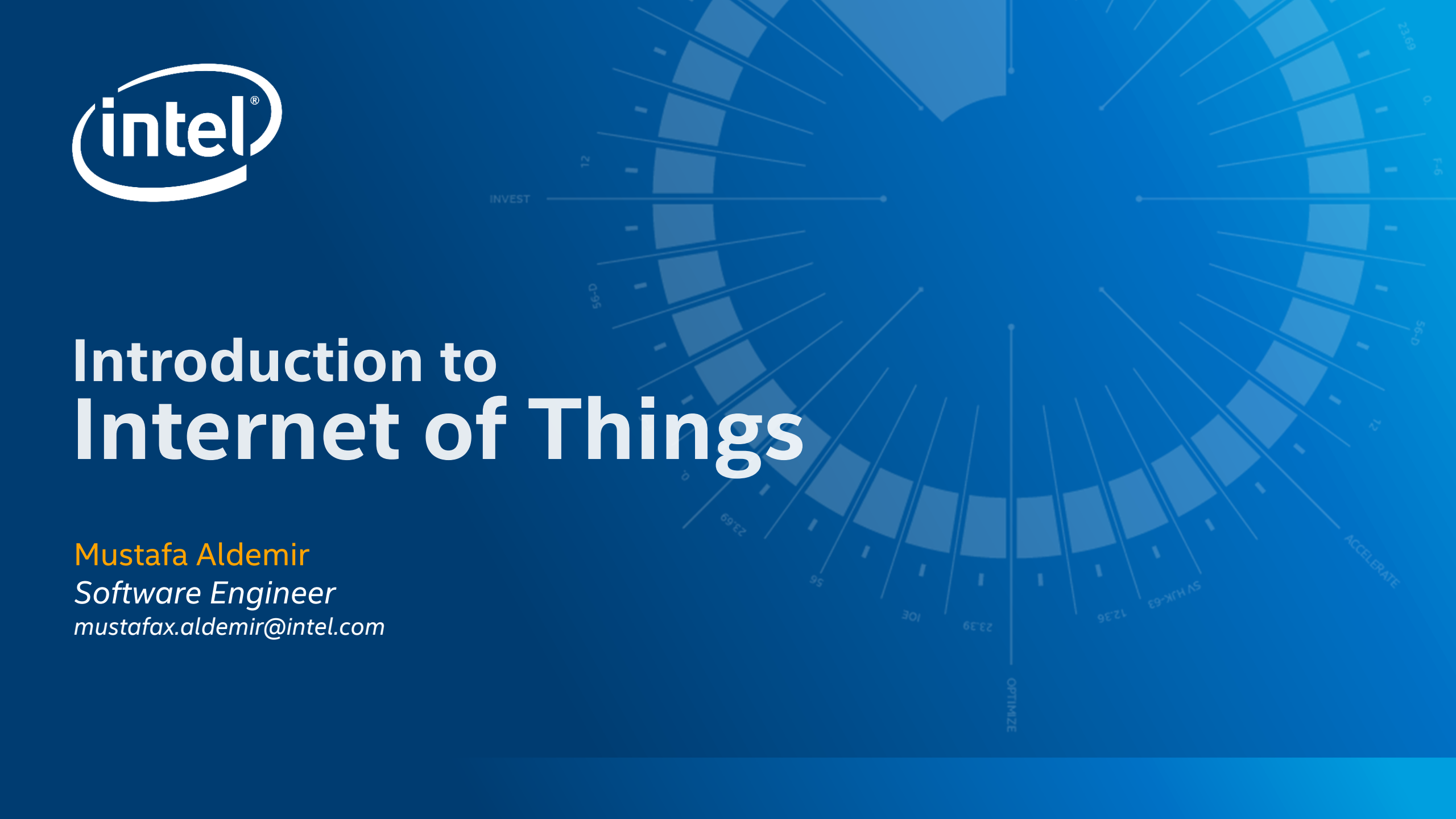

Introduction to Internet of Things

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SECTION 1: INTRODUCTION

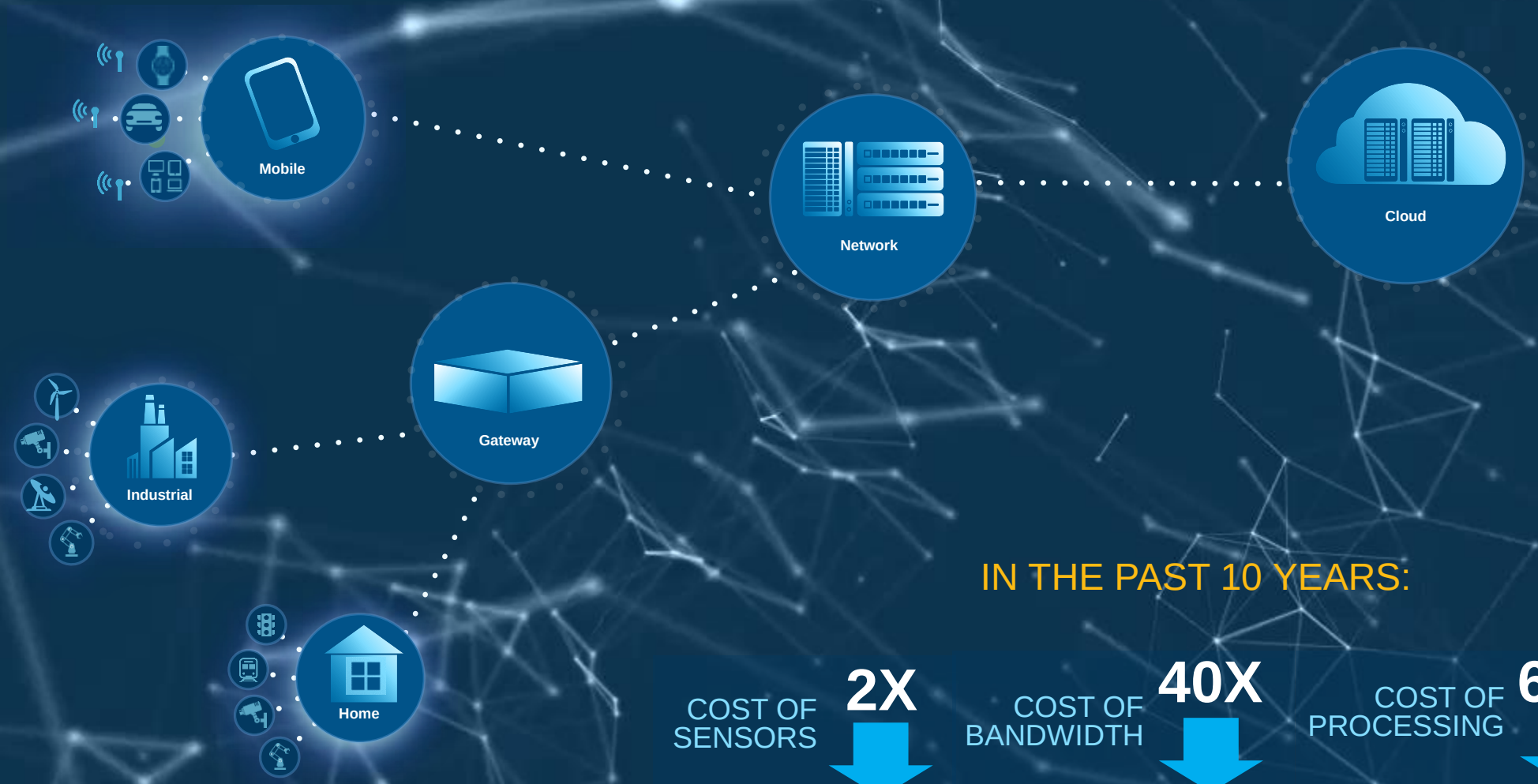
The Internet of Things, by 2020...

50B
DEVICES[1]

212B
Sensors

44
ZETABYTES[2]

85%
UNCONNECTED[4]



IN THE PAST 10 YEARS:

COST OF SENSORS **2X**

COST OF BANDWIDTH **40X**

COST OF PROCESSING **60X**

1.IDC
2.MC/EDC: The Digital Universe of Opportunities
3.Goldman Sachs
4.IMS Research

NEED FOR IOT

The Internet of Things (IoT) is fueling innovation across a range of industries to optimize processes and increase efficiency.

Greater efficiency for HVAC systems, which account for 41% of U.S. building energy use.[1]

SMART BUILDING

Energy use monitoring; sensors in heaters and chillers to find inefficiencies

Supermarket cost-to-sales ratios can be reduced 2% by automatic checkout.[2]

RETAIL

Point of sale, vending machines, supply chain

IoT can optimize energy grids, which lose ~6% during transmission and distribution.3

ENERGY

Environmental data logging, substation monitoring, grid efficiencies

Manufacturers using IoT report 82% increased efficiency and 49% fewer defects.4

INDUSTRIAL & MANUFACTURING

Assembly-line equipment reporting, inventory management; automation

Enhanced driver coaching can save nearly 7% on fuel costs.5

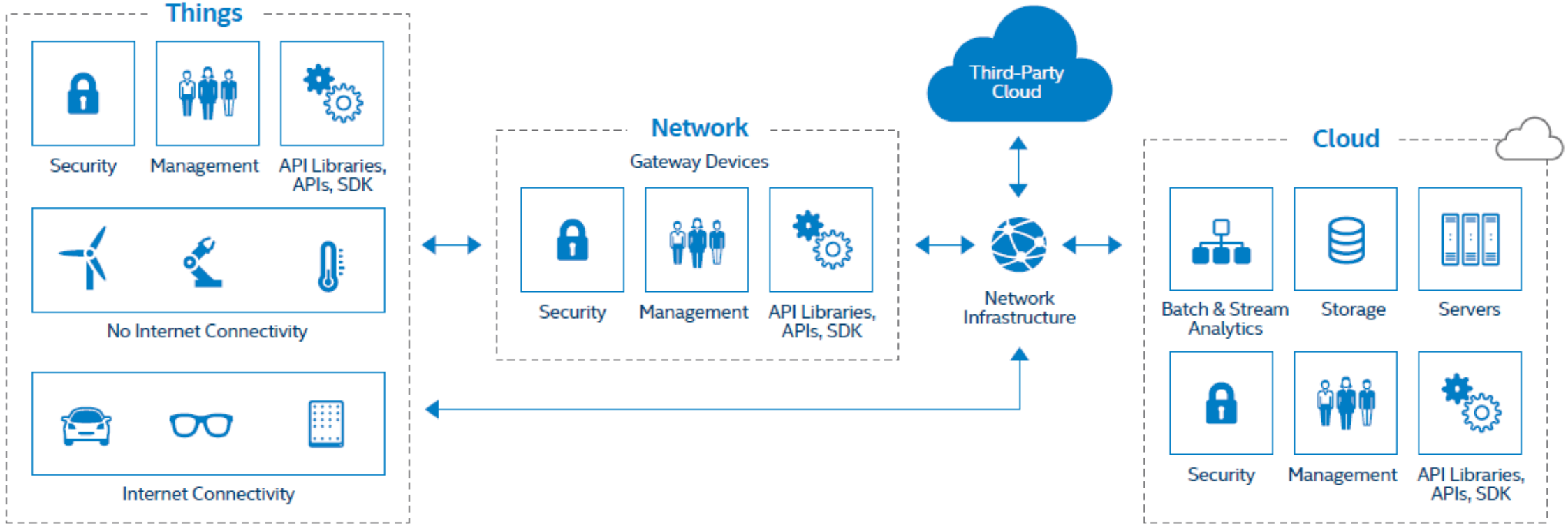
TRANSPORTATION

Fleet management, freight tracking, urban congestion management

1. *Research & Development Roadmap for Emerging HVAC Technologies*. U.S. Department of Energy (October 2014).
2. *The 'Internet of Things' Is Now, Connecting the Real Economy*. Morgan Stanley (April 3, 2014).
3. How much electricity is lost in transmission and distribution in the United States? U.S. Energy Information Administration (April 6, 2016).
4. "How Manufacturers Use IoT for Operational Efficiencies." *Industry Week* (October 21, 2015).
5. Tech Today Video Series Episode 3: Vnomics. Intel (March 4, 2014).

INTEL® IOT PLATFORM

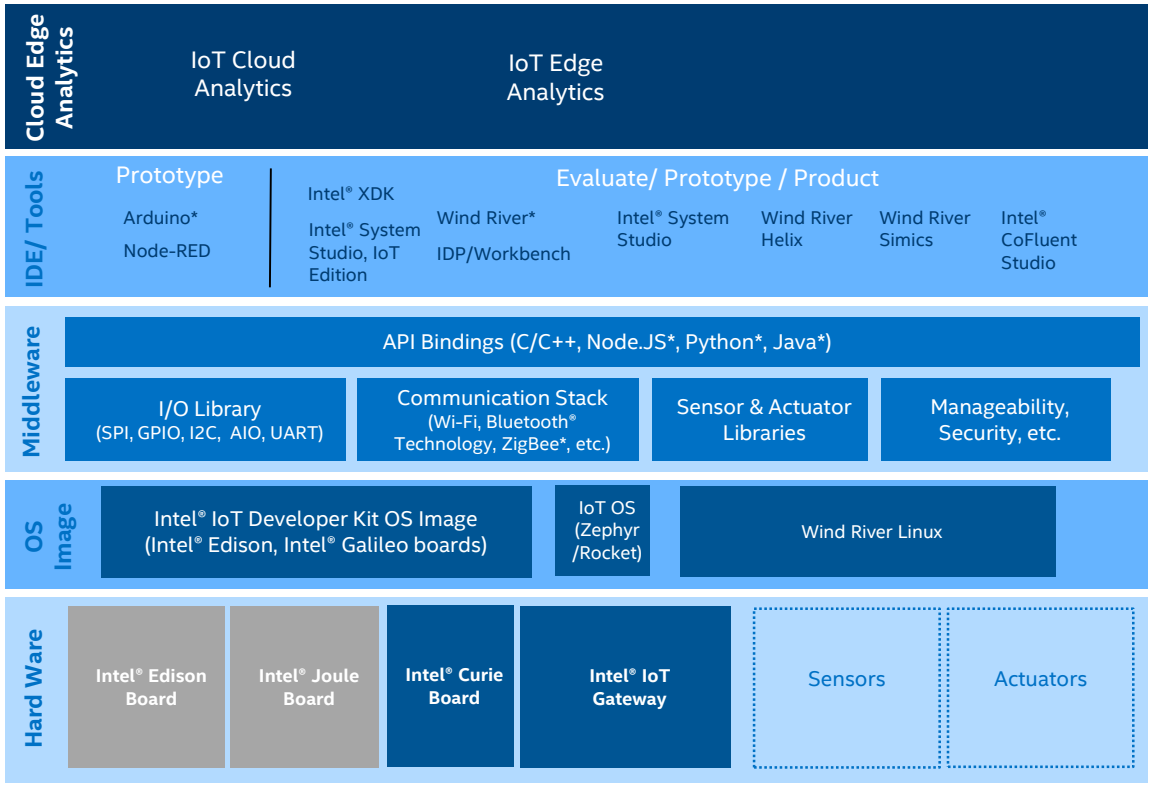
Endpoints, Gateways, Networks, and Cloud



INTEL® IOT DEVELOPER KIT

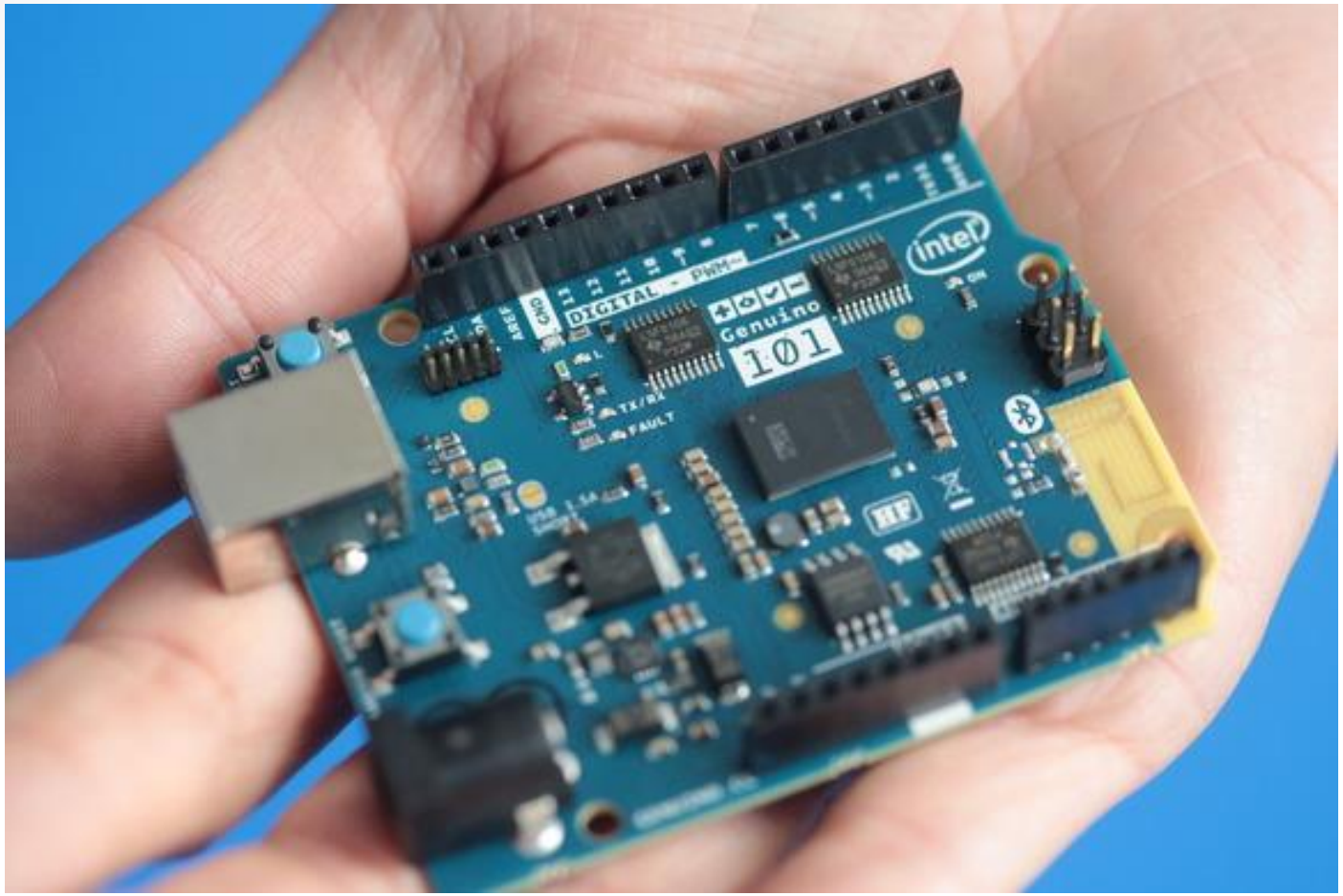
- Supports Intel® IoT Gateways, Intel® Edison, Intel® Joule & Intel MCU
- Middleware libraries for interacting sensors, actuators
- IDEs and tools to create, run, debug and optimize IoT solutions
- Arduino, C/C++, JavaScript, Python, and Java programming language support
- Advanced power & performance optimization tools
- Examples with Wind River Helix Cloud
- Deep hardware and software insights to speed up development, testing and optimization
- IoT cloud and edge analytics for data collection, visualization, and analytics

https://software.intel.com/en-us/iot/hardware/devkit

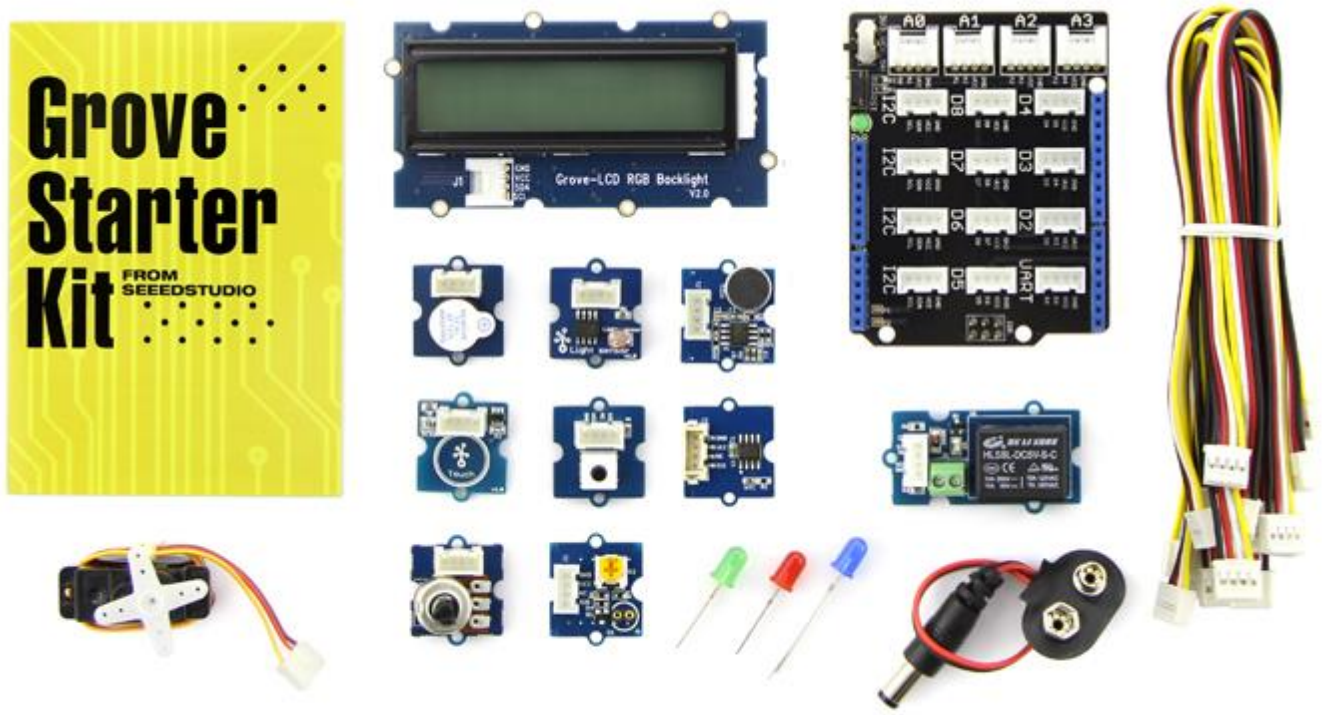


INTEL® IOT GATEWAY

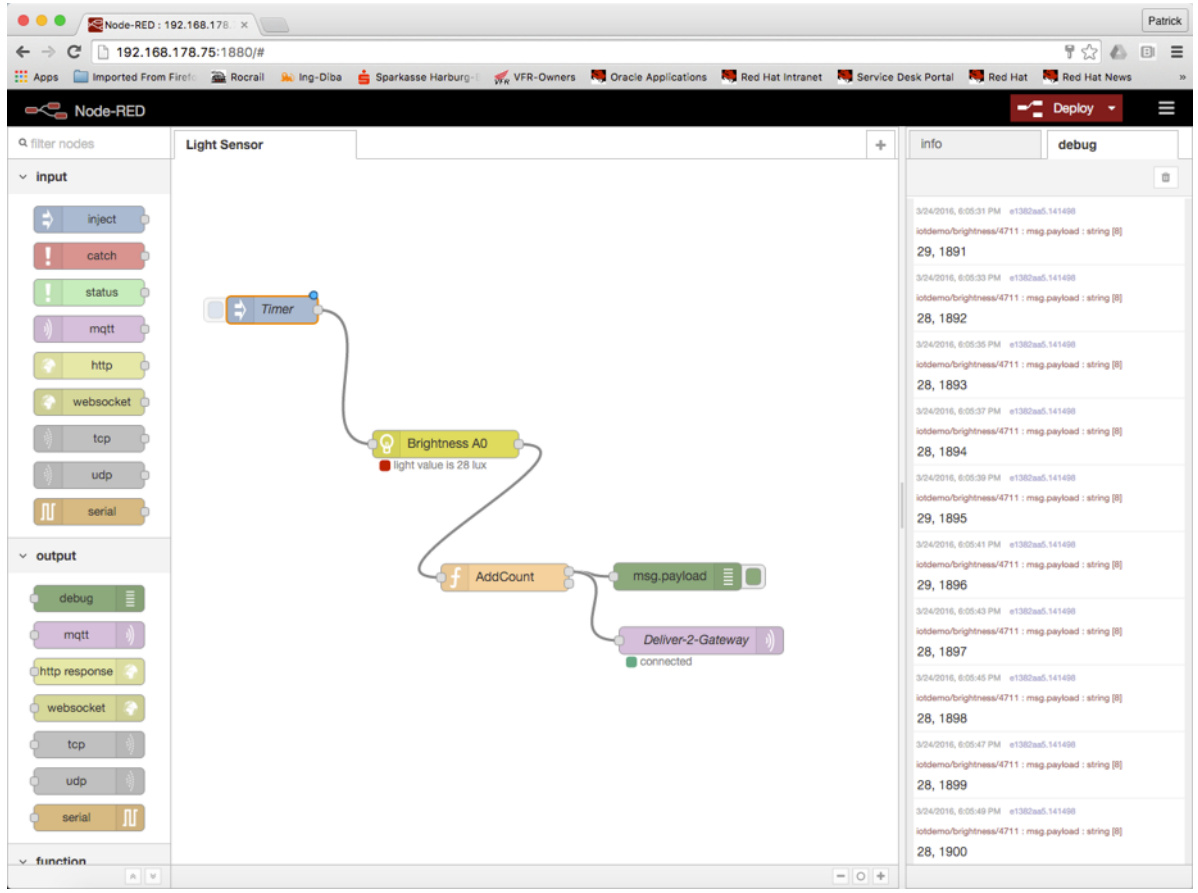
ARDUINO 101 (GENUINO 101)



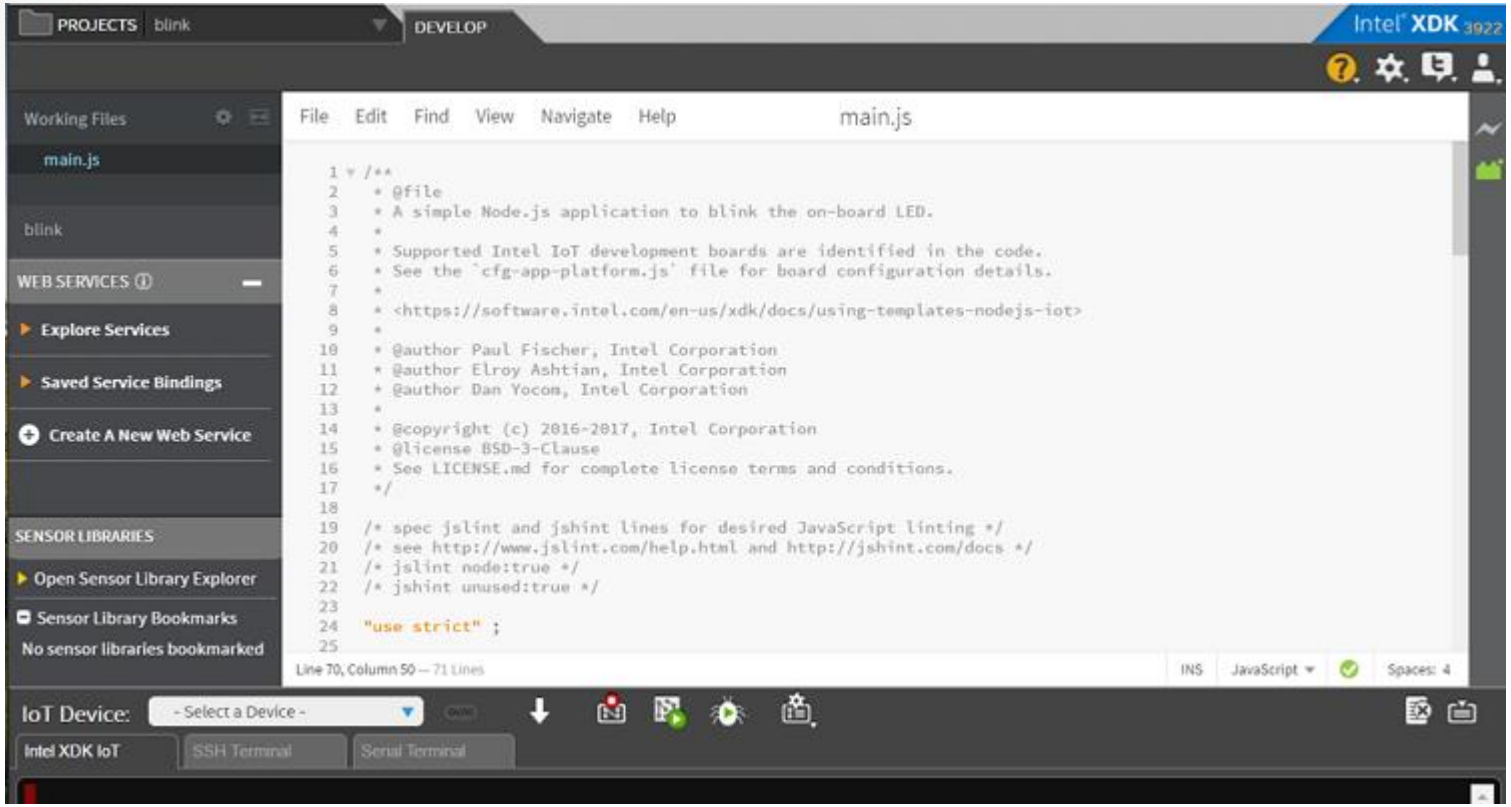
GROVE KIT


Grove
Starter
Kit
FROM
SEEEDSTUDIO
Grove-LCD RGB Backlight
V2.0
A0
A1
A2
A3
I2C
D8
D1
D7
D3
D6
D2
D5
UART

NODE-RED


Node-RED : 192.168.178
Patrick
192.168.178.75:1880/#
Apps
Imported From Firefo
Rocrail
Ing-Diba
Sparkasse Harburg-
VFR-Owners
Oracle Applications
Red Hat Intranet
Service Desk Portal
Red Hat
Red Hat News
Node-RED
Deploy
filter nodes
input
inject
catch
status
mqtt
http
websocket
tcp
udp
serial
output
debug
mqtt
http response
websocket
tcp
udp
serial
function
Light Sensor
Timer
Brightness A0
light value is 28 lux
AddCount
msg.payload
Deliver-2-Gateway
connected
info
debug
iotdemo/brightness/4711 : msg.payload : string [8]
29, 1891
28, 1892
28, 1893
28, 1894
29, 1895
29, 1896
28, 1897
28, 1898
28, 1899
28, 1900

INTEL® XDK


PROJECTS blink
DEVELOP
Intel XDK 3922
Working Files
main.js
blink
WEB SERVICES
Explore Services
Saved Service Bindings
Create A New Web Service
SENSOR LIBRARIES
Open Sensor Library Explorer
Sensor Library Bookmarks
No sensor libraries bookmarked
File Edit Find View Navigate Help
main.js
1 /**
2 * @file
3 * A simple Node.js application to blink the on-board LED.
4 *
5 * Supported Intel IoT development boards are identified in the code.
6 * See the 'cfg-app-platform.js' file for board configuration details.
7 *
8 * <https://software.intel.com/en-us/xdk/docs/using-templates-nodejs-iot>
9 *
10 * @author Paul Fischer, Intel Corporation
11 * @author Elroy Ashtian, Intel Corporation
12 * @author Dan Yocom, Intel Corporation
13 *
14 * @copyright (c) 2016-2017, Intel Corporation
15 * @license BSD-3-Clause
16 * See LICENSE.md for complete license terms and conditions.
17 */
18
19 /* spec jslint and jshint lines for desired JavaScript linting */
20 /* see http://www.jslint.com/help.html and http://jshint.com/docs */
21 /* jslint node:true */
22 /* jshint unused:true */
23
24 "use strict" ;
25
Line 70, Column 50 — 71 Lines
INS
JavaScript
Spaces: 4
IoT Device:
- Select a Device -
Intel XDK IoT
SSH Terminal
Serial Terminal

MIDDLEWARE LIBRARIES

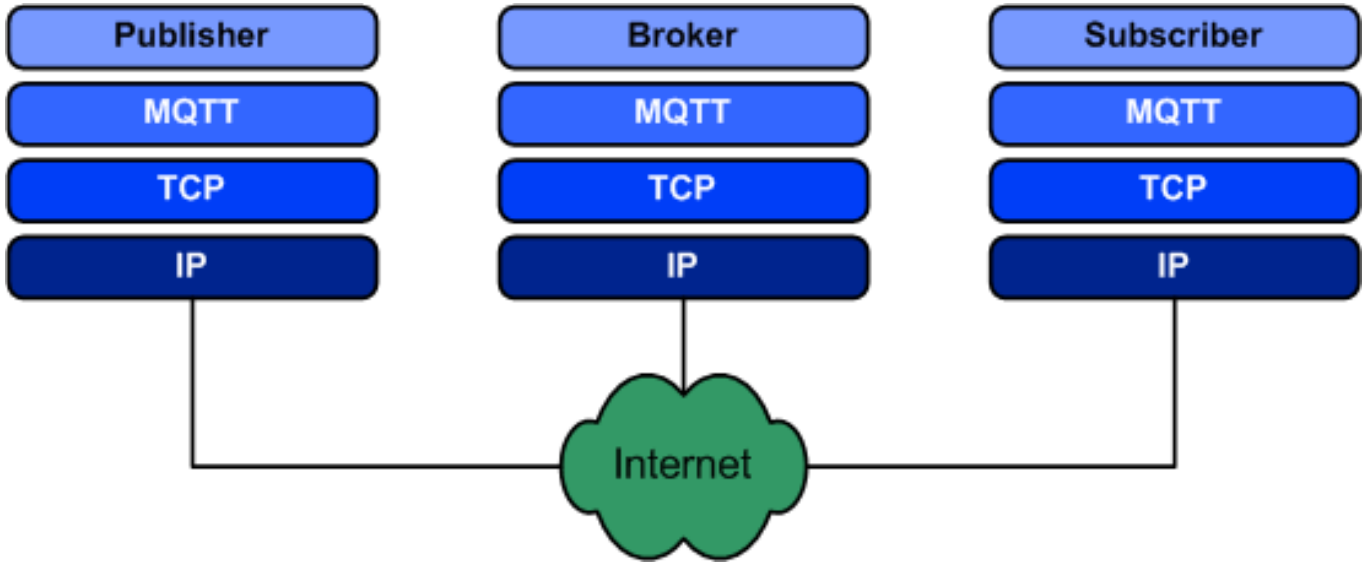
- **MRAA**
  - Interface with the I/O on your board
  - Developed in C/C++
  - Has bindings to JavaScript, Python, Java and C/C++
  - Open-source
  - Available on Github

  https://github.com/intel-iot-devkit/mraa

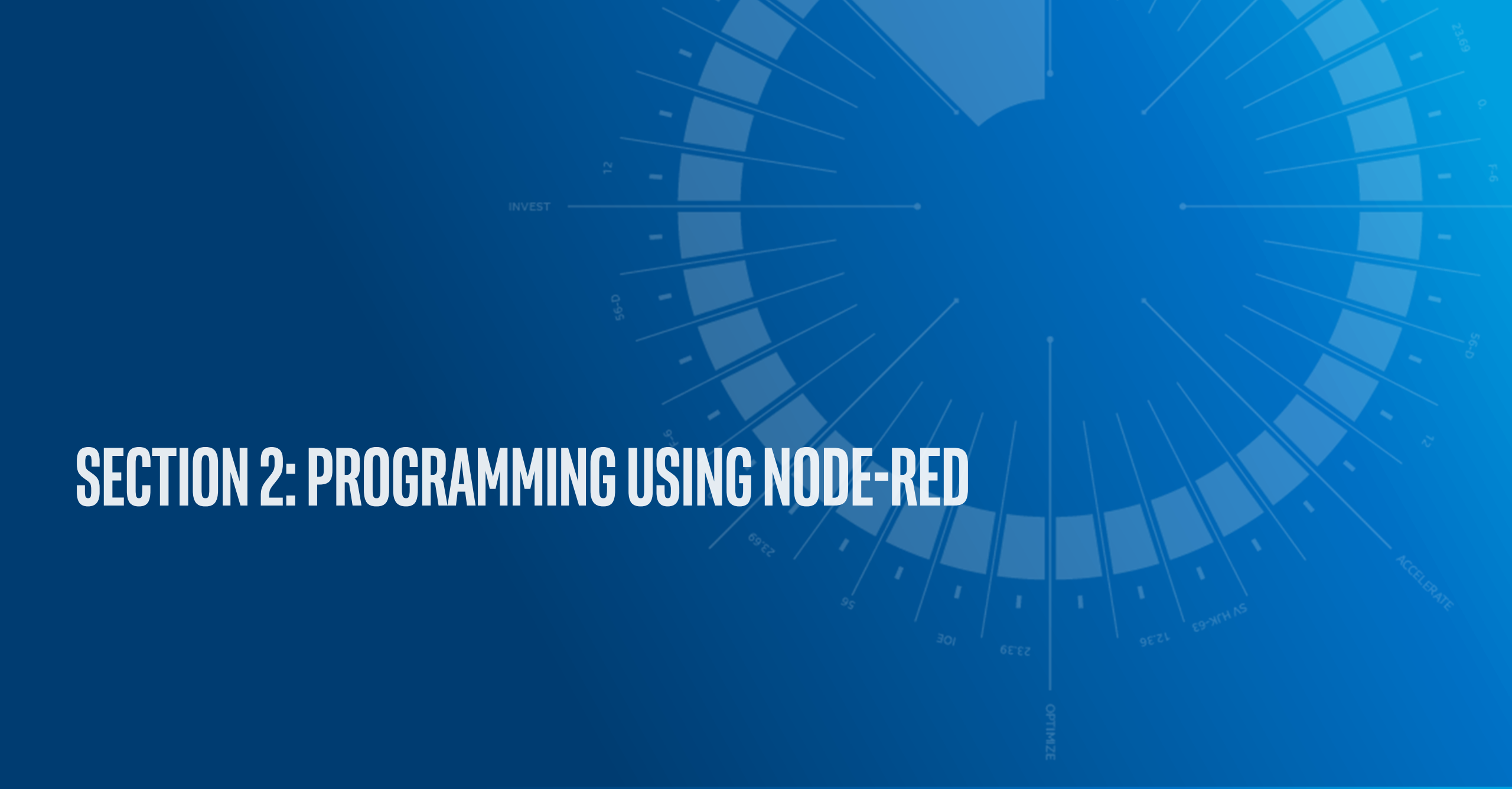
- **UPM**
  - High-level repository for I/O interfacing
  - Uses MRAA
  - Has bindings to JavaScript, Python, Java and C/C++
  - Open-source
  - Available on Github

  https://github.com/intel-iot-devkit/upm

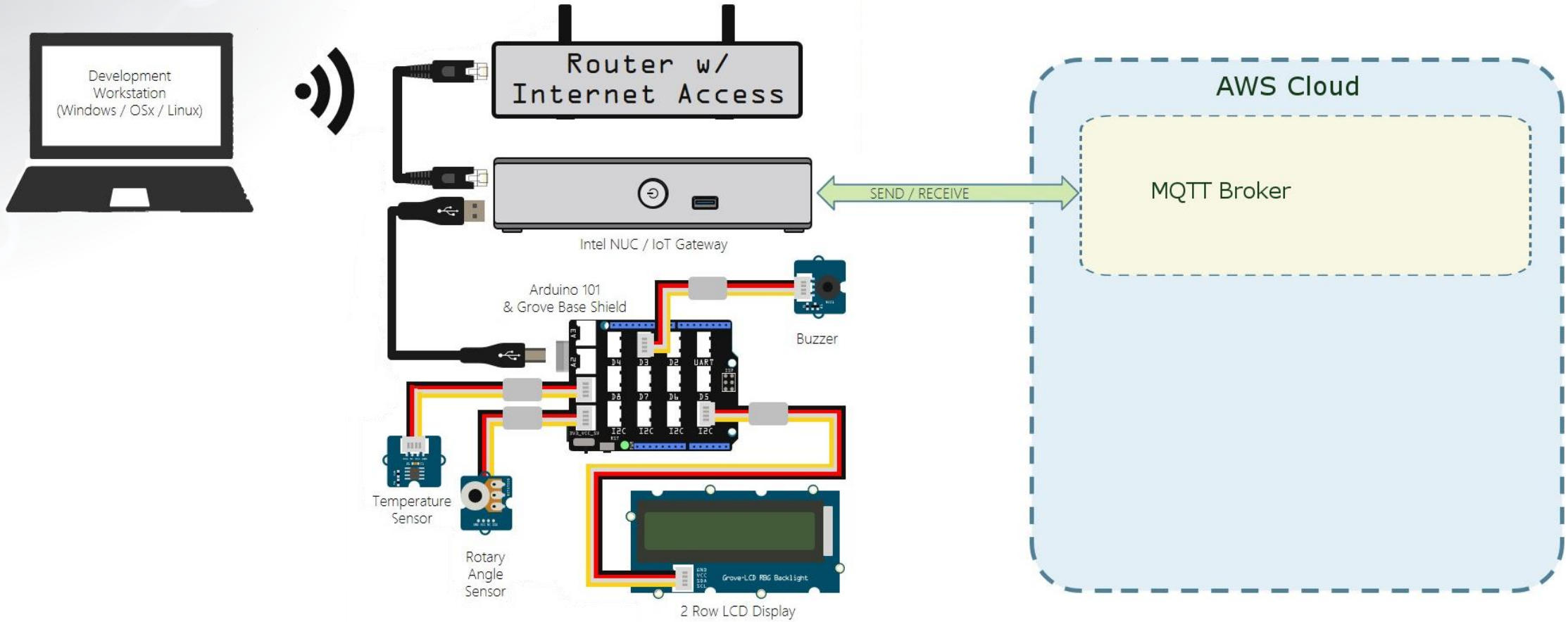
MQTT


Publisher
MQTT
TCP
IP
Broker
MQTT
TCP
IP
Subscriber
MQTT
TCP
IP
Internet

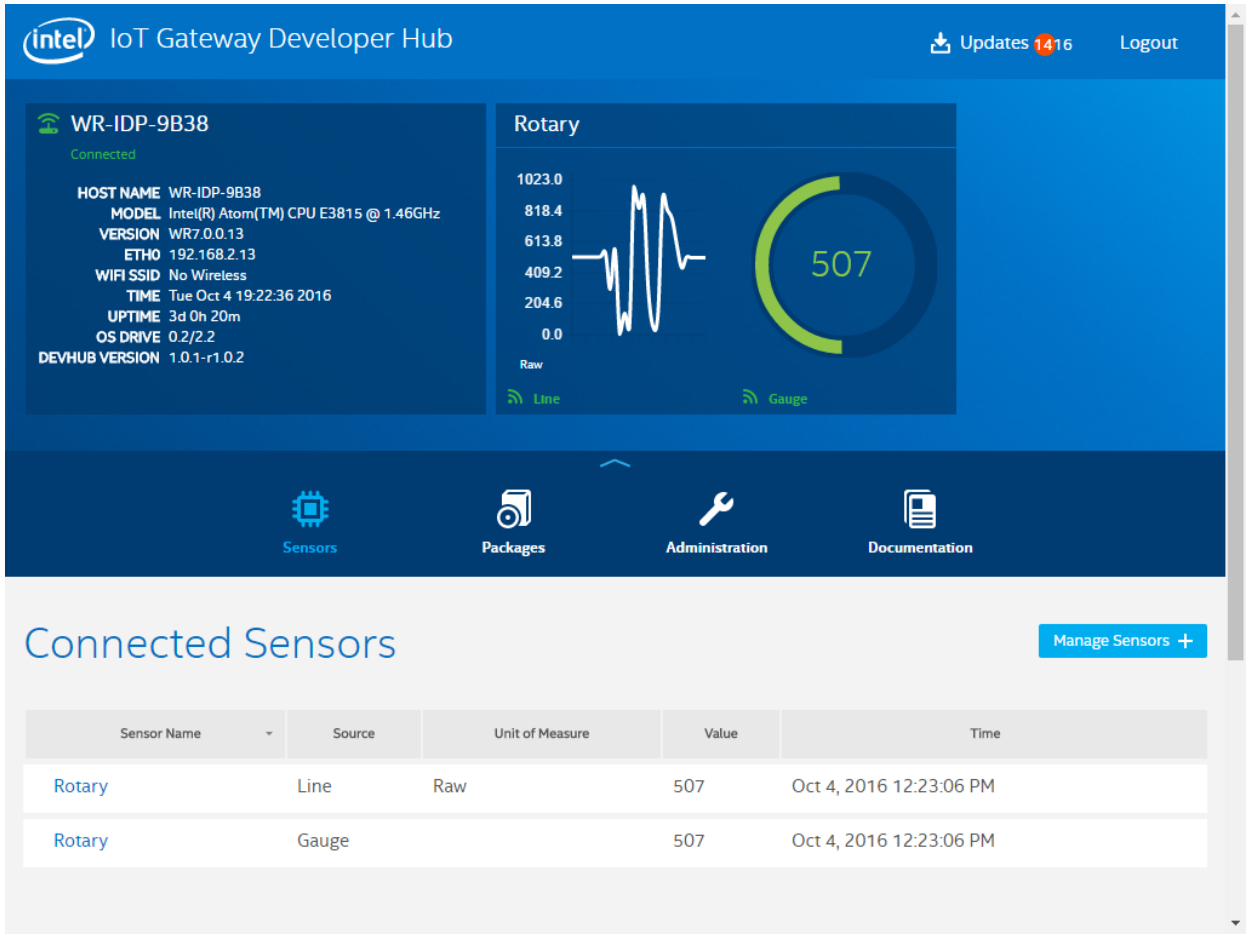
SECTION 2: PROGRAMMING USING NODE-RED



THE SETUP


Development
Workstation
(Windows / OSx / Linux)
Router w/
Internet Access
Intel NUC / IoT Gateway
SEND / RECEIVE
AWS Cloud
MQTT Broker
Arduino 101
& Grove Base Shield
Buzzer
Temperature
Sensor
Rotary
Angle
Sensor
2 Row LCD Display

INTEL IOT GATEWAY DEVELOPER HUB



NODE-RED PROGRAMMING

- Browser: Developer Hub http://192.168.6.141

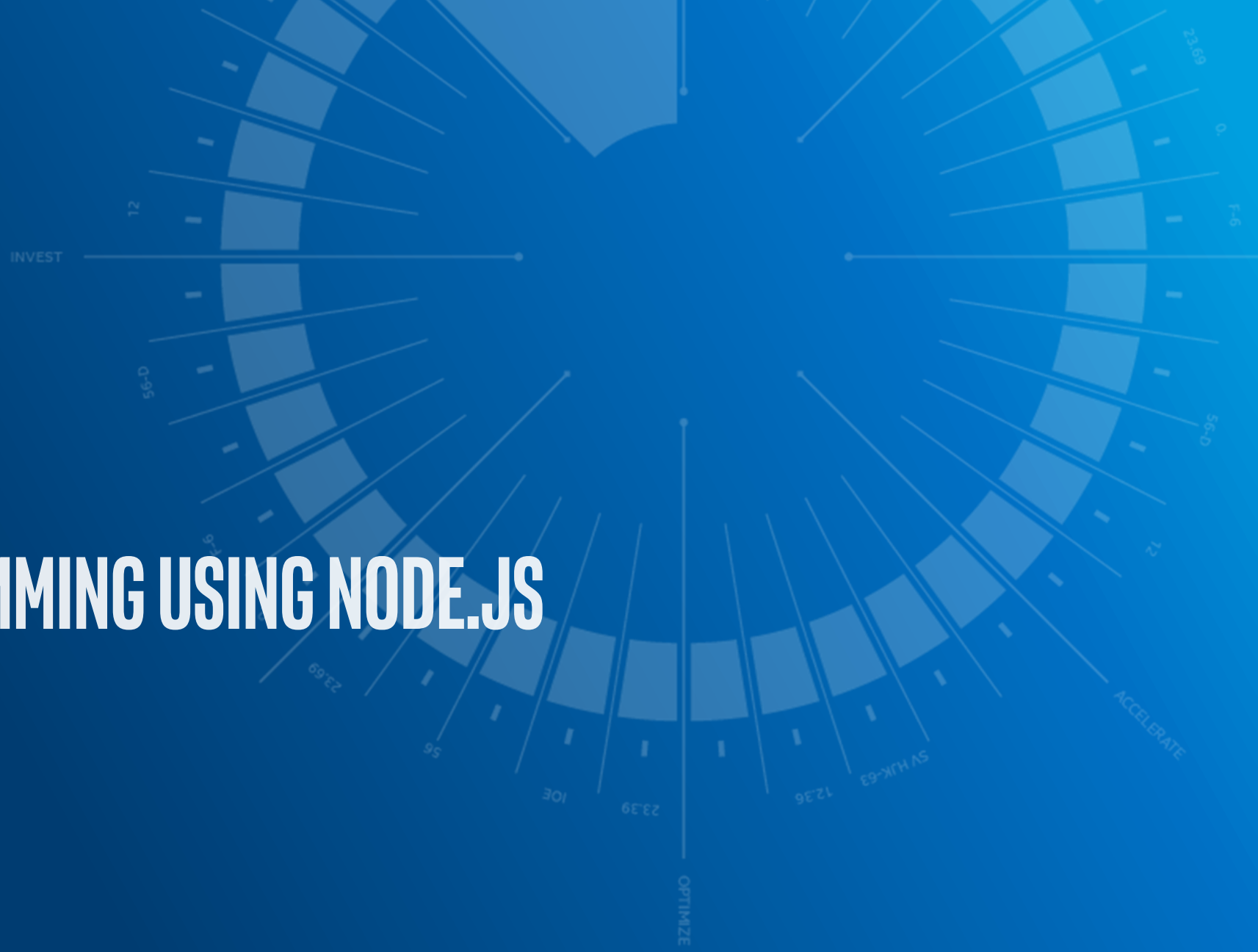
LAUNCHING AN AWS EC2 INSTANCE

- Browser: AWS Console http://console.aws.amazon.com

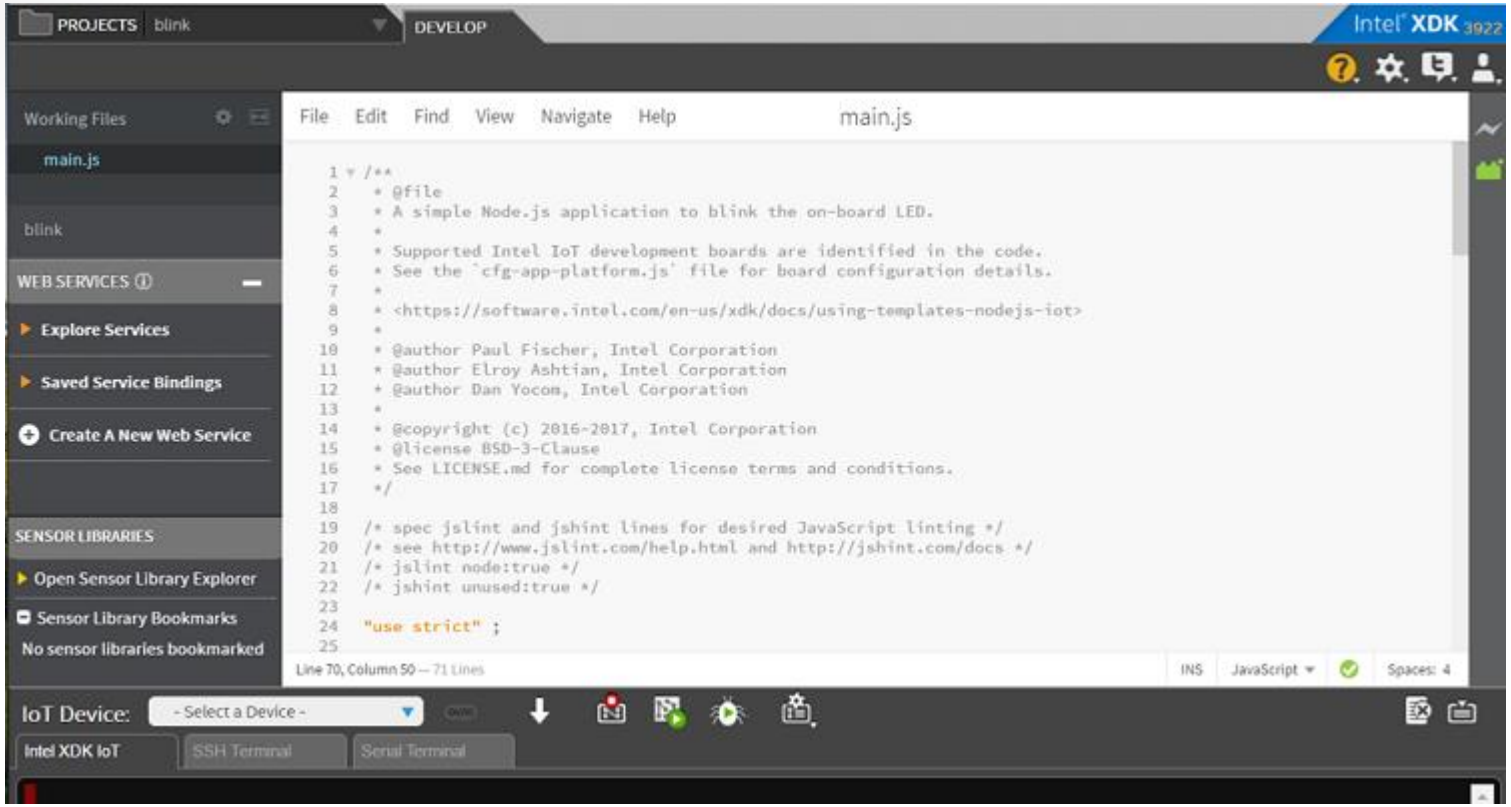
NODE-RED PROGRAMMING

- Browser: Developer Hub http://192.168.6.141

SECTION 3: PROGRAMMING USING NODE.JS



PROGRAMMING USING NODE.JS

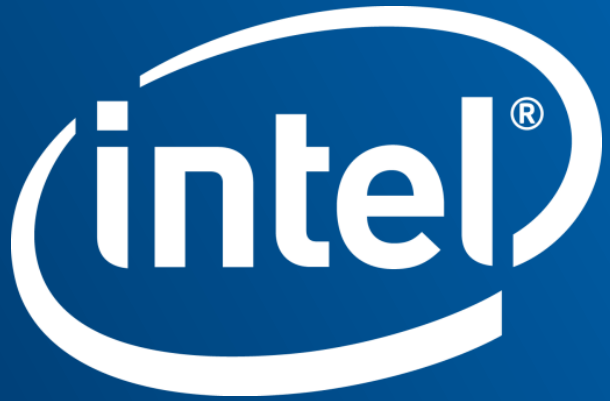


PROGRAMMING USING NODE.JS

- XDK:

PROGRAMMING USING NODE.JS

- XDK:


intel