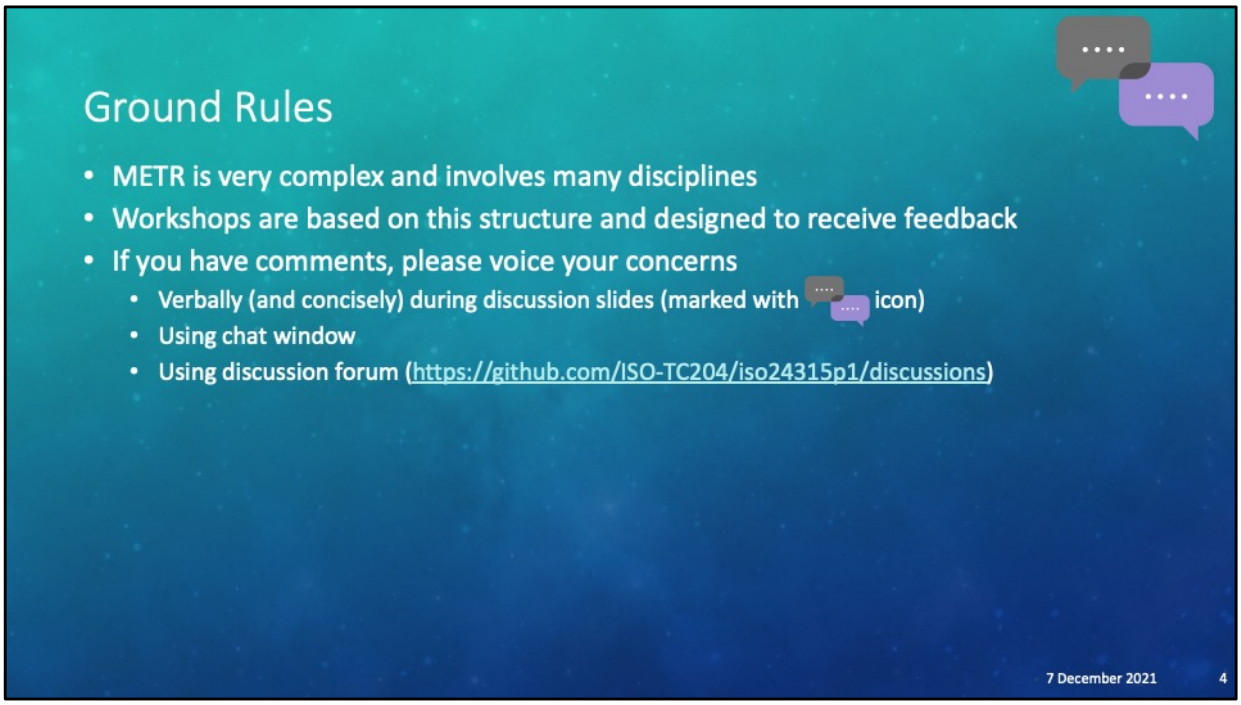
Welcome to the eleventh workshop on METR. Today we will talk about METR deployment issues.

The topics today are listed on this slide

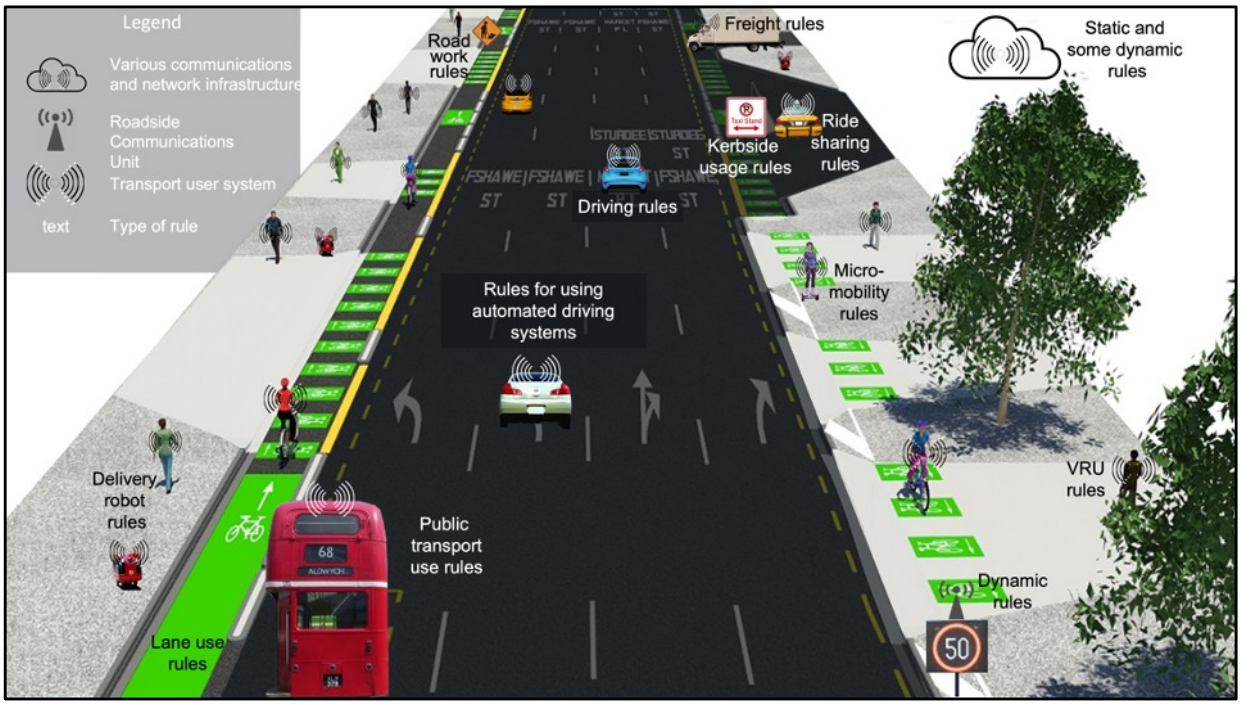
It is important to acknowledge that the materials developed to date represents a team effort. While there is a core editing group, as shown in the upper left, the concepts presented within this presentation already reflect valuable inputs from the review team shown on the right. In addition, the overall 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,

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.

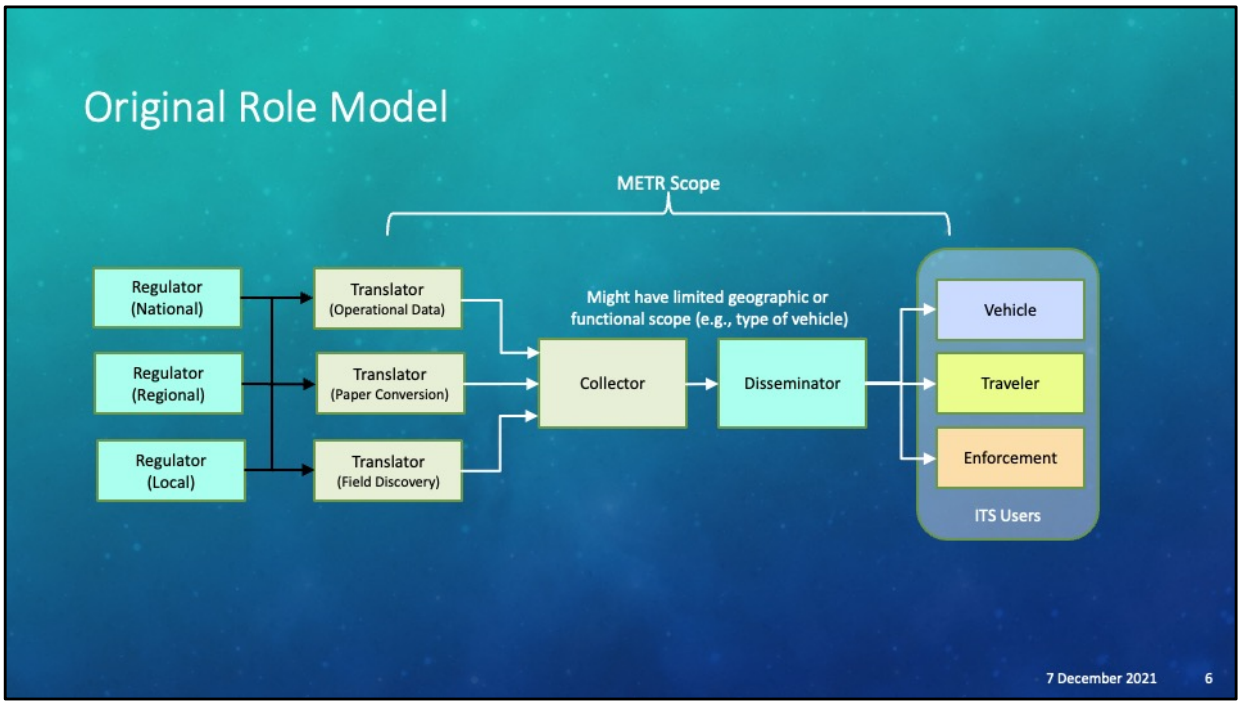


METR is intended to support all transport user systems. This includes: vehicle systems (e.g., automated driving systems and driver support systems), sidewalk delivery robots, and other devices such as smartphones used by pedestrians and perhaps units on-board micromobility devices (e.g., e-scooter interfaces)

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.



As we consider the effort to deploy METR, let's begin with a review of our role-based architecture.

Here is the original role-based architecture that we started with, as contained in the vision document. The basic premise is that there are "regulators" that define the rules of the road, including regulatory, warning, and guidance information for the travelling public. Regulators form the core of the "existing system" and within this model, the role only includes non-electronic tasks – with the recognition that in any given future system, a single entity can perform multiple roles (e.g., the regulator and translator roles might both be fulfilled by the same agency. For just about any location, there are likely to be multiple regulators that have some level of jurisdiction. For example, a vehicle might have to abide by national laws and local laws at the same time. In addition, within a single jurisdiction, there might be laws from a motor vehicle regulator, the public transport regulator, the police, etc. Each of these are recognized as distinct types of regulators.

The translator is responsible for translating non-electronic rules into electronic rules. There will often be multiple translators. For example, different geographic regions might use different translators and there might be translators that focus on particular

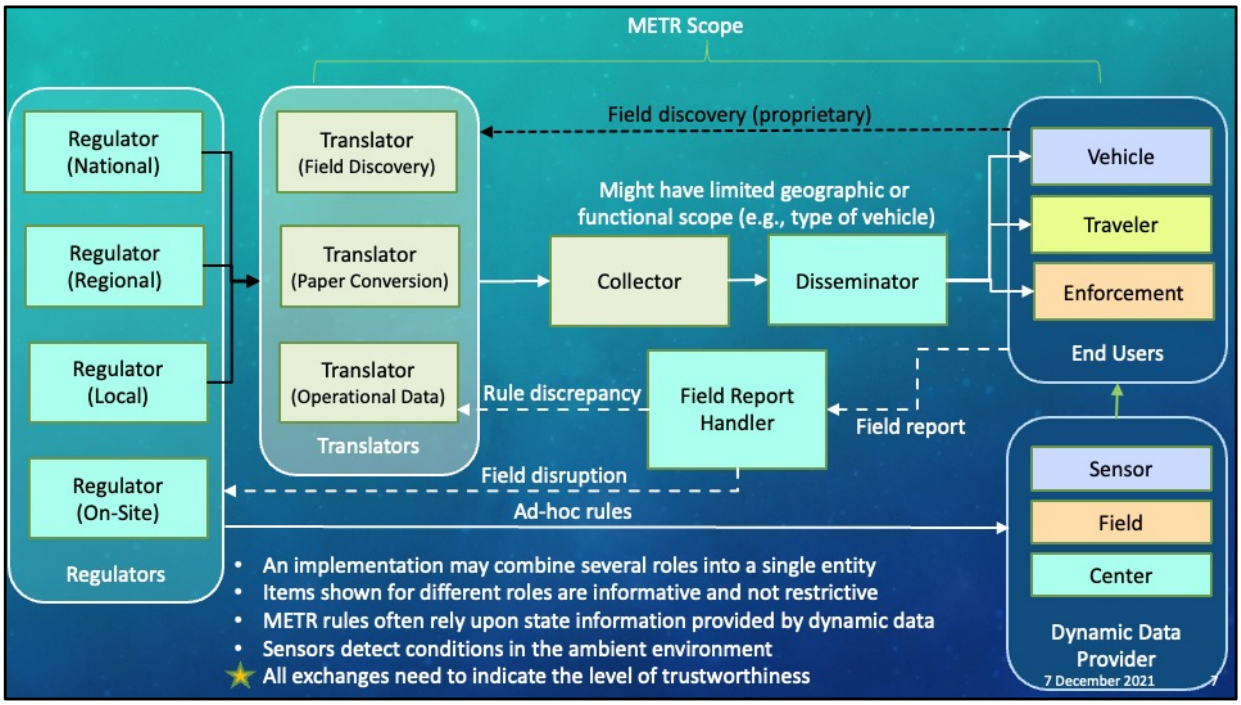
modes of travel (e.g., commercial vehicles).

The collector is responsible for collecting all necessary rules from all appropriate translators and providing them to a disseminator in an easy to consume format.

The disseminator is responsible for managing all of the rules and providing them to user systems, as needed. This is perhaps the most challenging component as a disseminator has to be able to provide the information to a large number of users, each operating asymmetrically (e.g., at any given time a large number of vehicles will not be operating) in a trustworthy way, including ensuring that the information is provided to each user in a timely manner.

Finally, ITS users include any consumer of the disseminator data, but this is most typically represented by a vehicle (e.g., motor vehicle, micromobility vehicle, sidewalk robot).

Within this model, the term METR applies to the electronic flow of rules and related information. Thus, it excludes the non-electronic interface between the regulator and the translator.



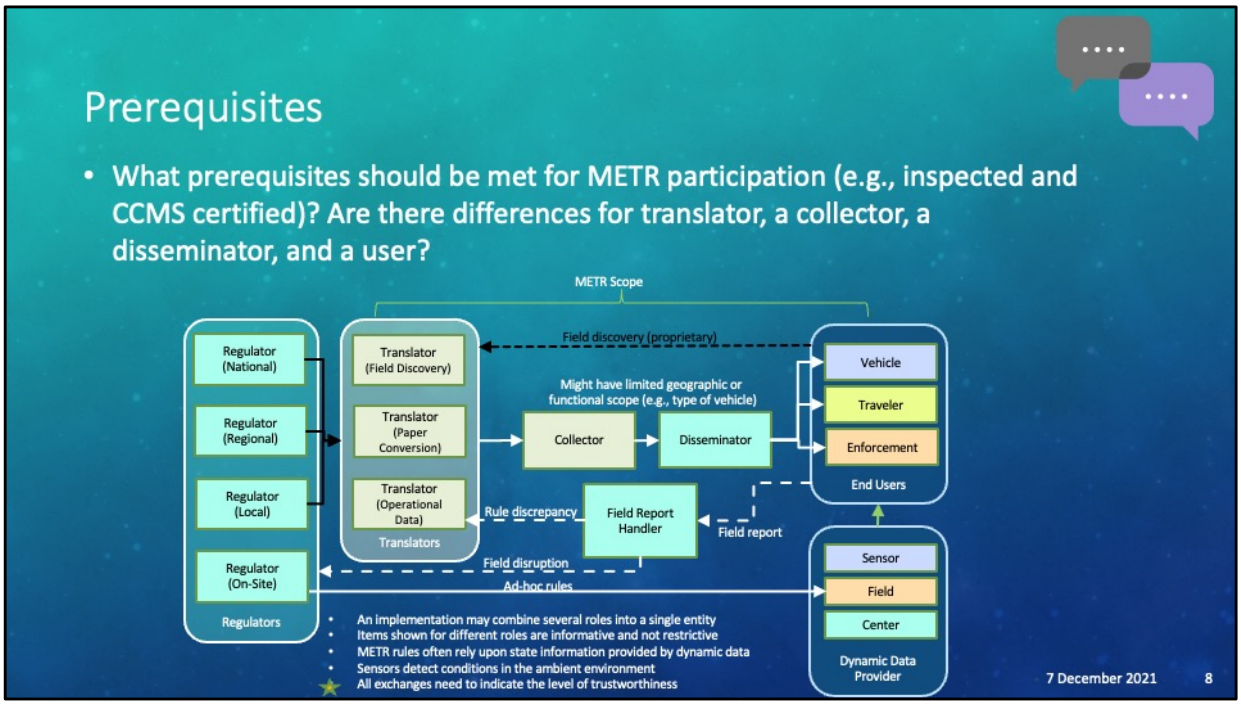
Based on the first 10 workshops, we have enhanced the original model to reflect some other key flows. The core process representing the provision of static rules to users remains the same. Translators define rules, which translators put into electronic format. Collectors then gather the electronic rules and pass them to disseminators, who are responsible for efficiently distributing them to end users.

This process works well for publicizing rules that are known in advance, which allows the use of a potentially remote disseminator. However, this structure does not meet the needs of every possible flow. Ad hoc rules can be implemented with little notice and local conditions (e.g., rain, presence of emergency vehicles) can change the applicability of rules within specific areas. Thus, in addition to the main pathway to provide static rules, METR also accommodates dynamic data providers. Dynamic data providers can be on-board sensors and equipment that alert the vehicle to current conditions (e.g., detection of a work zone sign, detection of rain on the windshield), roadside devices that provide C-ITS data to the vehicle (e.g., pedestrians present, current status of a traffic signal), or central systems that provide data remotely (e.g., variable speed limits, evacuation notices).

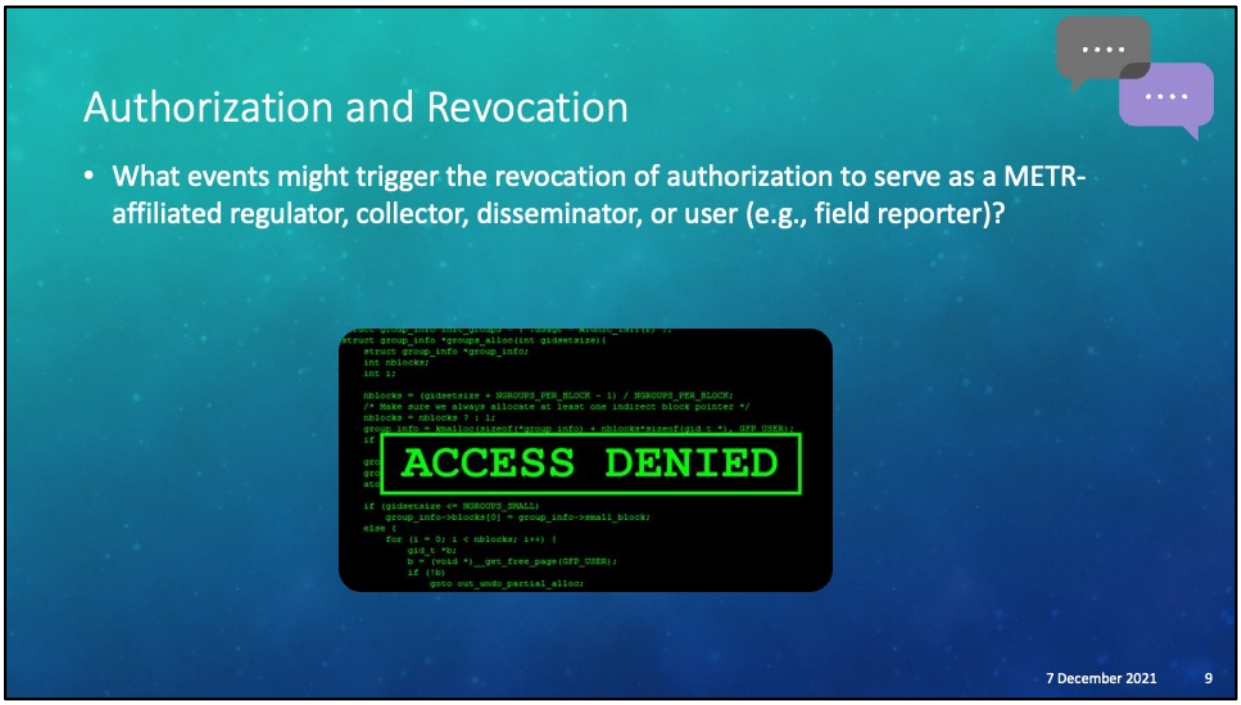
Finally, end users might also want to report field observations in one of two ways. The

most common case is the user providing a field report to a trusted field report handler. The field report handler might be an OEM, the disseminator, or other entity that can relay information up the chain while protecting the identify of the specific user submitting the report. The field report handler might handle field reports in different ways. For example, a field report might indicate an inconsistency between an electronic rule and a physical traffic control device. Such a report would be sent to the translator for resolution. In other cases, a field report handler might notice a significant change in traffic patterns or reports on social media that indicates that a particular road is impassable. In this case, the Field Report Handler could inform the regulator of a change so that the information can be handled in a more official process. For example, a similar process was used in Japan after the 2011 earthquake to update regional maps to show which roads were unavailable.

The second scenario for user to provide information from the field is for detailed mapping where an agency is conducting discovery of existing rules by having automated systems report actual field conditions. Based on workshop discussions, it appears that this would likely be a proprietary process and the interface for fulfilling this exchange does not need to be standardized.



Now that we have reviewed what we have discussed and developed in other workshops, what pre-requisites should be imposed on each component of the system to ensure that METR maintains trustworthiness?



Likewise, if there are requirements to become a METR component, do we need to specify conditions that will cause a component to lose its authorization?

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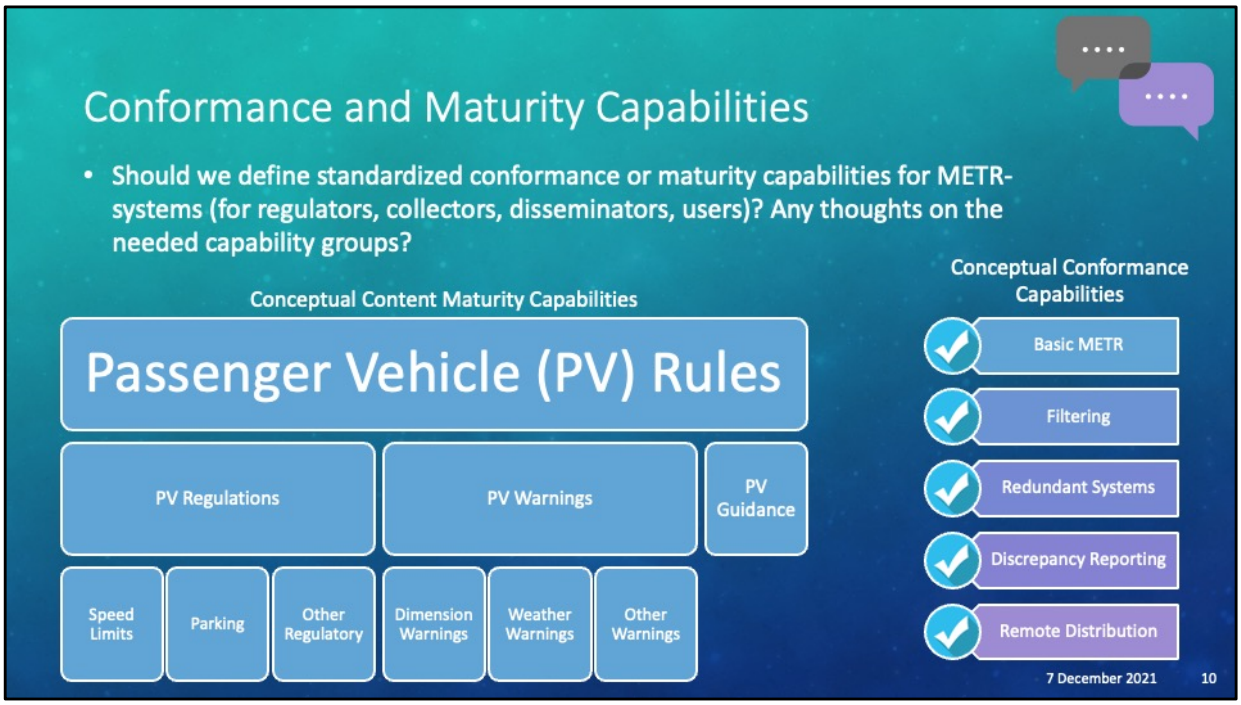


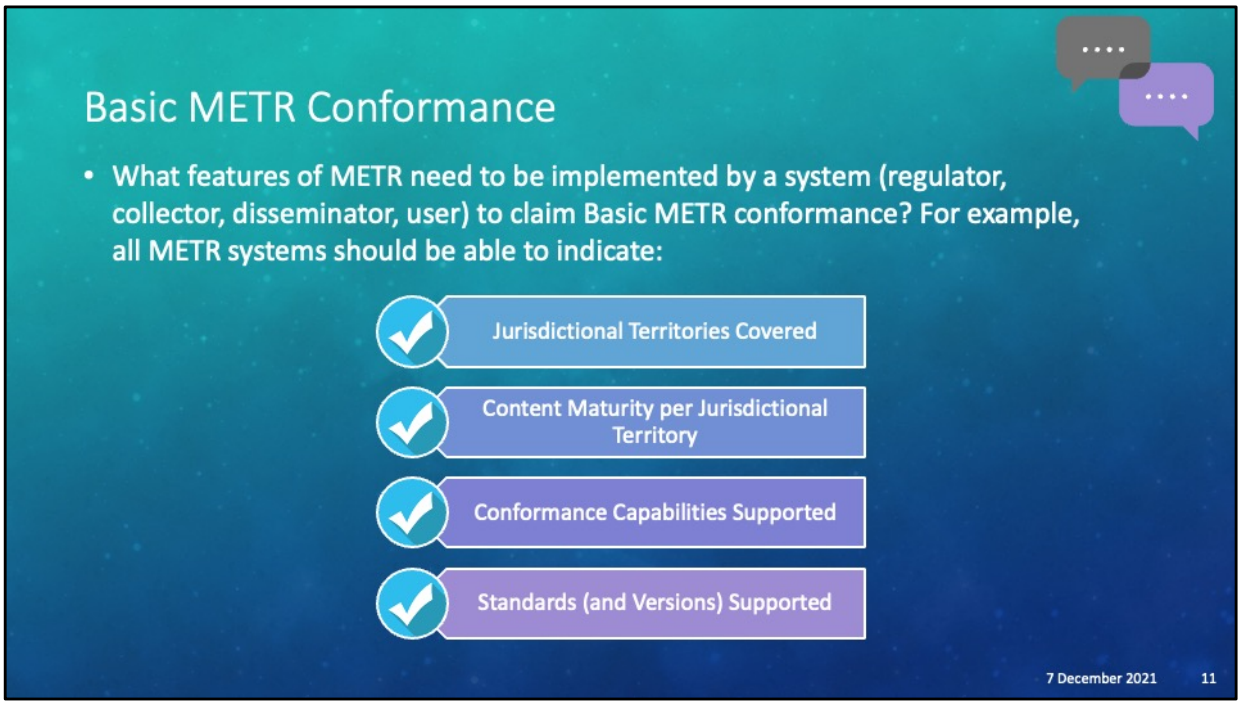
We previously talked about how different jurisdictions would likely implement their rules in stages (e.g., speed limits can be entered quickly while parking rules might require considerable time) and how different user systems would likely rely upon different types of rules (e.g., a manually driven vehicle with a speed regulator might need speed limits while an ADS-equipped vehicle might want virtually all rules). We plan to call these categories “maturity capabilities” (i.e., the indicate how mature a METR deployment is based on how much information is available – recognizing that there are not “levels” of maturity, rather it is whatever set of rule categories are supported)

Should the METR standardize the categories of rules or should these categories be left to each jurisdiction. If the latter, does METR need to provide a way for jurisdictions to define their categories (which would likely be much more difficult than just standardizing the categories)?

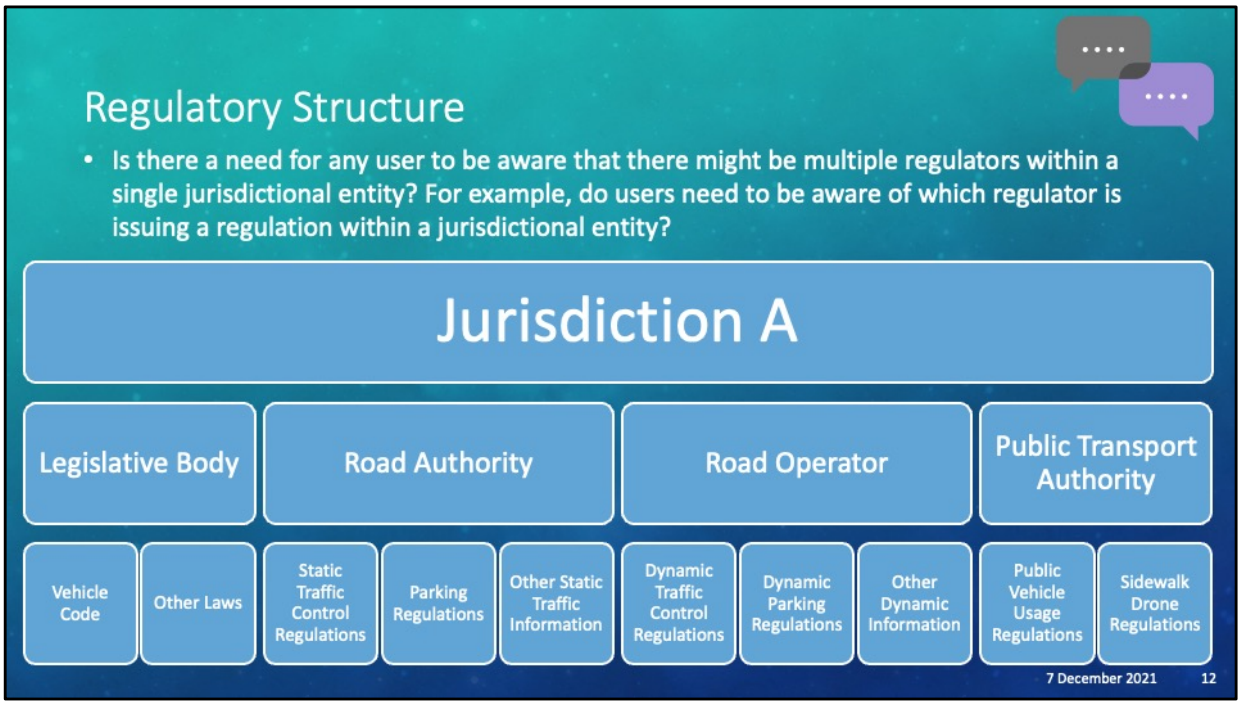
Likewise, as we develop the user needs for METR, we might identify user needs that are optional for systems to implement (e.g., discrepancy reporting). We plan to term these features “conformance capabilities”. With the idea that there will be one defined capability for each optional disseminator user need (and perhaps

requirement).

The idea is that a user system needs to be able to discover the capabilities (both maturity and conformance) of its current disseminator to determine to what extent it can rely upon METR data within a particular area. Are there any concerns about this approach or any suggestions as to what capabilities need to be specified?



What basic features do all METR disseminators need to support to claim conformance to our standard?



Within our structure we make a distinction between a “jurisdictional entity” and a “regulator”. A regulator is an entity recognized by a jurisdictional entity to issue rules. Many jurisdictional entities will divide up the rule-making responsibilities among multiple regulators, each authorized to establish certain types of rules. However, a user might be required to follow rules from multiple different regulators. For example, an ADS-equipped vehicle will need to obey the current speed limit, whether that speed limit was established by (1) the legislative body as the default speed for the particular type of road, (2) the road authority as the posted speed limit, (3) the road operator as the variable speed limit, (4) the maintenance division as a part of road works, or (5) the police in response to an incident.

While the user system needs to be aware of all of these rules, does the user system need to be aware of the issuer of the specific rule? Is it sufficient that METR (i.e., the distribution system) is aware of the regulator who issued the rule or is there a specific need for the user system to be able to directly identify the issuer of the rule. If the user system does need to know the regulator, what other information might it need to know (e.g., does it affect precedence of rules?)

METR Availability – Data Trustworthiness

- How should user systems (e.g., ADS-equipped vehicles, driver assistance systems) respond in the absence of real-time METR data for the user's current location? Are there differences for static and dynamic rules?
- How long can a user system trust previously captured information about static rules?
- Can recent changes in rules be enforced?

How should user systems respond to the absence of real-time data? To what extent does a user system need to be aware of this absence (e.g., to distinguish between nothing to report and nothing being reported)? How long do we expect downloaded rules to last? How does this affect enforcement and to what extent do we envision the legal aspects of these rules changing over time (i.e., do we need to have the METR disseminator indicate whether rules are enforceable or not)?

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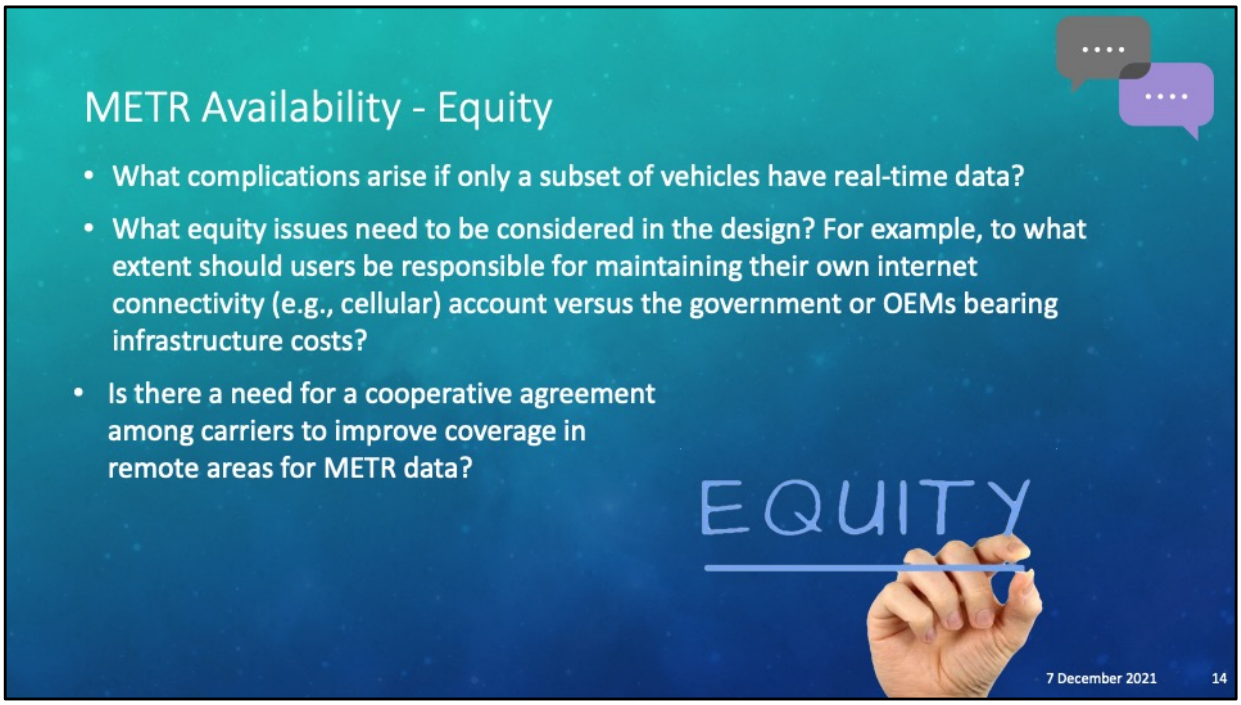

What happens if some vehicles do not have access to METR data? Might they be perceived as being disadvantaged somehow?

Does the standard need to identify a user need for equitable access, which might require the use of communication technologies that do not require service fees and/or publicly provided radio equipment and deployments in remote areas? Might this require cooperative agreements to ensure that remote areas are properly covered?

https://picpedia.org/handwriting/images/equity.jpg

METR Availability – Dynamic Data

- Is there a greater need for availability in areas that rely upon dynamic data?
- What implications might availability issues impose on deployments? For example, do all dynamic rules (e.g., work zones, variable speed limits) require localized beacons?

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Based on previous discussions, it would appear that there are concerns about the ability of remote disseminators to reliably provide dynamic data in a timely manner, such as variable speed limits and that it is preferred to use localized beacons. To what extent should this be presented as a preference or a requirement? What implications does this create?

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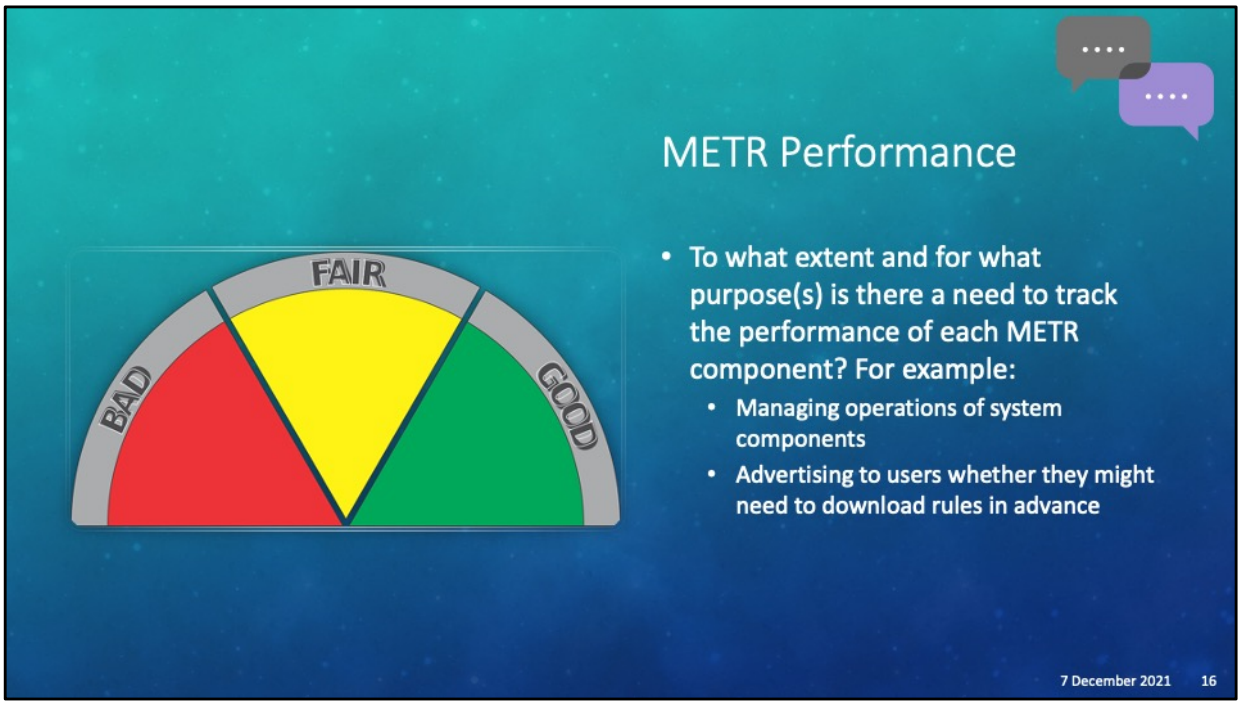

Do we need to track and/or advertise METR performance? For example, if a vehicle is headed into an area that has unreliable communication services, should it be warned to download rules in advance? Are there needs to monitor this information from a system managemet perspective that we want to mention within the standardized ConOps, or is this a project-by-project issue?

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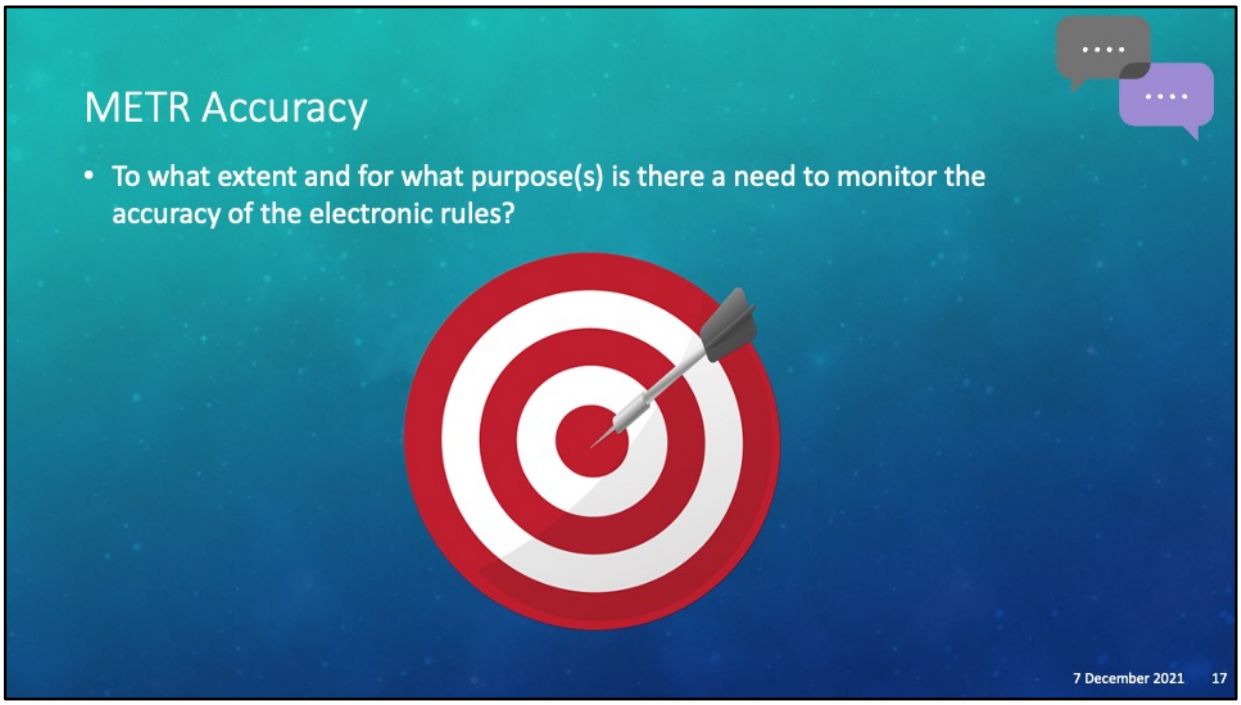

Electronic rules need to be trustworthy, but to what extent and for what purposes do rules need to be verified and monitored? Are the needs different based on the type of facility (e.g., major high-speed road, minor road, sidewalk, private parking lot, etc)

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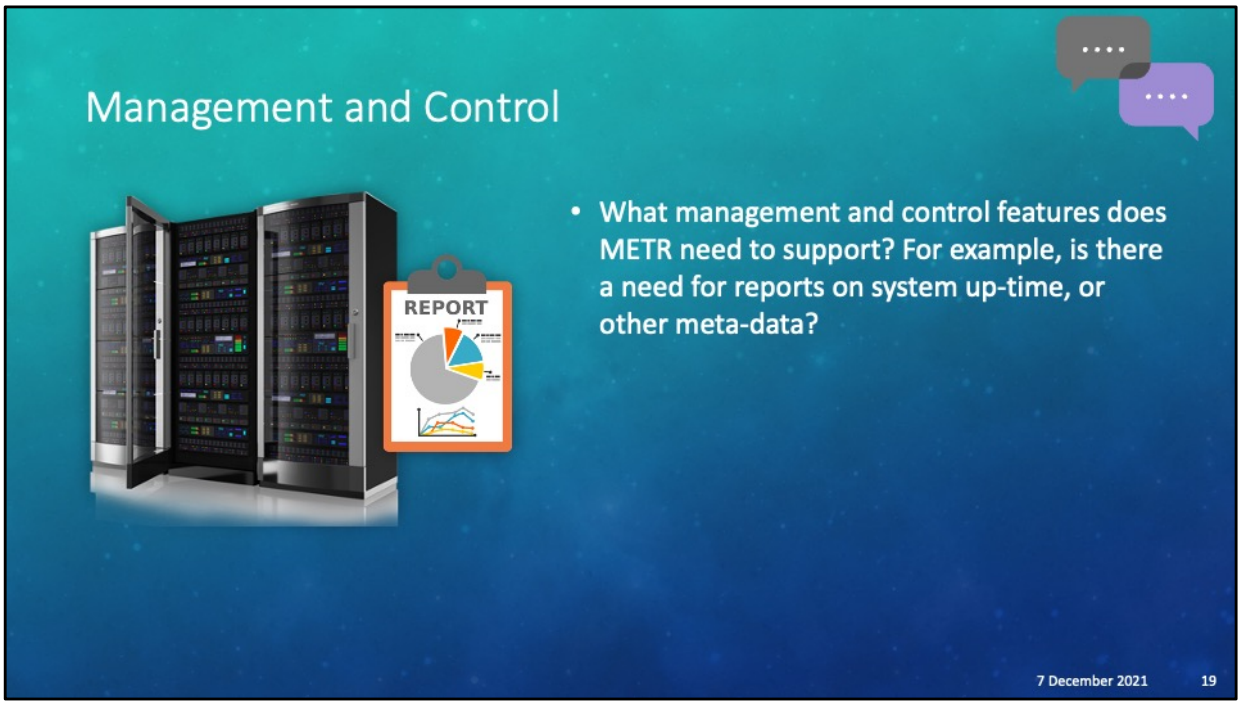
To what extent is there a need to support non-repudiation? Is this strictly for after-the-fact auditing and insurance claims? How long do records need to be kept and are there detectable conditions that might cause longer retention times?



What management features need to be identified in the standardized ConOps? Or should these be left to deployments to specify?

https://www.pngall.com/rack-png
https://freesvg.org/chart-report

Should the standardized ConOps specify who is responsible for maintenance operations of the system? If so, how should these tasks be assigned?

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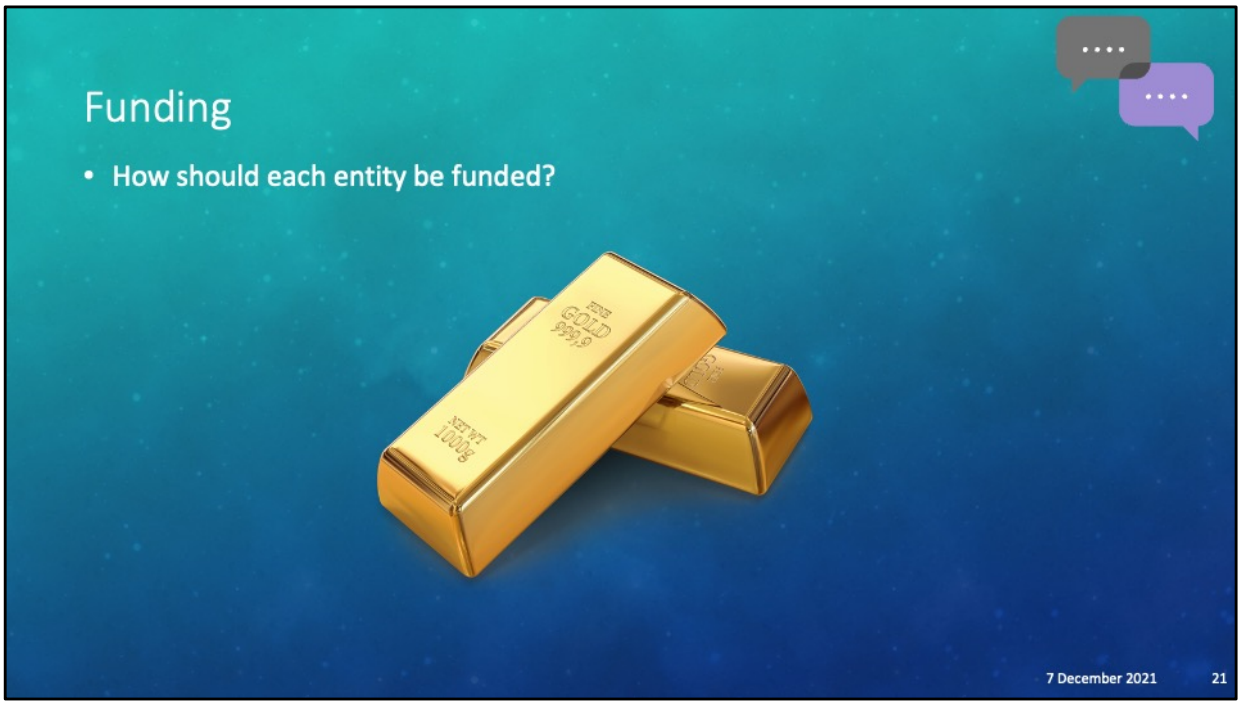

A ConOps typically identifies the project sponsors, support agencies, certifying bodies, etc. and assigns responsibilities to different entities and subsystems (e.g., assessing impacts on staffing requirements). Should the standardized ConOps specify any assumptions, constraints, or needs (e.g., for equity) related to funding, the assignment of responsibilities, and other such issues?

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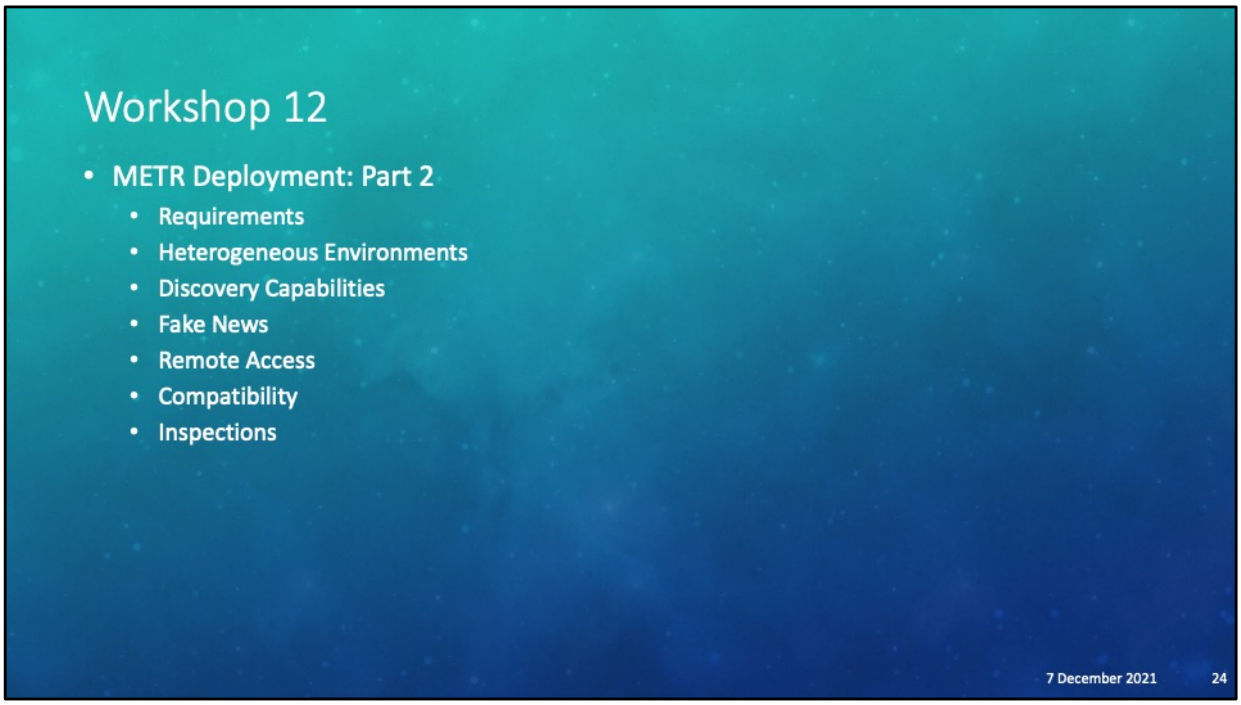
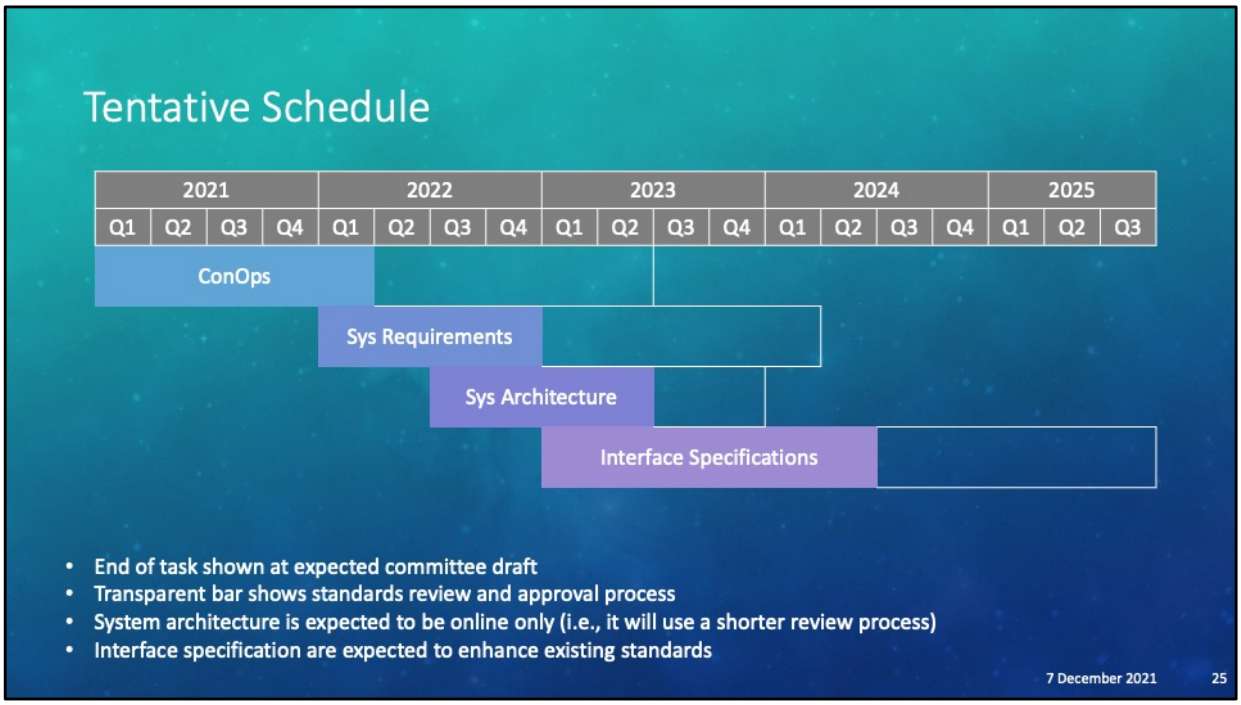
That completes our questions for Workshop 11.

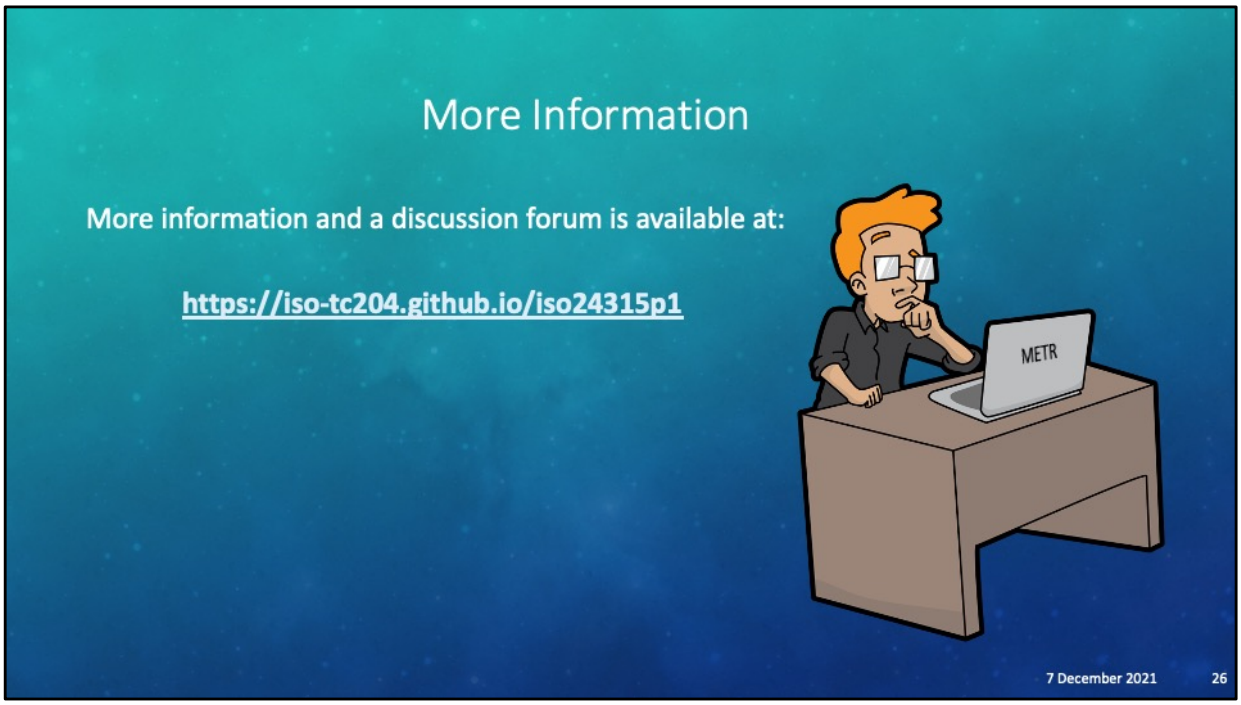
We've now completed 11 of our 12 workshops; just one left. Our next workshop will focus on additional deployment issues.



The next workshop will focus on the topics shown on this slide



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 are posted on our GitHub site. This includes a PDF of each workshop presentation as well as a disposition of each comment submitted via the chat log. In addition, the website includes a listing of all of the key summary points coming out of these workshops and other inputs into METR; each of these points are then traced to specific items to be incorporated into the draft ConOps. Further input on this draft material can be provided through the discussion forum on the site.

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