Communications Applications with Gigabit Ethernet Protocol

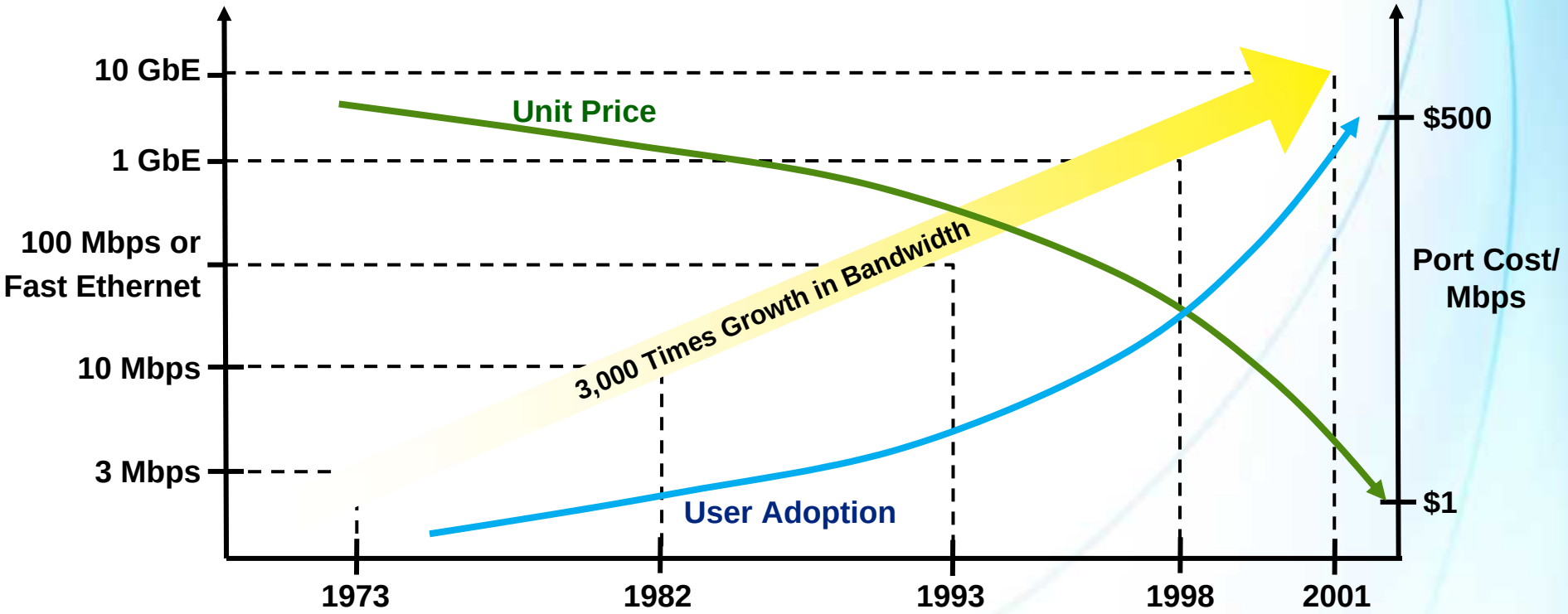
Agenda

- Gigabit Ethernet overview
- Emerging trends in communications
- Altera® Gigabit Ethernet solution
- Altera triple-speed Ethernet (TSE) intellectual property (IP) and demo

Gigabit Ethernet Overview

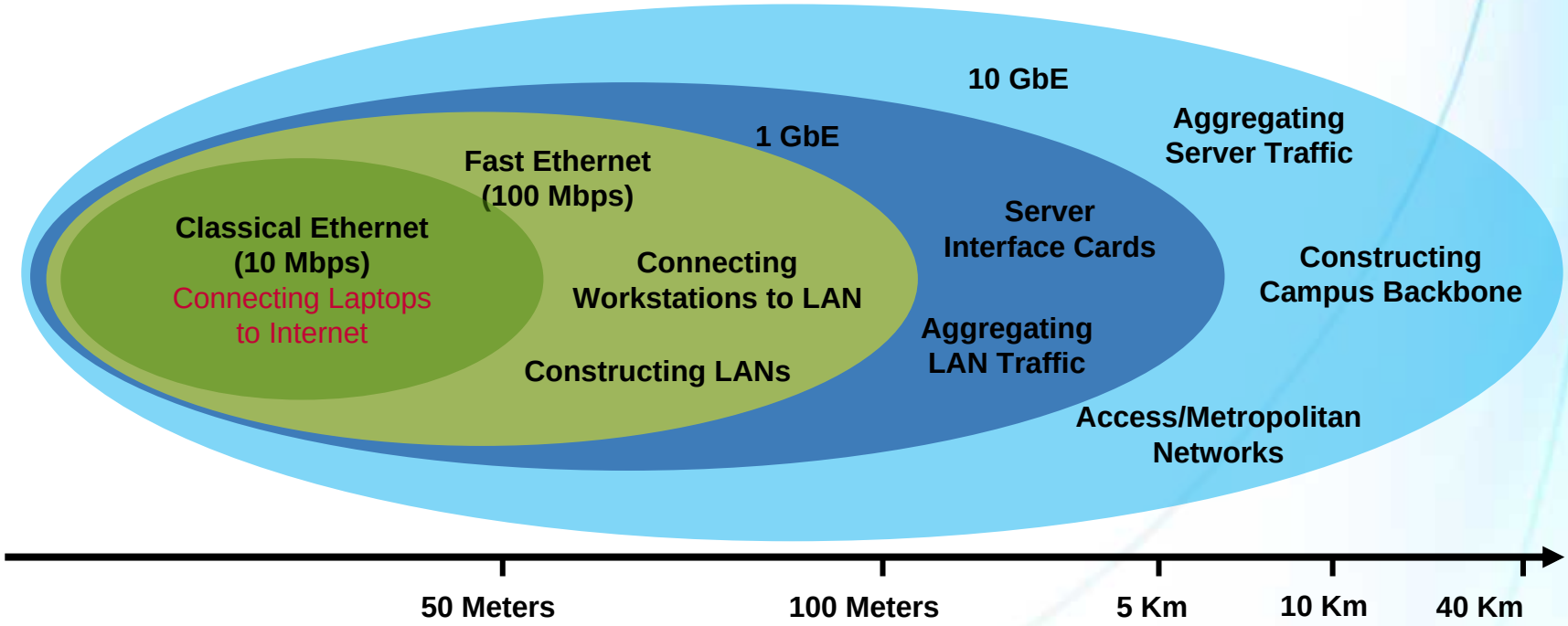
Ethernet Evolution

- Invented in 1973 at Xerox PARC to interconnect Altos workstations
- Ease of use led to wide adoption and lower costs
- Nearly 97% of computers use Ethernet to connect to Internet
- Consistently delivered higher performance at lower unit costs

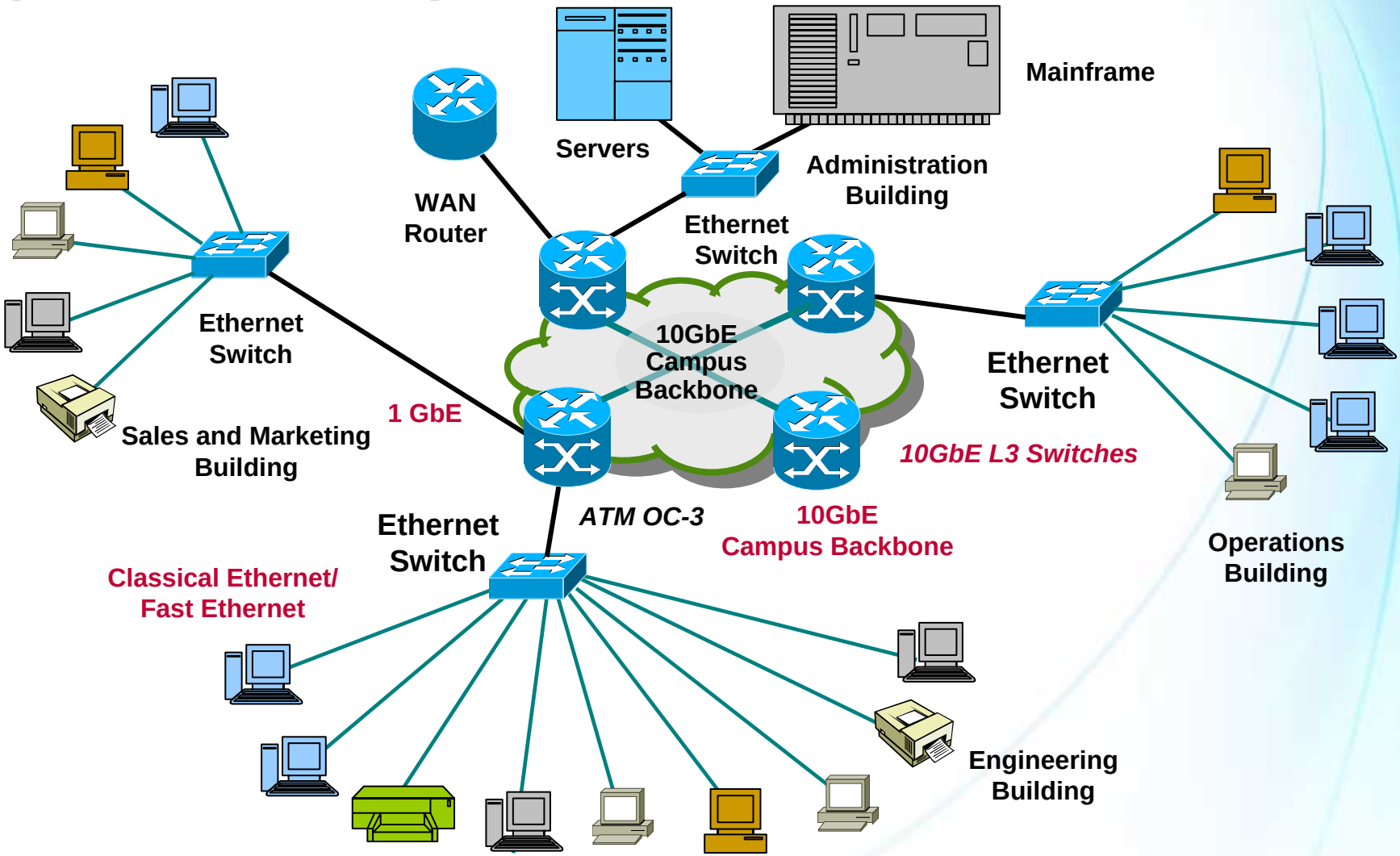


10 GbE: Extending the Reach and Applications of Ethernet

- **Fast Ethernet and Gigabit Ethernet**
  - 10/100 Mbps (Fast Ethernet) is universally used to connect computers to Internet
  - 1 GbE becoming pervasive LAN technology
- **10 Gigabit Ethernet**
  - Extend reach of Ethernet to data centers, campus backbones, and metropolitan area networks



Enterprise Campus Backbone
(10 GbE-Based)

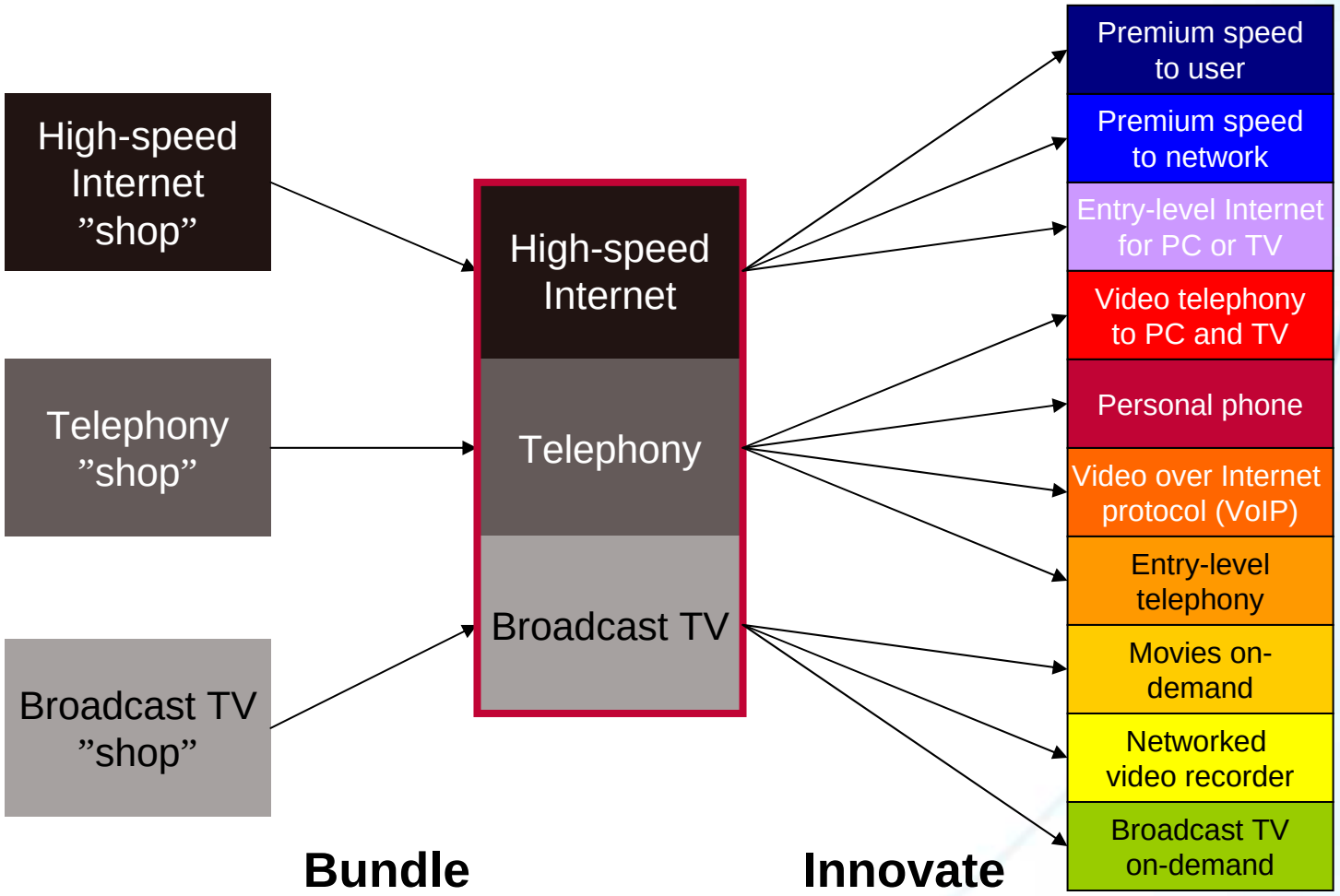


Benefits of 10 GbE

- Cost-effective solution
  - $10,000 per 10 GbE port
  - Competitive SONET OC192 solutions range from $64K to $144K per port
- Based on widely deployed 10/100 Mbps and 1 GbE
  - Wide user acceptance
  - Well-trained workforce
- Can be deployed in all parts of the network
  - LAN: local area networks
  - SAN: storage area networks
  - MAN: metropolitan area networks
  - WAN: wide area networks

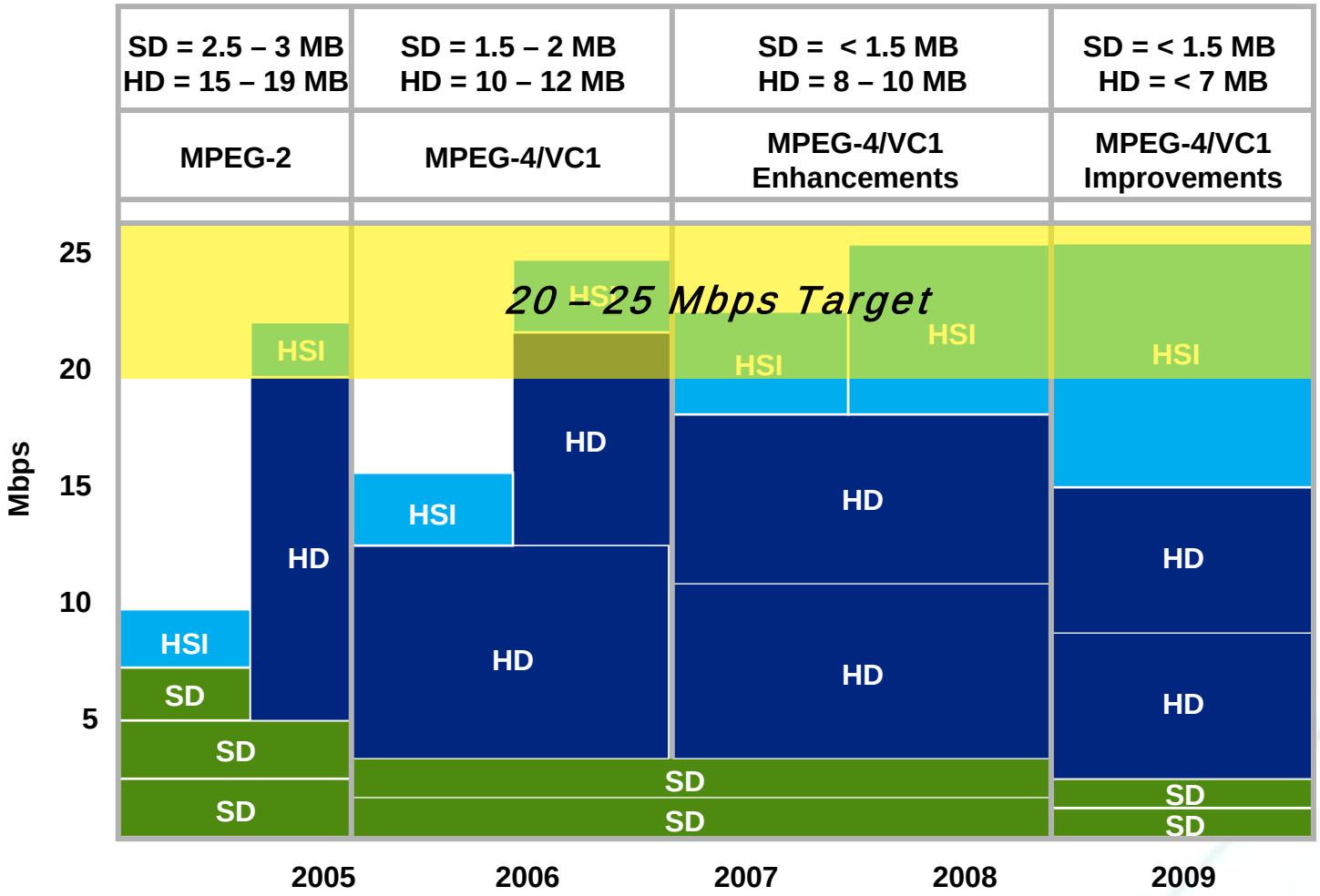
Emerging Trends in Communications

The Emerging Broadband Supermarket



Source : Ericsson

IPTV Bandwidth Requirements



- Service mix may vary (eg. voice over IP) or service subsets may be offered
- 2nd HD channel initially to support concurrent home personal video recorder (PVR) recording
- Assumes quality of picture competitive with digital satellite/cable

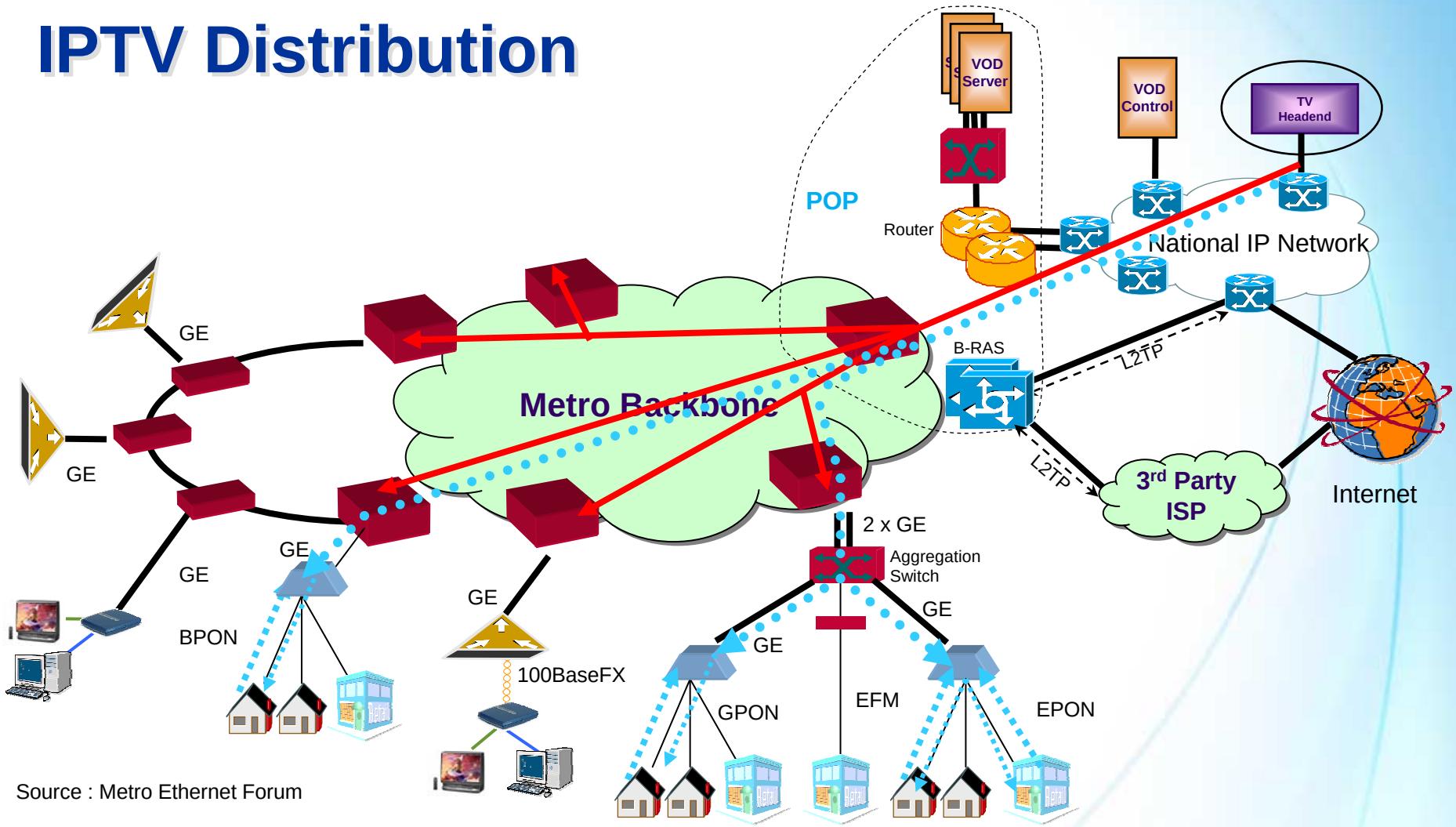
HD=High Definition TV
SD=Standard Definition TV
HSI =High Speed Internet

Video Services Driving Bandwidth Requirements to the Home

Source: Alcatel

Source : Alcatel

IPTV Distribution

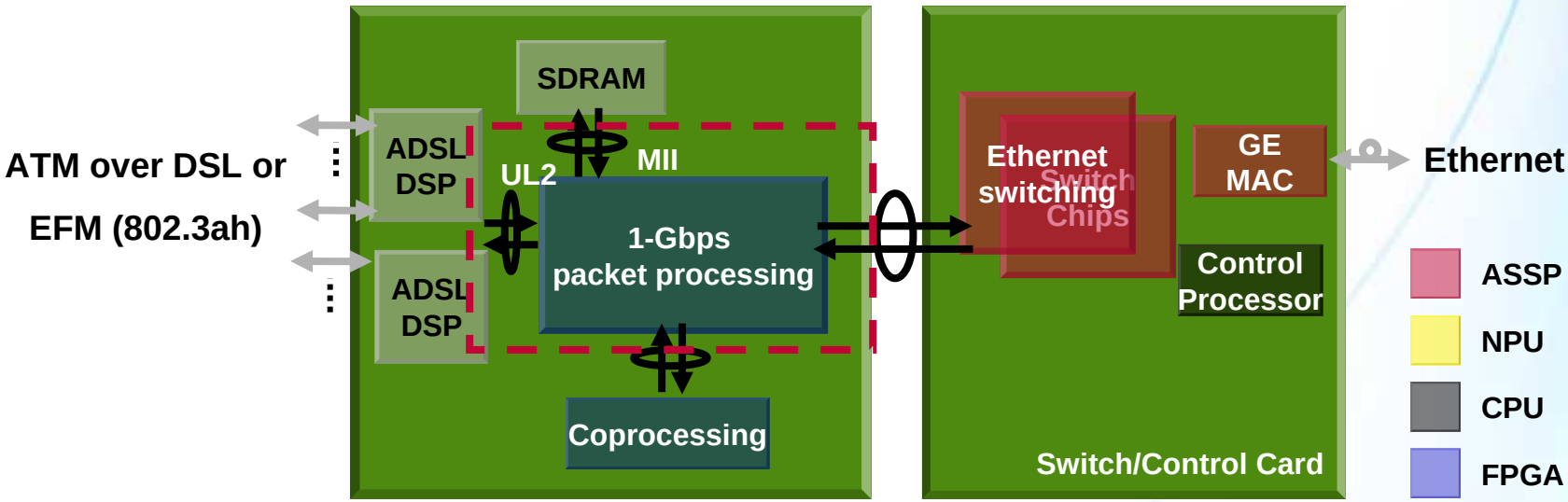


Source : Metro Ethernet Forum

Multicast Requirements for Video Driving Ethernet Aggregation Market

DSL Trends: Distributed IP-DSLAM

- Distributed intelligence on line card: 1-Gbps network processing unit (NPU)
  - Local multicast replication ensures quick video response times
  - Internet Group Management Protocol (IGMP) snooping, IPv4 forwarding, L2TP tunneling
  - Flexibility critical
- Increased bandwidth requirements driving:
  - High-speed backplane
  - Bonded DSL links
- Momentum of NPUs targeting DSL line cards threatens FPGA business in DSLAM space



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Networking Trends

- Ethernet everywhere
  - Reduction of time division multiplexed (TDM) interfaces on routers/switches
  - High number of GE/10GE ports: up to 200 GE + 20 10GE per node
  - High-density line card (24xGE, 48xGE, 4x10GE over-subscribed to 10G packet processing)
- Emergence of Ethernet aggregation
  - Driven by IPTV and business Ethernet services
  - Ethernet aggregation switches lower cost of edge router
    - Simpler header processing causing NPUs to shift focus from router to metro switch, e.g. Xelerated, EZchip, Greenfield Networks
    - Carrier class failure recovery scheme (< 50 ms) requires proprietary implementation (FPGA)
    - FPGA opportunities for bridge and CoS-aware scheduler
- Migration of legacy TDM onto Ethernet networks
  - Driven by high-margin business services
  - FPGA for interworking function (ATM, FR, POS, RPR, pseudowire)

Altera Gigabit Ethernet Solution

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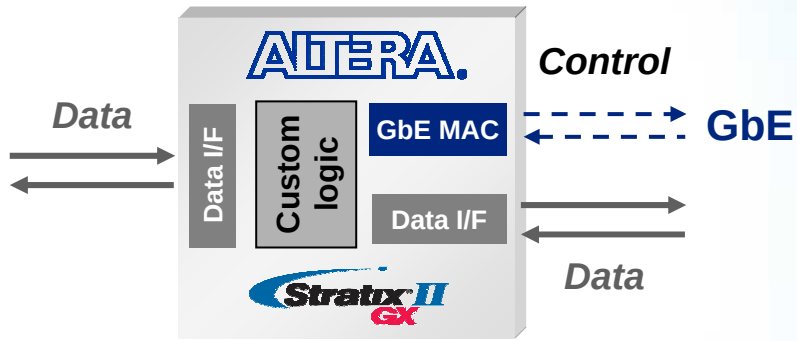
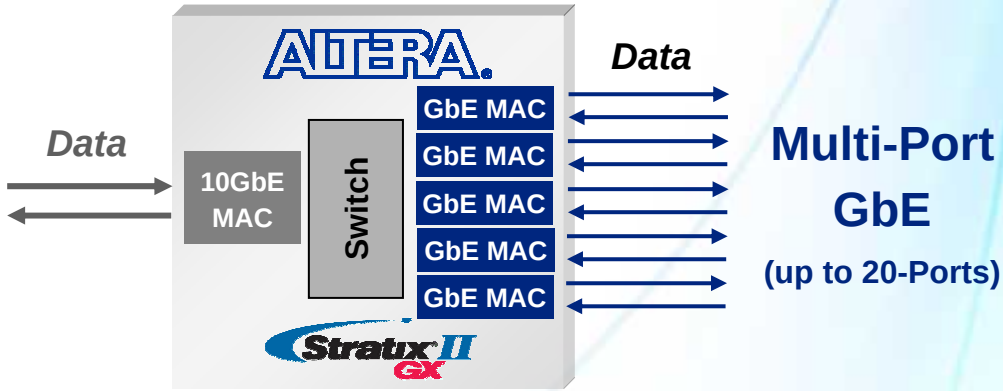
Stratix II GX Advantages for GbE

- Single device solution
- Lowest power per lane
- IEEE 802.3-compliant PCS and PMA
  - Chip-to-chip
  - Board-to-board
  - Backplane
  - SFP fiber optics
- Flexibility
  - Implement the GbE ports required by your unique application
    - 1, 2, 3, … 20 ports

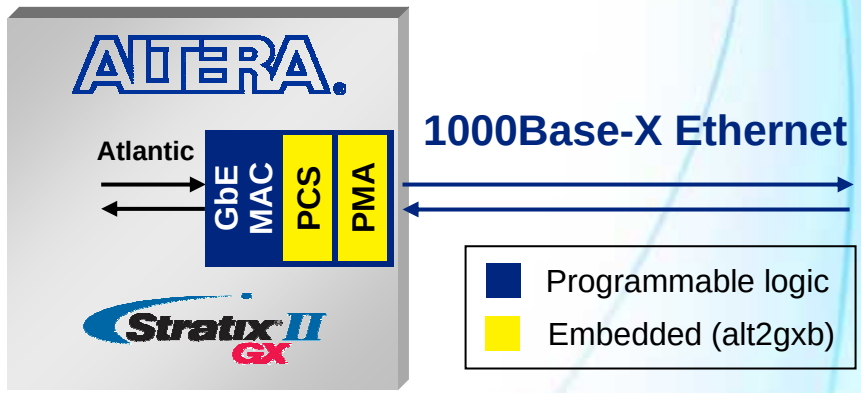




Stratix II GX Gigabit Ethernet Media Access Control (MAC) Solution

from *Altera* and *MorethanIP*

- Full-duplex Gigabit Ethernet MAC
- Integrated 1000 Base-X PCS and PMA
- Full implementation of IEEE 802.3 specification and compliance
- Supports all Stratix® II GX FPGAs
- Altera Atlantic™ interface to application logic
- Developed by MorethanIP
  - Over 10 years experience with Ethernet technologies
- Distributed, licensed, and supported by Altera
  - **FREE** with Quartus® II software subscription

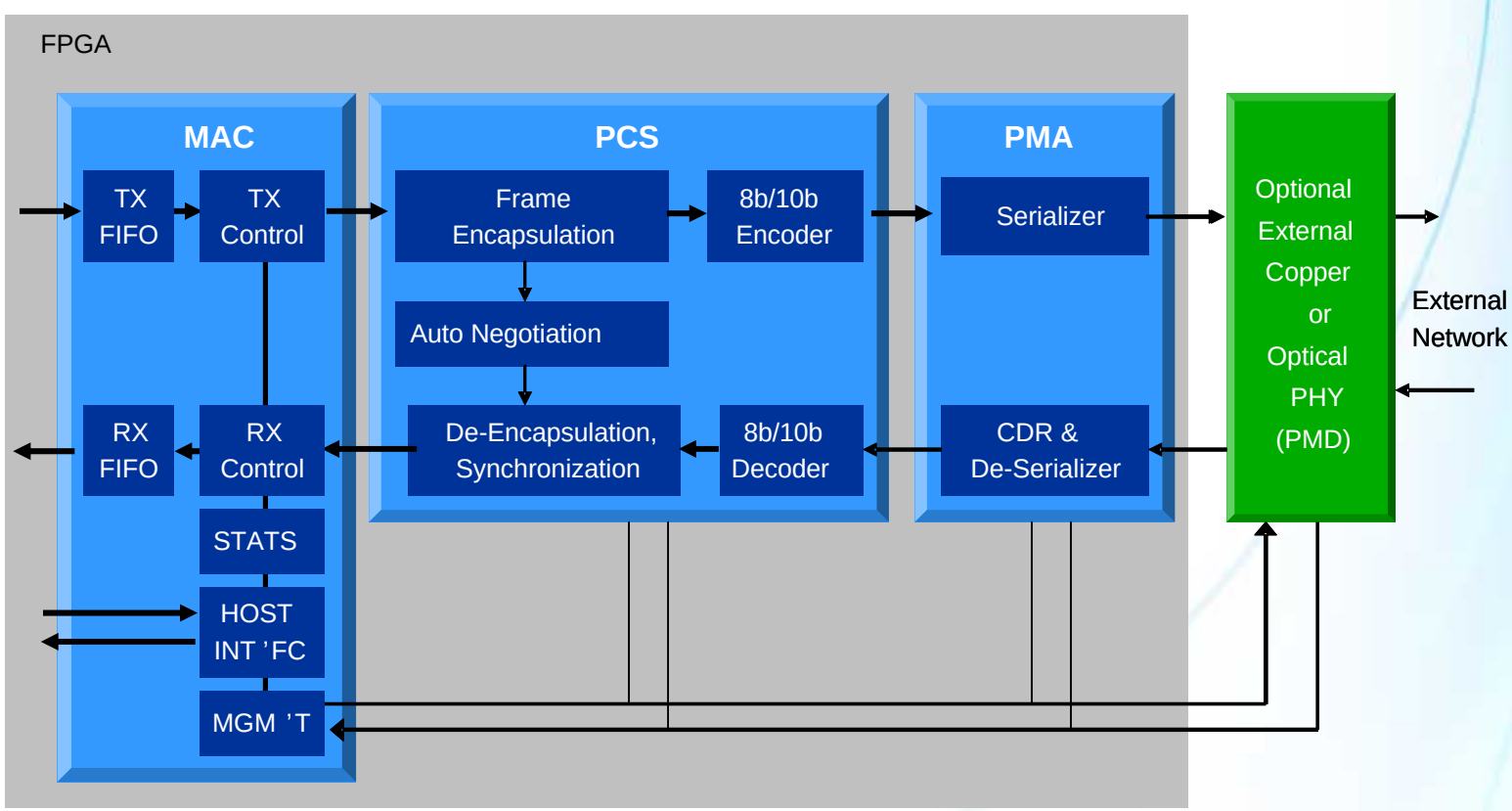


TSE MegaCore Feature Overview

- Flexible and integrated MAC/PHY Ethernet solution
  - Standalone 10/100/1000Mbps MAC
  - Standalone PCS
  - PCS + PMA
  - 10/100/1000Mbps MAC + PCS + PMA
- MegaWizard® II GUI
- SOPC Builder-ready
- Software driver and protocol stack support
- IEEE 802.3 compliance
- UNH validated

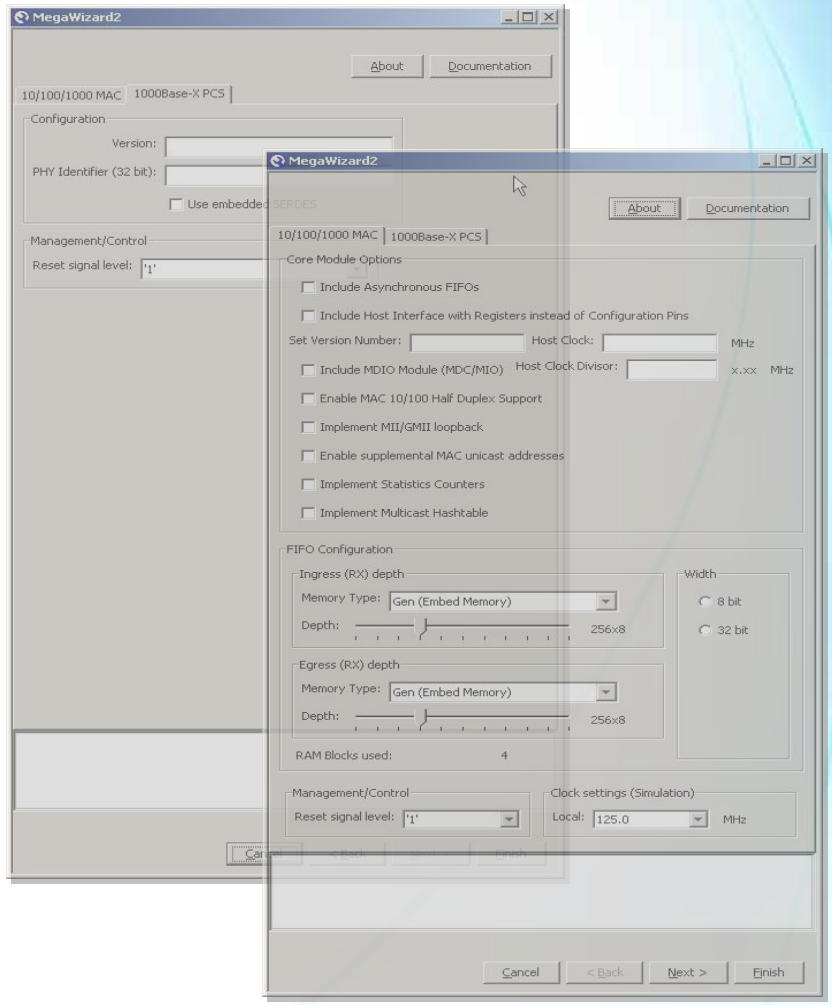
TSE MegaCore Function

- Single to multiple port 10/100-Mbps or 1-Gbps Ethernet applications
- LAN and WAN data plane or control plane (embedded system) applications
- Chip-to-chip, board-to-board, and inter-system network connectivity

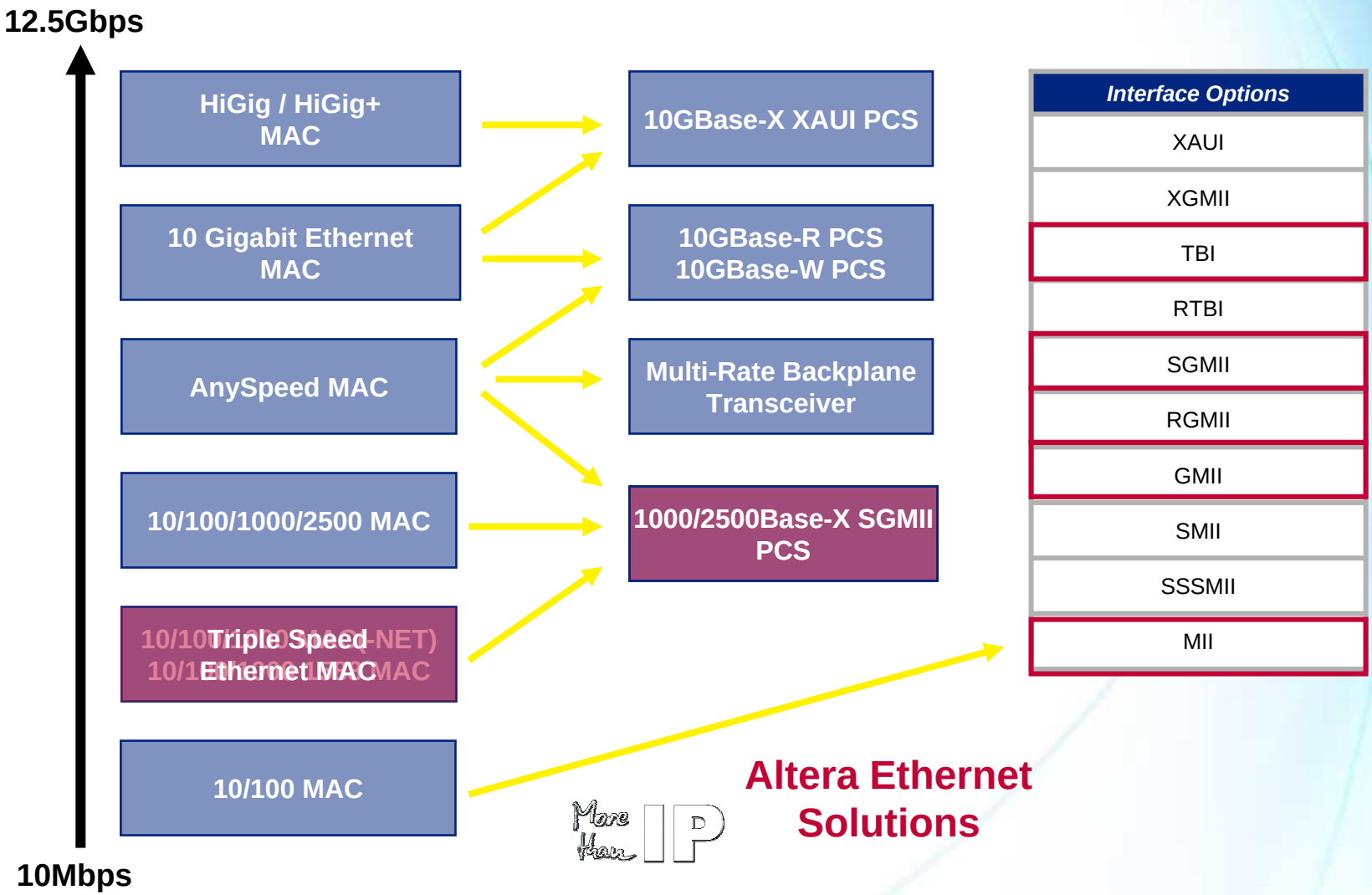


TSE v6.1 MegaWizard

- MegaWizard II GUI
  - Parameterize
    - Capture user options
    - Provide resource usage estimation
    - Derive HDL parameter and port information
  - Generate
    - Top-level register transfer level (RTL) variation file
    - IP functional simulation model
    - Quartus II software constraint files
    - HDL testbenches and ModelSim simulation scripts



Availability – IP Cores



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Summary

- Gigabit Ethernet technology pervasive in communications due to aggregation of services
- Altera provides best-in class FPGAs for Gigabit Ethernet applications
  - Stratix II GX FPGAs for high-performance systems
  - Arria™ GX FPGAs for mainstream Gigabit Ethernet applications
- Complete solution validated in hardware
  - IP cores, characterization reports, development boards
  - Interoperability

Altera Triple Speed Ethernet (TSE) MegaCore Demo