Thing Commerce: IoT-Enabled Digital Commerce

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Smart things can make purchases on behalf of customers based on rules, context and preferences, creating new business opportunities and interactive channels. IT leaders supporting digital commerce should understand the business implications to plan for the supporting technology and infrastructure.

Key Findings

- Within the Internet of Things (IoT), connected appliances such as washing machines, fridges, cars and printers are capable of thing commerce, the primary purpose of which is to reduce customer efforts and friction in the purchasing process.
- Product replenishment and predictive maintenance are the "low-hanging fruits" of thing commerce due to the ease of predictability.
- Thing commerce enables businesses to capture incremental revenue, provide better customer service and predict market trends demands.
- Thing commerce requires sensing/input technologies, real-time decision management and transaction management capabilities.

Recommendations

For IT leaders supporting digital commerce:

- Identify products and services that are suited to thing commerce, and decide whether to offer it directly to customers and/or partner with platforms.
- Design the customer experience related to ordering the business' own products and accessing partners' services, and identify technologies such as virtual personal assistants (VPA), sensors and smart machines needed to support such an experience.
- Develop a strategy for the information ecosystem to govern who has access to the data collected via thing commerce, and the mechanism of order bidding and negotiation.
Integrate analytics into thing commerce early on to gain insight into customer behavior and market trends. Feed the insight into product development processes and customer engagement programs.

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Strategic Planning Assumptions

By 2018, 30% of businesses with a digital commerce strategy will include "things" and 5% will have deployed their own thing commerce platforms.
By 2018, at least five leading internet companies will have used VPAs to handle thing commerce, disintermediating 90% of the consumer goods companies.

Analysis

Thing commerce describes a service where smart things make purchases on behalf of the human customer by directly taking requests from the customer or inferring demand based on the rules, context and preferences, and then making optimized decisions. A smart thing is a connected appliance that may have embedded sensors and/or conversational interface, and can communicate with cloud services to take actions accordingly. The primary purpose of thing commerce is to reduce customer efforts and friction in purchases. Product replenishment and predictive maintenance are the "low-hanging fruits" of thing commerce because they’re relatively easy to predict.

Three Stages of Thing Commerce

There are three stages of thing commerce, the most sophisticated of which is Stage 3 (Figure 1). These stages are not mutually exclusive and can overlap and coexist with each other. For example, in Stage 3 things make autonomous decisions but will also take command from customers (Stage 1) and make repeat purchases based on usage (Stage 2).

Figure 1. Three Stages of Thing Commerce

Table 1 below provides a comparative overview of the three stages.
Table 1. Three Stages of Thing Commerce

<table>
<thead>
<tr>
<th>Stages</th>
<th>Description</th>
<th>Use Cases</th>
<th>Example</th>
<th>Decision Management Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>Purchase predefined products</td>
<td>Replenishment, maintenance</td>
<td>Detergent replenishment</td>
<td>Rule-based system (one to one) Human review (optional)</td>
</tr>
<tr>
<td>Adaptable</td>
<td>Select from a limited range of similar products</td>
<td>Replenishment, maintenance, ad hoc purchases</td>
<td>Choose among competing brands of detergent based on price</td>
<td>Rule-based system (one to several) Human review (optional)</td>
</tr>
<tr>
<td>Autonomous</td>
<td>Select from a wide range of different products</td>
<td>Behavior- and context-driven purchases, e.g., birthday present, social gathering</td>
<td>Order groceries from the customer’s favorite store for a friends gathering based on their preferred cuisine inferred from social media</td>
<td>Rule-based system (one to many) Smart machine Human review (optional)</td>
</tr>
</tbody>
</table>

Source: Gartner (July 2016)

Stage 1: Fixed

In this stage, smart things only order specific items as predefined or requested by customers. Here are a few examples:

- **Amazon Dash Replenishment Service (DRS)** — DRS can be embedded in any connected device such as a washing machine, printer or pet food dispenser with the purpose of reordering consumables. DRS comes with usage sensing and measuring capabilities, and automatically places orders for replenishment when the supply/usage falls under the threshold. Partnering devices include Brita water pitchers, Brother printers, Whirlpool washers, Gmate glucose monitors and Petnet feeders.

- **Amazon Echo** — A voice-enabled speaker that recognizes speeches, responds to queries and takes actions accordingly. Alexa is the intelligence behind Echo, which processes natural languages and has over 1,400 skills such as getting information, controlling home appliances and cars, playing music and making purchases. Alexa is an open platform that connects the customer directly with the business without requiring the use of Amazon services. For example, customers can order pizza from the pizza chain, call a taxi with Uber and pay their bills, all through voice-powered commands.

- **HP Instant Ink** — An ink replacement service that sends ink cartridges to customers before they run out of ink. The sensor in the printer predicts when customers will run out of ink, and orders replacement by taking into account the shipping time and normal usage before the order arrives. A subscription plan is associated with the service, which is billed monthly based on the number of pages printed.
Stage 2: Adaptable

In this stage, smart things can choose among competing products and decide the one to buy based on predefined rules. People define the rules, and things are trusted with decision making. Confirmation may still be required as customers build trust in the service and can be removed when the trust is established.

Here are some examples:

- **Staples Easy System** — A service enabling businesses to reorder office supplies via text, email, voice and the Staples Easy Button. Employees can text or email to the service, speak the item(s) to the mobile app or press the Easy Button. The service identifies the item(s) from the historic order based on brand, package and quantity preferences. All requests are aggregated at the company level, reviewed and approved by the administrator before sending to Staples.

- **RoboCrib** — An industrial vending machine that issues parts and tools to employees. The machine can automatically reorder from the designated suppliers when the inventory is low, streamlining the ordering process. It also manages issues, returns and other business processes. The company behind it, AutoCrib, claims it can help businesses reduce inventory by 20% to 50%.

- In the future, services will allow customers to define product ranges so things can choose within that range. For example, a customer is indifferent to three detergent brands and therefore delegates the smart appliance to choose the brand with the lowest price, or to choose the one with the lowest unit price and order larger quantities when there is a promotion on large packages. This requires more sophisticated rule engines and things being able to optimize the selection.

Stage 3: Autonomous

Things can buy various products by predicting customer needs based on the context and learned customer preferences. Purchases include not only consumables and routine services, the usage of which is relatively easy to predict, but also ad hoc purchases that require an understanding of user context and behavior. Things have predictive and prescriptive engines as well as machine learning, so they get smarter the more they learn about customer preferences. They can even have negotiation and auction capabilities to get the best offer to comply with rules.

In the future, for example, smart things may be able to know from the calendar that friends are coming home for dinner. They will then order groceries from the customer’s favorite store based on the cuisine friends like, inferred from their social postings or public profiles. The order will be delivered before the customer gets home, and the customer will be provided with the recipe to make use of the ingredients ordered. The oven will be preheated to the temperature required for the cooking. This is a future scenario with an advanced level of intelligence and requires advanced smart machine technologies. Gartner predicts that this kind of intelligence will arrive no earlier than 2022.
In the initial stage, thing commerce can be conducted via rule-based systems because the relationship between things and products is straightforward and order triggers can be clearly defined by customers. When things have multiple skills and need to make sophisticated choices and trade-offs, systems need to have decision-making capabilities assisted by smart machines. Typically, thing commerce systems require three technology layers to interact (Figure 2).
Figure 2. The Three Technology Layers of Thing Commerce

HMI = human-machine interface

Source: Gartner (July 2016)
Sensing/input technologies: These monitor the status of things or usage of consumables, or enable people to send requests. Sensors play a role in monitoring, especially in systems without a human interface. In cases where human interactions are included, a human-machine interface (HMI) is required where voice is the most common way of interaction, but it can also include facial, gesture, text message, email, image, video and social. Natural-language processing is an important capability and will be included in most thing commerce services. In the longer term, VPA is a primary HMI delivery method.

Real-time decision management: This includes smart machines that learn about human behavior and understand customer needs based on context, history, behavior, etc. The learning from the smart machine will feed to the rule-based system to make the selection. Customers still have the possibility to double-check the selection before the order is finally sent for processing.

Transaction management: Transaction management processes order by accessing user profiles and payment credentials, and connecting with order management and logistics providers for fulfillment and delivery.

Customers may have many smart things at home — mobile phones, thermostats, speakers, washers, fridges, cars — and they can use different VPAs and things depending on the use case. For example, when customers are on the go, they will use the VPA on the phone, and when they are in the living room, they will resort to the speaker. However, this can be confusing as the number of things increases and the VPAs may compete for customer attention and even make contradictory decisions.

A mediation mechanism is then required to coordinate with all other VPAs. This can be a bot that interconnects with all VPAs to send instructions and/or review and approve decisions to ensure consistency. The bot may sit on one device such as a mobile phone, or be embedded into other things and work seamlessly with the thing-specific VPA. For example, Ford has linked its smart cars to Alexa so customers can remotely control the vehicle and home systems by talking to Alexa either at home or when driving.¹

Implications for Businesses

Businesses have two ways to participate in thing commerce — integrate with platforms or go direct — and can choose to do both at the same time to broaden their customer reach and enrich functionality.

Integrate With Platforms

Platforms such as Amazon, Google, Microsoft and Apple are likely to be providers of VPAs and become the hub of services for consumers and enterprises. By working with platforms, businesses can ensure their products are exposed to the broadest reach of customers, and avoid efforts in building their own VPAs and related infrastructure. The majority of businesses are likely to use this approach.

There are two ways that businesses can work with platforms:
Develop services for platforms — Companies whose products and services are not related to smart things can add their services to the platform to enable ordering via the platform VPA. They should follow the guidance and documentation published by platforms such as Alexa Skills Kit (ASK).

Integrate platform services into smart things — Manufacturers of smart things can integrate platform services into their products. For example, a number of manufacturers have integrated Amazon DRS into their connected appliances and allow customers to configure the reordering process. This usually requires things to have sensors to measure usage and calculate the supply level. Automotive manufacturers such as BMW, Audi and Ford have made their cars work with Apple’s CarPlay and Google’s Android Auto. Although they don’t have commerce functionality today, they may do so in the future.

There are, however, limitations to working with platforms:

- **Functional constraints** — The features and functions offered are decided by the platform. Given the nascent state of existing platforms, there will be functionality gaps that businesses won’t have the ability to fill, meaning they may have to develop a work-around.

- **Operational constraints** — Platforms may impose certain rules and conditions on businesses when participating in the offering. For example, Amazon DRS requires the use of Fulfillment by Amazon even when products are not sold through Amazon. In addition, platforms are likely to have a review and approval process similar to what mobile app stores do today, and may deny the access of some services based on their own rationale.

- **Lack of control of customer experience** — Customer experience is likely to be similar among competing products. Businesses cannot differentiate their offerings even when they have brilliant ideas. Sometimes poor performance of the platform, such as poor voice recognition or real-time infrastructure, will also impact customer experience, which may lead to customer frustration and even churn.

- **Lack of customer data** — Platforms may not share customer data with businesses, even customers are buying their products.

**Go Direct**

Leading businesses are likely to go direct with their own offerings and build the infrastructure to process thing commerce. Businesses have two ways to go direct, and can do both when necessary.

1. **Build Sensors Into Things**

Manufacturers that provide devices and equipment can benefit from this approach. Sensors help collect usage and status information. For example, sensors measure usage of consumables such as washing powder and printer ink, and trigger the ordering system when the usage threshold is hit. They can also alert support services when things are malfunctioning and give initial diagnosis so that service staff can be prepared. Examples include consumer products such as home appliances.
and cars, as well as industrial equipment such as engines, medical equipment, ATMs and power grids.

Businesses need to have specific customer information — at least for payment and shipping — to process reordering. This is more of a challenge for consumer-facing businesses that require strong brand and consumer trust to render such information. One possible scenario is that the information is held on the customer’s master VPA, which will share the information with various service providers under specific conditions.

There can also be a service plan associated so that the purchase process can be automated. HP Instant Ink, for example, has a monthly plan based on pages printed, and the system will automatically send cartridge replacement when the ink level is low. Businesses can also use the pay-per-purchase model so customers pay exactly for what they use.

2. Build Your Own VPA and Platform

This is a direct channel for businesses to communicate and serve their customers. It gives the greatest flexibility as to how functionalities and interactions are created. For businesses interested in having their own VPA, they may leverage existing technology in the market. For example, Alexa Voice Service can be embedded into smart devices with a microphone and speaker that are not built by Amazon, so companies don’t have to develop their own voice recognition technology. The VPA can be offered as a software such as a mobile app, or may be embedded into things. Examples include Google Assistant in the Android operating system, the Easy Button in Staples Easy System and BMW ConnectedDrive in BMW cars and personal devices.

It is important that the platform not only allows customers to purchase a company’s own products but also gives them access to value-added services from partners, such as to control things and related functions. For example, the car allows customers to activate the home security system as they are leaving, or raise the room temperature as they are coming home. The air quality detector can order filter replacement and an air-conditioning cleaning service based on the pollution level. Businesses can build the open platform with open APIs or development frameworks. For example, LG is developing a platform to be used by its own appliances, as well as enabling connectivity to devices from other manufacturers such as smart thermostats.

More importantly, this approach allows businesses to own customer data. When done correctly, and assisted with good analytics, businesses gain valuable insight into customer needs and wants, pain points in using the products, and are even able to personalize offerings based on the insight (see below). Businesses need to respect customer privacy and comply with local regulations in each country.

Challenges of going direct include the following:

- Branded VPAs require a tremendous amount of investment and are suited to businesses with a strong brand, deep pockets, and strong R&D capabilities in at least HMI and machine learning.
- Not all things need a VPA. A VPA requires customer interaction and needs to fit nicely into the use case. But things can just have sensors to detect usage and provide service status to allow businesses to respond proactively to customer needs.
Privacy is always a concern when businesses are obtaining personal data and constantly tracking user behavior. The issue is more pronounced when businesses are opening the platform to third parties or sharing customer data with partners. Immature standards and regulations can lead to increased misuse of customer data, and increase a company’s liability when “things” are making decisions. Additional security investments may also be required when operating a platform.

New Business Opportunities

A New Way of Marketing and Selling
As smart things are making decisions, it is difficult for businesses to market to customers if they don’t have their own things/VPAs and sell through other platforms. Thing commerce providers may offer advertising for product/service recommendation to customers, in a similar way to how keyword advertising recommends those vendors that bid the highest. Thing commerce providers may also allow businesses to bid for orders based on customer rules, and companies can change pricing and conditions in real time to win the order. Thing commerce providers may charge a fee for the bidding service.

Personalized Products
Thing commerce providers have the opportunity to personalize product offerings based on customer data. For example, pharmaceuticals and medical service providers can personalize medicine and caring service based on the patient’s vital signs, dietary and workout routines. Sportswear manufacturers can customize design to best suit the customer’s measurement and workout routines. They can also use the aggregate data to predict future trends and even demand and design new products, and plan production accordingly.

Data as a New Business
Thing commerce providers may share some customer data with partners to offer better customer experience. They may also sell anonymized and aggregate data, and customized data insight based on business requests, bringing in new revenue streams.

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Internet of Things Scenario: When Things Become Customers"

"Architect Your Business to Engage, Interact and Serve ‘Things’ as a New Customer Segment"

"Top 10 Strategic Technology Trends for 2016: Autonomous Agents and Things"

"Top 10 Strategic Technology Trends for 2016: Ambient User Experience"
"Preparing for the Post-App Era"

"Emerging Technology Analysis: Natural-Language Question Answering"

"Smart Agents Will Drive the Switch From Technology-Literate People, to People-Literate Technology"

Evidence

1 "Smart Cars Meet Smart Homes: Ford Exploring Sync Integration With Amazon Echo and Alexa, Wink." The Ford Motor Company MediaCenter, Ford. 5 January 2016.
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