BIG DATA & ANALYTICS – WHAT SHOULD YOU BE DOING?
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TOLLING. MOVING SMARTER.

PRESENTATION OBJECTIVES

- Setting the scene – the importance of tolls and the impending data wave

- Explain the Kyra Solutions perspective on Big Data

- Explore the value of big data

- Describe ways in which data analytics can affect toll performance

- Provide a "starter set" of analytics for your toolbox

THE GROWING POPULARITY OF TOLLING!

THE IMPENDING DATA WAVE: PROBES AND SENSORS

Ford Fusion Energi plug-in hybrid

Google's autonomous vehicle: 1GB/Sec

"……….has more than 145 actuators, 4,716 signals, and 74 sensors to monitor the perimeter around the car as well as the car's functions and driver responses.

These sensors produce more than 25 gigabytes of data hourly from more than 70 on-board computers that analyze it in real-time." if all vehicles in the USA did this, then it would generate………

2 Zetabytes per year across the USA

Currently, the San Diego Association of Governments (SANDAG) I-15 Integrated Corridor Management (ICM) project generates

1 Terabyte per day

What about toll back offices ?

BIG DATA : THE KYRA SOLUTIONS PERSPECTIVE

- Data has become too large and complex to process with traditional applications. (DRIP)

- With the growing number of AV/CV's, data will increase exponentially in:
  - *Volume*
  - *Velocity*
  - *Variety*
  - *Variability*
  - *Vulnerability*

- Will need data collection and distribution to/from the vehicle!

Considerations

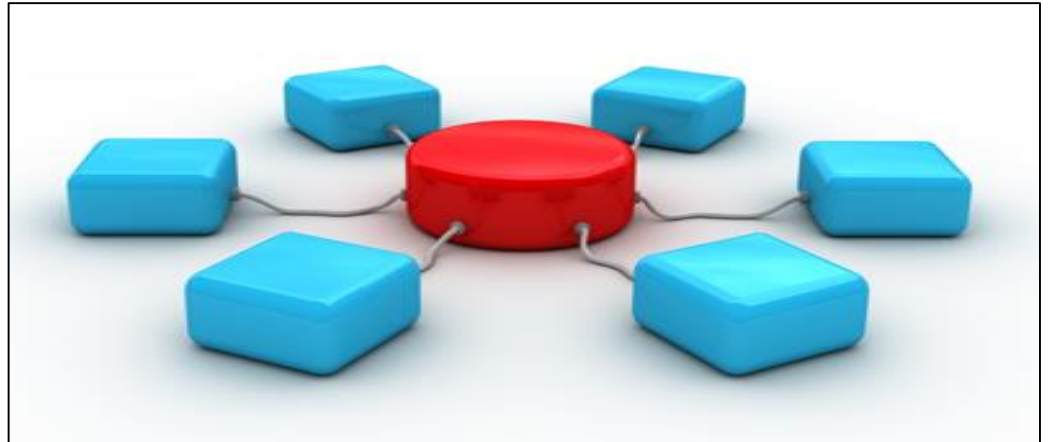**Economics:** increased amounts of data you can afford to capture

Tools: uncover insights/quickly find the signal in the noise, from new non-relational data types

Architecture: an ecosystem for both old & new tools on old & new data (i.e. right tool for right job)
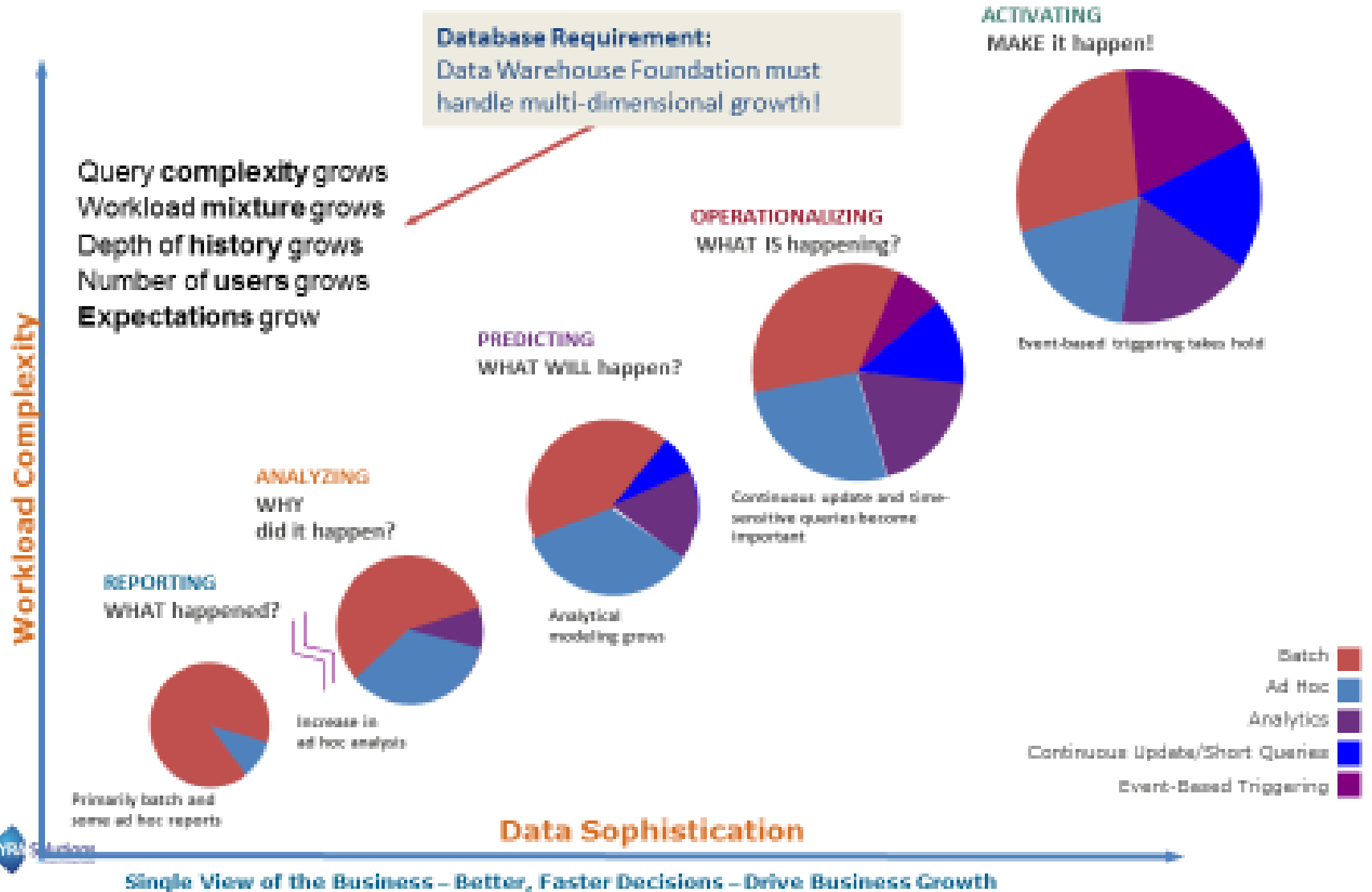
New analytics: new options for developing unique insights by coupling non-relational with existing relational data, thru text, graph, "path" & statistics analytics

WAYS IN WHICH DATA ANALYTICS CAN AFFECT TOLL PERFORMANCE

- Provides new insights and understanding

- A step towards traffic management automation

- Integration of multiple toll data sets, both internal and external

- Harnessing the power of data for safety, efficiency and customer service

- Defining useful analytics

- Identifying actionable insights and response strategies

TURNING BIG DATA INTO "ACTIONABLE" INFORMATION IS THE KEY

Database Requirement:
Data Warehouse Foundation must handle multi-dimensional growth!

Query **complexity** grows
Workload **mixture** grows
Depth of **history** grows
Number of **users** grows
Expectations grow

Workload Complexity (vertical axis)

Data Sophistication (horizontal axis)

REPORTING
WHAT happened?

Primarily batch and some ad hoc reports

ANALYZING
WHY did it happen?

Increase in ad hoc analysis

PREDICTING
WHAT WILL happen?

Analytical modeling grew

OPERATIONALIZING
WHAT IS happening?

Continuous update and time-sensitive queries become important

ACTIVATING
MAKE it happen!

Event-based triggering takes hold

Legend:
- Batch
- Ad Hoc
- Analytics
- Continuous Update/Short Queries
- Event-Based Triggering

Single View of the Business – Better, Faster Decisions – Drive Business Growth

• THE FINE PRINT….

"What you will see on the next 2 screens will not be readable from your chairs!"

- We will introduce a "starter set" of Toll Data Analytics that are yours to take home…free of charge. (See me for a copy)
- We would like to develop steps for our industry towards the creation of a tolls data lake to benefit all players.
- We need help from you in identifying those analytics that would be the most valuable.

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TOLL USE CASES: SAFETY AND USER EXPERIENCE

Aarea	Use Case Label	Use Case Description	Objectives	Analytics Proposed
safety	Safety management	Managing the overall safety of the operation including crashes and incidents and monitoring the effectiveness of safety management and imprdvement programs based on data and effective understanding	**Improve safety** **Increase the efficiency and effectiveness of safety management** **Increase the efficiency and effectiveness of incident management**	Dollars invested in safety programs as a proportion of the number of crashes Dollars invested in incident management programs as a proportion of total number of incidents Number of incidents by date, time of day and location Number of fatalities by date, time of day and location Number of dollars spent on safety per year per trip Number of dollars spent on safety per year as a proportion of total toll revenue Average incident response time by date and time of day Average incident clearance times by date and time of day

Aarea	Use Case Label	Use Case Description	Objectives	Analytics Proposed
user experience	customer relationship management	Managing customer relationships and expectations using data and analytics and social media analysis techniques	**Understand user perception** **Improve customer relationship management** **Improve customer perception of the toll operations** **Communicate to users the value returned for the total** **Understand customer behavior and develop appropriate strategies**	Return on toll User satisfaction per location Change in user satisfaction in work zones Customer distribution by location

- Kyra Solutions has worked with leading toll professionals, data scientists, and subject matter experts to define this initial list
- We would like to work with a range of agencies to expand and enhance it

TOLL USE CASES: EFFICIENCY

Aarea	Use Case Label	Use Case Description	Objectives	Analytics Proposed
Efficiency	Financial management	Stewardship of expenditure on capital and operations through a detailed understanding of the effects of investments	**Increase efficiency** **Optimize expenditure** **Understand effects of investments** **Understand future investment needs** **Understand distribution pattern for expenditure** **Understand the relationship between needs and expenditure**	Comparison of problem areas to investment patterns Cost of fraud is a proportion of total revenue Cost of enforcement as a proportion of total revenue Average toll per trip per vehicle class Toll revenue per region Toll revenue per electronic toll collection point Total revenue by vehicle class Total revenue by roadway segment Total revenue by lane Total revenue by time of day Total revenue by method of payment Total revenue by electronic toll collection point Average toll amount by electronic toll collection point and vehicle class Average number of toll collection points per trip per vehicle class Average length of trip per vehicle class Average toll per mile per vehicle class Toll revenue growth rate by toll collection point, lane and vehicle class Transaction growth rate by toll collection point, Lane and vehicle class Nonrevenue transactions by toll collection point and vehicle class Proportion of business users to others Transaction cost per payment type Financial trends – revenue and expenses as a proportion of total budget Variance between expected and actual traffic volumes by month by toll collection point toll agency bond rating Toll agency debt service coverage rating
	Operational management	Management of day-to-day operations based on data and an understanding of the mechanisms and patterns	**Increase efficiency** **Optimize expenditure** **Understand effects of resources and processes** **Detect underlying trends, patterns and mechanisms and appropriate response strategies**	DMV license data accuracy compared to required accuracy Proportion of payments through different payment channels Cost of each payment channel Cost of department operations as a proportion of total revenue Average travel time from milepost to milepost Average travel time from exit to exit Average travel time between top 10 origin destination pairs Variability and travel time from outpost the milepost Variability in travel time from exit to exit Variability and travel time between top 10 origin destination pairs Speed variability compared the number of occurrences and locations Travel time reliability index – average travel time reliability across the toll network compared to historical average Yearly operational expenditure as a proportion of total revenue Yearly operational expenditure by operations type and date Yearly operational expenditure by roadway segment

WHAT NEXT?

- Dialogue on analytics
- Discussion on use cases
- Determining the steps towards the creation of a tolls data lake
- Harnessing the power of Big Data and analytics for tolls
- Opens the ability to partner and exchange data with key third parties.

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World class reporting can only ever make you a well-informed spectator at the game

Analytics will empower you to be a coach and influence the **performance** of the team

THANK YOU!