

Urban Management Analytics

Emerging Research Efforts

Hoong Chuin LAU
School of Information Systems

Urban City Phenomenon



Congestion



Crowds

Resource Planning and Coordination for Sustainability



Queues



More Queues



URBAN MANAGEMENT ANALYTICS

THEME: Understanding, optimizing, and coordinating flows & interactions in urban settings



URBAN LOGISTICS

*Improving Freight Flow
e.g. last-mile multi-party delivery
coordination in a mega city*



URBAN LESISURE & TOURISM

*Improving Visitor Flow
e.g. crowd coordination/control
at theme parks, trade events,
expos, etc*



URBAN MOBILITY

*Improving Passenger Flow
e.g. last-mile passenger share-
riding at bus/MRT stations*



URBAN SAFETY & SECURITY

*Enforcement and Surveillance
e.g. deployment of patrols and
inspectors at crowded places*



URBAN HEALTHCARE

*Improving Patient Flow
e.g. dynamic queue control at
hospital emergency departments*

URBAN LOGISTICS

MULTI-PARTY LAST MILE DELIVERY COORDINATION

Funded by ASTAR's Collaborative Urban Logistics Programme



- Management of urban freight transport and distribution systems
- **The last mile** - transit of urban freight from the distribution center(s) to the city center (malls, offices and homes) – amounting up to 75% of total logistics costs in Singapore

- Stakeholders:

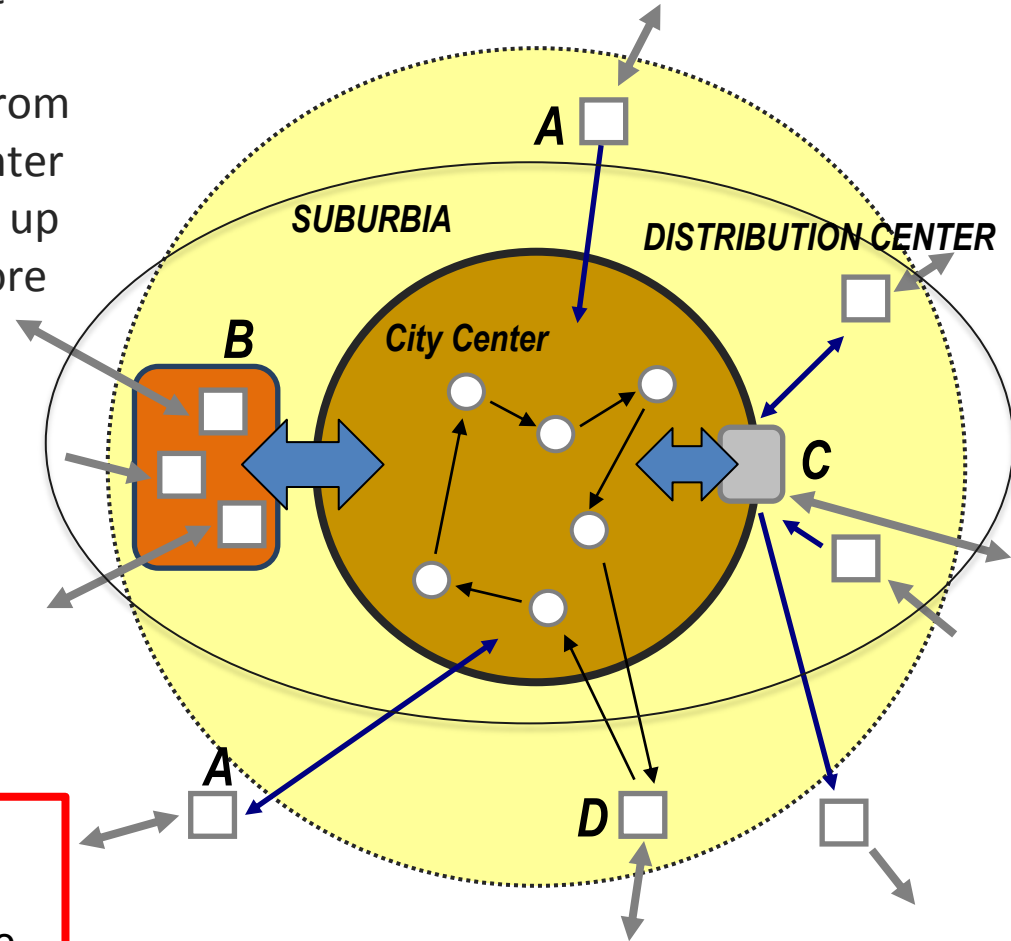
Government

1. Congestion and mobility
2. Environmental pollution
3. Safety and livability

Businesses

1. Sustainability (CSR)
2. Service level improvement

Mechanism designs and Optimization for getting business stakeholders (shippers, carriers, retailers) to collaborate to improve last mile delivery operations



URBAN MOBILITY

DEMAND-RESPONSIVE PUBLIC TRANSPORT SYSTEMS

Funded by NRF SMART's Future Urban Mobility Programme



Speed: 941

START STOP SETTING

PAUSE RESUME

Generation: Auto Load File

Batch: Single Multi

Interval: 600000

Tolerance: 0.5

Capacity: 4 #Taxis: 20

Lamda: 100.0

Taxis

Running: 20 Idle: 0

Demands

Waiting: 0 Served: 77 Expired: 35

Total: 112

Time

Global Time: Wed Jul 01 00:08:53 SGT 2009

Start Time: Wed Jul 01 08:00:00 SGT 2012

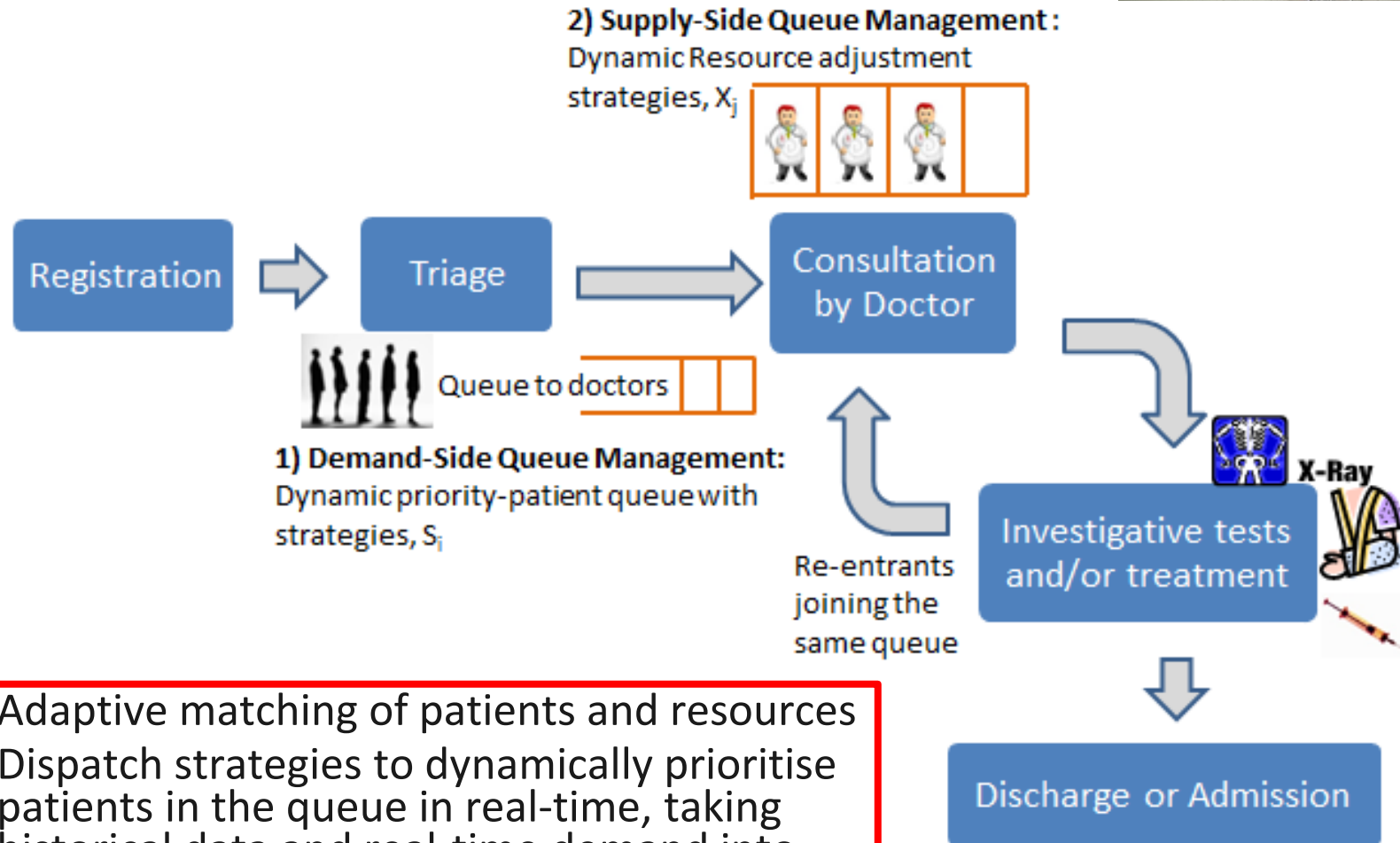
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- Optimized matching of taxi supply and passenger demand
 - Taxis and passengers are self-interested
 - Last-mile passenger ride-sharing mechanism design
 - Online demand-aware routing under stochastic demands
- Agent-based simulator to evaluate new policies and control mechanisms

URBAN HEALTH-CARE

DYNAMIC QUEUE CONTROL FOR EMERGENCY DEPARTMENTS

Interactions with Khoo Teck Puat Hospital and other hospitals



- Adaptive matching of patients and resources
- Dispatch strategies to dynamically prioritise patients in the queue in real-time, taking historical data and real-time demand into consideration

URBAN LEISURE & TOURISM

CROWD COORDINATION AT THEME PARKS

Project with Resorts World Sentosa Singapore (under LARC)



VISITOR

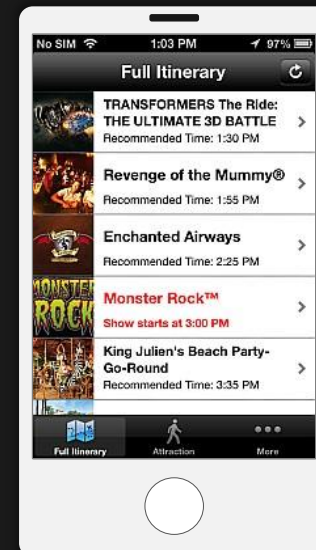
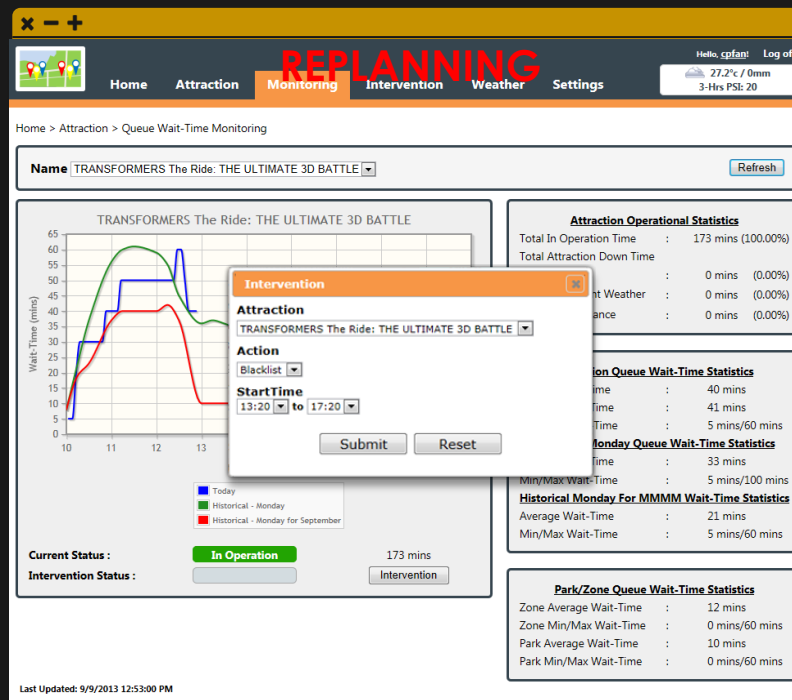
USER PROFILE and

**REAL-TIME
RIDE STATUS,
QUEUE TIMES,
SHOW SCHEDULES**



OPERATOR

**OPERATOR
MONITORING
& INTERVENTION**



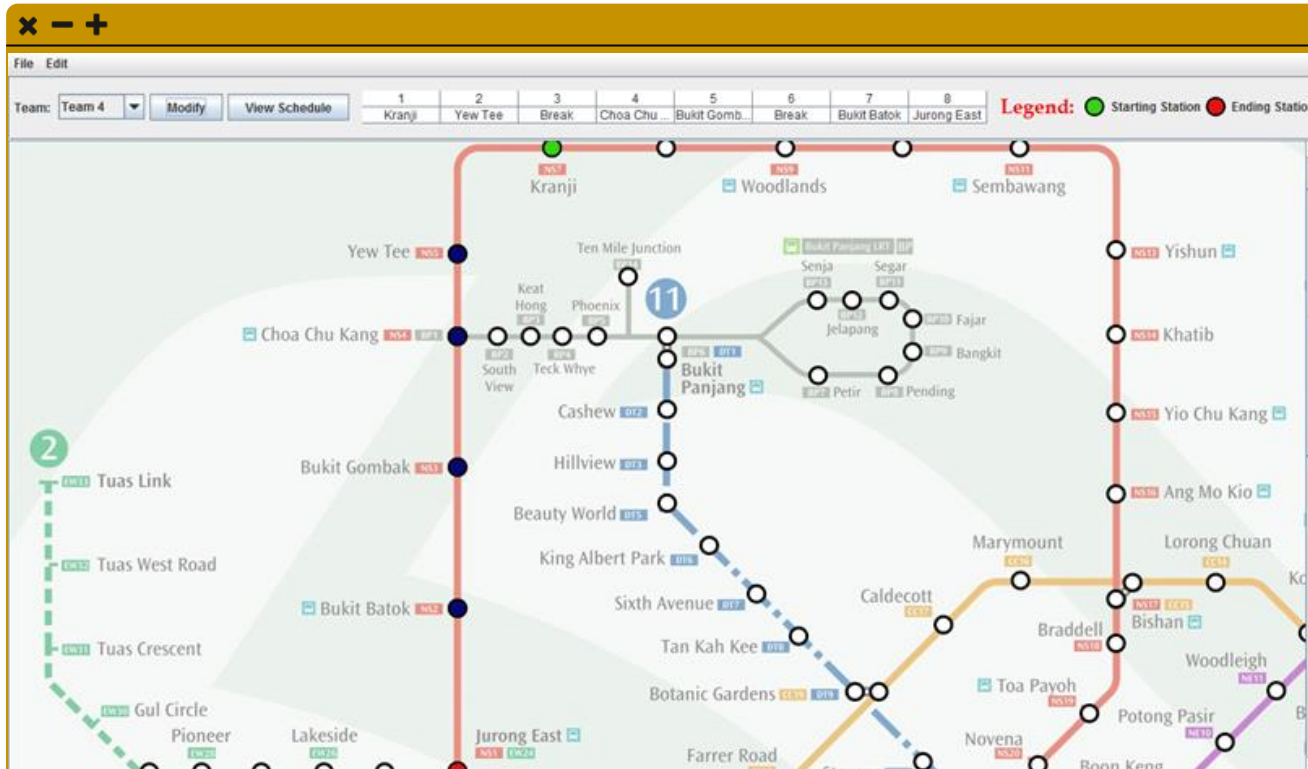
**DYNAMIC
RECOMMENDATION**

- Dynamic Route Guidance and Multi-agent Orienteering
- Agent-based simulation of visitor movement in a crowded facility

URBAN SAFETY & SECURITY

RANDOMIZED MANPOWER DEPLOYMENT IN PUBLIC PLACES

Interactions with Ministry of Home Affairs and National Environment Agency



Enforcement and Surveillance

- Randomized scheduling of limited resources (e.g. security officers) to patrol the network that maximizes deterrence of crimes / offenses
- Randomized rostering of health inspectors to enforce food hygiene and sanitation requirement