

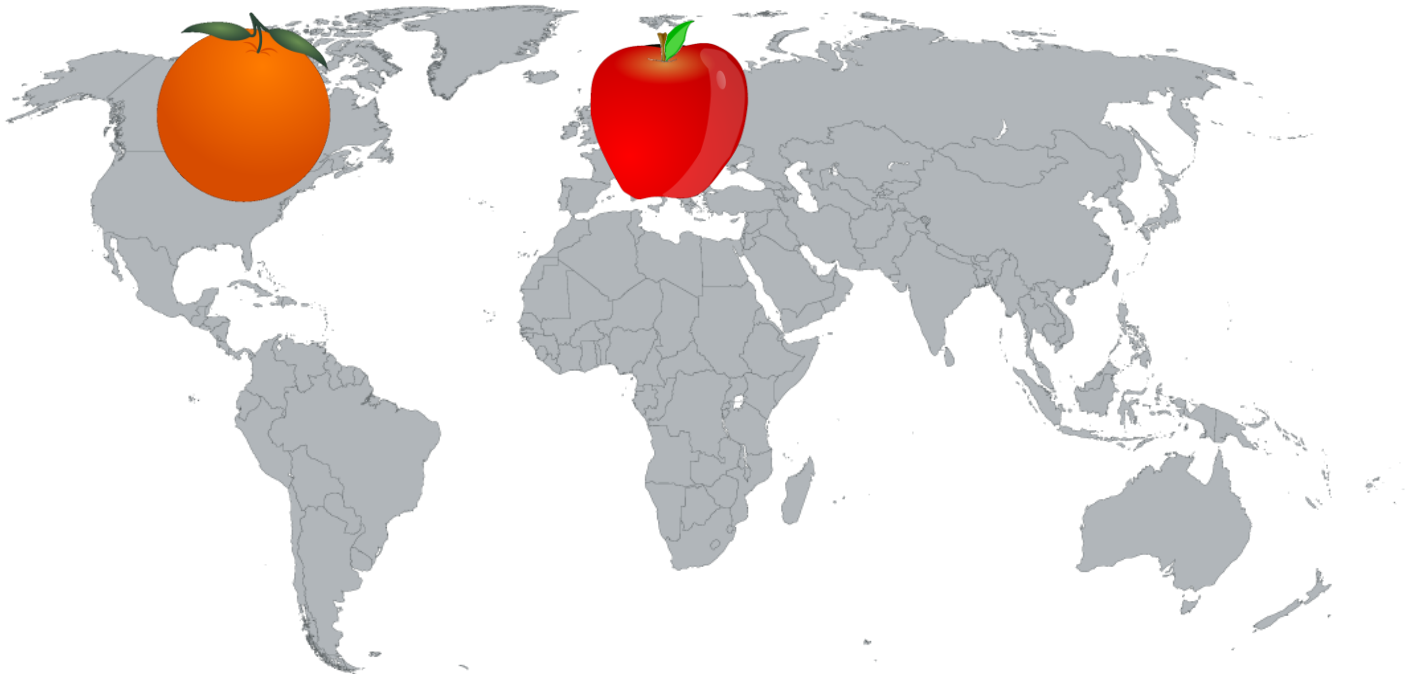


E/E Testing and the Natural Evolution Toward Standards

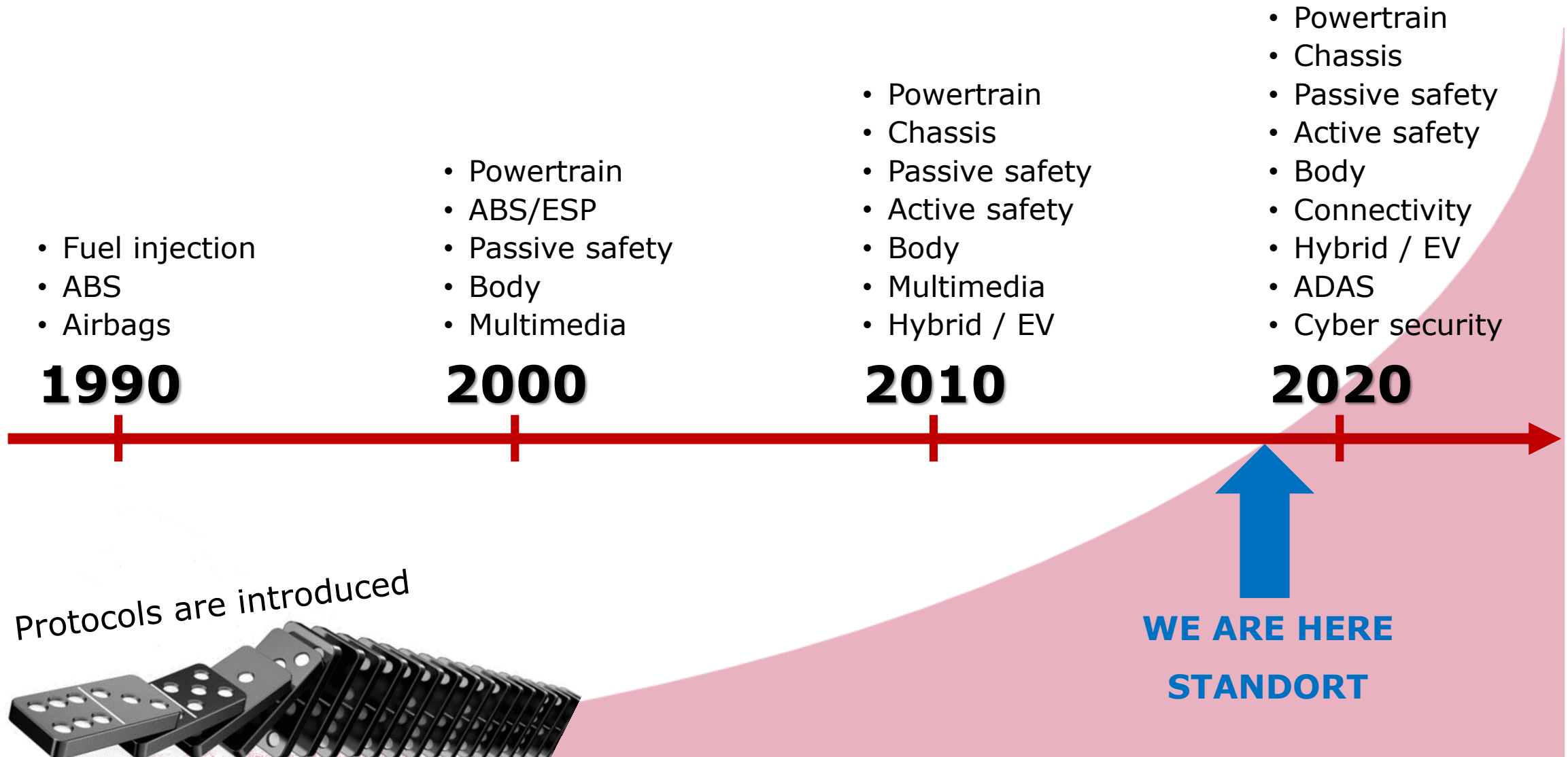
ASAM General Assembly – June 14, 2018

ASAM regional activities – Apfels and oranges

- ▶ ASAM activities have been quite different in Germany and the US
 - ▶ Past – each region had a different starting point
 - ▶ Present – the regions are converging on a common situation
 - ▶ Future – let's review our paths and see where we may be headed...



E/E testing – a 30-year timeline



E/E testing – circa 1990

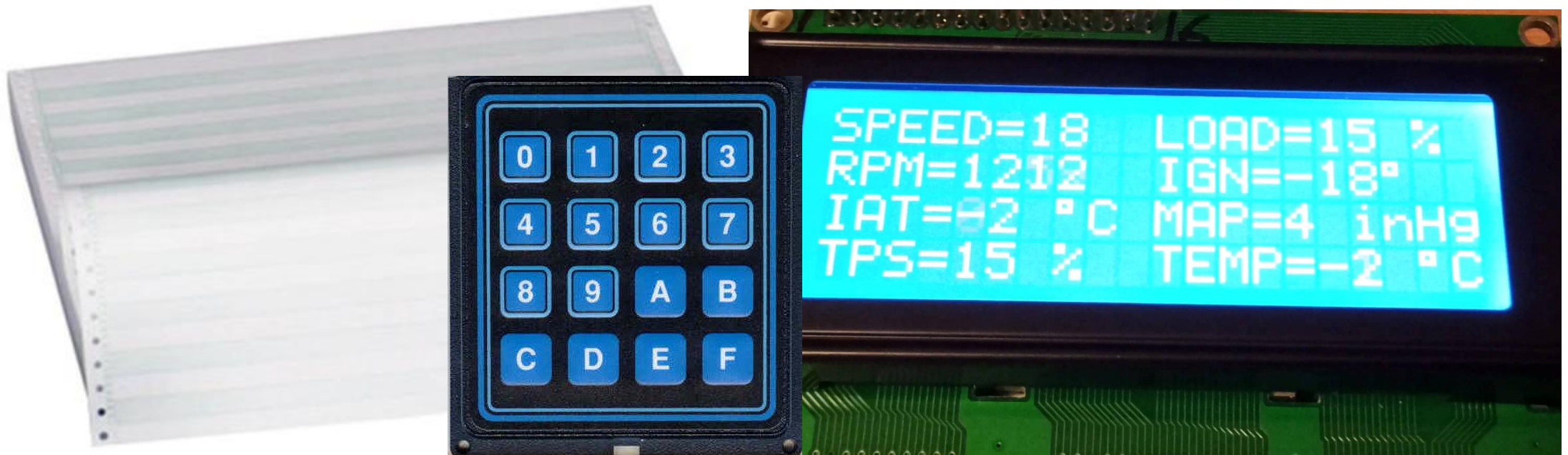
1990

2000

2010

2020

- ▶ Everything is proprietary by necessity
 - ▶ Protocols – mostly simple stuff, *but this is the origin of modern E/E testing !*
 - ▶ Data formats – no databases to define ECU data; measurement data is raw
 - ▶ Tools – mostly homegrown, there is no real tool supply base to buy from



E/E testing – circa 1990



▶ US trends

- ▶ Future ECU suppliers are divisions within the vehicle OEMs
- ▶ Vehicle OEMs develop ECUs as a continuation of their internal components business
- ▶ Vehicle OEMs develop their own E/E test infrastructures

▶ Europe trends

- ▶ Traditional component suppliers develop ECU products as a continuation of their business
- ▶ Vehicle OEMs and ECU suppliers are exchanging proprietary E/E test tools
- ▶ Observation – E/E testing is non-competitive and can be standardized and commoditized



▶ Enter ASAM

- ▶ German vehicle OEMs come together to form ASAM in 1991



E/E testing – circa 1990

1990

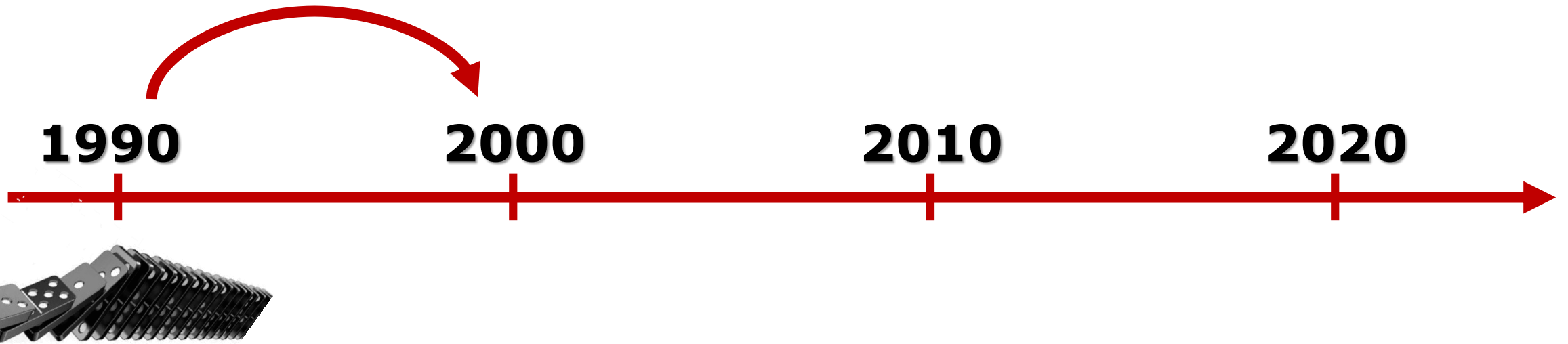
2000

2010

2020 

	US		EUR
Pass Car OEMs	3	≠	20+
ECU Strategy	ECUs are developed internally • OEMs are the ECU supply base	≠	ECU can be purchased • ECU supply base is evolving
Test Tool Strategy	Tools are developed by OEMs • Internal tool groups are growing	≈	Tools are developed by OEMs • ECU suppliers are doing the same
Standards Strategy	Standards are not a priority • Limited need for interoperability	≠	Standards become a priority • Strong need for interoperability

E/E testing – a 30-year timeline



E/E testing – circa 2000

1990

2000

2010

2020

▶ US trends

- ▶ Vehicle OEMs are spinning off component divisions as Tier 1 suppliers
- ▶ CAN is rapidly replacing J1850 and proprietary vehicle networks
- ▶ ECU suppliers require universal tools that work across all of their customers



▶ Europe trends

- ▶ E/E test tool supply base is evolving around PC-based CAN-based solutions
- ▶ Standards-based commercial off-the-shelf (COTS) tools become best practice



▶ ASAM US activities

- ▶ US interest in ASAM is in its earliest stages; raise awareness of ASAM standards
- ▶ CCP protocol and A2L files are growing with the adoption of CAN

E/E testing – circa 2000

1990

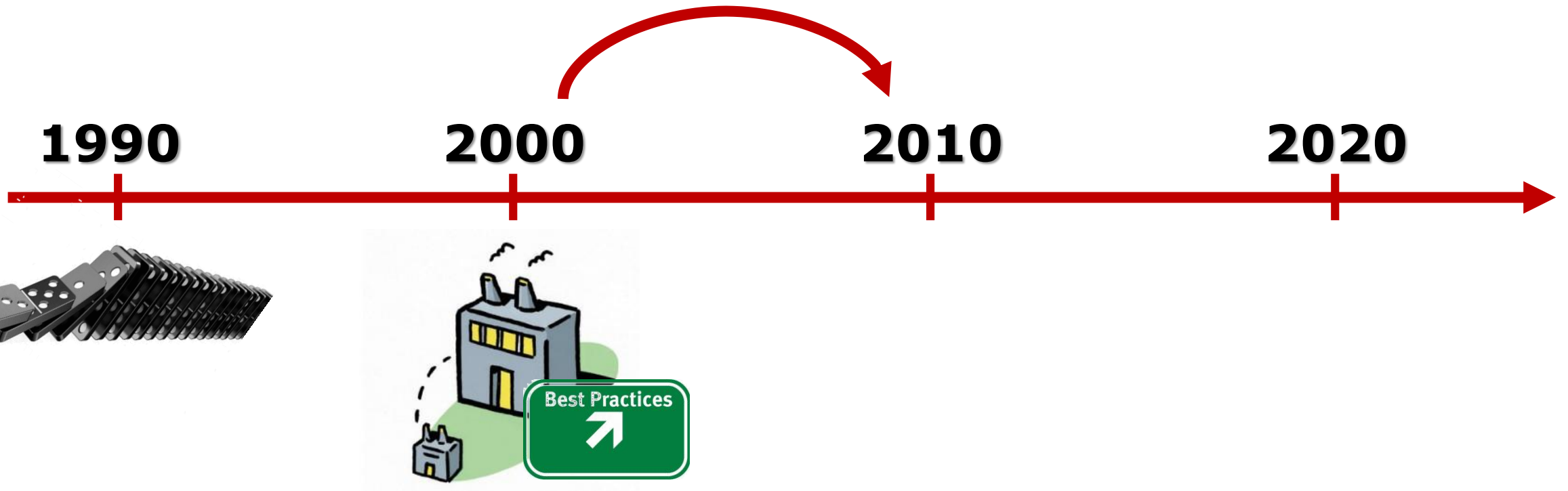
2000

2010

2020 

	US		EUR
Pass Car OEMs	3?	≠	20+
ECU Strategy	ECUs can be purchased <ul style="list-style-type: none"> • OEMs spin off ECU suppliers • CAN is replacing J1850 	←	ECU are purchased <ul style="list-style-type: none"> • Supply base is highly developed
Test Tool Strategy	Tools are developed by OEMs, but... <ul style="list-style-type: none"> • New tools are needed for CAN • Suppliers want universal tools 	←	COTS tools can be purchased <ul style="list-style-type: none"> • Supply base is evolving
Standards Strategy	Standards are showing new value <ul style="list-style-type: none"> • Time to revisit make vs. buy 	←	OEMs are driving standards bodies <ul style="list-style-type: none"> • Question of make vs. buy is done

E/E testing – a 30-year timeline



E/E testing – circa 2010

1990

2000

2010

2020

▶ US trends

- ▶ Region is emerging from downturn – all costs are under the microscope
- ▶ OEMs sharpen focus on COTS tools

▶ China trends

- ▶ Many new vehicle OEMs are emerging and need E/E testing solutions
- ▶ Market timing drives the quick adoption of COTS tools

▶ ASAM US activities

- ▶ Passive – keep costs to a minimum; accept ASAM standards from Germany as-is
- ▶ XCP use is growing rapidly on CAN and Ethernet
- ▶ ODX use is growing rapidly



COTS

E/E testing – circa 2010

1990

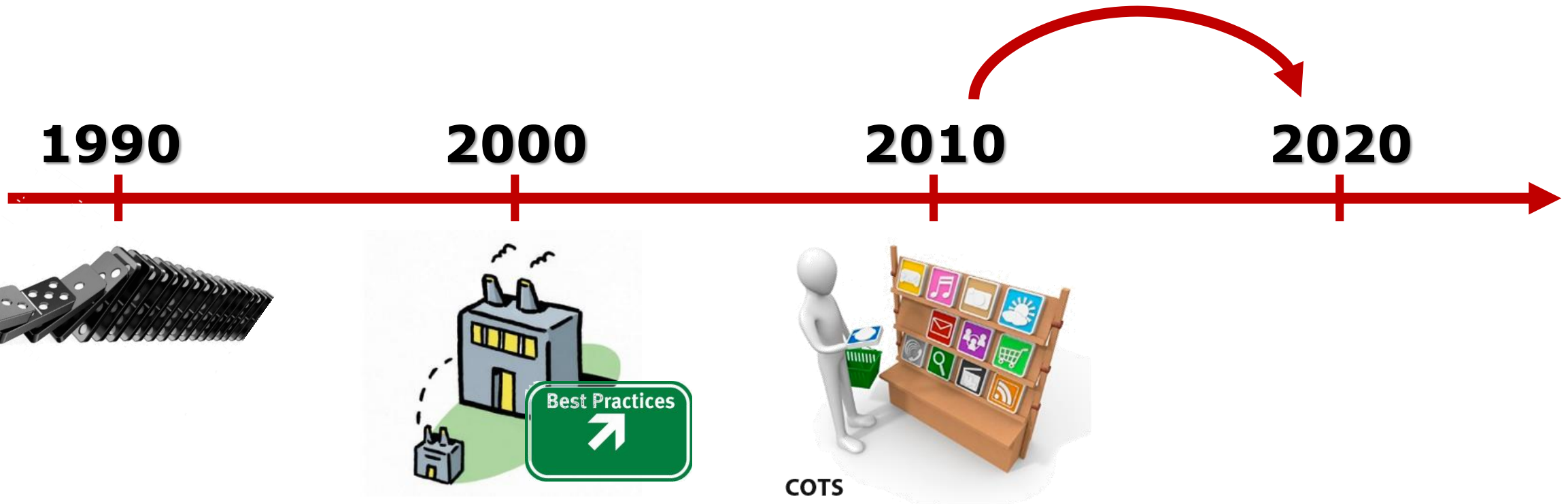
2000

2010

2020 

	US		EUR
Pass Car OEMs	3+	≠	20-
ECU Strategy	ECUs are purchased • Supply base is global	=	ECU are purchased • Supply base is global
Test Tool Strategy	Tools are purchased • Supply base is highly developed	=	Tools are purchased • Supply base is highly developed
Standards Strategy	Standards become the norm • Question of make vs. buy is done	=	Standards are entrenched • Stds orgs are highly developed

E/E testing – a 30-year timeline



E/E testing – forecast 2020

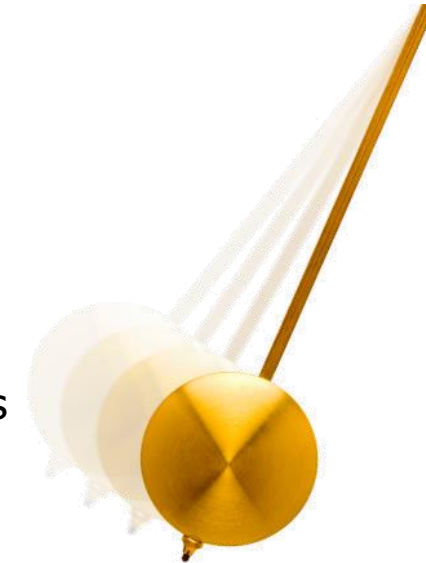
1990

2000

2010

2020 

- ▶ E/E testing has globally evolved towards standards... momentarily
- ▶ New disruptive E/E technologies are a challenge to this approach
 - ▶ ADAS, V2X, and cyber security require new testing capabilities
 - ▶ Big Data technologies can enhance and expand virtual testing
 - ▶ Standards leave gaps that are filled with proprietary niche solutions
 - ▶ The pendulum is at risk of swinging back... away from standards
- ▶ ASAM US activities – forecast
 - ▶ US and other regions merge their activities into global ASAM activities
 - ▶ US and other regions are active in standards development efforts
 - ▶ MDF 4 and ODS play key roles in big data applications with E/E testing
 - ▶ POD standard provides new interoperability for ECU interface hardware/software



E/E testing – forecast 2020

1990

2000

2010

2020 **Global****Pass Car
OEMs**

40+

**ECU
Strategy**

ECUs are developed/purchased in layers

- Application software is often a key asset developed by vehicle OEMs
- Hardware and operating system software are purchased from suppliers

**Test Tool
Strategy**

Tools are purchased where possible, but...

- New E/E technologies and testing requirements present a gap in standards
- Proprietary testing solutions are emerging out of necessity

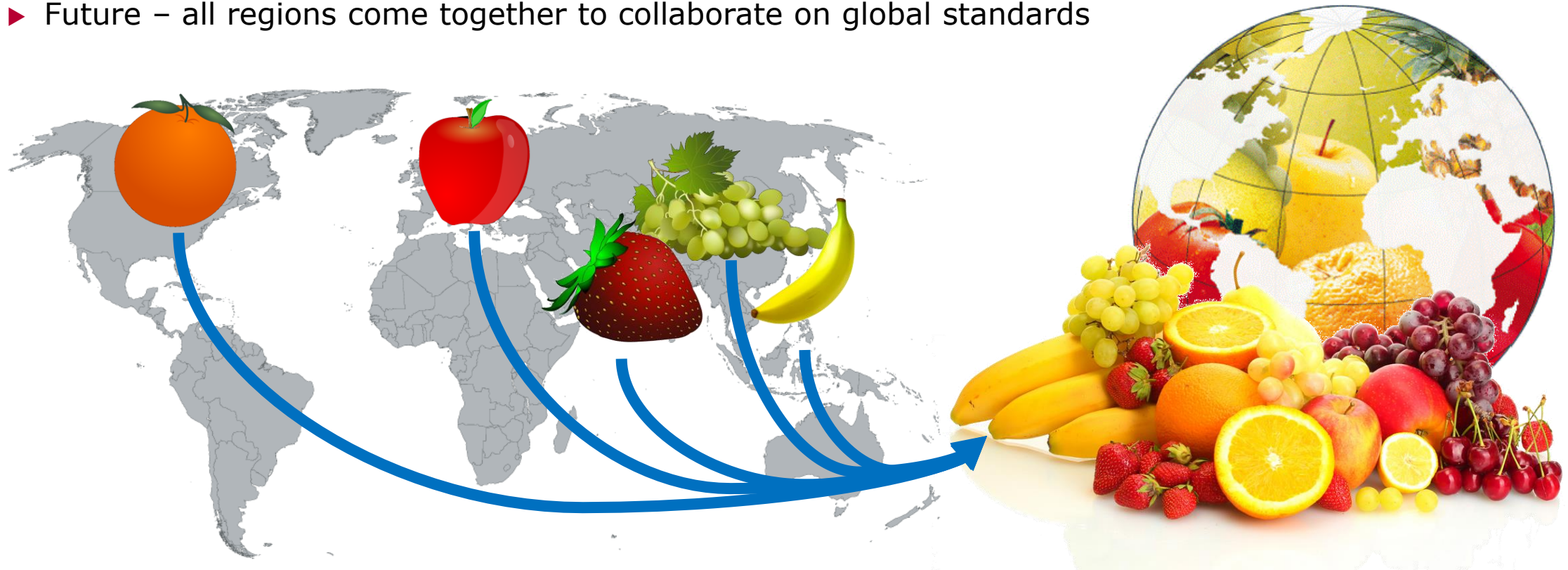
**Standards
Strategy**

Standards are under development to address new testing needs/opportunities

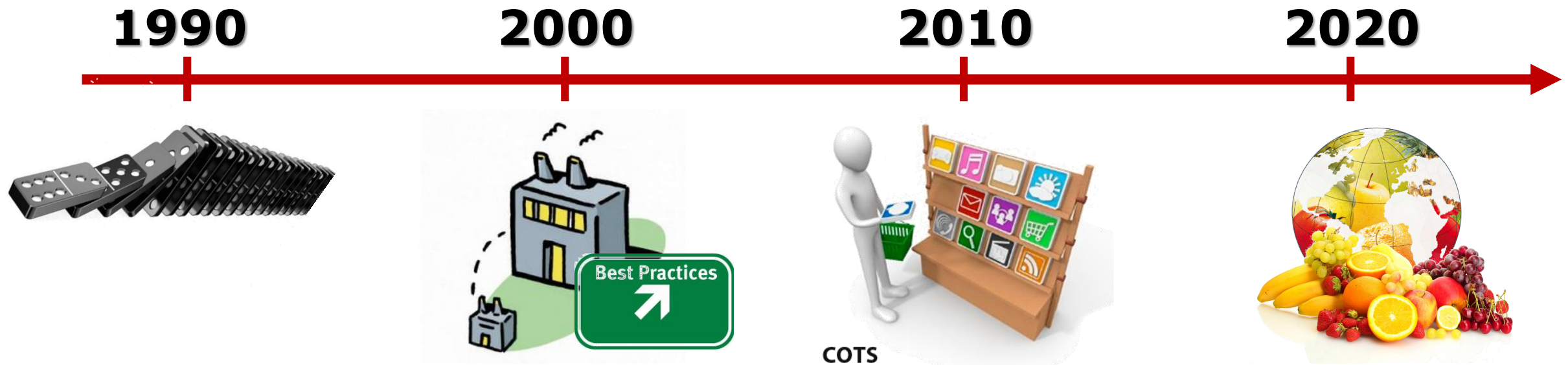
- Participation in standards development activities is expanding globally

ASAM regional activities – global fruit basket

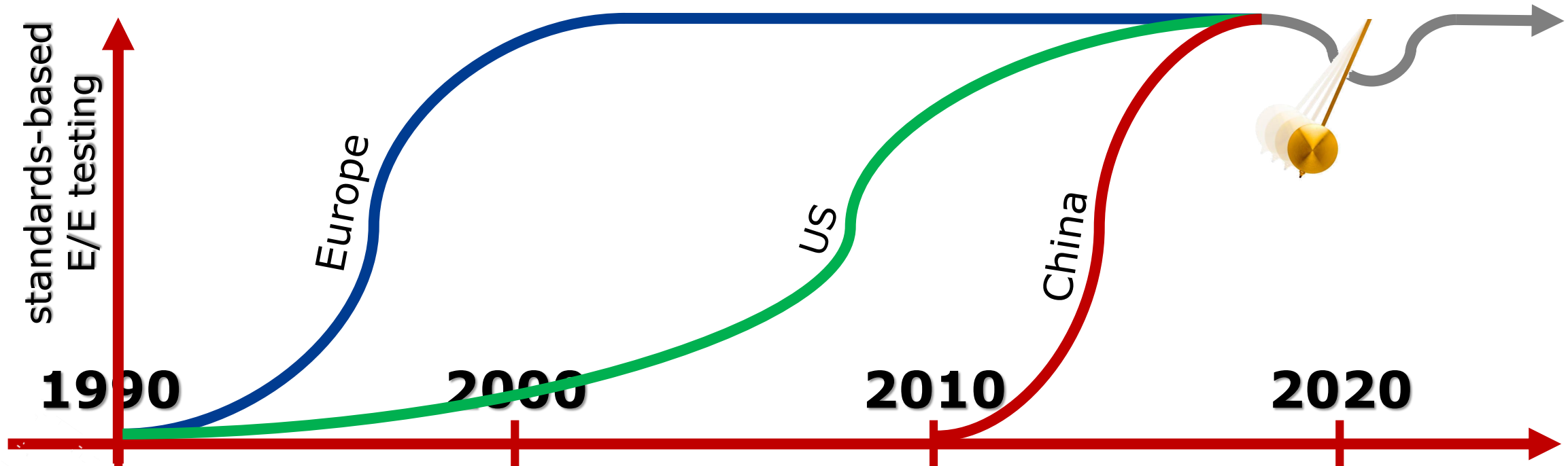
- ▶ ASAM activities have been quite different from region to region
 - ▶ Past – each region had a different starting point
 - ▶ Present – the regions are converging (have converged?) on a common situation
 - ▶ Future – all regions come together to collaborate on global standards



E/E testing – a 30-year timeline



E/E testing – a 30-year timeline



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