

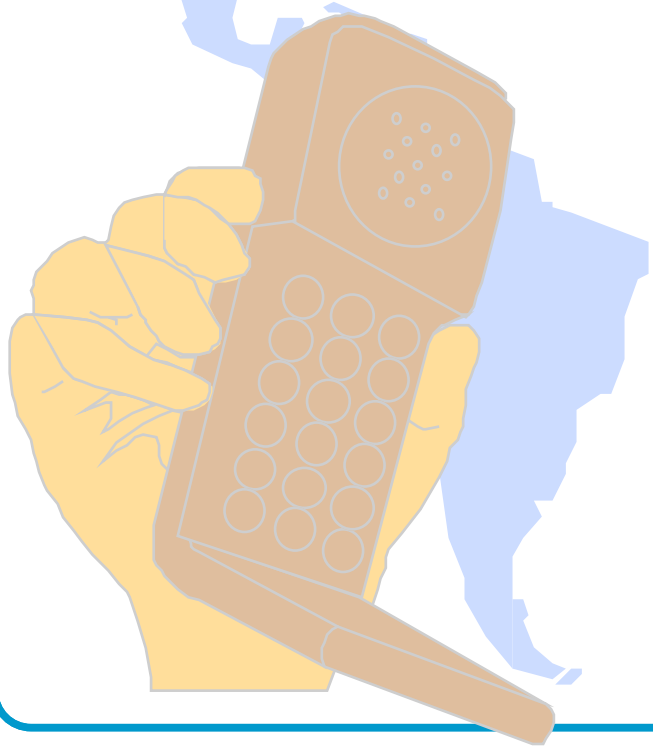
Evaluation Methodology for IMT-2000 Radio Transmission Technologies

Fumio Watanabe

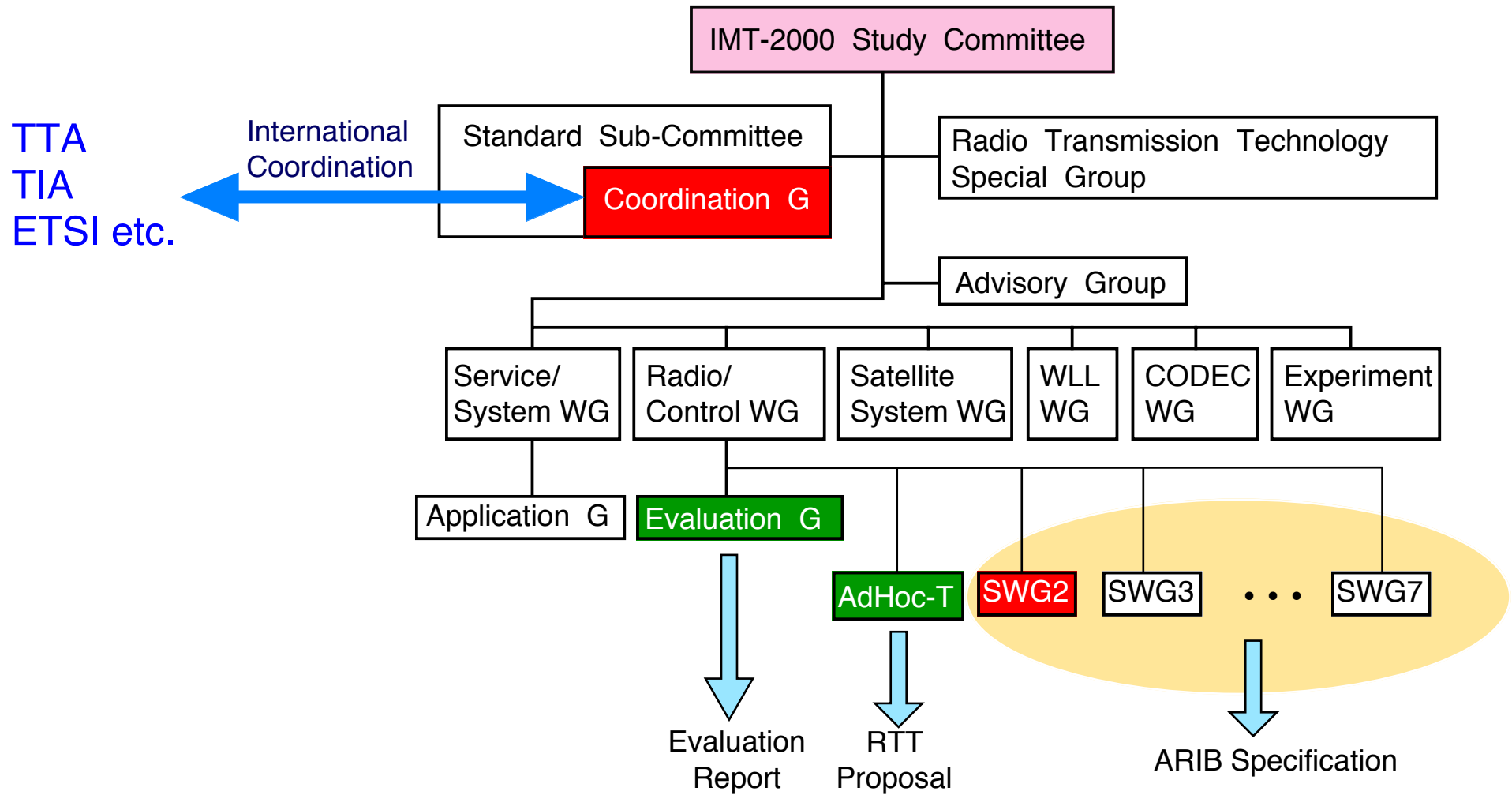
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Chairman, ARIB Evaluation Group

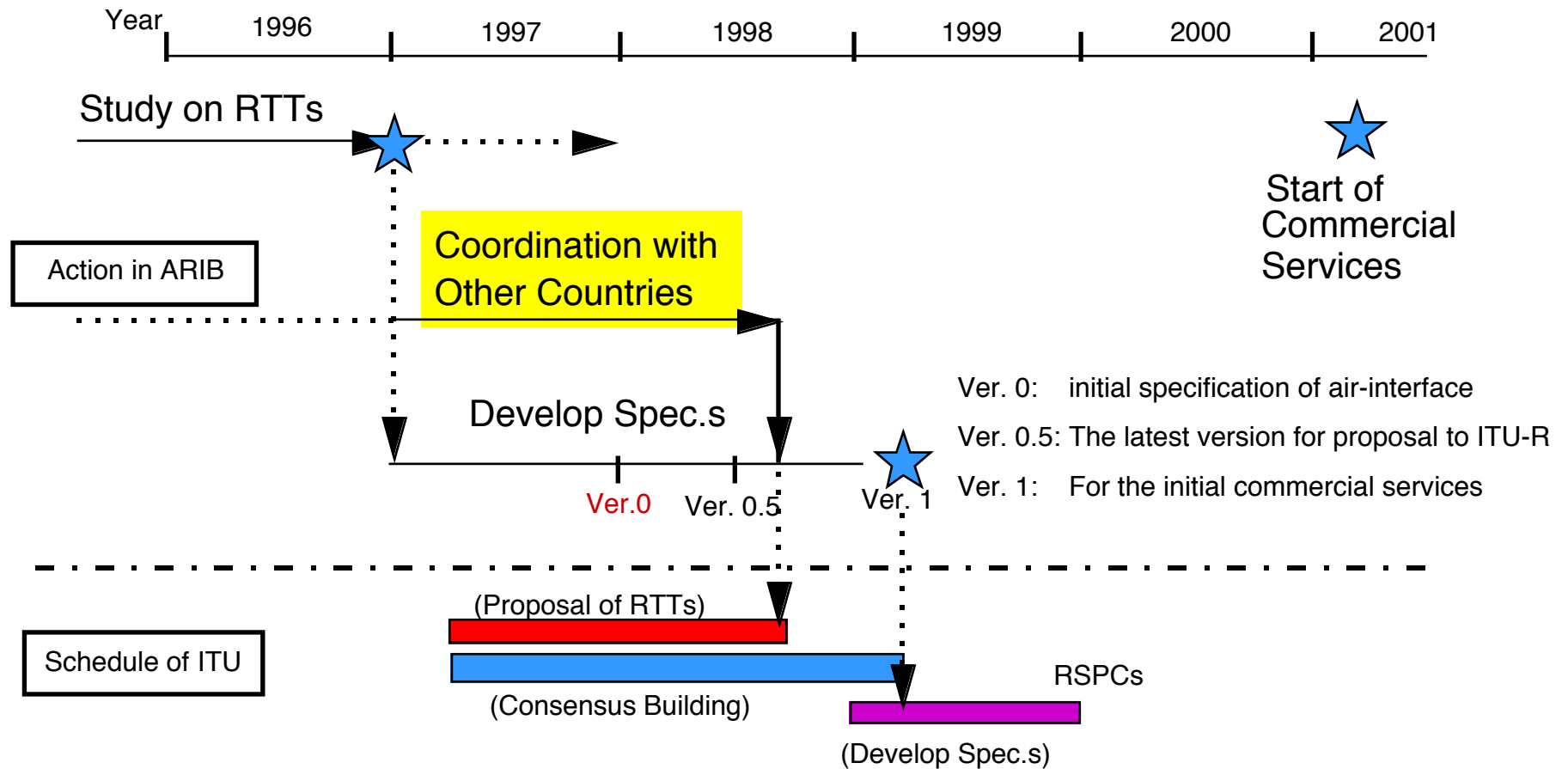
Vice President, Managing Director
Mobile Communications Laboratory
KDD R&D Laboratories Inc.



Study Structure of Air-Interface Specification



Overall Schedule of IMT-2000 Standardization



EVALUATION PRINCIPLE (1)

■ Objectives of Evaluation

- ◆ The primary purpose of the evaluation is to confirm that all the ITU requirements are fulfilled.
- ◆ Evaluation activities **should accelerate the convergence process** in ITU, within standardization bodies and between standardization bodies.
- ◆ Evaluation would clarify the characteristics and advantages/disadvantages of the proposed RTT candidate. However, comparison through deliberation of advantages and disadvantages of the proposed systems is not the main purpose of the ARIB evaluation process.

EVALUATION PRINCIPLE (2)

■ Relative Evaluation and/or Absolute Evaluation

- ◆ Evaluation should be an **absolute** nature.
- ◆ Each RTT candidate should be **evaluated individually**.
- ◆ It should not be a process of relative comparison between RTT candidates.

■ Quantitative and/or Qualitative Evaluation

- ◆ Each criterion is basically evaluated **qualitatively**.

EVALUATION PRINCIPLE (3)

■ Weighting of Criteria

- ◆ The purpose of the ARIB evaluation process is to clarify the features of the proposal. Therefore **the weighting with numerical values for criteria's evaluation should not be defined.**

■ Verification of submitted RTT performance

- ◆ The ARIB evaluation group asks proponents to provide an information document on the proposed RTT performance, including parameters and assumptions used for evaluation in submission of the RTT proposal. Considering the information, the correctness of the claimed RTT performance is verified.
- ◆ Only when a specific situation requires it, does the ARIB evaluation group verify the RTT performance by its own simulation.

EVALUATION PRINCIPLE (4)

■ Summary evaluations

- ◆ Summary evaluations for a criterion are made based on the Annex 3 of M.1225, i.e. "detailed evaluation procedures," on a RTT basis.
- ◆ The overall evaluation of each RTT highlights its features based on criteria's summary evaluations.
- ◆ The evaluation group will compare across different RTTs, only when required by ARIB. However, this comparison **shall not be for the purpose of selection** but for clarifying the difference between RTT features.

ADDITIONAL EVALUATION METHODOLOGY (1)

ANNEX IV of the Methodology Doc.

■ Additional Requirements and Objectives

- ◆ Support of **IP(Internet Protocol)-based services** which provide a number of multimedia and data application via the Internet
- ◆ Support **Location services** using position identification information with appropriate accuracy
- ◆ Support **Priority Access** and The **Emergency services** as are contained in ITU-T Recommendation F.115.

ADDITIONAL EVALUATION METHODOLOGY (2)

ANNEX II of the Methodology Doc.

■ Test Environments and Deployment Models

- ◆ Considering fair comparison of multiple proposals and convenience of computer simulations, Annex 2 of M.1225 has been modified and further description has been added.
- ◆ In order to avoid excessively complex computer simulations, methods considered as optional are distinguished from evaluation requirements and added as appendices to this annex.
- ◆ Methods or conditions that are not specified in this annex but proponents have to specify are introduced in each related section.
- ◆ The annex was editorially changed to remove ambiguous description of the original document.

Simulation Cases and Priorities

+ ARIB has added 384 kbps in Vehicular environment

+High priorities items correspond to minimum performance requirement of ITU

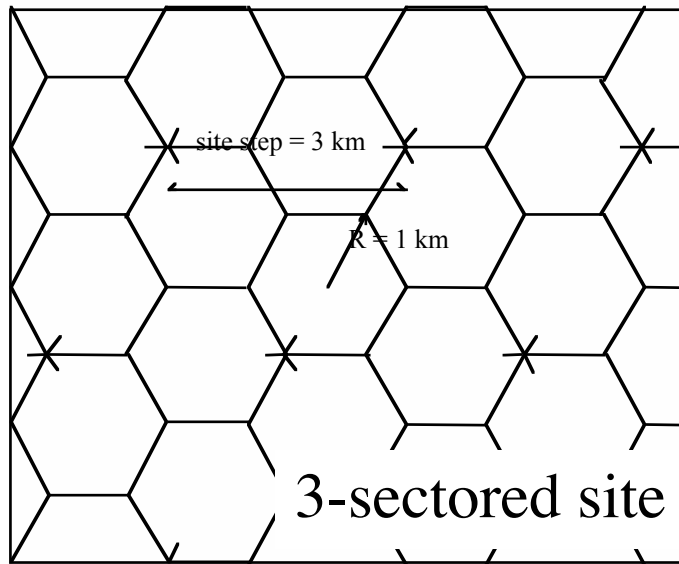
| | Indoor (A), 3km/h | Pedestrian (A), 3 km/h | Vehicular (A), 120 km/h |
|------------------------------|--------------------------------------|-------------------------------------|---|
| Speech BER = 10^{-3} | 8 kbps (high) | 8 kbps (high) | 8 kbps (high) |
| LCD BER = 10^{-6} | 64 kbps (medium) 2048 kbps (high) | 64 kbps (medium) 384 kbps (high) | 64 kbps (medium) 144 kbps (high) 384 kbps (medium) |
| UDD BER = 10^{-6} | 64 kbps (medium) 2048 kbps (high) | 64 kbps (medium) 384 kbps (high) | 64 kbps (medium) 144 kbps (high) 384 kbps (medium) |

LCD: Long constrained Delay data bearer services

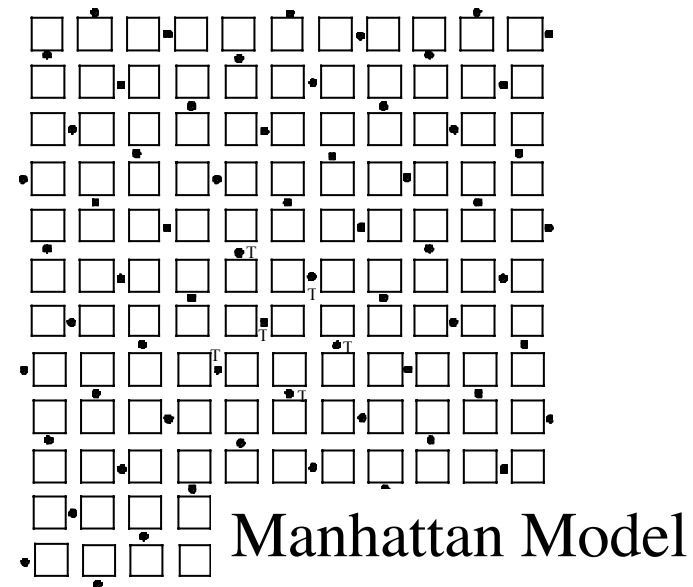
UDD: Unconstrained Delay Data bearer services

Cell Model

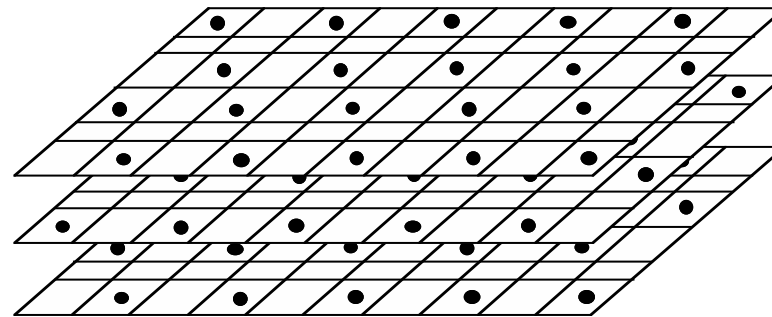
Vehicular Model



Outdoor to Indoor and Pedestrian



Indoor Office (3-story office)



System Level Simulation Model

- Cell model is determined for each environment
-> E.g. **tri-sectored cell** model for vehicular
- **Movement** of MSs and **handover** procedure are simulated
- **Wrap around model** is employed (vehicular)
-> No edge exists
- **% satisfied user*** is used as a performance measure
- **Packet traffic** is modeled

* users who do not experience call block nor forced call termination nor quality degradation (outage) are considered as “satisfied users.”

Link Level Simulation Model

- Sampling is made at chip level
- Fast power control is simulated
- Random error is added to backward TPC bits
- Results using Turbo-codes under investigation
(Convolutional coding + Reed-Solomon has been used)

ADDITIONAL EVALUATION METHODOLOGY (3)

■ Evaluation Criteria

■ In order to make reasonable evaluation and to remove ambiguity, the Annex 3 of M.1225 indicating the attributes for each criterion has been modified a little.

- ◆ Because the core network and speech codec are not directly relevant to the RTT evaluation and the echo control is depend on speech codec, A3.2.1 'Need for echo control' is deleted.
- ◆ The round trip delay 'D1' is deeply depend on speech codec, the attribute 'D1' in A3.3.2 is deleted.
- ◆ Because speech codecs are not directly relevant for RTT evaluation process, the ranking of A3.3.7 'voice quality' is changed.
- ◆ The following attributes are deleted, since the core network related matters are not directly relevant to the RTT evaluation. (A3.5.2, A3.5.3, A3.5.3.1, A3.5.3.2, A3.5.3.3, A3.5.3.4)
- ◆ Frequency band plans and frequency duplexing arrangements for IMT-2000 may differ with Regions, regions and countries. A new attribute A3.4.2.1.4 is added to evaluate how capable of flexible usage of the planed spectrum the proposed RTT can offer.

REQUIRED INFORMATION FROM PROPONENTS

- Cover Sheet for Submission of Proposed RTTs (Attachment 2 of the Circular Letter)
- Technologies Description Template (Annex I of this document)
- Link budget templates for test services (Table 6 in Annex II of this document)
- ■ **Compliance Template for the Minimum Performance Capabilities (Attachment 6 of the Circular Letter)**
- IMT-2000 Requirements and Objectives Compliance Template (Annex IV of this document)
- List of any known patent or any known pending patent application of relevance to the proposal
- ■ **Views and comments of the proponents on each attribute in Annex III template in this document, i.e. the criteria evaluation template**
- Additional information which the proponent may consider relevant to the evaluation

IMT-2000 RTT Proposals

<http://www.itu.int/imt/2-radio-dev/rtt/index.html>

- ARIB/Japan: W-CDMA
- ESA: SW-CDMA & SW-CTDMA
- ICO: ICO RTT
- CATT/China: TD-SCDMA
- TTA/South Korea: Global CDMA I & II, & satellite RTT
- EP DECT: DECT
- ETSI: UTRA
- TIA/USA: TR45.3 (UWC-136), TR45.5 (cdma2000) & TR46 (WIMS W-CDMA)
- T1P1-ATIS/USA: WCDMA/NA
- INMARSAT: Horizons

The evaluation group may not evaluate all RTT proposals

Target Proposals in ARIB evaluation activity (draft)

- (a) The evaluation activities in ARIB is a part of the harmonization procedure towards a common specification.
 - (b) ARIB has discussed how to harmonize other proposals during the recent years.
 - ▶ ARIB has successfully harmonized with UTRA FDD mode.
 - ▶ Many parts of the technical differences between cdma2000 have been resolved and already reflected in the ARIB proposal to ITU.
 - (c) The harmonization activities between ARIB and other organizations are still on going.
-
- (1) Making the evaluation report for the ARIB proposal (self evaluation) should be the highest priority.
 - (2) The evaluation report for the ARIB proposal will describes the relation between the ARIB proposal and the FDD mode of the UTRA proposed by ETSI.
 - (3) Under the condition (1), ARIB will prepare the evaluation report for cdma2000 proposal from TIA TR45.5. The report will concentrate on technical aspects for the harmonization activity.
 - (4) ARIB will prepare a report on other proposals, if the harmonization with the ARIB proposal progresses.
 - (5) ARIB will not prepare evaluation reports on the satellite specific proposals.

Concluding Remarks

■ Evaluation activities should

- ◆ confirm the IMT-2000 requirements, objectives and performance
- ◆ **accelerate the convergence process to a common standard**
- ◆ highlight commonality between RTTs

Evaluation activities should not be Olympic Games highlighting minor difference in proposed technologies.