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First Responder IoT Environments:
Examining Data Foundations

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PUBLIC SAFETY INTERNET OF THINGS

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This work is sponsored by:

Agenda

- Introduction to PSCR / DHS S&T Project
- Data Foundations Project Goals
- The Benefits of Defined Data
- Phase 1 Outcomes
- Conclusion / Contact Us

Introduction to Data Foundations Project

- Began in 2017
- Initial Goal: Research interoperability issues related to Personal Area Network sensor systems
  - For additional information, see previous PSCR Stakeholder sessions
  - 2018: Personal Area Networking and the Internet of Things
  - 2019: Next Generation First Responder Deployables and IoT Technology
- There are currently numerous efforts underway to standardize the way that public safety interacts with data
- In 2019, the project began in-depth discussions with both public safety and industry players

Roundtable Conclusions

Capabilities Required of Public Safety IoT Devices

Data Progression

Raw IoT data should move from the network edge to the public safety user, with data enrichment to provide enhanced situational awareness

Consistent Situational Awareness Data

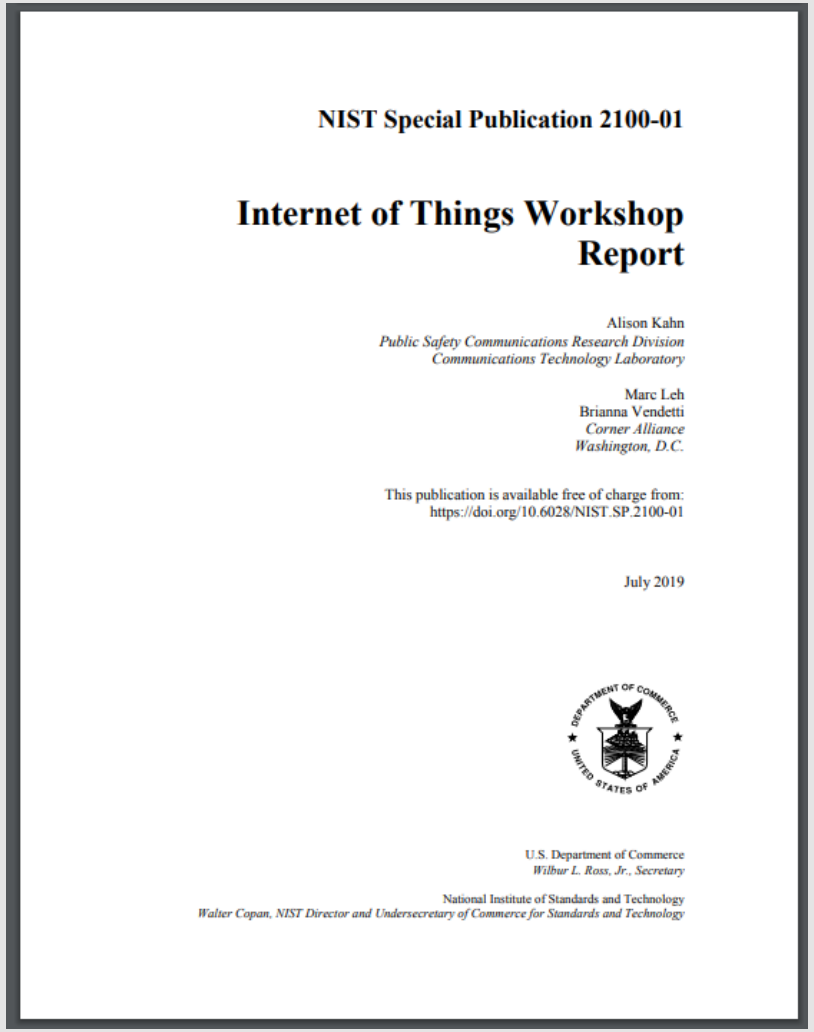
Data used by public safety must be vetted, real-time, reliable

Data Formats and Interfaces

Vendor applications and visualizations can be more open if the data ingested is a known entity

Full overview of workshop proceedings is available: NIST.SP.2100-01

https://www.nist.gov/publications/internet-things-workshop-report



NIST Special Publication 2100-01

Internet of Things Workshop Report

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Communications Technology Laboratory

Marc Leh
Brianna Vendetti
Corner Alliance
Washington, D.C.

This publication is available free of charge from:
https://doi.org/10.6028/NIST.SP.2100-01

July 2019

U.S. Department of Commerce
Wilbur L. Ross, Jr., Secretary

National Institute of Standards and Technology
Walter Copan, NIST Director and Undersecretary of Commerce for Standards and Technology

Data Foundation Goals

Data as a Quilt

- Each square in the quilt represents a piece of data
- A series of connected squares is a full quilt
- There are many ways to connect the squares
- But without knowing what your squares look like when you start, the quilt could end up disorganized

Data Foundation Goals

Data as a Quilt

- Each square in the quilt represents a piece of data
- A series of connected **data objects** make a full **system**
- There are many ways to connect the **data (via standards)**
- But without knowing what your **data** looks like from the start, the **system** could end up disorganized and difficult to utilize

Data Foundation Goals

Project Outputs

- Determine which data is most important through public safety consensus feedback
- Define software objects to represent these data objects
- Develop a document that shows the necessary data objects within a public safety sensor system

GPS Location

Sample Data Object

INDEXES	SHORT FORM	GLOBAL?	UNITS	REQUIRED	DATA TYPE	SAMPLE VALUE	OOBNV
Latitude	lt	Global	degrees	✓	<float>	36.089	999
Longitude	lg	Global	degrees	✓	<float>	-79.162123	999
Altitude	lz	Global	meters (AMSL)	✓	<integer>	182	-999
Speed	ls		meters/sec	✓	<float>	22.35	-1
SpeedMph	lm		miles/hr	✓	<integer>	50	-1
Heading	lh	Global	degrees	✓	<integer>	359	-1
Accuracy	la	Global	meters	✓	<integer>	4	-1
Numsats	lns			✓	<integer>	7	-1
Timestamp	ts		seconds	✓	<integer>	1596014568	-2
Source	src			✓	<string>	"GPS" or "Wi-Fi"	""

GPS Location

Sample Data Object

INDEXES	SHORT FORM	GLOBAL?	UNITS	REQUIRED	DATA TYPE	SAMPLE VALUE	OOBNV
Latitude	lt	Global	degrees	✓	<float>	36.089	999
Longitude	lg	Global	degrees	✓	<float>	-79.162123	999
Altitude	lz	G		✓	<integer>	182	-999
Speed	ls			✓	<float>	22.35	-1
SpeedMph	lm			✓	<integer>	50	-1
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Source	src			✓	<string>	"GPS" or "Wi-Fi"	""

The long form identifiers for each information element

GPS Location

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Latitude	lt	Global	degrees	✓	<float>	36.089	999
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Speed	ls		meter		<float>	22.35	-1
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Source	src			✓	<string>	"GPS" or "Wi-Fi"	""

Shortened identifiers used when data size and bandwidth are limited

GPS Location

Sample Data Object

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Latitude	lt	Global	degrees	✓	<float>	36.089	999
Longitude	lg	Global	degrees			79.162123	999
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Speed	ls		meters/sec			22.35	-1
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Accuracy	la	Global	meters	✓	<integer>	4	-1
Numsats	lns			✓	<integer>	7	-1
Timestamp	ts		seconds	✓	<integer>	1596014568	-2
Source	src			✓	<string>	"GPS" or "Wi-Fi"	""

Core information that can be referenced in other data objects

GPS Location

Sample Data Object

INDEXES	SHORT FORM	GLOBAL?	UNITS	REQUIRED	DATA TYPE	SAMPLE VALUE	OOBNV
Latitude	lt	Global	degrees	✓	<float>	36.089	999
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Altitude	lz	Global	meters (AMSL)		<inte		-999
Speed	ls		meters/sec		<flo		-1
SpeedMph	lm		miles/hr		<integer>	50	-1
Heading	lh	Global	degrees		<integer>	359	-1
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Numsats	lns				<integer>	7	-1
Timestamp	ts		seconds		<integer>	1596014568	-2
Source	src				<string>	"GPS" or "Wi-Fi"	""

Expected units of measure for each index

GPS Location

Sample Data Object

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Latitude	lt	Global	degrees	✓	<float>	36.089	999
Longitud		bal	degrees	✓	<float>	-79.162123	999
Altitud		bal	meters (AMSL)	✓	<integer>	182	-999
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Timestamp	ts		seconds	✓	<integer>	1596014568	-2
Source	src			✓	<string>	"GPS" or "Wi-Fi"	""

Specified if an index MUST be present in a data object

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Latitude	lt	Global	degrees	✓	<float>	36.089	999
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Timestamp	ts		seconds	✓	<integer>	1596014568	-2
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Data type of the attribute

GPS Location

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Speed	ls				<float>	22.35	-1
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Numsats	lns				<integer>	7	-1
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Sample of how the data should be presented

GPS Location

Sample Data Object

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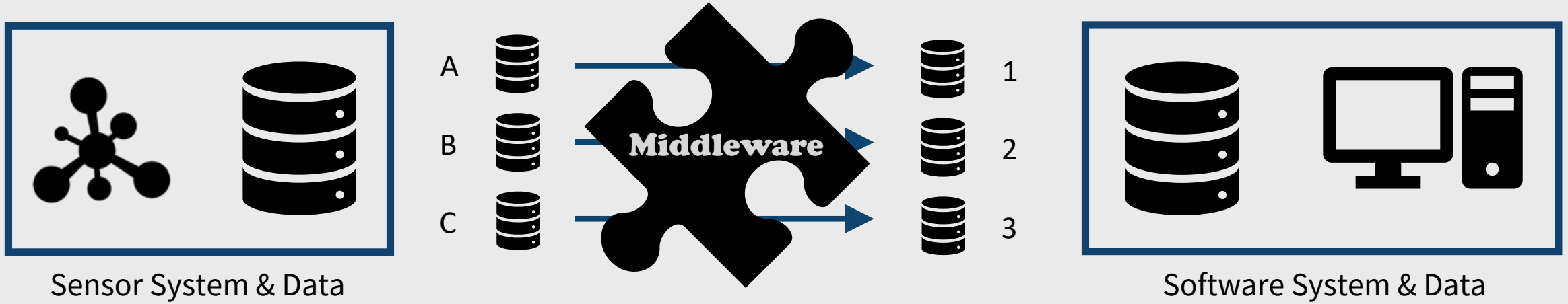
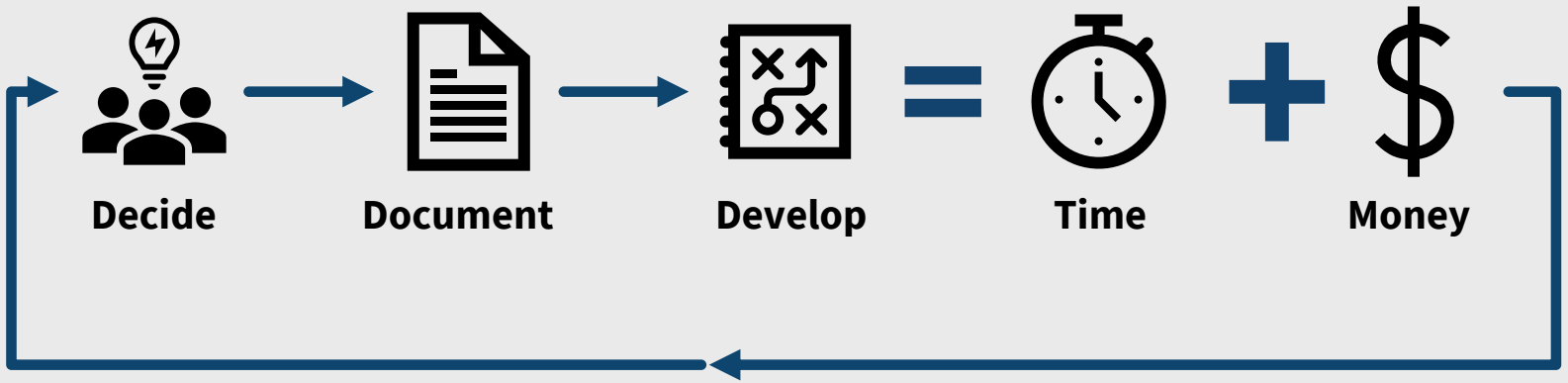
Timestamp	ts		seconds	✓	<integer>	1596014568	-2
Source	src			✓	<string>	"GPS" or "Wi-Fi"	""

"Out of Band Null Value"—Value used when data is not present

System Integration

Current Methodology



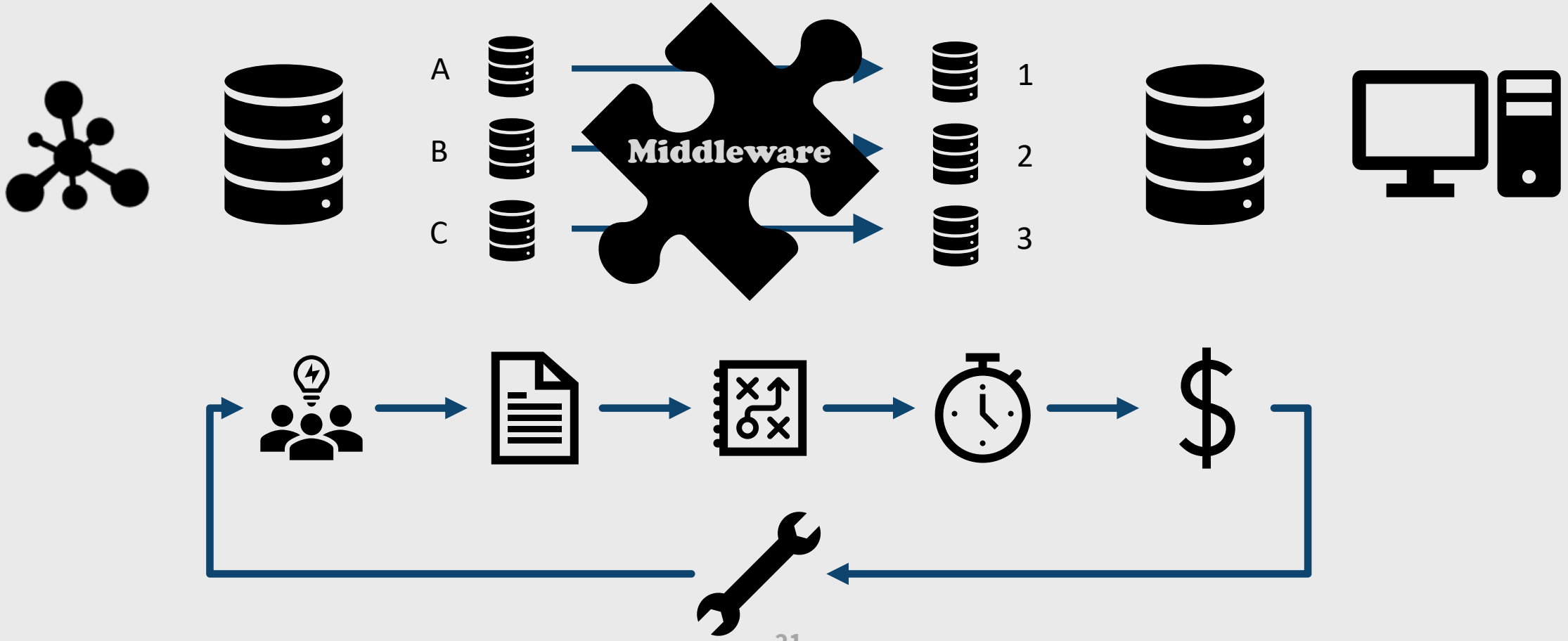


This often becomes the responsibility of the system owner

System Integration

Benefits of Predefined Data

1. All parties have baseline data expectations



System Integration

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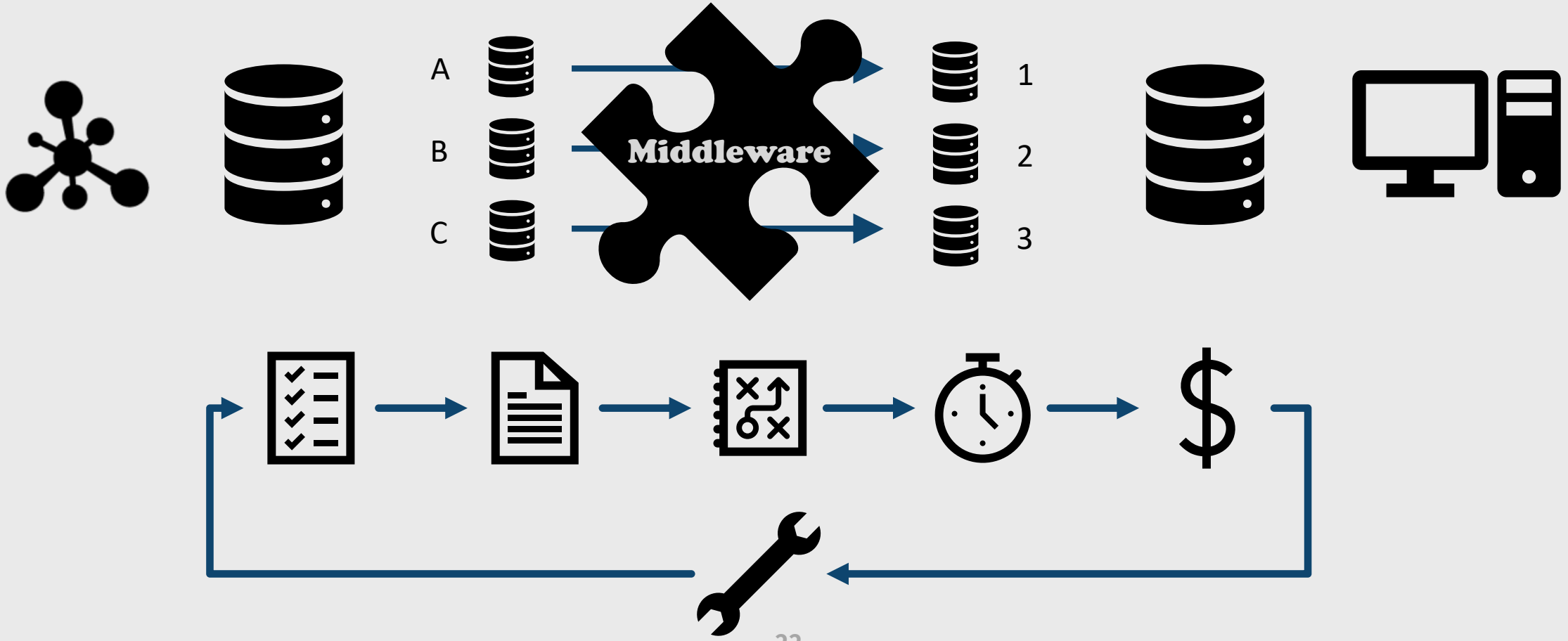
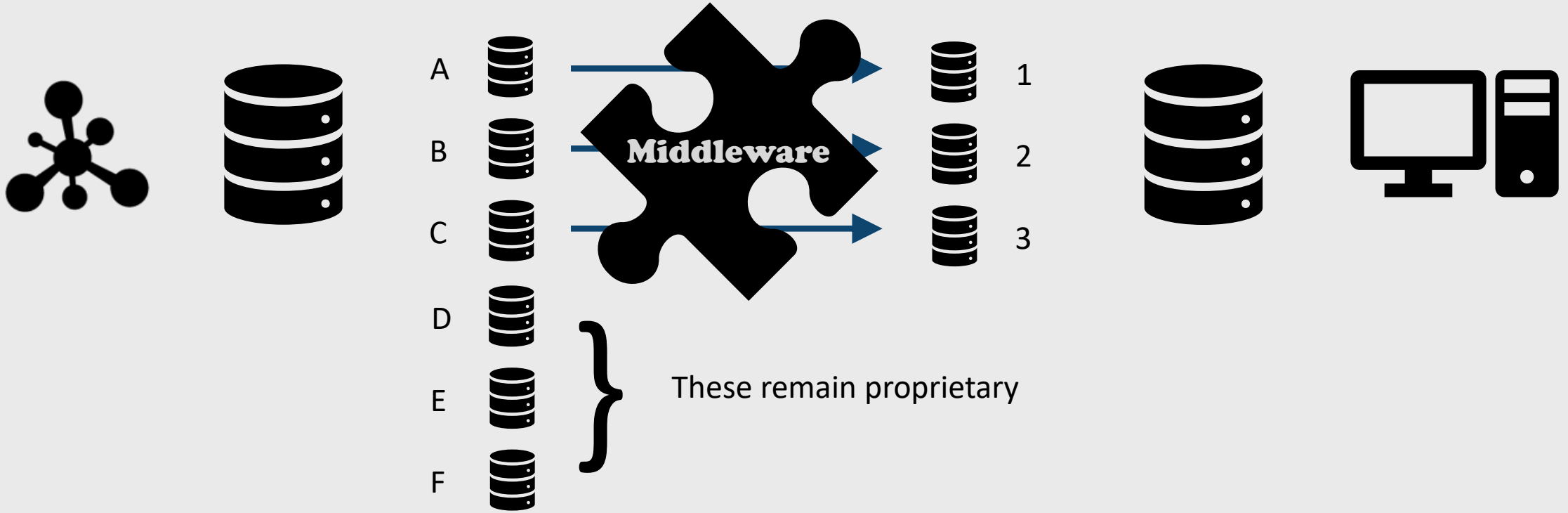


System Integration

Benefits of Predefined Data

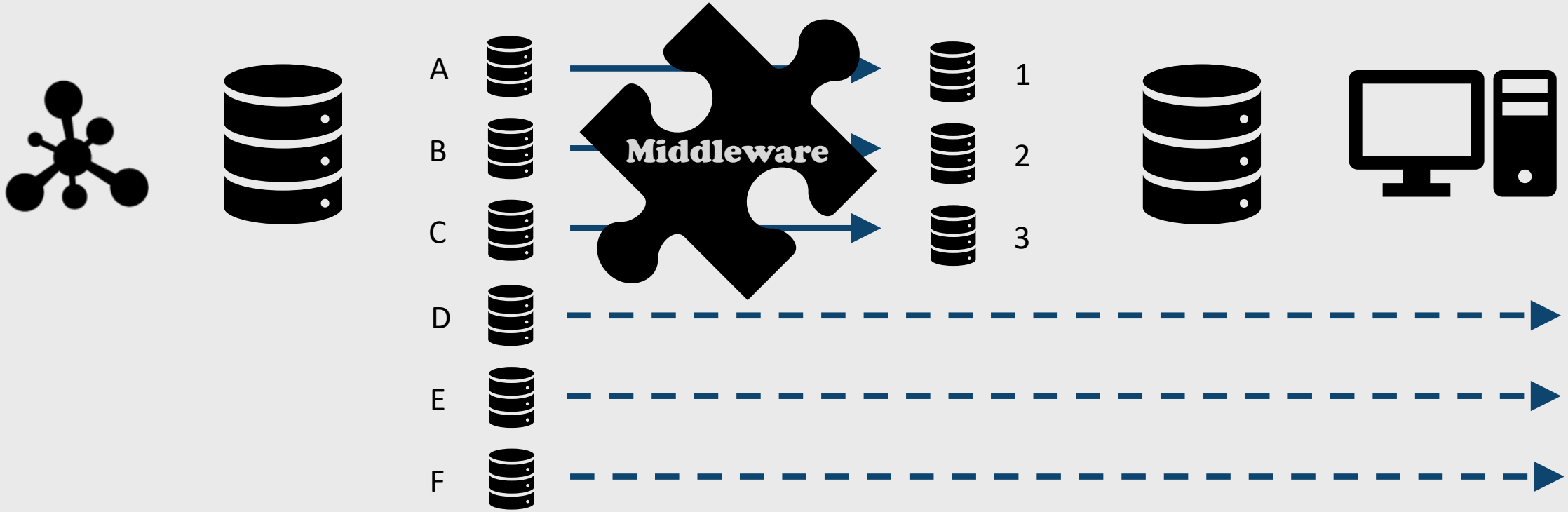
2. Sensor Developers Own Their Data



System Integration

Benefits of Predefined Data

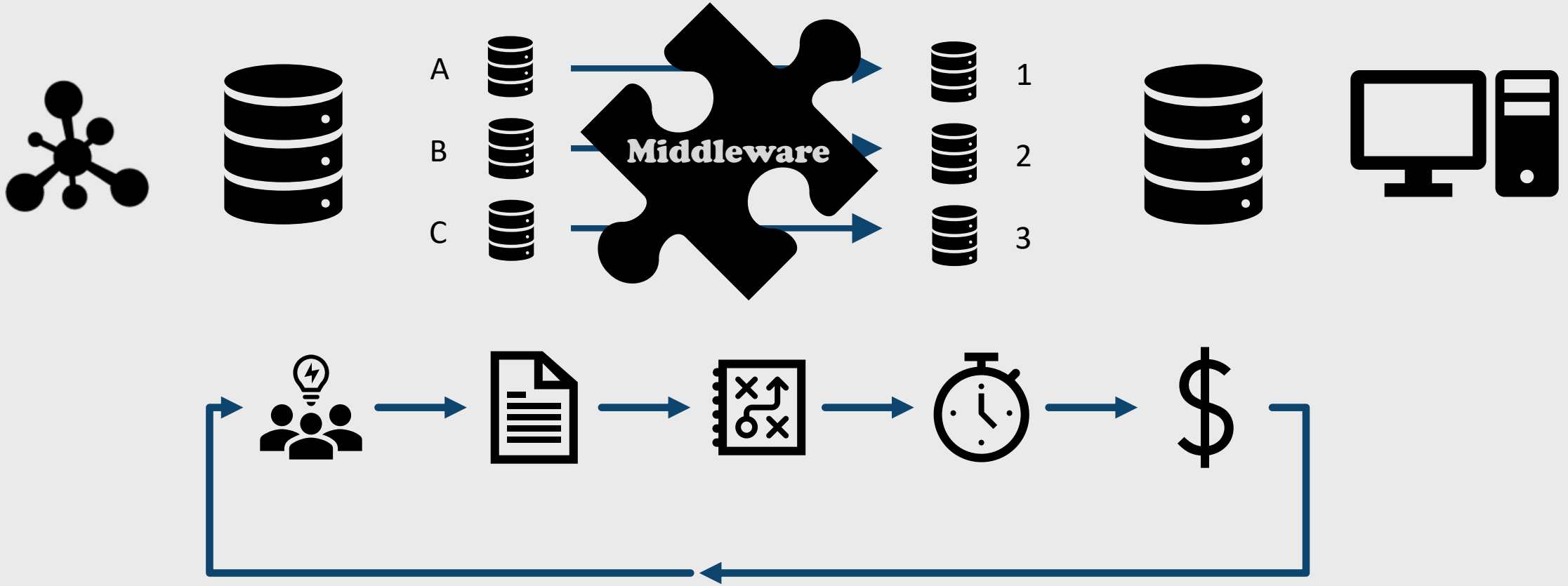
3. Data Elements become backwards compatible



System Integration

Benefits of Predefined Data

4. Middleware simplifies to a plug and play application



System Integration

Benefits of Predefined Data

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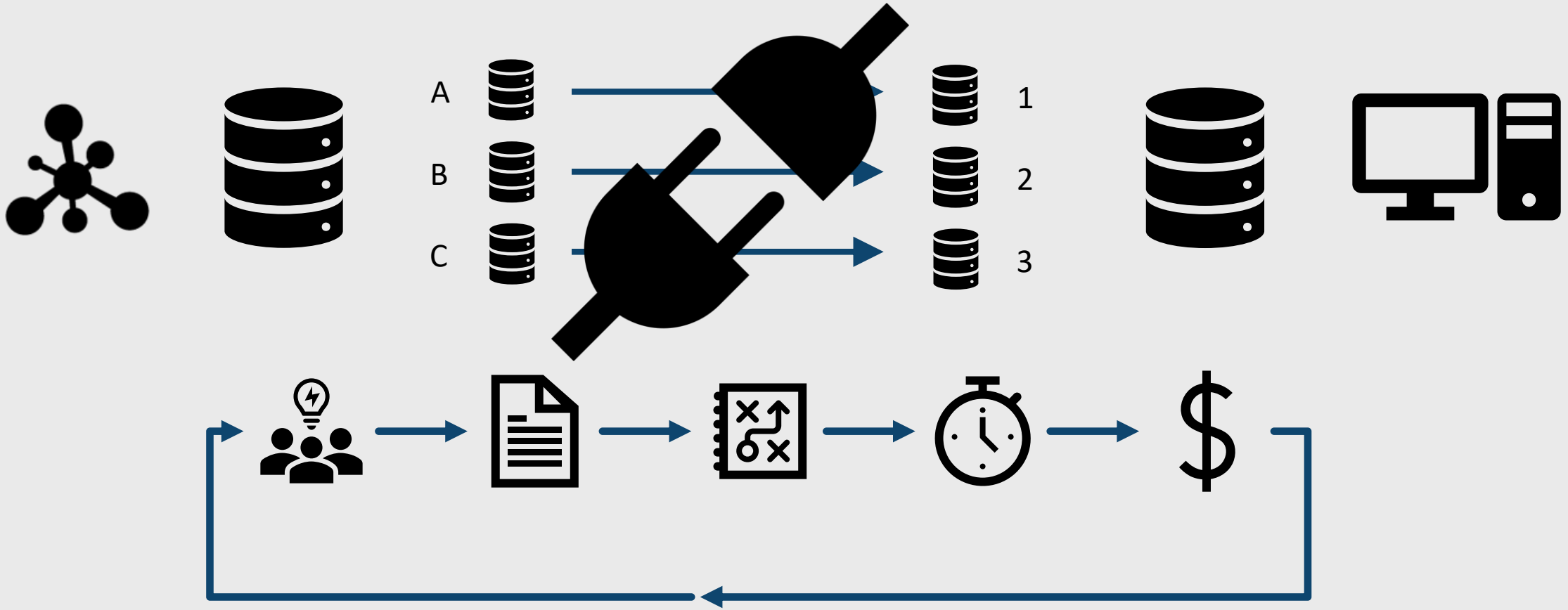


Data Foundations Process

Phase 1

- Reach out to fire service professionals
- Conduct one-on-one interviews with members of the fire service
- Determine information trends amongst fire service professionals

Concluded 4/30/2020

Phase 2

- Repeat Phase 1 with members of law enforcement / EMT community
- Continue outreach to fire service
- Extract data foundation information from all three groups

Ongoing through 7/30/2020

Phase 3

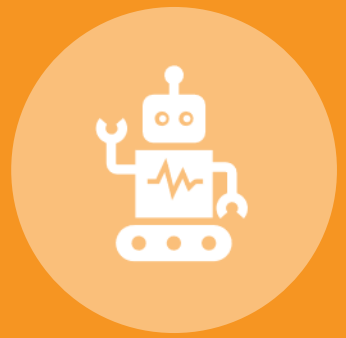
- Highlight commonalities between the three groups
- Incorporate feedback received throughout the process
- Socialize outputs between industry and public safety

Interview Topics

WHO

Is Using This Data?

- Position
- Field
- Environment
- Scenarios



WHAT

Technology Is Used?

- Personal / Work
- Tech Type
- Software
- Systems

WHEN

Is Technology Useful?

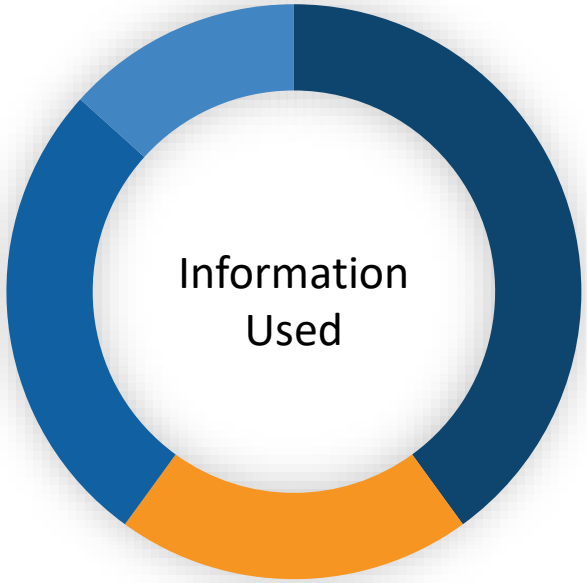
- Event type
- Information
- Display

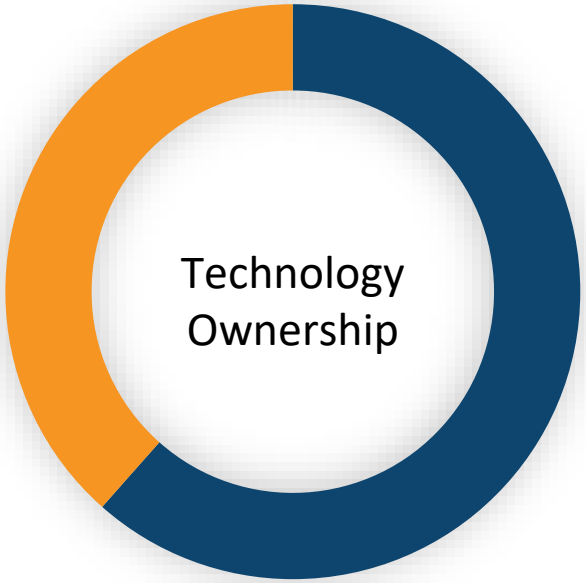
WHERE

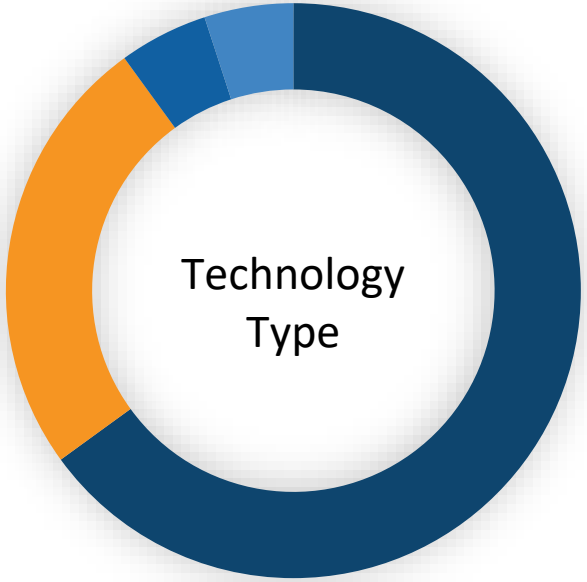
Can Advances Be Made?

- Additional Info
- Hardware
- Price Point
- Personnel

Respondent Themes from Phase 1







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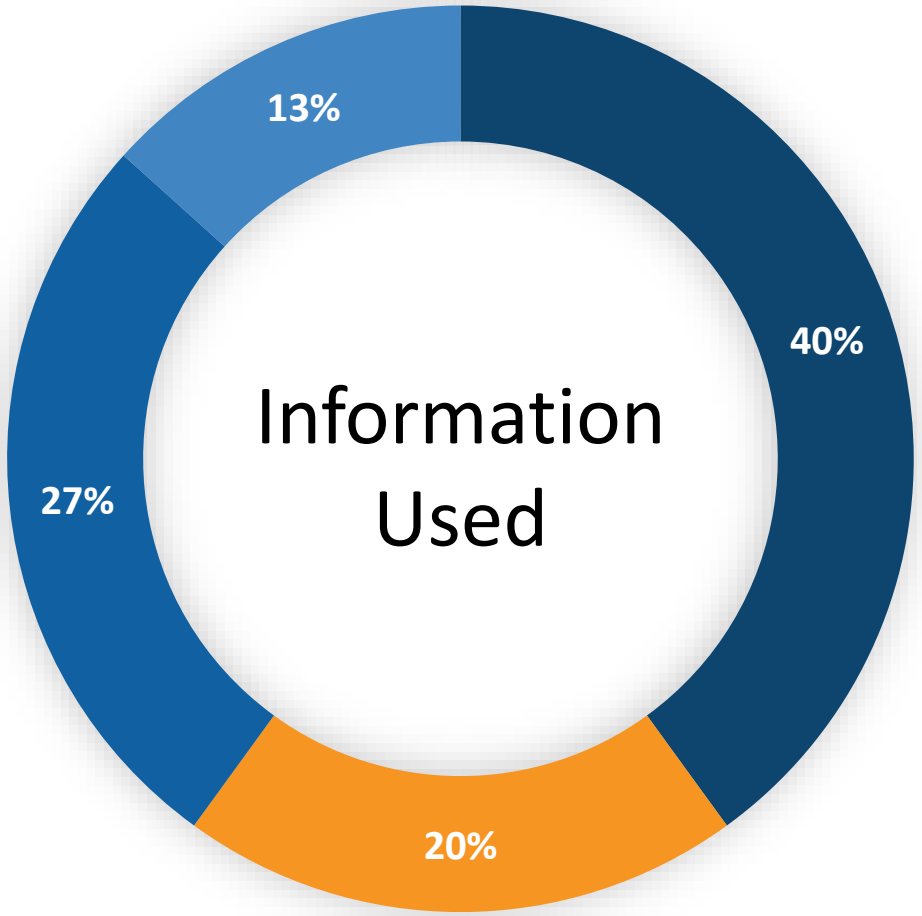

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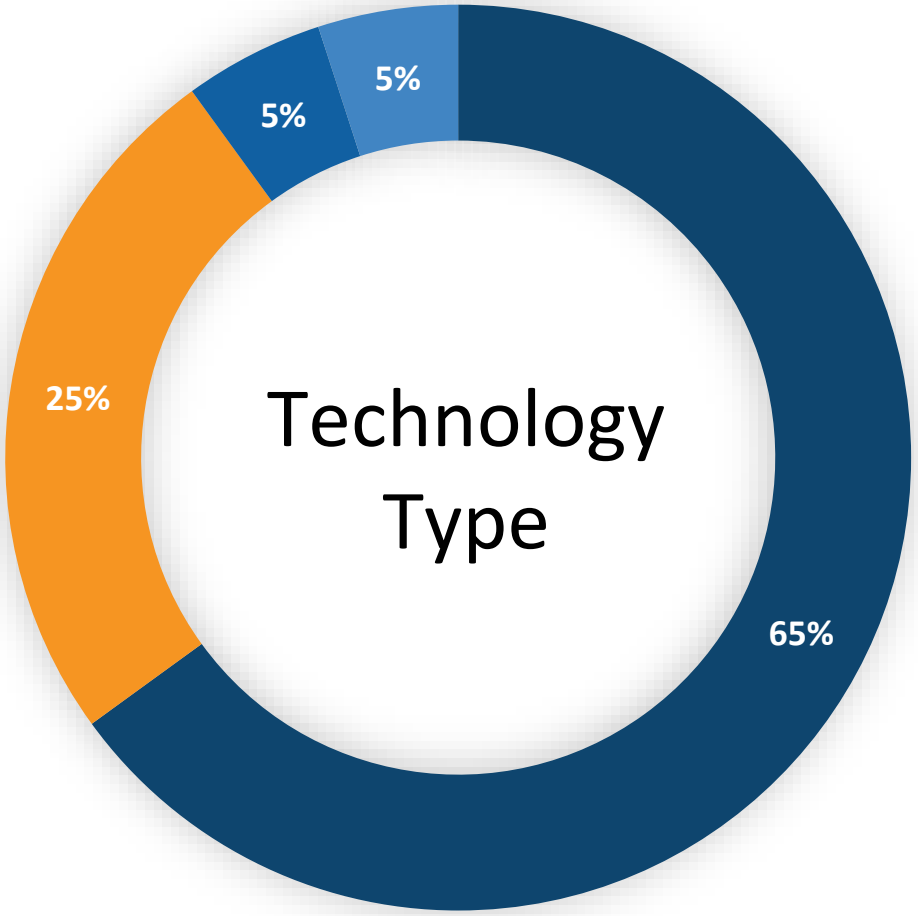

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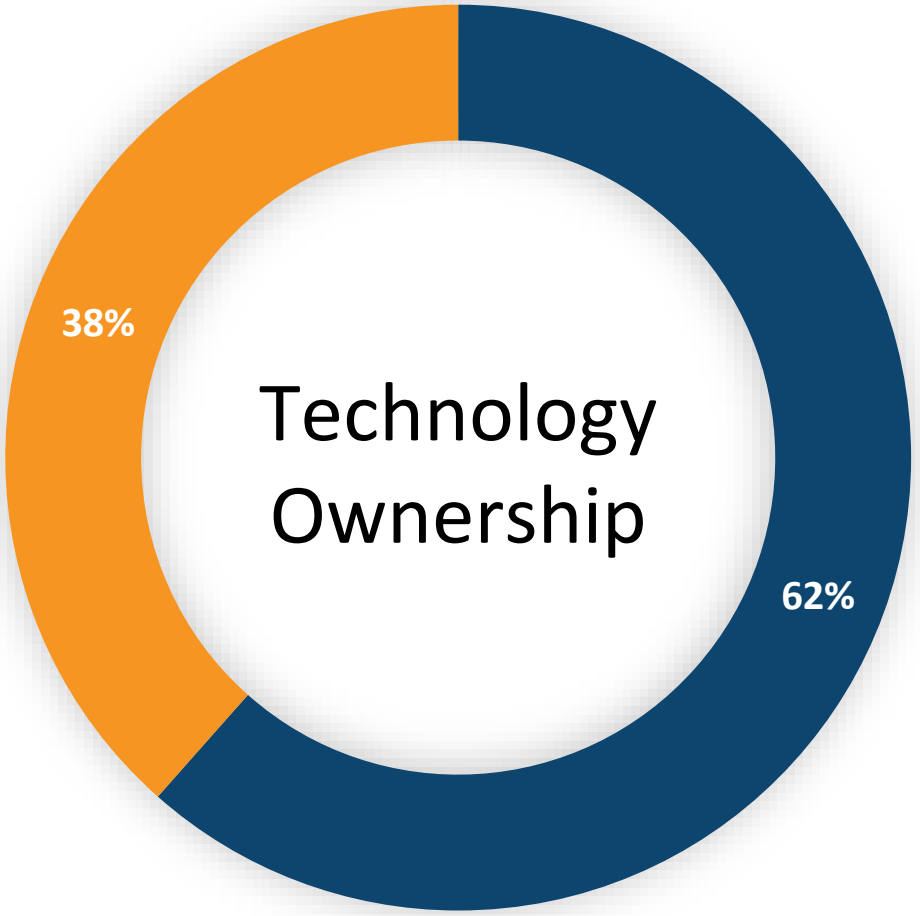

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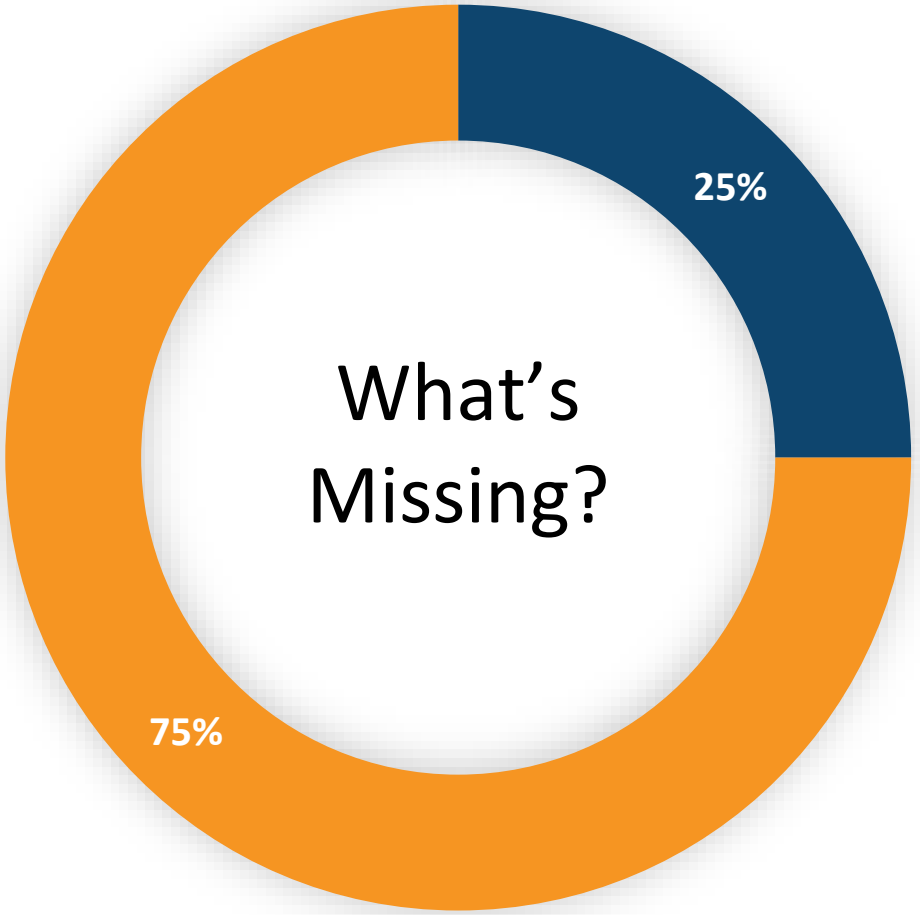

Continued Outreach

- First Responder Preliminary Survey – Google Forms Document (now closed)
- Interviews Continuing for First Responders through July 2020
  - Looking for fire service, law enforcement, EMT professionals, or those with direct knowledge of public safety use case
  - See link on presentation webpage
- Announcement will be made upon document publication

Conclusion

- This project aims to start a conversation between first responders and the technology community
- Guidelines will help identify and emphasize the importance of certain information for public safety
- Confirmation of necessary information helps accelerate tool development while allowing for innovation
- Input and feedback welcome from all parties

Contact Us

alison.kahn@nist.gov

THANK YOU

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