UTILITY DAY

METERING ECOSYSTEM

Del MDC a la Analítica: el Futuro del MDM

UTILITY DAY
METERING ECOSYSTEM

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BSNE, NE Degree, North Carolina State University .MS ENGINEERING, University of South Florida. MBA, University of Tennessee.

Ha trabajado en la industria energética durante 35 años, empezando en simulación de plantas de energía nuclear, diseño de ingeniería, ingeniería de proyectos, gestión de proyectos, pruebas y mantenimiento. Los últimos 20 años se ha centrado para mercados internacionales en temas como Transmisión y Distribución, Medición, AMI, MDMS, Analíticas, Prepago, Automatización de la Distribución, Renovables, Micro Grids, Tecnologías de la Comunicación, y Estrategia y Planificación de Marketing y Ventas. Su experiencia con Utilities alrededor del mundo le brinda una comprensión profunda de los problemas de estas empresas cuando intentan modernizar sus redes y minimizar las pérdidas de ingresos, tanto técnicas como no técnicas.

UTILITY DAY
METERING ECOSYSTEM

From MDC to Analytics, The Future of MDM

UTILITY DAY
METERING ECOSYSTEM

Bogota, Colombia
October 24 & 25, 2018

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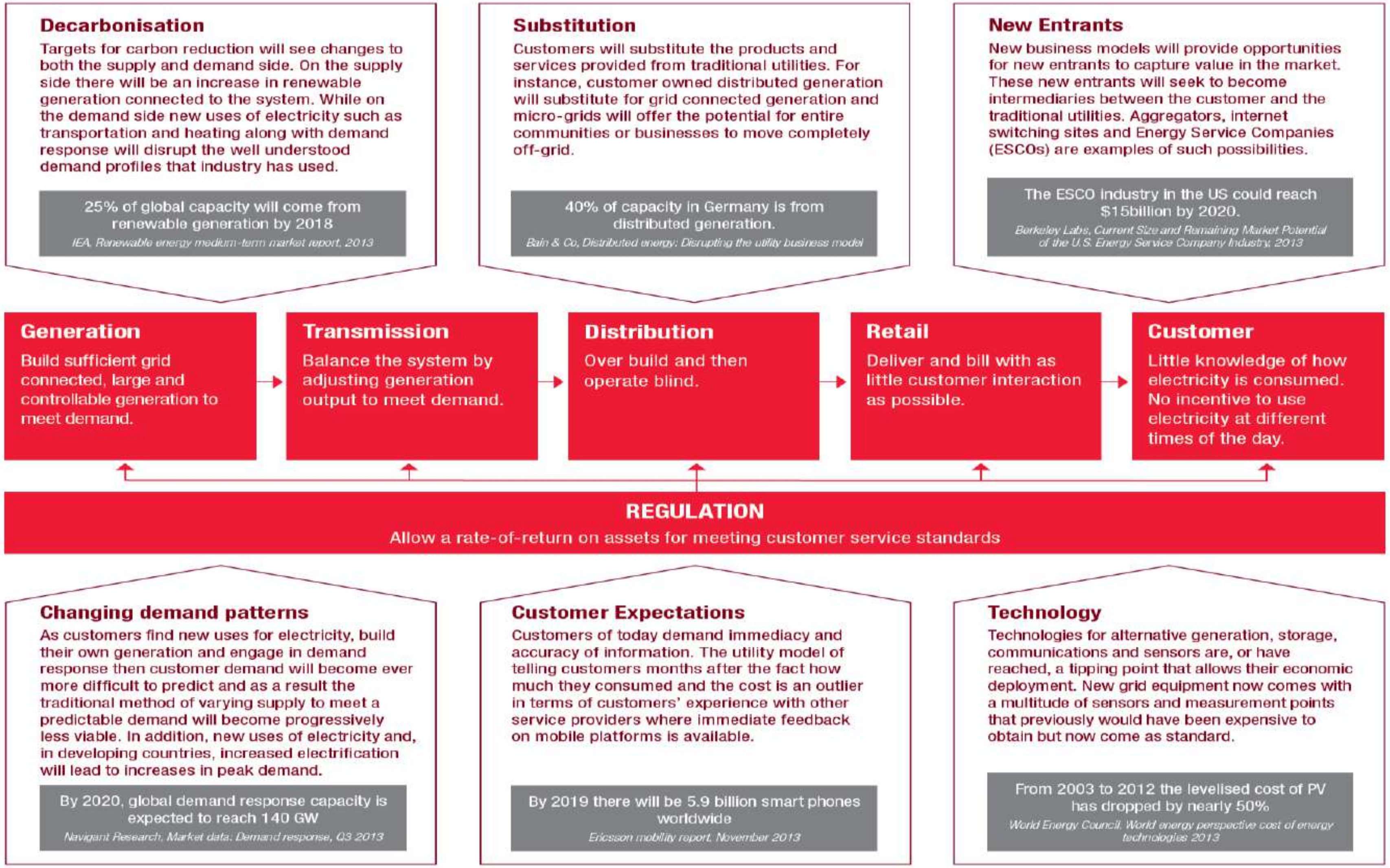
OBROS INTERNATIONAL, LLC

THE OLD GRID IS UNDER ATTACK



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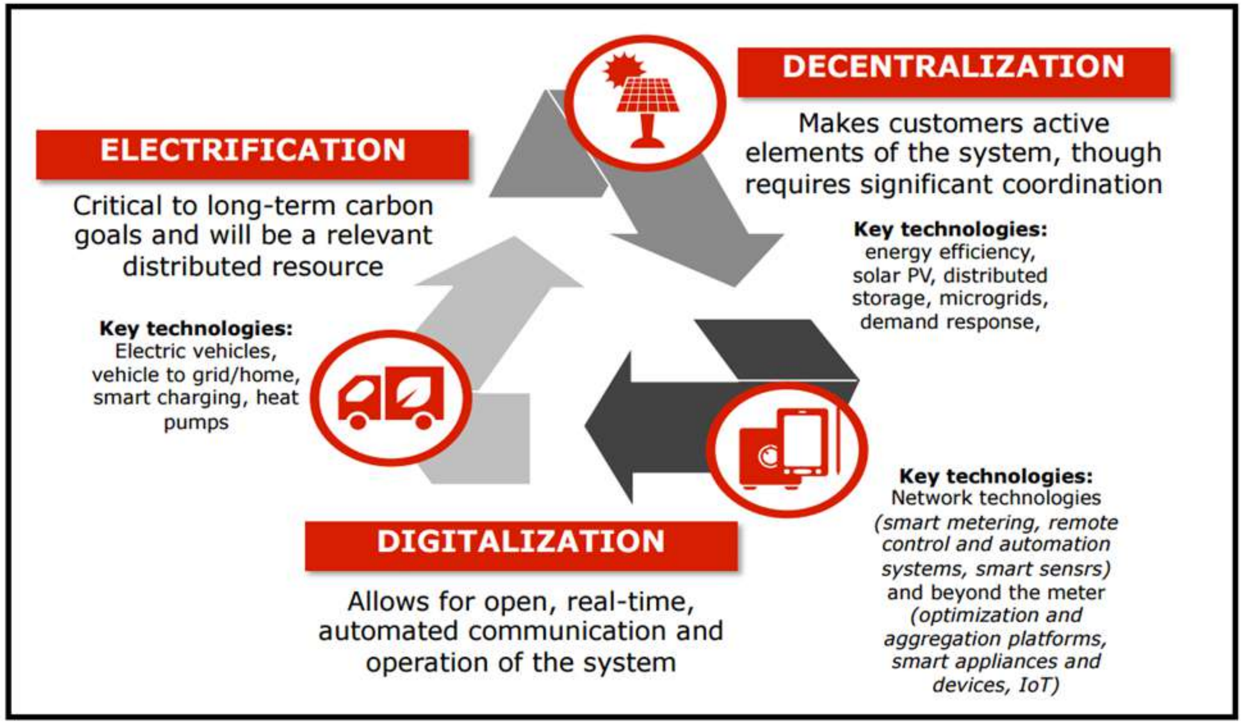
KEY ELECTRIC UTILITY INDUSTRY INSIGHTS FROM THE WORLD ECONOMIC FORUM – DRIVING CHANGES



1. Electrification, which is where more things become powered by electricity, such as within trucks and domestic heating. Due to the increasing availability of renewable energy sources, electrification will reduce our reliance on fossil fuels. In many cases, electrification will also increase energy efficiency.
In OECD markets, the most promising electrification opportunities are in those segments that are among the largest polluters: transportation, commercial applications and residential heating and cooling.
For decades we have relied on massive power plants and grids to bring us our energy, but that landscape is about to change dramatically.

2. Decentralization takes the power supply and storage away from the main grid and into locations closer to where it's needed. There are various advantages to this, such as reducing losses of energy during transmission and lowering carbon emissions. Blackouts will be reduced as the security of supply is increased, thanks to the larger number of available power sources.
Decentralization also enables control of energy use during peak-demand and high-pricing periods.

3. Digitization is the increasing use of the internet within this space. For example, smart meters, which measure exactly how much energy is being used, will connect with a digitized grid. The grid, in turn, will be able to process and use all that information to maximize its efficiency.

Source-Reference 8

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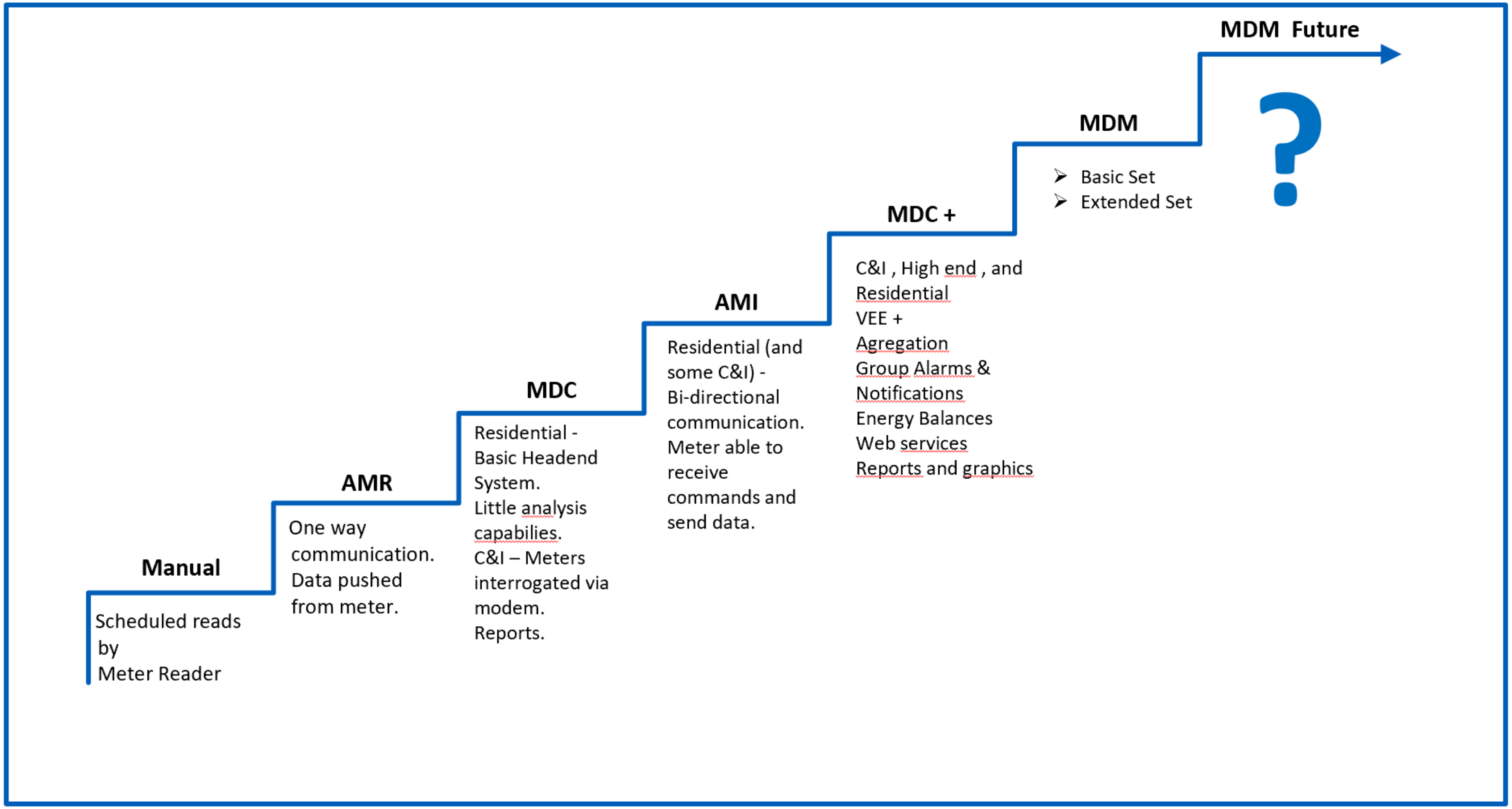
FROM MDC TO THE MDM



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MDM APPLICATION SETS

Base Applications

- Data Receipt
- Data Validating, Estimating, Editing (VEE)
- Aggregation and Affiliation
- Storage
- Official Record Keeping
- Interfaces to the Enterprise
- Reporting
- Relationship Management

Extended Applications

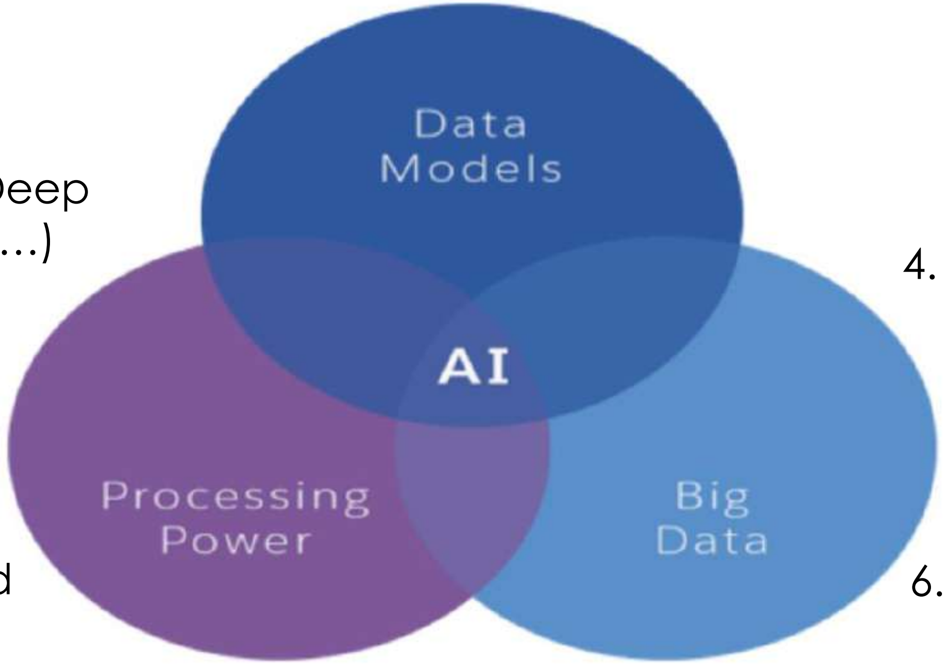
- Asset Management
- Customer Billing Information System
- Commercial & Industrial customer web portal
- Energy Theft
- Workforce Management
- Financial Management
- Outage Management
- Settlements
- Credit and Collections
- Demand Response and Load Curtailment
- Load Research and Forecasting
- Customer Engagement
- Geographical Information Systems
- Power Quality
- Rate Design
- Line Loss Analysis
- Prepayment

Source-Reference 3

HOW ARE BIG DATA AND ARTIFICIAL INTELLIGENCE RELATED?

1. It is extremely difficult to store the massive amount of data a utility company generates.

2. Traditional computing techniques are not able to handle such large datasets. Artificial intelligence is often used to process this type of data



3. Artificial Intelligence and its sub branches (Machine Learning, Deep Learning, Neutral Networks, etc…) all are algorithm based.

4. These algorithmic methods are used on Big Data to produce desired results and to find trends, patterns and predictions.

5. The idea of computer-based artificial intelligence dates to 1950, when Alan Turing proposed what has come to be called the Turing test: Can a computer communicate well enough to persuade a human that it, too, is human?

6. The term "artificial intelligence" was coined in 1955, to describe the first academic conference on the subject, at Dartmouth College. That same year, researchers at the Carnegie Institute of Technology (now Carnegie Mellon University) produced the first AI program, Logic Theorist.

Source-Reference 5 & 7

DIFFERENCE BETWEEN DATA ANALYTICS AND AI MACHINE LEARNING

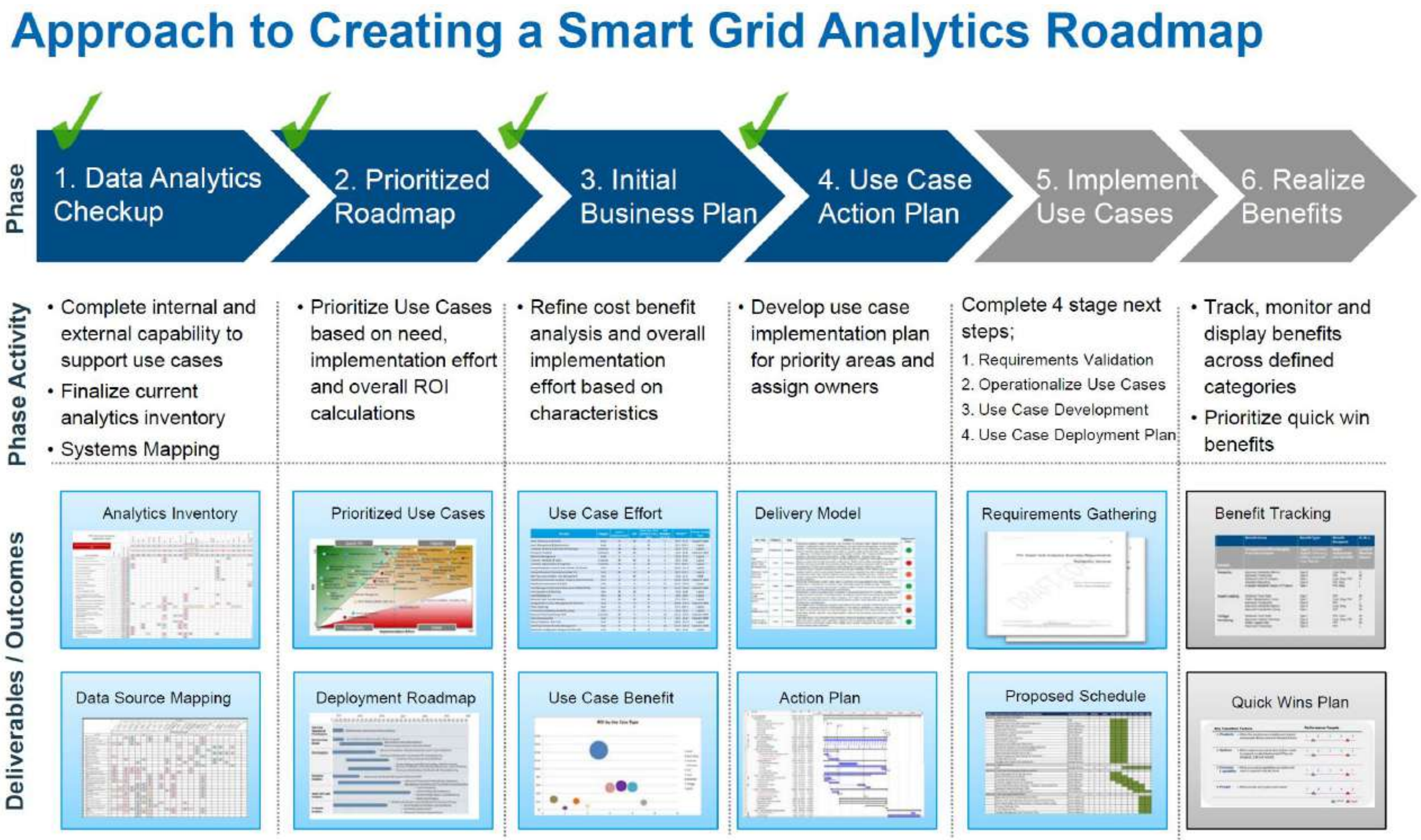
- **Data Analytics**
  Data Analytics is the process of aggregating data in order to report a result, search for a pattern and find relationships between variables. Assumptions are made by humans, and data is queried to attest to that relationship. If valid, testing may continue on additional data.

- **Predictive Analytics**
  Data analytics leads naturally to predictive analytics using collected data to predict what might happen. Predictions are based on historical data and rely on human interaction to query data, validate patterns, create and then test assumptions. Assumptions drawn from past experiences presuppose the future will follow the same patterns. "What/if" assumptions are informed by human understanding of the past, and predictive capability is limited by the volume, time and cost constraints of human data analysts

- **AI Machine Learning**
  Machine learning is a continuation of the concepts around predictive analytics, with one key difference: The AI system is able to make assumptions, test and learn autonomously. AI is a combination of technologies, and machine learning is one of the most prominent techniques utilized for hyper-personalized marketing. AI machine learning makes assumptions, reassesses the model and reevaluates the data, all without the intervention of a human. This changes everything. Just as AI means that a human engineer does not need to code for each and every possible action/reaction, AI machine learning is able to test and retest data to predict every possible customer-product match, at a speed and capability no human could attain.

Source-Reference 9

PHI– PEPCO, ATLANTIC CITY ELECTRIC, DELMARVA POWER



Source-Reference 2

PHI - SMART GRID USE CASES

Industry Use Cases Layer

Grid
- AMI Operations & MDM
- Distribution Automation & SCADA
- Data Model/Store (Big Data Capable)
- Network Connectivity Analysis
- Network Models - T&D, Secondary
- Network Cyber & Physical Security
- Distributed Generation Analysis - Impacts, Interconnection
- Demand Response Control, Fuse Checker, PV Checker
- Demand Response Planning (EV's)
- Fault Management & System Restoration (FMSR/OFISR)
- Line Impedance & Matching
- Load Shedding
- Outage/Fault Location & Detection
- Phase Balancing
- Protection
- State Estimation

Reliability
- ASR Scheme Analysis
- Environmental/Sensitive Area Analysis (for Reliability, Works Management)
- Optimal Switch/Recloser Placement
- Reliability Analysis (including outage analysis)
- Reliability Optimization & Cost/Benefit
- Storm Analysis (Monte Carlo, etc..)
- Vegetation Management

Asset Management
- Asset Performance & Health
- Asset Management & Maintenance
- Materials Management

Enterprise
- Financial Management
- Human Resource Management
- Meter to Cash Analysis
- Business Process Operations
- Fleet Optimization
- Program/Project Management
- Settlements

Customer
- Customer Service & Call Centre Performance
- Customer Reliability & Safety
- Customer Segmentation & Targeting
- Revenue Protection/Energy Theft

Load
- Asset Load Analysis
- Distribution Load Forecasting
- Load Balancing
- Load Profiling
- Power/Load Flow Analysis

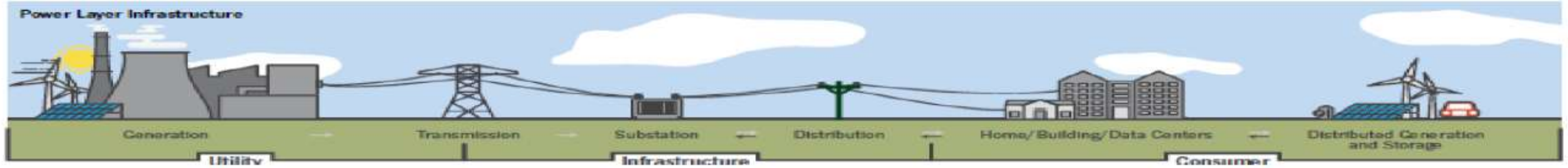
Voltage
- Voltage Monitoring
- Voltage Optimization & Cost/Benefit
- Conservation Voltage Reduction
- Optimal Capacitor Bank Design & Placement
- Volt/VAR Control

Work
- Field Force Performance
- Work Management Analysis

Security

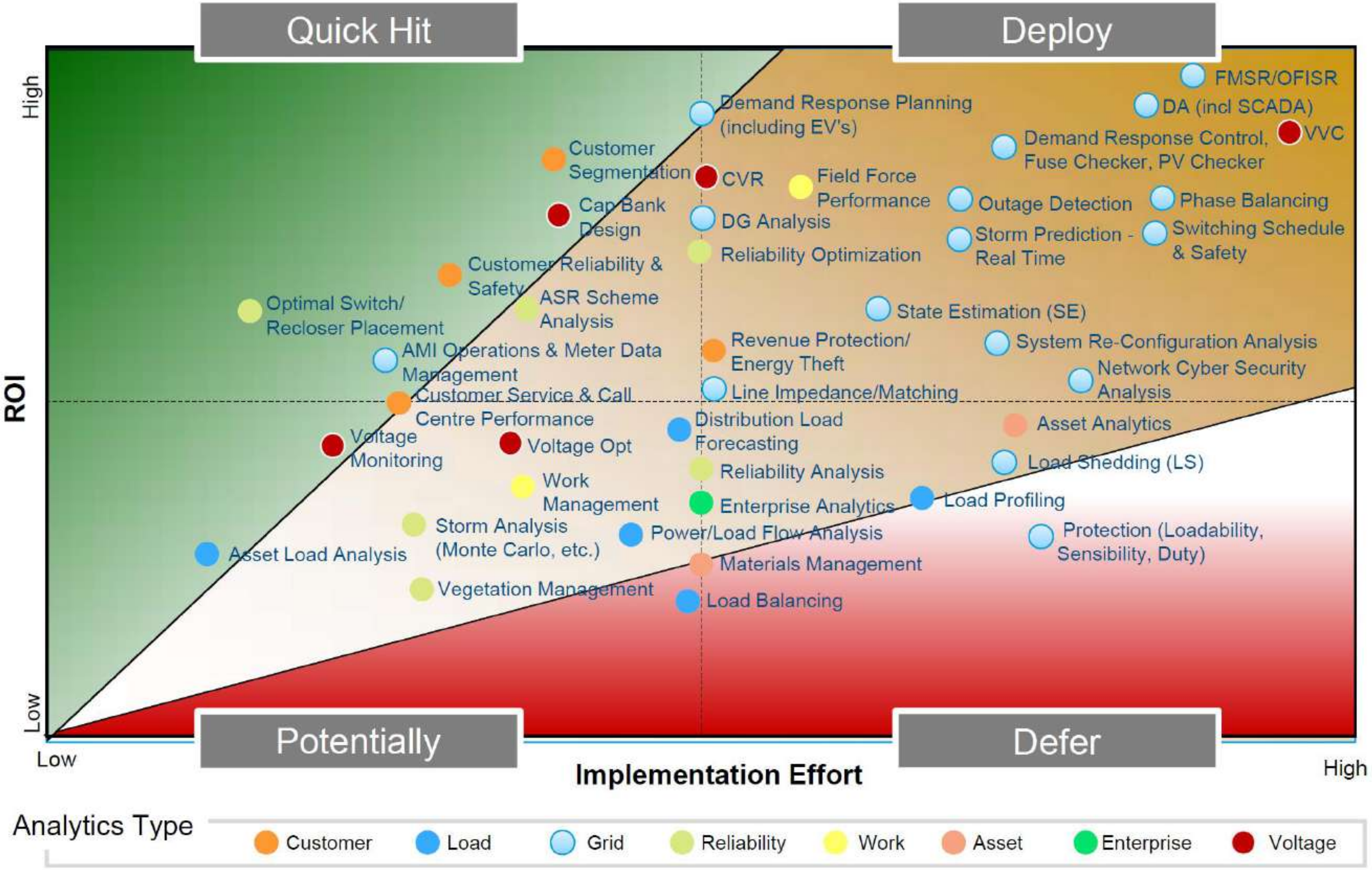
Intelligent Endpoint Devices and Application Layer

Communications Layer



Source-Reference 2

PHI – PRIORITIZED USE CASES



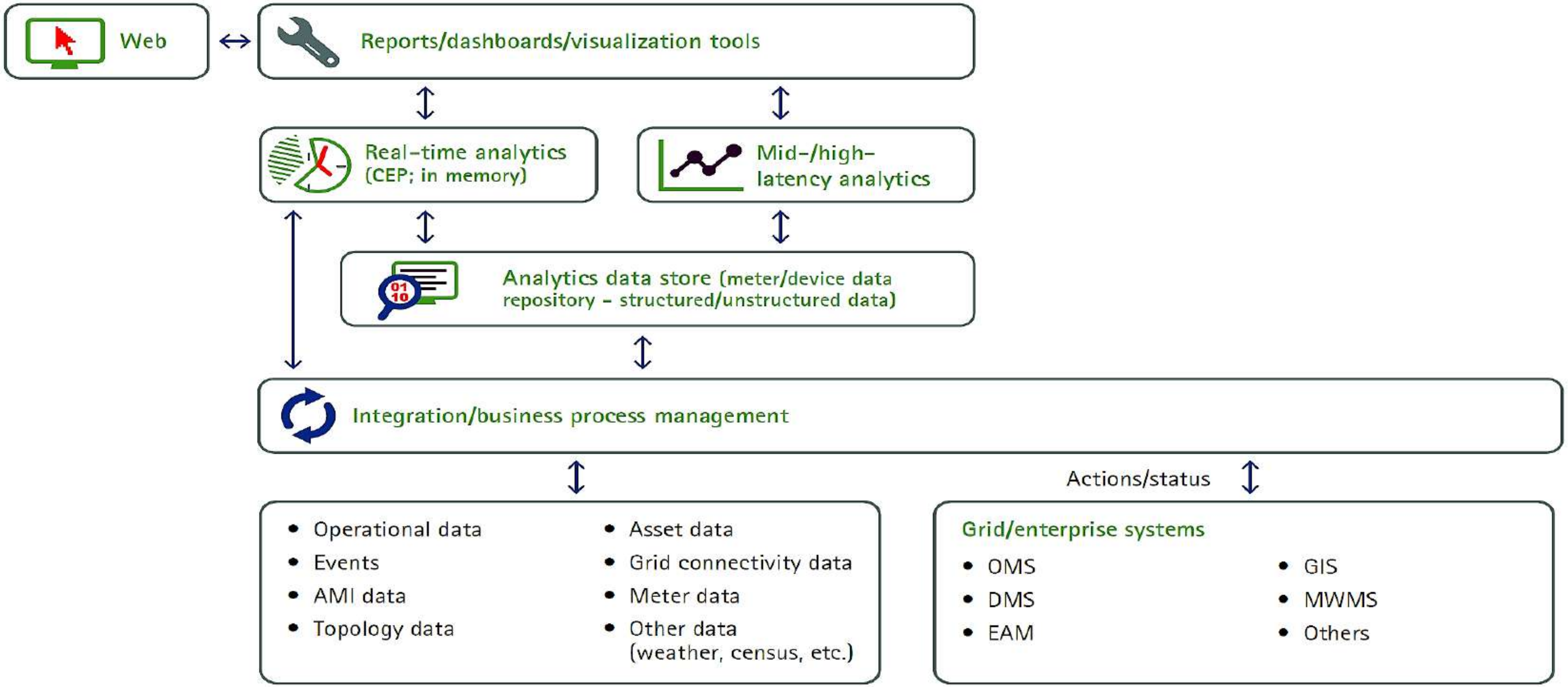
Source-Reference 2

MAJOR ANALYTICS BENEFITS – EXPECTED METRICS OF SUCCESS

Category	Metrics of Success			
	↑ Revenue ($)	↓ Avoided Cost ($)	↑ Service	↑ Productivity ($)
Grid	• Improved revenue outcomes from tailored DR tariffs	• Optimized Capital Spend • Truck rolls/field visits	• Customer Satisfaction • Regulator Satisfaction	• Resolution/Restoration • Operational response time
Voltage	• N/A	• Optimized Capital Spend	• Voltage Swell and Sag • Customer Satisfaction	• Planning throughput/output • FTE/Contractors
Customer	• Segmented customer rates • Recovery/Theft	• Service Calls • Customer Cost	• Customer Satisfaction	• Process throughput/output • Call Centre Performance
Reliability	• N/A	• Outage # and $ • Overtime	• SAIDI, SAIFI, CAIDI, CIME	• Planning throughput/output • FTE/Contractors
Load	• N/A	• Optimized Capital Spend • Asset failure	• Optimized Load & Demand • Environmental Outcomes	• Planning throughput/output • FTE/Contractors
Asset	• N/A	• Asset Failure • Maintenance Cost	• Asset Health & Life	• Planning throughput/output • FTE/Contractors
Work	• N/A	• Truck Rolls • Overtime/Contractors	• Customer Satisfaction	• Re-work events • Optimized Work Day
Enterprise	• Revenue Assurance (meter to cash)	• Business Operations/Process Waste	• Process & Service Consistency/ Efficiency	• Cycle time/Output • FTE/Contractors

Source-Reference 2

CONCEPTUAL ARCHITECTURE FOR ANALYTICS



Note: OMS: outage management system, DMS: distribution management system,
EAM: enterprise asset management, GIS: geographic information system, MWMS: mobile workforce management system.
Source: Accenture.

Source-Reference 1

TEN PRIORITY USE CASES THAT CAN DRIVE SIGNIFICANT VALUE FOR UTILITIES

Opportunity Areas	Drivers
Revenue protection	Detecting unauthorized use and configuration errors and recovering lost revenue
Voltage optimization	Using asset-condition models to refine operational settings of assets to save on power costs
Demand-response effectiveness	Increasing participation in demand-response programs and improving savings achieved from load control
Load forecasting and planning	Improving long-term investment planning based on bottom-up demand and asset load and condition indexes
Outage detection and response	Reducing outage costs from enhanced response to outages (detection, isolation and restoration)
Outage prevention	Reducing equipment outages by focusing on assets with highest risk of failure
Investment planning	Revising priorities of asset investments based on analysis of asset risk and consumer impact
Maintenance strategies	Revising maintenance strategies, policies and programs based on condition and risk analytics
Energy efficiency	Identifying and helping consumers improve value from energy and energy efficiency
Energy services	Targeting consumers for services and pricing to help improve value from energy and with adoption of new uses (e.g., use of distributed generation, photovoltaics)

Source-Reference 1

EXAMPLES OF UTILITES USING ANALYTICS AND ARTIFICIAL INTELLIGENCE

UtilityAnalytics INSTITUTE

1. **WEBINAR** - Integrating Artificial Intelligence into Outage Management Systems at Florida Power & Light
2. **WEBINAR** - Optimizing Energy Asset Lifecycles with Predictive Analytics – NOKIA
3. **WEBINAR** - Analytics as Strategy - Integrating Analytics to Drive Customer Value and Operational Excellence – Tacoma Public Utility
4. **WEBINAR** - Delivering Utility Customer Value with Analytics and the Digital Grind
    1. **Presentation:** SAS 2018 - Delivering Utility Customer Value with Analytics and the Digital Grid
    2. **Presentation:** ENTERGY - 2018 - Delivering Utility Customer Value with Analytics and the Digital Grid

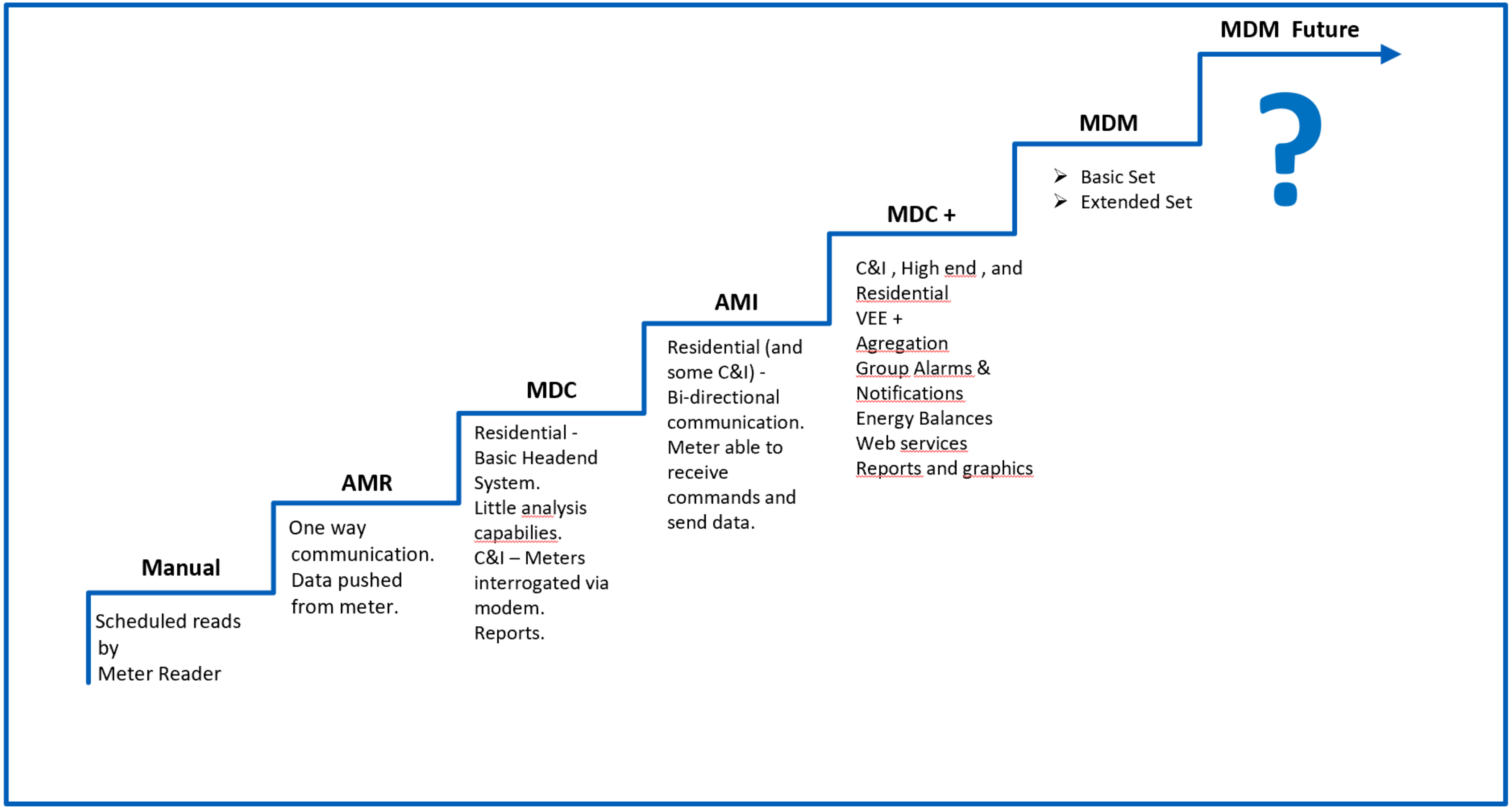
WHAT WILL HAPPEN TO MDM?

At least two Scenarios are possible:

- The application as it is has existed so far will disappear and its purpose and functionalities absorbed into Business Intelligence and Analytics solution packages.
- The application will continue to be marketed as an standalone solution with different providers targeting different customers segments, but in essence will be an Analytics-based solution.
- In either scenario the interface set must expand to accommodate the new grid imperatives.

Source-Reference 9

FROM MDC TO THE MDM



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2. Creating a Smart Grid Analytics Roadmap, Karen Lefkowitz and Gregg Edeson, 2015.
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6. Crossing the frontier: How to apply AI for impact, McKinsey Analytics, p.66, 2018.
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8. What is the grid edge? (And does it really mean cheaper energy bills?), Alex Grey, 2018
9. Do You Know The Difference Between Data Analytics And AI Machine Learning?, Vance Reavie, Forbes Agency Council, 2018

THANK YOU!!!

Source-Reference 6

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Any Questions

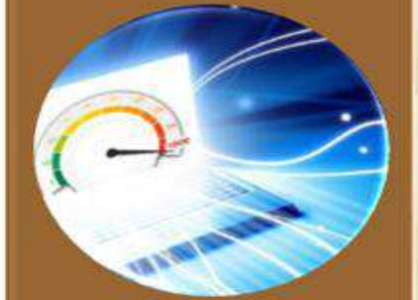
PrimeStone
Intelligent Data Collection + Analytics

Prime Analytics+

Coming soon

Objetivos de Prime Analytics+

SCALABILITY
- The system scalability will be determined by the hardware
- The software will not have constraints in itself to scale



HIGH PERFORMANCE
- All hardware resources will be properly used
- Business processes will be decoupled thanks to a modular design in order to enhance performance

TESTABILITY
- The new architecture simplifies test automation and quality assurance across the entire solution set

CENTRALIZED ADMINISTRATION
- All current software applications will be integrated under a single user interface.
- Therefore, the administration of all features will be centralized

CYBER SECURITY
- Cyber security is now a key non-functional requirement of all the software that is being coded.
- Findings are being addressed as they are detected.

MULTITENANT / INTEROPERABLE

USABLE / ROBUST / MAINTAINABLE

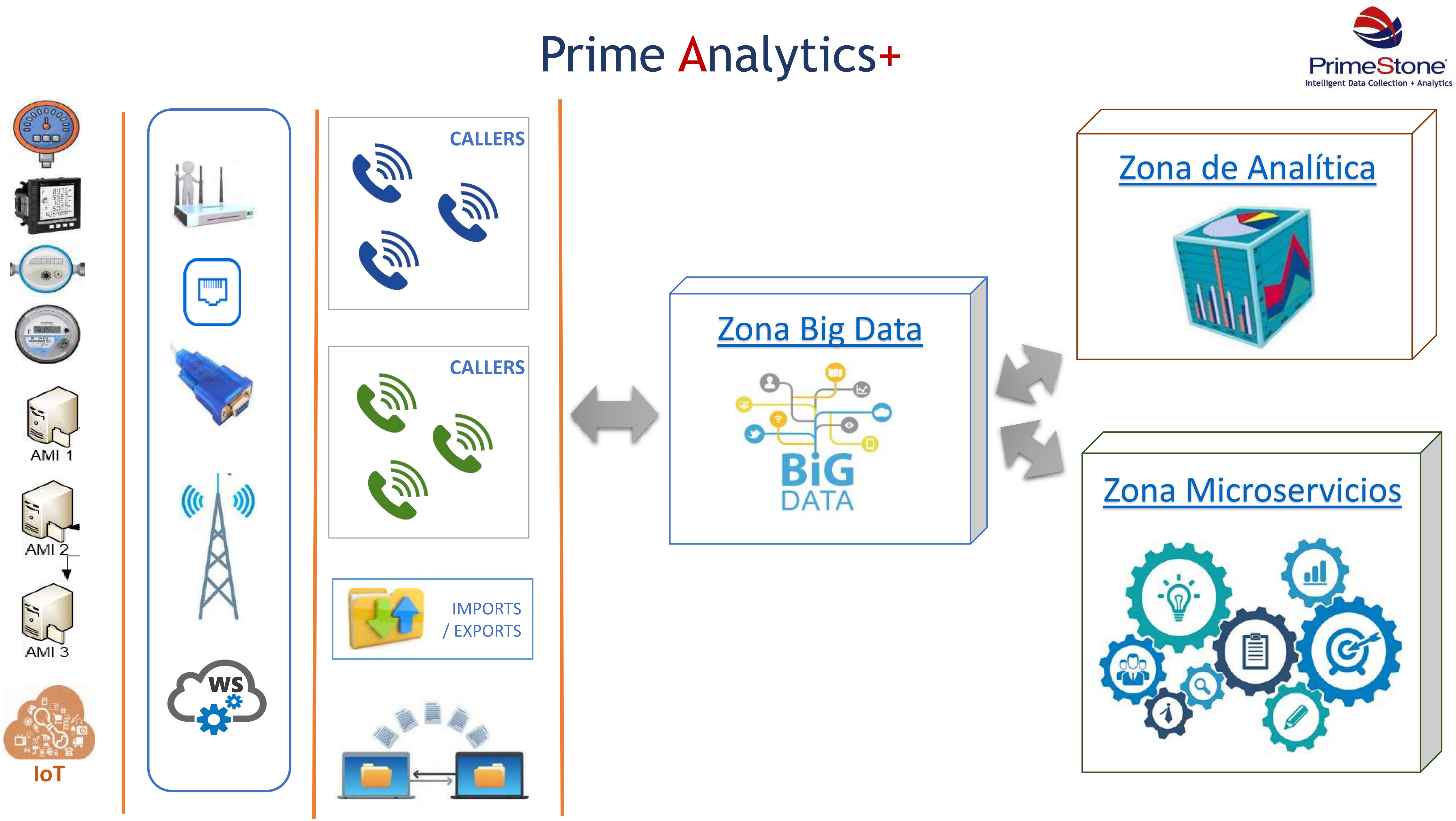
Prime Analytics+

PrimeStone
Intelligent Data Collection + Analytics

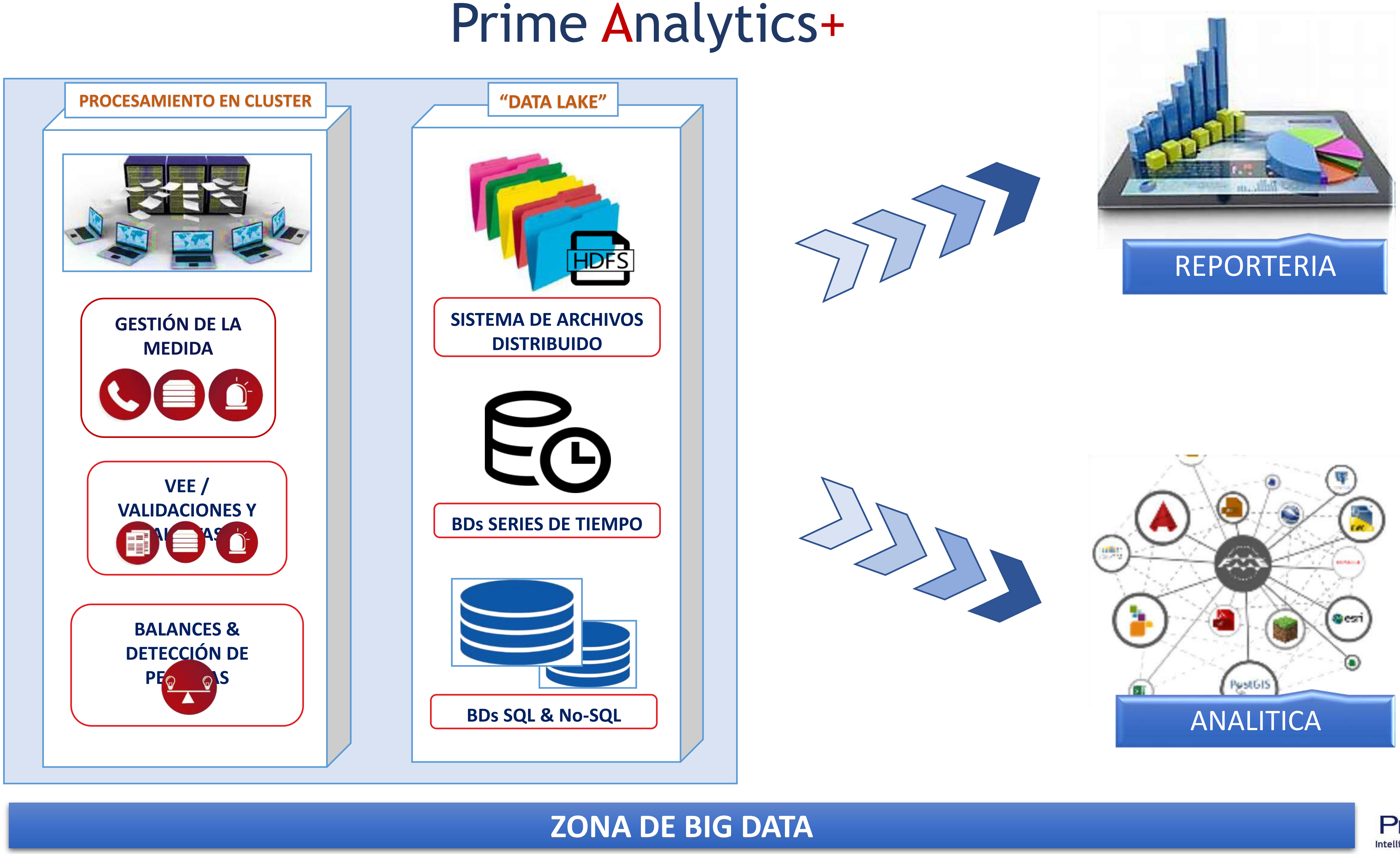
Características principales

- Procesamiento distribuido – Cluster, Cache, Tecnologías MOM
- Multi-tenant
- Soporte a BDs relacionales o no-relacionales – Uso de Tecnologías Big Data
- Arquitectura de microservicios & estándares de interoperabilidad
- Contenido de la soluciones
- Experiencia de usuarios en usabilidad
- Soporte de estándares de seguridad
- Soporte plataformas IoT

Prime Analytics+



Prime Analytics+



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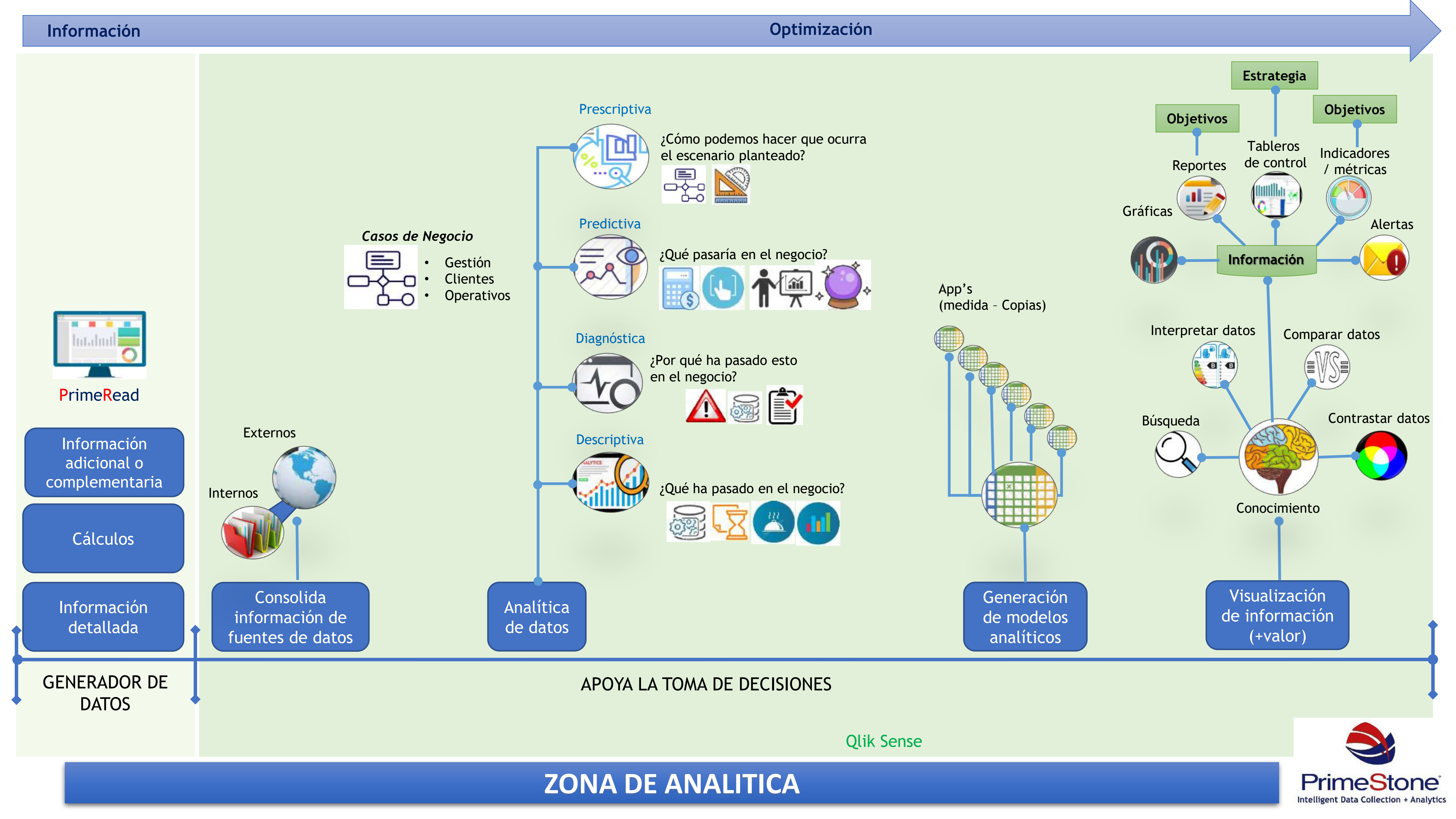
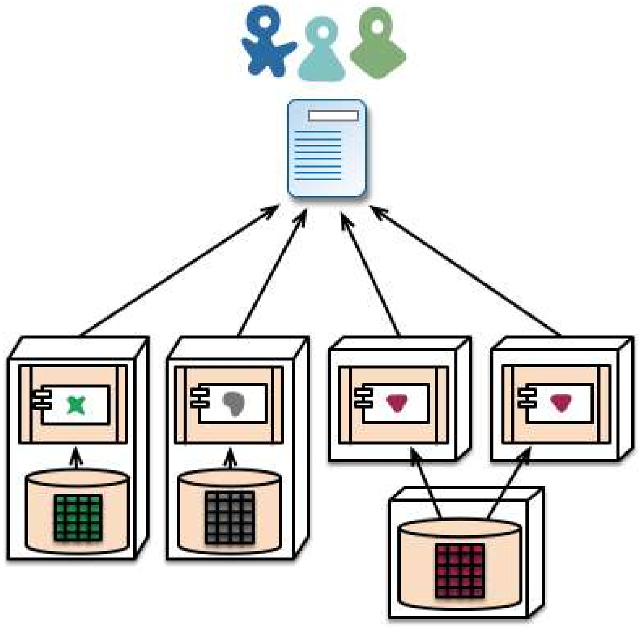


Información
Optimización
PrimeRead
Información adicional o complementaria
Cálculos
Información detallada
GENERADOR DE DATOS
Externos
Internos
Consolida información de fuentes de datos
Casos de Negocio
Gestión
Clientes
Operativos
Prescriptiva
¿Cómo podemos hacer que ocurra el escenario planteado?
Predictiva
¿Qué pasaría en el negocio?
Diagnóstica
¿Por qué ha pasado esto en el negocio?
Descriptiva
¿Qué ha pasado en el negocio?
Analítica de datos
App's
(medida - Copias)
Generación de modelos analíticos
Estrategia
Objetivos
Objetivos
Reportes
Tableros de control
Indicadores / métricas
Gráficas
Alertas
Información
Interpretar datos
Comparar datos
Búsqueda
Contrastar datos
Conocimiento
Visualización de información (+valor)
APOYA LA TOMA DE DECISIONES
Qlik Sense
ZONA DE ANALITICA
PrimeStone
Intelligent Data Collection + Analytics

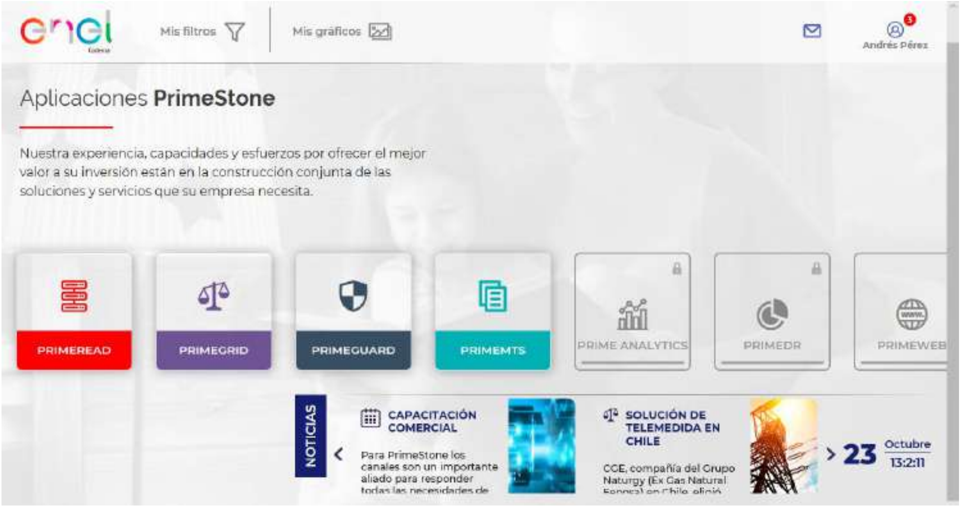
Prime Analytics+

MICROSERVICIOS



microservices - application databases

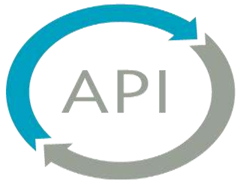
INTERFAZ DE USUARIO



INTEROPERABILIDAD

Servicios Web

Estándares de Integración



ZONA DE MICROSERVICIOS

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Prime **A**nalytics+

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Gestion de la medida y comunicacion

Aseguramiento de ingresos


Análisis de consumos


Respuesta a la demanda / EE



Análisis de outage


Calidad de potencia

Pronosticos de demanda



Análisis de Micro grid

Alumbrado Publico / Mto preventivo


VEE - Alarmas - Balances	Calc - Agregacion	Ver. de datos

Intelligent data collection