Welcome

Dynamic Multi Sensor Management System






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Introduction

A Sensor Performance Data Management System is proposed to account for interaction of static and dynamic aspects of sensor performance.

This will support Battlespace Management of sensor networks by providing information of sensor performance at specific locations and times within an area of interest.

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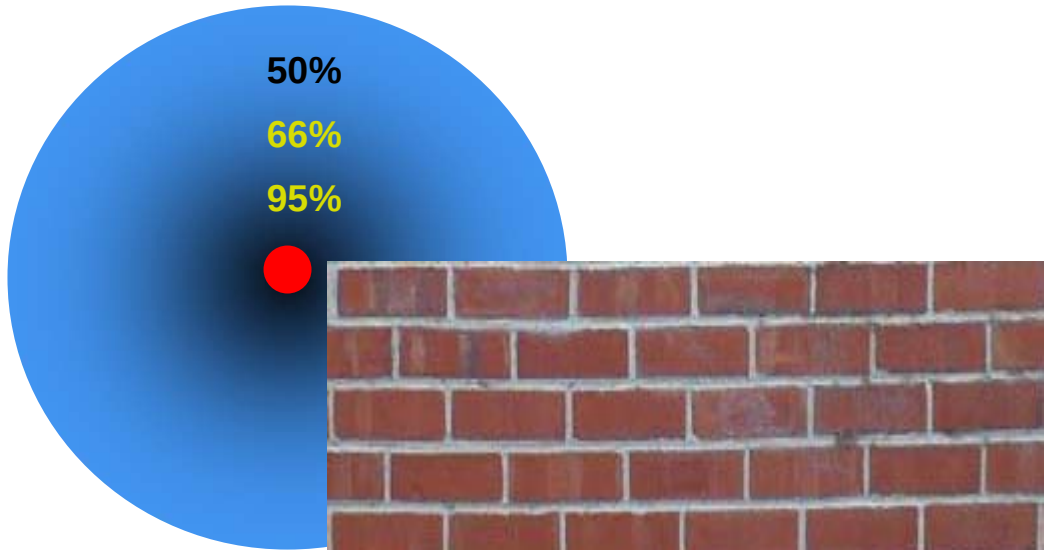
Multi Sensor Network To Protect Entry Gate

Each Sensor has a limited field of regard

Each Sensor has it's own unique performance contour



Chemical Sensor

Multi Sensor Network To Protect Entry Gate

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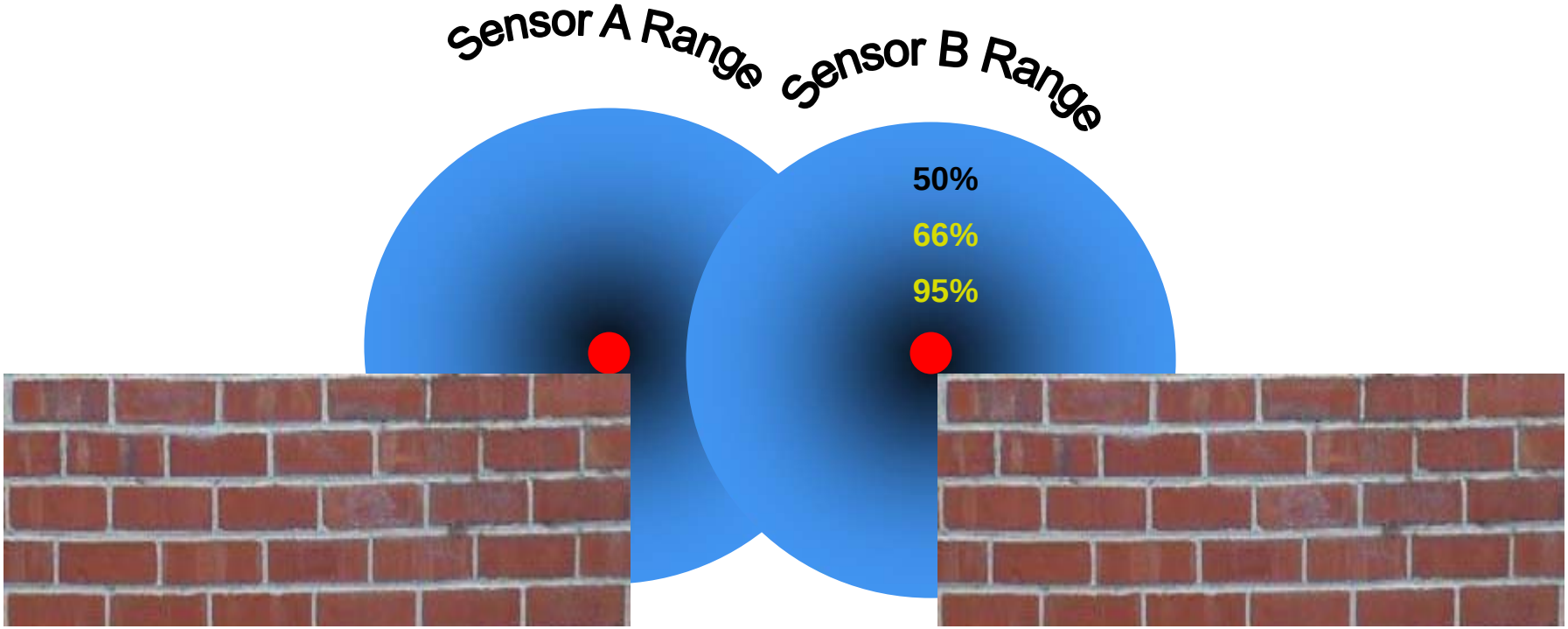

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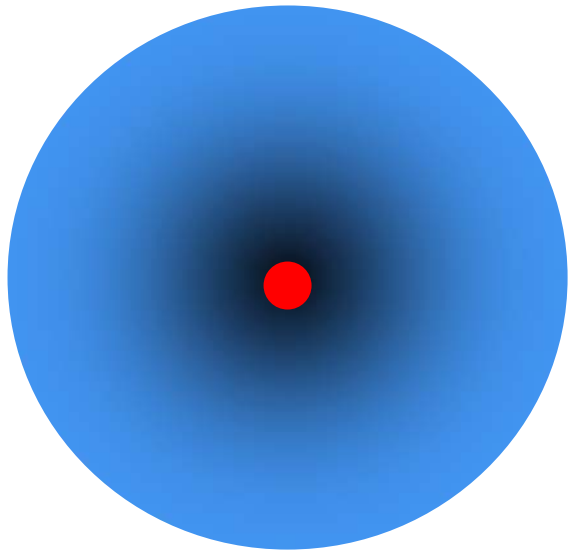
Performance Modeling Today

- Performance Modeling (PM) is often a single prediction as though sensor performance is uniform over an entire field of regard assuming
  - Worst Case
  - Average Case
  - Best Case



Issues

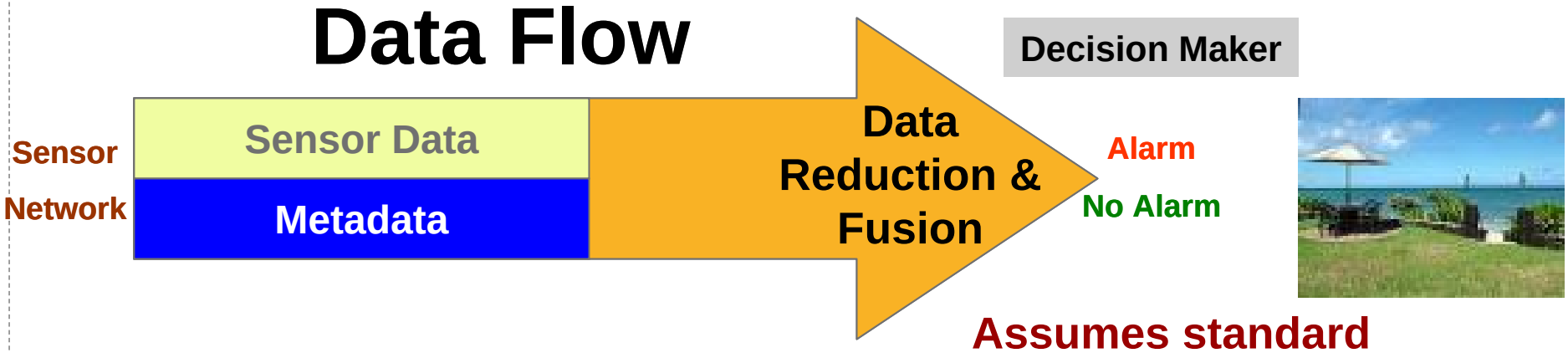
- Sensor performance is inherently a spatially AND temporally variant quantity
  - A single performance prediction may be good ‘on average’, but poor at any particular location or time
  - What happens when a sensor is not operating within design limits?

Variables Effecting Sensor Performance

- **Environmental Issues**
  - Wind
  - Humidity
  - Lighting
  - Temperature
- **Sensor Issues**
  - Calibration state
  - Sensor health

Decision Maker Assumes Standard Operating Environmental Conditions

Data Flow



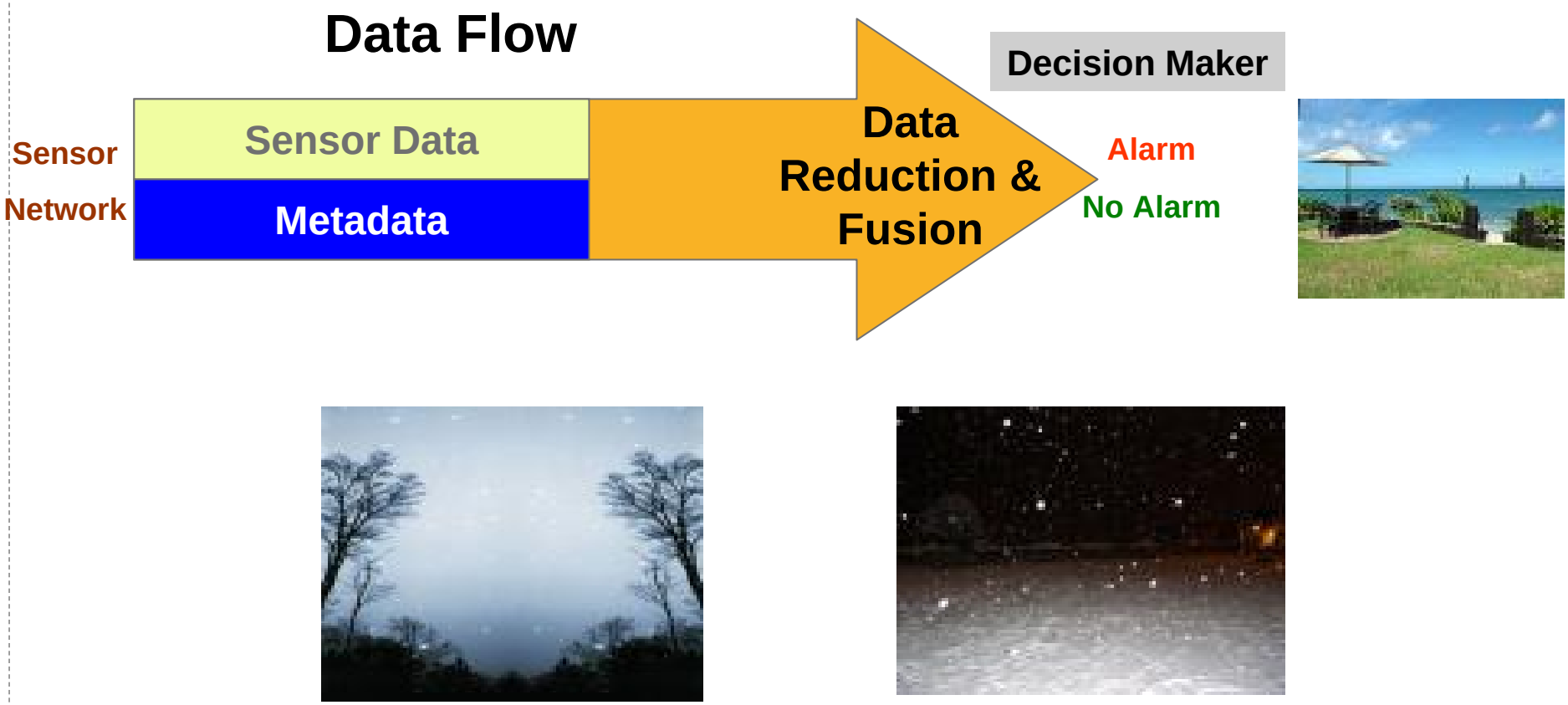
Assumes standard conditions:

1. Environmental

2. Sensor State

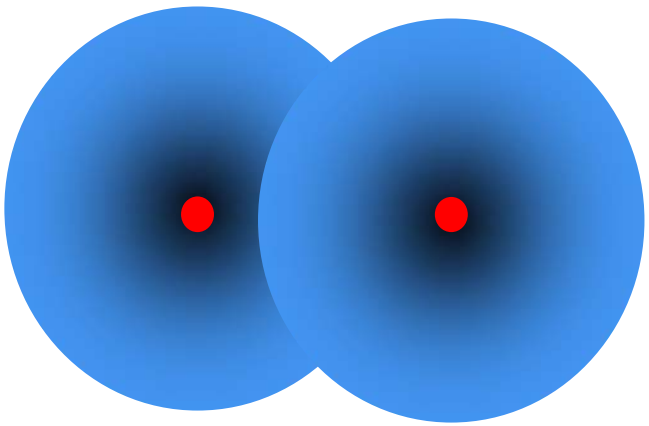
The decisions are based on standardized operating conditions (nominal)

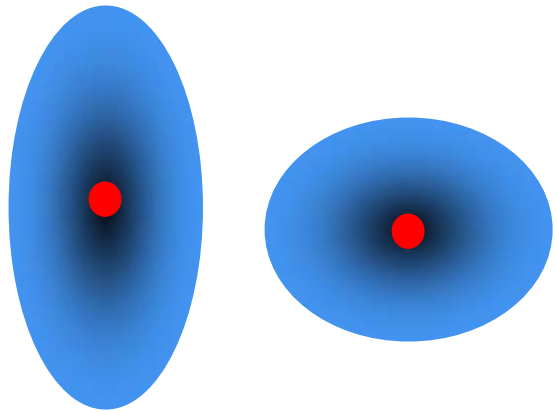
Actual Environmental Conditions



As standardized operating conditions vary, assumptions about sensor performance will change

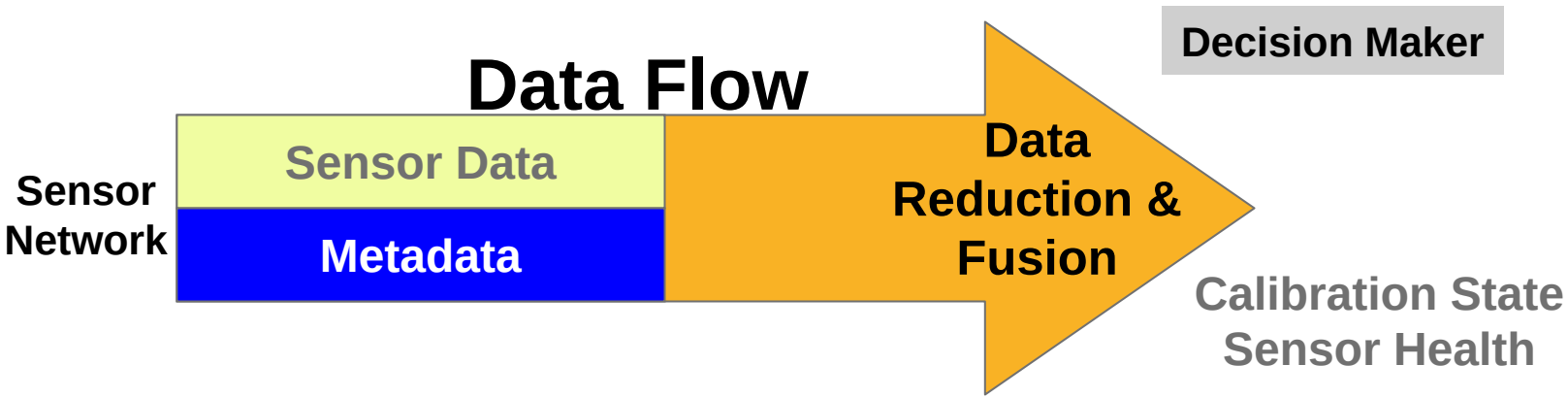
Sensor Coverage: Environmental Differences





Sensor Operating Performance & Area Coverage

Sensor State Conditions



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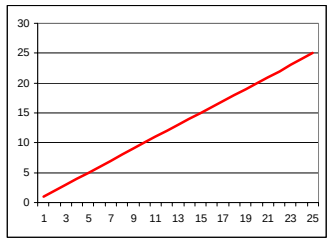
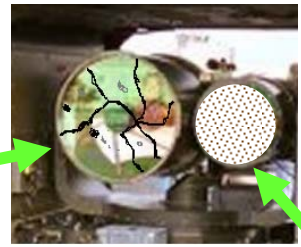
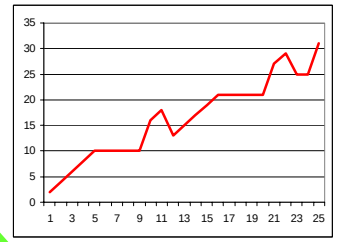
Sensor State Coverage

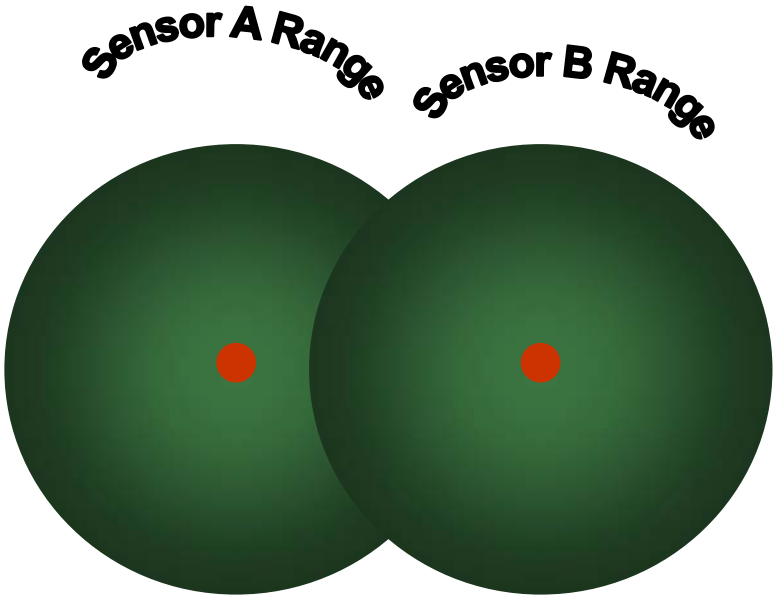


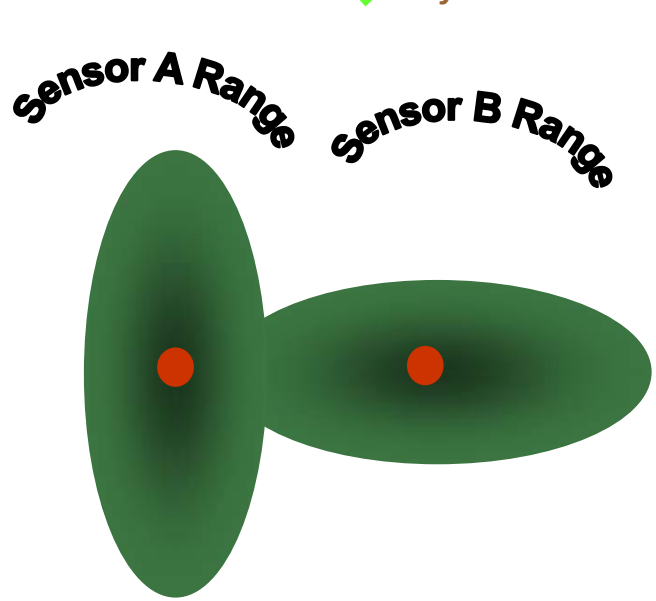
Lens cracks





Dirty Window





Sensor State Operating Performance & Area Coverage

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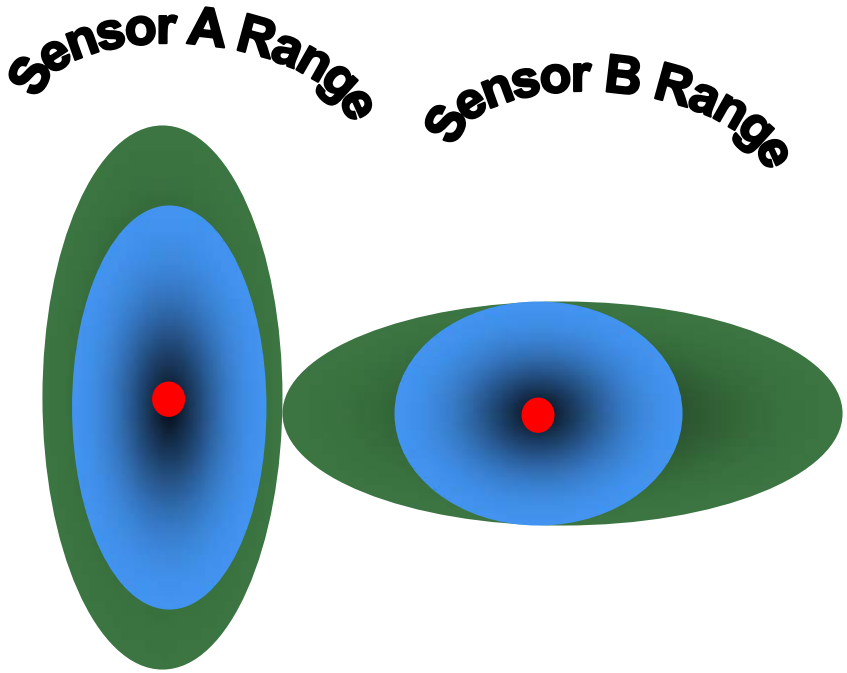
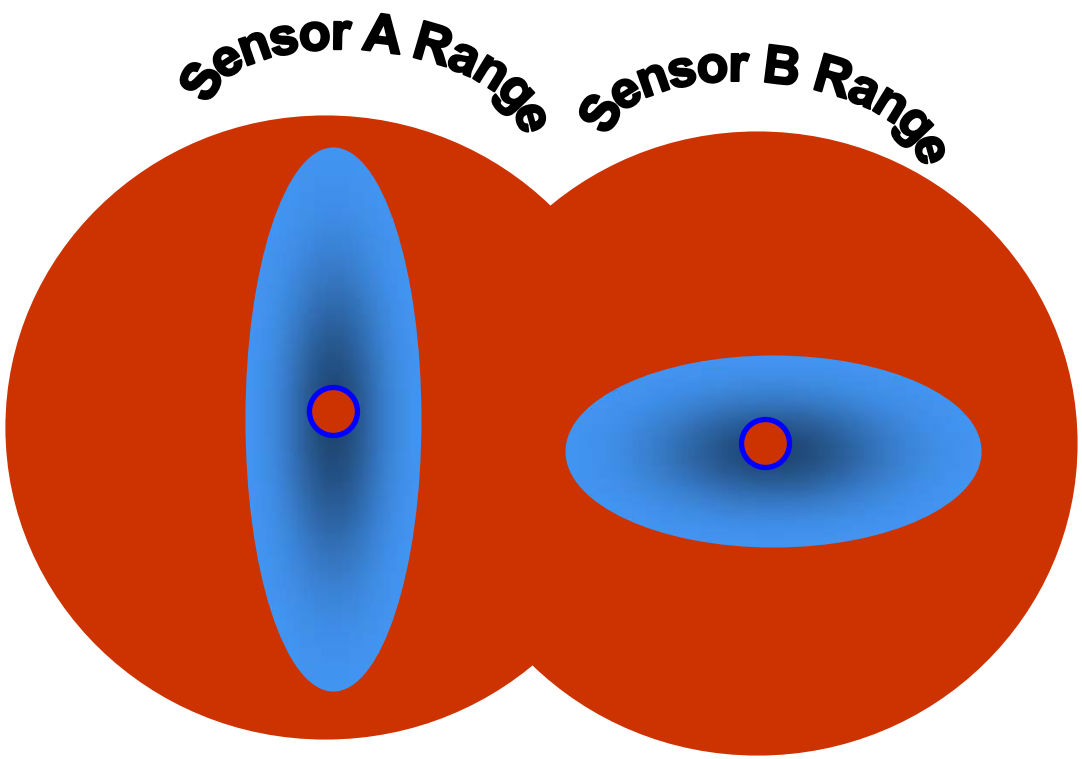
Combination of Environmental and Sensor State Contours



Sensor Area Coverage Lost from Nominal Conditions

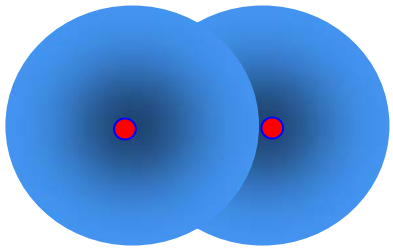


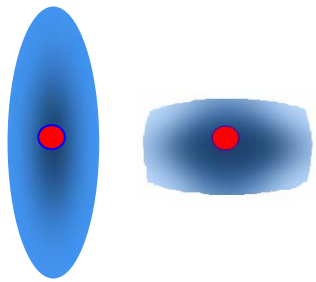
= Sensor area coverage lost due to Environmental & Sensor State Restraints

Solution: A Picture of Sensor Performance

Manage Sensor performance actively during operations of each sensor

Update as a function of location and time within the sensor field of regard





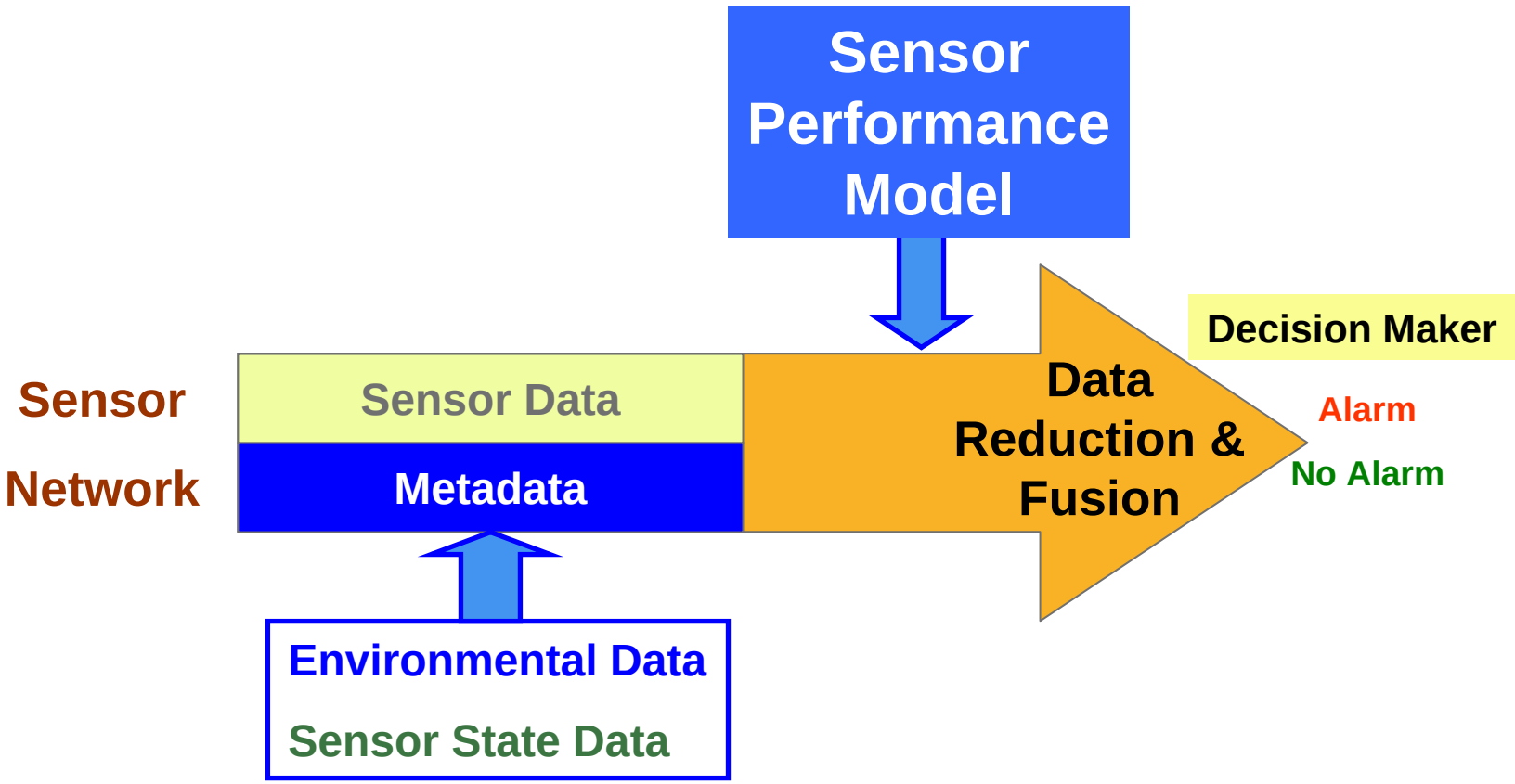
Sensor Performance Models

Sensor Performance Models are commonly used in sensor development and testing.

Examples:

- Chemical and Gas Sensing models include plume migration and wind effects as well as other important factors
- Imaging Sensor Models account for exposure, focus and atmospherics as well as other important factors

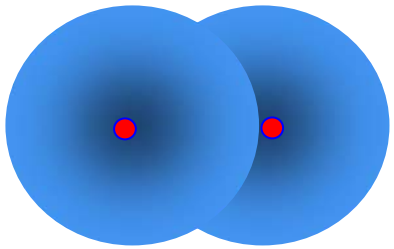
Solution: Insert Sensor Performance Model



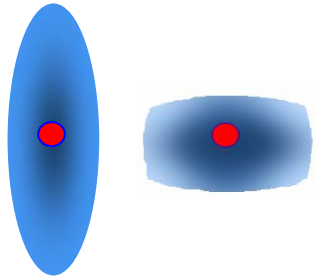
Insert Sensor Performance Model into operational architecture

Solution: Insert Sensor Performance Model

Is it this



Or this?



Sensor Performance Model

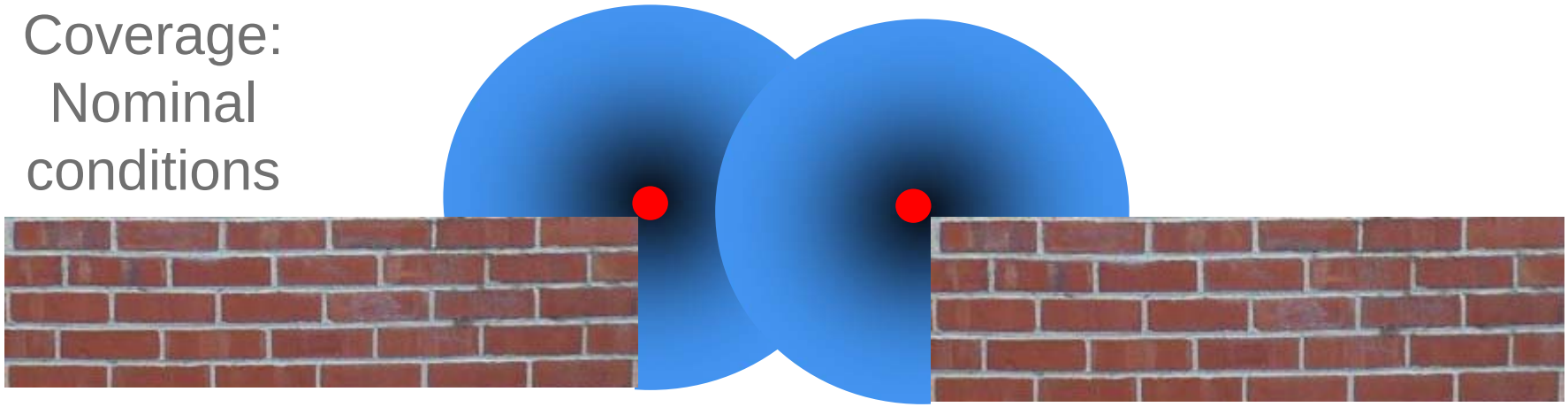
Evaluate Predictions Against Requirements

Confirm coverage **Or** Identify gaps

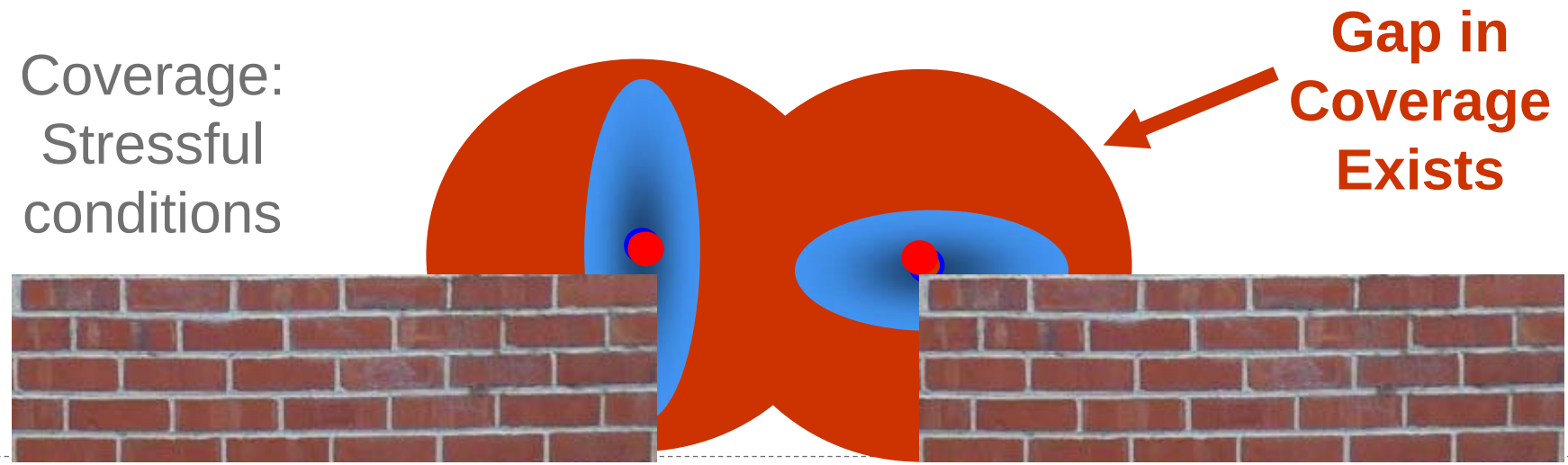
Decision Maker

Predictions Evaluated Against Requirement

Coverage: Nominal conditions



Coverage: Stressful conditions



Near Real Time Threat Mitigation

Identify coverage gaps due to

- Changes in Environmental conditions
- Failed/degraded sensors

Answer the following questions

- Where coverage gaps?
- How big are they?
- Can I redeploy existing sensors to remove/reduce the gap?
- Where do I deploy additional sensors to fill gaps?

Threat Management Applications

Supports re-assessment of network capability during operations

Provides capability to assess performance against stressful operational scenarios

Allows Redesign of operational sensor networks

- **New mission requirements**
- **Variable threat levels**
- **New/improved sensor technologies**

Conclusion

Integration of the Sensor Performance Model into your operational sensor network will provide dynamic knowledge of the system performance at particular locations and times within an area of interest.

This benefits battlespace management by supporting:

Near Real Time Threat Mitigation

Threat Management Applications

ITT Sensor Performance Modeling Experience

Sensor Type	Application
Thermal	Night time and low light Target Detection and identification
Video	Target detection, identification and tracking
Multi-Spectral	Materials Detection and Identification, full color and false color imaging
Hyper-Spectral	Material and Chemical Agent Detection and identification.
IMS	Chemical Gas Detection
LIDAR	Solid and Gas Biological and Chemical Agent Detection