Implementation Experience on ForCES

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Overview

- Two systems implemented for ForCES
  - A ForCES Router system, which includes
    - A ForCES protocol middleware

      that acts as a protocol stack and complies with almost all ForCES protocol specifications and FE model definitions
    - A User Operation Management (UOM)

      that provides graphical management for router resources based on ForCES FE model definitions
    - A TML based on TCP/UDP
    - Adapters supporting third-party entities like routing protocol stacks, SNMP agent, etc
  - A sub-system for ForCES interop test
    - Based on the ForCES protocol middleware
    - SCTP TML implemented

Implementation environment

- Operation system: developed isolated from OSs
  - Can run on Linux, vxWorks, etc
- Language: C
- Code amount
  - ForCES protocol middleware: about 25,000 lines, excluding notes and blanks.
  - User Operation Management (UOM): about 30,000 lines
  - SCTP TML: about 3000 lines

Implementation Results on ForCES Protocol

Items		Implemented	Planning to Implement	Note
Protocol Mechanism	**Execution**			
	Execute all-or-none	Y		
	Continue-execute-on-failure	Y		
	Execute-until-failure	Y		
	Transaction			Implemented but not fully tested
	Atomicity	Y		
	Consistency	Y		
	Isolation	Y		
	Durability	Y		
	Batching	Y		
	Command Pipelining	N	Y	
	Heartbeats	Y		

Items		Implemented	Planning to Implement	Note
Protocol Messages	Association Setup	Y		
	Association Setup Response	Y		
	Association TearDown	Y		
	Configuration	Y		
	Configuration Response	Y		
	Query	Y		
	Query Response	Y		
	Event Notification	Y		
	Packet Redirect	Y		
	HeartBeat	Y		
Main Header	Correlator	Y		
	Flags			
	Acknowledge	Y		
	Priority	Y		
	Execution Mode	Y		
	Atomic	Y		
	Transaction	Y		

Items		Implemented	Planning to Implement	Note
TLVs	Redirect TLV	Y		
	Association Setup Result TLV	Y		
	Association TearDown Reason TLV	Y		
	LFBSelector TLV	Y		
	Operation TLV	Y		
	PathData TLV	Y		
	KeyInfo TLV	Y		Implemented but not fully tested
	FullData	Y		
	SparseData	Y		
	ILV	Y		
	Metadata TLV	Y		
	Result TLV	Y		
	Redirect Data TLV	Y		

Items		Implemented	Planning to Implement	Note
Operation Types Supported	Set	Y		
	Set Prop	Y		
	Set Response	Y		
	Set Prop Response	Y		
	Del	Y		
	Del Response	Y		
	Get	Y		
	Get Prop	Y		
	Get Response	Y		
	Get Prop Response	Y		
	Report	Y		
	Commit	Y		Implemented but not fully tested
	Commit Response	Y		
	TRComp	Y		

Implementation Results on ForCES Model

Items		Implemented	Planning to Implement	Note
Model Features	**Basic Atomic Types**			
	char	N		Here, types “not implemented” actually means the types are still not used yet in current LFBs . It’s easy to apply these types when we need them.
	uchar	Y		
	int16	N		
	uint16	N		
	int32	Y		
	uint32	Y		
	int64	N		
	uint64	Y		
	boolean	Y		
	string[N]	Y		
	string	Y		
	byte[N]	Y		
	octetstring[N]	N		
	float16	N		
	float32	N		
	float64	N		

Items		Implemented	Planning to Implement	Note
Model Features	**Compound Types**			
	structs	Y		
	Arrays	Y		
CoreLFBs	FEObjectLFB	Y		
	FEProtocolLFB	Y		
DataTypes Created	**Protocol Data Types**			
	CEHBPolicy Values	Y		
	FEHIBPolicy Values	Y		
	FERestarPolicy Values	Y		
	CEFailoverPolicy Values	Y		
	FEHACapab	N	Y	
	Model Data Types			
	LFBAdjacencyLimit Type	Y		
	PortGroupLimitType	Y		
	SupportedLFBType	Y		
	FEStateValues	Y		
	FEConfiguredeighborTyp e	Y		
	LFBSelectorType	Y		
	LFBLinkType	Y		

	Items	Implemented	Planning to Implement	Note
Components Created	**Protocol Components**			
	CurrentRunningVersion	Y		
	FEID	Y		
	MulticastFEIDs	Y		
	CEHBPolicy	Y		
	CEHDI	Y		
	FEHBPolicy	Y		
	FEHI	Y		
	CEID	Y		
	BackupCEs	N	Y	
	CEFailoverPolicy	Y		
	CEFTI	Y		
	FERestartPolicy	N	Y	
	LastCEID	N	Y	
	Model Components			
	LFBTopology	Y		
	LFBSelectors	Y		
	FEName	Y		
	FEID	Y		
	FEVendor	Y		
	FEModel	Y		
	FEState	Y		
	FENeighbors	Y		

Items		Implemented	Planning to Implement	Note
Capabilities created	**Protocol Capabilities**			
	SupportableVersions	Y		
	HACapabilities	N	Y	
	Model Capabilities			
	ModifiableLFBTopology	Y		
	SupportedLFBs	Y		
Events created	**Protocol Events**			
	PrimaryCEDown	N	Y	
LFBs	EtherPort	Y		with main components implemented
	EtherDecap	Y		
	IPv4Validor	Y		
	IPv4UcastLPM	Y		
	IPv4NextHopApplicator	Y		
	Ether/encap	Y		
	Scheduler	Y		
	Queue	Y		
	RedirectSink	Y		
	RedirectTap	Y		
	MetaClassifier	Y		

Implementation Results on (SCTP) TML

Items	Implemented	Planning to Implement	Note
TML Priority Ports			Implemented for Interop test
High priority (6700)	Y		
Medium priority (6701)	Y		
Low priority (6702)	Y		
Messaging: High Priority			
Association Setup	Y		
Association Setup Response	Y		
Association Teardown	Y		
Config	Y		
Config Response	Y		
Query	Y		
Query Response	Y		

Items	Implemented	Planning to Implement	Note
Messaging: Medium Priority			Implemented for Interop test
Event Notification	Y		
Messaging: Low Priority			
Packet Redirect	Y		
Heartbeats	Y		
Security Feature			
Ipsec	N	Y	

Thanks!