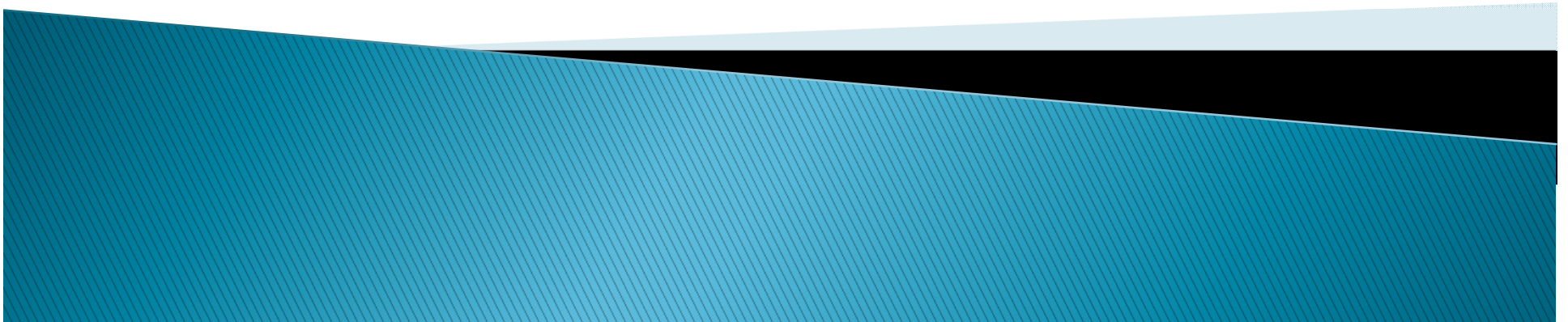


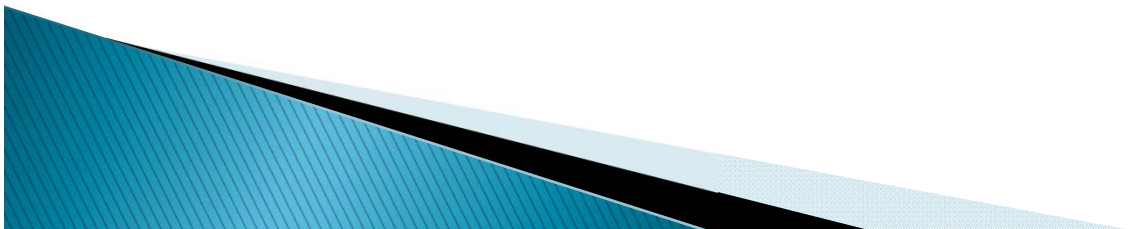
Parking Garage Automation

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The Problem

- ▶ As a customer...
 - Where can we find parking in a city we've never visited?
 - How can we secure parking on a recurring basis, i.e. every day, week, month, at a certain time?
 - How can we be sure that a spot will be available for parking when we arrive?
 - Carrying spare change to pay meters or cash to pay parking attendants is cumbersome.
- ▶ As a parking garage owner...
 - How can I maximize revenue and profit?
 - How can I better integrate my garage into the community, so that people will choose me over the competition?



The Solution

- ▶ The Park-A-Lot system!
- ▶ An automated, web-based solution that can:
 - Make and track reservations for future parking;
 - Handle automated, monthly billing so that paying for parking on-the-spot becomes unnecessary;
 - Online accounts that can help manage parking for single customers or corporations;
 - Can be managed remotely, reducing staff and overhead costs of operation;
 - Park vehicles quickly and more efficiently than a manual system.



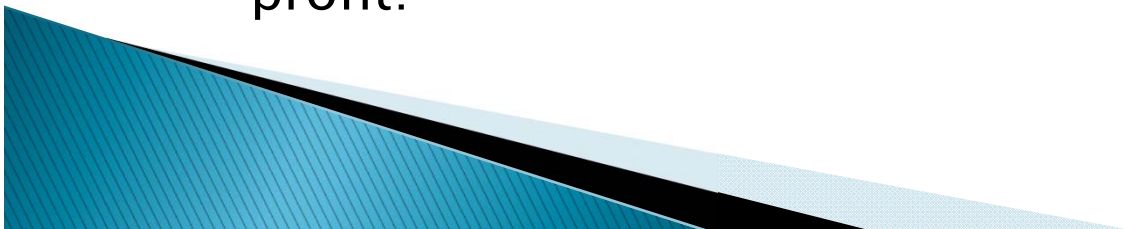
Benefits

▶ For customers...

- Use the web-based system to manage their accounts and track their parking history;
- Create reservations for one time or for a recurrence of times (i.e. every Monday for the next month);
- Pay bills online.

▶ For owners...

- Manage system pricing and check parking lot capacity online, from the comfort of their homes;
- Collect monthly payments from customers – no need to hire additional help;
- An efficient system that will reduce overhead and increase profit!



Implementation

- ▶ From a web browser, customer's can
 - Access their accounts, review past and future parking, and pay their monthly bill.
 - Create single and recurring reservations.
 - View a calendar of their upcoming reservations, and cancel or extend them as necessary.
 - Add vehicles that the garage will recognize upon arrival.
- ▶ Owner's can...
 - View garage usage history;
 - Set prices for the garage.



Implementation

- ▶ At the garage...
 - Customers will either be recognized automatically by their vehicle's license plate, or enter their customer ID and password to park.
 - A spot will be assigned to the customer automatically to ensure the most efficient possible parking in the garage.
 - We implemented this by simply including another tab for the web-based system which simulates parking – we didn't actually build a parking garage on which to test our system.



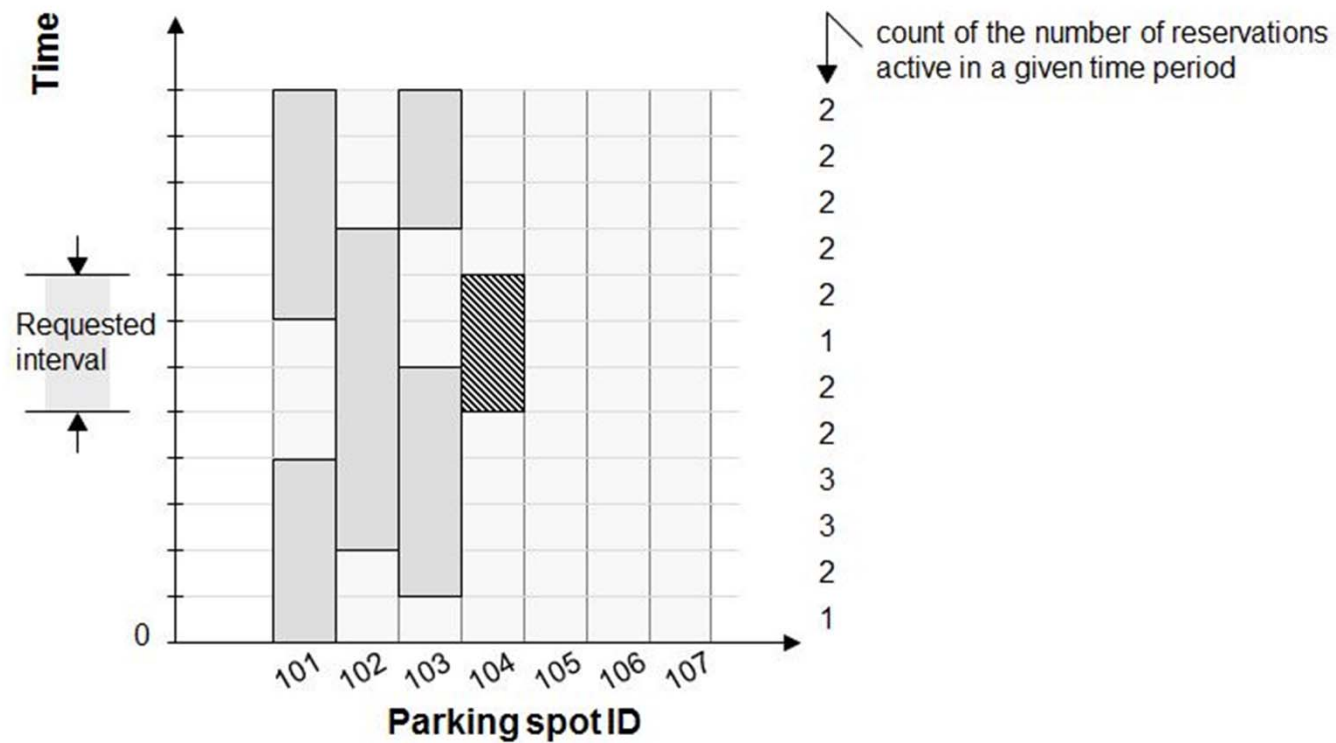
Parking Algorithms

▶ Reservation Swapping

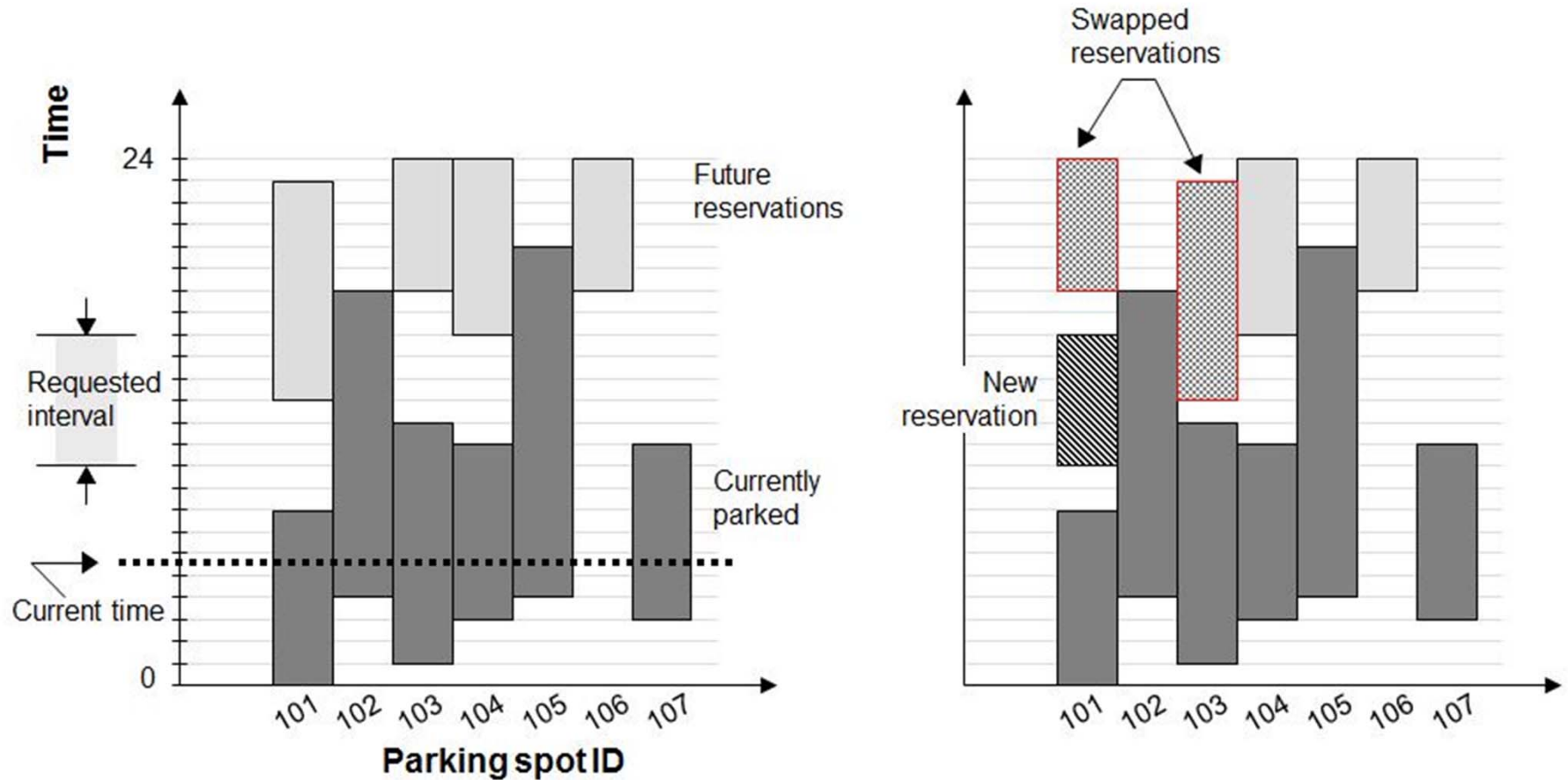
- We consider a parking lot bitmap which encodes all parking spot numbers and time intervals up to some date in the future.
- If a reservation cannot be assigned, we might try swapping two reservations in an attempt to make room for the new one.
- If no swap is possible, the reservation cannot be made.



Reservation Swapping

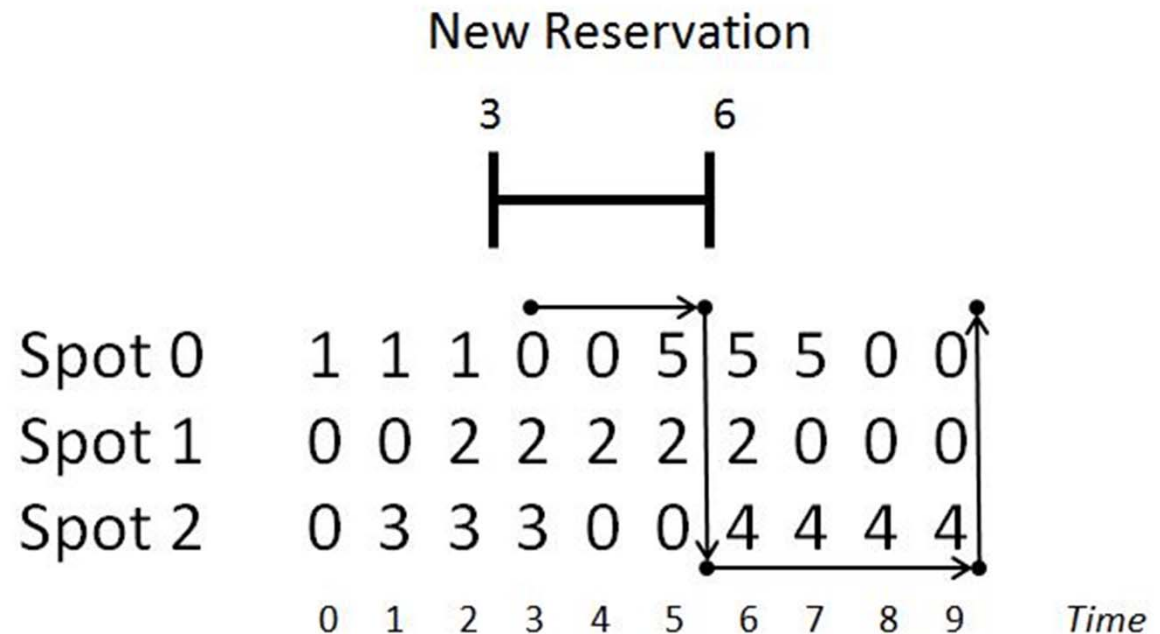


Reservation Swapping



Reservation Swapping

- ▶ For a table, it might look like this.
- ▶ Here, we swap 4 and 5 to make room for the new reservation.



Future Plans

- ▶ Additional features that could be implemented:
 - Capability to handle multiple garages, and if one garage is full the customer may be directed to another nearby garage;
 - Targeted advertising on website, specific to date, time and location at which customer plans to arrive (i.e. customer parks in NYC at 7pm, let him know there is a Broadway play starting nearby at 8pm when he is making reservation);
 - Smartphone applications developed through implementation of an API;
 - Support for hours of operation.

