FICON Performance

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History

- Parallel channel data transfer rate = 4.5 MB/sec
- ESCON® = 17 MB/sec
  - For 1K record data transfer time for parallel is .22 mills and this drops to .06 mills with ESCON
  - Fixed overhead nearly constant time and > 1 mill so minimal throughput gains with ESCON on 1K records
  - Near linear gains on large blocks for ESCON
- FICON link data rate = 100 MB/sec
  - Much higher throughput on small records over ESCON
- G5 max of 24 FICON and 168 ESCON
  - Each FICON takes out ESCON card with 4 CHPIDs
- G6 max of 36 FICON and 120 ESCON
- zSeries® 900 max of FICON is 96
  - The 96 will grow as MIPS are increased
  - FICON + ESCON <= 256
FICON Advantages

- Ability to fully utilize the CPUs of large CECs
  - All ESCON might not be able to handle the IO throughput
- Greatly improved large distance performance
- Less channels, ports and fiber optic cabling to manage if consolidate current ESCON channels
- Higher data transfer rates for large block sizes
  - Capture time reduction
  - Reduced time to take large control dumps with 3590
# ESCON, FICON Bridge, FICON Native

## ESCON Channels

<table>
<thead>
<tr>
<th>Server</th>
<th>9032-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1</td>
<td>CH2</td>
</tr>
<tr>
<td>CH3</td>
<td>CH4</td>
</tr>
<tr>
<td>CH5</td>
<td>CH6</td>
</tr>
<tr>
<td>CH7</td>
<td>CH8</td>
</tr>
</tbody>
</table>

## FICON Bridge Channel

<table>
<thead>
<tr>
<th>Server</th>
<th>9032-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1</td>
<td>Bridge card</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bridge</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCON</td>
<td>G5/G6 FICON</td>
</tr>
<tr>
<td>I/O Operations at a time</td>
<td>Any one</td>
</tr>
<tr>
<td>Avg. I/Os / second per channel (4k block size) with % channel utilization</td>
<td>300 25%</td>
</tr>
<tr>
<td>Unit addresses per channel</td>
<td>1K</td>
</tr>
<tr>
<td>Bandwidth degradation (beyond)</td>
<td>9 km</td>
</tr>
</tbody>
</table>

* 100 km with RPQ and repeaters
Native FICON Channel

Server
with
FICON/
FICON
Express
feature

FC

Full Duplex

Native FICON Channel end to end connectivity

FICON Director

FICON Frames

FICON Control Units

CU-A

Devices

CU-B
Large CEC Channel Constraints

- Several TPF customers are pushing the limits of 256 channels per CEC
- Consider a z900 8 to 10 CP machine - assume 1.3 BIPS
  - At 8000 inst/IO => 162500 IO/sec
  - Assuming 220 DASD channels => 738 IO/sec/channel
  - We recommend running channels at a max of .8 utilization
  - ESCON channel at .8 busy is .8(700)=560 IO/sec
- IBM could have solved this problem by removing the 256 channel limitation
- Customers want fewer channels to manage and therefore more powerful channels
Throughput

- Recent zSeries 900 FICON Express measurements
  - 4K Read Hit
  - FICON channel to native FICON director with two ESS CU ports
  - Maximum throughput of 7200 IO/sec at utilization=1
- As with ESCON must balance number of channels mapped to CU and director ports
- In past ESCON channel capacity == CU port capacity
- FICON channel throughput will be <=,=,=> CU FICON interface over the next several years

Distance Considerations

- FICON is significantly better than ESCON at large distance
  - ESCON droop begins at 9 km
  - At 20 km ESCON bandwidth is < 1/2 that at 0 distance
  - FICON and FICON Express have been tested to have no droop at 100 km
  - At 150 km FICON should get roughly .8 of max link capacity but this distance is untested
- Why FICON is less sensitive to distance
  - Increased buffer sizes in FICON card
  - Fewer handshakes across the link
  - ESCON channel, link and CU port are busy during additional time to execute program over distance
  - Multiplexing of FICON allows it to work on other channel programs when one of its programs service time is increased
    - Light speed propagation delay is .1 mill roundtrip per 10 km
FICON Channels

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