Agile Systems for Time-Critical Predictive Customer Intelligence

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June, 2015

Executive Summary

More than ever before, it is the customer's choice today that determines a brand's or a company's destiny. In an era of an increasingly mobile, dynamic and connected global world, customers are rapidly redefining markets in more ways than anticipated. Companies are recognizing this shift in mindset from reactively transacting with their customers to proactively earning customer loyalty. These businesses must 'be there' where customers are and 'when' they need them. For this, they are implementing Predictive Customer Intelligence (PCI) solutions leveraging the remarkable recent advances in Information Technology (IT).

By providing a 360-degree view of customers, IBM Predictive Customer Intelligence (PCI) ensures that all customer interactions are coordinated, optimized, and effective. PCI can quickly sift through a wide range of customer information to provide insight and determine the "next best action" for individual customers at critical points in the customer experience. This enables companies to maximize customer satisfaction, loyalty and increase sales and profits.

But the sheer volume, velocity and variety of data are obstacles to deliver the performance needed for real-time "next best actions". To meet these challenges, organizations must deploy a cost-effective, high-performance, reliable and agile IT infrastructure to deliver the best possible business outcomes. This is the goal of IBM's agile Power and Storage Systems.

Companies could improve the performance of time-critical PCI tasks by using these agile IBM Systems for their IT infrastructure. These systems could also lower the total cost of ownership (TCO) while improving utilization and reliability. Additionally, IBM offers industry-leading financing and leasing programs that make it easy to acquire these systems and solutions.

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Optimizing Business Value

Predictive Customer Intelligence for Better Business Outcomes

Science and technology continue to profoundly transform and disrupt the marketing function.[1] Marketers are continually challenged to battle for today's empowered consumer's attention in the midst of changing demographics and a multitude of available market channels. Today, customers demand a highly personalized experience and have exceptional flexibility of choice. Using online, social and mobile interactive channels, they express and share their opinions at lightning speed, directly influencing other stakeholders and prospective buyers in their path-to-purchase cycle. Often, these opinions multiply and magnify through social media, rapidly affecting a company's future branding.

To attract and retain an increasingly empowered customer base, organizations must:

- Predict and identify customer behavior and patterns to build customer loyalty, drive product/services innovation, boost sales, and make marketing effective and efficient
- Be aware of the cultural nuances of their clients and their personal preferences
- Deliver consistent, speedy, seamless and engaging experience across all channels
- Implement integrated holistic customer relationship management (CRM) solutions.

Customer Analytics is a key CRM component. For over a decade, companies have used Customer Analytics to leverage their vast structured transactional enterprise data from their *Systems of Records* (Figure 1) to answer key questions such as: what products/services to develop and sell; and how to price them? Which products to discount and when? How to maximize customer reach, retention and life-time value, and so on?

The increasing use of smart phones and social media is transforming the speed and scope of the Customer Analytics process and also causing the rise of unstructured "Big Data" in *Systems of Engagements* (Fig.1). About 85% of data is unstructured and originates from audio, documents, emails, images, RFID, social media, video, web logs, weather data, etc.

Predicting Customer Intelligence from Systems of Records and Engagements is a game-changing opportunity to deliver an exceptional personalized customer experience, enhance marketing effectiveness, improve client retention, service quality and increase top-line and bottom-line growth.
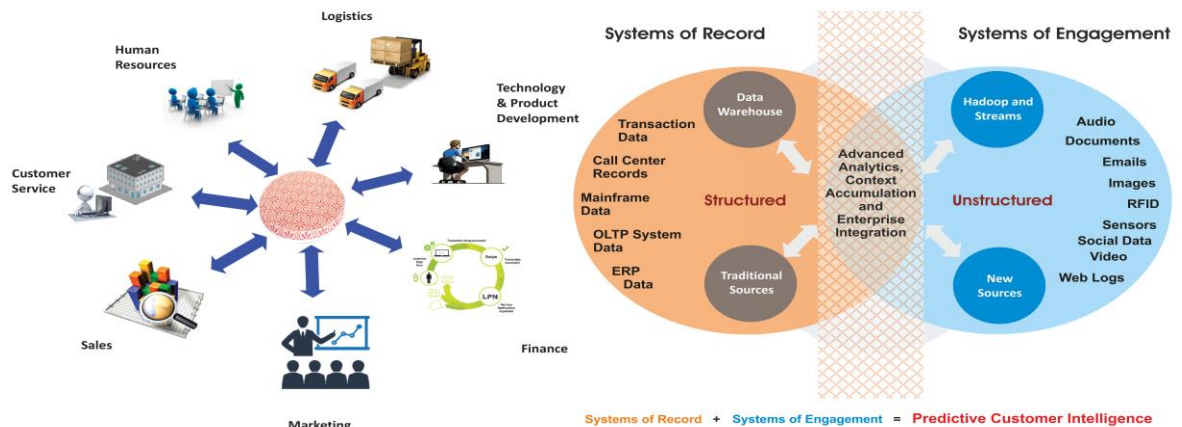
Figure 1: Better Business Outcomes with Predictive Analytics on Structured and Unstructured Data

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[1] Jonathan Gordon and Jesko Perry, "The dawn of marketing's new golden age", McKinsey Quarterly, February 2015.

Key Elements to Implement Predictive Customer Intelligence (PCI)

To get high value insights from Big Data, organizations must align strategy, culture, processes and *information technology.*[2] This is not easy. To maximize PCI value, IT systems must:

- Promote close collaboration between Business and IT users
- Integrate all relevant data and systems (including legacy systems), minimizing silos
- Provide a consistent personalized 360° perspective on each customer with 'self-learning"
- Ensure all relevant data sources and software are accessible for analytics users from various business units through easy-to-use interfaces, allowing them to run analytics on the fly
- Build advanced predictive models that turn data to insights, analyze patterns in customer buying behavior in each step of the buying cycle to – most importantly – frontline actions.[3]
- Automate and streamline data and analytics processes for critical business operations
- Reliably process growing volumes of data with speed for real-time "next best actions".

To analyze these huge volume and variety of data real-time, companies must invest in a new breed of systems infrastructure. According to a recent Chief Marketing Officers (CMOs) survey by McKinsey[4], getting this infrastructure working right is the biggest challenge they face.

Enterprise-grade High-performance Systems are Crucial

Traditional approaches to batch offline analysis or business intelligence with siloed data marts are limiting. They cannot keep up with the volume, variety and velocity of data that enterprises deal with today as a result of several fast-growing intertwined technology trends – Cloud, Social, Mobile, Internet of Things (IoT) and Big Data Analytics. Technical obstacles include slow data loading and querying, large network latencies, low system reliability and utilization, and the costs and complexities of managing distributed infrastructure.
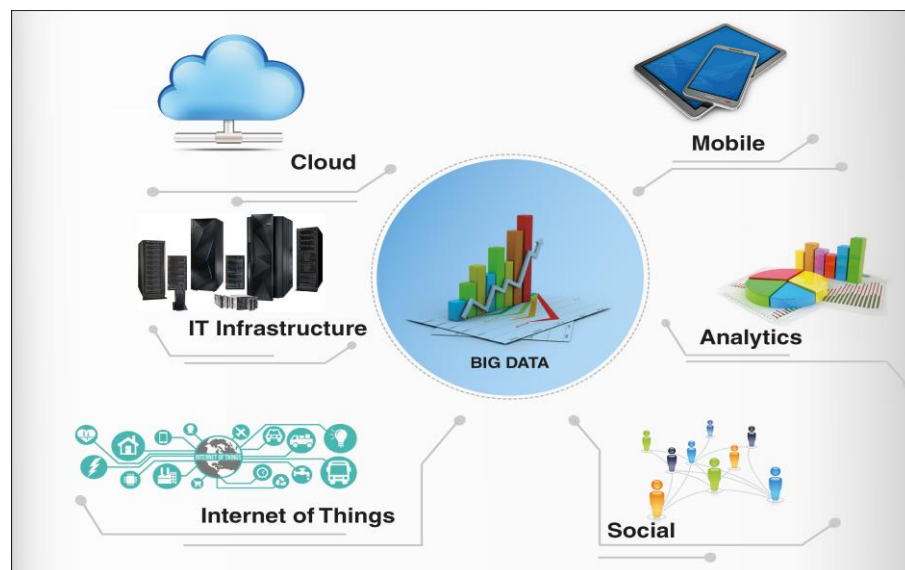

Figure 2: Intertwined Technologies of Cloud, Social, Mobile, IoT and Analytics Driving IT Systems

IT infrastructure matters to maximize value from PCI

Intertwined trends of Cloud, Social, Mobile, IoT and Analytics driving IT infrastructure needs

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[2] IBM Institute for Business Value 2013 Big Data & Analytics Study, http://www.ibm.com/services/us/gbs/thoughtleadership/ninelevers/
[3] Peter Breuer, Jessica Moulton, and Robert Turtle, "Applying advanced analytics in consumer companies", McKinsey Paper, 2013.
[4] http://www.mckinsey.com/client_service/marketing_and_sales/latest_thinking/big_data_analytics_and_the_future_of_marketing_and_sales

To deal with these challenges and at the same time deliver new, revenue generating products/services without letting costs go out of control, companies must implement a high-performance, scalable and agile information foundation to support both real-time and large-scale analytics capabilities. These include the use of emerging open source technologies such as Hadoop and various NoSQL offerings to reduce the processing time for the growing volumes of data, especially in distributed computing environments.

In addition, businesses also need robust Reliability-Availability-Serviceability (RAS), security and governance processes, normally found in enterprise-grade IT solutions such as the IBM Predictive Customer Intelligence solution anchored on the IBM Analytics Platform whose foundation includes IBM Power Systems and IBM Storage.

The IBM Predictive Customer Intelligence Solution[5]

The IBM Predictive Customer Intelligence (PCI) solution ensures that all interactions with customers are coordinated, optimized, and effective. Companies can quickly sift through a wide range of information to obtain key customer insights and determine the next best actions for individual customers. With these capabilities, companies can maximize customer satisfaction and increase revenue and profits. This single integrated PCI solution:

- Provides a personalized rich 360-degree view of each customer
- Determines the best action for each particular customer, after scoring several alternatives
- Helps retain customers, identified as likely to leave, by making personalized offers
- Microsegments customers to provide targeted individualized marketing
- Identifies the best time and the most appropriate channel to deliver an offer to a customer, such as email, telephone call, or a message to their mobile device.

Figure 3 depicts PCI's layered architecture that facilitates company-specific customization.
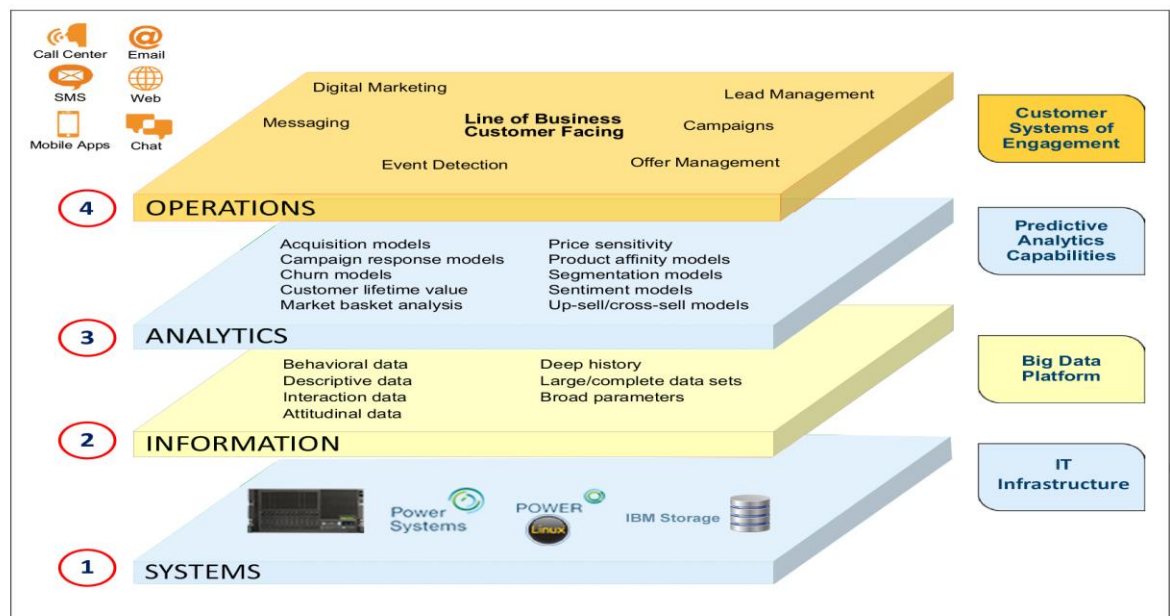
Figure 3: IBM Predictive Customer Intelligence High Level Contextual Layered Architecture

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[5] IBM Redguide, "Retain and Delight Your Customers by Applying IBM Predictive Customer Intelligence", 2015.

Layer 4: Operations: Includes all the line-of-business customer-facing teams and systems of engagements provided by IBM or a third-party. PCI integrates with these systems providing key information that the teams and systems use in their customer-facing processes to improve marketing, sales, and customer service outcomes.

Layer 3: Analytics: Consists of an extensive set of predictive modeling and analytic capabilities that discover hidden relationships and insights from structured and unstructured data to make specific recommendations to Operations to optimize customer interactions and improve customer experience. For example, predictive models can be used to determine the likelihood of a future customer purchase based on factors, such as customer age, browsing, and transaction history.

PCI contains various industry-specific modeling capabilities, such as customer acquisition, campaign response, churn, customer life time value (CLTV), market-basket, price sensitivity, product affinity, segmentation, sentiment, and up-sell/cross-sell models. IBM developed these models leveraging many extensive engagements with organizations over the years.

Layer 2: Information: This analytics platform manages a wide variety of customer data, including behavioral, descriptive, and attitudinal data, data from interactions, historical data, large and complete data sets, and broad parameters. The platform can:

- Capture, maintain, and analyze various types of *data in motion* (streaming data) in their original format
- Provide deep insights based on advanced in-database analytics
- Analyze large volumes of *data at rest* (structured and unstructured data) to gain insights. Data can be analyzed in its native format, without imposing a schema or structure, enabling fast ad hoc analysis
- Perform master data management (MDM) that provides a single view of customers, products, services, and assets
- Integrate information including moving, transforming, and remediating information as it flows between the various layers.

Layer 1: Systems: The IT infrastructure matters[6] and provides the foundation to ingest, store, easily access, combine, and analyze large data sets. IBM Power Systems and IBM Storage are optimized to support real time analytics on growing volumes of streaming and at rest data. Compared to commodity alternatives, these IBM systems provide reliable, secure, high-performance in-memory processing so that users get timely access to the relevant information for more informed decisions. To improve business agility, business managers, analysts, and IT staff must collaborate to optimize their IT infrastructure for data-centric computing.

IBM Agile Systems for Predictive Customer Intelligence

As data volumes grow exponentially, the costs of moving the data in and out of a central processor becomes prohibitive. To move 1 byte from storage to the central processor, it could cost 3-10 times the cost of one floating point operation (flop).[7] So why not move data less by running workloads where the data resides? This requires "computing" at all levels of the

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[6] http://www.ibm.com/systems/infrastructure/us/en/it-infrastructure-matters/it-infrastructure-report.html
[7] https://www.nersc.gov/assets/NERSC-Staff-Publications/2010/ShalfVecpar2010.pdf

system stack including network, memory and storage. This is, in essence, IBM's Agile Systems approach (Figure 4) with the following key architectural principles:[8]

1. **Minimize data motion** by providing hardware and software to support and enable compute in data and schedule workloads to run where they run best.

2. **Enable compute in all levels of the systems hierarchy** with "active" system elements throughout the stack including network, memory, storage, etc.

3. **Build Modularity** with a balanced, composable architecture that is scalable from a sub-rack to hundreds of racks.

4. **Optimize for PCI** by using real workloads/workflows to drive design points optimized for client business value.

5. **Leverage the OpenPOWER Foundation**[9] to accelerate innovation and provide clients flexibility and choice to deploy well-integrated, best-of-breed solution components.
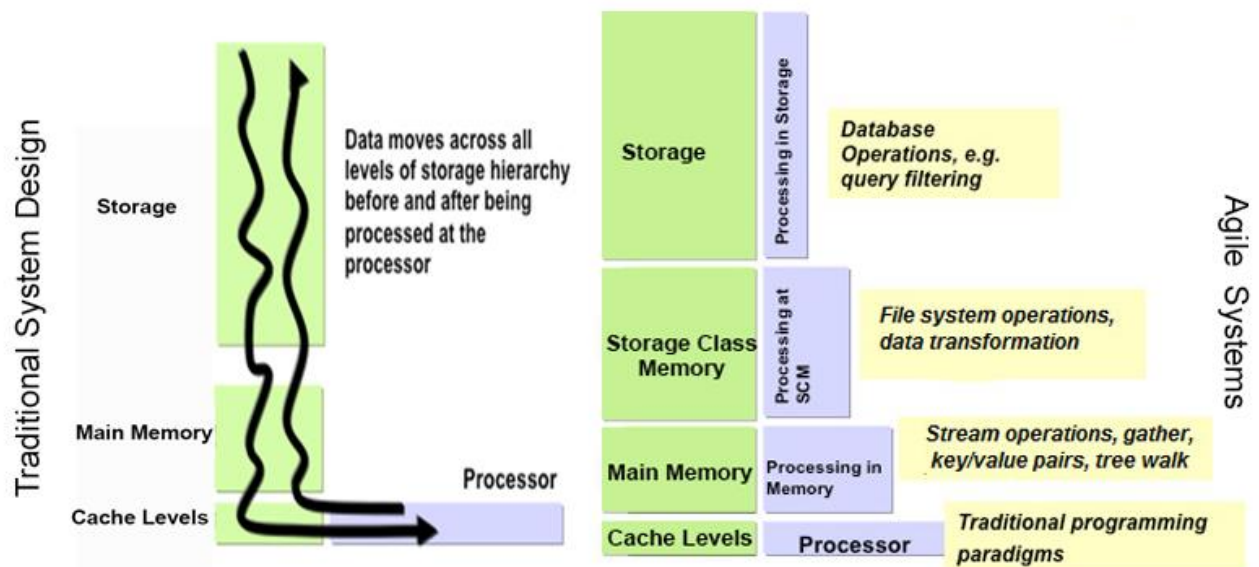
Figure 4: Traditional and Agile System Designs

IBM offers a wide array of IT infrastructure solutions including high-performance systems, clusters, software and cloud services. Featured systems include: IBM Power Systems and IBM System Storage on Linux and IBM AIX. Key software includes a high-performance shared-disk clustered file system – IBM Spectrum Scale. Additionally, IBM offers industry-leading financing and leasing programs that make it easy to acquire systems and solutions.

IBM Systems (POWER8 processors and Storage) offer a tightly-integrated and performance-optimized infrastructure for PCI workloads with enduring economics:

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[8] Tilak Agerwala and M. Perrone, "Data Centric Systems: The Next Paradigm in Computing", http://icpp.cs.umn.edu/agerwala.pdf , 2014.
[9] http://openpowerfoundation.org/

1. **Massive Threads:** Each POWER8 core is capable of handling eight hardware threads simultaneously for a total of 96 threads executed simultaneously on a 12-core chip.

2. **Large Bandwidth:** Very large amounts of on- and off-chip eDRAM caches and on-chip memory controllers enable very high bandwidth to memory and system I/O.

3. **Higher Performance:** POWER8 is capable of clock speeds around 4.15GHz, with a Thermal Design Power (TDP) in the neighborhood of 250 watts.

4. **Agile Integration and Better Economics:** IBM FlashSystems deliver more scalable performance, enduring economics, and agile integration.

5. **Excellent RAS:** Many studies[10,11] across a range of enterprises have indicated that IBM Power systems perform better than x86 systems in Reliability, Availability and Serviceability (RAS), performance, TCO, security and overall satisfaction.

6. **Game-Changing Performance with Coherent Accelerator Processor Interface (CAPI):** CAPI, a direct link into the CPU, allows peripherals and coprocessors to communicate directly with the CPU, substantially bypassing operating system and driver overheads. In the case of flash memory attached via CAPI, the overhead is reduced by a factor of 24:1. More importantly though, CAPI can be used to attach coprocessors — directly to the POWER8 CPU for significant PCI workload-specific performance boosts.

7. **Innovation with the OpenPOWER Foundation:** IBM has opened up the technology in Power Systems architecture offerings, such as processor specifications, firmware and software. The Foundation – with over 120 global technology leaders and growing – was founded by NVIDIA, Mellanox, IBM, Google and Tyan.

   There are several real world examples of innovations and performance enhancements resulting from the OpenPOWER Foundation and these span the business spectrum ranging from Monte Carlo financial risk modeling, Big Data and Java acceleration, NoSQL acceleration, Key Value Store (KVS) acceleration and so on – all key to PCI.

Key PCI Components Planned for Optimization on IBM Systems include:

1. **The IBM BLU Acceleration Solution** – a next generation in-memory IBM DB2 database technology for real time analytics.

2. **IBM Solution for Analytics** – enables rapid deployment of business and predictive analytics using SPSS, Cognos and DataStage.

3. **IBM InfoSphere BigInsights** – a comprehensive, enterprise-grade full-featured Hadoop platform for Analytics.

When optimized, these components will provide high levels of performance even when reading tens of millions of records and/or scoring transaction loads with petabytes of data volumes. As a result, IBM Systems are more likely to execute scoring with real-time operational transactions, and keep up with the operational throughput than comparable x86 server scale out configurations. This is especially important for quickly providing the "frontline next best action" that is critical to enhance the customer experience in real time.

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[10] Edison Group, " Better Performance, Lower Costs The Advantages of IBM PowerLinux 7R2 with PowerVM versus HP DL380p G8 with vSphere 5.1, http://public.dhe.ibm.com/common/ssi/ecm/en/pol03161usen/POL03161USEN.PDF
[11] Solitaire Interglobal, "Power Boost Your Big Data Analytics Strategy", http://www.ibm.com/systems/power/solutions/assets/bigdata-analytics.html

To Enhance Value and Agility with PCI across Multiple Industries …

With industry-specific templates for banking, retail, telecommunications, insurance, and energy and utilities, the IBM Predictive Customer Intelligence solution can be customized to enhance business value and agility across several industries.

Banking: Banks can maximize revenue from customers and touch points by proactively making the right offer at the right time and place leveraging predictive repurchase propensity models. Better customer segmentation optimizes marketing spend and boost revenues.

Retail: Retailers can improve customer loyalty through personalization and tailor cross-sell/upsell offers through affinity analysis in real time to improve revenues and profits. With detailed hourly analysis of in-stock rates by store, retailers can reduce out-of-stocks, provide a better shopping experience for consumers, and boost sales and profits.

Telecommunications: Service Providers can get a deeper understanding of their customer preferences to provide higher-value services to maintain customer loyalty and minimize churn with real time response during a subscriber interaction. This improves revenues and profits.

Insurance: With a deeper understanding of policyholders' needs and products sales, Insurers can proactively develop products and personalized communications to mitigate customer churn and improve customer service. Near real-time reporting and dashboards at the branch level help support decisions on reissuance and underwriting.

Energy and Utilities: Companies can empower consumers by providing them with near real-time, detailed information about their energy usage combined with improved customer service. With real-time meter information, companies can improve distribution planning, prevent outages, detect diverted and stolen consumption and increase profitability.

… IT Infrastructure Matters

With the ever increasing volume, velocity and variety of data and the need to support real time "frontline next best actions", companies implementing PCI should consider IBM Power Systems and IBM Storage for their IT Infrastructure:

- Accelerates analytics tasks many fold and minimizes costly data-motion across PCI layers.
- Lowers total cost of ownership (TCO) with fewer servers with improved utilization, lower PCI operational costs and less storage and data bottlenecks because of consolidation, fewer redundant copies, novel compression algorithms and efficient data-aware scheduling.
- Many businesses already run mission-critical Data Warehouses and Business Intelligence Applications on Power Systems and IBM Storage with excellent RAS and performance. By deploying PCI on this infrastructure, current IT investments in people, processes, platforms and applications are protected, while having a seamless and cost-effective path to scale.

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