



Inter-Networking Research Group

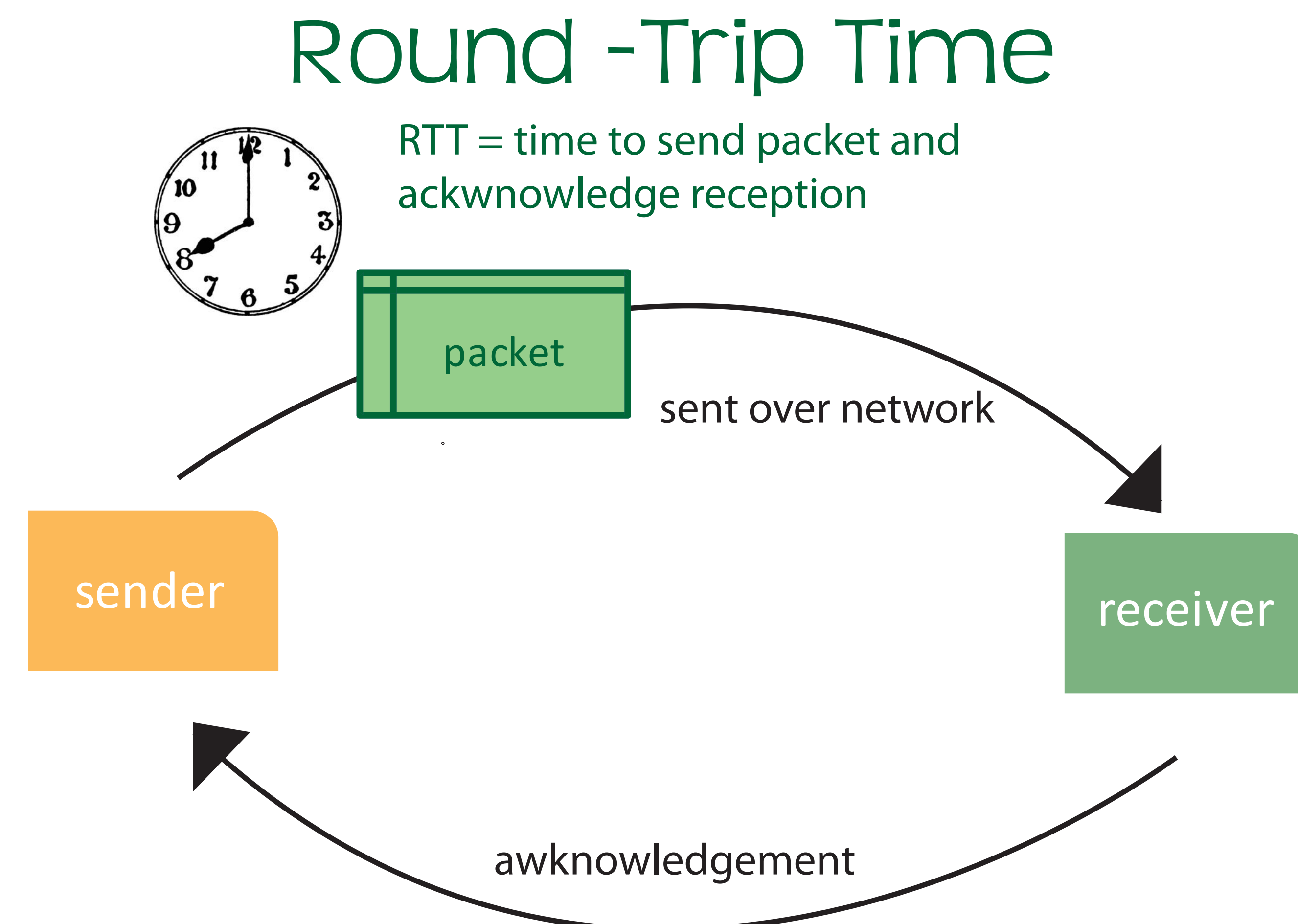
Improving Internet Speed A Comparison of Round-Trip Time Algorithms

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Motivation and Goals

- Round-Trip Time (RTT) is difficult to calculate precisely due to fluxuations and sudden drops and spikes
- Wanted to develop an algorithm which better approximated the RTT
- Implemented and compared three methods,
 - Jacobson's Algorithm- original RTT approximator
 - Experts Algorithm- iNRG team's algorithm
 - Eifel Algorithm- another research team's approach



To optimize the time taken sending packets too **small** a time interval, packet is not fully sent too **large** a time interval wastes time

3 Algorithms

Jacobson

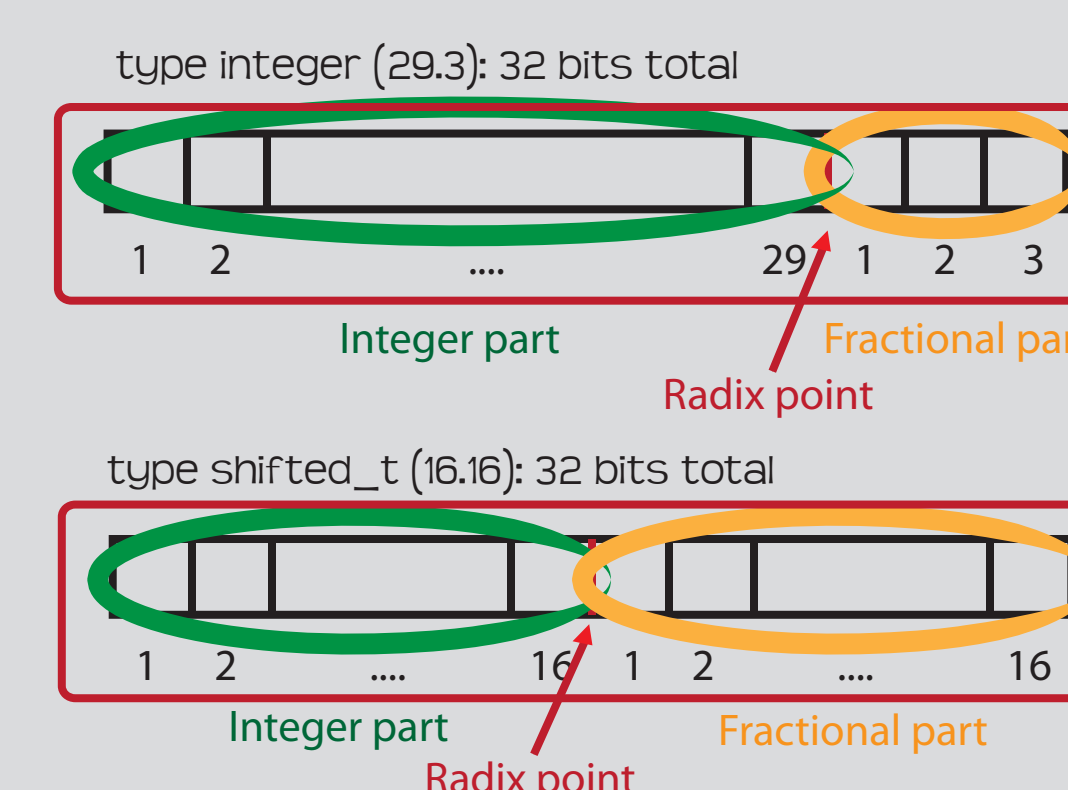
- Developed by Jacobson in 1988
- Original RTT implementation in all standard systems
- Simple arithmetic - addition, subtraction, multiplication
- Use bit shifting to perform simple multiplications
- Numbers stored as basic 29.3 integers

Experts

- Developed by Bruno Nunes, Kerry Veenstra, and Katia Obrackza in 2009
- Similar overall four step structure to Jacobson, with a modified step
- Complex arithmetic - exponential and logarithmic- needed to develop an entire math library
- Numbers stored as 29.3 integers

Eifel

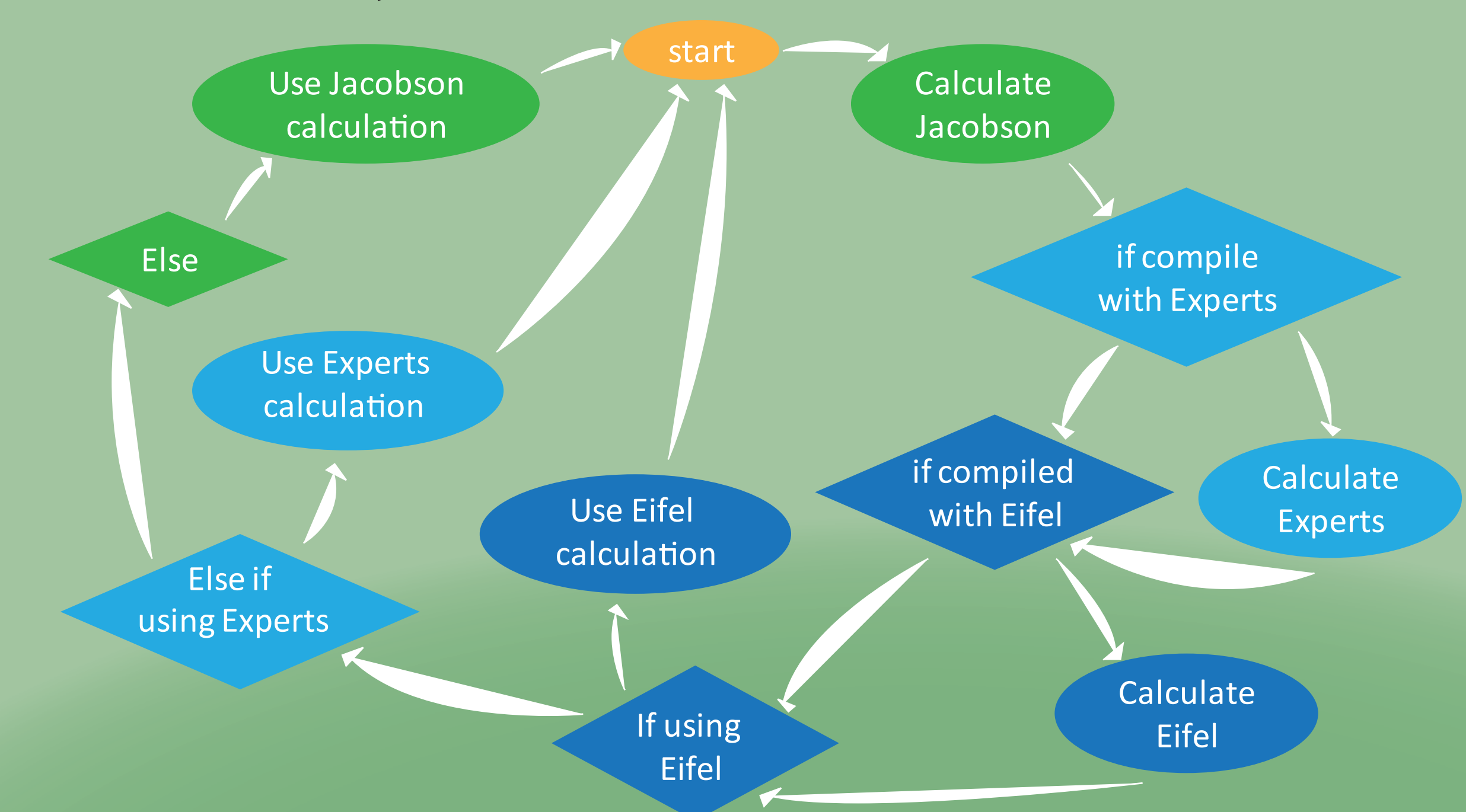
- Developed by Reiner Ludwig and Keith Sklower in 2000
- Cannot have floating point numbers in linux kernel
- Incorporated 16.16 integers and bit shifting so as not to lose data in division



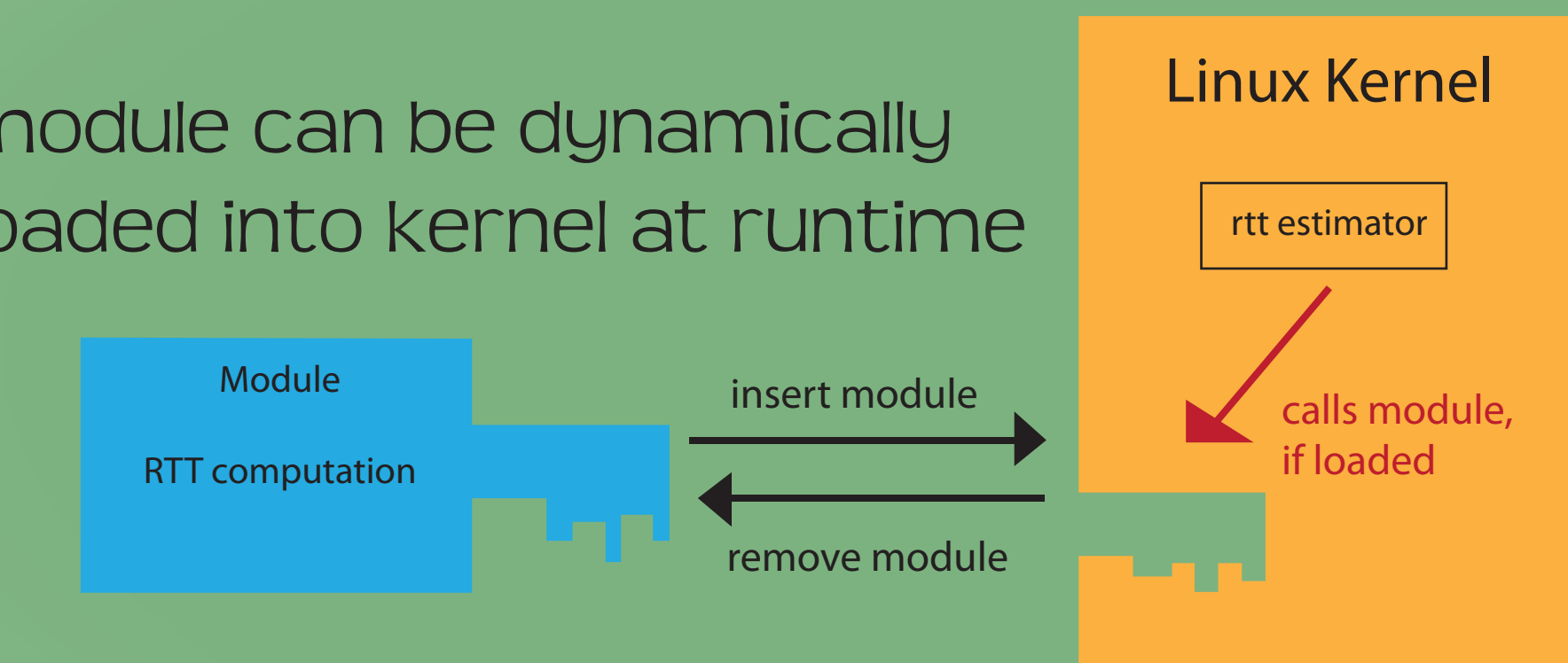
Implementation

RTT Computational Cycle

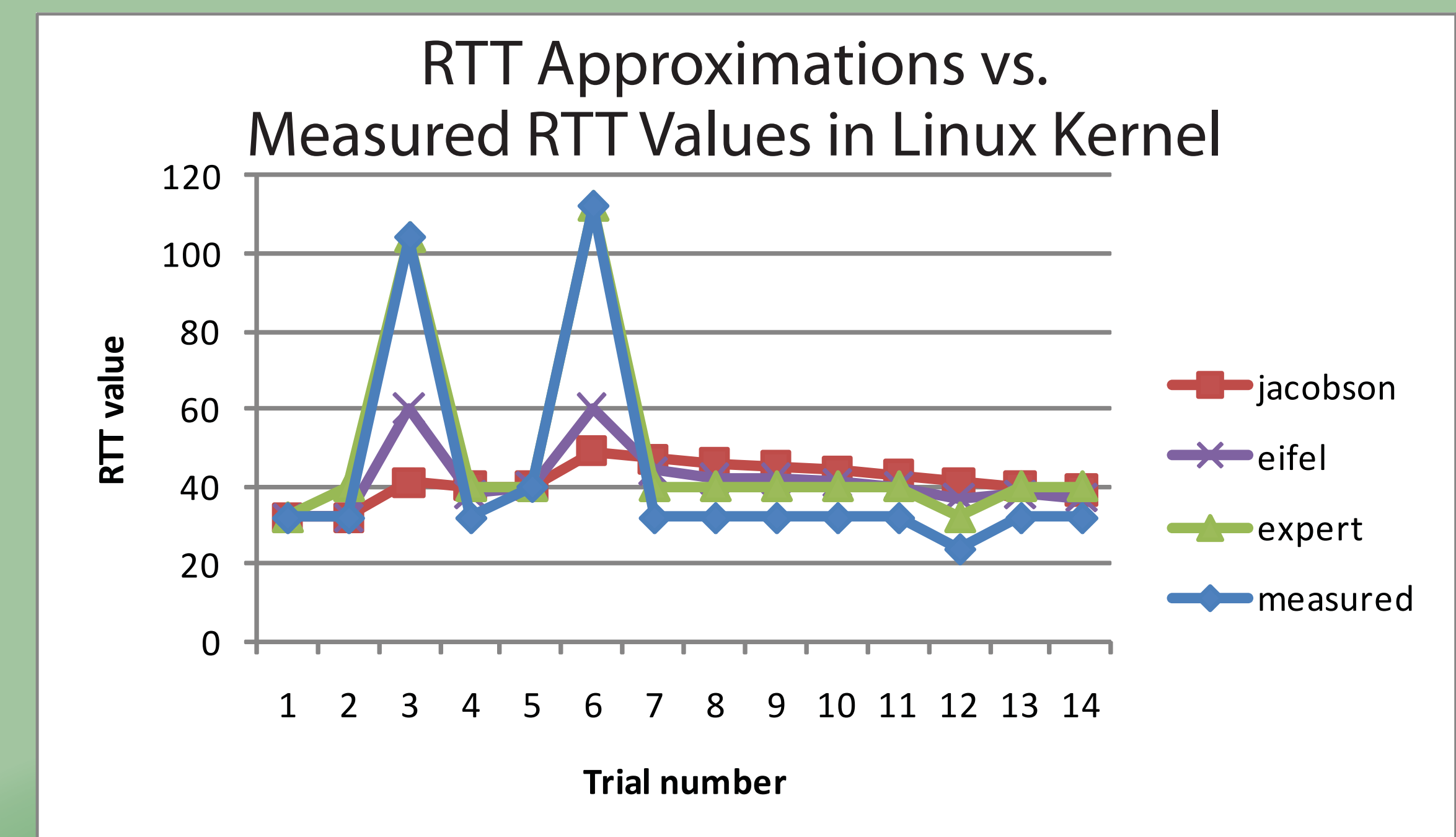
- kernel can compute all three estimations at runtime
- only one result is used



module can be dynamically loaded into kernel at runtime



Preliminary Results



- Jacobson is the furthest from true value
- Eifel falls as the middle best approximator
- Experts achieves the closest values to measured, especially when measured fluxuates