Use of a Software Simulator for Modeling the ACTS Link

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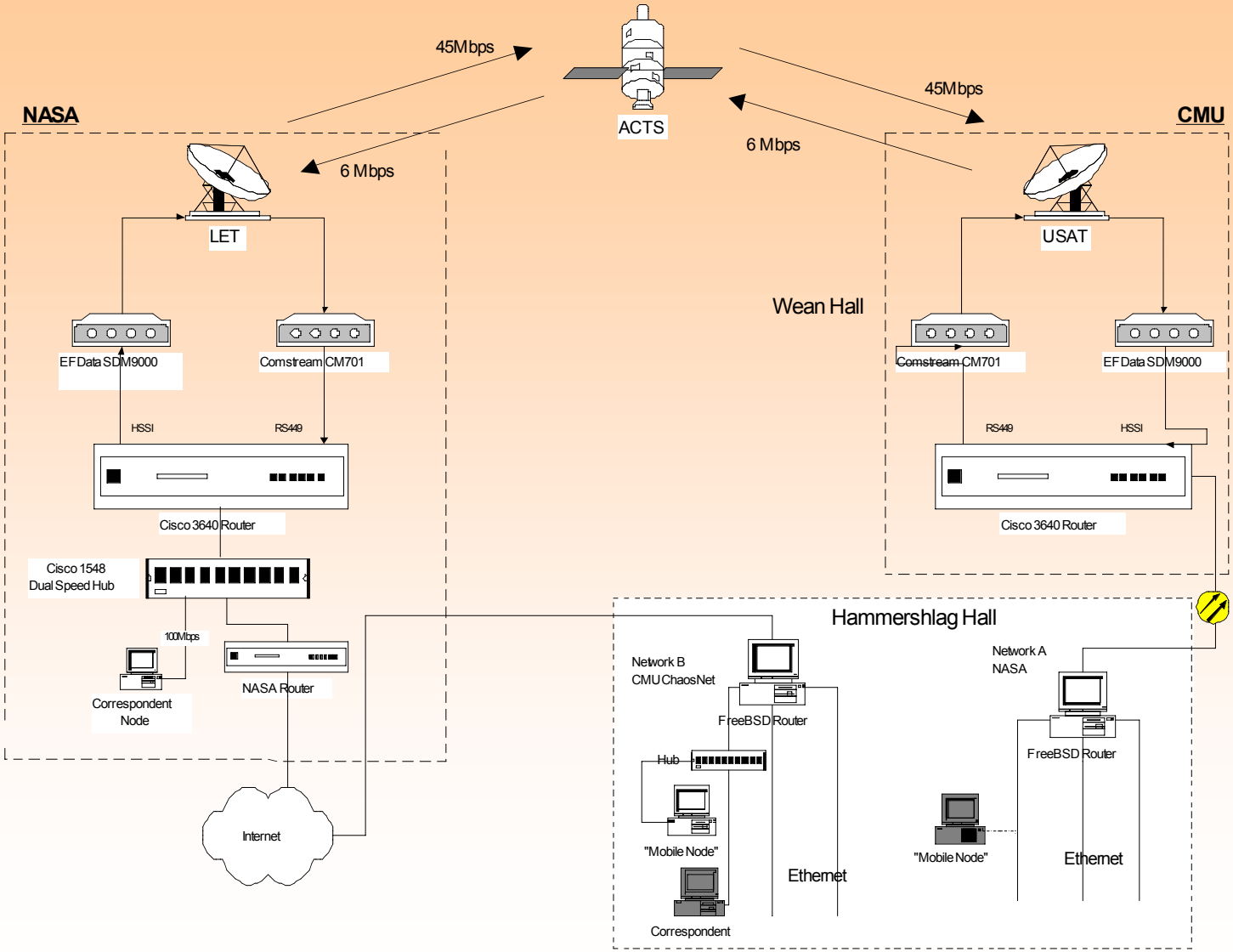
Agenda

- CMU/NASA ACTS Experiment
- Network Simulator (ns)
- Error Modeling for the ACTS Link
- Data collection and analysis
- Conclusions and Future Research

Goals

- *ACTS Error Modeling module for NS*
- **Performance analysis and Improvement of TCP behavior over ACTS**
- **Mobile IP performance over ACTS**

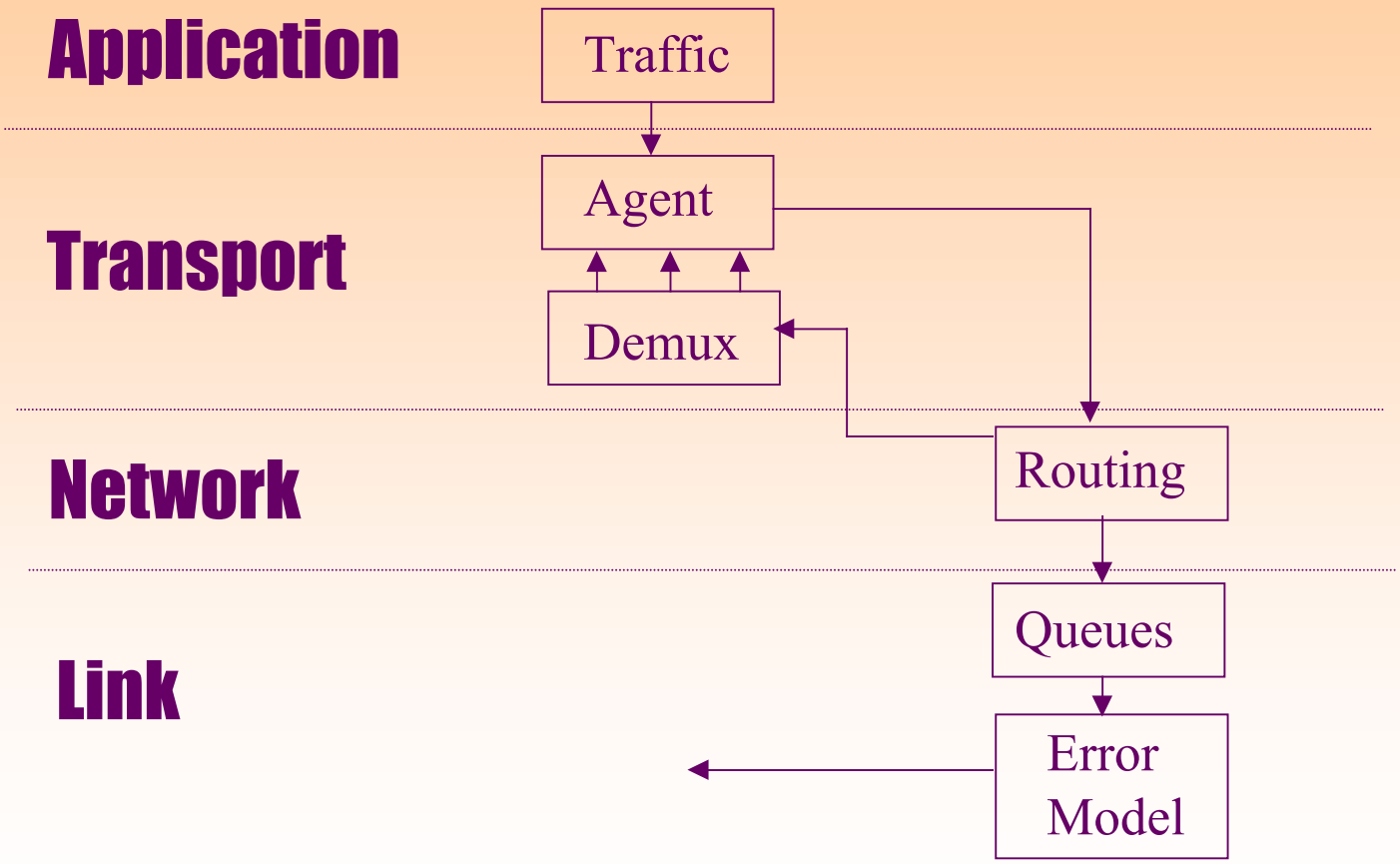
CMU/NASA ACTS Experiment



Network Simulator (ns)

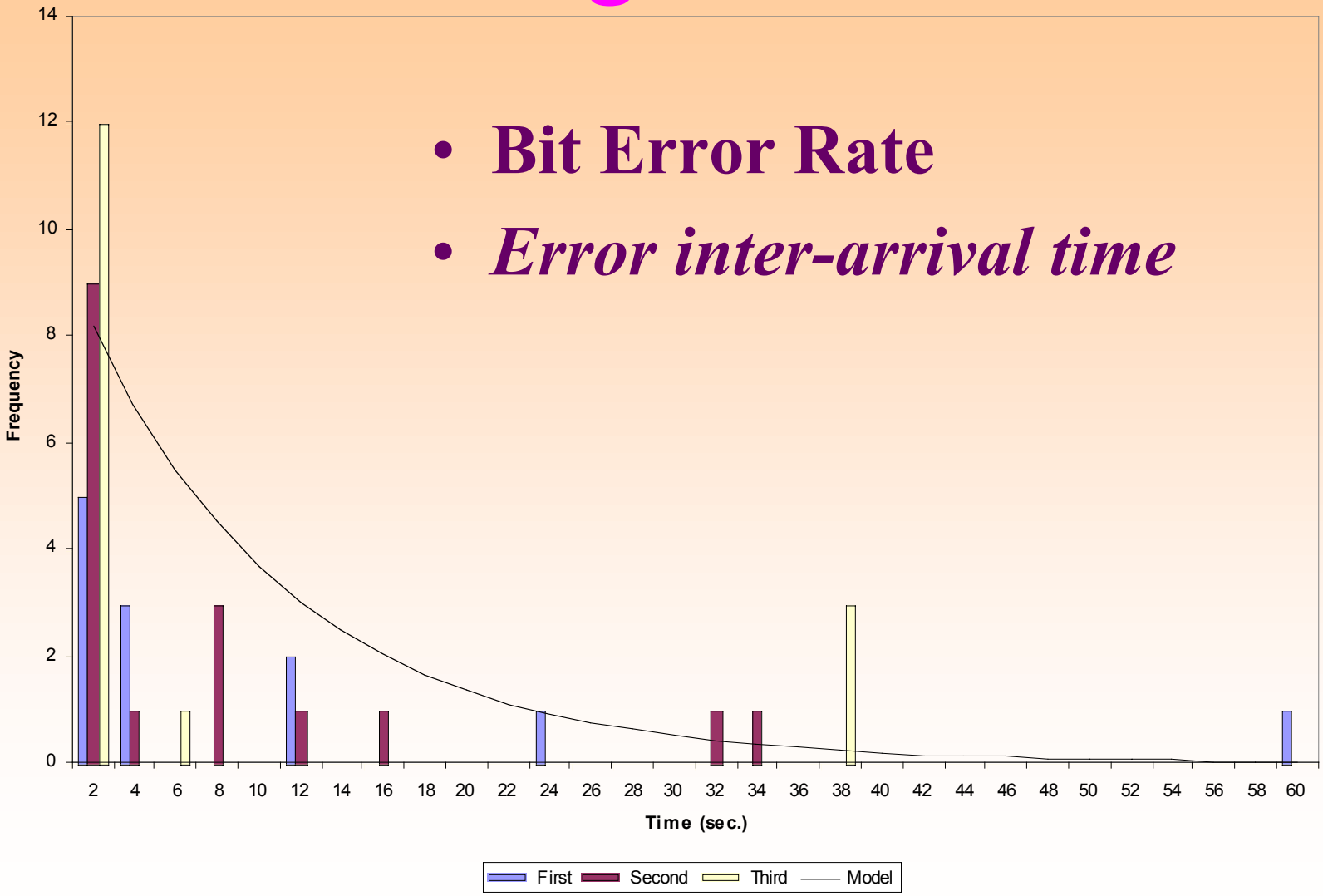
- Collaborative effort: USC/ISI, PARC, LBNL & UCB
- Event based queue modeling
- Easily extendable modular framework
- Protocol definition and simulation configuration using scripting language
- Graphical tools for animation and configuration

ns Architecture



Error modeling in ns

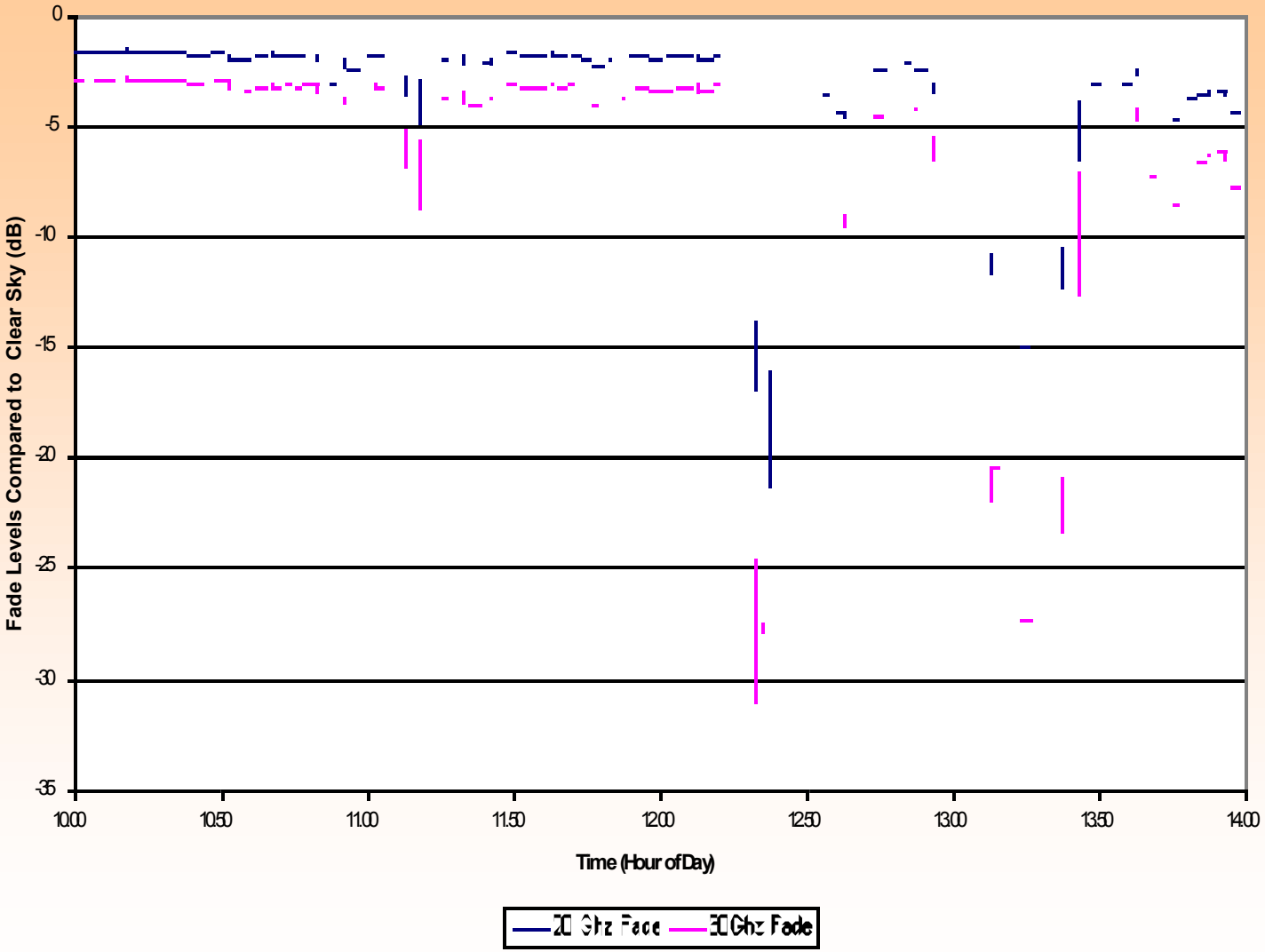
- **Bit Error Rate**
- ***Error inter-arrival time***



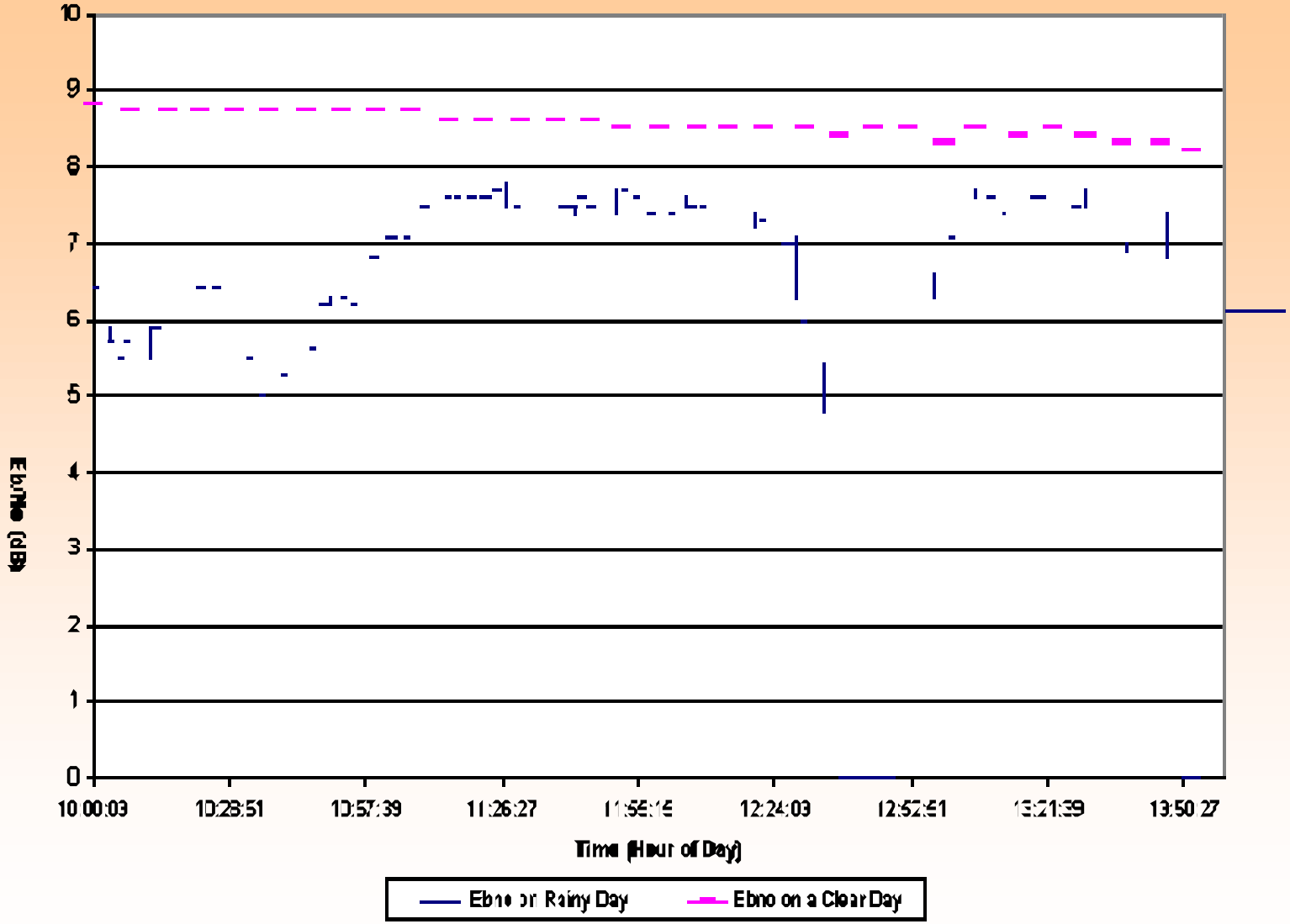
Experiment Data

- Eb/No, BER, Beacon Fade and TCP data
- Signal Degradation on a Rainy day
- Effect on the TCP tests performed

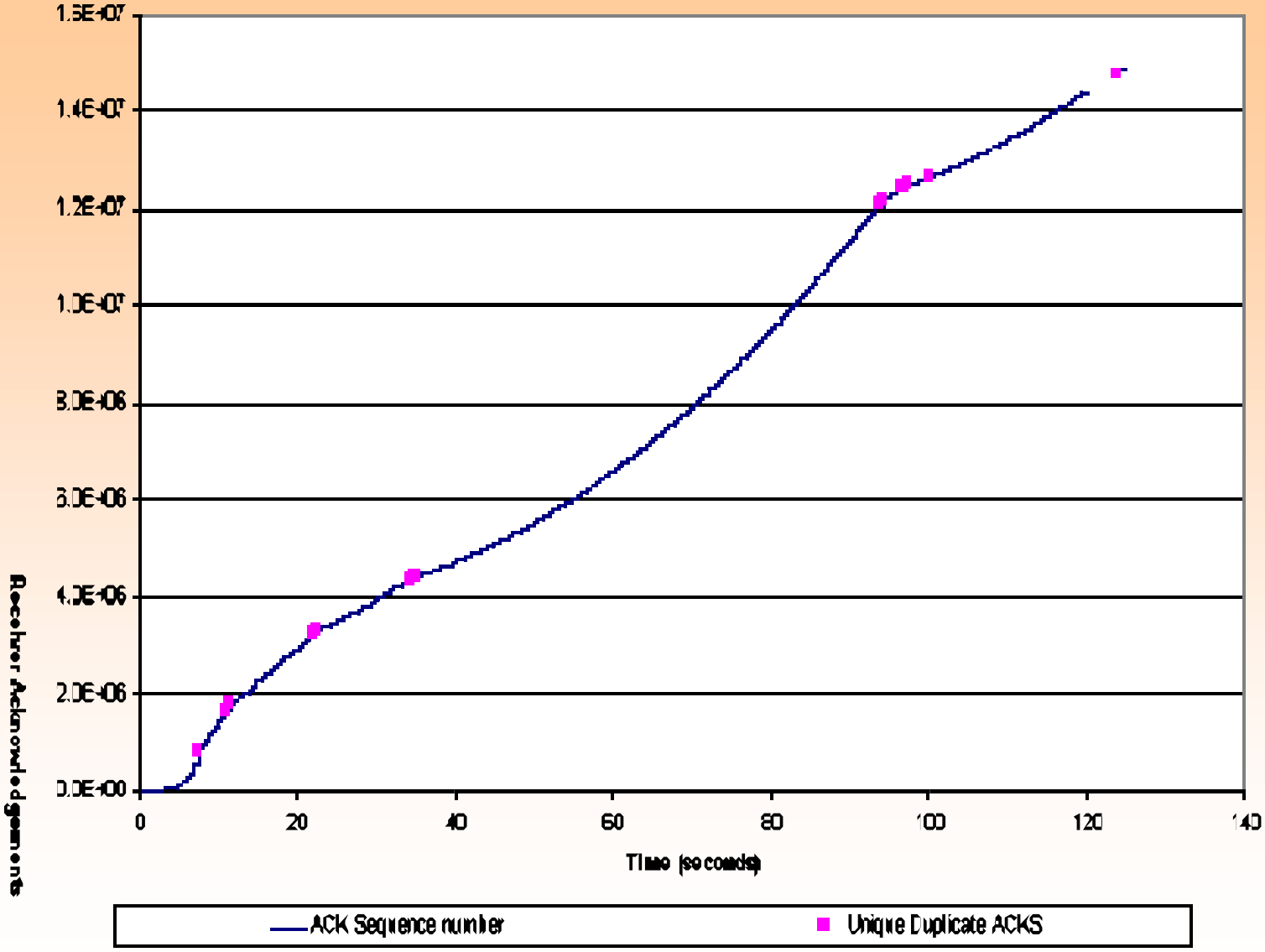
Fade data on Rainy Day from Beacon Signals at 20Ghz and 30Ghz



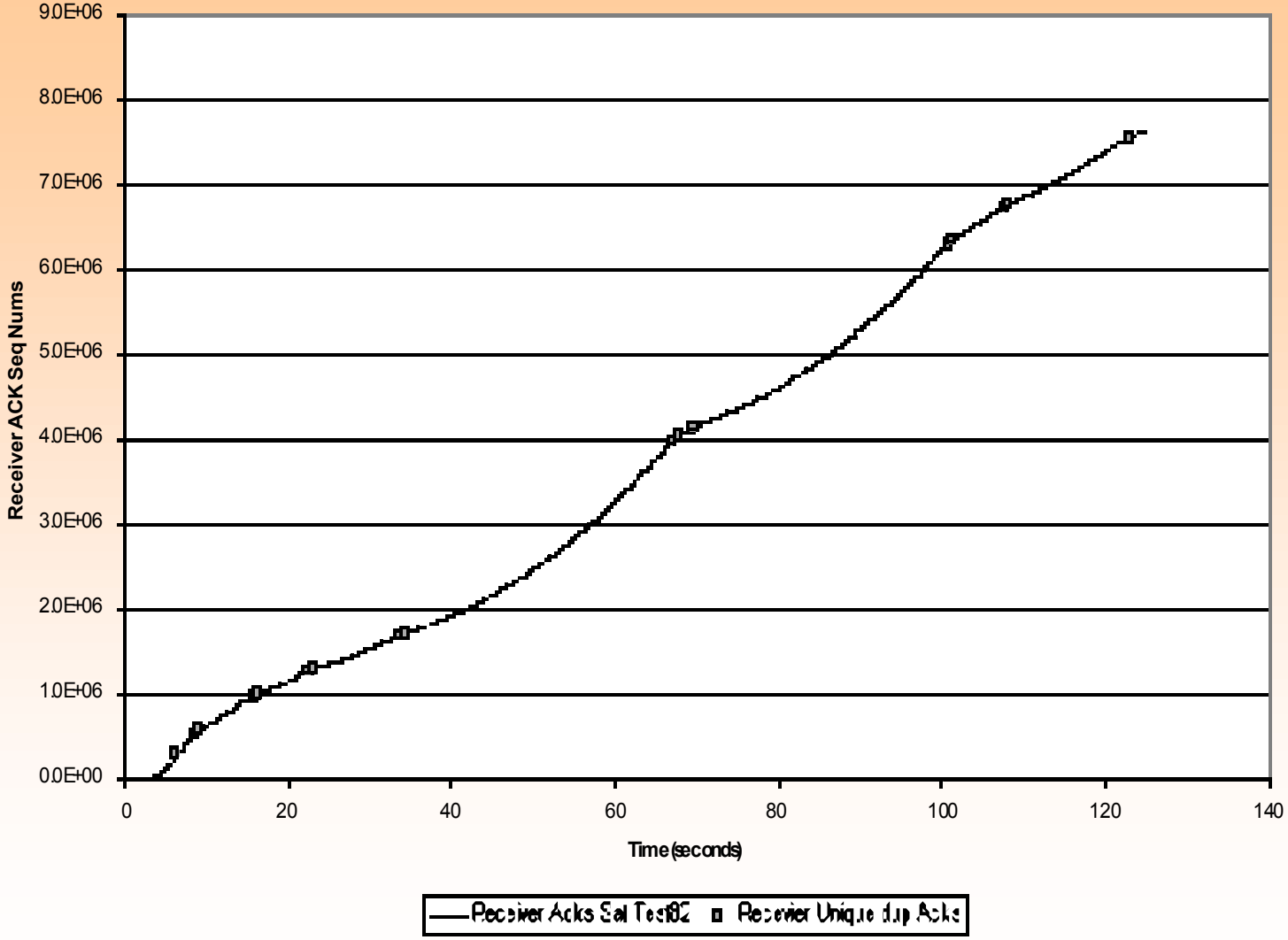
Eb/No plot for the Rainy Day [08/10/98]

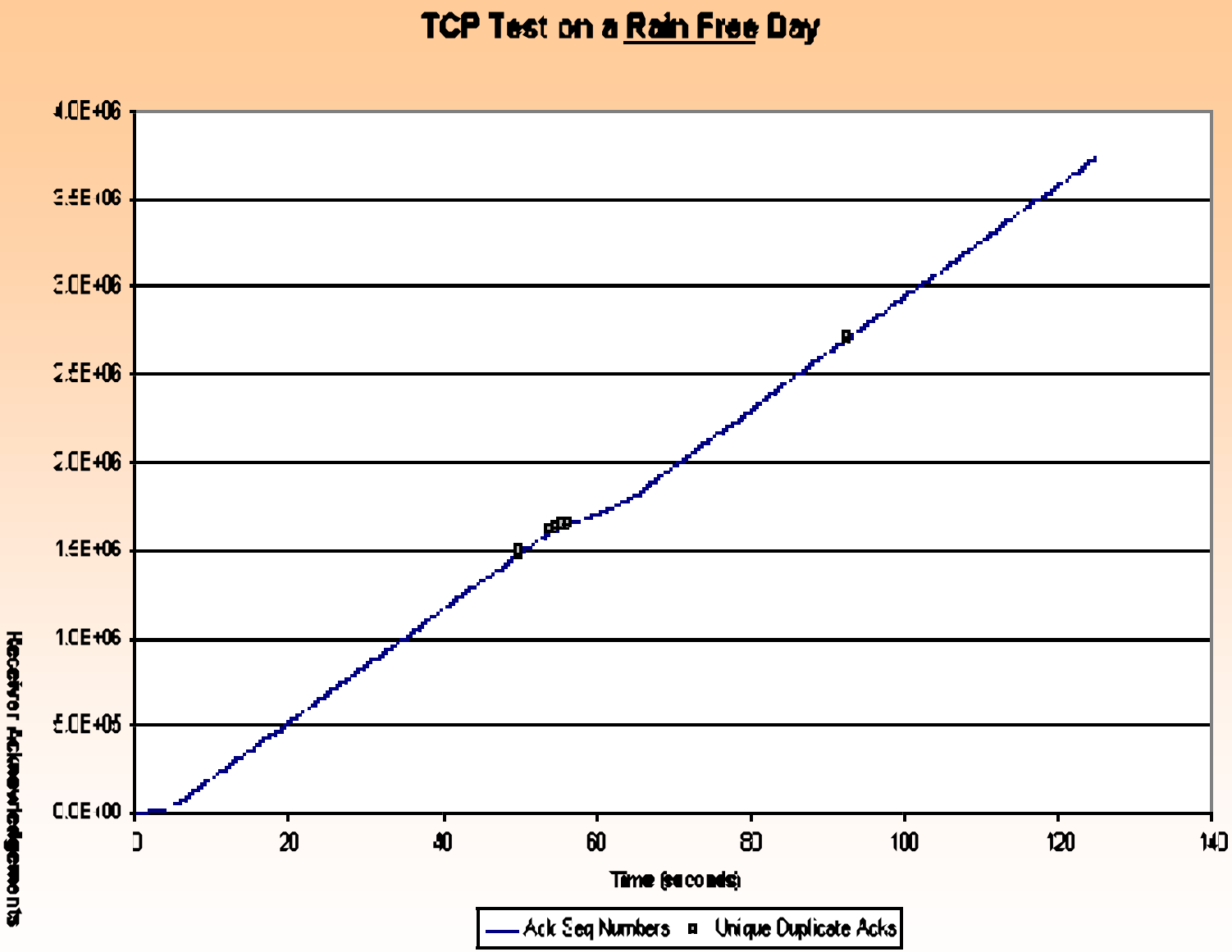


TCP Test Before Fade Event



TCP Test Near Fade Event

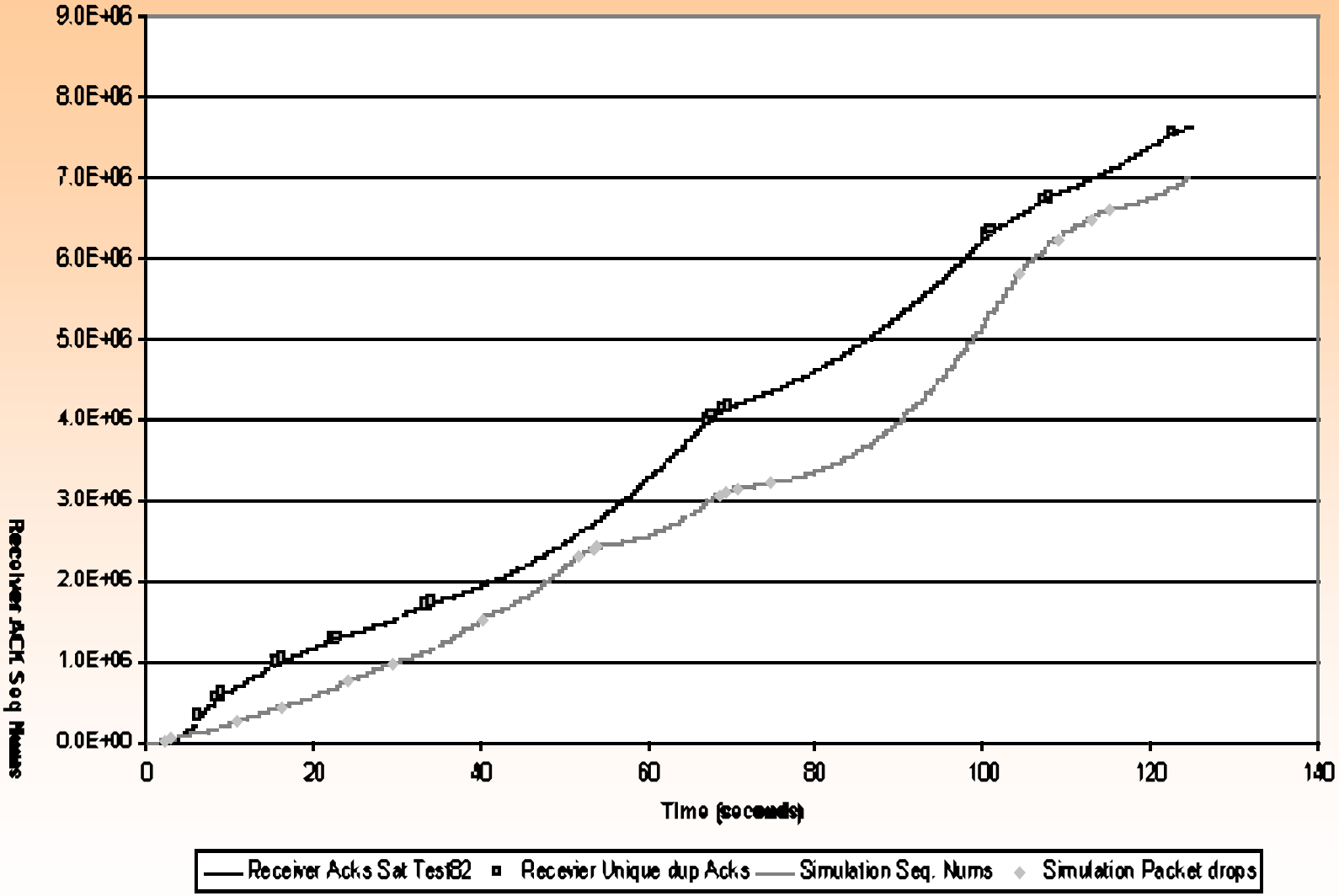



TCP Test on a Rain Free Day
4.0E+06
3.5E+06
3.0E+06
2.5E+06
2.0E+06
1.5E+06
1.0E+06
5.0E+05
0.0E+00
0
20
40
60
80
100
120
140
Time (seconds)
Ack Seq Numbers
Unique Duplicate Acks

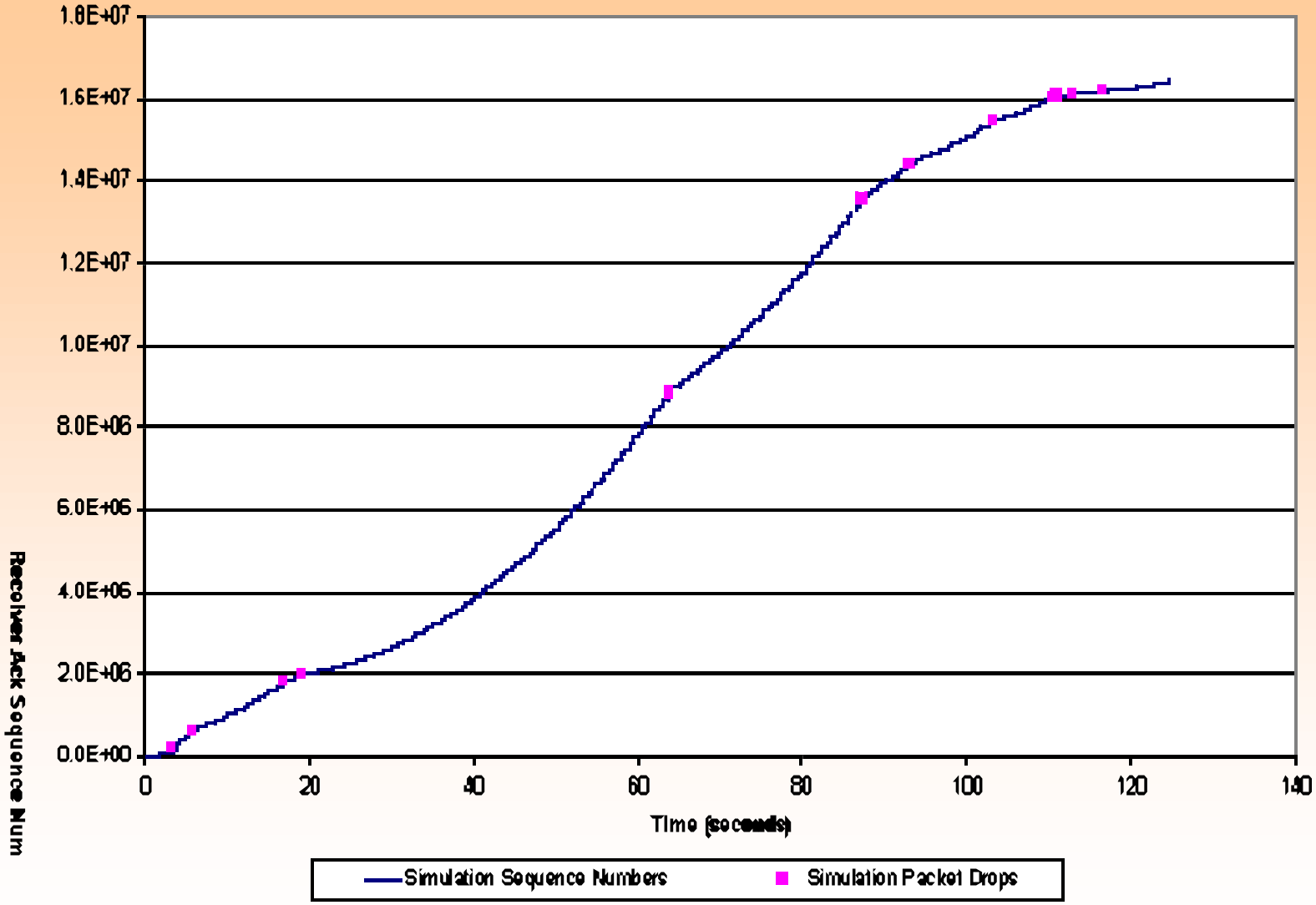
Simulation verification

- Modeling the Observed Link Conditions
- Model vs Observed Link Behavior
- Multiple Simulation Run Results

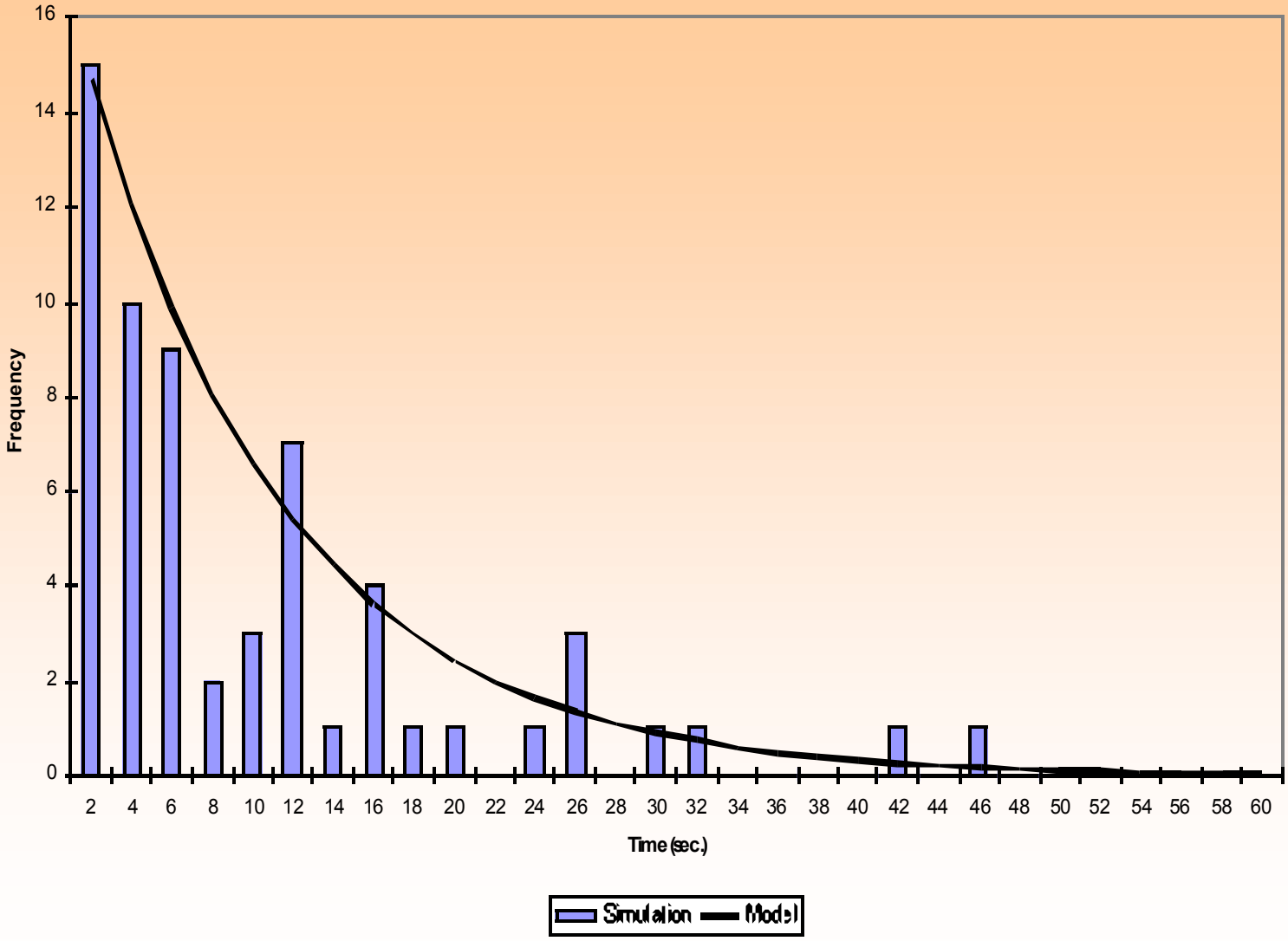
Simulation Verification for Tests Near Fade Event



Simulation Run for TCP Test on a Clear Day



Multiple Simulation Run Results



Conclusions

- BER and error inter-arrival time used for modeling
- NS : modular extendable tool for modeling propagation
- ACTS ns model can be used for research of current and future protocols over similar links

Future Research

- ns in emulation mode
- Mapping of fade data and atmospheric conditions to predict expected Bit Error Rate

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