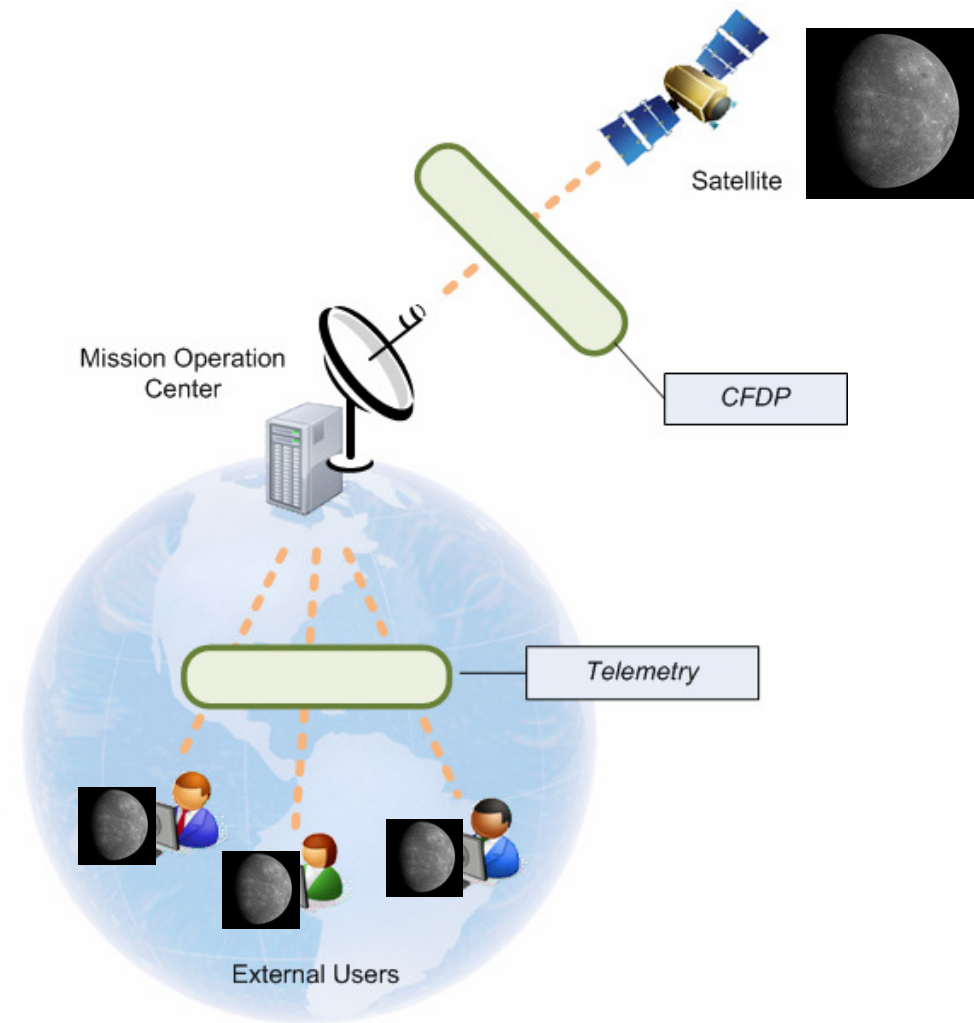# Using Inexact Matching for Validating Communication Behavior
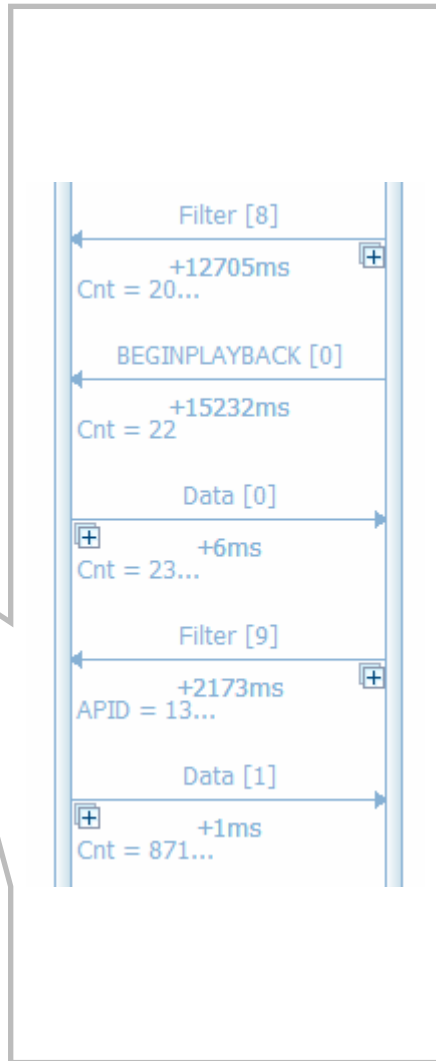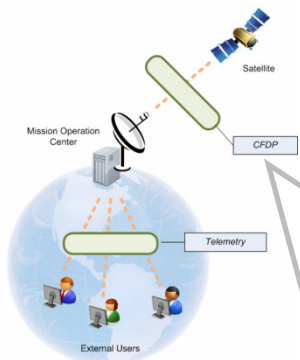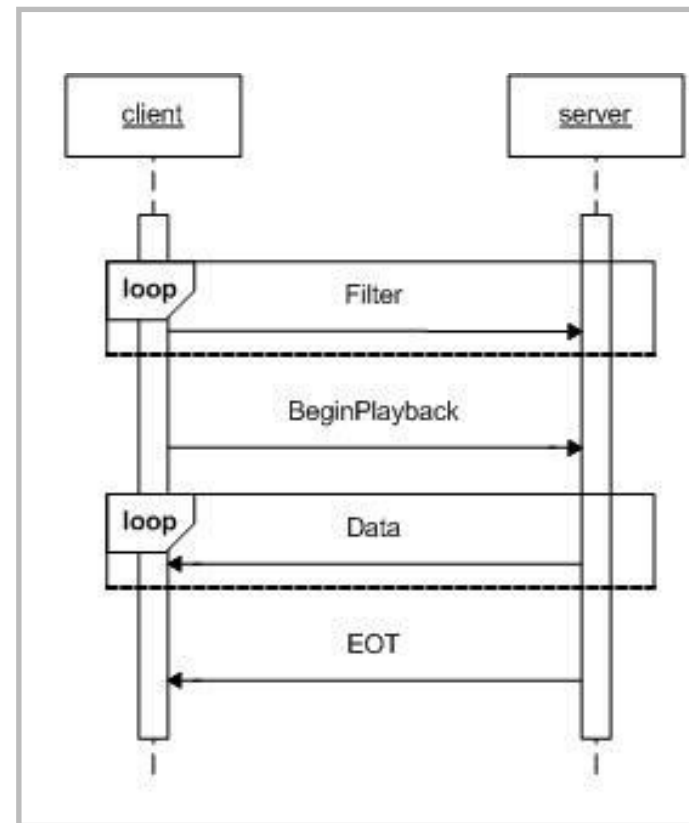
Nico Zazworka and Chris Ackermann

Motivation

- Systems collaborate to fulfill larger task

- Communication determines reliability of systems

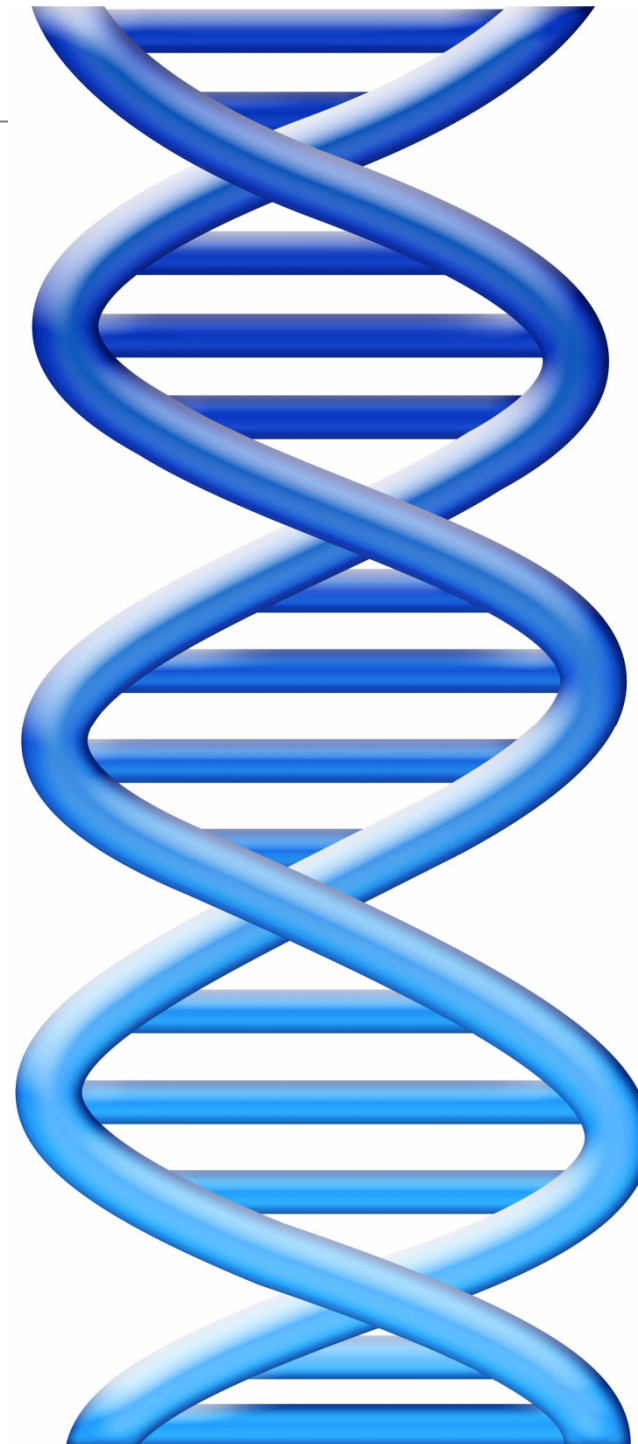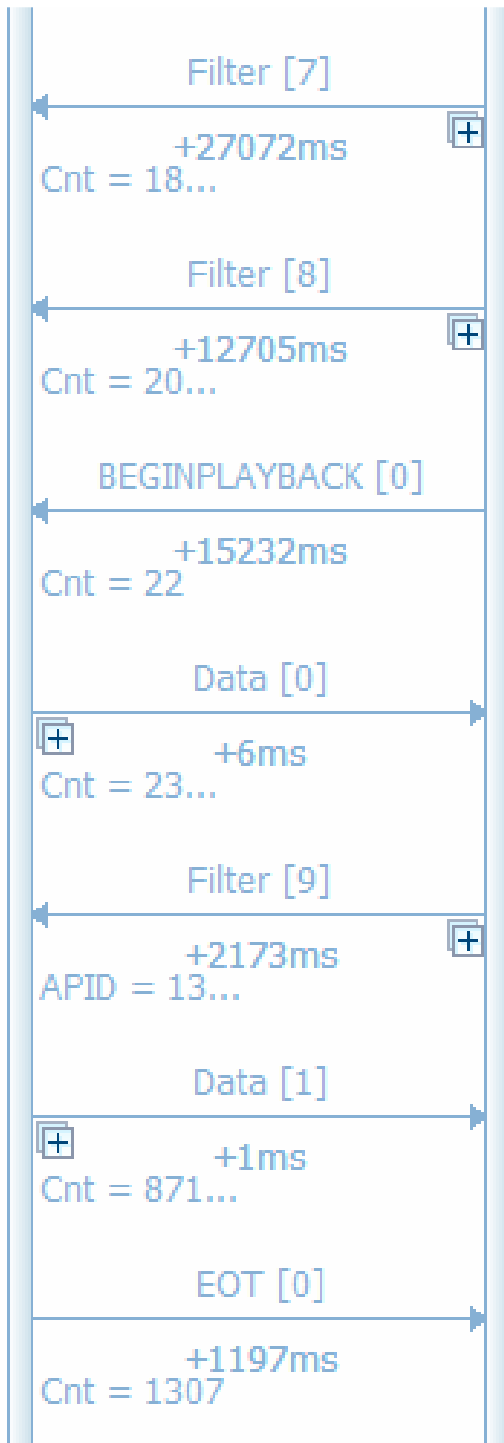- Communication errors frequently lead to serious issues

Satellite

Mission Operation Center

CFDP

Telemetry

External Users

Actual/Planned Communication

Protocol is specified in Interface Control Document (ICD)

3

Filter [7]

+27072ms

Cnt = 18...

Filter [8]

+12705ms

Cnt = 20...

BEGINPLAYBACK [0]

+15232ms

Cnt = 22

Data [0]

+6ms

Cnt = 23...

Filter [9]

+2173ms

APID = 13...

Data [1]

+1ms

Cnt = 871...

EOT [0]

+1197ms

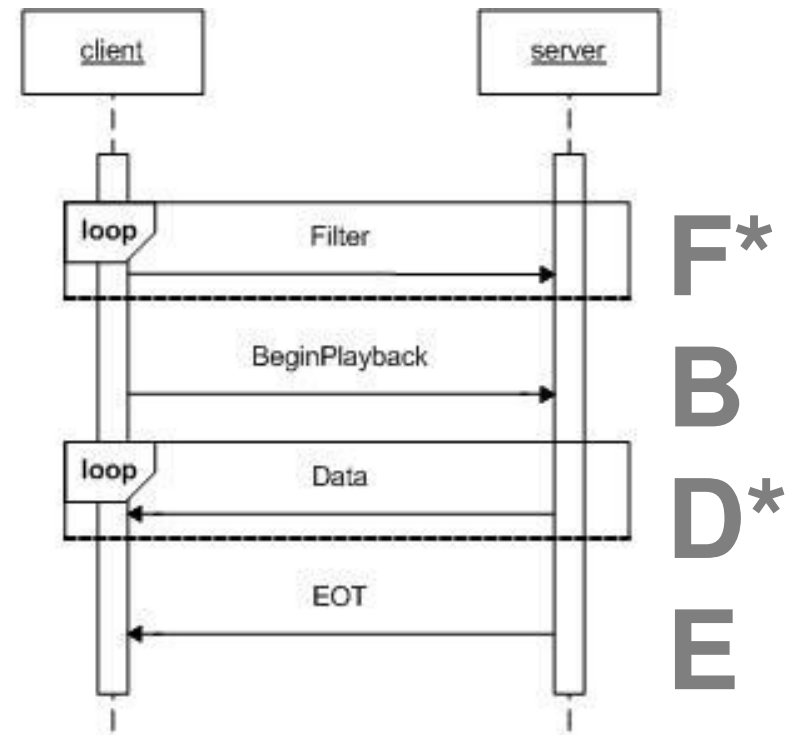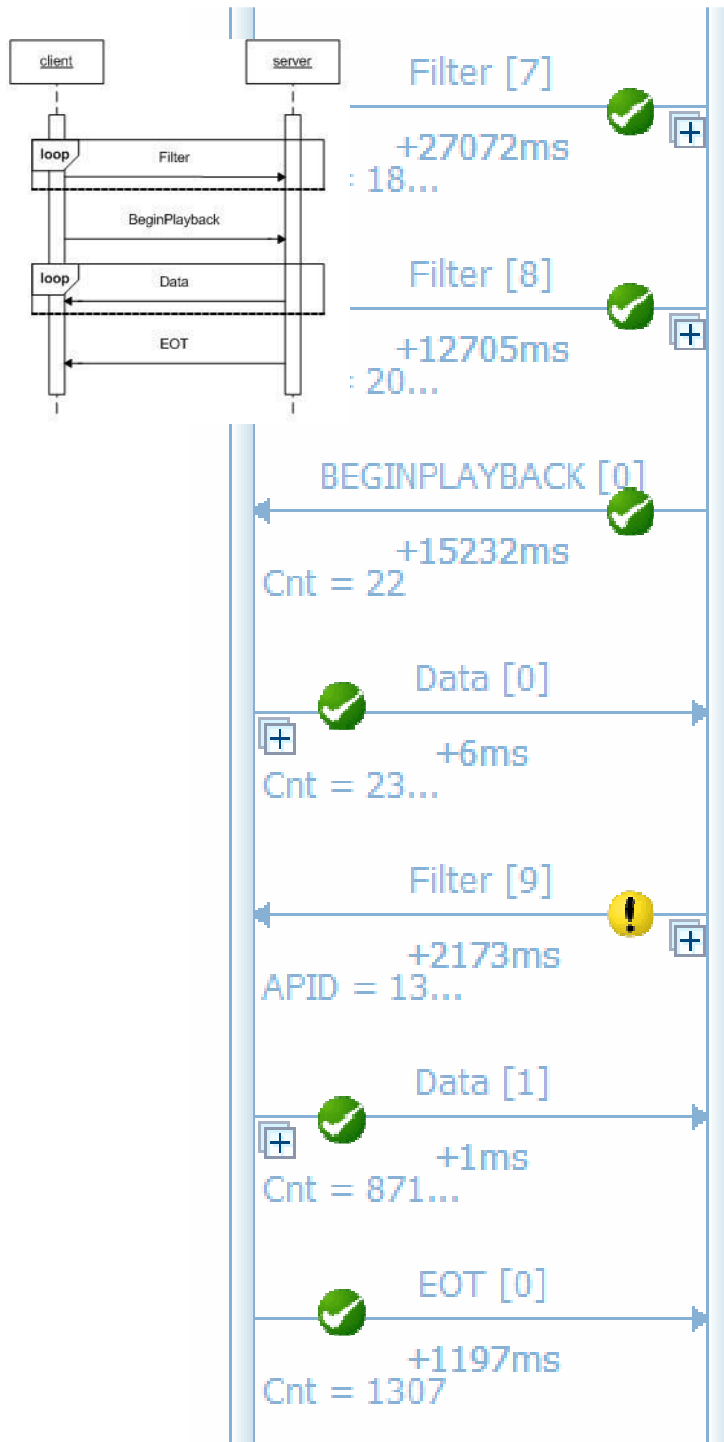Cnt = 1307

Idea

Communication can be expressed as sequence of characters
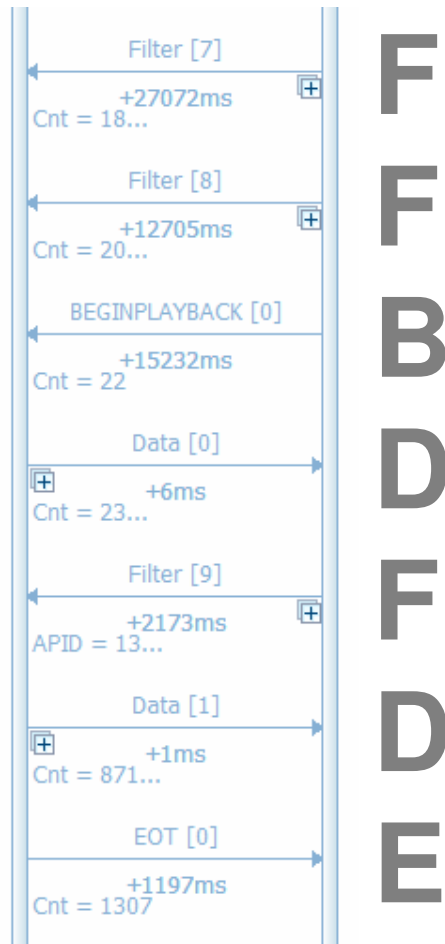
Protocol can be expressed as regular expression

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Output

- Indicate deviation visually

- Need to find communication that is easiest to understand

- That means with the least possible edits!

Objective

- Goal:
  - Design algorithm to generate the optimal solution (annotated sequence diagram)

- Challenges:
  - Need to match string with regular expressions
  - We don't know where in the protocol the captured sequence begins
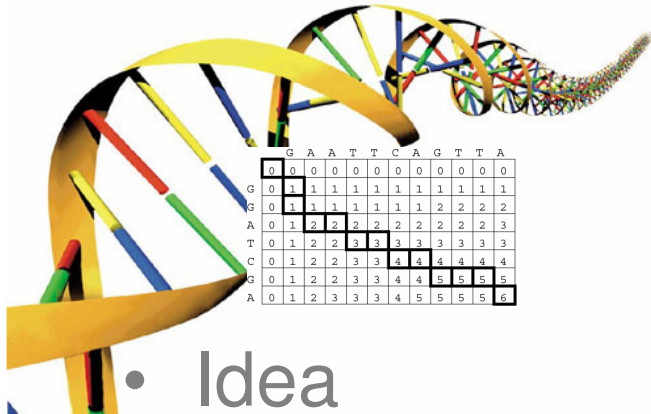
- Idea
  - Extend **dynamic programming** algorithm to handle regular expressions.

- Observations
  - Need to add a notion of state to keep track of where we are in the regular expression
  - Use state machines in combination with a dynamic programming table