Digital Product Lifecycles
Initial Thoughts

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Introduction

Exploring the product analogy for data sharing, brings us rapidly to ask the following types of questions:

- How is a digital product implemented?
- What is a digital product instance verses a digital product release?
- How is data in a digital product corrected if mistakes are found?
- How is the schema, or terms and conditions for a digital product changed once you have consumers relying on it?

As always, explicit worked examples are often the quickest way to explore a new concept. What follows is a proposed view of different styles of digital products and how they are managed.
Each example of a digital product is related to an organization's (Coco Pharmaceuticals in this case) focus on improving sustainability through reduction in carbon emissions and better use of resources.

You will notice that the different types of digital products fall into three broad categories.

Data products are standardised collections of data values, optimised for a particular purpose. Data is returned into the consumer's environment to use and each consumer gets the same set of data values.
Insight services provide APIs that combine information from the consumer with its data and analytics resources to provide customised insight to the consumer. The insight service runs in the product delivery environment and is called from the consumer's environment.
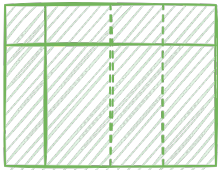**Embedded features** are downloadable software capabilities that run in the consumer's environment. They may call back to the product delivery environment to retrieve data and software updates.

Please note that there are many ways to implement each of these given styles. While we show particular technologies for simplicity, other choices are possible.

1.0 Static data products

Probably, the simplest forms of data products are the ones that deliver a somewhat fixed collection of data values. Often these are look-up tables that are used in many reports, transformations and business processing.

Coco Pharmaceuticals site list is an example of this:

	Coco Pharmaceuticals Sites A list of the different physical sites operated by Coco Pharmaceuticals. Details of each site include its name, address, site manager, along with details of each of the facilities operating at the site and person responsible for the facility.	
Versions	**File name**	**Version description**
V1.0	coco-sites-v1.csv	First version.
V1.1	coco-sites-v1.1.csv	New product instance reflecting addition of the new Bucharest site.
V1.1.1	coco-sites-v1.1.1.csv	Restatement of V1.1 to correct the address of new Bucharest site.
V2.0	coco-sites-v2.csv	New version that has a new format making it easier to integrate with reporting tools.

The site list is implemented as a CSV file to make it easy to consume both by individuals and systems/tools. Despite the fact that this data is relatively static, there are occasional changes made to it.

Whenever a change is necessary, a new CSV file is created. This is a new **product instance**.

The version identifier describes the product instance's relationship with the other instances. For example V1.1 is an update to V1.0. It reflects a new situation - the addition of a new site - at a particular point in time.   A report may use both the V1.0 and V1.1 versions of the file if it is comparing activity across different time periods for example.

V1.1.1 is slightly different. It is correcting an error in V1.1 and should supersede (replace) it. We call this a **restatement**. A new product instance is created to allow consumers to identify whether they have a particular data fix installed. For example, once V1.1.1 is available, the report described above should switch to using V1.0 and V1.1.1. V1.1 should be discarded.

All of the V1 product instances have the same format, and terms of use associated with it. The same processing can work with any of the V1 product instances.

V2.0, uses a different format. For example, it may have its columns in a different order, or use different data types for certain values. This means the consumers will have to be adapted to support the new version. Because of that the major version number is incremented and this is a new **product release**.

While this example is described using a CSV file, the same patterns could be applied if the data was maintained in another technology, such as a relational table.
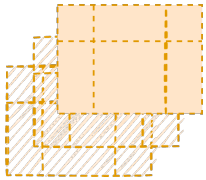
2.0 Periodic data products

Now let us compare the static reference data product to those that deliver data that is periodic.

Periodic data products deliver new product instances on a regular schedule. Often this type of data describes an aspect of the organization's activity and the product instances capture data related to a specific time-period.

Periodic data products can be delivered either as a delta, or as a snapshot.

2.1 Periodic delta data products

This next example is delivering a **delta**. By this we mean it delivers all of the new/changed data values that have been collected in the last time period.

	Monthly carbon emissions
	A list of the activities that occurred each month and the associated carbon emissions.

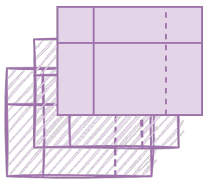| Versions	File name	Version description
V1.january-2022	monthly-carbon-january-2022-v1.csv	Carbon producing activity for January 2022.
V1.february-2022	monthly-carbon-february-2022-v1.csv	Carbon producing activity for February 2022.
V1.february-2022.1	monthly-carbon-february-2022.v1.1.csv	Restatement of the figures for February 2022 due to a data collection error at the Austin site.
V1.march-2022	monthly-carbon-march-2022.v1.csv	Carbon producing activity for March 2022.
V1.april-2022	monthly-carbon-april-2022.v1.csv	Carbon producing activity for April 2022.
V2.april-2022	monthly-carbon-april-2022.v2.csv	Carbon producing activity for April 2022.
V1.may-2022	monthly-carbon-may-2022.v1.csv	Carbon producing activity for May 2022.
V2.may-2022	monthly-carbon-may-2022.v1.csv	Carbon producing activity for May 2022.

Notice that new product instances are produced regularly (one a month in this example). The expectation is that they are used together, and the consumer is aggregating the values for their own use.

There are also two product releases: V1 and V2, that use different data formats. V1 has instances going back to January 2022 and V2 starts in April 2022. There is an overlap in the time periods that the product instances for each release cover. This is to give consumers time to move to the V2 format. In fact, the organization may choose to retrospectively release V2 product instances for January 2022 to March 2022 to aid that process. When all of the consumers have moved to V2, production of the V1 product instances can stop.

In this example, there is also a restatement of the V1 figures for February 2022. As before , the V1.february-2022.1 product instance should replace the V1.february-2022 product instance in each consumer's environment.

2.2 Periodic snapshot data products

Periodic data products that produce a **snapshot** are regularly delivering product instances containing the current known data values for a collection of data. Each new product instance can be used to replace the previous instance in the consumer's environment, unless the consumer is interested in the history of these values.

	Aggregated carbon emissions Calculations of the organization's carbon emissions for the year organized by site and activity.

Versions	File name	Version description
V1.january-2022	aggregated-carbon-position-january-2022-v1.csv	Aggregated carbon position for January 2022.
V1.february-2022	aggregated-carbon-position-february-2022-v1.csv	Aggregated carbon position for February 2022.
V1.february-2022.1	aggregated-carbon-position-february-2022.v1.1.csv	Restatement of the figures for February 2022 due to a data collection error at the Austin site.
V1.march-2022	aggregated-carbon-position-march-2022.v1.csv	Aggregated carbon position for March 2022.
V1.april-2022	aggregated-carbon-position-april-2022.v1.csv	Aggregated carbon position for April 2022.
V2.april-2022	aggregated-carbon-position-april-2022.v2.csv	Aggregated carbon position for April 2022.
V1.may-2022	aggregated-carbon-position-may-2022.v1.csv	Aggregated carbon position for May 2022.
V2.may-2022	aggregated-carbon-position-may-2022.v1.csv	Aggregated carbon position for May 2022.

Notice that the production of the product instances mirror those of the monthly carbon emissions. In fact they could even be produced by the same digital service. This means there are product instances for the V1 and V2 formats, and this product also needed a restatement in February 2022 due to the same input data error.

3.0 Continuous data product

Continuous data products emit the current value of a particular data item. The consumer can choose how frequently they sample the emitted values and what history they maintain.

The continuous nature of this type data product means there is only one product instance for each product release. As before, a new release is created whenever the format, or the terms of use is changed. Typically, each release emits at a different endpoint.

	Current production activity level A continuous feed of the production activity level in each of Coco Pharmaceutical factories. The values are refreshed once a minute. It can be used in scheduling new production requests.
Versions	**URL**	**Version description**
V1.0	/feed/v1/current-production-activity	First release.
V2.0	/feed/v2/current-production-activity	New release that adds details of the Bucharest site and separates production of personalised medicine from traditional medicine.

Restatements do not occur with these types of data products. If an error is discovered, future emitted values contain the correct data values.

4.0 Event data product

Event data products produce a notification whenever a particular event occurs. Consumers can receive the notifications in real-time or periodically review the events that have occurred. For each event product release there is one original product instance and a new product instance for each restatement.
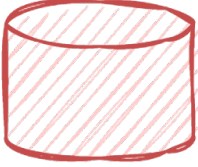
	Sustainability-related invoices A topic emitting an event for each invoice received by the accounts team that is relevant for Coco Pharmaceuticals' sustainability calculations. This includes employee travel, particular chemical purchases and logistics services.	
Versions	**URL**	**Version description**
V1.0	/topic/v1/sustainability-related-invoices	First release.
V1.1	/topic/v1.1/sustainability-related-invoices	Correction of events that describe employee travel to avoid double-counting flights that were being supplied twice via separate data sources.
V2.0	/feed/v2/sustainability-related-invoices	New release that adds details of the associated payments for the invoices.

5.0 Accumulating insight service

The accumulating insight service provides a queryable interface over a collection of data. The consumer provides query parameters to limit the data returned.
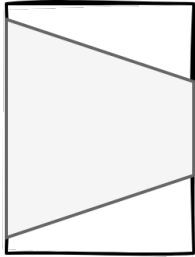
The data source(s) behind the insight service are continuously accumulating new data and so the same query issued on two successive days may not return the same values. Where consistency is important, accumulating insight services offer an **asOf** option to their query interface to allow the query to be based on a particular point in time.

	Carbon inventory List of Coco Pharmaceuticals' resources that need to be included in carbon emission calculations. Each entry describes the resource		
Versions	**URL**	**Version description**	
V1.0	/api/v1/carbon-inventory	First release.	
V1.1	/api/v1.1/carbon-inventory	Correction of emission-basis for factory operations.	
V2.0	/api/v2/carbon-inventory	New release that adds support for IT systems.	

It is possible to provide a restatement product instance (V1.1 in the carbon inventory example) if the process that calculates the data values, or a data source is found to be in error. As before, a changing format or terms of use results in a new product release.
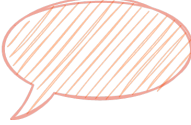
6.0 Learning insight service

The learning insight service uses analytics and data to provide additional insight around the data supplied by the consumer. The consumer's data may be added to the insight service's data sources to continuously improve the results.

	Sustainable travel planner
	Provides employees with advice on methods of travel and accommodation choices to minimise the environmental impact of their business trip. The employee provides details of their trip and any constraints they may have. The insight service returns different options along with the environmental impact of each option. The employee makes a choice and the tool books the travel.

Versions	URL	Version description
V1.0	/api/v1/sustainable-travel-planner	First release.

Augmenting insight services continuously improve its results based on experience. Therefore they do not have restatement product instances. There is typically one product instance per product release.

7.0 Informing embedded feature

An informing embedded feature runs on the consumer's hardware. It provides information to the consumer, often combining information from the consumer with its algorithms and remote data sources. It may provide information back to the product owner.

	Personal carbon calculator iPhone app Locally collects data about an individual's activities and provides a running estimate of their carbon footprint. The app periodically downloads reference data to use for its calculations. No personal or activity information is shared.

Versions	URL	Version description
V1.0	/apps/v1/personal-carbon-calculator	First release.
V2.0	/apps/v2/personal-carbon-calculator	Add support for car travel.
V3.0	/apps/v3/personal-carbon-calculator	Add support for home energy use.

New versions are being released. Depending on the type of subscription, they could be upgraded under the control of the consumer, or pushed out as soon as they are available. The choice of upgrade model determines how many releases are in use at one time.

8.0 Operating embedded feature

An operating embedded feature controls an aspect of the consumer environment. It may provide information to the consumer and well as feed information back to the product owner.

	Coolant emission detector A smart detector providing reporting on the level of coolant being released in the location. It sets off an alarm if the levels go above a specified threshold.	
Versions	**URL**	**Version description**
V1.0	/apps/v1/coolant-emission-detector	First release.

New versions of the product can be made available for download to the consumer's environment. The readings may be captured and made available as, for example, a periodic data product.

Summary

Although these product types are implemented using different technologies and offer different styles of services, they all respect the fact that the consumer will have made an investment in to the use of the product and any changes to the product will require changes on the consumer's side too. So new versions are offered in parallel to the existing versions, giving the consumers time to migrate. Scope changes often lead to a new data product rather than a new version.

Mistakes can happen, and so the product categories define how these mistakes will be corrected, and what the consumer should do to pick up the corrections.

Finally, some products include both software and data. They may be updated on a different lifecycle and that needs to be understood by the consumer. Part of the agreement between the product supplier and the consumer can include how and when new versions of the software are enabled, since this will change not only the data, but the processing that occurs within the product.