Demystifying Cloud and PLM:
Cloud, PLM and in the era of COVID – Part 1

Michael Finocchiaro

EXECUTIVE SUMMARY

Cloud has been a hot topic in Product Lifecycle Management (PLM) for quite some time. With the onset of the COVID-19 pandemic, this movement will accelerate as companies move forward their digital initiatives to minimize physical contact while increasing collaboration. This article will talk briefly about the history of PLM and cloud computing and attempt to dispel some myths about cloud that are commonly circulating. It will talk about today's SaaS PLM platforms with a particular emphasis on **3D**EXPERIENCE platform from Dassault Systèmes because it is the most mature multi-tenant SaaS offer on the market today (and because I worked on its release). I will then give some pros and cons of leveraging cloud technologies before giving you a list of self-assessment questions about the risks involved in moving your PLM to the cloud.

Some of the topics will include:

- Security in the Cloud
- Vendor Lock-In
- Cloud Economics
- Current Cloud Platforms from the Major PLM Vendors
- Cloud Strengths and Cloud Challenges

Target Audience: PLM Deciders, IT Managers, CTOs of Manufacturing companies

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The "To Cloud" Crowd

Many companies have begun to look seriously at cloud for a multitude of factors. Perhaps the first factor is cost: they feel that moving from a front-loaded capital expenditure (capex) to a subscription-based operating expenses (opex) system gives them more flexibility and allows them more freedom with their cashflow. They also feel they can significantly reduce IT and facilities expenses by sunsetting local machine rooms and data centers. The idea that there will be no ceiling to scalability due to the elasticity of the distributed cloud computing model is also a highly seductive aspect in favor of cloud. Finally, the factor of peer pressure is also non-negligible as the cloud buzzword has been in the business press headlines for several years now and is often mentioned in conjunction with other buzzwords like "Industry 4.0", "digital thread", and "digital twin" creating misunderstandings as to what all these terms actually mean and other enterprise software functions such as HR and CRM have moved to cloud, so why not PLM?

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Then you have the folks that are extremely reluctant to move to cloud. The primary objection is fear: fear for the security of their data. If it is on the cloud, isn't it more vulnerable to hackers and industrial espionage? There is also always justifiable fear of change in general: if it works, don't fix it. Another legitimate fear is vendor lock-in: if I want to change platforms, will I be able to get my data out of the cloud? Lastly, there are also those who feel that cloud is a fad and that the pendulum will swing back to on-premises once enough people get burned by their failed cloud implementations.

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Neither of these two clubs has all the answers and both are asking the right questions. The rest of this white paper will try to address each of these objections and ask additional questions in order to help managers demystify the various decision factors around whether moving PLM to cloud is the right thing for their organization. Let's first look at the PLM market and its approach to cloud.

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[1] https://www.linkedin.com/pulse/demystifying-3dexperience-cloud-michael-finocchiaro

A Short History of PLM

Product Lifecycle Management has evolved enormously during my 30 years of working on innovation and product development. Initially conceived for airplanes and cars, computer-aided design (CAD) and computer-aided manufacturing (CAM) were used to make computer models of the product being designed (now rebaptized “digital twins”). Three-dimensional (3D) modeling soon became the norm, meaning larger more complex files which required sophisticated systems for storing the large CAD models. This was baptized Product Data Management (PDM). And once many engineers wanted to work simultaneously on the same assembly, the digitalization of change management, part classification, project and program management, and digital mockup among other engineering processes all created a need for a database to store usernames, change orders, parts libraries, and all the other metadata, or data about the 3D geometry files and their governance models. This was called Product Lifecycle Management (PLM) (see Figure 1). Once the data became unwieldy and diverse, indexation servers were required to search through the mountains of information. What you ended up with was application servers on the front end, databases, index servers and file servers on the backend and a lot of headaches when it came to migration, patching and upgrades.

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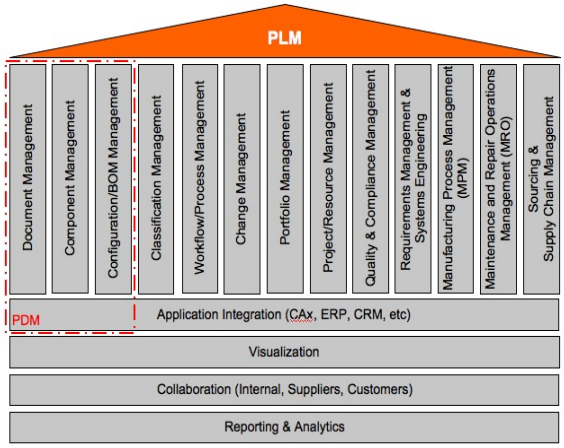

Figure 1 – PDM and PLM Functionalities (from BeyondPLM.com)

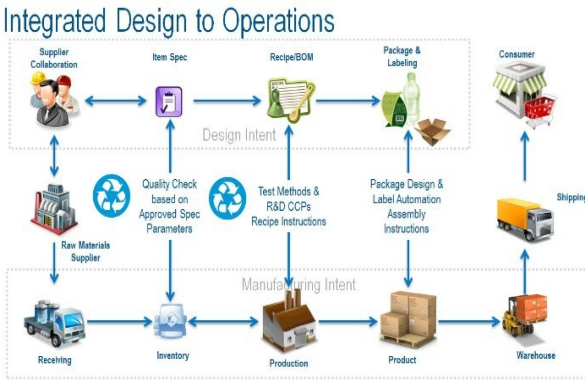

Figure 2 - Illustration of Design vs Manufacturing in a Consumer Packaged Goods (CPG) product (from https://www.linkedin.com/pulse/what-plm-mes-erp-raymond-wodar/)

PLM systems such as Dassault Systèmes VPM, MatrixOne, Sherpa, UGS Unigraphics, SDRC Metaphase, PTC Pro/INTRALINK and Pro/PDM, Computervision (CV) OPTEGRA, Autodesk AutoCAD Vault among others tried to capitalize on these initiatives. One obscure company, created by ex-SDRC veterans James Hepplemann and John Gibson called Windchill, started writing a Java-based toolbox that was being considered by CV as an OPTEGRA replacement. All of these deployments required relatively large computer servers and storage and were sometimes relegated to the dark, blinking machine rooms running the enterprise resource management (ERP) software, which was already running the factories, the procurement processes, human resources, billing, etc. Sometimes, they were installed in an abandoned cubicle. Since the deployment was so heavy in defining data models and adapting the systems to existing business processes, it was not uncommon for the IT aspects to be overlooked while the business units were busy deploying and customizing the system. This led to performance issues and frustration for users and management as deployment schedules became months or years instead of weeks. Also, with an ERP, business line management can point to reduction in inventory or reduced cost in manufacturing to justify the required investment IT**. The financial benefits are far harder to quantify with PLM and it was often seen as a toy for engineers rather than a powerful platform for increasing design and production efficiency.**

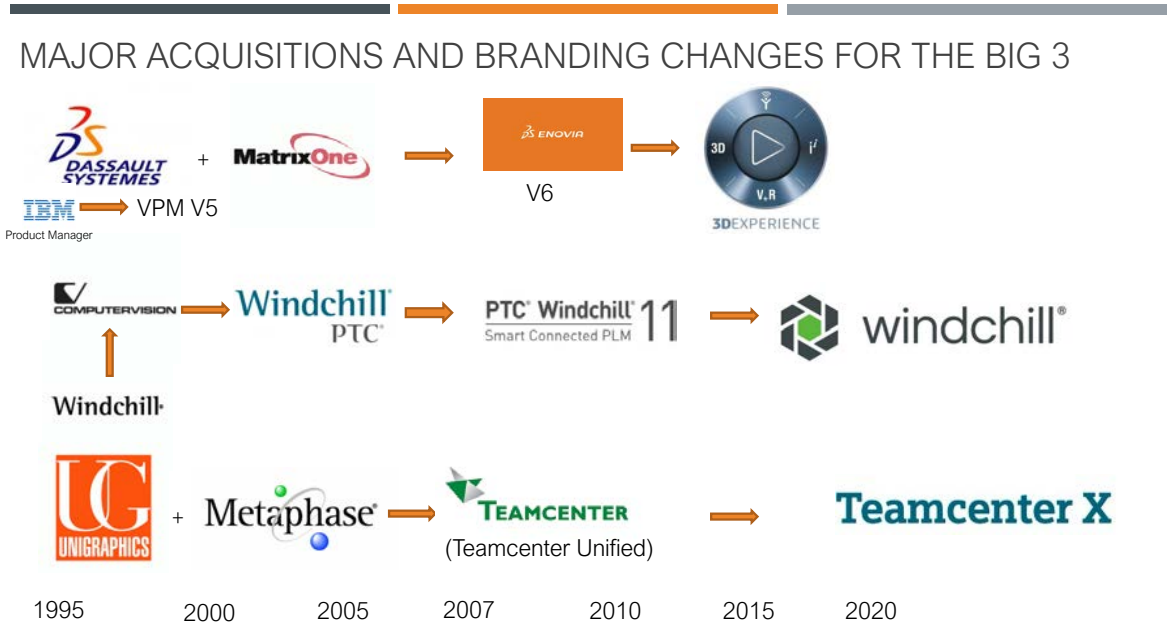

Figure 3 - Acquisitions and Brand History the Big Three PLM Vendors

During the '90s and '00s, there was a massive amount of consolidation in the industry: Siemens bought the company Unigraphics which had already purchased Metaphase and merged them to create Teamcenter; PTC bought Computervision who in the meantime had acquired a minority stake in Windchill, quickly replacing Pro/INTRALINK, Pro/PDM and CV Optegra as PTC's flagship PLM platform; Dassault bought MatrixOne and merged it with VPM to create V6, later rebranded **3D**EXPERIENCE. Each of these companies also made massive acquisitions in the '10s to expand towards manufacturing (the purchase of Tecnomatix by UGS and subsequent merge into Teamcenter; DENEB, EAI-Delta and Safework were acquired by Dassault to create the DELMIA brand; simulation (Dassault purchased ABAQUS to create the SIMULIA brand, Siemens purchased LMS to create SimCenter; Autodesk purchased NEi NASTRAN to create Inventor Nastran), and, most recently, the internet of things (IOT) with PTC's purchase of ThingWorx (see Figures 4 through 6 below for examples) Oracle purchased Eigner&Partners E6 and created the on-premises PDM platform Agile. After creating Oracle Cloud, they dubbed a subset of the Supply Chain Management solution dedicated to Product Lifecycle Management.

Figure 4 - PTC Acquisition History (to 2020)

Figure 5 - Siemens Digital Industries Software Acquisition History (up to 2016)

Figure 6 - Dassault Systèmes Acquisition History (to 2017)[2]

This consolidation in the PLM software industry expanded the footprint from just CAD data management towards managing the entire upstream and downstream development processes from conception to fabrication, what has more recently been relabeled as "digital thread" or "digital continuity." This also meant from an IT point of view that PLM complexity increased exponentially as the data models became infinitely more sophisticated and more and moan increasing number of external systems needed to be integrated to exchange data with PLM. Companies started to look for ways to reduce their IT spend and offload the complexities of migration, patching, integrations, and upgrades to external partners so that rather than spending 20-30% (or more) of their time **MANAGING** the PLM system, and spend more of their time actually **USING** it and seeing the potential gains (time to market, innovation acceleration, improved quality, etc.) that the vendors promised.

One last thing to keep in mind is that what started out as an expensive niche solution for the aerospace and automotive industries quickly applied to other industries as well. Heavy machinery and industrial equipment, agricultural equipment, cruise ships, energy, powerplants, oil platforms, circuit boards, and consumer electronics all became very interested in the potential savings from PLM. Soon, also high-tech, pharmaceuticals, consumer goods, fashion and retail, construction and engineering, and many other industries adopted PLM as well. **Some of these new industries did not have a tradition of heavy IT skills and this became a barrier to adoption due to the implicit complexities in PLM deployments.**

Short History of PLM Cloud Offerings

In order to respond to this expressed desire to outsource PLM and to address the newer industries, the PLM vendors all started to look into simplifying deployment of the systems. One of the very first online PLM systems was BOM.com which changed its name to Arena Solutions in 2003, but it remained a niche player as few companies were willing to move their PLM online.

In 2005, PTC and IBM teamed up to create Windchill PDMLink On Demand with perhaps the market's first multi-tenant PLM with full CAD integration. In other words, there was a single Windchill instance serving multiple clients, but since the code is shared, individual customizations of the system are severely limited. It grew to nearly 100 customers, but there was frustration by the limitations in customization imposed by multi-tenant systems. The alternative for PTC customers was to leverage partners such as NetIDEAS and their PaaS offerings for Windchill

[2] https://www.3ds.com/about-3ds/history/

managed services. PTC acquired NetIDEAS in 2013 and, as we will see later, it will become part of the foundation for the new PTC Atlas platform announced in mid-2020.

Early in the 10s, there were several perfunctory approaches to PLM on the cloud from longtime PLM heavyweights Dassault and Autodesk such as the ill-fated PLM Express and n!Volve suites from Dassault and the similarly stillborn PLM 360 from Autodesk both from back around 2011 to 2013. Were they both too early to the market or was the flop due to positioning or product gaps? Probably a little of each. Dassault's suite was excessively CATIA-centric, had little or no BOM or Change Management, and as such was rejected by their customer base. As for Autodesk, they had a PR mess due to CEO Carl Bass' dissing of PLM in years[3] past which they had to walk back. PLM 360 was essentially a mashup of about 12 acquisitions including Datastay which was their new core. However, when one looked under the hood, there was a lack of depth in each of the solutions and a true lack of connectivity between them which was an inhibitor to sales.

State of the Market 2020

Fast forward several years and now the three largest vendors, PTC, Dassault Systèmes, and Siemens Digital Industry Software as well as Autodesk have revamped and repositioned their cloud offerings. **3D**EXPERIENCE platform was launched on DS Public Cloud in 2015 (full disclosure: I was intimately involved in that effort at Dassault), PLM 360 was rebranded as Autodesk Fusion Lifecycle, Siemens recently launched Teamcenter X as a cloud-native platform, and PTC purchased Onshape and has announced a forthcoming Atlas platform as a SaaS backend. Aras Innovator has always been cloud-ready and is preparing a pure-SaaS offering for the near future. Add to this mix smaller PLM solutions such as Propel PLM, Arena Solutions, and OpenBOM, and there is quite a lot of choice for customers looking at cloud-readiness or SaaS deployments for their PLM. Each of these will be discussed separately at the end of this white paper. It should be added that in order to more specifically incite the massive SOLIDWORKS user base to **3D**EXPERIENCE platform, in 2019, Dassault introduced a complete suite of products stemming from their ENOVIA and DELMIA brands on the cloud rebranded as **3D**EXPERIENCE WORKS - all fully optimized for use with SOLIDWORKS.

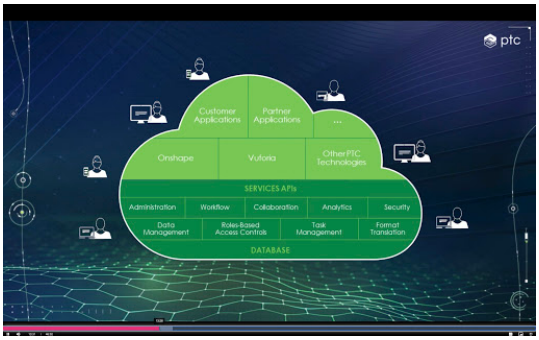

Figure 7 - PTC Atlas Announcement (June 2020)

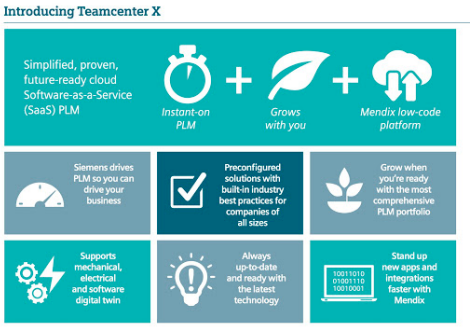

Figure 8 – Teamcenter X Announcement (June 2020)

[3] https://www.youtube.com/watch?v=SxDDFmtmgPk

*Figure 9 – **3D**EXPERIENCE WORKS Portfolio (2019)*

Figure 10 - Autodesk Product Innovation Platform Portfolio (2016)

Oddly, however, despite all this effort, the big money is still being made primarily on-premises. Why is that?

A Brief History of PLM and Cloud, Part 1 (IaaS and PaaS)

Let's step back a moment and think about the history of Cloud-based PLM. The first move from a dark, dusty server room in the company basement was outsourcing the servers to a hosting partner, in other words Infrastructure as a Service (IaaS). This did not fundamentally change how PLM operated, other than reducing cost (electricity, water cooling, air conditioning, etc.) via delegating the physical hardware and its management to a 3rd party.

The next phase, primarily pushed by PTC and Siemens-PLM, was the hosting of the PLM platform on a specific cloud partner's hardware such as NetIDEAS, IBM, or HP, running the app servers, databases, and file stores on an appliance (a server blade) which was a primitive form of Platform as a Service (PaaS). It was still operated on a single-tenant basis (dedicated hardware for each hosted customer) and allowed for some further cost reduction, but the primary issue here was the continuing massive cost of upgrades due to customization. In other words, the cost of maintaining hardware and networking had been reduced, but the software maintenance costs were still abominably high, and adoption flagged as it was deemed easier to just do everything in-house. Today, Aras Innovator is still sold in this way on the Azure store, and services providers such as Minerva PLM also setup instances of Aras Innovator on AWS. These are all examples of PLM on Cloud as PaaS, not to be confused with SaaS.

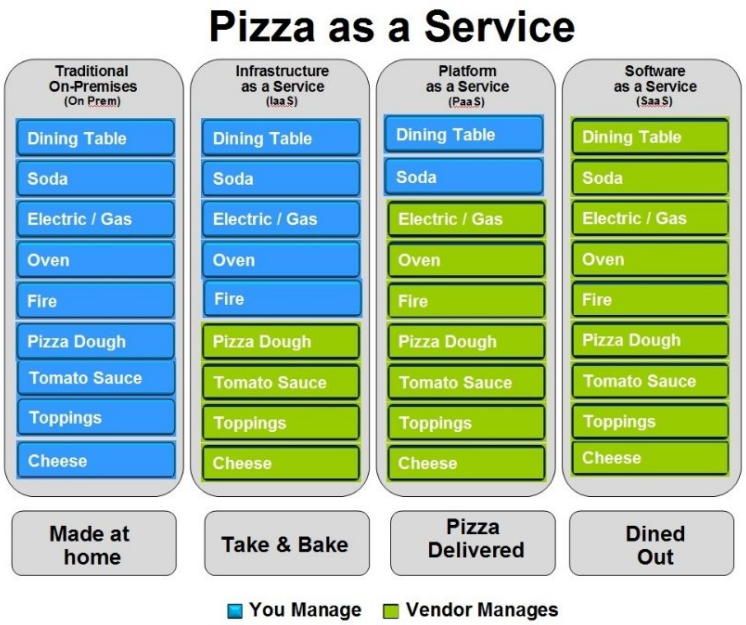

Figure 11 - Pizza as a Service https://tinyurl.com/y77wqq2s. This is a good illustration at a very high-level to explain the differences between On-Prem PLM and the increasing levels of service from IaaS to SaaS from Albert Baron of IBM in 2014.

A Brief History of PLM and Cloud, Part 2 (SaaS)

Each of the Big 3 PLM vendors + Autodesk have released or announced new portfolios of SaaS offerings hosted at one of the major cloud vendors (primarily Amazon Web Services or Microsoft Azure) or their own cloud provider (French provider Outscale for Dassault's **3D**EXPERIENCE platform). For Dassault, Autodesk and Siemens, the default choice is AWS (in fact, for Autodesk it is the ONLY choice); for PTC and Aras, the default is Azure. We have also, as mentioned above, seen a wave of smaller, more focused SaaS-only PLM platforms such as OpenBOM, Propel PLM and Upchain. This new way of deploying PLM harkens back to the old days of mainframe computing (shared resources with unique logins) but was given the sexier name of "cloud" to make an old idea sound new. In this case, you access all the PLM functionality via a web address and pay a monthly or yearly subscription based on how many platform apps you use. Some explanatory examples shown below in Figure 12.

COMPARING PAAS AND SAAS FOR CLOUD PLM

Non-functional Requirements	PaaS / Managed Service	SaaS / Software as a Service
Multi-Tenant	No	Yes[1]
Access to Command Line Prompt	Yes	No
Upgrade / Patch Management	Manual by Service Provider	Automated by Vendor
Degree of Customization	Normally unlimited	Vendor-dependent
Configuration Files	Sometimes	Never
VPN Access	Yes	Yes, but not always
External Integrations	Yes	Vendor-dependent

1 – Some vendors offer SaaS with mono-tenant, DS Private Cloud is one example as well as PTC Windchill.

Figure 12 - Comparing PaaS and SaaS with Cloud PLM

Oleg Shilovitsky at Beyond PLM has written a great blog article describing SaaS and PLM[4]. First pioneered to great success in the CRM world by SalesForce, the holy grail of a customizable and upgradable system wholly dematerialized on the cloud sounds very appealing on paper and, as mentioned above, has been heavily pushed by each of the major PLM vendors. But how effective is it and why aren't more companies moving there? What are the advantages and disadvantages of this approach? And, no one really questions moving CRM to the cloud, why is PLM any different?

[4] http://beyondplm.com/2019/12/29/saas-plm-what-do-you-need-to-know-about-cloud-architecture-and-data-management-in-2020/

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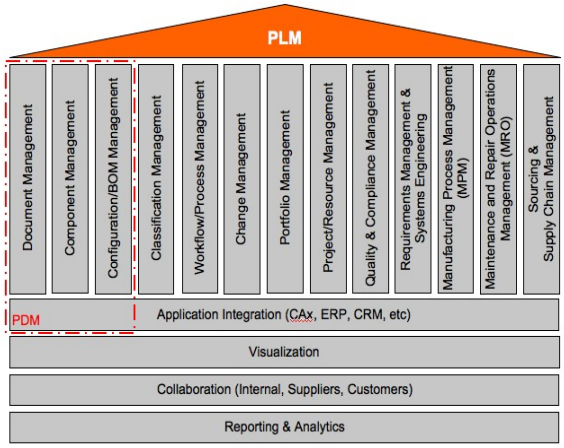

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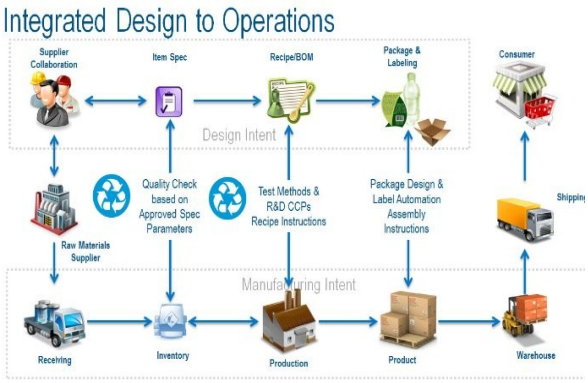

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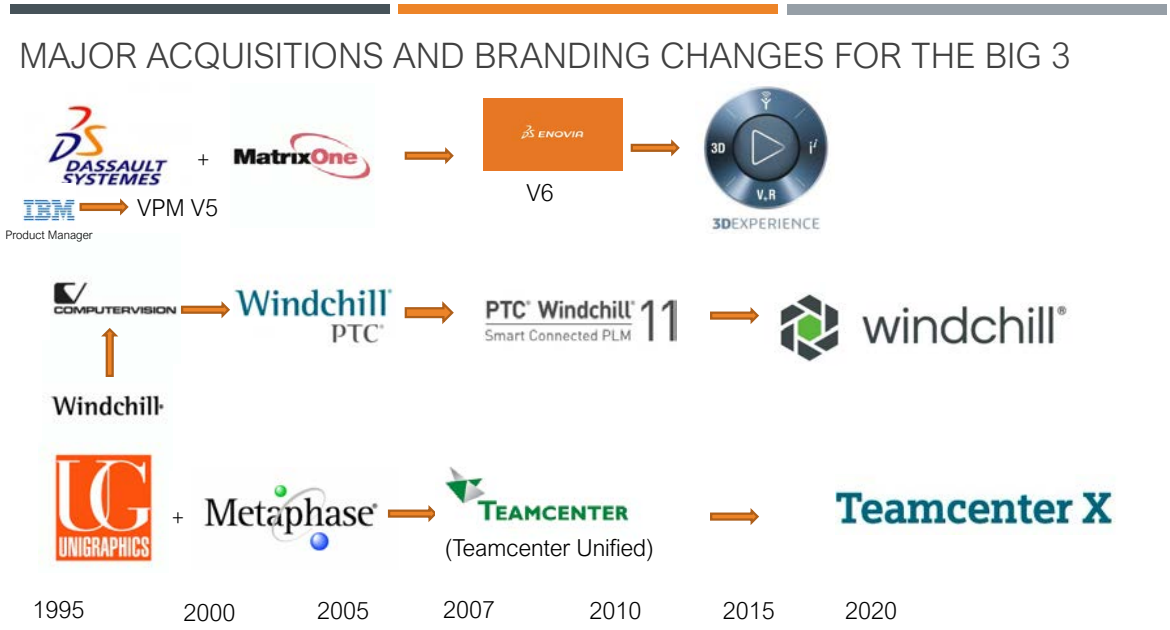

Figure 3 - Acquisitions and Brand History the Big Three PLM Vendors

During the '90s and '00s, there was a massive amount of consolidation in the industry: Siemens bought the company Unigraphics which had already purchased Metaphase and merged them to create Teamcenter; PTC bought Computervision who in the meantime had acquired a minority stake in Windchill, quickly replacing Pro/INTRALINK, Pro/PDM and CV Optegra as PTC's flagship PLM platform; Dassault bought MatrixOne and merged it with VPM to create V6, later rebranded **3D**EXPERIENCE. Each of these companies also made massive acquisitions in the '10s to expand towards manufacturing (the purchase of Tecnomatix by UGS and subsequent merge into Teamcenter; DENEB, EAI-Delta and Safework were acquired by Dassault to create the DELMIA brand; simulation (Dassault purchased ABAQUS to create the SIMULIA brand, Siemens purchased LMS to create SimCenter; Autodesk purchased NEi NASTRAN to create Inventor Nastran), and, most recently, the internet of things (IOT) with PTC's purchase of ThingWorx (see Figures 4 through 6 below for examples) Oracle purchased Eigner&Partners E6 and created the on-premises PDM platform Agile. After creating Oracle Cloud, they dubbed a subset of the Supply Chain Management solution dedicated to Product Lifecycle Management.

Figure 4 - PTC Acquisition History (to 2020)

Figure 5 - Siemens Digital Industries Software Acquisition History (up to 2016)

Figure 6 - Dassault Systèmes Acquisition History (to 2017)[6]

This consolidation in the PLM software industry expanded the footprint from just CAD data management towards managing the entire upstream and downstream development processes from conception to fabrication, what has more recently been relabeled as "digital thread" or "digital continuity." This also meant from an IT point of view that PLM complexity increased exponentially as the data models became infinitely more sophisticated and more and moan increasing number of external systems needed to be integrated to exchange data with PLM. Companies started to look for ways to reduce their IT spend and offload the complexities of migration, patching, integrations, and upgrades to external partners so that rather than spending 20-30% (or more) of their time **MANAGING** the PLM system, and spend more of their time actually **USING** it and seeing the potential gains (time to market, innovation acceleration, improved quality, etc.) that the vendors promised.

One last thing to keep in mind is that what started out as an expensive niche solution for the aerospace and automotive industries quickly applied to other industries as well. Heavy machinery and industrial equipment, agricultural equipment, cruise ships, energy, powerplants, oil platforms, circuit boards, and consumer electronics all became very interested in the potential savings from PLM. Soon, also high-tech, pharmaceuticals, consumer goods, fashion and retail, construction and engineering, and many other industries adopted PLM as well. **Some of these new industries did not have a tradition of heavy IT skills and this became a barrier to adoption due to the implicit complexities in PLM deployments.**

Short History of PLM Cloud Offerings

In order to respond to this expressed desire to outsource PLM and to address the newer industries, the PLM vendors all started to look into simplifying deployment of the systems. One of the very first online PLM systems was BOM.com which changed its name to Arena Solutions in 2003, but it remained a niche player as few companies were willing to move their PLM online.

In 2005, PTC and IBM teamed up to create Windchill PDMLink On Demand with perhaps the market's first multi-tenant PLM with full CAD integration. In other words, there was a single Windchill instance serving multiple clients, but since the code is shared, individual customizations of the system are severely limited. It grew to nearly 100 customers, but there was frustration by the limitations in customization imposed by multi-tenant systems. The alternative for PTC customers was to leverage partners such as NetIDEAS and their PaaS offerings for Windchill

[6] https://www.3ds.com/about-3ds/history/

managed services. PTC acquired NetIDEAS in 2013 and, as we will see later, it will become part of the foundation for the new PTC Atlas platform announced in mid-2020.

Early in the 10s, there were several perfunctory approaches to PLM on the cloud from longtime PLM heavyweights Dassault and Autodesk such as the ill-fated PLM Express and n!Volve suites from Dassault and the similarly stillborn PLM 360 from Autodesk both from back around 2011 to 2013. Were they both too early to the market or was the flop due to positioning or product gaps? Probably a little of each. Dassault's suite was excessively CATIA-centric, had little or no BOM or Change Management, and as such was rejected by their customer base. As for Autodesk, they had a PR mess due to CEO Carl Bass' dissing of PLM in years[7] past which they had to walk back. PLM 360 was essentially a mashup of about 12 acquisitions including Datastay which was their new core. However, when one looked under the hood, there was a lack of depth in each of the solutions and a true lack of connectivity between them which was an inhibitor to sales.

State of the Market 2020

Fast forward several years and now the three largest vendors, PTC, Dassault Systèmes, and Siemens Digital Industry Software as well as Autodesk have revamped and repositioned their cloud offerings. **3D**EXPERIENCE platform was launched on DS Public Cloud in 2015 (full disclosure: I was intimately involved in that effort at Dassault), PLM 360 was rebranded as Autodesk Fusion Lifecycle, Siemens recently launched Teamcenter X as a cloud-native platform, and PTC purchased Onshape and has announced a forthcoming Atlas platform as a SaaS backend. Aras Innovator has always been cloud-ready and is preparing a pure-SaaS offering for the near future. Add to this mix smaller PLM solutions such as Propel PLM, Arena Solutions, and OpenBOM, and there is quite a lot of choice for customers looking at cloud-readiness or SaaS deployments for their PLM. Each of these will be discussed separately at the end of this white paper. It should be added that in order to more specifically incite the massive SOLIDWORKS user base to **3D**EXPERIENCE platform, in 2019, Dassault introduced a complete suite of products stemming from their ENOVIA and DELMIA brands on the cloud rebranded as **3D**EXPERIENCE WORKS - all fully optimized for use with SOLIDWORKS.

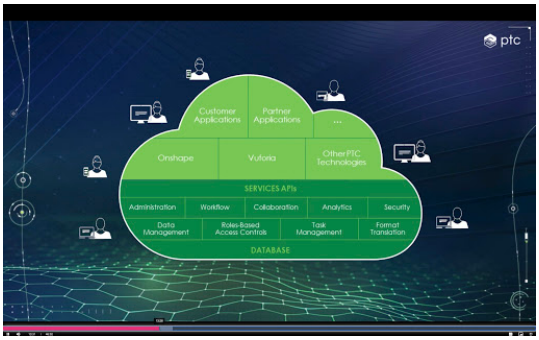

Figure 7 - PTC Atlas Announcement (June 2020)

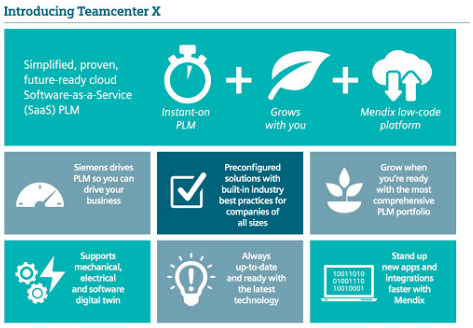

Figure 8 – Teamcenter X Announcement (June 2020)

[7] https://www.youtube.com/watch?v=SxDDFmtmgPk

*Figure 9 – **3D**EXPERIENCE WORKS Portfolio (2019)*

Figure 10 - Autodesk Product Innovation Platform Portfolio (2016)

Oddly, however, despite all this effort, the big money is still being made primarily on-premises. Why is that?

A Brief History of PLM and Cloud, Part 1 (IaaS and PaaS)

Let's step back a moment and think about the history of Cloud-based PLM. The first move from a dark, dusty server room in the company basement was outsourcing the servers to a hosting partner, in other words Infrastructure as a Service (IaaS). This did not fundamentally change how PLM operated, other than reducing cost (electricity, water cooling, air conditioning, etc.) via delegating the physical hardware and its management to a 3rd party.

The next phase, primarily pushed by PTC and Siemens-PLM, was the hosting of the PLM platform on a specific cloud partner's hardware such as NetIDEAS, IBM, or HP, running the app servers, databases, and file stores on an appliance (a server blade) which was a primitive form of Platform as a Service (PaaS). It was still operated on a single-tenant basis (dedicated hardware for each hosted customer) and allowed for some further cost reduction, but the primary issue here was the continuing massive cost of upgrades due to customization. In other words, the cost of maintaining hardware and networking had been reduced, but the software maintenance costs were still abominably high, and adoption flagged as it was deemed easier to just do everything in-house. Today, Aras Innovator is still sold in this way on the Azure store, and services providers such as Minerva PLM also setup instances of Aras Innovator on AWS. These are all examples of PLM on Cloud as PaaS, not to be confused with SaaS.

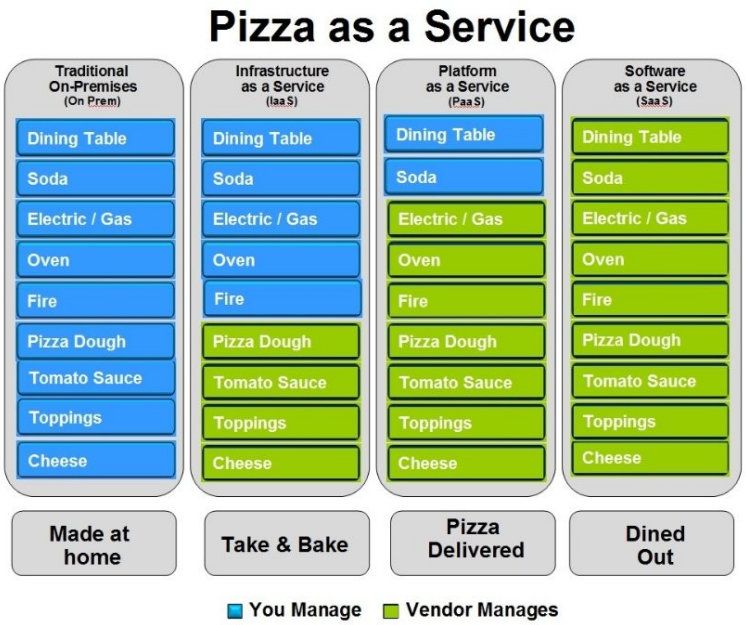

Figure 11 - Pizza as a Service https://tinyurl.com/y77wqq2s. This is a good illustration at a very high-level to explain the differences between On-Prem PLM and the increasing levels of service from IaaS to SaaS from Albert Baron of IBM in 2014.

A Brief History of PLM and Cloud, Part 2 (SaaS)

Each of the Big 3 PLM vendors + Autodesk have released or announced new portfolios of SaaS offerings hosted at one of the major cloud vendors (primarily Amazon Web Services or Microsoft Azure) or their own cloud provider (French provider Outscale for Dassault's **3D**EXPERIENCE platform). For Dassault, Autodesk and Siemens, the default choice is AWS (in fact, for Autodesk it is the ONLY choice); for PTC and Aras, the default is Azure. We have also, as mentioned above, seen a wave of smaller, more focused SaaS-only PLM platforms such as OpenBOM, Propel PLM and Upchain. This new way of deploying PLM harkens back to the old days of mainframe computing (shared resources with unique logins) but was given the sexier name of "cloud" to make an old idea sound new. In this case, you access all the PLM functionality via a web address and pay a monthly or yearly subscription based on how many platform apps you use. Some explanatory examples shown below in Figure 12.

COMPARING PAAS AND SAAS FOR CLOUD PLM

Non-functional Requirements	PaaS / Managed Service	SaaS / Software as a Service
Multi-Tenant	No	Yes[1]
Access to Command Line Prompt	Yes	No
Upgrade / Patch Management	Manual by Service Provider	Automated by Vendor
Degree of Customization	Normally unlimited	Vendor-dependent
Configuration Files	Sometimes	Never
VPN Access	Yes	Yes, but not always
External Integrations	Yes	Vendor-dependent

1 – Some vendors offer SaaS with mono-tenant, DS Private Cloud is one example as well as PTC Windchill.

Figure 22 - Comparing PaaS and SaaS with Cloud PLM

Oleg Shilovitsky at Beyond PLM has written a great blog article describing SaaS and PLM[8]. First pioneered to great success in the CRM world by SalesForce, the holy grail of a customizable and upgradable system wholly dematerialized on the cloud sounds very appealing on paper and, as mentioned above, has been heavily pushed by each of the major PLM vendors. But how effective is it and why aren't more companies moving there? What are the advantages and disadvantages of this approach? And, no one really questions moving CRM to the cloud, why is PLM any different?

[8] http://beyondplm.com/2019/12/29/saas-plm-what-do-you-need-to-know-about-cloud-architecture-and-data-management-in-2020/