



VEHICLE INFORMATION NEEDS

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Welcome to the sixth METR workshop. Today, we will talk about vehicle operations.

Agenda

- Overview
- Vehicle Information Needs
 - Static ODD Boundary and Implications
 - Dynamic ODD Boundary and Implications
 - Partial METR Support
 - End of Coverage
 - Support Flows
 - Conflicting Regulations and Mitigation
- Terminology

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After our overview, we'll dive directly into a series of discussion topics covering the variety of issues shown here.

Acknowledgements

Small group has started structuring the problem

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- Jim Marousek (US)
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Standards Process

- ISO/TC 204/WG 19
 - Drafting Team

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It is important to acknowledge that the materials developed to date represents a team effort. While there is a core editing group, as shown in the upper left, the concepts presented within this presentation already reflect valuable inputs from the review team shown on the right. In addition, the overall document is being prepared under the auspices of ISO/TC 204/WG 19, and especially its METR Drafting Team.

Ground Rules

- METR is very complex and involves many disciplines
- Workshops are based on this structure and designed to receive feedback
- If you have comments, please voice your concerns
 - Verbally (and concisely) during discussion slides (marked with  icon)
 - Using chat window
 - Using discussion forum (<https://github.com/ISO-TC204/iso24315p1/discussions>)

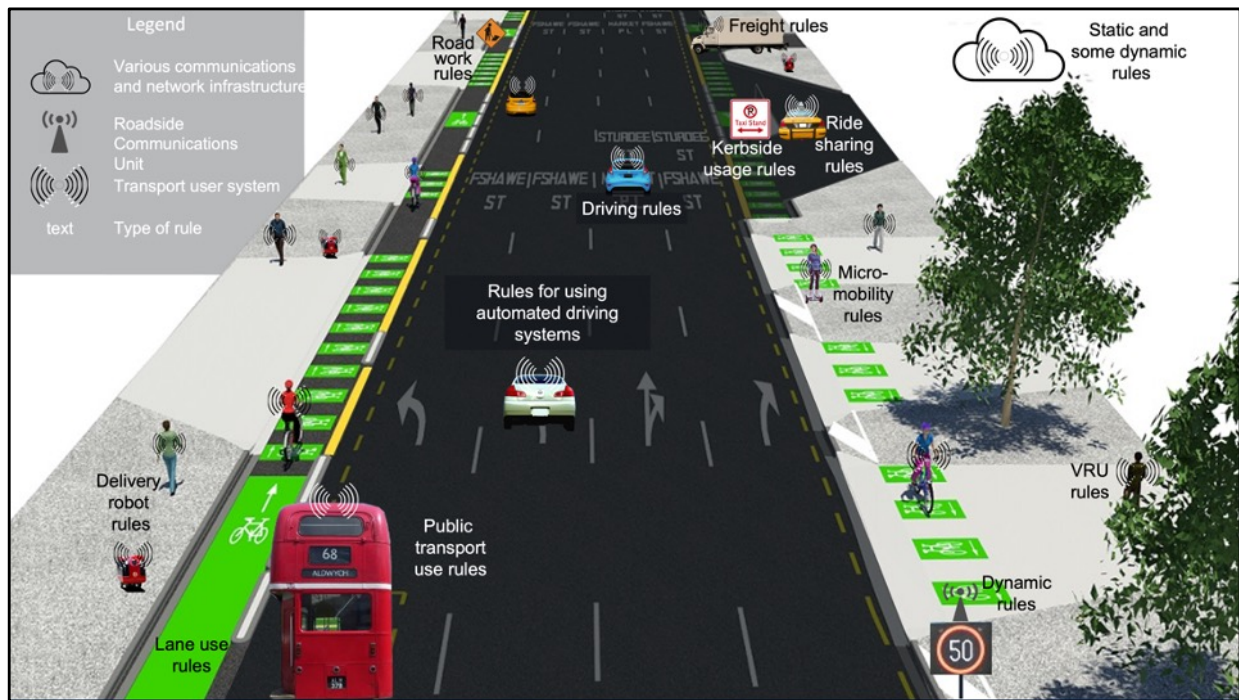
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Before we begin, it is useful for everyone to understand the ground rules of our conversation. The development of the ConOps is intended to be a cooperative effort that reflects the input from stakeholders from different perspectives. To facilitate this process, the development team has prepared the workshops to gain feedback from stakeholders – but your feedback does not have to be limited to the topics presented.

The workshops are generally structured to present a topic and then gain feedback. Participants are welcome to voice their concerns during the workshop presentations, either verbally or using the chat window, but we request that verbal feedback is made when we are on discussion slides. We also recognize that our workshops are time limited and comments should be kept fairly concise. If major topics of discussion arise we can schedule additional meetings to focus on specific points, as needed. We have also established a discussion forum on the Github site to promote off-line conversations and encourage everyone to use the facility,

After we complete the workshops, we expect to prepare a draft ConOps early next year, and there will be ample opportunity for additional comments on the document once distributed.



METR is intended to support all transport user systems. This includes: vehicle systems (e.g., automated driving systems and driver support systems), sidewalk delivery robots, and other devices such as smartphones used by pedestrians and perhaps units on-board micromobility devices (e.g., e-scooter interfaces)

The information provided to these users would potentially include all rules related to using the transport facilities, such as (from top and proceeding clockwise) any special rules for freight delivery or for the operation of heavy vehicles, kerbside usage rules (e.g., bus stop, taxi stand), ride sharing rules (e.g., what forms of ride sharing are allowed), micromobility rules (e.g., are e-scooters allowed in cycle lanes), VRU rules (e.g., is the sidewalk closed to pedestrians), dynamic rules (e.g., variable speed limits, lane control signals), public transport use rules (e.g., does my ticket qualify me for a transfer, what are the fare zones), lane use rules (e.g., bike only, bus only, HOV-2), delivery robot rules (e.g., what is the maximum speed for a delivery robot for this sidewalk), road work rules (e.g., speed limit for the work zone). METR is intended to be flexible enough to address all of the transport rules, these are just a few examples that demonstrate the breadth of the effort.

Importantly, in order to cover all rules, the scope must include rules that can change

or be imposed in a dynamic fashion. For example, temporary lane closures due to unplanned incidents and signal timing information need to be considered and handled in a trustworthy way, even when long-range communications may not be available. Thus, the full scope of METR will likely need to rely on both cloud based delivery mechanisms as well as local broadcast of exceptional data.

Static ODD Boundary

- What data does a vehicle need from METR to properly handle a static ODD boundary? (i.e., a boundary that is based on infrastructure characteristics rather than environmental and operation characteristics)
 - For example, does METR need to advertise the coverage areas and the types of information within each coverage area



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Our first question today deals with static ODD boundaries, such as those defined by physical infrastructure. What data do vehicles need for these boundaries?

Exit - https://cdn.pixabay.com/photo/2012/04/28/19/38/exit-44205_960_720.png

End of Motorway -

https://upload.wikimedia.org/wikipedia/commons/thumb/c/c1/Mauritius_Road_Signs_-_Information_Sign_-_End_of_Motorway.svg/1024px-Mauritius_Road_Signs_-_Information_Sign_-_End_of_Motorway.svg.png

End Divided Highway -

https://upload.wikimedia.org/wikipedia/commons/thumb/8/81/MUTCD_W6-2.svg/600px-MUTCD_W6-2.svg.png

Primitive Road - https://farm1.staticflickr.com/27/63123607_2c57ec04ff_z.jpg

Magic Roundabout - <https://www.flickr.com/photos/robinhamman/27117099659>

Implications of Boundary

- What is the operational scenario associated with a vehicle approaching a static ODD boundary that limits the vehicle's operation?
 - For example, does the ADS-equipped vehicle need to know where to park if the human driver does not respond?



ADS = Automated Driving System

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And what operational scenario do we need to consider within our ConOps?

Exit - https://cdn.pixabay.com/photo/2012/04/28/19/38/exit-44205_960_720.png

End of Motorway -

https://upload.wikimedia.org/wikipedia/commons/thumb/c/c1/Mauritius_Road_Signs_-_Information_Sign_-_End_of_Motorway.svg/1024px-Mauritius_Road_Signs_-_Information_Sign_-_End_of_Motorway.svg.png

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Primitive Road - https://farm1.staticflickr.com/27/63123607_2c57ec04ff_z.jpg

Magic Roundabout - <https://www.flickr.com/photos/robinhamman/27117099659>

Dynamic ODD Boundaries

- What additional information needs to be conveyed by METR to enable a vehicle to properly handle a dynamic ODD boundary?
 - For example, an ADS-equipped vehicle might have an ODD that is limited by snowfall. Does METR need to convey any information if it starts snowing?



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In addition to static ODD boundaries, there are dynamic ODD boundaries, in other words, under normal conditions an ADS-equipped vehicle might be able to drive the road, but at present there is some special condition that is outside the bounds of the ADS logic. What information does METR need to convey to ensure the safe operation when these conditions occur, if any?

Snow Blind - https://c2.staticflickr.com/8/7209/6802244796_c9fc9e3592_b.jpg

Rain - <http://www.publicdomainpictures.net/pictures/60000/velka/dramatic-sky-while-driving.jpg>

Implications of Boundary

- What is the operational scenario associated with a vehicle encountering a dynamic ODD boundary that limits the vehicle's operation?
 - For example, does the ADS-equipped vehicle need to know where to park if the human driver does not respond?



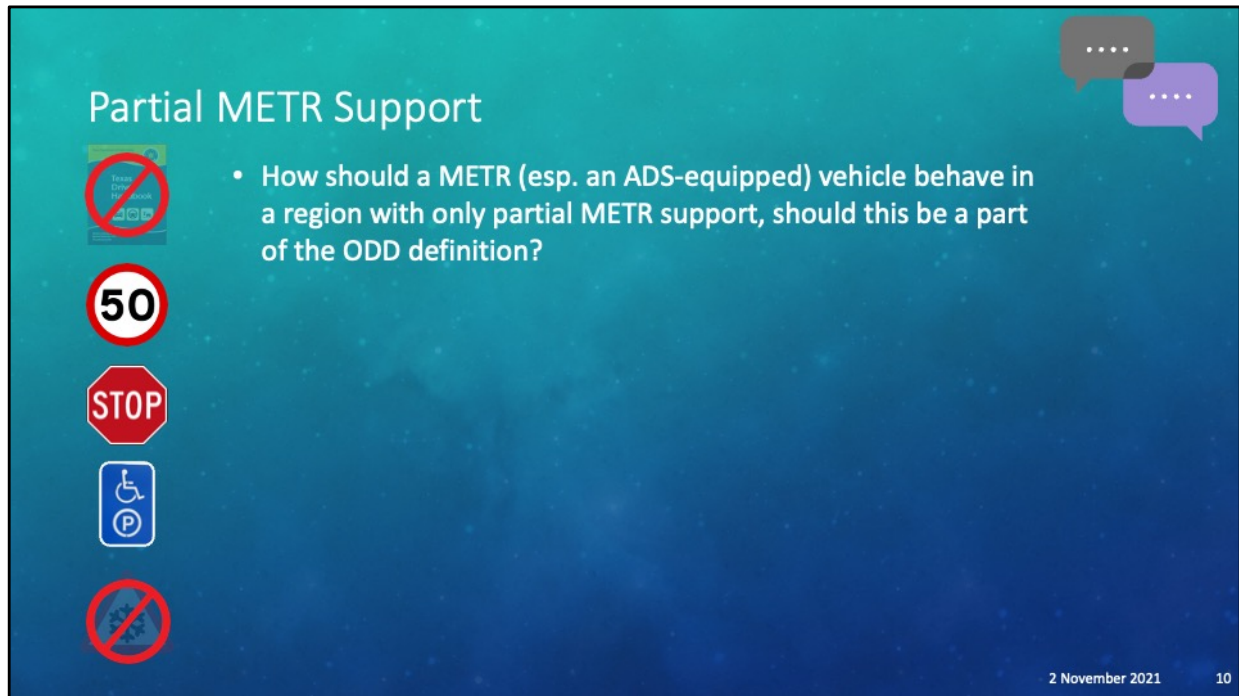
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And what should our ConOps describe as far as an operational scenario for this case?

Snow Blind - https://c2.staticflickr.com/8/7209/6802244796_c9fc9e3592_b.jpg

Rain - <http://www.publicdomainpictures.net/pictures/60000/velka/dramatic-sky-while-driving.jpg>



Partial METR Support

- How should a METR (esp. an ADS-equipped) vehicle behave in a region with only partial METR support, should this be a part of the ODD definition?

The slide features a vertical list of five traffic signs on the left side: a red circle with a diagonal line through it (prohibitory sign), a white circular speed limit sign with a red border and the number '50', a red octagonal stop sign with the word 'STOP' in white, a blue square handicapped parking sign with a white wheelchair symbol and a 'P' in a circle, and a blue circular sign with a white 'P' in a circle (parking sign). In the top right corner, there are two speech bubble icons, one grey and one purple, both containing three dots. The bottom right corner of the slide contains the date '2 November 2021' and the number '10'.

Our next question deals with a scenario where a particular geographic region supports some METR data but not other data. Our assumption is that if a region claims support for any particular type of data (e.g., parking information), it must support ALL rules related to that type of data (e.g., default rules, static rules, and dynamic rules). How should METR convey that some types of rules are provided while others are not?

Stop -

https://upload.wikimedia.org/wikipedia/commons/thumb/7/7b/Canada_Stop_sign.svg/1024px-Canada_Stop_sign.svg.png

50 -

https://upload.wikimedia.org/wikipedia/commons/thumb/7/7b/Mauritius_Road_Signs_-_Prohibitory_Sign_-_Speed_limit_50.svg/600px-Mauritius_Road_Signs_-_Prohibitory_Sign_-_Speed_limit_50.svg.png

Texas Driver Handbook - <http://dps.texas.gov/internetforms/forms/dl-7.pdf>

Handicap -

https://upload.wikimedia.org/wikipedia/commons/thumb/3/36/Handicap_parking_sign%2C_canada_2008.jpg/1200px-Handicap_parking_sign%2C_canada_2008.jpg

Snow Advisory -

https://upload.wikimedia.org/wikipedia/commons/thumb/3/38/UK_traffic_sign_554.2.svg/869px-UK_traffic_sign_554.2.svg.png
No - https://cdn.pixabay.com/photo/2012/04/24/12/29/no-symbol-39767_960_720.png

End of METR Coverage

- To what extent does METR need to provide warnings, especially to ADS-equipped vehicles, that you are approaching an area without METR coverage or with a lower level of conformance? (e.g., jurisdictions that do not have information entered, information is partially entered, system not (fully) operational)



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To what extent does METR need to indicate that coverage is ending or changing?

Exit 162 - https://en.wikipedia.org/wiki/Interstate_70_in_Utah#/media/File:I-70noservices1.jpg

Primitive Road - https://farm1.staticflickr.com/27/63123607_2c57ec04ff_z.jpg

Support Flows

- Does METR need to identify adjacent jurisdictions/METR download zones (e.g., when a user requests information for a jurisdiction or as a user nears a boundary)?



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What support flows does METR need to provide so that a user system that is about to cross a regional boundary knows which disseminator to connect to?

https://upload.wikimedia.org/wikipedia/commons/thumb/a/a3/Area_code_202.svg/422px-Area_code_202.svg.png

Response to Conflicting Regulations

- While the goal is clearly to avoid conflicts within METR, what should a user (or user system) do when encountering conflicting METR regulations (e.g., from different levels of jurisdictions)? For example, a national government imposes a maximum speed limit of 100 kph for any road while a local jurisdiction posts a 120 kph speed limit on a specific road.

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What should happen when a user system encounters an inconsistency in the received rules? Granted, this should be avoided, but in practice it is bound to occur at times and we should consider what a user system should do in this scenario.

Conflicting Regulation Mitigation

- What, if any, attributes (e.g., priority information) need to be conveyed by METR so that users can appropriately process potentially conflicting regulations from different layers of jurisdictions? For example, some vehicles might be allowed to operate on local roads although they are not allowed on roads maintained by the larger jurisdiction. Do regulations need to indicate if they can be revised by lower regulatory entities (e.g., a national speed limit can be overridden by local posted signs)
- What should a user do when encountering physical infrastructure that conflicts with received electronic regulations (e.g., missing sign, sign present when none expected, sign with different times posted than expected)?

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What information should each METR rule include so that user systems can determine the relative priority of rules. For example, default speed limits often have wording such that it is the defined speed limit unless otherwise posted. How should METR convey the concept of “unless otherwise posted”?

Likewise, what should the ConOps say about a user encountering a physical traffic control device that is inconsistent with the rules that it has received electronically. While this should be avoided, inconsistencies are bound to arise at times and we should consider what advice we should give and consider how these inconsistencies can be reported so that they can be resolved in a timely manner.

Draft Terminology: Data Semantic/Temporal Category

- Rule: regulation, advisory, or guidance
- Static rule: rule that does not change based on real-time operational decisions
 - NOTE: Static rules can be determined in advance and will be known to be valid for a defined period of time.
 - NOTE: Static rules can be complex and be associated with activation times or conditions.
 - NOTE: Static rules can be overridden by dynamic rules.
- Dynamic rule: rule that can change or be applied based on real-time operational decisions made by a regulator or that otherwise cannot be known in advance
- Dynamic (formerly C-ITS) data: data that might change with little notice
 - Often originates from a source outside of the METR system?
 - C-ITS
 - On-board
 - Inclusive of rules or not?

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We now get into a set of term definitions. Our goal is to get feedback from the participants as to what terms and definitions we should use within the ConOps.

We propose that we will define a rule to be a general term that is used for a regulation, advisory, or guidance. Static rules are those that do not change based on real time conditions and dynamic rules do. Rules are a type of data and the state of rules (even static rules) might depend on the current values of other dynamic data. For example, there might be a rule to turn on headlights when it is raining. That would be a static rule, but the data about whether it is currently raining is dynamic data. Whether or not the speed limit is currently reduced is dependent upon that dynamic data.

Draft Terminology: Data Delivery Category

- Pull data – data received that is associated with a relatively long expiration time
 - Expiration time might be measured in days, weeks, months, etc.
 - User is responsible for refreshing
- Push data – data received that is associated with a short expiration time
 - Expiration time might be measured in minutes, seconds, milliseconds, etc.
 - Jurisdiction is responsible for broadcasting
- Push-to-Pull data – A push message that announces availability of data that should be pulled
- **Push data always takes precedence over pull data**
- On-board data – data that the transport user system is responsible for determining according to its own process (e.g., time, location, temperature)
 - Might rely on internal sensors or external sources

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We also talk about data from other perspectives. One such perspective is whether it is the user system's responsibility to pull the data or whether it is the regulator's responsibility to push the data to the user. These roles are formally defined to be based on whether the data is expected to have a long expiry time or short expiry time (i.e., how long before data that was previously downloaded can no longer be considered valid). Data with short expiration times (e.g., signal timing states, variable speed limits) need to be pushed (often in localized areas) in order to prevent a massive load of requests from users to their disseminators.

There is also a possibility of "push-to-pull" data, this is where the regulator informs a user that new data is available that needs to be pulled. This is particularly useful when the amount of data that needs to be sent might exceed local push capabilities (e.g., data capacities).

In general, push data is assumed to always take precedence over pull data as it is the latest data received and very possibly reflects a change in states and is more recent.

A final scenario is data that is not exchanged outside of the user system at all but is determined on-board (e.g., using on-board sensors). We propose to call this "on-

board data”

Draft Terminology: Data Latency Category

- Low latency – ability to provide data to all users who need the data within a very short time
 - Typically used for push data
 - Typically via short range wireless (SRW)
 - Typically requires latency of seconds or less
- High latency – inability to provide data to all users who need the data within a very short time
 - Typically used for pull data; might provide supplementary source for push data
 - Can use various technologies (typically avoids SRW due to bandwidth limitations)
 - Typical provision times are minutes or more for last user to be notified

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A final perspective that is considered is the communications technology and how quickly data is needed. For example, how long of a time lag is allowed between it is known that a rule will change to the time that all affected users must be notified. Typically, this is similar to the concept of push and pull but rather than considering how often the rule changes we are looking at notification times.

Terminology: Example Classifications

Data	Semantic	Delivery	Latency	Notes
Date/time information	Dynamic D	On-board	N/A	
On-board sensor data	Dynamic D	On-board	N/A	
GNSS data	Dynamic D	On-board	N/A	Time from separate satellites is "cloud"
Special vehicle alert	Dynamic D	Push	Low	
Weather data	Dynamic D	Per Rule?	Per Rule?	Rule might require a source or leave to vehicle
workers are present	Dynamic D	OB or Push	N/A or Low	Workers might be prohibited until cloud publishes
SPaT data	Dynamic D	Push	Low	
Variable speed limit spd	Dynamic D	Push	Low	Pull allowed if scheduled or delayed enforcement
Ad hoc on-scene	Dynamic R	Push	Low	Might be possible to switch to high latency after an initial period as long as (1) vehicles that just started will obtain updates prior to reaching location and (2) any change to data starts with a new push period. High latency can also supplement low latency.
Ad hoc planned response (close gate on road)	Dynamic R	Push or Push-to-Pull	Low	
Installation of new TCD	Dynamic D	Push	Low	
Traditional speed limit	Static rule	Pull	High	
Signal locations	Static rule	Pull	High	

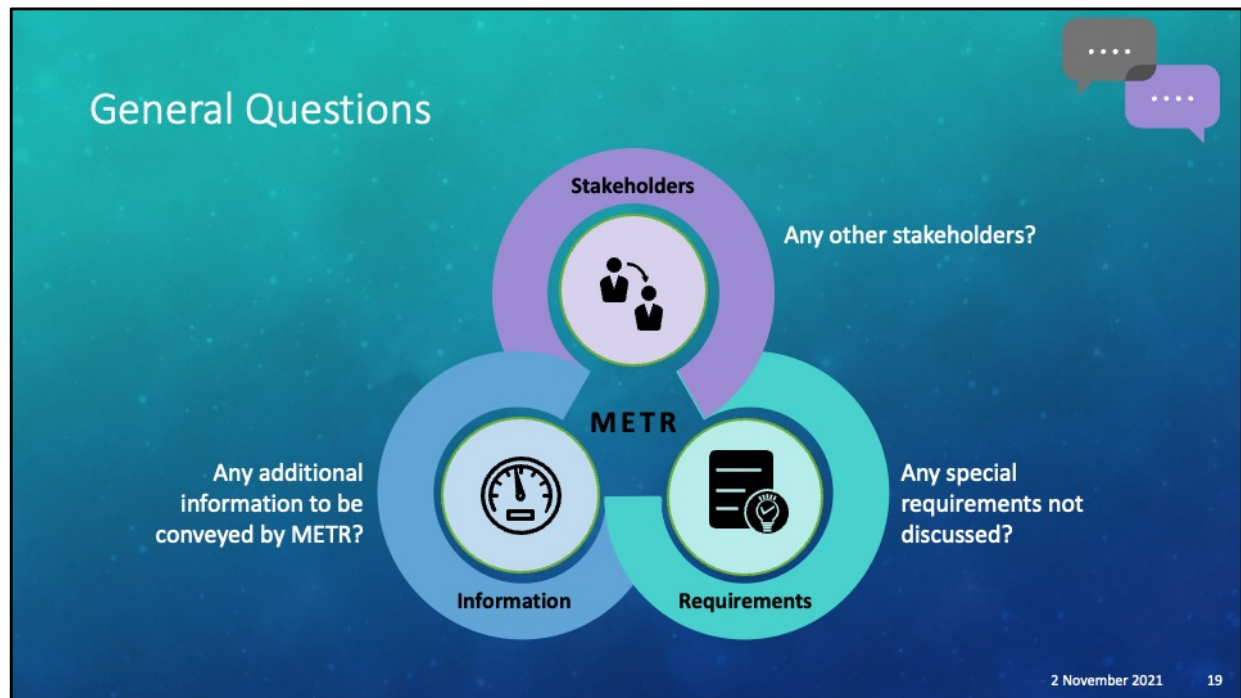
Not intended to assign flows, only intended to clarify terminology that is needed

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Finally, we look at a variety of scenarios to determine which terms are appropriate and which terms are needed. For example, do we need to define both push/pull data and low/high latency data – or are those terms always paired with each other? Is there ever a case where low-latency data depend solely on pull processes?

Note, this table is not attempting to assign flows to specific domains; it is merely attempting to describe the typical assignments and to get us thinking about what combination of terms might occur.



Finally, have we missed anything in our analysis? Are there other stakeholders that we need to engage; other topics that we need to cover?



Workshop Schedule

Date	Topic
28 September	METR operations
5 October	METR operational structure
12 October	Electronic regulation life cycle
19 October	Electronic regulation conflicts
26 October	Vehicle operations
2 November	Vehicle information needs
9 November	Campus governance
16 November	Campus regulations
23 November	Roadwork and emergency operations
30 November	Multimodal and micromobility operations
7 December	METR deployment: Part 1
14 December	METR deployment: Part 2

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We've now completed 6 of our 12 workshops; we are half way through. Our next workshop will focus on campus governance.

Workshop 7 Topics

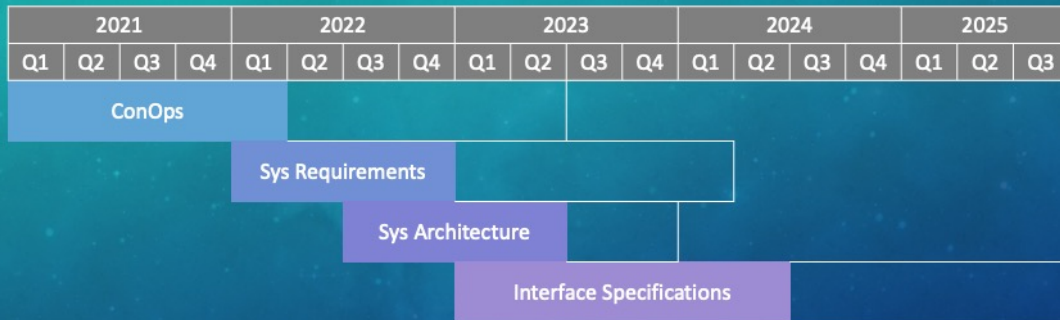
- Campus Governance
 - Regulator Requirements
 - Authorization of Regulators
 - Campus Regulation Management
 - Jurisdictional Boundaries
 - Completeness of Data
 - Boundary Conditions
 - Change Control

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The workshop will focus on the topics shown on this slide

Tentative Schedule



- End of task shown at expected committee draft
- Transparent bar shows standards review and approval process
- System architecture is expected to be online only (i.e., it will use a shorter review process)
- Interface specification are expected to enhance existing standards

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As a reminder our current expected timeline is shown here. We hope to have a ConOps draft in early 2022, whereupon it will start the standardization process (of multiple reviews prior to standardization)

More Information

More information and a discussion forum is available at:

<https://iso-tc204.github.io/iso24315p1>



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More information about the project and the latest developments will be posted on our GitHub site. This will include a PDF of weekly presentation files to be posted after our meetings each week.

https://upload.wikimedia.org/wikipedia/commons/thumb/2/24/Cartoon_Guy_In_Deep_Thought_Using_A_Computer.svg/1200px-Cartoon_Guy_In_Deep_Thought_Using_A_Computer.svg.png