IBM Institute for Business Value

Empowering the edge

Use case abstract for the ADEPT proof-of-concept

Overview

This use case abstract supplements the IBM Institute for Business Value practitioner perspective, "Empowering the edge: Practical insights on a decentralized Internet of Things." These ADEPT B2C and B2B use cases spanned devices and capabilities, and were executed with functional Samsung products in close collaboration with Samsung Electronics.

This abstract illustrates the value of devices autonomously performing various IoT transactions, both financial and non-financial, thereby potentially creating new digital economies.

The B2C use cases were implemented for the Autonomous Decentralized Peer-to-Peer Telemetry (ADEPT) proof-of-concept (PoC) in the second phase of the 2014 IBM Internet of Things Study. The B2C cases were:

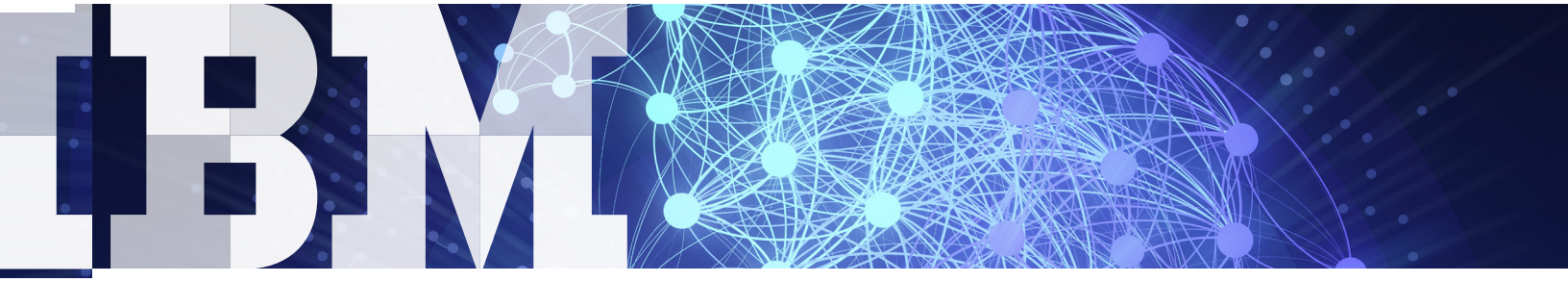
- A W9000 Samsung washer autonomously reordering detergent
- A W9000 Samsung washer autonomously reordering service parts
- A W9000 Samsung washer autonomously negotiating power usage.

The B2B case consisted of Samsung Large Format Displays (LFDs) autonomously displaying advertising content.

B2C cases: Autonomous washer participates in the consumables, service and energy marketplaces

Our set of B2C use cases was demonstrated by a washer, a common household appliance. Using ADEPT, it became an autonomous device capable of managing its own consumables supply, performed self-service and maintenance, and even negotiated with other devices, both in the home and outside, to optimize energy consumption.

We also envision scenarios where micro-commerce solutions can be built using a set of ordinary home appliances. Functions such as warranty checks, payments and notifications would be achieved without a central controller orchestrating or mediating between the devices – a revolutionary result based on how appliances generally work today.



Use case 1. Consumables marketplace: A washer orders its own detergent

Today, most appliances with consumables require the user to order or purchase refills via a retailer. Examples include: printer cartridges, coffeemaker filters, disposable vacuum cleaner bags, refrigerator water filters and washer detergent.

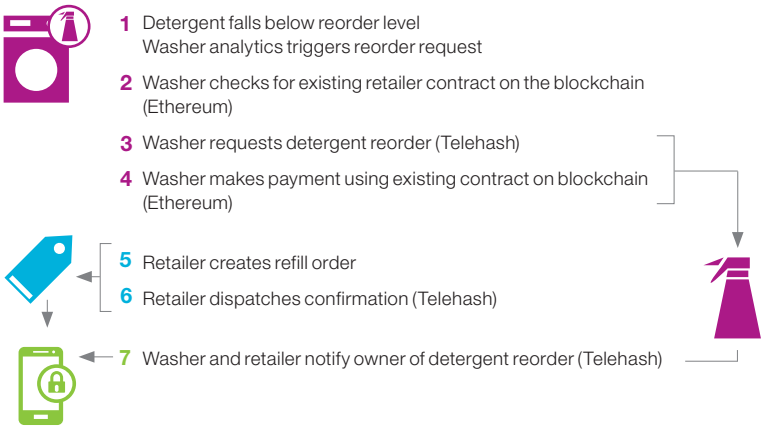
The ADEPT washer consumables use case is based on the premise that appliances of the future will have sufficient intelligence to autonomously manage their consumables by engaging in real-time with a consumables marketplace (see Figure 1). The Samsung washer W9000 used for demonstration of the PoC can run device-level analytics to detect when its detergent supply runs low. In addition, the ADEPT-enabled W9000 washer was able to:

- Query the blockchain and determine that there was a pre-existing contract with a retailer for the refill of detergent
- Request a detergent refill by means of a peer-to-peer message to the retailer
- Invoke a pre-existing contract with the retailer and make a secure payment for the order over the blockchain
- Inform the owner via a peer-to-peer message that a replenishment order was being placed.

The retailer in this case was able to:

- Determine the validity of the contract with the washer on the blockchain
- Receive secure payment through the contract over the blockchain
- Generate the refill order once the payment was received
- Communicate delivery details to the washer by means of a peer-to-peer message.

Figure 1
IoT transactions for the autonomous washer's order of a consumable (detergent, in this case).



In a more complex scenario of this use case, retailers would be able to bid on the blockchain based on price, inventory or delivery performance, and consumers (the appliances themselves) could select retailers by consensus. Such a decentralization of the marketplace opens up economic opportunities in industries that are otherwise very tightly controlled.

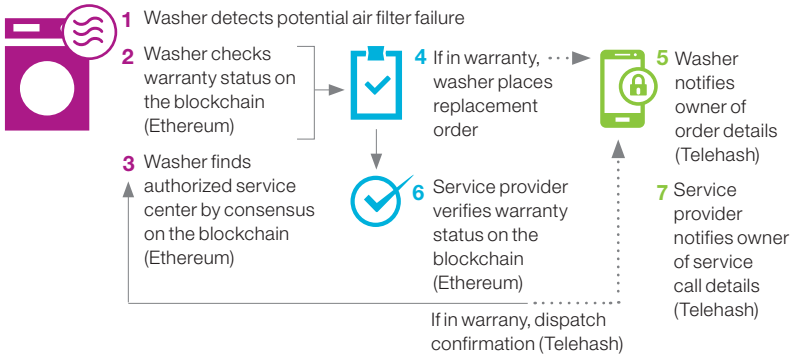
Use case 2. Service marketplace: A washer requests and pays for its own maintenance call

The appliance service market today is very fragmented, with neither service providers nor consumers achieving the highest level of value in the marketplace. The ADEPT PoC attempted to better connect supply and demand in service marketplaces by leveraging features of the blockchain. Every ADEPT-enabled device has key information, such as its device ID and warranty information, registered to the blockchain. Devices also store their own warranty information in the local peer list. In addition to detecting an impending part failure, the autonomous washer was able to autonomously order a service replacement part in the marketplace.

For this use case, the ADEPT washer was enabled to engage in the following actions (see Figure 2):

- Run device analytics to assess part or component performance. The washer triggered a service request when an impending part or component failure was detected.
- Query its peer list for local warranty details to determine its own warranty status
- Identify an appropriate service vendor by checking for peer-rated consensus over the blockchain
- Once a service vendor was selected, the washer raised a service request to the service vendor. If the appliance was under warranty, no payments would be needed. If out of warranty, the appliance, owner and service vendor could create a new contract to make a payment.
- Upon receiving the request, the service vendor checked the warranty status of the device in the blockchain
- Upon verification of active warranty coverage, the service request was then accepted as a service order in the vendor's service system and the details were sent to the washer, along with a notification to the owner
- The owner and vendor could negotiate through messaging to confirm when the service professional would arrive to replace the part.

Figure 2
IoT transactions for autonomous washer service order.



In a more complex scenario of this use case, service providers could bid on the blockchain – based on an inventory of service parts, utilization and proximity of service personnel, quality of service and other chosen variables – and consumers would be able to select a service provider by consensus. Such a decentralization of the service marketplace should improve profitability in industries that otherwise are not operating at optimal capacity.

Use case 3. Energy marketplace: Home appliances negotiate power usage to reduce costs

Physical assets often have unused capacity or resources a majority of the time. These resources could include compute power, memory, bandwidth or energy. Such excess capacity and resource often cannot be effectively utilized due to insufficient discoverability, security or payment mechanisms.

By improving discoverability, usability and payment mechanisms, ADEPT enables better resource optimization between devices. A small instance of this concept is captured in the use case of the ADEPT washer participating in a power bartering transaction to optimize overall energy consumption. In this use case, the washer created a contract to negotiate transactions and payments among power-hungry appliances in the home (see Figure 3).

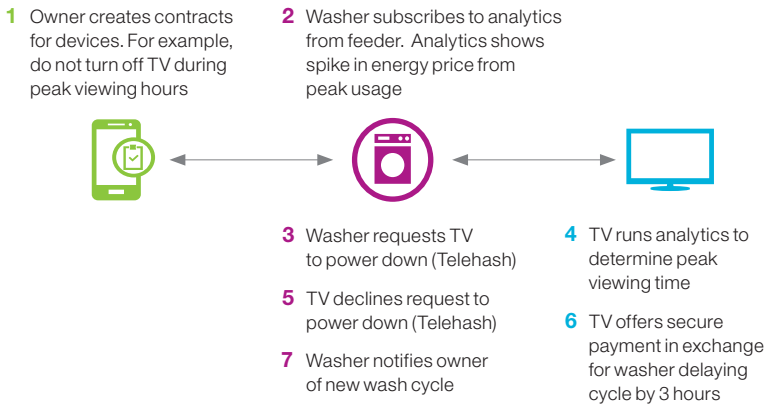
The washer was enabled to:

- Subscribe to analytics from a feeder that indicated an upcoming spike in energy price. Accordingly, it determined that a power negotiation with its peers was required to protect the owner from punitive charges.
- Detect that the TV was operational and request it to "power down." (A TV was used for demonstration purposes, but this scenario could apply to other appliances).

The TV was enabled to:

- Run analytics to recognize that it could not power down because the request came during peak TV viewing time
- Send a notification to the washer declining to power down and, in turn, compensate the washer with owner-approved payment, per the contract
- Make a secure payment and delay the washer cycle to a pre-determined time
- Inform TV viewers that an impending power price hike was offset by the washer delaying its cycle.

Figure 3
IoT transactions for autonomous energy barter between appliances.



An extension of this use case showed the washer negotiating directly with a community-owned micro-grid. In exchange for a specific number of KWH of power for one week, the washer was able to offer a pre-determined number of free wash cycles to community members at a later date, per a contract between the owner and the community.

B2B case: Large Format Displays (LFDs) participate in the advertising marketplace

Use case 4. Advertising marketplace: Devices control content and scheduling

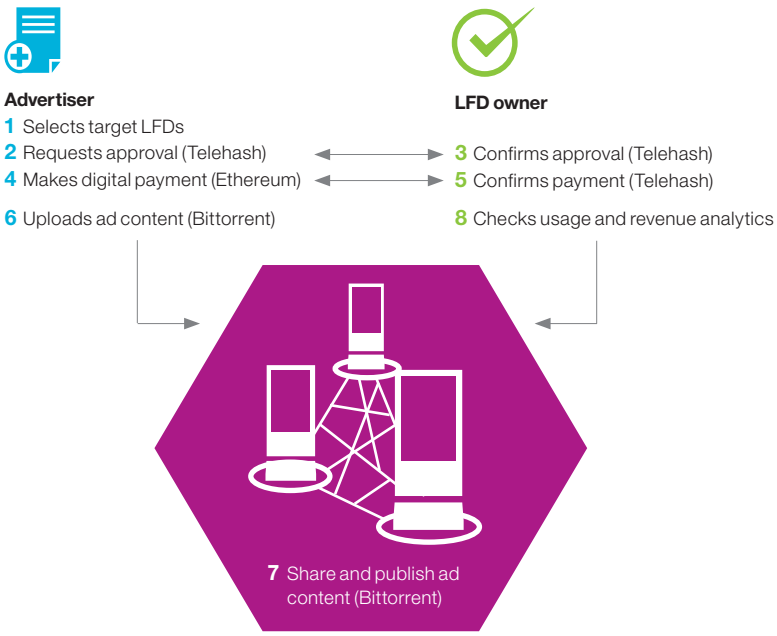
Advertising is another marketplace that is highly centralized today with content tightly controlled by a few large players. Our B2B ADCast use case demonstrated a decentralized advertising marketplace using Large Format Displays (LFDs) to share and publish content, all without a centralized authority (see Figure 4). The LFD owner had multiple LFDs hosted at strategic locations. In this use case, the LFD owner:

- Published availability of display slots in real time
- Leased display space on the devices to candidates after reviewing their content.

LFDs participating in this marketplace were enabled to:

- Discover available slots in real time and submit a request to display content
- Receive content uploaded by the owner through distributed file sharing
- Approve and automatically transmit content to be displayed at appropriate time slots
- Make and receive secure payments for displaying content through the blockchain.

Figure 4
IoT transactions for an autonomous advertising marketplace



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Related publications

Pureswaran, Veena, Sanjay Panikkar, Sumabala Nair and Paul Brody. "Empowering the edge: Practical insights on a decentralized Internet of Things." IBM Institute for Business Value. March 2015. http://www-935.ibm.com/services/us/gbs/thoughtleadership/empoweringedges/

Brody, Paul and Veena Pureswaran. "Device democracy: Saving the future of the Internet of Things." IBM Institute for Business Value. September 2014. www.ibm.biz/devicedemocracy

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