



Texaco Pipelines, LLC SCADA96 System

Evolution of an RTAP System

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Overview

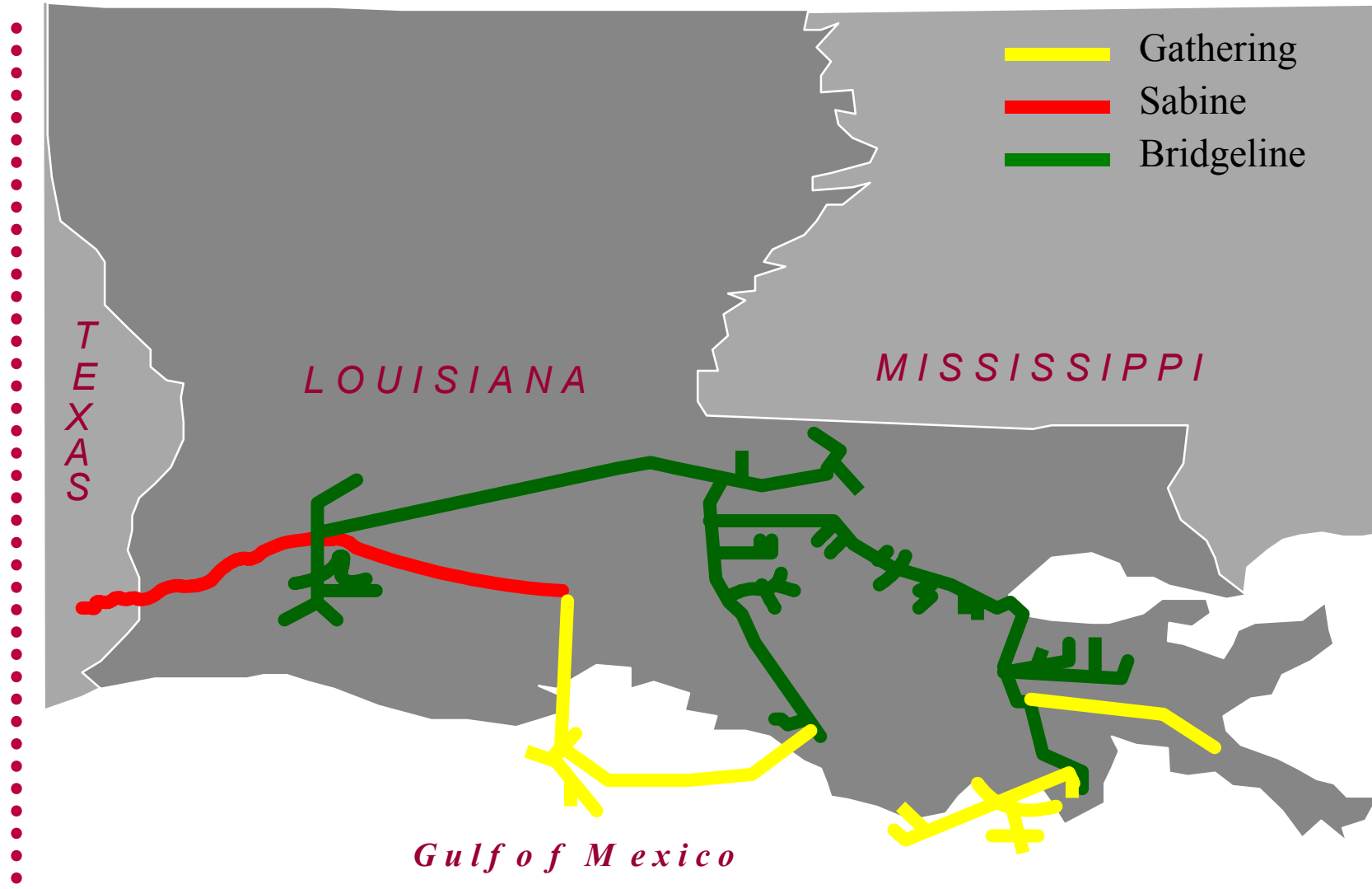
- The original SCADA96 system
- Discovery Pipeline
- Y2K
- LRC Pipeline
- Additional Challenges

SCADA96: In the Beginning

Three natural gas pipelines

- Bridgeline Gas Distribution Company
 - Texaco Gas Gathering
 - Sabine Pipe Line Company
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- 1100 miles of transmission lines
 - 400 miles of gathering lines

Texaco Pipelines

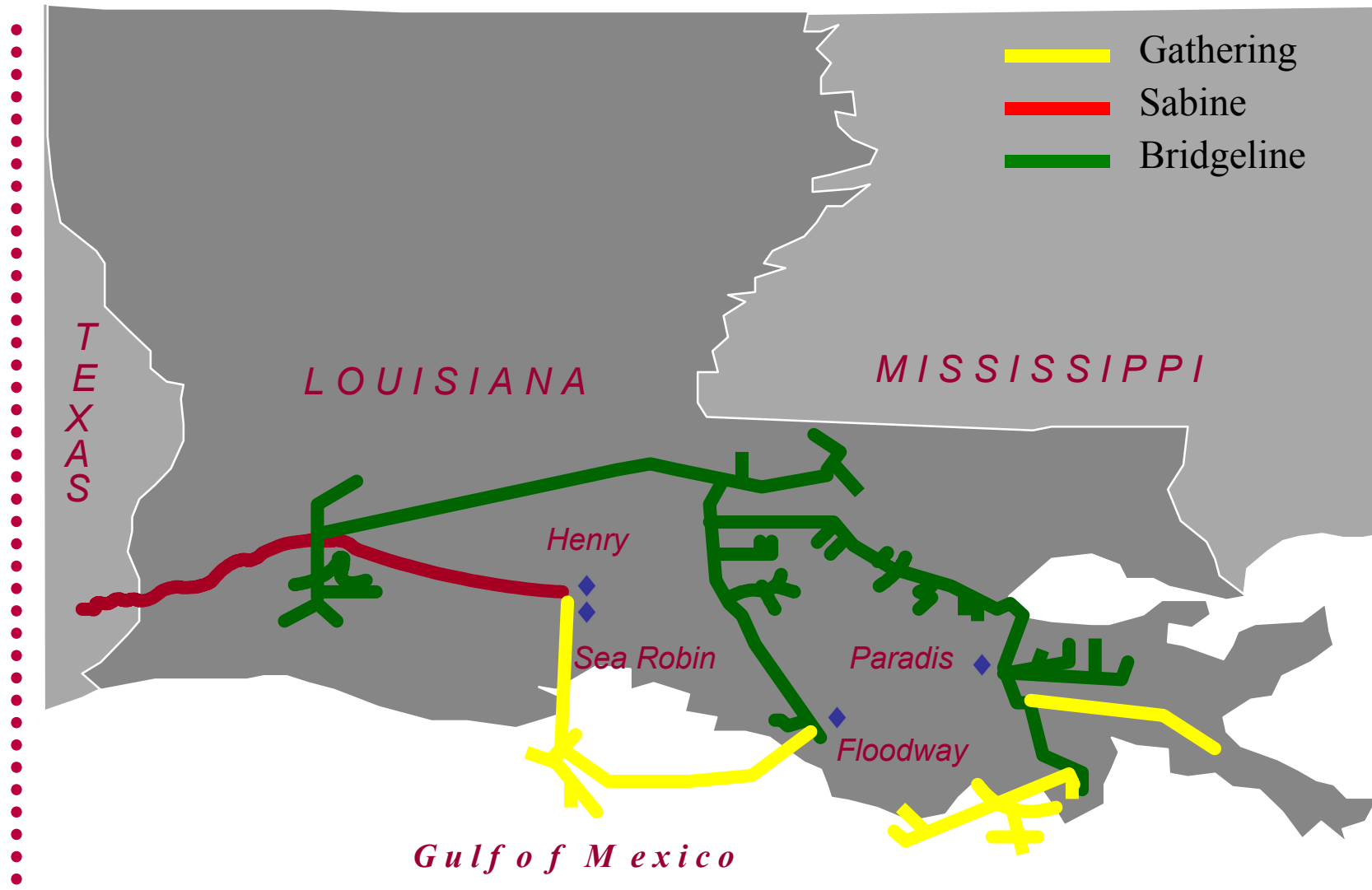


SCADA96: In the Beginning

Four natural gas processing plants

- Floodway
- Henry
- Paradis
- Sea Robin

Texaco Pipelines

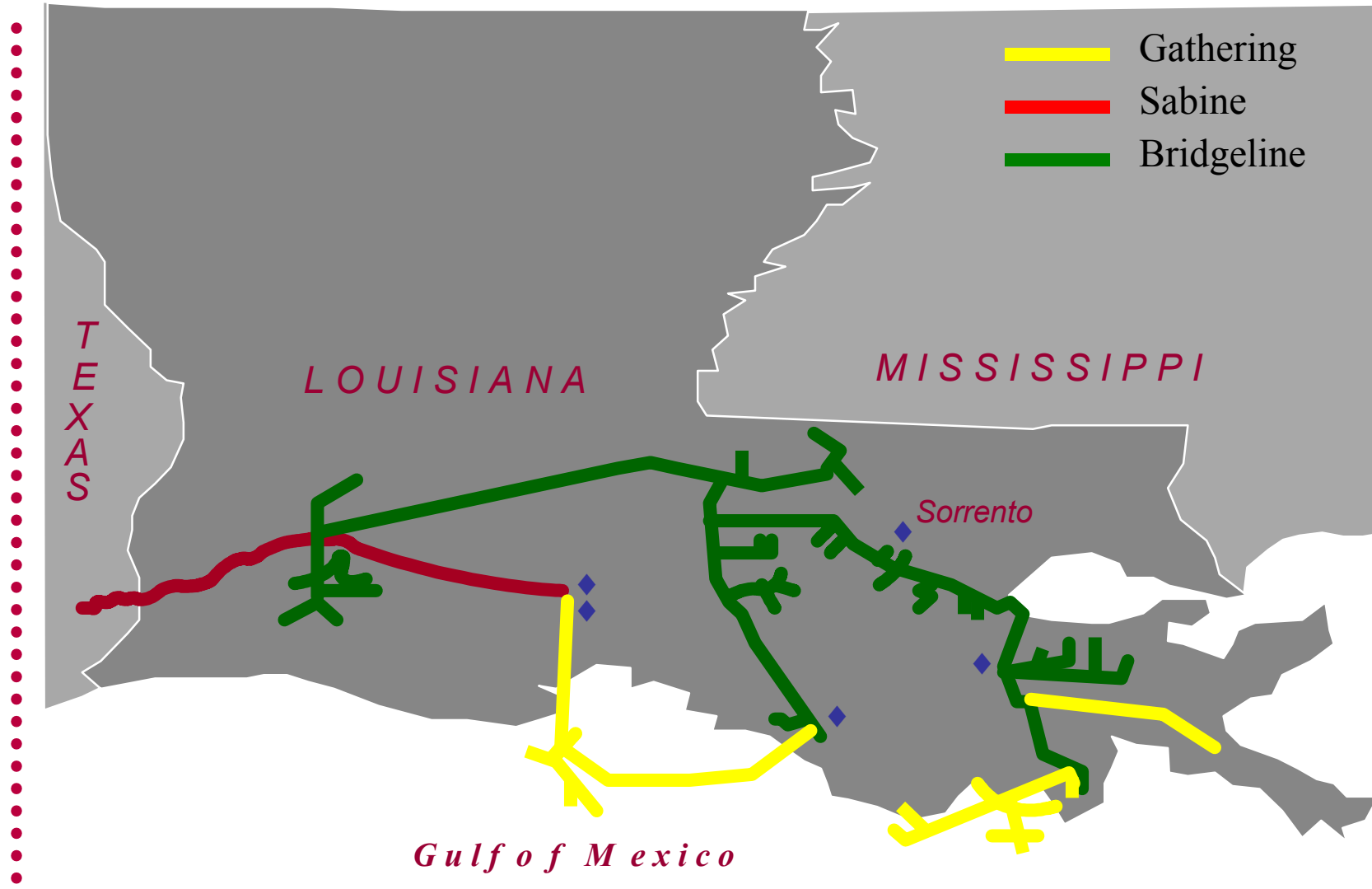


SCADA96: In the Beginning

Gas Storage

- Underground storage cavern located in Sorrento, Louisiana
- 3,578 mmcf working capacity
- 100 mmcfd maximum injection capacity
- 350 mmcfd maximum withdrawal capacity

Texaco Pipelines



Field Hardware

- 80 Gas Flow Measurement Computers (GFMC's) – Proprietary RTU's using Texaco's RTU88 protocol
- 20 Daniel 2500's (Modbus protocol)
- RTU communication by leased phone lines, microwave, and satellite

Basic System Requirements

- Central control facility in St. Rose, Louisiana
- Enterprise access to data
 - Pipeline control
 - Auditable flow measurement
 - Business systems
- High availability
- Maintainable by Texaco
- Expandable
 - Object oriented design of system components

Central Control Facility

- Gas controller personnel
 - Monitor pipeline
 - Monitor and control customer flows and pressures
 - Dispatch field personnel to handle problems
- Dual-head consoles for operators
- Single head consoles for maintenance and remote access

Enterprise Access to Data

In addition to control and monitoring:

- Casual and/or infrequent users inside Texaco
 - Web servers
 - Remote consoles
- Customers
 - Web servers
- Business systems

High Availability

HP MC/ServiceGuard

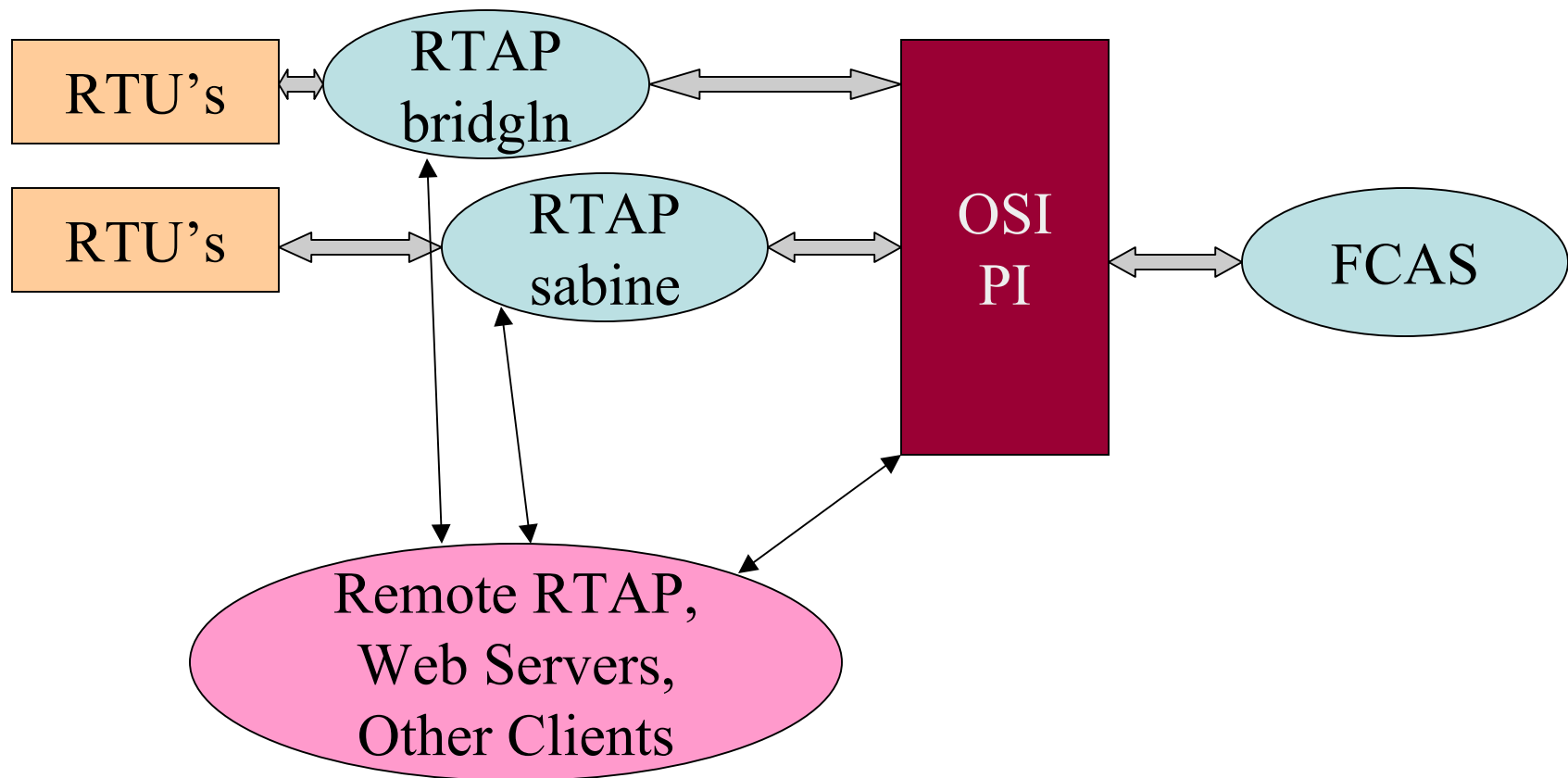
- Clusters
- Databases and web servers are packages
- Files for packages are logical volumes
- Mirrored disks
- Redundant Ethernet LANs for server clusters
- Client LAN
- Data acquisition LAN

Expandable

Sized for growth

- Servers accommodate multiple processors
- Additional RAM and disk capabilities
- Available network bandwidth
- Database architecture that allows for incorporation of additional servers and operator consoles
- Terminal servers for serial I/O

SCADA96 Data Flow Overview



SCADA96 Hardware Summary

- 4 K class HP servers
 - 2 servers per cluster
 - RTAP databases on one cluster
 - PI and web servers on other cluster
- HP 712's for operator and remote consoles
- Terminal servers for RTU serial communication

SCADA96 Software Summary

- RTAP/Plus 6.7
- HP-UX 10.10
- OSI PI time series archive database
- Netscape Enterprise Server
- Trending package
- Flow Computer Archival System (FCAS)
- Scripting language as integration tool

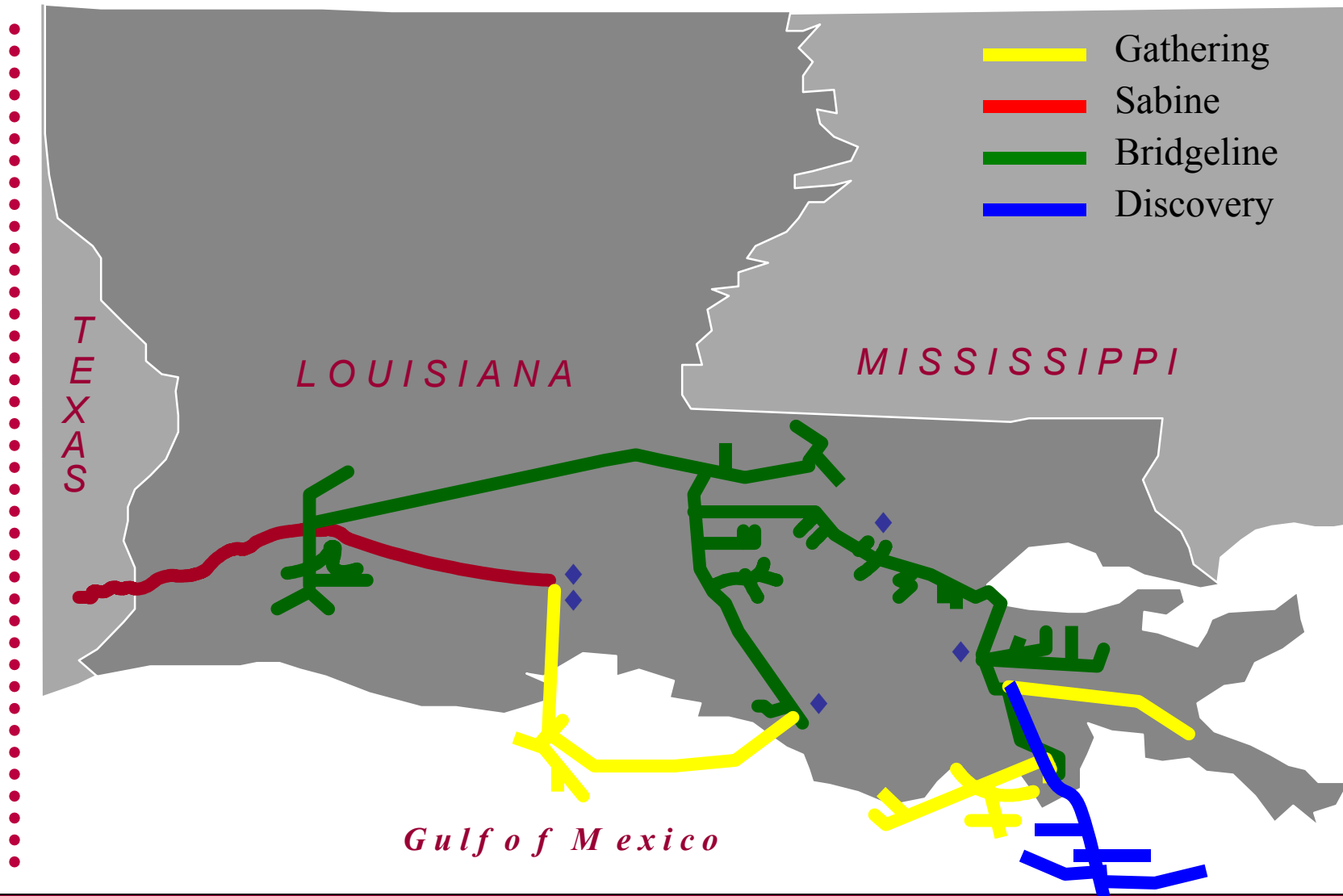
SCADA96 User Interfaces

- RtapSchematX, RtapASDisplay – Detailed view of process and alarms mainly for operators
- CPU PlotServer – Realtime/archive trends for operation and maintenance
- Web browsers
 - Gas dispatchers – data history, meter run/station info
 - Technicians - communication status, RTAP and PI database browsers
 - Users – Configurable reports, schematic snapshots, history

The Discovery System Addition

- For transportation of gas from offshore platforms
- Deployed in early 1999
- Tested design of system for expansion

Discovery



Discovery

- Added 21 Flow Automation Automate RTU's
 - New scan task
- Used same servers, but increased capabilities with additional processor and RAM
- Added new RTAP database
- Increased size of PI database

Discovery

Validated design of system

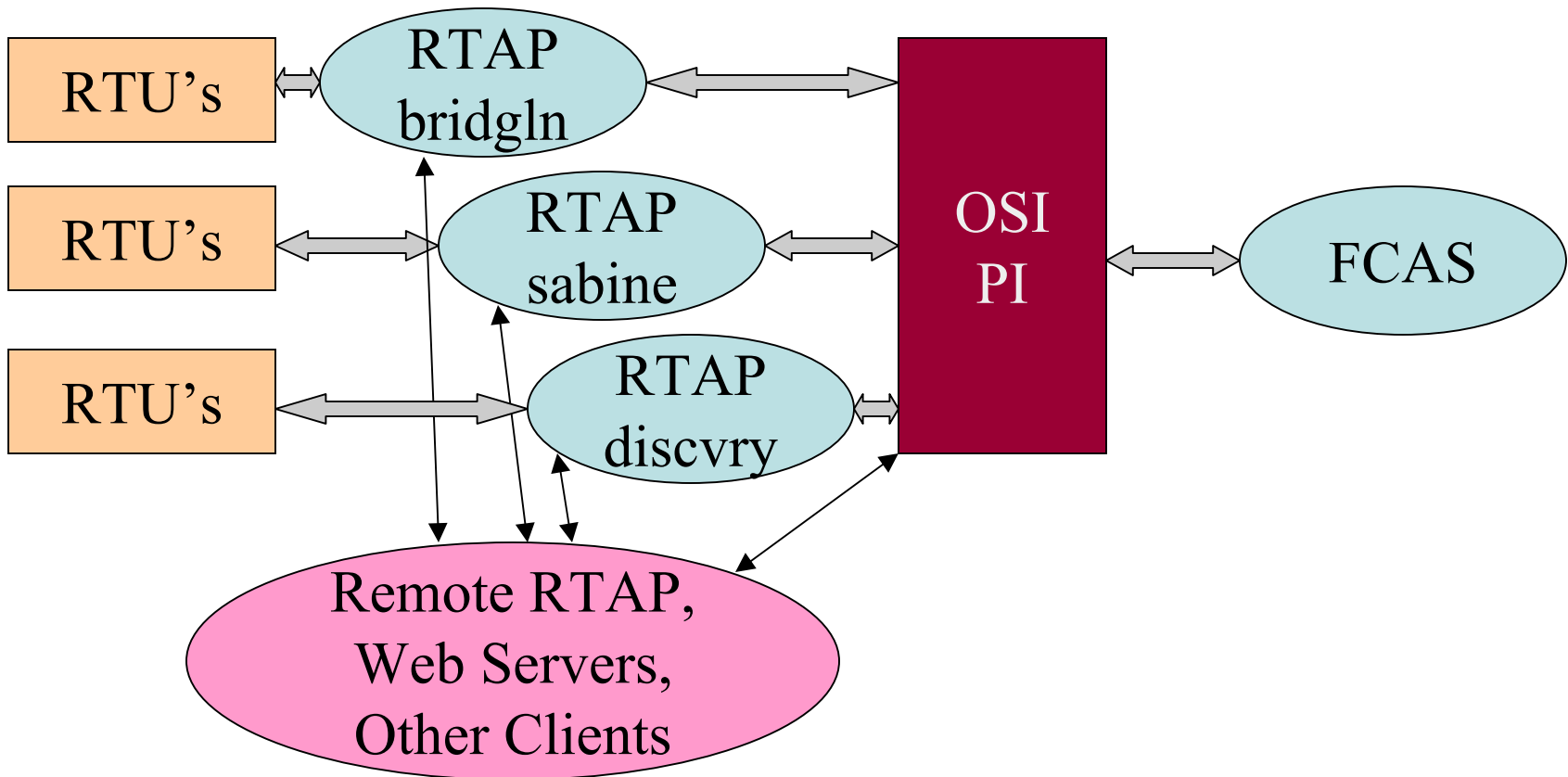
- No change in architecture
- No change in operation or maintenance
- No change in GUI or data presentation

Discovery

Challenges

- Flow Automation RTU scan task for dialout modems using once-per-day communications

SCADA96 Data Flow Overview



Preparations

- Upgrade to HP-UX 10.20
- Patches for OS
- Upgrade to Rtap 7.0
- Staged system complete with RTU's
 - Comprehensive test plan to exercise data movement from RTU to GUI

Y2K

Result of preparations

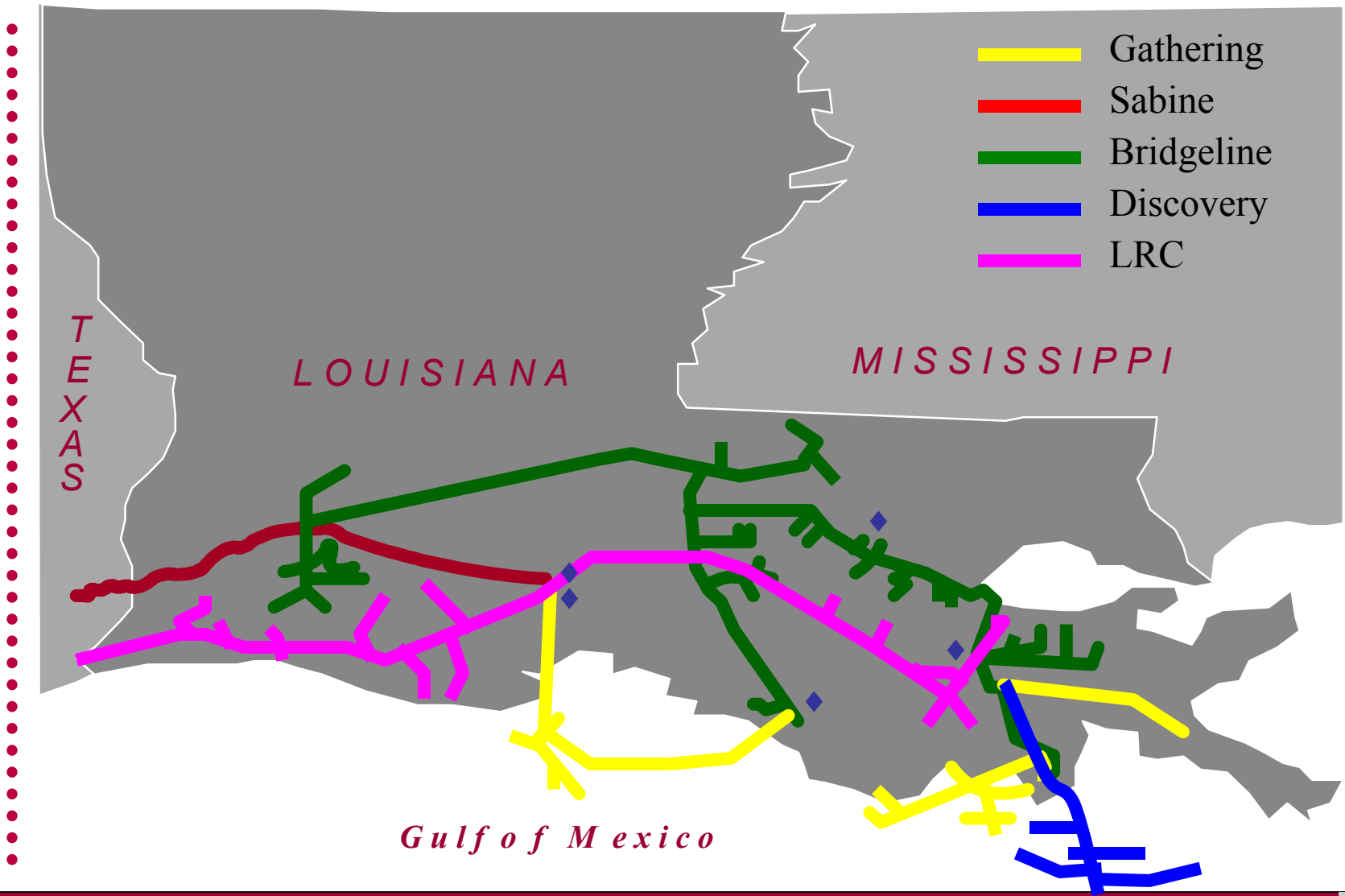
- A non-event

The LRC Addition

Louisiana Resources Pipeline Company Limited Partnership (LRC)

- Added 58 Bristol RTU's
- Same number of servers
- Incorporated into existing "bridgIn" RTAP database
- Current database sizes (93000+ scanned inputs)
 - bridgIn – 39000 points
 - sabine – 12500 points
 - discvry – 5000 points
- Increased size of PI database (total size now 50000+ tags)

LRC



LRC Challenges

- Additional scan task for Bristol RTU's
- Aggressive schedule for implementation
- Aggressive schedule for deployment
 - Purchased pipeline was operational, so switch to control and monitoring by SCADA96 had to be quick and efficient
- Project team consisted of personnel that were not involved in original SCADA96 deployment

LRC Results

- Implementation complete ahead of schedule
- Deployment success by programmatically generating database
- Payoff from object-oriented design and disciplined implementation of database

Additional Challenges

- Communication bottlenecks in LRC system
 - Numerous RTU's share single low-speed communication line
- Upgrade to HP-UX 11.0
- Upgrade to RTAP 8.0
- Eventual replacement of workstation hardware

Summary

- SCADA96 has increased in size by about 70% since deployment
- Original design goals not compromised by growth
- Daily maintenance still handled by Texaco
- Still room to grow