Welcome!
Texas Instruments New Product Update

- This webinar will be recorded and available at www.ti.com/npu
- Phone lines will be muted
- Please post questions in the chat or contact your sales person or field applications engineer

New Product Update:

Real-time computing with web services with new cost optimized AM64x Sitara Processors

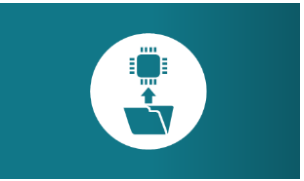
Srik Gurrapu

02/18/2021

Webinar | Agenda

- Top industry4.0 trends
  - Processing requirements
  - Sitara processor family and introduction of AM64x
- AM64x product details
  - Block diagram and different variants
  - Evaluation Module
  - Collateral available
- Target applications
  - AM64x value proposition
- Call to action

Why TI for Processors?



Single Scalable Platform

Scalability across single to multicore Processors and control MCUs through a **unified software platform**, optimal SoC solutions for multiple end markets, from Sensor to Cloud and Industrial to Automotive

Continuous Innovation

System BOM optimized single to multicore heterogeneous architectures, security, on-chip DSP and hardware accelerators, ICSS, analytics accelerators, unique IP, performance entitlement (systems expertise)

Support & Community

Industry-leading forum support, on-demand training on ti.com, **Main Line open-source Linux** and Embedded community, robust platform software and applications, analytics & motion control software packages enabling reduced time to market for customers

Quality Reliability & Longevity

100K power on hours for Industrial, Q100 Automotive certifications, standards compliance, ECC, Low SER and FIT rates, and Safety and Security. Industry expertise gained from 30+ years shipping DSPs & SoCs, ability to support 10+ year systems.

Processors | overview

Scalable, cost-optimized portfolio with accelerators, analog integration, robust connectivity, security and functional safety designed for automotive and industrial markets

SoCs

Single-core to quad-core **Arm Cortex-A53** and **A72 cores**	**Compute**	**Control** Dual-core to quad-core **Arm Cortex-R5F** with optional Lock-Step support
Secure-boot, run-time security, tamper protection and **high-security modules**	**Safety & Security**	**Analog** High-level integration of high-performance **ADC, DAC, comparators** and **PWM**
Power-optimized **neural network accelerators, audio DSP,** and **GPU**	**Deep Learning & Accelerators**	**Connect** **USB3, PCIe Switch, Ethernet Switch, Industrial Protocols, CAN-FD,** and more
Open source device enablement for **Mainline Linux, RTOS** and **Bare Metal** 3P software support – **AUTOSAR**, **QNX**, …	**Unified Software Platform**	Simplified tools (**SysConfig**) and libraries (**DSPLIB**, **TIDL, ...**) to accelerate development and performance entitlement

Power-optimized design | **ASIL-B/D and SIL2 functional safety** | **-40 to 125C temperature range** | **Q100 automotive qualified options**

Scalable platform with common software development kit and pin-to-pin compatibility in common packages

Industry 4.0 Market Trends | Processing Needs

Edge Nodes e.g., Remote I/O, drives
- Sensors/Actuators
- Connectivity

Networking
MCUs with deterministic connectivity

Time-critical control
- Low Latency
- Low jitter

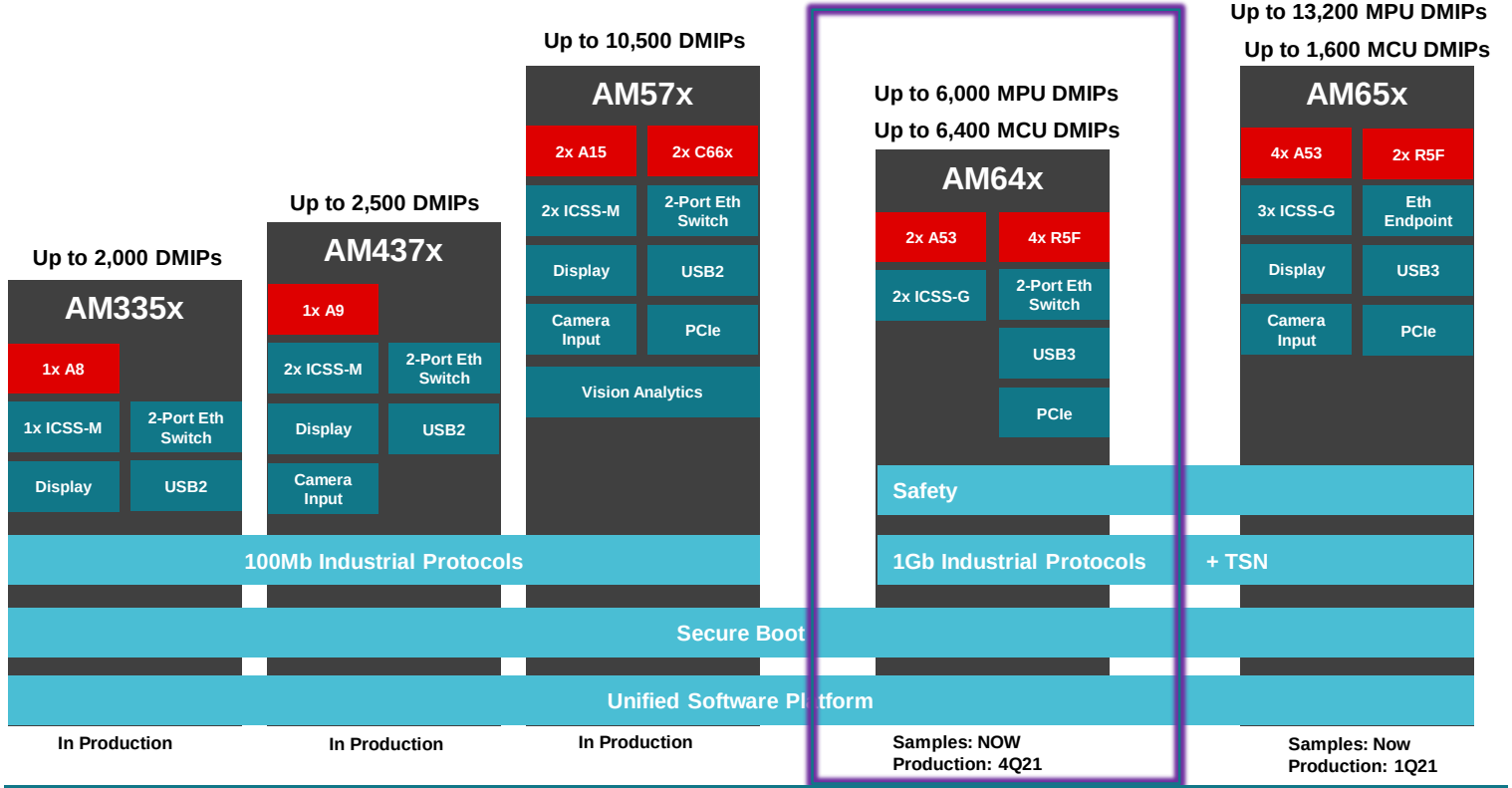
Real-time Compute
Isolate/Deliver time critical functions

Services e.g., Gateway, PLC
- Remote Diagnostics
- Predictive maintenance

Linux
OS and Web server

AM64xx: A **real-time** MPU platform with **low-latency control** and **networked services**

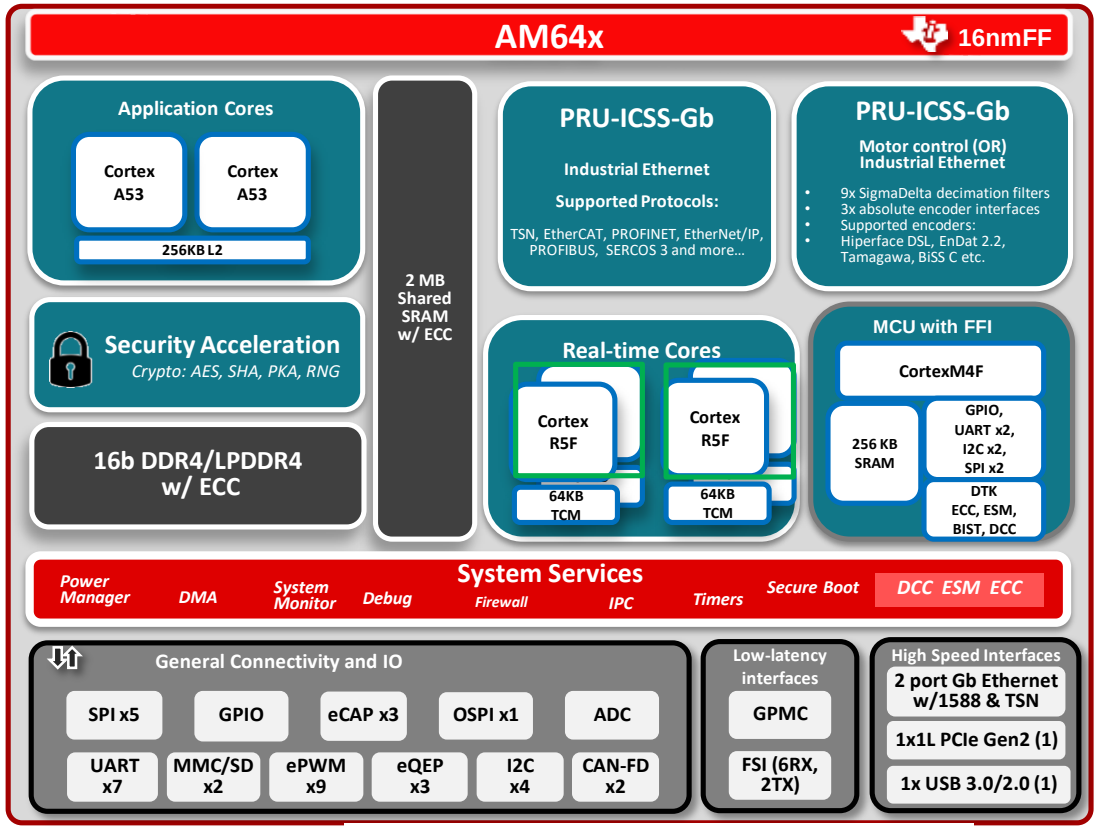
Processors scalable portfolio | AM64x positioning



AM64x: power and cost optimized for broad industrial applications

AM64x Cortex®-A53 based processors

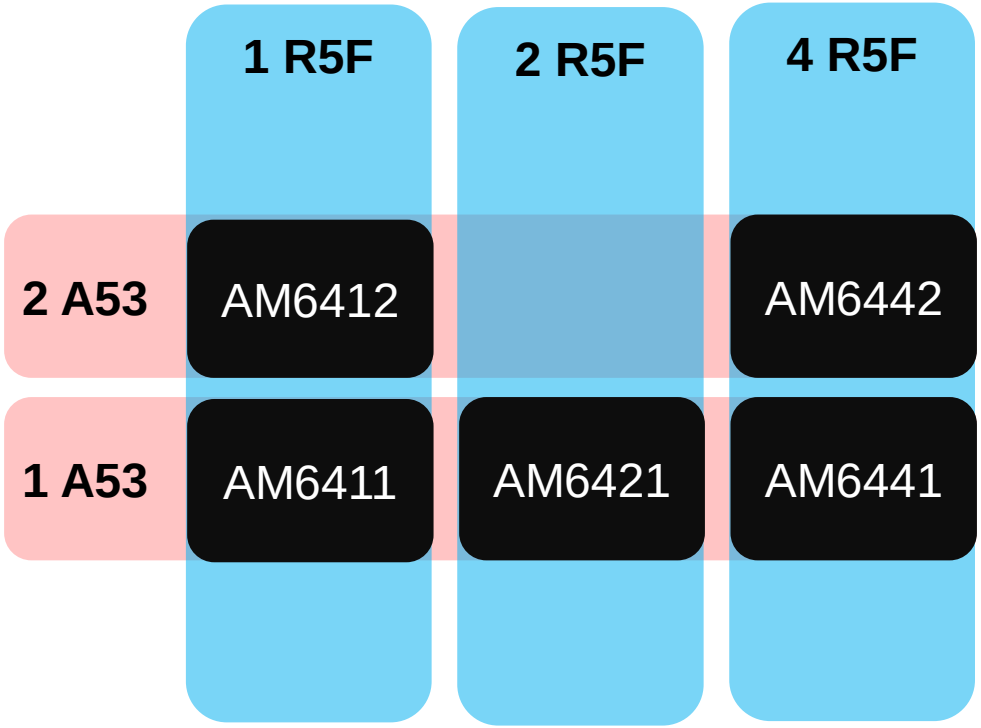
- **Cores & Memory**
  - Dual Cortex-A53 up to 1GHz (6K DMIPS)
  - Dual or Quad Cortex-R5F up to 800MHz (6.4K DMIPS)
  - >2MB on-chip SRAM
  - ECC on all critical memories
  - 16b LPDDR4/DDR4 controller with **inline** ECC, 1600 MT/s
- **Functional safety features**
  - 400MHz Cortex-M4F subsystem with **freedom from interference** (FFI) from rest of SoC for Safety monitoring
    - Dedicated Peripherals I2C, SPI, UART & GPIO
    - Tightly coupled memory of 256KB
  - Diagnostic tool kit for entire SoC voltage, temp, clock, ECC monitors and Error signaling
- **2xPRU-ICSS-Gb**
  - Enables up to 2x Gb industrial Ethernet protocols
  - 1x industrial Ethernet protocol + motor control current and position feedback
- **Peripheral / IO Highlight**
  - GPMC (32b parallel bus) and FSI (serial connection for use with TI's C2000 MCUs) offer low-latency interfaces to motor control front-end
  - PCIe Gen2, USB3.0/2.0, and 2-port Gb Ethernet Switch CPSW provide high-speed (Gbps) connectivity options
  - RS485 support on UART
  - Octal/Quad-SPI with execution-in-place support
- **Integrated analog**
  - 8-channel, 12-bit ADC with 4 MSPS
  - Simplified power solution, Integrated Voltage Monitors and SD card LDO
- **Package**
  - 17.2 x 17.2mm, 0.8mm ball pitch



(1) PCIe and USB 3.0 share the same SERDES

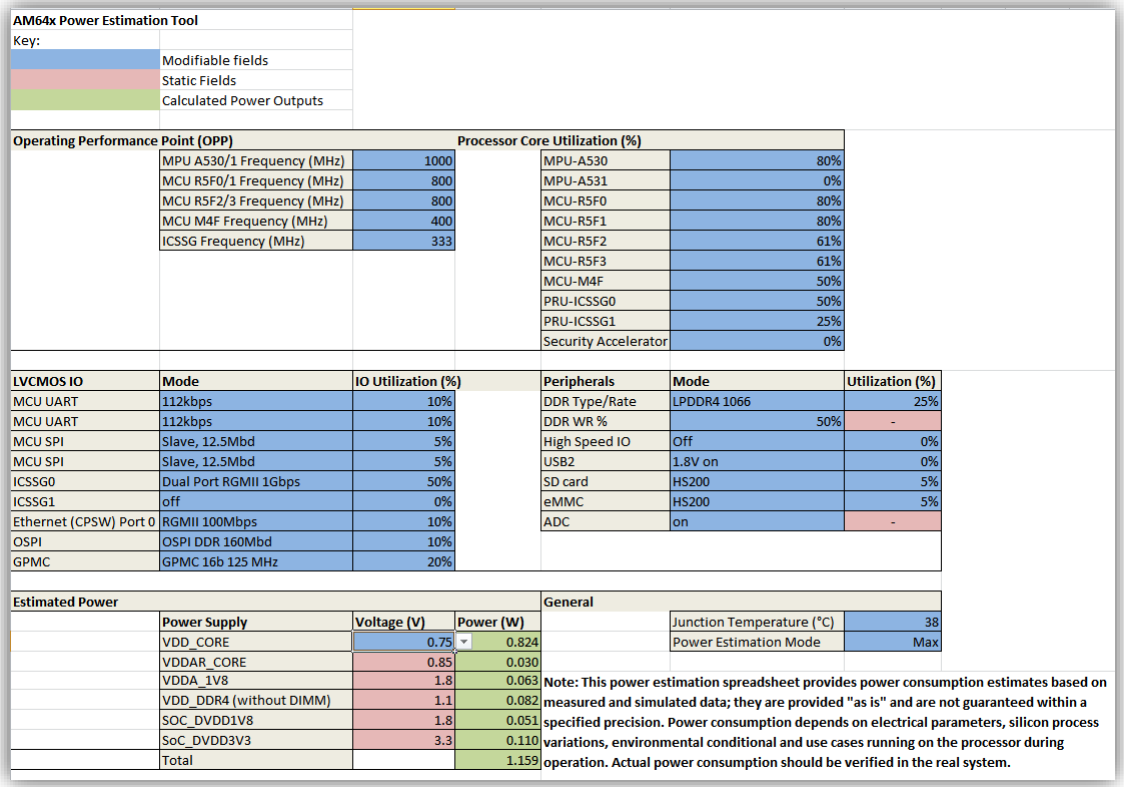
AM64x Family Overview

- **Scalable:**
  - Spans a broad range of performance levels to enable pin-to-pin scalable platforms
- **Industrial / Automotive:**
  - All devices are rated for -40 to 125C junction temperature support
  - 100K Power-on-hours @ 105C
  - 20K Power-on-hours with Auto temperature profile
  - Optional EtherCAT and functional safety enablement
- All devices are in a 17.2mm x 17.2mm package
- Secure boot available
- Target of <1-2W power consumption



AM64x Power Estimation Tool

- The power estimation spreadsheet provides power consumption estimates based on measured and simulated data.
- Users can estimate device power consumption at different electrical parameters, silicon process variations, environmental conditions, and uses cases running on the processor during operation.
- The spreadsheet can be downloaded from: https://www.ti.com/lit/zip/sprm779



AM64x Power Estimation Tool

Key:

	Modifiable fields
	Static Fields
	Calculated Power Outputs

Operating Performance Point (OPP)	
MPU A530/1 Frequency (MHz)	1000
MCU R5F0/1 Frequency (MHz)	800
MCU R5F2/3 Frequency (MHz)	800
MCU M4F Frequency (MHz)	400
ICSSG Frequency (MHz)	333

Processor Core Utilization (%)	
MPU-A530	80%
MPU-A531	0%
MCU-R5F0	80%
MCU-R5F1	80%
MCU-R5F2	61%
MCU-R5F3	61%
MCU-M4F	50%
PRU-ICSSG0	50%
PRU-ICSSG1	25%
Security Accelerator	0%

LVCMOS IO	Mode	IO Utilization (%)
MCU UART	112kbps	10%
MCU UART	112kbps	10%
MCU SPI	Slave, 12.5Mbd	5%
MCU SPI	Slave, 12.5Mbd	5%
ICSSG0	Dual Port RGMII 1Gbps	50%
ICSSG1	off	0%
Ethernet (CPSW) Port 0	RGMII 100Mbps	10%
OSPI	OSPI DDR 160Mbd	10%
GPMC	GPMC 16b 125 MHz	20%

Peripherals	Mode	Utilization (%)
DDR Type/Rate	LPDDR4 1066	25%
DDR WR %	50%	-
High Speed IO	Off	0%
USB2	1.8V on	0%
SD card	HS200	5%
eMMC	HS200	5%
ADC	on	-

Estimated Power

Power Supply	Voltage (V)	Power (W)
VDD_CORE	0.75	0.824
VDDAR_CORE	0.85	0.030
VDDA_1V8	1.8	0.063
VDD_DDR4 (without DIMM)	1.1	0.082
SOC_DVDD1V8	1.8	0.051
SoC_DVDD3V3	3.3	0.110
Total		1.159

General

Junction Temperature (°C)	38
Power Estimation Mode	Max

Note: This power estimation spreadsheet provides power consumption estimates based on measured and simulated data; they are provided "as is" and are not guaranteed within a specified precision. Power consumption depends on electrical parameters, silicon process variations, environmental conditional and use cases running on the processor during operation. Actual power consumption should be verified in the real system.

AM64x Part variants

Function	Detailed features	AM6442	AM6441	AM6421	AM6412	AM6411
Real-time compute	MCU Cores	4x R5F	4x R5F	2x R5F	1x R5F	1xR5F
	Frequency (MHz, each core)	800	800	800	800,400	800, 400
	DMIPS (Total): R5F at 2DMIPS/MHz	6,400	6,400	3,200	3,200	1,600
High level OS and services	MPU cores	2x A53	1x A53	1x A53	2x A53	1xA53
	Frequency (MHz, each core)	1,000	1,000	1,000	800, 1,000	800, 1,000
	DMIPS (Total): A53 at 3 DMIPS/MHz	6,000	3,000	3,000	6,000	3,000
System control	Dedicated MCU core with functional isolation	1x CM4 @ 400MHz	1x CM4 @ 400MHz	1x CM4 @ 400MHz	1x CM4 @ 400MHz	1x CM4 @ 400MHz
Connectivity	Real-time Industrial Ethernet	Yes	Yes	Yes	No	No
	TSN (time-sensitive networking)	Yes	Yes	Yes	Yes	Yes
Security	IP Authentication and Protection (Confidentiality), Anti-cloning protection, Cryptography accelerators, Trusted execution environment	Yes	Yes	Yes	Yes	Yes
Safety	Independent Cortex-M4 MCU channel from main domain, Error monitoring	Yes	Yes	Yes	Yes	Yes
Power consumption	Low power design techniques	<2W	<1.75W	<1.5W	<1.25W	<1W
Starting 1Ku Price		$13.39	$11.87	$11.38	$7.96	$6.95

Scalable Features, Performance with pin compatibility

Industrial Communication Software | Included in device pricing for the 1st time

3P Based
Previous Model

- Stacks licensed from 3Ps
- Separate license per protocol
- Licenses available as buyout, per project, and per family
- Stack support from 3Ps
- Pre-certified solutions

Simple
One-stop shop: Directly from TI

- Fully bundled solution directly from TI
- One license for all TI-offered stacks
- Licensing included in device
- Stack support directly from TI
- Pre-certified solutions

One stop shop for the first time: Easy engagements starting with AM64x in Jan/2021

AM64x | ti.com launch on Jan 29th 2021

GPNs	**AM6442** 2x A53, 4x R5F	**AM6441** 1x A53, 4x R5F	**AM6421** 1x A53, 2x R5F	**AM6412** 2x A53, 1x R5F	**AM6411** 1x A53, 1x R5F
Pricing	On ti.com:1/29/21 **Starting at $6.95**				
Evaluation boards	**EVM** **Part#:** TMDS64GPEVM **Price:** $299 **Description:** Designed for industrial networking & control and evaluating main device interfaces 				
Target Markets	• Servo drives • PLCs • Remote I/O modules	• Communication modules • I/O Link Master modules • Gateways	• Industrial robots • Automated machinery		
Key content	• Motor control demo (AM64x + F2800x) (video link) • AM64x overview technical article here. • AM64x benefits in Remote IO technical article • Refreshed motor drives and TSN white papers				

Servo Drives

AM64x Benefits | Motor Drives

Compact. Precise. Connected

Sitara™ processors enable the connectivity, performance and premium web services for intelligent motor drives in Industry 4.0

Driving the future

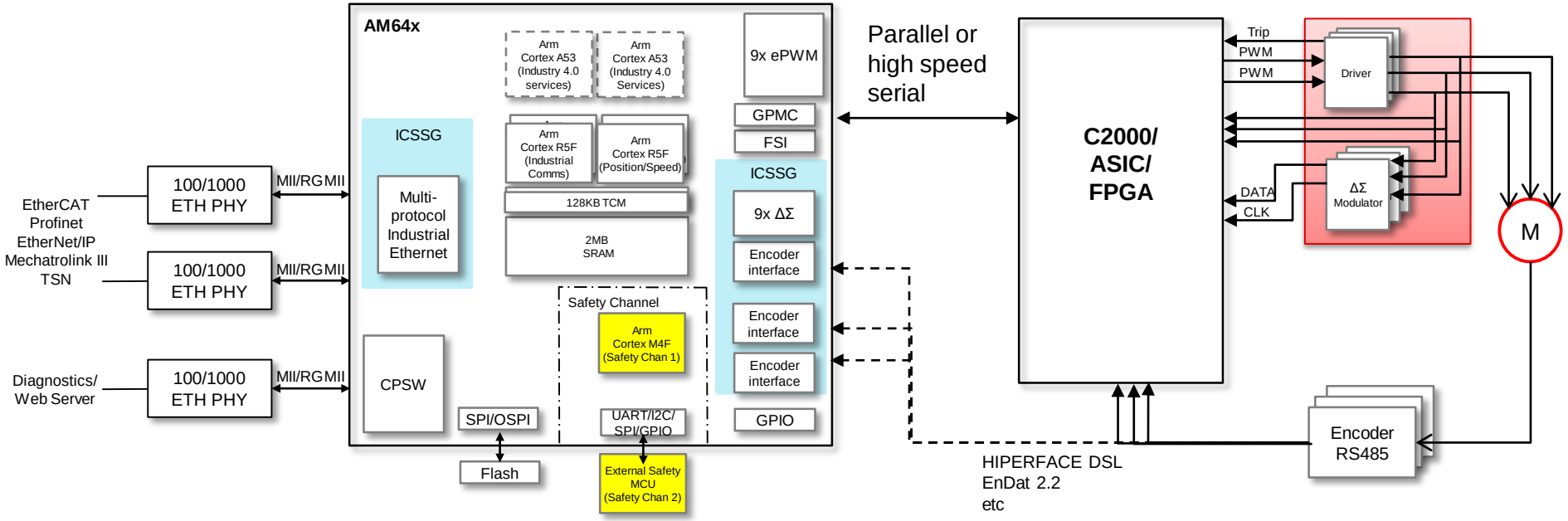
Target End Equipment

- Servo Drive control module
- Servo Drive communication module
- AC Drive communication module
- AC Drive control module

AM64x benefits

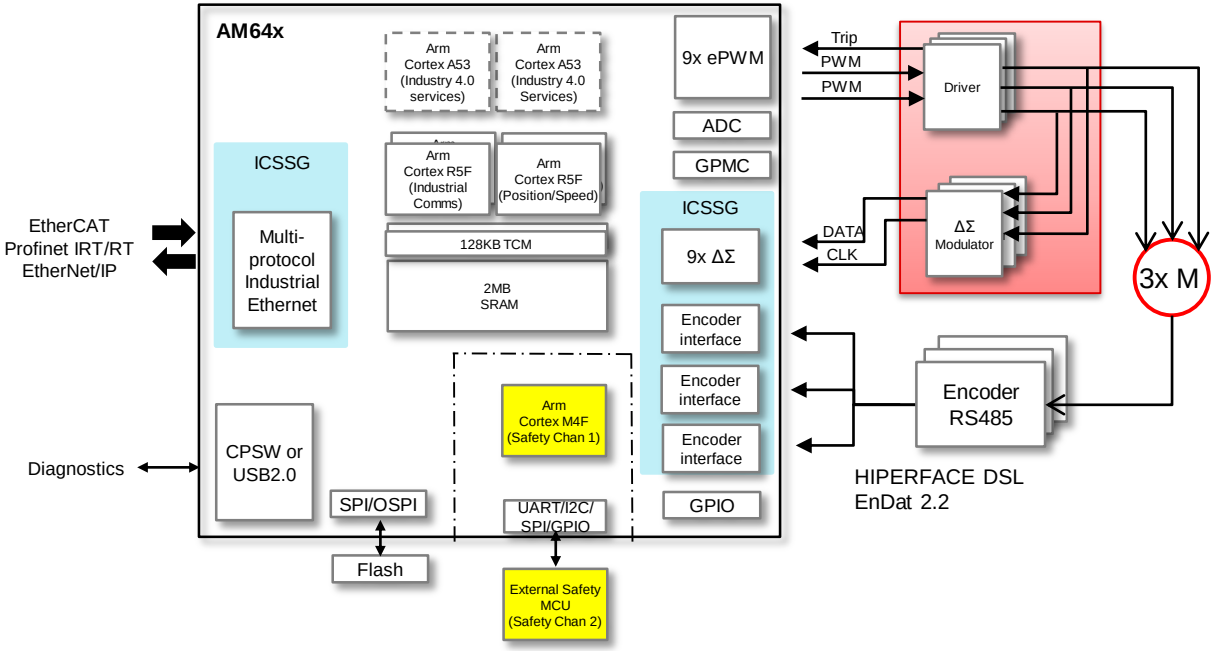
- Precise motor control with less than 400nsec control loops
- Connect to the Smart Factory through TSN, EtherCAT, PROFINET, EtherNet/IP, or Mechatrolink3
- Add intelligence and IoT capabilities with Linux
- Save BOM cost with integration

Servo drive control module based on AM64x: 2-chip



Demo is available on ti.com

Servo drive control module based on AM64x: Single-chip



Webinar: Thu 2/4 at 8AM EST/7AM CST

AM6442: Webinar: New Sitara AM64x Processor Enables Communication and Real-time Control

RonB
192.91.101.30

Mastermind 23090 points
Texas Instruments

Replies: 0

Views: 16

Part Number: AM6442

If you are interested in learning more about the new AM6442
Sitara Processor family and how it enables communications and control in one device, please join us for a Webinar on Thursday, February 4th at 8AM EST, 7AM CST. There is a registration link below.

Here is a quick overview video of one of the excellent demonstrations that is enabled by AM64x and available now. Click on the picture to watch the video.

If you'd like to learn more about this system, we will dive deeper into the software and how the system is enabled by the AM64x architecture. You will learn from this example how AM64x combines communications and real-time control in a variety of ways.

Click here to register now for the event.

Recorded training will be posted here

https://e2e.ti.com/support/processors/f/791/t/975576

Remote IO

AM64x Benefits | Remote IO

Sitara™ processors enable the protocols, performance and premium features necessary for Remote IO

Driving the future

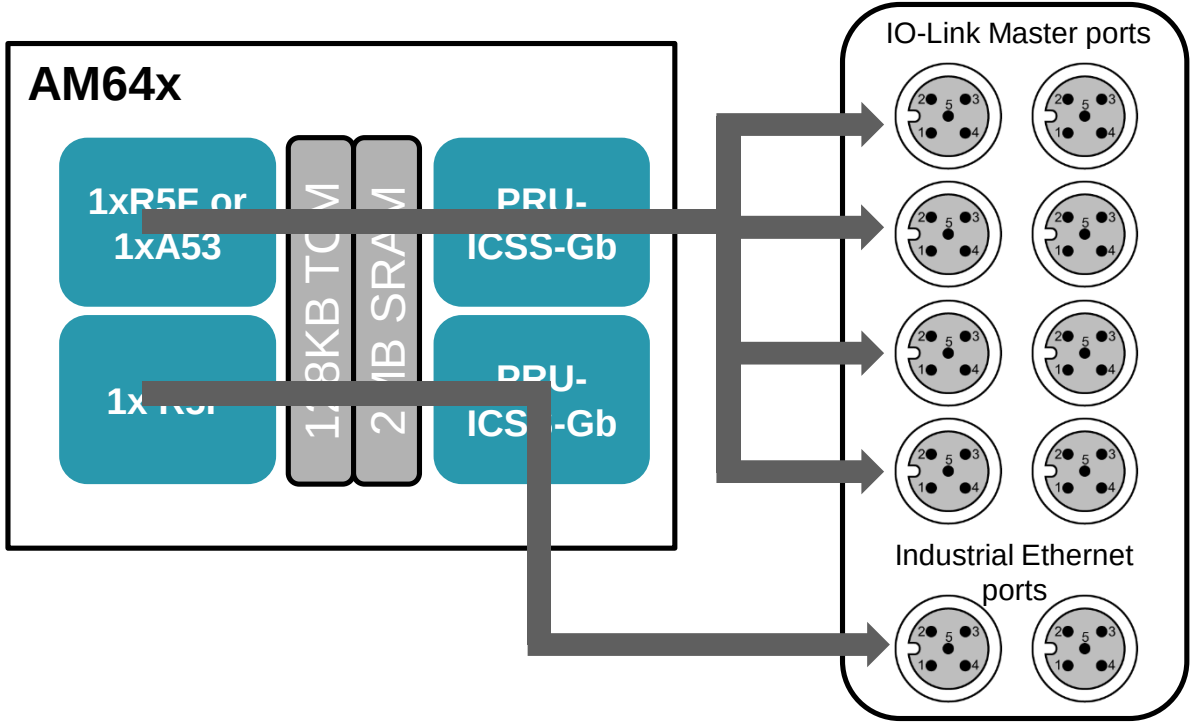
Remote IO Trends

- Reduced material costs
- Increased connectivity
- Intelligent and customizable
- Evolving network standards
- Software configurable I/O
- Higher bandwidths

AM64x benefits

- Rich peripheral integration reduces system complexity and cost
- Enables connectivity to 100Mb Profinet, EtherCAT, Ethernet/IP and Gb Profinet@TSN networks
- Bring Linux to the edge with pin-compatible, Linux-enabled devices
- Bridge between industrial Ethernet and IO-Link Master
- Simple development and engagement model through pre-integrated protocol stacks

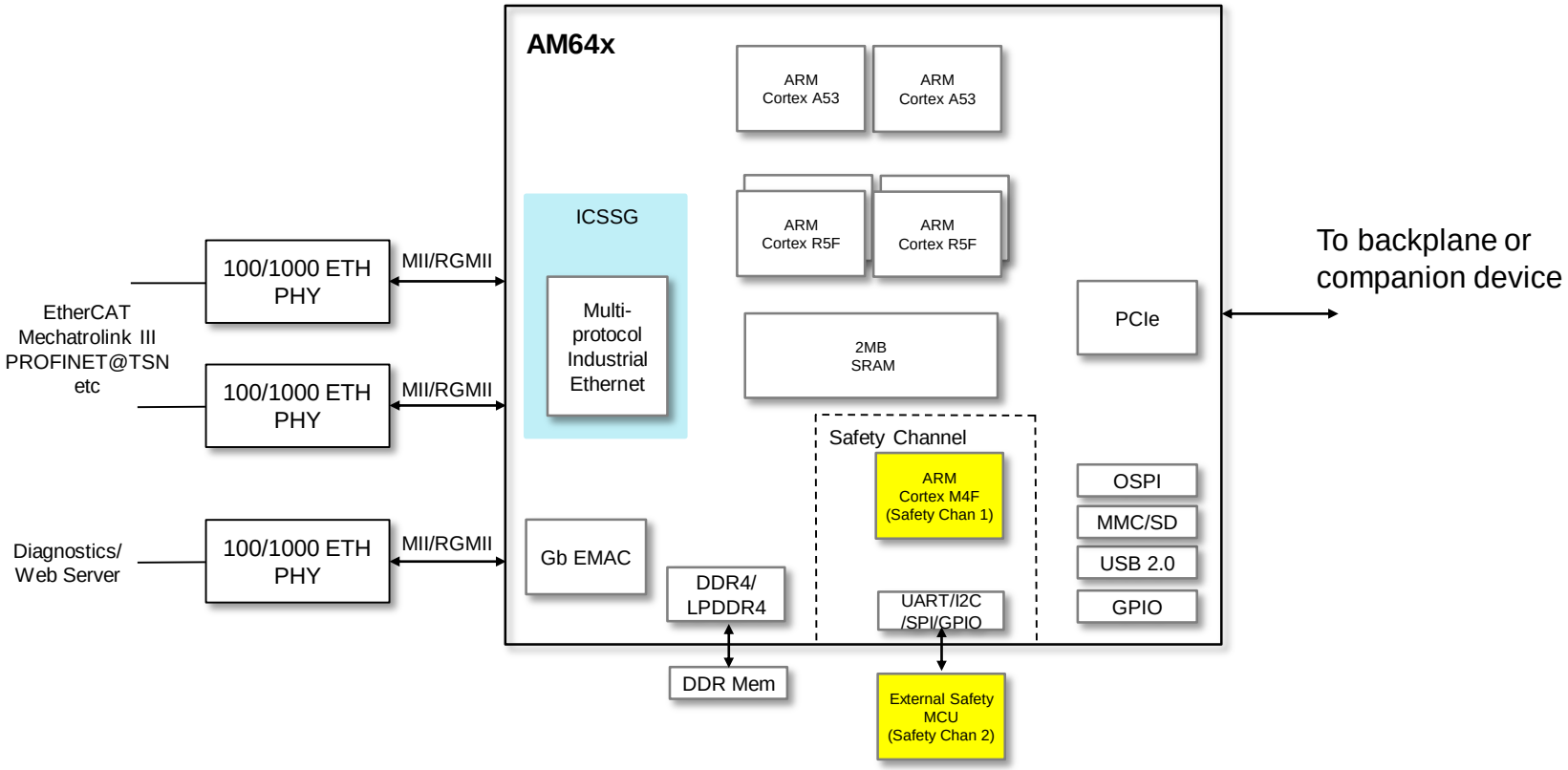
AM64x integrates 3 MCUs into 1 for IO-Link Masters



- Traditional approach requires 3 MCUs:
  - 2x MCU for 4-port IO Link Master each
  - 1x MCU for Industrial Ethernet

- Key benefits of AM64x solution
  - Cost savings due to one-chip solution
  - Reduce board space
  - Synchronize 8 sensors with an integrated Frame Handler
  - Connect to the factory with Gb TSN
  - Bring intelligence to the edge with optional integrated Linux (Additional A53 core)

Remote IO example



PLC

AM64x Benefits | PLC Controller (CPU Module)

Sitara™ processors offer power-efficient computing, the protocols, performance for low- to mid-end PLC systems

Driving the future

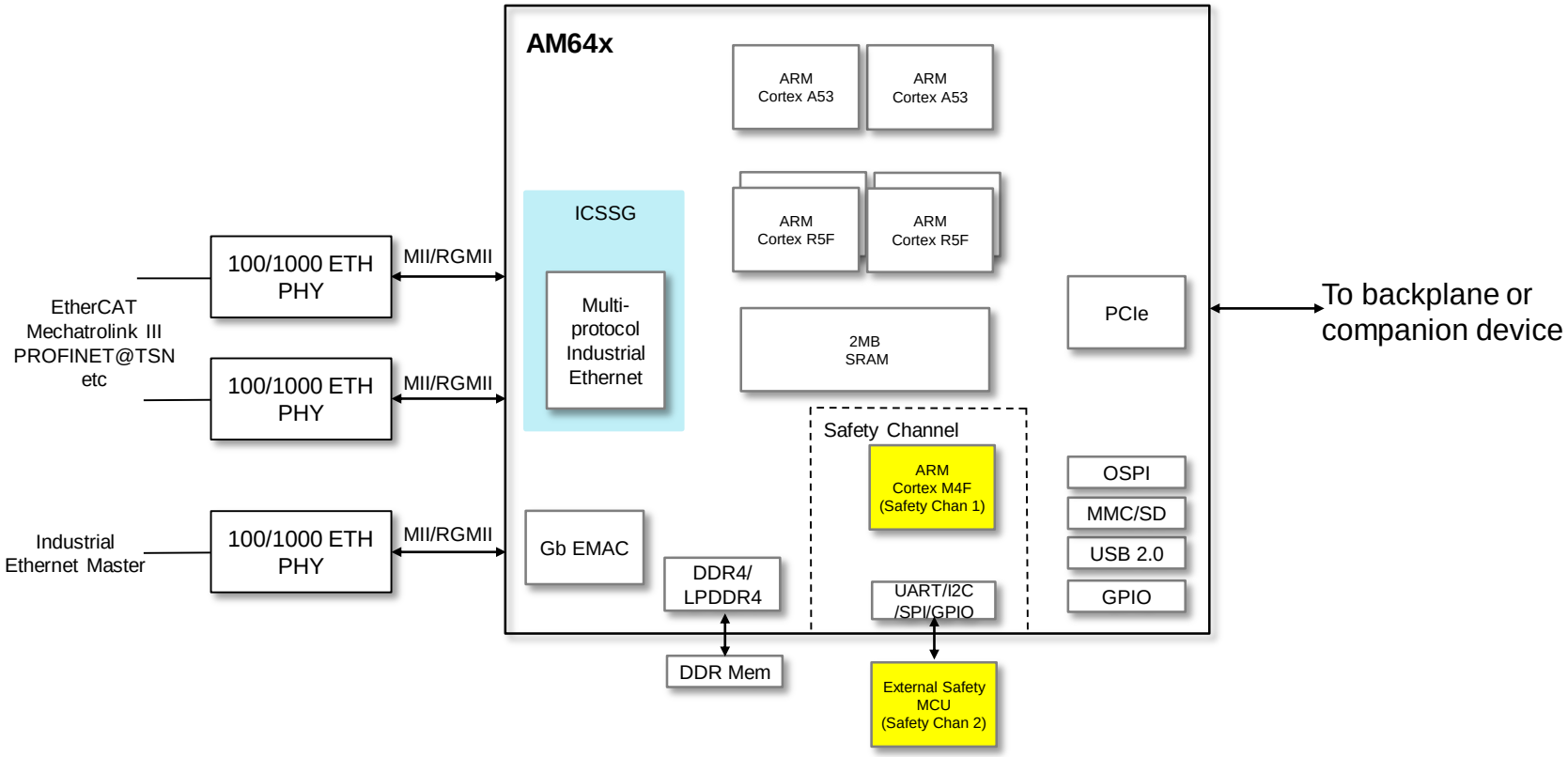
PLC Trends

- Reduced material costs
- Increased connectivity
- Intelligent and customizable
- Evolving network standards
- Software configurable I/O
- Higher bandwidths

AM64x benefits

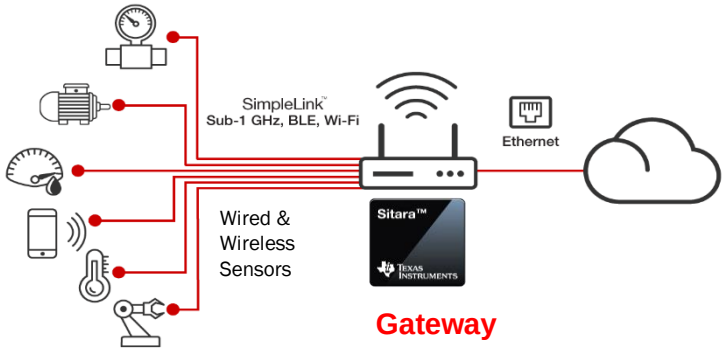
- Mainline Linux enables **Codesys** and other PLC SW framework seamlessly
- Single and Dual A53 cores at
  - **AM6411: $6.95/1Ku** **AM6412: $7.99/1Ku**
- 2-port Ethernet Switch (typically, Master protocols)
- Enables flexible connectivity (Device level too) - 100Mb Profinet, EtherCAT, Ethernet/IP and Gb Profinet@TSN networks

PLC CPU Controller example



IoT Gateways

AM64x Benefits | IoT Gateway



Sitara™ processors enable the protocols, power-efficient computing performance and premium features

Driving the future

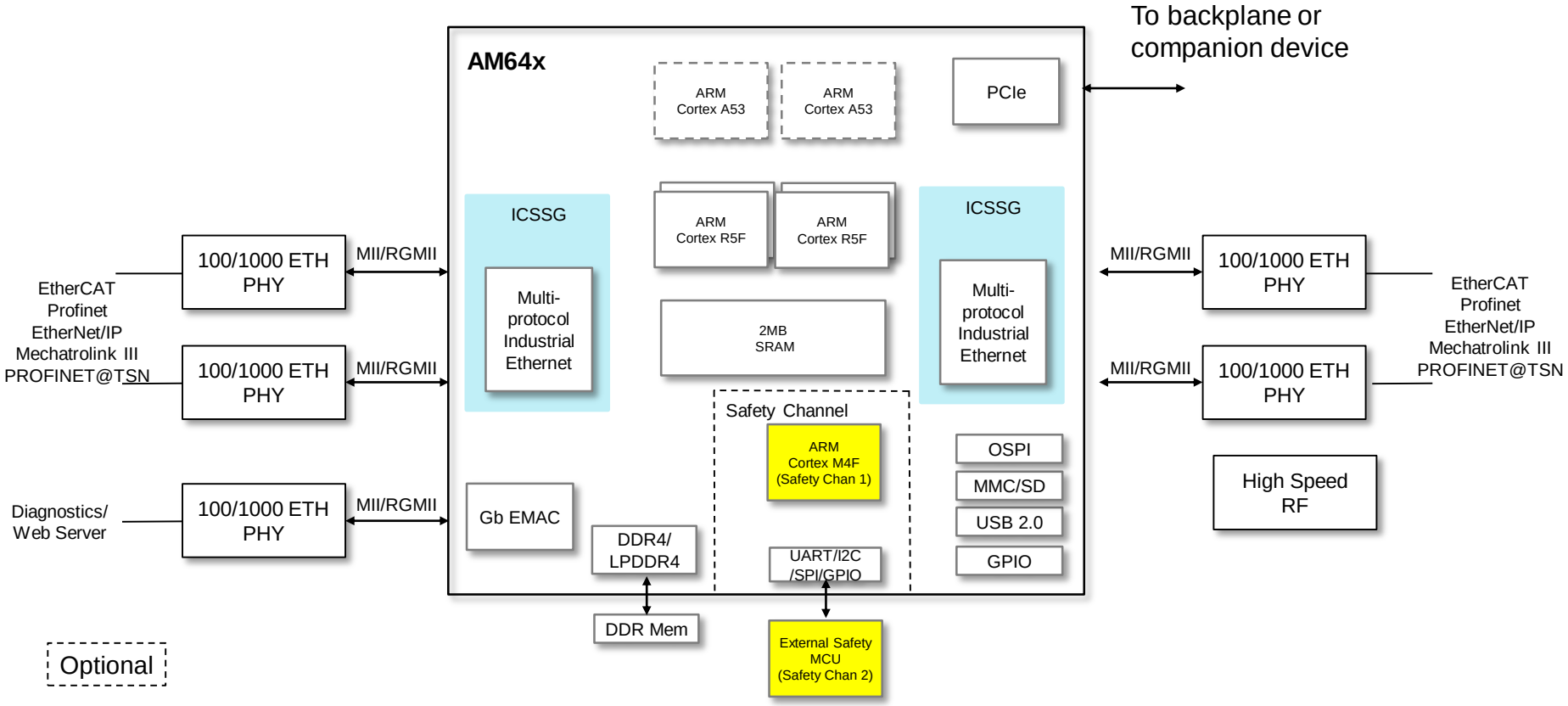
Market Trends

- Increased connectivity options
- Increased performance
- Security

AM64x benefits

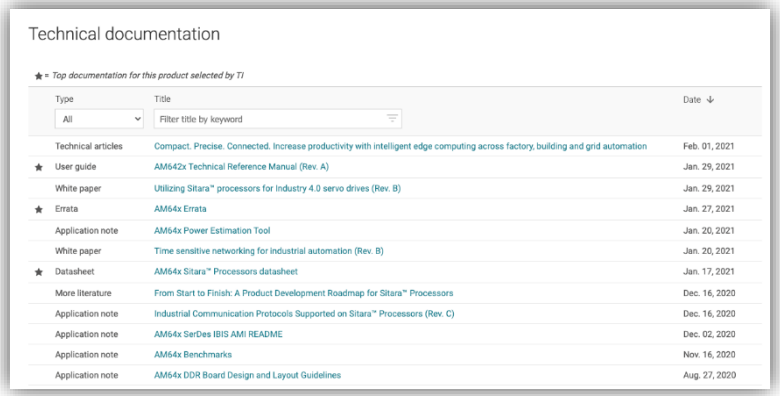
- Flexible connectivity options (SDIO, SPI, 2x Ethernet)
- Mainline Linux long term support (LTS)
- Secure boot for IP protection and authentication
- Performance scalability with multiple cores
- Low power processing <1.0 W (A53 only)
- AM64x SK EVM with on-board WiFi (Apr 2021)

Industrial gateway example



Call to action

- Check out more information on AM64x on ti.com
  - ti.com/6442 ti.com/6441 ti.com/6421
  - ti.com/6412 ti.com/6411
- Check out the training and collateral available now
  - https://www.ti.com/product/AM6442#tech-docs
- Order an EVM to evaluate for your own application
  - https://www.ti.com/tool/TMDS64GPEVM
  - P/N: TMDS64GPEVM


Technical documentation

★ = Top documentation for this product selected by TI

	Type	Title	Date
	All	Filter title by keyword	
	Technical articles	Compact. Precise. Connected. Increase productivity with intelligent edge computing across factory, building and grid automation	Feb. 01, 2021
★	User guide	AM642x Technical Reference Manual (Rev. A)	Jan. 29, 2021
	White paper	Utilizing Sitara™ processors for Industry 4.0 servo drives (Rev. B)	Jan. 29, 2021
★	Errata	AM64x Errata	Jan. 27, 2021
	Application note	AM64x Power Estimation Tool	Jan. 20, 2021
	White paper	Time sensitive networking for industrial automation (Rev. B)	Jan. 20, 2021
★	Datasheet	AM64x Sitara™ Processors datasheet	Jan. 17, 2021
	More literature	From Start to Finish: A Product Development Roadmap for Sitara™ Processors	Dec. 16, 2020
	Application note	Industrial Communication Protocols Supported on Sitara™ Processors (Rev. C)	Dec. 16, 2020
	Application note	AM64x SerDes IBIS AMI README	Dec. 02, 2020
	Application note	AM64x Benchmarks	Nov. 16, 2020
	Application note	AM64x DDR Board Design and Layout Guidelines	Aug. 27, 2020

Any questions? Please use our E2E forum!

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