GR303 Architecture Overview

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1. Introduction – What does GR303 mean to us

Expend our market from trunking-only to trunking+accessing, together with AAL2 VoATM capability
2. GR303 Basics

- GR303 is an industrial standard that specifies the interface between a remote telephone access device (RDT) and an end office switch (IDT).

- Physically, the interface is composed of a TMC/CSC, an EOC and a number of DS0 channels.
• Functionally, the GR303 interface is responsible for:
  - call handling (over-subscription, DS0 channel assignment, call signaling)
  - RDT provisioning, maintenance and alarm/report handling
• Protocol-wise, GR303 is composed of a SET of standard protocols:
  - Q.931 based channel assignment protocol for TMC/CSC
  - 16-State Robbed bit signaling (CAS) for call control
  - CMIP and ROSE/ACSE for RDT management over the EOC
  - LAPD as the link layer for TMC/CSC and EOC

• Protocol stack on EOC

```
<table>
<thead>
<tr>
<th>IDT</th>
<th>RDT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIB</td>
<td>MIB</td>
</tr>
<tr>
<td>CMISE</td>
<td>CMISE</td>
</tr>
<tr>
<td>IS9595/IS9596</td>
<td>IS9595/IS9596</td>
</tr>
<tr>
<td>ROSE / ACSE</td>
<td>ROSE / ACSE</td>
</tr>
<tr>
<td>X219/229</td>
<td>X219/229</td>
</tr>
<tr>
<td>LAPD</td>
<td>LAPD</td>
</tr>
<tr>
<td>DS1/DS0 12</td>
<td>DS1/DS0 12</td>
</tr>
</tbody>
</table>
```
• Protocol stack on TMC/CSC

IDT
- Q.931
- LAPD
- DS1/DS0 24

RDT
- Q.931
- LAPD
- DS1/DS0 24

• Protocol stack on DS0 Bearer Channel (TMC)
- 16-state robbed bit signaling for call control

CAS
- DS1/DS0 x

CAS
- DS1/DS0 x
• GR303 specified line services
  
  - Required: all VF services including loop-start, ground-start & loop-reverse-battery services
  - Optional: Coin, non-local/non-switched, DDS, ISDN BRA & DS1 extension

• GR303 requirements on reliability
  
  - 1:1 path protection on TMC/CSC and EOC (required)
  - 1:n path protection on DS1 facilities (optional)
3. GR303 Operation Overview

- Call Operation

**Originating a call**
- Off-hook
- Assign DS0
- Send dial tone
- Route call

**Terminating a call**
- Exchange messages over TMC
- CAS signaling over DS0
- Collect digits
- Assign DS0
- Ringing
- CAS over DS0
• Management/Maintenance Operation
  - RDT Object Provisioning/Controlling
  - RDT Event/Alarm Reporting
• Path Protection
  - TMC/CSC Path Protection (1:1)
    + Primary TMC/CSC
    + Secondary TMC/CSC
  - EOC Path Protection (1:1)
    + Primary EOC
    + Secondary EOC
  - DS1 Path Protection (1:n)
4. GR303 in ICS2000

- System-wise overview
  - Call related components
  - Management related components
• GR303 Call Procedure
  - DS0 Channel Assignment
  - Call Signaling (CAS)
  - Call Control
• GR303 Call Flows
  - Call Initiated by RDT

RDT | GR303_IDT | CAS_ASC | DSP
--- | --- | --- | ---

**Service Req**
--- SETUP MSG ---*<--- Assign DS0, Tx/Rx
ABCD on DS0

* No Action

* React to ABCD
--- CONN MSG ---*<---

* React to ABCD
--- ABCD (LC) ---*<---
No reaction to ABCD

* Pass the latest ABCD
& DS0 Info to CAS
--- ABCD (LC) ---*<---

<--------------- Dial Tone from DSP ____________________________

--------------- Dial Digits to DSP _____________________________*<---

Init. Conn Ind.
• GR303 Call Flows
  - Call Initiated by IDT

  RDT | GR303_IDT | CAS_ASC | DSP
  ---- | --------- | ------- | ----
  Recv Conn Req
  * <------- CAS Call Req -------
  Assign DS0
  * <-------- CAS Call Rpy ------> *
  Actv. CAS line & Assign DSP
  * <------------- ABCD -----------------
  Accept Call & Conn to line
  * <------------ SETUP MSG ---------
  Accept Call & Conn to line

  * <--------------------- ABCD ------------------>
  No reaction to ABCD

  * <------- CONN MSG -------->
  Pass latest ABCD to CAS
  * <--------------------- ABCD ------------------>
  React to ABCD
  * <-------------------------- ABCD (Ring) -------------->
  Caller ID etc.
  * <-------------------------- ABCD (LC) -------------->
  Init. Conn Resp
GR303 Call Flows
- Call Release

RDT | GR303_IDT | CAS_ASC | DSP
---|----------|--------|---

On-hook detected

--------------- ABCD (LO) ---------------------------------> *

Release trunk side
& DSP resource

* <--------- DISC MSG --------<------ CAS Rels Req -------> *

Stop react to ABCD
& disc line unit

-------- CAS Rels Resp -------> *

-------- RELS MSG ---------> *

De-assign DS0

* <-------- RLC MSG --------
GR303 Management/Provision Procedure
- Provisioning GR303 Objects
- Binding to CAS lines
- Managing the RDT through EOC
  + Provisioning RDT objects
  + Handling RDT Event/Alarm
• Provisioning GR303 Entities
  - Management Protocols: CMIP & SNMP
  - Managing IDT objects
Provisioning GR303 Entities
- Managing RDT objects
• GR303 Objects
  - IDT side objects

[Diagram of GR303 Interface Group (IG) with GR303 IDLC Terminal, DL Term, Profiles Etc., IF 1, DS1 LT 1, IF n, DS1 LT n, DS1 FPT 1, DS1 FPT n, EOC, TMC/CSC, DS0 Chan Term, DS0 Chan Term, DS0 Chan Term]
**GR303 Objects**
- RDT side objects

- GR303 Interface Group/NE (IG)
  - IF 1
  - IF n
  - IF 1 LT 1
  - IF n LT n
  - GR303 IDLC Terminal
  - DL Term
  - DS1 LT 1
  - DS1 LT n
  - DS1 FPT 1
  - DS1 FPT n

- GR303 Line Term
  - ALT
  - ISDN LT
  - DDS LT

- ISDN 3DS0 FPT
  - ISDN FPT
  - QDS0 Chan Term
  - DS0 Chan Term

- EOC
  - TMC/CSC
  - DS0 Chan Term

- Profiles Etc.

- DS0 Chan Term
• GR303 Objects
  - Phase I supported objects
    > Alarm Count List
    > Analog Line Termination
    > Circuit Pack
    > DS0 Channel Termination
    > DS1 Framed Path Termination
    > DS1 Line Termination
    > Equipment
    > Equipment Holder
    > Event Report Control
    > IDLC Data Link Profile
    > IDLC Data Link Termination
    > IDLC Terminal
    > Network Element
    > Protection Group
    > Protection Group Unit
    > IDLC Call Processing Profile
    > Analog Line Termination Profile
GR303 Object Management Flow Using SNMP (IDT side)
GR303 Object Management Flow Using SNMP (RDT side)
- **GR303 Bind to CAS Endpoint**
  - Call related ABCD signaling (CAS) is handled by CAS endpoint
  - Need to let CAS know about GR303 analog line provisioning (CRV)

<table>
<thead>
<tr>
<th>CLI</th>
<th>CAS CMM</th>
<th>GR303 CMM</th>
<th>CAS EPT/ASC</th>
<th>GR303 IG/IF</th>
<th>TSU DVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>-- Bind GR303 IF to DS1 cmd --&gt; *</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
</tr>
<tr>
<td>Rsv DS1, get CPEPT</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
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<tr>
<td>------ Bind GR303 IF to DS1 -------&gt; *</td>
<td>&lt;complex CLI command&gt;</td>
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<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
</tr>
<tr>
<td>Get DVM Hdlr</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
<td>&lt;complex CLI command&gt;</td>
</tr>
</tbody>
</table>

- **Binding to DS1 port done**

- **Bind CAS EPT to IG ->**
  - Save IG’s ID
  - ------ Bind CAS EPT to IG -----------> *
  - Reg. To GR303 IG
  - Pass line status hdlr, ABCD hdlr, idle code, CAS EPT private hdlr
  - <------ Line status update With IF information
  - Save line and IF information

- **Association Between CAS EPT and GR303 IG Established**


- Protection Group and Protection Group Unit

- Protection Group defines the protection algorithm
- Protection Group Units map to Physical Objects (TMC, EOC, DS1 etc.)
• GR303 TMC PPS

- Protection Algorithm
  + 1:1 protection
  + non-revertible protection

- Protection group units maps to TMC Data Link Termination
- Protection Algorithm
  + 1:1 protection
  + non-revertible protection

- Protection group units maps to EOC Data Link Termination
- Protection Algorithm
  + 1:n (n <= 27) protection
  + revertible / non-revertible protection
- Protection group units maps to DS1 LineTermination
GR303 TMC/EOC PPS Details

EOC Agent

TMC Agent

PPS

LAPD

Primary DS1

EOC Path Timeslot 12

EOC PPS SAPI=1/TEI=0

OAM&P SAPI=1/TEI=4

EOC Path Timeslot 12

TMC Path Timeslot 24

TMC PPS SAPI=0/TEI=0

Call Processing SAPI=0/TEI=0

EOC PPS SAPI=1/TEI=0

OAM&P SAPI=1/TEI=4

EOC Path Timeslot 12

TMC Path Timeslot 24

TMC PPS SAPI=0/TEI=0

Call Processing SAPI=0/TEI=0

Secondary DS1
5. Provisioning the GR303 in ICS2000

• Provisioning Philosophy
  - Simple Provisioning interface to Operator
  - Conform with GR303 Standard Object Definition and Hierarchy
  - Manually Created Objects and Automatically Created Objects

• Provisioning Procedure
  - Provisioning the interface group (IG)
    Create gr303 interfaceGroup GR303-IG-BOSTON
    set gr303 interfaceGroup GR303-IG-BOSTON <attribute> (attribute value)
    enable gr303 interfaceGroup GR303-IG-BOSTON

    This will trigger the internal automatic creation of all interface
    group related objects, like IDLC terminal, IDLC call processing
    profile, network element, equipment, equipment holder, inherently
    created alarm counter list, event report control.

  - Bind GR303 interface group to CAS endpoint
    Bind GAS endpoint CAS-BOSTON to GR303 Interface group GR303-IG-BOSTON
Provisioning Procedure

- Provisioning the interface (IF)

before doing this, we need to provision the DS1 port

Create ds3 port Boston on tsu in slot 10 port 1
Set ds3 port Boston channelized to ds1
Set ds3 port Boston lineType m23

// for (n=1; n<=m n++) do the followings to set DS1 port attributes
// where m <= 28
Set ds1 port Boston-n channelized to ds0
Set ds1 port Boston-n lineType esf
Enable ds1 port Boston-n

Enable ds3 port Boston

create gr303 interface GR303-IF-BOSTON-n
set gr303 interface GR303-IF-BOSTON-n <attribute> (attribute value)
set gr303 interfaceGroup GR303-IG-BOSTON add interface GR303-IF-BOSTON-n
bind gr303 interface GR303-IF-BOSTON-n to ds1 port Boston-n
enable gr303 interface group GR303-IF-BOSTON-n

This will trigger the internal automatic creation of all interface related objects, like DS1 line termination, DS1 framed path termination, DS0 channel termination etc.
• Provisioning Procedure

- Provisioning the primary/backup TMC and EOC

set gr303 interfaceGroup GR303-IG-BOSTON primary/backup TMC/EOC on interface GR303-IF-BOSTON-n channel m

This will trigger the internal creation of all IDLC data termination related objects, like IDLC data link termination, IDLC data link profile, protection group and protection group unit etc.

- Provisioning the analog line profiles

create gr303 analog line profile GR303-ALTP-BOSTON-m
set gr303 analog line profile GR303-ALTP-BOSTON-m <attribute> (attribute value)
set gr303 network element GR303-IG-BOSTON-NE add analog line profile GR303-ALTP-BOSTON-m
enable gr303 analog line profile GR303-ALTP-BOSTON-m

- Provisioning the analog lines

create gr303 analog line termination GR303-ALT-BOSTON-m
set gr303 analog line termination GR303-ALT-BOSTON-m crv (value)
set gr303 analog line termination GR303-ALT-BOSTON-m <attribute> (attribute value)
set gr303 analog line profile GR303-ALTP-BOSTON-m add analog line GR303-ALT-BOSTON-m
enable gr303 analog line termination GR303-ALT-BOSTON-m
• Provisioning Procedure

- Provisioning additional alarm count list

create gr303 alarm count list GR303-ACL-BOSTON-m
set gr303 alarm count list GR303-ACL-BOSTON-m <attribute>
   (attribute value)
set gr303 network element GR303-IG-BOSTON-NE add alarm count list
   GR303-ACL-BOSTON-m
enable gr303 alarm count list GR303-ACL-BOSTON-m

• Naming Convention for Auto-created Objects

MasterObjName-ObjType-SuffixIfNeeded

- Object types
  IDLCT ---- IDLC terminal        CPP ---- IDLC call processing profile
  NE ---- network element         EQP ---- equipment
  EQPHD ---- equipment holder     ALC ---- alarm counter list
  EVCTRL ---- event report control DS1LT ---- DS1 line termination
  DS1FPT ---- DS1 framed path termination
  CHAN ---- DS0 channel termination
  DLT ---- IDLC data link termination
  DLP ---- IDLC data link profile
  PTGRP ---- protection group
  PTUNT ---- protection group unit
• Naming Convention for Auto-created Objects

    MasterObjName-ObjType-SuffixIfNeeded

- Object Suffix

    EOCP  ----  primary EOC related object
    EOCB  ----  backup EOC related object
    TMCP  ----  primary TMC related object
    TMCB  ----  backup TMC related object
    n  ----  n = 1,2, ....

• Example

    IG: GR303-IG-BOSTON ------> NE created: GR303-IG-BOSTON-NE.