2024 CCDUG: IMS06: Understanding the IMS TM Scheduler

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Agenda

- IMS Architecture
- IMS Queuing
  - Class, Priority
  - Limit Priority, Limit Count
  - PROCLIM, Quick Reschedule
- Scheduling
  - MPR classes
- Other scheduling related parameters
  - WFI
  - PWFI
  - Serial vs Parallel scheduling, PARLIM

IMS Architecture Overview

z/OS

IMSCTL
Control Region
- Telecommunications
- Message Queue Pool
- Message Scheduling
- Logging Restart

DBRC
Recovery Control
- LOG CTL

DLISAS
DL/I Separate Address Space
- DL/I ACTION MODULES

MPR
Message Processing Region
- Application Program

BMP
Batch Message Processing Region
- Application Program

IFP
Fast Path Region
- Application Program

JMP
Java Message Processing Region
- Application Program

JBP
Java Batch Processing Region
- Application Program

Dependent Regions

MSG QUEUE

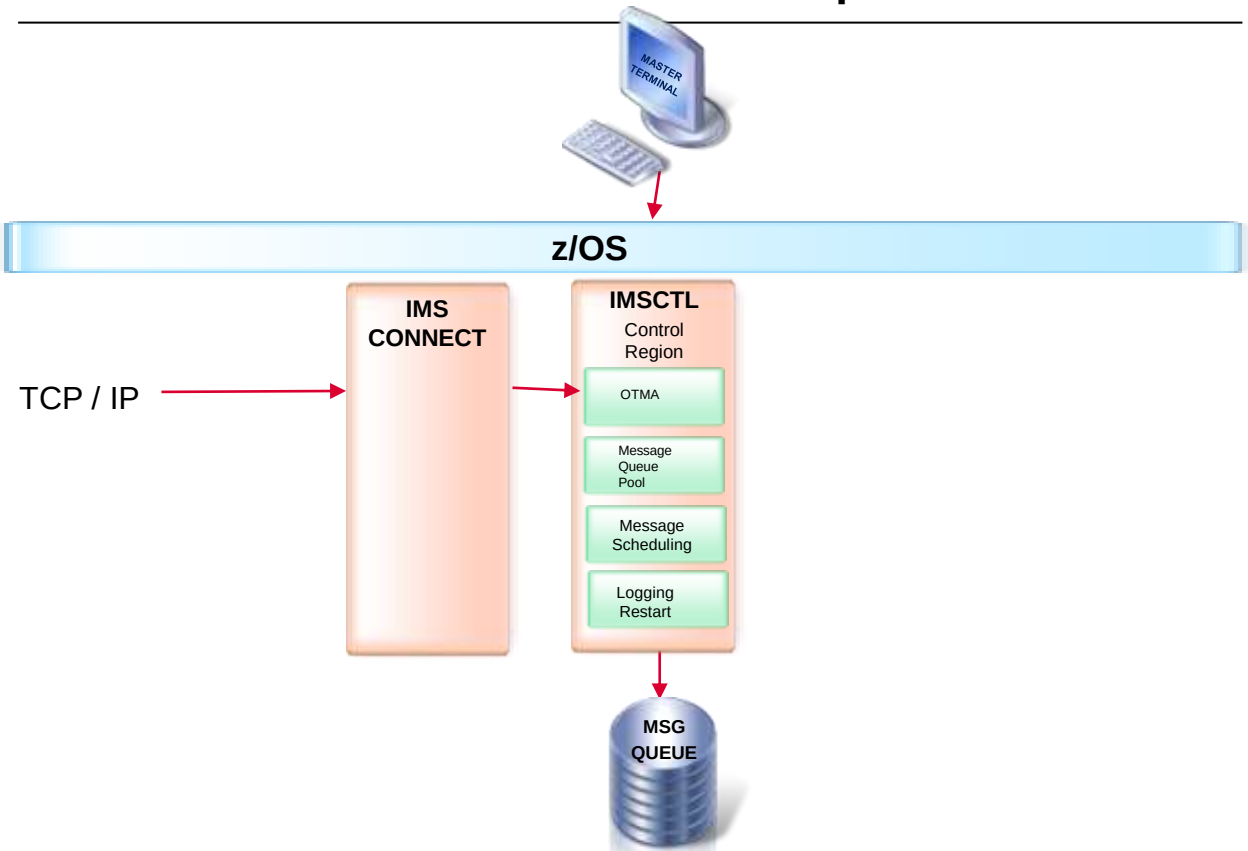
ONLINE LOG DATA SET

RECON

CORPORATE DATABASE

IMS TM makes data available to the end user

IMS Architecture Overview – TCP/IP input



Scheduling Overview

- Picking the Transaction to process
  - Scheduling path length (can involve serialization)
  - Make sure the resources it needs are available
- Once the transaction is picked
  - Load the application program into the dependent region
  - And give control to the program

Defining Application resources

- IMSGEN or DRD (Dynamic Resource Definition)

- IMSGEN Macros:

```
DATABASE DBD1
DATABASE DBD9
APPLCTN    PSB=PROGRAM1, …
       TRANSACT    CODE=TRANX, …
       TRANSACT    CODE=TRANY, …
APPLCTN    PSB=PROGRAM2, …
       TRANSACT    CODE=TRANW, …
```

- APPLCTN & TRANSACT macros contain scheduling parms

Transaction Class & Priority

Transaction Classes & Priorities

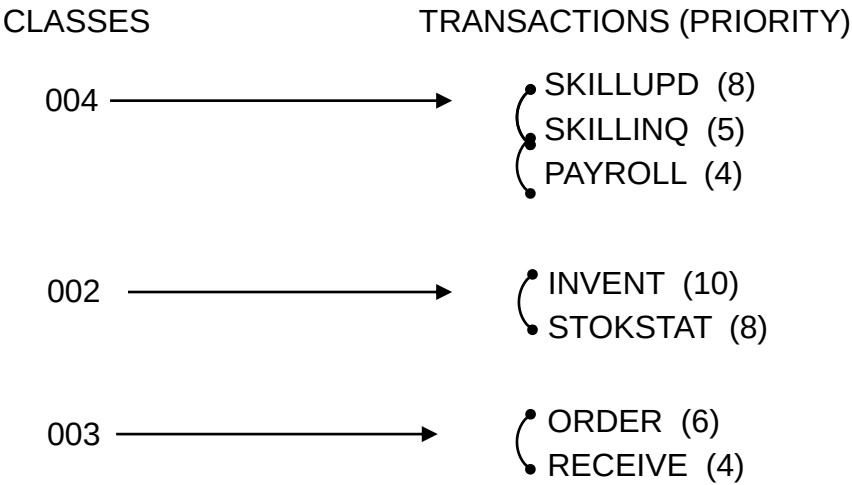
- Every transaction belongs to a class & has a priority within that class

- Class can be specified on the APPLCTN or TRANSACT macro:

```
APPLCTN     PSB=PROG1, …, PGMTYPE=(TP,,class)
        TRANSACT CODE=XYZ, …, MSGTYPE=(,,class)
```

- Class can be dynamically changed via /ASSIGN command

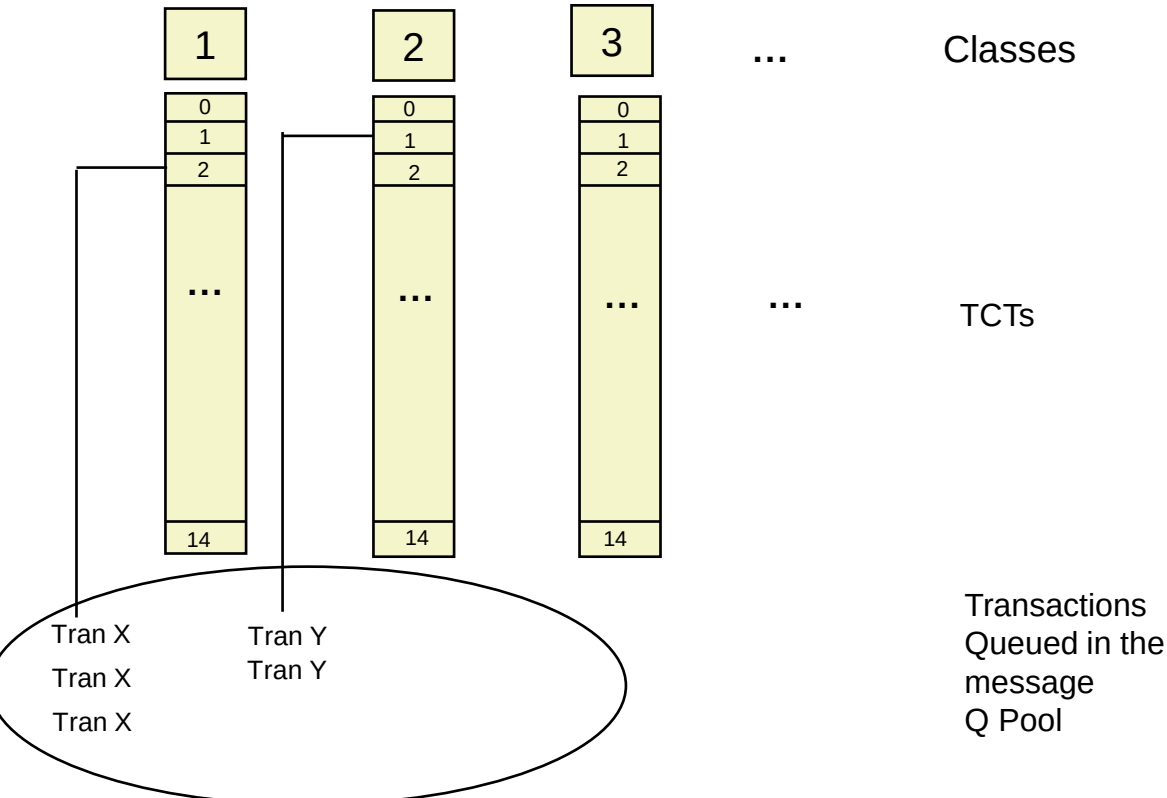
Transaction Class & Priority



- Transactions are queued by Class and
  - Within class by priority

- Classes: 1 – 999
- Priority: 0 (Low) – 14 (High)

Transaction Queuing



Transaction Priorities

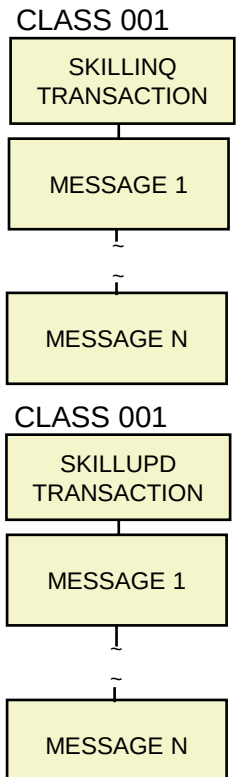
- Specified on the TRANSACT macro via PRTY parm:
  - PRTY (normal, Limit, Limit Count)

- Example:

```
APPLCTN     PSB=PROG1, …, PGMTYPE=(TP,,1)
        TRANSACT CODE=SKILLINQ, …, PRTY=(5,10,30)
```

- Defaults:
  - Normal priority: 1
  - Limit priority: 1
  - Limit count: 65535

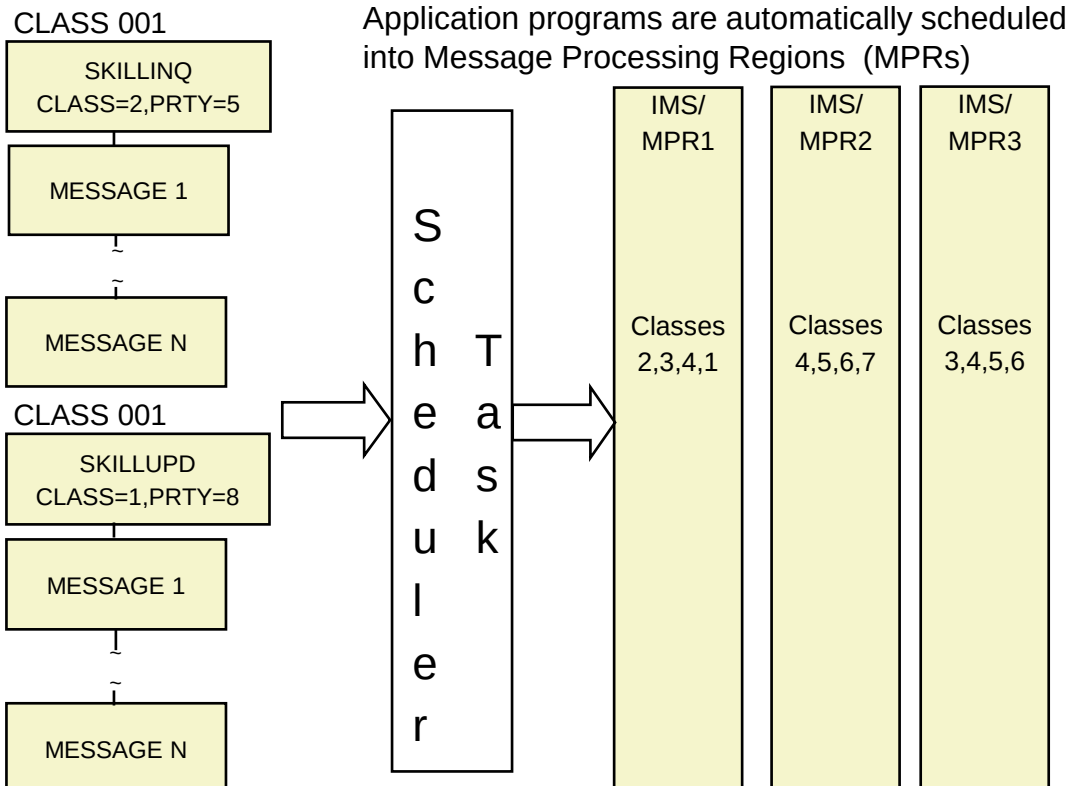
Transaction Priorities



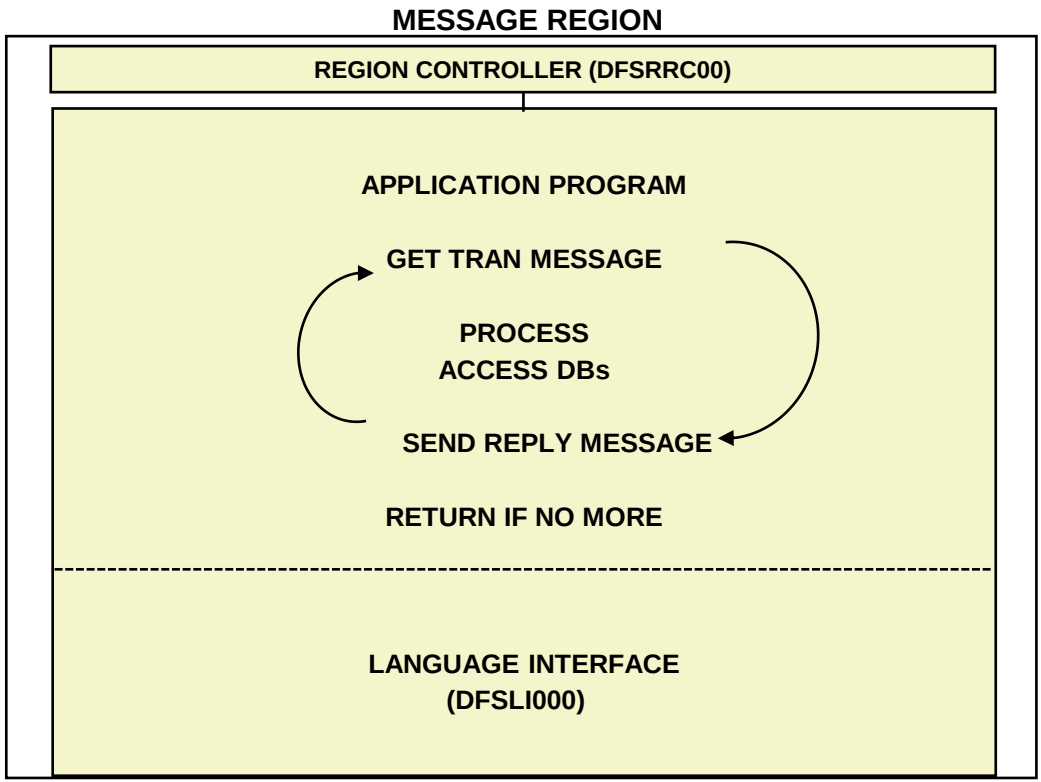
	TIME 1	TIME 2	TIME 3
NORMAL PRIORITY	5	5	5
LIMIT PRIORITY	10	10	10
LIMIT COUNT	30	30	30
QUEUE COUNT	8	31	0

	TIME 1	TIME 2	TIME 3
NORMAL PRIORITY	8	8	8
LIMIT PRIORITY	12	12	12
LIMIT COUNT	4	4	4
QUEUE COUNT	2	1	3

Transaction Scheduling



MPP Program flow



PROCLIM – Processing Limit Count

- Specified on the TRANSACT macro:

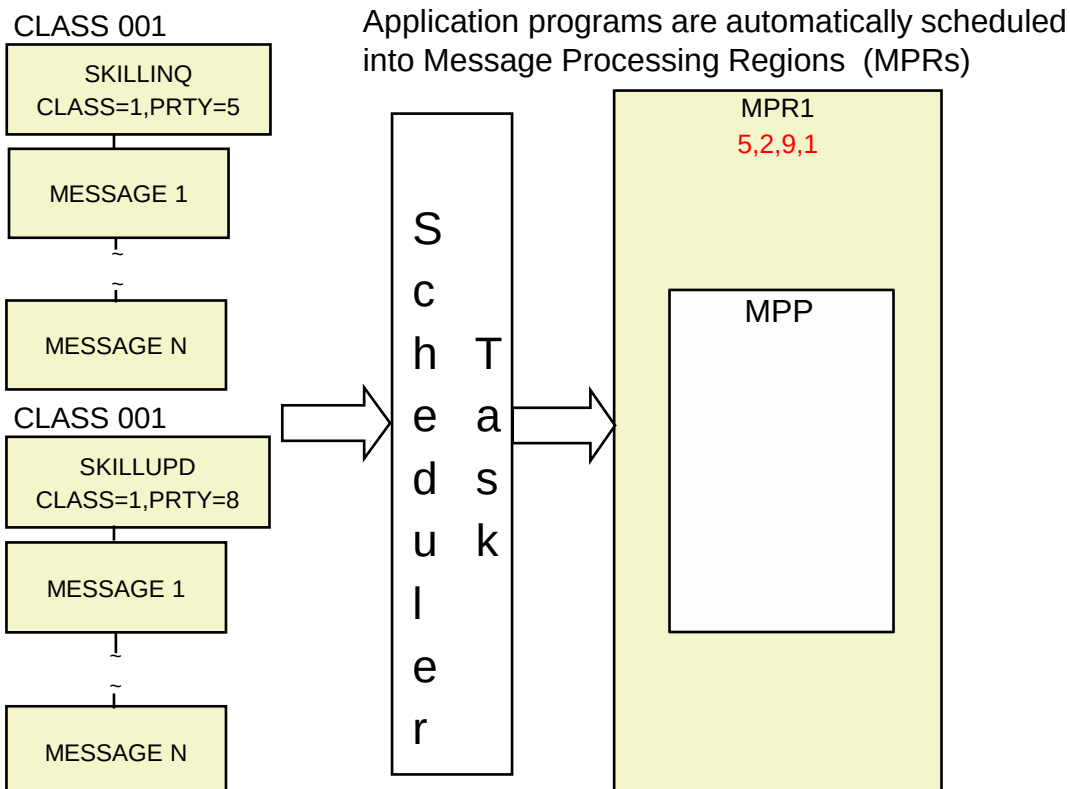
  TRANSACT CODE=SKILLINQ, …, PRTY=(5,10,30),
  PROCLIM=(count, time)

- Count: number of messages program can process in one scheduling.
  - Default: 65535 – no limit
- Time: CPU seconds to process one transaction

PROCLIM – Quick Reschedule

- Avoids unnecessary terminations & schedules.
- Invoked when PROCLIM>0
- When PROCLIM count reached
  - If same transaction would be rescheduled
    - Does not return ‘QC’ status code
    - Returns the next message
  - If same transaction would not be rescheduled
    - Returns ‘QC’ status code
    - Program terminates
- If PROCLIM count=0
  - Quick Reschedule is disabled
  - Only one transaction processed per schedule

WFI (Wait for Input)



WFI (Wait for Input) Transactions

- Specified on the TRANSACT macro:

  TRANSACT CODE=SKILLINQ, …,WFI, …

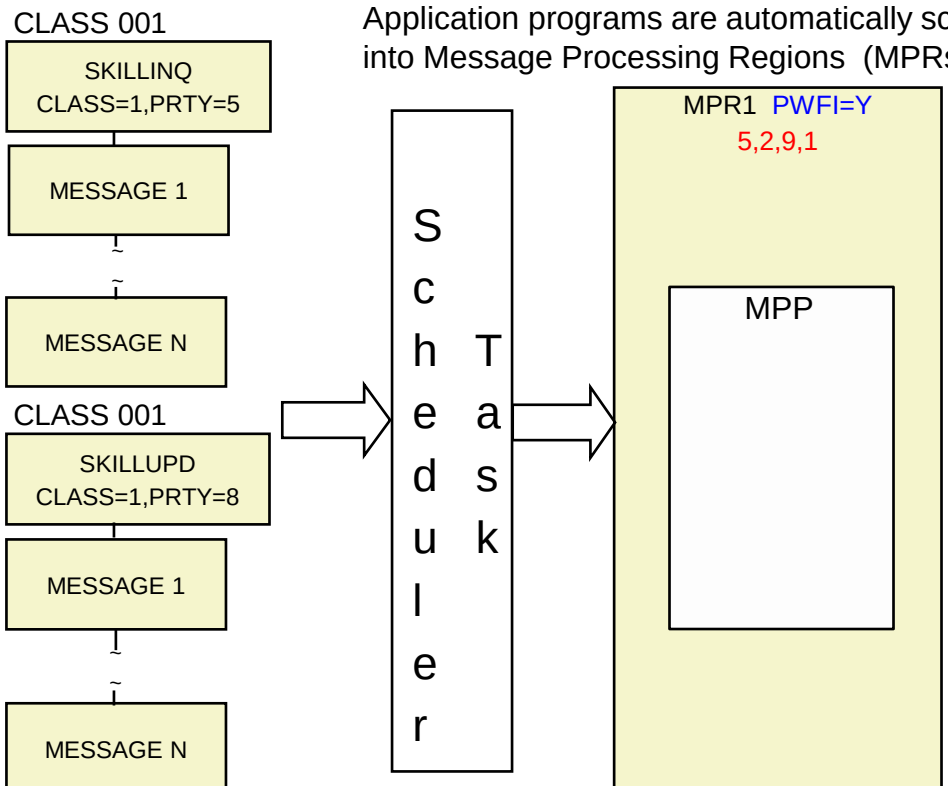
- Lack of message does not cause IMS to terminate program in region
  - GU to the IOPCB will NOT return ‘QC’ status code
  - Program is waiting for the next message to arrive

- Basically, provides a dedicated region for high priority transaction where response time is critical.
  - Avoids the scheduling overhead of those high priority transactions

WFI (Wait for Input) Transactions (cont.)

- WFI transactions do not give up their regions
- Programs terminated only by:
  - Reaching PROCLIM
  - /STOP TRANSACTION for MPP
  - /PSTOP Region reg# TRANSACTION tran for BMP
  - Shutdown checkpoint of IMS system
  - UPDATE PGM START(REFRESH) – IMS V14

PWFI (Pseudo Wait for Input)



PWFI (Pseudo Wait for Input) Transactions

- Specified on the MPP region JCL:

// EXEC PGM=DFSRRC00,PARM='MSG,...,PWFI=Y,...‘

- Specifies what IMS will do when there are no more transaction messages to process:
  - GU to IOPCB will not result in ‘QC’ status code
  - Instead, waits for next message to arrive for the region
  - If next message is the same transaction code, great!! Avoids termination and scheduling of transaction.
  - If next message is different transaction code, returns ‘QC’, terminates program and schedules new program.

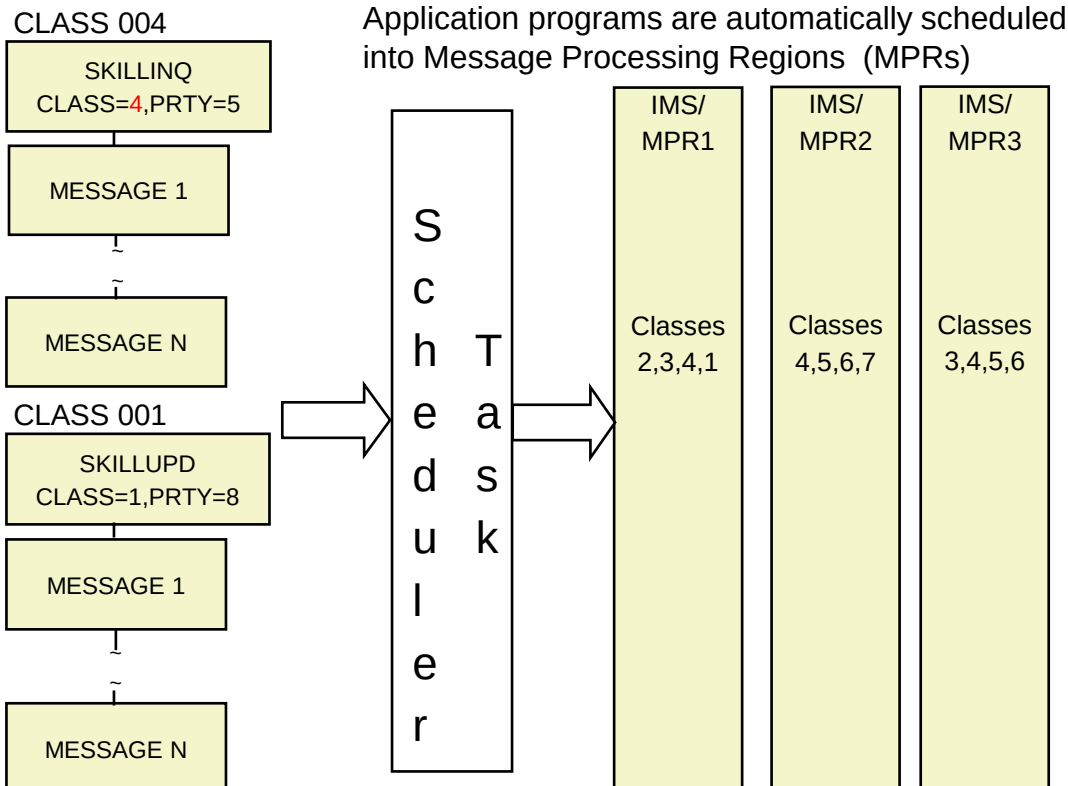
Dynamic Refresh for PWFI & WFI regions

- Introduced in IMS V14
- Via Type 2 command:

UPDATE PGM START(REFRESH)

- Regions do not need to be restarted.
- Programs get ‘QC’ status code if waiting for work or if processing a transaction, then after the current message is processed.

Serial vs Parallel Scheduling



PARLIM – Parallel Limit

- Specified on the TRANSACT Macro;

TRANSACT CODE=SKILLINQ, …,PARLIM=2, …

- Requires SCHDTYP=PARALLEL on APPLCTN macro

- Says transaction will be scheduled in another region if:

Tran Q Cnt > PARLIM x number of regions tran is currently scheduled

PARLIM – Parallel Limit (cont.)

- Example:

TRANSACT CODE=SKILL, …,PARLIM=2, …

SKILL Transaction current queue count=6

SKILL transaction currently scheduled in 2 MPRs.

3rd MPR becomes available

Can we schedule SKILL in the 3rd MPR?

PARLIM – Parallel Limit (cont.)

- A way to Load Balance the parallel scheduling of transactions
- PARLIM=0 always causes new transactions to be eligible for another available region

MAXRGN

- Specified on the TRANSACT Macro;

TRANSACT CODE=SKILLINQ, …,MAXRGN=7, …

- Limits the number of MPP regions that may have the transaction concurrently scheduled

- Used to keep a “dog” transaction from occupying too many regions

Unit Summary

- Queuing
- Scheduling
- Scheduling related parameters:
  - Class
  - MPR Class specification
  - Priority, Limit Priority & Limit Count
  - PROCLIM, Quick Reschedule
  - WFI, PWFI
  - Serial vs Parallel scheduling, PARLIM

Thank You!