Internet of Things (IoT)

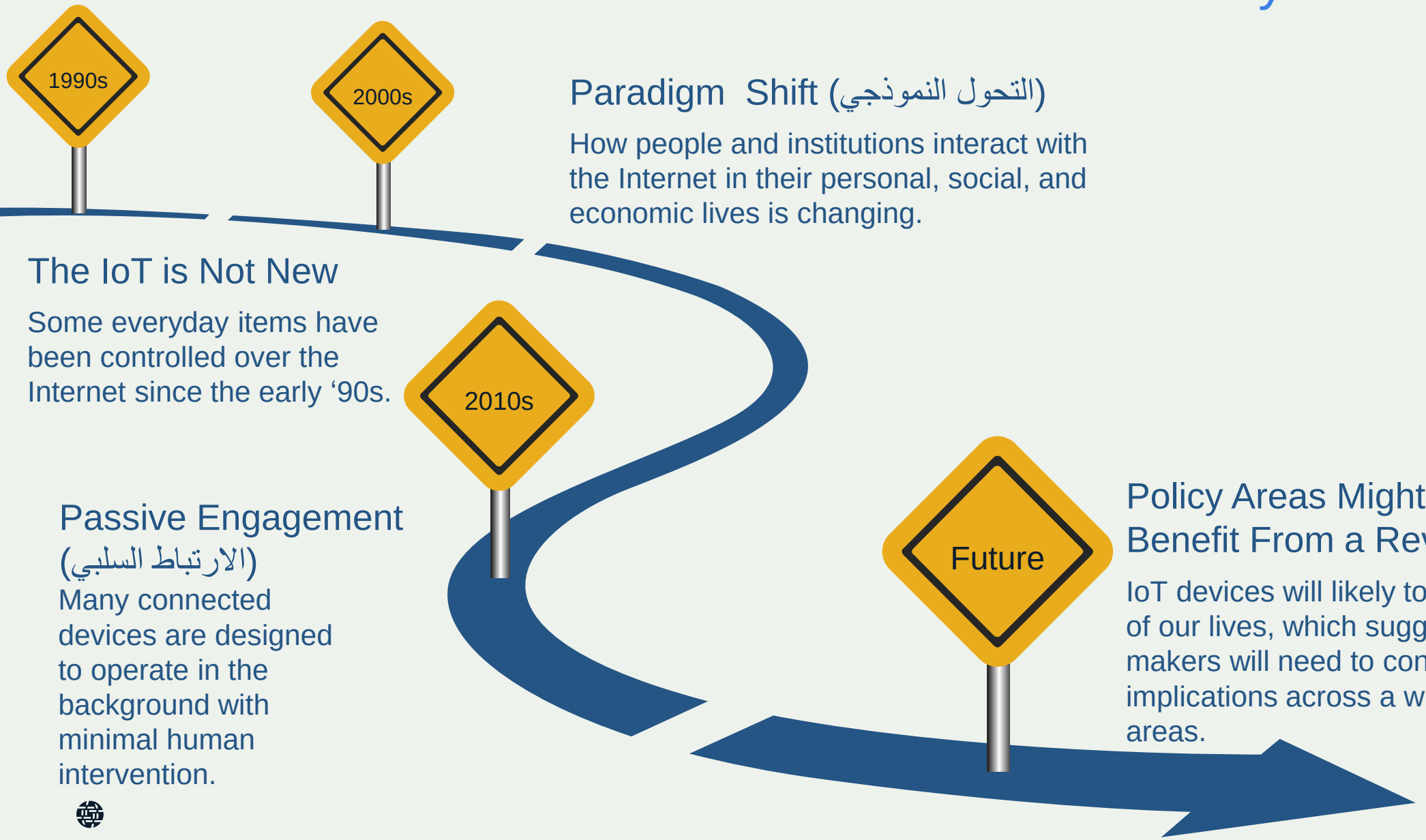
- Everyday items connected to the Internet will transform the ways we work, live, and play.
- The Internet of Things is a broad term used to describe ***devices, sensors, and everyday items which are not ordinarily considered to be computers but which have Internet connectivity and computing capability***. These objects include: consumer goods, cars and trucks, industrial components, wearable health monitors, and collections of devices working together to create concepts such as “smart cities” and “smart homes”.

- These objects collect data from their surroundings which are then transmitted and remotely analyzed to create new insights, deliver services, and control other items. It is projected that there will be 100 billion connected IoT devices by 2025.

- The potential for tremendous growth, innovation, applications, and services leads to the open nature of the Internet’s architecture and design, which does not place limits on the kinds of devices or services that can connect to it.

- There remain significant challenges associated with the IoT which must be addressed in order for technology to reach its full potential. These challenges include the issues of: security, privacy, interoperability (التوافقية), and standards, as well as regulatory (تنظيمي) and rights (حقوق) issues, and the readiness (الاستعداد) of emerging economies (الاقتصاديات الناشئة) to adopt it (لاعتماده).

Key Considerations



Paradigm Shift (التحول النموذجي)

How people and institutions interact with the Internet in their personal, social, and economic lives is changing.

The IoT is Not New

Some everyday items have been controlled over the Internet since the early ‘90s.

Passive Engagement (الارتباط السلبي)

Many connected devices are designed to operate in the background with minimal human intervention.

Policy Areas Might Benefit From a Review

IoT devices will likely touch most aspects of our lives, which suggests policy makers will need to consider the broad implications across a wide array of areas.

- **The concept of connecting objects and items to the Internet is not new.** The first everyday items to be controlled over the Internet emerged in the early 1990s and set the stage for today's Internet of Things.
- **How people and institutions interact with the Internet in their personal, social, and economic lives is changing**. The Internet of Things may represent a shift in how users engage with (ارتبط) and are impacted by the Internet. For example, today's Internet experience is largely characterized by users actively downloading and generating content through their computers and smartphones. But this might be about to change…
- **Many Internet of Things devices are designed to operate in the background.** These devices send and receive data on a user's behalf with little human intervention (التدخل) or even awareness (الوعي); others are designed to control objects and physical assets (الأصول المادية) in the world, such as vehicles and buildings, or to monitor human behavior.
- It is projected that there will be 100 billion connected IoT devices by 2025. If the projections (التوقعات) and trends (الاتجاهات) about the IoT become reality, **we would be wise (الحكمة) to consider the implications (تداعيات) of a world in which the most common interaction with the Internet comes from passive engagement (الارتباط المجهول او السلبي) with connected objects**, rather than active engagement with content. *For example, governments may want to ensure that their policies keep pace (تواكب) with this rapidly changing environment (البيئة).*

Here are some common applications for IoT technology:

1. Consumer Applications

There is a wide range of consumer uses for IoT, including connected vehicles, connected health, home automation (such as lighting and speaker systems), wearable technologies, and appliances the include remote monitoring capabilities, such as remote video-enabled doorbells. Many of these are also part of the smart home.

2. Smart Home Applications

Lighting, heating and air conditioning as well as media and security systems are all part of an IoT-enabled home. These can provide energy savings by turning of devices that are not needed. Many smart homes are based around a central platform or hub that connects with smart devices and appliances. These are usually controlled from a smartphone, tablet or other device, sometimes without the need for a Wi-Fi bridge. These systems can be linked to standalone platforms such as Amazon Echo or Apple HomePod, or use an open source ecosystem like Home Assistant or OpenHAB.

3. Care Applications

Internet-enabled devices can also deliver invaluable assistance for the elderly or those with disabilities, providing a better quality of life. For example, voice controlled devices can assist users with sight or mobility limitations. Sensors can also monitor for medical emergencies such as falls.

4. Medical and Healthcare Applications

The IoT can be used for a number of different medical and healthcare purposes including data collection and analysis for research and patient monitoring. When used in such settings, the IoT is referred to as 'The Internet of Medical Things (IoMT).'

Other healthcare applications include consumer devices designed to encourage a healthier lifestyle, such as connected scales or fitness monitors.

5. Transport Applications

The Internet of Things has numerous applications for transport, for example with inter-vehicular and intra-vehicular communication, smart traffic control, smart parking, vehicle control, safety and road assistance. Bringing together vehicles with the transport infrastructure, IoT can also deliver vehicle-to-everything communication (V2X), vehicle-to-vehicle communication (V2V), and vehicle-to-infrastructure communication (V2I).

6. Building Applications

IoT devices can monitor and control aspects of various types of building, including mechanical, electrical and electronic systems. The integration of the Internet with buildings create smart buildings that can help reduce energy consumption.

7. Industrial Applications

Industrial Iot (IIoT) devices allow for data from equipment, technologies and locations to be collected and analysed. The IIoT also allows for automated updates for assets to maintain efficiencies and prevent lost time and money for repairs and other situations.

8. Agriculture Applications

Agricultural IoT applications include data collection for weather conditions, soil content.The data can help automate farming techniques, inform decisions, improve safety, reduce waste and increase efficiency.

9. Infrastructure Applications

IoT can be used to monitor and control sustainable urban and rural infrastructure, including bridges, railway tracks or wind farms.

10. Metropolitan Applications

Entire cities can be managed with the help of the IoT, to create a smart city that offers a range of benefits for residents. These benefits include everything from parking space location, environmental monitoring, traffic management, reduced pollution, security systems, lighting, smart bus stops, and more.

11. Energy Management Applications

Internet connectivity can provide energy consumption management for lamps, household appliances, industrial assets and more. Energy consuming devices can be managed remotely to save energy when they are not required. As a side application, the smart grid can collect data on energy use to improve efficiencies and electricity distribution.

12. Environmental Monitoring Applications

Monitoring air or water quality is another way in which IoT-enabled sensors can change our world. The IoT allows for data to be collected on wildlife movements, soil condition and more. The IoT can also monitor for natural disasters like tsunamis or earthquakes, helping streamline emergency response and damage limitation.

13. Military Applications

The application of IoT technologies for military purposes has created the Internet of Military Things (IoMT). Applications in this area include reconnaissance and surveillance (الرصد والاستطلاع), and more to deliver battlefield data. This can include the use of sensors, munitions (الذخيرة), vehicles, robots and wearable technologies.

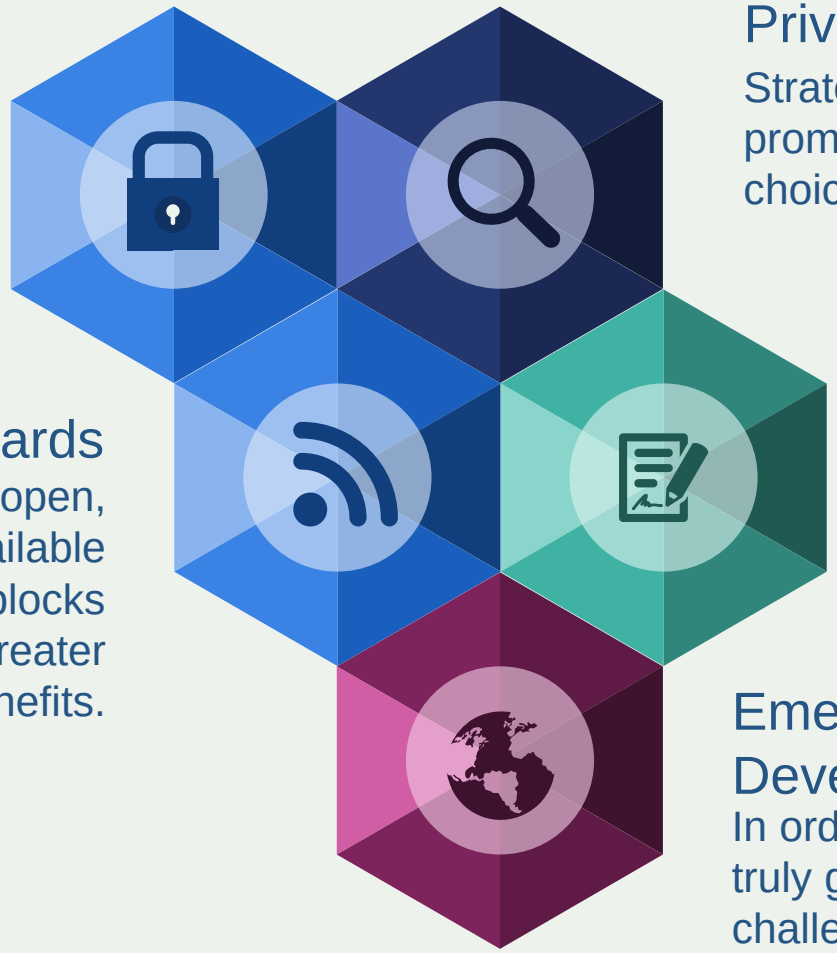
Challenges

Security

How to ensure robust and lifelong security in IoT products and services?

Interoperability and Standards

The voluntary use of open, interoperable, and widely available standards as technical building blocks for IoT devices will deliver greater benefits.



Privacy

Strategies need to be developed that promote transparency, fairness, and user choice in data collection and handling.

Regulatory, Legal, and Rights Issues

The rapid rate of change in IoT technology could outpace the ability of associated policy, legal, and regulatory structures to adapt.

Emerging Economy and Development Issues

In order for the benefits of the IoT to be truly global, the unique needs and challenges of implementation in less-developed regions will need to be addressed.

Challenges:

A number of challenges need to be addressed in order for the Internet of Thing's potential benefits to individuals, societies, and economies to be fully realized:

Security

- Internet of Things devices present new and unique security challenges. **A collaborative approach to IoT security will be needed to develop effective and appropriate solutions that are well-suited to the scale and complexity of the issues.**
- Devices and services with weak security are vulnerable to cyber attacks and can expose user data to theft. Because an increasing number of IoT devices online increases the number of potential security vulnerabilities, this a key IoT challenge to be addressed.
- Manufacturers are frequently presented with economic and technical challenges when building and maintaining robust security features in IoT devices.
- Ensuring lifetime security in IoT products and services must be a fundamental priority to maintaining overall user trust in this technology. ***Users need to trust that IoT devices and related data services are secure, especially as they become more pervasive and integrated into our daily lives.***

Privacy

- The ability to collect, analyze, and transform data drives much of the value of IoT devices and services.
- However, this data can be used to paint detailed and invasive profiles of users. This raises **concerns about a potential increase in surveillance and tracking**, and the amount of sensitive data that can be collected by devices operating in our homes, businesses, and public environments.
- **Sometimes these devices collect data about individuals without their knowledge or informed consent.**
- IoT devices that collect data about people in one jurisdiction may transmit that data to another jurisdiction for data storage or processing. Challenges can arise if the data collected is deemed to be personal or sensitive and is subject to data protection laws in multiple jurisdictions. ***Enabling cross-border data flows that protect privacy and promote legal certainty for users and IoT***

Interoperability (التوافقية) and Standards

- Today's marketplace offers a variety of technical approaches to the IoT. Some companies see strategic advantages to developing proprietary ecosystems, while others are developing their own approaches because common technologies do not yet exist. A wide range of companies, industry groups, and researchers are working on approaches that create greater IoT interoperability and standards.
- The Internet Society believes that ***greater interoperability and the use of generic, open, voluntary, and widely available standards as technical building blocks for IoT devices and services will support greater user benefits, innovation, and economic opportunity.***
- This is because interoperability among IoT devices and data streams can encourage innovation and provide efficiencies for device manufactures and users, thereby increasing overall benefits and economic value.

Regulatory, Legal, and Rights Issues

- The rapid rate of change in IoT technology could outpace the ability of associated policy, legal, and regulatory structures to adapt.
- For example, ***If someone is harmed as a result of an IoT device's action or inaction, who is responsible? The answer is often complicated***, and in many instances there is not enough case law to support a position.
- IoT devices also raise ***potential human rights concerns*** regarding the pervasiveness of societal monitoring, the secondary uses of data by the government, and access to data from personal IoT devices by law enforcement or as evidence in legal actions, among other challenging issues.
- **Given the broad nature of IoT regulatory and policy challenges, a collaborative governance approach to policy development that relies on input and participation by a range of stakeholders is needed for the best outcomes.**

Emerging Economy and Development Issues

- The IoT holds significant promise for delivering social and economic benefits to emerging and developing economies in areas such as sustainable agriculture, water quality and use, healthcare, industrialization, climate monitoring, and environmental management.
- However, **developing regions present unique challenges related to the deployment, growth, implementation, and use of the technology.** These challenges include the deployment of adequate Internet and basic communications infrastructure in rural and remote areas, incentives for investment, and local participation in the development of IoT solutions.

The Internet Society urges governments to take the following steps to accommodate, and foster, IoT deployment:

> Promote Internet and data-infrastructure growth

Governments should review their existing Internet infrastructure in light of the potential increased data communication needs of IoT devices.

- *For example, consider removing burdensome equipment taxes or licensing requirements to encourage the development of new datacentres and physical infrastructure.*

➢ Encourage IPv6 deployment

➢

IPv6 is an enabling technology for Internet growth, and it will become even more critical as the IoT drives up the number of connected devices.

- *For example, governments should consider making IPv6 adoption a national priority and engage with stakeholders in their community to encourage IPv6 rollout.*

> Encourage open, voluntary IoT standards

The use of open, voluntary, and widely available standards as technical building blocks for IoT devices will support greater user benefits, innovation, and economic opportunity.

- *For example, governments should refrain from mandating technical approaches to the IoT. Instead, governments should encourage industry, researchers, and other stakeholders to work together and to develop open, consensus-based standards that support interoperability.*

> Adopt a collaborative, multistakeholder approach to IoT policy discussions

The IoT is a challenging area for policymakers, as it is a rapidly developing environment and its technology spans many industries and uses.

- *As a result, a collaborative governance approach that draws on the expertise and engagement of a wide range of stakeholders will be needed to develop effective and appropriate solutions. The Internet Society believes that policies should aim to promote users' ability to connect, speak, innovate, share, choose, and trust in a manner that both promotes innovation and enables user rights.*

➢ Encourage a collaborative approach to IoT security

Participants in the IoT space should adopt a collaborative approach to security by assuming responsibility, sharing best practices and lessons learned, encouraging dialog on security issues, and emphasizing the development of flexible, shared security solutions that can adapt and evolve as threats change over time.

- *IoT security is the collective responsibility of all who develop and use IoT devices. IoT security policy should thus focus on empowering players to address security issues close to where they occur, rather than centralizing IoT security among a few, while also preserving the fundamental properties of the Internet and user rights.*

> Encourage responsible design practices for IoT sevices

IoT device developers should be encouraged to respect the end-user's privacy and data security interests and consider those interests a core element of the product-development process. They should also consider the full lifecycle of the IoT system to ensure obsolete devices don't pose security risks and are compatible with responsible environmental stewardship.

- *For example, governments should encourage security-by-design and privacy-by-design practices for IoT devices.*

- Today billions of Internet of Things devices are already connected to the Internet and transforming our lives. However, the recent confluence of key technologies and market trends is ushering in a new reality for the Internet of Things, with some seeing on the horizon a fully interconnected “smart” world, with relationships between objects and people, and objects and their environment, becoming more tightly intertwined.

- While the potential benefits are significant, **there are serious challenges that must be addressed so that we can maximize the benefits while reducing the risk** — particularly in the areas of security; privacy; interoperability and standards; legal, regulatory, and rights issues; and the inclusion of emerging economies.

- The Internet of Things involves a complex and evolving set of technological, social, and policy considerations which require input from a diverse set of stakeholders. **Finding solutions will thus require informed engagement, dialogue, and collaboration across a range of stakeholders to plot the most effective ways forward.**