QorIQ T Series: T1 amd T2 Family Product Overview

AMF-NET-T1034

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Challenges for Next Generation Networking Systems

Networks strained by use of smarter, bandwidth-hungry devices need:

- Multicore platforms performing more intelligently and securely
- Low-power, low-cost, easy-to-use equipment
- Scalable platform built on a common architecture to design a range of products
- Less software complexity

T1/T2 Target Markets, Key Features

Enterprise Routers/Switches

Industrial Computing and Networking

UTM Security Appliances

The T1/T2 embedded processor are architected to provide maximum performance per watt

- Highest performance CPU cores in a power envelope
- Integration multilayer Gigabit Ethernet switch to reduce system cost and design complexity.
- Offload engines – Encryption/ Decryption for high performance security
- Deep packet inspection offload engine enabling UTM services.
- DPAA – for QoS and balanced networking performance
- Virtualization to support customers and 3rd party software
- Small form factor, fanless and convection cooled designs

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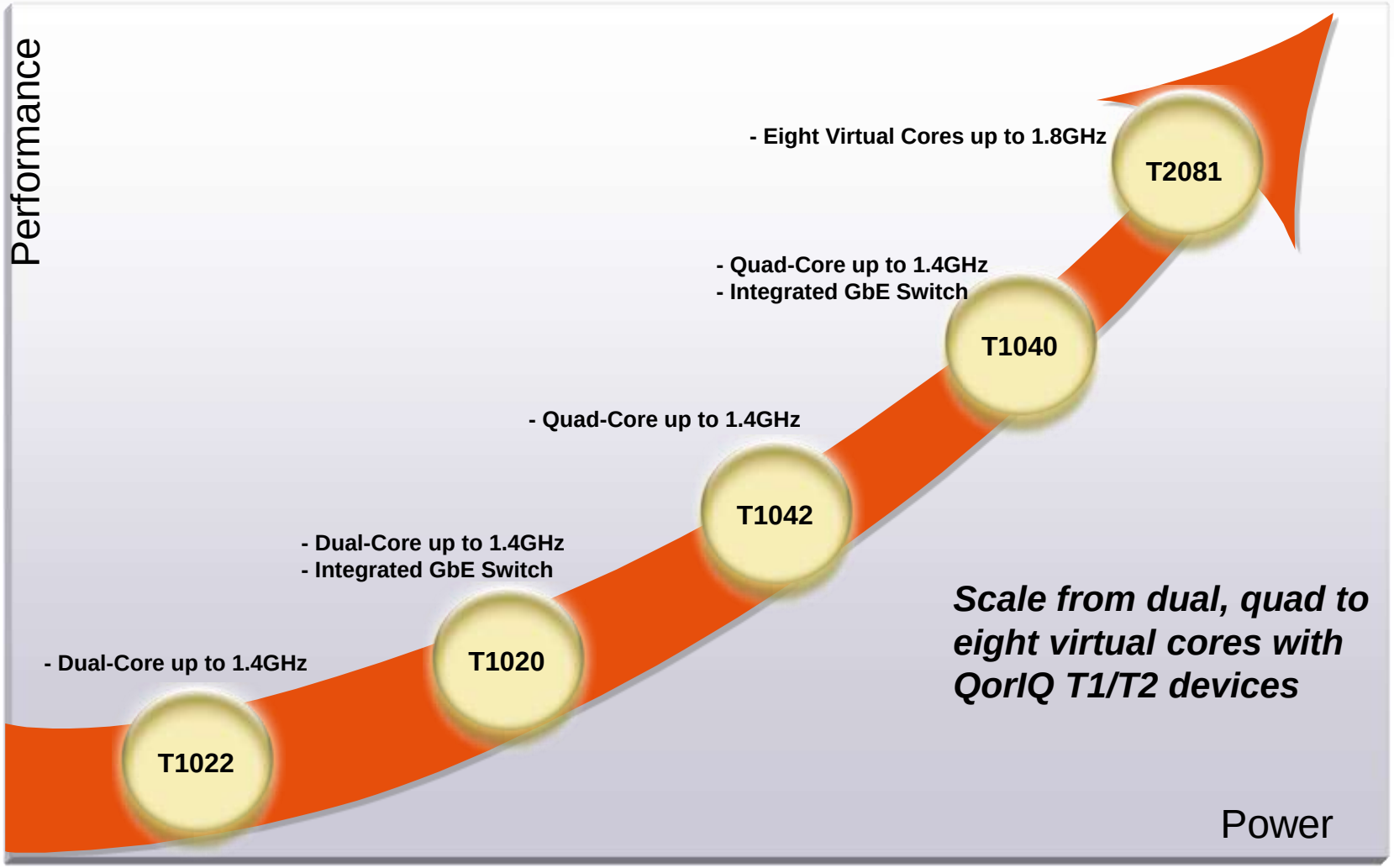
One of the Industry's Most Scalable, Pin-Compatible Communications Processor Family



T1040 Target Applications

Gateway

- Packet transfert (wire, wireless)
- Protocols (field bus, IP)
- Packet manipulation

Enterprise Ethernet router

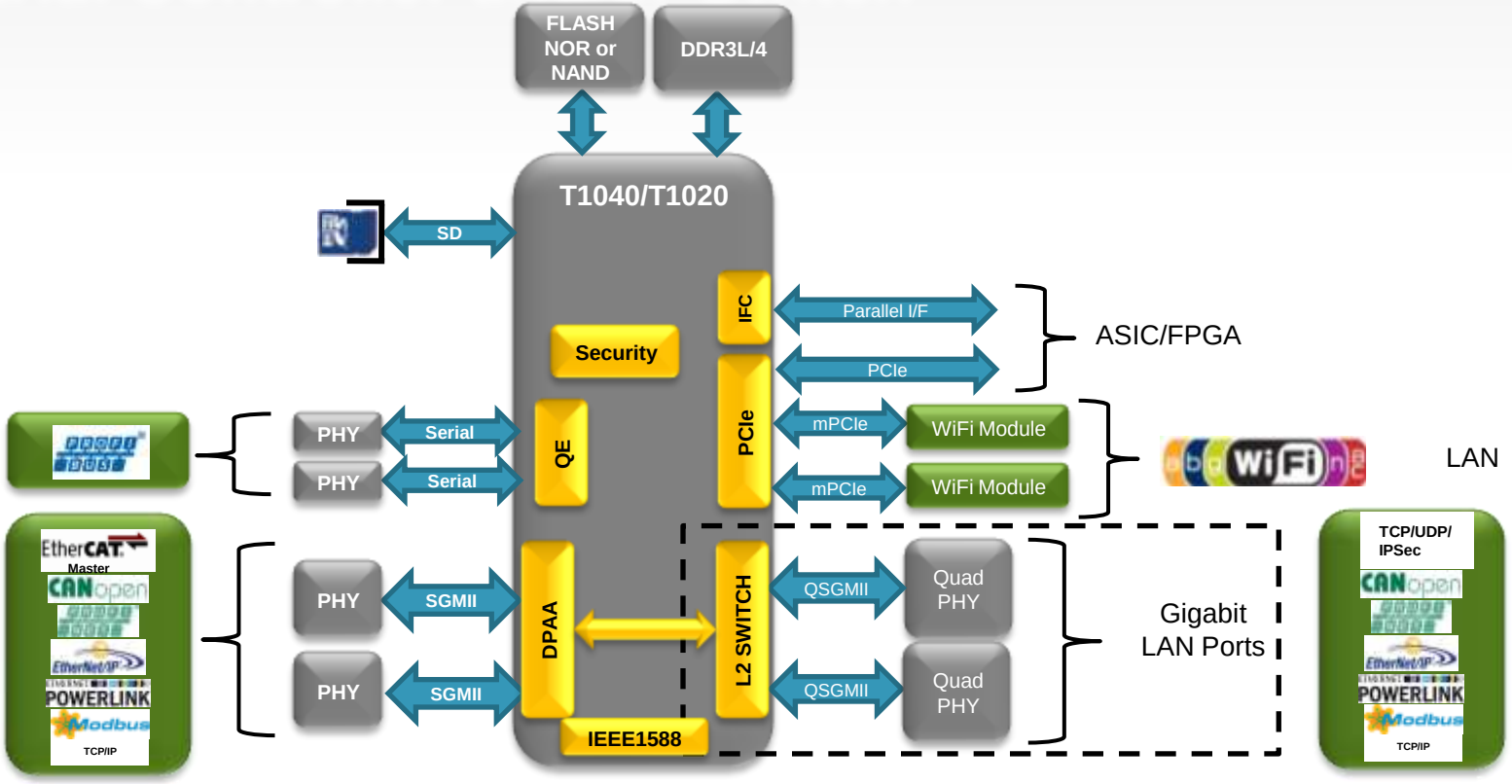
Wifi Ethernet router

Industrial router

Programmable Logic Controller (PLC)
Industrial systems with Profibus / Ethercat

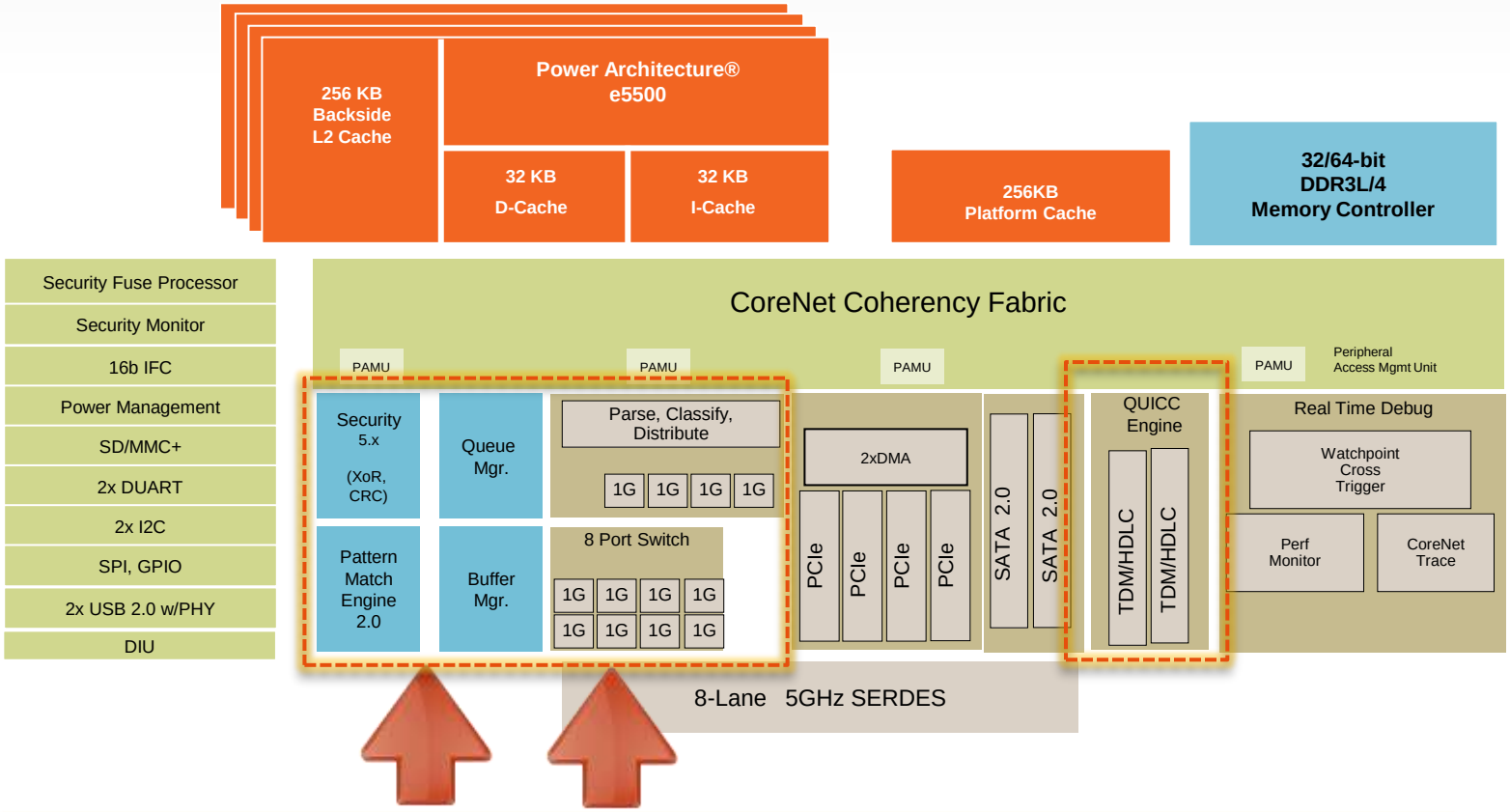
Military router

Industrial Controller and/or Switch



- Support Legacy protocols like PROFIBUS and Ethernet (10/100/1000Mbps) generation of industrial protocols
- Multi Core with hardware based virtualization for multi function integration
- Data Path Acceleration Architecture to offload packet processing and to help with higher level switching capabilities
- Secure Boot and Trust Architecture ensuring communication link and device integrity
- Support for SPI, I2C, UART and USB

T1040: Industry's First 64-bit Embedded Processor with an Integrated Gigabit Ethernet Switch



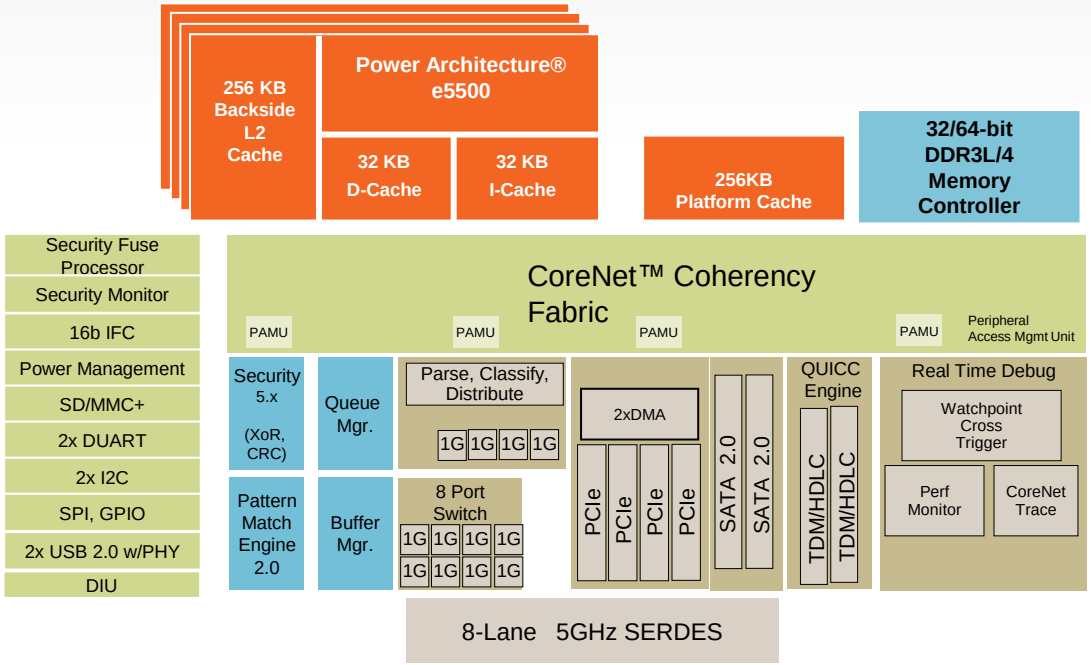
Intelligent Integration

- **High performance software controlled data path architecture**
- **High performance accelerators to offload compute intensive functions (IPSec, IDS/IPS)**
- **Integrated Gigabit Ethernet Switch – to reduce system cost, simplify HW and SW design**
- **Integrated QUICC Engine for legacy TDM services**

T1 Family Features & Benefits

Features	Benefits
Scalable Performance Pin compatible dual core to eight virtual cores	**Future Proofing** Upgrade to higher performance as needed >2x-4x the performance of existing P1 series
Gigabit Ethernet Switch Integrated Gigabit Ethernet Switch	**Lowers System Cost/Simplifies design** Eliminates cost of external GE switch Simplifies HW and SW implementation Reduces overall system power
Accelerators DPAA - Classification, Traffic Management Pattern Matching Security	**Enforce SLAs/Reduce CPU cycles** Manage traffic guarantees to enforce SLAs Security policies based on application/services High performance HW based encryption VortiQa Security Appliance S/W and AppID
Hardware Assisted Virtualization Hypervisor level I/O MMU – controls memory I/Os can access Support for Topaz, KVM, Linux Containers,	**Higher performance (Vs. software emulation)** Enables virtualization layer to enforce system security Simplifies I/O virtualization and sharing Flexibility to use multiple options to meet system needs Support for S/W Hypervisor, KVM and Linux Containers
Power Management Best performance per watt Deep Sleep – proxy for sleeping hosts Enables ½ Watt AC	**Green Energy Efficient System Designs** Optimized for best performance and power Enables Compliance with Energy Consumption standards (ECC, EnergyStar, ECMA 393) Power Management software as part of SDK

T1040



Device

- 28HPM Process
- 780-pin 3-2-3 C4 FC package
- 23x23mm, 0.8mm pitch

Power targets

- Enable Convection cooled system design

Datapath Acceleration

- SEC- crypto acceleration
- PME- Reg-ex Pattern Matcher

Processor

- 4x e5500, 64b, up to 1.4GHz
- Each with 256KB backside L2 cache
- 256KB Shared Platform Cache w/ECC
- Supports up to 64GB addressability (36 bit physical addressing)

Memory SubSystem

- 32/64b DDR3L/4 Controller up to 1333MHz

Cygnus Switch Fabric

High Speed Serial IO

- 4x PCIe Gen2 Controllers
- 2x SATA 2.0, 3Gb/s
- 2x USB 2.0 with PHY

Network IO

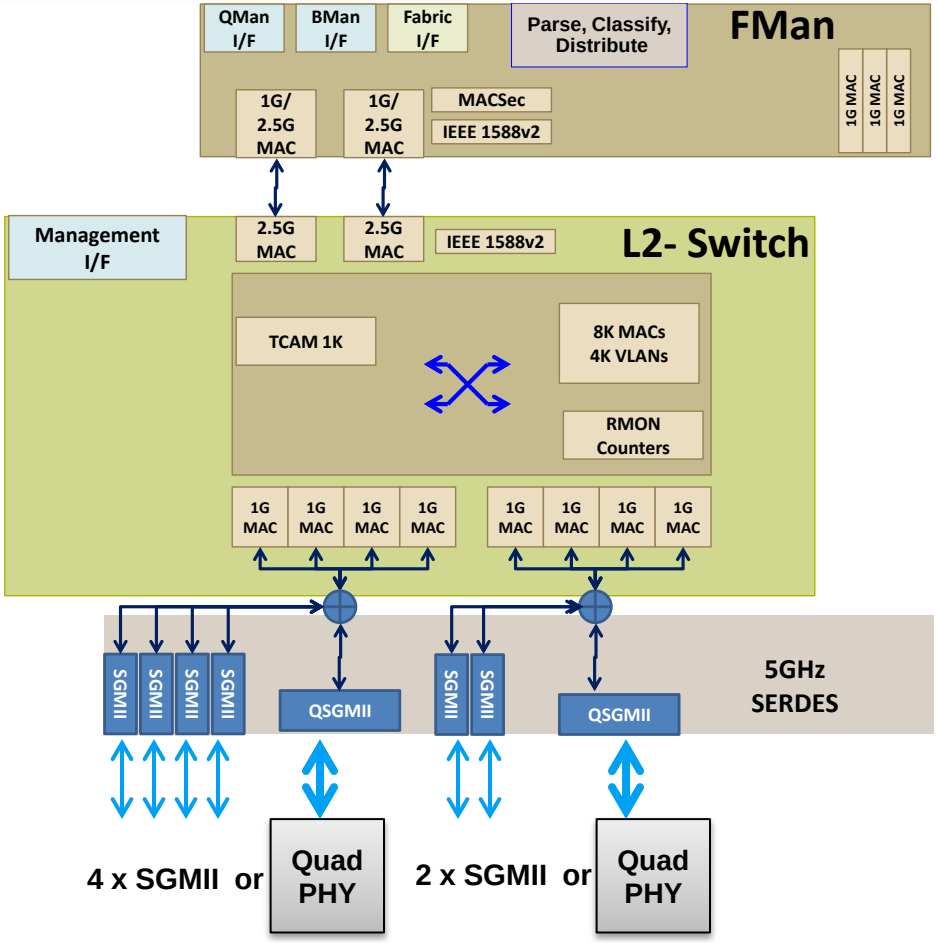
- FMan packet Parse/Classify/Distribute
- Lossless Flow Control, IEEE 1588
- Up to 4x 10/100/1000 Ethernet Controllers
- **8-Port Gigabit Ethernet Switch**
- QUICC Engine
  - HDLC, 2x TDM
- **Green Energy Operation**
- Fanless operation quad-core 1.2GHz
- Packet lossless deepsleep
  - Programmable wake-on-packet
  - Wake-on-timer/GPIO/USB/IRQ

Product Matrix

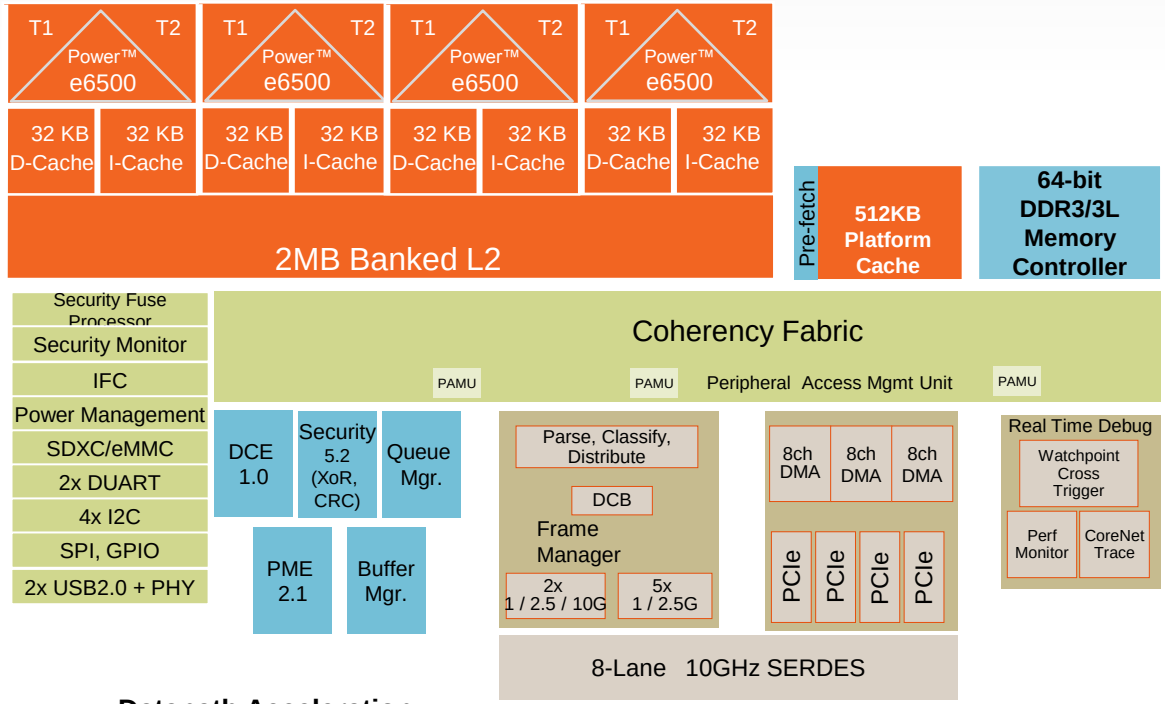
	P1020, P1011 P1021, P1012	P2020 P2010	T1020	T1022	T1040	T1042	T2081
CPU	1 to 2 e500	1 to 2 e500	2 e5500	2 e5500	4 e5500	4 e5500	4 e6500/8 threads
	Up to 800MHz	Up to 1200MHz	1200-1400MHz	1200-1400MHz	1200-1400MHz	1200-1400MHz	1500 - 1800MHz
	32K I/D	32K I/D	32K I/D	32K I/D	32K I/D	32K I/D	32K I/D
L2 Cache	256KB	512KB	256KB/Core	256KB/Core	256KB/Core	256KB/Core	512KB/Core
DDR I/F	DDR2/3	DDR2/3	DDR3L/4	DDR3L/4	DDR3L/4	DDR3L/4	DDR3/3L
10/100/1000 Ethernet (with IEEE1588v2)	3 x 10/100/1000	3 x 10/100/1000	8-Port GE Switch & 4 x 10/100/1000	5 x 10/100/1000	8-Port GE Switch & 4 x 10/100/1000	5 x 10/100/1000	2x 1/10GE + 5x 1GE
TDM	Yes	-	Yes	Yes	Yes	Yes	No
QUICC Engine	In P1021/12	-	TDM and HDLC	TDM and HDLC	TDM and HDLC	TDM and HDLC	No
SERDES	4 lanes	4 lanes	8 lanes	8 lanes	8 lanes	8 lanes	8 lanes
PCI-Exp	2 (Gen-1)	3 (Gen-1)	4 (Gen-2)	4 (Gen-2)	4 (Gen-2)	4 (Gen-2)	3 (Gen2) and 1 (Gen3)
DIU	-	-	Yes	Yes	Yes	Yes	No
SATA	-	-	Yes	Yes	Yes	Yes	-
USB2.0	2	1	2 with PHY	2 with PHY	2 with PHY	2 with PHY	2 with PHY
Accelerators	SEC3.3	SEC3.1	DPAA, PME SEC5.x with Trust Architecture	DPAA, PME SEC5.x with Trust Architecture	DPAA, PME SEC5.x with Trust Architecture	DPAA, PME SEC5.x with Trust Architecture	DPAA,PME, DCE, SEC5.2 with Trust Architecture
Power Management	<5.0W	<8.0W	Power Management with Deepsleep	Power Management with Deepsleep	Power Management with Deepsleep	Power Management with Deepsleep	
Package			**Pin Compatible**				

T1040: Gigabit Ethernet Switch

- Advanced Features
  - Priority flow control - lossless
  - Lower latency and shared buffer management
  - Advanced classification, shaping an policing
- Power savings
  - With support for latest standards including IEEE 802.3az Energy Efficient Ethernet (EEE)
- Cost savings
  - Through switch integration, low-pin count QSGMII connectivity and port count / cost optimization
- Increased ROI - Lower TTM and high re-use
  - Integrated solution kit with software reuse potential
- Support for Full featured L2 software stacks



T2081



Datapath Acceleration

- **SEC**- crypto acceleration 10Gbps
- **DCE** - Data Compression Engine 17.5Gbps
- **PME** – Pattern Matching Engine to 10Gbps

Processor

- 4x e6500, 64b, 1.5 - 1.8GHz
- Dual threaded, with 128b AltiVec
- 2MB shared L2; 256KB per thread

Memory Subsystem

- 512KB Platform Cache w/ECC
- 1x DDR3/3L Controllers up to 2.1GHz
- Up to 1TB addressability (40 bit physical addressing)
- HW Data Prefetching

Switch Fabric

High Speed Serial IO

- 4 PCIe Controllers, one at Gen3 three at Gen2
  - 1 with SR-IOV support
  - x8 Gen2
- 2 USB 2.0 with PHY

Network IO

- Up to 25Gbps Simple PCD each direction
  - 2x 1/2.5/10GE + 5x1GE
  - XFI, 10GBase-KR, XAUI, SGMII, RGMII, 1000Base-KX

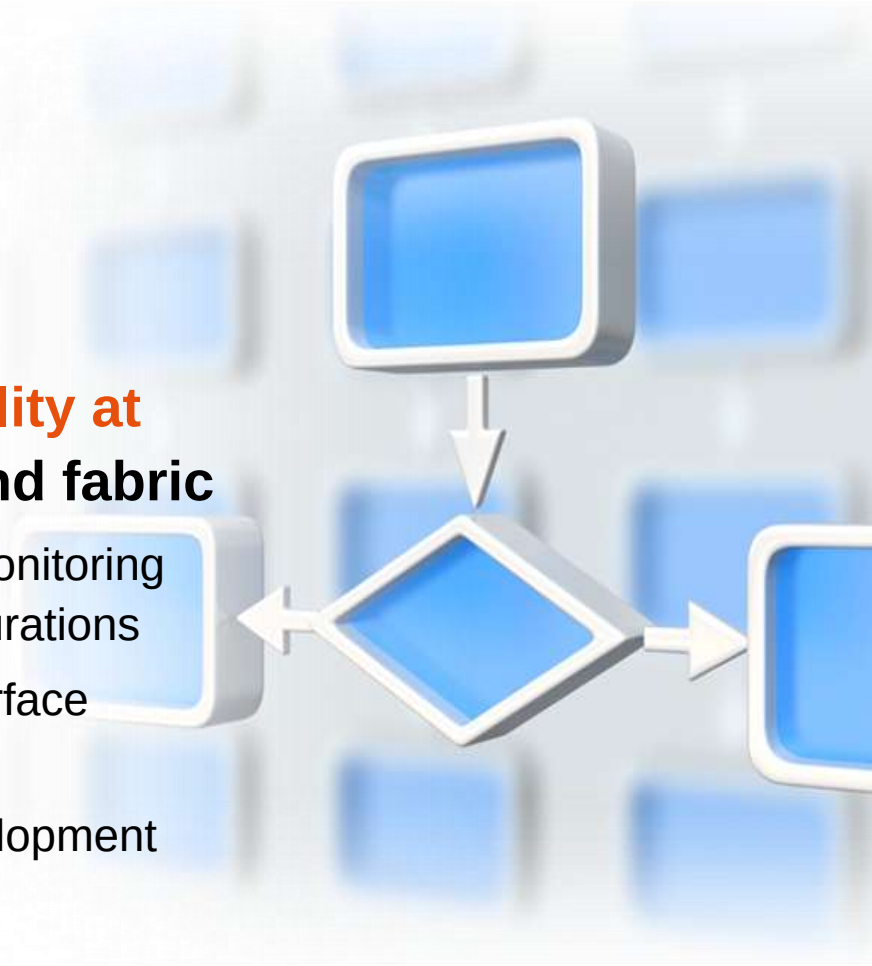
Device

- TSMC 28HPM Process
- 23x23mm, 780pins, 0.8mm pitch, pin compatible with T1042
- Power estimated at 19.6 – 25.3W (thermal) depending on frequency

Schedule: samples: 2H-2014; qual Q1-15

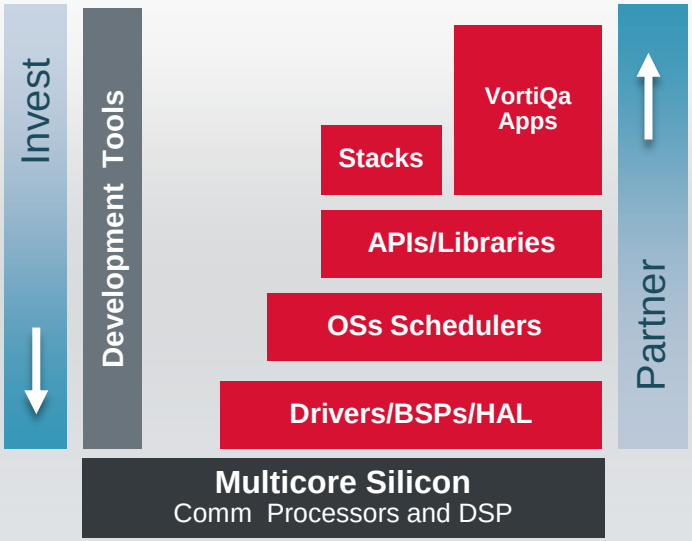
Improved Productivity:
Multicore Software Development

- **QorIQ Hardware-assisted Virtualization Implementation**
  - Extra privileged level added to cores for Hypervisor support
  - Virtualization of network-bound interfaces
- **Deep Introspection Debug Visibility at block level: core, accelerators and fabric**
  - System debug, trace and performance monitoring with control of thousands of event configurations
  - Security mechanisms prevent debug interface intrusion
  - Enabled by Freescale CodeWarrior Development Suite plus vibrant 3rd party community



Digital Networking Software Strategy

Best-in-Class Multicore Software Development and Debug Solution



Key Software Acquisitions & Investments

1999: Metrowerks
2002: AMC, Lineo
2003: Freescale Professional Services
2005: Seaway Networks
2008: Intoto
2009: MQX Runtime Platform
2010: Processor Expert, Chipwerks
2013: Launch Digital Networking Services

+ Open Ecosystem of Partners

Investment in silicon optimized software IP across our Multicore portfolio

- *Over 1000 in-house software resources*
- Stand-alone base tools and run-time technologies built around standard platforms
- Available throughout the ecosystem

In-house resources & IP *plus* Partners provide open choices for vertical solutions and tools

- Optimized solutions, reference designs and greater application performance
- Alternative to restrictive/captive approaches
- Peace of mind that software IP will not be locked in
- Freescale Professional Services where needed

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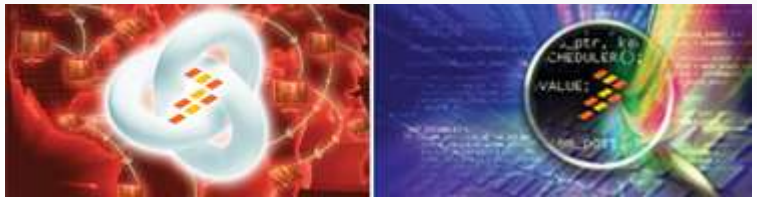
Networking Software and Services Group

- ***Accelerate*** **Customer Time to Market**
  - Speed Adoption of Multicore
  - Dedicated expert staff with access to software and SoC teams



- ***Deliver*** **Commercial Software, Support, Services and Solutions**
  - Commercial Software: VortiQa, CodeWarrior, Processor Expert
  - Accelerate new technology adoption

- ***Simplify*** **Software Engagement with Freescale**
  - Consolidate Freescale software and solutions
  - Streamline business processes

- ***Create*** **Success!**
  - Partner with customers
  - Leverage *your* strengths, add *our* capabilities

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Networking Software and Services Group

Software Products and Custom Services

Development Tools	Runtime Products	Solutions Reference	Linux® Services	Integration Services
• CodeWarrior – IDE – Debug – Compiler – Trace • QorIQ Optimization Suite – Scenarios Tools – DDrV	• Vortiqa Software Products – Application Identification Software (AIS) – Open Networking Switching Framework – Platform Services Package (PSP) – Mobile Transport	• Storage Controller • SDN Switch • Wireless LAN • Data Concentrator • Smart Converged Gateway • Digital Signage	• Commercial Support • Frozen Branch • Application Specific Hardening • Feature Acceleration	• Systems Consulting • Design Services • Porting • Migration
CodeWarrior QorIQ	VortiQa			

Faster Time to Market

Processors	Turnkey Software	Key Platform	Right Partners
Freescale QorIQ Processors	VortiQa Security Applications	Optimized Reference Design	ODM Integration Partners

Freescale Reference Designs

Enabling ODMs

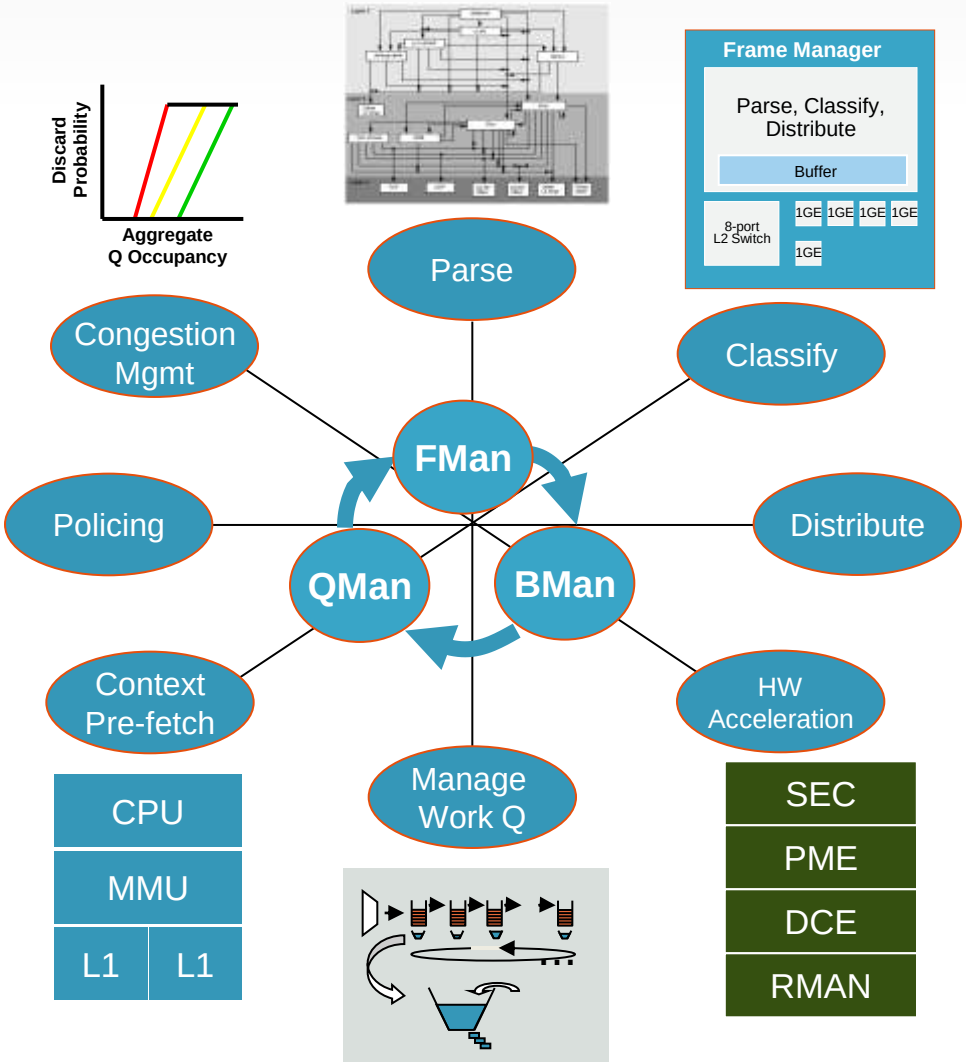
- Multiservice gateways
- Enterprise switches
- Security appliance
- Industrial communications
- Networking/Telecom line cards

Freescale's Comprehensive Ecosystem

Tools and Operating Systems	Virtualization	Application Software	Systems Integration & Services	Development Systems
freescale CodeWarrior	KVM	freescale VortiQa	RadiSys.	
criticalblue Accelerating Embedded Software	lxc Linux Containers	Elliptic Embedded Security you can Trust	MERCURY COMPUTER SYSTEMS	
ENEA	freescale	GWIND Bitdefender	ADVANTECH	
Green Hills SOFTWARE, INC.	Green Hills SOFTWARE, INC.	Broadweb	Portwell	
QNX	ENEA	MERCURY COMPUTER SYSTEMS	Lanner	
mentor embedded		One Convergence	EMERSON Network Power	
WIND RIVER	WIND RIVER	mocana	FLEXTRONICS	

Work Scheduling and Hardware Acceleration

- Provide sharing of network interfaces and hardware accelerators by multiple cores
- Reduce software overheads associated with managing and moving "***work***"
- Congestion management and avoidance for higher data rates and distributed processing
- Hardware acceleration offload for compute intensive tasks – classifying, encryption, content processing
- The QorIQ™ Datapath Acceleration Architecture provides this infrastructure



QorIQ T1 and T2 Families Extend Market Leadership

- **First 64-bit embedded processor with an integrated GbE switch**
  - Reduces system cost, design complexity and power
- **One of the industry's most scalable, pin-compatible family of devices**
  - Performance scalability with a common architecture
- **Energy efficiency and low power**
  - Designed to be compliant to European Code of Conduct, and EnergyStar energy consumption standards
- Ideal for **low- to mid-range** networking and industrial connectivity applications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