Internet of Things (IoT)

- Vikram Raval GSMA

Introductions

Your objectives

- What do you expect to learn from this course?
- How is it relevant to you?

Themes

- Understanding the benefits IoT can bring
- Key differences between IoT and Traditional Telecom services
- Regulation and IoT

Aims of this course

- Define IoT
- Understand the technology behind IoT
- Analyse operational aspects of IoT
- Understand IoT business models
- Explore the policy and regulatory implications of IoT
- Examine a number of examples of IoT

Outline of the session

- Overview of IoT
- What is IoT?
- What are the common elements of IoT?
- Definitions of IoT from around the world
- What are the differences between IoT and traditional services?
- What are the levers, drivers and inhibitors of IoT?
- What are the benefits of IoT to citizens and wider socio-economic benefits?
- Discovering the business models and innovation in business models to enable successful IoT
- How can governments can help foster and drive IoT adoption and innovation in their country?

Overview of IoT

- An introductory video
- What is IoT?
- Exercise: How does IoT differ from traditional services?
- Drivers and inhibitors of IoT
- Connections and revenue forecasts

Overview of IoT: what is IoT?

Key messages

1. Many vertical markets will adopt IoT solutions
2. IoT is still at a very early stage of development, so definitions are still evolving

What is IoT?

Smart meters

Smart cities

Smart mining

Connected car

Connected thermostat

Remote health monitoring

Smart solar power plant

Smart farm

Connected thermostat

Connected car

Remote health monitoring

Smart solar power plant

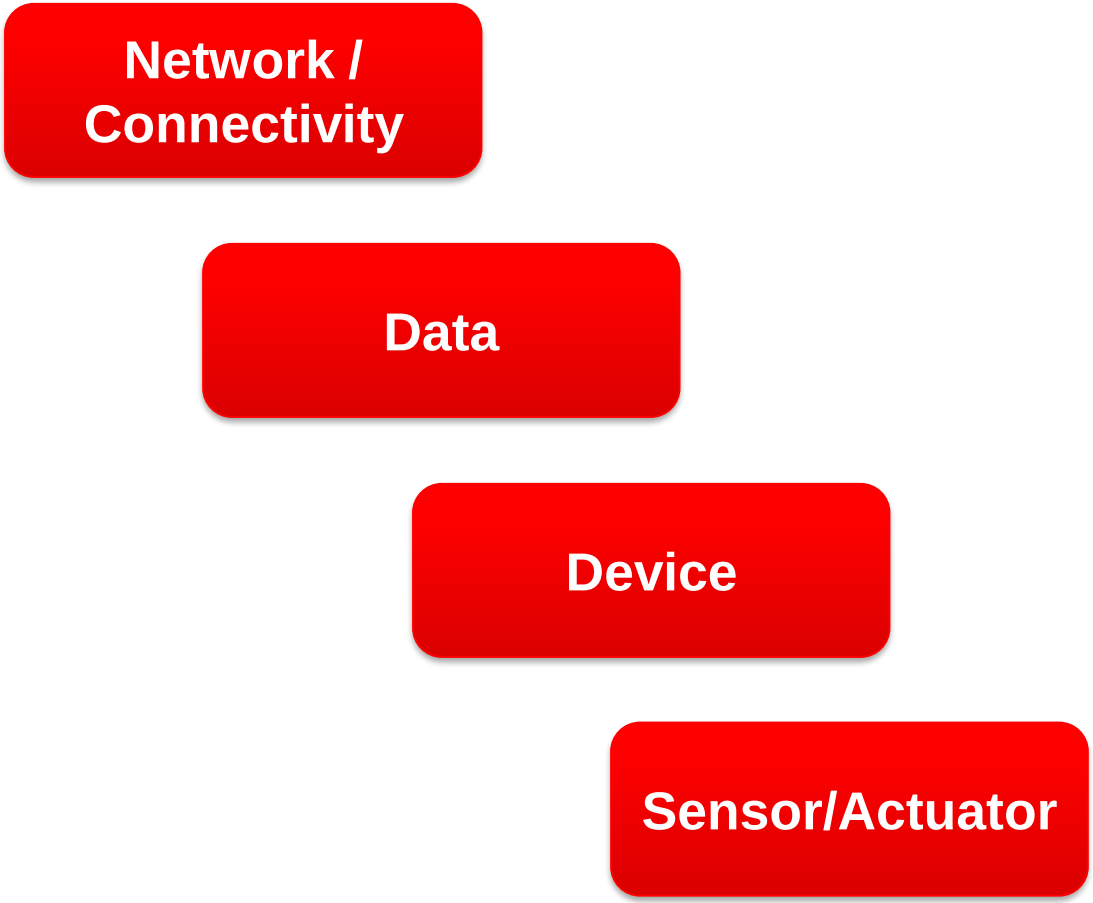
Smart meters

Smart mining

Smart city

Smart farm

Common elements of IoT



Common elements of IoT

Network / Connectivity

typically

Internet

…but also

Private

Common elements of IoT

Data

typically

Multiple sources

…but also

Single source

Common elements of IoT

Device

typically

Existing

…but also

New

Common elements of IoT

Sensor / Actuator

typically

Sensor and actuator

…but also

Sensor only

Common elements of IoT

Connectivity / Network	typically	Internet	…but also	Private
Data	typically	Multiple sources	…but also	Single source
Device	typically	Existing	…but also	New
Sensor / Actuator	typically	Sensor and actuator	…but also	Sensor only

Exercise: Identify common IoT elements

- Thinking about the eight examples just presented, what common patterns/elements can you identify across the solutions?
- What would be your definition of IoT?

Definitions of Internet of Things:

The Internet of Things (IoT) refers to the use of intelligently ***connected devices*** and systems to leverage ***data*** gathered by embedded ***sensors*** and ***actuators*** in machines and other physical objects. – *GSMA*

The IoT is […] the ***interconnection*** of multiple M2M applications, often enabling the exchange of ***data*** across multiple industry sectors. An example is the ability to manage traffic flow, reduce pollution and improve health by combining data from a range of transport, healthcare and environmental ***sensors***. – *Ofcom*

Noun - The ***interconnection*** via the Internet of computing ***devices*** embedded in everyday objects, enabling them to send and receive ***data*** – *Oxford Dictionary*

Definitions of Internet of Things:

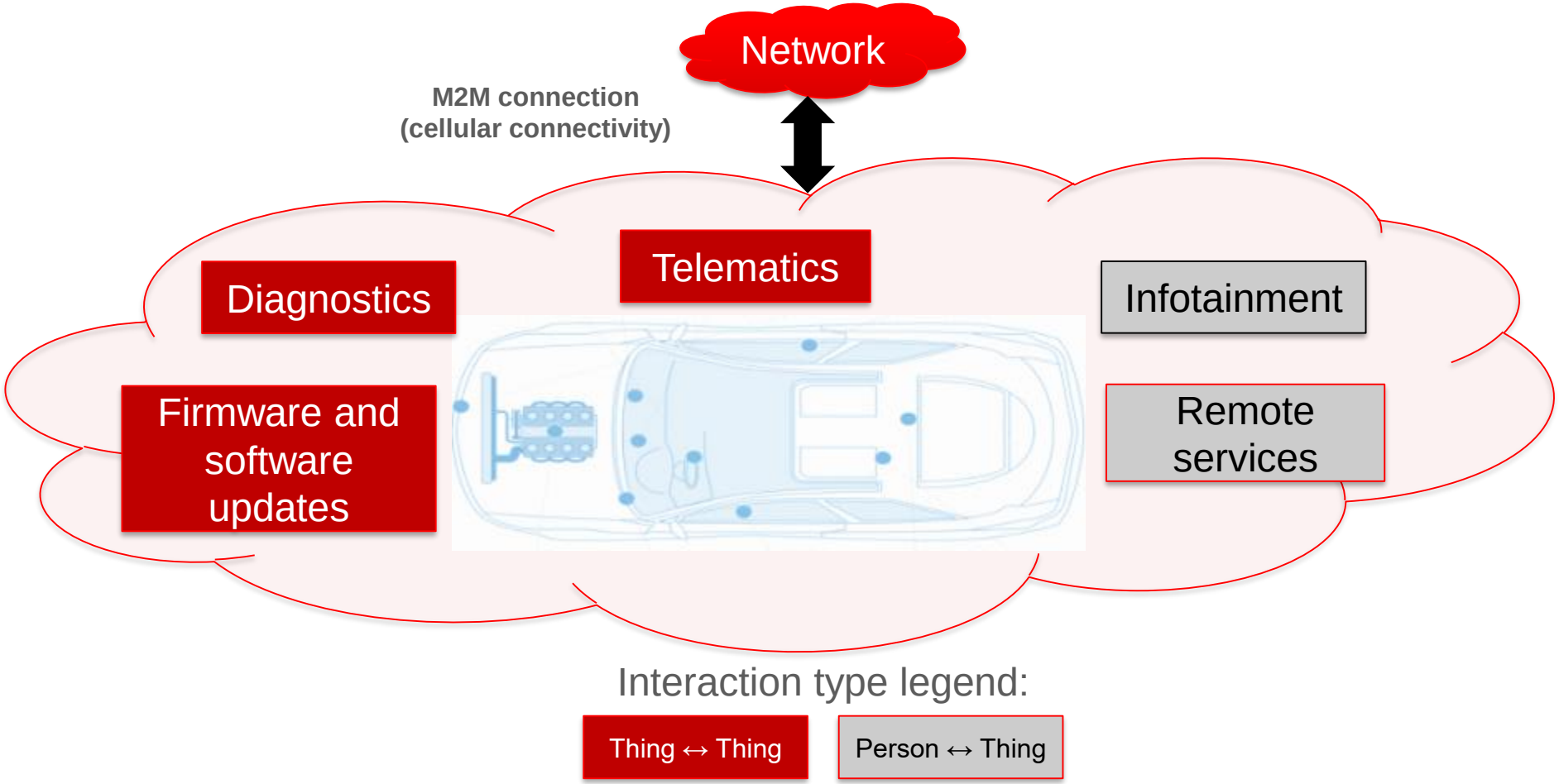
The Internet of Things (IoT) refers to the use of intelligently ***connected devices*** and systems to leverage ***data*** gathered by embedded ***sensors*** and ***actuators*** in machines and other physical

“what all definitions of IoT have in common is that they focus on how computers, sensors, and objects interact with one another and process data.” - FTC

and improve health by combining data from a range of transport, healthcare

Noun - The ***interconnection*** via the Internet of computing ***devices*** embedded in everyday objects, enabling them to send and receive ***data*** – *Oxford Dictionary*

Internet of Things (IoT) vs Machine-to-Machine (M2M)



Summary: what is IoT

1

There are four key elements common to an IoT solution

- A network is used to provide connectivity
- Data is transmitted and often received by the end device
- The solution is integrated into a new or existing device
- Data is captured by sensors and can trigger a reaction by actuators

2

IoT is still evolving and, as a result, so is its definition

Overview of IoT: How does IoT differ from traditional services?

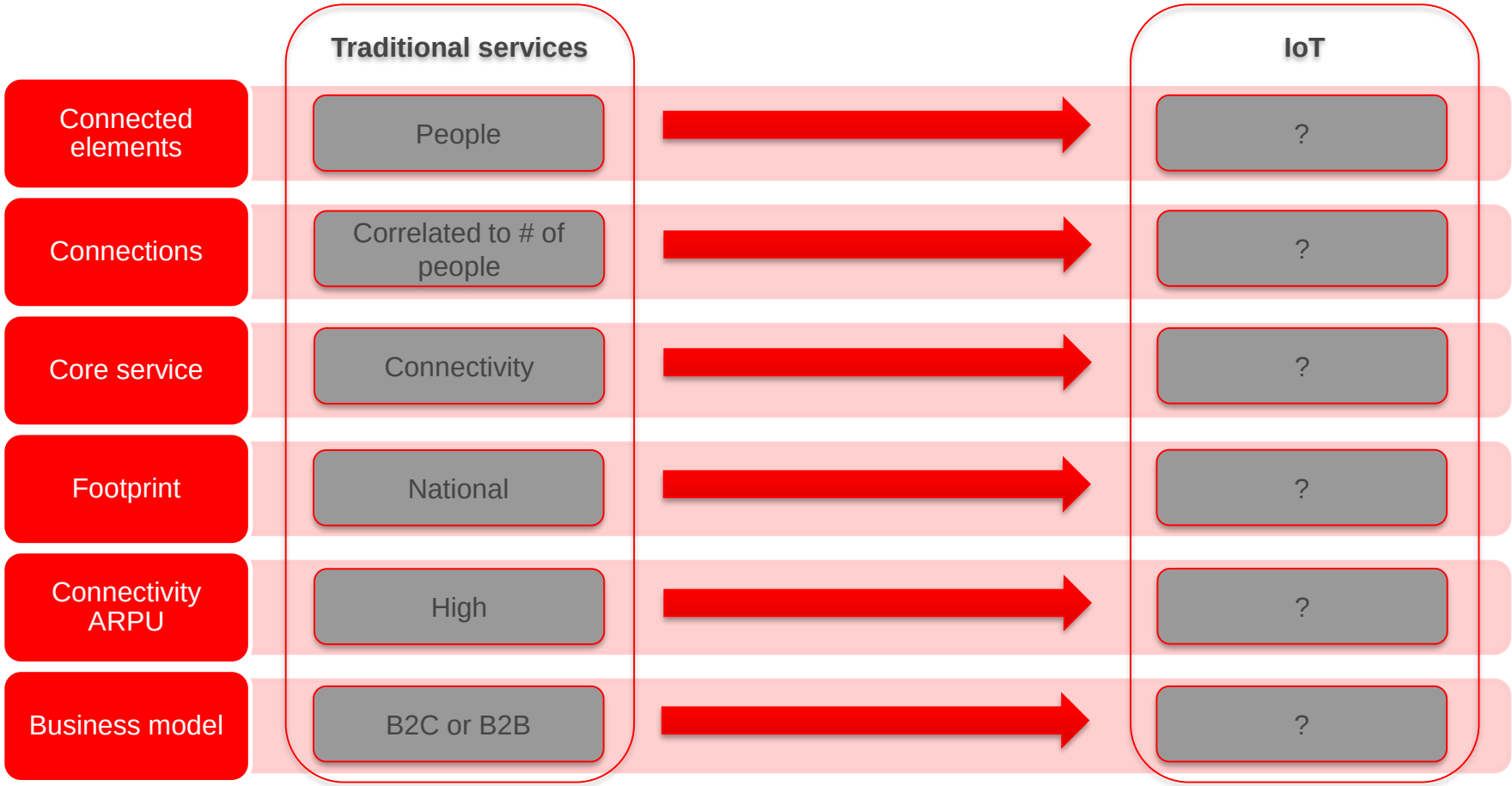
Key messages

1. IoT services are fundamentally different from traditional telecoms services, such as voice and messaging

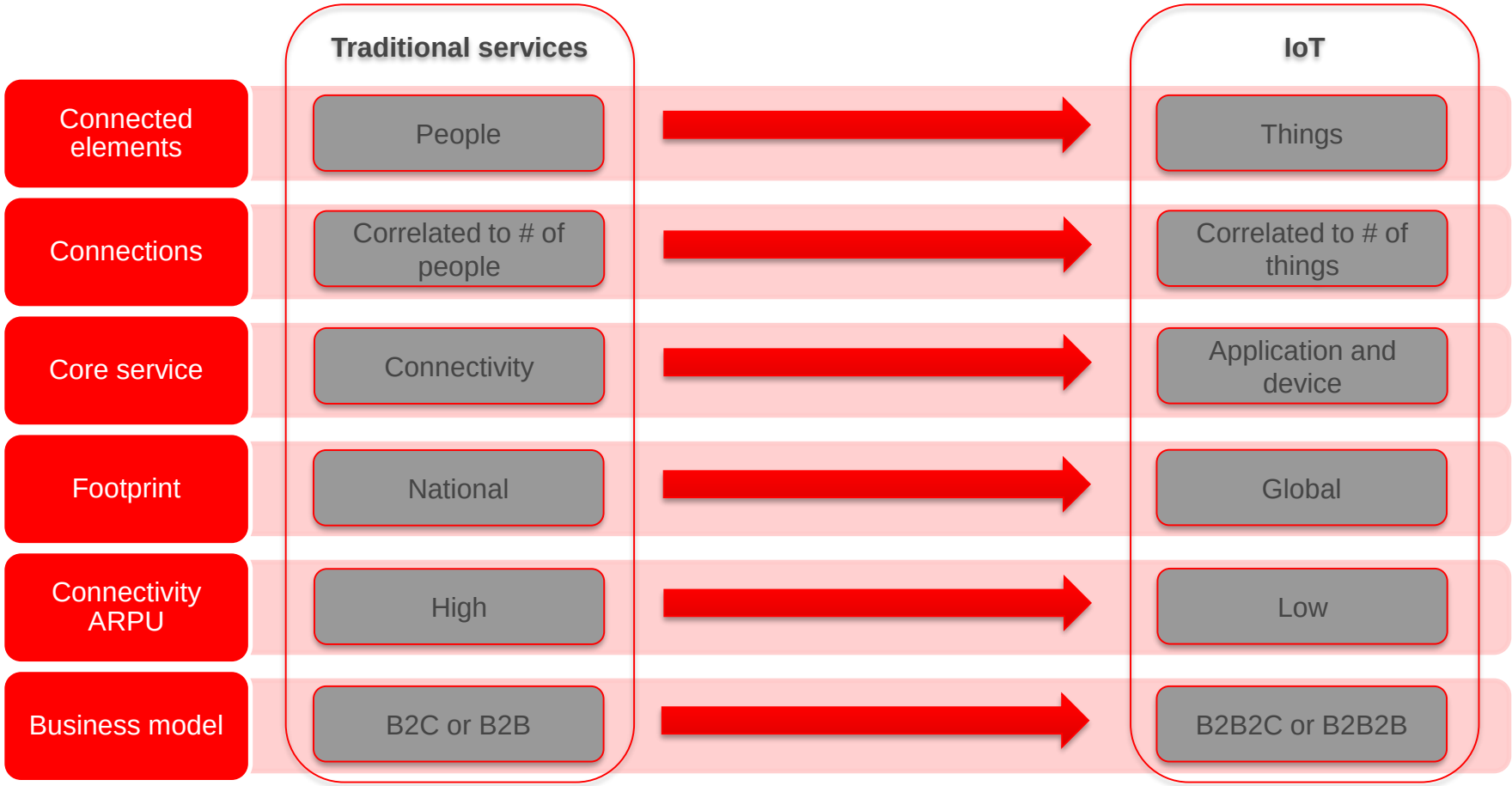
2. Regulators should recognise these differences when considering policy and regulatory frameworks

How does IoT differ from traditional services?

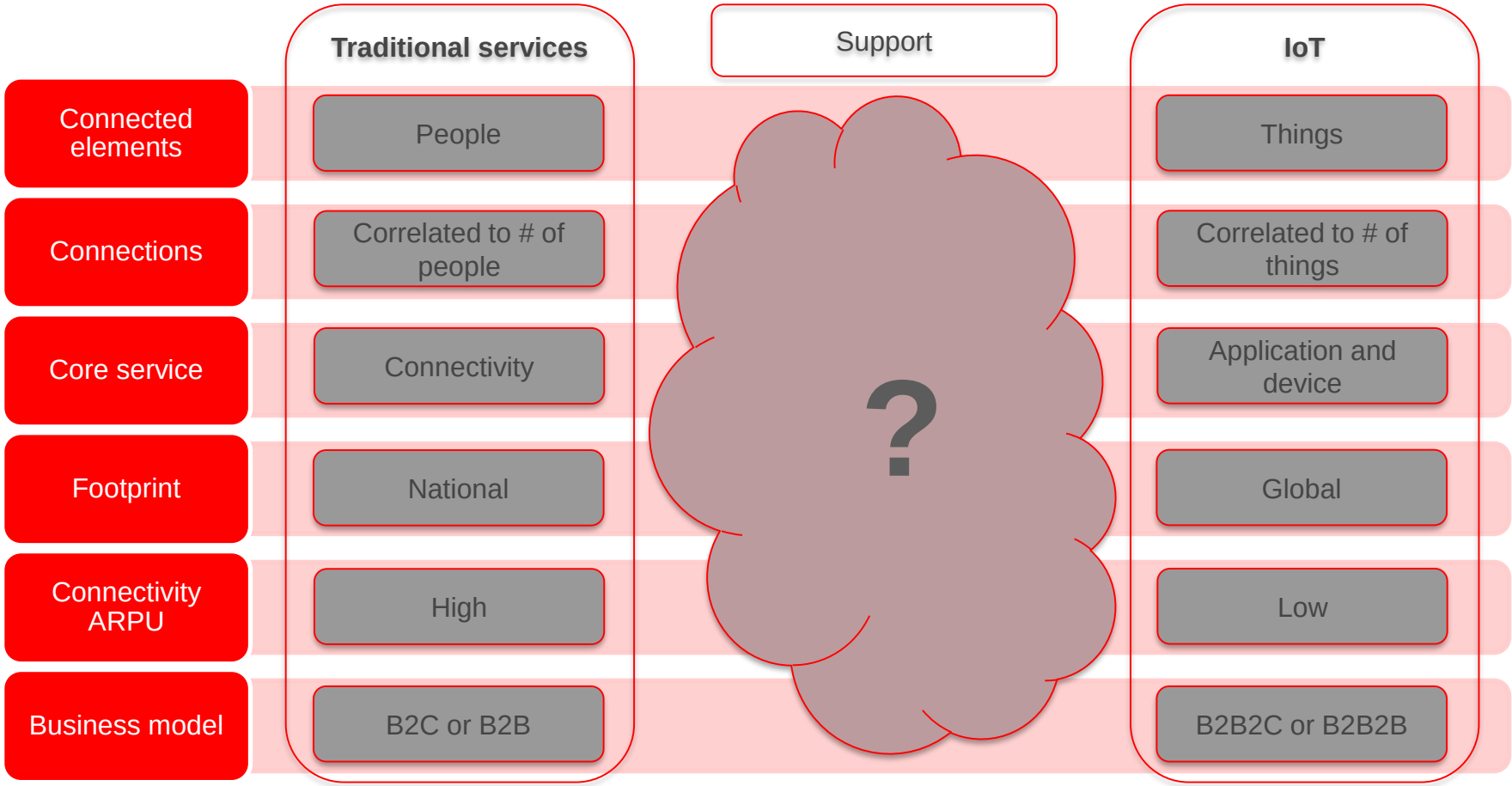
How does IoT differ from traditional services?



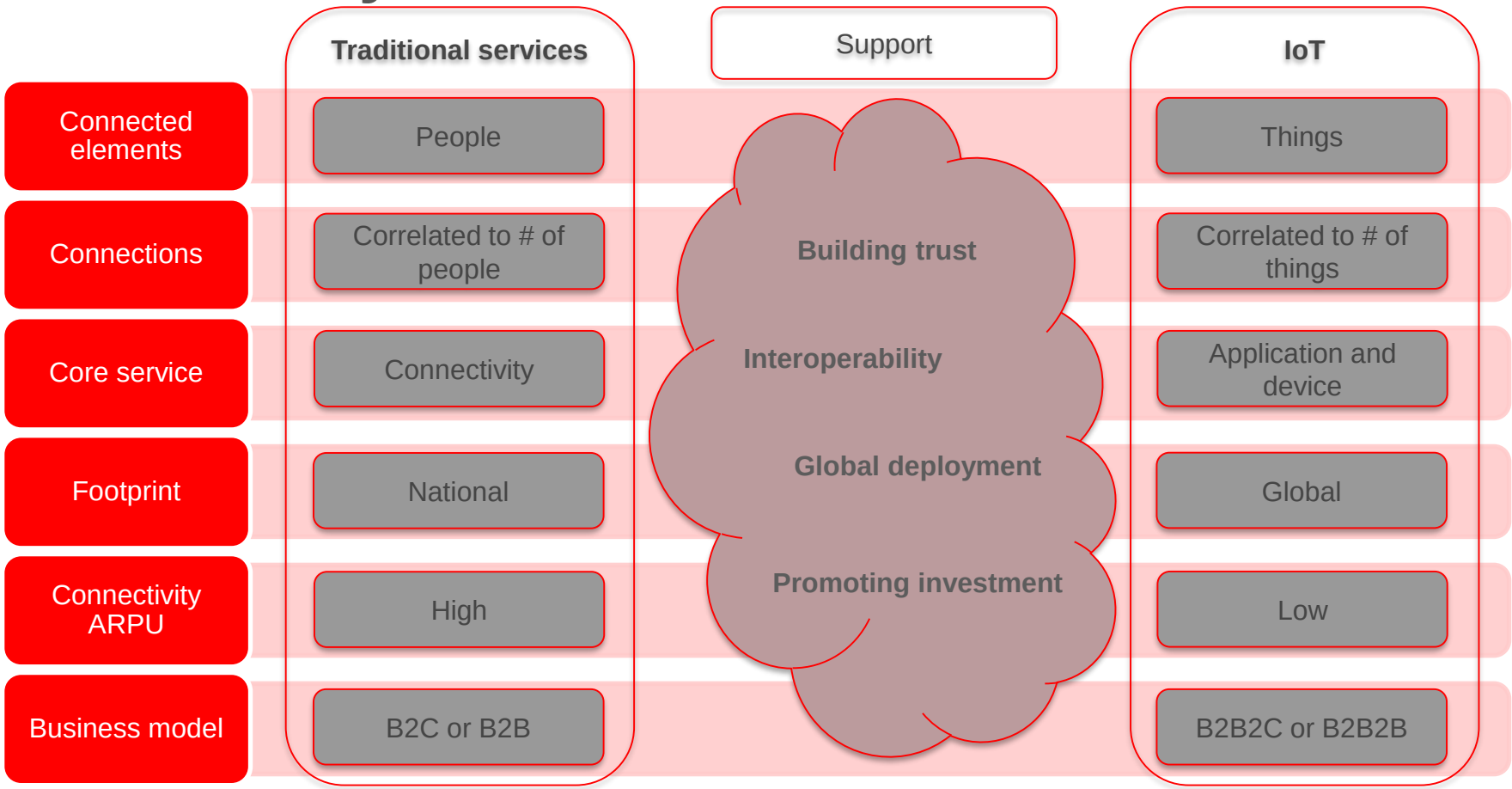
There are many differences…



…and governments can help IoT grow…



…by applying existing laws transparently and consistently



Summary: How does IoT differ from traditional services?

1

IoT services differ from traditional service on dimensions such as:

- What is being connected (things vs people)
- The core element of the service (application vs connectivity)
- The volume of connections
- The ARPU (low vs high)

2

Governments can help drive IoT adoption in their country by focusing on four areas:

- Enabling global deployment, promoting investment, building trust, promoting interoperability

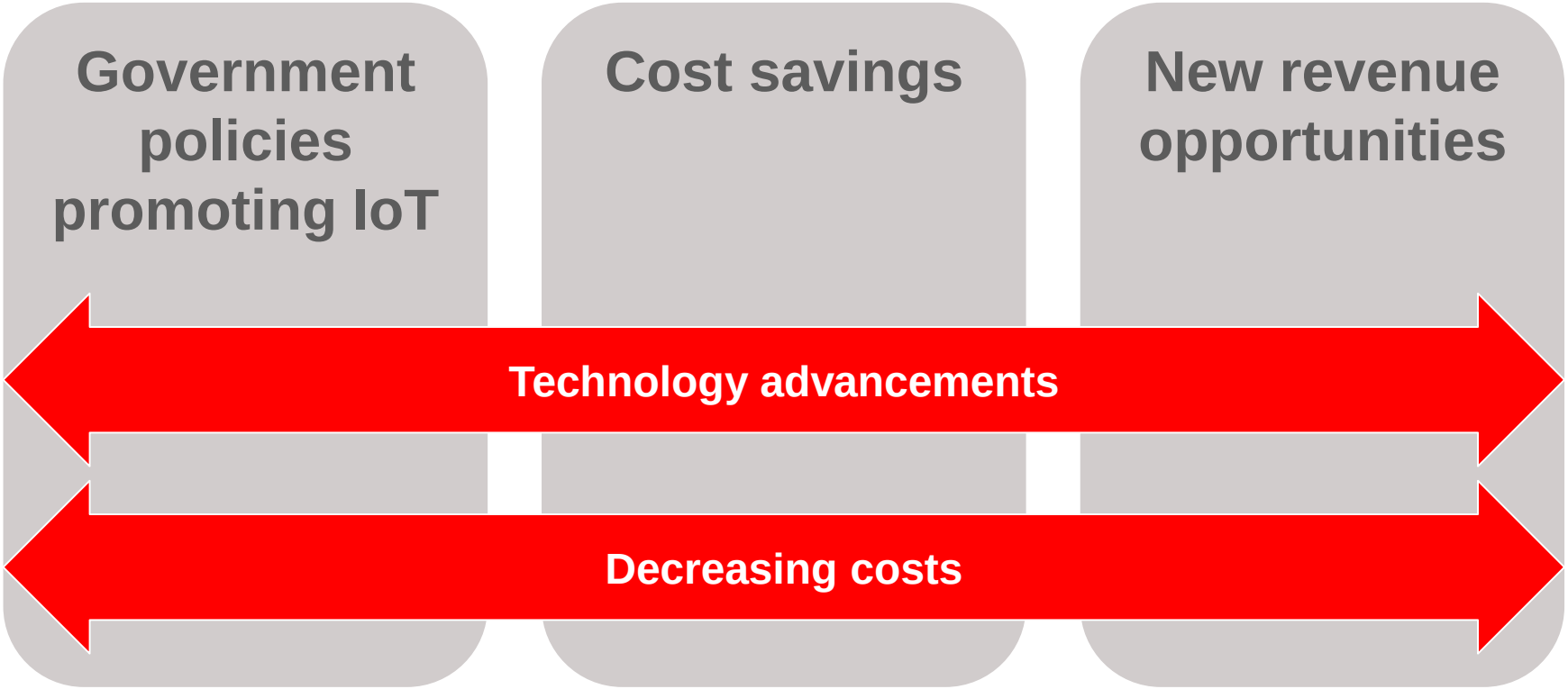
Overview of IoT: drivers and inhibitors of IoT

Key messages

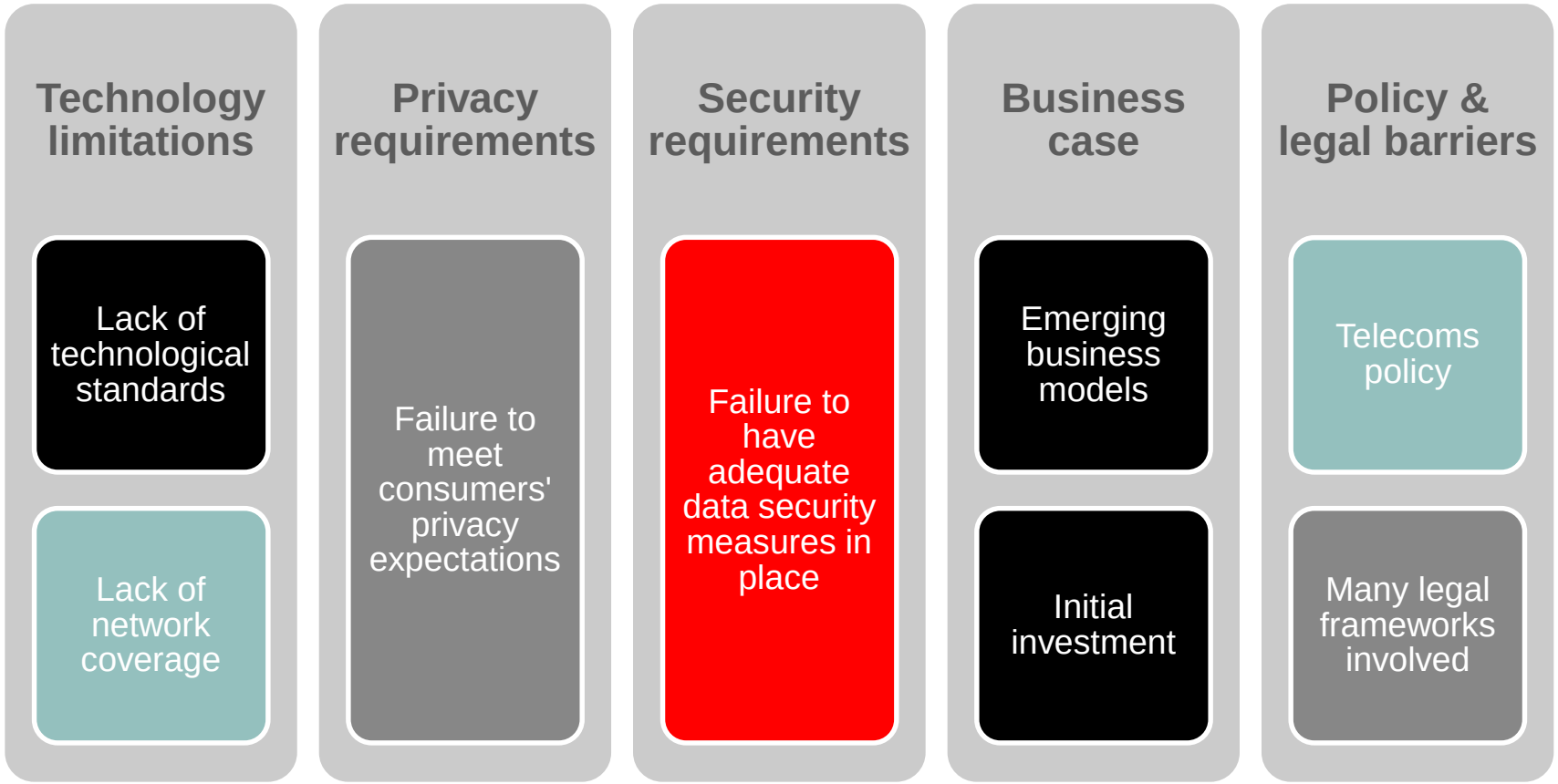
1. IoT is being driven by technology advancements, decreasing costs and demands for efficiency

2. Clarity on how data privacy laws are applied to IoT can help this nascent market develop

Some drivers of IoT…



…and some inhibitors of IoT



Summary: drivers and inhibitors of IoT

1

IoT is driven by:

- Government policies promoting IoT growth
- Cost savings
- New revenue opportunities

2

IoT's growths can be hindered by:

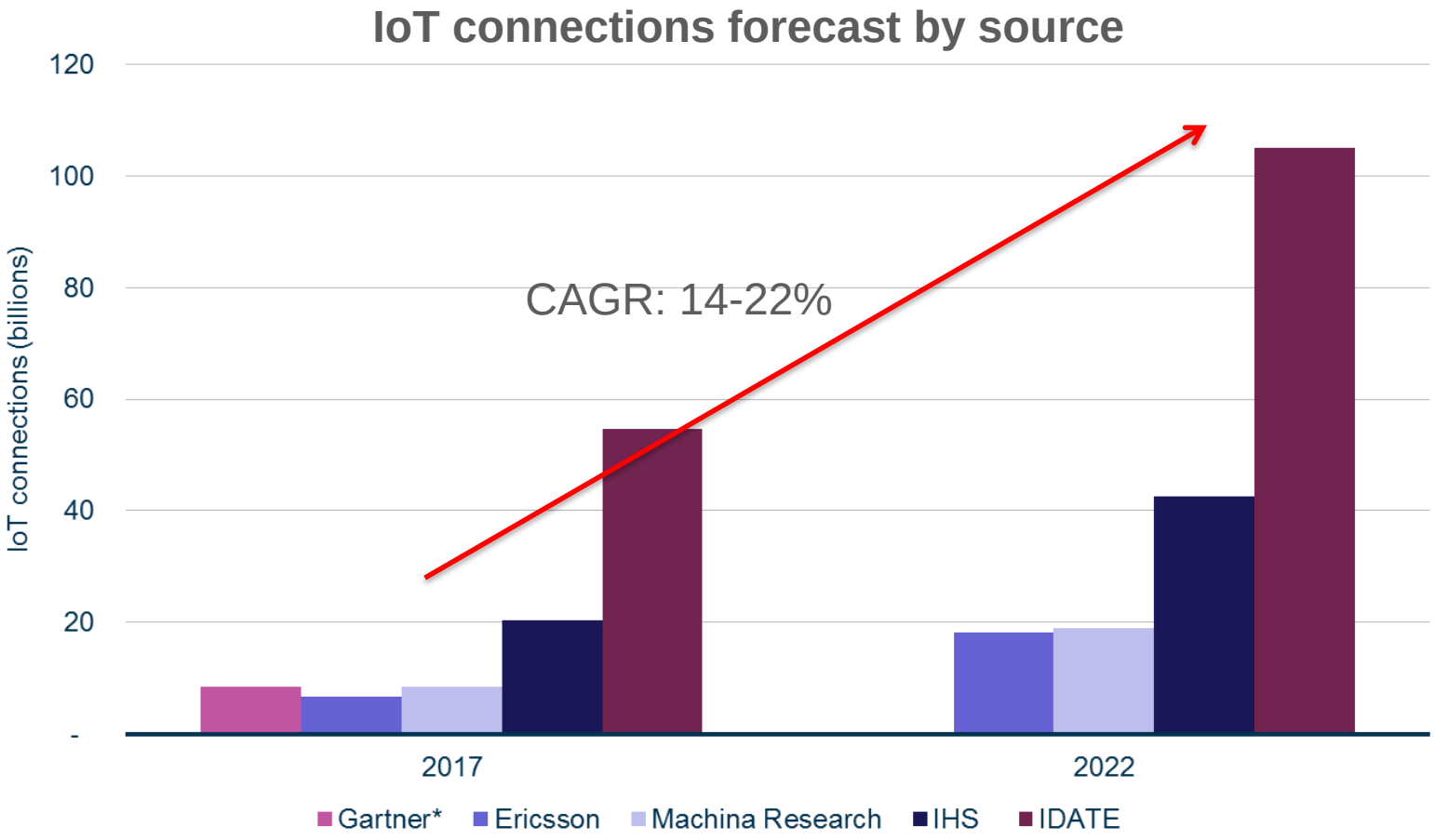
- Technology limitations
- Privacy requirements
- Security requirements
- The business case
- Policy and legal barriers

Overview of IoT: connections and revenue forecasts

Key messages

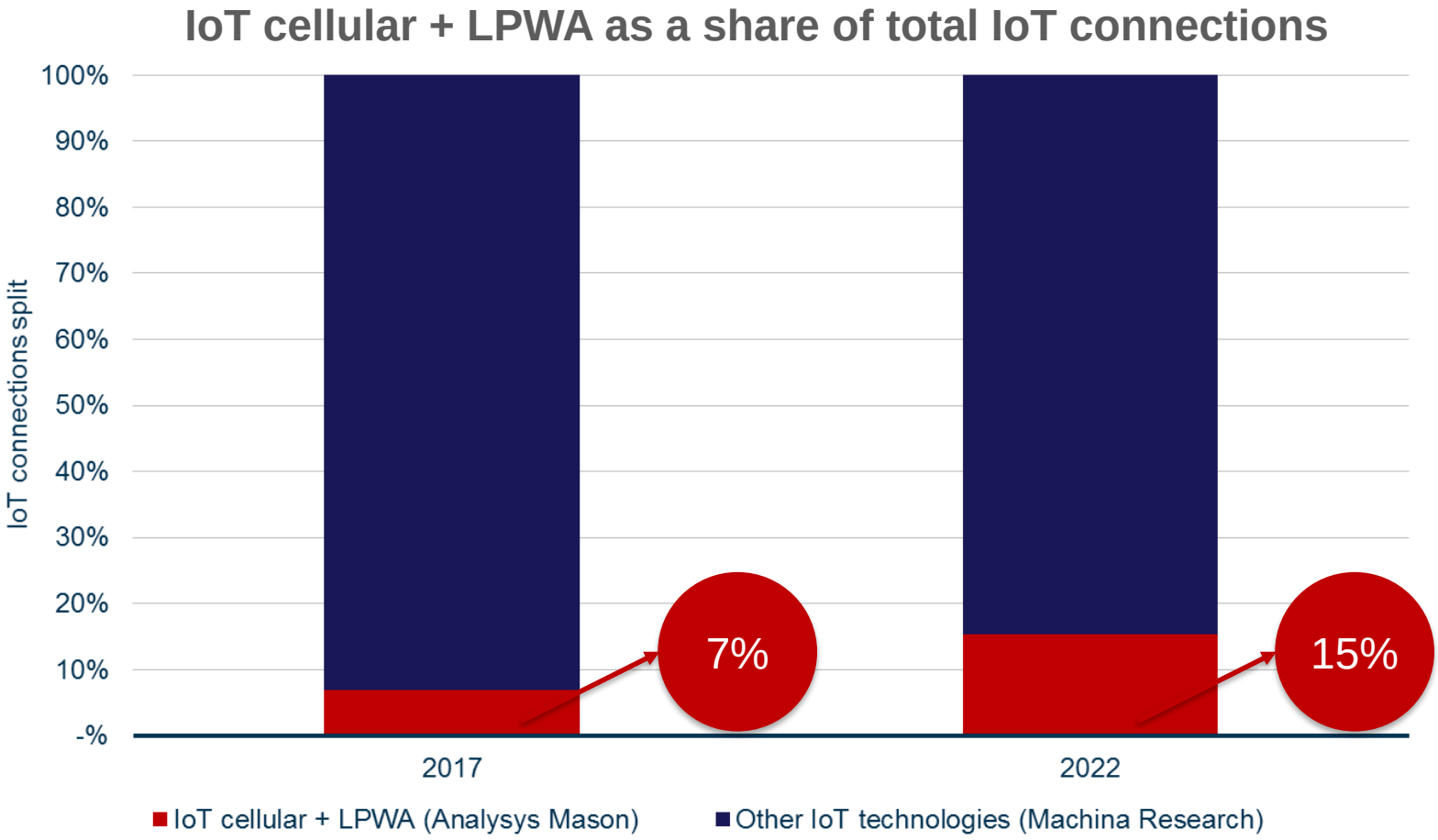
1. IoT is still a nascent industry and is expected to grow at a fast pace
2. Cellular-connect IoT accounts for a very small share of the total IoT market
3. There are many socio-economic benefits that IoT solutions can deliver

IoT connections



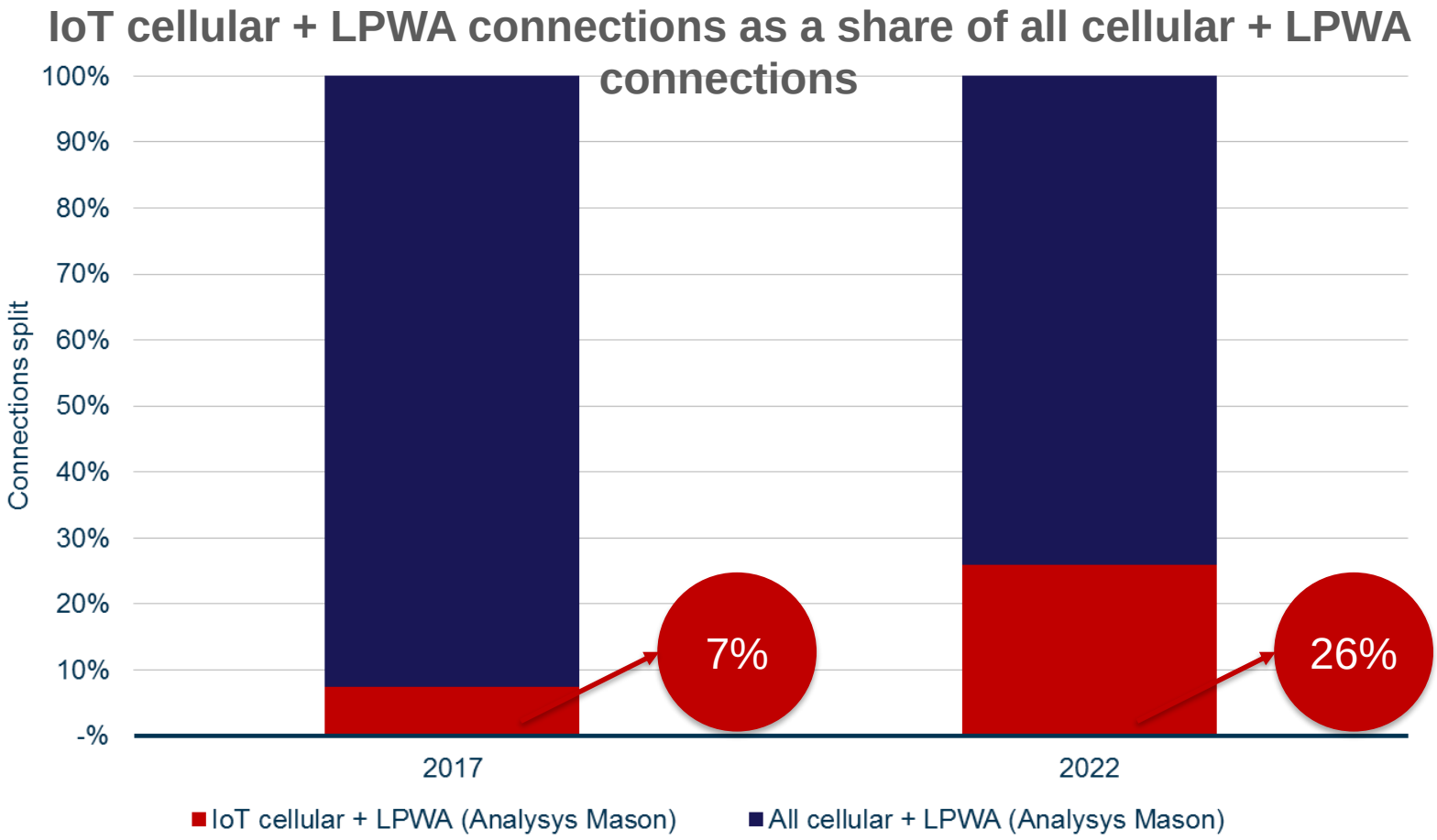
** Gartner did not report forecasts for 2022*

IoT cellular and LPWA connections



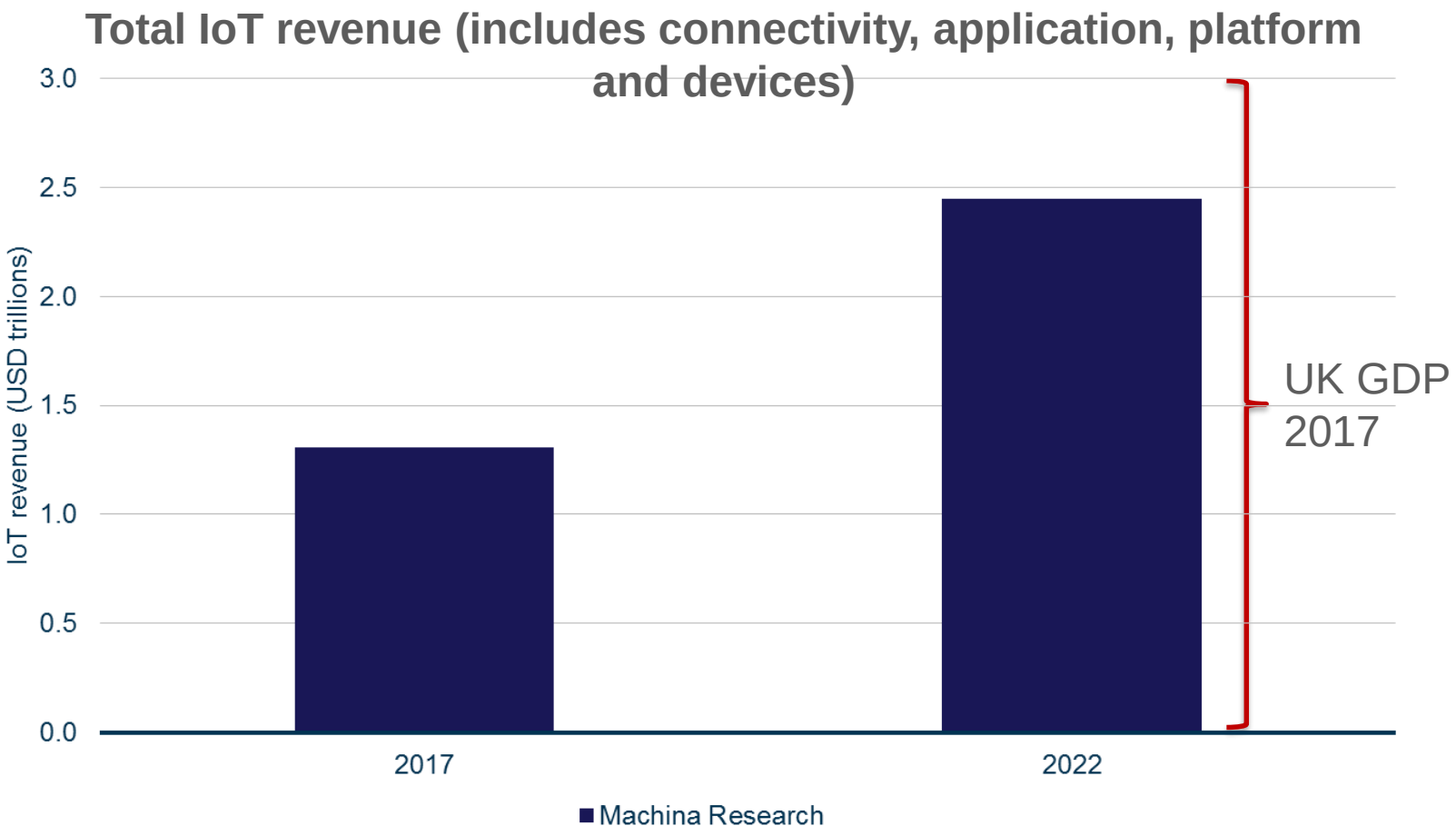
Source: Analysys Mason

IoT cellular and LPWA connections

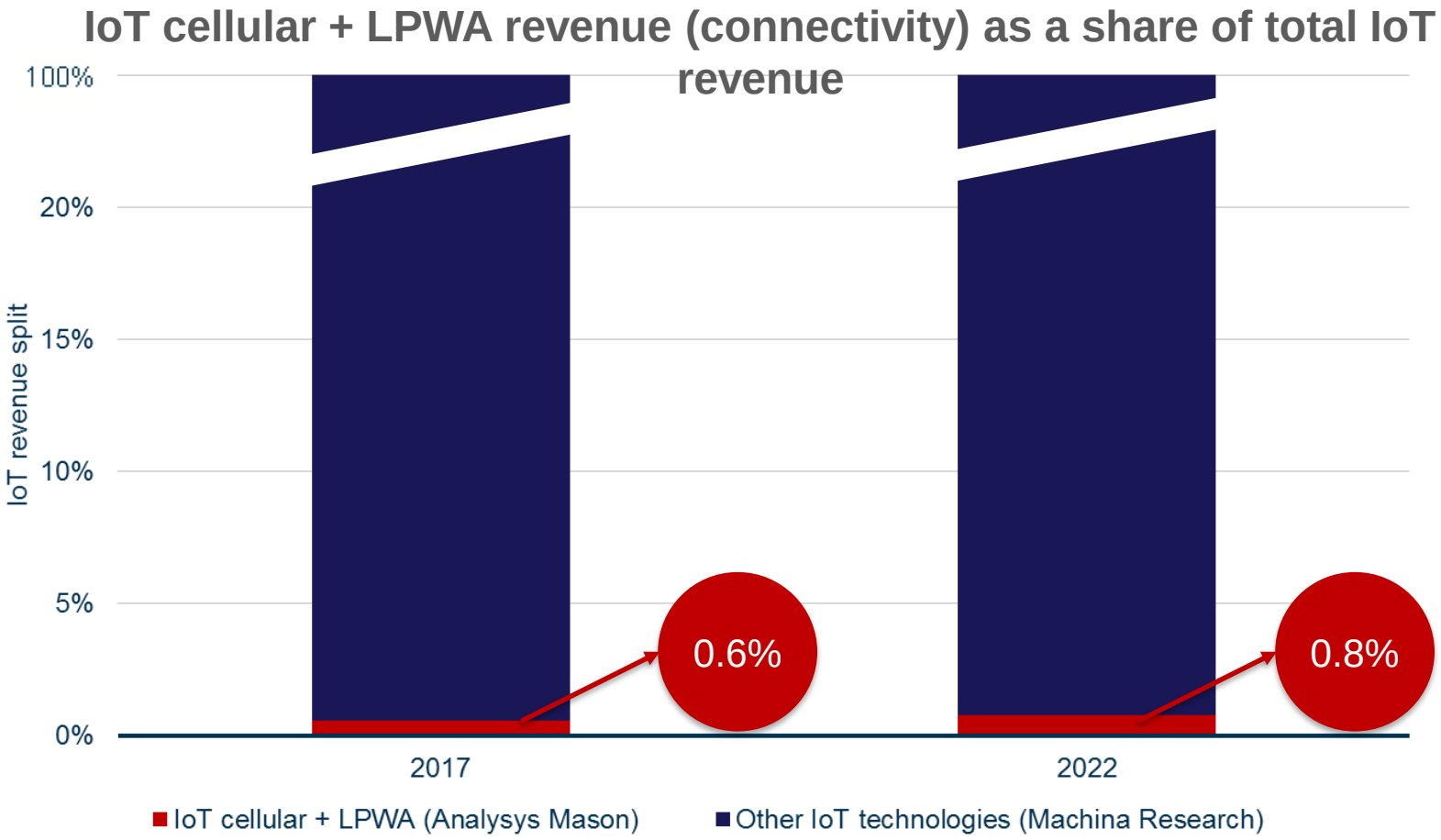


Source: Analysys Mason

IoT revenues

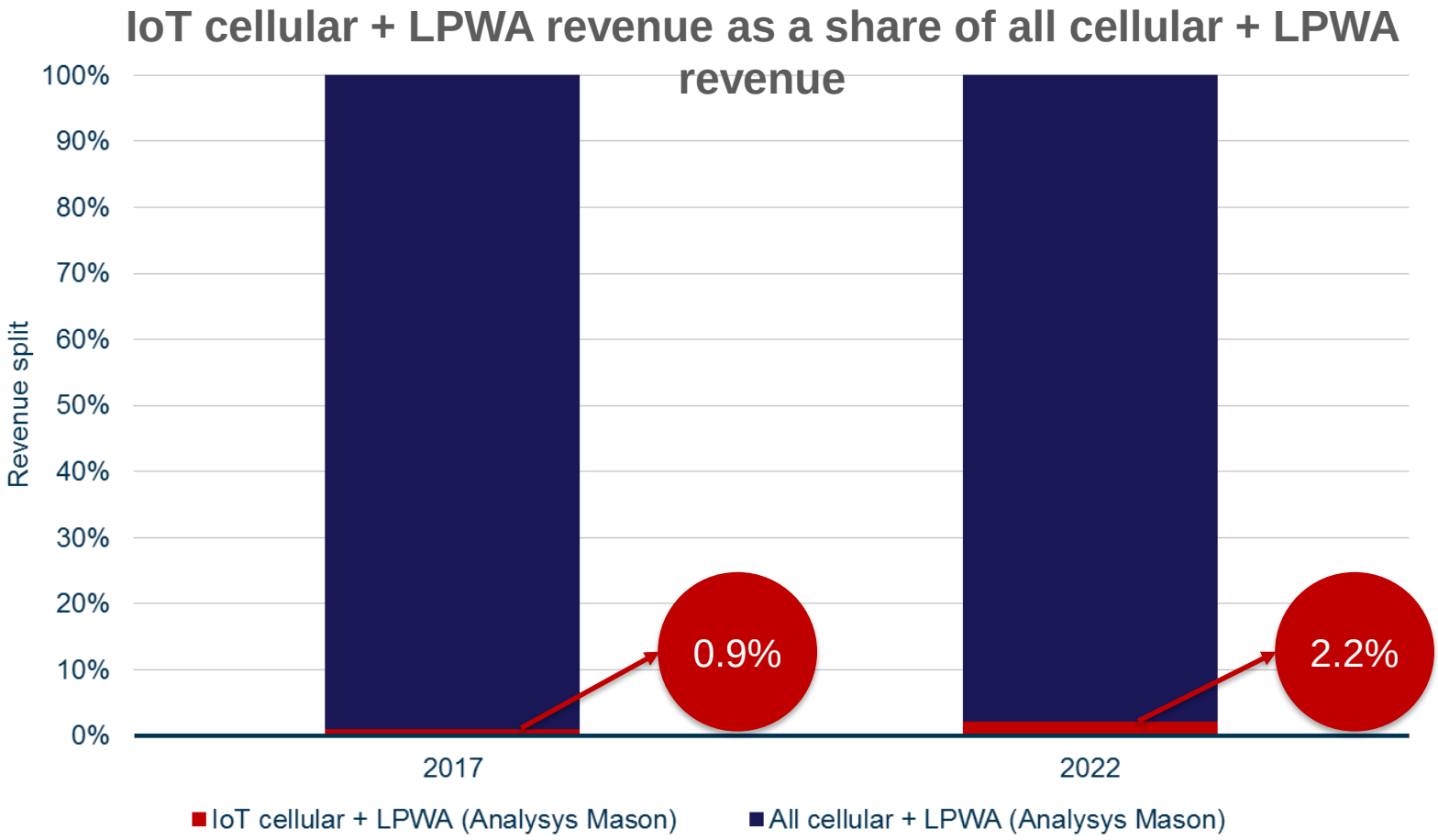


IoT cellular and LPWA revenues



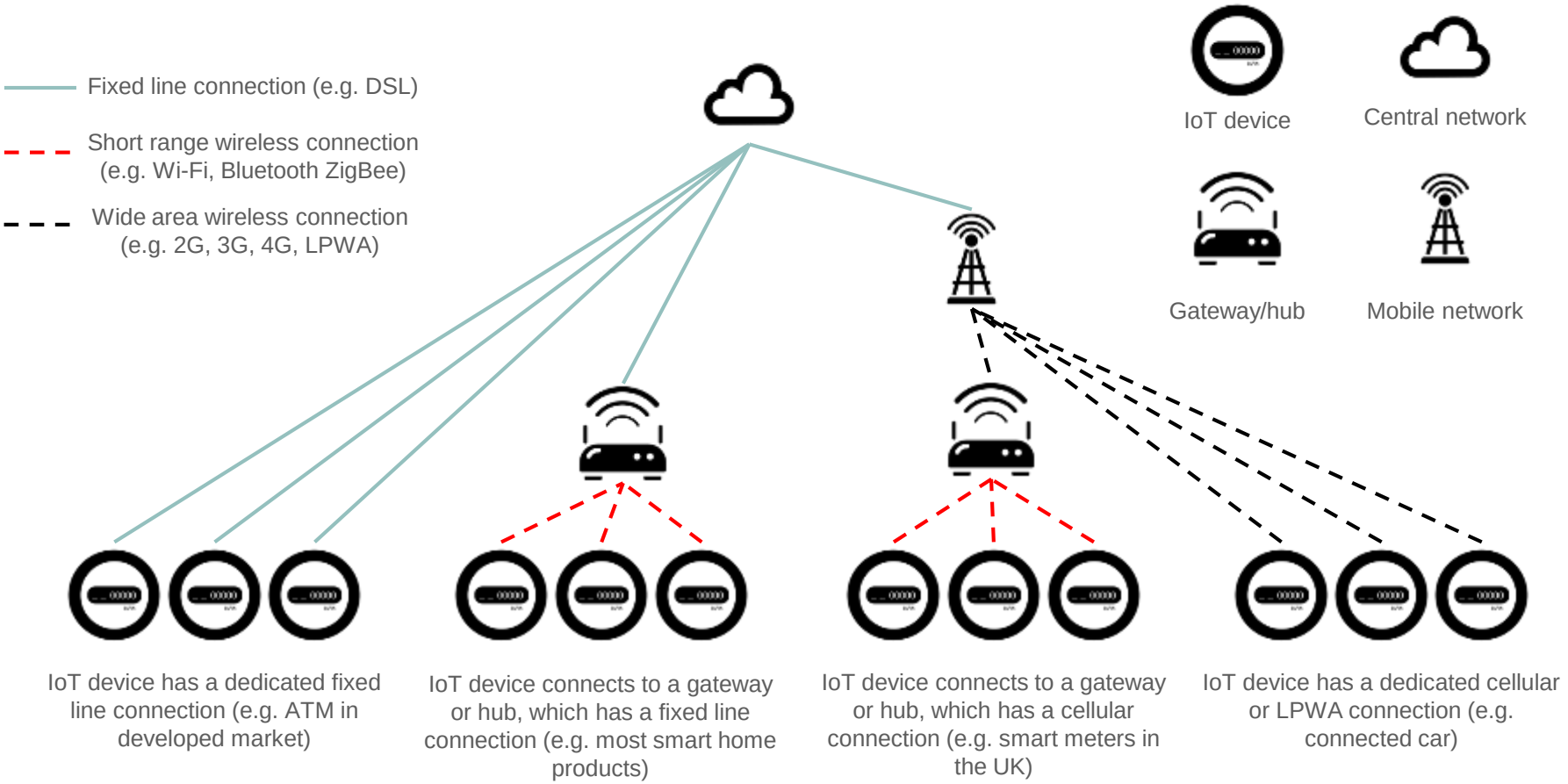
Source: Analysys Mason

IoT cellular and LPWA revenues



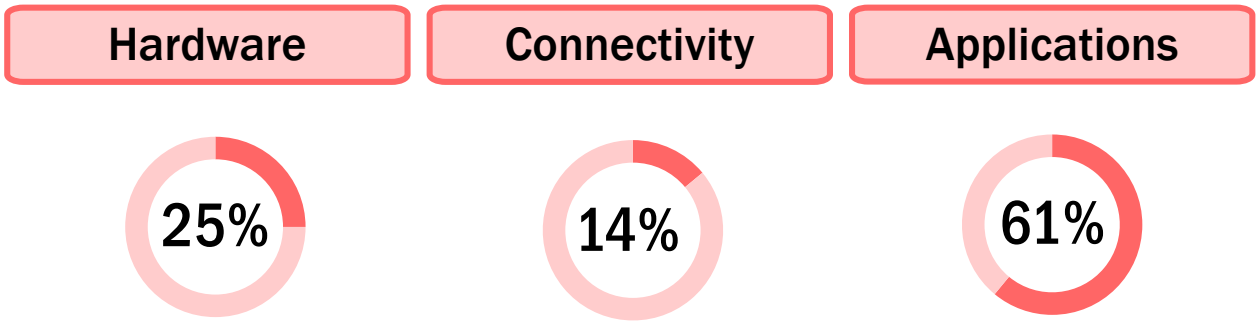
Source: Analysys Mason

There are many configurations for IoT solutions



Even for solutions using mobile networks, connectivity is only a small share of revenue

Revenue for IoT services using cellular and LPWA connectivity, by value chain element



Source: Analysys Mason

Socio-economic benefits of IoT

Social benefits

- 1 in 9 lives saved in road accidents - GSMA
- $400 billion savings in healthcare in 2017 - GSMA
- 400 million extra people fed by avoiding food wastage - GSMA
- $20 billion from traffic optimisation - PWC

Economic benefits

- Between $3.9tn and $11.1tn of economic impact by 2025 - Mckinsey
- $14.4 trillion in higher revenue and lower cost - Cisco
- Annual global savings of over $5.6tn with semi-autonomous and autonomous cars – Morgan Stanley

Summary: connections and revenue forecasts

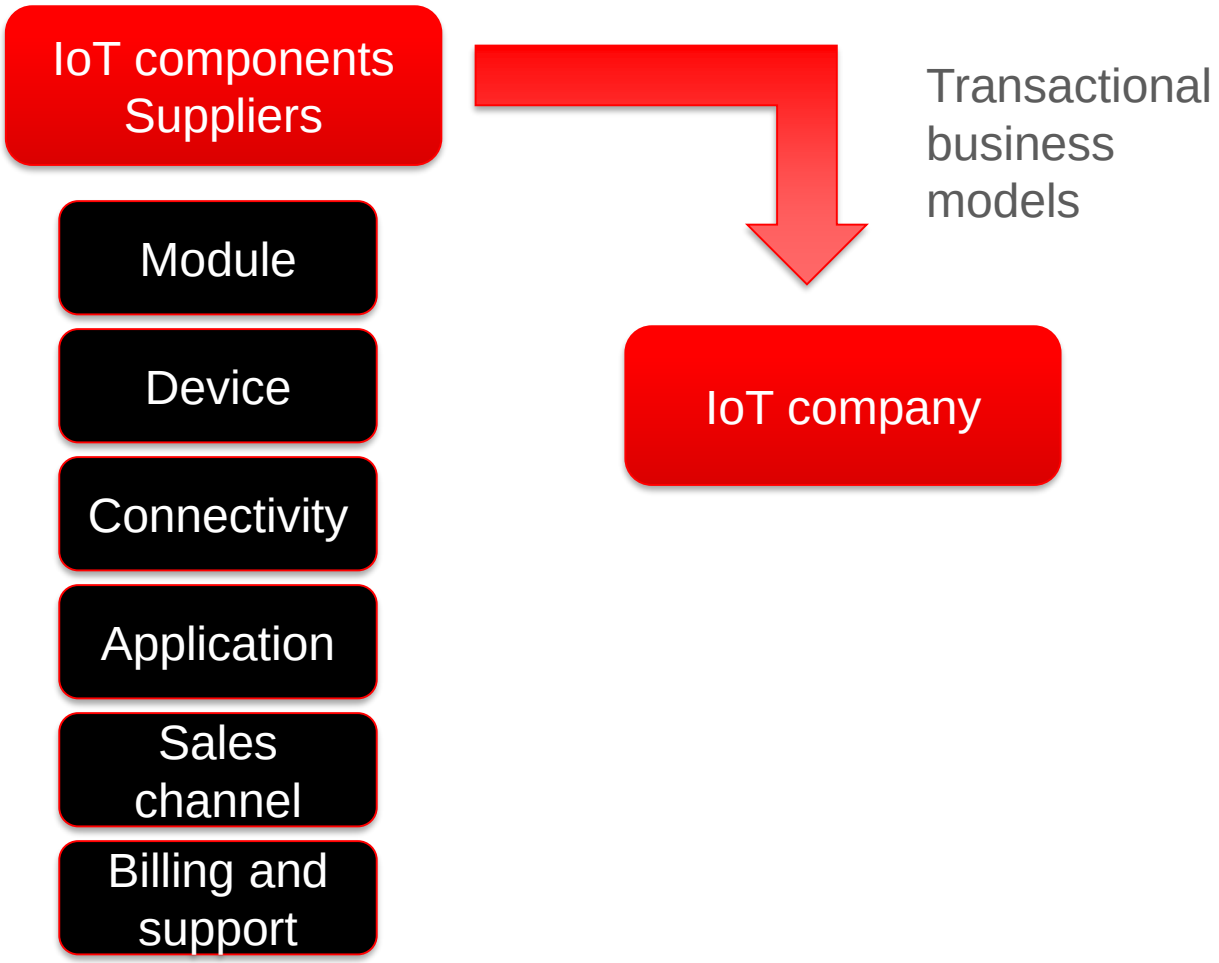
1	IoT is still a nascent industry and is expected to grow at a fast pace
2	IoT cellular accounts for a very small share of the total IoT
3	There are a wide range of socio-economic benefits that IoT can deliver

Business models of IoT

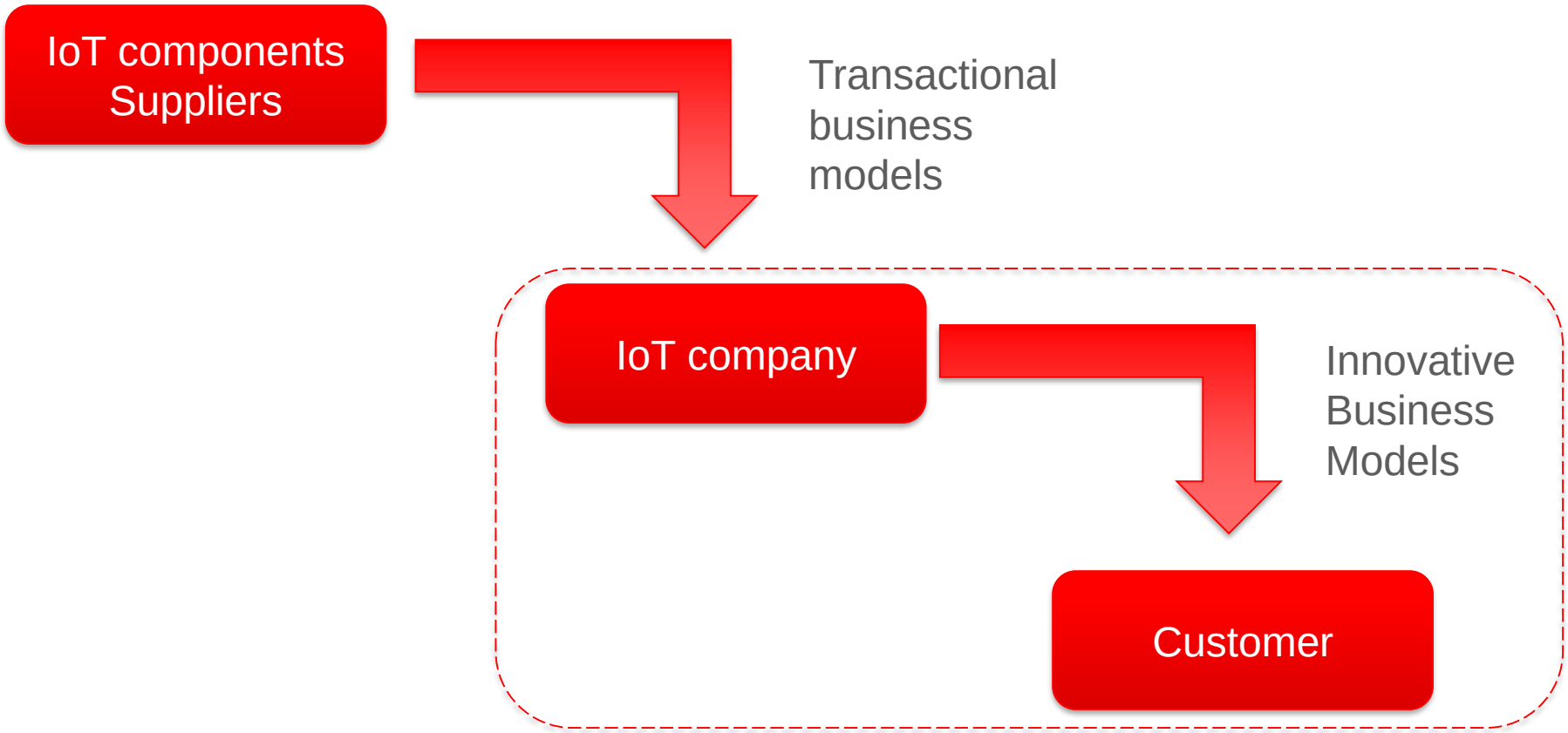
Key messages

1. IoT can provide significant innovation in business models
2. Business model innovation will mostly impact where the IoT company interacts with the customer

Business models of IoT: from suppliers to customer



Business models of IoT: from suppliers to customer



There are 5 main business models enabled by IoT between the IoT company and the customer …

Business models
Revenue-sharing
Cost-savings sharing
Product-sharing
Product-as-a-Service
Performance-as-a-Product
Transactional

Source: Analysys Mason

…and can be compared in terms of revenue structure and device ownership

Business models	Revenue of the IoT company			Device ownership	
	Upfront	Recurring	Usage	User	IoT company
Revenue-sharing		✓			✓
Cost-savings sharing		✓			✓
Product-sharing			✓		✓
Product-as-a-Service		✓			✓
Performance-as-a-Product			✓	✓	
Transactional	✓			✓	

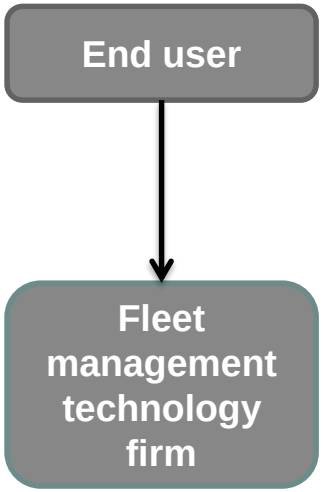
The descriptions above are the most common and variations are possible.
For example, transactional may also include device ownership from the IoT company.

Revenue-sharing

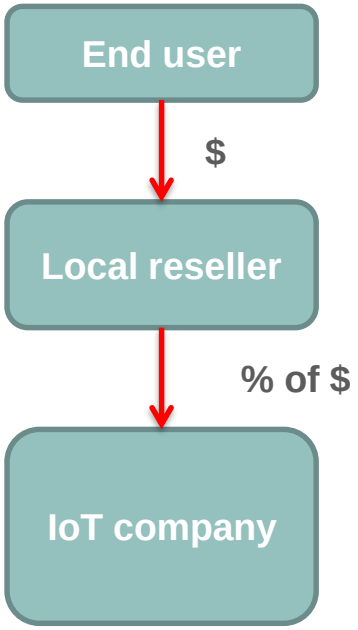
Problem	Tracking location and status of vehicles
Traditional solution	• Traditional fleet management solutions were static software packages that could not provide the fleet manager real time information on a vehicle's location or status
IoT solution	• A tracking device, like an on-board diagnostics (OBD-II) module, can be placed in the vehicle and provide the fleet manager with real time information
IoT business model	• A local reseller, like a mobile operator, sells and supports the solution. It shares revenues with the company providing the technology (hardware and software) for the service.

Revenue-sharing

Traditional business model



IoT business model



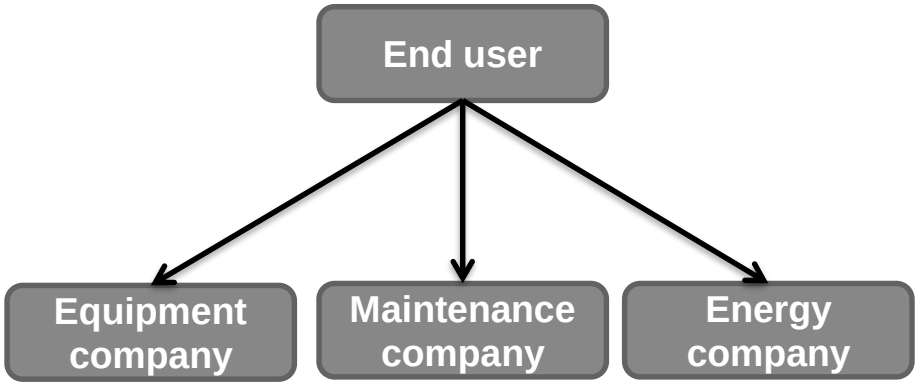
The revenue share model gives the local reseller access to a broader range of technology. For the fleet management firm, the model allows it to enter new countries. For both parties, the revenue share model limits risk.

Costs savings sharing

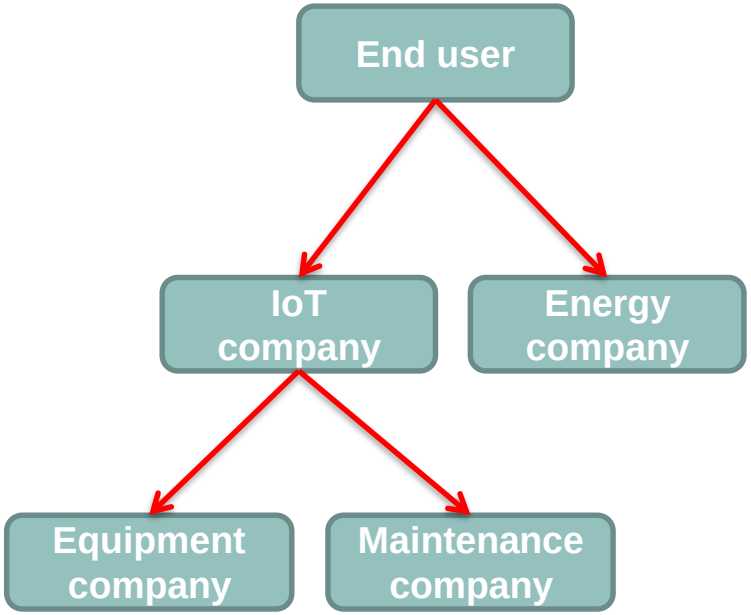
Problem	Home/building energy consumption.
Traditional solution	• The end user pays for the Heating, Ventilating and Air Conditioning (HVAC) system and its maintenance, and also pays the energy company for its power consumption.
IoT solution	• The IoT company installs equipment to monitor and control the HVAC system at the customer's premise. The HVAC system automatically adjusts to the user's requirements and optimises its energy consumption.
IoT business model	• The end user pays no up front fees; equipment costs are covered by the IoT company. • The end user benefits from lower energy costs. A share of the money saved goes to the IoT company to cover the cost of equipment.

Costs savings sharing

Traditional business model



IoT business model



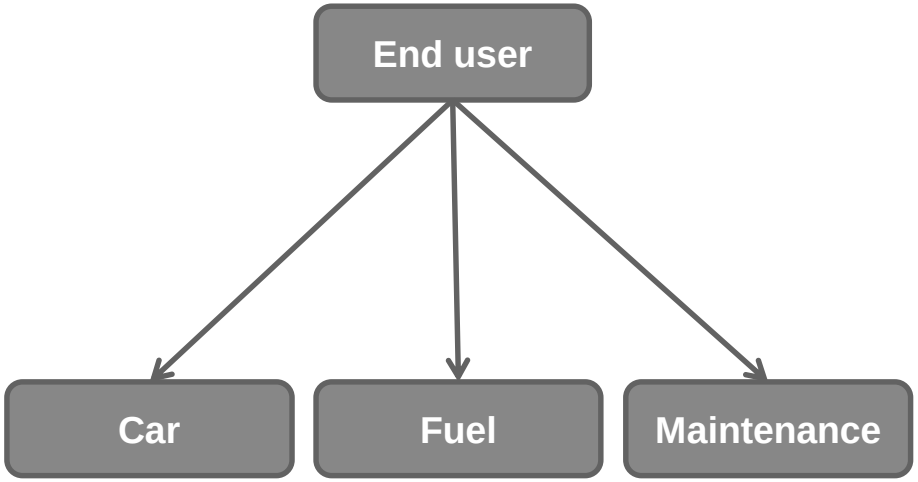
The IoT solution allows end users to save on their energy consumption costs and use part of the savings to pay for the IoT solution

Product-sharing

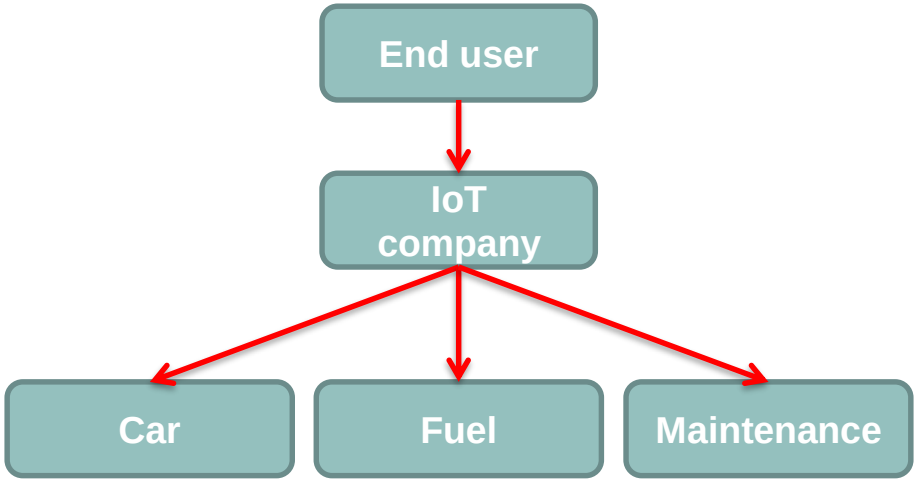
Problem	Relatively high investment and maintenance costs of a car.
Traditional solution	• The end user buys the car upfront and pays for its ongoing maintenance, fuel and insurance.
IoT solution	• The end user can drive a number of cars made available across a city, without needing to own one. • All car related costs are managed by the IoT company, Car2Go. A smartphone app, allows users to reserve the car, locate and unlock it.
IoT business model	• The IoT company charges end users by the minute for using a car. The fees include the cost of the car, its maintenance, fuel and insurance. • From managing a large fleet of vehicles, the IoT company can achieve economies of scale, which can be translated into competitive prices for the end user.

Product-sharing

Traditional business model



IoT business model



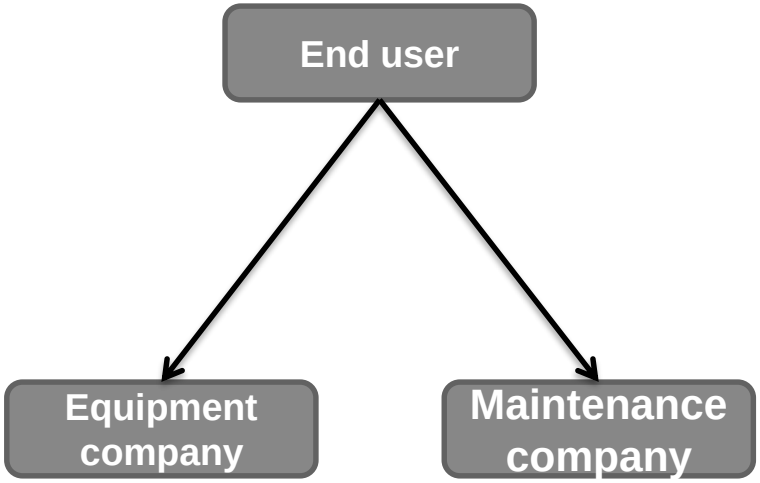
The IoT business model allows the IoT company to transfer savings from economies of scale to the end user

Product-as-a-Service

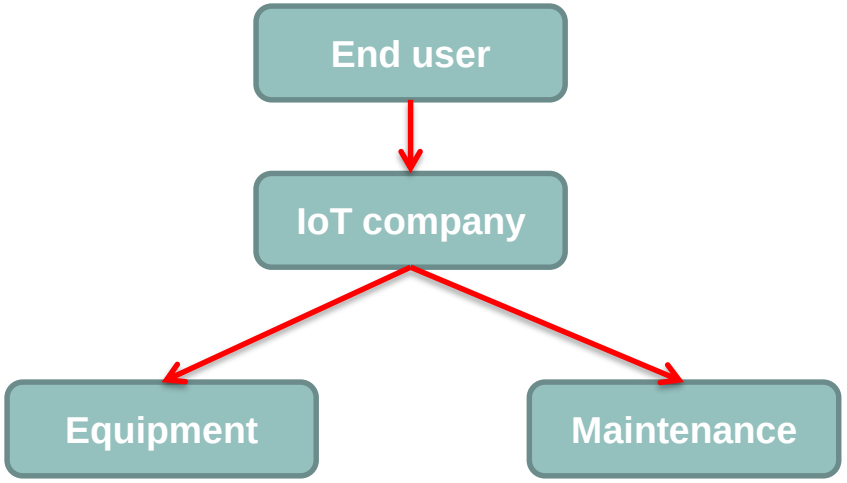
Problem	High investment and maintenance cost of heavy medical equipment.
Traditional solution	• The user (e.g. hospital) buys the equipment upfront and can face high maintenance costs. Different suppliers may be involved in selling and supporting the equipment.
IoT solution	• The hospital pays for the equipment and maintenance to the IoT company. • The equipment is remotely monitored in terms of usage and performance, allowing the IoT company to perform predictive maintenance. As a result, the end user can benefit from reduced or no disruption from equipment downtime.
IoT business model	• The IoT company charges a recurring fee to the hospital. This fee includes the use of the equipment and its maintenance. • The equipment is owned by the IoT company, who by actively monitoring it can pre-empt potentially serious issues that could result in expensive maintenance.

Product-as-a-Service

Traditional business model



IoT business model



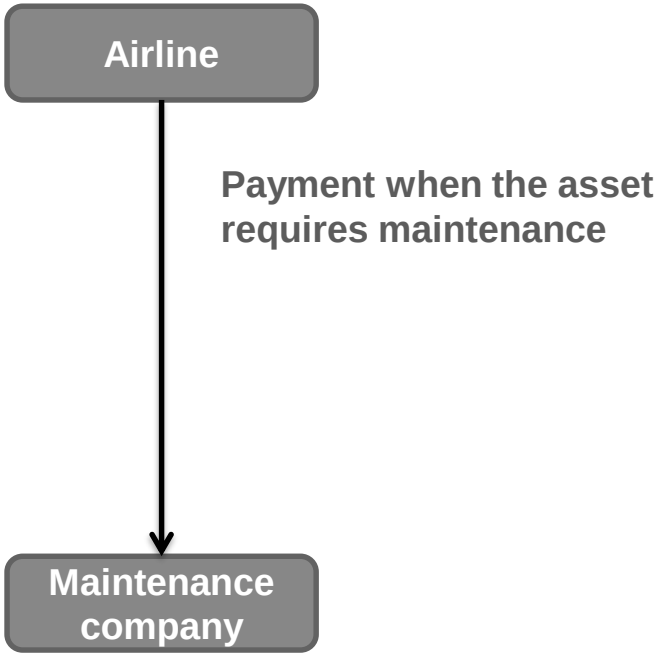
The IoT solution can perform predictive maintenance, allowing the end user to benefit from lower or no disruption and more affordable cost

Performance-as-a-product

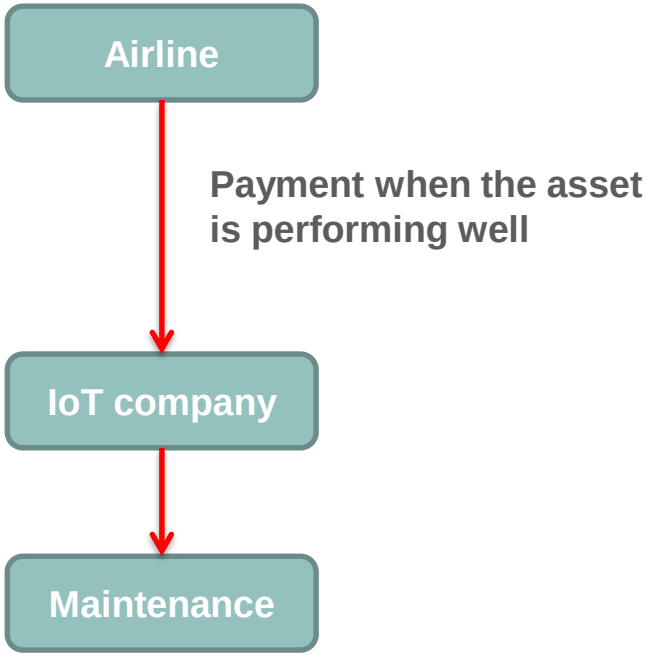
Problem	Uncertain aircraft engine maintenance cost.
Traditional solution	• Airlines would buy the engine from manufacturers such as Rolls-Royce and take on the risk of the engine becoming inoperable and possible high maintenance cost.
IoT solution	• The aircraft engines have embedded sensors that send data back to the engine manufacturer (IoT company). • This information is used by the IoT company to identify and fix problems remotely, minimising the risk of engine downtime.
IoT business model	• Rolls-Royce's TotalCare program is sold to airlines as a solution to make the engine's maintenance costs predictable. • Under this program, Rolls-Royce is responsible for the engine's maintenance and only gets paid if the engine is operational. Its revenues equal a fixed fee per flying hour.

Performance-as-a-product

Traditional business model



IoT business model



The IoT solution aligns the interests of the airline with the maintenance provider

Summary: business models

1	IoT can be a catalyst for significant innovation in business models
2	Business model innovation will have the most impact in the area where the IoT company interacts with the cutomer

Wrap up

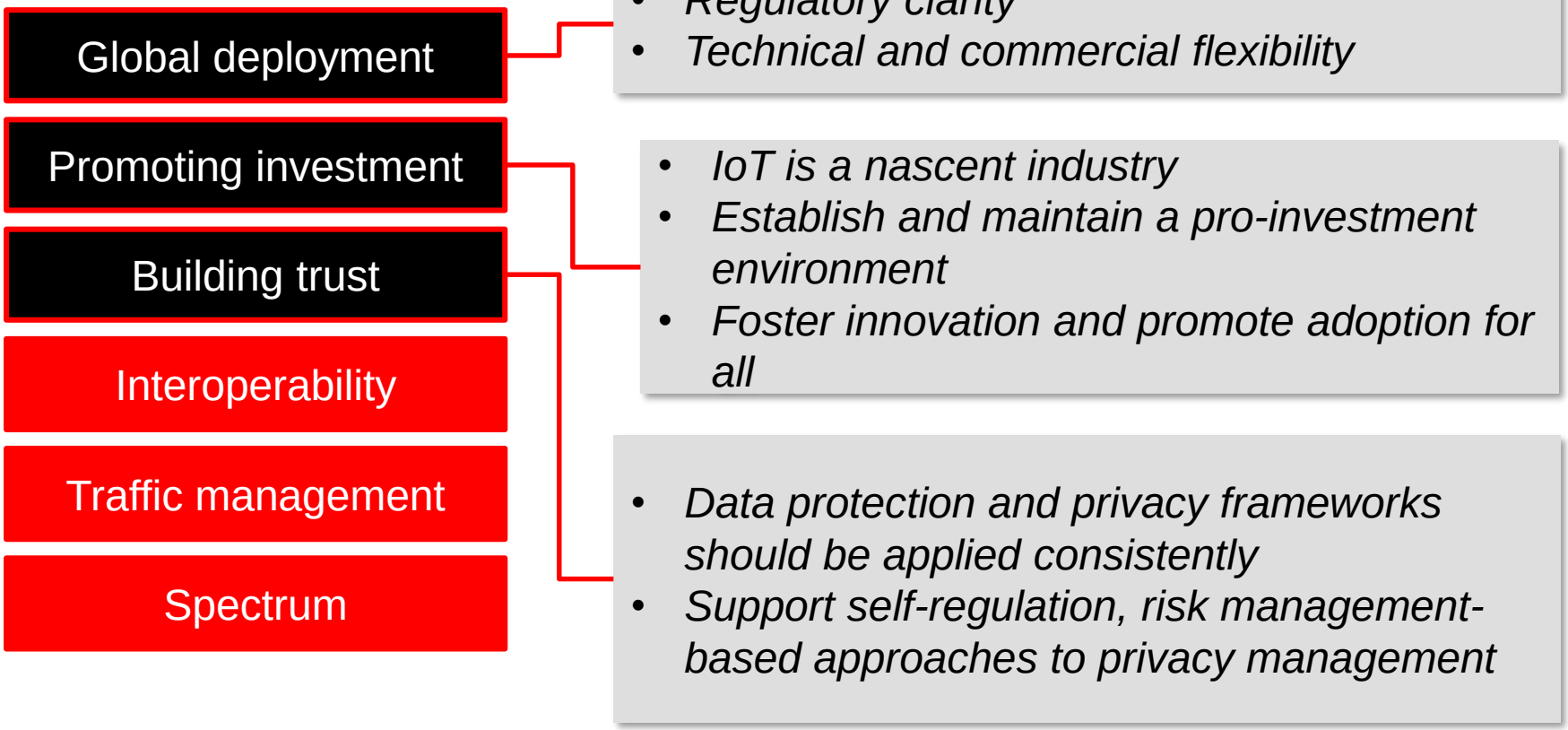
- **We have learnt that:**
- IoT is still nascent and there is no single definition
- The transition from traditional services to IoT requires policymakers and regulators to apply existing rules in a transparent and consistent way
- There are several technological, economic and legal drivers and inhibitors of IoT
- IoT can help deliver a wide range of socio-economic benefits
- IoT can enable new business models
- So on to the final subject . . . .

How governments can help drive IoT adoption in their country

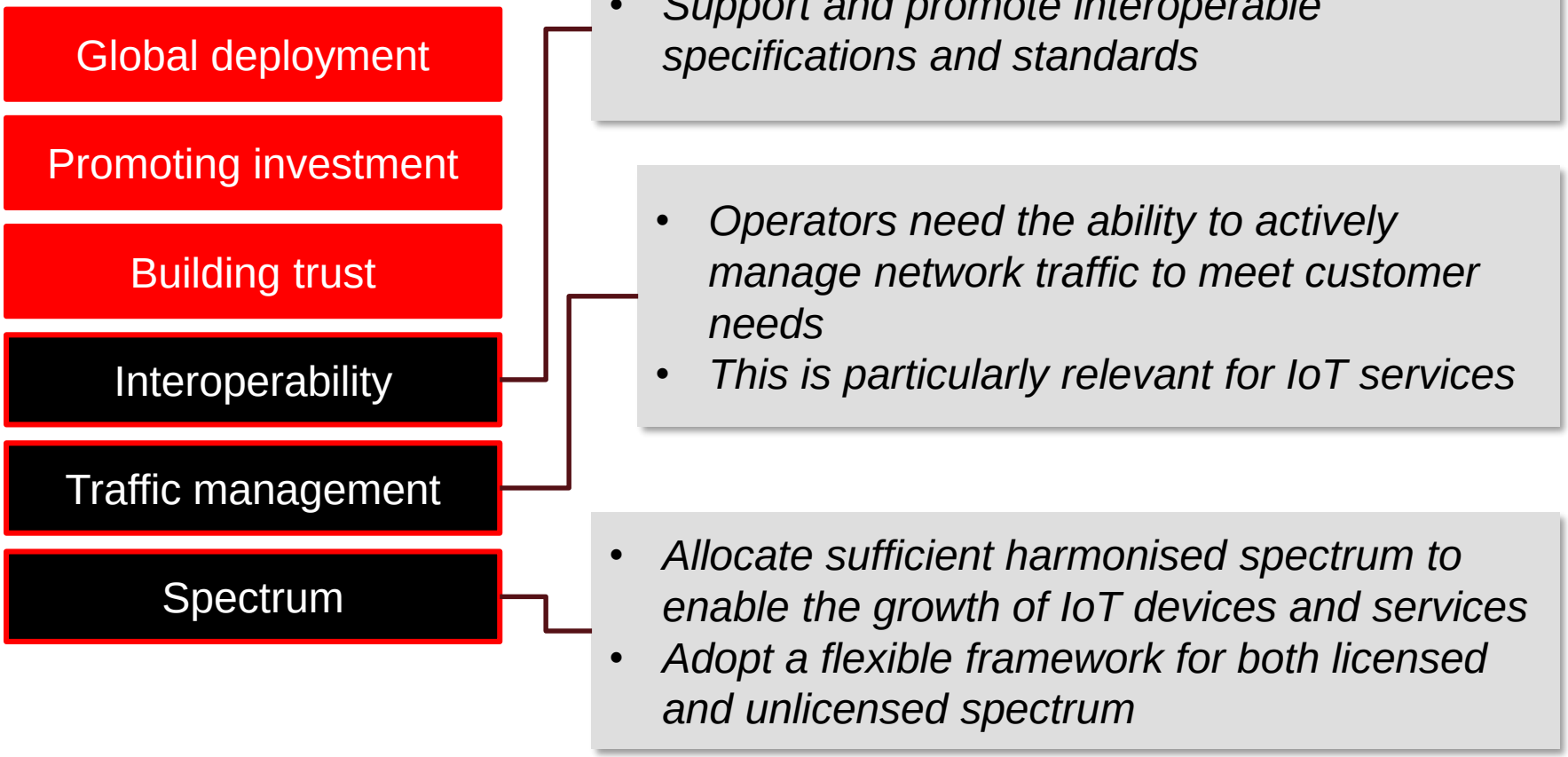
Governments should focus in six main areas to help drive the adoption of IoT products and services

- Global deployment
- Promoting investment
- Building trust
- Interoperability
- Traffic management
- Spectrum

Facilitating global deployments, promoting investment, building trust…



…supporting interoperability, traffic management and spectrum harmonisation



Thank you!