CPS: Breakthrough: Secure interactions with Internet of Things (CNS-1646130) – Detecting Misplaced RFID Tags

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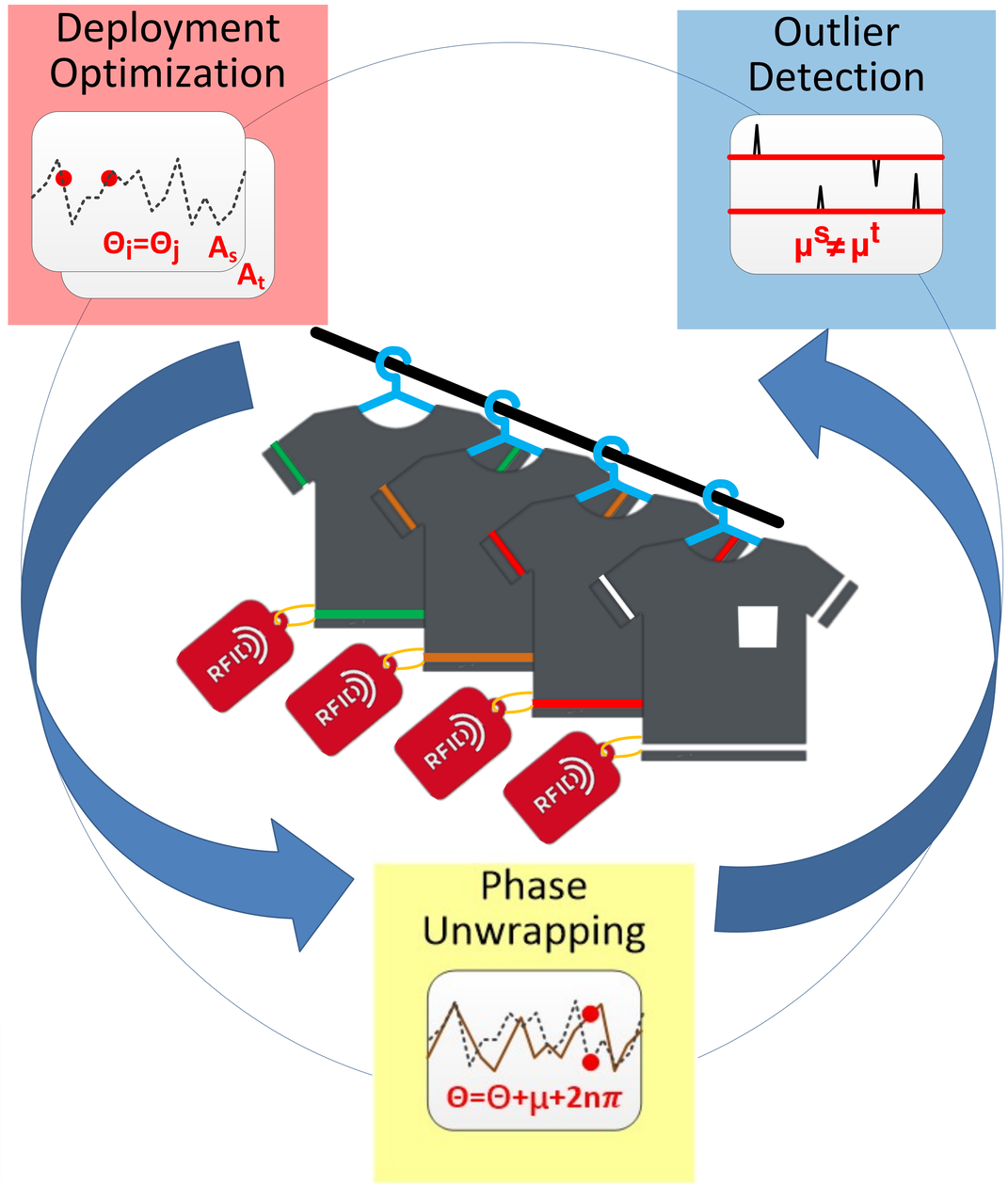
Goal: 3R3P

- **R**ight **P**roduct is available
- on the **R**ight **P**lace
- at the **R**ight **P**rice

Challenge:

- Position ambiguity
  - –different positions may yield the same measured phase
- Phase wrapping
  - –the measured phase may contain one or more 2π jumps
- Device diversity
  - –antennas may have different unknown initial phases



Solution:

- Deployment optimization
  - –maximizes the phase discrimination of any 2 tag positions by optimizing antenna positions
- Phase unwrapping
  - –eliminates the effect of 2π jumps by comparing the measured phase with theoretical phase
- Outlier detection
  - –estimates the systemic error, and detects abnormal phase deviations to identify misplaced tags

Secure interactions with Internet of Things (CNS-1646130, The University of Michigan, Kang G. Shin, kgshin@umich.edu)

Scientific Impact:

- Locate, in real time, passive tags with stationary antennas
  - –remove inconsistency between measured and theoretical phases
  - –evaluate and optimize system performance through numerical calculations

Broader Impact:

- Smart shelving
  - –replacing visual checks by store staff
  - –consistent shelf-space allocation compliance
- Asset tracking
  - –deploy some reference tags at known positions
  - –localize or track tags at unknown positions