Cold Jet *CONNECT*

IoT-Phase II

Data Platform Recommendation

Ned Portune

Oct 01, 2019

IOT DATA PLATFORM (CURRENT) SYNOPSIS

In December 2018 Cold Jet entered into a 1 year agreement with EAC for a 12 month subscription to the PTC *Thingworx* IoT data platform. This agreement was intended to support a March 2019 PCS 60 launch, and was to provide:

- **Initial Commercial IoT product availability, with**
  - Customer IoT interface
  - Customer Service IoT interface
  - Diagnostics data retention
  - User/access management

In addition we hoped to gain insight into:

- Effort/resource needs to deploy
- Effort/resource needs to customize
- Usability
- Performance
- Reliability

The *Thingworx* platform has now been in place since March 30, 2019, with significant vendor development support.

This document captures the evaluation of the *Thingworx* platform and the recommendation for our IoT platform for the next 3 year period.

SUMMARY

The recommendation as of 10-01-2019 is that Cold Jet:

- *Should NOT* renew the subscription/contract for the *Thingworx* platform at its renewal date of 12/01/2019,
- *Should* proceed immediately with parallel development (ongoing) of In-house IoT platform,
- *Should* launch/release In-house platform as *Cold Jet Connect II* on or before 11/30/2019,
- *Should* fill the posted position of *IoT Developer/Analyst* with Bob Gruen
  - and backfill with a fulltime Junior Developer in April 2020
  - and terminate the Web Co-op position after April 2020

Details supporting this recommendation are enclosed.

THINGWORX VS IN-HOUSE PLATFORM EVALUATION

As mentioned, the *Thingworx* platform was imperative to meet our goals of a March 2019 product launch.

While the launch, and associated Marketing benefits were realized, the overall IoT product experienced issues with hardware data loss and communication errors – problems that were not fully addressed until September 2019 with firmware 7.29, corresponding to the rollout of the PLT 60 product.

The *Thingworx* platform was also in a state of slow enhancement between May and September as usability, stability, and data concerns were addressed. During this timeframe we were able to fully evaluate *Thingworx* on the key performance indicators for any commercial software platform. Those are:

- Rapid prototyping/development/deployment
- Customization development cost
- Performance
- Reliability
- Scalability
- Usability
  - of the platform
  - of the end product
- Maintainability
- Interoperability
- Resource availability
  - External availability
  - In-house expertise
- ROI and cost predictability

Meanwhile, we have been developing and evaluating in parallel an In-house application solution. In the evaluation KPIs of the *Thingworx* platform below, I also list the similar anticipated rating of the In-house solution.

Ratings are based on the following scale:

- Poor
- Fair
- Average
- Good
- Very Good

RAPID PROTOTYPING/DEVELOPMENT/DEPLOYMENT

Thingworx Status: Poor

The *Thingworx* platform is a proprietary development environment and as such requires specific training and skill set to use. In addition, we had hoped that as an existing development platform there would be a significant body of existing widgets/features to be easily implemented in our deployment. This has not proven to be the case, and most work has been customizations performed uniquely for us and in some cases functionality may not exist at all.

In-house (estimated): Very Good

The ability to perform quick prototyping, and deploy updates quickly is immensely easier with an in-house solution based on standard programming language/platform instead of proprietary controls.

CUSTOMIZATION DEVELOPMENT COST

Thingworx Status: Average

On a per hour basis, *Thingworx* consultancy cost is mid-range at $160/hour. EAC as a vendor has been judicious in their billing, and we have not felt overcharged in hours of work billed. However, as with all outsourced projects, this may not be the case with resource downstream.

In-house (estimated): Good

It may seem cheaper for in-house development because we are not seeing ongoing billing, but we do have cost as this will entail a full time developer. However, we get the benefit of direct control, fulltime access and development across projects inherent in internal employee resource.

PERFORMANCE

Thingworx Status: Average

The *Thingworx* user performance feels sluggish. The installation has been tuned, and performance enhancements included, but the performance has a “laggy” feel in practice.

This is concerning based on number of assets (200 machines) currently being managed. While the platform itself is scalable, the performance cannot afford to become slower.

In-house (estimated): Very Good

To date we have run our in-house development system in parallel with *Thingworx*, using the same full data set, and performance of the controls and dashboards has appeared significantly better. We control all aspects of server resource so this should not be an issue as we expand.

RELIABILITY

Thingworx Status: Fair

While the platform has been "up" for 99% of its operation, there have been several significant periods of either outage or concern.

The server setup is complicated, allowing itself to become unresponsive due to a number of issues, generally solved with a server or service reboot – but not often identified when it happens, causing an outage or usability issue for customers.

While having a 99% uptime, this is rated only as Fair (a low rating) because level of confidence in it running long term without issue is low.

In-house (estimated): Very Good

We have thus far experienced 100% uptime with our in-house platform.

SCALABILITY

Thingworx Status: Very Good

The *Thingworx* platform manages tens of thousands of assets and is very scalable. My only concern here is that while the underlying platform is scalable, it is undetermined if performance will be impacted by an increasing asset base.

In-house (estimated): Very Good

We control all aspects of server resource and have the capability to expand this resource as needed. The database technologies we are using also scale to several billions of data rows *per table*. We do not expect any issues with scalability.

USABILITY – DEVELOPMENT PLATFORM

Thingworx Status: Average

The *Thingworx* platform is proprietary and requires special training and knowledge to develop within. Additionally, there are functions that it simple does not support (i.e. mobile app development support is poor).

In-house: Good

Our in-house product is built using standard web-based application technology, including html, php, mysql and javascript. Basic programming interfaces, including command line programming, are utilized.

USABILITY – END PRODUCT

Thingworx Status: Average

The usability of the end-user interface deployed through *Thingworx* is usable, but not customer engaging. Available feature set is limited. And functionality is quirky. Mobile devices are not well supported currently.

In-house: Very Good

Being a standard web-based product, interface design is flexible and can be modified to meet customers' needs without platform limitations.

MAINTAINABILITY

Thingworx Status: Very Good

As a managed service, the *Thingworx* platform should have a high level of expected maintainability, with low resource drain on Cold Jet.

In-house (estimated): Good

As a service and application that we maintain, there will be considerably more work, and responsibility, for platform maintenance. However, this is nothing more than the responsibility we had for 10+ years with the Cold Jet website – so the skillset and expertise needed resides within Cold Jet.

INTEROPERABILITY

Thingworx Status (estimated): Poor

As a proprietary platform, interoperability is dependent upon specific and existing APIs for functional data exchange. If an API exists for your application it can make interoperability extremely simple. However, customization to support applications that do not have existing APIs, or that have limited APIs can be time consuming and costly, and may not support functionality we require. As an example, it has already been determined that the *Thingworx* function we believed would help us manage remote firmware updates cannot be utilized (and we have moved firmware management to the Particle cloud service).

In-house (estimated): Good

As a standard web-based platform utilizing industry standard open data platform technology (mysql), interoperability can be developed in a straightforward fashion. While these hooks into applications such as Epicor and EDA do not currently exist, and will require development, the effort is a standard development effort.

RESOURCE AVAILABILITY – EXTERNAL

Thingworx Status: Fair

Finding external resource (i.e. vendors, developers) who are expert in the *Thingworx* platform, a skilled proprietary environment, is more challenging than not, and is costly.

Additionally, vendor development at $150-$200/per hour is significantly more costly than standard programming development which can be found at $60-$120/hr.

In-house: Very Good

External resource for web-based application development (html, php, mysql, javascripte, etc.) is easily available and does not present a challenging resource situation.

RESOURCE AVAILABILITY – INTERNAL EXPERTISE

Thingworx Status: Poor

We do not have internal expertise at this time on the *Thingworx* platform.

In-house: Very Good

We have internal expertise in web-based application development.

ROI AND COST PREDICTABILITY

Thingworx Status: Poor

The *Thingworx* costing model is costly, complicated, requires manufacturing production estimates 12 months in advance, and is susceptible to annual pricing increases outside of our control.

In-house: Very Good

ROI and cost predictability from our own In-house development resource, when containing appropriate skillset and expertise, is both predictable and the best ROI we can expect to achieve in any development project.

Estimated 3 year cost projection comparison is shown below.

ESTIMATED 3-YEAR COST PROJECTION

Thingworx, 3-yr projection

This assumes a 10% annual platform pricing increase, a 10% resource cost increase, and a cumulative asset count of 1500 by end of 2020, 3000 by end of 2021, and 4500 by end of 2022.

	2020	2021	2022
Thingworx platform license	$ 51,000.00	$ 56,100.00	$ 61,710.00
Asset licenses	$ 46,494.00	$ 77,973.00	$ 103,473.00
Consulting for ECaSP	$ 40,000.00	$ -	$ -
Consulting for DIMS	$ 80,000.00	$ -	$ -
IoT Technical Developer	$ 81,250.00	$ 89,375.00	$ 98,312.50
	$ 298,744.00	$ 223,448.00	$ 263,495.50
		3-yr projection	**$ 785,687.50**

Assets		#	$/per	$/annual	total annual	
51	100	49	$ 60.00	$ 2,940.00	-	
101	200	99	$ 49.00	$ 4,851.00	-	
201	400	199	$ 39.00	$ 7,761.00	-	
401	800	399	$ 32.00	$ 12,768.00	-	
801	1500	699	$ 26.00	$ 18,174.00	$ 46,494.00	*2020*
1501	3000	1499	$ 21.00	$ 31,479.00	$ 77,973.00	*2021*
3001	4501	1500	$ 17.00	$ 25,500.00	$ 103,473.00	*2022*

In-house, 3-yr projection

This assumes backfilling with a Junior web developer, and a 10% resource increase annually.

However, $28K (annually) of this cost should be offset due to the ability to eliminate (in April 2020) the web development Co-op position.

Note: it is also possible we could incur additional server expenses up to $1K/mo by 2022 for expanded system resources.

	2020	2021	2022
Thingworx platform license	$ -	$ -	$ -
Asset licenses	$ -	$ -	$ -
Consulting for ECaSP	$ -	$ -	$ -
Consulting for DIMS	$ -	$ -	$ -
Junior developer	$ 68,750.00	$ 75,625.00	$ 83,187.50
	$ 68,750.00	$ 75,625.00	$ 83,187.50
		3-yr projection	**$ 227,562.50**
		savings	**$ 558,125.00**

COLD JET CONNECT "II" INTERFACE

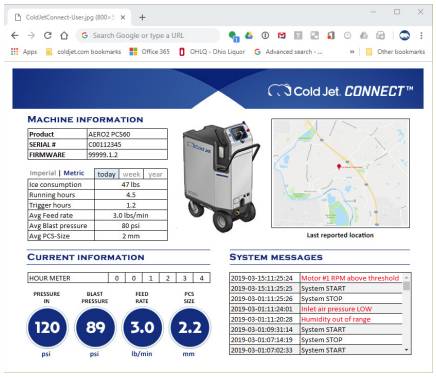
As mentioned, the *Thingworx* platform was imperative to meet our goals of a March 2019 product launch, and to build knowledge in the requirements for platform infrastructure. Moving forward, our In-house solution provides a more flexible platform and value-added interface for our customers.

USER/CUSTOMER INTERFACE SCREEN(S)

Current – Thingworx

The current Customer view is a single page/screen, containing:

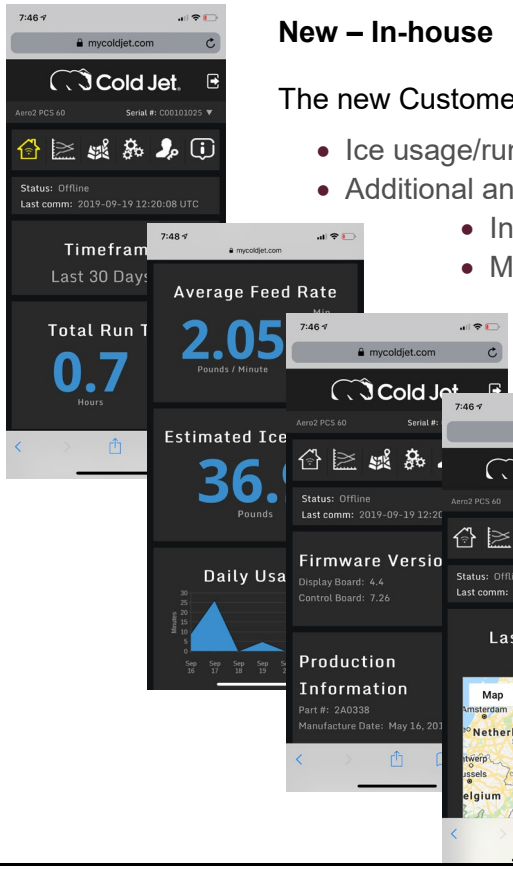
- Machine identification (reliable)
- Ice usage/hours (unreliable)
- Current settings (confusing)
- Basic static location map

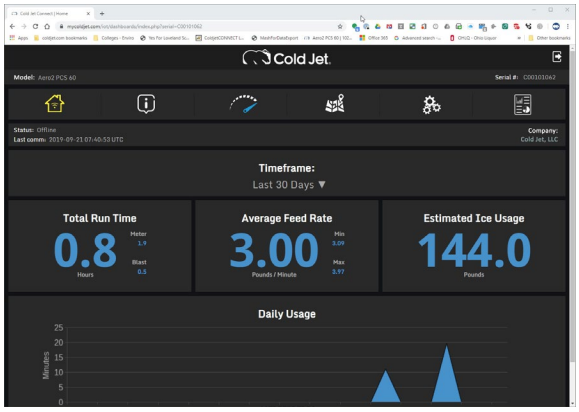


New – In-house

The new Customer view is interactive and multi-tabbed, containing:

- Ice usage/running hours (more reliable)
- Additional analytics (TBD)
  - Interactive Google Map
  - Machine identification
    - Saved user preferences (units, timeframes)
    - Report download capability (TBD)



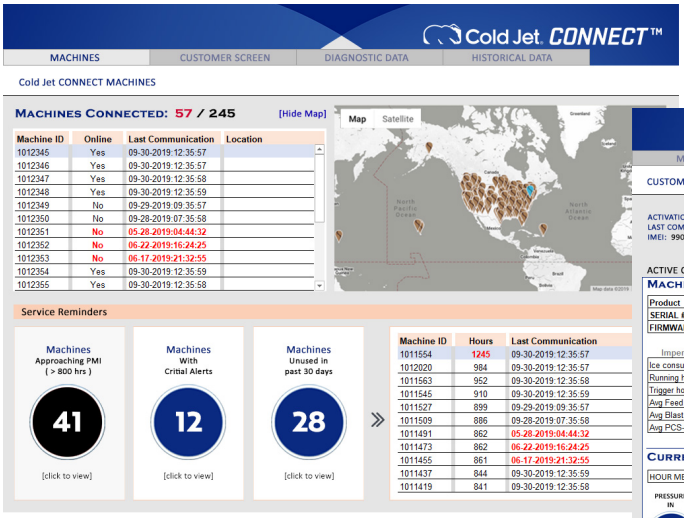


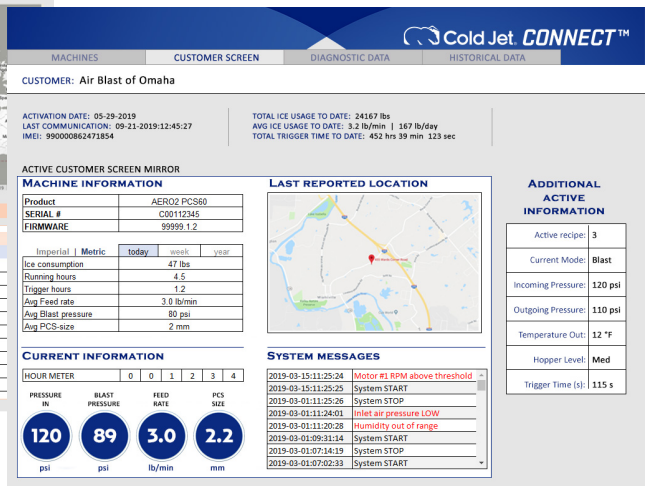
CUSTOMER SERVICE INTERFACE

Current – Thingworx

The current Customer Service view is multi-screen, containing:

- Overview/summary screen to view machine KPIs
- Customer and Diagnostics screen to view individual machine data
- Admin screen to manage user accounts

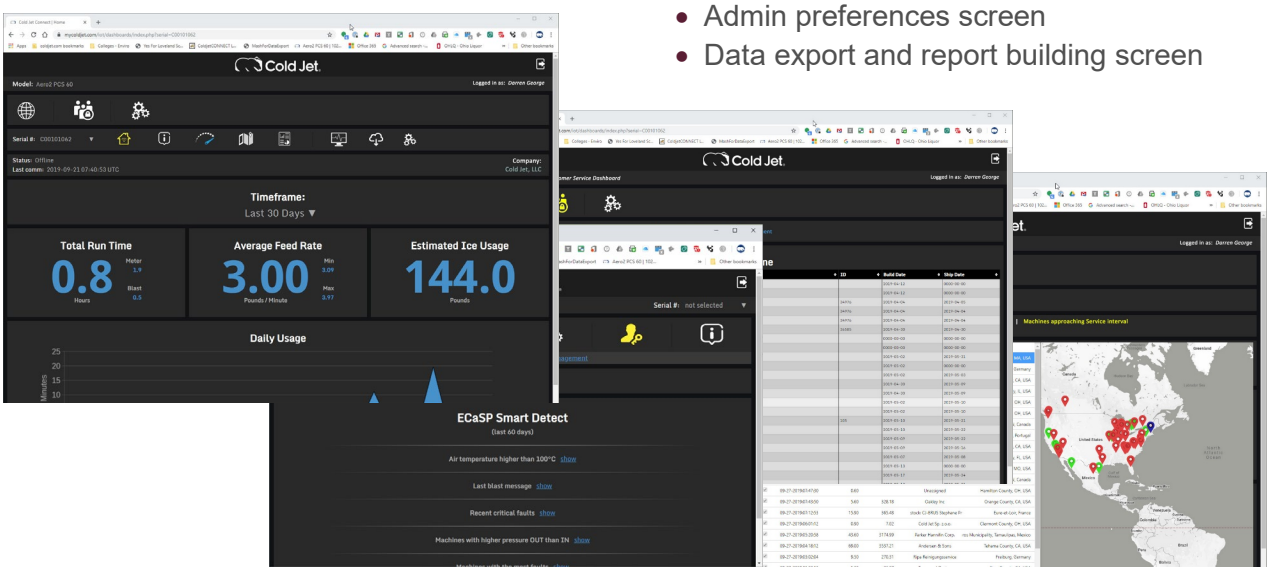




New – In-house

The new Customer Service view is intended to allow Cold Jet to view, monitor and manage machines and users, and export data and reports.

- Overview/summary screen to view machine KPIs
- Customer and Diagnostics screen to view individual machine data
  - Admin screen to manage user accounts
  - Smart Detect screen to manage KPI analysis
    - Admin preferences screen
    - Data export and report building screen



** END **