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TO: John Lohmeyer
        Chairman, X3T9.2

FROM: Peter Johansson

DATE: January 7, 1988

RE: Management of the "Grown" Defect List

This is a resubmission of the issues raised in X3T9.2/87-151, my
memorandum of August 28, 1987. The original escaped inclusion on
plenary or working group agenda and minutes, so I have reviewed
the issues against the current SCSI-2 draft. I remain convinced
that the FORMAT UNIT, READ DEFECT DATA and REASSIGN BLOCKS
commands for direct-access devices need enhancement and
clarification with respect to management of the "Grown" defect
list and request the committee's consideration.

First, the READ DEFECT DATA command. Just what does it mean to
return a list of logical block addresses for defect locations if
they are remapped by the target? The third sentence of the
paragraph referenced below obliquely addresses the problem, but
because defect locations that have been remapped have no logical
block addresses, I believe it is not strong enough. I suggest
that the first paragraph on page 8-55, Section 8.1.9 of Revision
3 of the working draft be altered as follows:

> The Defect List Format field specifies the format of the
> defect list data returned by the target. Legal values
> for this field are defined in the FORMAT UNIT command
> (see section 8.1.1.1, Defect List Format). ~~The logical
> block and physical sector formats may not include defects
> in user inaccessible areas.~~ If the logical block format
> is specified, only those defect locations that have not
> been remapped by the target shall be returned. If either
> the bytes from index or physical sector formats are
> specified, the complete list(s) of defects shall be
> returned; however, some of the defects may not lie in
> user accessible areas (depending on the disk geometry
> used by the most recent FORMAT UNIT command). If the
> value in ~~this~~ the Defect List Format field does not match
> the defect list format requested by the initiator in the
> CDB, the target shall transfer the defect data and return
> a CHECK CONDITION status with the sense key set to
> RECOVERED ERROR and an additional sense code of DEFECT
> LIST NOT AVAILABLE.

This ability to distinguish between defects that are recorded in
a target's Primary or "Grown" lists and defects that are both
recorded and remapped is useful in conjunction with REASSIGN
BLOCKS as described below.

Secondly, the REASSIGN BLOCKS command description makes no
mention of the fact that the "Grown" defect list is updated when
the command is executed. This fact is buried back in the FORMAT
UNIT command description. This command provides the only means
of adding to the "Grown" defect list other than at the time the
unit is formatted, and because of that should have the added
capability to add defect(s) to the "Grown" list without remapping
them. Three situations come to mind where this is valuable: 1) A
volume in use for some time has exhausted its spare sectors and
this fact is revealed by a CHECK CONDITION after a REASSIGN
BLOCKS command. The initiator will need to reformat the volume
with more spare capacity; rather than go through a tortuous
logical block address calculation for the new "virtual" disk
geometry and the "physical" logical block addresses (now rather
confusedly described under the FORMAT UNIT command) it would be
more direct for the initiator to issue a REASSIGN BLOCKS command
for the affected blocks (specifying no remapping) followed by a
FORMAT UNIT command that retains the "Grown" defect list. 2) The
initiator does not remap any defects, performs its own defect
management schemes but wishes to utilize the target's capability
to record defect lists for future reference. 3) An initiator
performs and incoming inspection test of the target with all
defect management and remapping disabled and discovers "Grown"
defects. These are to be added to the defect list when the
target is reformatted with defect remapping enabled; once again,
it would be more direct to use the REASSIGN BLOCKS command rather
than a calculation of "physical" logical block addresses.

There are at least two ways to modify REASSIGN BLOCKS to add new
functionality: a) add a bit in the CDB that specifies that the
block(s) are to be recorded in the "Grown" list, only, and not
reassigned or b) change the definition of the actions performed
after the NO DEFECT SPARE LOCATION AVAILABLE error condition such
that the defect location being processed is added to the "Grown"
list. The first approach is cleaner and is reflected in the
proposed wording for the REASSIGN BLOCKS command attached to this
memorandum.

In informal discussions at the Colorado Springs meeting about the
REASSIGN BLOCKS command, the objection was raised that all
defects recorded in the "Grown" defect list at present are
reassigned and that if REASSIGN BLOCKS were to be modified as
described above the initiator would not be able to distinguish
reassigned from unreassigned defects. The changes to READ DEFECT
DATA (which I believe are needed on their own merits), along with
the newly added address translation functions of SEND DIAGNOSTIC
and RECEIVE DIAGNOSTIC RESULTS answer this objection.

Lastly, there is the management of the "Grown" defect list
through the FORMAT UNIT command. Revision 3 of the SCSI-2 draft
incorporates some of the changes recommended the August 28
memorandum and is less ambiguous with respect to the logical
block format when the CmpLst bit is one. Additional
clarification could be provided by revising the first paragraph
on page 8-5, Section 8.1.1 as follows.

A Complete List (CmpLst) bit of one indicates that the
data supplied by the initiator during the DATA OUT phase
of the command (D list) includes the complete list of
known defects. Any previous defect map or defect data,
except the P list (if any), shall be erased by the
target. The result is to purge any previous G list and
to build a new G list. If there was a previous P list,
it shall be retained. The target may add to this D list
as it formats the medium, according to the format options
selected in the defect list header (see Table 8-3), by
performing a target certification process (creating a new
C list). The combination of the D list and the C list
(if certification is performed) creates the new G list.
When using the block format with a CmpLst bit of one, the
defect list refers to the new block length (~~and not to
the previous block length, if it is different~~) and the
defect list refers to physical block addresses (i.e.
addresses that the logical blocks would occupy ~~if there
were no defects~~ prior to any spare sector or track
allocation and prior to any defect reassignment,
including that of the P list, not the previous logical
block addresses).

Thank you for your consideration of these interrelated problems.

8.1.11. REASSIGN BLOCKS Command

Peripheral Device Type: Direct-Access and Write-Once
                          Read Multiple
Operation Code Type: Optional

Table 8-36: REASSIGN BLOCKS COMMAND

Bit Byte	7	6	5	4	3	2	1	0
0				Operation Code (07h)				
1	Logical Unit Number							NoMap
2				Reserved				
3				Reserved				
4				Reserved				
5				Reserved				
6				Control Byte				

The REASSIGN BLOCKS command (Table 8-36) requests the target to
reassign the defective logical blocks to an area on the logical
unit reserved for this purpose and to record the defective
logical blocks to the "Grown" defect list. More than one
physical or logical block may be relocated by each defect
descriptor sent by the initiator. This command does not alter
the contents or location of the Primary defect list (see section
8.1.1.1, FORMAT UNIT command).

If the suppress reassignment (NoMap) bit is one, the target
shall enter the defect(s) in the "Grown" defect list but not
attempt to reassign references to the location(s) specified in
the defect list.

The initiator transfers...(the remainder of the REASSIGN BLOCKS
command description is unchanged).