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CODE PRESENTS

# The CODE Lisperer's Guide to .NET Integration with Microsoft 365

A webinar *and* CODE Magazine article
presented by Bob Calco


Bob Calco
Chief Architect & Lead Developer
Apex Data Solutions, LLC


Ask CODE Magazine authors questions about the topics they write about!

**Wednesday September 14, 2022 @ 1:00pm Eastern (UTC-5) / 10:00am Pacific**

# Kicking Things Off

## Jim Duffy

- Director of Business Development
  CODE Magazine & Consulting
- Former Developer – Drawn to the Dark Side: Now Responsible for Marketing & Business Development
- jduffy@codemag.com / My Bio
- International Author and Speaker
- Former Microsoft RD (Regional Director) 9 years
- Former 11-time Microsoft Most Valuable Professional (MVP)
- Twitter: @jmduffy

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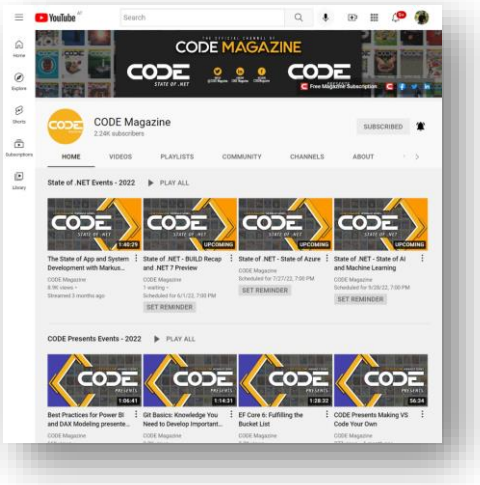

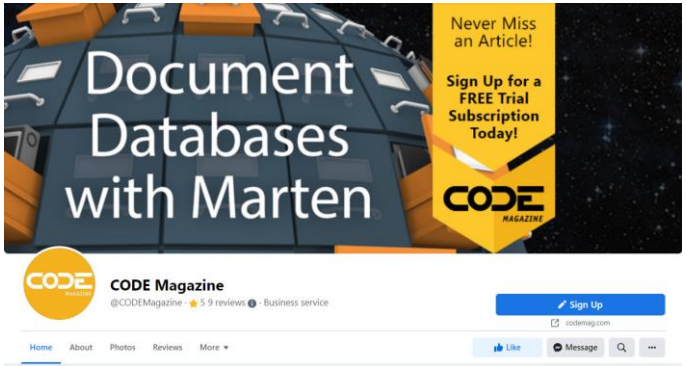

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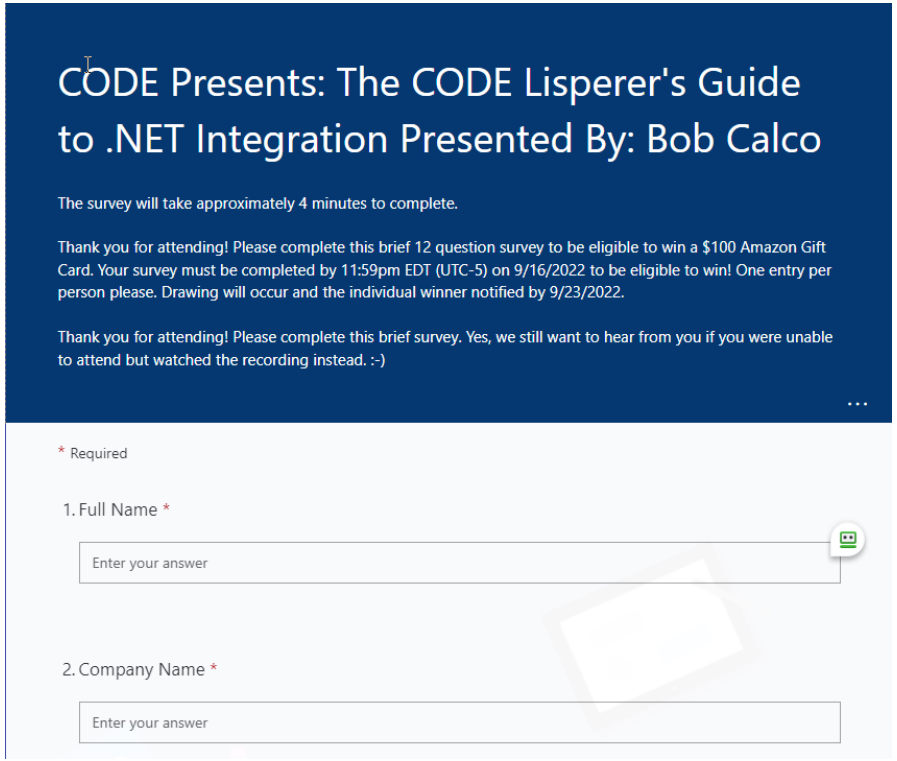


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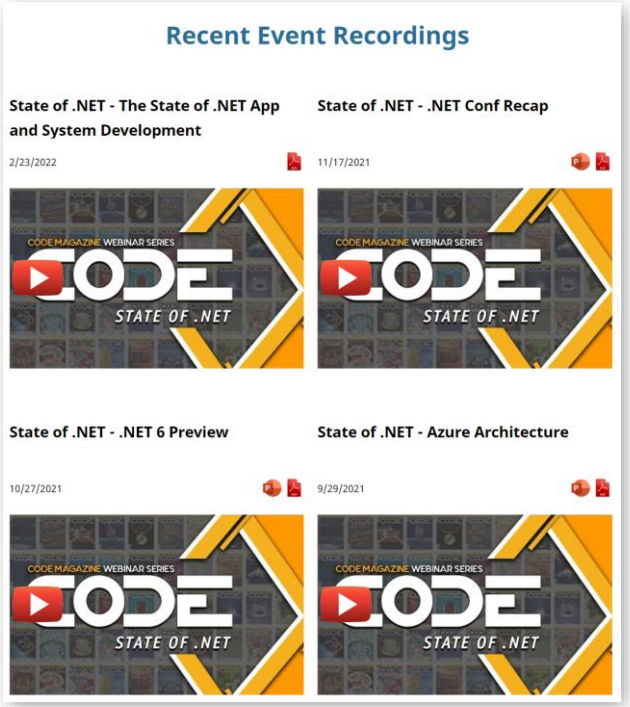
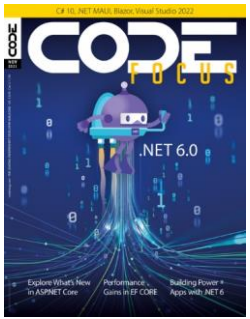


# About the Presenter

- **Bob Calco**
  - Chief Architect and Lead Developer
  - Experienced Enterprise Architect
  - Unique Experience in Data Federation & Interoperability
  - 20+ Years Software Development Experience



APEX DATA SOLUTIONS

CODE Presents:

# The CODE Lisperer's Guide to .NET Integration with Microsoft 365

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# Bob Calco
# Chief Architect and Lead Developer

Mr. Calco is a seasoned enterprise architect and a proven software innovator with over 20+ years of experience designing, building and leading teams to deliver large-scale, enterprise solutions in the healthcare, financial services and retail sectors. For the past 5 years, Mr. Calco's work has focused on data sharing and interoperability both within and between large distributed enterprise systems. Mr. Calco was the primary visionary and architect for the VistA.js Platform within the VA, a Class 1 enterprise microservices framework that enabled data federation and reconciliation across the VA's 154 medical centers. That experience now drives his vision behind Apex's *Unify!* and *DomainMaster*, and their use of scripting in support of distributed microservices for sharing data across systems and even organizational boundaries. He is leading the Apex Team utilizing these technologies to address current industry challenges associated with Provider Data Management/Provider Directories.

Mr. Calco is a certified expert in multiple programming languages, having worked productively in over a dozen programming environments and platforms as diverse as C++, Delphi, Ada, Java, .NET (C#, VB), JavaScript, LISP, Clojure, Scala, Smalltalk, Ruby and others.

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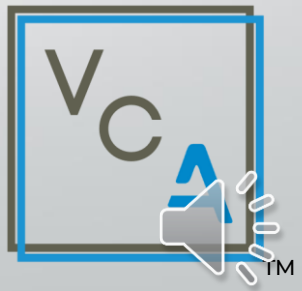
# Visual Scheme for Applications™ and Visual Clojure for Applications™

There are many ways to integrate custom code into Microsoft Office/365, but none provide the raw power, code simplicity, developer reach, or rapid development benefits of combining a proper Lisp with the Common Language Runtime (CLR). In this webinar we will explore several examples of both Scheme and Clojure as proper Lisps powering Microsoft 365 from the inside-out—on top of the .NET runtime.

A sneak preview of features from the upcoming Professional Edition of Acceλerate for Microsoft 365, which will change how you think about "upsizing" and modernizing Office solutions to the cloud.

- Lambdas as reusable business objects in Excel formulas—and SQL functions!
- Database transparency vs the anti-pattern of storing data directly in Excel.
- Writing macros/syntax extensions to build DSLs for Office solutions.
- Office artifacts as portable, linked-data microservices to support data interoperability.

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# Agenda

- The motivation for Acceλerate Pro – I'm sure you have lots of questions!
  - Why extend Office at all? What's the purpose?
  - Why extend it with …Lisp?
  - Wait…. Why TWO Lisps?!
  - Why Office artifacts  as microservices?
  - Why linked data microservices?!
- Answer: Rethinking "legacy application modernization" ← *We'll start with this!*
- Looking ahead to a world of real data interoperability
  - Three phases of interoperability implementation and how our current work ties in
- An update on what's coming up in Acceλerate and Acceλerate Pro

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# Let’s Play Fantasy Jeopardy!

- YOU: “Thanks, Alex! I’ll take ‘Unsolved IT Problems’ for $500.”
- ALEX: “It’s the process of preparing a system of record (SOR)or data silo for real-time data sharing and general data interoperability.”
- YOU: “What is ‘the modern approach to legacy application modernization’?”
- ALEX: “Congratulations! You win the game and the biggest prize ever!”

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# Back to Reality…

- Three common but usually doomed drivers of “legacy app modernization” (i.e., where risk > reward):
  - **Stack Driven.** Upgrade a currently working application to the latest version of the stack because it has new features that we might want some day.
  - **Management Needs Driven.** Replace a currently running system of record with a recently procured one that nobody in our organization has ever used before because it serves the interest of management.
  - **Buzzword Driven.** “Web enablement” because investors insist on it.

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# Rethinking what “modern” in “modernization” means

- One distinguishing feature of “modernity” that comes to mind is instant, asynchronous communication of information.
- For this reason, we like to imagine interoperability through the anthropomorphic metaphor of “systems talking to each other.”
- IT systems have been moving in this direction with patterns like Publish-Subscribe and Point-2-Point REST APIs.
- Data silos not built on these patterns are getting left behind.
- *But is this point-to-point comms the right abstraction?*

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# Toward a new concept of modernization…

- A modern application should
  - Be reactive (“change happens”)
  - Be self-descriptive (“speak the language of the domain”)
  - Be extensible (“easy to code/test/deploy”)
  - Be available (“easy to scale on anyone’s cloud”)
- The Adapter Pattern is our friend

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# Engineering Goals of a General Modernization Solution in an MS 365 Context

- Base it on the reach and power of .NET.
- Language(s) used should be simple yet extensible, and easy to teach.
- Able to run outside of Office as well as inside it, on Windows, and in the Cloud.
- Speak the language of the domain in linked-data terms.
- Interoperate with existing VBA solutions.

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# Why not VB(A)?

- Cannot natively take advantage of .NET
- COM doesn't run on non-Windows platforms
- VBA is being deprecated long-term anyway in favor of Node.js add-ins.
- Even VB.NET is on a sunset path on the CLR.
- Syntax is not as simple as people think, nor is it extensible.

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# So you wanna use… a LISP!?

- Two Lisps, actually:
  - **Scheme** for casual scripting, automation and lambda functions – a great alternative to both VBA and JS/TS.
  - **Clojure** (Professional Edition) for portable microservices, more advanced data-oriented development work, and deeper platform integration
- And both run on top of .NET!
- BONUS: Interop with existing VBA solutions is straightforward via Office interop assemblies.

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# What's so special (or modern!) about Lisp?

- "Lisp is a programmable programming language."
  - John Fodararo, CACM, September 1991
- "Lisp isn't a language, it's building material."
  - Alan Kay
- "Lisp was far more powerful and flexible than any other language of its day; in fact, it is still a better design than most languages of today… Lisp freed ITS hackers to think in unusual and creative ways."
  - Eric Raymond, in Open Sources on MIT's first OS, ITS

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# So why TWO Lisps?

- (Iron)Scheme:
  - A tiny Lisp language with almost no syntax – super easy to learn
  - Was designed to be minimalist.
  - Sports a 1st class syntax extension facility and basic .NET interop.
  - Ideal for writing lambda code in Excel.
- Clojure(CLR) (Professional Edition):
  - A Lisp specially designed for concurrency/parallelism, functional programming, & DOP
  - Direct, complete integration with the host runtime
  - Runs on both JVM and CLR (and JS and Erlang VM!), so ideal for interoperability work.

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# Simple Syntax (S-expressions) based on lambda calculus

## Scheme

```
(define (identity a)  a)

(define identity
  (lambda (a) a))
```

## Clojure

```
(defn identity [a]  a)

(def identity
  (fn [a] a))
```

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# Other Common Benefits (1/2)

- First Class Functions (Lambdas everywhere!)
  - Especially powerful in Excel context, or SQL custom functions (or both)
  - Variadic functions, pass/return functions, currying & composition of functions, etc.
- Libraries (Scheme) and namespaces (Clojure) for modular programming
  - Source-control friendly file system-based coding without limits
- Full CLR interop
  - The full reach and breadth of the platform at your fingertips from inside Office – and outside of it
- Macros – every Lisp is inherently moldable to the domain
  - Enables features like LINQ, database transparency, and other alien powers

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# Other Common Benefits (2/2)

- Full reach of Scheme
  - Support for advanced Scheme-native libraries like miniKanren and unit testing already built in.
  - Extensive support for SRFIs
- Full reach of Clojure
  - Port existing JVM-based libraries to the CLR using “reader conditionals”

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# Data(base) Transparency

- Storing data in Excel is a common anti-pattern
- Data limits in both Access and Excel limit the potential of Office Solutions that store data in either application.
- What if interacting with data in Office solutions was not bound to the documents per se but rather integrated into the language of lambdas for automation and integration?
  - Think FoxPro of old, but with an explicit industry mission to build interoperable systems!

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# Example (Scheme)

```
> (foreach smith-client in (from c in (sqlite/execute *all-clients-query*)
                                 where (= (client-last-name c) “Smith”)
                                 select c)
    (display (string-append (client-first-name smith-client) “ “ (client-last-name smith-client)))
    (newline))

=>
“John Smith”
“Adam Smith”
“Fred Smith”
“Jane Smith”
```

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# Macros and Syntax Extensions

- A unique property of every proper Lisp that makes metaprogramming fun and easy is the fact that that code is just data.
- This means you can write code that writes code. No practical limits besides your imagination!
- You don’t have to wait for a vendor to implement a new language feature – you are your own language vendor!

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# Scheme

```
(import (visualscheme unit-testing) (visualscheme data sqlite))
(define ultimate-answer (lambda () 42))
(let ((memory-db
       (make-sqlite-connection "Data Source=:memory:")))
 (define-sqlite-function on memory-db
  "ultimate_answer" -> Int32 as pure
  (lambda () (ultimate-answer)))
  (let ((ultimate-answer-cmd
         (make-sqlite-command "SELECT ultimate_answer()" memory-db)))
    (connection/open memory-db)
    (let ((ultimate-answer-result
           (->int32 (command/execute-scalar ultimate-answer-cmd))))
      (connection/close memory-db)
      (check that ultimate-answer-result
                  from “SQLite custom function tests”
                  is equal to 42
                  because
                 "The answer to the ultimate question of the universe is 42.")))
```

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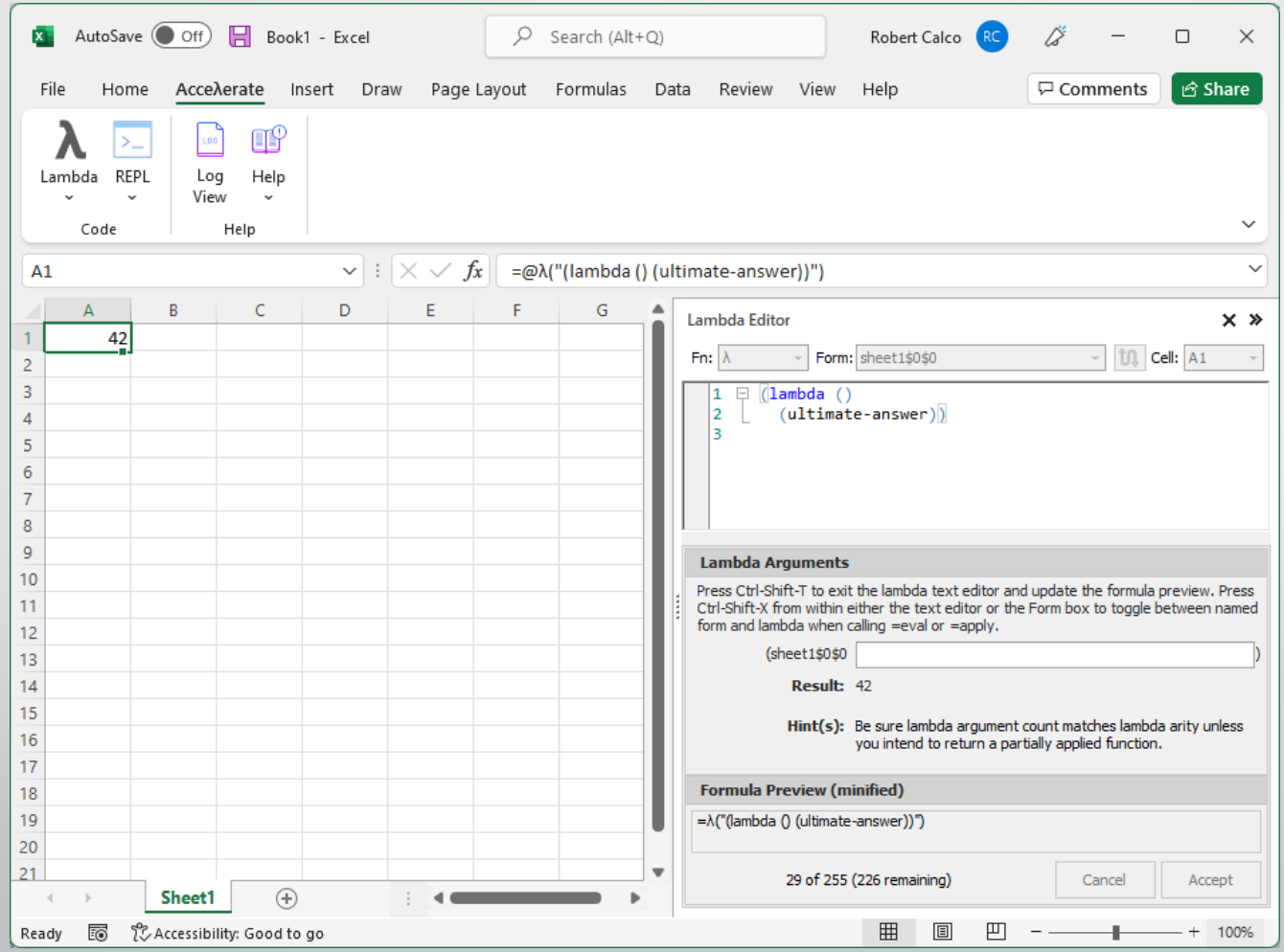


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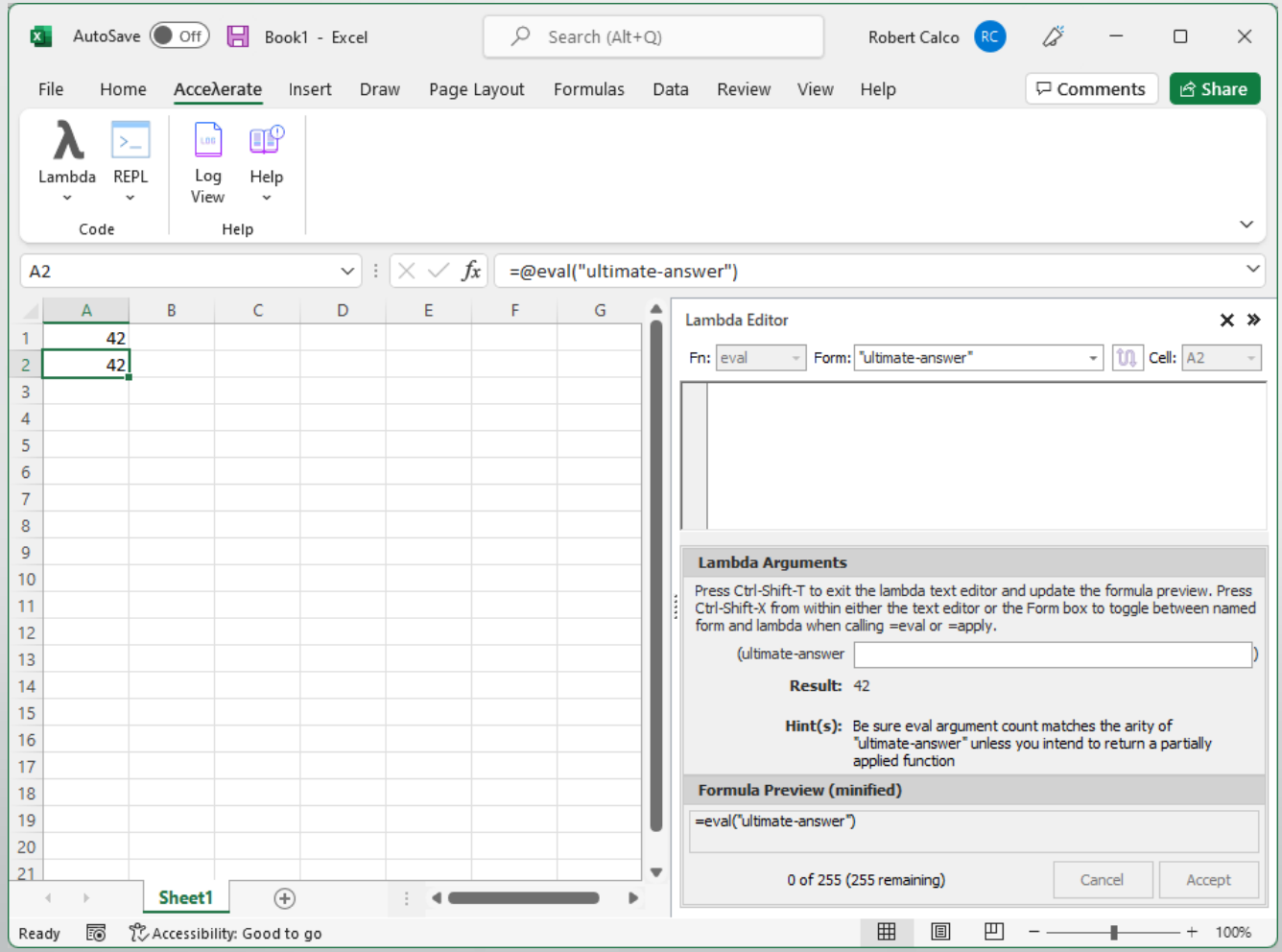


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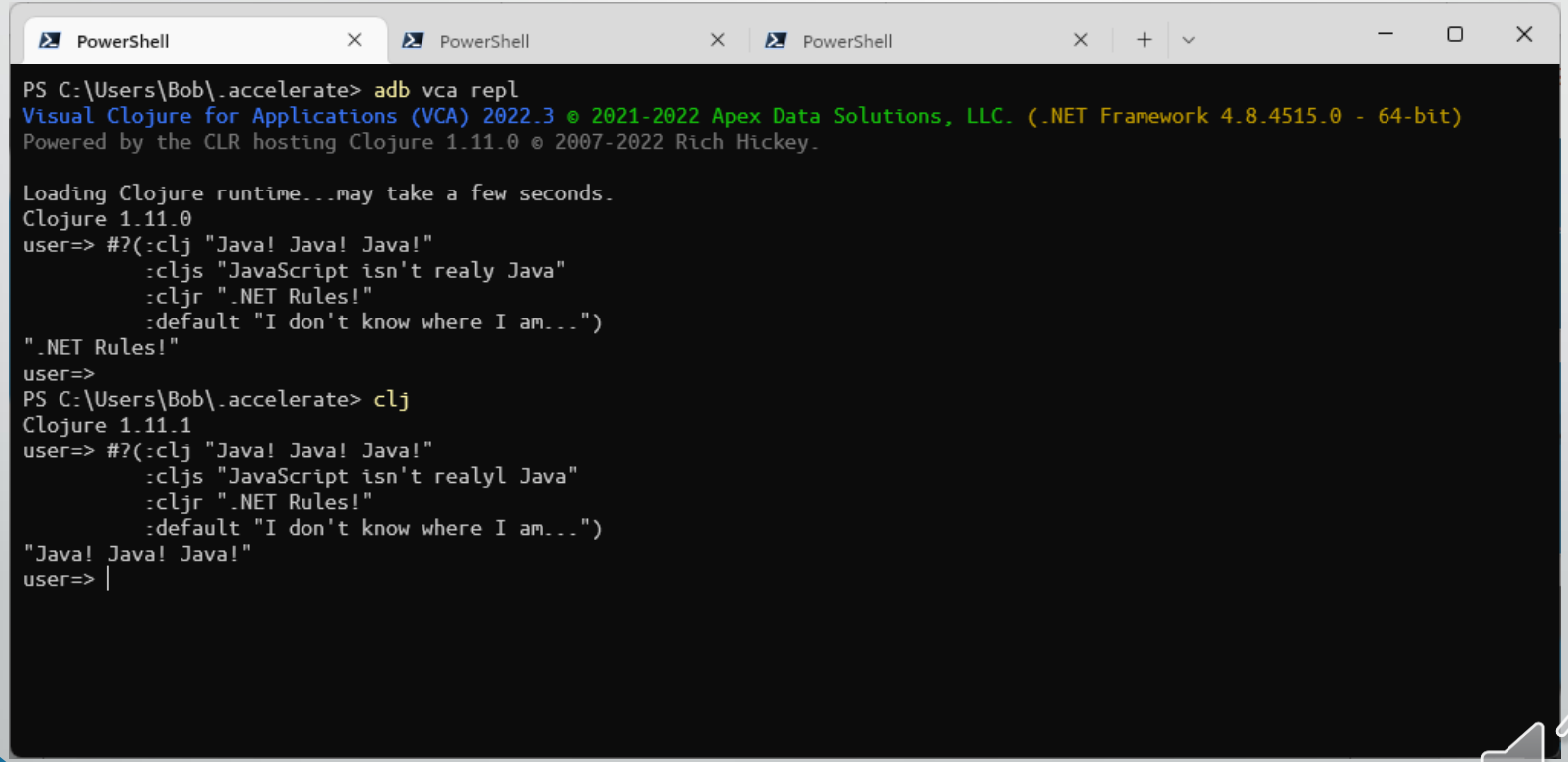
# Clojure

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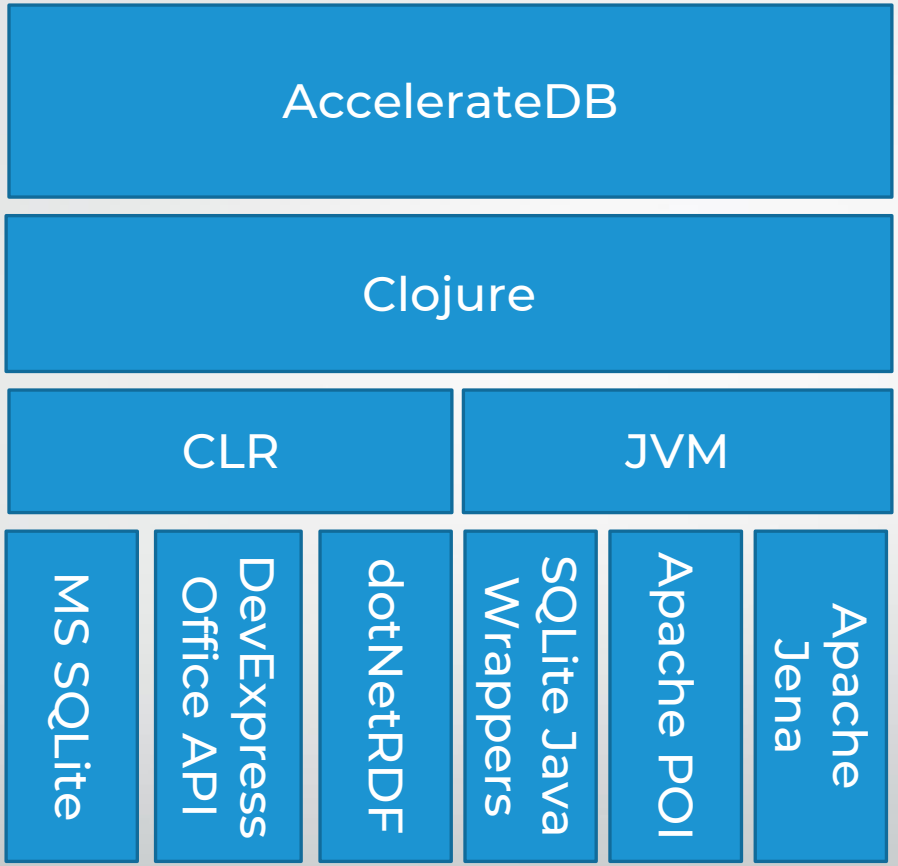


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# The Goal is General Data Interoperability

- MS 365/Office solutions in the enterprise are typically created ad hoc and deployed as “silo” applications, posing data sharing challenges to the broader IT organization.
- Small business Office solutions are typically domain-specific and have a narrow path to upscaling when an organization outgrows them.
- What is needed is a way to transform the data in these artifacts into sharable information and deploy them as services according to best practices.

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# Latest HIMSS definition of Interoperability

- **Foundational (Level 1):** Establishes the inter-connectivity requirements needed for one system or application to securely communicate data to and receive data from another
- **Structural (Level 2):** Defines the format, syntax and organization of data exchange including at the data field level for interpretation
- **Semantic (Level 3):** Provides for common underlying models and codification of the data including the use of data elements with standardized definitions from publicly available value sets and coding vocabularies, providing shared understanding and meaning to the user
- **Organizational (Level 4):** Includes governance, policy, social, legal and organizational considerations to facilitate the secure, seamless and timely communication and use of data both within and between organizations, entities and individuals. These components enable shared consent, trust and integrated end-user processes and workflows

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# Keys to the Solution

- Information Model based on Linked Data
- Dynamic Architecture Style: Think Office data/artifacts as Microservices
- Open, extensible programming model
- Flexible, Internet-savvy deployment model

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# Pre-requisites of Interop

- Legacy Application Modernization reframed as a process of preparing data silos for services-oriented interoperability
- Operationalizing the sharing of data means recasting it in the “language of the domain” (hence linked data)
- Preventing throwing bad data after good is the key concern of any operational data sharing

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# What is Linked Data?

- An W3C standard information model, also known as RDF or Resource Description Framework, based on statements of fact, composed of *triples*:
  - Subject (the thing we're talking about)
  - Predicate (a property or attribute we associate with the subject)
  - Object (a valid value for that property or attribute)
- Multiple triples form a *graph. Open world assumption!*
- *Graphs* can be queried in a language called SPARQL
- Graphs can be linked, and new data generated from exiting data, by associating classes using RDFS+ and OWL and reasoning with rules.

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# Phases of Interop

| Phase | Goal | Tool |
|---|---|---|
| 1. SOR Preparation | Adapt (legacy) systems of record for change propagation. | Accelerate Pro |
| 2. Initiate Change Propagation | Enable Real-Time Data Propagation | DomainMaster |
| 3. Real-time, scalable alignment of downstream SORs across organizational boundaries. | Allow participants in data exchange maximum autonomy and strong guarantees about state/time. | Unify! |

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# *Accelerate™ for Microsoft 365 and Accelerate™ Pro*

What to expect in the upcoming release of *Accelerate™ Pro:*

- *Better tooling inside Office for solution developers*
- *Clojure as a first-class automation and cloud deployment language*
- *Deeper support for linked-data and microservices to aid in interoperability*

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# To Summarize…

- Extending Microsoft 365/Office with the full power of .NET adds real value to the goal of enterprise interoperability.
- Leveraging a proper Lisp as the .NET integration language multiplies that value because of the unique properties of Lisp as an especially domain-moldable language.
- There are two proper Lisps on .NET, and we use them both for different use cases in Acceλerate Pro!
- All of this was done in the service of our interoperability mission, but you can use the same tools for any domain.
- Office/365 can be a platform for developing interoperable solutions for small business and the enterprise!

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# Questions?

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# Kicking Things Off

## Jim Duffy

- Director of Business Development
  CODE Magazine & Consulting
- Former Developer – Drawn to the Dark Side: Now Responsible for Marketing & Business Development
- jduffy@codemag.com / My Bio
- International Author and Speaker
- Former Microsoft RD (Regional Director) 9 years
- Former 11-time Microsoft Most Valuable Professional (MVP)
- Twitter: @jmduffy

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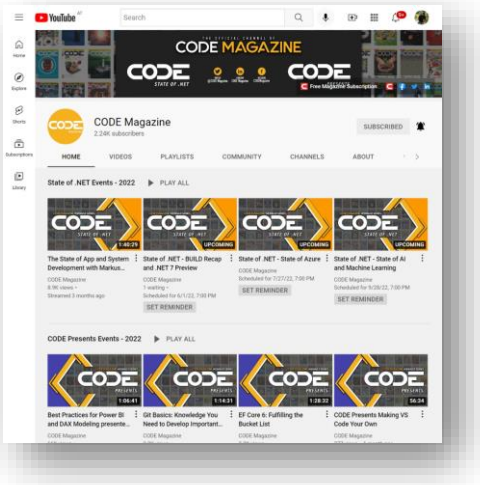

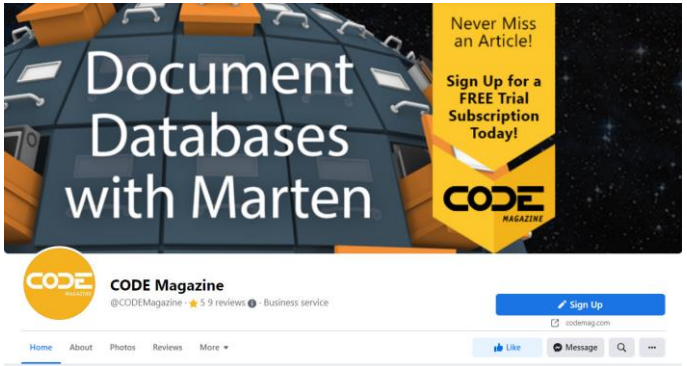

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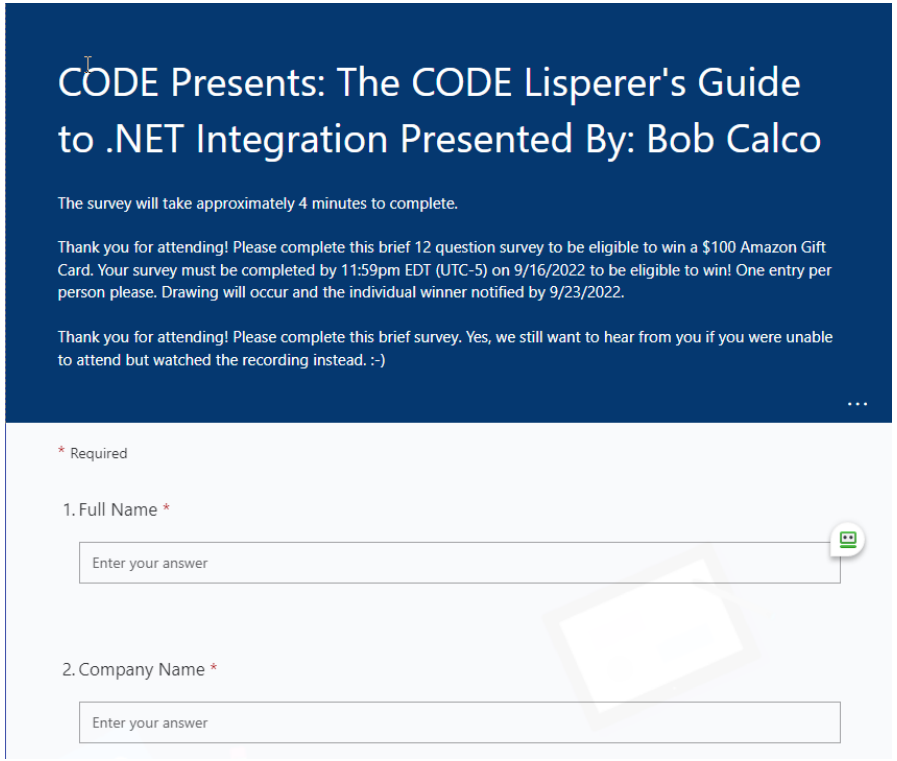


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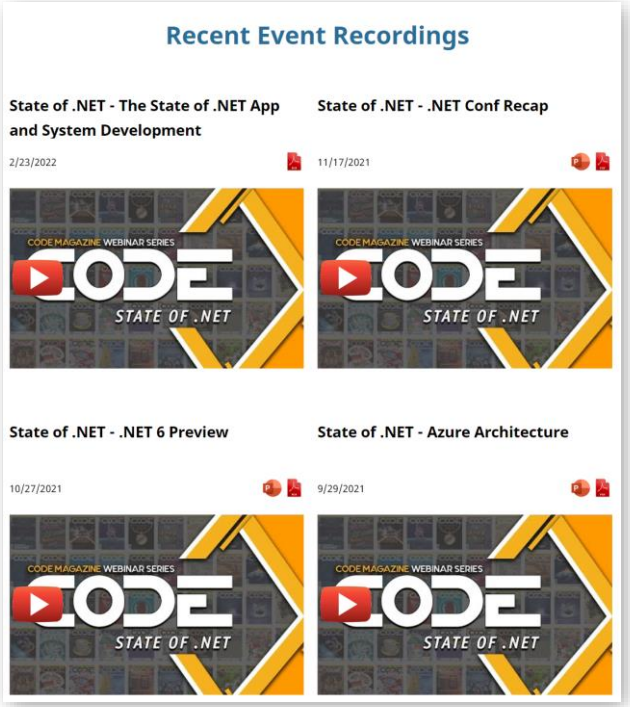
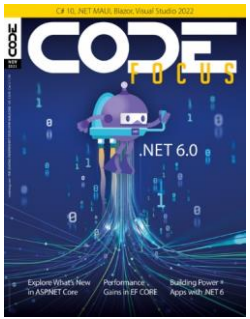
# Recordings & Slide Decks

- State of .NET Webinar Series
  - https://www.codemag.com/StateOfDotNet
- CODE Presents Webinar Series
  - https://www.codemag.com/CODEPresents



# About the Presenter

- **Bob Calco**
  - Chief Architect and Lead Developer
  - Experienced Enterprise Architect
  - Unique Experience in Data Federation & Interoperability
  - 20+ Years Software Development Experience



# Other Announcements

# Event Survey – Win $100!

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https://bit.ly/3B3Teku

- Survey must be completed by **11:59pm ET** on **Friday 09/16/2022** to be eligible!
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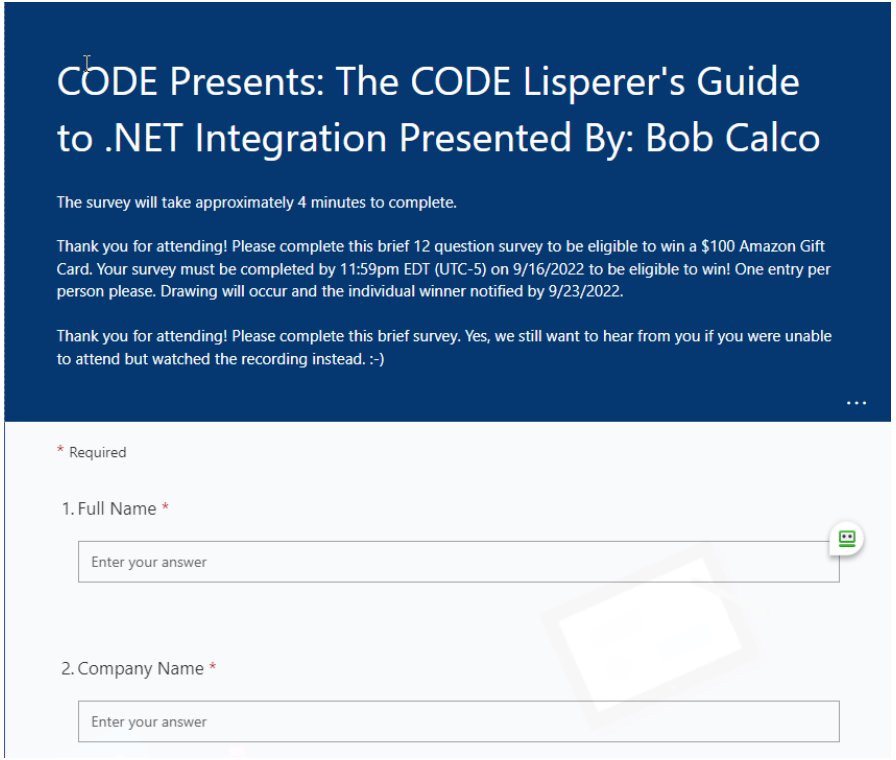

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October 12, 2022

1:00pm ET (UTC-4)

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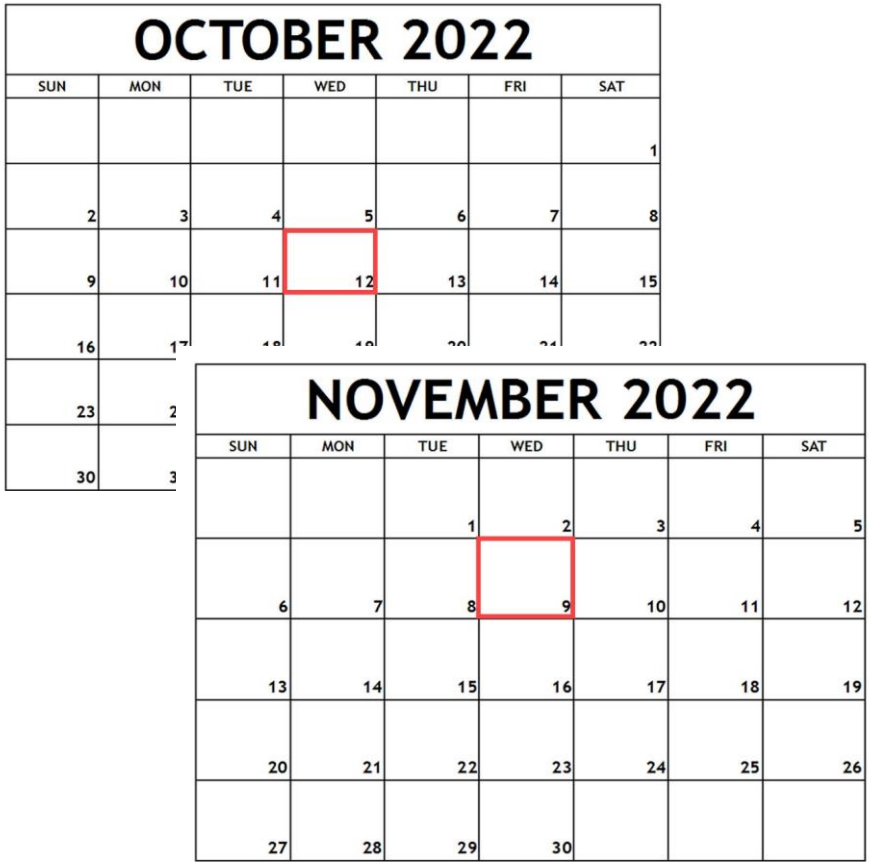
**CODE Presents: Improving String Handling Performance in C#**

November 9, 2022

1:00pm ET (UTC-4)

Register Today! https://bit.ly/3qoo0Q6



# Upcoming State of .NET Webinars!

**State of .NET - .NET 7**
**Presented By: Markus Egger**

October 2022

**State of .NET - State of AI and Machine Learning**
**Presented By: Markus Egger**

November 2022

# .NET 7 Launch!

https://www.dotnetconf.net/

# Q&A

## Contact us with questions!

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jduffy@codemag.com