



Digital Twin Business Maturity Model

A Digital Twin Consortium Whitepaper

2024-11-20

Authors

Dana Kawas (Thynkli), Tim Connolly (APTUMX)

Contents

1 Introduction.....	3
2 Why the Business Maturity Model is Important for Digital Twin Adoption	3
3 What Is the Business Maturity Model?	4
4 Ambition & Strategy: This Is Where You Set Your North Star and Define the Business Outcomes You Are Looking to Achieve	7
5 Leadership: This Is Where You Make Sure That You Have Pilots to Steer the Vessel	8
6 Culture, Change and Capability: This Is the Oil for Your Organization’s Engine	10
7 Operating Model & Process Standardization: This Is the Engine that Moves the Ship	11
8 Digital Twin Technology: The Flame that Will Ignite the Engine	13
9 How to Go About it	14
10 Sample Assessment.....	15
11 Authors and Legal Notice	17

FIGURES

Figure 3-1: Business Maturity Model. (Source: DTC Business Maturity Subgroup.)	7
--	---

TABLES

Table 4-1: Ambition and Strategy. (Source: DTC Business Maturity Subgroup.)	8
Table 5-1: Leadership. (Source: DTC Business Maturity Subgroup.)	9
Table 6-1: Culture, Change and Capability. (Source: DTC Business Maturity Subgroup.)	11
Table 7-1: Operating Model. (Source: DTC Business Maturity Subgroup.)	12
Table 8-1: Digital Twin Technology. (Source: DTC Business Maturity Subgroup.)	14
Table 9-1: Digital Twin User Groups. (Source: DTC Business Maturity Subgroup.)	15

1 INTRODUCTION

The Business Maturity Subgroup started after discussions with the various working groups in the Digital Twin Consortium (DTC). The need was identified as the conversations around the role of digital twin technology evolved from technology to an instrument for business transformation tied to business outcomes and operational excellence.

The Business Maturity Subgroup was launched under the Capabilities & Technology Working Group to be integrated horizontally with all Working Groups across the consortium and to create a maturity framework for all Working Groups to build on. This paper has drawn on findings from all Working Groups at the DTC, embedding necessary elements for building digital twins, such as platform stack, interoperability, and security and trustworthiness into the model.

2 WHY THE BUSINESS MATURITY MODEL IS IMPORTANT FOR DIGITAL TWIN ADOPTION

Change in the digital age is happening at speed and with high frequency, creating interconnected disruptions that are difficult to identify and react to. Organizations will not be able to fully realize the benefits of digital twins if they are not equipped to change and mature in alignment to these developments. The Business Maturity Model will help organizations to:

- Assess and understand the starting point.
- Assemble and align the resources needed for successful implementation.
- Define the value of the digital twin in the form of business outcome(s).
- Determine the best approach to building digital twins for a particular organization.

Organizations need to have a tool where they can continuously assess where they are and where to start when it comes to implementing digital twin technology and increasing the technology adoption.



Where am I?



What should I do?



Where should I go?

The Digital Twin Consortium's definition of a digital twin states¹:

- Digital Twins are motivated by outcomes, driven by use cases, powered by integration, built on data, enhanced by physics, guided by domain knowledge, and implemented in

¹ *Definition of a Digital Twin*, Digital Twin Consortium.

Digital Twin Business Maturity Model

dependable and trustworthy IT/OT/ET systems.

- Digital Twin Systems transform business by accelerating and automating holistic understanding, continuous improvement, decision-making, and interventions through effective action.
- Digital Twin Systems are built on integrated and synchronized IT/OT/ET systems, use real-time and historical data to represent the past and present, and simulate predicted futures.
- Digital Twin Prototypes use data to model and simulate predicted futures before being integrated into IT/OT/ET Systems and before synchronization with the real-world entity or process.

Companies typically take an ad-hoc approach to designing and implementing digital twins for different needs, which leads to architectural inconsistencies, scalability complexity and maintainability challenges. The biggest challenges faced in many industries include:

- Lack of vision and digital ambition that describes the business outcomes; the focus usually lies in the How, not the Why.
- People's slow pace in adopting digital twins because of the change the technology introduces, especially to how things get done.
- Barriers between operational business units that create silos and inhibit data sharing and make it difficult to establish an end-to-end view of business processes.
- Scattered data with poor data management, governance and interoperability that causes poor quality information that does not feed the digital thread.
- Insufficient understanding of operational process accompanied with lack of standardization.

To address these challenges, we created a Business Maturity Model to guide you through the journey of designing and implementing digital twins, enhancing and deepening an organization's digital capabilities, and realizing the business value that this technology adds to your business.

One final thought, to quote American novelist Charles Dudley Warner, "Begin with the end in mind!", the reality is that developing and using digital twins is a never-ending journey. By its nature, a digital twin replicates what happens in a business or part of it— and as we all know, change in today's businesses is continuous and always will be.

3 WHAT IS THE BUSINESS MATURITY MODEL?

The Business Maturity Model is a model for measuring progress. It will help you to create, run and benefit from digital twins to formulate, execute and continuously refresh business strategy.

Digital Twin Business Maturity Model

It identifies the characteristics that an organization needs to develop in order to successfully navigate a digital twin journey. It is your stencil that helps identify where to start and how to manage change that digital twins introduce to your business.

The Business Maturity Model Working Group identified five stages of maturity through which companies will most likely pass on their journey towards optimizing the potential of digital twins in their organization, and five elements against which these maturity stages should be evaluated.

These five stages are points on a continuum and describe attributes of the organization that will have a bearing on its receptiveness to digital twin technology, mindsets and ways of working. It is almost certain that, at any point in time, an organization will be at different stages of maturity against different elements of the model, and understanding these nuances and complexities is essential to successful incorporation of digital twins into the organization.

The five stages of maturity are, in summary:

1. **Passive:** Active and passive resistance to digitalization. Little or no digitization is found in many legacy projects.
2. **Starter:** Passive observers of digital twins where there is some virtual and digital modeling. Their existence and even their value is recognized but adoption does not yet seriously feature on the agenda. The attitude towards change is still that it is a necessary evil rather than a business opportunity.
3. **Progressive:** Early-stage participants in digital twinning where there is leverage of operational data for insights with some integration and automation, but only in siloed proofs of concept starting to realize the value, usually in pockets of enlightenment where the attitude to change is also more positive and accepting.
4. **Mature:** Active prototypes of digital twins that are comprehensive with simulation for future “What if scenarios.” The Owners see the benefit and start sharing data between point solutions, often providing the technology platforms, and are actively encouraging collaboration on digital twin projects across the silos of the organization. This integration follows a System-of-Systems approach and spreads across all phases controlled by the owners internally.
5. **Master:** Active adoption of digital twins and continuous evolution of the use cases in different parts of the organization with autonomous decision making and the ability to learn and act on behalf of users with no human interference.

Reaching the highest maturity level does not end the process. Change agents and industry innovators continue to evolve and adapt their processes to create new levels of digital twin maturity. The journey never ends.

Digital Twin Business Maturity Model

The five elements against which maturity stages should be evaluated are:

1. Ambition & Strategy

- Vision & Digital Ambition
- Strategic Planning
- Alignment

2. Leadership

- Style
- Skill

3. Culture, Change, & Capability

- Culture
- Change
- Capability

4. Operating Model & Process Standardization

- Process
- Operations
- Decisions

5. Digital Twin Technology

- UX and Models
- Data Services
- Intelligent Services
- Integration
- Management & Trustworthiness

Digital Twin Business Maturity Model

	Level 1 Passive	Level 2 Starter	Level 3 Progressive	Level 4 Mature	Level 5 Master
Strategy & Ops	No clear strategy	Limited strategy Unaligned with Ops	Limited strategy & Ops alignment	Strategy consistency & Ops alignment	Strategy continuously drives Ops decisions
Leadership	"Leaders" are misnomer	Traditional and limited leadership capabilities	Leadership skills recognized but not embedded in ways of working	Leadership enables cross-functional collaboration	Leadership promotes continuous change
Culture, Change & Capability	Active resistance to change and ideas	Change is the exception not the norm	Change not integrated at a strategic level	Digital Twins are recognized as effective drivers for change	Change is integral to culture supported by Digital Twin & Agile
Operating Model & Process Standardization	Siloed Ops, ad-hoc decisions, no data, no process	Limited process standardizations	Process standardization & basic automation	End to end process automation & Intelligence	Use of (DTO) and real time operational monitoring
Digital Twin Technology	Descriptive • scattered, static data in systems • no integration, communication or automation	Diagnostic • operational & sensory data • dashboard with operational insights	Predictive • contextualized data • machine learning • some automation, connected data and systems	Prescriptive • real time data from integrated systems • situational awareness • recommendations	Autonomous • continuous decision intelligence • adaptive and generative AI • self-sufficient

Figure 3-1: Business Maturity Model. (Source: DTC Business Maturity Subgroup.)

The elements of the Business Maturity Model describe the competencies that drive maturity stages of the organization and improve performance in each of the competencies with the support of digital twin technology.

4 AMBITION & STRATEGY: THIS IS WHERE YOU SET YOUR NORTH STAR AND DEFINE THE BUSINESS OUTCOMES YOU ARE LOOKING TO ACHIEVE

Competency	Passive	Starter	Progressive	Mature	Master
Vision & Digital Ambition	The need for a digital vision and strategy isn't clearly understood at a senior level. Little or no awareness of digital technologies.	Some awareness of the need for a digital vision and of the major technologies that shape the industry.	Aware of the broad technologies that shape the industry including digital twins but not clear on the business outcomes.	Understand the impact and importance of digital twin technology with defined business outcomes but not making full use of its potential.	Digital twin technology is used to shape and continue to update and communicate the vision and achieve business outcomes.
Strategic Planning	No strategic planning occurs within the organization. If	Strategic planning is the responsibility of a small team and	Structured and open planning process involving people throughout	Strategic plans are developed and revised regularly (more frequently)	Strategy drives critical organizational decisions and

Digital Twin Business Maturity Model

	goals are defined, there is no link to the strategy or how they are going to be achieved. Very limited and narrow use of data to measure performance.	is not integrated. Performance measures are defined and collected on a largely ad-hoc basis in focused operational areas.	the organization and occurs approximately every 1-2 years. Performance measures are collected covering most strategic objectives, but not integrated or consistent.	than once a year) by cross functional planning teams. Performance measures are broadly collected and used to improve organizational performance and inform decisions.	continuous planning process is maintained. Performance measures are comprehensively used, revised and improved using real-time data.
Alignment	Work is performed in silos with little or no alignment to what limited articulation there is of goals. No insights from internal or external stakeholders.	Little alignment exists between strategy and operational areas. Little or no alignment across operational functional teams.	Cross-functional alignment with overall strategy.	Strategy has been cascaded down to all levels in the organization and is aligned with personal goals. There is effective use of feedback loops.	All structures, systems, processes, people are aligned with the strategy and continuously improved.

Table 4-1: Ambition and Strategy. (Source: DTC Business Maturity Subgroup.)

5 LEADERSHIP: THIS IS WHERE YOU MAKE SURE THAT YOU HAVE PILOTS TO STEER THE VESSEL

Competency	Passive	Starter	Progressive	Mature	Master
Style	Leaders are vested in existing ways of doing things and feel threatened by new ideas. Command and control are the prevailing style of management.	Leadership is perceived to be for senior roles only. There is some recognition of the benefits of engaging and empathizing with staff but limited capability to do it in practice.	Leaders understand their role and have clarity of vision, but this is not embedded in the organization's culture or ways of working. Innovation and novel approaches to solving business problems are encouraged but the	Senior leaders are good at engaging and empathizing with staff at all levels and this is an attribute that is replicated by some staff at all levels. It is widely recognized that leadership is about creating an	Engagement and empathy are attributes of leaders at all levels of the organization. The leadership philosophy and style encourage and reward change-readiness.

Digital Twin Business Maturity Model

		Visions are limited and more to do with “holding what we have” than creating exciting goals that people can rally around.	organization falls short in its ability to execute.	environment in which innovation and change are welcomed as a necessary component of business survival and growth.	
Skill	“Leadership” is a misnomer. Senior people have been promoted for the wrong reasons – technical ability, popularity or nepotism – and not for their aptitude for leadership. People with real leadership potential recognise the problem, become frustrated at the lack of understanding of what developing leadership skills entails, are deterred and drift away.	Senior people are typically good managers and there is an awareness of the importance of good leadership, but limited leadership capabilities. The need to develop and encourage leadership at all levels of the organization is not recognized.	Leaders tend to be predominantly quite narrowly focused on their own areas of responsibility. Interoperability and cross-functional working are still a little way off. Leadership potential is recognized in people at different levels in the organization, but there are no leadership development mechanisms or programs.	Leaders have the ability to think and act cross-functionally and recognize the need to understand the business end-to-end. Interoperability and cross-functional work are becoming established as the norm. Leadership skills are being developed throughout the organization and this is recognized as a strategic priority.	Leaders facilitate the operation of a distributed, networked environment with inter-operable systems. Leaders have fostered a philosophy of change-readiness, leading to an environment in which the real-time change enabled by digital twin technology is recognized as the normal way of doing business.

Table 5-1: Leadership. (Source: DTC Business Maturity Subgroup.)

6 CULTURE, CHANGE AND CAPABILITY: THIS IS THE OIL FOR YOUR ORGANIZATION'S ENGINE

Competency	Passive	Starter	Progressive	Mature	Master
Culture	Innovative ideas are quickly neutralized either by active resistance or inertia, and the people with the ideas lose heart.	The prevailing culture is “steady as we go,” usually with relatively little openness to new ideas, whether internal or from external sources such as customers, competitors and suppliers.	The culture encourages collaboration, openness and innovation but in practice these things are still limited by organizational boundaries and silos.	Cross-functional collaboration is prevalent and actively encouraged by leaders, consigning silo-based views of the organization to the history books.	Fundamentally new ways of thinking and working are actively encouraged and recognized as integral to the culture, enabling the acceptance and active deployment of new technologies such as digital twins.
Change	Resistance to change is often disguised as lip service to the idea but is accompanied by the many reasons why “it wouldn’t work here.” Modeling any aspect of the current business is not even thought about.	Change is regarded as the exception rather than the rule. Change is generally managed on a small scale and incrementally and is limited to what’s needed to preserve the status quo – with the odd exception. There is openness to modeling the status quo from which insights into the potential for positive change might follow.	The organization has become used to tactical change and has begun to embrace digitalization and all that comes with it. Change is recognized as part of the culture but is not integrated at a strategic level. Some modeling for the status quo to improve outcomes.	Although legacy systems and information flows still prevent the full-scale recognition of change as a business-as-usual competence, there is a widespread recognition of the need to reach this point. Digital twins now become potentially very effective drivers of change and will be recognized as such.	Change is accepted as the norm in all aspects of the organization. It attracts people who thrive in an innovative and change-ready environment and have overcome the typical structural barriers to change, from organizational silos to technology systems and end-to-end process flows.

Digital Twin Business Maturity Model

					Digital twins are becoming integral to how the organization operates and how it plans and executes change.
Capability	Digital skills are not recognized as important.	There is a recognition of the need to develop digital capabilities but little concrete action.	The organization is investing in developing digital literacy and learning.	Digital self-development is the norm. Digital creation and innovation are actively enabled and encouraged.	Digital “scholarship” is recognized as an important capability.

Table 6-1: Culture, Change and Capability. (Source: DTC Business Maturity Subgroup.)

7 OPERATING MODEL & PROCESS STANDARDIZATION: THIS IS THE ENGINE THAT MOVES THE SHIP

Competency	Passive	Starter	Progressive	Mature	Master
Process	Multiple different ways of describing and performing the same process in different parts of the business. Siloed organization, no end-to-end view. Limited use of basic process mapping tools.	Some clarity about business model. Processes not understood – they are like a plate of spaghetti. A degree of process standardization but still multiple exceptions and variations.	Understanding of business processes and started creating standardization. The organization has started to use task automation and RPA.	Cross-functional organization and end-to-end processes are becoming the norm. Limited end-to-end process automation and wide use of RPA – automated routine, repetitive and predictable tasks. Adoption of process mining technologies	Digital Twin of Organization (DTO) brings process and technology together. Automated end-to-end business processes enable real-time monitoring and integration with legacy applications.

Digital Twin Business Maturity Model

		Technology is used only to document processes, not to improve them.		to achieve real-time information by collecting, processing and analyzing event logs to discover, monitor and optimize processes.	
Operations	Heavy reliance on individuals' knowledge, creating dependency on a small number of people. Very difficult to achieve consistency of operation or data standards across the business.	Growing recognition of the need to reduce dependency on individuals by systematizing the business – but not there yet. Basic procedures in place to cleanse and standardize data in all parts of the business.	Executives recognize the need for a consistent target operating model to create a coherent way of doing business.	Target operating model is being deployed and is enabling the organization to become agile, networked and distributed.	Use of a Digital Twin of Organization (DTO)- by creating a dynamic software model of the whole organization (business modelling). Relying on real-time data to operationalize business model, respond to changes, and deploy resources.
Decisions	Decisions are not data-driven based. ad-hoc and reactive.	Decisions made based on some past and present data – hindsight and insight.	Some decisions are made based on future data- foresight and oversight.	Most decisions are made based on future data- foresight and oversight.	Fully data-driven decisions made automatically.

Table 7-1: Operating Model. (Source: DTC Business Maturity Subgroup.)

8 DIGITAL TWIN TECHNOLOGY: THE FLAME THAT WILL IGNITE THE ENGINE

Assessing the digital twin technology based on the key capabilities defined in the Digital Twin Consortium's Capabilities Periodic Table.²

Capability	Passive	Starter	Progressive	Mature	Master
UX and Modelling	Post reality monitoring and capturing Sketched maps for design, no models of behaviors or dynamics.	Physical entities modeled to have a similar visual appearance and rendered in 2D or 3D drawings or models. Processes modeled but only within silos and without any consistency across the business.	"Quasi-real-time" monitoring and capture - only within the constraints of how real-time the data is. Modeling of behaviors and dynamics.	Near real-time synchronized, federated, and interactive operations using digital thread (two-way integration and interaction) Visualization and simulation are incorporated into the models.	Autonomous operations and maintenance. Real time synchronization – that is defined by the use case.
Data Services	As-built data set of the asset geometry or system design.	Connect to a small number of data sources that are static. Some operational data are used for insights	Contains all meaningful and measurable data sources from assets, GIS, BIM, IoT sensors and more. Data model that is based on industry taxonomy standards.	Use the data from the connected asset with derivative data, correlated data from federated sources, and/or intelligence data from analytics and algorithms.	All external data sources seamlessly connected to the digital twin.
Intelligence Services	Human beings reading and interpreting data. No automation.	Human beings using computer applications to filter and use data, low levels of automation.	Computers providing basic intelligence, some level of automation.	Use of Predictive (what will, might, can happen?" and prescriptive analytics –	The use of AI-deep learning which computes multi-layer neural network to make decisions. No human interference or

² Capabilities Periodic Table, Digital Twin Consortium.

Digital Twin Business Maturity Model

		Reporting dashboards (post hoc) – static, point-in-time reporting. Use of virtual and digital model, some use of non-immersive virtual reality.	Use of some Descriptive analytics (“Why is it happening?”) and diagnostic analytics (What is happening?) Real-time dashboards and analytics.	“What should happen?” Augmented Reality and Intelligent dashboards being used. Remote collaboration and diagnosis.	interpretation of dashboards – totally autonomous. Output can easily be distributed across silos. The value chain is entirely connected and clearly visible, end to end.
Integration	No integration or communication between systems.	Some integration between systems such as Enterprise systems or collaboration platforms.	Linked interactive data especially common data: GIS, BIM, IoT data, Systems data, etc. Flow of data unidirectional and bidirectional with real - time analytics.	Frequency of synchronization between systems are predictable and deterministic. Connected and interoperable systems using System of Systems.	Data in business context is linked throughout the lifecycle- upstream and downstream. Communication protocols and allow for interchangeable systems - exchange between a simulation and real system or between different systems.

Table 8-1: Digital Twin Technology. (Source: DTC Business Maturity Subgroup.)

9 HOW TO GO ABOUT IT

After understanding the stages and the elements of the Business Maturity Model, it is important to identify the different user groups that will be consuming and benefiting from the model.

	User Group	Description
Organizations / Members	Executives	As in most organizations, executives define the digital ambition and strategies; it is common for them to use the model as a tool to assess the overall business maturity. They are the pilots to steering the vessel and making sure that the organization is moving towards common business outcomes.

Digital Twin Business Maturity Model

	Operations	Another set of users that use the Business Maturity Model is the operational team including middle management to check the pulse of the organization especially on the culture, capability and change, the operating model and processes to continuously increase the digital twin technology adoption in all areas.
	Technologists	Technologists are key users for the Business Maturity Model as they will be using the tool to assess the maturity of the different enablers of the digital twin technology.
Digital Twin Consortium	Working Groups	The Digital Twin Consortium Working Groups can benefit from the Business Maturity Model by using it as a template and standard to build their own specific maturity models taking into consideration the key areas that they need to consider when they are building any maturity model.
Consumer – externals		Future initiatives – assessment, questions, and tools.

Table 9-1: Digital Twin User Groups. (Source: DTC Business Maturity Subgroup.)

10 SAMPLE ASSESSMENT

When it comes to starting the digital twin technology implementation journey, here is a tool to identify where you are, where to start, and prioritize and guide your action plans along the way.

We recommend that you collect the assessment data from different stakeholders in your organization with different levels and in different business units.

Assessment Statements from Model	
1	We actively resist this.
2	We acknowledge the importance but little / no positive action.
3	There are pockets of enlightenment.
4	We actively support this.
5	We are active adopters of this.

Ambition & Strategy					
Digital twin technology is used to shape and continue to update and communicate the vision and achieve business outcomes.				1	2
				3	4
				5	

Digital Twin Business Maturity Model

Strategy drives critical organizational decisions and continuous planning process is maintained.	1	2	3	4	5
Performance measures are comprehensively used, revised and improved using real-time data.	1	2	3	4	5
All structures, systems, processes, people are aligned with the strategy and continuously improved.	1	2	3	4	5
Leadership					
Engagement and empathy are attributes of leaders at all levels of the organization.	1	2	3	4	5
The leadership philosophy and style encourage and rewards change-readiness.	1	2	3	4	5
Leaders facilitate the operation of a distributed, networked environment with interoperable systems.	1	2	3	4	5
Leaders have fostered a philosophy of change-readiness, leading to an environment in which the real-time change enabled by digital twin technology is recognized as the normal way of doing business.	1	2	3	4	5
Culture, Change & Capability					
Fundamentally new ways of thinking and working are actively encouraged and recognized as integral to the culture, enabling the acceptance and active deployment of new technologies, such as digital twins.	1	2	3	4	5
Change is accepted as the norm in all aspects of the organization. It attracts people who thrive in an innovative and change-ready environment and have overcome the typical structural barriers to change, from organizational silos to technology systems and end-to-end process flows.	1	2	3	4	5
Digital twins are becoming integral to how the organization operates and how it plans and executes change.	1	2	3	4	5
Digital "scholarship" is recognized as an important capability.	1	2	3	4	5
Operating Model & Process Standardization					
Digital Twin of Organization (DTO) brings process and technology together. Automated end-to-end business processes enable real-time monitoring and integration with legacy applications.	1	2	3	4	5
Use of a Digital Twin of Organization (DTO) by creating a dynamic software model of the whole organization.	1	2	3	4	5

Digital Twin Business Maturity Model

Relying on real-time data to operationalize business model, respond to changes, and deploy resources.	1	2	3	4	5
Fully data-driven decisions made automatically.	1	2	3	4	5
Digital Twin Technology					
Autonomous operations and maintenance.	1	2	3	4	5
Real time synchronization is identified per use case.	1	2	3	4	5
All external data sources seamlessly connected to the digital twin.	1	2	3	4	5
Leveraging AI and machine learning to make better decisions.	1	2	3	4	5
No human interference or interpretation of dashboards, we have high to full level of automation.	1	2	3	4	5
Output can easily be distributed across silos.	1	2	3	4	5
The value chain is entirely connected and clearly visible, end to end.	1	2	3	4	5
Data in business context is linked throughout the lifecycle- upstream and downstream.	1	2	3	4	5
Scalable mechanisms are in place to exchange data between the simulated and real system or between different systems.	1	2	3	4	5
The communication protocols and capabilities are agnostic and allow for interchangeable systems.	1	2	3	4	5

11 AUTHORS AND LEGAL NOTICE

Copyright © 2024, Digital Twin Consortium®, a program of Object Management Group, Inc. (“OMG®”). All other trademarks in this document are the properties of their respective owners. The views expressed in this document are those of the author(s) and do not necessarily reflect OMG official policy or position.

This document is a work product of the Digital Twin Consortium Business Maturity Model Subgroup, chaired by Dana Kawas (Thynkli) and Tim Connolly (APTUMX). The Subgroup is part of the Capabilities & Technology Working Group.

Authors: The following persons contributed substantial written content to this document: Dana Kawas (Thynkli) and Tim Connolly (APTUMX).

Technical Editor: Dan Isaacs (DTC CTO) oversaw the process of organizing the contributions of the above Authors and Contributors into an integrated document.