LA Area Traffic Management and Big Data and Connectivity

- 8:00 - 9:00 Check-In/Breakfast (Hosted by IPAM)
- 9:00 - 9:15 Joe Butler (UC Berkeley PATH) Thoughts on the Future of Traffic
- 9:20 - 9:35 Samson Teshome (California Department of Transportation, Los Angeles) Integrated Corridor Management at Caltrans
- 9:40 - 9:55 Christian Claudel (University of Texas at Austin) New data sources
- 10:00 - 10:15 Montasir Abbas (Virginia Polytechnic Institute and State University) Incorporating Class-of-Service into Network Control
- 10:20 - 10:35 Alan Clelland (Iteris Inc.) An industry perspective
- 10:40 - 10:55 Break
- 10:55 - 12:15 Panel Discussion (Fred, Jane, Steve, Allen, Ed)
- 12:15 - 1:15 Lunch (Hosted by IPAM)

- 1:30 - 5:30 Field Trip to Caltrans Los Angeles Traffic Management Center

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Thoughts on the future of Transportation

IPAM-Institute for Pure and Applied Mathematics

October 7, 2015

What might affect transportation?

- Demographics
  - Aging and growing population, mega regionalization, virtual/cloud based communities
- Culture
  - Sustainability, immediacy, ceding of decisions to machines, sharing economy, civic tech
- Technology
  - Connectivity – Augmented and Virtual Realities
  - Robotics – Will solve the “last foot” problem
  - Flight - Drones and personal transportation
  - Pervasive Intelligence – Requires greater governance

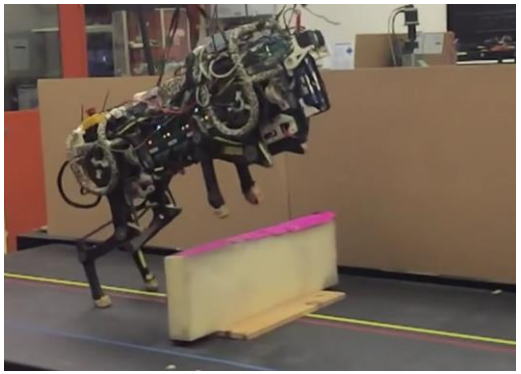
Virtual and Augmented Reality

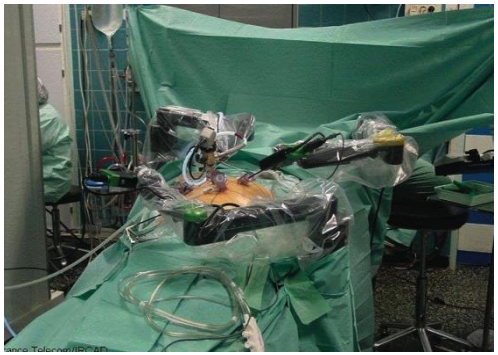
VR/AR is expected to be a 150 Billion Market by 2020
The technology that will replace your phones and possibly your cars

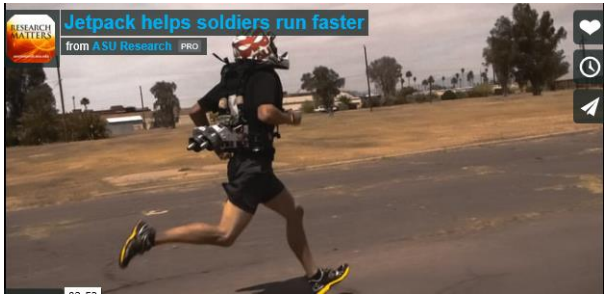
AR - Combined with robotics permits telepresence for physical work
VR – Permits telepresence for mental work
Combined they create a true virtual work space

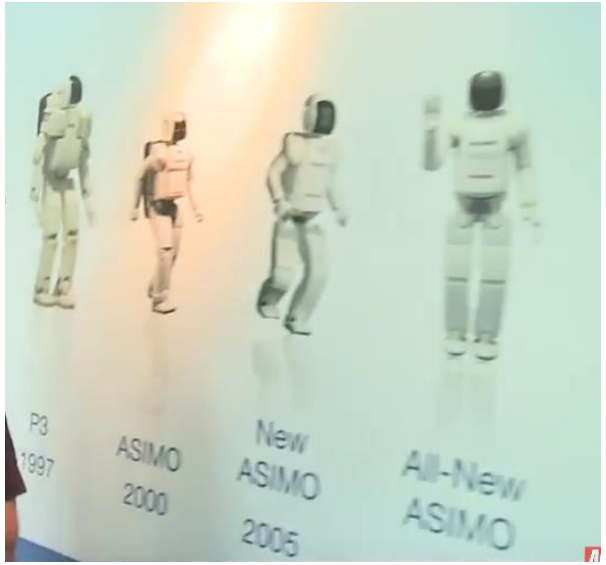
Potentially much less physical travel

Robotics









Robotics will help solve the “last foot” problem

Flight takes off

Martin Jet Pack

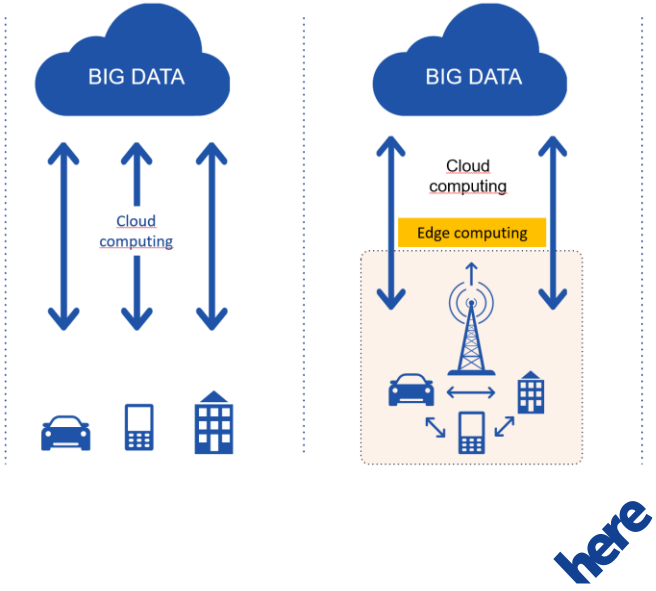
Drones

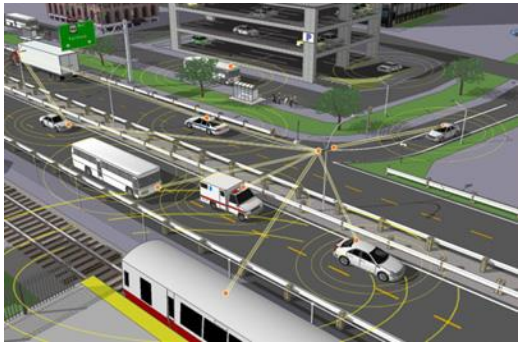
NASA study: Air taxis could be affordable, convenient

Drones growing by 200,000 per month

ITOP and Intelligence

- Internet of Things, Organizations and People
- Cloud to Edge Computing
- Distribution of Intelligence
- Multiplying of Intelligent Agents





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Intelligence - Cooperating or Fighting

- Intelligence
  - Needs information
  - Needs guidance (governance)
  - Tends to think its way is correct
  - Is able to be manipulated (a form of hacking)

Enhanced Decision Support

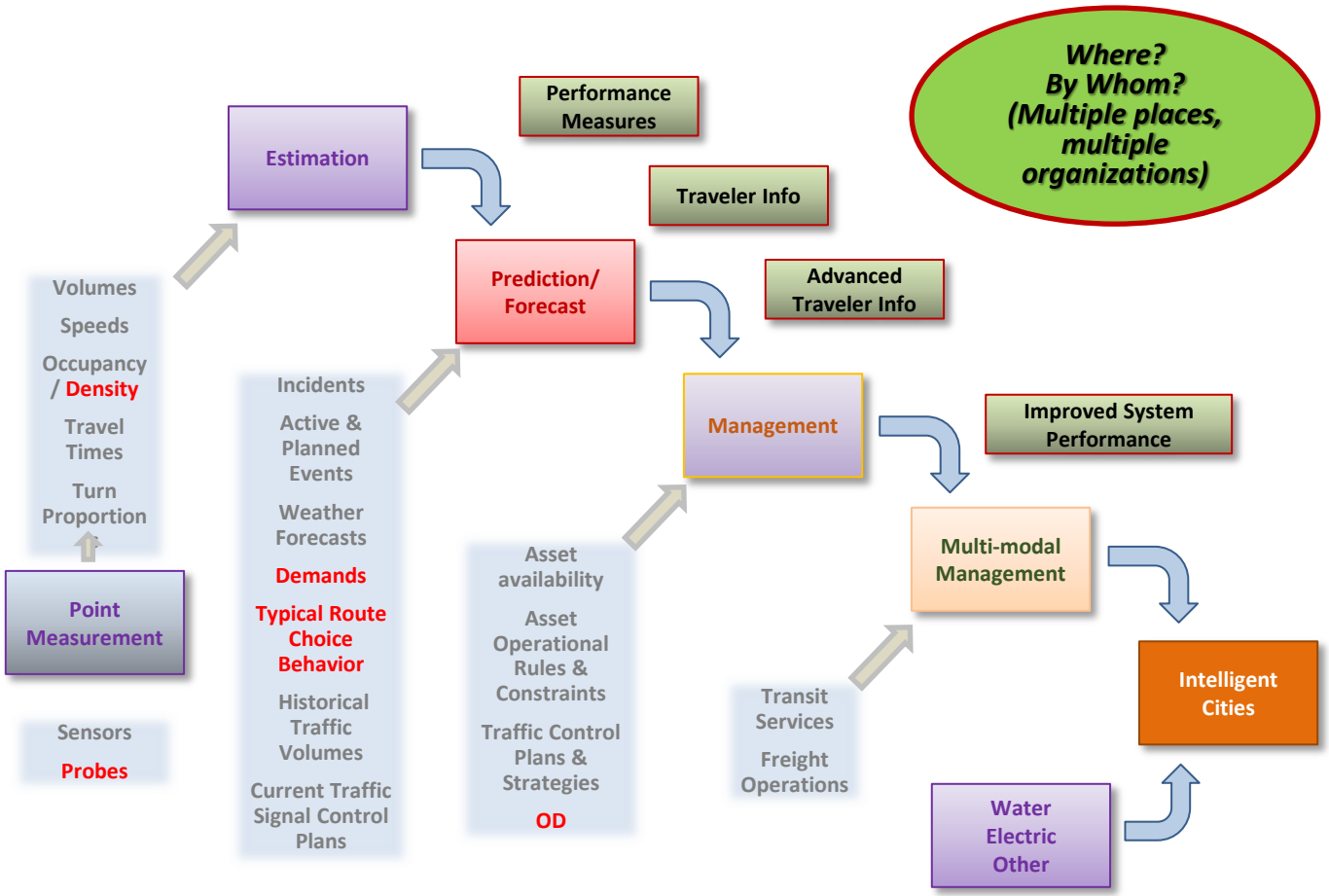
- Helps to set overall agendas (governance)
- Ensures data quality for good decisions
- Looks for manipulation and hacking
- Can work with non deterministic systems and goals

Suggested Transportation Research Areas

- Quality of results – Need probability distributions
  - How good is the data
  - How accurate are the estimations and predictions
  - How likely is it that the control or advice will work
- Deciding – How to make a good decision
  - We have machine learning, AI, inference, etc but how do combine these to suggest a decision (choose control options) with an error bound
- Control – How to control non deterministic systems with multiple goals and many control points

- We need University courses to train transportation professionals in data driven management
- Can we start papers with “Assuming we have sort of reasonable data…”

Missing Information



Here to There 2.0

Intelligent Systems - ITOP			Simularity			Multideminsionality	
Intelligent Components	**Big Data**	**Pervasive Communication**	**Everything just wants to move**	**Everything can move something**	**The First and Last Foot Challenge**	**Multi-Modal /3D**	**Multi Dimensional Demand**
Vehicles and ITS components and becoming intelligent. How do we manage and utilize this.	All availalble data is not being used, effectively and quality needs to be better managed	The Internet of Things is here. How to use this to gather data, provide decision support and enable distributed decision making	People, packages and freight are separately managed leading to inefficiencies in the system	The system is not efficiently using all components to deliver people, packages and freight	How do we get packages and disabled people the first and last foot	Systems are not effectively managed as true multimodal. Drones and personal flight are coming	Demand is also energy, pollution, safety, etc not just vehicles per hour
Research distributed intelligence systems	Bring new algorithms and data sources into play.	The rapid exchange of information focused on system management	Build optimization routines assumming everyone / everything is freight	Algorithms that use the system as a whole to transport people and goods	Utilize all system components including people to help solve this problem	Build management sytems based on true multi-modal.	Build multidimensionality into our processes, algorithms and tools

Here to There 2.0

Decision Complexity			Infrastructure		Adoption		
Soltions are Socio-Technical in nature	**Decisions are distributed**	**Many Control Points**	**Resiliant distributed computing**	**Security**	**Performance Based Culture utilizing Decision Support Tools**	**Test Beds are Important**	**Common software platform**
Our systems are composed of people, busineses, organization and technology. We need Decision Support based on this and including demand mgmt	With so many intelligent actors decisions are made in many places	Not only many actors but many ways to influence transportation	There are computers everywhere. What should be processed and decided where.	Pervasive communication leads to both hacking and sabotage risks	Transportation agencies are not staffed, trained or cultured to do this	We do not have a testbed for testing out these ideas	Without standard tools it is difficult to involve multiple people in solving problems
Research this and build a decision support system based on this including effective behavioral influence	How to manage and guide a system of distributed intelligence and decision making	Understand the interaction between control mechanisms	Understand how to distribute computing needs in a dynamic world	How do design systems to reduce the risks	Change the culture and educational bedrock of transportation agencies	Turn the I-210 into a testbed, use other testbeds	Open source socio- technical decision support system with industry wide data sources

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Smart Corridor

Thank You

May 9, 2015