
MODULE *definitions*

LOCAL INSTANCE *Integers*
 LOCAL INSTANCE *Sequences*
 LOCAL INSTANCE *FiniteSets*
 LOCAL INSTANCE *utils*

CONSTANTS *BcNodes*, *BftNodes*, *CrossLink2Nodes*
 CONSTANTS *ByzBft*, *ByzCl*
 CONSTANTS *Sigma*, *L*

VARIABLES *bc_chains*, *bft_chains*, *crosslink2_chains*

The genesis blocks for the chains.

$BcGenesisBlock \triangleq [context_bft \mapsto 0, hash \mapsto 0]$
 $BftGenesisBlock \triangleq [headers_bc \mapsto \langle \rangle, hash \mapsto 0]$
 $CrossLink2GenesisBlock \triangleq [fin \mapsto \langle BcGenesisBlock \rangle]$

Convenient sets

$HonestBftNodes \triangleq 1 \dots BftNodes \setminus ByzBft$
 $BftAllNodes \triangleq 1 \dots BftNodes$
 $BcAllNodes \triangleq 1 \dots BcNodes$

Choose the best *BC* chain (the longest one).

$BestBcChainIdx \triangleq$
 CHOOSE $i \in BcAllNodes$:
 $Len(bc_chains[i]) = Max(\{Len(bc_chains[j]) : j \in BcAllNodes\})$

The number of nodes supporting the same chain as node i .

$BftSupport(i) \triangleq Cardinality(\{j \in BftAllNodes : bft_chains[j] = bft_chains[i]\})$

Byzantine classic fault tolerance threshold condition

$BftThresholdOK \triangleq BftNodes \geq 3 * Cardinality(ByzBft) + 1$

Choose the best *BFT* chain (the longest one with the most support).

- $Lmax$ = maximum length of all *BFT* chains
 - S = set of nodes having the longest chains
 - $supMax$ = maximum support among the longest chains
 - T = set of nodes having the longest chains with the maximum support
 $BestBftChainIdx \triangleq$

LET
 $Lmax \triangleq \text{Max}(\{Len(bft_chains[k]) : k \in BftAllNodes\})$
 $S \triangleq \{i \in BftAllNodes : Len(bft_chains[i]) = Lmax\}$
 $supMax \triangleq \text{Max}(\{BftSupport(k) : k \in S\})$
 $T \triangleq \{i \in S : BftSupport(i) = supMax\}$
 IN
 CHOOSE $i \in T$: TRUE

Definition: Computable efficiently function

$\star bftlastfinal : \star bftblock \rightarrow \star bftblock \cup \{\perp\}$

$BftLastFinal(n) \triangleq bft_chains[n]$