Layerscape Solution Update

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Product Marketing EMEA

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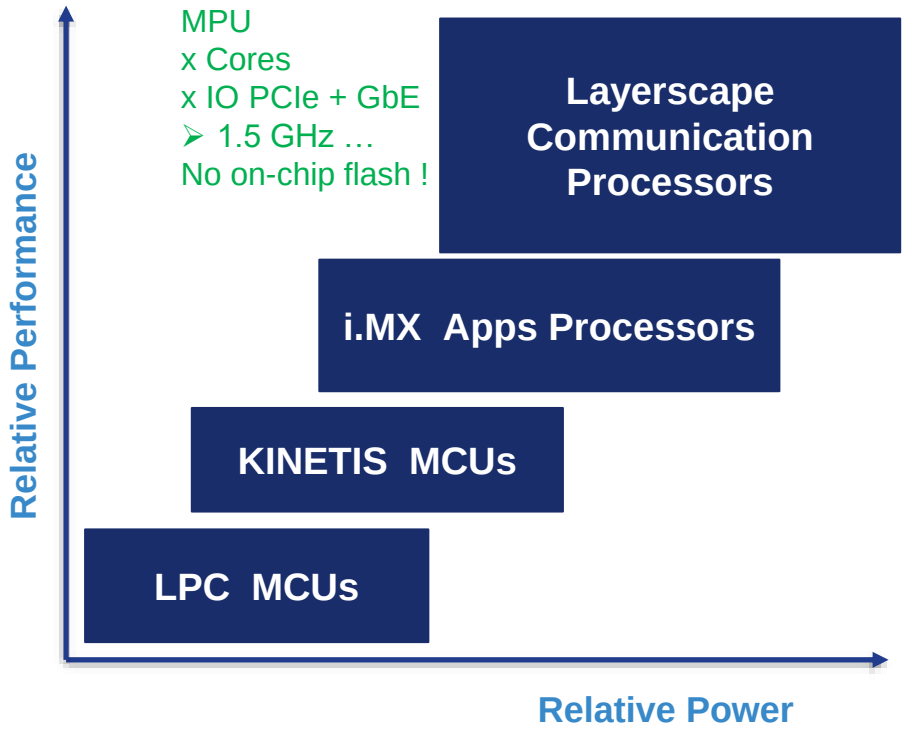
SECURE CONNECTIONS FOR A SMARTER WORLD

Agenda

- Layerscape target market & application
- Roadmap update
- LX2160 (8,12,16 cores) + LS1028 (A72 + TSN)

NXP ARM Portfolio – Industry Leading Embedded Portfolio

Scalable Product Portfolio



Deep System & Application Knowledge

Portfolio

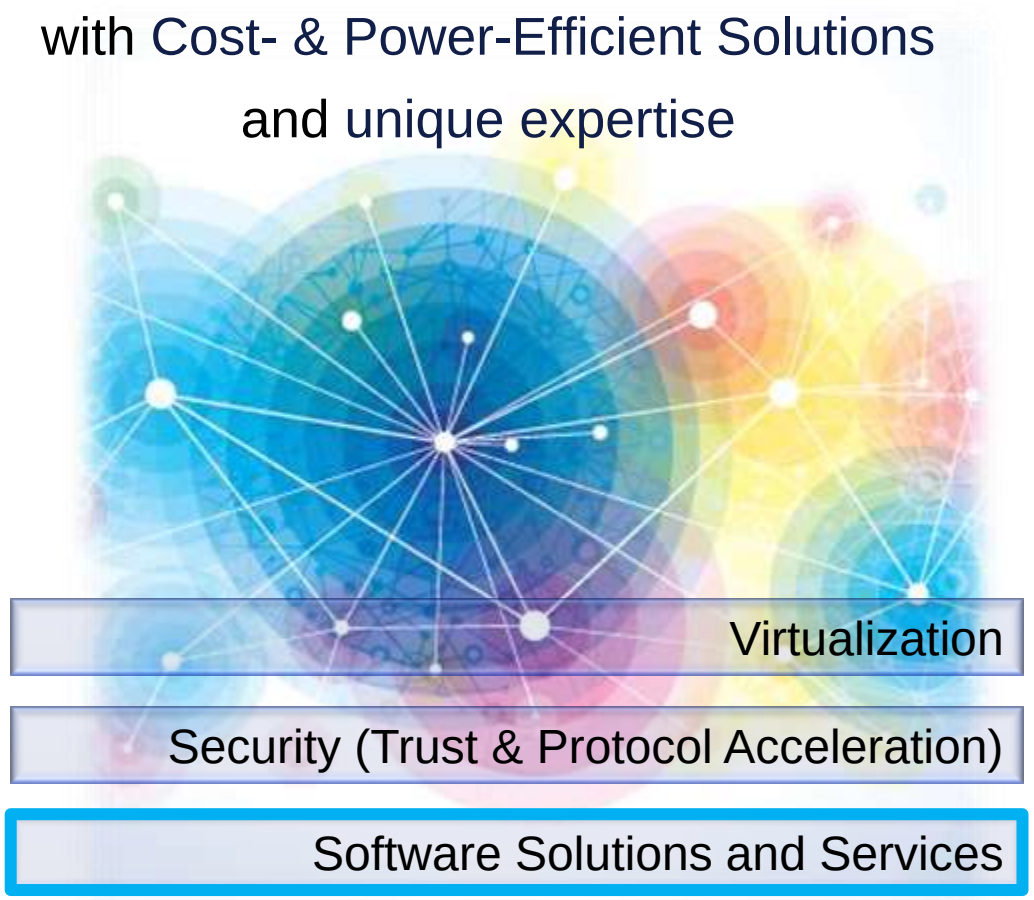
- Broadest range of embedded processing from lowest power 32-bit MCUs to high performance multi-core 32/64-bit application & communications processors
- Differentiated software ecosystem
- Delivering turnkey solutions (SW + Si)
- Commercial support & Services

Customers and Markets

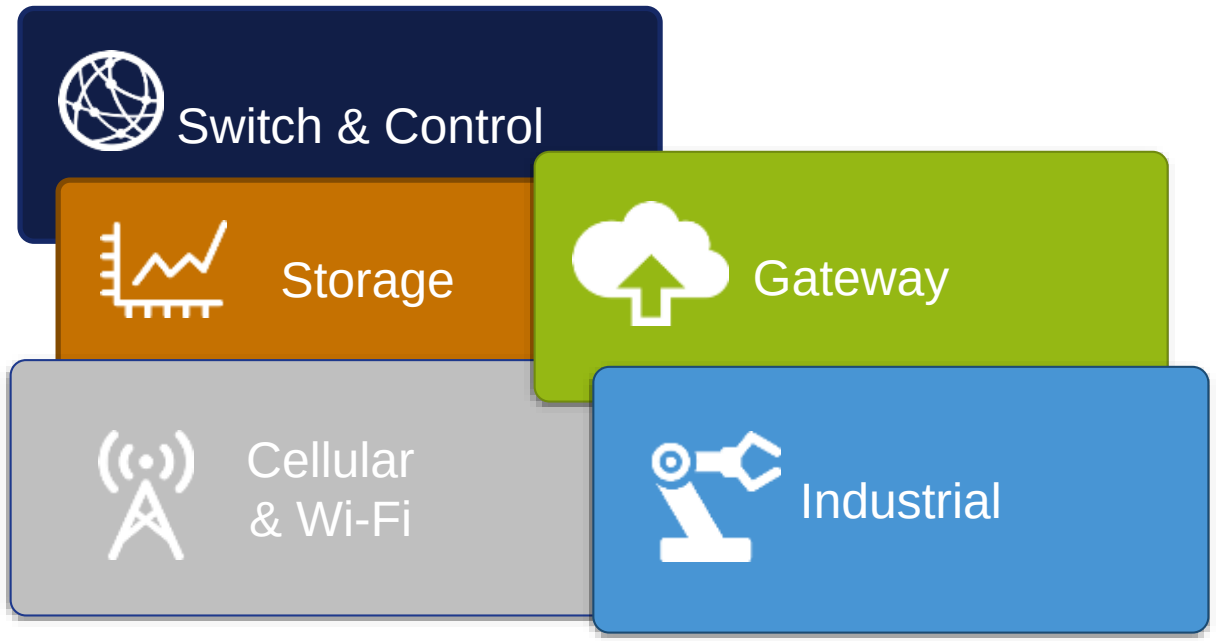
- Highly diversified customer base
- Global multi-market focus
- Strong presence in emerging applications

Layerscape product line

Enabling Secure Infrastructure
with Cost- & Power-Efficient Solutions
and unique expertise



Targeted Solution Segments

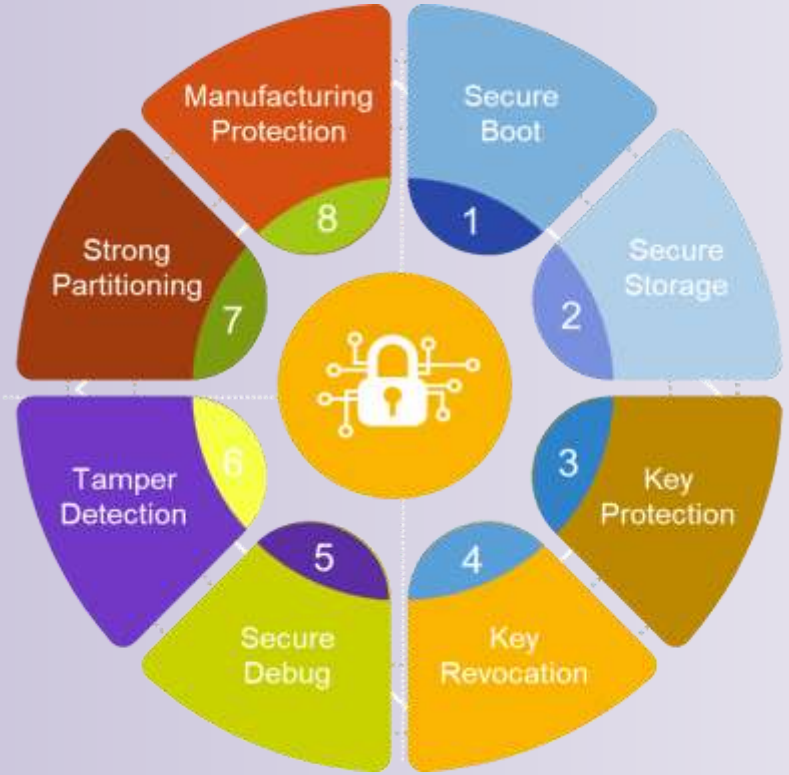


Security

Security

Covering every system vulnerability of the Product Life-Cycle

- Design – Hardware, IO, Storage: Trust Architecture
- Manufacturing – Key Generation, Provisioning, Updates: Secure Provisioning Tool
- Software – Operating System, Applications, Permissions: Trusted Linux
- Connectivity – Remote Access, Communications: Network Security Suite



Industrial Requires Scalable Application Processing

Analyze

Automate

Monitor

Improving time to market, manufacturing flexibility, and increasing quality and efficiency will require smarter, connected businesses

Powering Industrial Applications
for over 6 decades

1 Billion Industrial Application
Processors Shipped

Legacy	Longevity	Extreme Op	Security

Complete Solutions for Industrial Processing

Industrial Solutions Enabled by NXP ARM product family

Industrial Managed Ethernet Switches

Leverage networking leadership position

ARM

LS1

Gateway/ Router

Leverage networking leadership position

Industry leading low power – performance portfolio across ARM,

LS1

Industrial Firewall

Scalable IPSEC

Support for broadest range of cyphers

HW acceleration

ARM

LS1, LS2

Remote Terminal Unit (RTU) / Automation Controller

Scalable 1-to -4 cores

ARM

LS1

Programmable Logic Controllers (PLCs)

Single-Dual Core ARM & Power

Low power

LS1-Families

Robotics

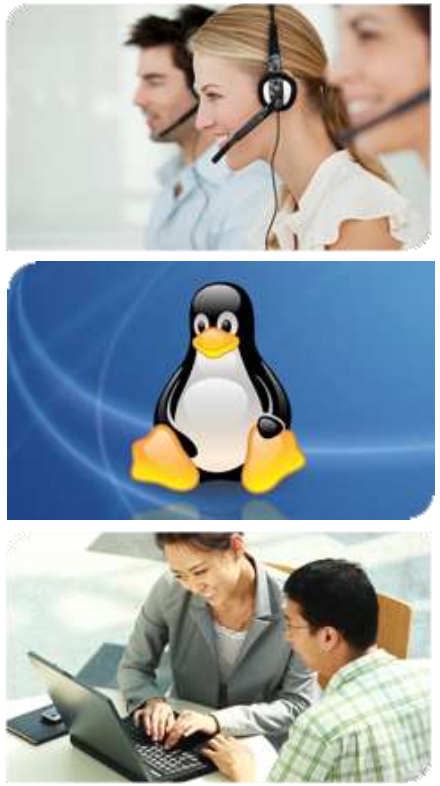
Scalable 1-to-many cores

Power & ARM

High Compute-to Power dissipation ratio

- LS1-families
- LS2-families
- LX2 families

Software Support and Services



Premium Support

- Market competitive support policies
- Direct access to SW Apps, Guaranteed Response Time
- Periodic upgrades as applicable
- Flexible support packages

Long-term Support – “Frozen Branch”

- Maintain existing software base/fork for customer
- Back-port, Forward-port across kernel versions
- Support and “maintenance”
- Custom upgrade with select patches, fixes

Custom Services

- Custom features, enhancements.
- Use-case specific migration, integration.
- Performance optimizations, hardening.
- Turnkey Hardware + Software Design

Software

Platform Software

LSDK

- Based in Ubuntu Linux – File-system and apps.
- Components: Kernel.org, NXP drivers, user-space libraries, tools, boot-loaders and configuration.

Linux SDK

- Customer community focus
- Layered Kernel
- Support for multiple community distros: OpenWRT, ONL/ONIE, Ypctp, and OpenIL

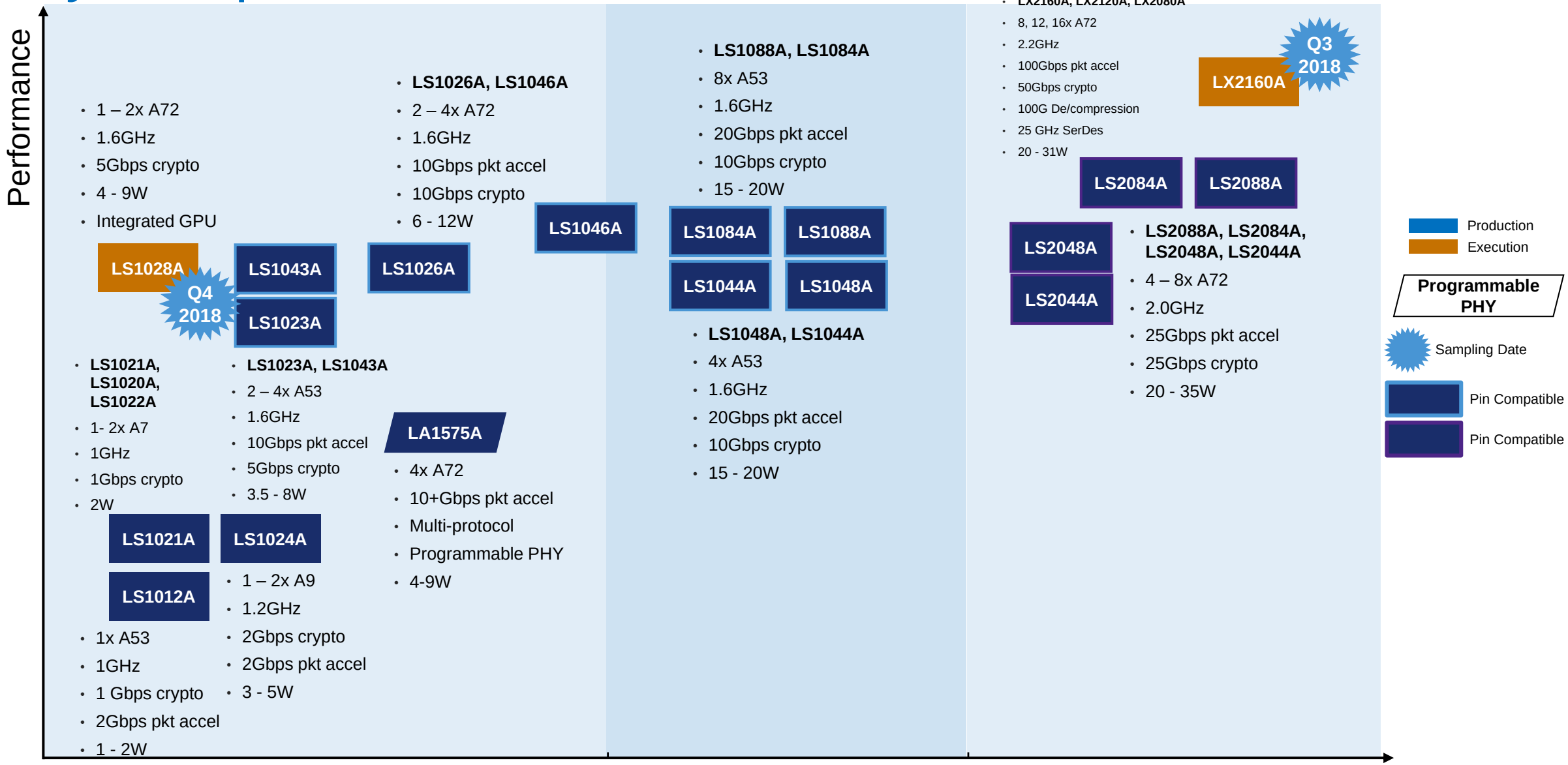
ASK / ADK

- Middleware (ADK): Security offloads, comunication offloads, routing.
- ASK: Complete Solutions – NAS, BHR, Gateways

Custom / Bespoke:

- Custom features, enhancements.
- Use-case specific migration, integration.
- Performance optimizations, hardening.
- Turnkey Hardware + Software Design

Layerscape Series



T-e2v Hi Rel MicroProcessors
Key differentiators

- Based on a 30 years Key Partnership with NXP
  - ✓ Full access to NXP Test Vectors, offering 100% e2v Test coverage
  - ✓ Specific Support (H/W, …)
- Avionics, Aerospace & Defense Grade Solution provider
  - ✓ Mil Temp (-55 +125C) (Extended range option -65 +175C)
  - ✓ Customized Screening : Power, Clock , Temperature
  - ✓ Leaded Packages
- MCM Qormino® Product Line
- Long Term Supply
  - ✓ Lifecycle Management SLIM™ Program
- AS9100 Certified
  - ✓ Aerospace Applications components Manufacturer

Layerscape Series: Scalability and Flexibility
Leverage One Design into Diverse Product Portfolio

Scalable series of **64-bit** ARM-based SoC Families

LS1012A	LS1021A	LS1024A	LS1023A	LS1026A	LS1043A	LS1046A	LS1048A	LS1088A	LS1028A	LS2048A	LS2088A	LX2160A
A53	2x A72	2x A9	2x A53	2x A72	4x A53	4x A72	4x A53	8x A53	4x A72	4x A72	8x A72	16x A72
64-bit ARM 2Gbps Packet 1Gbps Crypto 1-2W	32-bit ARM 2Gbps Pkt 1Gbps Crypt 2W	32-bit ARM 2Gbps Pkt 2Gbps Crypto 3-5W	64-bit ARM 10Gbps Pkt 5Gbps Crypto 3.5-5W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 6-10W	64-bit ARM 10Gbps Pkt 5Gbps Crypto 5-8W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 8-12W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 15-20W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 15-20W	64-bit ARM 5Gbps Crypt Integrated CPU 4- 9W	64-bit ARM 40G Pkt 20G Crypto 20-35W	64-bit ARM 40G Pkt 20G Crypto 20-35W	64-bit ARM 100G Pkt 50G Crypto 20-30W

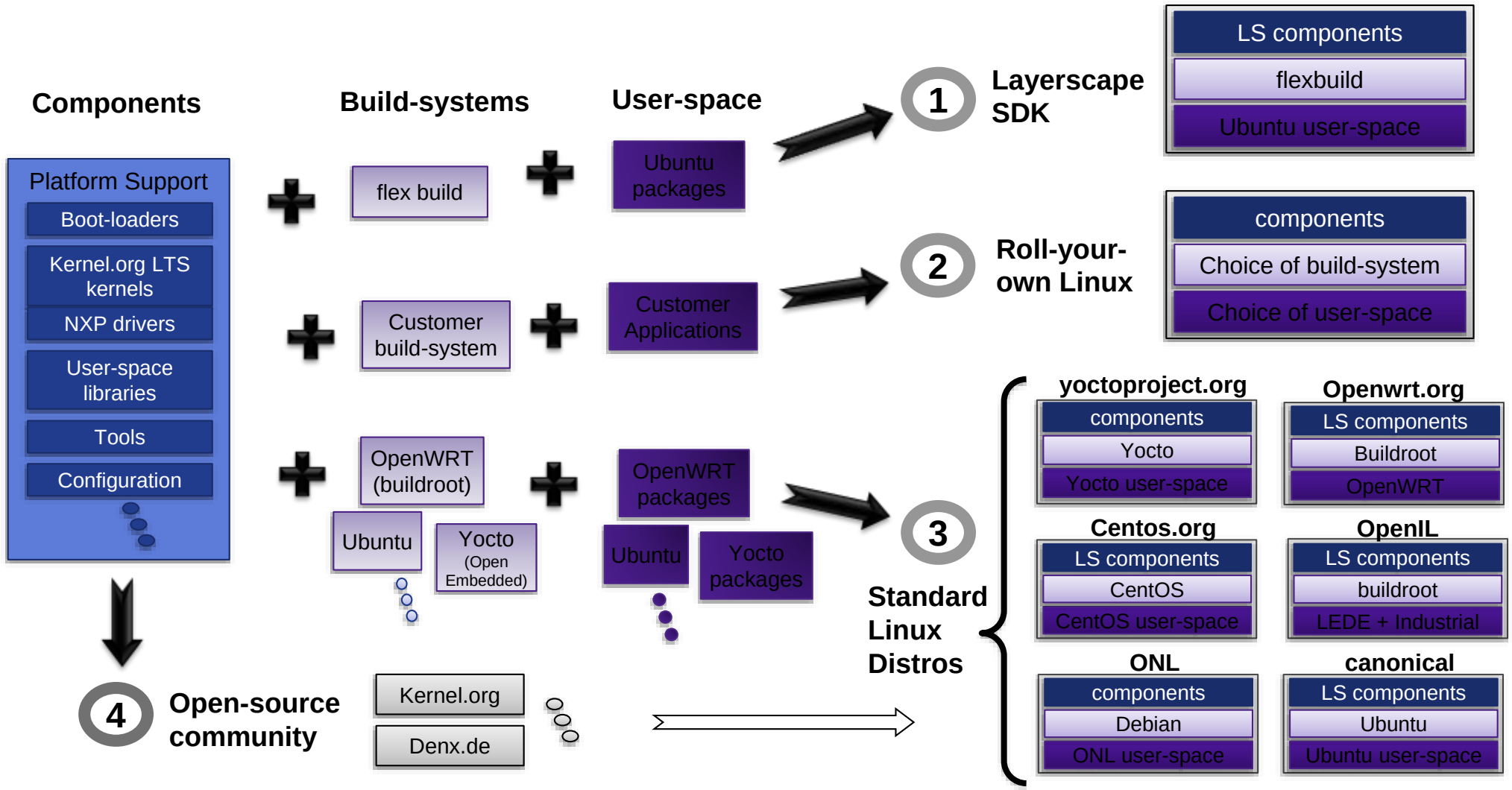
Pin-to-pin Compatible

Pin-to-pin Compatible

Software Compatible

Expanded series for performance, power efficiency and lower BOM

Linux Easy to Choose and Use



OpenIL.org

Hard real-time applications support

Built-in **TSN** and **IEEE1588** Support

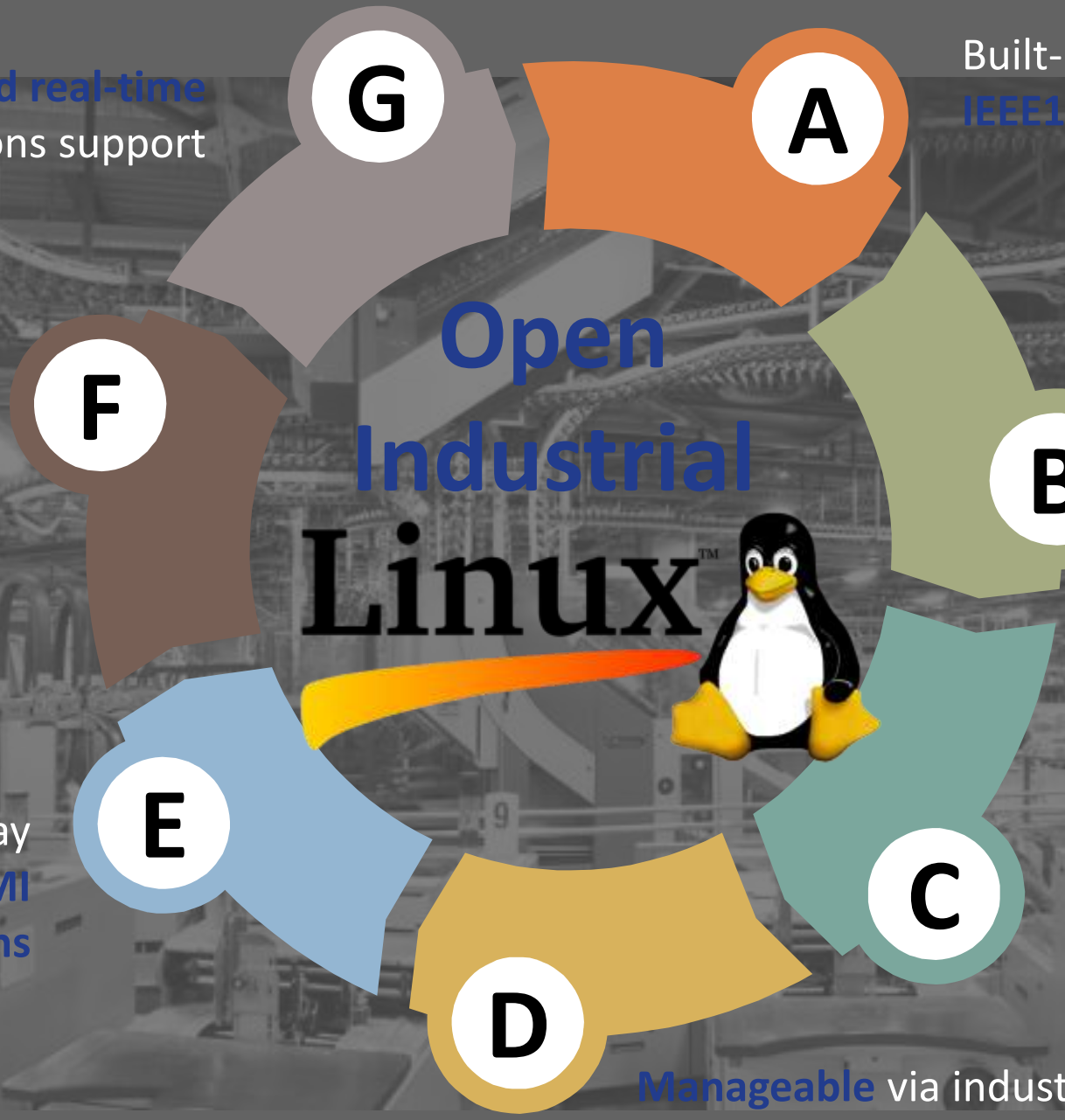
Open Software Repository and Community

Built-in **industrial-grade security**

Built-in graphic display support for **HMI Applications**

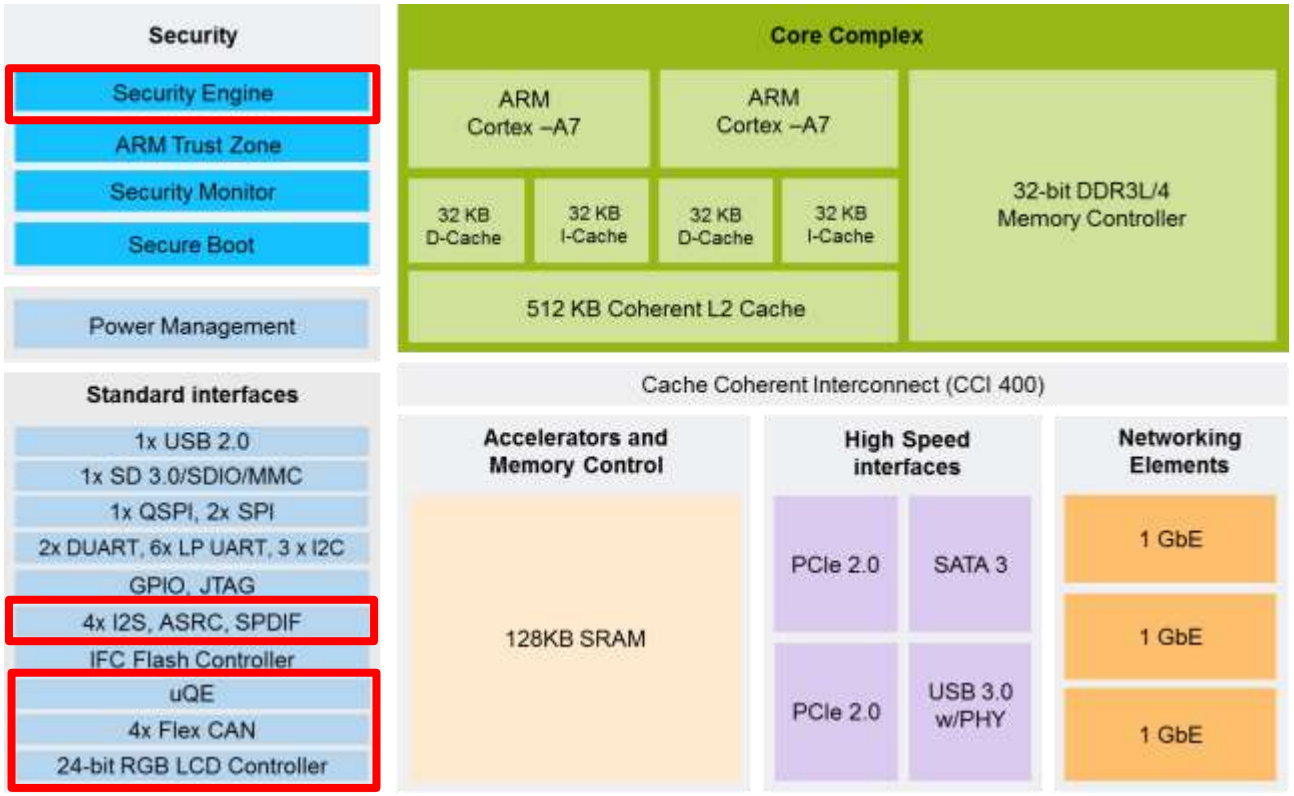
Support for various **industrial networking protocols**

Manageable via industrial control and networking protocols



LS1021A: Dual ARM Cortex A7 Processor

Dual core processor for Industrial control



Target Applications:

- Enterprise AP routers for 802.11ac/n
- Industrial gateways
- Industrial and factory automation
- Printing & Imaging
- Mobile wireless routers
- Building automation
- Smart energy

Development platforms:

- LS1021A-TSN-RD
- **TWR-LS1021A**
- **LS1021A-IoT**

Core complex

- 2x 32-bit Cortex-A7 with Neon SIMD engine
- Speed up to 1200 MHz
- Parity and ECC protected 32 KB L1 instruction and 32 KB L1 data cache
- 512 KB L2 cache with ECC protection

Basic peripheral and Interconnect

- 1x USB 3.0/2.0 controller with integrated PHY
- 1x USB 2.0 controller with ULPI
- 1x eSDHC controllers supporting SD 3.0, eMMC 4.4 and eMMC 4.5 modes
- 4x SAI supporting I2S, ASRC and SPDIF
- 4x FlexCAN ports
- Integrated LCD display (2D-ACE) 24-bit RGB

Networking elements

- 3x three-speed Ethernet MACs supporting 1G, 100M, 10M
- Supports MII, RGMII, SGMII
- Up to 2 x SGMII supporting 1 Gbps
- 2x PCI Express Gen 2 controller
- 1x SATA Gen 3.0 controller

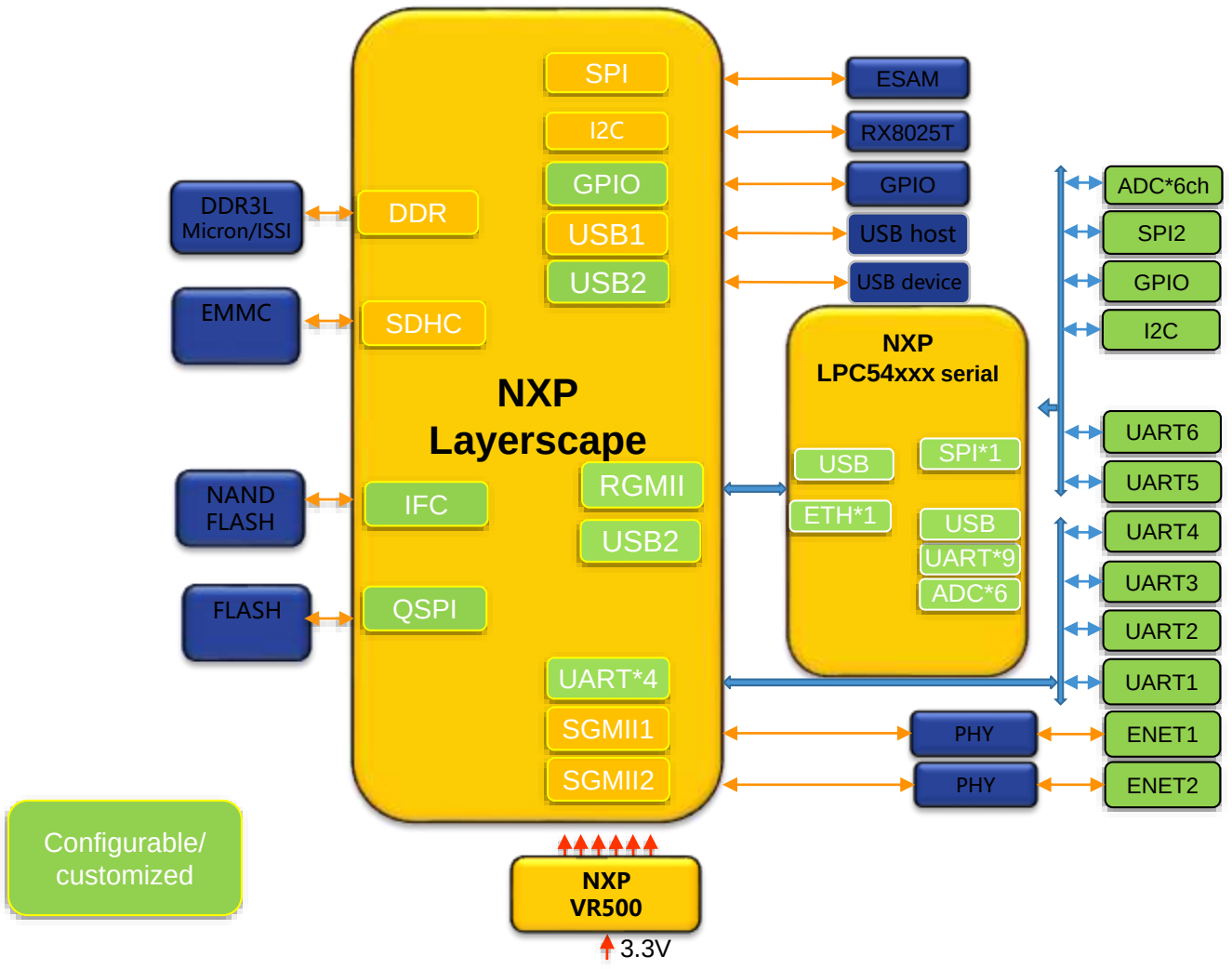
Accelerators and Memory Control

- 1x 32-bit DDR3L/DDR4 Controller up to 1.6 GT/s
- Security Engine (SEC)
- QUICC Engine supports TDM and HDLC
- QorIQ Trust architecture: Secure boot, ARM Trust zone and security monitor

Qualification

- Commercial and extended temperature

Intelligent distribution transformer terminal: Example



Spec peripheral requirements

- Multi core SoC ,CPU frequency >700MHz, DDR>512MB, FLASH>1GB
- 1x wireless 3/4G remote communication module(USB/PCIe)
- 2xRS485, 4xRS485/RS232(From 9600bit/s to 19200bit/s)
- 2xI2C
- 2xSPI
- 2xUSB(host and device)
- 2x 1GE ethernet
- 1xSDHC
- >30GPIO
- Extended temperature conditions (-40C to 70C)
- CPU support Linux + virtual container (>4 containers)
- 4x ADC sample for AC /AV
- Communication protocol including Modbus、DL/T 645、Q/GDW 1376.1、Q/GDW 1376.2、DL/T 634-103/104

LS1021A-IOT-B: Evaluation/Development Platform

LS1021A-IOT-B - $429 Resale

Features

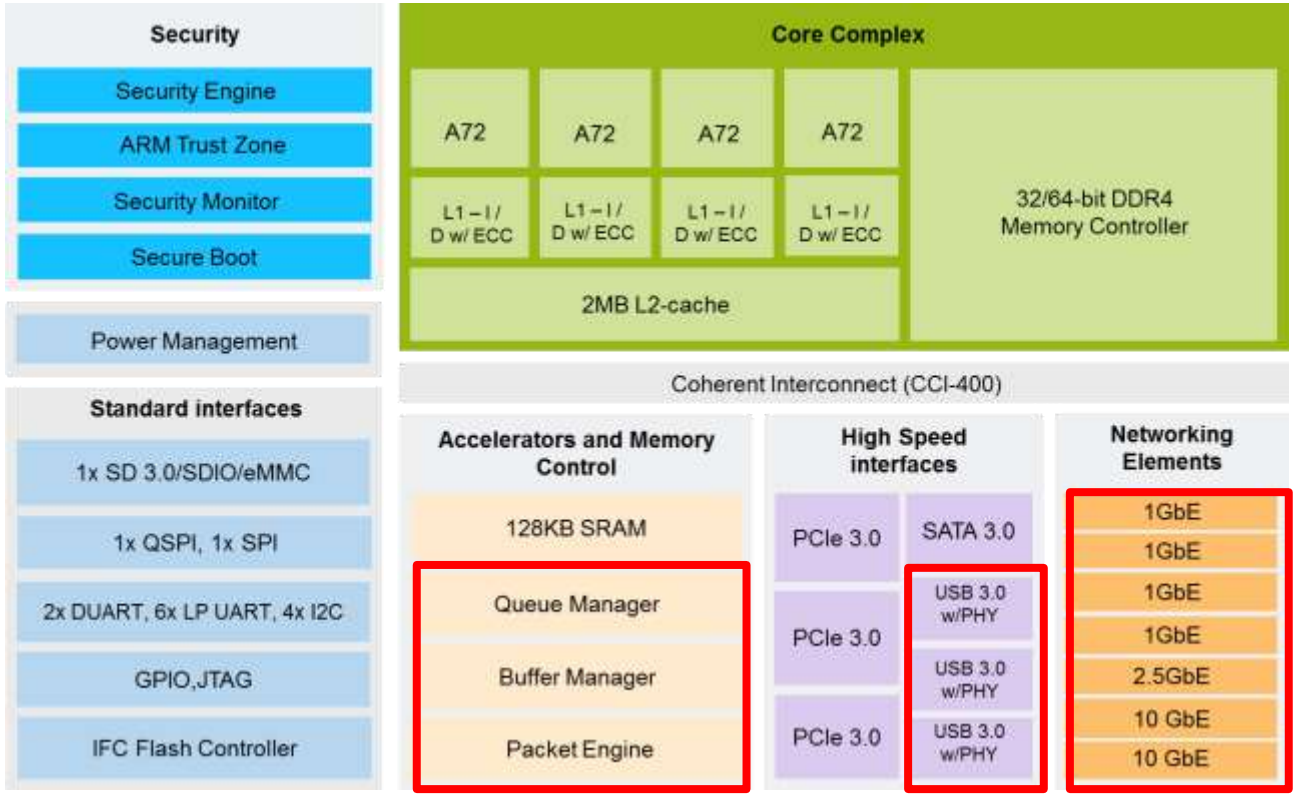
- OpenWRT Support for Gateway/Router/IoT applications
- LS1021A – 1200MHz CPU
- 64 MB serial NOR + 1GB serial NAND QSPI
- 4 GB eMMC Flash
- 1 GB DDR3L SDRAM
- MC34VR500 Power Management IC
- Dual 1000Base-T Ethernet interfaces with RJ-45 connectors
- USB3.0 – 2 ports USB-A
- mSATA3.0 slot
- Dual MiniPCIe connectors
- 13 GPIO or 8 FTM (PWM)
- 10-pin JTAG connector
- Arduino Shield header for expansion
- KW40 MCU
- Gyro Sensor
- Accelerometer + Magnetometer Sensor

Demos:

- TSN Demo

LS1046A: Quad ARM Cortex A72 Processor

1st Value Tier A72 ARM for gateways and routers



Target Applications:

- Enterprise routers and switches
- Line card controllers
- Network attached storage
- Security appliances
- Virtual customer premise equipment (vCPE)
- Service provider gateways
- Single board computers

Development platforms:

- LS1046A-RDB

Core complex

- 4x 32/64-bit Cortex-A72 with Neon SIMD engine
- Speed up to 1800 MHz
- Parity and ECC protected 48 KB L1 instruction and 32 KB L1 data cache
- 2 MB L2 cache with ECC protection

Basic peripheral and Interconnect

- 3x USB 3.0 controllers with integrated PHY
- 1x eSDHC controllers supporting SD 3.0, and eMMC 4.5 modes

Networking elements

- Packet parsing, classification, and distribution
- Queue Management for scheduling, packet sequencing and congestion management
- Hardware buffer management for buffer allocation and de-allocation
- Up to five SGMII supporting 1 Gbps
- Up to three SGMII supporting 2.5 Gbps
- Up to two XFI supporting 10 Gbps
- Up to one QSGMII
- 3x PCI Express Gen 3 controller
- 1x SATA Gen 3.0 controller

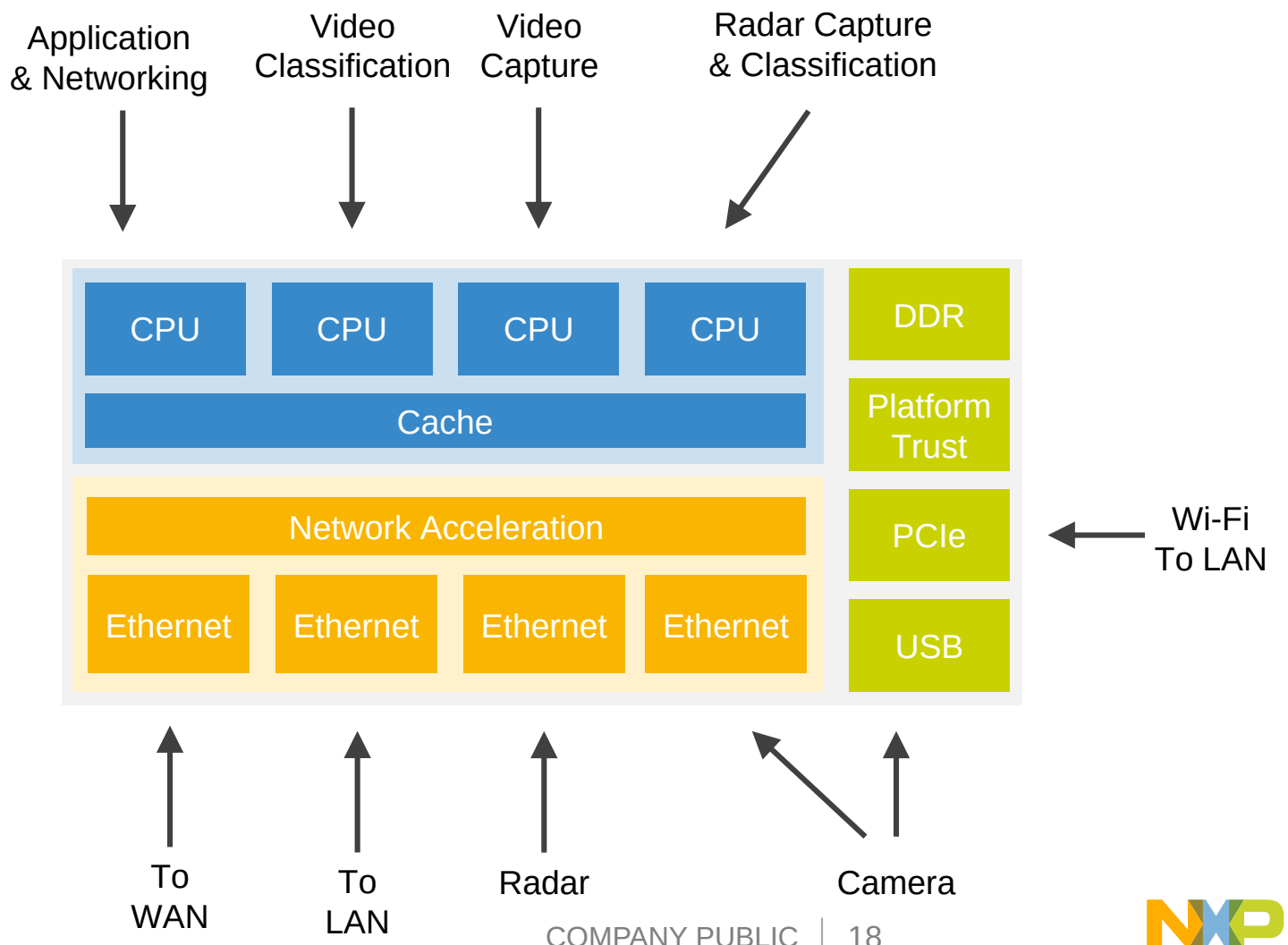
Accelerators and Memory Control

- 1x 32-bit DDR4 Controller with ECC support up to 2.1 GT/s
- Security Engine (SEC)
- QorIQ Trust architecture: Secure boot, ARM Trust zone and security monitor

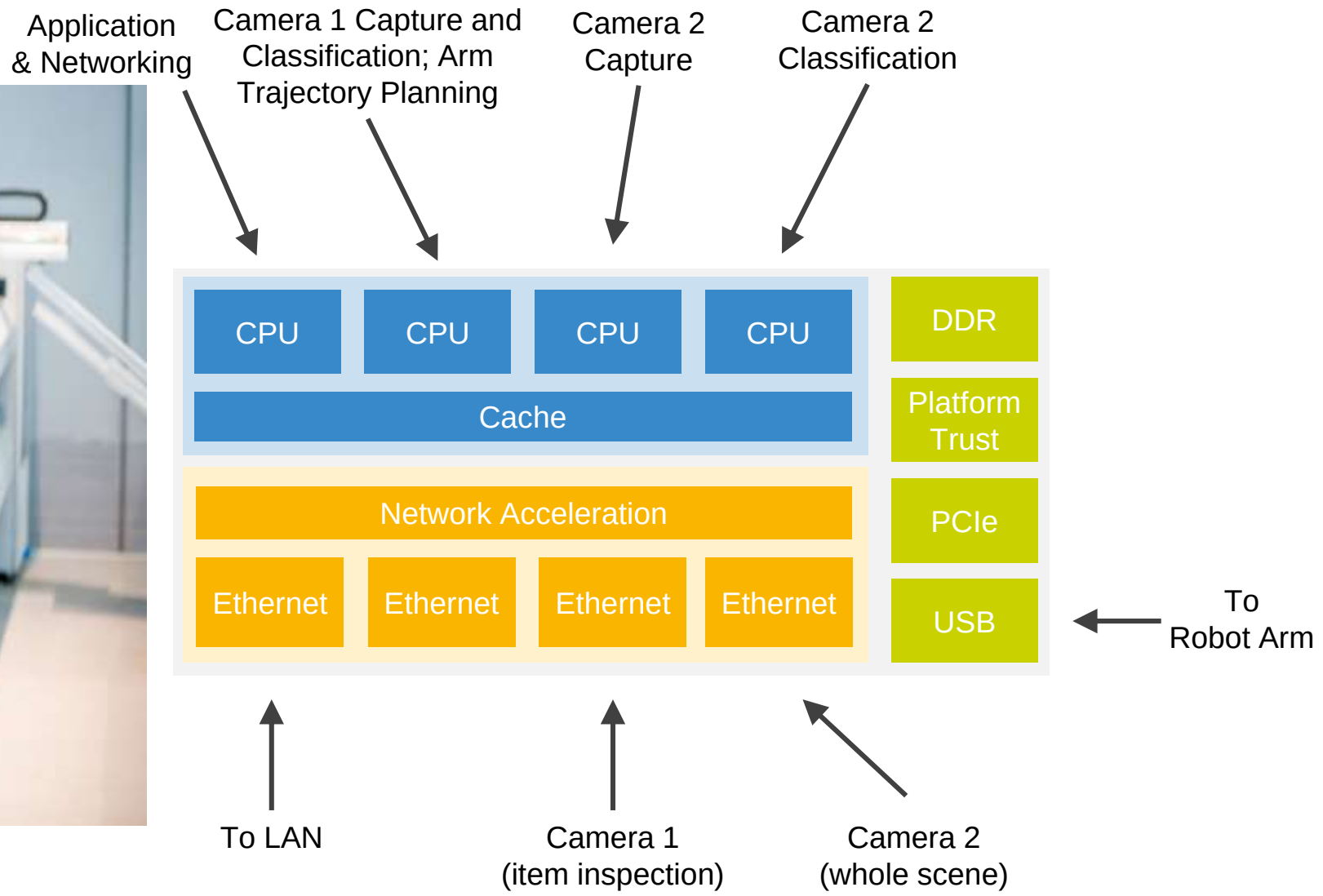
Qualification

- Commercial and extended temperature

Example: Mapping Home Automation and Safety to Layerscape LS1046



Example: Mapping Robot Arm Picker to Layerscape LS1046



LS1046A-RDB: QorIQ® LS1046A Reference Design Board

Features

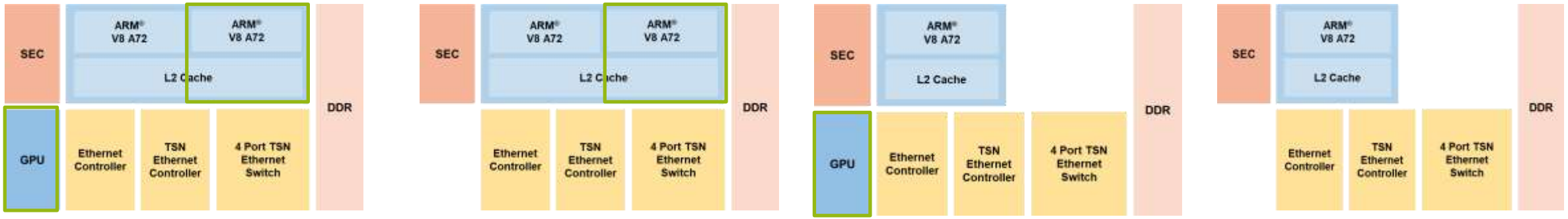
- Four 32/64-bit ARM(R) Cortex(R)V8 A72 CPUs, up to 1.6 GHz core speed
- Provides one 288-pin DDR4 DIMM connector
- DIMM connector supports unbuffered X72 8 GB dual rank
- SDHC port connects directly to an adapter card slot, featuring 4 GB eMMC memory device
- One 512 MB SLC NAND flash with ECC support (1.8 V)
- Two USB 3.0 controllers with integrated PHYs
- One USB1 3.0 port is connected to a Type A host connector
- Supports SGMII 1G PHYs at Lane 2 and Lane 3
- Supports SFP+module with XFI retimers
- Supports AQR106/107 10G PHY with XFI/2.5G SGMII
- Mini PCIe express x1 (Gen1/2/3)card
- Standard PCIe x1 (Gen1/2/3) card
- Standard PCIe x1 (Gen1/2/3) card
- One SATA 3.0 connector

Coming soon

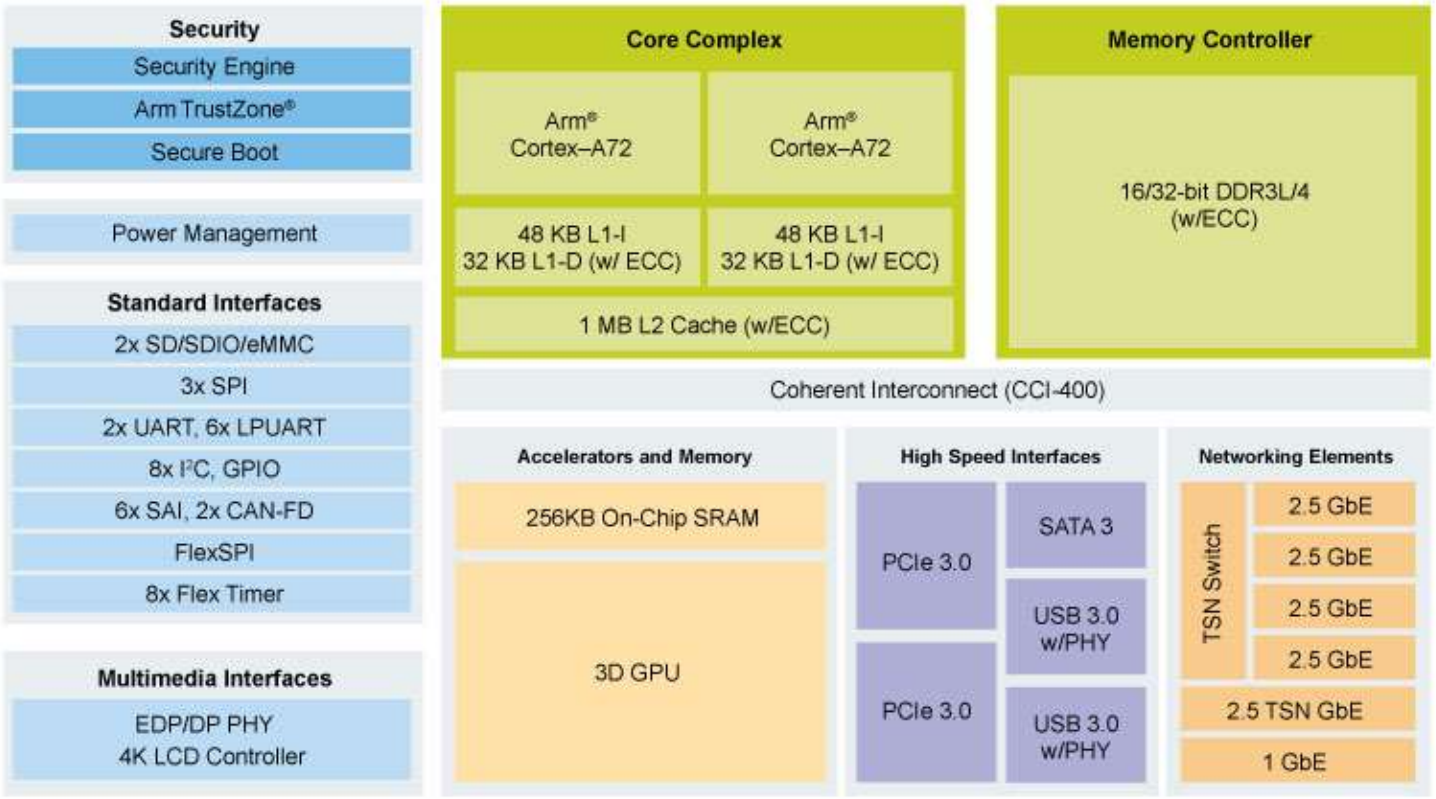
LS1028A Family of Devices

LS1028A Family

LS1028A	LS1027A	LS1018A	LS1017A
• 2x A72 • Graphics – 3D GPU, 4K, DisplayPort PHY • 4x 2.5 GbE Switched Ethernet • 2.5 GbE Ethernet Controller • 2x PCIe 3.0	• 2x A72 • 4x 2.5 GbE Switched Ethernet • 2.5 GbE Ethernet Controller • 2x PCIe 3.0	• 1x A72 • Graphics – 3D GPU, 4K, DisplayPort PHY • 4x 2.5 GbE Switched Ethernet • 2.5 GbE Ethernet Controller • 2x PCIe 3.0	• 1x A72 • 4x 2.5 GbE Switched Ethernet • 2.5 GbE Ethernet Controller • 2x PCIe 3.0



LS1028A: Dual ARM Cortex A72 Processor



Target Applications:

- Industrial Control, PLCs, Gateways
- Automotive
- Professional Audio/Video
- IoT Gateways
- Human Machine Interface

Samples

- Alpha – July -2018
- Beta – Aug – 2018
- General – Oct - 2018

Core complex

- 2x 64-bit Cortex-A72 with Neon SIMD engine
- Speed up to 1300 MHz
- Parity and ECC protected 32 KB L1 instruction and 32 KB L1 data cache
- 1 MB L2 cache with ECC protection

Basic peripheral and Interconnect

- 2x USB 3.0 controllers with integrated PHY
- 2x eSDHC controllers supporting SD/SDIO 4.0
- 2x CAN-FD controllers
- 8x UART serial ports

Networking elements

- Four Port TSN Ethernet Switch
- Up to four SGMII supporting 1 Gbps
- Up to one USXGMII supporting 2.5 Gbps
- Up to one QSGMII
- 2x PCI Express Gen 3 controllers
- 1x SATA Gen 3.0 controller

Accelerators and Memory Control

- 1x 16/32-bit DDR3L/4 Controller with ECC support up to 1.6 GT/s
- Time Sensitive Networking (TSN) Ethernet Switch
- Auto Respond
- Security Engine (SEC)
- QorIQ Trust architecture: Secure boot, ARM Trust zone and security monitor

Qualification

- Commercial and extended temperature (support for 125C Tj)

Package

- 17x17mm, 0.75mm pitch FC-PBGA

Power

- 5W TDP

Layerscape Series: Scalability and Flexibility
Leverage One Design into Diverse Product Portfolio

Scalable series of **64-bit** ARM-based SoC Families

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A53	2x A72	2x A9	2x A53	2x A72	4x A53	4x A72	4x A53	8x A53	4x A72	4x A72	8x A72	16x A72
64-bit ARM 2Gbps Packet 1Gbps Crypto 1-2W	32-bit ARM 2Gbps Pkt 1Gbps Crypto 2W	32-bit ARM 2Gbps Pkt 2Gbps Crypto 3-5W	64-bit ARM 10Gbps Pkt 5Gbps Crypto 3.5-5W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 6-10W	64-bit ARM 10Gbps Pkt 5Gbps Crypto 5-8W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 8-12W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 15-20W	64-bit ARM 20Gbps Pkt 10Gbps Crypto 15-20W	64-bit ARM 5Gbps Crypto Integrated GPU 4- 9W	64-bit ARM 40G Pkt 20G Crypto 20-35W	64-bit ARM 40G Pkt 20G Crypto 20-35W	64-bit ARM 100G Pkt 50G Crypto 20-30W

Pin-to-pin Compatible

Pin-to-pin Compatible

Software Compatible

Expanded series for performance, power efficiency and lower BOM

LX2160 Family of Devices

LX21xxA Family

LX2160A

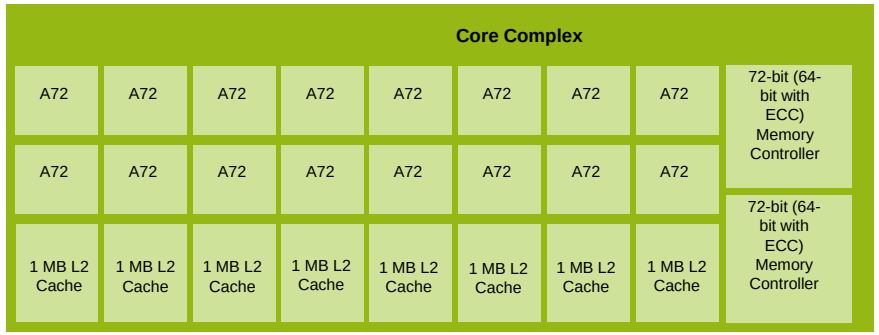
- 16x A72
- 8 MB Cache
- 6x PCIe Gen4
- 2x DDR4 3200 MT/s
- 130Gbps, 2x 40/50/100GE + 16x 1/2.5/10/25GE WRIOP
- 50 Gbps SEC
- 100 Gbps DCE
- 30W Thermal VDD power

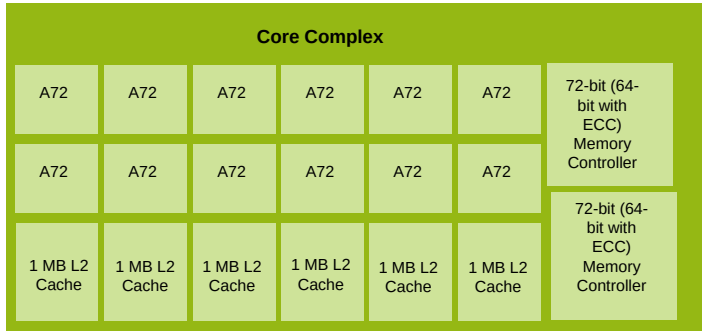
LX2120A

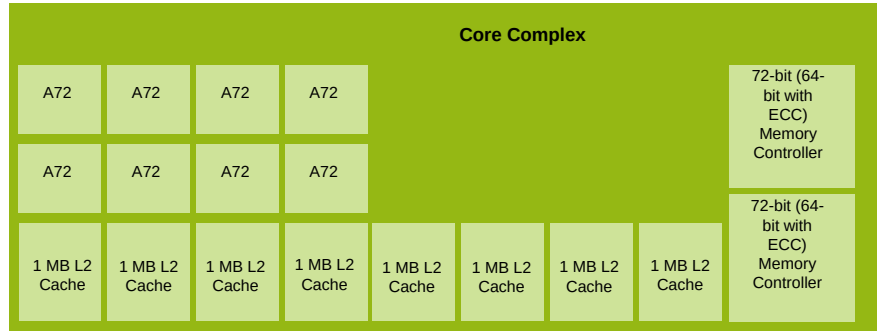
- 12x A72
- 6 MB Cache
- 6x PCIe Gen4
- 2x DDR4 3200 MT/s
- 130Gbps, 2x 40/50/100GE + 16x 1/2.5/10/25GE WRIOP
- 50 Gbps SEC
- 100 Gbps DCE
- 27W Thermal VDD power
-

LX2080A

- 8x A72
- 8 MB Cache
- 6x PCIe Gen4
- 2x DDR4 3200 MT/s
- 130Gbps, 2x 40/50/100GE + 16x 1/2.5/10/25GE WRIOP
- 50 Gbps SEC
- 100 Gbps DCE250W Thermal VDD power

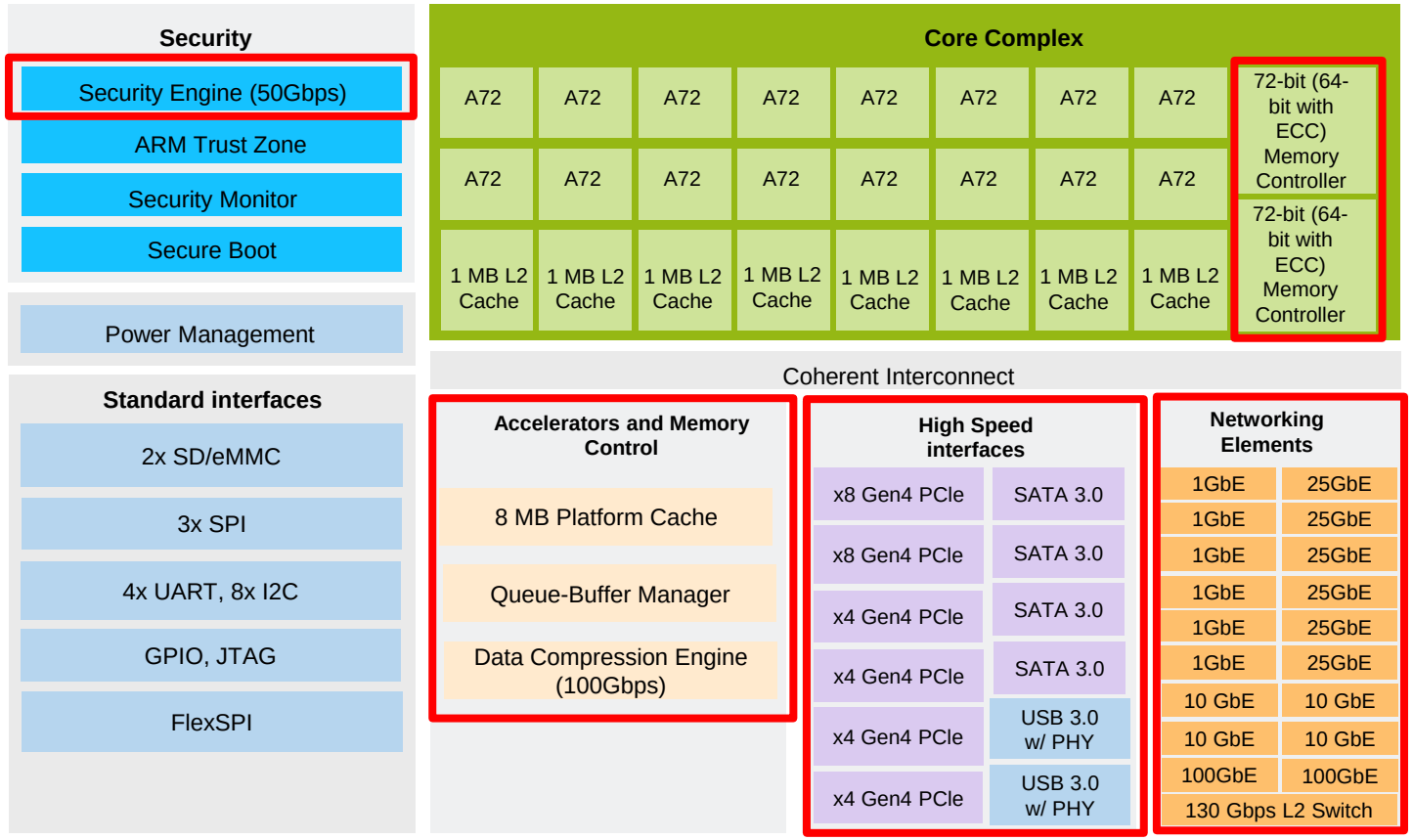






LX2160: ARM Cortex A72 Processor

Full Featured Highly Flexible Platform: 8-16 A72 Cores High Performance Packet Offload Engines



Core complex

- 16x 64-bit Cortex-A72 with Neon SIMD engine
- CPU Speed up to 2200 MHz
- Parity and ECC protected 48 KB L1 instruction and 32 KB L1 data cache
- 1 MB L2 cache with ECC protection/Cluster
- 8 MB Platform Cache

Basic peripheral and Interconnect

- 2x USB 3.0 controllers with integrated PHY
- 2x eSDHC controller supporting SD 3.0 and eMMC 4.5 modes

Networking elements

- Packet parsing, classification, and distribution
- Queue Management for scheduling, packet sequencing and congestion management
- Hardware buffer management for buffer allocation and de-allocation
- Data compression
- Data Center Bridging Support (iSCSI), TLV, DCBx, ETS(802.1Qaz), PFC(802.1Qbb)
- L2 Switching with 1G, 2.5G, 10G, 25G, 40G, 50G and 100G Ethernet
- Up to two RGMII interfaces
- 6x PCI Express Gen 4 controllers (2 with SR-IOV support)
- 4x SATA Gen 3.0 controllers

Accelerators and Memory Control

- 2x 64-bit DDR4 Controller with ECC support up to 3.2 GT/s
- Security Engine (SEC)
- QorIQ Trust architecture: Secure boot, ARM Trust zone and security monitor

Package & Qualification

- 16nm FinFet Compact
- 40 x 40mm Flip chip, 1mm pitch, 1517 pins
- Estimated Power 30W VDD (thermal) at 105C, 2.2GHz
- Commercial and Industrial temperature
- AEC-Q100 Grade 3 reliability stresses

LX2160 SerDes Table – Choose each bank independently

	SERDES1 (x8)							
	0	1	2	3	4	5	6	7
	H	G	F	E	D	C	B	A
1	PCIe.1 x4				PCIe.2 x4			
2	SGMII.3	SGMII.4	SGMII.5	SGMII.6	PCIe.2 x4			
3	USXGMII / XFI.3	USXGMII / XFI.4	USXGMII / XFI.5	USXGMII / XFI.6	PCIe.2 x4			
4	SGMII.3	SGMII.4	SGMII.5	SGMII.6	SGMII.7	SGMII.8	SGMII.9	SGMII.10
5	PCIe.1 x4				USXGMII / XFI.7	USXGMII / XFI.8	USXGMII / XFI.9	USXGMII / XFI.10
6	USXGMII / XFI.3	USXGMII / XFI.4	SGMII.5	SGMII.6	SGMII.7	SGMII.8	SGMII.9	SGMII.10
7	USXGMII / XFI.3	USXGMII / XFI.4	USXGMII / XFI.5	USXGMII / XFI.6	SGMII.7	SGMII.8	SGMII.9	SGMII.10
8	USXGMII / XFI.3	USXGMII / XFI.4	USXGMII / XFI.5	USXGMII / XFI.6	USXGMII / XFI.7	USXGMII / XFI.8	USXGMII / XFI.9	USXGMII / XFI.10
9	PCIe.1 x1	SGMII.4	SGMII.5	SGMII.6	PCIe.2 x1	SGMII.8	SGMII.9	SGMII.10
10	PCIe.1 x1 (gen 1,2)	USXGMII / XFI.4	USXGMII / XFI.5	USXGMII / XFI.6	PCIe.2 x1 (gen 1,2)	USXGMII / XFI.8	USXGMII / XFI.9	USXGMII / XFI.10
11	PCIe.1 x2		SGMII.5	SGMII.6	PCIe.2 x2		SGMII.9	SGMII.10
12	PCIe.1 x4				PCIe.2 x2		SGMII.9	SGMII.10
13	100GE.1				100GE.2			
14	100GE.1				PCIe.2 x4			
15	50GE.1		50GE.2		PCIe.2 x4			
16	50GE.1		25GE.5	25GE.6	PCIe.2 x4			
17	25GE.3	25GE.4	25GE.5	25GE.6	PCIe.2 x4			
18	USXGMII / XFI.3	USXGMII / XFI.4	25GE.5	25GE.6	USXGMII / XFI.7	USXGMII / XFI.8	USXGMII / XFI.9	USXGMII / XFI.10
19	USXGMII / XFI.3	USXGMII / XFI.4	25GE.5	25GE.6	40GE.2			
20	40GE.1				40GE.2			
21	25GE.3	25GE.4	25GE.5	25GE.6	PCIe.2 x2		25GE.9	25GE.10
22	USXGMII / XFI.3	USXGMII / XFI.4	USXGMII / XFI.5	USXGMII / XFI.6	PCIe.2 x2		USXGMII / XFI.9	USXGMII / XFI.10

	SERDES2 (x8)							
	0	1	2	3	4	5	6	7
	A	B	C	D	E	F	G	H
1	PCIe.3 x2 (gen1, Gen2)		SATA.1	SATA.2	PCIe.4 x4 (gen 1,2)			
2	PCIe.3 x8							
3	PCIe.3 x4				PCIe.4 x4			
4	PCIe.3 x4 (gen 1,2)				PCIe.4 x2 (gen 1,2)		SATA.1	SATA.2
5	PCIe.3 x4				SATA.3	SATA.4	SATA.1	SATA.2
6	PCIe.3 x4 (gen 1,2)				SGMII.15	SGMII.16	USXGMII / XFI.13	USXGMII / XFI.14
7	PCIe.3 x1 (gen1, 2)	SGMII.12	SGMII.17	SGMII.18	PCIe.4 x1 (gen 1,2)	SGMII.16	USXGMII / XFI.13	USXGMI / XFI.14
8	X	X	SATA.1	SATA.2	SATA.3	SATA.4	USXGMII / XFI.13	USXGMII / XFI.14
9	SGMII.11	SGMII.12	SGMII.17	SGMII.18	SGMII.15	SGMII.16	SGMII.13	SGMII.14
10	SGMII.11	SGMII.12	SGMII.17	SGMII.18	PCIe.4 x4			
11	PCIe.3 x1	SGMII10	SGMII.17	SGMII.18	PCIe.4 x1	SGMII.16	SGMII.13	SGMII.14
12	SGMII.11	SGMII.12	SGMII.17	SGMII.18	PCIe.4 x2 (gen 1,2)		SATA1	SATA2
13	PCIe.3 x4				PCIe.4 x2		SGMII.13	SGMII.14
14	PCIe.3 x2		SGMII.17	SGMII.18	PCIe.4 x2		SGMII.13	SGMII.14

	SERDES3 (x8)							
	0	1	2	3	4	5	6	7
	A	B	C	D	E	F	G	H
1	PCIe.5 x8							
2	PCIe.5 x4				PCIe.6 x4			

NXP Value Proposition

Hardware

- Scalable and pin compatible solutions
- Tj 125° (LS1028 family, LS1043)
- Power dissipation (3W to 13W)
- Industrial I/O (CAN /UART)

Performance

- Cortex A72, A53
- Low latency DDR
- Large L2 Cache
- Real-Time Operating Systems
- Optimized Low Latency Performance

Ecosystem

- OpenIL (Industrial Linux SDK)
- Xenomai (RTOS performance on Linux)
- Sysgo OS
- Greenhills OS
- QNX
- VxWorks
- EBS vendors specializing in railway market

Commitment to Industrial Requirements

- Supply Longevity Program
- Certification Support
- Software Priority Support
- Product Qualification (FIT, MTBF)

Agenda

- Layerscape target market & application
- Roadmap update
- LX2160 (8,12,16 cores) + LS1028 (A72 + TSN)

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