Tunnel Creek: Intel's First Generation Intel® Atom™ Processor-based System-on-Chip for Embedded

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Technology Insight SPCS002

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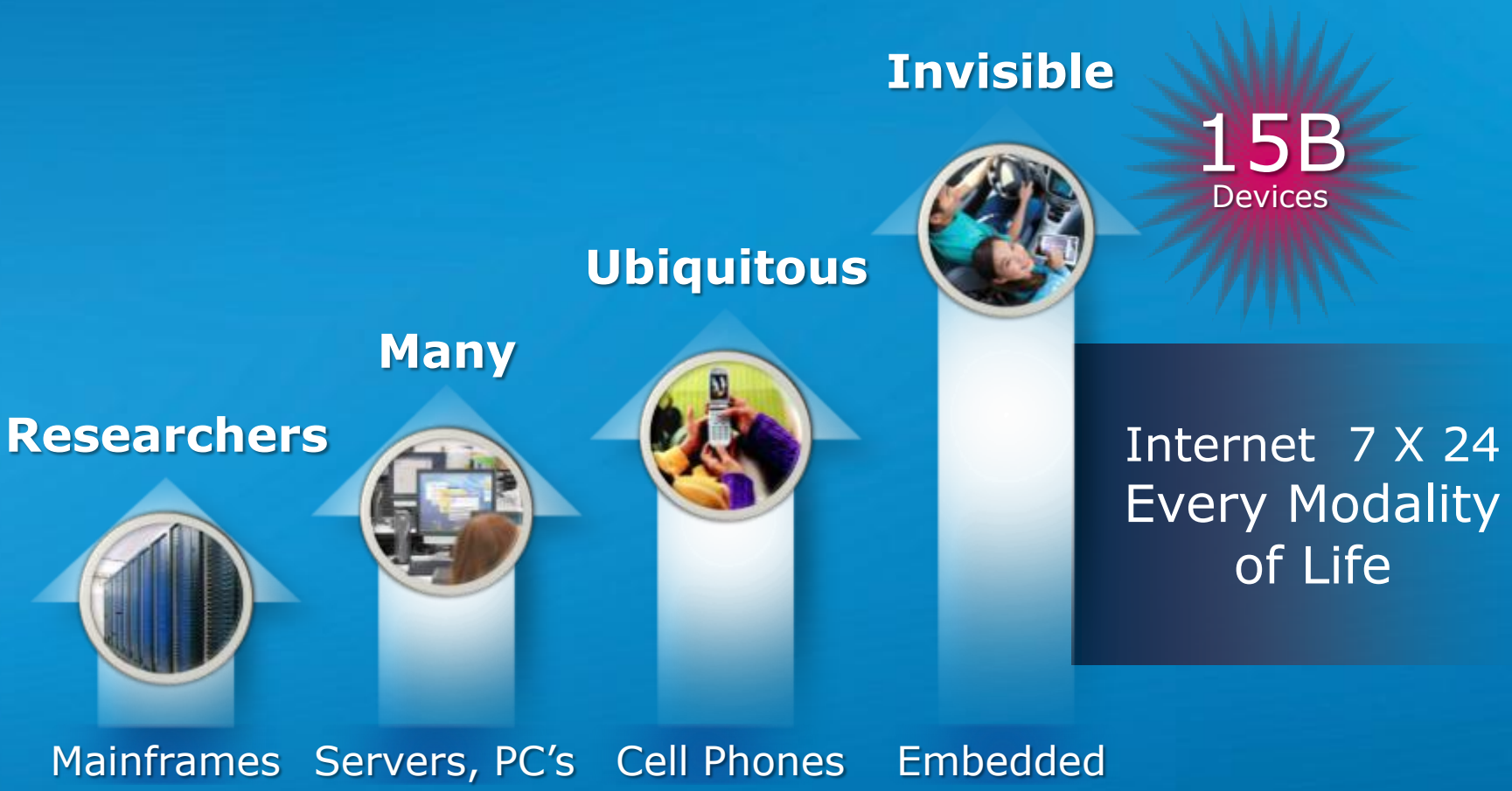
Agenda

- Tunnel Creek Architecture Overview
  - Platform Partitioning Flexibility
  - Platform BOM Reduction
  - Performance Density
- Tunnel Creek Application Case Studies
  - Industrial Automation
  - IP Media Phone
  - Electronic Cash Register
  - In-Vehicle Infotainment
- Summary

The Embedded Internet by 2015



Intel® ATOM™ Processor:
FUELING THE BUILD OUT

- Digital Blackjack Table
- Pachinko Machine
- Vending Machine
- Carwash Kiosk
- Subway Ticket Station
- Biometrics Finger Print Reader
- Point of Sale
- Digital Weight Scale
- ATM
- Hotel Concierge System
- Handheld Barcode Reader
- Handheld Wireless Spectrum Tester
- Handheld Ultrasound
- Hospital Bedside Terminal
- Voting Machine
- Lottery Machine
- Network Security Appliance
- VoIP PBX
- Test and Measurement Appliance
- Education Terminal
- Communications Gateway
- Programmable Logic Controller
- Computer Numeric Controllers
- Industrial HMI Panel
- Industrial PC
- Avionics System
- Wearable PC
- Connected Soldier Device
- Military Soldier Training Device

>2,900 Design Engagements

Enabling the Next 1,000 Embedded Customers

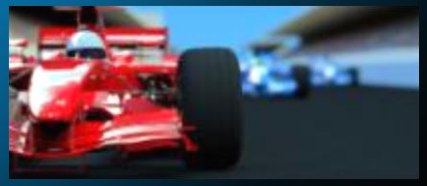
- **Customers Need:**
  - Reduced Cost on Bill of Materials
  - Increased Control of System Source code
  - Reduced Vendor Complexity
  - Reduced Boot Times
  - Reduced Foot Print
  - >Perf/Watt/Inch

3 Cornerstones of Innovation for Tunnel Creek

Platform Flexibility

Reduced Bill of Materials

Performance Density



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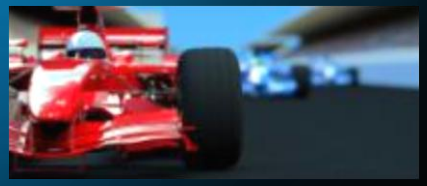
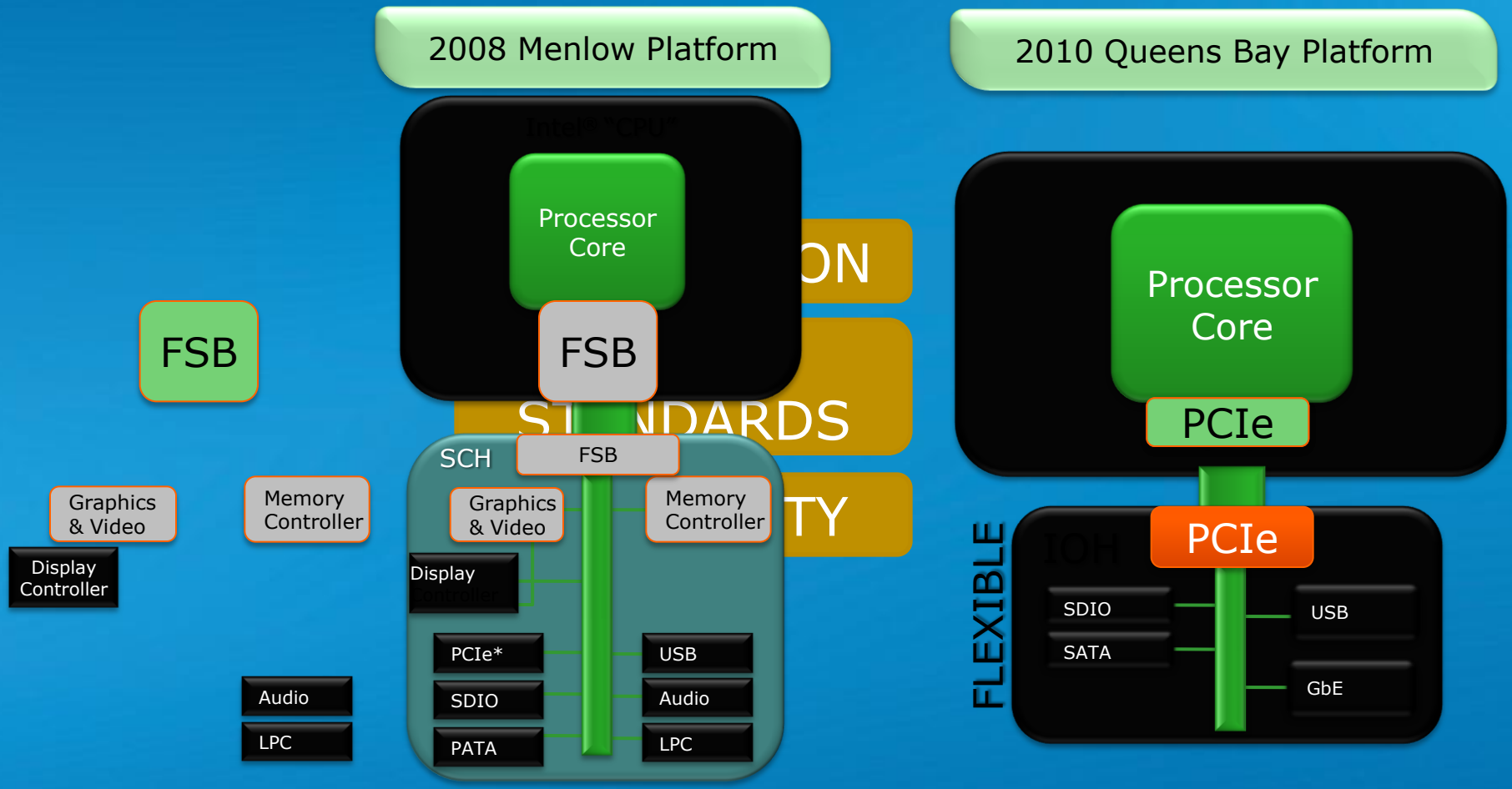


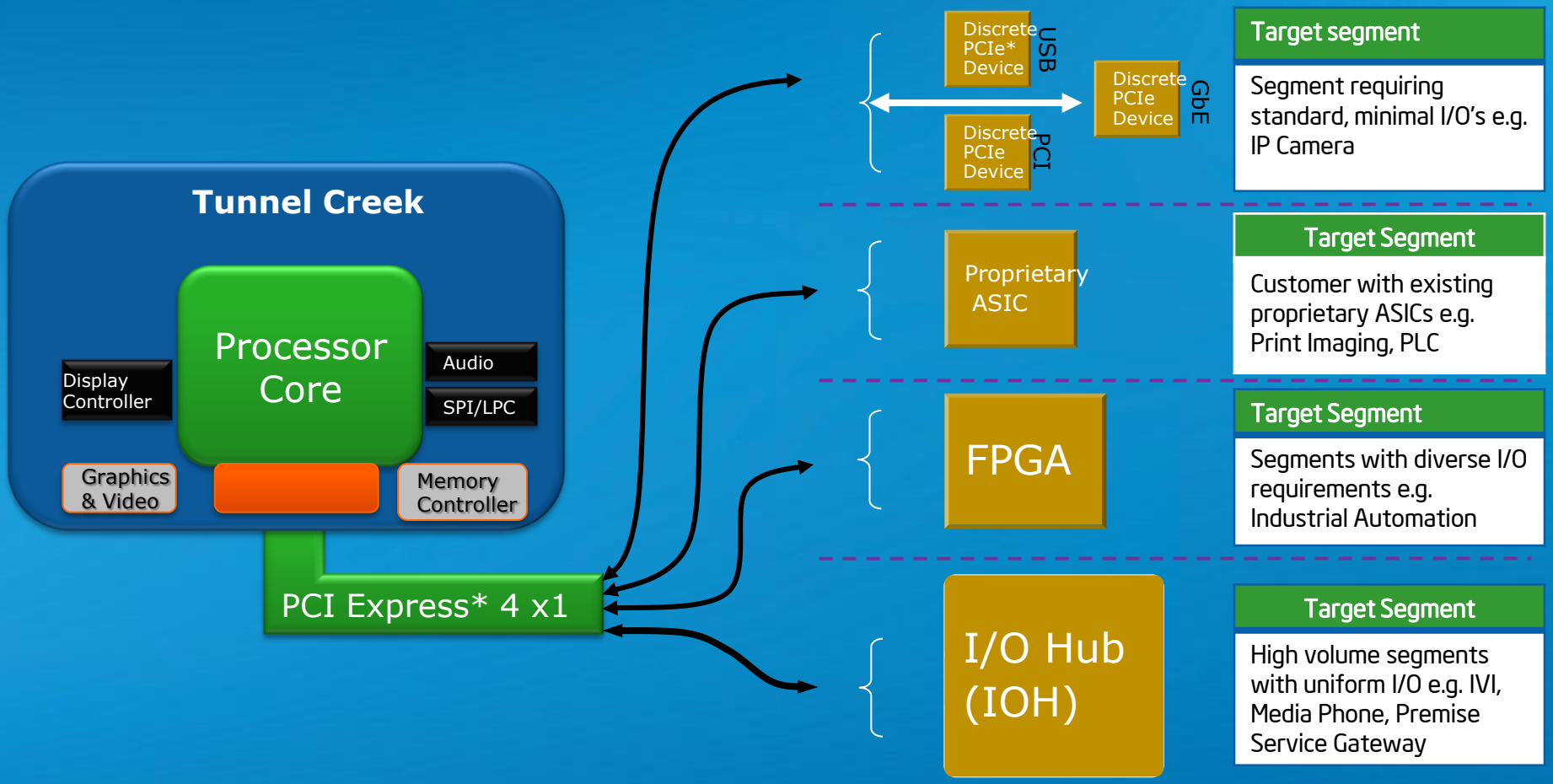
Re-Partitioning for Flexibility



Launching in Q4, 2010

Tunnel Creek: Intel® Atom™ Processor-based System-on-Chip for Embedded
Queens Bay Platform = The software, OS, boards & chipset that work with Tunnel Creek
PCIe = PCI Express* Technology
Menlow = platform with Intel® Atom™ processor Z510/530

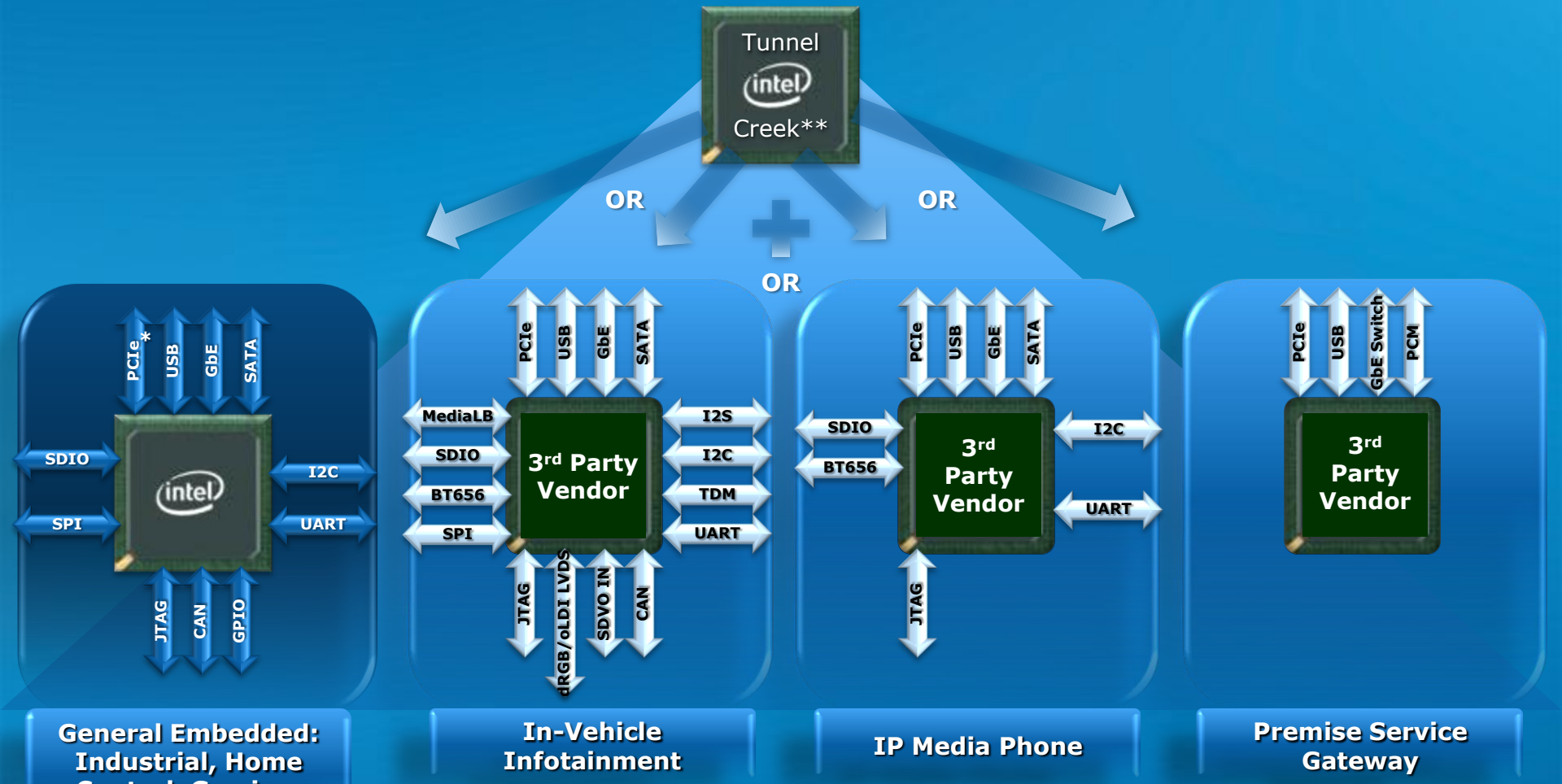
Queens Bay Platform
Unleashing Innovation for Optimization



Flexibility -> Scalable and Optimized Solutions

PCIe = PCI Express* Technology
Tunnel Creek: Intel® Atom™ Processor-based System-on-Chip for Embedded
Queens Bay Platform = The software, OS, boards & chipset that work with Tunnel Creek

Queens Bay Platform
Choice of IOH



General Embedded: Industrial, Home Control, Gaming, PoS, Medical, etc

In-Vehicle Infotainment

IP Media Phone

Premise Service Gateway

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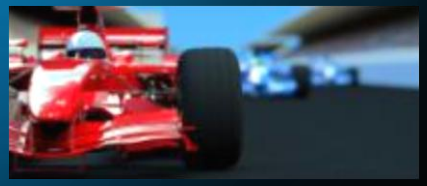
Queens Bay Platform = The software, OS, boards & chipset that work with Tunnel Creek

3 Cornerstones of Innovation for Tunnel Creek

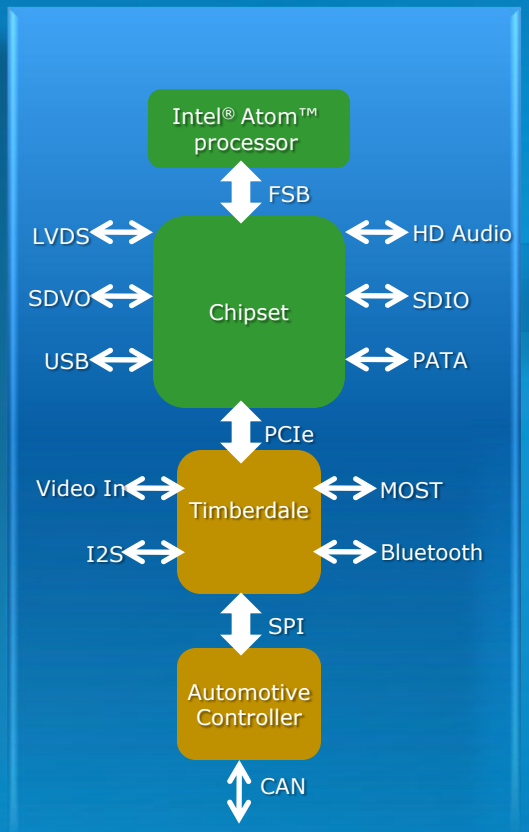
Platform Flexibility

Reduced Bill of Materials

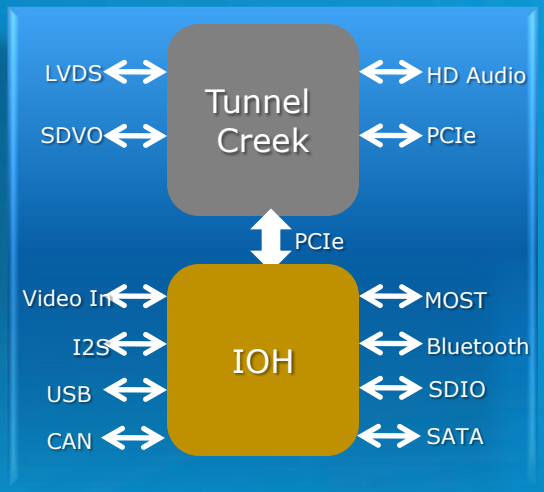
Performance Density



Hardware BOM Benefits of Flexibility



e.g., 2008 IVI platform



e.g. 2010 IVI platform

Software BOM:
A Spectrum of Options

Solution	Custom BIOS	Standard BIOS	Boot Loader Development Kit
Project Name	-	-	Trinity Lake
Rating	Best	Better	Good
Features	Advanced Features	All PC features	CPU, Memory, Basic IO initialization
OS	Off the Shelf OS, Windows * OS, RTOS, Custom OS	Off the Shelf OS, Windows OS	RTOS, Custom OS and Embedded OS
Availability	Ready for Silicon Launch	Ready for Silicon Launch	Likely after Silicon Launch
Completeness	Fine tuning, unique features & boot times	Turnkey Solutions, Reliable schedules	Some Assembly Required
Cost	Highest	Middle	Lowest

New Platform Capability

Software BOM:
A Spectrum of Options

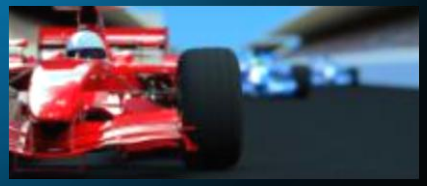
Intel is actively enabling the Embedded Eco-System

3 Cornerstones of Innovation for Tunnel Creek

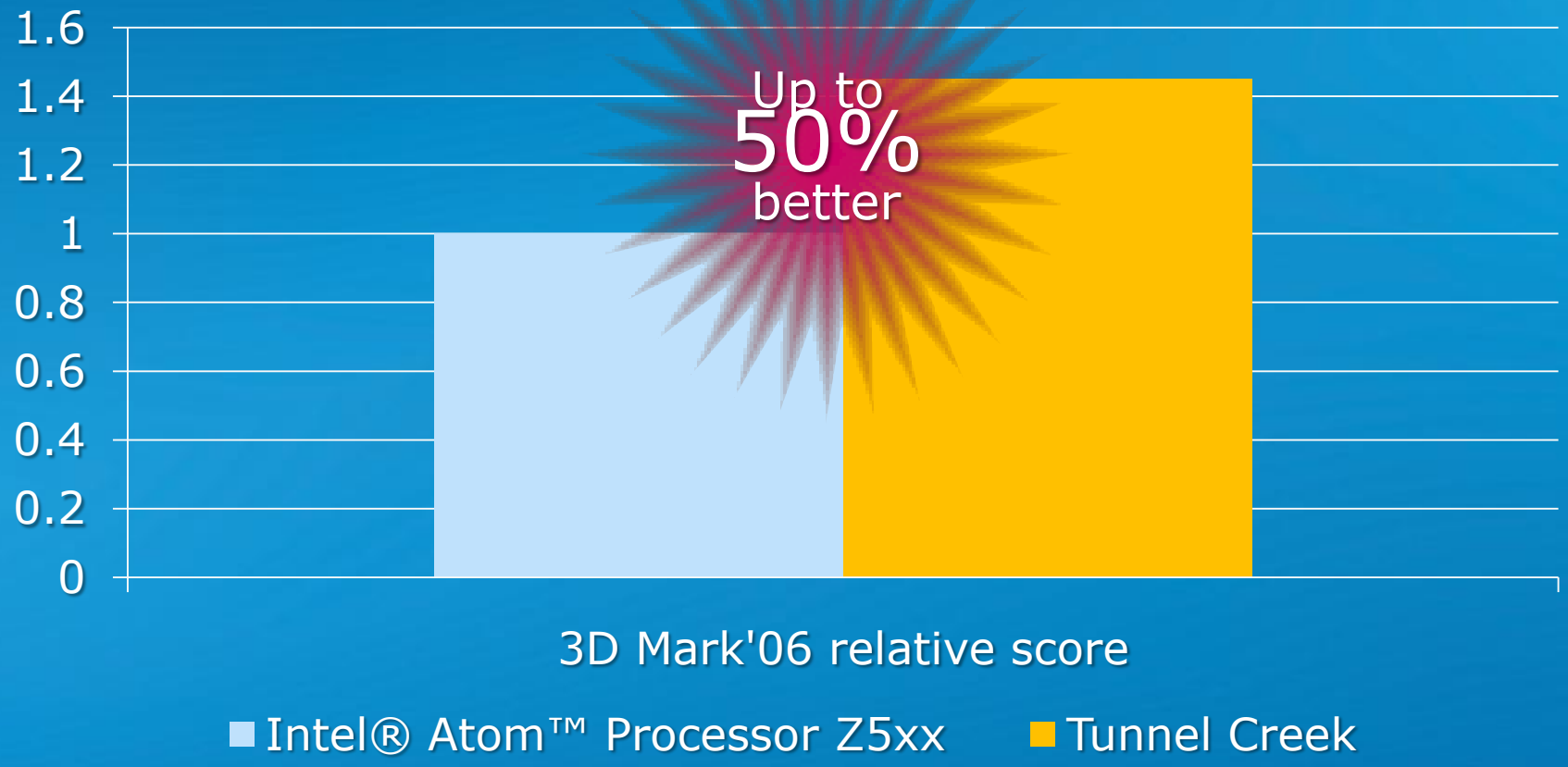
Platform Flexibility

Reduced Bill of Materials

Performance Density



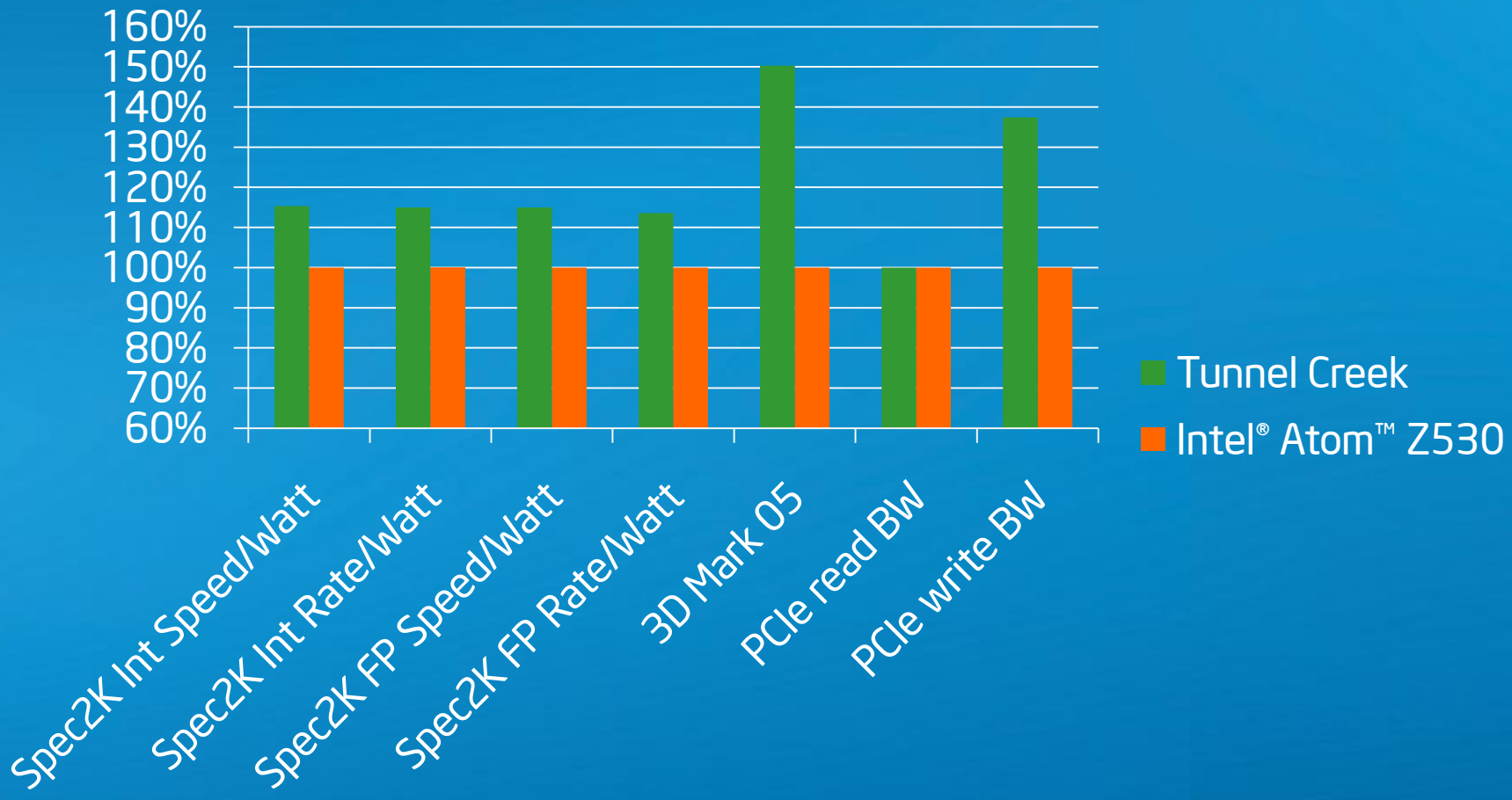
Tunnel Creek
Improved Graphics Performance



Menlow-XL package size (CPU: 22x22 + SCH: 37.5x37.5) = 1890mm2
Tunnel Creek+Topcliff package size (CPU: 22x22 + IOH: 23x23) = 1013mm2
46% smaller but 50% better graphics performance
Or 2.7x performance density improvement

Tunnel Creek: Intel® Atom™ Processor-based System-on-Chip for Embedded
Menlow = platform with Intel® Atom™ processor Z510/530

Tunnel Creek
Improved Performance Density



Boot Performance with Splash

- Video BIOS normally scans for panel timings and device priority
- Intel® Embedded Graphics Driver v10.2 supplies Embedded Pre-OS Graphics (EPOG) Driver
- Optimized Pre-OS driver for LVDS splash screen support
- Performance*
  - RESET# to Display < 500 mS
- Available on Intel® Atom™ processors Z5xx series

*Time estimated from CPU RESET vector, beginning of system firmware execution on a customer reference board based on the Intel® Atom™ processor Z5xx series and the Intel® System Controller Hub-based platform.

Tunnel Creek Application Examples

Tunnel Creek for Industrial Automation

Performance

Power

Factory System Level Controller

Industrial PC, Robotics

Human Machine Interface

Computer Numeric Controllers,

Programmable Logic Controllers

Programmable Logic Controllers

1. Historically hardware centric (ASIC+MCU)
2. Shifting to software centric design on IA
3. Enables software scalability across PLCs
4. Delivers Faster Time to Market
5. Increased performance headroom

The IA Continuum of Computing For Industrial Automation

Factory System Level Controller

Industrial PC

Robotics

Human Machine Interface

Computer Numeric Controller

Programmable Logic Controllers

One Software Code Base

Intel® Architecture

Tunnel Creek for IP Media Phones

News

Weather

Stock

Music

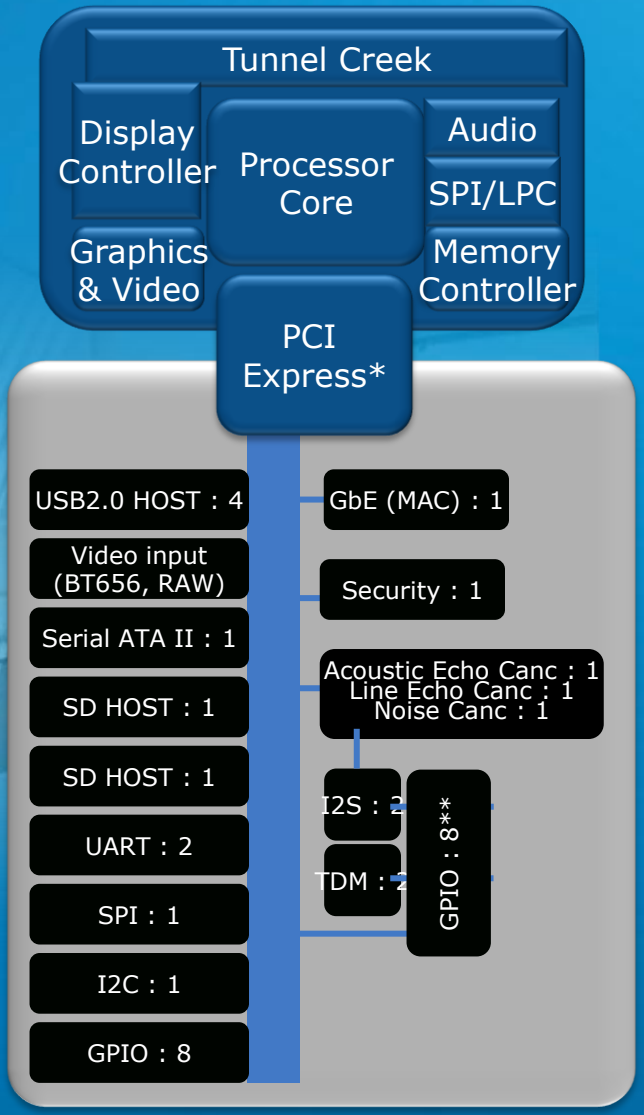
Photos

Video

Directory

+

IP Multimedia communication



Tunnel Creek for IP Media Phone
Lower Cost, Increased Capabilities

Menlow Today

- Scalable Solution
- Low Power
- Dual Independent Video Streams
- HW Accelerated De-Code
- Intel® Hyper-Threading Technology and HW virtualization (Intel® VT-x)
- Security Integrated in HW
- Intel® HD Audio 7 Channel, HW AEC

Queens Bay Adds

- HW Accelerated Encode

- 50% Boost in Graphics Performance

- Reduced BOM

- 45% Reduction in form factor*

- Integration of Acoustic Echo, Line Echo and Noise Cancellation

Tunnel Creek: Intel® Atom™ Processor-based System-on-Chip for Embedded
Intel® VT-x = Intel® Virtualization Technology for IA-32, Intel® 64 and Intel® Architecture

* Compared to Menlow XL

Tunnel Creek Opportunity for Smart Electronic Cash Registers (ECR)

Tunnel Creek for Smart Adaptable ECRs

Platform Flexibility:

Business specific Modular apps

Multi-lingual capability or Localization

Reduced Bill of Materials:

Integrated Peripherals

MeeGo* & Trinity Lake Support

Performance Density:

Internet capable

Human-Machine Interface

One-touch Interface

Tunnel Creek: Intel® Atom™ Processor-based System-on-Chip for Embedded
Trinity Lake: Boot Loader Development Kit for Intel® Atom™ Processor based platforms in Embedded

In-Vehicle Infotainment (IVI)

Navigation

Music

Video

Games

Directory

+

Apps

"Today we're thinking and behaving like a consumer-electronics company,"

Derrick Kuzak,
Ford Motor Company
VP of Global Product Development

January 2010

Tunnel Creek for IVI

Performance:

Advanced Usage Models

Multimodal HMI

ECU Consolidation

Energy Efficient CPU

Rich Internet Experience

Automotive Capable:

Extended Temp (-40C - +85C)

Embedded Lifetime (~7 – 10 yrs)

Auto Spec (Grade 3-AEC-Q100 Rev F)

Auto OS Support (Microsoft , QNX, MeeGo*)

Lower DPM

Rich Ecosystem:

Hardware and Software Compatibility and Re-use

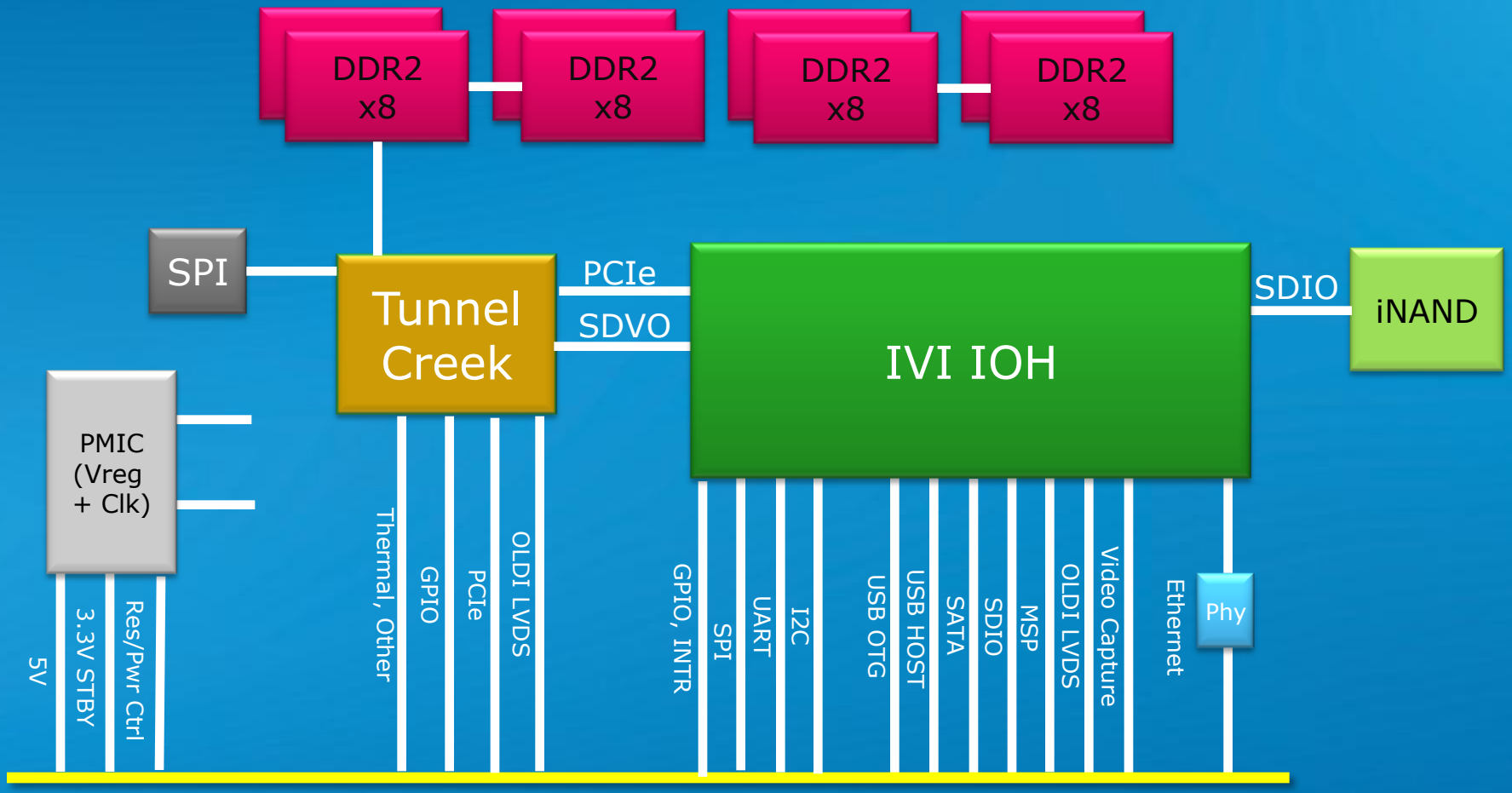
PC and Consumer Electronics Ecosystem

Tunnel Creek for IVI
In-Vehicle Infotainment Compute Module (ICM)

- 230 Pin MXM2 connector
- Defined Pin functions for 230 Pin
  - Includes numerous common automotive functions in addition to common CE functions
- 106mm x85mm, and 85mm x 85 mm versions
- Edge connector tested at Automotive conditions
- Easy migration to next generation
  - Pin functions service both Tunnel Creek + IOH & Next Gen Atom + IOH design migration without carrier board change

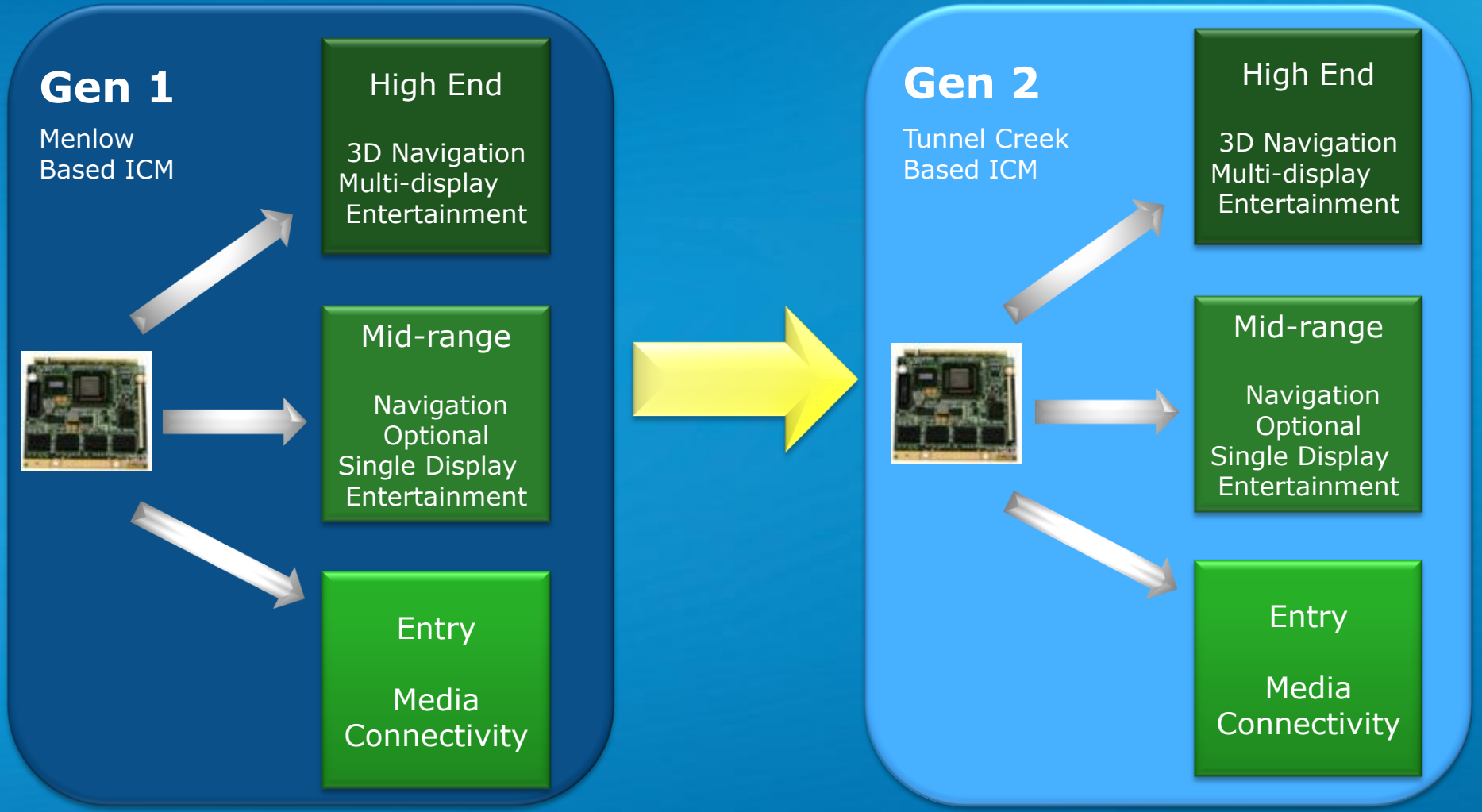
Item	Date
Customer Presentation/technical overview	NOW
Detailed Specifications/ Q&R material	March
Millville Development Systems	May
Sample ICMs	May
ODM sample ICMs	September
ICM development Kits (Crossville)	Q4 '10
ODM Production	Q4 '10 onward

Tunnel Creek based ICM Block Diagram



230 pin Finger Edge

ICM scales top to bottom and for multiple generations



ICM will have different CPU speed, memory and other population/depopulation options

ICM230
Go To Market Options

ODM Enabling

Design, Development, tooling, processes to produce ICM for Tier1 Customers

- An ODM fully enabled, and ready to Bid volume automotive business with Tier1's

ICM Licensing

Intel licensing of design, gerbers to enable Tier1's to choose their manufacturing channel

- Allows Tier 1 to choose and enable their own ODM or manufacturer and/or take advantage of automotive techniques

ICM Specification

Pin-out, connector, form factor etc.

- Allows room for Tier1 to choose exact cost points while maintaining pin out compatibility or carrier board interoperability

Summary

Tunnel Creek delivers
1st Generation Intel® Atom™ processor Based SoC for Embedded

Tunnel Creek unlocks a new generation of innovation
for Intel Atom processor in Embedded through:
I/O Flexibility
Bill of Materials Reduction
Performance Density

Tunnel Creek SoC architecture poised to enable
next 1,000 designs on IA

For Additional Information on Intel in Embedded Computing

Intel Embedded Design Center

http://edc.intel.com

Intel Embedded at IDF 2010:

http://edc.intel.com/Events/IDF2010/

Date	Time	Room	Session ID	Session Title
4/14	13:00	308	EMBS001	Embedded Modular Design Architecture
4/14	14:00	308	EMBS002	Embedded Software Development and System Debugging Tools for Intel® Atom™ Processor
4/14	15:00	308	EMBS003	Open Infotainment Platform for Next Generation In-Vehicle Infotainment (IVI) System
4/14	16:00	308	EMBS004	Architecting Communications Infrastructure and Networking Equipment on Intel® Architecture
4/14	17:00	308	EMBQ001	Hot Topic Q&A - Embedded Solutions

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98%
THE BIG OPPORTUNITY
INTEL PARALLEL STUDIO
REQUIREMENTS
DESIGN THREADING
CODE THREADING
DEBUG THREADING
TUNE THREADING
TODAY
2010
2012
2014
TEXT OVERLAYS
2D/3D VISUAL OVERLAYS
VISUAL SEARCH
MIR HYBRIDS
PROJECTED AUGMENTED REALITY EVOLUTION
AIO DESIGN CONSIDERATIONS
MANUFACTURING
MARKETING
ENGINEERING
2005
5.1M BOPS
8 RACKS
126 SERVERS
240 SQ FT
48 KW
2009
5.1M BOPS
1 RACK
17 SERVERS
40 SQ FT
6 KW
OPEN SPECIFICATION PHILOSOPHY
MAINSTREAM PLATFORM PARTITION
NEXT: IMMERSIVE CONNECTED EXPERIENCES
VISUAL COMPUTING
SOCIAL NETWORKING
MOBILE COMPUTING
BROADBAND CONNECTIVITY
USB
PCI EXPRESS
PCIE GRAPHICS
THE CHALLENGE
18" HDD
CAPACITY
60-120 GB
ALL IN ONE
ULTRA SFF
4-7 L
TINY
<4L
BATTERY OPTIONS
POSITIVE TERMINAL
PRESSURE VENT
TOP PLATE
ANODE
ANODE TAB
SEPERATOR
CATHODE
POLARIZER
INTEL SYSTEM CONTROLLER HUB
NETWORKING
AUDIO/VOICE
STORAGE
VIDEO CAPTURE
PERIPHERALS
CONTROL PERIPHERALS
VERIFY
TUNE
SYSTEM POWER
IDEAL POWER UTILIZATION
SYSTEM UTILIZATION
VIRTUAL MACHINE DEVICE QUEUES
VIRTUAL MACHINE DIRECT CONNECT

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Rev. 1/14/10