

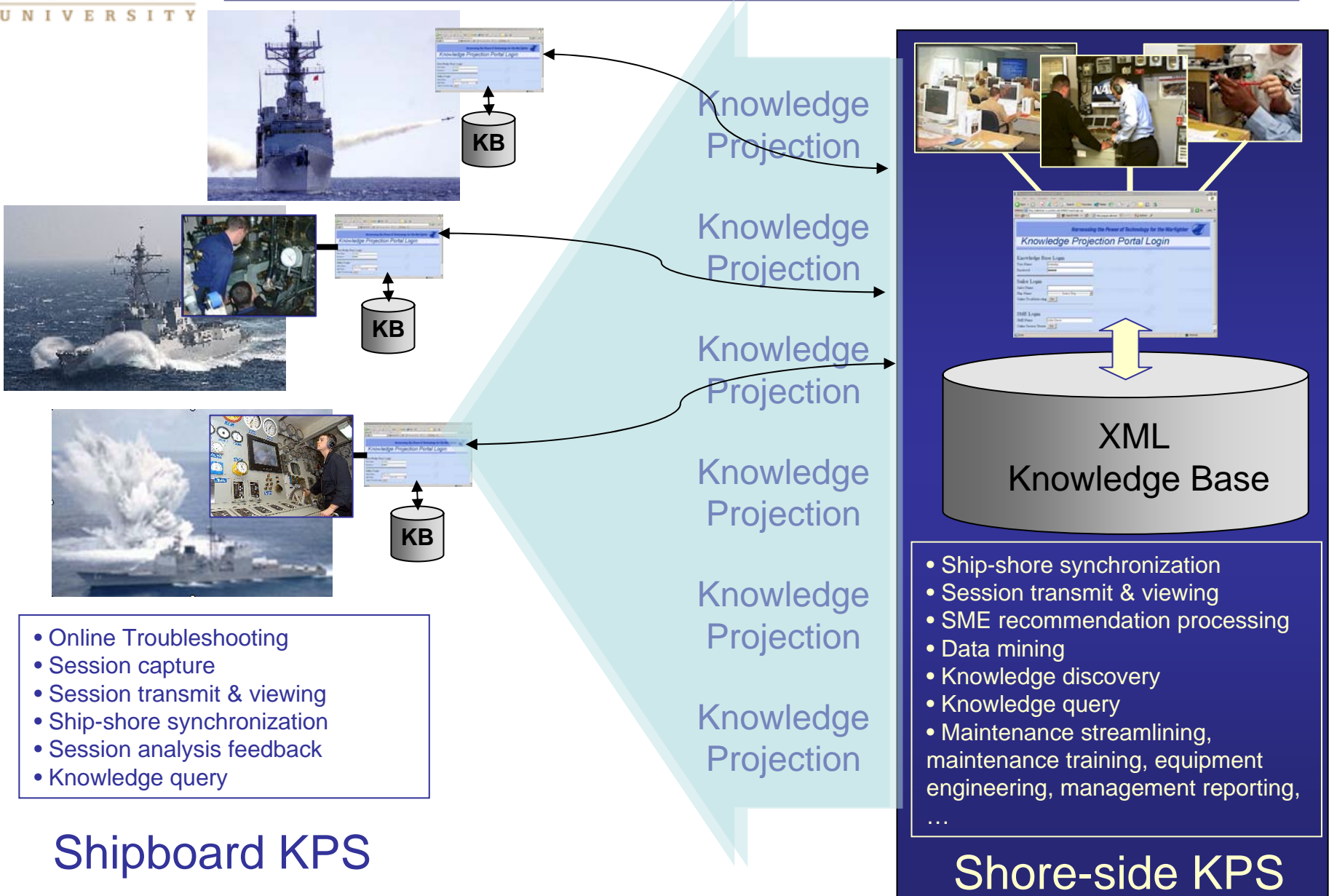


Troubleshoot Online

The Knowledge Projection System

Ann Christine Catlin

The Knowledge Projection System



KPS Supporting Technologies

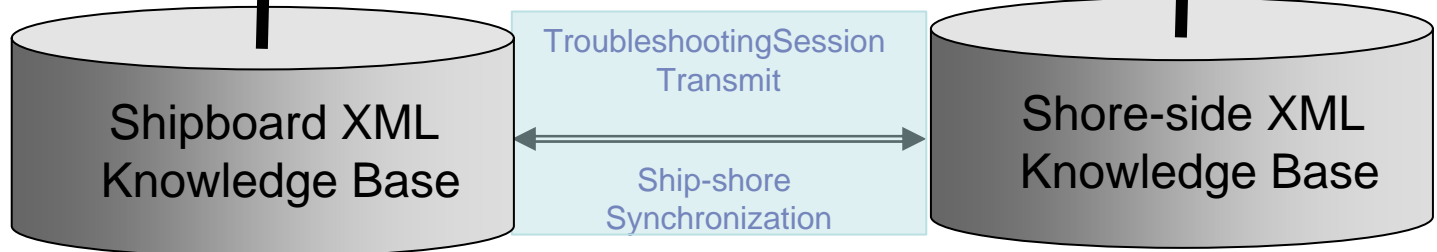
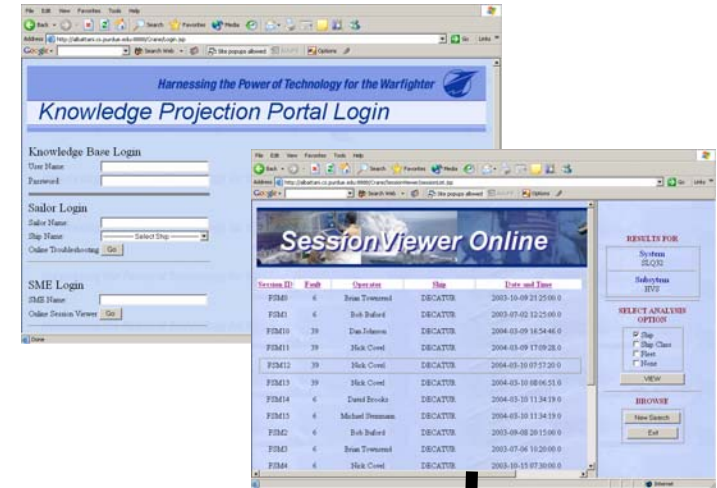
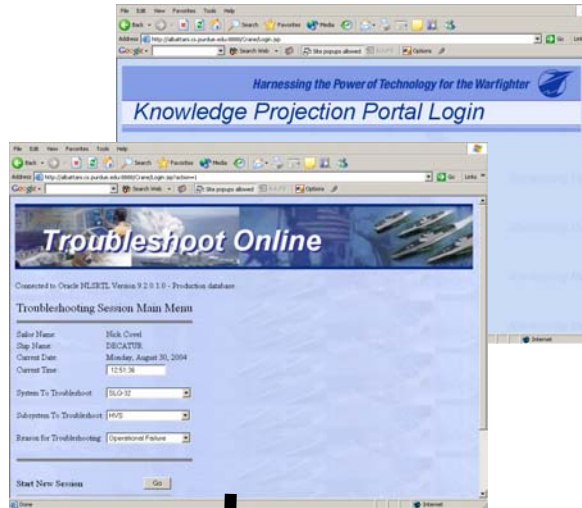
Oracle 9i
J2EE
oc4j

JSP
Applet
Java v1.4.1

JDBC

Oracle 9i

XML/XSL
Relational
Tables
&
Java v1.4.1
PL/SQL



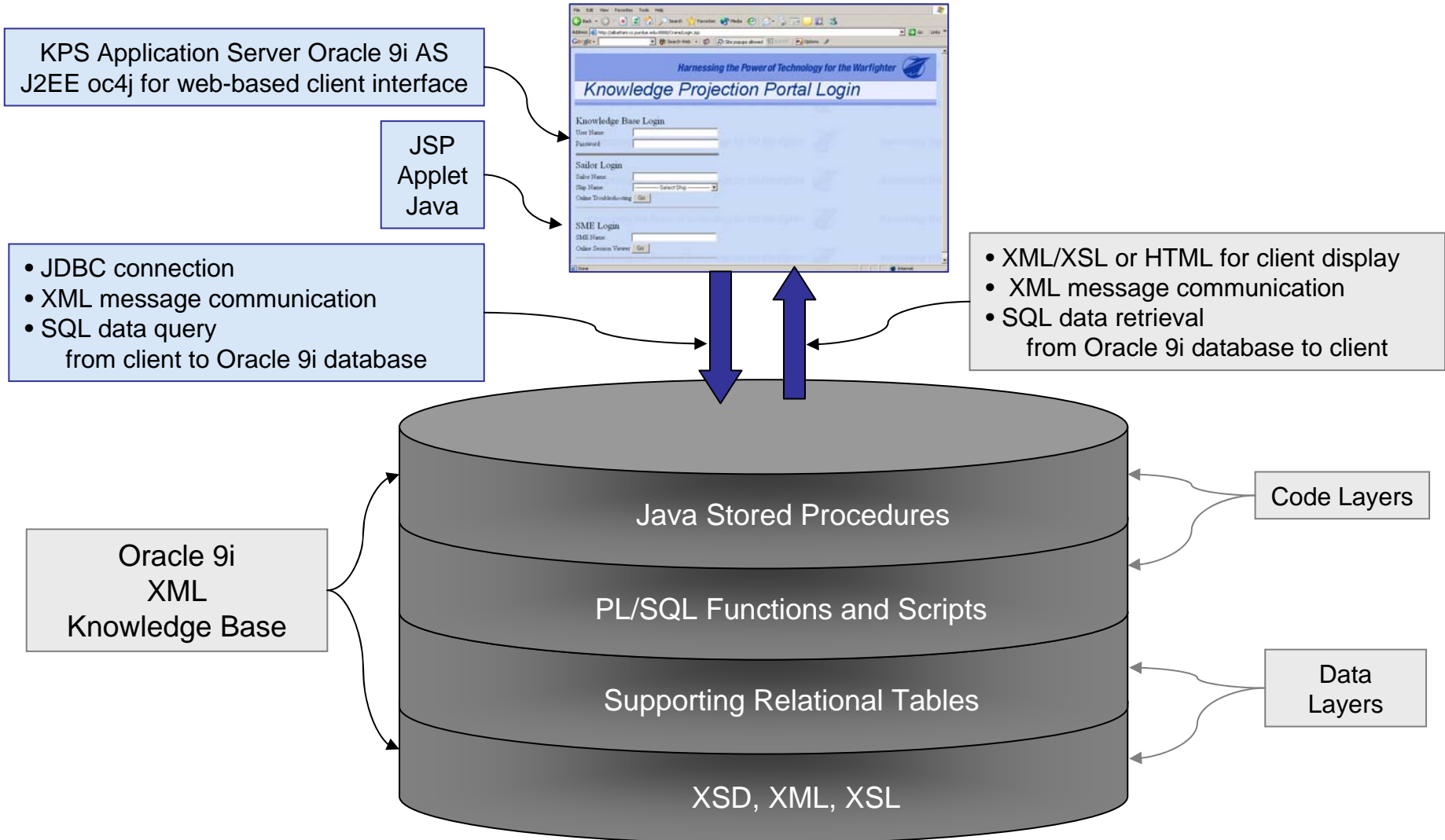
- Online Troubleshooting
- Fault Session capture
- Fault Session viewing
- Fault Session analysis feedback
- Session transmit
- SME recommendation processing
- Knowledge query

Shipboard KPS

- Fault Session viewing
- Fault Session analysis & mining
- Session transmit
- Knowledge query
- Maintenance streamlining, maintenance training, equipment engineering, management reporting ...

Shore-side KPS

KPS Infrastructure: Data & Code



KPS Infrastructure: Components

Client Component

KPS Portal



KPS Troubleshooting



KPS Fault Session Viewing, Mining, Feedback



Knowledge Base Component

**THE
FOCUS
IS ON THE
FAULT SESSION
!!**

Maintenance
Procedure
Processing

XML Scenario
XML smartTable
XML smartImage
XML Document
XML Link
Relational Tables

Fault Session
Capture

XML FaultSession
Relational Tables

Fault Session
Mining

Fault Session
Transform

XML FaultSession
Relational Tables

Fault Session
Viewing

Shipboard Online Troubleshooting

How does Purdue's KPS FY04 support
Online Troubleshooting?

- XML representations for troubleshooting procedures (Scenarios)
- XML representations for troubleshooting data (smartTables)
- Java code for procedure processing (ScenarioProcessor)
- Relational tables to support troubleshooting processing
- Web-based troubleshooting interface (web client)
- Client-database XML-based communication and routing



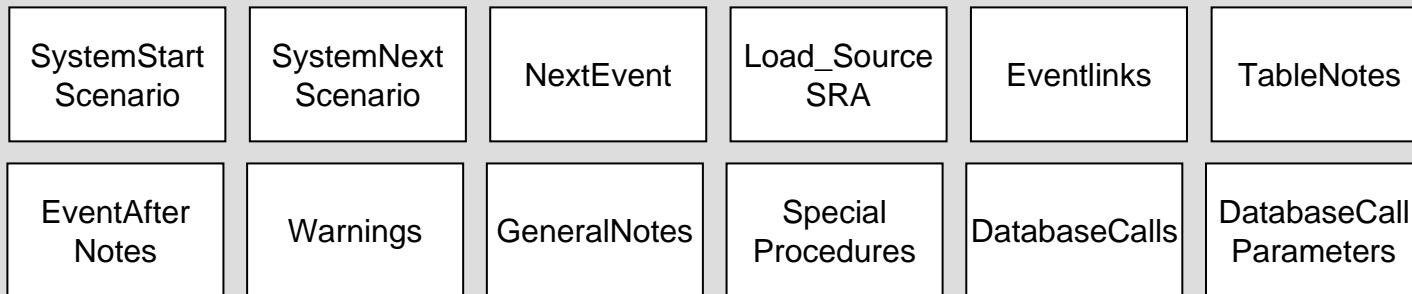
Shipboard Online Troubleshooting

How does Purdue's KPS FY04 support
Online Troubleshooting?

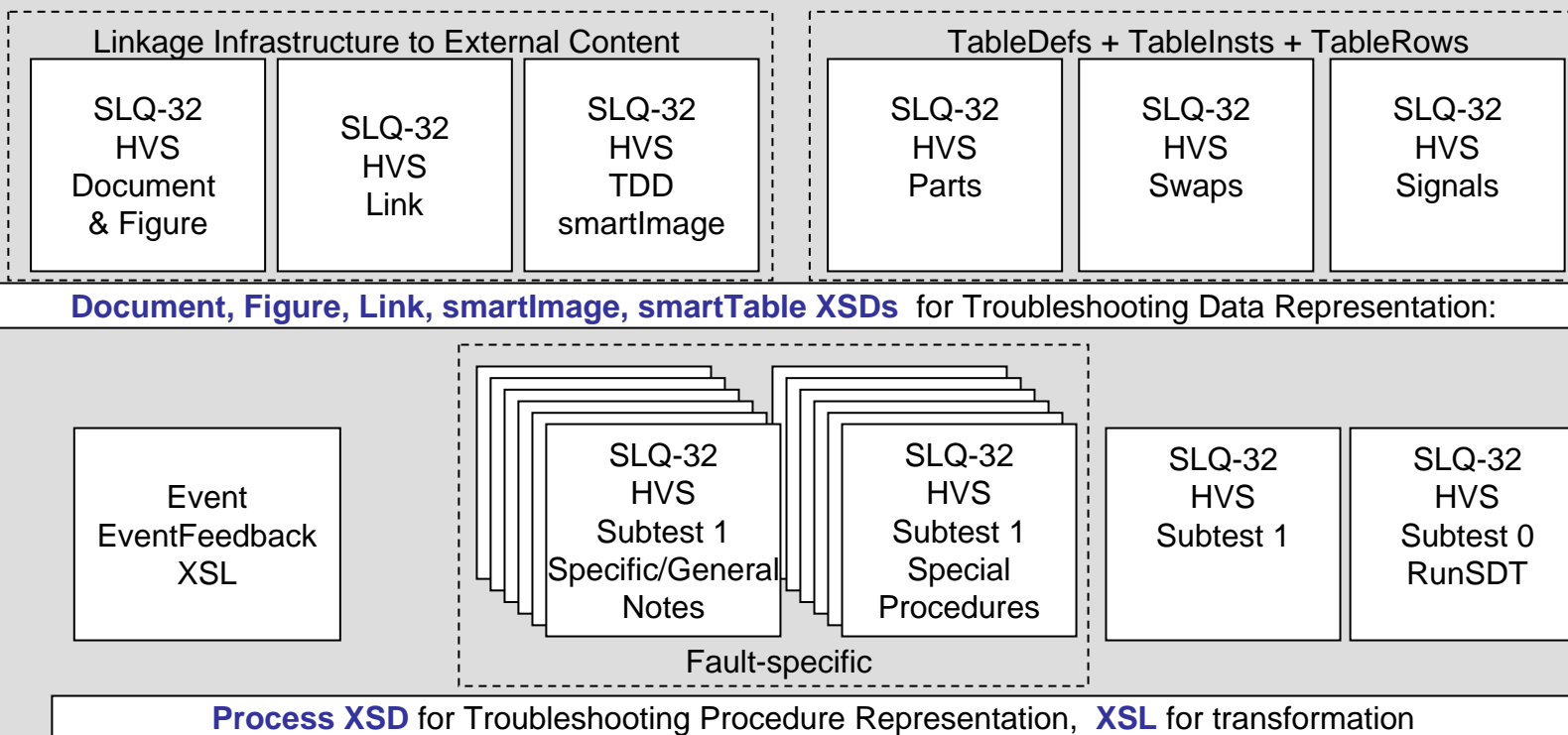
- Action-based scenario processing for step-by-step guidance
- XSL transformations of XML for web-based display
- Action-based resource access (XML Document, smartImage, Link)
- Automatic session capture
- XML representations for captured sessions
- Action-based resource capture

Troubleshooting Infrastructure - 1

12 SUPPORT
RELATIONAL
TABLES



7 SCHEMAS
More Than 200 XML Instances



Troubleshooting

Web Client Interface & Communication

Login.jsp Maintainer.jsp request.jsp

StoredProcedure Call.java CraneQuery.java Chart

1 Java Stored Procedure

ParseProces

24 PL/SQL Functions

Check Interchangeable SRU Check Interchangeable SRA

GetLoadSRA GetNextEvent GetNextNo

```

M:\Crane\project\web-app\WEB-INF\classes\parameter.xml - Micros...
File Edit View Favorites Tools Help
Back Forward Stop Home Search Favorites Media
Address M:\Crane\project\web-app\WEB-INF\classes\parameter.xml Go Links
Google Search Web 455 blocked

- <Parameters>
  <SystemID />
  <SubSystemID />
  <User />
  <OperatorID />
  <ShipID />
  <Reason />
  <Date />
  <Time />
  <ElapsedTime />
  <ScenarioType>Codified</ScenarioType>
  <MainScenario />
  <ScenarioID />
  <Event />
  <EventName />
  <EventType />
  <NextScenarioID />
  <NextEvent />
  <NextNOScenarioID />
  <NextNOEvent />
  <FaultNo />
  <CaptureFaultSession>N</CaptureFaultSession>
  <Comment />
  <Question />
  <Answer />
  <Links />
  <SessionParameters />
  <SessionID />
  <LastAction />
  <InterchangeableSRUrow>1</InterchangeableSRUrow>
  <InterchangeableSRArow>1</InterchangeableSRArow>
  <SpecialProceduresRow>1</SpecialProceduresRow>
  <SignalRow>1</SignalRow>
  <LoadSRArow>1</LoadSRArow>
  <Skipped>false</Skipped>
  <FaultStream />
  <TSSid />
  <TSSop />
</Parameters>
Done Internet
  
```

1 Java Stored Procedure

4 PL/SQL Functions

1 SCHEMA
15 Sample XML Instances

creat

eSession

Q-32
VS
test 1
mple
sessions

```

File Edit View Favorites Tools Help
Back Forward Stop Home Search Favorites Media AutoFill Options
Address M:\CapturedSession.xml
Google Search Web 455 blocked AutoFill Options

<?xml version="1.0" encoding="ISO-8859-1" ?>
- <FaultSession ID="FS102">
  <SystemID>SLQ32</SystemID>
  <SubSystemID>HVS</SubSystemID>
  <FaultNo>6</FaultNo>
  <Type>Automatic</Type>
  <Reason>Weekly Maintenance</Reason>
  <ScenarioID>S1</ScenarioID>
  - <Operator>
    <ID>EW1</ID>
    <Name>Brian Townsend</Name>
  </Operator>
  <ShipID>DECATUR</ShipID>
  - <Actions>
    - <Action No="1">
      - <Event>
        <ScenarioID>S1</ScenarioID>
        <EventID>E2</EventID>
        <EventName>Look Up Fault</EventName>
        <Skipped>>false</Skipped>
      </Event>
      - <OccuredAt>
        <Date>2003-07-06</Date>
        <Time>10:20:00</Time>
      </OccuredAt>
      <Parameters />
      <Links />
      <ElapsedTime>20</ElapsedTime>
      <Comment />
    </Action>
    - <Action No="2">
      - <Event>
        <ScenarioID>S1</ScenarioID>
        <EventID>E8</EventID>
        <EventName>Swap 3A5A2 and 3A5A14</EventName>
        <Skipped>>false</Skipped>
      </Event>
      - <OccuredAt>
        <Date>2003-07-06</Date>
        <Time>10:40:00</Time>
      </OccuredAt>
      - <Parameters>
        - <Parameter>
          <Type>Function</Type>
          <Name>DisplayInterchangeablesRA</Name>
          <Value>Swap 3A5A2 and 3A5A14</Value>
          <ValueType />
        </Parameter>
      </Parameters>
    </Action>
  </Actions>
</FaultSession>

```

FaultSes

Discussions Discussions not available for this document

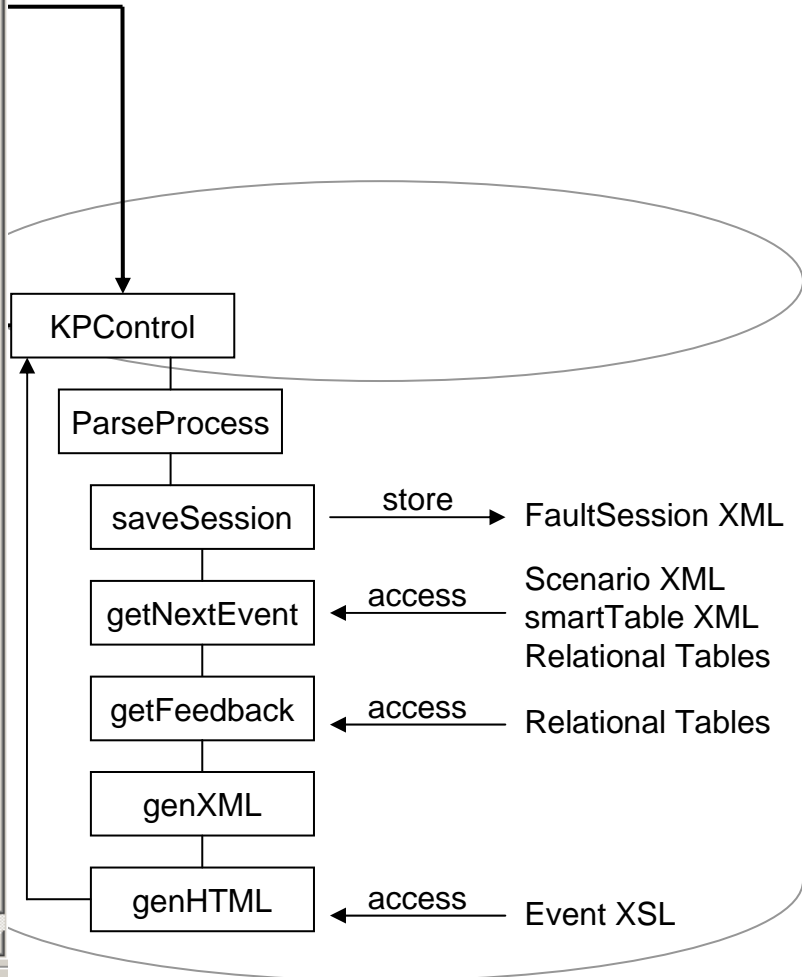
Done

Internet

Data Flow

```
File Edit View Favorites Tools Help
Address M:\parameter1.xml
Google Search Web 455 blocked

- <Parameters>
  <SystemID>SLQ32</SystemID>
  <SubSystemID>HVS</SubSystemID>
  <User>cranekp</User>
  <OperatorID>Nick Covel</OperatorID>
  <ShipID>DECATUR</ShipID>
  <Reason>PMS Weekly SDTs</Reason>
  <Date>2004-9-8</Date>
  <Time>13:10:02</Time>
  <ElapsedTime>513.59 seconds</ElapsedTime>
  <ScenarioType>Codified</ScenarioType>
  <MainScenario />
  <ScenarioID>S0</ScenarioID>
  <Event>E1</Event>
  <EventName>Run SDT</EventName>
  <EventType>Action</EventType>
  <NextScenarioID>S0</NextScenarioID>
  <NextEvent>E2</NextEvent>
  <NextNOScenarioID />
  <NextNOEvent />
  <FaultNo />
  <CaptureFaultSession>N</CaptureFaultSession>
  <Comment />
  <Question>null</Question>
  <Answer />
  <Links />
  <SessionParameters />
  <SessionID>FS254</SessionID>
  <LastAction />
  <InterchangeableSRURow>1</InterchangeableSRURow>
  <InterchangeableSRARow>1</InterchangeableSRARow>
  <SpecialProceduresRow>1</SpecialProceduresRow>
  <SignalRow>1</SignalRow>
  <LoadSRARow>1</LoadSRARow>
  <Skipped>>false</Skipped>
  <FaultStream />
  <TSSid>TSS9</TSSid>
  <TSSop>Start</TSSop>
</Parameters>
```



Ship/Shore Fault Session Activity

How does Purdue's KPS FY04 support captured Fault Session viewing and analysis?

- XML representations for captured fault sessions (FaultSession)
- Web-based session viewer interface (web client)
- Web-based fault session browsing and selection
- XSL transformation for fault session viewing (SessionViewer XSL)
- JSP interface for fault session action analysis data



Ship/Shore Fault Session Activity

How does Purdue's KPS FY04 support captured Fault Session viewing and analysis?

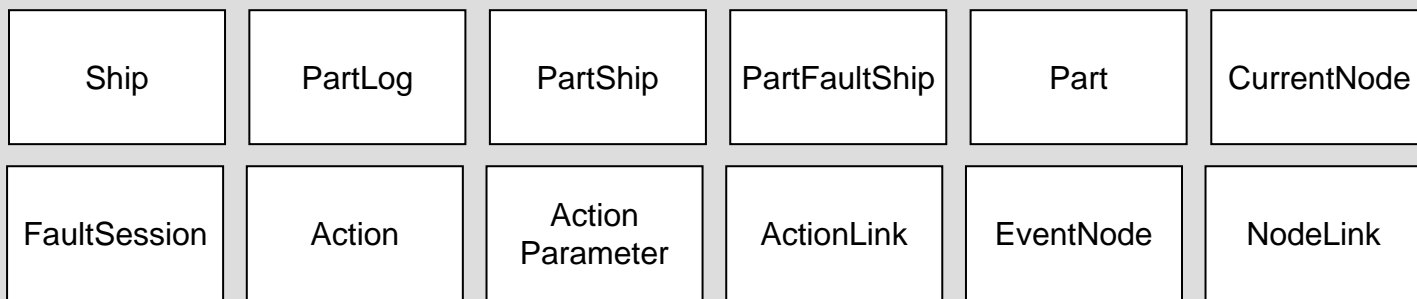
- Relational tables for optimal session mining representation
- XSL transformations for fault session mining preparation
- Ship asset representation
- Ship-Fault-Action based analysis and aggregation
- Action-based troubleshooting feedback
- Action-based session viewer feedback by Ship, Ship Class and Fleet
- Mining includes action statistics, diagnostic sequence analysis, action trigger analysis, part replacement analysis, part-fault history analysis

Fault Session Infrastructure - 1

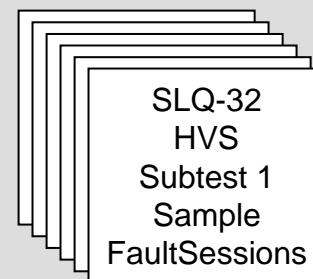
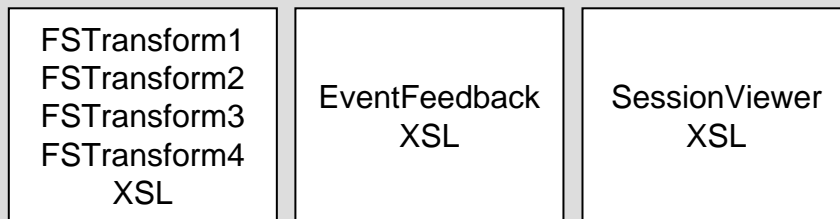
4 Java
Stored
Procedures

Miner.java getSession.java
FStranform.java mergeSession.java

12 SUPPORT
RELATIONAL
TABLES



1 SCHEMA
15 Sample XML
Instances



FaultSession XSD for Captured Fault Session Representation, **XSL** for transformation

Fault Session Infrastructure - 2

Web Client
Interface &
Communication

SessionViewer.jsp

sessionList.jsp

sessionView.jsp

sessions.jsp

navigate.jsp

StoredProcedure
Call.java

CraneQuery.java

1 Java
Program

SessionGenerator.java

Scenario
Session

Event
Node

Probability
Compiler

allPossiblePaths

Fault
Session
Support

transform

analyze
analyzeEvent

updateAll

retrieve

merge

Session Viewer - Microsoft Internet Explorer

Address: http://albattani.cs.purdue.edu:8888/Crane/SessionViewer/Viewer.jsp?ID=F5M3&Type=0010

SME FAULT SESSION REPORT

Ship: DECATUR **Operator:** Brian Townsend **Date:** 2003-07-06
System: SLQ32 **SubSystem:** HVS **Fault:** 6
Start Time: 10:20:00 **Total Time:** 110 min.
Reason: Weekly Maintenance
Observations: ---

Action : 1

Action:	<u>Look Up Fault</u>
Observations:	---
Date:	2003-07-06
Start Time:	10:20:00
Total Time:	20 min

Action : 2

Action:	<u>Swap 3A5A2 and 3A5A14</u>
Observations:	---
Date:	2003-07-06
Start Time:	10:40:00
Total Time:	5 min

General Parts History [Top](#)

Part SRA	Last Accessed	Last Replaced	Count Replaced	Average Lifetime	Replaced Frequency
3A5A2	Sep 8, 2004 at 02:14:44 EST	Sep 3, 2004 at 01:10:29 EST	3	93.0	16.7%
3A5A9	Sep 8, 2004 at 01:20:43 EST	Sep 8, 2004 at 01:20:43 EST	3	2.5	16.7%
3A5A10	Sep 8, 2004 at 01:19:44 EST	Sep 3, 2004 at 01:15:33 EST	3	180.0	16.7%
3A5A11	Mar 10, 2004 at 11:40:39 EST	Mar 10, 2004 at 11:40:39 EST	2	0.0	11.1%

1
↓
2
↓
3

Number fault

a

KNOWLEDGE PROJECTION ACTION 1

Ship

[Action History](#)

[Fault History](#)

[Diagnosis History](#)

[General Parts History](#)

[Fault Parts History](#)

Close

BROWSE

New Session

New Search

Exit

Discussions not available on http://albattani.cs.purdue.edu:8888/

Applet Chart started

Internet

Sh
Troubles

Shore-side
SMEs
Data
Mining

Shi
Action-
Fee

Sa
engineer
designer, r
K
I

Purdue KPS FY04 BAA Proposal

Tasking	Deliverables Specification	Deliverables
<p>Task 1 High Performance Knowledge Base</p>	<p>Knowledge Base Infrastructure</p> <p>Design and implementation of entire data layer (xsd, xml, xsl, supporting relational tables, script) and knowledge base modules for troubleshooting and fault session capture. Design and implementation of client, server, communication components following a 3-tiered architecture.</p>	<p>KPS Infrastructure code successfully installed on the Crane Testbed August 27, 2004</p> <p>System documentation Power point presentations</p>
	<p>Extraction of Shipboard System from Shore System</p> <p>Design of component for synchronization of shipboard and shore-side KP systems</p>	<p>Design documentation Power point presentation</p>
	<p>Impact Assessment of Windows Platform</p> <p>Port of Unix platform KPS to Windows platform. Assessment of SQL Server.</p>	<p>KPS code installed successfully on both Unix and Windows platforms</p> <p>SQL Server Lessons Learned documentation.</p>
	<p>Dynamic Maintenance Infrastructure</p> <p>Now known as online troubleshooting. Data, metadata, support data and component code for 4 SLQ-32 HVS faults. Encompasses xml, xsl, database java code and GUI client code. Includes sailor interaction window, flowchart and knowledge data feedback GUI.</p>	<p>Online Troubleshooting Infrastructure code successfully installed on the Crane Testbed August 27, 2004. Delivered system supports more than 4 faults.</p> <p>System documentation</p>

Purdue KPS FY04 BAA Proposal

Tasking	Deliverables Specification	Deliverables
Task 2 Data Mining	3M Database Analysis and Mining Covers analysis and mining of the 3M database data, including its use in analysis and mining within KPS.	Power point presentations
	Synthetic Session Generator Design and implementation of a session generator that build a KB layer for testing and validating the data mining.	Session Generator code successfully installed on the Crane Testbed August 27, 2004 Power point presentation
	Infrastructure for offline Fault-Session Mining Design and implementation of the underlying infrastructure to support analysis and mining of actions and fault-sessions. Includes data layer (xml, xsl, supporting data, scripts) and code for client and server to support capture, transformation, analysis, processing and feedback.	Fault Session Mining Infrastructure code successfully installed on the Crane Testbed August 27, 2004 System documentation Power point presentations
	Session and data mining Viewers and GUIs Design and implementation of web-based viewers and other graphical interfaces for the data mining component. This includes session viewers and mined data viewer.	SessionViewer code successfully installed on the Crane Testbed August 27, 2004
	Infrastructure for Offline Session-stream Mining Now known as Troubleshooting Session. Design of the underlying infrastructure to the analysis and mining of the troubleshooting session.	Design documentation This task has been modified. It now requires design for KPS support of Sailor-SME queueing/ transmission/ processing/ viewing rather than mining.



Purdue KPS FY04 BAA Proposal

Tasking	Deliverables Specification	Deliverables
Task 3 Query Processing and Knowledge Retrieval	Query Processing Infrastructure Design of the underlying infrastructure to support the query, search and retrieval of data from the Knowledge Base.	SessionViewer with Knowledge Projection viewing code successfully installed on the Crane Testbed August 27, 2004 Online Troubleshooting with Knowledge Projection feedback code successfully installed on the Crane Testbed August 27, 2004 Online Troubleshooting with linkage infrastructure code to access external technical content successfully installed on the Crane Testbed August 27, 2004

Purdue KPS FY04 Documents

Document	Date	Type
Session Generator	02.15.2004	PowerPoint
KPS Architecture	02.03.2004	PowerPoint
Fault Session Mining	03.20.2004	PowerPoint
3M Text Mining	05.19.2004	PowerPoint
KPS Functional	02.03.2004	PowerPoint
Ship Shore Synchronization	06.24.2004	PowerPoint
Lessons Learned SQL Server	01.05.2004	WORD
FY04 Purdue KPS Fault Coverage	08.30.2004	WORD
KPS External Content Linkage	06.30.2004	WORD
KPS Technical Content	06.30.2004	WORD
TSS Pre-Design Document	08.05.2004	WORD
TSS Event Block Design Document	08.05.2004	PDF
Purdue KPS 2004	09.10.2004	PowerPoint
Purdue KPS Troubleshooting	09.10.2004	PowerPoint
Purdue KPS Fault Session Mining	09.10.2004	PowerPoint
The Knowledge Projection Vision	09.10.2004	PowerPoint

FY04 Baseline Document Schedule

Document	Date	Type
KPS Installation Guide <i>Unix and Windows Platforms</i>	10.08.2004	WORD
KPS Requirements Specification Update	10.08.2004	WORD
KPS Design Specification Update <i>Database Design, Component Design and Data Flow Specification for the FY04 KPS</i>	10.08.2004	WORD
KPS Functional Specification Update	10.15.2004	WORD
KPS System Architecture	10.29.2004	WORD PowerPoint

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Thanaa Ghanem
Ammar Massar
Ercan Mehmet Mnergiz
Omar Alrawi
Javed Siddique
Yicheng Tu
Yuni Xia

Questions ... with Answers

- Purdue's FY04 BAA promised to deliver 4 SLQ-32 HVS faults. How many faults does KPS Online Troubleshooting support?
- A major change in the functionality, structure and goals for the KPS "troubleshooting session" was made at the end of FY04.
 - Identify the impact of this change to the KPS design deliverable.
 - Describe the impact of this change on the existing infrastructure for FaultSession capture, viewing, analysis and processing.
 - Can Purdue present a design for the "troubleshooting session" as it is now defined?
- Any other questions?