An Introduction to CQRS

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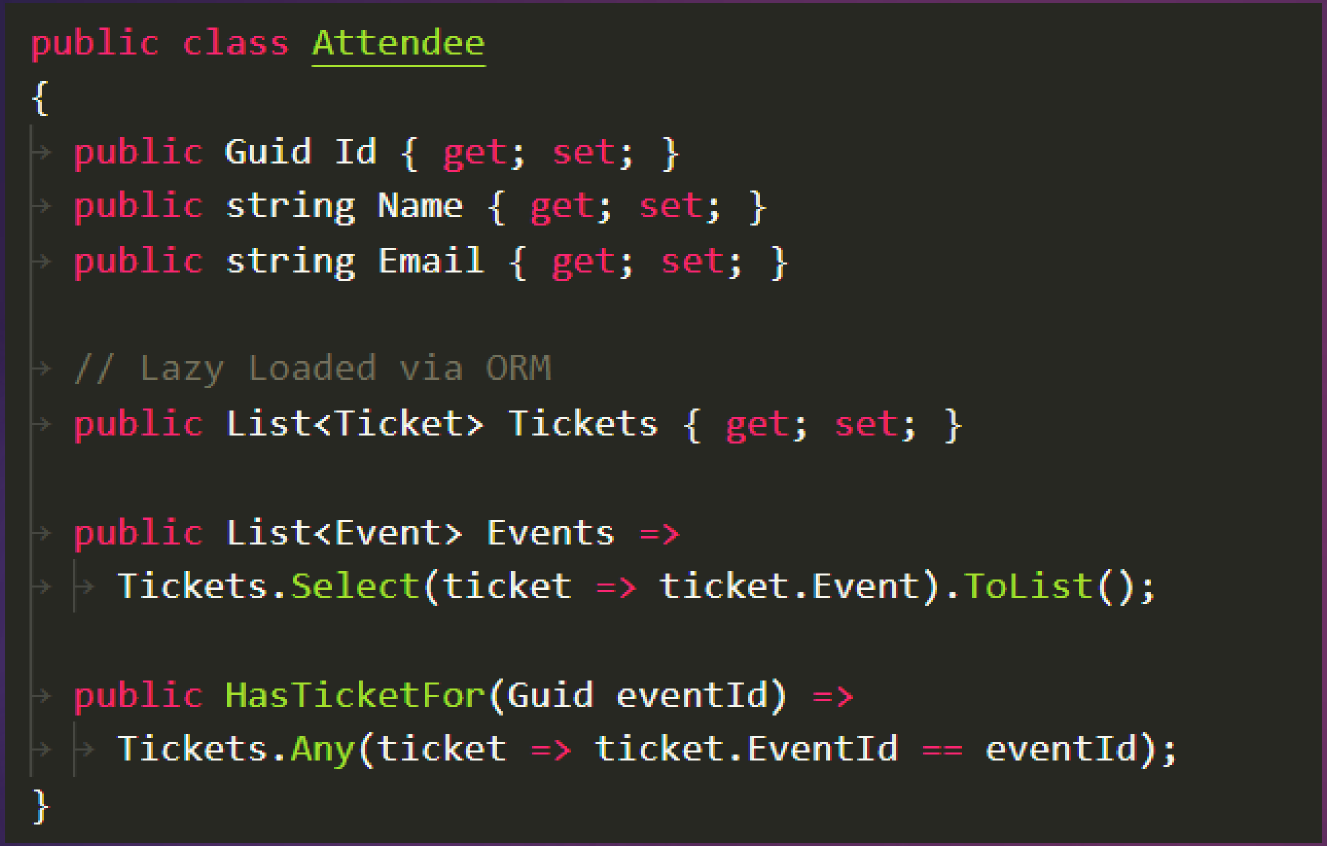
Who Am I?

- Web Engineer for Celina Insurance Group.
- Writing software for over a decade. The majority of which has been web applications.
- Twitter: @sam_ferree
- dev.to/sam_ferree
- github.com/CzechsMix/talks/

What is CQRS

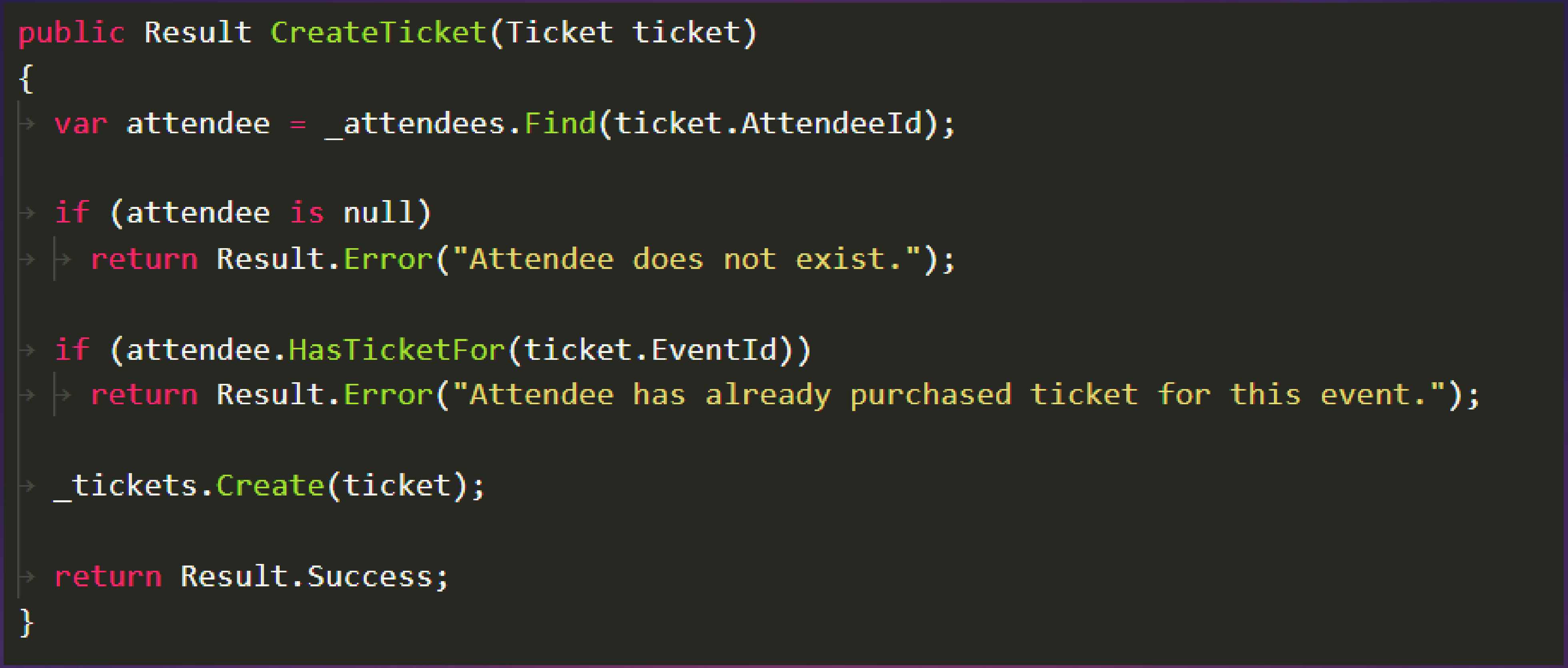
- Command Query Responsibility Segregation
- Coined by Greg Young in 2010
- Comes From Bertrand Myer’s CQS

Asking a question shouldn't change the answer.



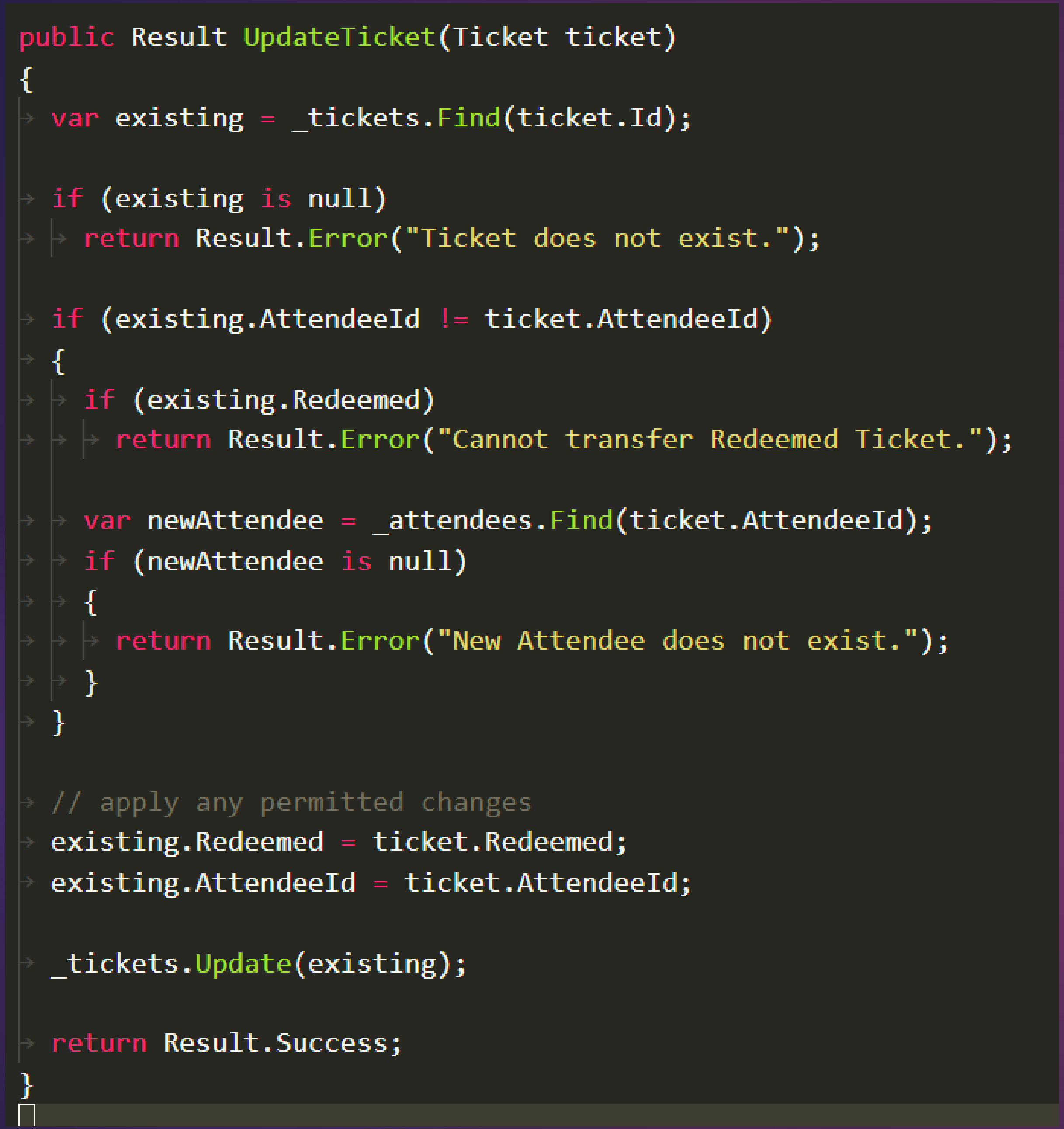
```
public class Attendee
{
    public Guid Id { get; set; }
    public string Name { get; set; }
    public string Email { get; set; }

    // Lazy Loaded via ORM
    public List<Ticket> Tickets { get; set; }

    public List<Event> Events =>
        Tickets.Select(ticket => ticket.Event).ToList();

    public HasTicketFor(Guid eventId) =>
        Tickets.Any(ticket => ticket.EventId == eventId);
}
```

Why Models?



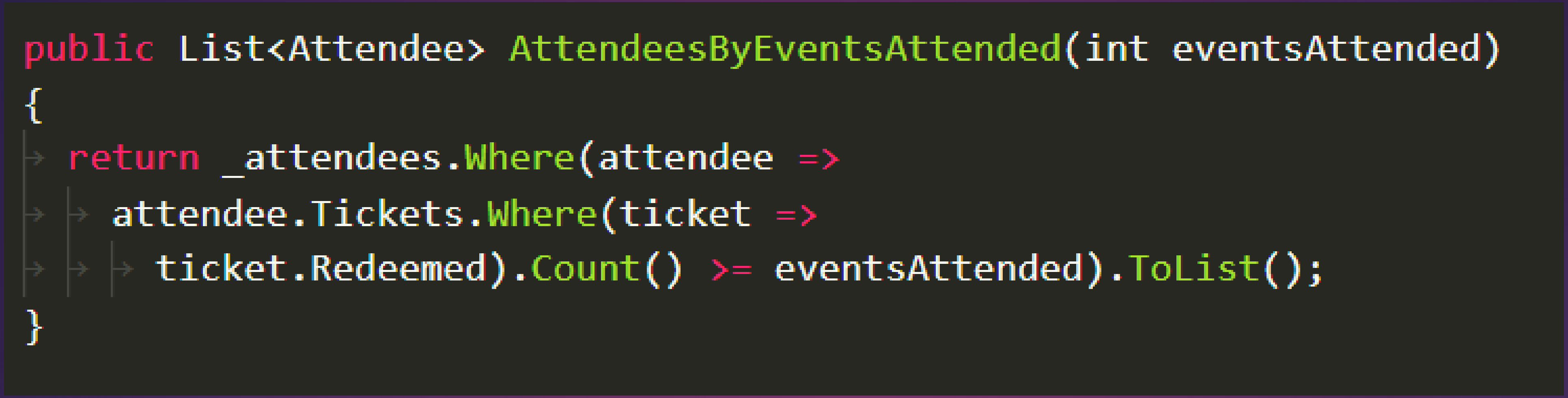
```
public Result CreateTicket(Ticket ticket)
{
    var attendee = _attendees.Find(ticket.AttendeeId);

    if (attendee is null)
        return Result.Error("Attendee does not exist.");

    if (attendee.HasTicketFor(ticket.EventId))
        return Result.Error("Attendee has already purchased ticket for this event.");

    _tickets.Create(ticket);

    return Result.Success;
}
```

Domain Logic



```
public Result UpdateTicket(Ticket ticket)
{
    var existing = _tickets.Find(ticket.Id);

    if (existing is null)
        return Result.Error("Ticket does not exist.");

    if (existing.AttendeeId != ticket.AttendeeId)
    {
        if (existing.Redeemed)
            return Result.Error("Cannot transfer Redeemed Ticket.");

        var newAttendee = _attendees.Find(ticket.AttendeeId);
        if (newAttendee is null)
        {
            return Result.Error("New Attendee does not exist.");
        }
    }

    // apply any permitted changes
    existing.Redeemed = ticket.Redeemed;
    existing.AttendeeId = ticket.AttendeeId;

    _tickets.Update(existing);

    return Result.Success;
}
```

Updates can do too much



```
public List<Attendee> AttendeesByEventsAttended(int eventsAttended)
{
    return _attendees.Where(attendee =>
        attendee.Tickets.Where(ticket =>
            ticket.Redeemed).Count() >= eventsAttended).ToList();
}
```

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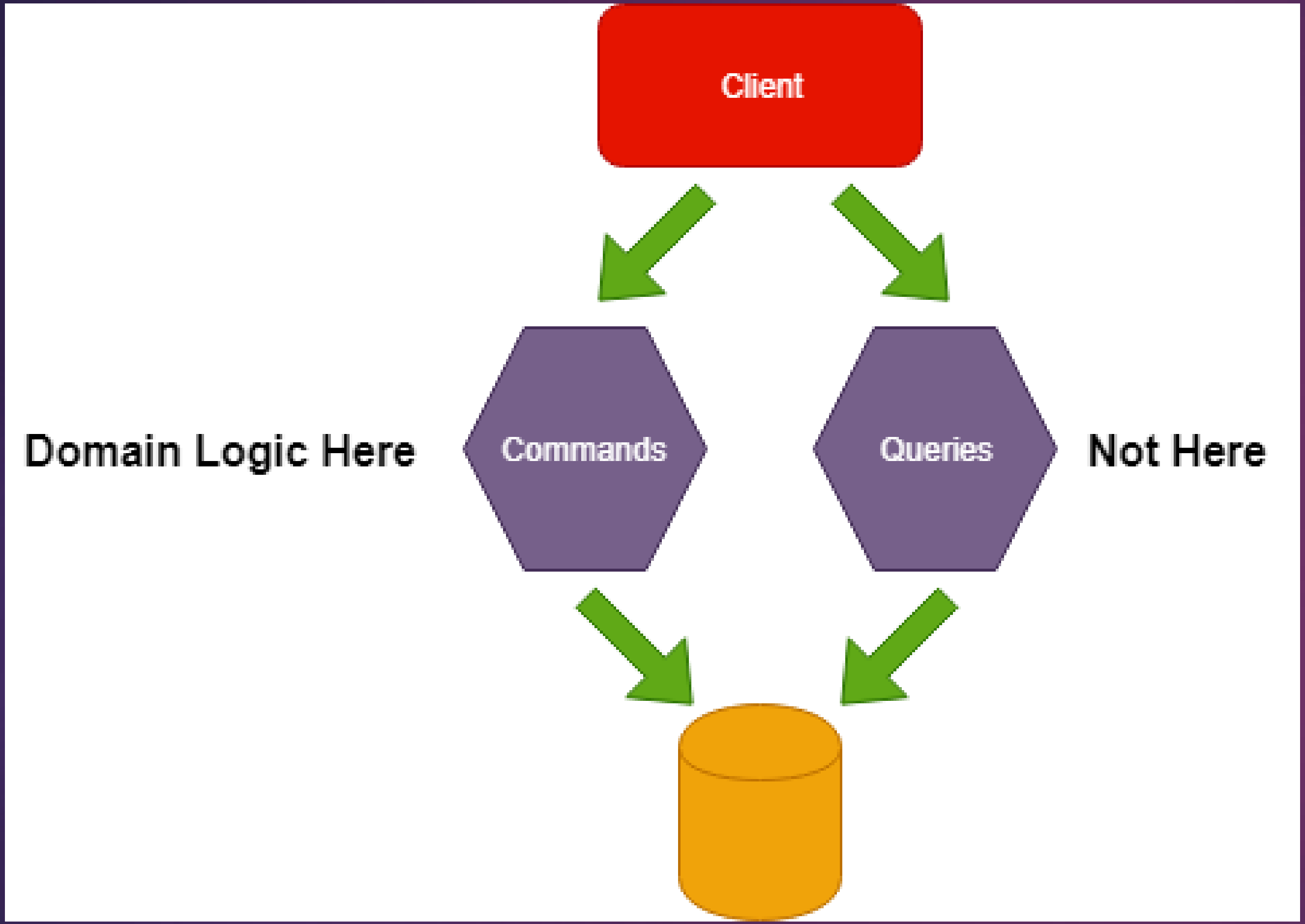
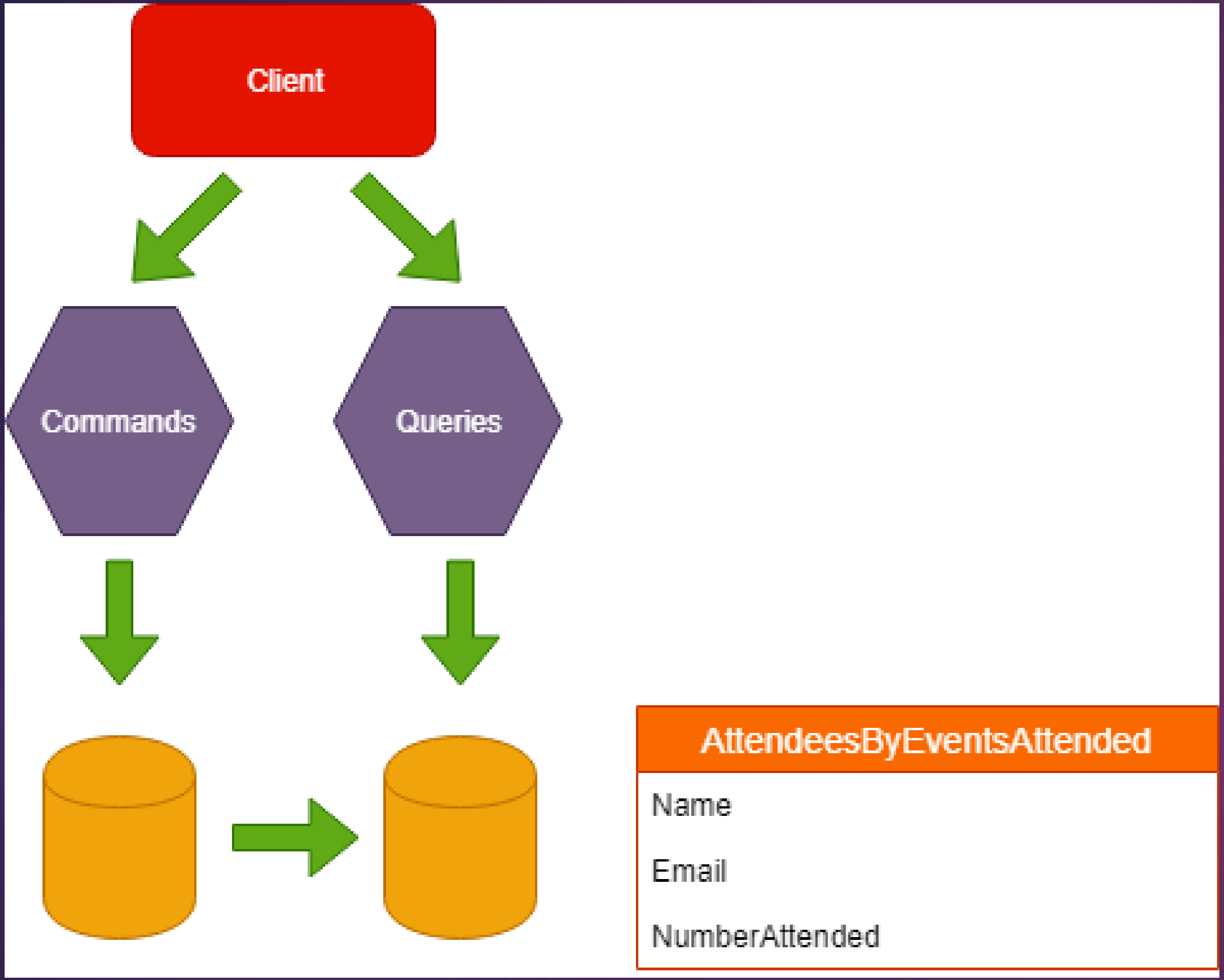
Reads are deceptive



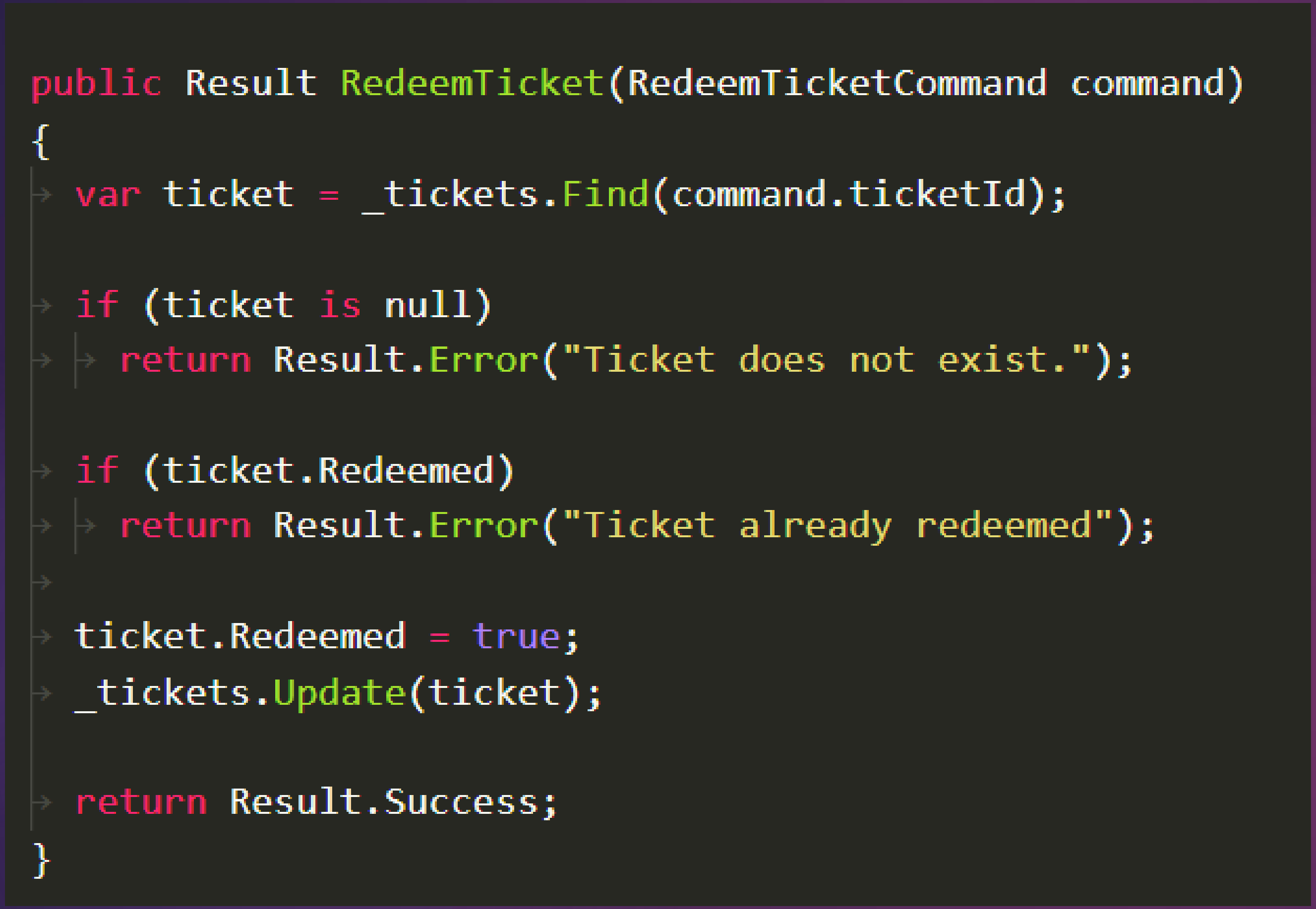
Queries are logic free



AttendeesByEventsAttended
Name
Email
NumberAttended

Querying separate databases

Redeem Command



```
public Result RedeemTicket(RedeemTicketCommand command)
{
    var ticket = _tickets.Find(command.ticketId);

    if (ticket is null)
        return Result.Error("Ticket does not exist.");

    if (ticket.Redeemed)
        return Result.Error("Ticket already redeemed");

    ticket.Redeemed = true;
    _tickets.Update(ticket);

    return Result.Success;
}
```

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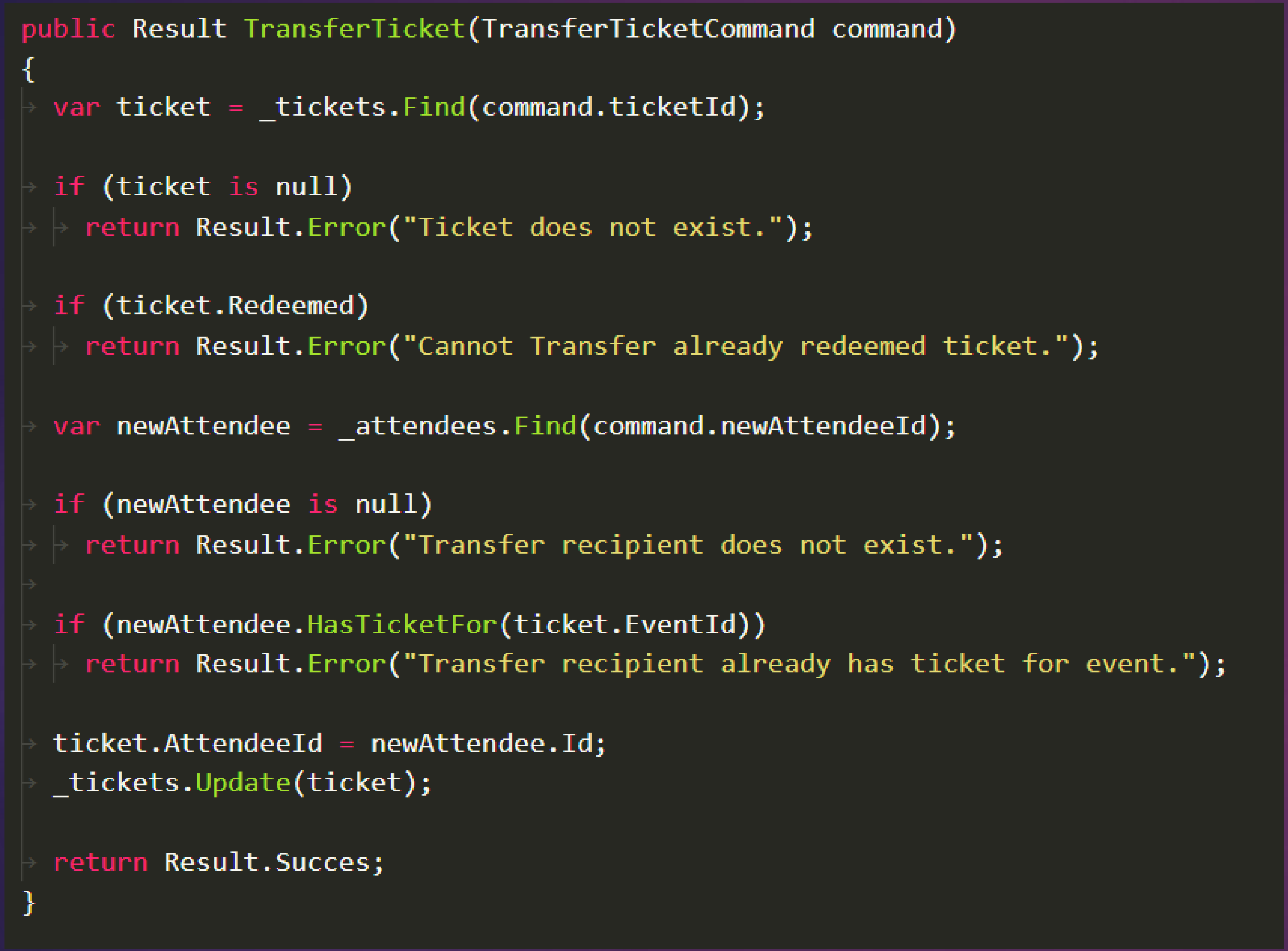
Transfer Command



```
public Result TransferTicket(TransferTicketCommand command)
{
    var ticket = _tickets.Find(command.ticketId);

    if (ticket is null)
        return Result.Error("Ticket does not exist.");

    if (ticket.Redeemed)
        return Result.Error("Cannot Transfer already redeemed ticket.");

    var newAttendee = _attendees.Find(command.newAttendeeId);

    if (newAttendee is null)
        return Result.Error("Transfer recipient does not exist.");

    if (newAttendee.HasTicketFor(ticket.EventId))
        return Result.Error("Transfer recipient already has ticket for event.");

    ticket.AttendeeId = newAttendee.Id;
    _tickets.Update(ticket);

    return Result.Succes;
}
```

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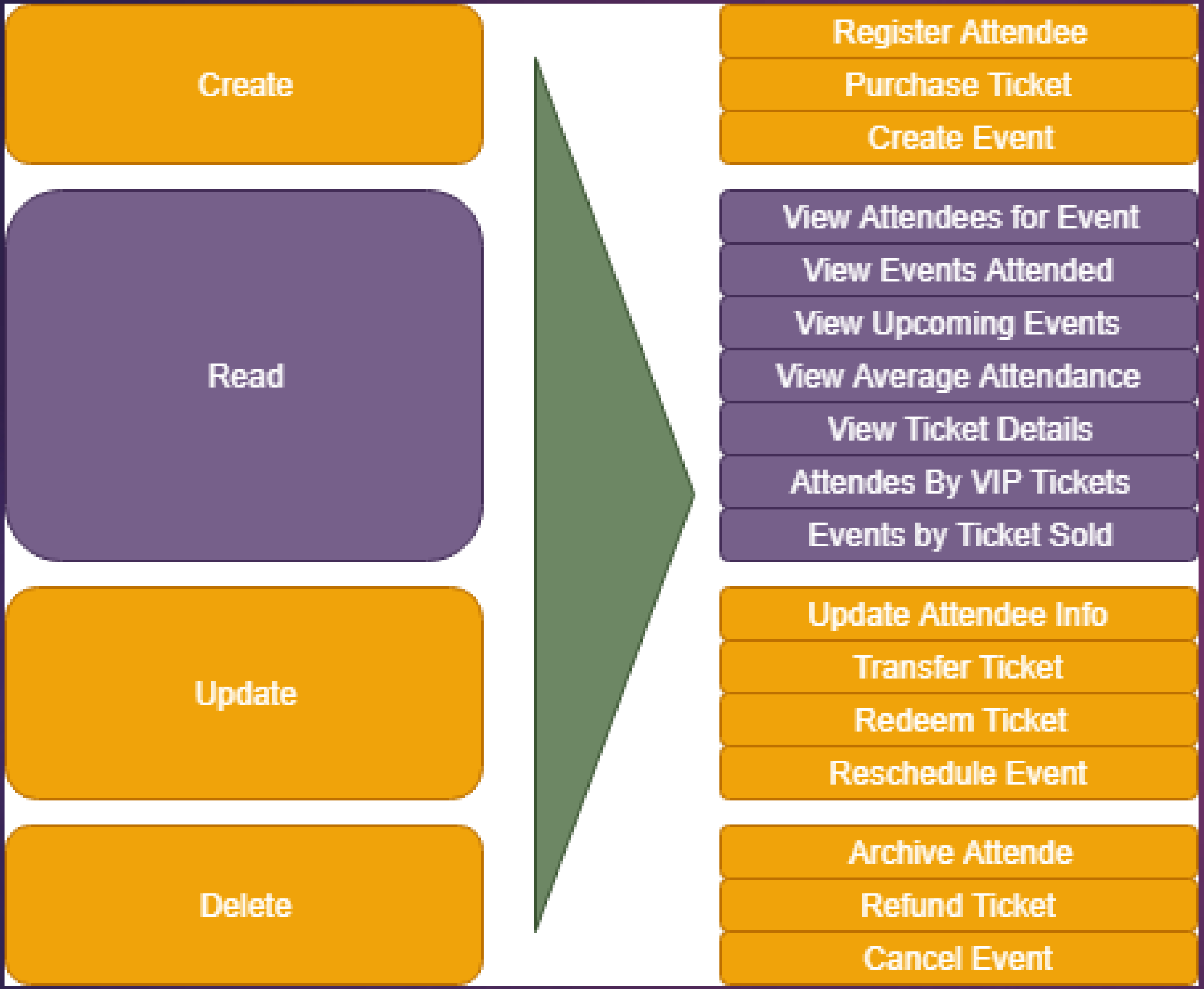
CRUD-Based vs Task Based



Create	Register Attendee Purchase Ticket Create Event
Read	View Attendees for Event View Events Attended View Upcoming Events View Average Attendance View Ticket Details Attendes By VIP Tickets Events by Ticket Sold
Update	Update Attendee Info Transfer Ticket Redeem Ticket Reschedule Event
Delete	Archive Attende Refund Ticket Cancel Event

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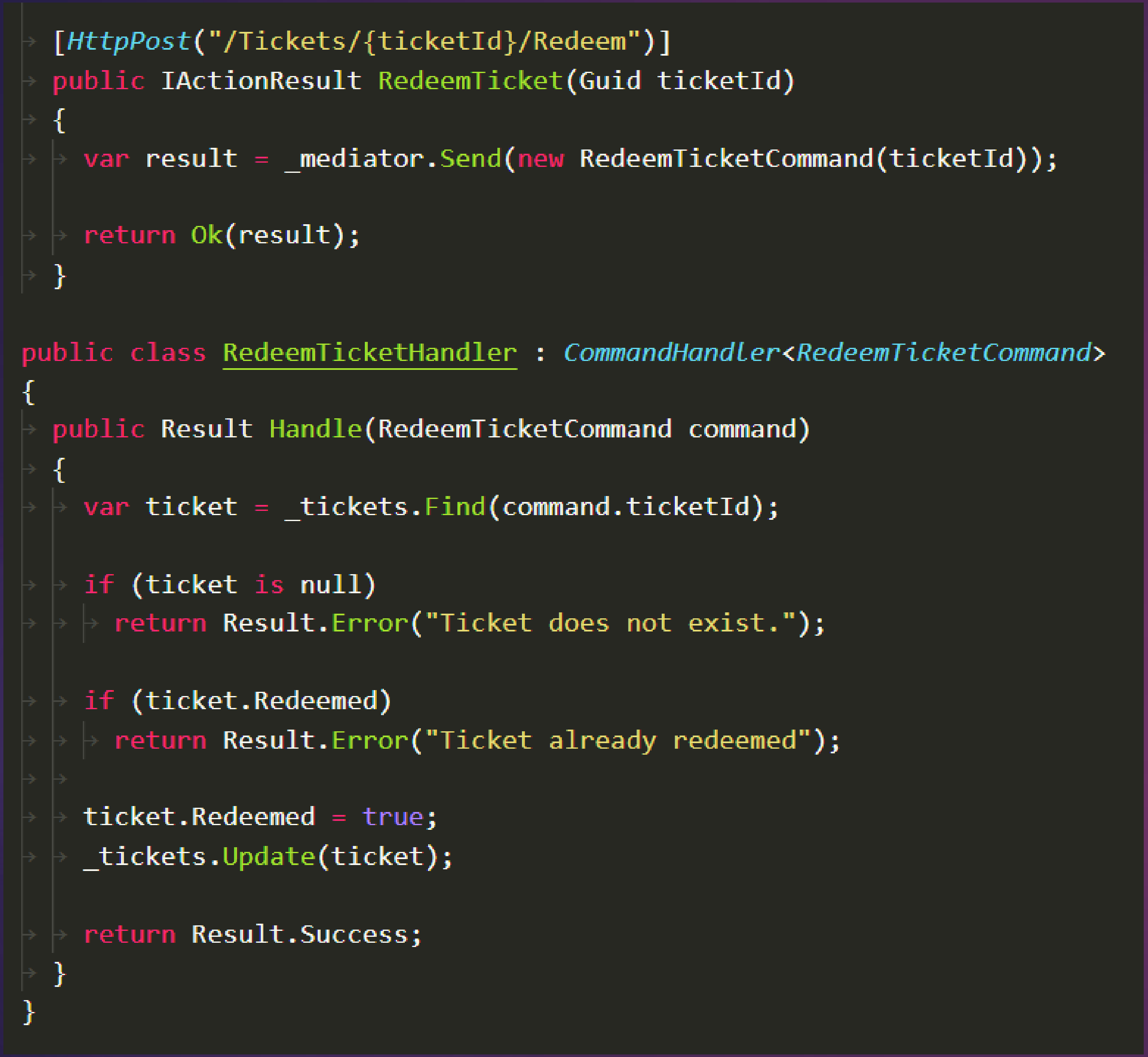
The Mediator Pattern



```
    [HttpPost("/Tickets/{ticketId}/Redeem")]
    public IActionResult RedeemTicket(Guid ticketId)
    {
        var result = _mediator.Send(new RedeemTicketCommand(ticketId));

        return Ok(result);
    }

public class RedeemTicketHandler : CommandHandler<RedeemTicketCommand>
{
    public Result Handle(RedeemTicketCommand command)
    {
        var ticket = _tickets.Find(command.ticketId);

        if (ticket is null)
            return Result.Error("Ticket does not exist.");

        if (ticket.Redeemed)
            return Result.Error("Ticket already redeemed");

        ticket.Redeemed = true;
        _tickets.Update(ticket);

        return Result.Success;
    }
}
```

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Trade Offs

- Complexity
- Eventual Consistency (aka Stale Data)

When to use CQRS

- Collaborative Domain
- Many and/or Complex Queries
- Large Complex Monolith
- Event Sourcing

Where to next?

- Pluralsight Courses:
  - https://app.pluralsight.com/library/courses/modern-software-architecture-domain-models-cqrs-event-sourcing/table-of-contents
  - https://app.pluralsight.com/library/courses/cqrs-in-practice/table-of-contents
- Jimmy Bogard's Contoso University:
  - https://jimmybogard.com/contoso-university-examples-with-cqrs-mediatr-automapper-and-more/
- An Introduction to CQRS and Event Sourcing Patterns - Mathew McLoughlin:
  - https://www.youtube.com/watch?v=9a1PqwFrMP0
- github.com/CzechsMix/talks/introduction-to-cqrs

Questions?