



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

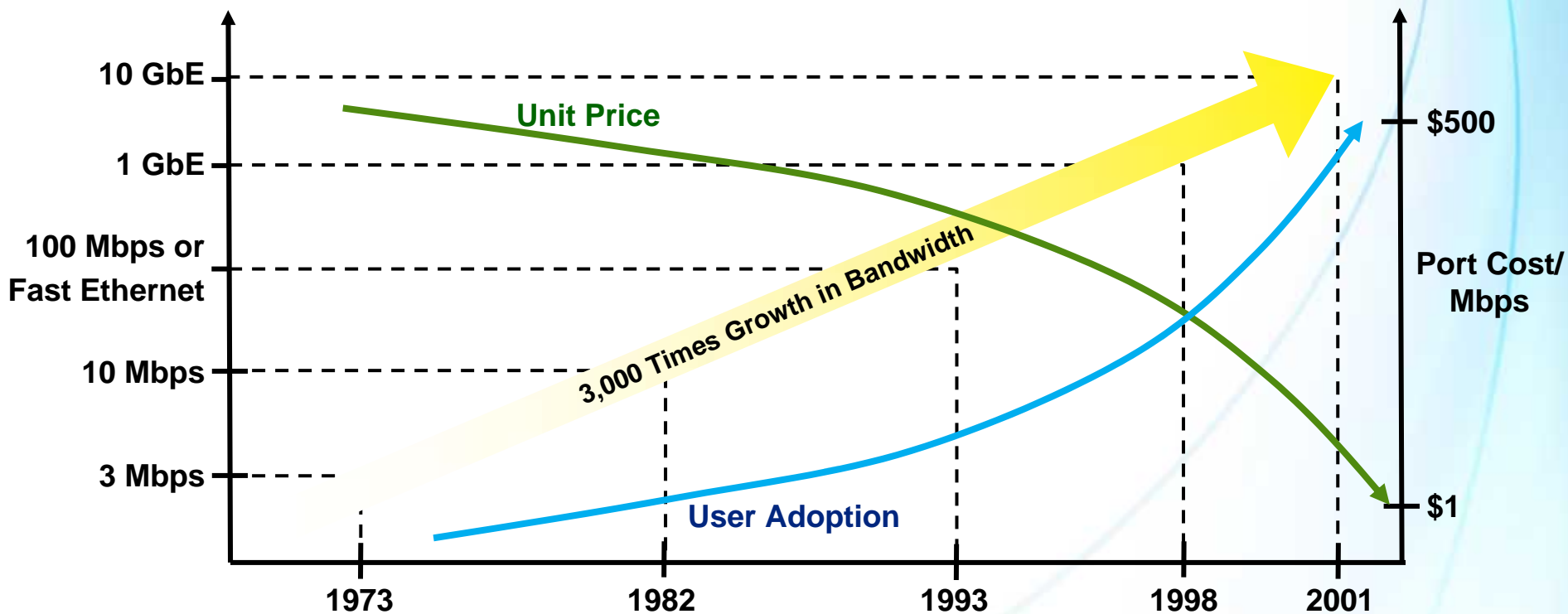


Gigabit Ethernet Overview



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



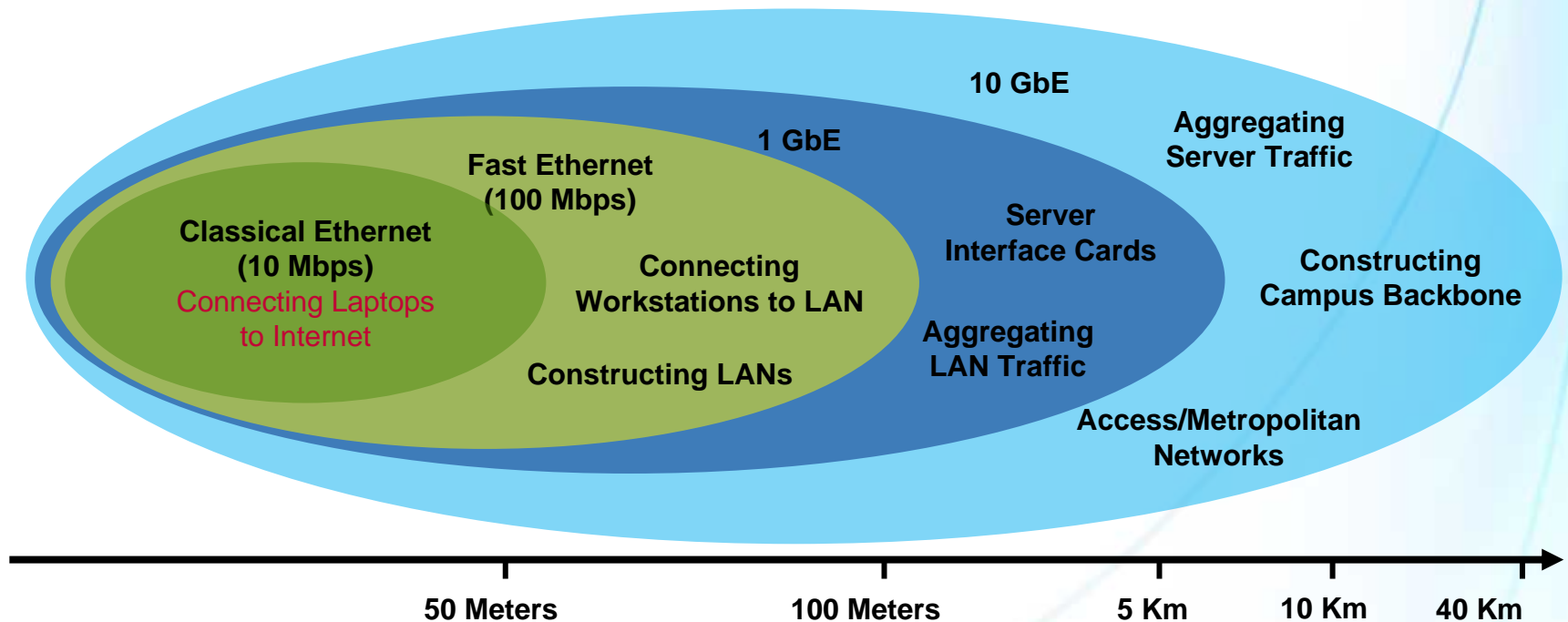
10 GbE: Extending the Reach and Applications of Ethernet

■ Fast Ethernet and Gigabit Ethernet

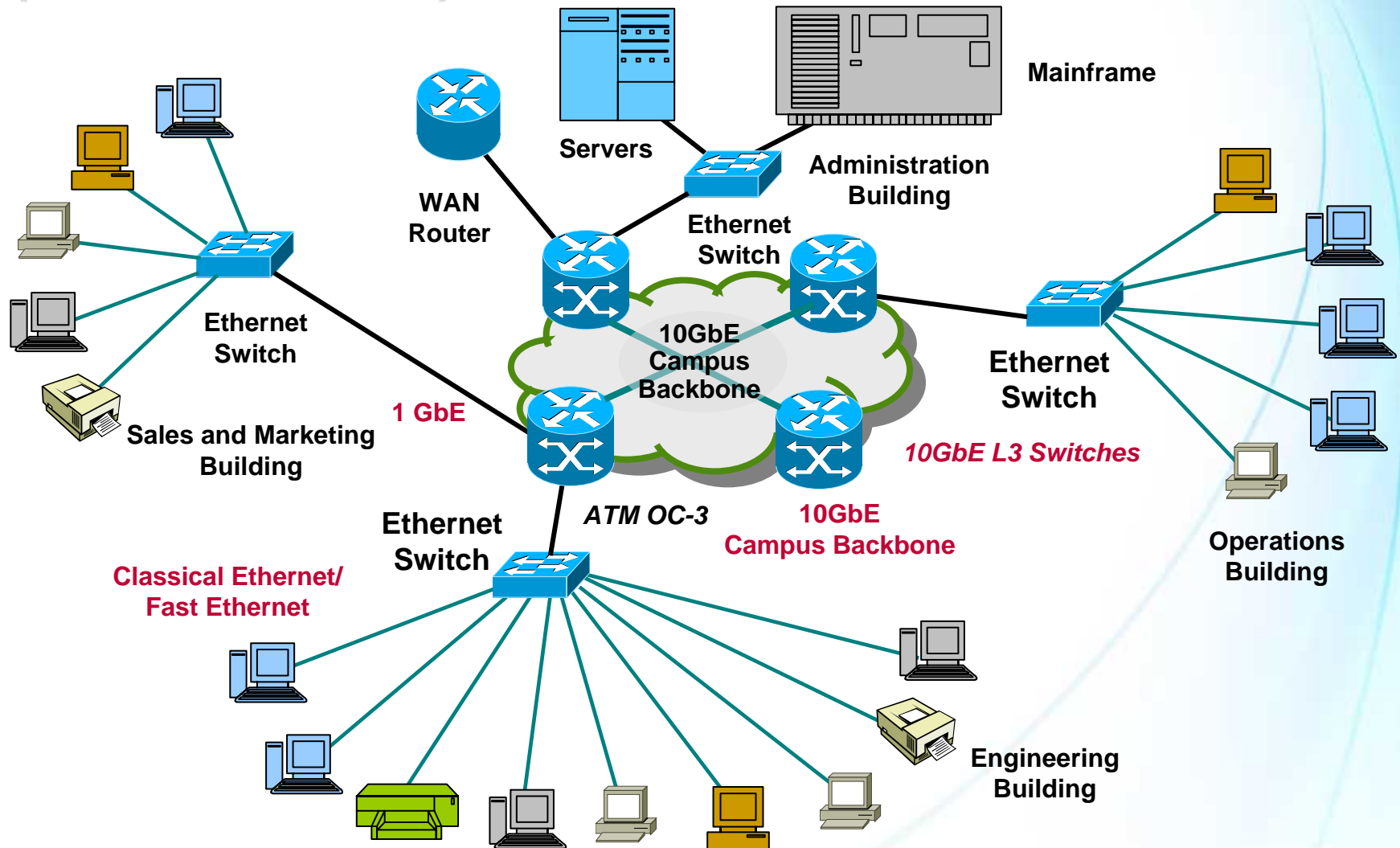
- 10/100 Mbps (Fast Ethernet) is universally used to connect computers to Internet
- 1 GbE becoming pervasive LAN technology

■ 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

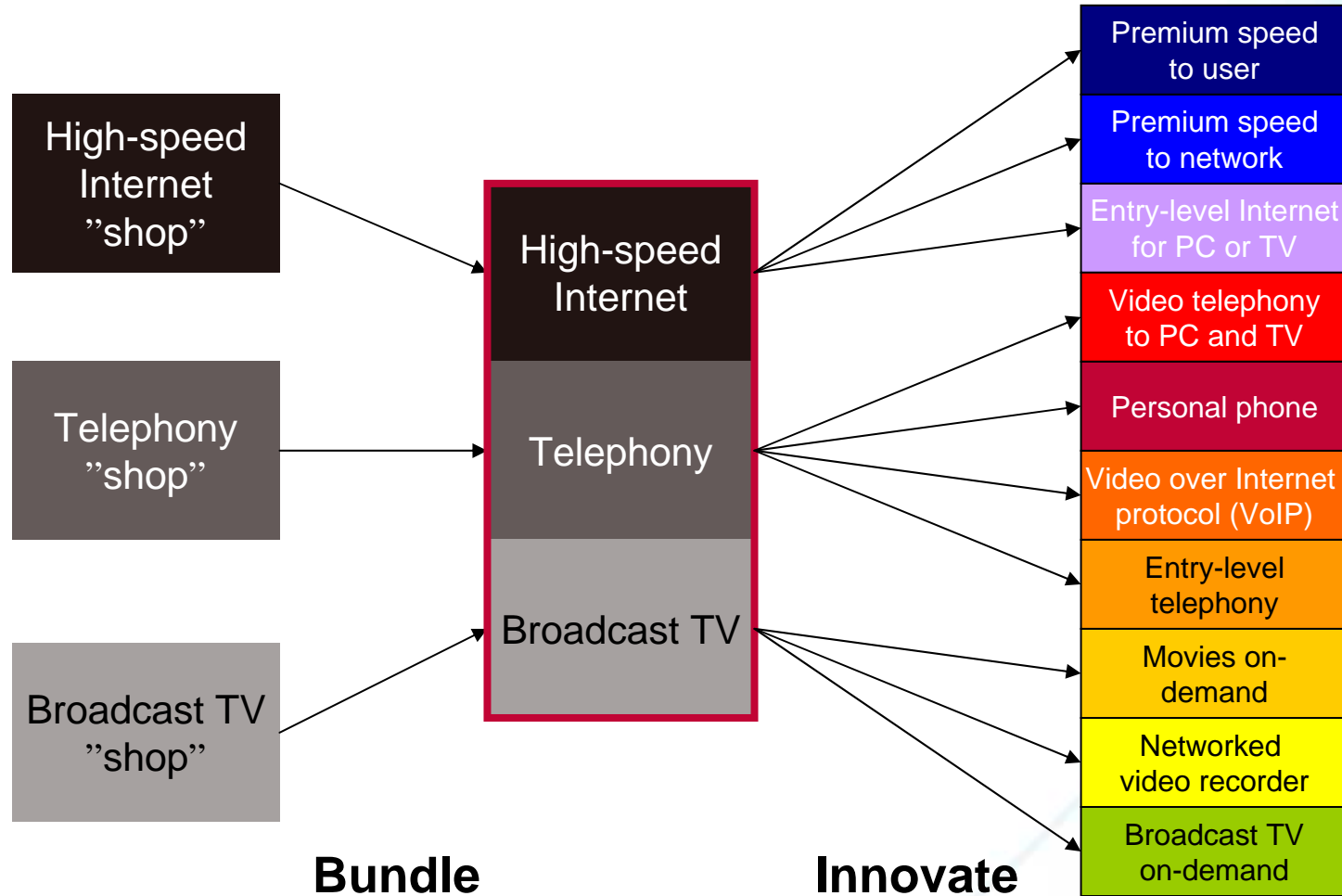
- Cost-effective solution
 - \$10,000 per 10 GbE port
 - Competitive SONET OC192 solutions range from \$64K to \$144K per port
- Based on widely deployed 10/100 Mbps and 1 GbE
 - Wide user acceptance
 - Well-trained workforce
- Can be deployed in all parts of the network
 - LAN: local area networks
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



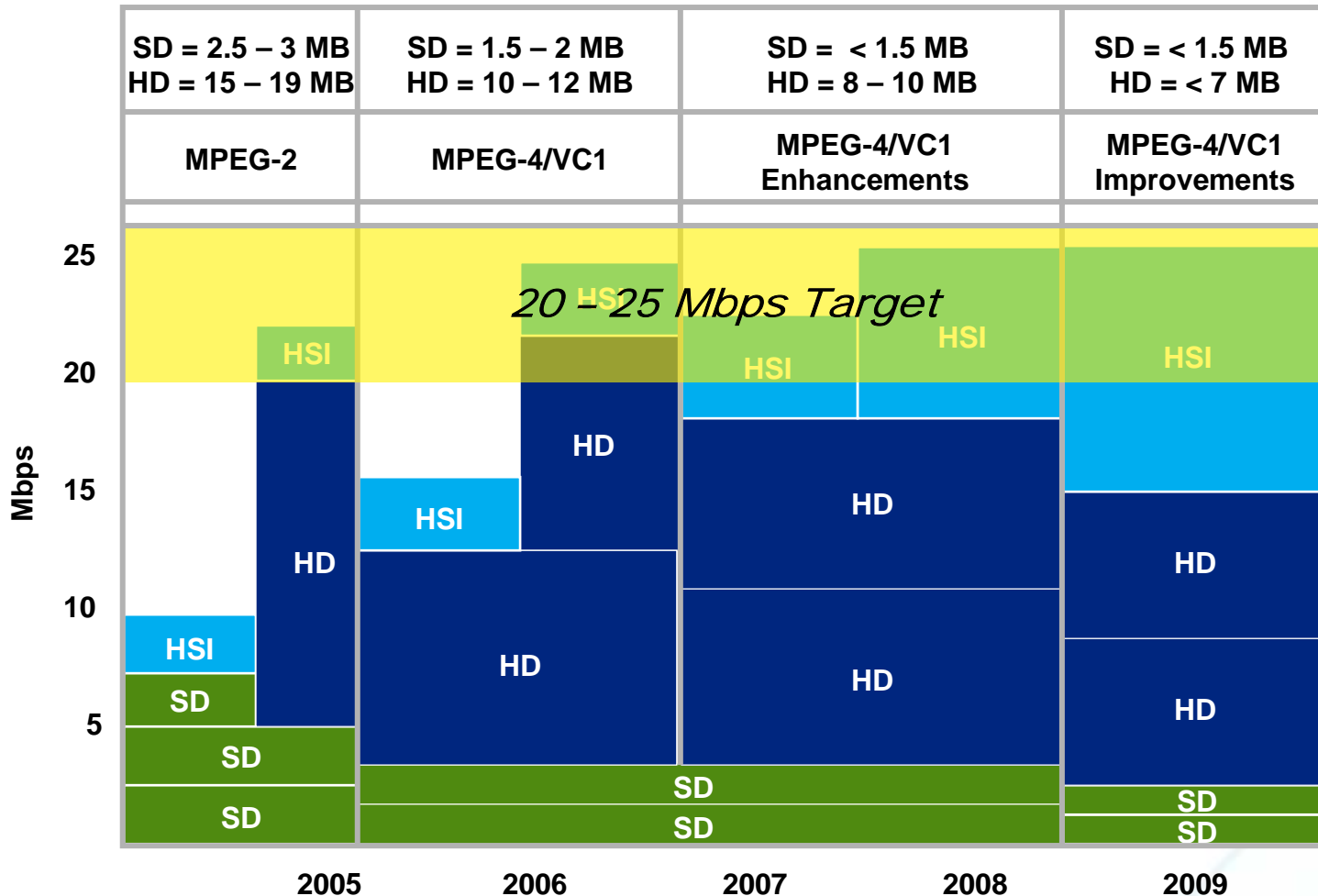
Emerging Trends in Communications



The Emerging Broadband Supermarket



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

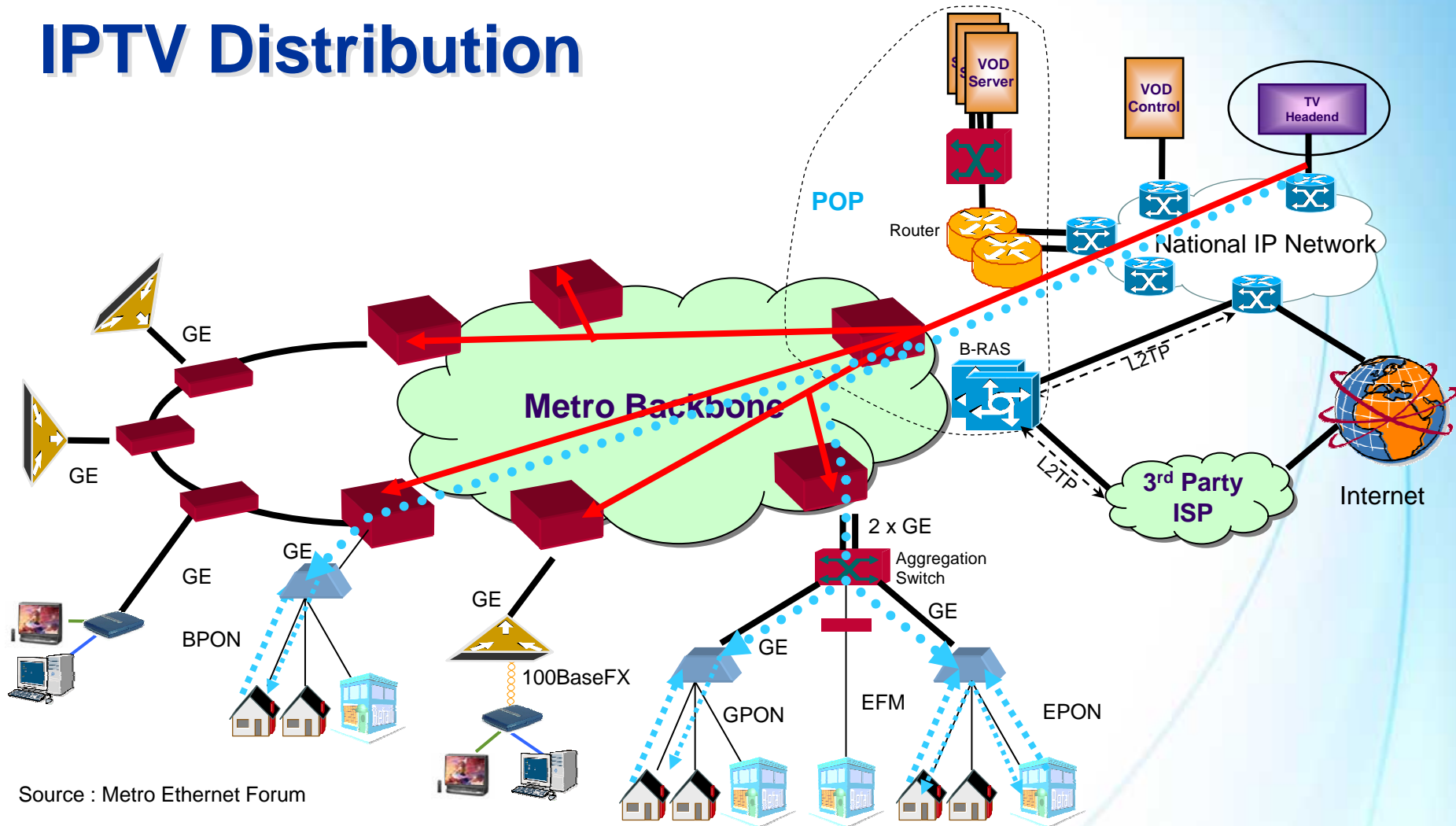
Source: Alcatel

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IPTV Distribution

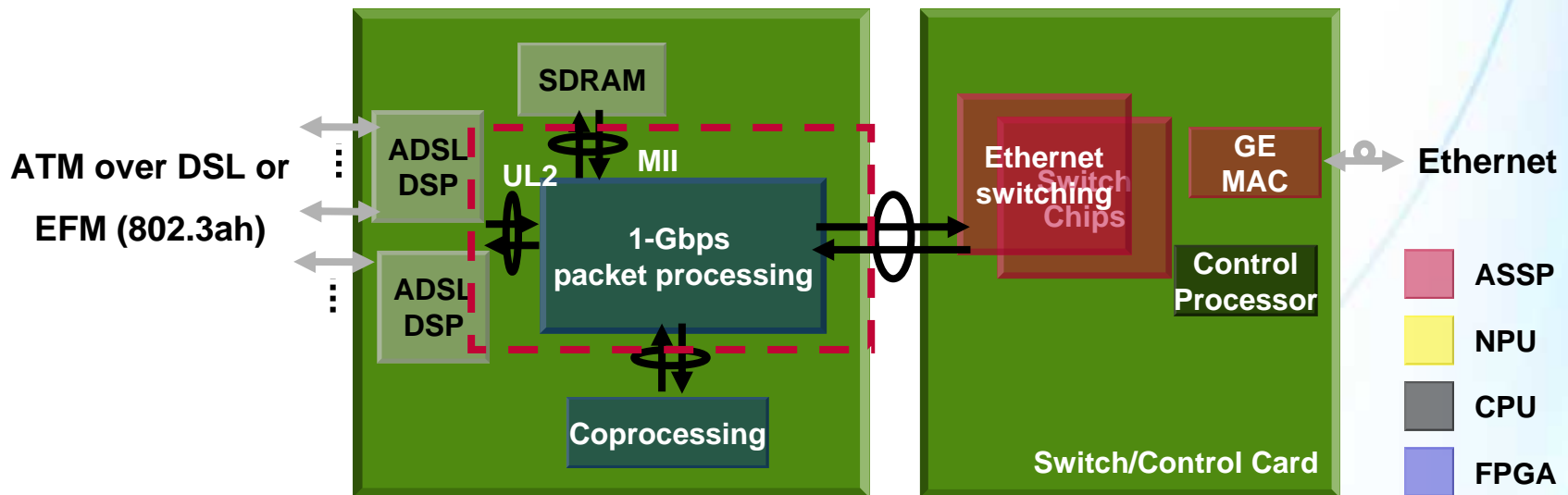


Source : Metro Ethernet Forum

*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



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)

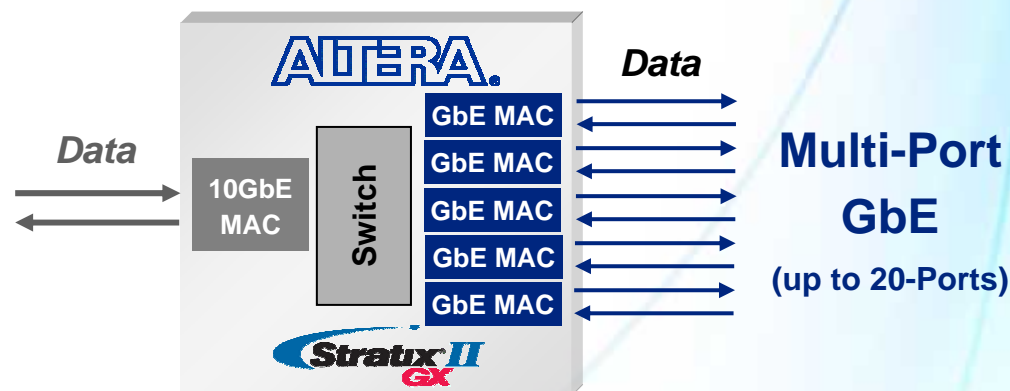
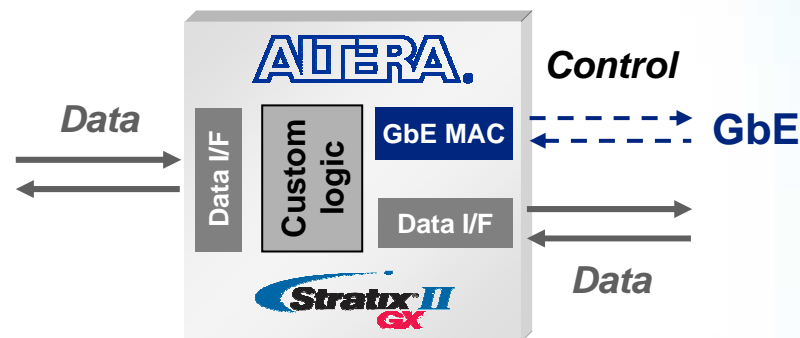


Altera Gigabit Ethernet Solution



Stratix II GX Advantages for GbE

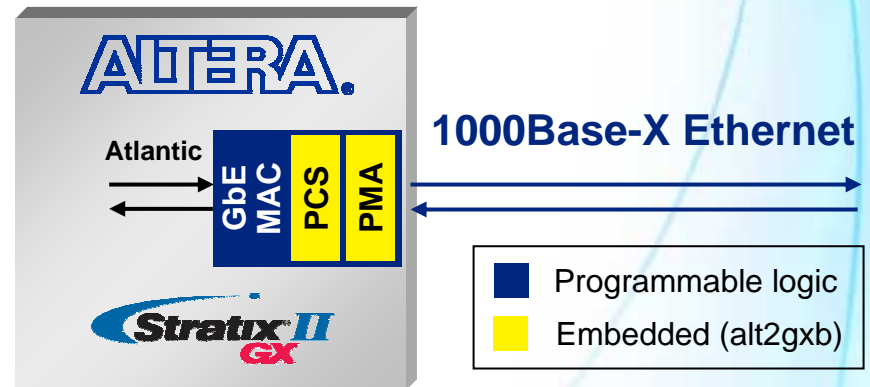
- Single device solution
- Lowest power per lane
- IEEE 802.3-compliant PCS and PMA
 - Chip-to-chip
 - Board-to-board
 - Backplane
 - SFP fiber optics
- Flexibility
 - Implement the GbE ports required by your unique application
 - 1, 2, 3, ... 20 ports



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

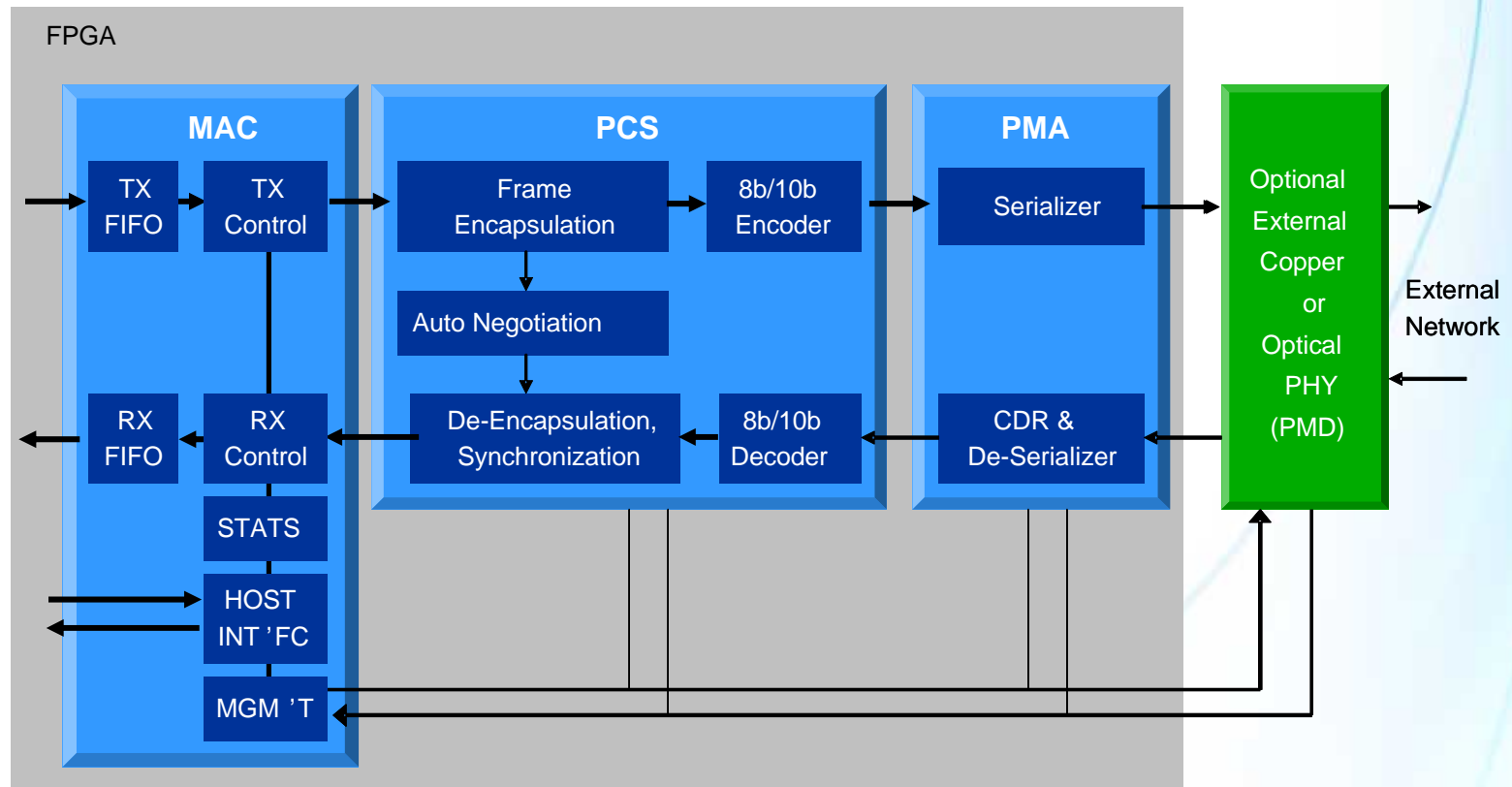


TSE MegaCore Feature Overview

- 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

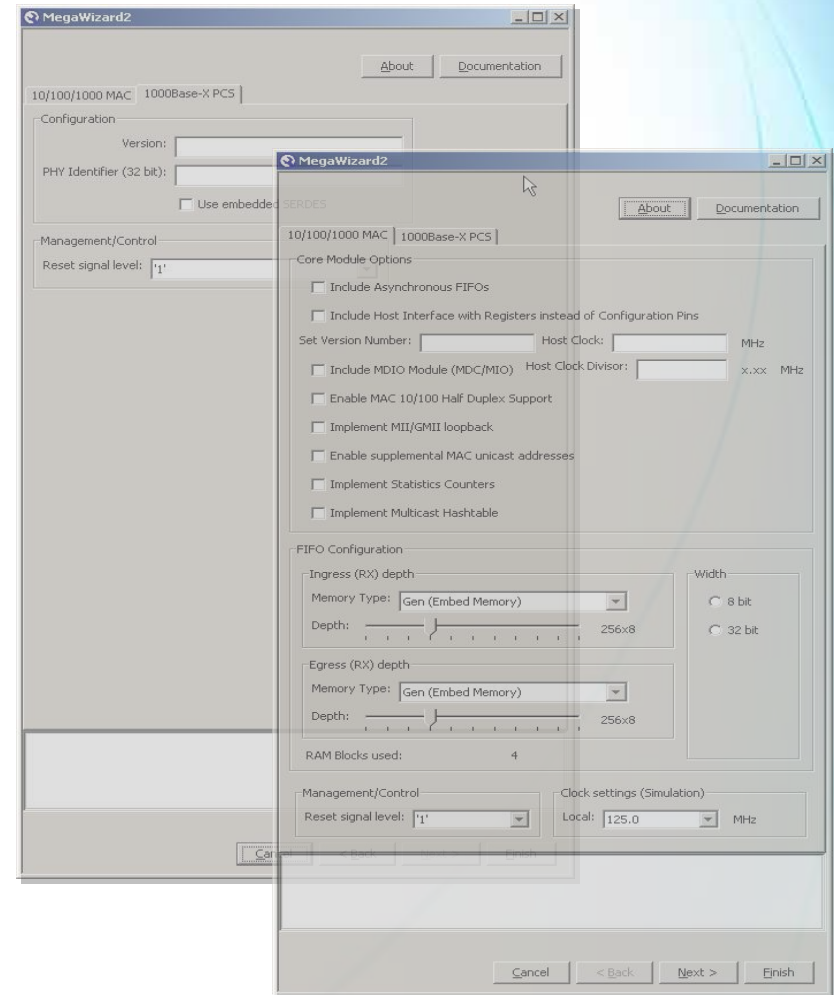
■ MegaWizard II GUI

– Parameterize

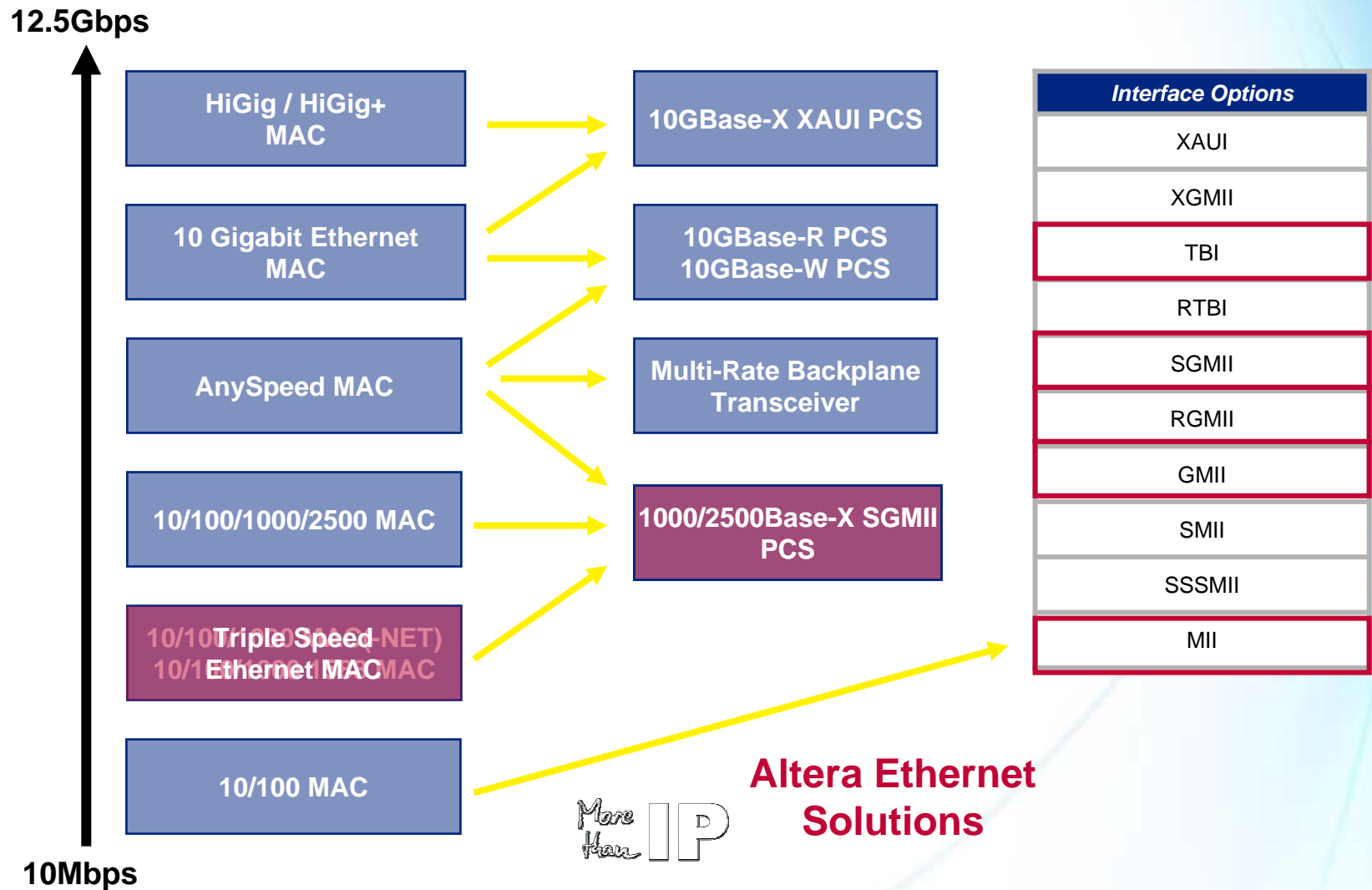
- Capture user options
- Provide resource usage estimation
- Derive HDL parameter and port information

– 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



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

