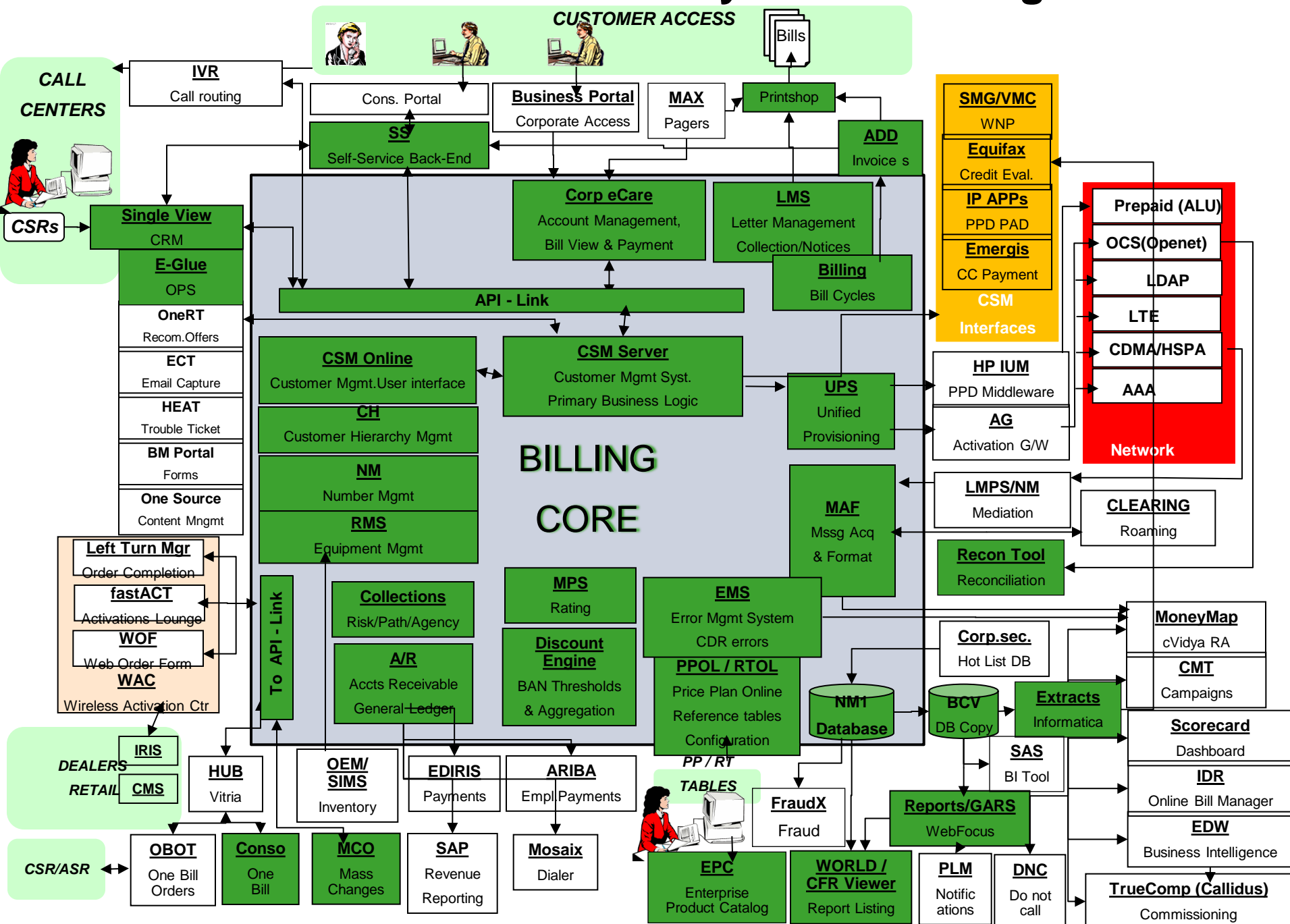# WGSigma Systems

Architecting intelligent real-time systems processing billions of events a day

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The Universal Corporate Challenge:

Hundreds or thousands of systems performing transactions in silos with no collective intelligence

About 20% of the Customer Systems in a large Telco

CUSTOMER ACCESS

Bills

CALL CENTERS

CSRs

IVR — Call routing
Cons. Portal
Business Portal — Corporate Access
MAX — Pagers
Printshop
ADD — Invoice s

SMG/VMC — WNP
Equifax — Credit Eval.
IP APPs — PPD PAD
Emergis — CC Payment
CSM Interfaces

SS — Self-Service Back-End

Corp eCare — Account Management, Bill View & Payment
LMS — Letter Management Collection/Notices
Billing — Bill Cycles

Single View — CRM
E-Glue — OPS
OneRT — Recom.Offers
ECT — Email Capture
HEAT — Trouble Ticket
BM Portal — Forms
One Source — Content Mngmt

API - Link

Prepaid (ALU)
OCS(Openet)
LDAP
LTE
CDMA/HSPA
AAA
Network

CSM Online — Customer Mgmt.User interface
CSM Server — Customer Mgmt Syst. Primary Business Logic
UPS — Unified Provisioning
HP IUM — PPD Middleware
AG — Activation G/W

CH — Customer Hierarchy Mgmt
NM — Number Mgmt
RMS — Equipment Mgmt

BILLING CORE

MAF — Mssg Acq & Format
LMPS/NM — Mediation
CLEARING — Roaming
Recon Tool — Reconciliation

Left Turn Mgr — Order Completion
fastACT — Activations Lounge
WOF — Web Order Form
WAC — Wireless Activation Ctr

To API - Link

Collections — Risk/Path/Agency
A/R — Accts Receivable General Ledger

MPS — Rating
Discount Engine — BAN Thresholds & Aggregation

EMS — Error Mgmt System CDR errors
PPOL / RTOL — Price Plan Online Reference tables Configuration
PP / RT

Corp.sec. — Hot List DB

MoneyMap — cVidya RA
CMT — Campaigns

NM1 Database
BCV — DB Copy
Extracts — Informatica
SAS — BI Tool

Scorecard — Dashboard
IDR — Online Bill Manager
EDW — Business Intelligence

DEALERS
RETAIL
IRIS
CMS

CSR/ASR

HUB — Vitria
OEM/SIMS — Inventory
EDIRIS — Payments
ARIBA — Empl Payments
TABLES
FraudX — Fraud
Reports/GARS — WebFocus

OBOT — One Bill Orders
Conso — One Bill
MCO — Mass Changes
SAP — Revenue Reporting
Mosaix — Dialer
EPC — Enterprise Product Catalog
WORLD / CFR Viewer — Report Listing
PLM — Notifications
DNC — Do not call
TrueComp (Callidus) — Commissioning

The Goal:

Create a collective knowledge of the operation where processing decisions are holistically optimized

….Patients

….Customers

…Subscribers

….Account Holders
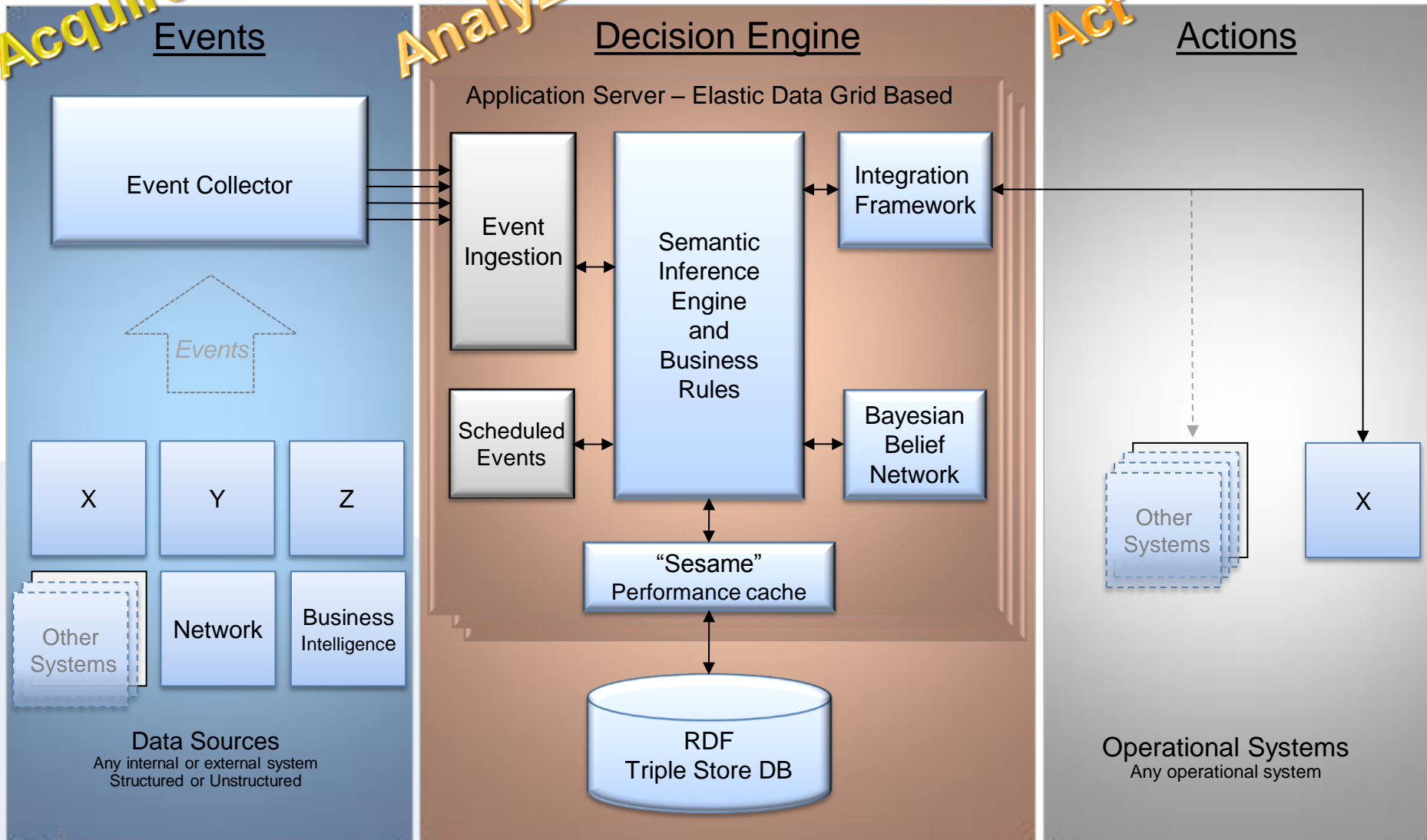
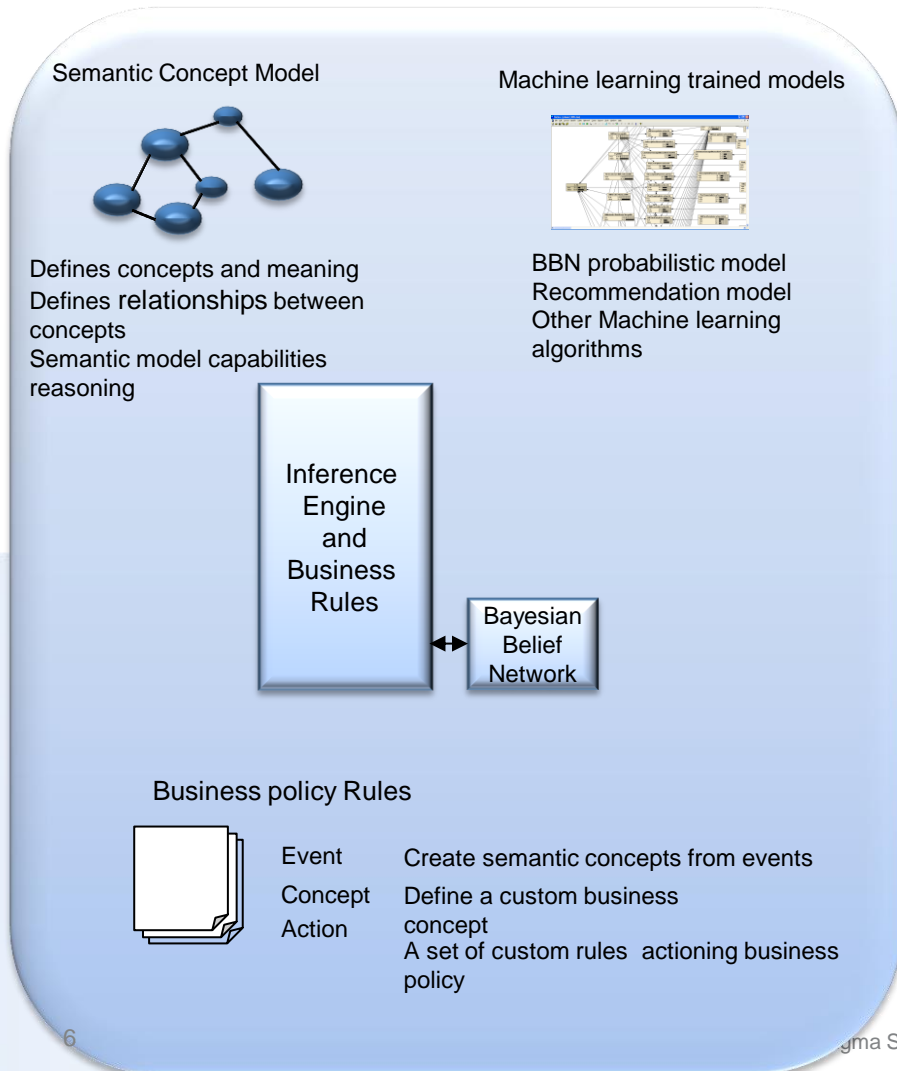# Closed Loop Event – Condition – Action

Acquire

Analyze

Act

Events

Decision Engine

Actions

Application Server – Elastic Data Grid Based

Event Collector

Event Ingestion

Semantic Inference Engine and Business Rules

Integration Framework

Events

Scheduled Events

Bayesian Belief Network

| X | Y | Z |

Other Systems

Network

Business Intelligence

"Sesame" Performance cache

Other Systems

X

RDF Triple Store DB

Data Sources
Any internal or external system
Structured or Unstructured

Operational Systems
Any operational system

Inferencing

Semantic Concept Model

Machine learning trained models

Defines concepts and meaning
Defines relationships between concepts
Semantic model capabilities reasoning

BBN probabilistic model
Recommendation model
Other Machine learning algorithms

Inference Engine and Business Rules

Bayesian Belief Network

Business policy Rules

Event	Create semantic concepts from events
Concept	Define a custom business concept
Action	A set of custom rules actioning business policy

Semantic Concept Model

The model defines the concepts including the high level business concepts

The model contains the relationship between concepts including the dependencies

Inference

When an event occurs the event handler rule fires for that event
  Evaluates the event message
  Evaluates the existing ontology
  Determines which semantic instances to create or update

When any data changes, the inference engine fires in a "When - Then" style of computing, updating all "Automatic" concepts. Custom concept rules are fired if necessary. This creates a chain of updates

When a "on demand" concept is needed the inference engine finds and computes all of the dependant concepts

Machine learning

When a concept is dependent on "machine learned" information the inference engine manages the invocation and timing of interfacing

Use Case: Customer Interaction Prediction and Best Action

Events collected in real time

- Interactions
- Orders
- Bills
- Payments
- Collections
- Charge dispute
- Customer
- Pay instructions
- Individual
- Device Activated
- Device heartbeat
- Subscriptions
- Device changes

Transformed into a connected graph of business concepts

Chronology of events

Subjective	"good payer"
Patterns	"always pays 2 days late"
Trends	"improving payer"
Geospatial	"within 5 miles of the tower"
Time	"within 5 minutes of an outage"
Probability	"probably will call about the bill"
Absence of occurrence	"missed payment"
Relationship between	" friend of a friend"
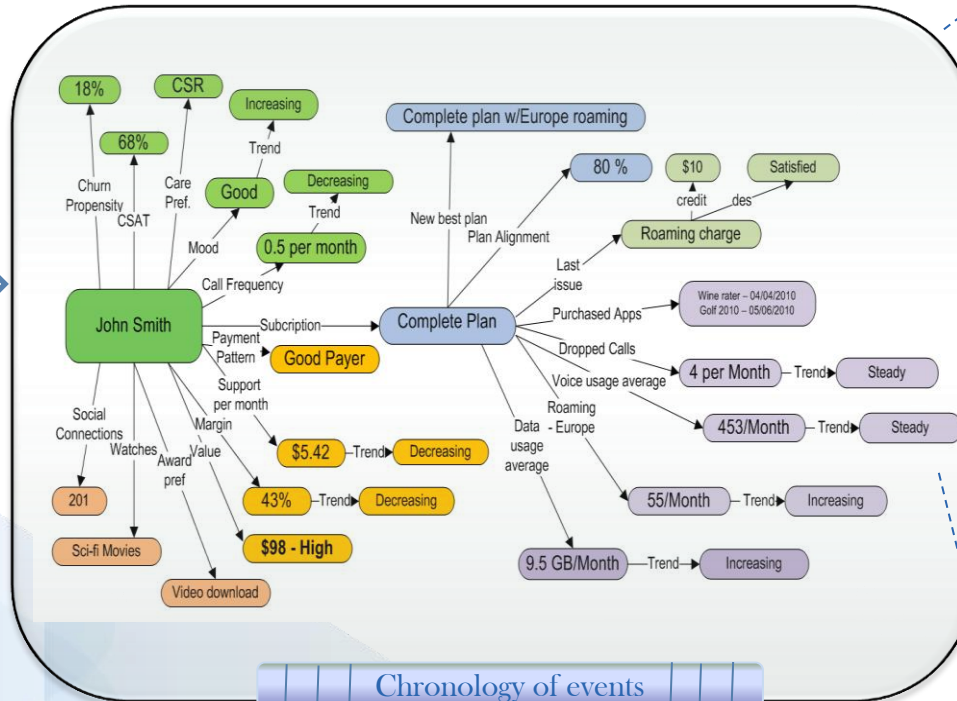
Predictions & Actions

Probability of call motivation

- Plan Overage
- Bill greater than last month
- Prorates
- Roaming charges
- Third Party Charges
- Abnormal fee
- Rate increases
- Charge dispute
- First bill
- Past due amount
- Pay bill
- Customer Cancellation
- Reactivation
- Device activation
- Device education
- Device exchange
- Device Lost
- Device not working
- Device resume
- Service data not working
- Service text not working
- Service voice not working
- Subscription cancellation
- Wrong plan

Scalability & Resilience

- Use in memory elastic data grid
  - New hardware nodes can be added and removed dynamically
  - Data is replicated to one other node (no single point of failure)
  - If a server fails, the backup becomes the primary seamlessly

- Partition grid across objects

- Graphs are partitioned across multiple triple store instances
  - A single index instance defines the location of each graph

- Historical data is subdivided into graphs by timeframe (e.g. quarters)

Event Collector/Router

Event Collector – Message Sender

1

Data Grids

2 Message Processor | Message Processor | Message Processor

3 Persistence Processor | Persistence Processor | Persistence Processor

Graphs
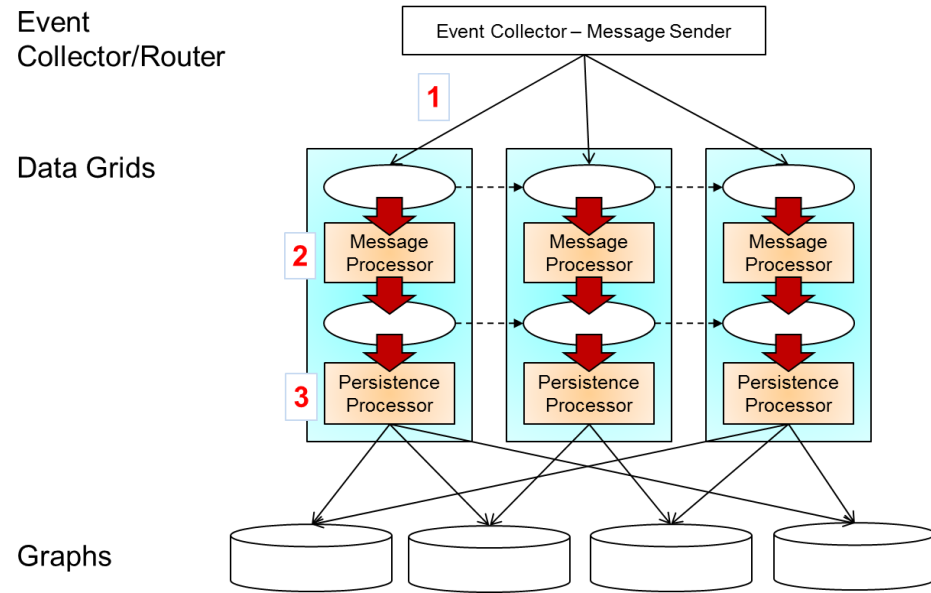
Make it Business Friendly

Technology Stack

Technology	Purpose
TopBraid Composer	Ontology Modeling
Java	Event Pipeline, Decision Engine, Integrations
R	Statistical and Predictive Modeling
ETL	Event ingestion - Extract, Transform, Mapping Relational to Graph
Red Hat BPMS & Drools	Forward and backward chaining rules, process definition and control
Red Hat HornetQ	JMS Queue persistent multi-threaded input and output (publish-subscribe)
Gigaspaces	Data Grid
Apache UIMA + Solr	Natural Language Processing, Semantic Searches, Content Analytics
Norsys Netica	BBN
Franz Allegrograph	Triple Store (RDFS)
Apache Cassandra	Time series data store