GT.M Update

K.S. Bhaskar

Development Director, FIS GT.M
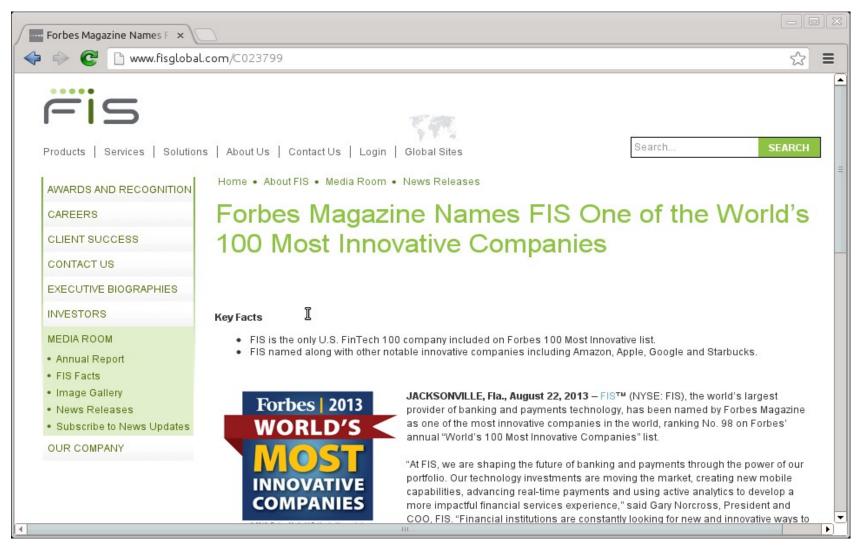
FIS
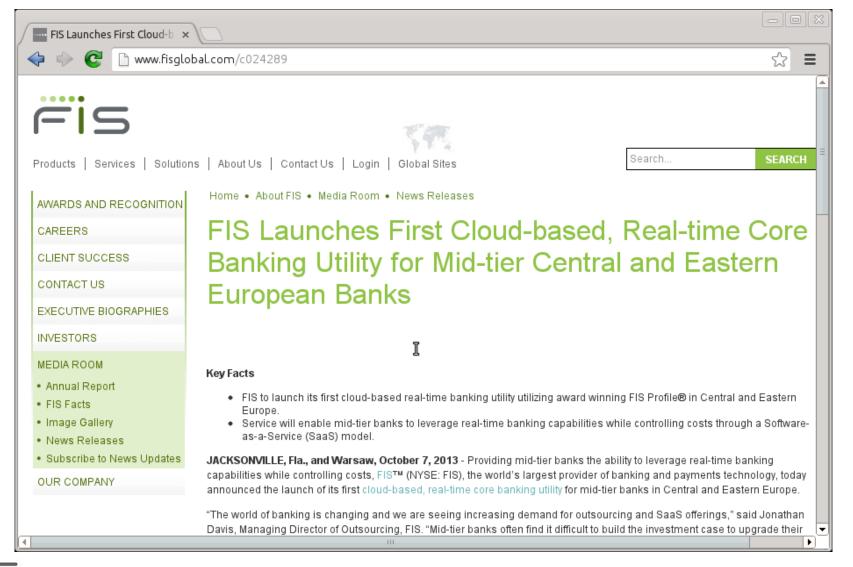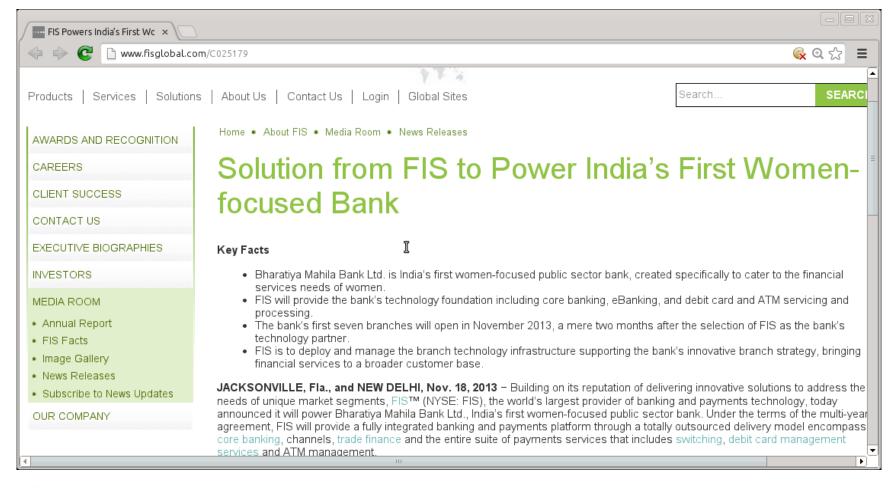
FIS

Forbes Magazine Names FIS One of the World's 100 Most Innovative Companies

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Key Facts

- FIS is the only U.S. FinTech 100 company included on Forbes 100 Most Innovative list.
- FIS named along with other notable innovative companies including Amazon, Apple, Google and Starbucks.

Forbes | 2013 WORLD'S MOST INNOVATIVE COMPANIES

JACKSONVILLE, Fla., August 22, 2013 – FIS™ (NYSE: FIS), the world's largest provider of banking and payments technology, has been named by Forbes Magazine as one of the most innovative companies in the world, ranking No. 98 on Forbes' annual "World's 100 Most Innovative Companies" list.

"At FIS, we are shaping the future of banking and payments through the power of our portfolio. Our technology investments are moving the market, creating new mobile capabilities, advancing real-time payments and using active analytics to develop a more impactful financial services experience," said Gary Norcross, President and COO, FIS. "Financial institutions are constantly looking for new and innovative ways to

FIS Profile – in the Cloud

FIS Profile – Bharatiya Mahila Bank

FIS Profile – Sainsbury's

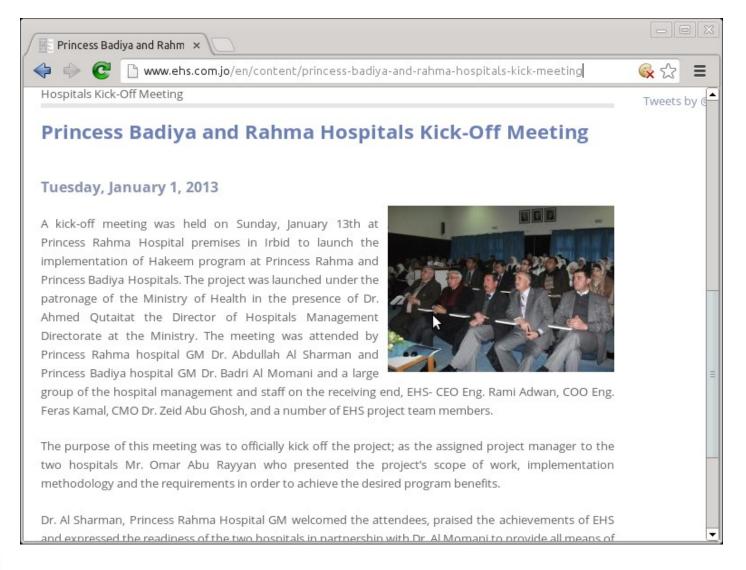Browser window showing www.fisglobal.com/C022304

UK's Sainsbury's Bank Selects FIS as Retail Banking Technology Partner

Key Facts

- FIS named as technology partner to Sainsbury's Bank, providing a fully outsourced real-time core banking solution, b[...] processing and transition support
- Agreement underscores FIS' ability to deliver cost-efficient and next-generation financial technology services to the gl[...] marketplace

JACKSONVILLE, Fla., and LONDON, May 8, 2013 – FIS™ (NYSE: FIS), the world's largest provider of banking and payme[...] technology, has been selected by Sainsbury's Bank as the bank's technology partner for all its retail banking operations. Und[...] terms of this strategic multi-year arrangement, FIS will provide real-time core banking and back-office processing support via [...] outsourced model on behalf of Sainsbury's Bank.

Announcing its Preliminary Results today, J Sainsbury plc confirmed its intention to acquire the Lloyds Banking Group 50 per [...] shareholding in Sainsbury's Bank. The announcement is the latest development in Sainsbury's overall strategy to help its cus[...] to Live Well For Less and at the same time grow sales and profits from complementary new business channels by leveragin[...]

EHS Continues Hakeem Rollout

Hospitals Kick-Off Meeting

Princess Badiya and Rahma Hospitals Kick-Off Meeting

Tuesday, January 1, 2013

A kick-off meeting was held on Sunday, January 13th at Princess Rahma Hospital premises in Irbid to launch the implementation of Hakeem program at Princess Rahma and Princess Badiya Hospitals. The project was launched under the patronage of the Ministry of Health in the presence of Dr. Ahmed Qutaitat the Director of Hospitals Management Directorate at the Ministry. The meeting was attended by Princess Rahma hospital GM Dr. Abdullah Al Sharman and Princess Badiya hospital GM Dr. Badri Al Momani and a large group of the hospital management and staff on the receiving end, EHS- CEO Eng. Rami Adwan, COO Eng. Feras Kamal, CMO Dr. Zeid Abu Ghosh, and a number of EHS project team members.

The purpose of this meeting was to officially kick off the project; as the assigned project manager to the two hospitals Mr. Omar Abu Rayyan who presented the project's scope of work, implementation methodology and the requirements in order to achieve the desired program benefits.

Dr. Al Sharman, Princess Rahma Hospital GM welcomed the attendees, praised the achievements of EHS and expressed the readiness of the two hospitals in partnership with Dr. Al Momani to provide all means of

Releases

- V6.0-003 & V6.1-000
  - Virtually unlimited global variable sizes
  - Another route to mapreduce / sharding
  - TCP over IPv6
  - Enhanced use of cryptography
  - Relink recursive
  - Local sockets (a.k.a UNIX domain sockets) for SOCKET devices
  - Pass a socket to child process with JOB command
  - Optimization for non-TP database reads, especially with thousands of concurrent processes
  - Nanosecond resolution timestamps (subject to OS accuracy) to determine whether source file is newer than object file

Virtually Unlimited Global Sizes

- Enabled by spanning regions (subscript level mapping) in global directories
- Map at any combination of levels, e.g.:

```
GDE> add    -name DIVISION("Europe","a":"m")    -region EURAL
GDE> add    -name DIVISION("Europe","m":"z")    -region EURMZ
GDE> add    -name DIVISION("Australia")         -region AUS
GDE> add    -name DIVISION("USA","East")        -region USE
GDE> add    -name DIVISION("USA","Mid","a":"m") -region USMAL
GDE> add    -name DIVISION("USA","Mid","m":"{") -region USMMZ
GDE> add    -name DIVISION("USA","West")        -region USW
```

- Ranges closed on left and open on right

```
GDE> add    -name PRODAGE(0:10)                 -region DECADE0
GDE> add    -name PRODAGE(10:20)                -region DECADE1
GDE> add    -name PRODAGE(20:30)                -region DECADE2
```

- Consistency of multi-region operations (e.g., $ORDER(), KILL) assured with TP logic

- (Triggers not yet supported for global variables that span regions; coming soon)

Another Route to mapreduce

- (All those interested in mapreduce and sharding applications with GT.M, let's find a time & place to huddle)

TCP over IPv6

- Mostly, Just Works™ for SOCKET devices, replication, backup
  - Encapsulate IPv6 addresses with [] for CONNECT deviceparameter (IPv4 also now optionally permits [])

  - Have different names for IPv4 & IPv6 addresses (GT.M uses the first protocol returned by DNS)

  - LISTEN/ZLISTEN accepts connections from both IPv4 & IPv6 connection requests
  - (Replication with older GT.M releases must ensure use of IPv4)

Enhanced Use of Cryptography

- TLS (SSL) for replication
  - GT.M Cryptography plugin API and reference implementation enhanced for TLS (requires certificate management)

  - OpenSSL - http://openssl.org - used for TLS (GT.M includes no cryptographic software)

  - New configuration file format to manage certificates & encryption requires libconfig - http://www.hyperrealm.com/libconfig/ - a standard library available via your package manager (current $gtm_dbkeys continues to work when only database encryption needed)

- Easier path to certification for compliance with FIPS 140-2

  - Requires OpenSSL or libgcrypt () installation which is certifiably FIPS 140-2 compliant
  - With environment variable gtmcrypt_FIPS set to 1, "yes", or "true" reference implementation of encryption plugin uses library in FIPS compliant mode
  - FIPS Certification involves software and processes (see implementation guidelines at http://csrc.nist.gov/groups/STM/cmvp/documents/fips140-2/FIPS1402IG.pdf)

Recursive Relink

- Long running processes always have M routine references on the invocation stack
- Existing ZGOTO 0:<entryref> works but is heavyweight and some application redesign needed

- Recursive relink allows new version of a routine to be ZLINK'd with a reference to an existing version on the M invocation stack

- Any DO, function call, GOTO or ZGOTO of a full entryref invokes the new routine (DO, function call, GOTO or ZGOTO of a label is always in the same routine as the caller)

- After QUIT from an old version (or last invocation of old version if recursively called), old version becomes inaccessible

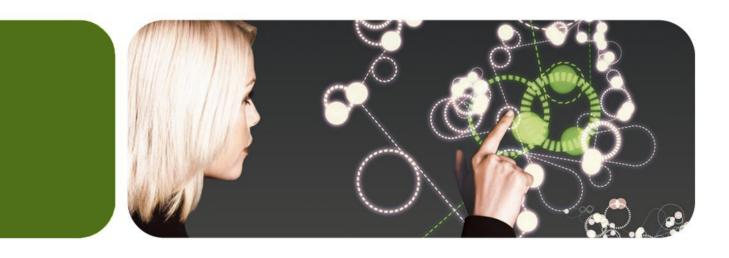- ZSHOW "R" displays routine stack with MD5 hashes of each routine's source code

And More...

- (Including enhancements and bug fixes)

Thank You

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