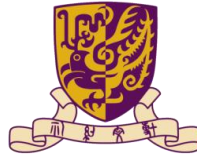


Creating A New Dimension in Hospital Management with RFID Positioning & Data Encryption Technologies



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Risks in Hospital and Traceability in Demand

HA Identified Patient Care Related Risks^(*)

Patient care related risks present a certain degree of relationship to the traceability of drugs and medical equipment, monitoring real time patient conditions, as well as location records of physicians and patients.

1. Misidentification	<ul style="list-style-type: none">• Patient• Specimen• Operation site
2. Medication	<ul style="list-style-type: none">• High risk drugs in wards• Drug reconciliation on admission / discharge• Drug Allergy
3. Infection	<ul style="list-style-type: none">• HAI- MRSA• HAI- Surgical site infection• Infectious disease outbreak
4. Patient's condition	<ul style="list-style-type: none">• Patient suicide• Patient fall• Pressure sore
5. Patient Care process	<ul style="list-style-type: none">• Patient assessment (identify critical ill patient)• Communication between caregivers• Use of Restrainer

^(*) Dr. Lui Siu Fai, "A new era of working together for a safer and better healthcare system for our patients and staff"

Active RFID in Hospital Management

有源RFID在医院管理中的应用

- ❑ 医院内传染病溯源
- ❑ 分析医患人员之间接触追踪
- ❑ 病人体征的连续监控
- ❑ 确定病人位置以防意外发生
- ❑ 贵重物品及设备实时定位
- ❑ 医护人员操作规范管理
- ❑ 病人活动范围记录及分析
- ❑ 医院病房环境的实时监控



- ❑ Source tracing of infectious disease in a hospital
- ❑ Interaction mapping between physicians and patients
- ❑ Continuous vital signal monitoring for unlikely critical ill patients
- ❑ Location tracking for accident prevention
- ❑ Real-time location tracking of valuable equipment
- ❑ Management of staff daily operation
- ❑ Recording and analysis of patient's daily activities
- ❑ Real-time monitoring of ward environment

Challenges in RFID Indoor Positioning

Influence of multipath phenomena

Fast environment change near the tagged object

Blockage of radio wave by large object

Network planning for accurate positioning

Scalability of a large scale network

Low cost RFID tags and reader infrastructure

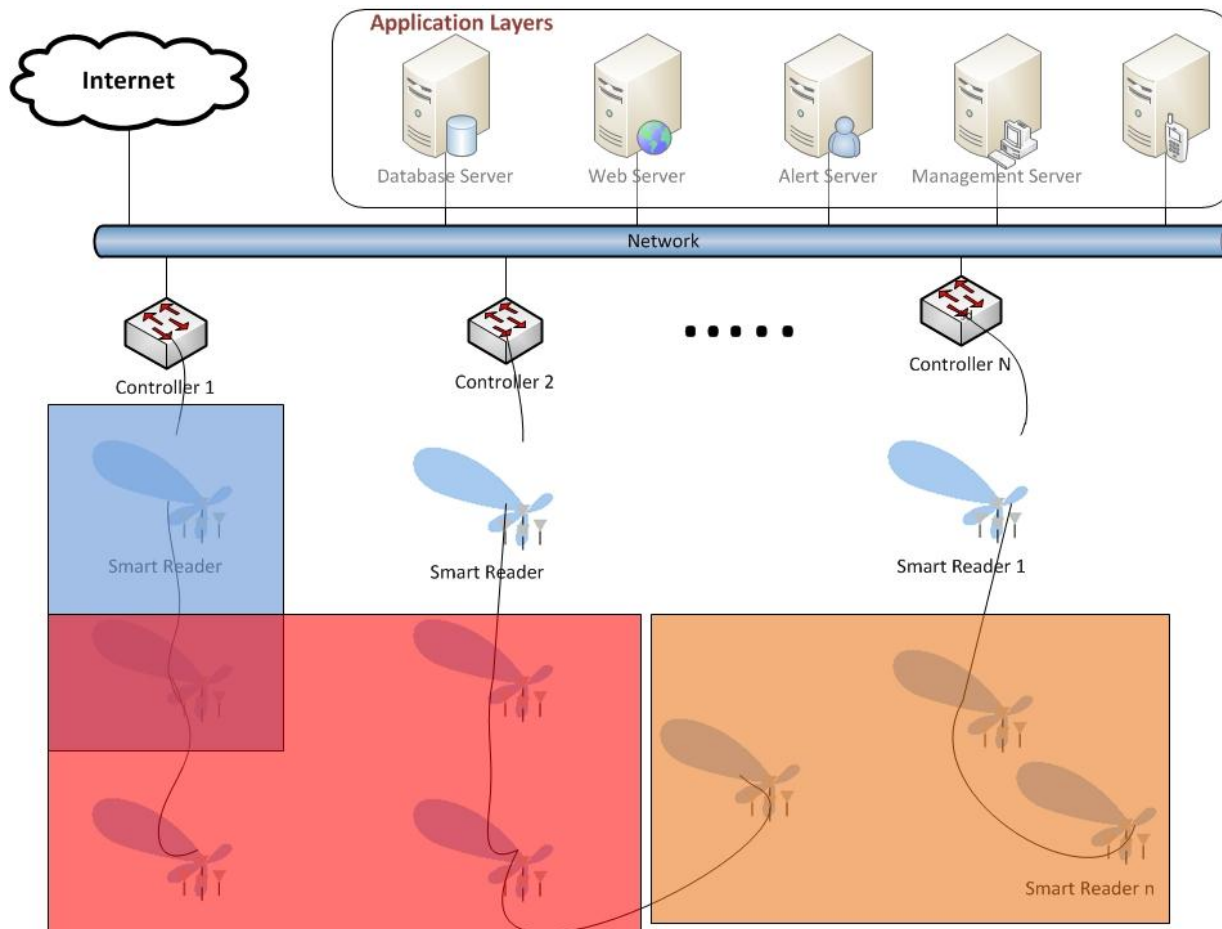
Low power consumption and long working period

Technical Specs of CUHK RFID System

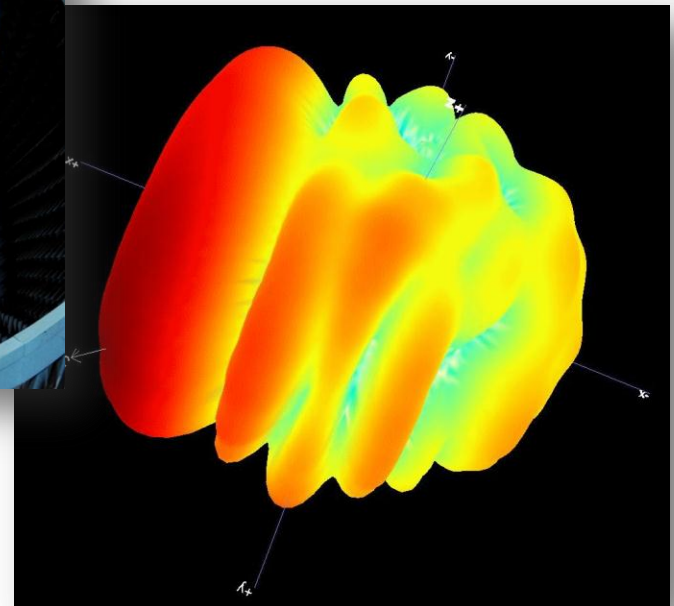
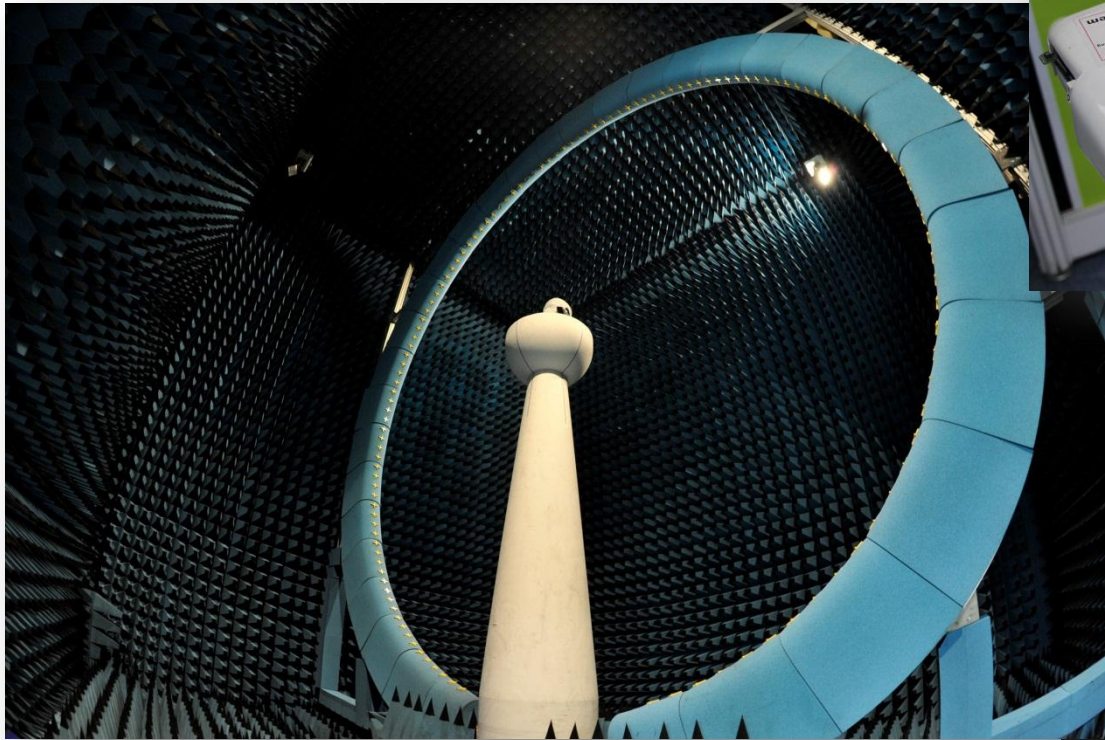
- ❑ ± 1 meter accuracy in a rang of 10 meters
- ❑ Real-time tracking of up to 40 tags by a 3-antenna group
- ❑ Low cost tags and AoA smart antenna technology
- ❑ Unique algorithm for overcoming multipath problem
- ❑ In-house middleware that supports various of applications
- ❑ A universal sensor interface for a wide range of vital signal monitoring

- 系统定位精度 ± 1 米（10米范围内）
- 每组天线能同时跟踪多达40个标签
- 低成本标签及基于AOA智能天线技术
- 独有的分组多解定位算法克服多路径问题
- 自主开发的可扩展中间件及多样化的应用软件
- 有源标签提供通用传感器接口

System Architecture of CUHK RFID System



Smart Antenna System



Antenna anechoic chamber &
Spherical Nearfield Scanner in CUHK

Multiple Form Factors of RFID Tags



- 专为医护人员、病人设计，方便工作及消毒。
- 若发射频率为三秒标签可用长达一年。

Real-time Monitoring of Ward Environment



CUHK RFID Real Time Locating System

FLOORPLAN

CONNECTION

TAG

READER

CONTROLLER

LOCATION

SETTINGS

STATISTICS

HISTORY

Controller 01



✓ R1 (🔥 24.89°C)

LOBBY2 (💧 40.29%)

✓ R2 (🔥 26.3°C)

LOBBY1 (💧 36.92%)

✓ R3 (🔥 25.99°C)

LOBBY4 (💧 38.01%)

Controller 02



✓ R9 (🔥 24.88°C)

LOBBY1 (💧 40.51%)

✓ R10 (🔥 24.98°C)

LOBBY2 (💧 39.99%)

✓ R11 (🔥 23.78°C)

RM02 (💧 42.73%)

Controller 03



✓ R17 (🔥 24.26°C)

LOBBY3 (💧 41.22%)

✓ R18 (🔥 23.58°C)

LOBBY3 (💧 44.1%)

✓ R19 (🔥 24.71°C)

RM04 (💧 41.65%)

Controller 04



✗ R22

T2

✗ R23

C4

✓ R24 (🔥 24.21°C)

C3S2;C4 (💧 40.95%)

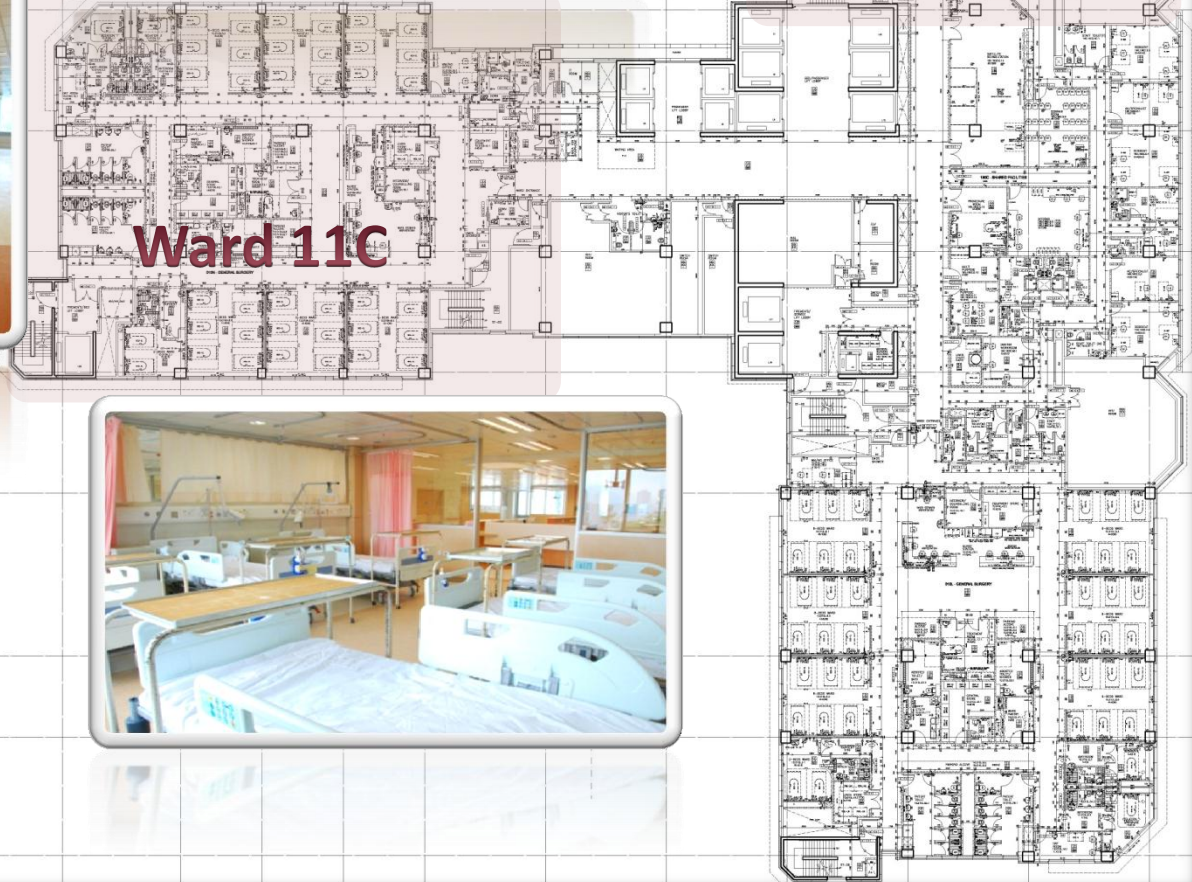
Pilot Implementation in Main Clinical Block and Trauma Centre of Prince of Wales Hospital (PWH)



Experimental RFID Network in PWH



Ward 11A



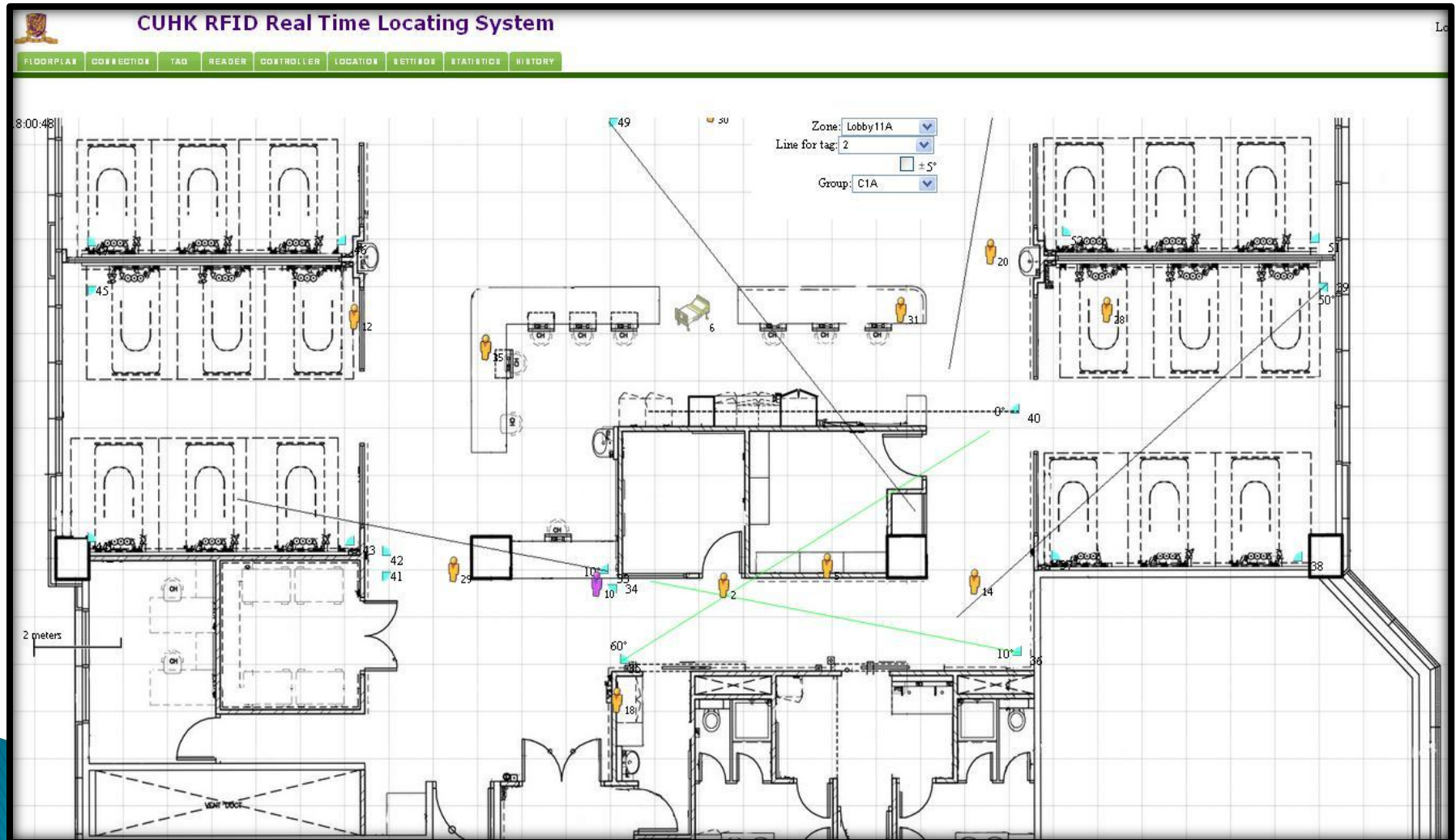
RFID Network Installation in PWH



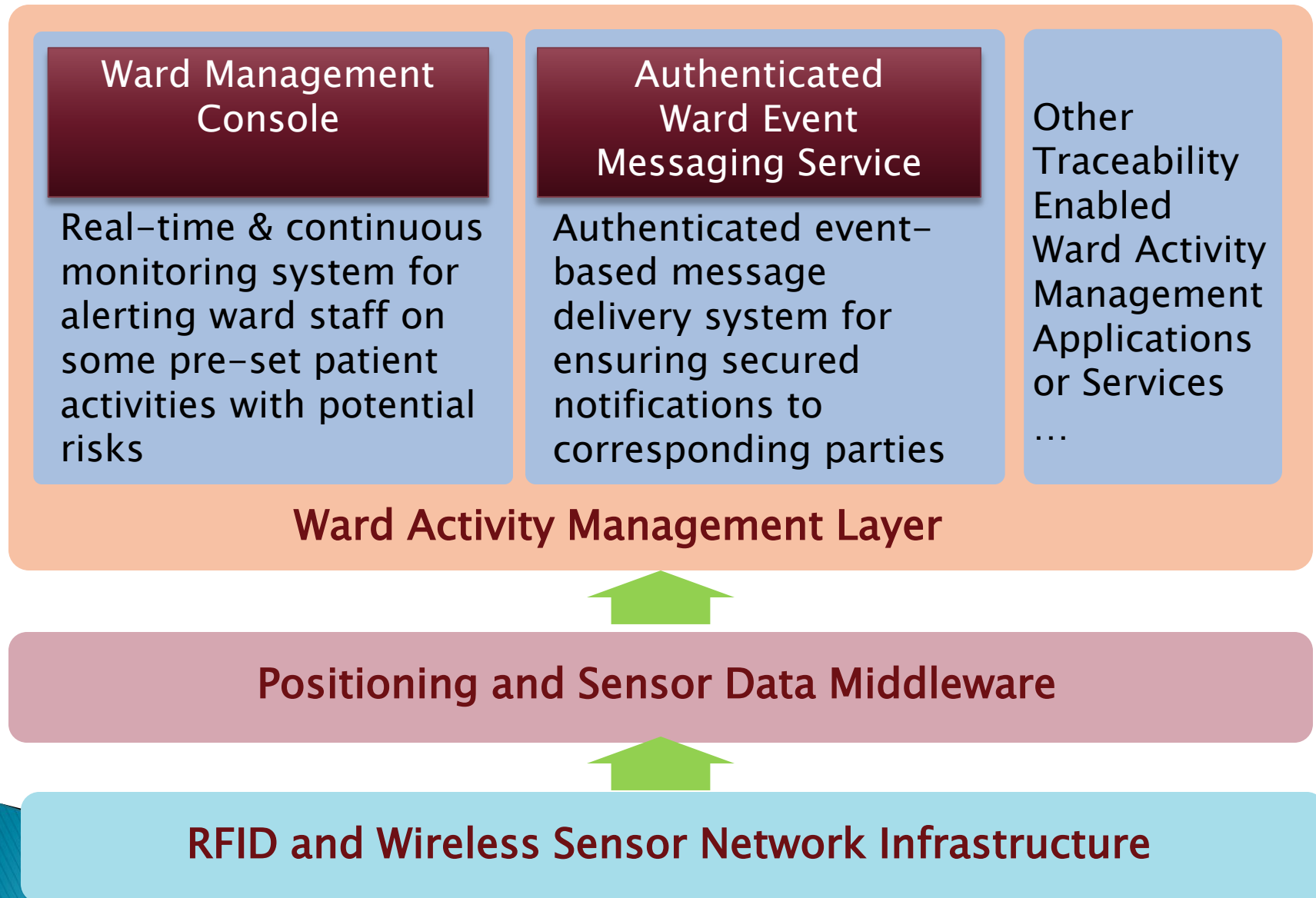
RFID Tagged Equipment in PWH



Static Testing near Nurse Station



Traceability Enabled Ward Management



Authenticated Ward Event Messaging Service

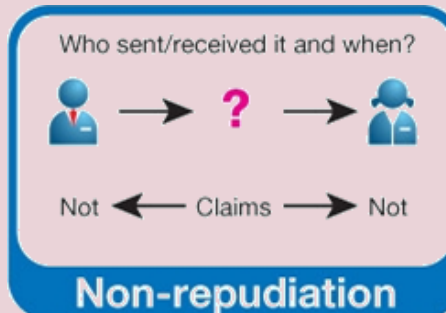
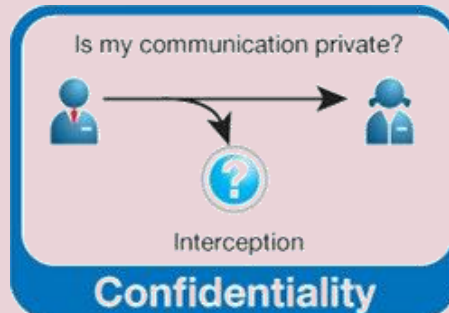
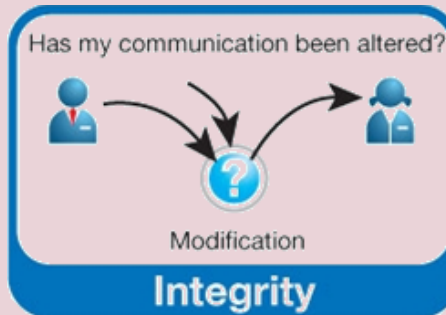
Ward Events

- Critical change of vital signal (via sensors)
- Regular measurement records
- Unexpected incidents
- Scheduled or unscheduled physician visits
- Unexpected environment change, etc.

Authenticated Messaging Service

PKI: Public Key Infrastructure

Using public key cryptography & digital certificates to ensure the integrity of the content & message communications



Message Compliance to Electronic Transactions Ordinance (Chapter 553)



Ward Management Console Application

Unattended Alerts Alert History Refresh 2011-9-18 11:47:13 AM LOGOUT

Patient

Enter Robotics 3

Patient Not in Ward List

Name	Patient Info.	Away (Mins)
PATIENT, ARNOLD PARAN TESTING ON ADULT WRISTBAND	F/27/HN07123456	2611
CHUK, ON HONG	M/36/HN10046725	4261

Patient Statistics

Statistics	Total	1	2	3	4	5	6	Else
# of Tagged Patients	2	0	2	0	0	0	0	0
# of Tagged Patients in Alerting Conditions	1							
# of Tagged Patients Not in Ward (<30 Mins)	0							
# of Patients Not in Ward (30-60 Mins)	0							
# of Tagged Patients Not in Ward (>60 Mins)	2							

Check-in Records of Central Laboratory :

Schedule	Last Check-in Time	Diff. Time	LoS (Mins)
2011-09-18 10:45		0	0
2011-09-18 09:30		0	0
2011-09-18 08:00		0	0

Check-in Records of Central Pharmacy :

Schedule	Last Check-in Time	Diff. Time	LoS (Mins)
2011-09-18 11:00		0	0
2011-09-18 05:00		0	0
2011-09-17 11:00		0	0

Equipment

Equipment Not in Ward

Equipment	Away (Mins)	Remarks
Wheel Chair	1	0
Stretcher	0	0
O2 Cylinder	0	0
Oximeter	0	0
IV Pump	0	0

Equipment Statistics

Statistics	TotalCount	Missing	1	2	3	4	5	6	Else
Wheel Chair	1	0	0	1	0	0	0	0	0
Stretcher	0	0	0	0	0	0	0	0	0
O2 Cylinder	0	0	0	0	0	0	0	0	0
Oximeter	0	0	0	0	0	0	0	0	0
IV Pump	0	0	0	0	0	0	0	0	0

Ward

Ward Condition (Hi/Lo in last 24 Hrs)

Zone	Curr. Temp.	Temp. (Min)	Temp. (Max)	Curr. Humid.	Humid. (Min)	Humid. (Max)
Robotics	0	0	0	0	0	0
Biomedical	0	0	0	0	0	0
Wireless & Mobile	0	0	0	0	0	0
Cloud Computing	0	0	0	0	0	0
Zone 10	0	0	0	0	0	0
Zone 11	0	0	0	0	0	0
Zone 32	0	0	0	0	0	0

Ward Management Console



Context-sensitive Event
Detection & Monitoring
In Hospital

Patient

Caregiver




Equipment

Ward

Real-time & Continuous Monitoring for Alerting Issues that Require Attention

Summary View on all 4 Monitoring Aspects







Alert information

Unattended Alerts
Alert History
Refresh
2011-09-18 11:47:13 AM
LOGOUT

Patient
Caregiver

Enter Robotics
! 3

 Tag Patient
 Untag Patient
 Suspend/Resume Tag
 Edit Patient Info
 Search Patient
 Set Patient Rules

Patient

Patient Not in Ward List

Name	Patient Info.	Away (Mins)
PATIENT, ARNOLD PARAN TESTING ON ADULT WRISTBAND	F/27/HN07123456	2611
CHUK, ON HONG	M/36/HN10046725	4261

Patient Statistics

Statistics	Total	1	2	3	4	5	6	Else
# of Tagged Patients	2	0	2	0	0	0	0	0
# of Tagged Patients in Alerting Conditions	1							
# of Tagged Patients Not in Ward (<30 Mins)	0							
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Check-in Records of Central Pharmacy :

Schedule	Last Check-in Time	Diff. Time	LoS (Mins)
2011-09-18 11:00		0	0
2011-09-18 05:00		0	0
2011-09-17 11:00		0	0

Equipment

Ward

Equipment Not in Ward

Equipment	Away (Mins)	Remarks
Wheel Chair	1	0
Stretcher	0	0
O2 Cylinder	0	0
Oximeter	0	0
IV Pump	0	0
Cardiac Meter	0	0

Equipment Statistics

Statistics	TotalCount	Missing	1	2	3	4	5	6	Else
Wheel Chair	1	0	0	1	0	0	0	0	0
Stretcher	0	0	0	0	0	0	0	0	0
O2 Cylinder	0	0	0	0	0	0	0	0	0
Oximeter	0	0	0	0	0	0	0	0	0
IV Pump	0	0	0	0	0	0	0	0	0
Cardiac Meter	0	0	0	0	0	0	0	0	0

Ward Condition (Hi/Lo in last 24 Hrs)

Zone	Curr. Temp.	Temp. (Min)	Temp. (Max)	Curr. Humid.	Humid. (Min)	Humid. (Max)
Robotics	0	0	0	0	0	0
Biomedical	0	0	0	0	0	0
Wireless & Mobile	0	0	0	0	0	0
Cloud Computing	0	0	0	0	0	0
Zone 10	0	0	0	0	0	0
Zone 11	0	0	0	0	0	0
Zone 32	0	0	0	0	0	0

Caregiver




Equipment

Ward

Configuration


Alert Information


■ Viewing detailed alert information relating to a patient





Unattended AlertsAlert HistoryRefresh2011-9-30 10:34:59 AMLOGOUT


Patient



Tag Patient


Untag Patient


Suspend/Resume Tag


Edit Patient Info


Search Patient


Set Patient Rules

Caregiver

Equipment

Ward

Configuration

! Unattended Alerts

Close

Alert (1 of 65)View ALL

ALERT Time: Thu, 22 Sep 2011 15:28:51

ALERT Target: Patient / HN10046725

ALERT Summary: Near Lab 321 Door

Cleared Time:

Suggestions

Near Lab 321 Door side, he may leave

Patient Information

History: Location and Conditions

Location

Temperature

Pulse

Total 1,127 Record, displaying 1 to 10.
[First/Previous] 1, 2, 3, 4, 5, 6, 7, 8 [Next/Last]

Date	Time	Zone
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Back Side
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Door Side
2011-09-22	02:27	321 Back Side
2011-09-22	02:27	321 Door Side

DISMISSSNOOZE (1 mins)SKIP

Equipment Information



病人

护理员

设备

注册识别标签

注销识别标签

编辑设备信息

搜索设备

编辑设备守则

病房

设置

未处理的警报

警报记录

刷新

2011-9-6 10:29:33 AM

退出

搜索设备

步骤一：确认设备编号

编号

WC31

查询

步骤二：设备记录如下

设备信息

过去位置

Type: Wheel Chair

Loc: Cubicle 5

Total 110 Record, displaying 1 to 10.

[First/Previous] 1, 2, 3, 4, 5, 6, 7, 8 [Next/Last]

日期/时间	进/出	位置	备注
2011-09-06 02:48:02	OUT	Cubicle 5	
2011-09-06 02:48:02	IN	Cubicle 5	
2011-09-06 02:47:55	OUT	Cubicle 5	
2011-09-06 02:47:55	IN	Cubicle 5	
2011-09-06 02:47:54	OUT	Cubicle 5	
2011-09-06 02:47:54	IN	Cubicle 5	
2011-09-06 02:47:52	OUT	Cubicle 5	
2011-09-06 02:47:52	IN	Cubicle 5	
2011-09-06 02:47:51	OUT	Cubicle 5	
2011-09-06 02:47:51	IN	Cubicle 5	

Export: ☒ Excel

取消



Thank you for listening
We care what you care

