



CAPTURING THE SECOND BIOMETRIC WAVE

Dr. Hemant Mardia, CEO of IDEX ASA

Disclaimer

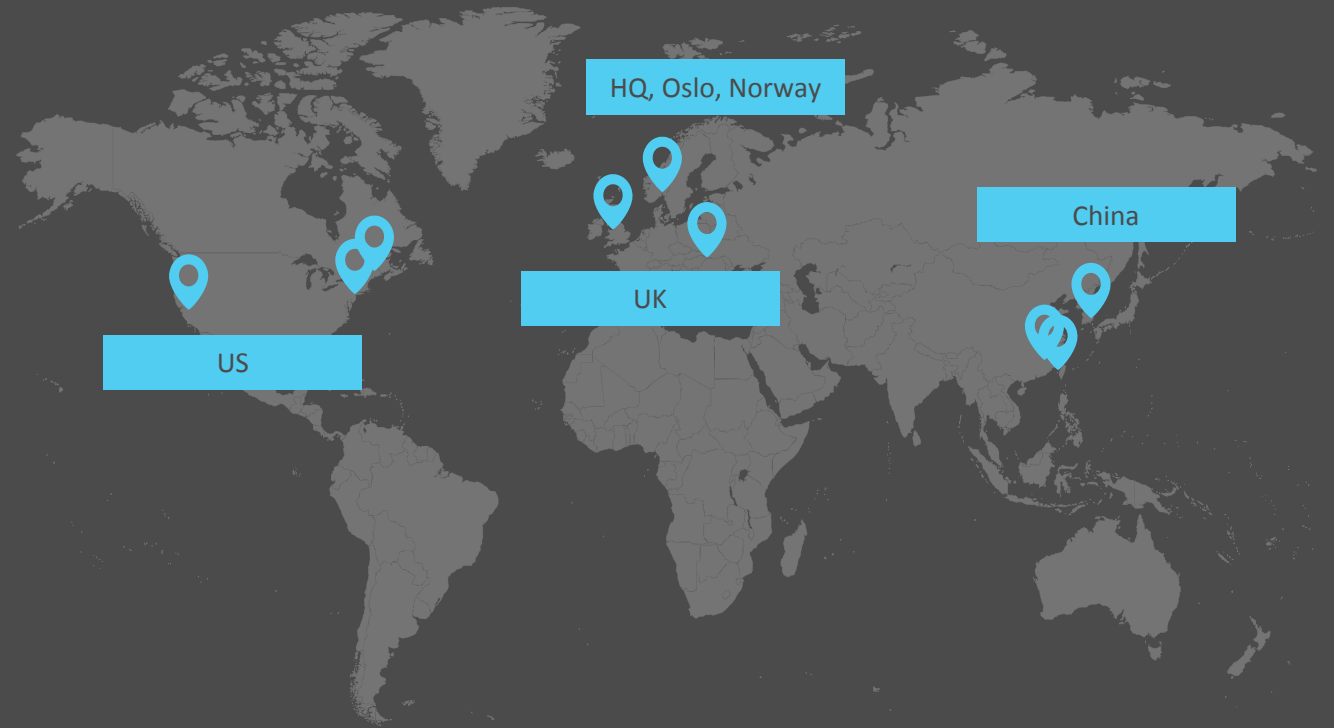
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IDEX delivers fingerprint solutions to mass-markets, based on a unique flexible and cost efficient off-chip technology



IDEX in brief

- Unique, flexible and cost efficient off-chip sensor technology
- Strong industry experience and system level innovation supported by quality IP
- 122 staff with deep biometric expertise
- Supply chain and channel to market established
- Listed on Oslo Stock Exchange



Today's speakers



**Dr. Hemant
Mardia**

*Chief Executive
Officer*



**Fred
Benkley**

*Chief Technology
Officer*



**Antonio
D'Albore**

Smart Card Expert



**Henrik
Knudtzon**

*Chief Financial
Officer*



**Stan
Swearingen**

*Chief Products
Officer*

Capital markets day agenda

Time	Section	Speaker
10:00	Capturing the second biometric wave	Dr. Hemant Mardia, CEO
10:15	The rise of biometric card market	Antonio D'Albore, Smart card expert
10:30	Unique, flexible and cost efficient solutions	Fred Benkley, CTO
11:00	Strong foundation to capture market growth	Stan Swearingen, CPO
11:30	Scaling to revenue and profitability	Henrik Knudtzon, CFO
11:40	Concluding remarks and Q&A panel	Executive team
12:00	Lunch and product demonstrations	All

Demand for biometric solutions is undeniable



93%

of consumers prefer biometrics to passwords in online payment applications

92%

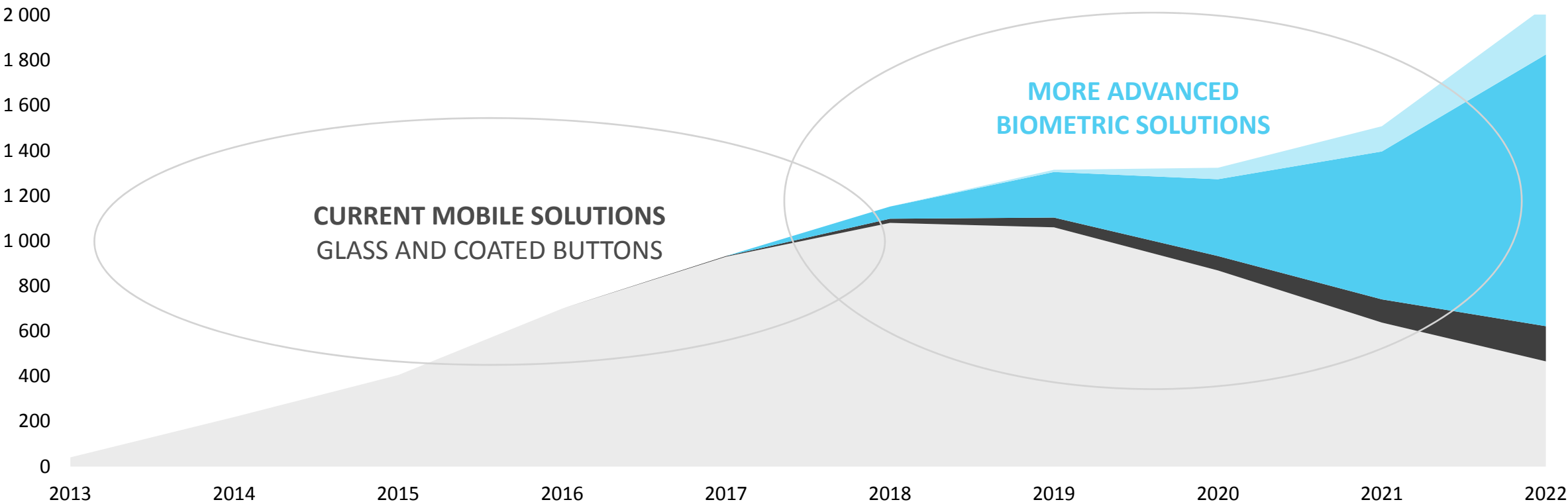
of banks want to adopt biometric technology

Source: Mastercard and University of Oxford

Large and growing market for fingerprint sensors

Fingerprint sensors shipped annually

Million units



* Source: IDEX estimates, Statista and Gartner

■ Mobile (coated buttons) ■ IOT ■ Biometric cards ■ Display integration

VISION

Convenient security

HOW

Identification and authentication through scalable biometric solutions



The second wave of biometric adoption is building momentum



FIRST WAVE

Catalyzed by Apple

Mobile sensors driven by industrial design

- Dominated by capacitive sensors
- Multi-modal biometrics adoption
- Market commodisation



SECOND WAVE

Catalyzed by Mastercard

Biometric solutions driven by convenience and security

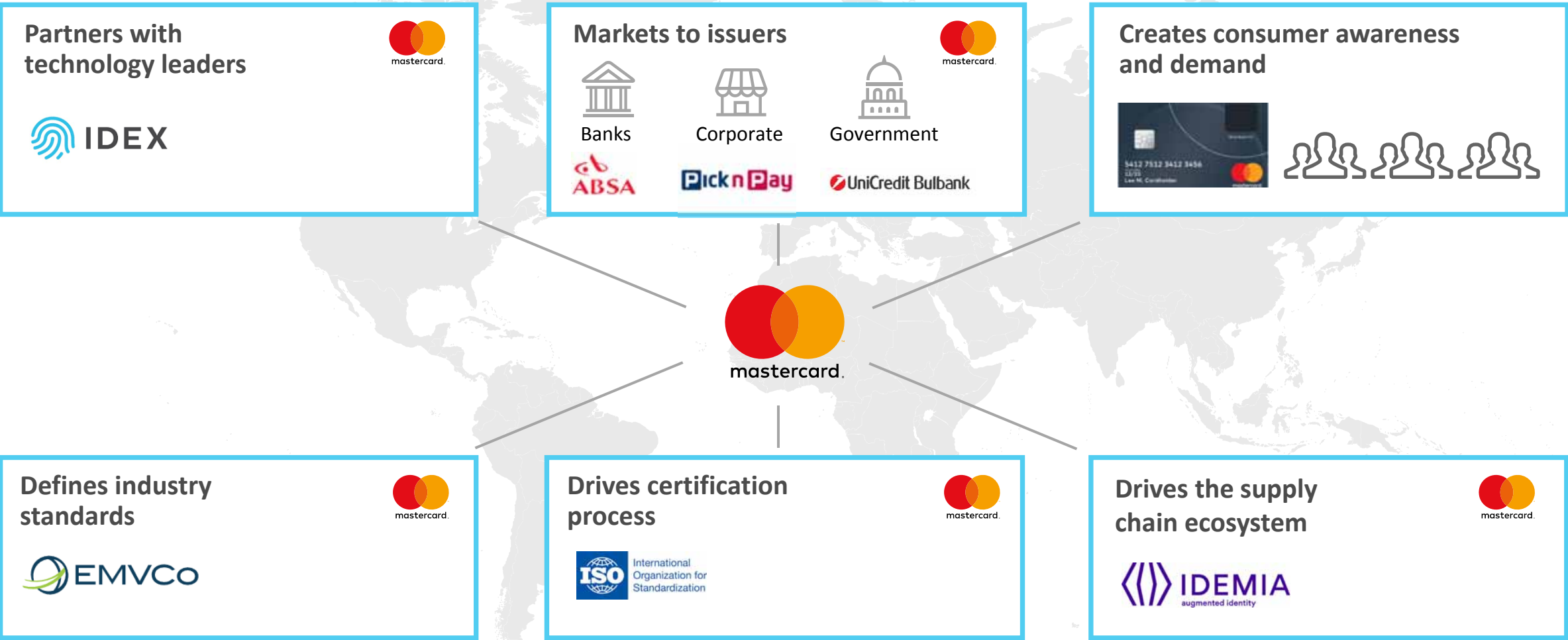
- Large market with global payment & ID standards
- Low power & scalable form factor
- Usability is paramount

“Our mission at Mastercard is to make biometrics in payment safe, simple and secure, and to that end we are proud of our Biometric Card solution. We find that IDEX’s deep expertise in fingerprint, culture of innovation and commercial focus positions them as one of our most credible partners in this field”

Bob Reany
Executive VP, Identity Solutions

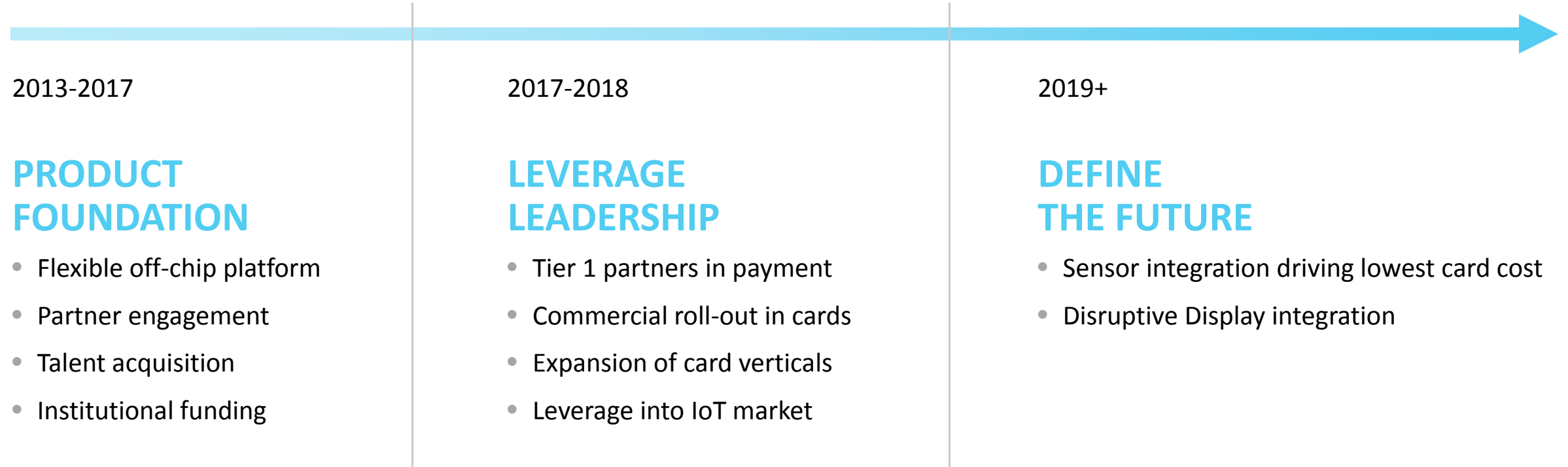


Mastercard is the leading driver in the global biometric card market



IDEX focus on the biometric card market

IDEX strategic path



Fundamental advantage of off-chip sensing

Indicative cost: off-chip vs silicon capacitive sensors

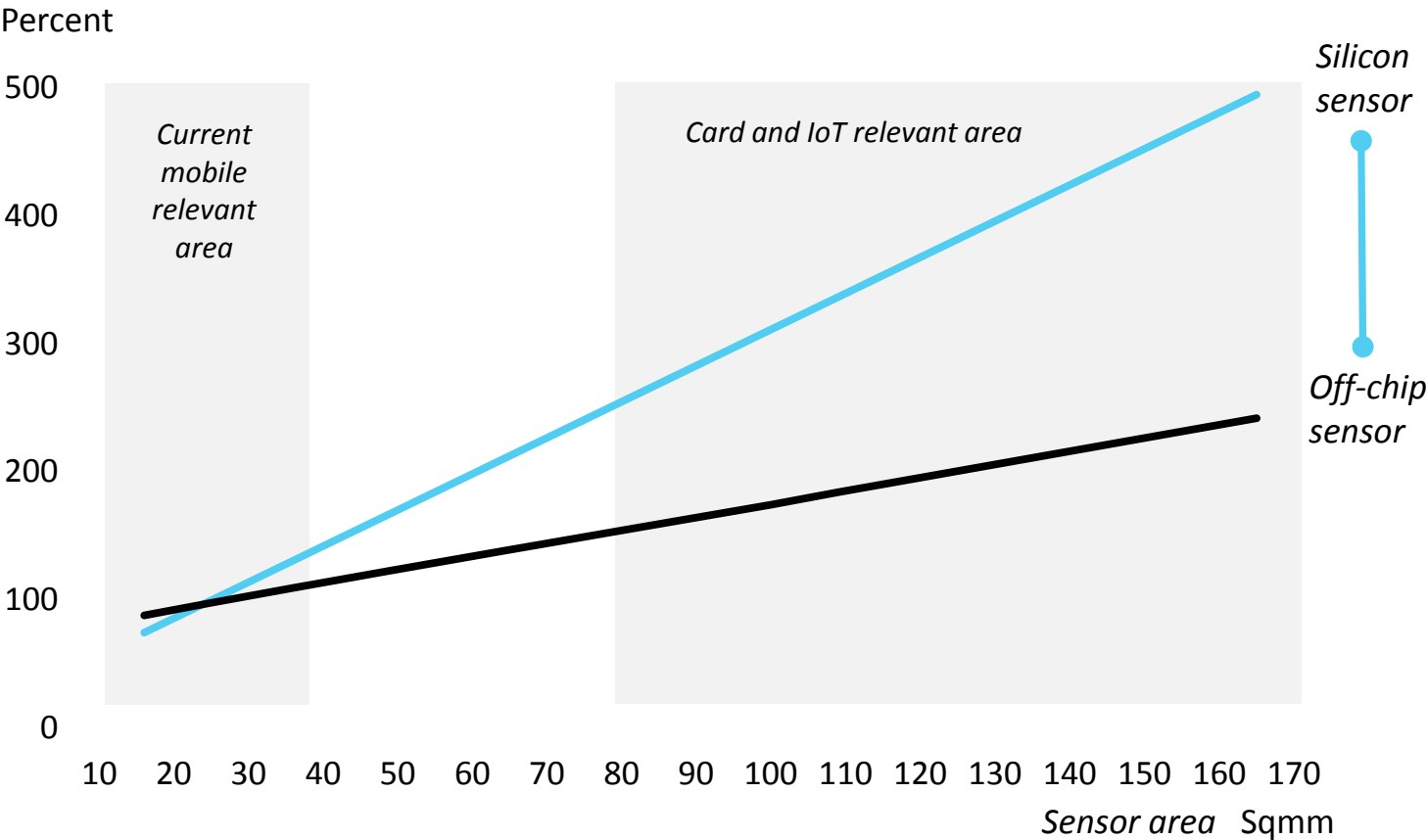
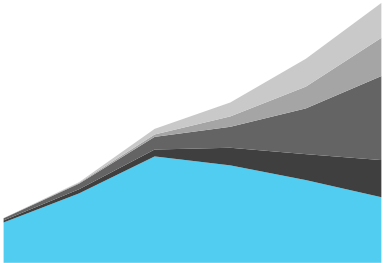


IMAGE SIZE MATTERS IN CARDS

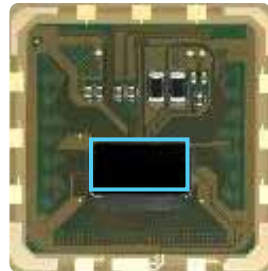
Significant cost and usability advantage at card system level

IDEX positioned to capture second wave of biometric adoption

Large market opportunity



Significant cost and scaling advantage



Deep partnerships with market leaders



Proven compliance with standards



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THE RISE OF BIOMETRIC CARD MARKET AND HOW TO SUCCEED

Antonio D'Albore,
Editor-In-Chief, Embedded Security News



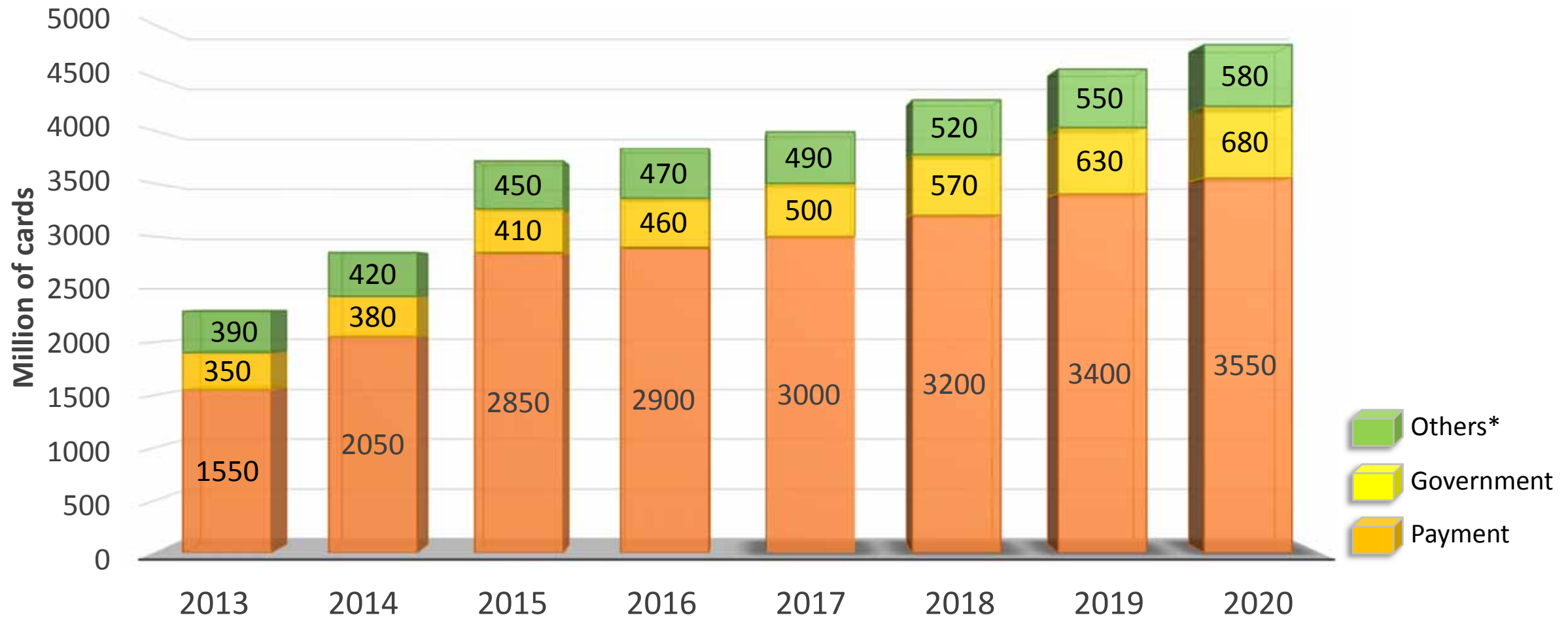
The Rise of Biometric Card Market



Antonio D'Albore
Editor-In-Chief
Embedded Security News

IDEX Capital Market Day
2 November 2017
London

Global Smart Card Shipments 2013 to 2016 & 2017 to 2020 Forecast



Source: Eurosmart, Embedded Security News estimates. *Others: Transportation Cards, Logical Access Cards, Physical Access Cards, Pay TV Cards.

Global Smart Card Trends

Despite growing E-and M-payments, Payment Cards remain still the favourite payment method.

Governments replacing paper-based National ID with Smart Cards IDs.

Strong industry push for Powered Smart Cards:

- OTP cards
- Dynamic CVV cards
- Multi-profiles cards



Multi-application cards like Maldives National ID Card incorporating ID + Passport + Payment + Healthcare + Insurance + Drivers license.

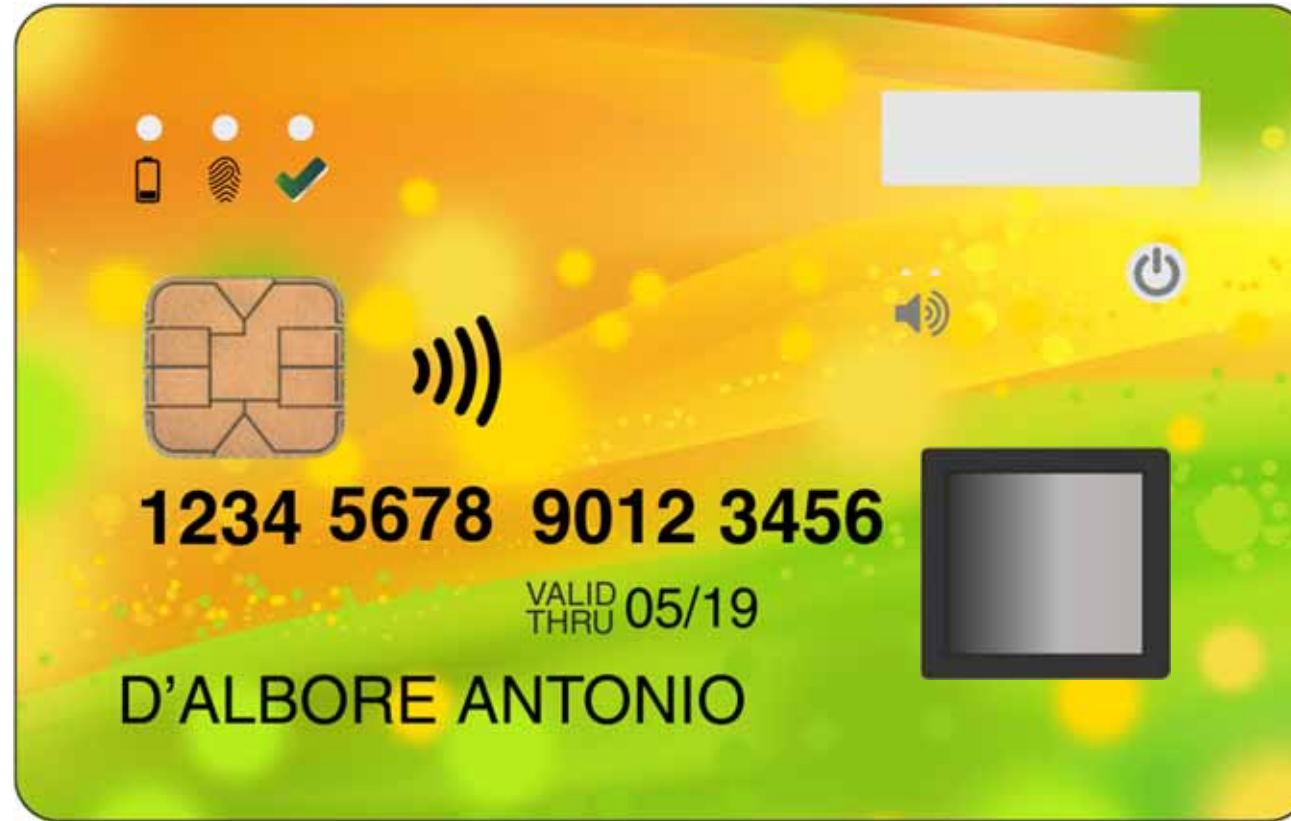
Why Biometric Smart Card Now

Industry & Government Needs:

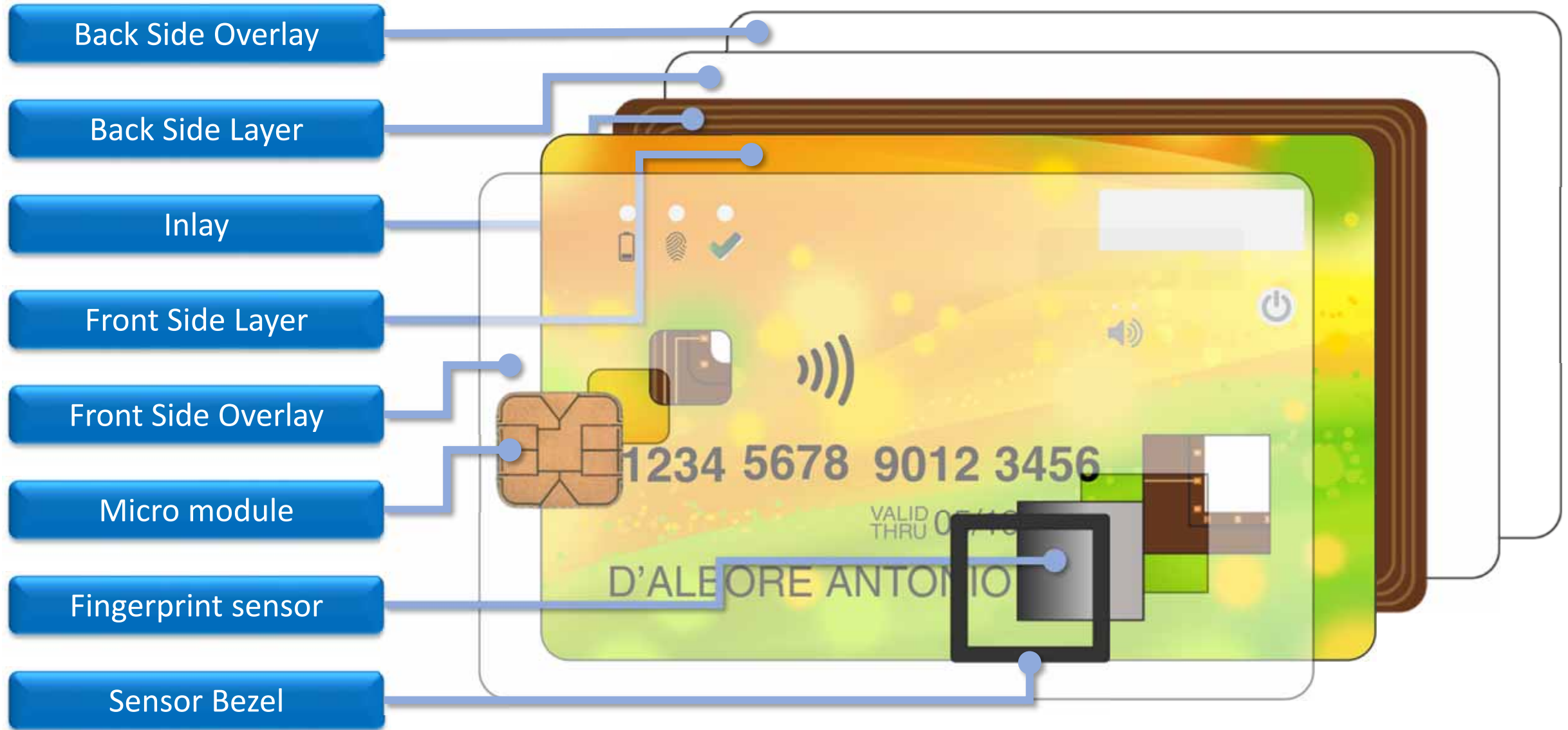
- Fight financial cards fraud
- Fight logical & physical access control crimes
- Fight criminal organizations fake IDs business
- Secure citizen, refugees and displaced Identification
- Preserve citizens privacy and compliance with national / states regulations (EU PSD 2, EU GDPR, USA BIPA)



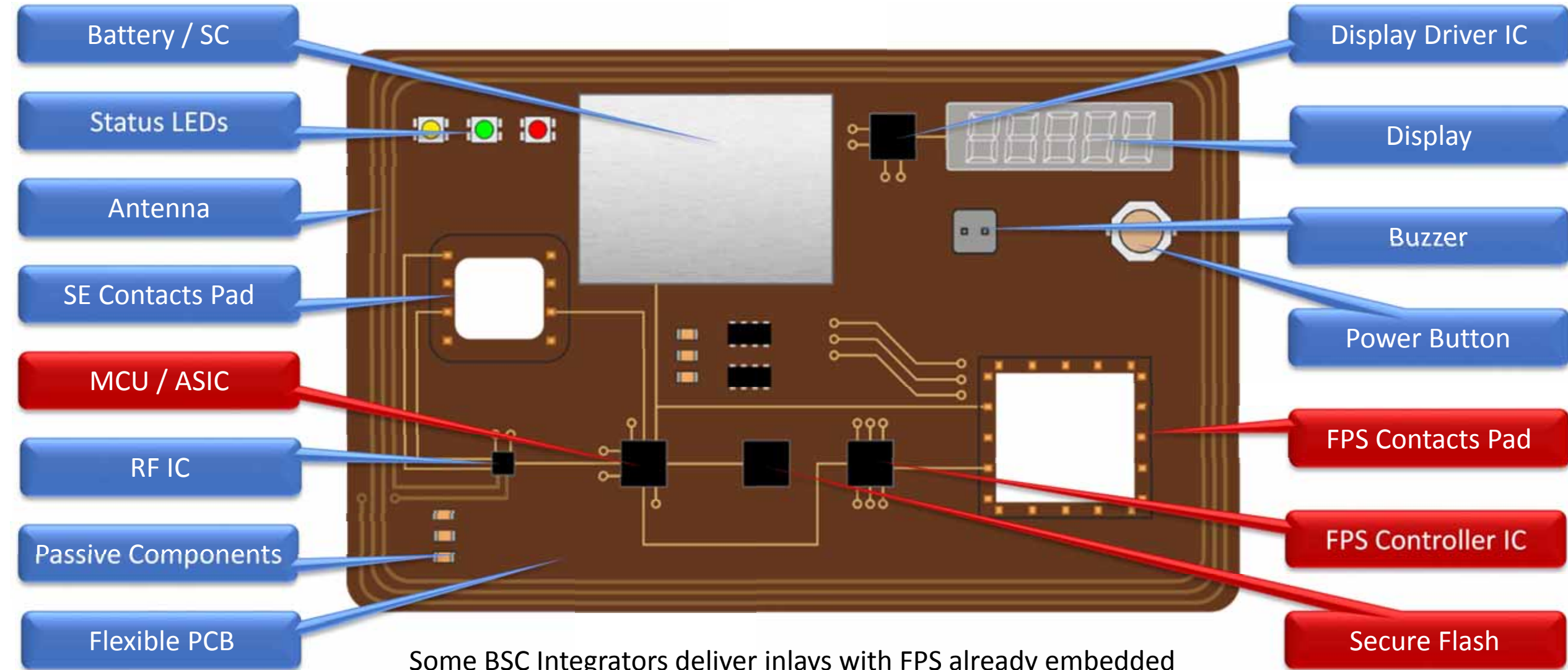
Anatomy of a Biometric Smart Card



Anatomy of a BSC: the components



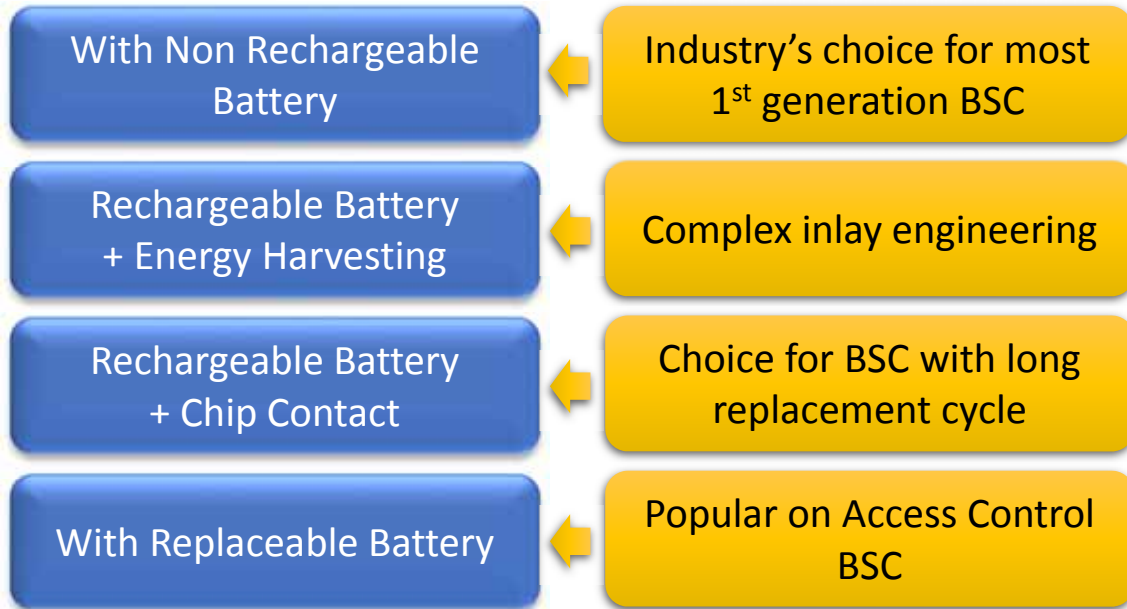
Anatomy of a BSC: The Inlay



Anatomy of a BSC: Power Supply



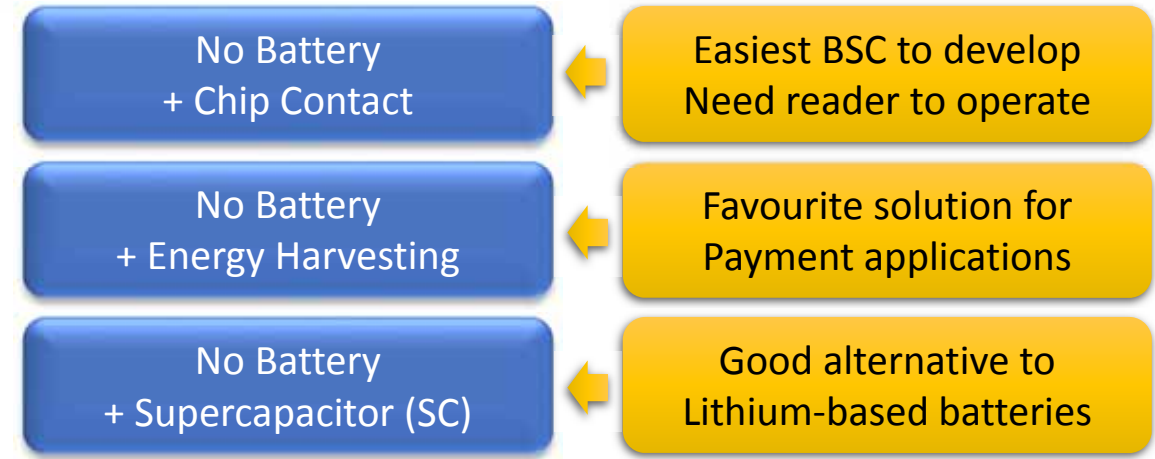
BSC With Battery



- Easy to implement.
- Because of Lithium, can be subject to certification or transport limitations in some countries.

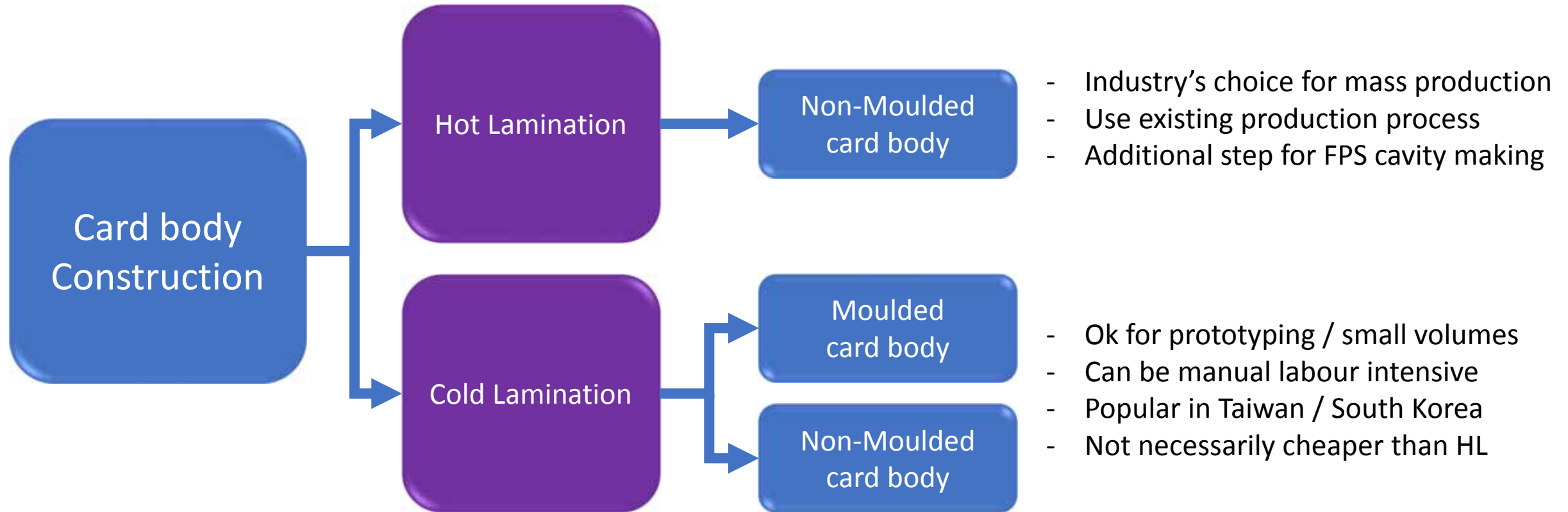


BSC Without Battery

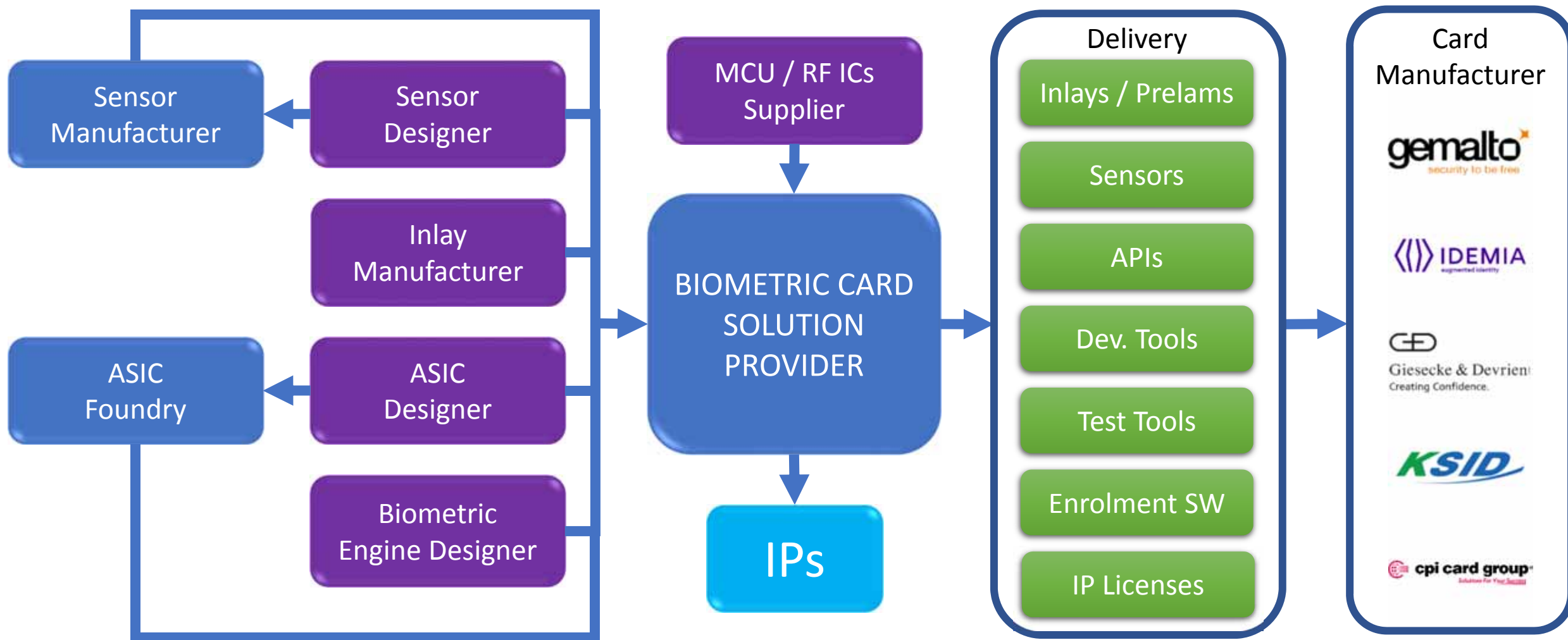


- Requires card reader / NFC reader for enrolment.
- Global BSC trends point toward battery-less solutions

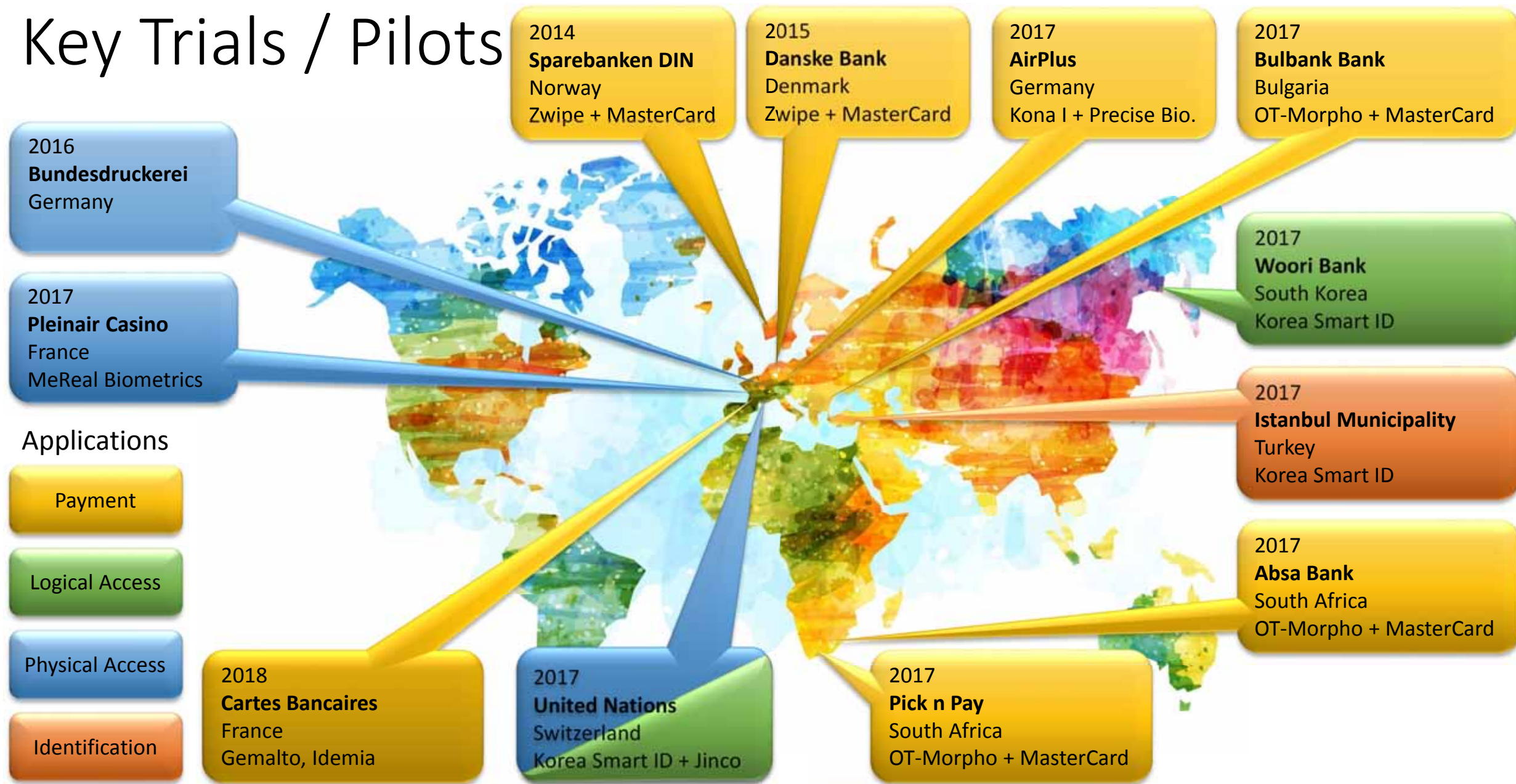
Anatomy of a BSC: Card Body Construction



Biometric Cards Value Chain



Key Trials / Pilots



Applications

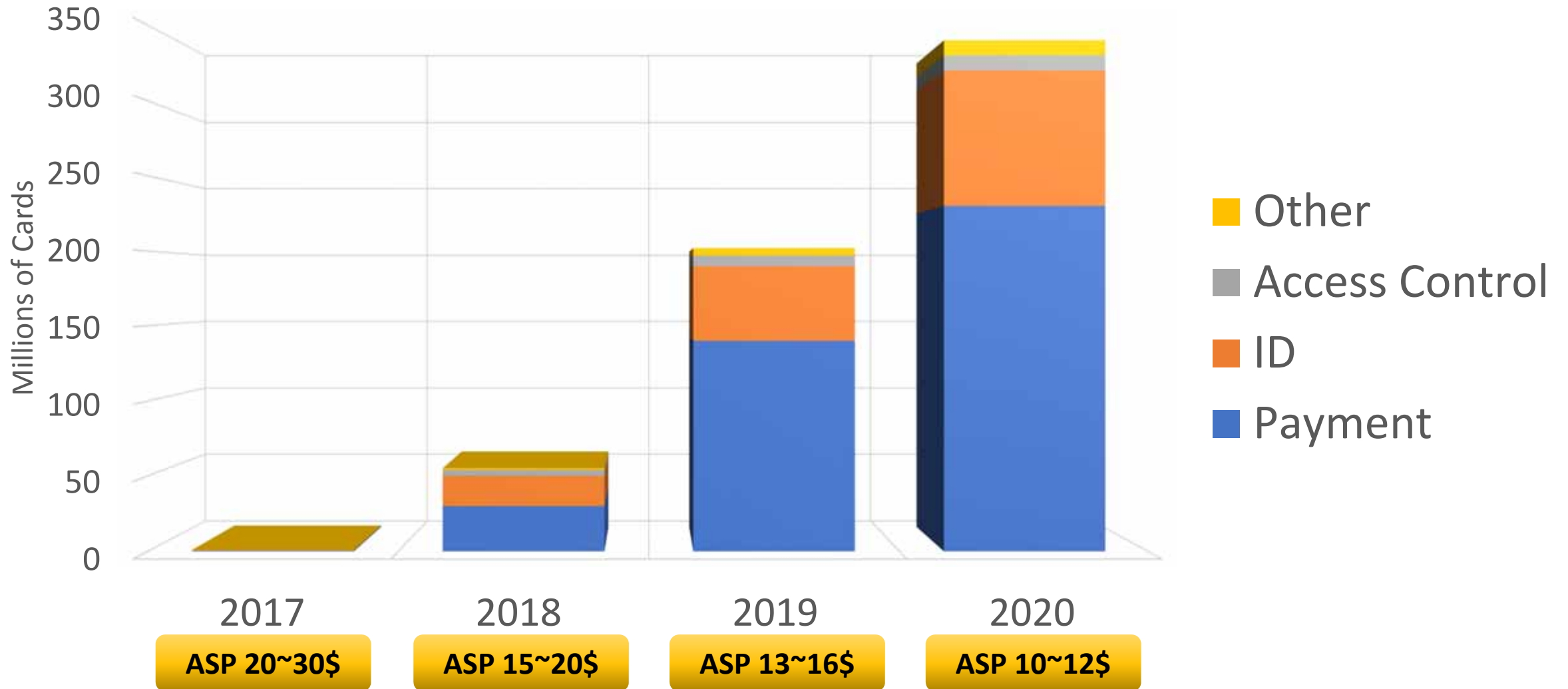
Payment

Logical Access

Physical Access

Identification

Global BSC Shipment Forecast Y2017-2020



Source: ABI Research, Fingerprint Cards, Gartner, HIS, Nilson Report, Precise Biometrics, Statista, Carnegie Research, Strategy Analytics, Swedbank, ESN estimates.

Critical Elements for Successful BSC Deployment

- Multiple suppliers to support mass market adoption
- Low components cost
- Low power consumption
- Flexible Sensor
- Seamless integration with smart card manufacturing process
- Compatibility with existing standards



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UNIQUE, FLEXIBLE AND COST EFFICIENT SOLUTIONS

Fred Benkley, CTO



Capacitive fingerprint sensors has the majority market share

FINGERPRINT TECHNOLOGIES

Optical	Thermal	Ultrasonic	Capacitive		
			Silicon Sensors	Off-chip Sensors	
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The second wave of biometric adoption building momentum



FIRST WAVE

Dominated by smaller capacitive sensors

- ID constraint and high silicon cost driving need for smaller sensors
- Sensor with minimal digital intelligence
- Smaller sensors compensated by multiple enrols and strong algorithms
- Advanced packaging and coating to protect silicon from damage



SECOND WAVE

New biometric applications require more flexible and larger area sensors

- Usability and security drives larger sensors
- Decoupling sensing elements from silicon changed basic size/area cost trade-offs
- Digital intelligence integrated into driver ASIC

Sensors size drives performance and usability

SMALLER SENSOR AREA



Less data from image
require more complex
matcher, demanding
higher power and
processing resource



Many enrols

LARGER SENSOR AREA



More information from
image, can use compact
matcher

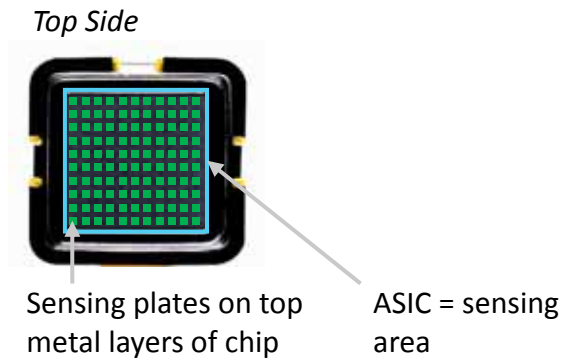


Few enrols

The off-chip sensing revolution

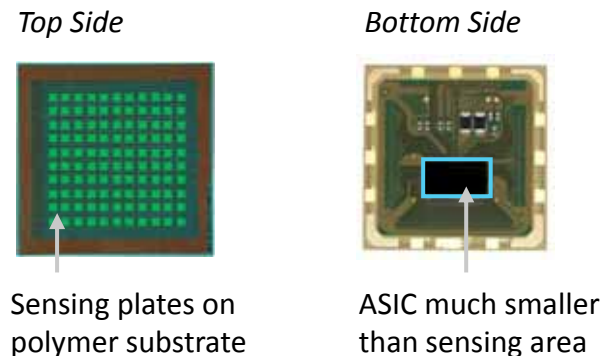
8x8mm sensor example

SILICON SENSORS



- Sensing area same as ASIC, $\sim 70\text{mm}^2$ for 8x8 sensor
- Silicon expensive, non-bendable
- Low flexibility for design and architecture
- Minimal digital intelligence

OFF-CHIP SENSORS

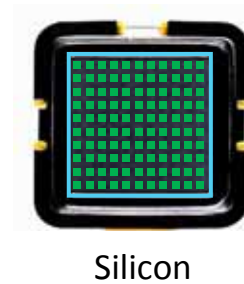
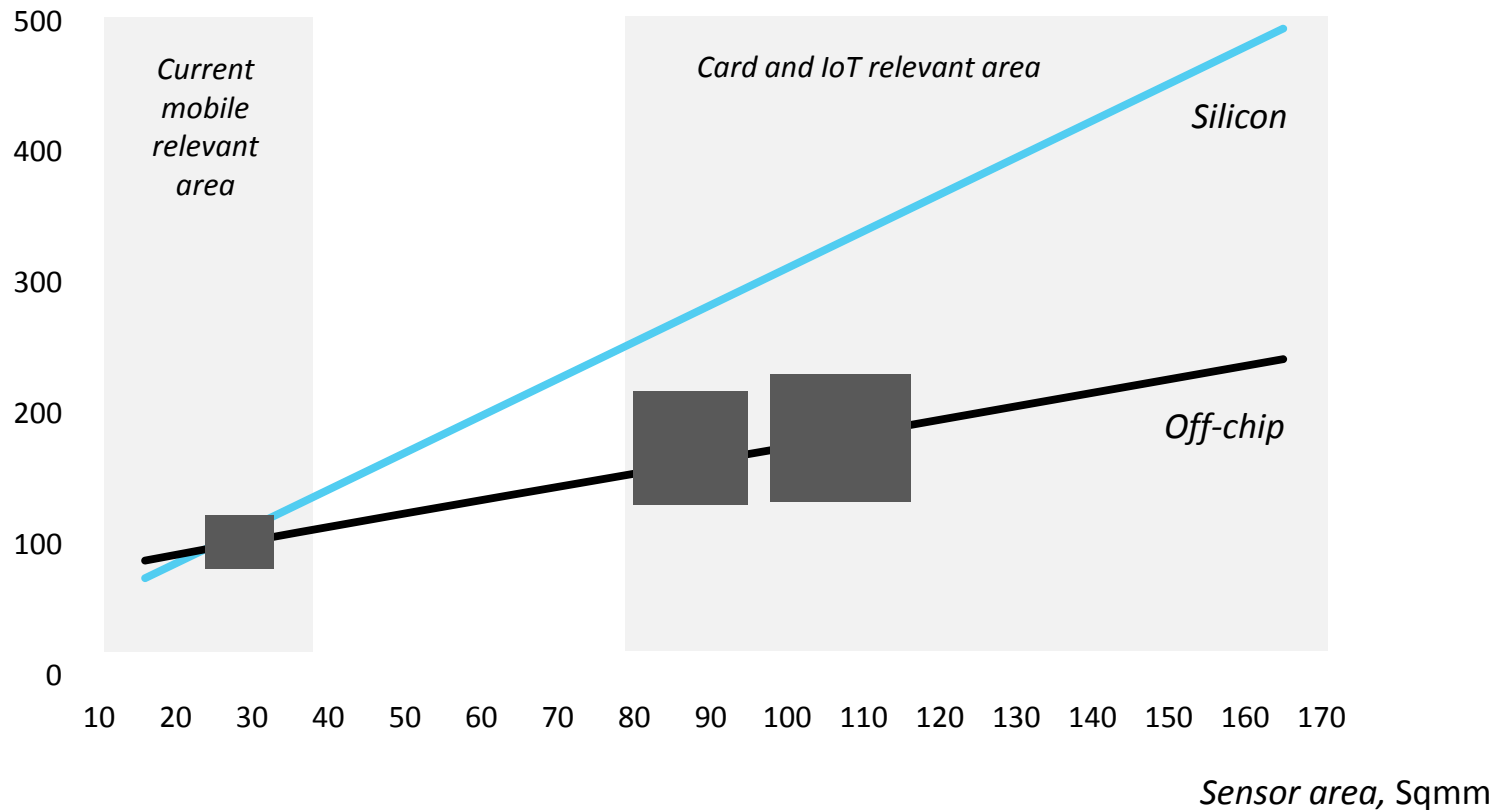


- Sensing area separated from ASIC, $\sim 13\text{mm}^2$ for any sensor size
- Polymer cheap and flexible
- High degree of flexibility for substrate and architecture
- High digital intelligence (processor, memory, encryption & firmware)

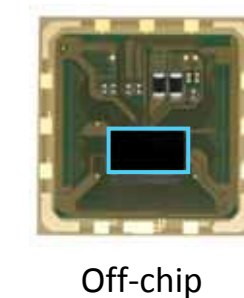
Fundamental advantage of off-chip sensing: cost

Indicative cost: off-chip vs silicon capacitive sensors

Percent



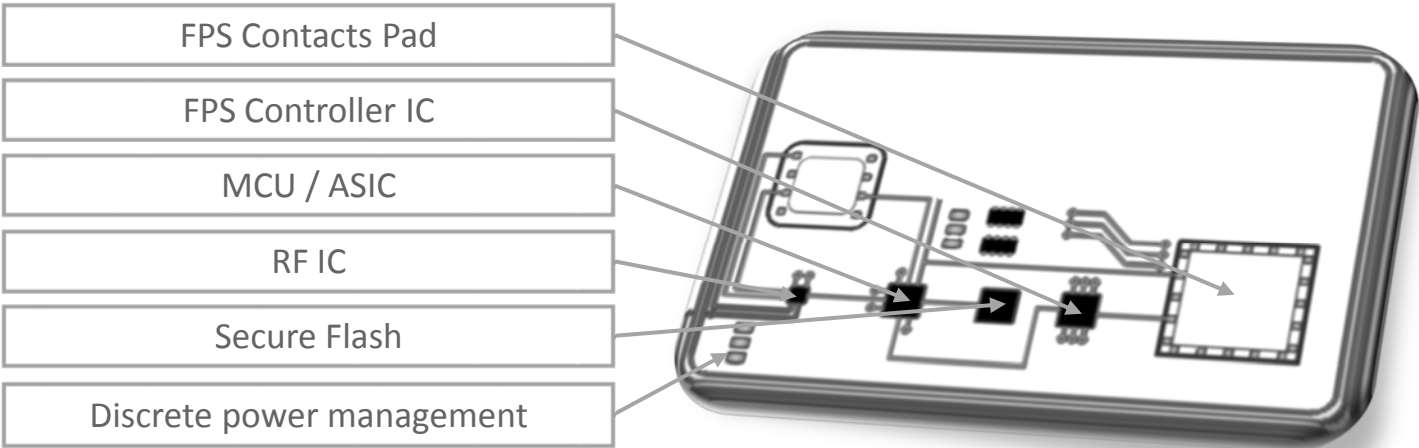
- Silicon footprint linear with increase in size
- Silicon most costly component of sensor



- Silicon footprint constant, common ASIC for all sensor shapes
- Cost of polymer substrate significantly lower than silicon
- Marginal increase in packaging cost from increase in sensor size

Fundamental advantage of off-chip sensing: card system integration

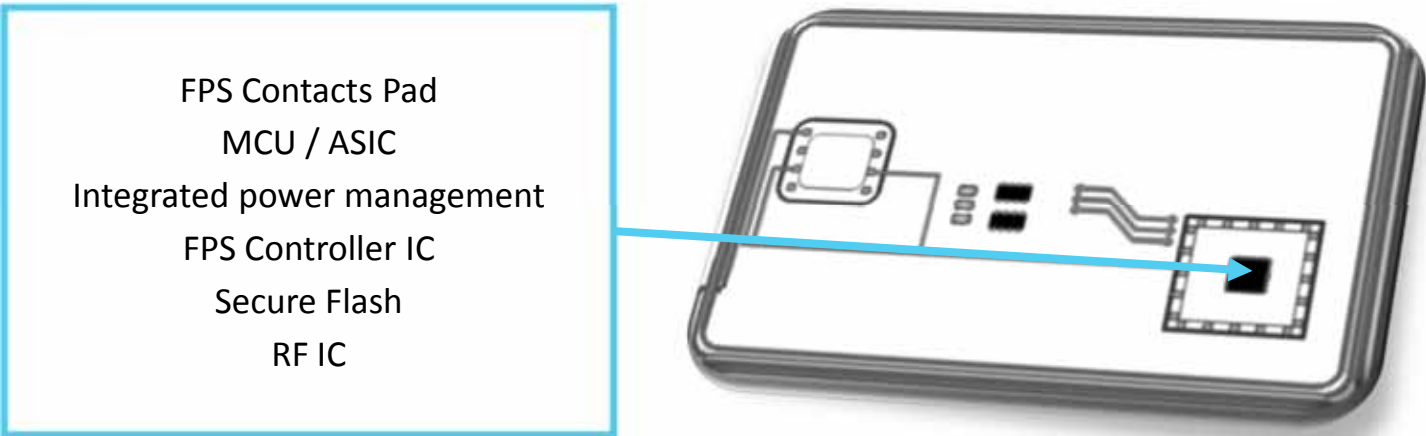
Conventional
silicon sensor



Discrete silicon sensing component

- Large number of supporting components
- Design complexity
- Complicates manufacturing
- Higher total cost

IDEX
off-chip
sensor



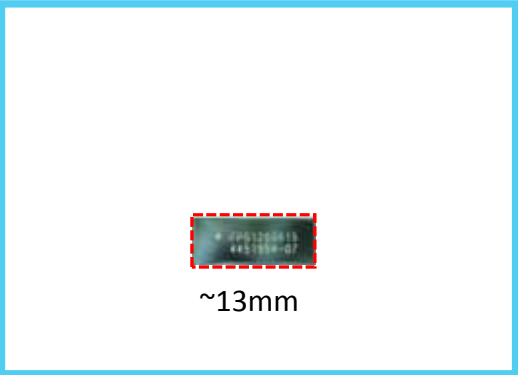
Integrated system solution

- Fewer components
- Simplified manufacturing
- Optimized biometric performance
- Optimal power efficiency
- Lower total cost solution

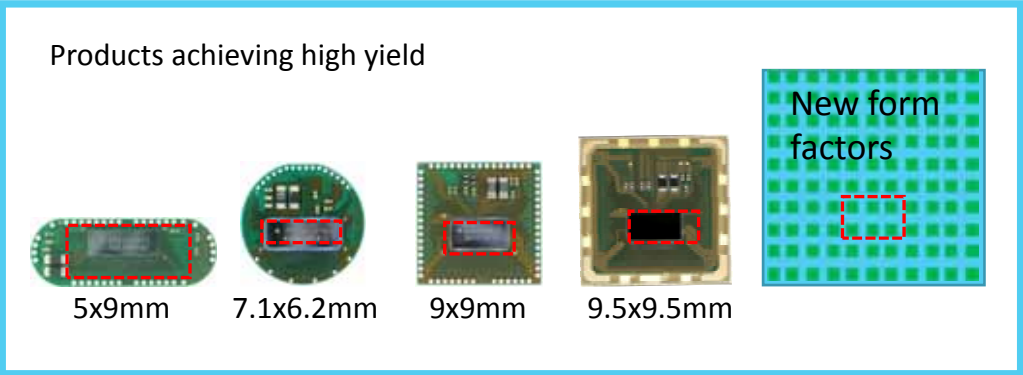
IDEX's off-chip technology demonstrates architectural adaptability

Components

One ASIC platform



Multiple substrates, multiple designs
& complete solution architectures



Multiple applications



Supply chain

- World's largest foundry
- Capacity >10 million 12-inch equivalent wafers in 2016

- One of the world's largest provider of packaging services
- 20,000 employees world-wide
- Modules for cards, IoT and mobile

Significant barriers to entry

Barriers to entry



ACCUMULATED KNOWLEDGE BASE

- IDEX's off-chip technology dates back to 2003
- Augmented IDEX's technology through Picofield & IP acquisition
- Acquired unique embedded matcher technology



SPECIALIST TEAM

- Extensive experience from in-display integration/ touch screen market
- Originators of first fully integrated display and touch screens with 'hover' capability
- Building security expertise



SYSTEM EXPERTISE

- Off-chip leads to natural system integration
- Delivering end-to-end scalable solution

Extensive and high-quality fundamental patents

Off-chip sensor



Biometric algorithms



Packaging



System



Innovations to full biometric system

SYSTEM INTEGRATION

- Next generation ASIC will leverage advanced process nodes with even more power efficient structures and increased functionality
- Leverage next generation substrate technologies to enable seamless device integration and reduce cost



Sensor



Advanced Enrolment

- Secure remote enrol on card
- Fewer touch enrol process using larger area sensors



Algorithm

- Matching technology
- Improved speed/power trade off
- Superior partial/tip touch performance



Security

- In-sensor encryption
- Breakthrough patented technology that will leapfrog traditional liveness detection

IDEX solution for the second biometric wave

OFF-CHIP SENSOR OFFERING

- Unique **adaptability** in design and architecture
- **Cost advantage** in larger sensors
- Enabling superior **usability**
- New level of **systems integration**



BIOMETRIC SMARTCARDS

- Limited power and processing power
- Flexibility for ISO form factor and durability
- Larger sensor critical for usability



IOT APPLICATIONS

- Limited power require larger sensors
- Larger sensor for usability
- Flexible sensors value proposition for wearable applications



IN-DISPLAY INTEGRATION

- In-display sensing compatible with off-chip polymer technology

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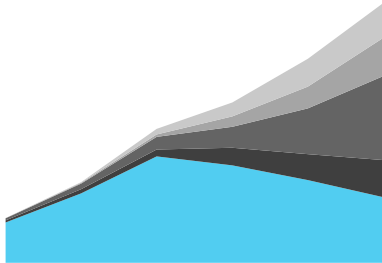
STRONG FOUNDATION TO CAPTURE MARKET GROWTH

Stan Swearingen, CPO

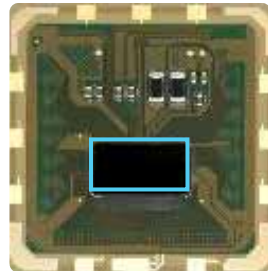


IDEX positioned to capture second wave of biometric adoption

Large market opportunity



Significant cost and scaling advantage



Deep partnerships with market leaders



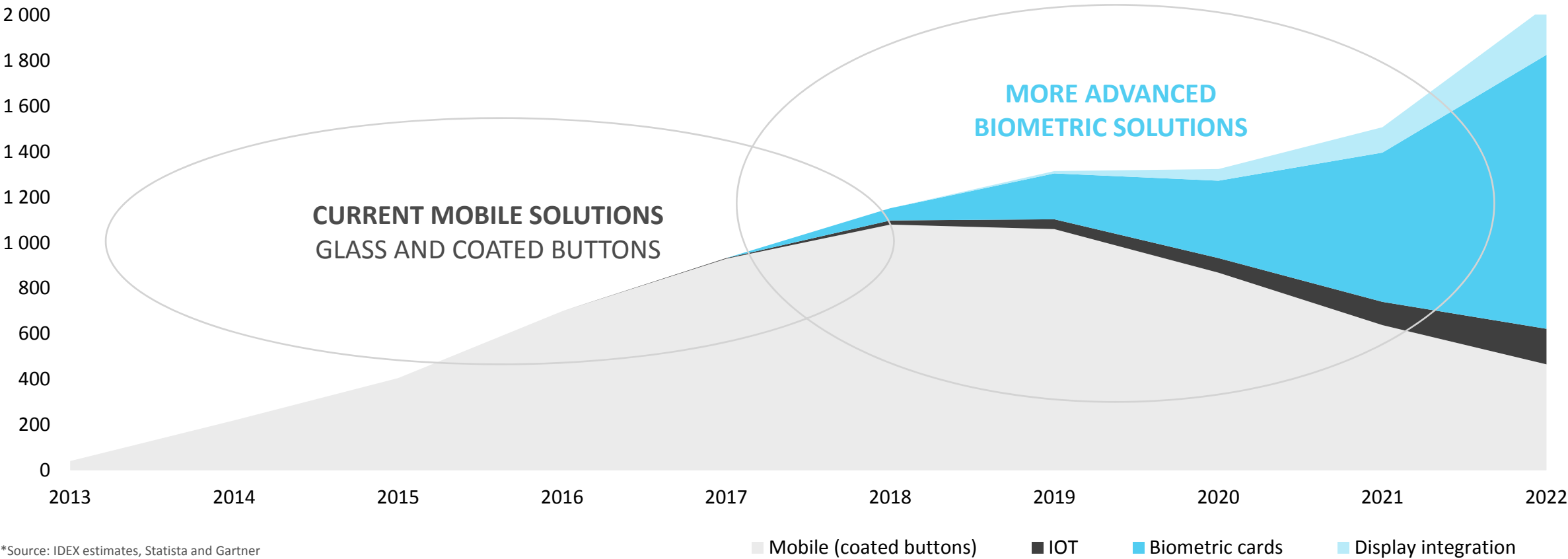
Proven compliance with standards



Large and growing market for fingerprint sensors

Fingerprint sensors shipped annually

Million units



*Source: IDEX estimates, Statista and Gartner

IDEX leading biometric card offering

OFF CHIP SENSOR SOLUTIONS

- Unique **adaptability** in design and architecture
- **Cost advantage** in larger sensors
- Enabling **superior usability**
- New level of **systems integration**



- Sensors or modules
- Compact matching algorithm
- Enrolment solution

Biometric card ecosystem

FINGERPRINT SENSOR

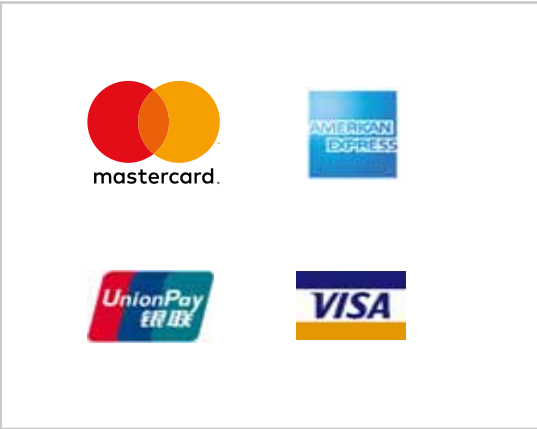


ASIC FOUNDRY AND PACKAGING

CARD INTEGRATORS



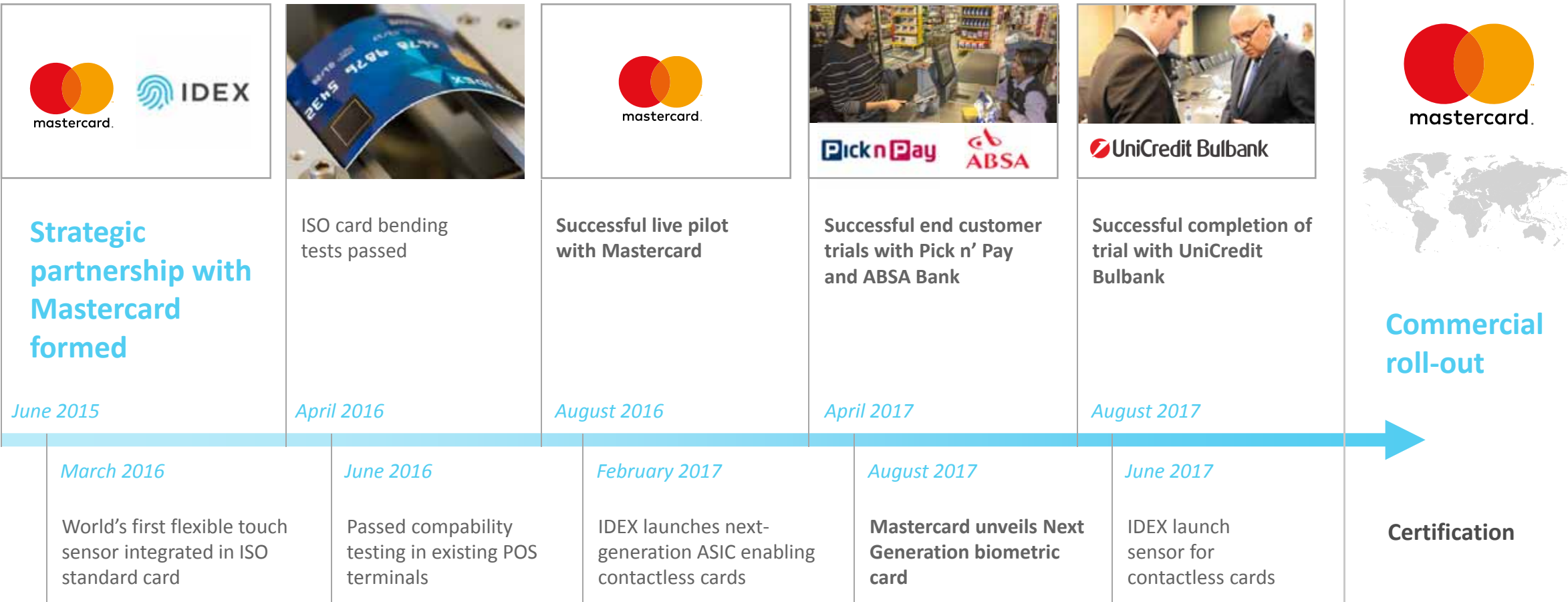
MARKET ENABLERS



ISSUERS



Mastercard creating biometric card mass market



IDEX solution compatible with installed base and industry standards



INDUSTRY STANDARDS

Card design for ISO standards

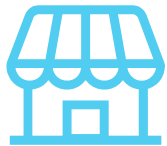


- Certification critical in deployment (given security oriented payment industry)
- Certification process requires finalized solution and rigorous testing
- **IDEX expect to commence certification imminently**



ISSUER

Designed into mass enrolment system



POS

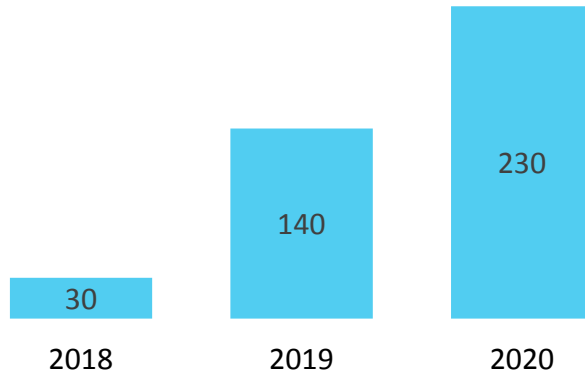
Compatible with existing POS terminals



Biometric payment cards market gaining momentum

Biometric payment card

Million units



MARKET DRIVERS

- Consumer pull driven by mobile adoption
- Banks want to differentiate
- Fraud reduction

BARRIERS TO ADOPTION

- Sensitivity to cost
- Rigorous standards and certification protocols
- Interoperability with existing infrastructure

CUSTOMER PROFILE

- Typical customer issues hundred of thousand to million cards per annum
- Early movers have piloted biometric cards in real life trials

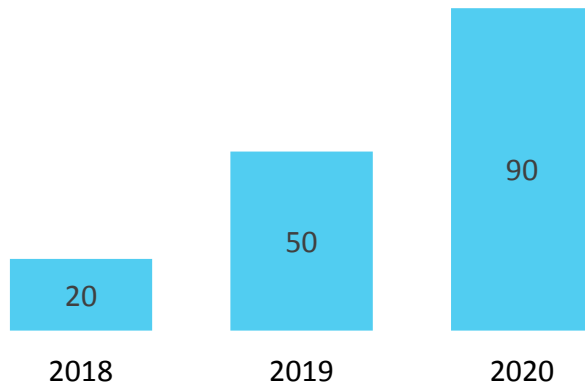


*Source: IDEX estimates, IHS, the Nilson Report

Financial inclusion and ID expected to be massive markets

Government ID

Million units



MARKET DRIVERS

- Need for secure identification
- Increased focus on security and increased mobility between countries
- Desire to give more people access to credit and financial infrastructure

BARRIERS TO ADOPTION

- Sensitivity to cost
- Need for mass enrolment of population
- Government inertia

CUSTOMER PROFILE

- Government institutions and public programmes
- Each programme based on whole or part of population in country or state – in the millions to tens of millions (and beyond for large countries)

*Source: IDEX estimates, IHS, the Nilson Report

IDEX expanding customer engagement

Initial order from leading Asian security and authentication smart card provider

- For biometric ISO form factor card for government ID and access control
- Delivery in Q4 2017

Accelerating customer pull across verticals and geographies

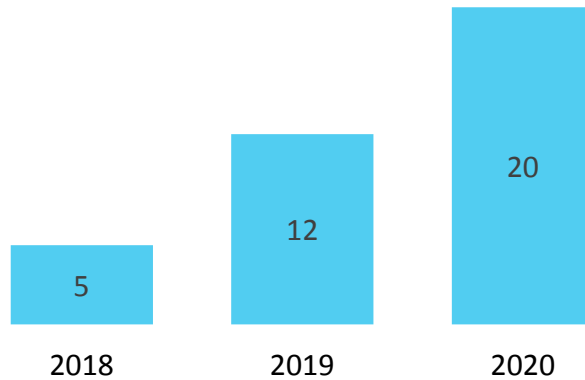
- Multiple European top tier card integrators
- Active collaboration with several technology partners to deliver complete system solutions
- High activity with OEMs across APAC



Access control and other segments driven by fast moving private sector

Access control and other

Million units



MARKET DRIVERS

- Easy and convenient user authentication
- User pull on the back of mobile adoption
- Not same stringent requirements to standards and security protocols as in payment

BARRIERS TO ADOPTION

- Sensitivity to cost
- Fragmented market with smaller volume potential per customer – requires standardisation

CUSTOMER PROFILE

- Corporate or government organisations with desire to secure access
- Typically larger entities with potential in the hundreds of thousands

*Source: IDEX estimates, IHS, the Nilson Report

High capacity supply chain ready for mass volumes

Components

One ASIC platform



Multiple substrates, multiple designs
& complete solution architectures



Multiple applications



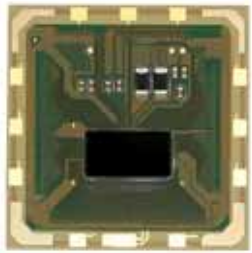
Supply chain

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- 20,000 employees world-wide
- Modules for cards, IoT and mobile

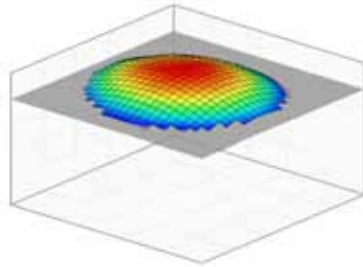
IDEX provides full biometric solutions

Innovative architecture



- Off-chip: low cost and high performance
- Intelligent sensor minimizes MCU workload
- Sophisticated power management and sequencing IP

System Level Approach



- Providing full system solution
- Complete reference design and contactless power solution

Designed For Manufacture



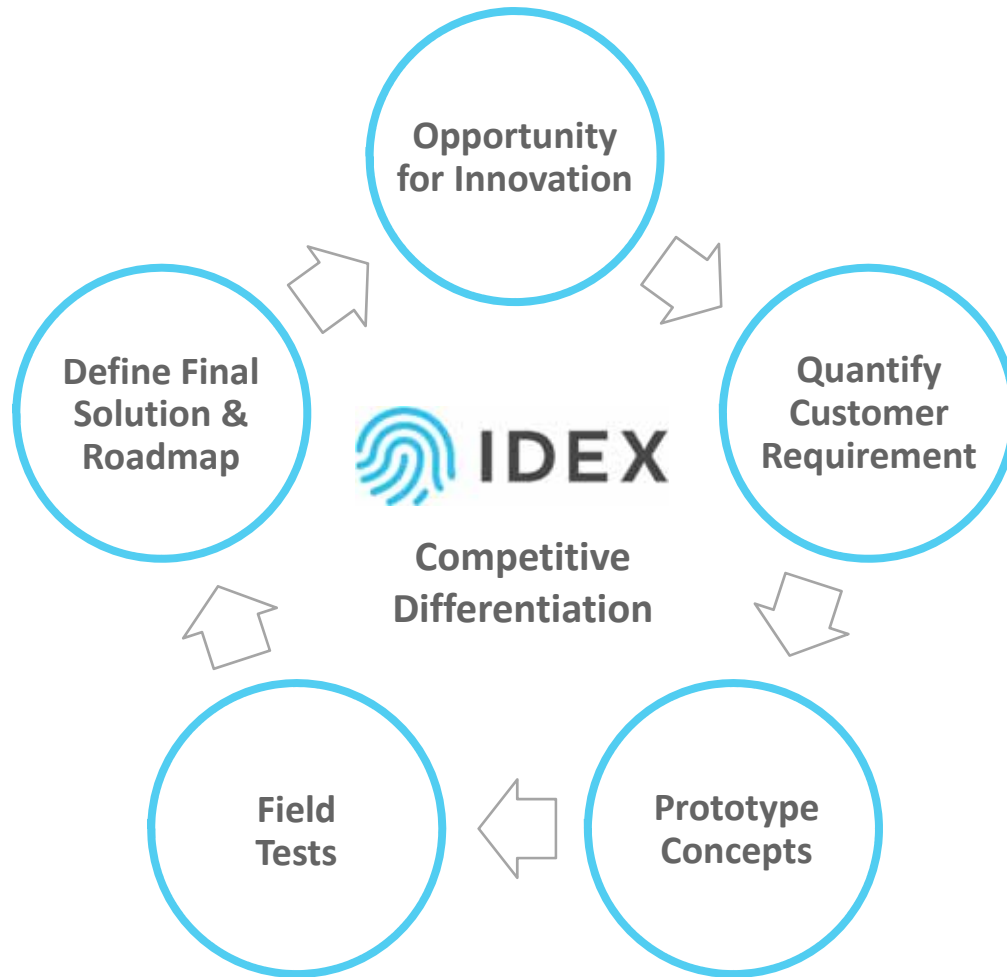
- Designed to use existing process flow and equipment
- Fully qualified bendable sensor

Compelling roadmap



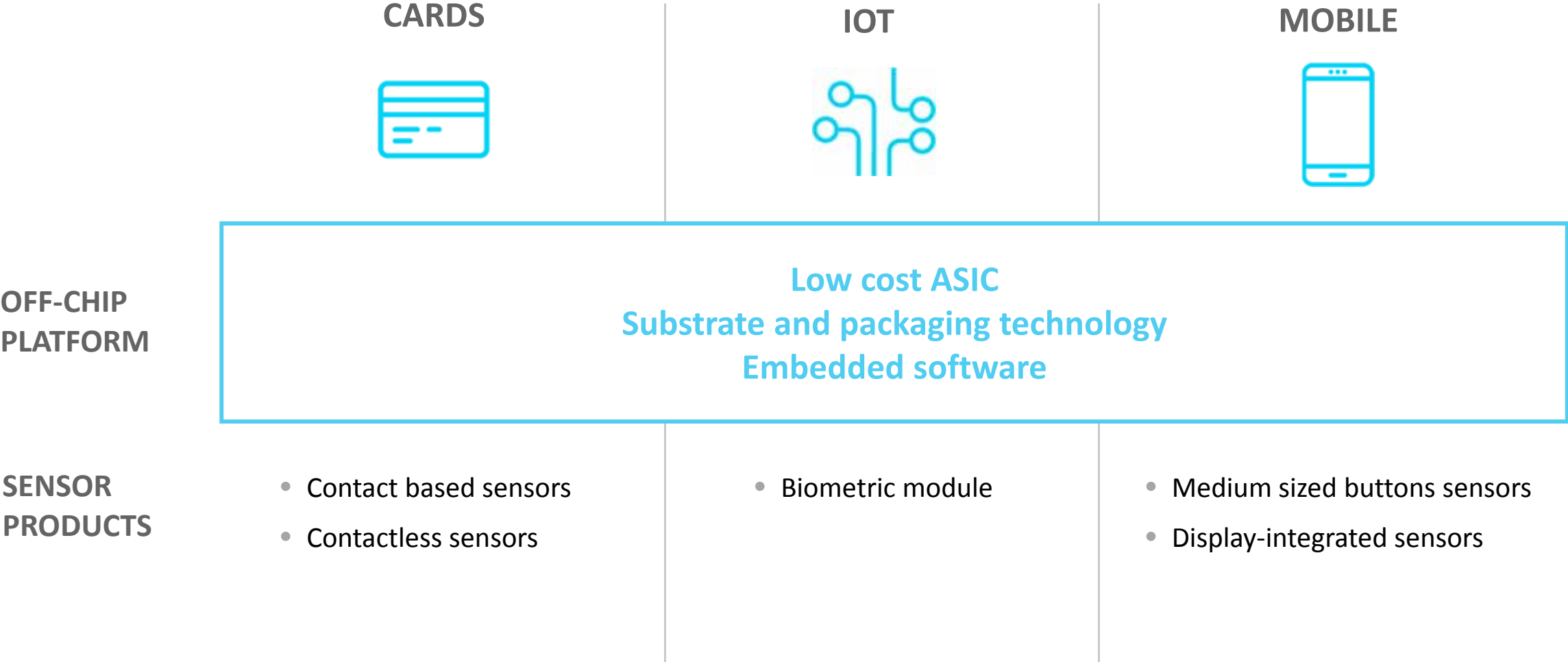
- Advance process node with additional sensor intelligence
- Simplify architecture to reduce components, cost and complexity
- State of the art packaging

Innovation agreement with global payments provider



- Validates IDEX's total system solution
- Provides direct access to customer needs
- Improves development cycle time
- Enables early insight for future products

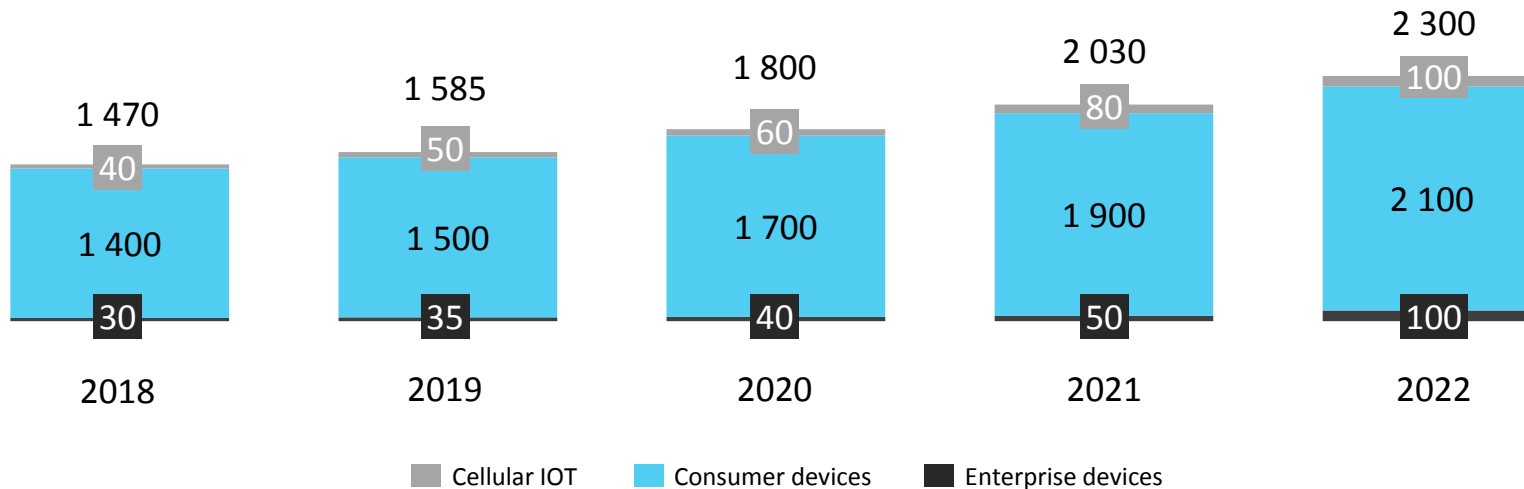
IDEX technology applicable across biometric solutions markets



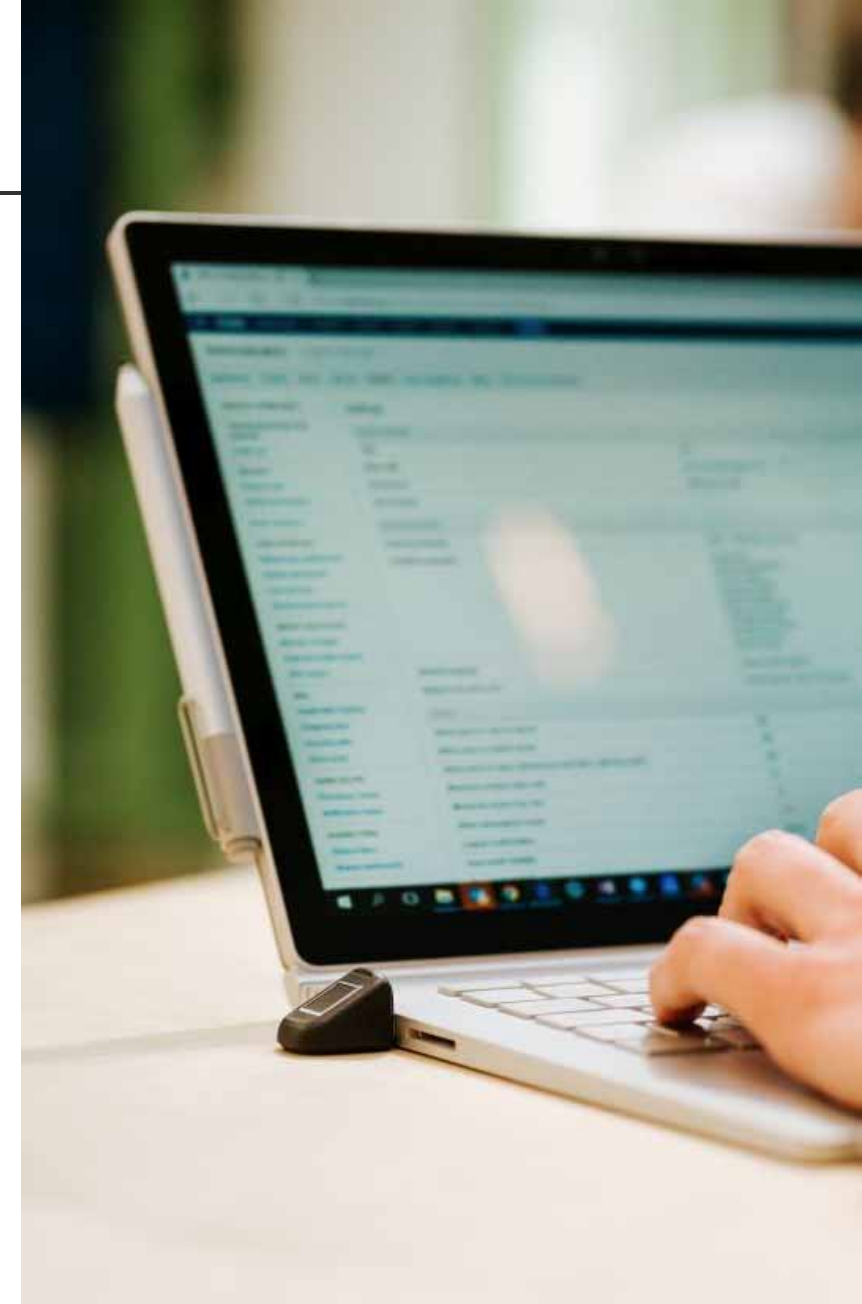
IoT – a fragmented market

IoT markets with high potential for biometric adoption

Million units

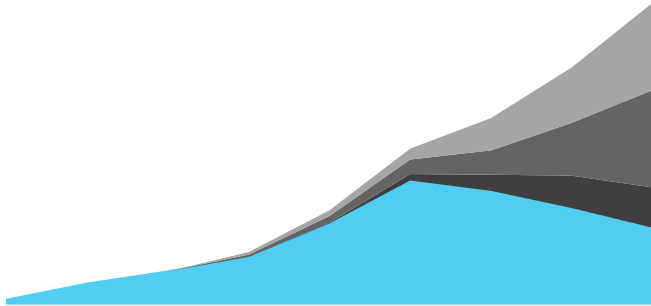


- Emerging, but highly fragmented market
- Diverse products ranging from wearables, door locks, smart remotes, etc.
- Each product category representing unique system requirements and uncertain volumes



Strong foundation to capture market growth

PROVEN MARKET WITH HUGE EXPECTED GROWTH IN NEW VERTICALS



- Fingerprint sensors proven in mobile
- Next wave – biometric cards

POLE POSITION IN THE BIOMETRIC CARD MARKET



- Low cost, flexible sensor ideally suited for cards
- Established value chain based on scalable design
- Strong partnerships in card ecosystem

OFF-CHIP TECHNOLOGY PLATFORM CAN BE LEVERAGED IN OTHER KEY VERTICALS



- Card solutions can be adopted to IOT
- Path to display integration in mobile

Agenda

Time	Section	Speaker
10:00	Capturing the second biometric wave	Dr. Hemant Mardia, CEO
10:15	The rise of biometric card market	Antonio D'Albore, Smart card expert
10:30	Unique, flexible and cost efficient solutions	Fred Benkley, CTO
11:00	Strong foundation to capture market growth	Stan Swearingen, CPO
11:30	Scaling to revenue and profitability	Henrik Knudtzon, CFO
11:40	Concluding remarks and Q&A panel	Executive team
12:00	Lunch and product demonstrations	All

SCALING TO REVENUE AND PROFITABILITY

Henrik Knudtzon, CFO



The second wave of biometric adoption building momentum



FIRST WAVE

Catalyzed by Apple

IDEX made significant investment in platform

- Off-chip sensor solutions
- Strong team currently at scale
- Strong IP portfolio



SECOND WAVE

Catalyzed by Mastercard

IDEX's path to profitability

- Securing significant revenue from leading position in biometric cards
- Leverage platform in IoT and mobile

Significant revenue potential from biometric cards

BUILDING BLOCKS TO REVENUE IN PLACE

- High growth market
- IDEX has differentiated value add products
- Partners and channel to deliver



INDICATIVE 2020 MARKET POTENTIAL FROM BIOMETRIC CARDS

Biometric cards market outlook
Million units

250-300

Attractive ASPs for
sensor solutions for cards

USD 3-5 per unit

Addressable market

USD 750 – 1,500 million

IDEX market share ambition

2020 target of market
share greater than 30%

Indicative business scenarios

ASSUMPTIONS

Average # units
per customer

Payment 600k

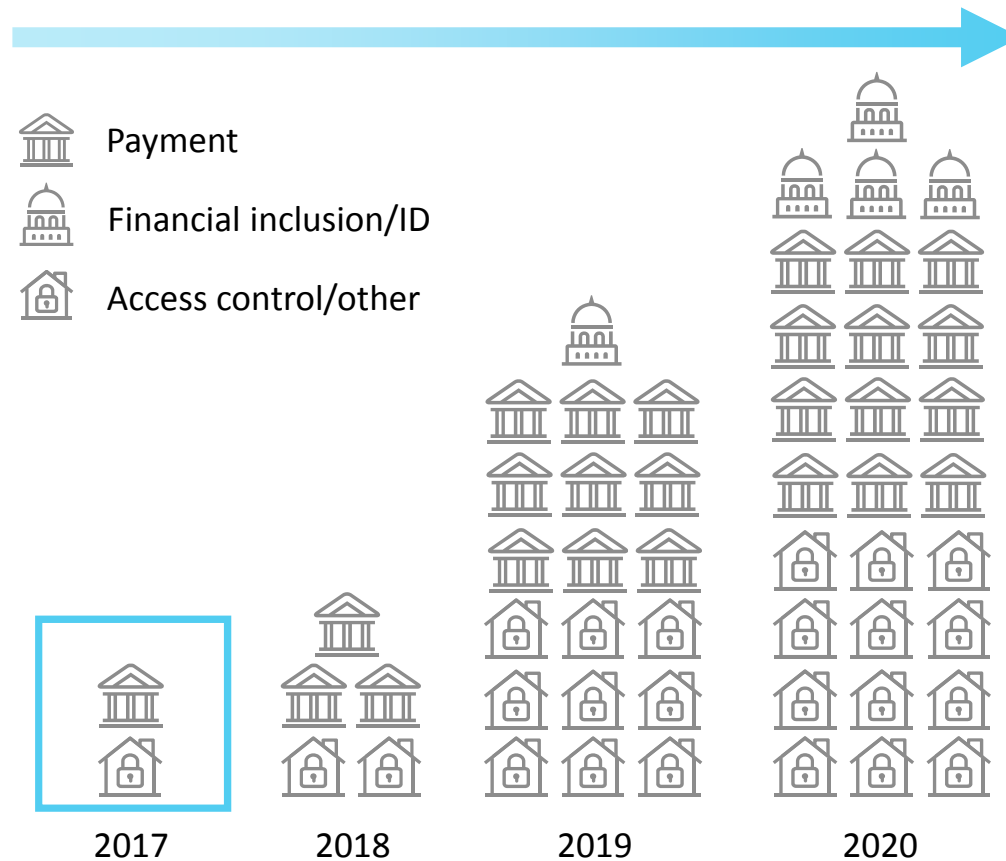
Financial inclusion/
ID customer 10m

Access control/
other customer 350k

PILOT

RAMP UP

AT SCALE

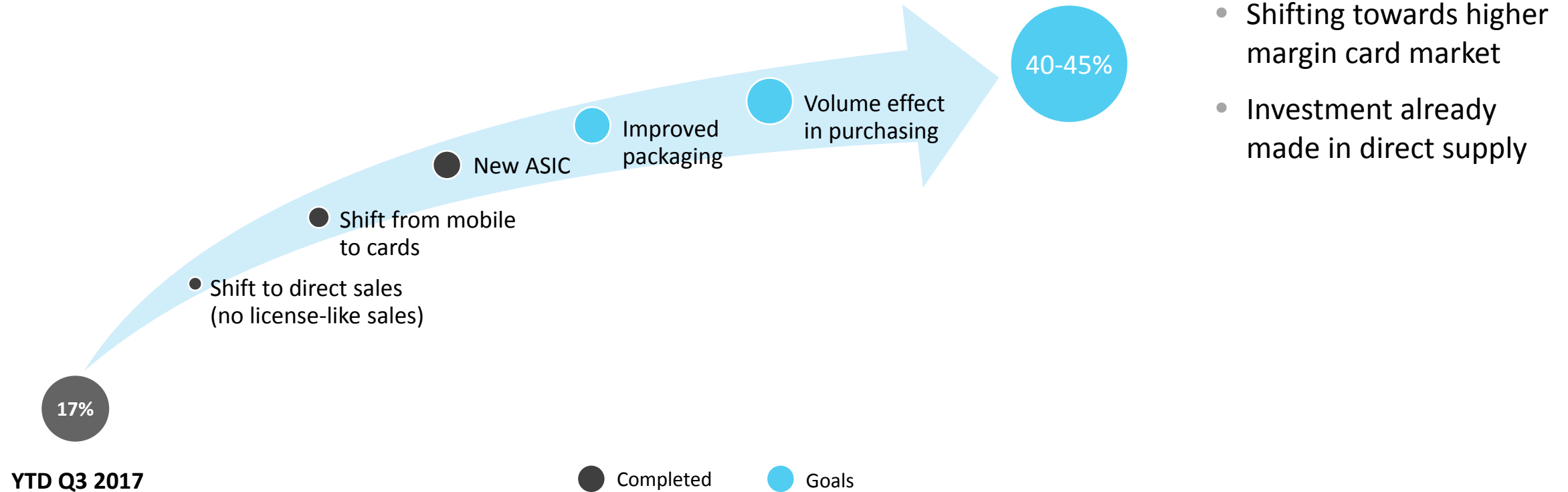


2020 VOLUME SCENARIOS

	Case I	Case II
2020 volumes Units	~75	~150
# IDEX customers per smartcard vertical		
Payment	40	75
Financial inclusion/ID	4	8
Access control and other	30	70

Targeting gross margin above 40%

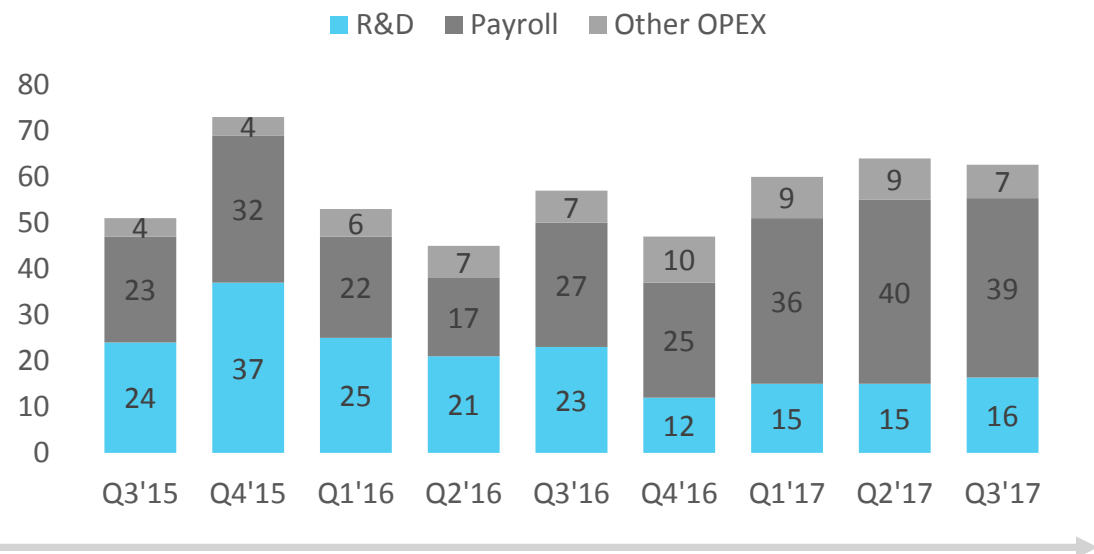
Gross margin



OPEX: at capacity to capture growth potential

OPEX

NOK million



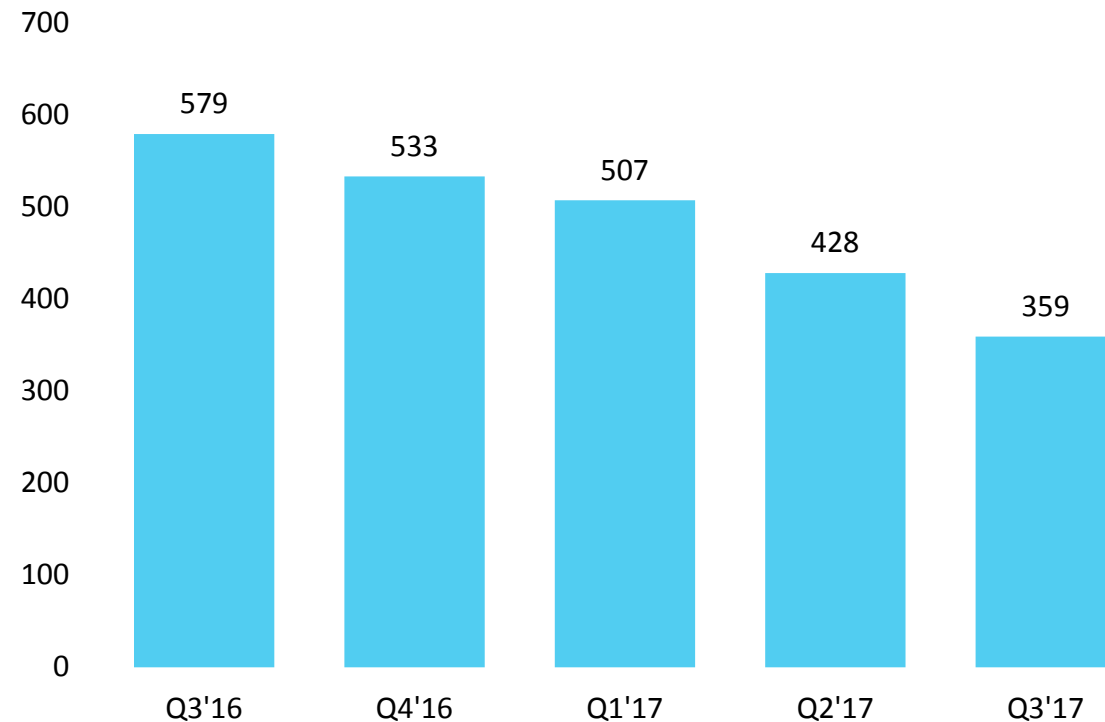
- Significant investments have been made
 - Market ready products
 - New silicon
 - Team expansion

- IDEX organisation at capacity to capture growth potential
- Increased internal capacity leading to reduced external spend
- Other operational costs expected to remain stable

Capacity to finance growth

Net cash position by quarter

NOK million



Going forward

Q4'17 and beyond

- Strong cash balance of NOK 359 million, no financial debt
- OPEX not expected to increase during next 12 months

Financial outlook

PRIORITY

OUTLOOK

Revenue growth

- Biometric cards main target market and revenue growth driver 2018
- Ambition level of a market share greater than 30% in biometric cards by 2020
- Leveraging card products to selectively address IoT opportunity
- Driving display integration technology in mobile

Gross margin improvement

- Targeting 40-45% run-rate in product portfolio
- Driven by shift to cards, product roadmap and volume purchasing

OPEX optimization

- Current organisation at capacity to capture revenue going forward
- External development spend expected to decrease given increased internal capacity

Investing in growth

- OPEX focused on biometric card opportunity in 2017-2019
- Investment to sustain leadership in off-chip technology platform

Capacity to finance growth

- Solid equity financing – strong cash position vs OPEX plan and revenue ambitions
- No debt

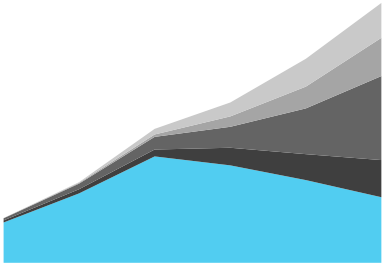


CONCLUDING REMARKS AND Q&A

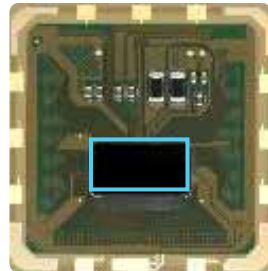


IDEX positioned to capture second wave of biometric adoption

Large market opportunity



Significant cost and scaling advantage



Deep partnerships with market leaders



Proven compliance with standards



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