Kara Location System Overview

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Revision 1.00

Javdan@Kara

Kara Location System (KLS)

Kara Location System is a RTLS system developed by Kara Telephone company with most state of the art technologies available for this purpose.

KLS uses UWB technology for ranging and TDoA technique to determine the locations.

The best achieved accuracy for LOS environments is 15cm

The capability of interconnection with KBM (Kara Building Management) is considered in the first release of the system.

- The new technology of KLS is started on 1393/08

- Prototype get read for 1394/03

- Pilot installation 1394/06

KLS Structure

KLS contains several application parts that all together provide required functionality of system

There is three major parts
- Sensor Network: Provides location data
- Location Engine: Process location data and provide Location Info
- User Interface: Provide Map System and show real time location information
- KLS DB: Location and map database
- Building Management Sensor Network
- KBM DB: Infrastructure database
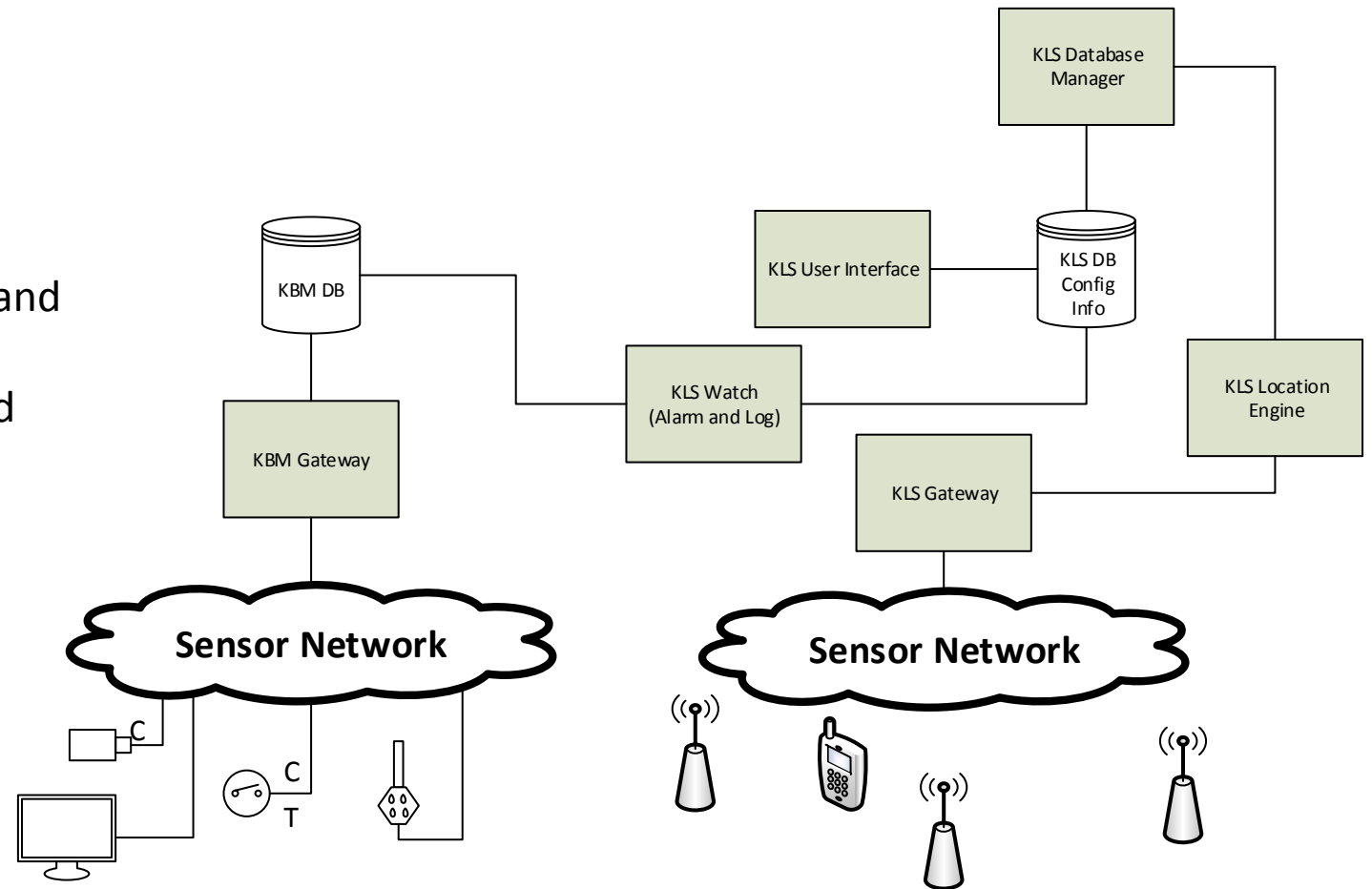
# KLS Concepts

- Reference Nodes. Fixed anchor nodes that provide system coverage

- Blind Nodes. Nodes attached to mobile targets

- Objects. Any person of stuff attached by a Blind Node

- Rule. A set of relations between objects and locations that enable system to generate event on defined situations

- Workflow. A set of rules that happened to complete a complicated task

- Blink. A chirp of a blind node that show its location to system

- Location. A defined area in the system map (room, partition or a sub-room)

- Zone. A group of locations that share a security level

KLS Software Specifications

- System map for real time tracking of defined objects
- Search capability for objects and locations
- Object lock and auto panning
- Object trace path
- Multilayer graphics (maps, blueprint, configuration, trace, objects)
- Location Capabilities (Sensors, Cameras, Actuators)
- Access to location cameras video stream (with capture and snapshot)
- Live Object list and status
- Live system log and alarms list with filtering capabilities
- Define rules between objects, locations and sensor conditions
- Define Rule Actions like audio alarm, SMS, email, Snapshot, actuator
- Workflow definition with scheduling capability
- Web based access to map views
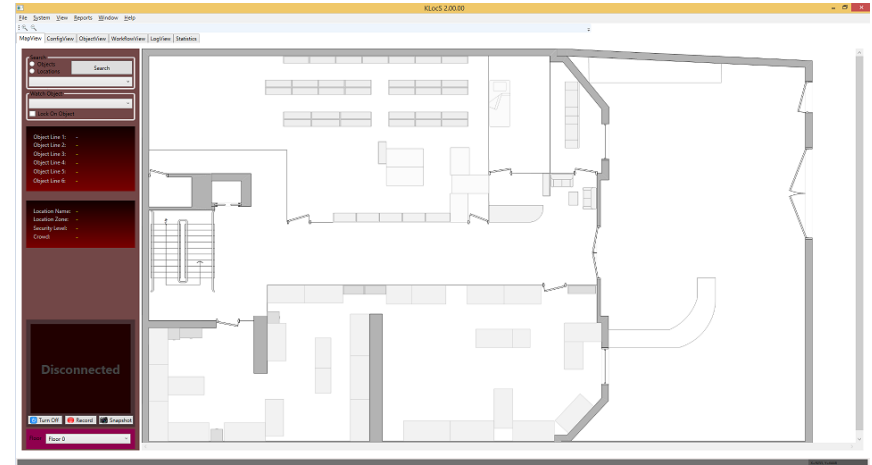
KLS Hardware Components (Computers)

KLS contains a Computer Application platform and a Sensor Network

- The Computer Application platform contains
  - Database Server
  - Computation Server(s)
  - Operator User Interface PC(s)

The Applications software can be collocated on a single PC for small systems. For extra large systems the computational servers can be distributed on several Embedded platforms.

KLS Hardware Components (Sensor Network)

KLS Sensor Network contains Reference nodes with known locations and Blind moveable nodes.

The Reference nodes must be placed in a special locations on the target structure.

The location, distance and distribution of the reference nodes depends on

- Size of the location

- Complexity of the structure (partition and obstacles)

- Material of walls and obstacles

KLS Hardware Components (Reference Nodes)

- Reference Nodes

Indoor Module
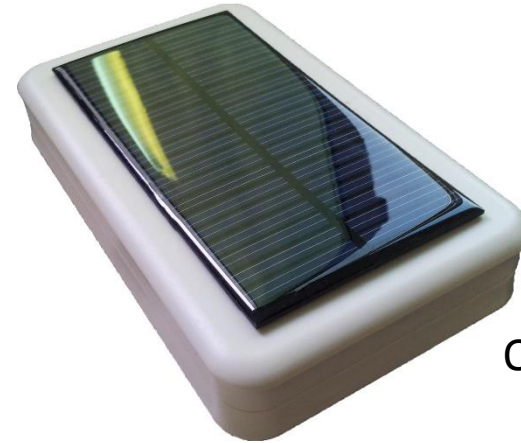
Outdoor Module

The indoor Reference node specifications
- 85x55x35
- 5VDC (7V max)
- 2400mAh (20h)

The outdoor Reference node specifications
- 155x95x30mm
- Solar source
- 10000mAh (80h)

KLS Hardware Components (Blind Nodes)

Blind Nodes used on target object (Person or Asset)

There is three type of Blind node

- Necklace
    - 72x38x15mm, 25gr
    - 370mAh (about 5 months)
    - Temperature, Accelerometer sensor
- ID Card
    - 85x55mm, 25gr
    - 630mAh (about 8 months)
    - Accelerometer
- Wrist watch
    - Dimension + weight
    - 150mAh (about 90 days)
    - Detach detection

Sensor Network Security and Data

- Sensor network is physically detached from System private network. So there is no way to access the private network through sensor network.

- The location information is extracted from location of the anchors. The air packet content is only a simple counter that worth nothing for listening. So the air content is completely secure.

- Any data packet required to be transferred on the network can be encrypted with AES or any other encryption method.

Frequency band usage

KLS UWB system works at 3.5 to 6.5GHZ with Bandwidth of 499.2 to 900MHZ

The KLS system is an indoor SRD system

The regulatory agreement from 1389/1/20 says

- Permission required for outdoor usage even with very low power devices.

- Usage of DAA and LDC methods otherwise max=-70dBm/MHZ and mean = -30dBm/MHZ (all the peaks are defined)

- Usage of recommendations ITU-R SM 1754..7

KBM System

KBM is a Building Management System developed by Kara. The key feature of this system is integration with KLS Map System.

The components of this system are in five categories
Sensors
Actuators
Cameras
Displays
Public Address

The KLS Rule manager can define rules between KBM components and even more...

It can create streaming from external sources or files to displays on schedules

The rules can provide automatic access control to locations

KBM Structure

KBM Add Sensor Status to Custom Rules

KLS Rules are about Objects and Locations

Internet

Web Server

Interactive map System

Operator View:
Map
Logs
Status

Custom Rule Management

KBM Data

Location Engine

KLS Data

KBM Gateway

KLS Gateway

Direct Access Gateway

KLS Configuration

KBM Configuration

Building Sensor Network

KLS and KBM Interconnections
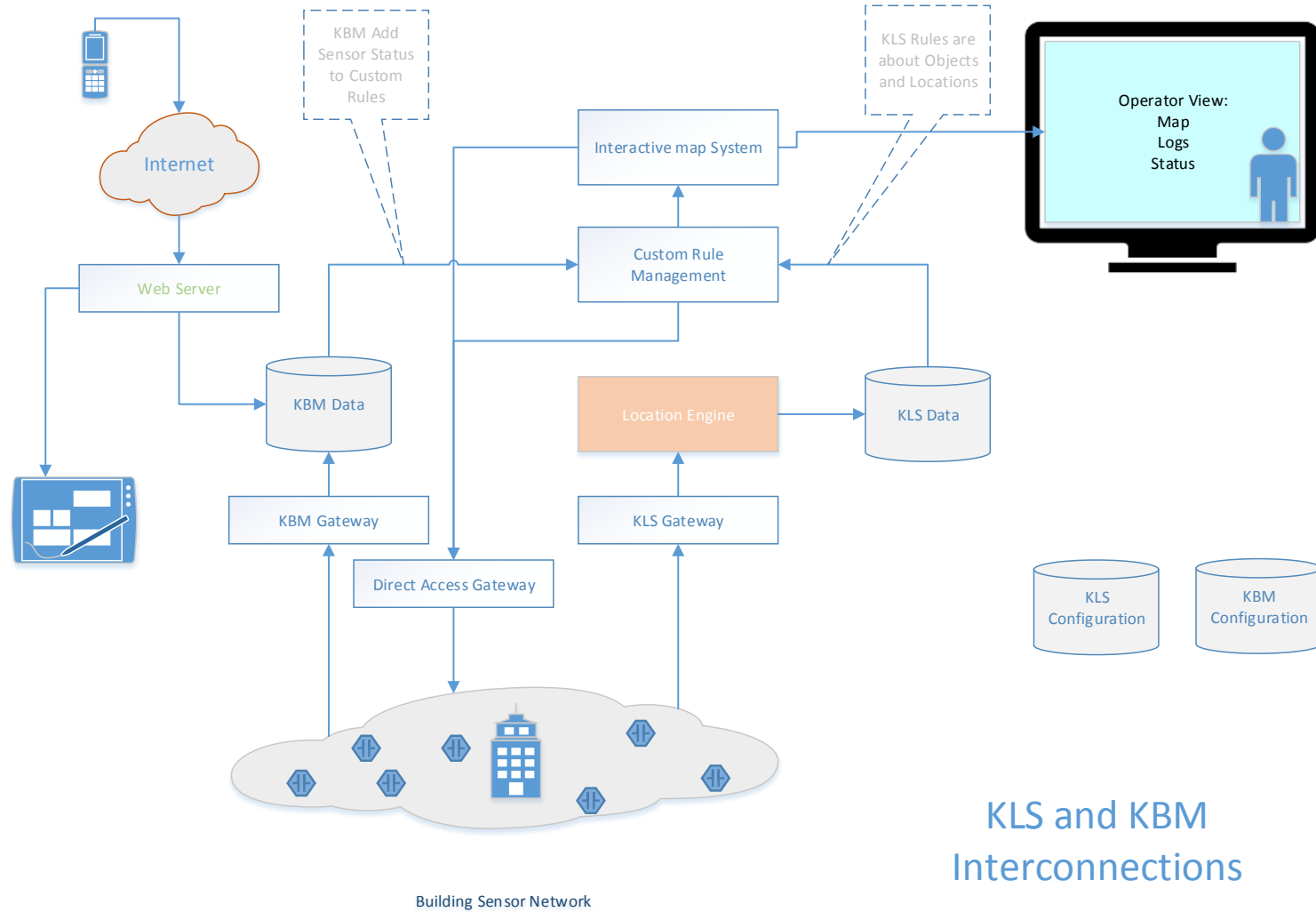
KLS and KBM Interconnection

The interconnection between KLS and KBM are provided by database.

Each of these two systems can act independently.

The common point of both systems is Map System.

Map system is a part of software that provides a view of the system maps and everything added to it as capability. The capabilities are shown as icons that their status and information can be seen by mouse over event.

Each of these two system have its own sensor network.
The KBM network can use KLS backbone data network.
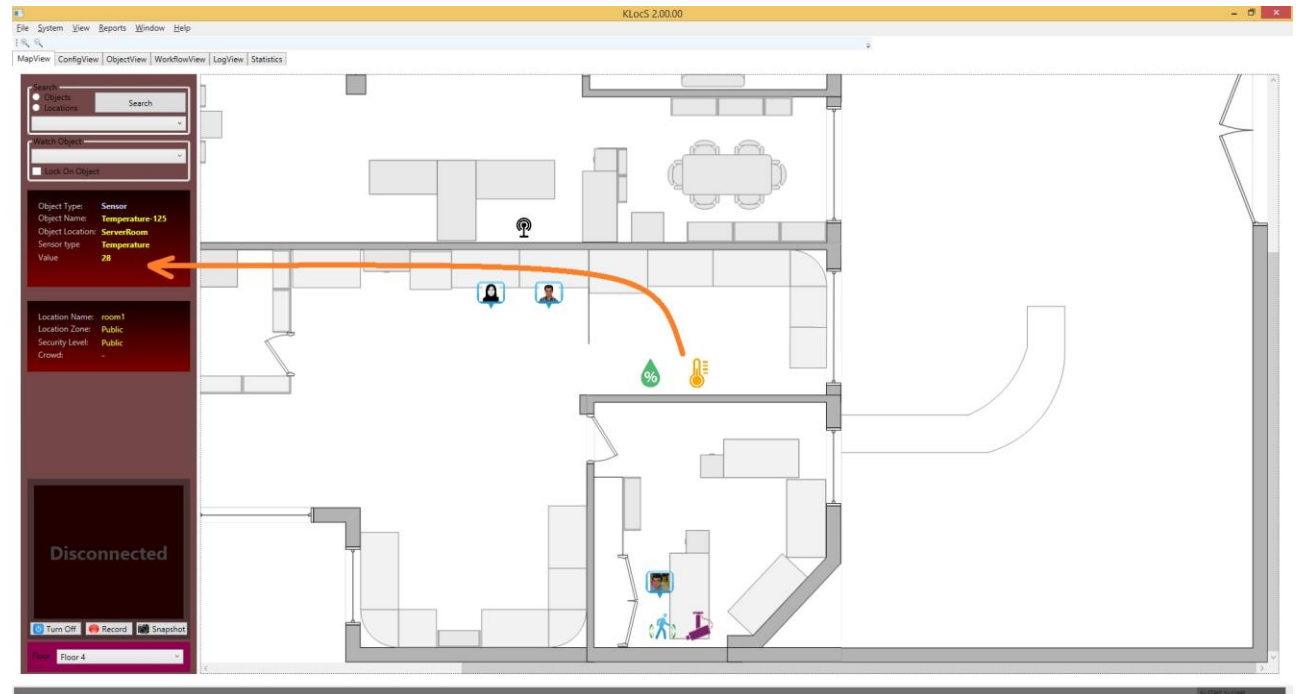
KLS Rules

KLS Rules are the most sophisticated control tool over the location system

It can control presence, proximity, crowd of objects over locations. Objects and locations can be generalized to Object Groups and Zones for easier rule definition.

Sensors can also included into a rule as **Sensor Only Rule** or in combination of objects and locations.

Rule can be scheduled to be checked over specified times (one time or periodically)

A collection of actions can be chosen if the rule violated, like audio alarm, SMS, email, Camera snapshot or actuator trigger.

KLS Workflow

- Workflow is a collection of tasks that must be performed one by one.
- The steps can be forced to be sequential or not.
- The result (start, stop and steps) will be shown in system log view.
- Each step can have its own actions (like a rule).

KLS Object View

- This View provide a list of system current objects. Location of all objects will be updated on every move. So the location is the last known location of the object.

KLS Log View

Log view shows the events occurred in system. Some of these event maybe the alarm.

Log types are
- Location change
- Rule violations
- Workflow event (Start, Steps, End)
- Request messages from blind nodes
- Alarms

The can be filtered by their types in addition to parameters like object, location

| | MapView | ConfigView | ObjectView | WorkflowView | LogView | Statistics |

Filters
- ☑ All
- ☑ Locations
- ☑ Rules
- ☑ Workflows
- ☑ Messages
- ☑ Alarms

- ◉ None
- ○ Object
- ○ Location
- ○ Object Group
- ○ Zone

☐ Show Unread Only   Clear Log

| EventType	EventID	Time	BlindObjectID	LocationID	Description	ReadStatus
2	1000	4/19/2015 6:58:39 PM	1000	13	<4/19/2015 6:41:39 PM> Location changed by 'Sahabi' to Lab'	0
6	1000	4/19/2015 6:41:39 PM	1000	12	<4/19/2015 6:41:39 PM> Rule Vialoation 'Intruder' by 'Shahabi' at 'Lab'	0
2	1000	4/19/2015 6:41:39 PM	1000	11	<4/19/2015 6:41:39 PM> Location changed by 'Sahabi' to 'ComputerRoom'	0

Security Level Control

- Each object have a security level as defined.

- Each Location belong to a zone which have defined security level.

- Any conflict between security level of object in locations will generate system alarm. For more action operator can define rules that generate more sever actions.
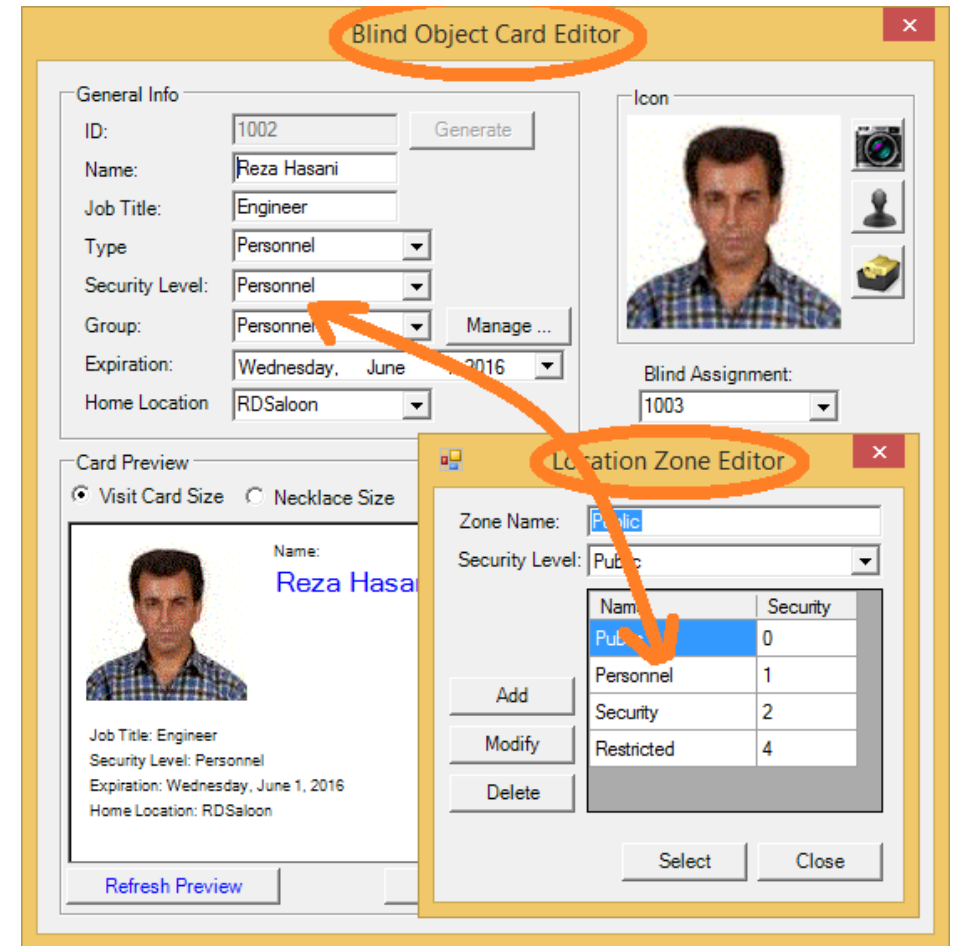
Performance Monitoring

The statistic view of the KLS can show how much time an object spend in different location during a time period.

It also show the entrance count for every location in a separate chart.
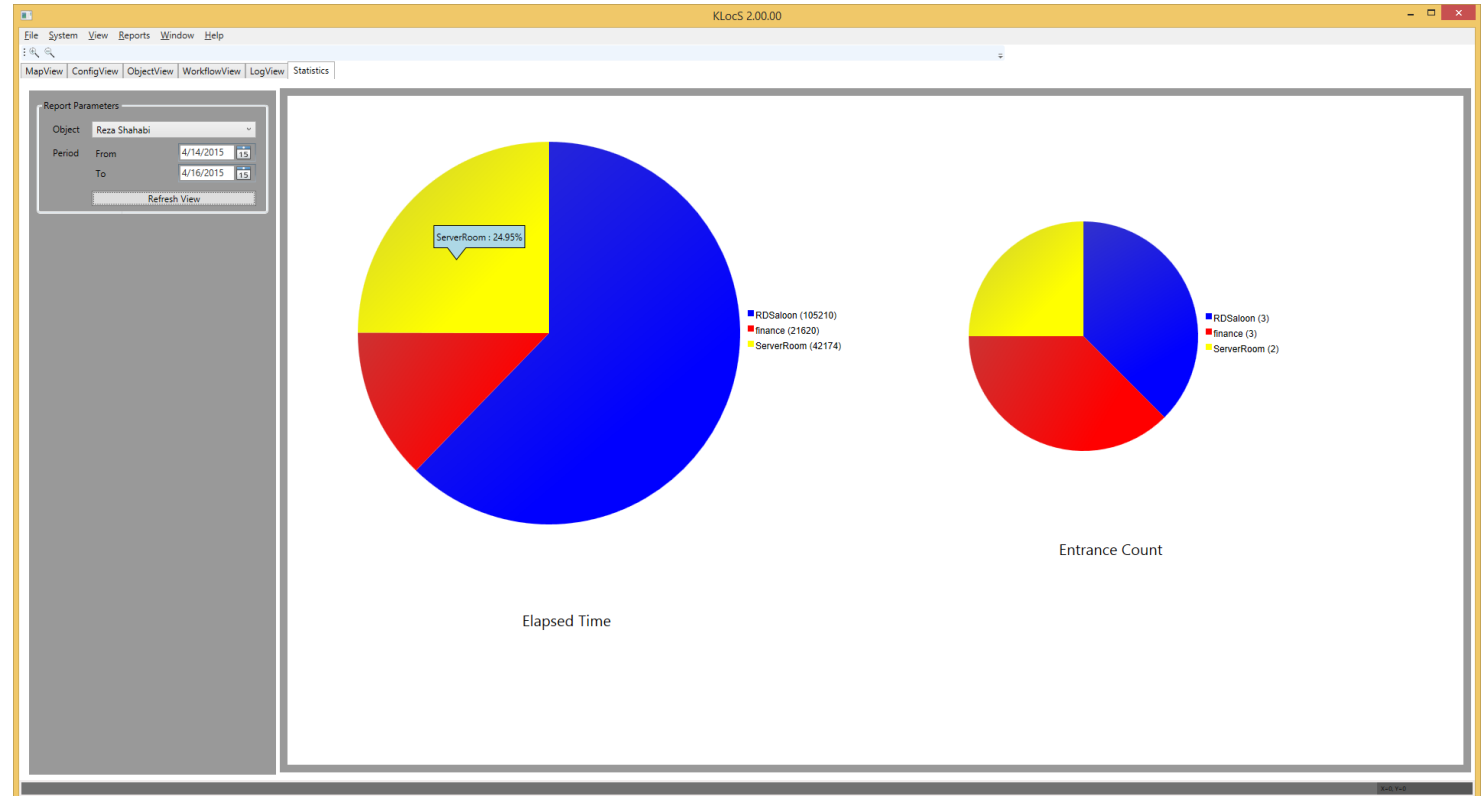
KLS Web Access

- The Web View of the KLS Map System is possible through login to KLS web server.

- Login is required for every group master (provided by system admin)

- Each login can only view its own group members (except for admin level which can see all)

- No configuration and sensitive data is accessible from web view