



# Binary Context Tree Based Middleware for Next Generation Context Aware Networks

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## Abstract

In this project, we present our

- **Context aware mobile application management system architecture** in sample **Smart Workplace Scenario**.

With our proposed,

- **Middleware**
- **Modelling technique** (*Binary Context Tree*)
- **Reasoning technique** (*Formal Language Based Logic Rules*)

## Introduction

- **Context** is any kind of information that is collected from environment with special functionalities as **acquisition, modelling, reasoning** and **distribution**.

• These functionalities are executed by **Middleware** as abstract layer.

- If this obtained context data used by systems then, these systems are called as **Context Aware Systems**.

-Intelligent & special systems

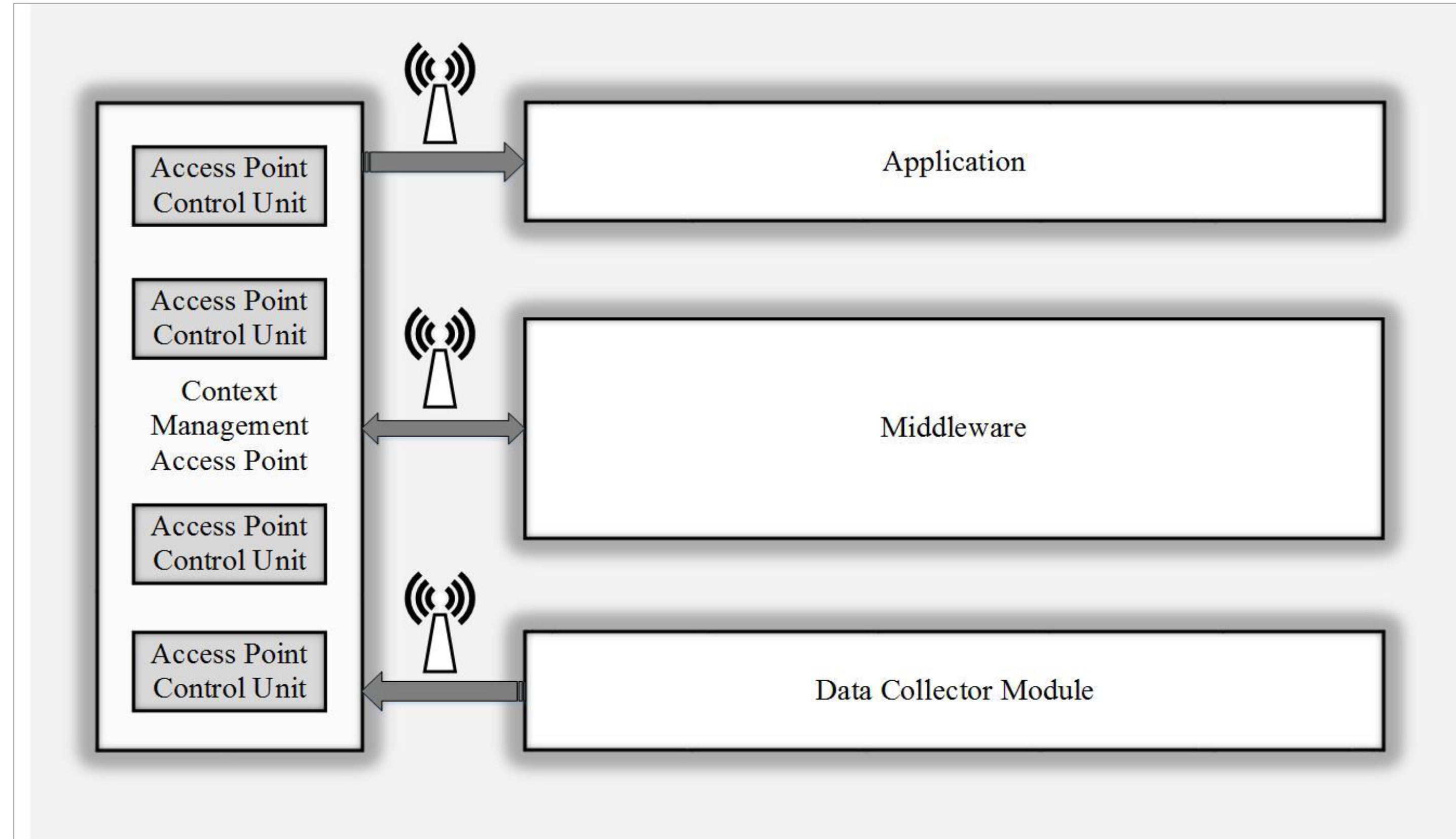
## Challenges

- Modelling method must be *simple & fast & well-structured & flexible*.
- Reasoning method must be *structured & standard & reusable*.
- Current methods *do not* enable all of these requirements at the *same time*.

## Contributions

- To solve above challenges, we propose
  - **Priority Based Binary Context Tree** as modelling technique.
  - **Formal Language Based Logic Rules** as reasoning technique.
  - Context Tuple as  $C = \langle \text{Existence, Location, Activity} \rangle$  for smart workplace scenario.

## The Proposed System Architecture



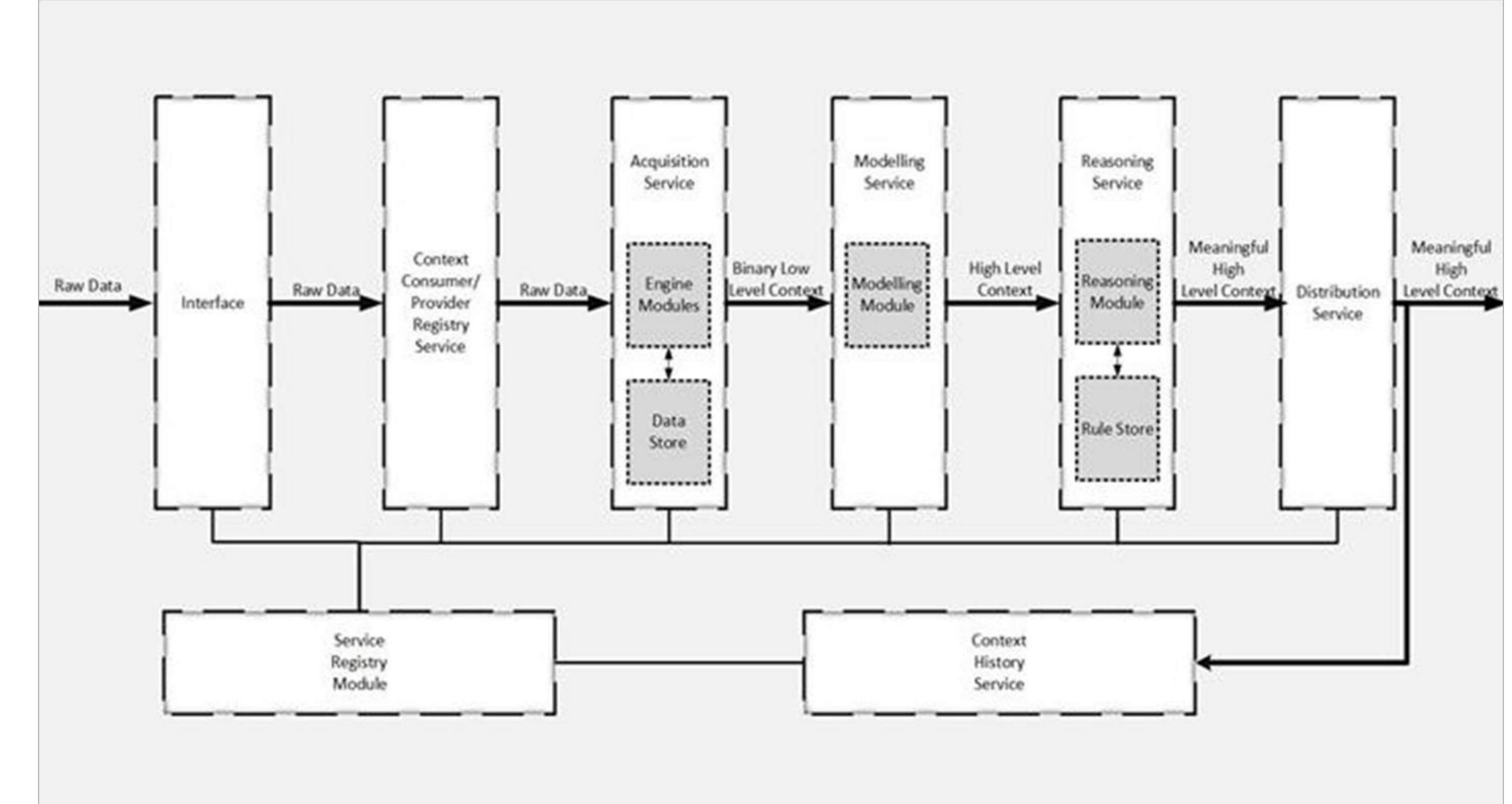
### Components:

- Two type sensor(signal & location) in Data Collector Module
- Context Aware Application
- Wireless Networks
- The Proposed Middleware
- Distributed Access Point Control Units

### Benefits:

- Extendable
- Scalable
- Fast

## The Proposed Middleware



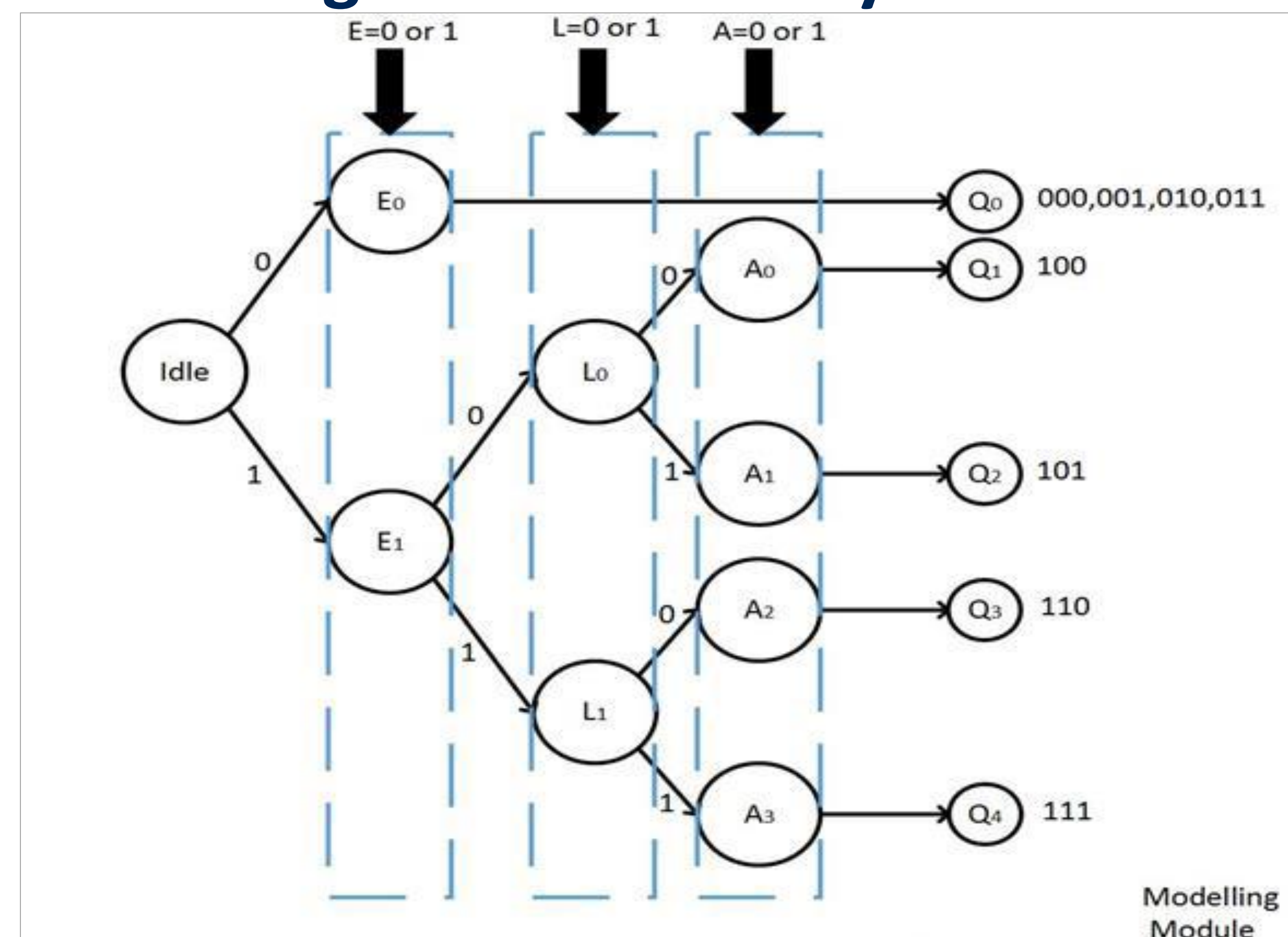
### Components:

- Interface
- Context Consumer/Provider Registry Service
- Service Registry Module
- Context History Service
- Acquisition Service
- Modelling Service
- Reasoning Service
- Distribution Service

### Benefits:

- Flexible structure
- High level abstraction
- Service Based

## Modelling Service - Binary Context Tree



### Benefits:

- Priority Based
- Simple
- Extendable
- Fast
- Quality Checking
- Well-structured

## Reasoning Service-Formal Language Based Logic Rules

Context	$\langle E, L, A \rangle$ 3- tuples
Alphabets	$E, L, A, E^*, L^*, A^*$
Grammer Rules	1: $E, L, A$ & 0: $E^*, L^*, A^*$
Words	$EL^*A^*$ $E^*L^*A^*$ $EL^*A$ $E^*L^*A$ $ELA^*$ $E^*LA^*$ $ELA$ $E^*LA$
Logic Rules	$E^*L^*A^*, E^*L^*A, E^*LA^*, E^*LA$    $E^*$ = Disconnect State (Not Available) $EL^*A^*$ = Employee is not in his own room and not working $EL^*A$ = Employee is not in his own room and working $ELA^*$ = Employee is in his own room and not working $ELA$ = Employee is in his own room and working

### Logic rules with

- Alphabets
- Grammar rules
- Words

### Benefits:

- Reusable
- Structured
- Formal
- Standard

**References** • C. Perera, A. Zaslavsky, P. Christen, and D. Georgakopoulos, "Context Aware Computing for The Internet of Things: A Survey," IEEE Communications Surveys & Tutorials,, pp. 414–454, 2014  
 • D. Garlan, D. P. Siewiorek, A. Smailagic, and P. Steenkiste, "Project Aura: Toward Distraction-Free Pervasive Computing," IEEE, Pervasive Computing, vol. 1, no. 2, pp. 22–31, 2002.