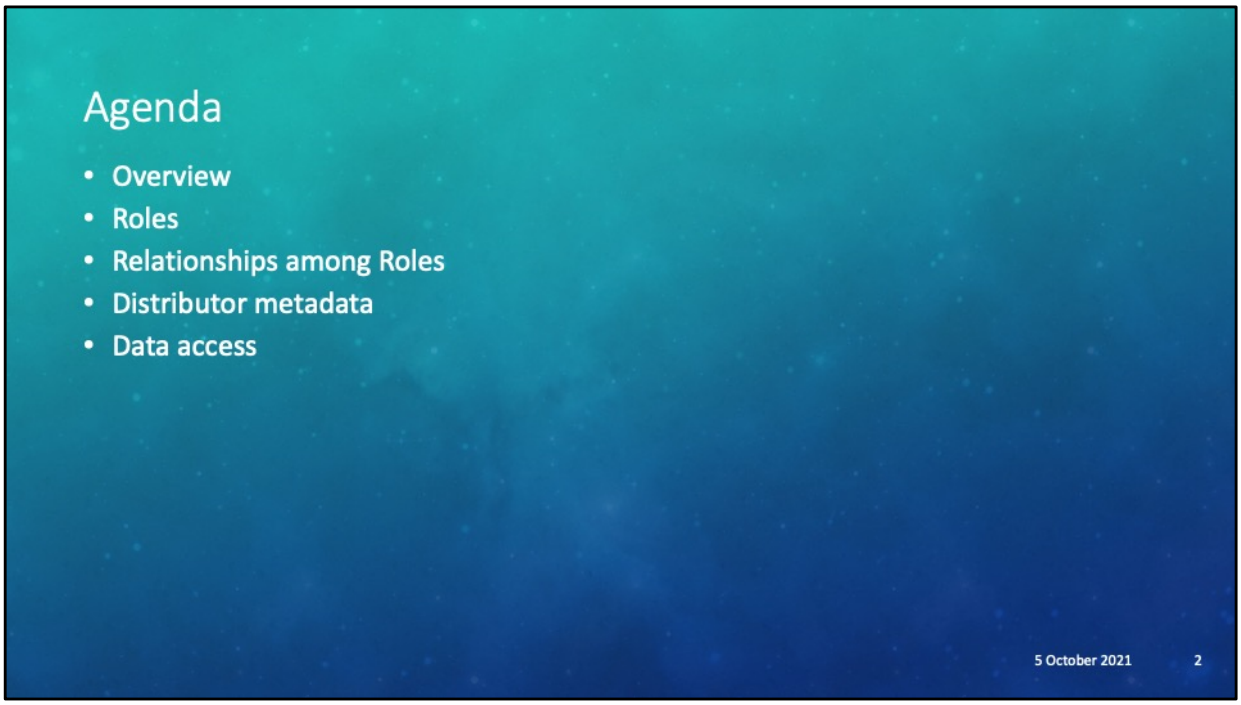
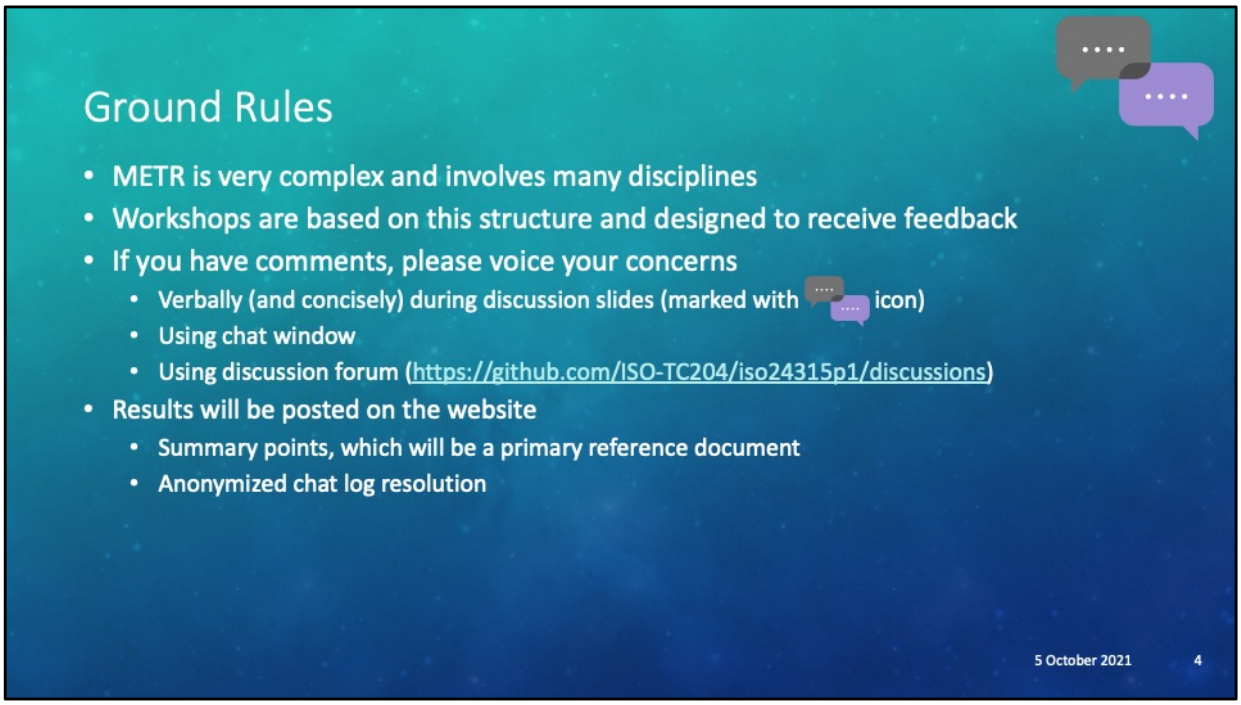
Welcome to the second stakeholder workshop for the development of the METR Operational Concept (ConOps)



Our discussion today will start with providing an quick refresh of the overview of METR is and then discuss various topics related to the METR operational structure, including the identification of roles and the relationships among these roles. We'll finish off with some questions about metadata for collectors and disseminators and then some questions about data access

Before we begin, 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.

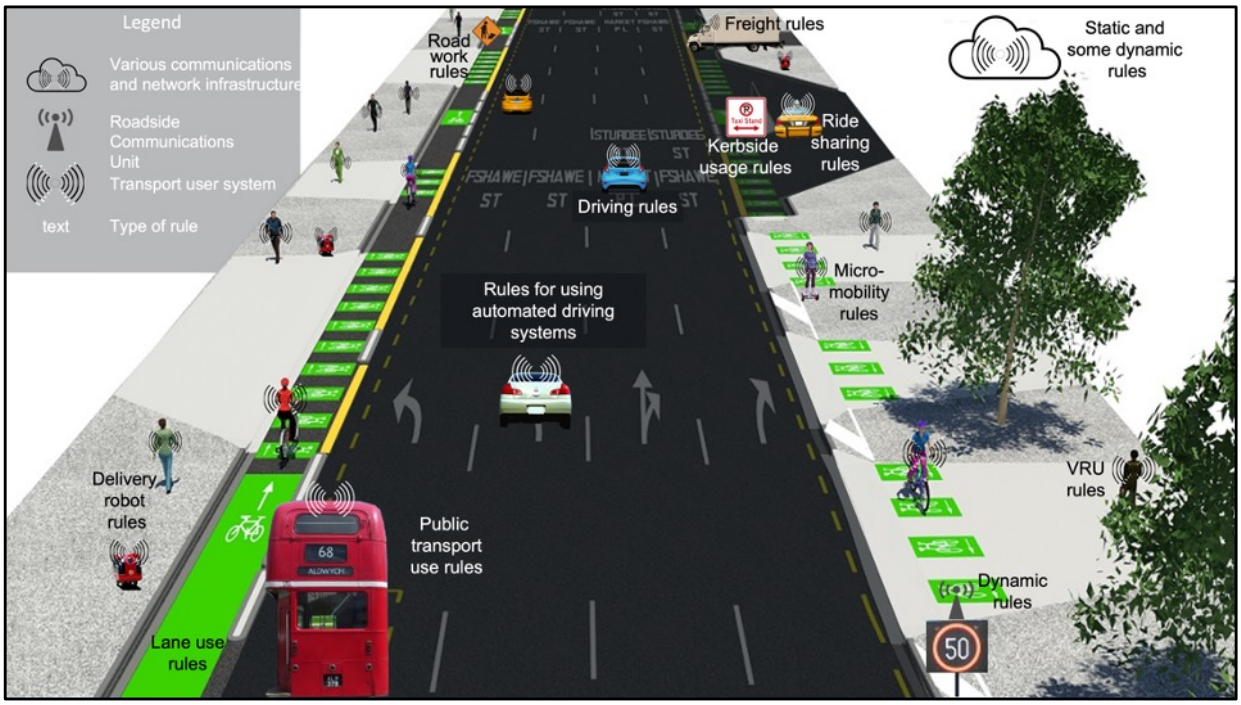


Before we begin, it is useful for everyone to understand the ground rules of our conversation. The development of the ConOps is intended to be a cooperative effort that reflects the input from stakeholders from different perspectives. To facilitate this process, the development team has prepared the 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,

The results of these discussions will be tracked on the website with a summary points document, which will be a primary resource as we develop the ConOps and an anonymized report showing the chat discussions that occurred during the meeting along with our responses to each point raised.

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.



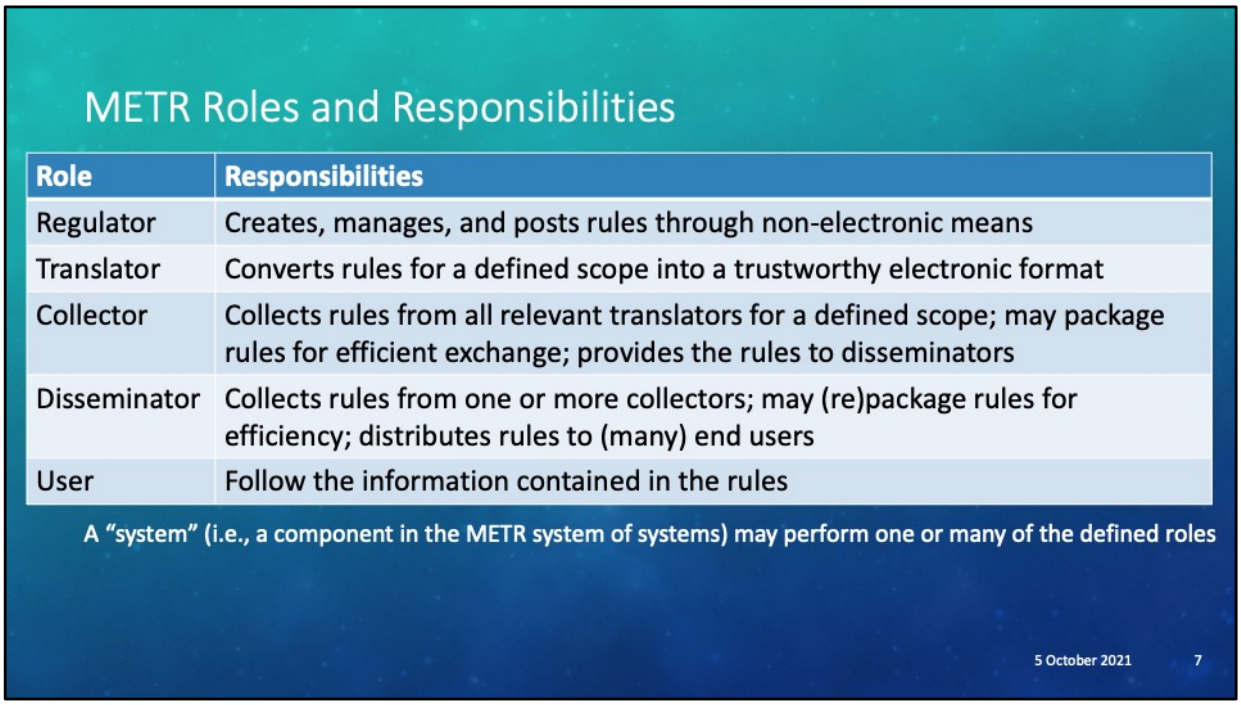
METR is intended to support all transport user systems. This includes: vehicle systems (e.g., automated driving systems and driver support systems), sidewalk delivery robots, and other devices such as smartphones used by pedestrians and perhaps units on-board micromobility devices (e.g., e-scooter interfaces)

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 quality 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.

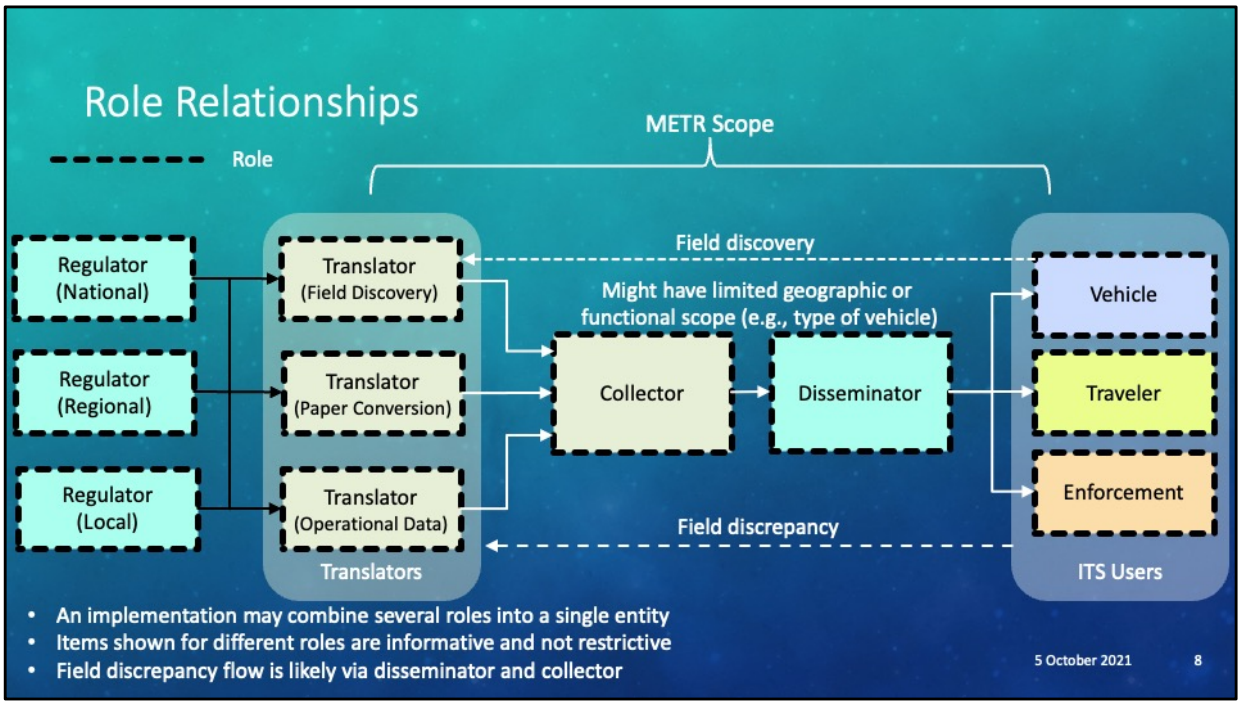
Importantly, in order to cover all rules, the scope must include rules that can change

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.

Now let’s take a look at the roles defined within the METR system.



This table identifies the five major roles that we envision within METR. It should be noted that METR is a system of systems. A component system may perform one or more of the identified roles and it is likely that different geographical regions will adopt different models. Some ideas of what these models might look like will be provided in the ConOps, but for now, we look at the system generically based on these role divisions.



This image provides a little more context to the roles identified on the previous slide by introducing the major relationships. The regulators (largely) operate outside of the METR process; they establish the rules of the road and METR provides one mechanism to publicize these rules. For any location, there will typically be multiple jurisdictional entities – and each jurisdictional entity (e.g., city) might have several regulators (e.g., city council, road authority, police officer). In some cases, the regulator role will be supported by a competent authority that has the legal authority to implement the rules once enacted. Within this diagram, the competent authority is included in the regulator box and is outside the scope of METR itself.

Once the rules have been established, they need to be converted into the approved electronic format; this is the job of the translator. Three major types of translators have been identified. For rules that are defined in real-time (e.g., variable speed limits, lane control signals), the translation may be included in the system where the rule is entered (e.g., the Traffic Management Centre might simultaneously electronically notify METR as it is posting a new variable speed limit for a section of road). Other rules are likely to be produced by processes that do not directly provide an electronic feed. In this case, a translator will be required to perform a manual translation of the (e.g., paper) rule into electronic format. Finally, in order to minimize

the amount of manual translation, some systems might allow for systems to discover posted rules in the field and to provide that information back to a translator. This mode might be especially useful during initial population of the METR database.

Once the data exists (somewhere) in electronic form, the collector role is responsible for gathering all of the information for the particular use cases that it claims to support. For example, a collector might have a limited geographic scope and/or set of user systems that it supports.

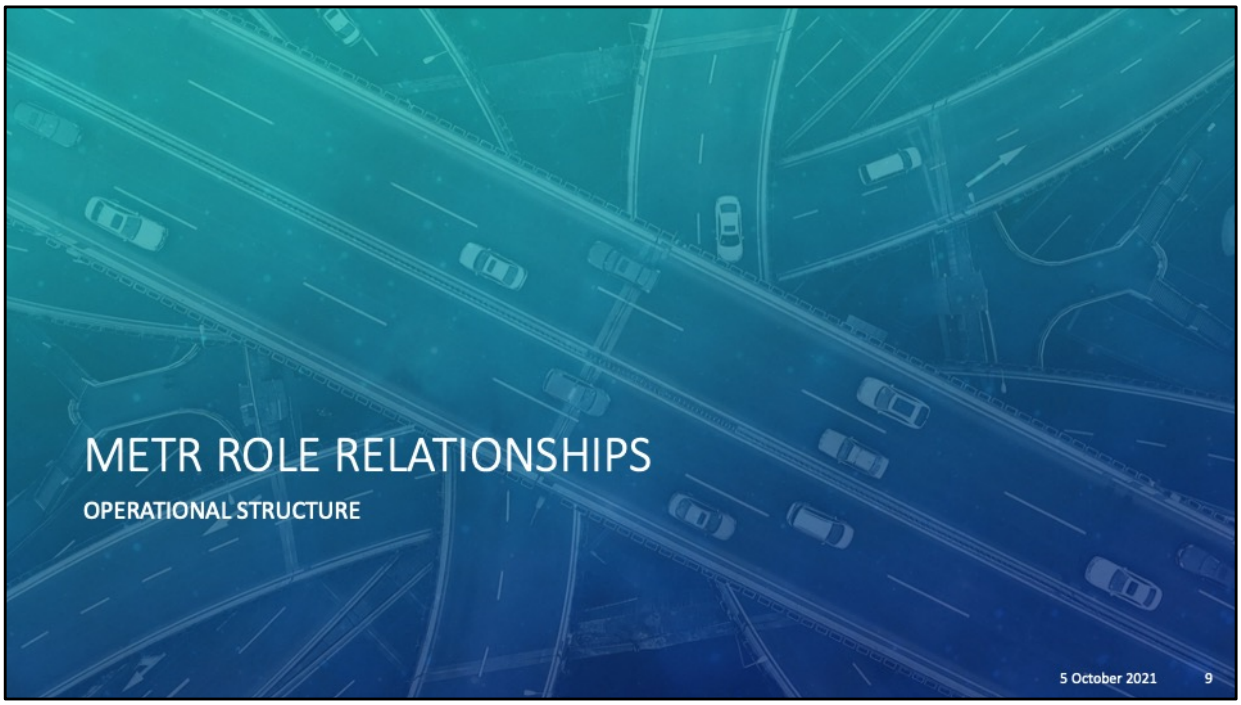
The disseminator is responsible for collecting data from a collector and disseminating it to the user systems. Once again, a disseminator might have limited geographic scope and/or user types.

Finally user systems are responsible for connecting to disseminators and obtaining rules per their agreement.

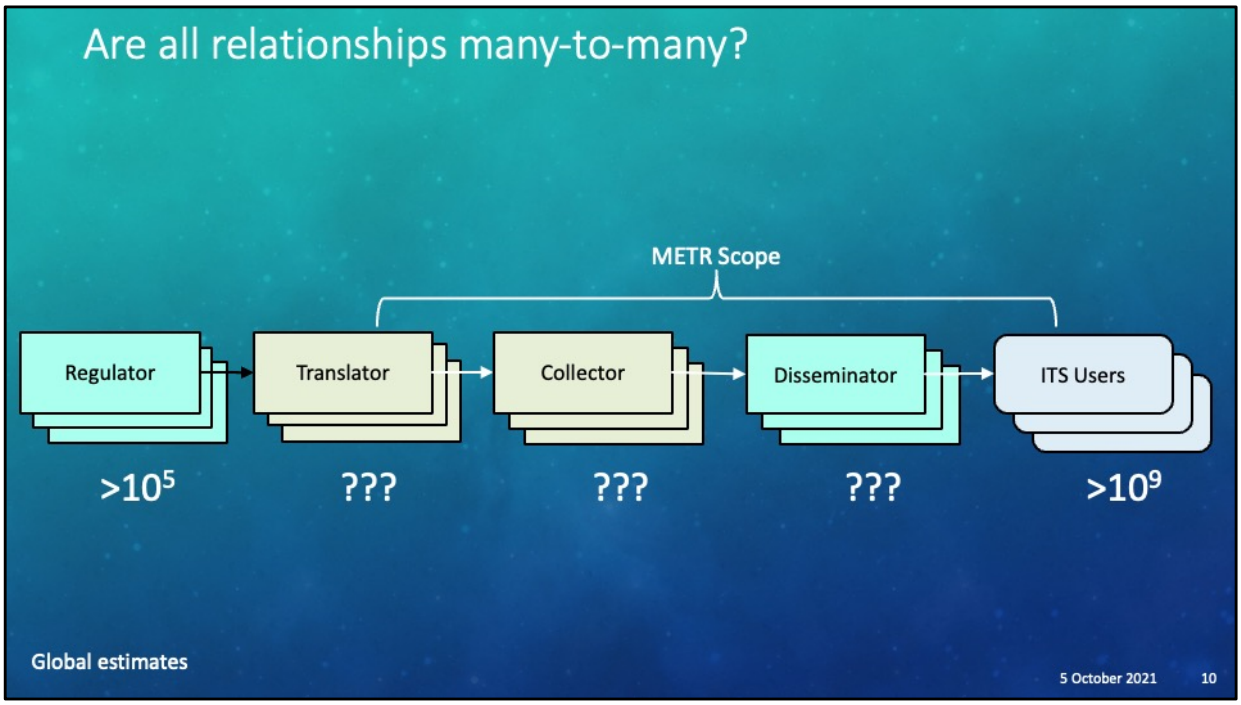
In addition, there are two potential return flows that have been identified. The first is from specialized vehicles that are designed to detect traffic control devices in the field and to report these directly to a specific translator as a means of efficiently entering the rules into the METR system. It is envisioned that this might be a more efficient mechanism for loading all of the rules into METR than manually entering all rules by hand; however, at the present time it is somewhat unclear if this flow needs to be standardized. The other return flow is similar, but more generic. It is envisioned than any user system equipped with sensors might be able to detect conflicts between the electronic rules it has received and the traffic control devices it detects (e.g., perhaps a missing stop sign or a stop sign where none is reported). When such conflicts are identified, the user system should notify translators so that the conflict can be investigated and the electronic and physical rules can be brought into alignment. However, the user system likely does not know the translator who provides this data; as such, the data will likely be routed through the disseminator and collector so that it can reach the correct translator. As this is an interface that needs to be supported by multiple user systems that are developed and managed by separate entities, a standardized interface will be needed.

It is important to note that these are just roles; specific implementations might group several roles into one system.

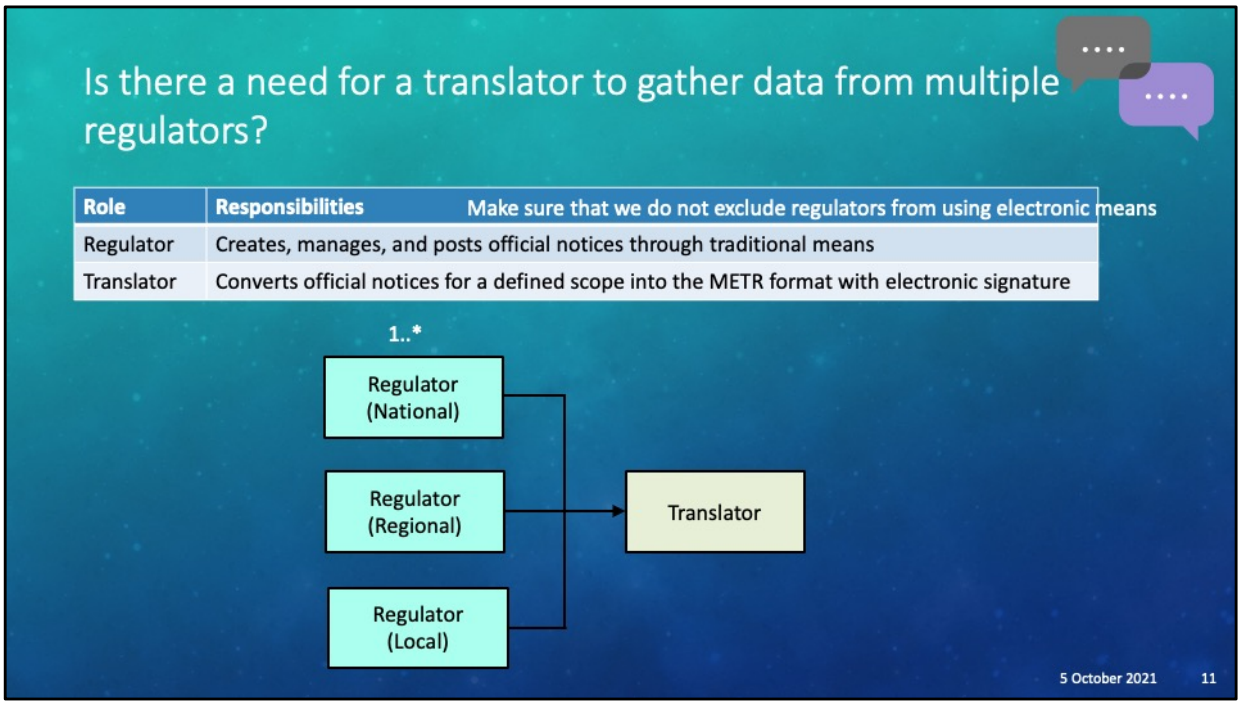
Are there any questions or concerns about this proposed structure?



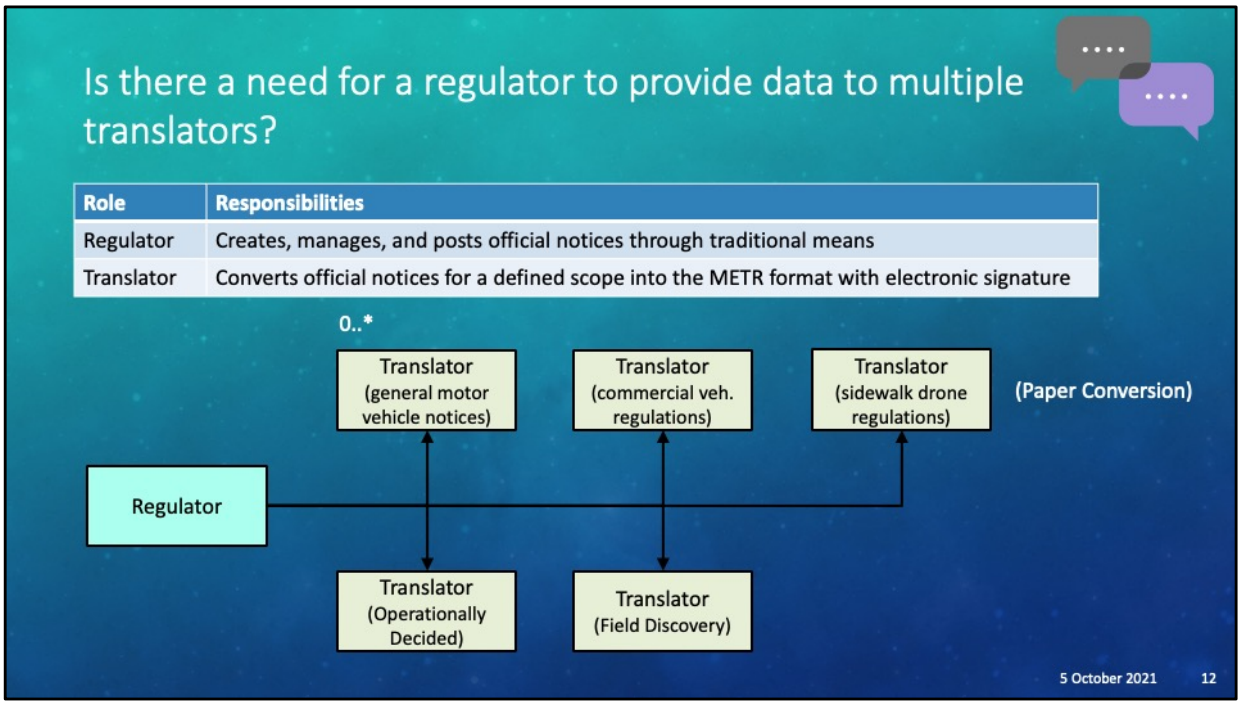
Now that we understand the major roles, let's consider the exact relationships at each level.



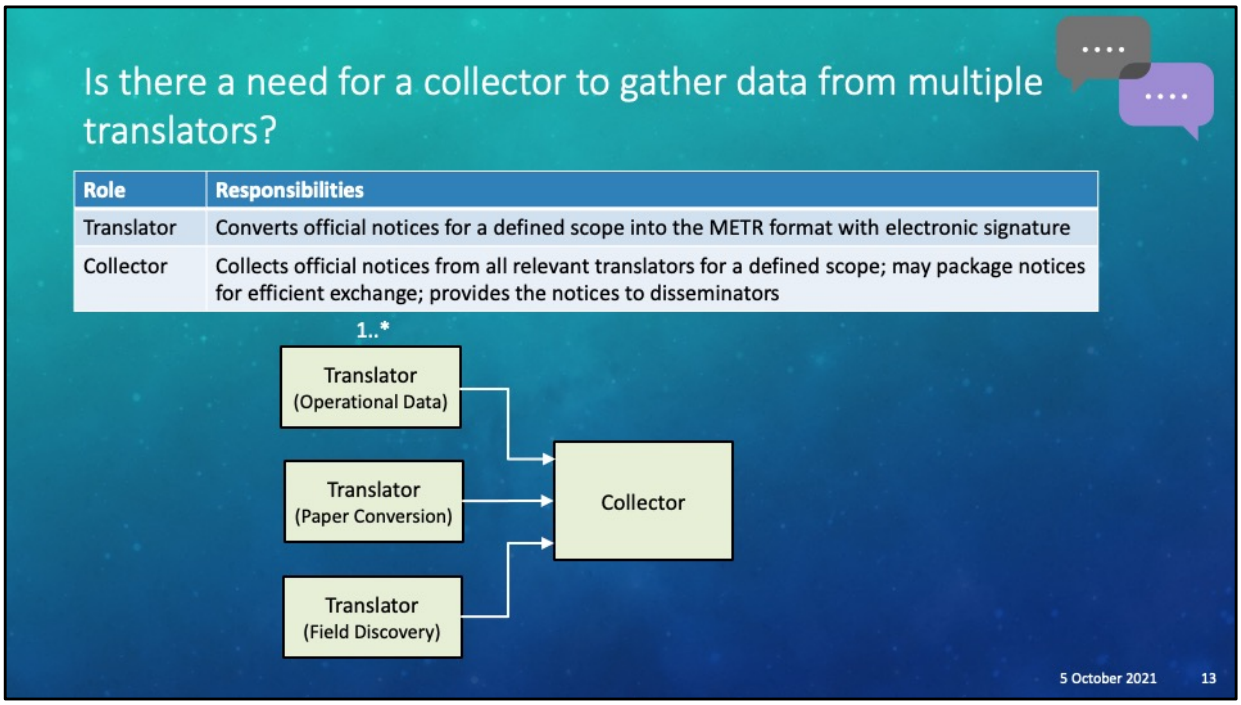
There area potentially billions of end ITS users of METR. On the other end, we know that there must be at least 100s of thousands of regulators that issue rules. But how many instances are there of the other roles and how do we envision these roles relating to one another? We'll look at these relationships one at a time.



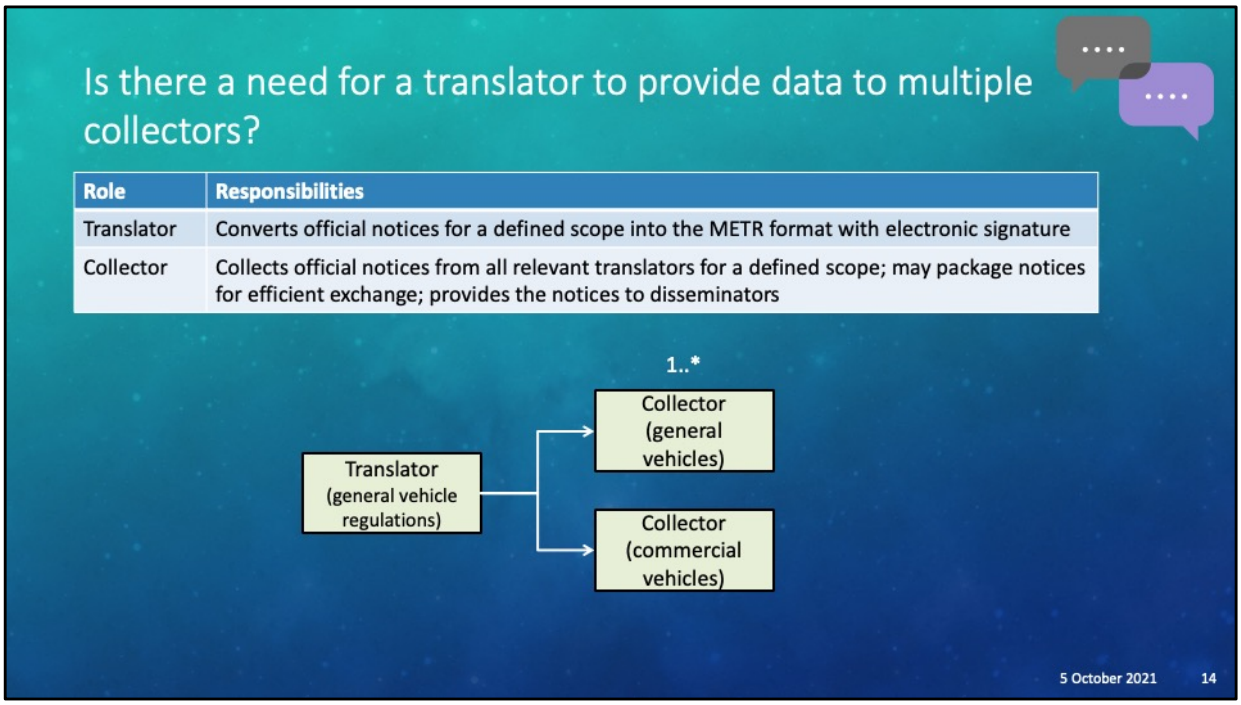
The first question is how many regulators might a translator need to deal with. While a regulator could act as its own translator (and provide a 1:1 relationship), the current proposal is that a translator should be able to create electronic rules for multiple regulators, potentially from different jurisdictional entities. Specifically, there could be 1 to many regulators per translator. Are there any concerns over this assumption?



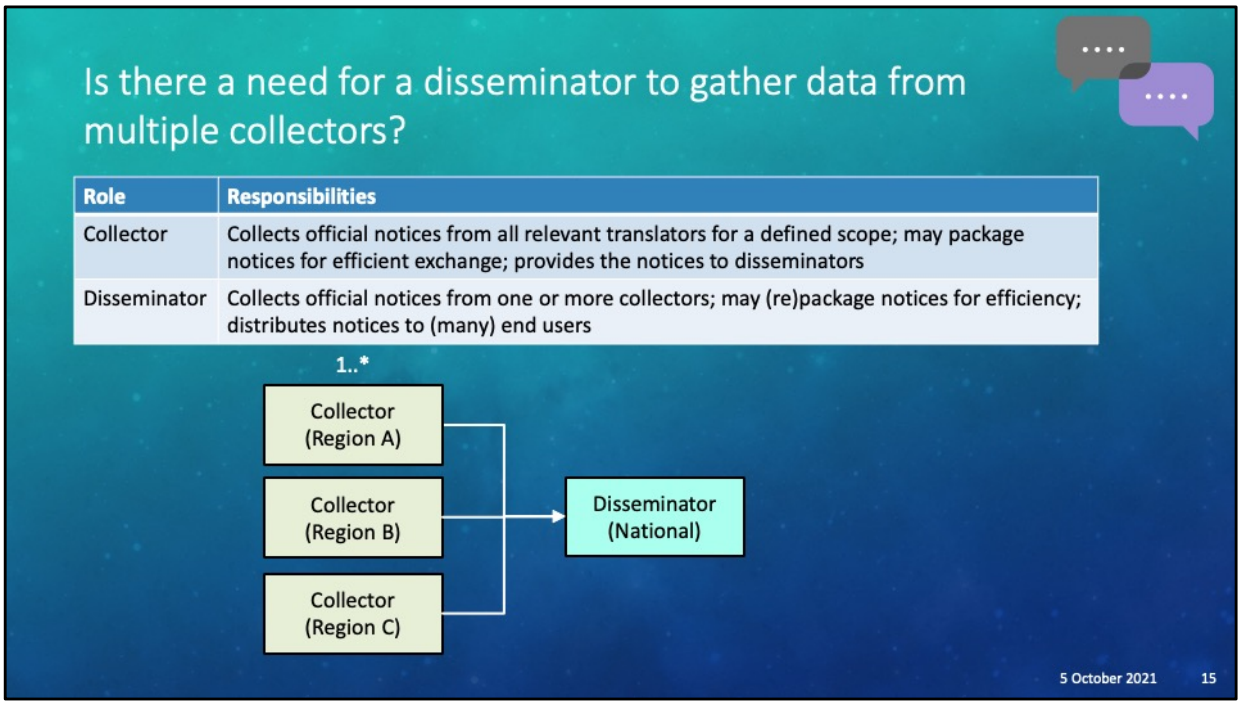
Next, how many translators might be associated with one regulator? The current proposal is to allow zero or more translators per regulator. In other words, a regulator might not yet have its regulations translated (0), might only have one translator ever (e.g., itself), or there might be multiple translators that are interested in digitizing different aspects of the regulator's rules. Are there any concerns about defining this as a zero to many relationship?



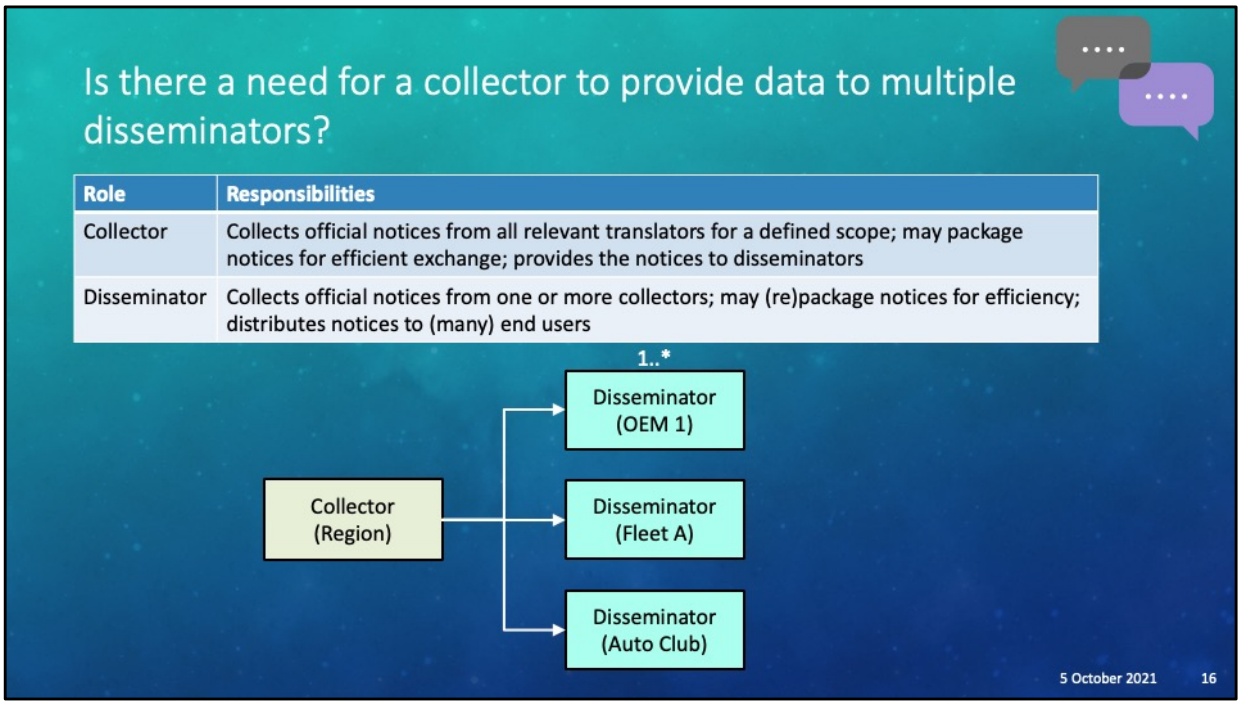
Now let's consider the relationship between collectors and translators. To be a collector, presumably, you need to collect from at least one source and the idea of a collector is that you likely collect from multiple sources. Are there any concerns about defining this as a 1..* relationship?



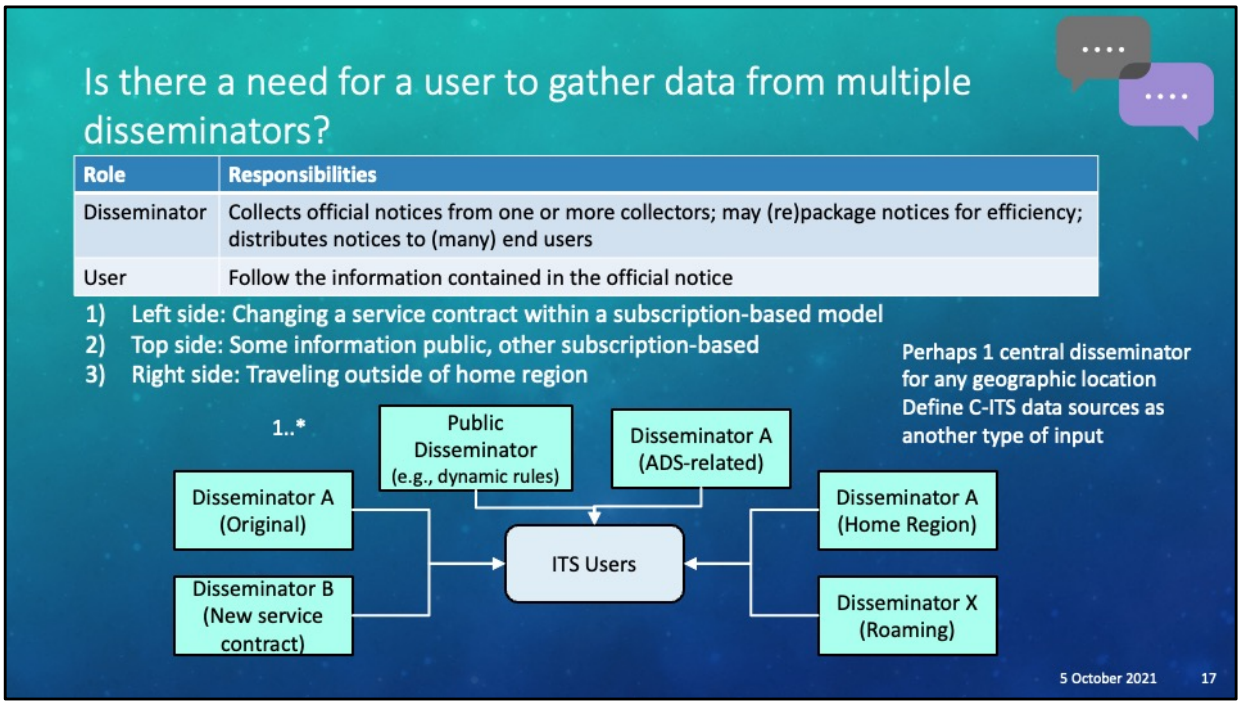
Conversely, a translator would seem to have a pointless job if they were not providing data to at least one collector. But a collector might digitize data that is provided to multiple collectors that specialize for different domains. Is there any concern about defining this as a 1..* relationship



Likewise, a disseminator would not be able to perform its responsibilities if it is not connected to at least one collector, but it is very possible that it might be connected to multiple collectors with different domains. Is there any problem on considering this to be a 1..* relationship?



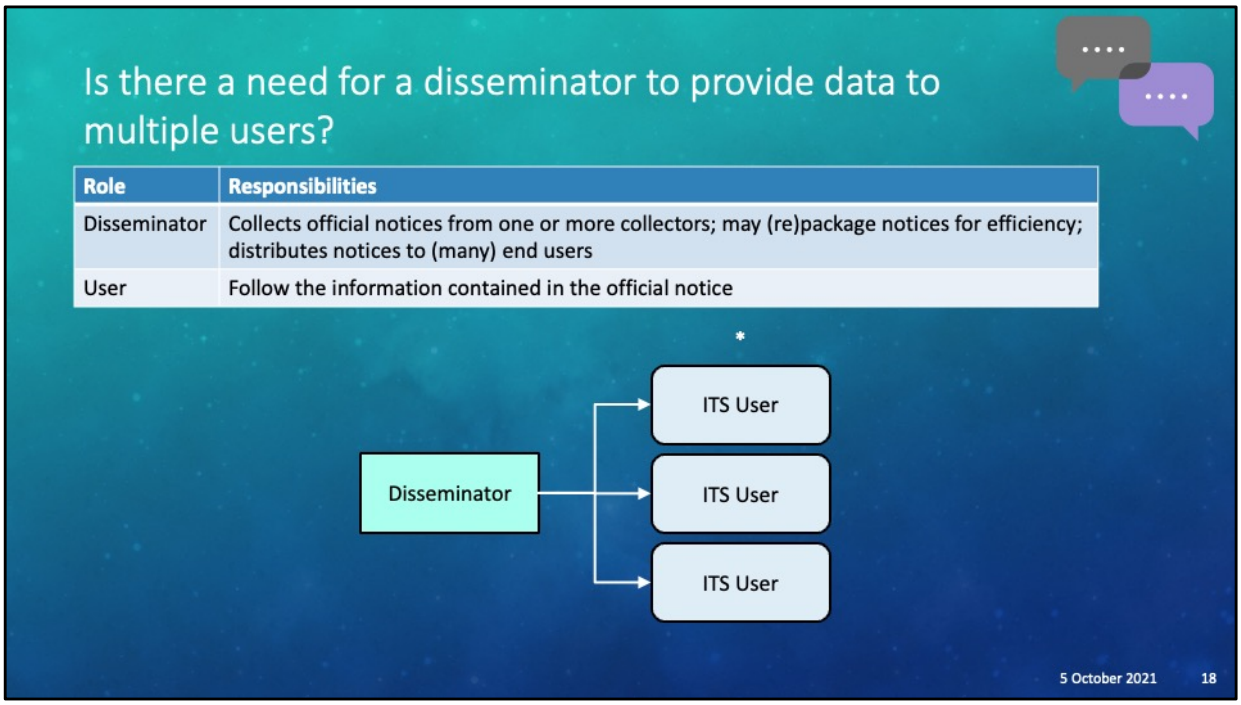
As with the translator, the collector would have a pointless job if it did not provide the collected rules to at least one disseminator; however, different disseminators might want to gain access from the same collector. Is there any concern in labelling this as a 1..* relationship?



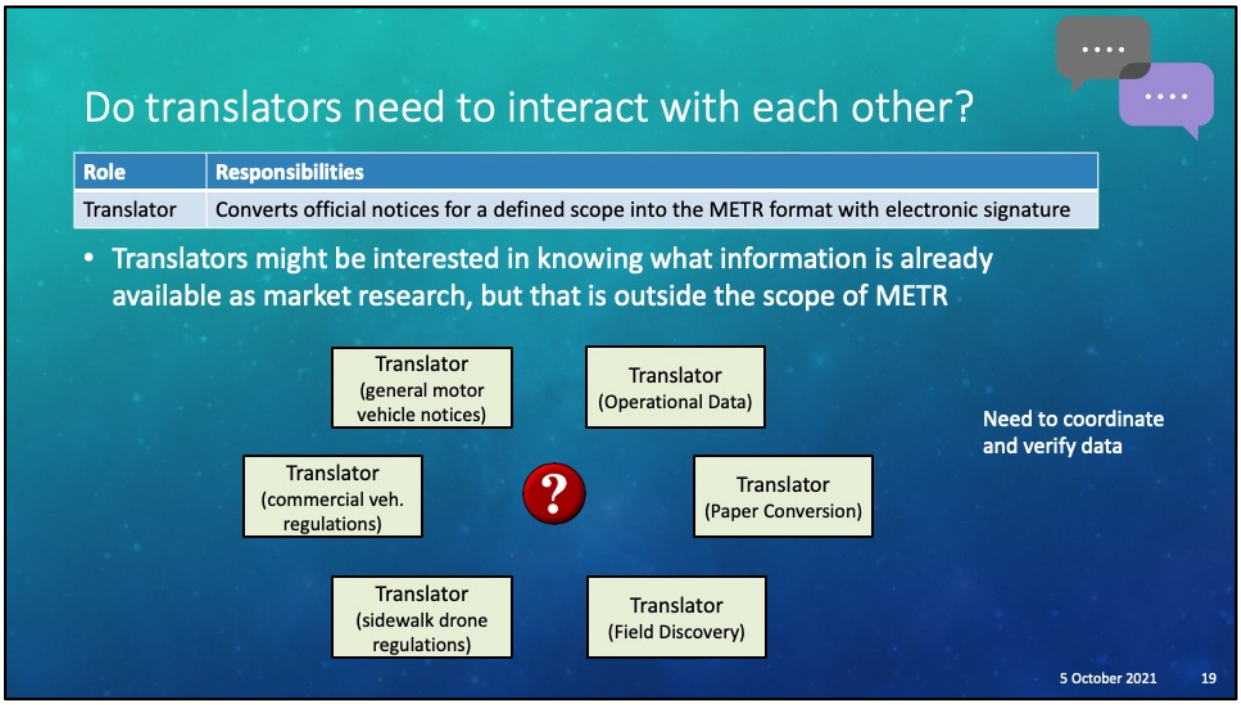
Next we consider the link between the disseminator and the ITS user. In order to fulfil the vision of METR, an ITS user needs to be able to access at least one disseminator. In addition, over time, it is conceivable that a user might need to access multiple disseminators, for example:

1. If the disseminator is based on some type of subscription-based model, a user might desire to change its service provider
2. A specialized vehicle might obtain generic rules from one disseminator and rely upon a different disseminator for specialized rules. For example, a public agency might provide some rules for free, but these might be insufficient to enable ADS, in which case, the OEM might provide additional rules so that the user can place the vehicle in automated driving mode.
3. A vehicle travelling outside its home territory might need to connect to another disseminator

4. Is there any concern with labelling this relationship as a 1..* relationship?



Finally, for the main flow, the main purpose of having a disseminator is to send the information to multiple users; values of zero or one are not really sustainable. Is there any concerns in labelling this relationship as many?



Those relationships are reasonably straight forward. We'll now look at flows among peers.

Are there any needs for translators to share information with one another? We were not able to identify any so far.

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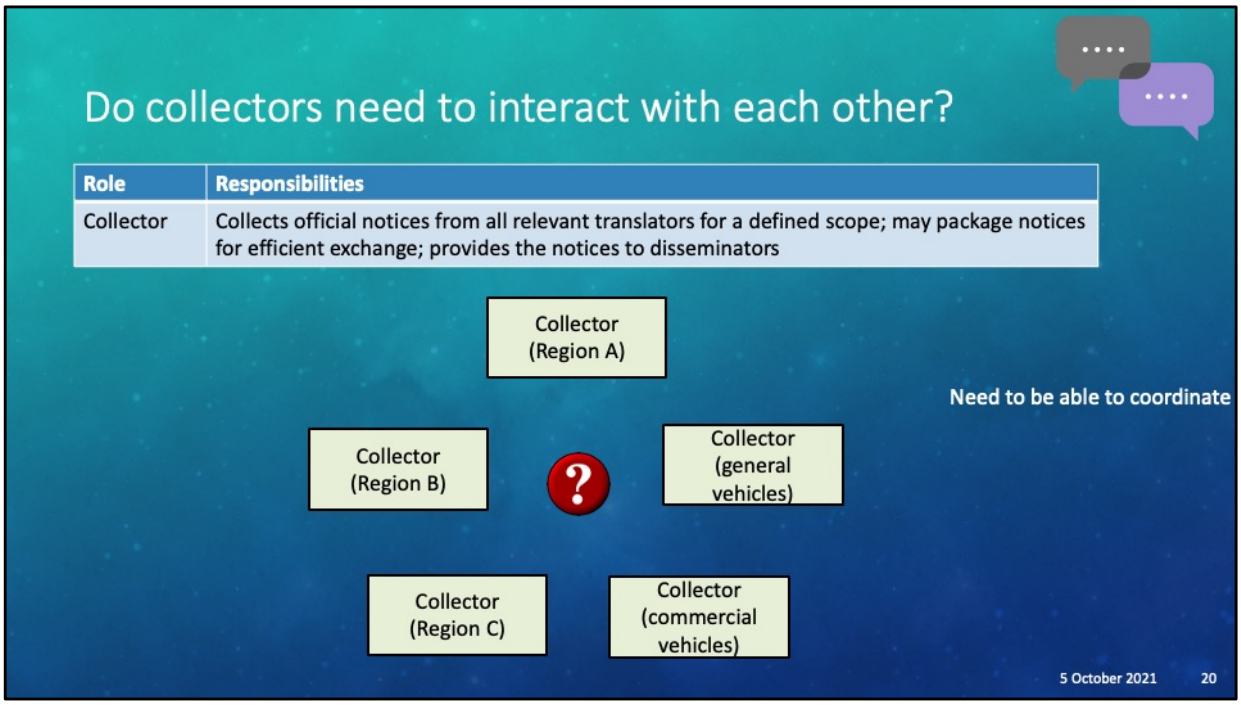

Likewise, are there any needs for collectors to share data?

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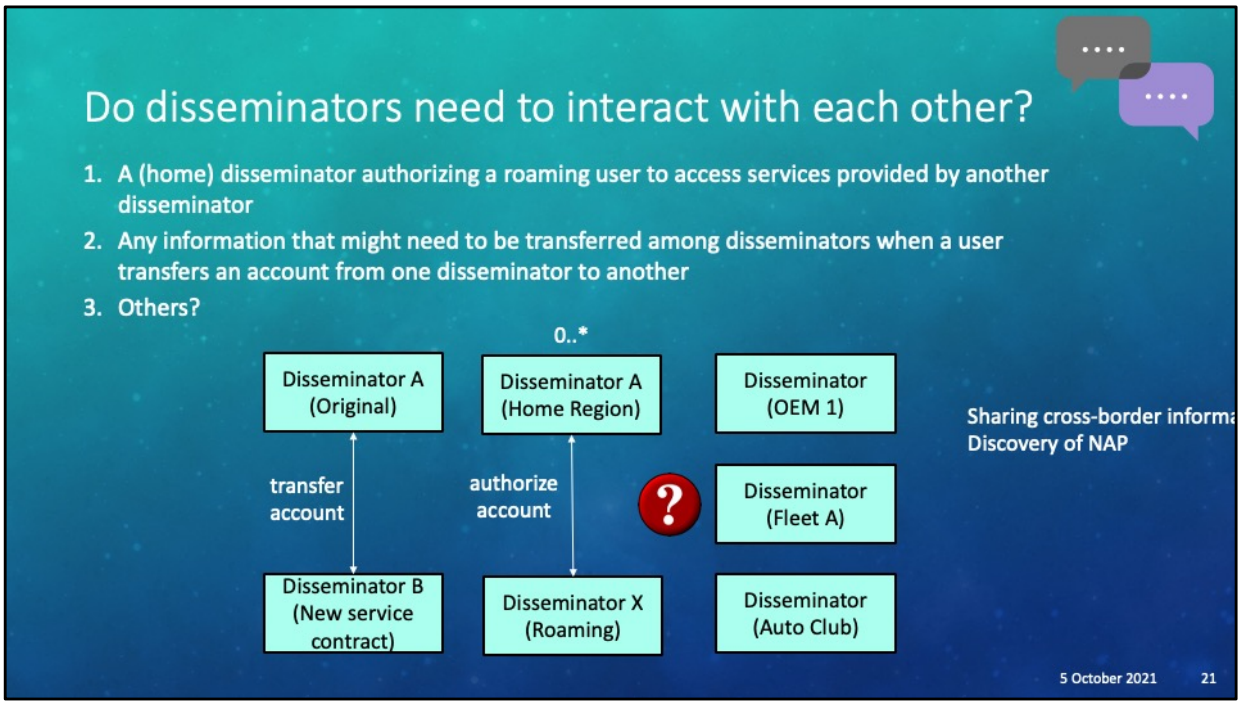

For disseminators, we were able to identify some potential exchange needs, for example, one possibility is the need for disseminators to share information about a user when transferring a subscription-based account from one disseminator to another. For example, when transferring a cellular service providers, it is often useful to share access to the phone number so that the user can retain the same number on his account; however, it is unclear that there is actually any need to share data in the case of METR for this type of operation.

Perhaps a more realistic scenario is a disseminator in one region entering into an agreement with a disseminator in another region to provide guest access. Thus, even though Disseminator A might not provide rules for particular geographic area, its users can gain access to data in those areas due to the partnership agreement between Disseminator A and Disseminator X.

Are there any other reasons for disseminators to share data?

In practice, these links are likely to be short lived and transaction based, but there does not appear to be any reason to prohibit multiple connections. Is there any reason not to allow a 0..* relationship

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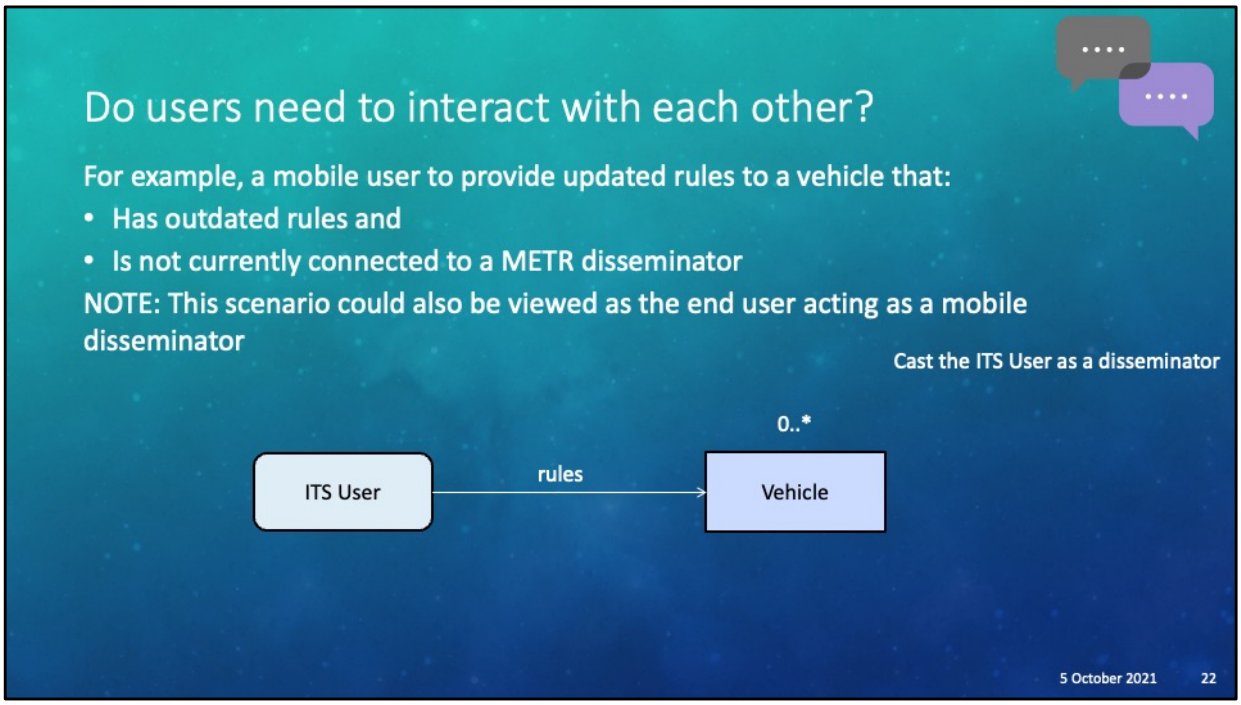
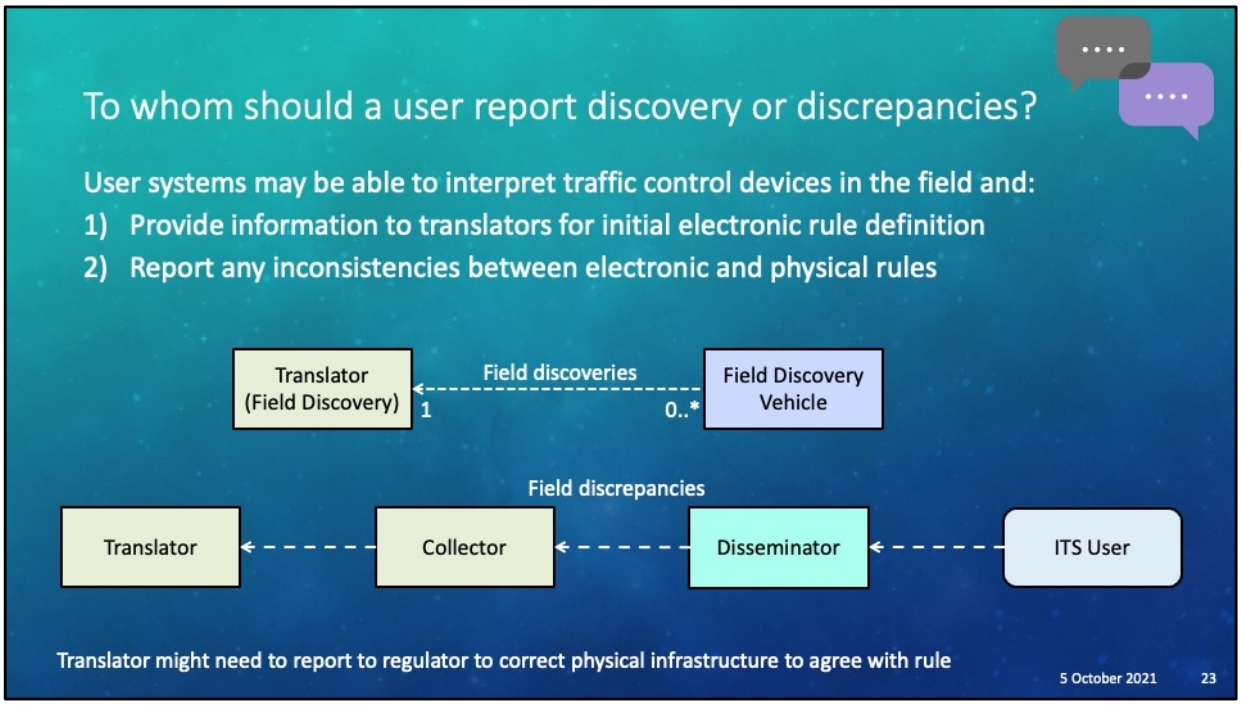


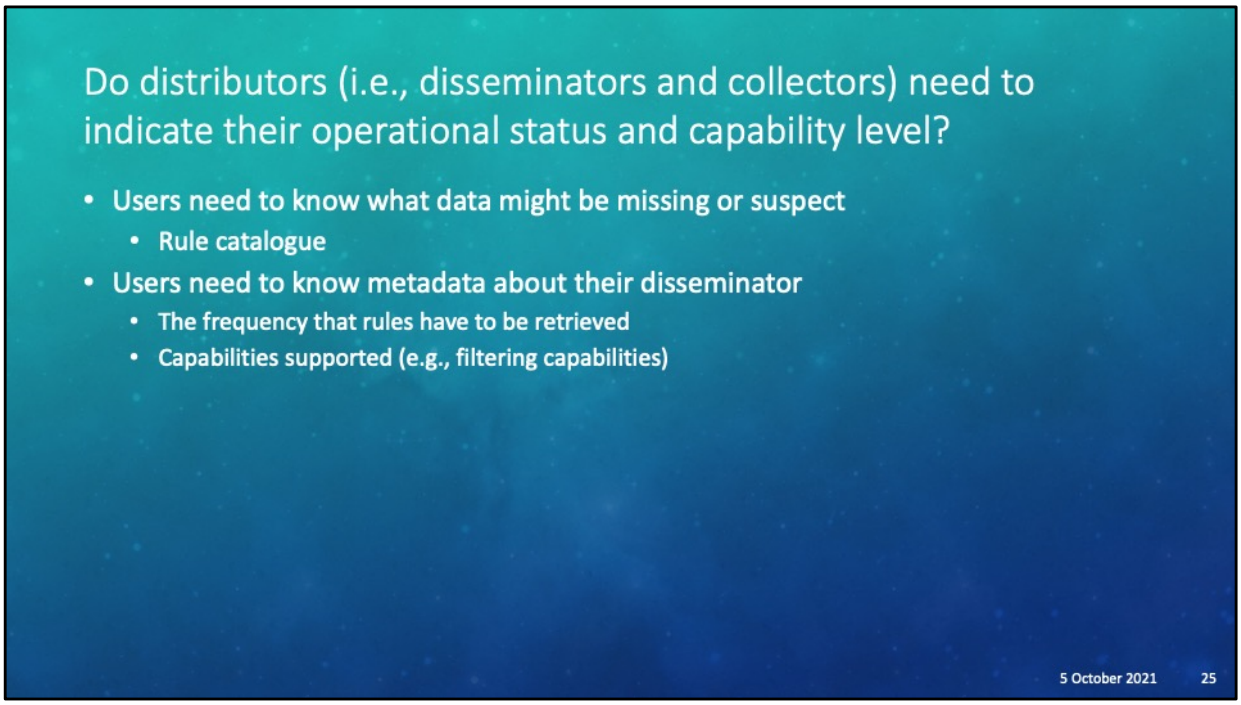
And finally, we consider the interaction between ITS users. The only scenario that we thought of here is in the case of a remote update. For example, a vehicle is parked in a remote location for a prolonged period of time and all of its rules are not longer valid. It might be desirable for the rules to be refreshed by simply downloading from a mobile device or another vehicle. While this is likely a one-to-one connection, is there any reason that it needs to be restricted to 1-to-1? Any concerns about listing this as a 0..* relationship.



Now let's consider the return flows. Are there any concerns about considering the field discovery vehicle to be specific to one translator and a translator being associated with zero or more field discovery vehicles.

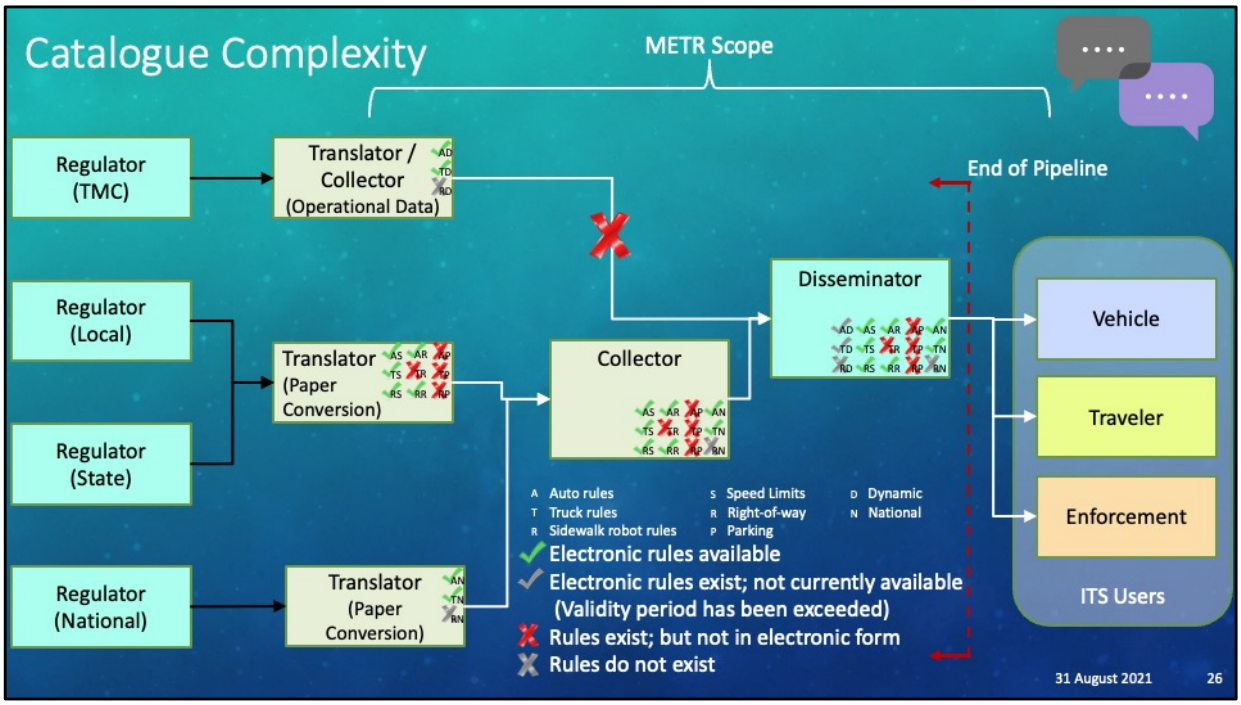
In the case of field discrepancies, our proposal is that it is the responsibility of each subsystem to know who provided the conflicting digital rule and how to contact the entity from which it was received. But the actual relationships among these entities are as previously defined.

That complete our discussion of relationships among the roles; now let’s look at information about distributors



Users need to know certain information about distributors, in particular:

- The data that is available and
- Metadata such as the required refresh rate and what capabilities might need to be supported



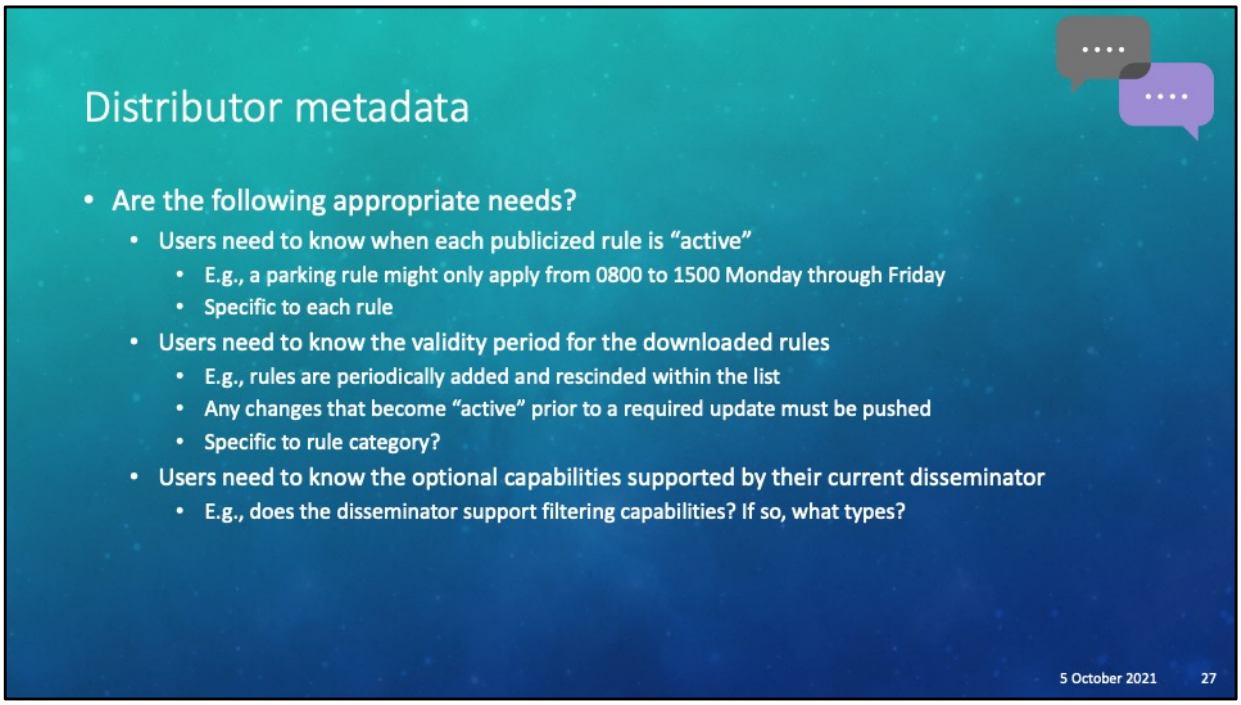
We already talked about the availability of data in Workshop 1, but we present this slide as a refresher since this provides background for some follow-on questions.

We assume that there the disseminator will be able to provide a catalogue that shows what data is available; this catalogue is likely to become very complex. For the various systems to interoperate, there needs to be an understanding of what items can exist in a catalogue. In the example above, we see that the rules are grouped into a matrix of categories where one dimension of the matrix indicates the type of vehicle (e.g., automobile, truck, or sidewalk robot) and the other dimension indicates the type of rule (e.g., speed limit, right of way (such as Stop), parking, dynamic (such as variable speed limit), and national)

The grouping of rules shown here are just for example, but eventually METR will likely need to standardize the categories to be used.

Any comments, questions, or concerns on this approach?

ConOps Section 6.3.1.1.4.1.3 Discover Rule Availability

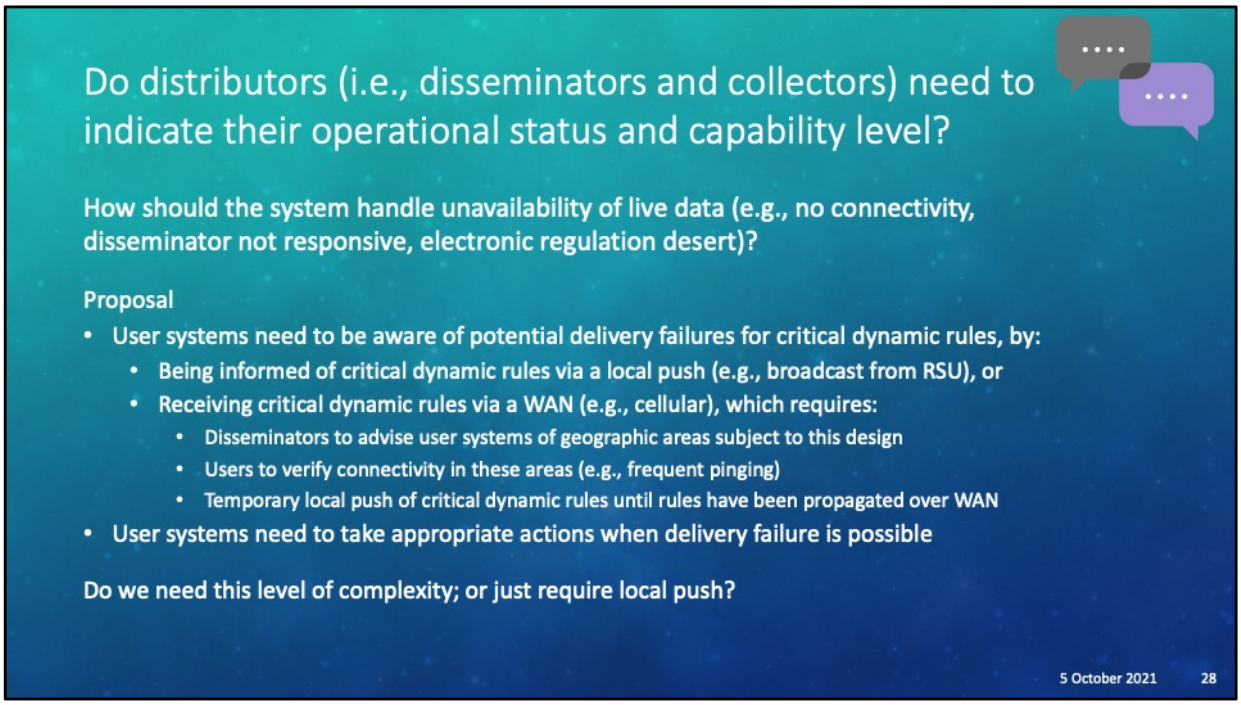


When obtaining rules, we propose that the user needs to know certain information. For example, each rule needs to be associated with information about when it is "active" (i.e., when it can be enforced). This information is likely specific to each rule. However, the user also needs to understand the validity period for each downloaded rule. In other words, for how long can the user trust the information to be accurate without having to refresh its download. A longer download period allows vehicles to remain outside of coverage areas for longer periods of time without losing capabilities – but it also increases the amount of dynamic rules that have to be sent.

How should a validity period be conveyed for "static" rules? Do all systems need to agree to a single standardized period, is each system different, are there advantages in allowing each category of information have its own validity period. For example, perhaps guidance rules have a longer validity than regulations? Such a design might allow a user to become aware of updates to non-critical rules in real time but to download them once within Wi-Fi coverage.

Finally, user systems should be aware of the capabilities of the disseminator – not only the catalogue categories supported, but also other features such as filtering capabilities (assuming specific filtering capabilities are optional). Given that we do

not yet know what all of the optional capabilities might be, we propose that the need be stated simply as a user being aware of the optional capabilities supported



Next we consider how a user system should handle its operations when data is not available.

At least in theory, any rule could change or be overridden a millisecond after a delivery failure occurs; however, systems are not able to stay absolutely synchronized within the timeframe that might be required for all rules (e.g., signal timing).

Rules are divided into three potential categories:
- Static rules: Users are responsible for pulling static rules at an agreed frequency (and perhaps at convenient times)
- Central-based dynamic rules: Users are responsible for more frequent pulling of dynamic rules from a central location; this is designed to minimize the amount of data that has to be pushed locally; and could be divided into more locally defined packages
- Local dynamic rules: These rules have to be pushed (e.g., broadcast) to users near the location where they apply to ensure that they have the latest information

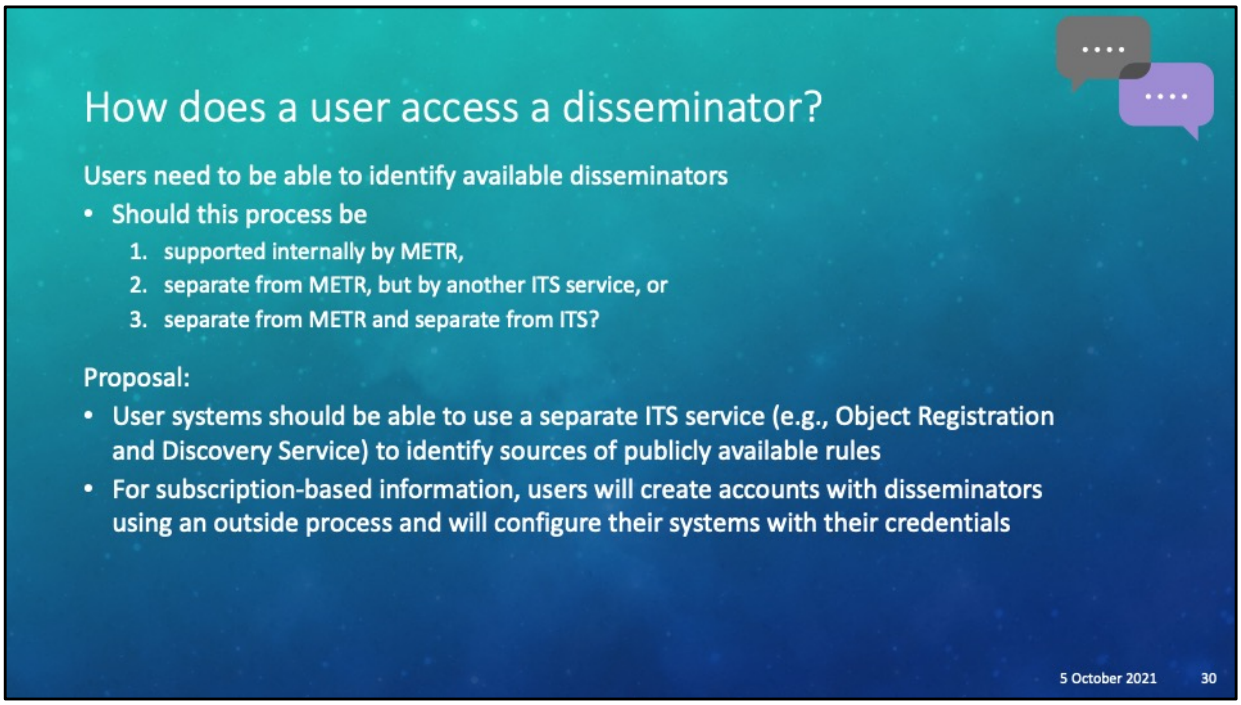
It should be noted that dynamic rules only need to be considered when deemed to be sufficiently time-critical. For example, a change in a guidance rule might not be

critical, but lowering the speed limit would be more so and signal timing data even more so.

If the middle level of distribution is to be useful, it must be able to provide a high confidence of delivery. Thus, it cannot be used in areas that do not have adequate wireless coverage and users must know that they are responsible for frequently updating their information when in these areas. Further, there is still bound to be some delay between activation of a rule in the field and the time it is available within the central system and all users affected by the rule being notified. Until the system can assure this delivery of information via central, the dynamic rule must be distributed locally.

Finally, we assume that it is the responsibility of the user system to take correct action whenever there is a potential for a lapse of data (based on understanding the above responsibilities). “Correct action” is intentionally left a little ambiguous as that it the subject to design decisions of the user system. For example, given that rules changing and being overridden are exceptional cases, how safe it might be for an ADS-equipped vehicle to continue driving might be dependent upon how good its external sensors are and how aggressive its designers are. We propose that the METR standard remain silent on what actions might ought to be taken, but the liability of taking action is borne by the OEM.

That complete our discussion of metadata; now let's look at information about data access



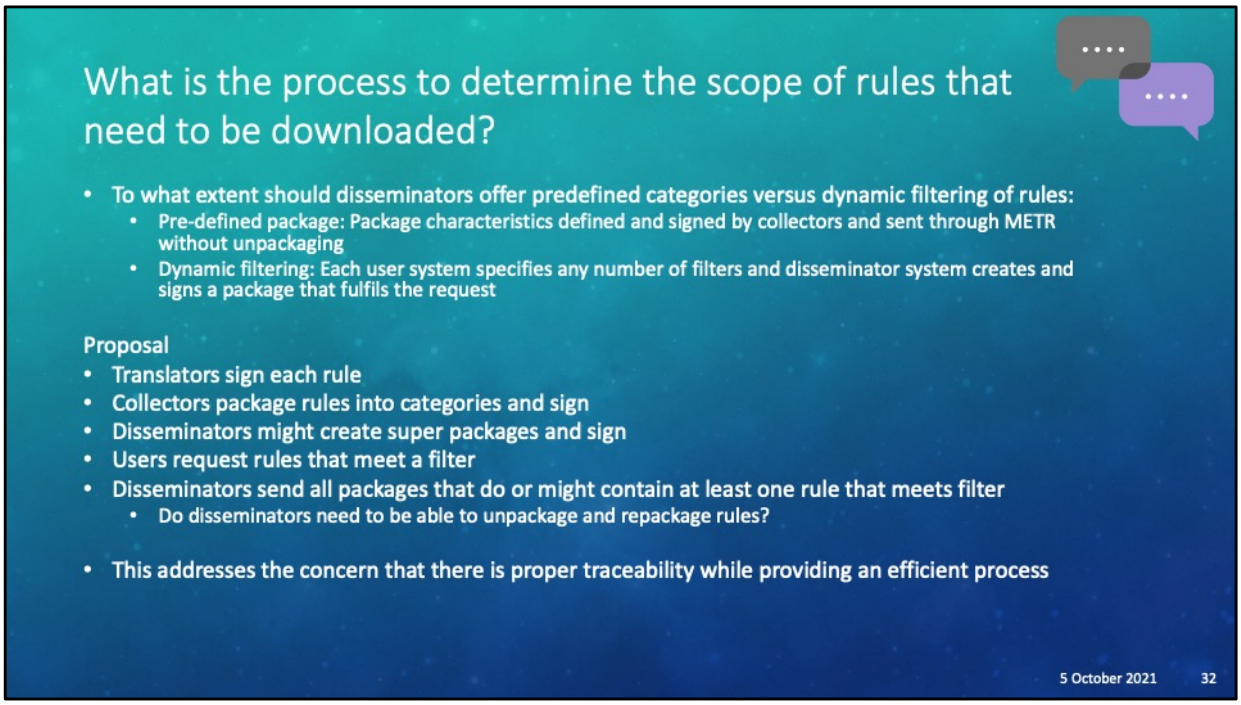
How should a user system discover the disseminator from which it collects data? Should this process be:

- Part of METR
- A different ITS service
- A process separate from ITS

Our proposal is that for publicly available disseminators, users should be able to use some external ITS service (e.g., object registration and discovery) and that METR does not need to worry about the details

For subscription-based services, we propose that the process is external to ITS (e.g., it might be part of an agreement with the OEM, an insurance company, or another entity)

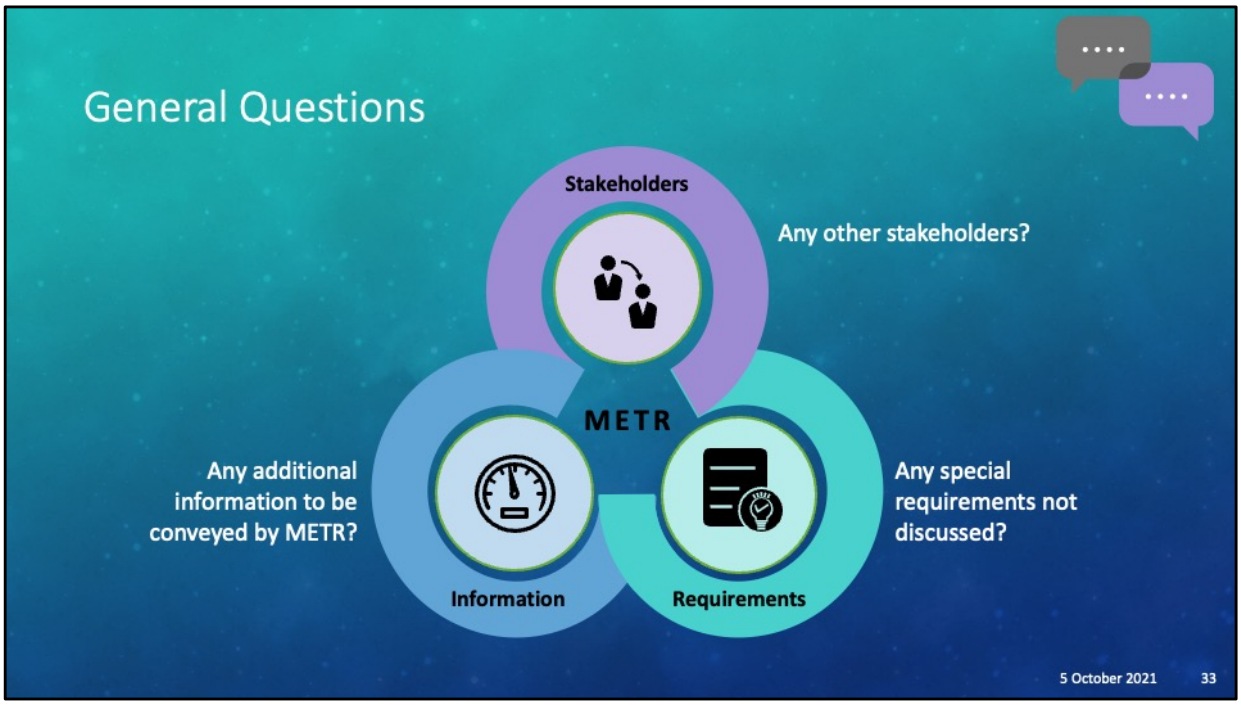
Likewise, while translators, collectors and disseminators will need to connect with one another, we propose that this is outside the scope of METR.



When a user accesses data, how do its filters work? For example, should the user request force the disseminator to look at a large database of individual rules and provide a report of all rules (and only rules) that meet the specified criteria? Or should the translators or collectors pre-configure downloadable sets of rules that can be downloaded. Then whenever a user request comes in, the disseminator sends all packages containing at least one rule that meets the filtering criteria?

Our intent is not to design this issue at present, but rather to identify the concerns and needs of stakeholders so that we can capture these within the ConOps. If there are no needs or concerns related to this issue; we can delay this decision until the design stage, but if there are concerns, they should be captured now

Road work
Incident
speed limits (static/variable)
lane use
heavy vehicle access restrictions

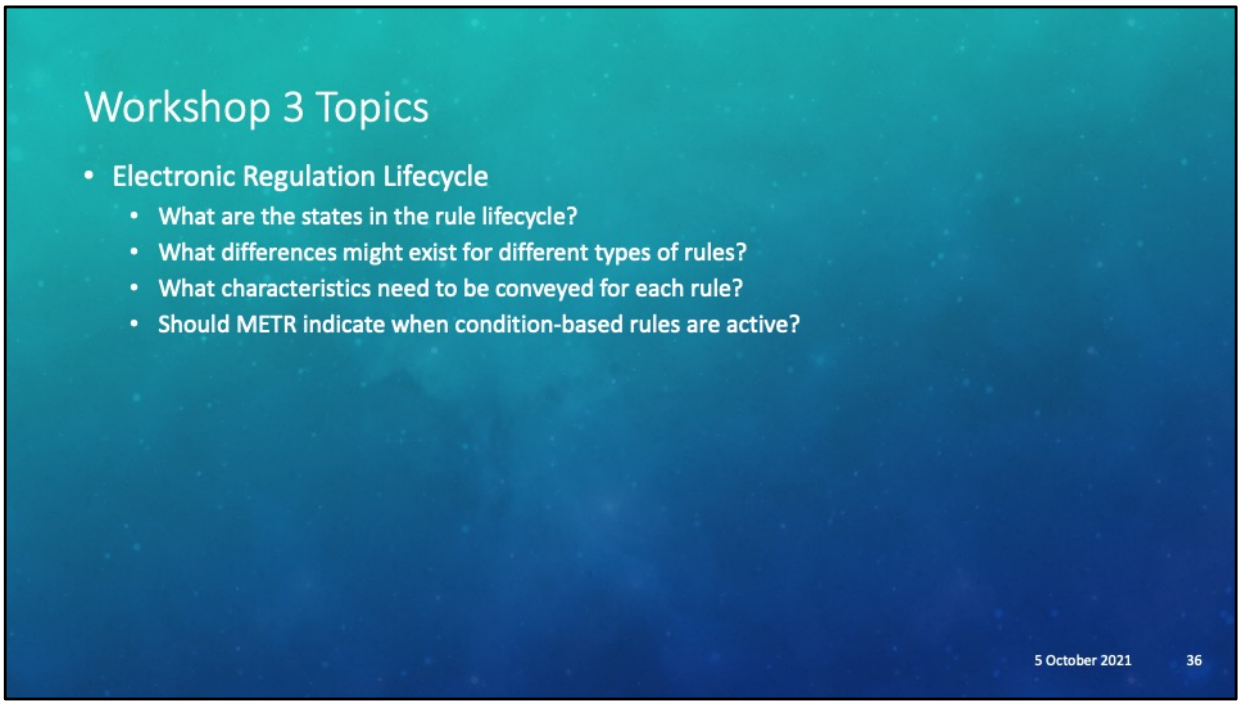


Finally, perhaps the hardest question set: What questions have we not asked about METR operations?
Are there other stakeholders that we need to contact?
Is there additional information that needs to be conveyed by METR?
Are there any special needs not discussed?

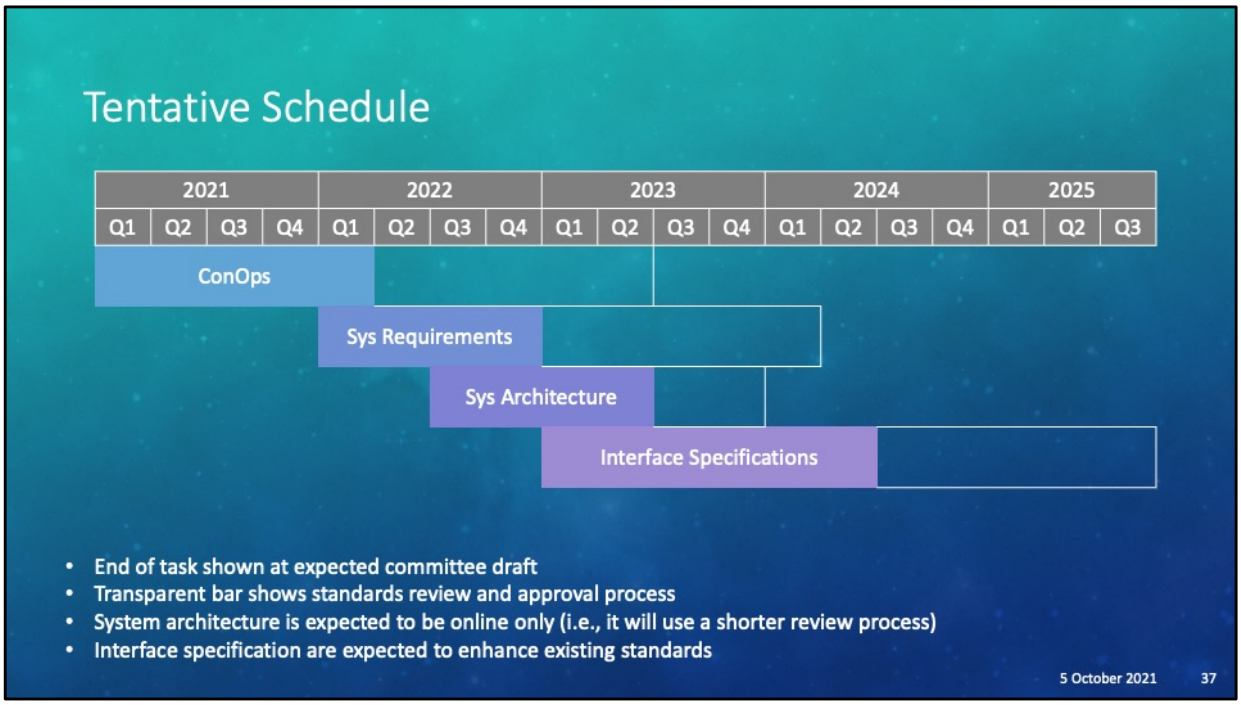
System manager and need to update and certify who can be collectors, etc.

That completes Workshop 2

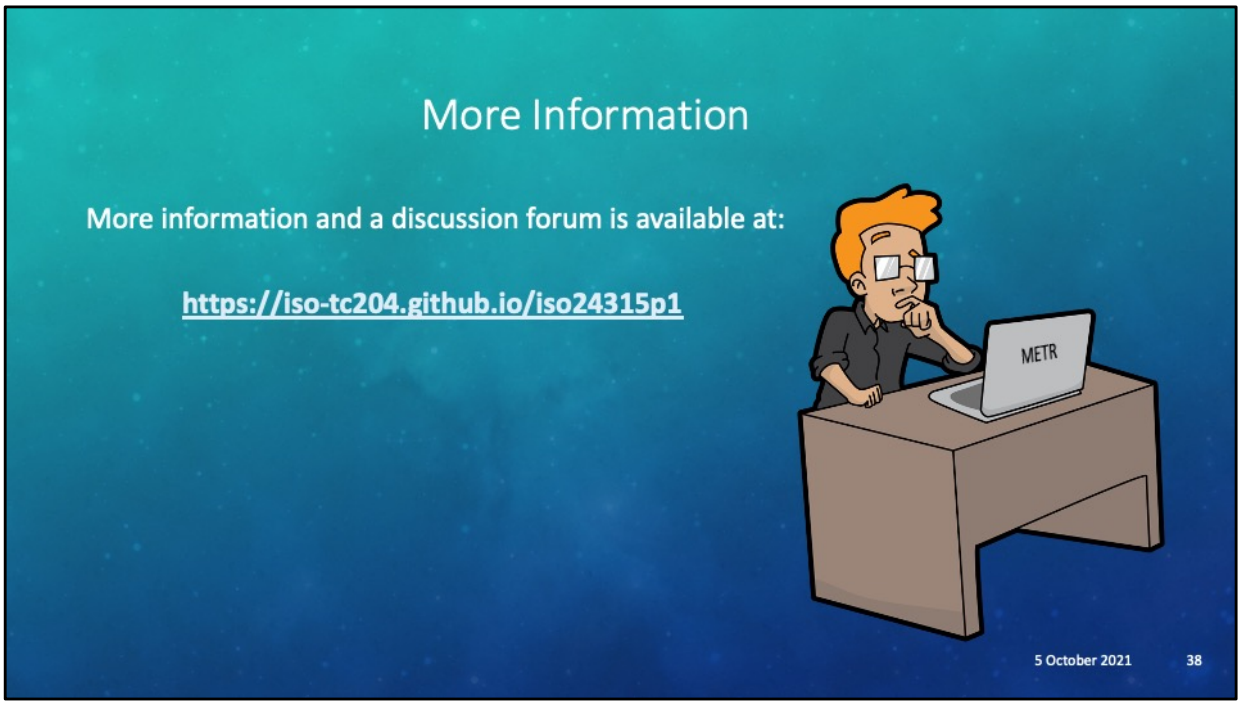
Thank you for your participation today. We have completed the first of 12 workshops and look forward to seeing you again next week for the discussion of METR operational structure.



Next week we will discuss the Electronic Regulation Lifecycle. This slide summarizes the major topic to be addressed next week.



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 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