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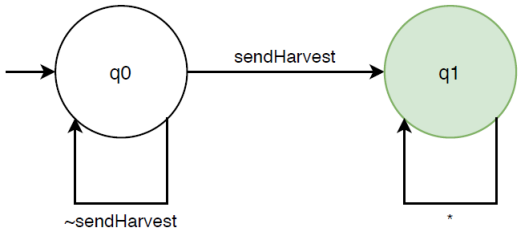
Monitor

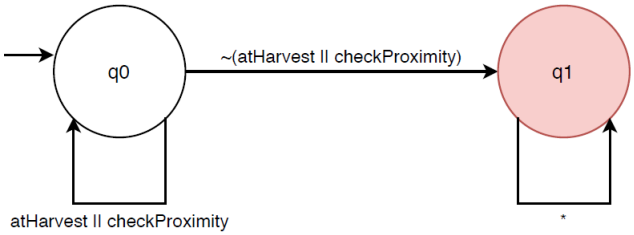
1. The Scout should at some point in time send a harvesting position to the Collector.

   - **LTL: F**(sendHarvest)
   - **Not Safety:** There is no bad prexif because for every infinite trace that is not in L we can always append {sendHarvest}. This would then be a good prefix. $\emptyset^\omega$ does not have a bad prefix
   - **Co-Safety:** Every trace in L has sendHarvest at some point which is a good prefix.
   - **Monitorable:** Every finite trace can be extended to a good prefix by appending {sendHarvest} so we do not have an ugly prefix.
   - **Automaton:**



2. The Collector should always check its proximity sensors unless it is at a decent harvesting position.

   - **LTL: G**(atHarvest $\vee$ checkingProximity)
   - **Safety:** Every trace not in L has at least one prefix $\{\sim \text{atHarvest} \implies \neg\text{checkingProximity}\}$ which is a bad prefix.
   - **Not Co-Safety:** $\{\text{atHarvest, checkProximity}\}^\omega$ does not have a good prefix. Every trace that is in L does not have a good prefix because we can always do $\{\neg\text{atHarvest} \wedge \neg\text{checkingProximity}\}$ in the next step.
   - **Monitorable:** Every finite trace can be extended to a bad prefix so it does not have an ugly prefix.
   - **Automaton:**



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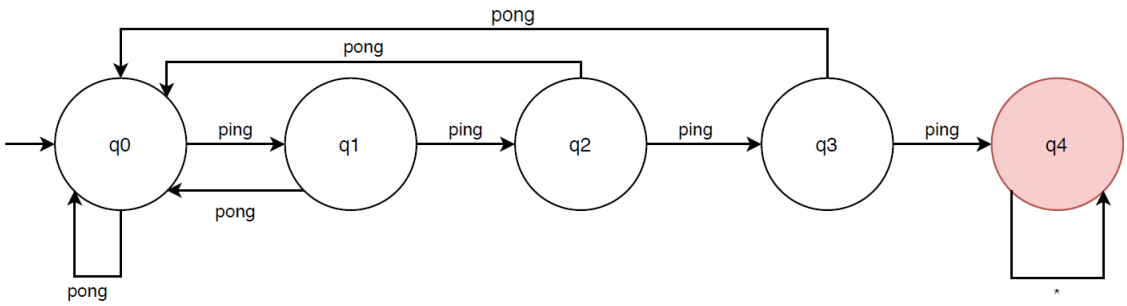
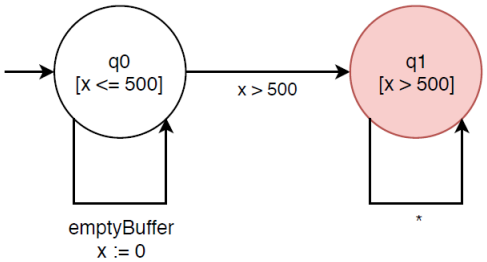
3. A robot should never ignore three consecutive PING messages.

   - **LTL:** $\mathbf{G}((\text{ping} \wedge \mathbf{X}(\neg\text{pong} \wedge \text{ping}) \wedge \mathbf{XX}(\neg\text{pong} \wedge \text{ping})) \rightarrow \mathbf{XXX}\,\text{pong})$
   - **Safety:** Every trace not in L has at least one prefix x which is a bad prefix.
   - **Not Co-Safety:** $\{\text{pong}\}^\omega$ does not have a good prefix. We can extend every good trace to a bad trace by appending {ping, ping, ping, ping}.
   - **Monitorable:** Every finite trace can be extended with the finite trace {ping, ping, ping, ping} to a bad prefix, therefore we do not have an ugly prefix.
   - **Automaton:**



4. When receiving a message, the robot copies the data over into a buffer. This buffer should be emptied at least every 500ms.

   - **LTL:** This specification cannot be expressed in LTL but only in TLTL.
   - **Safety:** Every trace not in L has at least one prefix where the buffer is not emptied for more than 500ms, which is a bad prefix.
   - **Not Co-Safety:** $\{(\text{emptyBuffer}, t)\}^\omega$ does not have a good prefix for all $t \in \mathbb{N}$ with $0 \leq t \leq 500$. We can extend every such good trace to a bad trace by appending $\{(\text{emptyBuffer}, t + 501)\}$.
   - **Monitorable:** Every finite trace be extended to a bad prefix, therefore we do not have an ugly prefix.
   - **Automaton:**



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SPI State Machine