

A Logical Characterization for Dense-Time Visibly Pushdown Automata

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2 April 2016

Verifying Real-Time Systems

Correctness of real-time systems depends on two factors

- Functional correctness
- Timing correctness

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while(guard == true) {  
    int e;  
    e = getEvent();  
    handleEvent(e);  
}
```

Verifying Real-Time Systems

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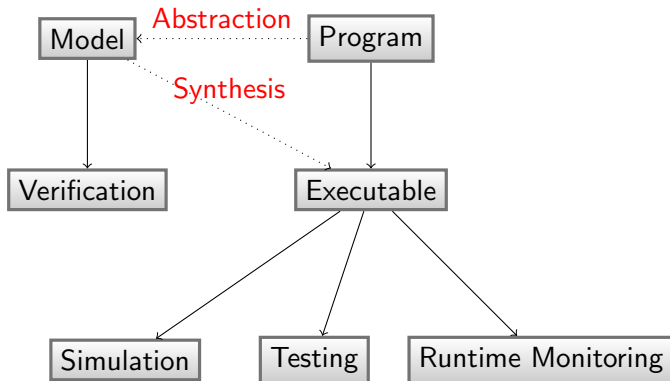
- Functional correctness
- Timing correctness

```
while(guard == true) {  
    int e;  
    e = getEvent();  
    handleEvent(e); // Deadline: 10 Units  
}
```

Verifying Real-Time Systems

```
while(guard == true) {  
    int e;  
    e = getEvent();  
    try {  
        handleEvent(e) within 0 to 10;  
    }  
    catch (TimeoutException ex) {  
        // Exception handler  
    }  
}
```

Verifying Real-Time Systems

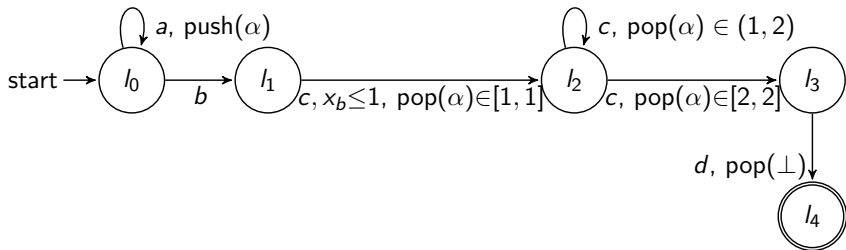


Required Computational Model

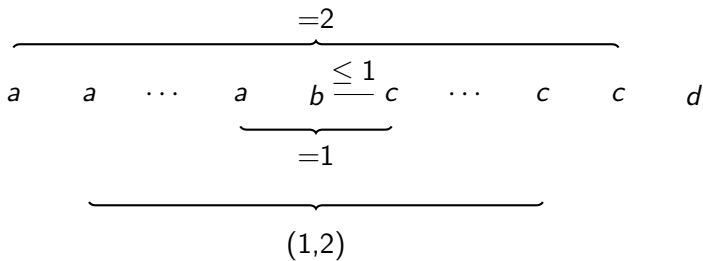
We need:

- **Stack**: To support functions call and return – Pushdown Automaton
- **Clock**: Time measurement and checking – Timed Automaton
- Good properties: **Complementable**, **Determinizable**

Dense Time Visibly Pushdown Automata



Accepted language: $a^n bc^n d$



Main results:

- Union closure
- Intersection closure
- Determinizable
- Complementable
- Emptiness checking: Decidable
- Inclusion, universality: Decidable
- Logical formula = Automaton

Properties of dtVPA

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Thank You!