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Communicating Requirements – Effectively!!

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Introduction

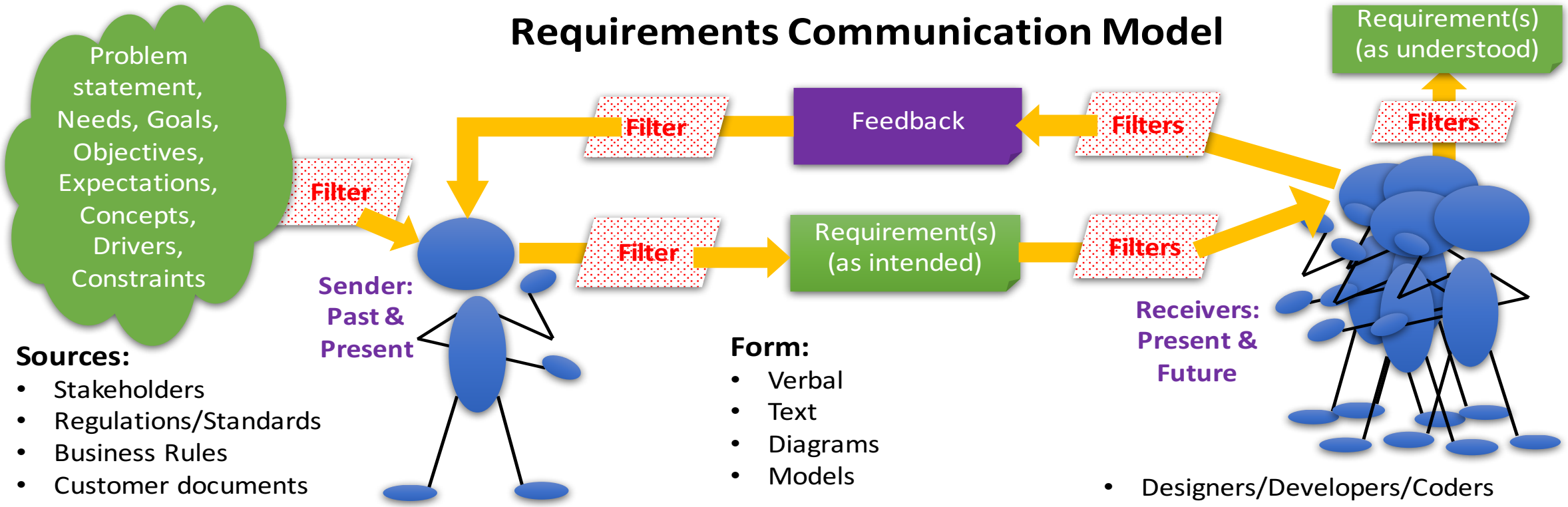
- Requirements are the language used to communicate stakeholder needs for a system of interest to developers, designers, builders, coders, testers and other stakeholders.

- Increasingly, the debate is about which means (form and media) of communication is the best way to communicate requirements.

Introduction

- Forms of communications include: verbal, text, diagrams, and models.
  - These forms can be communicated using various types of media: face-to-face, phone, email, text-messages, printed documents, electronic documents, electronic tool(s) database or model.
  - Depending on the idea or concept, the specific system type, domain, culture, people, and processes within a specific organization, one means of *communications of requirements* is often advocated (with a lot of passion in many cases) over the other forms.
- This issue is often debated between three principal groups:
  - “Traditional” Systems/Software Engineering (SE),
  - MBSE
  - Agile

Communications Model



Sources:
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- Regulations/Standards
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- Interface definition docs
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- Diagrams
- Concept descriptions
- Risks
- Assumptions
- Higher level rqmts
- Technology

- Customer
- Requirements Engineer
- Business Analyst
- Business Management
- Regulators
- Standards Org.
- Procurement
- Contracts; Lawyers

Form:
- Verbal
- Text
- Diagrams
- Models

Media:
- Face-to-face
- Phone
- Email
- Printed Document
- Electronic Document
- Electronic Tool(s) database/model

- Designers/Developers/Coders
- Testers (Verification/Validation)
- Customers
- Users/Operators
- Managers
- Quality Organization
- Regulators
- Standards Organization
- Procurement; Contracts; Lawyers
- Maintainers; Sustaining Engineers

Filters

- There really is no single “reality”, only what each individual perceives to be “reality”.
- Everyone has their own unique mind map that reflects their perception of the world around them.
- This mind map is a result of such aspects as the individual’s upbringing, family environment, gender, education, religion, age, work experiences, genetics, and life experiences.
- Included in this mind map are biases for or against certain concepts as well as preferences concerning the means used to communicate a message.
  - These biases can result in a receiver who may not have an open mind and has personal prejudices, making false interpretations and conclusions concerning the message being sent.
- Interpretation of a message also includes the assumptions being made
- This mind map serves as a “filter” on how we receive, interpret, and understand information and how we encode information we are sending to communicate with others.

Feedback

- Feedback is how the sender can determine how the message was interpreted and understood by the receiver(s).
  - When communicating verbally, face-to-face, we can establish a dialog with the sender getting immediate feedback.
  - However, with the other means of communication the feedback is often delayed.
  - In the requirements world, the delayed feedback may occur in written form or during some type of review, either informal or formal.
  - A less desirable form of feedback is when the developers come up with a design based on an alternate interpretation and understanding of the requirements that was not the intent of the sender – that is, a failure to communicate!

Feedback

- Our senses also are an important part feedback.
  - Some people may communicate best via visual cues, sound, or emotions/feelings.
  - When communicating verbally, face-to-face, it has been suggested that 80% of communications is nonverbal.
  - How our words sound, our facial expressions, our body language, odors, and our appearance all are part of communication.
  - Facial expressions and body language also provide feedback from the receiver(s).
  - **This poses a significant challenge when communicating using other, non-verbal, forms of communication and non-face-to-face, types of media.**

Time

- The senders could have sent a message in the past intended for both present and future receivers of the information (i.e., business rules, standards, regulations, requirements).
- Senders in the present have to consider that the message they are sending to present receivers has to be equally interpreted and understood by receivers in the future.
  - In many organizations and system development efforts, especially for projects spanning years, there will be turnover of personnel.
  - Verbal, face-to-face communication occurring in the present may be desired, but when it comes to requirements, there are limitations.
- For communications to future recipients, verbal communications, even if recorded, are not an effective form of communications for requirements.
  - For future recipients, senders need to not only communicate a message, but also the rationale behind the message and the context of the message.
  - For requirements, including rationale as an attribute is critical for successful communications to future recipients.

Formality – Formal Communications

- Formal communications refers to official communications both external and internal to the organization.
  - Examples include: Governance, regulations, standards, contracts, binding agreements, task assignments, granting official authority, and establishing binding goals and objectives.
- Formal communications generally take place in the written form such as the issuance of a notice, letter, memo, document, contract, etc.
  - Informal verbal or oral channels are avoided in formal communications as there is no record or proof of such communication. Thus, the old saying “I want it in writing!”

Formality – Formal Communications

- Advantages of formal communications include:
  - A well-defined and orderly flow of information;
  - The source of information can easily be determined;
  - The information itself can be easily located,
  - Formal communications allow one to show “proof” that the information was communicated.

Formality – Formal Communication

- Disadvantages of formal communications:
  - Formal communications often have to follow a formal review and approval process that takes time.
  - Changes also have to follow a formal review and approval process, taking additional time.
  - Often, the “document” itself and control of the document can overshadow the information being communicated via the document.
  - Feedback can also be a problem both in time and form.

Formality - Informal Communications

- Informal communication includes unofficial, nonbinding communications such as social interactions and discussions between individuals and team members, speeches, radio, television, etc.
- From a product development perspective, informal communications can be effective when occurring between individuals who trust each other and do not need “proof” of the exchange of information.
- Informal communications are often verbal or oral channels (face-to-face, phone, telecom, meeting, etc.), but may also take place via emails, text messages, and posts on social media.

Formality - Informal Communications

- Advantages of informal communications include.
  - Speed! Informal communications generally occur very fast without the time overhead that exists for formal communications.
  - Feedback is very fast as well
    - For verbal and oral face-to-face channels the feedback is immediate.
    - For the other informal means of communication, feedback can be very fast.
  - Changes can be communicated quickly based on the feedback.

Formality - Informal Communications

- Disadvantages of informal communication include:
  - It occurs an unsystematic manner,
  - No official record; it is not formally documented, lacking a way to show proof or cleanly disseminate the information,
    - For emails, text messages, and posts on social media there is a record, but unless formally controlled in some manner, the record is considered informal.
  - What was communicated can be subject to debate, especially when the various filters are considered (“he said/she said” type of arguments),
  - Informal communication can be distorted when passing from person to person due to the various filters,
  - Because it is not formal, it may not be binding and hard to legally enforce.

Means of Communicating Requirements

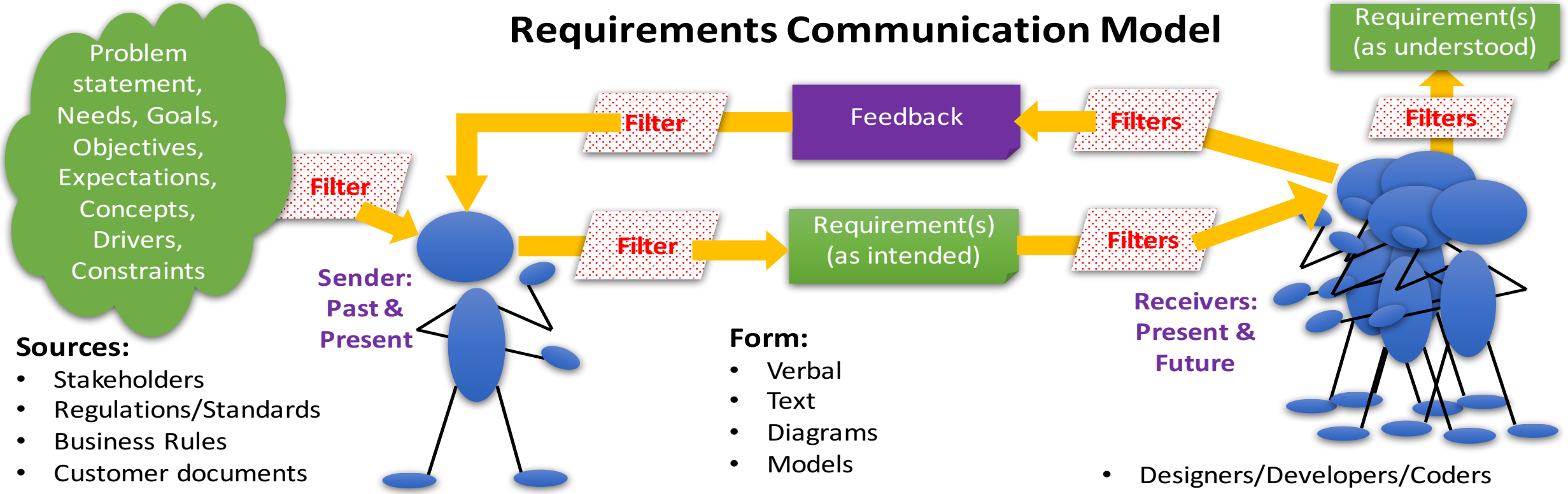
- We have a choice of the “how” or “means” to communicate a message in both the:
  - Form:
    - verbal,
    - text,
    - diagrams, and
    - models
  - Media:
    - face-to-face,
    - phone, text message,
    - email, printed documents,
    - electronic documents, and
    - electronic tool(s) database or model.

Which is Best??????

Means of Communicating Requirements

- In truth, there is no single “best” means (*form and media*) of communication that applies to all the various types and categories of requirements.
  - Each means has its strengths and weaknesses depending on:
    - what message is being communicated,
    - who the sender is,
    - who the receiver is,
    - the needs of the receiver, and
    - the filters used by both the sender to encode the message and the receiver who must decode the message.
- Each form has value; however, no single form is sufficient to clearly, completely, and consistently communicate all these various types and categories of requirements.
  - Each of the forms represent a visualization of the system from a perspective based on the intent of the message being communicated.

Communications Model



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Communications Model

- It is very instructive when we apply the communication model to the communication of requirements since requirements development and management are effectively exercises in communication.
  - The encoding of the message by the sender and the decoding of the message by the receiver(s) is based on their
    - Filters
    - Assumptions
    - Understanding of language,
    - Training in product development methodologies, processes, tools, culture
      - Traditional SE, MBSE, or Agile
    - Work environment of the organization they are employed
    - Types of systems being developed.

Communications Model

- The challenge in communicating requirements is whether the requirement received, interpreted, and understood by the receiver reflects the same intent of the requirement that was communicated by the sender.
  - When the messages are not the same, problems are going to exist such that the system under development is going to either, or both,
    - Fail system verification (not meeting requirements) and
    - Fail system validation (not meeting the needs of the stakeholders in the operational environment)

One Size Does Not Fit All!

- It is the responsibility of the sender that the message or information sent is in a form that is of value to the receiver.
  - To communicate requirements effectively, the sender must acknowledge the various filters used to encode and decode the requirement message that is being sent such that the sender's meaning is interpreted and understood as intended by the receivers, no matter the form or media used, and development lifecycle phase.

One Size Does Not Fit All!

- Using the communications model, pick one input, pick one type of sender, identify what the message is, decide who the recipient(s) is/are, whether you are communicating to current or future recipient(s), and then pick the means (form & media) of communication that is the most effective and will meet the needs of the recipient(s).
- The answer will be different for each of the inputs listed, the specific message, and each of the recipients.

One Size Does Not Fit All!

- If the source is stakeholder expectations for features and functions that will supply those features, then a functional flow block diagram may be the most effective form of communication.
- If the customer and developer are able to meet face-to-face frequently, then user stories, use cases, and agreed to success, evaluation, acceptance criteria can be used to communicate requirements.
- If a regulator is trying to communicate regulations to many present and future developers, a text-based set of requirements in a printed or electronic document would be the most effective means of communication.
- If a customer is developing a Request for Proposal (RFP) to be released to multiple, geographically located potential bidders, then both the technical requirements for the system as well as the Statement of Work (SOW) requirements on the bidders need to be text-based “shall” statements with the characteristics of well-written requirements as discussed later in this paper.

Challenges in Communicating Requirements Effectively

- A key consideration concerning requirements, no matter the means of communication, is that requirements are really about clear and effective communications.
- Communications - no matter the form, is inherently ambiguous.
  - Words often have different meanings based on assumptions, context, mind map, and filters of both the sender and receiver.
  - Context, like filters, are used to encode, decode, interpret, and understand messages.
  - Often the validity of a message depends on the assumptions (often not explicitly stated) made by both the sender and receiver(s).

Characteristics of Well-Formed Requirements

- It is the requirement communicator's job to follow best practices to reduce the ambiguity such that the requirement statements and sets of requirements have the characteristics of well-formed requirements defined in the
  - *INCOSE Guide for Writing Requirements* (INCOSE-TP-2010-006-01, 2017)
- To help facilitate effective communications of requirements, these characteristics have been defined, such that if the requirements, no matter the form, have these characteristics, effective communication of the requirements are more likely to occur.
- The Guide also includes a set of rules, that if followed, will result in requirements and sets of requirements having these characteristics.

Parting Thoughts

- No matter whether you practicing traditional SE, MBSE, or Agile, using the communications model, is should be clear that there is no single means (form and medium) that requirements can be communicated effectively that is suited to all circumstances.

- Each means of communication has value; however, no single means is sufficient to clearly, completely, and effectively communicate requirements.
  - Each of the various means represent a visualization (graphic or text) of the system from a perspective based on the intent of the message being communicated.

Parting Thoughts

- To successfully deliver winning products, business analysts and systems engineers should use whichever means (form and medium) is the most appropriate based on the message to be communicated, the context, filters of the senders and receivers, time, formality, and means.

Questions?

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- Senior Product Manager for Seilevel/Requirements Experts (RE)
- Has taught over 190 requirement seminars over the last 18 years.
- 22 years in the US Air Force
- Heavy involvement in space systems (DoD launch vehicles and spacecraft, NASA Space Shuttle, International Space Station)
- Worked in the Astronaut Office at Johnson Space Center for 6 years.
- Works with both government and industry clients.
- Chair of the INCOSE Requirements Working Group
- Member of PMI, the Software Engineering Institute (SEI), the World Futures Society, International Institute of Business Analysis (IIBA), and the National Honor Society of Pi Alpha Alpha.
- Has a BS degree in Electrical Engineering, MA degree in Computer Information Systems, MS degree in Environmental Management, and has completed the course work for an MS degree in Studies of the Future
- Author of numerous papers and presentations concerning requirement development and management
- Is the primary contributor to RE's blog on requirements best practices. The blog can be assessed at: http://www.reqexperts.com/blog .

Mike Ryan

- Mike Ryan is the Director of the Capability Systems Centre, University of New South Wales, Canberra, at the Australian Defense Force Academy.
- He holds Bachelor, Masters, and Doctor of Philosophy degrees in electrical engineering as well as a Graduate Diploma in Management Studies.
- For the first seventeen years of his career he held a number of communications engineering, systems engineering, project management, and management positions.
- Since joining UNSW in 1998, he lectures and regularly consults in a range of subjects including communications and information systems, systems engineering, requirements engineering, and project management.
- He is the conference chair of two annual international conferences, he is the editor-in-chief of the Journal of Battlefield Technology, and is chair of the Requirements Working Group in the International Council on Systems Engineering (INCOSE).
- He is an INCOSE Fellow.
- He is the author or co-author of twelve books, three book chapters, and over 200 technical papers and reports.

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