eMemory Briefing .

ememory
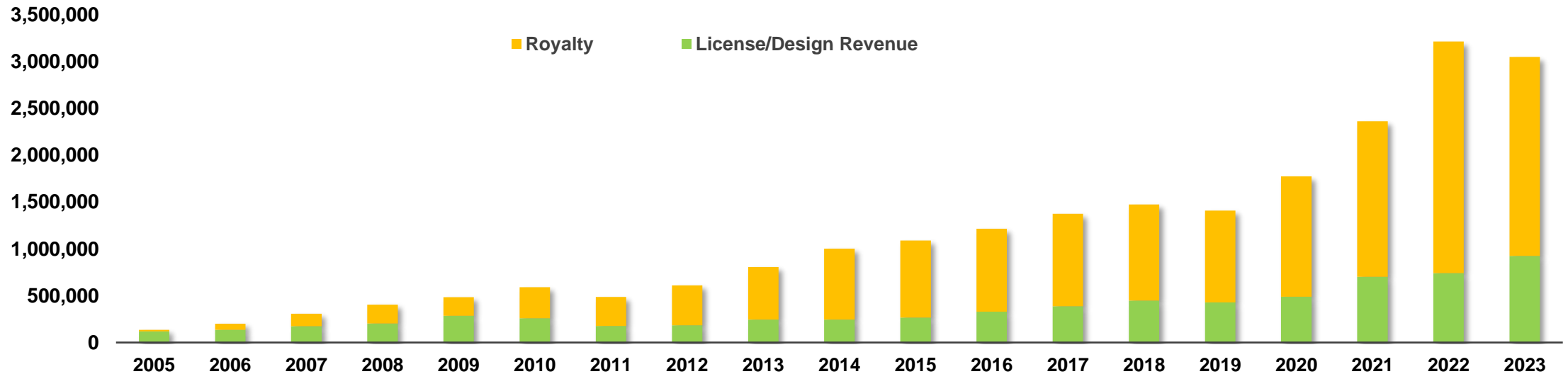
IPR Notice ■

Company Overview

- eMemory is the global leader of embedded non-volatile memory IP

Revenue Trend
(Unit: NT$ 1,000)

■ Royalty ■ License/Design Revenue

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |

(Y-axis: 0, 500,000, 1,000,000, 1,500,000, 2,000,000, 2,500,000, 3,000,000, 3,500,000)

Founded
In 2000
Based in Hsinchu, Taiwan. IPO in 2011. Over 53M wafers shipped.

1170+
Patents Issued
200 pending patents. 351 employees with 68% R&D personnel.

Best IP Partner
With TSMC
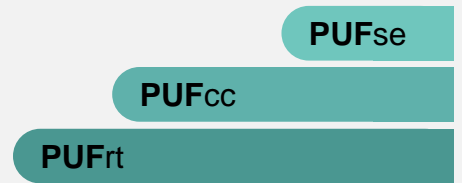TSMC Best IP Partner Award since 2010.

Technology Portfolio

With access to eMemory's widely verified IP process platform, PUFsecurity is uniquely positioned to provide **OTP and PUF-based** Security IP Solutions with **extensive availability** across various foundries and process nodes.
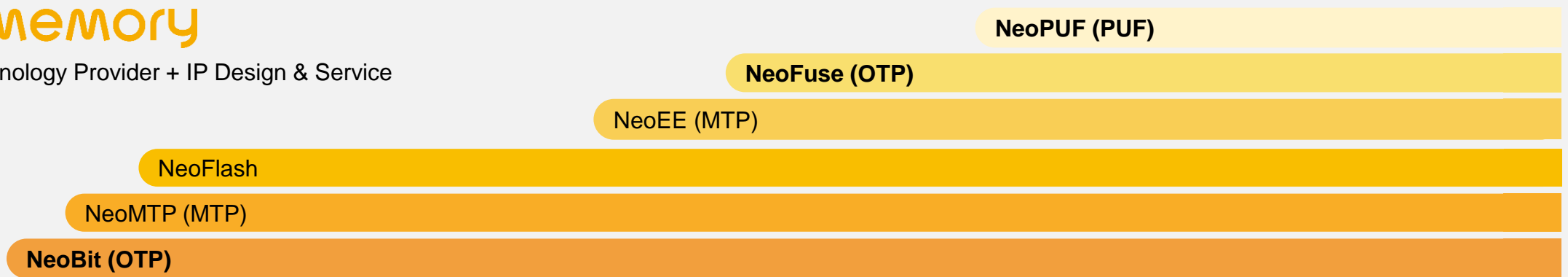
PUFsecurity
PUF-based Security IP Design & Service

- PUFse
- PUFcc
- PUFrt

ememory
Technology Provider + IP Design & Service
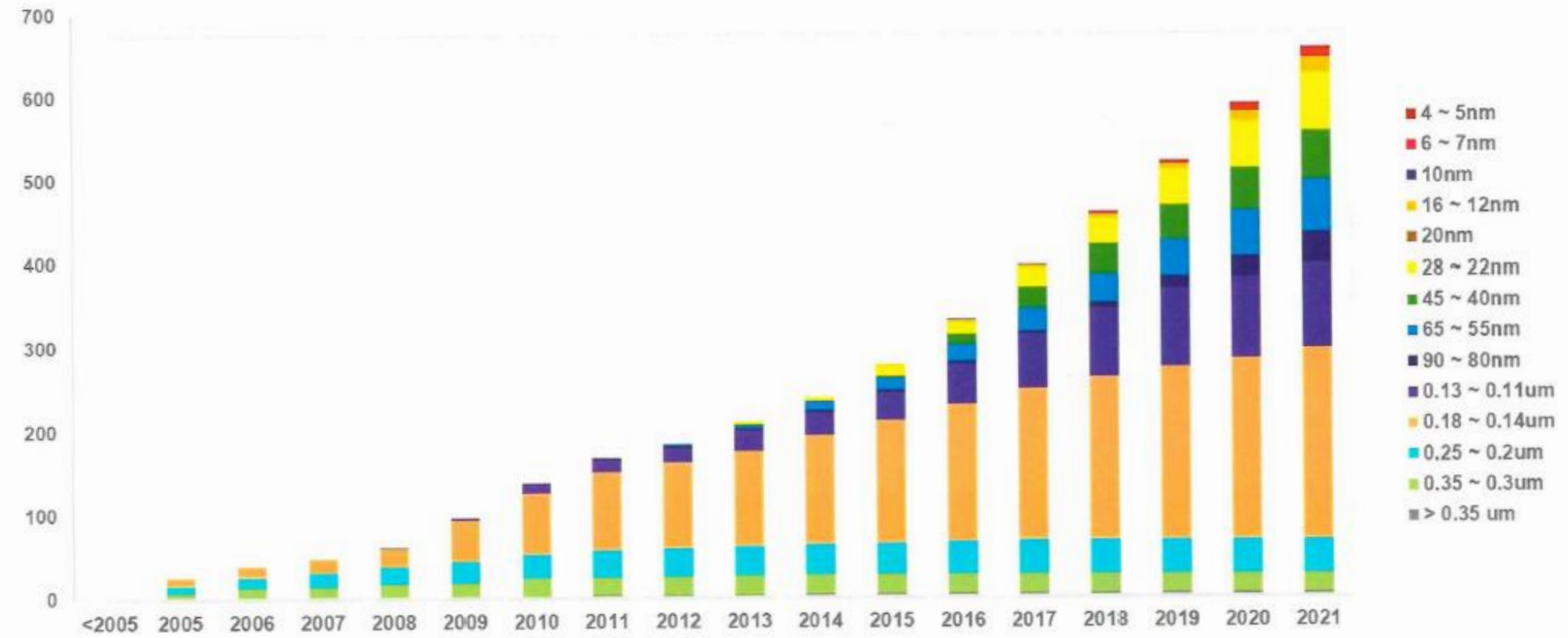
- NeoPUF (PUF)
- NeoFuse (OTP)
- NeoEE (MTP)
- NeoFlash
- NeoMTP (MTP)
- NeoBit (OTP)

| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |

Registered IP > 650
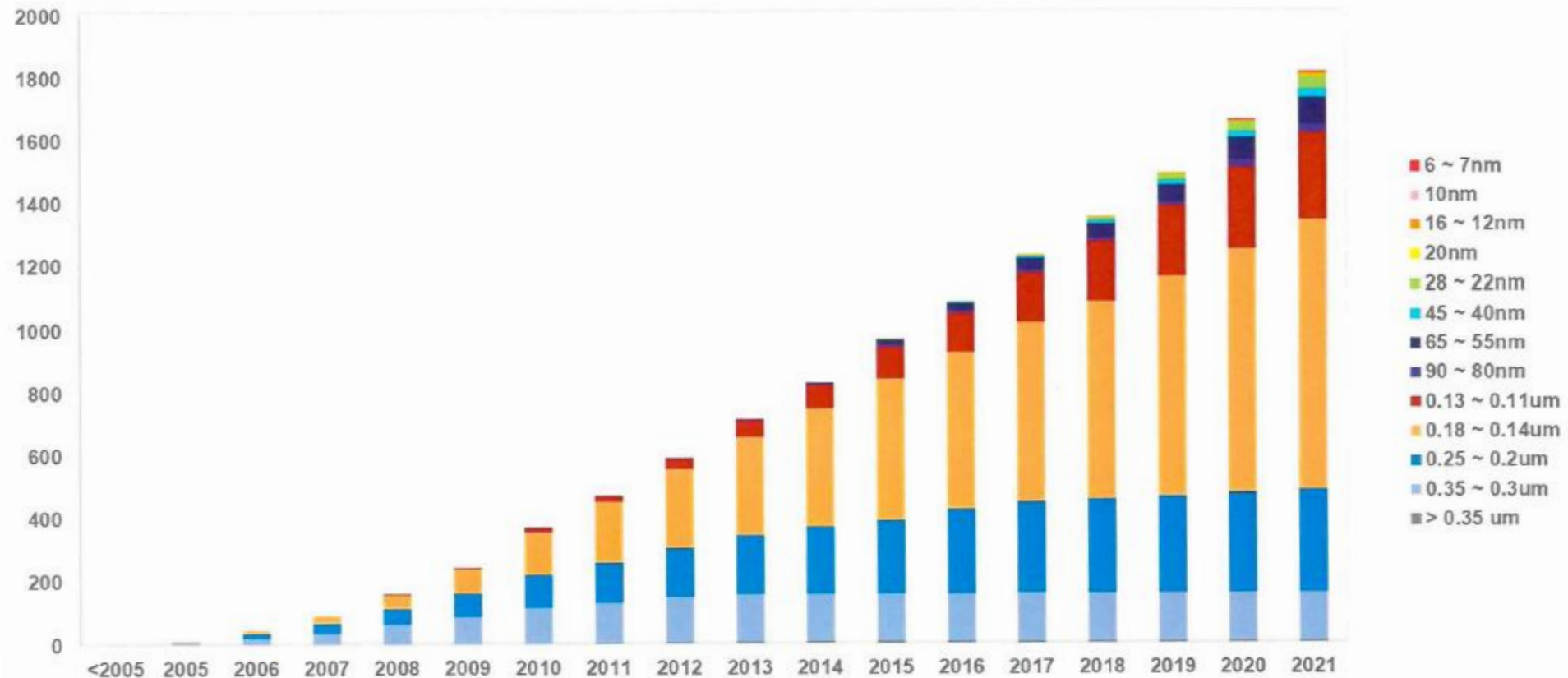
Wafer Contribution > 20M
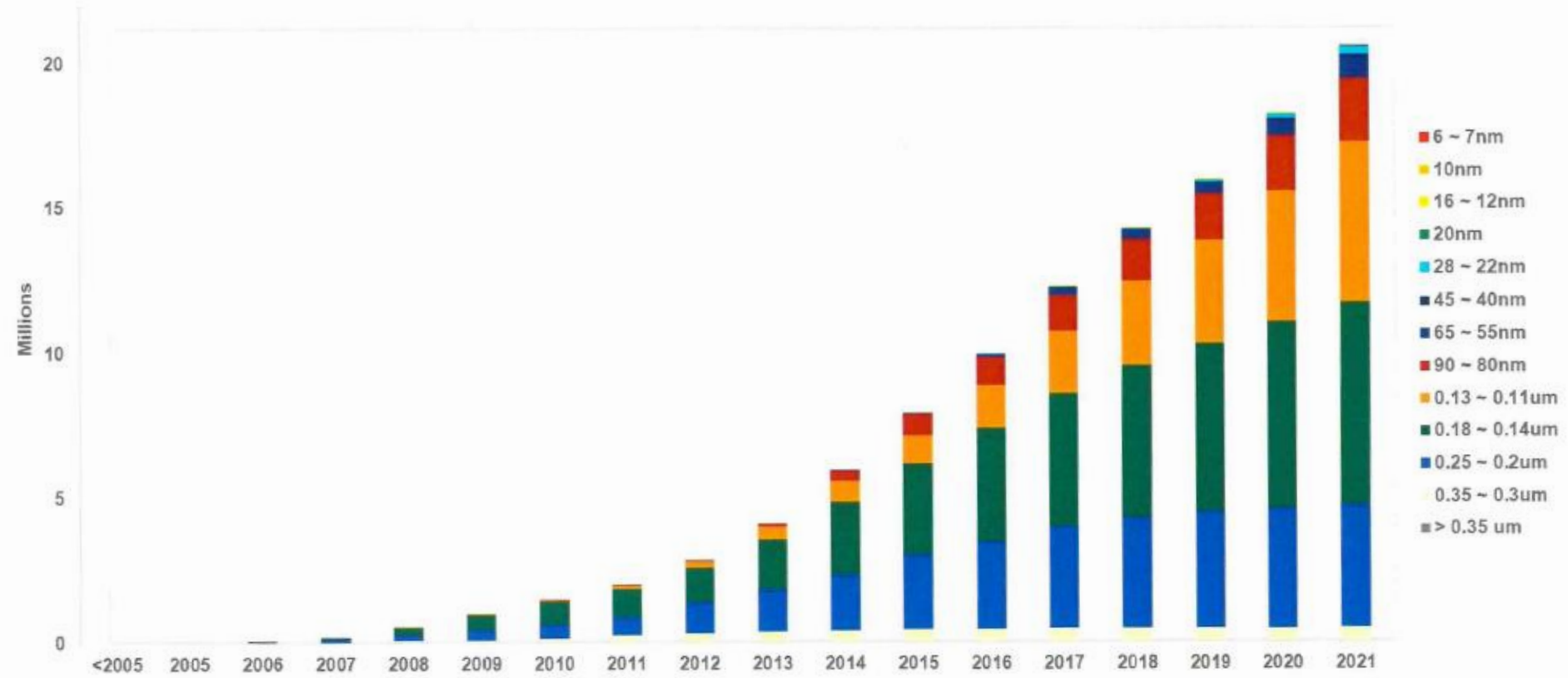
Revenue and Tape-out by Technology

	NTO		Revenue (USD)		
Year	NeoBit	NeoFuse	NeoBit	NeoFuse	PUF-based
2002	3				
2003	29				
2004	40				
2005	68		$ 4,217,380		
2006	133		$ 6,202,270		
2007	220		$ 9,402,479		
2008	253		$ 12,896,211		
2009	268		$ 11,695,587		
2010	284		$ 15,873,331		
2011	254		$ 15,399,098		
2012	270		$ 19,620,768		
2013	363	1	$ 25,436,669	$ 382,084	
2014	371	3	$ 31,831,985	$ 328,787	
2015	311	11	$ 30,943,426	$ 1,080,373	
2016	270	28	$ 30,247,340	$ 3,636,142	
2017	257	61	$ 34,619,653	$ 5,238,351	
2018	253	86	$ 31,834,860	$ 10,773,223	$ 85,000
2019	226	109	$ 27,602,332	$ 14,466,279	$ 195,000
2020	248	182	$ 30,378,346	$ 26,437,660	$ 434,998
2021	252	259	$ 32,367,560	$ 44,011,223	$ 1,160,702
2022	264	231	$ 35,327,060	$ 63,762,480	$ 4,207,209
2023	226	241	$ 23,251,721	$ 64,276,058	$ 4,375,409
Total	**4,863**	**1,212**	**$ 429,148,077**	**$ 234,392,660**	**$ 10,458,318**

*NTO stands for **New Tape-Out**   * Revenue includes both **licensing** and **royalty**

PUF-based Security Solutions

- Based on OTP Technologies, many different security functions IPs have evolved
- Regulations, such as TPM 2.0, now require Hardware Root of Trust

OTP	NeoFuse	→ Key Storage
PUF	NeoPUF	→ Key Generation
Root of Trust	**PUFrt**	→ Foundational Security IP
Cryptography	Cryptos	→ Encryption + Decryption
Secure Coprocessor	**PUFcc** + SW/FW	→ Security Sub-System
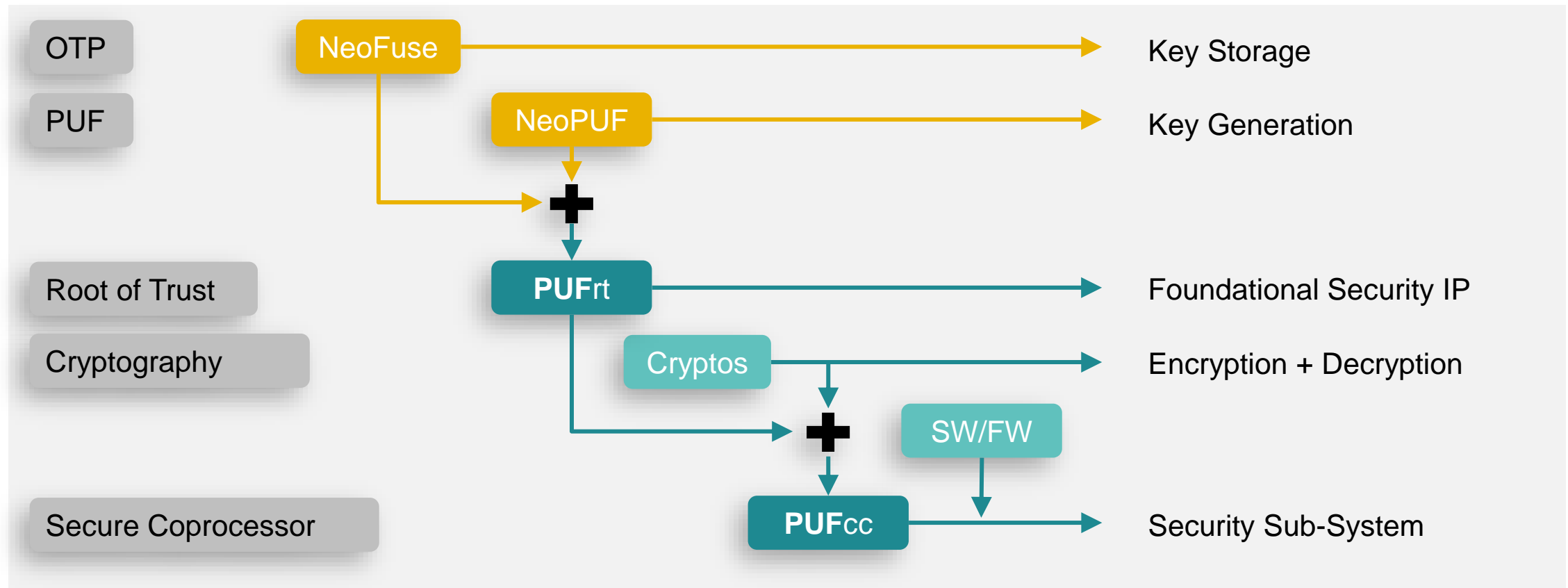
Standards Drive Hardware-Based Security .

Driving an open standard for silicon root of trust

Using asymmetric public/private key encryption technology and device ID to achieve fast and secure access to the network
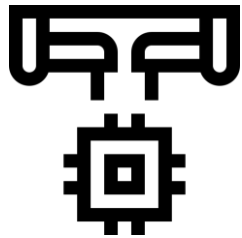
Data Center

IoT

eMemory Technology Inc.

Security Business Development

- As eMemory is an established IP company, there are different **platforms** that we can leverage for sales in security IPs and sub-systems
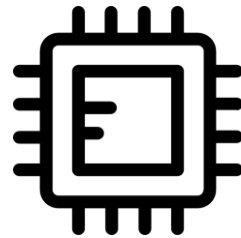
Foundry Platforms

TSMC, Intel, UMC, GF, etc.

- Licensed our security technology to major foundries
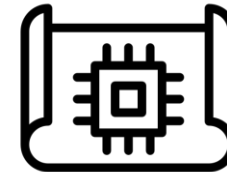- Co-promotional activities

CPU Partners

Arm, RISC-V, Cadence, etc.

- SoC customers looking for both CPU and security subsystems
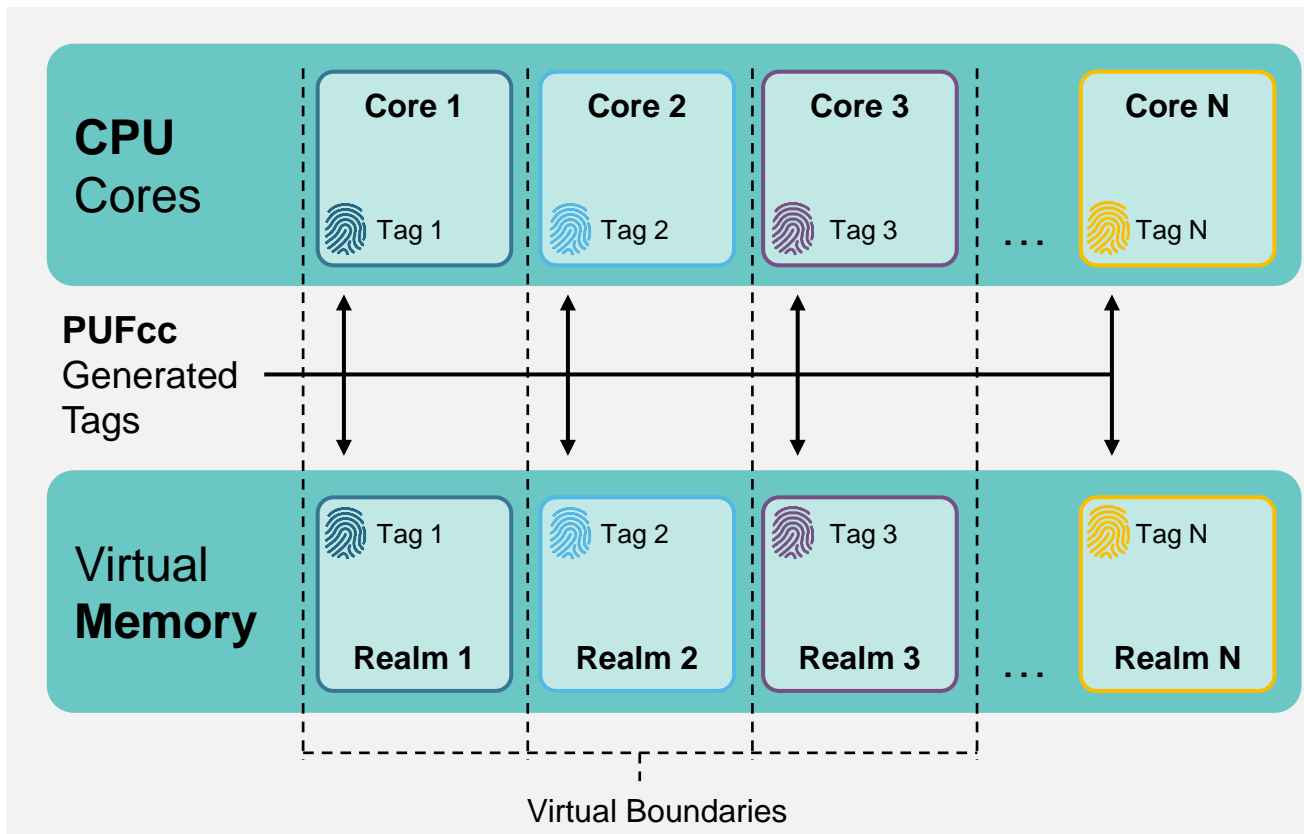
CSP

More to come

- Work with CSP and system companies for embedded security on a chip level

Market **Application**

- Customers with many different applications will begin to adopt **PUF-based Security Solutions**

CPU	AI	SSD
DPU	DTV/STB	Wi-Fi
FPGA	ISP	And More.

eMemory

Next Computing: **Confidential Computing**

CPU Cores:
- Core 1 — Tag 1
- Core 2 — Tag 2
- Core 3 — Tag 3
- ... Core N — Tag N

PUFcc Generated Tags

Virtual **Memory**:
- Tag 1 — Realm 1
- Tag 2 — Realm 2
- Tag 3 — Realm 3
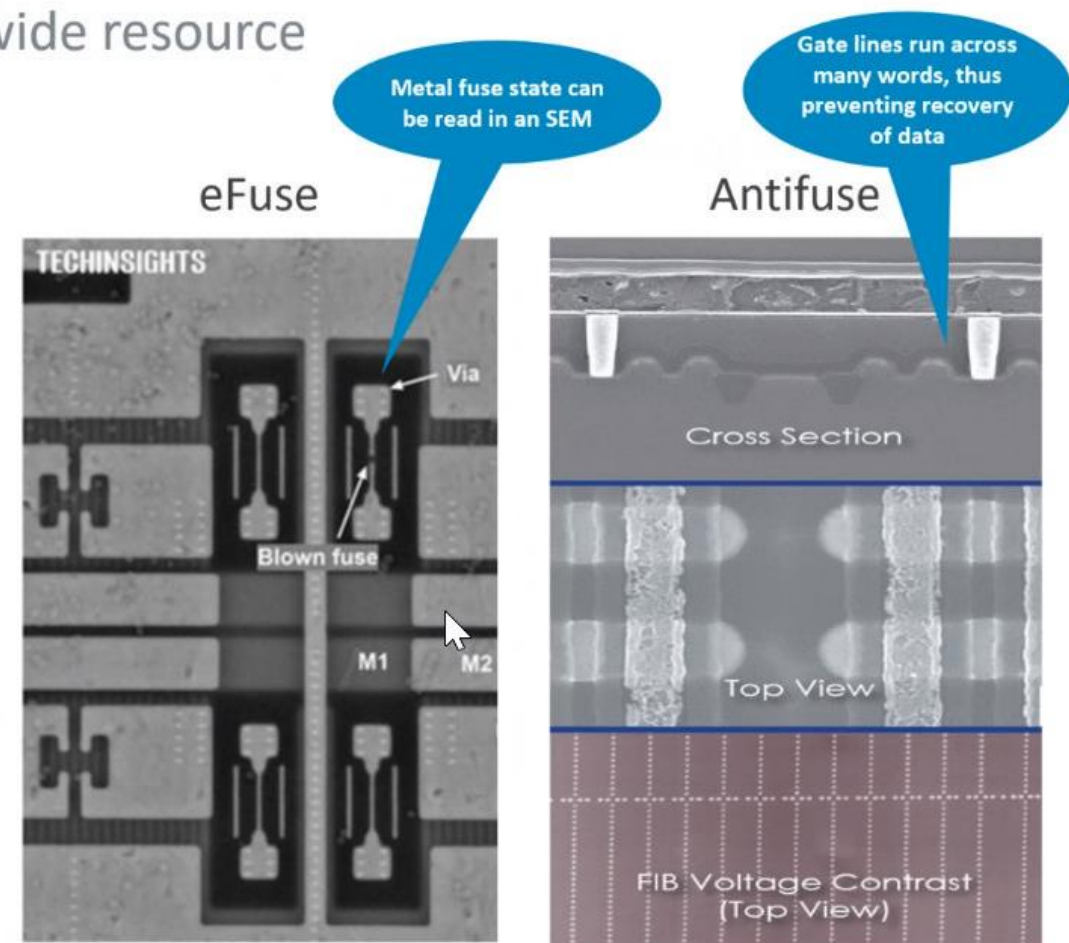- ... Tag N — Realm N

Virtual Boundaries

- **Protect data** in the Virtual Memory of Multi-Core CPUs

- CPU Cores and Virtual Memory have unique corresponding **tag numbers**

- Tag numbers are internally **randomly generated** by **PUFcc** (Crypto Coprocessor IP)
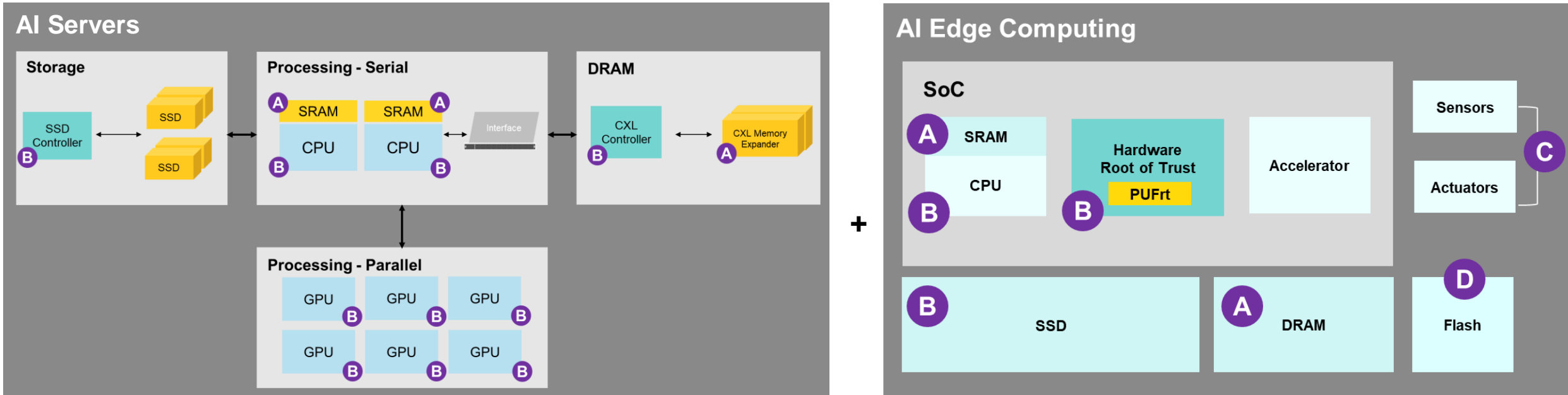
AntiFuse OTP vs. eFuse

One Time Programable (OTP) memory is a SoC-wide resource

- RSS supports OTP as field-programmable to store confidential code and data

- eFuse:
  - Area efficient for smaller arrays
  - Typically not field programmable
  - Can be easily read by delayering SoC (a few $k cost)
    - The secure channel key can be compromised
    - The device can then be cloned

- Antifuse OTP:
  - Cannot be read using a scanning electron microscope
  - Dense bit cells, efficient for large arrays
    - Macro periphery is large versus eFuse
  - Integrated charge pump enables field programming
  - PUF can be included for a small additional area
    - ~0.04mm2 on 7nm for 128x32 bit PUF

eFuse — *Metal fuse state can be read in an SEM*

Antifuse — *Gate lines run across many words, thus preventing recovery of data*

https://semiengineering.com/the-benefits-of-antifuse-otp/

Rainer Herberholz

arm

eMemory for **AI Servers** and **Edge Devices**

A **Memory Repair**

B **Root of Trust** provides:
1. Key storage/generation
2. Cryptographic processing to protect AI models, input data and output results
3. Confidential Computing

C **OTP** needed for trimming analog circuits in Sensors and Actuators

D **NeoFlash** to replace conventional eFlash for a much lower cost

Thank You for your time .

For more information, please visit:
eMemory Website: https://www.ememory.com.tw/
PUFsecurity Website: https://www.pufsecurity.com/

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