E66

IMS Version 8 Sysplex Terminal Management

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IMS

technical conference
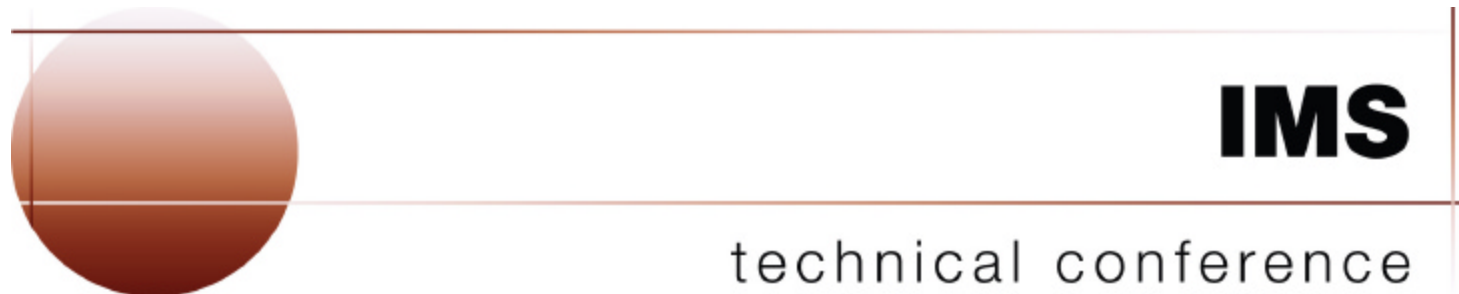
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Abstract

This presentation looks at
Sysplex Terminal Management
IMS's expoitation of the
Resource Management infrastructure
provided by Version 8 when using the
Common Service Layer (CSL) with a
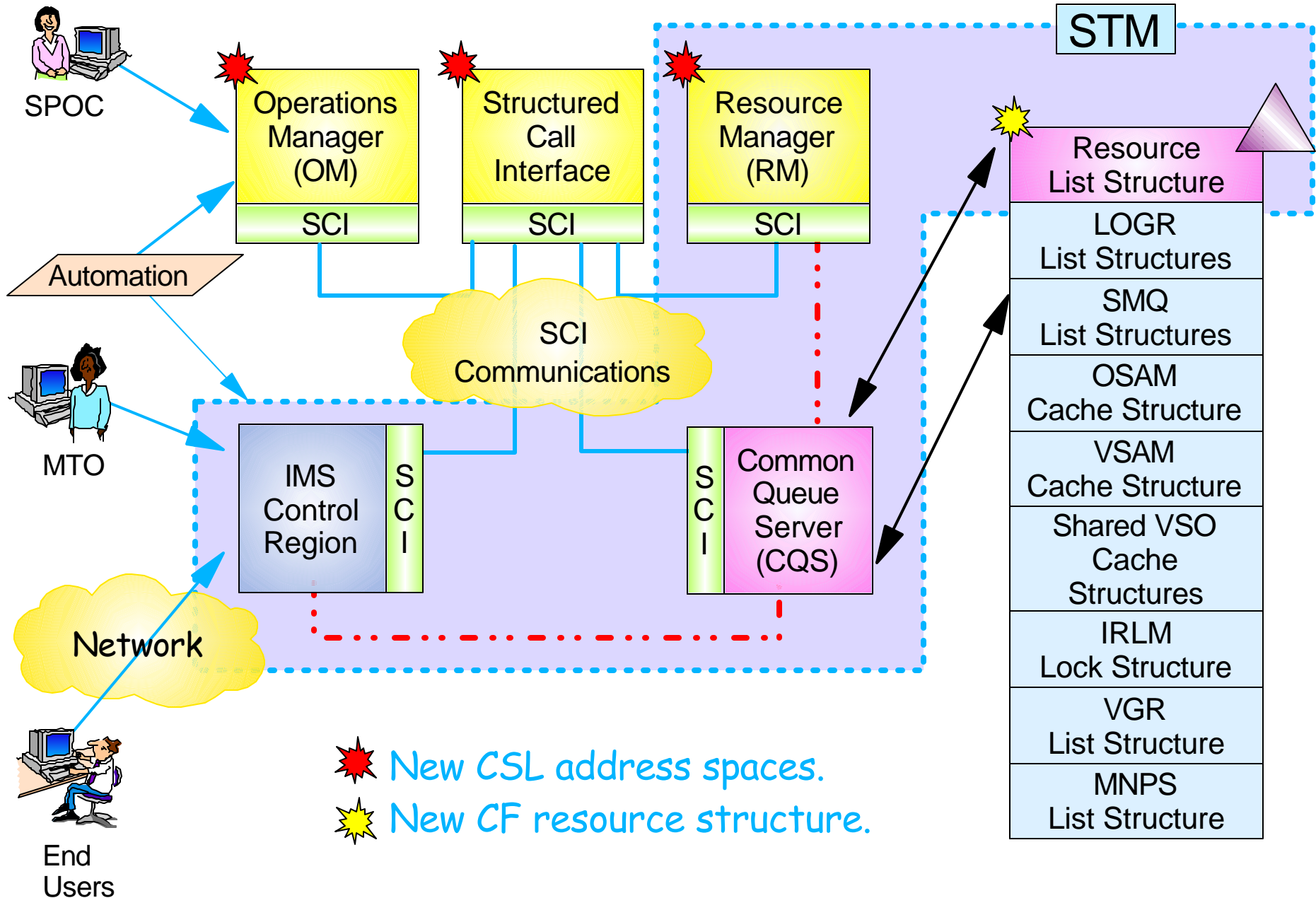**Resource Manager and a Resource Structure.**

Resource Management

Resources

Resource Management Infrastructure

Sysplex Terminal Managment (STM)

RM Infrastructure

STM

SPOC

Automation

MTO

Network

End Users

Operations Manager (OM) — SCI

Structured Call Interface — SCI

Resource Manager (RM) — SCI

SCI Communications

IMS Control Region — SCI

SCI — Common Queue Server (CQS)

Resource List Structure

LOGR List Structures

SMQ List Structures

OSAM Cache Structure

VSAM Cache Structure

Shared VSO Cache Structures

IRLM Lock Structure

VGR List Structure

MNPS List Structure

⭐ New CSL address spaces.

⭐ New CF resource structure.

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IMS, RM, CQS, and the Structure

- ➤ **IMS uses RM to manage resource information**

- ➤ **RM uses CQS to manage resource structure**

- ➤ **The resource structure contains information about IMS and IMSplex resources**

- ➤ **IMS and RM communicate using SCI services**

- ➤ **RM and CQS communicate using CQS services**

- ➤ **CQS uses XES services to access structure**

Resource
LOGR
SMQ
OSAM
VSAM
SVSO
IRLM
VGR

IMS Control Region (CTL)	Resource Manager (RM)	Common Queue Svr (CQS)	CF Resource Structure	CQS
SCI	SCI	SCI		CQS
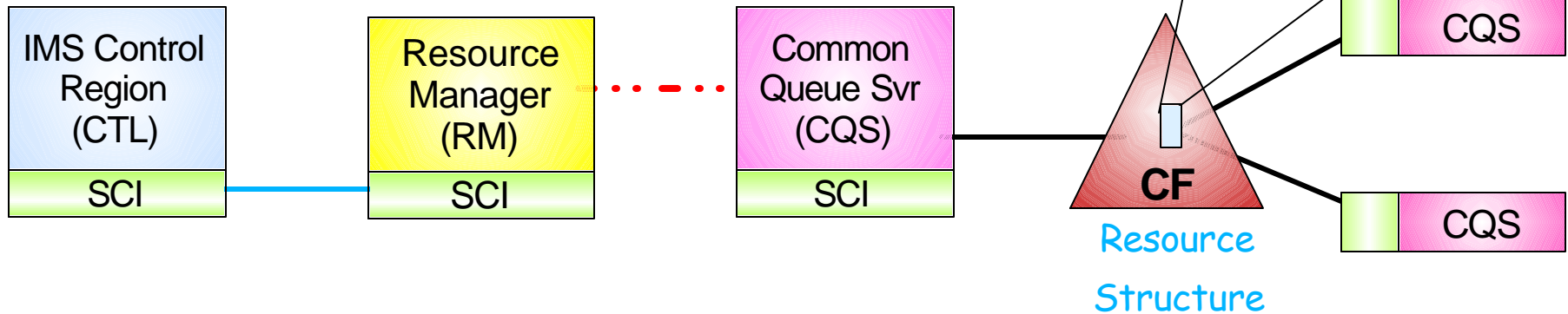
CF structure limit raised from 255 to 512 in OS/390 2.9

Resource Structure

Resource structure contains <u>**global resource information**</u> for uniquely named resources

- ► Transactions
- ► Nodes, lterms, msnames, APPC descriptors, users, userids
- ► Global processes
- ► IMSplex local and global information

Resource structure is optional

- ► If no resource structure defined
  - Terminal/user resource status saved locally; cannot be shared
  - *Sysplex terminal management disabled*
- ► Resource structure not required for global online change
  - Structure will be used if available

One resource structure may be defined per IMSplex

- ► Add to CFRM policy; activate policy
- ► Tell CQS and RM the name of the structure

RM Structure List Entry

Resource structure list entries identify the resource and provide resource status information about the resource.

List Headers

Resource List Structure
Transactions
Lterms
Msnames
Users
Nodes
Userids
Processes
.....
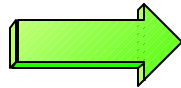
List Entry

List Entry Controls	
LISTNUM	4
ENTRYID(LEID)	12
ENTRYKEY	16
VERSION	8
Adjunct Area	
Owner	8
Recoverable Status 1	24
Reserved	32
Data Entry	
0 or more data elements	512
Recoverable Status 2	
	<61k

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Sysplex Terminal Management

Enables improved systems management in an IMSplex by sharing resource status information

- ► Applies to **_VTAM_** terminal and user resources
  - • BTAM and OTMA resources not supported

Sysplex terminal management requires the resource manager, a resource structure, and shared queues

- ► Resource names and status saved in resource structure
- ► Shared by all IMSs in IMSplex

Without a resource structure, user can opt for ...

- ► Local status recovery
  - • Same as pre-V8
- ► No status recovery
  - • New function in V8

Sysplex Terminal Management ...

Sysplex terminal management objectives

- ► Enforce global *resource type consistency*
  - Prevent naming inconsistencies between IMSs

- ► Enforce global *resource name uniqueness*
  - Prevent multiple logon / signon within the IMSplex

- ► Enable *terminal and user resource status recovery* across IMSplex
  - Resume significant status on another IMS after failure
  - Reduce need for IMS-managed VGR affinity

- ► Enable *global callable services*
  - User exits can access terminal and user information across IMSplex

STM Terms and Concepts

Resource

- ▶ VTAM terminal and user
  - • Static/dynamic
- ▶ Transaction
  - • Static/dynamic/CPI-C

Resource type consistency

- ▶ For message destinations

Resource name uniqueness

- ▶ Single active resource
- ▶ Single signon enforcable

Resource status

- ▶ Non-recoverable
- ▶ Recoverable
- ▶ Significant

Significant status

- ▶ Command
- ▶ End-user

Status recovery mode

- ▶ Global
  - • Recover anywhere
- ▶ Local
  - • Recover on local only
- ▶ None
  - • Not recoverable

Ownership and Affinities

- ▶ Resource ownership
- ▶ RM affinity
- ▶ VGR affinity

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STM Resources

STM-managed resources

SQ

Rsrc

CF

Descriptor Name

APPC

CPI-C Transaction

Static

IMSplex

Transaction

Node
(Static node user)
Lterm
Userid

Single Session

ISC

Node
(Static node user)
Lterm
Userid

Dynamic

Node
User
Lterm
Userid

Parallel Sessions

MSC

Msname

ISC

Node
User
Lterm
Userid

Resource Type Consistency

Shared Queue

Structure

TRANQ	→	PRSNL Data
LTERMQ	→	PRSNL Data

?

DFS62DTx

U PRSNL

IMS1

CF
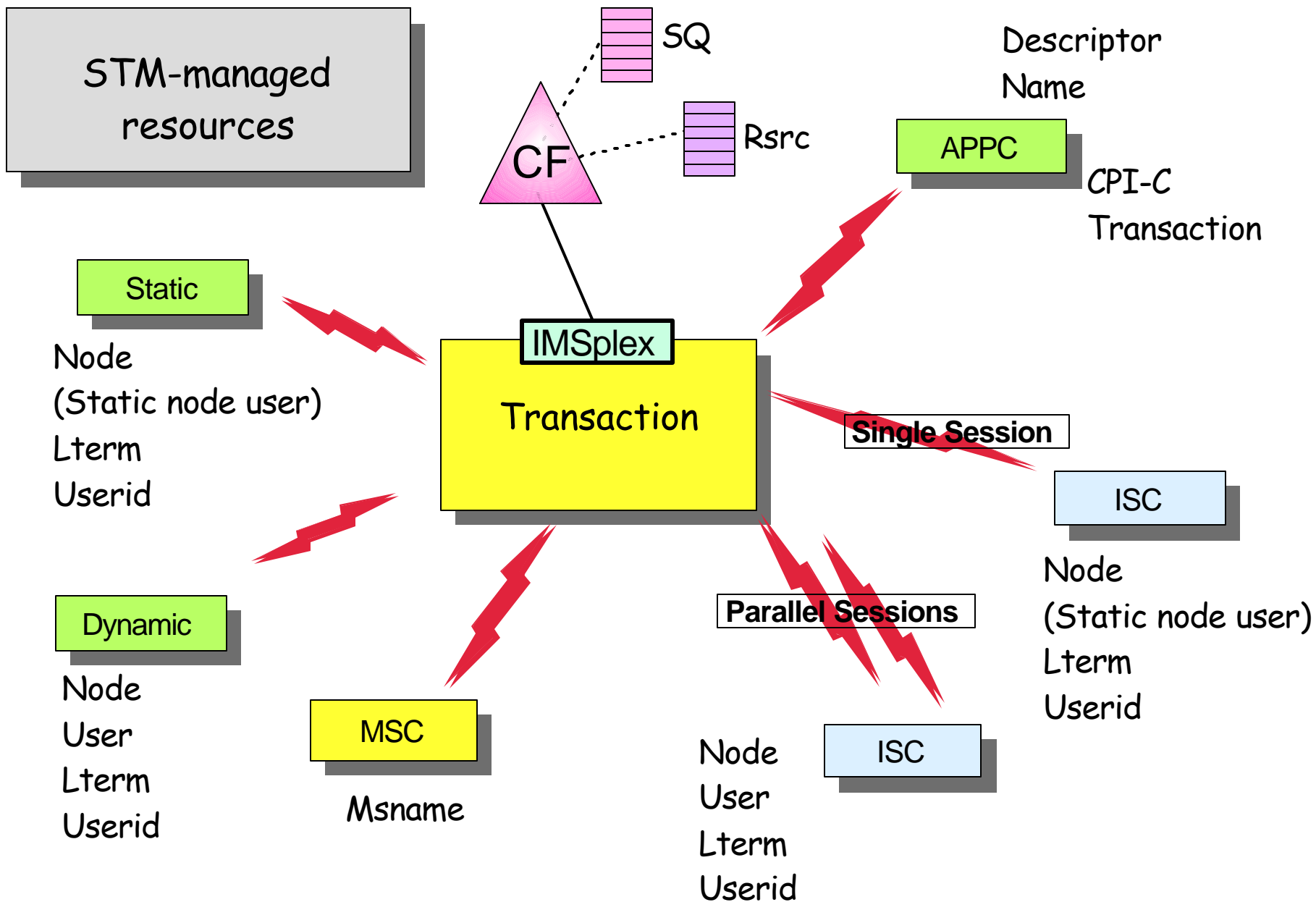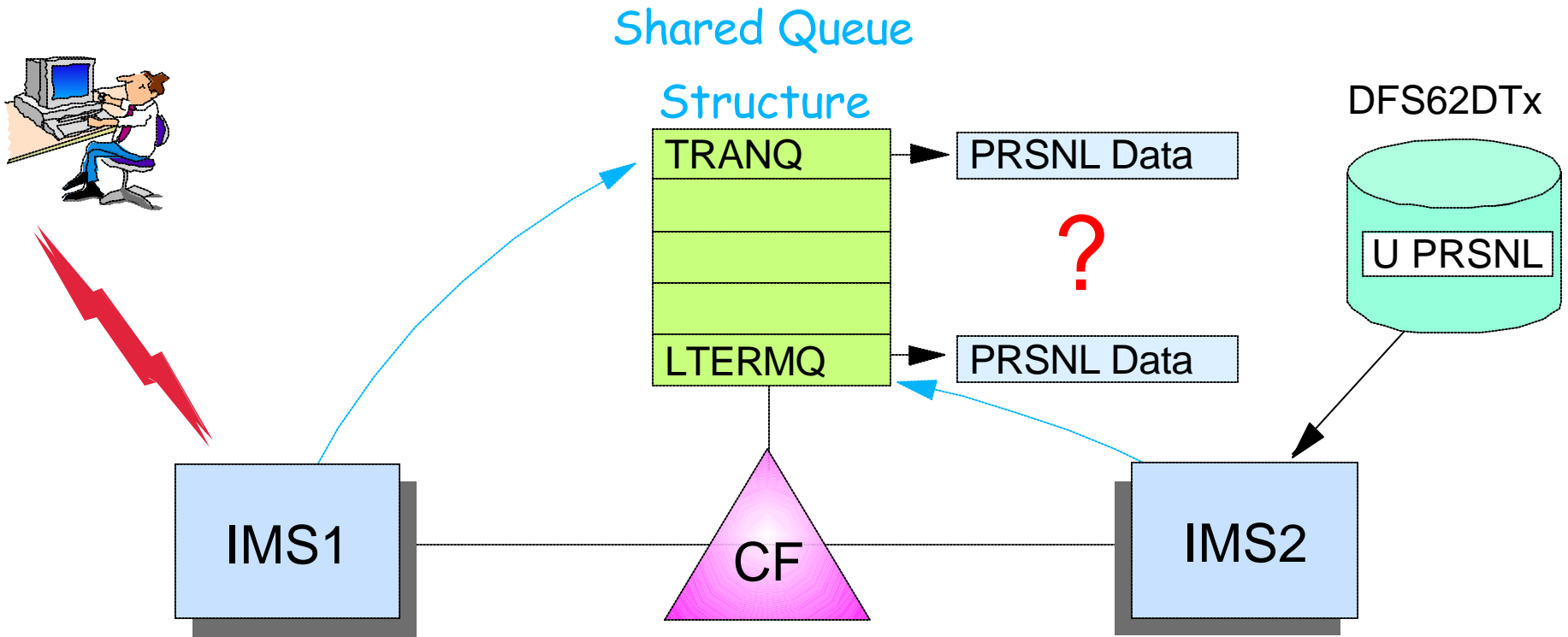
IMS2

APPLCTN ...
    TRANSACT   PRSNL

IMS1 will queue message
with destination PRSNL to

Transaction Queue.

CHNG PRSNL

IMS2 will queue message
with destination PRSNL to

Lterm Queue.

Resource Type Consistency ...

STM prevents the same resource name from being used for different message destination resource types

> ► For example, don't allow IMS1 to define transaction PRSNL and IMS2 to define APPC descriptor PRSNL

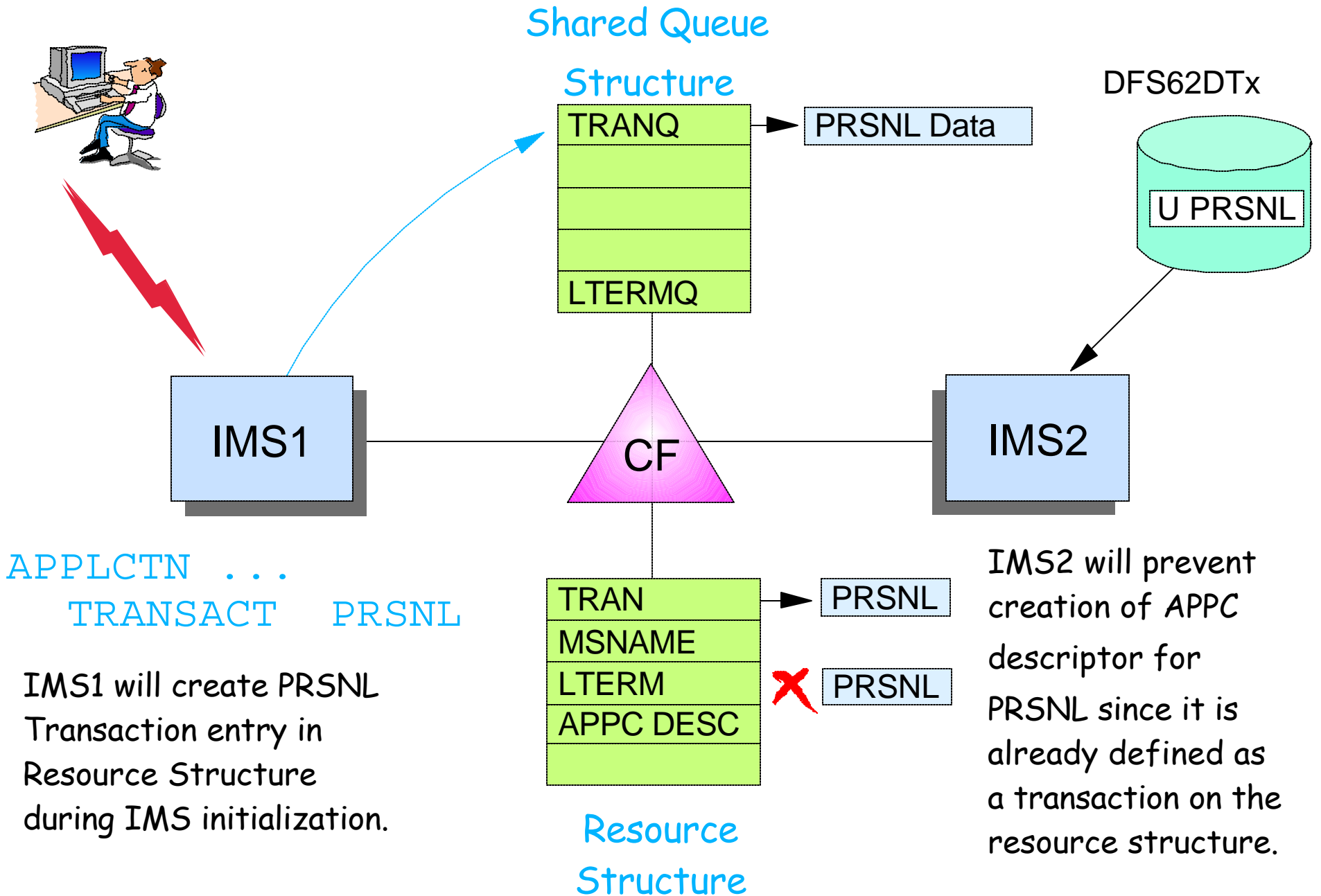Applies to message destinations

> ► *Transaction names - static and CPI-C*
> ► *Lterm names - static and dynamic*
> ► *Msnames*
> ► *APPC descriptor (lterm) names*

These are all Shared Queue destination names. !

Does not apply to

> ► Nodes, users, userids
> ► These are not message queue "destinations"
>   • For example, OK to have node name and lterm name the same

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Resource Type Consistency ...

Shared Queue Structure

DFS62DTx

TRANQ	→ PRSNL Data
LTERMQ	

U PRSNL

IMS1 — CF — IMS2

APPLCTN ...
   TRANSACT   PRSNL

IMS1 will create PRSNL
Transaction entry in
Resource Structure
during IMS initialization.

TRAN	→ PRSNL
MSNAME	
LTERM	✗ PRSNL
APPC DESC	

Resource Structure

IMS2 will prevent
creation of APPC
descriptor for
PRSNL since it is
already defined as
a transaction on the
resource structure.

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Resource Name Uniqueness

STM prevents some resource types from being active in more than one IMS

- ► These resources are *owned* by one IMS while active
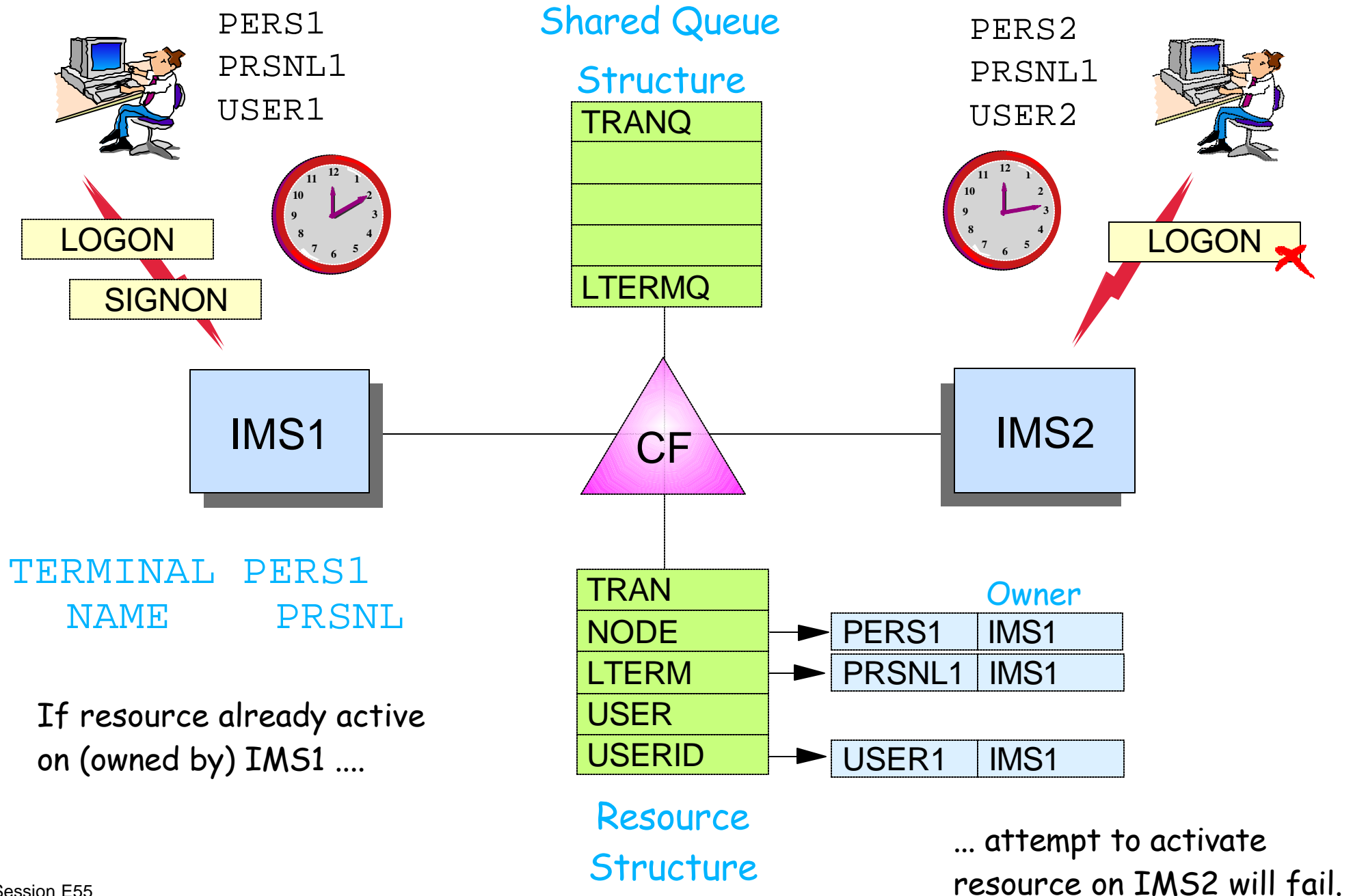 - Ownership maintained in structure

Applies to

- ► *Single session VTAM Nodes, static and ETO Users, Lterms*
- ► *Userids*
  - Only if single signon requested (SGN ¬= M)

Does not apply to

- ► Transactions
- ► Parallel session VTAM nodes
- ► Msnames
- ► APPC descriptor names
- ► Userids if SGN=M

Resource Name Uniqueness ...

PERS1
PRSNL1
USER1

Shared Queue
Structure

TRANQ
LTERMQ

PERS2
PRSNL1
USER2

LOGON

SIGNON

LOGON ✗

IMS1

CF

IMS2

TERMINAL PERS1
NAME   PRSNL

If resource already active
on (owned by) IMS1 ....

TRAN			Owner
NODE	→	PERS1	IMS1
LTERM	→	PRSNL1	IMS1
USER			
USERID	→	USER1	IMS1

Resource
Structure

... attempt to activate
resource on IMS2 will fail.

Resource Status

Non-recoverable status

- ► Status *not recovered across logoff+logon, or IMS restart*
- ► Exists in local control blocks only while resource is active
  - Status deleted/refreshed when resource becomes inactive
- ► Examples
  - Test mode, preset destination mode
  - *Full function response mode*

Recoverable status

- ► Status may be *recovered across signoff, logoff, or restart*
- ► Status saved in resource structure and/or local control blocks
- ► Recovered if resource not deleted
  - Deleted if *no significant status*
- ► Examples
  - Stopped, exclusive, MFS test, ...
  - Conversational, fast path, STSN

Significant Status

Significant status

- Recoverable terminal or user status that *prevents deletion of resource* at signoff, logoff, or IMS restart
- *Command significant status*
  - Terminal or user status normally set via command
  - Always maintained globally if RM structure is used
- *End-user significant status*
  - Work-related terminal or user status
  - Maintained locally, globally, or not at all depending on Status Recovery Mode

Non-significant status

- Any other terminal or user status
- If recoverable
  - Maintained same place as end-user significant status
- May or may not be recovered
  - Does not prevent deletion but may be recovered if other significant status prevents deletion

Significant Status ...

Command significant status

- ► VTAM terminal or user *status normally set by command*
  - /TEST MFS (node, user)
  - /STOP (node, user, lterm)
  - /EXCLUSIVE (node, user)
  - /TRACE (node)
  - /CHANGE USER AUTOLOGON SAVE (user)
  - /ASSIGN LTERM|USER xxx TO yyy SAVE (lterm)

- ► Command significant status *always kept globally if ...*
  - RM structure used

- ► Command significant status *also kept locally if ...*
  - Resource is active on local system, or
  - Resource is inactive but end-user status is kept locally, or
  - Trace status exists locally for a node

Significant Status ...

End-user (e-u) significant status (nodes and users)

- ► Work-related status
  - Conversation (active and held)
  - Fast path response mode
  - STSN sequence numbers (last input and output)
- ► May be kept *globally or locally*
  - Depends on Status Recovery Mode (SRM)

If a resource has **significant status** at session termination or ETO user signoff

- ► Resource *will not be deleted*
  - Unless SRM=NONE or RCVYxxxx=NO (status recovery not wanted)
- ► If resource not deleted
  - Recoverable status will be recovered at next logon, signon, or restart
  - Not all recoverable status is significant status

Status Recovery Mode

Status recovery mode (SRM) applies to e-u status

- ► Defines scope of _end-user_ status recovery for terminal/user resource
  - Command significant status always globally recoverable when using RM structure; locally recoverable if not
- ► GLOBAL
  - Recoverable status _kept in RM structure_
    - – Available from any IMS in IMSplex
  - Status restored at next logon/signon to any IMS
    - – Copied to local control blocks when resource becomes active
- ► LOCAL
  - Recoverable status _kept in local control blocks and log records_
    - – System default if not using RM, RM structure, and SQ
  - Status restored at next logon/signon only if logging on to same IMS
- ► NONE
  - Recoverable status _kept locally_ while resource active
  - Deleted at signoff, logoff, or IMS restart

Status Recovery Mode ...

System default can be overridden for each IMS

► Parameter in DFSDCxxx

SRMDEF=GLOBAL|LOCAL|NONE

- Global requires RM, RM structure, and shared queues
- Local (or none) requires neither

System default can be overridden for

each terminal or user

► For *all static and all STSN terminals*

- SRM set at terminal *logon* based on SRM default
  – Can be overridden by DFSLGNX0 if no end-user status at logon

► For *dynamic non-STSN terminals*

- SRM set at user *signon* based on SRM default
  – Can be overridden by user descriptor or DFSSGNX0
    if no end-user status at signon

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End-user Status Recoverability

When SRM is Global or Local

► *Recoverability* can be set for each type of end-user status

► Parameter in DFSDCxxx

- Conversation
  - Applies to conversational status only - messages are still recoverable

    RCVYCONV=YES|NO

- STSN
  - Applies to STSN sequence numbers only - messages are still recoverable

    RCVYSTSN=YES|NO

- Fast Path
  - Applies to both Fast Path status and messages

    RCVYFP=YES|NO

Ownership and RM Affinity

Applies to nodes, users, and userids

► When resource becomes active in any IMS
- Resource entry created on RM structure
  - Userid created only if SGN ¬= M
- Resource is *owned* by that IMS
  - Resource entry in structure contains imsid (owner)
  - ISC parallel session nodes and users do not set ownership
- Prevents owned resource from logging/signing on to IMS2 while still owned by IMS1

RM Affinity

► Another term for ownership (nodes and users)
- Means terminal/user *should* return to same IMS to resume status

Node1:

LOGON IMS1

ENTRYKEY	05NODE1
....	....
OWNER	IMS1
DATA	Rcvbl Status

Node1:

LOGON IMS2

Logon rejected

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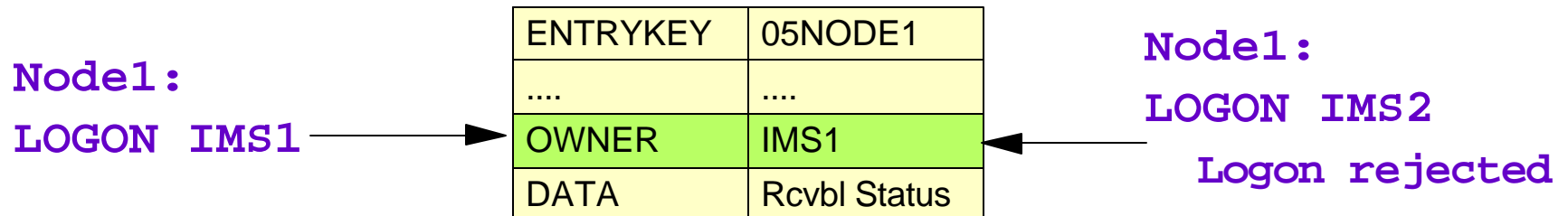
VTAM Generic Resources

IMS V8 (z/OS V1R2 and later)

- ► VTAM supports *session-level affinity*
  - IMS sets the affinity level (IMS or VTAM) during session initiation for every session, including ISC
    - – VTAM now supports ISC affinity management
  - GRAFFIN= keyword is ignored
    - – Still honored for OS/390

- ► VTAM-managed is set for ...
  - Static terminals with SRM=GLOBAL|NONE
  - Static and dynamic STSN terminals (ISC, SLUP, FINANCE) with SRM=GLOBAL|NONE
  - Dynamic non-STSN terminals with any SRM, including LOCAL

- ► IMS-managed is set for ...
  - Static terminals with SRM=LOCAL
  - STSN terminals with SRM=LOCAL

VTAM Generic Resource support for APPC is provided by APPC - not IMS.

Examples of Status Recovery

Status Recovery Mode

- ★ GLOBAL
- ★ LOCAL
- ★ NONE

Status Recovery

Resource Structure

VGR Structure

Shared Queues Structure

IMS1

OM	SCI	RM
SCI	SCI	SCI

SCI

| IMS CTL | S C I | | S C I | CQS |

NODEA LTERMA

CF

IMS2

OM	SCI	RM
SCI	SCI	SCI

SCI

| IMS CTL | S C I | | S C I | CQS |

NODEA LTERMA

VTAM (Generic Resources)
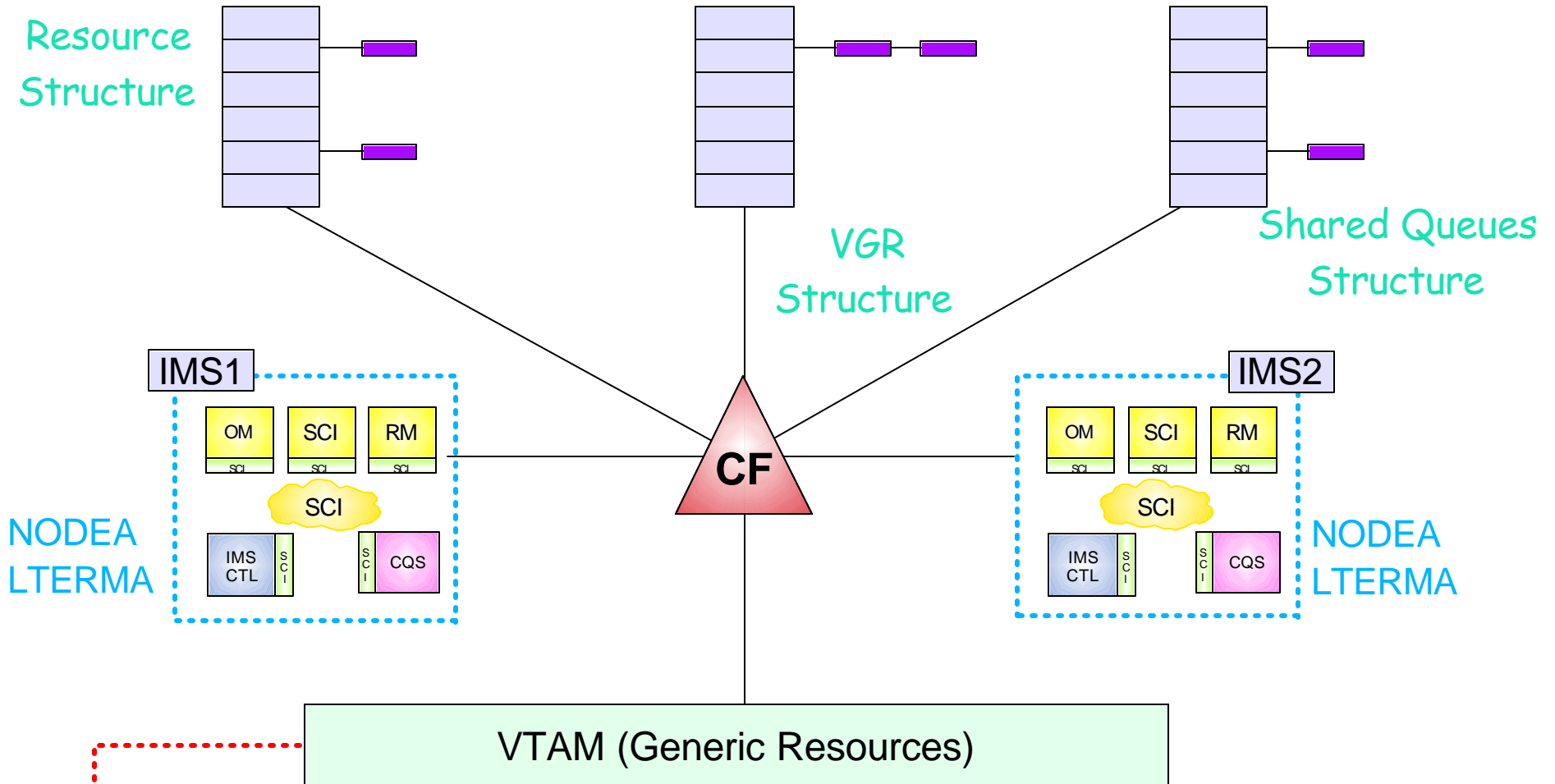
NODEA

★ Two IMSs in z/OS 1.2 IMSplex (IMS1 and IMS2)

★ Both have NodeA and LtermA defined

★ VTAM generic resources enabled (GRSNAME=IMSX)
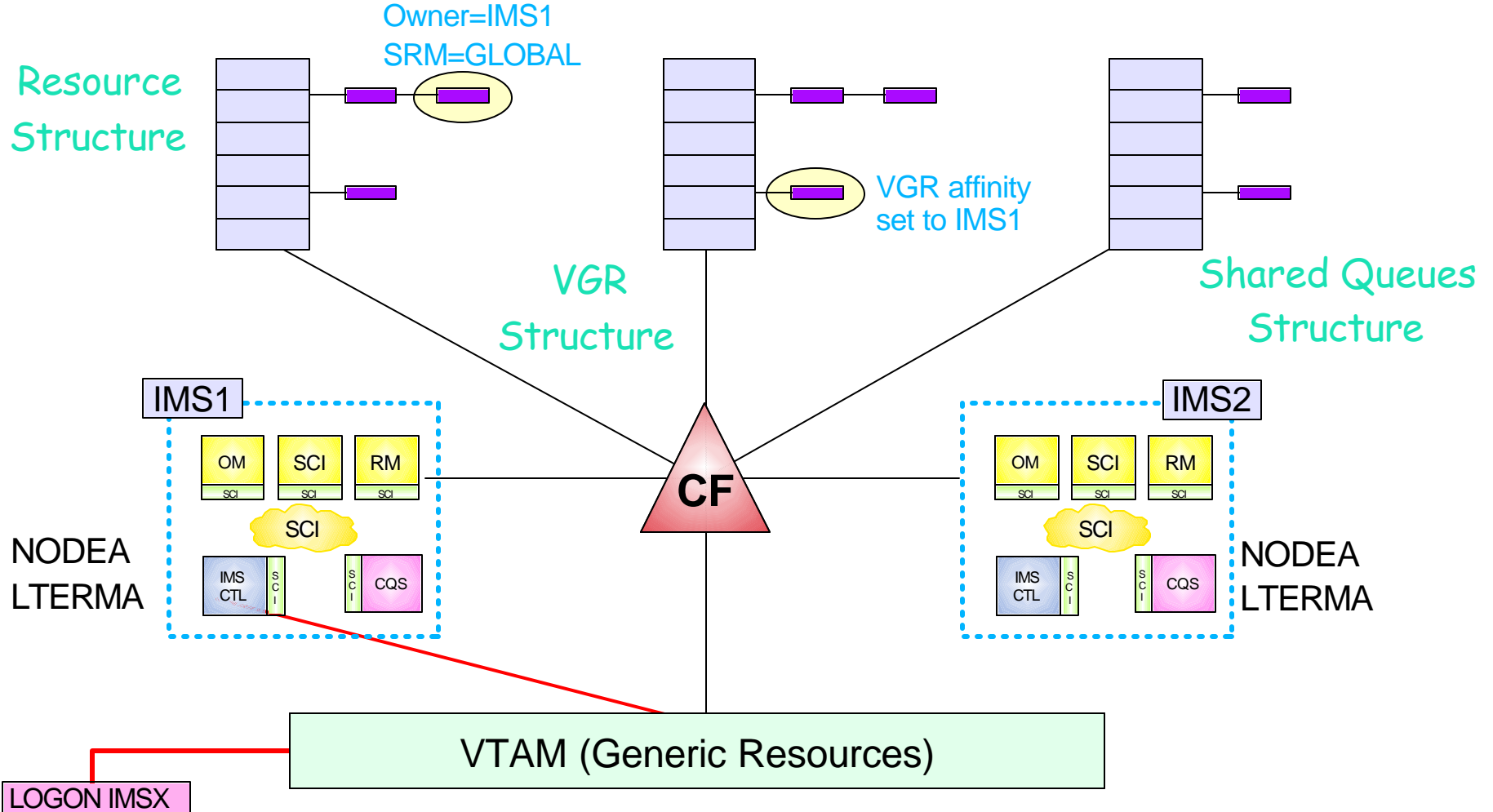
Status Recovery - SRM=GLOBAL

Owner=IMS1
SRM=GLOBAL

Resource
Structure

VGR
Structure

Shared Queues
Structure

VGR affinity
set to IMS1

IMS1

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

| IMS CTL | S C I | | S C I | CQS |

NODEA
LTERMA

CF

IMS2

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

| IMS CTL | S C I | | S C I | CQS |

NODEA
LTERMA

VTAM (Generic Resources)

LOGON IMSX

SRM=GLOBAL

★ End-user logs on using generic logon IMSX

★ VTAM routes logon to IMS1; sets VGR affinity to IMS1

★ IMS1 sets VGR affinity management to VTAM

★ IMS1 sets SRM=GLOBAL; RCVYCONV=YES

★ Resource entries created: Owner=IMS1, SRM=GLOBAL

Status Recovery - SRM=GLOBAL ...
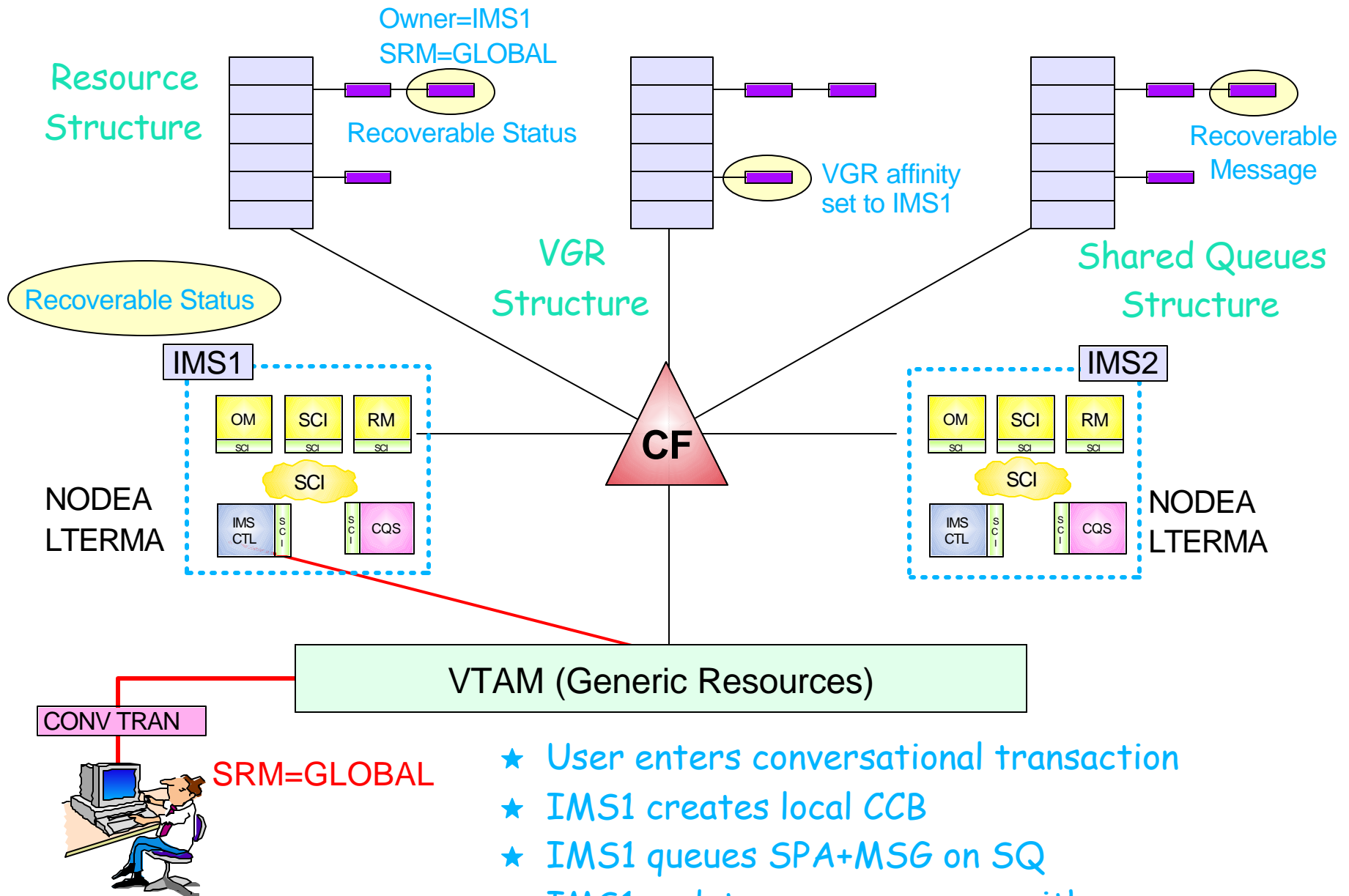
Resource Structure

Owner=IMS1
SRM=GLOBAL

Recoverable Status

Recoverable Status

VGR Structure

VGR affinity set to IMS1

Shared Queues Structure

Recoverable Message

IMS1

OM | SCI | RM
SCI | SCI | SCI

SCI

IMS CTL | S C I | S C I | CQS

NODEA LTERMA

CF

IMS2

OM | SCI | RM
SCI | SCI | SCI

SCI

IMS CTL | S C I | S C I | CQS

NODEA LTERMA

VTAM (Generic Resources)

CONV TRAN

SRM=GLOBAL

★ User enters conversational transaction

★ IMS1 creates local CCB

★ IMS1 queues SPA+MSG on SQ

★ IMS1 updates user resource with Conversational status

Status Recovery - SRM=GLOBAL ...

Ownership cleared
SRM=GLOBAL

Resource Structure

Recoverable Status

Recoverable Status

VGR affinity deleted

VGR Structure

Recoverable Message

Shared Queues Structure

IMS1

| OM | SCI | RM |
| SCI | SCI | SCI |

| IMS CTL | S C I | S C I | CQS |

NODEA
LTERMA

CF

IMS2

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

| IMS CTL | S C I | S C I | CQS |

NODEA
LTERMA

Rats!

VTAM (Generic Resources)
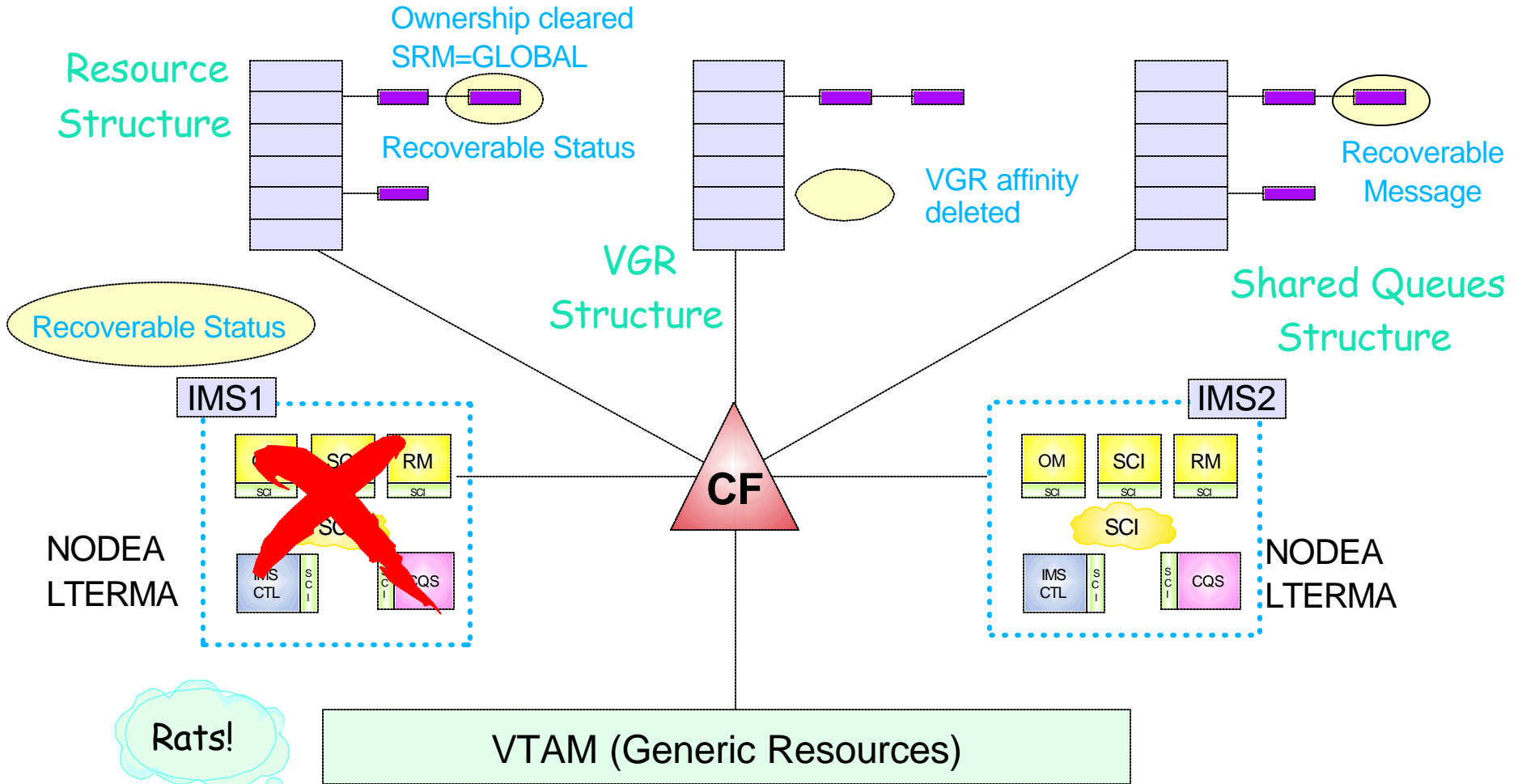
SRM=GLOBAL

★ IMS1 fails; IMS2 queries structure for IMS1 entries
★ IMS2 does not delete resource entry (in conversation)
★ IMS2 <u>clears ownership</u> (SRM=GLOBAL)
★ VTAM <u>deletes VGR affinity</u>
★ SPA+MSG still on SQ

Status Recovery - SRM=GLOBAL ...

Resource
Structure

Owner=IMS2
SRM=GLOBAL

Recoverable Status

VGR affinity
set to IMS2

VGR
Structure

Recoverable
Message

Shared Queues
Structure

Recoverable Status

IMS1

OM   SCI   RM
SCI   SCI   SCI

IMS
CTL   SCI   CQS

NODEA
LTERMA

CF

IMS2

OM   SCI   RM
SCI   SCI   SCI

SCI

IMS
CTL   SCI   CQS

Recoverable Status

NODEA
LTERMA

VTAM (Generic Resources)
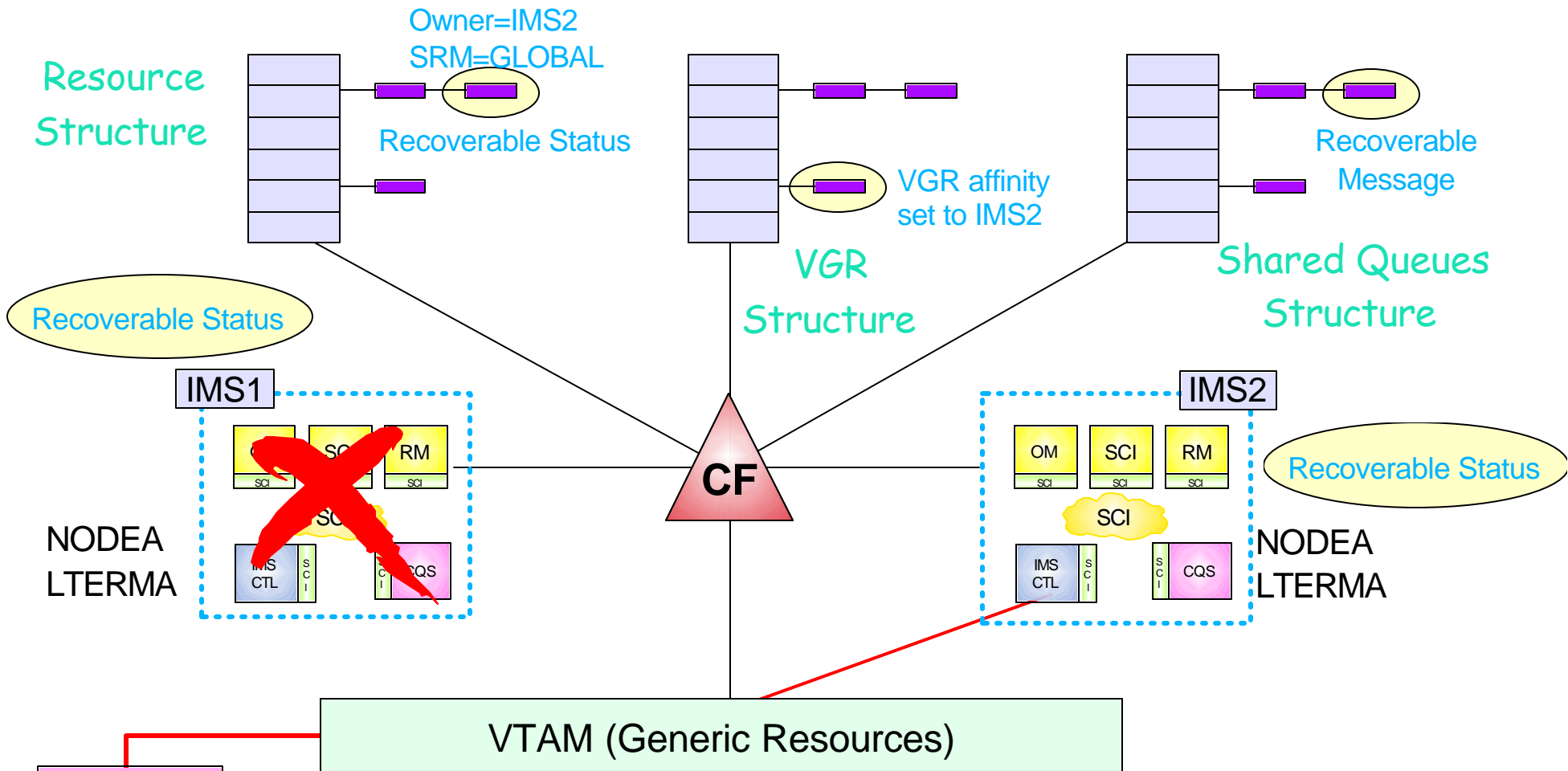
LOGON IMSX

SRM=GLOBAL

★ End-user logs on using generic logon IMSX

★ VTAM routes logon to IMS2; sets VGR affinity to IMS2

★ IMS2 sets ownership to IMS2

★ IMS2 <u>recovers conversation</u> from Resource Structure

and Shared Queue Structure

Resource Structure

Owner=IMS2
SRM=GLOBAL

Recoverable Status

VGR affinity set to IMS2

VGR Structure

Recoverable Message

Shared Queues Structure

✗ Recoverable Status

IMS1

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

| IMS CTL / SCI | SCI / CQS |

NODEA LTERMA

IMS2

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

| IMS CTL / SCI | SCI / CQS |

Recoverable Status

NODEA LTERMA

CF

VTAM (Generic Resources)

SRM=GLOBAL

★ IMS1 restarts; discovers recoverable status for SRM=GLOBAL resource

★ IMS1 deletes local recoverable status

Status Recovery - SRM=LOCAL

Owner=IMS1
SRM=LOCAL

Resource Structure

VGR affinity set to IMS1

VGR Structure

Shared Queues Structure

IMS1

OM	SCI	RM
SCI	SCI	SCI

SCI

| IMS CTL | S C I | | S C I | CQS |

NODEA
LTERMA

CF

IMS2

OM	SCI	RM
SCI	SCI	SCI

SCI

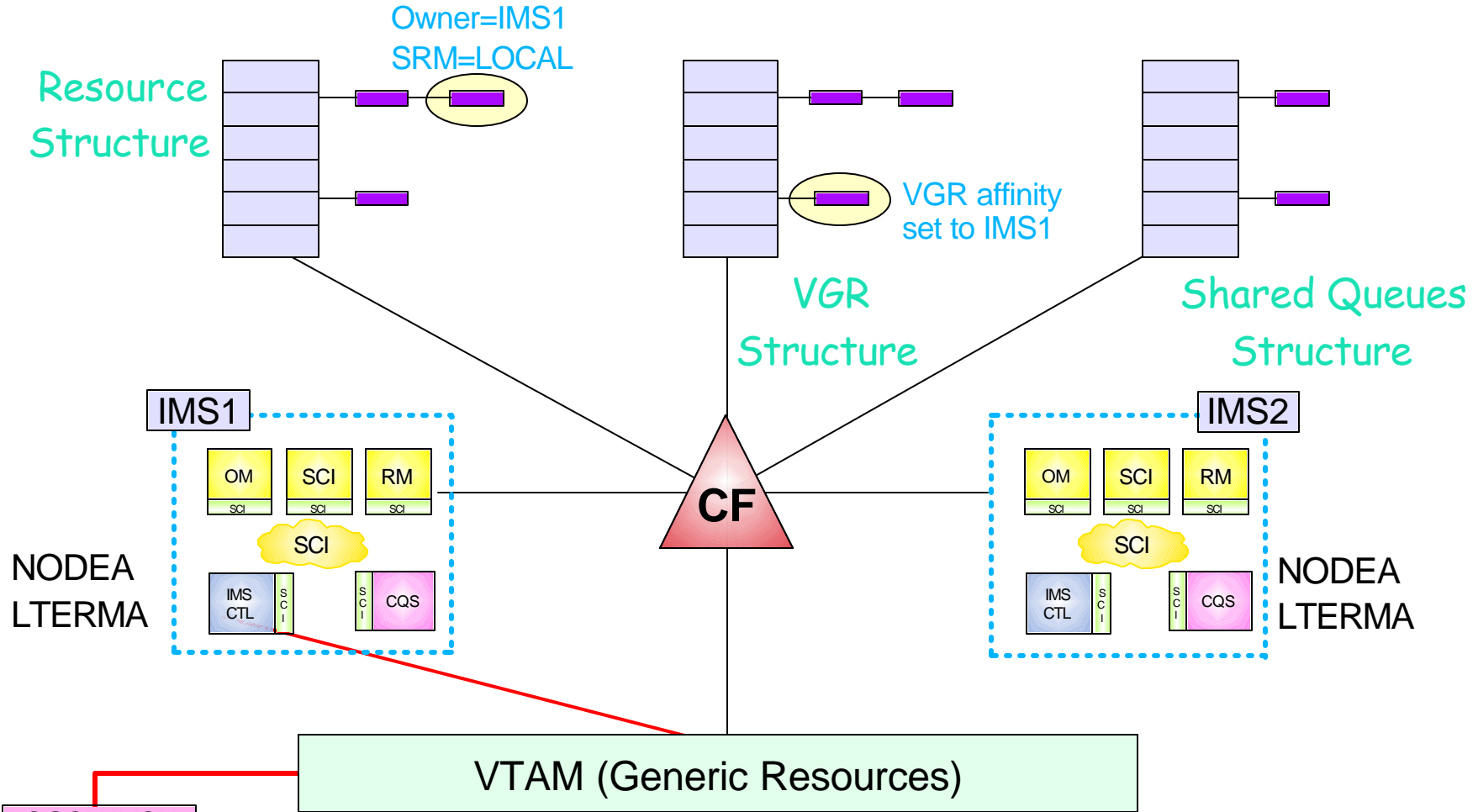| IMS CTL | S C I | | S C I | CQS |

NODEA
LTERMA

VTAM (Generic Resources)
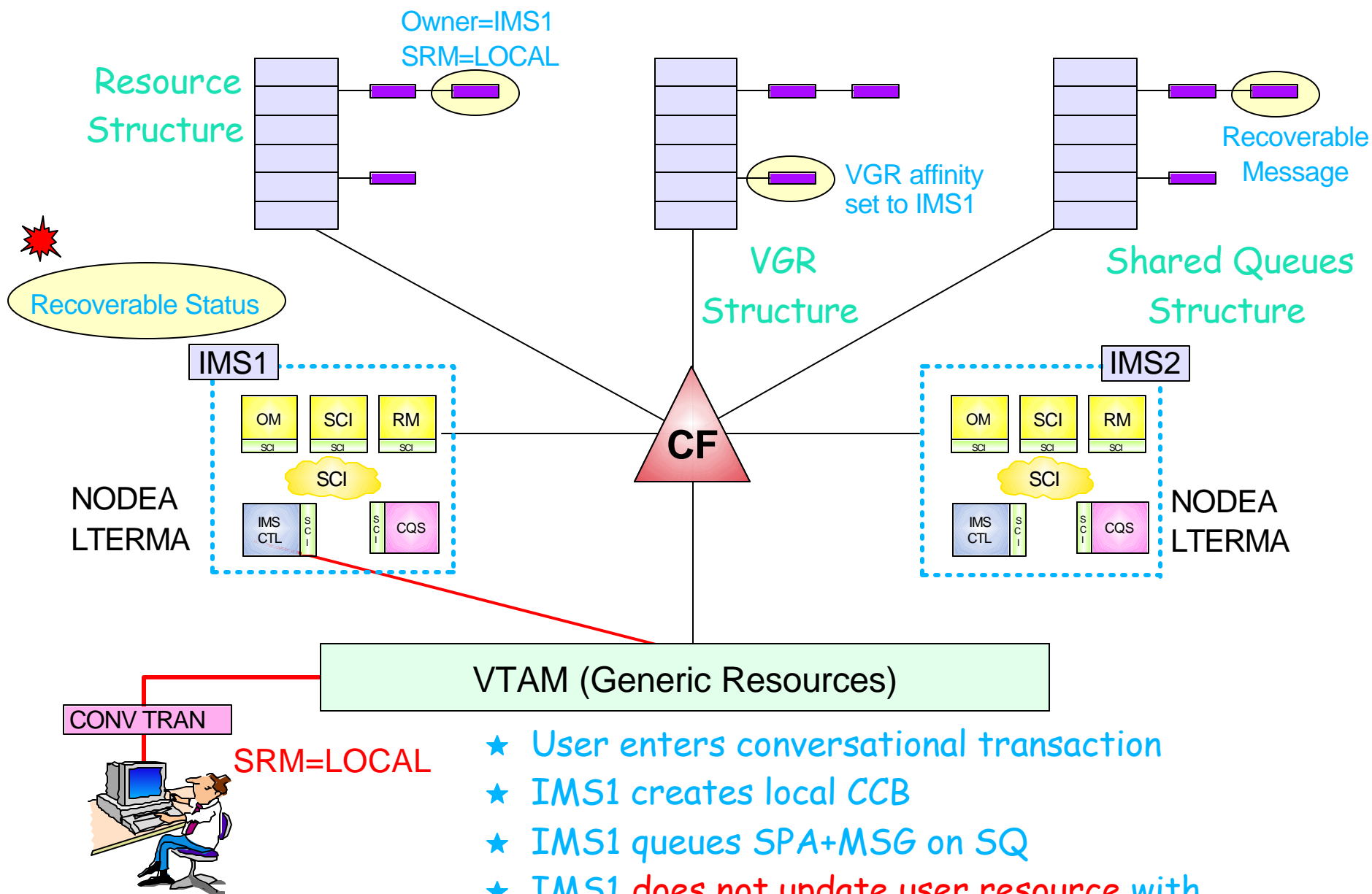
LOGON IMSX
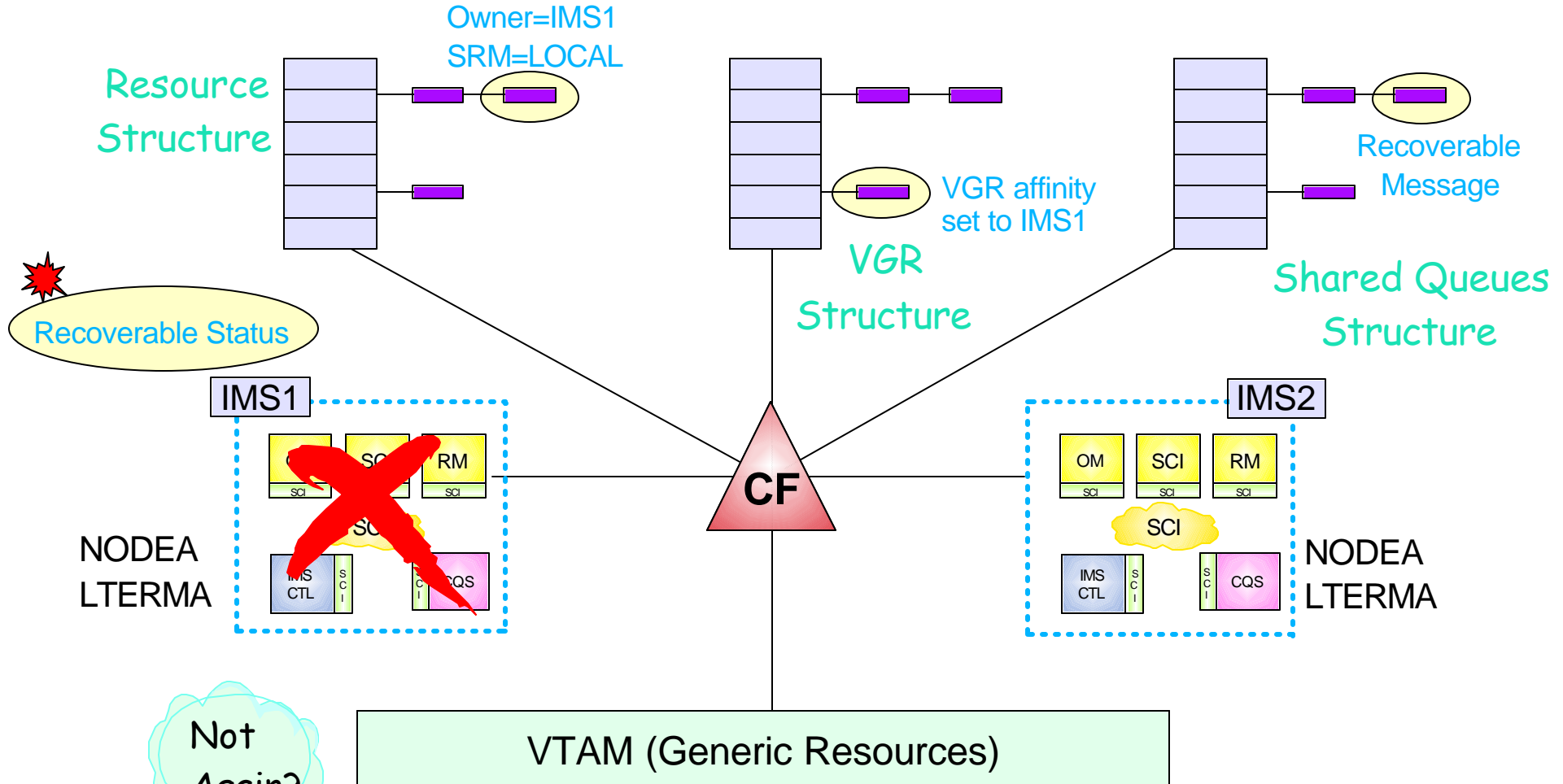
SRM=LOCAL

★ End-user logs on using generic logon IMSX
★ VTAM routes logon to IMS1; sets VGR affinity to IMS1
★ IMS1 sets VGR affinity management to IMS
★ IMS1 sets SRM=LOCAL
★ Resource entries created: Owner=IMS1, SRM=LOCAL

Status Recovery - SRM=LOCAL ...

Owner=IMS1
SRM=LOCAL

Resource Structure

Recoverable Message

VGR affinity set to IMS1

VGR Structure

Shared Queues Structure

Recoverable Status

IMS1

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

IMS CTL | SCI | SCI | CQS

NODEA LTERMA

CF

IMS2

| OM | SCI | RM |
| SCI | SCI | SCI |

SCI

IMS CTL | SCI | SCI | CQS

NODEA LTERMA

VTAM (Generic Resources)

CONV TRAN

SRM=LOCAL

★ User enters conversational transaction
★ IMS1 creates local CCB
★ IMS1 queues SPA+MSG on SQ
★ IMS1 <u>does not update user resource</u> with Conversational status (status maintained locally)

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Status Recovery - SRM=LOCAL ...

Owner=IMS1
SRM=LOCAL

Resource Structure

Recoverable Status

Recoverable Message

VGR affinity set to IMS1

VGR Structure

Shared Queues Structure

IMS1

OM   SCI   RM

SCI

IMS CTL   SCI   SCI   CQS

NODEA LTERMA

CF

IMS2

OM   SCI   RM
SCI   SCI   SCI

SCI

IMS CTL   SCI   SCI   CQS

NODEA LTERMA

Not Again?

SRM=LOCAL

VTAM (Generic Resources)
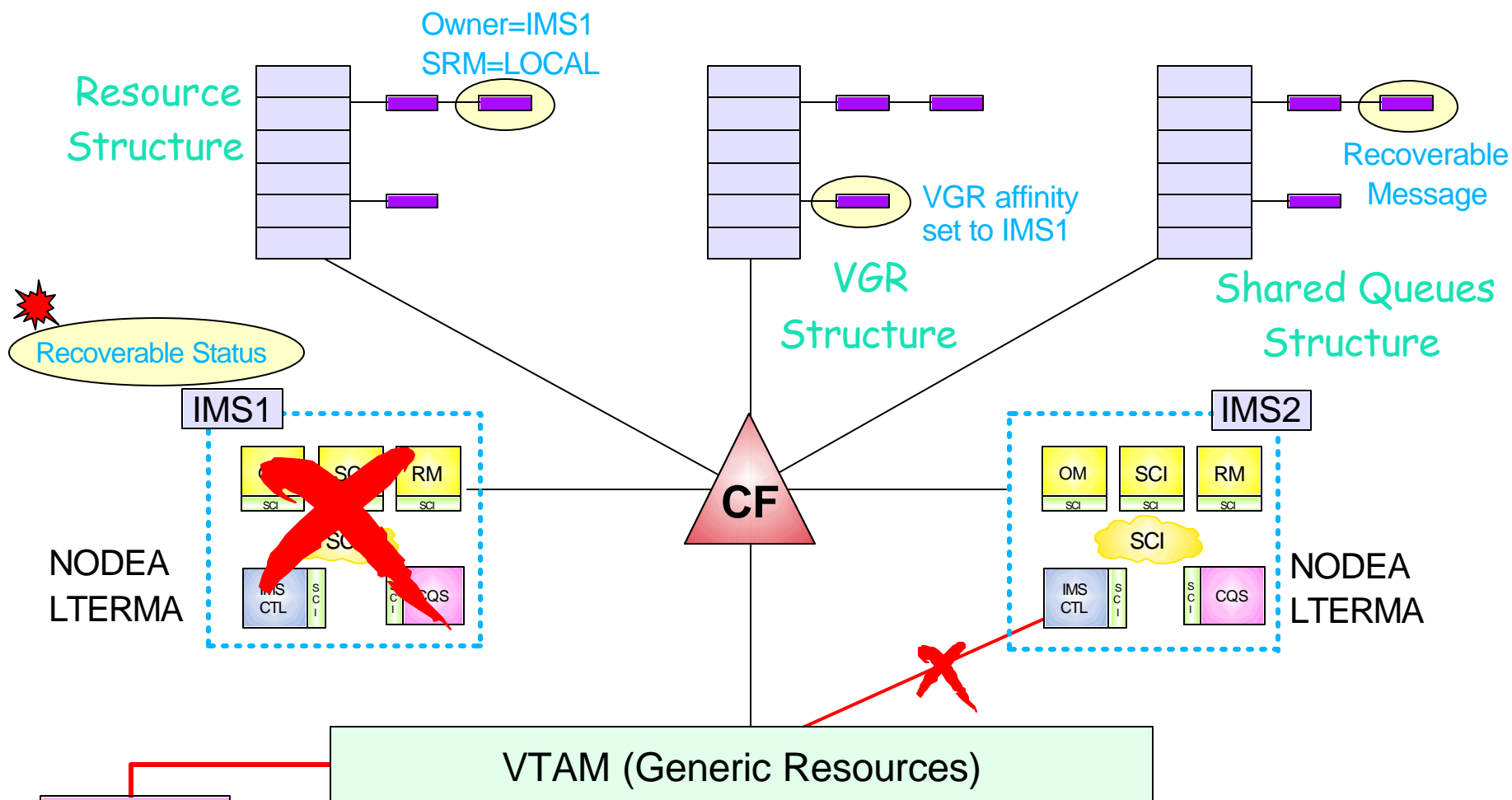
★ IMS1 fails; IMS2 queries structure for IMS1 entries
★ IMS2 does not delete resource entry (SRM=LOCAL)
★ IMS2 does not clear ownership (SRM=LOCAL)
★ VTAM does not delete VGR affinity

Owner=IMS1
SRM=LOCAL

Resource
Structure

Recoverable
Message

VGR affinity
set to IMS1

VGR
Structure

Shared Queues
Structure

Recoverable Status

IMS1

OM   SCI   RM
      SCI

SCI

IMS
CTL   SCI   CQS

NODEA
LTERMA

CF

IMS2

OM   SCI   RM
SCI   SCI   SCI

SCI

IMS   S
CTL   C   SCI   CQS
      I

NODEA
LTERMA

VTAM (Generic Resources)

LOGON IMSX
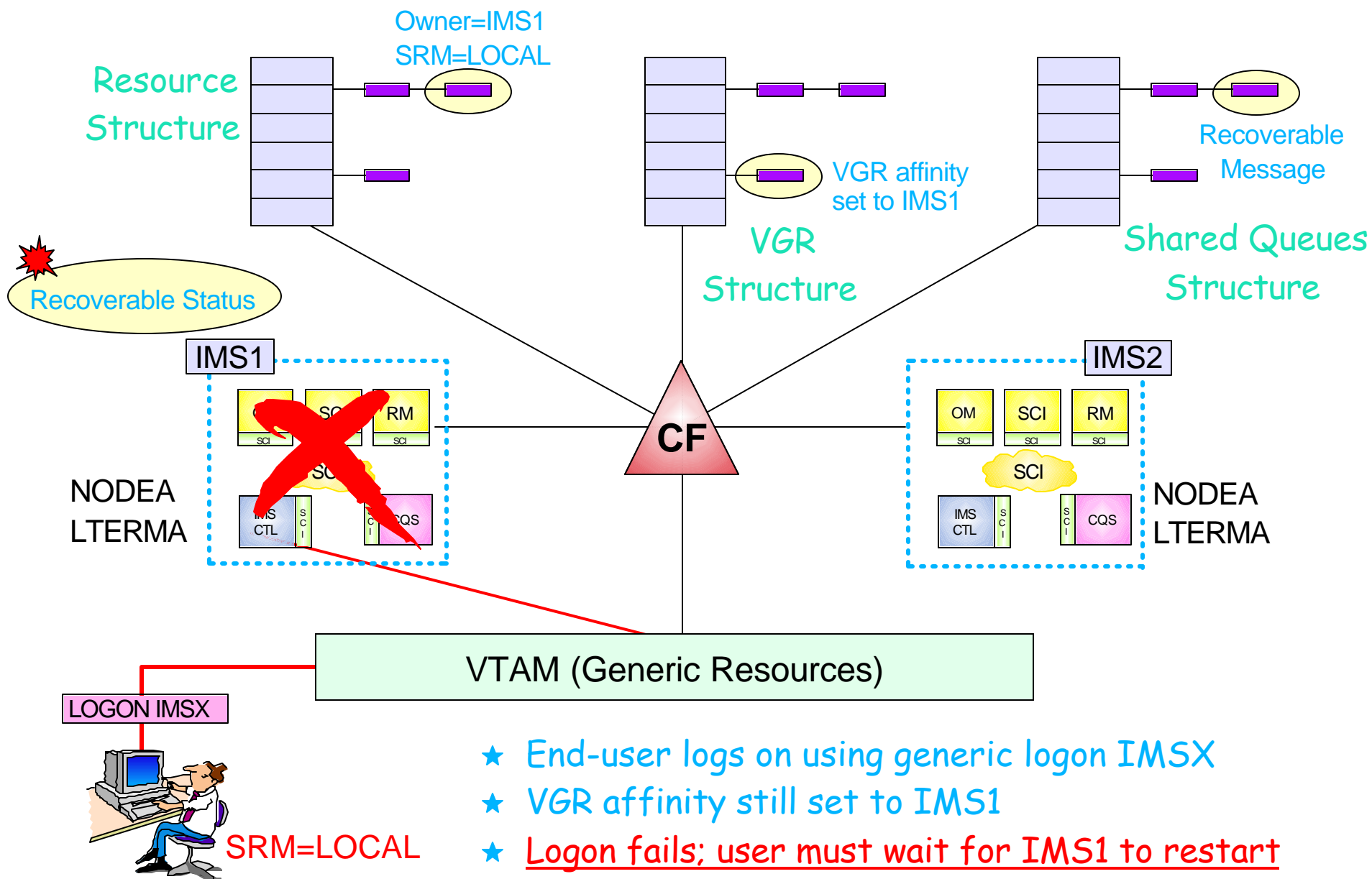
SRM=LOCAL

★ End-user logs on using generic logon IMSX
★ VGR affinity still set to IMS1
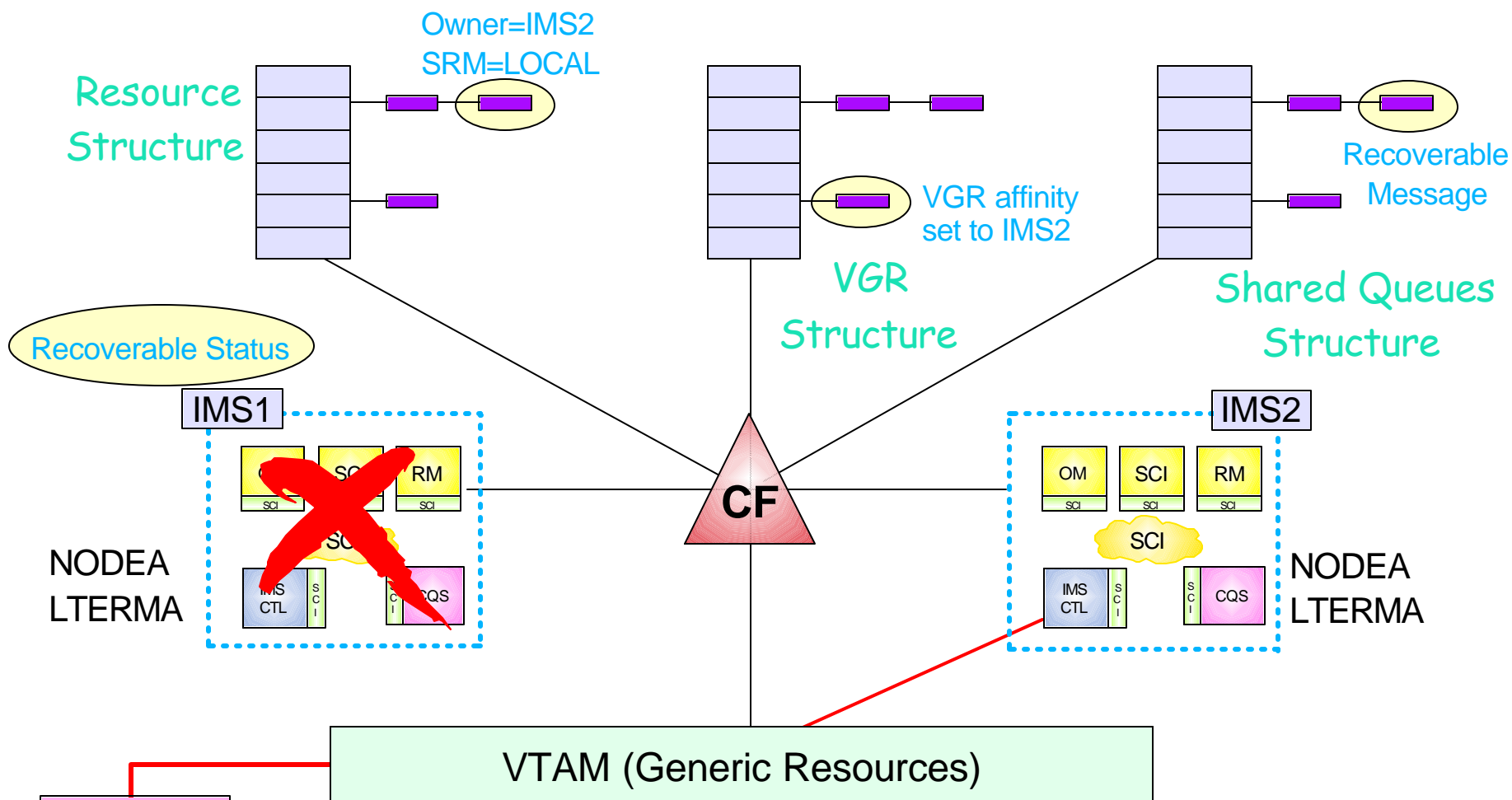★ Logon fails; user must wait for IMS1 to restart

Status Recovery - SRM=LOCAL ...

Owner=IMS1
SRM=LOCAL

Resource Structure

Recoverable Message

Recoverable Status

VGR affinity set to IMS1

VGR Structure

Shared Queues Structure

IMS1

OM   SCI   RM
      SCI   SCI

IMS CTL   S C I   CQS

NODEA
LTERMA

CF

IMS2

OM   SCI   RM
SCI   SCI   SCI

SCI

IMS CTL   S C I   CQS
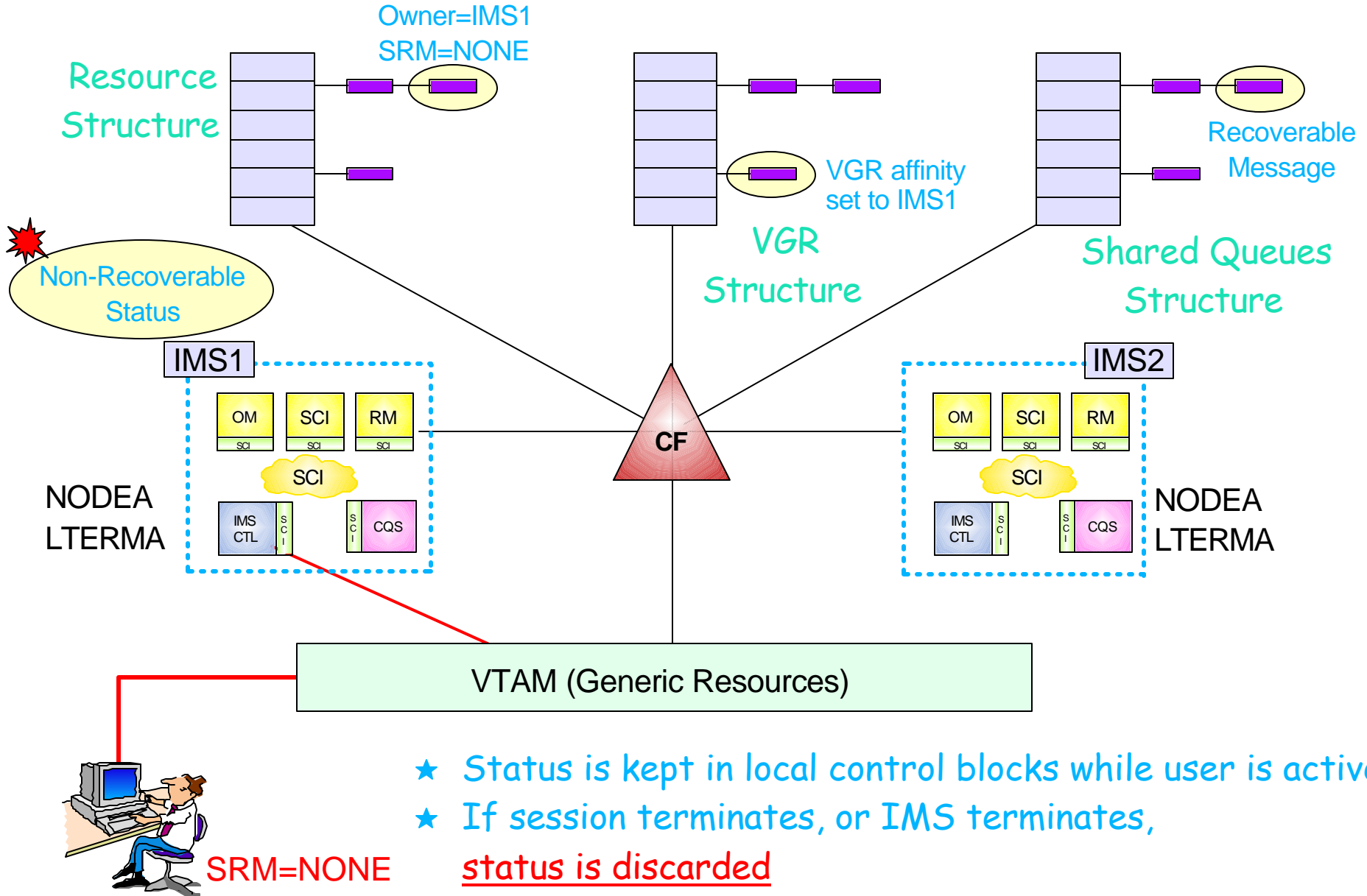
NODEA
LTERMA

VTAM (Generic Resources)

LOGON IMS2

SRM=LOCAL

★ If end-user logs on directly to IMS2
★ IMS2 checks resource entry for NODEA
★ Logon rejected (NODEA owned by IMS1)
★ User must wait for IMS1 to restart
★ Logon exit can "steal" node (status is not recoverable)

Status Recovery - SRM=LOCAL ...

Owner=IMS2
SRM=LOCAL

Resource Structure

VGR affinity set to IMS2

VGR Structure

Recoverable Message

Shared Queues Structure

Recoverable Status

IMS1

OM SCI RM
SCI SCI

SCI

IMS CTL | S C I | | CQS

NODEA
LTERMA

CF

IMS2

OM SCI RM
SCI SCI SCI

SCI

IMS CTL | S C I | | S C I | CQS

NODEA
LTERMA

VTAM (Generic Resources)

LOGON IMS2

SRM=LOCAL

★ If IMS2 Logon Exit steals node, logon accepted, status is non-recoverable

★ IMS1 will delete status when it is restarted (IMS1 no longer "owner")

Status Recovery - SRM=NONE

Resource Structure

Owner=IMS1
SRM=NONE

Non-Recoverable Status

VGR Structure

VGR affinity set to IMS1

Recoverable Message

Shared Queues Structure

IMS1

OM	SCI	RM
SCI	SCI	SCI

SCI

IMS CTL | S C I

S C I | CQS

CF

IMS2

OM	SCI	RM
SCI	SCI	SCI

SCI

IMS CTL | S C I

S C I | CQS

NODEA LTERMA

NODEA LTERMA

VTAM (Generic Resources)

SRM=NONE

★ Status is kept in local control blocks while user is active
★ If session terminates, or IMS terminates,
status is discarded

Global Callable Services

IMS exits can invoke callable control block services

> ► FIND or SCAN returns address of IMS control block

In IMS V8, callable services has "global" implications for nodes, users, and lterms

> ► If STM is not enabled (no resource structure)
>   - No change
> ► If STM is enabled
>   - If resource is owned by local system
>   - Local control block returned
>   - If resource not owned by local system but exists on structure
>   - "Hidden (dummy) control block" returned with global status
>   - Same format as "real" control block but limited information
> ► New flag in function specific parameter list
>   - Local - return local control blocks only
>   - Global - return "hidden" control blocks if no local status - *default*

Sysplex Terminal Management

Sysplex terminal management is an IMS function
which exploits the CSL infrastructure to provide ...

- Resource type consistency
  - Prevent naming inconsistencies between IMSs
- Resource name uniqueness
  - Prevent multiple logons / signons within the IMSplex
- Terminal and user resource status recovery across IMSplex
  - Resume end-user and command significant status on another IMS after failure
- Global callable services
  - User exits can access terminal and user information across IMSplex

STM requires

- CSL with resource structure
- Shared queues