

CMSC 304 Computer Ethics

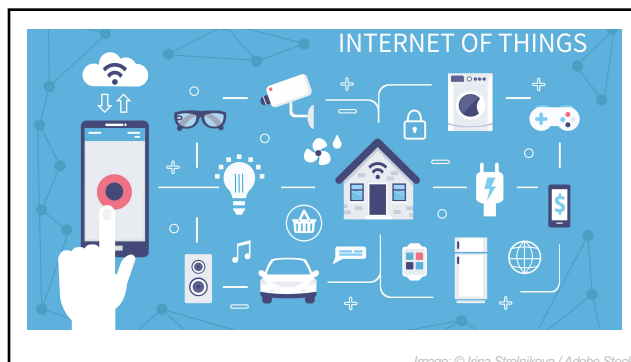
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Bookkeeping

- EA2 due 18th (Friday)
- Midterm 3/31
 - **Introductory material** (ethical reasoning, theories, argumentation)
 - **Topics to date** (e.g., bias in AI, cyberwarfare)
 - **Ethical thinking** as per class exercises
- EA3 topic will be out before spring break
- Paper topics due 4/12

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The Internet of Things

- Loosely, any physical thing that can be assigned an IP address that isn't a traditional computer
 - Usually omits smartphones
 - Smart watches are iffy
 - Devices that wouldn't typically have an internet connection
- Physical devices connected to the internet and each other
- Generally has some form of **sensor**
- Often has **actuators** that give it the ability to do something in the world

[dmoz.org.com/stories/that-s-why-the-internet-of-things-needs-artificial-intelligence](https://www.dmoz.org.com/stories/that-s-why-the-internet-of-things-needs-artificial-intelligence)

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How Did the IoT Happen?

- Low-power processors
- Physically small chips
- Proliferation of internet infrastructure (wireless everywhere)
- RFID tags – very low-power wireless communication
- IPV6

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How many IoT devices are there?

- Depends who you ask
- 20-50 billion
 - That's a big range
 - Depends partly on what you count
- Roughly 10 IoT devices per household in industrialized world
- Far more IoT devices than people

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Categories of IoT devices

- Health care
- Entertainment
- Transportation
- Home maintenance
- Wearable/portable electronics
- Manufacturing
- Commerce
- Security
- Building automation
- Retail
- Government
- Personal wellness
- Utilities

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IoT Benefits

For consumers

- Convenience
- Novel capabilities
- Safety
- Connectedness
- Measurability

For businesses

- Agility and efficiency
- Supply chain management
- Performance monitoring
- Data collection

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The IoT and Privacy

- Two sources of privacy failure:
- Non-authorized agents can access info about you (IoT and security)
- Device sellers or manufacturers collect personal data
- Smart homes and cars know a lot about people
 - "when you wake up (when the smart coffee machine is activated), how well you brush your teeth (thanks to your smart toothbrush), what radio station you listen to (thanks to your smart speaker), what type of food you eat (thanks to your smart oven or fridge), what your children think (thanks to their smart toys), and who visits you and passes by your house (thanks to your smart doorbell)."
 - "a researcher found that by analysing ... the home's energy consumption, carbon monoxide and carbon dioxide levels, temperature, and humidity ... they could work out what someone was having for dinner"

www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/

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The IoT and Privacy: Examples

- Smart TVs come with microphones and cameras
- Smart lightbulbs track your sleep and heart rate
- Smart vacuum cleaners recognize objects in the home
- Wireless routers collect location of users in the home
- CPAP machines communicate with health insurers
- **Users do not know what data is collected or where it goes**
 - Arguably this is by design
 - Research your smart devices carefully
 - Assuming you're in a space you control

<https://www.wired.com/story/smart-devices-how-we-use-2-ways-for-science-explain-how-the-internet-of-things-can-protect-your-privacy/>

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The IoT and Security

- Intentional privacy only works if well implemented
- Many devices are poorly secured (e.g., traffic not encrypted)
- Even secured devices are often not patchable (exploits cannot be fixed)
- IoT devices can give access to information about homes/facilities
 - E.g., cameras, medical devices, smart assistants, ...
- Can be used to hack everything from smart locks to toys to pacemakers
- Hacked devices can become part of botnets
 - Owners don't necessarily care

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The IoT and Data

- Billions of smart devices creating zettabytes of data
- Some are small bursts: checking a humidity sensor
- Some are large and continuing: smart cameras
- Voice requests, video streams, sensor readings, thermostat settings...
 - Can all be mined for information about owners
- Growth area: 5G enabled IoT devices

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The IoT and Physical Safety

- Consider cyber-warfare discussion
- “Smart” devices and sensors are progressively more involved in:
 - Municipal services, e.g., water treatment
 - Public health, e.g., COVID sewage monitoring
 - Transportation, e.g., smart cars
 - Physical security, e.g., door locks
 - Environment maintenance, e.g., heating and cooling
- “The ability to **act** in the physical world... open[s] the possibilities of physical risk”^[1]

[1] The Internet of Things: Foundational ethical issues - Allhoff & Henschke 2018

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Informed Consent

- Concept: People should **consent** to the use of their personal information, **knowing what that use entails and implies**
 - Or to things like medical interventions, study protocols, ...
- How do we collect that consent?
 - EULAs are terrible – meant to be unread, no lack of consent available
 - Other choices are potentially burdensome/expensive
- Regulatory constraints
 - Jurisdictional concerns
 - Difficulty of building a sufficiently broad framework

The Internet of Things: Foundational ethical issues - Allhoff & Henschke 2018

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Trust

- The IoT works partly because we **trust** our devices
- To be effective: do what we expect them to do
 - Correctly report glucose levels, turn on the heat before we get home
- To be safe: not have significant unintended consequences
 - That damage us; that damage others
- To be private: maintain the confidentiality of our personal data
 - Does seem to be people's expectation
- To have our best interests in mind

The Internet of Things: Foundational ethical issues - Allhoff & Henschke 2018

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Discussion Questions

- Pick one **interesting** device in each of these categories:
 - Health care
 - Entertainment
 - Smart homes
- Then, for each:
 - List the thing you would find most useful
 - List your biggest concern
 - **Discuss how it could be implemented without being harmful**
- Fill out: <http://tiny.cc/discussion-iot> (one entry/group)

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