Multi-Sector Urban System Initiatives

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Regional Approaches to Urban Sustainability
A National Academies Workshop
Portland, OR – May 28-29, 2013

From Engineering Efficiency to a Science of Cities

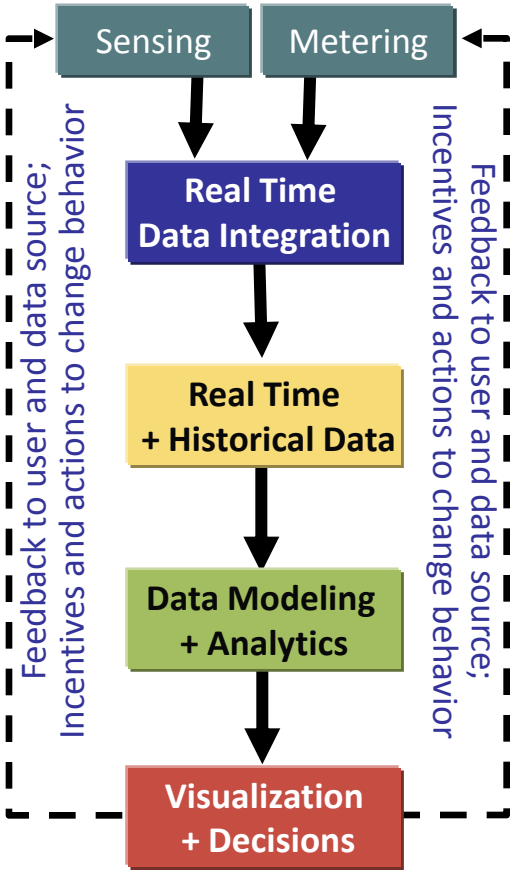
- 2005-7 Life on an Instrumented Planet
- 2008-10 Integrated, sustainable urban systems
- 2011- Sustainable and resilient urban systems
- 2012- People and urban systems
  A Science of Cities

Life on an Instrumented Planet

Improved performance derived from data and models to increase efficiency and effectiveness

- The world's resources are finite
  - Energy – cost, GHG emissions
  - Water – "no cost", Tragedy of the Commons
  - Space – roads take 20% of space
- Technology is cheap and available
  - Billions of sensors
  - Pervasive networks
  - Capacity to store and analyze
- Need to close the loop
  - Price signals
  - Social Computing
  - Behavioural Economics

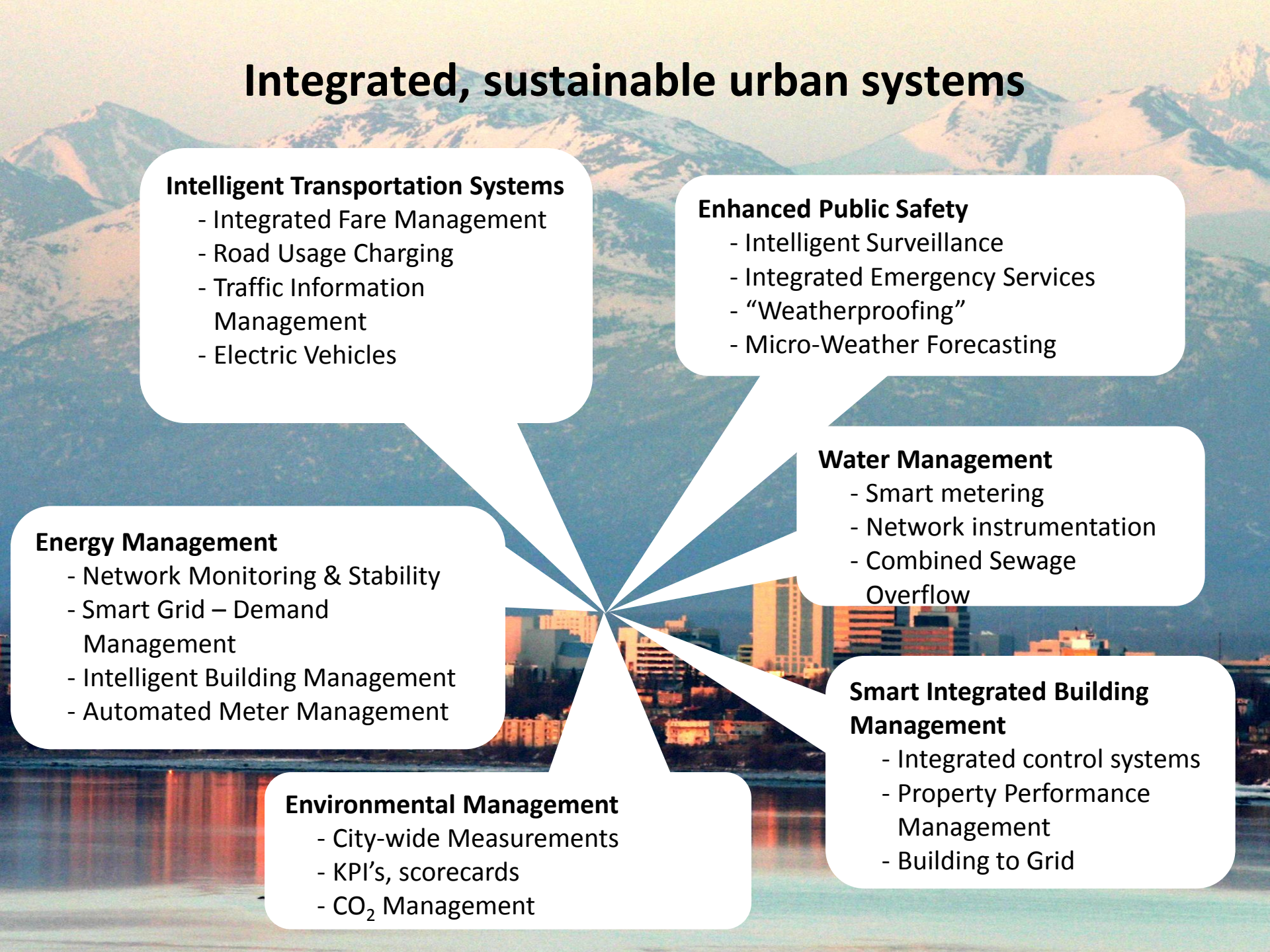
Measuring, Monitoring, Modeling and Managing



- **Data collection**
- **Data Integration**
- **Comparison of historical data, with newly collected data**
- **Data modeling and analytics to create insights from data to feed decision support and actions**

Source: "Instrumenting the Planet", IBM Journal of Research & Development, March 2009

Integrated, sustainable urban systems



Intelligent Transportation Systems
- Integrated Fare Management
- Road Usage Charging
- Traffic Information Management
- Electric Vehicles

Enhanced Public Safety
- Intelligent Surveillance
- Integrated Emergency Services
- "Weatherproofing"
- Micro-Weather Forecasting

Water Management
- Smart metering
- Network instrumentation
- Combined Sewage Overflow

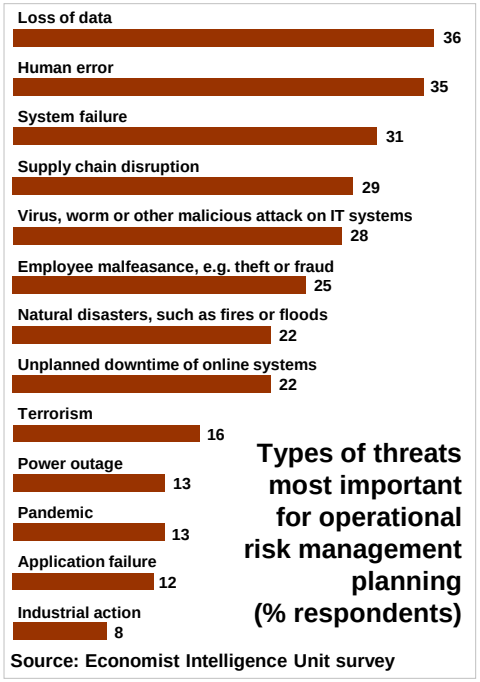
Energy Management
- Network Monitoring & Stability
- Smart Grid – Demand Management
- Intelligent Building Management
- Automated Meter Management

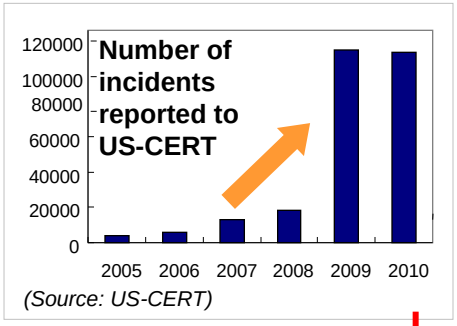
Smart Integrated Building Management
- Integrated control systems
- Property Performance Management
- Building to Grid

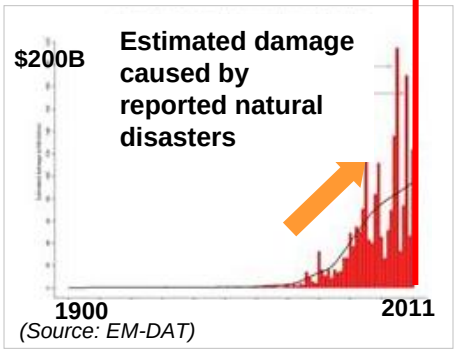
Environmental Management
- City-wide Measurements
- KPI's, scorecards
- CO_2 Management

Sustainable and Resilient Urban Systems

Natural disasters, human error, cascading failures, and cyber-security attacks highlight the complexity and fragility of our global society, its businesses and infrastructure

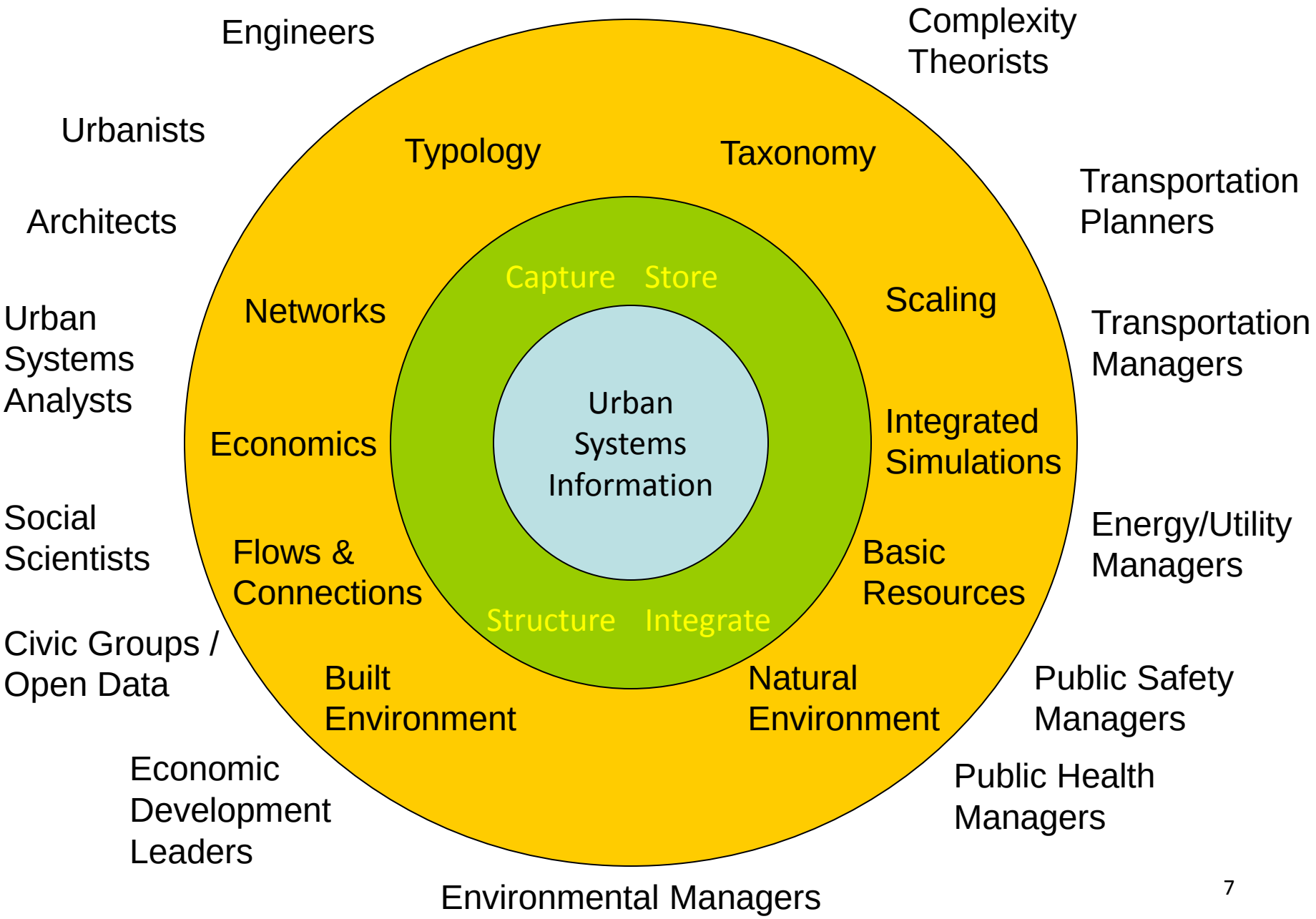






People and Urban Systems

A Science of Cities



Closing thoughts…the City as a Design Problem

- Cities are and always have been information processing systems.

- Cities today are both the source and the solution of many of our global society's challenges.

- Given the increasingly rich pathways between and among urban systems and people for digital information….what would Steve do?

Thanks for your attention!

Global Systems Science Challenges for Urban Systems

1. Formal representation of Urban Systems
   - Structures of components
   - Interactions (P2P, P2S, S2P, S2S)
   - Inter-dependencies (P<-S, S<-S)
2. Spatial, Temporal, and Domain Integration
   - "Single View of the Truth"
   - What real-world problems are we trying to solve?
3. The Need for Flower Collecting
   - Patterns & Principles to simplify model building
4. Scientific Modeling and Practical Modeling
   - Understanding and insight
   - Support for decision-making
   - Rule of one hand – tipping points
5. Resource consumption & production
   - Natural and Man-Made resources
   - By-products, waste
   - Economic outcomes
6. View of "what is the City trying to do?"
   - "Real-time" sensing of interactions, resource consumption & production
   - Match between intention and capabilities
   - City as a Design Problem – How well does it work?
7. Transformation of how the city works
   - Transition from Industrial Age to Information Age
   - Planning for One