

Turning IoT Vision into Reality: Semiconductors Lead the Way

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Who We Are

- A global semiconductor leader
- 2017 revenues of **\$8.35B** with year-on-year growth of **19.7%**
- Listed: NYSE, Euronext Paris and Borsa Italiana, Milan

- Research & Development
- Main Sales & Marketing
- Front-End
- Back-End



- Approximately **45,500** employees worldwide
- Approximately **7,400** people working in R&D
- **11** manufacturing sites
- Over **80** sales & marketing offices

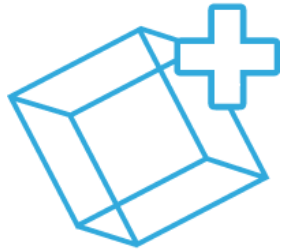
IoT Vision & Promise



Enabling billions of connected smart devices to communicate with each other

Almost any system can leverage the Internet and the ecosystem of Cloud Computing to innovate and make objects smarter and more aware

The IoT Enables a Smarter World



Smart Things



Smart Home & City



Smart Industry



Smart Driving

Connected Objects



300 million in 2017



800 million in 2021

Wearable computing devices



0.4 billion in 2017



1.8 billion in 2021

Excluding PCs & digital home



4 billion in 2017



10 billion in 2021

Retail, advertising, supply chain & Industrial IoT



1.1 billion in 2017



2.2 billion in 2021



Making driving Safer, Greener and more Connected



Safer

- Having cars drive better than we can and always watching for threats
- Making driving safer for car occupants and other road users by actively avoiding accidents



Greener

- Improving power and fuel efficiency, and helping minimize emissions and car maintenance
- Moving towards electric vehicles



More Connected

- Enabling personalized car entertainment and connectivity
- Allowing vehicles to communicate with each other and the infrastructure (V2X)



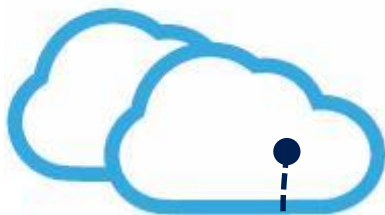
Smart Driving

Smart Driving Connected Services

Connected vehicles enable additional services

Vehicle-to-Cloud

- Diagnostics
- Software Upgrades
- Traffic information
- Infotainment
- Payment services
- Internet services
- eCall



Vehicle-to-Infrastructure

Real-time traffic information



Consumer device integration

- Smartphones
- Tablets



Vehicle-to-Vehicle

ADAS



Smart Driving

The Safer Connected Car

The connected car is revolutionizing vehicle safety



TELEMATICS/GNSS

- Vehicle diagnostics
- eCall accident location
- Navigation & Traffic Info



ADAS

- Radar-based car & hazard detection
- Machine Vision for high definition hazard & traffic sign recognition
- Remote parking



V2X

- Crash avoidance
- Cooperative cruise assist
- Emergency vehicle approaching
- Roadwork alerts
- Green light speed advisory



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Smart Driving

V2X (Vehicle to Everything) Benefits

8

Safety

Over 80 percent of accidents can be avoided by V2X and Connected Vehicle applications

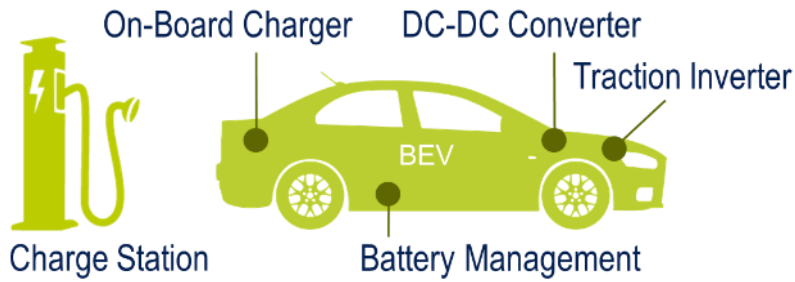
Mobility

42% reduction in travel time on freeway (with cooperative adaptive cruise control)

Environmental

22% of fuel savings (signal operations and freeway lane management applications)





Silicon Carbide

A Key Enabler for Electric Vehicles

Mileage extension, smaller battery (or increased reliability), fast & efficient charging

SiC
 VS
 Silicon IGBT

Efficiency gain @750V	~8% to~12%
Switching losses	~7x lower
Chip size	~5x smaller
Total loss	~50% lower
Switching frequency	~ 5 ..10 X



Si IGBT



SiC MOSFET



Smart Industry

Enabling smarter, safer and more efficient factories and workplaces

Industrial IoT (IIoT)



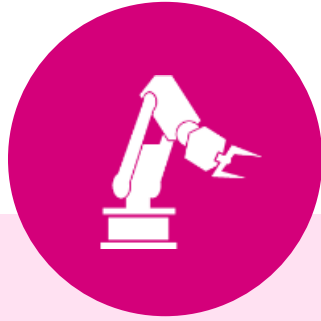
Smart Industry

- Factories that produce in a more efficient manner
- More flexibility and customization
- More sustainable production with less waste
- Safer working environments for people
- Better man-machine cooperation in the workplace
- Optimized usage of machines and tools



Smart Industry

IoT Opportunities in Smart Industry



Connected
Utilities &
Industrial IoT
Devices

1.5B

By 2021

(0.7B in 2017)

Source: ABI



Increase
machine life by
up to

20%

with
condition-based
maintenance

Source: McKinsey



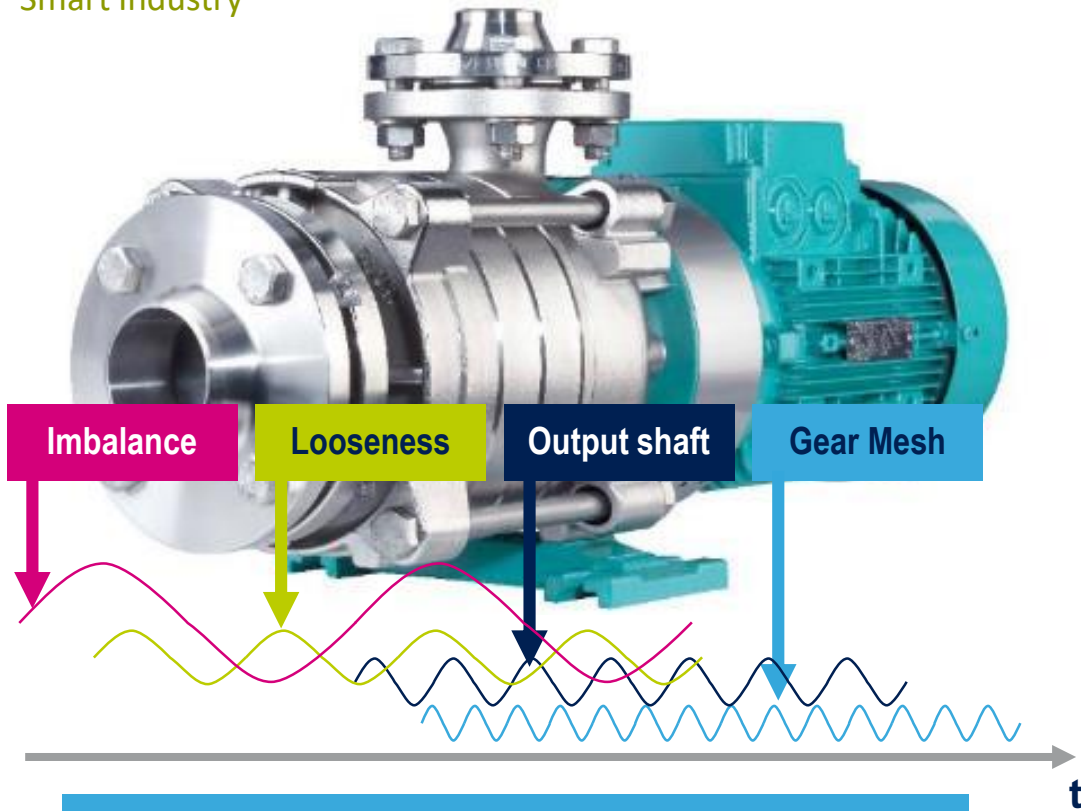
Industrial electric
motors installed
worldwide

300M

Increasing by
10% per year

Source: ABB





- Mechanical vibration**
- Displacement
 - Speed
 - Acceleration
 - Acoustic noise
 - Angular speed
 - Torque

Functional Needs

Semiconductor Products

Vibration Capture →



Motion sensors

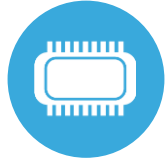
Connectivity →



Bluetooth, Sub-GHz
IO-Link



Processing →



MCU

Secure Connections →



Secure MCU

Power Management →



Power ICs



Smart Industry

Predictive Maintenance

Equipment to be monitored



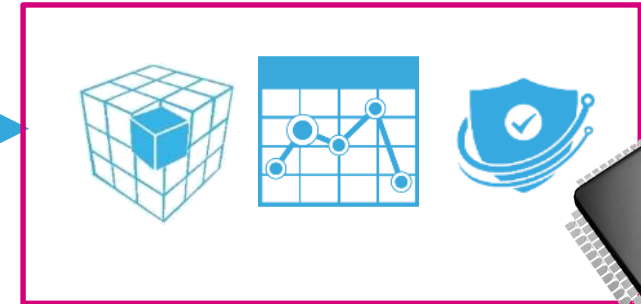
Smart Sensing



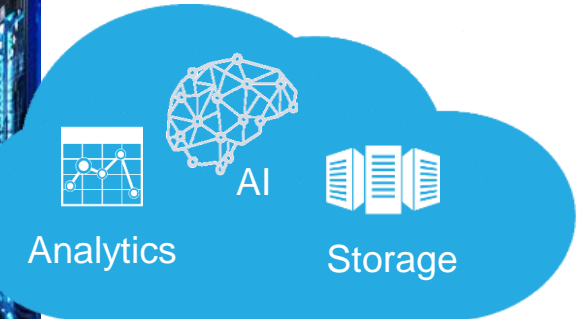
Connectivity



Data collection + Processing + Analytics
Security: authentication



Secure communication



Immediate Actions

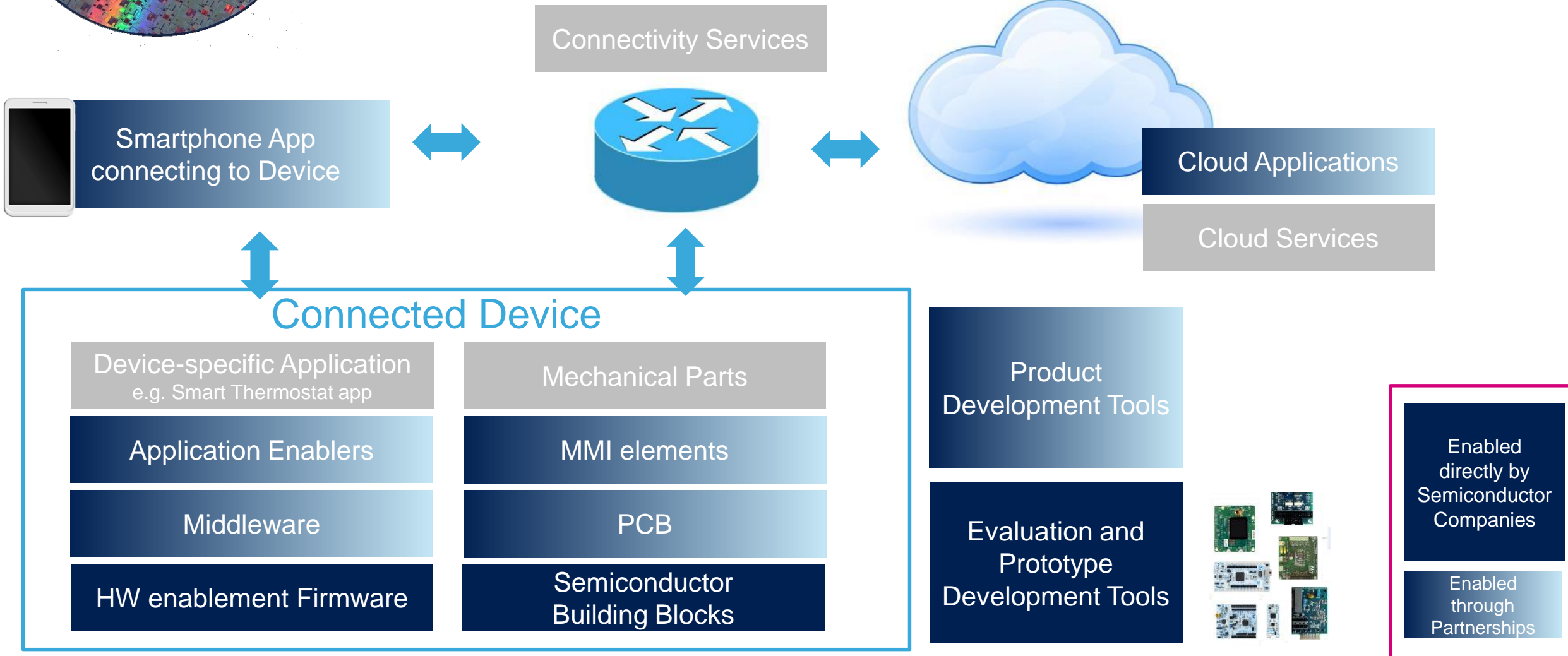
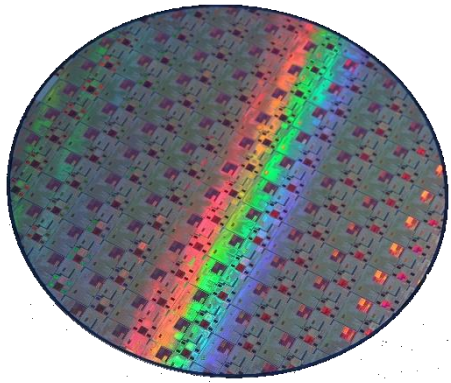


- Decisions
- Actions



















Maintenance



Role of Semiconductor Companies in enabling the IoT



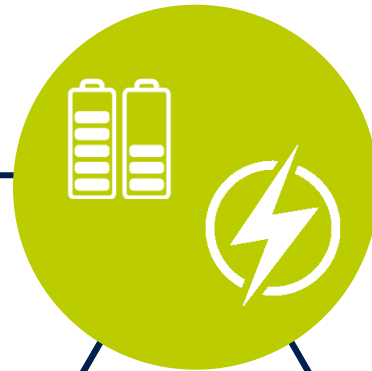
The Building Blocks of the IoT

	Sensing & Actuating	Processing	Security	Connectivity	Conditioning & Protection	Motor Control	Power & Energy Management
							
	Range of sensors and actuators	Ultra-Low Power to High Performance	Scalable security solutions	10 cm to 10 km	Nano Amps to Kilo Amps	Power conversion Monitoring Drivers	Nano Watt to Mega Watt
							
							
							

Some of the Challenges of IoT Devices

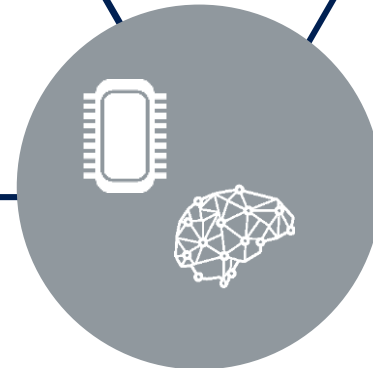
Low-power devices & Energy Efficient

Adapted connectivity



Security at all levels

The right types of Sensors



Intelligent processing



The 5G Disruption

What it brings to the end users



Very high data rate – **x100***
Reduced latency – **5 times lower***
Very high reliability – **99,999%**
Connections of **millions** of nodes
Improved coverage

What is changing in the infrastructure



New architecture with denser network (small cells)
New technologies: Advanced beam forming, massive MiMo
New spectrum: Use of millimeter waves

What is required from microelectronics



Higher silicon **integration**
Improved **RF performance**
Enhanced **power efficiency**
Cost-optimized solutions

* vs 4G

Advanced Process Technologies



Semiconductors



Range of
microcontrollers



Intelligent
sensors

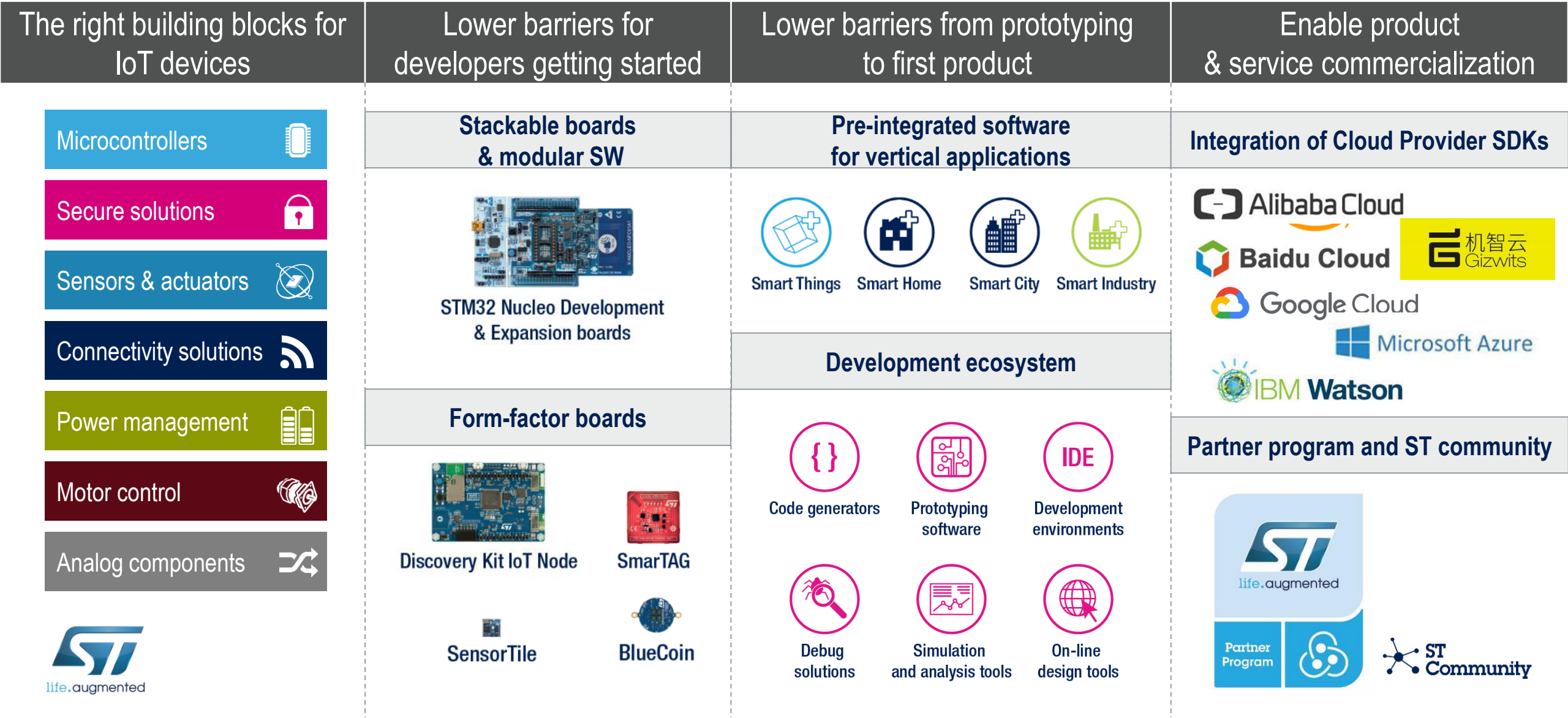


Advanced
connectivity



Smart power
and
energy management

Beyond the Building Blocks



Close Partnership with Key Enablers



Alibaba Cloud 机智云 Gizwits 科大讯飞 iFLYTEK
Baidu Cloud

- To develop SW to connecting to the Cloud & Cloud services for IoT users



中国移动 China Mobile 中国电信 CHINA TELECOM China unicom

- To develop NB-IoT/LoRa modules and FW package compatible with STM32 ecosystem



Bluetooth SMART Wi Fi LoRa™ NB-IOT

- To customize stack and develop RF modules compatible with STM32 ecosystem



AliOS Things IAR SYSTEMS arm Lite

- To implement secure solutions from device to cloud





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