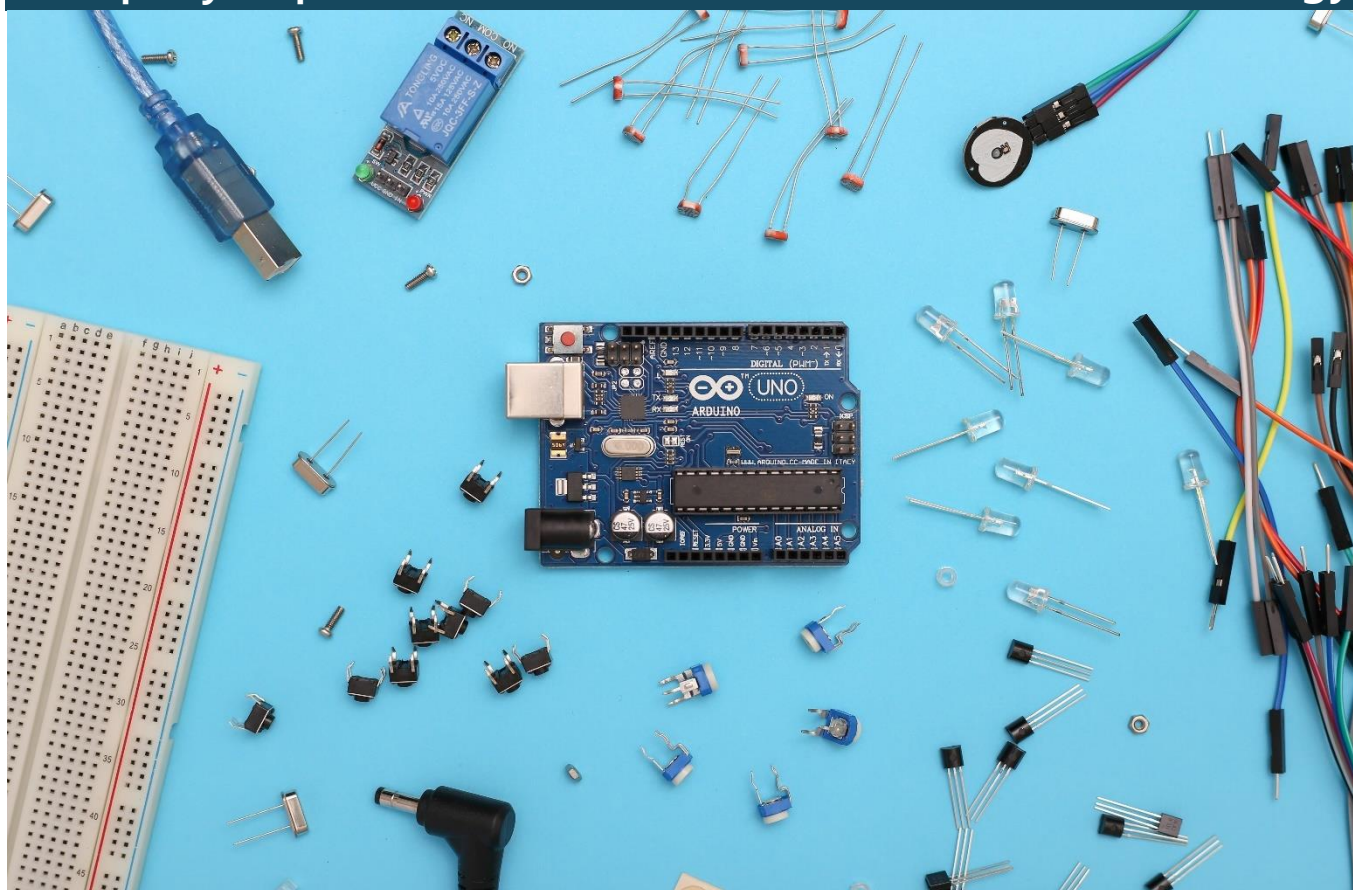


Company Report

Technology



Unfit for the current valuation...Initiate @SELL

June 15, 2021

INVESTMENT SUMMARY

- We conclude that TUYA is not a PaaS or SaaS business, but a module design company who generates revenue from module sales. Its PaaS/SaaS are post-sales services and therefore do not constitute sufficient entry barrier in the IoT industry;
- True IoT in the 2C scenario will soon call for suite intelligence (全屋智能), of which only major brands with comprehensive product line-up or platforms with enabling standards can do. IoT in the 2B scenario belongs to platforms and SI/ISV's;
- We believe TUYA's gross margin expansion is unsustainable. Initiate @ SELL with TP of US\$16.

Research Team



Tianli Wen
Head of Research

Samuel Lau
Research Associate

+852 21856115
research@blue-lotus.cn

TUYA, Inc. (NYSE: TUYA)

White label enabler has limitations...Initiate @ SELL

- We believe TUYA is basically a module design company selling SaaS/PaaS as post-sales service. It does the “dirty work” that others in the value chain do not want to do. Its valuation has exceeded its value;
- While white label products globally need a standard coordinator, TUYA can face compatibility barrier as the industry matures and consolidates;
- We initiate TUYA at sell with a TP of US\$16

TUYA's model is like Qualcomm, without the patent barrier

We are perplexed at valuing TUYA. At one end, interoperability among the labyrinths of IoT standards calls for a “coordinator”, especially the white label products. On the other hand, TUYA's valuation doesn't befit this role.

TUYA is an IoT module design company, not PaaS or SaaS

TUYA's cost of revenue and product offerings indicate it is an IoT module design company and its design mainly entails by mix-and-matching different components for the numerous IoT end use scenarios. While this work is necessary for white label manufacturers selling on Amazon, it exists largely because no one wants to do it.

White label is and will be TUYA's main customer base

Our study suggested 94% of TUYA's revenues comes from white label manufacturers. TUYA's solution runs on Amazon-backed FreeRTOS which in our view doesn't stand out among the universe of IoT standards because it is e-commerce driven and unit driven;

TUYA's gross margin is overstated, in our view

We believe the labor cost of a great number of engineers doing customization work at TUYA is currently placed under R&D, which we believe should be placed under the cost of revenue. We argue gross margin is not a good indicator of TUYA's operating performance.

Valuation is too high...Initiate @ SELL

We believe TUYA should be traded as a hardware+system integration company instead of as a PaaS/SaaS company. Initiate with SELL with PT of US\$16.

Summary financial data

Highlights	2019A	2020A	2021E	2022E	2023E
Revenues (US\$ mn)	106	180	339	532	843
Non-GAAP op. profit (US\$mn)	(68)	(60)	(113)	(104)	(51)
Non-GAAP EPADS (US\$)	(0.29)	(0.26)	(0.17)	(0.16)	(0.07)
GAAP EPS (US\$)	(0.32)	(0.30)	(0.29)	(0.32)	(0.34)
EBITDA margin	(64.5%)	(33.6%)	(33.4%)	(19.6%)	(6.0%)
P/S	117.39	69.04	36.66	23.34	14.74

Source: Bloomberg, Blue Lotus (as of, 13 June, 2021)

BUY

HOLD

SELL

Target Price: US\$ 16

Current Price: US\$ 21.93

RIC: (NYSE: TUYA)

BBG: TUYA US

Market cap (US\$ bn)

12.31

Average daily volume (US\$ mn)

37

Shares out/float (m)

561.25/NA

Source: Bloomberg, Blue Lotus (as of, 13 June, 2021)

Key Changes

	New	Old	Diff
BLRI Recommendation	SELL	-	-
BLRI Target Price	USD\$ 16	-	-
2021E EPADS (US\$)	(0.17)	-	-
2022E EPADS (US\$)	(0.16)	-	-
2023E EPADS (US\$)	(0.07)	-	-

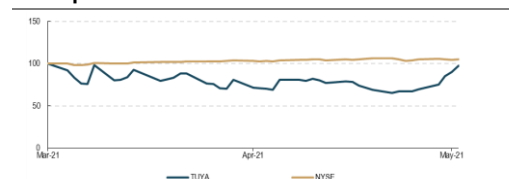
Source: Blue Lotus (as of, 13 June, 2021)

BLRI vs. The Street

No. of Bloomberg Recommendations	5
Target price vs. Bloomberg mean	(35%)
1-year-fwd EPS vs. Bloomberg mean	NA
Bloomberg recommendation	5

Source: Bloomberg Recommendation, Blue Lotus (1=SELL,5=BUY) (as of, 13 June, 2021)

Price performance and volume data



Source: Bloomberg, Blue Lotus (as of, 13 June, 2021)

Research team



Tianli Wen

Head of Research

research@blue-lotus.cn

Samuel Lau

Research Associate

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Blue Lotus Capital Advisors Limited

All prices are those current at the end of the previous trading session unless otherwise indicated. Prices are sourced from local exchanges via Reuters, Bloomberg and other vendors. Data is sourced from Bloomberg, Blue Lotus Capital Advisors Limited and subject companies. Consensus forward estimates are used in analysis. Past performance is not indicative of future results. Investors should consider this report as only a single factor in making their investment decision.

TUYA, Inc.: Financial Summary

Fiscal year ends-31-Dec

Exhibit 1. Income statement

(US\$ mn)	2020A	2021E	2022E
Revenues	180	339	532
Cost of revenues	(118)	(190)	(267)
Gross profit	62	148	265
Gross margin	34.4%	43.8%	49.8%
*Adjusted Gross margin	23.7%	29.2%	36.7%
Total operating expenses	(132)	(335)	(476)
Research and development expenses	(77)	(198)	(278)
Selling and marketing expenses	(38)	(96)	(146)
General and Administrative Expenses	(17)	(41)	(52)
Share-based compensation expense	(9)	(73)	(106)
Income from operations, GAAP	(70)	(186)	(211)
Operating margin, GAAP	(38.8%)	(55.0%)	(39.6%)
Income from operations, non-GAAP	(60)	(113)	(104)
Operating margin, non-GAAP	(33.6%)	(33.4%)	(19.6%)
Net income (loss), GAAP	(67)	(182)	(207)
Net margin, GAAP	(37.2%)	(53.8%)	(38.8%)
Net income (loss), non-GAAP	(57)	(109)	(100)
Net margin, non-GAAP	(31.9%)	(32.2%)	(18.8%)

Source: TUYA, Blue Lotus

Company Description

TUYA is an IoT provider that offers IoT module, IoT platform and related IoT SaaS services. Products powered by TUYA are sold in 220+ countries and TUYA has powered more than 300mn smart devices since inception. As of Q1 2021, TUYA has 2,200 IoT PaaS customers.

Industry View

We expect the smart home + smart business module market will grow from US\$1.9bn in 2020 and expected to go to US\$5.5bn by 2024 based on IDC estimation of 860mn (smart home + smart business) device shipment in 2020 and 2.5bn in 2024.

Exhibit 2. Balance sheet

(US\$ mn)	2020A	2021E	2022E
Cash and cash equivalents	159	1,111	1,020
Short term investment	21	21	21
Accounts receivable, net	12	23	36
Notes receivable, net	12	23	36
Inventories	42	68	96
Prepayments & others	4	8	13
Current Assets	248	1,249	1,213
Property and equipment, net	4	8	13
Operating lease	12	12	12
Other non-current assets	3	3	3
Non-Current Assets	19	23	28
Total Assets	267	1,272	1,242
Accounts payable	23	37	52
Advances from customers	27	51	80
Deferred revenue	3	7	10
Accruals and other liabilities	32	51	72
Taxes payable	0	0	0
Lease liabilities	6	6	6
Current Liabilities	92	153	222
Non-Current Liabilities	6	7	8
Total Liabilities	98	160	229
Mezzanine equity	334	0	0
Shareholders' equity (deficit)	(165)	1,113	1,012
Ordinary shares (Class A+Class B)	0	0	0
Additional Paid in Capital	27	1,414	1,414
Accumulated Profit (Loss)+ others	(192)	(301)	(401)
Total liabilities, mezzanine equity and shareholders' equity	267	1,272	1,242

Source: TUYA, Blue Lotus

Exhibit 3. Cash flow statement

(US\$ mn)	2020A	2021E	2022E
Net Income	(67)	(182)	(207)
Share-based compensation expense	9	73	106
Depreciation and amortization	6	3	6
Other adjustments	1	0	0
Changes in operating assets and liabilities	2	13	14
Accounts receivable	(7)	(11)	(13)
Notes receivable	(9)	(8)	(10)
Inventories	(20)	(26)	(27)
Prepayments and other current assets	4	(4)	(5)
Other non-current assets	(1)	0	0
Accounts payable	11	14	15
Advance from customers	13	24	29
Deferred revenue	3	4	4
Income tax payable	0	0	0
Accruals and other payables	12	20	21
Lease liabilities	(5)	0	0
Net cash generated from (used) operating activities	(49)	(93)	(80)
Capex (PPE & Intangible assets)	(3)	(7)	(11)
Proceeds from disposal of PPE	0	0	0
Purchase of short-term & long-term investments	(197)	0	0
Proceeds from short-term & long-term investments	193	0	0
Net cash generated from (used) investing activities	(8)	(7)	(11)
Issuance/(repayment) of equity & others	(0)	1,053	0
Net cash generated from (used) financing activities	(0)	1,053	0
Net change in cash and cash equivalents	(54)	952	(91)
Cash and cash equivalents, beginning of year	213	159	1,111
Cash and cash equivalents, end of year	159	1,111	1,020

Source: TUYA, Blue Lotus

See the last page of the report for important disclosures

Recent Reports

June 11th, 2021: [Xima (XIMA IPO Outlook)]:

Challenges ahead as the business scales up

June 10th, 2021: Tencent (700 HK, BUY, TP HK\$806) Company Update]: **<Mole> demonstrates challenge to Tencent**

June 8th, 2021: [Blue Lotus Sector Update]: **The impact of Harmony OS: long term but real**

June 8th, 2021: [Blue Lotus IPO Outlook]: **A fragmented market with increasing competition**

May 31st, 2021: Meituan (3690 HK, HOLD, TP HK\$310) Target Price Change]: **Growth is solid in near term, raise TP to HK\$310.**

May 28th, 2021: Pinduoduo (PDD US, BUY, TP US\$190) Target Price Change]: **Strong revenue amid slower user growth, cut TP**

May 28th, 2021: XPeng (XPEV US, HOLD, TP US\$37) Rating Change]: **Upgrade to HOLD on fundamental improvement**

May 28th, 2021: Li Auto (LI US, BUY, TP US\$31.6) Earnings Review]: **2021 Li One might be a milestone**

May 28th, 2021: VIOMI (VIOT US, HOLD, TP US\$8.8) Target Price Change]: **True IOT take off needs builder integration**

May 27th, 2021: Huazhu (HTHT US, HOLD, TP US\$52) Earnings Review]: **1Q slightly beat; overseas recovery remains weak**

May 27th, 2021: Alibaba Health (241 HK, HOLD, TP HK\$22) Target Price Change]: **Online pharmacy potential is fully priced in**

May 27th, 2021: [Blue Lotus Education Sector Update]: **Time for reassessing the attractiveness of the sector**

May 27th, 2021: Xiaomi (1810 HK, BUY, TP HK\$35) Target Price Change]: **Good time will continue for a while**

May 25th, 2021: Agora (API US, HOLD, TP US\$35) Rating Change]: **R&D cost may not lead to revenue reacceleration**

Investment Cases at a Glance

Why is it a Sell

- **TUYA is not a PaaS or SaaS business as its valuation suggests:** TUYA's gross margin profile shows adequately it is a module design company. Its product manual shows its PaaS solution refers to IoT module design and SaaS solution refers to start-ups services that generate one-time, instead of recurring revenues;
- **TUYA's gross margin is misleading:** The company classifies all of its engineer cost as R&D while we believe some of engineers do customization work for clients, mix-and-matching that should go to cost of revenues, instead of R&D;
- **TUYA does the "dirty work" that others do not want to do:** Because true IoT hasn't taken off, most white label IoT devices only claims connectivity but hardly do so. TUYA thrived under the chasms among rival IoT competitors at a time of market prematurity. We believe TUYA hasn't demonstrated or possessed enough technology innovation or assets to act as competitive moat;
- **True IoT interoperability calls for more than what TUYA does:** True IoT interoperability will soon emerge with suite intelligence (全屋智能) in the consumer electronics and home appliance industry. TUYA currently works with only a limited number of data types, a limitation carried by its operating system, which is FreeRTOS supported by Amazon;
- **Platforms control the traffic gateway:** TUYA's app is not the only way end customers can control TUYA's products. Both Amazon Alexa app and Google home app can control TUYA's products;
- **Major brands use product line ups to control traffic gateway:** Both Xiaomi and Huawei have an eye on the IoT market. Xiaomi uses in-house, e-commerce and investments to form an ecosystem with more than 300 IoT related companies. Huawei's 1+8+N strategy leverages in-house, cloud and partnership with major brands to achieve the same goal. Both are TUYA's potential competitors. Oppo/Vivo, Transsion (688036 CH, NR), or even Samsung (005930 KS, NR) might follow suit;
- **TUYA's universal connector strategy limits its potential in 2B IoT:** Most of IoT listco's in US, such as Alarm.com (ALRM US, NR), Dexcom (DXCM US, NR) and Impinj (PI US, NR), are all in the 2B space. 2B IoT has numerous industry verticals but with little interoperability needs. We are concerned that TUYA's "dirty work" approach in 2C IoT might deprive it the opportunity to capture a meaningful share in 2B IoT;
- **TUYA's downstream customer and product category limit its future growth:** TUYA's downstream customers are mainly white labels and its downstream products are mainly low value home appliances which are at the receiving end of IoT interactions. We believe such orientation will limit

See the last page of the report for important disclosures

May 24th, 2021: Tencent (700 HK, BUY, TP HK\$806) Target Price Change]: **High spending in upcoming quarters**

May 21st, 2021: Vipshop (VIPS US, BUY, TP US\$40) Target Price Change]: **Cut TP for increasing pressure of user acquisition**

May 21st, 2021: JD.com (JD US, BUY, TP US\$110) Earnings Review]: **Reinvestment leads to robust user/rev. growth**

May 20th, 2021: Baozun (BZUN US, BUY, TP US\$52) Earnings Review]: **Progress of omni-channel strategy is promising**

May 20th, 2021: Miniso Group (MNSO US, BUY, TP US\$33) Target Price Change]: **Domestic market to be the near-term focus**

May 20th, 2021: SEA Limited (SE US, BUY, TP US\$342) Earnings Review]: **C1Q21 review: Upward outlook on market expansion**

May 20th, 2021: NetEase (NTES US, BUY, TP US\$143) Earnings Review]: **A competitive gaming pipeline is ahead, maintain BUY**

May 20th, 2021: Yatsen Global (YSG US, SELL, TP US\$6.8) Target Price Change]: **C2Q21 guidance disappointing; Reiterate SELL**

May 20th, 2021: KE Holdings (BEKE US, BUY, TP US\$60) Target Price Change]: **Anti-monopoly starts to take its toll**

May 20th, 2021: ZTO Express (ZTO US, BUY, TP US\$35.8) Target Price Change]: **Stable sailing in turbulent waters...Maintain BUY**

May 19th, 2021: Trip.com (TCOM US, BUY, TP US\$48) Rating Change]: **Upgrade to BUY on promising C2Q21 outlook**

May 19th, 2021: Tencent Music (TME US, HOLD, TP US\$17) Target Price Change]: **Cut TP on lower expectation of social entertainment**

May 19th, 2021: ZTO Express (ZTO US, BUY, TP US\$32.6) Earnings Preview]: **A solid performer but price war is not abating**

TUYA's future growth headroom in high value appliances and centralized IoT interactions;

- **Connector companies are hard to make it big:** In 2C hardware, power connectors never produced large companies. In enterprise software, where labyrinth of standards also once existed, middleware companies like Vitria, webMethod, Tibco, Seebeyond and BEA Systems, founded their rare successes on customer service and legacy support, not on tech. and product;

What are the key catalysts for the next 3-6 months

- **Competitors hit the capital market (-):** Many competitors exist in the IoT module design space, like Ayla Networks (艾拉物联), Broadlink (博联) and MXCHIP (庆科). Further, integrated IoT product companies like Orvibo (欧瑞博), Aqara (绿米) might hit the capital market soon as well;
- **Margin improvement through switching sourcing from Espressif to Beken (+):** TUYA added Beken (博通集成) (603068 CH, NR) to its chip suppliers in the end of 2020. Beken's gross margin, ~25% in 2020, is significantly lower than that of TUYA's main supplier Espressif (688018 CH, NR), which was >40% in 2020. Apparently, such move can further boost TUYA's gross margin in the short run but we believe margin leverage from squeezing suppliers won't last, especially for a technology company;

Where can we be wrong?

- **Global software platforms need a hardware partner to compete against integrated hardware companies:** We acknowledge today TUYA is the No.1 player in the global white label IoT enabling solution market. It serves as a nexus between white label IoT hardware and platform software. However, we don't believe software leaders will dedicate their support to TUYA because we don't consider TUYA's technology barrier to be high enough to warrant such support;
- **A domestic substitution story exists in IoT modules:** We estimate companies like Beken, Espressif, MXCHIP and Quectel (移远) had majority market share in the low end IoT MCU market. TUYA benefits from rising market share of these Chinese fabless firms;

What can change our view?

- **TUYA injects itself with more cloud DNA's by achieving meaningful shares in Android Things and Harmony OS ecosystem:** So far TUYA mainly supports low end IoT devices like light bulbs and switches. Higher end home appliances and interaction scenarios call for alternative ecosystems like Google, Huawei, Alibaba and Tencent;
- **Meaningful acquisition in the Industrial IoT front:** We believe industrial IoT (IIoT) is an area where an enabling solution can effectively compete against software platforms and integrated hardware companies. Such acquisition will make us re-evaluate TUYA's valuation;

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TUYA should be valued as hardware

We believe TUYA is a module design company which also offers complimentary PaaS and SaaS function. As such, it does not qualify for the investment logic of a cloud company, either SaaS or PaaS. What TUYA did correctly and thus pulled ahead of its competitors in the white label market, is because it connects a dispersed upstream chip sector and another dispersed downstream white label sector. However, we believe the industry will sort it out in terms of low-cost interoperability and a “connector company” should be valued as high as TUYA today.

TUYA's business has no cloud company attributes. It is a module design company that sells IoT modules by offering complimentary PaaS and SaaS services. We believe it should be valued as such.

Labyrinth of 2C IoT scenarios led to the need for module design

IoT (Internet of things) connects numerous offline “things” to the internet. To do so a connectivity hardware must be “inserted” to the “things”, similar to inserting a sim card to our cellphones, to allow them to do so. Besides connectivity, this piece of hardware usually also incorporates other semiconductors to allow for some degrees of control, data storage, transfer and reemission. The combination of connectivity, memory and rudimentary processing is a piece of hardware called IoT chipset.

For security purposes most countries control what kind of network device can join their networks.

IoT chipsets need to further integrate with other semiconductor components, antenna, memory, etc. and need to pass certification of government (FCC, ETSI, MIIT) to be able to join the local network, and of technology groups (Zigbee Alliance, Bluetooth SIG, WiFi Alliance, Wi-Fi Alliance, etc.) to be able to bear the trademark. Dealing with various government bodies and industry groups is very tedious and time consuming for small IoT product companies.

Unlike cellular wireless standards which is dominantly European, American and Chinese, IoT standards are today made by industry groups, based on range, power consumption and cost considerations. Exhibit 5 shows the different network protocols available.

As a result, an industry formed to mix-and-match different IoT chipsets with different components to cater for the different IoT end user scenarios, which is called the IoT modules. In 2C settings these modules must also interoperable among themselves as network environment at the product end can vary. Domestic players catering to this market include Quectel Wireless (603236 CH, NR), Fibocom Wireless (300638 CH, NR) which mainly sell to the telecom carrier channel for industrial use. TUYA is such a company that caters to low end smart home products sold overseas.

The industrial IoT (IIoT) vendors in China mainly sell to transportation, oil exploration and power grids.

Exhibit 4. Common IoT network protocols

Protocol	Standard	Frequency	Data Rate	Network Size	Range	Power
WiFi	IEEE 802.11	24/5.0 GHZ	Up to 72 Mops	100	40 - 100m	High
Bluetooth	Bluetooth SIG	2.4 GHZ	1-3 Mbps	100	40 - 100m	Medium
ZigBee	IEEE 802.15.4	2.4 GHZ	250 kbps	250	40 - 100m	Medium
LoRaWAN	Proprietary	433 MHz, 868 MHz, 915 MHz, (137 MHz – 1020 MHz)	Down: 290 bps Up: 50 kbps	Very large	5 - 15km	Medium
NB-IoT	3GPP	700 MHz - 22GHz 452.2 - 467.5 MHz	~200 kbps	Very large	5km	high

Source: 3GPP, Wi-Fi Alliance, Bluetooth SIG, Zigbee Alliance, LoRa Alliance, Blue Lotus (as of 13 June, 2021)

What TUYA does is to offer the most comprehensive collection of IoT modules on the market and provide turnkey solution of a bare-bone cloud and an off-the-shelf mobile app to round out the product offering of the white label manufacturers. Because many white label manufacturers have frequent product turnovers, they welcome TUYA's solution to save them time and engineering resources, as a free add on.

TUYA's Cloud and SaaS help IoT module sale as a free giveaway.

[See the last page of the report for important disclosures](#)

The competitive positioning led by TUYA's product strategy has its value. Many white label manufacturers are flight-by-night Amazon sellers. TUYA did the "dirty work" which no other vendors are willing to do. When market experienced explosive growth unexpectedly, TUYA can even have a short period of pricing power, in our opinion.

But this value has its limitation. TUYA's niche is white label consumer electronics. IDC estimated, in March 2021, that worldwide shipment of smart home devices reached 802mn units in 2020, growing 4.5% YoY, of which 37% were TV, 21% home security, 16% smart speakers and others were 26%, or 209mn units. We estimate TUYA's customers' market share in the others category of smart home devices could reach 60-70%. In 2020, TUYA powered 116.5mn smart devices, according to its prospectus. In C1Q21 it only deployed (shipped) 39.2mn IoT PaaS solutions (IoT module units), showing meaningful slowdown, in our opinion, due to near term saturation of its market share.

IDC forecasts smart home device shipment to reach 1.5bn units by 2025 with others growing to 526mn, representing a CAGR of 20%. While near term market growth can be significantly higher than average, we believe TUYA's market share could be reaching saturation level, unless it (1) enters mid-to-high end smart home device categories, (2) enters industrial IoT.

TUYA can boost its growth by entering mid-to-high smart home devices or industrial IoT.

Entering mid-to-high end smart home or industrial IoT is not easy

As shown above, today the biggest market segment in smart home device is smart TV, followed by home security and smart speakers. The only segment that is not dominated by consumer electronics brands is home security, which is heavily tied to the builders and maintenance channel. While Amazon features the largest number of IoT devices, the one who claimed the biggest share of revenue is Samsung.

Microsoft Azure has exclusively focused on industrial IoT.

TUYA also faces daunting task when entering the industrial IoT space, which is dominated by manufacturing SaaS vendors like PTC (PTC US, NR), Altizon (private), as well as traditional system integrators like IBM, Hitachi, SAP, cloud companies like Microsoft Azure and industrial conglomerates like GE Digital. Microsoft Azure has exclusively focused on industrial IoT over consumer IoT.

In China, industrial IoT is still at early stage. But industrial conglomerates like Haier (600090 CH, NR), Sanyo (600031 CH, NR), FII (601138 CH, NR), XCMG (000425 CH, NR) and Supcon (688777 CH, NR), Internet platforms like Alibaba (BABA US, HOLD, USD\$ 230), Huawei and Tencent (700 HK, BUY, HKD\$ 806) and technology companies like Unigroup (000938 CH, NR), Langchao (000977 CH, NR) and Yonyou (600588 CH, NR) have all entered the field.

SOE, manufacturing conglomerates, Internet platforms and hardware/software companies have crowded industrial IoT space in China.

We believe industrial IoT business has more staying power because it can generate recurring cloud revenues. As such industrial IoT is a key focus for Amazon, Google and Tencent alike. However, to implement industrial IoT solutions likely will require very tedious on the ground consultation and user education. Further, TUYA will be competing against its technology sponsors like Amazon and Tencent if it chooses to enter the industry IoT business as a platform company.

How does TUYA's business model work?

TUYA purchases IoT chips from fabless chip manufacturers like Espressif (乐鑫科技), Beken (博通集成) and Realtek (2379 TW, NR) and design different IoT connectivity modules by mixing-and-matching peripheral components like antenna, memory, receiver/transmitter and GPIO (general purpose input/output) into finished modules. Exhibit 6 shows the eight IoT module versions TUYA

TUYA has neared a saturation level of its market share in the others category of Smart Home Devices.

[See the last page of the report for important disclosures](#)

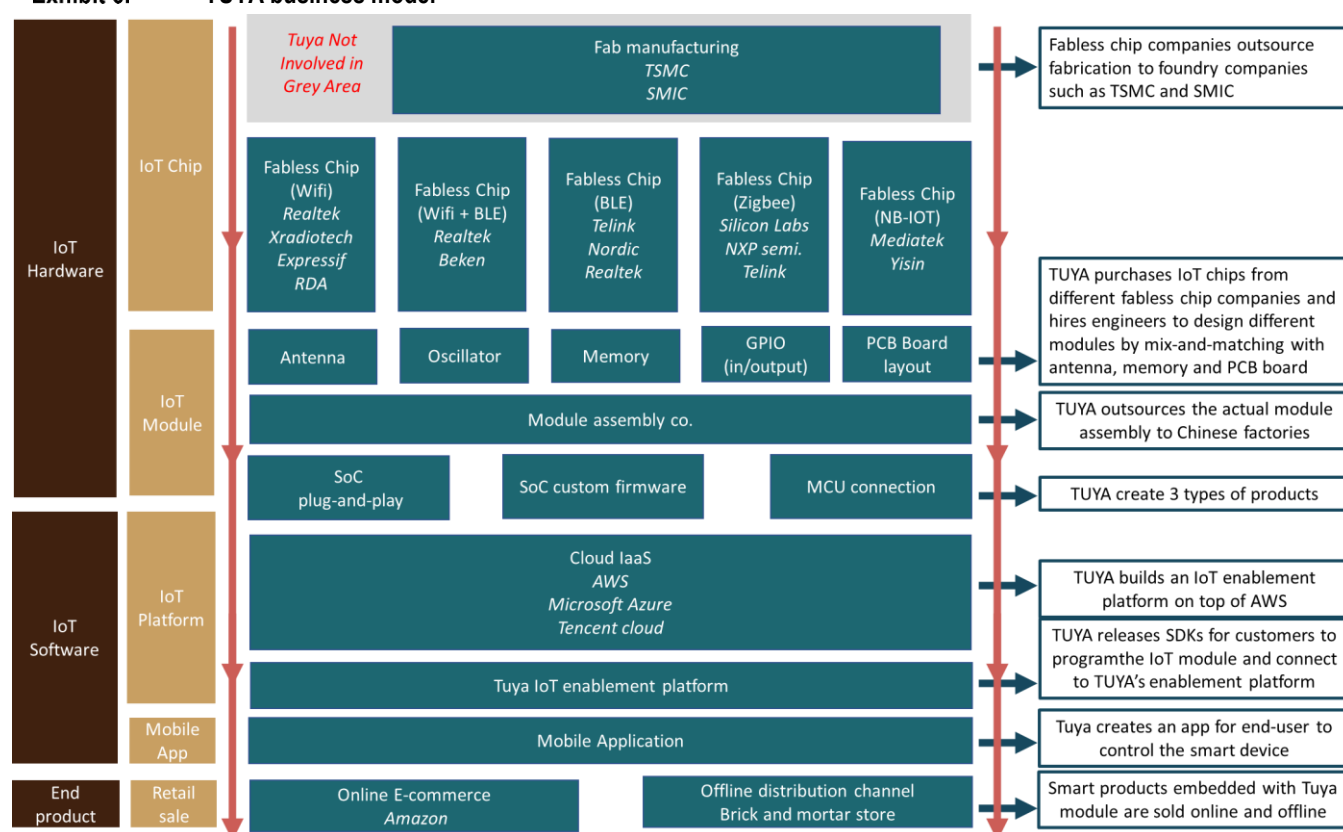
developed based on one single IoT chip, the RTL8710BN by Realtek (瑞昱). OEMs, mostly white label, then choose the module that best fit their smart IoT products.

Exhibit 5. IoT module versions TUYA developed based on RTL8710BN by Realtek

TUYA Model name	Chip	Chip manufacturer	Network Protocol	Dimension (mm)	Flash (MByte)	GPIO	UART
WR1	RTL8710BN	Realtek	WiFi	18*23.5*3.3	1	6	2
WR1E	RTL8710BN	Realtek	WiFi	18*23.5*3.3	2	6	2
WR2	RTL8710BN	Realtek	WiFi	15*18*4.9	2	5	1
WR2E	RTL8710BN	Realtek	WiFi	15*18*4.9	2	6	2
WR3E	RTL8710BN	Realtek	WiFi	16*24*3.4	2	7	2
WR4	RTL8710BN	Realtek	WiFi	13.8*15.5*3.3	1	9	1
WR5P	RTL8710BN	Realtek	WiFi	16*24*3.3	1	9	1
WR6-H	RTL8710BN	Realtek	WiFi	37.8*21.7*4.8	2	9	1

Source: TUYA, Blue Lotus (as of 13 June, 2021)

Exhibit 6. TUYA business model



Source: TUYA, Blue Lotus (as of 13 June, 2021)

TUYA also does not manufacture these modules but outsources them to third party assembly companies located in China. Before shipping to white label manufacturers, TUYA will test and certify the modules according to different IoT communication standards. At shipment, TUYA provides SDK (software development kit) for OEMs to program the IoT module to perform the desired functionality and to connect to TUYA's IoT cloud, similar to printer company providing a software driver. An illustration of TUYA's business model is shown in Exhibit 7.

Espressif and Beken make both IoT chips and generic modules. TUYA only customizes them.

See the last page of the report for important disclosures

Does TUYA sell to mostly the home electronics brands?

The answer is no. We calculated ~94% of TUYA's customers sell less than 400 units per month based on information provided by prospectus. Most of these customers are Chinese sellers selling on Amazon, whose predecessors were Chinese sellers selling on Walmart. The calculation is shown in Exhibit 8.

IoT devices having an IoT module only mean they are connected to the Internet.

Exhibit 7. TUYA IoT documentation breakdown

Items	Formula	Unit
Disclosure from prospectus		
Number of IoT PaaS customers	(A)	3,296
Device powered in 2020	(B)	116,500,000
Premium customers (contribute above USD\$100,000)	(C)	188
% of rev contributed by premium customers	(D)	87%
IoT PaaS Revenue (USD\$)	(E)	\$151,677,000
Calculation		
IoT PaaS Revenue from non-premium customers (USD\$)	$(F) = E * (1 - D) / (A - C)$	\$6,344
Price per IoT module (ASP in USD\$)	$(G) = E / B$	1.30
Result		
Device sold per non-premium customers, annual	F/G	4,873
Device sold per non-premium customers, monthly	F/G/12	406

Source: TUYA, Blue Lotus (as of 13 June, 2021)

An IoT suite connection (全屋智能) requires a software built on top to handle product-line level coordination. It is usually beyond the reach of white label manufacturers.

Today an IoT enabled product claim can boost sales. Some usage scenarios like smart lighting have also developed and have worked well in spacious houses in the US. However, an IoT enabled product doesn't mean it will be used as a connected product all the time. Control of IoT device has evolved from controlling by smartphone to controlling by smart speaker. The next step will be controlling by rules and the next after next will be controlling by sensors. To do so an IoT suite connection requires all IoT devices in the home to interoperate with each other under a centralized control. This means all IoT devices in the home, big or small, simple or sophisticated, must operate under one network and one protocol. Only brand with a broad product line up covering the full spectrum of devices can make it happen.

Small white label manufacturers do not have the incentive nor resources to build a IoT product suite.

We believe periodically one product from a major brand might try purchase TUYA module to quicken its time to market, due to the absence of interoperability in suite IoT at this time. But using TUYA isn't going to be the long-term product strategy of the major brands.

Using TUYA isn't going to be the long-term strategy of major home electronics brands.

What signs tell TUYA is not a PaaS or SaaS company?

TUYA's product manual shows its PaaS and SaaS offerings are supplement to its IoT modules and are optional to use. Despite claiming to work with many developers, TUYA's operating matrices do not consist of usage, instead of unit, based pricing mechanisms. We believe TUYA's PaaS/SaaS offering resembles more of post-sales service than recurring, subscription. Just like most iPhones are sold with iCloud offered free of charge. But not everyone uses iCloud, nor can it be monetized, even for Apple. As such TUYA's Net Dollar Retention (NDR) doesn't carry any meaning, in our opinion.

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This is why, we believe, TUYA pricing model is unit-based, because TUYA can only make money by selling IoT modules, but not by selling cloud data storage, transmission, processing and control. In most simple smart home appliances, of which TUYA's customers operate, minuscule amount of data is generated with almost no processing required. A smart light bulb that can be turned on and off via a mobile app transmitting only 0.6MB of data a day.

TUYA's cost of revenues showed it is a module company

According to prospectus, TUYA's cost of revenues consist of material cost, manufacturing charges from outsourced factories, warranty cost, inventories write-downs, production staff payroll cost, third-party cloud infrastructure expenses.

This contrasts to the cost of revenues of SaaS, PaaS and IaaS companies which are primarily bandwidth cost, server depreciation, IDC cost, etc. In Exhibit 9, we further referenced the cost of revenues of TUYA's competitors in module design to highlight the similarities between the cost of revenues of these companies (Exhibit 9), which shows TUYA is fundamentally a hardware company.

TUYA's NDR doesn't carry any meaning, in our opinion.

TUYA's cost of revenue suggested it is hardware company, not a cloud company

Exhibit 8. Compare Agora (PaaS), Salesforce (SaaS), Kingsoft (IaaS) & IoT module peers

Company	Cost of revenue
TUYA	Our cost of revenue consists of the costs directly related to providing our products to our customers. These costs and expenses primarily include (i) purchase price of materials (e.g. the modules on which the edge capabilities of IoT PaaS are embedded); (ii) manufacturing charges from outsourced factories ; (iii) estimated warranty costs; (iv) inventory write-downs; (v) payroll cost of production support personnel; and (vi) third-party cloud infrastructure expenses that are directly attributable to the provision of our products and services.
Agora (API US) (PaaS)	Cost of revenue consists primarily of costs of bandwidth purchased from network operators and cloud providers, data center co-location costs, depreciation of servers and network equipment and personnel costs for customer management and services employees.
Salesforce (CRM US) (SaaS)	Cost of subscription and support revenues primarily consists of expenses related to delivering our service and providing support, including the costs of data center capacity, certain fees paid to various third parties for the use of their technology, services and data and employee-related costs such as salaries and benefits.
Kingsoft Cloud (KC) (IaaS)	Our cost of revenues primarily consists of (i) IDC costs, (ii) depreciation and amortization costs, (iii) staff costs and (iv) other costs.
Quectel Wireless (603236 CH) (IoT Module design)	During report period, company did not directly manufacture product. All products are outsourced to third party. Cost of revenues include material costs for baseband chip, memory chip, radio frequency chip, outsourced labor cost and certification cost .
Fibocom Wireless (300638 CH) (IoT Module design)	During report period, company did not directly manufacture product. All products are outsourced to third party. Cost of revenues include material costs for baseband chip, memory chip, radio frequency chip, outsourced labor cost and certification cost .

Source: TUYA, Agora, Salesforce, Kingsoft, Quectel, Fibocom, Blue Lotus (as of, 13 June, 2021)

TUYA's product offering shows no cloud business attributes

We summarize TUYA's service offering in Exhibit 10 by reviewing TUYA's IoT platform documentation. We found most of the service offerings are one time development and certification. Only email/SMS/voice messaging and mobile phone notification services are charged based on usage with US\$2.97 per million API calls and US\$1.17 per million messages each month, which aren't going to generate a lot of revenues. How many times will you be notified about your light bulbs by email/SMS/voice messages?

We calculate, based on TUYA's service manual, that it can only charge a recurring fee of US\$4 a month if a consumer turns on and off or change color or temperature of his/her smart home device a million times in a month, which is clearly impossible.

Only white brand manufacturers who do not have a persist brand will use TUYA's service.

TUYA's PaaS/SaaS service component is a token.

See the last page of the report for important disclosures

The problem is, we don't think the usage level of TUYA enabled smart home products will go up over time, because they are simple devices. TUYA's technology foundation, which is built on Amazon FreeRTOS, can only be used for simple devices.

Exhibit 9. TUYA IoT documentation breakdown

Category in documentation (TUYA prospectus item)	Description	Pricing (USD\$)
Hardware product development (IoT PaaS)	Off-the-shelf or custom-made IoT modules, together with an app (offered for free) developed by TUYA to test the module functionality for some IoT modules	Per module unit
Cloud development (IoT PaaS)	Cloud development which has 4 products: 1) email service, SMS service, Voice messaging service & mobile push service	Annual fee (ranging \$3,000 to \$30,000) + Usage fee (\$2.97 per mn API calls & \$1.17 per mn messages every month)
Edge compute (IoT PaaS)	Off-the-shelf edge gateway purchase	Per gateway sale
Data center (IoT PaaS)	Data center which tracks 5 types of data: Number of activation, registration, fault, feedback and respective device region	Annual fee of \$ 60-100
Configure in platforms (Smart Device Distribution)	Order off-the-shelf smart device via TUYA IoT platform	Per smart device sale
Testing and certification (SaaS & Others)	1) Software testing (IoT modules functionality test) 2) Hardware testing (Packaging material, structure, validity of buttons) 3) Certification services which help customers secure national product safety standard	(One-time) WWGA (Work with google assistant) certification \$750
Smart product solutions (SaaS & Others)	US-compliant hardware design document	Free
Value-added service (SaaS & Others)	1) Enabling connection with smart speaker such as Alexa 2) Certification services with CQC (China quality certification center) 3) Smart operation which is device log storage and data analysis 4) Door Lock SMS notification and Cloud recipe (send recipe with an app) 5) IP camera including IPC video stream pushing and cloud storage for videos 6) Marketing including WeChat mall, Smart home VR experience software, white-background product photography and marketing video shooting 7) App customization 8) Smart product hardware design	(All one-time) Google/Alexa connection: Free WWGA (Work with Google): \$750 Device Log: Free Device data analysis: \$60-600 Video storage: Annual fee of \$44.99 WeChat Mini Program: \$1,500 App Mall: \$750 Product shot / Promo video: on-demand
IoT marketing channel platform (SaaS & Others)	Marketing channel platform (TUYA Expo platform, TUYA Mall, TUYAGo)	Annual fee: \$1,500
App development (SaaS & Others)	Customized mobile phone app development	(All one-time) App Advanced features: \$300 App Launch: \$450 OEM App Update: \$750
Panel development (SaaS & Others)	Customized the app user-interface	Included in app cost
Industrial IoT (SaaS & Others)	1) Production test solution which aims to reduce defects in the mass production process 2) cloud smart manufacture which is a guide to track the production status of the smart device using such as serial number	NA
Smart business (SaaS & Others)	1 item which is commercial lighting, pieced together by the existing TUYA smart blubs	No complete product yet

Source: TUYA, Blue Lotus (as of, 13 June, 2021)

TUYA has many competitors

TUYA has a commanding market share in the IoT modules that go into *white labelled, others* category of smart *home* devices. Each IoT module costs about US\$1-1.5, which can be a big fraction of a low-end smart home device like a light bulb or power switch sold on Amazon. It can also be a small fraction of the cost of high-end smart home device like a smart TV or smart speaker. From a broader IoT market perspective, TUYA has many competitors once it expands out of its niches. Exhibit 11 shows a summary of TUYA's competitive landscape in a broader sense.

TUYA faces little competition in its niche but many competitions if put under the scope of a broader IoT market.

Exhibit 10. TUYA competitive landscape in a glance

	Network technology focus		IoT module	IoT software		End product empowered	
	Short-range network technology (WiFi, Bluetooth, Zigbee)	Long-range network technology (2G-5G, NB-IoT, LoRa)		IoT cloud platform	Mobile application development	Stand-alone device	All-in-one brand of devices
TUYA	•		•	•	•	•	
Short-range module design peers							
Ailink (四川爱联) (P)	•		•	(Xiaomi Vela, AliOS)			
Gaosd (高盛达) (P)	•		•	(AliOS, Huawei HiLink, AWS)			
FN-Link (欧智通) (P)	•		•	(Ali, Google, AWS)			
MXChip (上海庆科) (P)	•		•	•	•	•	
Long-range module design peers							
Sunsea Group (002313 CH)	•	•	•	•	•	•	
Meigsmart (002881 CH)		•	•				
Quectel Wireless (603236 CH)		•	•				
Fibocom Wireless (300638 CH)		•	•				
Neoway Technology (688159 CH)		•	•	•			
Smart home IoT platform peers (mostly startup)							
Ayla Networks/Sunsea Group (P)	•		•	•	•	•	
Broadlink (博联) (P)	•		•	•	•	•	• *
Ewelink (易微联) (P)	•		•	•	•	•	
Gizwits (机智云) (P)	•	•	•	•	•	•	
AbleCloud (智云奇点) (P)		•	•	•	•	•	
Argrace (雅观科技) (P)	•		•	•	•	•	
Delan (杭州德澜) (P)	•		•	•	•	•	
Mobile app peers							
Home Connect (P)					•		
Smart home suite peers							
Orvibo (欧瑞博) (P)							•
Lifesmart (云起) (P)							•
Xiaomi	•		•	•	•		•
Huawei (P)	•	•	• **	•	•		•
All-round IoT platform (Not TUYA competitors)							
Amazon AWS		•		•			
Google Cloud		•		•			
Microsoft Azure		•		•			
Alibaba	•	•	• ***	•			•

Source: (P) = Private company; TUYA, Blue Lotus. *Broadlink launched its own product brand; **Ailink for WiFi, Hisilicon for 5G; ***MXchip & Delan for short-range

Generation gap sets competitors apart in the overall landscape

As Exhibit 11 shows, TUYA mainly powers standalone IoT devices that employs the short range IoT technology like Wi-Fi, Zigbee and Bluetooth, but not long-range technology like cellular, NB-IoT and LoRa. Short range are mostly 2C while long range are mostly 2B. There are companies and platforms that do both, such as Huawei, Alibaba and Sunsea Group (日海集团). Sunsea Group acquired the China arm of Ayla Networks in 2018 so it has presence in both short and long range.

All four short range module design companies have ties with Alibaba with TUYA the only exception, with was invested by Tencent.

In addition to modules, TUYA also offers an IoT cloud platform and a mobile app, which sets TUYA apart from the module designers that only do hardware. In this camp TUYA competes against Ayla, Broadlink, Gizwits, AbleCloud, Ewelink, Argrace and Delan, to name a few. Venture funding has dried up in this sector since 2019 due to the lack of profitability. Based on our research, MXCHIP has upgraded its offerings to include off-the-shelf IoT cloud platform and mobile app and thus should be considered a full-fledged competitor to TUYA.

On the mobile app front, short range module designers who do not offer their own mobile apps work directly with IoT platforms like Xiaomi's Vela, Huawei's Harmony/HiLink, Alibaba's AliOS, Amazon's Alexa, Google's Assistant etc. As IoT intelligence evolves from controlling by smartphones to by speakers to automatic rule to intelligent sensor controls, mobile app is widely expected to be phased out in a near future. White label manufacturers must choose one of the IoT platforms to join as the barrier of launching an ecosystem is far greater than building a mobile app.

Huawei, Alibaba and Sunsea have presence in both short range and long range IoT networking technologies.

TUYA's direct competitors are Ayla, Broadlink, Gizwits and AbleCloud.

Mobile app controlling IoT device is a rudimental stage of intelligent IoT.

Suite intelligence + IoT platform = true smart home

To realize the vision of true IoT, which is control by automatic intelligence in absence of human, instead of finger flips on a mobile phone, two parties must collaborate. One party is the IoT platforms which provides the tools. The other party is the system integrators which connect all the dots. The latter is the camp of smart home suite intelligence companies.

Home electronics companies already have a comprehensive product portfolio should be an ideal candidate for the later camp. This is where Xiaomi goes and soon Huawei and Oppo/Vivo will be going. Traditional home electronics giants like Haier, MIDEA and GREE are actively exploring to IoTize or broaden their product portfolios. New upstarts like Viomi Technology (VIoT US, HOLD, US\$8.8) tried to quickly assemble a broad range of products, sacrificing profitability along its growth trajectory.

A new breed of companies tried to assemble a suite intelligence product line by focusing first on the easy to automate appliance categories. The trend of furnishing new home has become a helping hand. According to our <Beike initiation: A self-propelling ecosystem with great potential>, pre-furnished new home units rose from 10% of total to 36% from 2016 to 2020. As pressure mounts to new home developers to sell their products quickly, pre-furnishing with IoT-enabled installations has become an eye-catching differentiator.

Companies in this category includes all the traditional home electronics makers, Xiaomi, Huawei, Oppo/Vivo, Viomi, as well as new companies like Orvibo and LifeSmart. Both Orvibo and LifeSmart invited real estate developers to be their shareholders, illustrating the importance of this distribution channel for their products.

Control beyond a mobile app requires technology that is beyond the white label manufacturers and TUYA who serves them.

Pressure from the government forces new home developers to differentiate by pre-furnishing their units, leading to wide experiment of IoT-enablement.

Providing the toolbox to these device makers, software vendors and system integrators are the IoT platforms like Amazon, Google, Microsoft, Alibaba and Tencent.

TUYA is a version 1.0 company of AIoT or smart home

TUYA's success to date reflects the failure, or prematurity, of the visions crafted by the IoT platforms. Instead of having an orderly network of cloud, traffic gateway and interconnected customer premise equipment's (CPE). IoT landscape is now a hodgepodge collection of disparate standards, confusing gateways, insecure information and single use devices.

Amazon sellers are the biggest beneficiary of the current status of 2C IoT. TUYA is, in turn, the biggest beneficiary serving this anarchistic group of vendors. But we argue that this will not always be the case. In fact, it reflects the market condition before maturity.

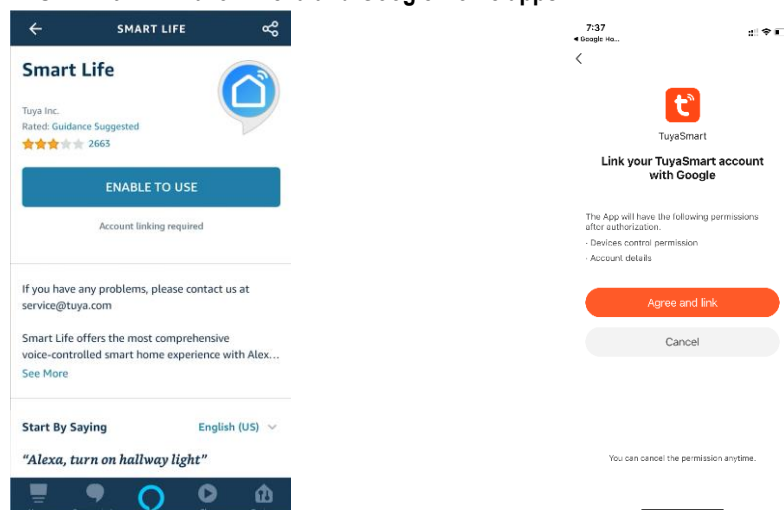
TUYA's software SDK runs on FreeRTOS, which is a kind of open-source real-time operating system (RTOS) supported by Amazon. Developers only needs to learn how to program in FreeRTOS in order to control smart device with TUYA's module.

Although TUYA provides a cloud IoT platform and a mobile app, they are not the only way to control devices with TUYA's IoT module. Both Amazon and Google released apps that can control TUYA-equipped products. In Amazon's Alexa app, end users only need to install a skill called <Smart Life> to gain control over TUYA's device. In Google Home, end users only need to choose TUYA under <Works with Google> to control TUYA's products (Exhibit 12). In both apps, TUYA is just one out of hundreds of that end user can tick to easily control their device.

TUYA has no control of the underlying IoT OS. Anyone who can use FreeRTOS can program TUYA's modules.

TUYA's app is not the only way to control TUYA's products

Exhibit 11. TUYA within Amazon Alexa and Google Home apps



Source: TUYA, Amazon, Google, Blue Lotus (as of 13 June, 2021)

As illustrated above, TUYA thrived at a time when the IoT market lacks product that can deliver a comprehensive user experience. TUYA's IoT module sales heavily rely on platform and ecosystem buildup done by the IoT platforms, with rules of engagement and ecosystem policy also dominated by these platforms. Unless the situation of anarchistic divergence continues, TUYA cannot continue to benefit from the IoT industry.

TUYA doesn't control any real asset to bargain against the IoT platforms.

Can TUYA become big enough to bargain for a better deal?

Not only does TUYA use IoT platform's standards, it also uses their cloud service like Amazon AWS. The question is can TUYA become big enough, or can it speak on behalf of the white label manufacturers, to bargain for a better deal when the IoT industry matures?

We believe the odds are there, but the challenge to profitability is daunting. Because to do so TUYA must continuously invest to do the "dirty work" for a transient customer base that will soon find their breathing space squeezed by suite intelligence and smartphone makers. At the early days, consumers are dazzled by the novelty of IoT devices, but the boundary of creativity will exhaust at some day. Quality and service will kick in as main attribute of the product. When market consolidates, each major player will try to establish their own mini-ecosystem. This will mean a proliferation of new sub-standards that need to interoperate. When upstream and downstream both consolidate, the profit margin of TUYA in between will get squeezed.

We believe TUYA's profit margin in the long run will get squeezed as its upstream and downstream both consolidate.

TUYA needs to upgrade to deal with more sophisticated scenarios

Among IoT OS, FreeRTOS is the low-end version judged from the amount of memory it uses. Exhibit 13 compares RTOS vs Full OS. in terms of their fit for use (Exhibit 13). This fits Amazon's e-commerce interest to support the numerous sellers selling devices, but does not fit with Amazon's cloud interest because the memory and storage these devices use are minuscule.

On the contrary, Google's IoT OS Fuchsia employs a few hundreds of KB of memory, which shows it is mainly used for bigger, more sophisticated IoT appliances. Huawei's Harmony is somewhere in between, showing it is trying to accommodate both high end and low end.

Space to highlight certain comments from the main body text. This will generally be a summary of the points that have been detailed in the main text.

Exhibit 12. IoT OS comparison

	RTOS (Real Time Operating System)	Full OS
Good for small devices	Yes	No
Level of application hardware control	Medium	None
Ability to multitask	Capable, but not with 100% separation	Yes
Overhead	Minimal	High
Efficient memory usage	Yes	No
Scalable / Portable	Medium	Easily portable
Memory required	<1KB	>16MB
Popular examples	FreeRTOS (Amazon)	Linux (Open-source)
	AliOS (Alibaba)	Windows (Microsoft)
	TencentOS Tiny (Tencent)	
	NuttX (Xiaomi)	
	RT-Thread (Open-source)	
	Raspbian (Open-source)	
	VxWorks (Commercial)	
	SafeRTOS (Commercial)	

Source: TUYA, Amazon, Google, Blue Lotus (as of 13 June, 2021)

Given TUYA's IoT platform only supports five types of data at the moment: activation times, registration, fault, feedback and device region, the intelligence which the device can carry is very rudimentary. TUYA might need to expand its platform support to include more sophisticated standards like Fuchsia or Harmony 2.0. Doing so means a period of heavy investments.

TUYA's neutral stance is a disadvantage in industry SaaS

TUYA's recently announced it would enter industry SaaS as a neutral platform. But we believe this strategy is ill-advised.

TUYA's competitors have been penetrating the industry IoT for years. Some, like Ayla China, part of Sunsea Group, has some tangible success, like in the hotel sector. Suite intelligence vendors like Orvibo and LifeSmart have some success through collaboration with leading developers like China Evergrande (3333 HK) and Country Garden (2007 HK). Aqara, as one of the Xiaomi investments, will likely ally with Xiaomi in the real estate sector.

Unlike 2C IoT, there doesn't exist a white label manufacturer community to pursue profit through meeting consumer demand. There exists, however, numerous service organizations to meet the business needs. TUYA will likely need to work with these service organization to penetrate the industry SaaS market.

Orvibo had allied with Evergrande and LifeSmart with Country Garden.

Finding an entrepreneurial group of vendors to enable is TUYA's challenge in industrial SaaS.

Valuation is unsustainably high

As of today, TUYA is trading at 36x 2021 PS. This compares to a domestic module comparable 2.6x 2021 PS and global module comparable 2.6x 2021 PS (Exhibit 14 and 15).

We believe several common pitfalls might exist in the valuation of TUYA.

- First, we don't believe TUYA's gross margin truly reflects its variable cost;
- Second, TUYA's total addressable markets (TAM) might be smaller than conventional wisdom thinks;
- Third, we believe TUYA should be valued as a hardware company, instead of a cloud company, as previously stipulated.

TUYA is very expensive comparing to its peers.

Exhibit 13. Comps valuations multiples

Company	Ticker	Price	Mkt Cap	PE (consensus)			PEG	PS (consensus)			EV/EBITDA (consensus)		
		(Local)	(US\$m)	2021E	2022E	2023E	2020E	2021E	2022E	2023E	2021E	2022E	2023E
Tuya Inc	Tuya US Equity	22.02	12,359	(141.7)	(112.2)	(105.0)	NM	36.2	22.3	14.5	(82.1)	(57.0)	(53.3)
China IoT module companies (long-range network technologies)													
Neoway Tech.	688159 CH Equity	29.22	419	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Quectel Wireless	603236 CH Equity	161.56	3,670	65.7	41.2	26.8	1.2	2.7	1.9	1.4	41.3	28.9	NM
Fibocom Wireless	300638 CH Equity	42.28	2,731	41.8	31.4	24.2	1.3	4.4	3.3	2.5	33.3	25.4	19.9
Sunsea AIoT Tech	002313 CH Equity	12.56	735	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Overseas IoT module companies													
Sierra Wireless	SWIR US Equity	16.94	625	(33.7)	205.8	105.9	NM	1.3	1.2	1.1	213.8	23.6	NM
Telit	TCM LN Equity	227.5	431	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Thales SA	HO FP Equity	86.04	22,208	15.1	12.7	11.2	0.9	1.0	1.0	0.9	8.5	7.5	6.9
Murata manufacturing	6981 JT Equity	8300	51,137	21.3	18.8	15.7	1.3	3.3	3.0	2.8	10.3	9.2	8.0
IoT Brand													
Alarm.com	ALRM US Equity	82.6	4,110	46.7	40.1	35.1	3.1	6.0	5.8	5.0	31.0	26.6	24.5
Viomi	VloT US Equity	8.16	569	11.7	8.1	7.8	0.5	0.5	0.5	0.4	5.2	4.9	4.2
Xiaomi	1810 HK Equity	28.15	90,940	29.3	24.1	19.9	1.4	1.7	1.4	1.2	22.1	18.9	15.6
Chips companies													
Qualcomm	QCOM US Equity	134.62	151,851	16.9	15.4	14.5	2.1	4.7	4.3	4.2	12.5	11.9	12.2
Intel	INTC US Equity	57.85	233,598	12.3	12.9	12.0	11.6	3.2	3.2	3.0	7.4	7.2	6.7
Mediatek	2454 TT Equity	980	56,449	16.7	15.7	14.4	2.1	3.3	2.9	2.6	13.2	11.5	10.4
Companies with IoT platform													
Amazon	AMZN US Equity	3346.83	1,687,886	45.1	35.4	27.3	1.6	3.4	2.9	2.5	22.7	18.4	14.6
Microsoft	MSFT US Equity	257.89	1,942,318	32.9	30.7	26.7	3.0	11.7	10.4	9.2	23.7	21.0	18.0
IoT application													
Impinj	PI US Equity	49.79	1,199	(339.8)	143.4	81.5	NM	6.9	5.8	5.0	(743.3)	188.9	75.8
Dexcom	DXCM US Equity	400.19	38,701	173.7	119.7	85.9	4.1	16.5	13.6	11.5	77.9	58.2	43.6
ASUS	2357 TT Equity	383	10,304	7.6	9.3	10.6	(0.5)	0.6	0.5	0.5	4.6	5.4	6.1

Source: Blue Lotus (as of 13 June, 2021)

Exhibit 14. Comps financial metrics

		Revenue (\$US mn)			Gross margin			Net margin (GAAP / IFRS)		
Ticker		2019A	2020A	2021E	2019A	2020A	2021E	2019A	2020A	2021A
Tuya Inc	Tuya US Equity	106	180	342	26.3	34.4	41.5	(66.6)	(37.2)	(37.9)
China IoT module companies (long-range network technologies)										
Neoway Tech	688159 CH Equity	113	83	NA	25.0	14.7	NA	7.0	(13.1)	NA
Quectel Wireless	603236 CH Equity	598	886	1,365	21.2	20.2	20.3	3.6	3.1	4.1
Fibocom Wireless	300638 CH Equity	277	398	617	26.7	28.3	27.7	8.9	10.3	10.6
China IoT module companies (long-range network technologies)										
Sunsea AIoT Tech	002313 CH Equity	672	549	NA	20.0	11.7	NA	1.7	(14.4)	NA
Overseas IoT module companies										
Sierra Wireless	SWIR US Equity	547	449	484	36.1	35.4	35.2	(12.9)	(11.0)	(12.8)
Telit	TCM LN Equity	393	344	NA	32.9	35.4	NA	12.1	1.8	NA
Thales SA	HO FP Equity	20,600	19,397	21,508	24.6	23.2	26.3	6.1	2.8	5.6
Murata manufacturing	6981 JT Equity	14,207	14,111	15,378	38.1	37.9	38.2	13.1	11.9	14.5
IoT Brand										
Alarm.com	ALRM US Equity	502	618	684	63.5	63.2	63.4	10.7	12.6	6.2
Viomi	VloT US Equity	673	845	1,107	23.3	18.6	19.7	6.3	3.0	3.8
Xiaomi	1810 HK Equity	29,803	35,670	52,397	13.9	14.9	15.9	4.9	8.3	6.5
Chips companies										
Qualcomm	QCOM US Equity	24,273	23,531	32,197	64.6	60.7	57.7	18.1	22.1	24.0
Intel	INTC US Equity	71,965	77,867	73,930	58.6	56.0	56.6	29.2	26.8	21.7
Mediatek	2454 TT Equity	7,970	10,941	17,254	41.9	43.9	45.3	9.4	12.7	19.6
Companies with IoT platform										
Amazon	AMZN US Equity	280,522	386,064	490,283	41.0	39.6	41.0	4.1	5.5	5.9
Microsoft	MSFT US Equity	125,843	143,015	166,252	65.9	67.8	64.7	31.2	31.0	35.7
IoT application										
Impinj	PI US Equity	153	139	174	48.4	46.9	50.6	(15.0)	(37.4)	(24.5)
Dexcom	DXCM US Equity	1,476	1,927	2,343	63.1	66.4	65.5	6.8	25.6	9.4
ASUS	2357 TT Equity	11,372	14,020	17,405	15.2	17.7	21.3	3.5	6.4	7.8

Source: Blue Lotus (as of 13 June, 2021)

Gross margin does not reflect true variable cost

Cost of revenue should reflect a company's variable cost. We believe this is not done with TUYA.

Based on our observation, TUYA's compensation cost for RF and embedded system engineers, who are essential to the production of TUYA's IoT modules, should be counted as cost of revenues. Their job is not to develop company specific technology that will benefit the company's future revenue streams, but to customize customer's requirements on a project-by-project basis.

We believe a better way to evaluate TUYA's true gross margin is to arrive at an adjusted gross margin by breaking down R&D cost into two parts and moving the labor cost of module customization into cost of revenues.

We refer to TUYA's job posting on job sites like BOSS Zhipin (BZ US, NR) to estimate the percentage of RF/embedded engineers in TUYA's employee structure. We estimate ~25% of the technology-focused job listings of TUYA are RF/embedded system engineers. We therefore shifted 25% of R&D cost off OPEX and into cost of revenues. The result shows TUYA's gross margin is in-line with peers. (Exhibit 16)

We adjust between TUYA's gross and operating margin line to better match revenue with cost.

Exhibit 15. TUYA gross margin and adjustments

	1Q20	2Q20	3Q30	4Q20	1Q21E
TUYA gross margin	30.3%	30.3%	34.4%	38.3%	41.1%
Adjusted gross margin	9.4%	19.9%	25.9%	28.2%	25.9%

Source: TUYA, Blue Lotus (as of 13 June, 2021)

Exhibit 16. TUYA total addressable market

	Unit
No. HH in countries w/ GDP/capita >US\$25,000 + China (mn)	907
(x) % smart home penetration rate	20%
Smart home household (mn)	182
(x) Number of smart appliances in each household	30
Total smart appliances (mn)	5,445
(x) Unit revenue (\$USD)	\$1.87
Total addressable market (\$USD bn)	\$10.2 Bn

Source: United Nations, Blue Lotus (as of 13 June, 2021)

Real addressable market is smaller than TUYA's market cap

By using unit economics calculation attached in Appendix, we calculated TUYA's real addressable market by subtracting module procurement cost from its revenues. Assuming total household with GDP/capita more than US\$25,000, including China, 20% smart home penetration rate, 30 smart appliances in each household, we arrive the total addressable market for TUYA's claimed PaaS/SaaS market to be US\$10.2bn, which is already bigger than TUYA's market cap, not to mention a sizable of this market should go to IoT platforms like Google, Amazon, Huawei, Xiaomi and many others.

We estimate TUYA's TAM to be only US\$10.2bn.

Exhibit 17. FCF valuation of TUYA

USD K	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Revenue	179,874	338,780	532,162	842,787	1,274,858	1,833,754	2,501,805	3,236,183	3,981,356	4,702,993	5,445,374
EBIT	(60,400)	(113,196)	(104,458)	(50,868)	73,487	322,086	734,638	982,645	1,248,725	1,522,092	1,816,812
NOPAT	(60,331)	(113,072)	(104,343)	(50,812)	73,406	321,732	733,830	981,564	1,247,352	1,520,417	1,814,813
Capex, net	(3,201)	(7,017)	(11,023)	(17,457)	(26,407)	(37,984)	(51,822)	(67,034)	(82,469)	(97,417)	(112,795)
Depreciation & amortization	1,662	3,203	5,882	10,111	16,624	26,186	39,520	57,169	79,368	106,078	137,292
Change in working capital	1,821	12,687	14,210	19,294	24,824	27,332	26,387	41,959	42,576	41,231	42,416
Free operating CF (FoCF)	(60,049)	(104,199)	(95,273)	(38,864)	88,447	337,266	747,915	1,013,658	1,286,826	1,570,310	1,881,727
Revenue growth, y/y (%)	70.0%	88.3%	57.1%	58.4%	51.3%	43.8%	36.4%	29.4%	23.0%	18.1%	15.8%
EBIT margin (%)	(33.6%)	(33.4%)	(19.6%)	(6.0%)	5.8%	17.6%	29.4%	30.4%	31.4%	32.4%	33.4%
DCF Parameters											
Interest-bearing liabilities as a % of EV	0.0%										
WACC	14.0%										
NPV of FoCF	9,989,635										
+ Net cash (debt), current	158,955										
- Pension prov. (Book value)	0										
- Minorities (Market value)	0										
+/- Other items	0										
= Equity value	10,148,590										
/ Number of American Depositary Shares	637,764										
= NPV per share (US\$)	16.0										

Source: Blue Lotus (as of 13 June, 2021)

Appendix

In appendix, we include the background research which lays the foundation of our report.

TUYA unit economics

Exhibit 18 shows our estimation of TUYA's unit economics by collecting module price listed on TUYA's IoT platform and applying a 30% margin. We applied a 15% discount because our check shows TUYA adopted a 3-tier membership scheme where members get a discount of 10-15% on IoT module after paying a membership fee of RMB \$300K – 600K. We attributed the difference between Exhibit 18 ASP and ASP of \$1.39 USD in 2021 Q1 earnings to our assumption of equal sales % of cheap and expensive module.

Exhibit 18. TUYA unit economics

Network Technologies	Series	Module Name	Chip manufacturer	Total Cost (\$USD)	Module Cost (\$USD)	License Key (\$USD)	RMB Total cost
WiFi	WR	WR3L WiFi module	Realtek	2.30	2.00	0.30	14.84
WiFi	WE	TYWE3S Wi-Fi Module	Espressif	2.03	1.73	0.30	13.09
WiFi+Bluetooth	CB	CB3L Wi-Fi&Bluetooth Module	Beken	1.66	1.36	0.30	10.71
WiFi+Bluetooth	TYJW	TYJW2S-5V-BL Wi-Fi Module	TUYA	3.30	2.30	1.00	21.29
WiFi+Bluetooth	WBR	WBR3 Wi-Fi&Bluetooth Module	Realtek	2.54	1.54	1.00	16.38
WiFi+Bluetooth	WB	WB3S Wi-Fi&Bluetooth Module	Beken	1.69	1.39	0.30	10.90
Bluetooth	BT	BT3L Bluetooth Module	Telink	1.10	1.00	0.10	7.10
Zigbee	ZT	ZTU ZigBee Module	Telink	2.20	1.70	0.50	14.19
Zigbee	ZS	ZS3L ZigBee Module	Silicon Labs	2.97	2.47	0.50	19.16
Average				2.20			14.18
Applying a 15% discount				1.87			12.06
Unit Profit assuming 30% margin				0.56			3.62

Source: TUYA, Blue Lotus (as of 13 June, 2021)

Areas IoT can be applied

Mckinsey used “settings” to define areas IoT could be applied. (Exhibit 19)

Exhibit 19. IoT settings (Mckinsey)

Setting	Description	Example
Human	Devices attached to or inside the human body	Devices (wearables) to monitor and maintain human health and wellness; disease management, increased fitness, higher productivity
Home	Buildings where people live	Home controllers and security systems
Retail environments	Spaces where consumers engage in commerce	Stores, banks, restaurants, arenas—anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
Offices	Spaces where knowledge workers work	Energy management and security in office buildings; improved productivity, including for mobile employees
Factories	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory
Worksites	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
Vehicles	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircraft, and trains; condition-based maintenance, usage-based design, pre-sales analytics
Cities	Urban environments	Public spaces and infrastructure in urban settings; adaptive traffic control, smart meters, environmental monitoring, resource management
Outside	Between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations), and flight navigation; real-time routing, connected navigation, shipment tracking

Source: Mckinsey

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Difference between Consumer IoT and Commercial & Industrial IoT

Exhibit 20 shows the difference between consumer IoT and Industrial IoT (IIoT). The stark differences between consumer IoT & industrial IoT lead to different wireless technology used and different companies in the respective industry chains.

Exhibit 20. Difference between consumer IoT and industrial IoT

Criteria	Consumer IoT	Industrial IoT (IIoT)
# of devices connected	<50	100-10000
Useful life	Several years	Decades
Deployment environment	Flat, urban areas	Remote, physically challenging locations such as humid, underground with limited power supply
Data points/Edge computing	Low as not much data is generated in consumer settings	High as IIoT can generate mn/bn datapoints, edge computing is essential in order not to overload the centralized systems
Range/coverage	Short range because deployment is confined to mostly household	Long range because of the deployment environment
Power efficiency requirement	Low	High because of the number of devices deployed
Precision and accuracy	Low	High
Programmability	Low	High because industrial systems are frequently re-programmed and reconfigured to support new processes
Low latency required	No	Yes
Reliability	Low	High
Wireless technology preference	WiFi, Bluetooth, BLE, Zigbee, Z-wave	Cellular (3G-5G), Low Power Wide Area Networks (LPWAN) such as LTE-M, NB-IoT, LoRa

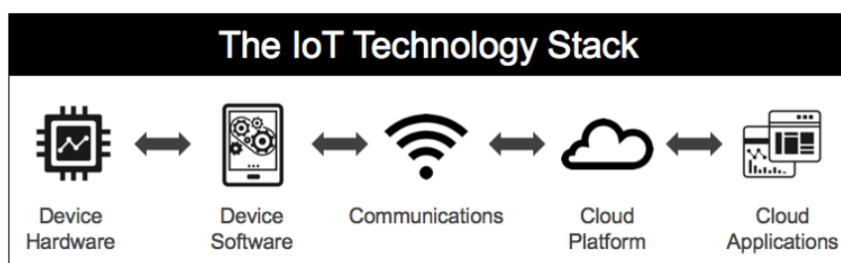
Source: Blue Lotus (as of 13 June, 2021)

IoT framework

We find the best framework to understand IoT is to break it down from a IoT product manager perspective. Because at the end of the day, product company pays for the IoT costs, therefore has the most stakes to identify the IoT partners best suit for its products. Note the below framework apply to both consumer IoT and commercial & industrial IoT.

To build a complete IoT solution, a product manager would need to answer all questions associated with below 5 building blocks (Exhibit 21).

Exhibit 21. IoT building block



Source: Daniel Elizalde website

Device hardware: Device hardware refers to the “things” in the internet of things. It acts as interface between the real and digital worlds.

Things to consider as a product manager:

- What real-world signals need to be measured? (i.e., what type of sensors do I need)
- How many sensors of each type required?
- How often the real-world signal is collected? (i.e., sample rate)
- How much accuracy required in measurement? (i.e., sensor resolution)

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- Cost to redesign the hardware
- Ease of deployment
- Reliability
- Useful lifetime

Device software (Edge): Device software enables device hardware to perform (multiple) applications based on the embedded software. Device software block includes the type of operating system (OS), and the type of applications and analytics the hardware will run. “Edge computing” is performed at the device software level.

Things to consider as a product manager:

- Operating System: Real-time OS? What type of I/O support required? Support for the full TCP/IP stack? (e.g. AWS FreeRTOS, Linux etc.)
- What % of functionality is carried out on the Edge vs Cloud?
- Need for a gateway?
- How much processing power required?
- Enough processing power for future software upgrades/releases?
- How many sensors required?
- Require to perform real-time control?
- How much local storage required? (affected by function, data retention policy, whether device needs to work offline)

Communications: Communications refers to all the different ways the smart device will exchange information with other devices / cloud through external connectivity. This includes both wireless technology and the network protocols used.

Things to consider as a product manager:

- Which wireless connectivity protocol to get data in and out from the cloud (WiFi, Zigbee, Bluetooth, BLE, Cellular 2G to 5G, LPWAN)
- What kind of network protocol to use? (MQTT vs HTTP? Or industry specific such as BACnet for property?)
- Do we have engineer to program the chip? (Module SDK, RTOS, IDE)

Cloud platform: The cloud platform is the backbone of IoT solution which performs data collection and device management, analytics and offer cloud APIs for customers / partners to interact with our devices or exchange data.

Things to consider as a product manager:

- How much data and what type of data we are collecting on a daily, monthly and yearly basis?
- What kind of analytical services a platform support?
- Firmware update capability?

Cloud Applications: Cloud applications refer to the part of the system that customer will see and interact with. Most likely be web-based, and may need separate apps for desktop, mobile, and even wearables.

Things to consider as a product manager:

- How many users? (for industrial IoT, likely to be more than 1 users)
- Functionality of customer-facing apps
- Development of internal apps that control remotely provision and troubleshoot devices, monitor the health of your device fleet, report on performance and predictive maintenance, etc.

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Process from Chip to Module

This website offers a good glimpse of the process of turning a chip into a module.

<https://zhuanlan.zhihu.com/p/43723989>

Real time operating system (RTOS)? IDE? How are they involve in IoT?

Upon selecting the way to connect the device to the internet, the product company next needs to hire engineer to program the device to perform the specific functions e.g. on/off, retrieve, process and send data etc. To perform these functions, a resource manager i.e. Operating system (embedded with a kernel) is required.

Besides Linux and windows, which are very popular in IoT development (but require more memory and computation power), Real-Time Operating System (RTOS) is commonly used because of their minimal memory requirement. There are many types of RTOS available, both open-sourced and commercial. The motive behind tech giants' (Amazon / Google) move to develop/own their RTOS because it helps drive cloud revenue. For instance, IoT developers could easily connect the devices to AWS IoT Core and update the devices remotely using OTA update feature if they opt for Amazon FreeRTOS.

Open source:

- FreeRTOS (supported by Amazon)
- Android Things (Google)
- RIOT
- Apache Mynewt
- Zephyr (Linux)
- Window IoT
- RT-Thread

Commercial RTOS:

- Microsoft Azure (ThreadX)
- VxWorks
- SafeRTOS (Commercial FreeRTOS)

Another tool required during the programming process is Integrated Development Environment (IDE). IDE is a software tool that enables programmers to consolidate the different aspects of writing a computer program. IDE increases programmer productivity by combining common activities of writing software into a single application: editing source code, building executables, and debugging. Popular IDE includes:

- Arduino IDE (Arduino is a company that builds MCU boards as well)
- Eclipse IDE
- Amazon Cloud9

Different types of IoT cloud platform

IoT platform is a group of technologies that provide the tools to develop IoT product. The “infrastructure” helps device companies to reduce development risk and cost, accelerate products time to market. Given the complexity of IoT system (esp. IIoT), it is rare for one single IoT platform that covers all areas of the IoT technology stack.

The most common categories of IoT platforms are:

- IoT enablement platform
- IoT connectivity platform
- IoT device management platform
- IoT Analytics platform

IoT enablement platform

IoT enablement platform provides the core building blocks for smart products, including consuming, transporting, storing, analyzing, and displaying data. These platforms aim to enable the rapid development of your application by abstracting the complexities of building an IoT solution.

There are hundreds of IoT enablement platform in the market including:

- Industrial platforms (Oracle, AWS, Azure, SAP, Schneider electric, Deutsche Telekom, PTC Thingworx, Hitachi)
- Consumer platforms (AWS, TUYA, Ayla Networks, Gizwits, Ablecloud)
- Platforms targeting developers and prototyping (Kaa, Devicehive, Particle, Verizon thingspace, Arduino IoT Cloud, Thinger.io)
- Platforms focusing on specific verticals (Ericsson for connected cars)

IoT Connectivity platforms

For most consumer IoT products that rely on Wi-Fi to connect to the internet, connectivity management might be included in their application enablement platform.

However, for industrial products such as manufacturing equipment, connected cars, these products rely on cellular technologies like 4G, 5G, or NB-IoT. The data doesn’t flow directly from the IoT device to the internet and into the Cloud platform. Instead, the data travels through a cellular network—managed by a mobile network operator—before being routed to the internet. The IoT system therefore needs to partner with multiple cellular carriers.

These connectivity platforms provide a single interface for deploying, monitoring, and managing all IoT devices around the world.

- Curiosity by Sprint, Jasper by Cisco, IoT Accelerator by Ericsson, and Pelion by ARM

IoT device management platforms

IoT device management platforms provide 1) provision and authentication, 2) configuration and control, 3) monitoring and diagnostics, and 4) software updates and maintenance.

- **Provisioning and authentication:** Provisioning involves the enrolment of a given device into the system, after which device authentication takes place to establish an identity for the device, to ensure that it is trusted and secure.
- **Configuration and control:** In order to boost a system’s control capabilities, remote resetting and configuration of devices are essential, in order to recover from errors, and to implement new changes to the device configuration.
- **Monitoring and diagnostics:** Diagnostics and monitoring are important aspects of IoT device management as they can mitigate the impact of device downtime, such as bugs in the software.

- **Software/Firmware updates and maintenance:** Software updates & maintenance refers to secure updates to and maintenance of remote device software.

Examples include:

- (Mostly IIoT) Intel, ARM Pelion, Nordic, Telit and Xilinx

IoT analytical platforms

IoT analytical platform helps analyze the data that the IoT device collects. Most of the Cloud platforms already include analysis tools, which may be enough for many applications. But for particular applications that require additional requirements around visualization, data processing, digital twins, artificial intelligence, or machine learning (ML), an IoT analytics platform can accelerate your IoT development. Example would be:

- IBM, C3 AI, SparkCognition, UpTake

For the smart home / consumer IoT, because minimal data is collected and analyzed and lower requirement on deployment environment, consumer-focused IoT platforms such as TUYA combined all 4 functions (enablement, connectivity, device management and analytics) together in one platform.

AWS IoT offerings and pricing

Exhibit 22. IoT building block

		Description	Pricing (USD\$)
Device Software			
FreeRTOS (used by TUYA)	Opensource, real-time operating system for MCU		Free (under MIT open-source license)
IoT Greengrass	Help develop IoT device software by enabling local processing, messaging, data management		Pay per device each month \$0.16 per month per device
Cloud Platform			
IoT core	AWS IoT Core can 1) connect and manage devices without managing servers, 2) support multiple connection protocol, 3) process device data		Connectivity: \$0.042 per device per year Messaging: \$1 per mn messages Rules Engine: (data processing) \$0.15 per mn rules
IoT device management	Register, track and monitor device		Bulk registration: \$0.1 per 1,000 things registered Fleet indexing and search: \$2.25 per 1 mn updates; \$0.05 per 10,000 queries Send update to device: \$0.003 per remote action
IoT device defender	IoT security		\$0.001 monthly, per device audited
Analytics service			
IoT analytics	Further data analytics		Data processing: \$0.2 (Per GB of data processed) Data storage: \$0.03 per GB data stored per month Query execution: \$6.5 per TB of data scanned

Source: Blue Lotus (as of 13 June, 2021)

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