Are You Ready to Profit ... From Real-Time Digital Data Streams?

By **Federico Pigni** and **Gabriele Piccoli**

There is no escaping the talk (and rhetoric!) about Big Data. Vendors are peddling Big Data solutions; consulting firms employ Big Data specialists to help you with your Big Data projects; universities offer Big Data courses; Big Data conferences are aplenty; and tech journalists, magazines, and even blogs are buzzing about the Big Data revolution. This is great, especially after the Great Recession we just endured. We welcome any excitement about technology buzzwords!

Today's wagon train is far on its way -- like gold rush adventurers migrating toward the Big Data promised land made of golden nuggets (of insight) to be found and extracted from mountains (of data). However, by focusing merely on the mountain (of Big Data), these adventurers are missing what we think is the real revolution -- digital data streams (DDS). The reason DDS is easy to miss is that it's like Big Data, but it's the *dynamic dimension of Big Data* -- and in motion.

DDS comprises the massive streams of digital data originating from events, individual experiences, and actions captured in real time by ubiquitous sensor networks. Every time someone googles, tweets, or posts to Facebook, corresponding digital data comes into being (a phenomenon known as "digital data genesis" -- DDG). DDS is the ready-to-process data available in continuous and constantly evolving streams. However, DDG does not simply occur when a user is in front of a screen. Rather, an increasing number of devices have become capable of tracking actions. Smartphones are incredible data-gathering platforms: intensity of light, sound, gestures, words, clicks, temperature, location, direction, tilt, and so on. Video surveillance systems deployed for security and monitoring purposes are other examples of real-time DDS sources.

We have been researching DDS for almost two years and believe the increasing digitization and availability of real-time data streams provides an unprecedented opportunity for value creation. New levels of productivity, service, and business are emerging in those organizations developing the capabilities to gather, stream, and/or harvest digital data in real time. The value that a company can unlock once it taps into DDS goes well beyond analytics. For example, SceneTap offers a unique social service, providing real-time information on how many people are at a venue (e.g., a nightclub), the male-to-female ratio, and the average age. SceneTap generates its own data stream from a sensor network centered on anonymous facial-detection technology.

In a previous *CBR* issue last year, Federico and his coauthor Elisabetta Raguseo introduced the DDS concept and provided some analytical tools to help managers identify and comprehend the opportunities The remainder of the article concentrates on our progress in the continuation of our study in this field. Specifically, we have been working for those readers who believe us; they see the potential of widespread DDS and want to unlock it.

In this article, we shed light on our study of DDS readiness and address an intriguing question: what are the IT and organizational capabilities your IT shop needs in order to unlock the wealth of real-time data flowing around you and inside your organization? We categorize these capabilities and then benchmark them with fresh data from the latest *CBR* survey and highlight the changes reported in last year's *CBR* on

A JUMP TO THE PAST: VALUE ARCHETYPES

When we began looking into the DDG phenomenon we asked ourselves, "What's new?" Some simple intuition told us that we could achieve "something" new through real-time data. As academics often do, we started categorizing what we saw (keeping up an old tradition made famous by Charles Darwin, the great categorizer of animal species). We gathered all the examples available in literature and in the press and examined both startups and examples of DDS users. It took us a year to make sense of what we collected. In the end, we were able to develop a framework, composed of value archetypes and value drivers, that describes the phenomenon well and identifies value-creation opportunities and challenges.

To begin, we propose five archetypes representing classes of value-creating initiatives employing real-time data streams:

1. **Generation.** A company may create value by originating the stream of data itself, either deliberately or as a byproduct of other activities. The company could then stream such data to other partners who can harvest it and create value-added services based on it.
2. **Aggregation.** A business may create value by focusing on collecting, aggregating, and repurposing a stream of real-time data.
3. **Service.** A company may create value by using one or more streams to provide services to consumers or to improve service quality.
4. **Efficiency.** A business may create value by using real-time data streams to optimize internal operations and/or to track business performance (e.g., waste reduction, response speed).
5. **Analytics.** This value archetype extends beyond aggregation; for example, a company creates value by processing real-time data and information to produce analyses or improved visualizations with the objective of enabling better decision making and/or producing superior insight or knowledge (e.g., through dashboards and data mining).

Archetypes are just a piece of the puzzle. They represent the general classes of value creation, or blueprints for business models. Graph 1 in the Survey Data section reveals our respondents use of each value archetype. Value drivers, discussed next, are what make this process unique and different from the past. So "What's new?"

BACK TO THE FUTURE: VALUE DRIVERS

Value drivers are the unique characteristics of an activity that changes its value contribution. They represent possibilities for business action. Value archetypes illustrate the templates of value creation through DDS, whereas value drivers represent the potential for value creation that stems from the DDG phenomenon. Our initial framework identifies four value drivers:

1. **Real-time sensing.** This consists of the ability to detect the current state of a given entity. Examples are the location of a plane, the speed of a car, or the mood of an individual. Real-time sensing is a *first-order* value driver as it represents the basis for all other value opportunities.

2. **Real-time mass visibility.** This *second-order* value driver is based on real-time sensing. It represents the ability to identify the state of multiple entities in real time, contextualized by their relationships. For example, if real-time sensing makes it possible to locate one vehicle, it is then possible to acquire visibility of all vehicles on a road, thus enabling the detection of traffic congestion.

3. **Real-time experimentation.** Another *second-order* value driver that also relies on real-time sensing is real-time experimentation. It consists of the possibility to fast-cycle reliable data generation and gathering. Mass visibility provides companies with the unprecedented opportunity to test and experiment business assumptions and derive immediate measurable feedbacks.

4. **Real-time coordination.** This is the final *second-order* value driver based on real-time sensing. We define it as the possibility of adjusting behavior based on fast-cycle feedback regarding the current state of other entities.

So what are companies doing today, and how does our current survey data compare to last year's survey?

STATE OF THE ART

Companies are increasingly adopting and exploiting real-time data in their business. In the companion article to this piece, Manjunath Paramashivaiah provides an interesting commentary on the need for companies to realize the value of real-time DDS. However, a large part of the managers we surveyed feels this potential remains untapped. As shown in Graph 2, nearly one out of five companies (22%) do not make use of real-time data streams in their business (a decrease of 8% compared to last year). Similarly, among those companies effectively exploiting DDS for value creation, only an average of 23% believe they make the most of them (see Graph 3).

Which Types of DDS Are Companies Most Exploiting?

In line with last year's results, companies are most comfortable in dealing with their internal DDS (36%; see Graph 3) and those related to their close business partners (29%). What really changed between the two surveys is the use of DDS originating from social networks and communities. This year, the majority of surveyed companies do make use of these DDS types (67% and 66%, respectively). This reflects the increasing popularity of solutions (and related offers!) for sentiment detection and analysis. Interestingly, respondents still believe that social network DDS has untapped potential as well: 11% recognize that they should effectively start exploiting it. The mobile device and smartphones DDS category confirms this pattern. Last year, only a third of respondents exploited mobile data. Today, a remarkable 51% now exploit mobile platforms.

Despite these numbers, companies still think they must search untapped potential of external DDS in mobile and social network streams. The relative novelty of DDS value extraction could well account for this results. Moreover, we think that companies are not extracting or benefitting from these types of DDS yet. Thus, these results emerge from a sort of "delusional hope." Managers invested and implemented systems harvesting social and mobile platform DDS expecting easy, achievable results. Effectively, several turnkey solutions emerged in the marketplace. However, in our experience -- shared with Manjunath's vision -- value creation requires the presence of several "ingredients" in the organization, not just a specific "context" and plan to make it happen. So, despite a first step into real-time DDS value extraction, companies are still experimenting and developing the necessary skills to master value creation.

What Are Companies Doing with DDS?

Companies have deployed several new data-oriented initiatives since last year's survey. In fact, all our proposed archetypes are exploited more now than last year (see Graph 1). This is particularly true for the efficiency and analytics archetypes. In particular, the trend concerning analytics reflects the

industry's current emphasis on Big Data and the promises of the business insights emerging from real-time analytics. Indeed, analytics are at the core of all business intelligence and data mining initiatives companies have experienced in the last few years. For some organizations -- and for some vendors, too -- Big Data is the natural extension of what they have been doing up until today. So we are not surprised that companies place their first bet on analytics for DDS value exploitation. We hope that, along with Manjunath, we convince *CBR* readers that real-time DDS is different -- a true new paradigm -- and that analytics is just one of the possible ways for value creation.

Another interesting aspect is that both the efficiency and analytics archetypes have a strong "inner focus" for the valorization of DDS. Companies generally use analytics for "business insights" (the golden nuggets we cited in the introduction), while efficiency typically concerns the optimization of internal operations and business monitoring. In this sense, organizations are creating value by improving their "inner" competitiveness: looking for insights and the improved decision making that emerges from DDS analysis. We think that several opportunities are still unexplored and possible, however, through the effective use of DDS heading "outward" (e.g., in new products and services).

Compared to the previous survey, firms are beginning to realize the potential of DDS generation through the creation of their own streams. As shown in Graph 1, 23% use it to a great extent. This practice has more than doubled compared to last year, although this archetype is still the least common. This observation reflects respondents' expectations regarding the untapped potential of mobile platforms. Mobile platforms and mobile applications are one of the most effective ways to generate DDS. The diffusion of both the iOS and Android mobile platforms have generated an affordable -- and often still untapped -- opportunity for sourcing directly valuable DDS.

These results show that DDS is a real value-creation opportunity. Companies are capable of profiting from them and awareness of this potential is spreading. However, for the majority of responding organizations, the potential of DDS is still untapped and terra incognita. An exploration of the drivers behind current initiatives could help us shed light on this point.

Why Are Companies Exploiting DDS?

The reasons behind DDS exploitation have not changed (see Graph 2) from the previous Cutter survey. Companies still believe that DDS value stems from the possibility provided by real-time mass sensing and visibility. Organizations recognize that DDS value creation is rooted in the potential for monitoring elements of the business and aggregating that information to gain an enhanced understanding and insight in the business itself. Again, an inward focus, rather than one on new products and services, dominates.

Value drivers are interesting to identify as they allow companies to map their business innovation territory. Different from archetypes, value drivers emerge from the interplay of business capabilities and the business environment. Value drivers are somehow "live" and evolve with a company's evolution and changes to the business environment. The four archetypes described in this article are currently recognized opportunities that have emerged from the availability of real-time DDS. Profiting from any of these drivers depends on the capabilities of companies to detect an opportunity -- that is, recognize the driver -- and exploit it. So are we ready for this?

BENCHMARKING READINESS: ARE YOU READY TO RIDE A (DIGITAL DATA) STREAM?

The bundle of organizational resources that allows for the identification and the exploitation of value- creation opportunities offered by available DDS determines the ability to *profit* from value drivers. For this reason, we focused on benchmarking DDS readiness for this year's survey. DDS readiness is the

degree of "preparedness" of a company's IT function to detect and implement specific DDS value- creating initiatives. DDS readiness is predicated on four capabilities, each addressing a necessary skill for DDS value extraction: mindset, skill set, data set, and toolset.

Mindset

A critical component of innovative initiatives is the willingness to invest and face risks. In this sense, the DDS mindset represents the willingness of organizational members to pursue DDS initiatives, thus embracing (risky) change. A hallmark of the successful DDS initiatives we have studied is the attitude of the organization to explore DDS value potential, along with a strategic focus. Consequently, the mindset capability comprises the attitude toward data and the strategy to profit from it.

Of all the companies already exploiting real-time DDS, 65% appear to be in an organization characterized by a data-driven culture (see Graph 4a). Although high, this aspect of mindset is significantly lower compared to the other factors surveyed. A promising 82% of respondents believe in experimenting and testing innovative IT ideas, while 71% feel that real-time initiatives can beat the competition. Yet, notably, more than a third feel that their company lacks a proper data culture.

Skill Set

The skill set dimension refers to the ability of an organization to manage a DDS initiative; that is, to acquire and orchestrate all the resources necessary to deliver value with the DDS. It comprises both the activities for the design of the initiative and the selection and combination of adequate resources (e.g., financial, human, technological) necessary for its implementation.

Respondents are confident in their capacity to correctly manage the development of real-time data initiatives, as confirmed by a consistent near 50% of them who exploit DDS (see Graph 4b). However, nearly 20% find themselves not adequately skilled.

Data Set

The data set component refers to the ability to effectively identify, intercept, and access the real-time data streams that match the organizational needs for value generation. In turn, effective access and use implies a good understanding of the data contained in the data streams, and of the business need of the organization. For example, the decision to use a particular data stream for creating a new service needs to account for the specific characteristics of the data, such as its intrinsic quality, in light of the "tolerance" available in the specific context. The use of low-quality data for the critical decision-making process could have disastrous consequences, as high-quality data positively equates to company success.

Conversely, data of dubious quality still provides value in the context of mobile social networks (e.g., Foursquare). To effectively create value through DDS requires both a proper understanding of the business context for using the data as well as the specific characteristics of the data. These aspects are generally reflected in a precise data and information governance configuration.

As shown in Graph 4c, about half of the responding companies appears to have a clear data governance policy; indeed, about one out of four actually manifest a lack of it. This likely relates to the increasing integration of external data streams into existing information systems. Companies are already deploying solutions based on real-time data streams but are still challenged by the integration process itself. The relatively low percentage of respondents (43%) who maintain an accurate catalog of available data streams reflects this assertion. This

pattern contrasts with what we have observed for the other dimensions of data set. A large majority of respondents track the sources of their data (75%) and assess the quality of the integrated data streams (66%), both fundamental

aspects of data governance.

Toolset

Once identifying a source, a company must then be able to tap into the streaming data. Toolset refers to the most technical of the four DDS capabilities: the capacity to use appropriate software and hardware to intercept DDS and harvest its content. It requires both the technical competences and the technical elements that are prerequisite to a real-time analytical system tuned for processing real-time data streams. As a technical capability, our understanding of it is already fairly advanced. In last year's *CBR* issue on real-time data streams, Zubin Dowlaty identified four main characteristics that, at the technical and architectural level, are required for operating real-time DDS:

1. **Message-orientated middleware (MOM) with an Enterprise Service Bus implementation,** allowing for a standardized and abstracted communication among heterogeneous systems
2. **Advanced analytics engine,** in terms of those algorithms, advanced analytics, or predictive analytics to be applied on DDS as per requirements of the application
3. **Business process modeling (BPM) engine,** enabling flexible and deep integration into the human workflow, which significantly assists in consumption
4. **Rules engine,** capable of executing business rules in runtime and a related rules repository (separating the business and the software/application component)

These elements are at the base of the toolset component. In general terms, the integration of real- time data streams in current architectures appears incomplete. About half of our respondents are skeptical when it comes to their capacity to integrate real-time data streams into current workflows or across heterogeneous systems (see Graph 4d). Rules engines, however, appear to be marginally more capable of supporting real-time data, scoring well with 56% of respondents. Finally, companies appear confident in their capacity to generate their own data streams (62%) in terms of both tools and technical talent. In the next article, Manjunath develops this concept further and discusses the actual challenges of the toolset component. He explicitly identifies 10 technical architectural characteristics that will be placed under pressure in all organizations willing to follow the DDS way of value creation.

Furthermore, Manjunath builds on top of these considerations, providing rich insight into the interaction between data set and tool set for taking advantage of DDS. The idea behind the benchmarking of DDS readiness is to develop an effective tool for determining the capacity of organizations to profit from real-time data. Given an initial configuration of mindset, skill set, data set, and toolset organizations seem to manifest a certain degree of DDS readiness. DDS readiness measures the potential to detect and implement the strategic initiatives instantiating one or more value drivers. We can then express the effect of the readiness in terms of value archetypes, process and procedures, and financial impacts.

MY READINESS AND ME

What we have learned in studying DDS readiness is that -- more than ever -- companies must properly orchestrate a heterogeneity of skills and competences to expect value from real-time data initiatives. The latest *CBR* survey provides additional support to these early conclusions. Higher levels of DDS exploitation prove to positively correlate to levels of DDS readiness. The extent of this relationship is particularly significant in relation to the value archetypes; the levels of service, efficiency, and analytics archetypes exploitation are associated with high levels of DDS readiness in more than 75% of the cases.

Moreover, when there's potential (measured through DDS readiness), exploitation takes place. DDS readiness represents *potential*, rather than the likelihood of the deployment of an initiative.

Therefore, profiting from DDS is not merely a problem of having the right "ingredients" -- the right stuff -- but instead requires accurate management in how these ingredients interact in the organizational setting.

But are all ingredients of readiness equal? Early on in our study, we argued whether we should weight some ingredients more than others. We thought this was a central question for managers, as it could lead to identifying "patterns" that a business could replicate for exploring DDS value creation. The survey provides partial confirmation of this. Simply put, different archetype adopters have different tastes! For example, the service archetype generally associates with high levels of the data set capability, while efficiency relies on tool set. For analytics, both the skill set and the data set capabilities are important. We can therefore conclude that organizations that exploit DDS are doing so mainly because of their managerial and data management skills, or the ones they esteem as the most developed. We think this partially relates to DDS exploitation maturity. As explained earlier, organizations appear to be capable of managing cross-functional projects and are unafraid of the multidiscipline challenges of DDS initiatives, a probable echo of their data mining and business intelligence recent past.

The great "absent" from all this appears to be mindset. Its influence is only marginal. This may be tightly related to what we just discussed: 35% of respondents effectively report that their companies lack a data-oriented culture (see Graph 4a), possibly hindering their potential for value exploitation. This could be one of the axes on which adequate managerial actions are required in order to profit from -- rather than simply pursue -- DDS initiatives.

READY OR NOT, IT WILL COME

Implementing real-time DDS initiatives is challenging. Companies must face problems in accessing technical tools and skills, developing analytical competencies, meeting budgetary constraints, demonstrating the value of the initiative, or involving the appropriate business partners. Confirming the results of the previous *CBR* survey on DDS, budgetary constraints and financial reasons are the main challenges in relation to DDS initiatives (56%; see Graph 5). The financial challenge is particularly significant in the light of DDS readiness. Companies with higher readiness perceive the financial constraints to be even more challenging. Again, the limit to the deployment of DDS initiatives appears to be that the organization itself -- despite being ready for profiting from these new initiatives -- has problems in allocating the required financial resources. Coupled with the relative novelty of the opportunity, nearly half of respondents are experiencing difficulties in making the case for demonstrating value. Conversely, lack of access to the technology and skills for implementing real-time data initiatives are at the bottom of the list of challenges.

Furthermore, interestingly, the challenges of realizing DDS initiatives present a more external orientation than what we found in the previous survey. On the one hand, companies find it relatively easy to access technical tools and skills; on the other, nearly 50% find it difficult to access reliable partners and consultants (see Graph 5). Partially in line with other studies, we found confirmation that an "analytics challenge" exists: 43% of respondents find it difficult to access analytical skills and tools in order to realize the potential of real-time DDS initiatives -- and related archetypes.

CONCLUSION

So back to our original question: what's new? The news is that DDS value-creation opportunities are the "real stuff." Companies are actively exploiting these initiatives for value creation. This exploitation appears to be consolidating around drivers that, in this digital era, are already becoming classic: sensing and mass visibility. Both of these connect well to elements that characterize Big Data "Vs" such as volume and velocity, but we believe we are still in the early stage, where companies are

exploring the potentials of DDS only to master them in the future. Lack of data-oriented organizational culture and an inward orientation are still major obstacles to overcome.

DDS readiness is the first tool for assessing and thinking about organizational preparedness for the exploitation of DDS. It identifies the main target of change and the capabilities organizations must mobilize and evolve to succeed in the DDS revolution. While we lack some details on how the four ingredients of mindset, skill set, data set, and toolset combine -- and how they impact competitiveness -- we know that "great things are easier than small things." We've simply just found our next challenge.

ENDNOTES

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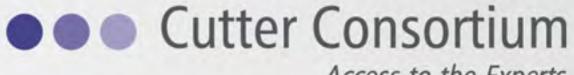
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ABOUT THE AUTHORS

Federico Pigni is Assistant Professor in Information Systems in the Management of Technology and Strategy Department at the Grenoble Ecole de Management (France), where his research centers on strategic application of information systems in the interorganizational context and the use of innovative IT to deliver customer service. Previously, he has taught at Carlo Cattaneo Unversity (Italy), Università Commerciale Luigi Bocconi (Italy), and the Catholic University in Milan. Dr. Pigni has participated in various research projects funded by Italian, regional, and EU agencies; private industry; and government partners. He has been published in *Journal of Enterprise Information Management*, *International Journal of Information Technology and Management* , *Journal of Information Technology Cases and Application*, *Production Planning & Control*, and *Supply Chain Forum: An International Journal*. Dr. Pigni holds a PhD in MIS and SCM. He can be reached at federico.pigni@grenoble-em.com.

Gabriele Piccoli is a Senior Consultant with Cutter Consortium's *Business Technology Strategies* practice and Editor Emeritus of *Cutter Benchmark Review*. He is Associate Professor at the Universitá di Pavia (Italy), former Associate Professor of Information Systems at the School of Economics and Business Administration at the Universitá di Sassari (Italy), and former Professor at Grenoble Ecole de Management (France). His consulting, research, and teaching expertise is in strategic information systems and the use of advanced IT to support customer service. Prior to moving to Europe, Dr. Piccoli was Associate Professor of Information Systems at the School of Hotel Administration and Hospitality Management at Cornell University. He has also held positions as Adjunct Professor of Information Systems at the AB Freeman School of Business at Tulane University and as instructor at the EJ Ourso College of Business at Louisiana State University, where he received his MBA as well as his PhD in business administration with emphasis in management information systems. Dr. Piccoli is the author of the book *Information Systems for Managers: Text and Cases*. His research has appeared

in both academic and applied outlets such as *MIS Quarterly*, *Decision Sciences Journal*, *MIS Quarterly Executive*, *Communications of the ACM*, *Harvard Business Review*, *The DATA BASE for Advances in Information Systems*, and *Cornell Quarterly*. He can be reached at gpiccoli@cutter.com.

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con **Gabriele Piccoli**

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