

Integrating Voltage Stability Applications into EMS

*NASPI Working Group Meeting
June 6th, 2012*

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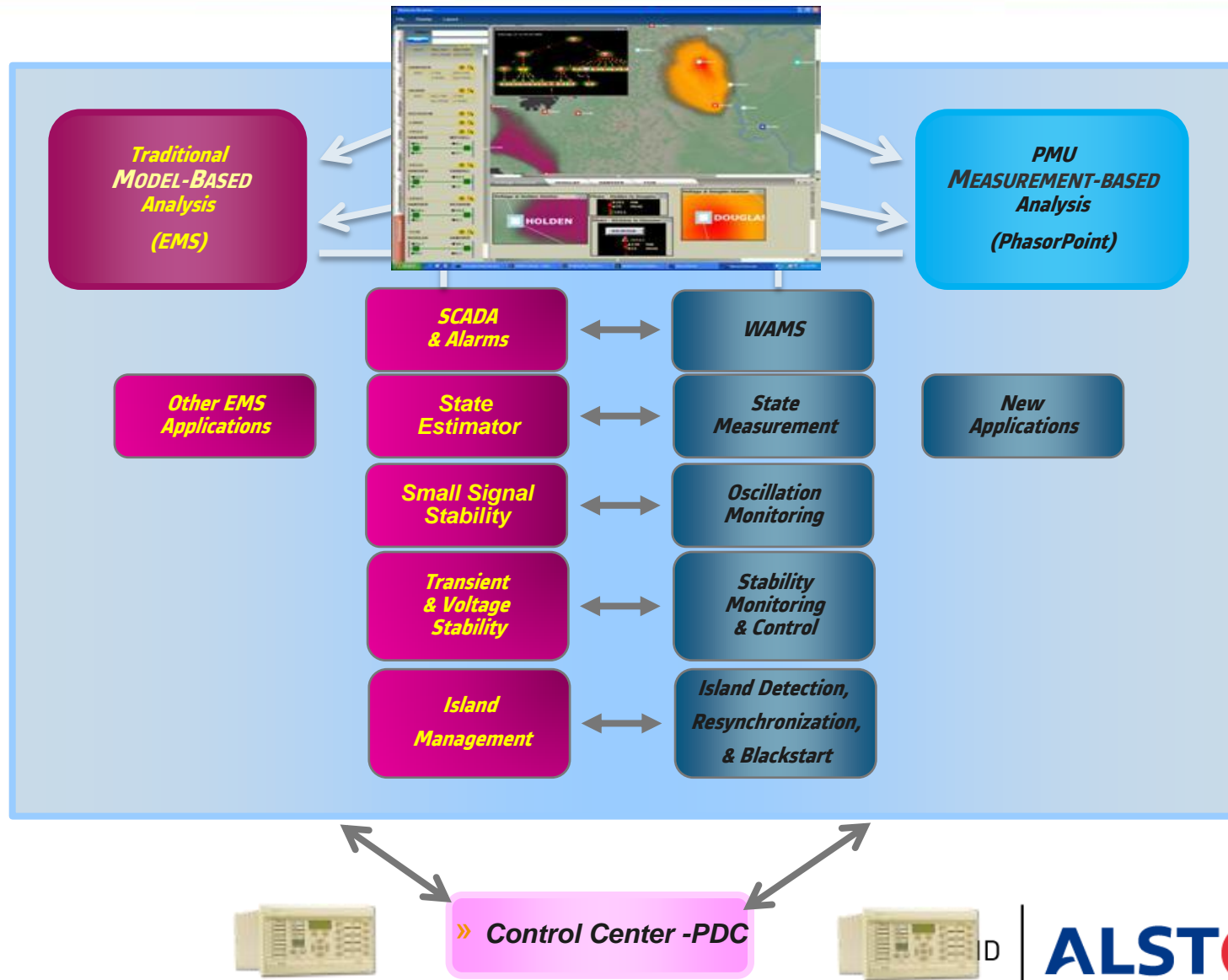
Manu Parashar
Jay Giri (presenter)

ALSTOM

A success story...

Manu is not here at Naspi !!

Our Vision



Hybrid Approach to Voltage Stability Assessment

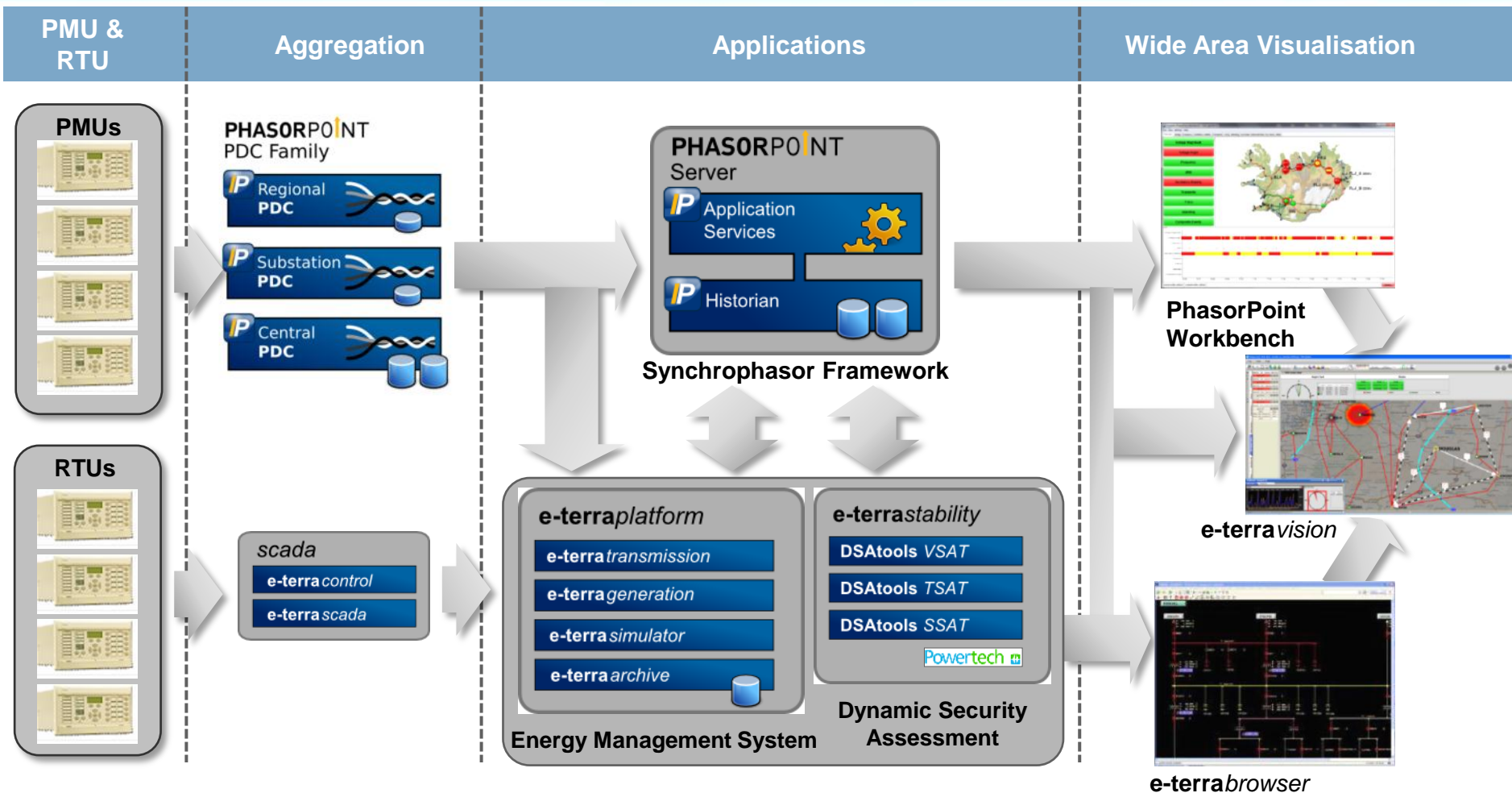
“Measurement-based” Voltage Stability Indicators identify potential stability problems, and include:

- **Wide Area Voltage “Composite” Alarms:** Identify low voltage violations simultaneously detected over a broad area.
- **Voltage Sensitivities:** Assess voltage degradation (i.e. kV/100MW) with increased MW loading bases on operating P-V locus.
- **Reactive Reserves:** Monitor available MVAR reserves in an area (i.e. all capacitors/reactors and units within a sub-network of the power grid).
- **Advanced Metrics (Voltage Instability Predictor, SVD):** Other indicators based on key properties associated with voltage collapse phenomenon (such as singularity or maximum loadability). **(FUTURE)**

“Model-based” Voltage Stability Analysis to evaluate:

- **MW Margins** to potential voltage violation or instability.
- **Weak elements** within the network that will be impacted during a voltage instability.
- **Critical contingencies** responsible for the voltage stability violation.
- **Corrective Actions** to mitigate away from an impending instability.

Online Stability Solution – System Architecture

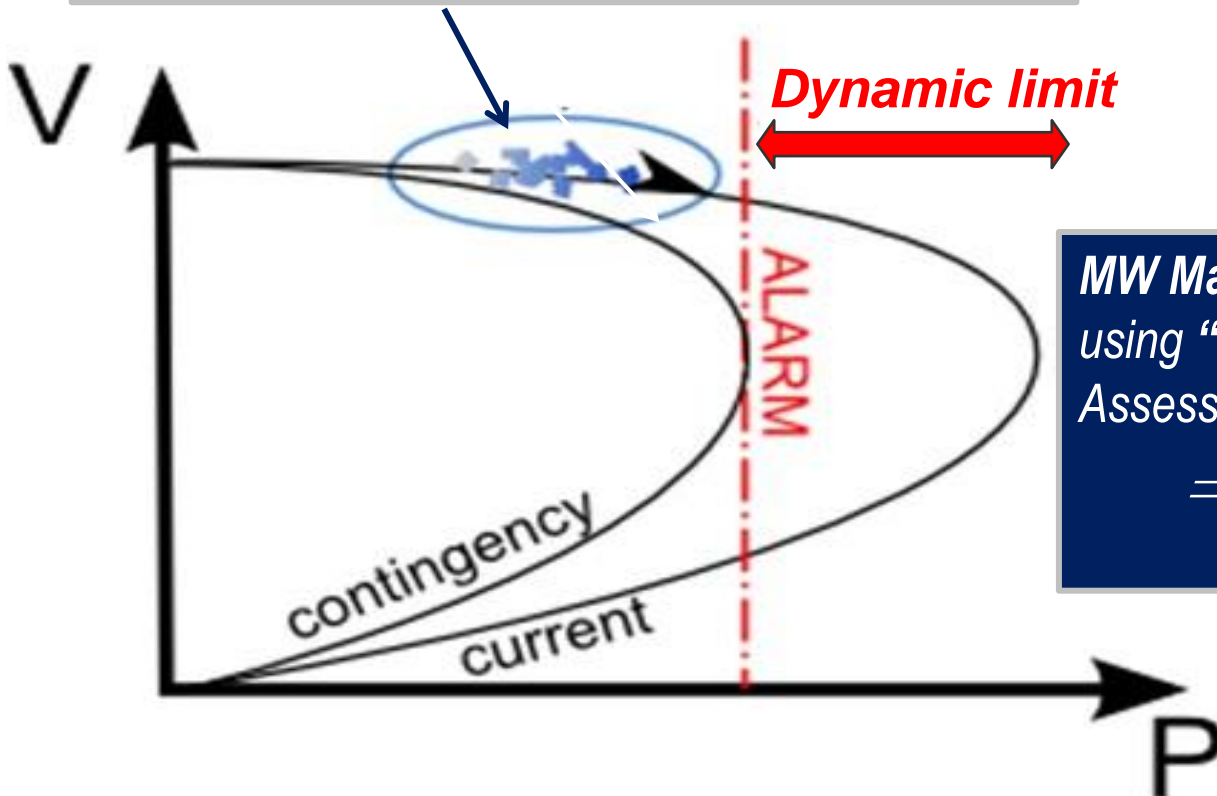


On-Line Voltage Stability Assessment

Integrated “measurement-based” and “model-based” analysis

Real-time **P-V locus** (and **voltage sensitivities**)
based on **PMU measurements**.

⇒ **monitor current operating condition**



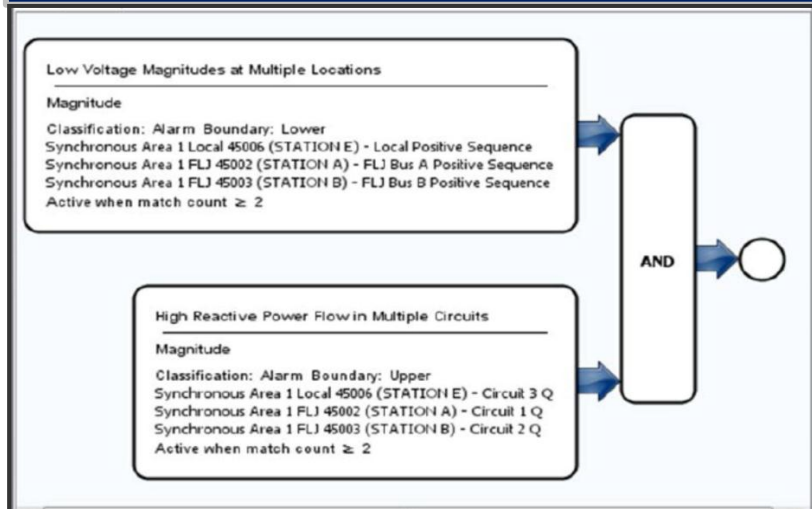
MW Margins are computed in real-time
using “**model-based**” Voltage Stability
Assessment Tools (VSAT).

⇒ **identify proximity to
voltage stability violation**

Comprehensive Voltage Stability Alarms

Linking WAMS “Wide-Area” Low Voltage Alarms to Operator Guides in EMS

WAMS Composite Alarms



*WAMS indicate the simultaneous occurrence of **Low Voltage** over a broad region.*

**Detect WHEN to Take Action...
and HOW to Respond!**

Operator Guides in EMS

The screenshot shows a web-based interface for an Operator Guide. The title bar indicates the browser is 'B - ACTIVE_OPGUID_DETAILS,RTNET[DT5]' with the address 'wx64dev05c2 (B)' and 'Page:1'. The interface includes a menu bar with options like 'File', 'Navigate', 'HABITAT Applications', 'EMP Applications', 'Grid Displays', 'Related Displays', and 'Help'. Below the menu, there's a section for 'Network State Guidelines' with a sub-link 'Active OPGUID Summary'. The main content area displays details for an active OPGUID: 'RTNET Last Solved: 03-Jan-2000 03:10:29', 'RTNET REALTIME', 'ACK OPG: DOUGLOVOLT', 'Activated: [checked]', 'New: [checked]', 'Ack: [checked]', 'Avail: [checked]', 'Description: OPERATOR GUIDE FOR LOW VOLTAGE AT DOUGLAS', 'Alarm Text: FOR LOW VOLTAGE AT DOUGLAS, SWITCH CAPS', 'Trigger: T1', 'Trigger Condition: COND1', 'Skip: [unchecked]', 'Met: [checked]', and 'OPGUID: LOW VOLTAGE CONDITION; SWITCH ON CAPS'. The status bar at the bottom shows 'Ready' and 'DT5@wx64dev05c2:b1 EV05C2 NONE'.

Decision making:

Operator Guides (e.g. “Switch On Capacitor Banks”).

Arm Special Protection Schemes

Reactive Reserve Monitoring in EMS

The screenshot shows a table for Reactive Reserve Monitoring. The table has columns for Group ID, % Worst, Cur Rsrv Up, % Min Rsrv Up, Min Rsrv Up, Cur Rsrv Down, % Min Rsrv Down, and Min Rsrv Down. The first row is highlighted with a red border and contains the data: FE_EXAMPLE1, -7, 804, 0, 805, 747, -7, 800.

Group ID	% Worst	Cur Rsrv Up	% Min Rsrv Up	Min Rsrv Up	Cur Rsrv Down	% Min Rsrv Down	Min Rsrv Down
FE_EXAMPLE1	-7	804	0	805	747	-7	800

Reactive Reserve (MVAR) monitoring for user-defined areas in EMS.

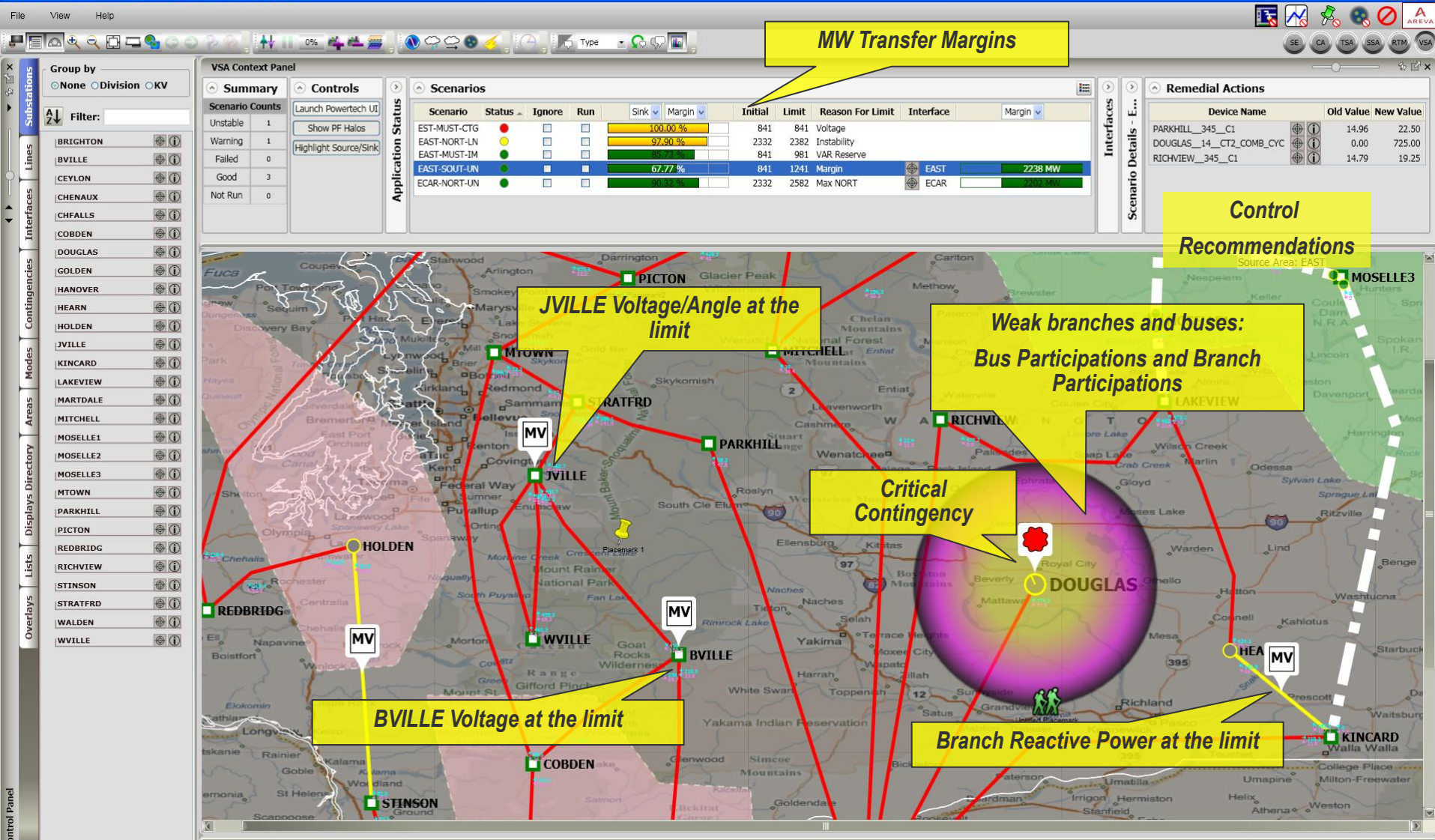
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Voltage Security Assessment Visualization

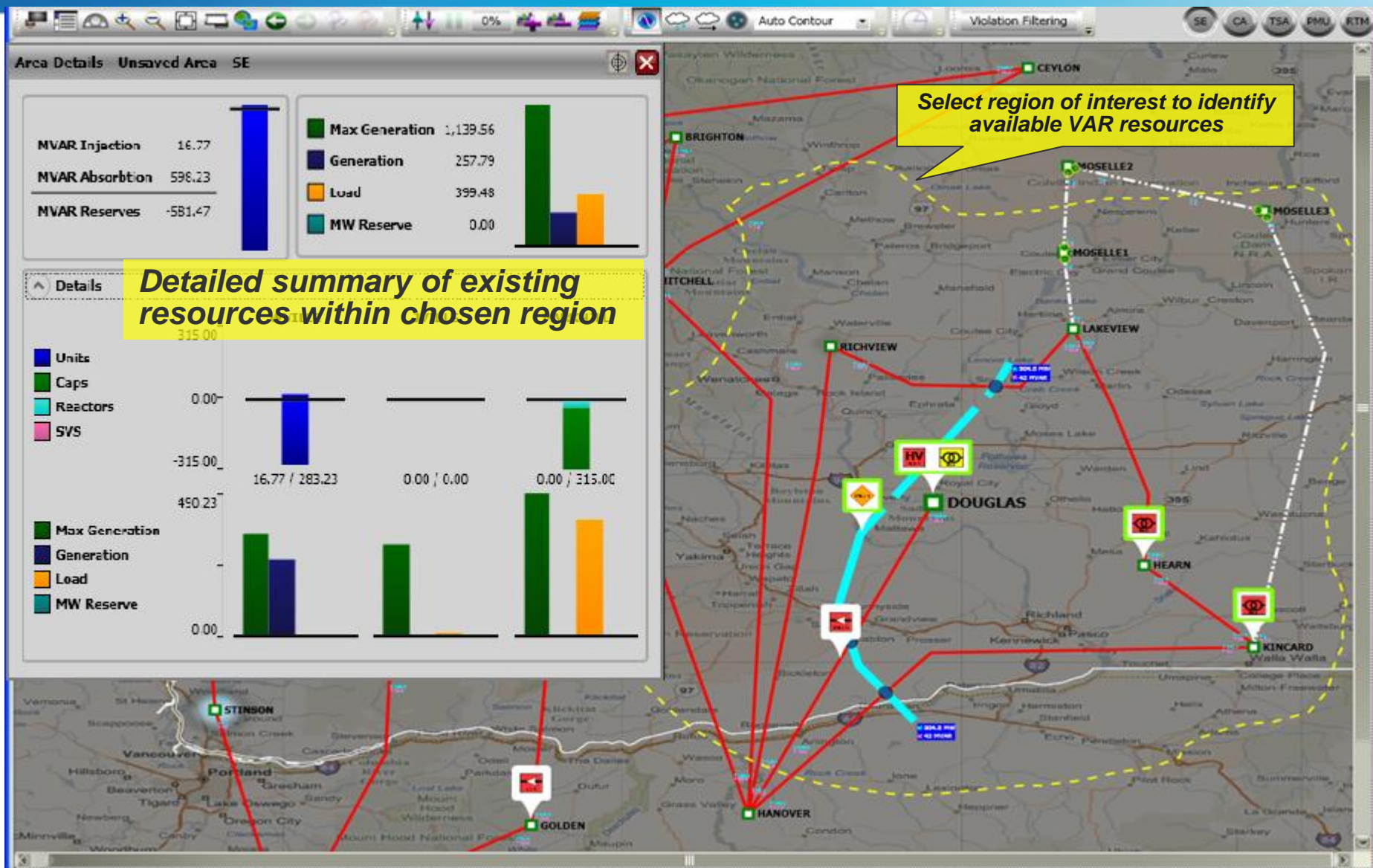
Voltage Contours, MW Margins, Weak Elements, Remedial Actions

Viewport [1] - Real Time - esca60_ov_interface 1025 opt - VSA



Regional Reactive Reserves

Where are the Vars ?



Thank You

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We are Shaping the future