

## *Using Mind Mapping to Design Test Cases*

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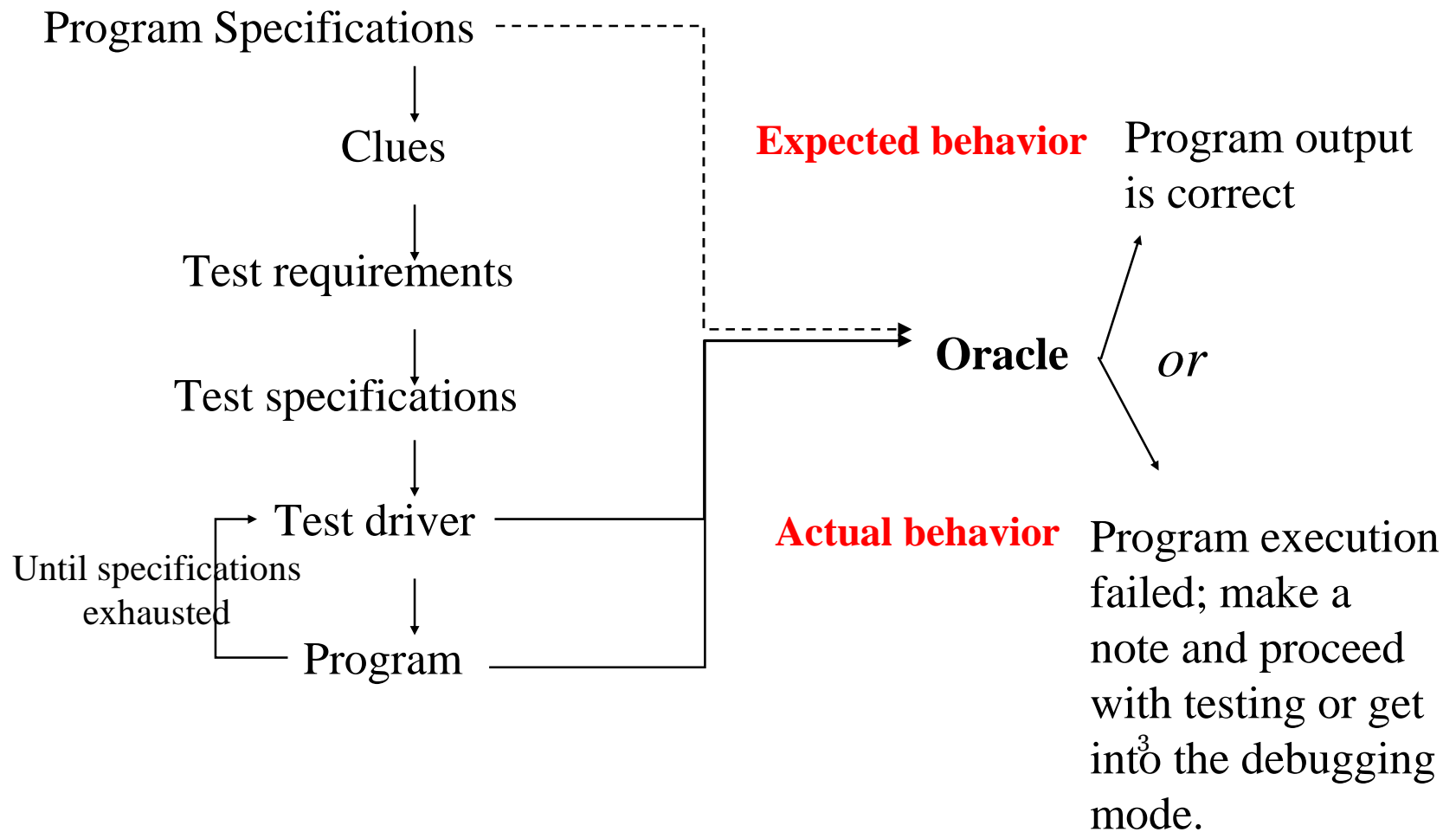
## *Speaker Biographical Sketch*

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- Senior Research Scientist & Project Manager  
Bellcore (Bell Communications Research)
  - Formerly part of AT&T Bell Labs
  - Now Telcordia Technologies
- Professor & Director of International Outreach  
Department of Computer Science  
University of Texas at Dallas
- Guest Researcher  
Computer Security Division  
National Institute of Standards and Technology (NIST)
- Vice President, IEEE Reliability Society
- Secretary, ACM SIGAPP (Special Interest Group on Applied Computing)
- Founder & Steering Committee Chair for the SERE conference  
(*IEEE International Conference on Software Security and Reliability*)  
(<http://paris.utdallas.edu/sere13>)



# Test Generation



## Mind Map: Overview

- A *mind map* is a diagram used to visually outline information.
  - It is often created around **a single word or text**, placed in the center, to which associated ideas, words, and concepts are added.
- Elements of a *mind map*
  - arranged *intuitively* according to the importance of the concepts
  - classified into groups, branches, or areas
  - aimed at representing semantic or other connections between portions of information
- *Mind maps* can be used to generate, visualize, structure, and classify ideas.

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## *Mind Map: An Example (1)*

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- Using a mind map to classify the months of a year



## Mind Map: An Example (2)

- Using a mind map to classify the months of a year



## Test Generation using Mind Map (1)

- Suppose we have a computer program to compute the cost of each phone call, using the following scheme

	Standard	Evening/Weekend	Time unit (second)
Domestic	\$0.05	\$0.01	1
International	\$1.00	\$0.30	20

- If an invalid country code or an invalid phone number is used, there will be no charge
- If no country code is given or it equals “USA”, then the charge is based on a *domestic* call
- If the country code equals “Canada,” “Mexico,” or “Brazil,” then the charge is based on an *international* call.
- If the country code equals any other valid country names, the call cannot go through and there will be no charge
- The duration of each call is rounded up to the next highest time unit



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## *Test Generation using Mind Map (2)*

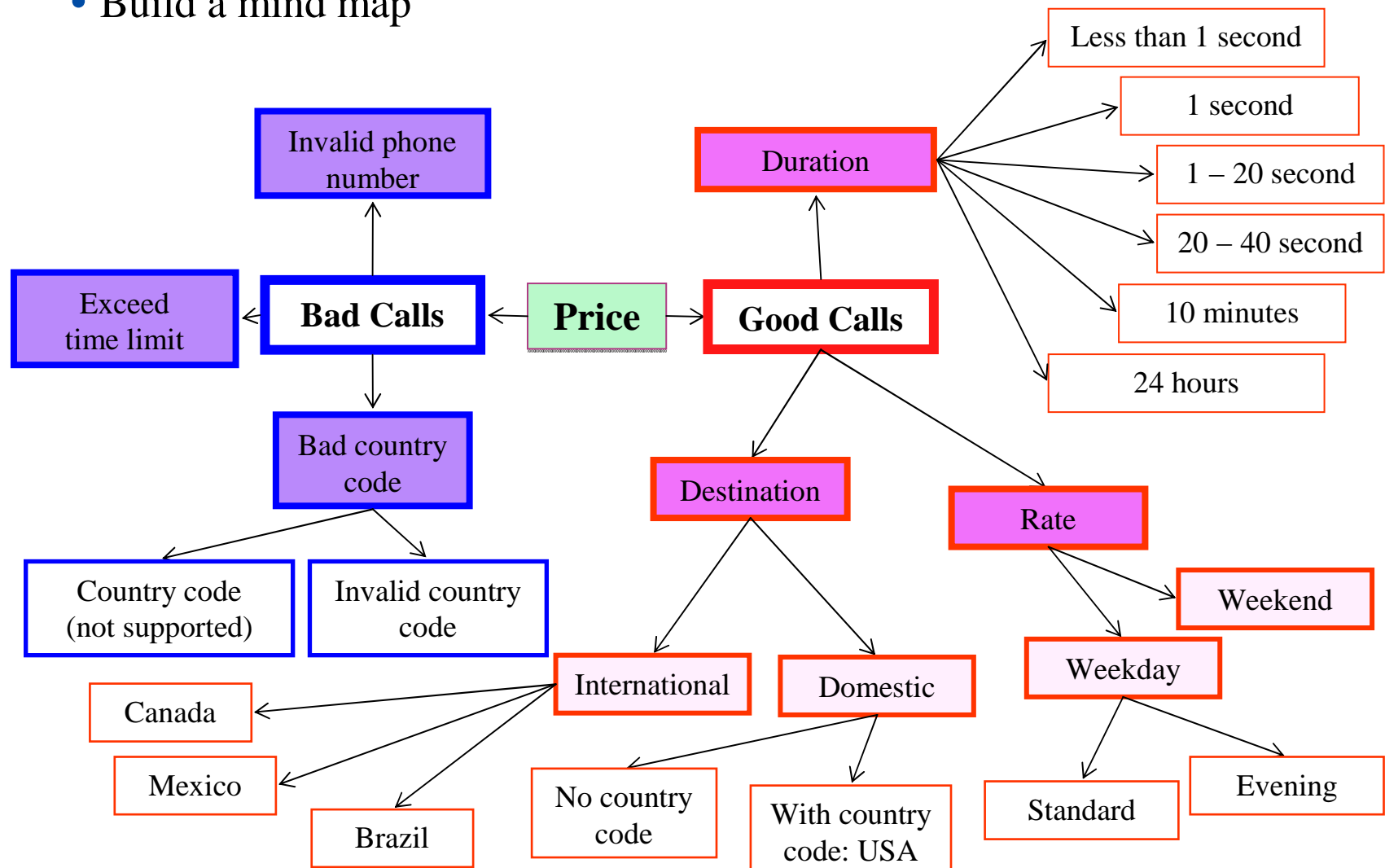
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- The maximal duration of each call is 24 hours
  - 86,400 units for a domestic call
  - 4,320 units for an international call
- The “evening” rate applies between 8 pm and 6 am
- The “weekend” rate applies on Saturday and Sunday
- .....



## Test Generation using Mind Map (3)

- Build a mind map



## *Test Generation using Mind Map (4)*

- Create equivalence classes based on a mind map
  - Phone number:
    - {valid phone number}, {invalid phone number}
  - Country code:
    - {invalid country code}, {valid country code (supported)}, {valid country code (not supported)}, {no country code}, {USA}
  - Rate
    - {Weekday, Standard}, {Weekday, Evening}, {Weekend}
  - Duration
    - {less than 1 second}, {1 second}, {1 – 20 seconds}, {20 – 40 seconds}, {40 seconds – 10 minutes}, {10 minutes to 24 hours}, {24 hours}
- Apply unidimensional or multidimensional partitioning for test generation



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## *Test Generation using Mind Map (5)*

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- Mind maps provide a visualization approach to classify the input domain.
- It can be easily combined with
  - ECP (Equivalence Class Partitioning)
  - BVA (Boundary Value Analysis)
  - etc.



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## *Tool Support*

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- There are tools to help users generate mind maps
  - CAM editor (<http://www.cameditor.org>)
  - FreeMind ([http://freemind.sourceforge.net/wiki/index.php/Main\\_Page](http://freemind.sourceforge.net/wiki/index.php/Main_Page))
  - Docear (<http://www.docear.org/>)