ACDSS – Variable Objective Multi Regime Adaptive Control

ACDSS

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Adaptive Signal Control – another one? !

WHY and What?

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Signal Control: a Historic Perspective

- **Early days.**
  - In the early 1900's, hand signs and semaphores
  - Interconnected traffic signals, 1917, Salt Lake City
  - Electrically interlocked system, Houston, 1922
  - Other historic milestones

- **The years during the 1920's-1930's witnessed introduction of fixed-time control and later actuated signal control.**

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Signal Control: a Historic Perspective

- **Major paradigm shift in the 1950's – 1960's.**
  - Digital computers performing centralized control
  - 1960~1963, the first urban traffic control system, in Toronto
  - 1967, FHWA initiated UTCS

- **Since 1970's, continued R&D of computerized signal optimization models led to adaptive signal control.**
  - Addressing short-term variations, long term pattern drifting
  - Various systems

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Signal Control: a Historic Perspective

- **In the past decades, the need for more intelligent signal control are marked by two parallel threads:**
  - Active R&D on real-time signal optimization algorithms, based on traffic engineering concepts, or burrowed ideas from other disciplines
  - Advancement of relevant ITS technologies
- **The two threads are promoting and encouraging each other**
  - New control concept/algorithm demands new types of data, while emerging ITS technology promoting new control concepts, ideas, and algorithms.

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ACDSS – Genesis, and the Vision

- **In 2007, as part of NYC's efforts upgrading its ITS infrastructure, a new adaptive control system was envisioned:**
  - The system has to be comprehensive, in that it should be able to address a wide range of traffic flow conditions, from light traffic, to oversaturated;
  - The system has to be variable-objective, in that it is *NOT limited* to any single optimization objective, but the control objective is variable based on traffic flow conditions;
  - The system has to be able to handle various geometric types, arterial, diamond interchanges, grid network, critical intersection etc;

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ACDSS – Genesis, and the Vision

- **Most importantly, the envisioned system should be FUTURE proof**
  - New control concepts/algorithms can be easily added to the system, when needed, as needed;
  - New data types can be incorporated in real-time control as soon as they are available;
  - Interface with central ATMS, to be employed as Active Traffic Management, or ***REGIONAL*** adaptive control;

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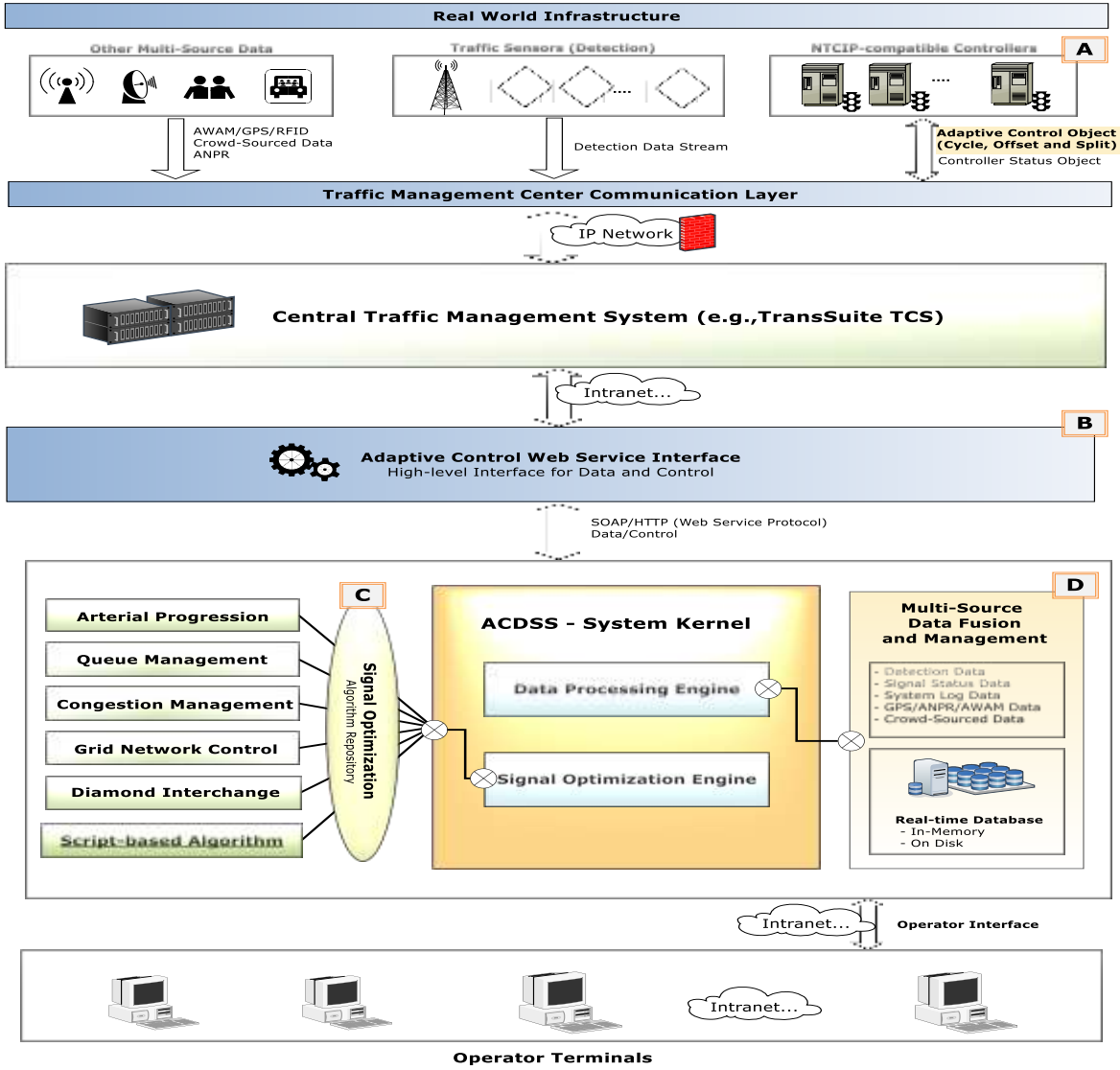
ACDSS – Design



High-Level Interface

- **Web Service Interface**
  - It is a high-level abstraction of data and control
  - Relieving the ACDSS kernel from directly dealing with the raw NTCIP communication with the field devices such as controllers or sensors
  - Allows adding new functionalities (“services”) easily, without affecting existing functionalities. For example, new adaptive control functionality can be added later that supports new type of adaptive signal control using Connected Vehicle technology

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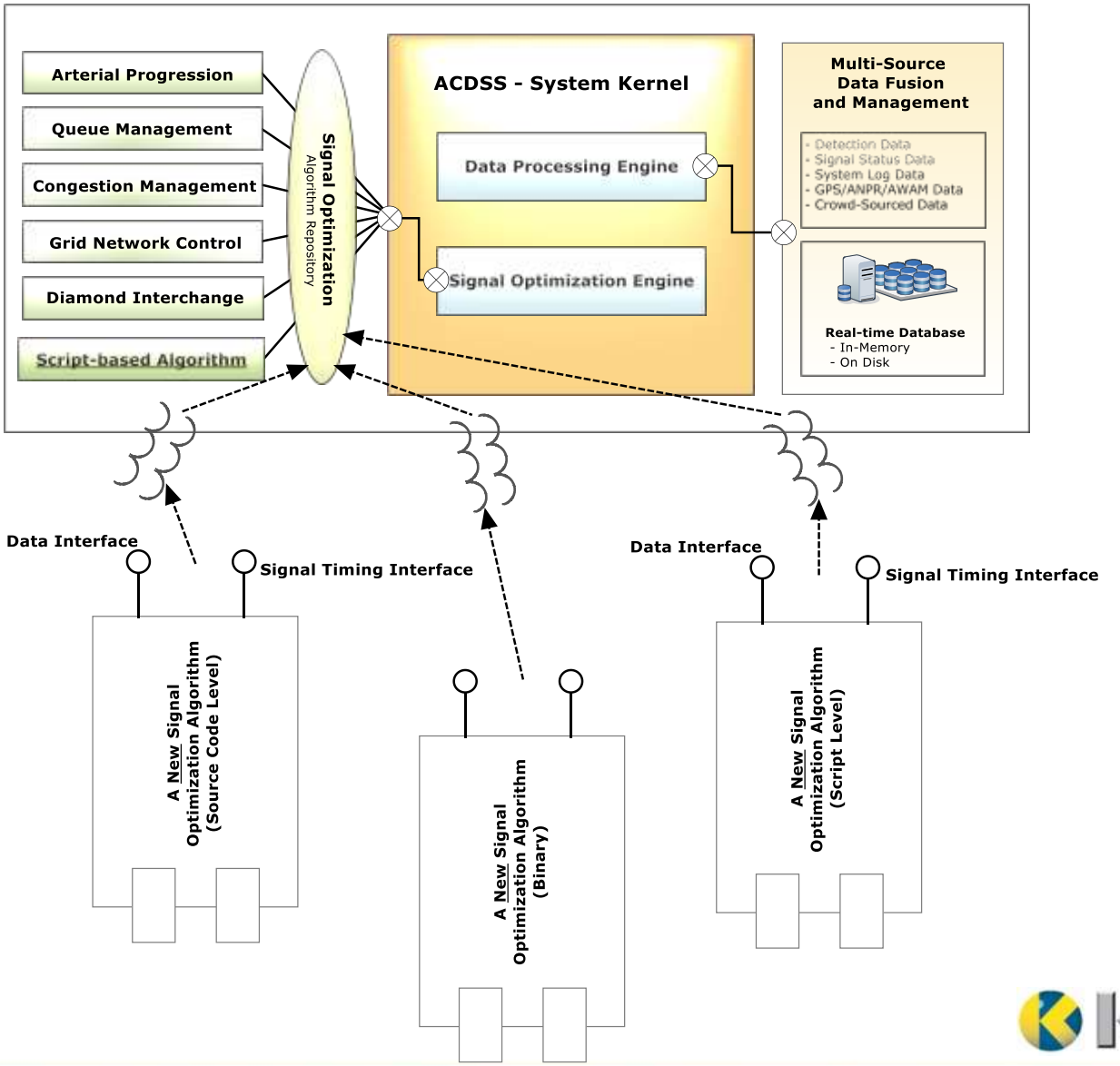
Optimization Alg. Repository



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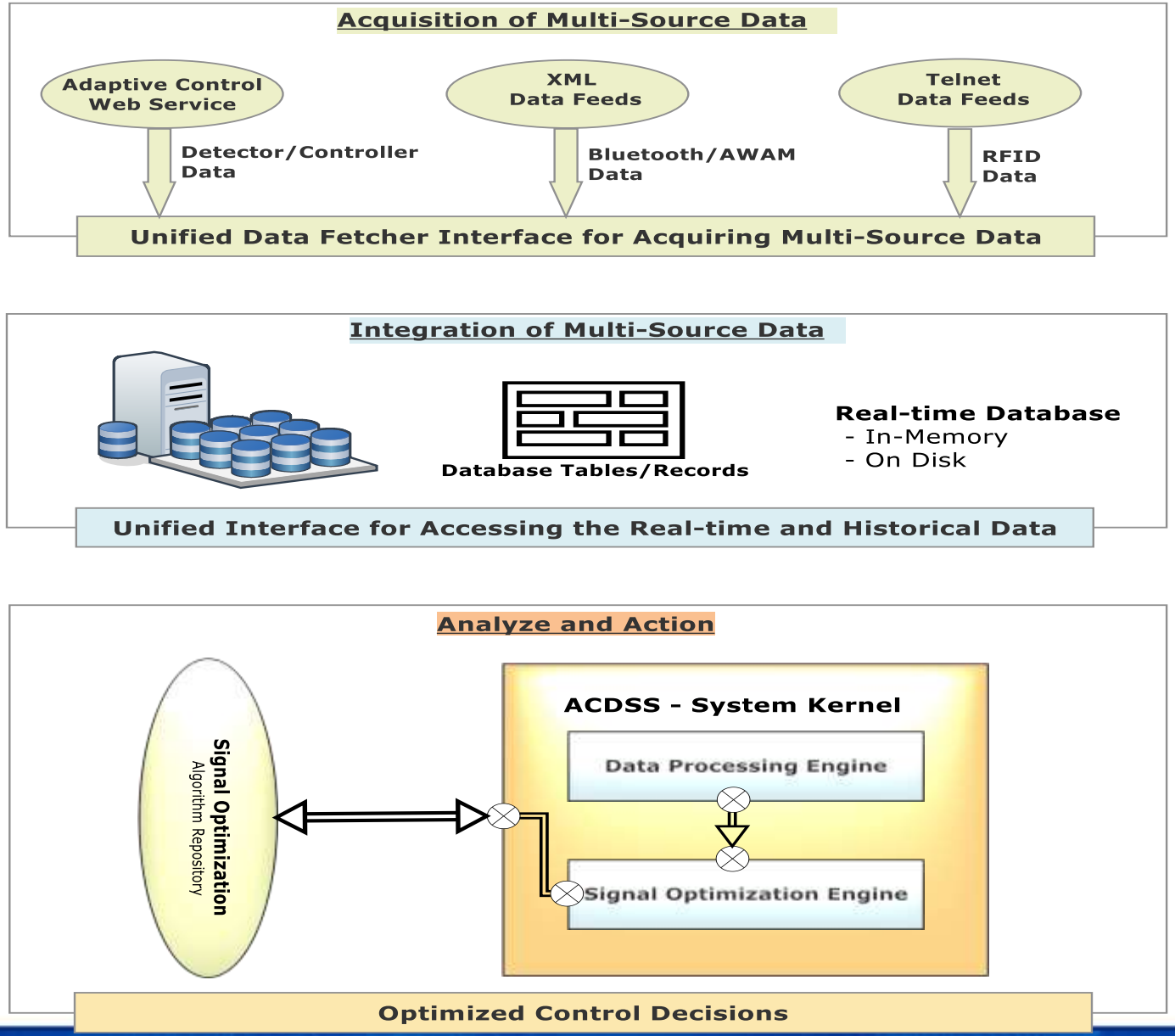
Multi-Source Data Fusion& Management



ACDSS - Recap

- **Three designs, distinguished from others**
  - High-level abstraction of Control and Data
  - Multi-source data fusion and management
  - Signal Optimization Algorithm Repository
- **The ABOVE are extremely important, for a system**
  - Providing solution for effectively addressing existing problems, while
  - Prepared for the future with new technological advances

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Thank you

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