The Predictive Casino

By

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Executive Summary

The predictive casino is a casino or an integrated resort that takes into account everything that is happening on the casino property by the patrons, customers (we'll consider these the people who haven't signed up for a player card yet and are, therefore, mostly untrackable), the employees, and the vendors. The predictive casino utilizes all of the data associated with all of these individuals to make better business decisions for the company as a whole. Descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics and the newest entrant into the growing field of analytics—edge analytics—are exploited throughout the enterprise to reach as real-time an IT environment as possible. The predictive casino comingles structured, semi-structured, and unstructured data to provide customer insights down to the granular level and utilizes these insights to improve customer intelligence, marketing automation, analytics, and social media marketing. Extrapolating one customer's experience to that of thousand, ten thousand, a hundred thousand, even, potentially, a million can provide insights into both short term labor needs, and long-term supply and operational needs.

The predictive casino culls data from the following sources:

- Gaming data from Bally's, IGT or other in-house gaming systems
- Customer Relationship Management (CRM) systems
- Patron management systems
- Transaction data from POS (F & B, spa, club and retail outlets) systems
- Hotel's reservation systems
- Casino website clickstreams
- Call center systems
- Surveillance and security datasets, including facial recognition technology information
- RFID chips, for both casino chips or other devices tracking inventory
- IoT sensors
- Geo-location data from in-house and on-bus Wi-Fi systems
- Table games revenue management systems
- Angel Eye card shoe data
- Social media data from WeChat, Facebook, Weibo, Twitter, Jeipang, etc., etc.
- Social media listening hubs
- HR and ERP systems, including virtual roster
- Weather data

All of this information can be fed into a data lake, where it can be utilized by a multitude of casino personnel, including patron management, marketing (including social media marketing), security, call center/customer service, pit bosses, hosts, slot managers, dealers, HR, hotel management, retail, spa, and F&B clerks, all the way up to the casino's top executives, as well as the highest C-level suite.

Data Lake vs. Data Warehouse

James Dixon, "Chief Geek" at Pentaho, is credited with coining the phrase "Data Lake". Dixon posted that each specialized data mart in a data warehouse could be likened to a bottle of water. The data was ready for use in a small, identifiable container. In contrast, a data "lake" was a massive, intermingled repository of all data in its rawest form.

A data lake is a hub or a repository of all of the data that a casino has access to, where the data is ingested and stored in as close to the rawest form as possible, without enforcing any restrictive schema on it. This provides an unlimited window into the data for anyone to run ad-hoc queries and perform cross-source navigation and analysis on the fly. Successful data lake implementations respond to queries in real-time and provide users an easy and uniform access interface to the disparate sources of data. Data Lakes retain all data, support all data types and all users, as well as adapt easily to changes, while providing faster insights into the data.

In recent years, businesses in general and casino companies in particular have come to the realization that data warehouses, while perfectly able to handle the BI and analytics needs of yesterday, don't always work in today's complex IT environments, which contain structured, unstructured and semi-structured data. Normal relational databases worked fine while business users were restricted to proprietary databases and the scope of work was limited to canned reports and modest dashboards that included limited drill down functionality, but, today, with the inclusion of so much unstructured data coming from mobile, social, web logs, and semi-structured data being created from a multitude of sources, limitations abound. Standard data warehouses require built-in, understandable schemas, but unstructured data, by its very definition, doesn't have a definable schema that is accessible and understandable in every case. Data lakes have been a response to these limitations.

According to PWC's (2014) article *Data lakes and the promise of unsiloed data:*

> *Job number one in a data lake project is to pull all data together into one repository while giving minimal attention to creating schemas that define integration points between disparate data sets. This approach facilitates access, but the work required to turn that data into actionable insights is a substantial challenge. While integrating the data takes place at the Hadoop layer, contextualizing the metadata takes place at schema creation time.*

Data lakes support a concept known as "*late binding*, or *schema on read*, in which users build custom schema into their queries. Data is bound to a dynamic schema created upon query execution" (PWC, 2014). "The late-binding principle shifts the data modeling from centralized data warehousing teams and database administrators, who are often remote from data sources, to localized teams of business analysts and data scientists, who can help create flexible, domain-specific context. For those accustomed to SQL, this shift opens a whole new world" (PWC, 2014). For a casino company, this means that departments as different as call center personnel, patron management people, on floor hosts and pit bosses, hotel or retail clerks, security personnel, and marketing analyst can access and utilize data drawn from the same data lake, just personalized for them and, potentially, their customers.

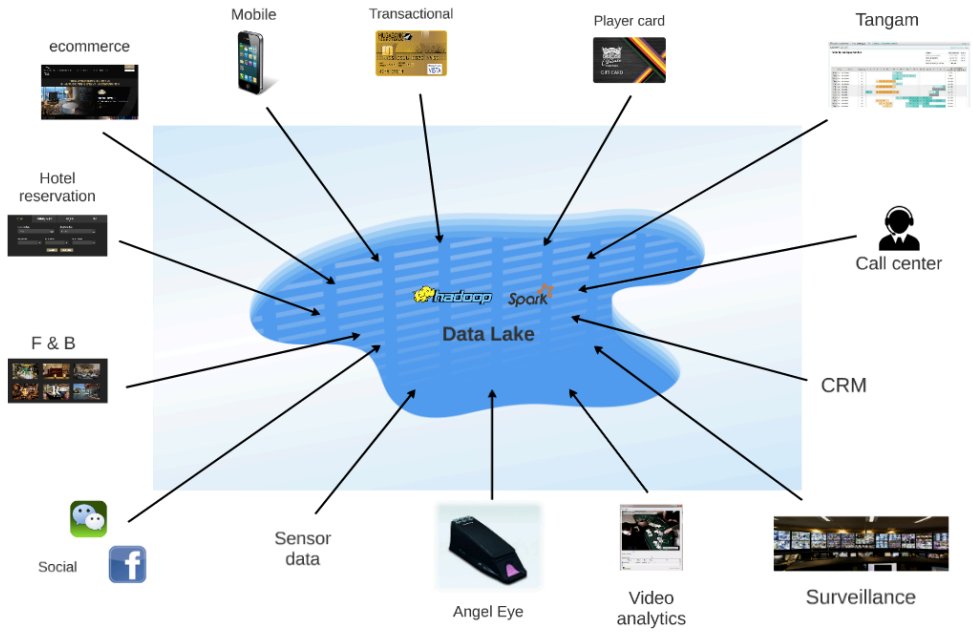

Figure 1: Data Lake for a casino property

Today's IT environment is nothing like the IT environment of even three years ago. Real-time data management capabilities have brought a whole new level of data available to customer intelligence,

customer interaction, patron management, HR, ERP, gaming, and social media systems. Today, one of the biggest challenges for IT departments is scalability. With a Hadoop back-ended data lake, businesses can dynamically scale up or down, according to their unique storage needs, even departmental storage needs. Over the past few years, the cost of storage has plummeted and virtual servers can be spun up very quickly and quite inexpensively (relative to the outright purchase of hardware). With this instant access to data, a whole new world of real-time interactions has been made possible.

The concept of "Edge Analytics"—the processing of analytics at the point or very close to the point of data collection—exponentially increases the ability to use predictive analytics where it can be utilized best—at the meeting point of customer interaction and data. In short, edge analytics brings analytics to the data rather than vice-versa, which, understandably, can reduce cost and increase its exploitability as the data is analyzed close to where it can make the most difference. This also reduces latency, which could be the difference between useful and useless analytics.

As Bernard Marr (2016) argues in his article *Will 'Analytics on The Edge' Be The Future Of Big Data?,* "Rather than designing centralized systems where all the data is sent back to your data warehouse in a raw state, where it has to be cleaned and analyzed before being of any value, why not do everything at the 'edge' of the system?"

Marr (2016) uses the example of a massive scale CCTV security system that is capturing real-time video feeds from tens of thousands of cameras. "It's likely that 99.9% of the footage captured by the cameras will be of no use for the job it's supposed to be doing—e.g. detecting intruders. Hours and hours of still footage is likely to be captured for every second of useful video. So what's the point of all of that data being streamed in real-time across your network, generating expense as well as possible compliance burdens?" (Marr, 2016). The solution to this problem, Marr (2016) argues is for the images themselves to be analyzed within the cameras at the moment the video is captured. Anything found to be out-of-the-ordinary will trigger alerts, while everything deemed unimportant will either be discarded or marked as low priority, thereby freeing up centralized resources to work on data of actual value (Marr, 2016).

For a casino, this philosophy can help in a multitude of ways; edge video analytics might help in places like Singapore, where the integrated resorts located there are required to check the passports of each incoming guest. With cameras that are able to compare the faces of entering customers against the casino's patron database, the patron records of returning customers could be quickly uploaded to a security personnel's computer, probably several moments before the actual person steps up to the guard station. Rather than waiting for a record to be pulled up, the security personnel would simply confirm or deny the patron in less than half the time it would normally take. This could cut down on the long lines at the front of the casino that are really costly choke points. The casino makes money when gamblers are gambling, not when they are standing in line to get in. As a great side benefit, the patrons will probably see this as a customer service improvement as well.

Besides the obvious use by a casino security team, for both patron and, potentially, perimeter security, edge analytics could also be used to spot high rollers venturing onto a property, or uncovering problem gamblers.

Edge analytics can also help in the retail space. "Large retailers could analyze point of sales data as it is captured, and enable cross selling or up-selling on-the-fly, while reducing bandwidth overheads of sending all sales data to a centralized analytics server in real time" (Marr, 2016). As today's integrated resorts are also, in many cases, huge retail malls, retail edge analytics could, potentially, become part of a marketing and/or analytics package the casino company makes available to its retail clients. First tier retailers like Chanel or Tiffany might not be interested in such packages, but the smaller retailers who don't have sophisticated in-house CRM systems might be. After all, there's no reason why casino companies can't monetize the data it legally collects throughout its vast properties.

Edge analytics, of course, goes hand-in-hand with the Internet of Things–"the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment" (Gartner, 2013). IoT technology costs are coming down, broadband's price has

dropped, while its availability has increased and there is a proliferation of devices with Wi-Fi capabilities and censors built into them. Smart phone penetration is also exploding. All of these individual technological advances were good for the IoT, together, however, they have created a perfect storm for it (Morgan, 2014). With less than 0.1% of all the devices that could be connected to the Internet currently connected (Marr, 2015), there is tremendous growth potential and those who embrace it now should have the first mover advantage that could prove enormously valuable in terms of ROI in the near term future.

The predictive casino sees the IoT as a gateway to more efficient business practices and processes. Bringing together all of the parts needed for the predictive casinos is not easy, however. Previous attempts of broad-based data integration have forced users to build data sets around common predetermined schemas, or a unifying data model, something not possible when unstructured and semi-structured data are added to the mix. This is where the data lake comes in. Unlike the monolithic view of a single enterprise-wide data model, the data lake relaxes standardization and defers modeling, resulting in a nearly unlimited potential for operational insight and data discovery. As data volumes, data variety, and metadata richness grow, so, too, do the benefits. Today, data is coming from everywhere, from business mainframes, corporate databases, log files, cloud services, APIs, RSS feeds, as well as from social media live streams; most of this information does contain meaning, if you know where and what to look for. A data lake makes it easier to read and understand this data, at least that's the theory that is being tested out by several forward-thinking companies right now.

With a data lake, the data is ingested and stored in as close to the rawest form as possible, without enforcing any restrictive schema atop it. No OLAP cubes are used to manipulate the data. This provides an unlimited view of the data for anyone within the organization who has been given access to it. The user will be able to run ad-hoc queries and perform cross-source navigation and analysis on the fly. Successful data lake implementations respond to queries in real-time and provide users an easy and uniform access interface. Data Lakes retain all data, support all data types, and adapt easily to changes, while providing faster insights.

With a normal data warehouse, a casino needs to decide on the structure (schema) of the data when creating the warehouse—before anything is even populated with data (schema-on-write). With a Hadoop-based data lake, however, a casino just has to store the data and structure it later, at a time when it is needed for each query or use case (a schema-on-read framework). Table 1 reveals the main differences between the two systems.

DATA WAREHOUSE	vs.	DATA LAKE
Structured, processes	DATA	Structured / semi-structured / unstructured, raw
Schema-on-write	PROCESSING	Schema-on-read
Expensive for large data volumes	STORAGE	Designed for low-cost storage
Less agile, fixed configuration	AGILITY	Highly agile, configure and reconfigure as needed
Mature	SECURITY	Maturing
Business professionals	USERS	Data scientists, et al.

Table 1: Differences between a Data Warehouse and a Data Lake

Using a data lake solution, a casino can:

- Gain visibility on a patron's true identity by culling through government and social media records during the sign up process
- Gain a comprehensive view of patron behavior by automatically cleansing and consolidating disparate gaming and nongaming activity into a single version of the truth

- Understand patron activity and behaviors—using segmentation to analyze data gathered at multiple touch points and then segmenting patrons according to their subtle gaming differences
- Identify the greatest drivers of patron value and projecting how those drivers will affect profitability and revenue projections months into the future, with enough lead time to take corrective actions, if necessary
- Create highly effective personalized promotions that are tailored to appeal to a casino's most valuable patrons by automating and personalizing marketing campaigns on a recurring basis
- Add social media as a customer service and marketing channel, utilizing automated Facebook, Twitter, etc., bots to disseminate IR-related information, like room rates, restaurant options and/or reservations, etc., etc.
- Maximize patron satisfaction and profitability by optimizing valuable resources to meet patron needs at every property touch point
- Get valuable customer insights into the hands of patron-facing employees, decision makers and others who can exploit it, with high-end reporting and data visualization capabilities
- Geo-locate a patron from the moment he or she arrives on property and include this particular individual's specific gaming play information into models that adjust table games revenue management in close to real time
- Understand real-time casino floor traffic flows so that casino personnel can be utilized more efficiently
- Capture PoS fraud and Anti-Money Laundering (AML) activity in real-time, thereby rooting out criminals and reducing costs
- Associate online ad marketing with patron conversions.

Data coming from mobile and social media sources like WeChat, Weibo, Facebook, YouTube, Twitter, YouKu, etc., tend to be highly unstructured, while data coming from CSVs, XML and JSON feeds are considered semi-structured. NoSQL databases are also considered semi-structured, while text within documents, logs, survey results, and e-mails also fall into the unstructured category. Data coming in from the plethora of casino source system, undoubtedly, can feed into a data lake and then be utilized in ways that are almost impossible for a normal relational DW, even one with in-memory capabilities.

Highly structured patron data could be combined with unstructured data coming in from social media feeds. If a patron tweets from the train heading towards Zhuhai or a car crossing the Nevada border, why shouldn't the casino marketing department be alerted? Setting up JSON feeds for Twitter users accounts is a very simple process and many other social media companies offer APIs that allow access to customer accounts. These are two-way systems as well, and the casino's marketing department should include social media as a channel to connect with patrons and potential customers, and these are probably the channels that customers want to be connected through. Facebook and Twitter bots can be set up to answer basic questions like hotel room rates, or concert calendars, or a multitude of things about the IR. These can be automated answers that can contain links to the hotel reservation page.

With quick and easy accessibility to a casino's data, customer conversion rates can be improved, revenue can be increased, and customer churn can be predicted and, hopefully, reduced as much as possible. Customer acquisition costs can be lowered as well. By utilizing the complex web of customer data coming in from several different channels—mobile, social media, customer loyalty programs, transaction data, e-commerce weblogs, IoT sensors, amongst others—a casino can also work more productively. By understanding customer patterns and behavior across the whole spectrum of the business—from patron pickup, to patron navigation throughout the property, to room and restaurant choice, to final car or bus trip home—a casino can use their customer behavior patterns to, potentially, map out its human capital and inventory needs as well.

Obviously, creating a single version of the truth is a highly sought after, but extraordinarily difficult thing to accomplish. However, if one could make considerable progress towards it, it would solve a world of problems that have been vexing casino analytics departments for decades, and it is certainly a worthy

goal to strive for. It is also a necessary condition for personalization marketing, which will be discussed in the Customer Journey section of this paper.

Internet of Things (IoT)

In his article, *The Internet of Things is Far Bigger Than Anyone Realizes,* Daniel Burris argues that, *"*Of all the technology trends that are taking place right now, perhaps the biggest one is the Internet of Things; it's the one that's going to give us the most disruption as well as the most opportunity over the next five years." According to Hitachi, the three elements that have become the enabler of the new era include:

- Enterprise cloud—This is a necessary component and the scalability of the cloud, which allows massive amounts of compute, storage and networking to be put on line up at affordable prices, lays the foundation for IoT's needed framework.
- Big data analytics—New technologies are allowing companies to better understand data and make more data-driven decisions. Some of these new technologies include predictive analytics, data management for big data in a highly distributed manner, and being able to blend structured and unstructured data from a variety of internal and external sources to bring context when solving complicated problems.
- Streaming data and real-time analytics—To be effective in a dynamic, ever changing, process-driven world requires the ability to process data in real time. Many use cases that depend on data require fast analysis rather than waiting for data to be processed in batch. For example, when managing the flow of traffic in a congested city, data must be analyzed in real time and actions must be immediately taken to decrease delays. The ability to act upon streaming data is becoming a prerequisite for many IoT applications.

For a casino property, IoT implementations could be as large as creating a micro energy grid for a massive integrated resort, to as small as capturing the face of every card that is turned over on a baccarat or blackjack table (which, to be fair, is already occurring). In between, the potential to capture and utilize property-wide sensor data can help a casino in countless ways, everything from understanding customer flow patterns, to improving marketing messages, to better labor management and inventory control. These and other potential use cases will be discussed throughout this article.

Stream Processing

As Kai Wähner (2014) explains in his article *Real-Time Stream Processing as Game Changer in a Big Data World with Hadoop and Data Warehouse*, "Stream processing is required when data has to be processed fast and/or continuously, i.e. reactions have to be computed and initiated in real time." Wähner (2014) adds:

> *"Streaming processing" is the ideal platform to process data streams or sensor data (usually a high ratio of event throughput versus numbers of queries), whereas "complex event processing" (CEP) utilizes event-by-event processing and aggregation (e.g. on potentially out-of-order events from a variety of sources—often with large numbers of rules or business logic). CEP engines are optimized to process discreet "business events" for example, to compare out-of-order or out-of-stream events, applying decisions and reactions to event patterns, and so on. For this reason multiple types of event processing have evolved, described as queries, rules and procedural approaches (to event pattern detection).*

Stream processing acts on real-time streaming data feeds, using 'continuous queries' (i.e. SQL-type queries that operate over time and buffer windows) (Wähner, 2014). With its ability to continuously calculate mathematical or statistical analytics on the fly within the stream, streaming analytics is an essential part of stream processing. "Stream processing solutions are designed to handle high volume in real time with a scalable, highly available and fault tolerant architecture" (Wähner, 2014). Fault tolerant is one of the keys here, since actions based upon real-time processing require as near perfect fault safeguards as possible.

"In contrast to the traditional database model where data is first stored and indexed and then subsequently processed by queries, stream processing takes the inbound data while it is in flight, as it streams through the server" Wähner (2014). Stream processing can also connect to an external data source, thereby adding a whole new dimension to analytical processes.

Wähner (2014) argues that one of the recent development in stream processing methods is the invention of the "live data mart," which "provides end-user, ad-hoc continuous query access to this streaming data that's aggregated in memory." "Business user-oriented analytics tools access the data mart for a continuously live view of streaming data. A live analytics front ends slices, dices, and aggregates data dynamically in response to business users' actions, and all in real time" notes Wähner (2014). For a casino, streaming data could be coming in from facial recognition software, fraud or anti-money laundering solutions, PoS systems, slot and table games data, patron card information, campaign management and redemption systems, employee/labor utilization data, as well as social media feeds. Although, not an absolute necessity, stream processing does help considerably with personalization marketing.

As Wähner (2014) explains, a stream processing solution has to solve the following eleven different challenges:

1. "Processing massive amounts of streaming events (filter, aggregate, rule, automate, predict, act, monitor, alert)
2. Real-time responsiveness to changing market conditions
3. Performance and scalability as data volumes increase in size and complexity
4. Rapid integration with existing infrastructure and data sources: Input (e.g. market data, user inputs, files, history data from a DWH) and output (e.g. trades, email alerts, dashboards, automated reactions)
5. Fast time-to-market for application development and deployment due to quickly changing landscape and requirements
6. Developer productivity throughout all stages of the application development lifecycle by offering good tool support and agile development
7. Analytics: Live data discovery and monitoring, continuous query processing, automated alerts and reactions
8. Community (component/connector exchange, education/discussion, training/certification)
9. End-user ad-hoc continuous query access
10. Alerting
11. Push-based visualization."

For casinos, real-time streaming can help in the following ways:

- Customer Service:
    - Geo-locate a patron when he or she signs onto the casino's in-house Wi-Fi, whether that is on a casino bus, while wandering through an integrated resort, in a hotel room, or at an event's center
    - Video analytics with facial recognition technology can spot and/or confirm a patron's true identity and alert any needed casino personnel
    - Social media customer service can cut down on normal customer service expenses, as well as allow casino reps to make highly personalized offers according to similar guest experiences
- E-Commerce
    - Clickstream analysis could allow personalized offers to returning guests when only an IP address is known
    - Improve accurate attribution analysis so that the marketing department understands which advertising is associated with which user, making it much more quantifiable
- Hosts:
    - Hosts can be alerted when a VIP, or even a premium mass player, steps onto the property or even onto one of the casino's buses

- Hotel:
    - Hotel room revenue management; offer the right price to the right person at the right time, on the right channel
    - Offer high-profit upgrades to those most likely to use and pay for them
- Human Capital Management:
    - Employee schedules can be adjusted according to labor managements needs almost in real-time
    - Casinos can take the guesswork out of hiring employees by building templates that show what model employees looks like in terms of skills.
- Patron Management:
    - Customer relationship management (CRM) systems can target its messaging to only those patrons who are most likely to respond to a promotion, thereby becoming highly channel-specific
    - The amount of promotions available and channels through which to market through increases considerably as campaign lift can be assessed in terms of hours rather than days or weeks
    - Customer acquisition is accelerated because business users throughout the property can quickly derive answers to the following questions:
        - Which combinations of campaigns accelerate conversion?
        - What behavior signals churn?
        - Do web search key words influence deal size?
        - Which product features do users struggle with?
        - Which product features drive product adoption and renewal?
        - What drives customers to use costly sales channels?
    - Customer interaction data can quickly be turned into business opportunities
    - Powerful recommendation engines can ingest data from a multitude of sources and then be made available to frontline staff, who can react in near real time
- Pit Bosses / Floor Managers:
    - Facial recognition technology allows for immediate knowledge of patrons entering the casino, which can improve customer service for both VIPs and premium mass players
    - Facial recognition can spot self-excluded patrons and alert security about the potential problem gambler
    - Table game minimums can be raised or lowered according to almost up-to-the-minute demand forecasts
    - TGRM models can be fed with additional data (like reservation check-in, mobile, location and/or social media data) so that activity beyond the table game floor can be added to these predictive models
    - Slot floor optimization
    - Casino floor maps that reveal floor traffic can assist in the opening and closing of tables
- Retail and F & B:
    - Outliers in data sets that might point to fraudulent activity on POS systems can push alerts to managers in real time
    - Retailers can better target market merchandise, sales, and promotions and help redesign store layouts and product placement to improve the customer experience and increase sales
- Security:
    - Uncover AML activity
    - Spot blacklisted players trying to gamble
    - Reduce exposure to high risk patrons
    - Uncover gaming scams
    - Counter surveillance scanners can spot the use of unauthorized video cameras on the casino floor

- Cyber attack prevention
- Regulatory compliance
- Spot dealing patterns that might reveal the cards haven't been shuffled properly, or at all
- Motion-detecting systems can spot roulette cheats trying to add chips after the roulette wheel has been spun, a problem many croupiers are unable to catch as it happens.

Real-time Technology

As *The Cluetrain Manifesto*[1] points out, "Real-time marketing is the execution of a thoughtful and strategic plan specifically designed to engage customers on their terms via digital social technologies" (Macy and Thompson, 2011). Adding to that description, Wikipedia notes that real-time marketing is, "marketing performed 'on-the-fly' to determine an appropriate or optimal approach to a particular customer at a particular time and place. It is a form of market research inbound marketing that seeks the most appropriate offer for a given customer sales opportunity, reversing the traditional outbound marketing (or interruption marketing) which aims to acquire appropriate customers for a given 'pre-defined' offer." Real-time marketing can be inexpensive compared to the cost of traditional paid media, however, because "Expensive research, focus groups, and awareness campaigns can be replaced with online surveys, blog comments, and tweets by anyone or any business" (Macy and Thompson, 2011).

In his article *How Real-time Marketing Technology Can Transform Your Business*, Dan Woods (2011) makes an amusing comparison of the differing environments that marketers face today as compared to what their 1980s counterparts might have faced:

> *Technology has changed marketing and market research into something less like golf and more like a multi-player first-person-shooter game. Crouched behind a hut, the stealthy marketers, dressed in business-casual camouflage, assess their weapons for sending outbound messages. Email campaigns, events, blogging, tweeting, PR, ebooks, white papers, apps, banner ads, Google Ad Words, social media outreach, search engine optimization. The brave marketeers rise up and blast away, using weapons not to kill consumers but to attract them to their sites, to their offers, to their communities. If the weapons work, you get incoming traffic.*

Today's marketing executive doesn't have time for a market research study in this sort of first-person-shooter game, Woods (2011) argues. "The data arrives too late and isn't connected to the modern weapons of marketing. The world is now bursting with data from social media, web traffic, mobile devices, and tripwires of all kinds" (Woods, 2011). Companies have massive amounts of evidence about consumer behavior coming at them constantly. The challenge is to make sense of the data in time to matter, to understand how consumer attitudes and behavior are changing and how they are being changed by marketing and advertising efforts.

Woods (2011) contends that the challenge in understanding the modern consumer is making sense of all of the customer data, coming in from vast unstructured and various sources. Some of this information explains the broad fluctuations in mass opinion, while other evidence explains what consumers are doing on a company Website (Woods, 2011). Others still explain what consumers have done, en masse or as individuals (Woods, 2011).

Successful mobile advertising requires three thing—reach, purity and analytics; reach can be fostered by accessing accounts through multiple platforms like blogs, geofencing applications, OTT services, mobile apps, QR codes, push and pull services, RSS feeds, search, social media sites, and video-casting, amongst other things. "Purity" refers to the message and its cleanliness; if the data is unstructured and untrustworthy it is, basically, useless and data governance is paramount for real-time advertising to work

[1] T*he Cluetrain Manifesto* is a set of 95 theses organized and put forward as a manifesto, or call to action, for all businesses operating within what is suggested to be a newly connected marketplace. The ideas put forward within the manifesto aim to examine the impact of the Internet on both markets (consumers) and organizations.

properly. Analytics is the third ingredient and it "involves matching users' interests—implicit and explicit, context, preferences, network and handset conditions—to ads and promotions in real time" (Sharma et al., 2008).

Successful marketing is about reaching a consumer with an interesting offer when he or she is primed to accept it. Knowing what might interest a consumer is half the battle to making the sale and this is where customer analytics comes in. Customer analytics has evolved from simply reporting customer behavior to segmenting customers based on his or her profitability, to predicting that profitability, to improving those predictions (because of the inclusion of new data), to *actually manipulating customer behavior* with target-specific promotional offers and marketing campaigns. These are the channels that real-time thrives in and this is where a casino can gain a powerful competitive advantage when using it.

For a real-time platform to work, data must be gathered from multiple and disparate sources, which can include Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Social CRM (SCRM) platforms, geofencing applications (like Jiepang and Foursquare), Over-The-Top services (like WhatsApp and WeChat), mobile apps, augmented reality apps, and other mobile and social media systems. This data must be collected and then seamlessly integrated into a data warehouse that can cleanse it and make it ready for consumption (Sharma et al., 2009).

A few industry examples from *Information Week's In-memory Databases, IBM, Microsoft, Oracle, and SAP Are Fighting to Become Your In-memory Technology Providers. Do You Really Need the Speed?* (Henschen, 2014b) might shed some light on the subject of real-time marketing and customer interactions, including:

- Online gaming company Bwin.party uses in-memory capabilities to handle 150,000 bets per second. This compares to their normal system rate of 12,000 bets per second
- For retail services company Edgenet, "in-memory technology has brought near-real-time insight into product availability for customers of AutoZone, Home Depot, and Lowe's. That translates into fewer wasted trips and higher customer satisfaction" (Henschen, 2014)
- ConAgra, an $18 billion-a-year consumer packaged goods company "must quickly respond to the fluctuating costs of 4,000 raw materials that go into more than 20,000 products, from Swiss Miss cocoa to Chef Boyardee pasta" (Henschen, 2014) and an in-memory system assists them in material forecasting, planning, and pricing
- ConAgra also taps its in-memory solution to make company promotions more relevant by using faster analysis, which allows ConAgra and its retailer customers to command higher prices in an industry notorious for razor-thin profit margins
- Maple Leaf Foods, a $5 billion-a-year Canadian supplier of meats, baked goods, and packaged foods, finds that profit-and-loss reports which "used to take 15 to 18 minutes on conventional databases now take 15 to 18 seconds on their in-memory platform" (Henschen, 2014)
- Temenos, a banking software provider that uses IBM's in-memory-based BLU Acceleration for DB2 system, reports that queries that used to take 30 seconds now take one-third of a second thanks to BLU's columnar compression and in-memory analysis.

For Temenos, in particular, that difference in speed means that mobile customers can quickly retrieve all of their banking transactions on their mobile devices, rather than just their last five, which could mean the difference between handling customer issues on a mobile device rather than in a company store (Henschen, 2014). "Online or mobile interaction costs the bank 10 to 20 cents to support versus $5 or more for a branch visit" (Henschen, 2014). The cost savings are, obviously, substantial. Savings of these kinds are probably available to a large integrate resort as their business processes are vast and wide, covering a multitude of areas, including customer call centers.

Analytics

Since a data lake is a repository of all the data that a casino has access to, it theoretically should allow anyone with the proper access to it to run unlimited ad-hoc queries and perform cross-source navigation and analysis on the fly. Successful data lake implementations respond to queries in real-time and provide

users an easy and uniform access interface to the disparate sources of data. This window into a casino's data should allow users to utilize any one of the following four different types of analytics, including:

- Descriptive analytics—What happened?
- Diagnostic analytics—Why did it happen?
- Predictive analytics—What could happen?
- Prescriptive analytics—What should happen?

Figure 2 shows the Analytic Value Escalator, which explains how these four types of analytics processes can be used.

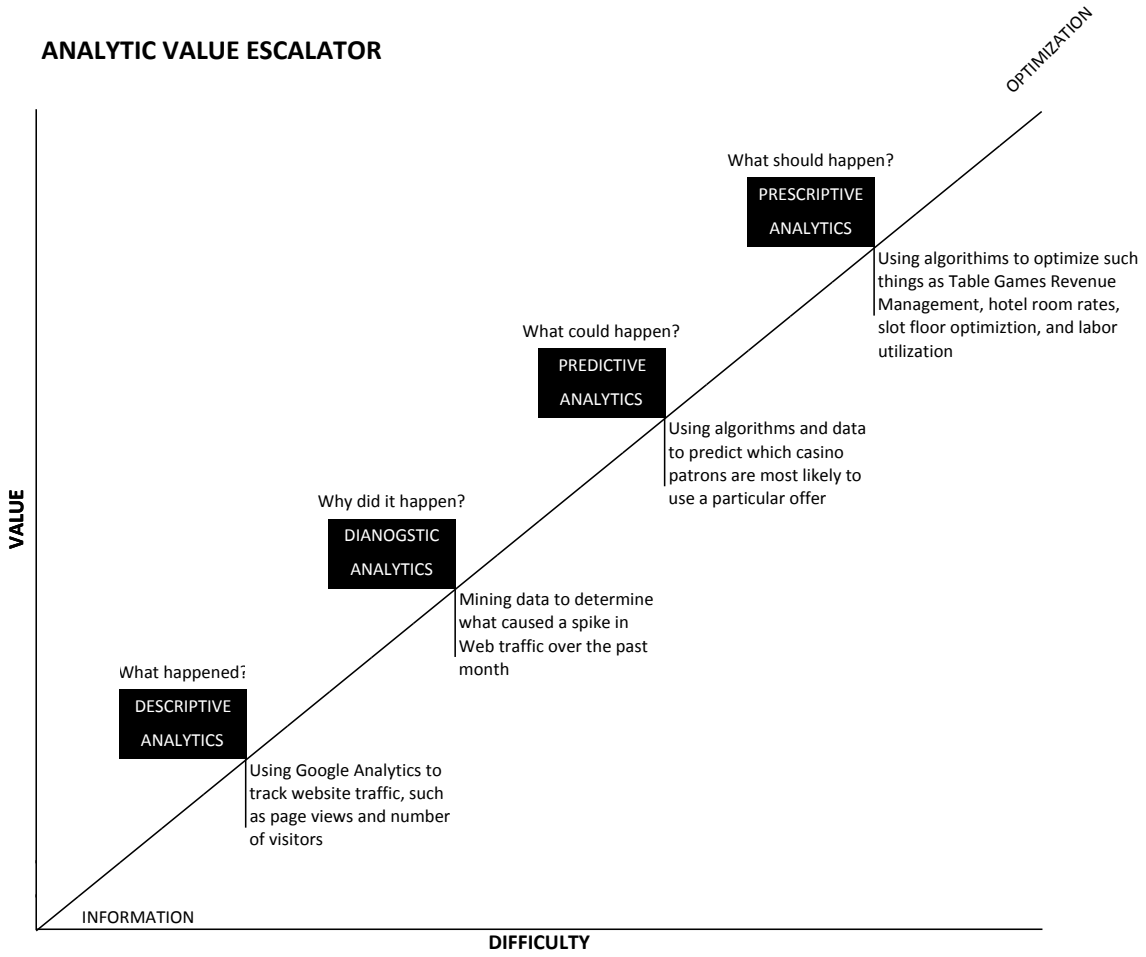

Figure 2: Analytics Value Escalator

For a casino company, descriptive, predictive and prescriptive analytics can be used to uncover what has happened, why it happened, what could, potentially, happen and what should happen (see Figure 3 for more use cases). Descriptive analytics could include pattern discovery methods such as customer segmentation, i.e., culling through a patron database to understand a patron's preferred game of choice. Simple cluster segmentation models could divide customers into their preferred choice of games and this information can be given to the marketing department to create lists of baccarat players for a baccarat tournament, for example.

UNDERSTANDING ANALYTICS

Definitions, sample applications and opportunities, and underlying techniques

	Descriptive	Predictive	Perscriptive
	What HAS happened?	What COULD happen?	What SHOULD happen?
What the user needs to DO	• Increase asset reliability • Reduce labor and inventory costs	• Predict infrastructure failures • Forecast facilities space demands	• Increase asset utilization • Optimize resource schedules
What the user needs to KNOW	• The number and types of asset failures • Why maintenance costs are high • The value of the materials inventory	• How to anticipate failures for specific asset types • When to consolidate underutilized facilities • How to determine costs to improve service levels	• How to increase asset production • Where to optimally route service technicians • Which strategic facilities plan provides the highest long-term utilization
How analytics gets ANSWERS	• Standard reporting - What happened? • Query/drill down - Where exactly is the problem? • Ad hoc reporting - How many, how often, where?	• Predictive modeling - What will happen next? • Forecasting - What if these trends continue? • Simulation - what could happen? • Alerts - what actions are needed?	• Optimization - What is the best possible outcome? • Random variable optimization - What is the best outcome given the variability in specified areas?
What makes this analysis POSSIBLE	• Alerts, reports, dashboards, business intelligence	• Predictive models, forecasts, statistical analysis, scoring	• Business rules, organization models, comparisons, optimization

Table 2 Understanding Analytics

Source: *Descriptive, predictive, prescriptive: Transforming asset and facilities management with analytics IBM*[2]

Market basket analysis, which utilizes association rules, would also be considered a descriptive analytics technique. Casinos can use market basket analysis to bundle and offer promotions, as well as gain insight into gaming, shopping and pretty much any kind of purchasing behavior.

Diagnostic analytics is a form of advance analytics that examines data or content to answer the question, "Why did it happen?" Diagnostic analytics attempts to understand causation and behaviors by utilizing such techniques as drill-down, data discovery, data mining and correlations. Building a decision tree atop a web user's clickstream behavior patterns could be considered a form of diagnostic analytics.

According to Charles Nyce (2007), "Predictive analytics is a broad term describing a variety of statistical and analytical techniques used to develop models that predict future events or behaviors. The form of these predictive models varies, depending on the behavior or event that they are predicting. Most predictive models generate a score (a credit score, for example), with a higher score indicating a higher likelihood of the given behavior or event occurring."

Data mining, which is used to identify trends, patterns, and/or relationships within the data, can then be used to develop a predictive model (Nyce, 2007). Prediction of future events is the key here and these analyses can be used in a multitude of ways, including forecasting customer behavior that could lead to a competitive advantage over rivals. Gut instinct can sometimes punch you in the gut and predictive analytics can help factor in variables that are inaccessible to the human eye or intellect. Often the unknown event of interest is in the future, but predictive analytics can be applied to any type of unknown, whether that is in the past, the present and/or the future.

Predictive analytics uses many techniques from data mining to analyze current data to make predictions about the future, including statistics, modeling, machine learning, and artificial intelligence. For example, logistic regression can be used to turn a market basket analysis into a predictor so that a casino can understand what items are usually purchased together. Of course, the old beer and diapers market basket story wouldn't fit for a casino, but gleaning data from the casino floor could reveal second favorite games that patrons like to play. This could be useful information when a patron is having a run of bad luck on his

[2] *https://static.ibmserviceengage.com/TIW14162USEN.PDF*

or her favorite game. Perhaps a marketing offer for a game he or she sometimes dabbles in would be appreciated rather than an offer on his or her favorite game, as that might not be seen in such a positive light while the patron is in the midst of a losing run.

For a casino company, predictive analytics can also be used for CRM, collection analysis, cross-sell, customer retention, direct marketing, fraud detection, product prediction, project risk management, amongst other things.

Prescriptive analytics tries to optimize a key metric, such as profit, by not only anticipating what will happen, but also when it will happen and why it is happening. Furthermore, "prescriptive analytics suggests decision options on how to take advantage of a future opportunity or mitigate a future risk and shows the implication of each decision option. Prescriptive analytics can continually take in new data to re-predict and re-prescribe, thus automatically improving prediction accuracy and prescribing better decision options" (Wikipedia).

Prescriptive analytics can ingest a mixture of structured, unstructured, and semi-structured data, and utilize business rules that can predict what lies ahead, as well as advise how to exploit this predicted future without compromising other priorities. Stream processing can add an entirely new element to prescriptive analytics as well.

Social Media Monitoring and Analytics

Social technologies allow individuals to interact with large groups of people at almost any location in the world, at any time of the day, at marginal, if not no cost at all (Chui et al., pg. 5, 2012). With advantages like these, it is not surprising that social media has become so widespread that almost one in four people worldwide use it. It is actually surprising that the figure is so low.

Businesses are quickly recognizing the power of social media. "Thousands of companies have found that social technologies can generate rich new forms of consumer insights—at lower cost and faster than conventional methods" (Chui et al., pg. 2, 2012). In addition to this, businesses can watch what "consumers do and say to one another on social platforms, which provide unfiltered feedback and behavioral data (i.e., do people who "like" this movie also "like" this brand of vodka?)."

The power of social media marketing really comes to light when one compares it to broadcasting and telephone and email marketing models. In their book *Marketing Communications: Integrating Offline and Online with Social Media*, P.R. Smith and Ze Zook (2011) show just how powerful social media marketing can be. Smith and Zook (2011) looked at the target audiences for three different types of marketing platforms—broadcast network, telephone and email network, and social media.

According to Smith and Zook (2011), "Broadcast network is based on a 'one to many' model (e.g., old TV advertising). It is the Sarnoff network (after David Sarnoff, the broadcasting legend). A hypothetical Sarnoff network with 20 viewers has a score of 20. The network score is simply the number of nodes (i.e., audience members)" and this equates to a paltry sum of twenty individuals.

The telephone and email network is based on the Metcalf model (named after Bob Metcalf, one of the inventors of the Internet) and this is a "many to each other" model (Smith and Zook, 2011). This model allows everyone in the group to connect with everyone else (Smith and Zook, 2011). Because any member of the group can contact anyone else in the group, the total number of potential contacts is 20 squared, or 400 (Smith and Zook, 2011). Obviously, this is a much more powerful communication model than the Sarnoff model as the network score is the node number to the power of 2, which is 400. A good number, but it still pales in comparison to the social network model.

Named after David Reed (who noticed that people in social situations usually belong to more than just one network), the social network model is a "many belong to numerous networks" model (Smith and Zook, 2011). "The possible value of a Reed network is two to the power of the number of nodes on the network," explain Smith and Zook (2011). If you take the same group of 20 people in a social situation, a "Reed network generates a score of 2 to the power of the node" (Smith and Zook, 2011), which generates

a network score of over one million people; obviously, this is a number exponentially higher than the number of people reached by the Sarnoff and Metcalf models. This is the power of social media and it cannot be underestimated. When coupled with mobile, that number can be even greater and, just as importantly, the reach can be lightning fast.

Social media analytics is "the practice of gathering data from blogs and social media websites and analyzing that data to make business decisions. The most common use of social media is to mine customer sentiment" (Rouse).

Social media analytics evolved out of the disciplines of Social Network Analysis, Machine Learning, Data Mining, Information Retrieval (IR), and Natural Language Processing (NLP) (Melville and Lawrence, 2009). It is a "powerful tool for uncovering customer sentiment dispersed across countless online sources. This analysis is often called Social Media Listening or Online Listening. The analytics allow marketers to identify sentiment and identify trends in order to better meet their customer's needs" (Wikipedia). As Figure 3 shows, there are a multitude of use cases for social media listening.

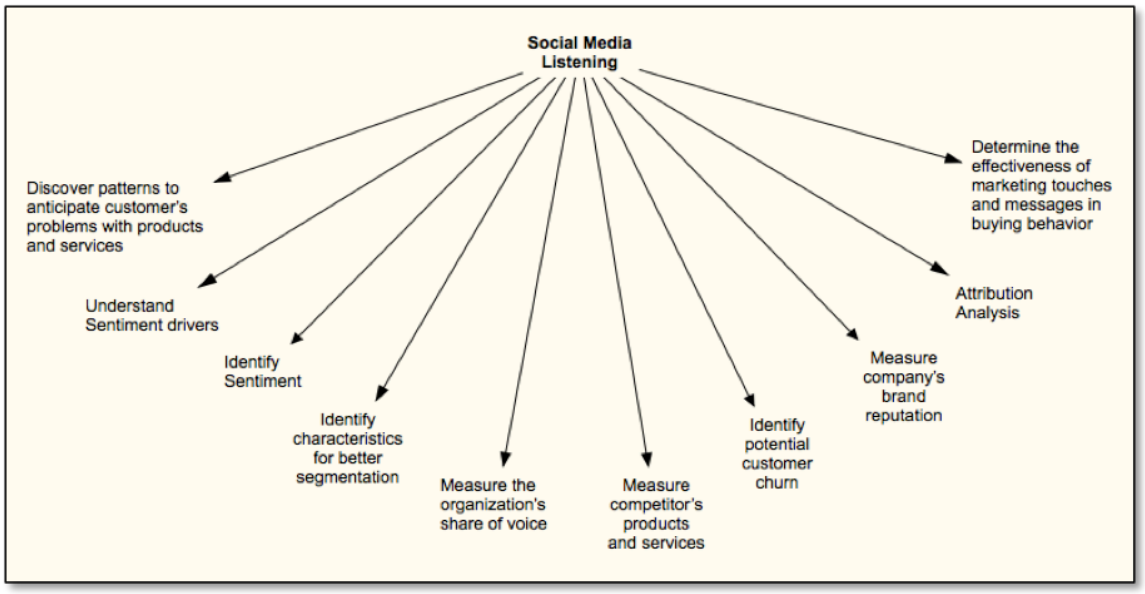

Figure 3: Social Media Listening

A casino can use a data lake and predictive technology to answer such questions as:

- How can a casino measure the benefits of social media?
- How should a casino organize its social media presence or presences?
- How should a casino spread social media usage throughout its organization?
- How has social media changed the relationship between a customer and a casino?

Casinos can also use social media in the following ways:

- Adding interactivity to a Website
- Brand and Anti-brand management
- Brand loyalty enhancement
- Building fanbases
- Crisis management
- Discovering important brand trends
- Driving traffic to a Website
- Engaging customers and potential customers
- Harvesting customer feedback
- Marketing to consumers

- Reputation management
- Social shopping

Web 2.0 changed the relationship between a company and its consumers forever. In shifting the power away from the corporation and into the hands of the consumer, Web 2.0 empowered the consumer with a voice unheard of in the history of advertising. The voice of the online consumer is now part of the message and consumers are fully vested participants in the conversation (Outing, 2007). This fact shouldn't frighten casino executives, it should actually excite them.

A casino company is only as strong as its weakest customer relationship and mobile and social media are proving to be highly valuable marketing tools because they create a two-way relationship between a company and its consumers. This dialogue can help a casino property in a myriad of marketing ways, including providing an easy avenue for users to opt-in to company CRM databases. Since these consumers have implicitly agreed to receive a company's marketing material, they are usually the type of consumers marketers pay a lot of money to reach because they are knowledgeable, empowered and, more often than not, highly motivated to buy.

With a simple TweetDeck feed, a casino can have a real-time feed on its Twitter accounts, utilizing them in ways that could improve CRM, customer intelligence, and, potentially, security. Allowing users to tweet security issues they might find throughout the property is advantageous because these tweets could include geo-location data. Hotel reservations could also watch the Twitter feeds for customers wanting to know about room rates. Concertgoers might also want to know what tickets are available for an upcoming concert. There are a multitude of other ways that a creative casino could utilize Twitter, Weibo and a whole host of other social platforms.

"Analytics are critical for enabling organizations to make the right decisions about when, where, and how to participate in social media. It isn't enough to just listen; *organizations* much insert themselves and become part of the conversation," argues Stodder (2012). Smart companies will start viral campaigns, for example, using Twitter *Hashtags* for a topic; the campaign could be a component of a larger marketing strategy" (Stodder, 2012). In Macau and/or China, Weibo and WeChat can also be used to seed conversations. The casino could "then monitor social media to see what people say and analyze how the campaign is playing among influencers and across networks," Stodder (2012) recommends.

The Customer Journey

Pre-Arrival

The customer journey starts way before the customer enters the casino. It begins the moment a customer notices an advertisement for the casino and/or integrated resort, whether that advertisement is on TV, on a website or on a billboard. It can be while browsing the casino's website, connecting with its social media accounts, or even the moment the customer actually enters the casino. From checking into the hotel, to gambling (or learning how to gamble), to eating in the IR's restaurants, drinking in its bars, enjoying a show or an event, through to the moment the patron leaves. Throughout this customer journey, a data lake can help collect, analyze, visualize and live stream recommendation content.

Clickstream Analysis

When a person surfs a website, he or she leaves behind a digital trail. Clickstream analysis is the process of collecting, aggregating, reporting and analyzing the browsing behavior of a web surfer to better understand the intentions of users and their interests in specific content or products on a website. Clickstream analysis (also called clickstream analytics) is the process of collecting, analyzing and reporting aggregate data about which pages a website visitor visits—and in what order. The path the visitor takes though a website is, basically, the clickstream.

There are two levels of clickstream analysis, traffic analytics and e-commerce analytics. Traffic analytics operates at the server level and tracks how many pages are served to the user, how long it takes each page to load, how often the user hits the browser's back or stop button and how much data is transmitted

before the user moves away from the website. E-commerce-based analysis uses clickstream data to determine the effectiveness of a website as a channel-to-market. It is concerned with what pages the browser lingers on, what he or she puts in or takes out of a shopping cart, what items are purchased, whether or not the buyer belongs to a loyalty program and uses a coupon code, as well as his or her preferred methods of payment.

Utilizing clickstream analysis, a casino can help build a Master Marketing Record for each customer in real-time. This allows the casino to test scenarios and options for the website, as well as develop personalized responses for individuals. The system should include a combination of social listening, analytics, content publication and distribution, and tracking, as well as a strong workflow and rules engine that is geared around strong governance. All of these applications are built to ultimately feed a Master Marketing Profile—a centralized customer record that pulls in all data based on digital activity that can be identified by a single customer ID. Through this clickstream analytics, personalization marketing can begin, and associating this activity with a customer once he or she walks through the front door should be a casino's primary goal. This can be done by enabling new users to log into his or her account via web or mobile applications like a casino's WeChat app.

Personalization

Today, "Personalization"—the process of utilizing geo-location, mobile app, Wi-Fi, and OTT technology to tailor messages or experiences to an individual interacting with them—is becoming the optimum word in a radically new customer intelligence environment. Even though this personalization comes at a price—privacy—it is a price most consumers seem more than willing to pay if a recognized value is received in return. For the retailer (and, potentially, the integrated resort), "personalization" requires an investment in software analytics, but retailers should recognize that this price must be paid because highly sophisticated consumers will soon need an exceptional shopping experience to keep them from purchasing products online, or at another retail establishment (that will, undoubtedly, offer such services).

Figure 4: Personalization throughout the customer journey
Source: VB Insight, Marketing Personalization: Maximizing Relevance and Revenue

To compete in this highly competitive industry, casino companies are recognizing the importance of personalization when it comes to customer interactions. Most casinos today have customer loyalty programs that are a part of a CRM and/or a SCRM initiative to provide their guests with an intimate experience that will make them want to return again and again and again. Mobile and social media channels are some of the best ways to reach these customers.

Currently, there is an big disconnect between what companies think they are delivering in terms of personalization and what consumers are experiencing. In his article *Study finds marketers are prioritizing personalization… but are further behind then they realize,* Andrew Jones (2015)

argues that, "Although two-thirds of the marketers surveyed rate their personalization efforts as 'very good' or 'excellent,' just 31 percent of consumers reported that companies are consistently delivering personalized experiences."[3]

"Aside from this disparity, the report finds that personalization strategies today are immature. It shows that 91 percent of the marketers surveyed are prioritizing personalization over the coming year, yet many still rely on basic segmentation strategies," Jones (2015) notes. This isn't that surprising as many companies are struggling with the ability to not just capture the information necessary for personalization, but also creating DWs that can silo the data properly, then delivering it to highly complex analytical programs that can make sense of all that data. It's like finding a needle in a haystack for each and every customer in a database; a herculean task, no doubt.

It is obvious that a creating a consolidated customer view is a necessary component of personalization, but, unfortunately, "most marketers today are working with customer data that is decentralized, spread across the organization in multiple databases that are updated in batch processes. To find success, marketers must prioritize consolidating data into a single database," states Jones (2015) and this is where a data lake comes in.

Another important step to bringing personalization efforts up to a user's expectation will be using behavioral data. "In order to create these types of [personalized] customer experiences, marketers must strategically collect and utilize customer data, including real-time signals of intent, which are typically not captured today," argues Jones (2015). Figure 5 lists out the identity-related data sources that can be used for personalization and it is a considerable amount of data that must be culled through, siloed, and understood.

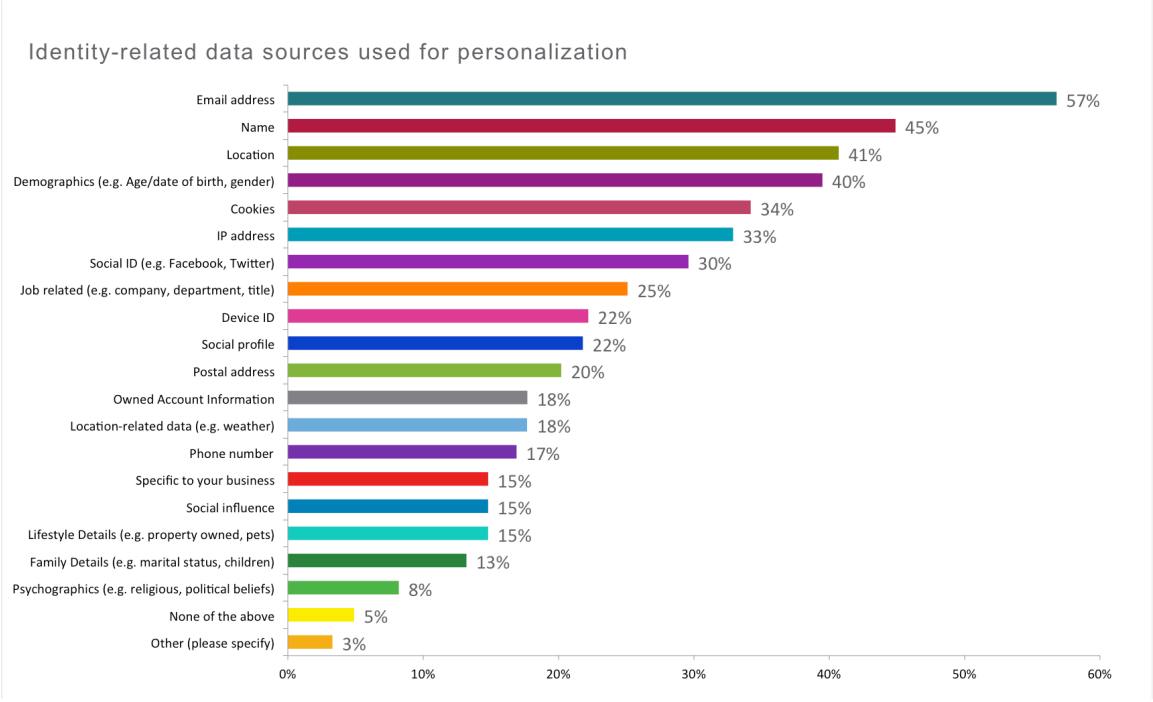

Figure 5: Identity-related data sources used for personalization
Source: VB Insights[4]

[3] http://venturebeat.com/2015/12/14/study-finds-marketers-are-prioritizing-personalization-but-are-further-behind-than-they-realize/ (accessed 26 November 2016)

With customers attitudes towards personalized content being shaped by recommendation engines like Amazon, Pandora, and Netflix, consumers are becoming more used to receiving what they want, when they want it, on what ever channel they want it on (Jones, 2015). Casinos and integrated resorts must keep this in mind when developing personalization programs. The consumer has become highly sophisticated and he expects the level of sophistication he receives on platforms like Amazon and Pandora, don't waste his time with non-matching offers or he will go down the street to a competitor's property.

Arrival and Stay

Once a customers has arrived in Macau, Las Vegas, Manila, or any casino city, he or she will leave a trial that can be picked up in a multitude of ways, including via social media, geo-fencing applications, facial recognition technology, simply by a check-in at the hotel, or a swipe of a patron card in a slot machine or at a casino table. The following technology can spot, track and help a casino better personalize a customer's visit to a casino property.

Geofencing Applications

Today, most smart phones have geofencing capabilities, which are features of a software program that tap into GPS or RFID technology to define geographical boundaries. Basically, geofencing programs allow an administrator to set up triggers—usually SMS push notifications or email alerts—so when a device crosses a "geofence" and enters (or exits) a set boundary, a user is notified (TechTarget, 2011). Applications such as Foursquare and China's Jiepang use geofencing to locate users, as well as help them find their friends and/or check into places.

Perhaps one of the best uses of location-based services is in the Meetings, Incentive, Conferencing and Exhibition (MICE) space. The massive size of some IR exhibition halls can make finding a particular booth or floor section a daunting proposition. Indoor mobile communication technology with location awareness technology can help conference-goers navigate a vast conference floor (Giaglis et al., 2002). Also, before arriving at a conference, a mobile user would be able to register his personal preferences and, once he enters the exhibition hall, a route map would be sent to his or her mobile phone. Vendor appointments could even be set up so that they are located near each other so that the conference-goer wouldn't have to run around frantically trying to make meetings that are spread out all over the convention floor (Giaglis et al., 2002).

Facial Recognition

Rapid advancements in facial-recognition technology have reached the point where a single face can be compared against 36 million others in just one second. A system made by Hitachi Kokusai Electric and reported by DigInfo TV shown at a security trade show recently was able to achieve this blazing speed by not wasting time on image processing—it takes visual data directly from the camera to compare the face in real time. The software also groups faces with similar features, so it's able to narrow down the field very quickly. The usefulness to the casino's security enforcement is pretty obvious.

Augmented Reality

Tarun Wadhwa (2013) states that augmented reality works by "displaying layers of computer-generated information on top of a view of the physical world." It is "a technology that alters the perception of reality by distorting it, allowing escape from it, and enhancing it—all at the same time" (Wadhwa, 2013).

[4] http://insight.venturebeat.com/report/marketing-personalization-maximizing-relevance-and-revenue?utm_source=vb&utm_medium=refer&utm_content=editorial-post&utm_campaign=personalization-report (accessed 26 November 2016)

Analysts now predict that the AR market will grow from roughly $181 million in revenues in 2011 to nearly $5.2 billion by 2016.[5] [6] By 2017, more than 2.5 billion mobile augmented reality apps will be downloaded to smartphones and tablets annually; 3.5 times the number of Angry Birds downloads in 2011. Anticipated market growth and trending investments have led the *Harvard Business Review* to predict that AR will soon have an impact on everything from advertising, to location services, to healthcare, to relationships, to the very nature of knowledge" (Deloitte, 2013).

According to its press release *Gartner Says Augmented Reality Will Become an Important Workplace Tool*, "Augmented reality is the real-time use of information in the form of text, graphics, audio and other virtual enhancements integrated with real-world objects." Tuong Huy Nguyen, principal research analyst at Gartner, states that, "AR leverages and optimizes the use of other technologies such as mobility, location, 3D content management and imaging and recognition. It is especially useful in the mobile environment because it enhances the user's senses via digital instruments to allow faster responses or decision-making" (Gartner, 2014). A *Pokemon Go!* type of app that contained property-wide 3D content could help patrons navigate through a large integrated resorts, which could cut down on the time gamblers take to reach their game of choice, whether it's a slot machine or a table game.

Mobile advertising

Successful mobile advertising requires three things—reach, purity and analytics. Analytics "involves matching users' interests–implicit and explicit, context, preferences, network and handset conditions—to ads and promotions in real time" (Sharma et al., 2008). Stuart Elliot, a columnist for the *New York Times* states that, "If the 20th Century was known in marketing circles as the advertising century, the 21st Century may be the advertising measurement century. Marketers are increasingly focused on the effectiveness of their pitches, trying to figure out the return on investment for ad spending" (Elliot, 2007). Because of the unique nature of the mobile user, marketers now have much more powerful–and effective–ways to measure the success of their advertising campaigns as well.

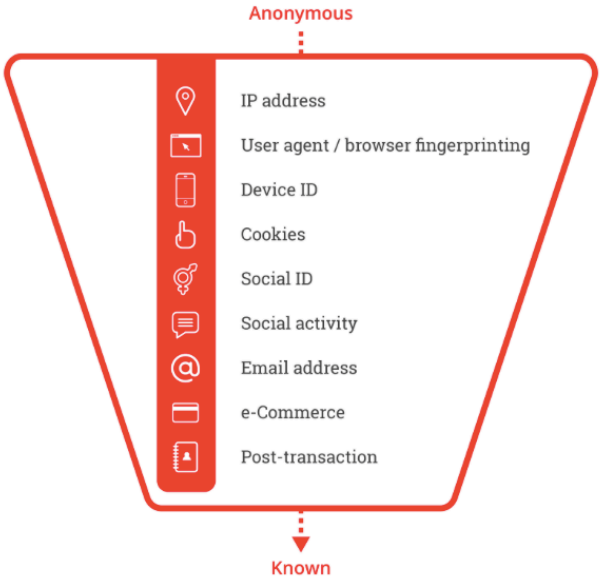

Figure 6: Identity Funnel: Anonymous to Known
Source: VB Insights

By assigning a digital fingerprint to a particular mobile user, casinos can know in real-time exactly what that user is clicking on. A per Figure 6, a user's IP address could be the first point of contact, with their device ID and user cookie ID the second and third. From there, a casino should aim to get their Social ID, his or her email address, which will reveal their social activity and potential e-commerce activity, which for a

[5] "Research and Markets: Global Augmented Reality Market Forecast by Product for Gaming, Automotive, Medical, Advertisement, Defense, E-Learning & GPS Applications — Expected to Grow to $5,155.92 Million by 2016," Business Wire, December 7, 2011, http://www.businesswire.com/news/home/20111207005613/en/Research-Markets-Global-Augmented-Reality-Market-Forecast (Retrieved: 17 November 2016)

[6] Juniper Research, "Press Release: Over 2.5 Billion Mobile Augmented Reality Apps to Be Installed Per Annum by 2017," August 29, 2012, http://www.juniperresearch.com/viewpressrelease.php?pr=334 (Retrieved: 17 November 2016)

casino would probably only be purchases of such things as hotel rooms. This would be a great starting point for a personal profile that could then be augmented with patron gambling and on property purchasing behavior.

In this mobile advertising world, patrons would be seen as participants rather than as a "target audience." With blogs, vlogs, social networks, message boards, and viral messaging, advertisers are now faced with a radically different marketing landscape than they were just a few short years ago. This is a new landscape, a landscape in which casino marketers are no longer in complete control of the message, and it is a world that must be embraced and not feared.

Mobile advertising can revolutionize the way casinos connect with their customers. A multi-screen, always on strategy that follows a marketer's audience throughout his or her digital day should be developed. The technology's inherent ability to create a highly personal, instant two-way connection between purchaser—or potential purchaser—and seller is something that has never been seen before in the history of commerce.

e-Commerce

With a few click strokes, a casino's ecommerce department can create a click path analysis that reveals customer interactions on the casino's several different websites. Descriptive analytical functionalities can then provide a deeper understanding of the customer journey. Column dependencies (standard in most of today's Data Integration software tools) can visually display the strength of a relationship between attributes within any dataset. This helps users better understand the characteristics of their data and is often used to help target further analytics.

Column dependencies can highlight relationships between job title and purchase amount, age, location and product selection, transaction type and frequency. Decision trees can be built to automatically help users understand what combination of data attributes result in a desired outcome. The structure of the decision tree reflects the structure that is possibly hidden in a casino's data.

A recommendation engine can also predict a person's interest based on historical data from many users. This is useful in increasing client engagement, recommending more relevant choices and increasing customer satisfaction. For example, recommendations can predict interest in casino games, products, hotel rooms, and services.

Retail Edge Analytics

Brick-and-mortar stores are looking for any competitive advantage they can get over web-based retailers, and near-instant edge analytics—where sales data, images, coupons used, traffic patterns, and videos are created—provides unprecedented insights into consumer behavior. This intelligence can help a retailer better target merchandise, sales, and promotions and help redesign store layouts and product placement to improve the customer experience. One way this is accomplished is through use of edge devices such as beacons, which can collect information such as transaction history from a customer's smartphone, then target promotions and sales items as customers walk through the store. As Integrated Resorts have become massive shopping malls, this is a service that the IR can offer to its retail clients.

Social Commerce

The B2C marketing cloud company Emarsys believes that social commerce will soon become a mainstay channel for consumers. Although many retailers don't know exactly what to do with social commerce yet the social channels are boldly leading the way. In 2015, Pinterest launched the 'Buy it' button and Instagram created an expanded ad program called 'Instagram Ads.' At the same time, other social media channels such as Twitter and YouTube are exploring 'Buy It Now' features and a multitude of mobile apps are popping up that allow easy e-commerce purchases. And why not? It makes complete sense to simplify the purchasing process and Facebook is already jumping into the fray as a new service inside Facebook Messenger allows users to readily swap money with others. Casinos should embrace this bold new

frontier and a data lake would simplify the purchasing process, as well as the purchasing behavior collection process.

A recent *Marketing Week* article entitled *Social commerce: How willing are consumers to buy through social media?* Includes the following interesting statistics:

> *More than half (56%) of consumers who follow brands on social media sites say they do so to view products. Dubbed 'social shoppers', research shows that these individuals visit social networks as part of their everyday shopping behavior, and use images that they see on social media sites to inspire purchases. Nearly a third of online shoppers (31%) say they are using these channels to browse for new items to buy, Facebook is the most popular network people are using (26%), followed by Instagram (8%) and Pinterest (6%).*

As previously mentioned, integrated resorts have become massive retail outlets and casino resorts can turn store windows into 24/7 retail platforms via technologies like interactive touch screens and QR codes. According to the JWT (2012), "In late 2012, PayPal rolled out a test in Amsterdam's De 9 Straatjes shopping district in which retailers posted QR codes on their storefronts, enabling shoppers with the campaign's mobile app to scan the code for purchase links to products in the window."

In Germany, shoppers outside an Adidas NEO Label store "were directed to a mobile URL that linked a smartphone with a shopping bag on the window; consumers could then drag products into the bag and buy them or save them for later purchase" (JWT, 2012).

Today, when a consumer uses his or her mobile device to take a picture of a QR Code in an ad, on a store shelf, off a TV or a chocolate bar, or in a hundred other places, he or she greatly enhances the marketing company's off-line marketing strategy because an association between the print advertisement and the transaction that follows is created (Sharma et al., 2008). This is data that can be added to a patron's purchasing behavior, which can also become intelligence for a marketing campaign.

Items purchased this way could be delivered directly to a buyer's home address, which would reduce the need to stock up on so many items and the consumer would probably like this feature as he or she wouldn't have to lug the item home after a trip to an integrated resort.

Snapchat could also be an interesting platform to sell out last minute hotel rooms. If Betfair can team up with Snapchat to sell bets on premier league games, why can't Integrated Resorts utilize the same technology to sell last-minute rooms?

Departure

Once the patron leaves the property, the marketing cycle begins anew. RFM models can project the time at which a patron is likely to return and social media should be checked for any comments, likes or uploads. All of a patron's captured information can now become part of the Master Marketing Profile that will be the basis for future marketing efforts. Combing the daily, weekly and monthly Master Marketing Profiles will also allow the casino to develop insightful macro views of its data, views that could help with facilities, labor management and vendor needs

Facilities and Labor Management

By definition, a data lake is a massive, intermingled repository of all of a company's data in its rawest form. By understanding customer patterns and behavior across the whole spectrum of the business—from outside marketing activities, to patron pickup, to patron navigation throughout the property, to room and restaurant choice, to a patron's buying and gambling habits, to all patron incidentals charges, to final car or bus ride home—a casino can use these customer behavior patterns to map out its human capital needs, all the way down to the seat on the bus that takes a dealer home at the end of a shift.

As facilities and assets become more IT-like—instrumented, intelligent and interconnected—the convergence of physical and digital infrastructures makes their management increasingly complex. And in a physical world outfitted with millions of networked sensors, vast amounts of facilities- and asset-

generated data make extracting meaning increasingly difficult. To take advantage of the opportunity to transform facilities and asset management, organizations need analytics capabilities that can identify operating anomalies in real time, as well as predict outcomes and deliver optimization models.

Organizations need analytics solutions that can extract meaning from huge volumes of data to help improve decision making, handle wide varieties of data and data sources from within and outside the enterprise, and keep up with the rapid velocity of data in motion. They need capabilities for analyzing historical and real-time data, as well as forecasting for the future, to distill what's valuable, detect patterns and reveal insights they may not even have thought to ask about. With such solutions, they can achieve benefits ranging from increased revenue to lowered operating expenses, enhanced service availability and reduced risk.

The following technology will produce data that could be included in a data lake that will help optimize a casino or integrated resort.

Augmented Reality

Gartner (2014) believes "AR technology has matured to a point where organizations can use it as an internal tool to complement and enhance business processes, workflows and employee training." Gartner (2014) also believes that "AR facilitates business innovation by enabling real-time decision-making through virtual prototyping and visualization of content" (Gartner, 2014).

Wearable AR devices can "allow users to access standardized sets of instructions for a particular task in real time, triggered by environmental factors and overlaid on the user's field of vision" (Deloitte, 2013). Research has shown that overlaying 3D instructions over a real-life process can reduce the error rate for an assembly task by 82 percent, with a particularly strong impact on cumulative errors due to previous assembly mistakes (Deloitte, 2013). This may not work on the casino floor, where hosts, dealers and pit bosses have to interact with patrons, but it certainly can be useful in physical plant and property management departments.

"AR allows for improved senses and memory through the capture and enhancement of the user's perspective. By recording video/audio, capturing images and removing elements that obscure the senses, AR technology allows users' eyes to act as cameras, and can enhance the senses in ways not available naturally, such as night vision or the ability to zoom in on far-away objects" (Deloitte, 2013).

AR's benefits include the "potential to improve productivity, provide hands-on experience, simplify current processes, increase available information, provide real-time access to data, offer new ways to visualize problems and solutions, and enhance collaboration" (Deloitte, 2014).

Geo-fencing

As TechTarget (2011) explains, geofencing has many uses, including:

- Asset management—An RFID tag on a pallet can send an alert if the pallet is removed from the warehouse without authorization
- Compliance management—Network logs record geo-fence crossings to document the proper use of devices and their compliance with established rules
- Fleet management—when a truck driver breaks from his route, the dispatcher receives an alert
- Human resource management—An employee's smart card will send an alert to security if an employee attempts to enter an unauthorized area
- Marketing—A retail business can trigger a text message to an opted-in customer when the customer enters a defined geographical area.

For indoor location-based services such as "libraries, museums, exhibitions, and hypermarkets, location awareness can become a crucial determinant of a superior quality of service, deriving from the ability to locate the co-ordinates of a person or an object with reasonable accuracy at all times, and thus provide spatially-aware services" (Giaglis et al., 2002). For example, location-based services can help customers

who are shopping in a supermarket or at a hypermarket; by registering a shopping list before she arrives at the store, a shopper can, upon entering the store, receive a suggested route that will guide her to the products she wants (Giaglis et al., 2002). This helps not only the shopper but also the retailer because it will know the exact positions of their customers at all times, which can help with workforce allocation and shelf replenishment (Giaglis et al., 2002). Customers won't linger in a store as long as they normally would either because they will know exactly where every product they want to purchase is located, meaning the store would probably be less crowded than it would be otherwise. With some casinos today being massive integrated resorts, indoor location-based services can help patrons navigate through an enormous property to the specific slot machine they might want to play. With location-aware technology, casinos can easily create personal guided tours for visitors.

Hosts, Hostesses, and Pit Bosses

Table Games Revenue Management (TGRM) is a system that is used by a lot of casinos to raise and lower table games minimums in an attempt to maximize revenue. In Macau, where table games make up 70%-80 of a casino's revenue, TGRM is more important than ever. Tangem, a TGRM system that is currently being used by many casinos around the world, can either be fed with additional data so that activity beyond the gaming floor can be added to Tangem's predictive models. This could even allow real time adjustments to table game minimums that would be affected by such things as reservation check-in, geo-locating data, mobile check-ins, social data, weather, traffic and/or border crossing information.

Data captured on the gaming floor by systems like Angel Eye and video analytics programs can be used to access not only the table games minimum hand prices, but it can also be utilized to understand employee productivity. Game pace statistic dashboards can easily be created to understand dealer speed so that the casino can know which dealers are the most productive and which might need additional training. Alerts can be set up so that pit bosses can understand who is on course to meet daily and monthly targets as well as who is lagging. Patterns can be analyzed so that a deeper understanding of why certain dealers and/or tables are performing well or not so well.

Real-time processing systems can also help hosts and hostess keep up-to-the minute records to keep track of complimentaries that they hand out to customers.

Conclusion

With a data lake, business events can be processed in real time, enabling a casino and/or an integrated resort make faster and more informed decisions across the entire spectrum of the business, from gaming to retail to F&B, spa, and any other form of entertainment offered. This enables the most effective and strategic outcomes with regards to risk management, customer engagement, and marketing. It is not an either-or question—Data Lake vs. Relational Data Warehouse; a data lake doesn't necessarily have to replace a relational data warehouse (and probably shouldn't) but with the explosion in data sources and data content, it is probably one of the best ways to wrangle data so that it can become actionable intelligence.

Data lakes are also one of the best ways for casino operators to gain the in-depth understanding of a patron that is needed to deliver personalization marketing. In today's marketing world, demanding patrons will require nothing less than deep customer understanding. They want offers that they have previously shown a preference for to be delivered on the channels they prefer, when and where they want it. Short of this, casino companies will probably see their customers headed to a competitor, a company that has made the investment in personnel and resources to deliver this kind of actionable intelligence.

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