Microsoft Dynamics 365

Performance Troubleshooting

Dynamics 365 FastTrack
Architecture Insights

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Common Data Service and Dynamics 365 Customer Engagement R&D

Agenda

- Basic Understanding
- Top issues
- Measuring and Tools
- Best practices

Basics

Expected Performance

- Align performance expectations with business departments
- Set a performance baseline for your organization as a reference
- Consider automated performance testing in your ALM process measure impact solution updates and releases.

Latency and Bandwidth

- **Bandwidth is** the width or **capacity** of a specific communications channel
- **Latency is** the **time required for a signal to travel** from one point on a network to another and is a fixed cost between two points. And usually many of these “signals” travel for a single request

Power Platform model-driven app network requirements

Power Platform model-driven apps (including Dynamics 365 apps) are designed to work best over networks that have the following elements:

Bandwidth greater than 50 KB per second (400 kbps)

Latency under 150 milliseconds

Notice that these values are recommendations and don’t guarantee satisfactory performance

The recommended values are based on systems using out-of-the box forms that aren’t customized

If you significantly customize the out-of-box forms, we recommend that you test the form response to understand bandwidth needs

Browser Caching

Caching is the process of storing data locally so that future requests for that data can be accessed more quickly

In the most common type of caching, web browser caching, a web browser stores copies of static data locally on a local hard drive

By using caching, the web browser can **avoid making multiple roundtrips** to the server and instead access the same data locally, thus saving time and resources.

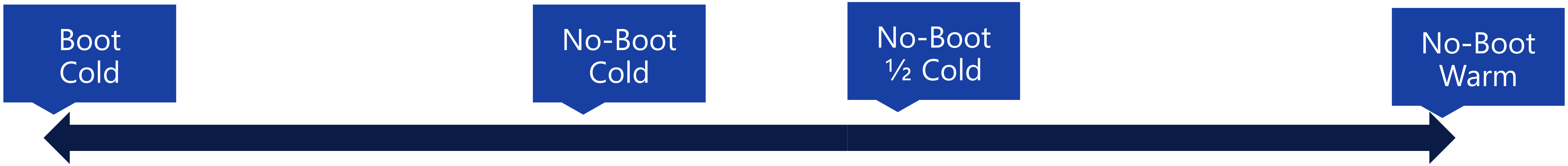
Caching is well-suited for locally managing small, static data such as static images, CSS files, and JavaScript files.

Without proper caching, there will be a boot cold load which is the worst-case scenario for performance during high latency

Page Load types

There are many potential variations for the type of load the Power Platform model driven apps are performing

These range from fully 'cold' loads where no data or code is locally cached to fully 'warm' loads where all data is readily available



Boot Cold

No-Boot Cold

No-Boot ½ Cold

No-Boot Warm

Top Issues

Top common issues affecting performance

- Generic issues
  - Slow network conditions of end users
  - Legacy IE11 usage
- Form load issues
  - Synchronous network calls
  - Multiple network calls to fetch roles of user
  - Long running custom actions
  - Long running scripts
  - Frequently opening forms in new browser tab
  - Opening the forms inline
- Grid load issues
  - View configuration without proper filters
  - Costly SQL queries
- Dashboard load issues
  - In-efficient view and chart configurations
  - Costly SQL queries
- Server-side SDK operations
  - Synchronous workflows
  - Repeated CRUD operations as part of same SDK message

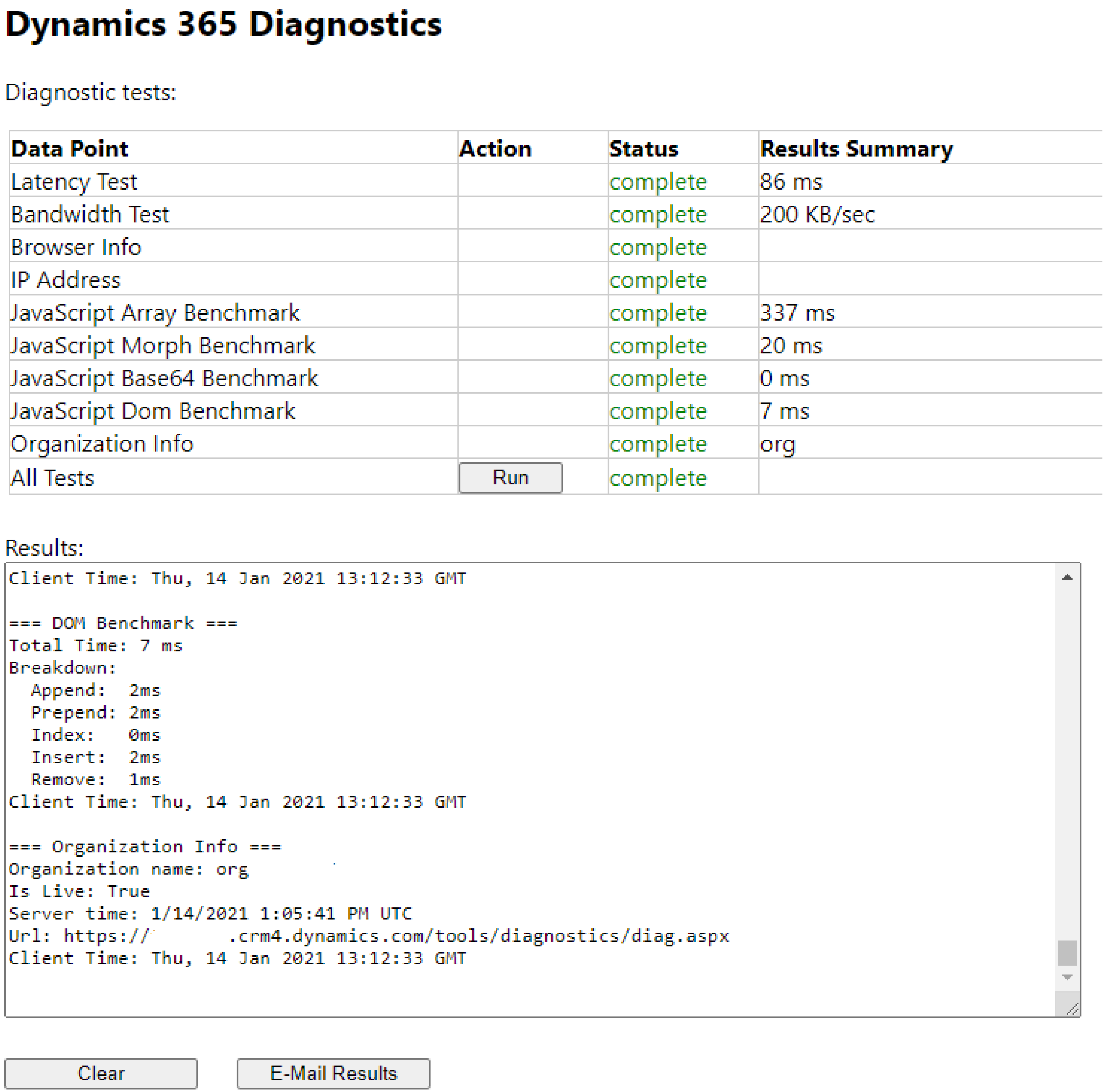
Measurement and Tools

View latency and bandwidth using OOB diagnostic tool

Dynamics 365 apps include a **basic diagnostic** tool that analyzes the client-to-organization connectivity and produces a report

To run the Diagnostics tool;

1. On the user's computer or device, start a web browser, and sign-in to an organization
2. Enter the following URL *https://**myorg.crm.dynamics.com**/tools/diagnostics/diag.aspx*, where ***myorg.crm.dynamics.com*** is the URL of your organization.



Dynamics 365 Diagnostics

Diagnostic tests:

Data Point	Action	Status	Results Summary
Latency Test		complete	86 ms
Bandwidth Test		complete	200 KB/sec
Browser Info		complete	
IP Address		complete	
JavaScript Array Benchmark		complete	337 ms
JavaScript Morph Benchmark		complete	20 ms
JavaScript Base64 Benchmark		complete	0 ms
JavaScript Dom Benchmark		complete	7 ms
Organization Info		complete	org
All Tests	Run	complete	

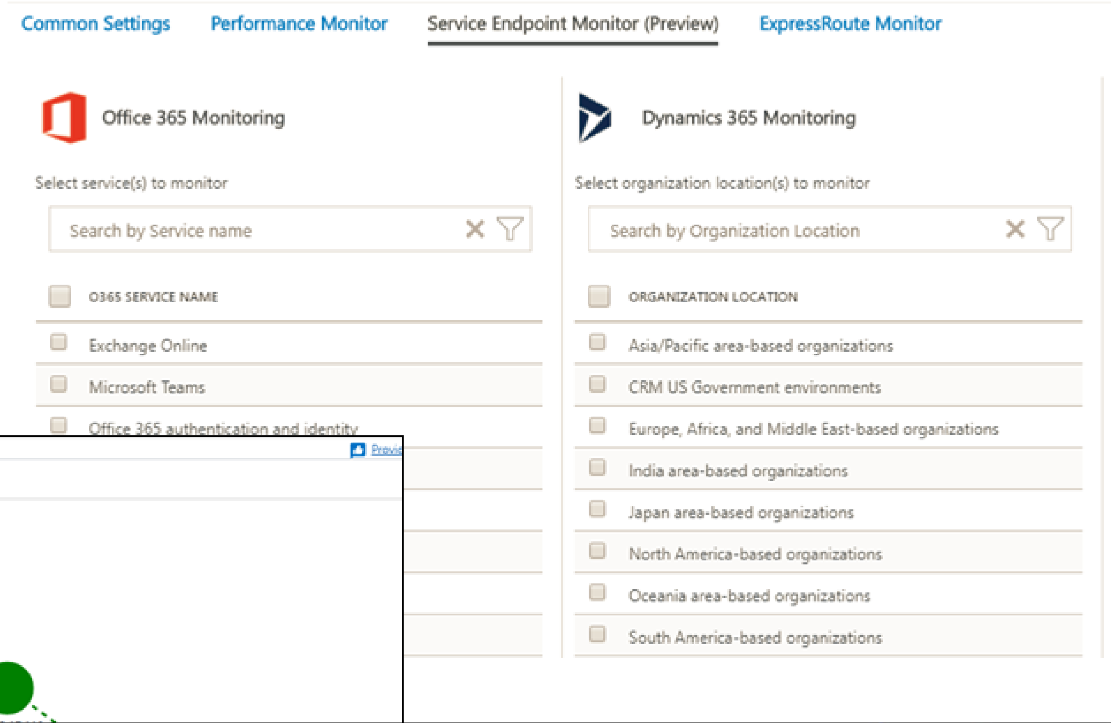
Results:

```
Client Time: Thu, 14 Jan 2021 13:12:33 GMT

=== DOM Benchmark ===
Total Time: 7 ms
Breakdown:
  Append:  2ms
  Prepend: 2ms
  Index:   0ms
  Insert:  2ms
  Remove:  1ms
Client Time: Thu, 14 Jan 2021 13:12:33 GMT

=== Organization Info ===
Organization name: org
Is Live: True
Server time: 1/14/2021 1:05:41 PM UTC
Url: https://       .crm4.dynamics.com/tools/diagnostics/diag.aspx
Client Time: Thu, 14 Jan 2021 13:12:33 GMT
```

Monitoring network performance

Monitor Dynamic 365 connectivity from remote locations continuously using network monitoring tools like [Azure Network Performance Monitor](#)or 3rd party tools

These tools help identifying any network related problems **proactively** and drastically **reduce troubleshooting time of any potential issue**



Office 365 Monitoring

Select service(s) to monitor

Search by Service name

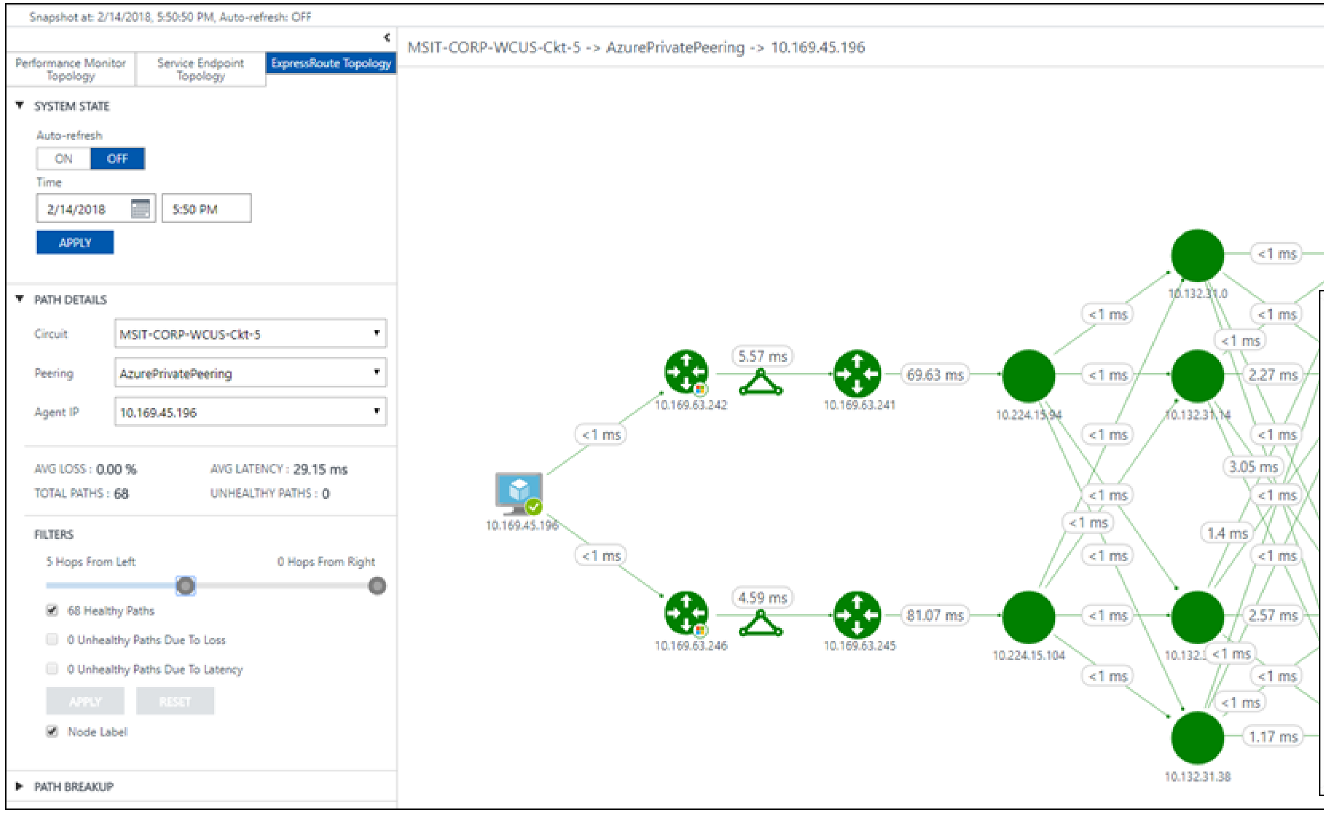
□ O365 SERVICE NAME
□ Exchange Online
□ Microsoft Teams
□ Office 365 authentication and identity

Dynamics 365 Monitoring

Select organization location(s) to monitor

Search by Organization Location

□ ORGANIZATION LOCATION
□ Asia/Pacific area-based organizations
□ CRM US Government environments
□ Europe, Africa, and Middle East-based organizations
□ India area-based organizations
□ Japan area-based organizations
□ North America-based organizations
□ Oceania area-based organizations
□ South America-based organizations



Snapshot at: 2/14/2018, 5:50:50 PM, Auto-refresh: OFF

MSIT-CORP-WCUS-Ckt-5 -> AzurePrivatePeering -> 10.169.45.196

SYSTEM STATE

Auto-refresh: ON [✓ OFF]

Time: 2/14/2018 5:50 PM

PATH DETAILS

Circuit: MSIT-CORP-WCUS-Ckt-5

Peering: AzurePrivatePeering

Agent IP: 10.169.45.196

AVG LOSS : 0.00 % AVG LATENCY : 29.15 ms

TOTAL PATHS : 68 UNHEALTHY PATHS : 0

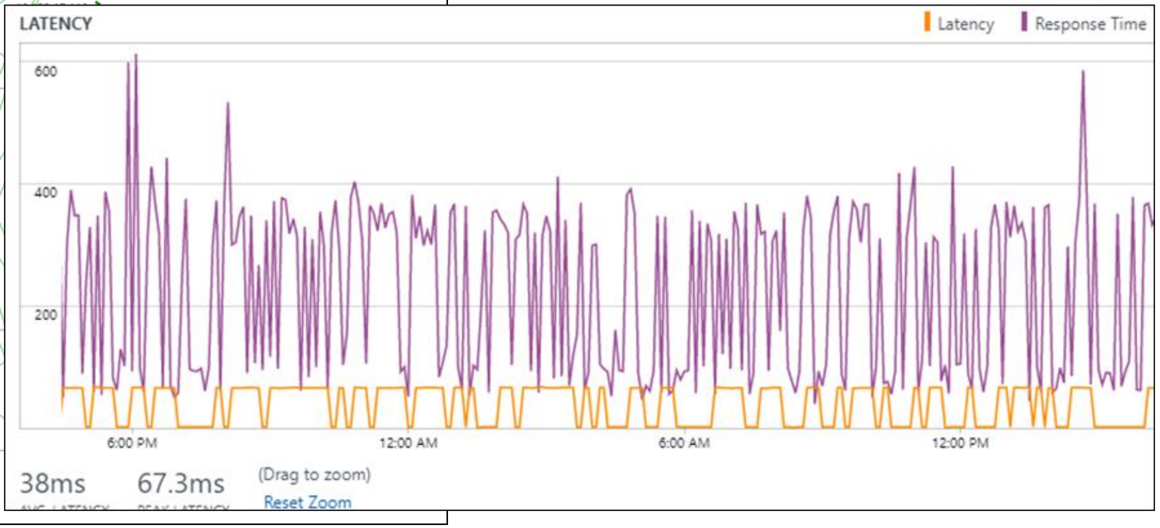
FILTERS

5 Hops From Left 0 Hops From Right

☑ 68 Healthy Paths
□ 0 Unhealthy Paths Due To Loss
□ 0 Unhealthy Paths Due To Latency

☑ Node Label

PATH BREAKUP



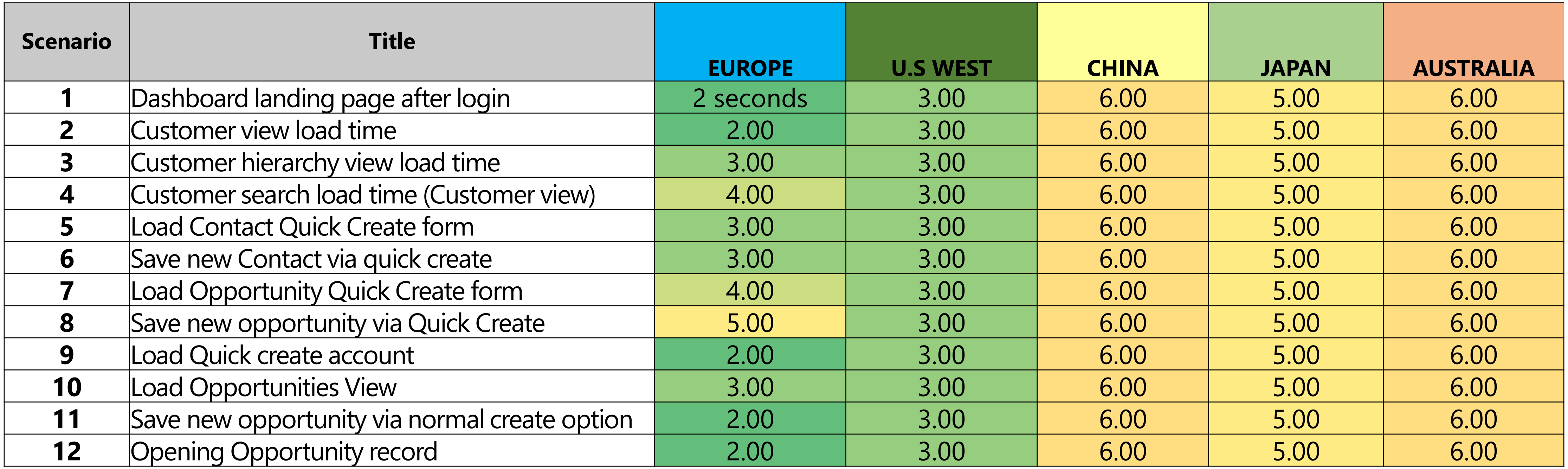
LATENCY

38ms AVG LATENCY 67.3ms PEAK LATENCY (Drag to zoom) Reset Zoom

Collecting Metrics : Manual Approach

- Suitable for manual deployments without any automation
- Create a vanilla instance, run basic form load tests for critical forms / operations from various locations using stopwatch method, store them as a baseline
- Repeat same tests after each sprint/deployment to identify performance problems, compare with the baseline

Sample



Scenario	Title	EUROPE	U.S WEST	CHINA	JAPAN	AUSTRALIA
1	Dashboard landing page after login	2 seconds	3.00	6.00	5.00	6.00
2	Customer view load time	2.00	3.00	6.00	5.00	6.00
3	Customer hierarchy view load time	3.00	3.00	6.00	5.00	6.00
4	Customer search load time (Customer view)	4.00	3.00	6.00	5.00	6.00
5	Load Contact Quick Create form	3.00	3.00	6.00	5.00	6.00
6	Save new Contact via quick create	3.00	3.00	6.00	5.00	6.00
7	Load Opportunity Quick Create form	4.00	3.00	6.00	5.00	6.00
8	Save new opportunity via Quick Create	5.00	3.00	6.00	5.00	6.00
9	Load Quick create account	2.00	3.00	6.00	5.00	6.00
10	Load Opportunities View	3.00	3.00	6.00	5.00	6.00
11	Save new opportunity via normal create option	2.00	3.00	6.00	5.00	6.00
12	Opening Opportunity record	2.00	3.00	6.00	5.00	6.00

Collecting Metrics : Diagnostics and performance telemetry

(Public Preview)

Description of the feature

- Customers can choose to receive platform and model driven apps diagnostics and performance telemetry into customer-owned Application Insights instance, **without needing to write custom tools**
- In App Insights, they can use the out of box dashboards, build custom reports or set up alerts
- Customers can also write Kusto queries for additional troubleshooting
- Telemetry includes UCI page loads (form, grid, dashboard and quick create form loads and app launch), API calls, Plugin executions and SDK executions

Collecting Metrics : Diagnostics and performance telemetry

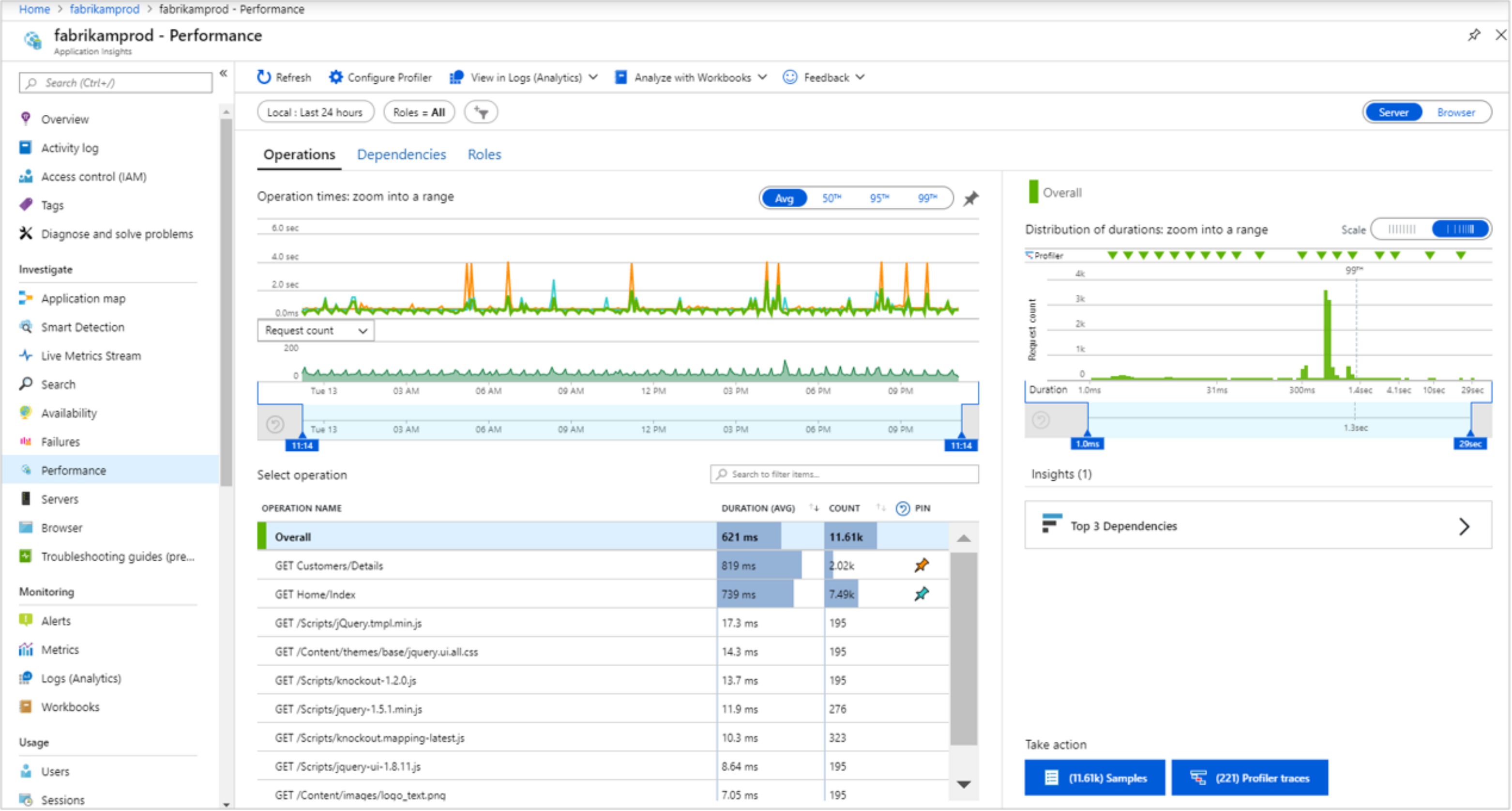
(Public Preview)

How to set it up

1. Admin logs into https://aka.ms/ppac and select on an “Add data export” button.
2. Admin can select Dataverse diagnostics and performance and choose an environment for which data is to be continuously exported to customers App Insights
3. Admin can select an org (environment), from a list which is based of the environments that the admin has access to and set up the data export to the App Insights instance selected above.
4. Admin can save the App Insight key, which will be used as the destination for the data export for the selected environment
5. Once complete, admin is taken to a landing page. Under the App Insights tab, admin will get a view of the following - data package (eg: Dataverse Diagnostics and Performance), storage account name (app insights acct), data export status (green if last export succeeded and red if it failed, with a link for red showing details of failure reason), data last exported on (datetime), created by (name of creator), created on (datetime)
6. Once data starts flowing into customers own App Insights every 25 minutes or so, the model app, API, plugin related error/performance metrics will be visible in App Insights OOB reports. Customers can also choose to build custom reports.

Collecting Metrics : Automatic Approach

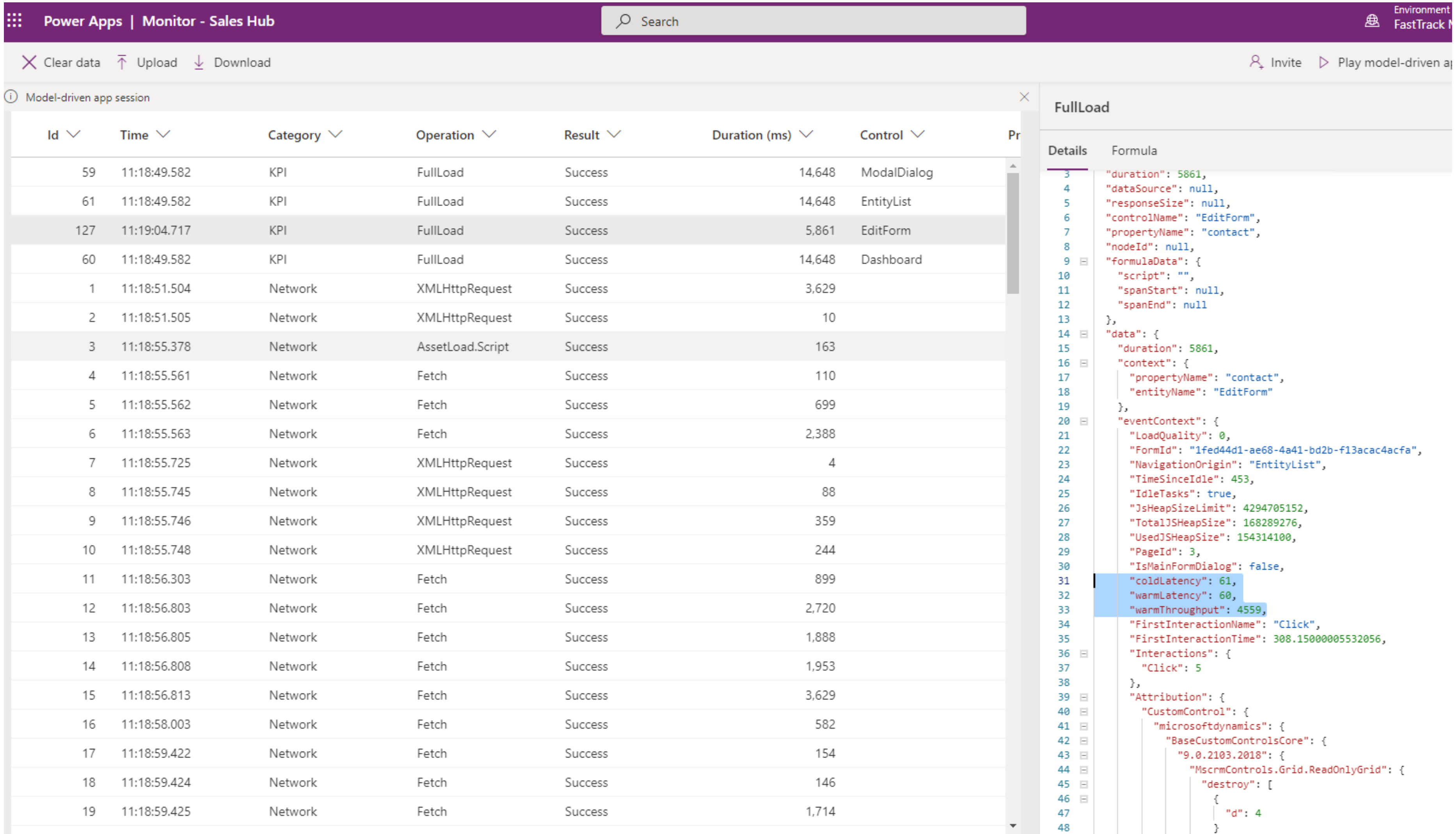
- Suitable if automated testing is already planned
- EasyRepro is an open-source framework built upon Selenium allowing automated UI tests to be performed on a specific Dynamics 365 organization. It can be extended to capture execution timings and push these into Azure Application Insights.
- Good for end user performance testing involving also client-side scripting
- Config steps are defined here



OPERATION NAME	DURATION (AVG)	COUNT	PIN
Overall	**621 ms**	**11.61k**	
GET Customers/Details	819 ms	2.02k	
GET Home/Index	739 ms	7.49k	
GET /Scripts/jQuery.tmpl.min.js	17.3 ms	195	
GET /Content/themes/base/jquery.ui.all.css	14.3 ms	195	
GET /Scripts/knockout-1.2.0.js	13.7 ms	195	
GET /Scripts/jquery-1.5.1.min.js	11.9 ms	276	
GET /Scripts/knockout.mapping-latest.js	10.3 ms	323	
GET /Scripts/jquery-ui-1.8.11.js	8.64 ms	195	
GET /Content/images/logo_text.png	7.05 ms	195	

Collecting Metrics : PowerApps Monitor tool

- Monitor is a tool that offers makers the **ability to view a stream of events from a user's session** to diagnose and troubleshoot problems. Works both for **model driven apps and canvas apps.**



Id	Time	Category	Operation	Result	Duration (ms)	Control	Pr
59	11:18:49.582	KPI	FullLoad	Success	14,648	ModalDialog	
61	11:18:49.582	KPI	FullLoad	Success	14,648	EntityList	
127	11:19:04.717	KPI	FullLoad	Success	5,861	EditForm	
60	11:18:49.582	KPI	FullLoad	Success	14,648	Dashboard	
1	11:18:51.504	Network	XMLHttpRequest	Success	3,629		
2	11:18:51.505	Network	XMLHttpRequest	Success	10		
3	11:18:55.378	Network	AssetLoad.Script	Success	163		
4	11:18:55.561	Network	Fetch	Success	110		
5	11:18:55.562	Network	Fetch	Success	699		
6	11:18:55.563	Network	Fetch	Success	2,388		
7	11:18:55.725	Network	XMLHttpRequest	Success	4		
8	11:18:55.745	Network	XMLHttpRequest	Success	88		
9	11:18:55.746	Network	XMLHttpRequest	Success	359		
10	11:18:55.748	Network	XMLHttpRequest	Success	244		
11	11:18:56.303	Network	Fetch	Success	899		
12	11:18:56.803	Network	Fetch	Success	2,720		
13	11:18:56.805	Network	Fetch	Success	1,888		
14	11:18:56.808	Network	Fetch	Success	1,953		
15	11:18:56.813	Network	Fetch	Success	3,629		
16	11:18:58.003	Network	Fetch	Success	582		
17	11:18:59.422	Network	Fetch	Success	154		
18	11:18:59.424	Network	Fetch	Success	146		
19	11:18:59.425	Network	Fetch	Success	1,714		

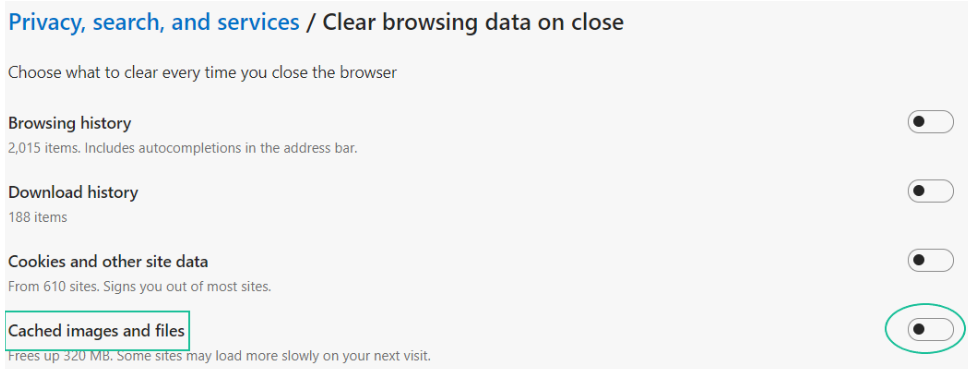
```
  "duration": 5861,
  "dataSource": null,
  "responseSize": null,
  "controlName": "EditForm",
  "propertyName": "contact",
  "nodeId": null,
  "formulaData": {
    "script": "",
    "spanStart": null,
    "spanEnd": null
  },
  "data": {
    "duration": 5861,
    "context": {
      "propertyName": "contact",
      "entityName": "EditForm"
    },
    "eventContext": {
      "LoadQuality": 0,
      "FormId": "1fed44d1-ae68-4a41-bd2b-f13acac4acfa",
      "NavigationOrigin": "EntityList",
      "TimeSinceIdle": 453,
      "IdleTasks": true,
      "JsHeapSizeLimit": 4294705152,
      "TotalJSHeapSize": 168289276,
      "UsedJSHeapSize": 154314100,
      "PageId": 3,
      "IsMainFormDialog": false,
      "coldLatency": 61,
      "warmLatency": 60,
      "warmThroughput": 4559,
      "FirstInteractionName": "Click",
      "FirstInteractionTime": 308.15000005532056,
      "Interactions": {
        "Click": 5
      },
      "Attribution": {
        "CustomControl": {
          "microsoftdynamics": {
            "BaseCustomControlsCore": {
              "9.0.2103.2018": {
                "MscrmControls.Grid.ReadOnlyGrid": {
                  "destroy": [
                    {
                      "d": 4
                    }
```

Best Practices

Browser caching key best practices

Ensure that users are properly leveraging browser caching

- ☑ Check if devices have enough space allocated for browser cache
- ☑ In the browser;
  Clearing cached images and files setting and
  ClearCachedImagesAndFilesOnExit policy should be disabled
- ☑ Check if there is any limit on disk cache size
- ☑ Train users to not to clear the browser cache manually
- ☑ Use modern browsers (IE 11 not supported since August 2021)



Privacy, search, and services / Clear browsing data on close

Choose what to clear every time you close the browser

Browsing history
2,015 items. Includes autocompletions in the address bar.

Download history
188 items

Cookies and other site data
From 610 sites. Signs you out of most sites.

Cached images and files
Frees up 320 MB. Some sites may load more slowly on your next visit.

Customization key best practices

☑ Remove unused scripts/files (to improve the performance during a possible boot)

☑ Avoid opening a new tab or window using Xrm.Navigation.openForm with openInNewWindow, open the form in the main form dialog (or leverage multi-session apps)

☑ Avoid synchronous JavaScript calls, try to execute web service calls asynchronously

☑ In the client-side code, cache JavaScript promises as much as possible to avoid sending multiple XHR (XmlHttpRequests) for retrieving same data

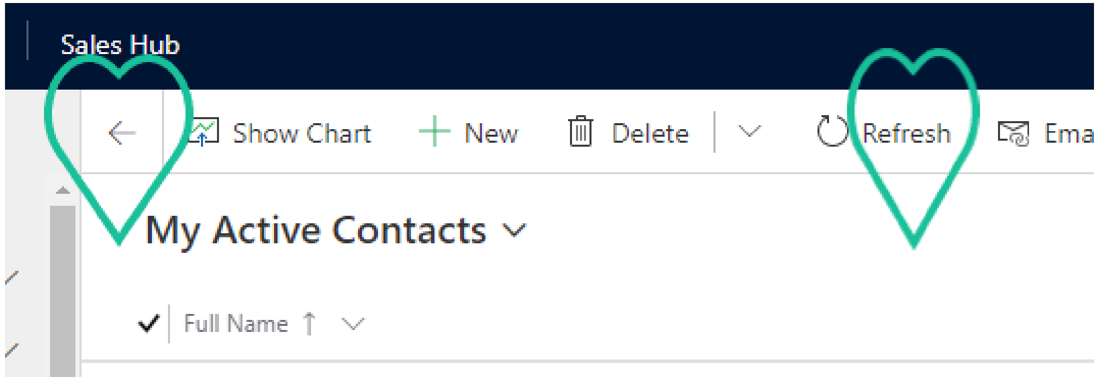
☑ Leverage IFrame component of Power Apps Component Framework over HTML iframe. This is faster, rendered as part of the same context, loads at the same time as other form components and provides a seamless experience

☑ Choose Xrm.WebApi over of creating Xml HTTP Requests (XHR) on your own

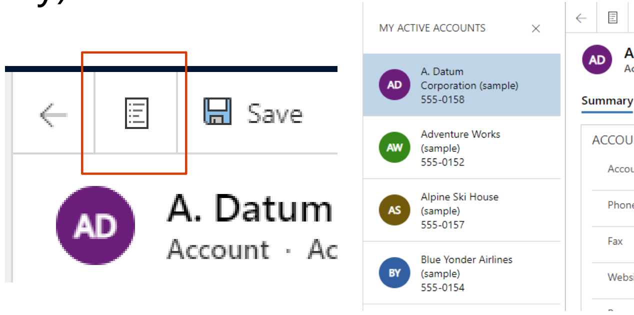
☑ Minimize fields and components on the form, create multiple forms for each persona

Usage key best practices

- ☑ Use inline refresh over browser refresh (should not use F5)
- ☑ Use inline back button instead browser’s back button
- ☑ Avoid InPrivate/Incognito modes in browser which causes cold loads



- ☑ Make users aware that running applications which consumes lot of bandwidth (like video streaming) may affect performance
- ☑ Do not install browser extensions unless they are necessary (this might be also blocked via policy)
- ☑ Do use Record Set to navigate records quickly without switching from form back to the list



Essential best practices

1. Review FastTrack for Dynamics 365 Performance Optimization Tech-Talk

2. Run Power Apps Solution Checker to check solutions against a set of best practice rules (including performance) and quickly identify these problematic patterns

3. Plan and run Performance Tests
   - If Unified support is in place, there are offerings to run these for the customers and partners
   - You may consider leveraging a 3rd party tool in order to save time

Links and references

General Requirements

[PowerPlatform Web Application Requirements]
[Azure network round-trip latency statistics]
[About multiple environments and tenants]
[Mobile Offline Capabilities]
[Dynamics 365 (Preview) mobile app for Windows]

Monitor performance

[How to check latency using OOB diag tool]
[Analyze model-driven apps and Dataverse telemetry with Application Insights]
[Store metrics with Easy Repro into Application Insights]
[Azure Network Performance Monitoring]
[Microsoft 365 Network Assessment Tool]
[Debug a Model Driven App with Monitor]

Best Practices

Optimize form performance

Define ribbon enable rules (model-driven apps) - Power Apps | Microsoft Docs
Improve form load time in Dynamics 365 for Customer Engagement (on-premises) | Microsoft Docs
Optimizing Microsoft 365 network connectivity

FastTrack for Dynamics 365 Performance Optimization Tech-Talk

Azure Peering Service

Azure Express Route

Omnichannel for Dynamics 365 Customer Service

Customer Service Workspace

Interconnect with China using Azure Virtual WAN and Secure Hub

Geographical Availability for Dynamics 365 and Power Platform

Power Apps Solution Checker

Xrm.WebApi (Client API reference) in model-driven apps

IFrame component of Power Apps Component Framework

Q&A

Thank you

Microsoft Dynamics 365