Passenger Location-Based Services: Way finding and Beyond

ACI BIT Spring Conference
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Panel Members

Representatives from Technology Providers

- John Powell
  - Business Development Manager, SITA’s Airport Management Solutions

- Hamish Macmillan
  - Regional Sales Director, VITEC

- Gunder Rask
  - Program Manager, Google Indoor Maps

- Dave Wilson
  - Chief Aviation Technologist, SEA (Moderator)
Location-Aware Benefits

ONE (1) AIRPORT’S PERSPECTIVE
Security says your employee locator device isn't turned on.

My what? I think you call it a smartphone.

I might have some questions. Put them in a text to yourself. I'll read them later.

1984

2012
Introduction – SEA Historical Perspective

- Earliest efforts were GIS / GPS focused
- Tracked vehicles with image processing
- Web site customization based on location
  - Customer service initiative
- Checkpoint wait time service next effort
  - Determine average wait time goal – customer service
- Intrigued by potential of Wi-Fi triangulation
  - Planning – trend analysis of PAX movements
  - Emergency Management – tracking OPS/FD/PD staff
- Mobile tagging started out as a marketing tool
  - QR code scan - time, location and device
GPS Mobile Devices – FD/PD
Image Processing: Vehicle Tracking

• Largest consolidated garage North America*
• Way finding for travelers – customer service
• Sustainability - total cost of ownership
• Future proof – leading edge risk downside
• Year round, all weather conditions
First Location Application - Website
Customized SEA Wi-Fi Web site

Access Point near Gate A6 to A8

Known or Inferred Itinerary
• Gate and flight status
• Destination weather
• Destination advertising
• Time critical shopping
• Alerts and messages

Departing in 55 Minutes

( Deploy in 2012 )
Bluetooth Smartphone Tracking

- Proof of concept project in 2010 – office floor only
- Small form factor / low cost Linux kernel
SEA conducted a survey of PAX last December

Results suggest that Bluetooth and Wi-Fi tracking would be very effective
Mobile Tag – Location Aware and Tracking

Scan QR Code for Flight Info
For the most recent flight arrival information, please scan the QR code below or go to our website at: http://seatac-arrivals.appspot.com

When you leave the Cell Phone Lot:
- Follow signs to Terminal/Arrivals to meet your passengers on Baggage Claim.
- Airline signs are overhead, outside the doors closest to Airline Baggage Carousel.

Pilots: During peak arrival (morning hours and around holidays), there could be heavy traffic. If you need to meet your passengers, follow the signs to the Departures level. Enter on the first floor under Flight Arrivals. This is great for guests with only carry-on luggage.

( Very Successful Pilot Project )
Latest QR Pilot Project

Our restroom appearance is important to us, please rate the cleanliness of this restroom.

SEATTLE-TACOMA INTERNATIONAL AIRPORT

Port of Seattle
Terminal Way Finding – Future?

- Personalized directions
- Updated in real-time
Summary - Location Aware Technologies

- GPS / GIS integration
- CCTV video analytics
- Bluetooth devices
- 802.11 Wi-Fi devices
- NFC and Mobile tags

Device determines its own location

Infrastructure computes device locations
SITA

JOHN POWELL
John Powell is Business Development Manager for SITA’s Airport Management Solutions. John has been involved in the airport industry for 24 years serving in sales, project management and product management roles.

Prior to joining SITA John was with several flight information display companies.

John is also active on ACI, AAAE, FAC and IATA IT committees currently serving as vice chair on the ACI/IATA AIDX committee.
Optimizing airport operation through effective passenger flow management
What the industry is saying about Passenger Flow Monitoring

Cool

SLA Compliance

Revenue generation

Everybody wants one

Reduce cost

An idea whose time has come

Understand passenger behavior

Proven technology

Improving the passenger experience
Motivation for passenger tracking solutions

*From 2010 Airport IT Trends Survey

Reduce congestion to improve the passenger experience
- Very important: 56%
- Important: 32%
- Marginal: 6%
- Unimportant: 6%

Integrate information with other systems to improve resource planning
- Very important: 43%
- Important: 27%
- Marginal: 14%
- Unimportant: 12% (4%)

Measure wait times to comply with agreed SLAs
- Very important: 36%
- Important: 32%
- Marginal: 16%
- Unimportant: 8% (8%)

Reduce congestion to increase non-aeronautical revenue opportunities
- Very important: 38%
- Important: 29%
- Marginal: 23%
- Unimportant: 8% (2%)

Report wait times to the public
- Very important: 20%
- Important: 24%
- Marginal: 33%
- Unimportant: 16% (6%)
### Top Investment Priority

**Improve Customer Service**

<table>
<thead>
<tr>
<th>Priority</th>
<th>Airline IT Trends</th>
<th>Airport IT Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving Customer Service</td>
<td>69%</td>
<td>63%</td>
</tr>
<tr>
<td>Enabling new market and revenue opportunities</td>
<td>64%</td>
<td>53%</td>
</tr>
<tr>
<td>Reducing the costs of business operations</td>
<td>63%</td>
<td>46%</td>
</tr>
</tbody>
</table>

Please rate the following priorities when making IT investment decisions in the current fiscal year—Key drivers:

- **1 High priority**
- **2**
- **3**
- **4 Low priority**

Examples:
- 69% for improving customer service
- 64% for enabling new market and revenue opportunities
- 63% for reducing the costs of business operations
- 63% for improving airport safety and security
- 46% for reducing the costs of business operations
40% of passengers are interested in navigation services on mobiles.

Airports plan navigation services on mobile phones...

- Today: 5%
- By 2014: 49%
**Anonymous**
- Don’t know WHO it is
- Could be unique: eg. BlueTooth, Wifi
- eg. Termal people counters are truly anonymous
- To identify general passenger behaviour

**Named**
- Passenger specific, know WHO it is
- “Who and Where am I” data
Queue time
- Improve passenger experience
- GH SLA's to A/L
- Resource management (CI desks, Security lanes, Immigration, ...)

Dynamic dwell time
- Airport transfer walk time statistics / BI
- Retail area dwell time
- Lounge usage statistics (total time, time of day, patterns, ...)

PAX flow monitoring
- Safety, Emergency evacuation
- People counting
NAMED PASSENGERS
PASSENGER TRACKING

- PAX navigation/wayfinding
  - “Where am I?” Navigation & Path finding
    - How do I get to my gate?
    - Receive flight details when entering airport
    - Retail advertising/coupons
    - Augmented reality
  - “Where is my passenger?”
    - Push reminders
    - Off loading PAX who will not make it
    - View passengers in transit
    - Lounge access up-sell (for pax nearby and who still have time)
- “Where is my arriving friend/family?”
- “Where is my staff?”
NAMED PASSENGERS
SECURITY, VERIFICATION & ID. MANAGEMENT

- Self Service BagDrop
- Boarding Card Validity Check
- Automated Border Control
- Intelligence led passenger differentiation at Security
  - IATA Check-point of the Future
- Automated Boarding
- PAX and STAFF access management
  - Express lanes
  - Airline Lounge access
## TECHNOLOGIES TO CAPTURE & VERIFY DATA

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anonymous</td>
<td>Pax Tracking</td>
</tr>
<tr>
<td></td>
<td>BlueTooth, Thermal, Laser, Video, WiFi, 2DBC, NFC, Biometrics, RFID...</td>
</tr>
<tr>
<td>Named</td>
<td>Pax Tracking</td>
</tr>
<tr>
<td></td>
<td>WiFi, 2DBC, NFC,...</td>
</tr>
<tr>
<td>Security &amp; ID</td>
<td>OCR, 2DBC, Biometrics, NFC, RFID...</td>
</tr>
</tbody>
</table>

*Same technology can be used for multiple Use Cases*

*Technologies come and go... Data acquisition, verification and business intelligence needs remain*
Technology agnostic tracking platform
... list of example applications

- **B2C applications**
  - Wait times at security
  - Navigation/Wayfinding
  - Augmented reality

- **Airline applications**
  - Where is my passenger?
  - Interface to passenger location data from airline mobile applications
  - Upsell, e.g., lounge access

- **Airport Applications**
  - Airport information portal
  - SLA performance (at Security and/or Immigration)
  - Dwell time analysis for greater retail revenue
BCBP passenger tracking issues

- **Accuracy**
  - The platform doesn’t “see” manually boarded passengers

- **Data ownership and privacy**
  - Track by flight, not passenger name
  - Driven by rules engine and data filter capability

- **Web and mobile boarding passes**
  - Not seen until scanned at the airport

- **Tracking by BCBP only is limited**
  - Solution: complement BCBP with another technology
Business Intelligence tools
... correlation of collected data

• Correlate data from different sources
  – BCBP
  – Bluetooth
  – People counters
  – AODB/FIDS

• Potential to provide granular statistics by flight, e.g., link BCBP to Bluetooth

• Adhoc reporting capability
FAQ – top three questions asked

- What about data ownership/privacy?
- What is a sufficient sample size for tracking purpose?
What about data ownership/privacy?

- Tracking is currently anonymous, whether by BCBP, Bluetooth or WiFi
- Data ownership/privacy continues to be explored
  - Determination varies by country
  - May limit the data that is collected and shared
- BCBP data property of airport, airlines and/or pax
  - Community needs to agree on collection and usage
  - iTrack’s configurable data filter allows each data field within the BCBP to be collected or not
- If stakeholders agree to share their respective data, then the Airport can operate more efficiently
What is a sufficient sample size for tracking purpose?

- Typically 5 to 15% of the population have Bluetooth enabled, which is statistically relevant.
  - Assuming 5% penetration, whether a passenger is #60 or #80 in line, their elapsed time through Security is similar.
  - The greater the number of passengers in the queue, the more accurate the data, e.g., average queuing time.
Thermal Sensors

✓ Highest accuracy
✓ Counts both directions
✓ Flexible shaped zones
✓ Lowest cost of ownership
✓ Simple Cat5/6 Cabling
✓ Most reliable
✓ Very low bandwidth required
✓ Cannot be blocked or manipulated
✓ Not affected by lighting, trolleys
✓ Only counts people!
**Height**: 2.5 to 5m

**Width**: 2.5 to 5m

**Depth**: 2.5 to 5m

**Feature**: all 5 people are tracked until they cross the zone

**Benefit**: high accuracy with prams and trolleys ignored
<table>
<thead>
<tr>
<th>Airside</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airside A</td>
<td>Coming Soon</td>
</tr>
<tr>
<td>Airside C</td>
<td>Coming Soon</td>
</tr>
<tr>
<td>Airside E</td>
<td>5 Minutes</td>
</tr>
<tr>
<td>Airside F</td>
<td>Coming Soon</td>
</tr>
</tbody>
</table>

Current Airside Security Wait Times

Wednesday September 28, 2011 5:02 PM
Passenger benefits

- Delivering services and marketing opportunities
- Providing navigation information
The WiFi accuracy required varies by use case.

CPH airport made a significant WiFi infrastructure investment to achieve the high accuracy rates throughout the airport.

High accuracy requirement was to meet a passenger Augmented Reality use case – if you’re going to give directions to a passenger you need to be sure you know where the passenger is.

If the airport use case is for dwell time analysis, then the same infrastructure investment may not be required, depending upon the accuracy requirements.
Observed accuracy from CPH pilot

- Under 10m: 15%
- Between 10m and 20m: 35%
- Between 20m and 30m: 20%
- Between 30m and 50m: 15%
- Between 50m and 100m: 15%

Notes:
- Devices with accuracy above 100m were discarded
- The above accuracy values were provided by the Cisco MSE.
Where people spend time

Understand the patterns and rules of people's movements.

Main
- Dwell
- Departure

Points

Cluster: 46
Average dwell time: 10.95 min
No points: 13959
No devices: 1308
Crowding index: 0.74
Zones: [landside, T2]

Dwell time color scale:
- 2.41-6.61 min
- 6.61-10.8 min
- 10.8-15.0 min
- 15.0-19.2 min
- 19.2-23.39 min
Airport Crowding

Understand the patterns and rules of people's movements.

Data  Points  Paths  Alternative Paths  Zone Editor  Airport  Configuration

Main  Dwell  Departure  Crowding  Departure

Crowding index color scale:
- 0.01-0.21
- 0.21-0.41
- 0.41-0.6
- 0.6-0.8
- 0.8-1.0
Most common paths - Arrival

Understand the patterns and rules of people's movements.

Data  Points  Paths  Alternative Paths  Zone Editor  Airport  Configuration

Main

Arrival

Path 1
Path 2
Path 3
Path 4
Path 5
Path 6
Path 7
Path 8
Path 9
Most common paths - Departure

<table>
<thead>
<tr>
<th>Path</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path 1</td>
<td></td>
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<tr>
<td>Path 2</td>
<td></td>
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<td>Path 3</td>
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<tr>
<td>Path 7</td>
<td></td>
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<tr>
<td>Path 8</td>
<td></td>
</tr>
<tr>
<td>Path 9</td>
<td></td>
</tr>
</tbody>
</table>
Prediction of passenger movements
People moving around airport

Most people go direct from T3 to T2 without visiting Duty Free
1. Define your use-case(s)
   coordinate ....... technology comes later
2. What intelligence you need
   must have – nice to have ....... data privacy
3. How the intelligence will be used
   strategic – tactical ... reports – automated feeds
4. Get advice on required technology(s)
   multiple ....... technology changes
5. Trials, poc’s or production
Mr. Macmillan Biography

- Mr. Macmillan joined VITEC in February 2009 as Regional Sales Director, with responsibility for growth of video acquisition and media management business. As VITEC has continued to grow and invest in new companies and technologies, his role has likewise grown into the management of new targeted business initiatives in North America, including transportation.

- A seasoned sales professional of over 20 years, a successful term as European Sales Manager for a Minnesota-based video-focused technology company resulted in a company move to the US in 2003.
The Impact of IP Video Technologies on Airport Customer Information

Hamish Macmillan
Information Benefits

*IP Video Provides Multiple Airport Improvements*

- Customer Satisfaction
- Operational Efficiencies
- Security Improvements
- Business Analytics
- Airport Performance
Queue Management

An Efficient QMS Impacts Multiple Management Areas

- **Customer Satisfaction**
  - Reduce Stress, Wait Times – Extend Retail Experience

- **Operational Efficiencies**
  - Reduce Flight Delays – Improve Passenger Flow

- **Security Improvements**
  - Optimize Resources, Anticipate Overcrowding

- **Business Analytics**
  - Passenger Statistics, Movements and Behaviors

- **Airport Performance**
  - Increase Airport Traffic Capacity and Revenues
“We only can improve what we can measure.”

Passenger Flow Analysis

Measure

React

Analyze

Occupancy

Waiting

Counting

Counting

Waiting

Occupancy

Queue

Waiting Time: 06 MIN
Queue Time Objectives

Reduce the wait time
- To satisfy every passenger
- To avoid flight delay
- To optimize resource allocation
- To increase airport traffic capacity
- To increase airport revenue by increasing spending rate per passenger

No Time To Wait

Security
Queues, time pressure, anxiety ➔ stress

Retail
Refreshment, Lifestyle, Purchasing ➔ relief
Why Manage Queues?

- Enhance passenger experience:
  - Reduced stress levels

- Increase your revenue streams:
  - Optimize security costs: the right people at the right place
    - Arrival/Departure/Service fees – a fixed amount depending on cost of terminals and staff – the cost of processing passengers
  - Increase retail revenues: can be half of airport revenues
    - Shops and restaurants pay fee based on turnover
    - “Duty free” / Advertising space / Rental of offices/counters
    - Car parking

**LESS time in queues - MORE time in retail**
Queue Management System

- **People Counters:** Passengers leaving the queue
- **Video Sensors/Cameras:** Passengers in the line
- **Queue Management:** Queue management + Passenger Flow
- **Waiting Time:**

**Network Architecture:***

- **Queue Manager**
- **Servers**
- **IP Network**
- **POE**
- **Counters**
- **Sensors**
**Sensors/Cameras:**
Measure directly the number of people in one area
Broad range from 25m² to 400 m² per sensor

**Counters:**
Measure exit flow and processing time

**Servers:**
Capture images, compute density and wait time
Queue time = \frac{\text{number of passengers}}{\text{passengers/min}}

Queueing time = 3 minutes
QMS Information Delivery

99% SLA

Overcrowded

69% SLA

A global view
Informational Dashboards

- Exit flow per minute
- Open Gates
- Closed Gates
- Alarms
QMS Operational Impact

PAX DISTRIBUTION: TERMINAL 2F

Terminal
- 2E
- 2F
- 2F1

Occupancy
- %
- Period

Distribution
- Nb de pax

Legend
- > 1h
- 30 min
- 15 min
- <10min

Pax
- 4
- 6
- 8
- 10
- 12
- 14
- 16
- 18
- 20
- 22

8:30

4h

12:30

Hours

Day
Passenger Flow Enhancement

Anticipation (Wait time display)
- Passengers
- Security Managers
- Airport Operations Manager

SLA Compliance (Dashboards)
- Airport Directors
- Security
- Airlines Directors

Statistics (Reporting, Database)
- Business Analysts
- Strategy Directors
- IT Directors

Alarms (SMS/MAIL)
- Airport Operations Manager
- Check-in Manager
- Queue Manager

Queue Waiting Time: 06 MIN

Passenger Flow Enhancement
Airport Benefits Summary

- **Passengers**:• A better experience
  • Enjoy time in retail area

- **Operational Managers**:• Reducing flight delays
  • Management of passenger flow

- **Security Managers**:• Optimization of resource allocation
  • Anticipation of overcrowding

- **Business Analysts**:• Increase awareness of resources
  • Analysis of passenger behaviour

- **Airport Directors**:• Increase airport revenues
  • Increase airport traffic capacity

**BECOME A REALLY SMART AIRPORT**
Gunder Rask is a Program Manager for Google Indoor Maps. He leads the organization's field operations and shares responsibility for strategic partnership development.

Prior to Google, Gunder spent 9 years in digital media business development focused on license agreement and content syndication work.

A Northwestern University alum, he began his career in The Boston Consulting Group's Chicago headquarters.
Google + Air Travel: Flight Search
Google + Air Travel: Flight Status

Flight status for Cathay Pacific Airways 845

<table>
<thead>
<tr>
<th>Flight Information</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On-time</strong></td>
<td>JFK (New York) 1:12am (was 1:00am)</td>
</tr>
<tr>
<td><strong>Arrival</strong></td>
<td>HKG (Hong Kong) 5:02am (was 5:30am)</td>
</tr>
</tbody>
</table>

Updated 3 minutes ago by Flightstats.com - Details

FlightAware > Cathay Pacific Airways (CX) 845 Flight Tracker

FlightAware is a Live Flight Tracker. Cathay Pacific Airways (CX) 845 Flight Tracker (en route flights, arrivals, departures, history) with live maps and aircraft photos.

**CX 845 JFK-HKG Impressions - FlyerTalk Forums**

www.flyertalk.com - ... - Airline Programs - Cathay Pacific Asia Miles

Apr 16, 2011 - So just got to HK from CX 845. The terminal was dead as this was the last flight or the first flight since it's 12am. BA Terraces First Lounge it.

**What I did on Arrival CX845 JFK - HKG** - Feb 5, 2012

CX 845 - Sep 15, 2011

What I saw on Arrival CX 845 - Jan 17, 2011

Lounge at JFK for CX845 - Jan 15, 2011

More results from flyertalk.com

Cathay Pacific CX 845 JFK-HKG Takeoff 777-300 ER - YouTube

www.youtube.com/watch?v=b3Zs0sV1zxyY

Apr 23, 2011 - 2 min - Uploaded by AllThingsNitches

Cathay Pacific CX 845 JFK-HKG Takeoff 777-300 ER

Cathay Pacific Airways flight CX 845 New York (JFK) - Hong Kong ...

www.youtube.com/watch?v=CDQsY3IwRHAc

Oct 20, 2011 - 10 min - Uploaded by macneilpa16

Abord Cathay Pacific Airways flight CX 845 arriving at Hong Kong International Airport from New York ...

Cathay Pacific Airways flight CX 845 New York (JFK) - Hong Kong ...

www.youtube.com/watch?v=mRryz8_d280

Oct 20, 2011 - 7 min - Uploaded by macneilpa16

Cathay Pacific Airways flight CX 845 New York (JFK) - Hong Kong ...

www.youtube.com/watch?v=mRryz8_d280

Oct 20, 2011 - 7 min - Uploaded by macneilpa16
Google + Air Travel: Indoor Maps
Google Indoor Maps: Where Could We Go?
You've arrived at the airport early and cleared the security checkpoint well in advance of your flight. As a connecting passenger, you have two hours to kill before your next flight departs, or perhaps your flight has been delayed due to inclement weather. Is there anything interesting to do in the airport if you have time on your hands in one of 14 U.S. airports three days after Google and the airports have made it easier for you to discover what to do and where to find it while you wait for your flight. Several airports recently have partnered with Google to create indoor maps of their terminals and concourses. Android users (Google owns the Android technology) can download Google Maps 6.0 to view floor-by-floor layouts that help direct travelers to indoor airport locations, such as shops, restaurants, airline gates and restrooms, without having to find floor-map directories or signage. Although Google has identified outdoor locations for years, the company now is targeting indoor features as well, including those at airports. Google Maps 6.0 shows a 2-ots that measures the height of an airport's interior, showing a passenger which floor he or she is on and changing floors as the passenger does. According to Google spokesperson Dena Yick, the idea for this feature (it is not an "app") because it is a function within Google Maps 6.0, began in 2010. Yick says that Google Maps users already access indoor maps. Because many airports have large ticketing, retail and gate areas, terminal maps are useful to the millions who use airports each day.
Google Indoor Maps: What We Learned

- There is tremendous unmet demand for maps of complex indoor spaces

- Direct partnerships work(ed).

- Airports are one of the best use cases for GIM
  - Checking-in early . . .
  - Transfers in unfamiliar airports . . .
  - Indoor navigation helps alleviate gate lock, allowing passengers to locate not just their gate but also revenue opportunities (i.e., food/beverage, retail, service)

- Way finding is a bigger pain point than we thought

- Parking revenue matters. A lot.

- Deregulation + Consolidation
Location-Aware Technology

PANEL DISCUSSION