



# Welcome to: **Brunch and Learn**

Today's session will begin shortly

Friday 19<sup>th</sup> July 2024

.NET on IBM Power

Paul Chapman:

Global Power Modernisation Technical Lead

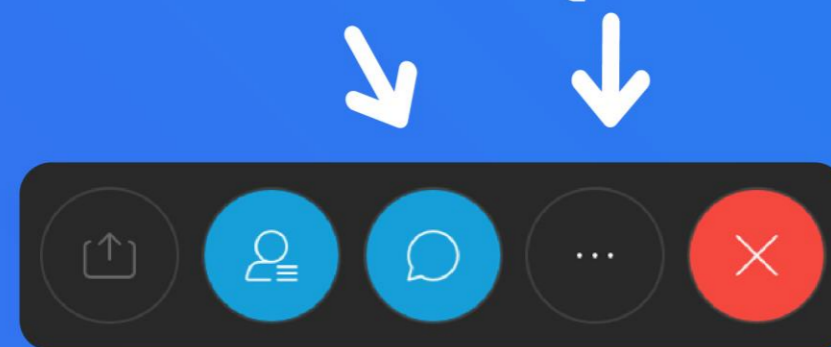
Remi Rouillot:

CTO Aumerial.

## **Note:**

Upon joining, you are muted and cannot see other attendees

Feel free to use the Chat or Q&A functions (panel on RHS of screen)



**Systems** UKI



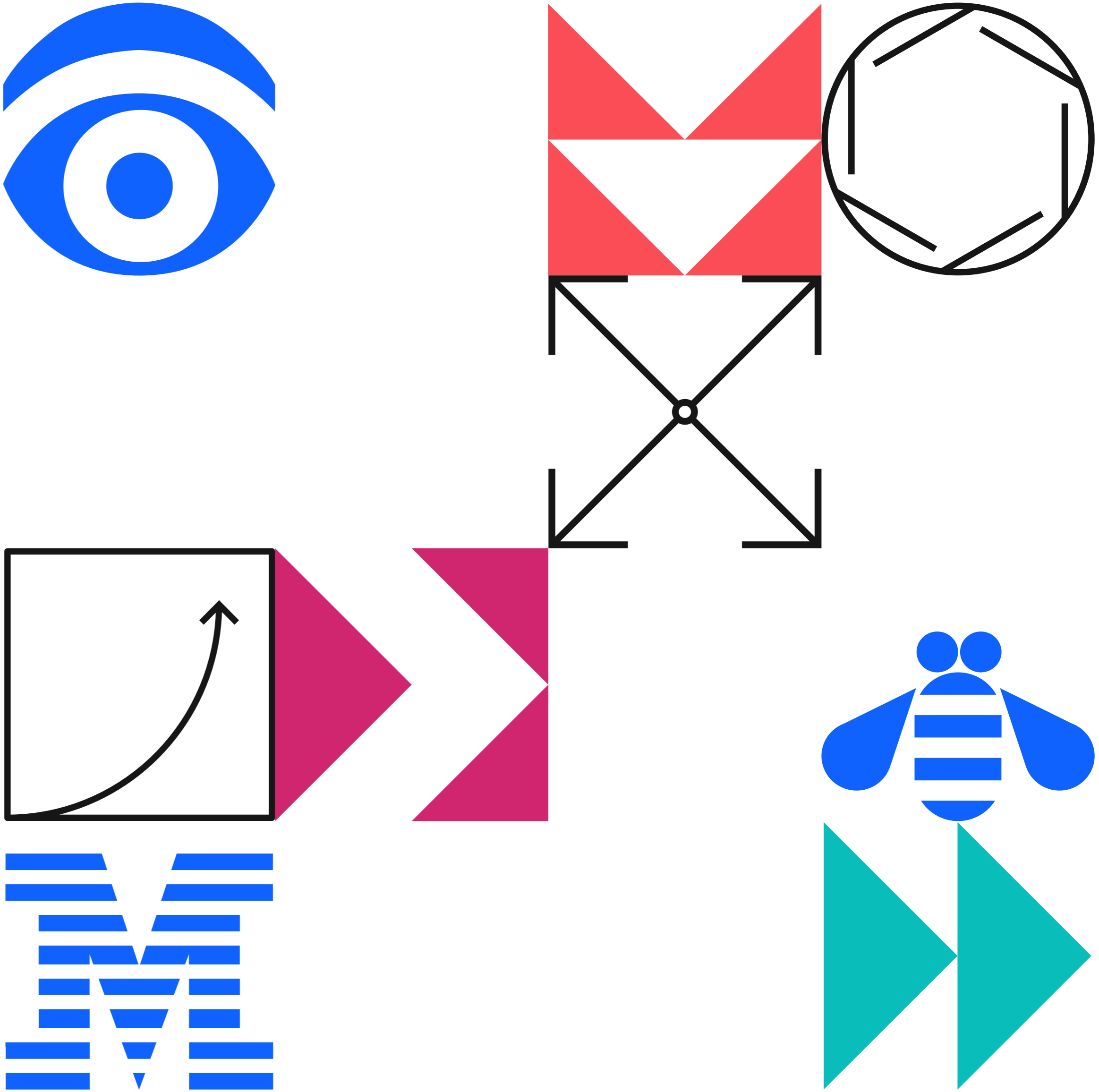
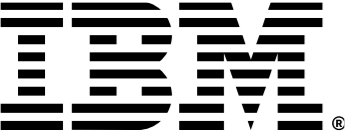
# Bringing .NET to Life with Power



[Rémi Rouillot](#)  
CTO AUMERIAL



[Paul Chapman](#)  
IBM, Global Power Modernization Technical Lead



# Agenda

- 01 **Delivering .NET on Power**
- 02 First customer experience & references
- 03 .NET announcements, blogs & release notes
- 04 Survey Results, Support & Lifecycle
- 05 Migrate .NET to Power
- 06 Hands-on Labs & Demo's
- 07 IDE & Debugging
- 08 Where to learn more & stay up to date

# .NET on Power Drumbeat

2H 2022

Prior years By customer request - IBM Request for Enhancement -> IBM Ideas

Q2 Suggest & agree to promote .NET on Power drumbeat through 2H

June Test early release .NET 7 on P9 – Success

## Q3 SKM Informatik - .NET 7 on Power Early Adoption Program (Azure to OpenShift on Power Virtual Server)

Promote .NET during IBM, BP & Customer App Mod & Hybrid Cloud presentations  
Share .NET 7 plans and demonstration recordings with

WW Peers, America's and APAC

EMEA Partner Technical & Red Hat Advocates

RHA completed 25 Application Modernisation Workshops

Ongoing program

## ISVs AUMERIAL & smeup

3 requested enrolment in Early Adoption Program

1 more just starting PoC in Montpellier

## BP/MSPs

2 requested enrolment in EAP

1 already migrated from Azure to PVS

1 starting PoC

1 reviewing customer base to progress through 2023

1 already running Mono

## Customers

1 plans PoC

1 plans to deploy in Q1

1 awaiting next steps, linked to ISV

Internal Publication [Win Wire](#)

Public Reference [SKM Informatik](#)

Q3

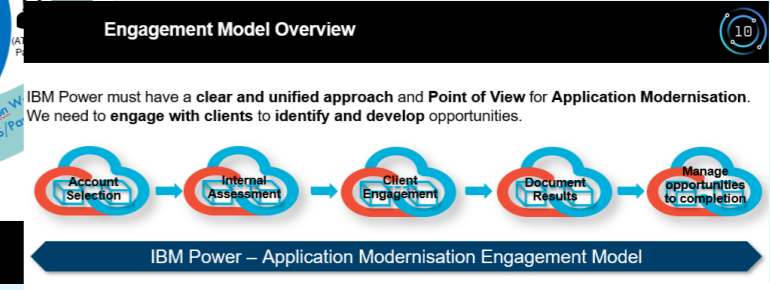
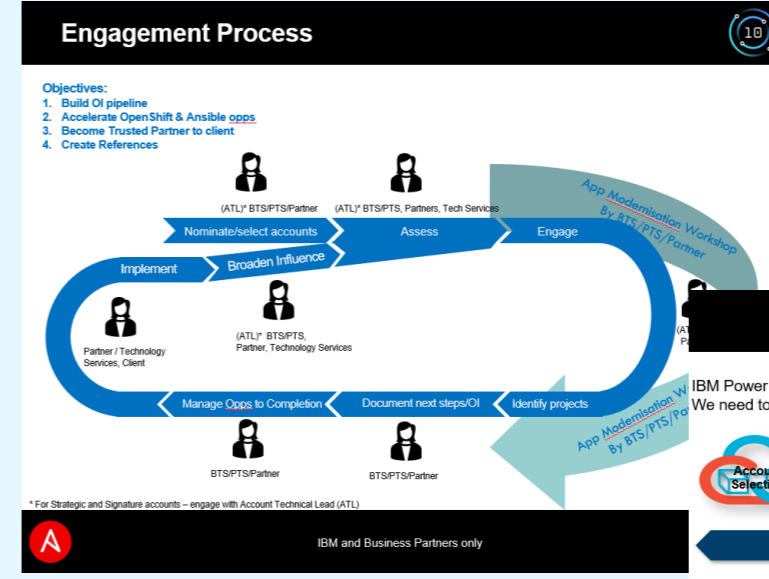
Q4

Open Source and OpenShift Container Packages for App Modernization and Cloud Native Apps

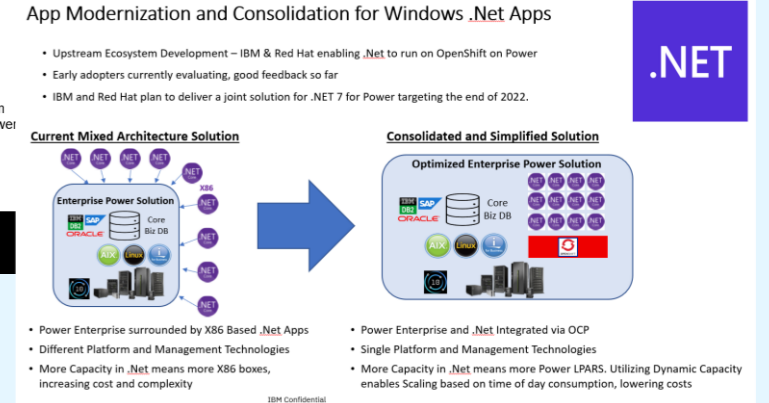
- Upstream Ecosystem Development – IBM & Red Hat
- Target initial early adoption availability mid-Summer
- Desire collaboration with key ISV, MSP & customers

Build and run SKM .Net application on Power Demonstration

SKM Application Architecture



- Engagement Model – Actions:
1. **Client deck** – Read and understand the [Application Modernisation deck](#)
  2. **Account Selection** – Identify potential clients to engage
  3. **Internal Assessment** – Assess and decide which clients will be part of the program
  4. **Client Engagement** – Client meetings to explore Application Modernisation on Power
  5. **Document Results** – Capture next actions and create ISC opportunities
  6. **Manage to Completion** – Track opportunities to successful closure via ISC



Fueling innovation with hybrid cloud and application modernization

Migrate from Microsoft Azure to IBM Power Virtual Server with .NET 7

Fueling innovation with hybrid cloud & application modernization

Business need: Migrate from Azure to Power Virtual Server with .NET 7

Proposed solution

Solution outcome

Initial changes required to run x86 .Net code on Power with .Net 7



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# #1 AUMERIAL NTi Data Provider

IBM i & .NET applications everywhere

## Platform Agnostic

Operates on any architecture  
(Power, ARM, x86, RISC-V ...)

## Version Agnostic

Runs with any IBM i version, even older ones.

## No installation

Nothing to install on the IBM i, standard TCP services are used

## Driverless

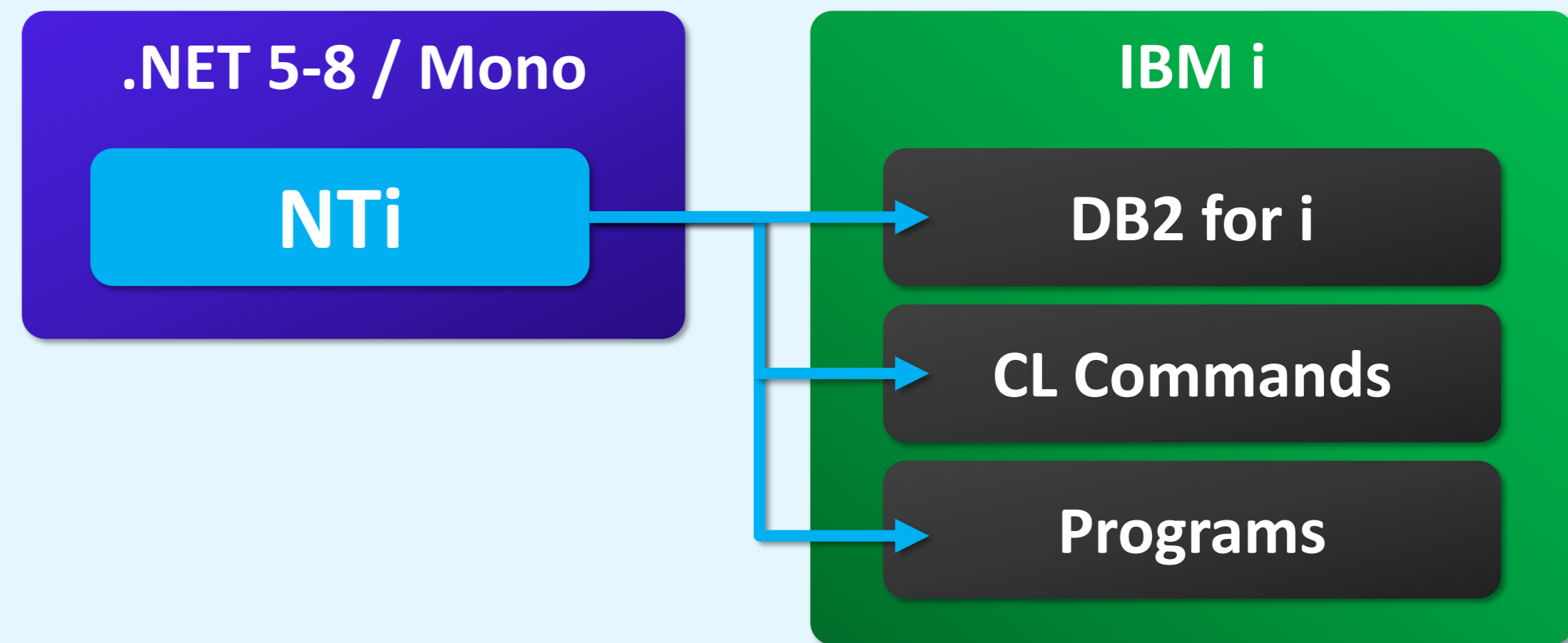
Does not rely on OS-specific driver

## Lightweight

Resource and memory-efficient

## Easy to use

Standard ADO.NET syntax known by everyone, works with many ORMs such as Dapper



## Any Use Case

Web

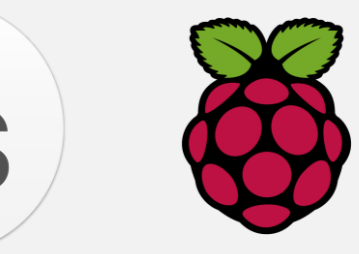
Desktop

Mobile

AI

Cloud

## Any Environment



## Any Architecture

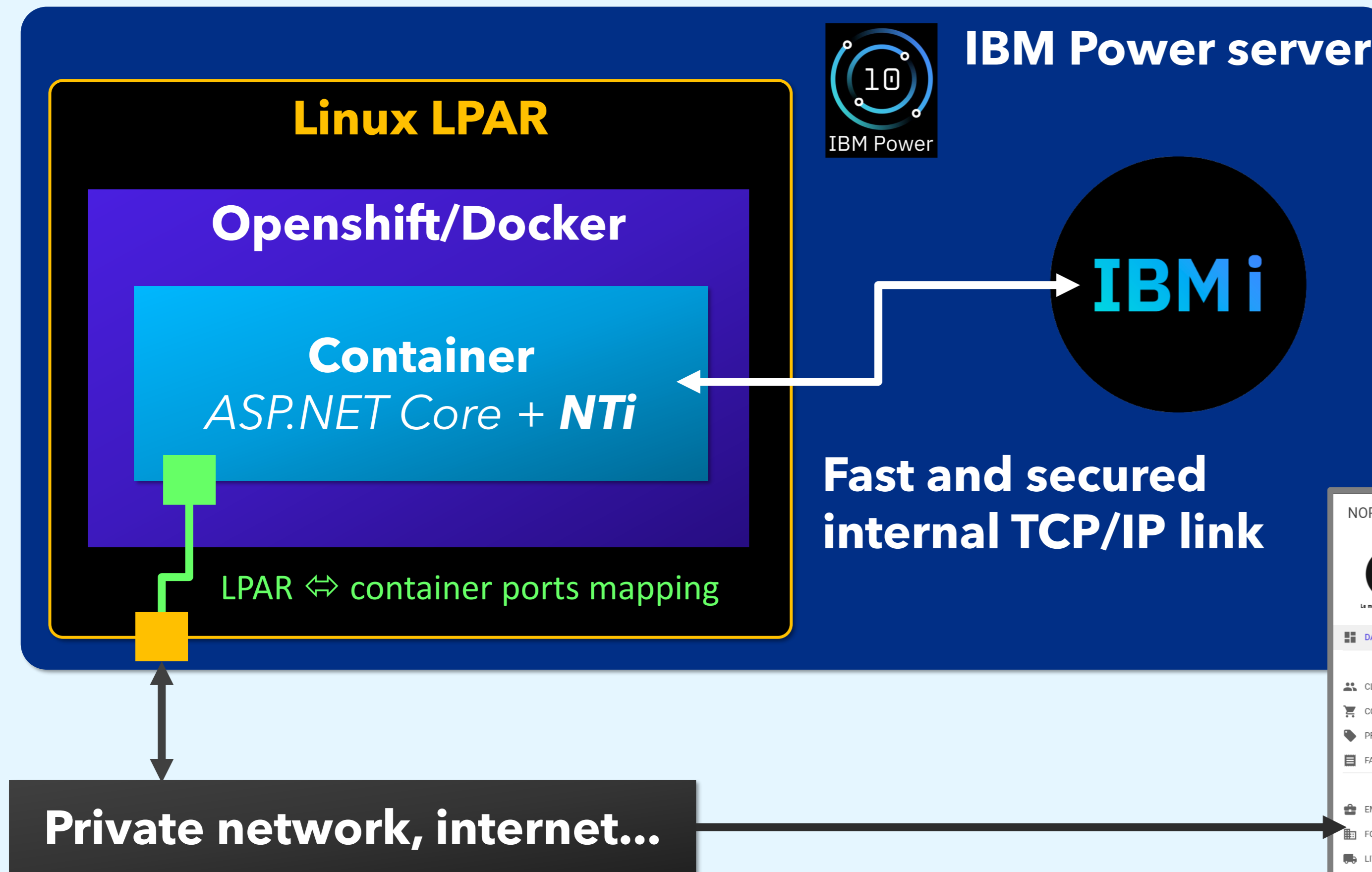


# AUMERIAL NTi Data Provider

Step-up infrastructure efficiency, security and sustainability

## Example:

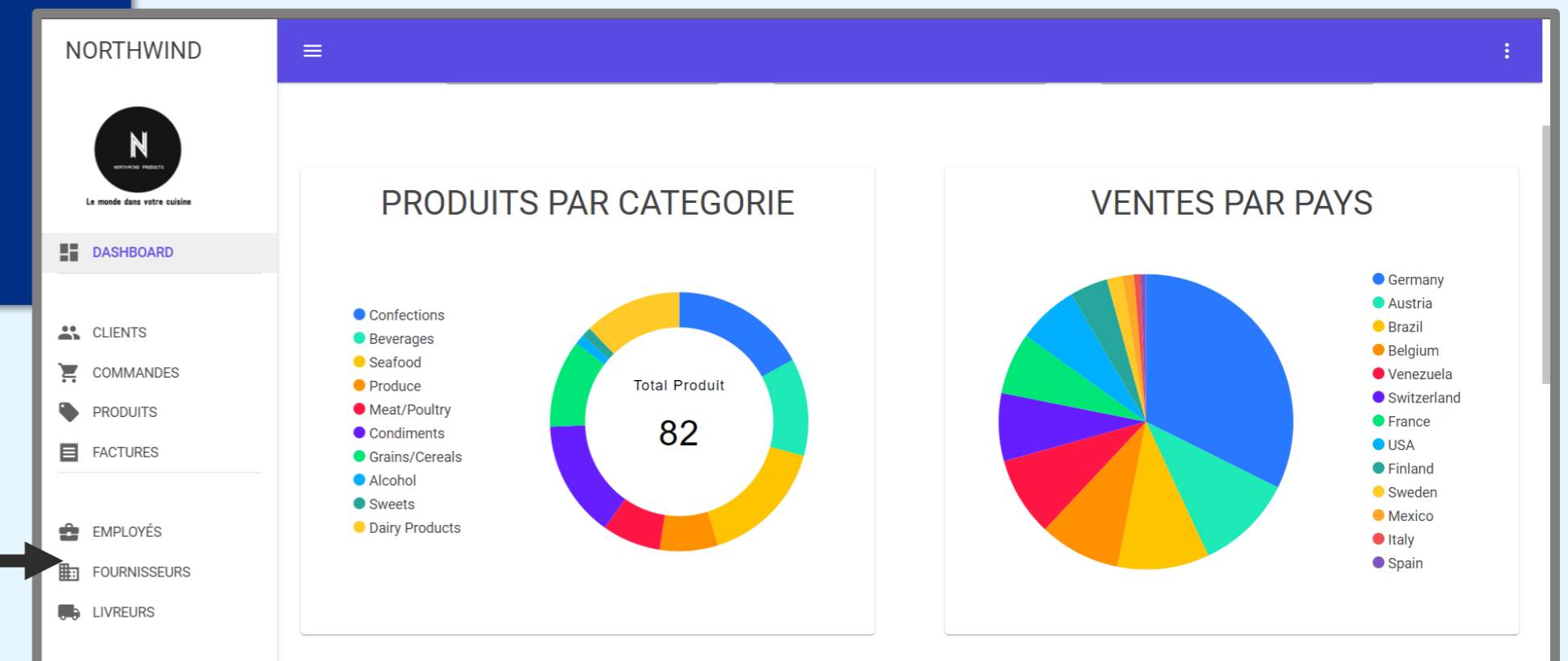
.NET / IBM i application running in a linux container within the same IBM Power server. No need to provision additional application server/VM.



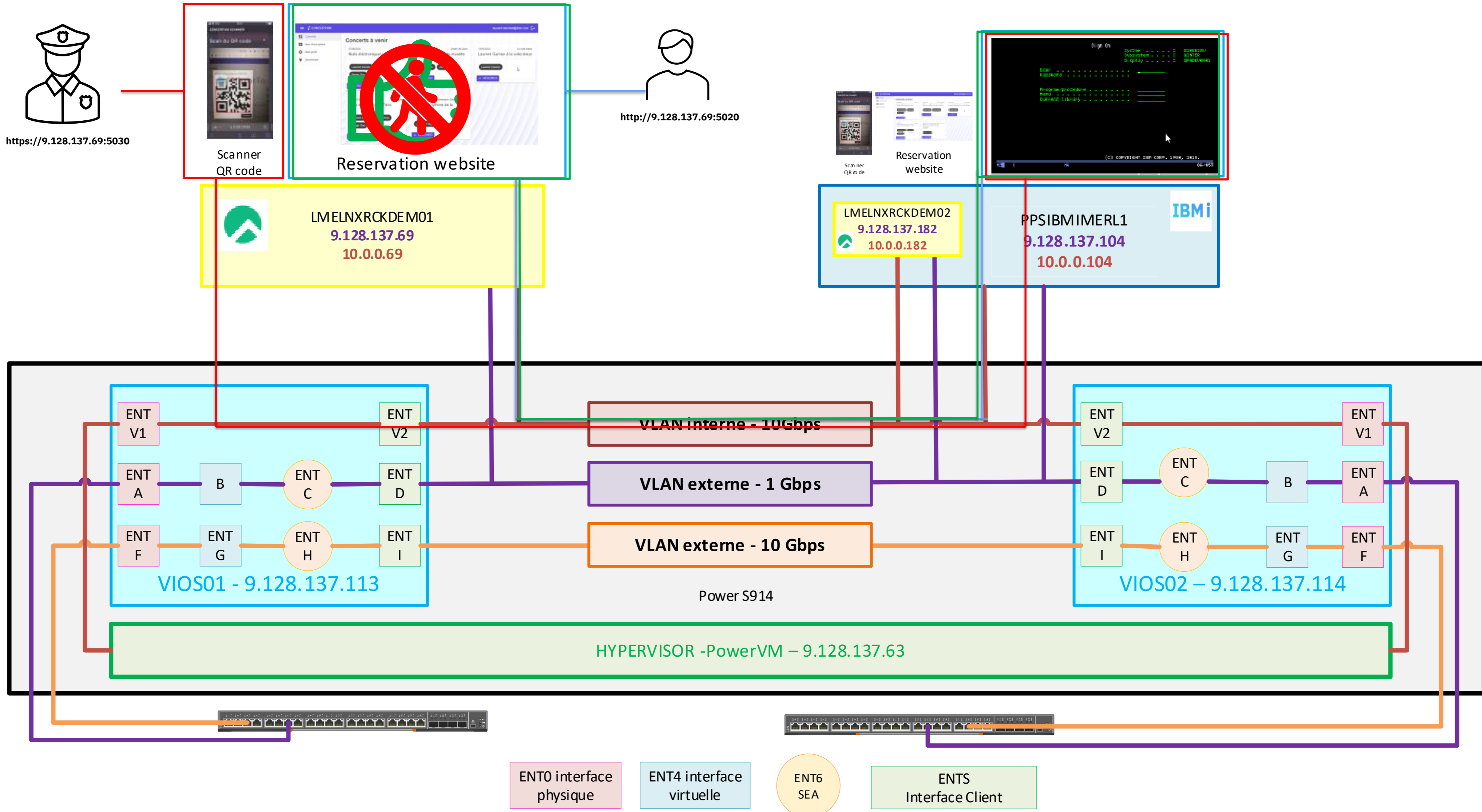
**Low latency**  
~0.3ms/query

**Sustainable**  
Energy efficient Power 10 resources

**Low TCO & footprint**  
No additional server



# Infrastructure NTI/IBM i - concert400 + Scanner QR code .Net / RockyLinux / IBM i / PowerVM / Power9

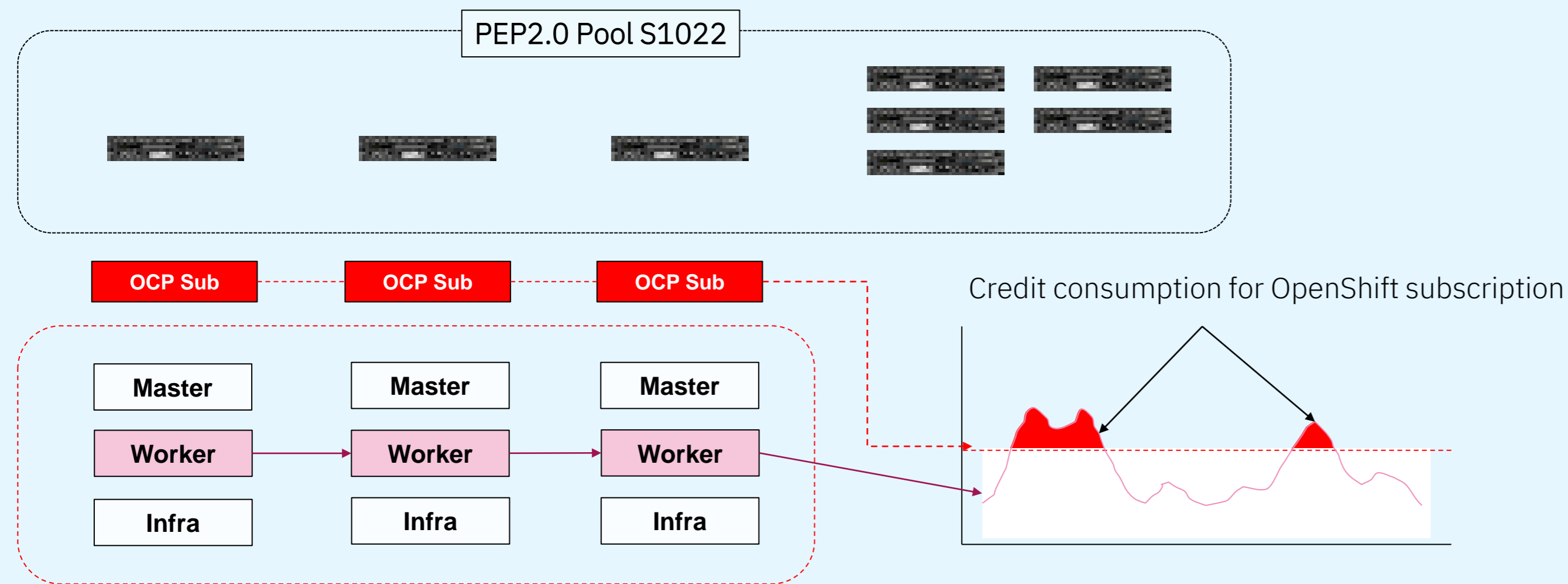
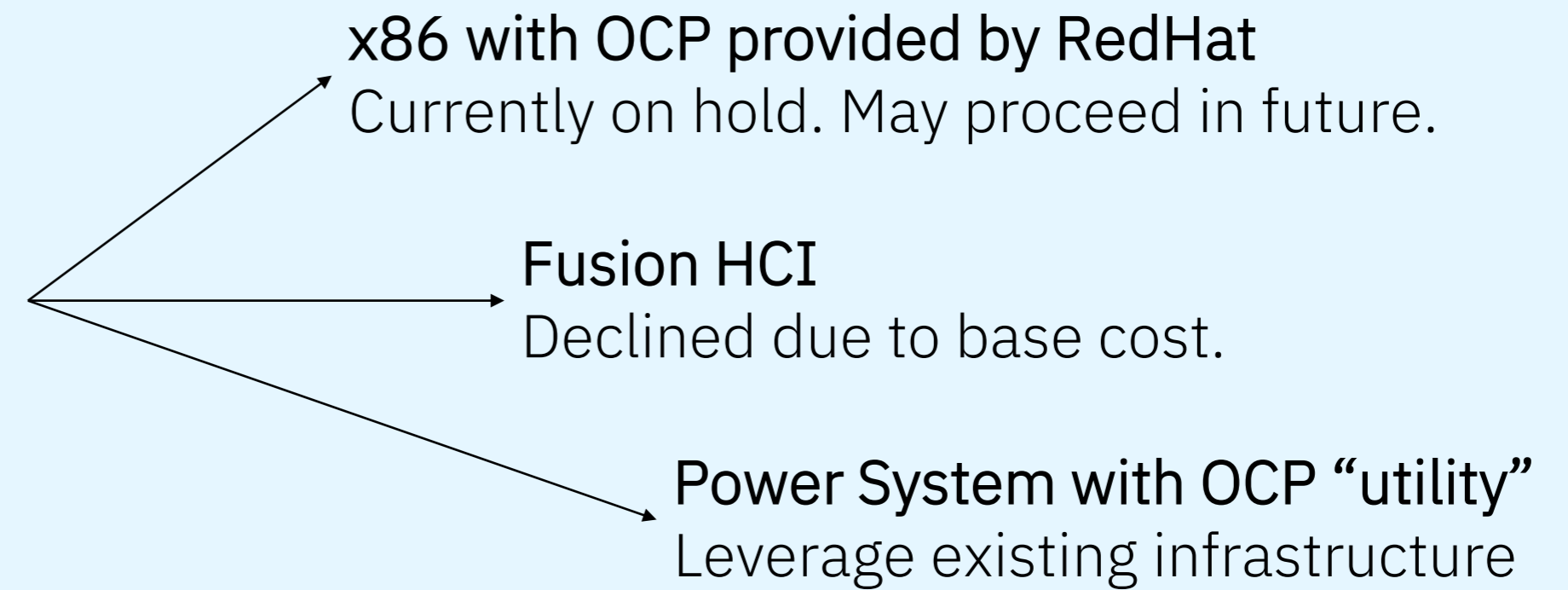




# #2 .NET PoC with OpenShift & PEP 2.0

## Opportunity:

PoC for .NET software development project. Infrastructure engagement.  
No Kubernetes. Interest on OpenShift.  
High attention to acquisition costs.



## Hardware cost

- Zero Initial investment for the project
- Minimal credit consumption possible

## Software cost

- 3 OCP subscriptions (minimum base)
  - Credit consumption possible in future
  - No “out of policy” risk with growth
- Existing IBM Spectrum Scale licenses

# #3 .NET with OpenShift Multi-Arch Compute

smeup LAB

## Co-creation Project

data

**Paul Chapman** · 1<sup>o</sup>  
Global Power Modernisation Technical Lead

Now you can run x86 & Power Worker Nodes in the same OpenShift Container Platform Cluster with Multi-Arch Compute.

...vedi altro

Vedi traduzione

Agenda

- 01 Why Power?
- 02 What is MAC?
- 03 Why use MAC?
- 04 How to use MAC?
- 05 Early Adoption Program
- 06 Demo

UKI Brunch & Learn - Red Hat OpenShift - Multi-Architecture Compute

www.smeup.com

© smeup 2024

1. Set up MAC Cluster
2. Deploy existing application in MAC
3. Deploy new application
  - Understand **what customer does** in their environment
  - Explore **customer use case/demo**
  - Help customer build **their multi-arch components** (part of MAC Onboarding Essentials Manual in addition to **development support**)
  - Customer **deploys their application** across specific architecture

**IBM Team**

- Erica Albert
- Paul Bastide
- Paul Chapman
- Geoffrey Pascal

# Thanks!

# .NET with OpenShift Multi-Arch Compute

The screenshot shows the OpenShift Nodes page for the 'Co-creation Project'. The page header includes 'smeup LAB' and 'data'. The 'Nodes' section has a search bar and a table with the following columns: Name, Status, Roles, Pods, Memory, CPU, Filesystem, Created, and Instance type. The table lists seven nodes with their respective details. The 'Instance type' column is highlighted with a blue box for 'e980' nodes and a red box for 'bx2-4x16' nodes.

Name	Status	Roles	Pods	Memory	CPU	Filesystem	Created	Instance type
mac-573b-worker-0	Ready	worker	22	4,49 GiB / 15,86 GiB	0,133 cores / 8 cores	20,98 GiB / 119,9 GiB	10 nov 2023, 14:37	e980
mac-573b-worker-1	Ready	worker	22	4,42 GiB / 15,86 GiB	0,117 cores / 8 cores	21,89 GiB / 119,9 GiB	10 nov 2023, 14:44	e980
rdr-mac-cust-sm-l477g-master-0	Ready	control-plane, master	52	8,52 GiB / 15,63 GiB	0,786 cores / 4 cores	39,82 GiB / 99,78 GiB	9 nov 2023, 21:28	bx2-4x16
rdr-mac-cust-sm-l477g-master-1	Ready	control-plane, master	32	6,34 GiB / 15,63 GiB	0,722 cores / 4 cores	83,15 GiB / 99,78 GiB	9 nov 2023, 21:28	bx2-4x16
rdr-mac-cust-sm-l477g-master-2	Ready	control-plane, master	57	7,54 GiB / 15,63 GiB	0,813 cores / 4 cores	82,38 GiB / 99,78 GiB	9 nov 2023, 21:28	bx2-4x16
rdr-mac-cust-sm-l477g-worker-1-k2mn	Ready	worker	30	6,65 GiB / 15,63 GiB	0,483 cores / 4 cores	40,14 GiB / 99,78 GiB	9 nov 2023, 21:42	bx2-4x16
rdr-mac-cust-sm-l477g-worker-2-jz92	Ready	worker	26	8,13 GiB / 15,63 GiB	0,490 cores / 4 cores	40,79 GiB / 99,78 GiB	9 nov 2023, 21:43	bx2-4x16

# .NET with OpenShift Multi-Arch Compute

smeup LAB

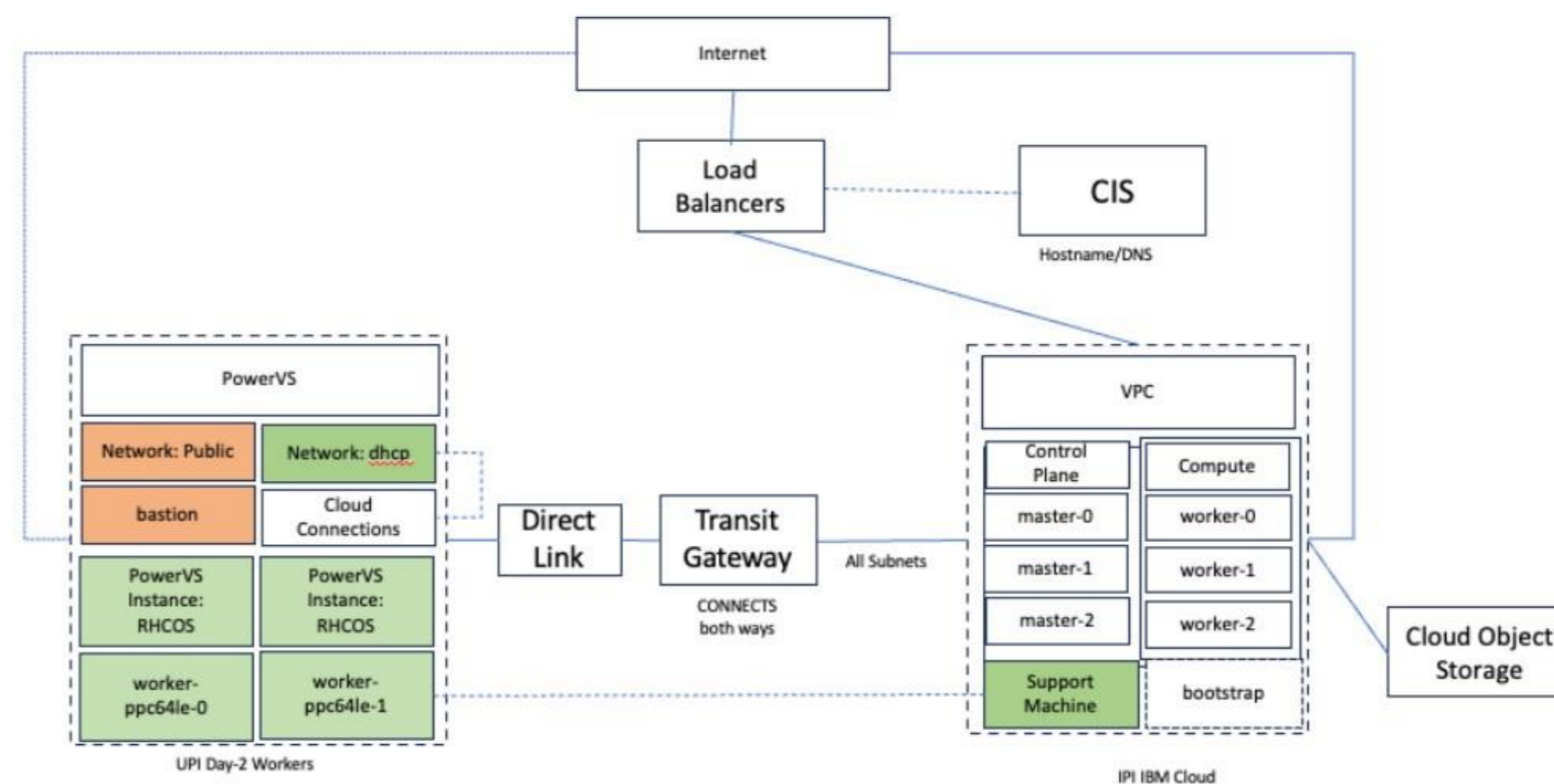
## Open Shift Multi-Architecture

Running the same OS Cluster on  
Intel and Power!

### Use cases

- Not supported application runtimes
- Not (yet) supported application versions
- Reuse existing resources

www.smeup.com



# #4 Introduction to SKM EAP Experience

(Early Adoption Program)



## Introduction

SKM Informatik GmbH

The system house SKM Informatik GmbH was founded in 1990 in Schwerin and supports companies worldwide with the introduction and use of IT/CAD/CAM/CAE technologies with 40 specialists. The solution competence of SKM goes far beyond the delivery competence of hardware and software components. Rather, we jointly develop technologies that enrich value chains in companies and take account of the changing digital working world.

1. SKM Informatik want to build a webservice in conjunction with .NET application & Keycloak authentication for their end-customer to login. Currently that runs on Azure, but they want to move away from that (if everything works on Power).
2. Another key driver is MLOps/Kubeflow for the training of AI noise detection models - that works quite well.

The above are individual projects, and this document concentrates on the project to migrate Azure based solution to Power Virtual Server using .Net.



.NET

# The Journey



## Previously

1. SKM experienced technical difficulties running Mono on Power Virtual Server
2. SKM provided IBM [generic code](#) to troubleshoot the problem license, enabling W4AIOps
3. IBM [demonstrated](#) SKM provided .NET code with [pre GA](#) .NET 7 Core runtime container running on Power 9
4. SKM and IBM agreed to collaborate to migrate the Azure workload from Azure to PVS Cloud. IBM propose to provide pre-GA Apha .Net Core container, for SKM to test and provide feedback to IBM Development team
5. SKM have provided IBM [specific application code](#) privately via GitHub to test
6. IBM have provided and requested SKM signed and return an Agreement for Exchange of Confidential Information (NDA)
7. IBM have successfully [demonstrated](#) SKM specific application code working with .NET 7 on Power, with minor changes in Dockerfile and Skm.Web.HoloServerCore.csproj as documented later in this document
8. SKM signed [Non-Disclosure Agreement](#), protecting both parties Intellectual Property
9. IBM Development OSSC scan, applied fixes and built a container. IBM Legal review of the latest code is now complete and approved
10. Paul Chapman [demonstrated](#) .NET with SKM application
11. IBM shared .NET alpha code to test (non-production) with their application
12. SKM shared application architecture diagrams
13. SKM provided excellent feedback, reported no problems and moved development workload to OCP on PVS
14. Microsoft and Red Hat announced support for .NET 7 on Power 8<sup>th</sup> November
15. SKM agreed that IBM could reference the project Publicly

- SKM Success Story/Case Study: The project may be profiled in a sales/marketing deliverable to be published in hard copy or on IBM web sites
- Reference SKM Project in IBM Speech or Presentation: The project may be referenced in an IBM speech or presentation
- SKM Logo: SKM agrees to use of their company logo (original version) by IBM in the situations agreed above



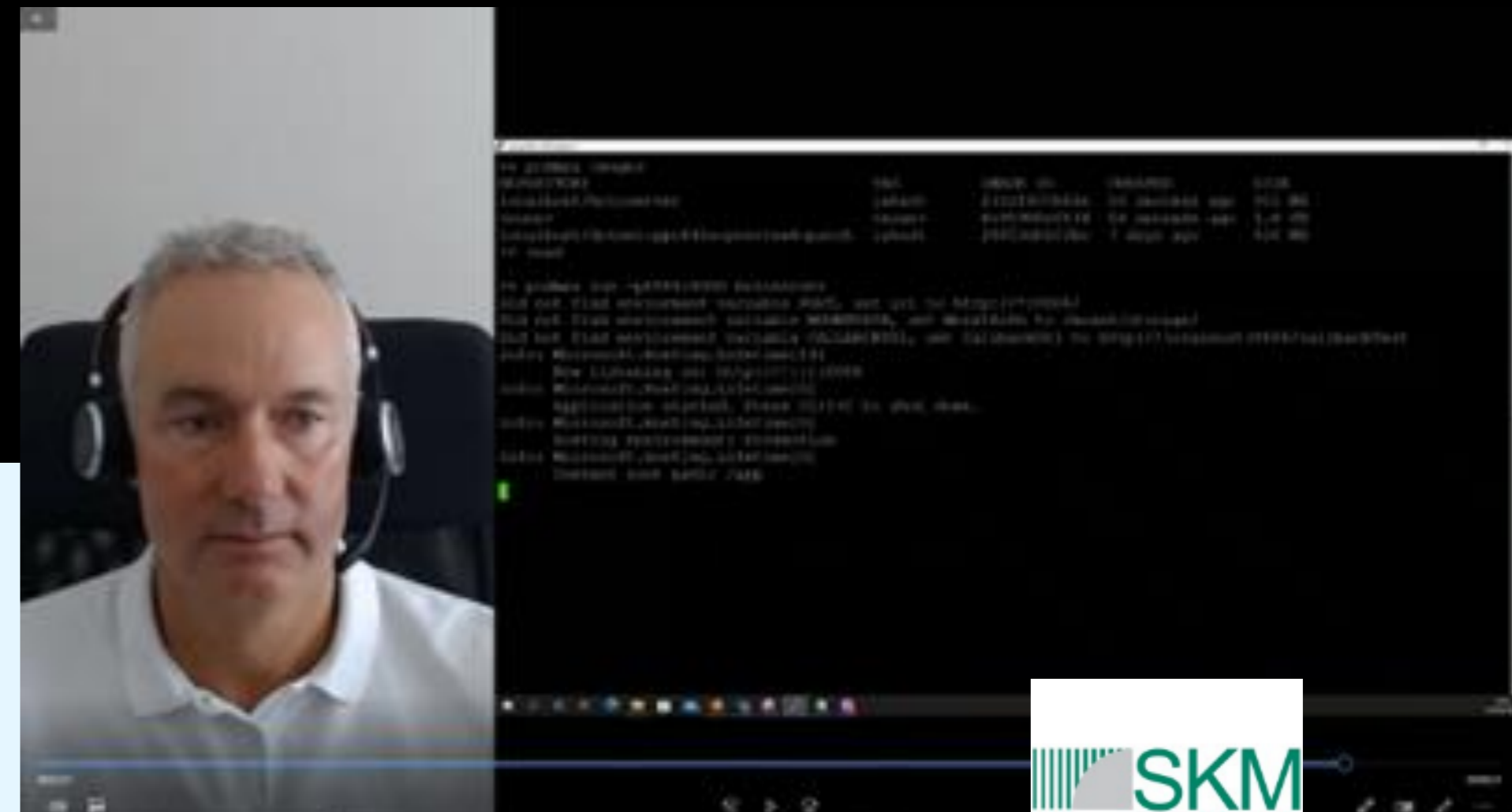
# Build and run SKM .NET application on Power Demonstration



cecuser@p1317-bastion:~

```
[cecuser@p1317-bastion ~]$ podman images
REPOSITORY          TAG          IMAGE ID          CREATED          SIZE
localhost/test-skm  latest      c97c2088431d     20 hours ago    900 MB
localhost/dotnet_runtime  latest      d0c5af0a7598     3 weeks ago     878 MB
[cecuser@p1317-bastion ~]$ podman run -ti test-skm
Did not find environment variable PORT, set url to http://*:8000/
Did not find environment variable MOUNTPATH, set MountPath to /mount/storage/
Did not find environment variable CALLBACKURL, set CallbackUrl to http://localhost:8080/callbackTest
info: Microsoft.Hosting.Lifetime[14]
      Now listening on: http://[::]:8000
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
      Hosting environment: Production
info: Microsoft.Hosting.Lifetime[0]
      Content root path: /app
^Cinfo: Microsoft.Hosting.Lifetime[0]
      Application is shutting down...
[cecuser@p1317-bastion ~]$
```

Shared  
7th September 2022



~~Internal~~ Public demonstration

<https://youtu.be/5gr0uTrcgr4?si=8vMnhMYoFx2n3A2r>

<https://ibm.box.com/s/r95qq7ujjnwl3rlfpjbn7p2xbm90396>



# Container Configuration Changes x86 to Power



## Dockerfile

```
#FROM mcr.microsoft.com/dotnet/aspnet:5.0 AS base //commented
FROM dotnet_runtime_devel as base //used our image "dotnet_runtime_devel"
WORKDIR /app
EXPOSE 80

#FROM mcr.microsoft.com/dotnet/sdk:5.0 AS build //commented
FROM dotnet_runtime_devel as build //used our image "dotnet_runtime_devel"
RUN mkdir /holo
```

Changed base from MS to  
IBM Dev image

## Skm.Web.HoloServerCore.csproj

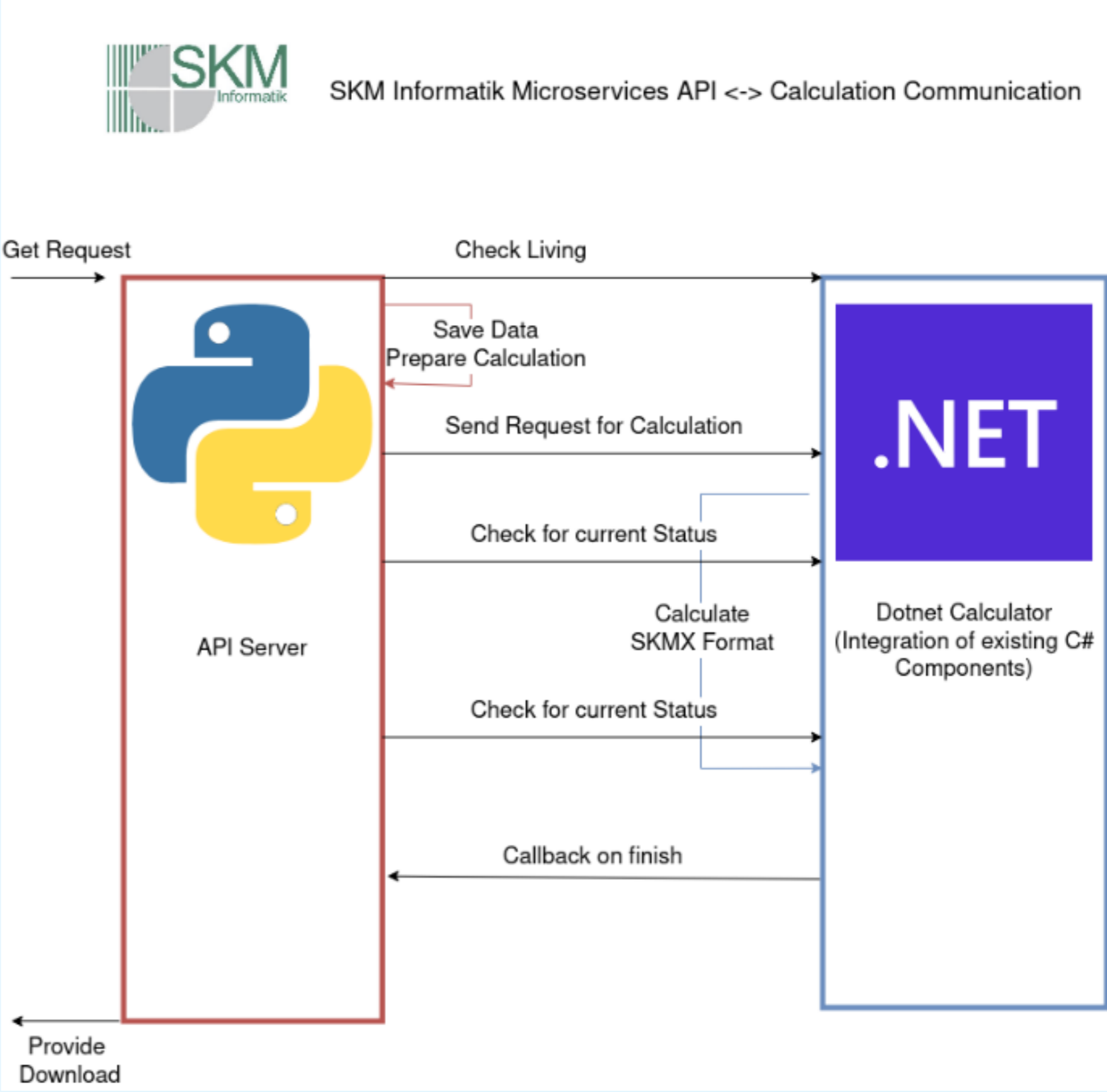
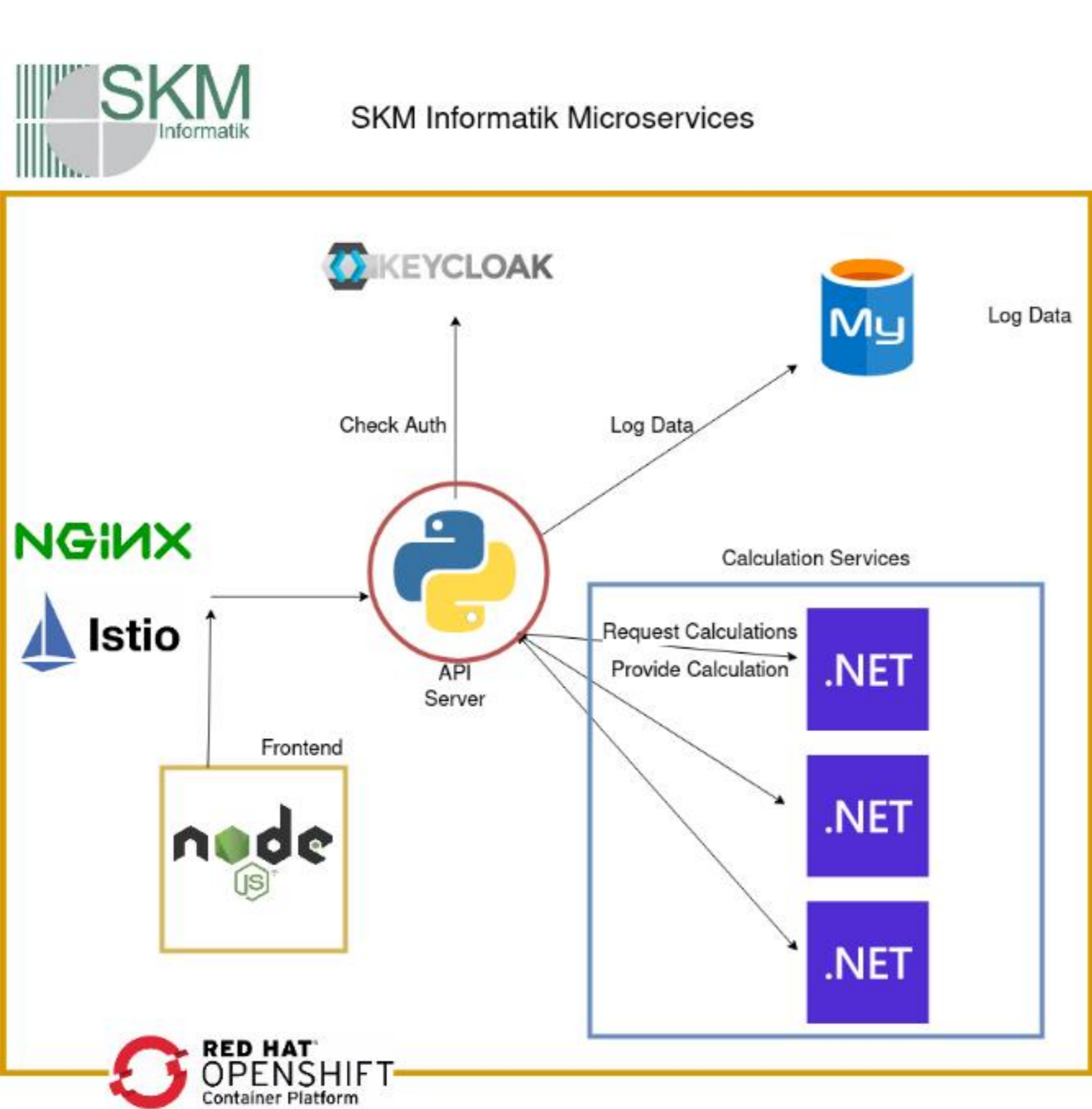
```
<PropertyGroup>
  <TargetFramework>net7.0</TargetFramework> //net7.0 instead of net5.0
  <DockerDefaultTargetOS>Linux</DockerDefaultTargetOS>
  <ErrorOnDuplicatePublishOutputFiles>>false</ErrorOnDuplicatePublishOutputFiles>
</PropertyGroup>
```

Changed to from net5 to  
.Net 7





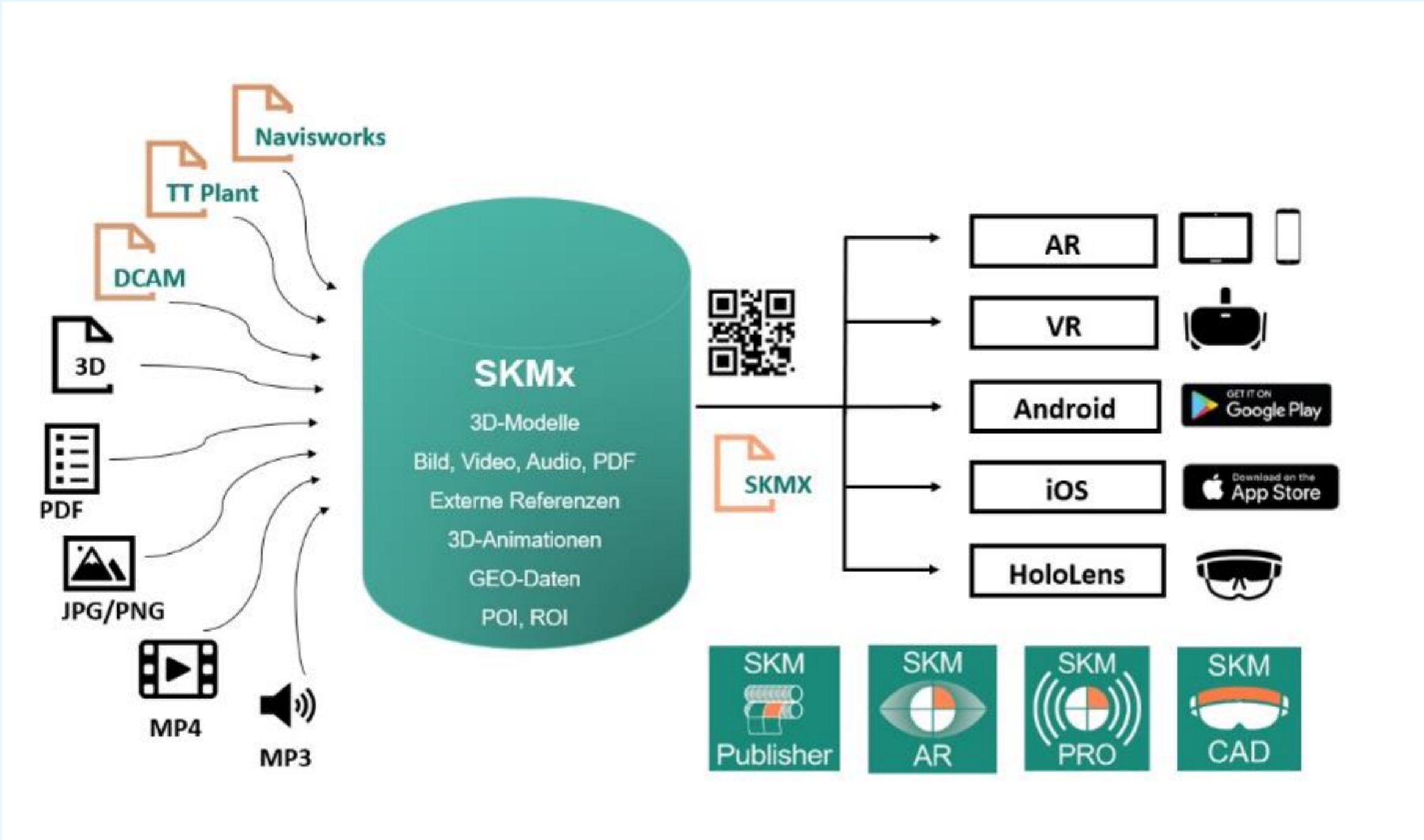
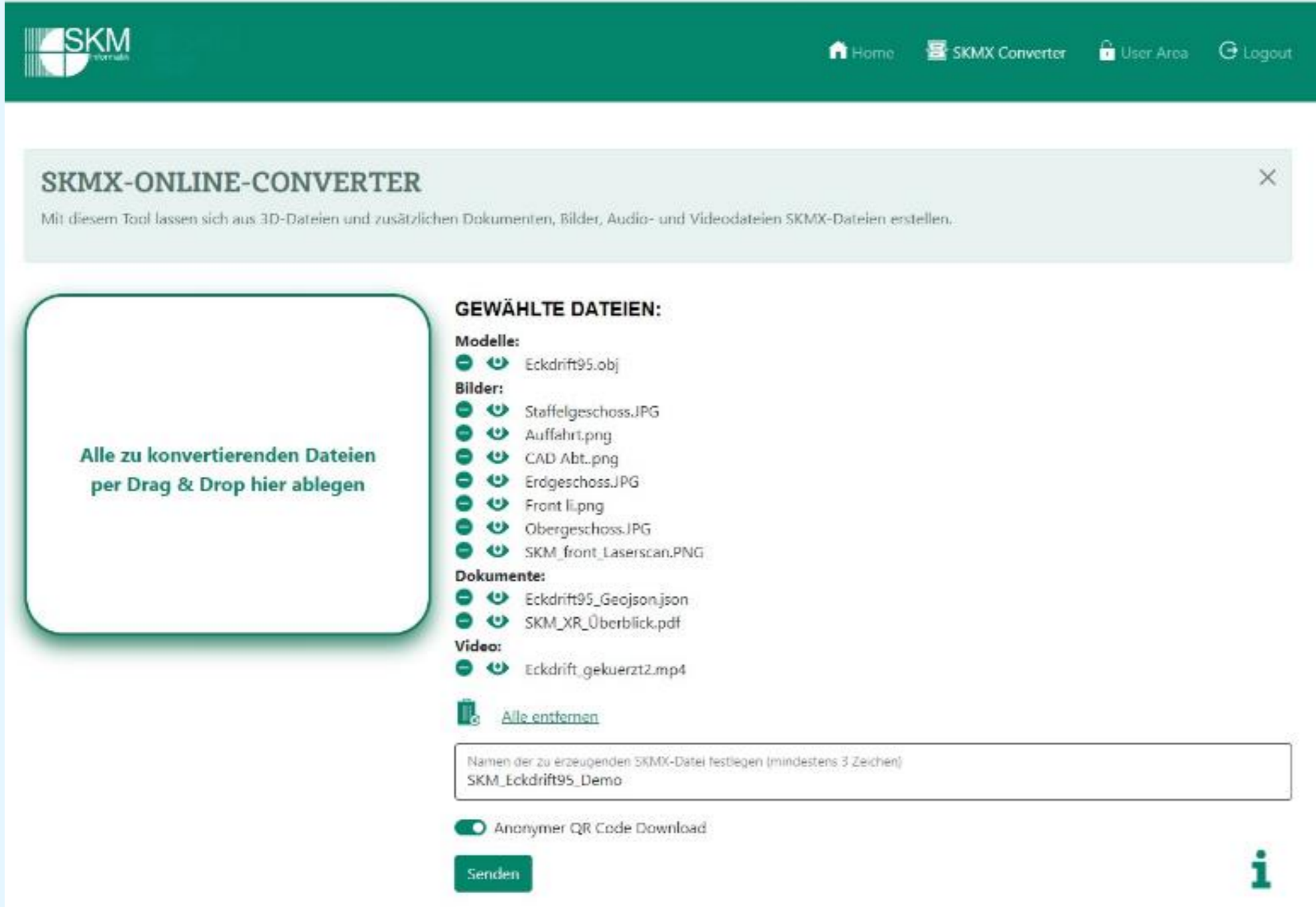
# SKM Application Architecture



# SKM Application 1-3



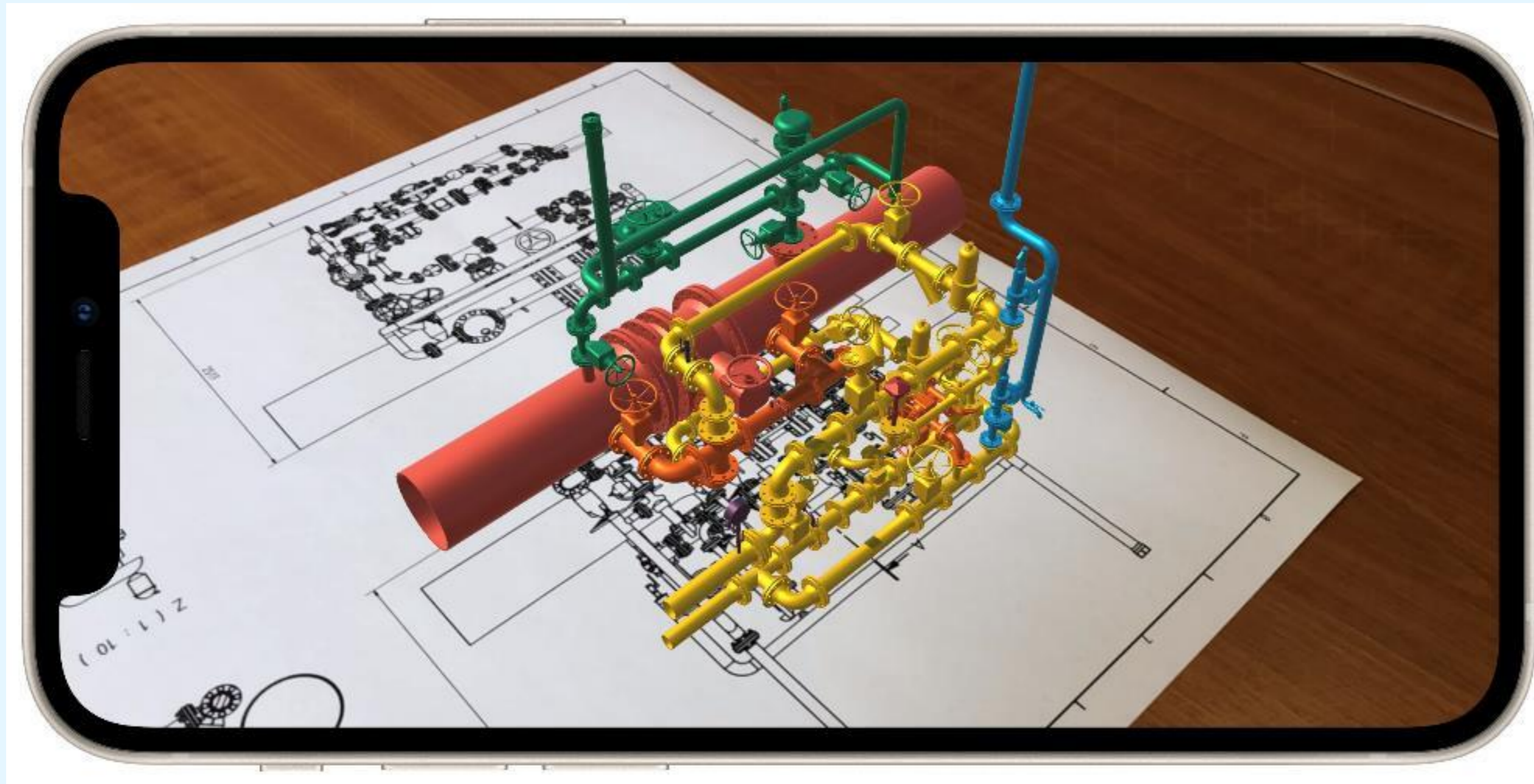
The C# .NET 7 container packs 3D data for visualization in XR (mobile device AR, Hololense AR, VR-Headsets)



# SKM Application 2-3



The C# .NET 7 container packs 3D data for visualization in XR (mobile device AR, Hololense AR, VR-Headsets)



# SKM Application 3-3



The C# .NET 7 container packs 3D data for visualization in XR (mobile device AR, Hololense AR, VR-Headsets)



# Internal Customer Reference



Internal use only



## Fueling innovation with hybrid cloud & application modernization



Company: SKM Informatik GmbH  
Industry: IT software and services  
Country: Germany



Paul Chapman,  
Senior Red Hat & IBM Cloud  
Technology Architect for EMEA  
[paulchapman@uk.ibm.com](mailto:paulchapman@uk.ibm.com)



### Business need: Migrate from Azure to Power Virtual Server with .Net7

SKM Informatik GmbH is an IT system house based out of Germany with 40 specialists that support companies worldwide with the introduction and use of IT/CAD/CAM/CAE technologies. SKM goes far beyond the delivery of hardware and software. Instead, SKM works to jointly develop and maintain the technology that comprises a company's digital framework for years to come.

Partnering with IBM, SKM Informatik has supplied and serviced a wide variety of IBM technology for its customers. Since the announcement of Red Hat OpenShift being

supported on IBM Power Systems Virtual Server back in 2020, the inherent benefits have solicited substantial interest from clients and partners alike. With aspirations of conducting cloud-native development with Red Hat OpenShift on IBM Power Systems Virtual Servers, SKM began development and testing with the help of the local IBM team. All while continuing to work with IBM on other projects in the background, like the positioning of the open source MLOps tool, Kubeflow, demonstrating how aligned IBM has remained in assisting SKM with various business-critical operations.

Internal use only



### Proposed solution

With its existing web service running on Azure, migrating the solution to run on Power Virtual Server required some reassurance from the IBM team that everything would work properly. If possible, SKM needed to build a web service with .Net 7 and Keycloak authentication for end-users to log in. In the beginning, SKM experienced technical difficulties when running Mono on IBM Power Virtual Server, which it looked to remedy by providing IBM with the generic code to troubleshoot. Using the code provided, the IBM team successfully demonstrated how the .Net code with pre GA .Net 7 runtime container could run on Power9. This success solidified SKM's willingness to move forward with the migration process with the help of IBM.

SKM and IBM collaborated to migrate the Azure workload to PVS Cloud. To test and receive feedback, the IBM Development team provided a pre-GA Alpha .Net 7 container, which SKM used to deliver specific application code through GitHub privately.

Embrace the benefits of Red Hat OpenShift running on IBM Power Systems Virtual Server.

- Deploy and scale workloads globally
- Build cloud-native applications
- Get back time for core tasks
- Get more from software with less servers
- Modernize your applications
- Accelerate digital transformation with IBM Cloud Paks

### Solution outcome

With only a few minor changes needed in Dockerfile and Skm.Web.HoloServerCore.csproj, the IBM team successfully demonstrated SKM's specific application code working with .Net 7 on Power. IBM and SKM Informatik have continued their efforts to enable the migration of the Enterprise Solution from Azure to IBM Power Virtual Server. As a result of the collaboration, tremendous progress has been made. The IBM team has successfully wrapped up testing the final release, which has been provided to SKM to test with its application. With no reported problems thus far, SKM's testing of the Early Release .Net 7 with OpenShift on Power Virtual Server is said to be the last step in securing the holistic solution running on Power.

The IBM team is continuing their efforts to provide SKM with .Net 7 container support as the final testing and collaboration period continues, seeing the project through to the very end. Soon, SKM will serve as the first fully functioning example of how to run .Net 7 with OpenShift on IBM Power Virtual Server.

*"I used the image and did not have any trouble with it. It is stable, even on heavy workload. Thanks to you we were able to create a fully functional development environment of all our web contents in the IBM Cloud under OpenShift."*

*"Anyway, thanks a lot for the image. It was the last puzzle piece missing for us to implement our services on Power-OpenShift."*

Michael Hermelschmidt,  
Software Developer at SKM Informatik

Internal use only



### Initial changes required to run x86 .Net code on Power with .Net 7

#### Dockerfile

```
#FROM mcr.microsoft.com/dotnet/aspnet:5.0 AS base //commented
FROM dotnet_runtime_devel as base //used our image "dotnet_runtime_devel"
WORKDIR /app
EXPOSE 80
```

```
#FROM mcr.microsoft.com/dotnet/sdk:5.0 AS build //commented
FROM dotnet_runtime_devel as build //used our image "dotnet_runtime_devel"
RUN mkdir /holo
```

#### Skm.Web.HoloServerCore.csproj

```
<PropertyGroup>
  <TargetFramework>net7.0</TargetFramework> //net7.0 instead of net5.0
  <DockerDefaultTargetOS>linux</DockerDefaultTargetOS>
  <ErrorOnDuplicatePublishOutputFiles>>false</ErrorOnDuplicatePublishOutputFiles>
</PropertyGroup>
```

### Application running with .Net 7 on Power

```
[ecuser@p1317-bastion ~]$ podman images
REPOSITORY TAG IMAGE ID CREATED SIZE
localhost/test-ekm latest c97c2088431d 20 hours ago 900 MB
localhost/dotnet_runtime_devel latest d0e5a1d07598 3 weeks ago 878 MB
[ecuser@p1317-bastion ~]$ podman run -ti test-ekm
Did not find environment variable PORT, set url to http://*:8000/
Did not find environment variable MOUNTPATH, set MountPath to /mount/storage/
Did not find environment variable CALLBACKURL, set CallbackUrl to http://localhost:8080/callbackTest
[info: Microsoft.Hosting.Lifetime:14]
Now listening on: http://*:8000
[info: Microsoft.Hosting.Lifetime:0]
Application started. Press Ctrl+C to shut down.
[info: Microsoft.Hosting.Lifetime:0]
Hosting environment: Production
[info: Microsoft.Hosting.Lifetime:0]
Content root path: /app
^C[info: Microsoft.Hosting.Lifetime:0]
Application is shutting down...
[ecuser@p1317-bastion ~]$
```

Want to see more? [CLICK HERE](#) to watch a video demonstration of Paul Chapman building and running the SKM application with .Net 7 on Power.

### The winning team

SKM Informatik GmbH  
Pascal Wille, [pwille@skm-informatik.com](mailto:pwille@skm-informatik.com)  
Dirk Scharberth, [dscharberth@skm-informatik.com](mailto:dscharberth@skm-informatik.com)  
Michael Hermelschmidt, [mhermelschmidt@skm-informatik.com](mailto:mhermelschmidt@skm-informatik.com)

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Sebastian Lebrig, [Sebastian.Lehrig1@ibm.com](mailto:Sebastian.Lehrig1@ibm.com)

<https://ibm.box.com/s/cbw5301lsudae9ywjy1cizylti1va996>



.NET

# Public Customer Reference



## Migrate from Microsoft Azure to IBM Power Virtual Server with .NET 7

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With only a few minor changes needed in Dockerfile and Skm.Web.HoloServerCore.csproj, the IBM team successfully demonstrated SKM's specific application code working with .NET 7 on Power. IBM and SKM Informatik have continued their efforts to enable the migration of the Enterprise Solution from Azure to IBM Power Virtual Server. As a result of the collaboration, tremendous progress has been made. The IBM team has successfully wrapped up testing the final release, which has been provided to SKM to test with its application. With no reported problems thus far, SKM's testing of the early release .NET 7 with OpenShift on Power Virtual Server is said to be the last step in securing the holistic solution running on Power.

The IBM team is continuing with its effort to provide SKM with .NET 7 container support as the final testing and collaboration period continues, seeing the project through to the very end. Soon, SKM will serve as the first fully functioning example of how to run .NET 7 with OpenShift on IBM Power Virtual Server.

### Embrace the benefits of Red Hat OpenShift running on IBM Power Virtual Server.

- Deploy and scale workloads globally
- Build cloud-native applications
- Get back time for core tasks
- Get more from software with less servers
- Modernize your applications
- Leverage open source to drive innovation

"I used the image and did not have any trouble with it. It is stable, even on heavy workload. Thanks to you we were able to create a fully functional development environment of all our web contents in the IBM Cloud under OpenShift."

"Anyway, thanks a lot for the image. It was the last puzzle piece missing for us to implement our services on Power-OpenShift."

Michael Hermelschmidt, Software Developer at SKM Informatik

### Initial changes required to run x86 .NET code on Power with .NET 7

#### Dockerfile

```
#FROM mcr.microsoft.com/dotnet/aspnet:5.0 AS base //commented
FROM dotnet_runtime_devel as base //used our image "dotnet_runtime_devel"
WORKDIR /app
EXPOSE 80

#FROM mcr.microsoft.com/dotnet/sdk:5.0 AS build //commented
FROM dotnet_runtime_devel as build //used our image "dotnet_runtime_devel"
RUN mkdir /holo
```

#### Skm.Web.HoloServerCore.csproj

```
<PropertyGroup>
  <TargetFramework>net7.0</TargetFramework> //net7.0 instead of net5.0
  <DockerDefaultTargetOS>Linux</DockerDefaultTargetOS>
  <ErrorOnDuplicatePublishOutputFiles>false</ErrorOnDuplicatePublishOutputFiles>
</PropertyGroup>
```

### Application running with .NET 7 on Power



<https://www.ibm.com/downloads/cas/29RYARBY>

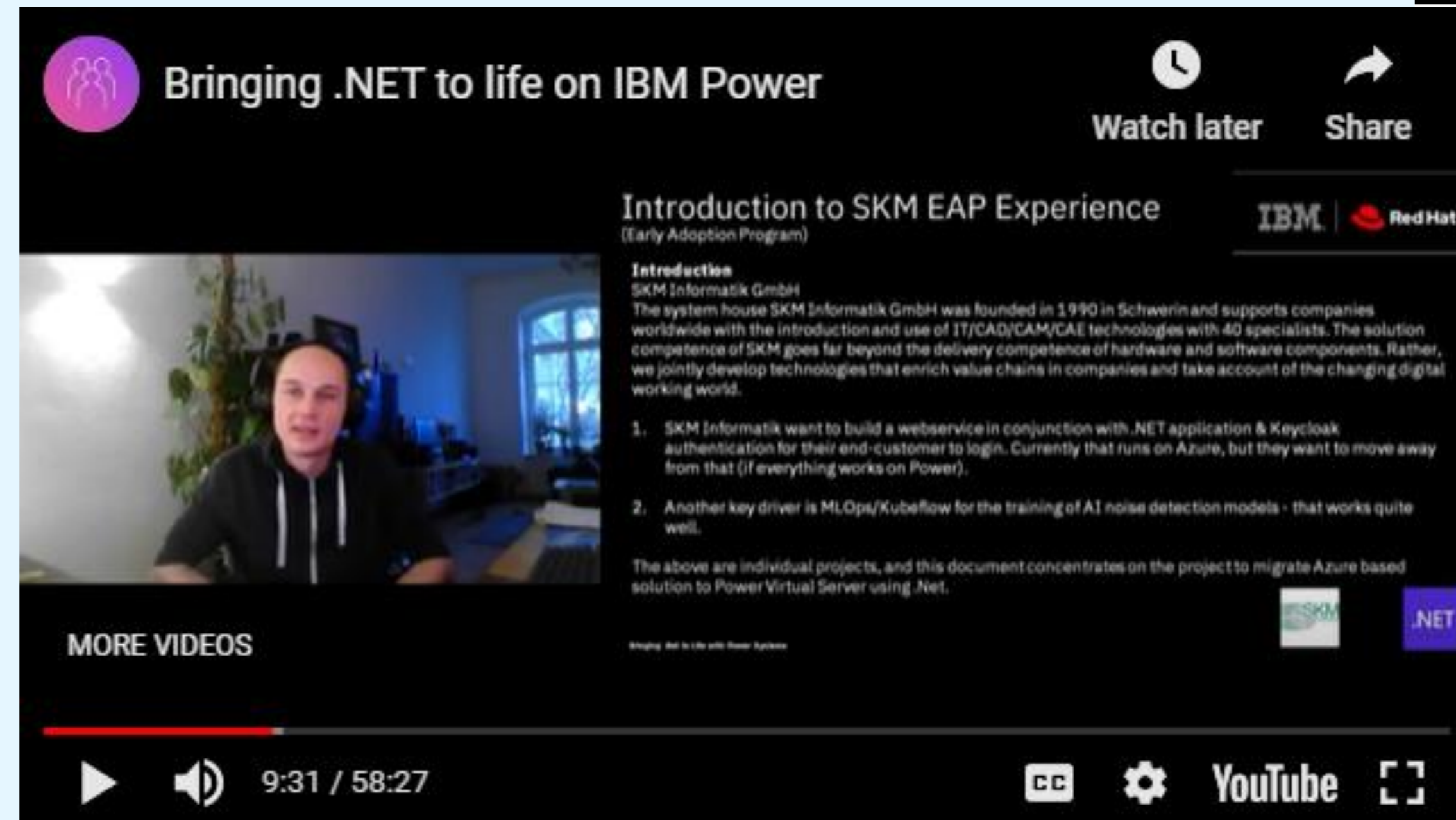


# SKM Video Reference & Customer Quote



## Customer Quotes – SKM

## Public YouTube Reference



*“I used the image and did not have any trouble with it. It is stable, even on heavy workload. Thanks to you we were able to create a fully functional development environment of all our web contents in the IBM Cloud under OpenShift.”*

*“Anyway, thanks a lot for the image. It was the last puzzle piece missing for us to implement our services on Power-OpenShift.”*

**Michael Hermelschmidt,**  
**Software Developer at SKM Informatik**



# Agenda

- 01 Delivering .NET on Power
- 02 First customer experience & references
- 03 .NET announcements, blogs & release notes**
- 04 Survey Results, Support & Lifecycle
- 05 Migrate .NET to Power
- 06 Hands-on Labs & Demo's
- 07 IDE & Debugging
- 08 Where to learn more & stay up to date



# .NET 8 Announcement, Blogs & Demo



[00:00](#) .NET 8 is available on Power / Janani's Blog

[00:14](#) Install .NET 8 on Power

[01:13](#) Pull .NET 8 from Red Hat Container Registry

[02:43](#) Red Hat .NET 8 Documentation

[03:25](#) Check .NET version

[04:20](#) Create new .NET project

[04:37](#) Edit csproj file to specify container usage

[05:27](#) Tom Desden's blogs, simplify the containerisation of .NET

[05:44](#) Publish the app and create the container

[06:11](#) View the container using podman

[06:24](#) Start the container/application

[06:35](#) Access the web-based Hello World containerised .

NET 8 application on Power

[07:04](#) Stop and restart the application

[07:43](#) .NET Public Customer Reference

[07:57](#) Let me know how you get on, or if you would like any help with .NET on Power

The screenshot displays a video player interface. The main content is a blog post titled "NET 8 on Power with Red Hat Enterprise Linux" from the Power Developer eXchange. The article discusses how to get .NET 8 for Linux on Power, mentioning that fully supported Red Hat Package Manager (RPM) packages and container images are available. It provides the command `dnf install dotnet-sdk-8.0` for installation on RHEL. Below this, it shows how to use container images as standalone images or with OpenShift, providing the command `podman run ubi8 dnf install -y dotnet-sdk-8.0`. The article also references the RHEL .NET 8 Documentation for more details. A terminal window is overlaid on the right side of the video, showing the execution of the `dnf install dotnet-sdk-8.0` command, which successfully updates subscription management repositories and installs the dotnet-sdk-8.0 package from Red Hat CodeReady Linux Builder for RHEL 8 Power, Red Hat Enterprise Linux 8 for Power, little en, and Red Hat Enterprise Linux 8 for Power, little en.

[https://youtu.be/s\\_nhuIps9k8?si=dvN2ZN1-pH4MCA2V](https://youtu.be/s_nhuIps9k8?si=dvN2ZN1-pH4MCA2V)



# .NET 8 Announcements and Blogs



## Announcing .NET 8 on IBM Power



By [Janani Janakiraman](#) posted Mon November 20, 2023 11:52 AM

1 Like

IBM®, [Microsoft®](#), and [Red Hat®](#) recently announced the availability of .NET 8, with delivery included in RHEL 8.9, RHEL 9.3, and Red Hat OpenShift. This release also provides support for Linux on Power (ppc64le) and IBM Z systems (s390x). .NET 8 succeeds [.NET 7](#), which was introduced for the first time approximately a year ago. This version is a [long-term support release of .NET](#).

In addition to being a long-term support release, .NET 8 comes with feature enhancements and bug fixes. The software development kit (SDK) supports the use of the latest C# version (C# 12) and F# version (F# 8). It also includes built-in support for constructing container images directly from .NET projects. For Linux on Power (ppc64le) and IBM Z (s390x), the .NET 8 SDK now supports building self-contained applications. The base library, garbage collector (GC), and just-in-time compiler (JIT) have undergone numerous performance improvements.

For a comprehensive list of feature enhancements, refer to the [Microsoft .NET 8](#) article.

## How can I get .NET 8 for Linux on Power?

Fully supported Red Hat Package Manager (RPM) packages and container images, built from the [open-source dotnet project](#), serve as the means for Red Hat customers to acquire .NET for the Power platform.

You can install .NET 8 on RHEL with the usual command:

```
dnf install dotnet-sdk-8.0
```

The .NET 8 SDK and runtime container images are available from the Red Hat Container Registry. You can use the container images as standalone images and with OpenShift on all supported architectures:

```
podman run ubi8 dnf install -y dotnet-sdk-8.0
```

Refer to the [RHEL .NET 8 Documentation](#) for detailed information, including 'Getting Started with .NET 8', '.NET 8 RPM Release Notes', and '.NET 8 Container Release Notes'.

## Use Case - Containerization of .NET applications on Power

Article

## .NET 8 now available for RHEL and OpenShift

November 20, 2023 [Twitter](#) [Facebook](#) [LinkedIn](#) [Email](#) [Print](#) [C#, Linux, Open Source Communities](#)

[John Clingan](#)

[Tom Deseyn](#)



[Table of contents: New features in .NET 8](#)

The .NET 8 release is now available, targeting [Red Hat Enterprise Linux \(RHEL\) 8.7, RHEL 9.1, and Red Hat OpenShift](#). Here's a quick overview of what developers need to know about this new major release.

### New features in .NET 8

This release ships with the following features:

- The SDK supports using the latest C# (C# 12) and F# (F# 8) versions.
- The SDK now includes source link—which enables the debugger to find back the source code of the binaries used from the version control repositories—and it has built-in support for building [container](#) images directly from .NET projects.
- The base library, GC, and JIT have seen many performance improvements. Additionally, the libraries have better support for use with trimming and native AOT through source generators.
- .NET 8 comes with many API additions that improve performance, like the new [FrozenDictionary](#) and [FrozenSet](#) types optimized for "write once, read many" scenarios, and the new [Utf8SpanFormattable](#) interface that enables directly writing out a UTF-8 string representation for an object. .NET 8 also brings many enhancements to its JSON support.
- ASP.NET Core 8 enables server-side rendering of Blazor components. It improves the built-in identity authentication and authorization support. Also, minimal API and gRPC applications can now be built with native AOT.

### How to install .NET 8

You can install .NET 8 on RHEL with the usual command:

```
# dnf install dotnet-sdk-8.0
```

[Copy snippet](#)

The .NET 8 SDK and runtime container images are available from the Red Hat Container Registry. You can use the container images as standalone images and with OpenShift on all supported architectures:

```
$ podman run --rm registry.redhat.io/ubi8/dotnet-80 dotnet --version
```

```
8.0.100
```

[Copy snippet](#)

### Long-term support for .NET 8

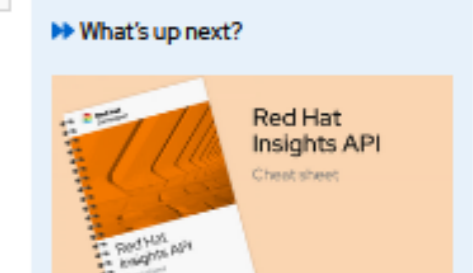
.NET 8 is a long-term support release. It will be supported for 3 years, until November 2026.

The existing .NET 7 short-term support release is supported until May 2024, and the previous .NET 6 long-term support is supported until June 2024 (RHEL 7) and November 2024 (RHEL 8 and 9). Additional support life cycle details are available on the [.NET Life Cycle page](#).

Last updated: November 29, 2023

- #### Recent Articles
- [Convert CentOS Linux to RHEL using Red Hat Insights](#)
  - [Monolith to microservices: Breaking down apps the useful way](#)
  - [How to install and upgrade Data Grid 8 Operator](#)
  - [Red Hat Developer Hub: Your gateway to seamless development](#)
  - [How to deploy Vue.js apps to OpenShift](#)

- #### Related Content
- [Containerize .NET applications with .NET 8](#)
  - [Containerize .NET for Red Hat OpenShift: Windows containers and .NET Framework](#)
  - [Hello Podman using .NET](#)
  - [How to deploy .NET apps as systemd services using containers](#)
  - [Three ways to containerize .NET applications on Red Hat OpenShift](#)
  - [Containerize .NET applications without writing Dockerfiles](#)



View the announcement from IBM [here](#).  
View the Red Hat .NET 8 announcement [here](#).  
Read the IBM technical blog on the Power Developer eXchange [here](#).



# .NET 8 Announcements and Blogs



**Announcing .NET 8**

Gaurav Seth

November 14th, 2023

[Download .NET 8 today!](#)

We are happy to announce the availability of [.NET 8](#), the latest [LTS](#) version of one of the world's leading development platforms, starting today. .NET 8 delivers thousands of performance, stability, and security improvements, as well as platform and tooling enhancements that help increase developer productivity and speed of innovation. The .NET team, our partners, and the .NET community will be talking about what's new in .NET 8 as well as what people are building with .NET today to meet their needs of tomorrow at [.NET Conf 2023, a three day virtual event \(November 14-16\)](#). Come, join us!

**Performance**

**.NET MAUI**

**.NET 8**

**Cloud Native**

**Artificial Intelligence**

**ASP.NET Blazor Full Stack**

With this release, .NET reshapes the way we build intelligent, cloud-native applications and high-traffic services that scale on demand. Whether you're deploying to Linux or Windows, using containers or a cloud app model of your choice, .NET 8 makes building these apps easier. It includes a set of proven libraries that are used today by the many high-scale services at Microsoft to help you with fundamental challenges around observability, resiliency, scalability, manageability, and more.

Tell us about your PDF experience.

## .NET fundamentals documentation

Learn the fundamentals of .NET, an open-source developer platform for building many different types of applications.

**Learn about .NET**

**DOWNLOAD**

[Download .NET id](#)

**OVERVIEW**

[What is .NET? id](#)

[Introduction to .NET](#)

[.NET languages](#)

**CONCEPT**

[.NET Standard](#)

[Common Language Runtime \(CLR\)](#)

[.NET Core support policy id](#)

**WHAT'S NEW**

[What's new in .NET 8](#)

[What's new in .NET 7](#)

[What's new in .NET 6](#)

[What's new in .NET 5](#)

[What's new in .NET Core 3.1](#)

[What's new in .NET Core 3.0](#)

**Install .NET**

[OVERVIEW](#)

## What's new in .NET 8

Article • 11/14/2023

.NET 8 is the successor to .NET 7. It will be supported for three years as a long-term support (LTS) release. You can [download .NET 8 here](#).

### .NET Aspire

.NET Aspire is an opinionated, cloud ready stack for building observable, production ready, distributed applications. .NET Aspire is delivered through a collection of NuGet packages that handle specific cloud-native concerns, and is available in preview for .NET 8. For more information, see [.NET Aspire \(Preview\)](#).

### ASP.NET Core

For information about what's new in ASP.NET Core, see [What's new in ASP.NET Core 8.0](#).

### Core .NET libraries

This section contains the following subtopics:

- [Serialization](#)
- [Time abstraction](#)
- [UTF8 improvements](#)
- [Methods for working with randomness](#)
- [Performance-focused types](#)
- [System.Numerics and System.Runtime.Intrinsics](#)
- [Data validation](#)
- [Metrics](#)
- [Cryptography](#)
- [Networking](#)
- [Stream-based ZipFile methods](#)

### Serialization

Many improvements have been made to [System.Text.Json](#) serialization and deserialization functionality in .NET 8. For example, you can [customize handling of members that aren't in the JSON payload](#).

Microsoft Announcing .NET 8	<a href="https://devblogs.microsoft.com/dotnet/announcing-dotnet-8/">https://devblogs.microsoft.com/dotnet/announcing-dotnet-8/</a>
.NET fundamentals documentation	<a href="https://learn.microsoft.com/en-us/dotnet/fundamentals/">https://learn.microsoft.com/en-us/dotnet/fundamentals/</a>



# .NET 8 Red Hat Release Notes

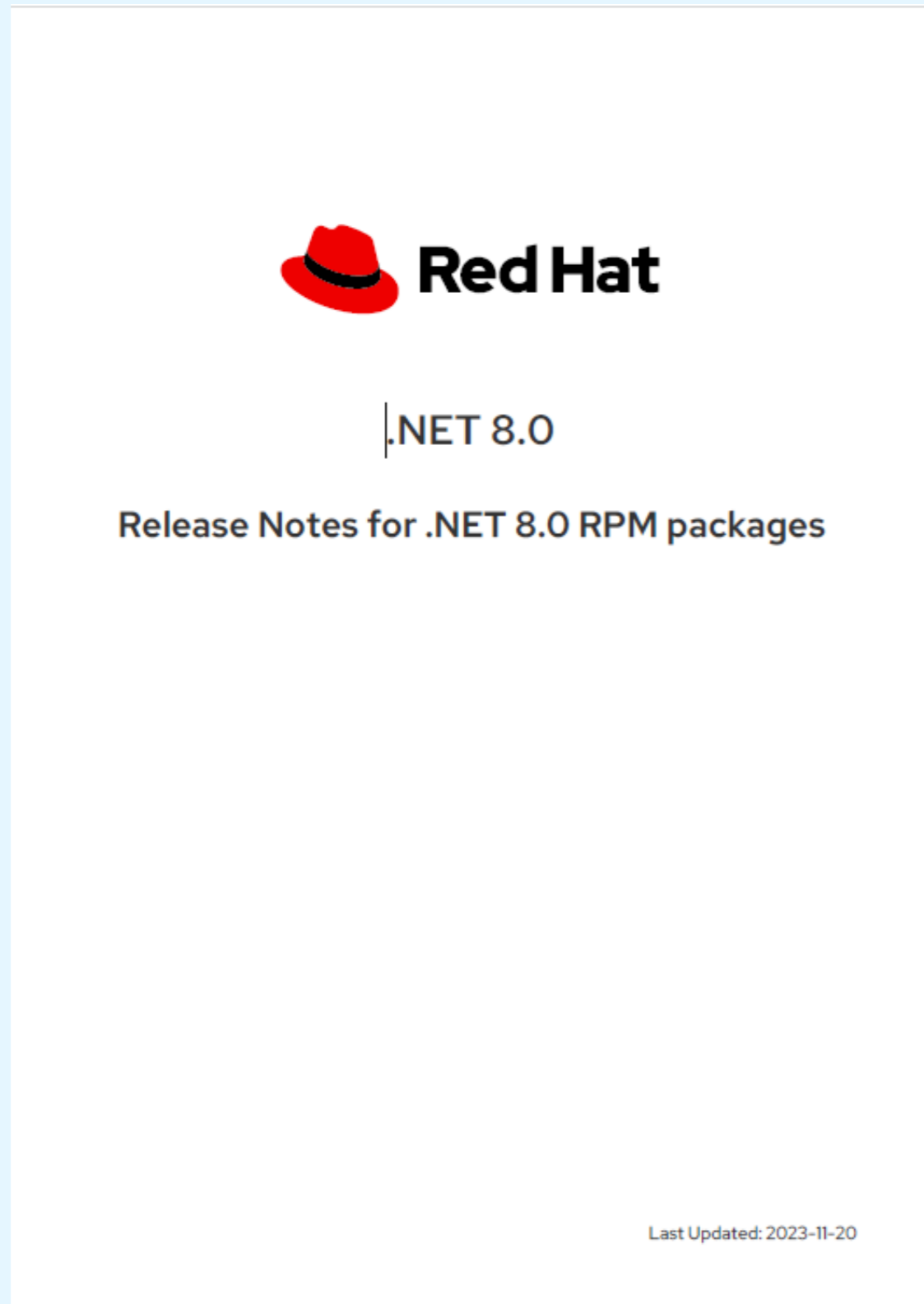
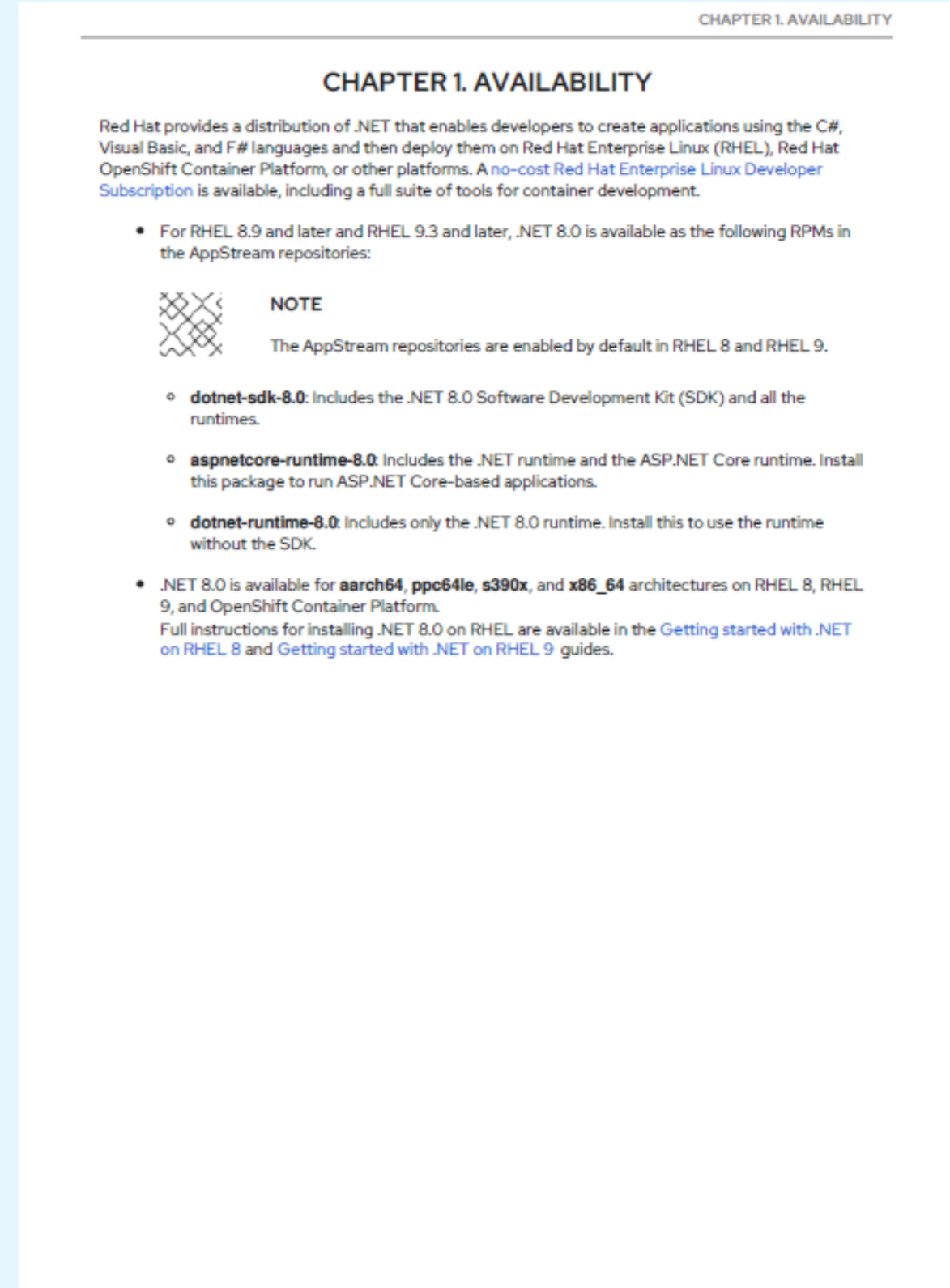


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- [Release Notes for .NET 8 RPM Packages](#)
- [Release Notes for .NET 8 Containers](#)



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# .NET Survey Results

Power Modernisation, Dec 2023

## Survey Participants

- 100% (n = 122) Power Customers
  - 67% running Linux on Power
  - 63% running IBM i
  - 21% running AIX

## Are customers using .NET on Power?

- 85% are aware .NET runs on Power on Power
- 80% have .NET based applications
- 67% were running .NET on Power
- 89% wanted to run .NET closer to critical apps or data

### High Awareness of .NET

- 85% of participants (104/122) were aware .NET is open source and runs on Linux on Power

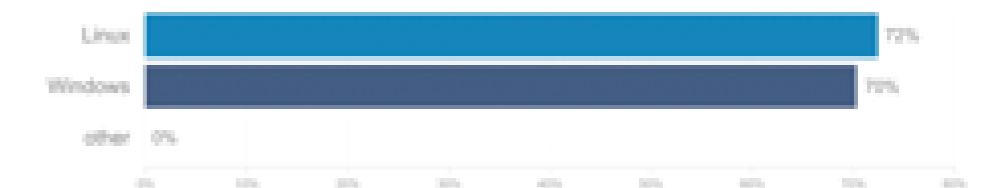


### Majority Running .NET

- 80% of participants (98/122) have .NET based applications



- 72% on Linux and 70% on Windows



### Many Running .NET (on Power)

- 67% of participants (65/97) participants were running .NET on Power



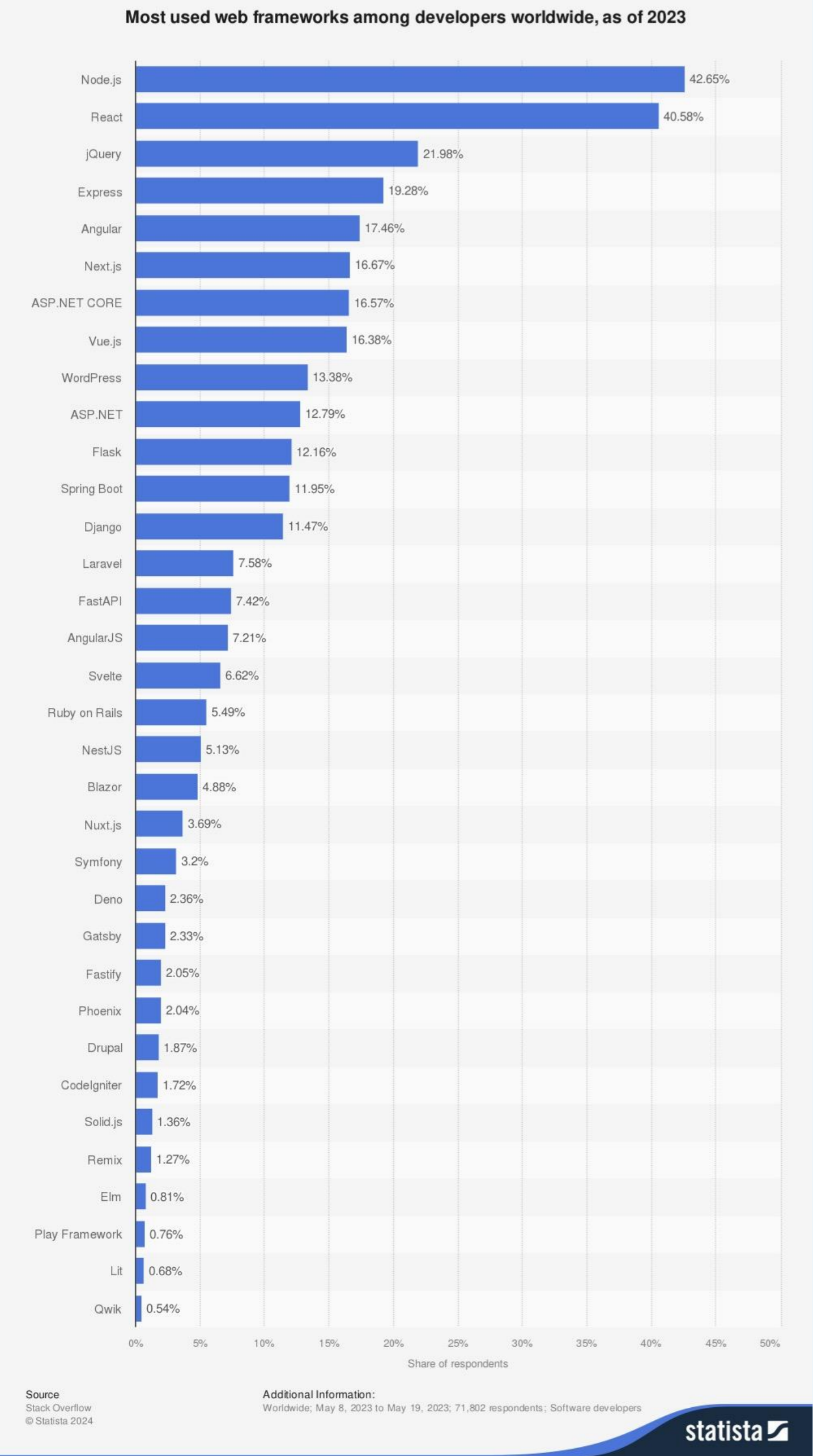
### Interest in running .NET applications closer to mission critical apps or data (n=97)



- 89% yes
- 11% no

Credit for study: IBM Power design team with researcher Erica Albert and assistance from Paul Chapman (Tech Sales) and Bruce Anthony (Development)

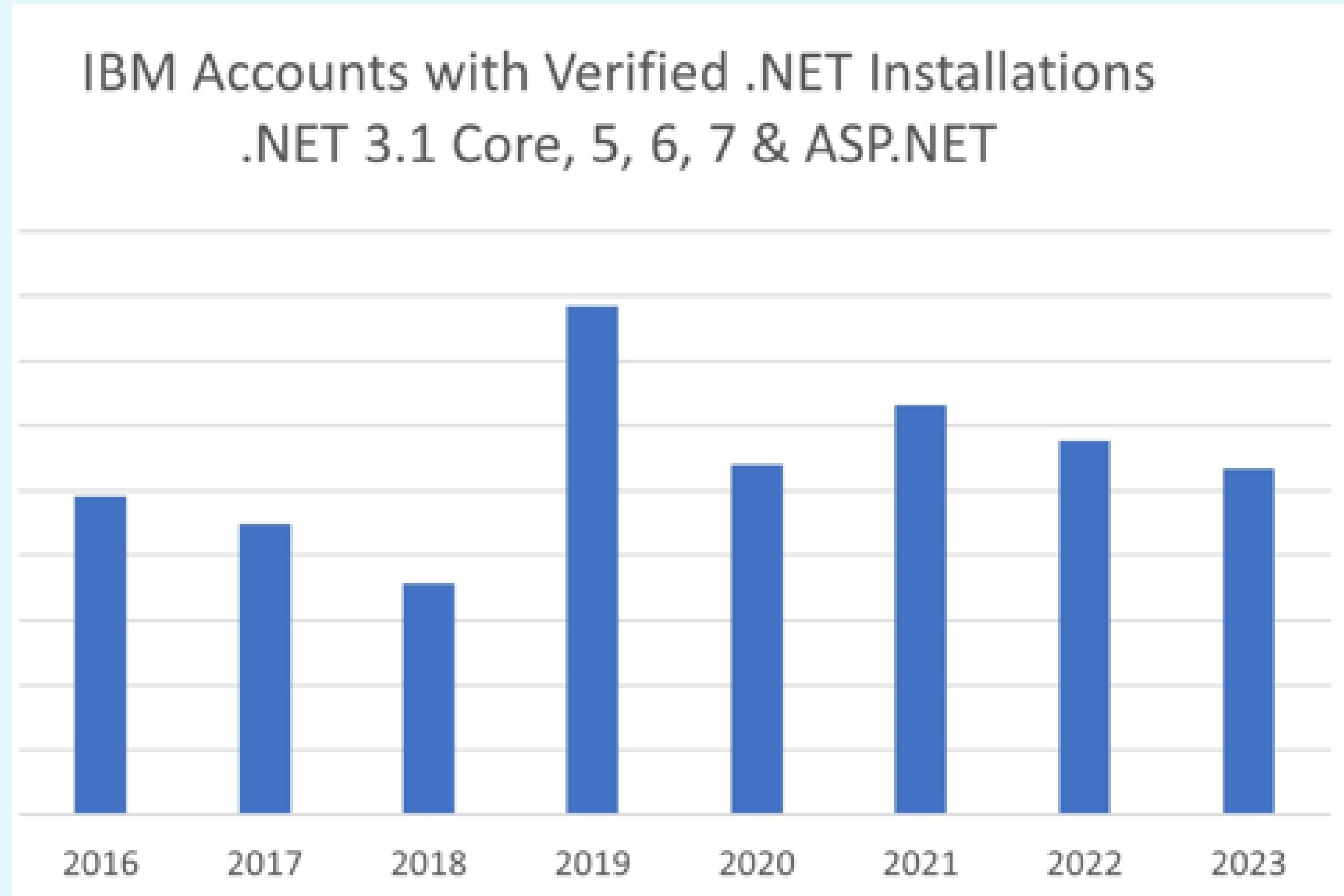
# Most Used Web Frameworks as of 2023



## Frameworks used within .NET

- [ASP.NET.Core](#) – (16.57%) multi-arch platform for building .NET based web applications.
- <http://asp.net/> – (12.79%) legacy system for building .NET based web apps.
- React (40.58 %), Blazor (4.88 %) and Angular(17.46 %) technologies are also supported and used within .NET

# .NET installations within IBM Accounts



.NET installations appears consistent over time.



# .NET Release Life Cycle

Version	General availability	Full support ends	End of Life
<b>Full support</b>			
.NET 8.0	14 November 2023	10 November 2026	10 November 2026
.NET 6.0 (RHEL 8,9)	10 November 2021	12 November 2024	12 November 2024
.NET 6.0 (RHEL 7)	10 November 2021	30 June 2024	30 June 2024
<b>End of life</b>			
.NET 7.0	10 November 2022	14 May 2024	14 May 2024
.NET 5.0	7 December 2020	9 May 2022	9 May 2022
.NET Core 3.1	3 December 2019	13 December 2022	13 December 2022

# Agenda

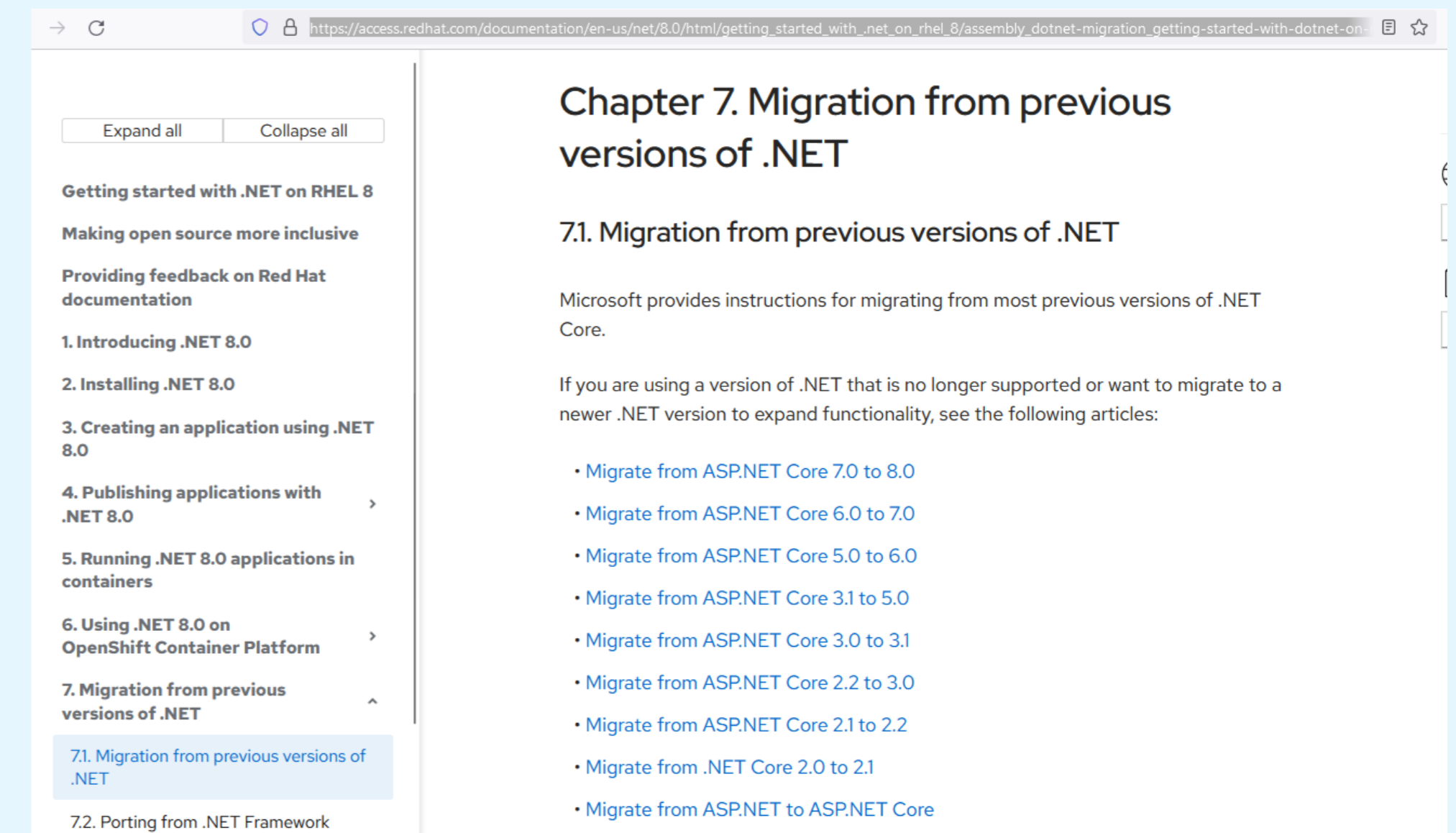
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# Migrate .NET applications to Linux on Power



- Figure out which version your current application is based on (<https://docs.microsoft.com/en-us/dotnet/standard/frameworks>)
- Port application to .NET8
  - If application is already on .NET5/6/7, porting may be very simple.
  - The real problem is if code or functionality has been sunset between versions, so not Power specific. See [breaking changes](#) that may affect .NET7 apps.
  - [Instructions](#) for migrating from most previous versions of .NET Core
- Ensure that the application runs on Linux
- Avoid using Windows specific frameworks & Assemblies
- Port any C/C++ code to Linux ( ppc64le)
- Same issues apply to third party dependencies

This blog, [IdentityServer \(SQLite DB\) on .NET 7](#), shows you how to migrate a .NET 3.1 application (IdentityServer) with a SQLite backend to .NET 7 on a Power system running Red Hat Enterprise Linux (RHEL) 8.7 or 9.1.



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# Deploy & use .NET on Power Labs



IBM

IBM TechXchange



## Bringing .NET to Life on Power Deploy & Use .NET on IBM Power

Lab Exercise Guide

23-25 January 2024  
Barcelona International Convention Centre

[Paul Chapman](#)  
Global Power Modernisation Technical Lead

IBM TechXchange

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4

### Deploy & use .NET on IBM Power [2080]

""A series of hands on labs to gain experience deploying multiple .NET capabilities on Power. I will provide attendees with their own OpenShift Cluster running on IBM Power. I have several hands-on lab exercises guiding students to deliver .NET applications on IBM Power with RHEL & OpenShift. Please register in advance, as I need to provide you VPN access to your OpenShift cluster running on IBM Power. You need Admin permissions for your laptop to install the Cisco VPN, which I will share the week before. Let me know if you have any questions! "" "

Session Type: Hands-on Lab

Session Topic: Power

Tech Tracks: Infrastructure

Paul Chapman, IBM Global Power Modernisation Technical Lead, IBM

You Are A Participant Tuesday, Jan 23 | 1:45 PM - 3:15 PM CET | Room 113.2 - Lab

<https://reg.tools.ibm.com/flow/ibm/techxchangeem24/attendeportal/page/sessioncatalog?search=2080&showMyInterest=false>

# Demonstrations & Replays



## Customer

- [Power Modernisation Website](#)
- [.NET YouTube Playlist](#)

## IBM & BP

- [TechZone](#)

Updated Jun 11, 2023

### Bringing .Net to Life

We believe in Sustainability and Cloud without lock-in. Customers can benefit from Cloud with greater sustainability, scale, security, performance and economics when consolidating existing .Net applications from x86 to Power Systems.

Offerings  
.Net, Red Hat Portfolio, PaaS Foundation &aaS Offerings Portfolio - Private Cloud, dotnet, ...

Visibility  
IBMers, Business Partners

Status  
Active

Updated Jun 11, 2023

### Collection for Application Modernization Hands-on

Show customers how their existing Power environment can help customers on their hybrid cloud journey

Offerings  
Power 10 E1080, Spectrum Scale  
Scale-Out File and Object Storage, Red Hat Portfolio, Cloud Native PaaS, PaaS Foundation &aaS Offerings Portfolio - Private Cloud, ...

Visibility  
IBMers, Business Partners

Rating  
5

Status  
Active

### Quickly Deploy .NET Web Messaging Application

Learn how to deploy a simple browser-based web message application written for x86 with ASP.NET Core and SignalR library using source code shared on GitHub. The same source code is used to deploy on Power with OpenShift, and Fedora on x86. Full guided instructions are provided. Deploy .NET Message App on Power - GUI Deploy... [Continue reading](#)

Published 18 February 2023  
Categorized as dotnet, IBM, open source, OpenShift, Power Systems, Red Hat  
Tagged #IBMPowerSystems, dotnet, openshift, red hat, enterprise linux, redhatopenshift, .net

### Category: dotnet

### Quickly Deploy .NET Game on Power & x86 From the Same Source

Learn how to deploy a simple arcade-style game written for x86 with .NET using source code shared on GitHub. The same source code is used to deploy on Power with OpenShift, and Fedora on x86. Full guided instructions are provided. Deploy .NET game on Power Deploy .NET game on x86 Deploy on Power - GUI... [Continue reading](#)

Published 18 February 2023  
Categorized as dotnet, IBM, open source, OpenShift, Power Systems, Red Hat  
Tagged #IBMPowerSystems, dotnet, openshift, red hat, enterprise linux, redhatopenshift, .net

https://www.youtube.com/playlist?list=PLfj-244JZEg\_hrrwb9RzkgYqtbPvQqQ8

### Bringing .NET to life with Power Systems

Paul Chapman

Public

13 videos 27 views Last updated on Mar 16, 2023

- Bringing .NET to life with Power Systems - ASP.NET Core with SignalR Demo  
Paul Chapman • 169 views • 5 months ago
- Bringing .NET to life on IBM Power  
IBM TechXchange Community • 74 views • 4 months ago
- Bringing Customer .NET Application to life with Power Systems - EAP Demo  
Paul Chapman • 65 views • 4 months ago
- Create and deploy .NET game on Power  
Paul Chapman • 40 views • 3 months ago
- Demonstrate ML.NET application on both x86 & POWER9  
Paul Chapman • 34 views • 3 months ago
- Deploy .NET game to OpenShift on Power - CLI  
Paul Chapman • 29 views • 3 months ago
- Deploy .NET Message App to Power OpenShift - CLI  
Paul Chapman • 19 views • 3 months ago
- .NET Messaging App from GitHub to OpenShift GUI in 90 seconds.



# Agenda

- 01 Delivering .NET on Power
- 02 First customer experience & references
- 03 .NET announcements, blogs & release notes
- 04 Survey Results, Support & Lifecycle
- 05 Migrate .NET to Power
- 06 Hands-on Labs & Demo's
- 07 IDE & Debugging**
- 08 Where to learn more & stay up to date

# IDE & Debugging



**Develop** normally on x86 with Visual Studio, push the code to GitHub and pull to Power

[Red Hat OpenShift Dev Spaces](#) ( formerly called CodeReady Workspaces ) provides a web-based IDE ( VS Code and IDE ) where a developer only needs a system with a web browser to code, build, test and run on developer workspaces provided with Dev Spaces. C# is one of the languages supported in RH Dev Spaces workspace.

**This blog show how a .NET user can use the web-based IDE VS Code-editor in RH Dev spaces on ppc64le.**

[Develop .NET applications on IBM Power using Virtual Studio Code with OpenShift Dev Spaces](#)

## **Debugging** tips and tricks

[Basic debugging techniques for .NET applications](#)

[Debugging .NET C# apps with ilasm and ildasm](#)

A screenshot of a dark-themed web page. At the top, the title "Learn how to deploy Dev Spaces IDE on Power" is displayed in a light-colored font. Below the title is a horizontal line. Underneath, there is a short introductory paragraph. A list of links follows, including "Index", "Useful Dev Spaces Links", "Installing Dev Spaces", "Create a new .NET application", "Clone Source from GitHub", "Source Control", "Review Topology in OCP", and "Remove Dev Spaces". At the bottom of the list, there is a small text prompt: "Type / to choose a block".





# Connecting .NET application to Databases



A .NET application can connect to backend database servers using Entity Framework (EF) Core, ADO.NET, ODBC, or native drivers.

Examples:

➤ **.NET applications that access a backend database on the SAME system:**

- C# program that connects to MariaDB using an ODBC connector
- C# program that connects to a NoSQL database (MongoDB using native drivers)
- C# program that connects to Postgres using EF Core
- C# program that connects to SQLite database using EF Core
- C# program that connects to MySQL server using ADO.Net
- C# application that connects too EDB PostgreSQL

➤ **.NET applications on Linux partition connecting to IBM i database:**

- C# program on Linux partition connecting to Remote Database Server on IBM i using ODBC
- C# program on Linux partition that connects to Oracle on an AIX partition

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# Learn about .NET on Power

## The IBM Power .NET Blog of Blogs



### Learn about .NET on Power

- Read the [.NET 7 announcement](#) from Microsoft.
- Read this article from Red Hat that describes [what developers need to know about .NET 7 for RHEL and OpenShift](#).
- Learn how [.NET 7 on Linux on Power is different from the Mono project](#) that has been around for many years.
- Watch this demo to learn about [deploying a .NET 7 application using ASP.NET Core with SignalR library on IBM Power with Red Hat OpenShift](#) using both the command line and s2i via the OpenShift GUI.

<https://ibm.biz/dotnet-on-power-blogs>

The blog of blogs: .NET on IBM Power resources for developers

By Linda Alkire posted Wed January 18, 2023 05:35 PM 4 Likes

Updated: April 28, 2024  
IBM®, Microsoft®, and Red Hat® recently announced the availability of .NET 8, with delivery included in RHEL 8.9, RHEL 9.3, and Red Hat OpenShift. This release also provides support for Linux on Power (ppc64le) and IBM Z systems (s390x). .NET 8 succeeds [.NET 7](#), which was introduced for the first time approximately a year ago. This version is a [long-term support release of .NET](#).

To help get you started with .NET on Power, we have curated this list of developer-focused resources on topics from installing .NET and running a simple Hello World program to more advanced topics like how to use an IDE to develop .NET applications on ppc64le, and many others in between. We plan to update the list as new content is developed so follow this blog (click the little star up above) to make sure you receive notifications when we do.

### Learn about .NET on Power

- Read the [.NET 8 announcement](#) blog.
- Read the [.NET 7 announcement](#) from Microsoft.
- Read this article from Red Hat that describes [what developers need to know about .NET 7 for RHEL and OpenShift](#).
- Learn how [.NET 7 on Linux on Power is different from the Mono project](#) that has been around for many years.
- [.NET 7 on ppc64le Fedora](#) – Now available!
- [Cross build .NET 7 on x86 for IBM Power](#). This blog shows you how to take the upstream .NET code and build an SDK for ppc64le on the distro of your choice, which is a longer, more complex task.
- Learn how to [Cross and source build .NET 8 on Ubuntu for IBM Power](#).

### Get started with .NET on Power

When you're ready to try .NET on Power, check these resources to get you started.

#### Get access to a Power machine

Read this blog, [Accelerate your open source development with access to IBM Power resources](#), that lists several IBM Power cloud, emulation, and on-prem options to help you get access to development tools and resources.

- Enterprise users might consider Power Virtual Server
- Independent software developers (ISVs) and Business Partners might consider IBM TechZone
- ISVs may also consider a RADAR-ISV system in Montpellier France
- Open source developers might consider the Open Source Lab at Oregon State University.

#### Install .NET and run your first Hello World program

After you have access to a Power machine, you're ready to [install .NET and run a sample Hello World application on IBM Power](#).

# Run .NET HelloWorld on Power

<https://ibm.biz/dotnet-on-power-blogs>



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- Install .NET and run your first Hello World program

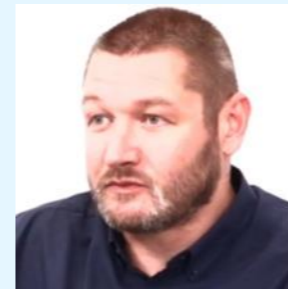
After you have access to a Power machine, you're ready to [install .NET and run a sample Hello World application on IBM Power](#).

# Thank You

## We are here to help you!



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Senior Partner Technical Specialist



[Paul Chapman](#)  
IBM, Global Power Modernization Technical Lead

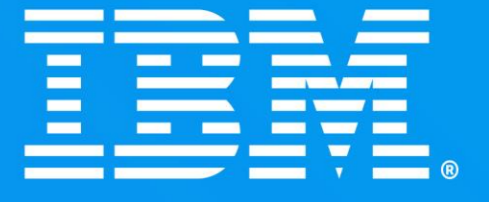


[Manoj Tiwari](#)  
.NET on Power Product Manager



[Janani Janakiraman](#)  
.NET on Power Development Lead

Join us again...



More sessions coming...

If you have questions, please contact Paul Bentley [bentlep@uk.ibm.com](mailto:bentlep@uk.ibm.com)

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