

3G CDMA / wireless capabilities
will expand the consumer
market



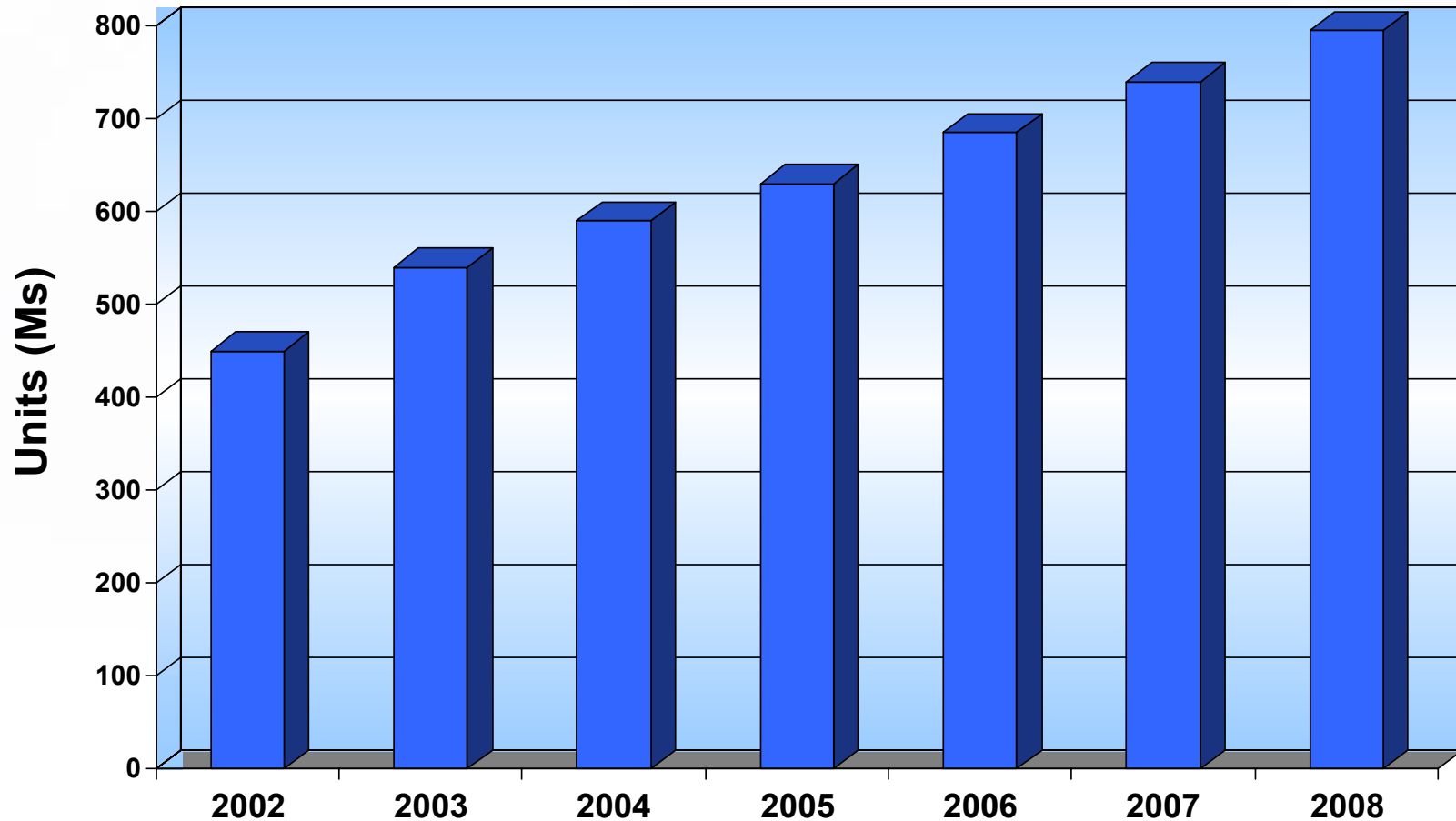
Consumer Electronics and EDA tools A Fabless view



Wireless Providing New Applications



Worldwide Handset Shipments Forecast



Cumulative Handset Semiconductor Revenue 2003-2008: \$181 Billion

Our experience is driven by communications and the environment around us:

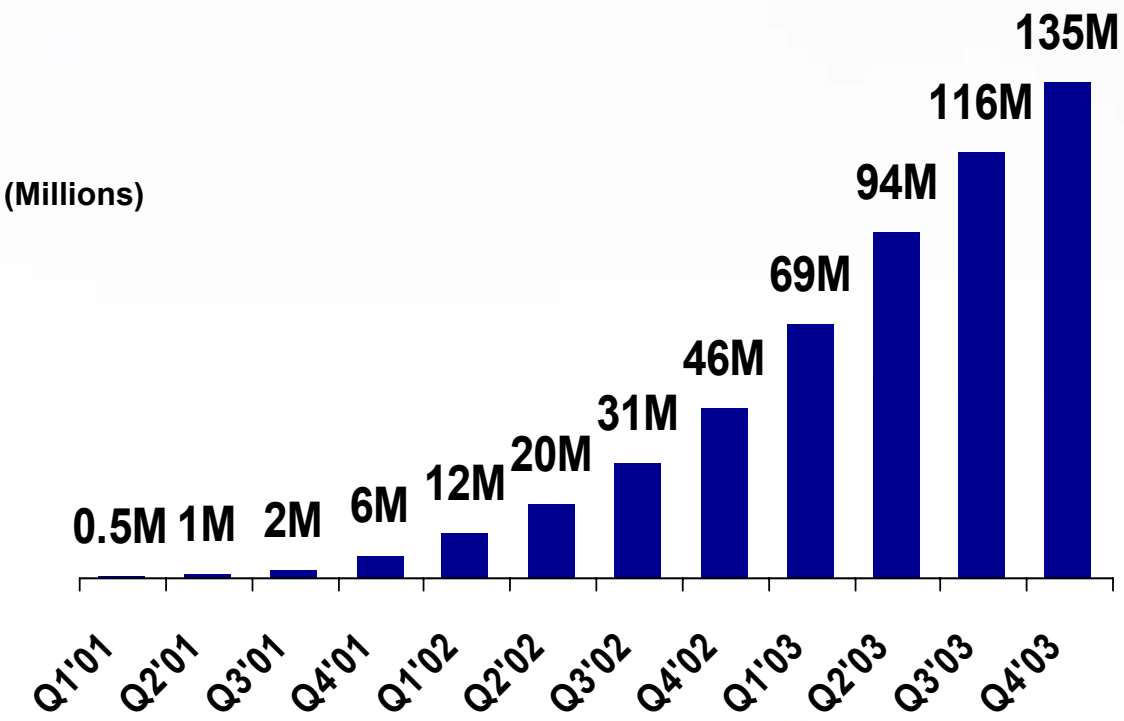
- Today smart phones with camera, PDA capability, MPEG player, , interactive / personal games, video clips, GPS
 - Can control remote wireless electronic displays, cameras, microphones and speakers to provide a hands-free, portable and private audio and video interface.
- Tomorrow phones / wireless devices will have:
- Biometrics - devices thumb prints, mood translators, remote diabetes monitor, electrolyte analysis, love / lie detectors
 - Security – location, displays, cameras, sensors
- All of these features are driven by Data and processing capability



99% of QUALCOMM Devices Support Data



Cumulative CDMA2000 1X and CDMA2000 1xEV-DO Chip Shipments (Fiscal Quarters)



3G CDMA

- Over 90M 3G Subscribers reported today
- 74 Commercial Operators in 37 Countries
- 46 Vendors With 443 CDMA Devices*



* Data as of January 31, 2004

Perception is the key to success

Popular culture helps to drive consumer perception.

- Cost Matters
- Size Matters –
 - Smaller is better, bigger is nicer
 - Cell phones by the gram
 - HDTV - cms thick / meters wide
- And of course

I want it now !!!

When does science fiction



meet science



Cyber gloves



**Heads up
displays**

New Uses for Wireless Are Emerging

Evolution of Wireless Industry Services

Future

- Broadcast Media
- Location-based Services
- Network-based Gaming
- PTT, multimedia



Broadcasting Media

Present

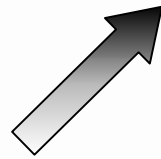
- Ring tones
- Photo messaging
- Video-On-Demand
- Broadband Access
- Video Telephony



Video Telephony



Location-based Services



Past

- Mobility
- Roaming
- Increased capacity
- Voice quality

How the Wireless / Consumer products relate to the EDA tools

- Cost
 - Shrinking geometries
 - Process migration and rules 90nm, 65nm, 45nm
 - Time to Yield / Manufacturability requirements
 - Analysis Capabilities to drive yield and stability
 - Multiple devices in one package
 - Inter-device models
 - Thinned die and stress changes in performance
 - Shrinking packages and products
 - Heat
 - Stress
 - Tool cost and Quality
 - Time to market
 - Mask cost
 - Silicon spins
 - Manufacturability

How the Wireless / Consumer products relate to the EDA tools

Low Power

- Moore's first law is a two-edged sword - more transistors for the same price. As the processor power doubles, the power consumption also rises. To minimize power systems are going to:
 - 1 Volt Vdd
 - Low Standby power (leakage)
 - Back gate bias
- To meet the challenges advanced analysis tools are needed for:
 - Transient noise, active power, leakage, clock trees
 - Device complexity and verification
 - Thermal limitations and product heat loads

Level of Complexity / Integration

- Only microprocessor systems are more complex than wireless communication systems
- 70% of overall design time is spent in verification

How the Wireless / Consumer products relate to the EDA tools

- **Geometry:**
 - 90nm / 65nm / 45nm process migration
- **Systems Solutions & System Tools**
 - System analysis and verification tools needed
- **Advanced Tools Required**
 - Design Failure Analysis, Design for Testing, Design for Manufacturability, Design for Verification, DF Statistical Timing Analysis
- **Close the process gap between Fabless & IDM**
 - Minimal gap on 90nm – How do you help control the gap?
- **R&D**
 - Collective EDA / Foundry R&D spend has to meet IDM outlay
 - Intel: \geq \$1B+/year

- To continue Moore's law, and to assure the overall net efficiency of electronic systems, we must continue on the geometry roadmap, improve power control and deal with thermal challenges posed by the highly integrated, dense systems being brought to market today.
- The EDA challenge is to provide tools that will facilitate the fundamentals of today's consumer electronics.
 - Those are: Acceptable battery life - power control; High quality images- Accurate analysis; Low cost - ease of process migration early in a process, yield, manufacturability, and competition.
- The larger challenge for the EDA industry is to help ensure competition and innovation by assuring equal technical capabilities to the Fabless semiconductor firms.