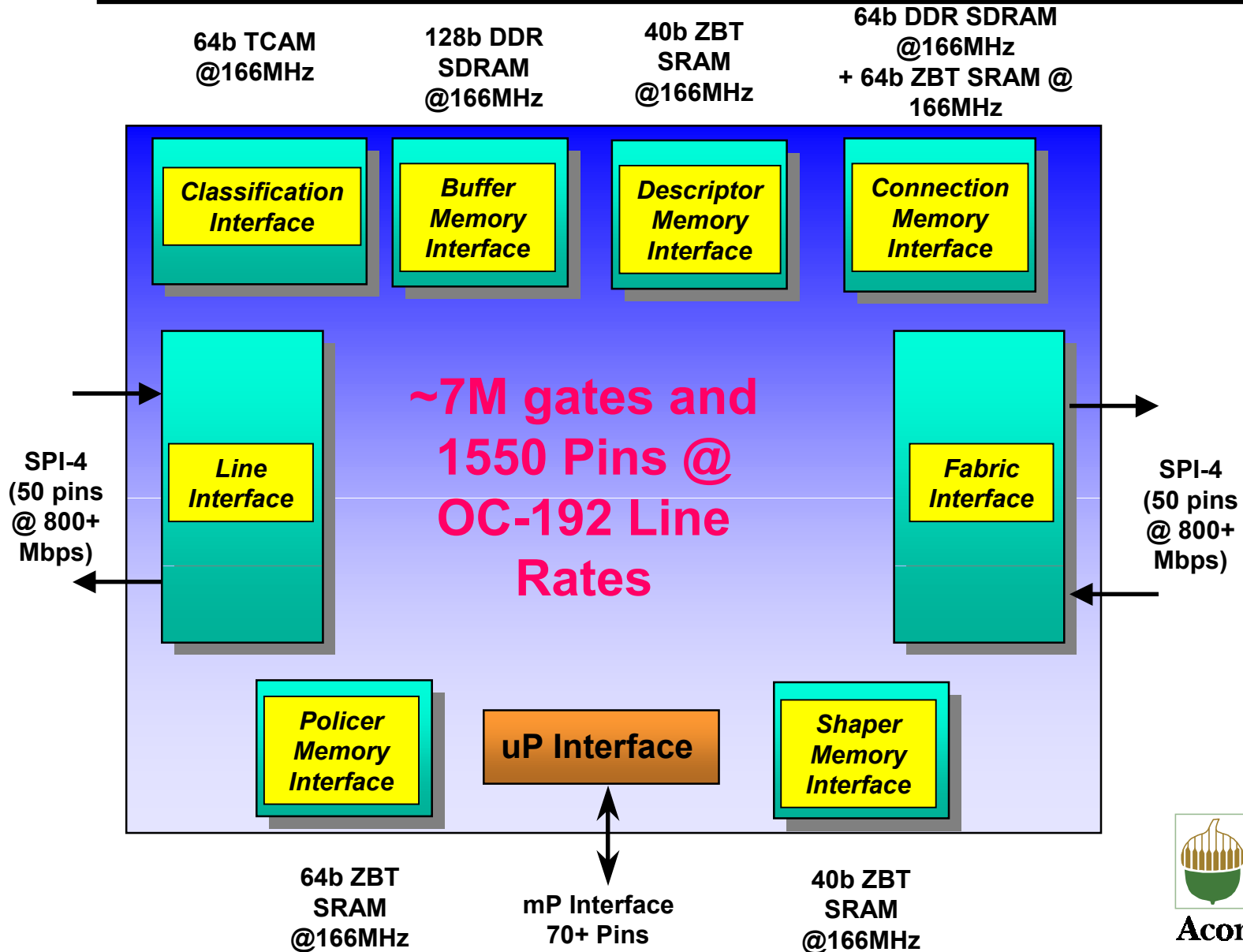
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Wire-speed TM Design Challenges

- Supporting 0.1sec to 1sec of network delay necessitates the use of external DRAM (GBytes of traffic)
  - Simple TM with a few queues can be implemented using on or off-chip SRAM
  - External DRAM provides the density, low power and low cost to buffer GBytes of transient traffic
  - TM, by definition, requires re-ordering, demanding significant storage

- Implementations based on external DRAM technologies create special design challenges
  - Memory bandwidth (roughly 30-40 Gbps required for OC-192c applications due to DRAM overhead on short packets)
  - Memory latency (for OC-192c internal control pipelines are based on 4-8 cycle periods, while external memory access latency still spans over several periods)

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The I/O Challenge

64b TCAM @166MHz

128b DDR SDRAM @166MHz

40b ZBT SRAM @166MHz

64b DDR SDRAM @166MHz + 64b ZBT SRAM @ 166MHz

Classification Interface

Buffer Memory Interface

Descriptor Memory Interface

Connection Memory Interface

SPI-4 (50 pins @ 800+ Mbps)

Line Interface

~7M gates and 1550 Pins @ OC-192 Line Rates

Fabric Interface

SPI-4 (50 pins @ 800+ Mbps)

Policer Memory Interface

uP Interface

Shaper Memory Interface

64b ZBT SRAM @166MHz

mP Interface 70+ Pins

40b ZBT SRAM @166MHz

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Acorn Network's Solution Provides:

- Deterministic Traffic Management
  - User (flow) based bandwidth management (vs class-based)
  - IP-based Virtual Private Networking (IP VPN)
  - Service Level Agreements (Explicit rate scheduler reserves SLA-defined BW)
  - Intelligent per flow (billable transaction) queuing, scheduling, and shaping
- Contract enforcement and billing:
  - Per flow policing of all supported protocols
  - Policy based discard mechanisms (I.e. WRED)
  - Per flow statistics gathering for billing support
- Support for both "new" (POS, MPLS, Enet) and "legacy" (FR, ATM) protocols
- Scalability in:
  - System size
  - Architecture

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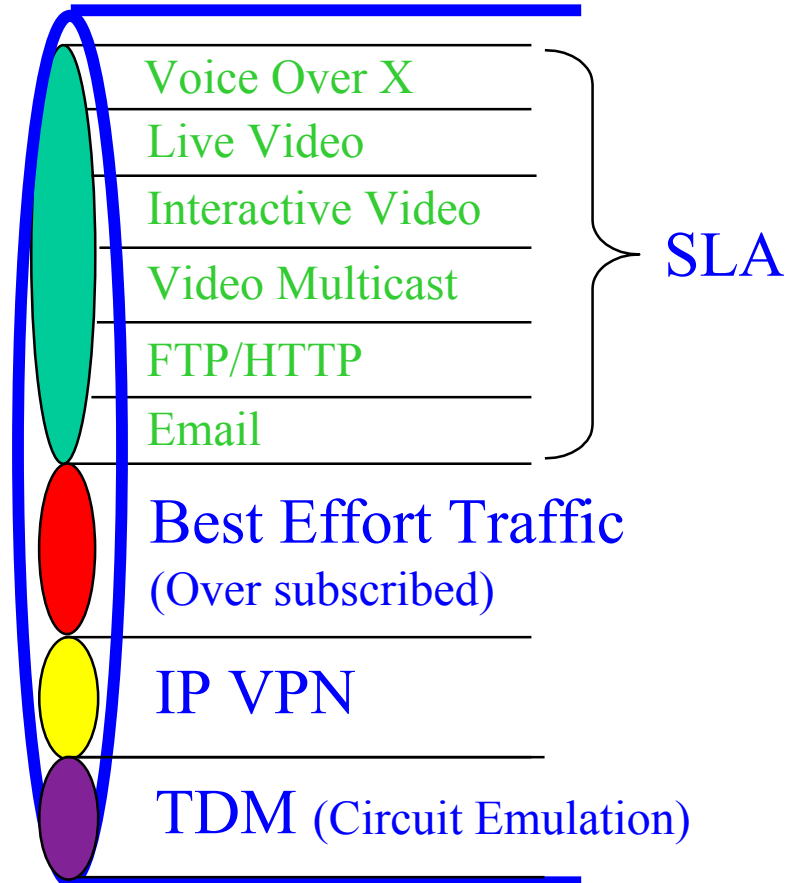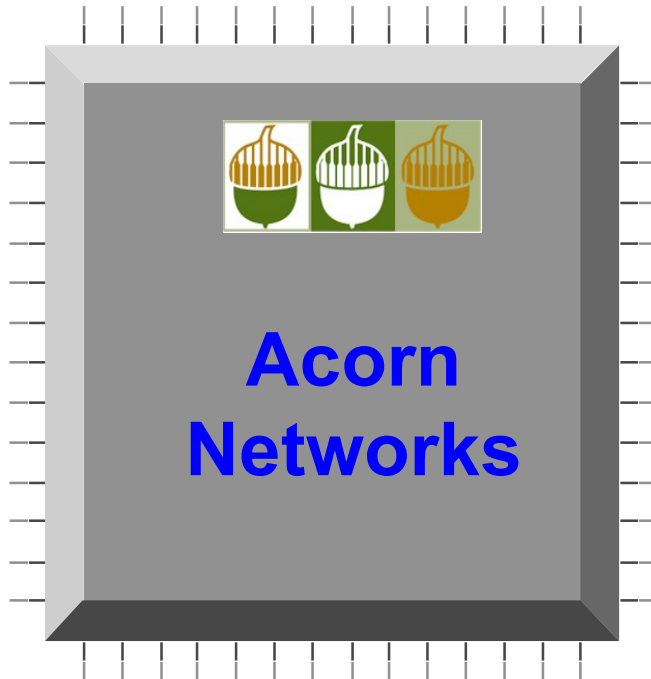# Acorn's TM increases the value per transmitted bit

IP

ATM

MPLS

FR

Enet

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Voice Over X

Live Video

Interactive Video

Video Multicast

FTP/HTTP

Email

SLA

Best Effort Traffic (Over subscribed)

IP VPN

TDM (Circuit Emulation)

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In Summary….

◆ **I/O and Gate count requirements for Traffic Management at OC-48 and above force coprocessor approach**

   – **Integration with Packet Processor saves few pins**

   – **Memory requirements for real network solutions prevent integrated approach**

◆ **Acorn's genFlow Traffic Management coprocessor solutions uniquely address this problem**

   – **OC-48 is available today**

   – **OC-192 is on its way**

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Wire-speed Multiprotocol Traffic Management Coprocessor Solutions

Thank You

www.acorn-networks.com