Event-Driven Programming and the Internet of Things

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Event-Driven EV3 Programming

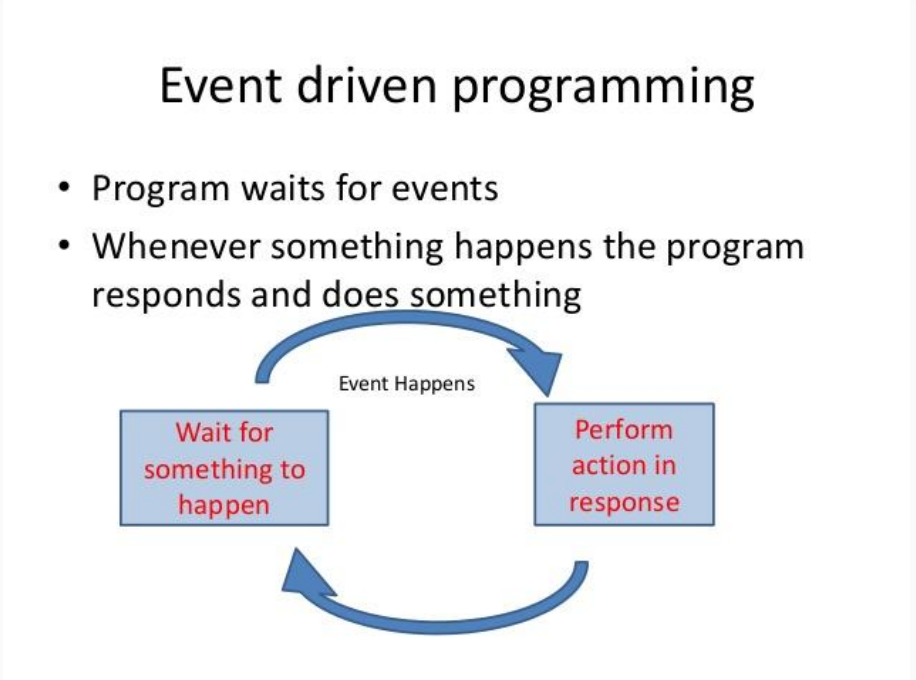
The problem

- Deceptively hard programming tasks
- Procedural programming doesn't reflect the real world

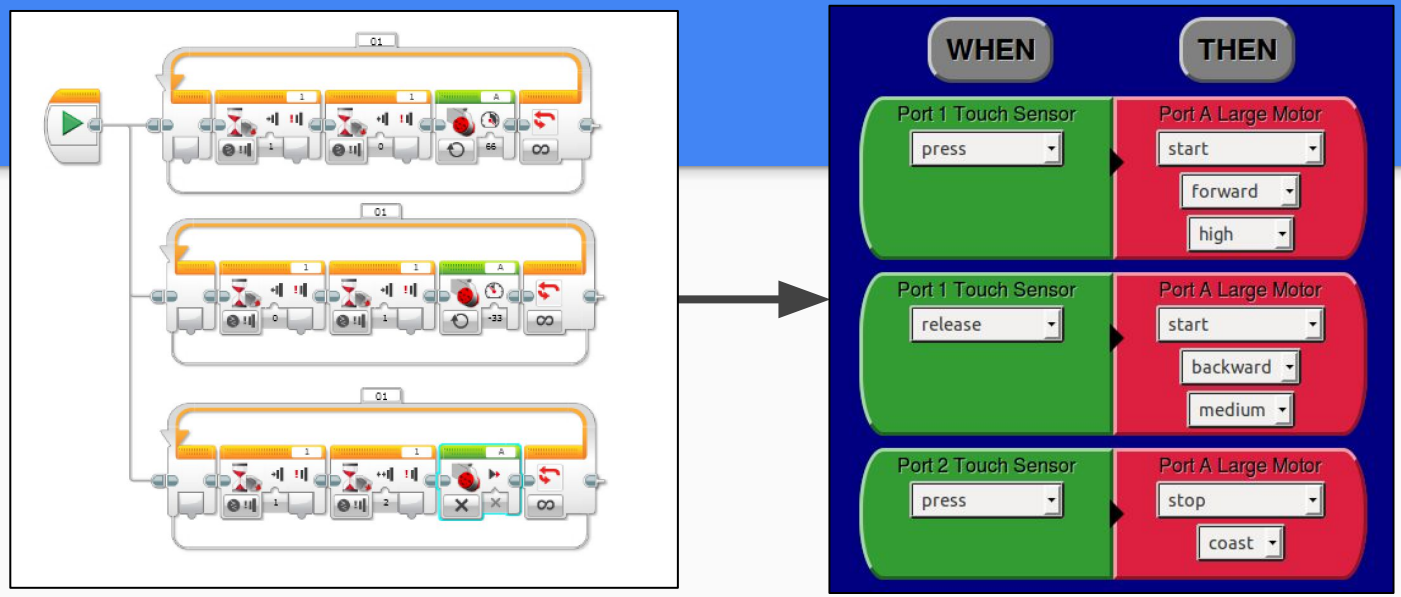
Solution: "When-This-Then-That" logic inspired by IFTTT.com

What are the benefits?

- Robots designed around sensor inputs
- No complex syntax necessary!
- Gateway into the Internet of Things (IoT)



Simpler Syntax



Syntax is a major barrier to entry for new programmers.

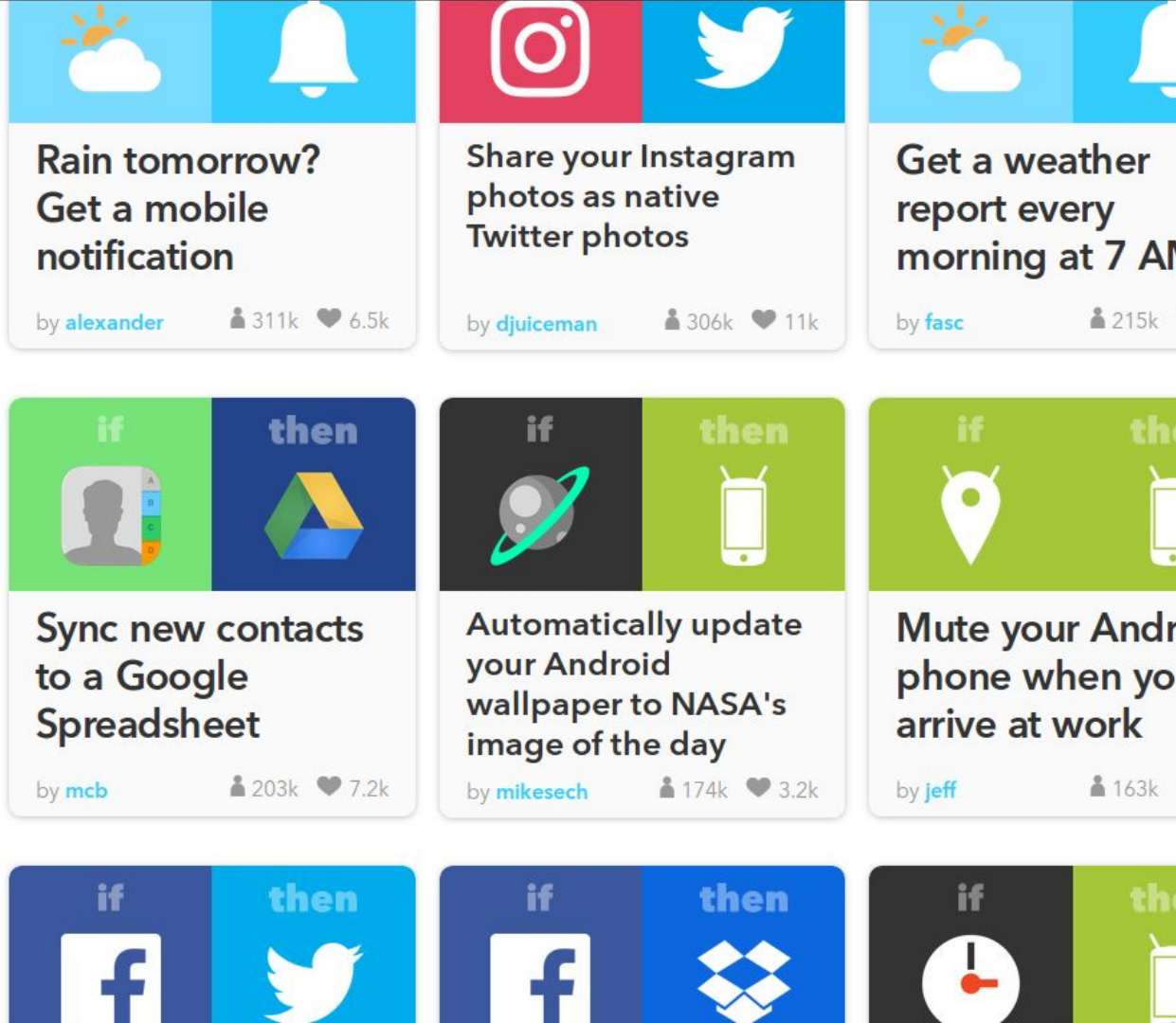
The **consistent structure** of a simple event-driven model minimizes this issue.

Research – IFTTT

Takeaways:

- Concurrency
- Large colorful interface with blocks
- “Triggers” and “Actions” which belong to “Channels”
- “Triggers” are always state *changes*, not state values

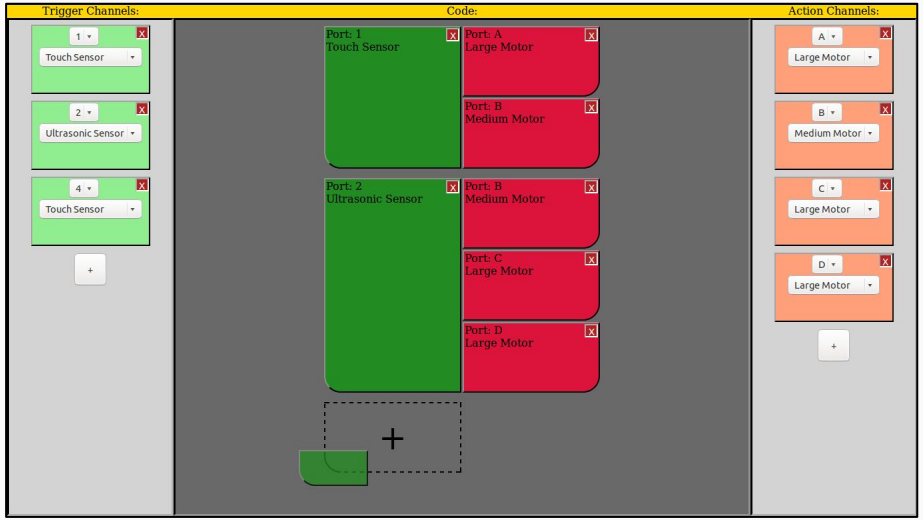
IFTTT’s web interface is very clunky, but its functionality is close to what we want

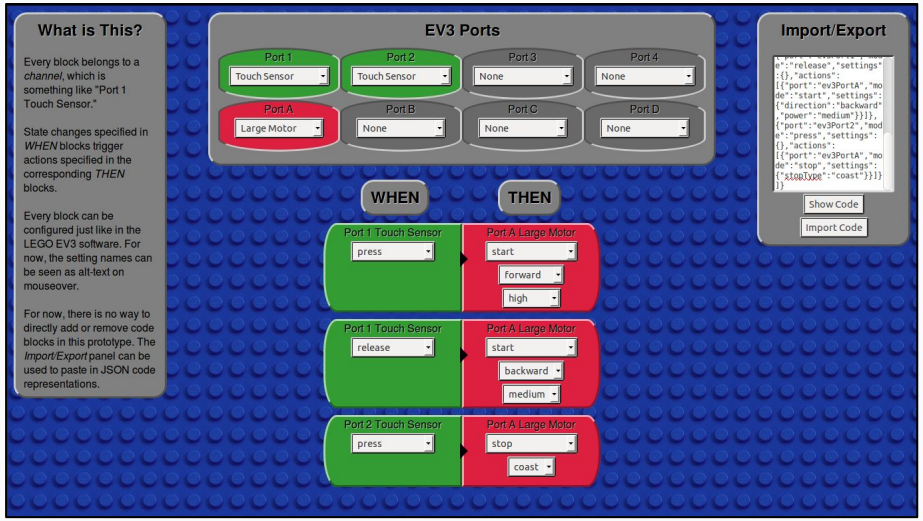


Interface Prototypes

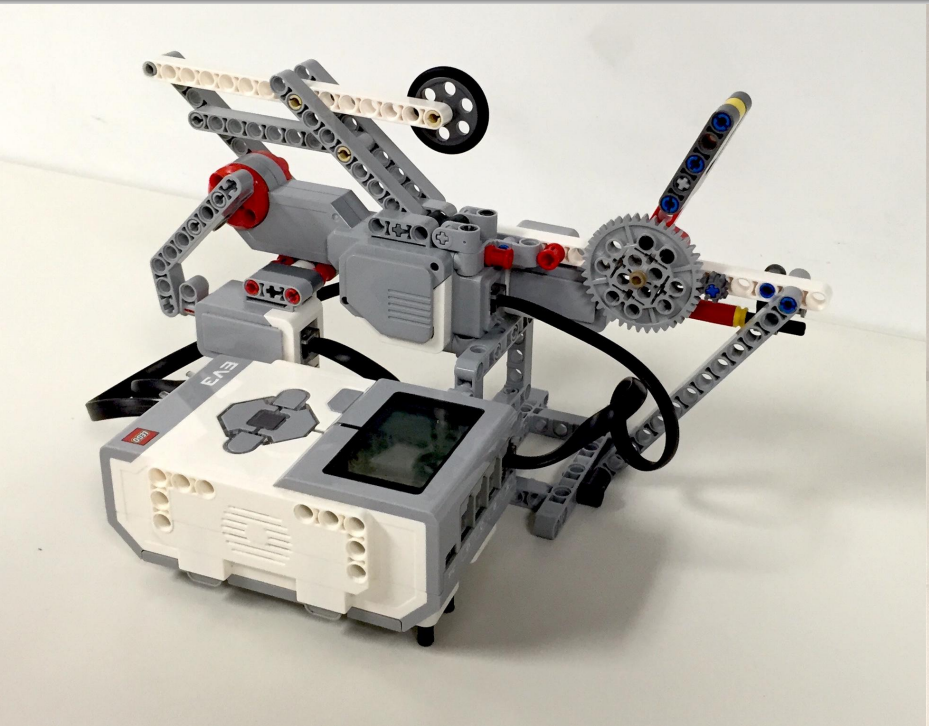
- Global port configuration
- Drag-and-drop code blocks
- A comprehensive data model for representing programs
- Color-coding based on peripheral type

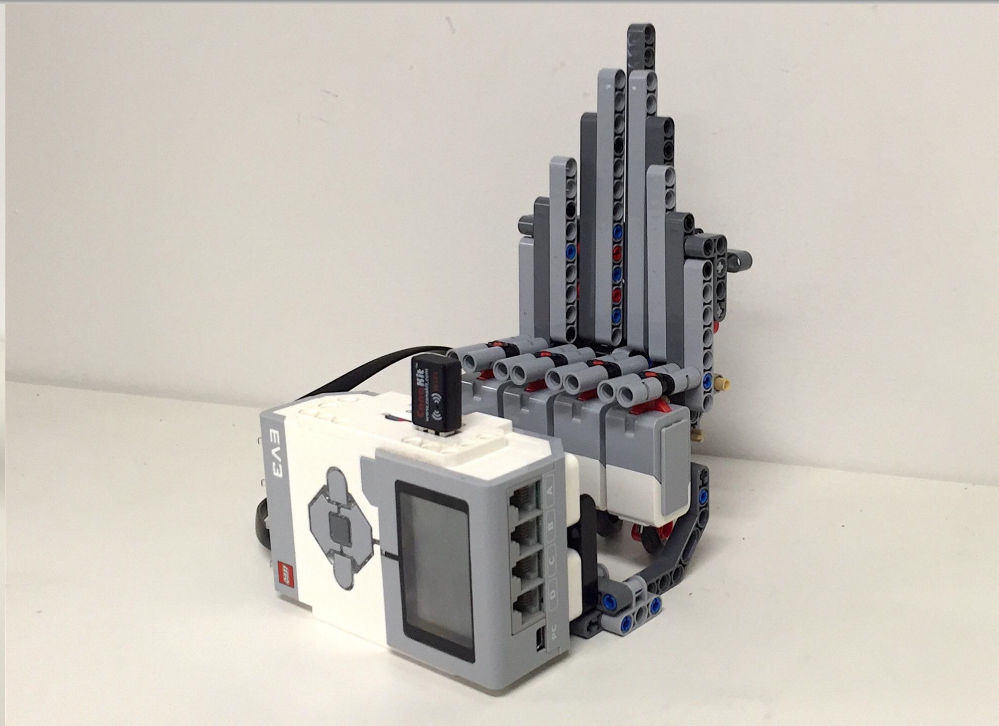
Our most current interactive prototype can represent complete programs



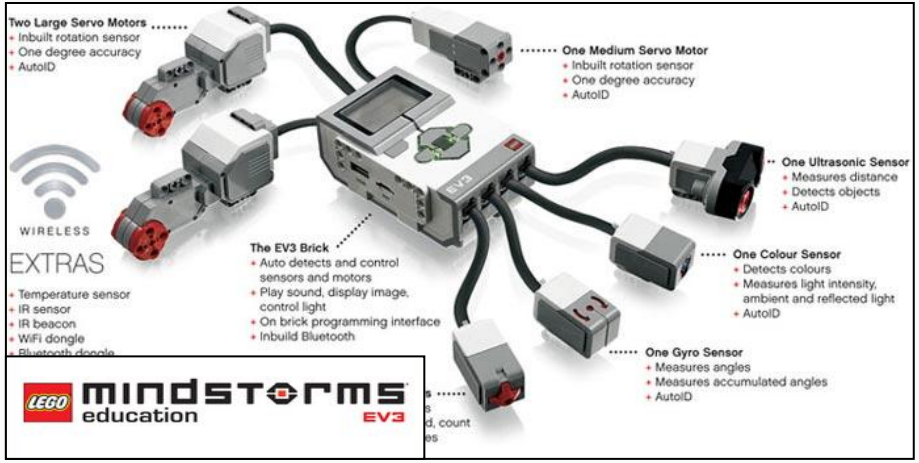


EV3–Interface Communications (Demos)





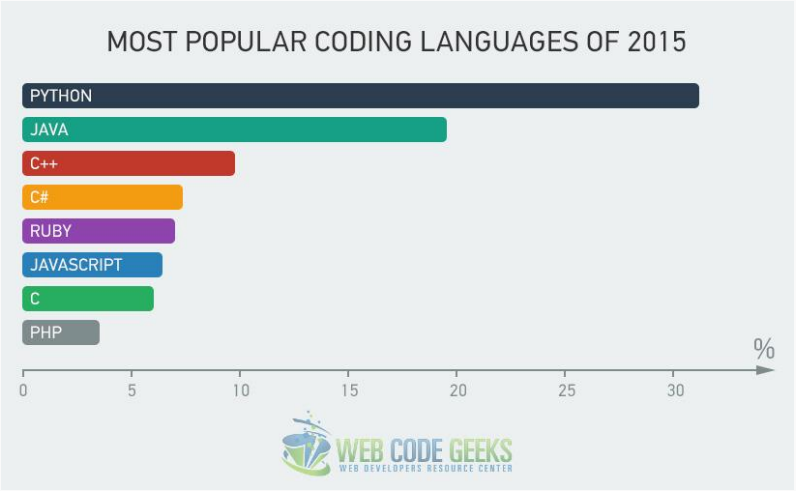
IoT with LEGO MINDSTORMS EV3



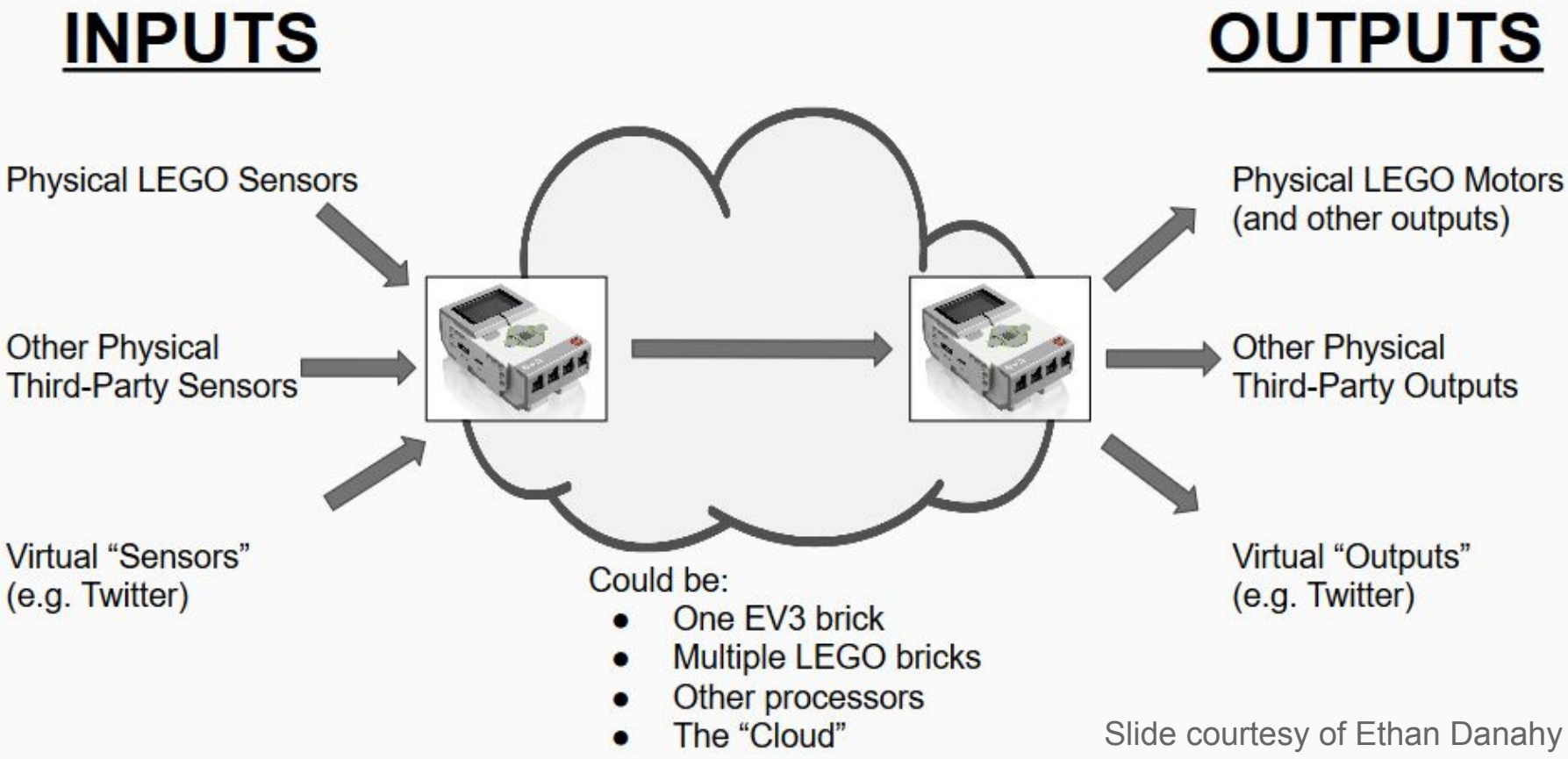
- Out-of-the-box EV3 capabilities:

Why change the EV3?

A. Option to program in Python
B. Expanded capabilities of the EV3

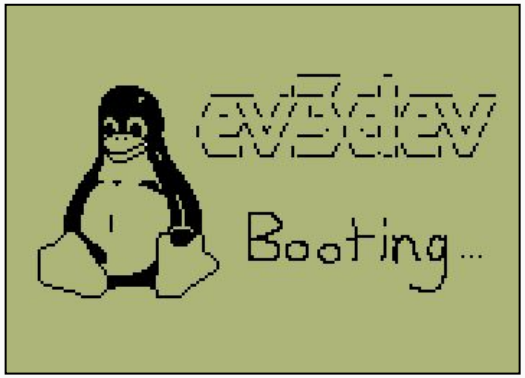


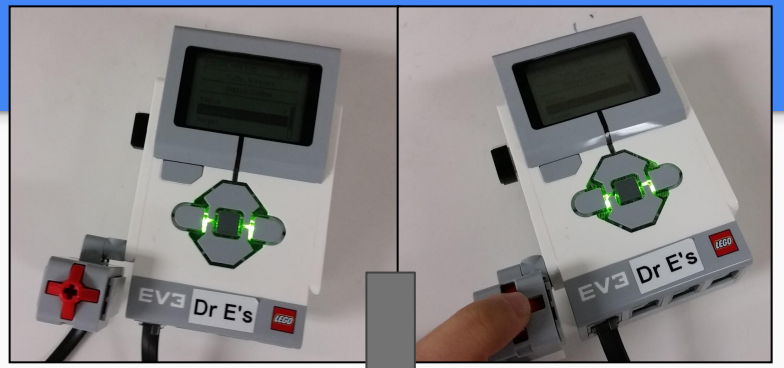
New Capabilities of the IoT-Capable EV3



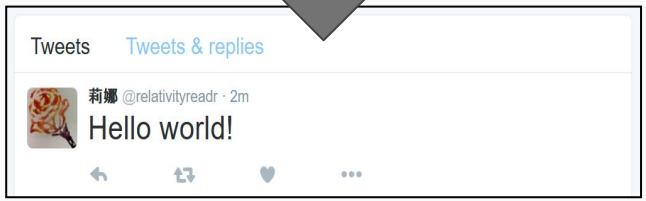
Slide courtesy of Ethan Danahy

IoT with EV3 (via Python)



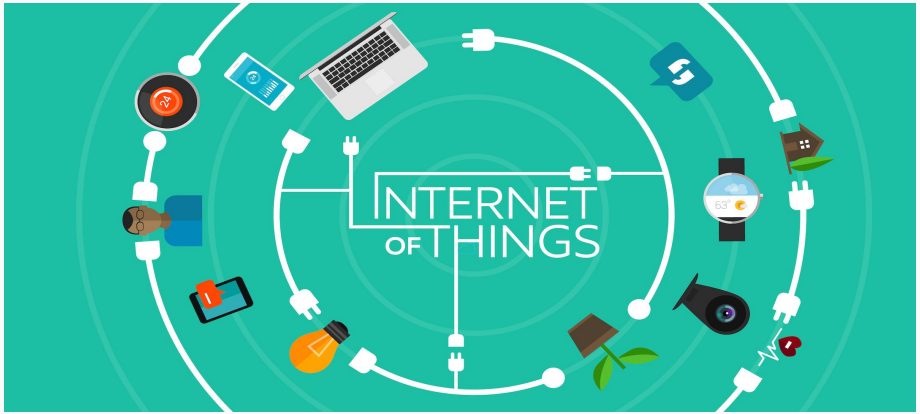


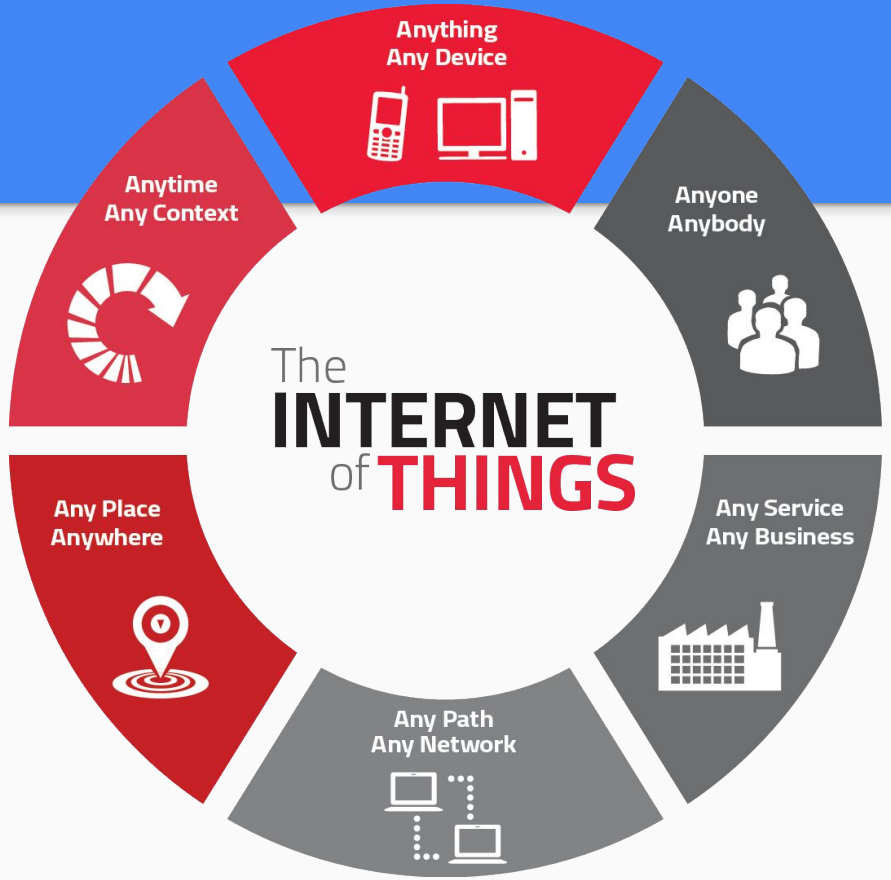

```
robot@ev3dev:~/Testing$ python TwitterBot.py
What message would you like to post? : Hello world!
```



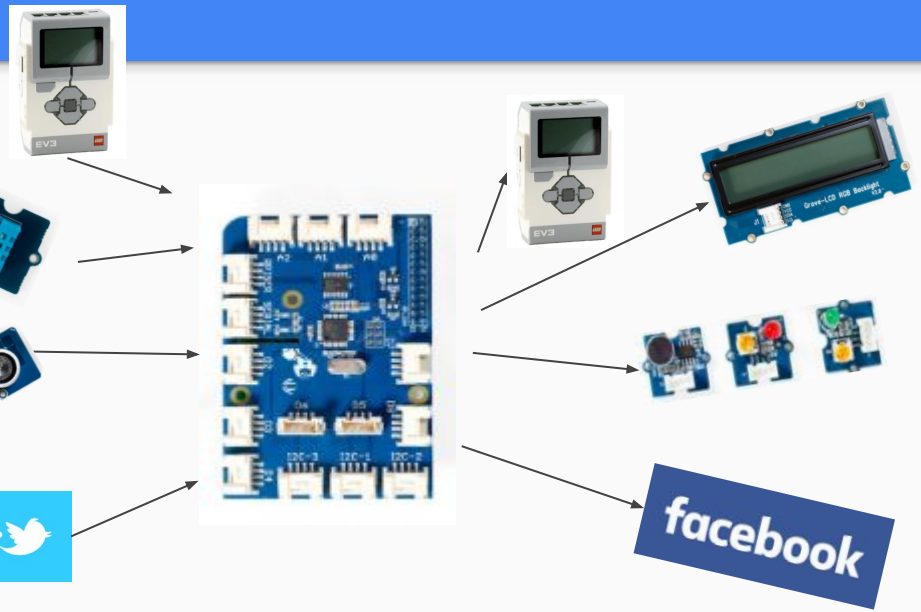
The Importance of IoT

- Combines the Physical and Virtual worlds
- Two-way Data Stream





IoT with GrovePi



INPUTS

- Physical GrovePi Sensors
- Virtual “Sensors”

OUTPUTS

- Physical GrovePi Sensors
- Virtual Outputs

EXAMPLE VIDEO: https://youtu.be/KWlcQqoKCoU

- Expanding the Internet of Things
- Can connect to IoT-Capable EV3

Future Goals

- Delegate processing to EV3 Intelligent Brick for faster run-speed.
- Add support for inter-device communication over WiFi (multiple EV3 robots able to use each-other's sensor data)
- Include Boolean Logic (AND, OR, NOR, etc.) to allow for more complex programs.
- Merge Prototype Interfaces
- Extend compatibility to more systems (beyond EV3, GrovePi)

More Information

- Project details website (NOTE: viewable by invitation only):
  - https://sites.google.com/site/discoverylabforlegoeducation/event-driven-ev3
  - https://sites.google.com/site/discoverylabforlegoeducation/python-programming-ev3
- GitHub Repositories:
  - https://github.com/CEEO-DrEsLab/event-driven – Interface and Communications
  - https://github.com/CEEO-DrEsLab/IoT – EV3 and GrovePi
- For more information or for access to the Google Site:
  - Ethan Danahy – ethan.danahy@tufts.edu

Image Credits

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https://www.webcodegeeks.com/web-development/become-web-developer/

http://www.slideshare.net/MsWillcox/event-driven-programming-amazeballs

http://tblocks.com/internet-of-things/

https://datafloq.com/read/internet-of-things-angels-and-demons/1134

http://www.dexterindustries.com/grovepi/