CICTP 2016

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User-centric flexible transportation systems

User-centric flexible transportation systems

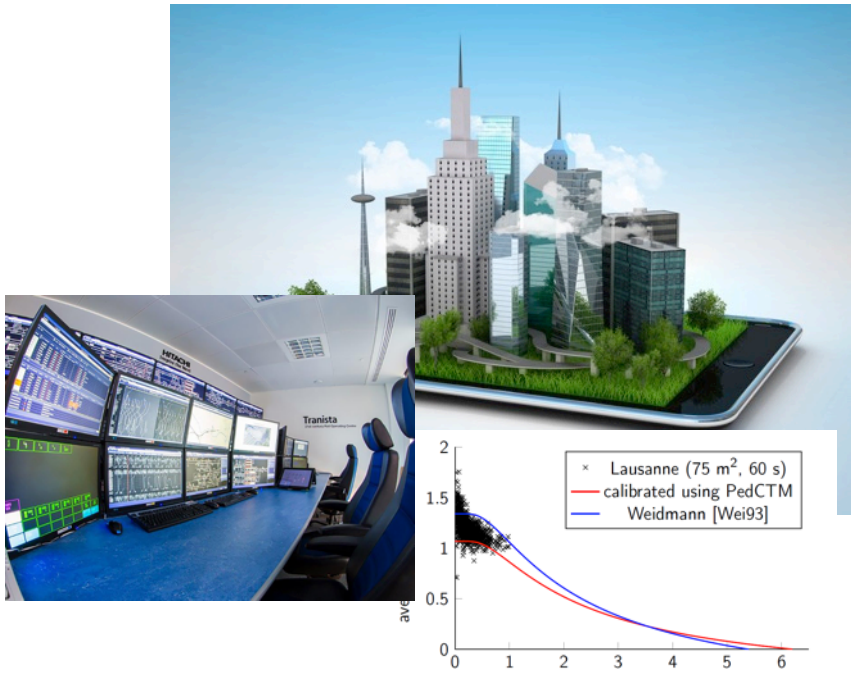
1) Concepts

- Demand
- Supply

2) Challenges

- Technologies
- Integration
- Optimization
- Business model

3) Research @ EPFL



Supply and demand

Supply

Before

Now

Demand

Before

Now

Supply and demand

Multimodality

2	Station/Stop	Time	Platf./ Edge	Travel with	Occupancy	Comments
	1350 Orbe, Chemin des Covets 51 Orbe, hôpital			walk		11 min.
	Orbe, hôpital Orbe, gare	dep 08:18 arr 08:21		BUS 685		Bus 685 91100 Direction: Orbe, gare
	Orbe, gare Orbe			walk		1 min., Y
	Orbe Chavornay	dep 08:26 arr 08:35	 Pl	R		Regio 26929 Direction: Chavornay 2
	Chavornay Renens VD	dep 08:38 arr 08:57	3 4	S 1	1. 2.	Urban train 1 12123 Direction: Lausanne
	Renens VD Renens VD, gare			walk		3 min., Y
	Renens VD, gare Ecublens VD, EPFL	dep 09:02 arr 09:08		M 1		Underground 1 Direction: Ecublens VD, EPFL

Duration: 1:01;
runs 31. May until 1. Jul 2016 Mo - Fr

Ecocalculator | Map | Calendar | Text view | Read out | Fully accessible connection | Price list

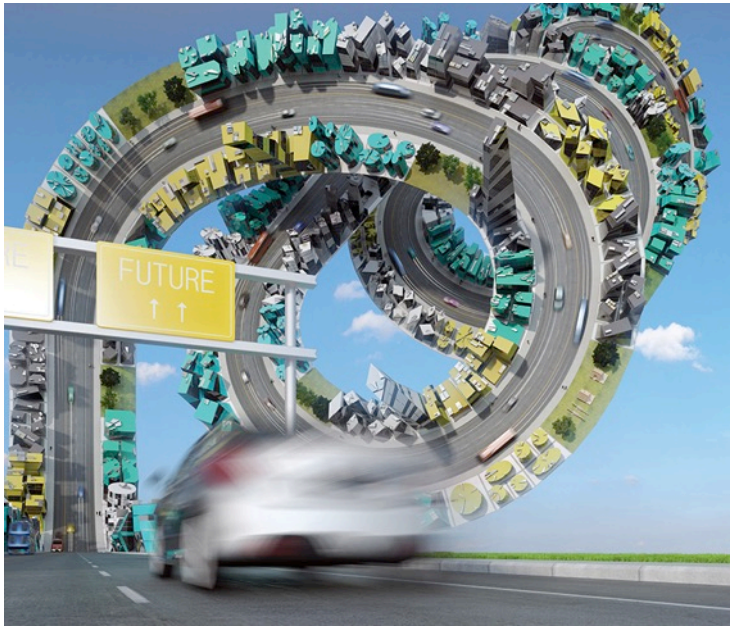
Show intermediate stops | Fare/Buy

Last mile

Supply and demand

Demand

Supply



User-centric

Flexible

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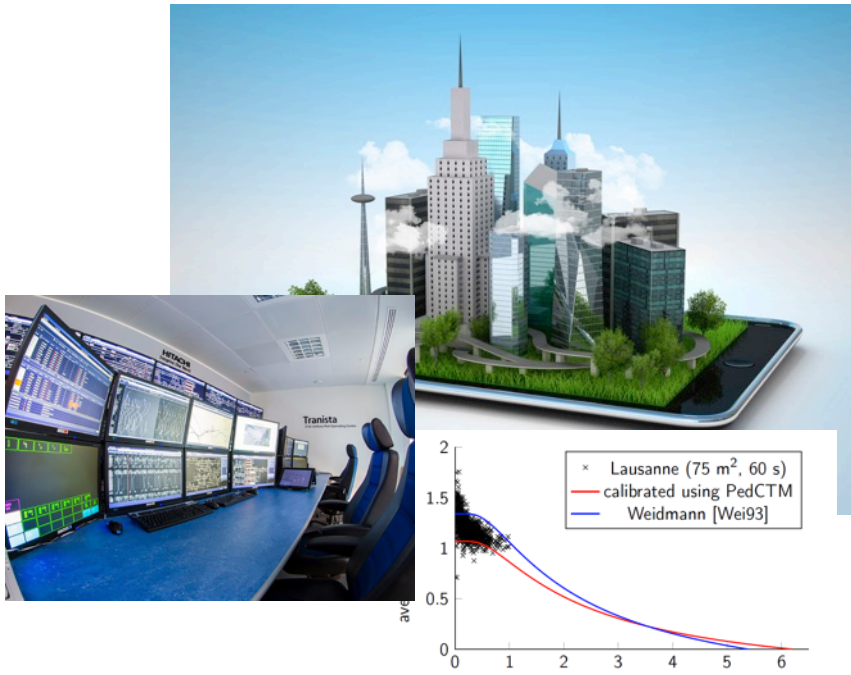
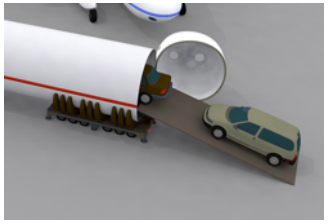
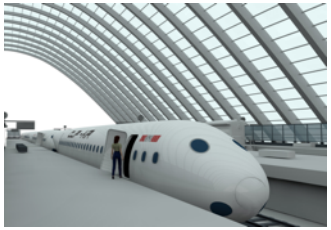


Challenges: technology



Load freight…



… or passengers at the train station…

… and take-off!

▶▶ Clip-Air

- Innovative aircraft with **detachable load units to adjust capacity to demand**
- Capsules: clipped on the flying wing, or carried on trains or trucks

→ **Partners@EPFL: TRANSP-OR lab, ICOM Lab, mechanical engineering labs and LIV Lab**

Challenges: technology

Switch inspection

Catenary inspection

Construction sites

- **Advanced "Detection & Tracking" and collision-avoidance algorithms** for unmanned aircrafts.
- New methodologies to **inspect** infrastructure

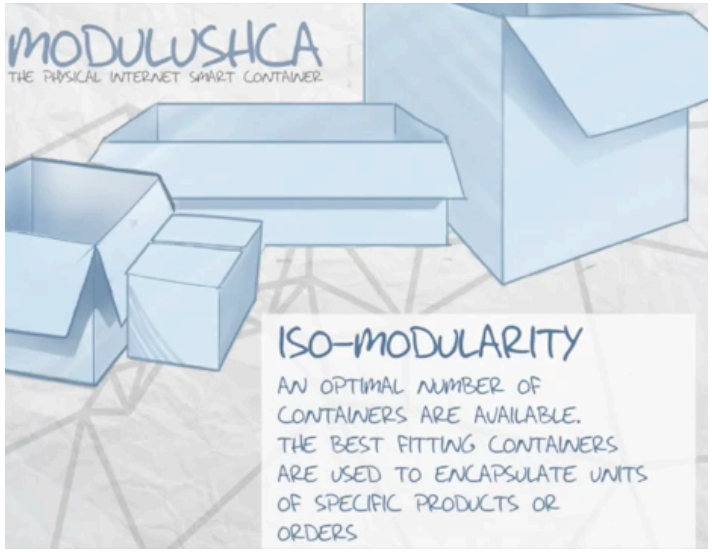
→ **Partners: CVLAB Lab, DISAL Lab, REACT Lab**

▶▶ Drones

Challenges: integration

Enable freight operations using …

… flexible modular logistics units

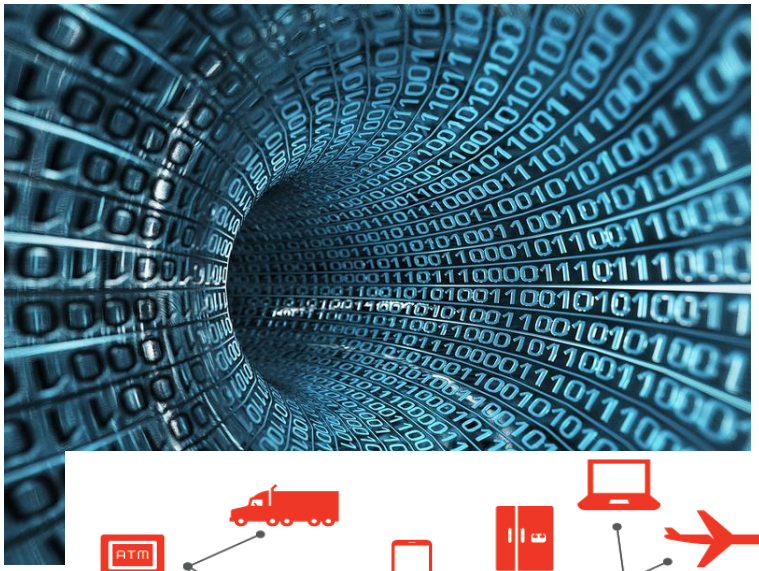


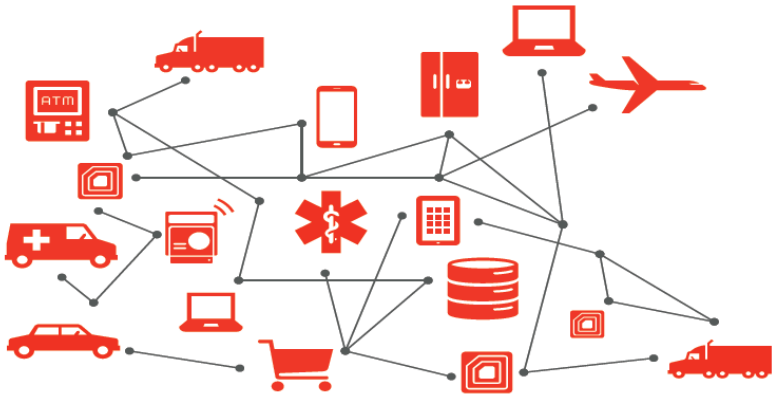
►► Physical Internet : modular logistics

- Iso-modular logistics units of size adequate for real **modal and co-modal** flows of fast-moving **consumer goods.**
- **Design robust** collaborative scheduling and routing schemes for interconnected logistics.

→ **Partners: PTV, Procter&Gamble, ARMINES, CIRRELT, TU Berlin, Italian Posta and EPFL (TRANSP-OR Lab)**

Challenges: optimization





- "Big data"
- Choice modeling
- **Customized services**

►► **Learn preferences and tastes…**
… for user-centric optimization

Défis : optimisation

Partners: ABB tpg

Collaboration HE-ARC

- **Objectives:**
  - Develop a **decision-aid tool** for the **dimensioning** and the **design** of a bus system operated with a fleet of “catenary-free” electric buses.
  - Optimize the **operational costs** and the **electricity consumption** of the system.
  - Conduct a **pilot study** on the bus line 5 between Geneva Airport and Geneva’s Hospital.

➢ **PI & Lab** Prof. M. Bierlaire, TRANSP-OR

Challenges: optimization

- Timetabling design
- **Minimize the costs**
- **Maximize user satisfaction**
- Trade-off between the two

$$\max \sum_{\ell \in L} \sum_{v \in V^\ell} \sum_{s \in S^\ell} \omega_{vs}^\ell \cdot e_s - \sum_{\ell \in L} \sum_{v \in V^\ell} \left(\alpha_v^\ell \cdot f \cdot k^\ell + \mu_v^\ell \cdot o \cdot k^\ell \right)$$

►► Calculate the best timetable…
…account for supply and demand

Challenges: business model

Who pays?

Who receives the money?

Reconcile cooperation and competition

How to use the revenues?

►► Generate, deliver and capture value

Challenges: business model

- Mobility pricing
- Tool for demand management
- Heterogeneity of needs
- Different willingness to pay

►► **Mobility Pricing**

Singapore

ERP

London

Stockholm

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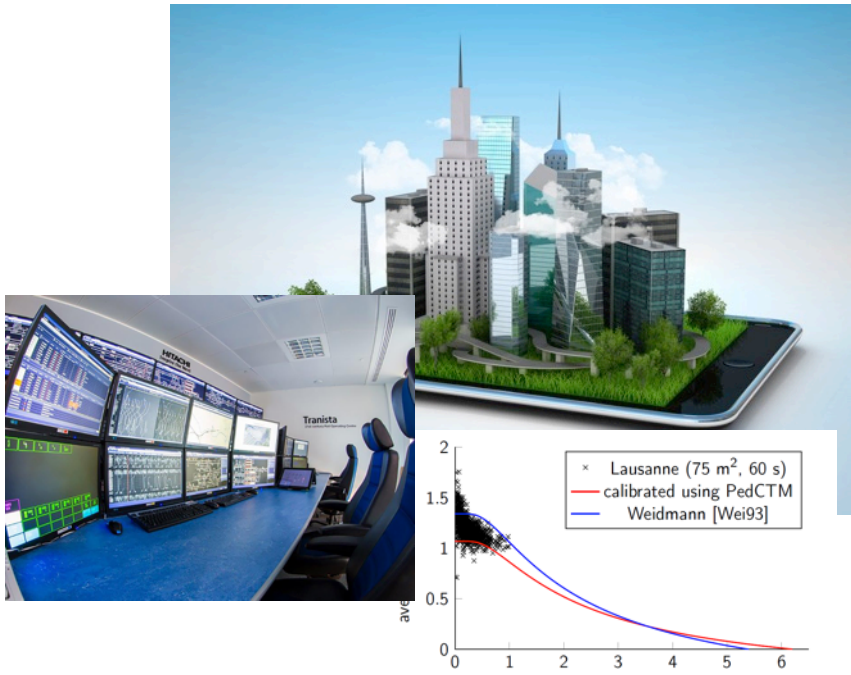


Transportation Center @ EPFL

Our three main divisions

Mobility behavior & transportation needs

Conception of transportation systems

Vehicles & infrastructures

Mobility behavior & transport needs

A demand-orientated axis

↓

To understand mobility needs and individuals' mobility behaviors.

- ✓ Demand modeling & prediction
- ✓ Pedestrian flow modeling
- ✓ Mobility behaviors

Conception of transportation systems

A system-orientated axis

↓

To optimize transport systems and to coordinate policies for transportation, land use, housing, etc

- ✓ Modeling of transport systems
- ✓ Intelligent Transport Systems
- ✓ Operation Research for optimization

Vehicles & infrastructures

A technological-orientated axis

↓

To improve safety, efficiency, sustainability of vehicles and infrastructures.

- ✓ Sensing & Intelligent vehicles
- ✓ Smart Grids concept solutions
- ✓ Energy efficiency / Energy recovery systems

CONCLUSION

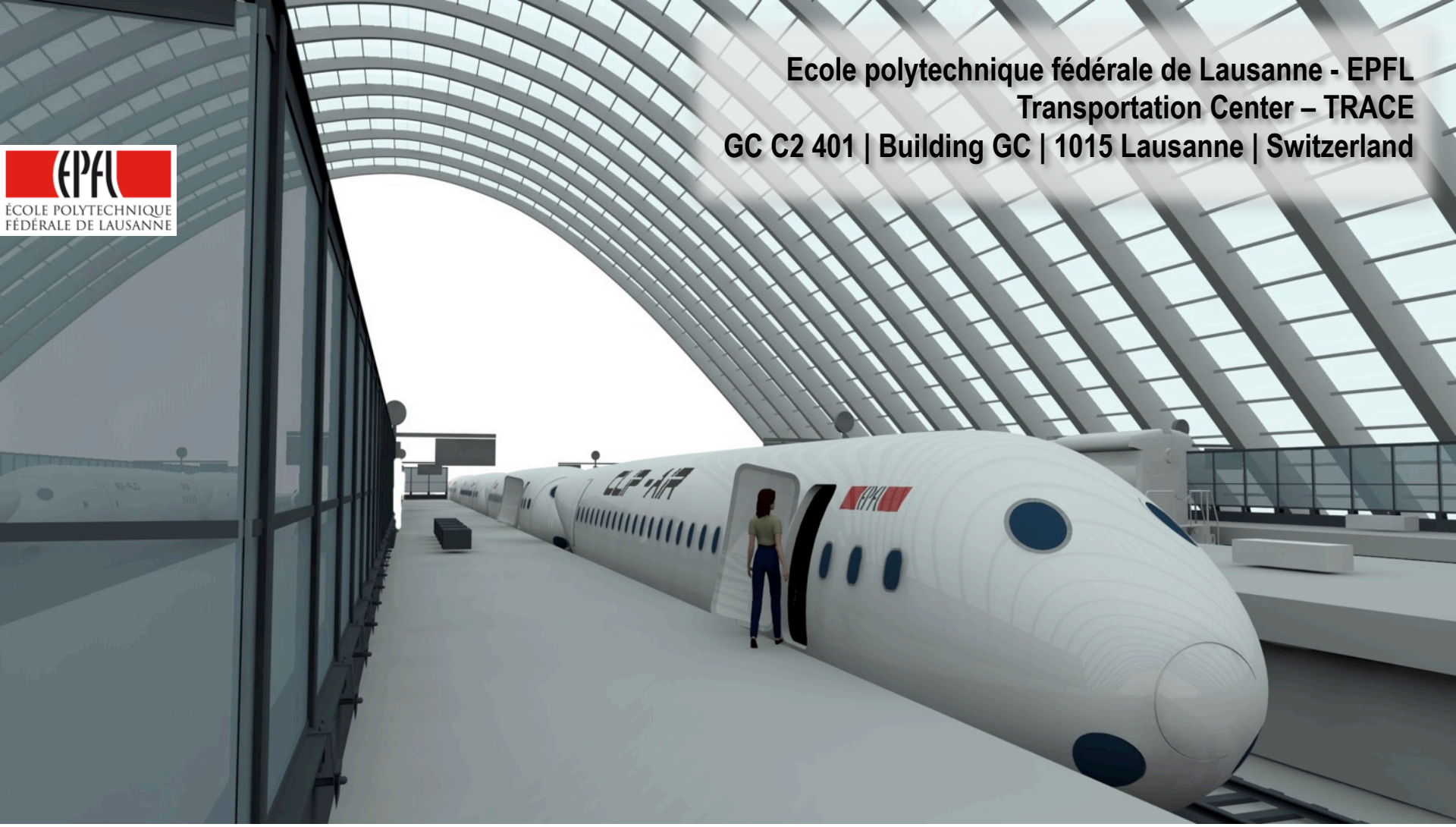
User-centric

New technologies – “big data”

Flexible

Standardization – optimization

Research is more and more important



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