Celtic-Plus
Smart Connected World

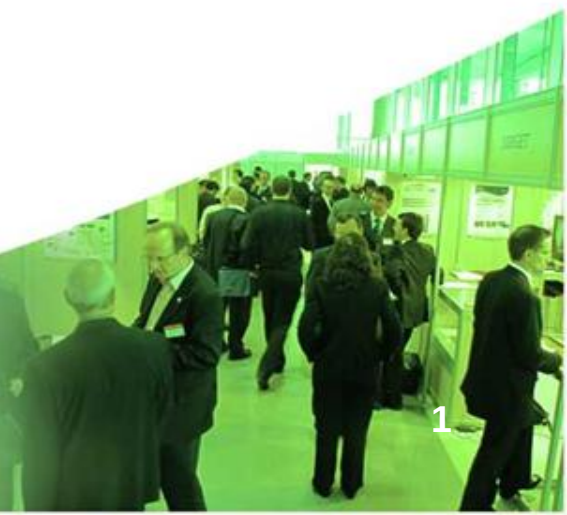
EUREKA

Celtic-Plus Event
28-29 April 2016, Stockholm

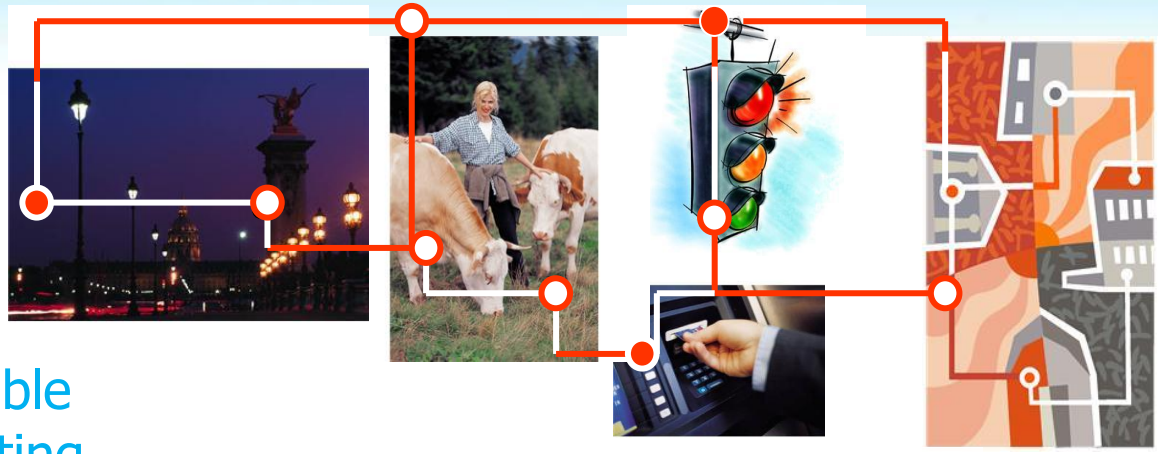
The Smart Sensor & Semiconductor NVM Switch.

UNIST
ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY
2009

Prof. Yunsik Lee
www.unist.ac.kr



What makes IoT success?



Wearable computing

Home Automation

Gesture sensing controller

Bio-Measurement

Machine-2-machine

Internet of Things
(Semiconductor)

Industrial Automation

Smart Sensors

Sensor Hubs

Automotive

Sensor Network

Smart Power Grid

Wireless connectivity

Organisation Profile

- Open : 2009.03.
- Korean Government Funded
- 10 Schools, 23 Tracks,
- 400 Faculty, 5,000 Students
- US152M$ Budget for Schools

World Leading University

UNIST

ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

No.	Name	Citation Per Publication	Outputs in the top Percentiles	Field Weighted Citation Impact
1	Caltech	17.7	38.6	2.51
2	Harvard	15.2	33.7	2.43
3	Stanford	14	30.9	2.5
4	MIT	14	30.1	2.44
5	UC-Berkeley	13.9	29.2	2.49
6	Univ. of Chicago	13.8	29.6	2.33
7	Duke Univ.	13.3	28.7	2.23
8	Johns Hopkins Univ.	13.2	29.9	2.19
9	Yale Univ.	12.9	30.7	2.1
10	Univ. of Oxford	12.5	28.6	2.26
11	Univ. of Cambridge	12.4	28.6	2.13
12	Univ. of Pennsylvania	12.3	28	2.2
13	Princeton Univ.	12.2	28.2	2.27
14	Columbia Univ.	12.1	27.8	2.18
15	Imperial College London	11.9	28.6	2.16
16	UNIST	11.8(16위)	31(3위)	2.17(13위)
17	Cornell Univ.	11.7	26.7	2.11
⋮	⋮	⋮	⋮	⋮
29	싱가포르국립대	9	22.5	1.78
30	홍콩대	7.9	20.2	1.61

Proposal Introduction / 1. sensor

Celtic-Plus

EUREKA

Wifi

Bluetooth 4.0

ZigBee

Lte

Almost all RF/internet protocols need 32bit MCU to run!

Processor Unit:
Microprocessor,
Microcontroller,
DSP, FPU…

Data processing
Flow control
IO control
Basic Data analysis
Data encryption

Wireless Connectivity Unit:
WiFi, GPS, BT, Proprietary RF, 3G/4G, VoLTE, Zigbee,..

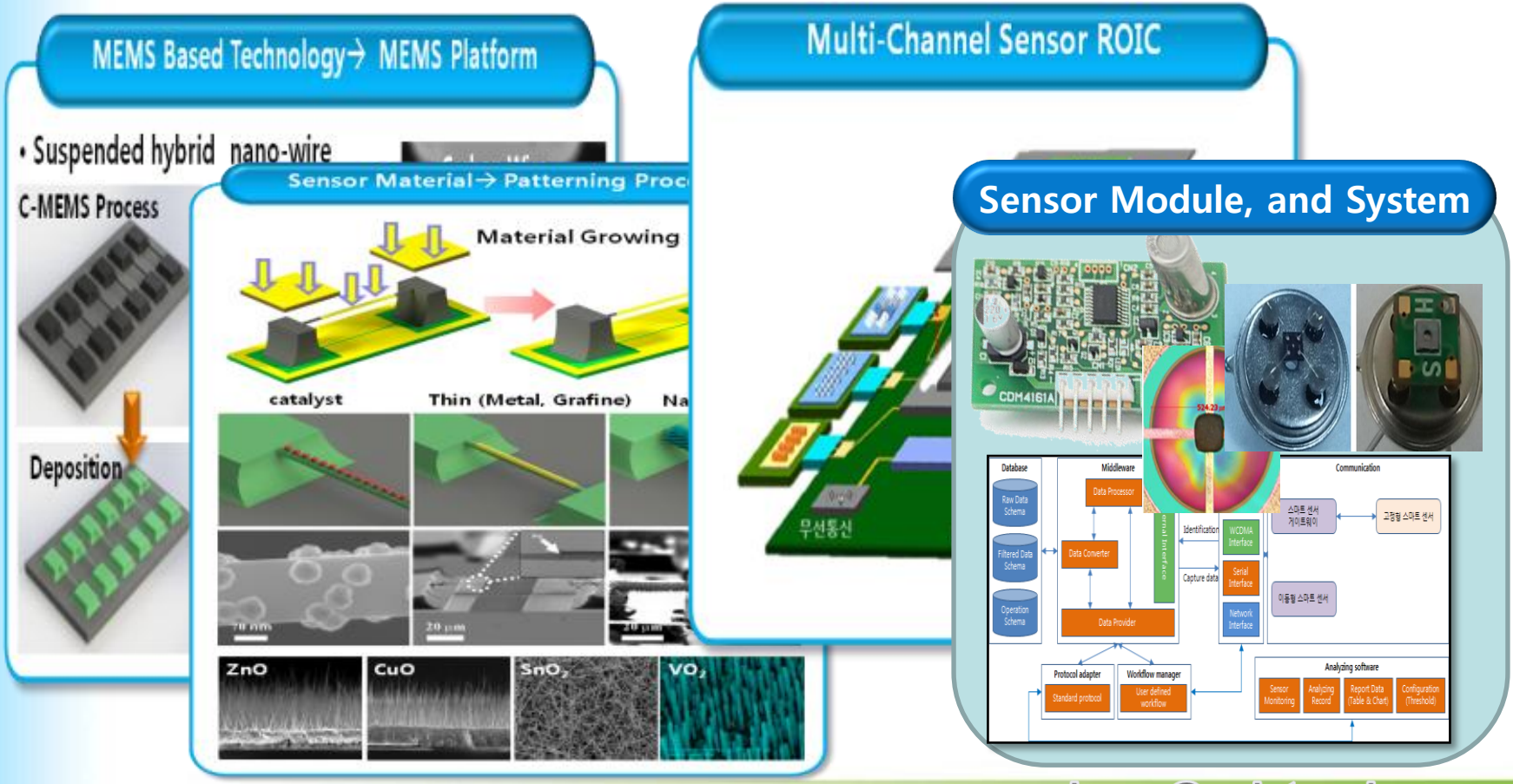
IoT Device

I/O Unit:
Sensors, I/Os, Displays…

thermal
pressure
G-sensor
….

Proposal Introduction / 1. sensor

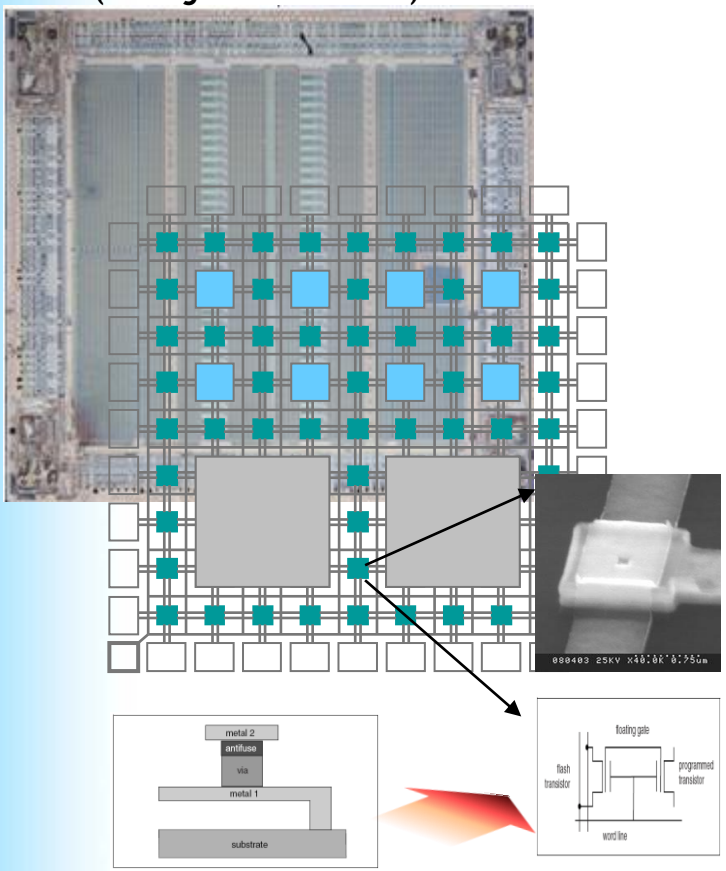
- ☞ World class CMOS based smart gas sensor, prototype available at 2017.
- ☞ Joint R&D development and business.

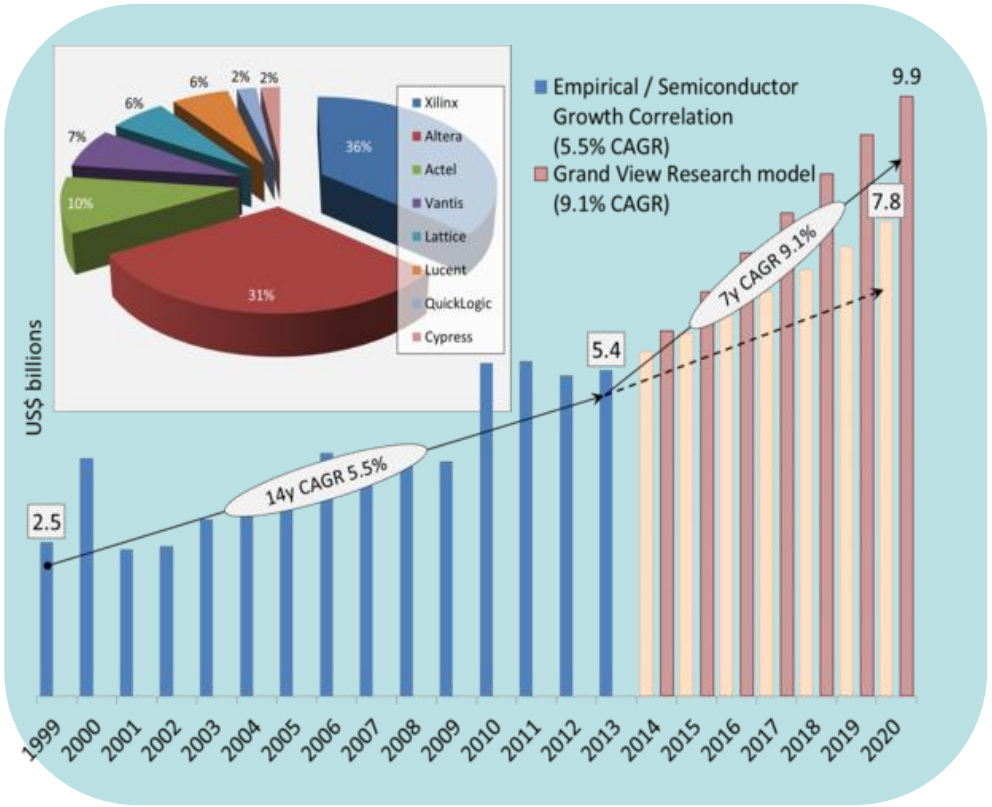


Proposal Introduction /2. Conf. Device

- ☞ Configurable device(FPGA) is ideal for future!
- ☞ SW driven semiconductor/ US6B$ market

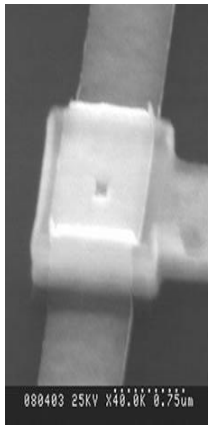
FPGA(Configurable Device)

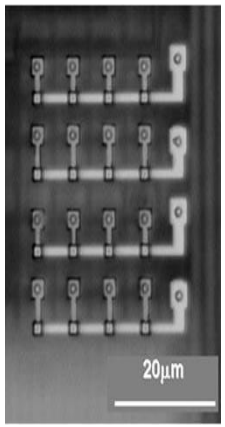


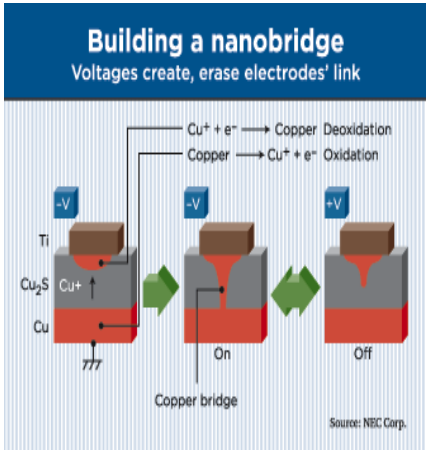


Proposal Introduction /2. Conf. Device

- ☞ R&D on the device switch(NVM)
- ☞ Seeking partner to joint R&D!



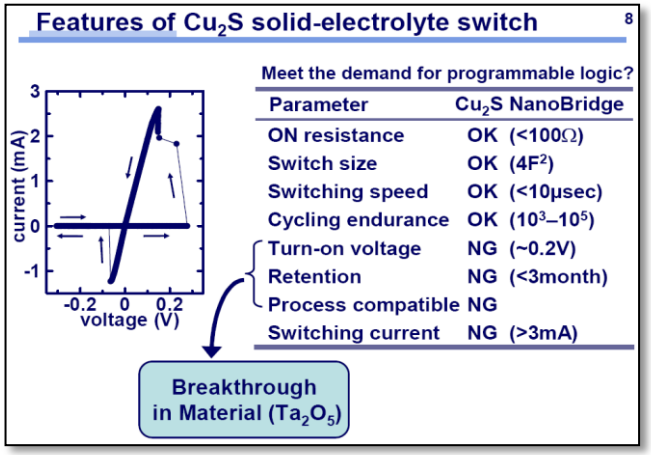




- Function: Nonvolatile, reprogrammable, solid-electrolyte switch
- **Performance Target** (SRAM switch)
  - 1/30 area ($4F^2$ vs. $120F^2$)
  - 1/40 turn-on resistance (50Ω vs. 2KΩ)
- Current Statue

① 1st Gen.
- Based on Cu_2S
- 1 month data retention time

② 2nd Gen.
- Based on Ta_2O_5
- Improved turn-on voltage
- 10 year retention time
- Compatible with standard logic process



Parameter Name	Cu_2S switch[1)]	Ta_2O_5 switch
ON resistance	OK (<100Ω)	OK (<100Ω)
Switch size	OK ($4F^2$)	OK (4-$8F^2$)
Switching speed	OK (<10μsec)	OK (<100μsec)
Cycling endurance	OK (10^3–10^5)	OK (10^4)
Switching voltage	NG (~0.2V)	OK (>1V)
ON-state duration	NG (<3month)	OK (>10years)
Turn-off current	NG (>3mA)	Allowable (~5mA)
Process Compatibility	NG	OK

Partners(sensor, FPGA, etc.)

Contact Info.

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