



APM “X-Gene” Launch Press Briefing

January 2012

Cloud Dynamics



Viral Explosion of Data

- Harnessing the Future of Consumptive Computing -

Yesterday (1980's/90s)

Today (2000s)

Tomorrow

ZB of Data

PB of Data

GB of Data



- Desktop Publishing

- Email

- eCommerce

Google

- Web 2.0

- Social Networking

twitter

facebook

- Social Commerce

NETFLIX

- Mobile Apps

amazon.com.

- Search

- Ecosystem Connectivity



- Intelligent Appliances



- Network Intelligence

Business Computing

Cloud Computing

Networked Computing

Focusing on the Cloud: The Undiscovered Country

Facebook & Google Account for
~20% of Internet Traffic

60+TB of Data uploaded Each Week

~1+ Million Servers Used
between Facebook & Google

57% of a Datacenter Monthly Cost
is Related to Servers

Current Datacenter PUE (Power Usage
Effectiveness) by EPA: 1.83-1.93

EPA Target PUE for State-of-the-
Art Datacenter: 1.2

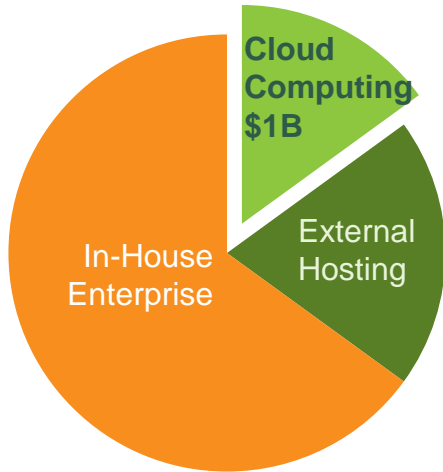
Datacenters account 1.1-1.5% of
Total World Electricity

\$44.5B Spent a Year Powering
& Cooling WW Servers

Datacenter Technology Needs to Scale Efficiently to Meet
Cloud Computing Consumption Rates

Datacenter Server Disruption → Cloud Computing

Market Dynamics



- Total Server Processor Addressable Market:
\$8.3B, CAGR: ~6%
- Cloud Computing Processor:
\$1B, CAGR: 17%
- Growth Vectors: Social Networking / Web 2.0



Cloud Computing Market Trends

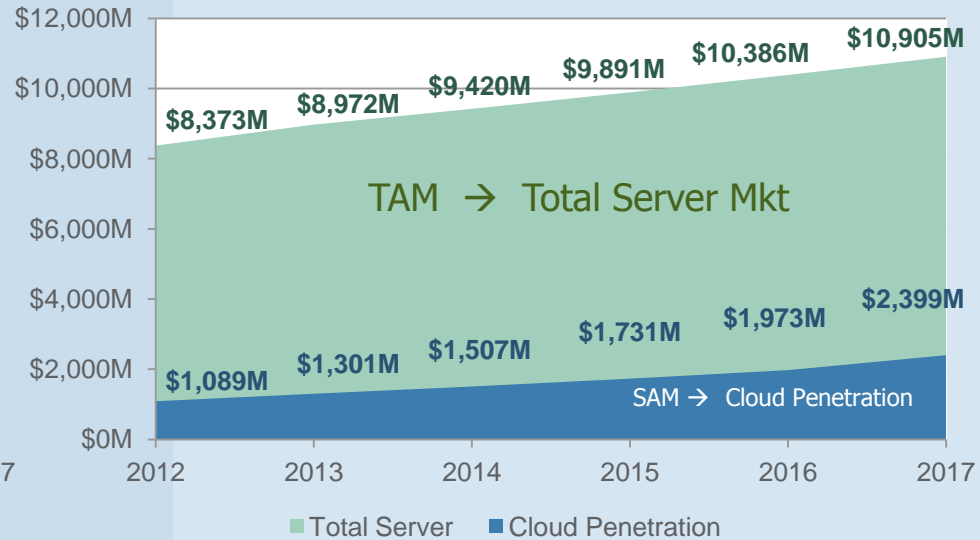
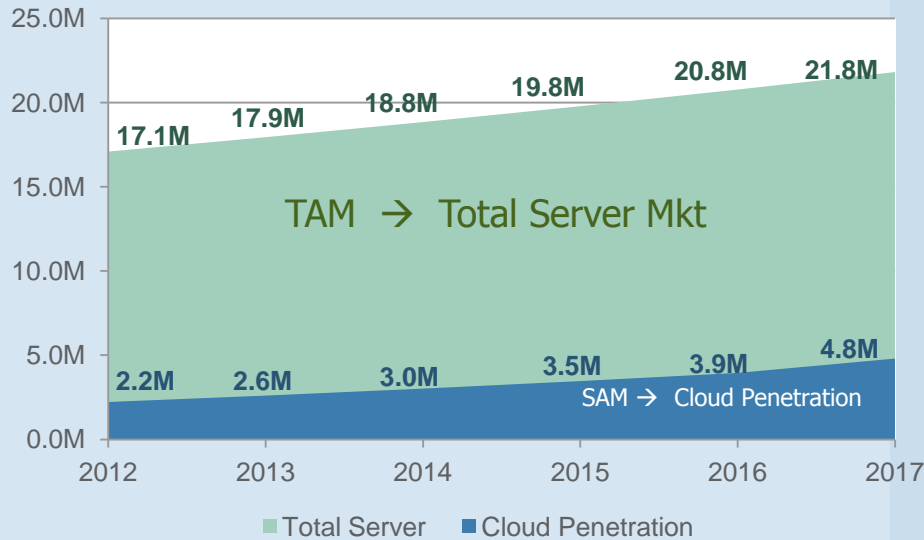
- Datacenters Consume 1-1.5% of world energy
- Drive towards Single & Dual Rack Unit
- Distributed Compute Environment
- System Power Budget → <250W

Source: Gartner Feb'11

Cloud Server Penetration Growth (SAM)

Units Shipment

Revenue



	2012	2013	2014	2015	2016	2017
Cloud Penetration Rate:	13.0%	14.5%	16.0%	17.5%	19.0%	22.0%

Public/Internet Cloud → Amazon EC2, Microsoft Azure, Google, Facebook, Web2.0

Private/Enterprise Cloud → Productivity Tools (Mail, Word), Publishing, Financial Analytics, Video Publishing

Source : Linley, Intel, Wells Fargo Securities, Trefis Analytics, APM

AppliedMicro in the Cloud



- 10/40/100G Optical PHY
 - Converged Ethernet/FC/OTN
 - Full Feature Set
- 10G BaseT
 - Best Reach (120m Cat6A)
 - Robust EMI Cancellation
 - Ultra-low Power (<1W), Low-cost Short Reach MicroPHY



- Embedded Processor
 - Intelligent Power Management
 - Asymmetric Multi-Processing
 - Security
- Server Compute at Mobile Power
 - CPU Virtualization
 - Grid Computing
 - Low Power



● APM Presence Today

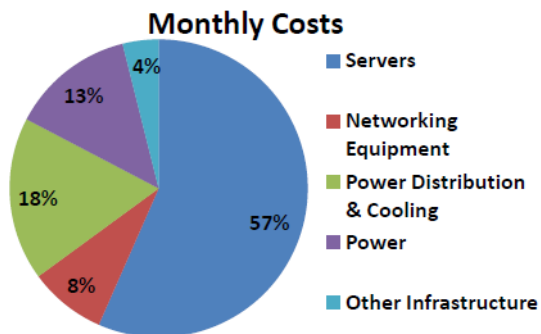
Dedicated End-to-End Cloud Computing Coverage

the Green Cloud



Trends in Data Center Computing

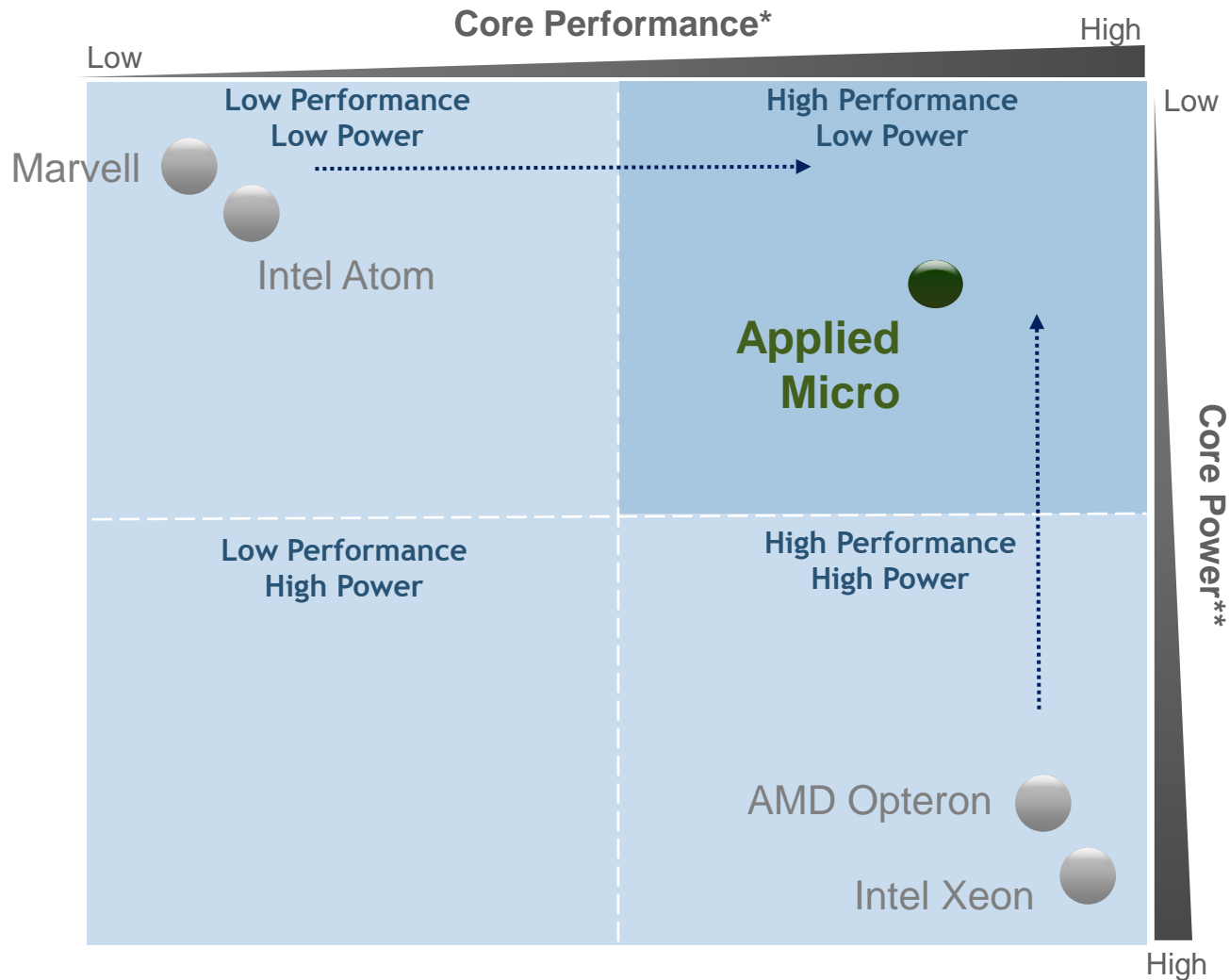
- Market Place is looking for an alternative ISA to IA
- Server Workloads Changing → From Structured Data to Unstructured Data
- Energy Efficient computing becoming critical → 31% of data center costs functionally related to Power
- Networking Costs → 8% of overall costs and 20% of total server cost
- Memory, Networking, and Storage not Keeping up with CPUs → Right Sizing is more important than performance
- Centralized Control Plane → OpenFlow / Software Defined Networking



Source: James Hamilton, Amazon

	CPU	DRAM	LAN	Disk
Annual bandwidth improvement (all milestones)	1.5	1.27	1.39	1.28
Annual latency Improvement (all milestones)	1.17	1.07	1.12	1.11

Cloud Computing Value Positioning

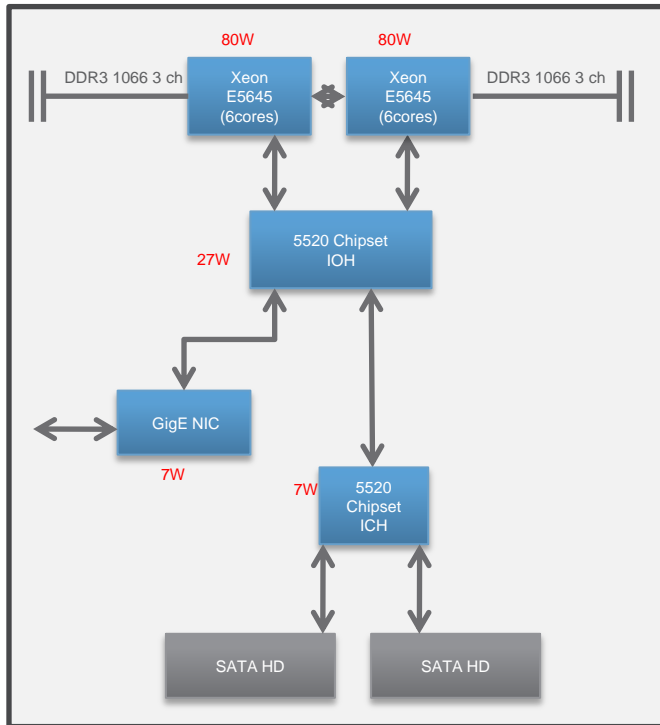


*SPECINT
**TDP

Ideal Product Centers Performance, Power, & Right-Sizing

Right Sizing → *Applied Micro's Approach*

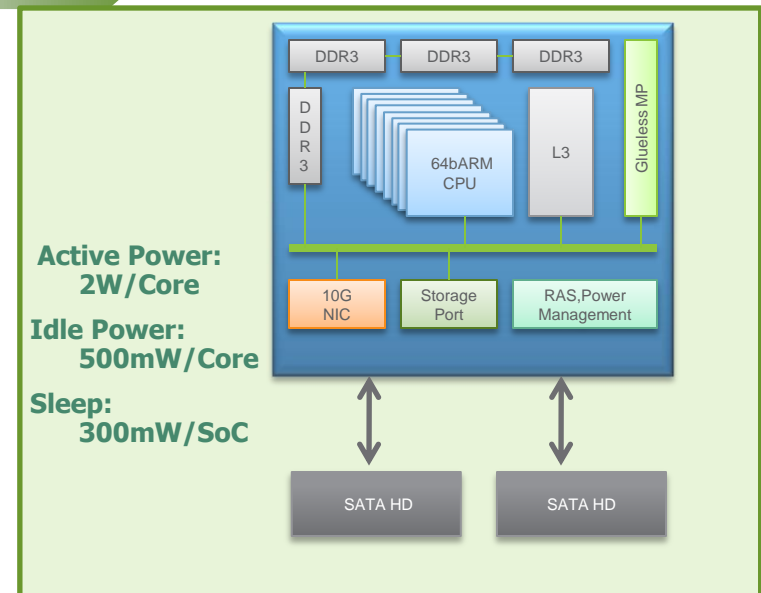
Traditional Thinking



Traditional Multi-Tier Chipset Architecture:

- IO Hub for PCIE Fanout (27W)
- ICH for legacy connectivity (7W)
- Total 200 watts total silicon power alone

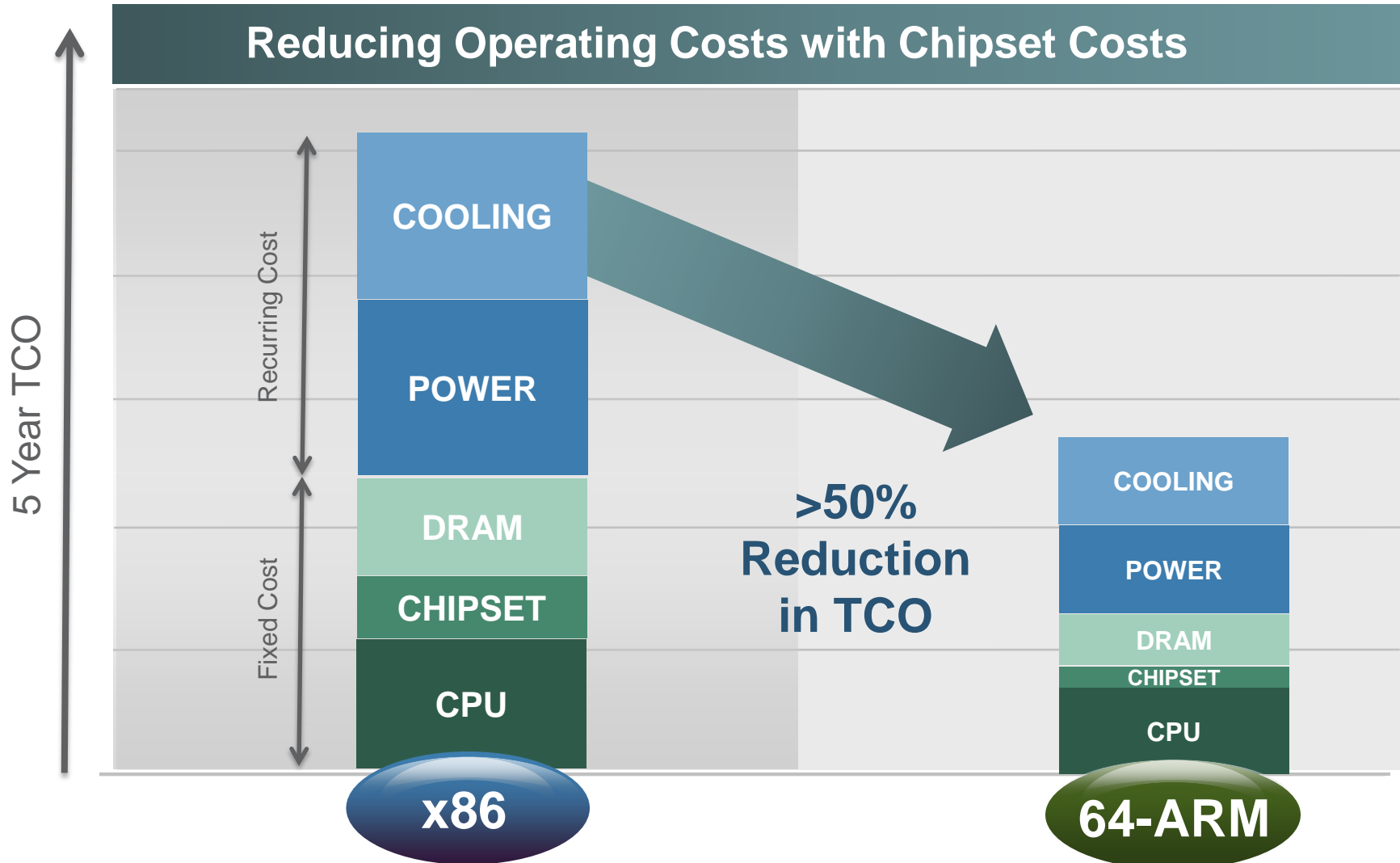
New World Thinking



- ✓ Disruptive Performance/Power/Price
- ✓ Optimized Cloud Server SoC Design
- ✓ Software Friendly Architecture
- ✓ Power reduction of >2x

Worlds First 64-bit ARM Server On a Chip (SoC)

Ultimate Bottomline Value to Datacenters




Architectural Digest



X-Gene Platform Architecture

Worlds First 64-bit ARM SoC

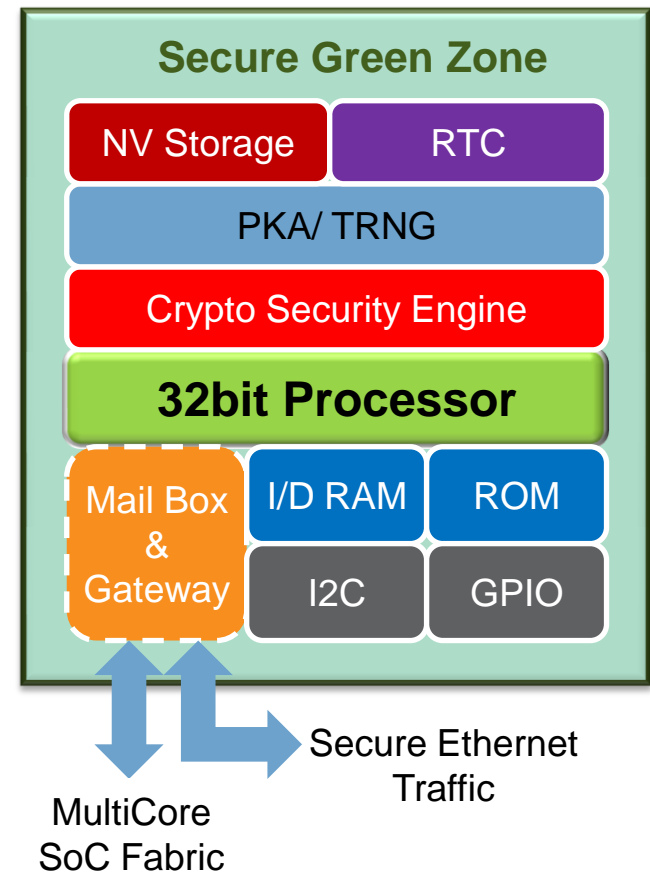
High Performance	Integrated Network	Intelligent Parallelism
<p>2-128 Cores @ 3GHz</p> <p>Quad Issue Out-of-Order</p> <p>L1/L2/L3 Tri-level Cache</p>	<p>Fully Integrated LAN, Storage and WAN PHYs</p> 	<p>Fully non-Blocking Terabyte Coherent Fabric with QOS</p>
<p>Dynamic Freq TDP (Thermal Dissipated Power)</p> <p>Standby Power <300mW</p>	<p>Up to 3 Inter-Chip Connectivity @ 100Gbps</p>	<p>Offload Accelerator Engines</p> <p>Dedicated Context & Queue Manager</p>
Energy Smart	Scalable Coherency	Configurable Customization

SLIMPRO™ - The First Intelligent on-chip Resource Manager

Scalable Light-weight Intelligent Management Processor

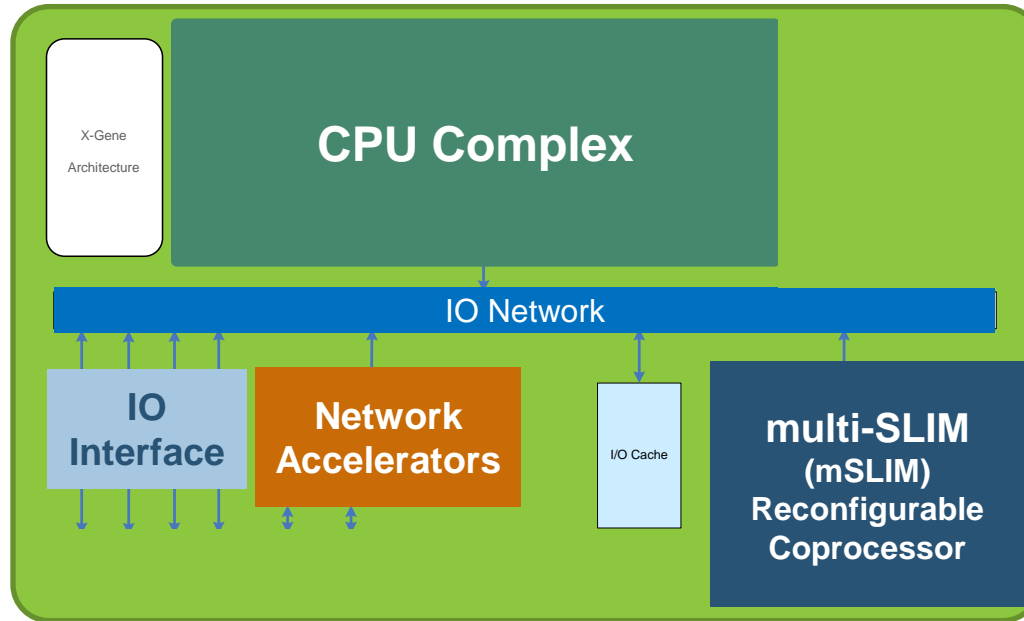
Secured & guarded from any on-chip or external access / attacks

SLIMPRO Application	Description
Power Management	Ultra Fine SoC Frequency, Voltage and feature control. 200mW to full operation.
Secure Boot	Authenticate OS, System S/W and Loader. Real-time Security Agent
Trusted Management Module	On-chip protected Private / Public storage; Crypto Engine. Tamper Detection and Response
Secure Debug	Secure remote monitoring, debug, update and reporting
Concurrent & Secure AMP	Secure domain protection. Concurrent and independent MultiCore operation



X-Gene Platform Architecture

Evolutionary Product Extensions Based off a Common DNA



Server Applications

- Full IO Virtualization
- Advanced Power Management
- Datacenter Bridging
- Receiver Side Scaling

Data Plane Applications

- Reg-Ex
- Compression
- Traffic Management
- Security

Wireless Applications

- Slice based H/W accelerators
- Tightly integrated L1-L3 wireless processing
- Femto/Pico, Micro, Macro L1 Subsystem

First Proof → FPGA Implementation

World's First 64-bit ARM SoC Linux Boot

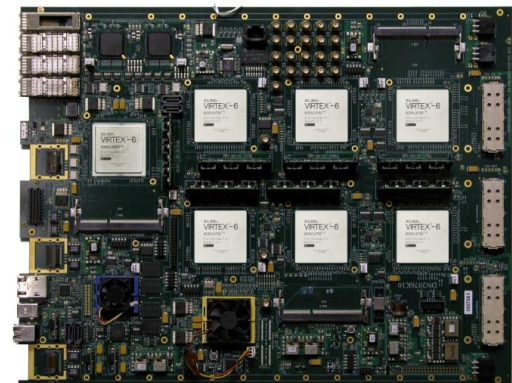
Server and Embedded Benchmarks

- Spec2006, SpecWeb, SpecJBB
- Facebook Memcache
- GoogleBench
- EEMBC → OA Mark, Networking, CoreMark
- CacheBench, LMBench, Stream
- Microsoft Bing Workloads

Server Workloads and Applications

- Open Source ARM 64-bit Linux
- GNU LAMP Stack
- Simplified Hadoop → Data Node
- Facebook Hip-Hop
- Redhat Linux → Development distro

- U-Boot (bootrom) boots successfully
- ARM 64-bit Linux boot to prompt
- CPU Complex, Fabric, Bridges, SoC Component
- CPU Complex → L1/L2 Cache enabled, MMU, FPU, Memory Subsystem
- Customer Eval Boards in Q1 2012



APM.
Lifestyle Networked



Vectors of Change: Architectural Innovation

- Redefining the Market -

- World's First 64-bit ARM v8 (2.5-3GHz)
- Enterprise Performance at Consumer Power

X-Gene (40/28nm)

2011/12

- Energy-Efficient SLIMpro™ SoC Subsystem Powering Intelligent Network Traffic

PACKETPro Gen 2 (40nm)

2010

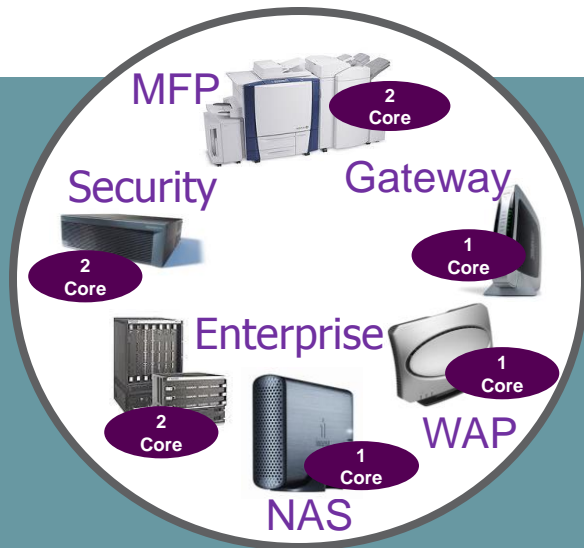
- PPC 405 & 460 Cores
- Licensed IP for Market-Focused SoC Applications

PACKETPRO Gen1 (90nm)

< 2009

Product Market Breadth

Low-to-Mid Range

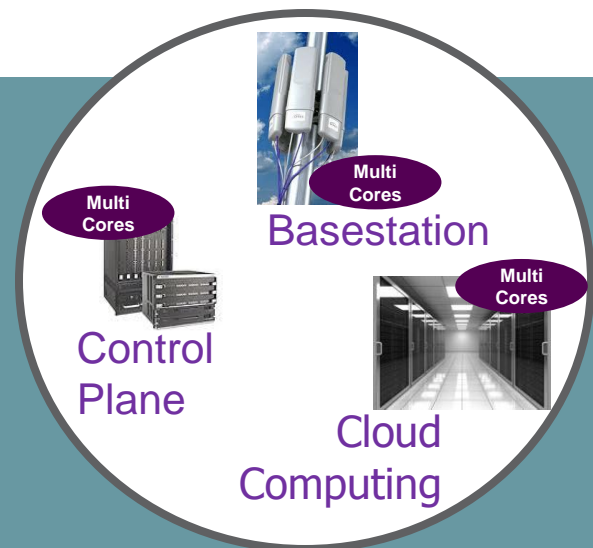


Embedded Markets



\$1.2B
SAM

Mid-to-High End Range



Embedded + Cloud Server Markets



\$5B
SAM

Customer & Ecosystem Traction

Customers

Major Server OEMs

- Positive executive & technical engagements
- Initial deployments identified
- Technical evaluation in progress

Major Cloud Players

- Enthusiastic & welcoming of ARM ISA
- Sharing workloads

OS & Software

- Support development in progress with key SW server developers
- 64-bit porting transition
- High interest and awaiting testing on FPGA

Tools & Hardware

- Co-development of a micro-server in progress
- Full software development & simulator running before silicon
- Open Source Linux 2.6.39 developed and supported by APM
- Current engagements for Java support & debuggers

Processor for the **Green** Cloud

- Delivering 2-3x the Performance per Watt

ARM 64

SoC
Integration

Energy
Efficient

- Lowering Datacenter TCO by Converging Value Economics with Ecosystem Economics

- Right-Sizing CPU-Memory Server System

Thank You