The TPF Operating System

**TPF: Transaction Processing Facility**

An overview of IBM’s coolest realtime operating system
Early description of Airline Control Program

New System Cuts Jet Reservation Time to Three Seconds

1. LOS ANGELES—Passenger books American Airlines flight for New York with Chicago stopover. IBM system takes seconds to check availability of space and confirm reservation with central processing unit in New York. Passenger's name and itinerary are then registered electronically in central computer.

2. CHICAGO—Passenger decides to extend Chicago stopover. Agent queries computer—receives complete passenger record and report on alternate space available within seconds. Agent instructs computer to make new reservation and change passenger record.

3. NEW YORK—Computer in New York stores information from 1,100 reservation desks for every seat in the American Airlines system. When completed, the new reservations system will be the world's largest electronic processing network in commercial use.
The TPF Operating System

It started out as: Airline Control Program

- (circa 1967) A collaboration of IBM and partner airlines to build a realtime operating system & set of applications to handle airline reservations & flight operations.
TPF: Evolution: Today

The TPF Challenge
Our customers are breaking new world records every day
Can you beat some of these?

As of 3/7/14, it has been 4,567 days since the last customer visible outage

- 1.5 million database reads per second
- 3,381,161,400 messages in 24-hours
- 1-hour sustained peak I/O of 2,136,571 I/O per second

New in use today
- Train conductors view manifest and lift tickets onboard the train from mobile devices
- Securely encrypt credit card numbers

Let's continue to break records together!

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What is a Transaction?

According to Wikipedia (motto: if it’s here it must be true!)

**Transaction** - (in general computing) the transmission and processing of **an item of data**. In TPF, one or more messages make up a transaction (ATM).

So, **Transaction Processing** is – the ability to handle a set of transactions that achieves some end result.

- e.g. a reservation, a purchase, a bank deposit, a cry for help.

Then, **Transaction Processing Facility** is – an operating system that enables the ability to process those transactions.
What is an Operating System?

From Wikipedia (again)

An **operating system (OS)** is software that manages computer hardware and software resources and provides common services for computer programs (applications).

Hardware Resources include: monitor, keyboard, mouse, DASD

Software Resources include: CPU time, memory
OK, TPF is fast. Why?

It utilizes Power of IBM Mainframes

- **Tightly Coupled Processor** - (TPF name for multiple cpus) The **z13** mainframe is based on a 5 GHz octa-core processor. A z13 system can have a maximum of 168 Processing Unit (PU) cores, 141 of which can be configured to the customer's specification to run applications and operating systems, and up to 10144 GiB (usable) of redundant array of independent memory (RAIM).

- **Loosely Coupled Processors** – the ability to connect multiple mainframe machines to one physical TPF database.
The operating system has some cool features.

- **Preallocation** – Everything is preallocated when the system is booted up. Standard “blocks” are used to hold data. Blocks are chained together – when used – in various ways. (4K and 1MB). Because maintaining non standard storage sizes is expensive.

- **Virtual File Access (VFA)** – TPF term for software cache that holds disk storage records in memory to avoid I/O* just in case* the record is accessed again. Because I/O is expensive.

- **Pooled Disk Storage** – preallocated areas on disk to use as long term holding areas (years?) for data.

- **KISS** – it *doesn’t* do “stuff” that is not part of its prime directive, processing transactions
  - Check processing, calculating pi to a billion places, drawing pictures (no GUI), compile code (??!1?), etc.

- And, more...
(ancient) view of a TPF network
(modern) view of a TPF network

Mobile Applications

Cloud-based Services

Loosely coupled TPF System
Any data processing environment that requires remote users to access shared information is a potential user of the z/TPF system. Also required – a need for speed and 24/7 availability. Non-airline applications:

- Hotel/Car reservations
- Credit authorization/verification
- Police car dispatching (911)
- Electronic funds transfer switching
- Online teller memo posting
- Message switching
- Loan payment processing
- Communication transaction routers.
**Transaction:** little computation, considerable data manipulation.

- TPF job 1: maximize performance for message driven applications
- TPF job 2: maximize performance for message driven applications
- TPF job 3: maximize performance for message driven applications

How does it do all these jobs?
The main supervisor...

- **Schedules work**
  - Via queues: Cross List (switch cpu), Ready List (in progress), Input List (new), Deferred List (save – for later).
    - Each queue is emptied before dispatching work from next queue.
    - Priority given to work in progress.
    - CPU Loop is the term used to service these queues
  - Handles I/O
  - Perform error handling (dumps – similar to dreaded BSOD)
(internal) view of TPF main supervisor
TPF doesn’t compile code ??!1?

- **TPF Code:**
  - Source Code “Lives” on a linux based file system.
  - Compiled on linux using Gnu Compiler Collection (gcc) cross compiler
    - Cross Compiler – compiler that exists on one operating system and emits executable code for another operating system.
  - TPF Loaders packages executable code,
  - Executable code ftp’ed onto TPF’s posix-based (i.e. ported unix) file system system
  - Executable code finally activated.
Social Business: TPF on the ‘net

Facebook – TPF’ers
- 794 members, current and previous TPFers

Twitter - https://twitter.com/IBM_TPF
- @IBM_TPF → 107 followers

YouTube - ibm.biz/IBM_TPF_recordings

developerWorks – TPF Blog
- Created in 2010

Paper.li - The TPF Times

LinkedIn Members – Good representation of technical community; need to reach leadership team.

LinkedIn - TPF, z/TPF, and ALCS Professionals
- Created in 2008 → 1,244 members
- Active technical discussions and Q&A
- Has ‘Entry’ level participation per LI
Beyond TPF: IBM

- http://www.ibmcampusus.com/
  - Check the twitter feed for all kind of tips!
- https://www.youtube.com/watch?v=39jtNUGgmd4
  - History of IBM’s first 100 years.
  - Best Quote: All of the problems of the world could be settled easily, if (people) were only willing to think
- Wasdev.net
  - Download your own websphere/java development environment.