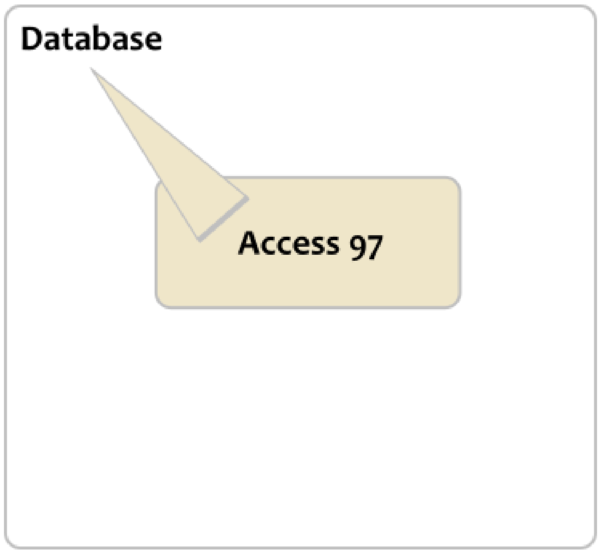
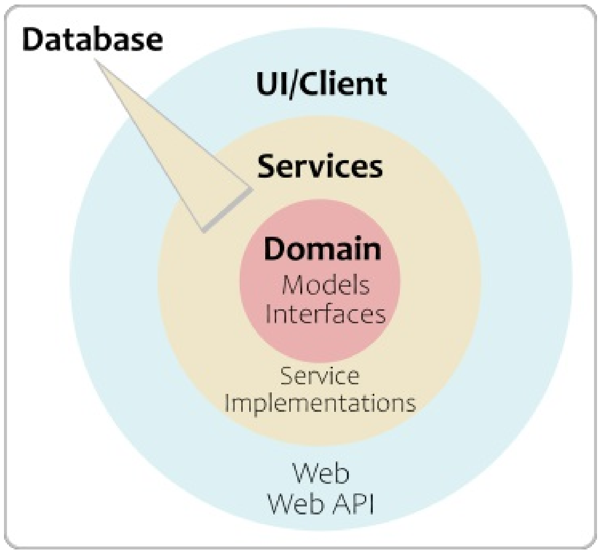
Migrating Background Check Verifications From Access 97 to ASP.NET MVC

Charles L Flatt

From This	To This
	

Slideshow PDF

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The client is a background check company contracted by HR departments and background check vendors.

The client verifies lots of information about applicants, including education, employment and character references, which require calling and/or emailing the contacts, and keeping track of the assignments and statuses of those calls.

Draw this on the whiteboard.

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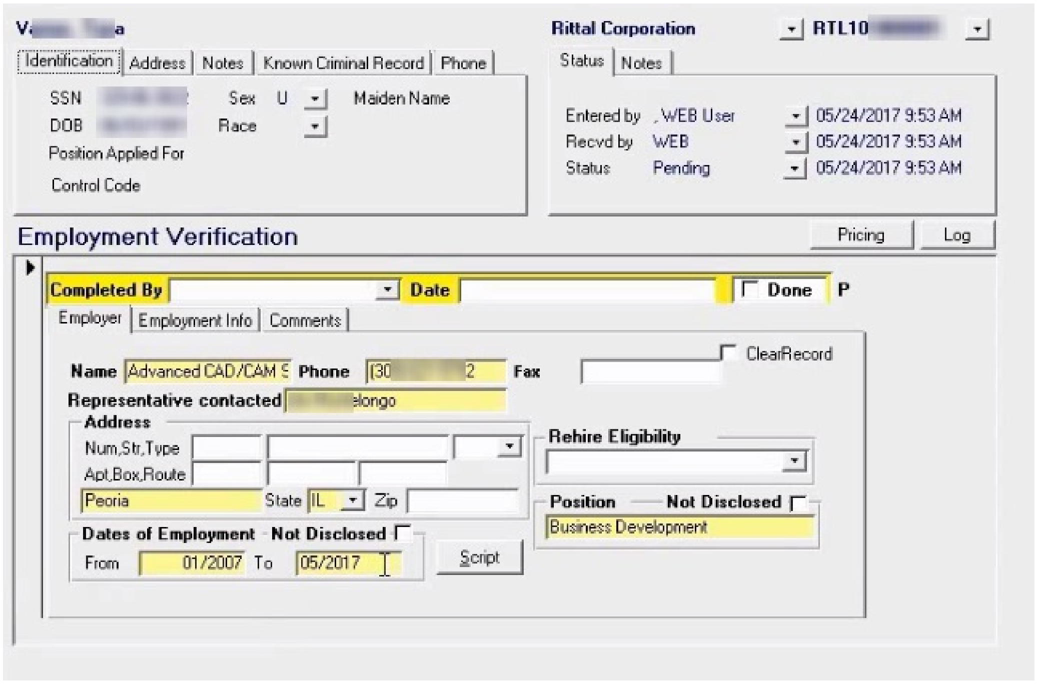
exclude:true

Contents

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

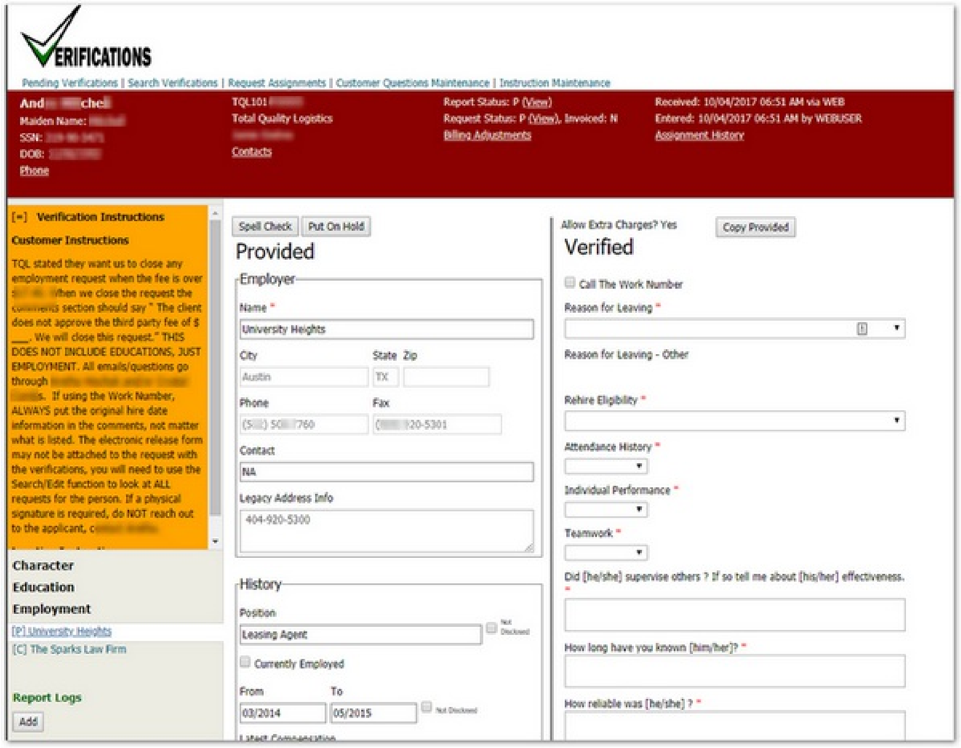
Pricing Log

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

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] ? *

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

???

There was already an internal site using a DDD architecture. Verifications was a separate project, not using those dependencies, but not diverging too much from that site's approach. It was my model.

I had been part of this effort before leaving, and had researched Jeff Palermo's onion architecture.

Designed the IRepository for EF (more on that mistake later).

Servers and Frameworks

- SQL Server
- IIS Server
- C#

- Entity Framework 6 (no patterns on top due to prior work)
- NancyFx, using Ninject for IoC.
- ASP.NET MVC for routing, AngularJS for UI.
- Membership Provider for Roles, but Active Directory authentication
- MS Test (I prefer xUnit.net)

And...

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

???

Previously used Targetprocess for boards and IT issues.

Object Structure

- Domain POCO classes *mostly* modeled database, mostly 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.
- 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.

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layout: true

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; }
    }
```

???

Hand out the snippet docs. Review for 5 minutes, then answer questions (but keep track of time).

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>----
    }
```

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>----
    }
```

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>----
        }
   }
```

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);
        }
    }
```

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;
         }
```

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>----
```

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;
        }
```

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);
        }
```

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);
        });
    }
```

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;
    }
```

---

layout: false

Database Access

Challenges included:

- Matching Access 97 queries and updates.
- Avoiding SQL trigger problems.
- Adding DB missing relational integrity into EF.
- Fixing relationships, e.g. One-Zero/Many in database, but is really One-Zero/One

  ```
  HasRequired(prin => prin.Report).WithOptional(a => a.EmploymentReport).Map(a => a.MapKey("ReportID"));
  ```

- Staying close to existing EF work, but diverging for clarity, specifically *consistent naming*.
- No mocking, neither using interfaces nor Effort

Their example of DbContext diverged from my contribution. Specifically, they attempted to implement IUnitOfWork, but didn't do it properly, so DbContext remained tightly-coupled. No chance of swapping out database even if you wanted to, and no mocking.

???

As much as I'm a coding guy, I'm also a data guy. I love working with data, and I'm particular about naming, organization and consistency. Their database wasn't *awful*....

Draw a crow's feet notation for one-to-zero-many vs one-to-zero-one.

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

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.)