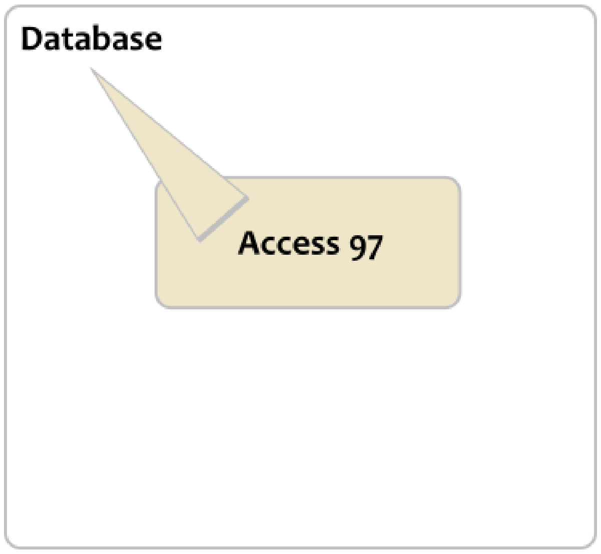
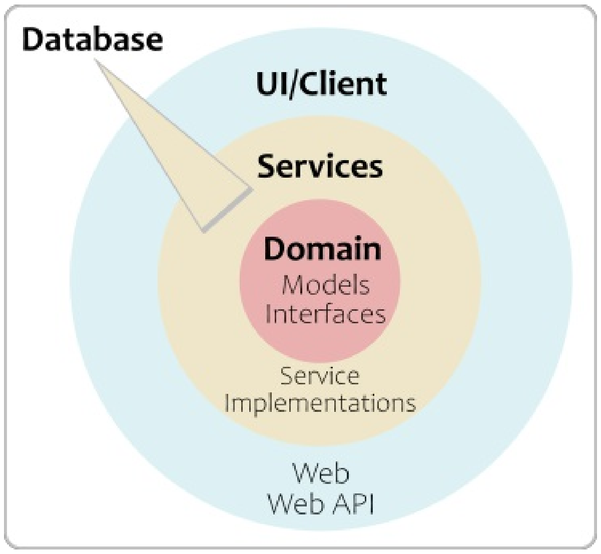
Migrating Background Check Verifications From Access 97 to ASP.NET MVC

From This	To This
	 Database UI/Client Services Domain Models Interfaces Service Implementations Web Web API

Slideshow Markdown File

Architecture

Clean Architecture ("onion")

- **Domain** (Request, Report, Verifier)
- **Service Interfaces** (IVerificationsService)
- **ORM** (Repository and Unit of Work)
- **Services** (VerificationsService)
- **WebApi** (/verifications/requests)(/verifications/reports)
  - Security
  - Unit Testing
- **Web**
  - Security

Servers and Frameworks

- SQL Server
- IIS Server
- C# Language
- POCO for Domain classes
- Entity Framework 6 (no patterns on top due to prior work)

- Services implement interfaces and talk to database via EF
- NancyFx injects services via interfaces, using Ninject.
    - Legacy Membership Provider for Roles, but Active Directory authentication
    - MS Test (I prefer xUnit.net)
- ASP.NET MVC for routing, AngularJS for UI.
    - Legacy Membership Provider for Roles, but Active Directory authentication

And...

- TFS 2015 for:
    - Kanban board
    - User stories/bug reports
    - Source control (TFVC, not Git)
    - Continuous Integration, and Deployment. I configured all of this, including Agent installation.

Object Structure

- Domain POCO classes *mostly* modeled database. No behavior.
- Domain service interfaces: state and behavior.
- Entity Framework "Code Second".
    - Modeled existing database
    - Renamed classes/properties for clarity and consistency.
    - Only modeled needed properties.
    - No "repository on top of repository"
- Services directly used EF (not truly injected).
- NancyFx.
    - Excellent choice. "Felt good" to use, and well-designed.
    - Service interfaces injected, so lots of unit testing here.
    - Returned ViewModels.
- ASP.NET MVC with AngularJS
    - Organized according to John Papa's Style Guide.
    - Limited libraries as much as possible.
    - Didn't use Bootstrap.
    - Limited CSS as much as possible.
    - Light CSS and assets isn't as pretty, but fast.

Code Snippets

Simple POCO Domain Class

```
public class ReportHoldLog
{
    public int ReportHoldLogId { get; set; }
    public string ReportId { get; set; }
    public int? FastraxLogId { get; set; }
    public int? EmployeeId { get; set; }
    public bool OnHold { get; set; }
    public DateTime CreatedOn { get; set; }

    //Navigation
    public Report Report { get; set; }
    public FastraxLog FastraxLog { get; set; }
    public Employee Employee { get; set; }
}
```

Code Snippets

Domain Class with Limited Behavior

```
public class Report
{
    ----<snip>----

    /// <summary>
    ///  Finds the related header's OnHold status, returns false if not found
    /// </summary>
    /// <returns></returns>
    public bool OnHold()
    {
        bool? result = CharacterReport?.OnHold | EducationReport?.OnHold | EmploymentReport?.OnHold;
        return result.HasValue ? result.Value : false;
    }

    /// <summary>
    /// Returns true if Completed OR Status=C
    /// </summary>
    /// <returns></returns>
    public bool IsCompleted()
    {
        return Completed || Status == "C";
    }

    ----<snip>----
}
```

Code Snippets

Service Interface

```
    public interface IVerificationService
    {
        List<Request> GetPendingVerificationRequests();
        List<int> GetWorkNumberReportIds(int[] reportAlternateIds);
        List<Request> SearchVerificationRequests(RequestSearchFilter filter);
        Request GetRequest(int requestAlternateId, params Expression<Func<Request, object>>[]
navigationProperties);
        void SaveCharacterReport(CharacterReport characterReport);

        ----<snip>----
    }
```

Code Snippets

DbContext

```
    public class FastraxDb : DbContext
    {
        public DbSet<BillTransaction> BillTransactions { get; set; }
        public DbSet<CharacterReport> CharacterReports { get; set; }
        public DbSet<CharacterReportCustomerQuestionTemplate> CharacterReportCustomerQuestionTemplates { get;
set; }

        ----<snip>----

        protected override void OnModelCreating(DbModelBuilder modelBuilder)
        {
            modelBuilder.Configurations.Add(new BillTransactionConfiguration());
            modelBuilder.Configurations.Add(new CharacterReportConfiguration());
            modelBuilder.Configurations.Add(new CharacterReportCustomerQuestionTemplateConfiguration());
            ----<snip>----
        }
  }
```

Code Snippets

EntityTypeConfiguration called from OnModelCreating

```
    public class ReportConfiguration : EntityTypeConfiguration<Report>
    {
        public ReportConfiguration()
        {
            ToTable("tblReportsRequested").HasKey(x => x.ReportId);
            Property(p => p.ReportId).HasColumnName("RecordID");
            Property(p => p.ReportAlternateId).HasColumnName("ID")

.HasDatabaseGeneratedOption(System.ComponentModel.DataAnnotations.Schema.DatabaseGeneratedOption.Identity);
            Property(p => p.RequestId).HasColumnName("RequestID");
            Property(p => p.RiskFactor).HasColumnName("Rating");

            Ignore(p => p.SearchAmericaReport);

            //Navigation
            HasRequired(prin => prin.Request);
            HasMany(dep => dep.FastraxLogs);
            HasMany(dep => dep.ReportHoldLogs);
            HasMany(dep => dep.SourceDatas);
        }
    }
```

Code Snippets

Service

```
   public class VerificationService : IVerificationService
    {
        private static ILoggingService _log = null;
        private IRecordUtilitiesService _recordUtilitiesService = null;
        private FastraxDb _db = null;

        private string[] _canceledRequestStatuses = { "R", "X" };
        //private string[] _pendingReportStatuses = { "I", "P", "X" };
        private int[] _userReportTypes = { 1, 3 };
        private int[] _verificationReportPackageIds = { 12, 14, 21 };
        private int _releaseFormPackage = 5000;


        public VerificationService(ILoggingService log, IRecordUtilitiesService recordUtilitiesService,
FastraxDb db) : base()
        {
            _log = log;
            _recordUtilitiesService = recordUtilitiesService;
            _db = db;
        }
```

Code Snippets

Some Sophisticated LINQ

```
        public List<Request> GetPendingVerificationRequests()
        {
            //This ONLY returns pending reports, which at the moment is OK
            //because the Pending list doesn't care about completed report counts in a request.
            //See the Search query for including completed, which is a lot slower.
            var requests =
                (from q in _db.Reports
                        .Include(a => a.CharacterReport)
                        .Include(a => a.EducationReport)
                        .Include(a => a.EmploymentReport)
                        .Include(a => a.Request.CustomerLocation.Customer)
                        .Include(a => a.Request.RequestAssignments.Select(b => b.Employee))
                 where (q.Completed == false & q.Status != "C")
                            & (q.CharacterReport != null
                            | q.EducationReport != null
                            | q.EmploymentReport != null)
                 & !_canceledRequestStatuses.Contains(q.Request.Status)
                 & !q.Request.CustomerId.Equals("UCT103")
                 & !q.Request.Invoiced
                 & _verificationReportPackageIds.Contains(q.PackageBaseId)
                 & _userReportTypes.Contains(q.ReportType)
                 select q)
                    //materialize the reports with their related entities using ToList()
                    .ToList()
                    //get the requests
                    .Select(a => a.Request)
                    .Distinct()
                    .ToList();
            ----<snip>----
```

Code Snippets

NancyFx

Note the helper method `JsonResponseFrom()`.

```
        public Verifications(IVerificationService verificationService, IEmployeeService employeeService,
            IRequestAssignmentService requestAssignmentService, IFastraxLogService logService,
base("/verifications")
        {
            _verificationService = verificationService;
            this.RequiresAuthentication();

            Get["/pending"] = _ => JsonResponseFrom(() => GetPending());
            Get["/search"] = _ => JsonResponseFrom(() => GetRequestSearch());
            Get["/request/{id}"] = _ => JsonResponseFrom(() => GetRequest(_.id));
            Get["/character/report/{id}"] = _ => JsonResponseFrom(() => GetCharacterReport(_.id));
            Post["/character/report"] = _ => JsonResponseFrom(() => PostCharacterReport(), "Unable to
save:");

            ----<snip>----

        protected List<VerificationRequestSummaryModel> GetPending()
        {
            var list = new List<VerificationRequestSummaryModel>();
            var pendingRequests = _verificationService.GetPendingVerificationRequests();
            list = GetSummaries(pendingRequests);
            return list;
        }
```

Code Snippets

Typical Unit Test

```
    [TestClass]
    public class Get_EmploymentReport_Should : VerificationsTests
    {
        ----<snip>----

        [TestMethod]
        [TestCategory("Verifications Test")]
        public void Return_expected_error_message()
        {
            //Using .ThrowError = true will get caught when getting the record
            //and return as "record not found."
            //Use a record that will fail during mapping.
            _verificationService.EmploymentReports = EmploymentReports.OnePendingReport;
            _verificationService.EmploymentReports[0].Report = null;
            var response = GetResponse(ReplaceId(_path, 1));
            string body = GetDeserializedResponseBody<string>(response);
            Assert.AreEqual(HttpStatusCode.BadRequest, response.StatusCode);
            Assert.AreEqual("Object reference not set to an instance of an object.", body);
        }
```

Code Snippets

Some AngularJS

```
(function () {
  'use strict';

  angular
    .module('verifications')
    .controller('VerificationsEdit', VerificationsEdit);

  VerificationsEdit.$inject = ['verificationsService', '$timeout', '$templateCache', '$scope', 'auth',
'focus'];
  function VerificationsEdit(verificationsService, $timeout, $templateCache, $scope, auth, focus) {
    //Initialize the message directive object
    $scope.msgObject = {};

    var vm = this;
    vm.request = {};
    vm.pristineRequest = {};
    ----<snip>----
    function getRequestVerifications(id) {
      $scope.msgObject.showWaiting();
      verificationsService.getRequestVerifications(id)
        .then(function (response) {
          setRequest(response.data);
          $scope.msgObject.hideWaiting();
        }, function (error) {
          $scope.msgObject.hideWaiting();
          $scope.msgObject.showError(error.data);
        });
    }
```

Code Snippets

Some CSS

```
/*https://www.inserthtml.com/2012/06/custom-form-radio-checkbox/*/

.verifications input[type=checkbox] {
    -webkit-appearance: none;
    background-color: white;
    border: 1px solid #005E7B;
    /*box-shadow: 0 1px 2px rgba(0,0,0,0.05), inset 0px -15px 10px -12px rgba(0,0,0,0.05);*/
    padding: 9px;
    border-radius: 3px;
    display: inline-block;
    position: relative;
}

    .verifications input[type=checkbox]:active, input[type=checkbox]:checked:active {
        /*box-shadow: 0 1px 2px rgba(0,0,0,0.05), inset 0px 1px 3px rgba(0,0,0,0.1);*/
    }

    .verifications input[type=checkbox]:checked:after {
        content: '\2714';
        font-size: 14px;
        position: absolute;
        top: 0px;
        left: 3px;
        color: #005e7b;
    }
```

Database Access

Challenges included:

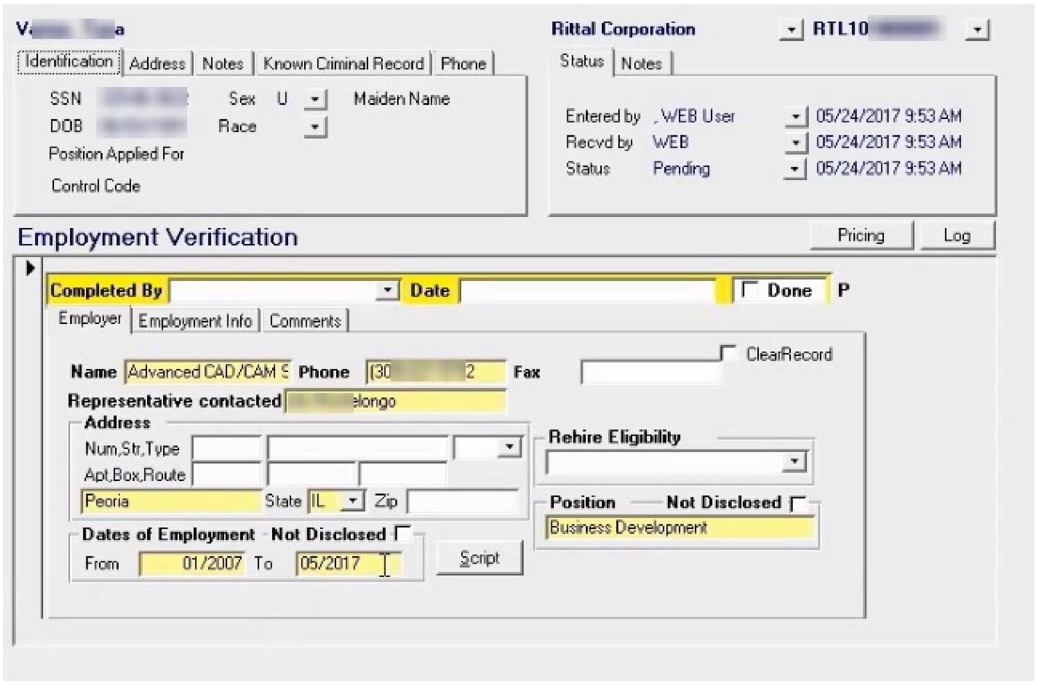
- Matching Access 97 queries and updates.
- Avoiding SQL trigger problems.
- Adding DB missing relational integrity into EF.
- Staying close to existing EF work, but diverging for clarity.

Design Considerations and Tradeoffs

> I'm not a designer, but I'm good at usability.

- I originally pitched a Kanban board approach as the final result.
- Layed out the UI to match the business flow.
- Kept hands on keys as much as possible.
- The site was intended to be integrated into the "main" site, so I designed with idea my HTML/CSS would be reworked.
- Looked more like Craigslist than Gmail, BUT
- Efficacy mattered more than aesthetics

The Old Look



V[redacted]a

Identification | Address | Notes | Known Criminal Record | Phone

SSN [redacted]
Sex U
Maiden Name
DOB [redacted]
Race
Position Applied For
Control Code

Rittal Corporation
RTL10[redacted]

Status | Notes

Entered by , WEB User 05/24/2017 9:53 AM
Recvd by WEB 05/24/2017 9:53 AM
Status Pending 05/24/2017 9:53 AM

Employment Verification
Pricing
Log

Completed By
Date
Done
P

Employer | Employment Info | Comments

ClearRecord
Name Advanced CAD/CAM S
Phone (30[redacted]2
Fax
Representative contacted [redacted]elongo

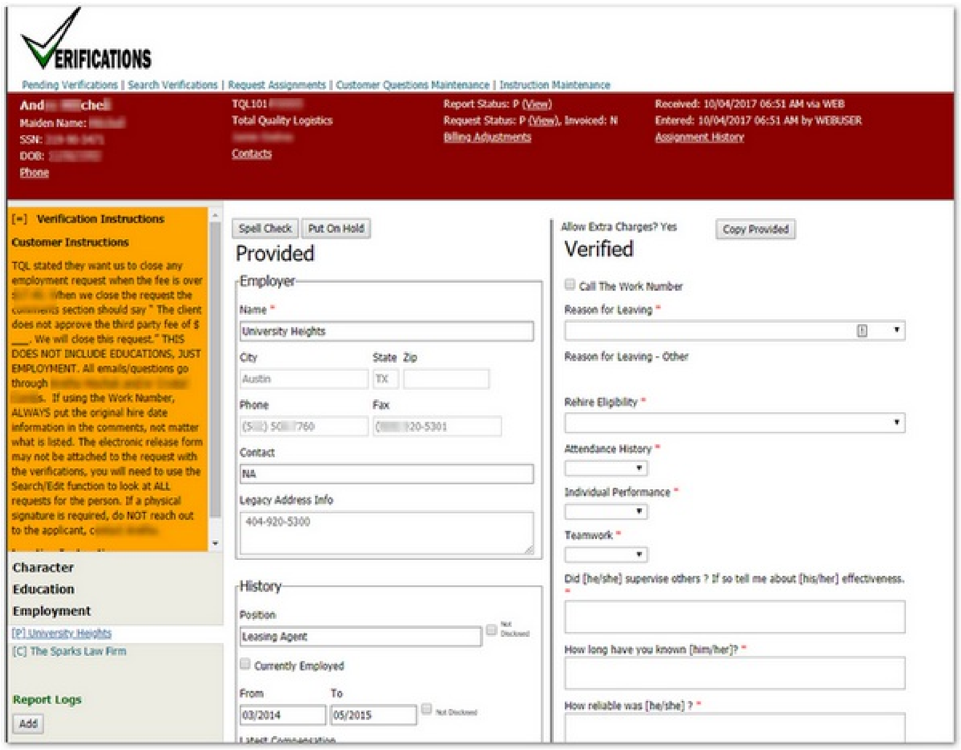
Address
Num,Str,Type
Apt,Box,Route
Peoria State IL Zip

Rehire Eligibility

Position Not Disclosed
Business Development

Dates of Employment Not Disclosed
From 01/2007 To 05/2017
Script

The New Look



Pending Verifications | Search Verifications | Request Assignments | Customer Questions Maintenance | Instruction Maintenance

And[redacted]che[redacted]
Maiden Name: [redacted]
SSN: [redacted]
DOB: [redacted]
Phone

TQL101[redacted]
Total Quality Logistics
[redacted]
Contacts

Report Status: P (View)
Request Status: P (View), Invoiced: N
Billing Adjustments

Received: 10/04/2017 06:51 AM via WEB
Entered: 10/04/2017 06:51 AM by WEBUSER
Assignment History

[=] Verification Instructions

Customer Instructions

TQL stated they want us to close any employment request when the fee is over [redacted]. When we close the request the [redacted] section should say " The client does not approve the third party fee of $ ___. We will close this request." THIS DOES NOT INCLUDE EDUCATIONS, JUST EMPLOYMENT. All emails/questions go through [redacted]s. If using the Work Number, ALWAYS put the original hire date information in the comments, not matter what is listed. The electronic release form may not be attached to the request with the verifications, you will need to use the Search/Edit function to look at ALL requests for the person. If a physical signature is required, do NOT reach out to the applicant, c[redacted]

Character
Education
Employment
[P] University Heights
[C] The Sparks Law Firm

Report Logs
Add

Spell Check | Put On Hold

Provided

Employer

Name *: University Heights
City: Austin
State: TX
Zip:
Phone: (5[redacted]) 50[redacted]760
Fax: ([redacted]20-5301
Contact: NA
Legacy Address Info: 404-920-5300

History

Position: Leasing Agent
Not Disclosed
Currently Employed
From: 03/2014
To: 05/2015
Not Disclosed
Latest Compensation

Allow Extra Charges? Yes
Copy Provided

Verified

Call The Work Number
Reason for Leaving *
Reason for Leaving - Other
Rehire Eligibility *
Attendance History *
Individual Performance *
Teamwork *
Did [he/she] supervise others ? If so tell me about [his/her] effectiveness. *
How long have you known [him/her]? *
How reliable was [he/she] ? *

Challenges

- Fear (of change)
  - Listen and understand.
  - Involve them via user stories.
  - Make changes based on their input.
  - Trust them and their strengths.
- Limited help from the lead developer
  - He was thinking of this being a "microservice." I never told him it clearly couldn't be.
  - Asked for and never received code reviews.
  - Kept CIO informed, to limit any blowback.
- Using Git locally, and pushing to TFS. This became even harder when their VPN changed, but significantly improved my productivity.

Time Machine

- Make my EF changes early. (However, making them later proved the code's maintainability)
- Less time on Kanban prototype. (However, this was great for business rule discovery.)