

SDGE PI Implementation



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San Diego Gas & Electric

PI T&D Users Group Meeting

September 17-18, 2003

Sempra Energy

- Sempra Energy (a Fortune 500 company, over 12,000 employees)
 - San Diego Gas & Electric Co. (SDG&E)
 - Southern California Gas Co. (SoCalGas)
 - Sempra Energy Financial
 - Sempra Energy Int'l
 - Sempra Energy Resources
 - Sempra Energy Trading



Sempra Energy
headquarters
San Diego, CA

SDGE & Power System

- 1.3 Million Customers (3 million population)
- 4,100 sq. mile service territory
- 3,960 MW System Peak Load (8/31/98)
- 120 Transmission RTUs (69kV, 138kV, 230kV and 500kV)
- 700 Distribution RTUs (12kV)
- Electric Transmission Division
 - Grid Operations Department
 - **GE Network Solutions XA21 EMS**
- Distribution Operations Division
 - Electric Distribution Operations Department
 - **Advanced Control Systems PRISM SCADA**
 - Electric Distribution Services Department

PI Project Background

- Enhancing EMS real-time monitoring displays (advanced graphical representation, dynamic and effortless display building, ...etc.)
- Improving/replacing EMS data collection and in-house developed historical data warehouse which has
 - 1-hour/30-minute collection frequency for most analogs
 - 2-second for only 500KV analogs
 - No digital/status collections
 - Tabular displays only, ...etc.
- A joint project of combined effort from
 - Electric Transmission (30%)
 - Distribution Operations (70%)

Accomplishment

- Started implementation in April/May 2003
- Created 50,000 tags: 10,000 for EMS and 40,000 for DMS
- Fine-tuned point attributes (i.e. exception/compression/zero/span, 200+ digital states for EMS, 400+ for DMS)
- Backfilled EMS historical data since 1995
- Backfilled DMS historical data since 2000
- Built Module Database for EMS & DMS
- Created ProcessBook and ActiveView displays
- Implemented PI-ODBC & PI-OLEDB and mounted PI server as a linked server on our existing SQL server
- Defined daily backup's for PI databases
- Built "IT Monitor" for EMS infrastructure data



A Sempra Energy utility

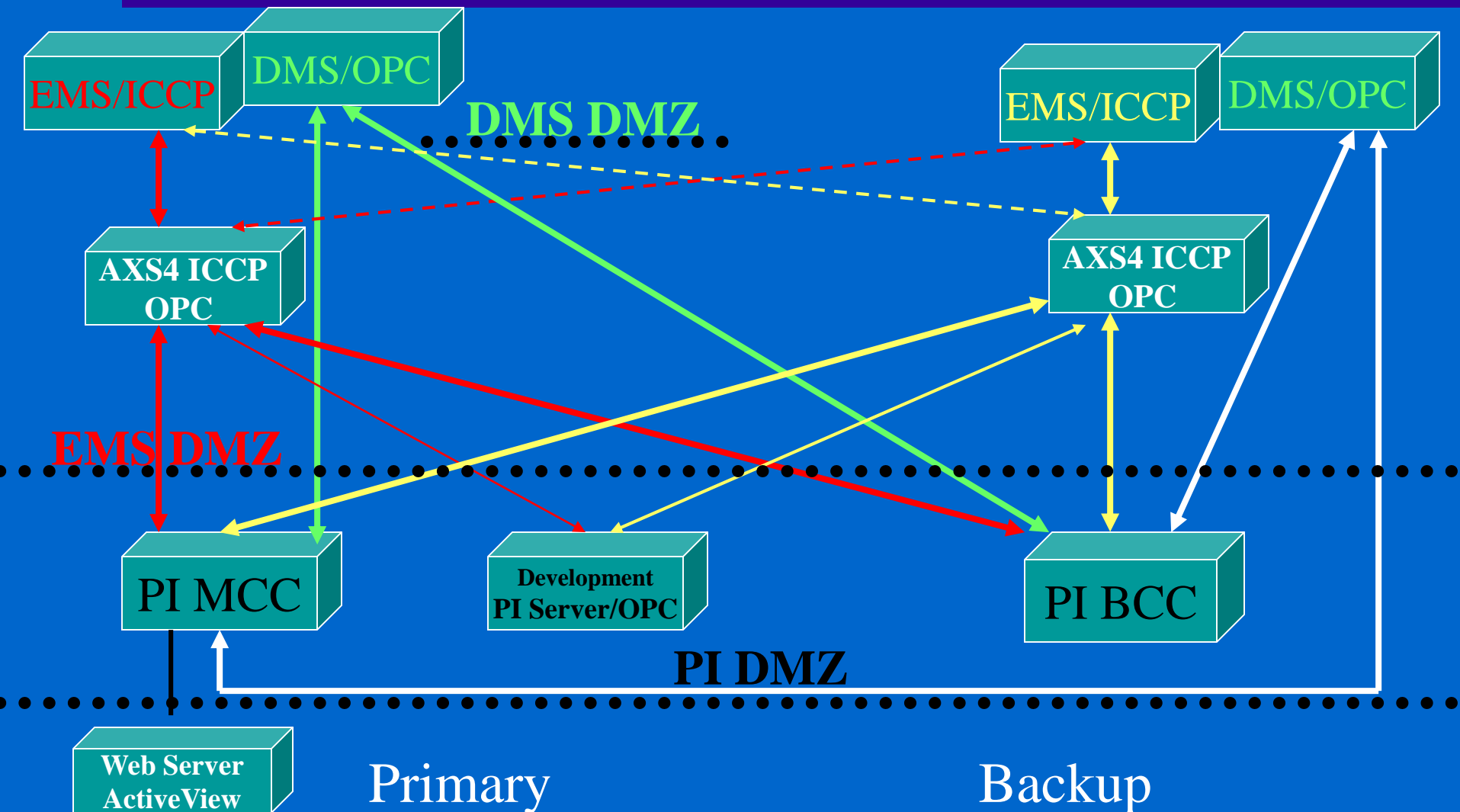
Configuration and Security

- Three PI platforms
 - Development PI server/OPC
 - Primary PI environment at the Primary Control Center
 - Redundant PI environment at the Backup Control Center
- Web Server for ActiveView and SQL server for PI-OLEDB
- EMS, DMS and PI servers are placed in different DMZs
- PI-Interfaces (OPC servers) are located in EMS/DMS DMZs
- SSL enabled web server and user authentication enforced
- ActiveX control digitally signed by Verisign
- Created PI users & groups with different access rights to view data and modify point attributes

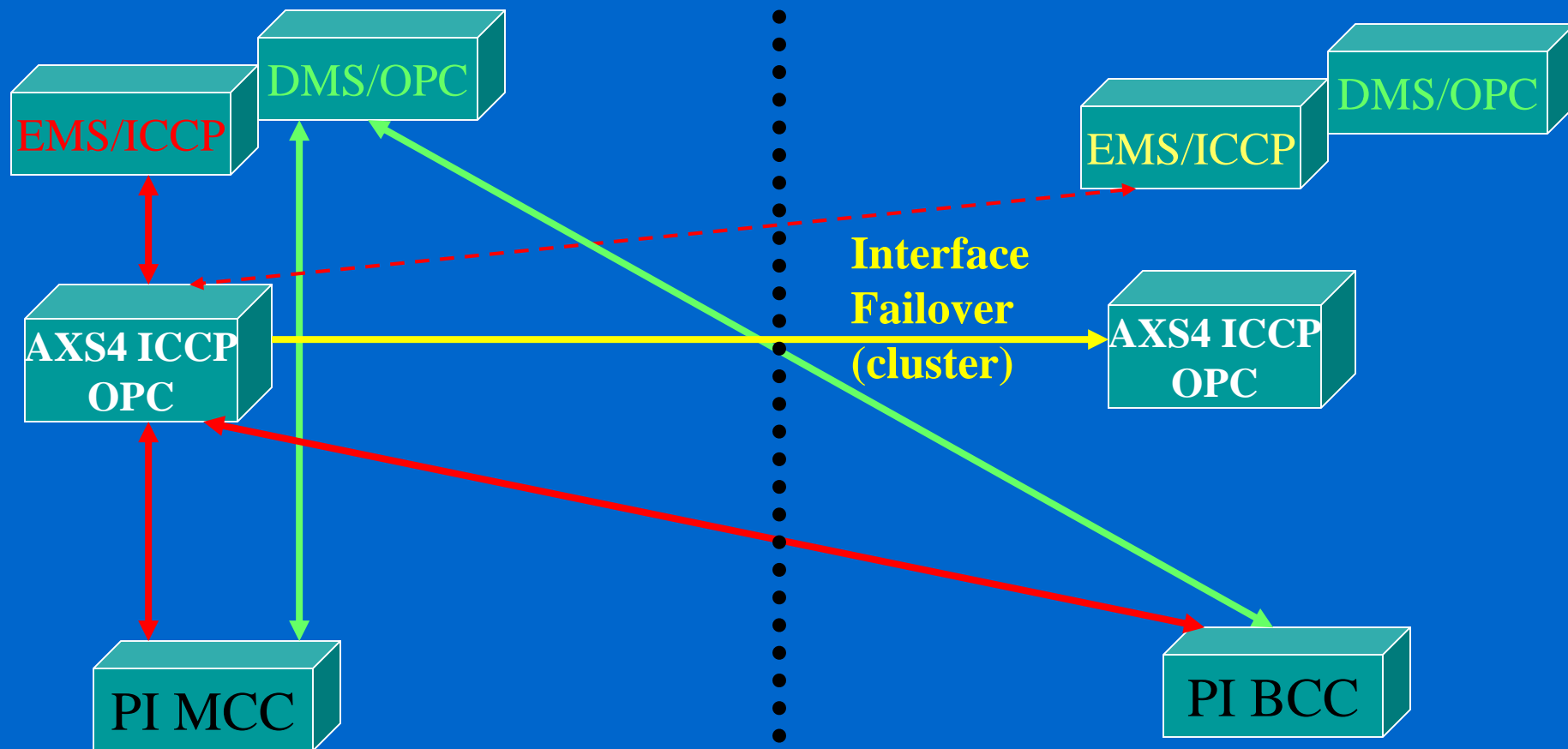


A Sempra Energy® utility

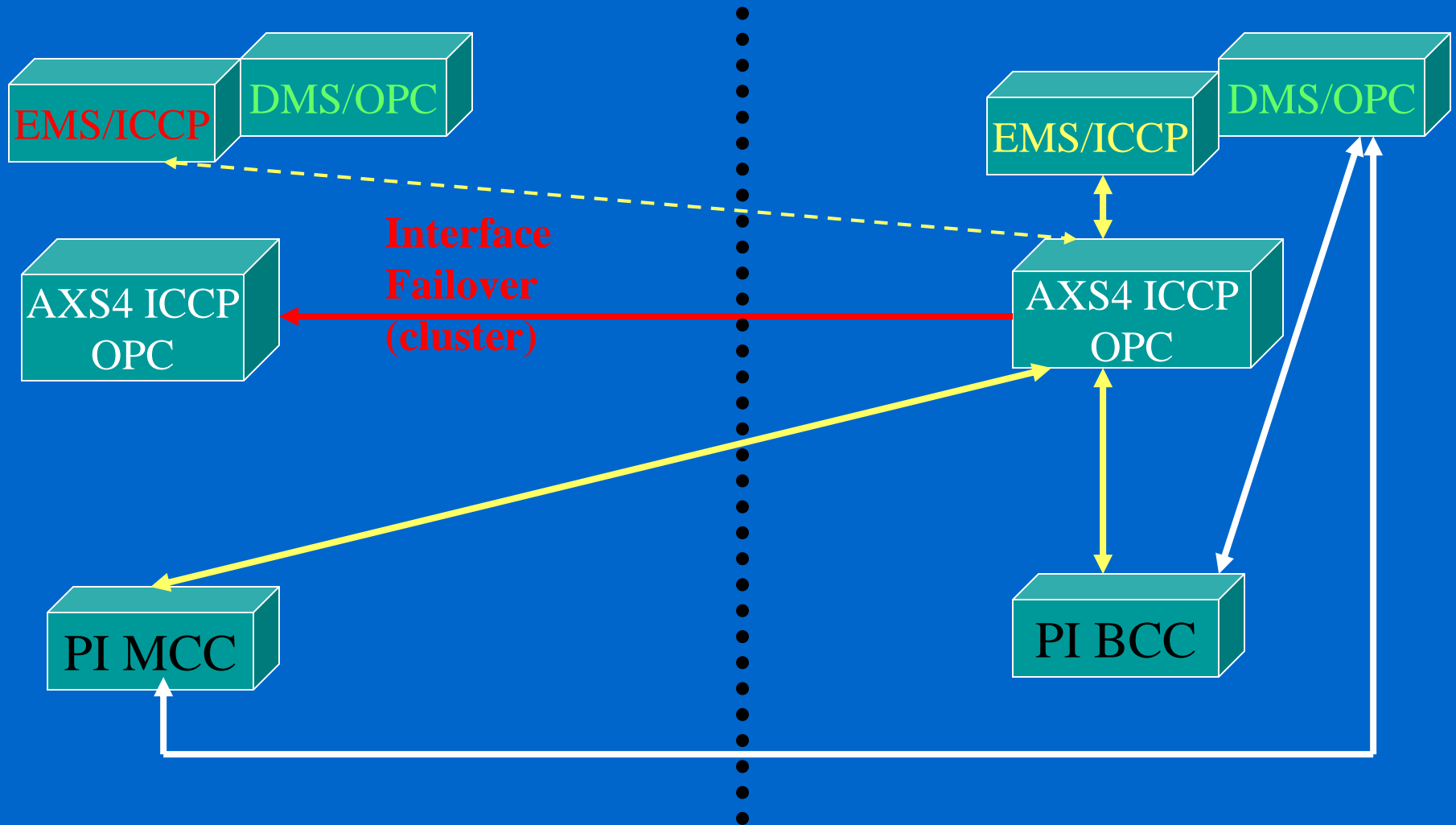
PI Architecture Overview



PI at Primary Control Center



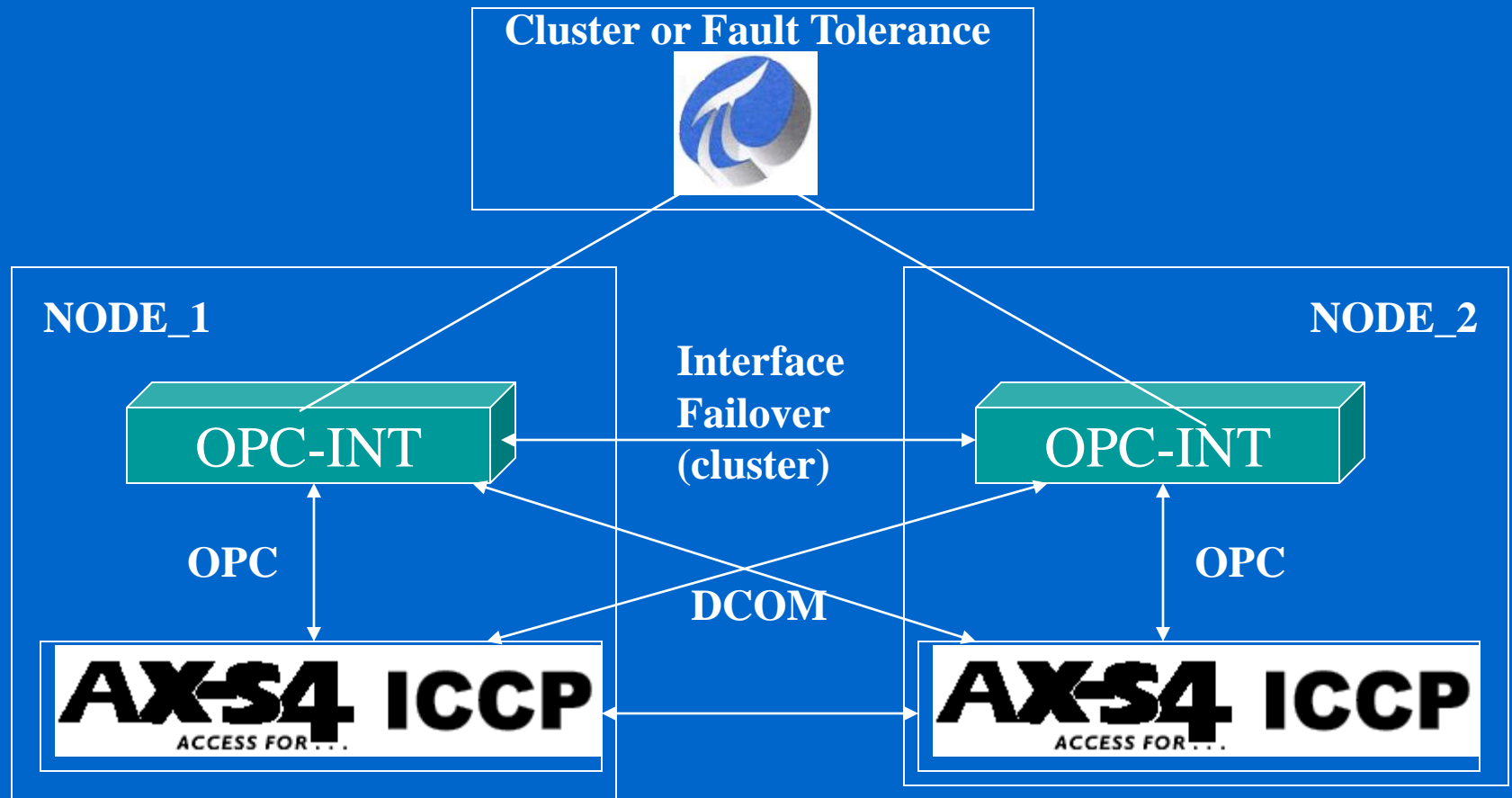
PI in Backup Control Center



SISCO AXS4 ICCP OPC Server

- Failover/redundant capability
- Bi-directional association (client & server): sending calculated data back to EMS
- Auto-Point-Sync capability with OPC
- Quality code and value can be mapped to single tag without creating separate quality tag (saving tags and \$\$\$)
 - ICCP quality mapped to OPC Quality
 - Capture of all ICCP Quality values requires a separate tag
- Option of utilizing EMS/DMS timestamp to store data on PI server (currently using NTP to source EMS T&F)
- Automatic creation/ICCP object synchronization
- User-Friendly GUI ICCP Configuration Utility

AXS4 Failover/Redundancy



PI Project Plans

- Phase I - 2003
 - Data warehouse for Transmission EMS and Distribution DMS
- 2004 and after
 - A potential component of Company T&D EDW- Engineering Data Warehouse for all time series data
 - Implement APS Auto-Point-Sync
 - Develop advanced applications using ACE (VB.net)
 - Develop applications for messaging and notification
 - Purchase and implement ICE?



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Module Database Creation Utility

PI Module Database Editor - Microsoft Internet Explorer provided by America Online

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Copy Paste

Address C:\Program Files\pipc\SMT\MDBEditor\MDBEditor.html Go Links AOL Anywhere

MW

Folder Items

- LC 138/69
- LI 69
- LJ 69
- LL 69
- LNL 138
- LP 69
- MAR 138
- ME 69
- MG 69
- MH 69
- MI 138/69
- ML 500
- ML230/138/69
 - ALARM-MISC
 - ANALOG
 - KV
 - MISC
 - MVAC
 - MVAR
 - MW
 - BREAKER
 - DISCONNECT
- MN 69
- MR 69
- MR GT
- MRM 69
- MS 138
- MS 230
- MS 69
- MSH 69
- MY 69
- NC 69
- NCM 138
- NCW 138

Sub-Modules PI Aliases PI Properties

PIAlias Name	Tag Name	Server	Snapshot Value	Snapshot Time
23021	T:ML230/138/69:23...	mccpi.sdge.com	323.2688	9/8/2003 3:20:52 PM
23022	T:ML230/138/69:23...	mccpi.sdge.com	398.706	9/8/2003 3:20:12 PM
621	T:ML230/138/69:62...	mccpi.sdge.com	54.4635	9/8/2003 3:20:42 PM
627	T:ML230/138/69:62...	mccpi.sdge.com	63.855	9/8/2003 3:20:01 PM
628B	T:ML230/138/69:62...	mccpi.sdge.com	42.84	9/8/2003 3:10:41 PM

frmMain

List Tags Server mccpi.sdge.com

Select All Create Trans Mods

Tag Mask T:ML*MW*

Tag	Module	Alias
<input checked="" type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	621
<input checked="" type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	627
<input checked="" type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	628B
<input checked="" type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	632C
<input type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	643
<input type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	6910
<input type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	BK60
<input type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	BK70
<input type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	BK71
<input type="checkbox"/> T:ML230/13...	Transmission\Substations\ML230/138/69\ANALOG\MW	BK80

Label1

0 Objects Type: PIModule Aliases: 12 Properties: 0 Effective Date: 12/31/1969 4:00:01 PM Query Date: 9/8/2003 3:20:46 PM Creator: piadmin ParentCount: 1

Done My Computer

Start PI - ProcessB... Microsoft Pow... PI Module Dat... frmMain 3:21 PM

Module Database Sample

PI Module Database Editor - Microsoft Internet Explorer provided by America Online

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Copy Paste

Address C:\Program Files\pipc\SMT\MDBEditor\MDBEditor.html Go Links AOL Anywhere

BREAKER

Folder Items

- LC 138/69
- LI 69
- LJ 69
- LL 69
- LNL 138
- LP 69
- MAR 138
- ME 69
- MG 69
- MH 69
- MI 138/69
- ML 500
- ML230/138/69
 - ALARM-MISC
 - ANALOG
 - BREAKER**
 - DISCONNECT
- MN 69
- MR 69
- MR GT
- MRM 69
- MS 138
- MS 230
- MS 69
- MSH 69
- MY 69
- NC 69
- NCM 138
- NCW 138
- NG 500
- NI GT
- NIM 69
- NS GT
- NSM 69

Sub-Modules PI Aliases PI Properties

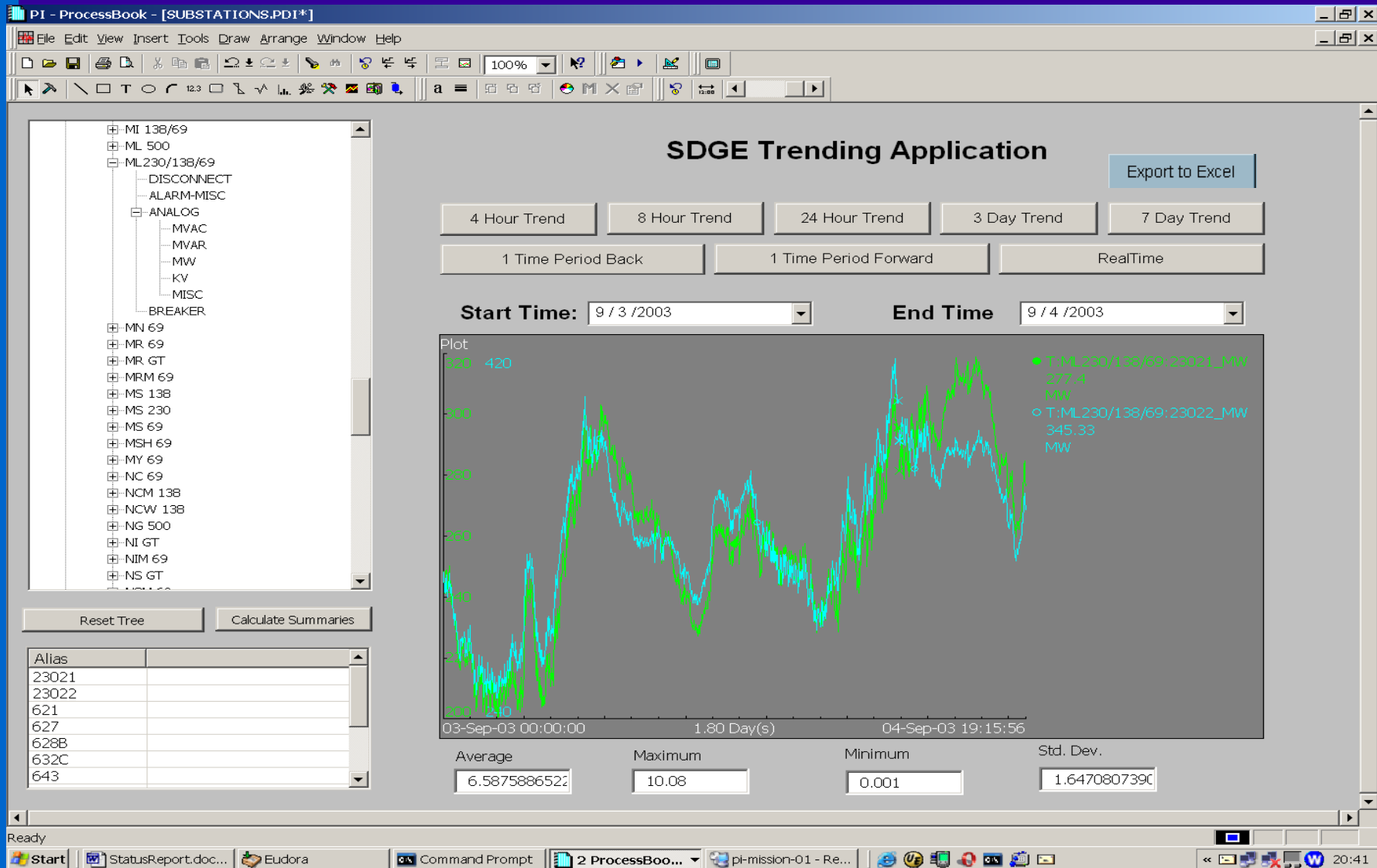
PIAlias Name	Tag Name	Server	Snapshot Value	Snapshot Time
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230_CB_3T	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_4N	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_4S	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_4T	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_5N	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_5T	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_6N	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_6S	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_6T	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_7N	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
230_CB_7S	T:ML230/138/69:23...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
6910_CB	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_643_CB	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_11N	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_11S	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_13N	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_13S	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_621	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_627	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_628	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
69_CB_632	T:ML230/138/69:69...	mccpi.sdge.com	CLOSE	9/8/2003 3:11:05 PM
CAP1_CB	T:ML230/138/69:CA...	mccpi.sdge.com	OPEN	9/8/2003 3:11:05 PM
CAP2_CB	T:ML230/138/69:CA...	mccpi.sdge.com	OPEN	9/8/2003 3:11:05 PM

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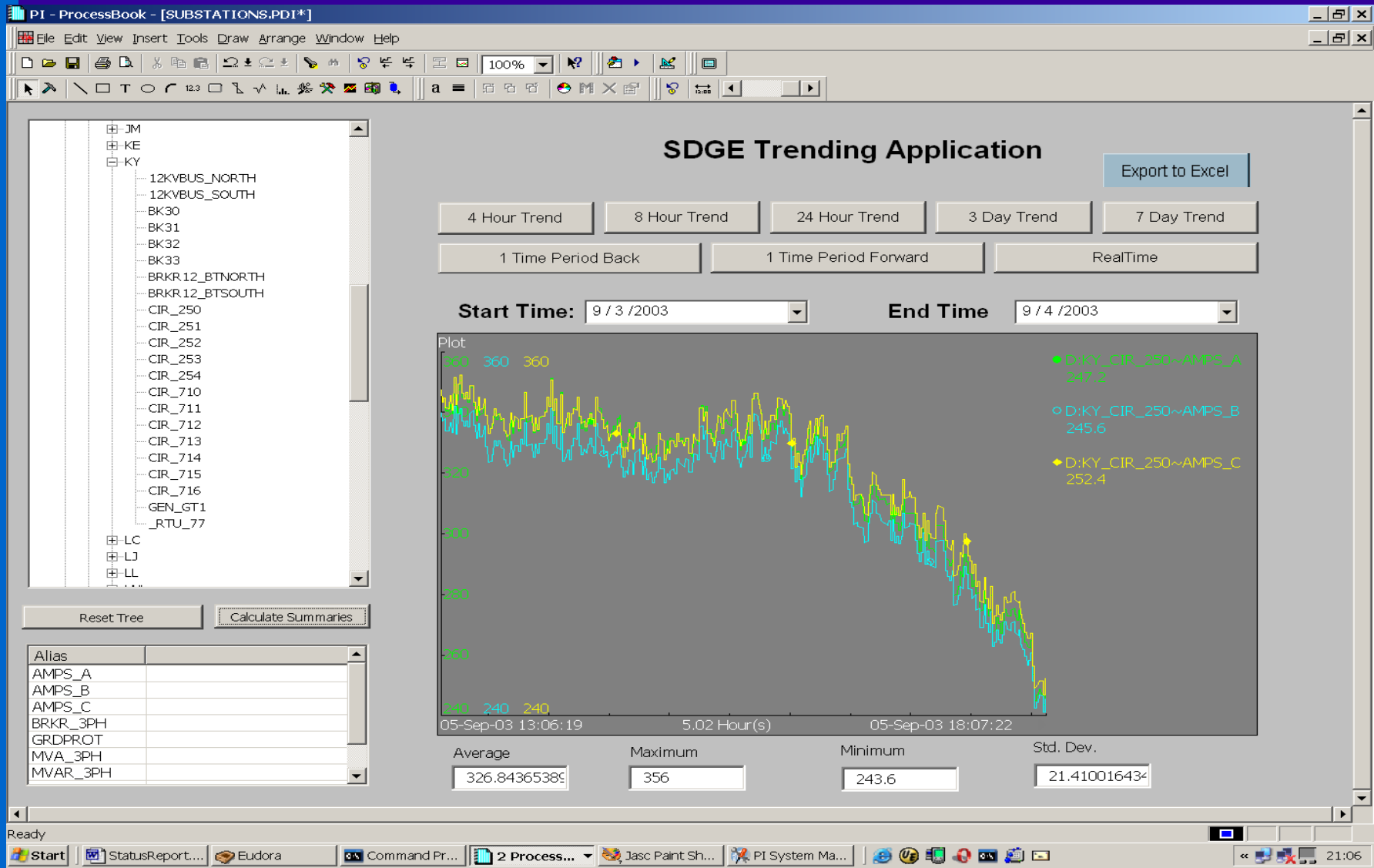
Done My Computer

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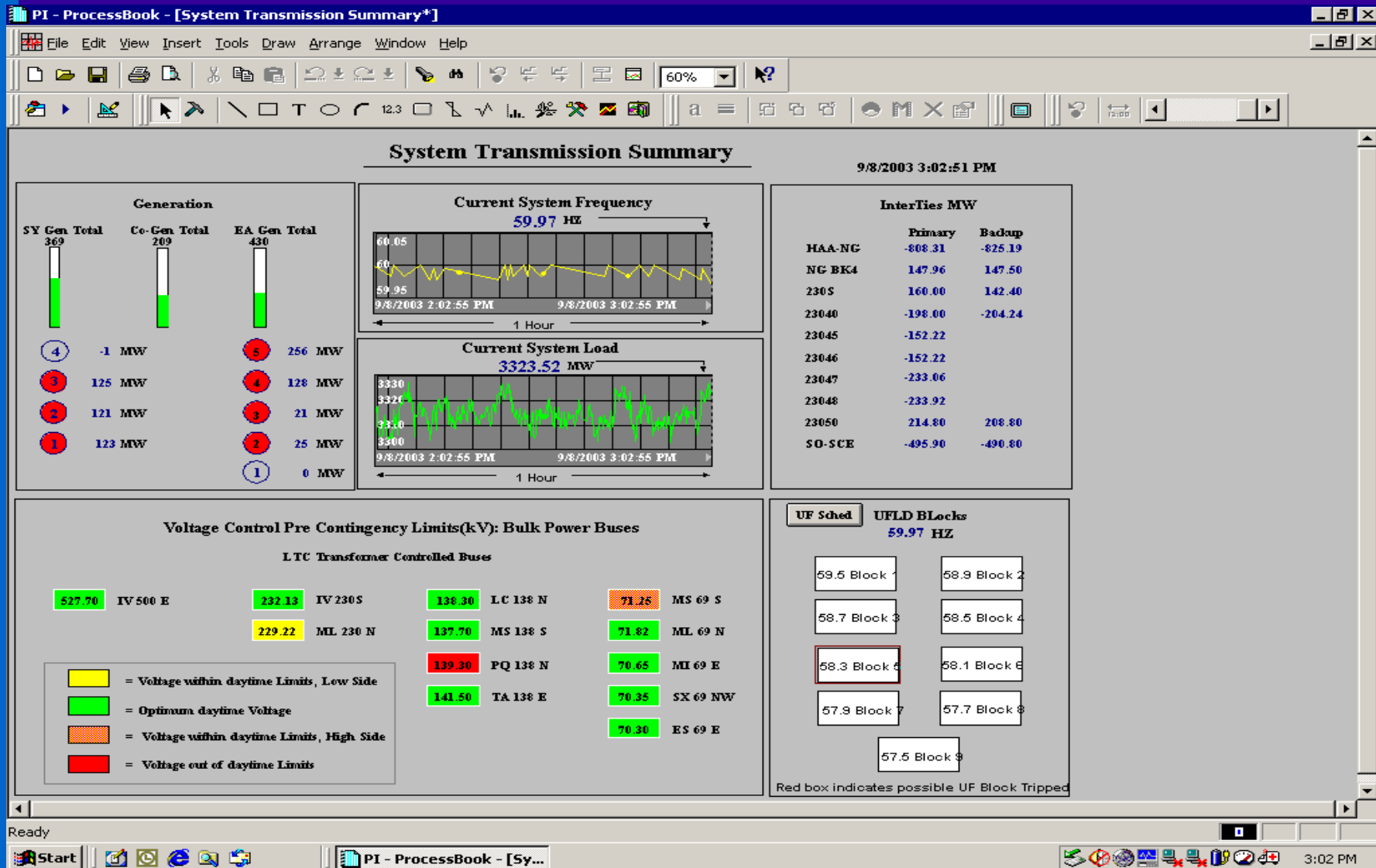
Transmission Substation Trending



Distribution Substation Trending



Transmission System Summary



Tie Line/Breaker Status

PI - ProcessBook - [69 KV Tie Lines*]

File Edit View Insert Tools Draw Arrange Window Help

100%

69 KV Tie Line Status 9/8/2003 3:44:51 PM

GREEN = OPEN

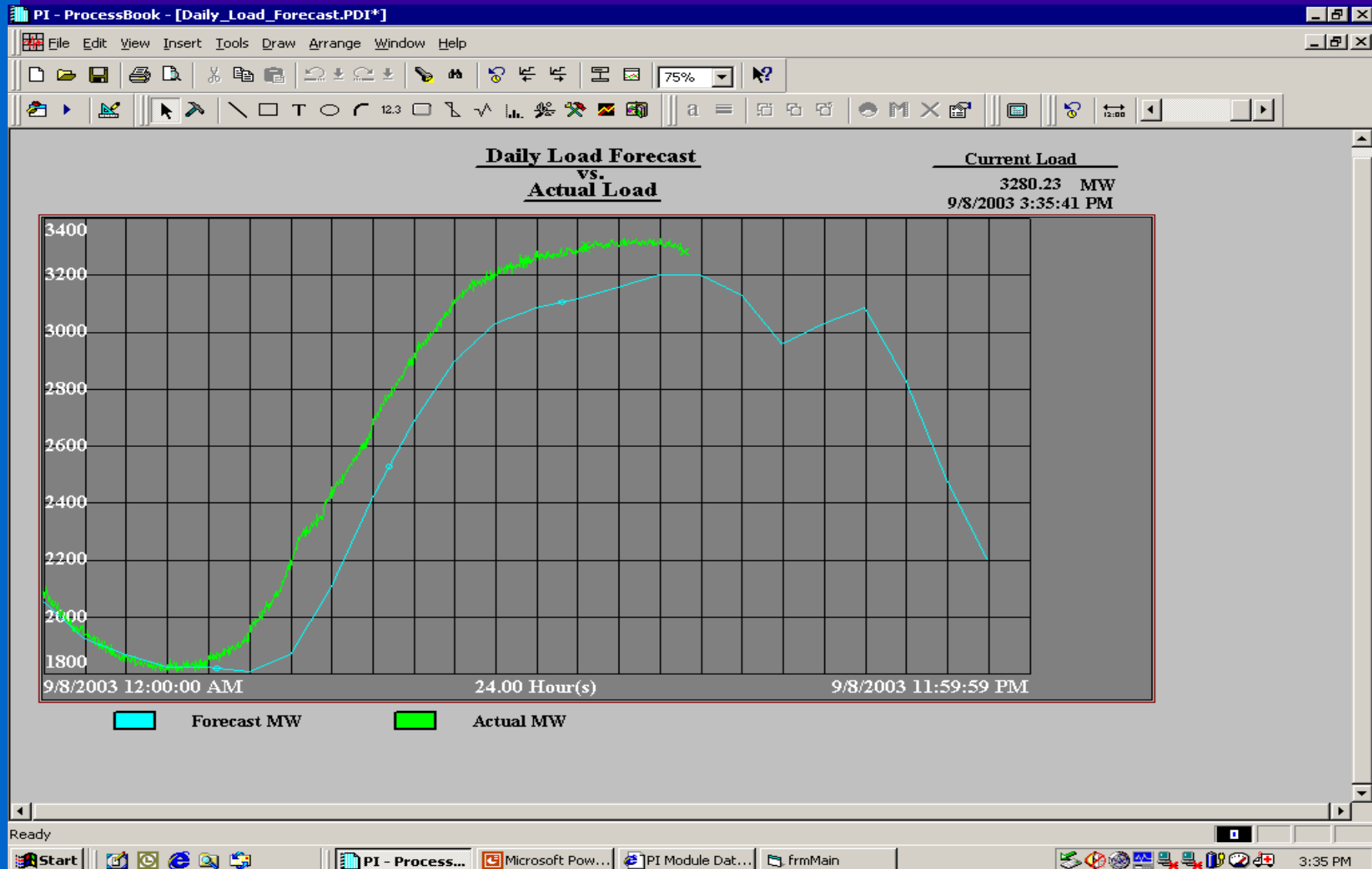
600 CM	KY	RN	625 DE	LL	BAR	650 B	CR	NIM	675 PQ	MRM	6900	6925 EC	GAR
601 B	UB		626 DE	ST		651 S	WA		676 MS	MSH	6901 DI	6926 VC	RIN
602 B	MI		627 JM	ML		652 MI	WA		677 MR	MRM	6902 CR	6927 EG	RN
603 NC	SW	NSM	628 ML	PD	SW	653 F	MS		678 AL	LC	6903 PL	6928	
604 KE	OT		629 DE	CN	CW	654 F	MS		679 ES	FE	6904 AL	6929 OY	OY1 PKR
605 MI	UB		630 EC	GR		655 CR	S		680 ME	SA	6905 PQ	6930 ES	OV
606 DI	NSM		631 EC	LC		656 MI	S		681 AS	FE	6906 PQ	6931 CW	BU
607 SR	WA		632 GR	LC	ML	657 MI	S		682 WR	RIN	6907 GE	6932 LI	PA
608 CS	SR		633 BE	RCL		658 DI	S		683 LI	RIN	6908 ES	6933 ES	ES1 PKR
609 B	KE		634 PO		ESC	659 CB	PL		684 ES	SM	6909 NIM	6934 ES	ES2 PKR
610 DM	PQ	SF	635 LC	CRE		660 DM	EN		685 ST	WR	6910 BD	6935 BD	BD12 PKR
611 PL	OT		636 EL	SN		661 PQ	RN		686 NW	WR	6911 JM	6936 BD	BD2 PKR
612 PL	OT		637 ST	CRE		662 PQ	TP		687 BR	NW	6912 PN	6937	
613 PB	OT		638 LC	SN		663 KY	MS		688 ES	LI	6913 PO	6938 EC	EC1 PKR
614 CS	SW		639 EL	SX		664 EG	PQ	MRC	689 BE	ES	6914 LC	6939	
615 CB	PL		640 CS	PD		665 GE	PQ		690 LP	OS	6915 SX	6940	
616 BE	OV	SF	641 MG	SY		666 DM	PQ	TP	691 AV	MN	6916 SX	6941 NC	S
617 LJ	PB	RN	642 MG	SW	SY	667 DM	PQ		692 LP	JA	6917 SX	6942	
618 MS	MY		643 JM	ML		668 MR	MRC		693 ME	SA	6918 ESC	6943	
619 MS	MY		644 SW	SY		669 MR	SS		694 MN	SA	6919	6944	
620 MY	GAR		645 OY	SY		670 CM	MS		695 JA	TA	6920 SX	6945	
621 ML	PD		646 OY	SY		671 EL	MS		696 AS	ES	6921		
622 CS	SY		647 IB	SY		672 KY	MSH		697 OS	SA	6922		
623 IB	OY	SYO	648 PO	RCL		673 LJ	RN		698 AV	MN	6923 CN	6948	
624 EC	JM		649 BD	OY	SYO	674 EN	PQ		699 B	MI	6924 SX	6949	

Ready

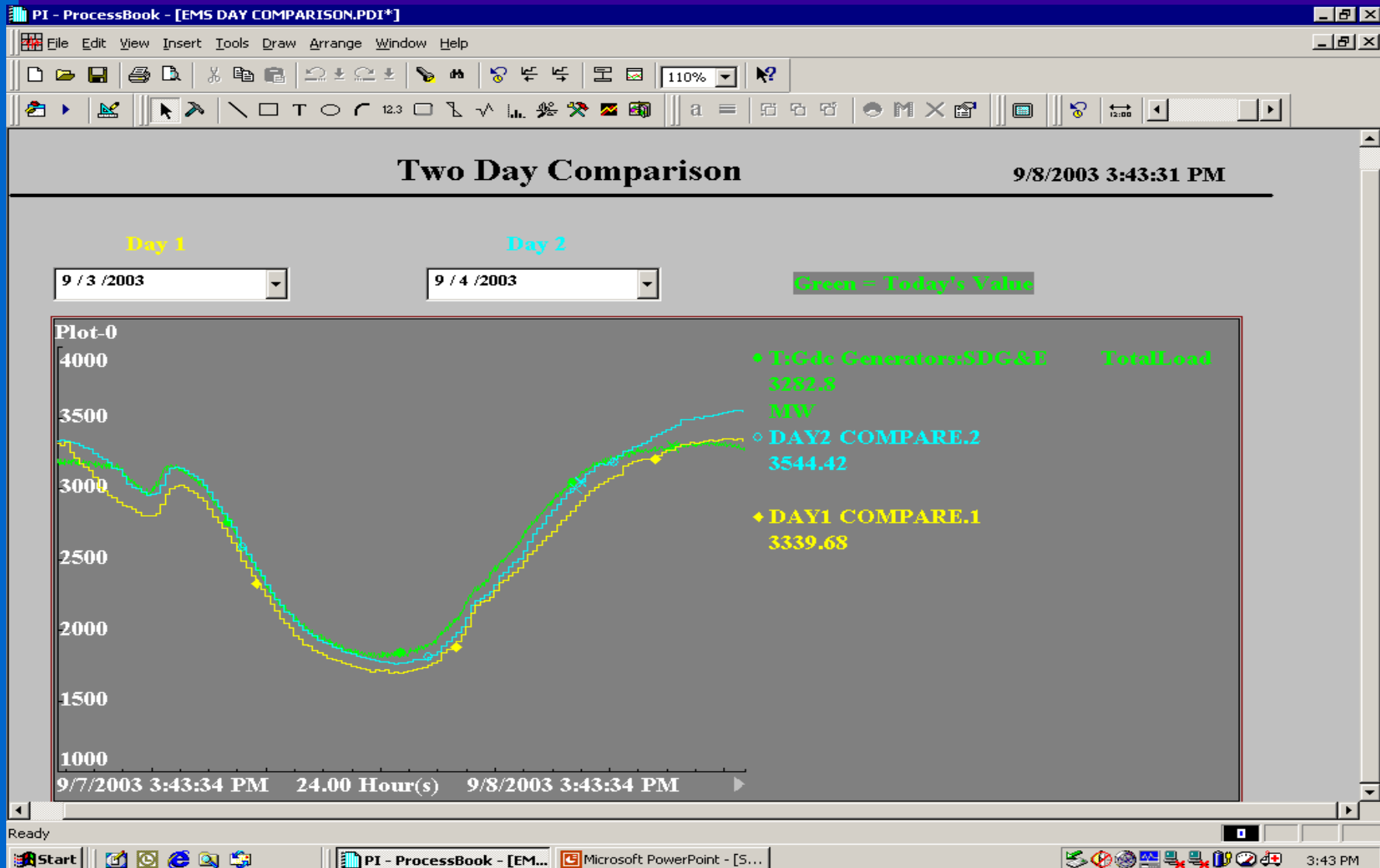
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3:44 PM

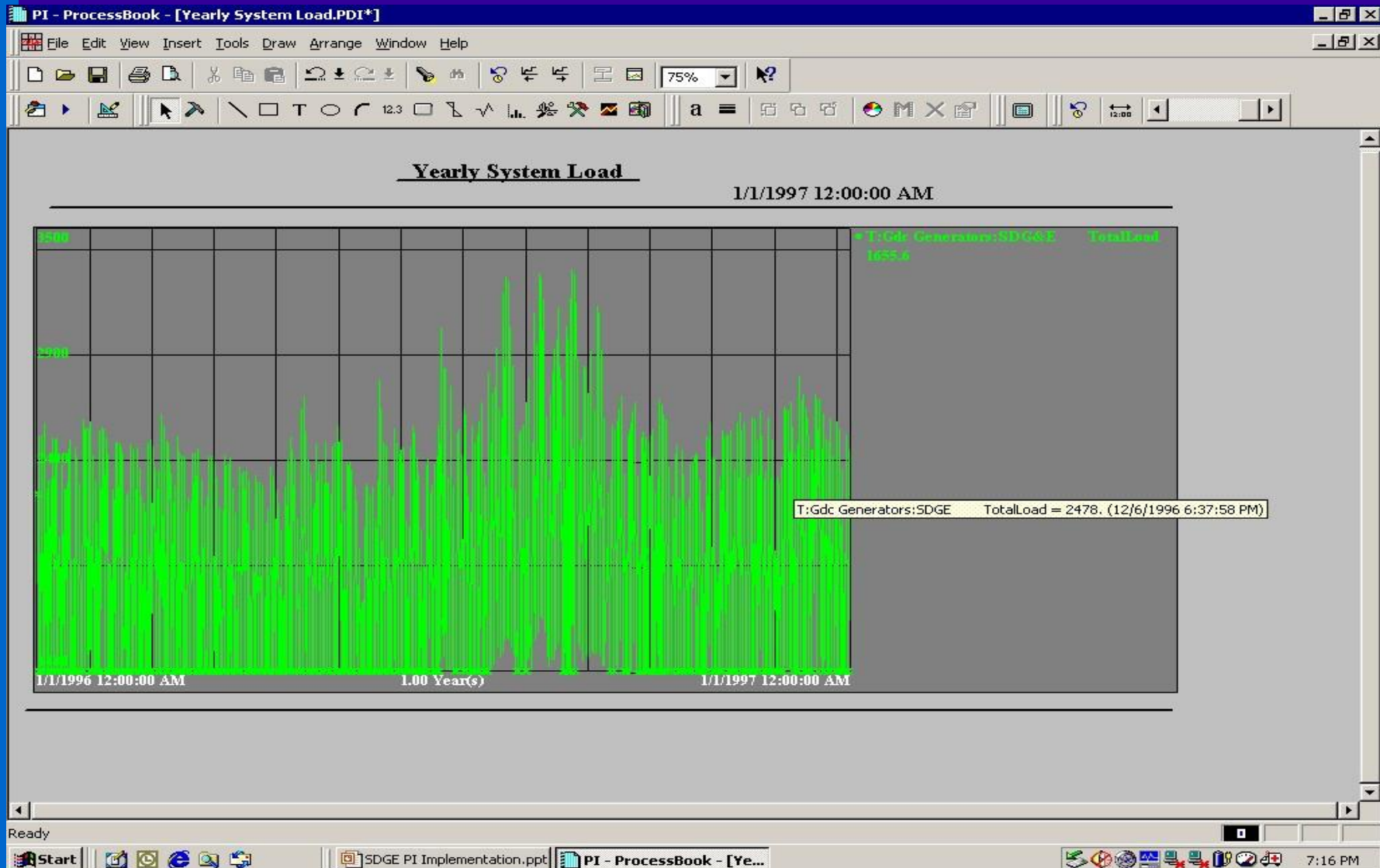
Load Forecast vs. Actual



System Load Day Comparison



System Load Yearly Summary



Looking Forward....

- Module database performance improvement
- PI client software enhancements to utilize module database automatically (ProcessBook 3) to reduce coding
- Million-tag PI server
- Exchanging ideas via PI user group

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or amoore@semprautilities.com