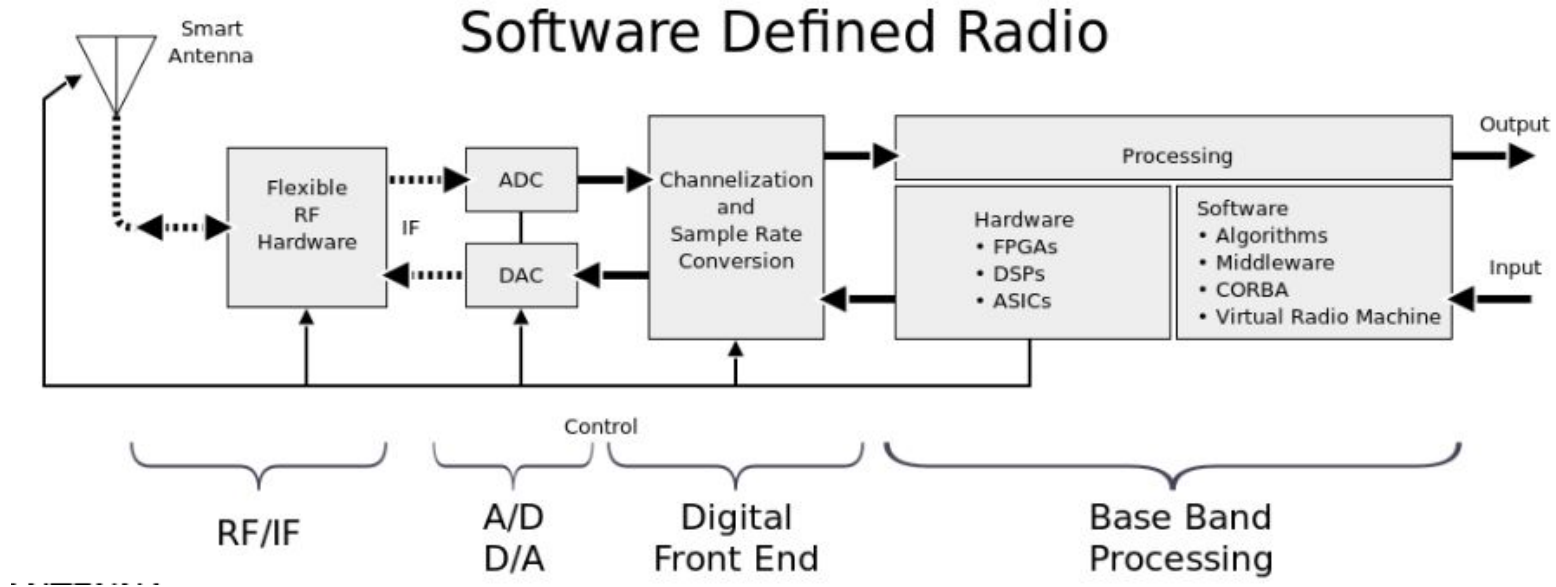
Cognitive Radar

Cognitive Radar for Target Tracking Using a Software Defined Radar System
IEEE Radar Conference 2015, Kristine Bell *et al*

> *"Tracking and classification can be improved using adaptation between the information extracted from the sensor/processor and the design and transmission of subsequent illuminating waveforms. As such, cognitive systems offer much promise for improved performance."*

Overview

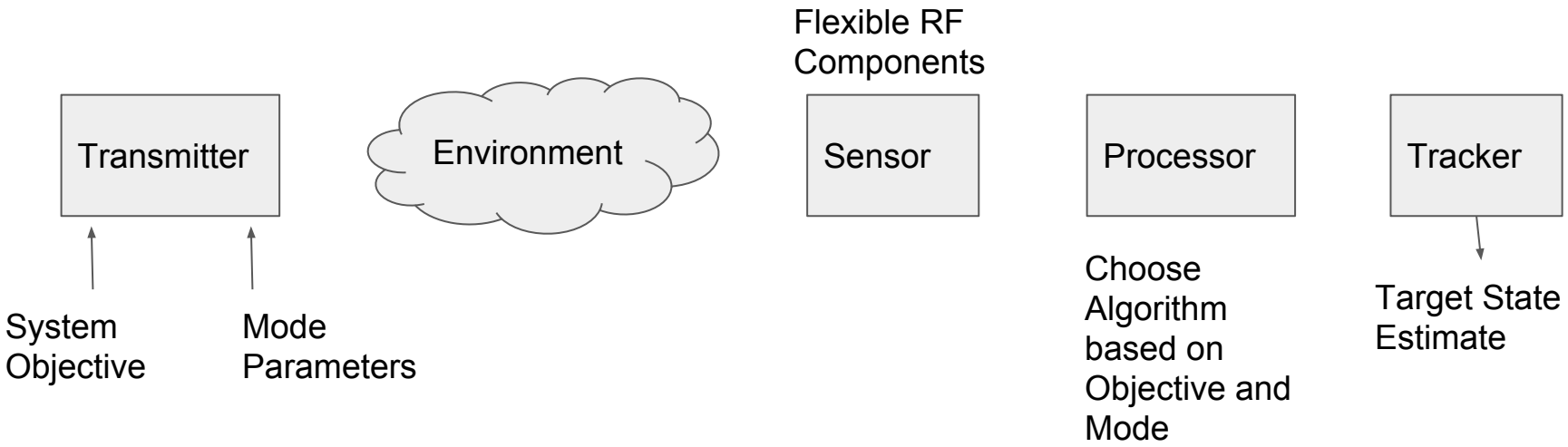
- Software Defined Radio
- Feed-forward Architecture
- Cognitive Radar
- Bats → Echolocation
- Bell Experiment and Results



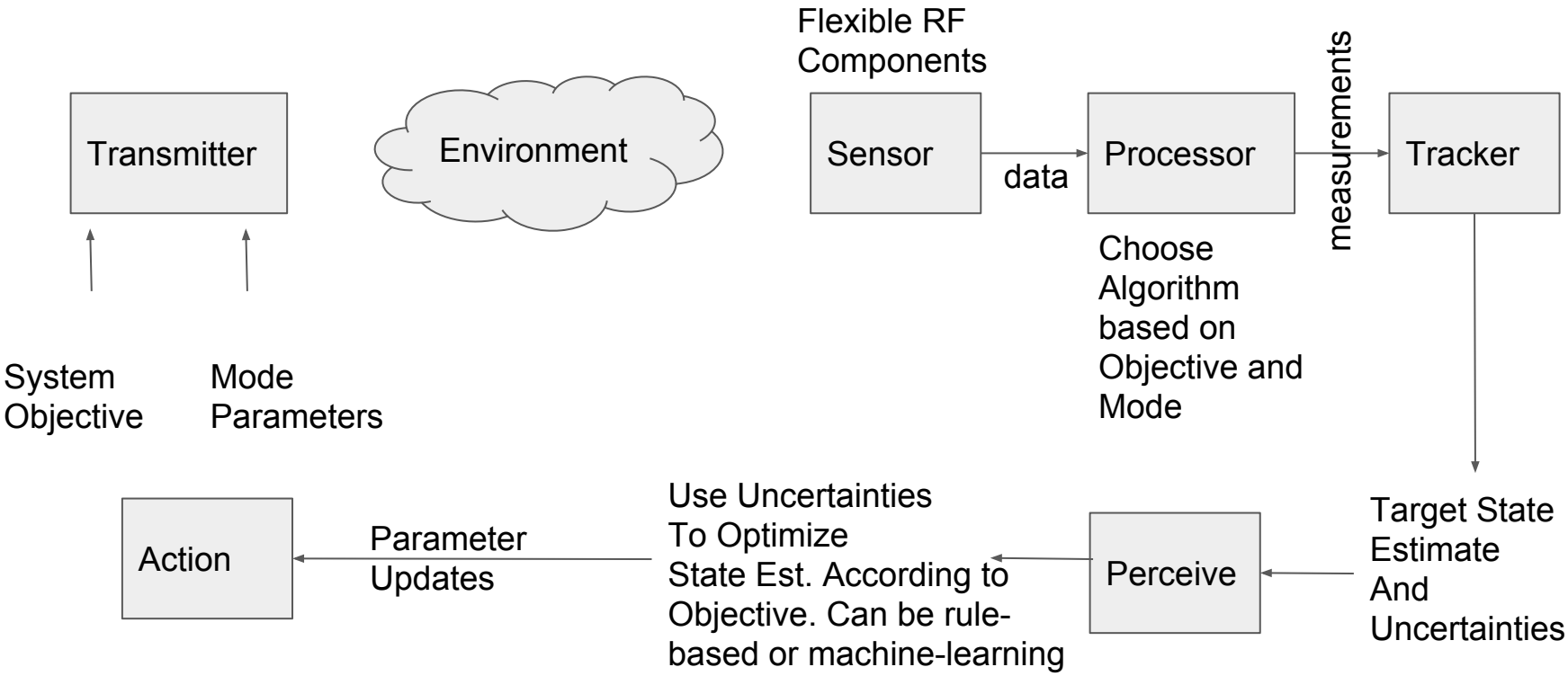
- **Enablers**
  - Faster A/Ds → Stable Clocks → Coherency
  - Computing Power (and SWaP)
  - Software Prototyping Environments (MATLAB)
  - RF circuit elements → Cheaper, Better

Feed-forward Radar System (SDR)

- Radiate a parameterized waveform into the environment
- Receive the returns, process and estimate target parameters
- Assign to tracker and optionally add to display



Feedback Radar (Cognitive on SDR platform)



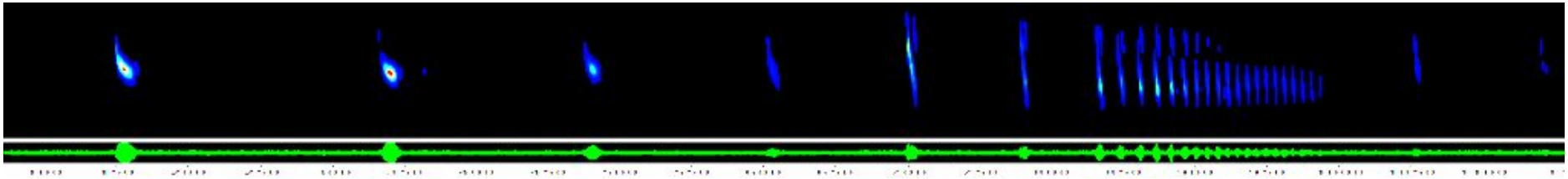
An Example from Nature (Cognitive Sonar)

System Objectives

- Gain Situational Awareness
- Seek out small airborne Prey
- Classify detections as Prey/not Prey
- Locate (Az, El, Range) Prey
- Capture Prey

Mode Parameters

- Carrier Frequency (Pitch: 10 - 200 kHz) → Size of prey
- Pulse Bandwidth (CW → LFM) → Spotlight vs. Search light
- Pulse Amplitude (Automatic Gain Control)
- Pulse repetition frequency



Bell Experiment

"a cognitive radar tracking system based on the Maximum a Posteriori Penalty Function (MAP-PF) methodology that allows us to cognitively control both the sensor and processor"

System Objective → Track Range/Doppler of moving person

Mode Parameter → Pulse Repetition Frequency