Message Switch Communications

2019 OpenFox® Training and Implementation Meeting

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Message Switch Communications

- **CPI has been providing communications interfaces at the State, Federal and Local message switch level since 1989**

- **Process**
  - **RFP or SOW**
  - **Discover, Design, Build, Test**
  - **Implementation/Deployment**
  - **Support**

Past Communication

- **3270 or SNA/SDLC** for Mainframe communication.
  Most have been replaced with MQ Series
- **Nlets dual socket protocol**
  Most have been replaced with Web Services
- **DMPP-2020 or Portal 100 protocol** for communicating with 3rd party workstations

Really Old

- Point to Point Bisync – Artic cards
- Honeywell VIP (HDS7)
- JBM Protocol converters
- Motorola Wireless Network Gateway
- Telnet

Current Communication

- **Web Services** for communicating with Nlets and many other systems such as CCH, Courts, DOC, DNR and DMV
- **FOXTalk** for shared communication between any application in the OpenFox® Desktop suite and the message switch. Also used to communicate with remote agencies
- **MQ Series** for communication with mainframes
- **ODBC/JDBC/OCI** for database communication
- **NCIC dual socket protocol**

Web Services

Definition - World Wide Web Consortium (W3C)

A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP-messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.

Source:- https://www.w3.org/TR/ws-gloss

Simple definition: A web service is a function that can be consumed by client programs over a network generally using HTTP.

Web Services

SOAP Web Services

Simple Object Access Protocol

- Supports XML exchanges only
- Contract driven (WSDL)
- Built-in support for WS-standards e.g.
  - WS-Security
  - WS-Trust
  - WS-Addressing
  - WS-Reliability
  - WS-Policy

RESTful Web Services

REpresentational State Transfer

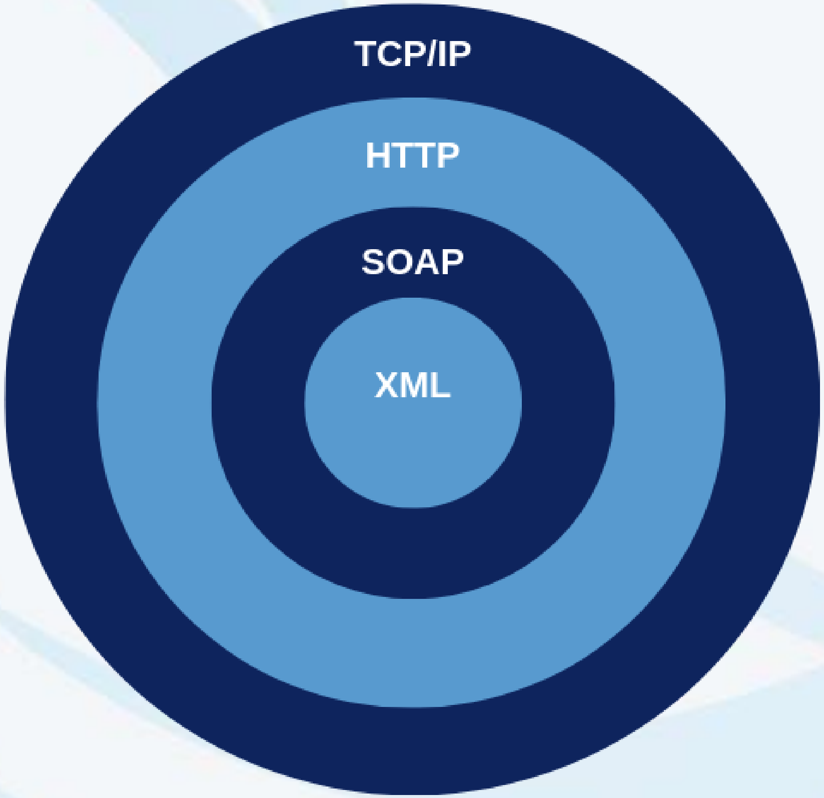
- XML, JSON, Text exchanges
- Simple Contract (WADL)
- Lightweight, less complex and can add additional standards e.g. OAuth
- Optimal for mobile communications

SOAP Web Services

Components

- TCP-IP
- HTTP
- SOAP
- XML
- WSDL + XSD Schema

Layers

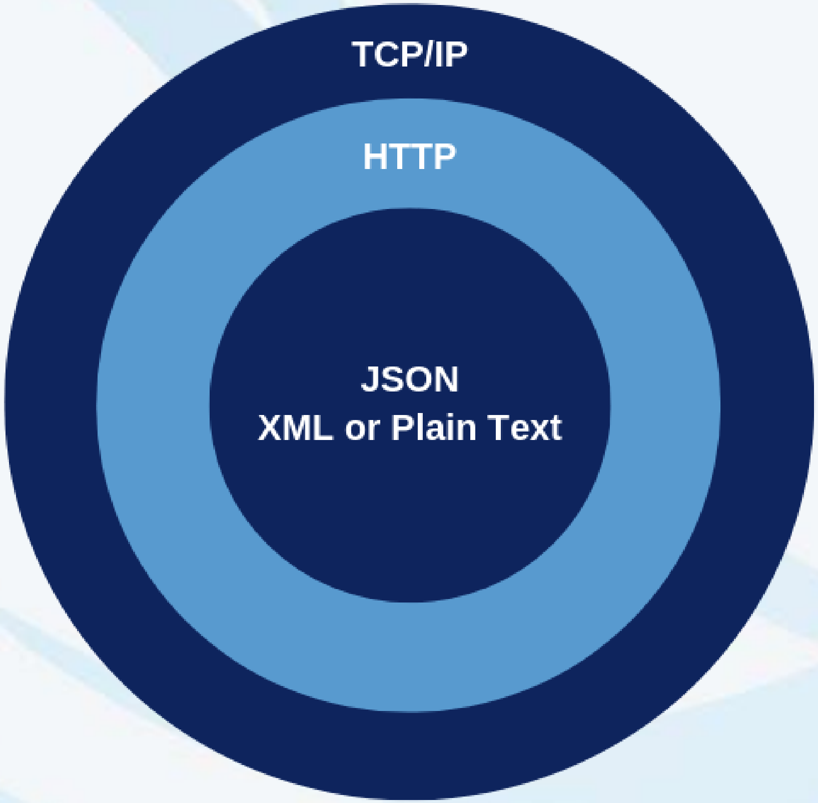


RESTful Web Services

Components

- TCP-IP
- HTTP
- JSON, XML, Text
- WADL

Layers



Web Services Implementations

- **Sync Model**
  - **DMV Client**
  - **DL Photo Client**
  - **Concealed Carry Client**
  - **Medical Marijuana Registry Client**

- **Async Model**
  - **Nlets Web Services**
  - **Arkansas mainframe replacement**

- **Sync / Async Model**
  - **NCIC Web Services**

FoxTalk

- **FoxTalk** protocol was developed by CPI as a common communication protocol between applications running in the OpenFox® Desktop and the OpenFox® Message Switch

- **FoxTalk** is also used to communicate with remote agencies typically SRVR/DAC or SRVR/XDAC configurations

- **FoxTalk** is an application-to-application protocol for use over a TCP/IP communications session.

FoxTalk Features

- **Connection Oriented**

  Persistent, smallest possible delay for time sensitive exchanges
- **Message Framing**

  Consistent, similar to familiar NCIC-2000 framing method
- **Frame Exchange Methodology**

  Connect, Device identification, Data Message, Encrypted Data Message, Positive/Negative Acknowledgments, Heartbeat
- **Content Negotiation**

  Frame length, Encryption, Image encoding type, Newline sequence, max idle time, default connection timeout
- **Application Acknowledgement**

  Guaranteed delivery, retries
- **Connection Maintenance**

  Hearbeats, half session failure detection

FoxTalk Myths

- **FoxTalk is proprietary**

  The FoxTalk™ Protocol was developed by CPI to interface our various client software products with our OpenFox® Message Switch in a consistent manner. CPI considers the protocol open to implementation by anyone, and will freely release the specification.

- **Pay CPI for using FoxTalk**

  There are no royalty or license charges for use of the FoxTalk™ Protocol.

FoxTalk Setup for 3rd Party Vendor

- **Provide FoxTalk Specification**

- **Decide Message Format**

  XML (OFML, NIEM, GJXDM) or Text

  - Provide OFML Specification if exchanging OFML
  - Provide XML schemas if NIEM or GJXDM
  - Provide legacy dot delimited format if Text

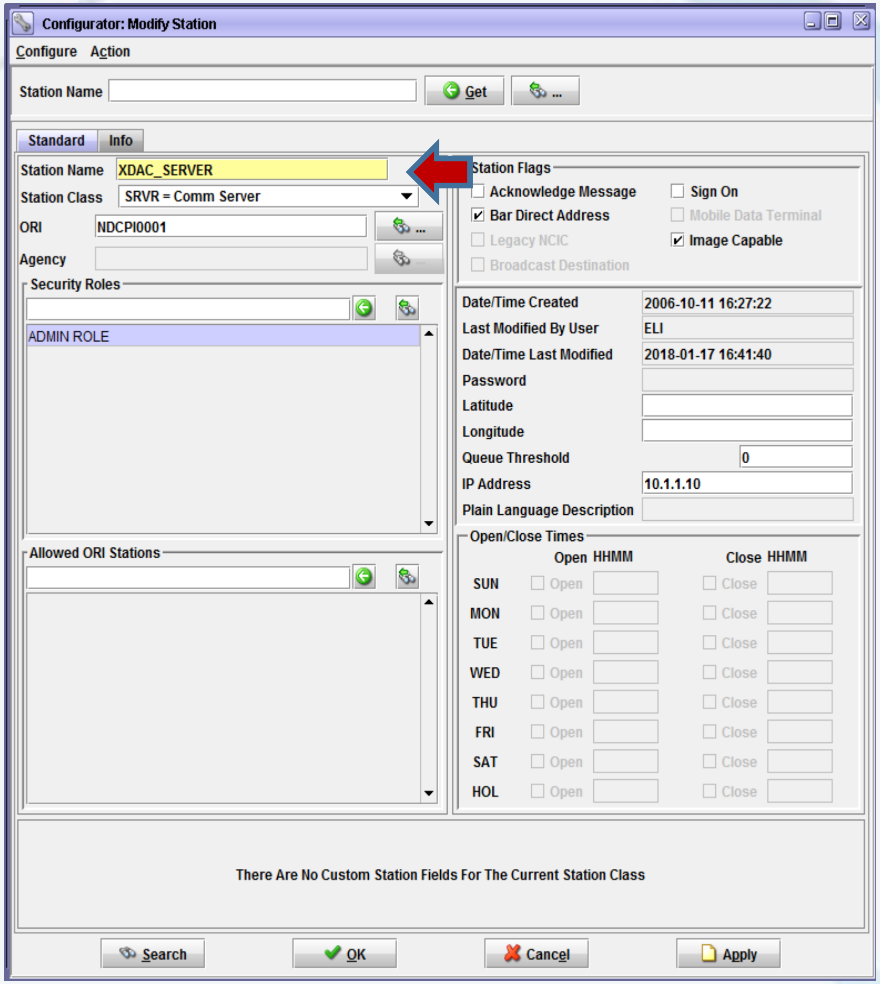
- **Configure SRVR station**

  IP address, open close times, etc..

- **Configure associated DAC/XDAC stations**

  DACs typically exchange text, XDACs exchange XML

FoxTalk Configuration



Station Name XDAC_SERVER

Station Class SRVR = Comm Server

ORI NDCPI0001

Agency

Security Roles

ADMIN ROLE

Allowed ORI Stations

Station Flags

☐ Acknowledge Message ☐ Sign On

☑ Bar Direct Address ☐ Mobile Data Terminal

☐ Legacy NCIC ☑ Image Capable

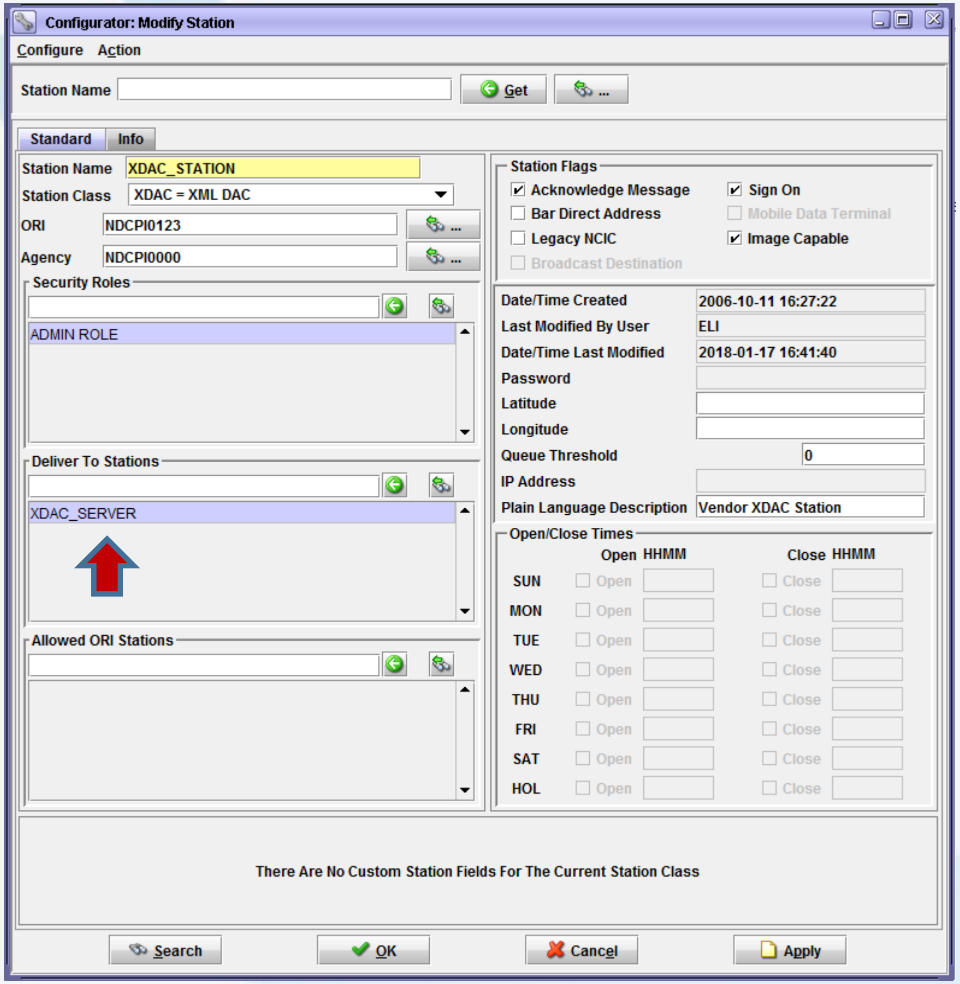
☐ Broadcast Destination

Date/Time Created	2006-10-11 16:27:22
Last Modified By User	ELI
Date/Time Last Modified	2018-01-17 16:41:40
Password	
Latitude	
Longitude	
Queue Threshold	0
IP Address	10.1.1.10
Plain Language Description	

Open/Close Times

	Open HHMM		Close HHMM	
SUN	☐ Open		☐ Close	
MON	☐ Open		☐ Close	
TUE	☐ Open		☐ Close	
WED	☐ Open		☐ Close	
THU	☐ Open		☐ Close	
FRI	☐ Open		☐ Close	
SAT	☐ Open		☐ Close	
HOL	☐ Open		☐ Close	

There Are No Custom Station Fields For The Current Station Class



Station Name XDAC_STATION

Station Class XDAC = XML DAC

ORI NDCPI0123

Agency NDCPI0000

Security Roles

ADMIN ROLE

Deliver To Stations

XDAC_SERVER

Allowed ORI Stations

Station Flags

☑ Acknowledge Message ☑ Sign On

☐ Bar Direct Address ☐ Mobile Data Terminal

☐ Legacy NCIC ☑ Image Capable

☐ Broadcast Destination

Date/Time Created	2006-10-11 16:27:22
Last Modified By User	ELI
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Password	
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Plain Language Description	Vendor XDAC Station

Open/Close Times

	Open HHMM		Close HHMM	
SUN	☐ Open		☐ Close	
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There Are No Custom Station Fields For The Current Station Class

FoxTalk vs. Web Services

FoxTalk

- Persistent Connection
- Fully configurable without CPI assistance
- Text, XML or JSON
- Multiple image formats

Web Services

- Non-Persistent
- Custom per exchange
- Wrapped Text, XML or JSON messages
- Base 64 encoded images only

Questions/Suggestions?

CPI

Join us in a Birds Of a Feather session!

OpenFox® Approach

- **Implement and Enforce Standards**
  - Create protocol specs
  - Create messaging specs

- **Make Standards Available**
  - New endpoints are configurable instead of programmable
  - CPI spec's are royalty and license free (FoxTalk)

- **Leverage Existing Work**
  - Interfaces can handle many sessions
  - No per-session effort (or cost)
  - Implement once, use many times

OpenFox® Approach

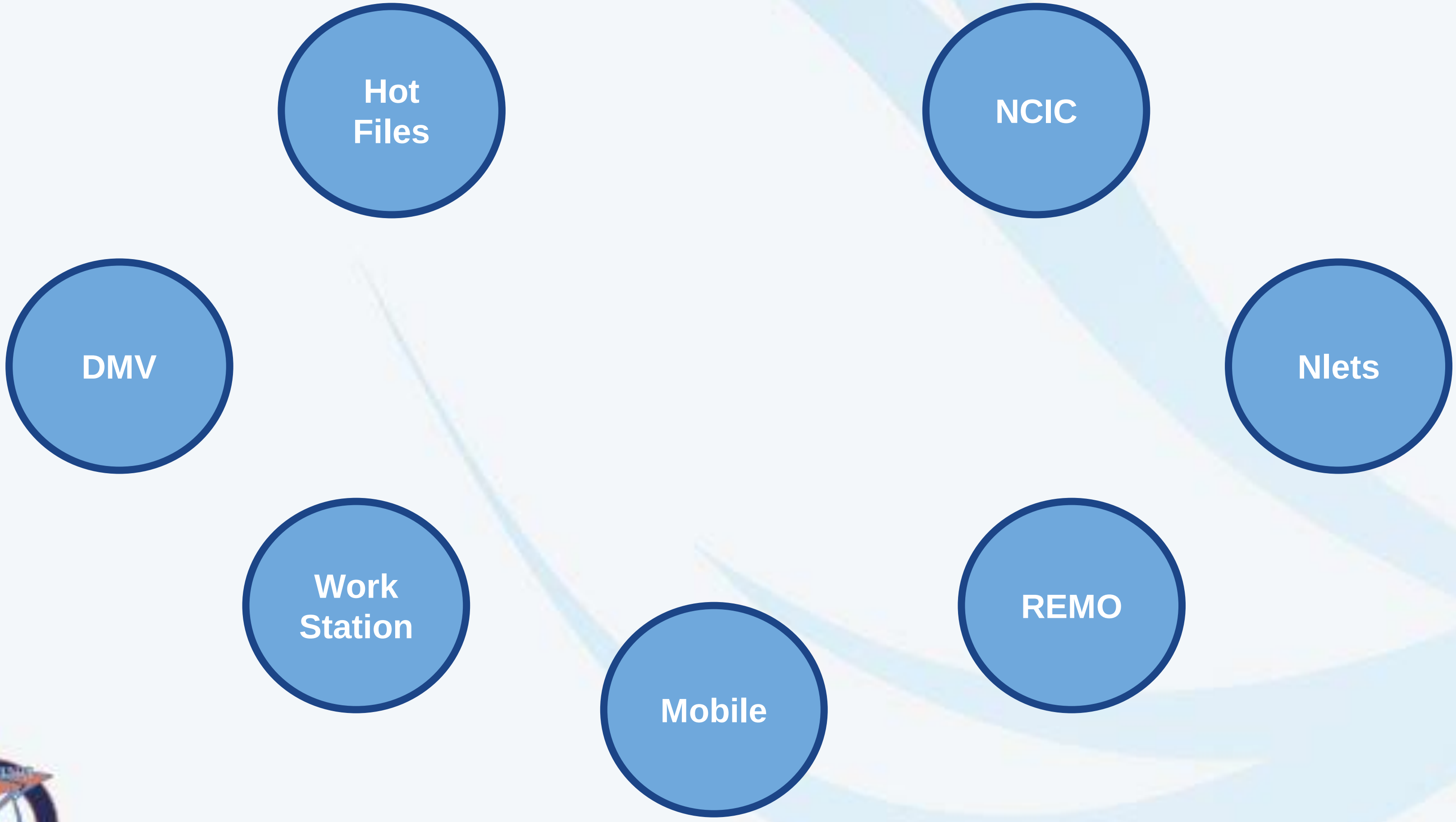
- Federated message brokering
  - Star network
- Enforce messaging standards
  - Must follow protocol and message formatting specs to communicate
- Translate formats between endpoints
  - Allow disperate solutions to intercommunicate
- Bridge protocols and formats
  - Only the hub needs to know how to talk to each spoke

Why?

- **Are we old fashioned?**
  - **What about peer-to-peer, or directly connected?**
- **Isn’t new tech made to NOT work this way?**
  - **What about Service Oriented Architecture?**
- **Isn’t forcing everything through the Message Switch a roadblock?**
  - **Why can’t we just call a downstream service directly?**
- **Every new change must be implemented in the Switch?**
  - **Switches are an impediment to information sharing?**

Why? Expansion

Adding a new service, un-federated:



Hot Files

NCIC

DMV

Nlets

Work Station

REMO

Mobile

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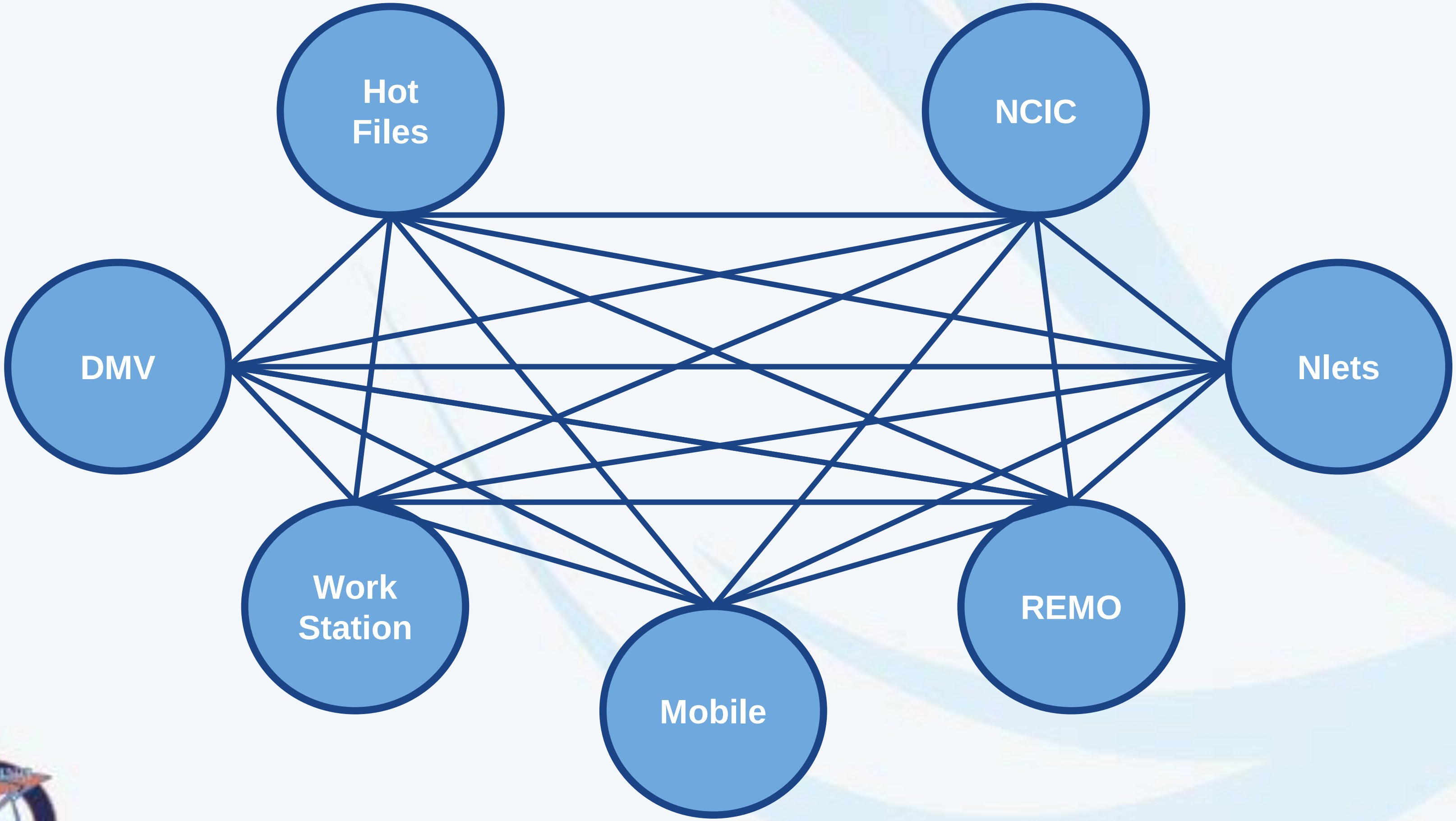

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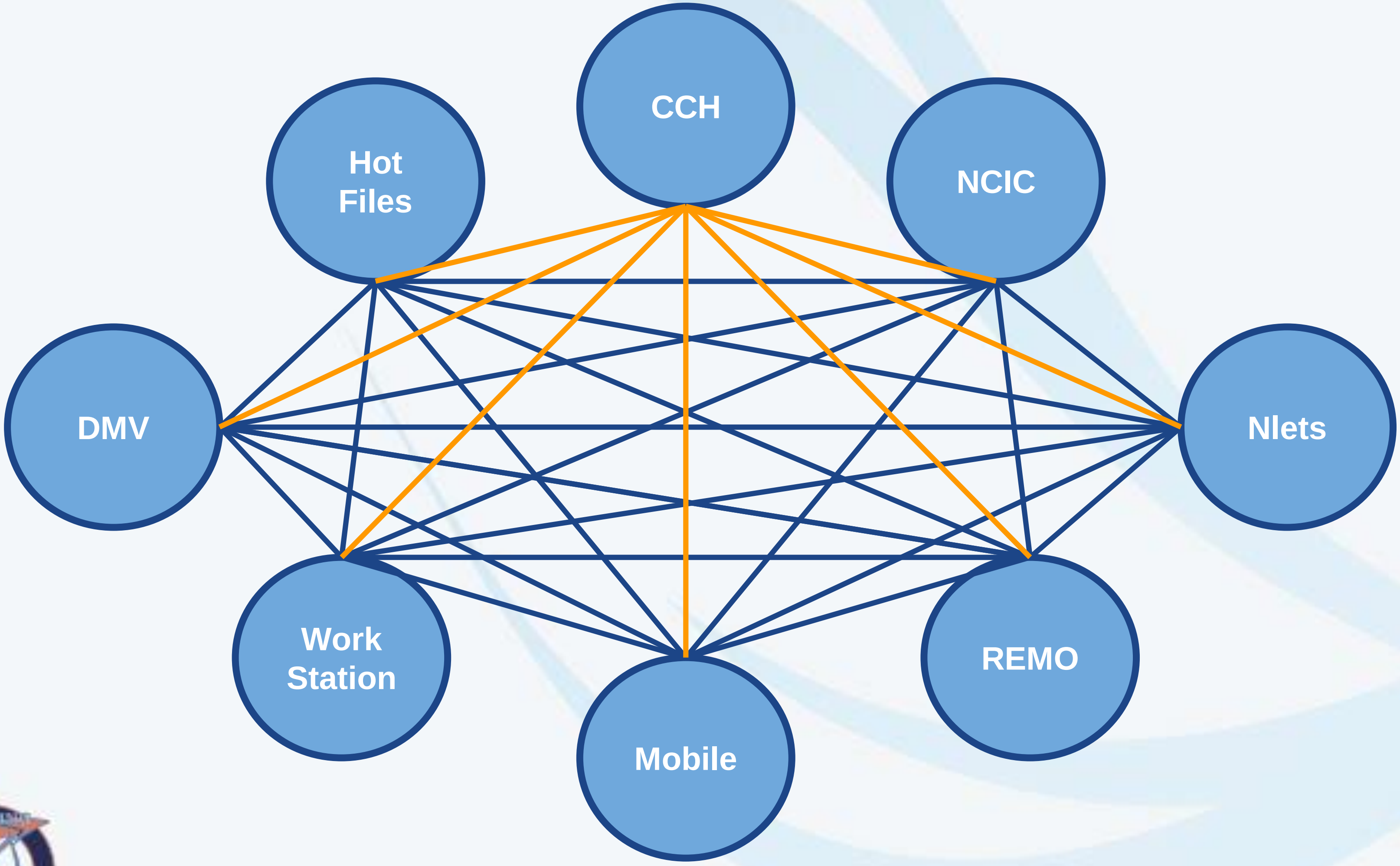

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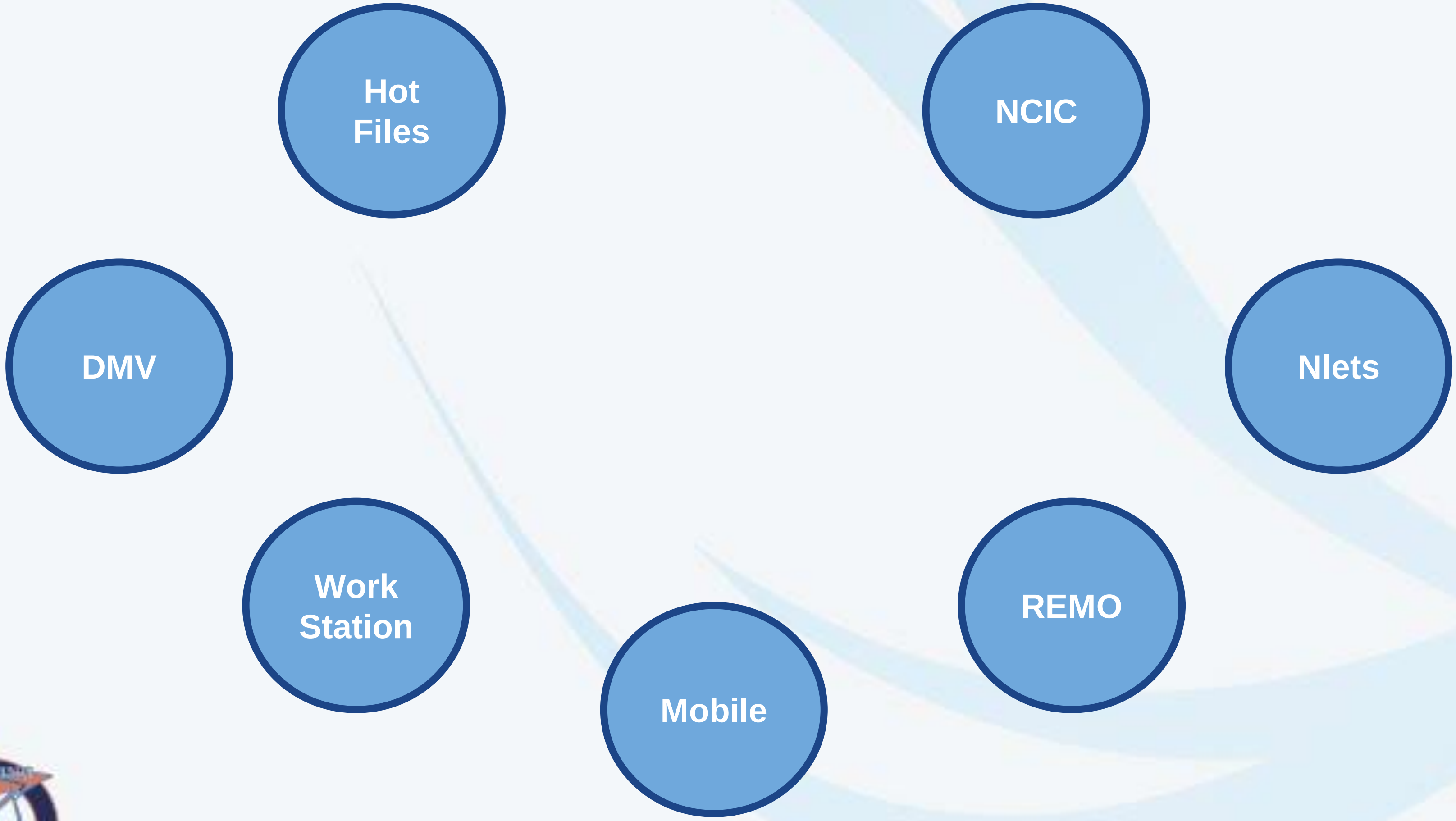

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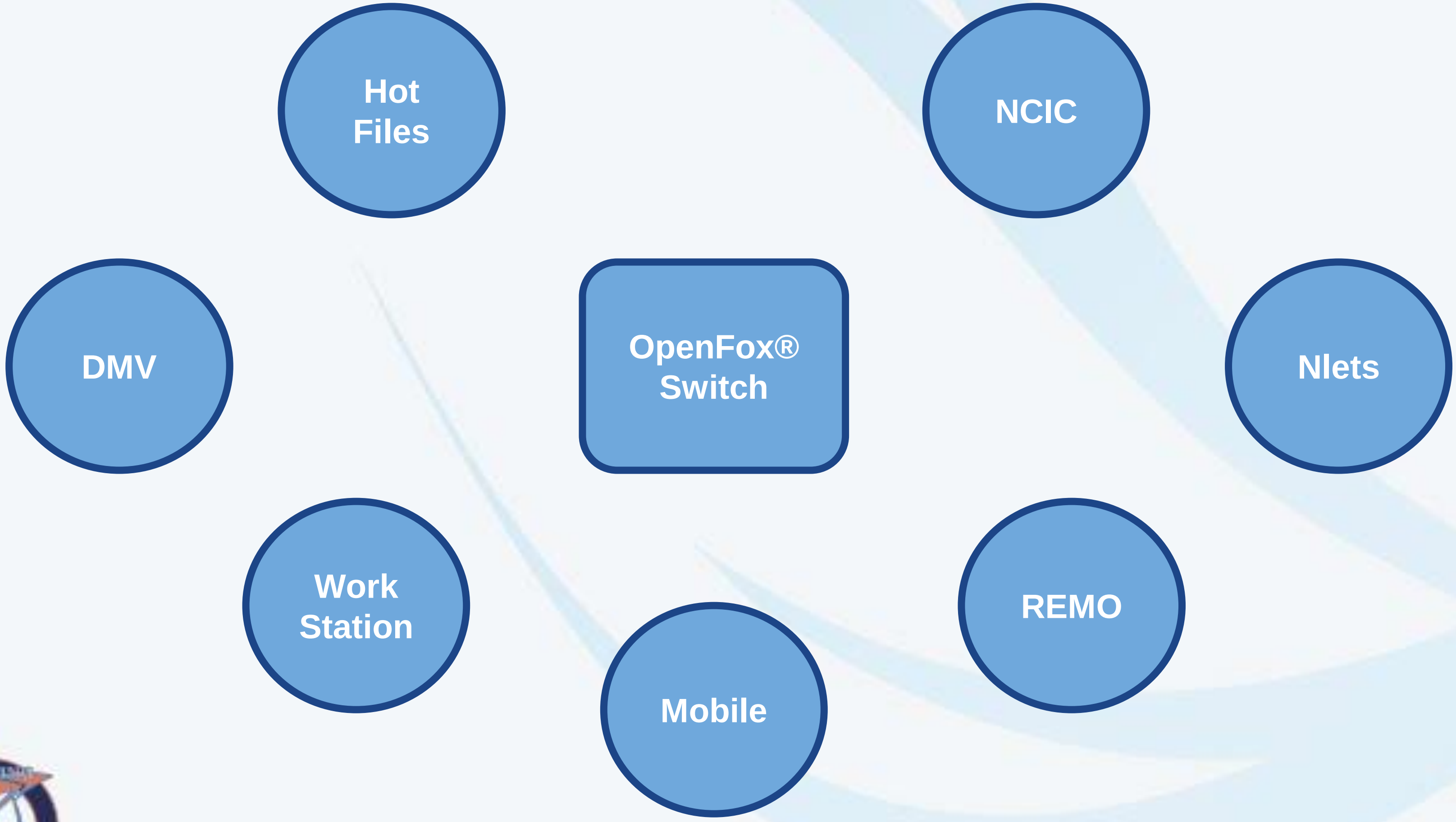

Hot Files

NCIC

DMV

OpenFox® Switch

Nlets

Work Station

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Why? Expansion

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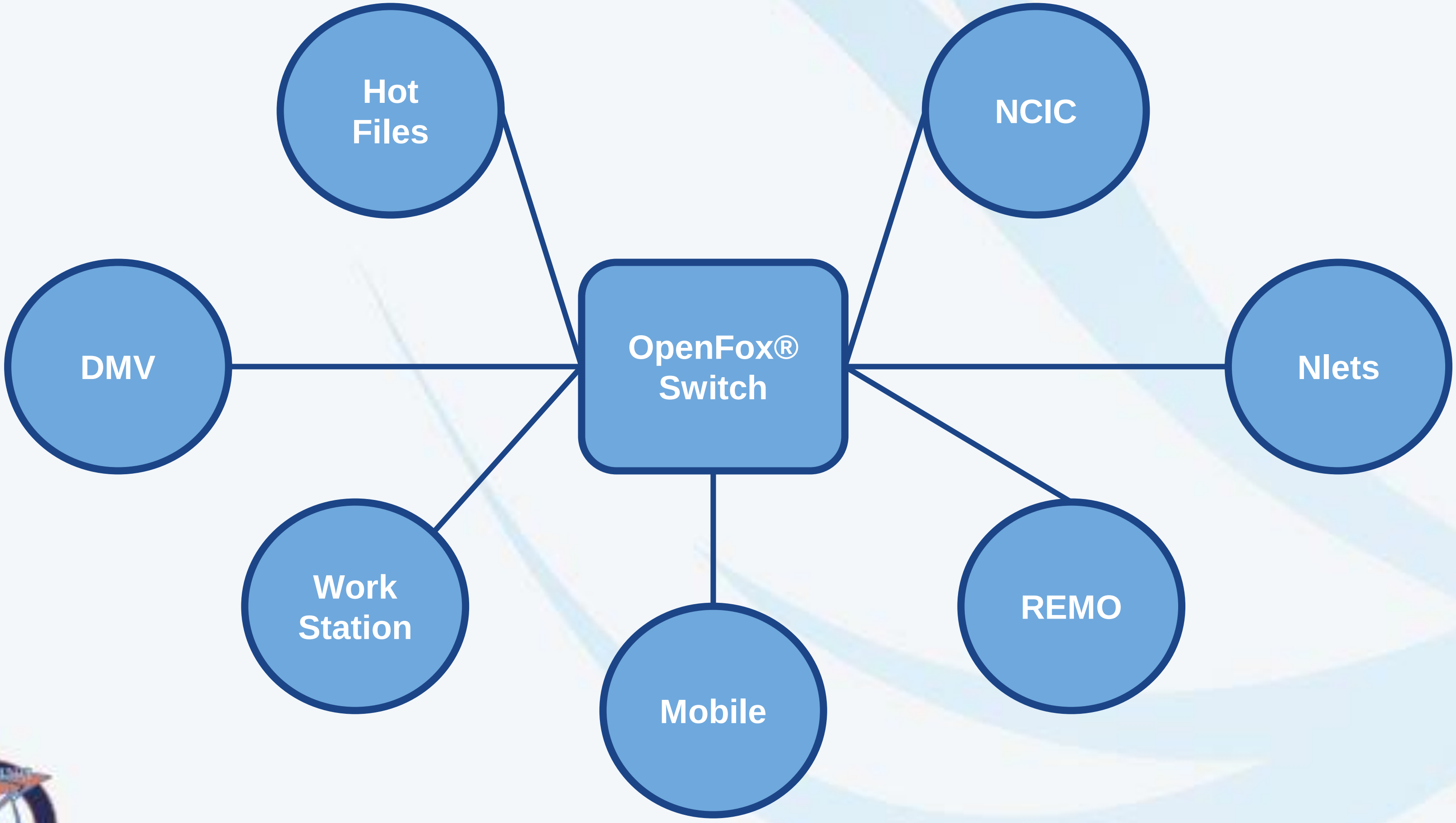

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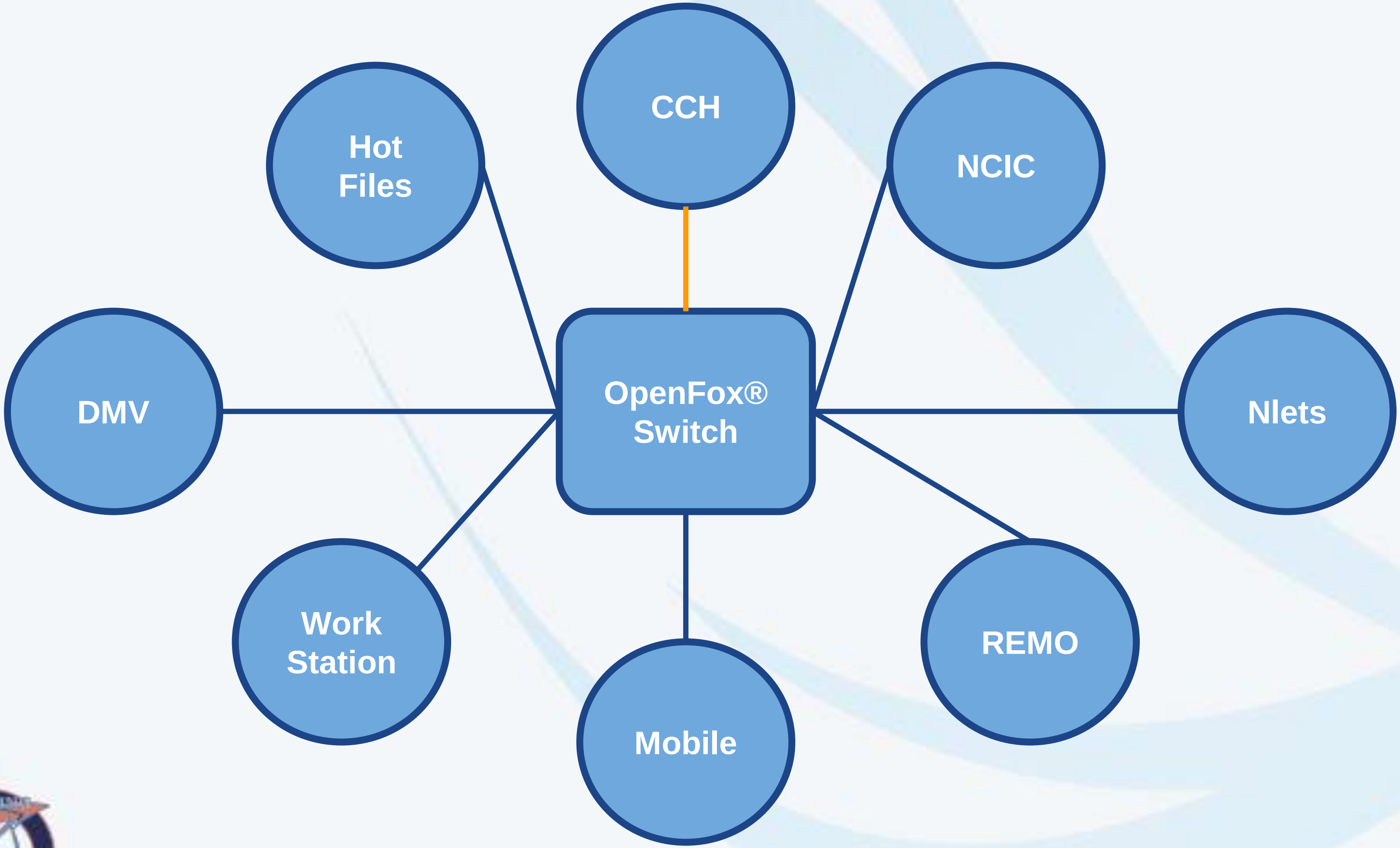
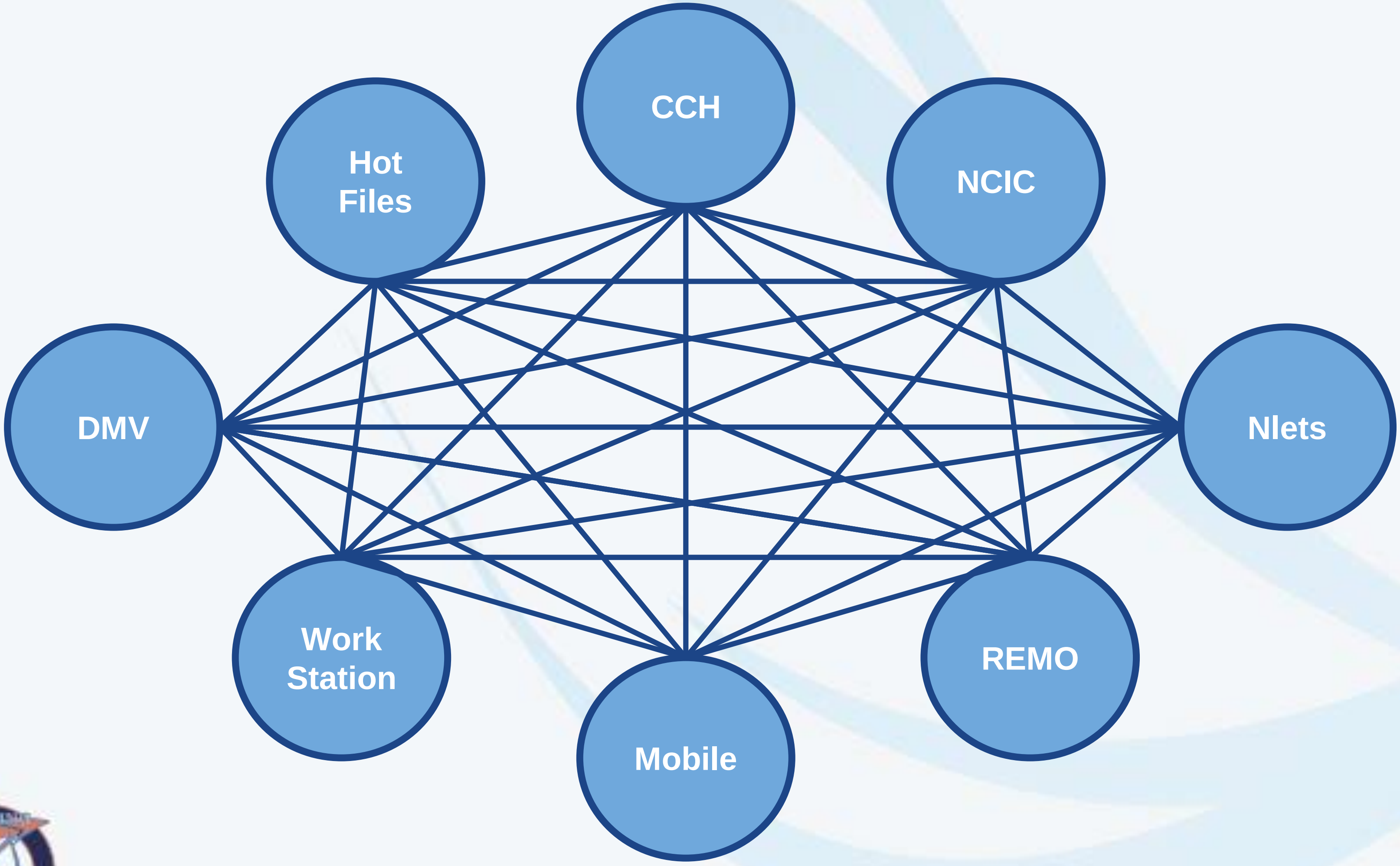


Why? Protocol Change

DMV Protocol Upgrade, un-federated:



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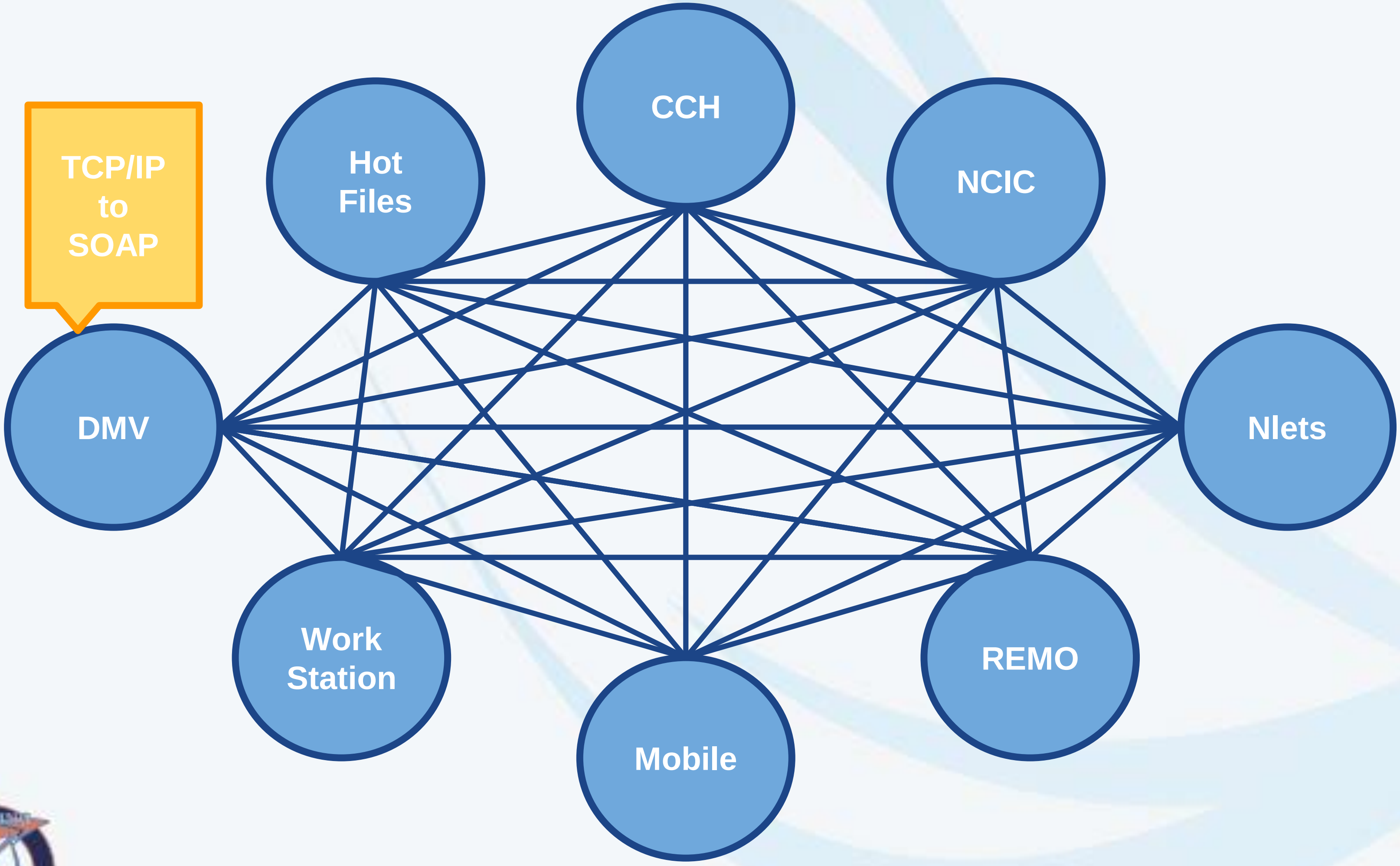

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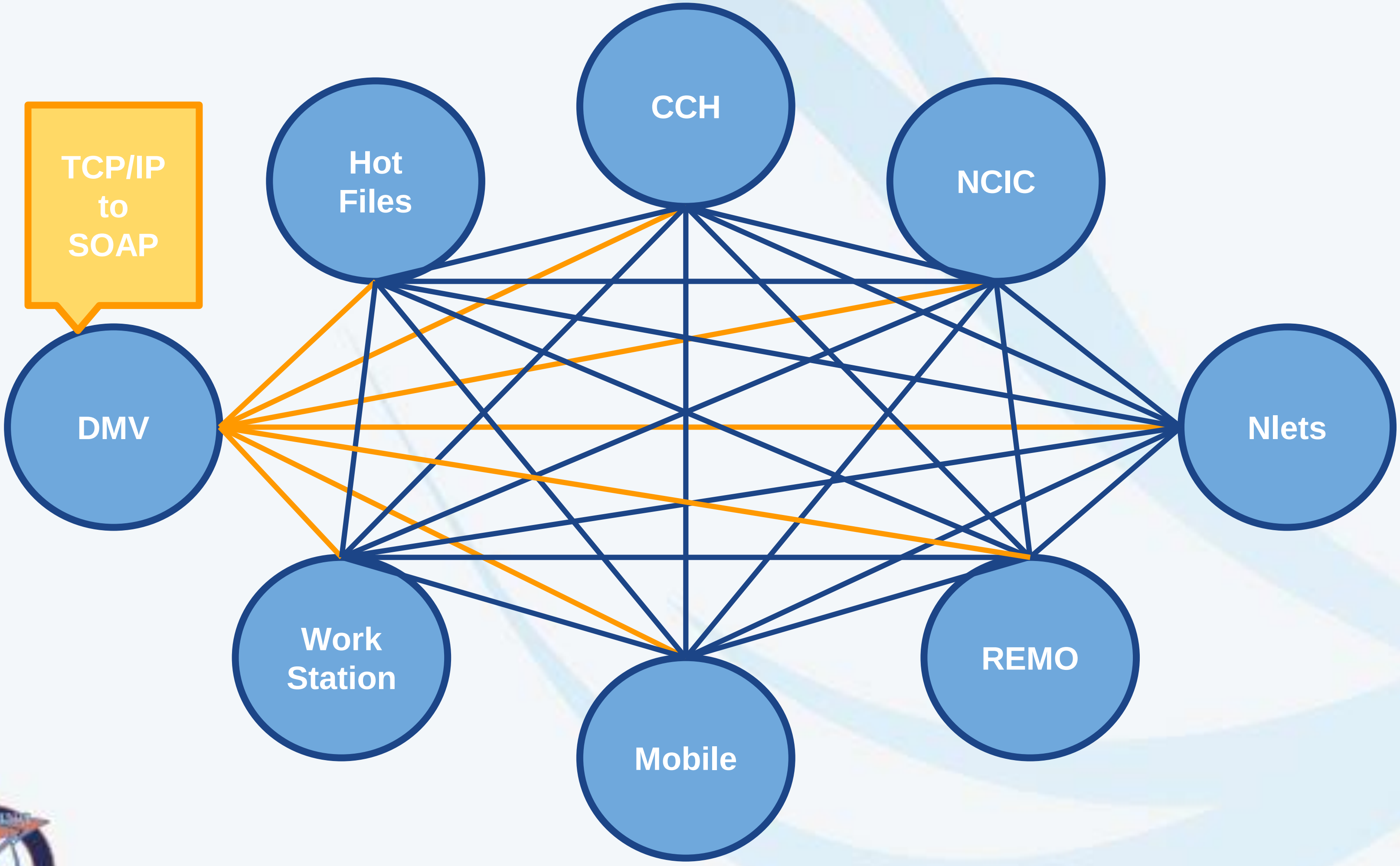
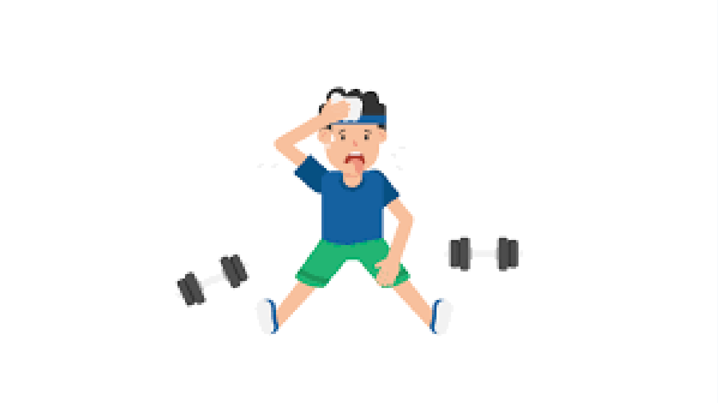


Why? Protocol Change

DMV Protocol Upgrade, un-federated:

1. Modify DMV System
2. Modify Hot Files
3. Modify CCH
4. Modify NCIC (Interface)
5. Modify Nlets (Interface)
6. Modify Regional Systems
7. Modify Mobile Systems
8. Modify Workstation Systems



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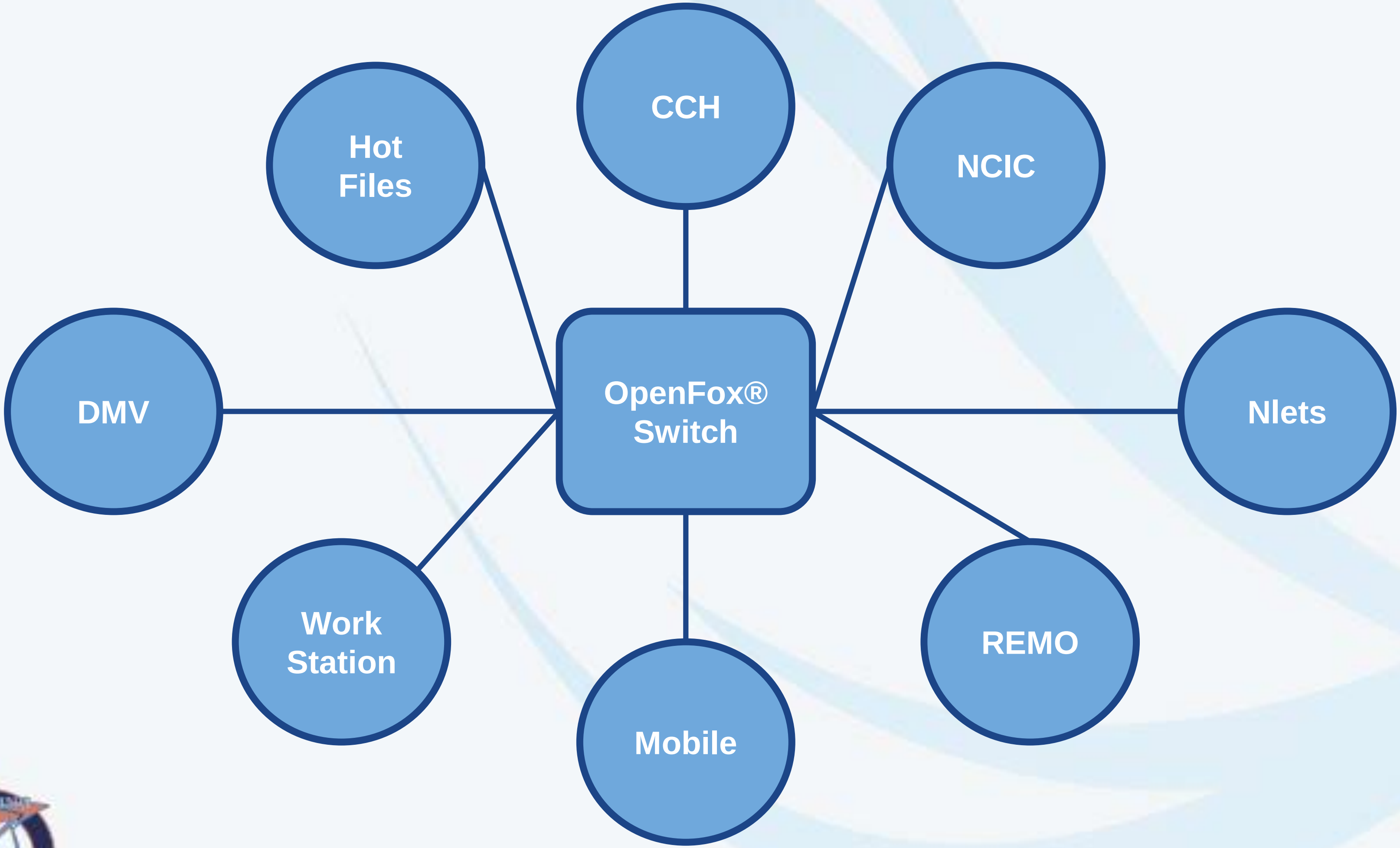

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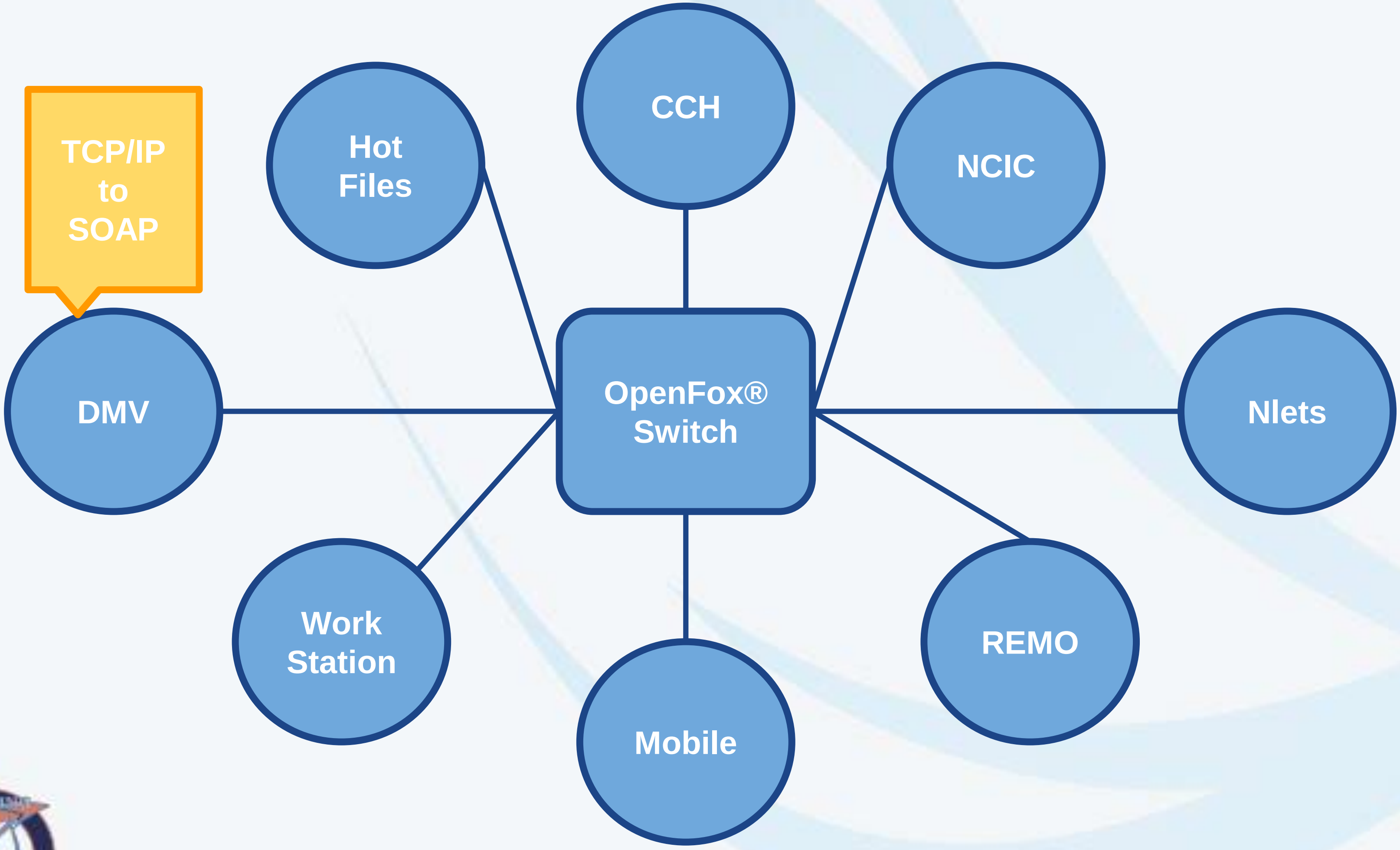

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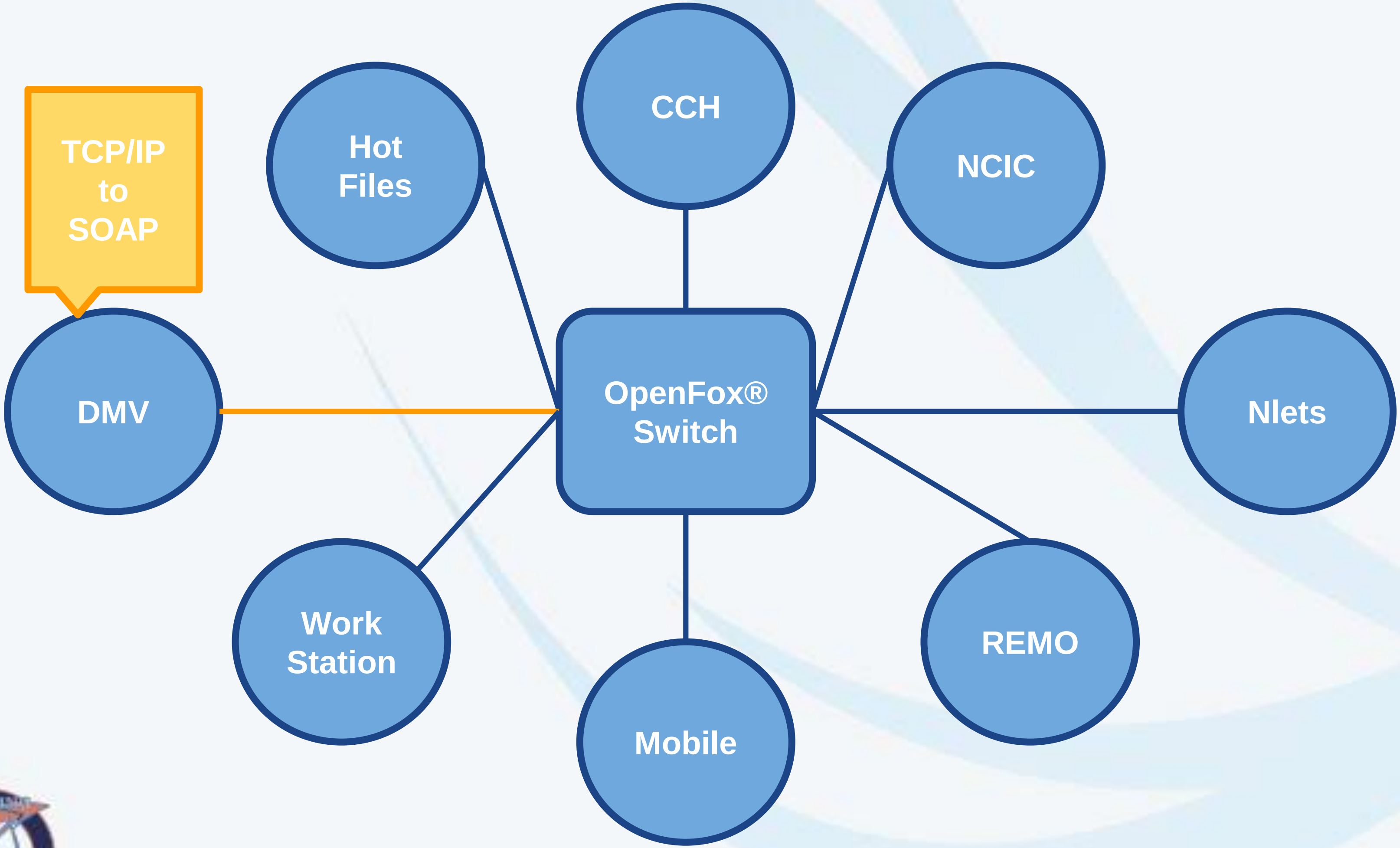

Why? Protocol Change

DMV Protocol Upgrade, OpenFox® Approach:

1. Modify DMV System
2. Modify OpenFox® Switch

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DMV Protocol Upgrade, OpenFox® Approach:

1. Modify DMV System
2. Modify OpenFox® Switch

How has this shrunk our budget?

How has this shrunk our schedule?

Why? Testing Time and Cost

- **Consider the Protocol Change**

Why? Testing Time and Cost

- **Consider the Protocol Change**
  - **What does testing look like, OpenFox® Approach?**

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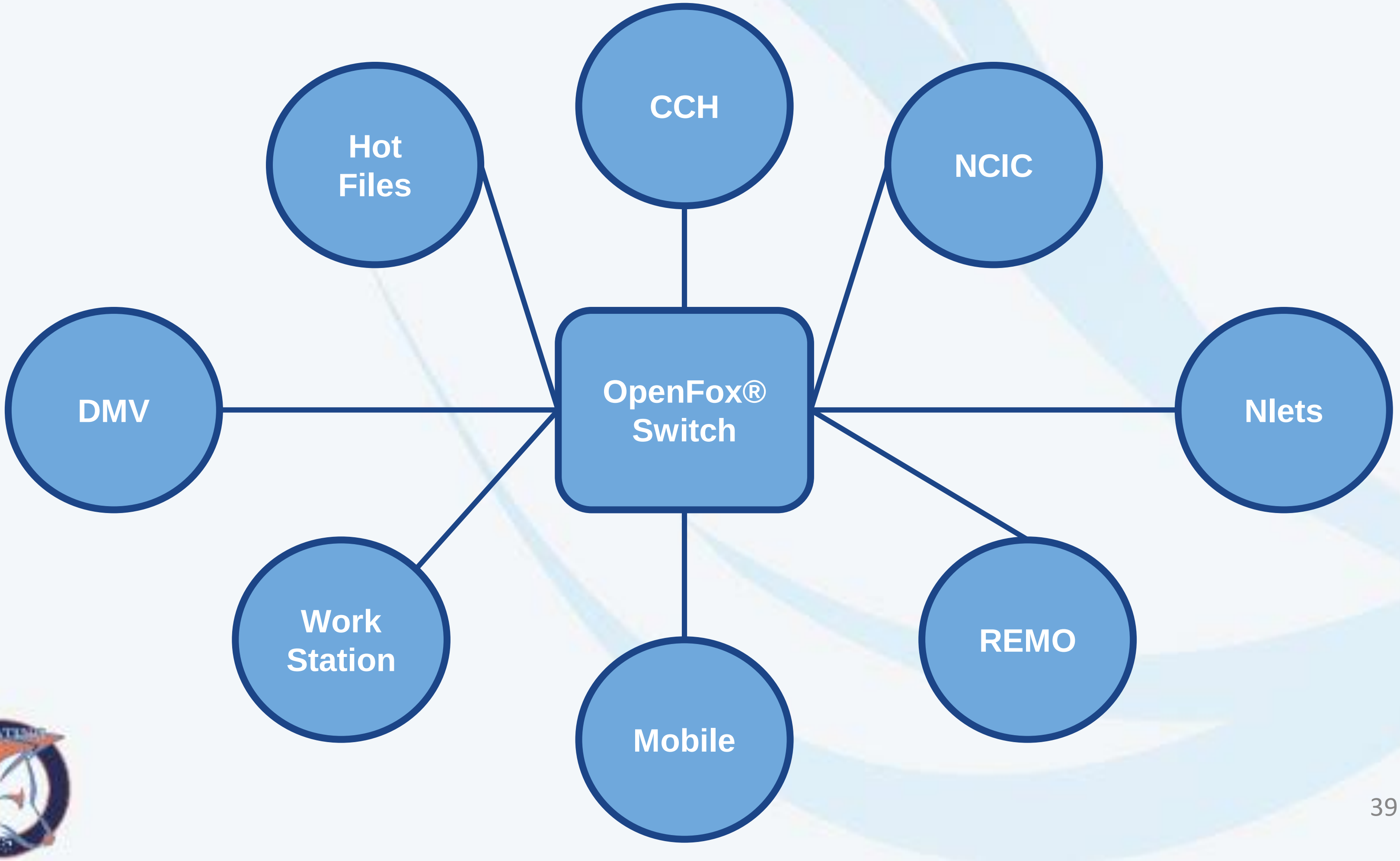

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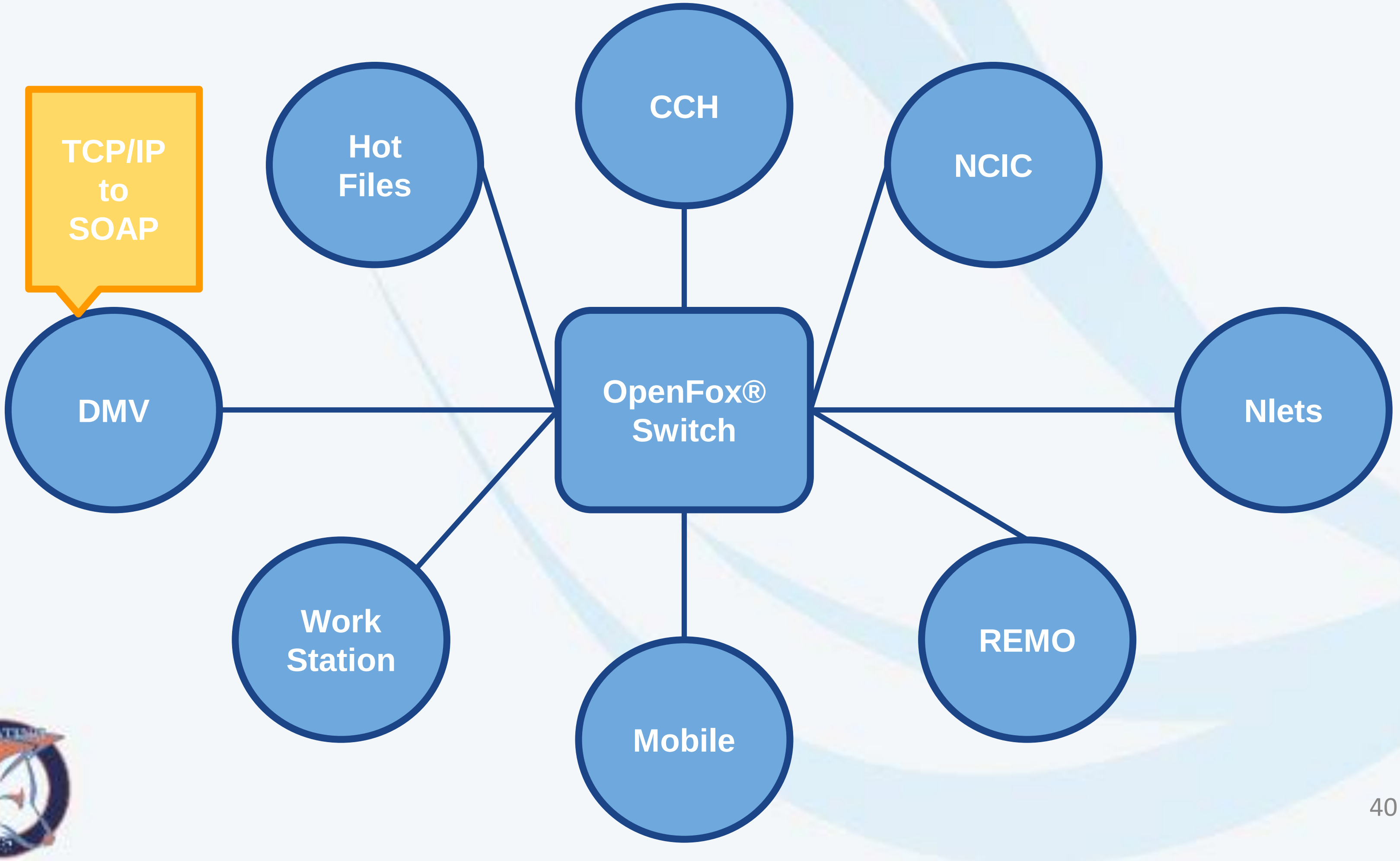

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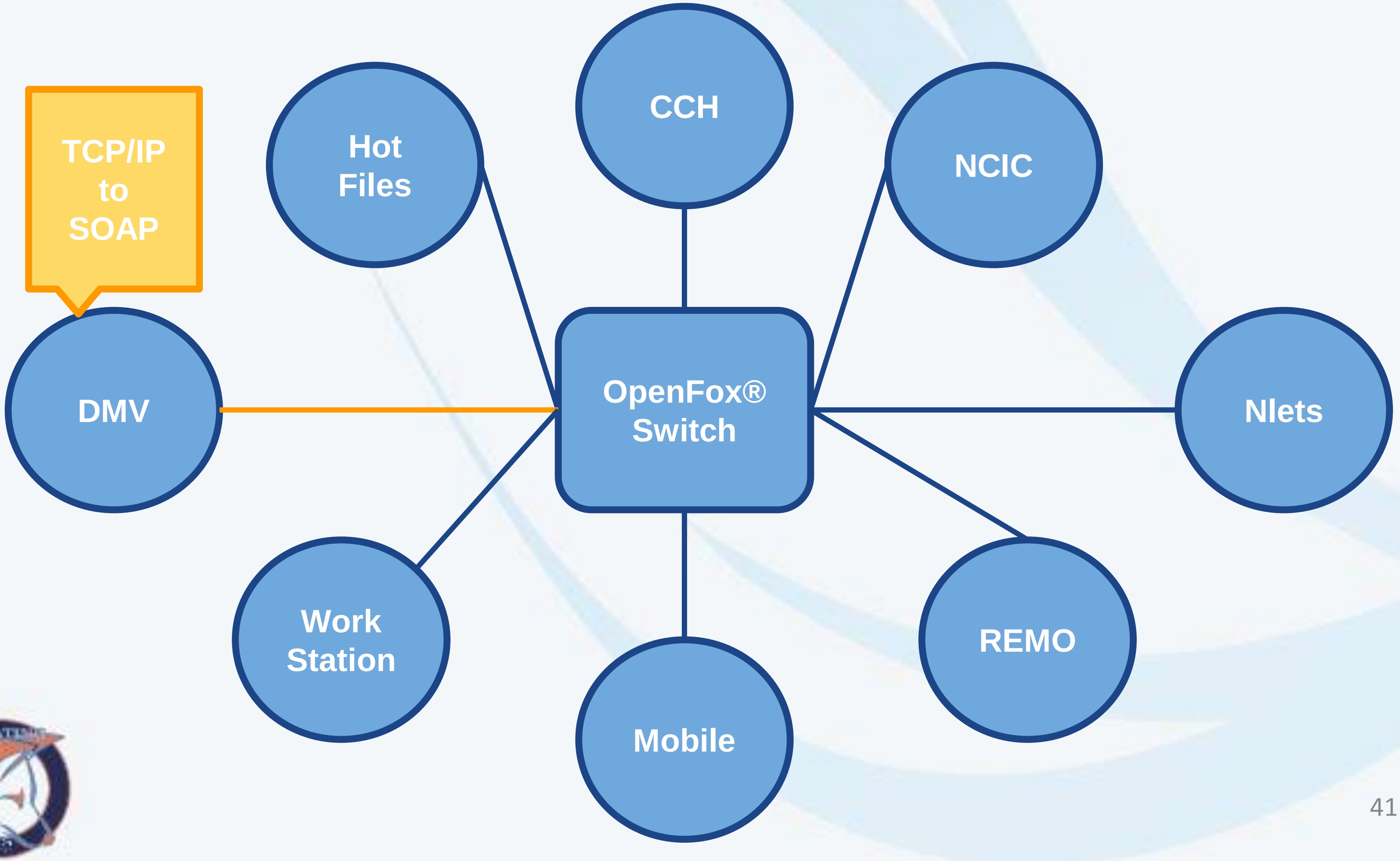

Why? Testing Time and Cost

- **Consider the Protocol Change**
  - **What does testing look like, OpenFox® Approach?**

1. **Test DMV with OpenFox® Switch**
2. **Done!**

Why? Testing Time and Cost

- **Consider the Protocol Change**

Why? Testing Time and Cost

- **Consider the Protocol Change**
  - **What does testing look like, unfederated?**

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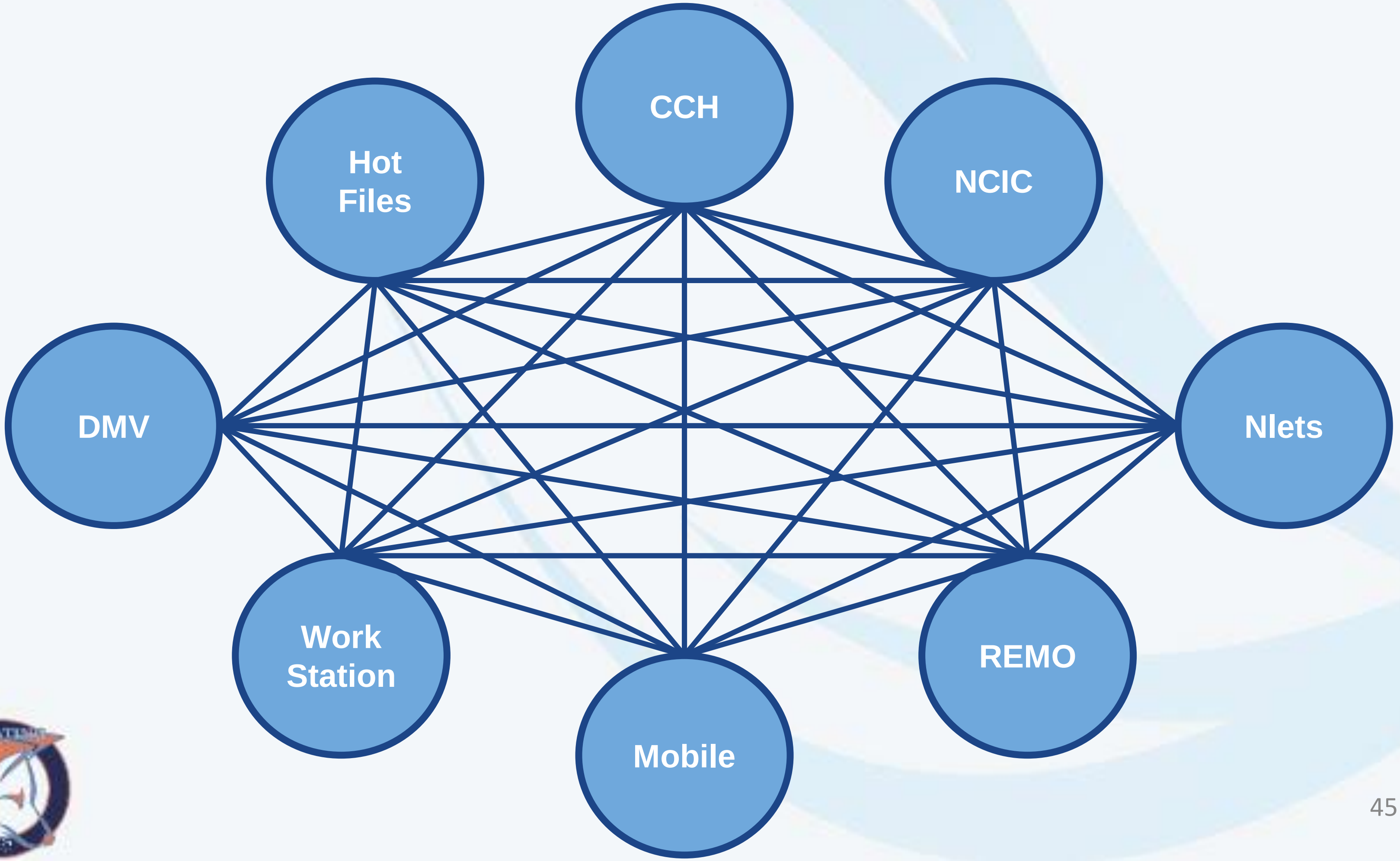

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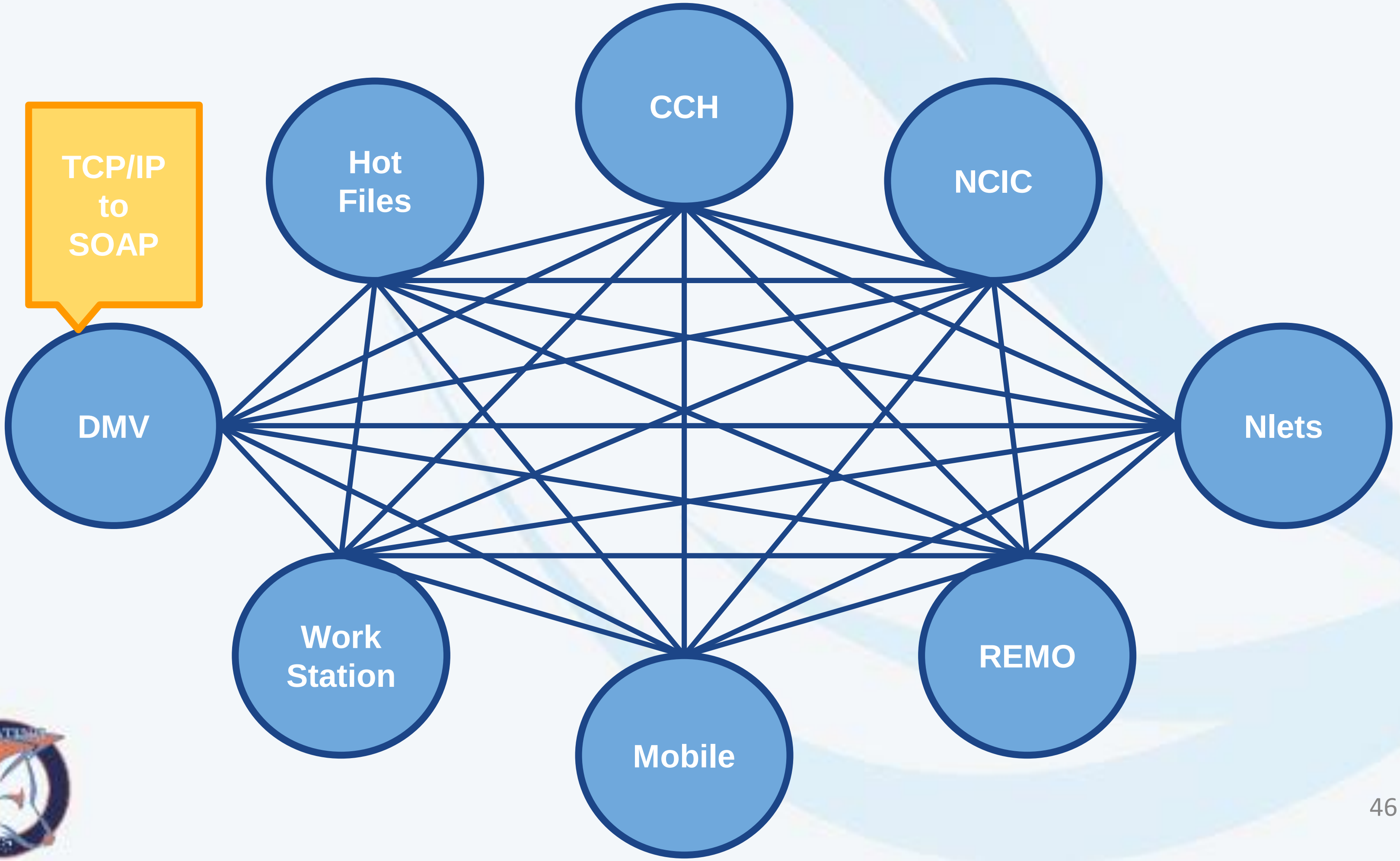

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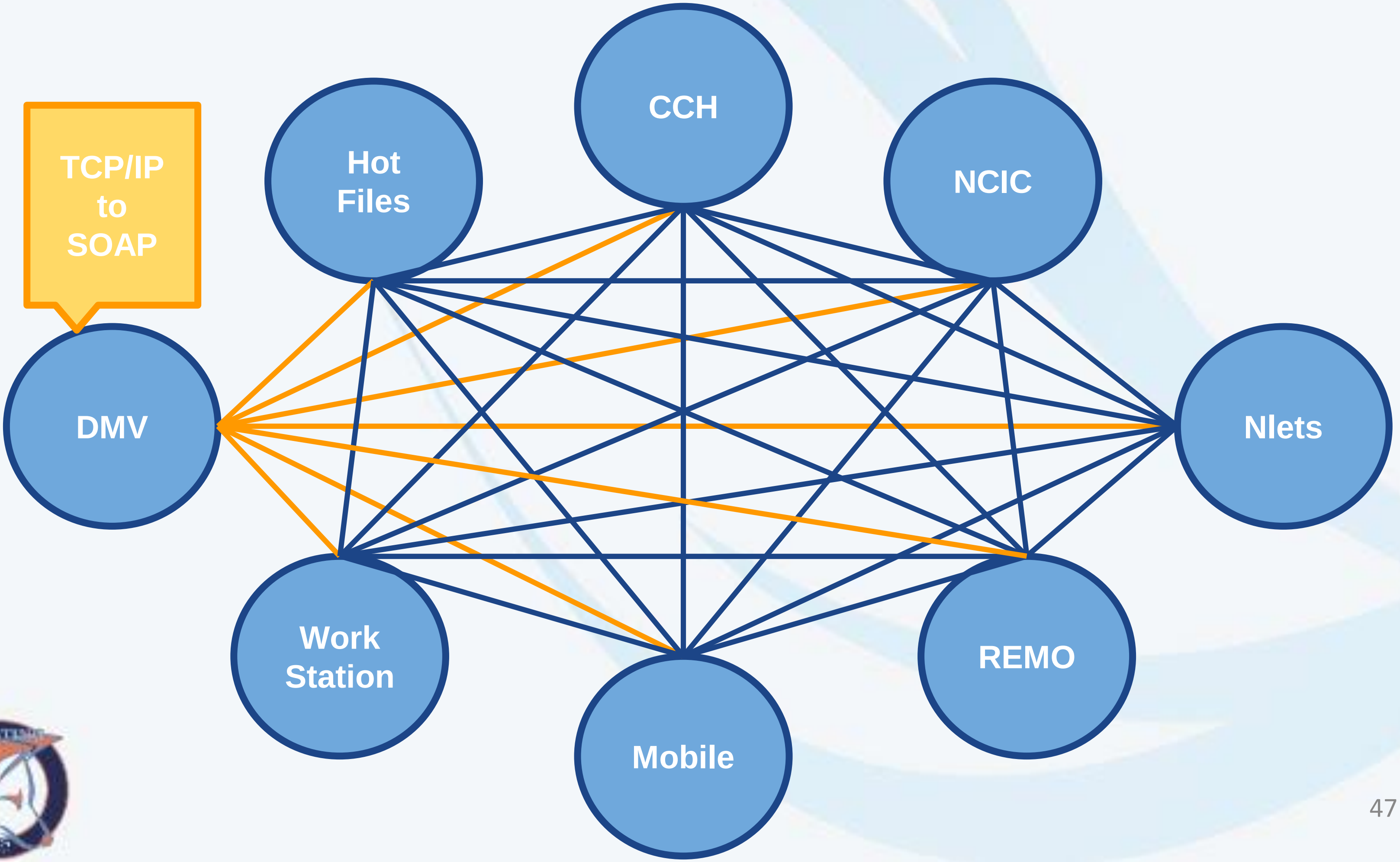

Why? Testing Time and Cost

- **Consider the Protocol Change**
  - **What does testing look like, unfederated?**

1. **Test DMV with Hot Files**
2. **Test DMV with CCH**
3. **Test DMV with NCIC**
4. **Test DMV with Nlets**
5. **Test DMV with Regionals**
6. **Test DMV with Mobiles**
7. **Test DMV with Workstations**
8. **Done!**

Why? Testing Time and Cost

- **Consider the Protocol Change**
  - **What does testing look like, unfederated?**

1. **Test DMV with Hot Files**
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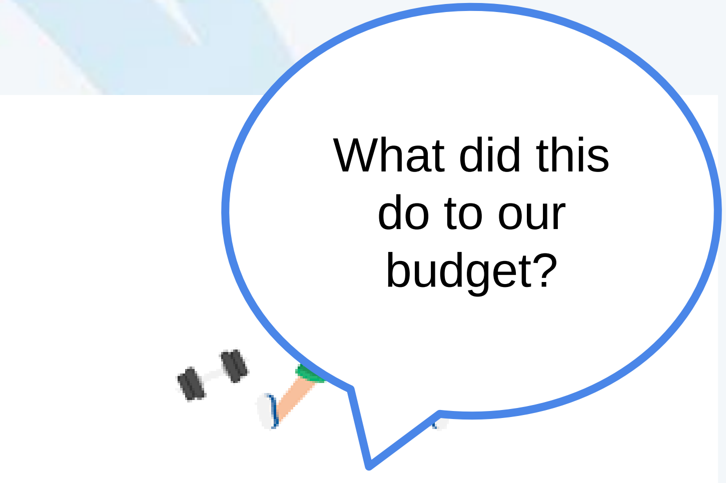
7. **Test DMV with Workstations**
8. **Done!**

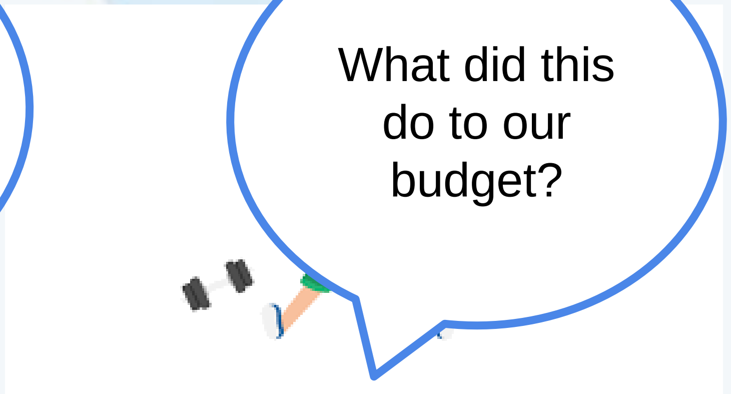


Why? Testing Time and Cost

- **Consider the Protocol Change**
  - **What does testing look like, unfederated?**

1. **Test DMV wi**
2. **Test DMV w**
3. **Test DMV w**
4. **Test DMV wit**
5. **Test DMV with Regionals**
6. **Test DMV with Mobiles**
7. **Test DMV tions**
8. **Done!**

What did this do to our schedule?



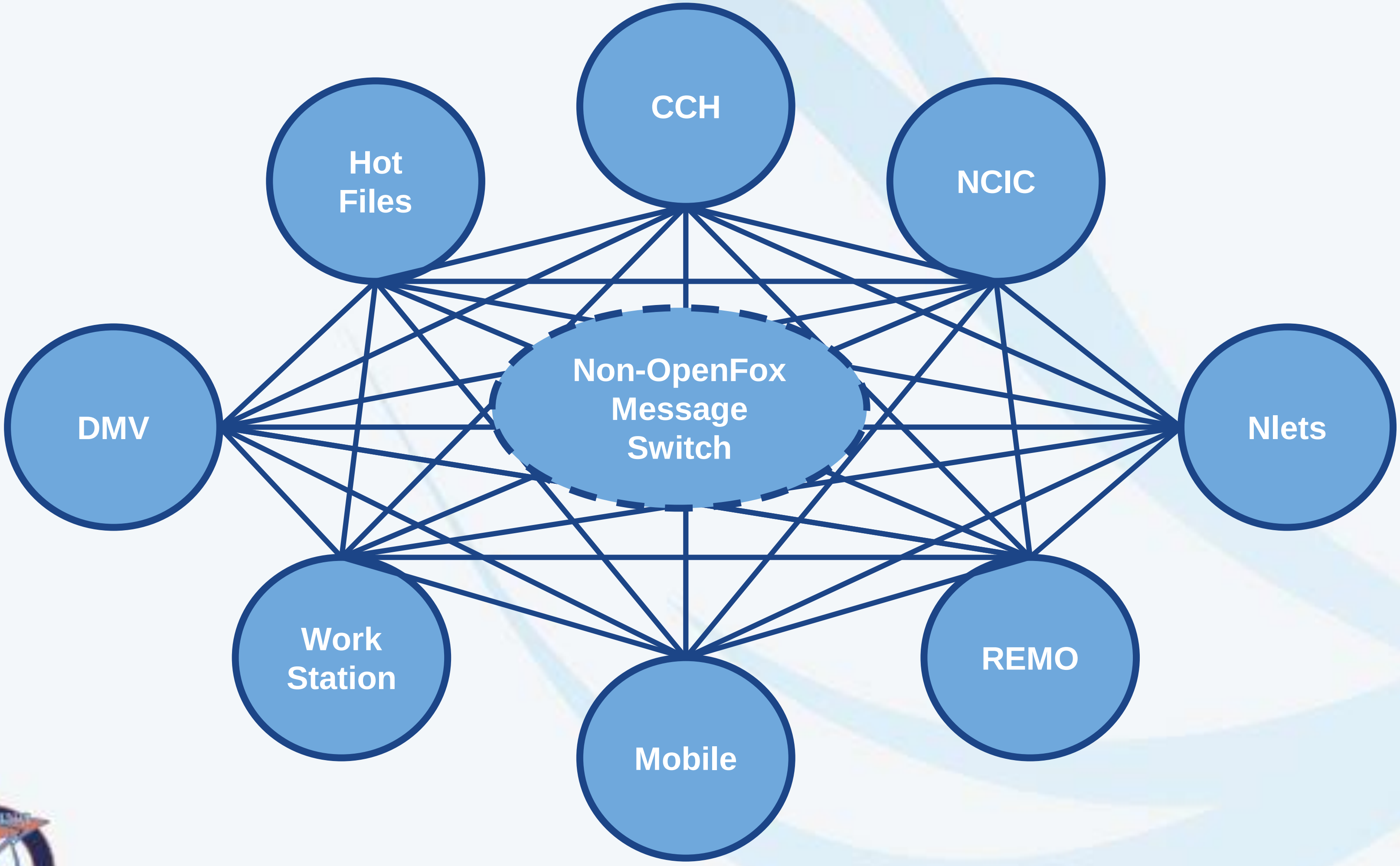
What did this do to our budget?

Why? Other Impacts

- **What else can change without a central control?**
  - **Can an endpoint alter their message format?**
    - **How will everyone else be notified of the change?**
    - **How long will it take for them to be able to consume it?**
  - **Can new services implement new protocols?**
    - **How long will it take everyone else to interface?**
  - **Are there optional elements in the messages that endpoints may implement differently?**
    - **How will everyone find the data important to them?**
  - **How many other system endpoints would be impacted by these sorts of event?**
  - **How will we be able to implement and test all the possible combinations?**

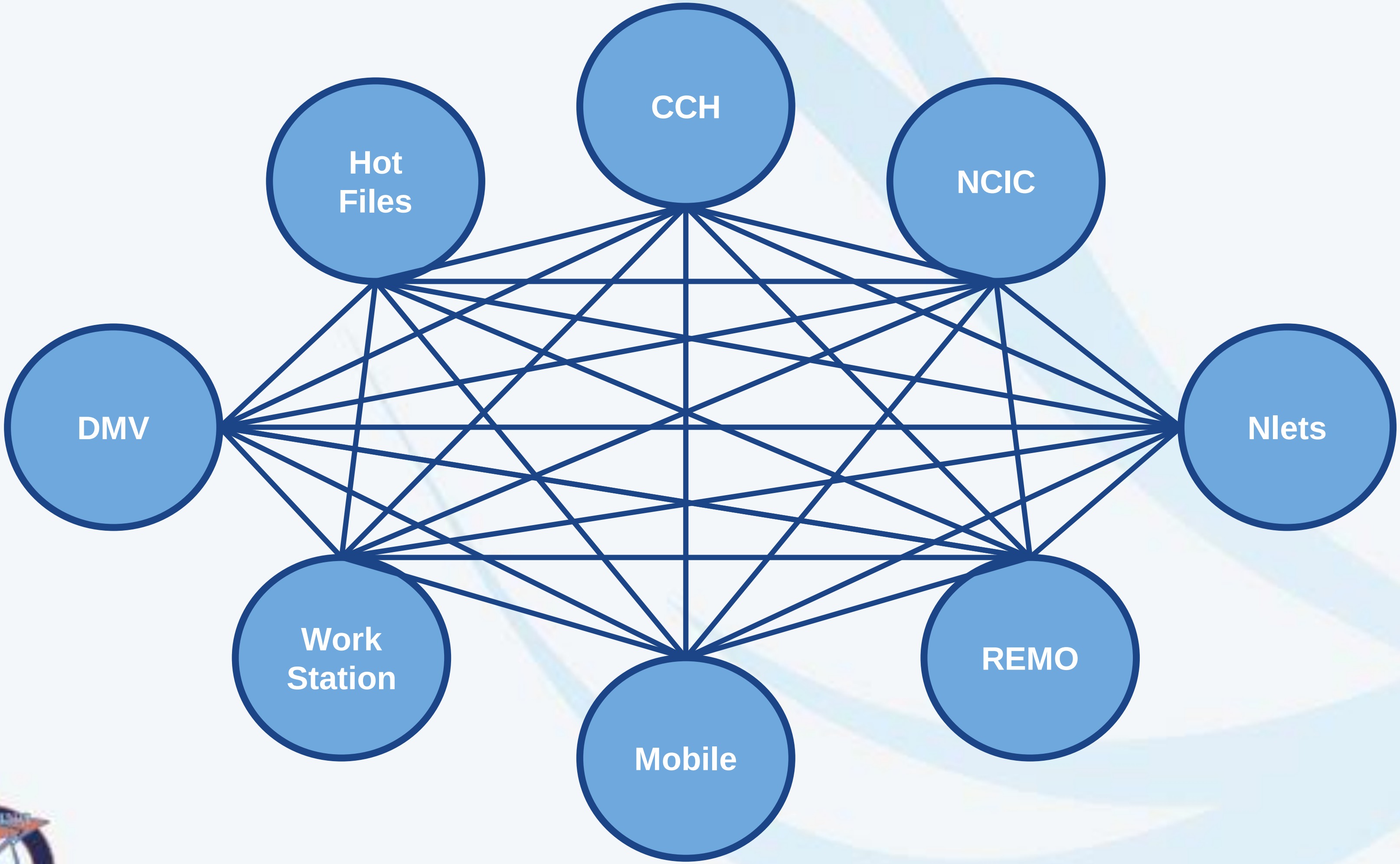
Value Add?

If a system is exposing messaging details to each endpoint:



Value Add?

What is the difference if there is NO system?



Value Add

- **Implementing an OpenFox® message switch that:**
  - **Enforces messaging formats and protocols**
  - **Translates formats and bridges protocols**

- **Gets results that:**
  - **Allow message format changes with MUCH less impact**
  - **Allow protocol changes with MUCH less impact**
  - **GREATLY reduced development budget and schedule**
  - **GREATLY reduced testing budget and schedule**
  - **GREATLY simplify our solution**

Value Add

- Our example was overly simplified

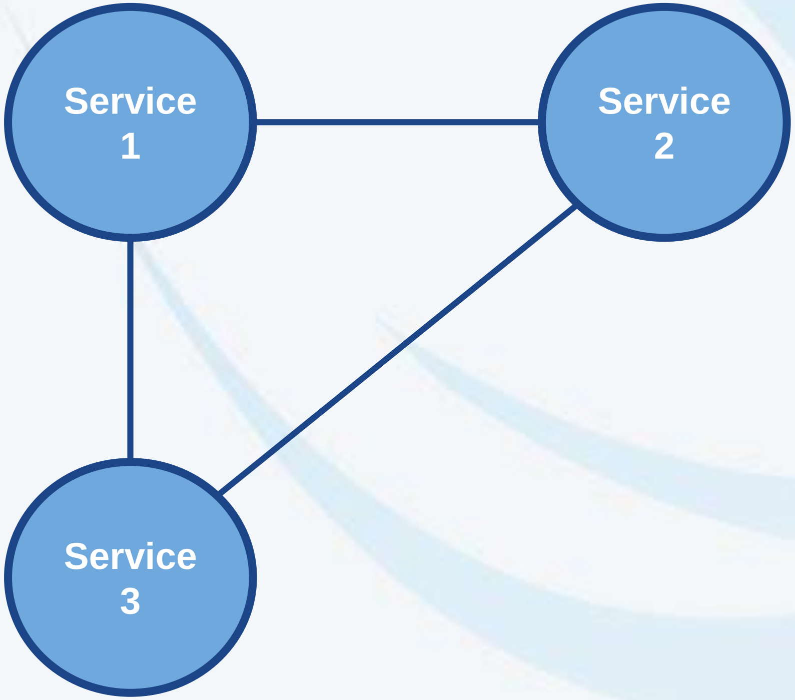
- The real world is worse

  - How many boxes do YOU have for mobile vendors?
  - How many boxes do YOU have for regional systems?
  - Can you imagine all of your regional systems having to change because DMV switched formats or protocols?
  - How long would development and testing take?
  - How much would it cost?

Value Add? Unfederated

- **What happens if we have 3 services**
  - **And we add a 4th**

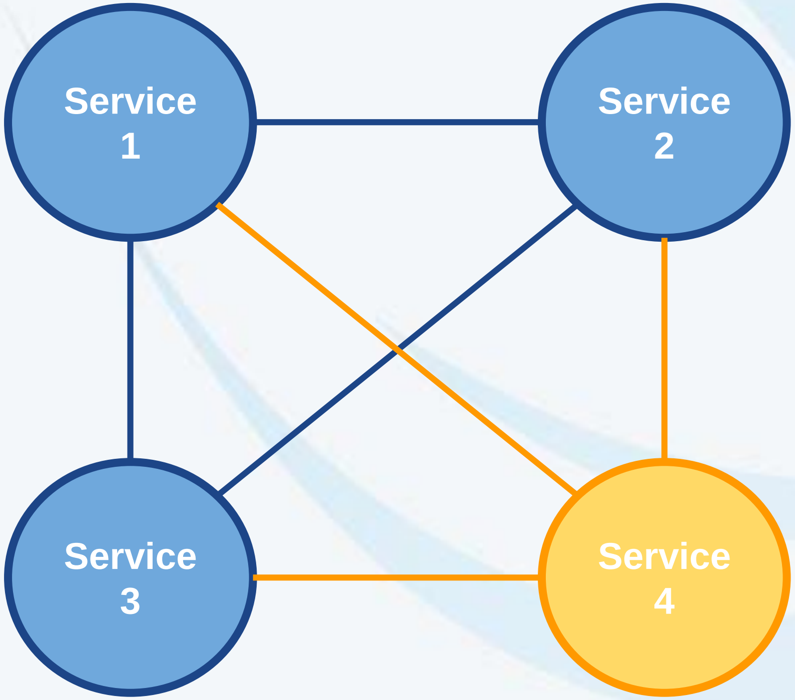
We go from 3 interfaces….



Value Add? Unfederated

- What happens if we have 3 services
  - And we add a 4th

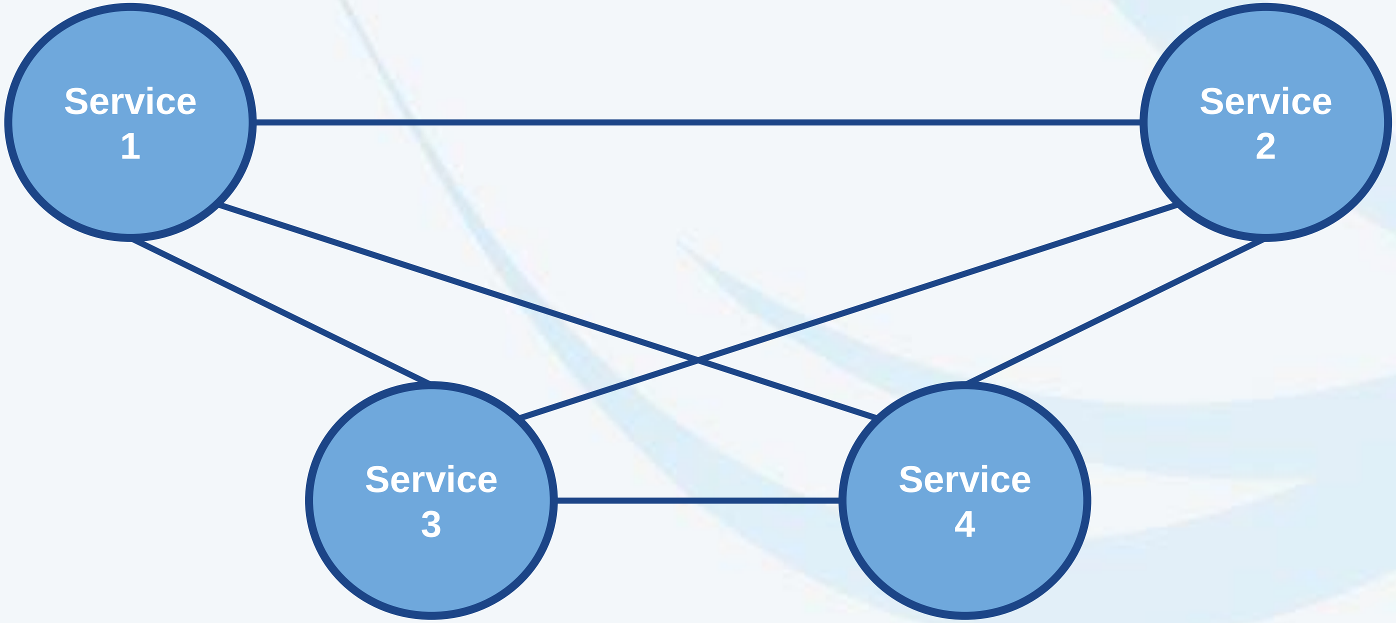
…. to 6 interfaces. 3 new ones to add 1 service



Value Add? Unfederated

- What if we have 4 services
  - And we add a 5th

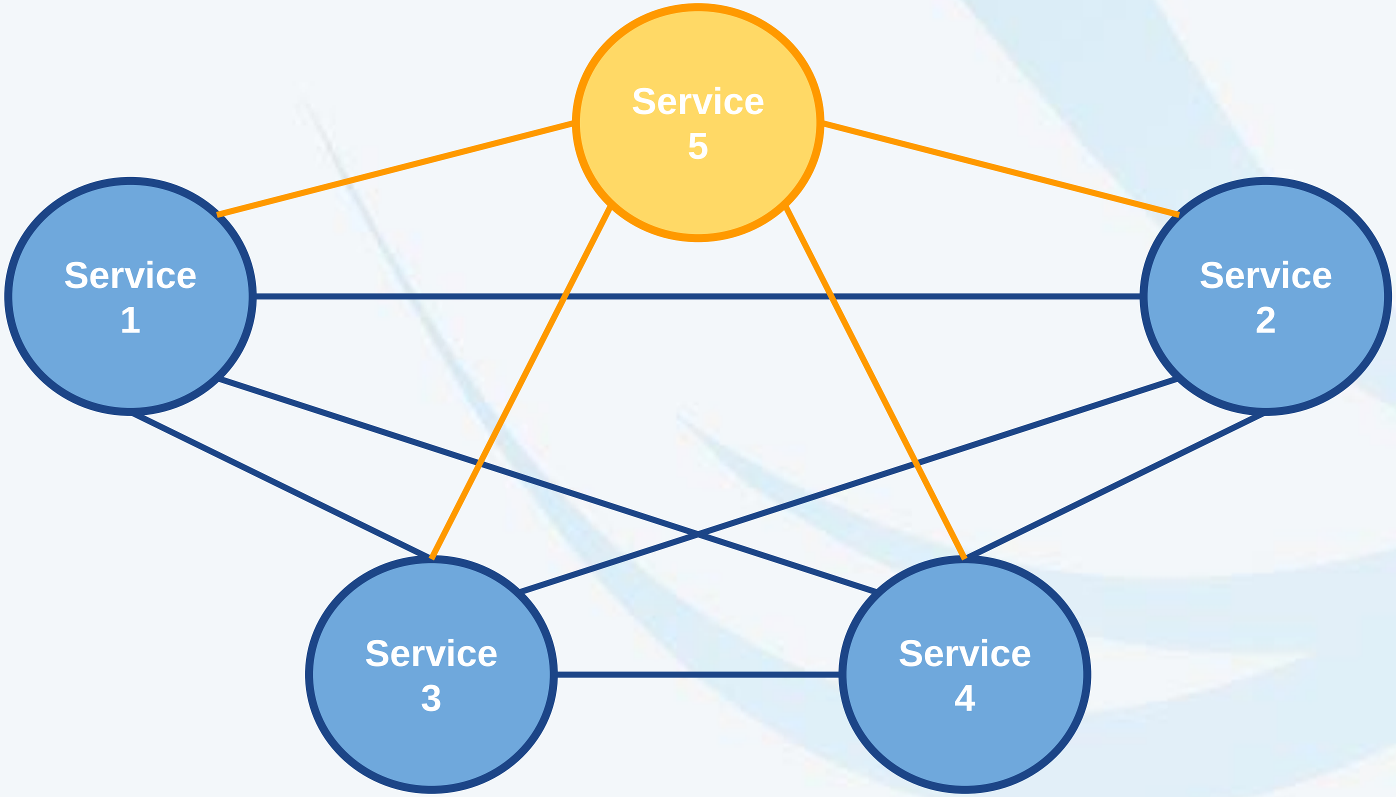
We start with our 6 interfaces….



Value Add? Unfederated

- What if we have 4 services
  - And we add a 5th

And add 4 more, for a total of 10



Value Add? Unfederated

Number of Services	Number of Interfaces	Delta
3	3	
4	6	3
5	10	4

Value Add? Unfederated

Number of Services	Number of Interfaces	Delta
3	3	
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Value Add? Unfederated

Number of Services	Number of Interfaces	Delta
3	3	
4	6	3
5	10	4

Technical Debt

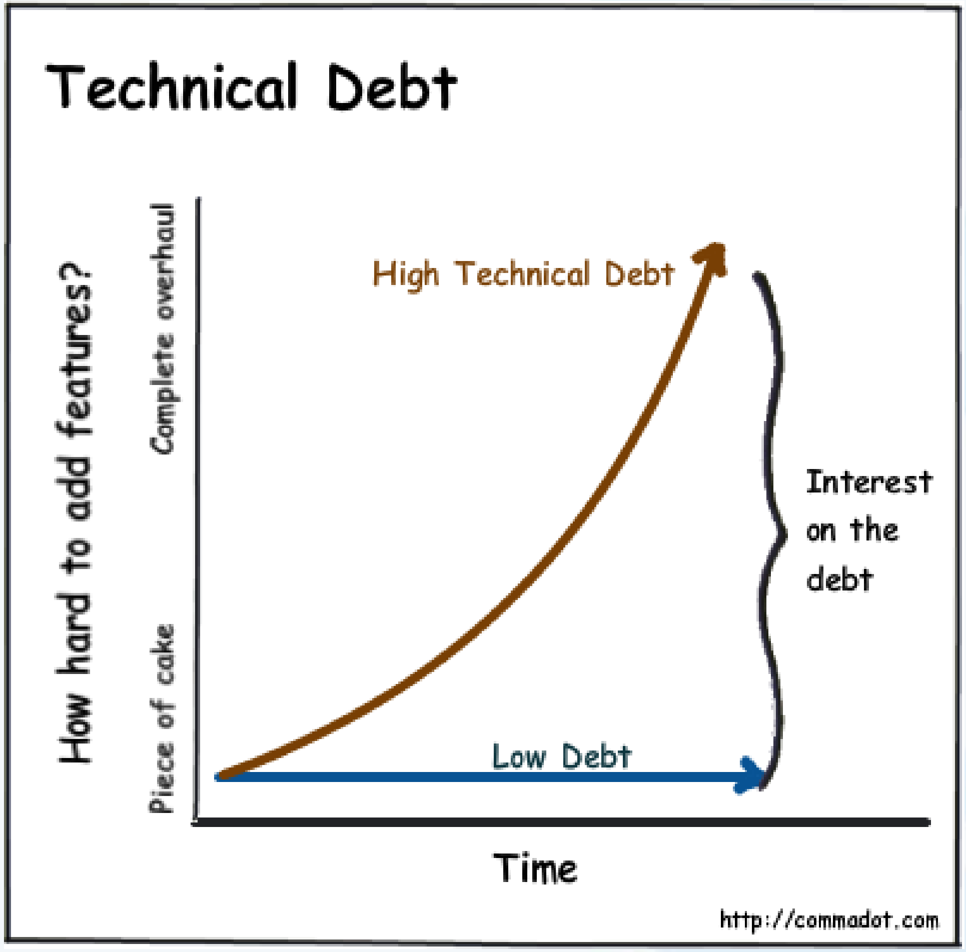
Unfederated - Technical Debt

- **The more you finish, the more you have to do!**
  - **Adding new services gets more and more difficult**
  - **Adding new services takes longer and longer**
  - **Adding new services costs more and more**

- **What is it like going from 9 services to 10?**
  - **You must implement 9 new interfaces**
  - **You will have a total of 45 interfaces to maintain**

Unfederated - Technical Debt

- **This is EXACTLY what the industry means by the term "Technical Debt"**



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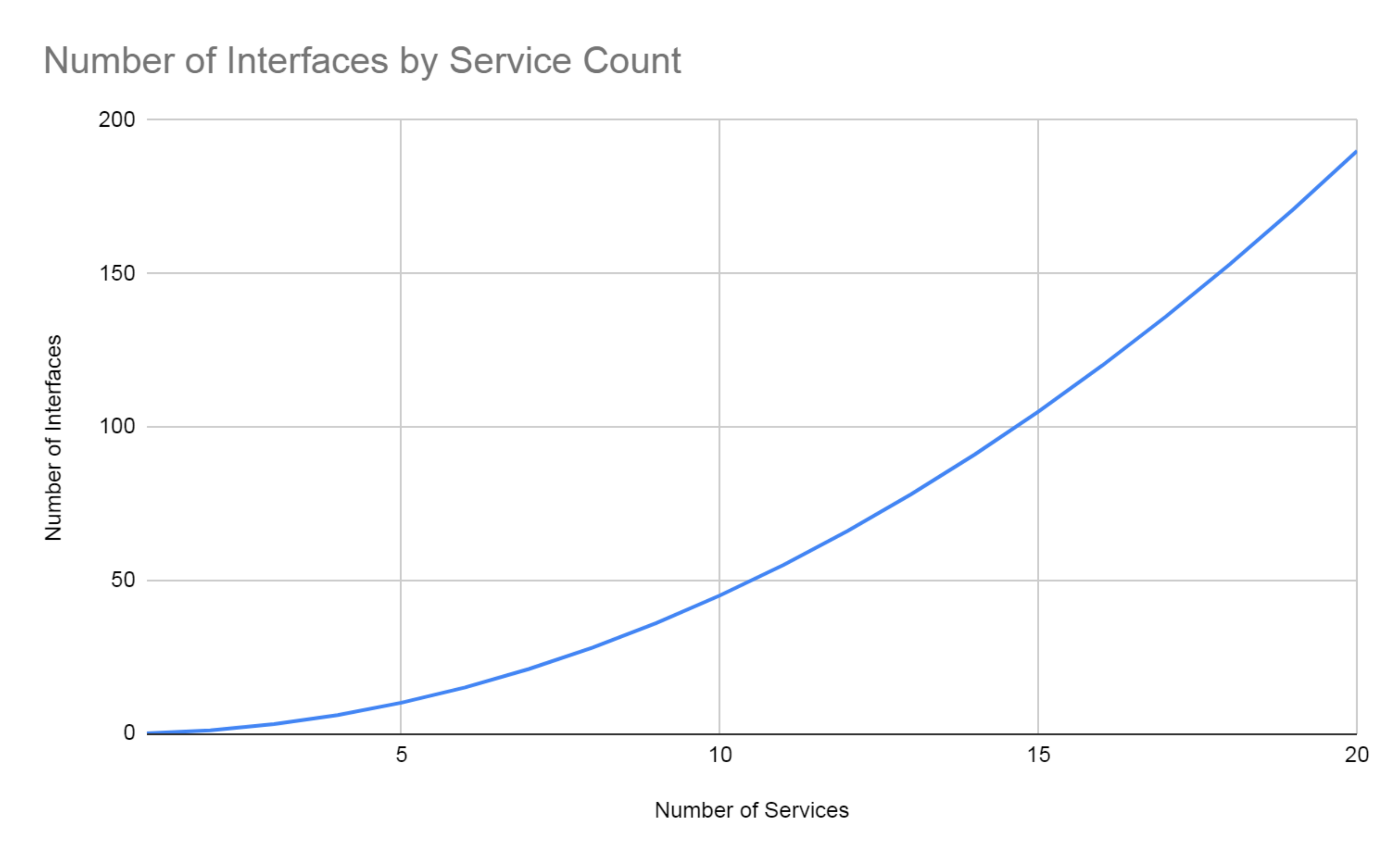

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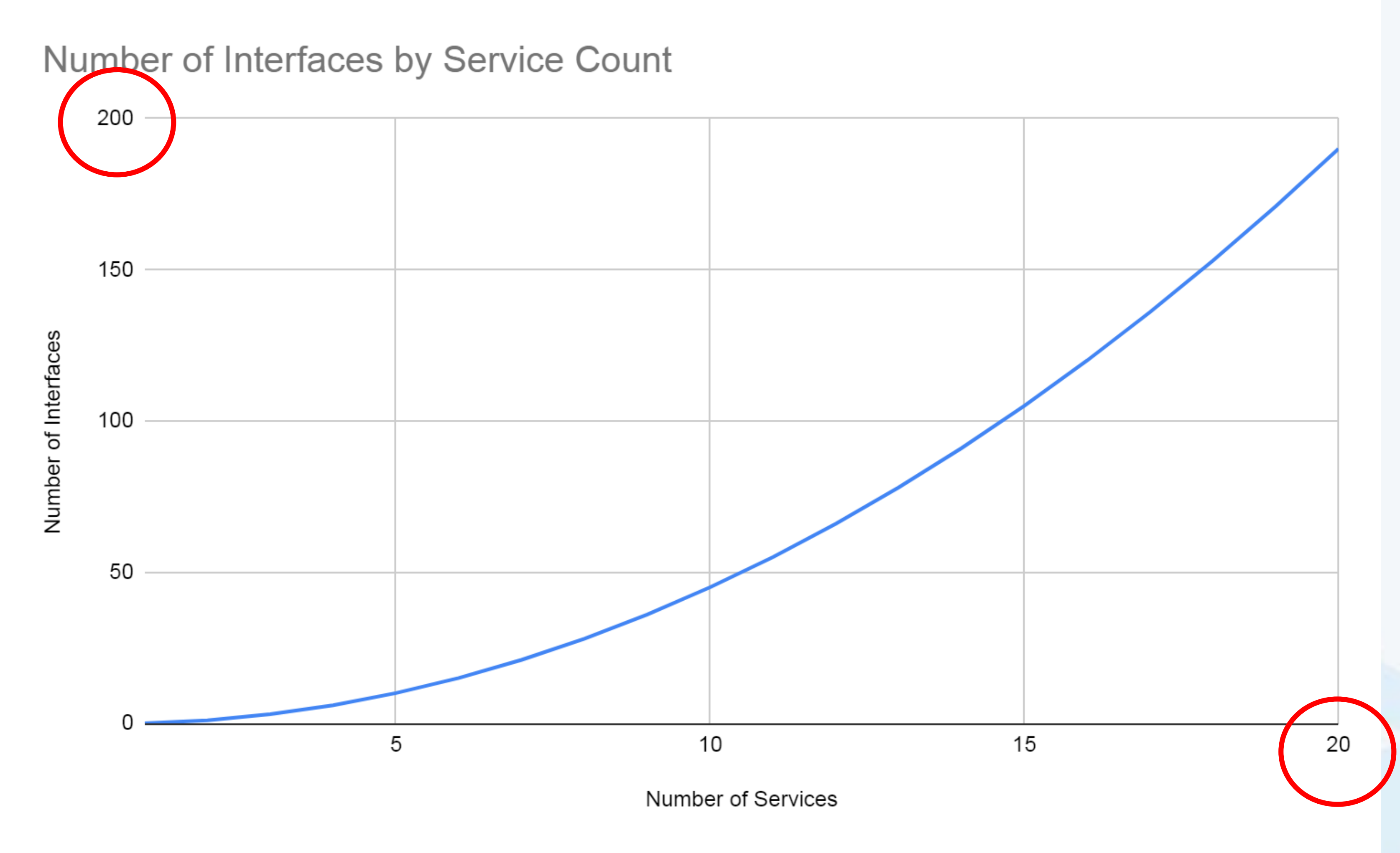
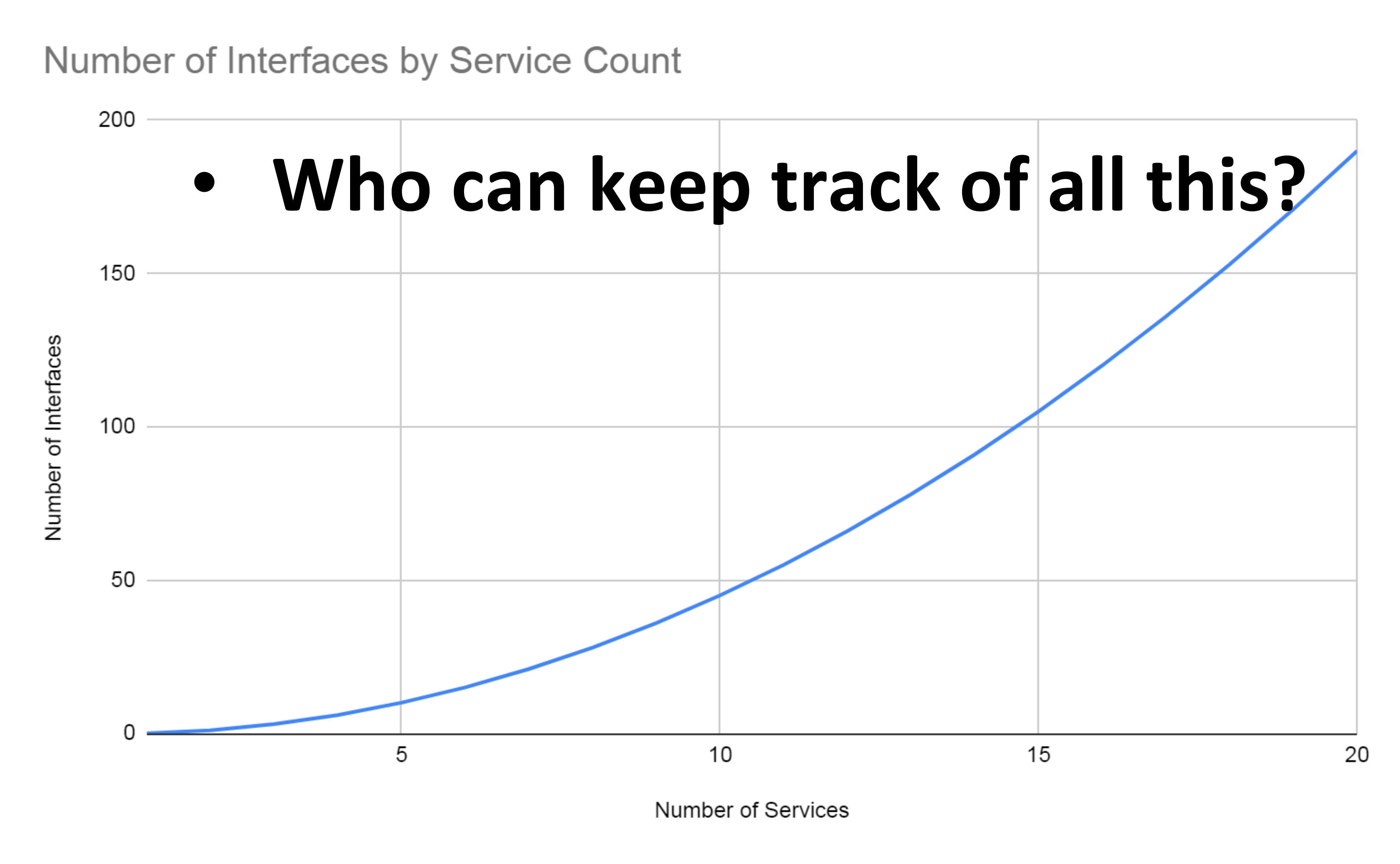
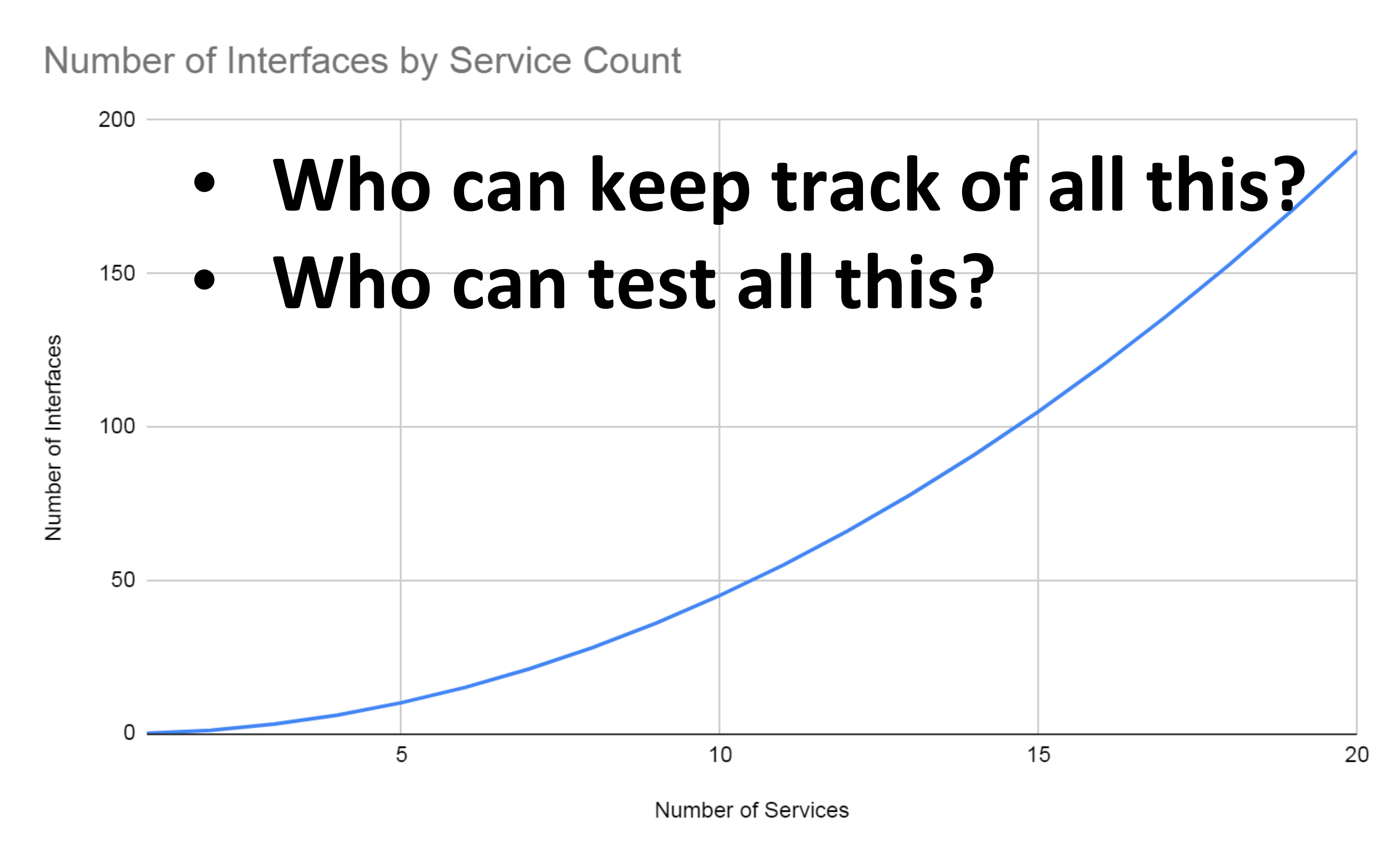


Unfederated - Technical Debt



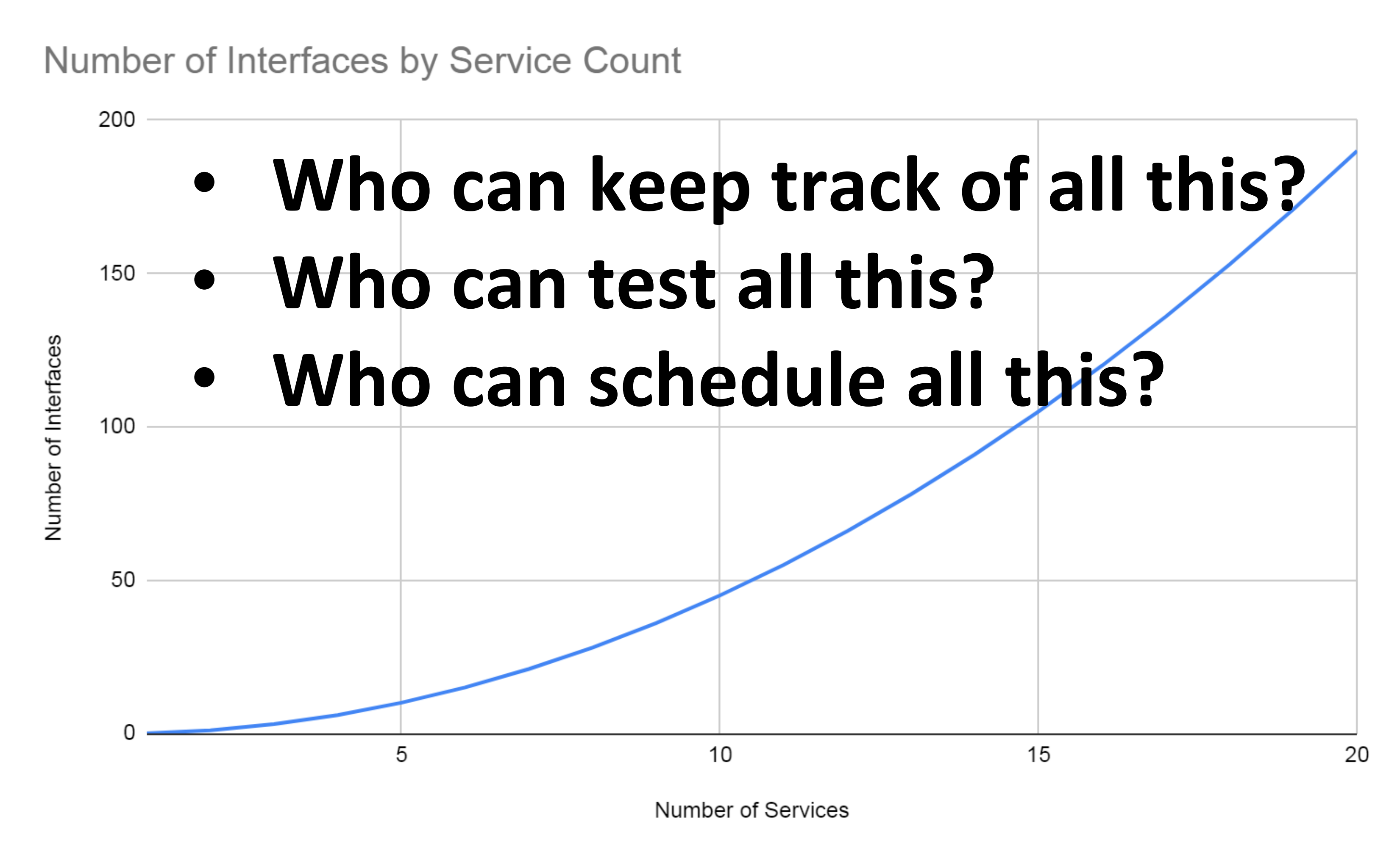
- **Who can keep track of all this?**

Unfederated - Technical Debt



- **Who can keep track of all this?**
- **Who can test all this?**

Unfederated - Technical Debt



- **Who can keep track of all this?**
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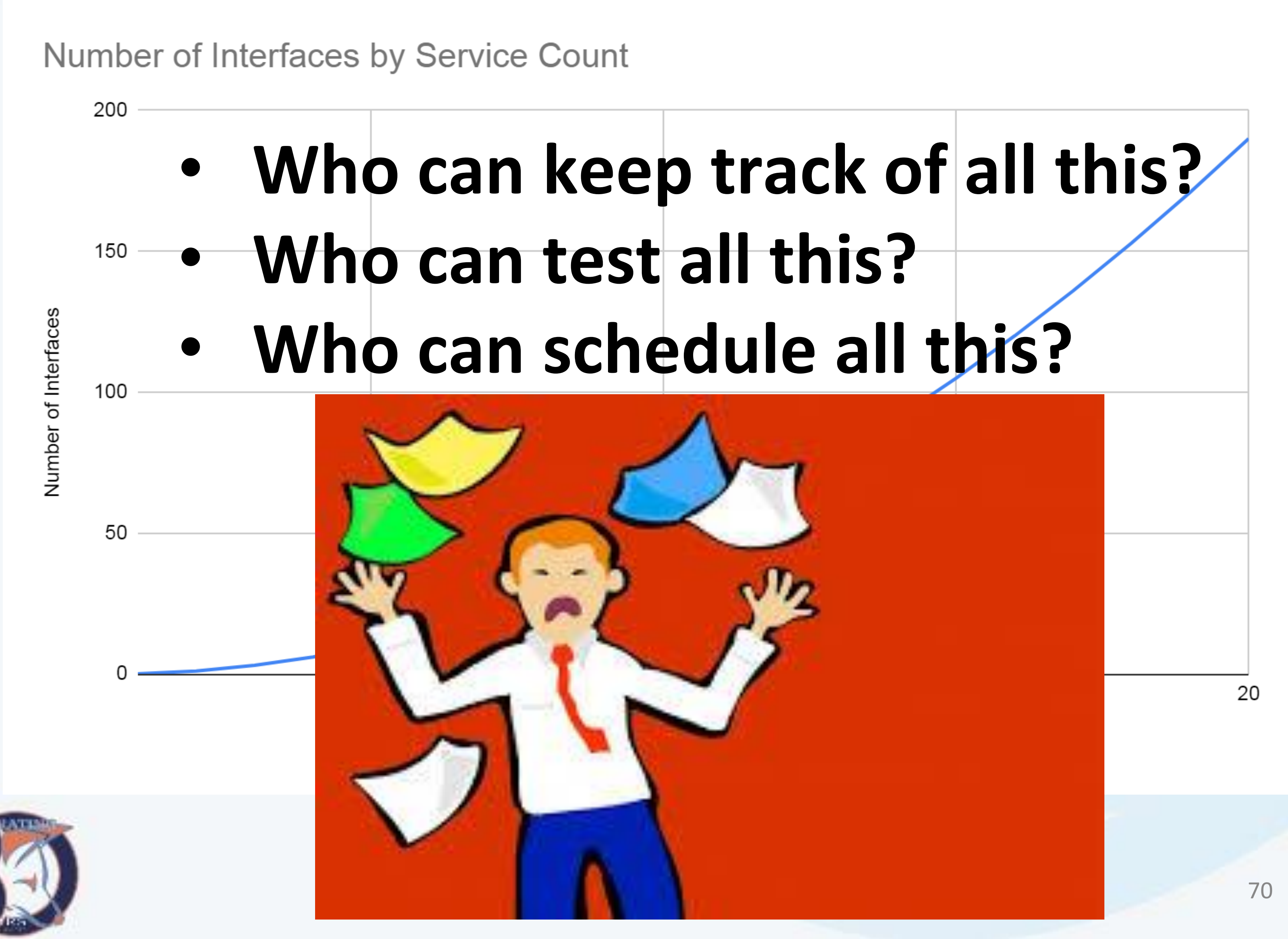
Unfederated - Technical Debt



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OpenFox® Approach

- **What does the chart look like, with the OpenFox® Approach?**

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Number of Services	Number of Interfaces	Delta
3	3	
4	4	1
5	5	1

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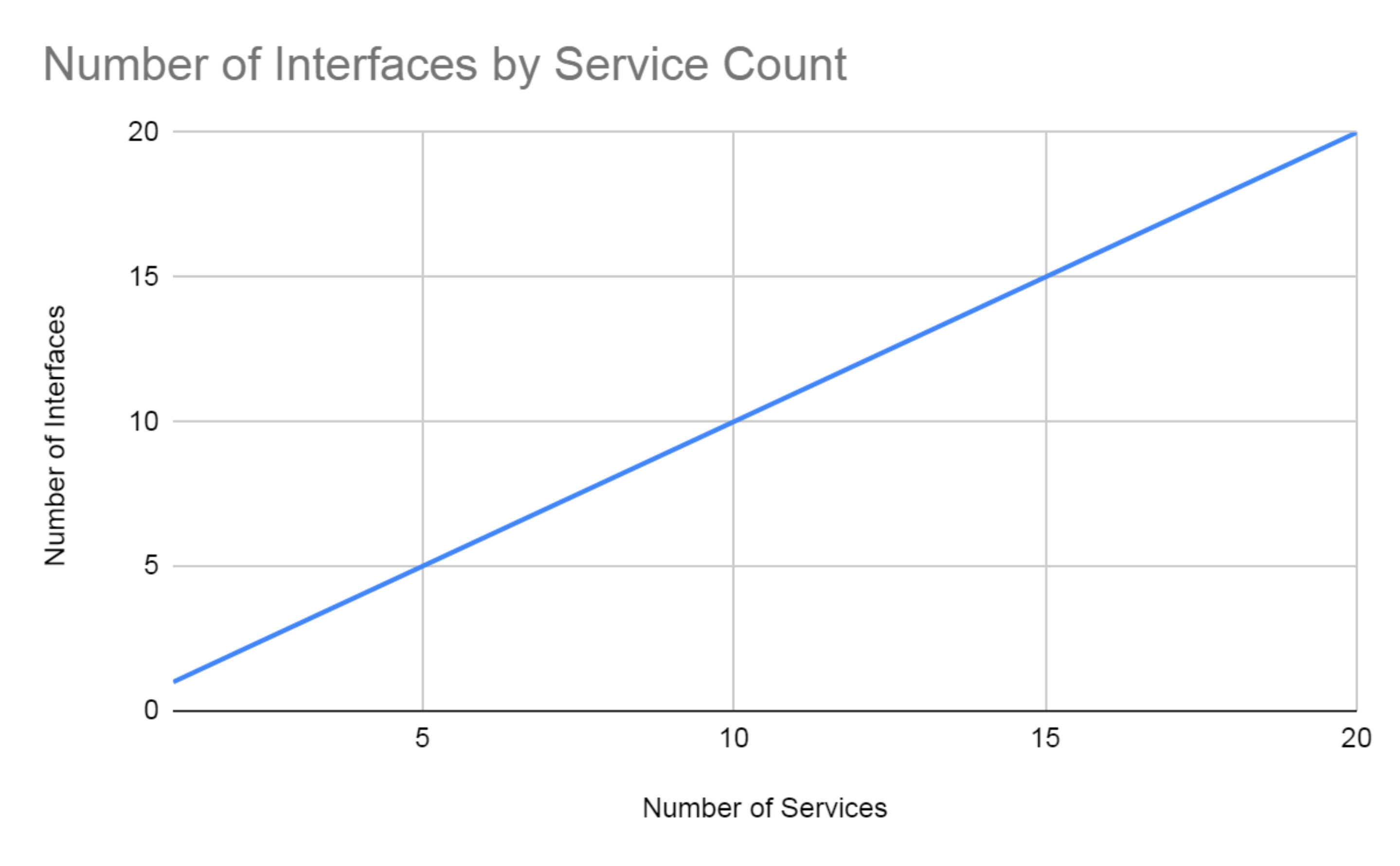

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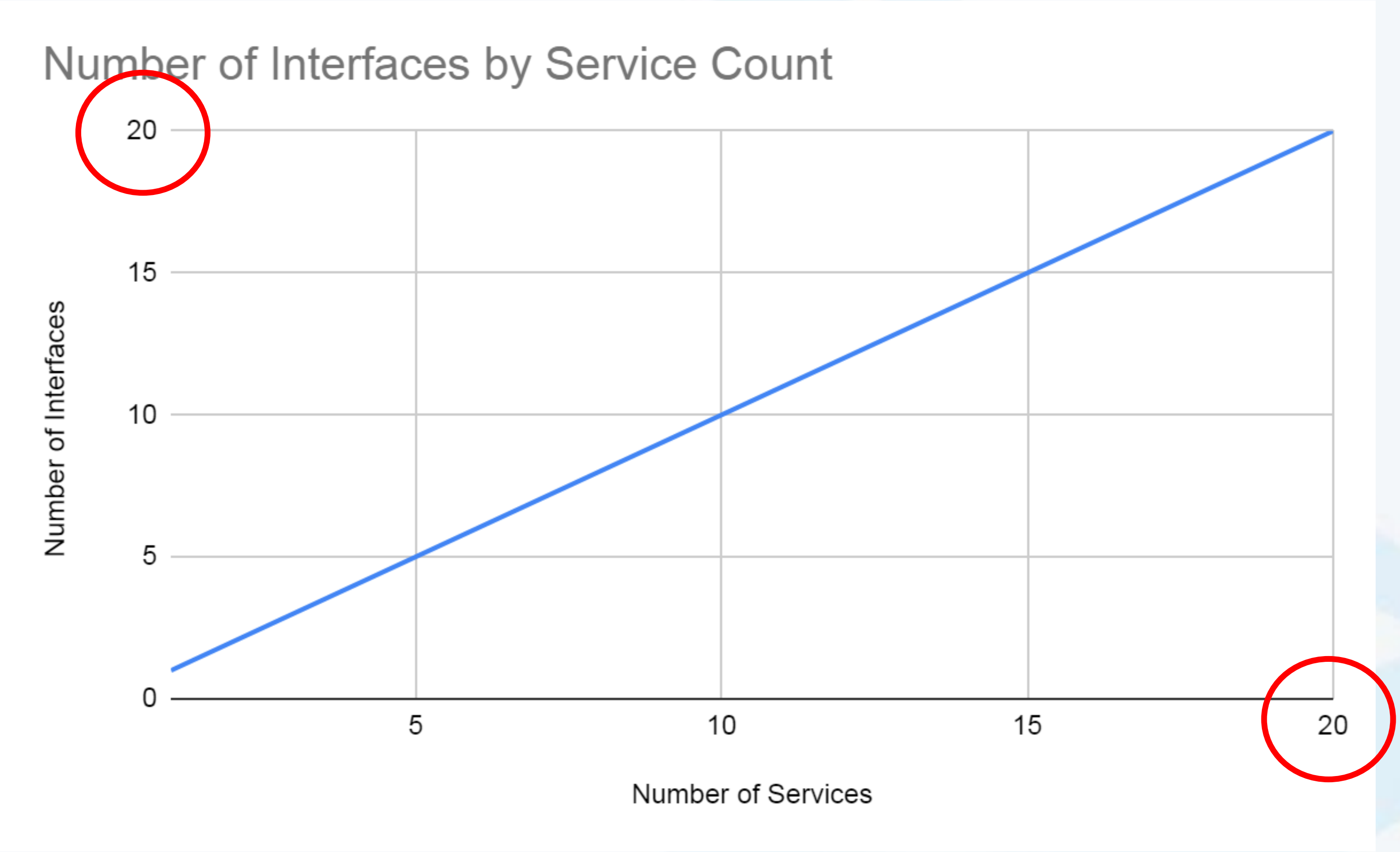

OpenFox® vs Unfederated

- **How do the charts compare to each other?**

OpenFox® vs Unfederated

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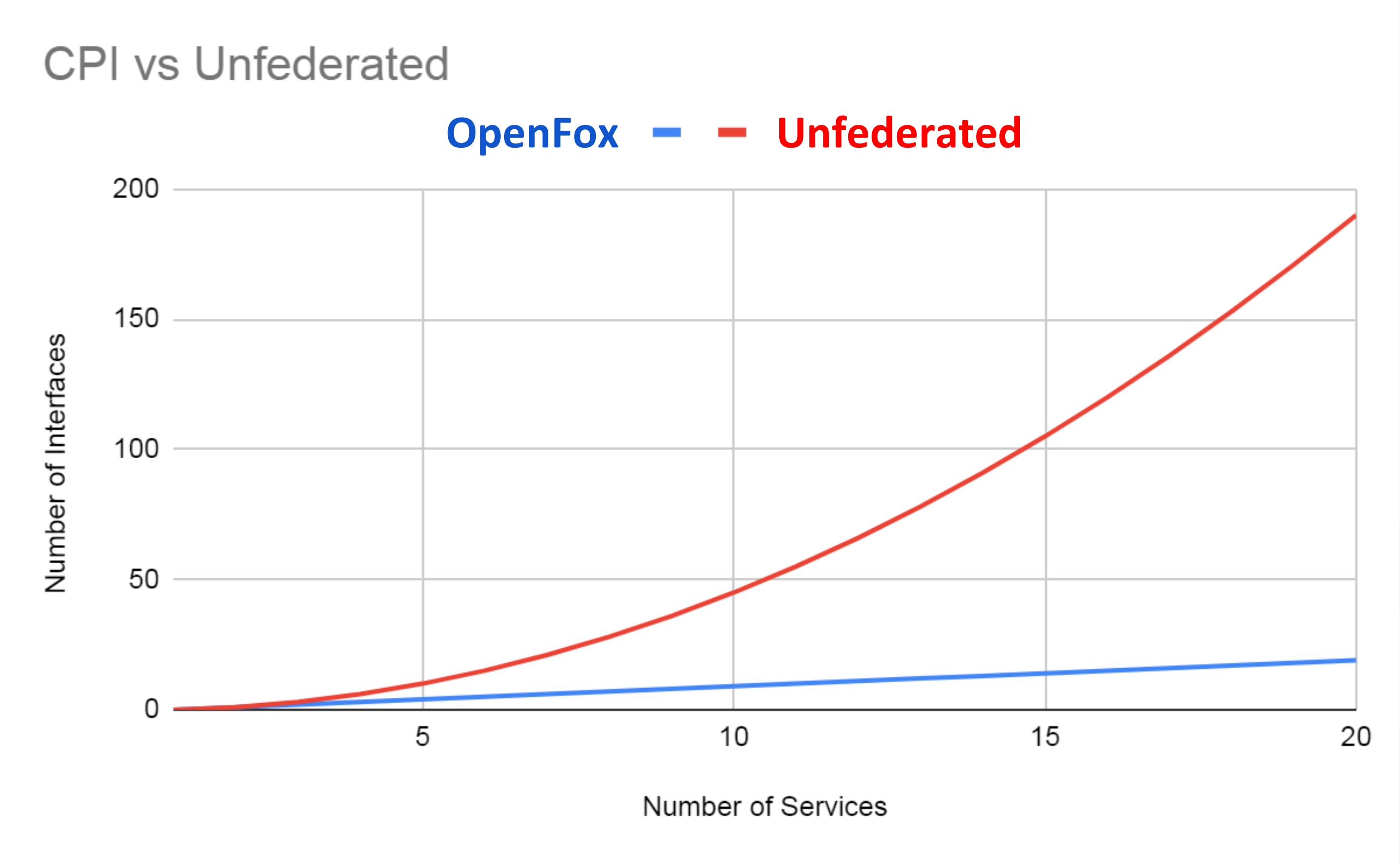
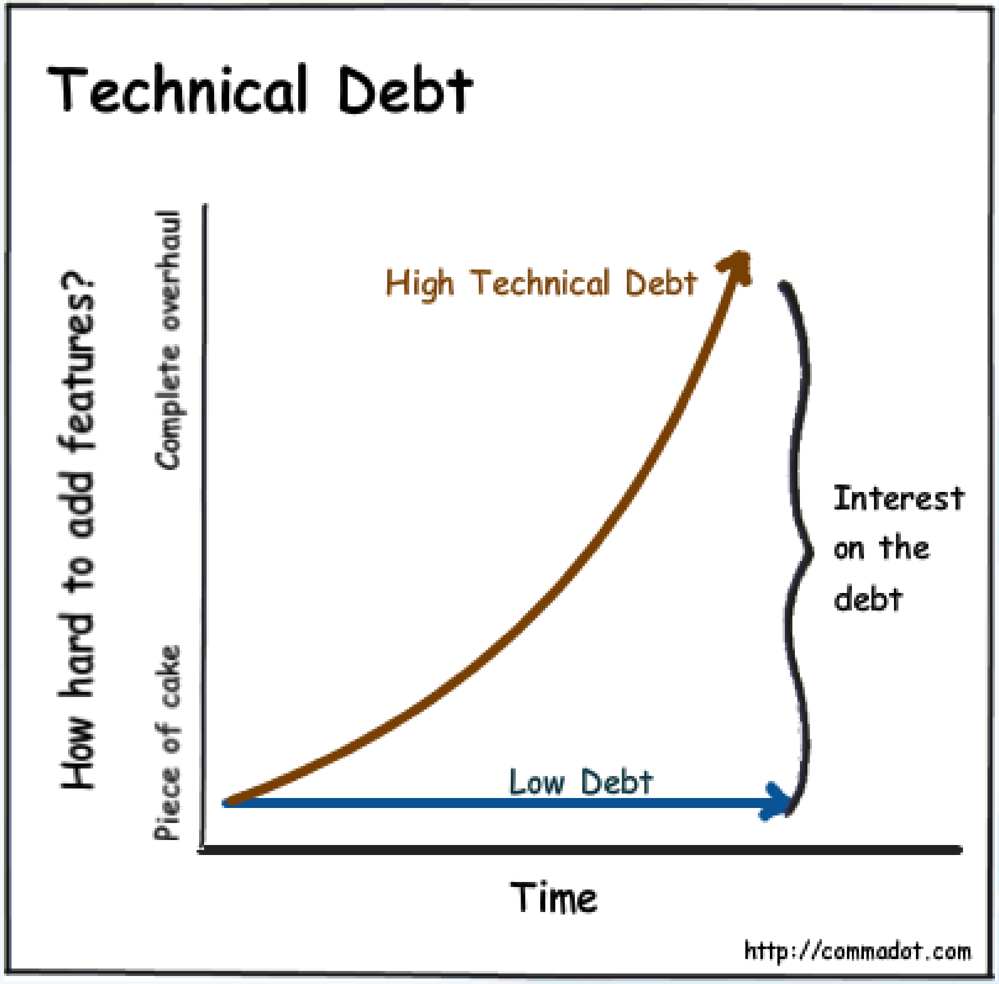


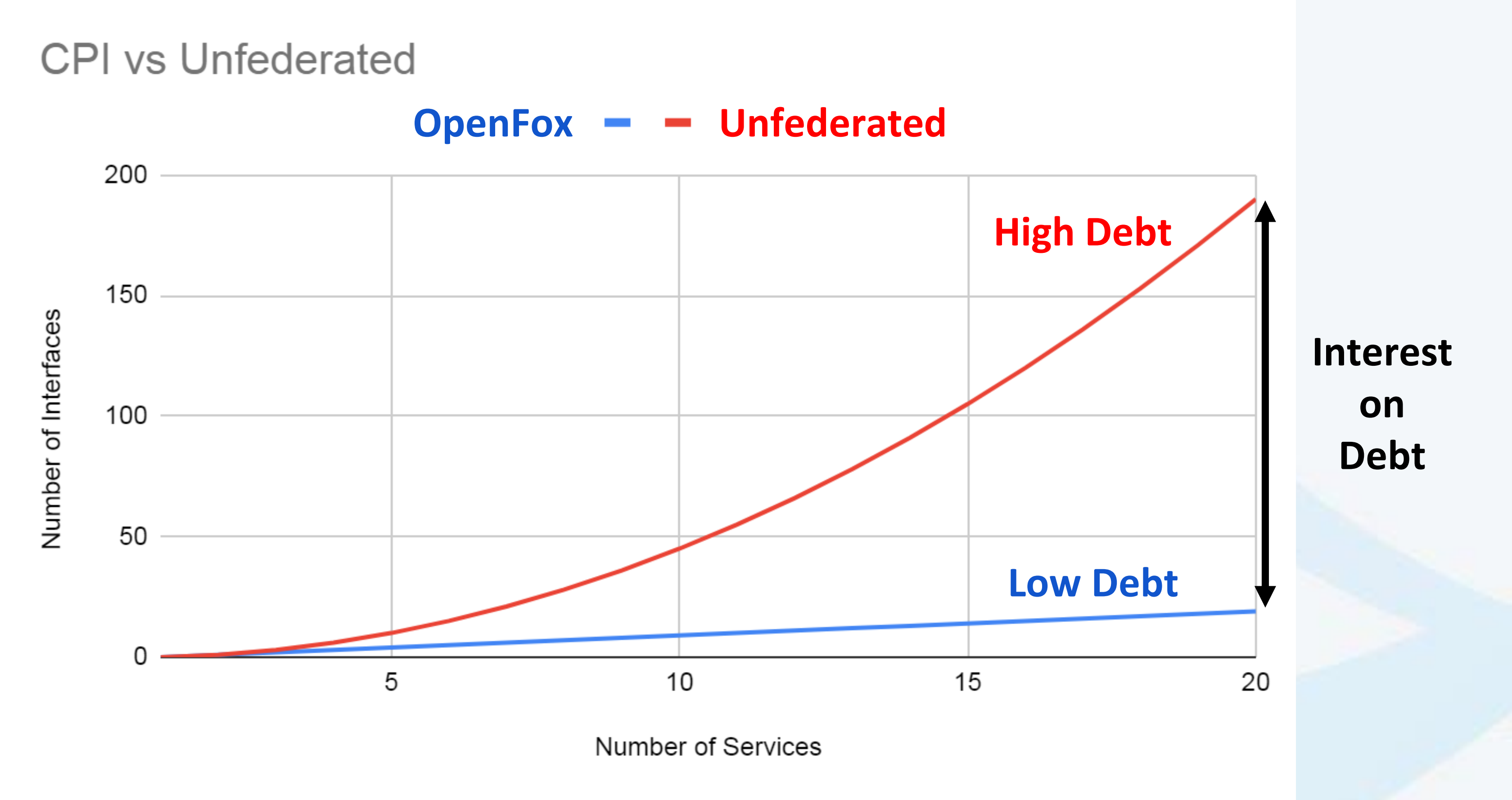
OpenFox® vs Unfederated

- **Remember our Technical Debt Chart?**



OpenFox® vs Unfederated

- ➢ **The OpenFox® Approach is Low Debt**



OpenFox® Approach

- **What does the chart look like, with the OpenFox® Approach?**
  - **The total interface count equals the total services count**
  - **No interest due on technical debt**
  - **Every service you add requires adding 1 interface**
    - **And ONLY one interface!**

- **We saved 170 interfaces with our approach**
  - **170 development cycles**
  - **170 test cases to be run through**
  - **170 events to coordinate at cutover**

Industry Trend - Building Tech Debt

- **Requests for new projects where:**
  - **The new service defines a new message format**
  - **The new service defines a new web service**
  - **The new service doesn’t leverage existing formats**
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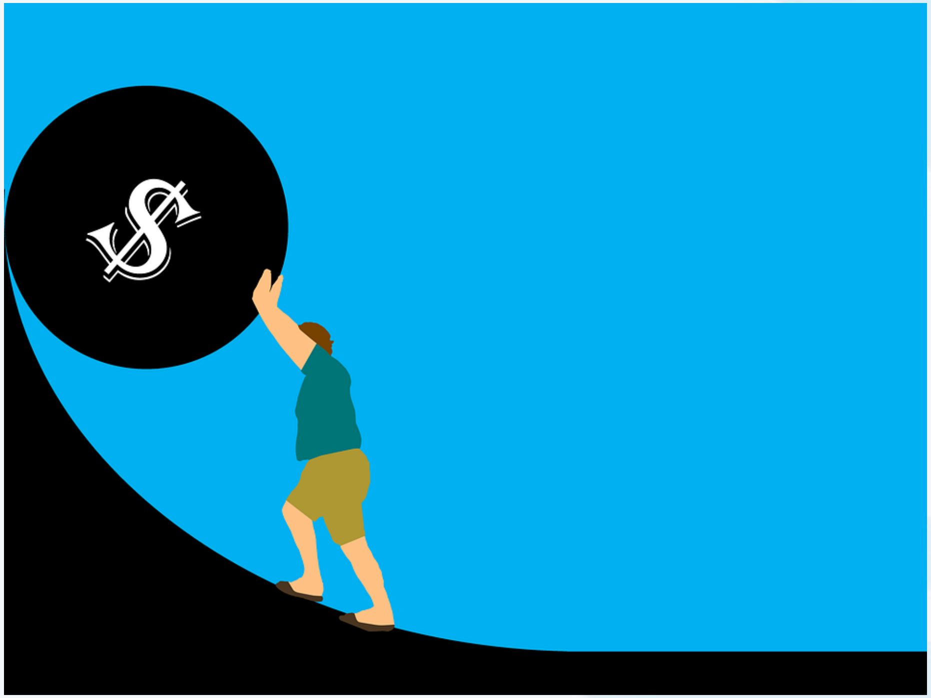

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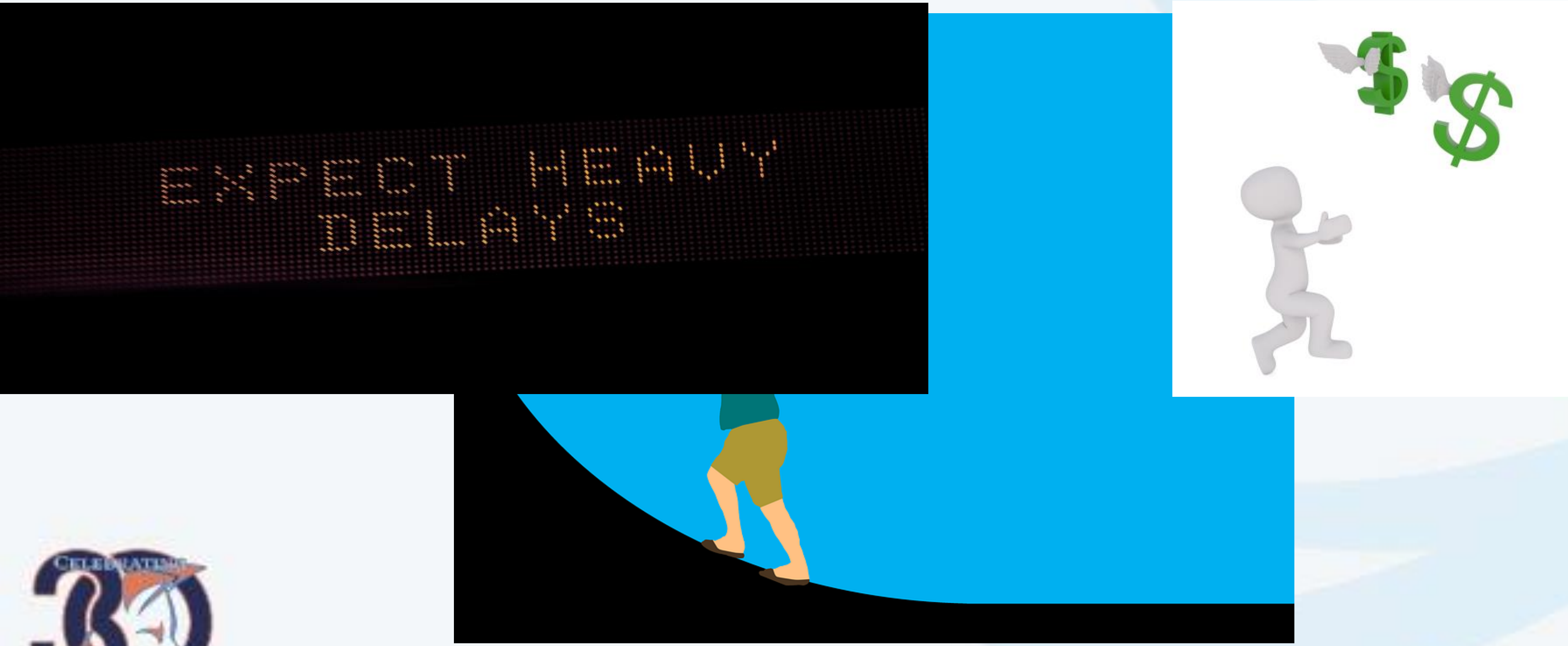

Industry Trend - Building Tech Debt

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OpenFox® Approach

- Benefits information sharing, does not impede it

- Increases consistency and quality of information

- Provides a flexible and extensible solution

- Leverages work already completed

- Doesn’t pay interest on expensive technical debt
  - Keep the technical debt low!
  - Shortcuts today are expensive tomorrow

OpenFox® Approach - Gets it DONE!

- **Benefits informati does not impede it**
- **Increases c nformation**
- **Provides on**
- **Leverage**
- **Doesn’t pa chnical debt**
  - **Keep the tec**
  - **Shortcuts today a orrow**

Thank you!

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