### IoT programmalary näme?

IoT programmalary – bu, IoT enjamlaryndan gelýän maglumatlary dolandyrmak, seljermek we işlemek üçin döredilen programma üpjünçiligidir. Olar amallary awtomatlaşdyrmaga, ulgamlaryň işleýşini optimizirläp, birikdirilen obýektleriň akylly gözegçiligini üpjün etmäge mümkinçilik berýär. IoT programma üpjünçiligi diňe bir enjamlary dolandyrmak bilen çäklenmän, eýsem, işleriň netijeliligini ýokarlandyrmagy, çykdajylary azaltmagy we real wagtda çözgütleri durmuşa geçirmegi maksat edinýär.

Aşakda dürli ugurlarda ulanylýan iň meşhur IoT dolandyryş platformalary we programmalary görkezilýär:

### ****1. IoT Platformalary we Bulut Dolandyryş Ulgamlary:****

* **AWS IoT Core** – Amazon Web Services tarapyndan hödürlenýän IoT dolandyryş platformasy.
* **Microsoft Azure IoT Hub** – Microsoft-yň IoT enjamlaryny dolandyrmak we maglumatlary işläp taýýarlamak üçin platformasy.
* **Google Cloud IoT** – Google-yň IoT enjamlary üçin maglumat saklamak we işlemek platformasy.
* **IBM Watson IoT** – IBM-yň emeli intellekt bilen utgaşan IoT dolandyryş ulgamy.
* **Bosch IoT Suite** – Bosch-yň senagat we awtomatlaşdyryş üçin niýetlenen IoT platformasy.

### ****2. Ulag we Logistika Dolandyryş Programmalary:****

* **Geotab** – Ulag flotlaryny dolandyrmak we maglumat seljermek üçin ulanylýar.
* **Cisco Kinetic** – IoT enjamlarynyň maglumatlaryny birleşdirýän we işläp taýýarlamaga mümkinçilik berýän ulgam.
* **ThingWorx** – PTC tarapyndan hödürlenýän senagat IoT platformasy.

### ****3. Smart City we Smart Home Programmalary:****

* **Google Nest** – Akyllı öý ulgamlaryny dolandyrmak üçin platforma.
* **Samsung SmartThings** – Akyllı öý enjamlaryny birleşdirýän we dolandyrýan programma.
* **Siemens MindSphere** – Şäher infrastrukturasyny we senagat ulgamlaryny dolandyrmak üçin niýetlenen IoT platformasy.

### ****4. Senagat we Zawod Dolandyryş Ulgamlary:****

* **Siemens Industrial Edge** – Senagat awtomatizasiýasy üçin niýetlenen IoT platformasy.
* **Rockwell Automation FactoryTalk** – Zawodlaryň önümçilik proseslerini optimizasiýa etmek üçin ulanylýar.
* **Honeywell Forge** – Senagat ulgamlaryny IoT bilen utgaşdyryp, maglumatlary seljerýär we dolandyrýar.

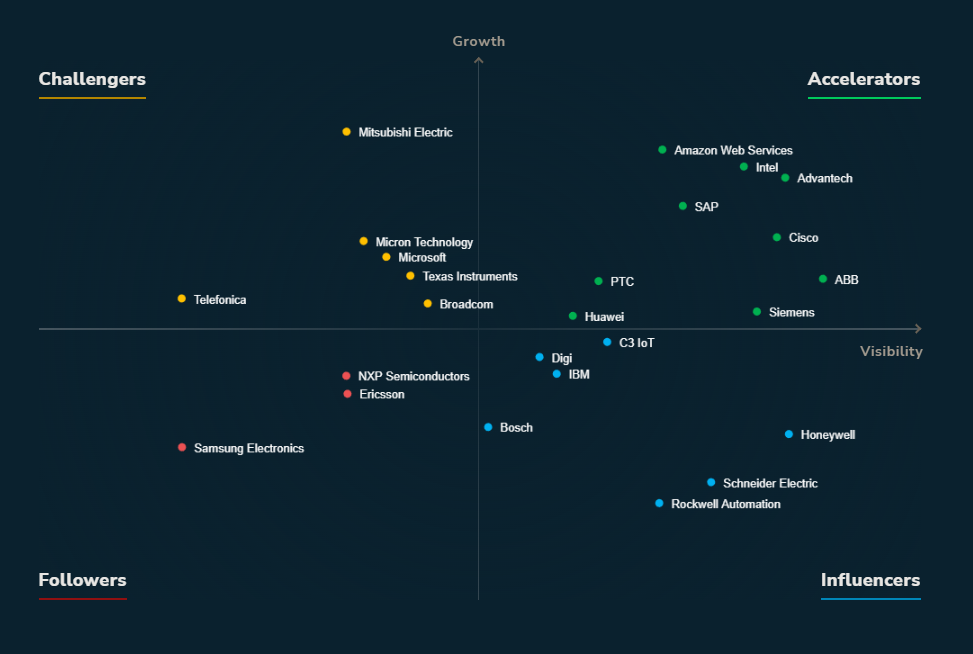
### ****5. Saglygy Goraýyş we Wearable IoT Programmalary:****

* **Apple HealthKit** – Apple enjamlary bilen saglyk maglumatlaryny toplamak we paýlaşmak üçin niýetlenen programma.
* **Google Fit** – Saglyk we fiziki işjeňlik maglumatlaryny saklamak üçin platforma.
* **Medtronic CareLink** – IoT arkaly ýürek ritmi we saglyk ýagdaýyny yzarlamak üçin ulanylýar

|  |  |  |  |
| --- | --- | --- | --- |
| **№** | **Platforma** | **Esasy aýratynlygy** | **Protokollar** |
| 1 | **AWS IoT Core** | Köpugurly bulut hyzmaty we güýçli howpsuzlyk (AWS IAM). | MQTT, HTTP, WebSockets, LoRaWAN |
| 2 | **Microsoft Azure IoT Hub** | Microsoft ekosystemasy bilen amatly integrasiýa (Azure ML, Power BI). | MQTT, AMQP, HTTPS |
| 3 | **Google Cloud IoT Core** | Ösen AI/ML mümkinçilikleri we Google Cloud-a göni integrasiýa. | MQTT, HTTP |
| 4 | **IBM Watson IoT** | AI arkaly dolandyrylýan IoT analitikasy we korporatiw howpsuzlyk. | MQTT, HTTP |
| 5 | **Cisco IoT Cloud Connect** | Senagat IoT we tor dolandyryşyna üns berilýär. | MQTT, CoAP, HTTP, WebSockets |
| 6 | **ThingWorx (PTC)** | Güýjli senagat IoT (IIoT) aýratynlyklary | MQTT, OPC-UA, REST, WebSockets |
| 7 | **Siemens MindSphere** | Senagat awtomatizasiýasy we Digital Twin mümkinçilikleri. | MQTT, OPC-UA, HTTPS |
| 8 | **GE Digital Predix** | Agyr senagat üçin bulutda ýerleşýän IIoT platformasy. | MQTT, OPC-UA, REST API |
| 9 | **Bosch IoT Suite** | Akylly senagat we baglanyşykly hereketlilik boýunça üns berilýär. | MQTT, CoAP, HTTP |
| 10 | **SAP Leonardo IoT** | SAP ERP bilen integrasiýa we analitika. | MQTT, AMQP, REST |
| 11 | **Oracle IoT Cloud** | Güýjli maglumat integrasiýa aýratynlyklary bolan korporatiw IoT platformasy. | MQTT, HTTP, CoAP |
| 12 | **HPE Universal IoT Platform** | Önümçilik sektorlarynda köpugurly IoT dolandyryşy. | MQTT, CoAP, LWM2M |
| 13 | **Ericsson IoT Accelerator** | Zellat IoT we telekomunikasiýa IoT çözgütleri. | MQTT, CoAP, HTTP |
| 14 | **Particle IoT** | Tez IoT prototipleşdirme we çäkli hasaplamalar üçin döredilen. | MQTT, CoAP, HTTPS |
| 15 | **Losant** | Az kody IoT programma taýýarlamak | MQTT, REST API, WebSockets |
| 16 | **Baidu IoT Core** | Hytaý bazarlary üçin AI integrirlenen IoT çözgütleri. | MQTT, HTTP, CoAP |
| 17 | **Tencent Cloud IoT** | Akylly şäherler bilen birleşdirilen güýçli bulut hasaplama mümkinçiligi. | MQTT, CoAP, HTTP |
| 18 | **Alibaba Cloud IoT** | Köpugurly IoT çözgütleri we güýçli AI analitikasy. | MQTT, CoAP, HTTP |
| 19 | **Arduino IoT Cloud** | Arduino enjamları bilen ýönekeý integrasiýa we tiz IoT ösüşi. | MQTT, HTTP, WebSockets |
| 20 | **Balena** | Kapsulalaşdyrylan IoT programma dolandyryşy. | MQTT, HTTP, WebSockets |
| 21 | **Kaa IoT** | Açyk çeşme IoT platformasy we elýeterli ýerleşdirmek mümkinçilikleri. | MQTT, CoAP, HTTP |
| 22 | **OpenRemote** | Açyk çeşme akylly şäherler we awtomatizasiýa IoT platformasy. | MQTT, HTTP, WebSockets |
| 23 | **Eclipse IoT (Kapua, Kura, we ş.m.)** | Açyk çeşme IoT ekosistemasy we köp sanly gurallar. | MQTT, CoAP, HTTP |
| 24 | **Samsung Artik Cloud** | Sarp ediji elektronikalara uly üns berýän IoT platformasy | MQTT, REST API, WebSockets |
| 25 | **Ayla Networks** | Akylly öý we senagat awtomatizasiýasy üçin IoT bulut platformasy. | MQTT, CoAP, HTTP |

**IoT programmalary beýleki programma üpjinçiliklerinden birnäçe özboluşly aýratynlyklara eýedir:**

1. **Dürli aragatnaşyk protokollaryny goldamak** – MQTT, CoAP, HTTP, LoRaWAN, Zigbee we ş.m.
2. **Uly göwrümli maglumatlar bilen işlemek** – maglumatlary real wagt režiminde işläp taýýarlamak, çaklamalar we awtomatlaşdyrmak üçin maşyn öwreniş tehnologiýalary.
3. **Howpsuzlyk talaplarynyň ýokary derejesi** – maglumatlary goramak, ulanyjylary şahsyýetlendirmek we hüjümleriň öňüni almak.
4. **Masştablaşdyryp bolýan arhitektura** – müňlerçe we millionlarça birikdirilen enjam bilen işlemek mümkinçiligi.
5. **Bulut hyzmatlary bilen integrasiýa** – AWS IoT, Azure IoT, Google Cloud IoT we ş.m.
6. **Çeýe sazlama mümkinçilikleri** – belli bir iş zerurlyklary üçin ýöriteleşdirilen konfigurasiýalar.



* *nji surat*

*IoT programmalarny hödürleýän kompaniýalar Gartner modelinde*

### ****IoT programma üpjünçiliginiň artykmaçlyklary****

1. **Netijeliligi ýokarlandyrmak:** Enjamlar we ulgamlaryň işini awtomatlaşdyryp, has ýokary netijeliligi gazanmak.
2. **Çykdajylary azaltmak:** Energiýa sarp edilişini we tehniki hyzmat çykdajylaryny azaltmak.
3. **Real wagt maglumatlary:** Maglumatlaryň çalt elýeterliligi we operasiýalaryň tizliginiň ýokarlanmagy.
4. **Has gowy müşderi tejribesi:** Akylly ulgamlaryň ulanylyşy müşderilere has amatly şertleri döredýär.
5. **Täze mümkinçilikleriň döremegi:** Täze iş ugurlarynyň we hyzmatlaryň döredilmegine ýol açýar.

### ****IoT programma üpjünçiliginiň kynçylyklary****

1. **Howpsuzlyk töwekgelçilikleri:** IoT ulgamlarynyň internet arkaly birikdirilmegi kiberhüjümlere sezewar bolup biler.
2. **Maglumatlaryň gizlinligi:** Ulgamlarda saklanýan şahsy we täjirçilik maglumatlarynyň goragly bolmagy möhüm meseleleriň biridir.
3. **Çylşyrymly maglumat dolandyryşy:** Uly göwrümli maglumatlaryň ýitgisiz saklanmagy we dolandyrylmagy tehniki kynçylyk döredip biler.
4. **Ulgamyň utgaşyklylygy:** Dürli görnüşdäki enjamlaryň we platformalaryň biri-biri bilen sazlaşykly işlemegi kyn bolup biler.

### ****IoT programma üpjünçiligi bilen baglanyşykly tehnologiýalar****

* **Bulut ulgamlary (Cloud Computing):** Maglumatlary saklamak we işlemek üçin ulanylýar.
* **Edge Computing:** Maglumatlary enjamlaryň özünde ýa-da has ýakyn serwerlerde işlemek.
* **Maşyn öwrenişi we süni intellekt:** IoT ulgamlaryndaky maglumatlary seljermek we näsazlyklaryň öňüni almak.
* **5G aragatnaşyk ulgamy:** IoT enjamlarynyň has çalt we durnukly aragatnaşygyny üpjün edýär.

IoT programma üpjünçiligi häzirki zaman tehnologiýasynyň iň möhüm bölekleriniň biri bolup, dünýä ykdysadyýetine uly täsir edýär. Türkmenistanyň önümçilik, oba hojalygy we şäher infrastrukturasyny döwrebaplaşdyrmakda IoT tehnologiýalaryny ulanyp, ösüşe goşant goşmagy mümkin.

**IoT platformalarynda ulanylýan prokollaryň artykmaçlyklary we kemçilikleri**

|  |  |  |
| --- | --- | --- |
| **Protokol** | **Artykmajlyklary** | **Kemçilikleri** |
| **Wi-Fi** | Ýokary tizlikde maglumat geçirýär.  Meşhur we giňden ulanylýar.  Azyk üpjünçiligi ýokary. | Köp energiýa sarp edýär.  Uzak aralykda işlemeýär. |
| **Bluetooth (BLE)** | Az energiýa sarp edýär.  Gysga aralykda ylalaşykly.  Arzan we giňden elýeterli. | Gysga aralyk çägi.  Maglumat geçiriş tizligi çäklidir. |
| **Zigbee** | Az energiýa sarp edýär.  Mesh torlary üpjün edýär.  Köp enjamlary birikdirmek üçin ýaramly. | Wi-Fi ýaly giňden ulanylmaýar. Maglumat geçiriş tizligi çäklidir. |
| **Z-Wave** | Az energiýa sarp edýär.  Mesh torlary üpjün edýär.  Wi-Fi bilen gatnaşykly däl. | Zigbee ýaly giňden ulanylmaýar. Bahasy birneme gymmat. |
| **LoRaWAN** | Uzak aralykda işleýär.  Az energiýa sarp edýär.  Köp enjamlary birikdirmek üçin ýaramly. | Maglumat geçiriş tizligi pes.  Infrastruktura gurmaly bolýar. |
| **MQTT** | Ýeňil we az trafik sarp edýär.  Köp enjamlary birikdirmek üçin ýaramly.  Asymmetrik baglanyşyklar üçin ýaramly. | Güýçli howpsuzlyk üpjünçiligi ýok.  Merkezi broker gerek. |
| **CoAP** | Az energiýa sarp edýär.  HTTP bilen ylalaşykly.  Ýeňil we çäklendirilen enjamlara laýyk. | Howpsuzlyk üpjünçiligi çäklidir.  UDP ulanylandygy üçin maglumat ýitgisi bolup biler. |
| **HTTP/HTTPS** | Meşhur we giňden ulanylýar. Howpsuzlyk üpjünçiligi ýokary (HTTPS). | Köp energiýa sarp edýär.  Çäklendirilen enjamlara ýaramly däl. |
| **AMQP** | Güýçli we ygtybarly maglumat geçiriş.  Köp platforma goldaw berýär. | Konfigurasiýasy çylşyrymly.  Köp energiýa sarp edýär. |
| **6LoWPAN** | IPv6 bilen işleýär.  Az energiýa sarp edýär.  Mesh torlary üpjün edýär. | Konfigurasiýasy çylşyrymly. Maglumat geçiriş tizligi çäklidir. |
| **NFC** | Gysga aralykda ylalaşykly.  Howpsuzlyk ýokary.  Az energiýa sarp edýär. | Gysga aralyk çägi.  Maglumat geçiriş tizligi pes. |
| **Sigfox** | Uzak aralykda işleýär.  Az energiýa sarp edýär. | Maglumat geçiriş tizligi pes.  Infrastruktura gurmaly bolýar. |
| **Thread** | Mesh torlary üpjün edýär.  IPv6 bilen işleýär.  Az energiýa sarp edýär. | Konfigurasiýasy çylşyrymly.  Giňden ulanylmaýar. |
| **NB-IoT** | Uzak aralykda işleýär.  Az energiýa sarp edýär.  GSM torlary bilen ylalaşykly. | Maglumat geçiriş tizligi pes.  Bahasy gymmat. |
| **Modbus** | Ýönekeý we giňden ulanylýar.  Köp enjamlary birikdirmek üçin ýaramly. | Howpsuzlyk üpjünçiligi ýok.  Maglumat geçiriş tizligi pes. |
| **OPC UA** | Güýçli we ygtybarly.  Köp platforma goldaw berýär. | Konfigurasiýasy çylşyrymly.  Köp energiýa sarp edýär. |

Bu tablisa, IoT protokollarynyň artykmajlyklary we kemçiliklerini umumy görnüşde görkezýär. Üstünlikli protokoly saýlamak üçin, ulgamyňyz üçin zerur bolan aýratynlyklary göz öňünde tutup saýlamak möhümdir.

### IoT programmalarynyň esasy kategoriýalary

Häzirki zaman IoT programmalary aşakdaky kategoriýalara bölünýär:

**Senagat IoT (IIoT)** – önümçilikde, energetikada, transportda we beýleki pudaklarda awtomatlaşdyrmak, monitoringlemek we enjamlaryň öňünden tehniki hyzmatyny amala aşyrmak üçin ulanylýar.

**Akylly öý (Smart Home)** – ýagtylygy, ýylylygy, howpsuzlyk ulgamlaryny we hojalyk enjamlaryny dolandyrmak üçin programmalar.

**Saglygy goraýyş (IoT lukmançylykda)** – geýilýän enjamlar, lukmançylyk datçikleri we uzakdan saglygy monitoringlemek ulgamlary.

**Logistika we transport** – GPS-yzarlamalar, awtopark dolandyryş ulgamlary we ýük daşamalaryny monitoringlemek.

**Akylly şäherler (Smart Cities)** – köçäniň yşyklandyrylyşyna, ulag infrastrukturasyna we çeşmeleri dolandyrmaga gözegçilik etmek.

**Oba hojalygy (AgriTech)** – awtomatlaşdyrylan suwaryş, toprak gözegçiligi we oba hojalyk tehnikasyny dolandyrmak.

**IoT-kyberhowpsuzlyk** – birikdirilen enjamlary goramak we kiberhüjümleriň öňüni almak üçin programmalar.

IoT programmalary birnäçe özboluşly aýratynlyklara eýedir:

**Dürli aragatnaşyk protokollaryny goldamak** – MQTT, CoAP, HTTP, LoRaWAN, Zigbee we ş.m.

**Uly göwrümli maglumatlar bilen işlemek** – maglumatlary real wagt režiminde işläp taýýarlamak, çaklamalar we awtomatlaşdyrmak üçin maşyn öwreniş tehnologiýalary.

**Howpsuzlyk talaplarynyň ýokary derejesi** – maglumatlary goramak, ulanyjylary şahsyýetlendirmek we hüjümleriň öňüni almak.

**Masştablaşdyryp bolýan arhitektura** – müňlerçe we millionlarça birikdirilen enjam bilen işlemek mümkinçiligi.

**Bulut hyzmatlary bilen integrasiýa** – AWS IoT, Azure IoT, Google Cloud IoT we ş.m.

**Çeýe sazlama mümkinçilikleri** – belli bir iş zerurlyklary üçin ýöriteleşdirilen konfigurasiýalar.

### IoT programma üpjünçiligi barada giňişleýin maglumat

**IoT (Internet of Things)**, türkmençe Zatlaryň Interneti diýlip atlandyrylýar, bu dürli fiziki enjamlaryň we sensorlaryň internet arkaly birikdirilip, maglumatlary alyş-çalşy etmek arkaly işlemeklige mümkinçilik berýär. IoT programma üpjünçiligi bolsa, şol enjamlaryň aragatnaşygyny üpjün edýän, maglumatlary ýygnap analiz edýän, dolandyryşy awtomatlaşdyrýan we tutuş ulgamy birleşdirýän esasy elementdir.

IoT programma üpjünçiligi diňe bir enjamlary dolandyrmak bilen çäklenmän, eýsem, işleriň netijeliligini ýokarlandyrmagy, çykdajylary azaltmagy we real wagtda çözgütleri durmuşa geçirmegi maksat edinýär.

### ****IoT programma üpjünçiliginiň düzümi****

IoT programma üpjünçiligi dürli böleklerden düzülýär. Onuň esasy düzümleri şu aşakdakylar bolup biler:

#### 1. **Maglumat ýygnamak we saklamak**

* IoT enjamlary köplenç real wagt maglumatlaryny (mysal üçin, temperatura, çyglylyk, hereket) ýygnamak üçin sensorlary ulanýarlar.
* Bu maglumatlar adatça IoT platformalaryna ýa-da bulut ulgamlaryna iberilýär.
* Maglumatlary saklamak üçin uly göwrümli maglumatlar bazasy (Big Data) tehnologiýasy ulanylýar.

#### 2. **Maglumat analitikasy**

* IoT programma üpjünçiligi ýygnalan maglumatlary analiz edýär.
* Analitika algoritmlary (mysal üçin, maşyn öwrenişi ýa-da süni intellekt) arkaly maglumatlardan peýdaly maglumatlary çykarmak mümkin.
* Mysal üçin, senagatda enjamlaryň näsazlygyny öňünden anyklamak üçin analitikany ulanyp bolýar.

#### 3. **Awtomatlaşdyrma we dolandyryş**

* IoT programma üpjünçiligi enjamlaryň işini awtomatlaşdyrýar. Mysal üçin, akylly öýlerde yşyklar we kondisionerler otagyň temperaturasyna ýa-da adamlaryň hereketine görä awtomatiki açylýar we öçýär.
* Bu ulgamlaryň dolandyrylyşy köplenç mobil programmalaryň ýa-da web interfeýsi arkaly amala aşyrylýar.

#### 4. **Howpsuzlyk we maglumat goragy**

* IoT ulgamlary, internet arkaly işleýändigi üçin, kiberhüjümlerden goragly bolmalydyr.
* Maglumatlaryň şifrlenmegi, ulanyjylaryň autentifikasiýasy (tassyklamasy), we ygtyýarly dolandyryş mehanizmleri IoT programma üpjünçiliginiň möhüm bölegidir.

#### 5. **Interfeýs (Ulanyjy üçin amatly görnüş)**

* IoT ulgamlaryny dolandyrmak üçin ulanylýan programma üpjünçiligi, ulanyjy üçin amatly we düşnükli bolmaly.
* Bu, köplenç mobil programmalaryň, web sahypalarynyň ýa-da sesli dolandyryş ulgamlarynyň (mysal üçin, Siri ýa-da Alexa) görnüşinde bolýar.

### ****IoT programma üpjünçiliginiň ulanylyş ugurlary****

IoT programma üpjünçiligi dürli pudaklarda ulanylýar. Onuň ulanylýan esasy ugurlary şulardan ybarat:

#### 1. **Akylly öýler we şahsy durmuş**

* Ýagtylyk we energiýa tygşytlamak: Akylly yşyklar we termostatlar.
* Öý howpsuzlygy: Kameralar, hereket sensorlary we gapy gulplarynyň uzakdan dolandyrylmagy.
* Akylly enjamlary dolandyrmak: Akylly ses enjamlary, telewizorlar we beýleki öý enjamlary.

#### 2. **Senagat we önümçilik**

* **Senagat IoT (IIoT)** önümçilikde enjamlaryň işini optimizasiýa etmek, önümçilik proseslerini awtomatlaşdyrmak we önümçilik desgalarynyň ýagdaýyny yzarlamak üçin ulanylýar.
* Önümçilik enjamlarynyň näsazlygyny öňünden anyklamak we tehniki hyzmat üçin maglumatlary ulanyp bolýar.

#### 3. **Oba hojalygy**

* Suwarmagyň awtomatlaşdyrylmagy: Ýerleriň çyglylygyny ölçäp, suwarmagy awtomatiki işledýän ulgamlaryň dolandyrylmagy.
* Hasyl önümçiligini optimizasiýa etmek üçin toprak we howa şertlerini seljermek.

#### 4. **Saglyk we lukmançylyk**

* Lukmançylyk enjamlarynyň uzakdan gözegçiligi: Mysal üçin, ýürek urşunyň tizligini ýa-da gan basyşyny ölçemek üçin enjamlar.
* Lukmanlara hassalaryň saglyk ýagdaýyny real wagtda yzarlamaga mümkinçilik berýär.

#### 5. **Logistika we transport**

* Ýükleriň ýerleşýän ýerini real wagtda yzarlamak.
* Ulaglaryň energiýa sarp edilişini we tehniki ýagdaýyny gözegçilikde saklamak.

#### 6. **Şäher infrastrukturalary**

* Akylyly şäher (Smart City) ulgamlary: Ulag hereketiniň dolandyrylmagy, energiýa tygşytlamak we howanyň hiline gözegçilik.

### ****IoT programma üpjünçiliginiň artykmaçlyklary****

1. **Netijeliligi ýokarlandyrmak:** Enjamlar we ulgamlaryň işini awtomatlaşdyryp, has ýokary netijeliligi gazanmak.
2. **Çykdajylary azaltmak:** Energiýa sarp edilişini we tehniki hyzmat çykdajylaryny azaltmak.
3. **Real wagt maglumatlary:** Maglumatlaryň çalt elýeterliligi we operasiýalaryň tizliginiň ýokarlanmagy.
4. **Has gowy müşderi tejribesi:** Akylly ulgamlaryň ulanylyşy müşderilere has amatly şertleri döredýär.
5. **Täze mümkinçilikleriň döremegi:** Täze iş ugurlarynyň we hyzmatlaryň döredilmegine ýol açýar.

### ****IoT programma üpjünçiliginiň kynçylyklary****

1. **Howpsuzlyk töwekgelçilikleri:** IoT ulgamlarynyň internet arkaly birikdirilmegi kiberhüjümlere sezewar bolup biler.
2. **Maglumatlaryň gizlinligi:** Ulgamlarda saklanýan şahsy we täjirçilik maglumatlarynyň goragly bolmagy möhüm meseleleriň biridir.
3. **Çylşyrymly maglumat dolandyryşy:** Uly göwrümli maglumatlaryň ýitgisiz saklanmagy we dolandyrylmagy tehniki kynçylyk döredip biler.
4. **Ulgamyň utgaşyklylygy:** Dürli görnüşdäki enjamlaryň we platformalaryň biri-biri bilen sazlaşykly işlemegi kyn bolup biler.

### ****IoT programma üpjünçiligi bilen baglanyşykly tehnologiýalar****

* **Bulut ulgamlary (Cloud Computing):** Maglumatlary saklamak we işlemek üçin ulanylýar.
* **Edge Computing:** Maglumatlary enjamlaryň özünde ýa-da has ýakyn serwerlerde işlemek.
* **Maşyn öwrenişi we süni intellekt:** IoT ulgamlaryndaky maglumatlary seljermek we näsazlyklaryň öňüni almak.
* **5G aragatnaşyk ulgamy:** IoT enjamlarynyň has çalt we durnukly aragatnaşygyny üpjün edýär.

IoT programma üpjünçiligi häzirki zaman tehnologiýasynyň iň möhüm bölekleriniň biri bolup, dünýä ykdysadyýetine uly täsir edýär. Türkmenistanyň önümçilik, oba hojalygy we şäher infrastrukturasyny döwrebaplaşdyrmakda IoT tehnologiýalaryny ulanyp, ösüşe goşant goşmagy mümkin.

**Введение в IoT-программы и их особенности**

### Что такое IoT-программы?

Интернет вещей (Internet of Things, IoT) представляет собой концепцию, при которой устройства, оснащенные датчиками и подключенные к сети, могут взаимодействовать друг с другом и с пользователями. IoT-программы – это программное обеспечение, разработанное для управления, анализа и обработки данных, поступающих от таких устройств. Они позволяют автоматизировать процессы, оптимизировать работу систем и обеспечивать интеллектуальный контроль над подключенными объектами.

### Основные категории IoT-программ

Современные IoT-программы можно классифицировать по следующим категориям:

**Промышленный IoT (IIoT)** – используется на производстве, в энергетике, транспорте и других сферах для автоматизации, мониторинга и прогнозного технического обслуживания оборудования.

**Умный дом (Smart Home)** – включает приложения для управления освещением, отоплением, системами безопасности и бытовыми приборами.

**Здравоохранение (IoT в медицине)** – носимые устройства, медицинские сенсоры и удаленные системы мониторинга здоровья.

**Логистика и транспорт** – GPS-трекеры, системы управления автопарками и мониторинг грузоперевозок.

**Умные города (Smart Cities)** – управление уличным освещением, транспортной инфраструктурой и ресурсами.

**Сельское хозяйство (AgriTech)** – автоматизированный полив, мониторинг почвы и управление сельскохозяйственной техникой.

**Кибербезопасность IoT** – программы для защиты подключенных устройств и предотвращения кибератак.

### Особенности IoT-программ

IoT-программы обладают рядом уникальных характеристик:

**Поддержка различных протоколов связи** – MQTT, CoAP, HTTP, LoRaWAN, Zigbee и др.

**Работа с большими объемами данных** – обработка информации в реальном времени, машинное обучение для прогнозов и автоматизации.

**Высокие требования к безопасности** – защита данных, аутентификация пользователей, предотвращение атак.

**Масштабируемость** – возможность работы с тысячами и миллионами подключенных устройств.

**Интеграция с облачными сервисами** – AWS IoT, Azure IoT, Google Cloud IoT и др.

**Гибкость настройки** – возможность кастомизации под конкретные бизнес-задачи.

Если вам нужно оценить вашу IoT-платформу, вот детализированный список категорий, по которым можно провести анализ:

### ****1. Функциональность****

* Поддержка различных типов устройств и протоколов (MQTT, CoAP, HTTP, LoRaWAN и др.)
* Возможность подключения и управления устройствами в реальном времени
* Поддержка аналитики и сбора данных
* Интеграция с облачными сервисами (AWS IoT, Azure IoT, Google Cloud IoT)

### ****2. Безопасность****

* Шифрование данных (TLS, AES и др.)
* Аутентификация и управление доступом (OAuth, JWT, сертификаты)
* Защита от DDoS-атак и вредоносного ПО
* Логирование и аудит событий

### ****3. Масштабируемость****

* Поддержка большого количества подключенных устройств
* Гибкость архитектуры (можно ли легко добавлять новые сервисы и функции)
* Возможность горизонтального и вертикального масштабирования

### ****4. Производительность****

* Задержки при передаче данных
* Скорость обработки событий
* Оптимизация энергопотребления устройств

### ****5. Пользовательский опыт и интерфейс****

* Удобство панели управления (UI/UX)
* Гибкость настройки дашбордов и отчетности
* Наличие мобильного приложения

### ****6. Интеграция и API****

* Поддержка RESTful и GraphQL API
* Возможность интеграции с внешними ERP, CRM, BI-системами
* Поддержка SDK для различных языков программирования

### ****7. Стоимость и экономическая эффективность****

* Ценовая модель (SaaS, лицензия, open-source)
* Стоимость внедрения и поддержки
* Окупаемость инвестиций (ROI)

### ****8. Поддержка и документация****

* Наличие технической документации и SDK
* Сообщество разработчиков и партнерская поддержка
* SLA и техническая поддержка

### ****9. Соответствие стандартам****

* Поддержка международных стандартов IoT (ISO/IEC 30141, OPC UA, OMA LWM2M)
* Соответствие требованиям GDPR, HIPAA (если используется в медицине)

Если вам нужно провести оценку IoT-платформы по этим критериям, можно составить матрицу и выставить баллы по каждому пункту. Хотите помощь с этим? 😊

<https://www.matellio.com/blog/top-iot-platforms/>

https://computools.com/top-iot-software-development-companies/

https://www.particle.io/iot-guides-and-resources/iot-protocols-and-standards/

https://www.g2.com/categories/iot-platforms

Aşakda dürli ugurlarda ulanylýan iň meşhur IoT dolandyryş platformalary we programmalary görkezilýär:

### ****1. IoT Platformalary we Bulut Dolandyryş Ulgamlary:****

* **AWS IoT Core** – Amazon Web Services tarapyndan hödürlenýän IoT dolandyryş platformasy.
* **Microsoft Azure IoT Hub** – Microsoft-yň IoT enjamlaryny dolandyrmak we maglumatlary işläp taýýarlamak üçin platformasy.
* **Google Cloud IoT** – Google-yň IoT enjamlary üçin maglumat saklamak we işlemek platformasy.
* **IBM Watson IoT** – IBM-yň emeli intellekt bilen utgaşan IoT dolandyryş ulgamy.
* **Bosch IoT Suite** – Bosch-yň senagat we awtomatlaşdyryş üçin niýetlenen IoT platformasy.

### ****2. Ulag we Logistika Dolandyryş Programmalary:****

* **Geotab** – Ulag flotlaryny dolandyrmak we maglumat seljermek üçin ulanylýar.
* **Cisco Kinetic** – IoT enjamlarynyň maglumatlaryny birleşdirýän we işläp taýýarlamaga mümkinçilik berýän ulgam.
* **ThingWorx** – PTC tarapyndan hödürlenýän senagat IoT platformasy.

### ****3. Smart City we Smart Home Programmalary:****

* **Google Nest** – Akyllı öý ulgamlaryny dolandyrmak üçin platforma.
* **Samsung SmartThings** – Akyllı öý enjamlaryny birleşdirýän we dolandyrýan programma.
* **Siemens MindSphere** – Şäher infrastrukturasyny we senagat ulgamlaryny dolandyrmak üçin niýetlenen IoT platformasy.

### ****4. Senagat we Zawod Dolandyryş Ulgamlary:****

* **Siemens Industrial Edge** – Senagat awtomatizasiýasy üçin niýetlenen IoT platformasy.
* **Rockwell Automation FactoryTalk** – Zawodlaryň önümçilik proseslerini optimizasiýa etmek üçin ulanylýar.
* **Honeywell Forge** – Senagat ulgamlaryny IoT bilen utgaşdyryp, maglumatlary seljerýär we dolandyrýar.

### ****5. Saglygy Goraýyş we Wearable IoT Programmalary:****

* **Apple HealthKit** – Apple enjamlary bilen saglyk maglumatlaryny toplamak we paýlaşmak üçin niýetlenen programma.
* **Google Fit** – Saglyk we fiziki işjeňlik maglumatlaryny saklamak üçin platforma.
* **Medtronic CareLink** – IoT arkaly ýürek ritmi we saglyk ýagdaýyny yzarlamak üçin ulanylýar.

### ****Harby IoT (MIoT) üçin Platformalar we Tehnologiýalar****

#### **1. Palantir Gotham**

* **Harby we aňtaw maglumatlaryny seljermek üçin ulanylýar.**
* **Big Data** we AI bilen goşun, howa we deňiz güýçleriniň maglumatlaryny integrirlemek we analiz etmek üçin niýetlenen.
* Düşnükli interfeýsi we real wagt maglumat işlemek aýratynlygy bar.

#### **2. AT&T Secure IoT**

* **Harby we hökümet ulgamlary üçin IoT howpsuzlyk platformasy.**
* Dronlar, ýerüsti tehnikalar we beýleki harby enjamlaryň aragatnaşyk howpsuzlygyny üpjün edýär.
* Kyber hüjümleriň öňüni almak üçin AI we maşyn öwreniş algoritmleri bilen işleýär.

#### **3. Raytheon RIOT (Real-time IoT)**

* **Howpsuz real wagt maglumat alyş-çalşy üçin döredilen IoT platformasy.**
* Harby dronlar, radar ulgamlary we hüjümden gorag ulgamlary bilen integrasiýa bolup bilýär.
* **Enjamlaryň arasynda awtomatlaşdyrylan koordinasiýa we maglumat alyş-çalşy üpjün edýär.**

#### **4. Lockheed Martin’s IoT-based C4ISR**

* **C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) harby ulgamy üçin niýetlenen.**
* Dronlar, sensorlar we serhet gözegçilik enjamlary bilen real wagt maglumat alyş-çalşyny üpjün edýär.
* **Düşnükli interfeýs we awtonom analiz mümkinçilikleri bar.**

#### **5. Thales Digital IoT Defense Platform**

* **Aýratyn enjamlar we howpsuz maglumat saklamak üçin harby IoT platformasy.**
* Howa hüjümlerine garşy gorag ulgamlary, AI bilen integrirlenen radar ulgamlary bar.
* **Serhet howpsuzlygy we gözegçilik üçin sensor we AI analizleri ulanýar.**

#### **6. General Dynamics Mission Systems IoT Solutions**

* **Harby transport we infrastrukturany dolandyrmak üçin niýetlenen IoT platformasy.**
* Harby ulaglar we awtomatiki dolandyryş ulgamlary bilen bilelikde işleýär.
* **Düşnükli real wagt maglumat analizini hödürleýär.**

### ****Harby IoT Ulanylyş Ugurlary****

* **Dron we robot ulgamlary:** Awtomatiki harby operasiýalary geçirmek üçin ulanylýar.
* **Serhet gözegçilik ulgamlary:** IoT sensorlary we AI bilen serhet howpsuzlygyny üpjün edýär.
* **Ulag we logistika dolandyryşy:** Harby transportlary real wagt yzarlamak üçin niýetlenen.
* **Howa goranyş ulgamlary:** IoT bilen radar ulgamlaryny kämilleşdirmek we howa hüjümlerini öňünden anyklamak.
* **Kyberhowpsuzlyk:** IoT bilen baglanyşykly maglumatlary goramak we haker hüjümleriniň öňüni almak.

### ****Senagat IoT (IIoT) Üçin Meşhur Platformalar****

#### **1. Siemens MindSphere**

* Siemens tarapyndan döredilen bulut esasly IIoT platformasy.
* Enjam maglumatlaryny ýygnamak, seljermek we önümçilik proseslerini optimizasiýa etmek üçin niýetlenen.
* AI we maşyn öwreniş (ML) tehnologiýalary bilen integrasiýa mümkinçiligi bar.

#### **2. GE Digital Predix**

* General Electric tarapyndan işlenip düzülen IIoT platformasy.
* Önümçilik, energetika we ulag pudaklarynda giňden ulanylýar.
* Real wagt maglumat seljerme we awtomatlaşdyryş aýratynlyklary bar.

#### **3. PTC ThingWorx**

* Senagat ulgamlary üçin ýörite işlenilen IoT platformasy.
* Maşyn we senagat enjamlary bilen aňsat integrasiýa edilýär.
* AI, maşyn öwreniş we AR (artdyrylan hakykat) mümkinçilikleri bar.

#### **4. IBM Watson IoT**

* IBM-yň IoT platformasy bolup, esasan, maglumat seljerme we AI (emeli intellekt) bilen tapawutlanýar.
* Senagat enjamlary üçin real wagt yzarlama we analiz funksiýalary bar.
* Maşynlaryň tehniki ýagdaýyny öňünden çaklamaga mümkinçilik berýär (Predictive Maintenance).

#### **5. Microsoft Azure IoT Hub**

* Microsoft-yň senagat we umumy IoT enjamlary üçin niýetlenen platformasy.
* Bulut esasly maglumat saklamak we AI bilen maglumatlary seljermek üçin mümkinçilik berýär.
* IIoT ulgamlary bilen aňsat integrasiýa bolýar.

#### **6. AWS IoT Greengrass**

* Amazon Web Services (AWS) tarapyndan hödürlenýän IIoT platformasy.
* Önümçilikde, robot tehnikasynda we awtomatlaşdyryşda ulanylýar.
* Bulut we ýerli enjamlarda işläp bilýär.

#### **7. Bosch IoT Suite**

* Bosch-yň senagat enjamlary üçin döredilen IoT platformasy.
* Awtomatlaşdyryş we smart zawodlar (smart factories) üçin niýetlenen.
* Howpsuz maglumat alyş-çalşy we AI integrasiýasy bar.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Platforms** | **Interoperability (communication protocols)** | **Key offering and its main function** | | **Top use cases** |
| Amazon Web Services IoT Platform | HTTP MQTT WebSockets | AWS IoT Core Connectivity Authentication Rules engine Development environment | | Smart city Connected home Agriculture |
| Microsoft Azure IoT | MQTT AMQP both over WebSockets HTTPS | Azure IoT Hub Connectivity Authentication Device monitoring Device management IoT Edge | | Healthcare Retail Manufacturing |
| Oracle IoT Intelligent Applications | HTTP MQTT | Oracle IoT Cloud Service Connectivity Asset monitoring Data analysis Data integration | | Smart manufacturing Predictive maintenance Connected logistics |
| ThingsBoard Open-Source IoT Platform | MQTT CoAP HTTP | ThingsBoard Community Edition Data collection Processing Visualization Device management | | Smart metering Smart energy Smart farming Fleet tracking |
| Particle | HTTP | Connectivity Hardware Software | | HVAC Systems Smart Energy Equipment Industrial Equipment Emissions Monitoring Light Electric Vehicles |
| IRI Voracity | MQTT | Data Discovery Data Integration Data Migration Data governance Data analysis | | Healthcare E-commerce Transport |
| Kaa Enterprise | HTTP HTTPS MQTT MQTT/TLS MQTT/WebSocket MQTT/WebSocket/TLS | Connectivity Configuration management Command execution Data collection Data management Hardware integrations | | Logistics Agriculture Healthcare Smart City Smart Energy Baby Tech Smart Retail Sport & Fitness |
| ThingWorx IIoT | AlwaysOn (HTTP, WebSocket) MQTT OPC ODBC SNMP REST APIs | Device Connectivity Data Ingestion and Aggregation Visualization and Dashboarding Analytics and Insights Remote Monitoring and Control Integration with Enterprise Systems Digital Twins | | Manufacturing Engineering |
| Siemens Cloud Connect / Insights Hub | OPC Unified Architecture MQTT | Interoperability Flexibility Openness Scalability | | Manufacturing Automotive Energy and Utilities Healthcare Agriculture |
| Bosch IoT Suite | HTTP MQTT | Pre-configured Fully managed, shared cloud service High availability & reliability Scalability Open & flexible | | Agriculture Energy Smart homes & buildings Retail Mobility Manufacturing |
| Blynk | Neither HTTP nor MQTT | Access Controls/Permissions Activity Dashboard Activity Tracking Asset Tracking Configuration Management Connectivity Management Data Import/Export | | Smart Home Smart Cities HVAC |
| Akenza.io | HTTP, MQTT, CoAP | Connectivity management  Device Type Library  Rules Engine (automated actions based on data)  Powerful Dashboards & Analytics Cloud Integrations | | Smart Buildings & Real Estate  Smart Cities & Infrastructure  Industrial IoT  Asset Tracking & Logistics  Environmental Monitoring |
|  |  | |  |  |

Here are **25 top IoT platforms** along with their key differentiators and the protocols they use:

### ****1. AWS IoT Core****

* **Differentiator:** Scalable cloud-based IoT service with strong security (AWS IAM).
* **Protocols:** MQTT, HTTP, WebSockets, LoRaWAN.

### ****2. Microsoft Azure IoT Hub****

* **Differentiator:** Integrates well with Microsoft’s ecosystem (e.g., Azure ML, Power BI).
* **Protocols:** MQTT, AMQP, HTTPS.

### ****3. Google Cloud IoT Core****

* **Differentiator:** Advanced AI/ML capabilities with seamless integration into Google Cloud.
* **Protocols:** MQTT, HTTP.

### ****4. IBM Watson IoT****

* **Differentiator:** AI-driven IoT analytics and enterprise-grade security.
* **Protocols:** MQTT, HTTP.

### ****5. Cisco IoT Cloud Connect****

* **Differentiator:** Focus on secure industrial IoT (IIoT) and network management.
* **Protocols:** MQTT, CoAP, HTTP, WebSockets.

### ****6. ThingWorx (PTC)****

* **Differentiator:** Strong industrial IoT (IIoT) features with AR (Augmented Reality) support.
* **Protocols:** MQTT, OPC-UA, REST, WebSockets.

### ****7. Siemens MindSphere****

* **Differentiator:** Industrial automation and digital twin capabilities.
* **Protocols:** MQTT, OPC-UA, HTTPS.

### ****8. GE Digital Predix****

* **Differentiator:** Cloud-based IIoT platform for heavy industry.
* **Protocols:** MQTT, OPC-UA, REST API.

### ****9. Bosch IoT Suite****

* **Differentiator:** Focus on smart manufacturing and connected mobility.
* **Protocols:** MQTT, CoAP, HTTP.

### ****10. SAP Leonardo IoT****

* **Differentiator:** Integrates with SAP ERP and predictive analytics.
* **Protocols:** MQTT, AMQP, REST.

### ****11. Oracle IoT Cloud****

* **Differentiator:** Enterprise IoT platform with strong data integration features.
* **Protocols:** MQTT, HTTP, CoAP.

### ****12. HPE Universal IoT Platform****

* **Differentiator:** Scalable IoT management across diverse verticals.
* **Protocols:** MQTT, CoAP, LWM2M.

### ****13. Ericsson IoT Accelerator****

* **Differentiator:** Cellular IoT and telecom-based IoT solutions.
* **Protocols:** MQTT, CoAP, HTTP.

### ****14. Particle IoT****

* **Differentiator:** Designed for rapid IoT prototyping and edge computing.
* **Protocols:** MQTT, CoAP, HTTPS.

### ****15. Losant****

* **Differentiator:** Low-code IoT application development with strong data visualization.
* **Protocols:** MQTT, REST API, WebSockets.

### ****16. Baidu IoT Core****

* **Differentiator:** AI-driven IoT solutions tailored for Chinese markets.
* **Protocols:** MQTT, HTTP, CoAP.

### ****17. Tencent Cloud IoT****

* **Differentiator:** Strong cloud computing capabilities with smart city integration.
* **Protocols:** MQTT, CoAP, HTTP.

### ****18. Alibaba Cloud IoT****

* **Differentiator:** Large-scale IoT solutions with strong AI analytics.
* **Protocols:** MQTT, CoAP, HTTP.

### ****19. Arduino IoT Cloud****

* **Differentiator:** Simple integration with Arduino devices for quick IoT development.
* **Protocols:** MQTT, HTTP, WebSockets.

### ****20. Balena****

* **Differentiator:** Containerized IoT application management.
* **Protocols:** MQTT, HTTP, WebSockets.

### ****21. Kaa IoT****

* **Differentiator:** Open-source IoT platform with flexible deployment.
* **Protocols:** MQTT, CoAP, HTTP.

### ****22. OpenRemote****

* **Differentiator:** Open-source smart city and automation IoT platform.
* **Protocols:** MQTT, HTTP, WebSockets.

### ****23. Eclipse IoT (Kapua, Kura, etc.)****

* **Differentiator:** Open-source IoT ecosystem with multiple tools.
* **Protocols:** MQTT, CoAP, HTTP.

### ****24. Samsung Artik Cloud****

* **Differentiator:** IoT platform with strong focus on consumer electronics.
* **Protocols:** MQTT, REST API, WebSockets.

### ****25. Ayla Networks****

* **Differentiator:** IoT cloud platform for smart home and industrial automation.
* **Protocols:** MQTT, CoAP, HTTP.

### ****Common IoT Communication Protocols:****

1. **MQTT (Message Queuing Telemetry Transport)** – Lightweight, low-power protocol, widely used in IoT.
2. **CoAP (Constrained Application Protocol)** – Designed for resource-constrained devices.
3. **HTTP/HTTPS** – Standard web communication, but consumes more power.
4. **AMQP (Advanced Message Queuing Protocol)** – Enterprise-grade messaging for IoT.
5. **OPC-UA (Open Platform Communications – Unified Architecture)** – Mainly used in industrial automation.
6. **LoRaWAN** – Low-power wide-area network protocol for long-range IoT applications.
7. **WebSockets** – Real-time full-duplex communication between clients and servers.

Would you like more details on any specific platform or protocol? 😊

Yes, **Zigbee** is a widely used protocol in **IoT platforms**, especially in **smart homes, industrial automation, and low-power IoT applications**. Zigbee operates on **IEEE 802.15.4** standard, focusing on **low-power, low-data-rate, and short-range communication**.

### ****Top IoT Platforms that Support Zigbee****

Here are some IoT platforms that natively support or can integrate with Zigbee devices:

### ****1. AWS IoT Core****

* **Zigbee Integration:** Through AWS Greengrass and third-party gateways (e.g., Zigbee2MQTT).
* **Use Case:** Smart homes, industrial IoT, and connected devices.

### ****2. Microsoft Azure IoT Hub****

* **Zigbee Integration:** Via Azure IoT Edge and third-party gateways.
* **Use Case:** Smart buildings, industrial monitoring, and asset tracking.

### ****3. Google Cloud IoT Core****

* **Zigbee Integration:** Needs additional hardware like Google Nest Hub or third-party bridges.
* **Use Case:** Smart homes, energy management, and automation.

### ****4. Home Assistant**** (Open-source)

* **Zigbee Integration:** Supports **ZHA (Zigbee Home Automation)** and **Zigbee2MQTT** natively.
* **Use Case:** Home automation, smart lighting, and security systems.

### ****5. OpenHAB**** (Open-source)

* **Zigbee Integration:** Supports Zigbee via the **Zigbee Binding** addon.
* **Use Case:** Smart home automation and connected devices.

### ****6. Domoticz****

* **Zigbee Integration:** Uses Zigbee2MQTT or Conbee II stick for compatibility.
* **Use Case:** Home automation and IoT device control.

### ****7. Samsung SmartThings****

* **Zigbee Integration:** Natively supports Zigbee for smart devices like bulbs, sensors, and locks.
* **Use Case:** Smart home automation and security.

### ****8. Hubitat Elevation****

* **Zigbee Integration:** Full Zigbee stack support for local processing of smart home devices.
* **Use Case:** Smart home hubs with low-latency automation.

### ****9. Tuya IoT Platform****

* **Zigbee Integration:** Works with Tuya Zigbee devices (smart plugs, lights, and sensors).
* **Use Case:** Consumer IoT, smart home devices, and automation.

### ****10. Zigbee2MQTT****

* **Zigbee Integration:** Acts as a bridge between Zigbee devices and MQTT brokers.
* **Use Case:** IoT integration with Home Assistant, Node-RED, and other automation systems.

### ****Zigbee and MQTT: How They Work Together****

Since many IoT platforms do not natively support Zigbee, **Zigbee2MQTT** is often used as a bridge. It converts Zigbee messages into MQTT, making them compatible with IoT platforms like AWS, Azure, and Home Assistant.

#### **Example Zigbee2MQTT Workflow:**

1. **Zigbee Device (e.g., Sensor, Smart Plug)** →
2. **Zigbee Coordinator (e.g., CC2531 USB stick, Sonoff Zigbee Bridge)** →
3. **Zigbee2MQTT (Running on Raspberry Pi, Home Assistant, or another gateway)** →
4. **MQTT Broker (e.g., Mosquitto, AWS IoT Core, Azure IoT Hub)** →
5. **IoT Platform (Processes Data & Sends Commands)**

### ****Why Use Zigbee in IoT?****

✅ **Low Power Consumption:** Ideal for battery-powered devices.  
✅ **Mesh Networking:** Devices can relay signals, increasing range.  
✅ **Interoperability:** Works across different manufacturers (e.g., Philips Hue, IKEA TRÅDFRI).  
✅ **Secure Communication:** Uses AES-128 encryption.  
✅ **High Device Capacity:** Supports **up to 65,000 nodes** in a network.

Would you like help choosing a Zigbee-compatible platform for your project? 😊

Deepseek

Here’s a list of \*\*top 25 IoT platforms\*\* along with their key features, supported protocols, and use cases. IoT platforms are essential for connecting devices, managing data, and enabling applications in various industries. The protocols mentioned are commonly used for communication between devices and the platform.

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### \*\*Top 25 IoT Platforms\*\*

1. \*\*AWS IoT Core\*\*

- \*\*Protocols\*\*: MQTT, HTTP, WebSockets, LoRaWAN

- \*\*Use Cases\*\*: Smart homes, industrial IoT, predictive maintenance, asset tracking.

- \*\*Features\*\*: Scalable, secure, integrates with AWS services like Lambda, S3, and DynamoDB.

2. \*\*Microsoft Azure IoT Hub\*\*

- \*\*Protocols\*\*: MQTT, AMQP, HTTP

- \*\*Use Cases\*\*: Smart cities, healthcare, manufacturing, energy management.

- \*\*Features\*\*: Device management, edge computing, integration with Azure services.

3. \*\*Google Cloud IoT Core\*\*

- \*\*Protocols\*\*: MQTT, HTTP

- \*\*Use Cases\*\*: Logistics, retail, smart utilities, environmental monitoring.

- \*\*Features\*\*: Real-time data processing, machine learning integration, global scalability.

4. \*\*IBM Watson IoT\*\*

- \*\*Protocols\*\*: MQTT, HTTP

- \*\*Use Cases\*\*: Industrial automation, supply chain optimization, predictive analytics.

- \*\*Features\*\*: AI-driven insights, blockchain integration, device management.

5. \*\*Siemens MindSphere\*\*

- \*\*Protocols\*\*: MQTT, OPC UA, REST API

- \*\*Use Cases\*\*: Industrial IoT, energy management, smart manufacturing.

- \*\*Features\*\*: Open cloud platform, advanced analytics, digital twin support.

6. \*\*ThingSpeak (MathWorks)\*\*

- \*\*Protocols\*\*: HTTP, MQTT

- \*\*Use Cases\*\*: Environmental monitoring, home automation, research projects.

- \*\*Features\*\*: Data visualization, MATLAB integration, real-time analytics.

7. \*\*Cisco IoT Control Center\*\*

- \*\*Protocols\*\*: MQTT, HTTP, CoAP

- \*\*Use Cases\*\*: Connected vehicles, smart cities, healthcare.

- \*\*Features\*\*: SIM management, network security, scalability.

8. \*\*SAP IoT\*\*

- \*\*Protocols\*\*: MQTT, HTTP, OPC UA

- \*\*Use Cases\*\*: Supply chain management, asset intelligence, predictive maintenance.

- \*\*Features\*\*: Integration with SAP ERP, machine learning, edge computing.

9. \*\*Oracle IoT Cloud\*\*

- \*\*Protocols\*\*: MQTT, HTTP, CoAP

- \*\*Use Cases\*\*: Fleet management, smart buildings, industrial automation.

- \*\*Features\*\*: Real-time analytics, device virtualization, integration with Oracle apps.

10. \*\*PTC ThingWorx\*\*

- \*\*Protocols\*\*: MQTT, HTTP, OPC UA

- \*\*Use Cases\*\*: Smart factories, predictive maintenance, AR-enabled IoT.

- \*\*Features\*\*: Rapid application development, digital twin support, edge connectivity.

11. \*\*Bosch IoT Suite\*\*

- \*\*Protocols\*\*: MQTT, HTTP, CoAP

- \*\*Use Cases\*\*: Smart homes, mobility, industrial IoT.

- \*\*Features\*\*: Device management, data analytics, integration with Bosch services.

12. \*\*GE Predix\*\*

- \*\*Protocols\*\*: MQTT, HTTP, OPC UA

- \*\*Use Cases\*\*: Industrial IoT, energy optimization, asset performance management.

- \*\*Features\*\*: Edge-to-cloud connectivity, digital twin, predictive analytics.

13. \*\*Kaa IoT Platform\*\*

- \*\*Protocols\*\*: MQTT, HTTP, WebSockets

- \*\*Use Cases\*\*: Smart farming, healthcare, logistics.

- \*\*Features\*\*: Open-source, device management, data visualization.

14. \*\*ThingsBoard\*\*

- \*\*Protocols\*\*: MQTT, HTTP, CoAP

- \*\*Use Cases\*\*: Smart metering, fleet tracking, IoT prototyping.

- \*\*Features\*\*: Open-source, customizable dashboards, rule engine.

15. \*\*Losant\*\*

- \*\*Protocols\*\*: MQTT, HTTP, WebSockets

- \*\*Use Cases\*\*: Smart agriculture, energy monitoring, industrial automation.

- \*\*Features\*\*: Drag-and-drop workflows, edge computing, real-time dashboards.

16. \*\*Ayla Networks\*\*

- \*\*Protocols\*\*: MQTT, HTTP, CoAP

- \*\*Use Cases\*\*: Smart appliances, healthcare, retail.

- \*\*Features\*\*: Device management, data analytics, cloud connectivity.

17. \*\*Zebra Savanna\*\*

- \*\*Protocols\*\*: MQTT, HTTP

- \*\*Use Cases\*\*: Asset tracking, supply chain optimization, retail analytics.

- \*\*Features\*\*: Real-time location tracking, data insights, edge computing.

18. \*\*Hologram\*\*

- \*\*Protocols\*\*: MQTT, HTTP, WebSockets

- \*\*Use Cases\*\*: Fleet management, remote monitoring, smart agriculture.

- \*\*Features\*\*: Global cellular connectivity, SIM management, cloud integration.

19. \*\*Ubidots\*\*

- \*\*Protocols\*\*: MQTT, HTTP, TCP

- \*\*Use Cases\*\*: Environmental monitoring, smart cities, industrial IoT.

- \*\*Features\*\*: Data visualization, alerts, integration with third-party services.

20. \*\*Blynk\*\*

- \*\*Protocols\*\*: MQTT, HTTP

- \*\*Use Cases\*\*: Smart homes, IoT prototyping, education.

- \*\*Features\*\*: Drag-and-drop app builder, cloud connectivity, open-source.

21. \*\*Datacake\*\*

- \*\*Protocols\*\*: MQTT, HTTP, LoRaWAN

- \*\*Use Cases\*\*: Smart agriculture, asset tracking, environmental monitoring.

- \*\*Features\*\*: Low-code platform, customizable dashboards, LoRaWAN support.

22. \*\*Telit IoT Platform\*\*

- \*\*Protocols\*\*: MQTT, HTTP, CoAP

- \*\*Use Cases\*\*: Connected vehicles, industrial IoT, smart cities.

- \*\*Features\*\*: Device management, data analytics, edge computing.

23. \*\*Carriots\*\*

- \*\*Protocols\*\*: HTTP, MQTT

- \*\*Use Cases\*\*: Smart homes, energy management, IoT prototyping.

- \*\*Features\*\*: Real-time alerts, data visualization, rule engine.

24. \*\*Axiomtek AIoT Platform\*\*

- \*\*Protocols\*\*: MQTT, HTTP, OPC UA

- \*\*Use Cases\*\*: Industrial automation, smart cities, healthcare.

- \*\*Features\*\*: Edge computing, AI integration, device management.

25. \*\*ClearBlade\*\*

- \*\*Protocols\*\*: MQTT, HTTP, WebSockets

- \*\*Use Cases\*\*: Smart manufacturing, transportation, energy.

- \*\*Features\*\*: Edge computing, real-time analytics, IoT application development.

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### \*\*Common IoT Protocols and Their Uses\*\*

1. \*\*MQTT (Message Queuing Telemetry Transport)\*\*

- Lightweight, ideal for low-bandwidth networks.

- Used in smart homes, industrial IoT, and remote monitoring.

2. \*\*HTTP/HTTPS\*\*

- Widely used for web-based communication.

- Suitable for data transmission in IoT applications.

3. \*\*CoAP (Constrained Application Protocol)\*\*

- Designed for resource-constrained devices.

- Used in smart lighting, environmental monitoring.

4. \*\*WebSockets\*\*

- Enables real-time, bidirectional communication.

- Used in live data streaming and IoT dashboards.

5. \*\*OPC UA (Open Platform Communications Unified Architecture)\*\*

- Secure, industrial communication protocol.

- Used in industrial automation and smart factories.

6. \*\*LoRaWAN\*\*

- Long-range, low-power protocol.

- Used in smart agriculture, asset tracking, and smart cities.

7. \*\*AMQP (Advanced Message Queuing Protocol)\*\*

- Reliable messaging for enterprise IoT.

- Used in financial services and healthcare.

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These platforms and protocols cater to a wide range of IoT applications, from consumer devices to industrial automation. The choice of platform and protocol depends on the specific use case, scalability requirements, and integration needs.

\*\*Zigbee\*\* is a popular wireless communication protocol designed for low-power, low-data-rate, and short-to-medium-range applications. It is widely used in IoT applications, particularly in \*\*smart home automation\*\*, \*\*industrial IoT\*\*, and \*\*sensor networks\*\*. Below is a list of \*\*IoT platforms and ecosystems\*\* that support or are compatible with \*\*Zigbee\*\*:

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### \*\*IoT Platforms and Ecosystems Using Zigbee\*\*

1. \*\*Amazon Web Services (AWS) IoT Core\*\*

- \*\*Zigbee Support\*\*: AWS IoT Core integrates with Zigbee devices through \*\*Zigbee bridges\*\* or \*\*hubs\*\* (e.g., Amazon Echo Plus, which has a built-in Zigbee hub).

- \*\*Use Cases\*\*: Smart home automation, lighting control, and energy management.

2. \*\*Samsung SmartThings\*\*

- \*\*Zigbee Support\*\*: SmartThings Hub supports Zigbee, Z-Wave, and Wi-Fi devices.

- \*\*Use Cases\*\*: Smart homes, security systems, and connected appliances.

3. \*\*Philips Hue\*\*

- \*\*Zigbee Support\*\*: Philips Hue smart lighting system uses Zigbee for communication between bulbs and the Hue Bridge.

- \*\*Use Cases\*\*: Smart lighting, home automation.

4. \*\*IKEA Tradfri\*\*

- \*\*Zigbee Support\*\*: IKEA’s smart lighting and home automation products use Zigbee for device communication.

- \*\*Use Cases\*\*: Smart lighting, blinds, and plugs.

5. \*\*Xiaomi Aqara\*\*

- \*\*Zigbee Support\*\*: Xiaomi’s Aqara ecosystem uses Zigbee for sensors, switches, and smart home devices.

- \*\*Use Cases\*\*: Home automation, security, and environmental monitoring.

6. \*\*Hive Active Heating and Home\*\*

- \*\*Zigbee Support\*\*: Hive uses Zigbee for its smart home products, including thermostats, sensors, and plugs.

- \*\*Use Cases\*\*: Smart heating, lighting, and security.

7. \*\*Hue Bridge (by Signify)\*\*

- \*\*Zigbee Support\*\*: The Hue Bridge acts as a Zigbee hub for Philips Hue devices.

- \*\*Use Cases\*\*: Smart lighting and home automation.

8. \*\*Hubitat Elevation\*\*

- \*\*Zigbee Support\*\*: Hubitat’s hub supports Zigbee and Z-Wave devices for local home automation.

- \*\*Use Cases\*\*: Smart homes, energy management, and security.

9. \*\*Home Assistant\*\*

- \*\*Zigbee Support\*\*: Home Assistant can integrate Zigbee devices using Zigbee USB dongles (e.g., Zigbee2MQTT or ZHA).

- \*\*Use Cases\*\*: DIY smart home automation, lighting, and sensors.

10. \*\*Tuya Smart\*\*

- \*\*Zigbee Support\*\*: Tuya’s ecosystem supports Zigbee devices through its smart hubs.

- \*\*Use Cases\*\*: Smart homes, lighting, and appliances.

11. \*\*Wink Hub\*\*

- \*\*Zigbee Support\*\*: Wink Hub supports Zigbee, Z-Wave, and Wi-Fi devices.

- \*\*Use Cases\*\*: Smart home automation, lighting, and security.

12. \*\*Deconz (by Dresden Elektronik)\*\*

- \*\*Zigbee Support\*\*: Deconz is a software solution that supports Zigbee devices using a Conbee or RaspBee USB stick.

- \*\*Use Cases\*\*: Smart home automation, lighting, and sensors.

13. \*\*Zigbee2MQTT\*\*

- \*\*Zigbee Support\*\*: An open-source solution that bridges Zigbee devices to an MQTT broker.

- \*\*Use Cases\*\*: DIY IoT projects, smart home automation.

14. \*\*Aqara Hub\*\*

- \*\*Zigbee Support\*\*: Aqara’s hub supports Zigbee devices for home automation.

- \*\*Use Cases\*\*: Smart lighting, security, and environmental monitoring.

15. \*\*Fibaro\*\*

- \*\*Zigbee Support\*\*: Fibaro’s home automation system supports Zigbee devices.

- \*\*Use Cases\*\*: Smart homes, lighting, and security.

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### \*\*Key Features of Zigbee\*\*

- \*\*Low Power Consumption\*\*: Ideal for battery-operated devices like sensors and switches.

- \*\*Mesh Networking\*\*: Devices can relay data, extending the network range.

- \*\*Interoperability\*\*: Zigbee devices from different manufacturers can work together (if they follow the same Zigbee profile).

- \*\*Security\*\*: Supports AES-128 encryption for secure communication.

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### \*\*Common Use Cases for Zigbee\*\*

1. \*\*Smart Home Automation\*\*:

- Lighting control (e.g., Philips Hue, IKEA Tradfri).

- Smart plugs, switches, and sensors.

- Security systems (e.g., door/window sensors, motion detectors).

2. \*\*Industrial IoT\*\*:

- Sensor networks for monitoring temperature, humidity, and pressure.

- Asset tracking and management.

3. \*\*Healthcare\*\*:

- Wearable devices and remote patient monitoring.

4. \*\*Energy Management\*\*:

- Smart meters and energy monitoring systems.

5. \*\*Retail\*\*:

- Beacon technology for customer tracking and engagement.

---

If you’re looking to build or integrate Zigbee-based solutions, platforms like \*\*Samsung SmartThings\*\*, \*\*Home Assistant\*\*, or \*\*Zigbee2MQTT\*\* are excellent choices due to their flexibility and wide device compatibility.

|  | **Tool** | **Best For** | **Trial Info** | **Price** |  |
| --- | --- | --- | --- | --- | --- |
| 1 | [IMG_256](https://www.datadoghq.com/dg/monitor/iot/" \t "https://thectoclub.com/tools/best-iot-device-management-platform/_blank)  [Datadog](https://www.datadoghq.com/dg/monitor/iot/)  Datadog allows you to customize your own interface for a more personalized feel. | Best for real-time monitoring and performance metrics | 14-day free trial  [Book DemoOpens new window](https://thectoclub.com/tools/best-iot-device-management-platform/#modal-id-ppl-form||category-id-1280||post-id-3194||utm-----book-demo-Datadog) | From $15/user/month (billed annually)  [Get Custom PricingOpens new window](https://thectoclub.com/tools/best-iot-device-management-platform/#modal-id-ppl-form||category-id-1280||post-id-3194||utm-----get-custom-pricing-Datadog) | [Website](https://www.datadoghq.com/dg/monitor/iot/) |
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