Follow-The-Sun Methodology in a Stochastic Modeling Perspective

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Our goal

- To discuss a formal mapping of Follow-The-Sun characteristics to a stochastic model in order to predict performance indices of teams such as availability

- Proposal of an initial modeling effort which aims to enhance understanding and feasibility evaluation for FTS projects
Context and motivation

- There are times when the speed of implementation of a software development project is important and special measures are needed to fast track it without impacting the rest of the project portfolio.

- Follow-The-Sun (FTS) is being experimented to reduce development phase duration, opening research opportunities in the field of team building, global software development tools, and coordination strategies.

- We did an initial study for modeling and evaluation of FTS projects
  - Demonstrate the benefits of using the Stochastic Automata Networks (SAN) formalism for the modeling and evaluation of distributed teams
  - Present a model trying to enhance the understanding and feasibility evaluation for FTS projects calculating probabilities for availability and project risk factor, such as hand-off efficiency
Analytical Modeling in FTS projects

- **Target**: geographically distributed projects - FTS
  - key factors in FTS: communication and coordination
  - analytical modeling of sites activities and interactions

- **Tool**: high-level modeling formalism
  - Stochastic Automata Networks (SAN) [Plateau’85]
  - modular representation (states, transitions, events)
  - suitable for modeling independent entities with synchronizing activities
  - numerical solution using GTAexpress software package [QEST’09]
Follow-The-Sun (3 sites example)
Site #1

- Off-line
- Opening hand-off
  - $wk_1(\pi_1)$
- Working
  - $wk_1(1-\pi_1)$
- Closing hand-off
  - $cl_wk_1$
- Reworking
  - $nt_1$
  - $rw_1$
  - $cl_rw_1$

Transitions:
- $open_1$ from Off-line to Opening hand-off
- $off_1$ from Off-line to Closing hand-off
- $cl_wk_1$ from Working to Closing hand-off
- $rw_1$ from Reworking to Working
- $nt_1$ from Reworking to Working

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## SAN Model Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
<th>Average Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>open</td>
<td>After being off-line for (in average) 16 hours, a site initiates the hand-off opening process.</td>
<td>16h</td>
</tr>
<tr>
<td>wk</td>
<td>A site spends in average 1 hour in the beginning of the workday performing the hand-off opening process.</td>
<td>1h</td>
</tr>
<tr>
<td>rw</td>
<td>A site works in average 1 hour per workday before reworking a pending issue.</td>
<td>1h</td>
</tr>
<tr>
<td>nt</td>
<td>A site remains reworking a task in average 0.5 hour before starting a new task.</td>
<td>0.5h</td>
</tr>
<tr>
<td>cl_wk</td>
<td>Before starting the hand-off closing process, a site remains working in average 4 hours per workday.</td>
<td>4h</td>
</tr>
<tr>
<td>cl_rw</td>
<td>Before going to a hand-off closing process, a site stays in average 0.5 hour reworking a task.</td>
<td>0.5h</td>
</tr>
<tr>
<td>off</td>
<td>A site spends in average 1 hour in the end of the workday executing the handoff closing process.</td>
<td>1h</td>
</tr>
</tbody>
</table>
Falar do Resultado e o porque o modelo ainda não esta pronto, como pode ser visto no gráfico, se possível já falar aqui de uma solução para o modelo.
### Possible scenarios configurations (example)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Quality Level Site 1 (event wk)</th>
<th>Quality Level Site 2 (event wk)</th>
<th>Quality Level Site 3 (event wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>8</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>9</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Varying parameters to predict other behaviors, it is possible to be done for each model event*
• Limitations
  ▪ to capture other important follow-the-sun dimensions such as increase the number of sites, synchronous hand-off, geographic distance, communication patterns and teams coordination.

• Conclusions and future work
  ▪ theoretical modeling effort to describe a complex environment
  ▪ analytical modeling is useful to predict behaviors before implementing a project or process
  ▪ once improved the model can provide new quantitative measures only changing model parameters
  ▪ focus on software development processes such as flow of requirements engineering, development and testing, project schedule evolution, etc.
This is part of a research program

State of the art review on software development using follow-the-sun and Stochastic Modeling

Quantitative study

- Stochastic Model creation and execution to collect numerical results from simulation using different scenarios to see FTS model behavior