Overview

- Introduction
- A short history of the future: platforms enabling breakthrough innovation
- The Internet of Things (IoT): history repeating itself
  - IoT Technology and Enabling Platforms
  - IoT Applications development
  - IoT Socio economic impact
  - IoT Main obstacles
- Key roles for IT professionals
- AIOTI
- Conclusions

AIOTI

Introduction

What is IoT for you, for me, for society ?

- For many, **IoT** is about technology
  - Devices interacting, autonomously making decisions
  - Communications networks
  - Information systems, security, AI, robotics, sensing, HW/SW, Data, algorithmics…
- For some, **IoT** is about business transformation
  - Commoditisation, servitisation, data analytics
- … or social transformation
  - Applications in smart cities, buildings, homes, mobility, health, farming, energy…
  - Loss of jobs, creation of new jobs
- **IoT** is <u>all</u> of it, requiring ‘separation of concerns’ <u>and</u> an integral approach

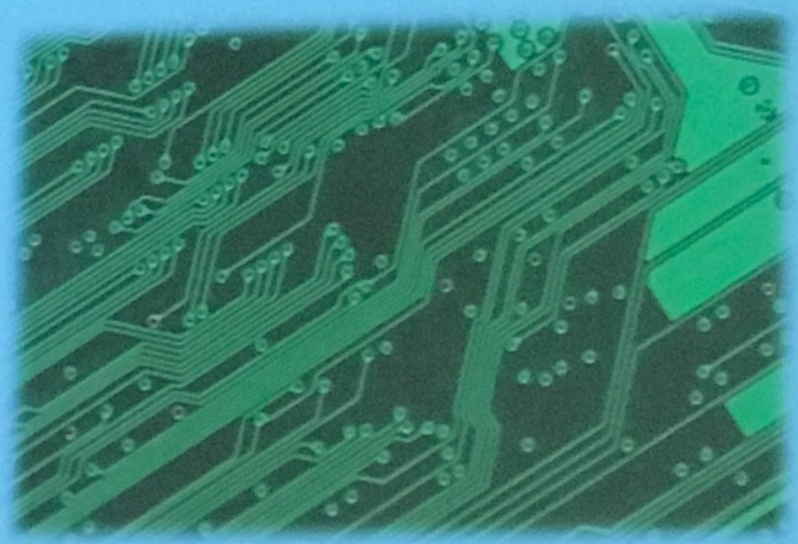
A short history of the future
Platforms enabling breakthrough innovation
AI TI

A short history of the future

Platforms enabling breakthrough innovation

- In the 80-ies the electronics industry was predominantly analog…
- Design, manufacturing & application required (scarce) deep and wide knowledge
- Once IC tech was mastered, one could massively apply transistors as switches…

- A **digital technology platform** was established
  - Enabling a new generation of designers with tools
  - Not requiring deep transistor and technology knowledge
  - Creating new frameworks of knowledge (professions)
  - Bifurcating business (fab and fabless)
- Driving for more, more, (Moore) digital switches & apps



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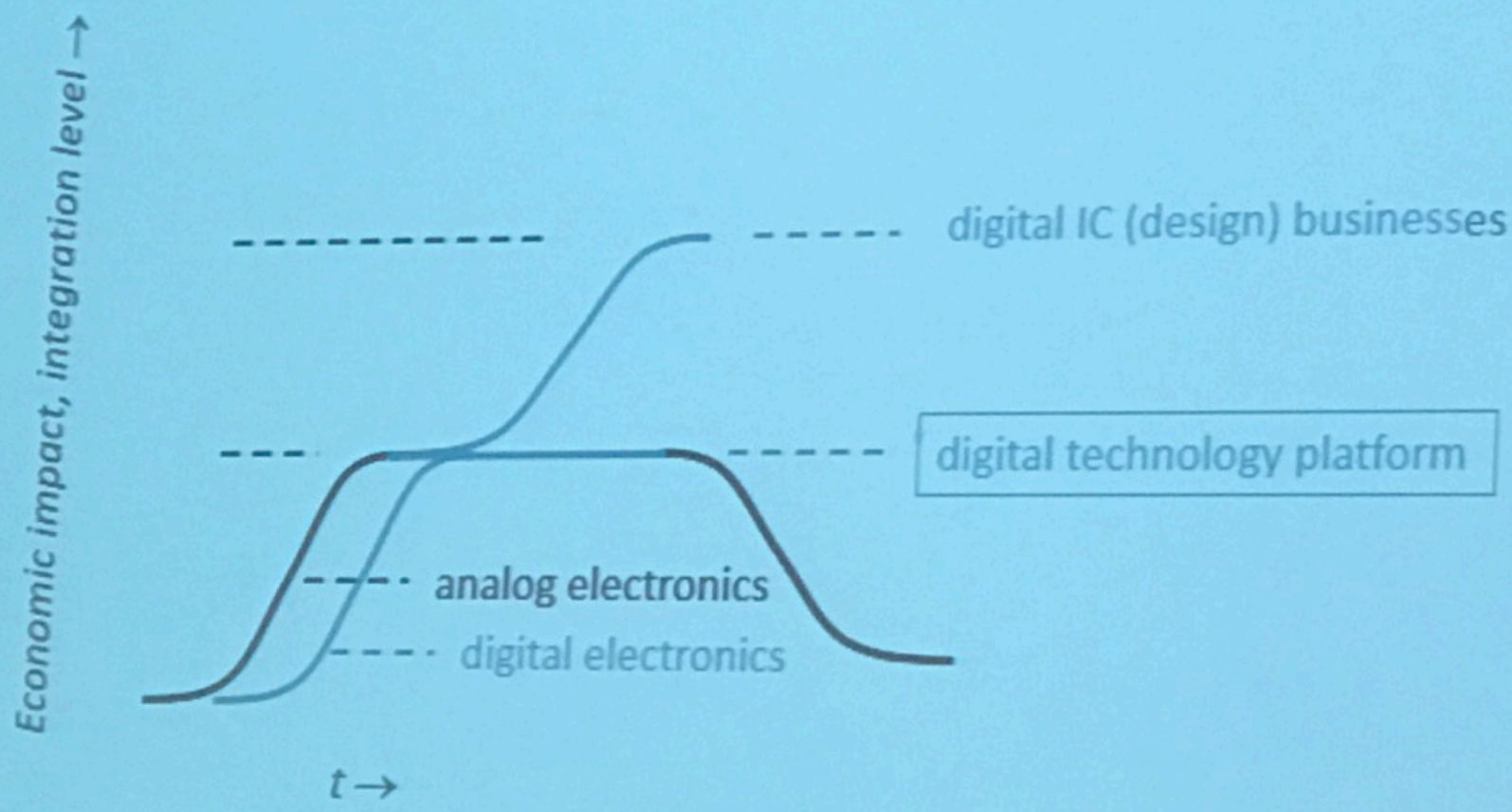
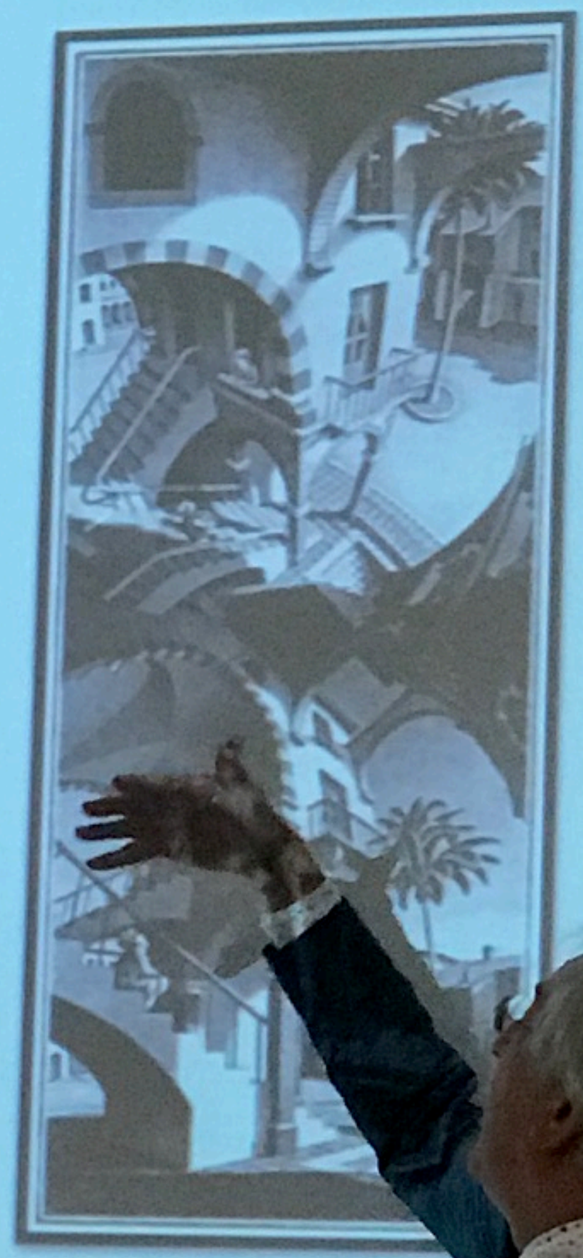
A short history of the future

Platforms enabling breakthrough innovation





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A short history of the future

Some consequences of ‘platformisation’

- Decide on your position in the value chain: above or below?
- ‘Separation of concerns’
  - Very different perspectives
  - Very different lifecycles
  - Very different competencies
  - Very different economics (business control points)
- Common interface language (simulation models, ‘digital twins’)
- Creating strong economic development and social impact
- Building on a strong interdependency

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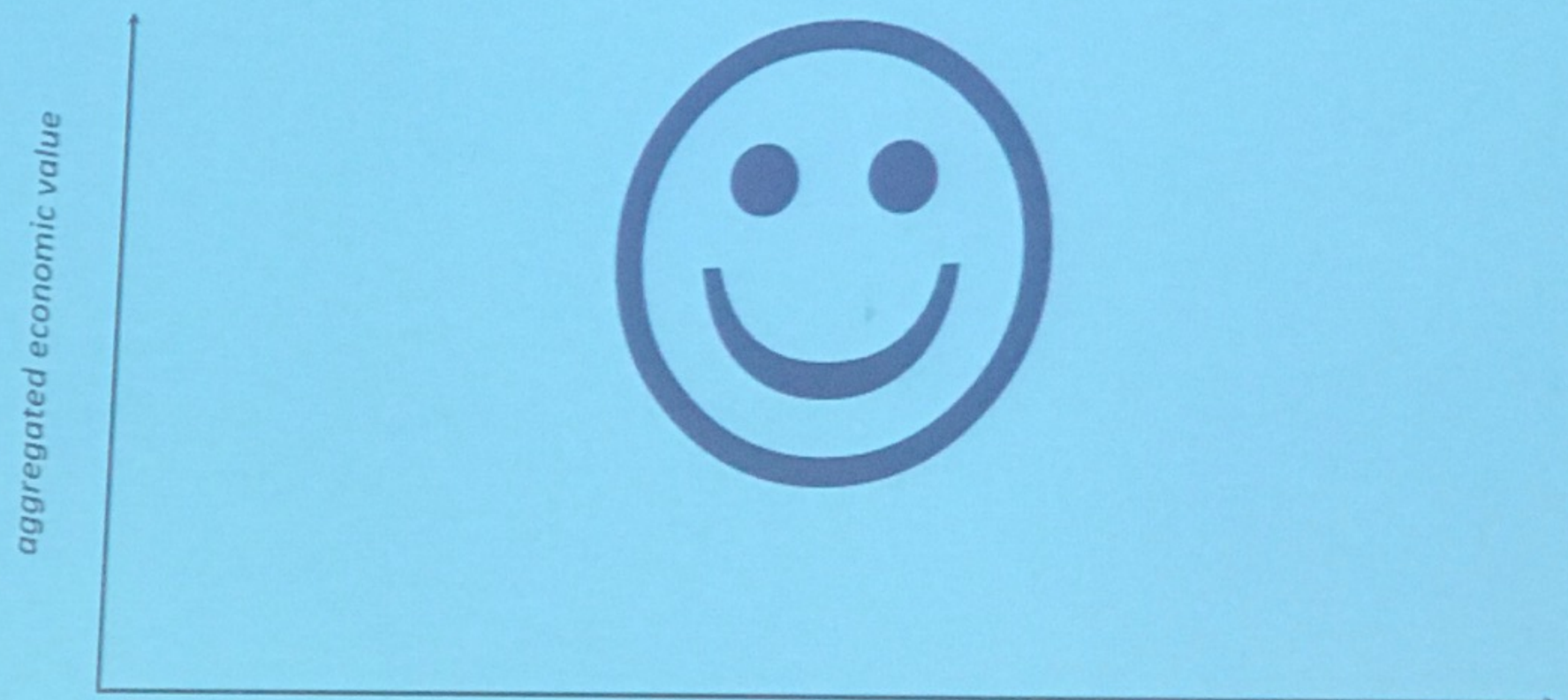
A short history of the future

The smile curve, not always fun... pick your place ‘above or below’



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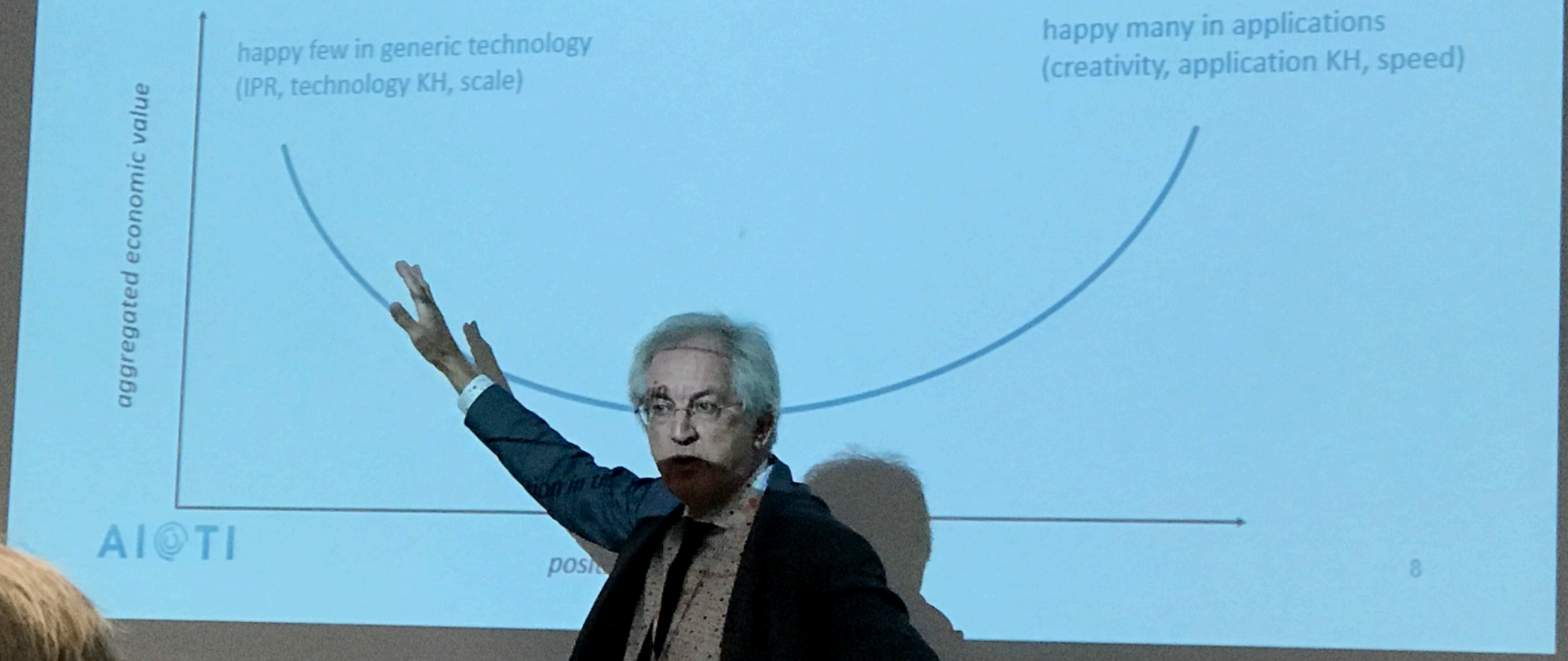

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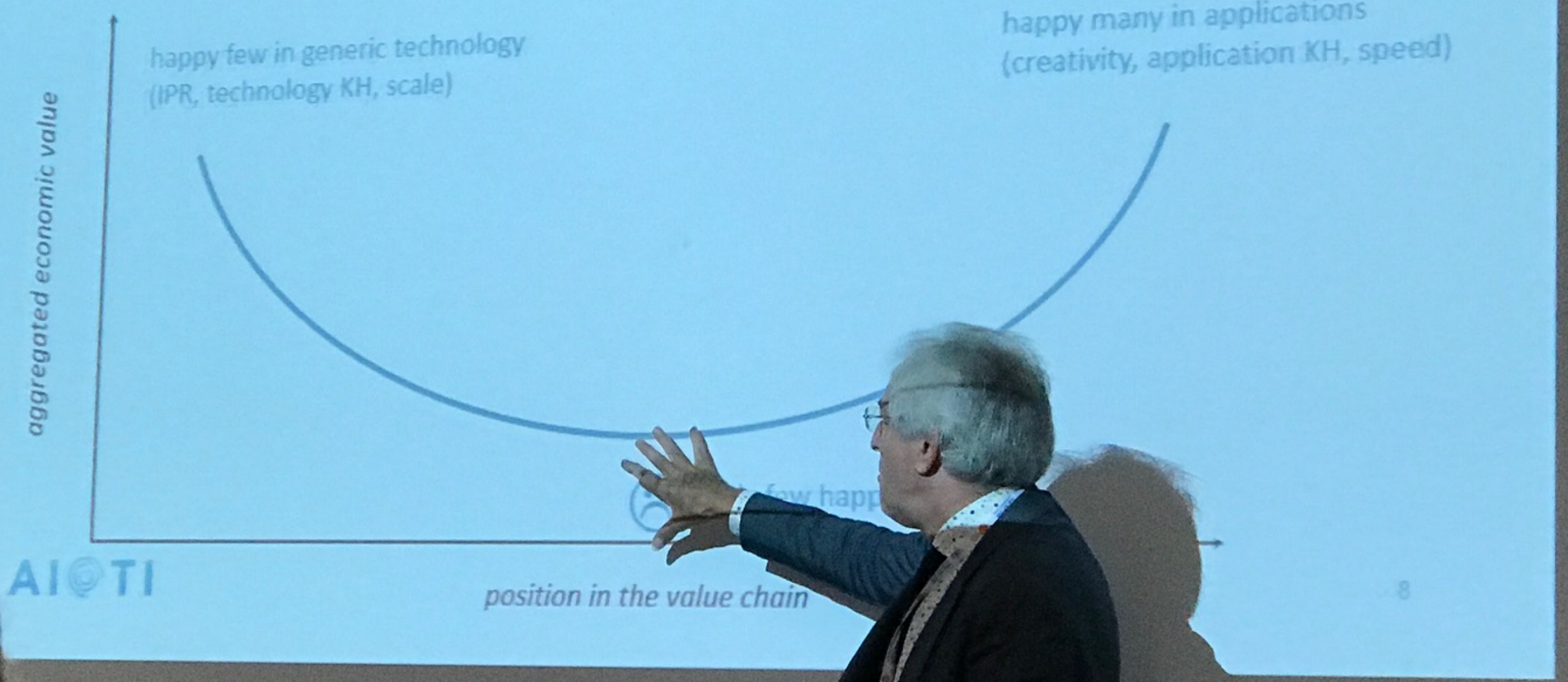

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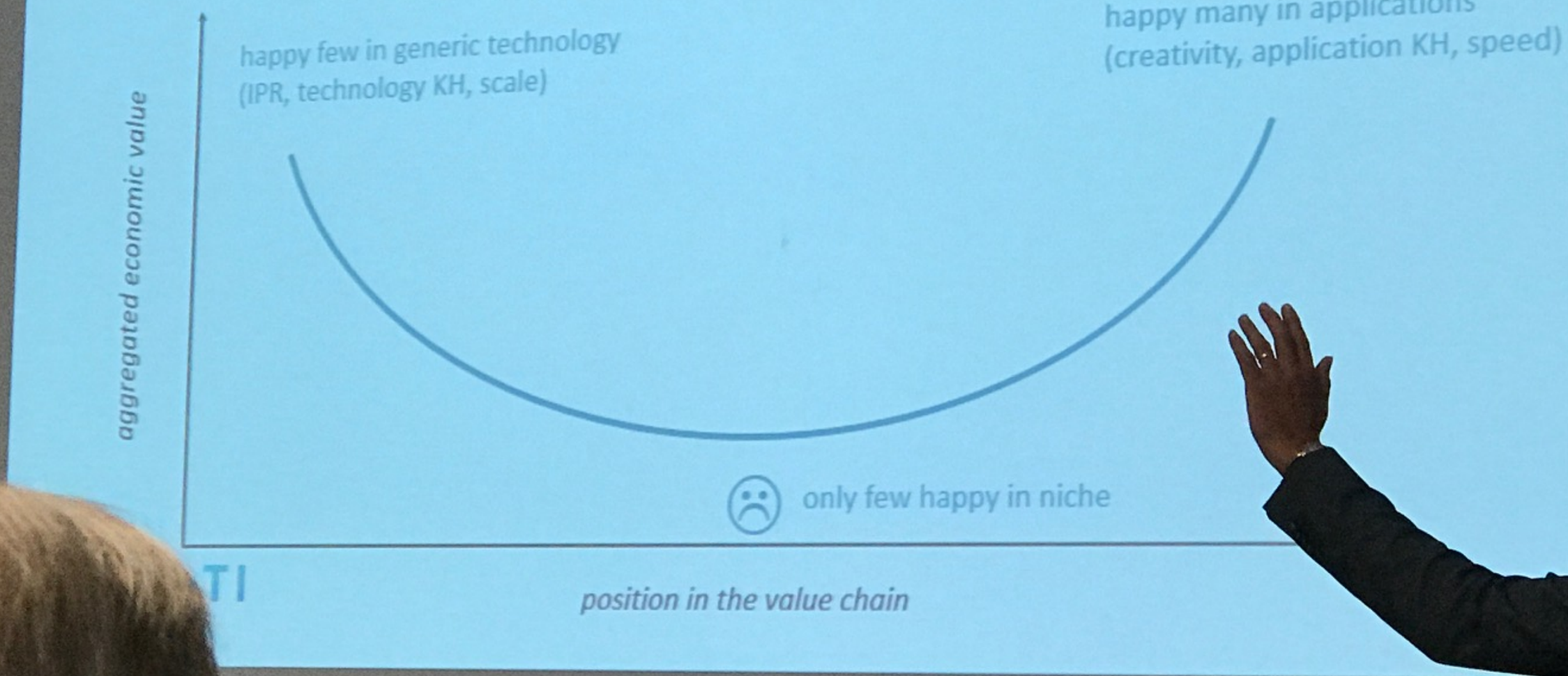
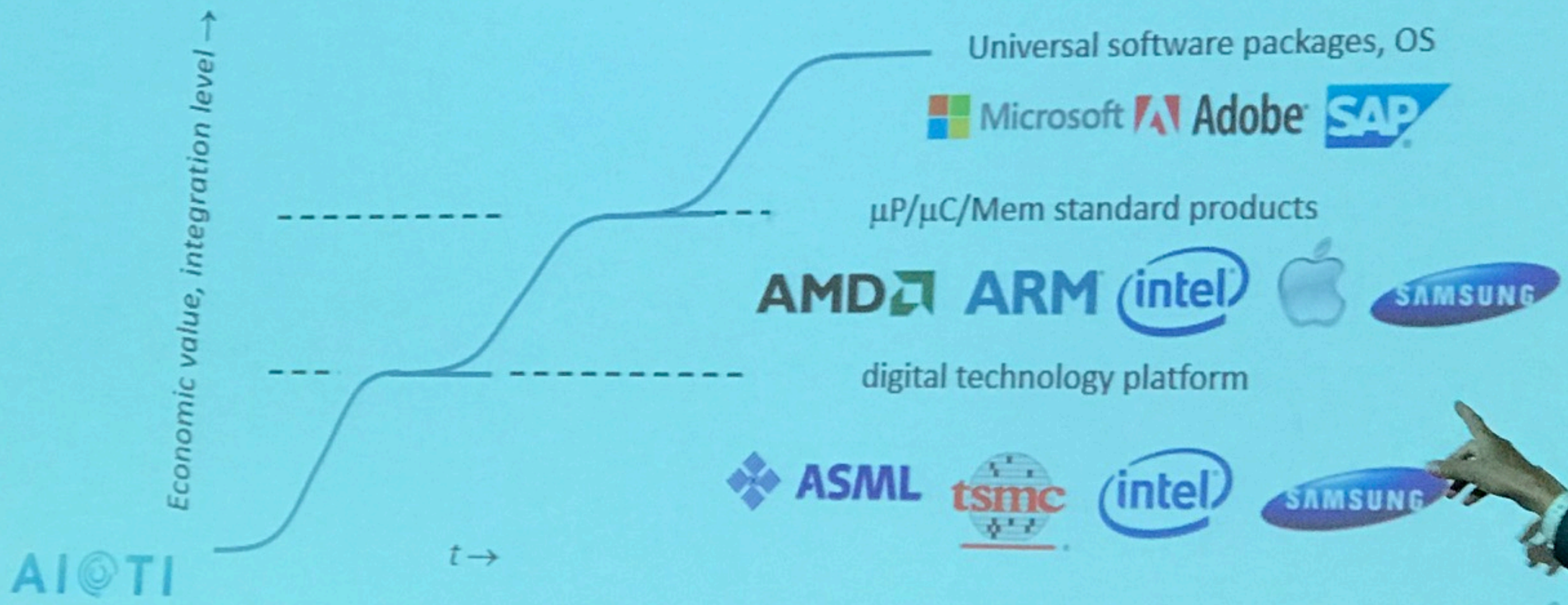


A short history of the future

HW/SW systems of systems...



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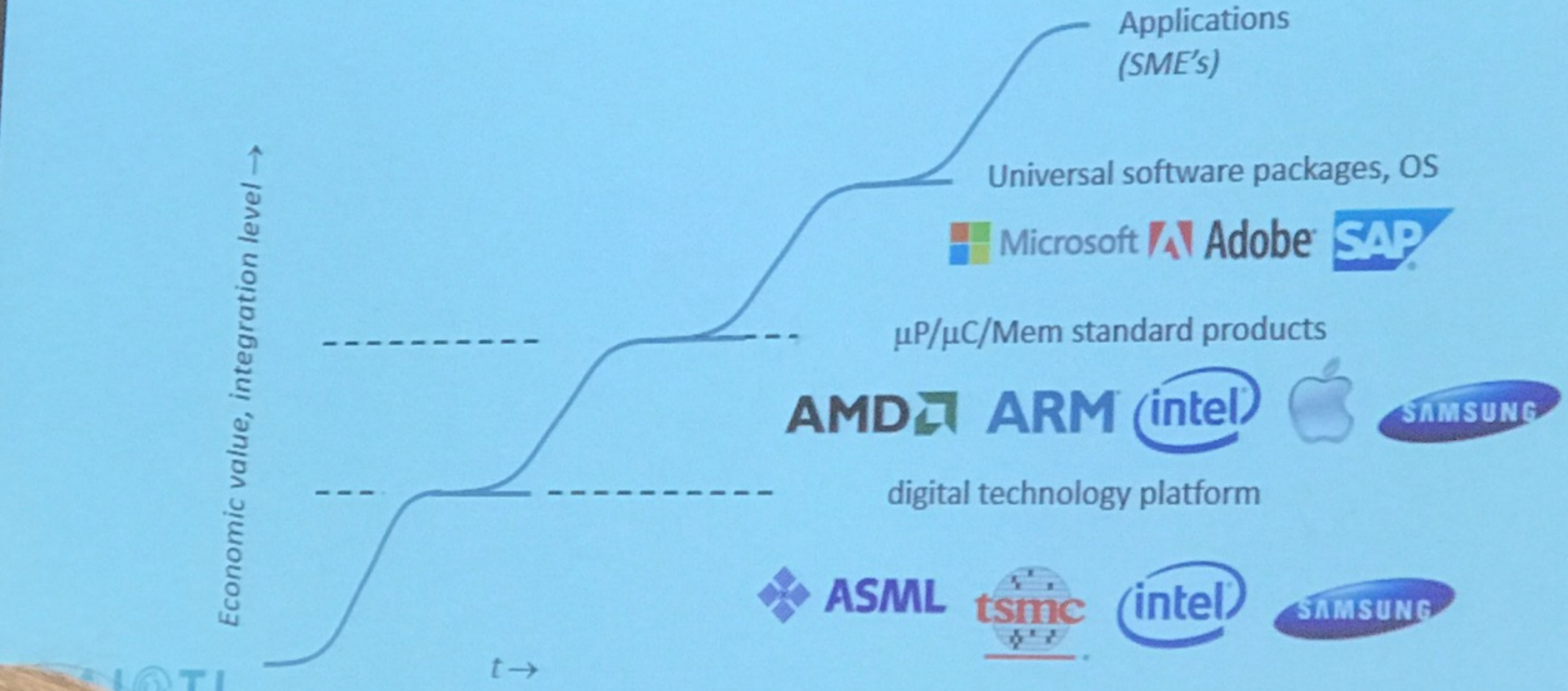

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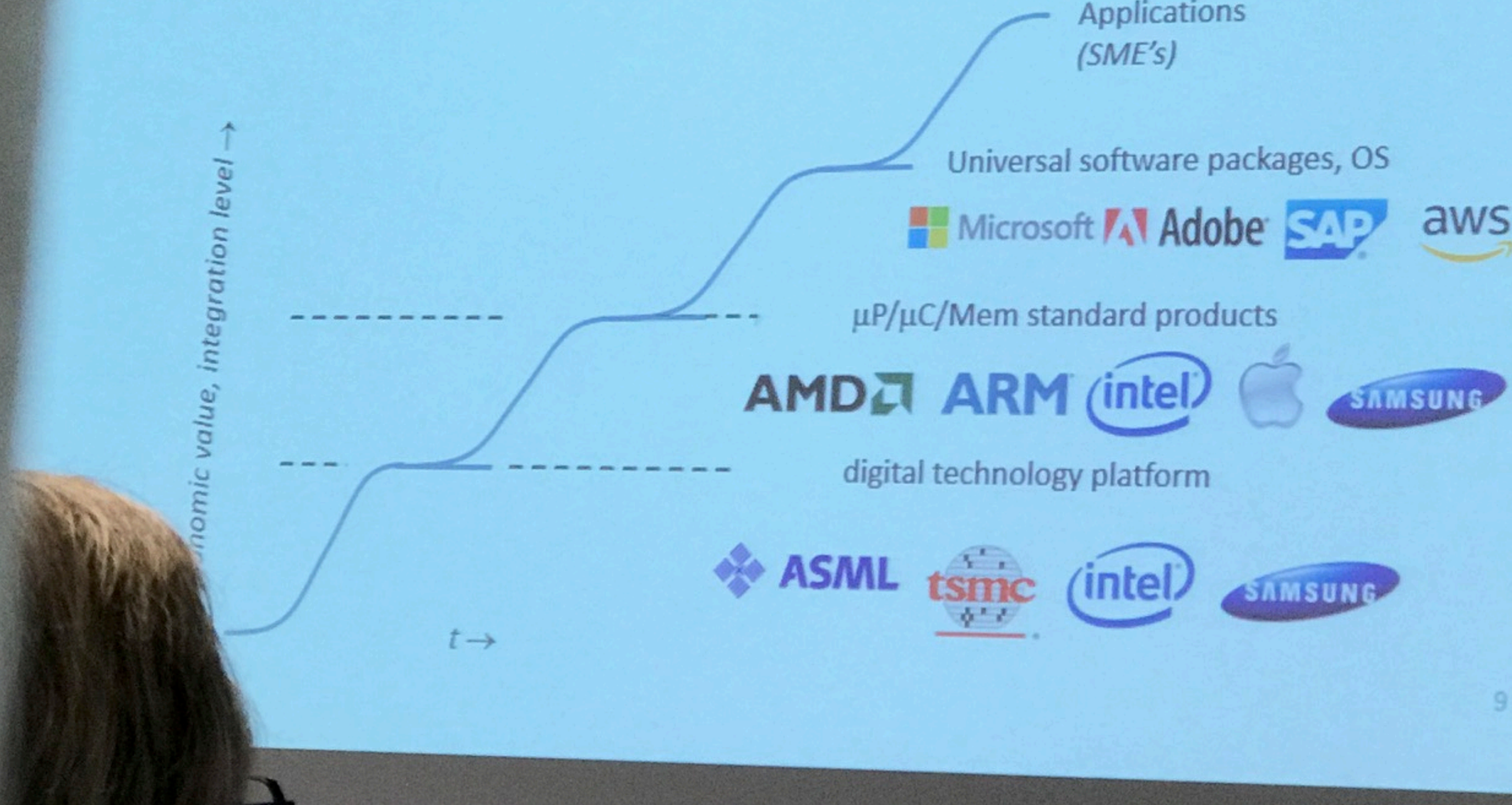


The Internet of Things (IoT)

History repeating itself

The Internet of Things

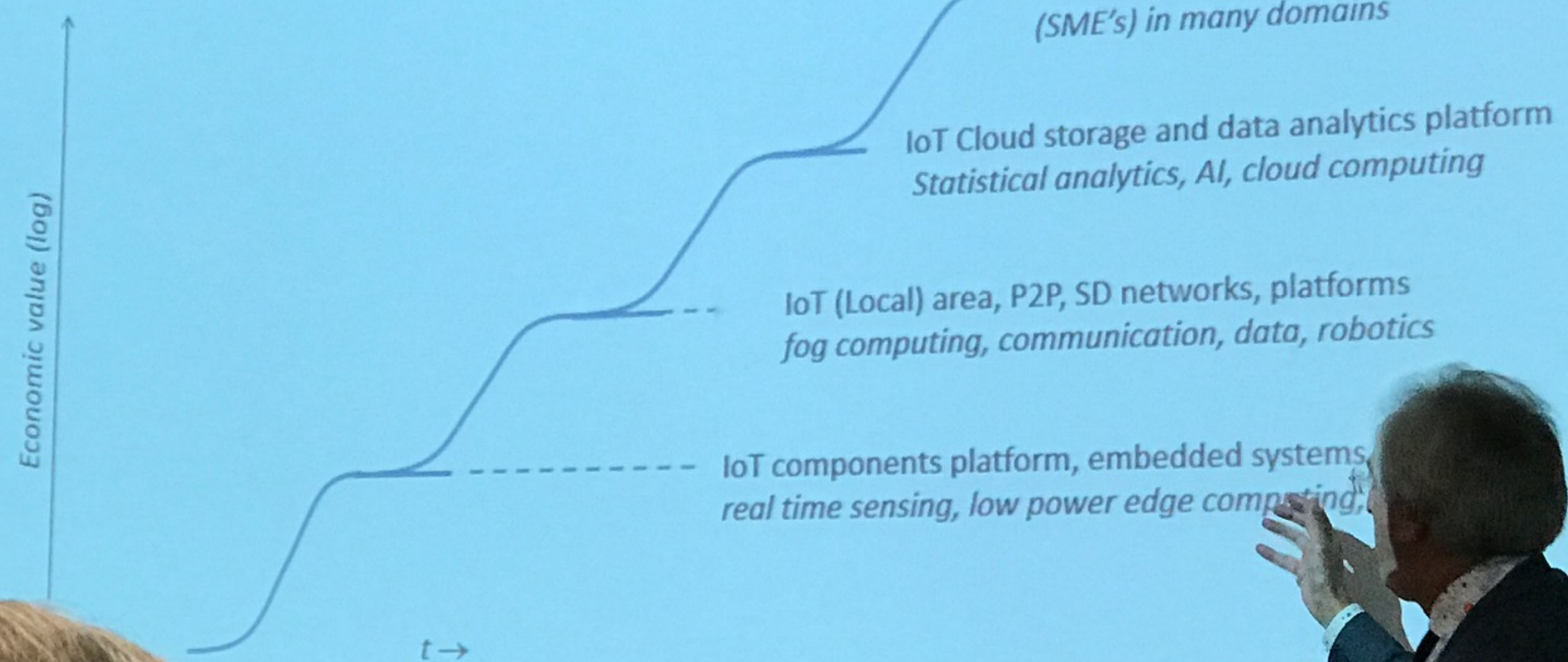
history repeating itself

A selection of critical elements

- (the issue with) IoT Technology and enabling platforms
- (the issue with) IoT Applications development
- (the issue with) IoT Socio-economic impact
- IoT Main obstacles

The Internet of Things

IoT Technology and Enabling Platforms



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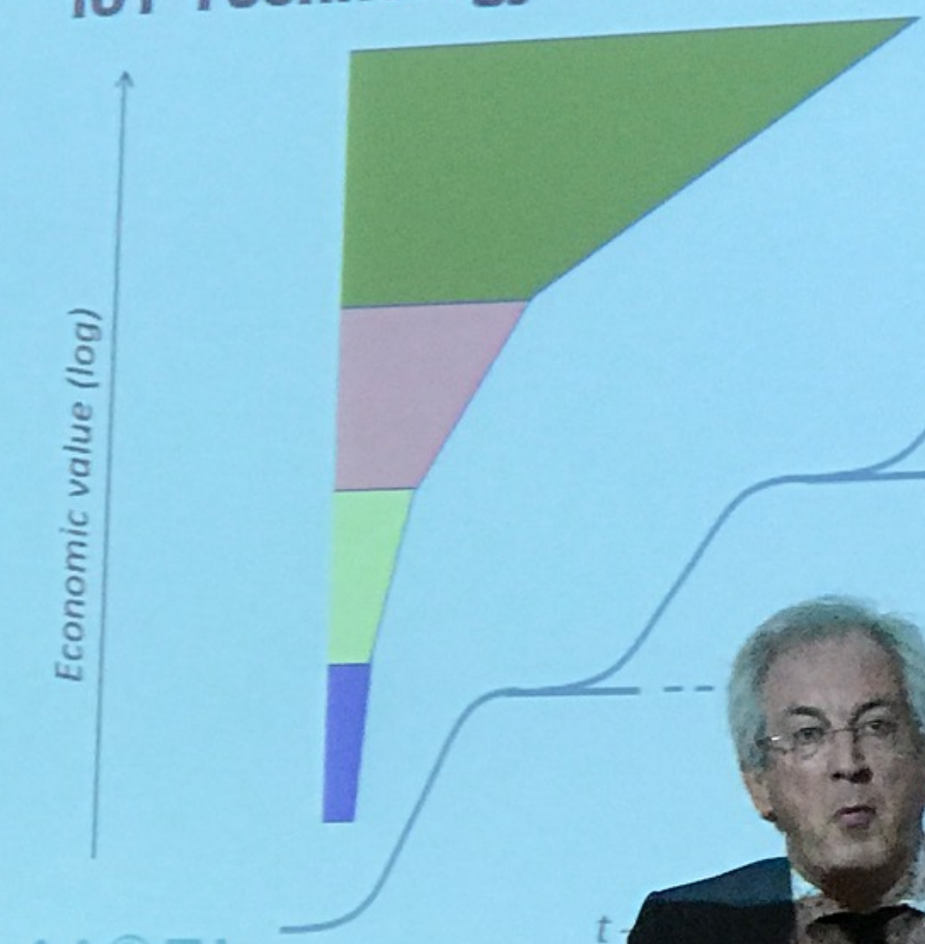

IoT Application platforms
(SME's) in many domains

IoT Cloud storage and data analytics platform
Statistical analytics, AI, cloud computing

IoT (Local) area, P2P, SD networks, platforms
fog computing, communication, data, robotics

IoT components platform, embedded systems
real time sensing, low power edge computing, comms)

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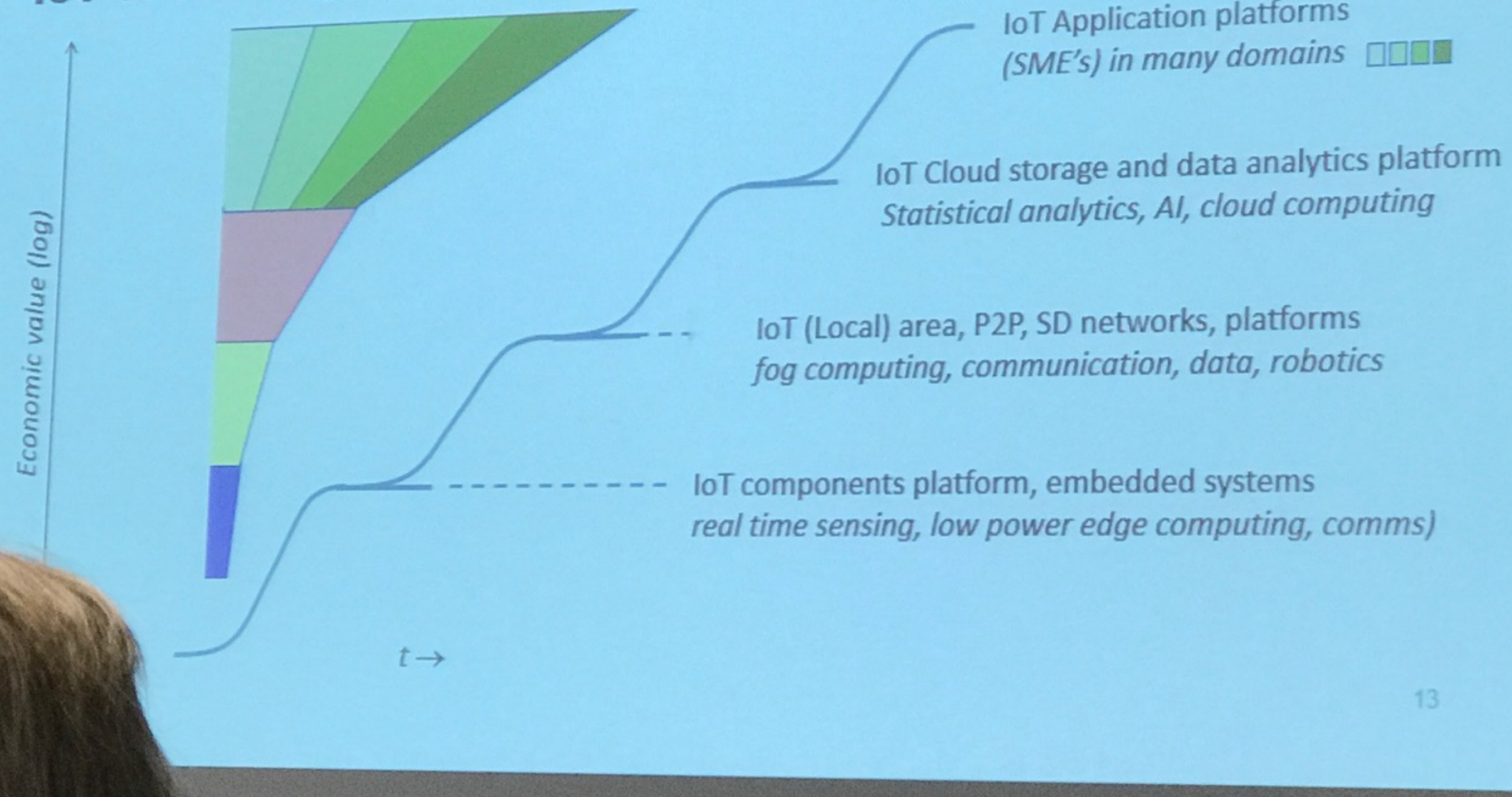
The Internet of Things

IoT Technology and Enabling Platforms



The Internet of Things

IoT Technology and Enabling Platforms

- IoT technology requirements differ from general Internet requirements
  - (standby) power, bandwidth, cost, P2P, distributed vs. centralised, footprint, security…
- The higher one gets, the wider the scope
  - Requiring application domain specialism: Smart Cities, Homes, Farming… whatever
  - Multi technology integration (HW, SW, Systems, UX, non-functional requirements)
  - Legal, socio economic, human aspects
  - Uncertainty about use-cases
  - A new order of wide complexity, requiring a new breed of engineers
- … because application platforms are hardly established…
- … because supporting platforms are insufficiently established

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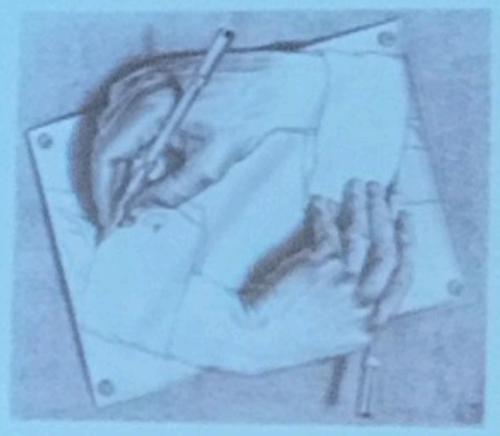

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The Internet of Things

The issue with IoT Technology and Enabling Platforms

- No single company/organisation can manage the whole stack
  - Economy of scale
  - Knowledge and competency, scope, culture
  - Acceptance by society and government (power)
- Separation of concerns ('mind your own business') and collaborate with others
- Systems of systems of systems of systems.... chains of smile curves...

The Internet of Things

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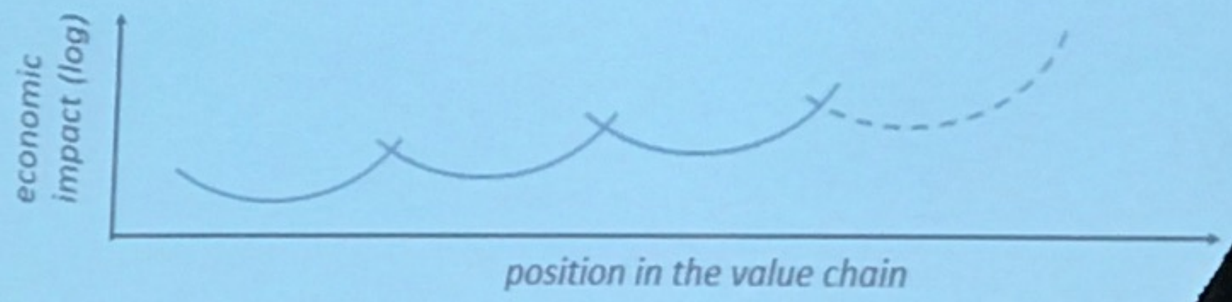

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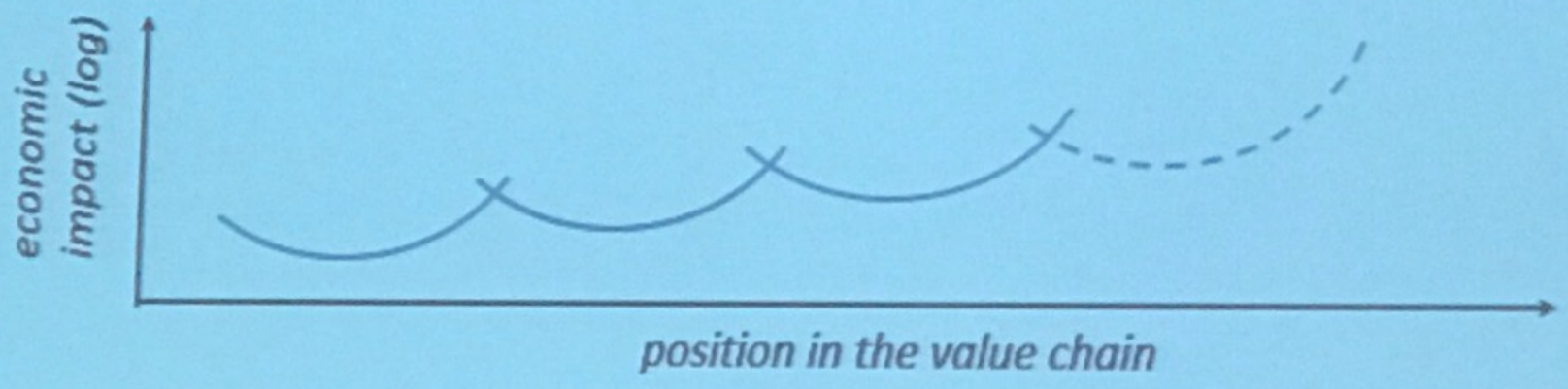
The issue with IoT Technology and Enabling Platforms

Without the establishment of **collaboration platforms** ...

- Orchestrated and managed interfaces
- Common goals, language and ways of working
- Incorporating multidisciplinary views (particularly in non-functional elements)

... value creation becomes a **fairy tale**



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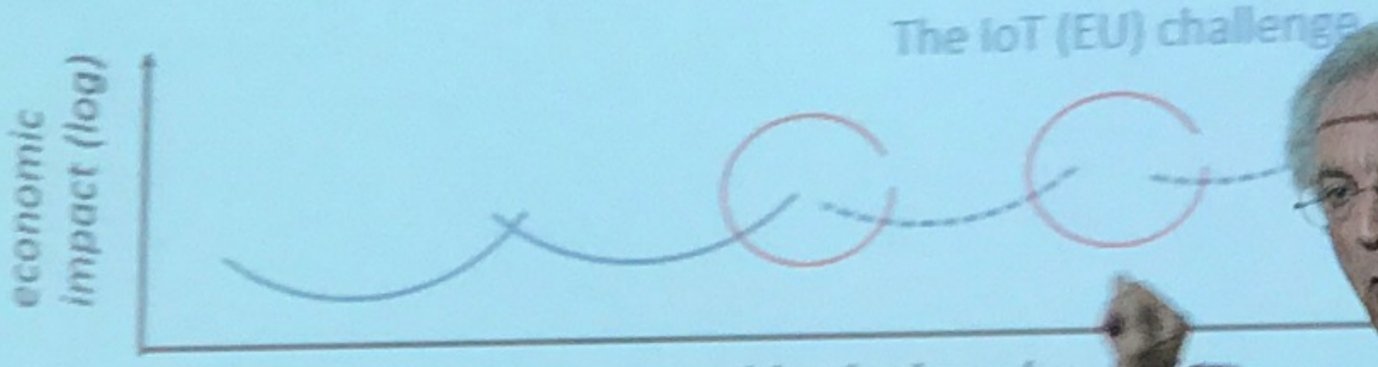

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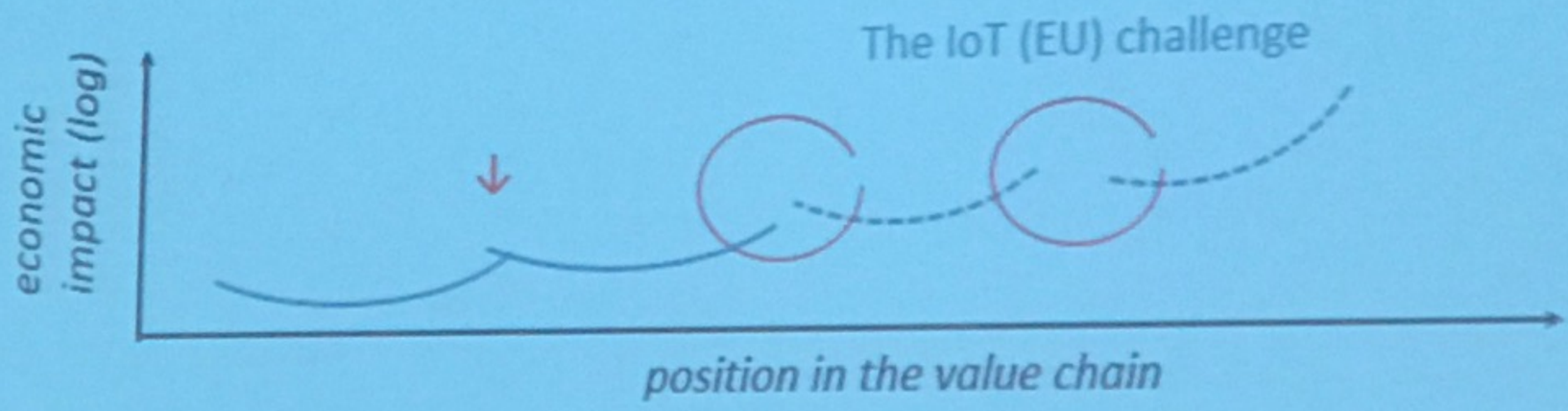

The Internet of Things
The issue with IoT Enabling Platforms, is not technology

But lack of

- Collaboration between industrial players
- Collaboration across functional silos
- Professional platform management (365/24/7) and application support
- Access for creatives, SME, contributing value with their applications
- Understanding that economic justification comes with multiple use cases
- Attention to **non-functional aspects**: security, privacy, portability, update-ability…

the '-ities'

Do you bet on your monopolistic/DIY power or your collaborative power?

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The Internet of Things

(The issue with) IoT applications development

- Economic justification for any platform comes from **collectives** of applications
- A single application can hardly justify a platform
- ...but without platform no single application can fly (for long)

- How to kickstart application (use-case) developments?
- Large companies **have** the capability to establish and maintain platforms, but often **lack** the speed and creativity for developing many applications
- SME's and start-ups **have** the agility and creativity for applications, but often **lack** (access to) platforms
- New Open Innovation Ecosystems required (collaboration platforms)

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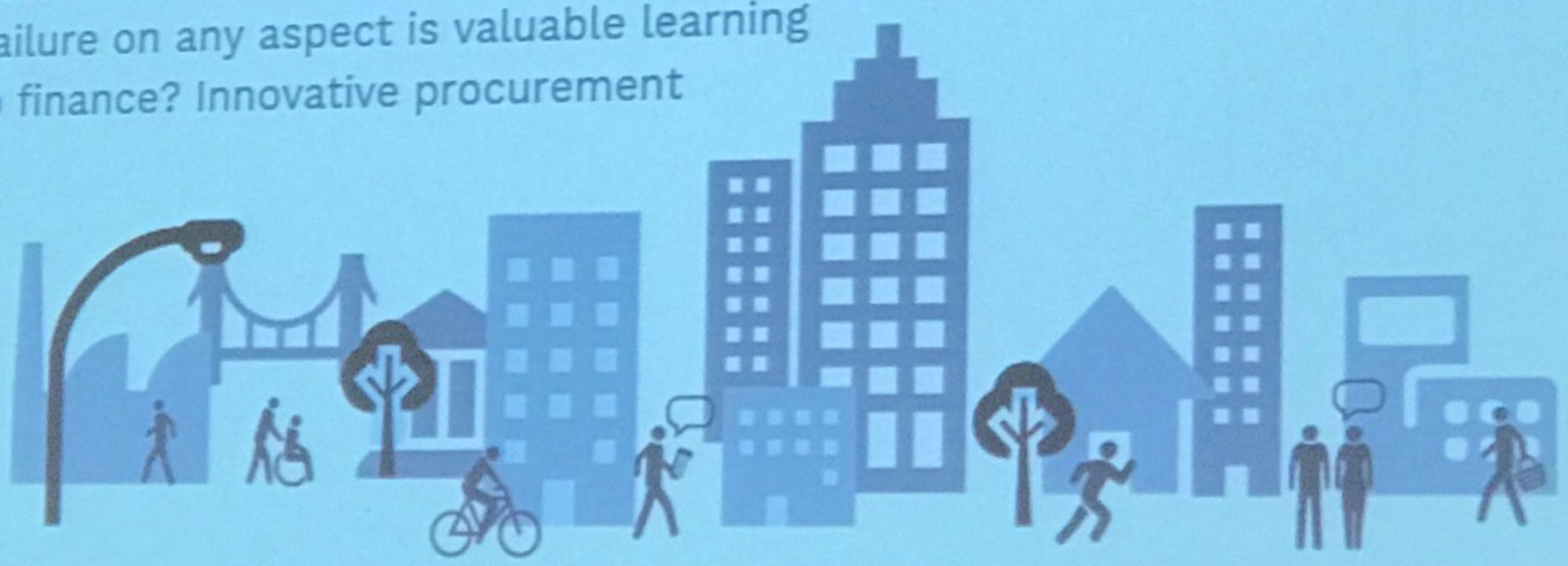
The Internet of Things

(The issue with) IoT applications development

- Managing **uncertainty**: many applications will fail, get used to it!
  several will be successful, count on it!
- Large scale **experimentation** on platforms
  - In real world environment (e.g. Smart City/Mobility/5G)
  - Early involvement of end-users and key stakeholders beyond technology
  - Expectation management (including non-functional aspects)
  - Early failure on any aspect is valuable learning
  - Who to finance? Innovative procurement



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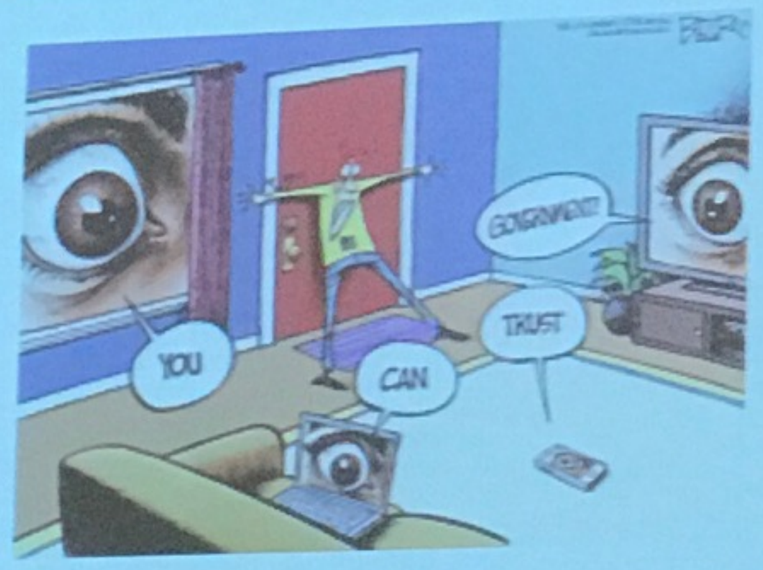
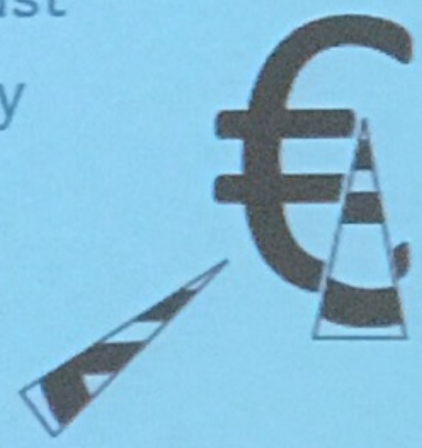
The Internet of Things

Socio-economic impact



- Little knowledge, experience and understanding in society
- Fear of traditional jobs losses, creating new
- Education required (all generations and professions)
- Governments and companies have work to do to establish (earn) trust
- The socio-economic impact of IoT is largely a self-fulfilling prophecy
  - For the good, re-distributing higher value across the value chain
  - Provided we first create it… collaboratively, constructively, inclusively…
  - For the bad, if we remain in our silos and neglect end-users
  - Mindset



- Experimentation <u>including</u> social and legal aspects in <u>trusted</u> environments

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IoT main obstacles

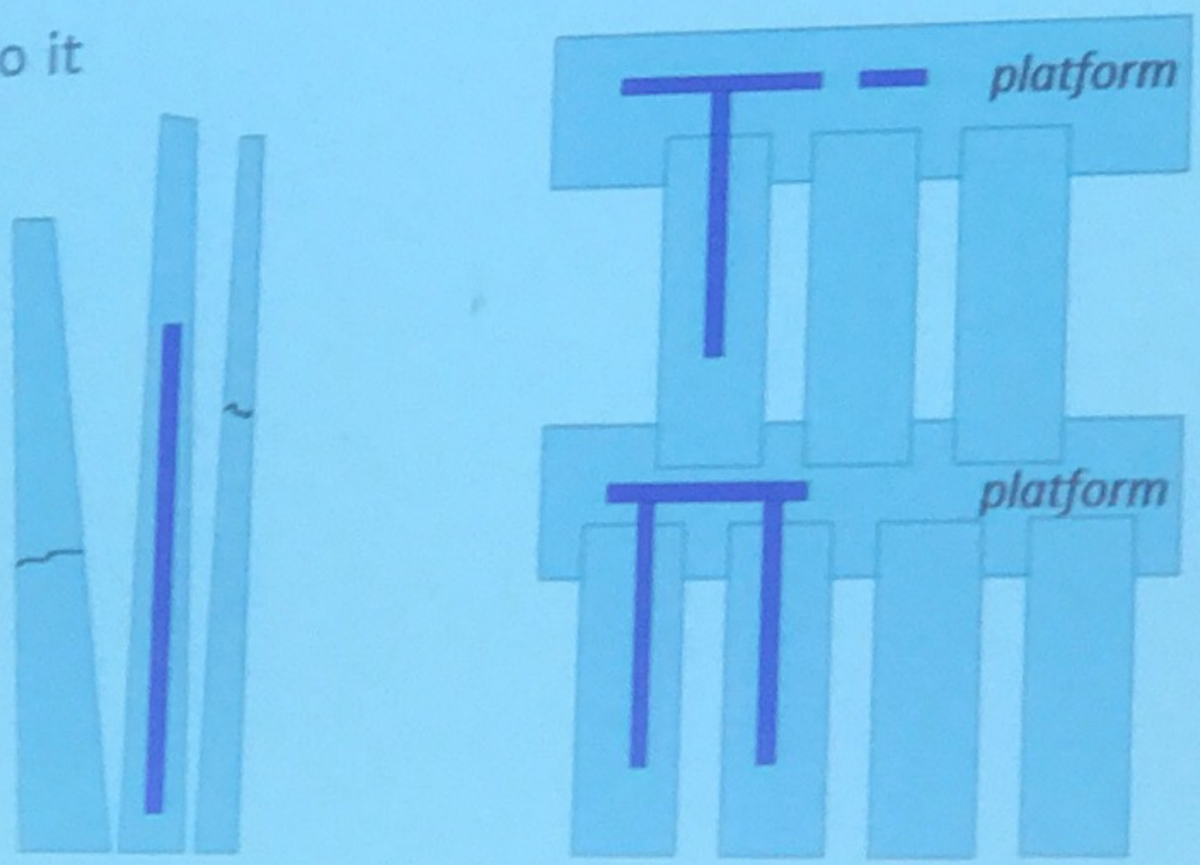
why the smile curves don't connect and don't smile (yet)

- TRUST (lack of)
  - Has many dimensions (AIOTI workshop)
  - Comes by foot, leaves by horse (on non-functionalities)
  - Expectation management
  - Involvement and education of all stakeholders
- Old-school Open Innovation, new collaborative approach required
- Platforms not established, disconnected approaches
- Lack of real scale, creative experimentation
- Lack of empathic, human centric IoT
- Critical architecture choices on non-functional aspects (resilience)

central vs. distributed

Key roles for IT professionals
in addition to the many domain specialists required

- T-profile Engineers, integrating across ('platformers') in many aspects
- Π-profile Engineers, linking with other disciplines (legal, social) or domains
- Unlikely that 'I' can do it



Key roles for IT professionals
in addition to the many domain specialists required

- Focus on solving societal challenges (including energy consumption by IT)
- Non-functional system aspects: '-ities', crucial for trust
  - Educating and involving society
  - Providing end users with options and data ownership
- Distributed Systems Architectures (in all aspects, including non-technical)
- Professionals managing convergence on **application** level
  - Internet, IoT, mobile, IIoT, OT, data analytics, systems of systems, SDN
  - Cybersecurity, and many other '-ities'
  - Cloud-, fog-, edge- computing
  - Real-time, mission critical SW
  - VR, AR, robotics, digital twins, BIM...
- Interoperability, portability

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IoT main obstacles

5 key EU challenges as identified in 2015, triggering AIOTI

- Rapid technological developments
  - Connectivity, computing power, robotics, AI, AR/VR, Data Analytics
- Users' take up and acceptability
  - Trust issues, security/privacy breaches (attention for non-functionals)
- Need to move into deployment
  - Find good use cases in application domains (Large Scale Pilots)
    Smart Industry, Cities, Homes, Buildings, Farming…
- Risk of fragmentation
  - Countries, regions, cities and companies trying on their own in silos
- International competition
  - Strong moves by US and China

AIOTI
an independent, member driven association with a mission

- Contribute to Large Scale Pilots to foster experimentation, replication, deployment
- Support convergence & interoperability of IoT standards
- Develop IoT ecosystem across vertical silos including start-ups and SMEs
- Identify, communicate and champion EU spearheads to speed up the IoT take up
- Gather evidence on market obstacles for IoT deployment in a Digital Single Market
- Mapping & bridging global, EU and Members States' IoT innovation activities

By

- Promoting an integrative approach
- Being member-driven, representing a wide range of stakeholders
- Leveraging existing initiatives, be the missing link

AIOTI

AIOTI's signature approach

- We embrace diversity
- Express the different views of interest group along the value chain
- The Alliance is the voice of European IoT industry leaders (large and small) and stakeholders in society
- We are at the forefront of IoT adoption able to identify what is required to drive this adoption
- We strive to break down silos so that the market for IoT can develop
- We co-operate with other global regions while European values, including privacy and consumer protection, are maintained

AIOTI structure

Founding members supported the establishment

General Assembly

Decision power with members

Working Groups

Steering Board

expertise, policy, content management

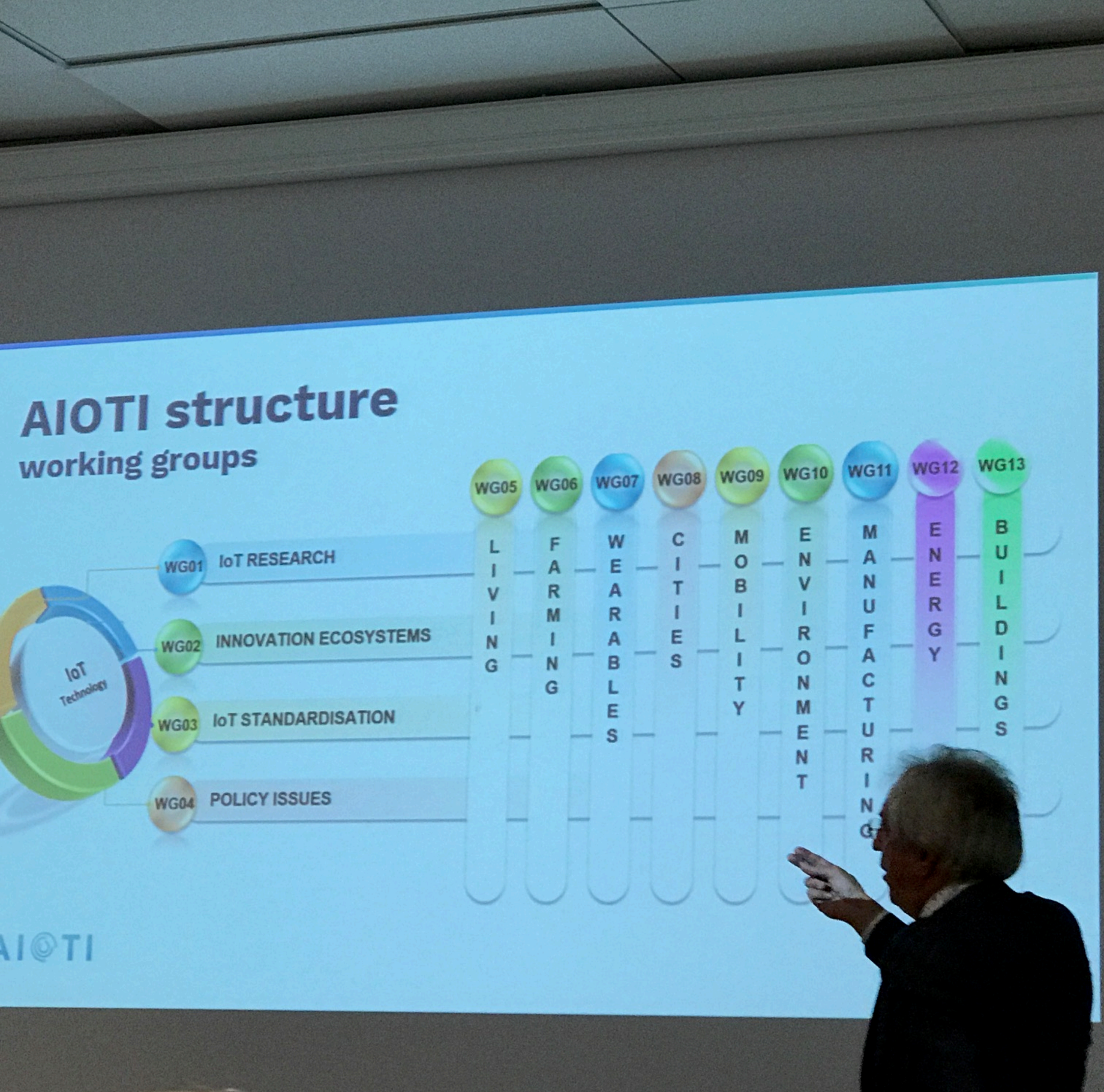
Management Board

facilitating general management

Note: every member is active in at least one Working Group

AIOTI structure

working groups



Conclusions

- The Internet of Things holds many **promises**...
- The Internet of Things has many **challenges** requiring a new approach
  - Socio-economic aspects, Human Centric IoT
  - Education and involvement of end-users
  - Privacy, security, resilience..., non-functional aspects
  - Collaborative platforms beyond technical platforms
  - Critical architectural choices
  - Real scale experimentation
- Key roles for IT professionals
  - T and Π profile engineers, including social responsibility
  - Architects
  - Application domain experts