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The State of IoT Regulatory Activities

Spring 2019

Executive Summary

- Xona Partners undertook benchmarking IoT regulatory and policy activities in 22 countries around the world. The benchmark covered key areas including critical resources (spectrum, numbering), Roaming and eSIM regulations, approach to IoT data management, and IoT policy initiatives. This presentation includes a subset of key findings:
  - Regulators follow a wide spectrum of approaches to IoT regulation and policy as influenced by industry and national priorities: light touch approach (e.g. US) to active engagement (e.g. Singapore)
  - Regulators in countries with advanced industrial base are thinking globally with regulations that encourage international service expansion
  - Regulatory activities remain focused on spectrum which is dominated by 5G and increased allocation of unlicensed spectrum
    - Shared spectrum regimes are an emerging trend (Germany, UK) that we anticipate will accelerate in the coming years
  - IoT data management laws (privacy, security, localization) are highly fragmented and slow to develop. GDPR addresses some IoT related issues, but there is resistance to use it as basis for emulation for IoT
    - Data localization laws are on the rise and leading to localization of data hosting services as corporations
  - Management of numbers (the other critical resource) has been lagging with many countries without IoT dedicated numbering range.
    - IPv6 and other addressing schemes are gaining traction quickly, so this lag is not we don't view this lag has large negative impact
  - IoT policy initiatives have largely failed to stimulate wide-scale IoT deployments.
    - There are islands of success – for example, deployment of smart meters; but wide IoT adoption remains constrained

About Xona Partners

Boutique Advisory Firm Specialized in Developing New Technology Ventures

Private Equity & Venture Funds

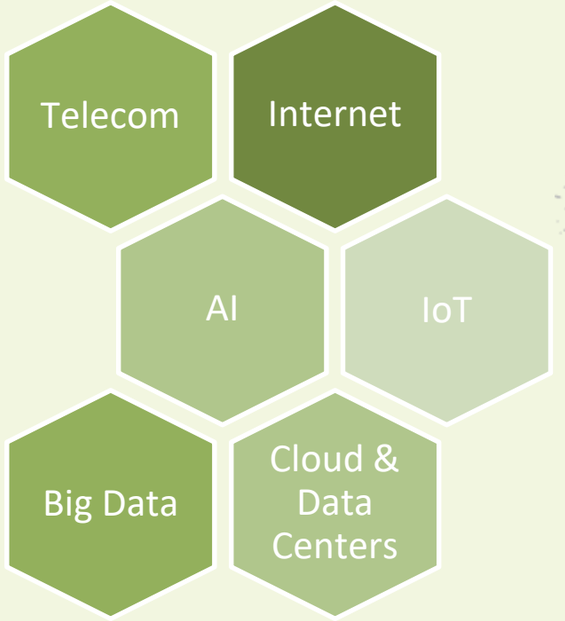
M&A due diligence

Technology Corporations

New business ventures; spin-outs, spin-ins

Governments, Regulatory & Policy Makers

Market & technology assessment



Trends and Observations

Key Regulatory Regulatory & Policy Topics

Regulatory & Policy Approach

Spectrum
- 5G
- Vertical applications
- Licensing regimes

Roaming
- Permanent roaming
- National roaming

Data Management
- Data security
- Data localization
- Data privacy

Numbering & Identification
- E164 / E212

Licensing, Certification & Interoperability

Policy
- National strategy & roadmap
- Focus sectors
- Stimulus

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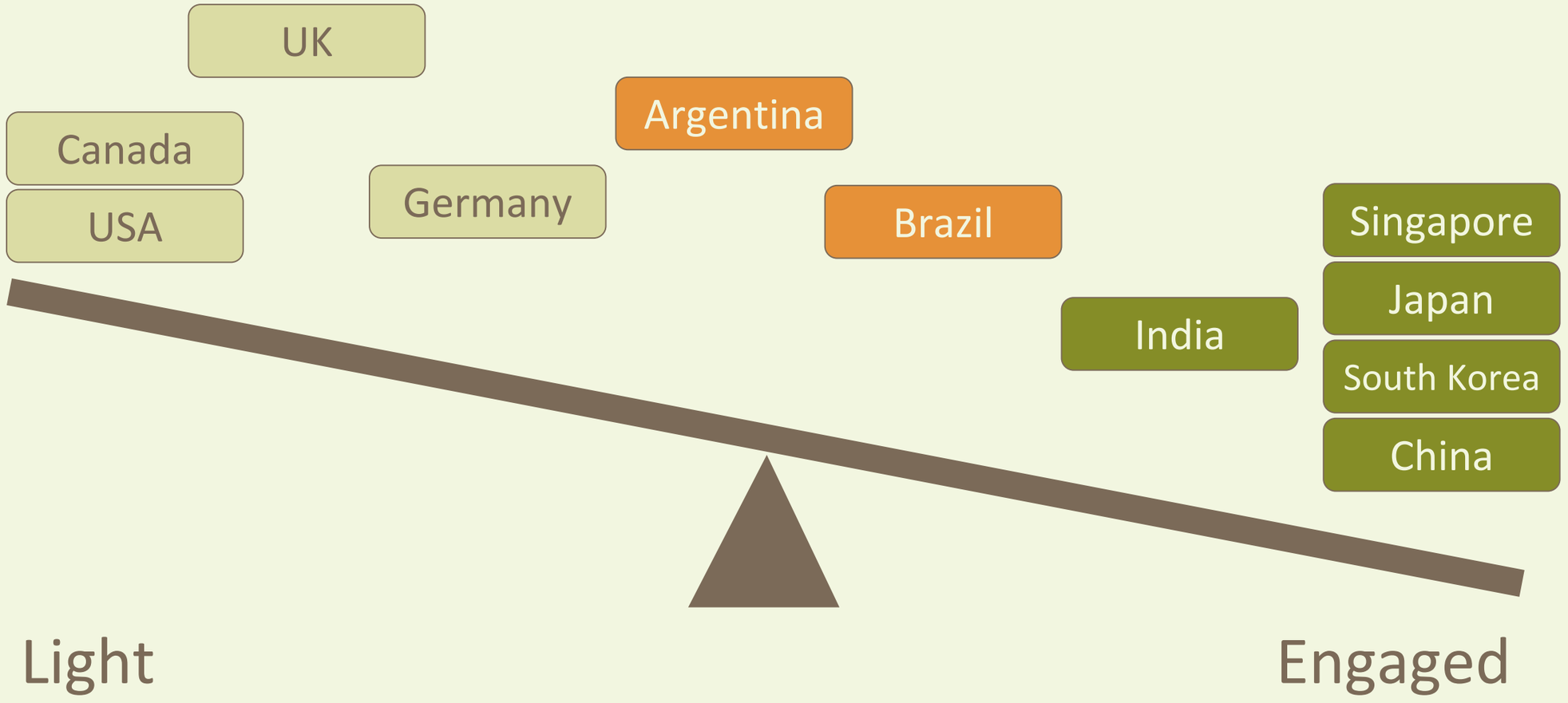
Approach to IoT Regulations



Active regulatory engagement

Light / targeted regulatory engagement

In process of forming engagement

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Trends and Observations

01	Light-touch approach	• Regulator steps in when consumer interest is at risk
02	Thinking globally	• Encourage international exchange of goods and services in favor of a nation's industrial complex
03	Lack of IoT data management regulations	• GDPR is influencing data management regulations, but remains light on IoT • High level of fragmentation for security and privacy regulations • Data localization gaining favor in certain markets
04	Prioritization of spectrum for 5G and LPWAN	• New spectrum allocations: shared, licensed and unlicensed • Spectrum refarming: wide channels - 100 MHz • Harmonization for LPWAN unlicensed spectrum
05	Failure of policy initiatives to speed IoT adoption	• Government stimulus and funding helped in some areas, but failed to stimulate the private sector deployment of IoT

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Spectrum Trends

C-Band as Universal 5G Band

	Frequency (MHz)	ITU Region 1				ITU Region 2		Region 3
		EU	Africa	ME	CIS	NA	LA	Asia
	470-698					✓	✓	✓
	1427-1452	✓	✓	✓	✓	✓	✓	✓
	1452-1492	✓	✓	✓	✓	✓	✓	
	1492-1518	✓	✓	✓	✓	✓	✓	✓
	3300-3400		✓				✓	✓
C-Band	3400-3600	✓	✓	✓	✓	✓	✓	✓
C-Band	3600-3700	✓				✓	✓	
C-Band	3700-3800	✓		✓				

- Japan, Korea, EU and US considering frequencies in the 3.8 - 4.4 GHz (or higher)
- China considering 4.4-4.5 GHz

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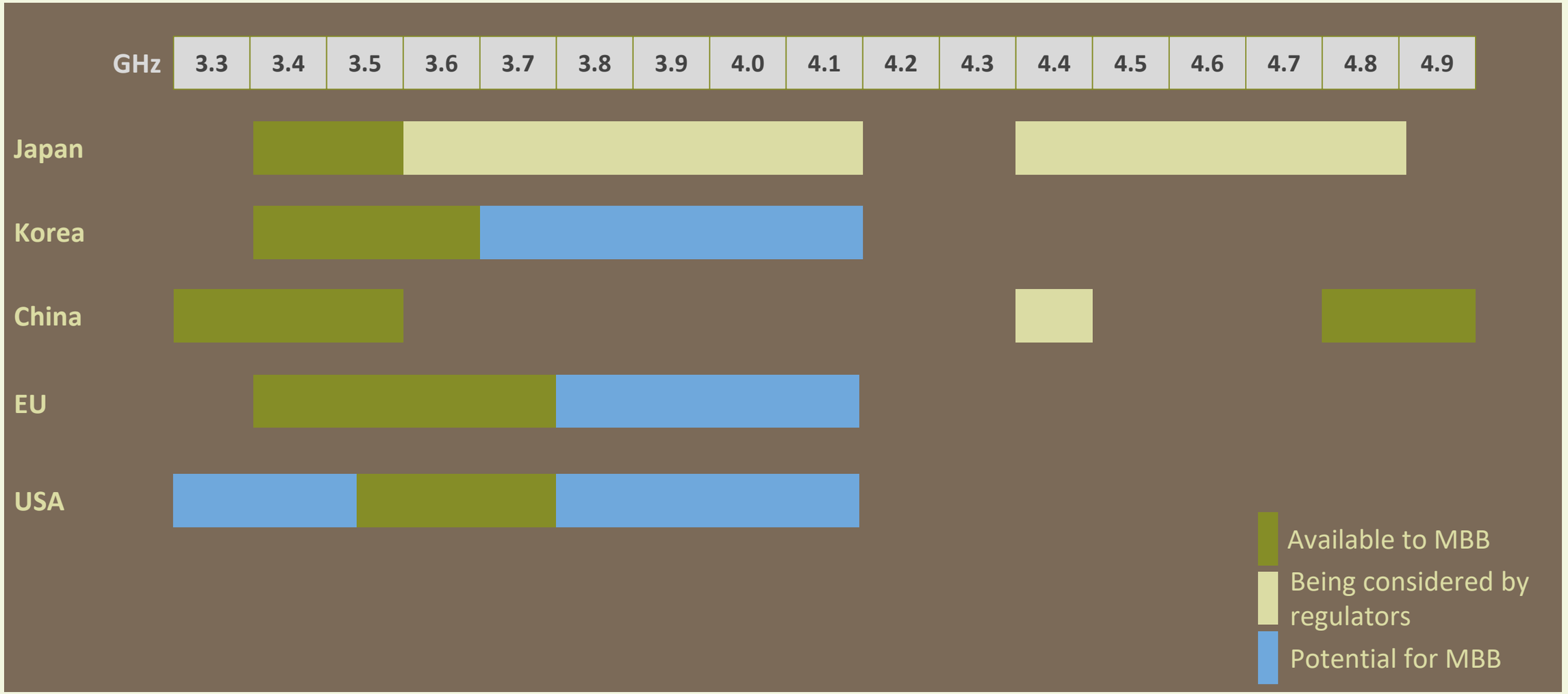
The C-Band Global Status



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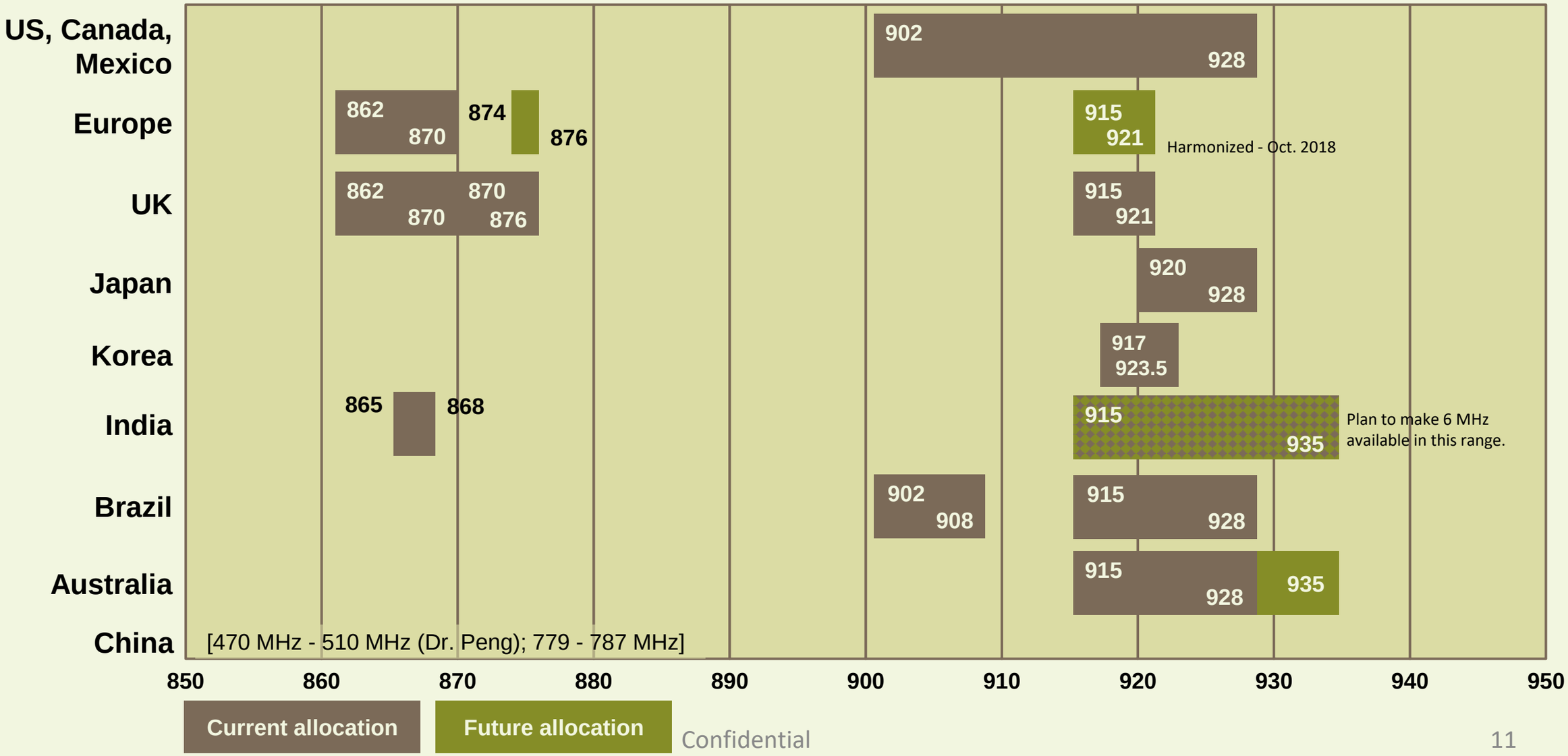
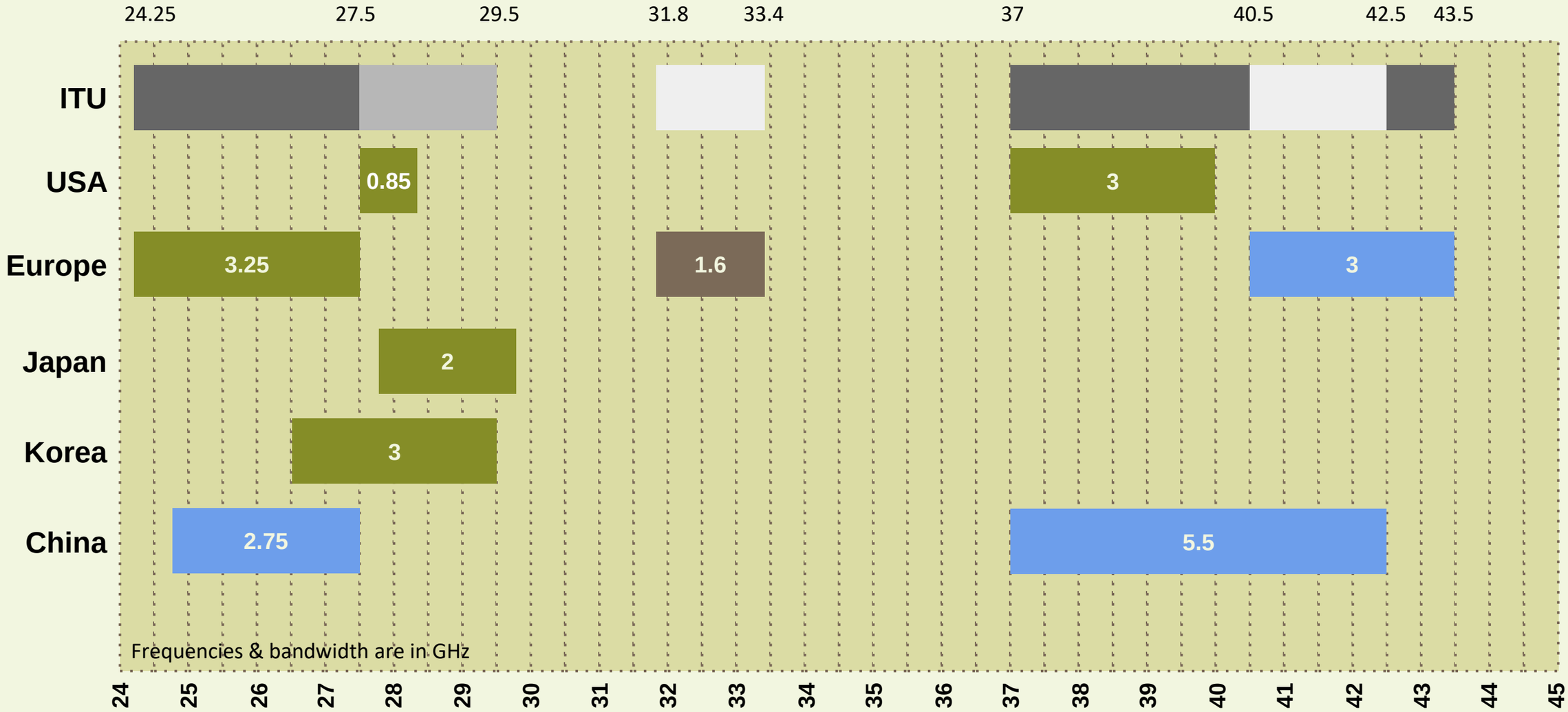
Increasing Unlicensed Allocation in 900 MHz



Source: Xona Partners

5G mmWave Spectrum Allocations



Available

Consultation

Potential

WRC19 scope; mobile allocated

WRC19 scope; require mobile allocation

Not in WRC19 scope; allocated to mobile

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New Spectrum Regimes: Encouraging Private Networks

Germany[1]

3.7-3.8 GHz licensed on local/regional basis:

- Individual assignments: no right to roaming on national networks
- Excludes large operators: cannot hold nationwide licenses in the 700MHz or 3.4-3.7GHz bands
- Up to 80 MHz for outdoor use: 3700-3780MHz on regional basis
- Local 'indoor' use, up to 100 MHz is to be made available using a simplified assignment procedure. Local indoor use is to co-exist with regional outdoor use
- 10-year license term

UK[2]

Enable shared access in 3 bands:

1. 3.8-4.2 GHz
2. 1800 MHz: 1781.7-1785 MHz / 1876.7-1880 MHz
3. 2300 MHz: 2390-2400 MHz

Ofcom to grant location specific license:

- Low power licence for local connectivity: per area licence
- Medium power licence for longer range connectivity: per base station licence; limited to rural areas`
- 3-year license term
- Fixed license price based on cost of administration
- Secondary re-use of existing national licensed bands: Ofcom to engage with MNOs

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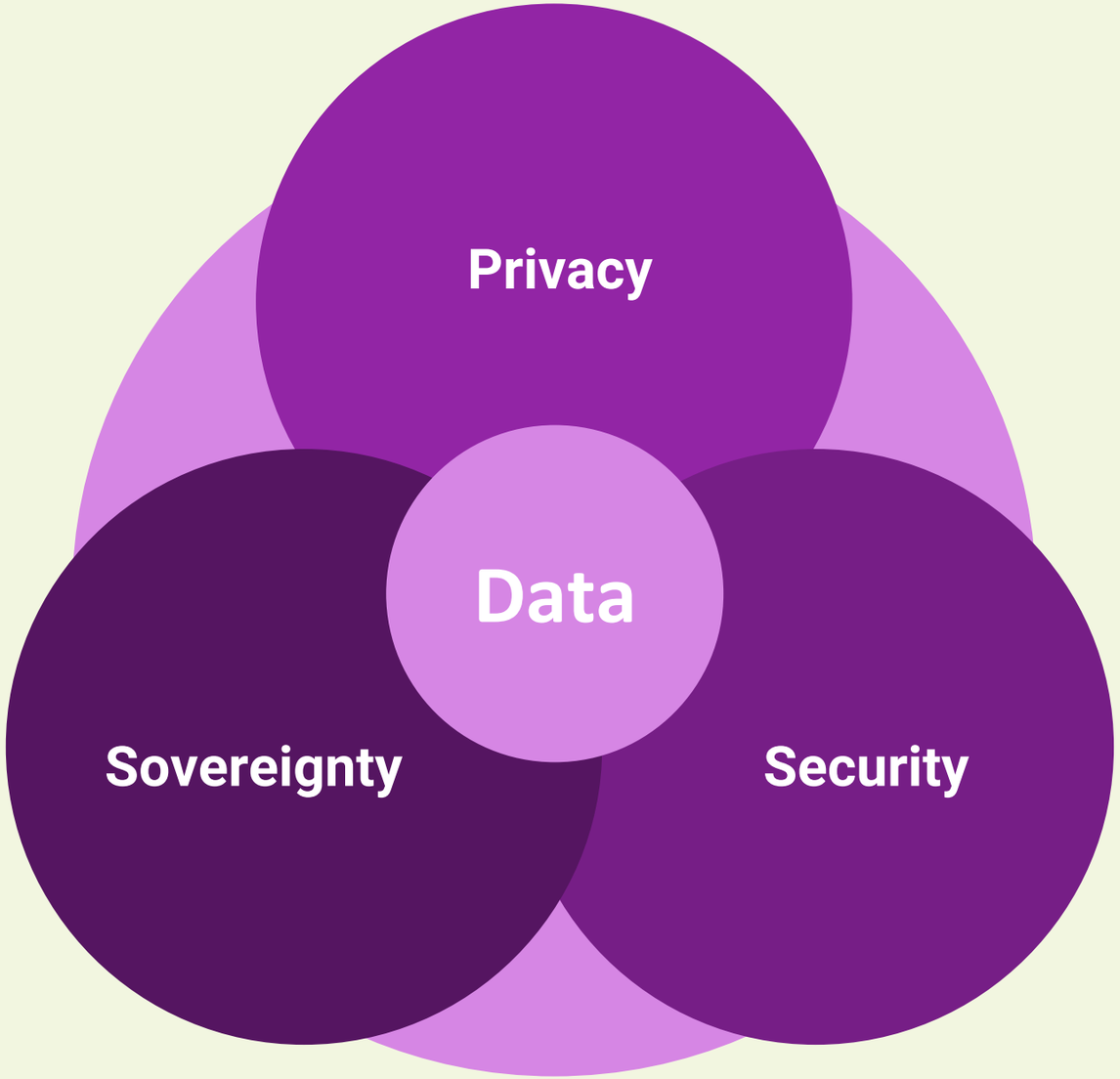
1- Consultation released in January 2018; auction planned in 1H2019
2- Consultation opened in December 2018, planned to close in March 2018

Data Management

IoT Data Management

What role do the communications and ICT regulators have to play in IoT data management?

Governing dependencies:
Who generates the data?
Who owns the data?
What is the data?



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Progression of Data Management Regulations

IoT data management regulations (to develop)

3

IoT-specific data laws and guidelines: highly fragmented

National & regional data management laws (emerging)

2

Data management laws addressing individuals

Sector-based regulations (established)

1

Regulations for specific sectors, such as banking & finance, critical infrastructure, health, education, etc.

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Approaches to Data Management

USA*

- **Security by design**. Security is built into devices at the outset; "defense-in-depth" approach to secure information passed over consumers' home networks
- **Data minimization**. Reasonable limits are imposed on the collection and retention of consumer data
- **Notice and choice**. Recommends various measures to ensure informed consumer choice "remains practicable in the IoT"
  - "management portals or dashboards" to (re)configure privacy settings for particular devices
  - "out of band" communications receive important information through emails or texts
  - "icons" for quickly and easily turning device connections on or off.

* As defined by FTC

Europe

- **Privacy by design.** In addition to security by design, privacy is built into devices at the outset "by default" and that a "privacy impact assessment framework" is applied
- **Data minimization.** Includes limiting "the amount of data leaving devices by transforming raw data into aggregated data directly on the device" or "at the nearest point of data collection"
- **Transparency and control.** Measures to ensure that consumers can exercise an informed choice:
  - "Granular choices" when granting access to data sources (data, time and frequency of capture)
  - "Local control over processing entities": consumers can "read, edit and modify the data without having to transmit the data to the device manufacturer."

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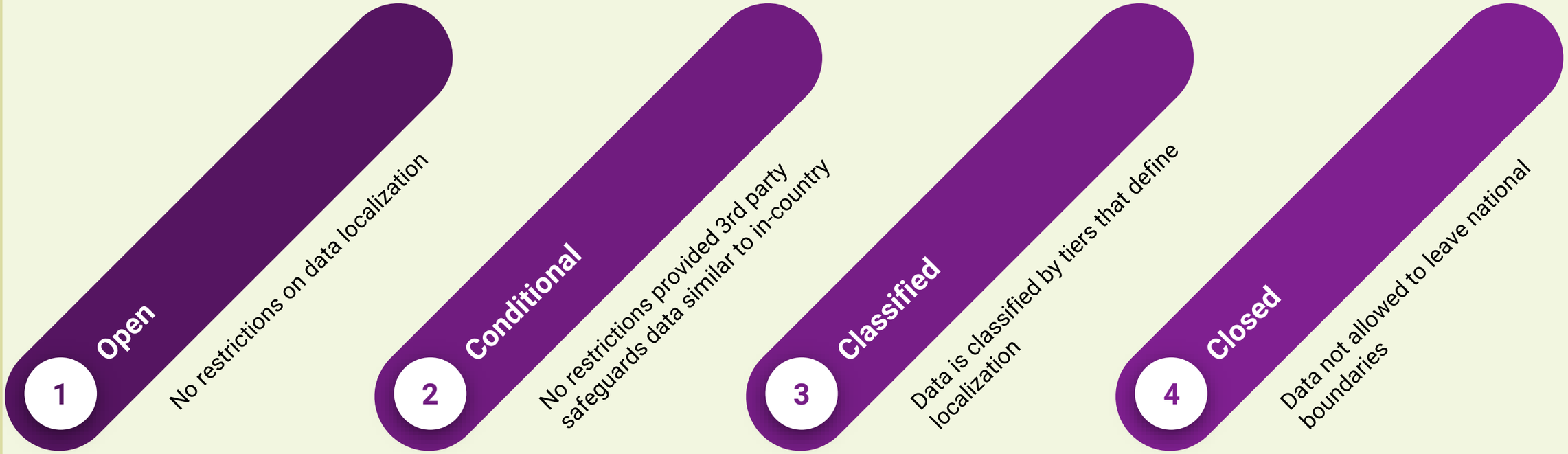
Data Localization (Sovereignty)



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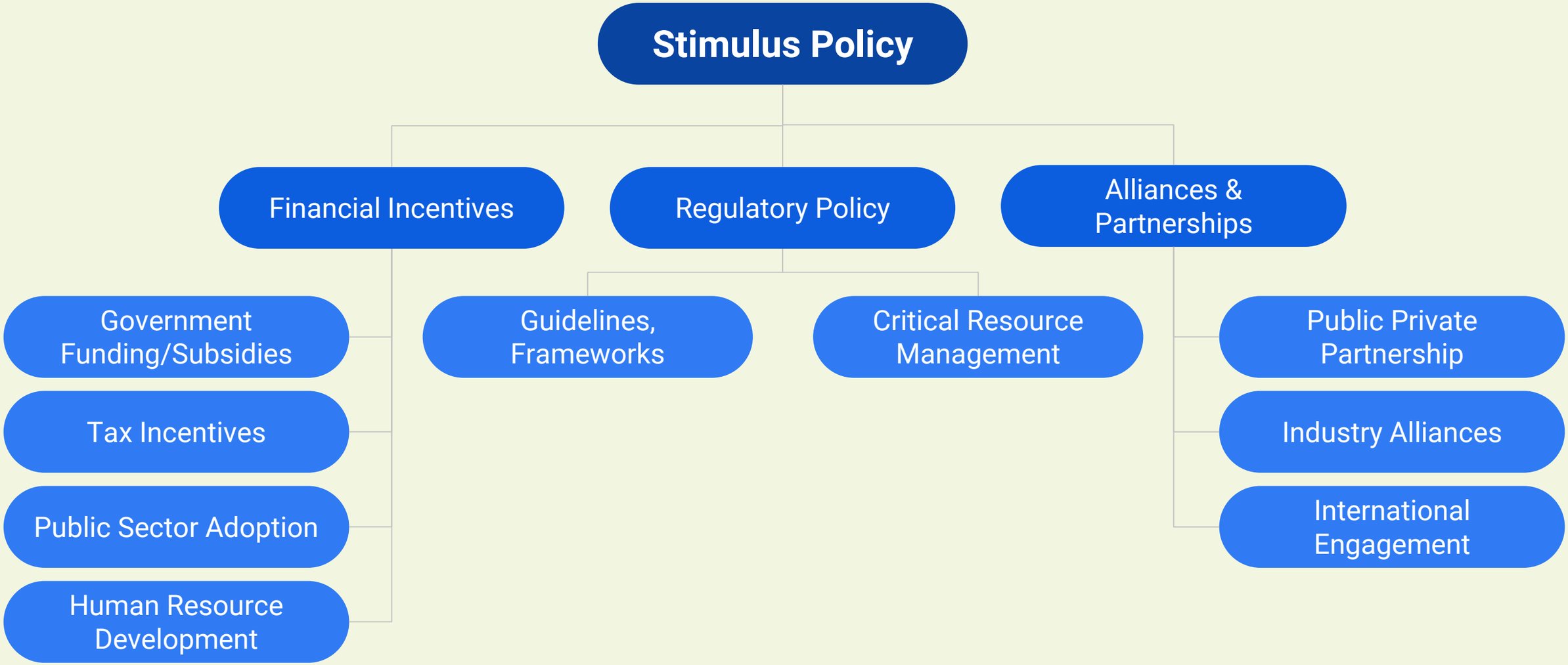
Policy Initiatives

IoT Policy: Stimulating Deployments



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Financial Incentives

01	Government Funding / Subsidies	• Investment to improve the ICT infrastructure: “Intelligent Brazil” • Invest in specific sectors: American Recovery and Reinvestment Act of 2009 provided $4.5 billion for Smart Grid deployment, and worker training • Provide subsidies: Canadian subsidies to deploy smart meters
02	Tax Incentives	• Reduce import tariffs • Reduce taxes: Brazil reduced taxes on IoT devices to improve the financial business case
03	Public Sector Adoption	• Government as early adopter of IoT to jumpstart the network effect through pilot programs and in full-scale implementations: global activities related to water or electrical meters
04	Human Resource Development	• Training programs • Incubation of startups • Investment in research and development, • Creation of demonstration centers

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Partnerships & Alliances

01	Industry Alliances	• Create national alliances to coordinate among ecosystem stakeholders, create guidelines, identify priorities, define investment plans
		  ○ Australia: Internet of Things Alliance Australia (IoTAA) to address security and privacy.
		  ○ Japan: IoT Acceleration Consortium (ITAC) to define priority areas for investment. Also founded the IoT Policy Committee to elaborate on relevant public policies for IoT.

02	Public-Private Partnerships	• Government acts as a catalyst to stimulate IoT deployments through partnership with industry. This model is actively followed in smart city project and relies on local talent and scientific expertise ○ India: Digital India Smart Cities projects to showcase IoT-based solutions.
03	International Coordination, Collaboration and Engagement	• Work through international organization on standard activities, collaborate with other nations. Model works best where there's a strong domestic sector that could benefit from standardized global IoT ○ China: Multi-pronged strategy to work through international organizations such as the ITU, WTO, IETF, 3GPP, etc.

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Regulatory & Policy

01	Managing Critical Resources	• Spectrum: quantity, access (license, unlicensed, shared) • Numbering scheme (E.164): Size; Accessibility: roaming, MVNO access to IMSIs, etc. ○ Germany allows permanent roaming without notification of the regulator. MVNOs can apply directly for IMSIs.
02	Guidelines and Frameworks	• Develop frameworks and guidelines with industry engagement particularly as related to IoT security and privacy
03	Policies and Other Regulations	• Make public sector data freely accessible through data portals and application program interfaces (APIs). ○ Chicago made available over 600 data sets

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Impediments to IoT Implementation

From Policy Makers' Perspective

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Example based on Brazil.

Example: Brazil National IoT Plan

Focus Sectors	
Smart Cities **$13-$27 B***	**Agribusiness** **$5-$21 B***
Healthcare **$5-$39 B***	**Industry: Oil&Gas, Mining, Textile, Automotive,** **$11-$45 B***

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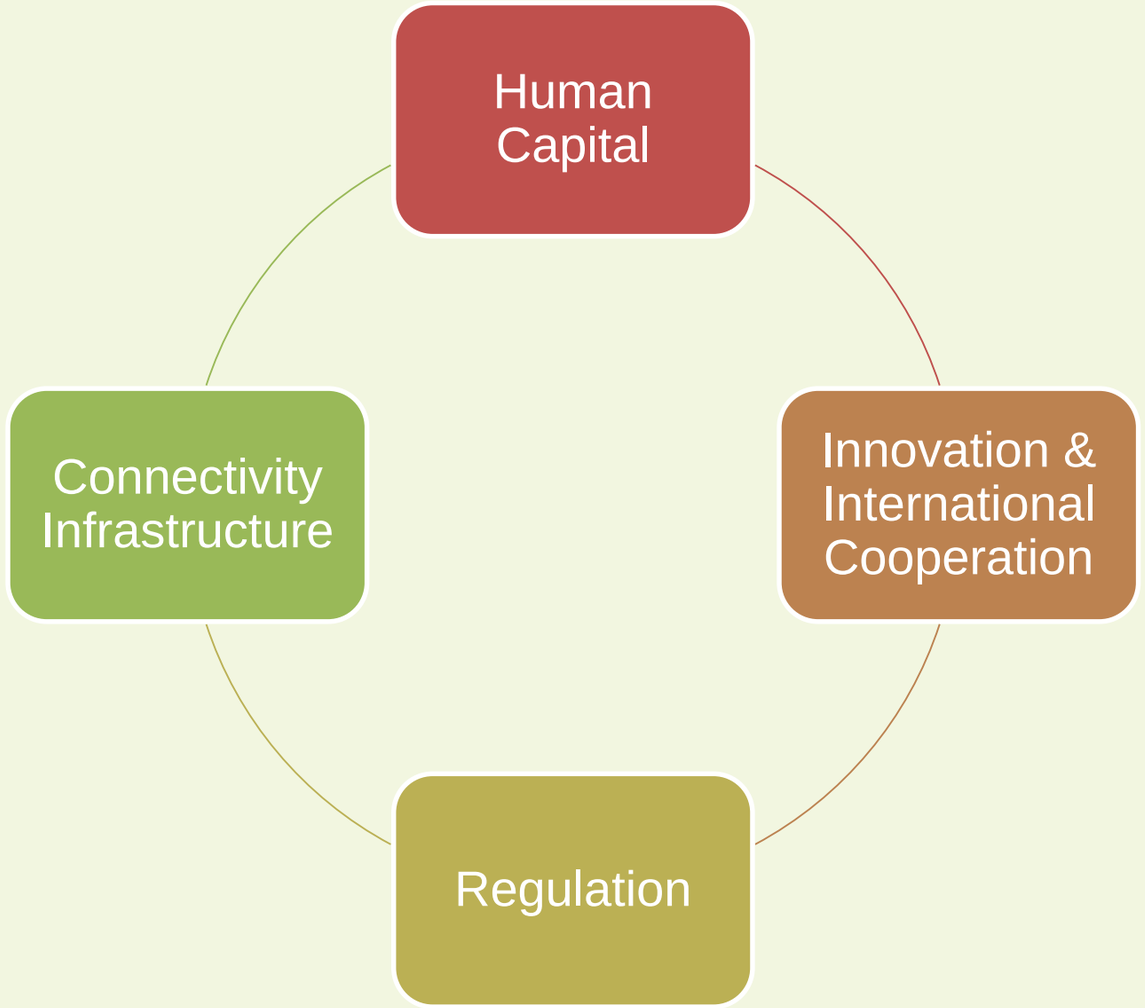
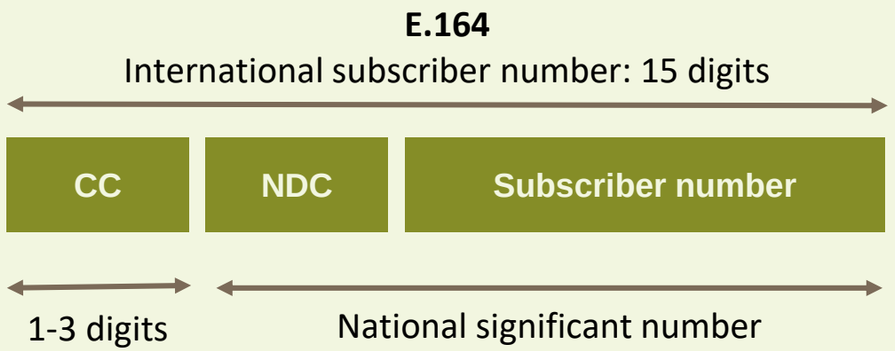


* Market value by 2025

Numbering & Roaming

Numbering Resources

1	Are there numbers assigned specifically for IoT?
2	How big should the IoT numbering space be? [i.e. how many digits?]
3	How to assign IoT numbers to service providers / users?
4	What is the allocation that a user can apply for?
5	Who can apply for IoT numbers?
6	Migration to all IP



CC = Country code
NDC = National destination code

Example: 10 digits assigned to IoT device
~ 10^10, or 10 billion numbers.

3

Numbering Plan Takeaways

01	Many countries have yet to define IoT range or enforce existing IoT allocation (>50%)
02	Different approaches to IoT numbers even within same economic block such as EU: wide variation in allocated space to IoT numbers
03	Countries have embarked on increasing the IoT allocation: a. countries with plans to increase IoT penetration (e.g. China, India); and b. countries with ambitious international expansion (e.g. France)
04	Most countries are not in danger of running out of numbers
05	New technologies will leverage IPv6 to reduce dependency on numbers

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Regulatory Arguments On Permanent Roaming

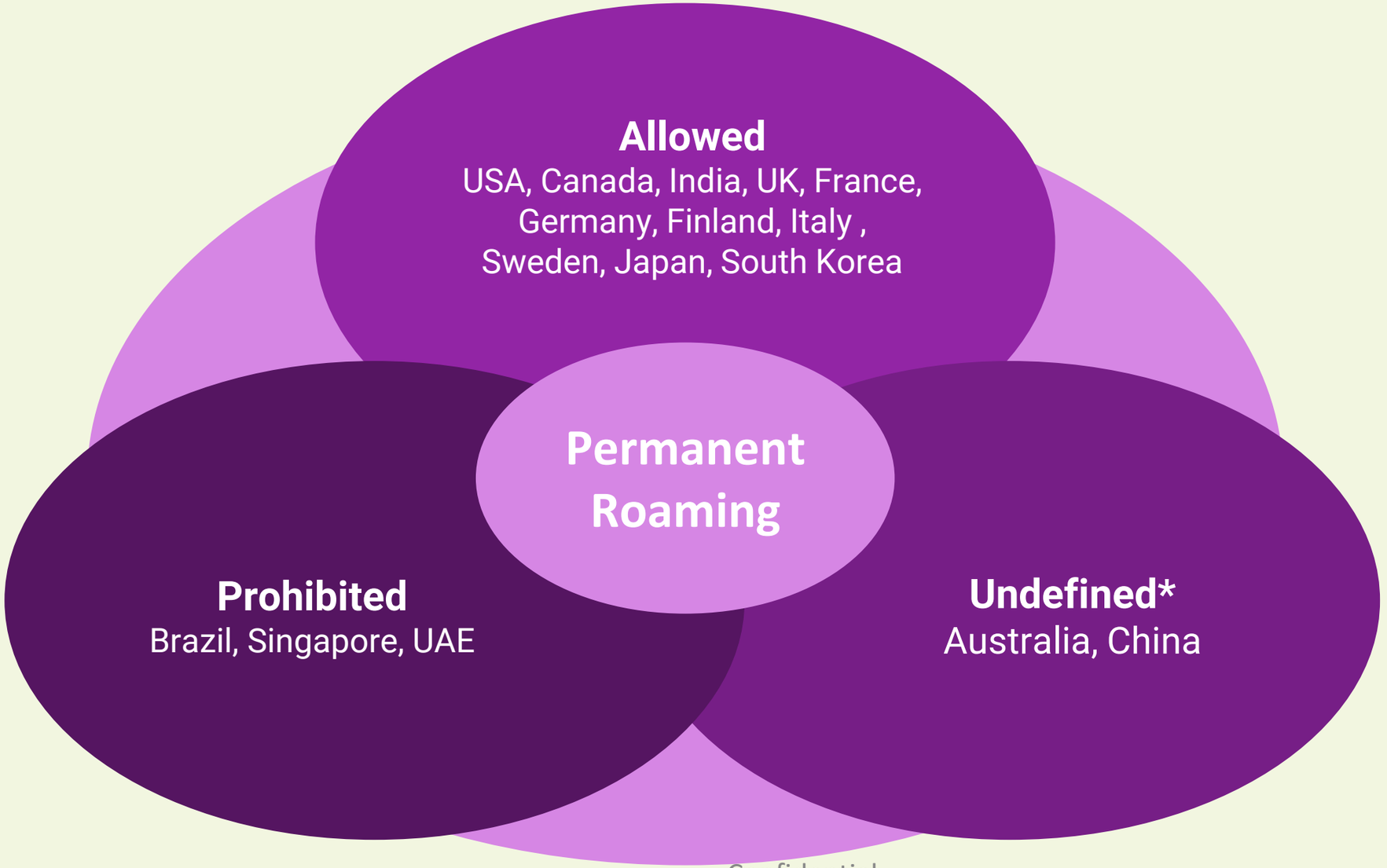
In Favor of Ban

- **National regulatory oversight**
  - Foreign operators tapping into market where they are not directly licensed to operate
- **Consumer protection**
  - Weak argument as there are few business to consumer contact points in IoT
- **Taxation**
  - Countries with SIM-card activation tax fear loss of those fees and roamers don't pay them
- **Lawful intercept**
  - Weak argument as there is fundamentally no difference in lawful intercept rules: the SIM is roaming on a national network, under national regulations

In Favor of Allowing

- **Time to market**
  - Accelerates IoT growth as global providers bring solution to the market
- **Permanent roaming is temporary tool**
  - IPv6 is a long term solution that will resolve issues related to number scarcity; India allows for up to 3 years
- **No stresses in current system**
  - Growth of IoT has been slow but steady
- **Free movement principle**
  - Applies in economic blocks like the EU where large number of IoT connections are roaming today
- **Banning will cause massive disruption**
  - Service to roaming connected devices will be severely disrupted leading to economic losses

Status of Permanent Roaming



Undefined: It could be left to MNOs as in Australia; or practically not allowed and implemented (China)

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